

**Group 1 – PUMPS**

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**Group 2 - PRESSURE CONTROL VALVES**

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**Group 3 - FLOW CONTROL VALVES**

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**Group 4 - DIRECTIONAL VALVES**

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**Group 5 - SUBPLATES AND MANIFOLDS**

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**Group 6 - MODULAR VALVES**

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**Group 7 – ACTUATORS**

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**Group 8 - PROPORTIONAL VALVES**

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**Group 8 - ELECTRONIC CONTROL UNITS**

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**Group 9 - ACCESSORIES**

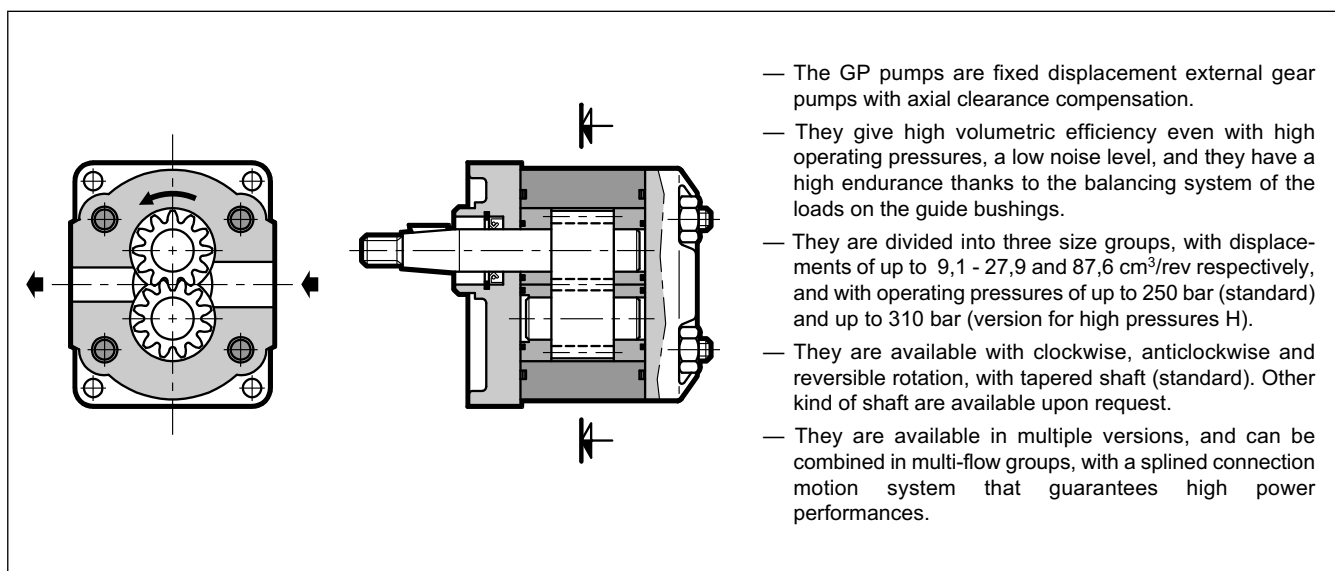


# GP

## EXTERNAL GEAR PUMPS

### SERIES 20

#### OPERATING PRINCIPLE

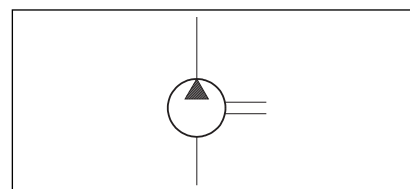


#### TECHNICAL SPECIFICATIONS

GP PUMP SIZE		GP1	GP2	GP3
Displacement range	cm <sup>3</sup> /rev	1.3 ÷ 9.1	7 ÷ 27.9	20.7 ÷ 87.6
Flow rate and operating pressures		see table 3 - Performances		
Rotation speed		see table 3 - Performances		
Rotation direction		clockwise, anticlockwise or reversible (seen from the shaft side)		
Loads on the shaft		radial and axial load are not allowed		
Max torque applicable to the shaft		see paragraph 14.1		
Hydraulic connection		flanged fittings (see paragraph 16)		
Type of mounting		4 hole flange - rectangular type		
Mass: standard version version H	kg	1.2 ÷ 1.6 1.9 ÷ 2.3	2.6 ÷ 3.5 3.8 ÷ 4.7	6 ÷ 8.5 8.7 ÷ 11.2

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-15 / +80
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 100

#### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE

### 1.1 - Identification code for single and front pumps

<b>G</b>	<b>P</b>			<b>-</b>						<b>/</b>	<b>20</b>	<b>N</b>	
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External gear pump

Pump size: \_\_\_\_\_  
**1** = from 1,3 to 9,1 cm<sup>3</sup>/rev  
**2** = from 7,0 to 27,9 cm<sup>3</sup>/rev  
**3** = from 20,7 to 87,6 cm<sup>3</sup>/rev

omit for single pumps (**standard**)  
**F** = only for front pump to be coupled

Nominal size \_\_\_\_\_  
 (see table 3 - Performances)

Rotation direction (seen from the shaft side) \_\_\_\_\_  
**R** = clockwise (**standard**)    **L** = anticlockwise  
**D** = reversible (option available for single pumps only)

Mounting flange \_\_\_\_\_  
**9** = 4 hole - rectangular type (**standard**)  
**0** = SAE J744 - 2 hole

**H** = version for high pressures.  
 Omit for standard pressure.

Seals:  
**N** = NBR seals for mineral oils

Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)

Hydraulic connection  
**F** = flanged ports (**standard**)  
**B** = BSP threaded ports  
**U** = UNF threaded ports

Type of shaft - see **NOTE 1**  
**7** = tapered with key (**standard**)  
**5** = cylindrical with key (available for single pumps only)  
**0** = cylindrical with key SAE-J744  
**1** = SAE-J744 splined

**NOTE 1:** See at table 1.4 compatibility among mounting flange, type of shaft and type of hydraulic connection

### 1.2 - Identification code for intermediate and rear pumps

<b>G</b>	<b>P</b>			<b>-</b>						<b>/</b>	<b>20</b>	<b>N</b>	
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External gear pump

Pump size: \_\_\_\_\_  
**1** = from 1,3 to 9,1 cm<sup>3</sup>/rev  
**2** = from 7,0 to 27,9 cm<sup>3</sup>/rev  
**3** = from 20,7 to 87,6 cm<sup>3</sup>/rev

Pump position: \_\_\_\_\_  
**M** = Intermediate  
**R** = Rear

Nominal size \_\_\_\_\_  
 (see table 3 - Performances)

Rotation direction (seen from the shaft side) \_\_\_\_\_  
**R** = clockwise (**standard**)    **L** = anticlockwise

**H** = version for high pressures.  
 Omit for standard pressure.

Seals:  
**N** = NBR seals for mineral oils

Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)

Hydraulic connection  
**F** = flanged ports (**standard**)  
**B** = BSP threaded ports  
**U** = UNF threaded ports

**NOTE 2:** Front, intermediate or rear pumps for multiple groups are supplied without mating joint, which must be ordered separately (see paragraph 1.5). To order a group of one or more pumps completely assembled see paragraph 1.3.

### 1.3 - Identification code for multiple pumps

identification code front pump    +    identification code intermediate pump (omit for double pumps)    +    identification code rear pump

### 1.4 - Compatibility among mounting flange, type of shaft and type of hydraulic connection

FLANGE CODE	SHAFT CODE				HYDRAULIC CONNECTION CODE		
	7	5	0	1	F	B	U
9	yes	yes	no	no	yes	yes	no
0	no	no	yes	yes	yes	no	yes

### 1.5 - Identification code for mating joints

FIRST PUMP	SECOND PUMP		
	GP1	GP2	GP3
GP1	3101100003	-	-
GP2	3101100004	3101100005	-
GP3	3101100006	3101100007	3101100008

### 1.6 - Examples

a) single pump size 1 - 1,3 cm<sup>3</sup>/rev - anticlockwise rotation - standard flange and shaft

**GP1-0013L97F/20N**

b) single pump size 2 - 14 cm<sup>3</sup>/rev - clockwise rotation - standard flange and shaft

**GP2-0140R97F/20N**

c) single pump size 3 - 22,5 cm<sup>3</sup>/rev - clockwise rotation - SAE flange and shaft

**GP3-0225R01F/20N**

d) double pump made of: - pump size 2 - 7 cm<sup>3</sup>/rev  
 - pump size 1 - 2 cm<sup>3</sup>/rev - high pressure

**GP2F-0070R97F/20N + GP1R-0020RF/20NH**

e) triple pump made of: - pump size 3 - 22,5 cm<sup>3</sup>/rev  
 - pump size 2 - 14 cm<sup>3</sup>/rev  
 - pump size 1 - 2 cm<sup>3</sup>/rev

**GP3F-0225R97F/20N + GP2M-0140RF/20N + GP1R-0020RF/20N**

## 2 - HYDRAULIC FLUID

### 2.1 Type of fluid

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives, in conformity with the requisites of the following standards:

- FZG test - 11th stage
- DIN 51525
- VDMA 24317

For use with other types of fluid (water glycol, phosphate esters and others), consult our technical dept. Operation with fluid at a temperature greater than 80°C causes a premature deterioration of the fluid quality and of the seals. The physical and chemical properties of the fluid must be maintained.

### 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	12 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1600 cSt	limited to only the start-up phase of the pump

### 2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with  $\beta_{20} \geq 75$  is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with  $\beta_{10} \geq 100$  is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 13.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

### 3 - PERFORMANCE RATINGS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

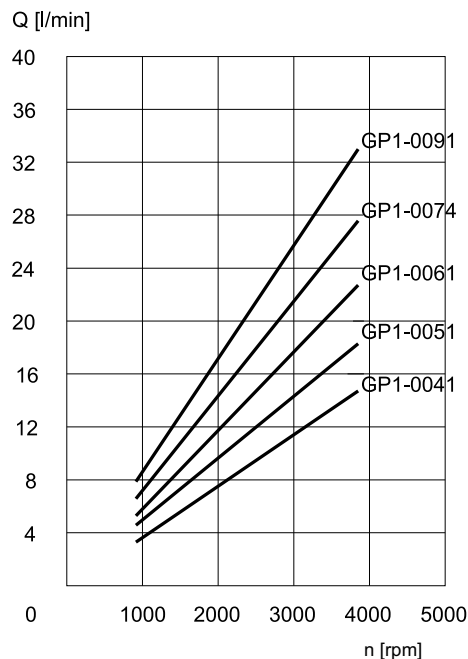
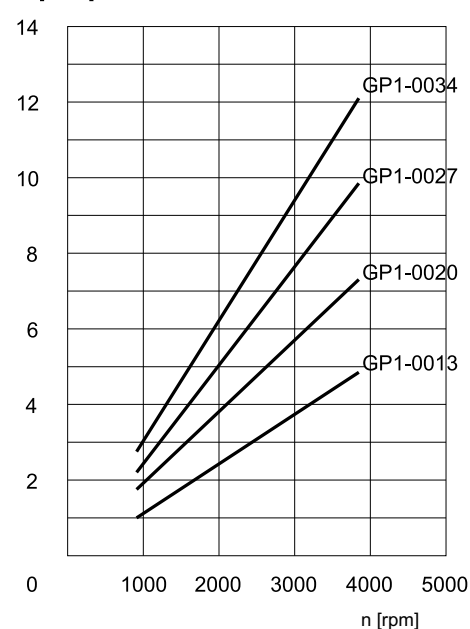
PUMP SIZE	NOMINAL SIZE	DISPLACEMENT [cm3/rev]	MAX FLOW RATE (at 1500 rpm) [l/min.]	MAX OPERATING PRESSURE (at 1500 rpm) [bar]	MAX PEAK PRESSURE (at 1500 rpm) [bar]	MAX ROTATION SPEED [rpm]	MIN ROTATION SPEED [rpm]
GP1	0013	1,3	2,0	250 (270)	290 (310)	6000	800
	0020	2,0	3,0				
	0027	2,7	4,0				
	0034	3,4	5,1				
	0041	4,1	6,1	230 (260)	260 (290)	4000	
	0051	5,1	7,6			3800	
	0061	6,1	9,1				
	0074	7,4	11,1	200	230	3200	600
	0091	9,1	13,6	180	210	2600	
GP2	0070	7,0	10,5	250 (280)	290 (310)	4000	600
	0095	9,5	14,2			3000	
	0113	11,3	16,9	230 (260)	270 (300)	4000	
	0140	14,0	21,0				
	0158	15,8	23,7	210 (260)	240 (290)	3600	
	0178	17,8	26,7				
	0208	20,8	31,2	180 (230)	210 (260)	3200	
	0234	23,4	35,1			3000	
	0279	27,9	41,8	170 (200)	200 (230)	2500	
GP3	0207	20,7	31,0	230 (280)	270 (310)	3500	500
	0225	22,5	33,7				
	0264	26,4	39,6				
	0337	33,7	50,5				
	0394	39,4	59,1	220 (260)	260 (290)	2800	400
	0427	42,7	64,0	210 (250)	250 (280)		
	0514	51,4	77,1	200 (230)	240 (260)		
	0600	60,0	90,0	190	220		
	0696	69,6	104,4	170	200		
	0776	77,6	116,4	160	190		
	0876	87,6	131,4	140	170		

**NOTE:** The values in parentheses refer to the version **H**, for high pressures.

## 4 - CURVES AND CHARACTERISTIC DATA OF GROUP GP1 PUMPS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

### 4.1 - Flow rate curves $Q=f(n)$ obtained with operating pressure 0 bar



### 4.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0013	0,90	0,82
0020	0,90	0,85
0027	0,95	0,90
0034	0,91	0,87
0041	0,94	0,90
0051	0,96	0,92
0061	0,96	0,92
0074	0,96	0,90
0091	0,96	0,88

The volumetric and total efficiencies for the various nominal dimensions of the Group GP1 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

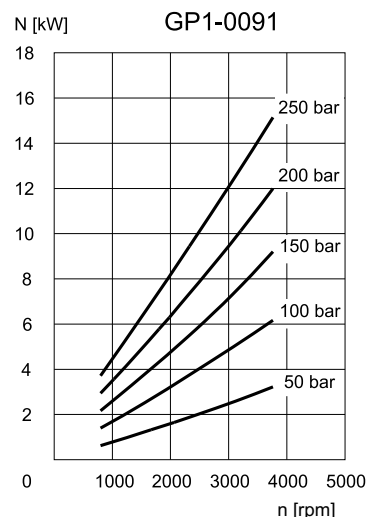
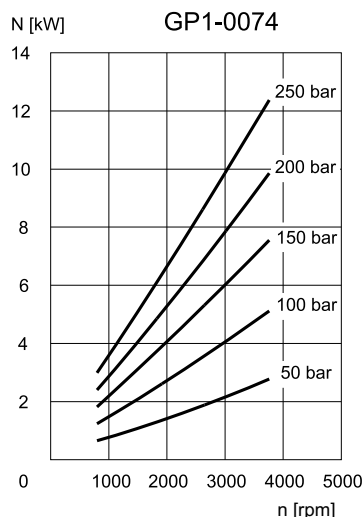
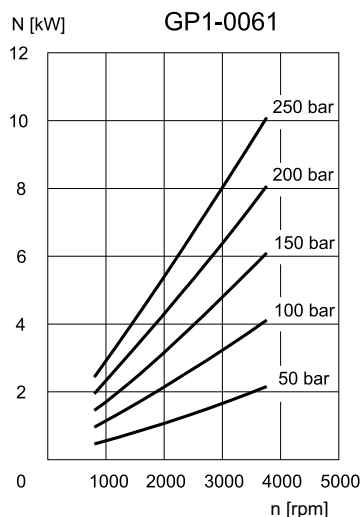
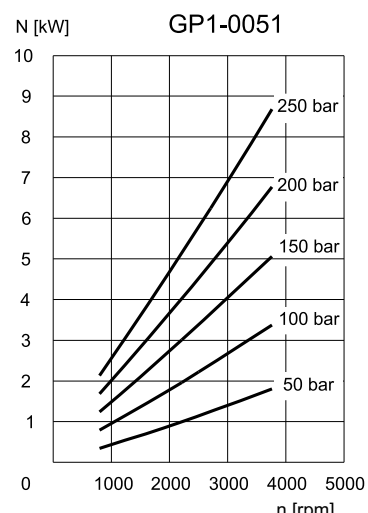
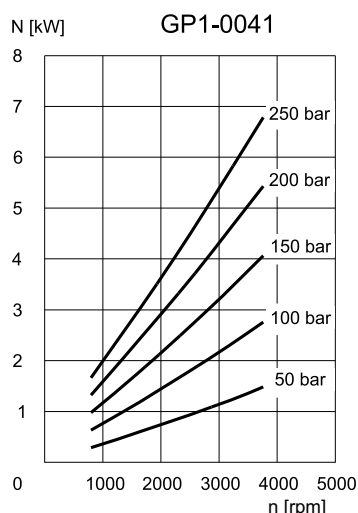
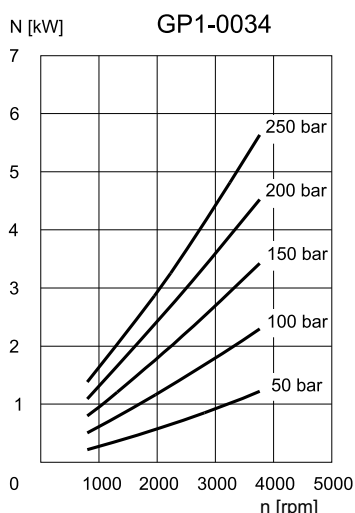
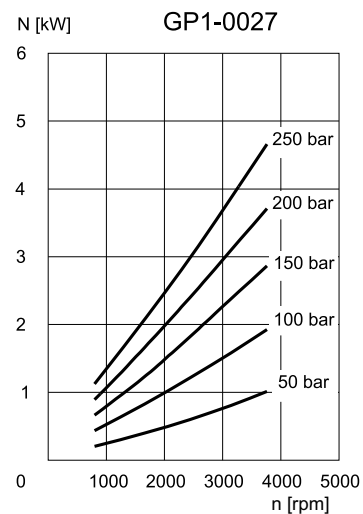
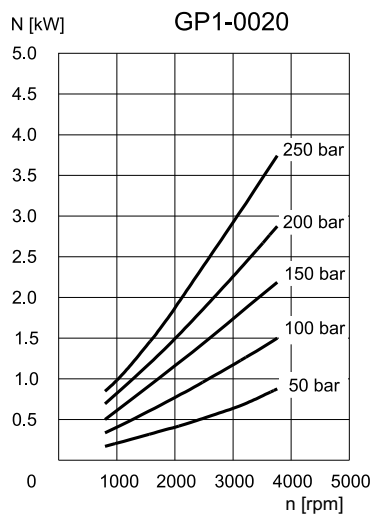
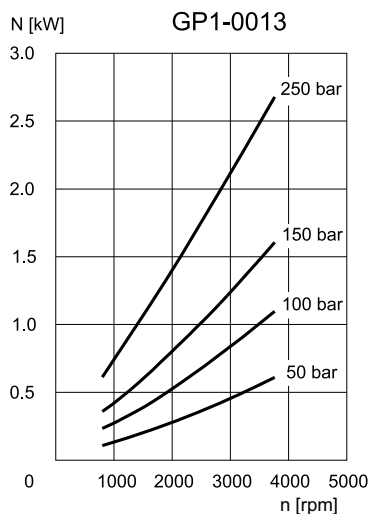
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

### 4.3 - Noise level

PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0013	65
0020	66
0027	68
0034	68
0041	70
0051	73
0061	73
0074	73
0091	77

The noise levels for the various nominal dimensions of the Group GP1 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

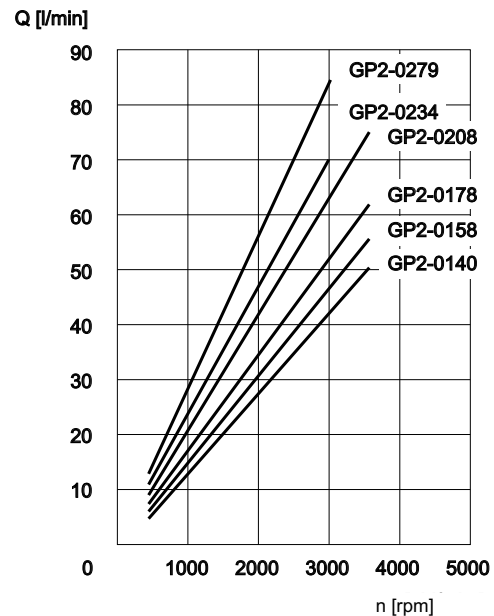
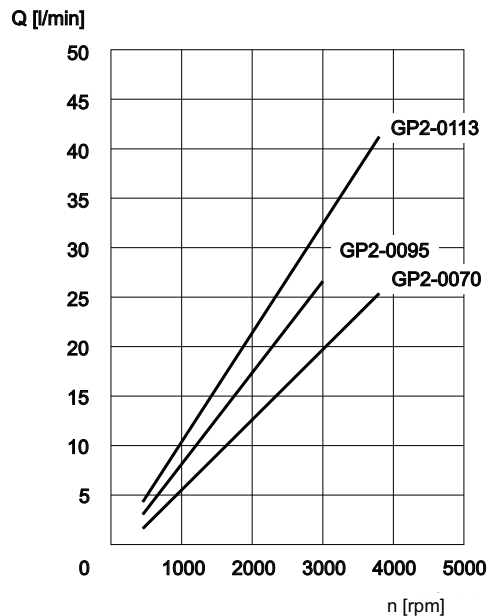
### 4.4 - Absorbed power curves $N=f(n)$ , measured with operating pressures from 50 to 250 bar



## 5 - CURVES AND CHARACTERISTIC DATA OF GROUP GP2 PUMPS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

### 5.1 - Flow rate curves $Q=f(n)$ obtained with operating pressure 0 bar



### 5.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0070	0,92	0,87
0095	0,95	0,88
0113	0,95	0,87
0140	0,93	0,87
0158	0,95	0,86
0178	0,93	0,85
0208	0,93	0,88
0234	0,97	0,89
0279	0,94	0,85

The volumetric and total efficiencies for the various nominal dimensions of the Group GP2 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

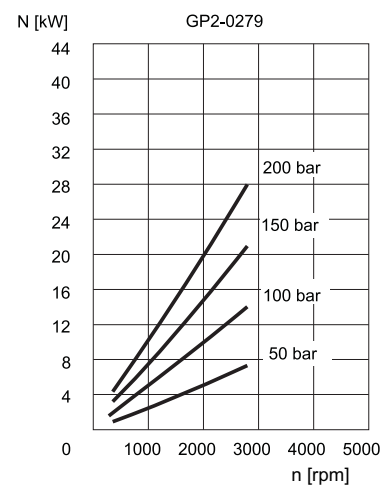
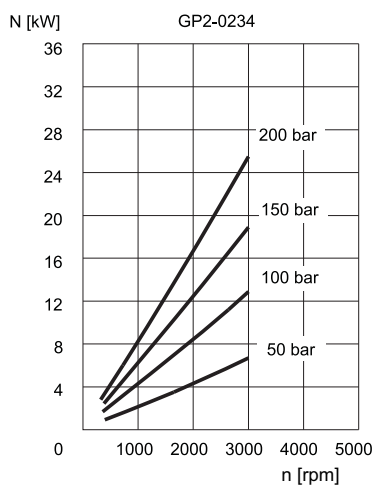
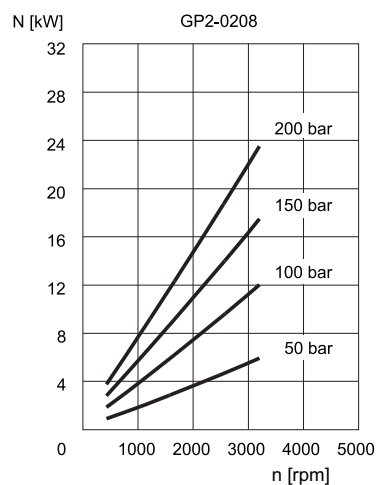
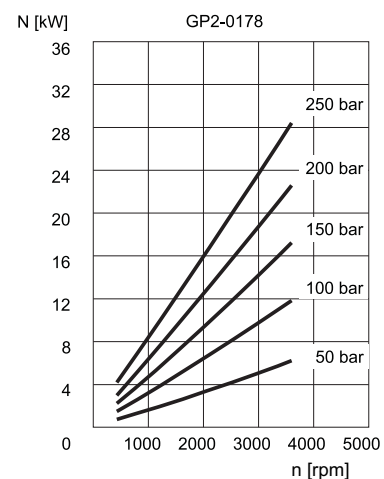
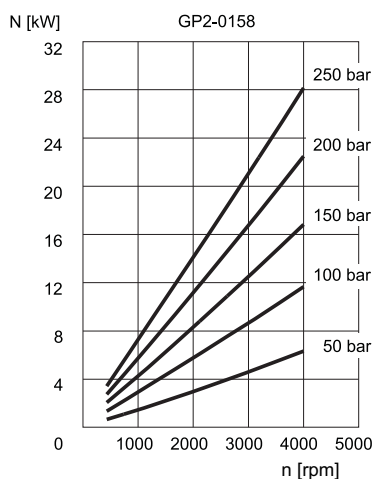
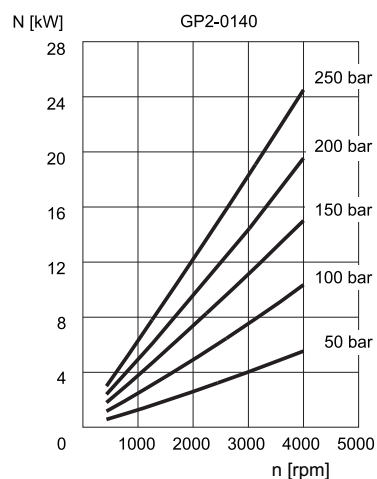
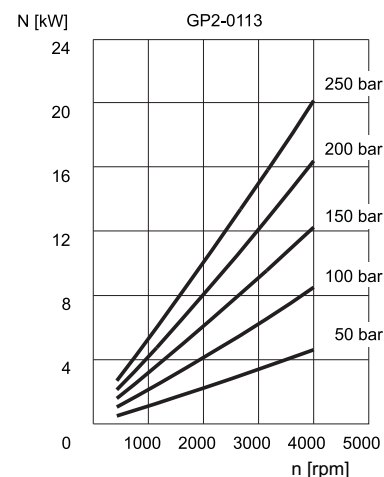
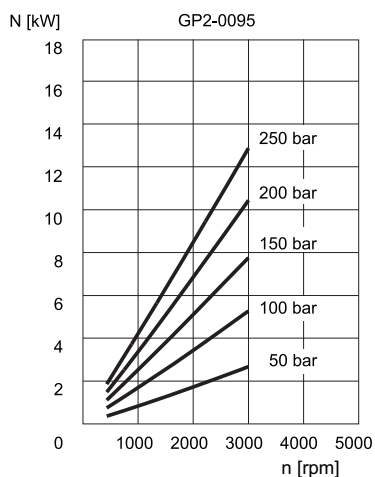
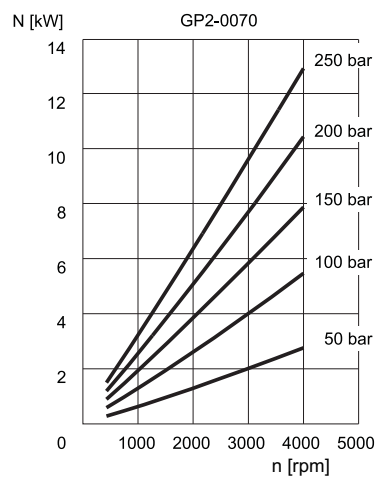
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

### 5.3 - Noise level

PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0070	75
0095	77
0113	77
0140	72
0158	72
0178	73
0208	74
0234	76
0279	76

The noise levels for the various nominal dimensions of the Group GP2 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

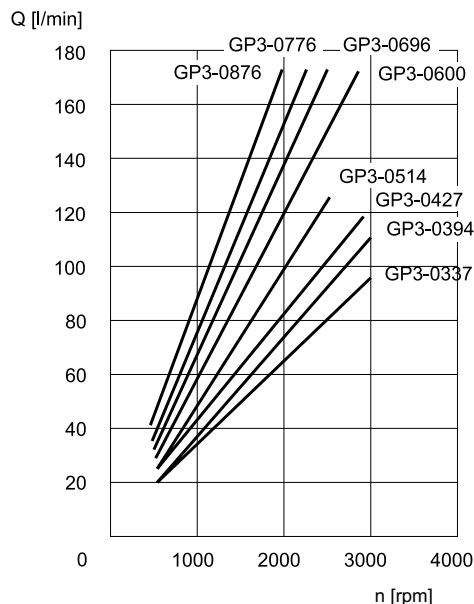
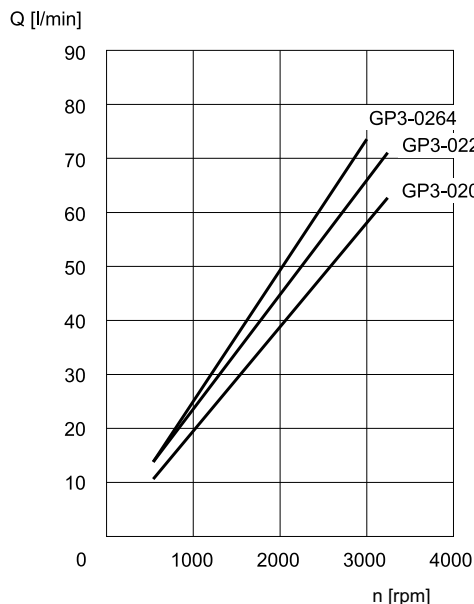
### 5.4 - Absorbed power curves $N=f(n)$ , measured with operating pressures from 50 to 250 bar



### 6 - CURVES AND CHARACTERISTIC DATA OF GROUP GP3 PUMPS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

#### 6.1 - Flow rate curves $Q=f(n)$ obtained with operating pressure 0 bar



#### 6.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0207	0,88	0,83
0225	0,97	0,92
0264	0,90	0,84
0337	0,92	0,87
0394	0,91	0,86
0427	0,92	0,82
0514	0,93	0,83
0600	0,85	0,82
0696	0,95	0,90
0776	0,93	0,87
0876	0,89	0,84

The volumetric and total efficiencies for the various nominal dimensions of the Group GP3 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

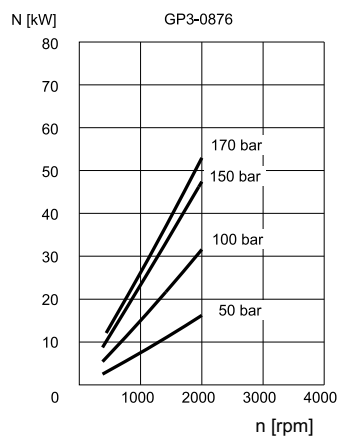
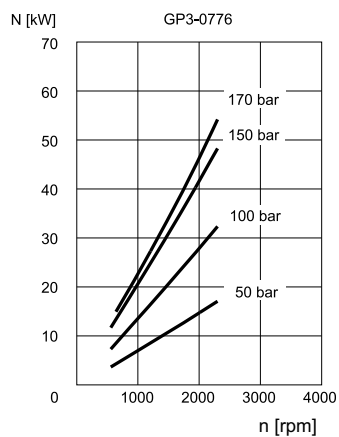
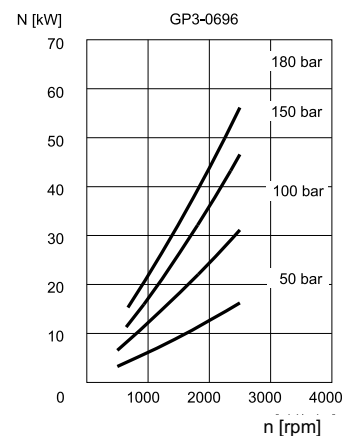
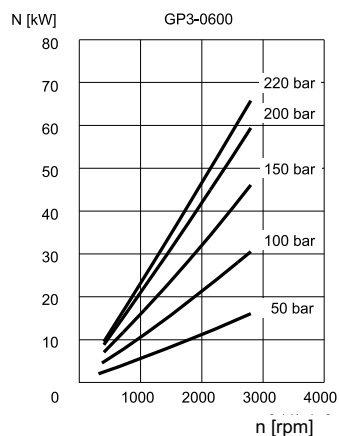
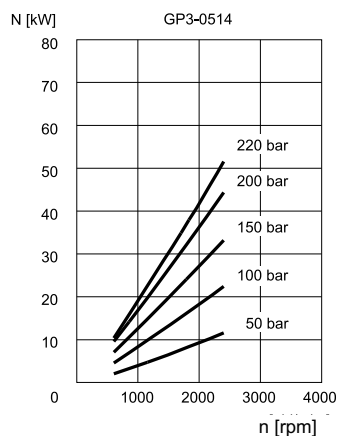
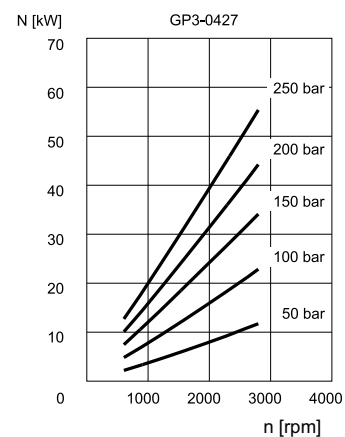
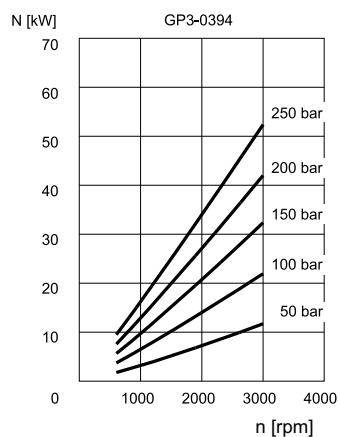
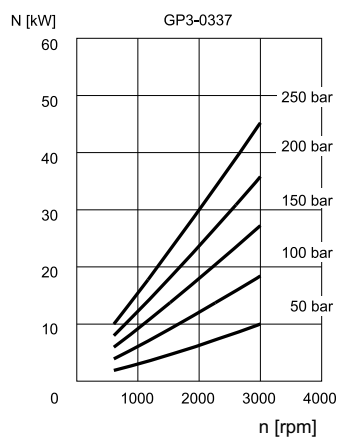
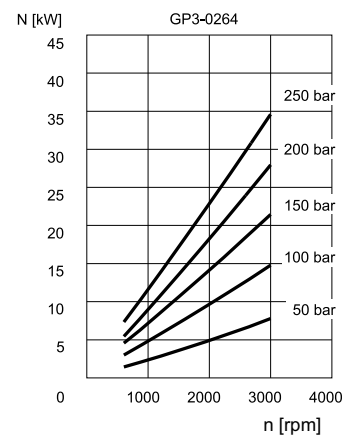
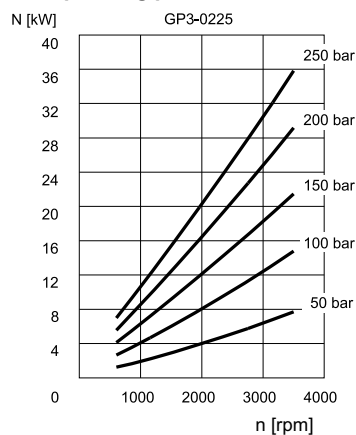
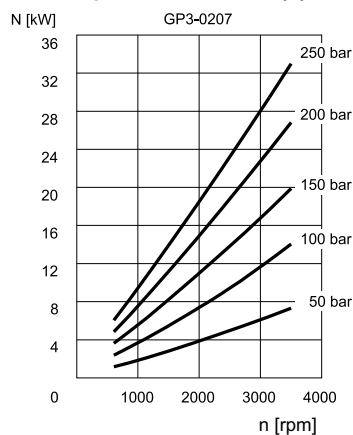
#### 6.3 - Noise level

PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0207	75
0225	75
0264	76
0337	72
0394	72
0427	73
0514	75
0600	77
0696	77
0776	76
0876	78

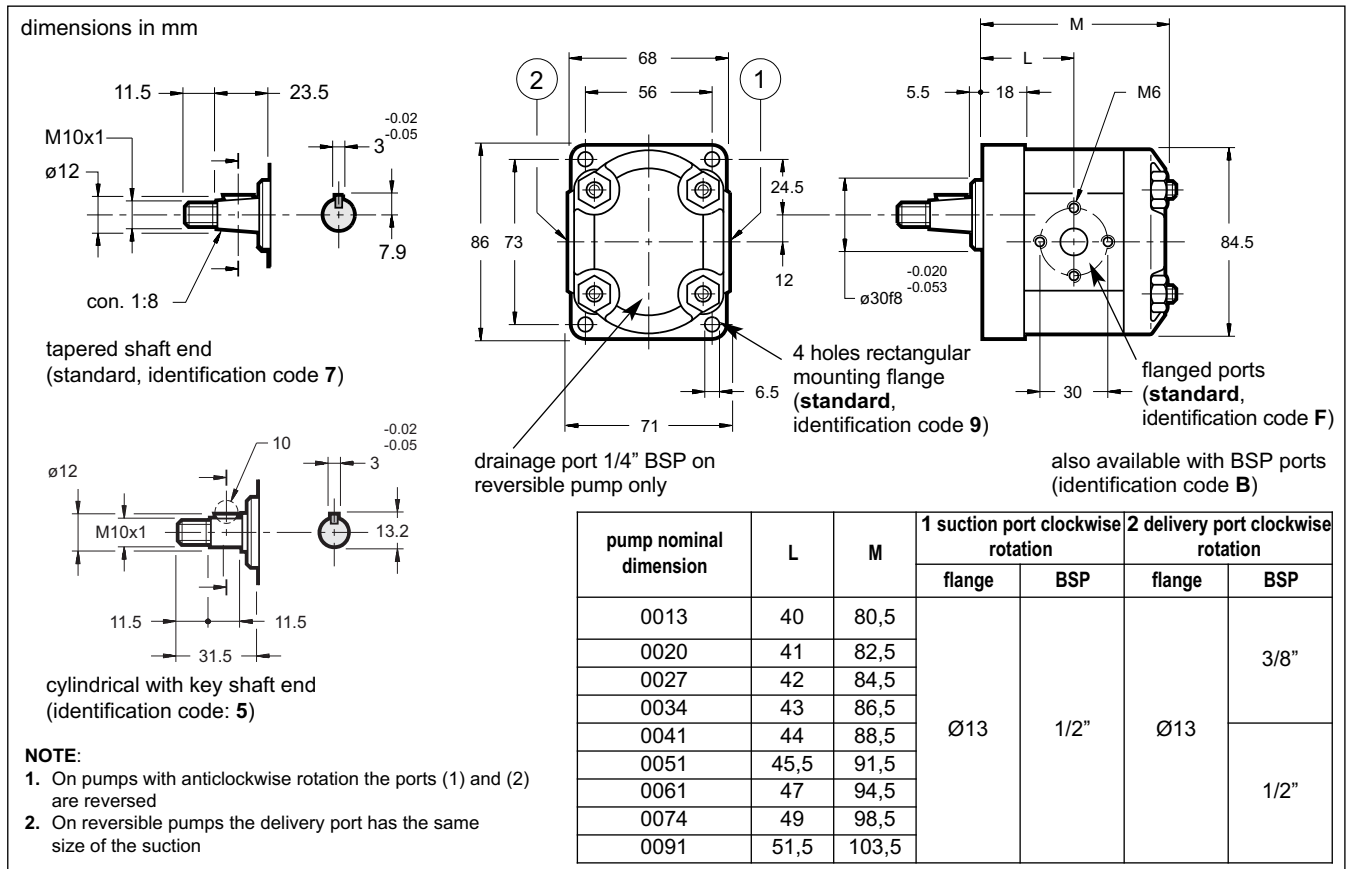
The noise levels for the various nominal dimensions of the Group GP3 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.



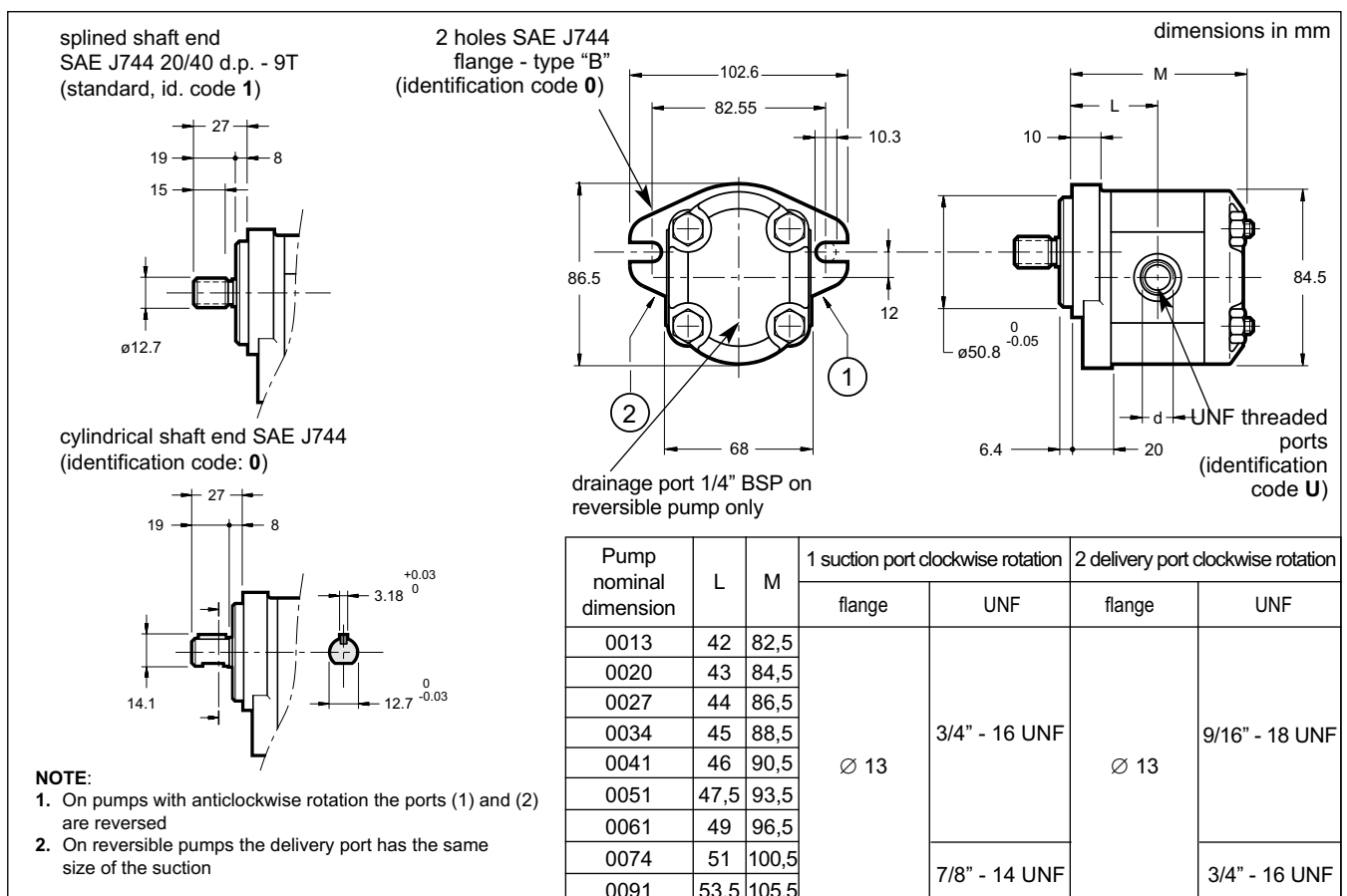
### 6.4 - Absorbed power curves $N=f(n)$ , measured with operating pressures from 50 to 250 bar



## 7 - GROUP GP1 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH STANDARD FLANGE

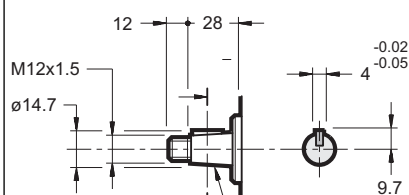


## 8 - GROUP GP1 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH SAE FLANGE

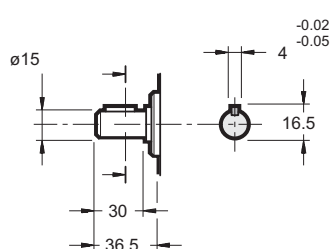


## 9 - GROUP GP2 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH STANDARD FLANGE

dimensions in mm



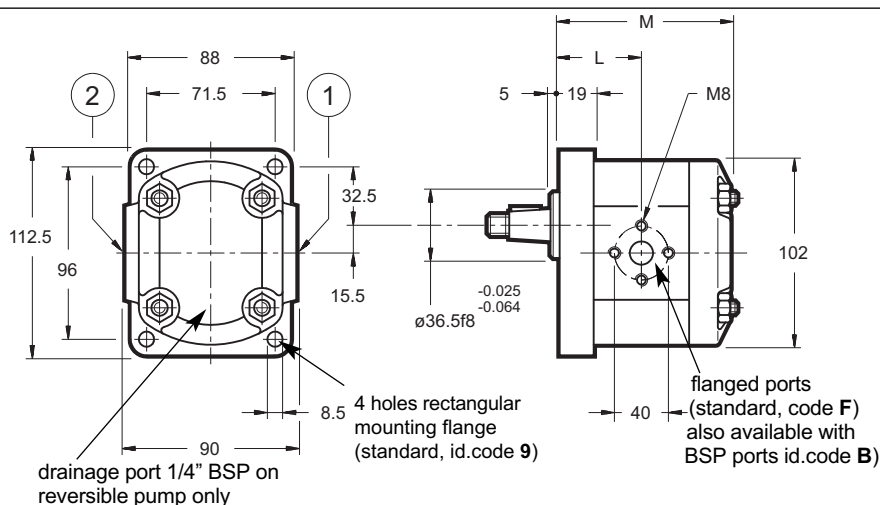
tapered shaft end  
(standard, id. code **7**)



cylindrical with key shaft end  
(id code: 5)

**NOTE:**

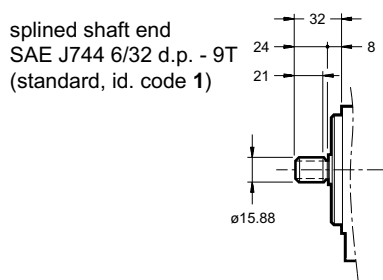
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction



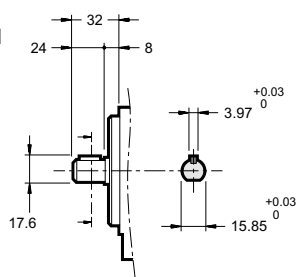
pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	BSP	flange	BSP
0070	47,5	97,5	Ø13	1/2"	Ø13	1/2"
0095	49,5	101,5				
0113	51	104,5	Ø19	3/4"		
0140	53	108,5				
0158	54,5	111,5				
0178	56	114,5				
0218	58,5	119,5				
0234	60,5	123,5			Ø19	
0279	64	130,5				

## 10 - GROUP GP2 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH SAE FLANGE

dimensions in mm

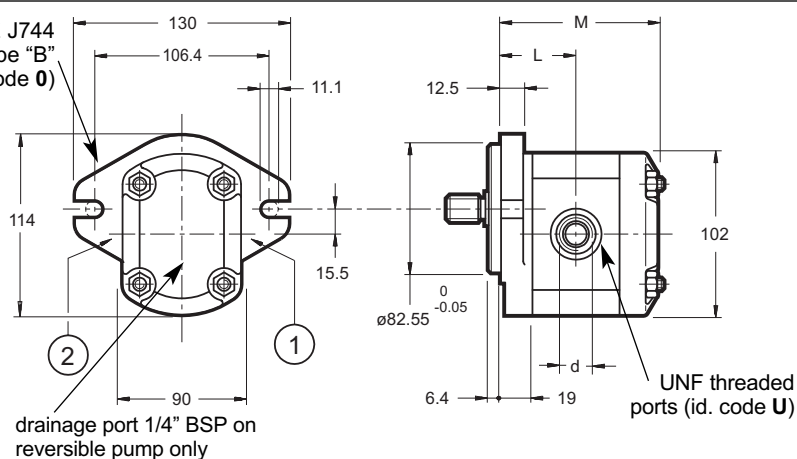


cylindrical shaft end  
SAE J744  
(id. code: **0**)



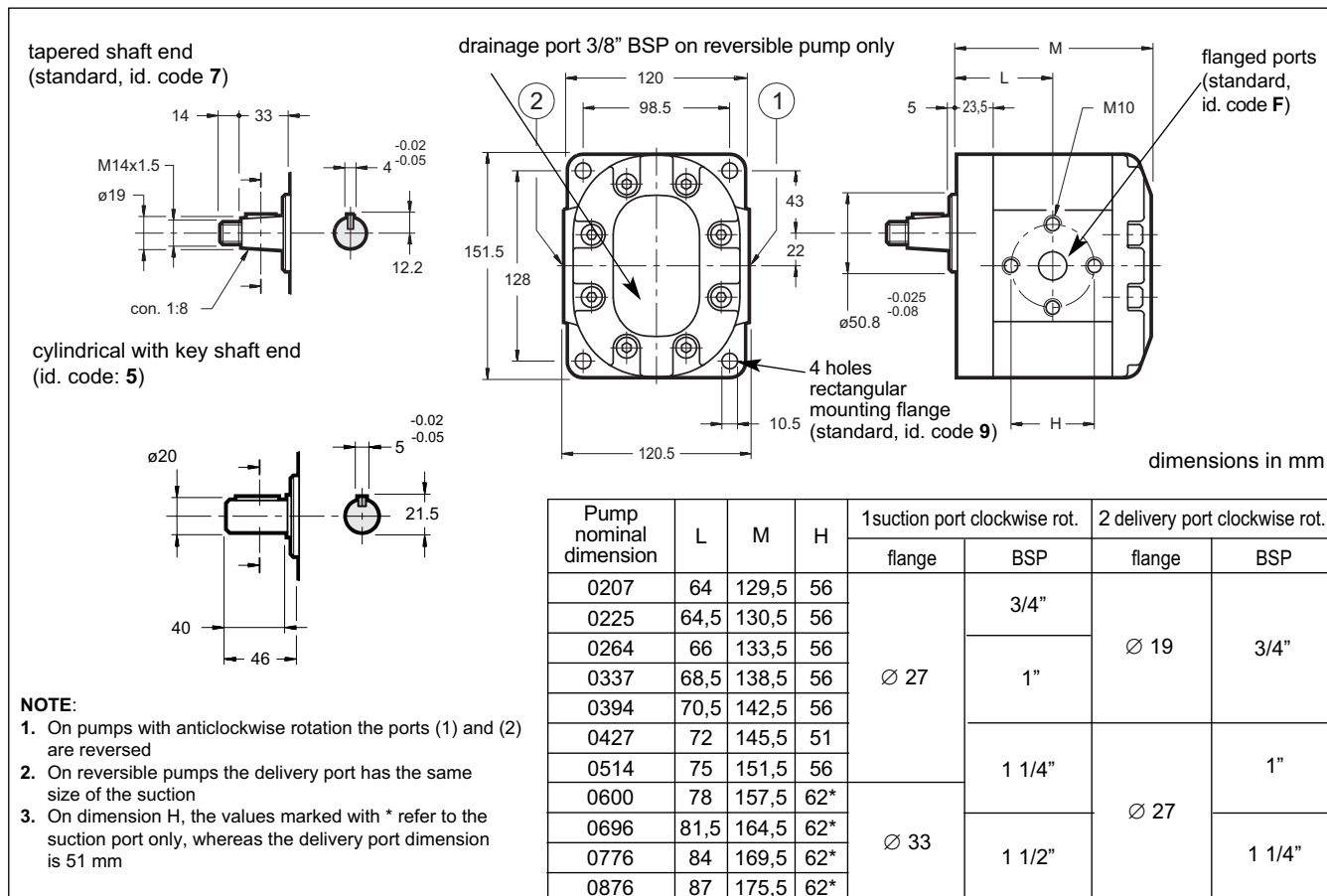
**NOTE:**

1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

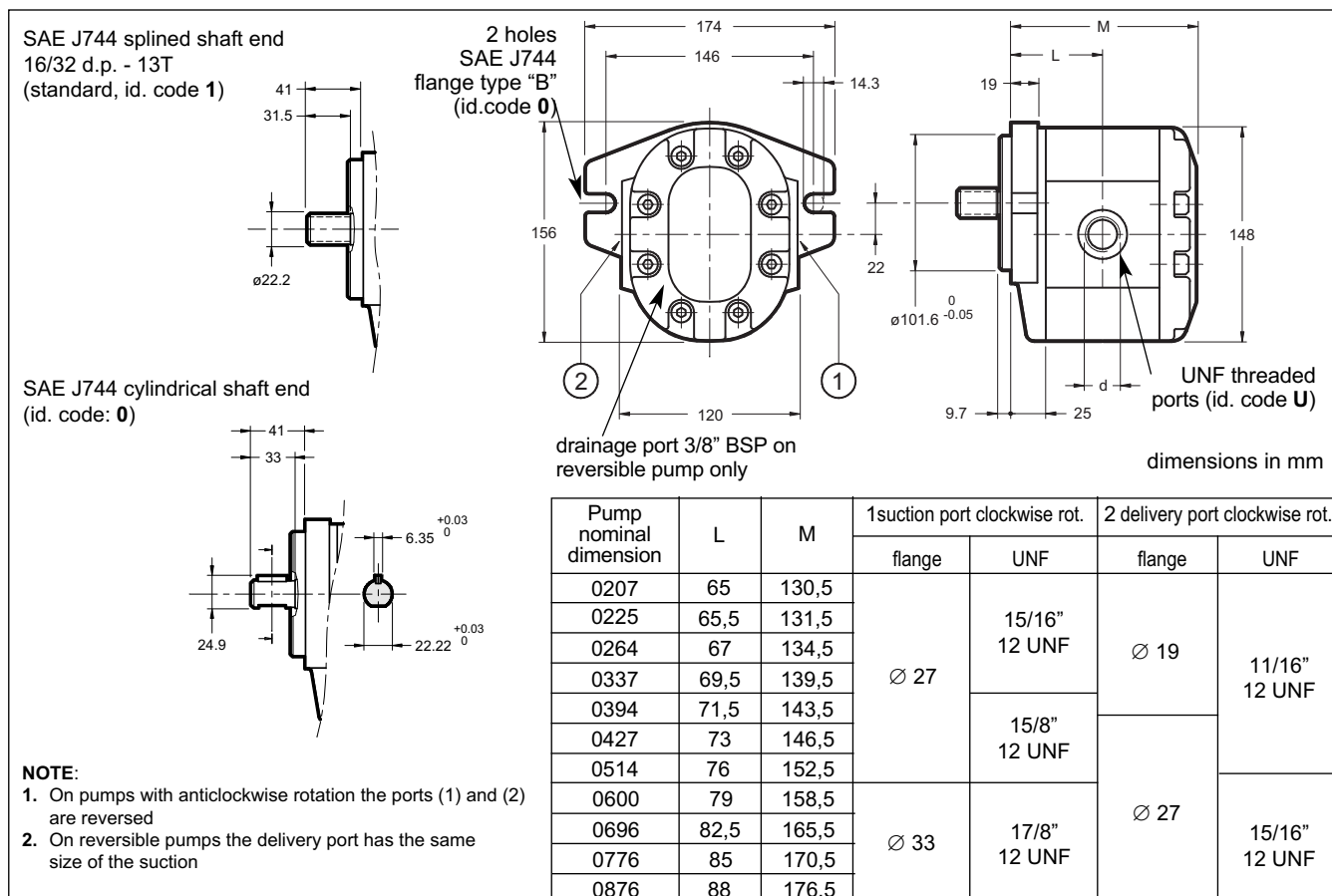


Pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	UNF	flange	UNF
0070	47,5	97,5	Ø 13	11/16” 12 UNF	Ø 13	7/8” 14 UNF
0095	49,5	101,5				
0113	51	104,5				
0140	53	108,5				
0158	54,5	111,5				
0178	56	114,5				
0208	58,5	119,5				
0234	60,5	123,5				
0279	64	130,5				
			Ø 19			

# 11 - GROUP GP3 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH STANDARD FLANGE



# 12 - GROUP GP3 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH SAE FLANGE



### 13 - INSTALLATION

- The GP gear pumps can be installed with the shaft oriented in any position.
- Be sure the control rotation direction corresponds to the direction of the arrow marked on the pump before putting the pump into operation.
- **Before starting, the pump body has to be filled with the fluid.**
- It is necessary to vent the air from the delivery connection before operating it the first time.
- The pump start up, especially at a cold temperature, should occur with the pump unloading.
- The suction line must be suitably sized to facility the flow of the oil. Bends and restrictions or an excessive line length can impede correct operation of the pump. It is advisable that the speed of 1 ÷ 2 m/sec is not exceeded in the suction line.
- The minimum suction pressure allowed is -0,3 bar relative. The pumps can not function with suction pressure.
- The gear pumps must not operate with a rotation rating of less than the minimum rotation speed (see table 3 - performance ratings). They must be filled with the same plant operation oil before installation. Filling is done through the connection lines. If necessary, rotate the pump manually.
- The motor-pump connection must be carried out directly with a flexible coupling able to compensate any offsets. Couplings that generate axial or radial loads on the pump shaft are not allowed.

### 14 - MULTIPLE PUMPS

The possibility to couple several pumps makes it possible to create multi-flow groups with independent hydraulic circuits.

While sizing coupled pumps, it is necessary to make reference to the following conditions:

- The coupling can be carried out between pumps with the same dimensions or to a size of decreasing order.
- The max. rotation speed is determined by the pump with the lowest speed.
- The values of the max. applicable torque can not be exceeded.

#### 14.1 - Maximum applicable torque

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [\text{Nm}]$$

n = rotation speed [rpm]

Q = flow rate [l/min]

where the absorbed power (N) is given by:

$\Delta p$  = differential pressure between the pump suction and delivery [bar]

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{\text{tot}}} = [\text{kW}]$$

$\eta_{\text{tot}}$  = total efficiency (see diagrams in par. 4.2 - 5.2 - 6.2).

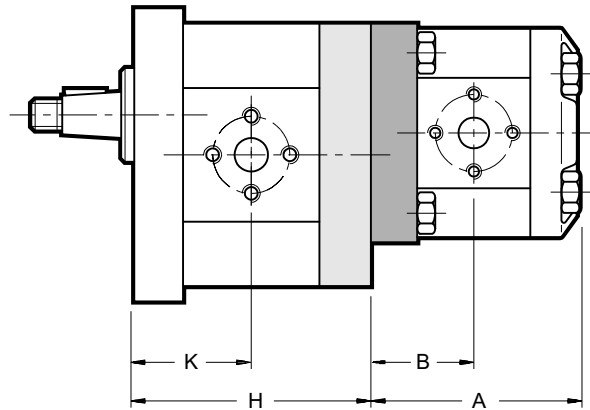
or it can be obtained from the diagrams ABSORBED POWER (see paragraphs 4.4 - 5.4 - 6.4).

If several pumps are coupled, the torque of each single pump has to be added to the torque of subsequent pumps when they are loaded simultaneously.

The obtained torque value for each pump has to be lower than the value specified in the table below.

If the obtained torque values are higher than the ones stated in the table, it is necessary to reduce the working pressure value or to replace the overloaded pump with a pump suitable to bear the required torque.

	MAX TORQUE APPLICABLE TO THE SHAFT OF THE FRONT PUMP [Nm]			MAX APPLICABLE TORQUE [Nm] (not simultaneously to the front pump)		
FRONT PUMP SIZE	tapered shaft with key code <b>7</b>	SAE J744 splined shaft code <b>1</b>	SAE J744 cylindrical shaft cod. <b>0</b>	PUMP TO BE MATED		
				GP1	GP2	GP3
GP1	100	100	60	50	-	-
GP2	200	185	140		100	
GP3	300	600	450			220

**15 - MULTIPLE PUMPS OVERALL DIMENSIONS**


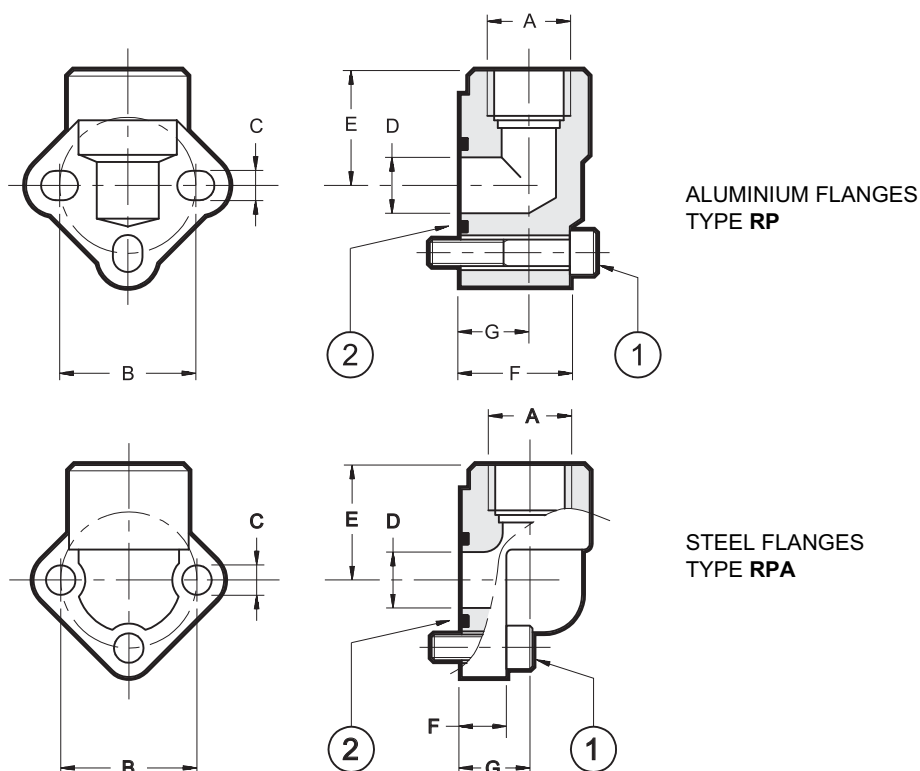
dimensions in mm

PUMP SIZE	NOMINAL SIZE	FRONT PUMP		REAR PUMP	
		H	K	A	B
GP1	0013	86	40	86,5	46
	0020	88	41	88,5	47
	0027	90	42	90,5	48
	0034	92	43	92,5	49
	0041	94	44	94,5	50
	0051	97	45,5	97,5	51,5
	0061	100	47	100,5	53
	0074	104	49	104,5	55
GP2	0091	109	51,5	109,5	57,5
	0070	101	47,5	103,5	53,5
	0095	105	49,5	107,5	55,5
	0113	108	51	110,5	57
	0140	112	53	114,5	59
	0158	115	54,5	117,5	60,5
	0178	118	56	120,5	62
	0208	123	58,5	125,5	64,5
	0234	127	60,5	129,5	66,5
	0279	134	64	136,5	70
GP3	0207	135,5	64	137	71,5
	0225	136,5	64,5	138	72
	0264	139,5	66	141	73,5
	0337	144,5	68,5	146	76
	0394	148,5	70,5	150	78
	0427	151,5	72	153	79,5
	0514	157,5	75	159	82,5
	0600	163,5	78	165	85,5
	0696	170,5	81,5	172	89
	0776	175,5	84	177	91,5
	0876	181,5	87	183	94,5

**NOTE:** For the dimensions of groups composed of three or more pumps, please consult our Technical Dept.

## 16 - CONNECTION FLANGES

dimensions in mm



### ALUMINIUM FLANGES TYPE RP

Fastening bolt and O-rings included

	Flange code	Flange description	$p_{max}$ [bar]	$\varnothing A$	B	C	$\varnothing D$	E	F	G	(1) SHC bolts	(2) seals
GP1	0610506	RP1 - 38	180	3/8" BSP	30	6,5	12,5	30	26	18	n°3 - M6x35	OR 121 (15.88x2.62)
	0610248	RP1 - 12		1/2" BSP	30	6,5	12,5	30	26	18		
GP2	0610508	RP2 - 12		1/2" BSP	40	8,5	18,5	40	31	20	n°3 - M8x45	OR 130 (22.22x2.62)
	0610249	RP2 - 34		3/4" BSP	40	8,5	18,5	40	31	20		
GP3	0610717	RP3 - 34		3/4" BSP	51	10,5	25	46	43	26	n°3 - M10x60	OR 4118 (29.75x3.53)
	0610250	RP3 - 100		1" BSP	56	10,5	25	46	43	26		

### STEEL FLANGES TYPE RPA

	Flange code	Flange description	$p_{max}$ [bar]	$\varnothing A$	B	C	$\varnothing D$	E	F	G	(1) SHC bolts	(2) seals
GP1	0771048	RPA1 - 38	315	3/8" BSP	30	6,5	12	24	17	9,5	n°3 - M6x20	OR 121 (15.88x2.62)
	0771049	RPA1 - 12		1/2" BSP	30	6,5	12	24	17	9,5		
GP2	0771050	RPA2 - 12		1/2" BSP	40	8,5	20	36	22	11,5	n°3 - M8x25	OR 132 (23.81x2.62)
	0770615	RPA2 - 34		3/4" BSP	40	8,5	20	36	22	11,5		
GP3	0771051	RPA3 - 34A		3/4" BSP	51	10,5	24	46	26	13	n°3 - M10x30	OR 3125 (31.42x2.62)
	0770617	RPA3 - 100A		1" BSP	51	10,5	24	46	26	13		
	0770618	RPA3 - 34B		3/4" BSP	56	10,5	24	46	26	13		
	0770619	RPA3 - 100B		1" BSP	56	10,5	24	46	26	13		
	0771052	RPA35 - 114A		1" 1/4 BSP	62	13	31	55	35	17	n°3 - M10x35	

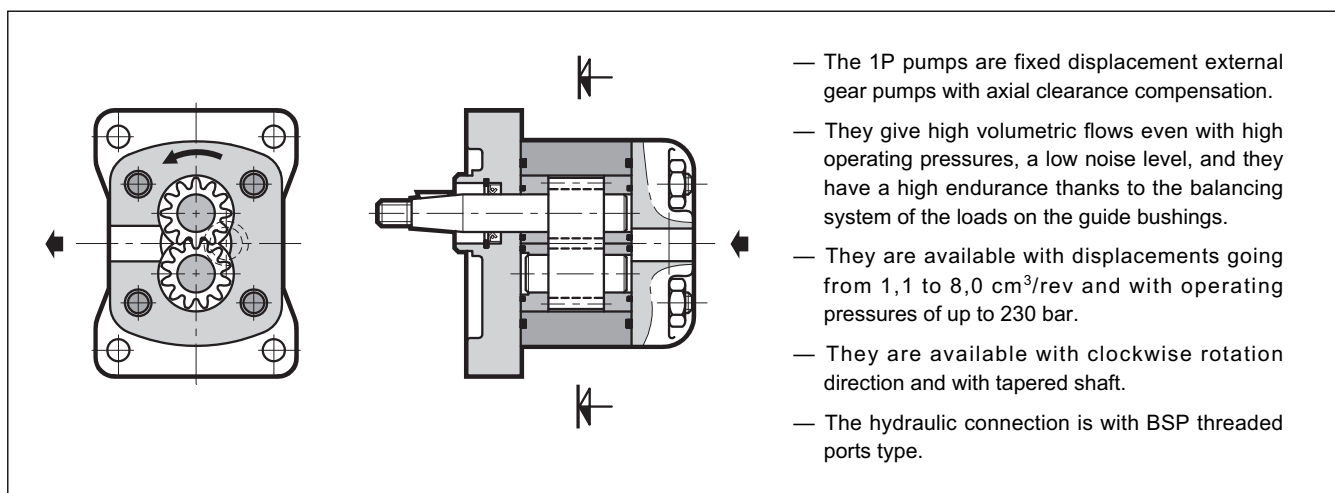


# 1P

## EXTERNAL GEAR PUMPS

### SERIES 11

#### OPERATING PRINCIPLE

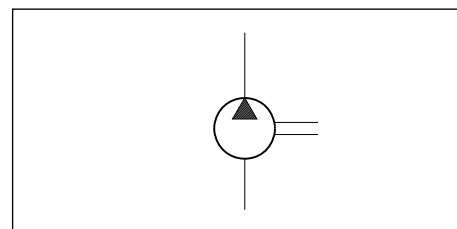


#### TECHNICAL SPECIFICATIONS

PUMP SIZE		1P
Displacement range	cm <sup>3</sup> /rev	1,1 ÷ 8,0
Flow rate and operating pressures		see table 3 - Performances
Rotation speed		see table 3 - Performances
Rotation direction		clockwise (seen from the shaft side)
Loads on the shaft		radial and axial load are not allowed
Hydraulic connection		threaded ports BSP
Type of mounting		4 hole flange - rectangular type
Mass	kg	approx. 1,6

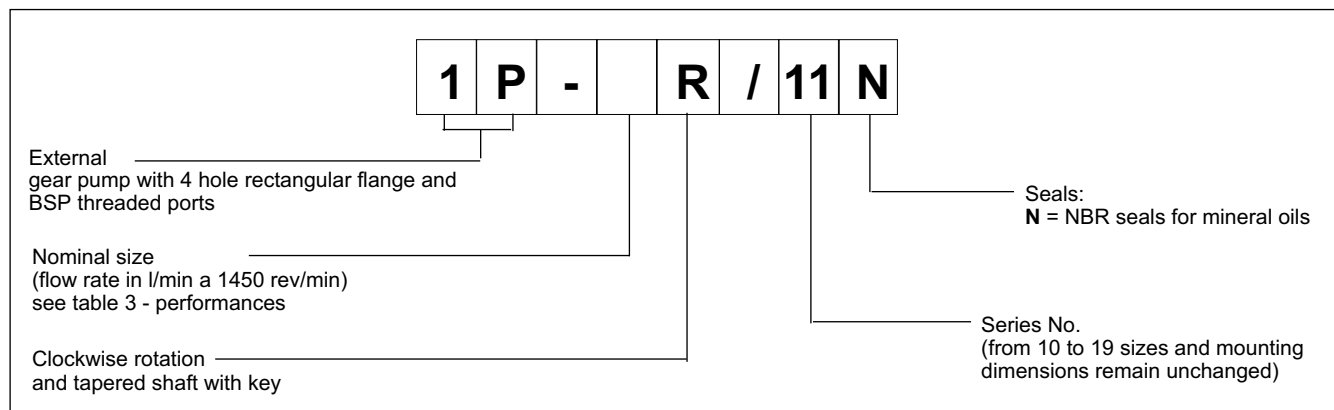
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-15 / +80
Fluid viscosity range	see par. 2.2	
Recommended viscosity	cSt	25 ÷ 100
Degree of fluid contamination	see par. 2.3	

#### HYDRAULIC SYMBOL





### 1 - CODIFICATION



### 2 - HYDRAULIC FLUID

#### 2.1 Type of fluid

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives, in conformity with the requisites of the following standards:  
 - FZG test - 11th stage      - DIN 51525      - VDMA 24317

For use with other types of fluid (water glycol, phosphate esters and others), consult our technical dept.

Operation with fluid at a temperature greater than 80°C causes a premature deterioration of the fluid quality and of the seals. The physical and chemical properties of the fluid must be maintained.

#### 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	12 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1600 cSt	limited to only the start-up phase of the pump

#### 2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with  $\beta_{20} \geq 75$  is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with  $\beta_{10} \geq 100$  is recommended.

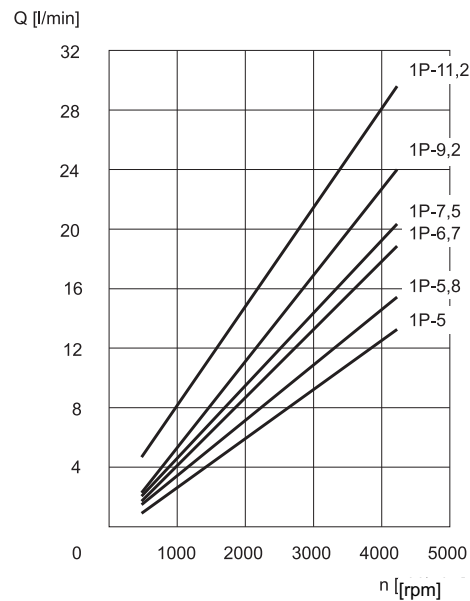
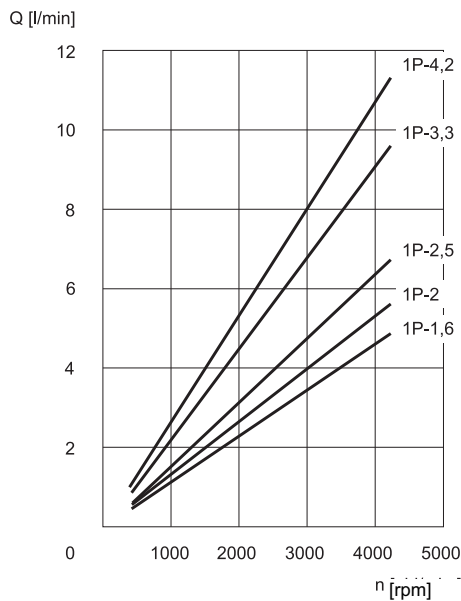
If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 6. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

### 3 - PERFORMANCES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

PUMP SIZE	NOMINAL SIZE	DISPALCEMENT [cm³/rev]	MAX. FLOW RATE (at 1500 rpm) [l/min.]	MAX. OPERATING PRESSURE (ar 1500 rpm) [bar]	MAX. PEAK PRESSURE (at 1500 rpm.) [bar]	MAX. ROTATION SPEED [rpm]	MIN. ROTATION SPEED [rpm]
1P	1,6	1,1	1,6	230	270	6000	1000
	2	1,3	2,0				
	2,5	1,6	2,4				
	3,3	2,1	3,2				
	4,2	2,7	4,0	210	250	5000 4500 4000	800
	5	3,2	4,8				
	5,8	3,7	5,6				
	6,7	4,2	6,4				
	7,5	4,8	7,2	190	230	3500	600
	9,2	5,8	8,7			3000	
	11,5	8,0	11,9	160	200	2100	

## 4 - CURVES AND CHARACTERISTIC DATA OF GROUP 1P PUMPS (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

### 4.1 - Flow rate curves $Q=f(n)$ obtained with operating pressure 0 bar



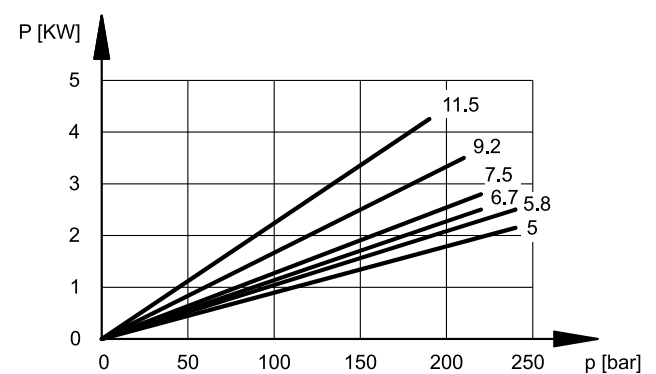
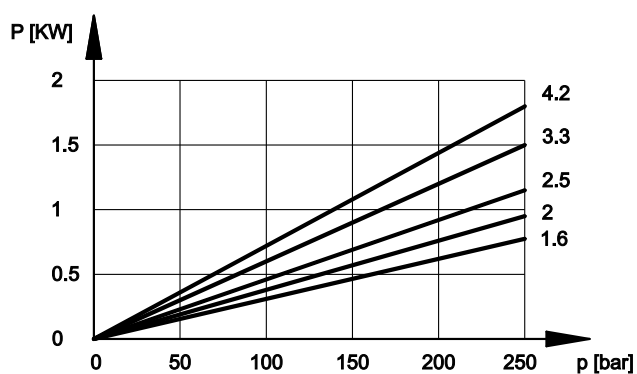
### 4.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
1,6	0,96	0,85
2	0,94	0,87
2,5	0,94	0,87
3,3	0,96	0,90
4,2	0,96	0,90
5	0,96	0,90
5,8	0,96	0,89
6,7	0,97	0,92
7,5	0,97	0,93
9,2	0,95	0,89
11,5	0,94	0,89

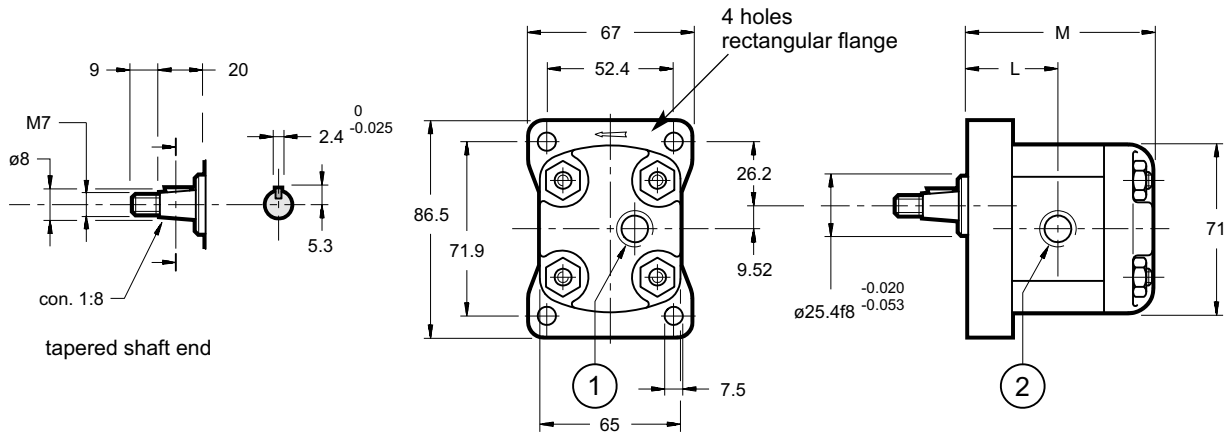
### 4.3 - Noise level (at 1500 rpm)

PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
1,6	55
2	58
2,5	58
3,3	60
4,2	65
5	66
5,8	66
6,7	68
7,5	72
9,2	72
11,5	74

### 4.4 - Absorbed power / pressure (at 1500 rpm)



## 5 - OVERALL AND MOUNTING DIMENSIONS

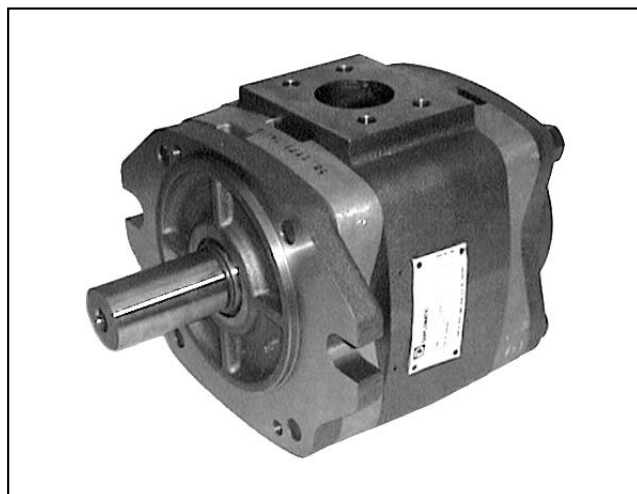


dimensions in mm

Pump code	Pump nominal dimension	L	M	1	2
0710842	1P-1,6	34	75	suction port: 3/8" BSP  clockwise rotation direction	delivery port: 3/8" BSP  clockwise rotation direction
0710843	1P-2	34,5	76		
0710844	1P-2,5	35	77		
0710845	1P-3,3	36	79		
0710846	1P-4,2	37	81		
0710847	1P-5	38	83		
0710848	1P-5,8	39	85		
0710849	1P-6,7	40	87		
0710850	1P-7,5	41	89		
0710851	1P-9,2	43	93		
0710852	1P-11,5	47	101		

## 6 - INSTALLATION

- The 1P gear pumps can be installed with the shaft oriented in any position.
- Be sure the control rotation direction corresponds to the direction of the arrow marked on the pump before putting the pump into operation.
- It is necessary to vent the air from the delivery connection before operating it the first time.
- The pump start up, especially at a cold temperature, should occur with the pump unloading.
- The suction line must be suitably sized to facility the flow of the oil. Bends and restrictions or an excessive line length can impede correct operation of the pump. It is advisable that the speed of  $1 \div 2$  m/sec is not exceeded in the suction line.
- The minimum suction pressure allowed is  $-0,3$  bar relative. The pumps can not function with suction pressure.
- The gear pumps must not operate with a rotation rating of less than the minimum rotation speed (see table 3 - performances). They must be filled with the same plant operation oil before installation. Filling is done through the connection lines. If necessary, rotate the pump manually.
- The motor-pump connection must be carried out directly with a flexible coupling able to compensate any offsets. Couplings that generate axial or radial loads on the pump shaft are not allowed.

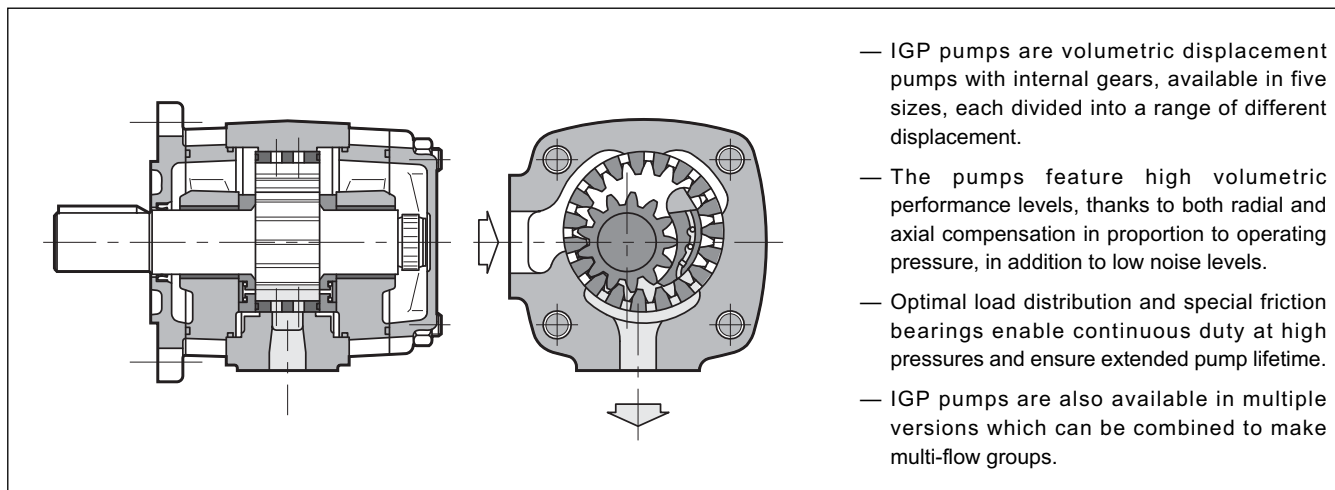


# IGP

## INTERNAL GEAR PUMPS

### SERIES 10

#### OPERATING PRINCIPLE

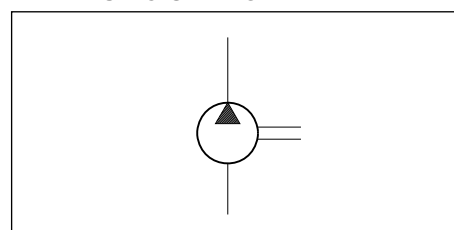


#### TECHNICAL SPECIFICATIONS

IGP PUMP SIZE		3	4	5	6	7
Displacement range	cm <sup>3</sup> /rev	3,6 ÷ 10,2	13,3 ÷ 32,6	33,1 ÷ 64,9	64,1 ÷ 126,2	125,8 ÷ 251,7
Flow rate range (at 1.500 rpm)	l/min.	5,4 ÷ 15,3	19,9 ÷ 48,9	49,6 ÷ 97,3	96,1 ÷ 189,3	188,7 ÷ 377,5
Operating pressures		see table 3 - performances				
Rotation speed		see table 3 - performances				
Rotation direction		clockwise or anticlockwise (seen from the shaft side)				
Loads on the shaft		consult our technical department for the extent of axial and radial loads				
Hydraulic connection		flanged fittings SAE J518 c code 61 (see par. 28)				
Type of fastening		flanged SAE J744 c				
Mass (single pump)	kg	4 ÷ 4,8	8,6 ÷ 11	15,5 ÷ 18,7	29,2 ÷ 35	46,5 ÷ 59

Ambient temperature range	°C	−10 / +60
Fluid temperature range	°C	−10 / +80
Fluid viscosity range	see par. 2.2	
Recommended true viscosity	cSt	25 ÷ 100
Degree of fluid contamination	see par. 2.3	

#### HYDRAULIC SYMBOL



## 1 - IDENTIFICATION CODE

**I G P**   **-**   **/**   **-**   **/**   **10**

Internal gear pump

Pump size: \_\_\_\_\_  
 - single pump  
 - front pump (only for double pumps):

3	= from	3,6 to	10,2 cm³/rev
4	= from	13,3 to	32,6 cm³/rev
5	= from	33,1 to	64,9 cm³/rev
6	= from	64,1 to	126,2 cm³/rev
7	= from	125,8 to	251,7 cm³/rev

Added pump size \_\_\_\_\_  
 (only for double pumps):

3	= from	3,6 to	10,2 cm³/rev
4	= from	13,3 to	32,6 cm³/rev
5	= from	33,1 to	64,9 cm³/rev
6	= from	64,1 to	126,2 cm³/rev
7	= from	125,8 to	251,7 cm³/rev

Size: \_\_\_\_\_  
 - single pump  
 - front pump (only for double pumps)  
 (see performances table, par. 3)

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Type of shaft end  
**1** = with key  
 other types of shafts are available upon request

Mounting flange  
**0** =type SAE - 2  
**1** =type SAE - 4 (only for IGP7)  
 other flange types are available upon request

Rotation direction (seen from the shaft side)  
**R** = clockwise    **L** = anticlockwise

Added pump size:  
 (only for double pumps)  
 (see performances table, par. 3)

## 2 - HYDRAULIC FLUID

## 2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives.

For use with other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solution with proportion of water ≤ 40 %)	<ul style="list-style-type: none"> <li>- The performances shown in the table in par. 3 must be reduced of 20%.</li> <li>- The maximum speed of the fluid in the suction line must not exceed 1 m/s.</li> <li>- The suction pressure must not be less than 0,8 bar absolute.</li> <li>- The maximum fluid temperature must be less than 50°C.</li> </ul>
HFD (phosphate esters)	Operation with this type of fluid is not allowed.

## 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the fluid working temperature in the tank
maximum viscosity	2000 cSt	limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

### 2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with  $\beta_{20} \geq 75$  is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with  $\beta_{10} \geq 100$  is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 3. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.



### 3 - PERFORMANCES (obtained with mineral oil with viscosity in the range of 25 ÷ 100 cSt)

PUMP SIZE	NOMINAL DIMENSION	DISPLACEMENT [cm³/rev] (note 2)	MAX. FLOW RATE (at 1500 rpm) [l/min.]	PRESSURE [bar] (note 3) steady/peak		MAX. ROTATION SPEED [rpm]	MIN. ROTATION SPEED [rpm] (note 4)
IGP3	003	3,6	5,4	330	345	3600	400
	005	5,2	7,8				
	006	6,4	9,6				
	008	8,2	12,3				
	010	10,2	15,3				
IGP4	013	13,3	19,9	330	345	3600	400
	016	15,8	23,7			3400	
	020	20,7	31,0			3200	
	025	25,4	38,1	300	330	3000	
	032	32,6	48,9	250	280	2800	
IGP5	032	33,1	49,6	315	345	3000	400
	040	41	61,5			2800	
	050	50,3	75,4	280	315	2500	
	064	64,9	97,3	230	250	2200	
IGP6	064	64,1	96,1	300	330	2600	400
	080	80,7	121,0	280	315	2400	
	100	101,3	151,9	250	300	2100	
	125	126,2	189,3	210	250	1800	
IGP7	125	125,8	188,7	300	330	2200	400
	160	160,8	241,2	280	315	2000	
	200	202,7	304,0	250	300	1800	
	250	251,7	377,5	210	250		

Note 1) In continuous operating conditions, the maximum suction pressure is 2 bar while the minimum pressure must not be less than -0,2 bar. A minimum suction pressure of - 0,4 bar is allowed for brief periods of time (the pressure values are to be considered relative).

Note 2) The working tolerances can reduce the displacement by 1,5% max. The flow rate at 1500 rpm shown in the table considers operation with pressure of 10 bar.

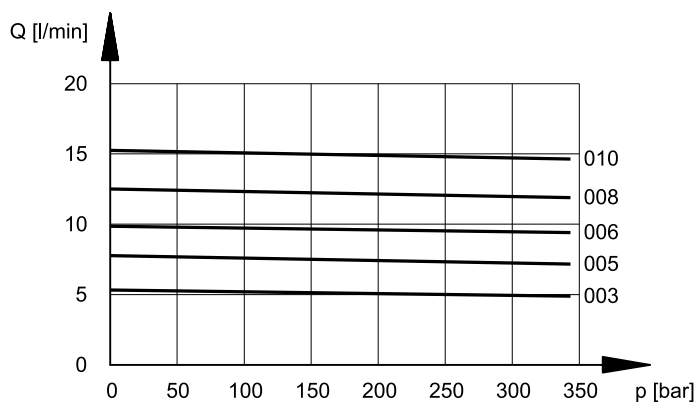
Note 3) The steady and peak pressures shown above are valid in the speed range of 400-1500 rpm. For speeds greater than 1500 rpm, the extent of the peak pressure must be reduced.

Note 4) For use at variable speed in the range less than 400 rpm or greater than 1500 rpm, there are limitations of the allowable pressures. Contact our technical department for applications outside this range.

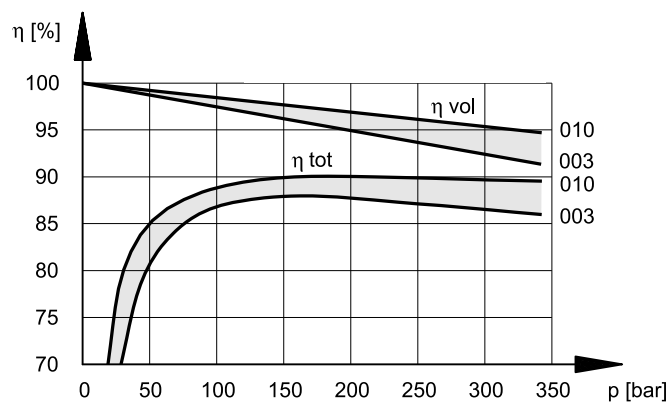
### 4- IGP3 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

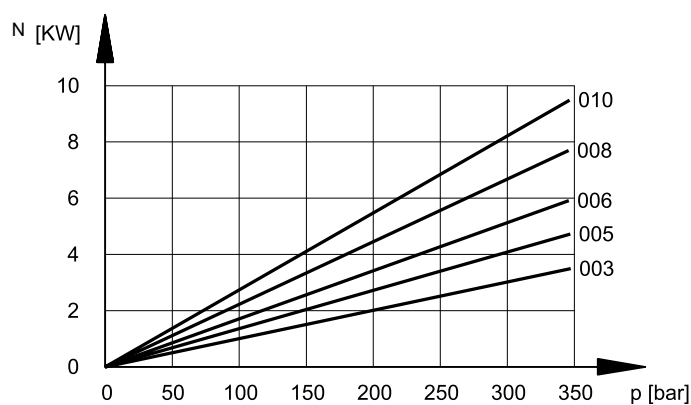
#### FLOW RATE/PRESSURE CURVES



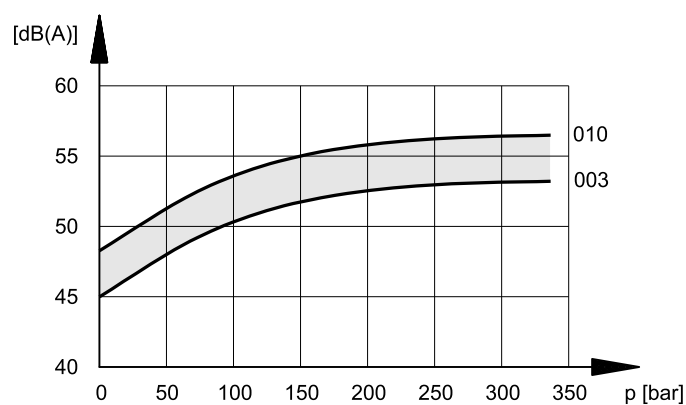
#### VOLUMETRIC AND TOTAL EFFICIENCY



#### ABSORBED POWER



#### NOISE LEVEL



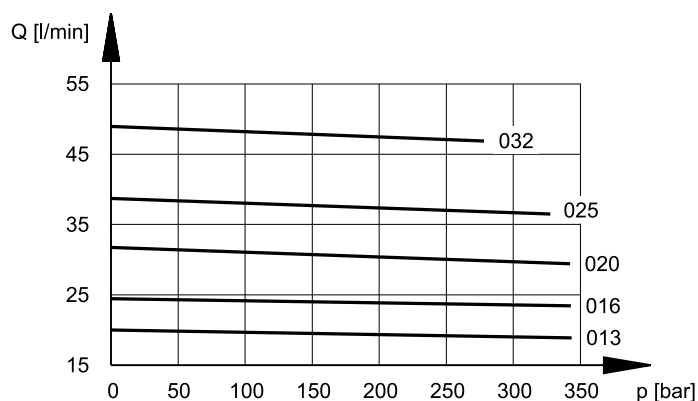
The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.

The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

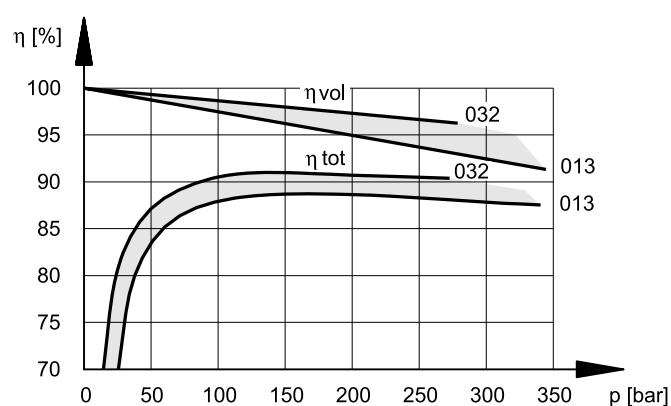
## 5- IGP4 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

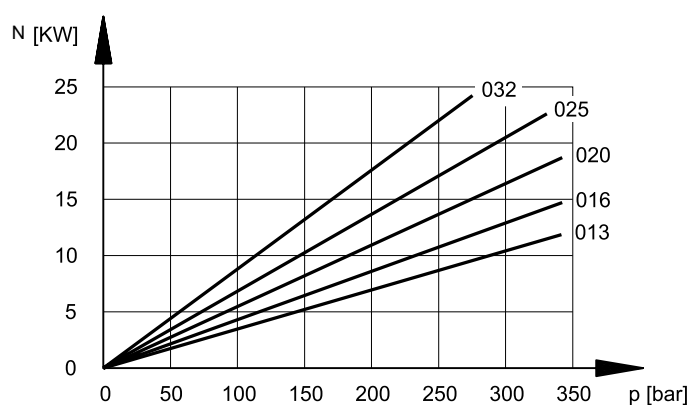
### FLOW RATE/PRESSURE CURVES



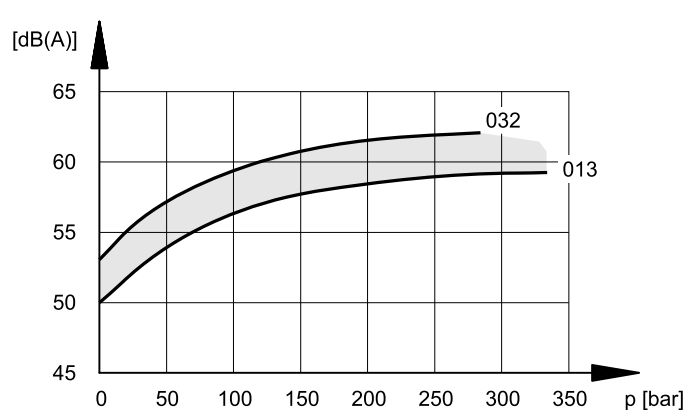
### VOLUMETRIC AND TOTAL EFFICIENCY



### ABSORBED POWER



### NOISE LEVEL



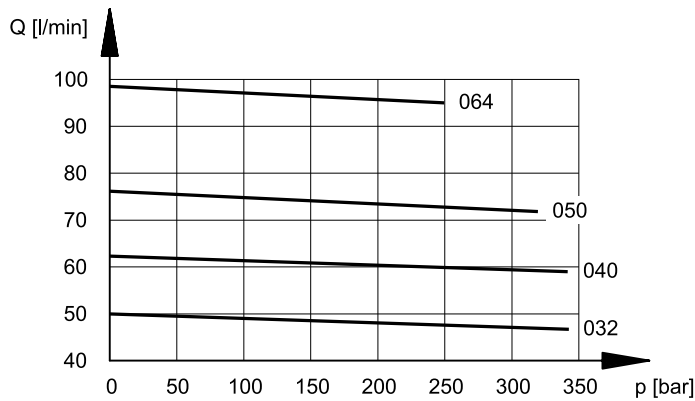
The noise pressure levels were measured in a semi-anechoic room, at an axial distance of 1 m from the pump.  
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.



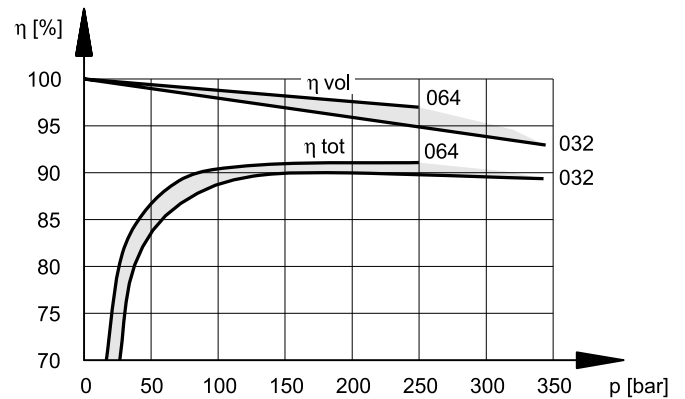
## 6- IGP5 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

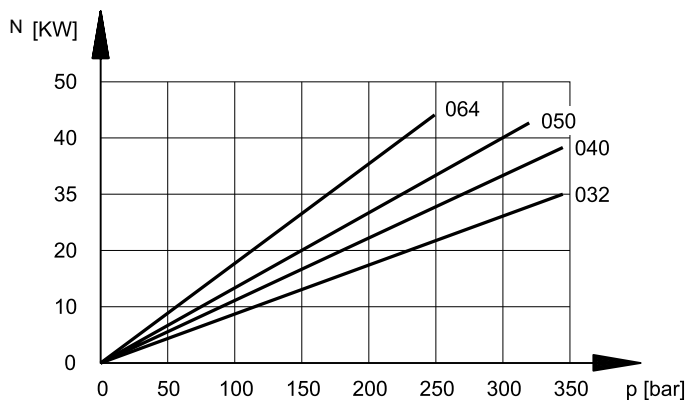
### FLOW RATE/PRESSURE CURVES



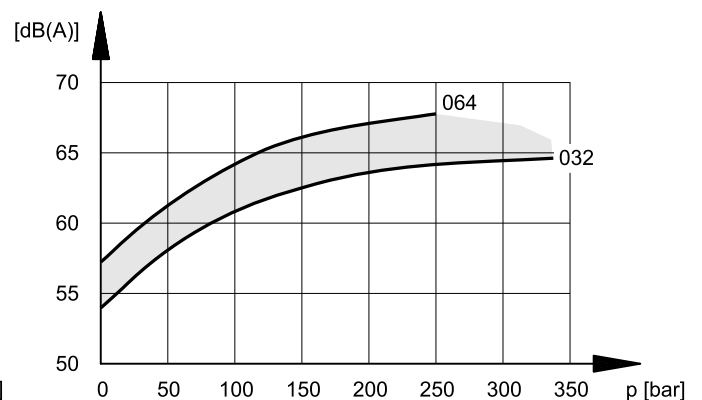
### VOLUMETRIC AND TOTAL EFFICIENCY



### ABSORBED POWER



### NOISE LEVEL



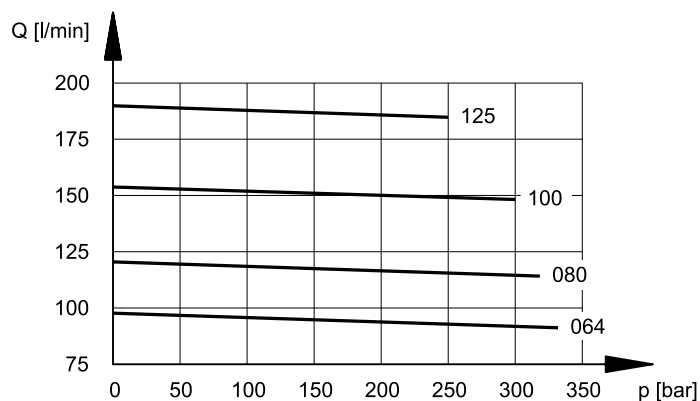
The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.

The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

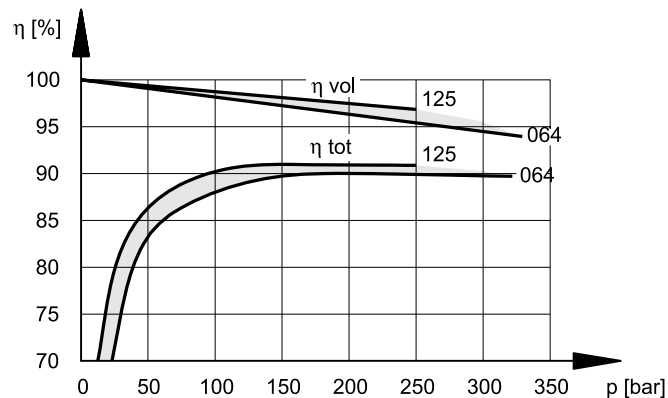
## 7- IGP6 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

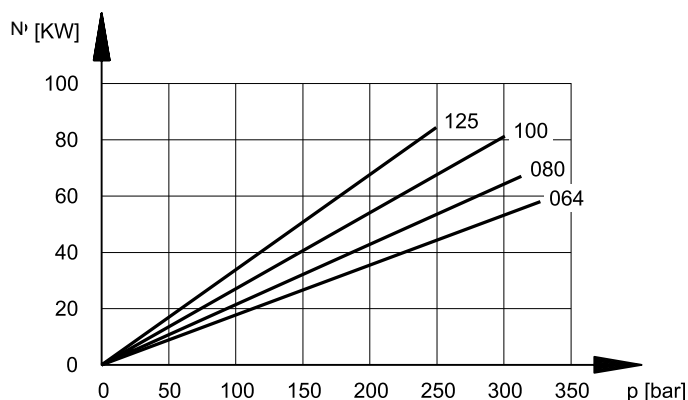
### FLOW RATE/PRESSURE CURVES



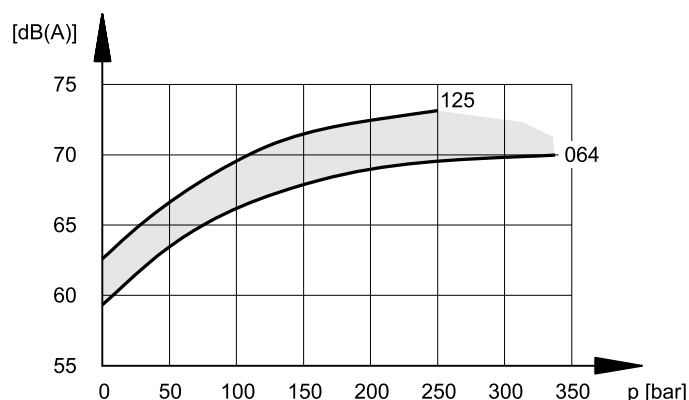
### VOLUMETRIC AND TOTAL EFFICIENCIES



### ABSORBED POWER



### NOISE LEVEL



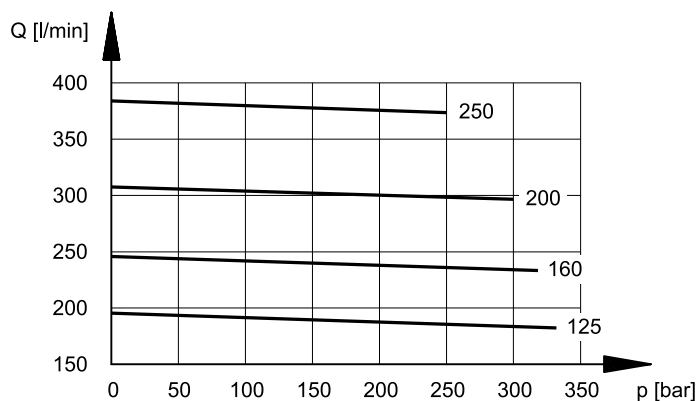
The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.

The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

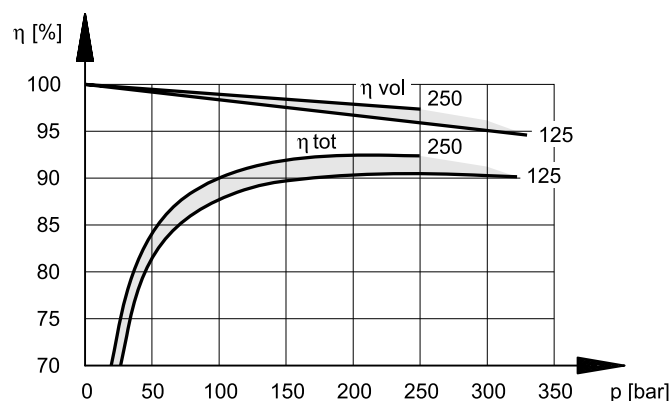
## 8- IGP7 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

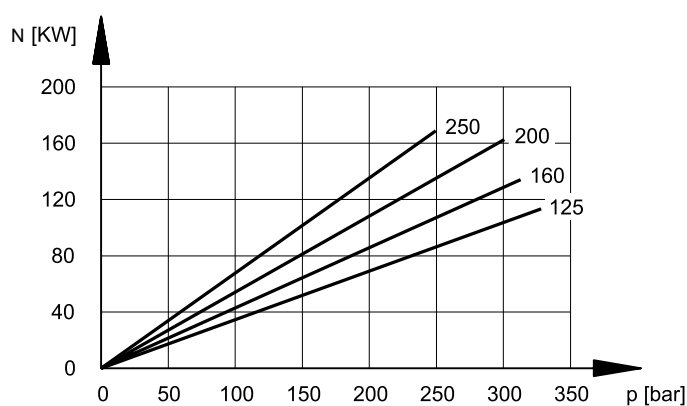
### FLOW RATE/PRESSURE CURVES



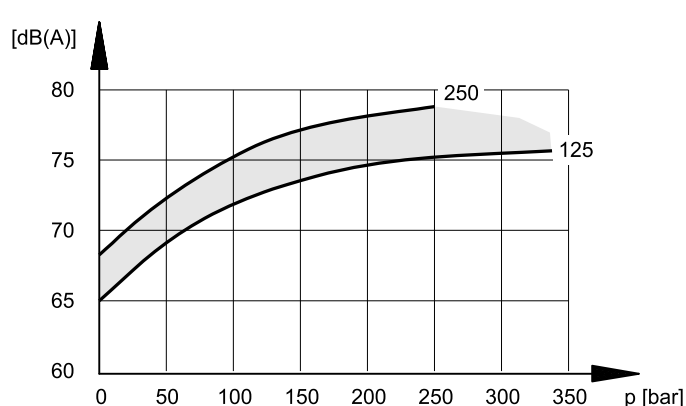
### VOLUMETRIC AND TOTAL EFFICIENCY



### ABSORBED POWER



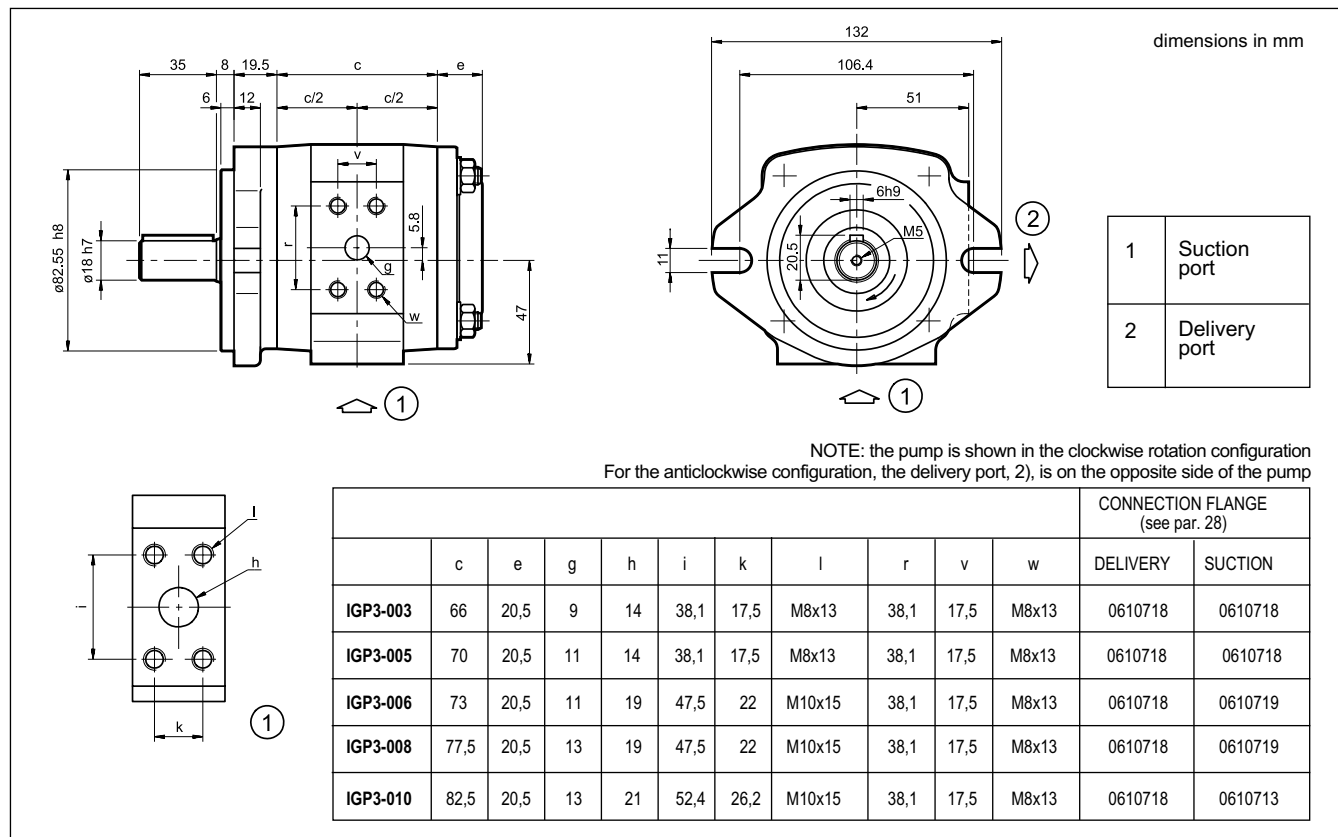
### NOISE LEVEL



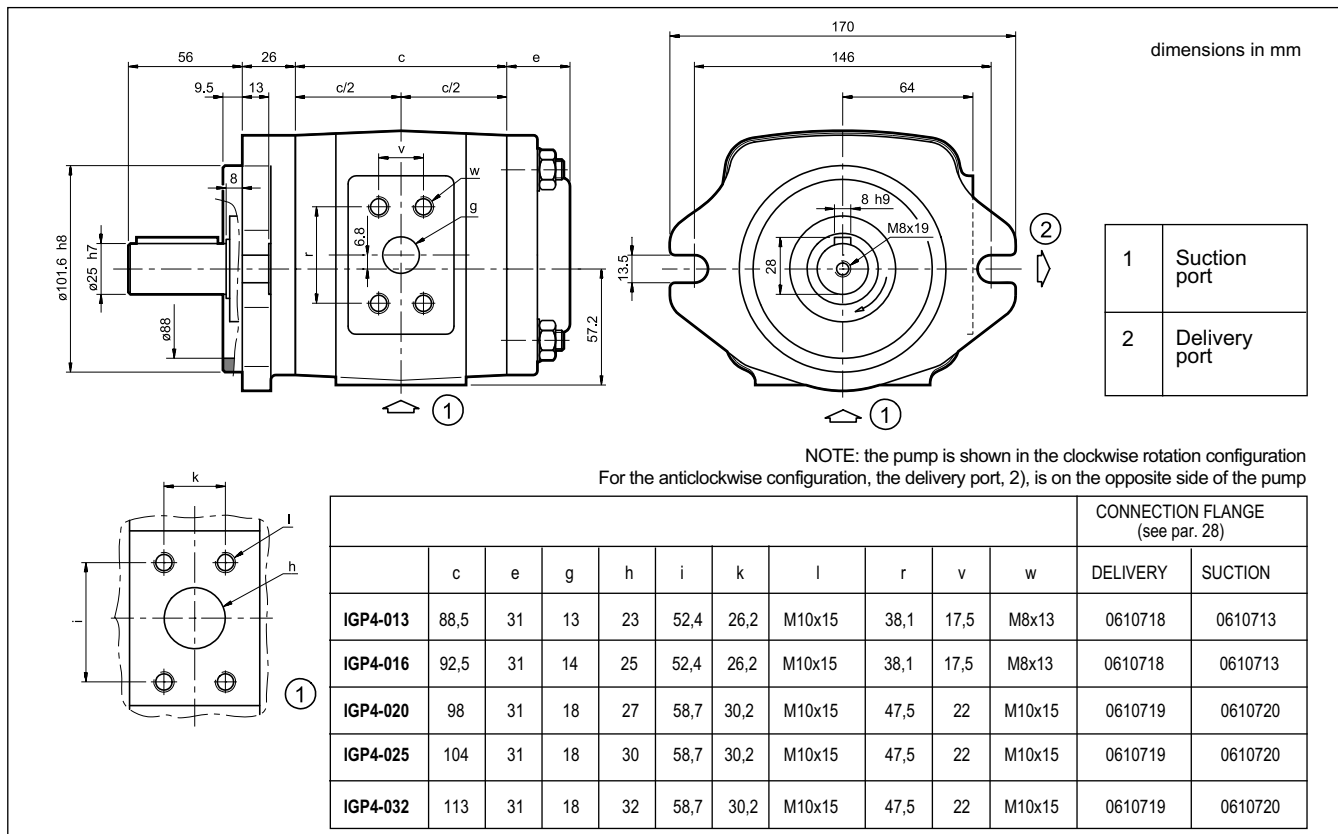
The noise pressure levels were measured in a semi-anechoic room, at an axial distance of 1 m from the pump.

The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

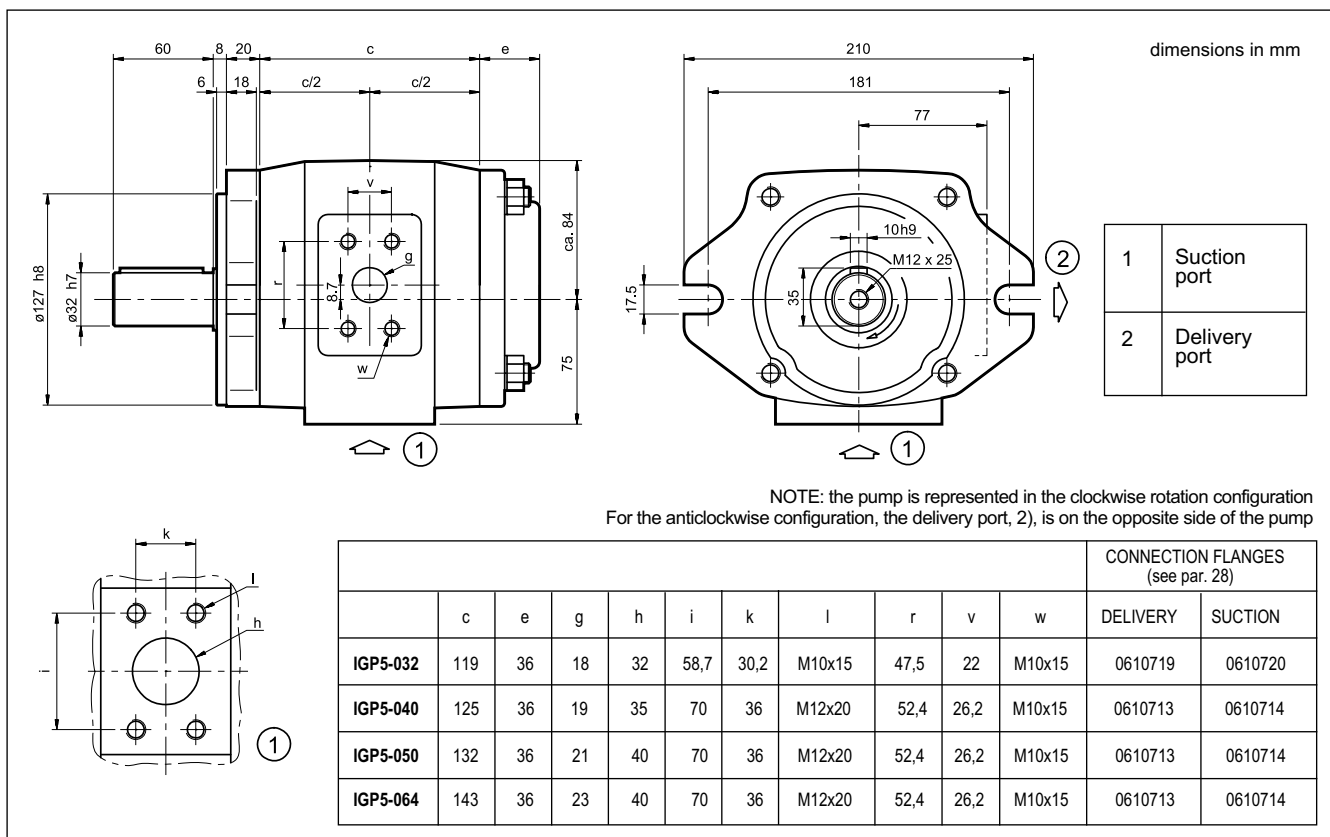
## 9 - IGP3 PUMP OVERALL AND MOUNTING DIMENSIONS



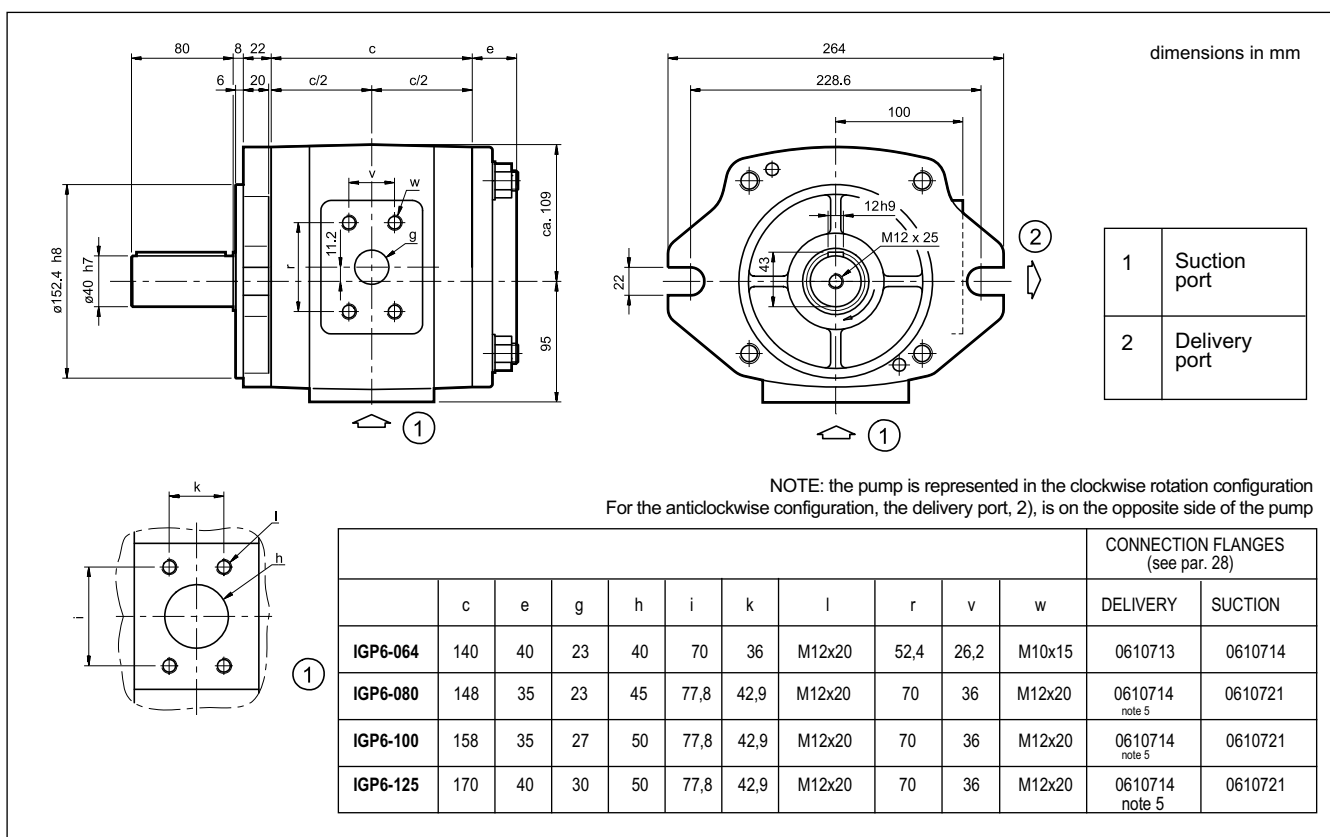
## 10 - IGP4 PUMP OVERALL AND MOUNTING DIMENSIONS



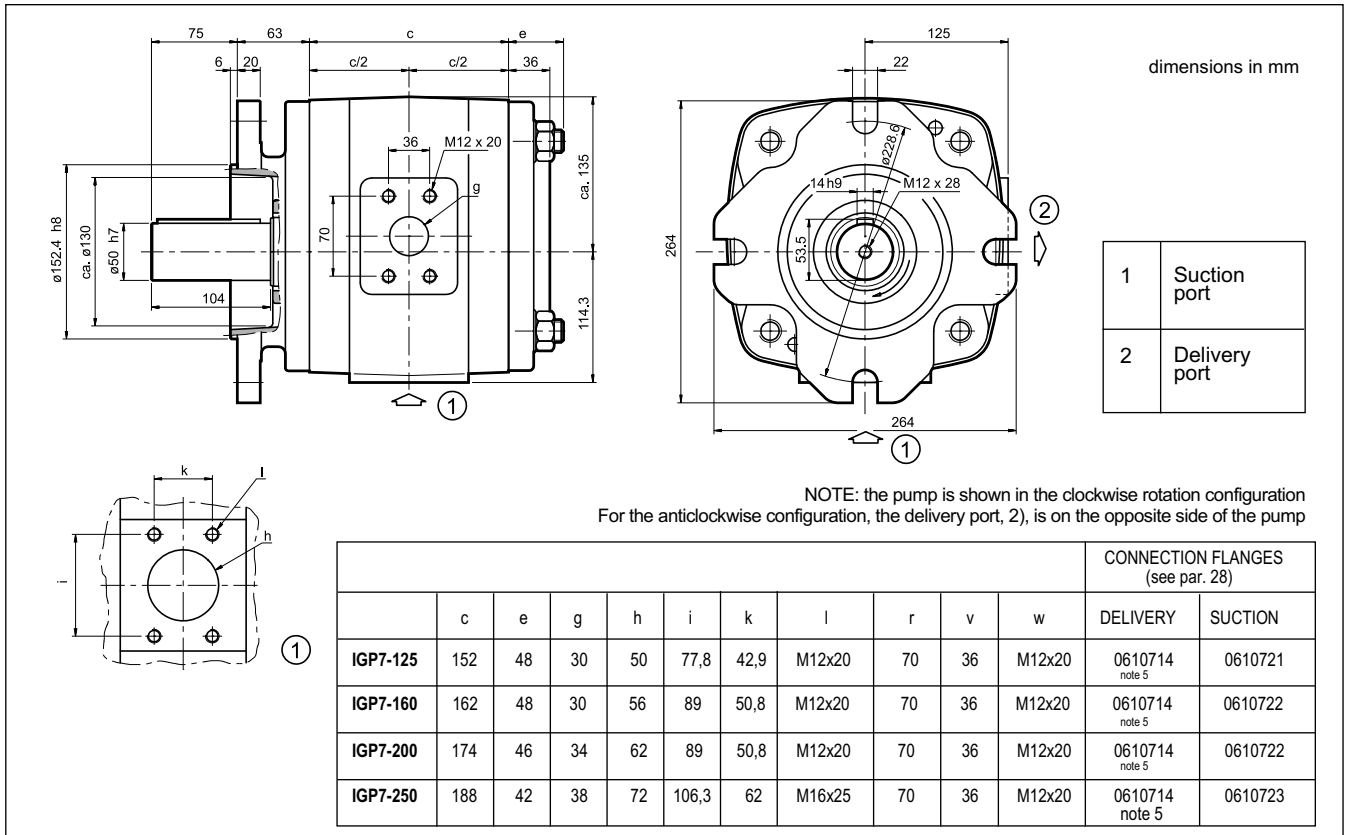
## 11- IGP5 PUMP OVERALL AND MOUNTING DIMENSIONS



## 12- IGP6 PUMP OVERALL AND MOUNTING DIMENSIONS

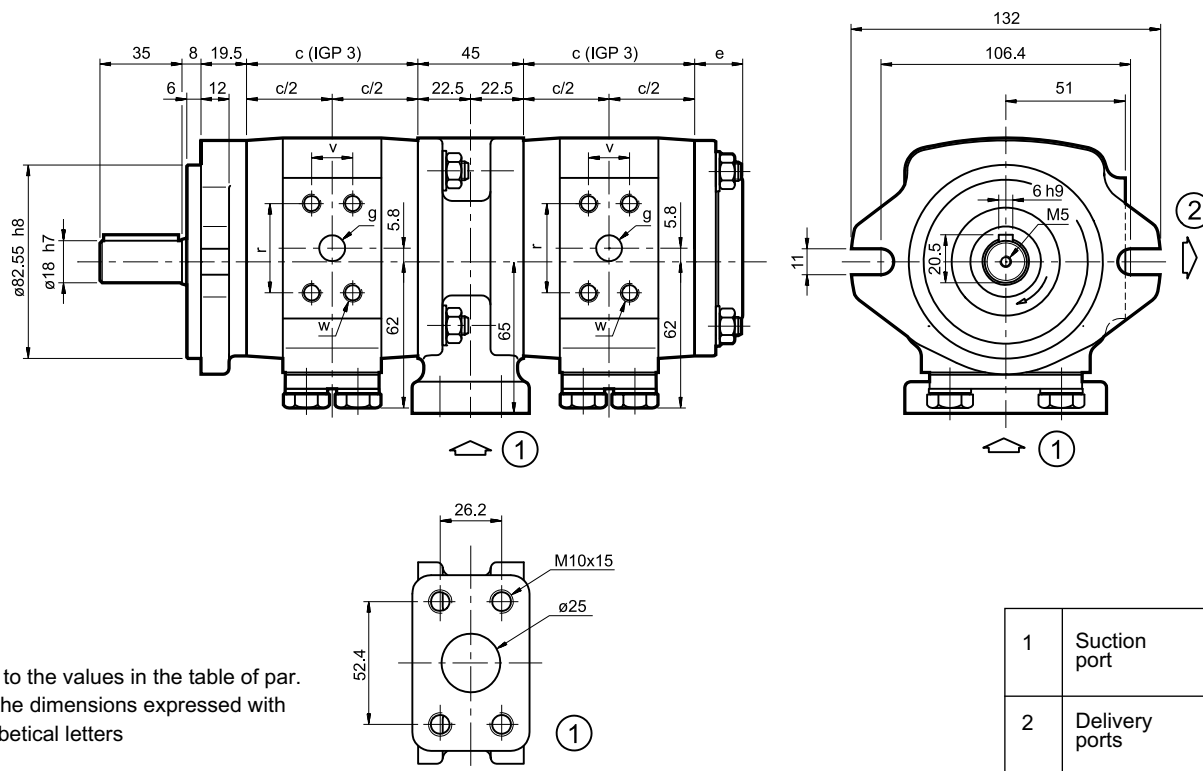


## 13- IGP7 PUMP OVERALL AND MOUNTING DIMENSIONS



**NOTE 5:** For applications with delivery pressure greater than 200 bar, it is necessary to use the special connection flange, code 0610725.

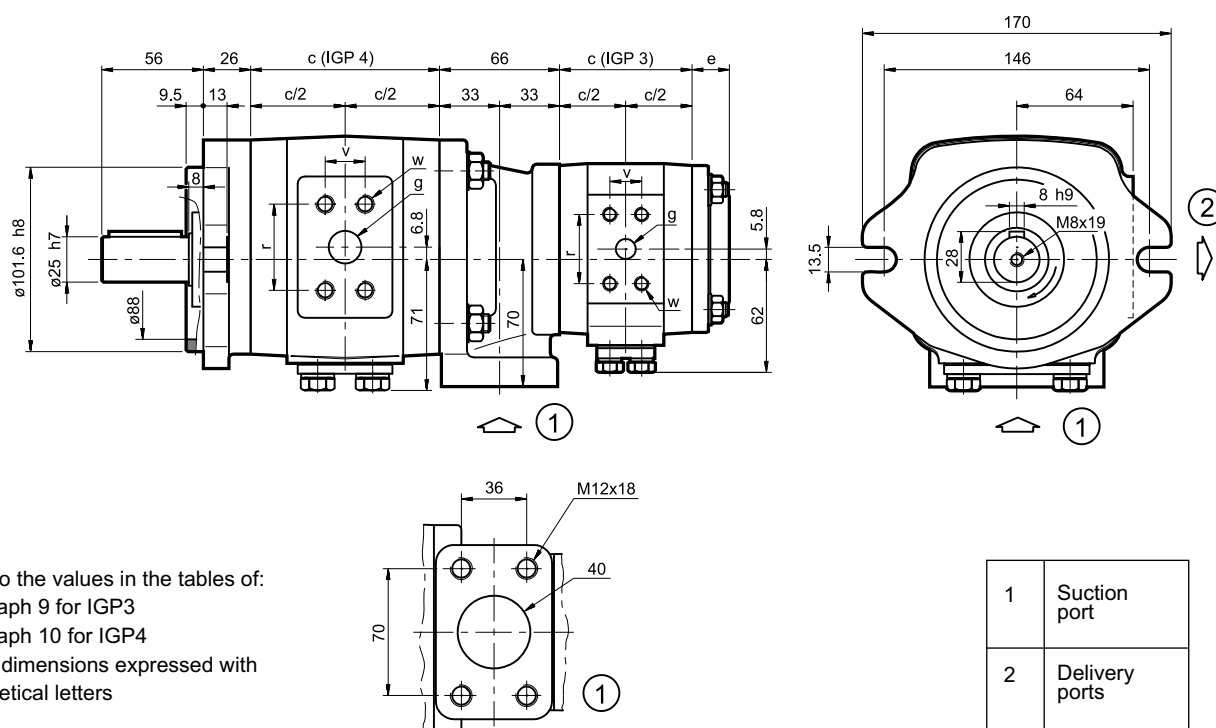
## 14 - IGP33 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration  
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

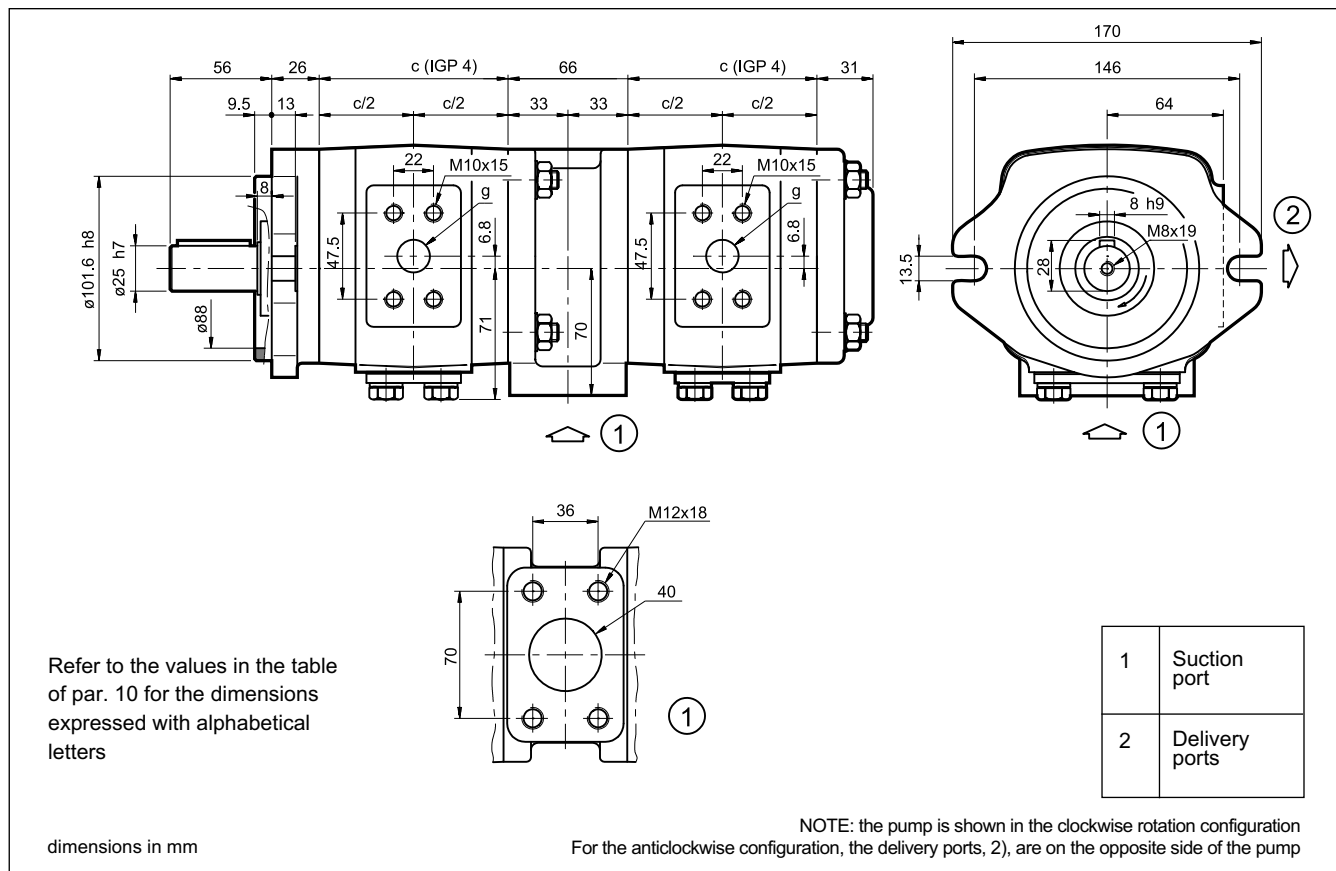
## 15 - IGP43 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



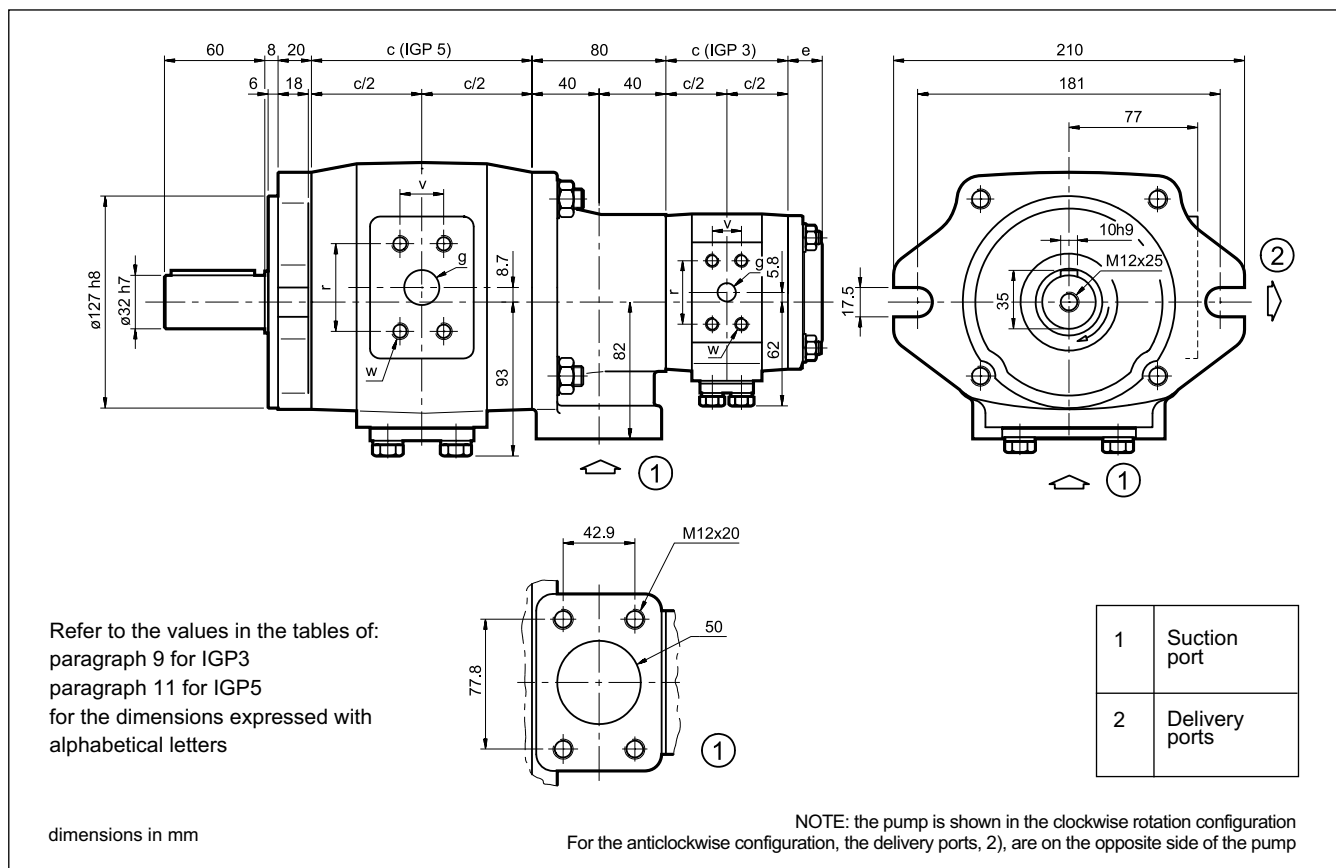
dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration  
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

## 16 - IGP44 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

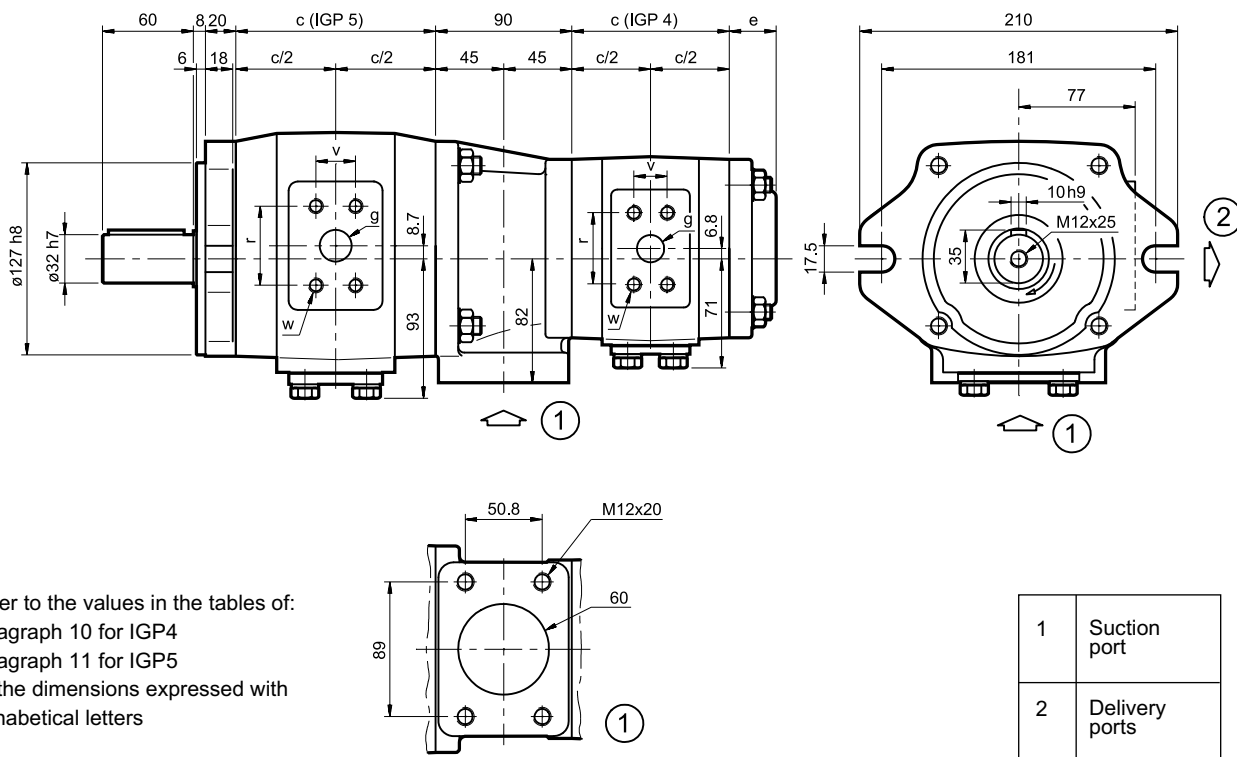


## 17 - IGP53 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





## 18 - IGP54 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

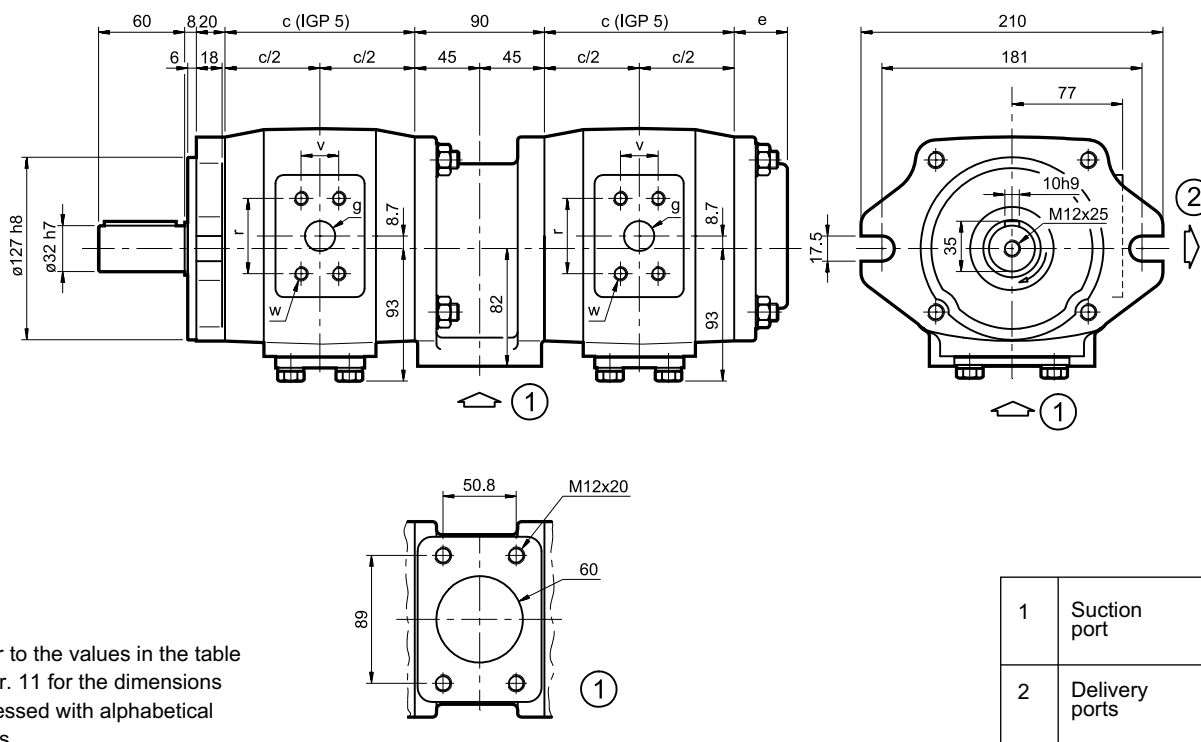


Refer to the values in the tables of:  
paragraph 10 for IGP4  
paragraph 11 for IGP5  
for the dimensions expressed with  
alphabetical letters

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration  
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

## 19 - IGP55 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

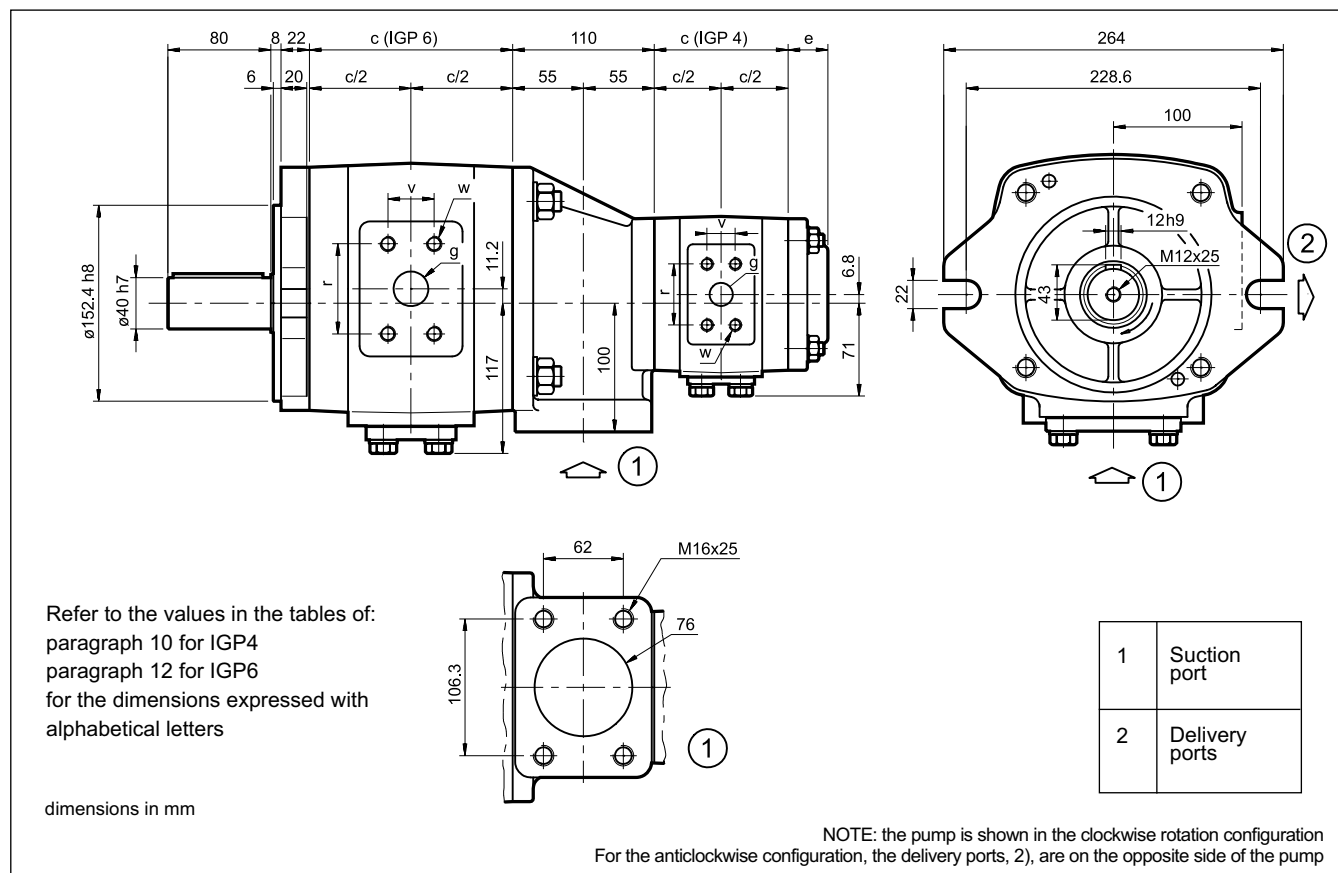


Refer to the values in the table  
of par. 11 for the dimensions  
expressed with alphabetical  
letters

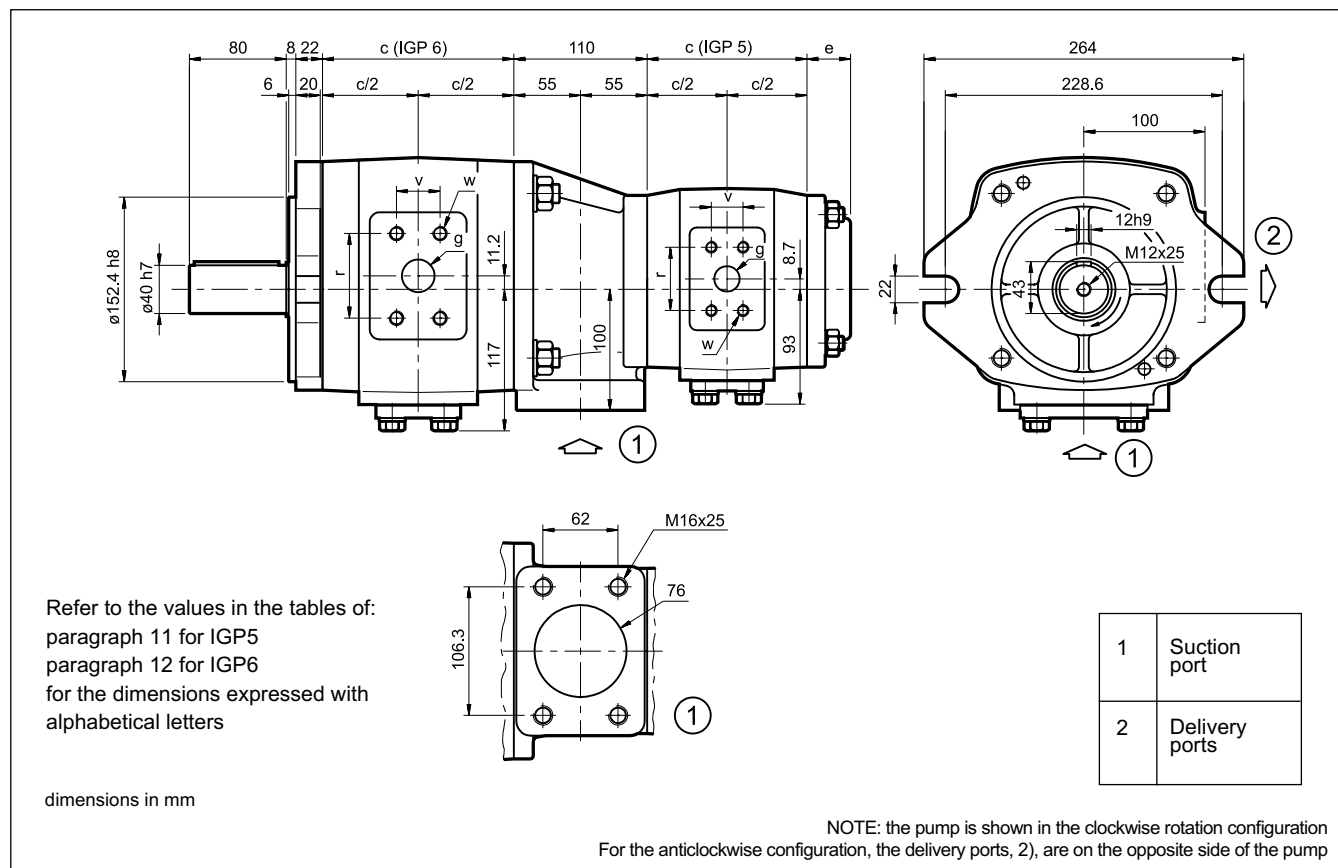
dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration  
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

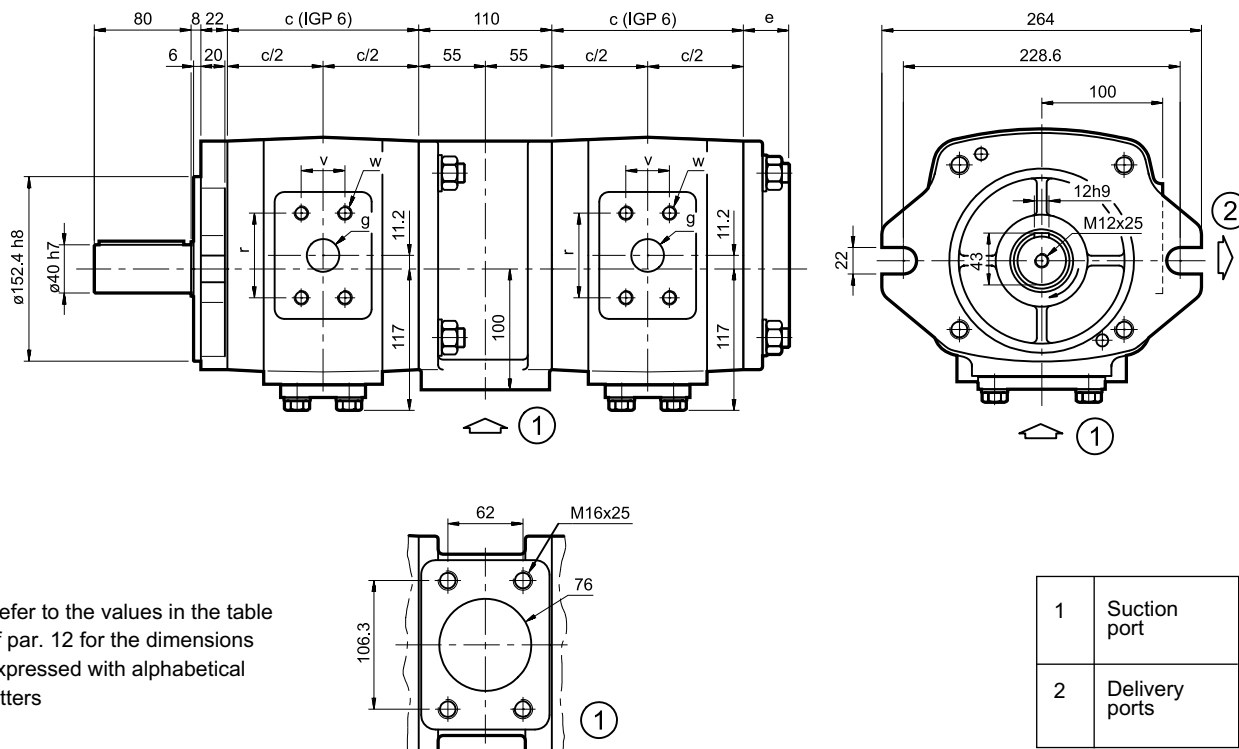
## 20 - IGP64 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



## 21 - IGP65 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



## 22 - IGP66 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

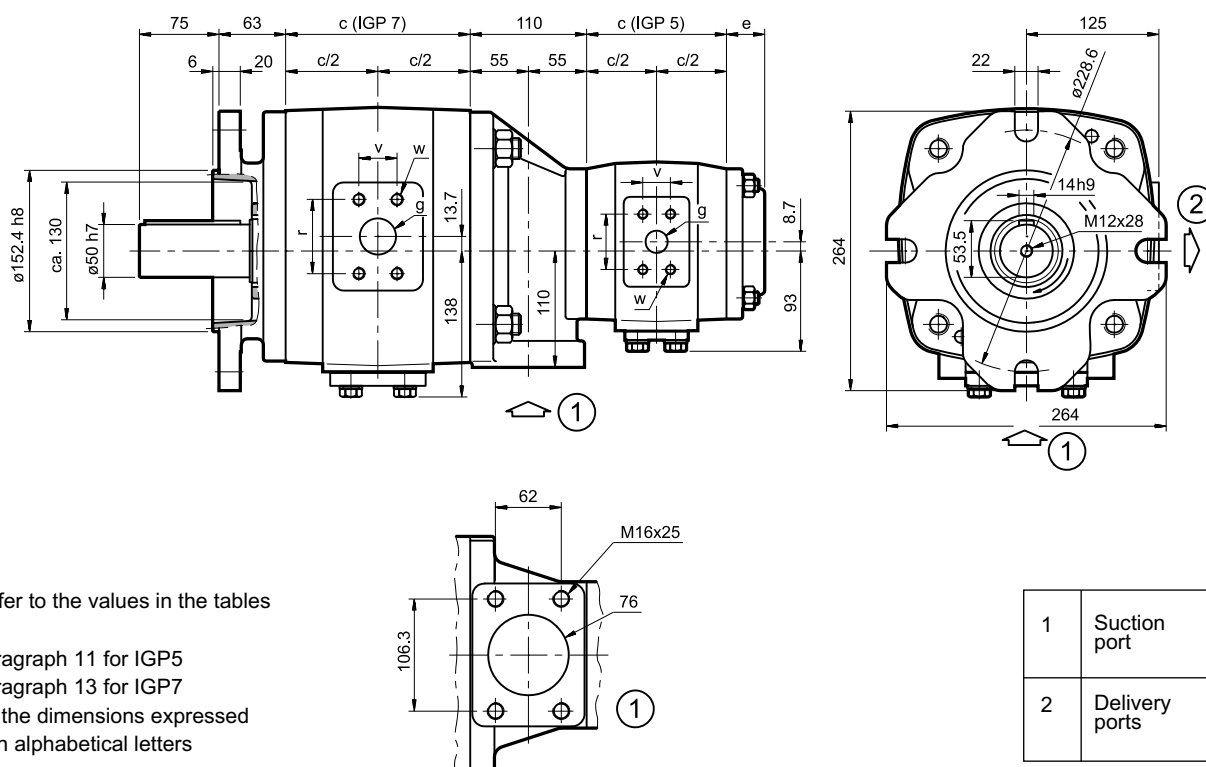


Refer to the values in the table of par. 12 for the dimensions expressed with alphabetical letters

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration  
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

## 23 - IGP75 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

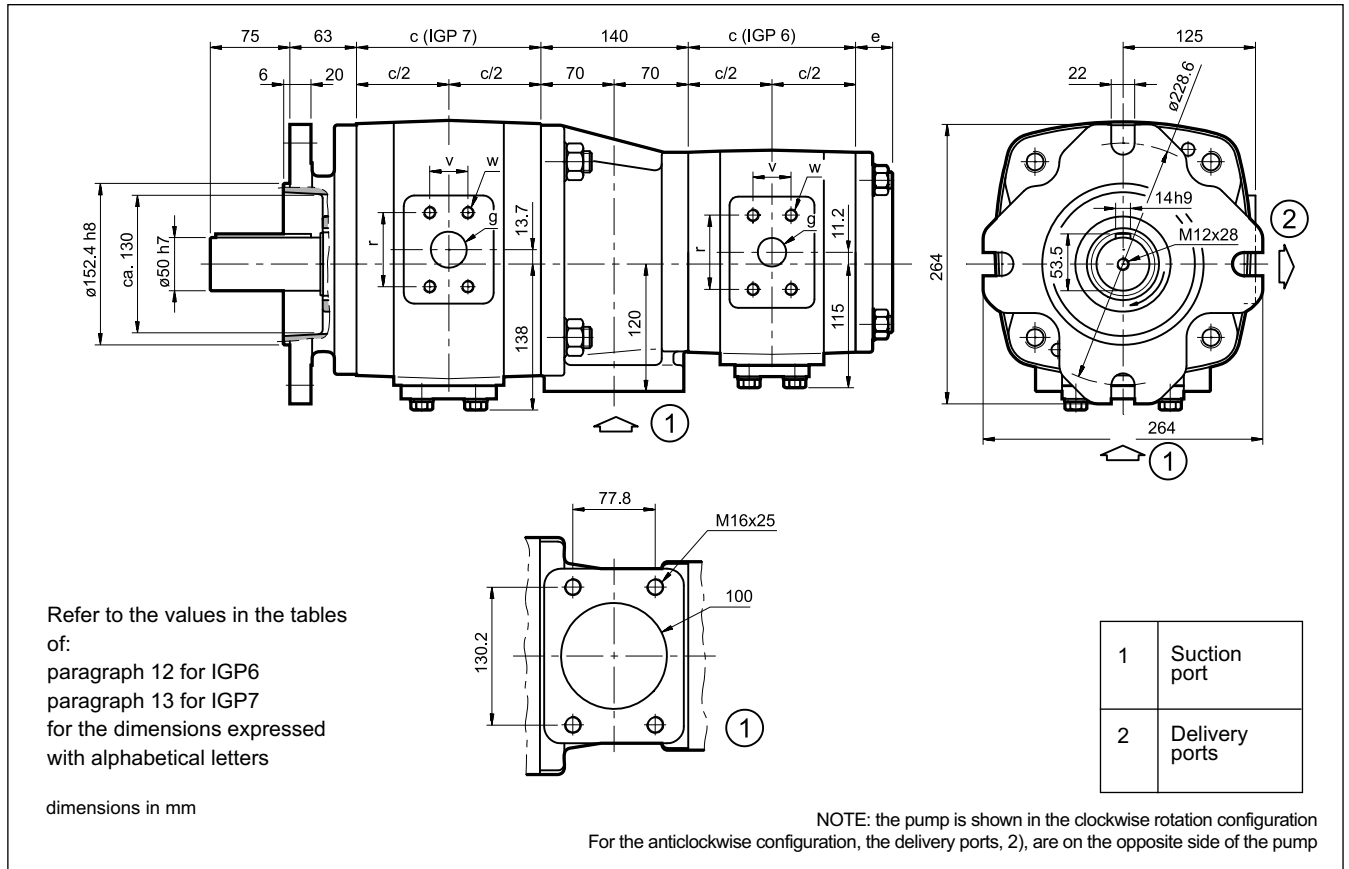


Refer to the values in the tables of:  
paragraph 11 for IGP5  
paragraph 13 for IGP7  
for the dimensions expressed with alphabetical letters

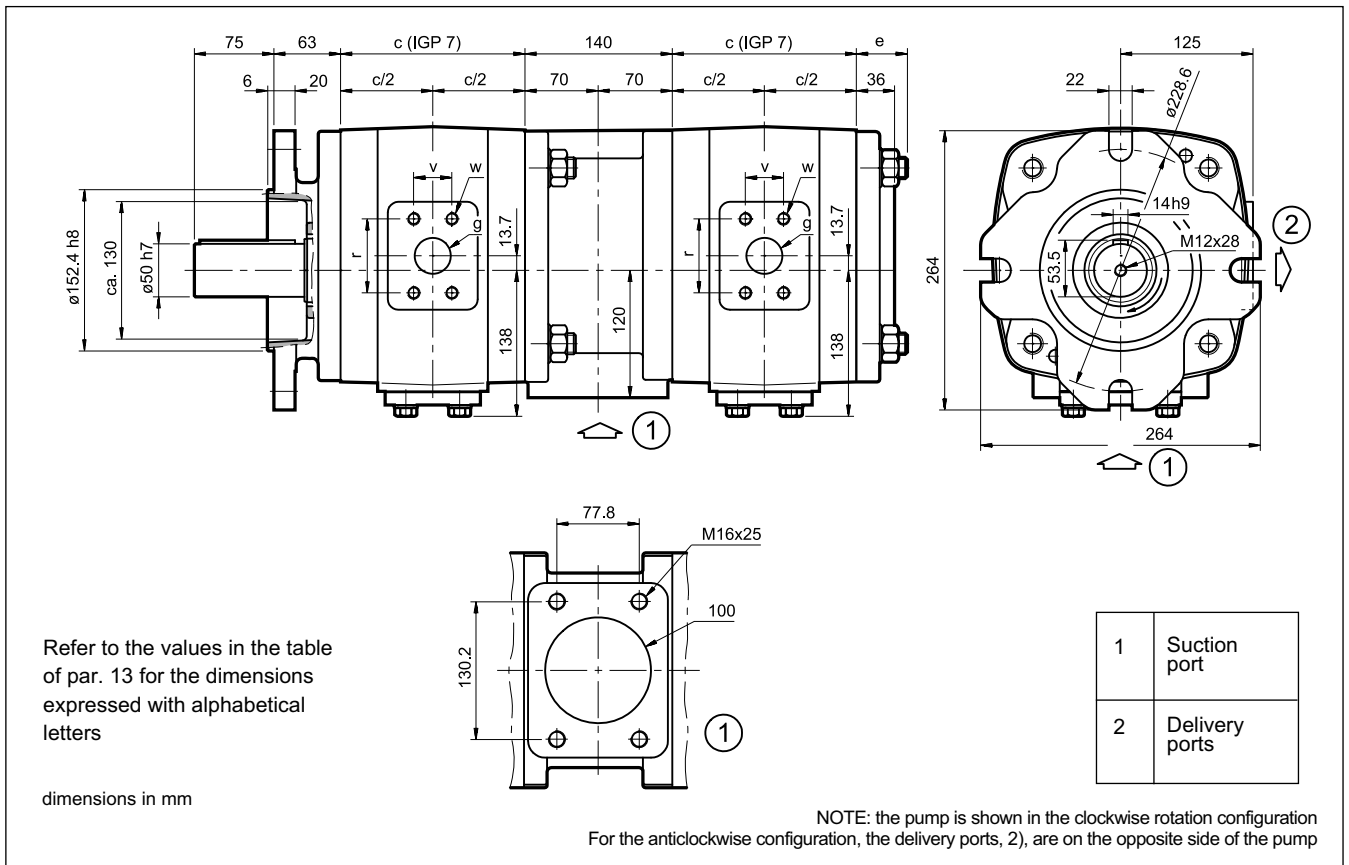
dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration  
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

## 24- IGP76 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



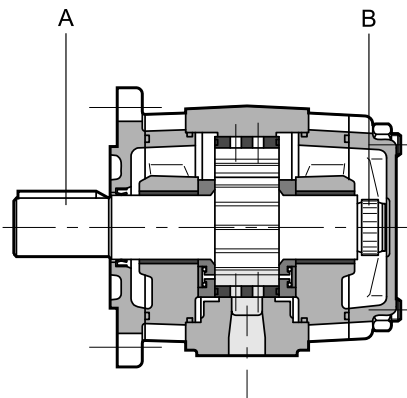
## 25- IGP77 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



## 26 - INSTALLATION

- The IGP pumps can be installed with the shaft oriented in any position.
- Prior to putting the pump into operation, check that the rotation direction of the motor is according to the direction of the arrow marked on the pump body.
- The suction line must be sized so that the speed of the fluid does not exceed 1 m/s (1,5 m/s with positive pressure at the pump inlet).  
The pump start up, especially at a cold temperature, should occur with the pump unloading.  
Any bends and restrictions or an excessive line length can impair correct working of the pump.  
The height of suction from the bottom of the tank must not be less than 50 mm.
- The IGP pumps are self-priming in the entire operating speed range specified. At the first start-up of the pump, it is necessary to vent the air from the delivery line.  
If a check valve with cracking pressure of >1 bar is installed on the delivery line, it is necessary to vent the air from the circuit branch between the check valve and the pump at the time of start-up.
- The motor-pump connection must be carried out directly with a flexible coupling.  
Consult our technical dept. for installations that generate axial or radial loads on the pump shaft.  
The coupling must be mounted without axially forcing the pump shaft. Be sure that the joint coupling diameter be made with a K7 tolerance.
- Refer to paragraph 2.3 for the characteristics and installation of the filtering elements.

## 27 - MAXIMUM APPLICABLE TORQUE



PUMP SIZE	MAX. TORQUE APPLIED TO THE SHAFT [Nm]	
	PRIMARY SHAFT <b>A</b>	SECONDARY SHAFT <b>B</b>
IGP3	160	80
IGP4	335	190
IGP5	605	400
IGP6	1050	780
IGP7	1960	1200

**NOTE:** The pumps must be connected in order of decreasing displacement and size.

### 27.1 - Maximum applicable torque for double pumps

In the case of double pumps, even of the same displacement, each pump can operate at the maximum performances specified in par. 3.

### 27.2 - Maximum applicable torque for multiple pumps

The torque (M) at the inlet of each pump is given from the following equation:

$$M = \frac{9549 \cdot N}{n} = [\text{Nm}]$$

where the absorbed power (N) is given from:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{\text{tot}}} = [\text{kW}]$$

n = rotation speed [rpm]

Q = delivery [l/min]

$\Delta p$  = differential pressure on the pump [bar]

$\eta_{\text{tot}}$  = total efficiency (noted from the relative diagrams in par. 4-5-6-7-8)

or is calculated from the ABSORBED POWER diagrams (see par. 4-5-6-7-8).

In the case of multiple pumps, the torque of the single pump must be added to the torque generated by the downstream pumps.

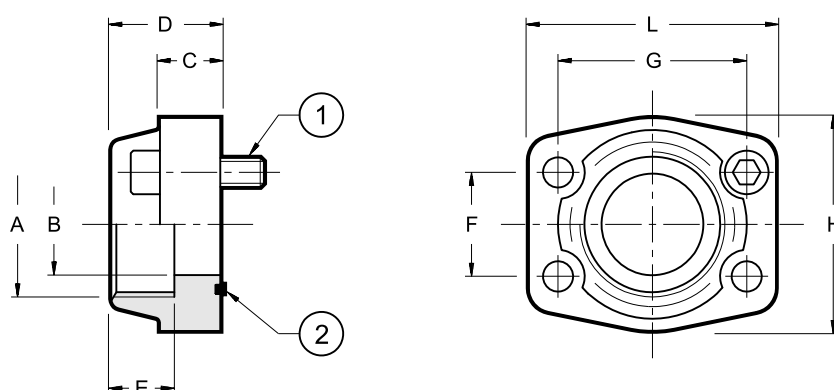
The torque value thus calculated for each pump must be less than the relative value specified in the above table, taking the following into consideration:

1st pump = refer to the specified values for primary shaft A

2nd, 3rd, 4th pump = refer to the specified values for secondary shaft B

In the event the calculated torque values are greater than the values shown in the table, it is necessary to reduce the operating pressure or substitute the overloaded pump with one that can support the required torque.

## 28 - SAE J518 c code 61 CONNECTION FLANGES



dimensions in mm

Flange code	Flange description	P <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	1 4 bolts	2
0610718	SAE - 1/2"	345	1/2" BSP	13	16	36	19	17,5	38,1	46	54	M8 x 30	OR 4075
0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	M10 x 35	OR 4100
0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70		OR 4131
0610720	SAE - 1 1/4"	276	1 1/4" BSP	32	21	41	22	30,2	58,7	68	79		OR 4150
0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	45	24	35,7	70	78	94	M12 x 45	OR 4187
0610725	SAE - 1 1/2"	345	1 1/2" BSP	38	36	50	25	36	70	80	95	M12 x 55 12K	OR 4187
0610721	SAE - 2"	207	2" BSP	51	25	45	30	43	77,8	90	102	M12 x 45	OR 4225
0610722	SAE - 2 1/2"	172	2 1/2" BSP	63	25	50	30	50,8	89	105	116		OR 4275
0610723	SAE - 3"	138	3" BSP	73	27	50	34	62	106,4	124	134	M16 x 50	OR 4437
0610726	SAE - 4"	34	4" BSP	99	27	48	34	77,8	130,2	146	162		OR 4437

The fastening bolts and the O-Rings must be ordered separately.

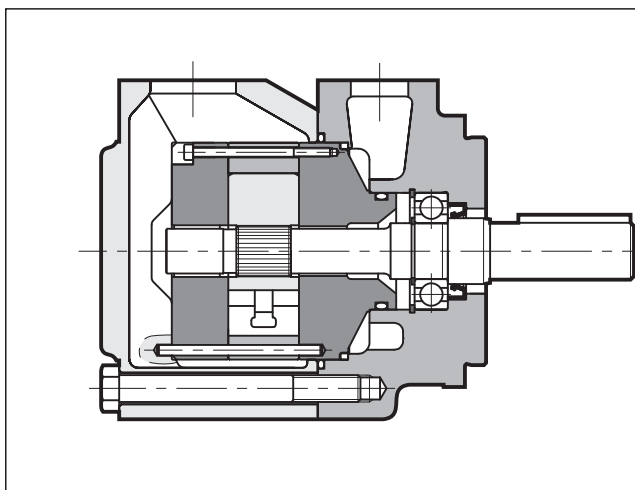


# DFP

## FIXED DISPLACEMENT VANE PUMPS

### SERIES 20

#### OPERATING PRINCIPLE



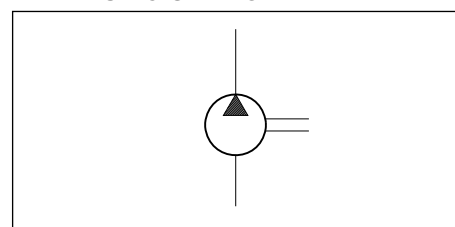
- The DFP pumps are fixed displacement vane pumps made in four different sizes, each size having five different nominal displacement. They are available with one pumping element (single pump) or with double pumping element (double pump). See par. 15 ÷ 20 for the combinations of double pumps.
- The pumping group is composed of a cartridge type compact element that contains the rotor, the vanes, the cam ring and the head disks. The cartridge is easily removable without the need to disconnect the pump from the hydraulic circuit, thus simplifying the maintenance operations.
- The special elliptical profile of the cam ring, with double suction and delivery chambers one against the other, eliminates the radial thrusts on the rotor, decisively reducing wear of the pump. In addition, the use of a 12-vane rotor reduces the delivery pressure pulsations, suppressing the vibrations and noise level of the pump.

#### TECHNICAL SPECIFICATIONS

DFP PUMP SIZE		1	2	3	4
Displacement range	cm <sup>3</sup> /rev	18 ÷ 45,9	40,1 ÷ 67,5	69 ÷ 121,6	138,6 ÷ 193,4
Flow rate range (at 1.500 rpm)	l/min.	26,1 ÷ 69,6	58,8 ÷ 99,8	101,4 ÷ 177,3	203,4 ÷ 285
Operating pressures		see table 3 - performances			
Rotation speed		see table 3 - performances			
Rotation direction		clockwise or anticlockwise (seen from the shaft side)			
Loads on the shaft		axial loads are not allowed			
Hydraulic connection		flange fittings SAE J518 (see par. 22)			
Type of fastening		flanged SAE			
Mass (single pump)	kg	12	15	23	34

Ambient temperature range	°C	−20 / +50
Fluid temperature range (see par. 4)	°C	−10 / +70
Fluid viscosity range	see par. 4.2	
Recommended true viscosity	cSt	25 ÷ 50
Degree of fluid contamination	see par. 4.3	

#### HYDRAULIC SYMBOL





### 1 - IDENTIFICATION CODE

<b>D</b>	<b>F</b>					<b>-</b>		<b>/</b>		<b>-</b>					<b>/</b>	<b>20</b>	<b>/</b>	
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Fixed displacement vane pump

Pump type  
**P** = single pump  
**DP** = double pump  
**C** = shaft side cartridge or for single pump  
**CC** = cover side cartridge

Pump size:  
 - single pump  
 - shaft side pump (only for double pumps):  
**1** = from 18 to 45,9 cm<sup>3</sup>/rev  
**2** = from 40,1 to 67,5 cm<sup>3</sup>/rev  
**3** = from 69 to 121,6 cm<sup>3</sup>/rev  
**4** = from 138,6 to 193,4 cm<sup>3</sup>/rev

Added pump size (only for double pumps):  
**1** = from 18 to 45,9 cm<sup>3</sup>/rev  
**2** = from 40,1 to 67,5 cm<sup>3</sup>/rev  
**3** = from 69 to 121,6 cm<sup>3</sup>/rev

**NOTE:** the cover side pump must be at least one size smaller than the shaft side pump

Size:  
 - single pump  
 - shaft side pump  
 - shaft side cartridge (see performances table, par. 3)

Seals: omit for mineral oils  
**V** = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 20 to 29)

Type of shaft end  
**1** = with key  
 other shaft types are available upon request

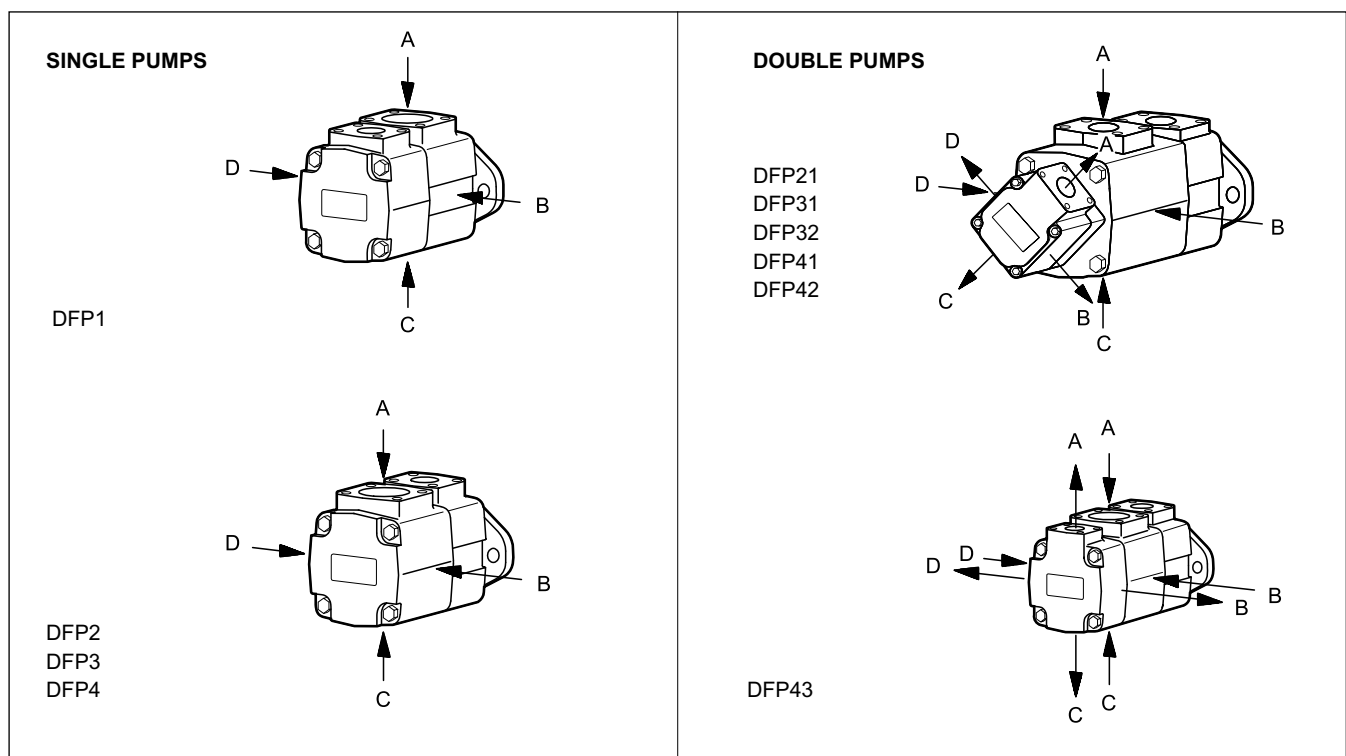
Cover side delivery port orientation compared with the shaft side delivery - for double pumps (omit for single pumps or cartridges)  
**A** = aligned on the same side  
**B** = at 90°  
**C** = opposed to each other  
**D** = at 270° } see par. 2

Suction opening orientation compared with the delivery (omit for cartridges)  
**A** = aligned on the same side  
**B** = at 90°  
**C** = opposed to each other  
**D** = at 270° } see par. 2

Rotation direction (seen from the shaft side)  
**R** = clockwise    **L** = anticlockwise

Size (only for double pumps)  
 - cover side pump  
 - cover side cartridge (see performances table, par. 3)

### 2 - PORTS ORIENTATION



### 3 - PERFORMANCES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

PUMP SIZE	NOMINAL DIMENSION	DISPLACEMENT [cm³/rev]	MAX. FLOW RATE (at 1500 rpm) [l/min.]	MAX. OPERATING PRESSURE (at 1500 rpm) [bar]	MAX. ROTATION SPEED [rpm] (see par. 5)	MIN. ROTATION SPEED [rpm]
DFP1	05	18	26,1	210	2700	600
	08	27,4	39,4			
	11	36,4	52,6			
	12	39,5	58,7	160		
	14	45,9	69,6	140		
DFP2	12	40,1	58,8	210	2500	600
	14	45,4	65,7			
	17	55,2	80,2			
	19	60,1	88,7			
	21	67,5	99,8			
DFP3	21	69	101,4	210	2400	600
	25	81,6	120,1			
	30	97,7	141,2			
	35	112,7	167,2			
	38	121,6	177,3			
DFP4	42	138,6	203,4	175	2200	600
	47	153,5	222,7			
	50	162,2	234			
	57	183,4	267			
	60	193,4	285			

### 4 - HYDRAULIC FLUID

#### 4.1 Fluid type

TYPE OF FLUID	MAXIMUM PRESSURE (bar)				MAXIMUM SPEED (rpm)				MAXIMUM FLUID TEMPERATURE [°C]
	DFP1	DFP2	DFP3	DFP4	DFP1	DFP2	DFP3	DFP4	
HFD PHOSPHATE ESTERS	175	175	175	175	1200	1200	1200	1200	≤ 70
HFC WATER GLYCOL	140	140	140	140	1500	1500	1500	1500	≤ 50

**NOTE 1:** The maximum suction pressure allowed, with all fluid types, is 1,4 bar. The minimum suction pressure varies from -0,2 bar with mineral oil to -0,1 bar with the other fluid types (the pressure values are to be considered relative).

The pressures, the maximum allowed speeds and the recommended temperatures according to the different types of hydraulic fluids used are shown in the table.

#### 4.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum temperature of 80 °C of the fluid
optimum viscosity	25 ÷ 50 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	800 cSt	limited to only the pump start-up phase

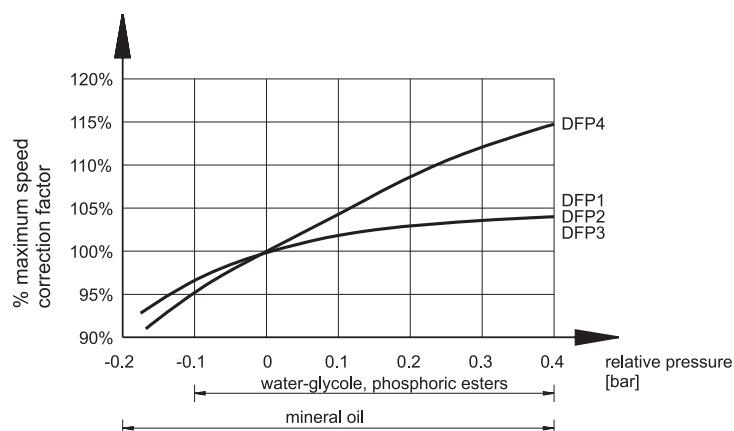
When choosing the fluid type, verify that the true viscosity at the operating temperature is within the above range.

#### 4.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with  $\beta_{20} \geq 75$  is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with  $\beta_{10} \geq 100$  is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in the note 1, at paragraph 3. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

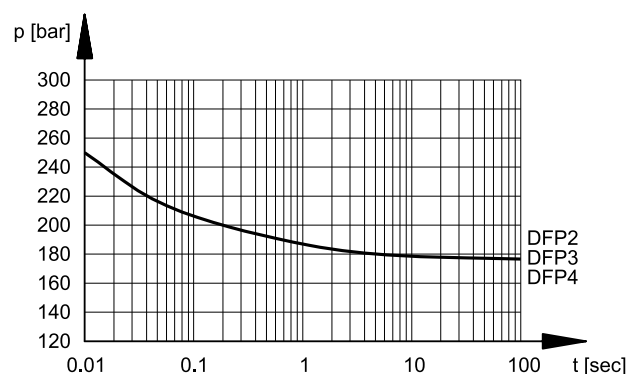
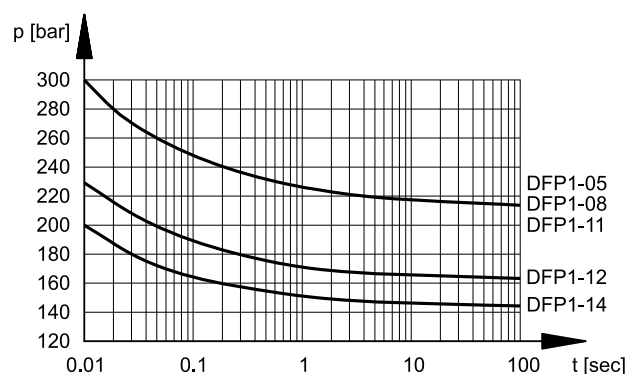
### 5 - MAXIMUM SPEED CORRECTION FACTOR



If the pressure in the suction line is different than zero, the maximum rotation speed shown in table 3 must be multiplied by the correction factor obtained from the diagram seen on the left.

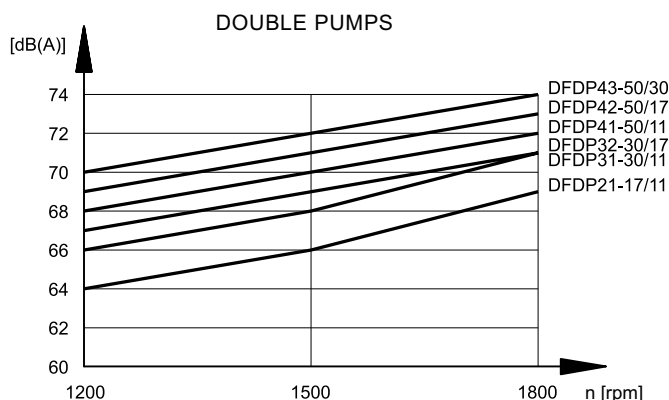
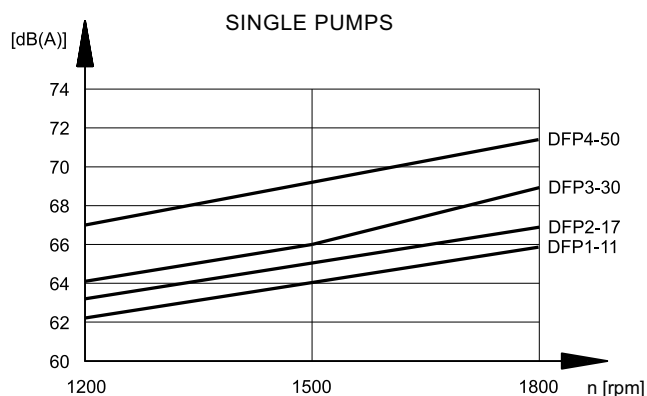
### 6 - PRESSURE PEAK (values obtained with mineral oil with viscosity of 32 cSt at 40°C, delivery pressure 140 bar and suction pressure 0 bar)

The maximum allowed over pressure on the pump delivery according to the pressure peak residency time is shown in the diagrams. The curves are valid for both single pumps and double pumps.



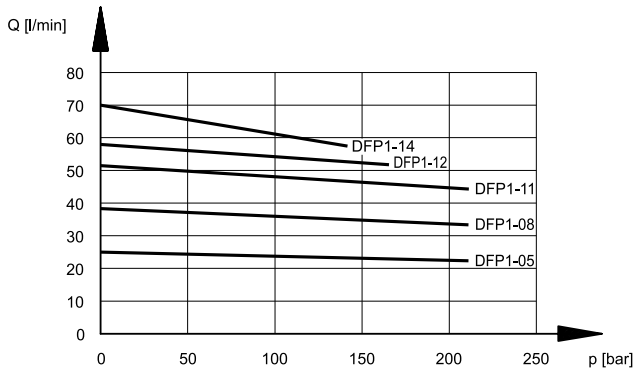
### 7- NOISE LEVEL (values obtained with mineral oil with viscosity of 32 cSt at 40°C, delivery pressure 140 bar and suction pressure 0 bar)

The diagram curves were measured in a semi-anechoic room according to ISO 4412/1 at a distance of 1 m from the pump. The values refer to the intermediate size pump.

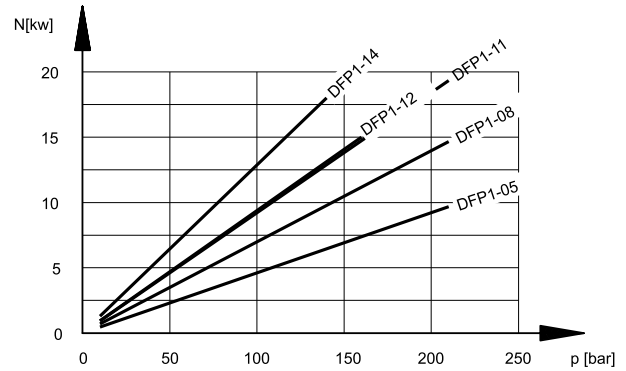


### 8 - DFP1 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

**FLOW RATE/PRESSURE CURVES**  
(measured at 1500 rpm)

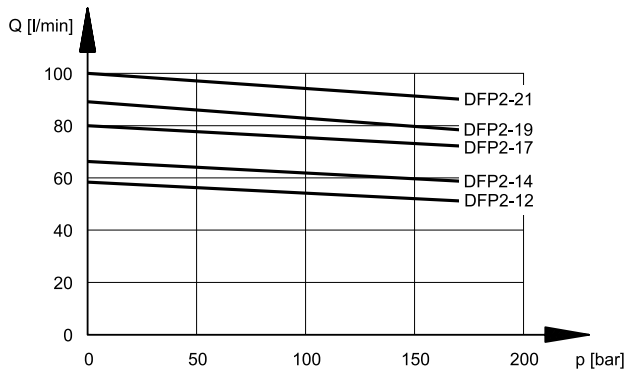


**ABSORBED POWER/PRESSURE CURVES**  
(measured at 1500 rpm)

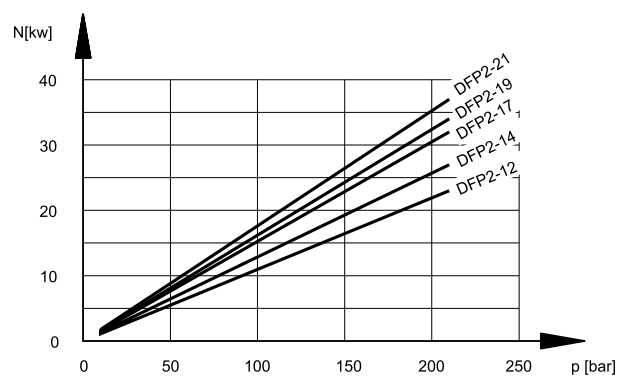


### 8 - DFP2 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

**FLOW RATE/PRESSURE CURVES**  
(measured at 1500 rpm)



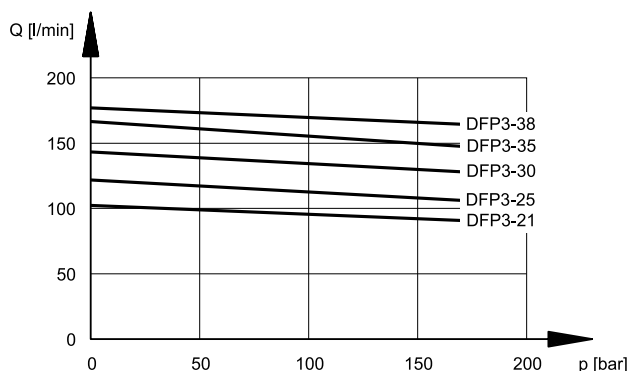
**ABSORBED POWER/PRESSURE CURVES**  
(measured at 1500 rpm)



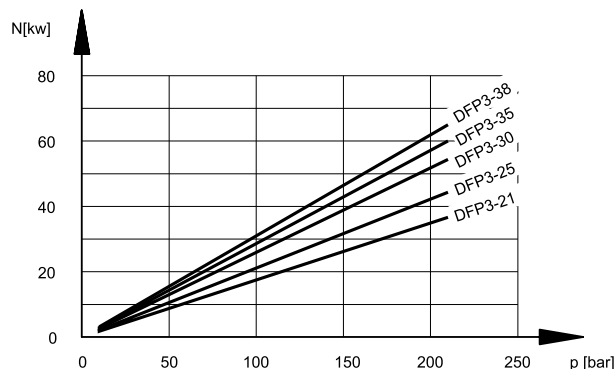


## 9 - DFP3 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 32 cSt at 40°C)

**FLOW RATE/PRESSURE CURVES**  
(measured at 1500 rpm)

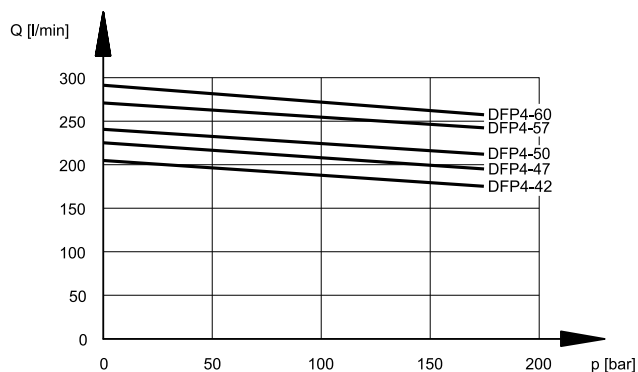


**ABSORBED POWER/PRESSURE CURVES**  
(measured at 1500 rpm)

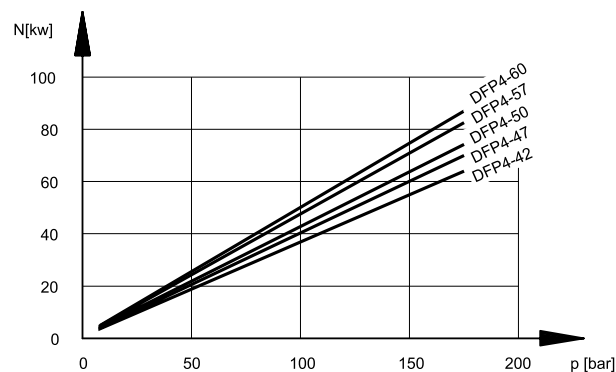


## 10 - DFP4 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 32 cSt at 40°C)

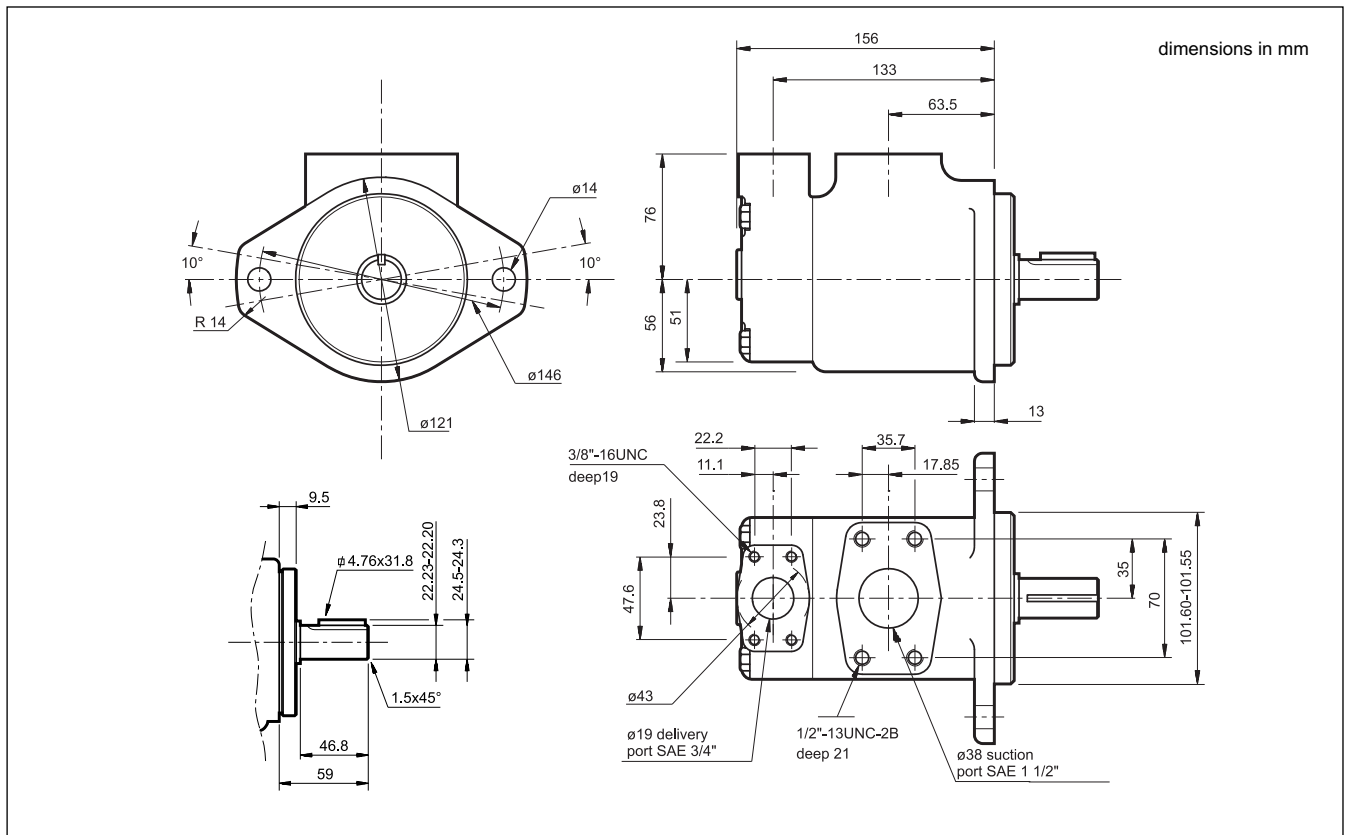
**FLOW RATE/PRESSURE CURVES**  
(measured at 1500 rpm)



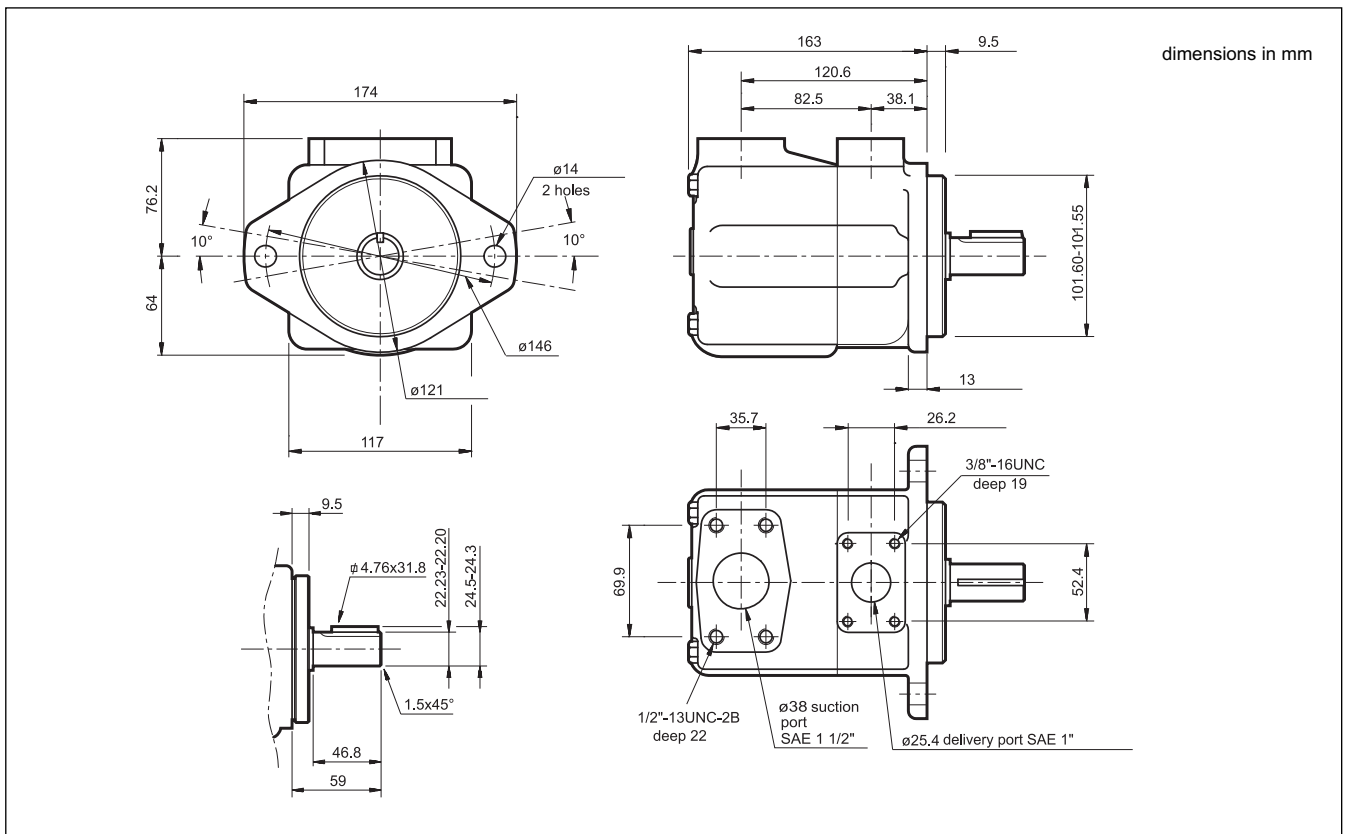
**ABSORBED POWER/PRESSURE CURVES**  
(measured at 1500 rpm)



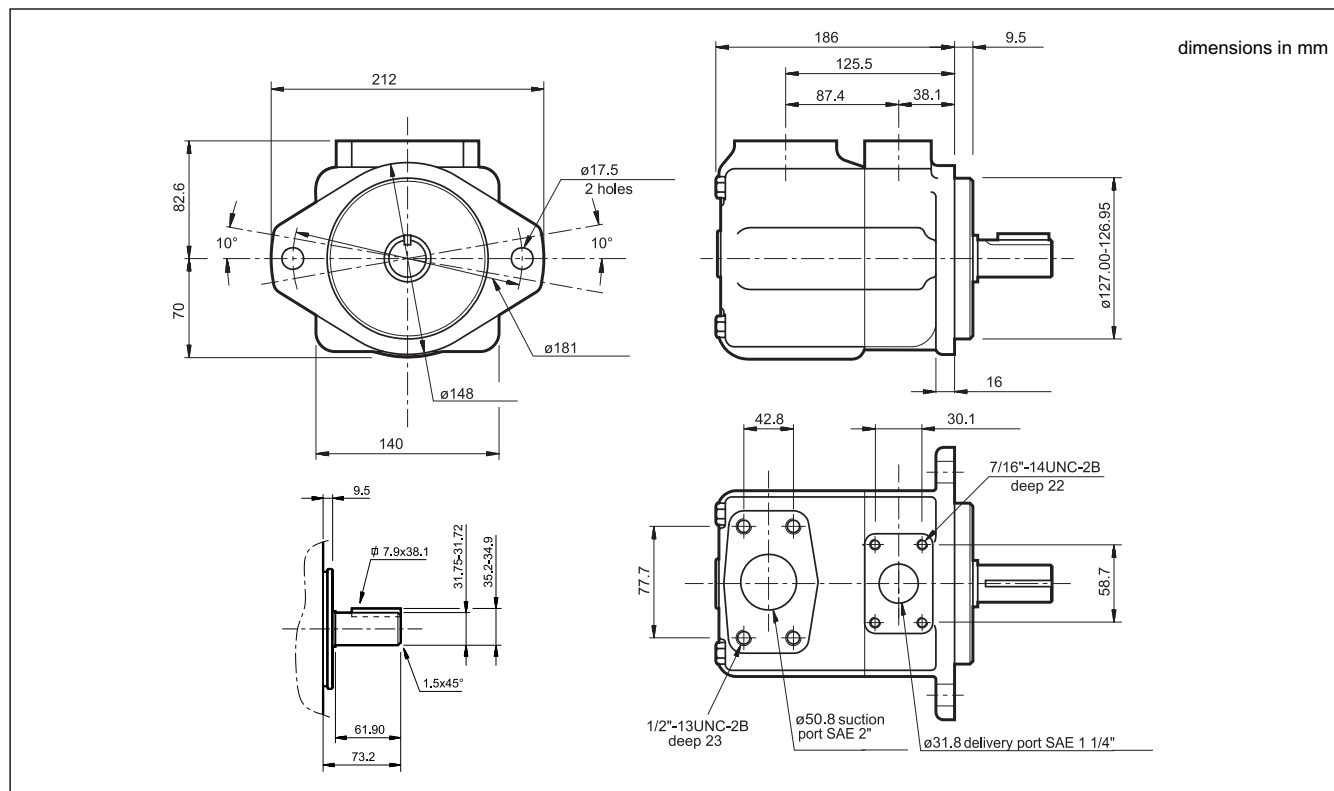
## 11 - DFP1 PUMP OVERALL AND MOUNTING DIMENSIONS



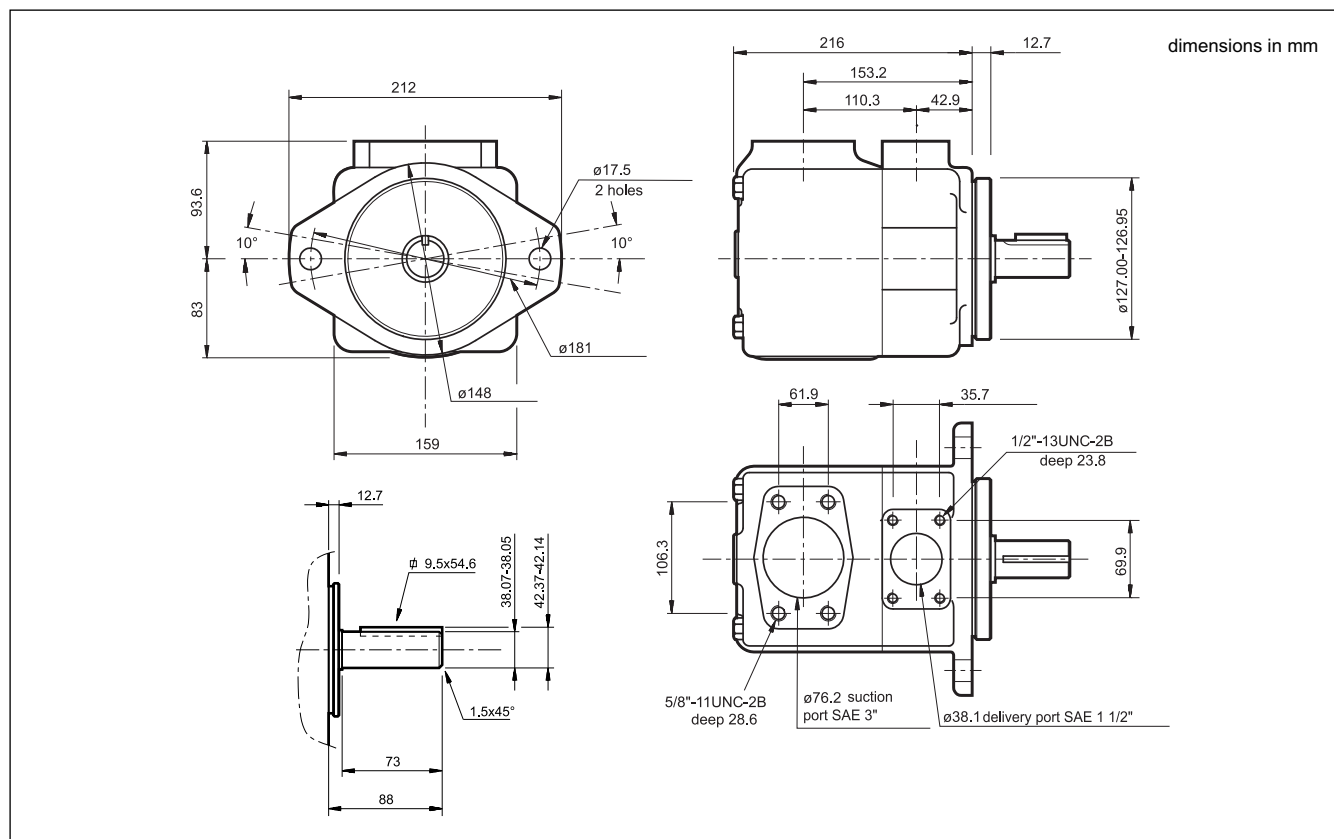
## 12 - DFP2 PUMP OVERALL AND MOUNTING DIMENSIONS



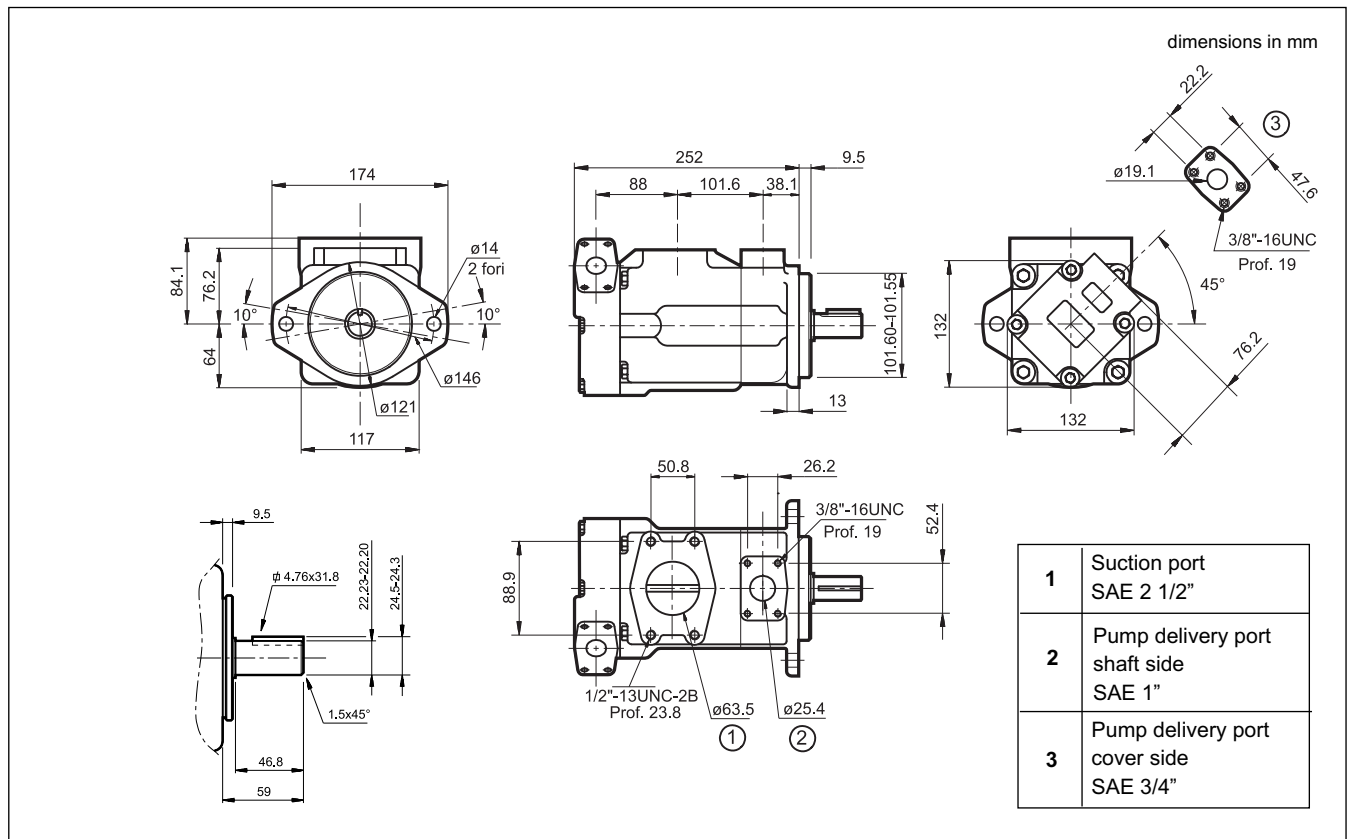
### 13 - DFP3 PUMP OVERALL AND MOUNTING DIMENSIONS



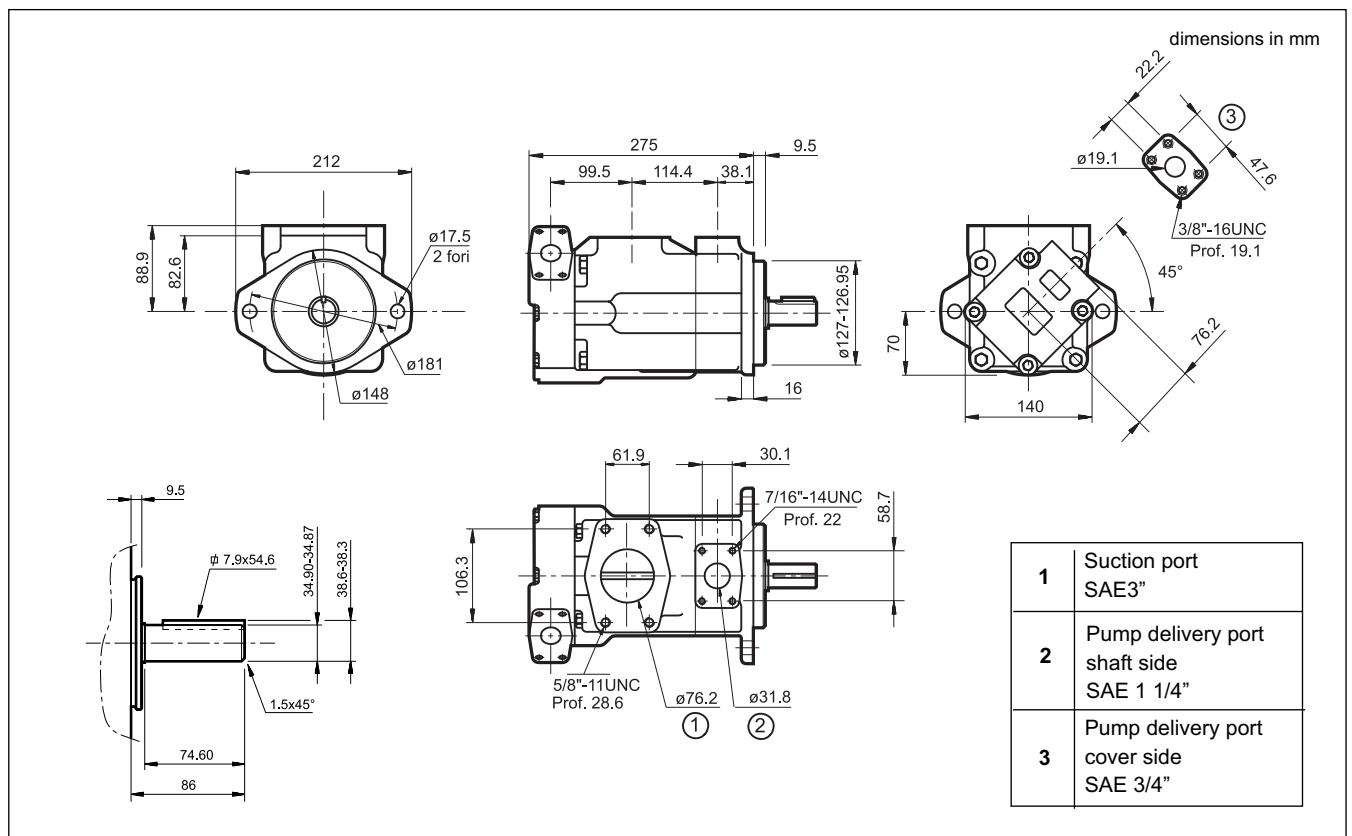
### 14 - DFP4 PUMP OVERALL AND MOUNTING DIMENSIONS



### 15 - DFDP21 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

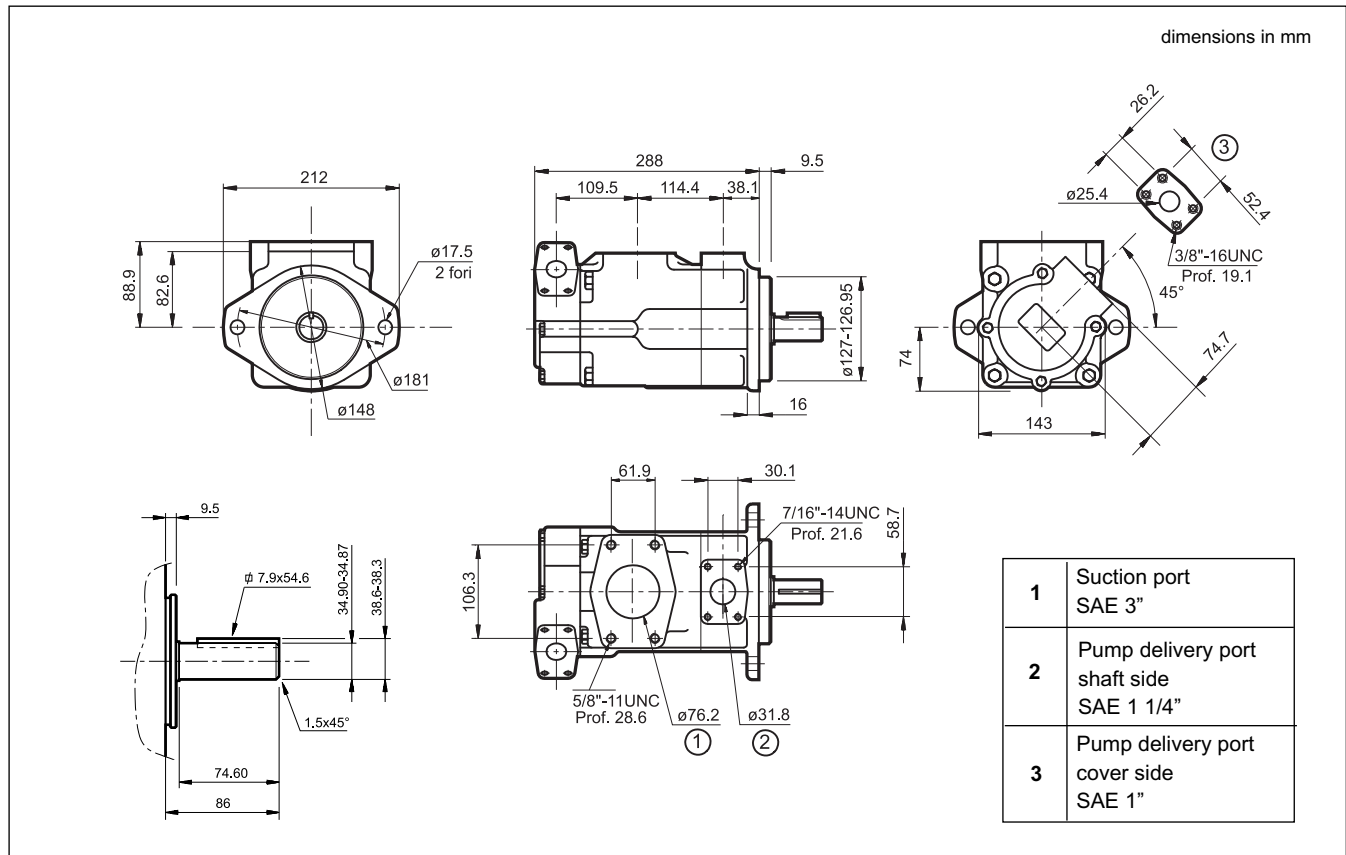


### 16 - DFDP31 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

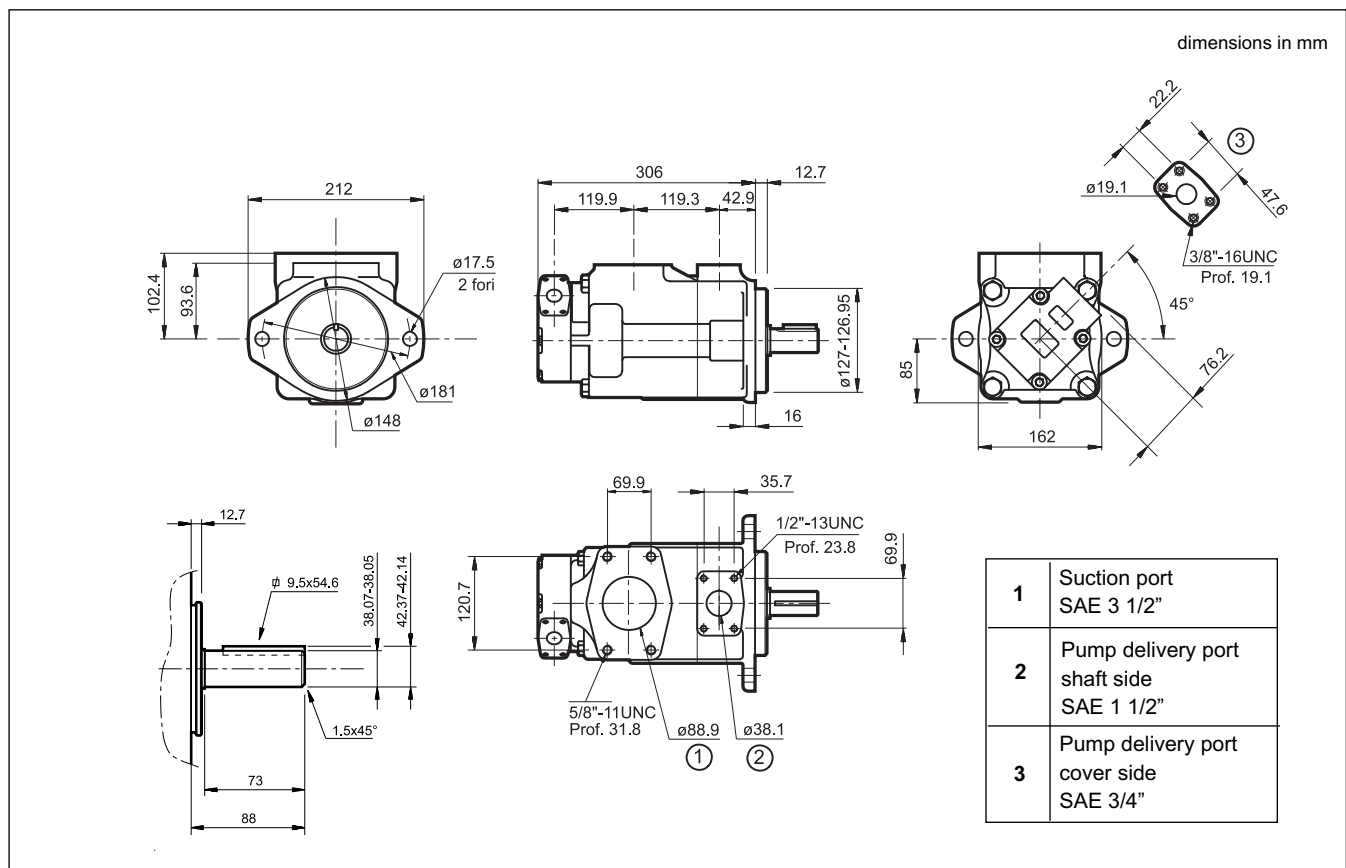




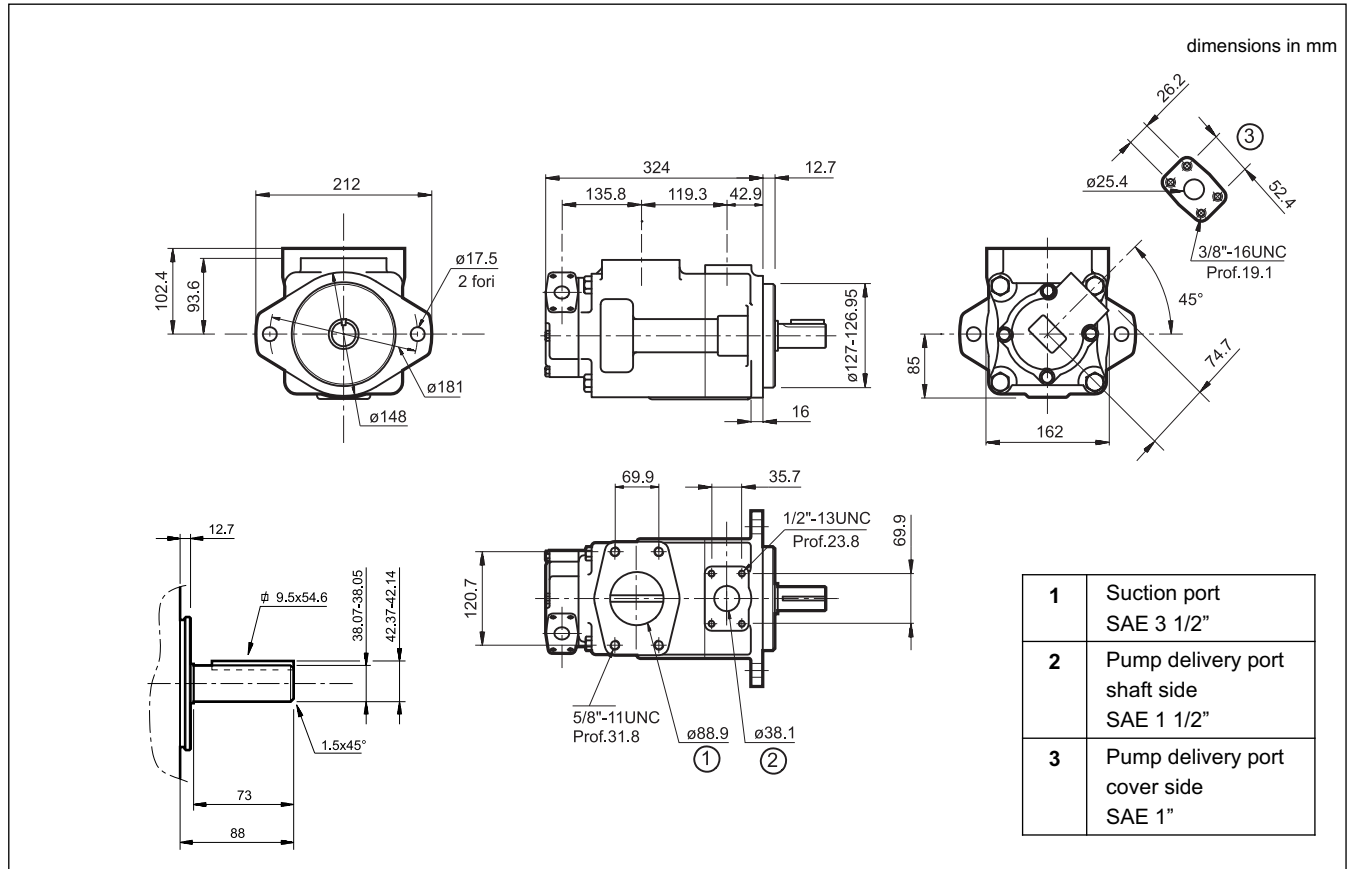
### 17 - DFDP32 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



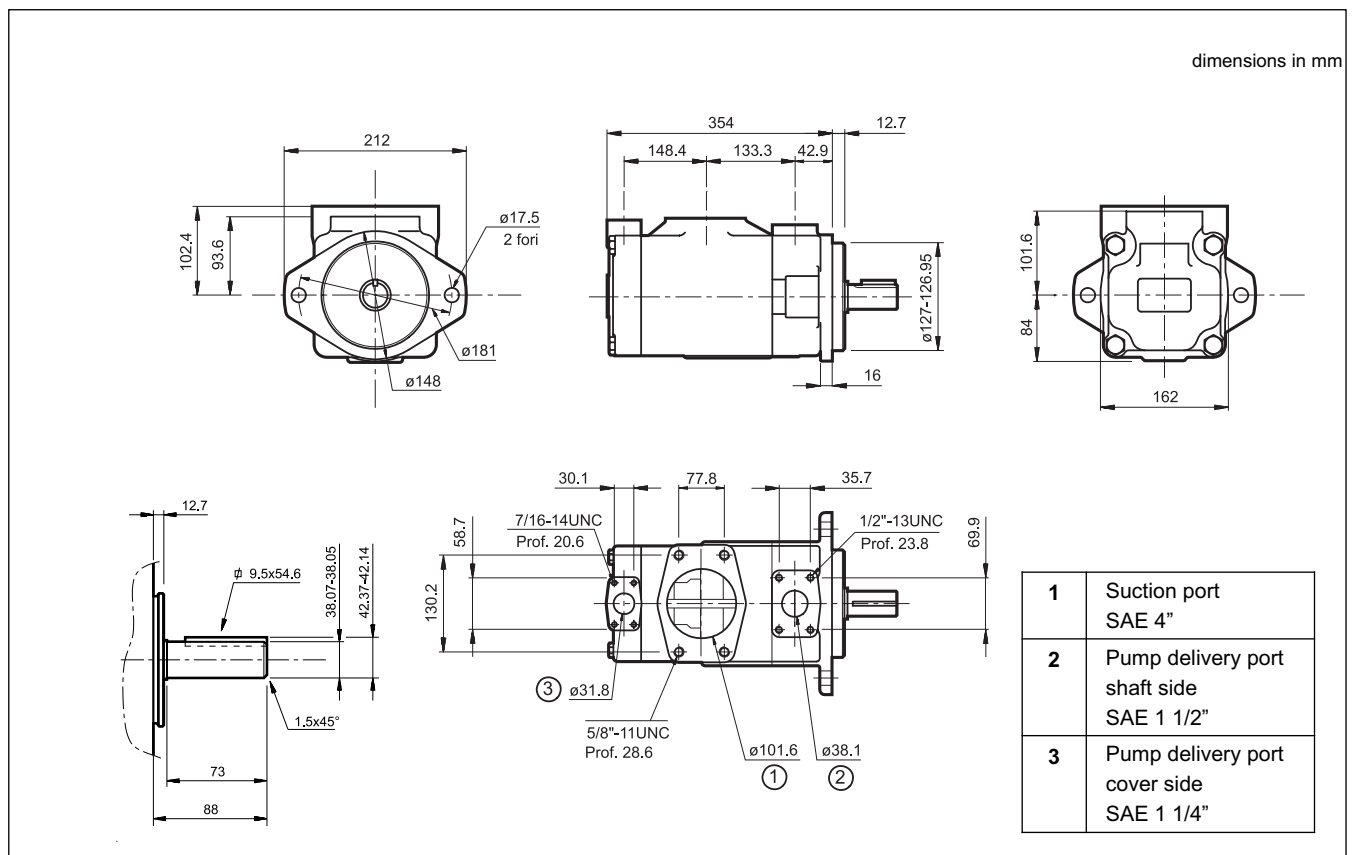
### 18 - DFDP41 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



### 19 - DFDP42 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



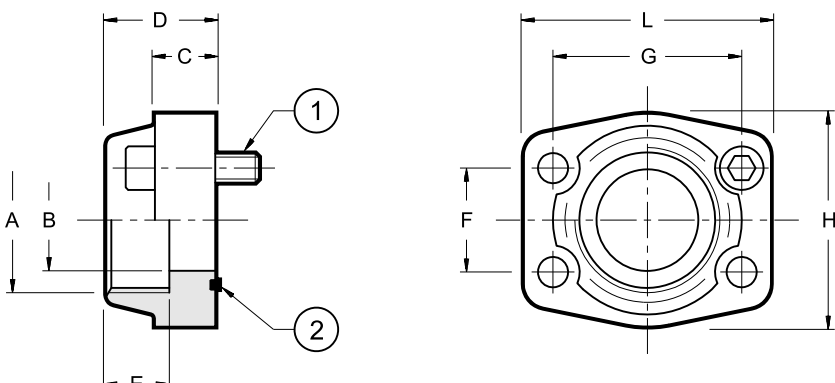
### 20 - DFDP43 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS



### 21 - INSTALLATION

- The DFP pumps can be installed with the shaft oriented in any position.
- Check that the rotation direction of the motor is according to the rotation direction of the pump before start up.
- The pump start up, especially at a cold temperature, should occur with the pump unloading.
- The suction line must be suitably sized to facilitate the flow of oil.  
Bends and restrictions or an excessive line length can impair correct functioning of the pump.
- The pumps are normally positioned directly above the oil tank.  
Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.
- The motor-pump coupling must be made directly with a flexible coupling.  
Couplings that generate axial or radial loads on the pump shaft are not allowed.
- Refer to paragraph 4.3 for the characteristics and installation of the filtering elements.

### 22 - SAE J518 CONNECTION FLANGES



dimensions in mm

Flange code	Flange description	P <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	1 N. 4 SHC bolts	Bolts code	2
0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	3/8" UNC x 1 1/2"	0530612	OR 4100
0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70			OR 4131
0610720	SAE - 1 1/4"	276	1 1/4" BSP	32	21	41	22	30,2	58,7	68	79	7/16" UNC x 1 1/2"	0530613	OR 4150
0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	45	24	35,7	70	78	93	1/2" UNC x 1 3/4"	0530638	OR 4187
0610721	SAE - 2"	207	2" BSP	51	25	45	30	43	77,8	90	102			OR 4225
0610722	SAE - 2 1/2"	172	2 1/2" BSP	63	25	50	30	50,8	89	105	116			OR 4175
0610723	SAE - 3"	138	3" BSP	73	27	50	34	62	106,4	116	134	5/8" UNC x 2"	0530658	OR 4337
0610724	SAE - 3 1/2"	34	3 1/2" BSP	89	27	48	34	69,8	120,7	136	152			OR 4387
0773528	SAE - 4"	34	4" BSP	99	27	48	34	77,77	130,18	146	162			OR 4437

The fastening bolts and the O-Rings must be ordered separately.

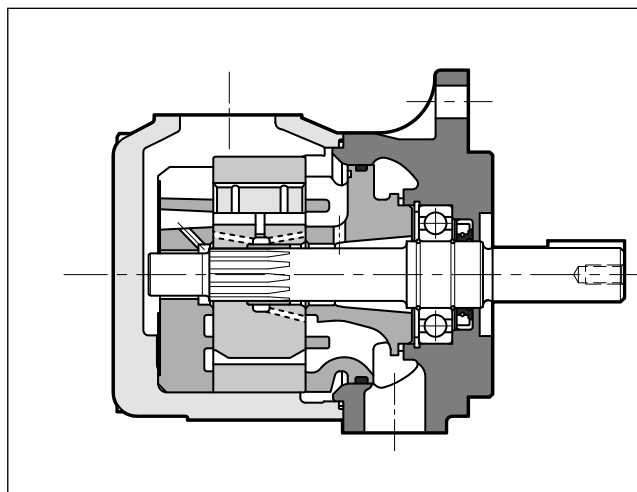


# FV6

## FIXED DISPLACEMENT VANE PUMPS

### SERIES 10

#### OPERATING PRINCIPLE



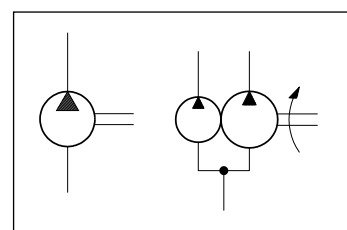
- The FV6 pumps are fixed displacement vane pumps, with several nominal displacement each. Single, double and triple pumps are available.
- The pumping group is composed of a cartridge element that contains rotor, vanes, cam ring and support plates. Cartridges are easily removable without disconnecting the pump from the hydraulic circuit, thus simplify the maintenance operations.
- The special elliptical profile of the cam ring, with double suction and delivery chambers one against the other, eliminates the radial thrusts on the rotor, reducing wear of the pump. The use of a 10 vane rotor reduces the delivery pressure pulsations, suppressing the vibrations and noise level of the pump.

#### TECHNICAL SPECIFICATIONS

PUMP SIZE (SINGLE)		FV6C	FV6D	FV6E
Displacement range	cm <sup>3</sup> /rev	10.8 ÷ 100	47.6 ÷ 158	132.3 ÷ 269
Flow rate range (at 1500 rpm - 0 bar)	l/min	16.2 ÷ 150	71.4 ÷ 237	198 ÷ 403
Operating pressure	bar	240	210	210
Rotation speed (max)	rpm	2800	2500	2200
Rotation direction		clockwise or anticlockwise		
Loads on shaft		see diagrams		
Hydraulic connections		SAE J518c		
Mounting flange SAE J744		SAE B	SAE C	SAE C
Mass (empty single pump)	kg	15.4	24	43

Ambient temperature range	°C	-20 / +60
Fluid temperature range (see par. 4)	°C	-10 / +70
Fluid viscosity range	cSt	see paragraph 4
Fluid contamination degree	see paragraph 4.3	
Recommended viscosity	cSt	30

#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE FOR SINGLE PUMPS

<b>FV6</b>	-	-					/	<b>10</b>	
------------	---	---	--	--	--	--	---	-----------	--

Fixed displacement vane pump with SAE flange

Pump size: \_\_\_\_\_  
**C** = from 10.8 to 100 cm<sup>3</sup>/rev  
**D** = from 47.6 to 158 cm<sup>3</sup>/rev  
**E** = from 132.3 to 269 cm<sup>3</sup>/rev

Cartridge size \_\_\_\_\_  
 see paragraph 2

Shaft end type: \_\_\_\_\_

**FV6C**  
**1** = cylindrical keyed SAE B J744  
**2** = cylindrical keyed no SAE  
**3** = splined SAE B J498b class 1  
**4** = splined SAE B-B J498b class 1

**FV6D**  
**1** = cylindrical keyed SAE C J744  
**2** = cylindrical keyed no SAE  
**3** = splined SAE C J498b class 1  
**4** = splined no SAE

**FV6E**  
**1** = cylindrical keyed SAE C-C J744  
**2** = cylindrical keyed no SAE  
**3** = splined SAE C J498b class 1  
**4** = splined SAE C-C J498b class 1

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Series No.  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

Ports position  
 (view from shaft side)  
 Pressure port always on top  
**00** = opposed (**standard**)  
**01** = in line  
**02** = 90° CW from P port  
**03** = 90° CCW 90° CW from P port

Rotation direction  
 (view from shaft side)  
**R** = clockwise  
**L** = counterclockwise

ports position

00	01	02	03



## 2 - PERFORMANCES

(obtained with antiwear mineral oil with viscosity of 24 cSt)

PUMP	CARTRIDGE SIZE	DISPLACEMENT [cm <sup>3</sup> /rev]	MAX FLOW RATE at 0 bar - 1500 rpm [l/min]	PRESSURE [bar]		ROTATION SPEED [rpm]	
				continuous	peak	max	min
FV6C	03	10.8	16.2	240	280	2800	600
	05	17.2	25.8				
	06	21.3	31.9				
	08	26.4	39.6				
	10	34.1	51.1				
	12	37.1	55.6				
	14	46.0	69.0				
	17	58.3	87.4				
	20	63.8	95.7				
	22	70.3	105.4				
	25	79.3	118.9				
	28	88.8	133.2	160	210	2500	600
	31	100.0	150				
FV6D	14	47.6	71.4	210	250	2500	600
	17	58.2	87.3				
	20	66.0	99.0				
	24	79.5	119.3				
	28	89.7	134.6				
	31	98.3	147.5				
	35	111.0	166.5				
	38	120.3	180.5				
	42	136.0	204.0				
	45	145.7	218.6				
	50	158.0	237	160	210	2200	600
FV6E	42	132.3	198.5	210	250	2200	600
	45	142.4	213.6				
	50	158.5	237.8				
	52	164.8	247.2				
	57	179.8	269.6				
	62	196.7	295.1				
	66	213.3	320.0				
	72	227.1	340.0				
	85	269	403	80	120	2000	600



### 3 - IDENTIFICATION CODE FOR DOUBLE PUMPS

<b>FV6</b>			-		/		-			/	<b>10</b>		-	
------------	--	--	---	--	---	--	---	--	--	---	-----------	--	---	--

Fixed displacement vane pump - SAE mounting flange

Pump size : \_\_\_\_\_  
1st pump+ 2nd pump  
**CC**  
**DC**  
**EC**  
**ED**

Option: \_\_\_\_\_  
**W** = Severe duty shaft.  
Available for FV6CC and FV6DC only.  
Omit if not required

1st cartridge size P1 \_\_\_\_\_  
see par. 3.2

2nd cartridge size P2 \_\_\_\_\_  
see par. 3.2

Shaft end type \_\_\_\_\_  
**FV6CC**  
1 = cylindrical keyed no SAE  
3 = splined SAE B-B J498b class 1  
5 = splined SAE B J498b class 1  
**FV6CCW**  
2 = cylindrical keyed SAE B-B J744  
**FV6DC**  
1 = cylindrical keyed SAE C-C J744  
2 = cylindrical keyed no SAE  
3 = splined SAE C J498b class 1  
4 = splined no SAE  
**FV6DCW**  
5 = cylindrical keyed no SAE  
**FV6EC, FV6ED**  
1 = cylindrical keyed SAE C-C J744  
2 = cylindrical keyed no SAE  
3 = splined SAE C J498b class 1  
4 = splined SAE C-C J498b class 1

FV6CC only:  
see par 3.4  
Ports dimensions = **00**  
**01**  
**10**  
**11**

Seals:  
**N** = NBR seals for mineral oils  
**(standard)**  
**V** = FPM seals for special fluids

Series No.  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Ports position  
(view from shaft side)  
see table 3.3

Rotation direction (view from shaft side)  
**R** = clockwise **(standard)**  
**L** = counterclockwise

#### 3.1 - Triple pumps

Triple pumps available. Please consult our technical offices.

### 3.2 - Available cartridges

Grey boxes indicates reduced performance. See paragraph 2 for limits.

The second cartridge (for P2) should have equal or lower displacement than the first.

CC		DC		EC		ED	
1st cartridge	2nd cartridge	1st cartridge	2nd cartridge	1st cartridge	2nd cartridge	1st cartridge	2nd cartridge
03	03	14	03	42	03	42	14
05	05	17	05	45	05	45	17
06	06	20	06	50	06	50	20
08	08	24	08	52	08	52	24
10	10	28	10	57	10	57	28
12	12	31	12	62	12	62	31
14	14	35	14	66	14	66	35
17	17	38	17	72	17	72	38
20	20	42	20	85	20	85	42
22	22	45	22		22		45
25	25	50	25		25		50
28	28		28		28		
31	31		31		31		

### 3.3 - Ports position codes

FV6CC FV6DC FV6EC	00		01		02		03		04		05		06		07	
	08		09		10		11		12		13		14		15	
	16		17		18		19		20		21		22		23	
	24		25		26		27		28		29		30		31	
	00		01		02		03		04		05		06		07	
	08		09		10		11		12		13		14		15	
	16		17		18		19		20		21		22		23	
	24		25		26		27		28		29		30		31	
	00		01		02		03		04		05		06		07	
	08		09		10		11		12		13		14		15	
	16		17		18		19		20		21		22		23	
	24		25		26		27		28		29		30		31	
	00		01		02		03		04		05		06		07	
	08		09		10		11		12		13		14		15	
	16		17		18		19		20		21		22		23	
	24		25		26		27		28		29		30		31	





### 3.4 - Ports dimensions for FV6CC and FV6CCW

The largest cartridge must always be installed on the front side.

P2 = 3/4" for 46 ml/rev max

S = 2" 1/2 for 126 ml/rev max

	P1	P2	S
00	1"	1"	3"
01	1"	3/4"	3"
10	1"	1"	2" 1/2
11	1"	3/4"	2" 1/2

## 4 - HYDRAULIC FLUID

Data in this catalogue are obtained with antiwear fluid petroleum base. Minimum allowable inlet pressure 0,8 absolute bar (-0,2 relative bars). Differential pressure between inlet and outlet pressure should be at least 1.5 bar.

Pressures, maximum allowed speeds and recommended temperatures are shown in the table below, according to the types of hydraulic fluid used.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	<p>The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows:</p> <p>max continuous pressure: 140 bar (FV6E-085 is 75 bar) max peak pressure: 175 bar (FV6E-085 is 75 bar) max rotation speed: 1800 rpm</p> <p>- Minimum allowable inlet pressure 1 absolute bar - The fluid maximum temperature must be between 10°C and 50°C. - Use NBR seals only. - Minimum viscosity 18 cSt</p>
HFD (phosphate esters)	<p>The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows:</p> <p>max continuous pressure: 175 /160 bar (FV6E-085 is 80 bar) max peak pressure: 210 bar (FV6E-085 is 120 bar) max rotation speed: 1800 rpm</p> <p>- Minimum allowable inlet pressure 1,08 absolute bar - The fluid temperature must be between -18°C and 70°C. - Use VITON seals - Minimum viscosity 18 cSt</p>

### 4.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to the maximum temperature of 90 °C of the fluid, with antiwear
optimum viscosity	30 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	840 cSt	limited to only the pump start-up phase at cold start.

When choosing the fluid type, verify that the true viscosity at the operating temperature is within the above range.

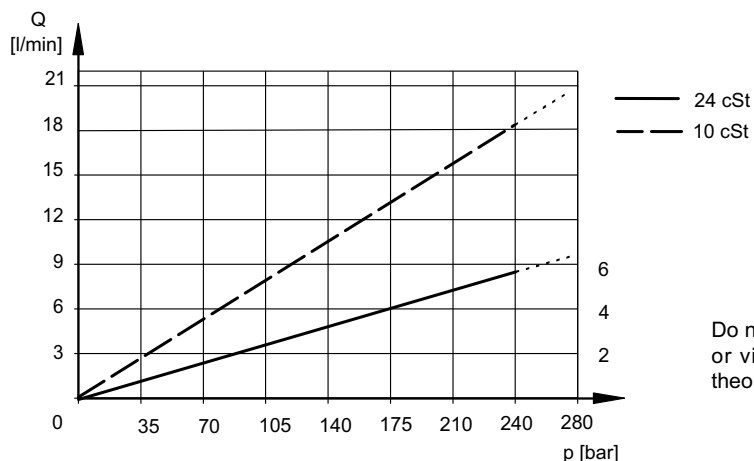
### 4.3 - Degree of fluid contamination

The degree of fluid contamination must be according to ISO 4406:1999 class 19/17/14 or better. Strainers on inlet port are not recommended. However, if requested, do not exceed 149 micron (100 mesh).

### 5 - CHARACTERISTIC CURVES OF SINGLE PUMPS

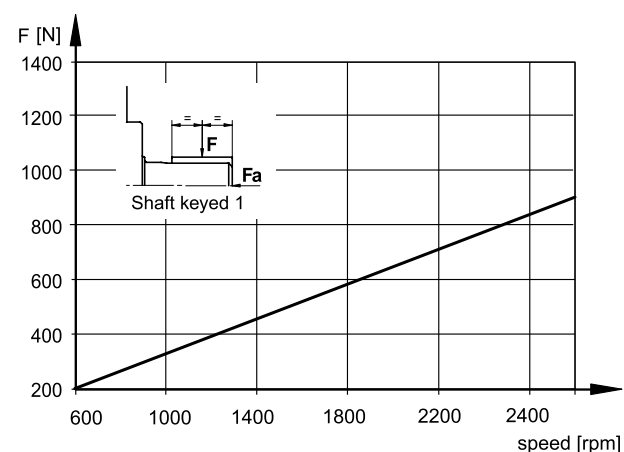
#### 5.1 - FV6C

##### INTERNAL LEAKAGE (typical)



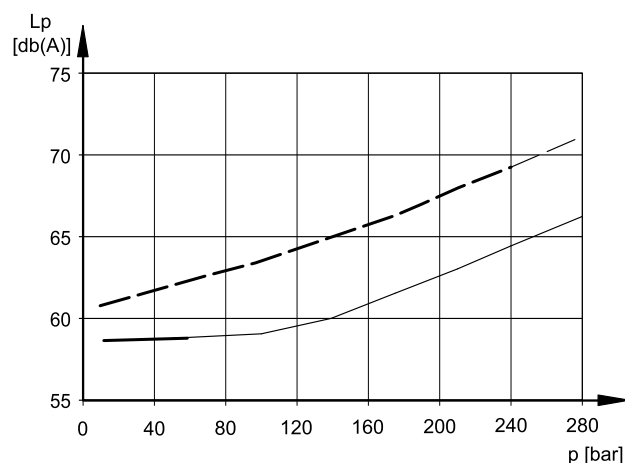
Do not operate the pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow.

##### PERMISSIBLE RADIAL LOAD



Maximum permitted axial load  $F_a = 800$  N

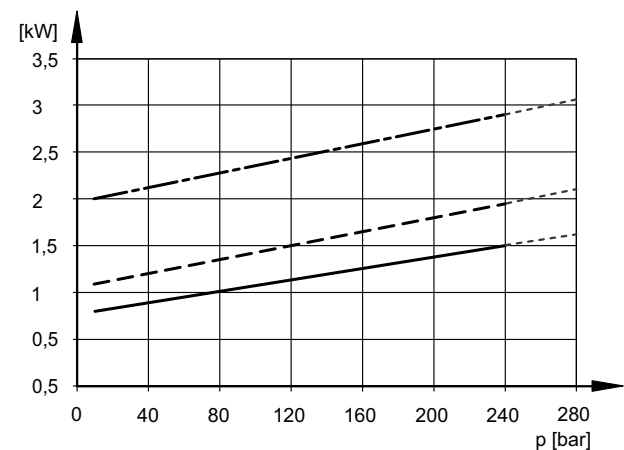
##### NOISE LEVEL (typical)



Value obtained with a FV6C-22 pump, according to ISO 4412  
1 mt distance

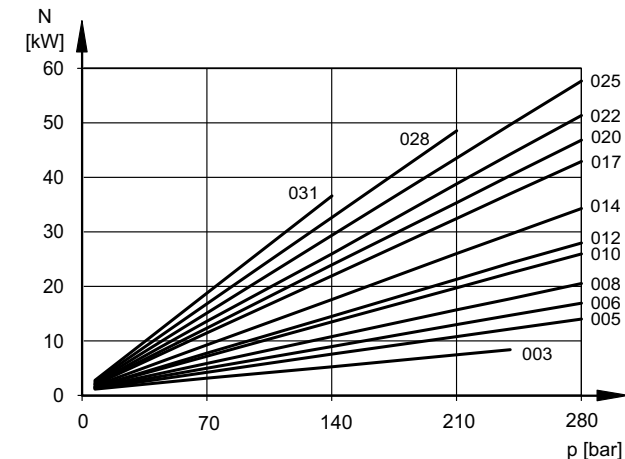
— 1000 rpm  
- - 1500 rpm

##### POWER LOSS HYDROMECHANICAL (typical)



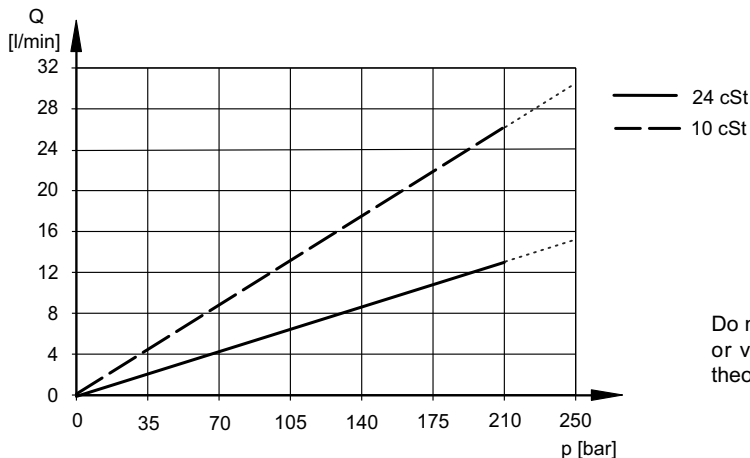
—  $n = 1000$  RPM  
- -  $n = 1500$  RPM [24 cSt]  
- .  $n = 2800$  RPM

##### ABSORBED POWER at 1500 rpm



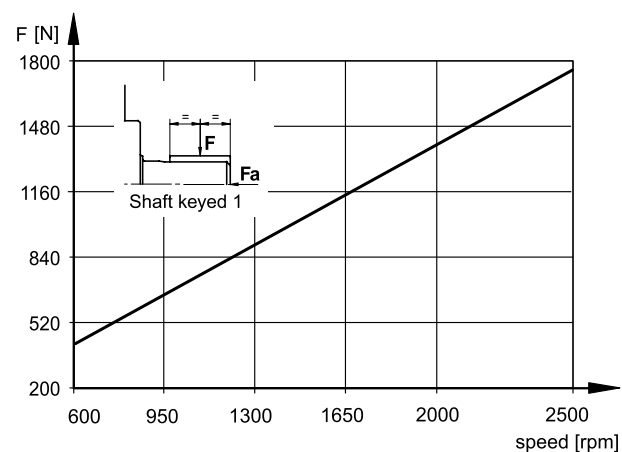
### 5.2 - FV6D

#### INTERNAL LEAKAGE (typical)

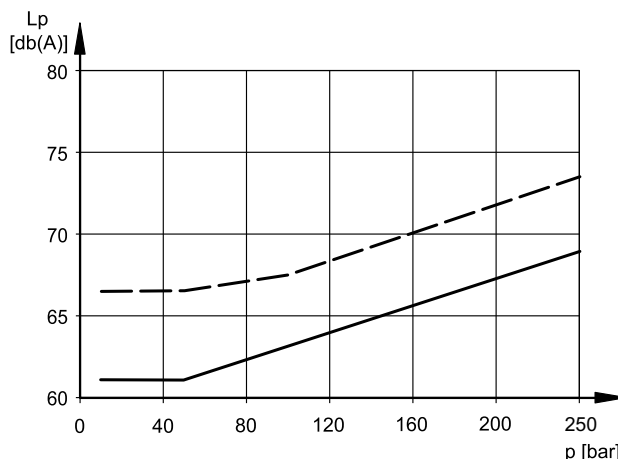


Do not operate the pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow.

#### PERMISSIBLE RADIAL LOAD

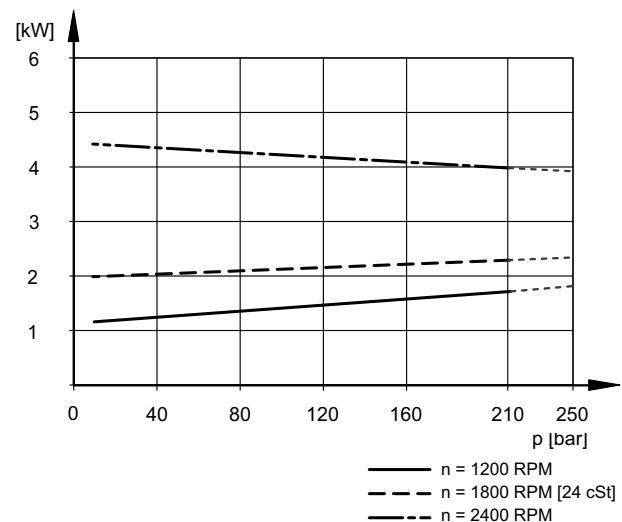


#### NOISE LEVEL (typical)

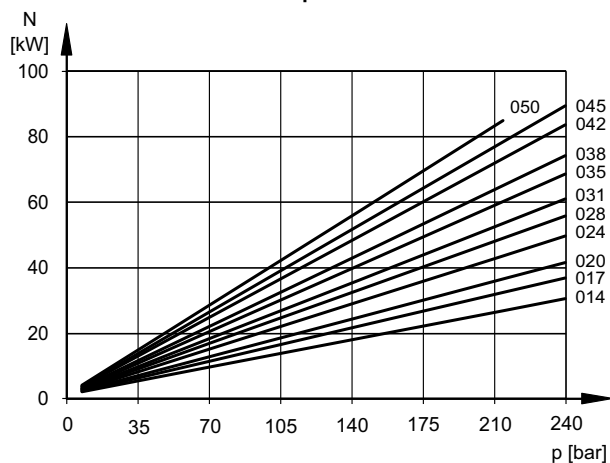


Value obtained with a FV6D-38 pump, according to ISO 4412  
1 mt distance

#### POWER LOSS HYDROMECHANICAL (typical)

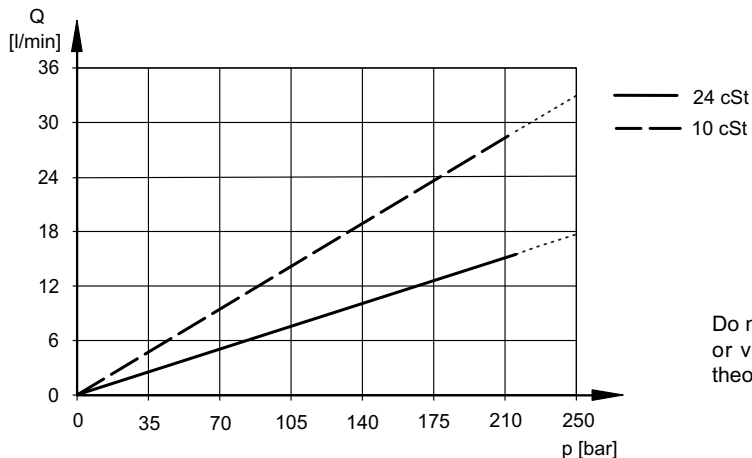


#### ABSORBED POWER at 1500 rpm



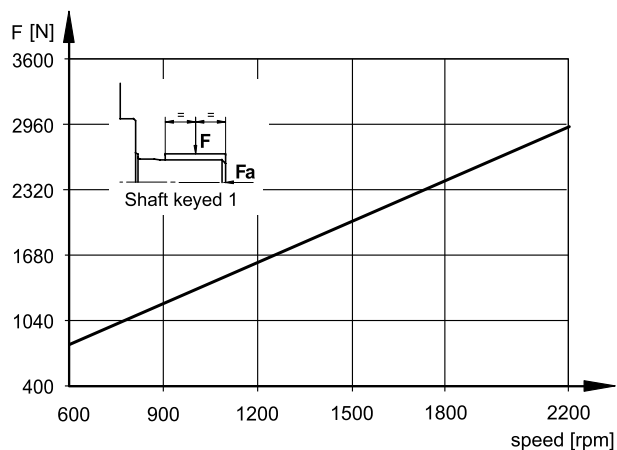
### 5.3 - FV6E

#### INTERNAL LEAKAGE (typical)



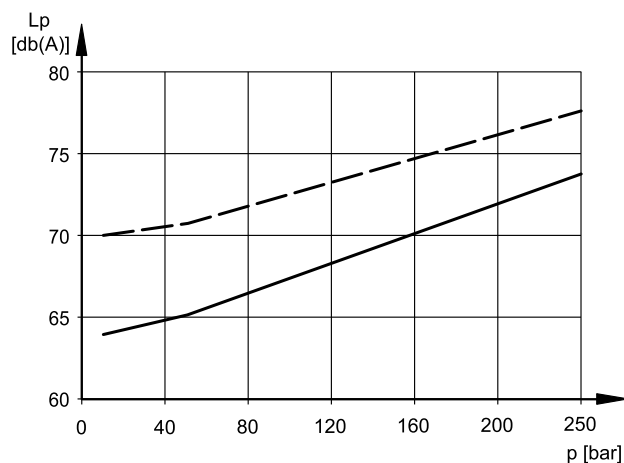
Do not operate the pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow.

#### PERMISSIBLE RADIAL LOAD



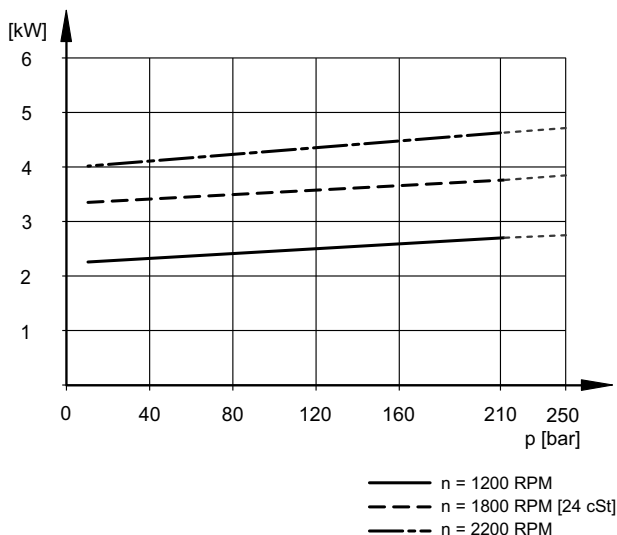
Maximum permitted axial load  $F_a = 2000$  N

#### NOISE LEVEL (typical)

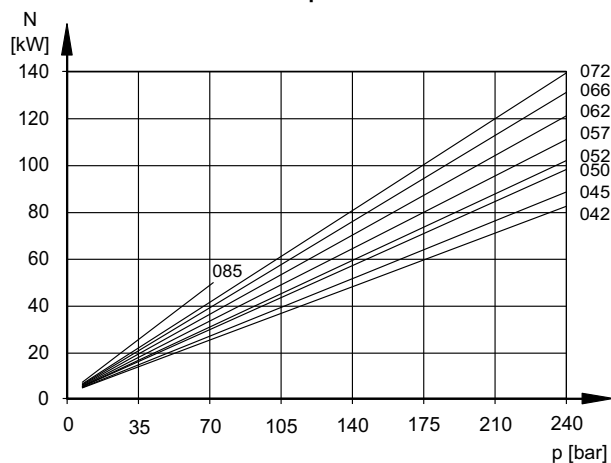


Value obtained with a FV6E-50 pump, according to ISO 4412  
1 mt distance

#### POWER LOSS HYDROMECHANICAL (typical)

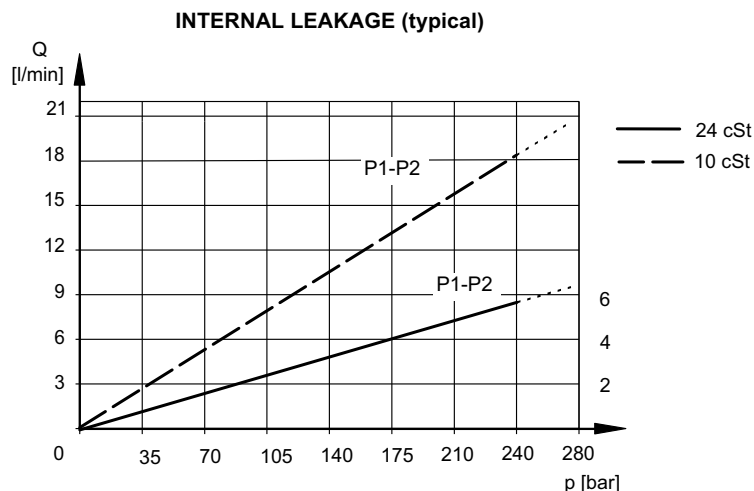


#### ABSORBED POWER at 1500 rpm



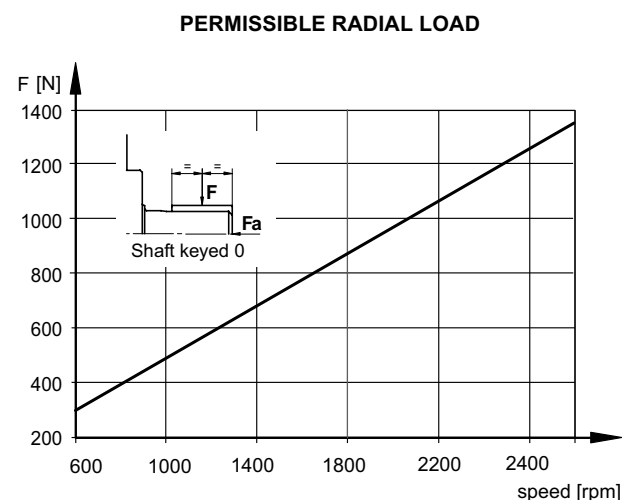
### 6 - CHARACTERISTIC CURVES OF DOUBLE PUMPS

#### 6.1 - FV6CC



Do not operate pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow

Total leakage is the sum of each section loss at its operating conditions.

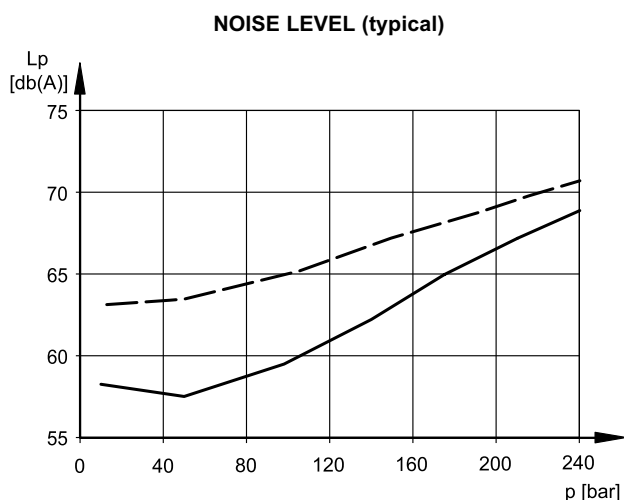


Maximum permitted axial load  $F_a = 800$  N

#### POWER LOSS HYDROMECHANICAL

Refer to diagram of FV6C pump.

Total hydromechanics power loss is the sum of each section at its operating conditions.

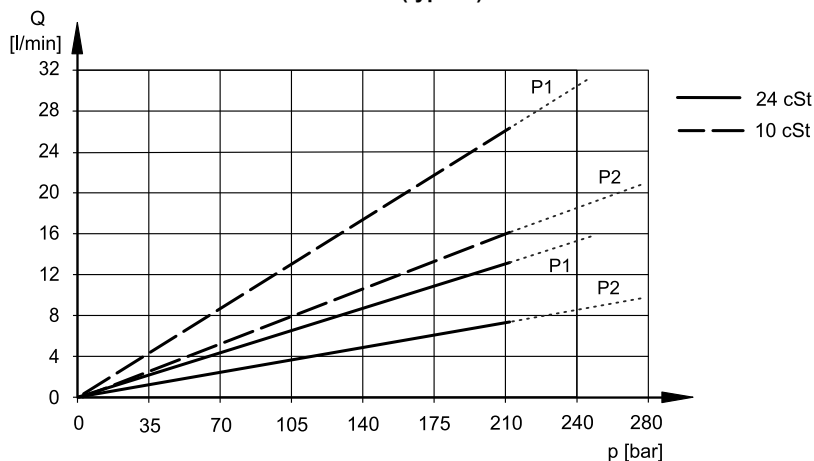


FV6CC-22/22 pump, according to ISO 4412, 1 mt distance.

Values obtained with  $p_e = 0.9$  bar abs and both stages discharging at the same pressure.

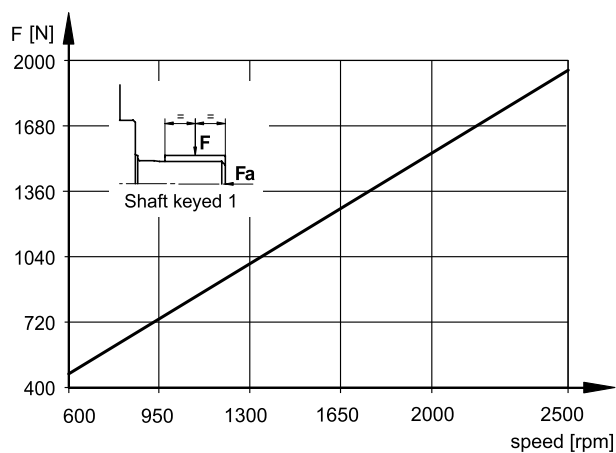
## 6.2 - FV6DC

**INTERNAL LEAKAGE (typical)**



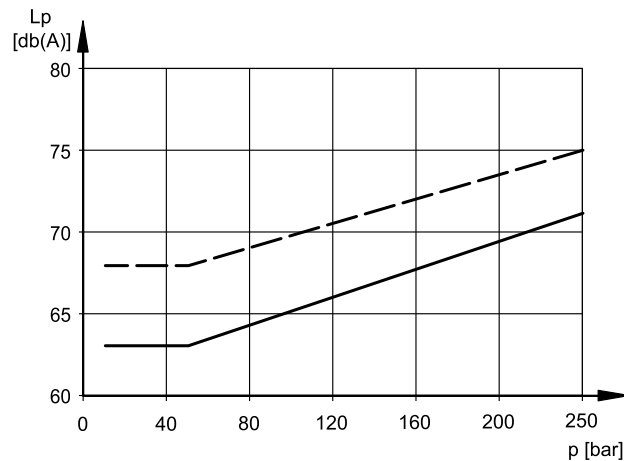
Do not operate pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow  
Total leakage is the sum of each section loss at its operating conditions.

**PERMISSIBLE RADIAL LOAD**



Maximum permitted axial load  $F_a = 1200$  N

**NOISE LEVEL (typical)**



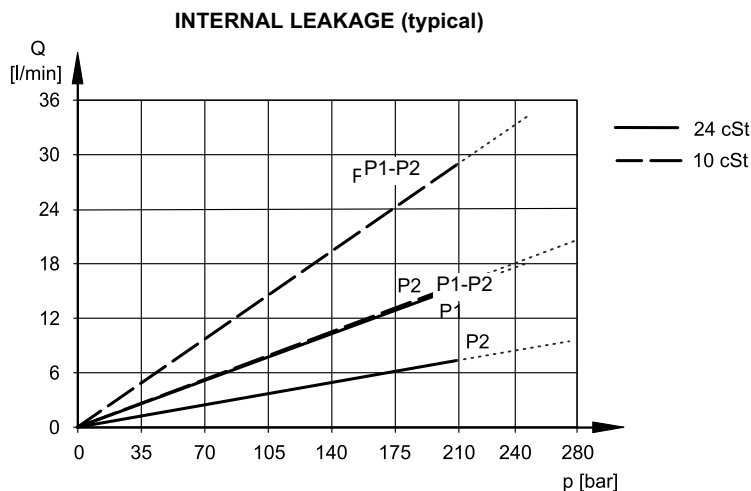
FV6DC-38/22 pump, according to ISO 4412, 1 mt distance  
— 1000 rpm  
- - 1500 rpm

Values obtained with  $p_e = 0.9$  bar  
abs and both stages discharging at the same pressure.

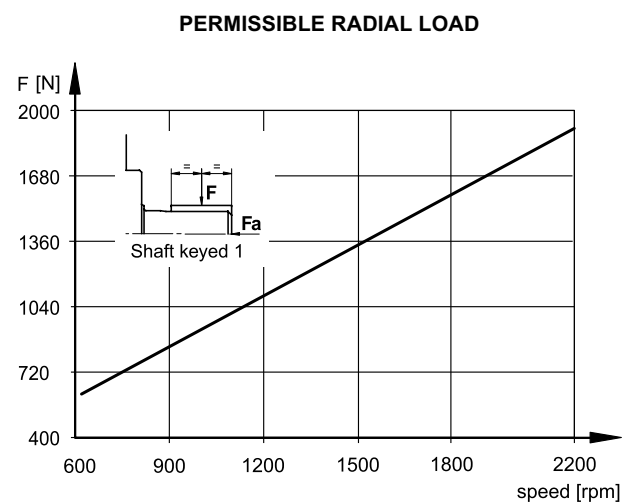
## POWER LOSS HYDROMECHANICAL

Refer to diagram of FV6D pump for P1 and to that of FV6C for P2.  
Total hydromechanics power loss is the sum of each section at its operating conditions.

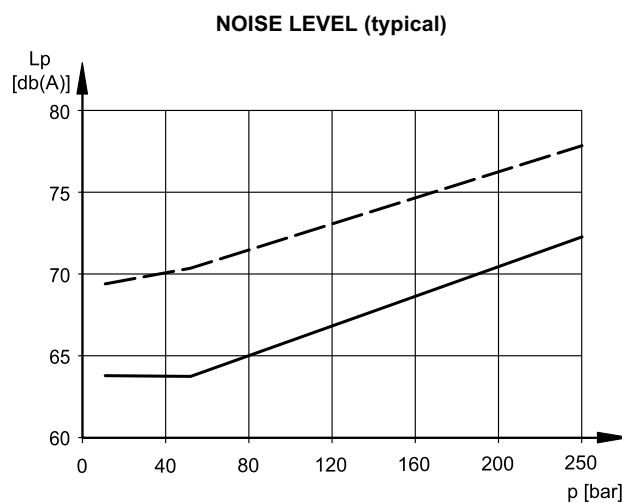
## 6.3 - FV6EC



Do not operate pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow  
Total leakage is the sum of each section loss at its operating conditions.



Maximum permitted axial load  $F_a = 2000$  N



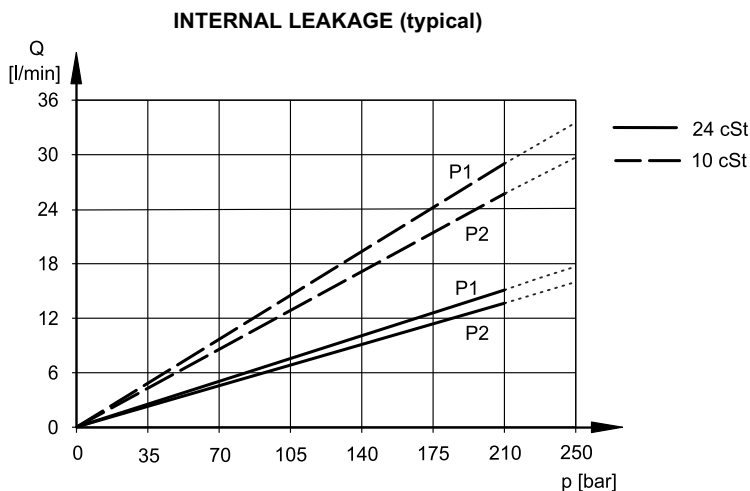
FV6EC-50/22 pump, according to ISO 4412, 1 mt distance.

Values obtained with  $p_e = 0.9$  bar abs and both stages discharging at the same pressure.

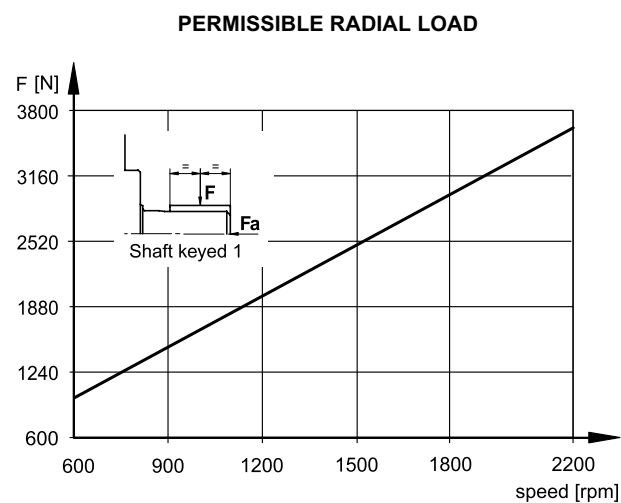
## POWER LOSS HYDROMECHANICAL

Refer to diagram of FV6E pump for P1 and to that of FV6C for P2.  
Total hydromechanics power loss is the sum of each section at its operating conditions.

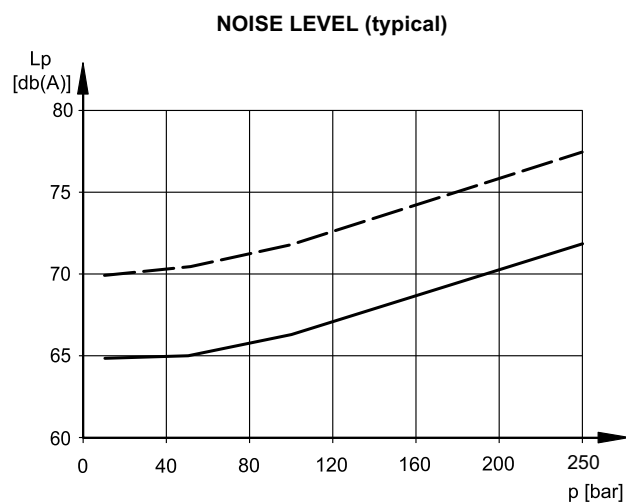
## 6.4 - FV6ED



Do not operate pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow  
Total leakage is the sum of each section loss at its operating conditions.



Maximum permitted axial load  $F_a = 2000$  N



FV6ED-50/38 pump, according to ISO 4412, 1 mt distance

Values obtained with  $p_e = 0.9$  bar abs and both stages discharging at the same pressure.

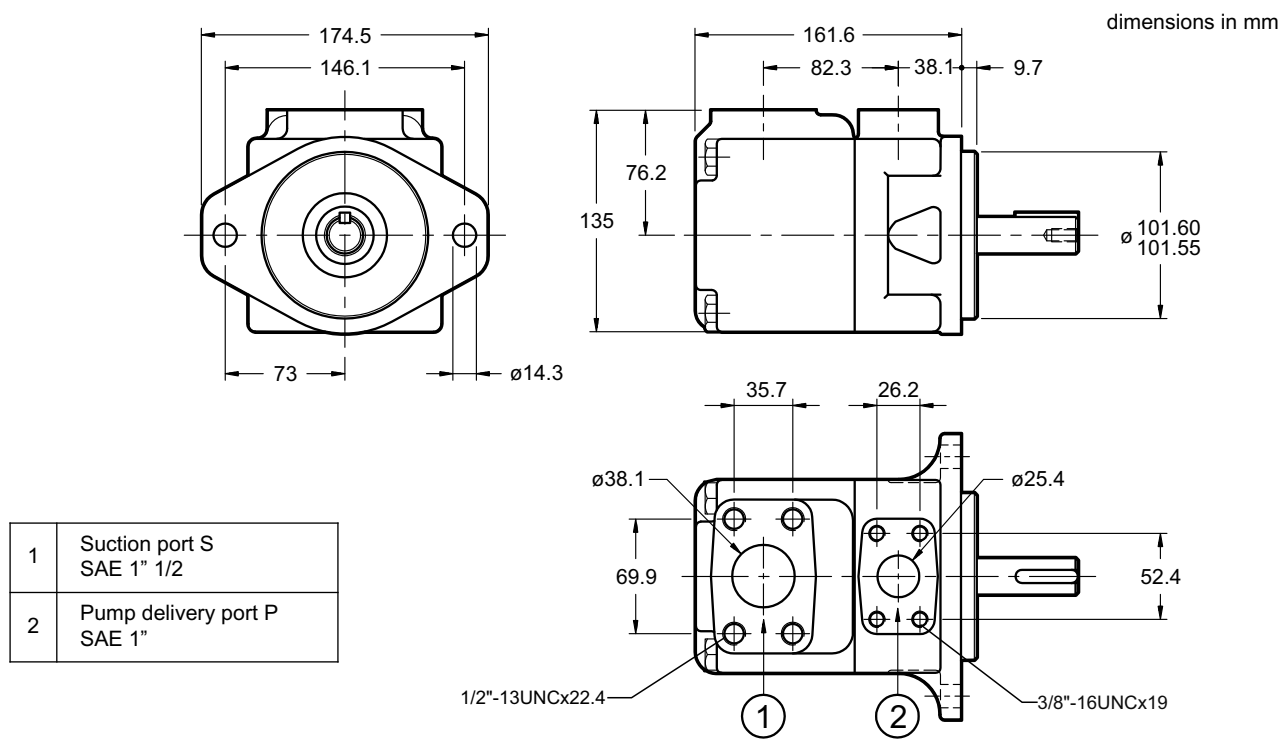
## POWER LOSS HYDROMECHANICAL

Refer to diagram of FV6E pump for P1 and to that of FV6D for P2.  
Total hydromechanics power loss is the sum of each section at its operating conditions.



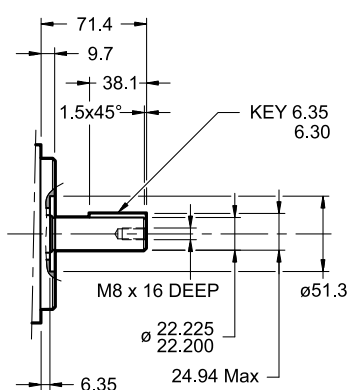
## 7 - SINGLE PUMPS OVERALL AND MOUNTING DIMENSIONS

### 7.1 - FV6C

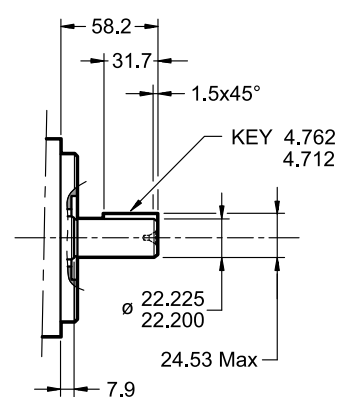


**SHAFTS:**

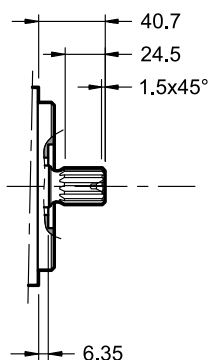
cylindrical keyed SAE B  
(identification code: 1)  
Torque limit: 275 Nm



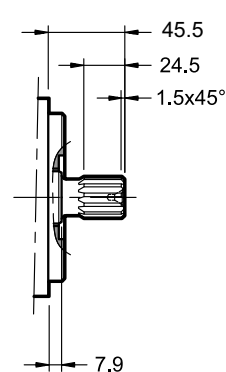
cylindrical keyed no SAE  
(identification code: **2**)  
Torque limit: 238 Nm



splined SAE B J498  
16/32 d.p. - 13T  
(identification code: **3**)  
Torque limit: 343 Nm

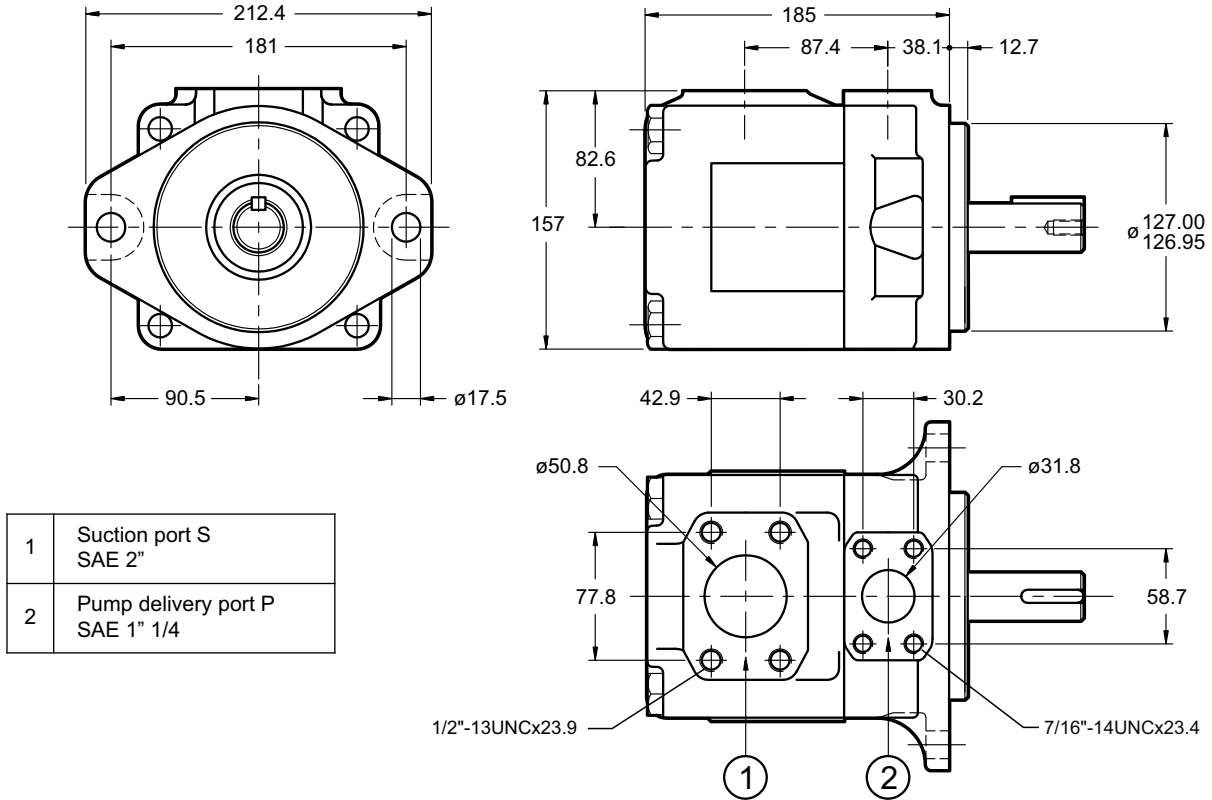


splined SAE B-B J498  
16/32 d.p. - 15T  
(identification code: 4)



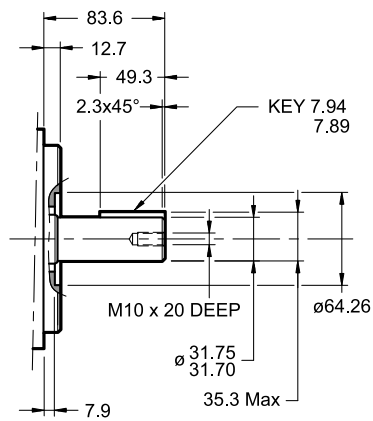
## 7.2 - FV6D

dimensions in mm

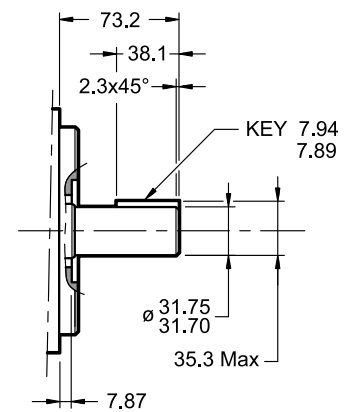


### SHAFTS:

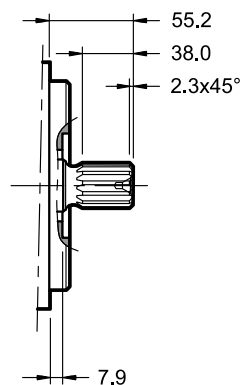
cylindrical keyed SAE C  
(identification code: 1)



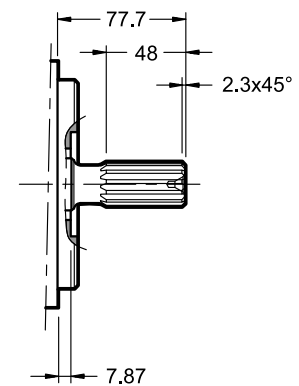
cylindrical keyed no SAE  
(identification code: 2)  
Torque limit: 577 Nm



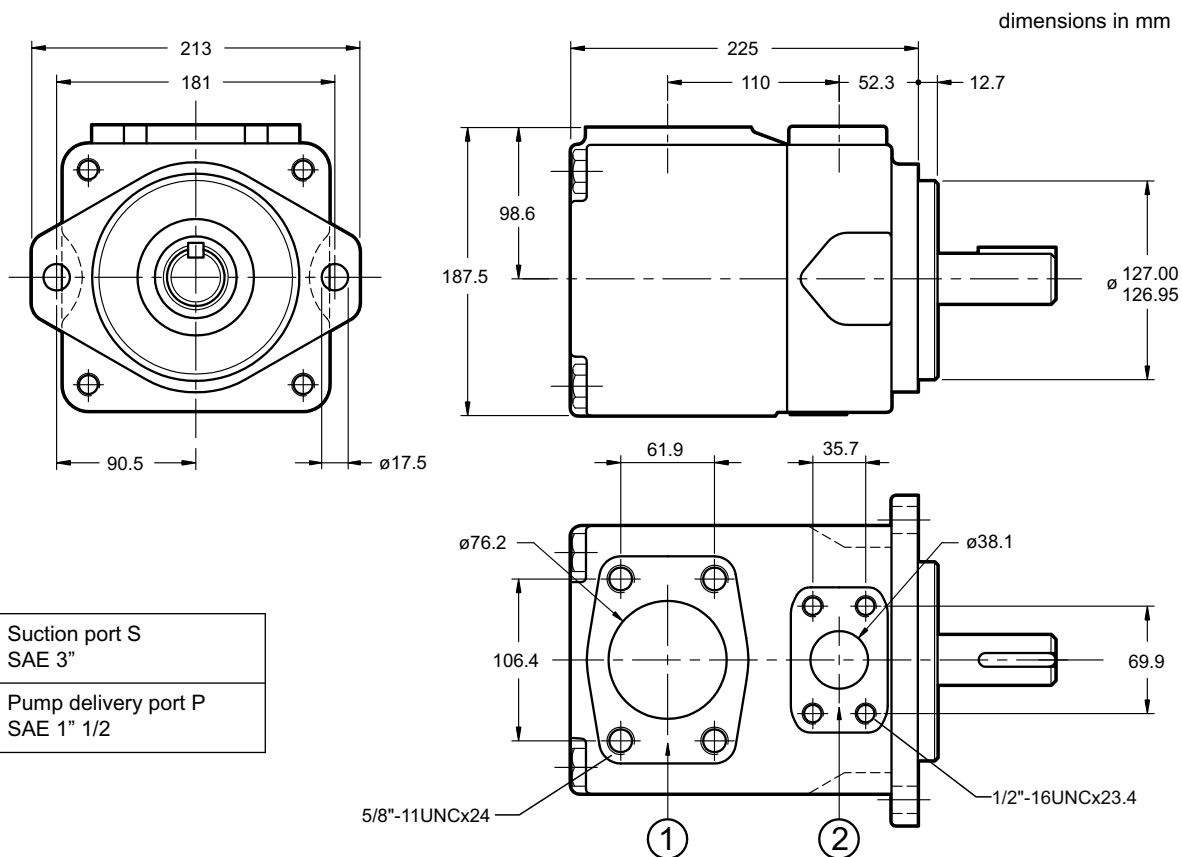
splined SAE C J498b  
12/24 d.p. - 14T  
(identification code: 3)



splined no SAE  
12/24 d.p. - 14T  
(identification code: 4)

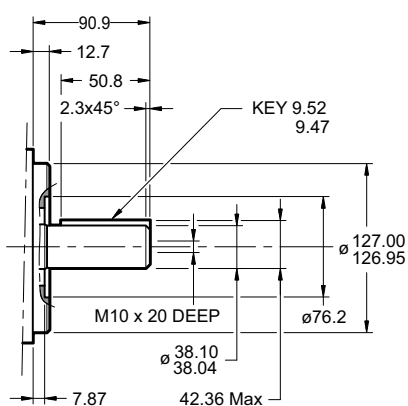


## 7.3 - FV6E

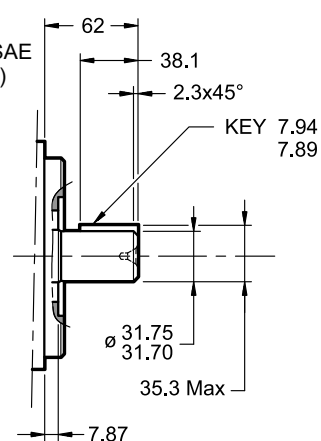


### SHAFTS:

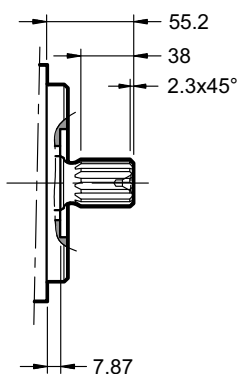
cylindrical keyed SAE C-C  
(identification code: 1)



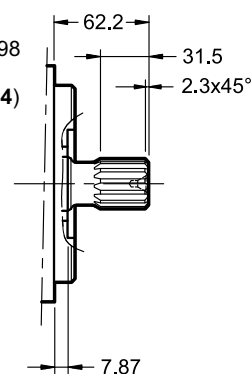
cylindrical keyed no SAE  
(identification code: 2)  
Torque limit: 577 Nm



splined SAE B J498  
12/24 d.p. - 14T  
(identification code: 3)

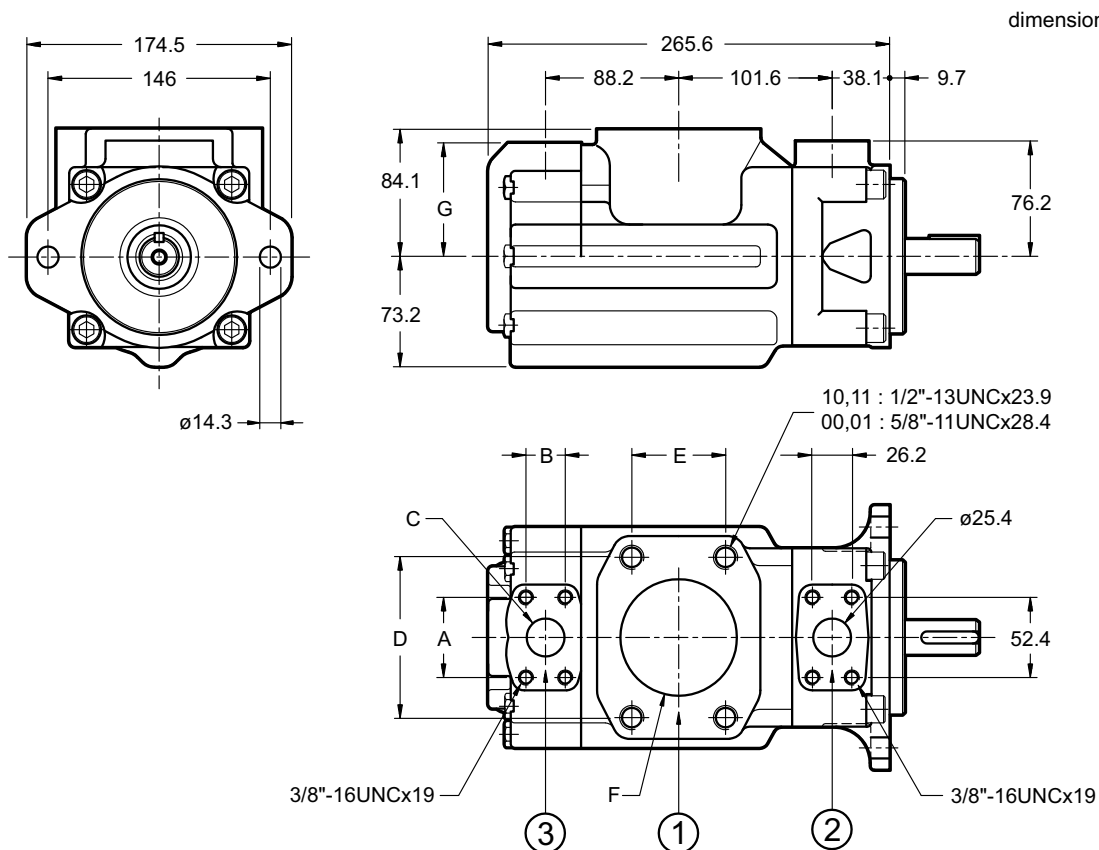


splined SAE B-B J498  
12/24 d.p. - 17T  
(identification code: 4)



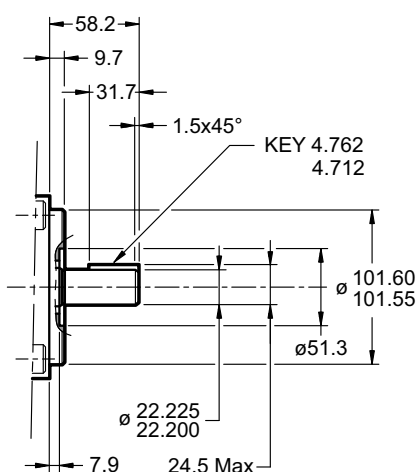
## 8 - DOUBLE PUMPS OVERALL AND MOUNTING DIMENSIONS

### 8.1 - FV6CC

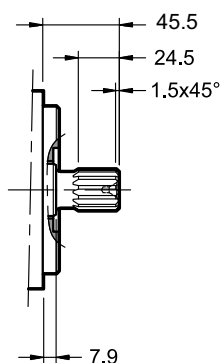


#### SHAFTS:

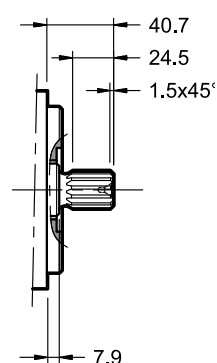
cylindrical keyed - no SAE  
(identification code: 1)  
Torque limit: 238 Nm



splined SAE B-B J498b  
16/32 d.p. - 15T  
(identification code: 3)  
Torque limit: 545 Nm



splined SAE B J498b  
16/32 d.p. - 13T  
(identification code: 5)  
Torque limit: 343 Nm



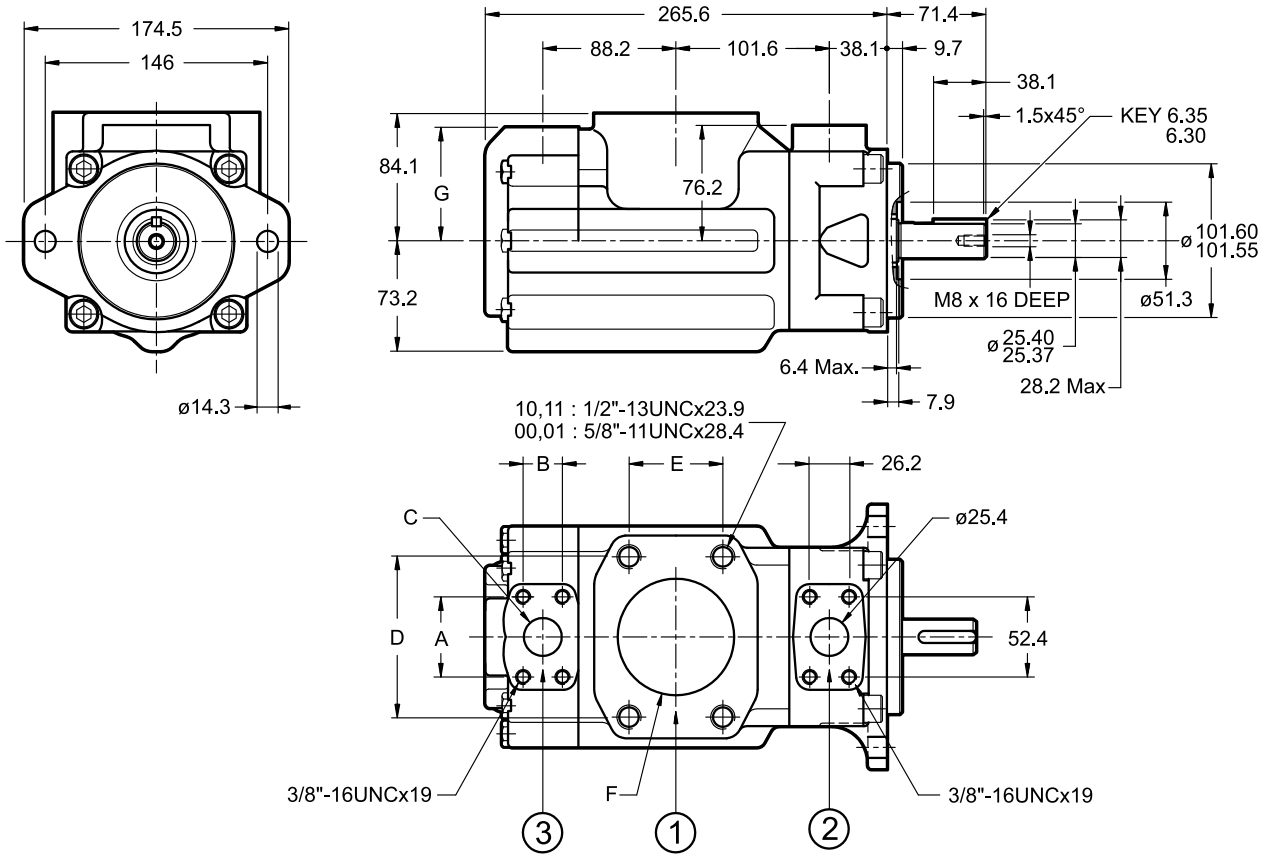
#### PORTS DIMENSIONS (mm)

code	A	B	$\phi C$	D	E	$\phi F$	G
00	52.4	26.2	25.4	106.4	61.9	76.2	74.7
01	47.6	22.2	19.0	106.4	61.9	76.2	76.2
10	52.4	26.2	25.4	88.9	50.8	63.5	74.7
11	47.6	22.2	19.0	88.9	50.8	63.5	76.2

1	Suction port S: 00, 01 : SAE 3" 10, 11 : SAE 2" 1/2
2	Delivery port P1: SAE 1"
3	Delivery port P2: 00, 10 : SAE 1" 01, 11 : SAE 3/4"

### 8.2 - FV6CCW

dimensions in mm



**SHAFT:**  
cylindrical keyed SAE B-B  
(identification code: 2)  
Torque limit 357 Nm

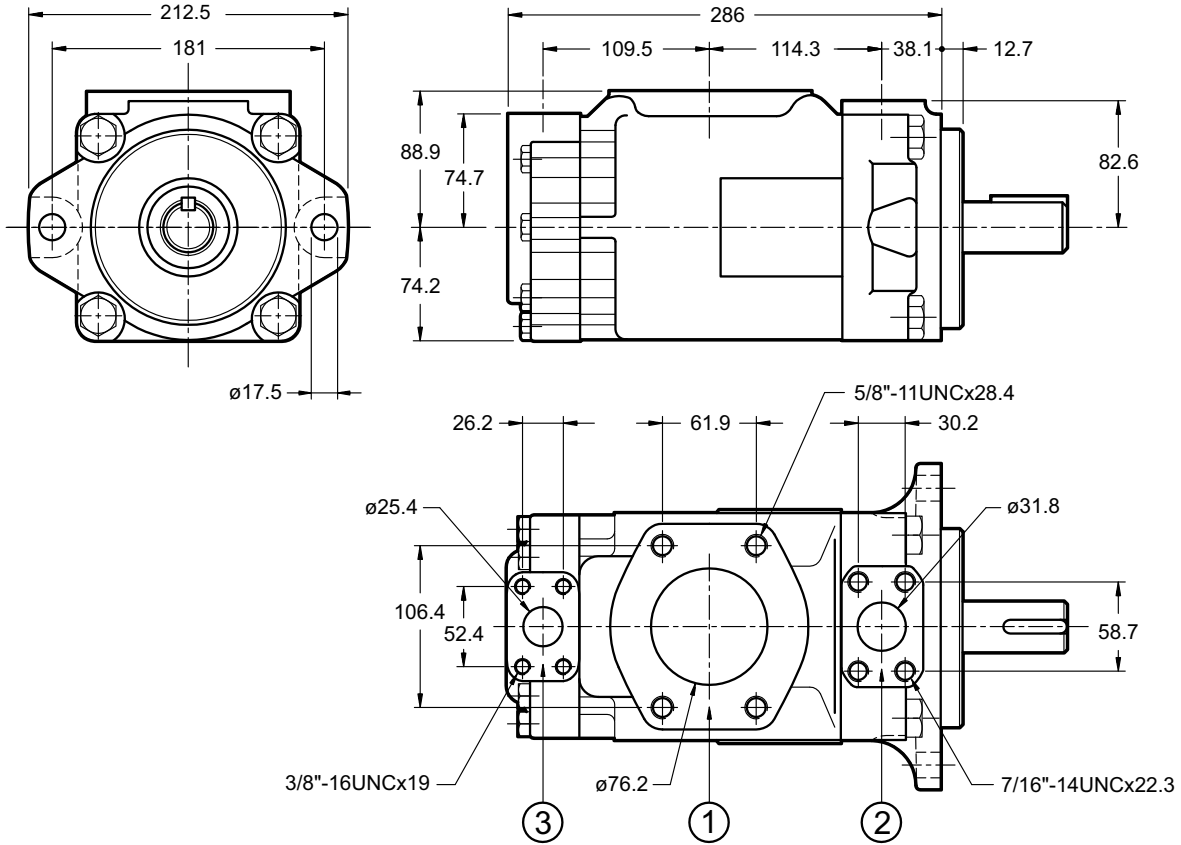
**PORTS DIMENSIONS (mm)**

code	A	B	ØC	D	E	ØF	G
00	52.4	26.2	25.4	106.4	61.9	76.2	74.7
01	47.6	22.2	19.0	106.4	61.9	76.2	76.2
10	52.4	26.2	25.4	88.9	50.8	63.5	74.7
11	47.6	22.2	19.0	88.9	50.8	63.5	76.2

1	Suction port S: 00, 01 : SAE 3" 10, 11 : SAE 2" 1/2
2	Delivery port P1: SAE 1"
3	Delivery port P2: 00, 10 : SAE 1" 01, 11 : SAE 3/4"

## 8.3 - FV6DC

dimensions in mm



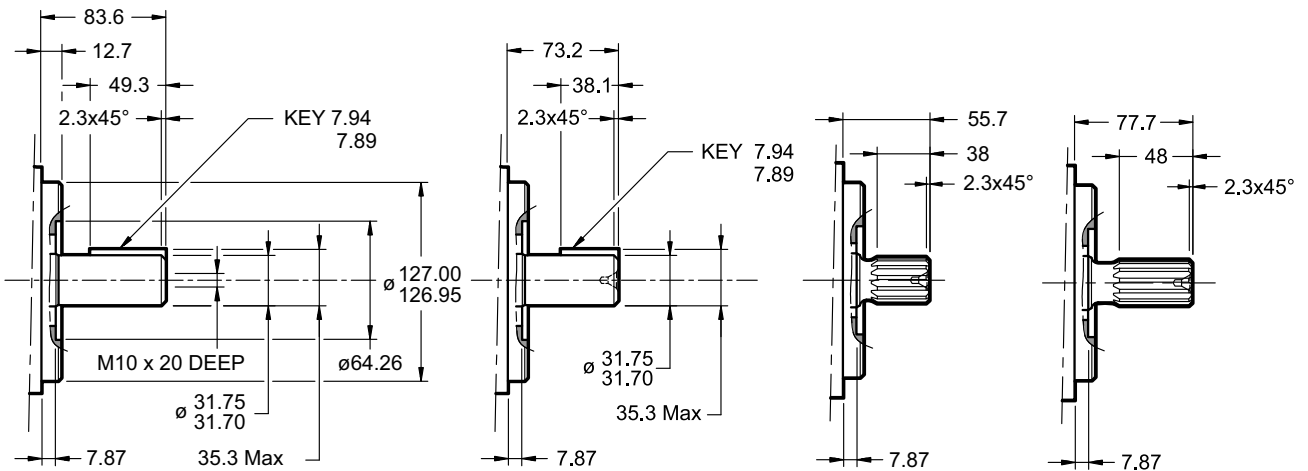
### SHAFTS:

cylindrical keyed SAE C-C  
(identification code: 1)  
Torque limit: 721 Nm

cylindrical keyed - no SAE  
(identification code: 2)  
Torque limit: 577 Nm

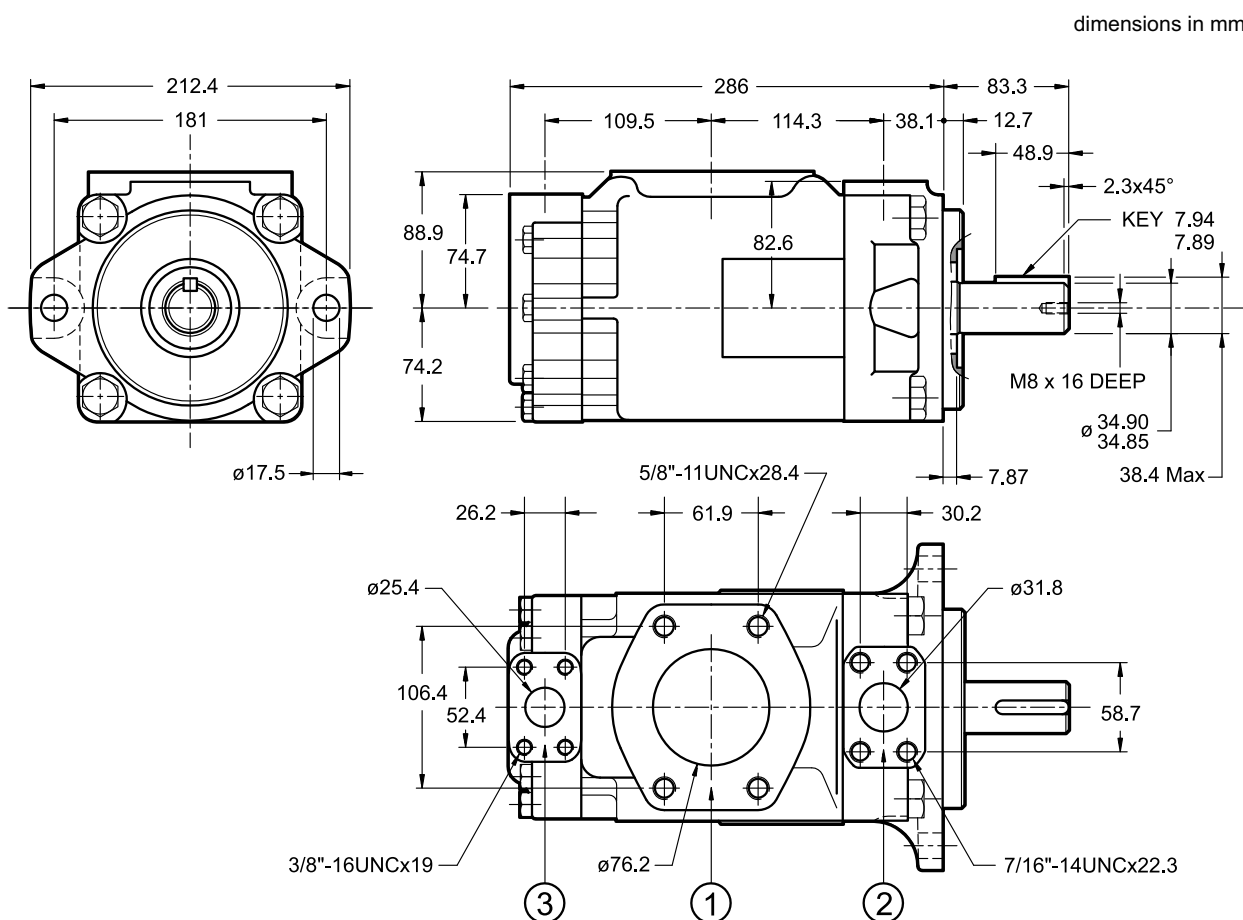
splined SAE C  
12/24 d.p. - 14T  
(identification code: 3)

splined - no SAE  
12/24 d.p. - 14T  
(identification code: 4)



1	Suction port S SAE 3"
2	Delivery port P1: SAE 1" 1/4
3	Delivery port P2: SAE 1"

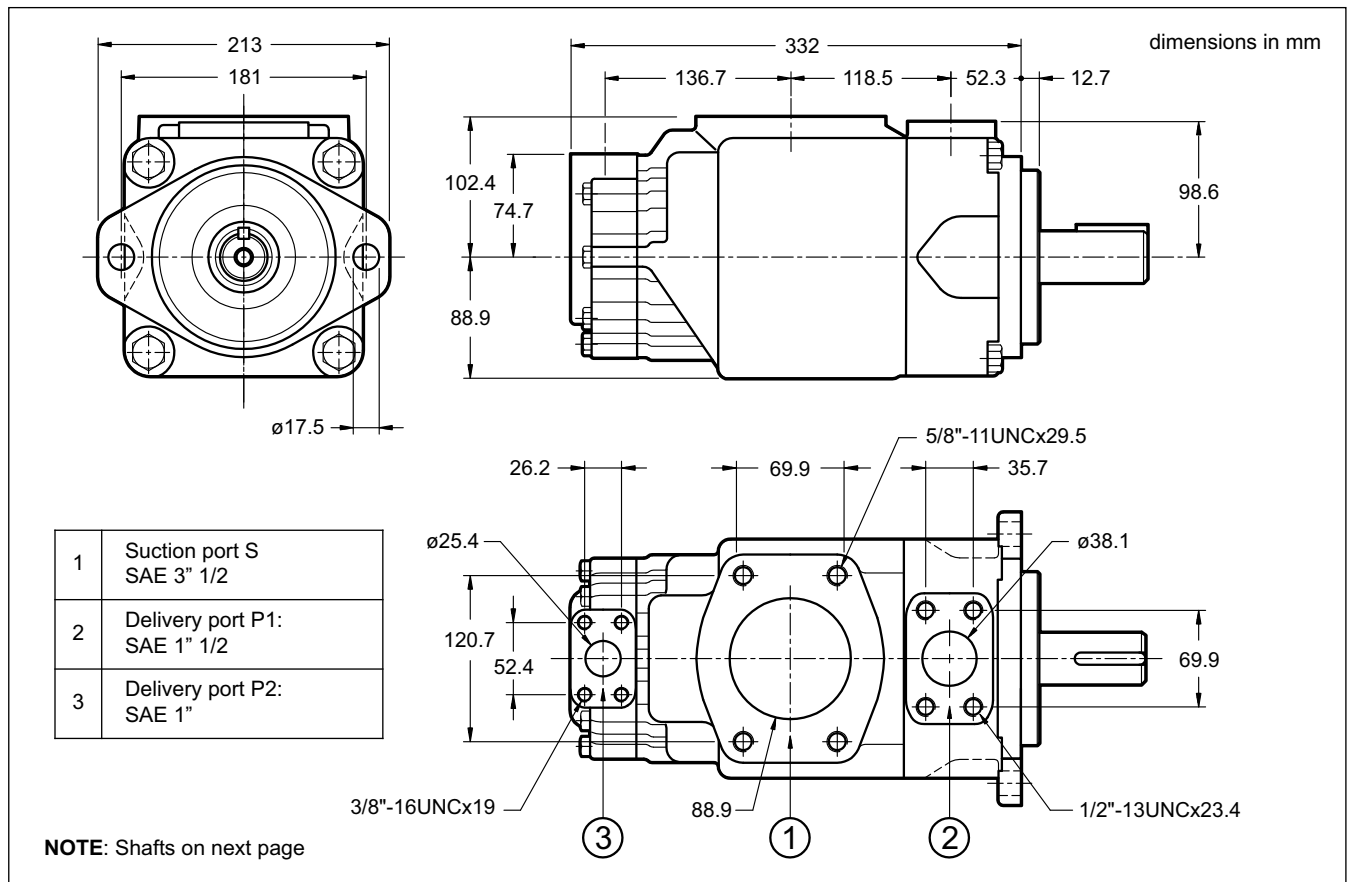
#### 8.4 - FV6DCW



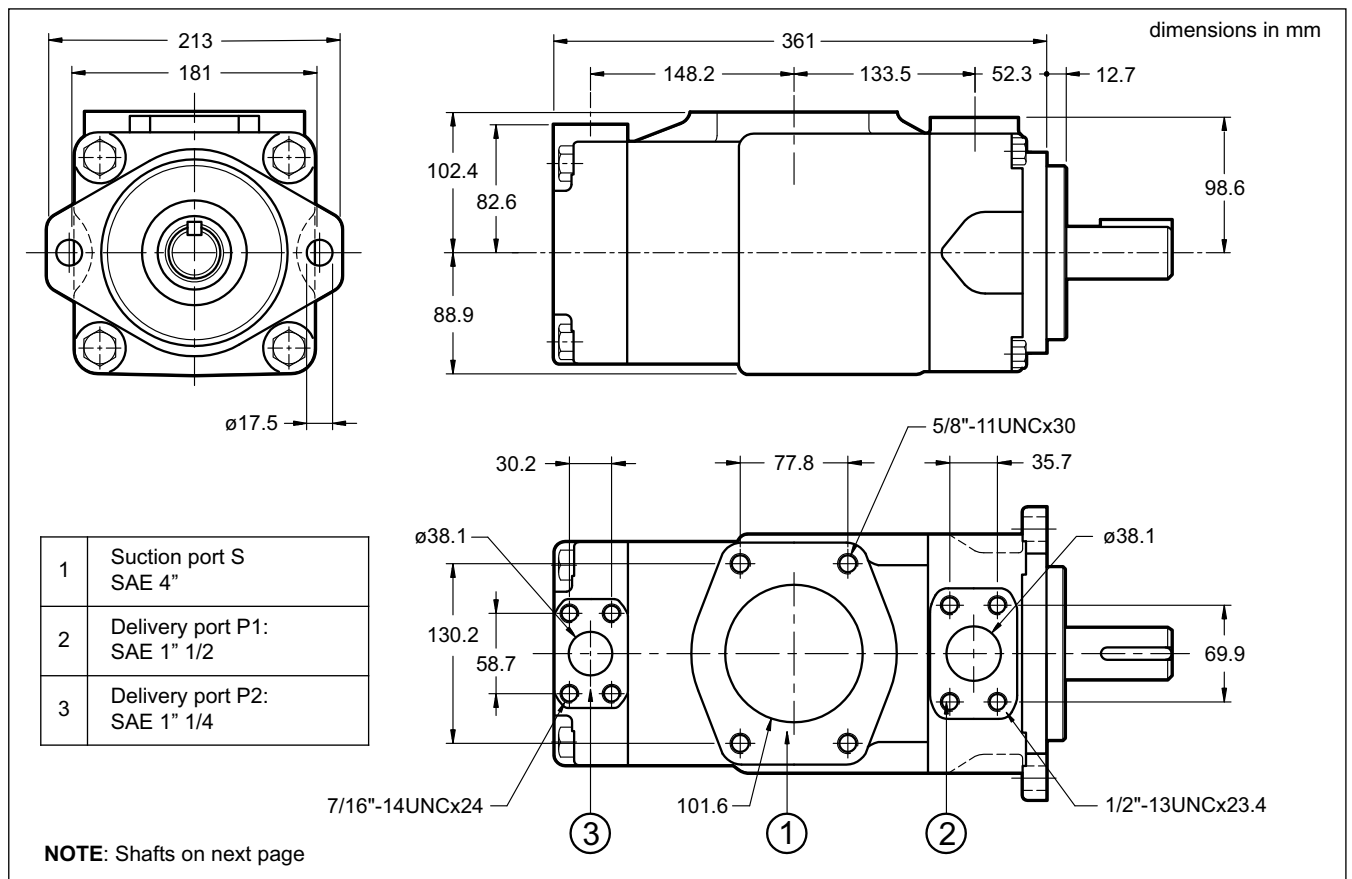
**SHAFT:**  
cylindrical keyed - no SAE  
(identification code: **5**)

1	Suction port S SAE 3"
2	Delivery port P1: SAE 1" 1/4
3	Delivery port P2: SAE 1"

## 8.5 - FV6EC



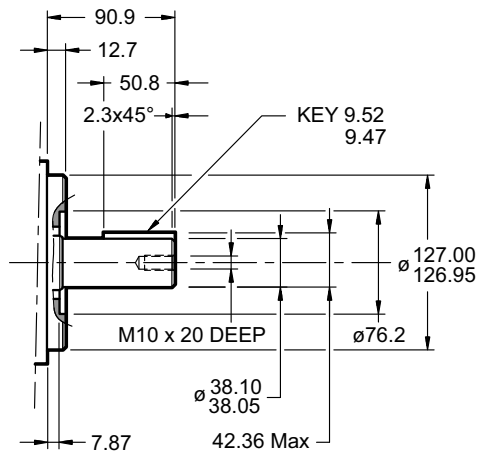
## 8.6 - FV6ED



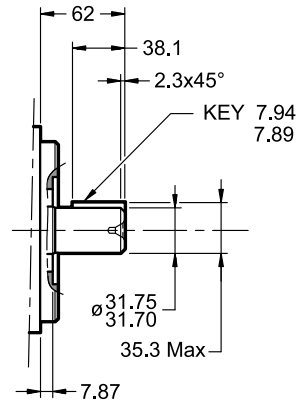


## 8.7 - Shafts for FV6EC and FV6ED

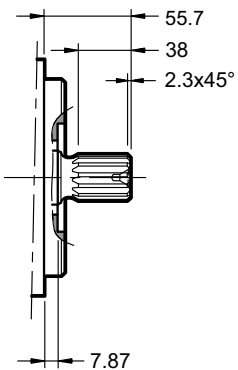
cylindrical keyed SAE C-C  
(identification code: 1)



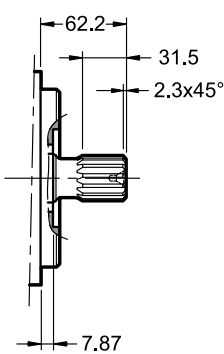
cylindrical keyed - no SAE  
(identification code: 2)  
Torque limit: 577 Nm



splined SAE C J498  
12/24 d.p. - 14T  
(identification code: 3)



splined SAE C-C J498b  
12/24 d.p. - 17T  
(identification code: 4)



### 9 - INSTALLATION AND START-UP

- FV6 pumps can be installed in any position. They are normally positioned directly above the oil tank. The installation below the oil level is suggested for circuits with high flow rates and pressures.
  - The suction line must be sized to facilitate the oil flow. Bends and restrictions or an excessive line length could impair the operation of the pump. A bevel on both suction and return lines is recommended to increase the surface and so lower the velocity. We suggest a 45° minimum angle.
  - Check the rotation direction of the motor is according to the rotation direction shown on the pump label before start up.
  - The pump start-up should occur with the pump unloaded, especially at cold temperatures. Set the pressure relief valve of the circuit to its minimum setting value so the pump is unloaded when started. Circuit priming and air bleed off have to be performed before resetting the pressure relief valve.
  - A minimum pump shaft speed of 600 rpm is recommended for priming. To prevent possible damage to the internal parts, the pump should never be started dry or without internal lubrication. The pump should prime quite instantly (few seconds). If not, shut down and check conditions.
- Pump with positive head: allow the fluid to flow to the pump inlet, loosen the discharge port(s) fitting(s) until the fluid comes out and re-tighten the discharge line(s). Then start the pump which should prime quite instantly. Purge the air off the circuit, preferably using air bleed off valves or pressure test points. Let the pump discharge several minutes unloaded.
- Pump mounted above fluid level: fill the pump through outlet port(s) with suitable and clean fluid and start rotation in jog mode. Purge the air off the circuit, preferably using air bleed off valves or pressure test points. Let the pump discharge several minutes unloaded.
- The motor-pump coupling must be made directly with a flexible coupling. Couplings that generate axial or radial loads on the pump shaft are not allowed.
  - Refer to paragraph 4.3 for the characteristics and installation of the filtering elements.

### 10 - SAE J518 CONNECTION FLANGES

dimensions in mm

**Fastening bolts are included with the pump.**

Flange code	Flange description	P <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	1 N. 4 SHC bolts	2
0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	3/8" UNC x 1 1/2"	OR 4100
0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70		OR 4131
0610720	SAE - 1 1/4"	276	1 1/4" BSP	32	21	41	22	30,2	58,7	68	79	7/16" UNC x 1 1/2"	OR 4150
0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	45	24	35,7	70	78	93	1/2" UNC x 1 3/4"	OR 4187
0610721	SAE - 2"	207	2" BSP	51	25	45	30	43	77,8	90	102		OR 4225
0610722	SAE - 2 1/2"	172	2 1/2" BSP	63	25	50	30	50,8	89	105	116		OR 4175
0610723	SAE - 3"	138	3" BSP	73	27	50	34	62	106,4	116	134	5/8" UNC x 2"	OR 4337
0610724	SAE - 3 1/2"	34	3 1/2" BSP	89	27	48	34	69.9	120.7	136	152		OR 4387
0773528	SAE - 4"	34	4" BSP	99	27	48	34	77.7	130.2	146	162		OR 4437



**FV6**  
SERIES 10



**DUPLOMATIC  
OLEODINAMICA**

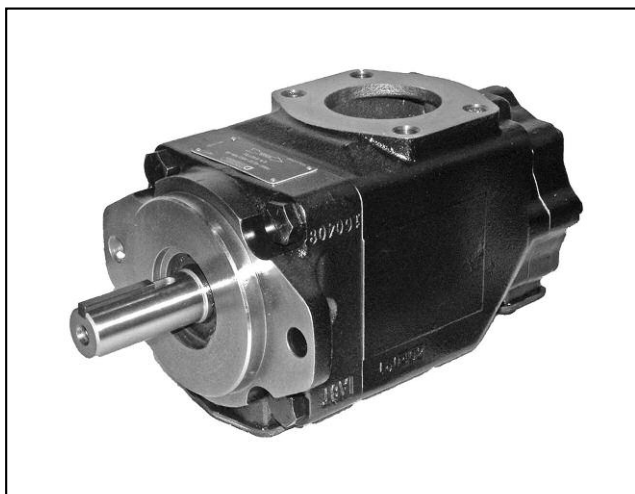
**DUPLOMATIC OLEODINAMICA S.p.A.**

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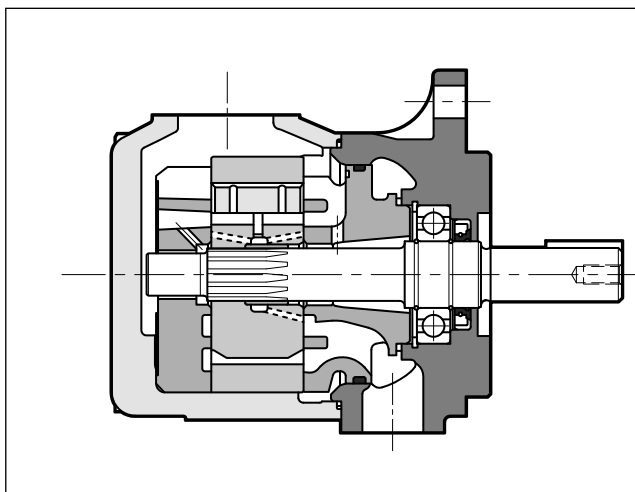


# FV7

## FIXED DISPLACEMENT VANE PUMPS

### SERIES 10

#### OPERATING PRINCIPLE



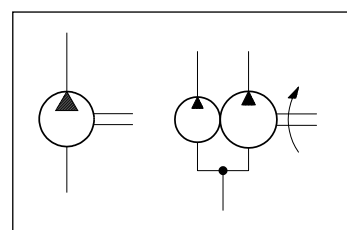
- The FV7 pumps are fixed displacement vane pumps, with several nominal displacement each. Single, double and triple pumps are available.
- The pumping group is composed of a cartridge element that contains rotor, vanes, cam ring and support plates. Cartridges are easily removable without disconnecting the pump from the hydraulic circuit, thus simplify the maintenance operations.
- The special elliptical profile of the cam ring, with double suction and delivery chambers one against the other, eliminates the radial thrusts on the rotor, reducing wear of the pump. The use of a 10 vane rotor reduces the delivery pressure pulsations, suppressing the vibrations and noise level of the pump.

#### TECHNICAL SPECIFICATIONS

PUMP SIZE (SINGLE)		FV7B	FV7D
Displacement range	cm <sup>3</sup> /rev	5.8 ÷ 50	44 ÷ 137.5
Flow rate range (at 1500 rpm - 0 bar)	l/min	8.7 ÷ 75	66 ÷ 206
Operating pressure	bar	320	250
Rotation speed (max)	rpm	3600	3000
Rotation direction		clockwise or anticlockwise	
Loads on shaft		see diagrams	
Hydraulic connections		SAE J518	SAE J518
Mounting flange		SAE J744 B or ISO 3019-2	SAE J744 C or ISO 3019-2
Mass (empty single pump)	kg	23	26

Ambient temperature range	°C	-20 / +60
Fluid temperature range (see par. 4)	°C	-10 / +70
Fluid viscosity range	cSt	see paragraph 4
Fluid contamination degree	see paragraph 4.3	
Recommended viscosity	cSt	30

#### HYDRAULIC SYMBOLS





## 1 - IDENTIFICATION CODE

<b>FV7</b>			-		-				/ 10		-	
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Fixed displacement vane pump

Pump size: \_\_\_\_\_  
**B** = from 5.8 to 50 cm<sup>3</sup>/rev  
**D** = from 44 to 137.5 cm<sup>3</sup>/rev

Mounting flange: \_\_\_\_\_  
Omit for ISO 3019-2 style  
**S** = SAE J744 (**standard**)

Cartridge size: \_\_\_\_\_  
see paragraph 2

Shaft end type \_\_\_\_\_  
**FV7B:**  
2 = cylindrical keyed ISO R775  
**FV7BS:**  
1 = cylindrical keyed SAE B  
3 = splined SAE B  
4 = splined SAE B-B  
**FV7D:**  
5 = cylindrical keyed ISO 3019-2  
**FV7DS:**  
1 = cylindrical keyed SAE C  
2 = cylindrical keyed - no SAE  
3 = splined SAE C  
4 = splined SAE C special

Rotation direction \_\_\_\_\_  
(view from shaft side)  
**R** = clockwise  
**L** = counterclockwise

For FV7B only:  
Pressure port size  
**00** = 1"  
**01** = 3/4"

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Series No.  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Ports position  
(view from shaft side)  
Pressure port always on top  
**00** = opposed (**standard**)  
**01** = in line  
**02** = 90° CW from P port  
**03** = 90° CCW 90° CW from P port

Ports position

00	01	02	03
<p>Diagram 00: Opposed ports P (top) and S (bottom). The shaft is in the center with a rotation arrow.</p>	<p>Diagram 01: In-line ports P (top) and S (bottom). The shaft is in the center with a rotation arrow.</p>	<p>Diagram 02: 90° CW from P port. The shaft is in the center with a rotation arrow. Port P is at the top, and port S is at the right.</p>	<p>Diagram 03: 90° CCW 90° CW from P port. The shaft is in the center with a rotation arrow. Port P is at the top, and port S is at the left.</p>



## 2 - PERFORMANCES

(obtained with antiwear mineral oil with viscosity of 24 cSt)

PUMP	CARTRIDGE SIZE	DISPLACEMENT [cm³/rev]	MAX FLOW RATE at 0 bar - 1500 rpm [l/min]	PRESSURE [bar]		ROTATION SPEED [rpm]	
				continuous	peak	max	min
FV7B	02	5.8	8.7	320	350	3600	600
	03	9.8	14.7				
	04	12.8	19.2				
	05	15.9	23.9				
	06	19.8	29.7				
	07	22.5	33.8				
	08	24.9	37.4				
	10	31.8	47.7				
	12	41	61.5	275	300	3000	
	15	50	75	240	280		
FV7D	14	44	66	250	300	3000	600
	17	55	82.5				
	20	66	99				
	22	70.3	105.5				
	24	81.1	121.7				
	28	90	135				
	31	99.2	148.8				
	35	113.4	170.1				
	38	120.6	180.9				
	42	137.5	206.3	230	260	2500	



### 3 - IDENTIFICATION CODE FOR DOUBLE PUMPS

<b>FV7</b>			-		/		-			/	<b>10</b>		-	
------------	--	--	---	--	---	--	---	--	--	---	-----------	--	---	--

Fixed displacement vane pump

Pump size : \_\_\_\_\_  
1st pump+ 2nd pump  
**BB**  
**DB**

Mounting flange: \_\_\_\_\_  
Omit for ISO 3019-2 style  
**S** = SAE J744 (**standard**)

1st cartridge size P1 \_\_\_\_\_  
see par. 3.2

2nd cartridge size P2 \_\_\_\_\_  
see par. 3.2

Shaft end type \_\_\_\_\_  
**FV7BB**  
5 = cylindrical keyed ISO R775  
**FV7BBS**  
1 = cylindrical keyed - non SAE  
2 = cylindrical keyed SAE B-B  
3 = splined SAE B  
4 = splined SAE B-B  
**FV7DB,**  
5 = cylindrical keyed ISO 3019-2  
**FV7DBS**  
1 = cylindrical keyed - SAE C  
2 = cylindrical keyed - no SAE  
3 = splined SAE C  
4 = splined SAE C special

FV7BB(S) and FV7DB(S) only:  
see par 3.4  
Ports size = **00**  
**01**  
**M1** (FV7DB(S) only)

Seals:  
**N** = NBR seals for mineral oils  
(**standard**)  
**V** = FPM seals for special fluids

Series No.  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Ports position  
(view from shaft side)  
see table 3.3

Rotation direction  
(view from shaft side)  
**R** = clockwise    **L** = counterclockwise

#### 3.1 - Triple pumps

Triple pumps available. Please contact our technical office.

#### 3.2 - Available cartridges

Grey boxes indicates reduced performance. See paragraph 2 for limits.

The second cartridge (for P2) should have equal or lower displacement than the first.

BB		DB	
1st cartridge	2nd cartridge	1st cartridge	2nd cartridge
02	02	14	02
03	03	17	03
04	04	20	04
05	05	22	05
06	06	24	06
07	07	28	07
08	08	31	08
10	10	35	10
12	12	38	12
15	15	42	15

### 3.3 - Ports position codes

FV7BB FV7DB	00 P1-P2 	01 P1-P2 	02 P1-P2-S 	03 P1-P2 	04 P1 	05 P1 	06 P1 	07 P1-S 
	08 P1-S 	09 P1-S 	10 P1 	11 P1 	12 P1 	13 P1 	14 P1 	15 P1 
	16 P1 	17 P1 	18 P1 	19 P1 	20 P1 	21 P1 	22 P1 	23 P1 
	24 P1-S 	25 P1-S 	26 P1-S 	27 P1-S 	28 P1 	29 P1 	30 P1 	31 P1 

### 3.4 - Ports dimensions

FV7BB			
	P1	P2	S
00	1"	3/4"	2" 1/2
01	3/4"		

FV7DB			
	P1	P2	S
00	1" 1/4	1"	3"
01	1" 1/4	3/4"	
M1			

**NOTE** : M1 version is metric threaded





## 4 - HYDRAULIC FLUID

Data in this catalogue are obtained with antiwear fluid petroleum base. Minimum allowable inlet pressure 0,8 absolute bar (-0,2 relative bars). Differential pressure between inlet and outlet pressure should be at least 1.5 bar.

Pressures, maximum allowed speeds and recommended temperatures are shown in the table below, according to the types of hydraulic fluid used.

FLUID TYPE	NOTES						
HFC (water glycol solutions with proportion of water $\leq 40\%$ )	<p>The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows:</p> <table><tr><td>max continuous pressure:</td><td>140 bar</td></tr><tr><td>max peak pressure:</td><td>175 bar</td></tr><tr><td>max rotation speed:</td><td>1800 rpm</td></tr></table> <ul style="list-style-type: none"><li>- Minimum allowable inlet pressure 1 absolute bar</li><li>- The fluid maximum temperature must be between 10°C and 50°C.</li><li>- Use NBR seals only.</li><li>- Minimum viscosity 18 cSt</li></ul>	max continuous pressure:	140 bar	max peak pressure:	175 bar	max rotation speed:	1800 rpm
max continuous pressure:	140 bar						
max peak pressure:	175 bar						
max rotation speed:	1800 rpm						
HFD (phosphate esters)	<p>The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows:</p> <table><tr><td>max continuous pressure:</td><td>210 bar</td></tr><tr><td>max peak pressure:</td><td>240 bar</td></tr><tr><td>max rotation speed:</td><td>1800 rpm</td></tr></table> <ul style="list-style-type: none"><li>- Minimum allowable inlet pressure 1,08 absolute bar</li><li>- The fluid temperature must be between -18°C and 70°C.</li><li>- Use VITON seals</li><li>- Minimum viscosity 18 cSt</li></ul>	max continuous pressure:	210 bar	max peak pressure:	240 bar	max rotation speed:	1800 rpm
max continuous pressure:	210 bar						
max peak pressure:	240 bar						
max rotation speed:	1800 rpm						

### 4.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to the maximum temperature of 90 °C of the fluid, with antiwear
optimum viscosity	30 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	840 cSt	limited to only the pump start-up phase at cold start.

When choosing the fluid type, verify that the true viscosity at the operating temperature is within the above range.

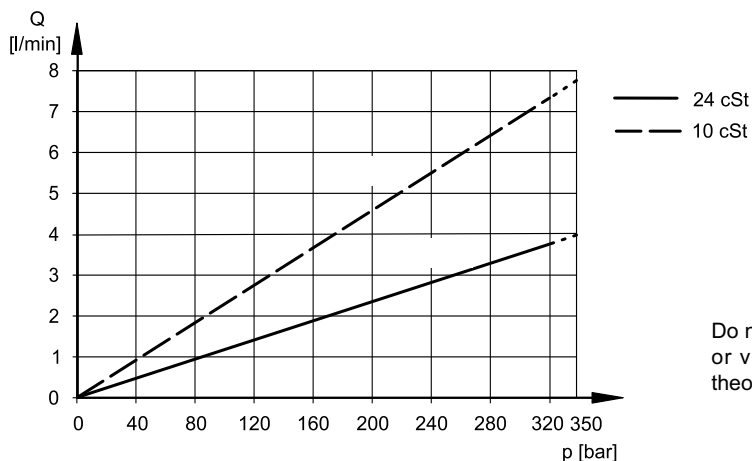
### 4.3 - Degree of fluid contamination

The degree of fluid contamination must be according to ISO 4406:1999 class 19/17/14 or better. Strainers on inlet port are not recommended. However, if requested, do not exceed 149 micron (100 mesh).

### 5 - CHARACTERISTIC CURVES OF SINGLE PUMPS

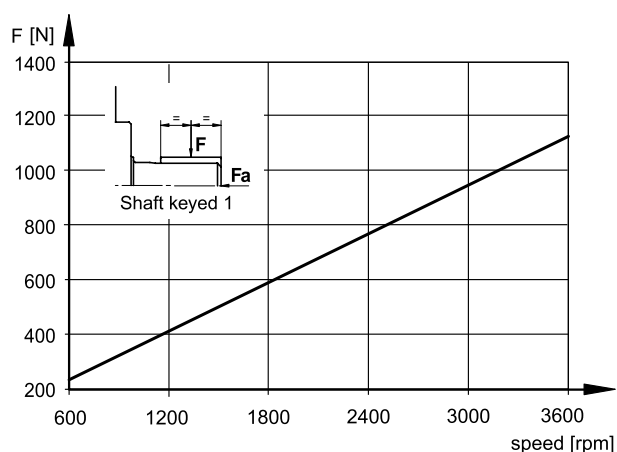
#### 5.1 - FV7B

##### INTERNAL LEAKAGE (typical)



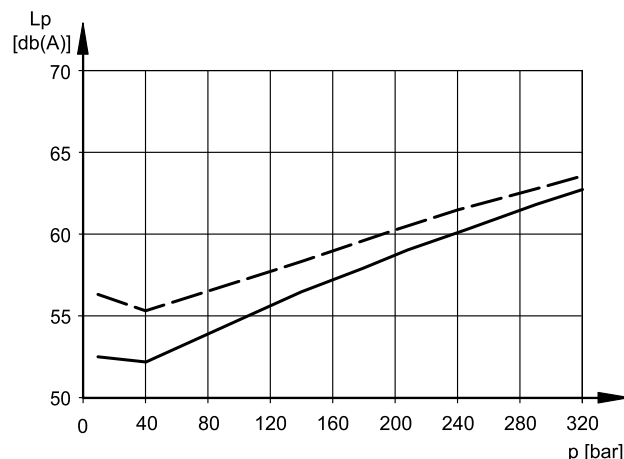
Do not operate the pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow.

##### PERMISSIBLE RADIAL LOAD



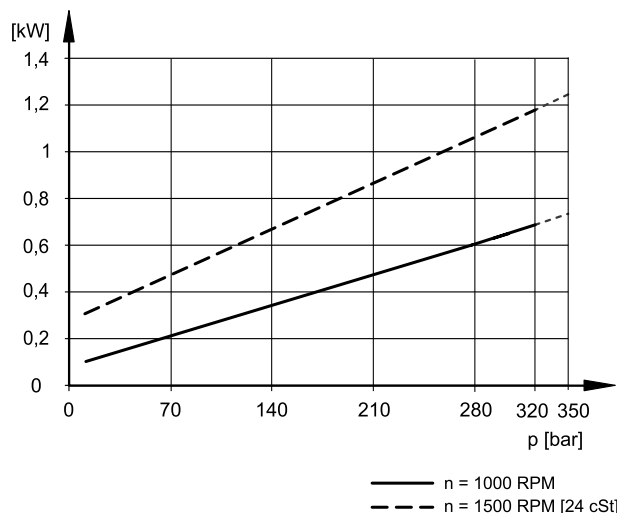
Maximum permitted axial load  $F_a = 800$  N

##### NOISE LEVEL (typical)

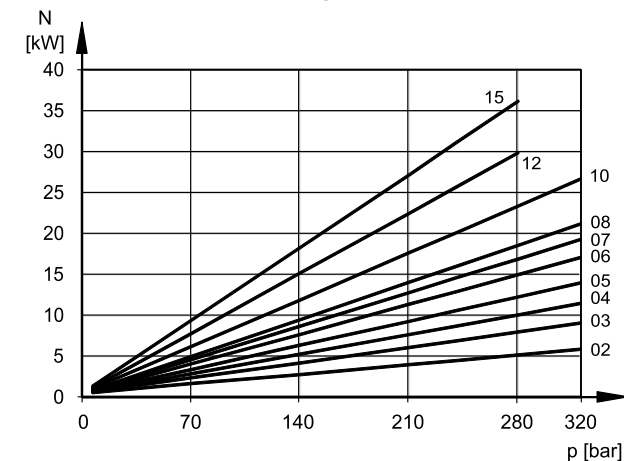


Value obtained with a FV7B-10 pump, according to ISO 4412  
1 mt distance

##### POWER LOSS HYDROMECHANICAL (typical)

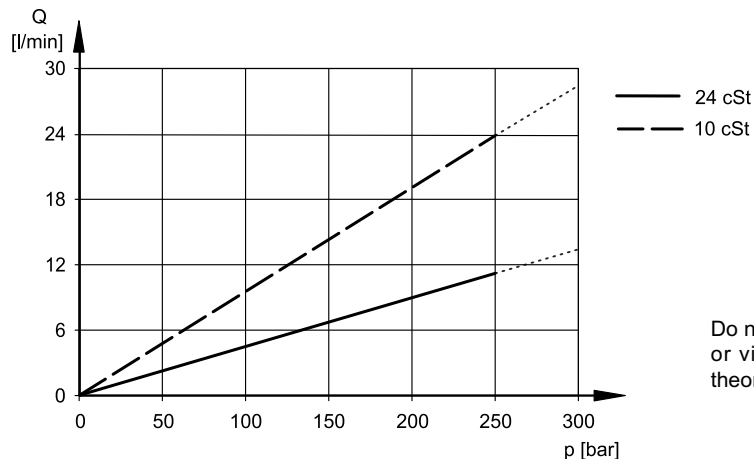


##### ABSORBED POWER at 1500 rpm



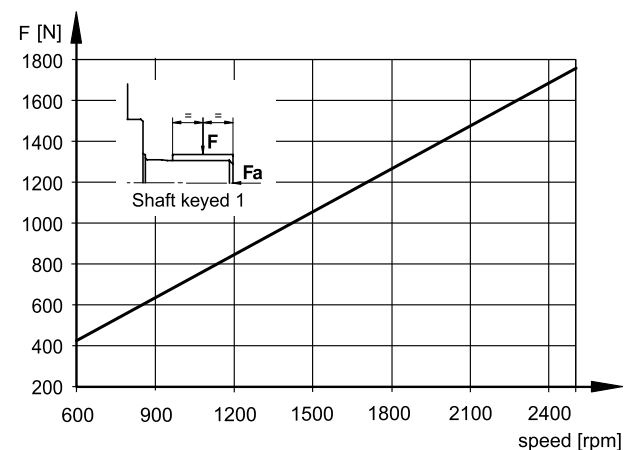
### 5.2 - FV7D

#### INTERNAL LEAKAGE (typical)



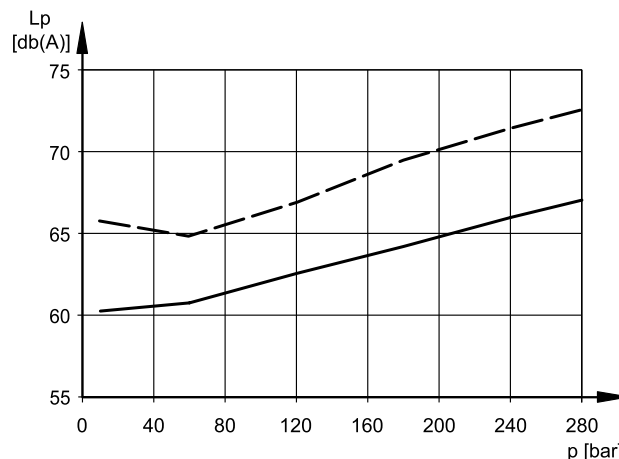
Do not operate the pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow.

#### PERMISSIBLE RADIAL LOAD



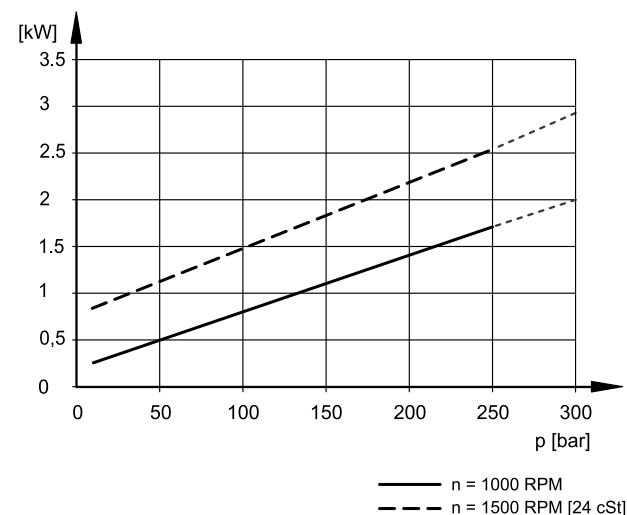
Maximum permitted axial load  $F_a = 1200$  N

#### NOISE LEVEL (typical)

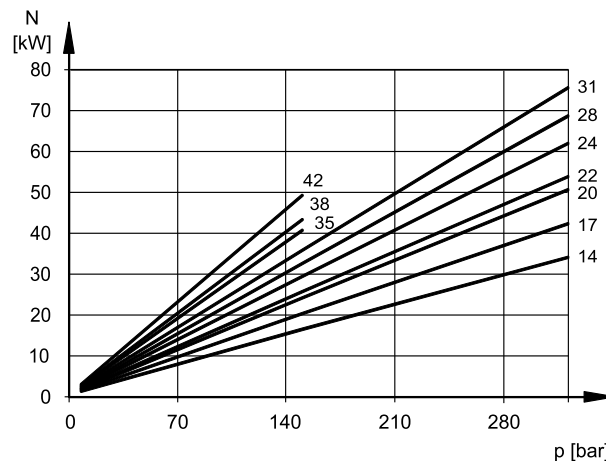


Value obtained with a FV7D-31 pump, according to ISO 4412  
1 mt distance

#### POWER LOSS HYDROMECHANICAL (typical)



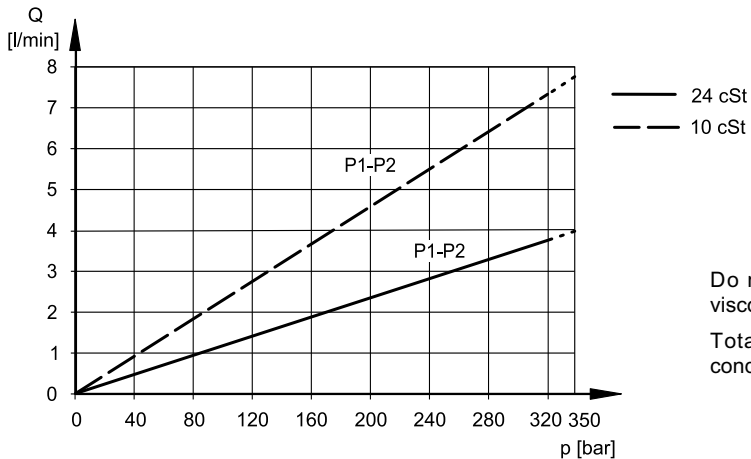
#### ABSORBED POWER at 1500 rpm



### 6 - CHARACTERISTIC CURVES OF DOUBLE PUMPS

#### 6.1 - FV7BB

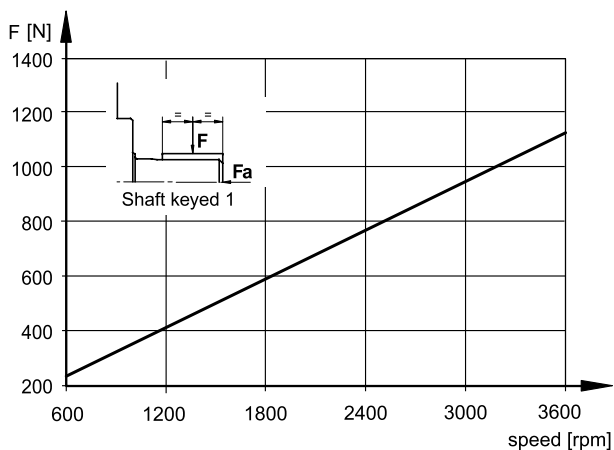
**INTERNAL LEAKAGE (typical)**



Do not operate pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow

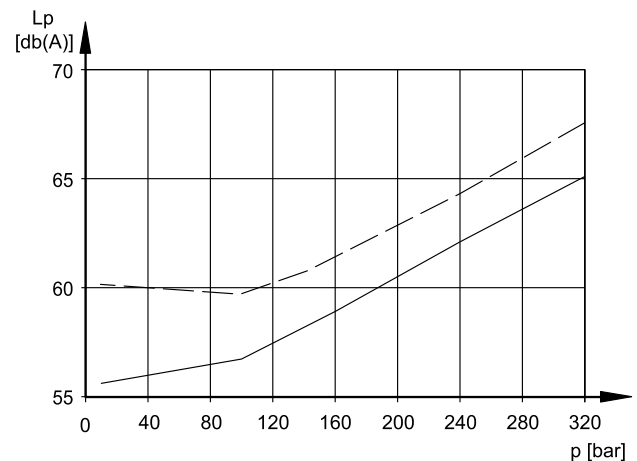
Total leakage is the sum of each section loss at its operating conditions.

**PERMISSIBLE RADIAL LOAD**



Maximum permitted axial load  $F_a = 800$  N

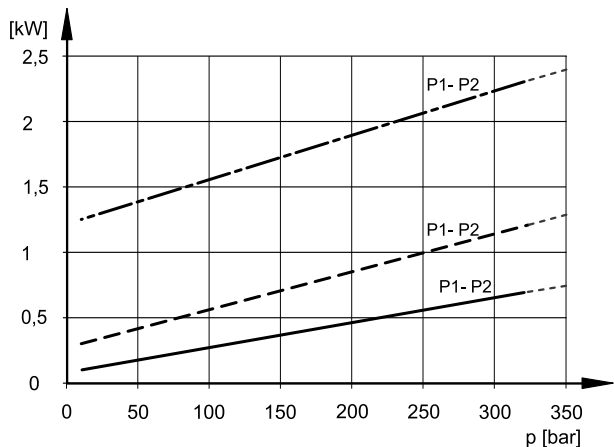
**NOISE LEVEL (typical)**



FV7BB-10-04 pump, according to ISO 4412, 1 mt distance.

Values obtained with  $p_e = 0.9$  bar abs and both stages discharging at the same pressure.

**POWER LOSS HYDROMECHANICAL (typical)**



Total hydromechanics power loss is the sum of each section at its operating conditions.

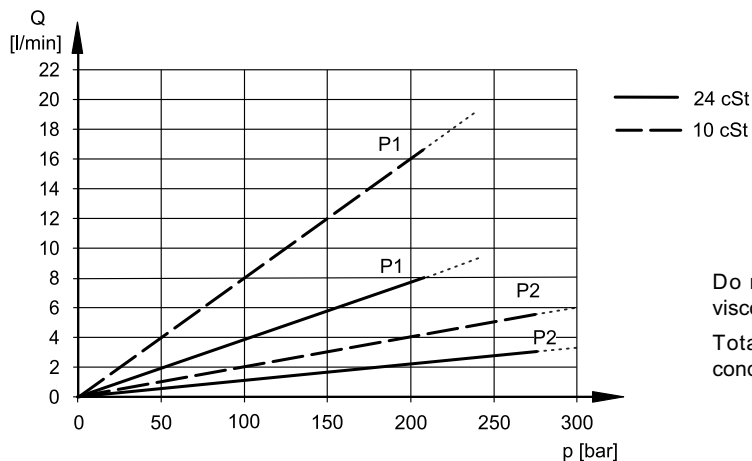
—  $n = 1000$  RPM

- - -  $n = 1500$  RPM [24 cSt]

- . -  $n = 2800$  RPM

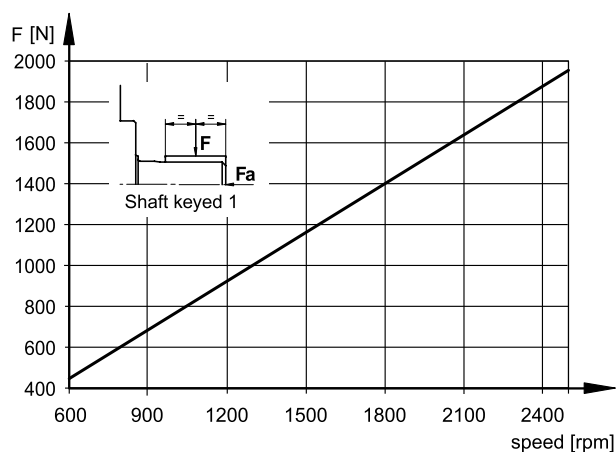
### 6.2 - FV7DB

#### INTERNAL LEAKAGE (typical)



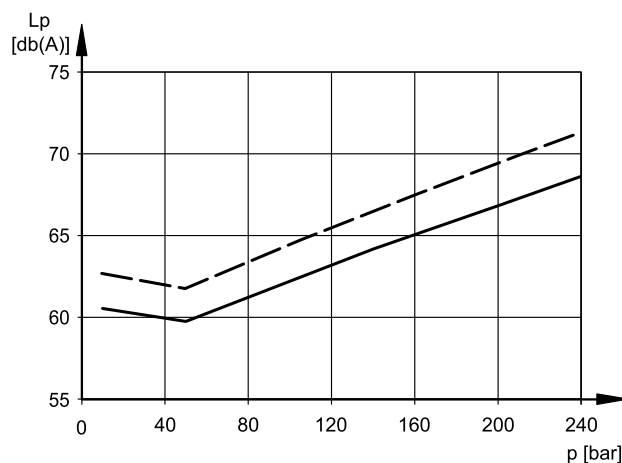
Do not operate pump more than 5 seconds at any speed or viscosity if the internal leakage is more than 50% of theoretical flow  
Total leakage is the sum of each section loss at its operating conditions.

#### PERMISSIBLE RADIAL LOAD



Maximum permitted axial load  $F_a = 1200$  N

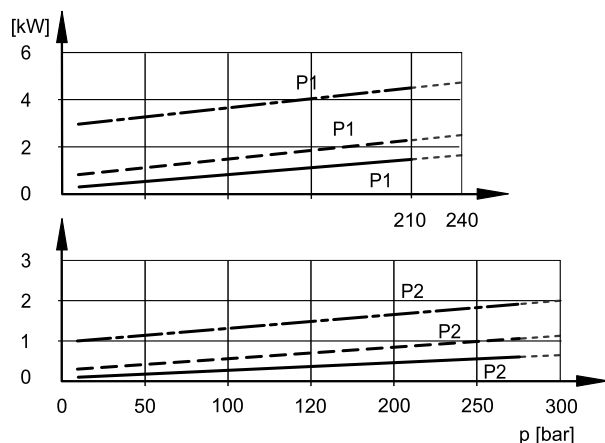
#### NOISE LEVEL (typical)



FV7DB-31-10 pump, according to ISO 4412, 1 mt distance.

Values obtained with  $p_e = 0.9$  bar abs and both stages discharging at the same pressure.

#### POWER LOSS HYDROMECHANICAL (typical)

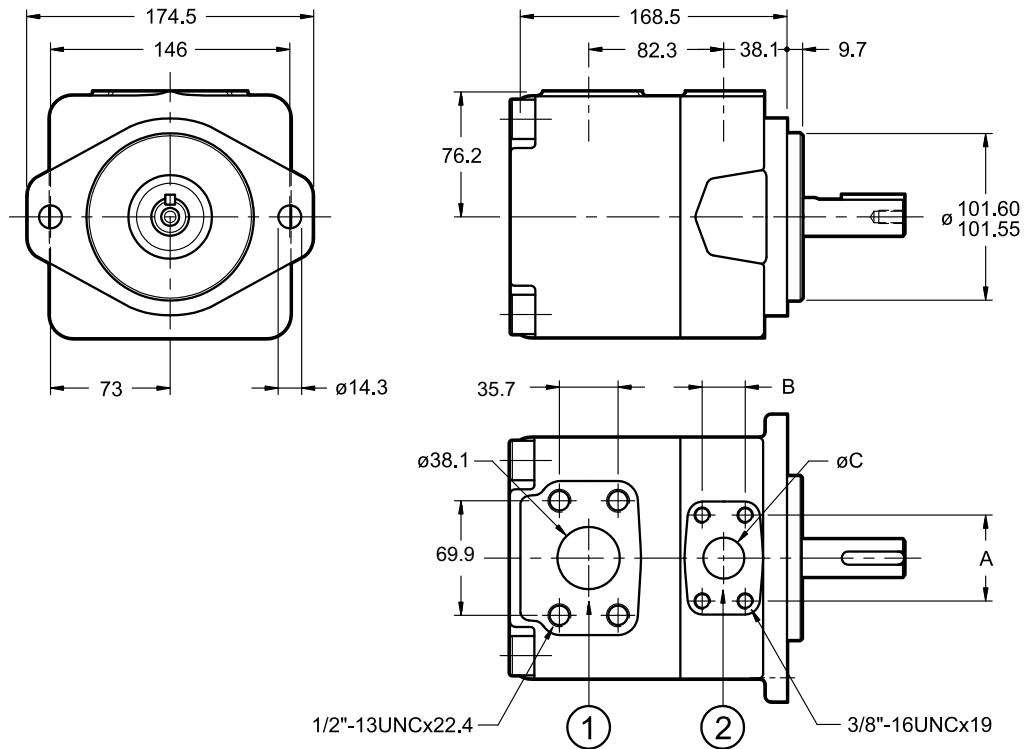


Total hydromechanics power loss is the sum of each section at its operating conditions.

## 7 - SINGLE PUMPS OVERALL AND MOUNTING DIMENSIONS

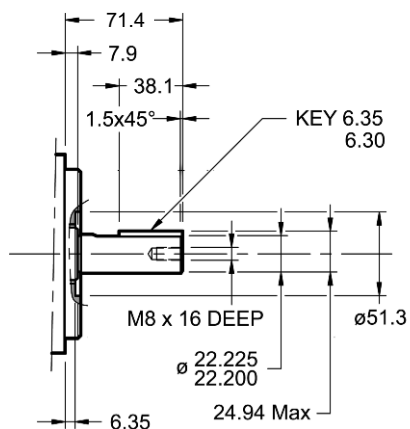
### 7.1 - FV7BS

dimensions in mm

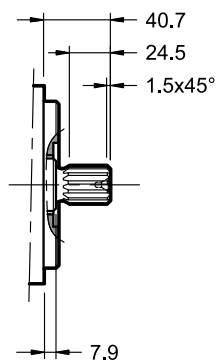


#### SHAFTS:

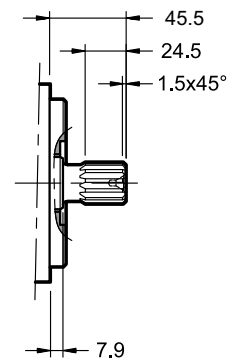
cylindrical keyed SAE B  
(identification code: 1)



splined SAE B  
16/32 d.p. - 13T  
(identification code: 3)



splined SAE B-B  
16/32 d.p. - 15T  
(identification code: 4)



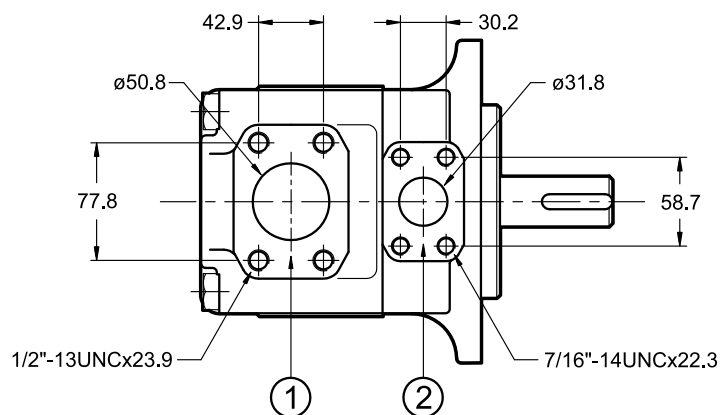
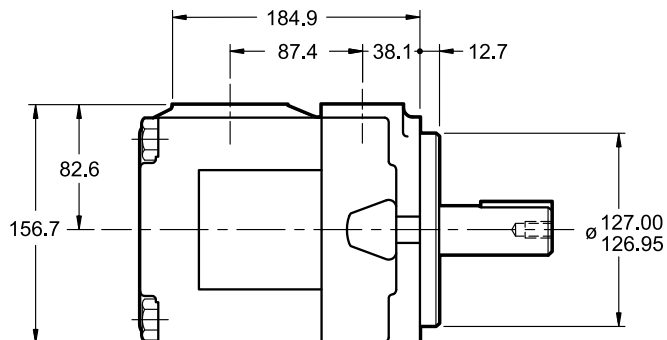
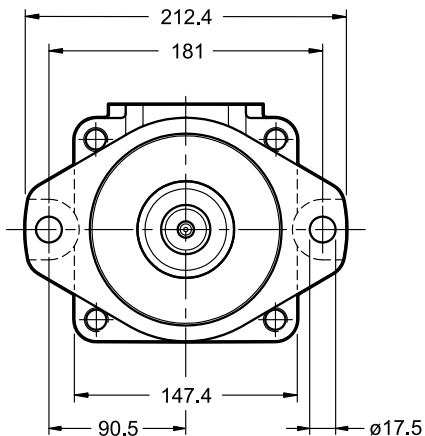
#### PORTS DIMENSIONS (mm)

code	A	B	ØC
00	52.4	26.2	25.4
01	47.6	22.2	19.0

1	Suction port S SAE 1" 1/2
2	Pump delivery port P 00 = SAE 1" 01 = SAE 3/4"

## 7.2 - FV7DS

dimensions in mm



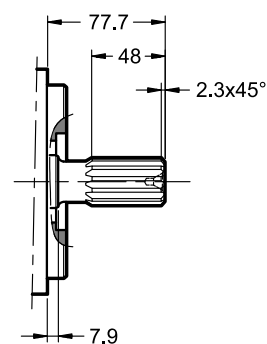
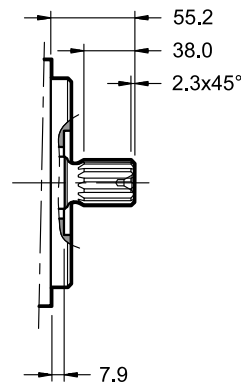
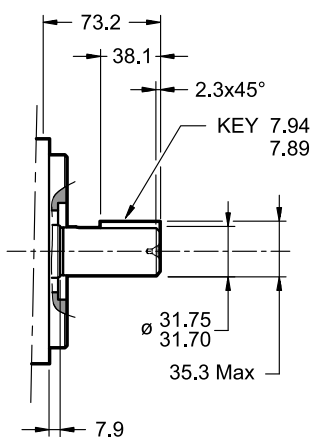
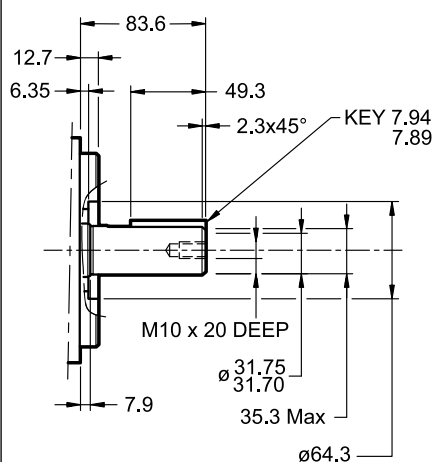
### SHAFTS:

cylindrical keyed SAE C  
(identification code: 1)

cylindrical keyed - no SAE  
(identification code: 2)

splined SAE C  
12/24 d.p. - 14T  
(identification code: 3)

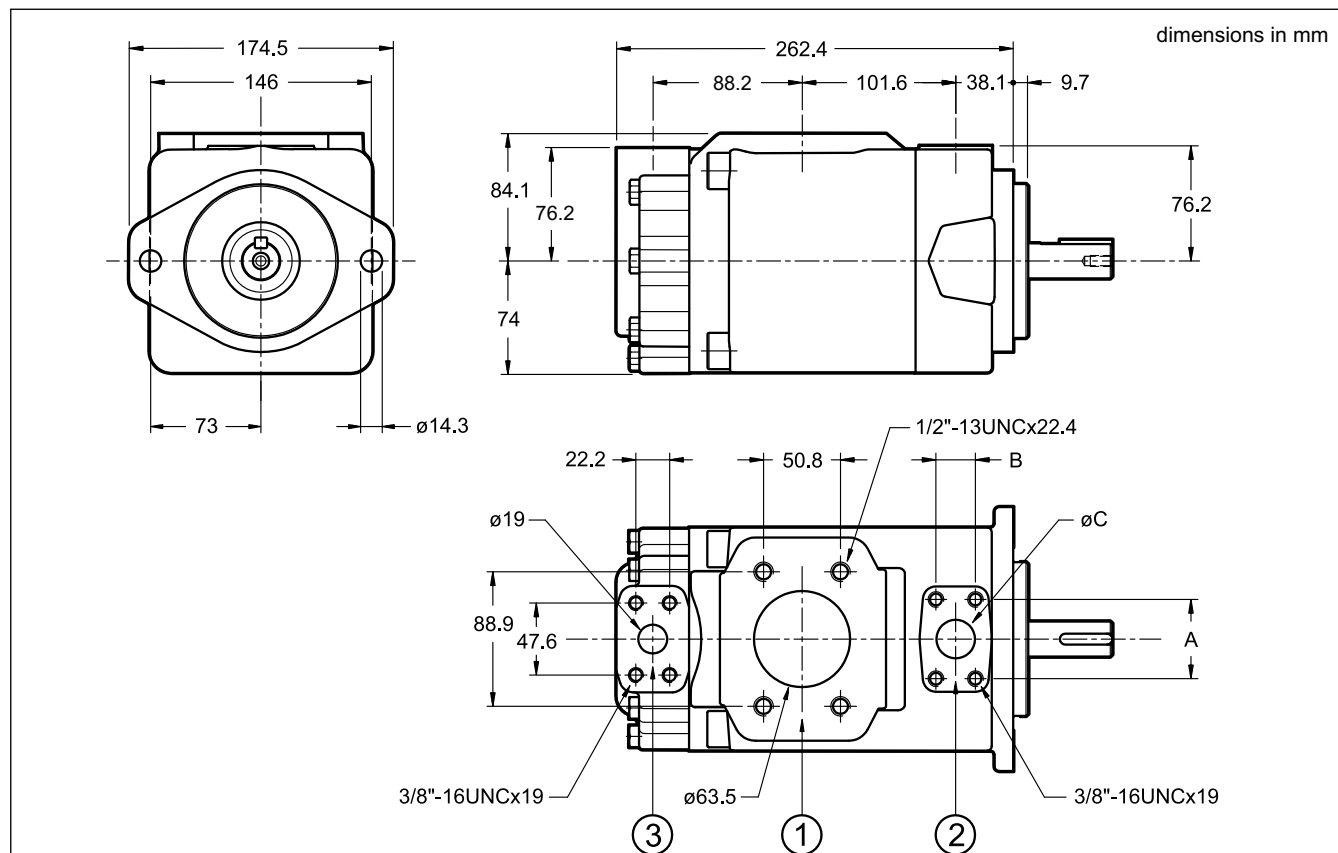
splined SAE special  
12/24 d.p. - 14T  
(identification code: 4)



1	Suction port S SAE 2"
2	Pump delivery port P SAE 1" 1/4

## 8 - DOUBLE PUMPS OVERALL AND MOUNTING DIMENSIONS

### 8.1 - FV7BBS



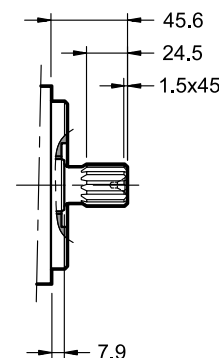
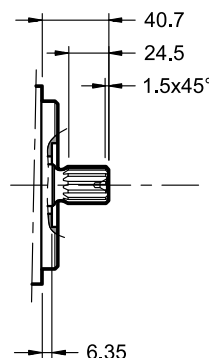
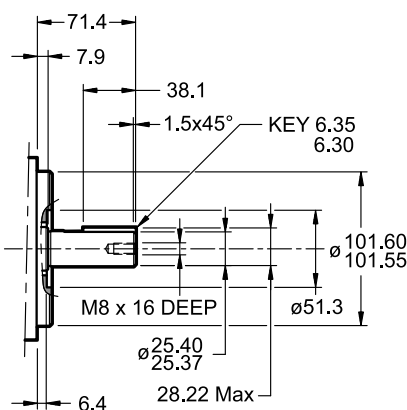
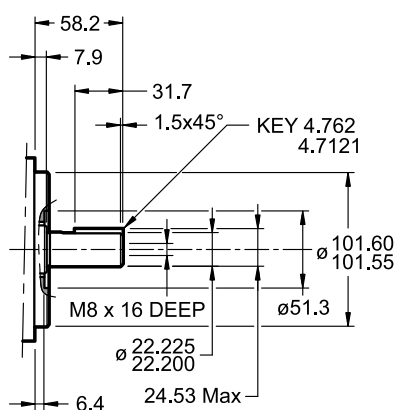
#### SHAFTS:

cylindrical keyed - no SAE  
(identification code: 1)  
Torque limit 238 Nm

cylindrical keyed SAE B-B  
(identification code: 2)  
Torque limit 357 Nm

splined SAE B  
16/32 d.p. - 13T  
(identification code: 3)

splined SAE B-B  
16/32 d.p. - 15T  
(identification code: 4)



#### PORTS DIMENSIONS (mm)

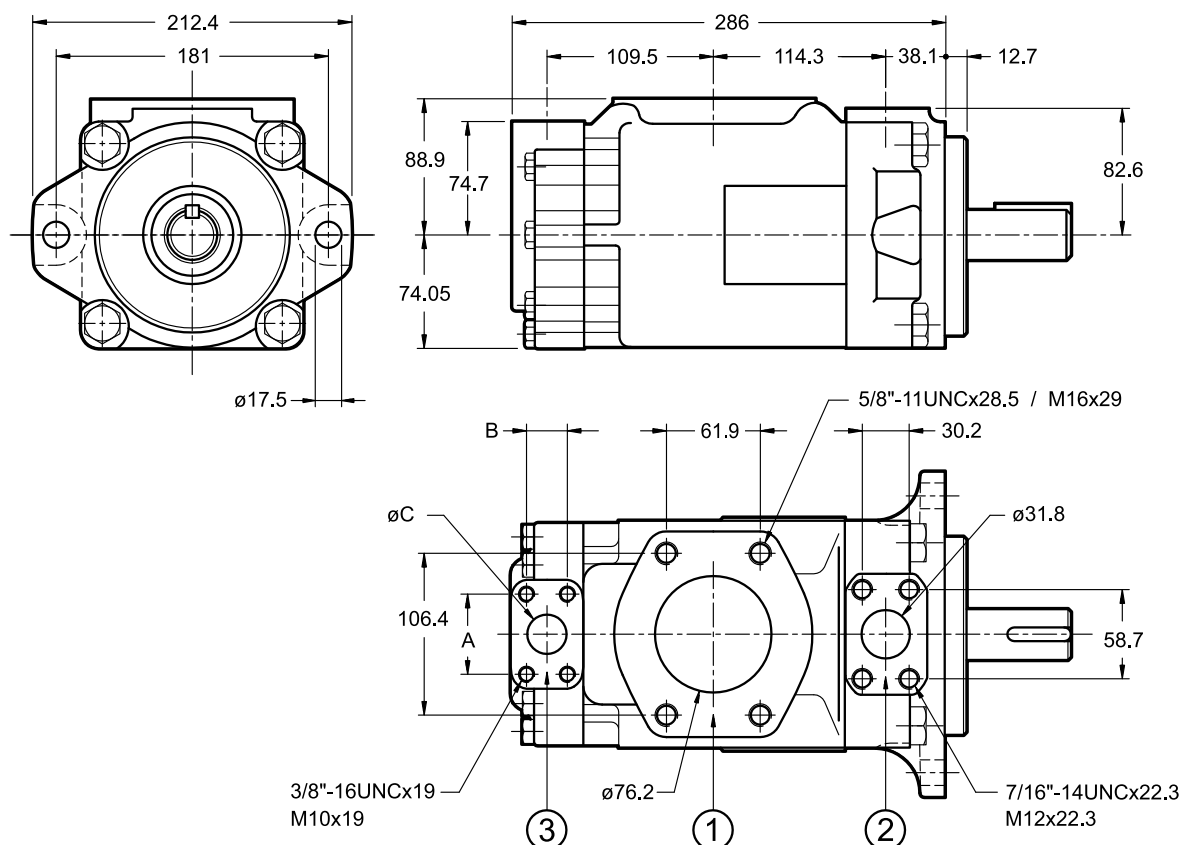
code	A	B	ØC
00	52.4	26.2	25.4
01	47.6	22.2	19.0

1	Suction port S: SAE 2" 1/2
2	Delivery port P1: 00: SAE 1" 01: SAE 3/4"
3	Delivery port P2: SAE 3/4"



## 8.2 - FV7DBS

dimensions in mm



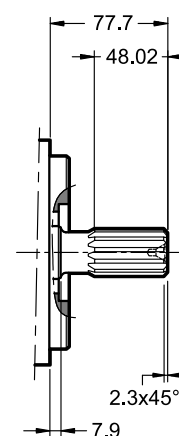
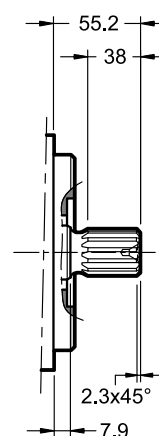
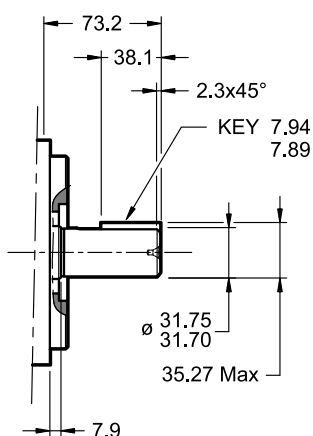
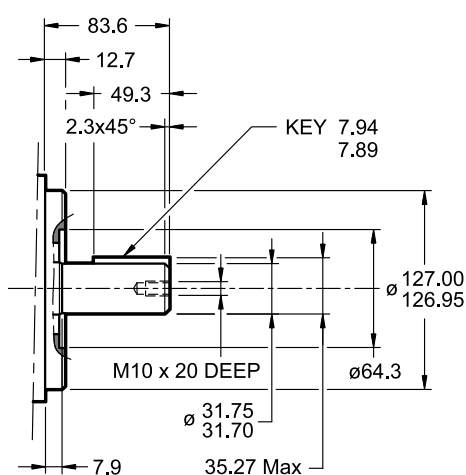
**SHAFTS:**

cylindrical keyed SAE C  
(identification code: 1)

cylindrical keyed - no SAE  
(identification code: **2**)

splined SAE C  
12/24 d.p. - 14T  
(identification code: **3**)

splined SAE C special  
12/24 d.p. - 14T  
(identification code: 4)



PORTS DIMENSIONS (mm)			
code	A	B	ØC
00	52.4	26.2	25.4
01, M1	47.6	22.2	19.0

**NOTE:** On M1 version, ports are threaded metric

1	Suction port S: SAE 3"
2	Delivery port P1: SAE 1" 1/4
3	Delivery port P2: <b>00:</b> SAE 1" <b>01, M1:</b> SAE 3/4"

## 9 - ISO MOUNTING VERSIONS

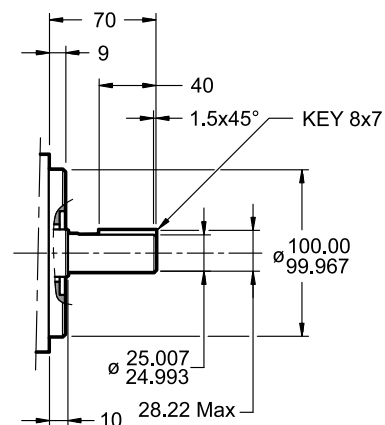
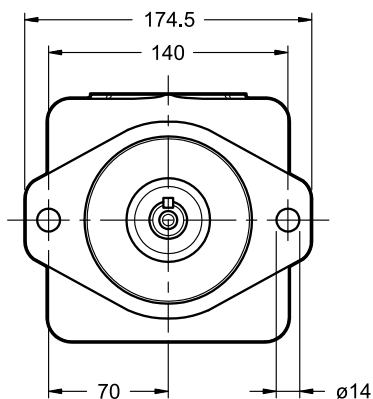
### 9.1 - FV7B and FV7BB

Flange ISO 3019-2 - 100A2HW

Shaft end: ISO/R 775  
cylindrical keyed

FV7B: identification code: **2**

FV7BB: identification code: **5**

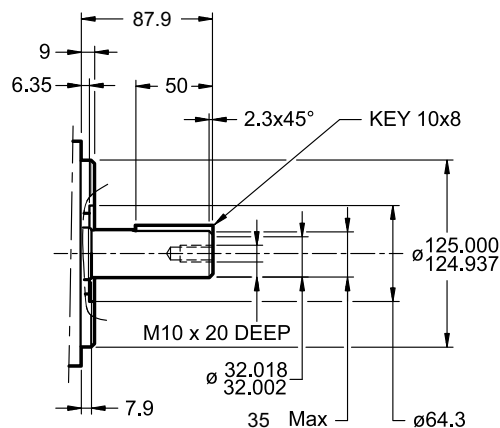
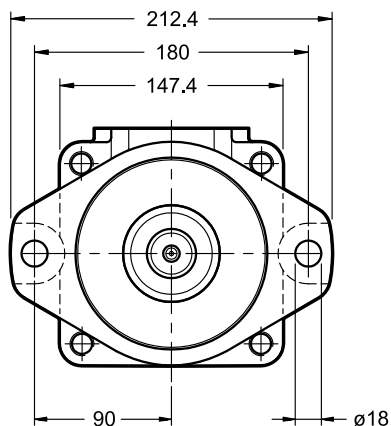


### 9.2 - FV7D and FV7DB

Flange ISO 3019-2 - 125A2HW

Shaft end: ISO 3019-2 G32M  
identification code: **5**

Oil ports are threaded metric only



### 10 - INSTALLATION AND START-UP

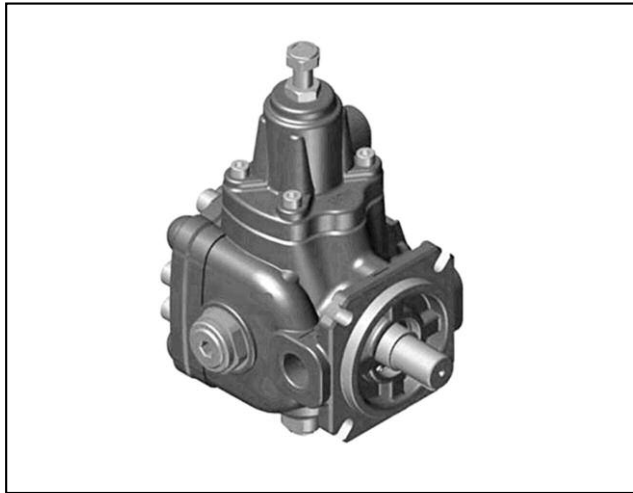
- FV7 pumps can be installed in any position. They are normally positioned directly above the oil tank. The installation below the oil level is suggested for circuits with high flow rates and pressures.
  - The suction line must be sized to facilitate the oil flow. Bends and restrictions or an excessive line length could impair the operation of the pump. A bevel on both suction and return lines is recommended to increase the surface and so lower the velocity. We suggest a 45° minimum angle.
  - Check the rotation direction of the motor is according to the rotation direction shown on the pump label before start up.
  - The pump start-up should occur with the pump unloaded, especially at cold temperatures. Set the pressure relief valve of the circuit to its minimum setting value so the pump is unloaded when started. Circuit priming and air bleed off have to be performed before resetting the pressure relief valve.
  - A minimum pump shaft speed of 600 rpm is recommended for priming. To prevent possible damage to the internal parts, the pump should never be started dry or without internal lubrication. The pump should prime quite instantly (few seconds). If not, shut down and check conditions.
- Pump with positive head: allow the fluid to flow to the pump inlet, loosen the discharge port(s) fitting(s) until the fluid comes out and re-tighten the discharge line(s). Then start the pump which should prime quite instantly. Purge the air off the circuit, preferably using air bleed off valves or pressure test points. Let the pump discharge several minutes unloaded.
- Pump mounted above fluid level: fill the pump through outlet port(s) with suitable and clean fluid and start rotation in jog mode. Purge the air off the circuit, preferably using air bleed off valves or pressure test points. Let the pump discharge several minutes unloaded.
- The motor-pump coupling must be made directly with a flexible coupling. Couplings that generate axial or radial loads on the pump shaft are not allowed.
  - Refer to paragraph 4.3 for the characteristics and installation of the filtering elements.

### 11 - SAE J518 CONNECTION FLANGES

dimensions in mm

Fastening bolts are included with the pump.

Flange code	Flange description	P <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	1	2
0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	3/8" UNC x 1 1/2"	OR 4100
0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70		OR 4131
0610720	SAE - 1 1/4"	276	1 1/4" BSP	32	21	41	22	30,2	58,7	68	79	7/16" UNC x 1 1/2"	OR 4150
0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	45	24	35,7	70	78	93	1/2" UNC x 1 3/4"	OR 4187
0610722	SAE - 2 1/2"	172	2 1/2" BSP	63	25	50	30	50,8	89	105	116		OR 4175
0610723	SAE - 3"	138	3" BSP	73	27	50	34	62	106,4	116	134	5/8" UNC x 2"	OR 4337

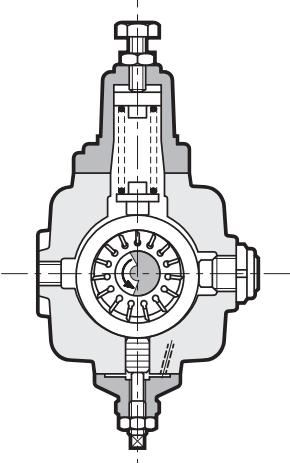


# RV1D

## VARIABLE DISPLACEMENT VANE PUMPS WITH DIRECT PRESSURE ADJUSTER

**SERIES 10**

### OPERATING PRINCIPLE



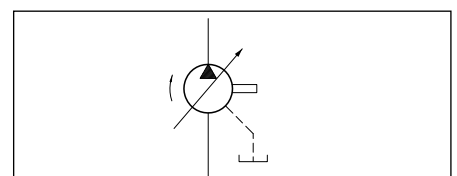
- The RV1D pumps are variable displacement vane pumps with mechanical pressure compensator.
- The pressure compensator keeps the cam ring of the pumping group in the eccentric position with use of an adjustable load spring. When the delivery pressure equals the pressure corresponding to the spring setting, the cam ring is moved toward the center instantaneously, adjusting the flow rate to the values required by the plant.
- Energy consumption is reduced and adequate in every phase of the cycle.
- The pump group has hydrostatic axial compensation distribution plates, that improve the volumetric efficiency and reduce wear of the components.
- In zero flow demand conditions, the pump delivers fluid only to compensate any possible leaks and pilot lines, keeping constant the circuit pressure .
- The compensator response times are very low such as to make unnecessary the pressure relief valve.

### PERFORMANCE RATINGS (measured with mineral oil with viscosity of 46 cSt at 40°C)

PUMP SIZE		016	020	025	032	040	050	063
Geometric displacement (UNI ISO 3662)	cm³/rev	16	20	25	32	40	50	63
Actual displacement (±3%)	cm³/rev	17.9	22,5	28	33.4	43	51	63
Maximum flow at 1500 rpm	l/min	26.8	33.7	42	50.1	64.5	76.5	94.5
Max working pressure	bar	120	100			100		
Pressure adjustment range	bar	20 ÷ 120	30 ÷ 100			30 ÷ 100		
Maximum drain port pressure allowed	bar	1						
Rotation speed range	rpm	800 ÷ 1800				800 ÷ 1500		
Rotation direction		clockwise (seen from the shaft side)						
Shaft loads		radial and axial loads are not allowed						
Max applicable torque on shaft: type R55 type R97	Nm	110 70	250 -			586 -		
Mass	kg	7.4	18.3			43.8		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	+15 / +60
Recommended viscosity	cSt	22 ÷ 68
Fluid viscosity range	see paragraph 2.2	
Degree of fluid contamination	see paragraph 2.3	

### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE

RV1D	-		PC	-	R				/	10		
------	---	--	----	---	---	--	--	--	---	----	--	--

Variable displacement vane pump

Pump size: \_\_\_\_\_  
group 05  
**016** = 17,9 cm<sup>3</sup>/rev  
group 1  
**020** = 22,5 cm<sup>3</sup>/rev  
**025** = 28 cm<sup>3</sup>/rev  
**032** = 33,4 cm<sup>3</sup>/rev  
group 2  
**040** = 43 cm<sup>3</sup>/rev  
**050** = 51 cm<sup>3</sup>/rev  
**063** = 63 cm<sup>3</sup>/rev

With mechanical pressure control \_\_\_\_\_

Rotation direction (seen from the shaft end) \_\_\_\_\_

Mounting flange: \_\_\_\_\_  
**5** = four-bolt mounting flange ISO 3019/2  
**9** = four-holes - rectangular - type GR2 (available for RV1D-016 only)

Shaft end: \_\_\_\_\_  
**5** = cylindrical keyed ISO 3019/2 (not available with flange type 9)  
**7** = conical keyed (not available for RV1D-016)

Option: Combined pumps.  
Omit for single pump  
See at par. 12

Seals:  
**N** = NBR seals for mineral oils  
(**standard**)  
**V** = viton for special fluids

Series No.  
(from 10 to 19 sizes and mounting  
dimensions remain unchanged)

Hydraulic connection:  
RV1D-016, 020, 025 and 032:  
**B** = BSP threaded ports  
RV1D-040, 050 and 063:  
**S** = suction / delivery SAE flanges with metric bolts;  
drain port BSP threaded

## 2 - HYDRAULIC FLUID

### 2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives. For use of other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for approval.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	-The values shown in the performance ratings table must be reduced by at least 50% - The pump rotation speed must be limited to 1000 rpm. - Use NBR seals only
HFD (phosphate esters)	There are no particular limitations with this kinds of fluids. Operation with a fluid viscosity as close as possible to the optimum viscosity range specified in par. 2.2 is recommended. - Use FPM (Viton) seals only

### 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

optimum viscosity      22 ÷ 68 cSt      referred to the fluid working temperature in the tank  
maximum viscosity      400 cSt      limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

### 2.3 - Degree of fluid contamination

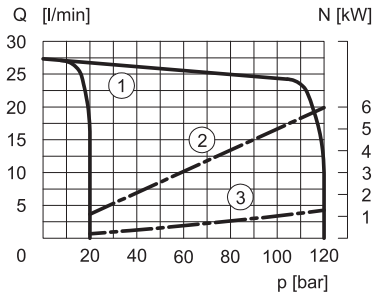
The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with  $\beta_{20} \geq 75$  is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with  $\beta_{10} \geq 100$  is recommended.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator. See intallation section for details.

### 3 - CHARACTERISTIC CURVES RV1D-016 (GR. 05)

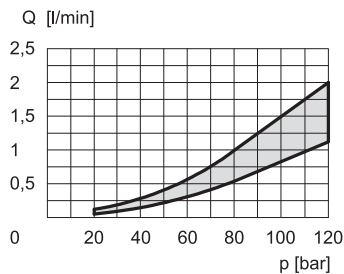
(obtained with viscosity of 46 cSt at 40°C)

#### FLOW RATE - PRESSURE - ABSORBED POWER

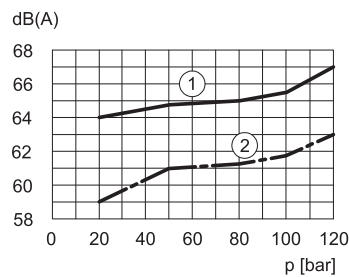


- 1) Flow rate - pressure curves, measured at 1500 rpm
- 2) Absorbed power at the maximum flow rate
- 3) Absorbed power at zero flow rate

#### DRAINAGE FLOW RATE



#### NOISE LEVEL



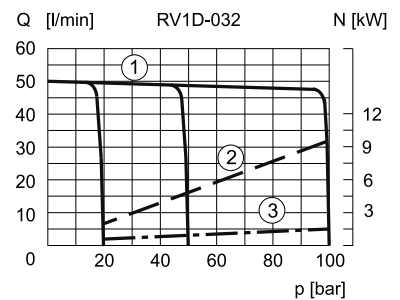
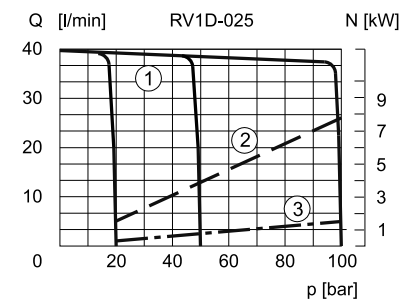
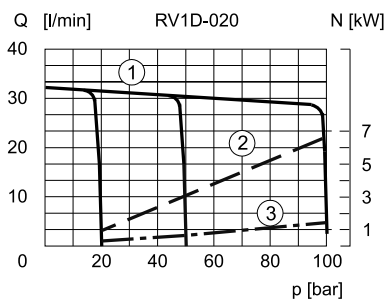
Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

- 1) noise at max flow
- 2) noise with zero flow

### 4 - CHARACTERISTIC CURVES OF RV1D-020, RV1D-025 AND RV1D-032 (GR. 1)

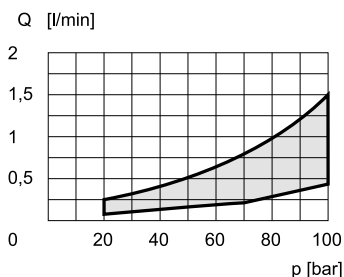
(obtained with viscosity of 46 cSt at 40°C)

#### FLOW RATE - PRESSURE - ABSORBED POWER

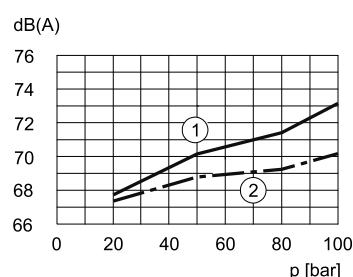


- 1) Flow rate - pressure curves, measured at 1500 rpm
- 2) Absorbed power at the maximum flow rate
- 3) Absorbed power at zero flow rate

#### DRAINAGE FLOW RATE



#### NOISE LEVEL



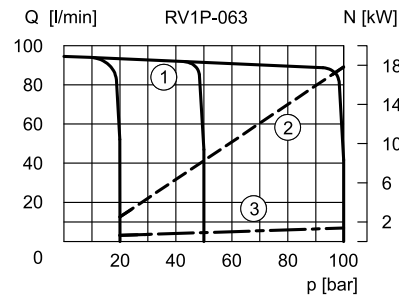
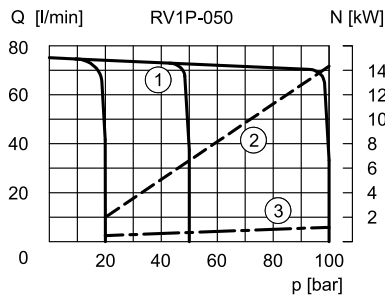
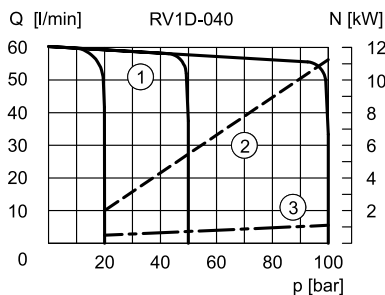
Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

- 1) noise at max flow
- 2) noise with zero flow

### 5 - CHARACTERISTIC CURVES FOR RV1D-040, RV1D-050 AND RV1D-063 (GR. 2)

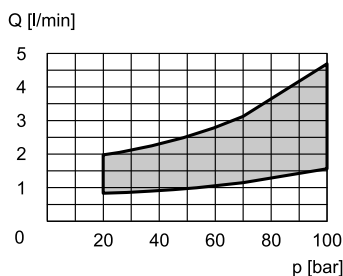
(values obtained with mineral oil with viscosity of 46 cSt at 40°C)

#### FLOW RATE - PRESSURE - ABSORBED POWER

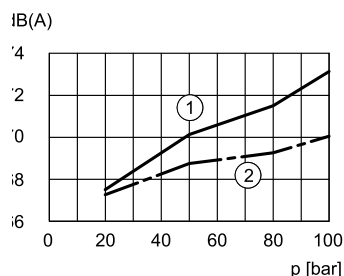


- 1) Flow rate - pressure curves, measured at 1500 rpm
- 2) Absorbed power at the maximum flow rate
- 3) Absorbed power at zero flow rate

#### DRAINAGE FLOW RATE



#### NOISE LEVEL



Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

- 1) noise at max flow
- 2) noise with zero flow

### 6 - VOLUME ADJUSTMENT SCREW

The volume adjuster is fitted as standard on all the pumps.

It consists of an adjustment screw and a small balanced piston that limit the maximum eccentricity of the pumping group cam ring, changing the displacement. The maximum flow is reduced by turning the adjustment screw clockwise. Indicative data, sensitive to performance tolerances.

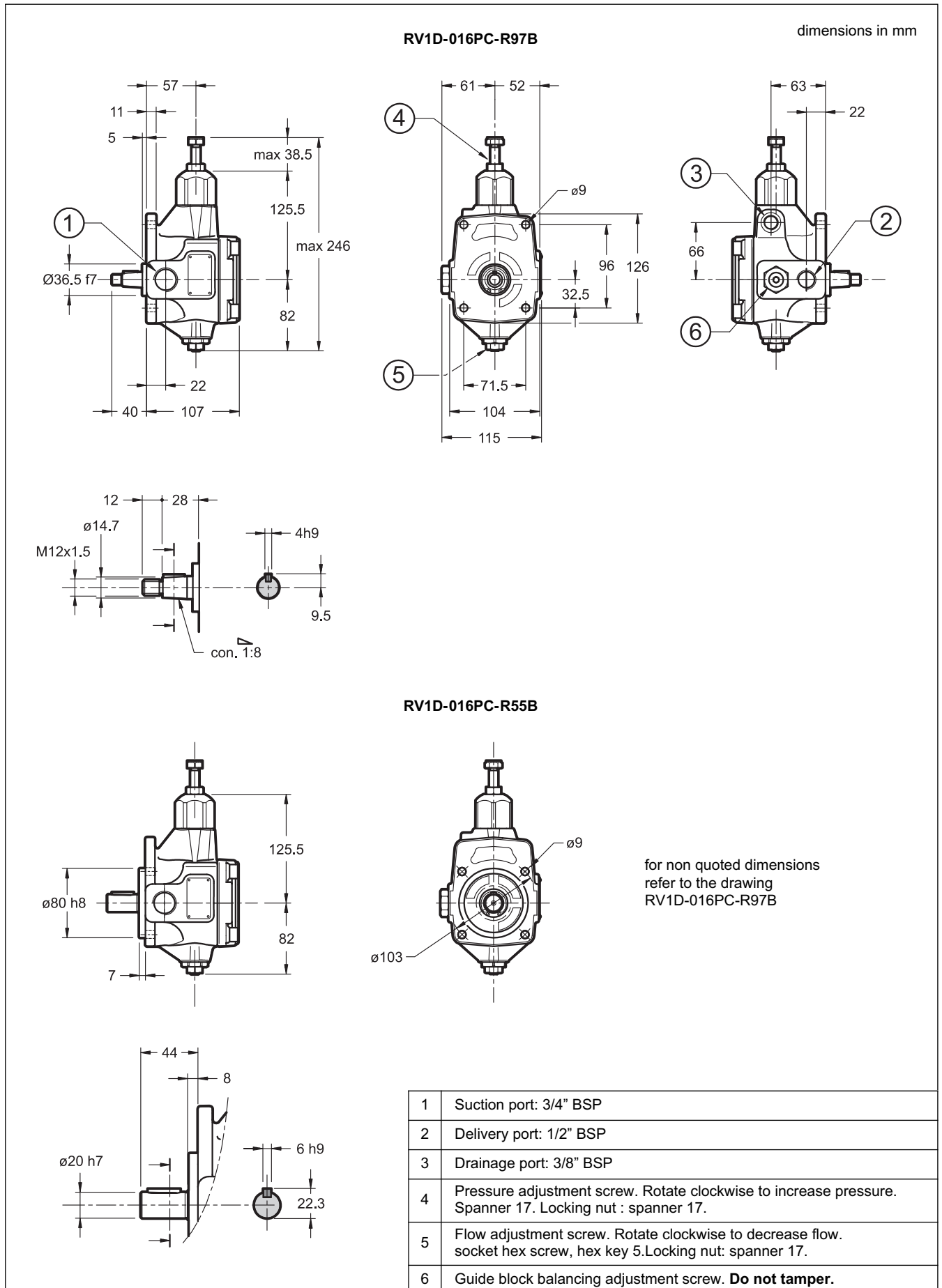
Nominal size		016	020	025	032	040	050	063
Reduction of displacement per turn	cm <sup>3</sup>	9,7	10			16		
Minimum possible displacement	cm <sup>3</sup> /rev	3,1	9,5	15	19	27,5	35,5	43,5

Tools required for adjustment:

RV1D-016: adjustment screw hexagon socket key 5. Locking nut spanner 17.

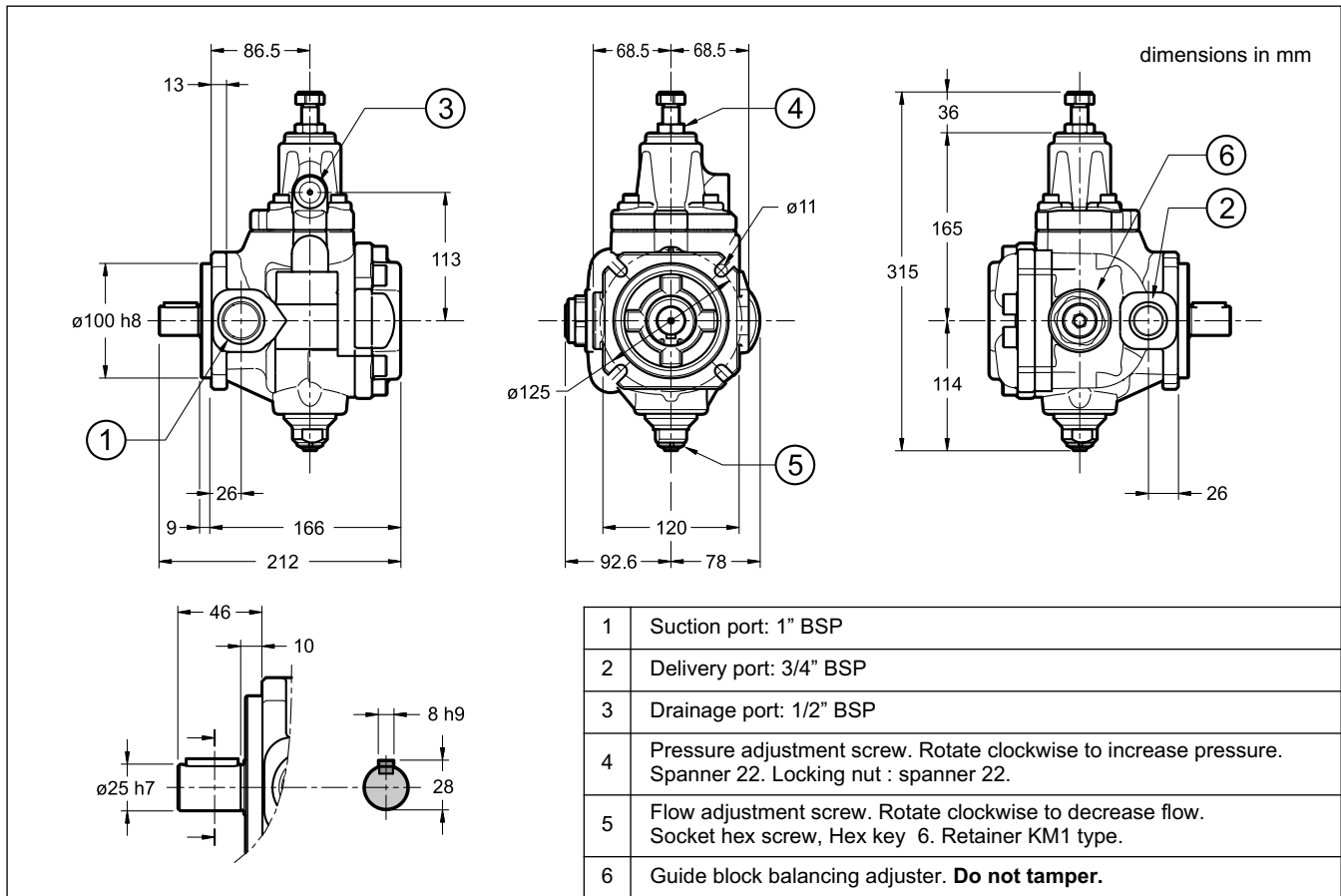
Other sizes: adjustment screw hexagon socket key 6. Tooth retainer KM1 type.

## 7 - OVERALL AND MOUNTING DIMENSIONS RV1D-016 (GR. 05)

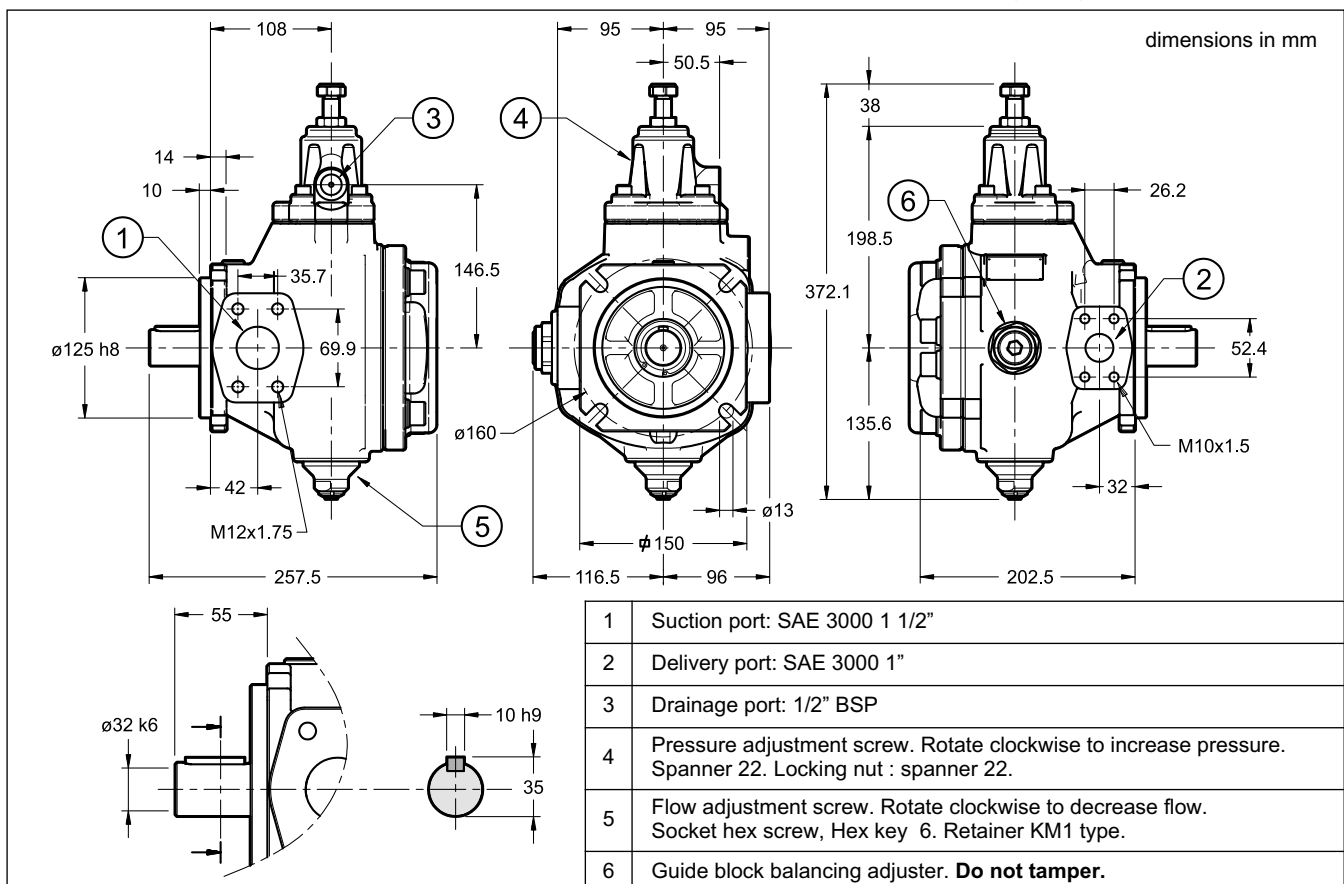




### 8 - OVERALL AND MOUNTING DIMENSIONS RV1D-020, RV1D-025 AND RV1D-032 (GR.1)



### 9 - OVERALL AND MOUNTING DIMENSIONS RV1D-040, RV1D-050 AND RV1D-063 (GR.2)



### 10 - INSTALLATION

The instruction manual for pumps installation and commissioning is always included in the packaging with the pump. Observe restrictions in this document and follow the instructions.

- RV1D-016, RV1D-020, RV1D-025 and RV1D-032 pumps can be installed in any position.

RV1D-040, RV1D-050 and RV1D-063 pumps need to be installed with the axis in horizontal position and with pressure compensator upward.

- Motor-pump coupling must be made with a self-aligning flexible coupling with convex teeth and a polyamide cam. Couplings that generate axial or radial loads on the pump shaft are not allowed.
- The suction line must be short, with end pipe cut at 45° with a small number of bends and without internal section changes. The minimum section of the inlet pipe must be equal to the section of the thread of the pump inlet port.

The pipe-end inside the tank should be cut at 45°, should have a minimum distance from the tank bottom of not less than 50 mm, and there should always be a minimum height of suction of 100 mm. The suction pipe should be completely airtight in order to avoid air intake which could be extremely damaging to the pump.

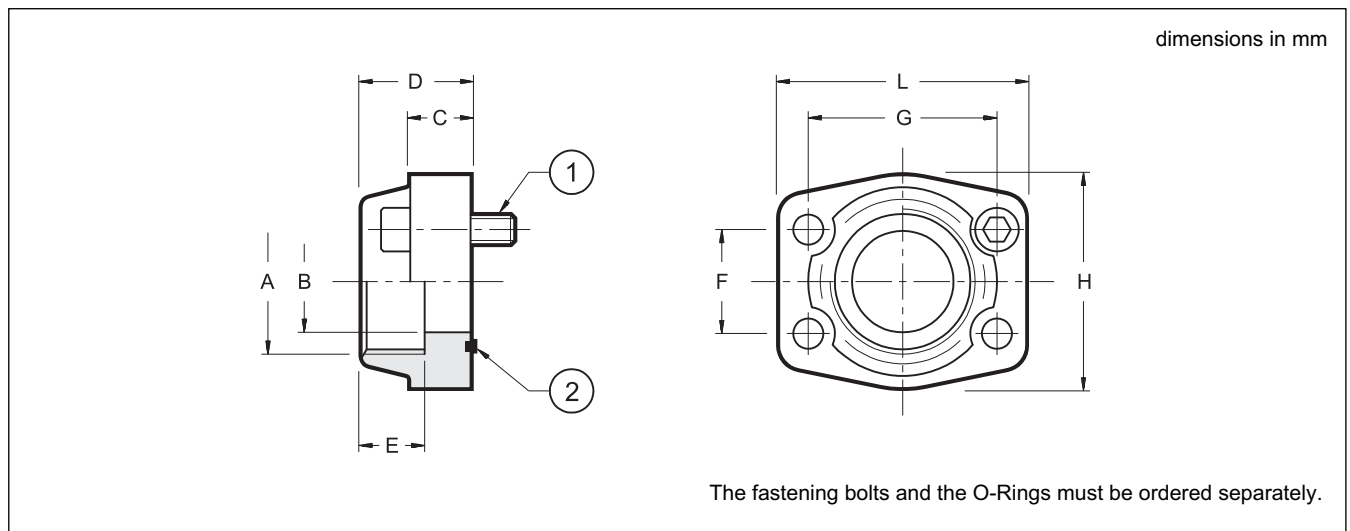
**Suction pressure should be between 0.8 and 1.5 bar absolute**

- The drainage pipe must be connected directly to the tank by a line separate from other discharges, located as far as possible from the suction line and lengthened to below the minimum oil level in order to avoid foaming.

**The fluid temperature must not exceed 60 °C**

- The tank must be suitably sized in order to allow the cooling of the fluid. It should be good that the fluid in the tank do not exceed 50°C. If necessary, consider the installation of a heat exchanger on the drain line.
- The pump start up must be done in full displacement (P→T) with flow to the tank with no pressure, to purge the air. The pump should prime within 5 seconds. If it does not, switch it off and investigate the cause. The pump should not run empty.
- If the volume adjuster has been set for values less than 50% of the nominal flow-rate, start-up is allowed only if provided the system and pump are fully filled of fluid.
- **It's essential that the difference between the fluid temperature and the ambient (pump body) temperature doesn't exceed 20 °C.**  
If this is the case, the pump should be switched-on only for intervals of about 1-2 seconds (start/stop mode) without pressure, until the temperatures came balanced.
- The pumps are usually placed directly upon the oil tank. Flooded suction port installation of the pump is recommended in the event of circuits with high flow rates and pressures.

### 11 - CONNECTION FLANGES



flange code	flange description	p <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	(1) no. 4 bolts	(2)
0610713	SAE - 1"	345	1" BSP	25	18	38	22	26.2	52.4	22	70	SHC M10x35	OR 4131 (32.93x3.53)
0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	44	24	35.7	70	78	93	SHC M12x45	OR 4187 (47.22x3.53)

### 12 - MULTIPLE PUMPS

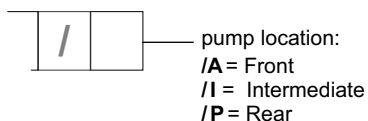
RV1D pumps are designed to be connected one to the other in decreasing order of displacement. The RV1D-016 pump suitable for multiple pumps is the R55B version only (ISO 3019-2 four-bolt flange with cylindrical keyed shaft end)

RV1D pumps can be coupled also with RV1P type pumps (see catalogue 14 201) and with GP gear pumps (see catalogue 11 100). The torque on the shaft must be further reduced after the second pump.

Consult our sales support department for this kind of applications.

#### IDENTIFICATION CODE FOR MULTIPLE PUMPS

Fill the ordering code, following the coupling sequence of the pumps. Insert the suffix that shows the pump position at the end of each RV1D pump identification code.

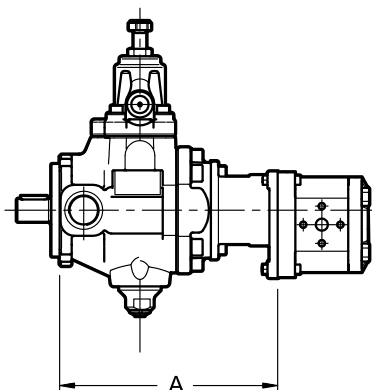
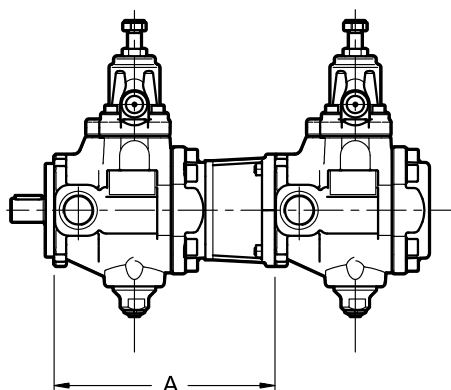


identification code    +    identification code    +    identification code  
1<sup>st</sup> pump                      2<sup>nd</sup> pump                      3<sup>rd</sup> pump  
(omit for single pumps)

Double pump identification example: RV1D-016PC-R55B/10V/A + RV1D-016PC-R55B/10V/P

Triple pump identification example: RV1D-025PC-R55B/10N/A + RV1D-025PC-R55B/10N/I + RV1D-025PC-R55B/10N/P

RV1D pump + gear pump identification example: RV1D-050PC-R55B/10N/A + GP2-00208R97F/20N



Max. torque applied to the shaft of the second pump (Nm)		
size group Primary pump	Second pump (same size group)	Second pump (smaller size group)
Group 05	55	-
Group 1	55	55
Group 2	110	110

dimension A (mm)	
with RV1D pump (same size group)	With gear pump type GP1 / GP2 / GP3
177	168 / 176 / -
238	227 / 235 / -
307,5	263,5 / 271,5 / 274,5

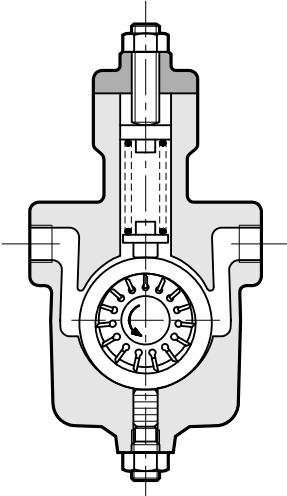


# PVE

## VARIABLE DISPLACEMENT VANE PUMPS WITH DIRECT PRESSURE ADJUSTMENT

### SERIES 30

#### OPERATING PRINCIPLE



- The PVE pumps are variable displacement vane pumps with direct pressure regulator.
- The pump group is complete with hydrostatic axial compensation distribution plates that improve the volumetric efficiency and reduce wear of the components.
- The pressure regulator adjustable load spring keeps the pump group cam ring in eccentric position.

When the delivery pressure equals the pressure corresponding to the spring setting, the cam ring is moved so to reduce the displacement, adjusting the flow rate to the values required by the plant.

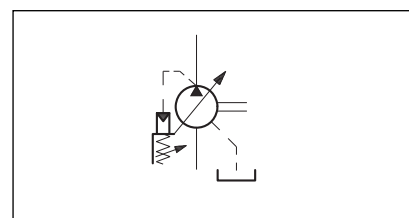
In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings, keeping the circuit pressure constant.

- The PVE pumps are available in four dimensions with maximum displacement from 6,6 to 22,2 cm<sup>3</sup>/rev and with pressure regulator max setting values up to 35 bar and 70 bar (standard).

#### TECHNICAL SPECIFICATIONS

PUMP SIZE		006	011	016	023
Displacement	cm <sup>3</sup> /rev	6,6	11,1	16,6	22,2
Flow rate (at 1.500 rpm and with 3.5 bar delivery pressure)	l/min	10,0	16,7	25,0	33,3
Operating pressure	bar	70			
Rotation speed	rpm	min 800 - max 1800			
Rotation direction		clockwise (seen from the shaft side)			
Shaft loads	N	radial and axial loads are not allowed			
Hydraulic connection		BSPP (parallel) threading fittings			
Type of mounting		SAE flange J744 - 2 holes		rectangular flange - 4 holes	
Mass	kg	5	6	9	9

#### HYDRAULIC SYMBOL



Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-10 / +70
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 50



## 1 - IDENTIFICATION CODE

<table><tr><td>P</td><td>V</td><td>E</td><td>-</td><td></td><td></td><td>-</td><td>R</td><td></td><td>0</td><td>B</td><td>/</td><td>30</td><td>N</td></tr></table>												P	V	E	-			-	R		0	B	/	30	N	NBR seals for mineral oils (standard)	
P	V	E	-			-	R		0	B	/	30	N														
Variable displacement vane pumps with direct pressure regulator												Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)															
Pump dimension: _____												BSPP (British Standard Pipe Parallel) threading hydraulic connection															
006 } 011 } 016 } 023 } see table 3												Shaft end type cylindrical SAE J744															
Pressure regulator: _____												Mounting flange 0 = SAE J744 - 2 holes (only for PVE-006 and PVE-011) 9 = rectangular - 4 holes (only for PVE-016 and PVE-023)															
PC3 up to 70 bar (standard) PC2 up to 35 bar												Clockwise rotation (seen from the shaft side)															

## 2 - HYDRAULIC FLUID

### 2.1 - Fluid type

Use only HL and HLP mineral oil based hydraulic fluids according to ISO 6743/4.

### 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum drainage fluid temperature of 70 °C.
optimum viscosity	25 ÷ 50 cSt	referred to the fluid working temperature in the tank.
maximum viscosity	800 cSt	limited to only the start-up phase of the pump.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

### 2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with  $\beta_{20} \geq 75$  is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with  $\beta_{10} \geq 100$  is recommended.

The filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

## 3 - PERFORMANCES (obtained with viscosity of 46 cSt at 40°C)

PUMP	REGULATOR	DISPLACEMENT [cm³/rev]	MAX FLOW RATE [l/min]		PRESSURE ADJUSTMENT RANGE [bar]		ROTATION SPEED [rpm]	
			1500 rev	1800 rev	min	max	min	max
PVE-006	PC2	6,6	10	12	15	35	800	1800
	PC3				50	70		
PVE-011	PC2	11,1	16,7	20	15	35		
	PC3				50	70		
PVE-016	PC2	16,6	25	30	15	35		
	PC3				50	70		
PVE-023	PC2	22,2	33,3	40	15	35		
	PC3				50	70		

**NOTE:** Flow rate values are obtained with delivery pressure = 3.5 bar

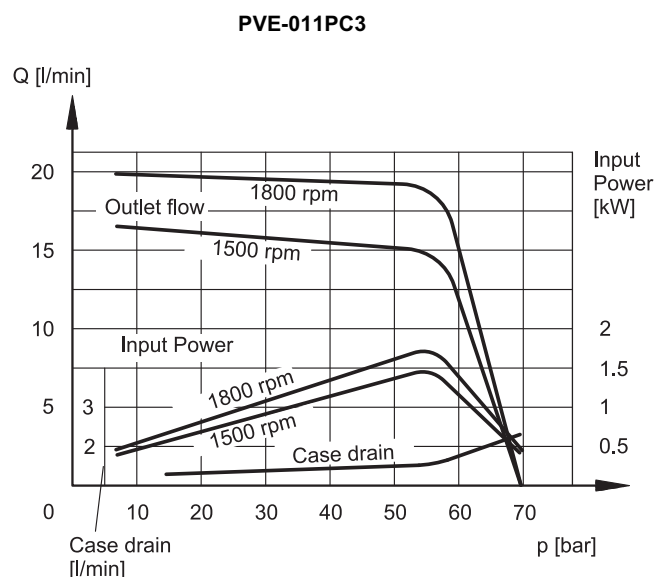
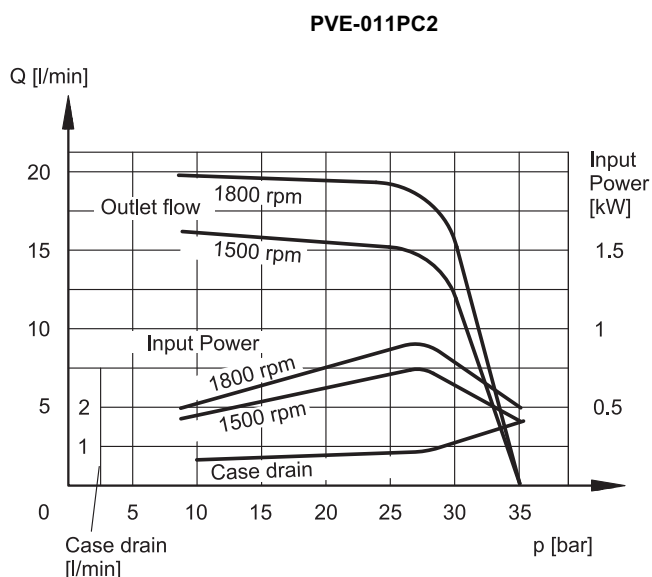
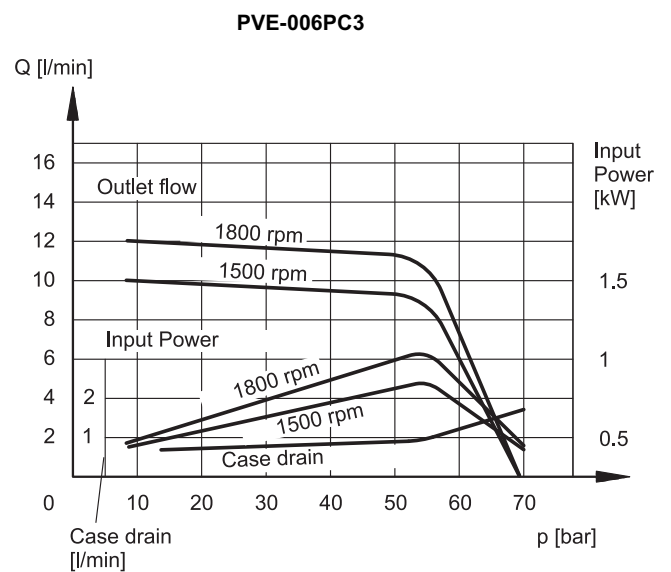
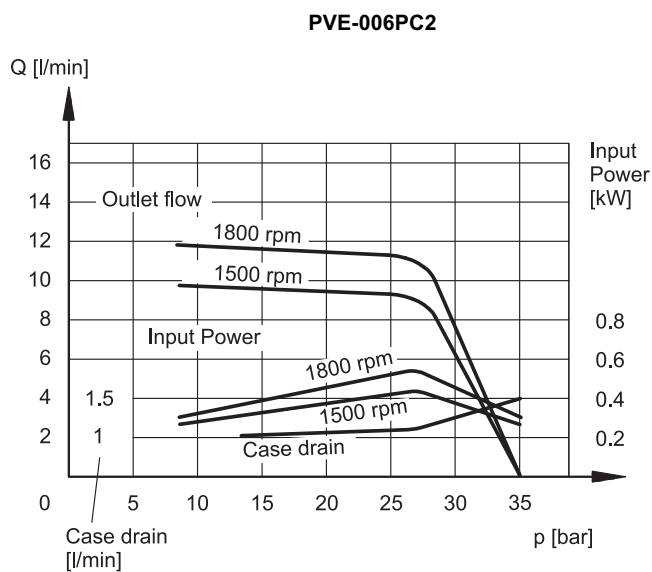
#### 4 - NOISE LEVEL

PUMP	NOISE LEVEL [dB (A)]	
	null displacement	full displacement
<b>PVE-006</b>	61	63
<b>PVE-011</b>	62	65
<b>PVE-016</b>	64	68
<b>PVE-023</b>	64	70

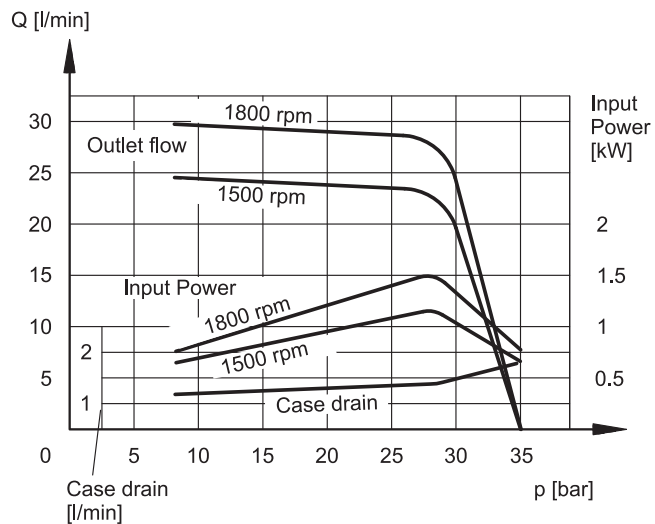
The noise pressure levels were measured in a semi-anechoic room, at an axial distance of 1 m from the pump.  
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

#### 5 - CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

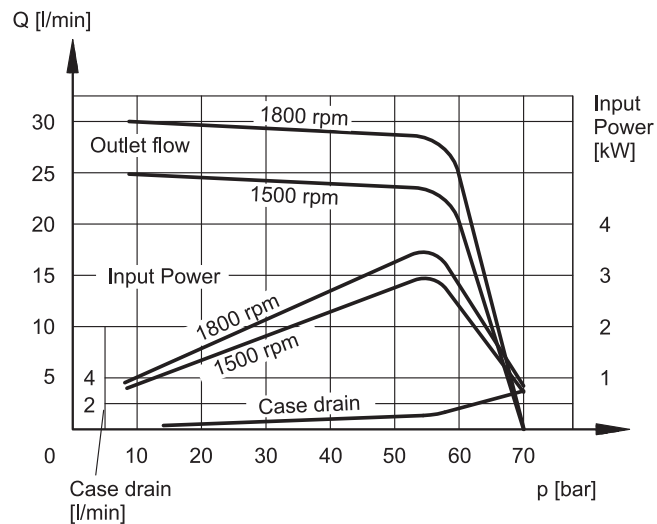
The diagram curves were measured with a pump rotation speed of 1500 and 1800 rev/min.



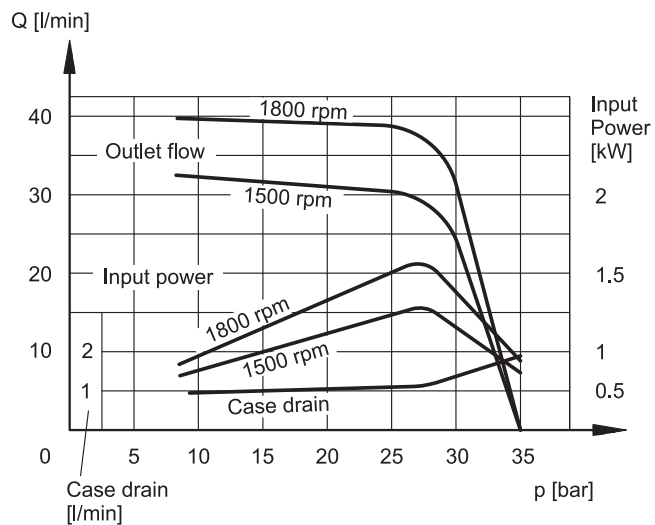
**PVE-016PC2**



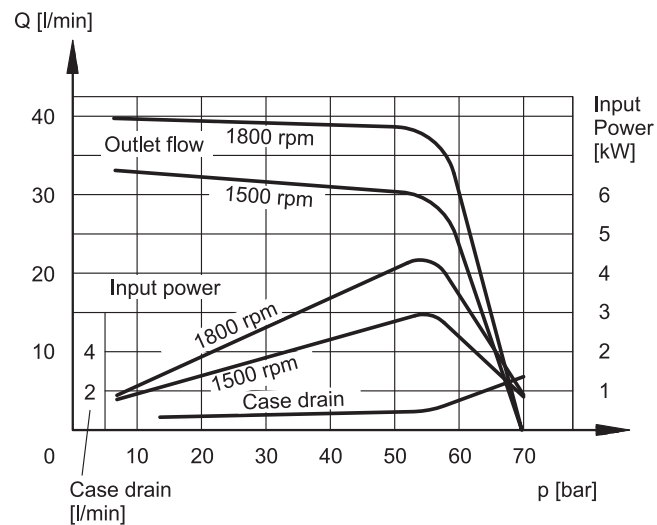
**PVE-016PC3**



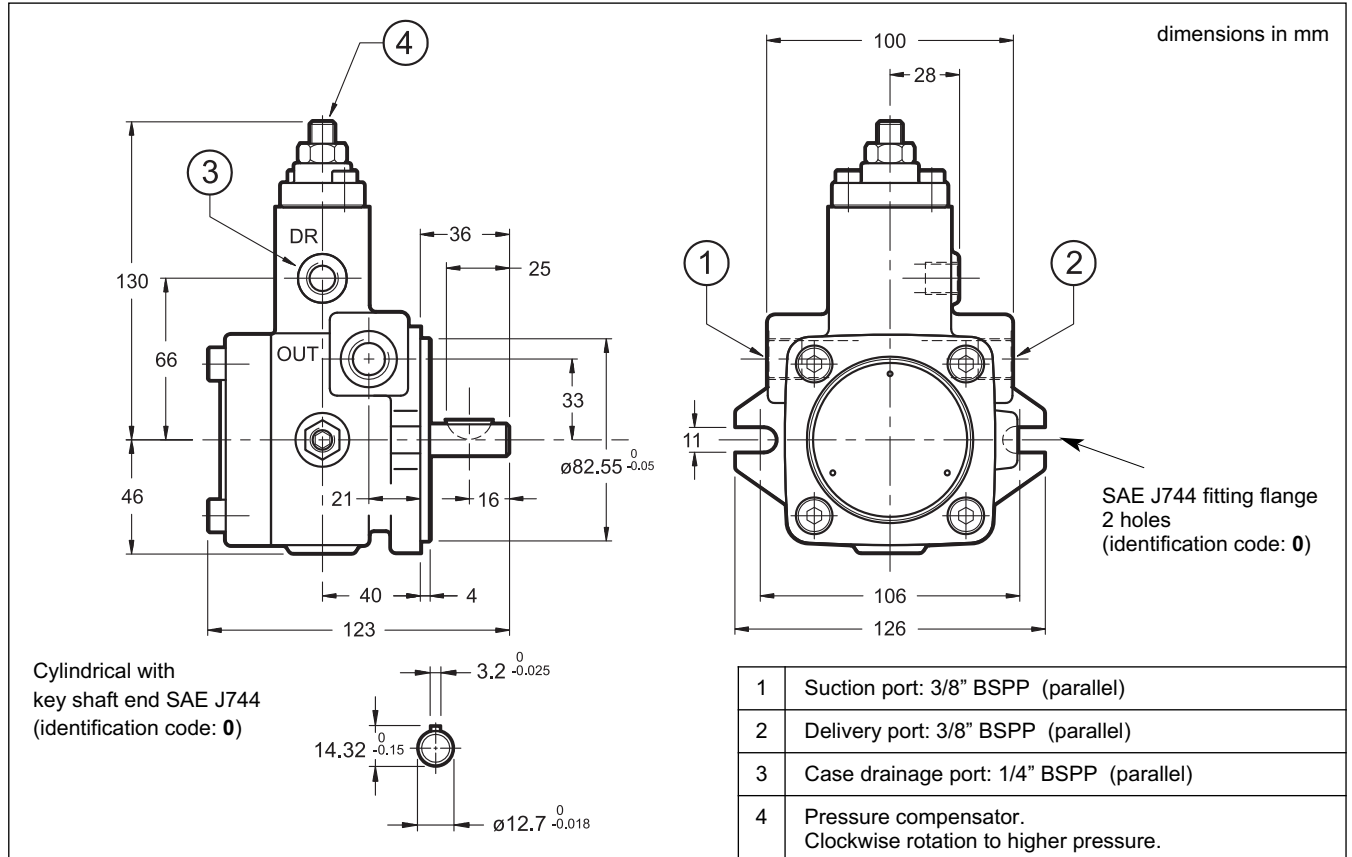
**PVE-023PC2**



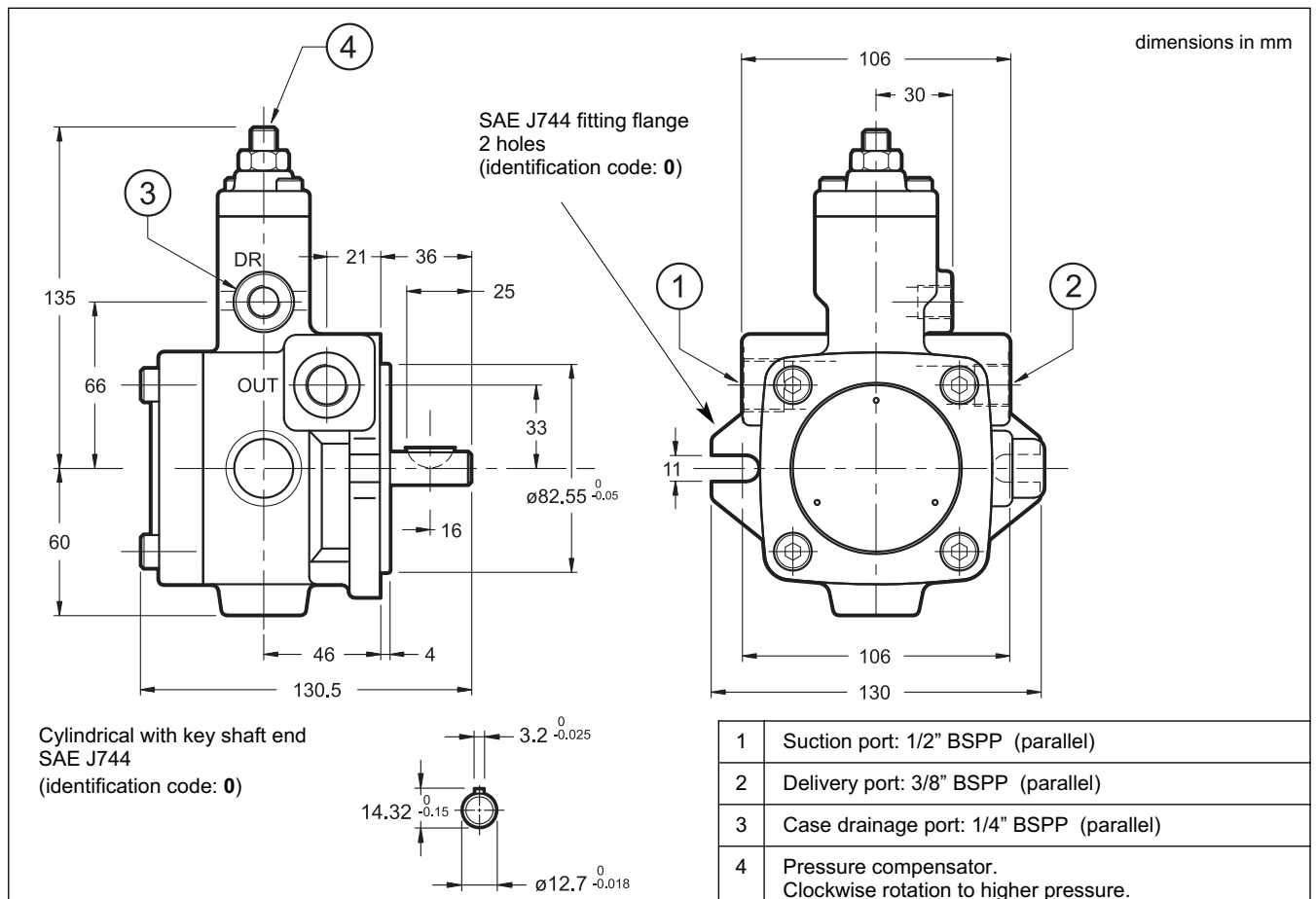
**PVE-023PC3**



## 6 - OVERALL AND MOUNTING DIMENSIONS PVE-006

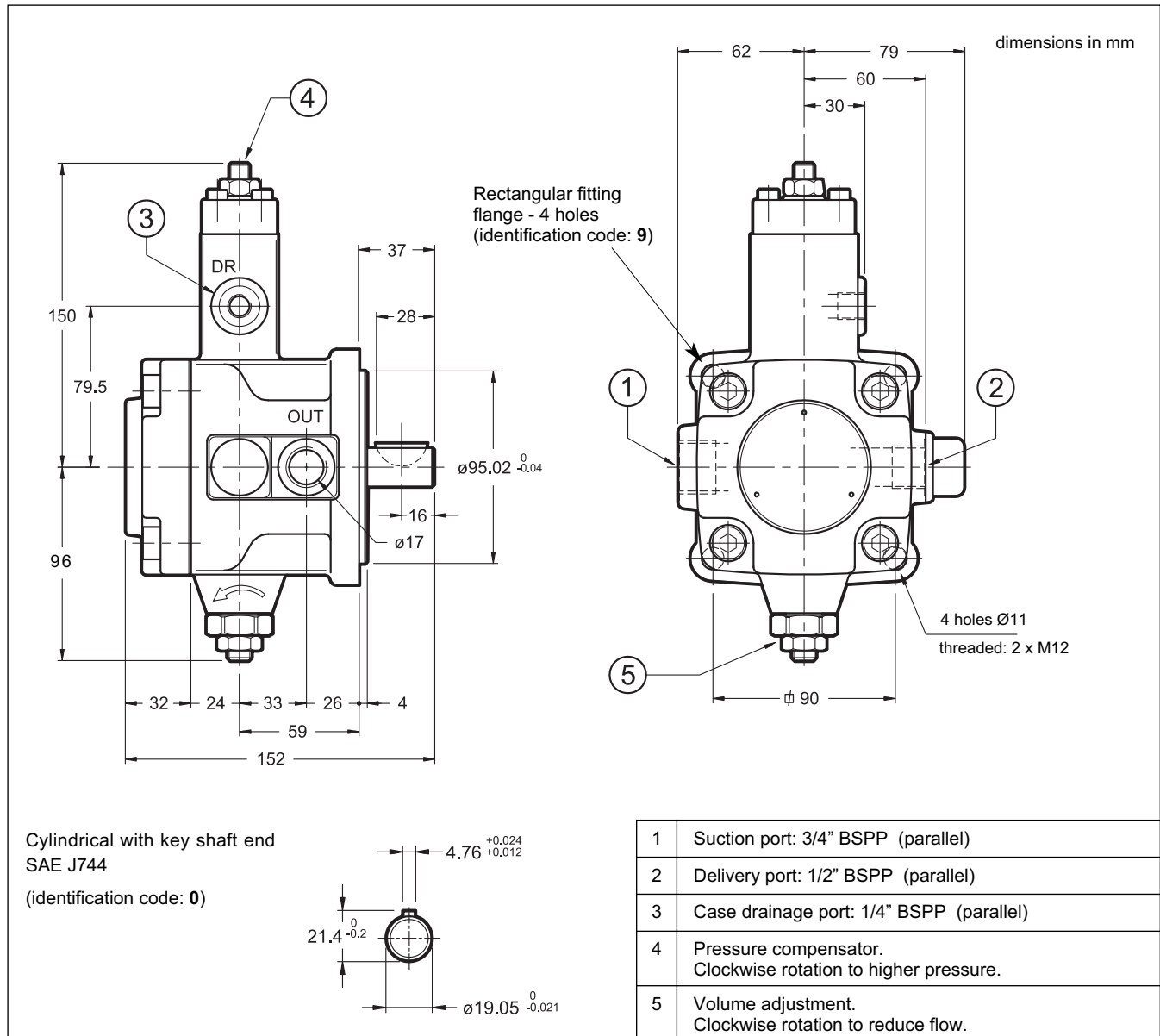


## 7 - OVERALL AND MOUNTING DIMENSIONS PVE-011





### 8 - OVERALL AND MOUNTING DIMENSIONS PVE-016 AND PVE-023



### 9 - INSTALLATION

- The PVE pumps can be installed with the axis oriented in any position.
- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.3 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.
- The drainage port must be connected directly to the tank by a line separate from other discharges, located far from the suction line and lengthened to below the minimum oil level so as to avoid formation of foam.
- **Before starting, the pump body has to be filled with the fluid.** The pump start up, especially at a cold temperature, should occur with the pump unloading. Start and stop motor several time in order to purge the air from pump and pipelines.
- The pumps are normally positioned directly above the oil tank. Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.3 bars (relative), even during the dynamic change and flow rate phases. The drainage tube has to unload inside the tank far from the suction area. We suggest to interpose a screen between the two lines.
- The motor-pump connection must be carried out directly with a flexible coupling. Couplings that generate axial or radial loads on the pump shaft are not allowed.

## 10 - MULTIPLE PUMPS

PVE-016 and PVE-023 pumps can be connected to external gear pumps (see available displacements in the table at par. 10.3). The possibility to couple two pumps makes possible to create multi-flow groups with independent hydraulic circuits.

### 10.1 - Maximum applicable torque

While sizing coupled pumps, consider that the shaft of the front pump must bear the torque generated by both pumps when they are loaded simultaneously.

**NOTE: The maximum applicable torque at the shaft of the front pump is 62 Nm.**

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [\text{Nm}] \quad n = \text{rotation speed [rpm]}$$

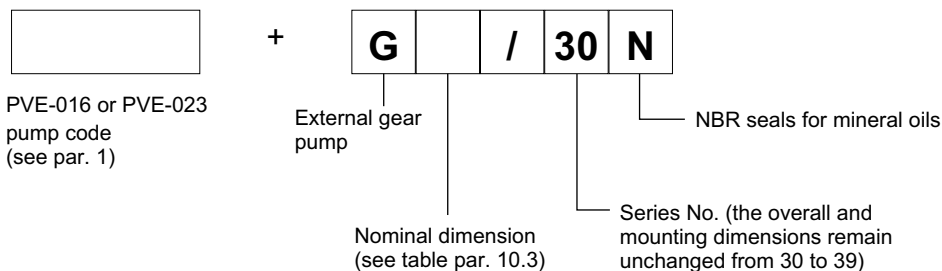
where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{\text{tot}}} = [\text{kW}]$$

Q = flow rate [l/min]  
 $\Delta p$  = differential pressure between the pump suction and delivery [bar]  
 $\eta_{\text{tot}}$  = total efficiency (coefficient = 0.8)

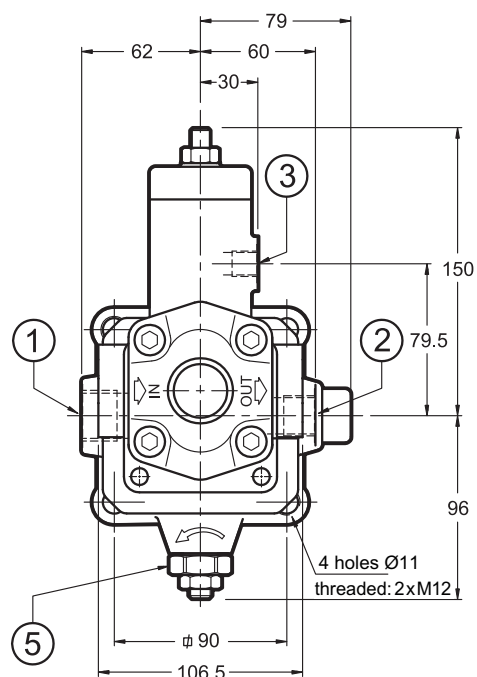
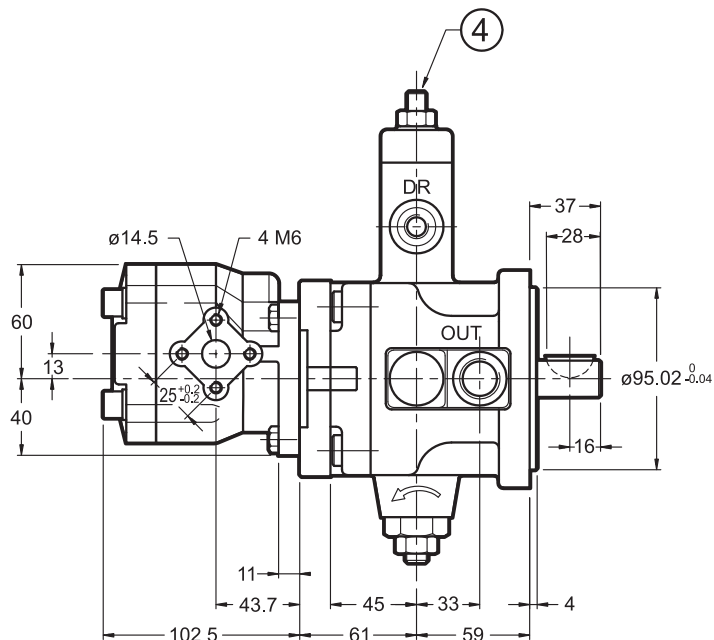
If the total of the obtained torques is higher than 62 Nm, it is necessary to reduce the working pressure / flow value of one or both the pumps until the total torque becomes lower than the maximum value indicated.

### 10.2 - Multiple pumps identification code

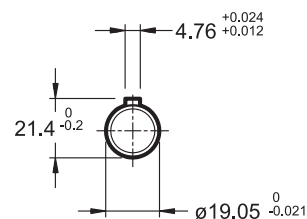


### 10.3 - Multiple pumps overall and mounting dimensions

dimensions in mm



Cylindrical with key shaft end  
SAE J744  
(identification code: 0)



#### AVAILABLE GEAR PUMPS

Nominal dimension	Displacement [cm³/rev]	Max working pressure [bar]	Peak pressure [bar]	Min speed [rev/min]
0020	2	210	250	900
0025	2.5			850
0030	3			
0040	4			
0050	5			
0060	6			
0075	7.5			
0090	9			
0105	10.5			
0120	12	175	210	800

Gear pump weight: 1.7 kg

1	Suction port: 3/4" BSPP (parallel)
2	Delivery port: 1/2" BSPP (parallel)
3	Case drainage port: 1/4" BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.
5	Volume adjustment. Clockwise rotation to reduce flow.

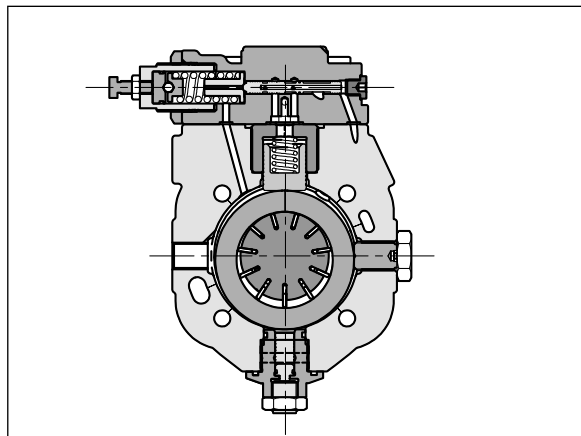


# RV1P

## VARIABLE DISPLACEMENT VANE PUMPS

**SERIES 10**

### OPERATING PRINCIPLE



- RV1P are variable displacement vane pumps with hydraulic operated pressure compensator, that permit instantaneous adjustment of the flow rate according to the circuit requirements. Energy consumption is reduced and adequate in every cycle phase.
- The pumping group is provided with double hydrostatic axial compensation, that improves the volumetric efficiency and reduces wear of the components. Both internal paths for inlet and outlet are double.
- The pressure compensator operates keeping the cam ring of the pumping group in the eccentric position by a piston hydraulically controlled by a pressure pilot stage. When the delivery pressure equals the pressure corresponding to the pilot stage setting, the cam ring is moved toward the center, adjusting the flow rate to the plant requirements. In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings and pilotings, keeping the circuit pressure constant.
- The compensator response times are very restrained such as to allow the removal of the pressure relief valve.

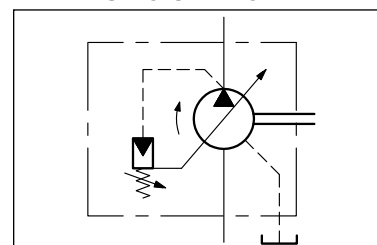
### TECHNICAL SPECIFICATIONS

(measured with mineral oil with viscosity of 46 cSt at 40°C)

PUMP SIZE		016	020	025	032	040	050	063
Geometrical displacement (ISO 3662)	cm³/rev	16	20	25	32	40	50	63
Actual displacement (± 3%)	cm³/rev	17.9	22.5	28	33.4	43	51	63
Nominal flow rate (at 1500 rpm)	l/min	26.8	33.7	42	50.1	64.5	76.5	94.5
Maximum operating range	bar	250						
Pressure adjustment range	bar	20 ÷ 250						
Maximum pressure on drain port	bar	1						
Rotation speed range	rpm	800 ÷ 1800				800 ÷ 1500		
Rotation direction		clockwise (seen from the outlet shaft side)						
Loads on the shaft		loads radial and axial not allowed						
Maximum applicable shaft torque	Nm	130	250			586		
Mass	kg	16.5	18.5			43.7		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	+15 / +60
Recommended viscosity	cSt	22 ÷ 68
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	

### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE

<b>RV1P</b>	<b>-</b>			<b>-</b>	<b>R</b>				<b>/</b>	<b>10</b>		
-------------	----------	--	--	----------	----------	--	--	--	----------	-----------	--	--

Variable displacement vane pump

Pump size: \_\_\_\_\_

group 05  
**016** = 17,9 cm<sup>3</sup>/rev

group 1  
**020** = 22,5 cm<sup>3</sup>/rev  
**025** = 28 cm<sup>3</sup>/rev  
**032** = 33,4 cm<sup>3</sup>/rev

group 2  
**040** = 43 cm<sup>3</sup>/rev  
**050** = 51 cm<sup>3</sup>/rev  
**063** = 63 cm<sup>3</sup>/rev

Control type: \_\_\_\_\_

**PC** = pressure control (**standard**)  
**PCX** = dual pressure values control, one of which is fixed

Clockwise rotation direction (seen from the shaft end) \_\_\_\_\_

Mounting flange: \_\_\_\_\_

**5** = four-bolt mounting flange ISO 3019/2  
**9** = four-holes - rectangular - type GR2 (available for RV1P-016 only)

Shaft end: \_\_\_\_\_

**5** = cylindrical keyed ISO 3019/2 (not available with flange type 9)  
**7** = conical keyed (not available for RV1P-016)

Option: Combined pumps.  
Omit for single pump  
See at section 14

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = viton for special fluids

Series No.  
(from 10 to 19 sizes and mounting dimensions remain unchanged)

Hydraulic connection:  
RV1P-016, 020, 025 and 032:  
**B** = BSP threaded ports  
RV1P-040, 050 and 063:  
**S** = suction / delivery SAE 3000 flanges with metric bolts; drain port BSP threaded

## 2 - HYDRAULIC FLUID

### 2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives. For use of other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for approval.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	- The values shown in the performance ratings table must be reduced by at least 50% - The pump rotation speed must be limited to 1000 rpm. - The max fluid temperature must be lower than 50°C - Use NBR seals only
HFD (phosphate esters)	There are no particular limitations with this kinds of fluids. Operation with a fluid viscosity as close as possible to the optimum viscosity range specified in par. 2.2 is recommended. - Use FPM (Viton) seals only

### 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

optimum viscosity	22 ÷ 68 cSt	referred to the fluid working temperature in the tank
maximum viscosity	400 cSt	limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

### 2.3 - Degree of fluid contamination

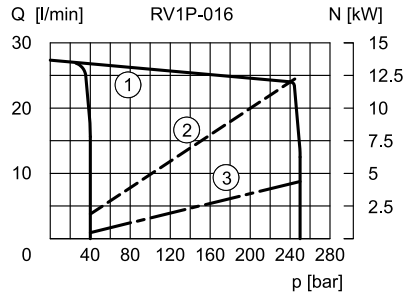
The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with  $\beta_{20} \geq 75$  is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with  $\beta_{10} \geq 100$  is recommended.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator. See installation section for details.

### 3 - CHARACTERISTIC CURVES RV1P-016 (GR. 05)

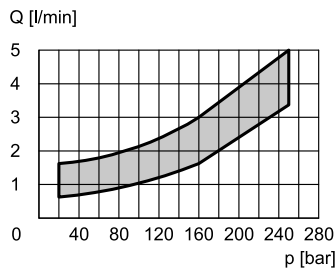
(obtained with viscosity of 46 cSt at 40°C)

#### FLOW RATE - PRESSURE - ABSORBED POWER

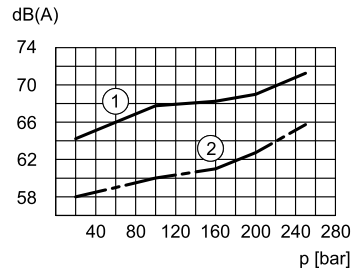


- 1) Flow rate - pressure curves, measured at 1500 rpm
- 2) Absorbed power at the maximum flow rate
- 3) Absorbed power at zero flow rate

#### DRAINAGE FLOW RATE



#### NOISE LEVEL



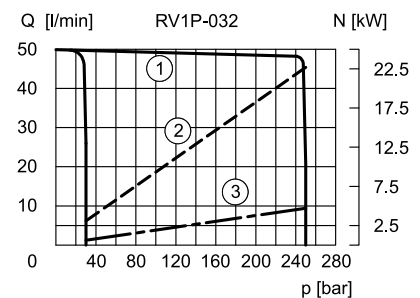
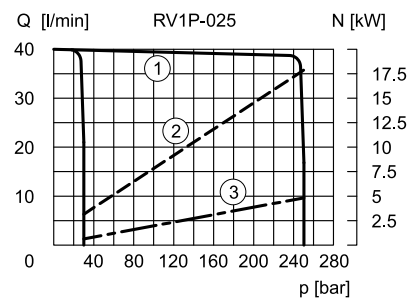
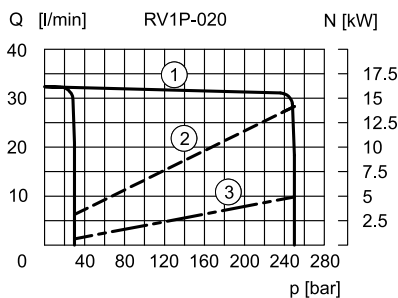
Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

- 1) noise at max flow
- 2) noise with zero flow

### 4 - CHARACTERISTIC CURVES OF RV1P-020, RV1P-025 AND RV1P-032 (GR. 1)

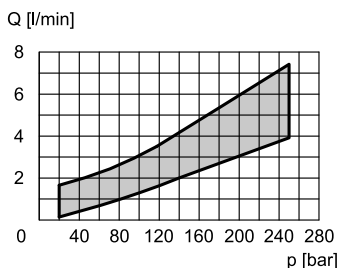
(obtained with viscosity of 46 cSt at 40°C)

#### FLOW RATE - PRESSURE - ABSORBED POWER

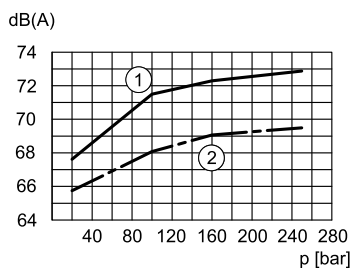


- 1) Flow rate - pressure curves, measured at 1500 rpm
- 2) Absorbed power at the maximum flow rate
- 3) Absorbed power at zero flow rate

#### DRAINAGE FLOW RATE



#### NOISE LEVEL



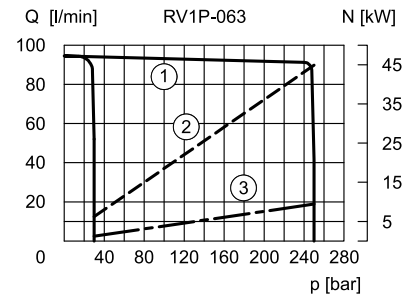
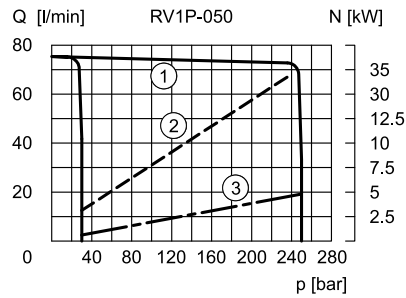
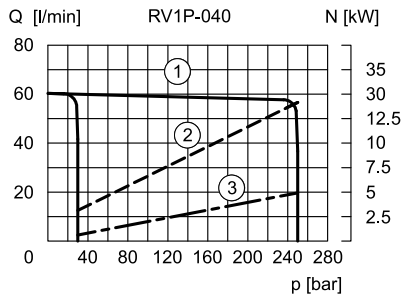
Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

- 1) noise at max flow
- 2) noise with zero flow

### 5 - CHARACTERISTIC CURVES FOR RV1P-040, RV1P-050 AND RV1P-063 (GR. 2)

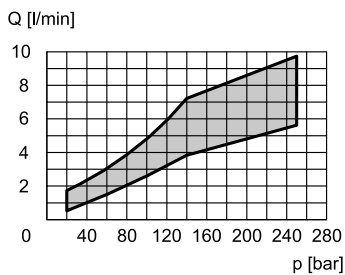
(values obtained with viscosity of 46 cSt at 40°C)

#### FLOW RATE - PRESSURE - ABSORBED POWER

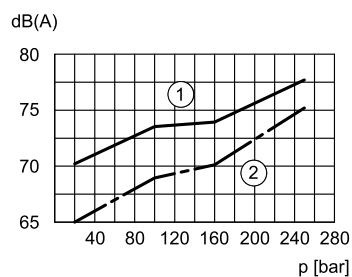


- 1) Flow rate - pressure curves, measured at 1500 rpm
- 2) Absorbed power at the maximum flow rate
- 3) Absorbed power at zero flow rate

#### DRAINAGE FLOW RATE



#### NOISE LEVEL



Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

- 1) noise at max flow
- 2) noise with zero flow

### 6 - VOLUME ADJUSTMENT SCREW

The volume adjuster is fitted as standard on all the pumps.

It consists of an adjustment screw and a small balanced piston that limit the maximum eccentricity of the pumping group cam ring, changing the displacement. The maximum flow is reduced by turning the adjustment screw clockwise. Indicative data, sensitive to performance tolerances.

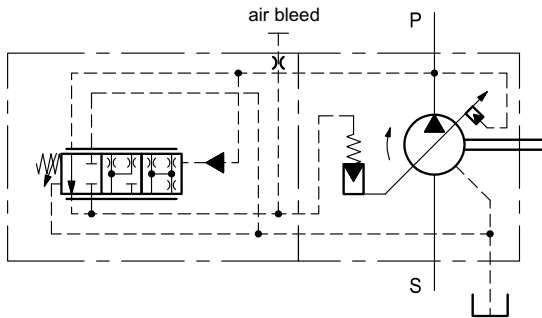
Nominal size		016	020	025	032	040	050	063
Reduction of displacement per turn	cm <sup>3</sup>	11	10			16		
Minimum possible displacement	cm <sup>3</sup> /rev	3,3	9,5	15	19	27,5	35,5	43,5

Tools required for adjustment:

RV1P-016: adjustment screw hexagon socket key 8. Locking nut spanner 24.

Other sizes: adjustment screw hexagon socket key 6. Tooth retainer KM1 type.

## 7 - PC PRESSURE CONTROL



The PC pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.

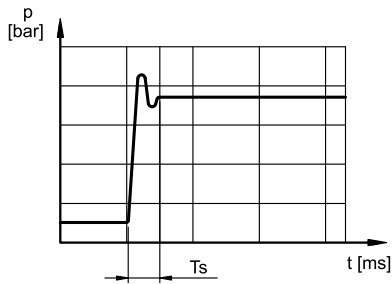
The desired pressure can be set by manually adjusting the screw.

Overall dimensions at sections 9, 10 and 11.

### FEATURES OF THE PC CONTROL:

- adjustable pressure range = 20 ÷ 250 bar
- default setting = 50 bar

### 7.1 - Response times and pressure peaks



Dynamic response curves obtained by switching the solenoid operated directional valve for closing the pump outlet.

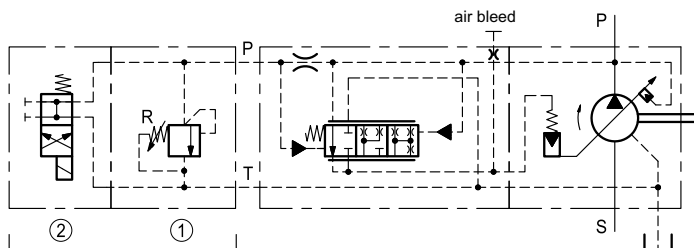
**Pressure peaks exceeding 30% of the maximum operating pressure must be eliminated.**

displacement	stabilisation time Ts (ms)	
	15 → 210 bar	15 → 250 bar
<b>016</b>	50	40
<b>020, 025, 032</b>	80	60
<b>040, 050, 063</b>	100	80



### 8 - PCX - DUAL PRESSURE CONTROL

#### Dual pressure value pump operating diagram



Valves that must be ordered separately:

- 1 - pressure control valve MCI5-SP
- 2 - solenoid switching valve DS3-SA2 (datasheet 41 150)

The PCX control, mated to a suitable two-position solenoid valve allows to switch between two working pressure values, one of which is fixed.

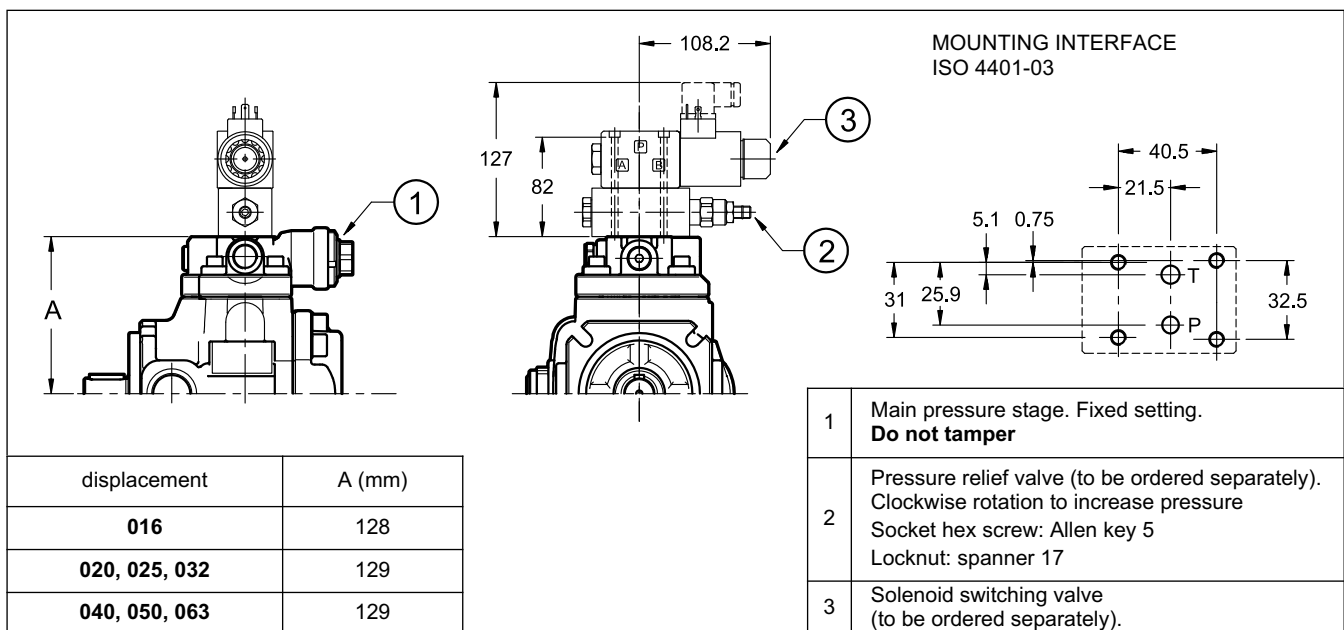
The main pressure compensator (fixed adjustment) is equipped with a ISO 4401-03 mounting interface for mounting both the pressure control valve and the solenoid operated directional valve.

**Both the switching valve and the pressure control valve must be ordered separately.**

#### FEATURES OF THE PCX CONTROL:

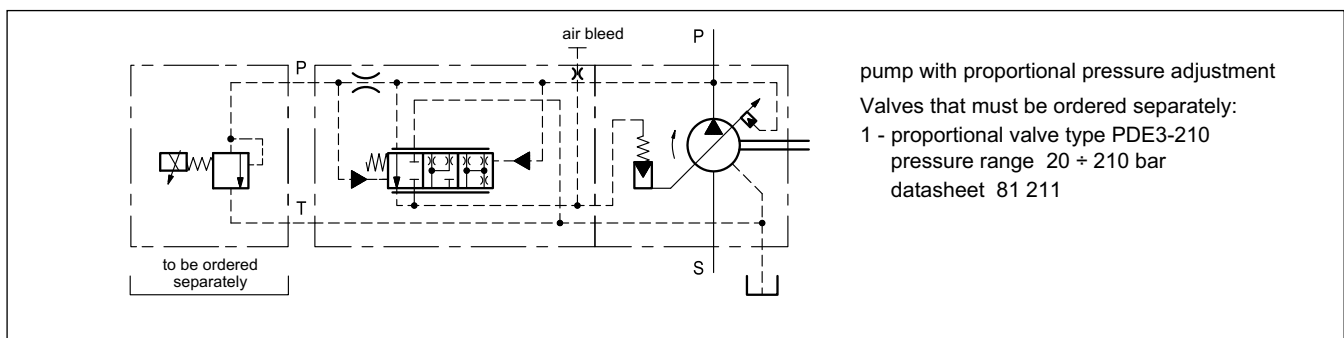
- solenoid valve OFF = delivery pressure 20 bar (by fixed stage) and pump at null displacement
- solenoid valve ON = delivery pressure set on control (R) and pump at maximum displacement.
- adjustable pressure range (R) = 20 ÷ 250 bar
- default setting (R) = 50 bar

#### 8.1 - Overall dimensions RV1P-\*PCX

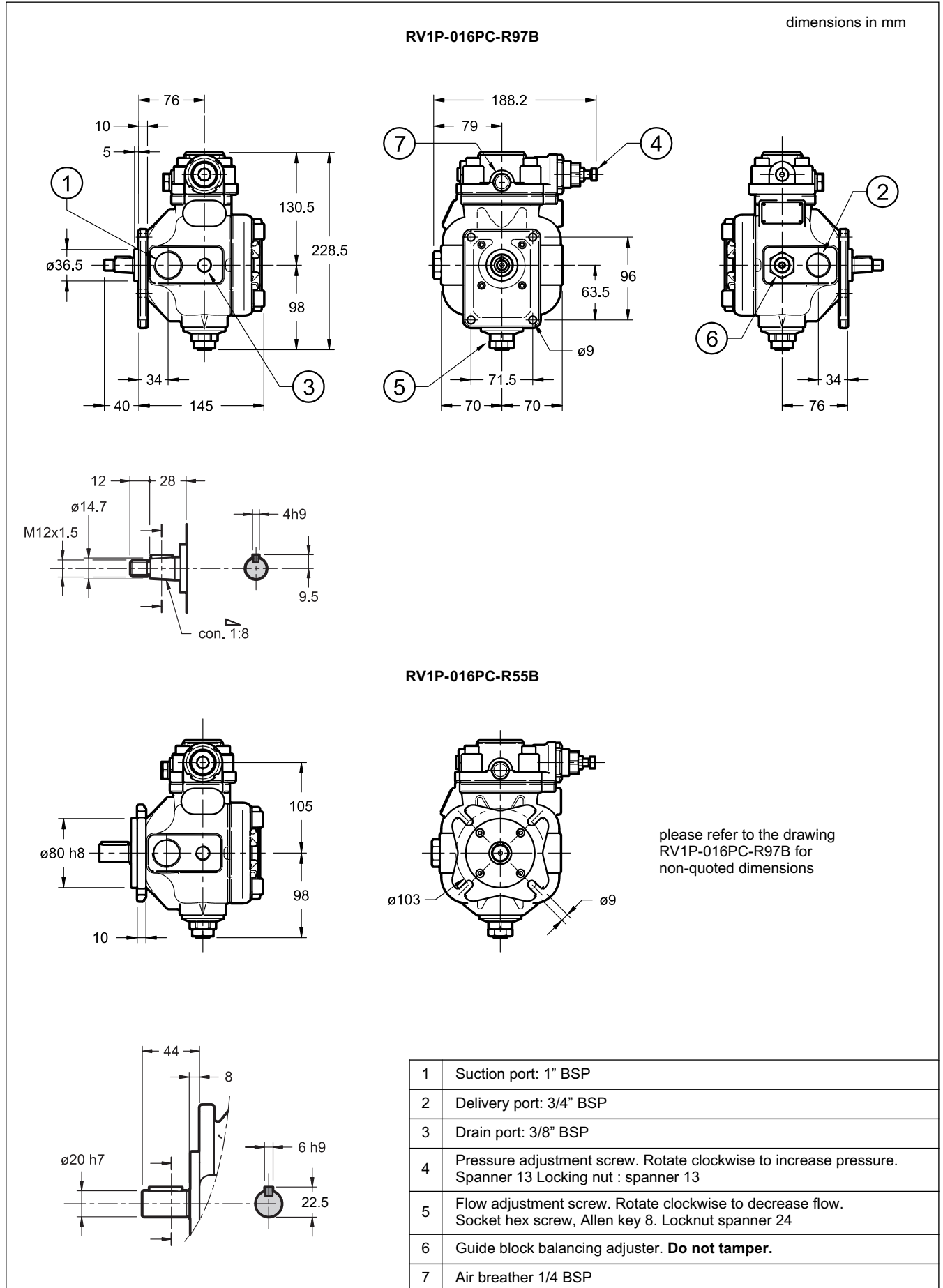


#### 8.2 - Example of pressure setting control circuit

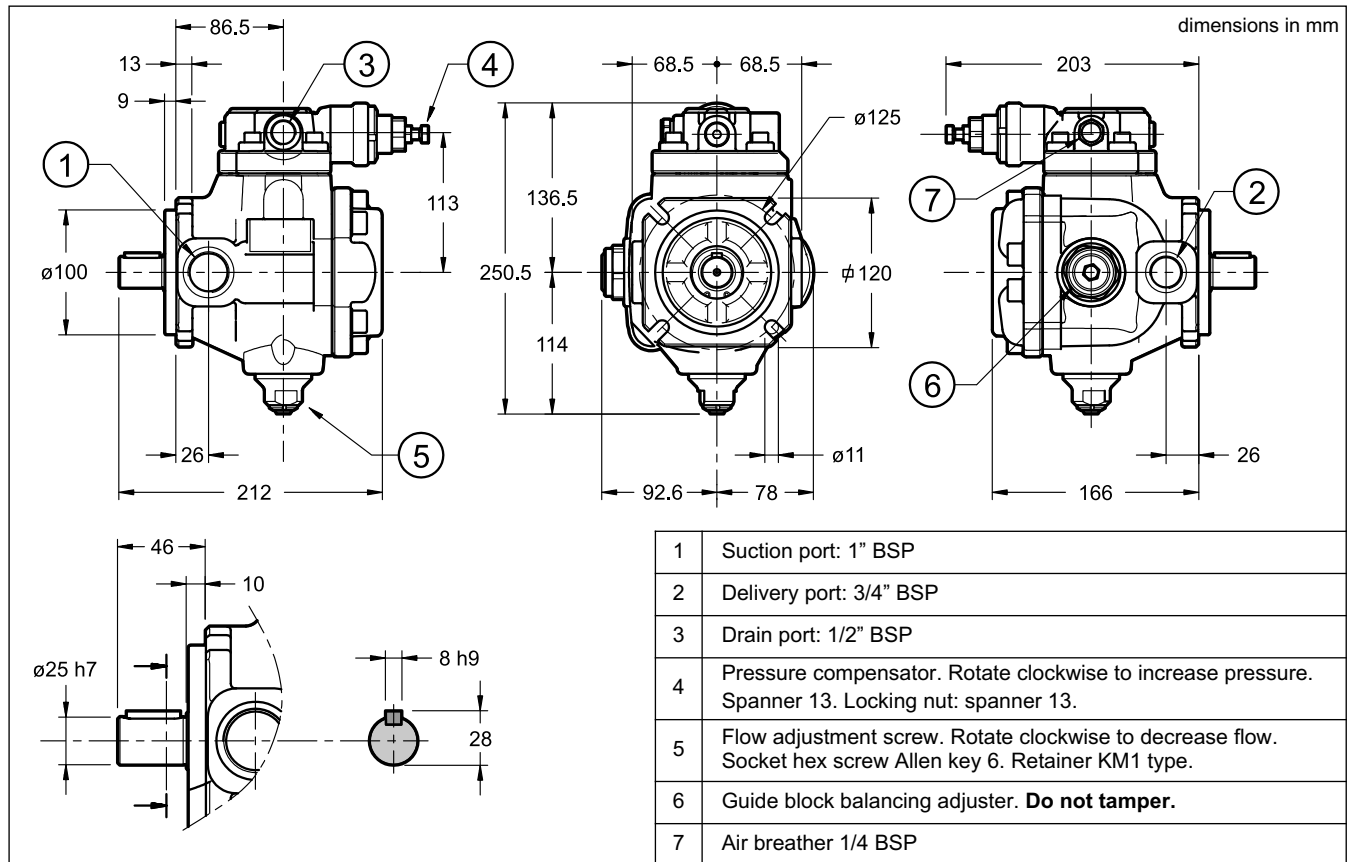
It is possible to make different pump set pressure control circuits. An example is outlined here below.



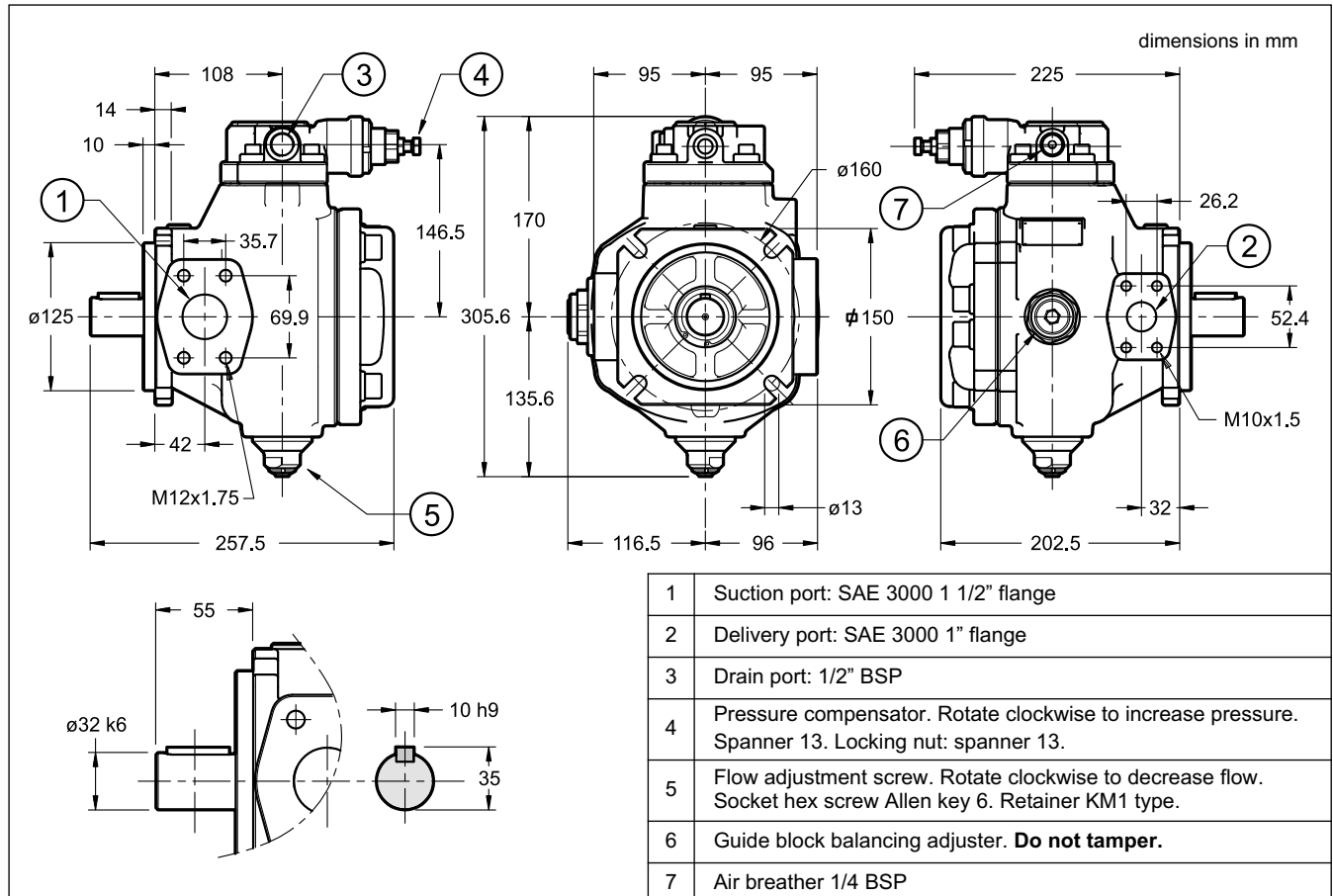
## 9 - OVERALL AND MOUNTING DIMENSIONS RV1P-016 (GR. 05)



### 10 - OVERALL AND MOUNTING DIMENSIONS RV1P-020, RV1P-025 AND RV1P-032 (GR. 1)



### 11 - OVERALL AND MOUNTING DIMENSIONS RV1P-040, RV1P-050 AND RV1P-063 (GR. 2)



### 12 - INSTALLATION

The instruction manual for pumps installation and commissioning is always included in the packaging with the pump. Observe restrictions in this document and follow the instructions.

- RV1P-016, RV1P-020, RV1P-025 and RV1P-032 pumps can be installed in any position.

RV1P-040, RV1P-050 and RV1P-063 pumps need to be installed with the axis in horizontal position and with pressure compensator upward.

- Motor-pump coupling must be made with a self-aligning flexible coupling with convex teeth and a polyamide cam. **Couplings that generate axial or radial loads on the pump shaft are not allowed.**
- The suction line must be short, with end pipe cut at 45° with a small number of bends and without internal section changes. The minimum section of the inlet pipe must be equal to the section of the thread of the pump inlet port.

The pipe-end inside the tank should be cut at 45°, should have a minimum distance from the tank bottom of not less than 50 mm, and there should always be a minimum height of suction of 100 mm. The suction pipe should be completely airtight in order to avoid air intake which could be extremely damaging to the pump.

**Suction pressure should be between 0.8 and 1.5 bar absolute.**

- The drainage pipe must be connected directly to the tank by a line separate from other discharges, located as far as possible from the suction line and lengthened to below the minimum oil level in order to avoid foaming. The drain fluid does not exceed 60°C.

- The tank must be suitably sized in order to allow the cooling of the fluid. It should be good that the fluid in the tank does not exceed 50°C. If necessary, consider the installation of a heat exchanger on the drain line.

- **Ensure that the pump shaft can be rotated manually without any resistance.**

- Fill the pump with the fluid through the drain port. The pump start up must be done in full displacement (P→T) with flow to the tank with no pressure. During this step bleed the air, unscrewing the cap of the air bleed port on the pressure compensator device, and then close the cap.

The pump should prime within 5 seconds. If it does not, switch it off and investigate the cause. The pump should not run empty.

Subsequents start-up under zero flow setting conditions are admissible only with pressure not exceeding 30 bar, and with the system and pump completely filled with fluid.

- If the volume adjuster has been set for values less than 50% of the nominal flow-rate, start-up is allowed only if provided the system and pump are fully filled of fluid.

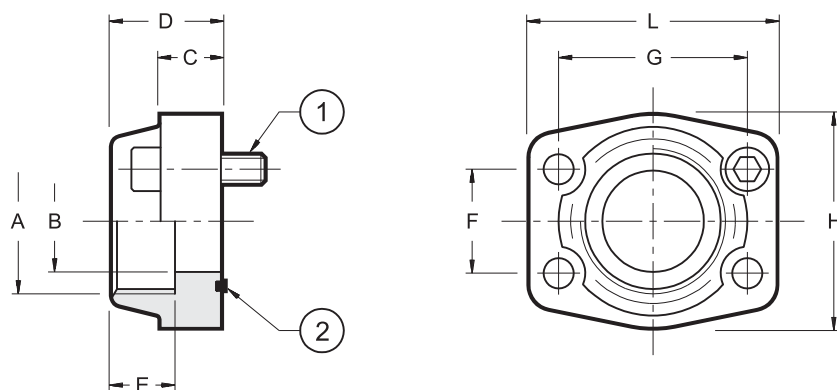
- **It's essential that the difference between the fluid temperature and the ambient (pump body) temperature doesn't exceed 20 °C.**

If this is the case, the pump should be switched-on only for intervals of about 1-2 seconds (start/stop mode) without pressure, until the temperatures came balanced.

- The pumps are usually placed directly upon the oil tank. Flooded suction port installation of the pump is recommended in the event of circuits with high flow rates and pressures.

### 13 - CONNECTION FLANGES

dimensions in mm



The fastening bolts and the O-Rings must be ordered separately.

flange code	flange description	P <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	(1) no. 4 bolts	(2)
0610713	SAE - 1"	345	1" BSP	25	18	38	22	26.2	52.4	22	70	SHC M10x35	OR 4131 (32.93x3.53)
0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	44	24	35.7	70	78	93	SHC M12x45	OR 4187 (47.22x3.53)

## 14 - MULTIPLE PUMPS

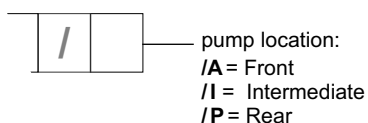
RV1P pumps are designed to be connected one to the other in decreasing order of displacement. The RV1P-016 pump suitable for multiple pumps is the R55B version only (ISO 3019-2 four-bolt flange with cylindrical keyed shaft end)

RV1P pumps can be coupled also with RV1D type pumps (see catalogue 14 101) and with gear pumps (see catalogue 11 100). The torque on the shaft must be further reduced after the second pump.

Consult our Sales Support department for this kind of applications.

### IDENTIFICATION CODE FOR MULTIPLE PUMPS

Fill the ordering code, following the coupling sequence of the pumps. Insert the suffix that shows the pump position at the end of each RV1P pump identification code.

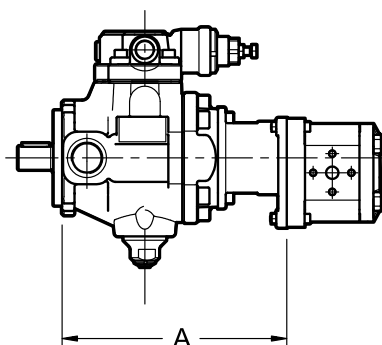
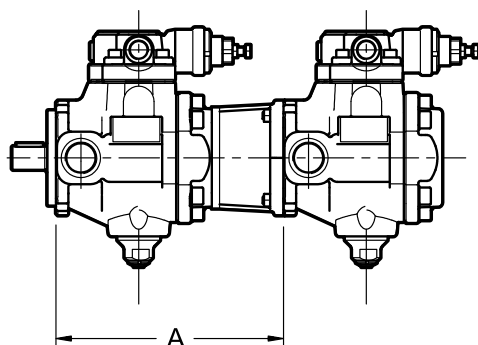


identification code    +    identification code    +    identification code  
1<sup>st</sup> pump                  2<sup>nd</sup> pump                  3<sup>rd</sup> pump  
  
(omit for single pumps)

Double pump identification example: RV1P-025PC-R55B/10V/**A** + RV1P-025PC-R55B/10V/**P**

Triple pump identification example: RV1P-040PC-R55S/10N/A + RV1P-040PC-R55S/10N/I + RV1P-040PC-R55S/10N/P

RV1P pump + gear pump identification example: RV1P-050PCX-R55S/10N/A + GP2-00208R97F/20N



Max. torque applied to the shaft of the second pump (Nm)		
size group Primary pump	Second pump (same size group)	Second pump (smaller size group)
Group 05	55	-
Group 1	55	55
Group 2	110	110

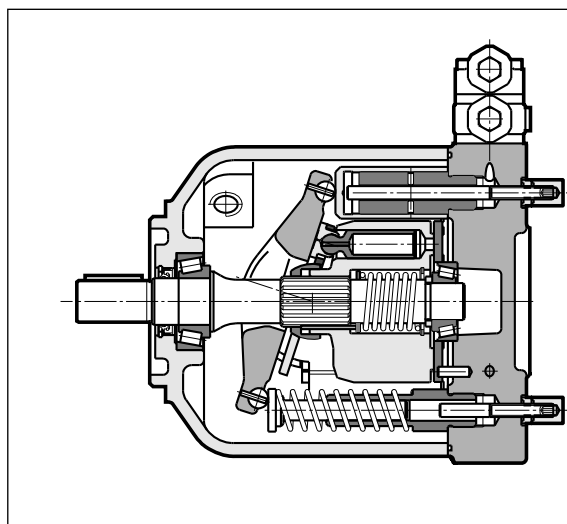
dimension A (mm)	
with RV1P pump (same size group)	With gear pump type GP1 / GP2 / GP3
212	203 / 211 / -
238	227 / 235 / -
307.5	263.5 / 271.5 / 274.5



# VPPM

## VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS

### OPERATING PRINCIPLE



- The VPPM pumps are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits.
- They are available in three different frame sizes with maximum displacements up to 29, 46, 73 and 87 cm<sup>3</sup>/rev.
- The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.
- The pumps feature medium-high working pressures (up to 280 bar constant and 350 bar peak). Thanks to some particular design features, these pumps are able to bear high axial and radial loads on the shaft.
- They are usually supplied with a ISO 3019/2 mounting flange, with the exception of the rear and intermediate pumps, which are only available with a SAE J744 2-holes flange and a SAE J744 splined shaft (see paragraph 16).
- They are available with seven different types of regulating control, each according to the application needs (see paragraphs 8 + 14).

### TECHNICAL SPECIFICATIONS

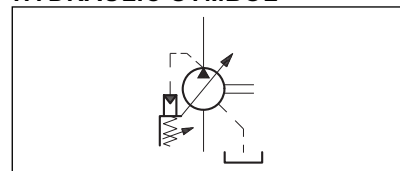
PUMP SIZE		029	046	073	087
Maximum displacement	cm <sup>3</sup> /rev	29	46	73	087
Max. delivery pressure (relative): - continuous - intermittent ( <b>NOTE 1</b> ) - peak	bar		280 315 350		250 280 315
Maximum rotation speed at maximum displacement ( <b>NOTE 2</b> )	rpm	3000	2600	2200	1850
Rotation direction		clockwise or anticlockwise (looking at the drive shaft)			
Hydraulic connection		SAE flange fittings (see paragraph 24)			
Type of mounting (single pump)		ISO 3019/2 flange			
Mass (empty single pump)	kg	18	24	33	33

Ambient temperature range	°C	-15 / +70
Fluid temperature range	°C	-25 / +80
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	15 + 35

**NOTE 1:** Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.

**NOTE 2:** Values referring to a zero bar pressure (relative) on the suction port.

### HYDRAULIC SYMBOL



## 1 - IDENTIFICATION CODES

### 1.1 - Identification code for single and front pumps with a through output shaft

<b>V</b>	<b>P</b>	<b>P</b>	<b>M</b>	-			-				/			/	
<p>Variable displacement piston pump</p> <p>Pump size: _____</p> <p><b>029</b> = 29 cm<sup>3</sup>/rev  <b>046</b> = 46 cm<sup>3</sup>/rev  <b>073</b> = 73 cm<sup>3</sup>/rev  <b>087</b> = 87 cm<sup>3</sup>/rev</p> <p>Regulator type: _____</p> <p><b>PC</b> = pressure regulator  <b>PCR</b> = remote-controlled pressure regulator  <b>PCX</b> = regulator with pressure control devices  <b>PQC</b> = pressure and flow rate regulator  <b>PQCE5</b> = integrated proportional flow and pressure control regulator - pmax 280 bar (not available for VPPM-029)  <b>PQNC</b> = power regulator  <b>PQNCE5</b> = power regulator with integrated proportional flow and pressure control pmax 280 bar (not available for VPPM-029)</p> <p>Rotation direction (seen from the shaft end) _____  <b>R</b> = clockwise    <b>L</b> = anticlockwise</p> <p>Mounting flange _____  <b>5</b> = ISO 3019/2 (<b>standard</b>)  <b>0</b> = SAE J744 - 2 holes</p>				<p><b>MXXX:</b> Torque setting value [Nm] only for pumps with a PQNC and PQNCE regulator (see paragraph 1.5)</p> <p>Intermediate flange  <b>000</b> = single pump without flange</p> <p><b>12S</b> } intermediate flange and  <b>62S</b> } mating joint for rear pumps  <b>63S</b> } (see par. 1.4)  <b>64S</b> }</p> <p>Seals:  <b>N</b> = NBR seals for mineral oils (<b>standard</b>)  <b>V</b> = FPM seals for special fluids</p> <p>Series No.  <b>11</b> for VPPM-*PQCE5 and VPPM-*PQNCE5  <b>10</b> for all the other versions (from 10 to 19 sizes and mounting dimensions remain unchanged)</p> <p>Hydraulic connection  <b>S</b> = suction / delivery SAE flange with metric bolts (<b>standard</b>)  drainage port with BSP threading  <b>T</b> = suction / delivery SAE flange with UNF bolts  drainage port with UNF threading</p> <p>Shaft end type  <b>5</b> = cylindrical with key ISO 3019/2 (<b>standard</b>)  <b>0</b> = cylindrical with key SAE J744  <b>1</b> = splined SAE J744</p>											

**NOTE 1:** See at table below compatibility among mounting flange, type of shaft and type of hydraulic connection

### Compatibility among mounting flange, type of shaft and type of hydraulic connection

FLANGE CODE	SHAFT CODE			HYDRAULIC CONNECTION CODE	
	5	0	1	S	T
5	yes	no	no	yes	no
0	no	yes	yes	yes	yes

VPPM pumps are supplied as standard with mechanical minimum and maximum displacements limit controls. These devices are not available for front and intermediate pumps with a through output shaft.

## 1.2 - Identification code for intermediate pumps with a through output shaft and rear pumps

<b>V</b>	<b>P</b>	<b>P</b>	<b>M</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>1</b>	<b>/</b>	<b>10</b>	<b>/</b>	<b></b>
----------	----------	----------	----------	----------	----------	----------	----------	----------	-----------	----------	---------

Variable \_\_\_\_\_  
displacement piston pump

Pump size: \_\_\_\_\_  
**029** = 29 cm<sup>3</sup>/rev  
**046** = 46 cm<sup>3</sup>/rev  
**073** = 73 cm<sup>3</sup>/rev  
**087** = 87 cm<sup>3</sup>/rev

Regulator type: \_\_\_\_\_  
**PC** = pressure regulator  
**PCR** = remote-controlled pressure regulator  
**PCX** = regulator with pressure control devices  
**PQC** = pressure and flow rate regulator  
**PQNC** = power regulator

Rotation direction (seen from the shaft end) \_\_\_\_\_  
**R** = clockwise    **L** = anticlockwise

Mounting flange \_\_\_\_\_  
 SAE J744 - 2 holes (**mandatory**)

Type of shaft end \_\_\_\_\_  
 splined SAE J744 (**mandatory**)

**XXXX**: torque setting value [Nm] only for pumps with a PQNC regulator (see paragraph 1.5)

Intermediate flange  
**000** = single pump without flange

**12S**  
**62S**  
**63S**  
**64S** } intermediate flange and mating joint for rear pumps (see paragraph 1.4)

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

Hydraulic connection  
**S** = suction / delivery SAE flange with metric bolts (**standard**)  
 drainage port with BSP threading  
**T** = suction / delivery SAE flange with UNF bolts  
 drainage port with UNF threading

## 1.3 - Identification code for double pumps

identification code + identification code  
 1st pump                      2nd pump

## 1.4 - Identification code for intermediate flange and mating joint for pumps with a through output shaft

According to the pump to be coupled, it is necessary to define, into the identification code, the flange and mating joint type to be applied to the pump with a through output shaft.

The following table states the flange and joint reference code according to the different pump types to be pulled, stating also the possible coupling combinations.

Identification code for intermediate flange + mating joint	intermediate flange	mating joint	pump to be mated	possible combinations for VPPM pump with a through output shaft			
				29	46	73	87
<b>12S</b>	SAE J744 2 holes - type "A"	SAE J744 splined 16/32 D.P. - 9T	GP 2 external gear	yes	yes	yes	yes
<b>62S</b>	SAE J744 2 holes - type "B"	SAE J744 splined 16/32 D.P. - 13T	GP 3 external gear VPPM-029	yes	yes	yes	yes
<b>63S</b>	SAE J744 2 holes - type "B"	SAE J744 splined 16/32 D.P. - 15T	VPPM-046	no	yes	yes	yes
<b>64S</b>	SAE J744 2 holes - type "C"	SAE J744 splined 12/24 D.P. - 14T	VPPM-073	no	no	yes	yes
<b>64S</b>	SAE J744 2 holes - type "C"	SAE J744 splined 12/24 D.P. - 14T	VPPM-087	no	no	no	yes

**NOTE:** For the flange type and dimensions see paragraph 20.



## 1.5 - Standardized torque values for PQNC and PQNCE regulators

ELECTRICAL MOTOR 4 POLES		VPPM-029		VPPM-046		VPPM-073		VPPM-087	
Power [kW]	N [rpm]	torque [Nm]	p regulation start. [bar]	torque [Nm]	p regulation start. [bar]	torque [Nm]	p regulation start. [bar]	torque [Nm]	p regulation start. [bar]
4	1425	26 (#)	46	-	-	-	-	-	-
5,5	1440	36 (#)	62	36 (#)	41	-	-	-	-
7,5	1450	50	84	50 (#)	56	-	-	-	-
9,2	1460	60	103	60 (#)	68	60 (#)	44	-	-
11	1455	72	124	72	82	72 (#)	53	-	-
15	1460	98	168	98	111	98 (#)	72	-	-
18,5	1460	-	-	122	137	122	89	-	-
22	1465	-	-	144	163	144	105	-	-
30	1470	-	-	-	-	196	143	196	126
37	1470	-	-	-	-	240	175	240	156
45	1470	-	-	-	-	-	-	293	190
55	1475	-	-	-	-	-	-	356	231

(#) With this adjustment value the pump is in venting position with a pressure lower than 280 bar.

## 1.6 - Identification examples

a) 29 cm<sup>3</sup>/rev single pump with pressure regulator - ISO mounting flange and shaft (standard)

**VPPM-029PC-R55S/10N000**

b) 46 cm<sup>3</sup>/rev single pump with pressure regulator with remote control - SAE mounting flange and SAE splined shaft

**VPPM-046PCR-R01S/10N000**

c) 73 cm<sup>3</sup>/rev single pump with pressure control devices - ISO mounting flange and shaft (standard)

**VPPM-073PCX-R55S/10N000**

d) 46 cm<sup>3</sup>/rev single pump with integrated proportional flow and pressure control regulator - pressure regulation up to 280 bar

**VPPM-046PQCE5-R55S/11N000**

e) 46 cm<sup>3</sup>/rev single pump with power regulator set at 18,5 kW at 1460 rpm (torque = 122 Nm)

**VPPM-046PQNC-R55S/10N000/M122**

f) 73 cm<sup>3</sup>/rev single pump with power regulator with integrated proportional flow and pressure control - power regulator set at 98 Nm - pressure regulation up to 280 bar

**VPPM-073PQNCE5-R55S/11N000/M098**

g) 73 cm<sup>3</sup>/rev front pump with pressure regulator, ready to mate to a VPPM-029 pump

**VPPM-073PC-R55S/10N62S**

h) double pump made of:

- 46 cm<sup>3</sup>/rev front pump with pressure and flow rate regulator
- 29 cm<sup>3</sup>/rear pump with pressure regulator

**VPPM-046PQC-R55S/10N62S + VPPM-029PC-R01S/N000**

i) triple pump made of:

- 73 cm<sup>3</sup>/rev front pump with flow rate and pressure regulator
- 46 cm<sup>3</sup>/rev intermediate pump with pressure regulator
- 14 cm<sup>3</sup>/rev rear gear pump group 2

**VPPM-073PQC-R55S/10N63S + VPPM-046PC-R01S/10N12S + GP2-0140R01F/20N**

## 2 - HYDRAULIC FLUID

### 2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives according to the DIN 51524 norm.

For use with other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water $\leq 40\%$ )	<p>The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows:</p> <p>max continuous pressure: 170 bar  max peak pressure: 200 bar  max rotation speed: VPPM-029 = 2100 rpm  VPPM-046 = 2000 rpm  VPPM-073 and VPPM-087 = 1700 rpm</p> <ul style="list-style-type: none"> <li>- The suction pressure must be lower than 0,8 absolute bars (-0,2 relative bars)</li> <li>- The fluid maximum temperature must be between 0°C and 50°C.</li> <li>- Use NBR seals only.</li> </ul>
HFD (phosphate esters)	<p>Such fluids do not require any particular performance limitation.  It is suggested to operate with continuous duty pressures not higher than 200 bar and pressure peaks not higher than 240 bar.</p> <ul style="list-style-type: none"> <li>- The operating temperature must be between -10°C and 90°C.</li> <li>- Use VITON seals</li> </ul>

### 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	15÷ 35 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

### 2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with  $\beta_{10(c)} \geq 75$  is suggested.

A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with  $\beta_{10(c)} \geq 100$  is recommended.

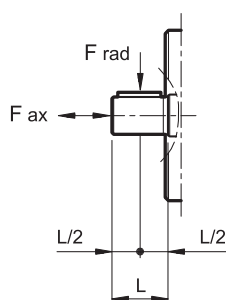
In the event that the filter is installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in the table of paragraph 3.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

### 3 - PERFORMANCES (measured with mineral oil with viscosity of 36 cSt at 50°C)

PUMP SIZE		029	046	073	087
Maximum displacement	cm <sup>3</sup> /rev	29	46	73	87
Maximum flow rate: - at 1500 rpm - at max rotation speed	l/min	43,5 87	69 119,6	109,5 160,5	131,9 162,6
Input pressure (absolute): - min - max	bar (abs)	0,8 25			
Max. delivery pressure (absolute): - continuous - intermittent ( <b>NOTE 1</b> ) - peak		280 315 350			250 280 315
Max pressure on drainage port	bar (abs)	2			
Maximum power ( $\Delta p = 280$ bar): - at 1500 rpm - at max rotation speed	kW	20,3 40,6	32,2 55,8	51,1 74,9	54,9 67,8
Max velocity at maximum displacement	rpm	3000	2600	2200	1850
Moment of inertia on the shaft	kgm <sup>2</sup>	0,0020	0,0030	0,0080	0,0080
Max absorbed torque: - $\Delta p = 100$ bar - $\Delta p = 280$ bar	Nm	46,2 129,3	73,2 205	116,2 325,3	139,9 349,8
Max operating pressure with NBR seals - minimum - continuous - peak	°C	-25 80 100			
Max operating pressure with Viton seals - minimum - continuous - peak	°C	-10 110 125			
Oil volume in the pump body	lt	0,7	0,9	1,5	1,5

**NOTE 1:** Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.

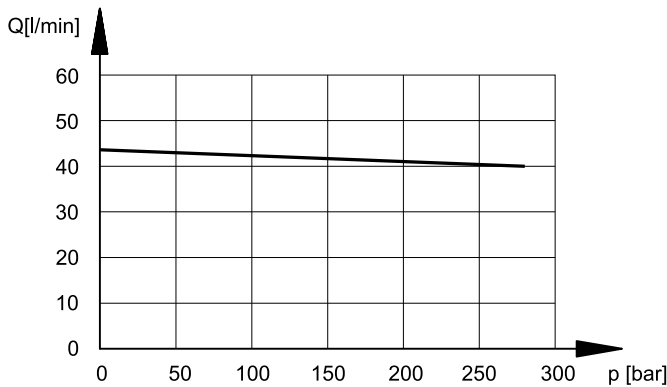


Loads on the shaft:					
- axial load ( $F_{ax}$ )	N	1000	1500	2000	2000
- radial load ( $F_{rad}$ )		1500	1500	3000	3000

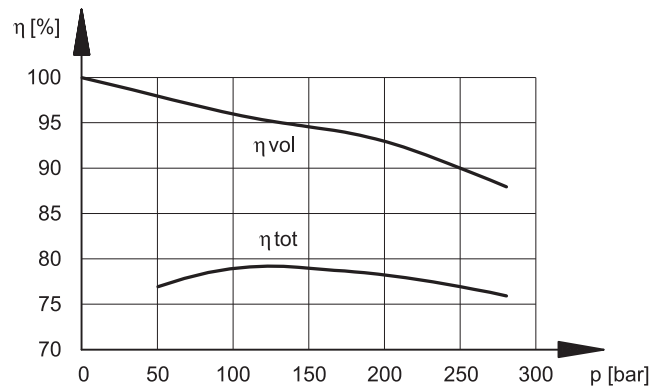
## 4 - VPPM-029 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

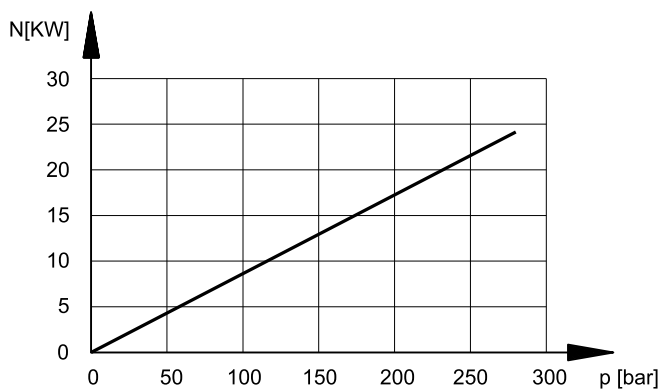
**FLOW RATE/PRESSURE CURVES**



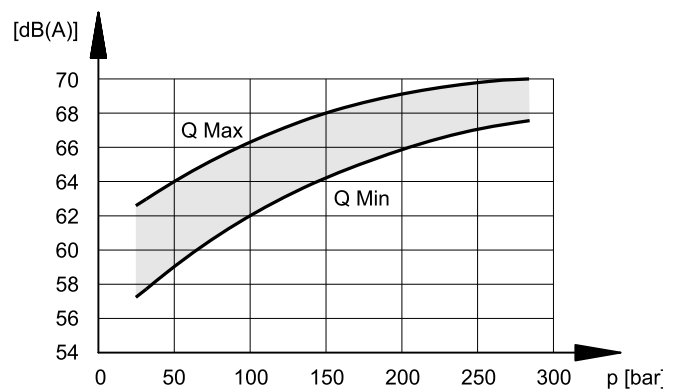
**VOLUMETRIC AND TOTAL EFFICIENCY**



**ABSORBED POWER**



**NOISE LEVEL**

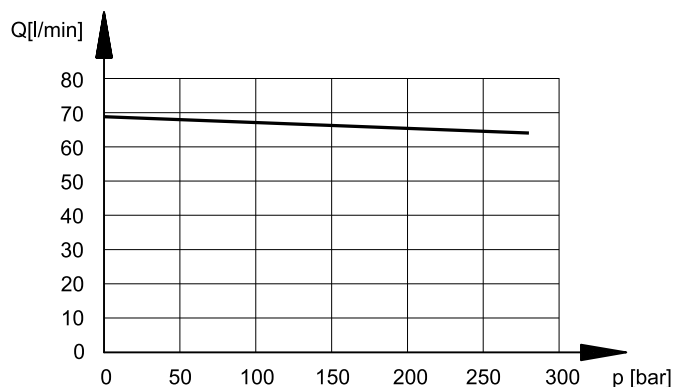


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of  $\pm 2$  dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

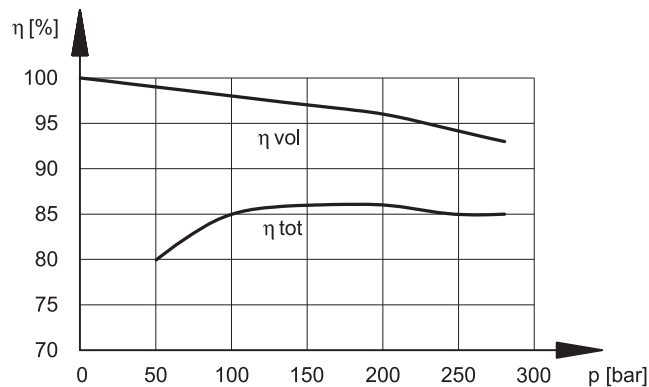
## 5 - VPPM-046 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

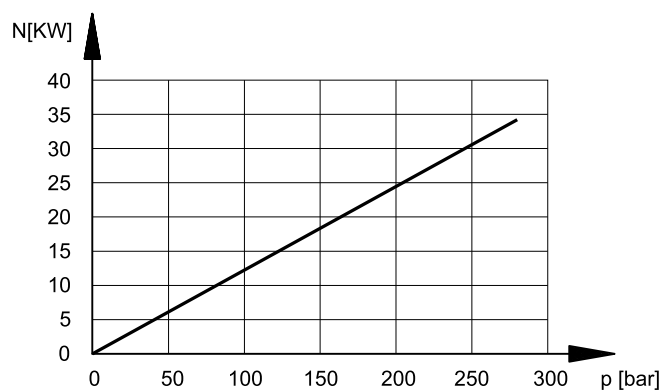
**FLOW RATE/PRESSURE CURVES**



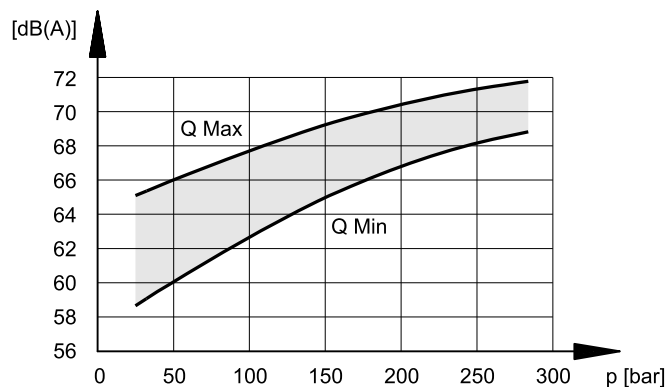
**VOLUMETRIC AND TOTAL EFFICIENCY**



**ABSORBED POWER**



**NOISE LEVEL**

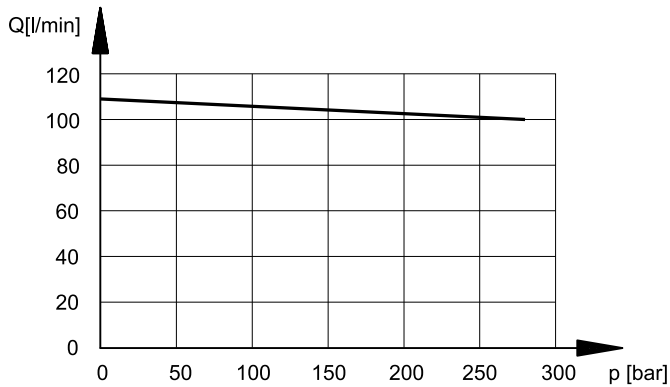


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of  $\pm 2$  dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

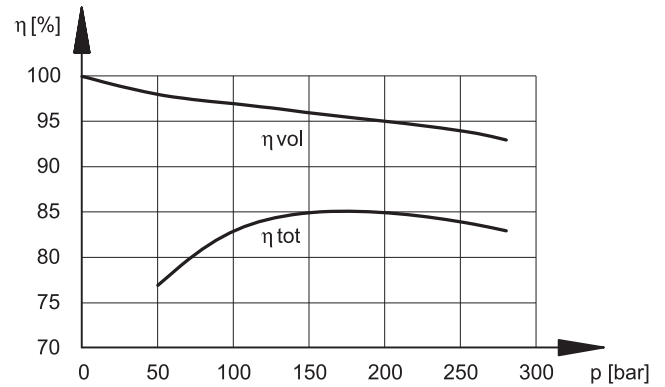
## 6 - VPPM-073 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

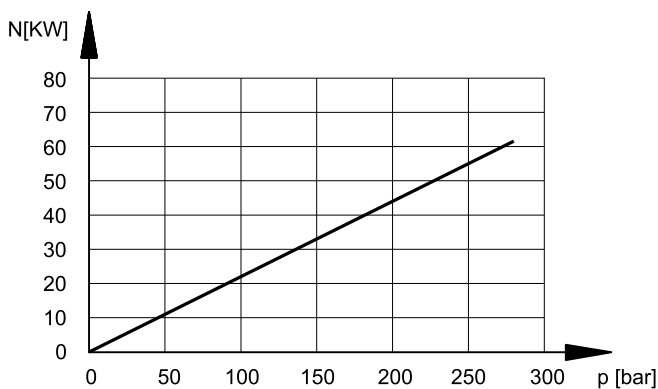
**FLOW RATE/PRESSURE CURVES**



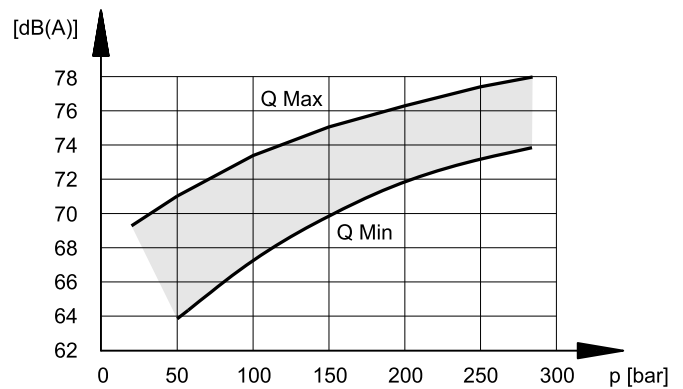
**VOLUMETRIC AND TOTAL EFFICIENCY**



**ABSORBED POWER**



**NOISE LEVEL**

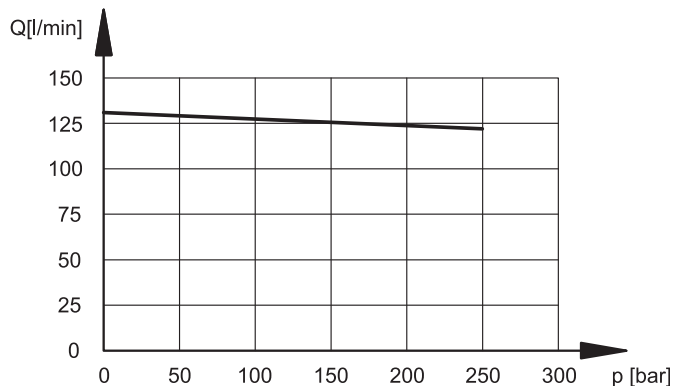


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of  $\pm 2$  dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

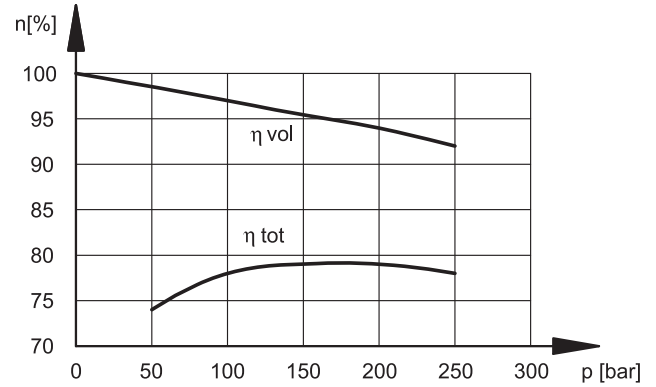
## 7 - VPPM-087 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

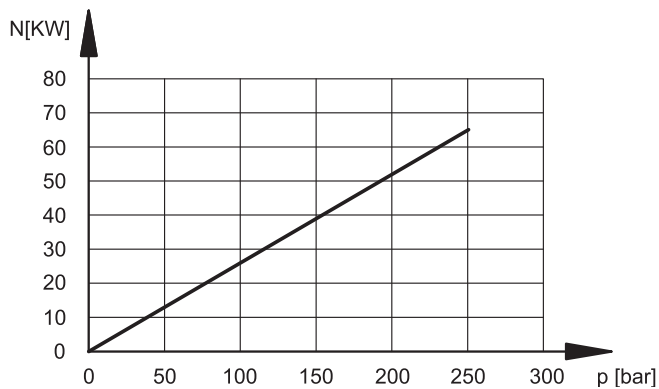
**FLOW RATE/PRESSURE CURVES**



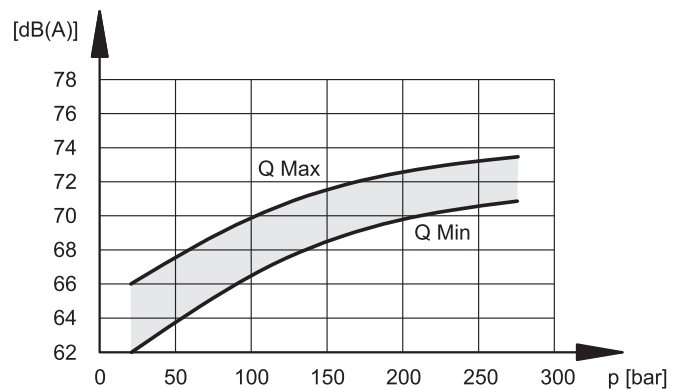
**VOLUMETRIC AND TOTAL EFFICIENCY**



**ABSORBED POWER**



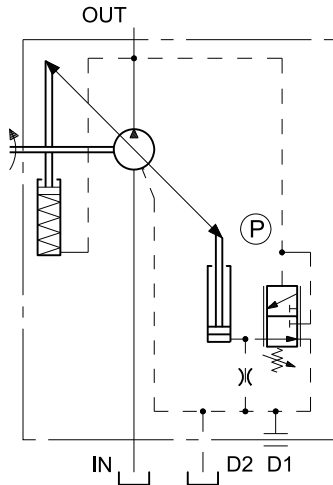
**NOISE LEVEL**



The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of  $\pm 2$  dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

## 8 - PRESSURE REGULATOR: PC

### FUNCTIONAL DIAGRAM



The PC pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.

The desired pressure can be set by manually adjusting the (P) regulation valve.

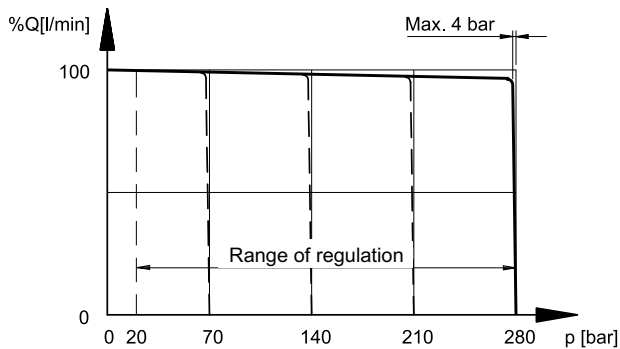
### FEATURES OF THE PC REGULATOR:

- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars

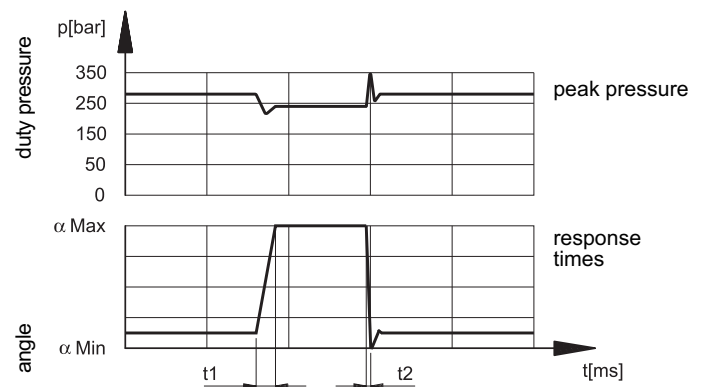
### 8.1 - Characteristic curves of the PC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

#### FLOW RATE/PRESSURE FEATURE



#### RESPONSE TIMES AND PEAK PRESSURE



t1 = response time for a change from a min. to a max. displacement.

t2 = response time for a change from a max. to a min. displacement.

### PC pressure regulator set at 280 bars

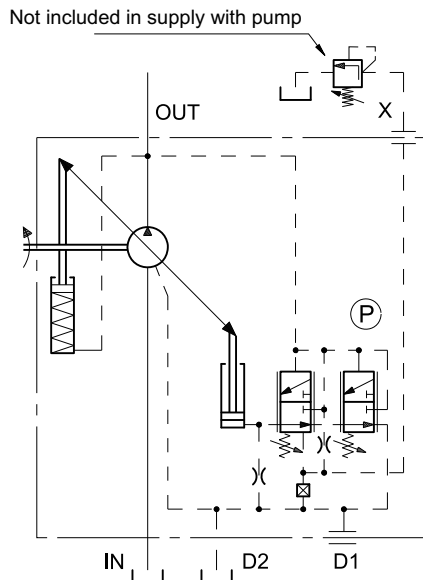
pump size	t1 [ms]	t2 [ms]
029	30	20
046	45	25
073	50	30
087	53	28

The values stated in the table are obtained from the opening until the instant the delivery level is achieved, by using a maximum pressure valve set at 350 bars for a load simulation, placed at a distance of 1 m from the pump delivery port.



## 9 - REMOTE-CONTROLLED PRESSURE REGULATOR: PCR

### FUNCTIONAL DIAGRAM



The PCR regulator, apart from limiting the line maximum pressure (P valve), allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps). In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.

N.B. The maximum length of the connection between the valve and the pump X port must not be longer than 2 m.

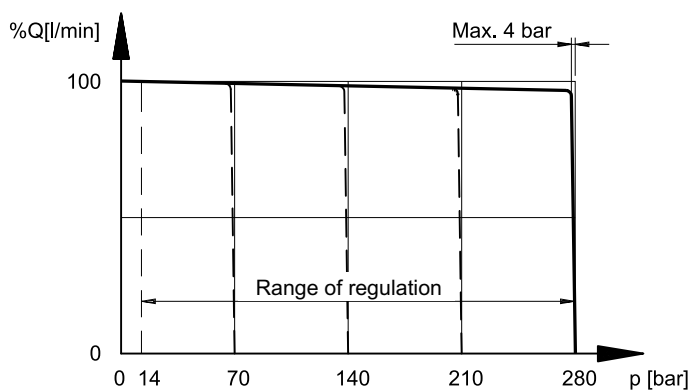
#### PCR FEATURES:

- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars
- remote-regulated pressure range = 14 ÷ 315 bars
- flow rate available on the X port for the remote-control = about 1,5 l/min

### 9.1- Characteristic curves of the PCR regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

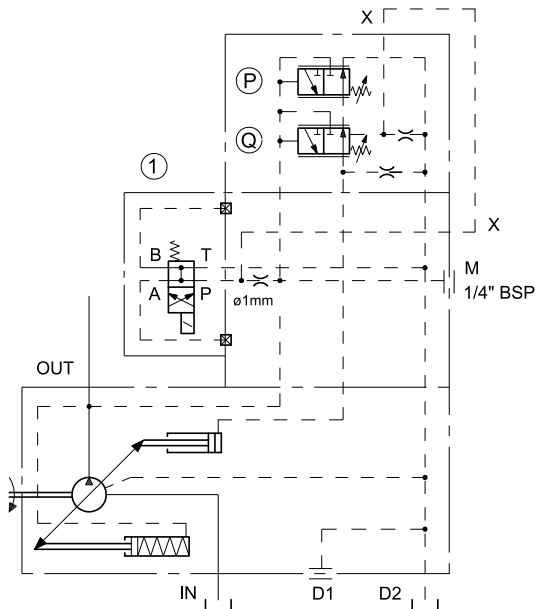
#### FLOW RATE / PRESSURE FEATURE



## 10 - REGULATOR WITH PRESSURE CONTROL DEVICES: PCX

### 10.1 - Electrical unloading

#### FUNCTIONAL DIAGRAM



The PCX regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

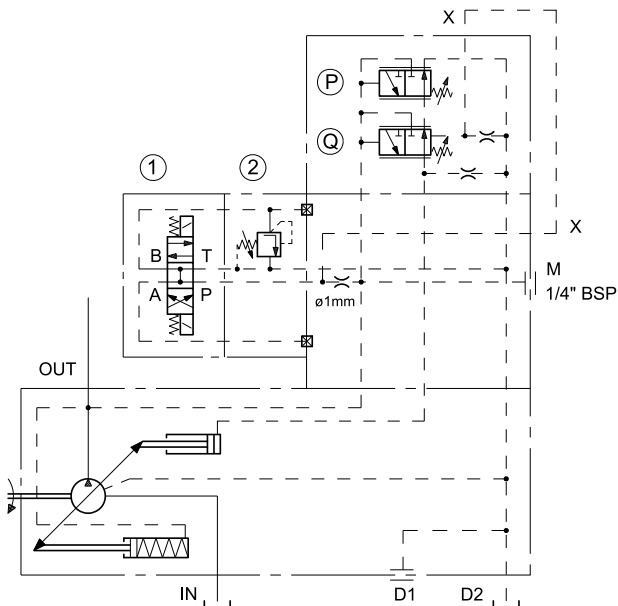
The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

#### PCX FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 (to be ordered separately see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator (P).
- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

### 10.2 - Two pressure settings + unloading

#### FUNCTIONAL DIAGRAM



This type of regulator allows to select, by means of a three-position solenoid valve, two different working pressures; it allows also the pump unloading.

The solenoid valve (1) and the relief valve (2) for the intermediate pressure setting are directly installed on the pump regulator and they are to be ordered separately.

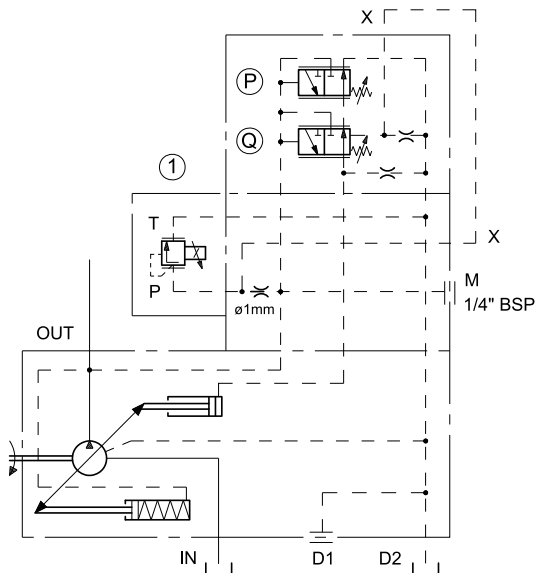
#### PCX FEATURES (two pressure settings + unloading):

- solenoid switching valve (1) = DS3-S2 (to be ordered separately see catalogue 41 150)
- solenoid valve OFF = pump unloading - delivery pressure = 20 bar
- solenoid side "a" ON = maximum displacement and delivery pressure set on relief valve (2) (intermediate value)
- solenoid side "b" ON = maximum displacement and delivery pressure set on regulator (P) (maximum value)
- pressure relief valve (2) = MCD\*-SBT (to be ordered separately - see cat. 61 200)
- pressure regulating range (2) = MCD3-SBT 20 ÷ 100 bar  
MCD5-SBT 20 ÷ 250 bar
- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

**NOTE:** For PCX regulators characteristic curves (with two pressure settings + unloading functions), see PC regulator diagrams at paragraph 8.1.

## 10.3 - Pressure regulation with electric proportional control

### FUNCTIONAL DIAGRAM



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

#### PCX FEATURES (proportional pressure regulation):

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar
- proportional pressure relief valve (1) = PRED3 (to be ordered separately with its relative electronic control unit - see catalogue 81 210)
- proportional pressure regulating range:
 

PRED3-070	20 ÷ 100 bar
PRED3-210	20 ÷ 240 bar

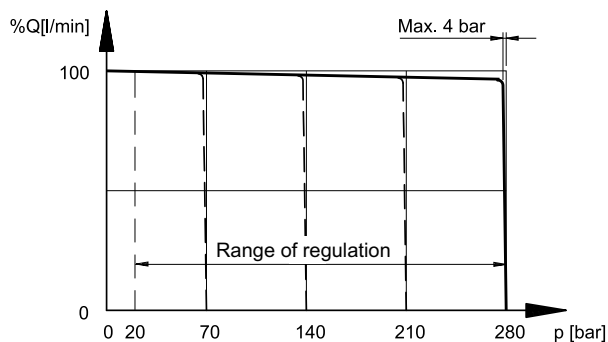
Hysteresis = < 5% of p nom

Repeatability = < ± 1,5% of p nom

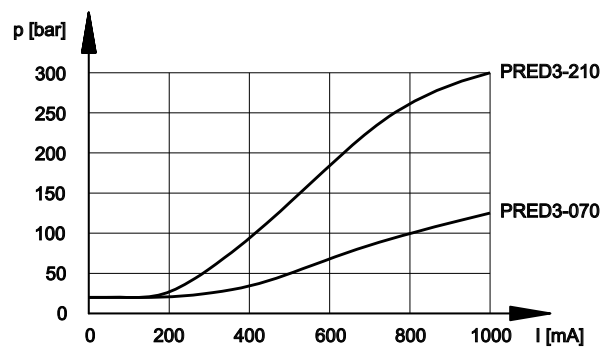
### 10.3.1 - Characteristic curves (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

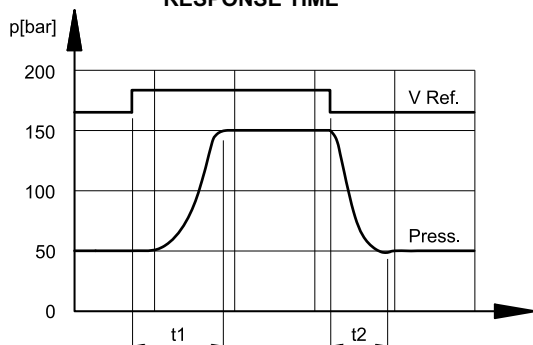
#### FLOW RATE / PRESSURE FEATURE



#### CURRENT / PRESSURE FEATURE



#### RESPONSE TIME



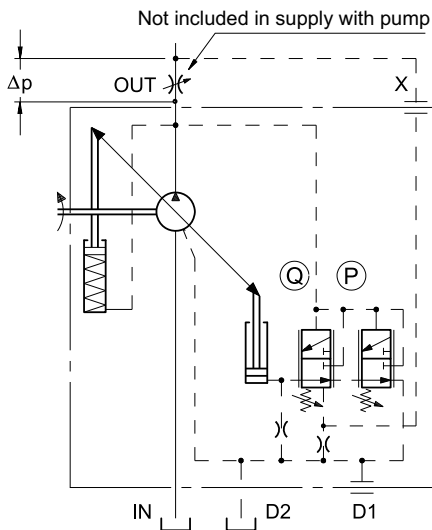
The response times are obtained with a VPPM-046 pump, by changing the reference signal (V Ref) on the proportional valve in order to have a line pressure variation from 50 to 150 bar and vice versa, with an oil volume of 5 lt.

t1 = 80 ms (response time for an increasing pressure change)

t2 = 60 ms (response time for a decreasing pressure change)

## 11 - FLOW RATE AND PRESSURE REGULATOR: PQC

### FUNCTIONAL DIAGRAM



This regulator, apart from regulating the pressure (as for the PC model), allows the pump flow rate to be regulated according to the  $\Delta p$  pressure drop measured on either side of a throttle valve installed on the user line. The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

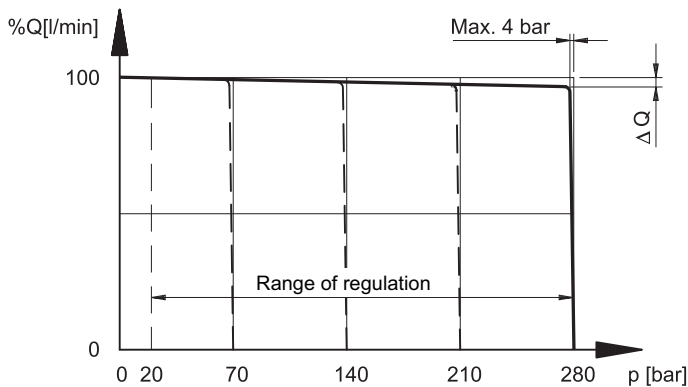
### PQC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar
- differential pressure regulating range (Q) = 10 ÷ 40 bars
- default setting = 14 bar
- Min. discharge head =  $18 \pm 2$  bar  
(with a zero flow rate, X discharge pilot and with a default (Q) setting of the differential regulator)

### 11.1 - Characteristic curves of the PQC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

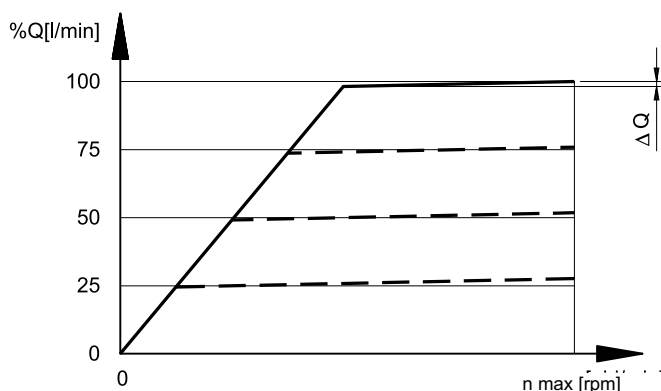
#### FLOW RATE / PRESSURE FEATURE



**Flow variation between minimum and maximum pressure with pump set at max displacement**

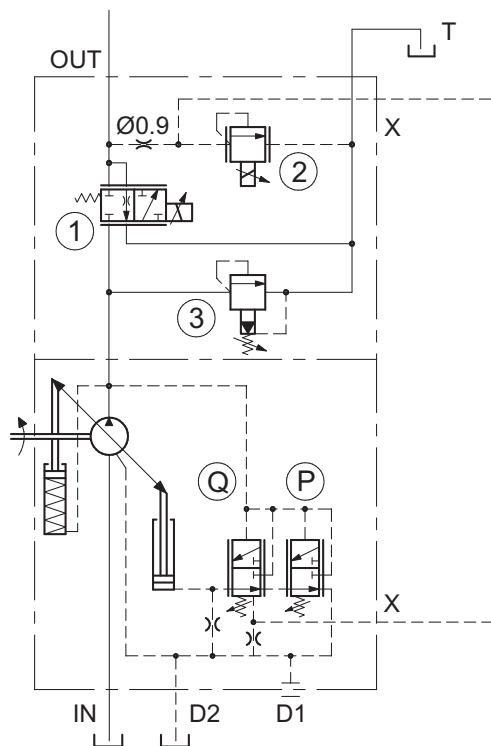
pump size	$\Delta Q$ max [l/min]
029	0.9
046	1.7
073	2.5
087	2.5

#### FLOW RATE / ROTATION SPEED STATIC FEATURE



## 12 - INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL REGULATOR: PQCE5

### FUNCTIONAL DIAGRAM



This regulator allows an independent regulation of the pump flow and pressure, both with an electric proportional control.

The pump flow is regulated through the proportional valve (1) which operates directly on the pump delivery, while the system pressure is controlled by means of the proportional relief valve (2) working as a pilot stage of the differential regulator (Q).

The maximum system pressure is limited by the regulator (P). The regulator is also equipped of a built-in pressure relief valve (3) with manual adjustment, which limits the pressure peak due to quick flow variations in the system.

### PQCE5 FEATURES

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar
- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar
- proportional pressure regulating range:  
20 ÷ 250 bar (for VPPM-\*PQCE5 pump)
- proportional flow regulating range:  
0 ÷ 69 l/min (for VPPM-046 PQCE5 pump)  
0 ÷ 109,5 l/min (for VPPM-073 PQCE5 pump)  
0 ÷ 132 l/min (for VPPM-073 PQCE5 pump)

### PERFORMANCES and ELECTRICAL CHARACTERISTICS

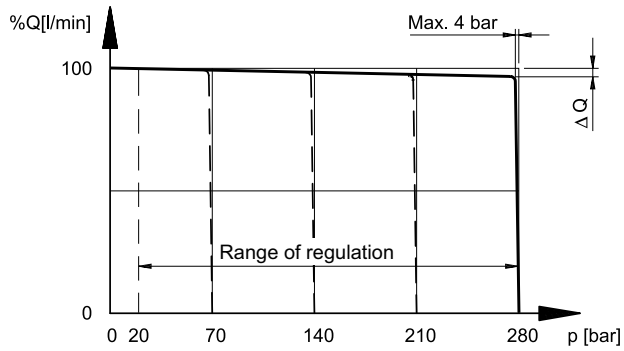
	FLOW REGULATION (1) (DSE5 valve)	PRESSURE REGULATION (2) (CRE valve)
HYSTERESIS	< 6% of Q max	< 5% of p nom
REPEATABILITY	< ±1,5% of Q max	< ±1,5% of p nom
NOMINAL VOLTAGE	24 VDC	24 VDC
COIL RESISTANCE (at 20°C)	8,65 Ω	16,6 Ω
MAXIMUM CURRENT	1,6 A	0,85 A
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CEE	
DEGREE OF PROTECTION : Atmospheric agents (CEI EN 60529)	IP 65	
ELECTRONIC CONTROL UNITS for proportional valves	EDM-M3312 see cat. 89 250	

## 12.1 - Characteristic curves of the PQCE5 regulator

(values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

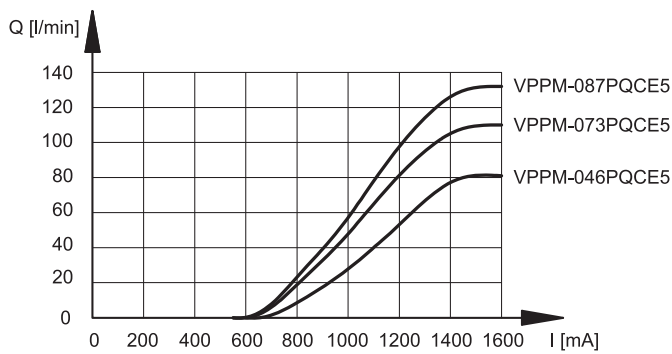
**FLOW RATE / PRESSURE CURVE**



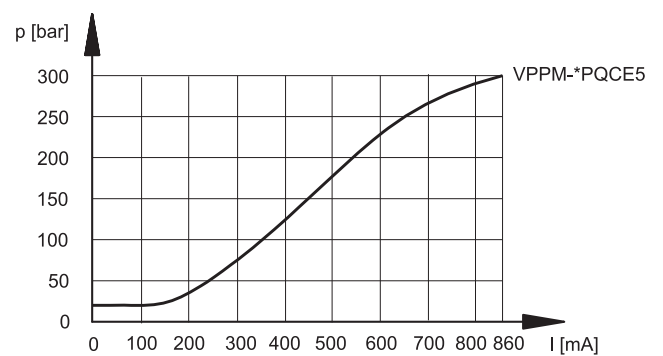
**Flow variation  
between minimum and maximum pressure  
with pump set at max displacement**

pump size	$\Delta Q$ max [l/min]
<b>046</b>	1.7
<b>073</b>	2.5
<b>087</b>	2.5

**CURRENT / FLOW CURVE**

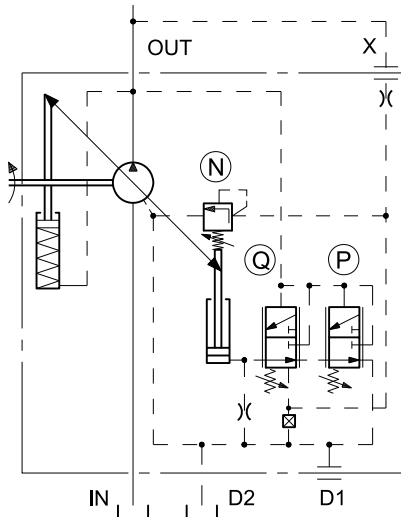


**CURRENT / PRESSURE CURVE**



## 13 - POWER REGULATOR: PQNC

### FUNCTIONAL DIAGRAM



Such regulator keeps the pump torque at a constant level by changing the displacement according to the delivery pressure, so that the ratio  $p \times (Q)$  (absorbed power) remains unchanged. The functions limiting the (P) maximum pressure and regulating the (Q) flow rate are always present, if a restrictor has been installed on the user line.

In the 1/8" BSP coupling supplied for the X port, there is a restrictor of  $\varnothing 0,8$  orifice.

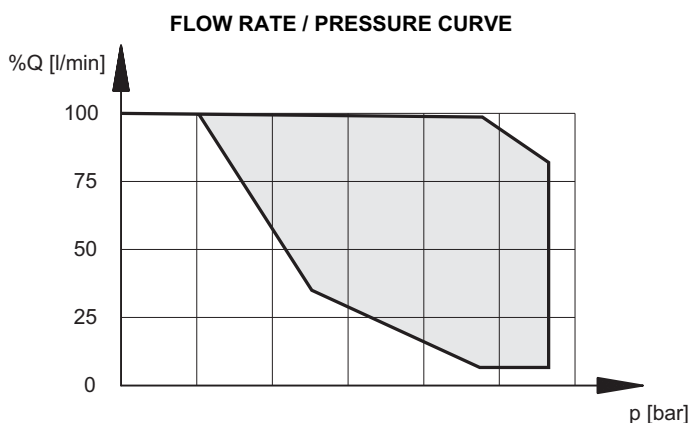
**Note:** The connection pipe between the X port and the pump outlet must always be made (customer charge).

#### PQNC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar
- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar
- min. discharge head =  $18 \pm 2$  bar  
(with a zero flow rate, X discharge pilot and with a default Q setting of the differential regulator)
- the power regulator is factory set. The setting value has to be specified with the order, by stating into the identification code the Nm torque value (see paragraph 1).
- Start of the regulation: looking at values table of paragraph 1.5

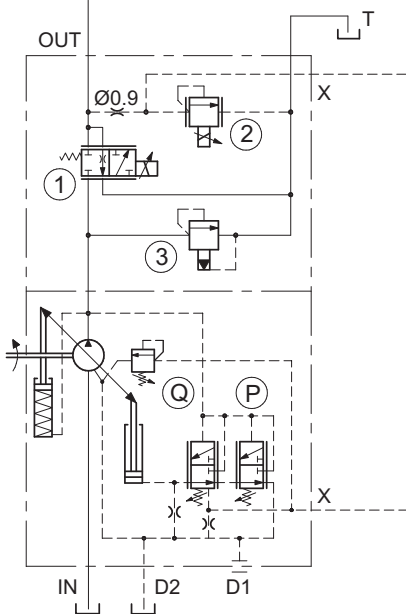
### 13.1 - Characteristic curves of the PQNC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.



## 14 - POWER REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL: PQNCE5

### FUNCTIONAL DIAGRAM



This system combines all the functions of the constant power control as a standard PQNC5 regulator, and moreover it allows the independent proportional regulation of the pump flow and pressure at values behind the power curve characteristic set on the regulator (N).

### PQNCE5 FEATURES

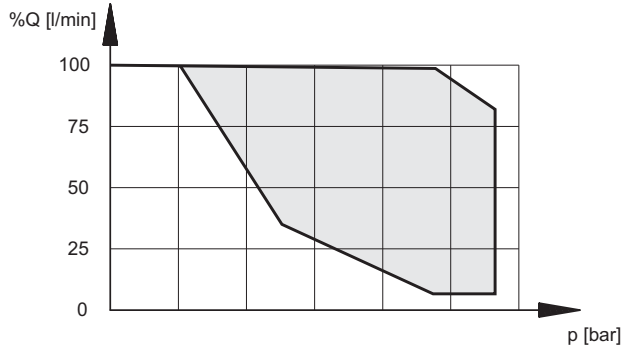
For technical characteristics and settings of regulator, see paragraph 13.

### 14.1 - Characteristic curves of the PQNCE5 regulator

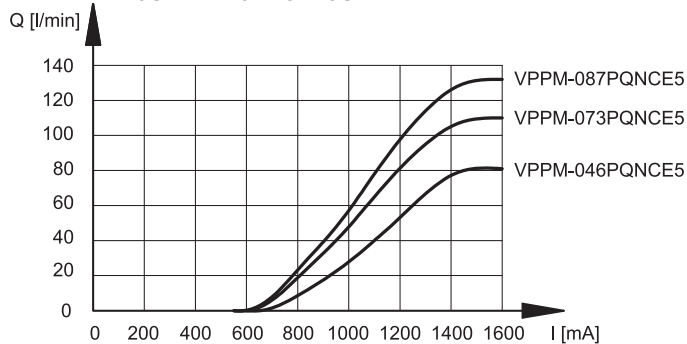
(values obtained with mineral oil with viscosity of 36 cSt at 50°C with driver EDM-M3312)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

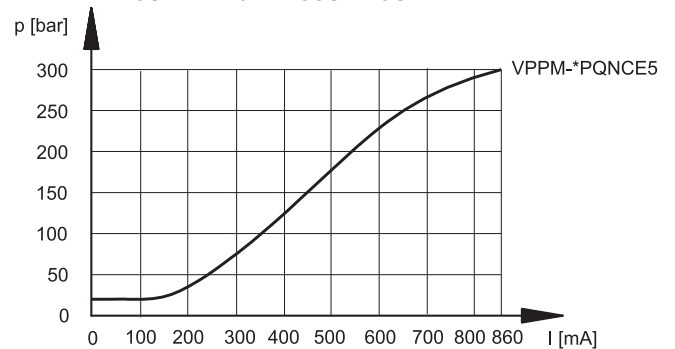
#### FLOW RATE / PRESSURE CURVE



#### CURRENT / FLOW CURVE



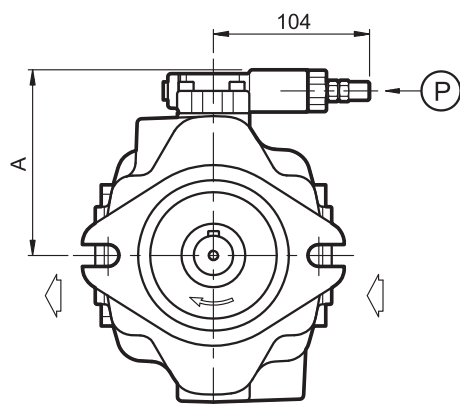
#### CURRENT / PRESSURE CURVE





## 15 - REGULATOR OVERALL DIMENSIONS

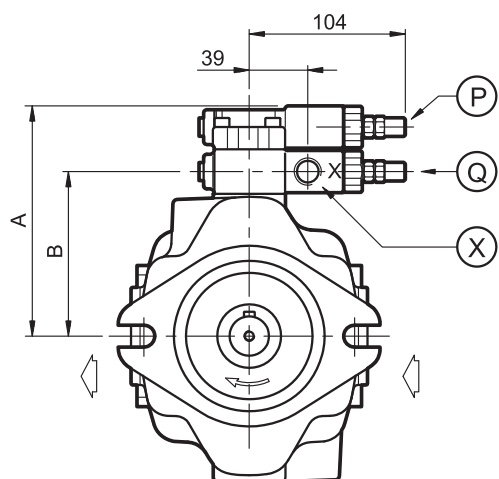
dimensions in mm



### PRESSURE REGULATOR PC

pump size	A [mm]
<b>029</b>	114
<b>046</b>	123
<b>073 / 087</b>	136

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
---	--

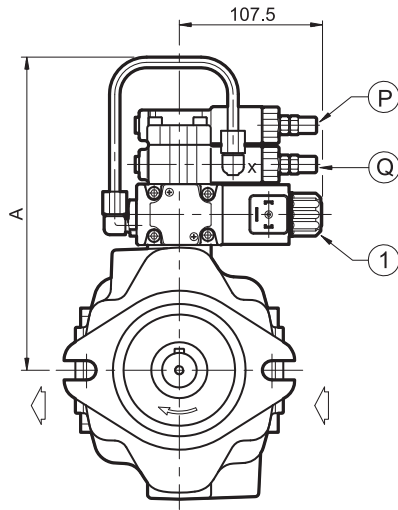


### REMOTE-CONTROLLED PRESSURE REGULATOR PCR

pump size	A [mm]	B [mm]
<b>029</b>	144	100
<b>046</b>	153	109
<b>073 / 087</b>	165	122

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilot port for remote control X: 1/8" BSP

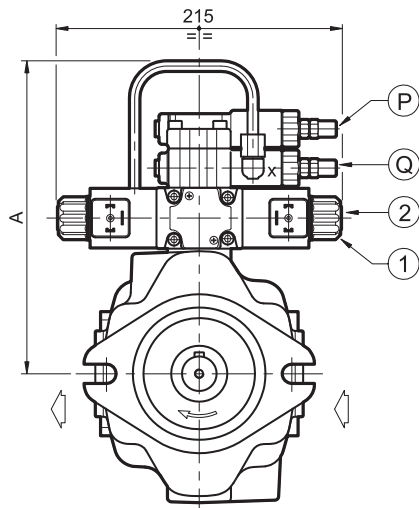
dimensions in mm



**PCX REGULATOR WITH ELECTRICAL UNLOADING**

pump size	A [mm]
<b>029</b>	244
<b>046</b>	253
<b>073 / 087</b>	265

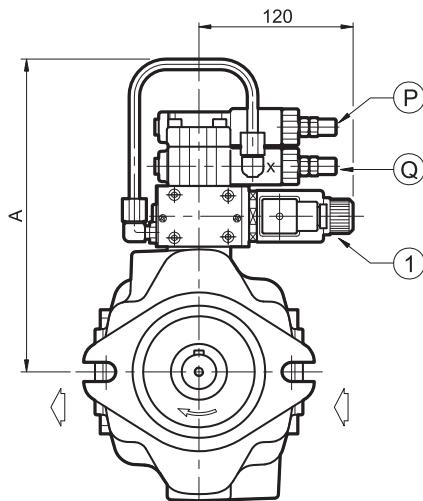
P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-SA2



**PCX REGULATOR WITH TWO PRESSURE SETTINGS  
+ UNLOADING**

pump size	A [mm]
<b>029</b>	244
<b>046</b>	253
<b>073 / 087</b>	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-S2
2	Relief valve for the intermediate pressure setting MCI*-SBT

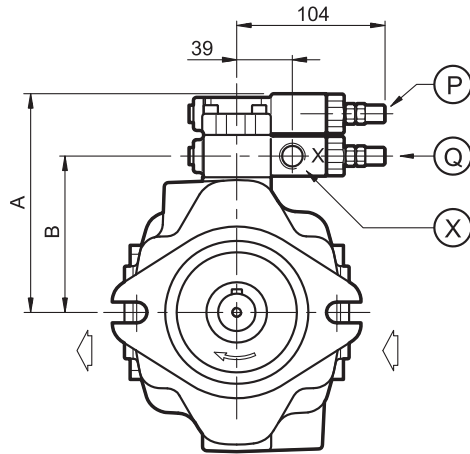


**PCX REGULATOR FOR PRESSURE REGULATION WITH  
ELECTRIC PROPORTIONAL CONTROL**

pump size	A [mm]
<b>029</b>	244
<b>046</b>	253
<b>073 / 087</b>	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional pressure relief valve PRED3 type

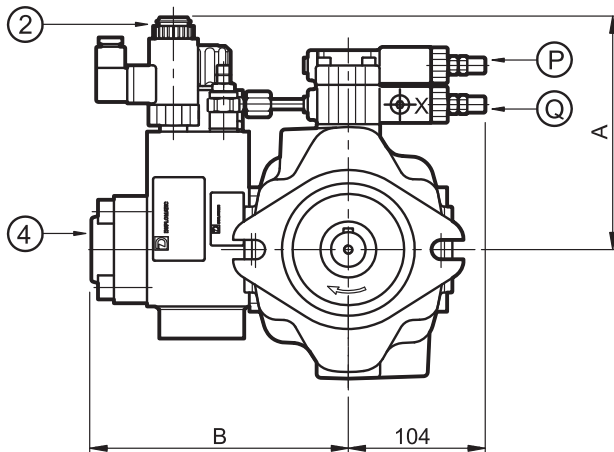
dimensions in mm



## FLOW RATE AND PRESSURE REGULATOR PQC

pump size	A [mm]	B [mm]
<b>029</b>	144	100
<b>046</b>	153	109
<b>073 / 087</b>	165	122

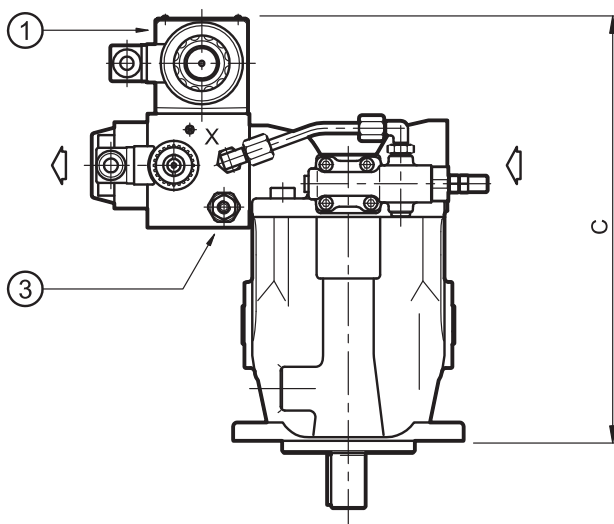
P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8" BSP (see paragraph 11)

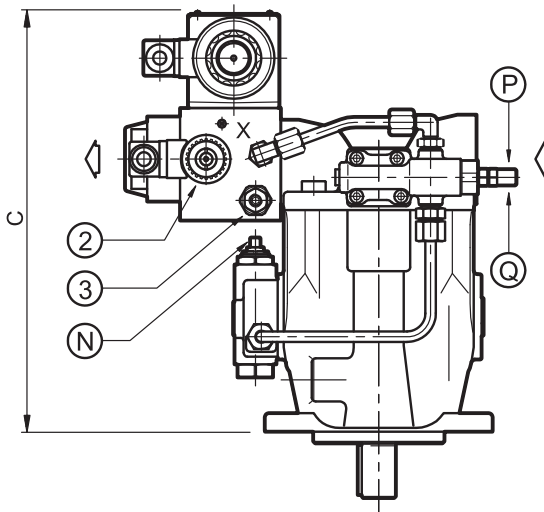
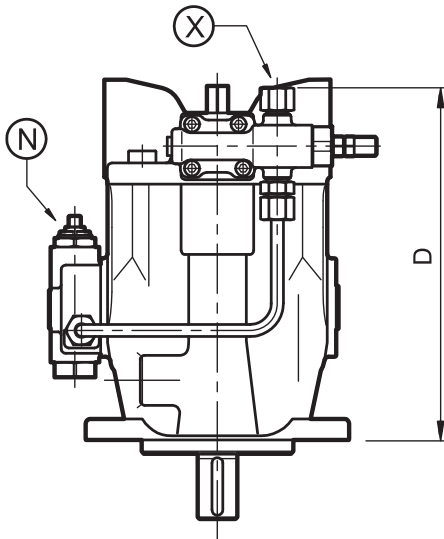
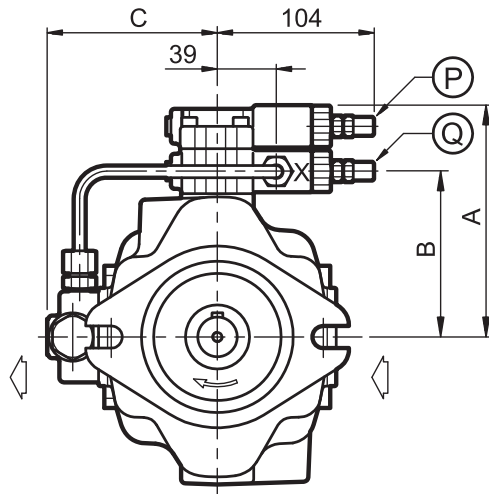


## PQCE REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL

pump size	A [mm]	B [mm]	C [mm]
<b>046</b>	175	194	337
<b>073 / 087</b>	181	207	345

P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional flow control valve type: DSE5-P070B - DSE5-P110SB
2	Proportional pressure valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange 1" for VPPM-046 - 1 1/4" for VPPM-073 and -087





**POWER REGULATOR PQNC**

dimensions in mm

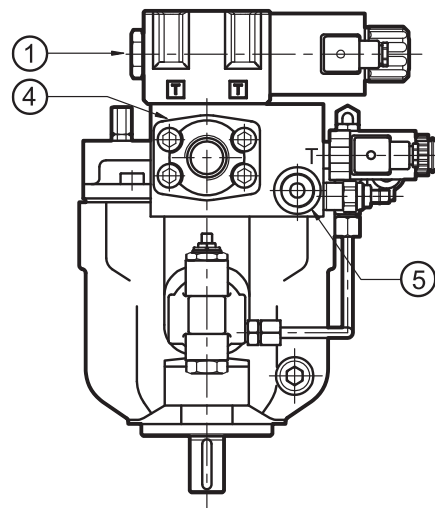
pump size	A [mm]	B [mm]	C [mm]	D [mm]
<b>029</b>	144	100	104	211
<b>046</b>	153	109	111	235
<b>073 / 087</b>	165	122	120	258

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8" BSP (restrictor with Ø0,8 orifice included - see paragraph 13)
N	Power regulator

**POWER REGULATOR WITH INTEGRATED PROPORTIONAL  
FLOW AND PRESSURE CONTROL PQNCE5**

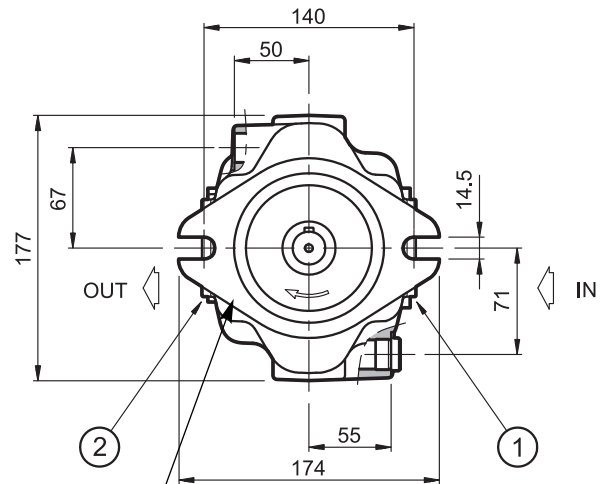
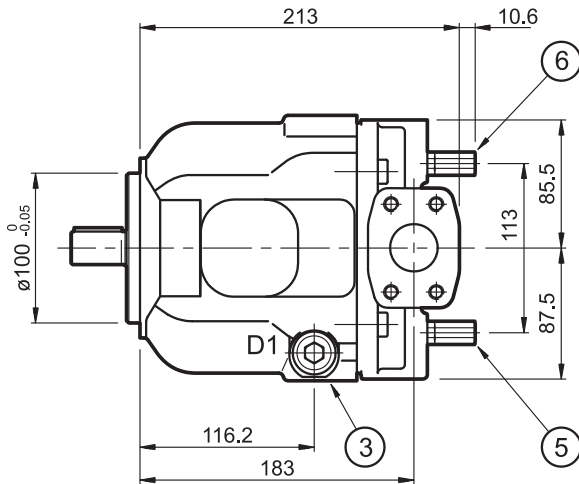
(for dimensions see PQCE5 page 22)

P	Pressure regulator countersunk hex adjustment screw: spanner 4. Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
N	Power regulator
1	Proportional flow control valve type: DSE5-P070SB - DSE5-P110SB
2	Proportional pressure control valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange: 1" for VPPM-046 - 1 1/4" for VPPM-073 and -087
5	Outlet port T: 3/4" BSP

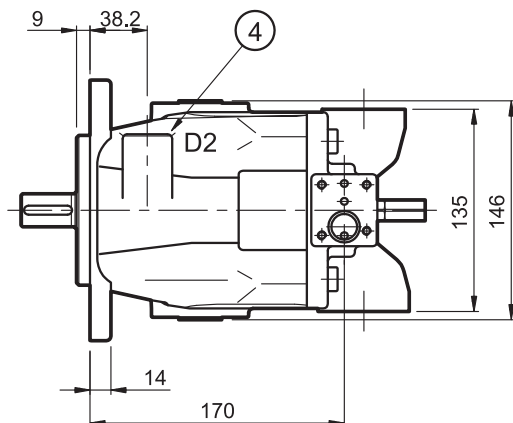


## 16 - VPPM-029 OVERALL AND MOUNTING DIMENSIONS

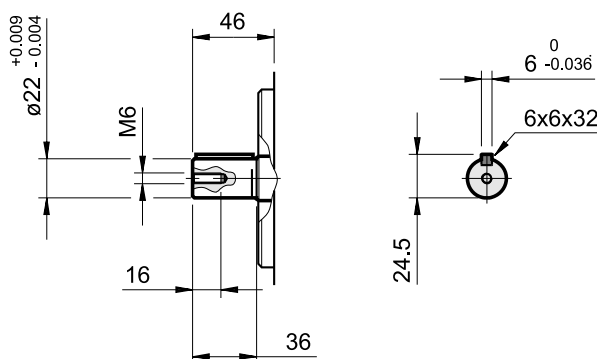
dimensions in mm



ISO 3019/2 fitting flange  
(standard, identification code 5)



Cylindrical shaft end with ISO 3019/2 key  
(standard, identification code 5)

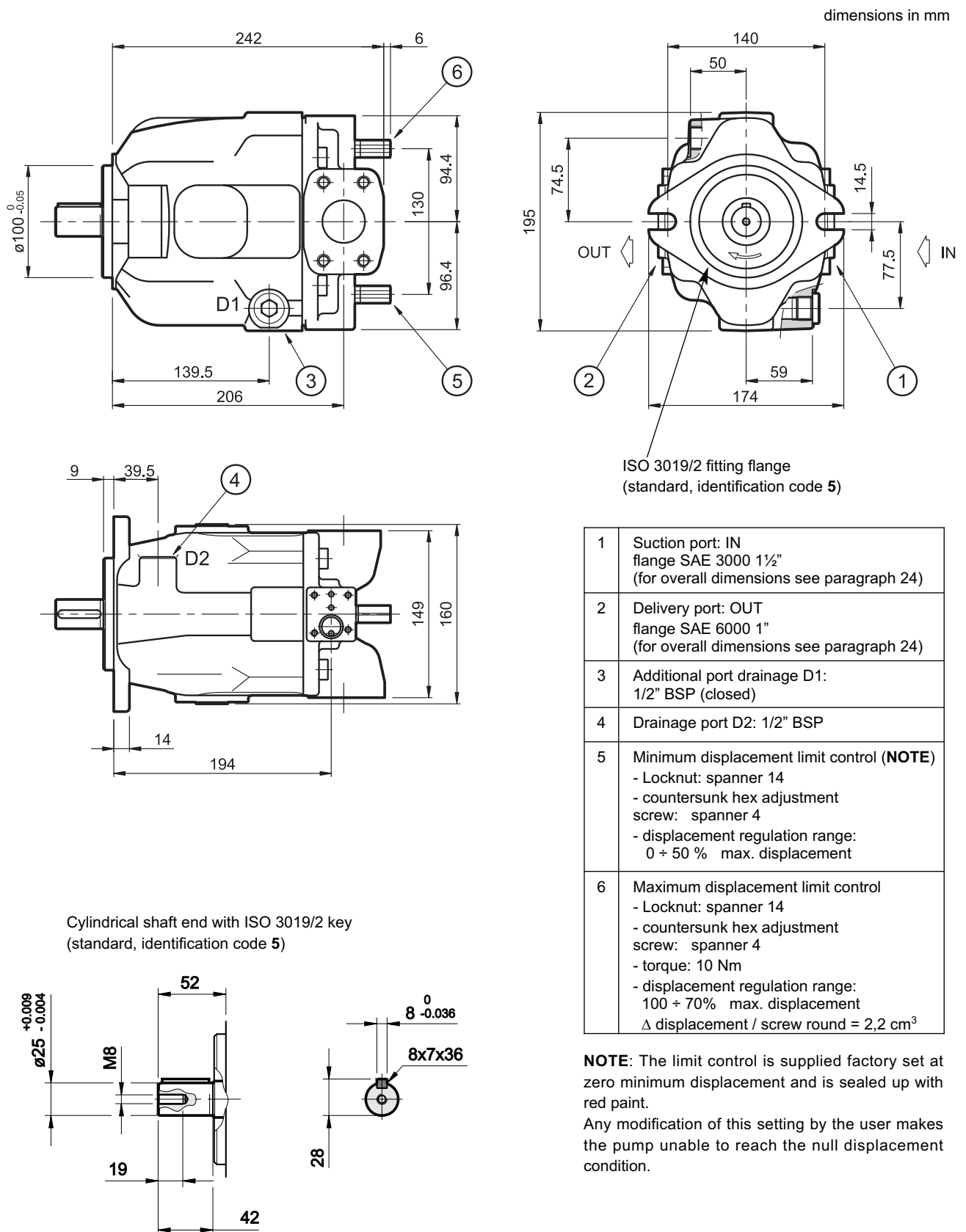


1	Suction port: IN flange SAE 3000 1/4" (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 3/4" (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2" BSP (closed)
4	Drainage port D2: 1/2" BSP
5	Minimum displacement limit control ( <b>NOTE</b> ) - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - torque: 10 Nm - displacement regulation range: 100 ÷ 70% max. displacement Δ displacement / screw round = 1,5 cm <sup>3</sup>

**NOTE:** The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.

Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

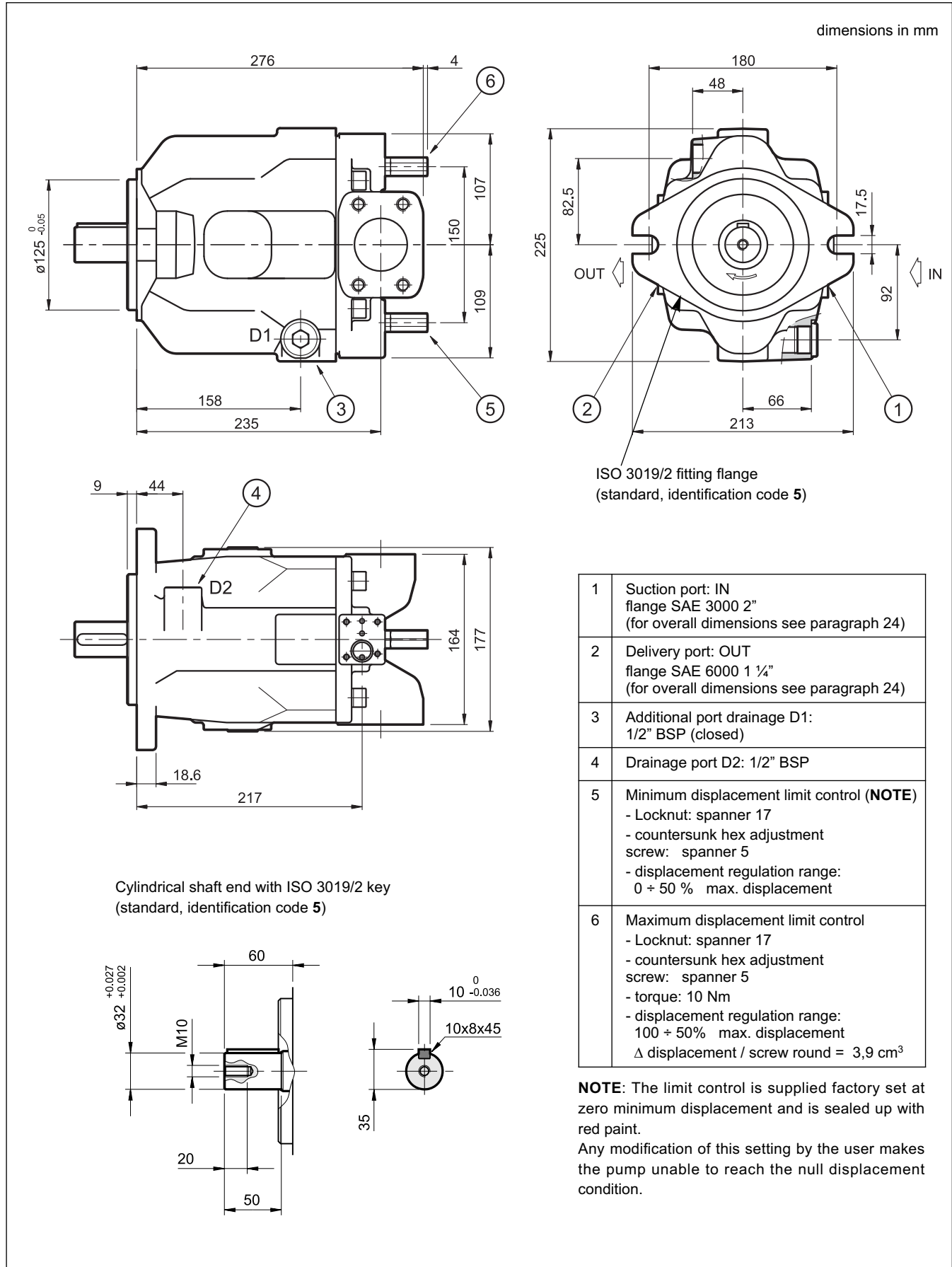
## 17 - VPPM-046 OVERALL AND MOUNTING DIMENSIONS



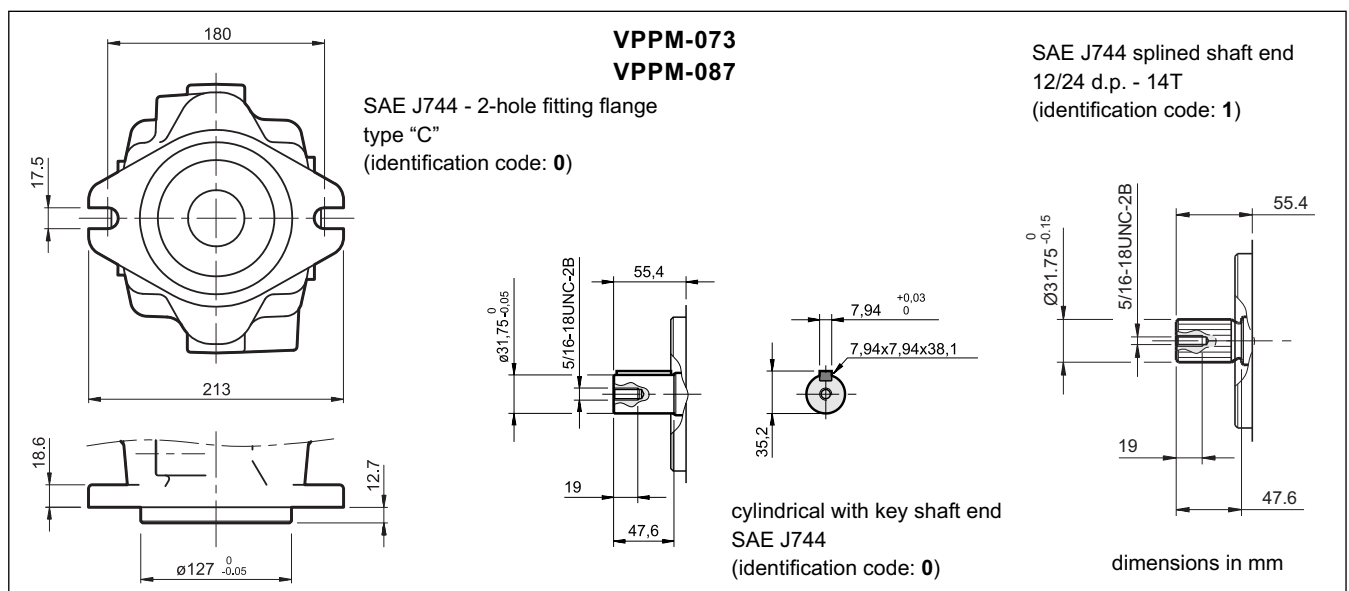
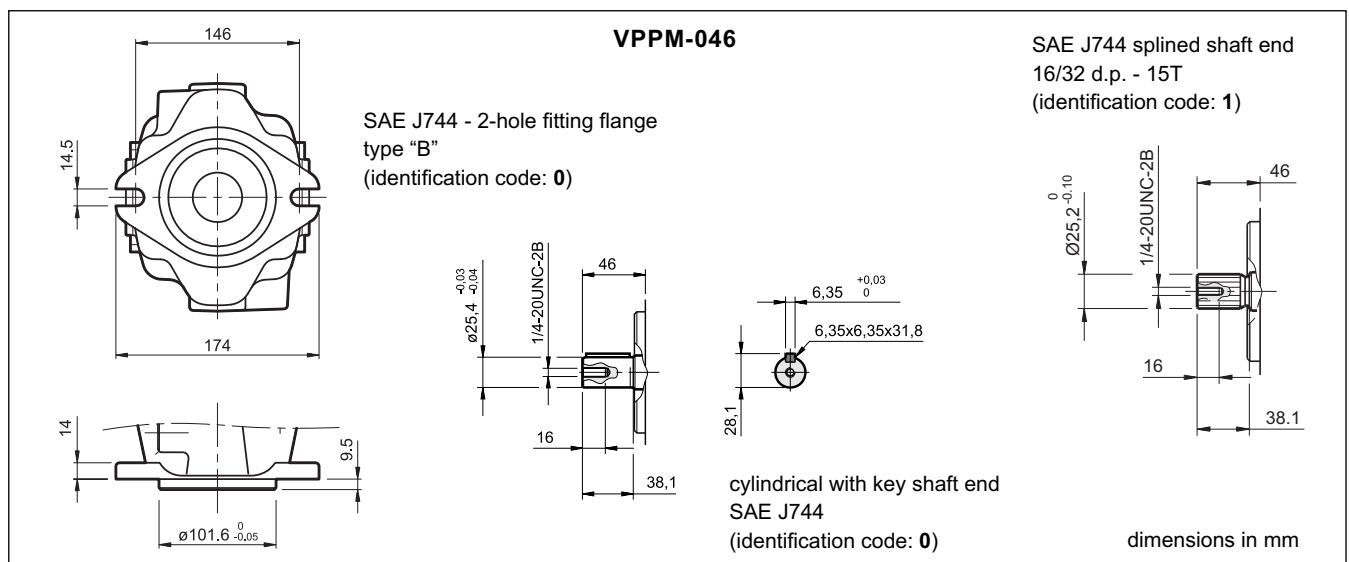
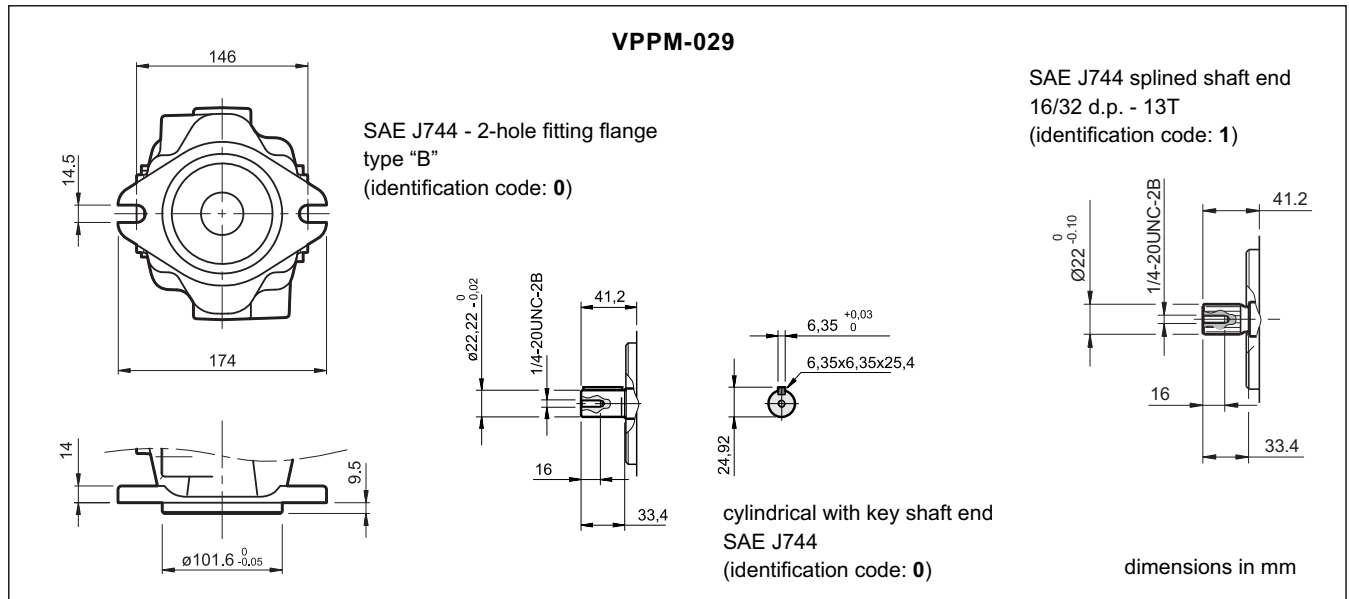
**NOTE:** The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.

Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

## 18 - VPPM-073 AND VPPM-087 OVERALL AND MOUNTING DIMENSIONS



## 19 - OVERALL DIMENSIONS FOR FLANGES AND SHAFTS TYPE SAE J744





## 20 - INSTALLATION

- The VPPM pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.

N.B.: The drainage port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume (according to the installation use the D1 or D2 drainage ports).

- Installation below the oil reservoir is suggested. As for an installation above the oil level, check that the min. suction pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.

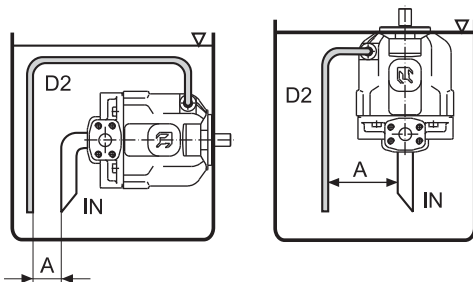
In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested that the drain tube is adjusted so that the pump higher bearing can be always lubricated.

- **Before starting, the pump body has to be filled with the fluid.**

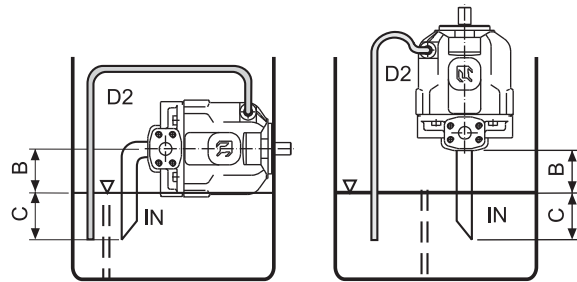
- It is necessary to vent the air from the delivery connection before operating it the first time. The pump start up, especially at a cold temperature, should occur with the plant at minimum pressure.
- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 2 bar (absolute), even during the dynamic change and flow rate phases. The drainage tube has to unload inside the tank far from the suction area. We suggest to interpose a screen between the two lines.
- The drain pressure can be max 0.5 bar higher than the suction pressure but it can never exceed the max of 2 bar of absolute pressure.
- No check valves allowed on the suction line.
- The motor-pump connection must be carried out directly with a flexible coupling. Radial and axial loads have to be lower than the values specified in the table at paragraph 3.
- As for details and the installation of filter elements, see par. 2.3.

### MOUNTING INSIDE THE TANK

Minimum level of oil in the tank at or above the surface of the pump flange  
 $A \geq 200 \text{ mm}$



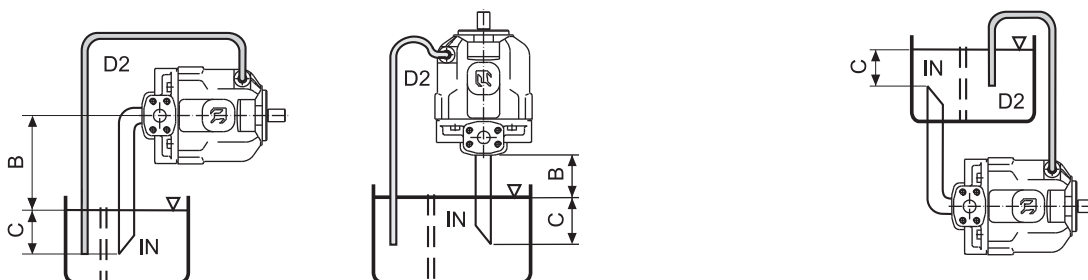
Minimum level of oil in the tank below the surface of the pump flange  
 Minimum inlet pressure = -0,2 bar (relative)  
 $B \leq 800 \text{ mm}$        $C = 200 \text{ mm}$



### MOUNTING OUTSIDE THE TANK

Minimum inlet pressure = -0,2 bar (relative)  
 $B \leq 800 \text{ mm}$        $C = 200 \text{ mm}$

$C = 200 \text{ mm}$



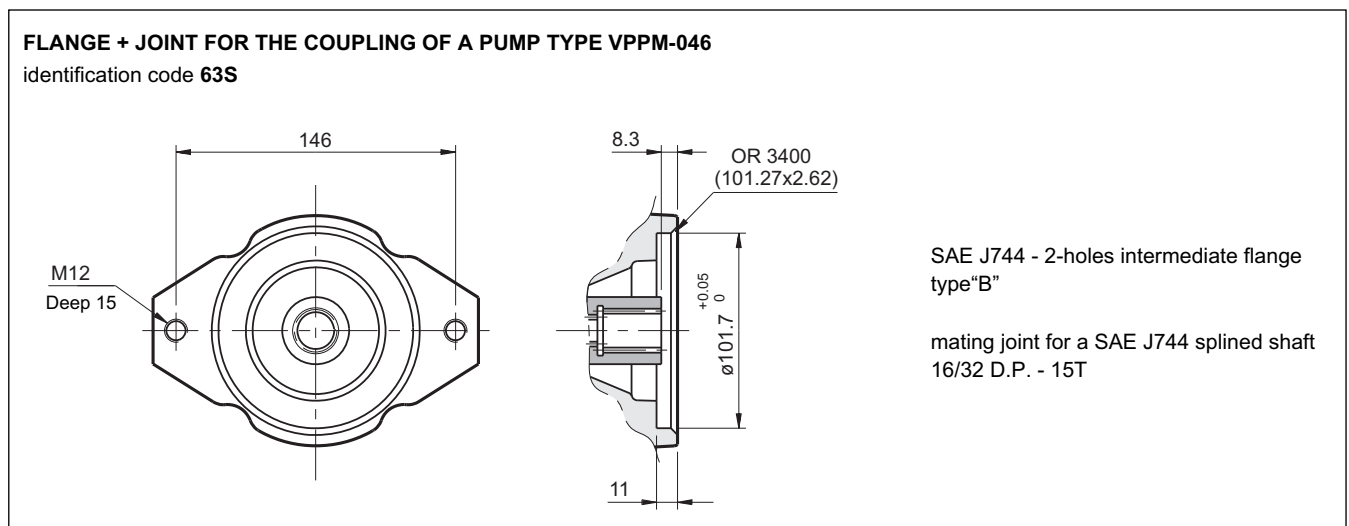
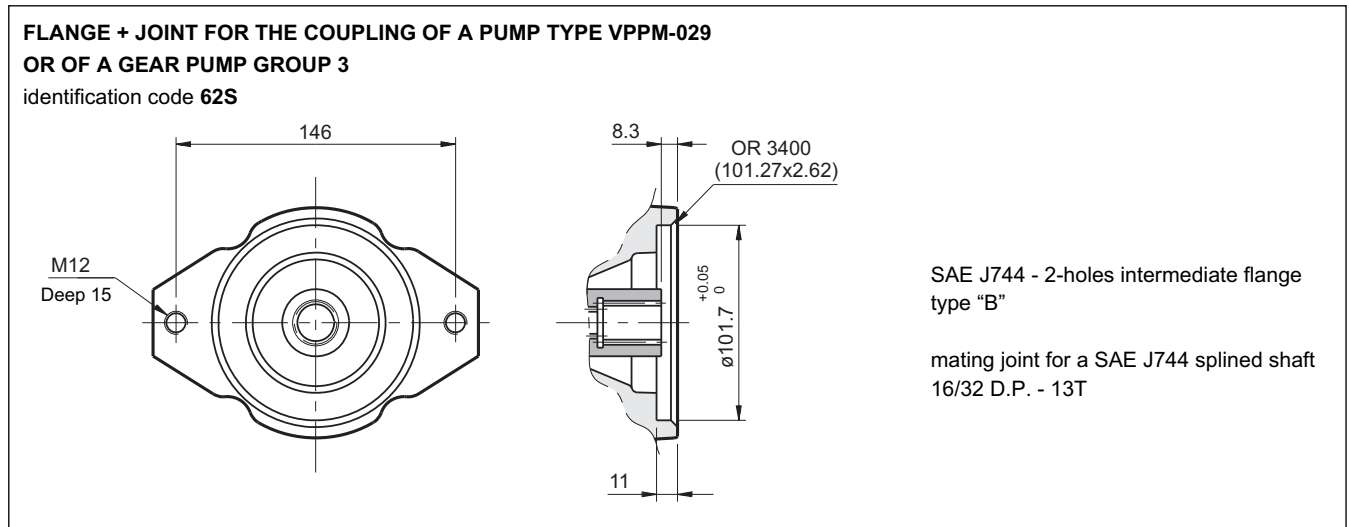
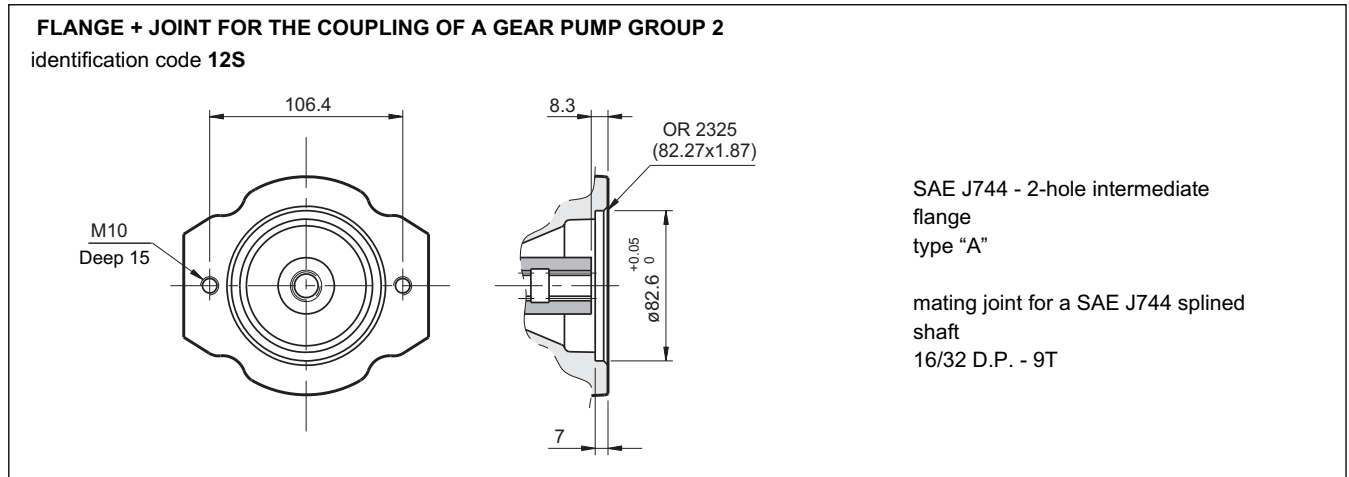
## 21 - THROUGH OUTPUT SHAFT

The VPPM pumps can be supplied with a through output shaft, which allows coupling with other pump models.

**N.B.:** The pumps with a through output shaft are supplied with an intermediate 2-hole flange type SAE J744 - and with a mating joint for splined shaft type SAE J744.

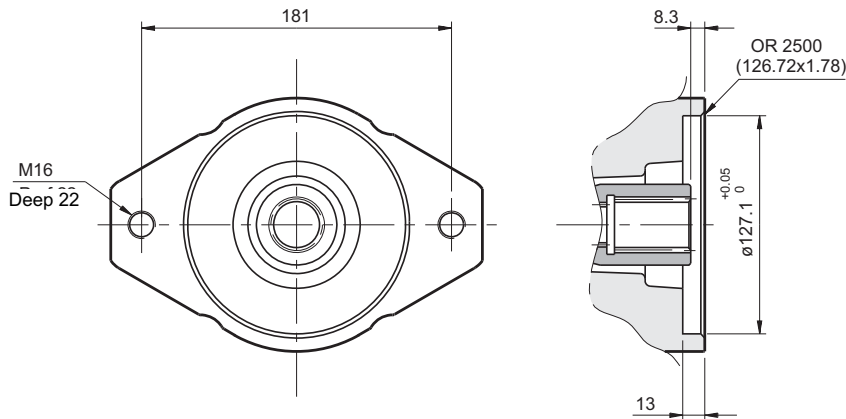
The mechanical adjustment for the min and max displacement are not available on these front or intermediate pumps: VPPM-029 with flange 62S, VPPM-073 with flange 64S, VPPM-087 with flange 64S.

As for identification see par. 1 "Identification code". For the pump overall dimensions (intermediate flange included) see paragraph 23 "overall dimensions for multiple pumps".



## FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-073

identification code **64S**



SAE J744 - 2-holes intermediate flange type "C"

mating joint for a SAE J744 splined shaft 12/24 D.P. - 14T

## 22 - MULTIPLE PUMPS

The possibility to couple several pumps makes it possible to create multi-flow groups with independent hydraulic circuits. While sizing coupled pumps, it's necessary to make reference to the following conditions:

- The coupling can be carried out between pumps with the same dimensions or to a size of decreasing order.
- The max. rotation speed is determined by the pump with the lowest speed.
- The values of the max. applicable torque can not be exceeded.

### 22.1 - Max. applicable torque

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [\text{Nm}] \quad n = \text{rotation speed [rpm]}$$

where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{\text{tot}}} = [\text{kW}]$$

Q = flow rate [l/min]  
 $\Delta p$  = differential pressure between the pump suction and delivery [bar]  
 $\eta_{\text{tot}}$  = total efficiency (obtainable from the diagrams in par. 4-5-6)

or it can be obtained from the diagrams ABSORBED POWER (see par. 4 - 5 - 6 -7).

If several pumps are coupled, the torque of each single pump has to be added to the torque of subsequent pumps when they are loaded simultaneously.

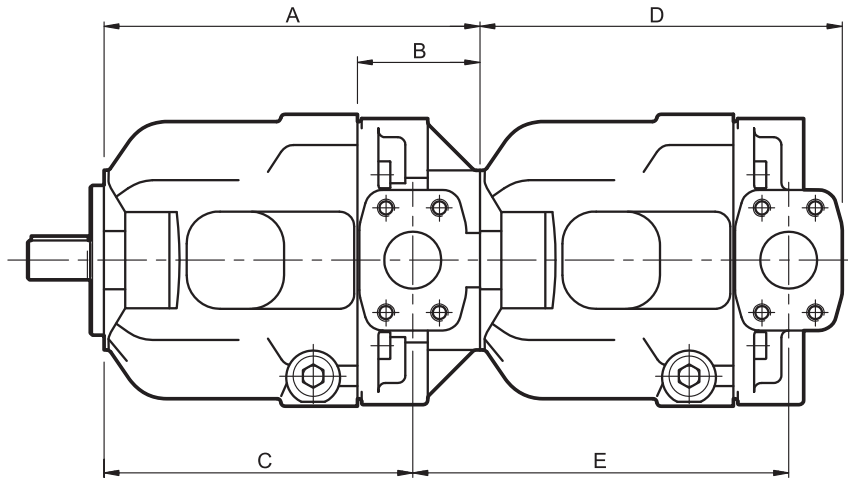
The obtained torque value for each pump has to be lower than the value specified in the table below :

pump with a through output shaft	MAXIMUM TORQUE APPLICABLE AT THE FRONT PUMP SHAFT [Nm]			MAXIMUM TORQUE APPLICABLE AT THE PUMP TO BE COUPLED [Nm] (not simultaneously to the front pump)					
	cylindrical ISO 3019/2 (cod. 5)	cylindrical SAE J744 (cod. 0)	splined SAE J744 (cod. 1)	GP2 external gear	GP3 external gear	VPPM-029	VPPM-046	VPPM-073	VPPM-087
<b>VPPM-029</b>	170	200	190	100	135	135	-	-	-
<b>VPPM-046</b>	220	230	330	135	250	250	250	-	-
<b>VPPM-073</b>	450	490	620	135	330	330	400	440	-
<b>VPPM-087</b>	450	490	620	135	330	330	400	440	440

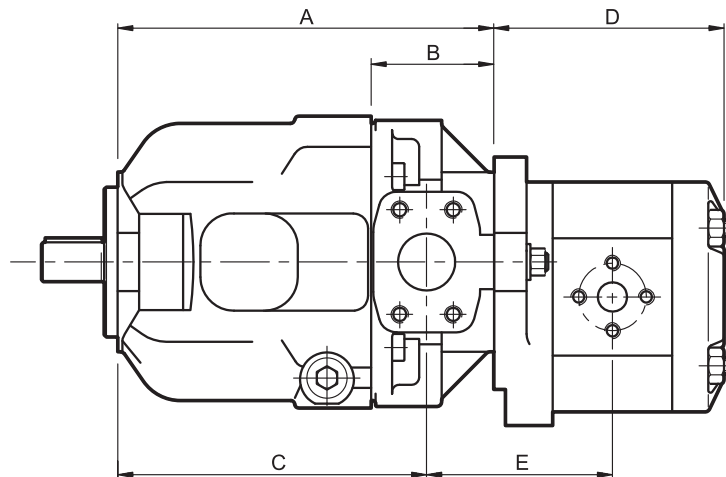
The maximum transmissible torque for those pumps with a through output shaft is determined by the coupling used for the transmission. If the obtained torque values are higher than the ones stated in the table, it is necessary to reduce the working pressure value or to replace the overloaded pump with a pump suitable to bear the required torque.

## 23 - OVERALL DIMENSIONS FOR MULTIPLE PUMPS

dimensions in mm



	REAR PUMP														
	VPPM-029					VPPM-046					VPPM-073 / 087				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
<b>VPPM-029</b>	222	77	183	213	222	-	-	-	-	-	-	-	-	-	-
<b>VPPM-046</b>	251	82	206	213	220	251	82	206	242	251	-	-	-	-	-
<b>VPPM-073 VPPM-087</b>	291	99	235	213	226	291	99	235	242	249	296	104	235	276	296



	REAR PUMP										
	external gear GP2					external gear GP3					
	A	B	C	D	E	A	B	C	D	E	
<b>VPPM-029</b>	222	77	183	99 ÷ 121	86 ÷ 97	-	-	-	-	-	
<b>VPPM-046</b>	251	82	206	99 ÷ 121	85 ÷ 96	251	82	206	132 ÷ 147	103 ÷ 110	
<b>VPPM-073 VPPM-087</b>	291	99	235	99 ÷ 121	91 ÷ 102	291	99	235	132 ÷ 147	109 ÷ 116	

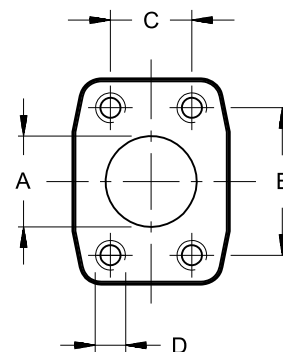
**NOTE:** The D and E values in the table make reference to the dimensions of the gear pumps according to the available min. and max. displacement range. For further details apply to our Technical department.

## 24 - SUCTION AND DELIVERY PORTS DIMENSIONS FOR SAE FLANGES

SUCTION PORT: "IN" (SAE 3000)						
Pump	nominal size	A mm	B mm	C mm	D threading and depth (mm) METRIC                      UNC	
VPPM 029	1 1/4"	32	58,7	30,2	M 10x28	7/16 -14 UNC-2B 28
VPPM 046	1 1/2"	38,1	70	35,7	M12x26	1/2 -13 UNC-2B 26
VPPM 073 VPPM 087	2"	50,8	77,8	43	M12x25	1/2 -13 UNC-2B 25

DELIVERY PORT "OUT" (SAE 6000)						
Pump	nominal size	A mm	B mm	C mm	D threading and depth (mm) METRIC                      UNC	
VPPM 029	3/4"	19	50,8	23,8	M10x24	3/8 - 16 UNC-2B 24
VPPM 046	1"	25,4	57,1	27,7	M12x20	7/16 -14 UNC-2B 20
VPPM 073 VPPM 087	1 1/4"	32	66,7	31,7	M14x23	1/2 - 13 UNC-2B 23



## 25 - CONNECTION FLANGES

dimensions in mm  
The fastening bolts and the O-Rings must be ordered separately

	Flange code	Flange description
SAE 3000	0610720	OR 4150 (37.69x3.53)
	0610714	OR 4187 (47.22x3.53)
	0610721	OR 4225 (56.74x3.53)
SAE 6000	0770075	OR 4100 (24.99x3.53)
	0770092	OR 4131 (32.93x3.53)
	0770106	OR 4150 (37.69x3.53)

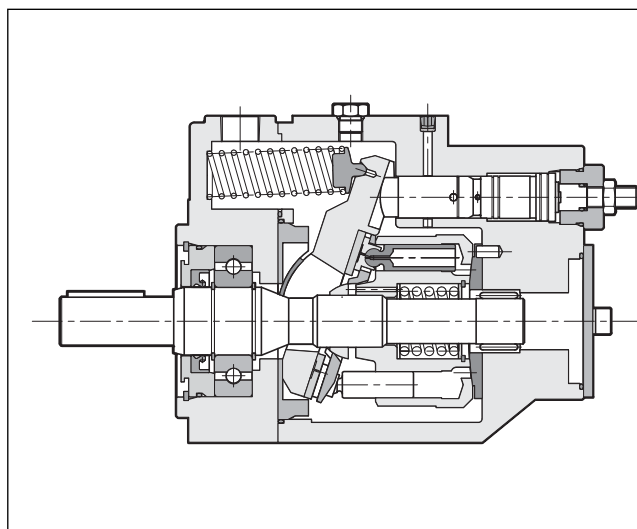
	Flange code	Flange description	P <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	metric SHCS	1 UNC SHCS
SAE 3000	0610720	SAE - 1 1/4"	280	1 1/4" BSP	32	21	41	22	30,2	58,7	68	79	n° 4 - M10x35	n° 4 - 7/16 UNC x 1 1/2"
	0610714	SAE - 1 1/2"	210	1 1/2" BSP	38	25	45	24	35,7	70	78	94	n° 4 - M12x45	n° 4 - 1/2 UNC x 1 3/4"
	0610721	SAE - 2"	210	2" BSP	51	25	45	30	43	77,8	90	102	n° 4 - M12x45	n° 4 - 1/2 UNC x 1 3/4"
SAE 6000	0770075	SAE - 3/4"	420	3/4" BSP	19	21	35	22	23,8	50,8	55	71	n° 4 - M10x35	n° 4 - 3/8 x 1 1/2"
	0770092	SAE - 1"	420	1" BSP	25	25	42	24	27,7	57,1	65	81	n° 4 - M12x45	n° 4 - 7/16 x 1 3/4"
	0770106	SAE - 1 1/4"	420	1 1/4" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	n° 4 - 1/2 x 1 3/4"



# VPPL

## VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS FOR INTERMEDIATE PRESSURE SERIES 20

### OPERATING PRINCIPLE



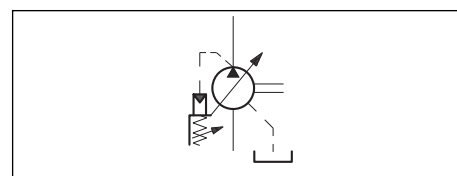
- The VPPL are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits and intermediate pressures.
- They are available in seven nominal sizes, with displacements of 8, 16, 22, 36, 46, 70 and 100 cm<sup>3</sup>/rev.
- The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.
- They are usually supplied with a SAE J744 2-hole flange and a SAE J744 cylindrical with key shaft.
- They are available with four different types of regulating control, each according to the application needs.

### TECHNICAL SPECIFICATIONS

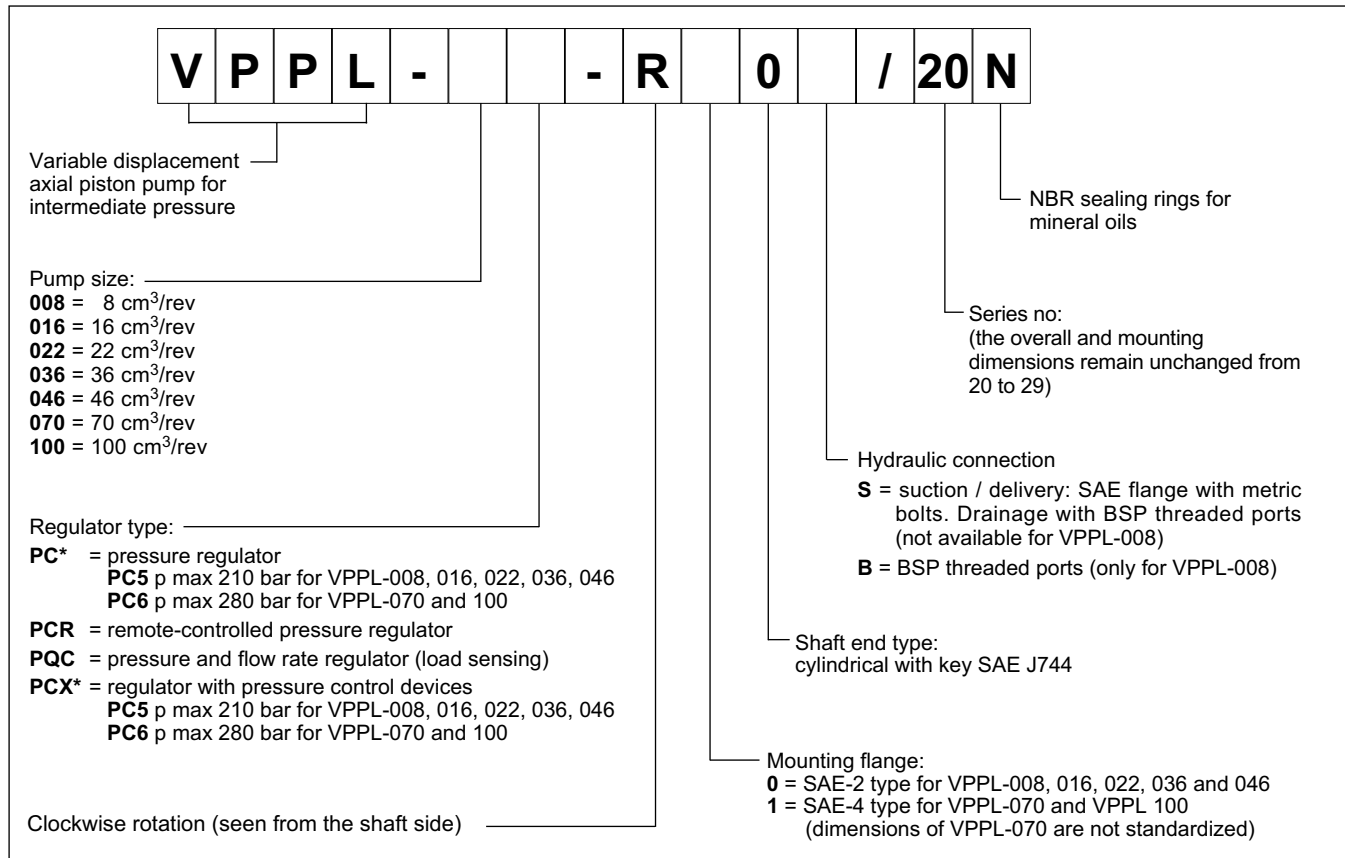
PUMP SIZE		008	016	022	036	046	070	100
Maximum displacement	cm <sup>3</sup> /rev	8	16	22	36	46	70	100
Flow rate at 1500 rpm	lt/min	12	24	33	54	69	105	150
Operating pressures	bar	210					280	
Rotation speed	rpm	min 500 - max 2000						min 500 - max 1800
Rotation direction		clockwise (seen from the shaft side)						
Hydraulic connection		SAE flange						
Type of mounting		SAE flange J744 - 2 holes						
Oil volume in the pump body	dm <sup>3</sup>	0,2	0,3		0,6		1	1,8
Mass	kg	8	12	12	23	23	41	60

### HYDRAULIC SYMBOL

Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-10 / +70
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	20 ÷ 50



### 1 - IDENTIFICATION CODE



### 2 - HYDRAULIC FLUID

#### 2.1 - Fluid type

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With these fluids use NBR seals. Using fluids at temperatures higher than 70 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

#### 2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	20 / 50 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

#### 2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with  $\beta_{20} \geq 75$  is suggested.

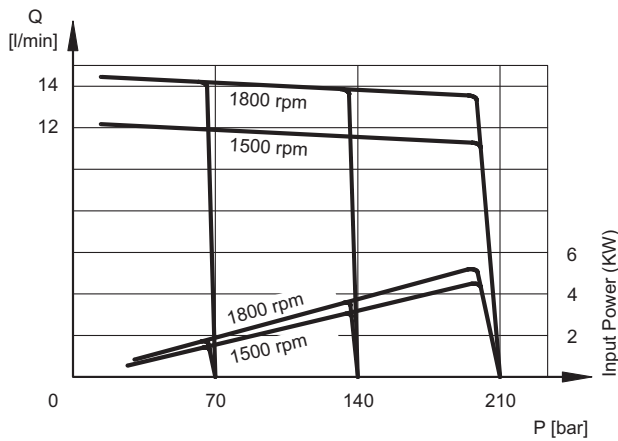
A degree of maximum fluid contamination according to ISO 4406:1999 class 20/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with  $\beta_{10} \geq 100$  is recommended.

For the installation of filters on the suction line, see paragraph 10. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

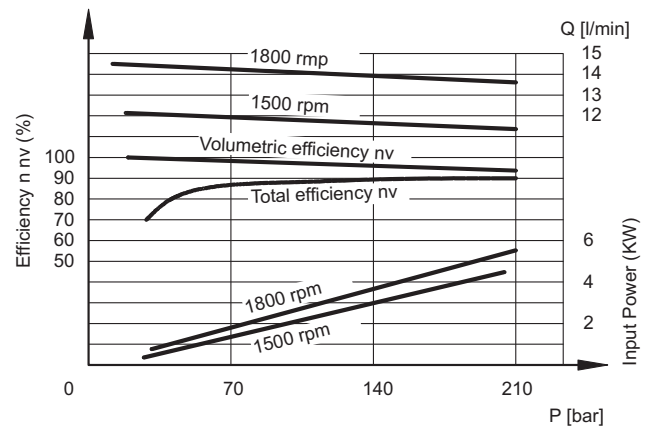
## 3 - CHARACTERISTIC CURVES

### 3.1 - VPPL-008 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

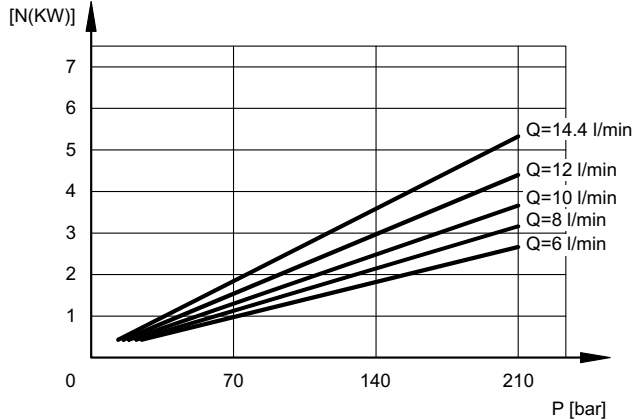
#### FLOW RATE / PRESSURE CURVES



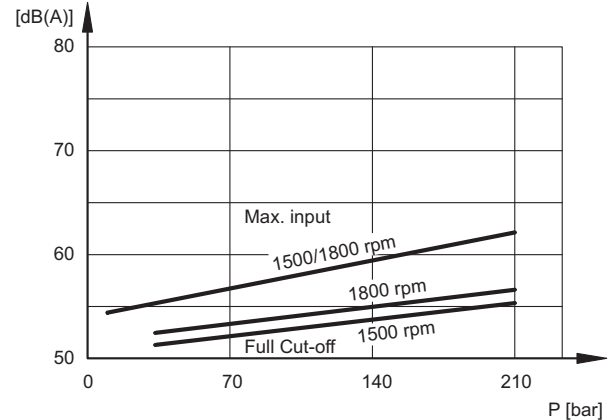
#### VOLUMETRIC AND TOTAL EFFICIENCY



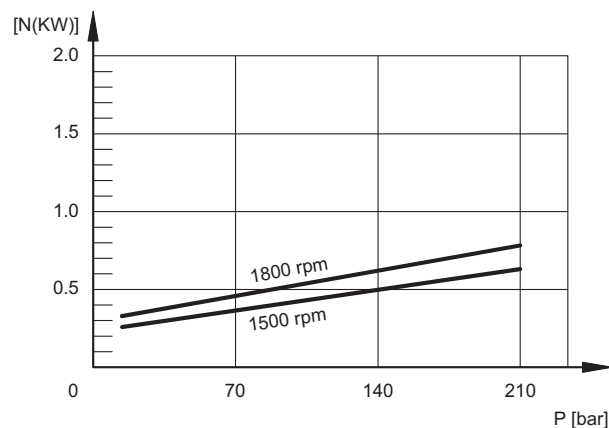
#### ABSORBED POWER



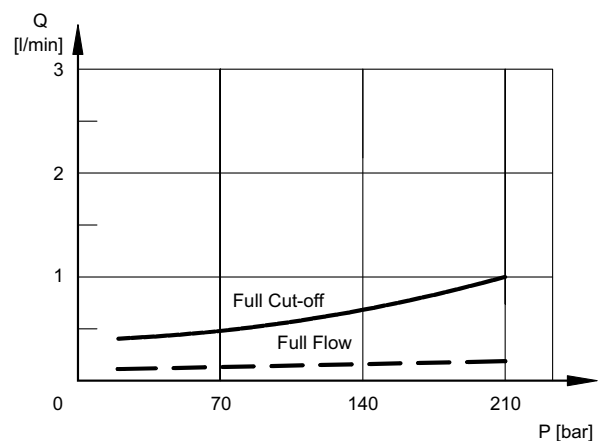
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF



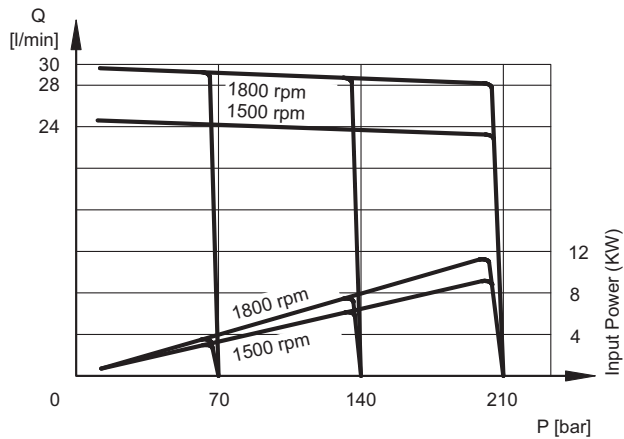
#### DRAIN FLOW RATE



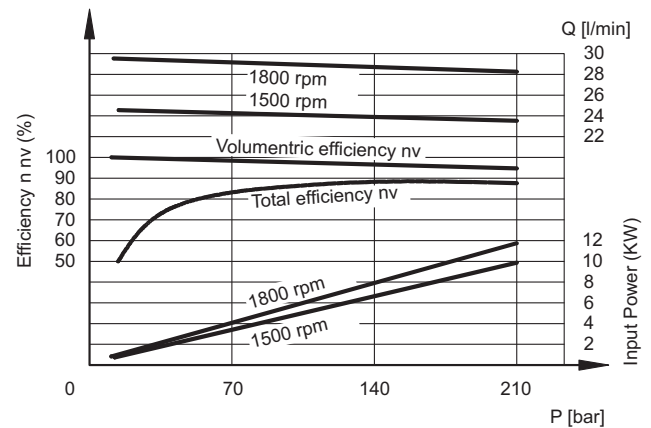


### 3.2 - VPPL-016 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

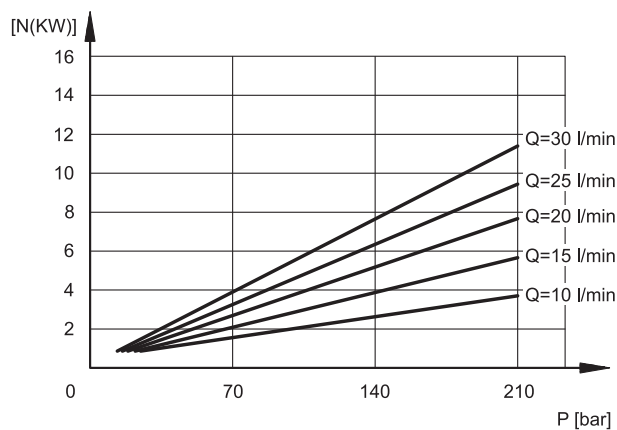
#### FLOW RATE / PRESSURE CURVES



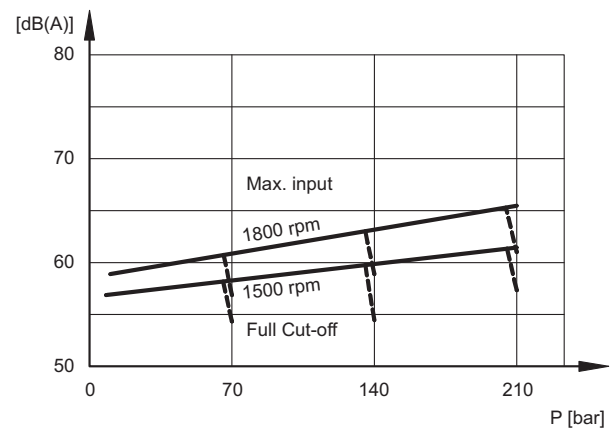
#### VOLUMETRIC AND TOTAL EFFICIENCY



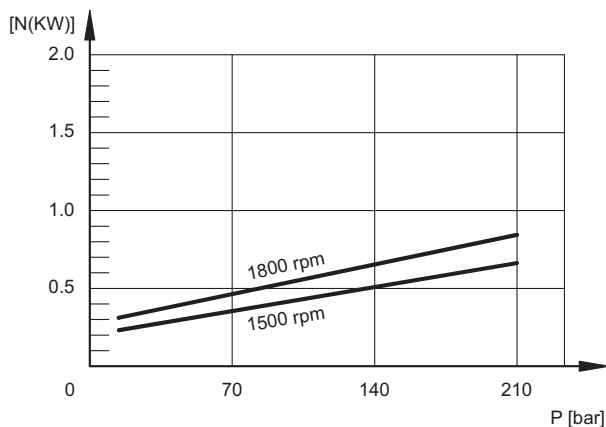
#### ABSORBED POWER



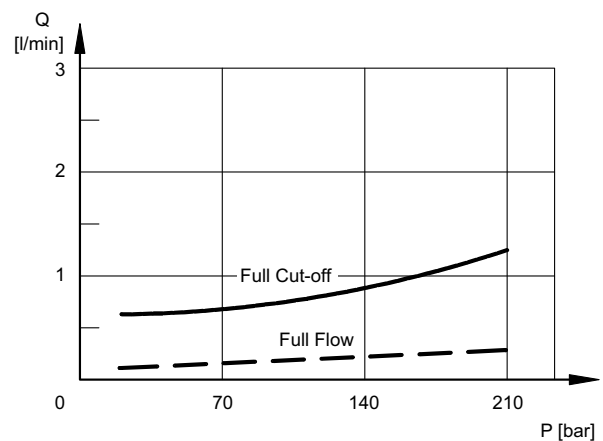
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

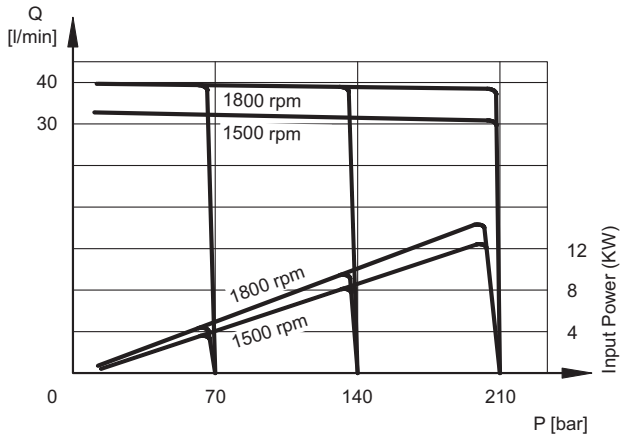


#### DRAIN FLOW RATE

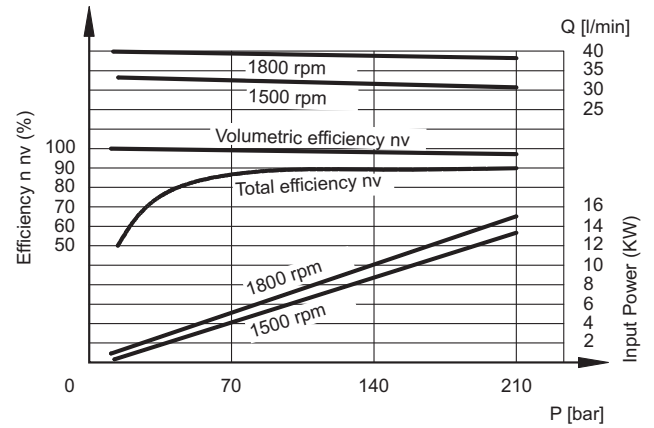


### 3.3 - VPPL-022 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

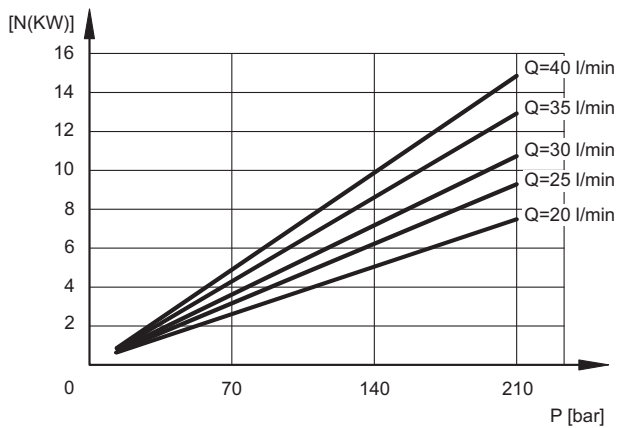
#### FLOW RATE / PRESSURE CURVES



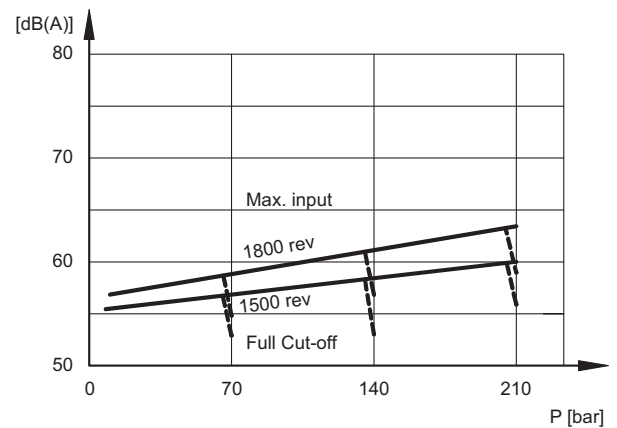
#### VOLUMETRIC AND TOTAL EFFICIENCY



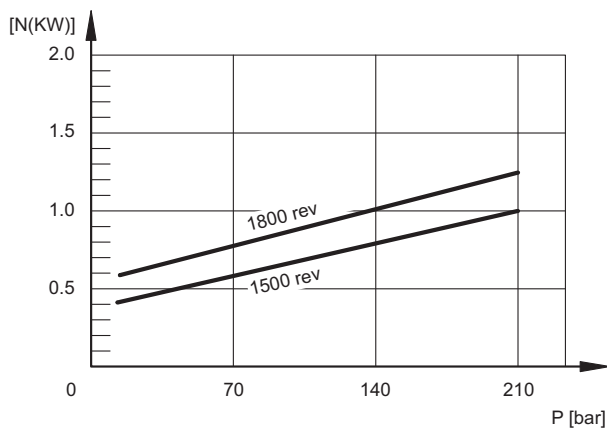
#### ABSORBED POWER



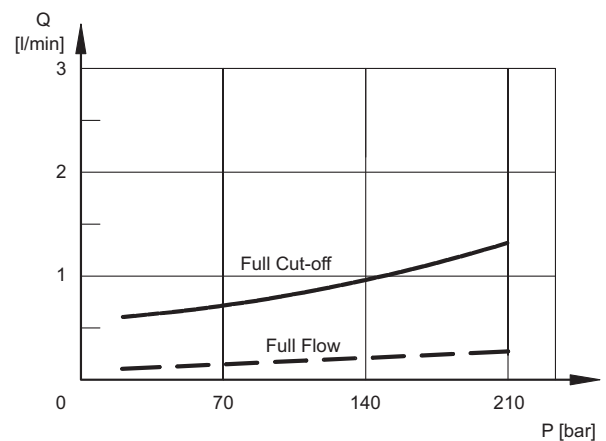
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

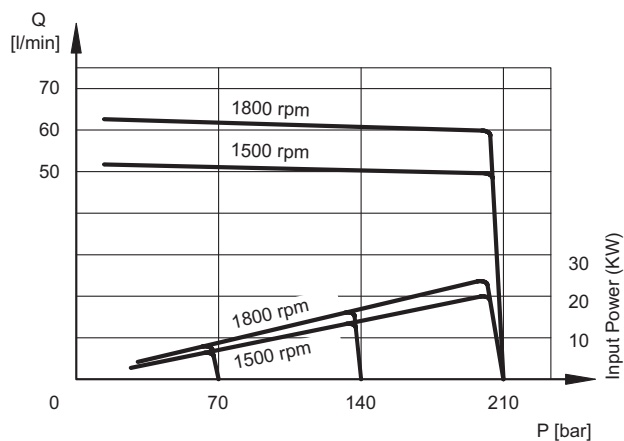


#### DRAIN FLOW RATE

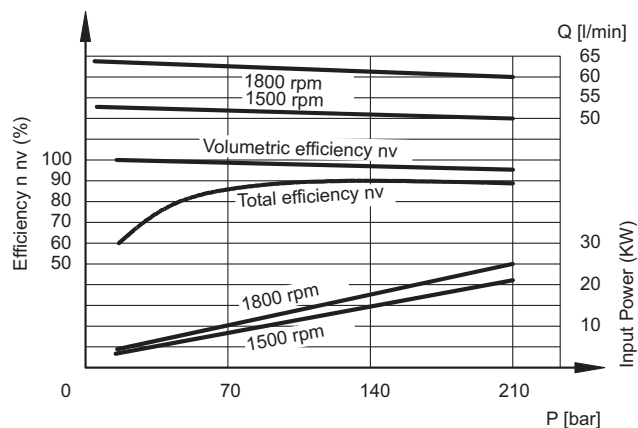


### 3.4 - VPPL-036 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

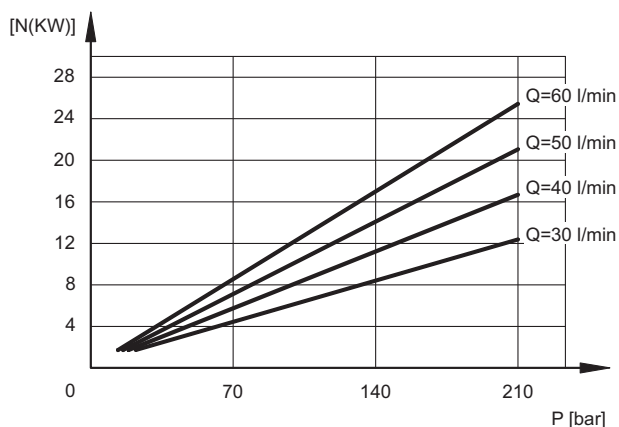
#### FLOW RATE / PRESSURE CURVES



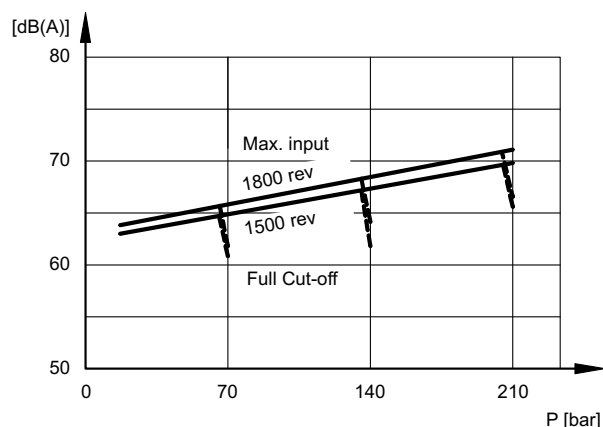
#### VOLUMETRIC AND TOTAL EFFICIENCY



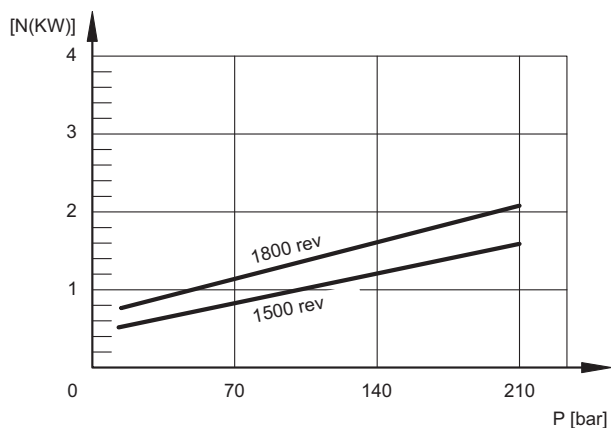
#### ABSORBED POWER



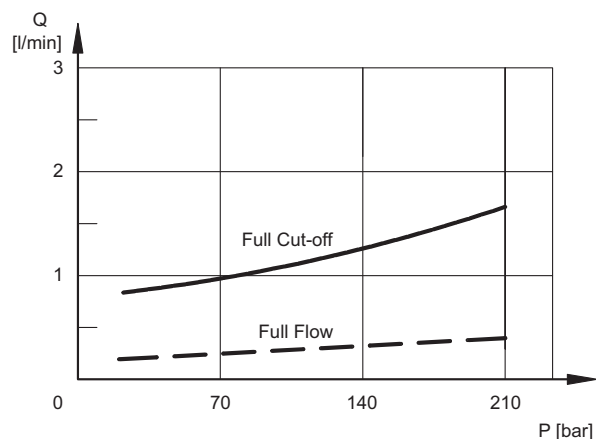
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

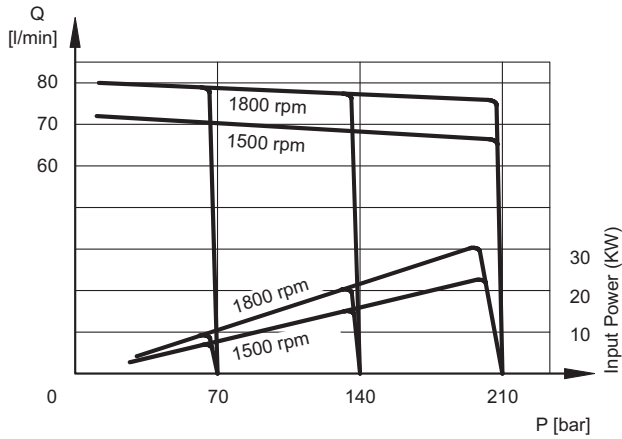


#### DRAIN FLOW RATE

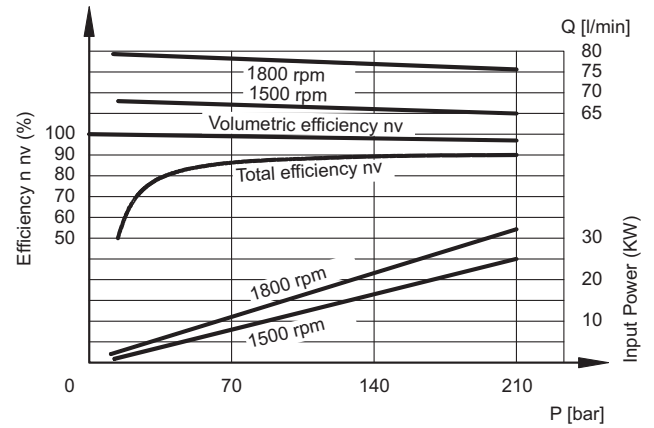


### 3.5 - VPPL-046 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

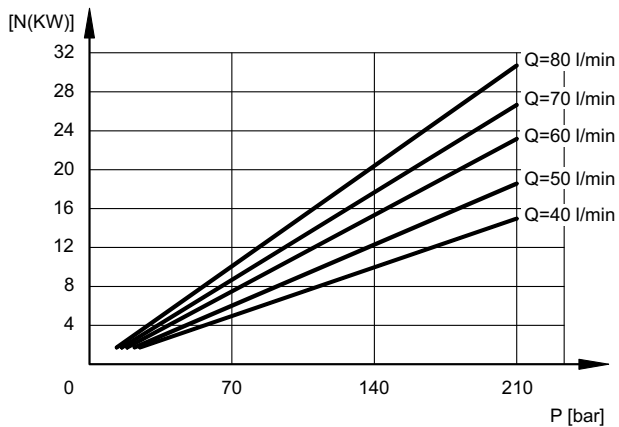
#### FLOW RATE / PRESSURE CURVES



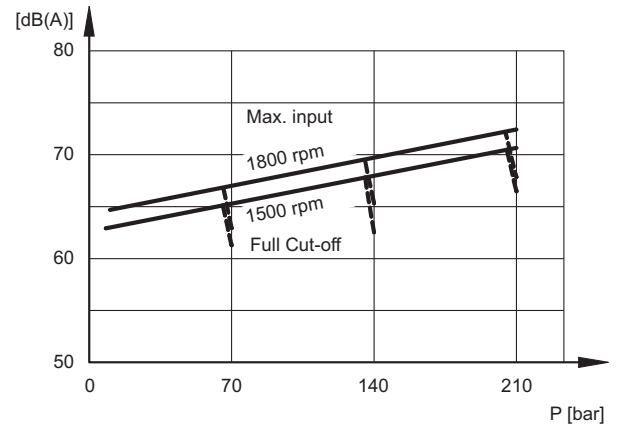
#### VOLUMETRIC AND TOTAL EFFICIENCY



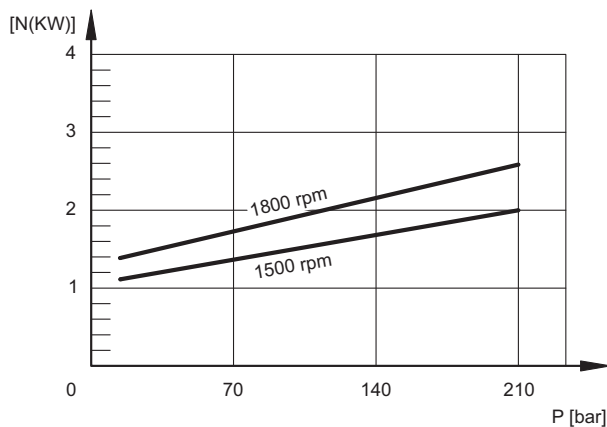
#### ABSORBED POWER



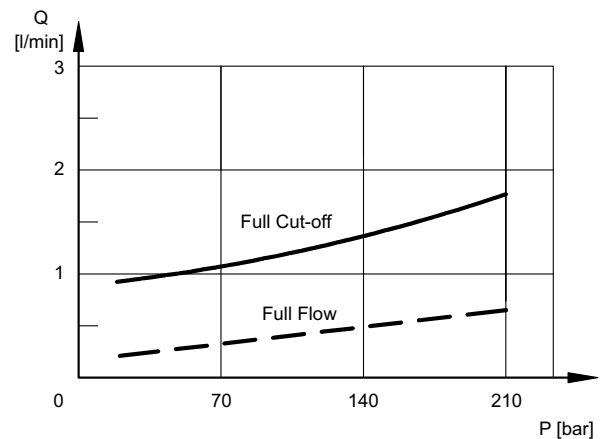
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

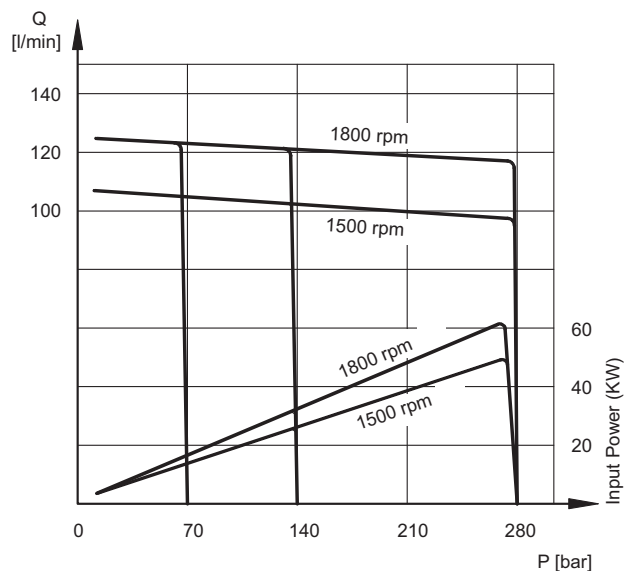


#### DRAIN FLOW RATE

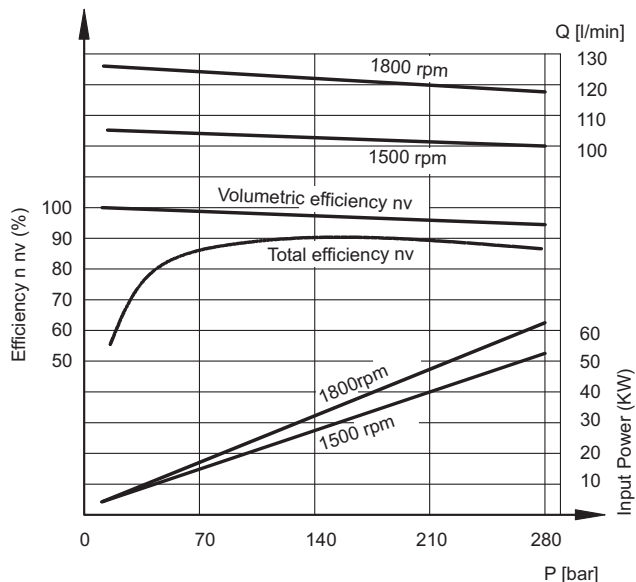


### 3.4 - VPPL-070 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

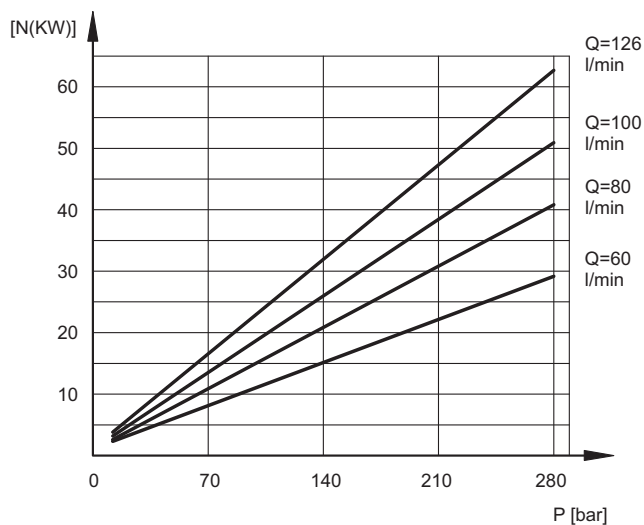
#### FLOW RATE / PRESSURE CURVES



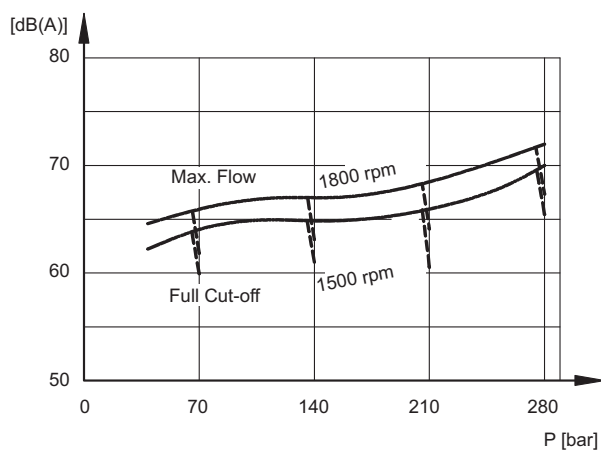
#### VOLUMETRIC AND TOTAL EFFICIENCY



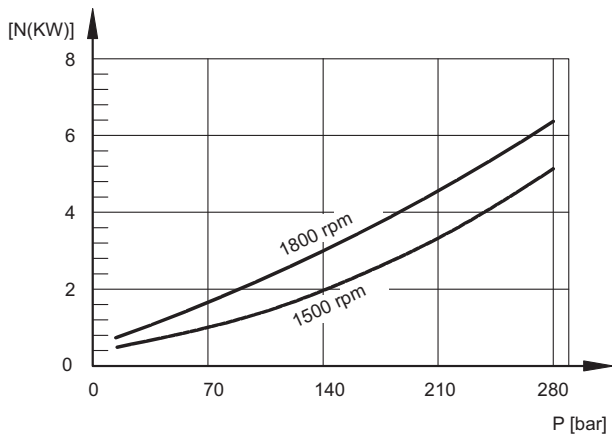
#### ABSORBED POWER



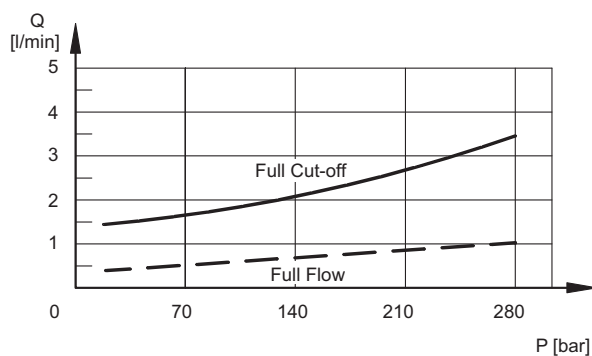
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

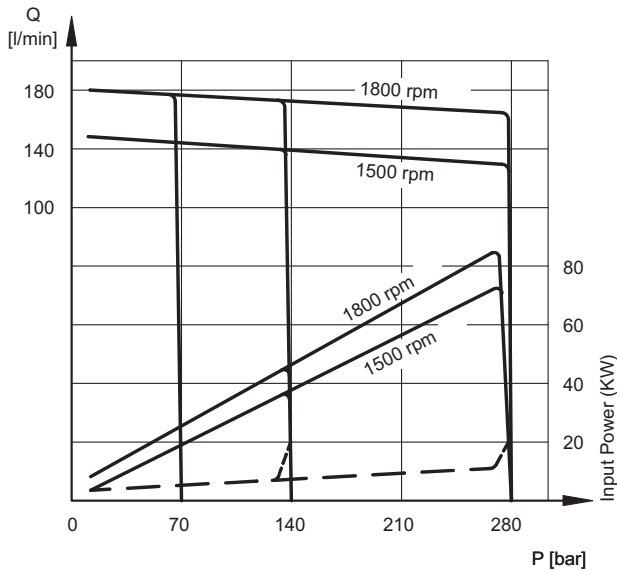


#### DRAIN FLOW RATE

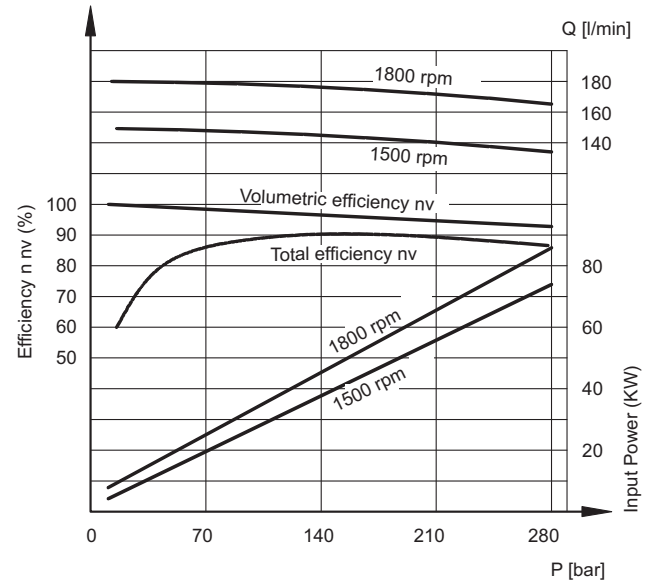


### 3.5 - VPPL-100 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

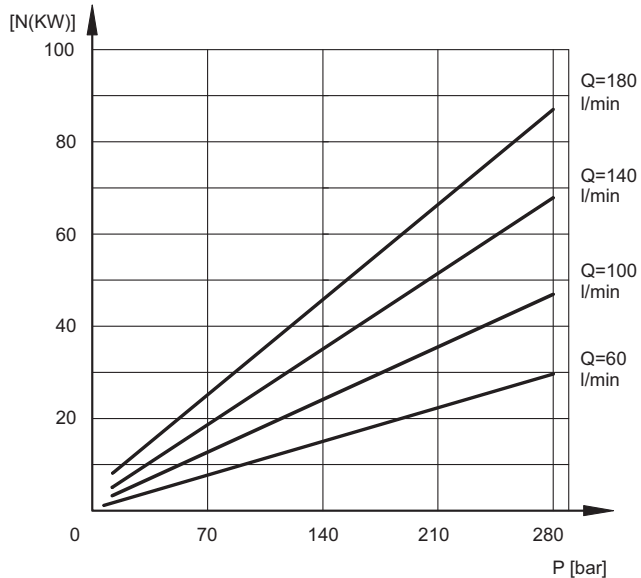
#### FLOW RATE / PRESSURE CURVES



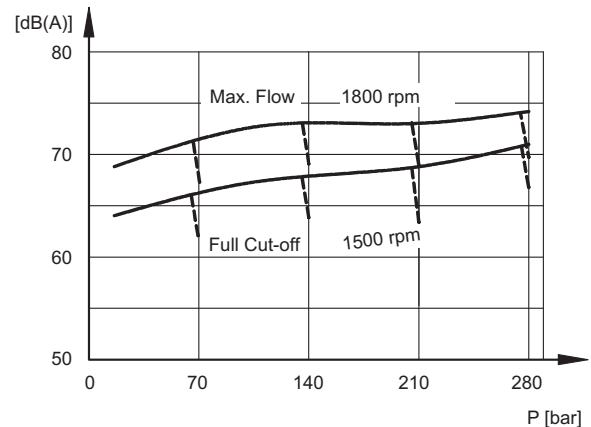
#### VOLUMETRIC AND TOTAL EFFICIENCY



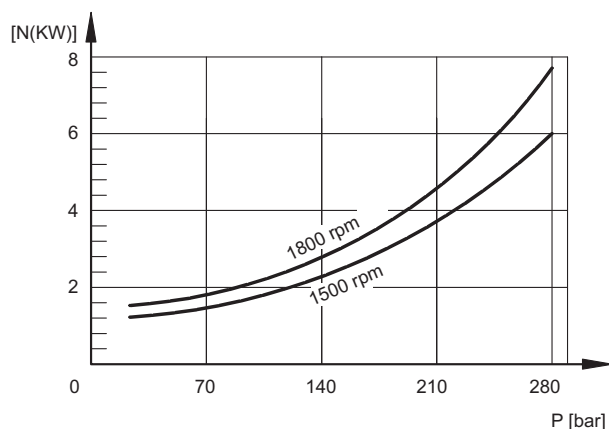
#### ABSORBED POWER



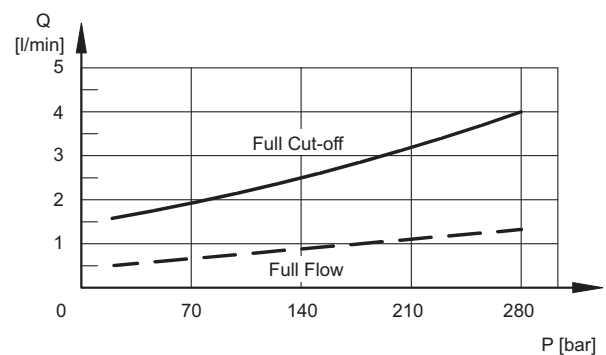
#### NOISE LEVEL



#### INPUT POWER AT FULL CUT-OFF

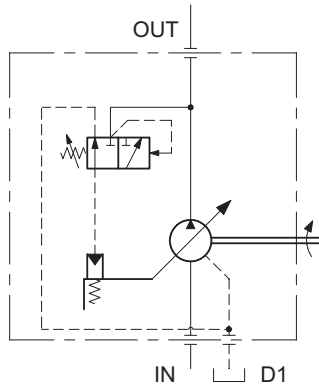


#### DRAIN FLOW RATE



## 4 - REGULATORS

### 4.1 - Pressure regulator: PC\*



The PC\* pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.

The desired pressure can be set by manually adjusting the P regulation valve. The clockwise rotation of the adjustment bolt makes the pressure increase.

#### FEATURES OF THE PC REGULATOR:

- pressure adjustment range:
  - PC5** = 30 ÷ 210 bar (for VPPL 008, 016, 022, 036 and 046)
  - pressure increase/adjustment screw round: 69 bar
  - PC6** = 30 ÷ 280 bar (for VPPL 070 and 100)
  - pressure increase/adjustment screw round: 78 bar

### 4.2 - Remote-controlled pressure regulator: PCR

The PCR regulator allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps).

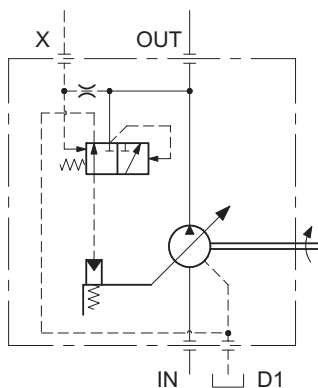
In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.

Note: The maximum length of the connection between the valve and X port of the pump must not be longer than 2 m.

#### 4.2.1 - Remote-controlled pressure regulator: PCR for VPPL 008, 016, 022, 036 e 046

##### FEATURES OF THE REGULATOR:

- remote-adjustment pressure = 20 ÷ 210 bar
- flow rate available on the X port for the remote-control = about 1,5 l/min (approx.)

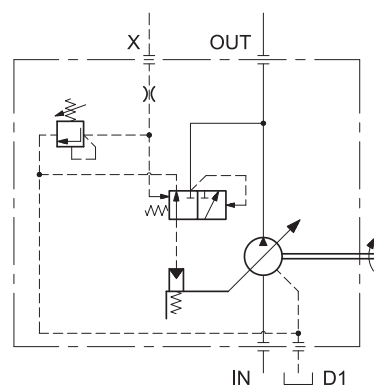


#### 4.2.2 - Remote-controlled pressure regulator: PCR for VPPL 070 e 100

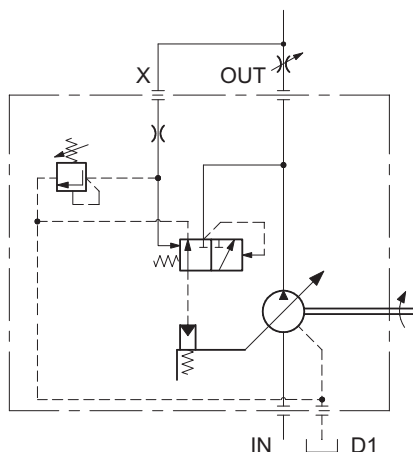
##### FEATURES OF THE REGULATOR:

It also limits the line maximum pressure.

- pressure regulating range 30 ÷ 280 bar
- pressure increase/adjustment screw round: 78 bar
- remote-regulated pressure range = 20 ÷ 280 bar
- flow rate available on the X port for the remote-control = about 1,5 l/min



### 4.3 - Pressure and flow rate regulator: PQC



This regulator, in addition to the pressure adjustment (as for the PC\* model), allows the pump flow rate control, according to the  $\Delta p$  pressure drop measured on either side of a throttle valve installed on the user line.

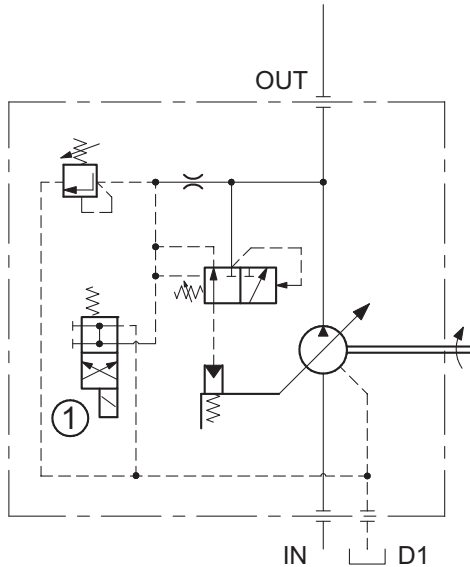
Note: The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

#### FEATURES OF THE PQC REGULATOR:

- pressure adjustment range:
  - 11 ÷ 190 bar (for VPPL 008, 016, 022, 036 and 046)
  - 13 ÷ 230 bar (for VPPL 070 and 100)
- pressure increase/adjustment screw round: 78 bar
- differential pressure adjustment range = 15 ÷ 28 bar
- minimum delivery pressure = 15 bar

### 4.4 - Regulator with pressure control devices: PCX\*

#### 4.4.1 - Electrical unloading



The PCX\* regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

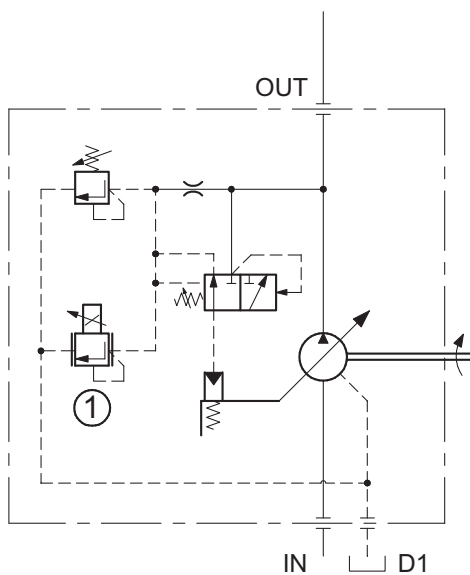
This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

#### PCX\* FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 type (to be ordered separately - see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator.
- pressure regulating range:
  - 20 ÷ 210 bar for VPPL-008, 016, 022, 036 and 046
  - 20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default settings:
  - 210 bar for VPPL-008, 016, 022, 036 and 046
  - 280 bar for VPPL-070 and 100

#### 4.4.2 - Pressure regulation with electric proportional control



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

#### PCX\* FEATURES (proportional pressure regulation):

- pressure regulating range:
  - PCX5** = 20 ÷ 210 bar for VPPL-008, 016, 022, 036, 046.
  - PCX6** = 20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default setting:
  - PCX5** = 210 bar for VPPL-008, 016, 022, 036 and 046
  - PCX6** = 280 bar for VPPL-070 and 100
- proportional pressure relief valve (1) = PRED3 type (to be ordered with the relative control card separately - see cat. 81 210)
- proportional pressure regulating range :
 

PRED3-070	20 ÷ 85 bar
PRED3-210	20 ÷ 225 bar

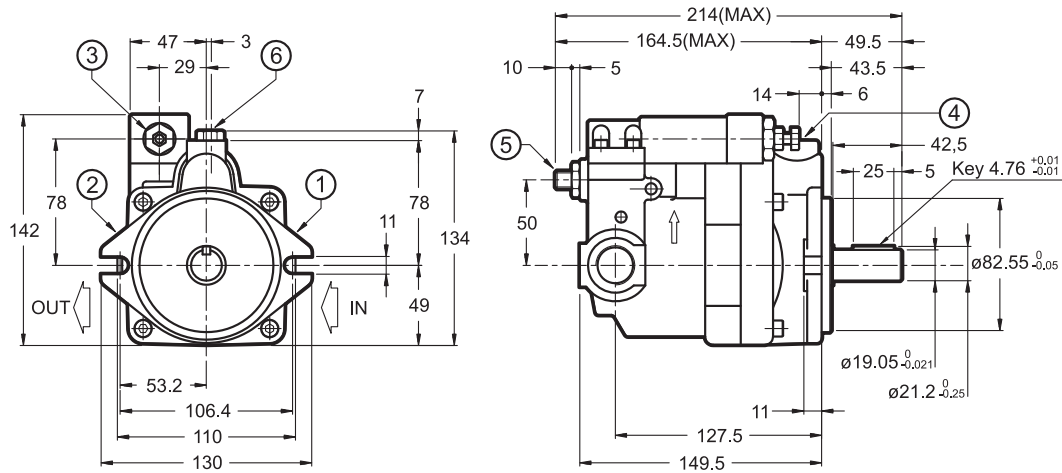
Hysteresis = < 5% of p nom

Repeatability = < ±1,5% of p nom

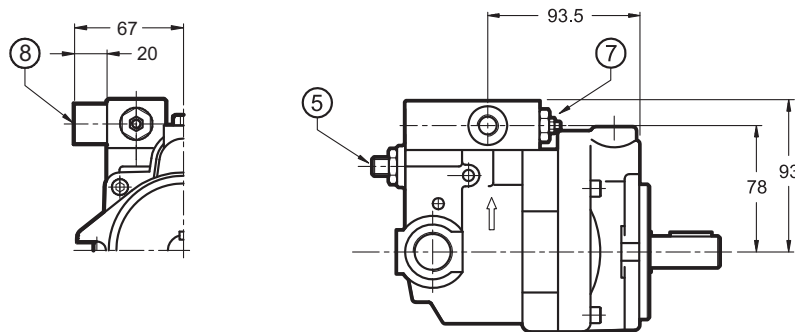


## 5 - VPPL-008 PUMPS OVERALL AND MOUNTING DIMENSIONS

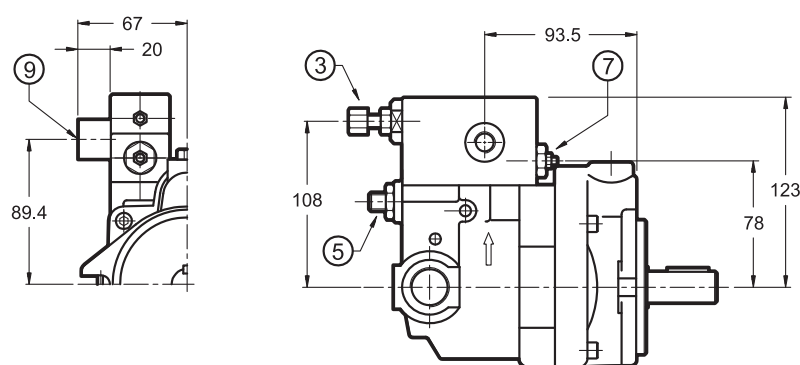
### VPPL-008PC5 PUMPS



### VPPL-008PCR PUMPS

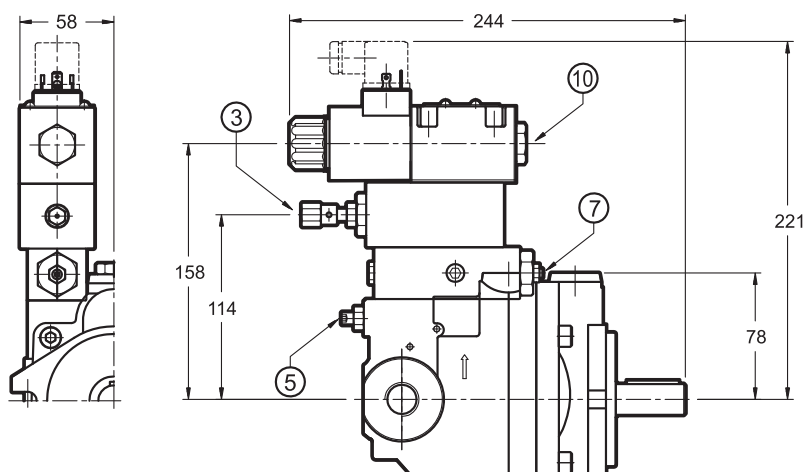


### VPPL-008PQC PUMPS



dimensions in mm

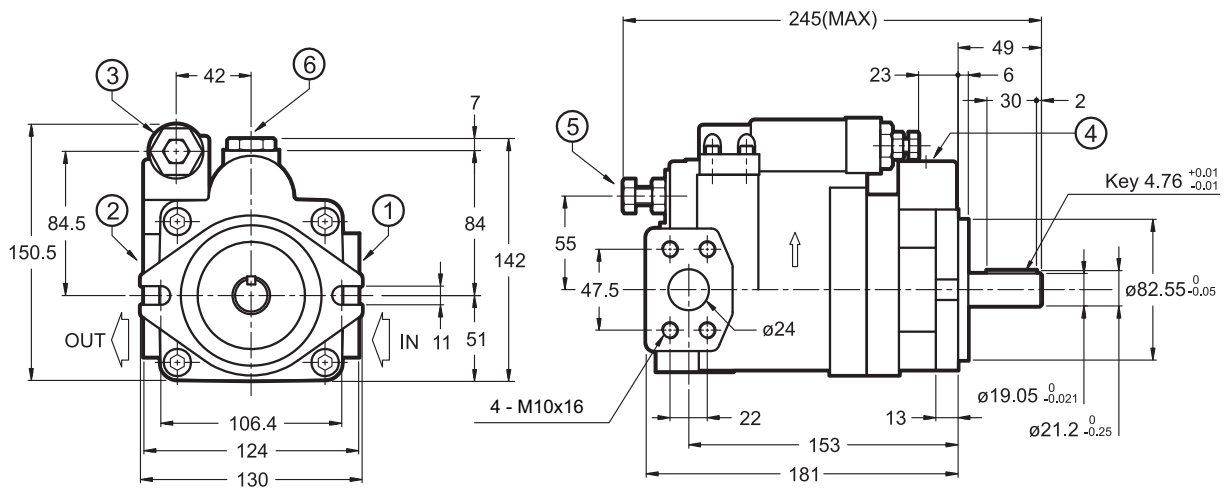
### VPPL-008PCX5 PUMPS



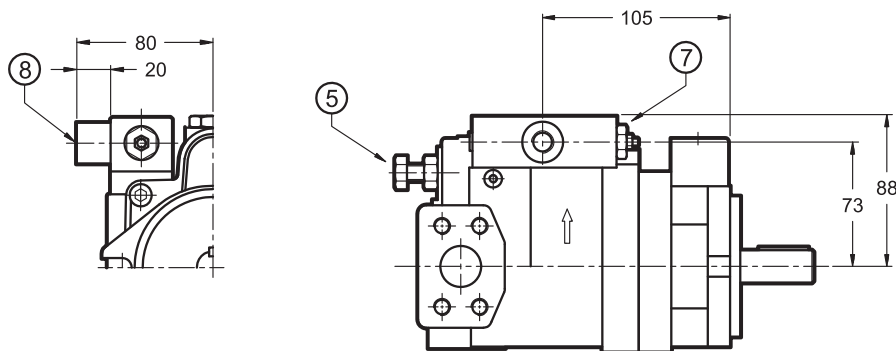
1	Suction port IN: 1/2" BSP
2	Delivery port OUT: 1/2" BSP
3	Pressure adjustment screw
4	Drain port: 3/8" BSP
5	Flow adjustment screw $\Delta$ displacement/round = 0,8 cm <sup>3</sup>
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP
10	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

## 6 - VPPL-016 and VPPL-022 PUMPS OVERALL AND MOUNTING DIMENSIONS

### VPPL-016PC5 and VPPL-022PC5 PUMPS

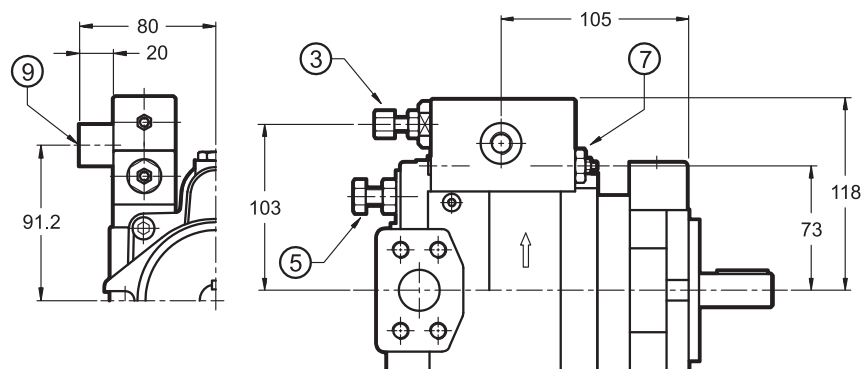


### VPPL-016PCR and VPPL-022PCR PUMPS



dimensions in mm

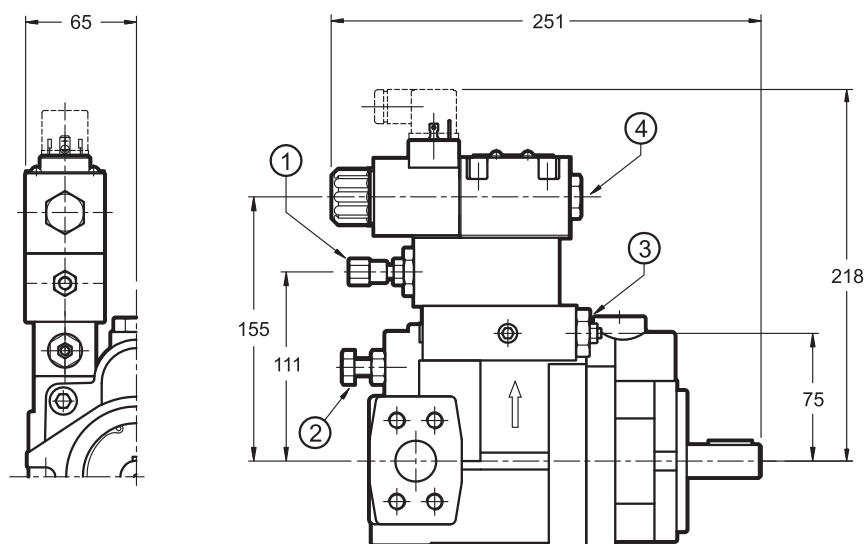
### VPPL-016PQC and VPPL-022PQC PUMPS



1	Suction port IN: SAE 3000 1" flange (see par. 11)
2	Delivery port OUT: SAE 3000 3/4" flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 3/8" BSP
5	Flow adjustment screw $\Delta$ displacement/round: 1,5 cm <sup>3</sup> (for VPPL-016) 2,0 cm <sup>3</sup> (for VPPL-022)
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP

## VPPL-016PCX5 and VPPL-022PCX5 PUMPS

dimensions in mm

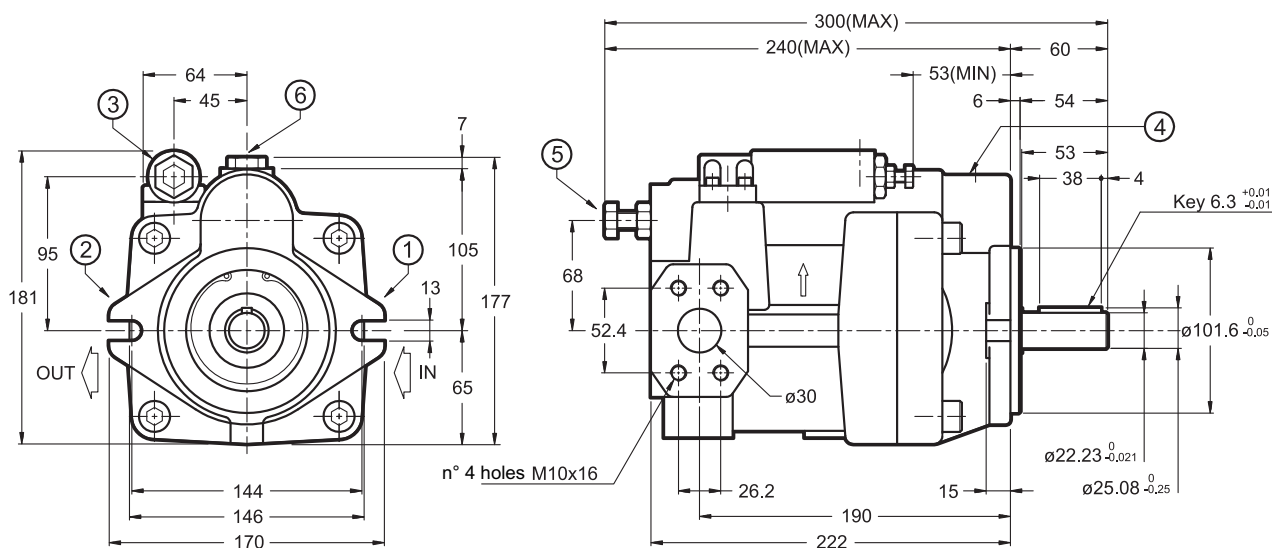


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round: 1,5 cm³ (for VPPL-016) 2,0 cm³ (for VPPL-022)
3	Differential pressure (not adjustable)
4	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

## 7 - VPPL-036 and VPPL-046 PUMPS OVERALL AND MOUNTING DIMENSIONS

## VPPL-036PC5 and VPPL-046PC5 PUMPS

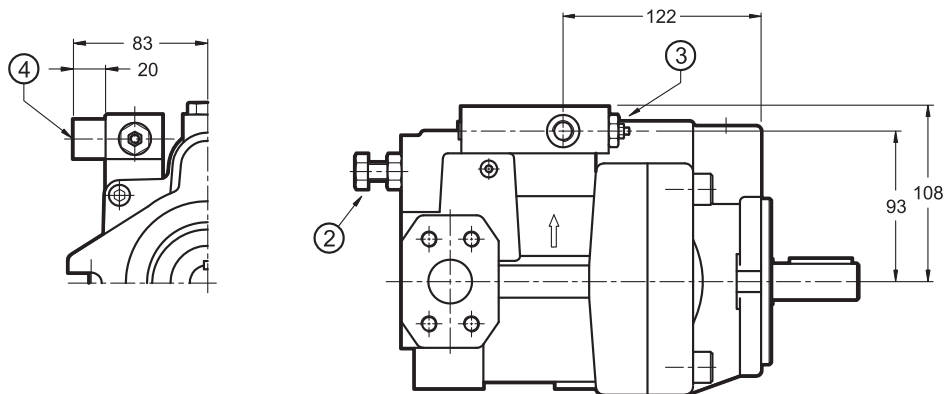
dimensions in mm



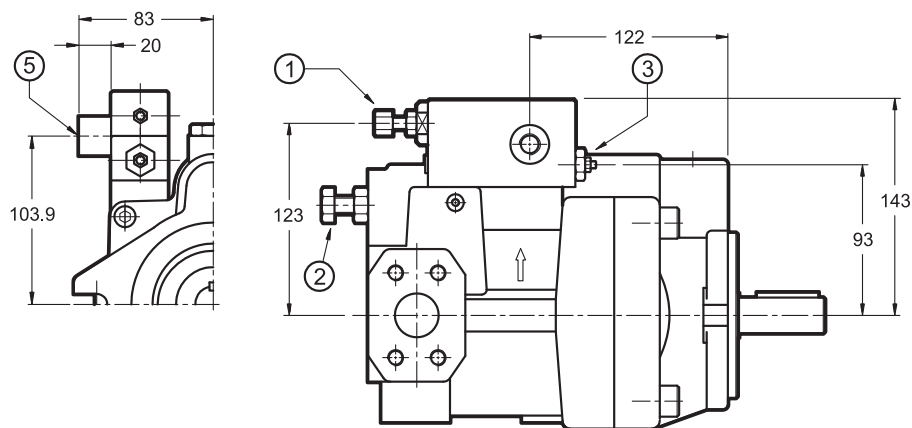
1	Suction port IN: SAE 3000 1 1/4" flange (see par. 11)
2	Delivery port OUT: SAE 3000 1" flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 1/2" BSP
5	Flow adjustment screw Δ displacement/round: 2,6 cm³ (for VPPL-036) 3,2 cm³ (for VPPL-046)
6	Oil supply port

## VPPL-036PCR and VPPL-046PCR PUMPS

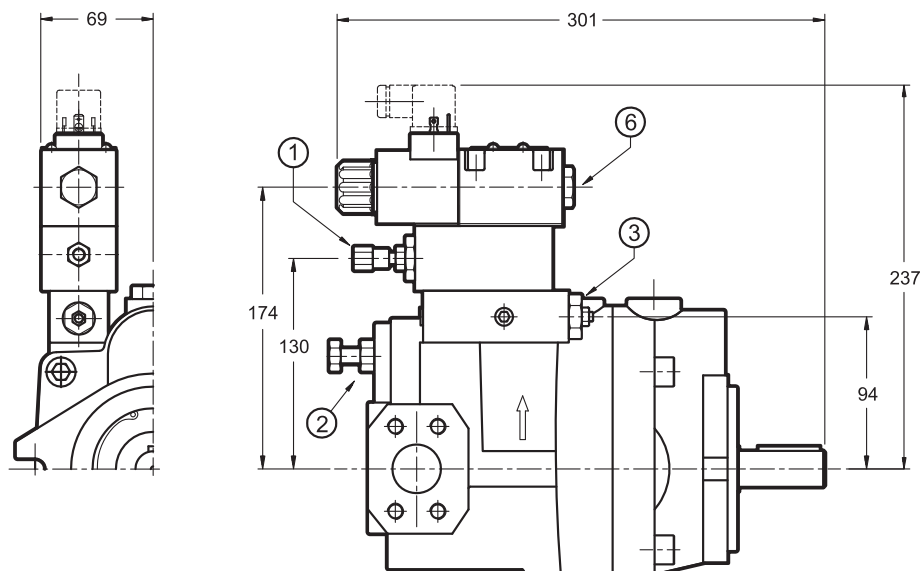
dimensions in mm



## VPPL-036PQC and VPPL-046PQC PUMPS



## VPPL-036PCX5 and VPPL-046PCX5 PUMPS

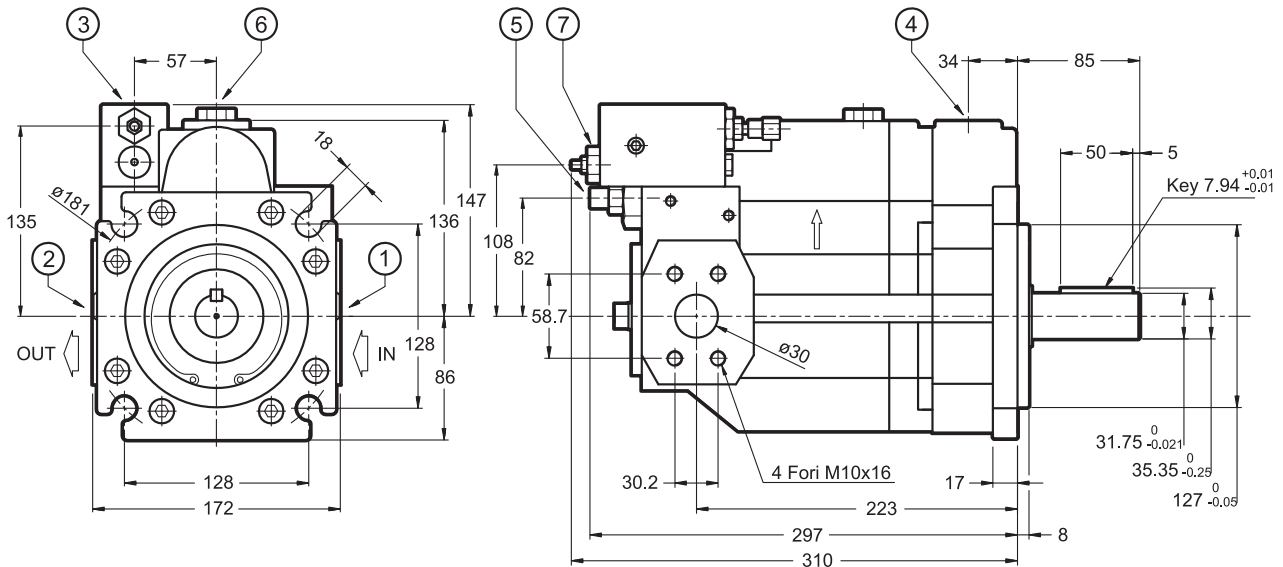


1	Pressure adjustment screw
2	Flow adjustment screw $\Delta$ displacement/round: 2,6 cm <sup>3</sup> (per VPPL-036) 3,2 cm <sup>3</sup> (per VPPL-046)
3	Differential pressure (not adjustable)
4	Remote pressure control port: 1/4" BSP
5	Load sensing port: 1/4" BSP
6	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

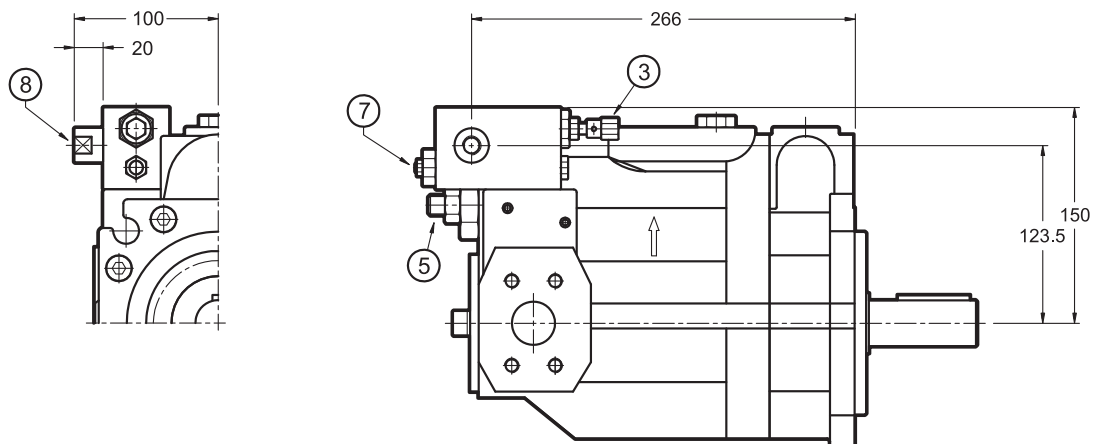
### 8 - OVERALL AND MOUNTING DIMENSIONS VPPL-070 PUMPS

#### VPPL-070PC6 PUMP

dimensions in mm



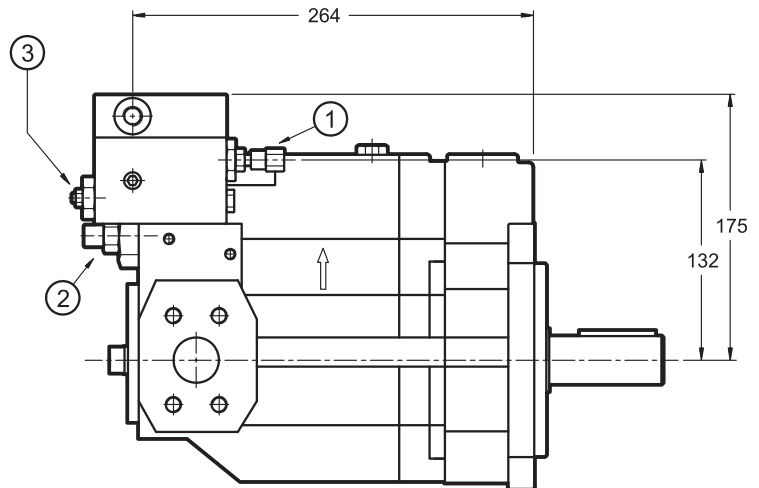
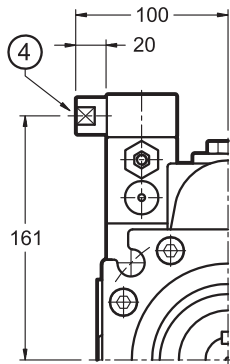
#### VPPL-070PCR PUMP



1	Suction port IN: SAE 3000 1 1/2" flange (see paragraph 11)
2	Delivery port OUT: SAE 3000 1 1/4" flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4" BSP
5	Flow adjustment screw $\Delta$ displacement/round = 4,1 cm <sup>3</sup>
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

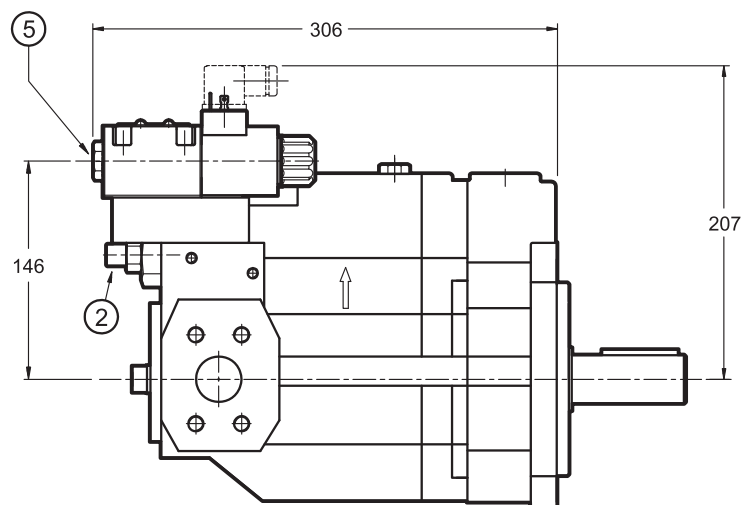
dimensions in mm

## VPPL-070PQC PUMP

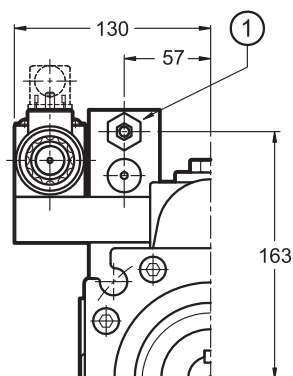


## VPPL-070PCX6 PUMP

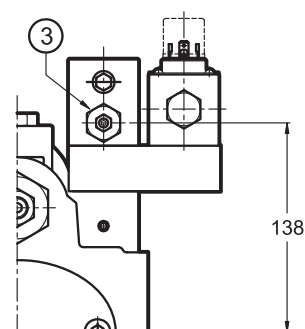
1	Pressure adjustment screw
2	Flow adjustment screw $\Delta$ displacement/round = 4,1 cm <sup>3</sup>
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)



Shaft side view



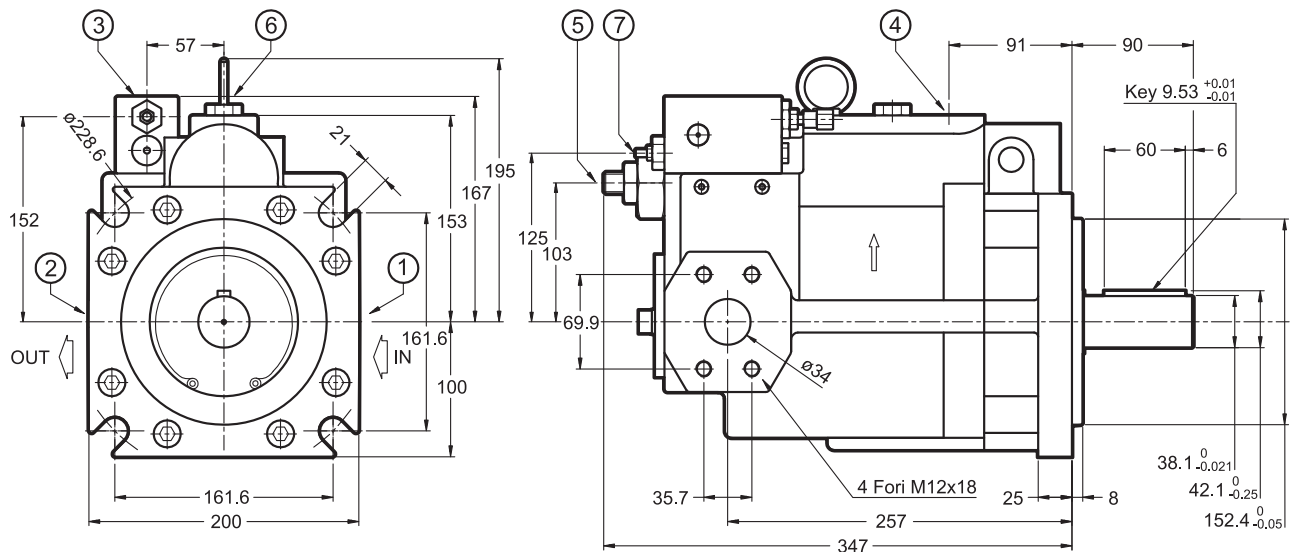
Regulator side view



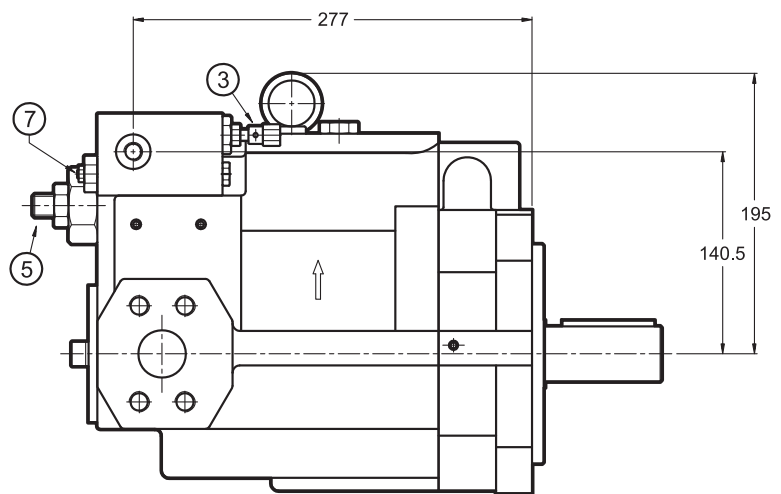
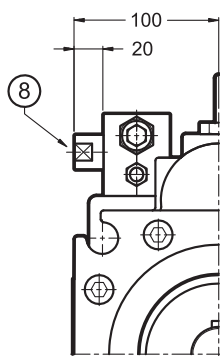
## 9 - OVERALL AND MOUNTING DIMENSIONS VPPL-100 PUMPS

## VPPL-100PC6 PUMP

dimensions in mm



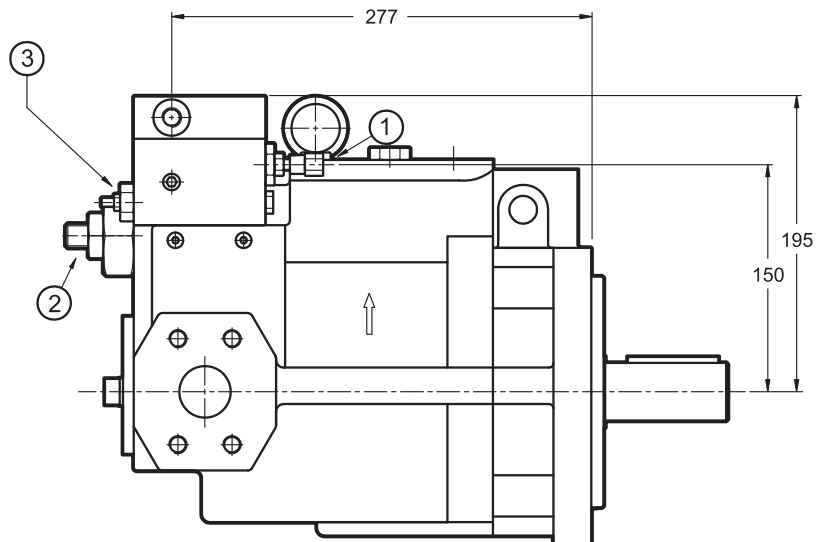
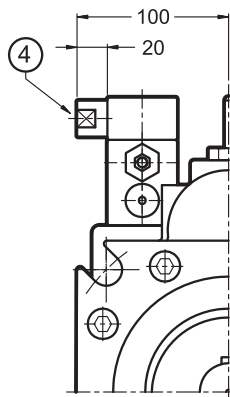
## VPPL-100PCR PUMP



1	Suction port IN: SAE 3000 2" flange (see paragraph 11)
2	Delivery port OUT: SAE 6000 1 ¼" flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4" BSP
5	Flow adjustment screw $\Delta$ displacement/round = 5,1 cm <sup>3</sup>
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

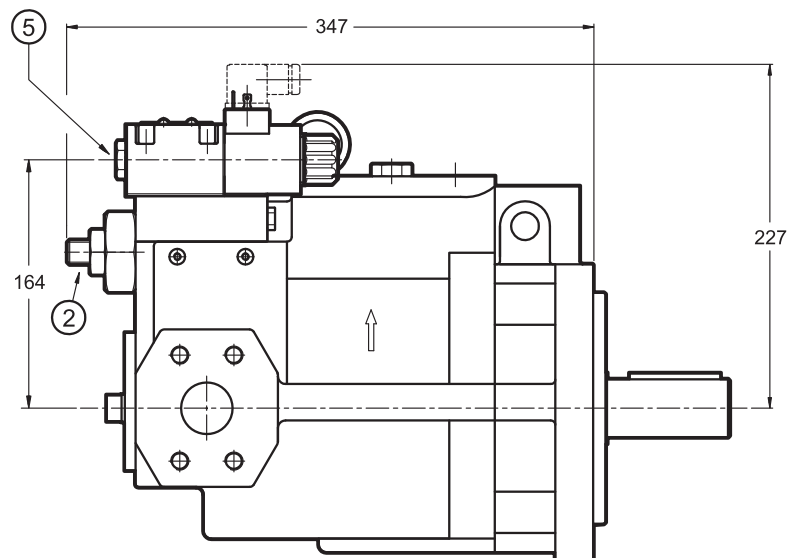
## VPPL-100PQC PUMP

dimensions in mm

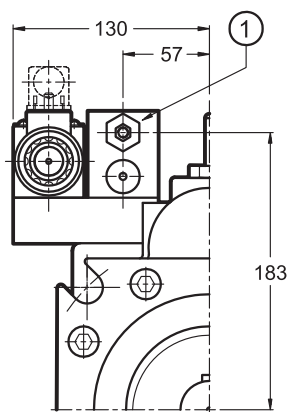


## VPPL-100PCX6 PUMP

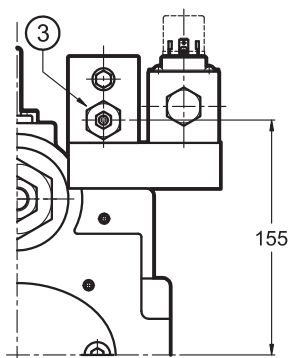
1	Pressure adjustment screw
2	Flow adjustment screw $\Delta$ displacement/round = 5,1 cm <sup>3</sup>
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)



Shaft side view



Regulator side view





### 10 - INSTALLATION

- The VPPL pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.

Note: the drain port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume.

- In the case of installation above the oil level, check that the minimal inlet pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.

In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested to adjust the drain tube so that the pump higher bearing can be always lubricated.

- **Before starting, the pump body has to be filled with the fluid.**

- Check the pump direction of rotation.

- It is necessary to vent the air from the delivery connection before operating it the first time. If the air venting should be difficult, the use of a venting valve is recommended.

The pump start up should occur with the plant at minimum pressure, especially with low temperatures.

- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.

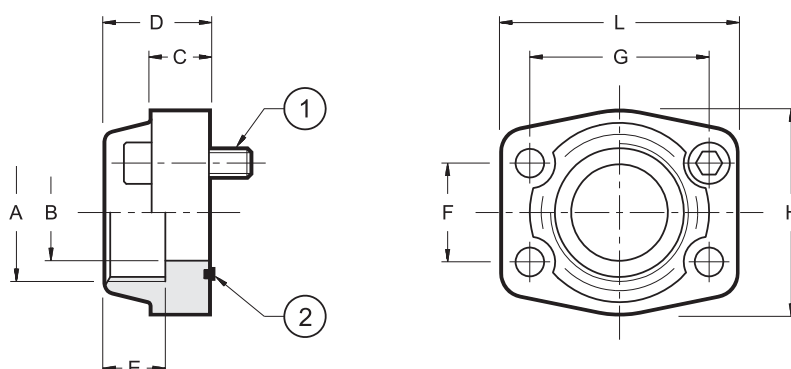
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.5 bars (relative), even during the dynamic change and flow rate phases. The minimum piping size is 3/8" for the pump type 008, 016 and 022, while it should be at least 1/2" for the pumps type 036 and 046, 3/4" for the 070 and 100 pumps type.

The drain tube has to unload inside the tank far from the suction area.

- No check valves allowed on the suction line. As for details and the installation of filter elements, see paragraph 2.3.

- The motor-pump connection must be carried out directly with a flexible coupling, to reduce at the minimum the axial and radial loads on the pump shaft. The alignment tolerance between the two shafts must be within 0.05 mm.

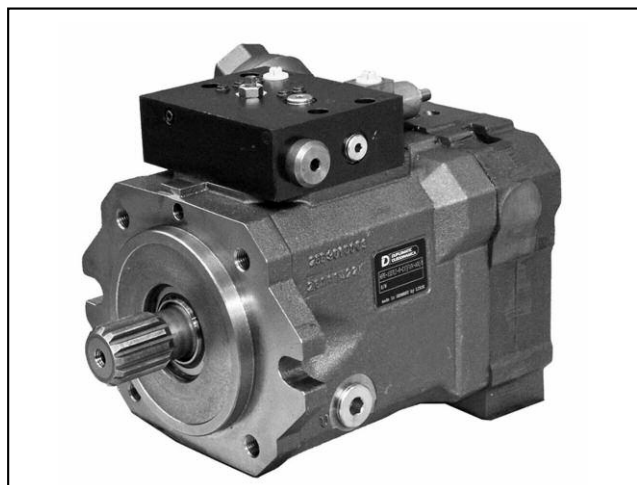
### 11 - CONNECTION FLANGES



dimensions in mm

Bolts and O-rings must be ordered separately.

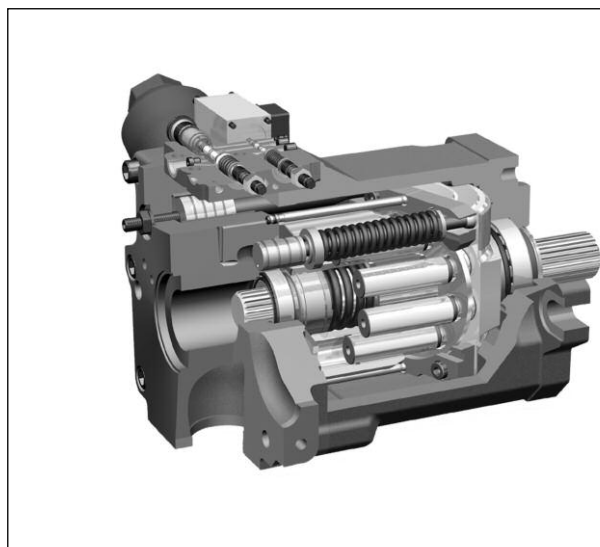
	Flange code	Flange description	$p_{max}$ [bar]	ØA	ØB	C	D	E	F	G	H	L	1 SHC bolts ISO 4762	2
SAE 3000	0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	n° 4 - M10x35	OR 4100 (24.99x3.53)
	0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70		OR 4131 (32.93x3.53)
	0610720	SAE - 1 1/4"	276	1 1/4" BSP	32	21	41	22	30,2	58,7	28	79		OR 4150 (37.69x3.53)
	0610714	SAE - 1 1/2"	207	1 1/2" BSP	38	25	45	24	35,7	69,9	78	93	n° 4 - M12x45	OR 4187 (47.23x3.53)
	0610721	SAE - 2"	207	2" BSP	51	25	45	30	42,9	77,8	90	102	n° 4 - M12x45	OR 4225 (56.74x3.53)
SAE 6000	0770106	SAE - 1 1/4"	420	1 1/4" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	OR 4150 (37.69x3.53)



# HPR

## HIGH PRESSURE SELF-REGULATING PUMP FOR OPEN LOOP OPERATION SERIES 10

### OPERATING PRINCIPLE



- HPR pumps are variable displacement axial-piston pumps with swash plate design, suitable for applications with open circuits.
- Seven frame sizes are available, from 55 up to 280 cm<sup>3</sup>/rev.
- The pump flow rate is proportional to the shaft speed and to the swash plate angle, which can be continuously modulated. The maximum angle can be limited mechanically by means of an adjustment screw.
- Due to the special design, these pumps are able to operate at high working pressures (420 bar continuously and 500 bar peak)
- All the pumps are equipped with a noise reduction device.

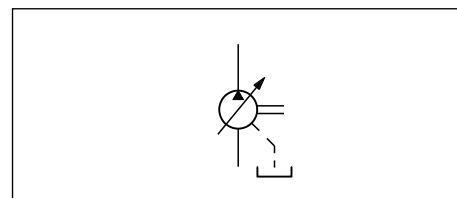
### TECHNICAL SPECIFICATIONS

PUMP SIZE		55	75	105	135	165	210	280
Maximum displacement	cm <sup>3</sup> /rev	55	75,9	105	135,7	165,6	210,1	281,9
Maximum operating pressure	bar	420						
Rotation speed and operating flow rate		see table 3 - Performances						
Rotation direction		clockwise						
Loads on the shaft: axial load radial load	N	2000 on request						
Hydraulic connection		flange fittings - SAE 3000 suction / SAE 6000 pressure						
Type of mounting		SAE J744						
Mass (empty single pump)	kg	39	39	50	65	89	116	165

Ambient temperature range	°C	-15 / +70
Fluid temperature range	°C	-20 / +80
Fluid recommended viscosity	cSt	15 ÷ 30
Fluid contamination degree (ISO 4406:1999)		18/16/13

**NOTE:** Values referring to 1 bar absolute on suction port.

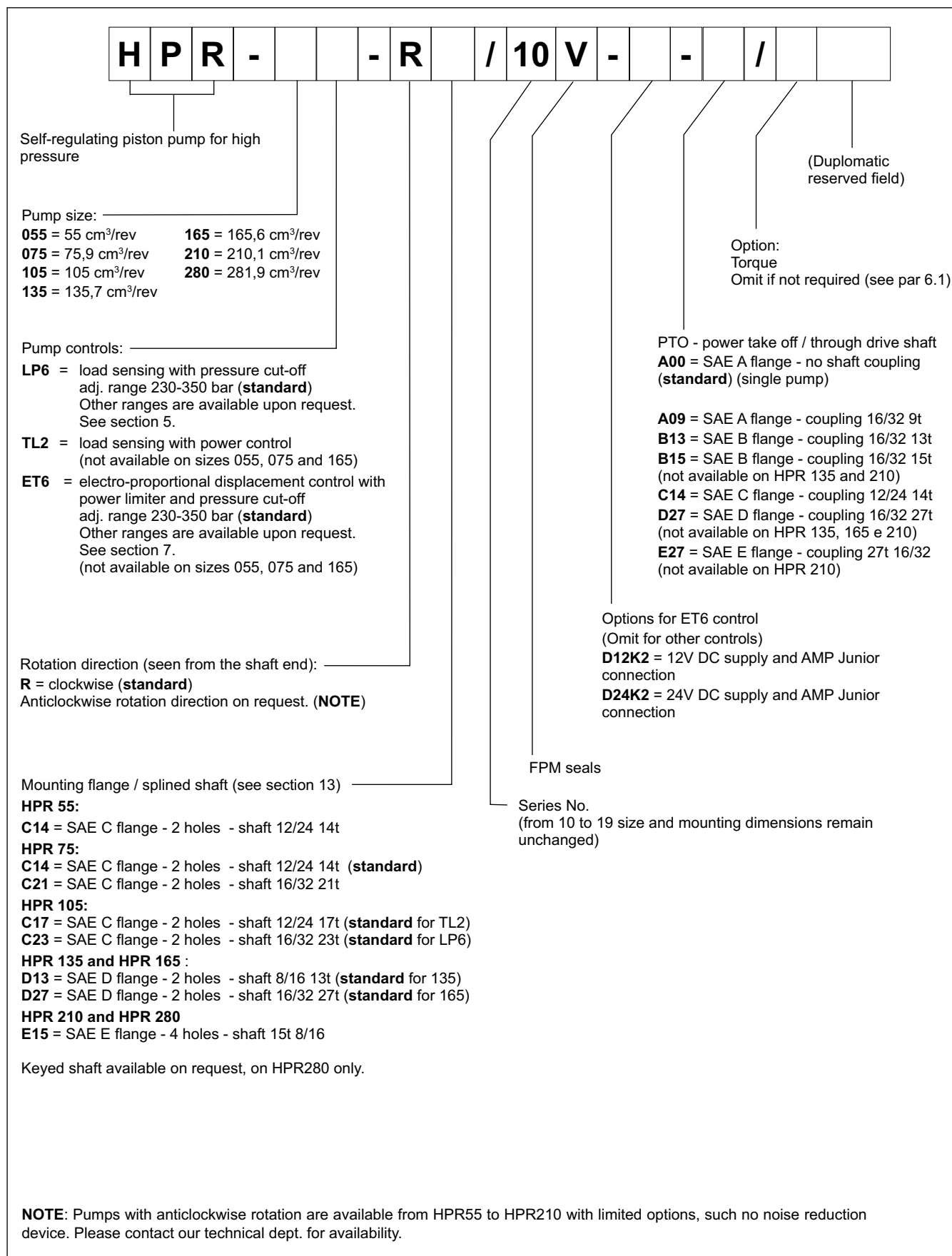
### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODES

### 1.1 - Identification code for single pumps and pumps with power take-off



## 2 - HYDRAULIC FLUID

### 2.1 - Fluid type

Use mineral oil based hydraulic fluids HLP with anti-foam and antioxidant additives according to the DIN 51524-2 standard. For use with other types of fluid, keep in mind the limitations shown here below or consult our technical department for authorization of use.

### 2.2 - Fluid viscosity

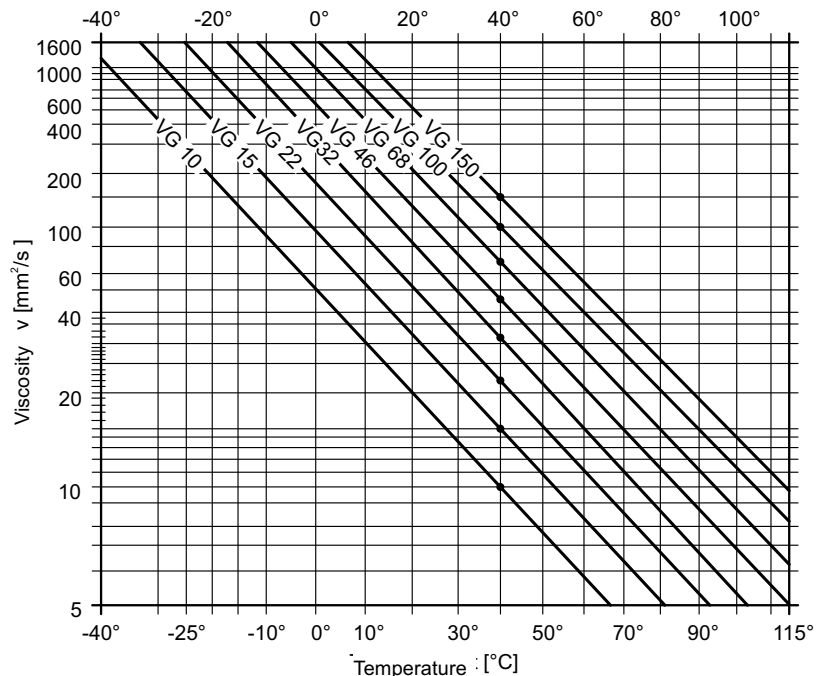
The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 80°C for the drain line
optimum viscosity	15 + 30 cSt	referred to the fluid operating temperature in the tank.
maximum viscosity	1000 cSt	limited to the cold start-up of the pump only, which has to be carried out with the circuit at minimum pressure.

When selecting the fluid type, check its viscosity is within the range specified above at the operating temperature.

Recommended viscosity values are indicated in the table and diagram.

Operating temperature [°C]	Viscosity class [cSt at 40°C]
from 30 to 40	22
from 40 to 60	32
from 60 to 80	46 or 68



### 2.3 - Degree of fluid contamination

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the purity of the operating fluid must comply with the following class according to the ISO 4406:1999. High purity oil can extend the service time of the hydraulic system significantly.

For reliable proper function and long service life 18/16/13

Minimum requirements 20/18/15

Commissioning The minimum purity requirement for the hydraulic oil is based on the most sensitive system component. For commissioning we recommend a filtration in order to achieve the required purity

Filling and operation of hydraulic systems The required purity of the hydraulic oil must be ensured during filling or topping up. When drums, canisters or large-capacity tanks are used the oil generally needs to be filtered.

We recommend the implementation of suitable measures (e.g. filters) to ensure the required minimum purity of the oil is also achieved during these tasks.



### 3 - PERFORMANCES

(values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

PUMP SIZE		055	075	105	135	165	210	280
Max displacement	cm <sup>3</sup> /rev	55	75.9	105	135.7	165.6	210.1	281.9
Max flow: - at 1500 rpm - at max rotation speed	l/min	82.5 148.5	113.9 189.8	157.5 262.5	203.5 318.9	248.2 364.1	315.5 441.2	422.9 563.8
Minimum operating speed	rpm	500						
Maximum operating speed	rpm	2700	2500	2500	2350	2200	2100	2000
Max delivery pressure: - continuous - intermittent	bar	420 500						
Inlet pressure:	bar abs	from 0.8 up to 20 bar (see par. 12)						
Max housing pressure	bar	1,5						
Max power ( $\Delta p = 420$ bar): - at 1500 rpm - at max rotation speed	kW	57.8 104	79.7 132.8	110.3 183.8	142.5 223.2	173.8 254.9	220.6 308.8	296 394.7
Max absorbed torque: $\Delta p = 100$ bar $\Delta p = 420$ bar	Nm	87 368	121 507	167 702	216 907	263 1106	334 1404	446 1884
Moment of inertia on the shaft	kgm <sup>2</sup> x 10 <sup>-2</sup>	0,79	0,79	1,44	2,15	3,41	4,68	8,34

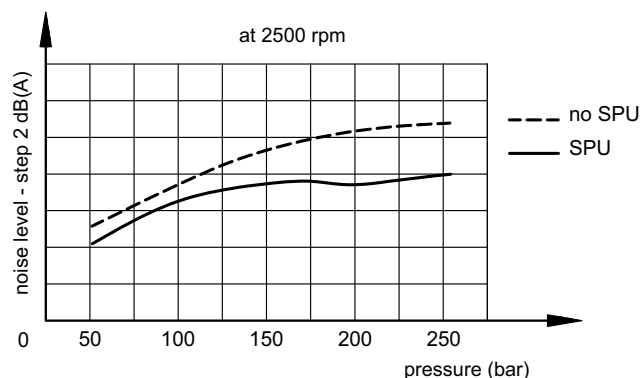
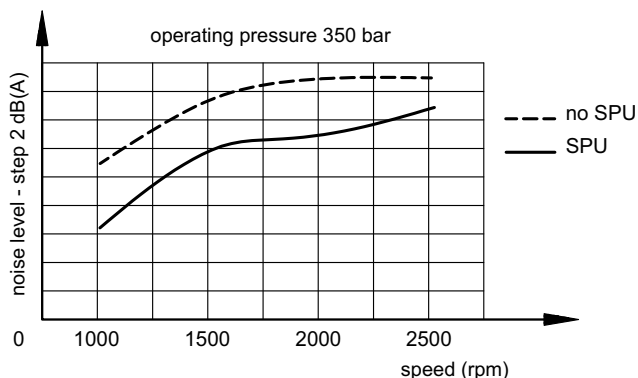
### 4 - NOISE REDUCTION DEVICE

All the HPR-02 hydraulic pumps are optimized with respect to pulsation characteristics and therefore noise generation. In addition to common primary measures such as exclusive use of noise-optimized port plates, the SPU noise reduction device is available.

Without affecting the functionality and efficiency of the pump, this system reduces pressure noise by up to 70%, irrespective of pressure, speed or temperature.

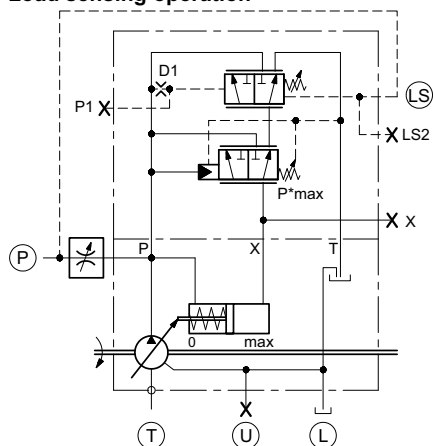
The SPU system is adaptive over the entire operating range. No setting up or maintenance is required.

#### Comparison of noise pressure levels for a HPR 75 pump with and without SPU



## 5 - LP6 - LOAD SENSING WITH PRESSURE CUT-OFF CONTROL

### Load sensing operation



This load sensing control allows the pump flow rate to be regulated according to the  $\Delta p$  pressure drop measured on both the sides of a throttle valve installed on the working line.

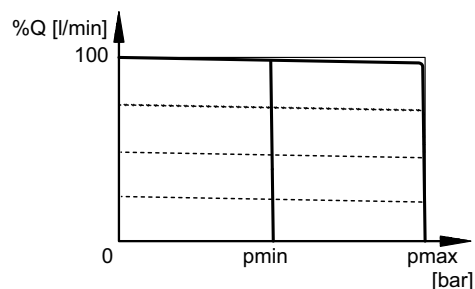
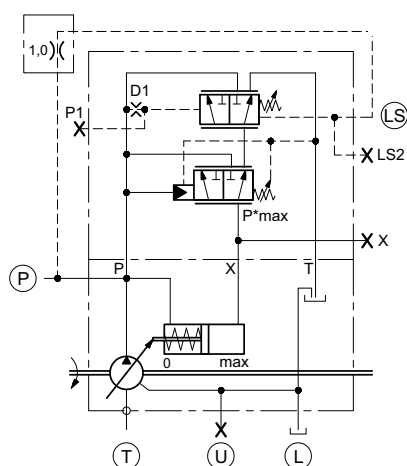
**NOTE:** The connection pipe between the LS port and the flow line downstream the restrictor (or valve) is always in customer's charge. **The restrictor is not supplied.**

The maximum operating pressure can be set manually adjusting the P\*max valve.

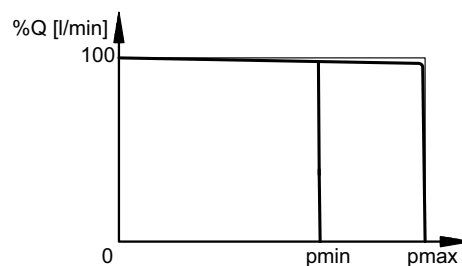
**LP\* FEATURES:**

- pressure adjustment range:  
**LP6** = 230 ÷ 350 (**standard**)  
default setting = 350 bar
- LP5** = 125 ÷ 230 (upon request)
- LP7** = 350 ÷ 420 (upon request)
- differential pressure regulating range = 16 ÷ 27 bar
- default setting = 20 bar

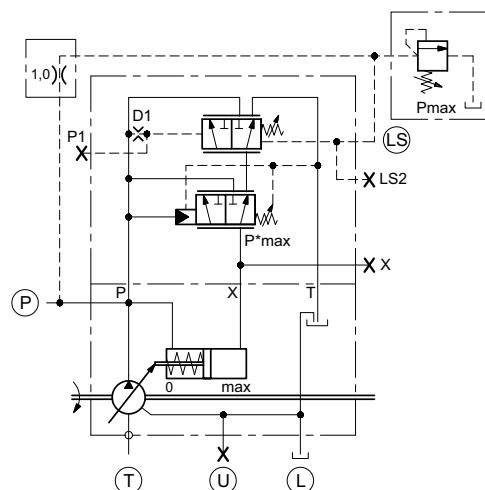
### Pressure control operation



Bypassing both P and LS ports with an external connection and an orifice (both in customer's charge) the pump will operate as pressure control that works at maximum displacement up to the set pressure  $P^*_{max}$ .

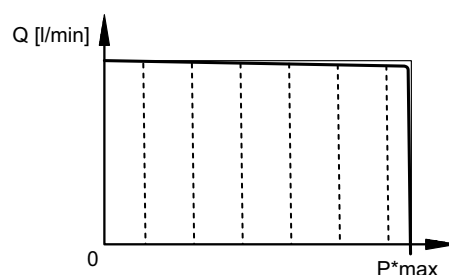


### Remote pressure operation

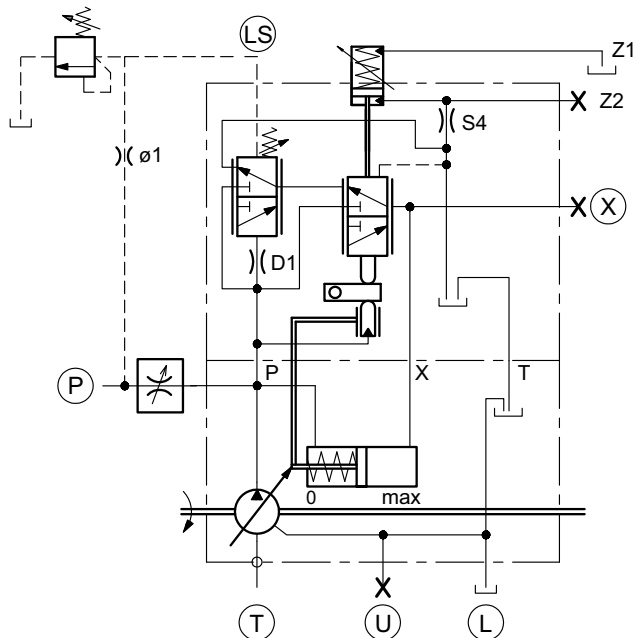


It is possible to create a remote pressure control by means of both an external pressure relief valve and an orifice (both in customer's charge) as shown in the schema.

This configuration allows to regulate remotely the maximum pressure up to  $P^{\text{max}}$ . When the pressure it's lower than the set value  $P^{\text{max}}$  the pump is at its maximum displacement.



### 6 - TL2 - LOAD SENSING WITH POWER CONTROL



The TL2 control is available for pumps HPR105, HPR135, HPR210 and HPR280.

This control combines the load sensing function typical of LP control with a power limiter with hyperbolic characteristic. Such limiter keeps the pump torque at a constant level by changing the displacement according to the delivery pressure, so that the absorbed power remains unchanged (at constant pump speed).

The Z1 port must always be connected to the tank separately and without back pressure. The Z2 port is plugged.

**NOTE:** The pipe connection between the LS port and the delivery of the pump, the orifice and the external pressure relief valve are always charged to the customer.

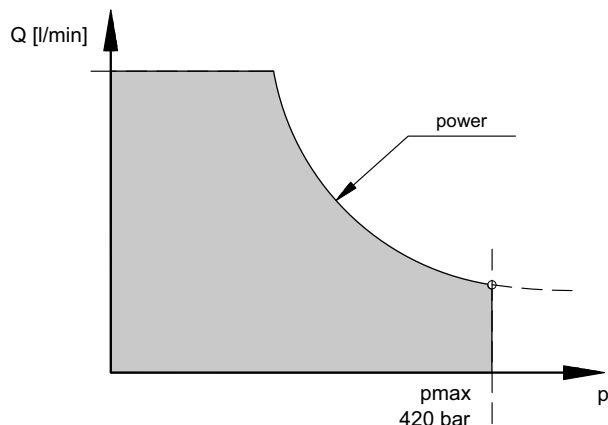
**NOTE:** The feature of the pressure cut-off is not present on this control, it is necessary to provide suitable external valve, as shown in the diagram at side.

#### TL2 FEATURES:

- differential pressure adjustment range = 16 ÷ 27 bar  
default setting = 20 bar
- pressure adjustment range for torque regulation:  
HPR105, HPR135 = 60 ÷ 250 bar  
HPR210, HPR280 = 80 ÷ 250 bar  
default setting = 250 bar

The power control is factory set. The setting value has to be specified with the order, by stating into the identification code the Nm torque value.

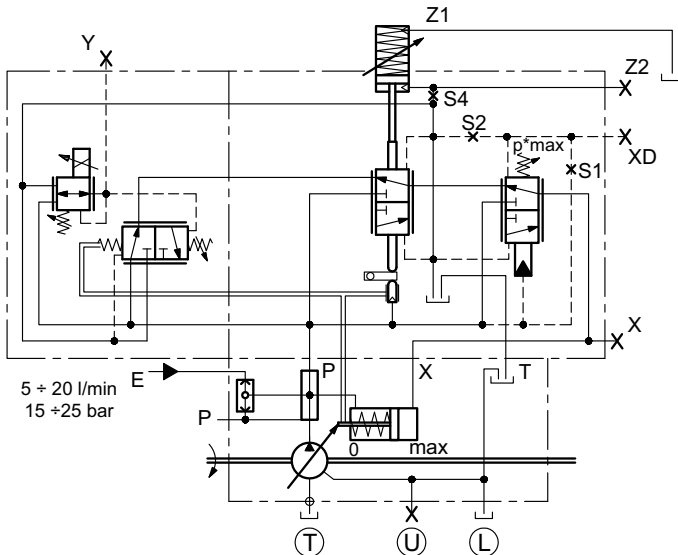
Start of the regulation: looking at values table below.



#### 6.1 - Standardized torque values

PUMPS	ELECTRICAL MOTOR 4 POLES (at 50 Hz)										
	Power [kW]	18.5	22	30	37	45	55	75	90	110	132
	N [rpm]	1500									
	torque [Nm]	118	140	191	236	286	350	477	573	700	840
105	start of pressure regulation [bar]	63	75	103	127	154	189	-	-	-	-
135		-	-	80	98	119	146	199	239	-	-
210		-	-	-	-	-	94	129	154	188	226
280		-	-	-	-	-	-	96	115	140	169

## 7 - ET6 - ELECTRO-PROPORTIONAL DISPLACEMENT CONTROL WITH POWER LIMITER AND REMOTE PRESSURE CUT-OFF



The ET6 control is available for pumps HPR105, HPR135, HPR210 and HPR280.

It combines a pump displacement regulation proportional to the current supplied to the solenoid with a constant input torque control. The limitation of maximum pressure is also available.

With no current the pump is in null displacement, so it is required a supply pressure on port E (located on the pump body) for the start of the control.

Once the P port is pressurized, then the shuttle valve on the pump excludes the piloting of port E and picks the fluid directly from the pump delivery line.

### ET6 FEATURES:

- pressure adjustment range:

**ET6** = 230 ÷ 350 (**standard**)  
default setting = 350 bar

**ET5** = 125 ÷ 230 (on request)

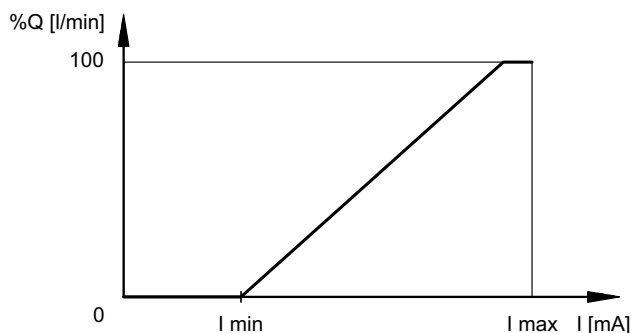
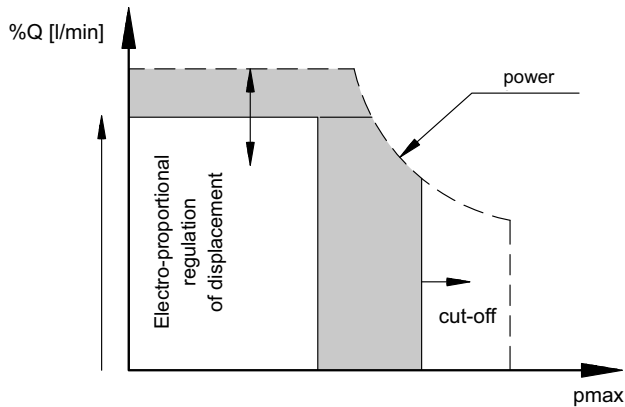
**ET7** = 350 ÷ 420 (on request)

- pressure adjustment range for torque regulation:

HPR105, HPR135 = 60 ÷ 250 bar

HPR210, HPR280 = 80 ÷ 250 bar

default setting = 250 bar



		D12K2	D24K2
Nominal voltage	V CC	12	24
Coil connection	AMP Junior (2 pin)		
Power consumption	W	15,6	
Nominal current	A	1,2	0,6
Relative duty cycle	100%		
Protection class (EN 60529)	IP 67		

regulation	pump	ET1	ET2
I min	<b>105, 135</b>	464 mA	232 mA
	<b>210</b>	490 mA	245 mA
	<b>280</b>	524 mA	262 mA
I max	<b>ALL</b>	1200 mA	600 mA





## 8 - PUMPS WITH LP6 CONTROL - OVERALL DIMENSIONS

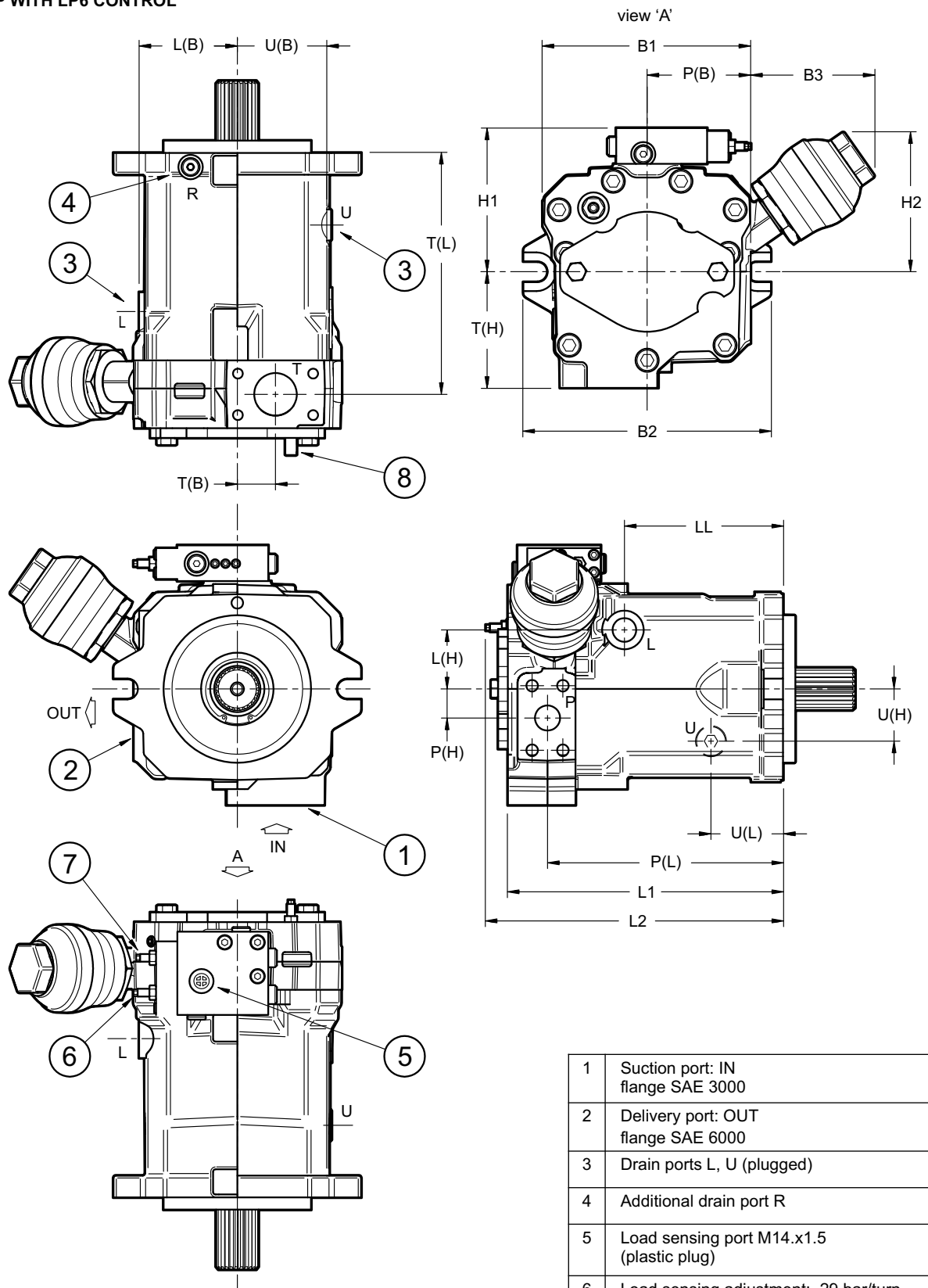
dimensions in mm

PUMP	55	75	105	135	165	210	280
Ø of flange	127			152.4		165.1	
L1	220.3	231.8	262	284.5	333.1	348	403
L2	259.3	270.8	301	323.5	372.1	387	442
H1	137	139	140.5	148.5	165.5	171.5	189
H2	146	146	136	145.5	152.4	143.5	238
B1	11	190.3	199.6	216	251.5	268	306.1
B2	208		207	256	269	268.8	314.5
B3	120	111	122	129	128.9	126.5	125.1

PUMP	55	75	105	135	165	210	280
P delivery (SAE)	3/4"		1"	1 1/4"		1 1/2"	
P (L)	182.8	194.3	218	243.5	283.1	295	344.5
P (H)	23.5		26	30	43	27	46
P (B)	91	90.5	100	107	134.5	134.5	149.5
T suction (SAE)	1 1/2"		2"	2"	2 1/2"	3"	3 1/2"
T (L)	189.8	201.3	227	249.5	285.6	298	344.5
T (H)	94		103.5	120	119	149	167
T (B)	21		25	30	0	57	
L, U drain ports	M22x1.5			M27x2			M33x2
L (L)	112.8	124.3	142	164	180.6	197.5	215.5
L (H)	52		53	61	65	71.5	80.5
L (B)	86.5		85	101.5	108	128	145
U (L)	72		72	74.5	81.1	83	109
U (H)	44		54	54	62	60	68
U (B)	78.5		92.5	92.5	101	118	129.5
R - additional drain port	M14x1.5, 13 deep ( <b>NOTE</b> )						

**NOTE:** If the pump is set vertically with shaft upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

## PUMP WITH LP6 CONTROL



1	Suction port: IN flange SAE 3000
2	Delivery port: OUT flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	Load sensing port M14.x1.5 (plastic plug)
6	Load sensing adjustment: 29 bar/turn
7	P*max adjustment: 22.8 bar/turn
8	Max displacement limit adjustment see par. 11



## 9 - SINGLE PUMPS WITH TL2 CONTROL - OVERALL DIMENSIONS

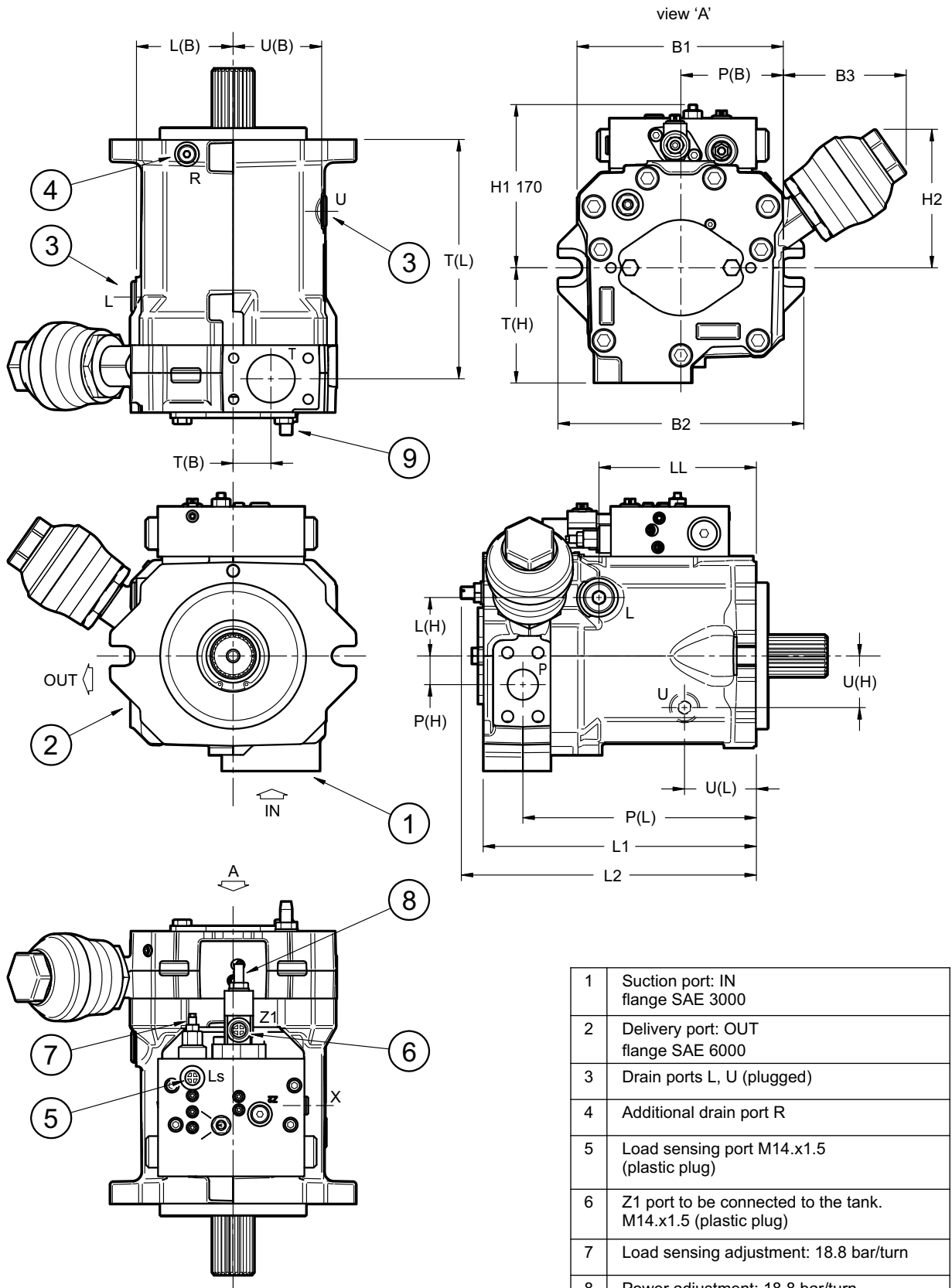
dimensions in mm

PUMP	105	135	210	280
Ø flange	127	152.4	165.1	165.1
L1	262	284.5	348	403
L2	301	323.5	387	442
H1	163	170	193	210.5
H2	134	144	144.3	200.7
H3	104.5	104	135	135
B1	194.5	214.8	266.3	314.5
B2	208	256.5	269	272
B3	118	106.7	102.4	119.5

PUMP	105	135	210	280
P delivery (SAE)	1"	1¼"	1½"	
P (L)	218	243.5	295	344.5
P (H)	26	30	27	46
P (B)	100	107	144.5	154.1
T suction (SAE)	2"	2"	3"	3½"
T (L)	227	249.5	298	344.5
T (H)	104	120	149	167
T (B)	25	39.5	27	44
L, U drain ports	M22x1.5	M27x2	M27x2	M33x2
L (L)	142	164	191	215.5
L (H)	53	61	97.5	80.5
L (B)	92.5	101	128	129.5
U (L)	72	74.5	83	109
U (H)	54	54	60	68
U (B)	85	92	118	159.5
R - additional drain port	M14x1.5 deep 13 (NOTE)			

**NOTE:** If the pump is set vertically with shaft upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

## PUMP WITH TL2 CONTROL





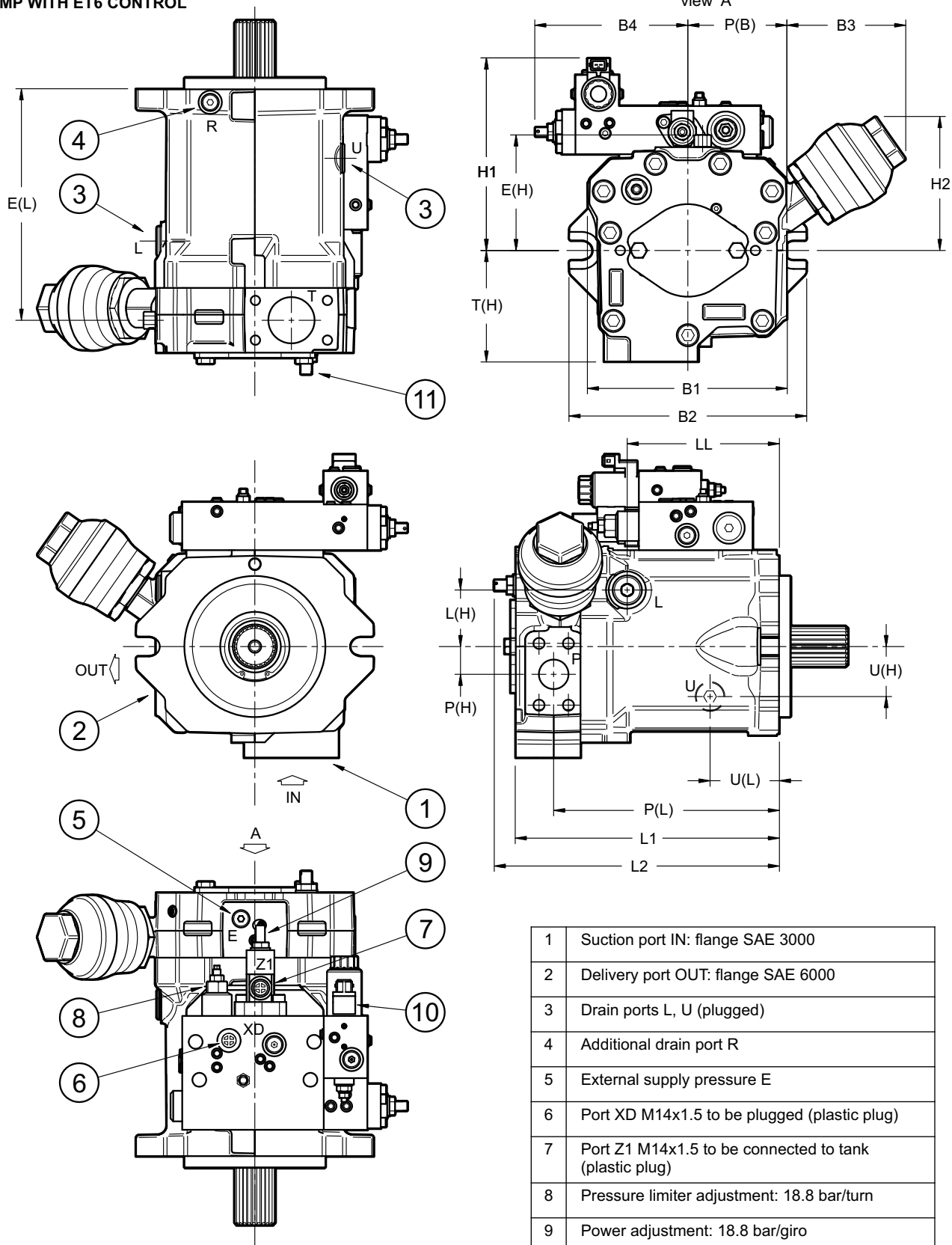
## 10 - SINGLE PUMPS WITH ET6 CONTROL - OVERALL DIMENSIONS

PUMP	105	135	210	280
Ø flange	127	152.4	165.1	165.1
L1	262	284.5	348	403
L2	301	323.5	387	442
L3	108.9	82.8	138.5	168
H1	200.5	207.5	230.5	248
H2	134	144	144.3	200.7
H3	104.5	104	135	135
B1	194.5	214.8	266.3	314.5
B2	208	256.5	269	272
B3	118	106.7	102.4	119.5
B4	165	165	165	146.5

PUMP	105	135	210	280
P delivery (SAE)	1"	1¼"	1½"	
P (L)	218	243.5	295	344.5
P (H)	26	30	27	46
P (B)	100	107	144.5	154.1
T suction (SAE)	2"	2"	3"	3½"
T (L)	227	249.5	298	344.5
T (H)	104	120	149	167
T (B)	25	39.5	27	44
L, U drain ports	M22x1.5	M27x2	M27x2	M33x2
L (L)	142	164	191	215.5
L (H)	53	61	97.5	80.5
L (B)	92.5	101	128	129.5
U (L)	72	74.5	83	109
U (H)	54	54	60	68
U (B)	85	92	118	159.5
R - additional drain port	M14x1.5 deep 13 (NOTE)			
E - external supply pressure	M14.x1.5			
E (L)	240.8	249.5	303	375
E (H)	135.6	142.6	165.6	183.1
E (B)	15	16	20	20

**NOTE:** If the pump is set vertically with shaft pointing upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

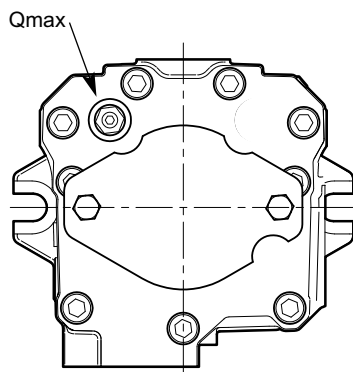
## PUMP WITH ET6 CONTROL



1	Suction port IN: flange SAE 3000
2	Delivery port OUT: flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	External supply pressure E
6	Port XD M14x1.5 to be plugged (plastic plug)
7	Port Z1 M14x1.5 to be connected to tank (plastic plug)
8	Pressure limiter adjustment: 18.8 bar/turn
9	Power adjustment: 18.8 bar/giro
10	Valve for proportional control of displacement AMP Junior connection
11	Max displacement limit adjustment see par. 11

## 11 - MAXIMUM DISPLACEMENT LIMITATION

The max angle for the swash plate is adjustable. The adjustment screw is placed on pump back. Values for pumps with rotary clockwise.

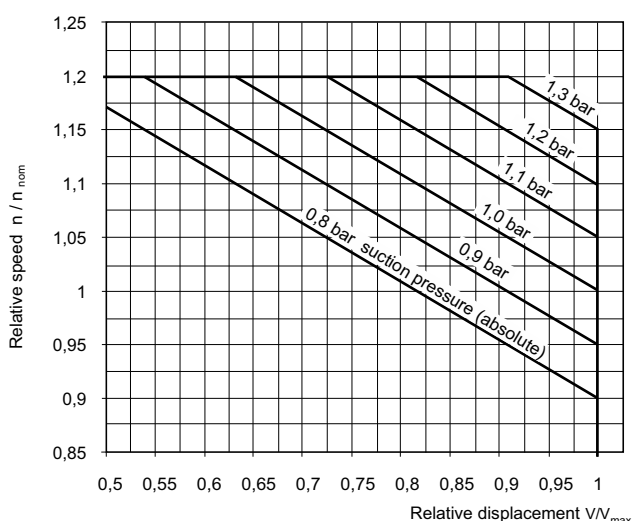


	Q max (cm <sup>3</sup> /turn)	displacement range (cm <sup>3</sup> )
55	4.9	35 - 55
75	5.2	50 - 75
105	6.2	75 - 105
135	7	105 - 135
165		135 - 165
210	9.4	165 - 210
280		210 - 280

## 12 - INSTALLATION AND START-UP

It is recommended to install the pump below the oil level and horizontally as shown. For installations above oil level and / or vertically, contact our technical dept. The maximum allowed input speed is also directly dependent on the suction pressure.

The temperature should not exceed 80 °C in any part of the system.



### Suction

- Provide suction/inlet line continuously rising towards the tank.
- Avoid cavitation events providing adequate flooded suction or pressurized inlet should be of adequate supply as to guard against cavitation.
- On designing the suction line attention must be paid to a straight, short conduct largely avoiding bends. If bends are required, the bending radius must be as large as possible. The suction inlet in the hydraulic tank must have as largest section as possible.
- The suction line itself must be installed in such a way that it ends more than  $\geq 100$  mm above the tank bottom. In order to enlarge the entry diameter of the suction boss in the hydraulic tank, its end must be cut under  $45^\circ$ . The distance between entry and oil surface must be large enough to avoid air suction, recommended  $\geq 200$  mm.
- Take care of the tightness of the pipe/hose so that air is not drawn in.

### Case drain

- Positive venting is vital for the correct operation of the hydraulic system.
- **The pump must be always filled with oil, both at start-up and during stops, also long term stops.**
- All case drain lines must be mounted continuously rising towards the tank. This allows any entrapped air to escape freely from the pump housing.
- **The highest case drain port of the pump housing (ports U, L and R) must be connected separately to the tank.** As a rule drain lines have to be kept separate from the main return line. The drain line has to enter the hydraulic tank below the oil level.
- The dimension must be ample enough that even at low temperatures the return flow pressure of the leak oil will be near zero. The case pressure (build-up) should not rise and stay higher than 2.5 bar(absolute) during operation.

### Piping

- Pipe work should be seamless drawn precision steel tube or hoses of suitable pressure rating.
- During installation, attention should be paid to cleanliness. The pipes must be deburred, washed and blown through.
- Scaled or rusted pipes must be scoured and then neutralized - Hoses must be brushed and flushed through when contaminated.

### Cleanliness

- Oil tank and installation have to be checked again for cleanliness before the hydraulic medium is added. This procedure has to be performed immediately before pouring takes place. It may even be expedient to flush the entire installation! Make sure that the pressure fluid corresponds to the required grade of cleanliness.

### Drive rotation

- **Before starting the engine** make sure that the HPR-02 pump will be driven with the correct direction of rotation. With electric motors, it must be checked that the electrical connections are correct.

### Filling pump and circuit:

- The initial filling of the system must be carried out in such a way that all of the air can escape from the high pressure circuit and from the pump housing before the hydraulic units are operated.
- **The suction port and the casing of the HPR-02 are not related to each other.** Before the hydraulic components may be exposed to load, the entire circuit must be filled and vented.

- Manually fill the HPR-02 pump at the most accessible case drain port with filtered oil. Manually fill the high pressure line with filtered oil. Fill the oil tank to the maximum level with filtered oil and fill all motor housings to the maximum level via the most accessible case drain port with filtered oil.

### Start-up

- If there is an on/off valve in the suction line, make sure it is completely open before starting the engine.
- Start the electric motor and allow the HPR-02 to rotate for 5 seconds.
- Switch engine off and check fluid level in the tank. Top off if necessary. Before restarting the engine, check the installation for tightness.
- Repeat previous steps at least four more times.
- Start the electric motor, then slowly actuate the pump function to allow the pump to increase to maximum displacement. Leave the function fully actuated for 30 seconds, and then repeat the step three times.

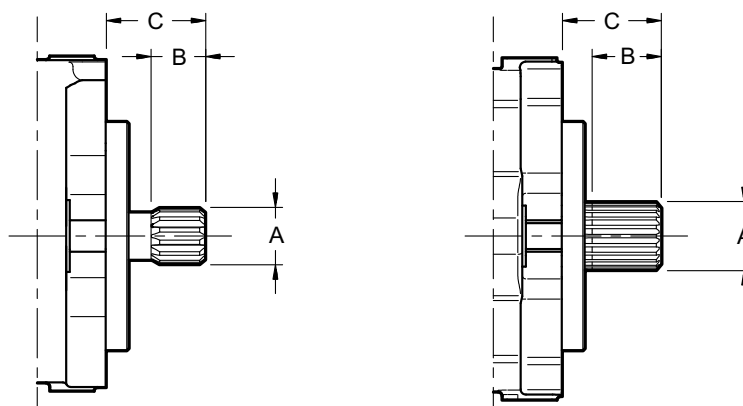
- Warm the system up by steadily increasing the pressure so as to allow any air to be purged from the fluid.
- Check the HPR-02 stand-by pressure, load sense margin pressure, pressure compensator setting (if applicable) and maximum flow setting when the hydraulic oil reaches its normal operating temperature.
- Check the oil level in the tank and refill with filtered oil if necessary before delivery of the machine.

## 13 - FLANGES AND SHAFTS

### 13.1 - Mounting flanges and splined shafts available as standard (SAE J774)

PUMP	55	75	105	135	165	210	280
Front mounting flange	SAE C - 2 holes			SAE D - 2 holes ( <b>NOTE</b> )		SAE E - 4 holes	
Pilot diameter	127			152,4		165,1	
Shaft	SAE C 14 t 12/24 DP		SAE C-C 17 t 12/24 DP	SAE D 13 t 8/16 DP		SAE F 15t 8/16 DP	
	-	21t 16/32	23t 16/32	27t 16/32		-	

**NOTE:** HPR165 has also 4 additional holes Ø17.5

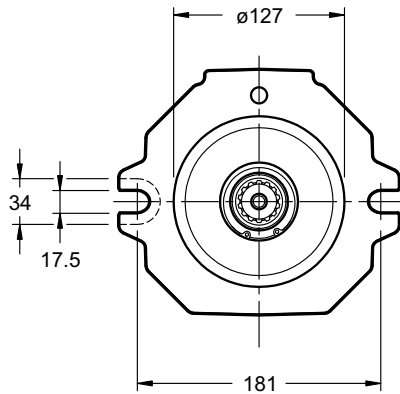


Shaft	SAE- J744 code	Type	A	B	C				
					HPR 55	HPR 75	HPR 105	HPR 135 /165	HPR 210 / 280
14 T 12/24 DP	SAE C	with undercut	31.22	30	54	55	-	-	-
21t 16/32		no undercut	34.51	39.5	-				
17 t 12/24 DP	SAE C-C	with undercut	37.68	30		55			
23t 16/32		no undercut	37.68	38.5			-		
13 t 8/16 DP	SAE D	with undercut	43.71	50		75			
27t 16/32		no undercut	44.05	62				-	
15t 8/16 DP	SAE F	no undercut	50.06	58	-	75			

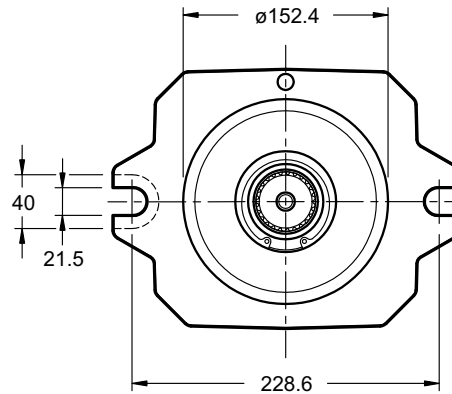


## 13.2 - Flanges

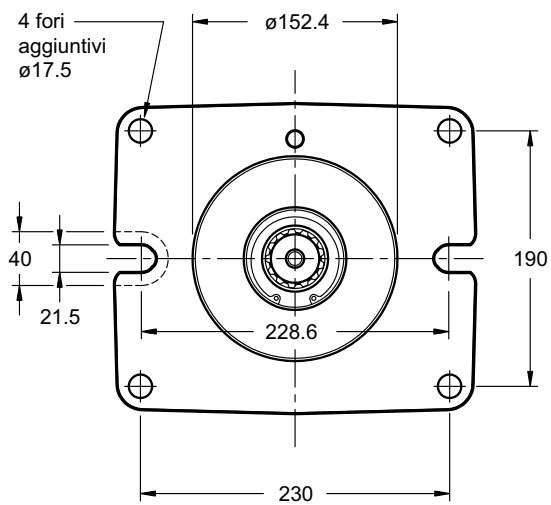
**SAE C, 2 holes**  
for HPR 55, 75, 105



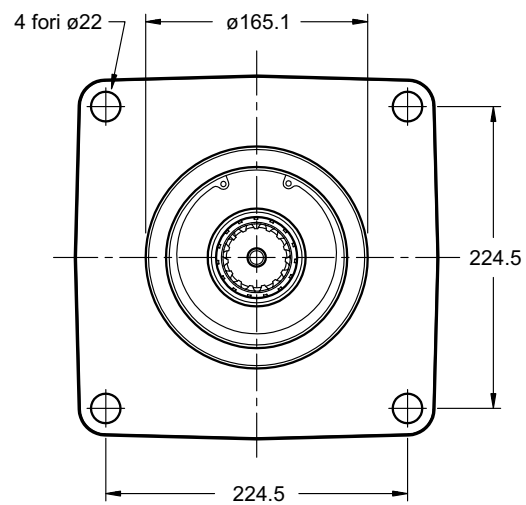
**SAE D, 2 holes**  
for HPR 135



**SAE D, 2 + 4 holes**  
for HPR 165



**SAE E - 4 holes**  
for HPR 210 and 280



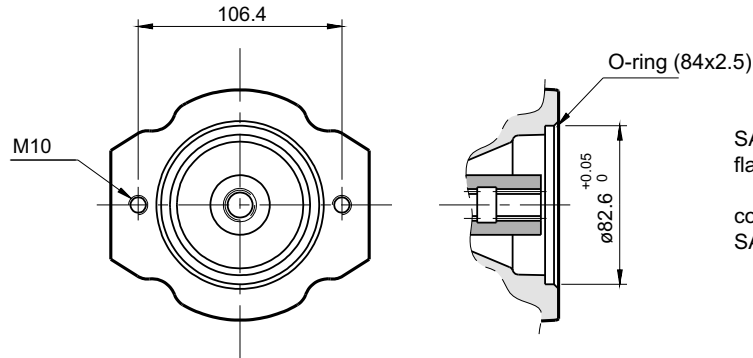
PUMP	55	75	105	135	165	210	280
flange thickness near fastening holes (mm)	20				25	26	30

## 14 - PTO - POWER TAKE OFF

The HPR pumps can be supplied with a power take-off SAE J744 type, which allows coupling with other pumps models. As for identification see par. 1 "Identification code".

### SAE A

identification code **A09**

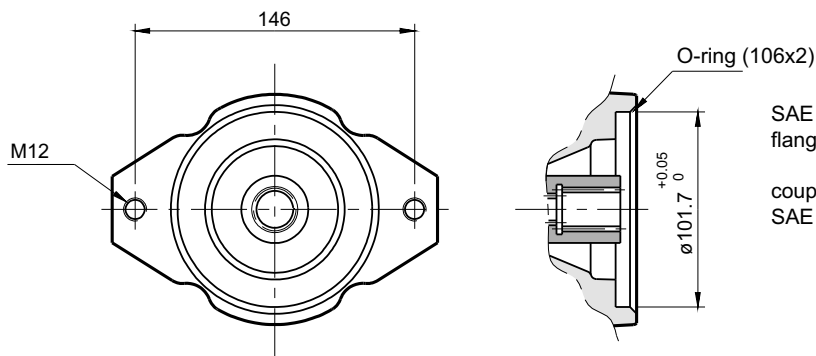


SAE J744 - 2 holes intermediate flange type "A"

coupling for splined shaft  
SAE J744 16/32 D.P. - 9T

### SAE B

identification code **B13**

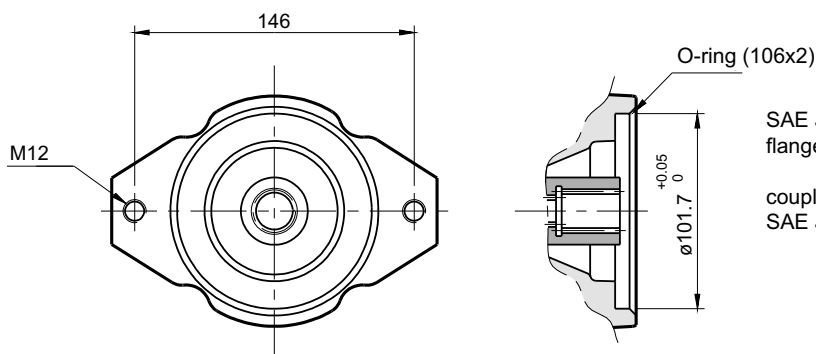


SAE J744 - 2 holes intermediate flange type "B"

coupling for splined shaft  
SAE J744 16/32 D.P. - 13T

### SAE BB

identification code **B15**

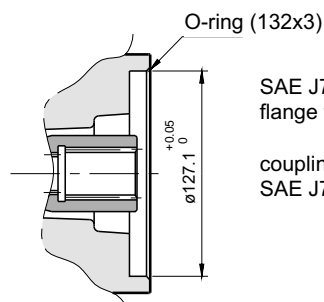
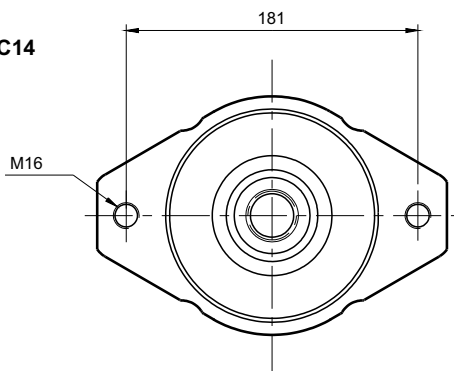


SAE J744 - 2 holes intermediate flange type "B"

coupling for splined shaft  
SAE J744 16/32 D.P. - 15T

## SAE C

identification code **C14**



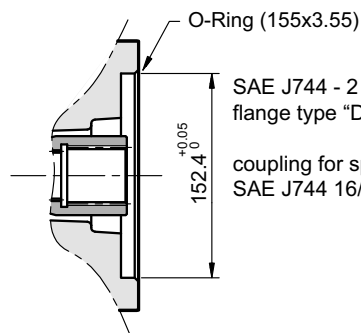
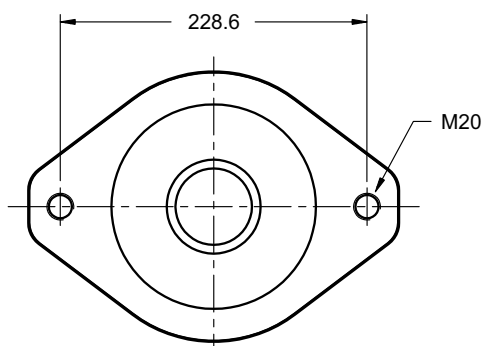
SAE J744 - 2 holes intermediate flange type "C"

coupling for splined shaft  
SAE J744 12/24 D.P. - 14T

## SAE D

identification code **D27**

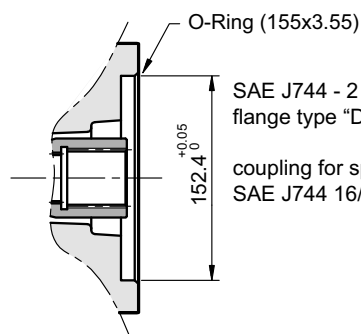
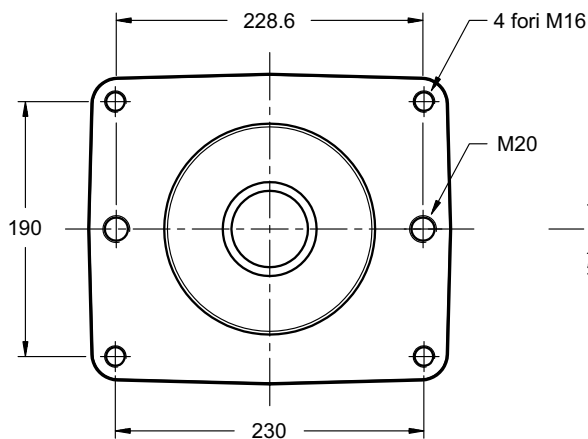
**HPR 135**



SAE J744 - 2 holes intermediate flange type "D"

coupling for splined shaft  
SAE J744 16/32 D.P. - 27T

**HPR 165 / 210**

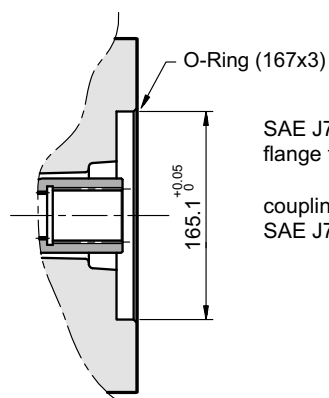
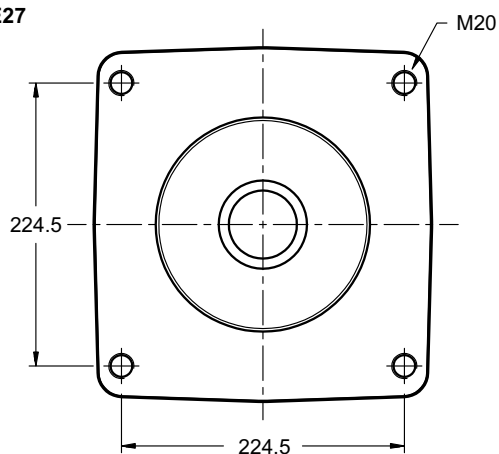


SAE J744 - 2 holes intermediate flange type "D"

coupling for splined shaft  
SAE J744 16/32 D.P. - 27T

## SAE E

identification code **E27**



SAE J744 - 4 holes intermediate flange type "E"

coupling for splined shaft  
SAE J744 16/32 D.P. - 27T

## 15 - SUCTION AND DELIVERY PORTS DIMENSIONS FOR SAE FLANGE WITH METRIC BOLTS

T - SUCTION (SAE 3000)					
Pump	nominal size	A mm	B mm	C mm	D Threading and depth mm
55, 75	1 ½"	38	69.9	35,7	M12x16
105	2"	50	77,8	42.9	M12x16
135	2"	50	77,8	42.9	M12x17
165	2 ½"	64	88,9	50,8	*M12x21.5
210	3"	76.2	106,4	61,9	M16x28.5
280	3 ½"	90	120.7	69,9	M16x29

P - DELIVERY (SAE 6000)					
Pump	nominal size	A mm	B mm	C mm	D Threading and depth mm
55, 75	3/4"	19	50,8	23,5	M10x17
105	1"	21	57,2	27,8	M12x17
135	1 ¼"	32	66.7	31.8	M14x19
165	1 ¼"	32	66,6	31.8	*M12x18.5
210	1 ½"	38.1	79,3	36,5	M16x25.5
280	1 ½"	38.1	79,3	36,5	M16x29

(\*) deviation from standard

## 16 - CONNECTION FLANGES

dimensions in mm  
The fastening bolts and the O-Rings must be ordered separately

	Flange code	Flange description	P <sub>max</sub> [bar]	ØA	ØB	C	D	E	F	G	H	L	1 SHC screws	2
SAE 3000	0610714	SAE - 1 ½"	210	1 ½" BSP	38	25	45	24	35,7	70	78	94	n° 4 - M12x40	OR 4187 (47.22x3.53)
	0610721	SAE - 2"	210	2" BSP	51	25	45	30	43	77,8	90	102	n° 4 - M12x40	OR 4225 (56.74x3.53)
	0610722	SAE - 2 ½"	172	2 ½" BSP	63	25	50	30	50,8	89	105	116	n° 4 - M12x45	OR 4275 (69,44x3.53)
	0610723	SAE - 3"	138	3" BSP	73	27	50	34	61,9	106,3	124	134	n° 4 - M16x55	OR 4337 (85.32x3.53)
	0610724	SAE - 3 ½"	34	3 ½" BSP	89	27	48	34	69,8	120,6	136	152	n° 4 - M16x55	OR 4387 (98,02x3.53)
SAE 6000	0770075	SAE - 3/4"	420	3/4" BSP	19	21	35	22	23,8	50,8	55	71	n° 4 - M10x35	OR 4100 (24.99x3.53)
	0770092	SAE - 1"	420	1" BSP	25	25	42	24	27,7	57,1	65	81	n° 4 - M12x40	OR 4131 (32.93x3.53)
	0770106	SAE - 1 ¼"	420	1 ¼" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x45	OR 4150 (37.69x3.53)
	0773462	SAE - 1 ½"	420	1 ½" BSP	38	30	94	26	36,5	79,3	94	112	n° 4 - M16x55	OR 4187 (47.22x3.53)



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# CR

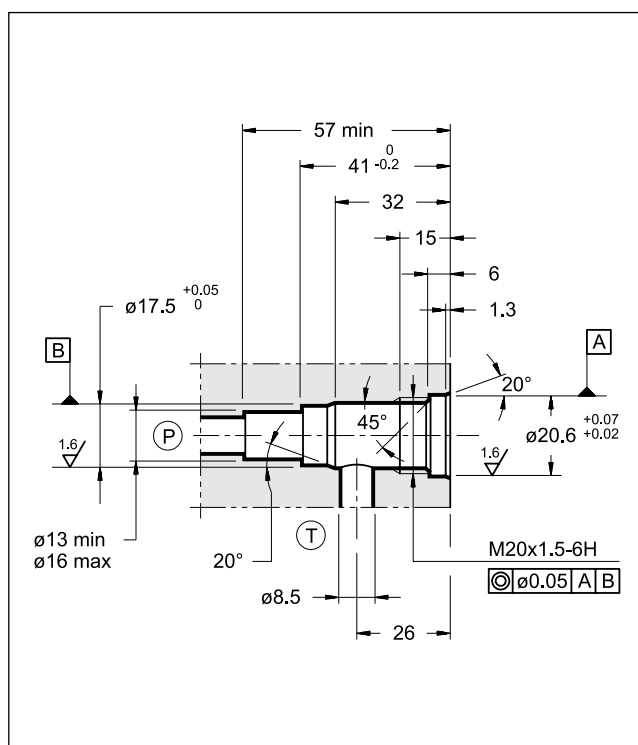
## DIRECT OPERATED PRESSURE CONTROL VALVE SERIES 22

### CARTRIDGE TYPE

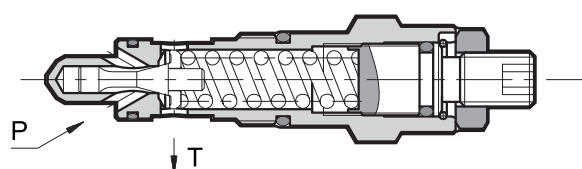
**p** max **350** bar

**Q** max **50** l/min

### SEAT DIMENSIONS: D-10B



### OPERATING PRINCIPLE

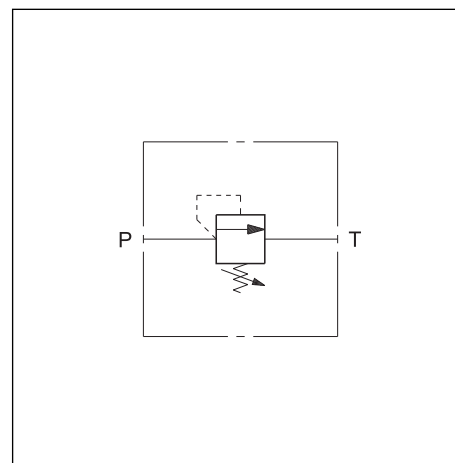


- The CR valve is a direct operated pressure control valve cartridge type that can be used in blocks or panels with type D-10B seat.
- It is normally used to control the maximum pressure in the hydraulic circuits or as a limiting device for pressure peaks generated during hydraulic actuator movement variation.
- It is available in five different pressure control ranges up to 350 bar.
- The circuit pressure acts on the shutter which is directly loaded by a spring on the opposite side. Once the set pressure is reached, the shutter opens, and discharges the excess flow in port T connected directly to the reservoir.
- The pressure can be adjusted by a screw, usually supplied as the countersunk hex type, equipped with locking nut and maximum adjustment limiter.

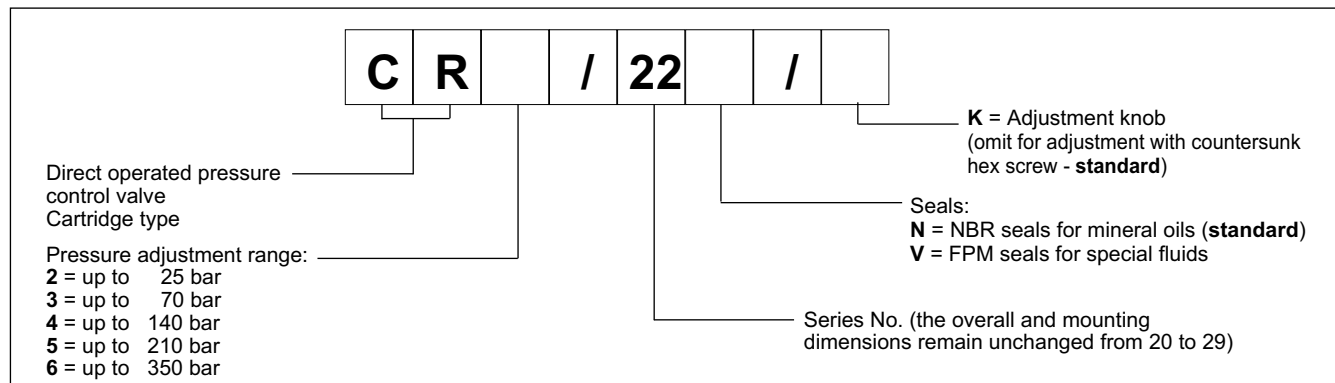
### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	50
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,16
Surface treatment: electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

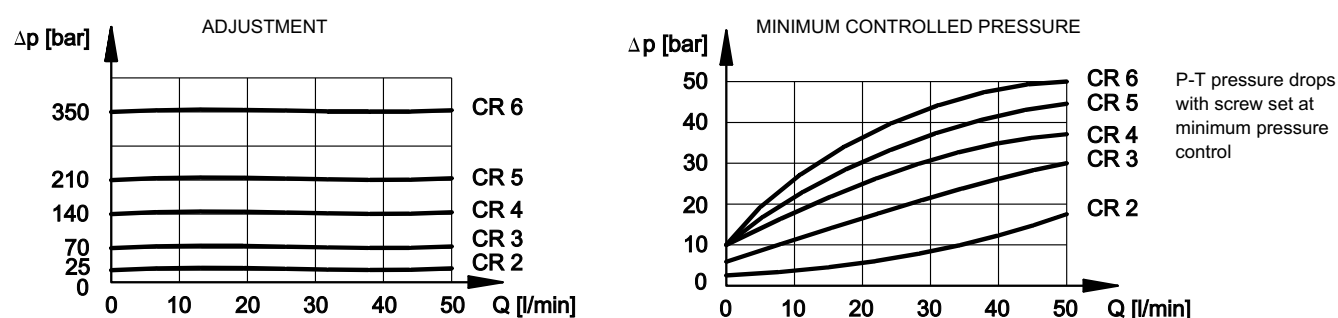
### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE



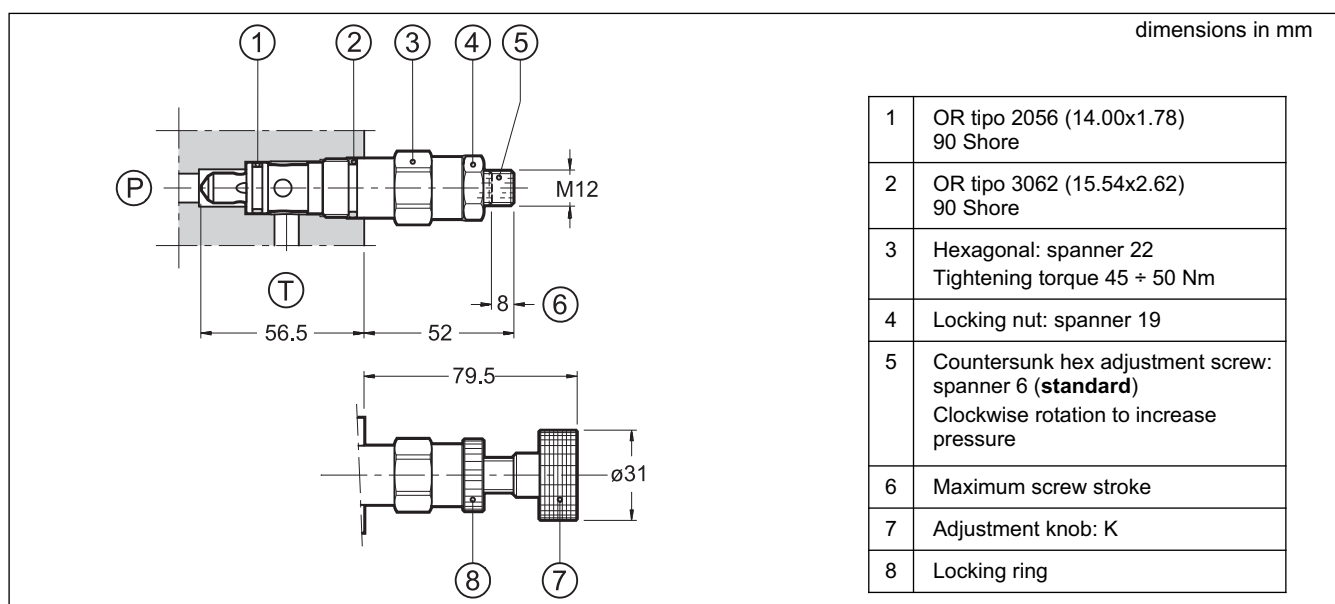
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





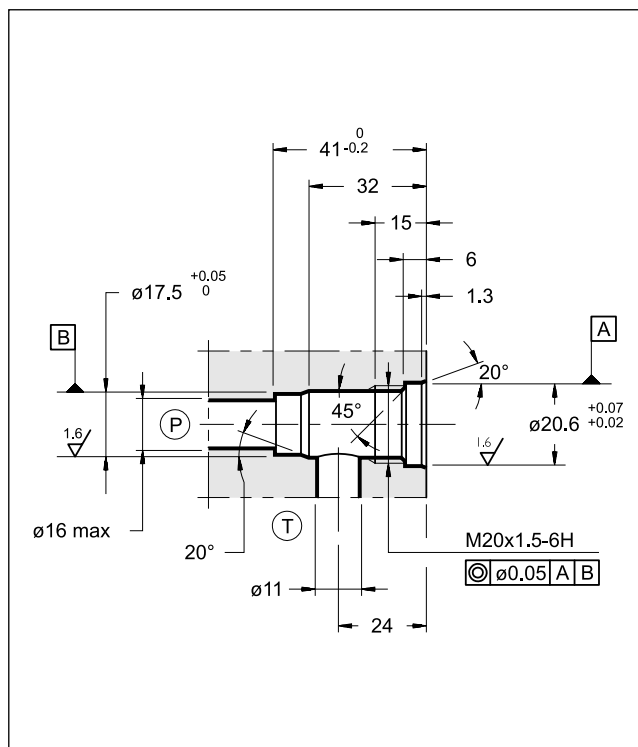
# CRQ

## PILOT OPERATED PRESSURE CONTROL VALVE SERIES 12

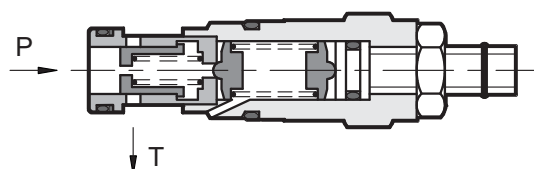
### CARTRIDGE TYPE

**p** max **350** bar  
**Q** max **100** l/min

### SEAT DIMENSIONS: D-10C



### OPERATING PRINCIPLE

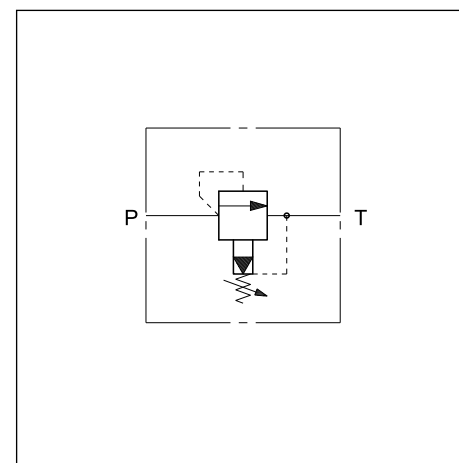


- The CRQ valve is a pilot operated pressure control valve cartridge type that can be used in blocks or panels with D-10C type seat.
- It is normally used to control the hydraulic circuit pressure and allows use of the entire flow of the pump even at pressure values near the set value.
- It is available in four different pressure control ranges up to 350 bar.
- It consists of a main balanced type spool and a pilot stage. The main spool, normally closed, opens when the circuit pressure exceeds the set value generated by the pilot stage, discharging the excess flow in port T, directly connected to the tank.
- The pressure is adjustable with a screw, usually supplied as the countersunk hex type, equipped with locking nut and with maximum adjustment limiter.

### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,16
Surface treatment: electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

### HYDRAULIC SYMBOL

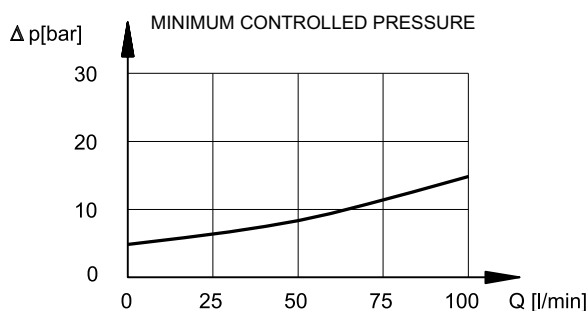
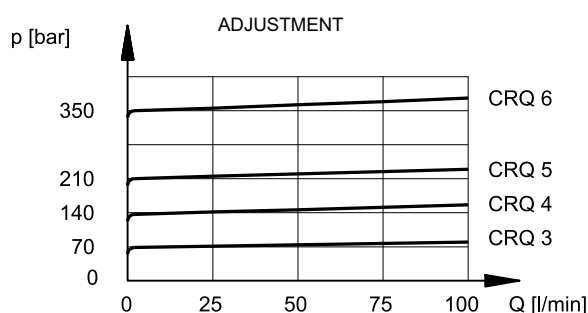




### 1 - IDENTIFICATION CODE

<b>C</b>	<b>R</b>	<b>Q</b>		<b>/</b>		<b>/</b>	<b>12</b>	<b>/</b>	
Pilot operated pressure control valve Cartridge type								Seals: omit for mineral oils <b>V</b> = viton for special fluids	
Pressure adjustment range:							Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)		
3 = up to 70 bar							<b>M1</b> = Adjustment knob (omit for adjustment with countersunk hex screw)		
4 = up to 140 bar									
5 = up to 210 bar									
6 = up to 350 bar									

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS

Technical drawing of a CRQ valve assembly showing two views: a side view and a front view.

**Side View Dimensions and Callouts:**

- Callout 1: OR type 2056 (14.00x1.78) 90 Shore
- Callout 2: Parbak 8-015 (14.81x1.14x1.35)
- Callout 3: OR type 3062 (15.54x2.62) 90 Shore
- Callout 4: Hexagonal: spanner 22
- Callout 5: Locking nut: spanner 17
- Callout 6: Maximum adjustment limiting device
- Callout 7: Countersunk hex adjustment screw: spanner 5
- Callout 8: Maximum screw stroke
- Callout 9: Adjustment knob: M1

**Dimensions:**

- 41 mm: Distance from seal to limiting device
- 50 mm: Distance from limiting device to adjustment screw
- 6 mm: Distance from adjustment screw to front view
- 66 mm: Length of adjustment knob
- 32 mm: Diameter of adjustment knob
- M10x1.25: Thread of adjustment screw

dimensions in mm

1	OR type 2056 (14.00x1.78) 90 Shore
2	Parbak 8-015 (14.81x1.14x1.35)
3	OR type 3062 (15.54x2.62) 90 Shore
4	Hexagonal: spanner 22 Tightening torque 45 ÷ 50 Nm
5	Locking nut: spanner 17
6	Maximum adjustment limiting device
7	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
8	Maximum screw stroke
9	Adjustment knob: M1



# PRK10

PILOT OPERATED  
PRESSURE CONTROL VALVE  
SERIES 11

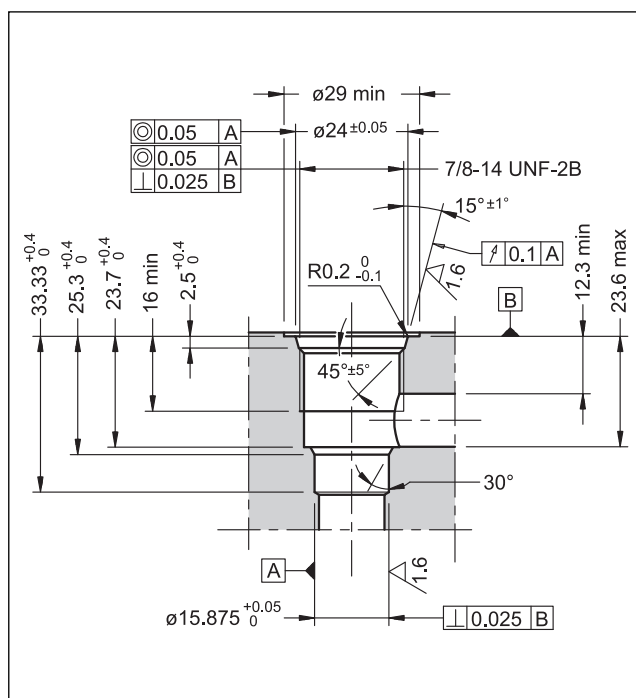
## CARTRIDGE TYPE

seat 7/8-14 UNF-2B (SAE - 10)

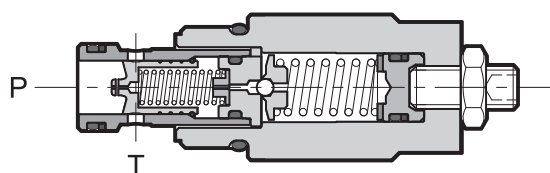
**p max 350 bar**

**Q max 120 l/min**

**SEAT DIMENSIONS: 7/8 - 14 UNF-2B (SAE - 10)**



## OPERATING PRINCIPLE



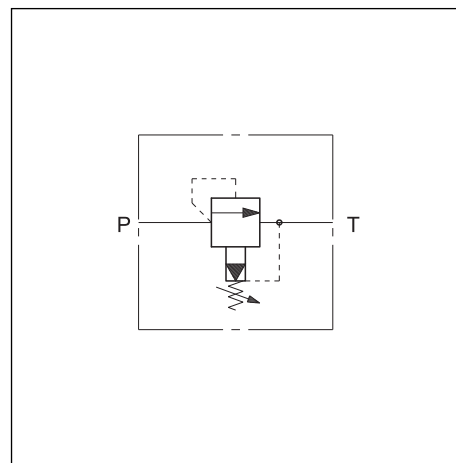
- The PRK10 valve is a pilot operated pressure control valve, cartridge type, that can be used in blocks or panels with 7/8-14 UNF-2B (SAE - 10) type seat.
- It is used to control the hydraulic circuit pressure and allows use of the entire flow of the pump even at pressure values near the set value.
- It consists of a main balanced type spool and a pilot stage. The main spool, normally closed, opens when the circuit pressure exceeds the set value generated by the pilot stage, discharging the excess flow in port T, directly connected to the tank.
- It's available in 4 pressure control ranges from 6 to 350 bar.
- The PRK10 are supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 h (test according to UNI EN ISO 9227 standards and test evaluation according to UNI EN ISO 10289 standards)
- The pressure is adjustable by a socket set screw with locking nut, or by knob.

## PERFORMANCES

(measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	120
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,2
Surface finishing: galvanic treatment	zinc-nickel	

### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE

<b>P</b>	<b>R</b>	<b>K</b>	<b>10</b>	<b>-</b>		<b>/</b>	<b>11</b>	<b>/</b>	
----------	----------	----------	-----------	----------	--	----------	-----------	----------	--

Pressure control valve, pilot operated

Cartridge type \_\_\_\_\_

Size \_\_\_\_\_

Pressure adjustment range: \_\_\_\_\_

**070** = from 6 to 70 bar (17 bar/turn)      **210** = from 6 to 210 bar (47 bar/turn)  
**140** = from 6 to 140 bar (32 bar/turn)      **350** = from 6 to 350 bar (78 bar/turn)

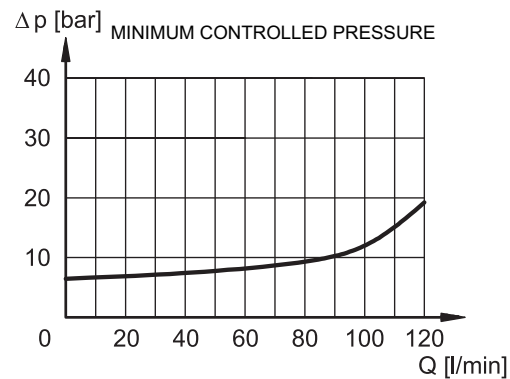
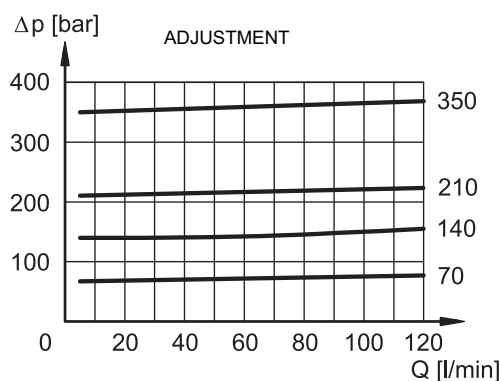
Option: **K** = Adjustment knob.  
Omit for adjustment with hex socket screw (**standard**)

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

### 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)

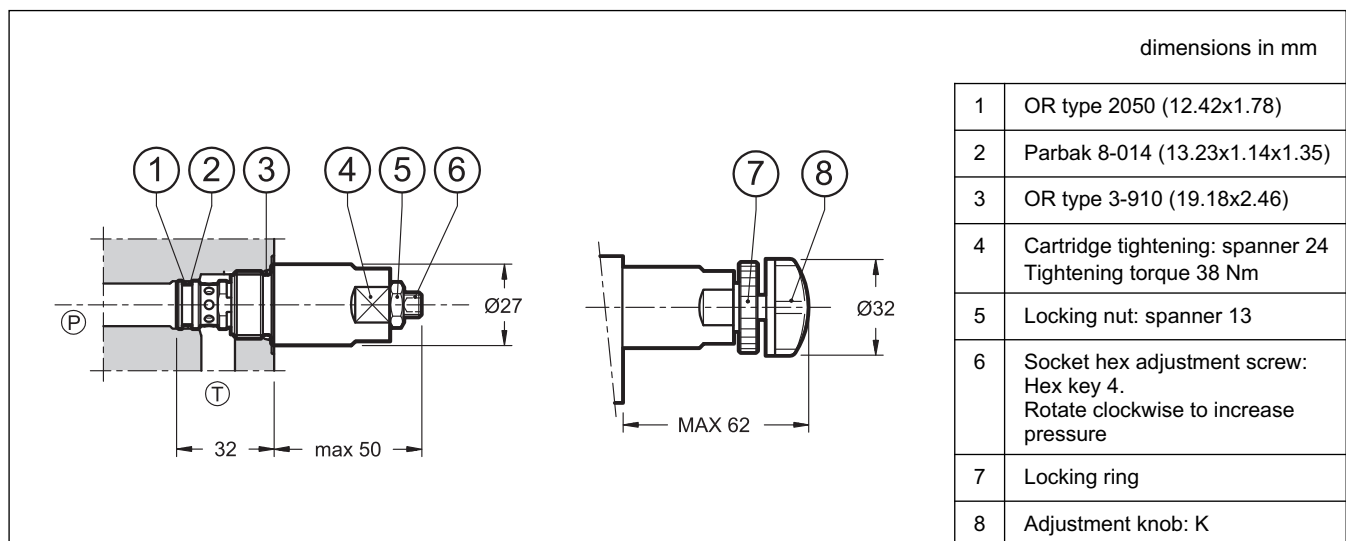


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





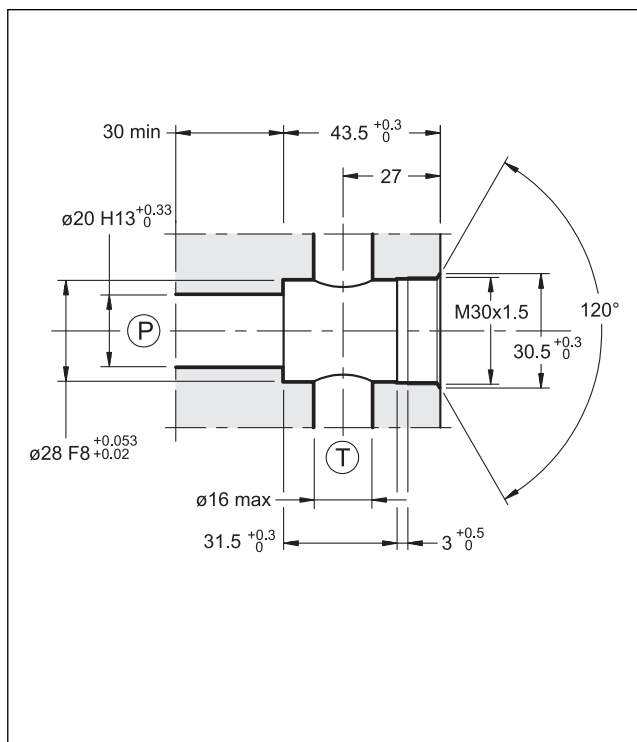
# DBV

## DIRECT OPERATED PRESSURE CONTROL VALVE SERIES 10

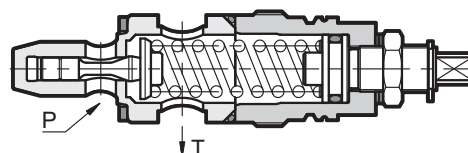
### CARTRIDGE TYPE

**p** max **380** bar  
**Q** max **120** l/min

### SEAT DIMENSIONS: D-10E



### OPERATING PRINCIPLE



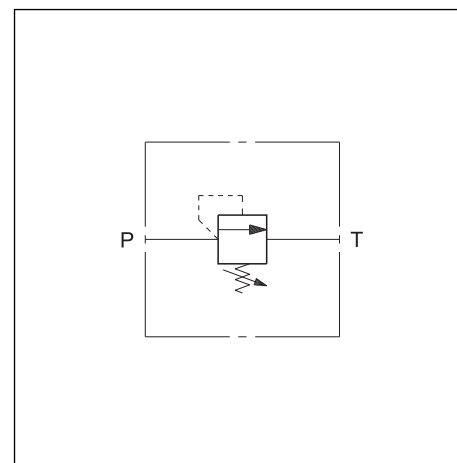
- The DBV valve is a direct operated pressure control valve cartridge type that can be used in blocks or panels with seat.
- It is normally used to control the maximum pressure in the hydraulic circuits or as a limiting device for pressure peaks generated during hydraulic actuator movement variation.
- It is available in different pressure control ranges up to 300 bar.
- The circuit pressure acts on the shutter which is directly loaded by a spring on the opposite side. Once the set pressure is reached, the shutter opens, and discharges the excess flow in port T connected directly to the reservoir.
- The pressure can be adjusted by a screw, equipped with locking nut and maximum adjustment limiter.

### PERFORMANCES

(measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	380
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	120
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,25
Surface treatment: electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE

D	B	V	-		/ 10	/	
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Direct operated pressure control valve  
Cartridge type

Pressure adjustment range:

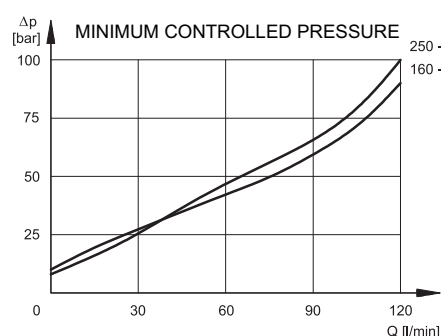
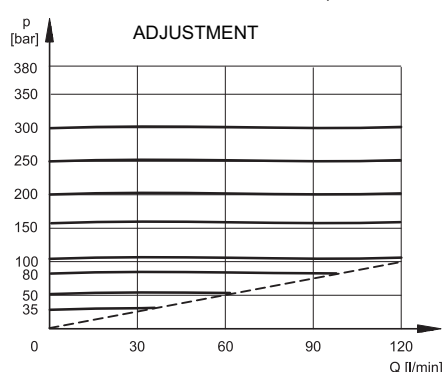
<b>035</b> = up to 35 bar	<b>160</b> = up to 160 bar
<b>050</b> = up to 50 bar	<b>200</b> = up to 200 bar
<b>080</b> = up to 80 bar	<b>250</b> = up to 250 bar
<b>100</b> = up to 100 bar	<b>300</b> = up to 300 bar

**K** = Adjustment knob  
(omit for adjustment with hex screw - **standard**)

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



P-T pressure drops with screw set at minimum pressure control

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS

1	Socket hex adjustment screw: spanner 8 ( <b>standard</b> ) Clockwise rotation to increase pressure
2	Locking nut: spanner 17
3	Hexagonal spanner 24 Tightening torque 70 ÷ 100 Nm
4	OR type 130 (22.22x2.62) 90 Shore
5	Maximum screw stroke
6	Adjustment knob: <b>K</b>

dimensions in mm



# PCK06

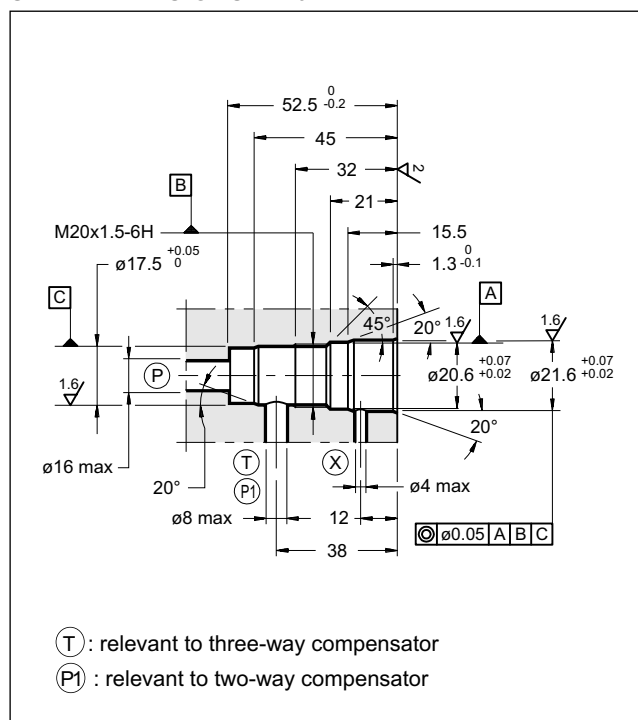
**TWO- AND THREE-WAY  
PRESSURE COMPENSATOR  
WITH FIXED OR VARIABLE  
ADJUSTMENT  
SERIES 10**

### CARTRIDGE TYPE

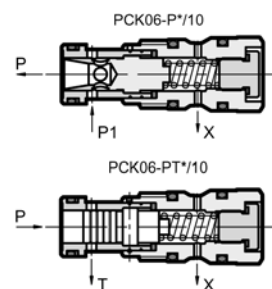
**p max 350 bar**

**Q max 40 l/min**

### SEAT DIMENSIONS D-10D



### OPERATING PRINCIPLE

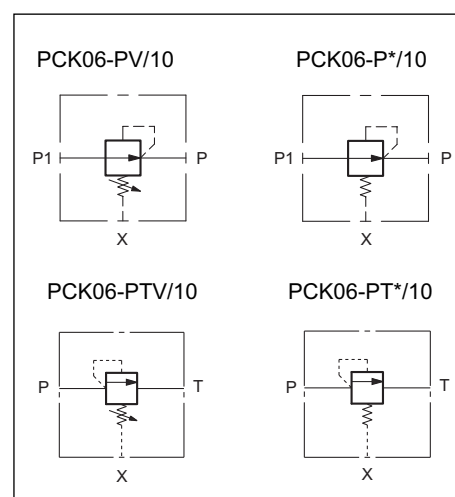


- The PCK06 valve is a two or three-way pressure compensator, cartridge type, for block or manifold application.
- It keeps the pressure drop (characteristic  $\Delta p$ ) between the P and the X pilot connections, at a constant level.
- It is normally used together with proportional directional valves, in order to control the flow rate independently of the pressure variations.
- The setting of the variable adjustment compensator can be varied from 7 to 33 bar; adjustment can be operated either via a countersunk hex adjustment screw, or via an adjustment knob.
- The fixed adjustment version can be supplied with a characteristic  $\Delta p$  setting of either 4 or 8 bar.

### PERFORMANCES (working with mineral oil of viscosity of 36 cSt a 50°C)

Maximum operating pressure	bar	350
Characteristic $\Delta p$ : fixed adjustment variable adjustment	bar	4 - 8 7 + 33
Maximum flow rate	l/min	40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	0,2
Surface treatment : electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

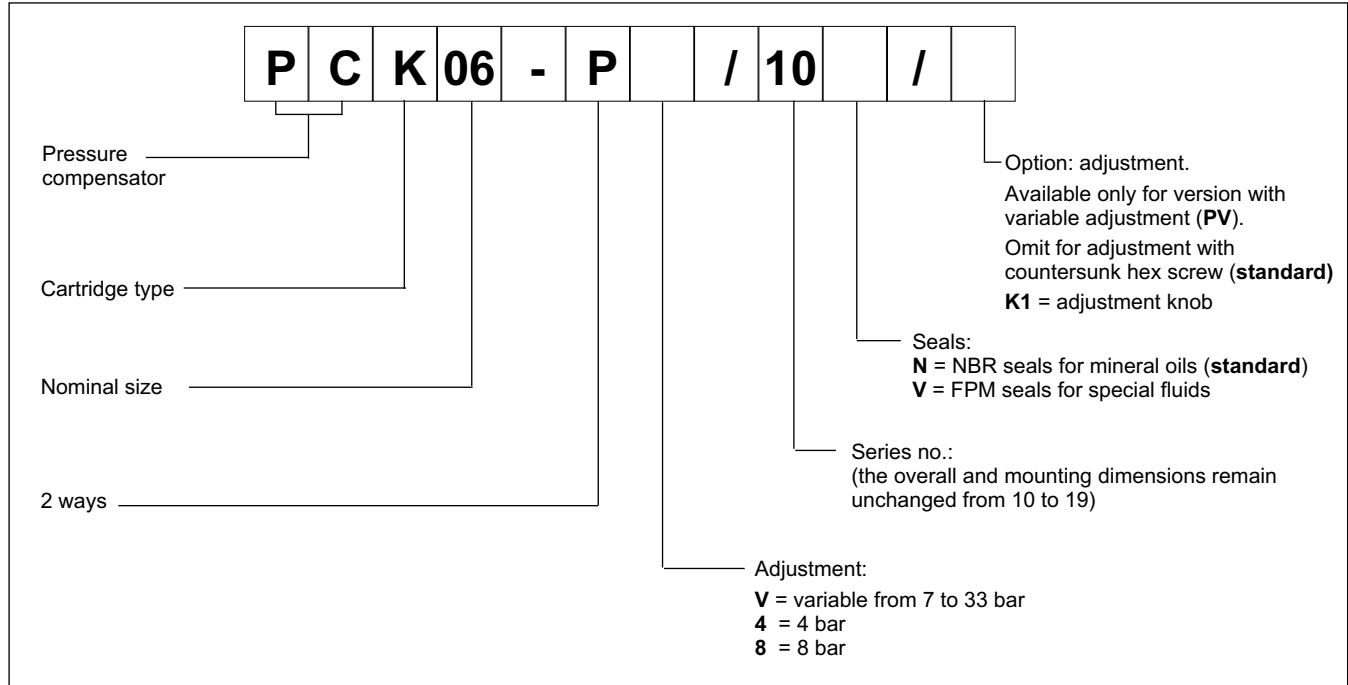
## HYDRAULIC SYMBOLS



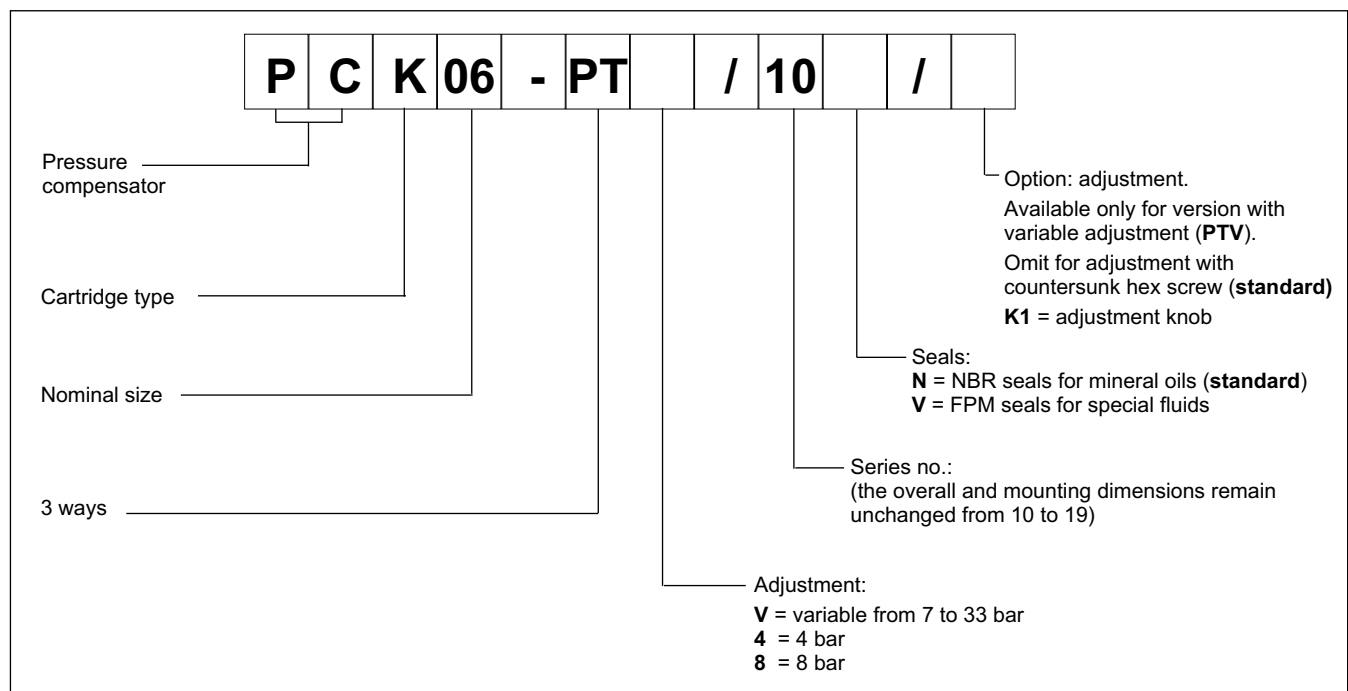


## 1 - IDENTIFICATION CODE

### 1.1 - Two-way compensator identification code



### 1.2 - Three-way compensator identification code

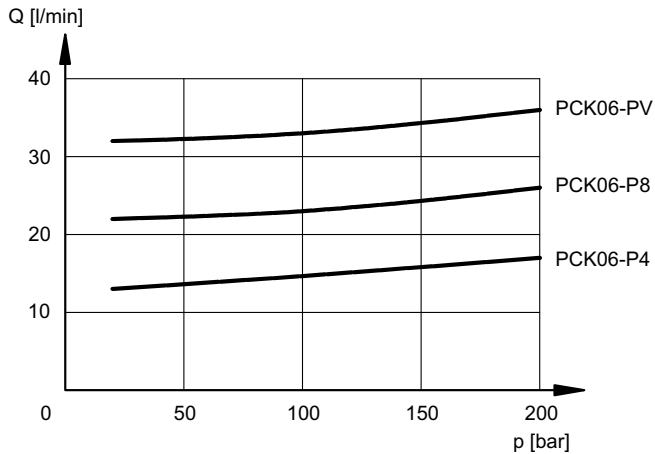




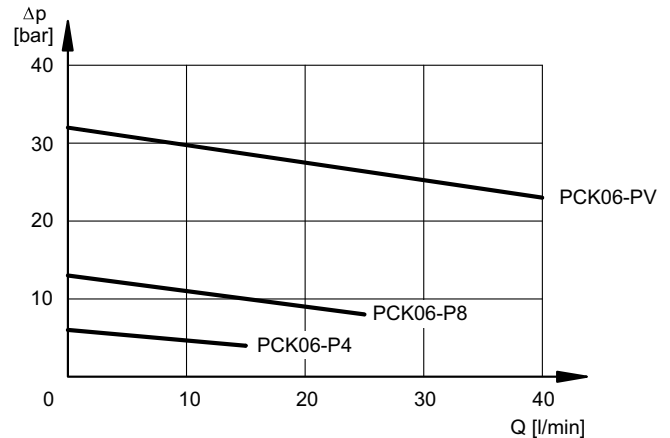
## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

### 2.1 - Two-way compensator characteristic curves

FLOW RATE - PRESSURE  $Q = f(p)$

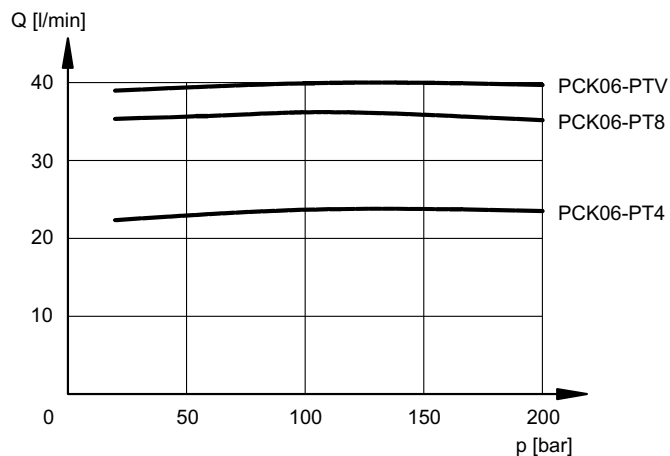


PRESSURE DROPS  $\Delta p = f(Q)$

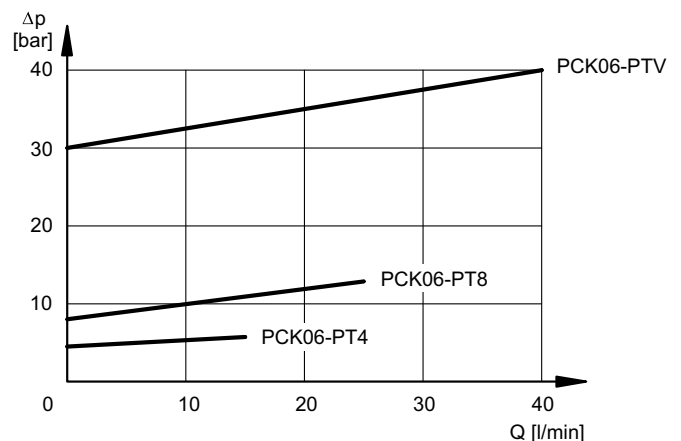


### 2.2 - Three-way compensator characteristic curves

FLOW RATE - PRESSURE  $Q = f(p)$



PRESSURE DROPS  $\Delta p = f(Q)$



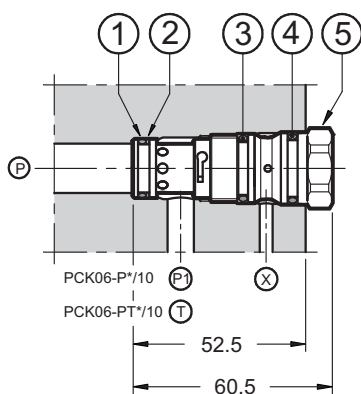
## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

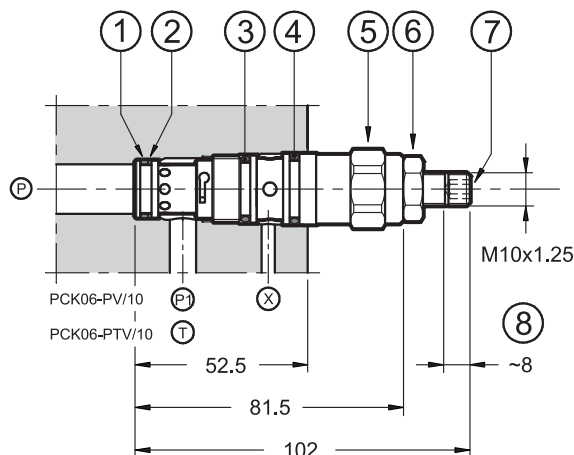


## 4 - OVERALL AND MOUNTING DIMENSIONS

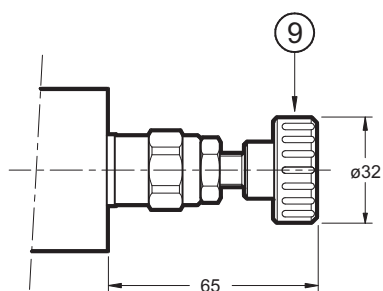
**PCK06-P\*/10**  
**PCK06-PT\*/10**



**PCK06-PV/10**  
**PCK06-PTV/10**



**PCK06-PV/10\*/K1**  
**PCK06-PTV/10\*/K1**



dimensions in mm

1	OR type 2056 (14.00x1.78)
2	Parbak 8-015 (14.81x1.14x1.35)
3	OR type 3062 (15.54x2.62)
4	OR type 3062 (15.54x2.62)
5	Hexagonal: spanner 22 Tightening torque 45 ÷ 50 Nm
6	Locking nut: spanner 17
7	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
8	Maximum screw stroke
9	Adjustment knob: <b>K1</b>



# CD1-W

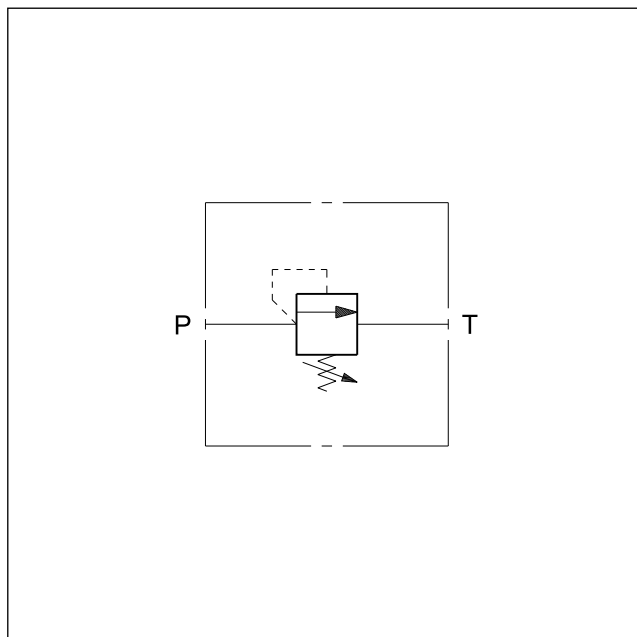
## DIRECT OPERATED PRESSURE CONTROL VALVE SERIES 10

### THREADED PORTS

**p** max **350** bar

**Q** max **3** l/min

### HYDRAULIC SYMBOL



### OPERATING PRINCIPLE

- The CD1-W valve is a direct operated pressure control valve with threaded ports and for flange mounting installation.
- It is used also for remote piloting of control valves and two-stage pressure reducers.
- It is available in four different pressure control ranges up to 350 bar.
- It is normally supplied with a countersunk hex adjustment screw, a locking nut and a maximum adjustment fastener.

### PERFORMANCE RATINGS (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	350
Minimum controlled pressure	see diagram	
Maximum flow rate	l/min	3
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended filtration		according to ISO4406:1999 class 20/18/15
Recommended viscosity	cSt	25
Mass	kg	1,2



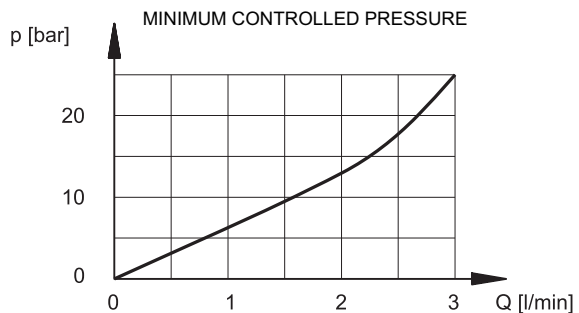
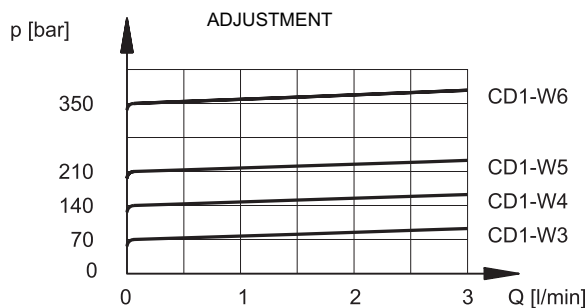
# CD1-W

## SERIES 10

### 1 - IDENTIFICATION CODE

<div>C D 1 - W / / 10 / </div>																	
Direct operated pressure control valve		Nominal dimension				Threaded ports: 1/4" NPT		Pressure adjustment range: 3 = up to 70 bar    5 = up to 210 bar 4 = up to 140 bar    6 = up to 350 bar		Seals: omit for mineral oils V = viton for special fluids							
										Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)							
										M1 = Adjustment knob (omit for adjustment with countersunk hex screw)							

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

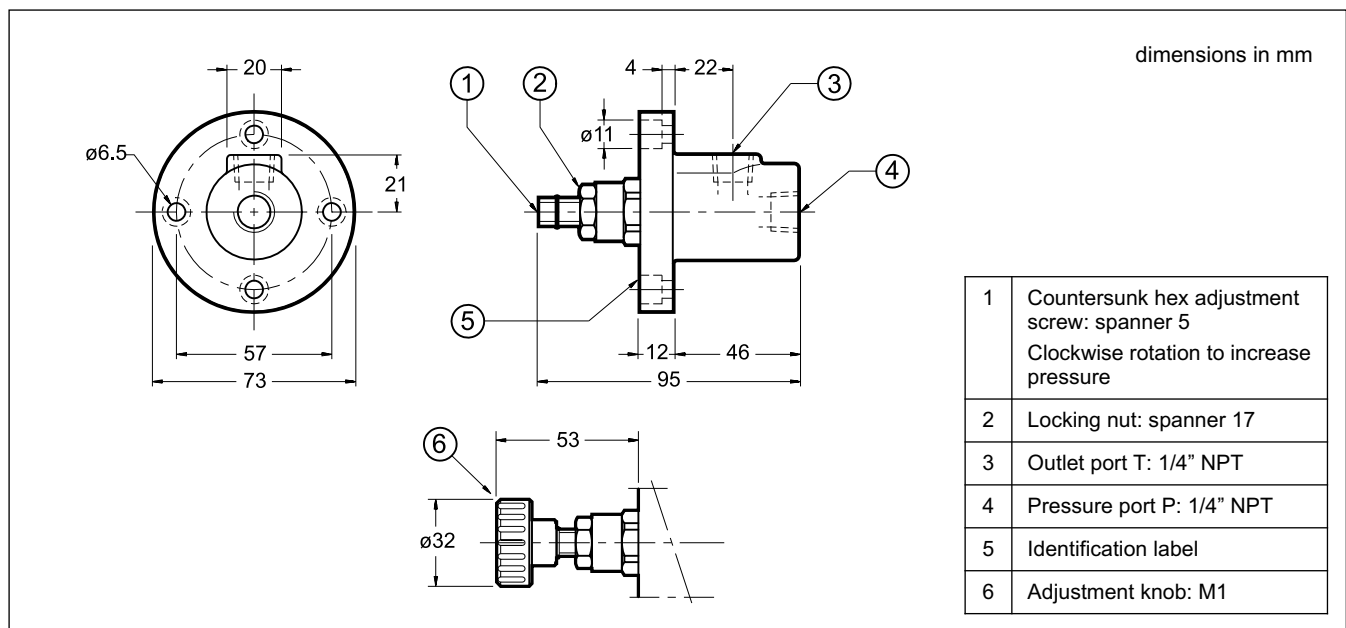


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



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# RM\*-W

## PRESSURE CONTROL VALVES

**RM2-W SERIES 31**

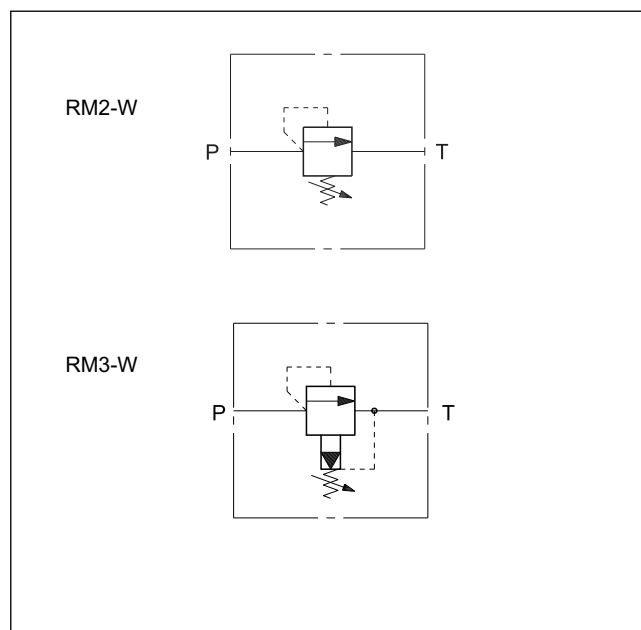
**RM3-W SERIES 30**

### THREADED PORTS

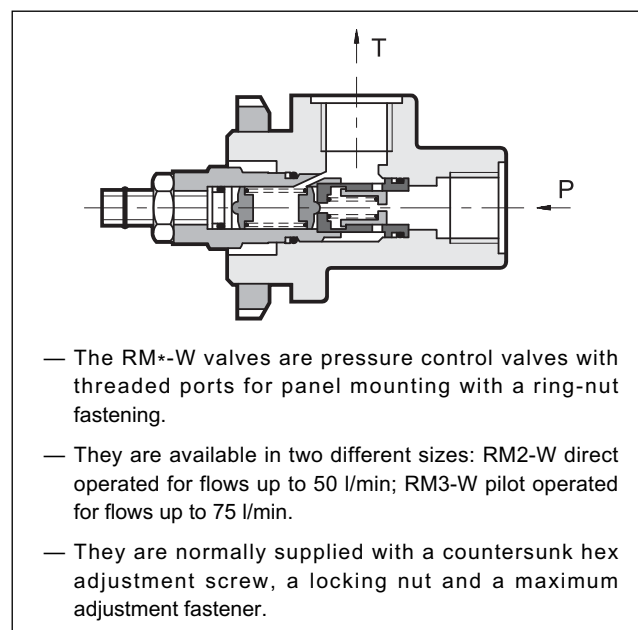
**p** max **350** bar

**Q** max (see table of performances)

### HYDRAULIC SYMBOLS



### OPERATING PRINCIPLE



### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RM2-W	RM3-W
Maximum operating pressure	bar	350	
Minimum controlled pressure		see diagram	
Maximum flow rate	l/min	50	75
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25	
Mass	kg	0,9	

## 1 - IDENTIFICATION CODE

**Example:** RM2-W3/31N/K  
RM3-W3/M1/30/V

**R** Pressure control valve

**M** Nominal dimension: 2 = 3/8" 3 = 1/2"

**-** Threaded ports BSP

**W** Pressure adjustment range: 3 = up to 70 bar 5 = up to 210 bar 4 = up to 140 bar 6 = up to 350 bar

**/** Series no: 31 for RM2-W 30 for RM3-W

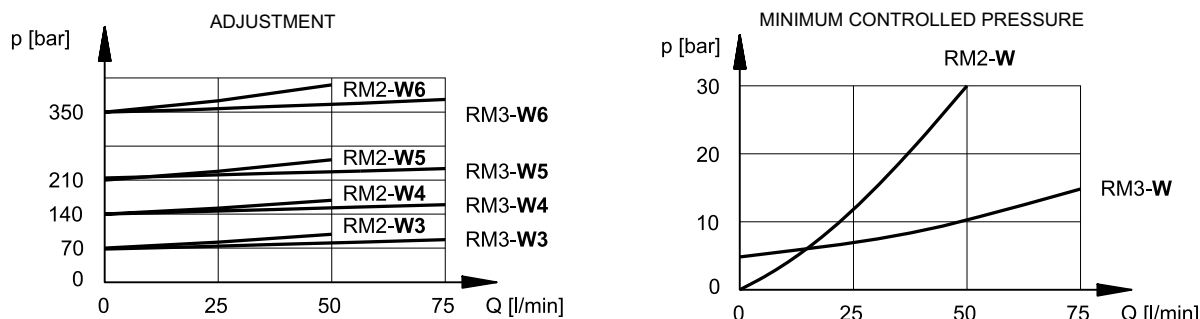
only for RM2: /K = Adjustment knob (omit for adjustment with countersunk hex screw)

only for RM3: Seals Omit for NBR seals for mineral oils (**standard**) IV = FPM seals for special fluids

only for RM2: Seals N = NBR seals for mineral oils (**standard**) V = FPM seals for special fluids

only for RM3: M1 = Adjustment knob (omit for adjustment with countersunk hex screw)

## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

#### 4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

1	Countersunk hex adjustment screw: <b>RM2-W:</b> spanner 6 <b>RM3-W:</b> spanner 5 Clockwise rotation to increase pressure
2	Locking nut: <b>RM2-W:</b> spanner 19 <b>RM3-W:</b> spanner 17
3	Ring-nut for flange mounting type SKF KM9
4	Outlet port 1/2" BSP
5	Pressure port: <b>RM2-W:</b> 3/8" BSP <b>RM3-W:</b> 1/2" BSP
6	Adjustment knob: <b>RM3-W: M1</b>
7	Adjustment knob: <b>RM2-W: K</b>
8	Locking ring



# RQ\*-W

## PRESSURE RELIEF VALVE

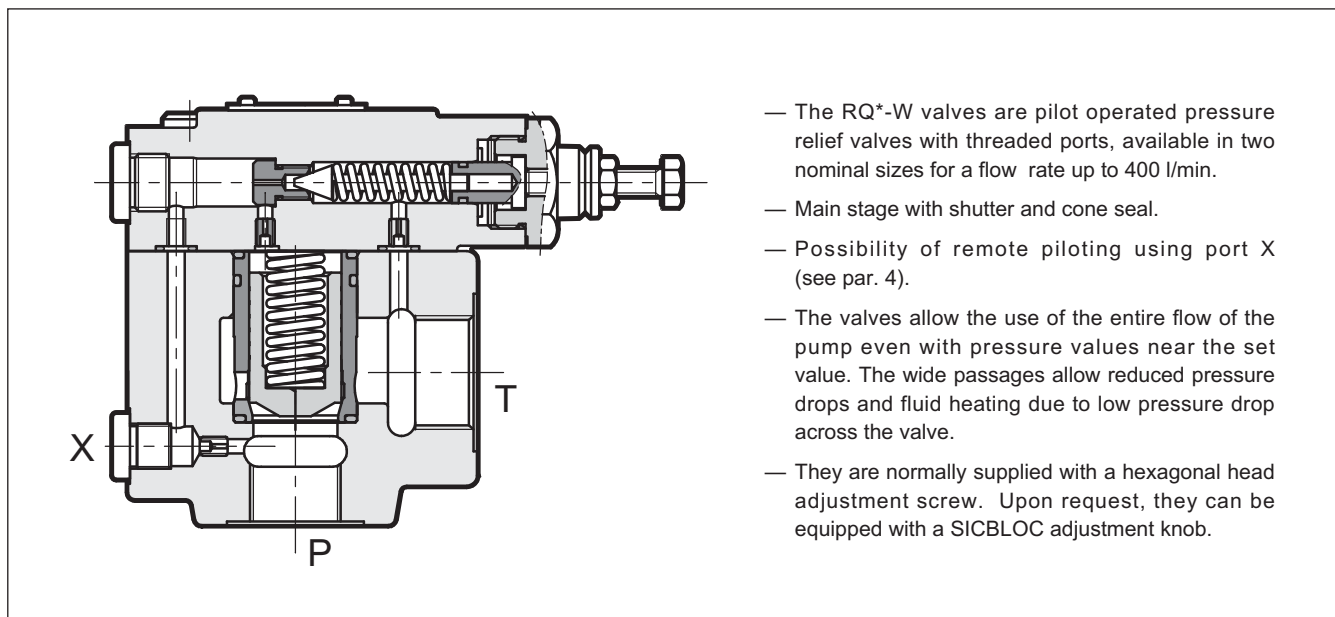
### SERIES 41

#### THREADED PORTS

**p** max **350** bar

**Q** max (see table of performances)

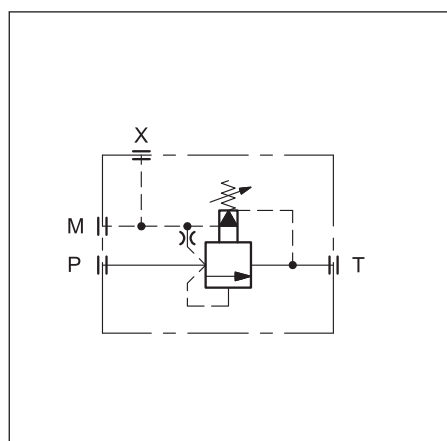
#### OPERATING PRINCIPLE



#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQ5-W	RQ7-W
Maximum operating pressure	bar	350	
Maximum flow rate	l/min	250	400
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	4,1	8

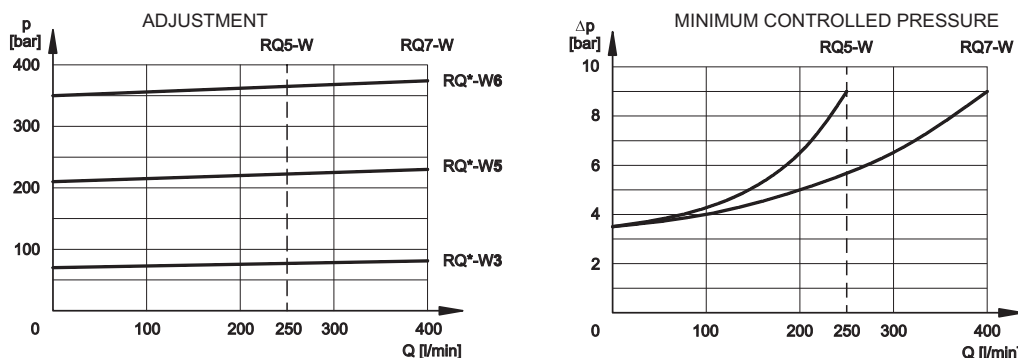
#### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE

<b>R</b>	<b>Q</b>	<b>-</b>	<b>W</b>	<b>/</b>	<b>/</b>	<b>41</b>	<b>/</b>	
Pressure control valve		Nominal dimension <b>5</b> = DN 25 <b>7</b> = DN 40		Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)		Seals: omit for mineral oils <b>V</b> = viton for special fluids		
BSP threaded ports		Pressure adjustment range: <b>3</b> = up to 70 bar <b>5</b> = up to 210 bar <b>6</b> = up to 350 bar		<b>M</b> = adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)				

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

1	Hexagonal head adjustment screw. Spanner 13. Clockwise rotation to increase pressure
2	Remote piloting port X: 1/4" BSP
3	Outlet port T <b>RQ5-W:</b> 1" BSP <b>RQ7-W:</b> 1" 1/2 BSP
4	Pressure port P <b>RQ5-W:</b> 3/4" BSP <b>RQ7-W:</b> 1" 1/4 BSP
5	Pressure gauge port 3/8" BSP
6	SICBLOC adjustment knob. To operate, push and rotate at the same time.

	A	B	C	D	ØE	F	G	H	I	L	M	ØN	ØO
<b>RQ5-W</b>	168	98	49	4	22	21.5	44.5	123	80	87	53	35.5	46
<b>RQ7-W</b>	168	98	49	4	22	43	59.5	145	102	109	68	50	56



# RQM\*-W

## SOLENOID OPERATED PRESSURE RELIEF VALVE WITH UNLOADING AND PRESSURE SELECTION

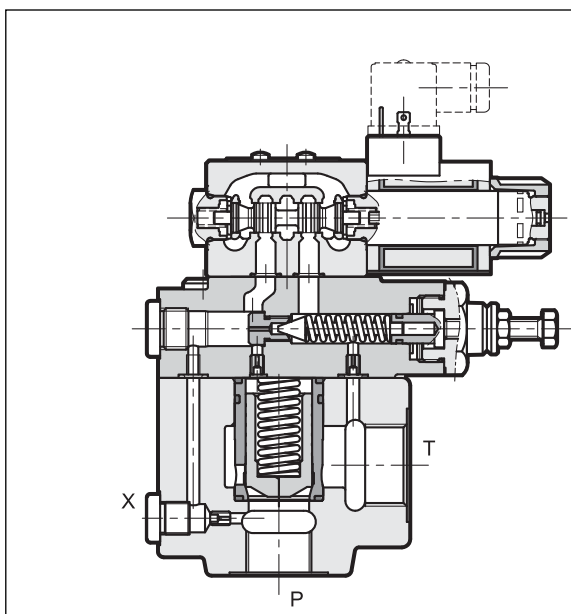
### SERIES 60

#### THREADED PORTS

**p** max **350** bar

**Q** max (see table of performances)

#### OPERATING PRINCIPLE



- The RQM\*-W valves are pilot operated pressure relief valves with BSP threaded ports, available in two nominal sizes for a flow rate up to 400 l/min.
- Available in five versions that allow, by means of a solenoid valve, unloading of the total flow and selection up to three pressure values (see table 2 for different versions).
- The adjustment of the second and third pressure value is obtained by a pressure relief valve placed between the main stage and the solenoid valve.
- They are normally supplied with a hexagonal head adjustment screw. Upon request, they can be equipped with a SICBLOC adjustment knob on the main pressure control.

#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQM5-W	RQM7-W
Maximum operating pressure	bar	350	
Maximum flow rate	l/min	250	400
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	

**NOTE:** for the solenoid valve DS3 characteristics see catalogue 41 150





# RQM\*-W

## SERIES 60

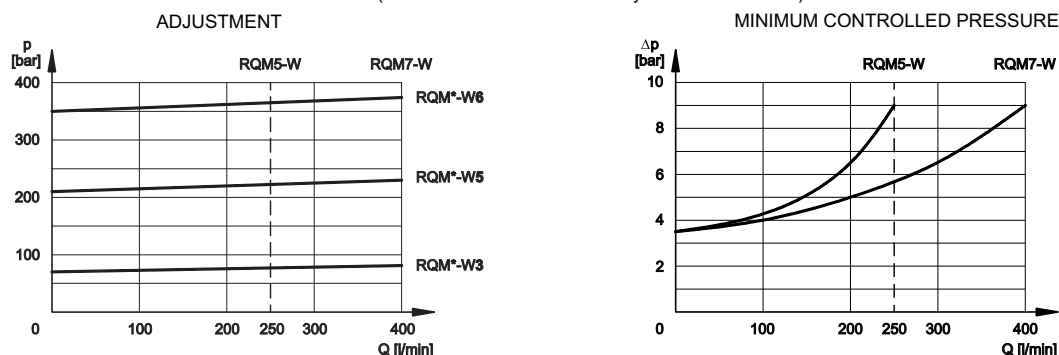
### 1 - IDENTIFICATION CODE

<b>R</b>	<b>Q</b>	<b>M</b>		<b>-</b>	<b>W</b>	<b>/</b>	<b>/</b>	<b>/</b>	<b>60</b>	<b>-</b>		<b>K1</b>	<b>/</b>	
Pressure relief valve pilot operated			solenoid valve for venting / pressure selection			Nominal dimension: <b>5</b> = ND 25 7 = ND 40			BSP threaded ports			Manual override: omit for override integrated in the tube ( <b>standard</b> ) <b>CM</b> = manual override, boot protected		
Pressure adjustment range: <b>3</b> = up to 70 bar <b>6</b> = up to 350 bar <b>5</b> = up to 210 bar			Versions: <b>A</b> <b>B</b> <b>C</b> <b>D</b> <b>G</b>			see description in table 2 versions			Coil electrical connection: plug for connector type DIN 43650 ( <b>standard</b> )			DC power supply <b>D12</b> = 12 V <b>D24</b> = 24 V <b>D48</b> = 48 V <b>D110</b> = 110 V <b>D220</b> = 220 V <b>D00</b> = valve without coils (see <b>NOTE</b> ) AC power supply <b>A24</b> = 24 V - 50 Hz <b>A48</b> = 48 V - 50 Hz <b>A110</b> = 110 V - 50 Hz / 120 V - 60 Hz <b>A230</b> = 230 V - 50 Hz / 240 V - 60 Hz <b>A00</b> = valve without coils (see <b>NOTE</b> ) <b>F110</b> = 110 V - 60 Hz <b>F220</b> = 220 V - 60 Hz		
<b>M</b> = adjustment with SICBLOC knob available on the main pressure control (omit for adjustment with hexagonal head screw)			Series No. (the overall and mounting dimensions remain unchanged from 60 to 69)									Seals: <b>N</b> = NBR seals for mineral oil ( <b>standard</b> ) <b>V</b> = FPM seals for special fluids		
<b>NOTE:</b> The locking rings of the coils and the relevant O-Rings are supplied together with valves														

### 2 - VERSIONS

<b>RQM*-W*/A</b>	<b>RQM*-W*/B</b>	<b>RQM*-W*/C</b>	<b>RQM*-W*/D</b>	<b>RQM*-W*/G</b>
<b>1 pressure setting and unloading with de-energized solenoid</b>	<b>1 pressure setting and unloading with energized solenoid</b>	<b>2 pressure settings The highest setting is reached with energized solenoid</b>	<b>2 pressure settings and unloading with de-energized solenoids</b>	<b>3 pressure settings The highest setting is reached with de-energized solenoids</b>

### 3 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



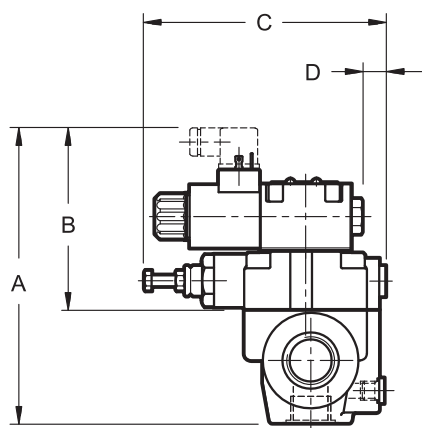
### 4 - HYDRAULIC FLUIDS

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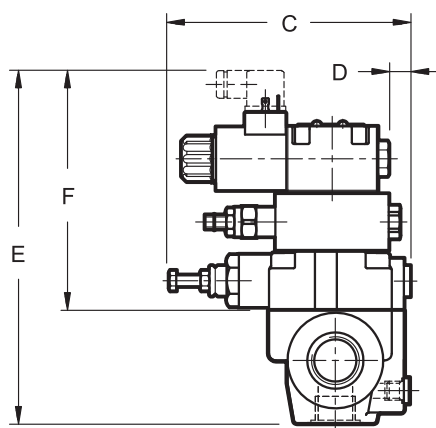
### 5 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

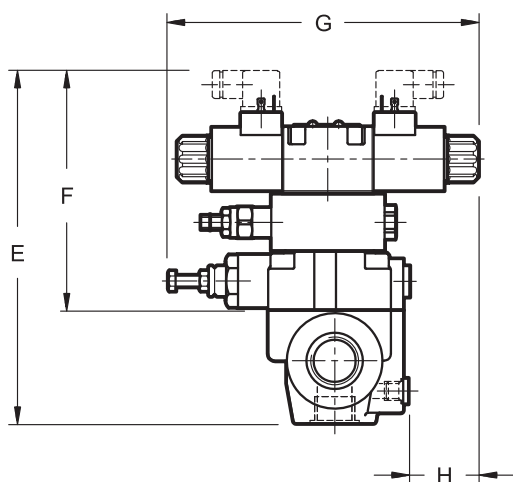
RQM\*-W\*/A  
RQM\*-W\*/B



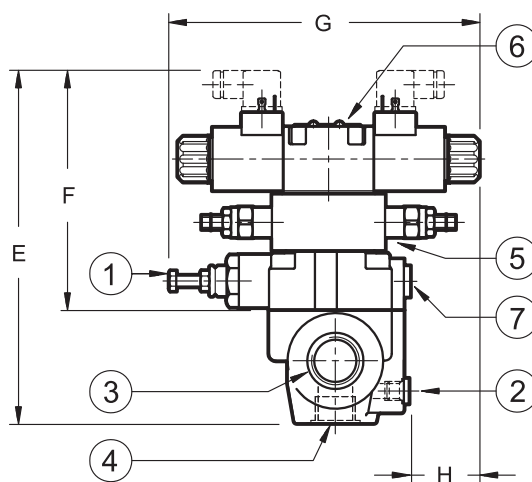
RQM\*-W\*/C



RQM\*-W\*/D



RQM\*-W\*/G



	A	B	C	D	E	F	G	H
<b>RQM5-W</b>	210	130	172	17	247	167	221.5	49.5
<b>RQM7-W</b>	232	130	172	17	269	167	221.5	49.5

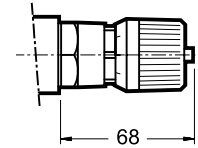
1	Hexagonal head main pressure adjustment screw: Spanner 13 Clockwise rotation to increase pressure	5	Second value pressure adjustment valve. Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
2	Remote piloting port X 1/4" BSP	6	ISO 4401-03 (CETOP 03) solenoid valve for pressure selection / unloading
3	Outlet port T <b>RQM5-W</b> : 1" BSP <b>RQM7-W</b> : 1" 1/2 BSP	7	Pressure gauge port 3/8" BSP
4	Pressure port P <b>RQM5-W</b> : 3/4" BSP <b>RQM7-W</b> : 1" 1/4 BSP		



## 6 - ADJUSTMENT KNOB

The RQ valves can be equipped with a SICBLOC adjustment knob, only on the main pressure regulation. To operate it, push and rotate at the same time.

To request this option, add: /**M** (see paragraph 1).



## 7 - ELECTRIC CONNECTORS

**The solenoid operated valves are delivered without the connectors. They must be ordered separately.**

For the identification of the connector type to be ordered, please see catalogue 49 000.

## 8 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override, boot protected, is recommended. Add the suffix **CM** to request this device (see paragraph 1).

For overall dimensions see catalogue 41 150.



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# RQ\*-P

## PRESSURE RELIEF VALVES

### SERIES 41

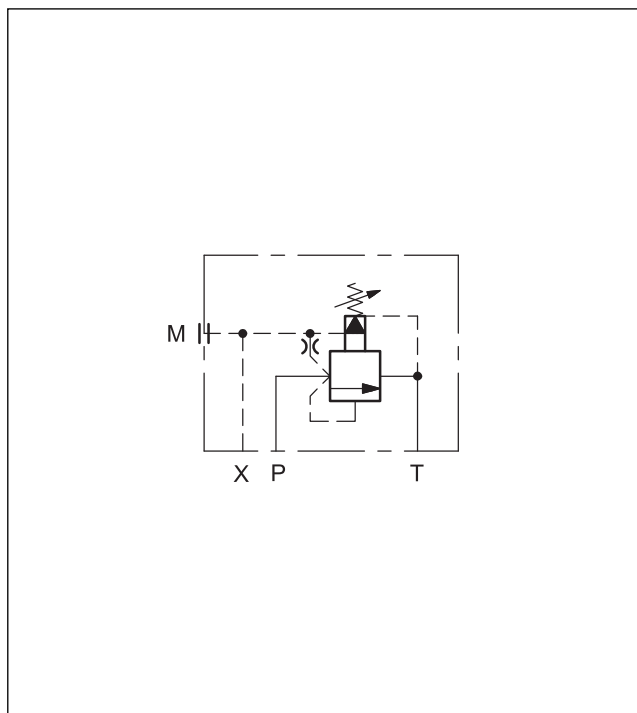
#### SUBPLATE MOUNTING

**RQ3-P ISO 6264-06 (CETOP R06)**

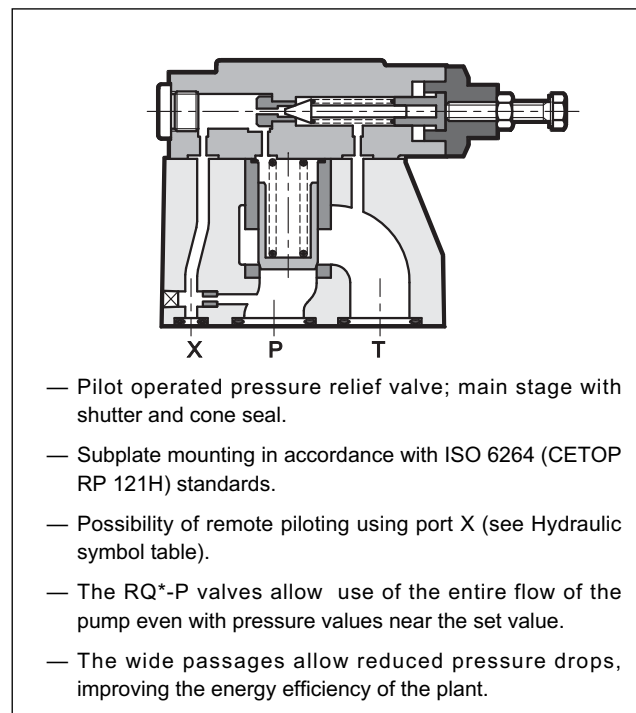
**RQ5-P ISO 6264-08 (CETOP R08)**

**RQ7-P ISO 6264-10 (CETOP R10)**

#### HYDRAULIC SYMBOL



#### OPERATING PRINCIPLE



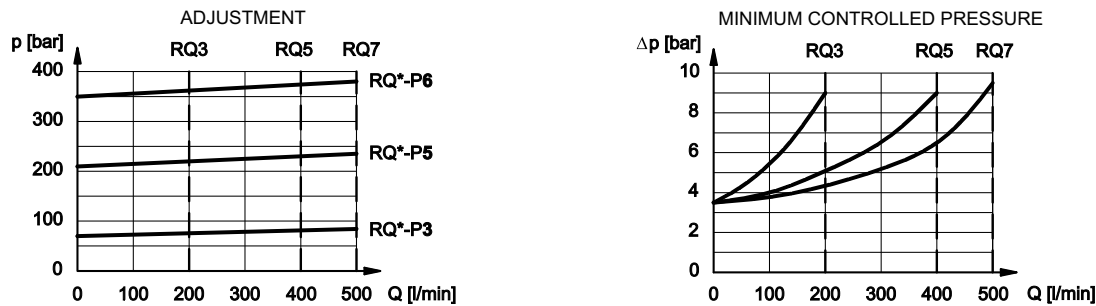
#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQ3-P	RQ5-P	RQ7-P
Maximum operating pressure	bar	350		
Maximum flow rate	l/min	200	400	500
Ambient temperature range	°C	-20 / +50		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		
Mass	kg	3,5	4,3	6,5

### 1 - IDENTIFICATION CODE

<b>R</b>	<b>Q</b>		<b>-</b>	<b>P</b>	<b>/</b>		<b>/</b>	<b>41</b>	<b>/</b>	
Double stage pressure relief valve										Seals: omit for mineral oils V = viton for special fluids
Size: <b>3</b> = ISO 6264-06 (CETOP R06) <b>5</b> = ISO 6264-08 (CETOP R08) <b>7</b> = ISO 6264-10 (CETOP R10)										Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)
Subplate mounting										
Pressure adjustment range: <b>3</b> = up to 70 bar <b>6</b> = up to 350 bar <b>5</b> = up to 210 bar										<b>M</b> = adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

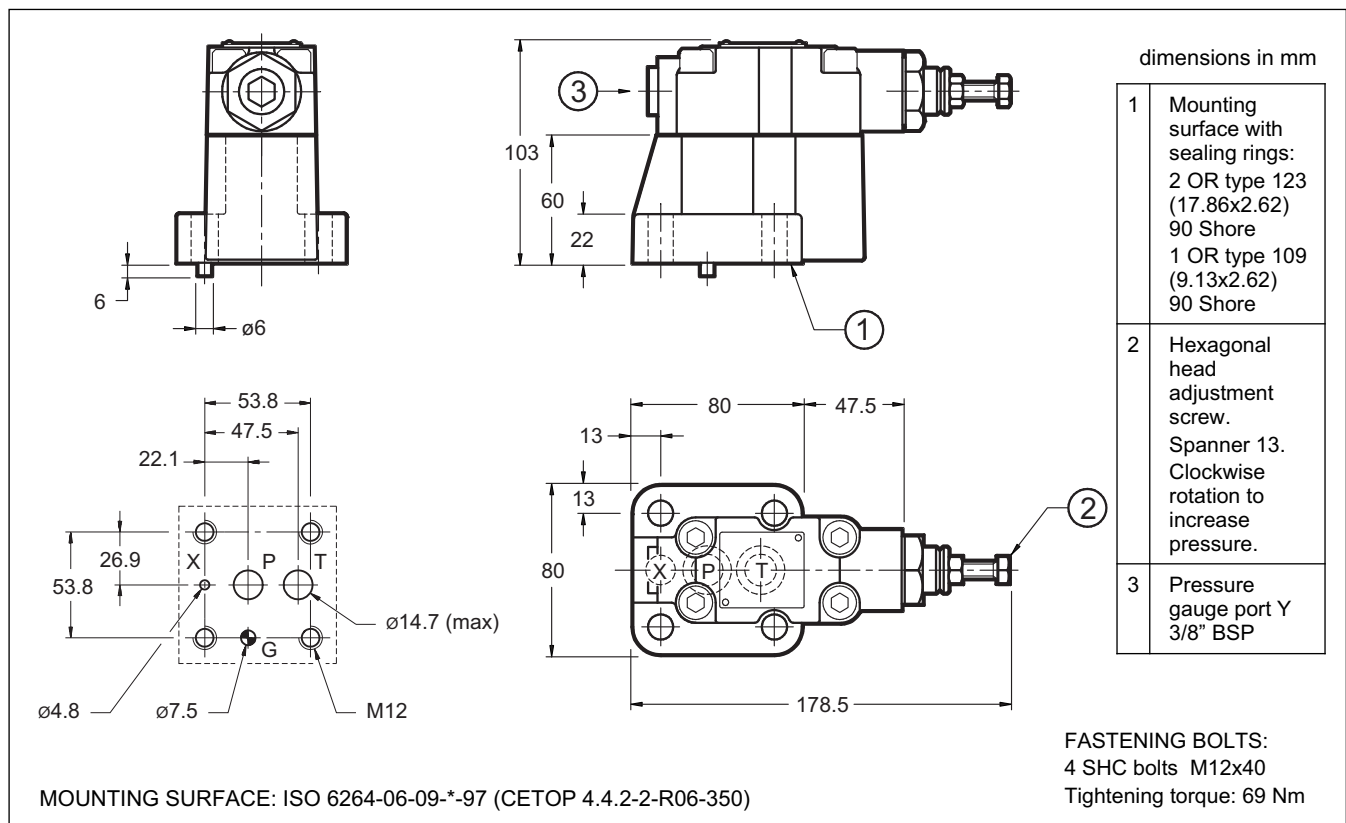


### 3 - HYDRAULIC FLUIDS

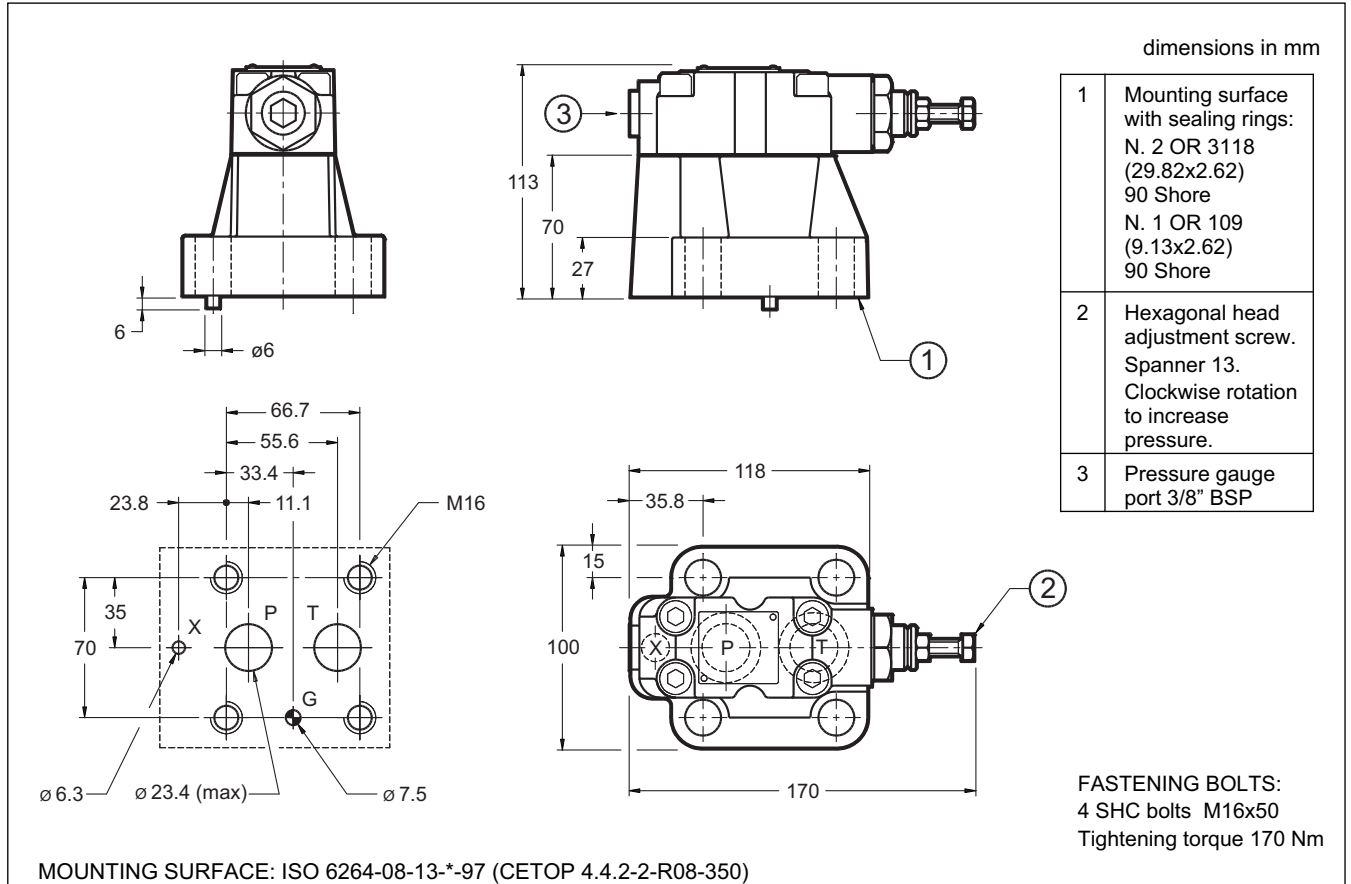
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

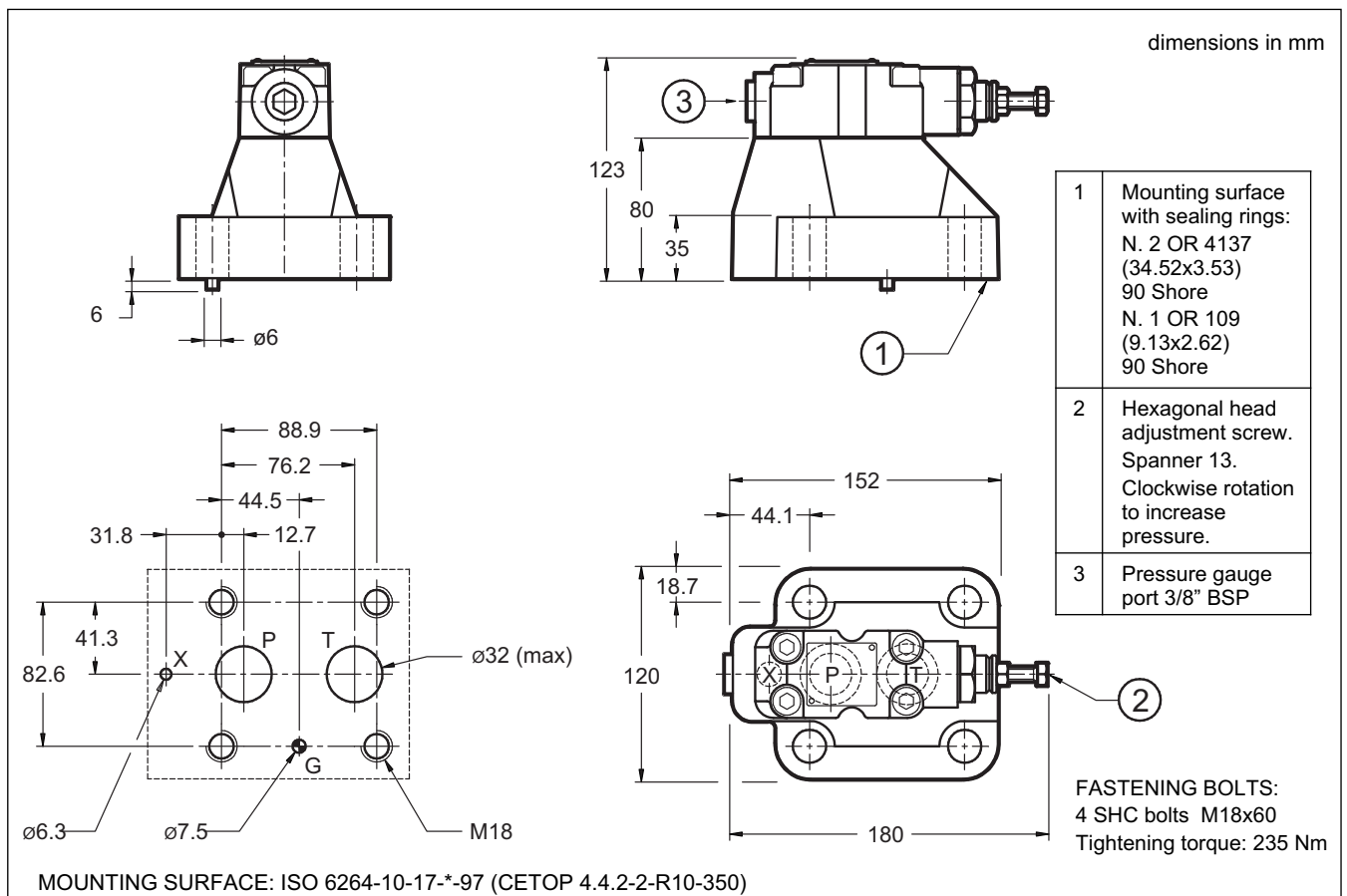
### 4 - RQ3-P OVERALL AND MOUNTING DIMENSIONS



### 5 - RQ5-P OVERALL AND MOUNTING DIMENSIONS



### 6 - RQ7-P OVERALL AND MOUNTING DIMENSIONS

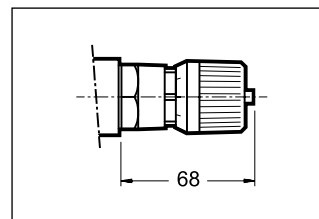




## 7 - ADJUSTMENT KNOB

The RQ valves can be equipped with a SICBLOC adjustment knob. To operate it, push and rotate at the same time.

To request this option, add: /M (see paragraph 1).



## 8 - SUBPLATES (see catalogue 51 000)

	RQ3-P	RQ5-P	RQ7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T ports dimension	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimension	1/4" BSP	1/4" BSP	1/4" BSP



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# RQM\*-P

## SOLENOID OPERATED PRESSURE RELIEF VALVES WITH UNLOADING AND PRESSURE SELECTION

### SERIES 60

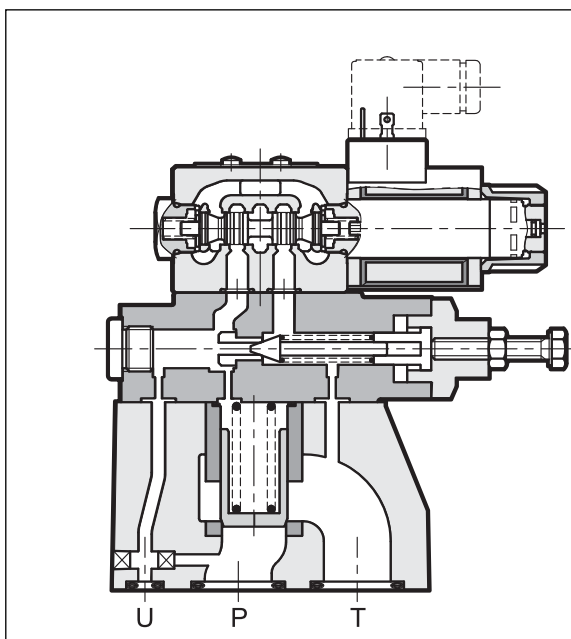
#### SUBPLATE MOUNTING

**RQM3-P ISO 6264-06 (CETOP R06)**

**RQM5-P ISO 6264-08 (CETOP R08)**

**RQM7-P ISO 6264-10 (CETOP R10)**

#### OPERATING PRINCIPLE



- The RQM\*-P valves are pressure relief valves available in three nominal sizes for flow up to 500 l/min.
- They are available in ISO 6264 (CETOP RP 121H) subplate mounting version.
- Available in five versions that allow, by means of a solenoid valve, unloading of the total flow and selection up to three pressure values (see table 2 Versions).
- The adjustment of the second and third pressure values is obtained by a pressure relief valve placed between the main stage and the solenoid valve.
- It is supplied with an hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob on the main pressure control.

#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQM3-P	RQM5-P	RQM7-P
Maximum operating pressure	bar	350		
Maximum flow rate	l/min	200	400	500
Ambient temperature range	°C	-20 / +50		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		

**NOTE:** for the solenoid valve DS3 characteristics see catalogue 41 150

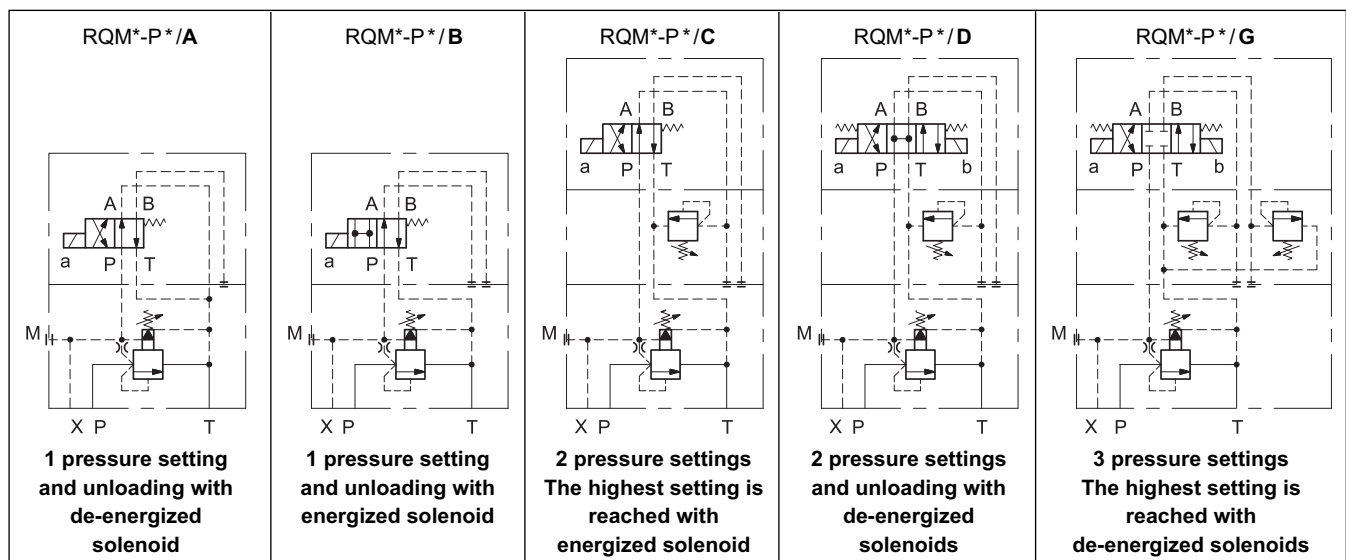


## 1 - IDENTIFICATION CODE

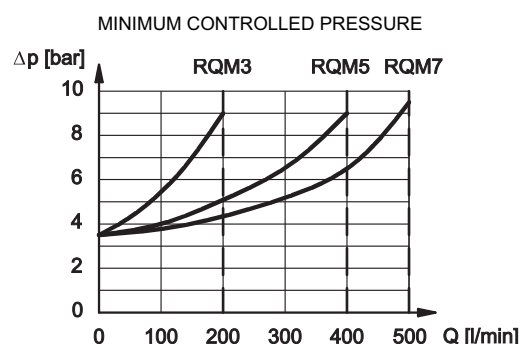
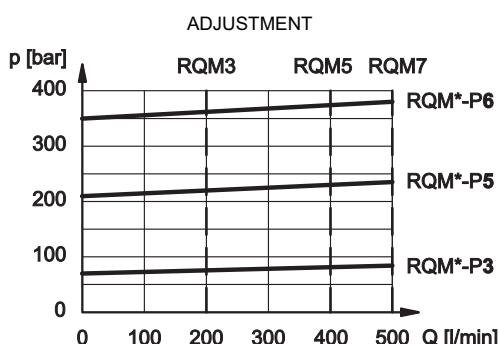
<b>R</b>	<b>Q</b>	<b>M</b>		<b>-</b>	<b>P</b>	<b>/</b>	<b>/</b>	<b>/</b>	<b>60</b>	<b>-</b>	<b>K1</b>	<b>/</b>	
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pilot operated pressure relief valve  
 solenoid valve for unloading / pressure selection  
 Size: **3** = ISO 6264-06 (CETOP R06)  
       **5** = ISO 6264-08 (CETOP R08)  
       **7** = ISO 6264-10 (CETOP R10)  
 Subplate mounting  
 Pressure adjustment range:  
**3** = up to 70 bar    **6** = up to 350 bar  
**5** = up to 210 bar  
 Versions: **A** } see description in hydraulic symbols table  
               **B** }  
               **C** }  
               **D** }  
               **G** }  
**M** = adjustment with SICBLOC knob  
 available only on the main pressure control  
 (Omit for adjustment with hexagonal head screw)  
 Series No. (the overall and mounting dimensions remain unchanged from 60 to 69)  
 Manual override: omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected  
 Coil electrical connection: plug for connector type DIN 43650 (**standard**)  
 DC power supply  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
**D220** = 220 V  
**D00** = valve without coils (see note)  
 AC power supply  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see note)  
**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz  
 Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids  
**NOTE:** The locking rings of the coils and the relevant O-Rings are supplied together with valves

## 2 - VERSIONS



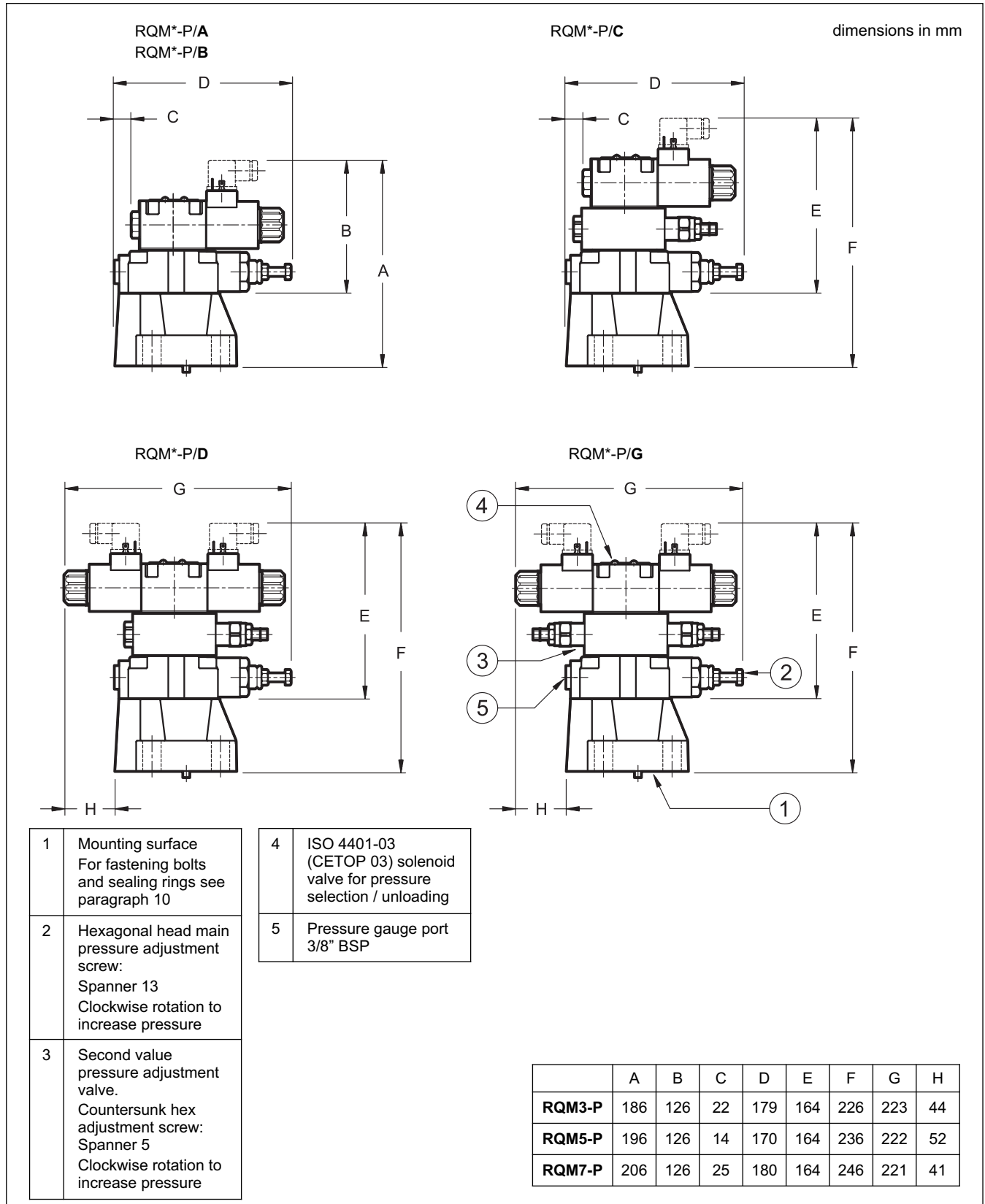
## 3 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 4 - HYDRAULIC FLUIDS

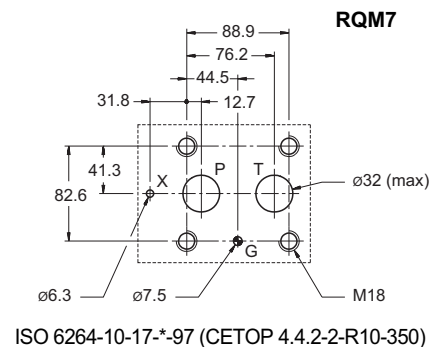
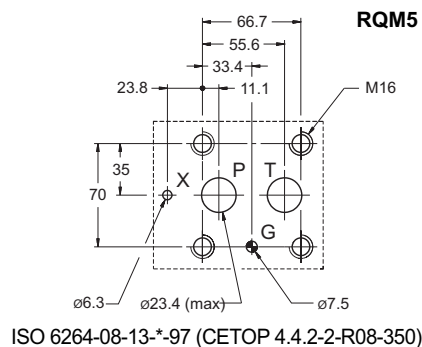
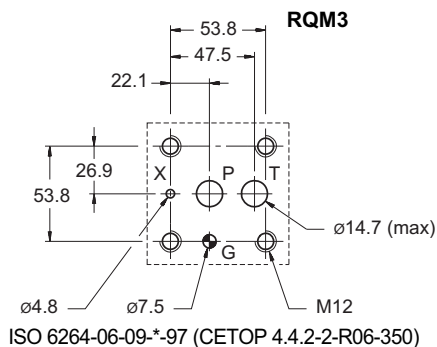
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 5 - OVERALL AND MOUNTING DIMENSIONS





## 6 - MOUNTING SURFACES



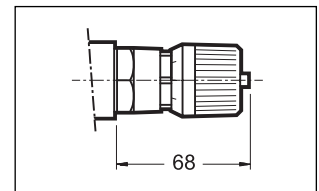
## 7 - ADJUSTMENT KNOB

The valves can be equipped with a SICBLOC adjustment knob, only on the main pressure regulation. To operate it, push and rotate at the same time.

To request this option, add: **/M** (see paragraph 1).

## 8 - ELECTRIC CONNECTORS

The solenoid valves are never supplied with connector. Connectors must be ordered separately. For the identification of the connector type to be ordered, please see catalogue 49 000.



## 9 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override boot protected is recommended.

Add the suffix **CM** to request this device (see paragraph 1). For overall dimensions see catalogue 41 150.

## 10 - FASTENING BOLTS AND SEALING RINGS

	RQM3-P	RQM5-P	RQM7-P
Fastening (4 SHC bolts ISO 4762)	M12 x 40	M16 x 50	M18 x 60
Torque	69 Nm	170 Nm	235 Nm
Sealing rings	N. 2 OR type 123 (17.86x2.62) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore	N. 2 OR type 3118 (29.82x2.62) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore	N. 2 OR type 4137 (34.52x3.53) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore

## 11 - SUBPLATES (see catalogue 51 000)

	RQM3-P	RQM5-P	RQR7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T, U ports dimension	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimension	1/4" BSP	1/4" BSP	1/4" BSP



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# MRQA

## UNLOADING VALVE

(FOR CIRCUITS WITH ACCUMULATOR)

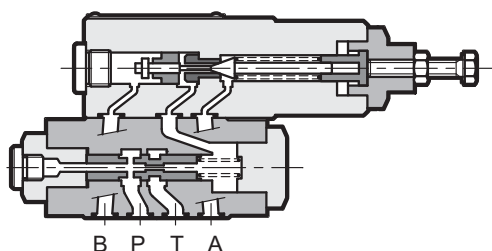
### SERIES 42

**SUBPLATE MOUNTING**  
**ISO 4401-03 (CETOP 03)**

**p** max **350** bar

**Q** max **40** l/min

#### OPERATING PRINCIPLE



- MRQA is a pressure relief and safety valve with automatic unloading. Upon reaching the set value, the valve freely unloads the pump and puts it under pressure again when the pressure values descend in the circuit to correspond to 63% or 75% of the set value.

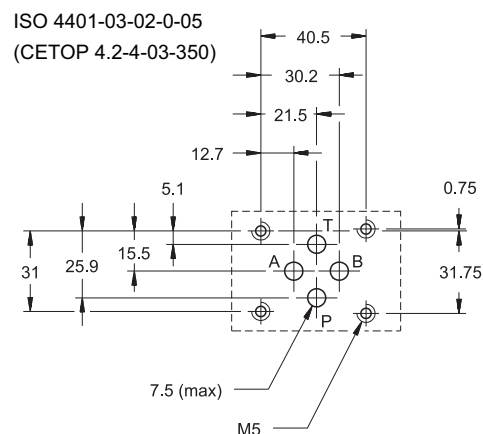
In order to assure this operation, it is necessary to use an accumulator (see hydraulic diagram) that guarantees pressure maintenance in the circuit. A check valve, incorporated in the panel or available as a plate under the valve MRQA/C, prevents the accumulator unloading through the open valve.

This system maintains the pressure in the hydraulic circuit, avoiding heating of the oil and reducing energy consumption.

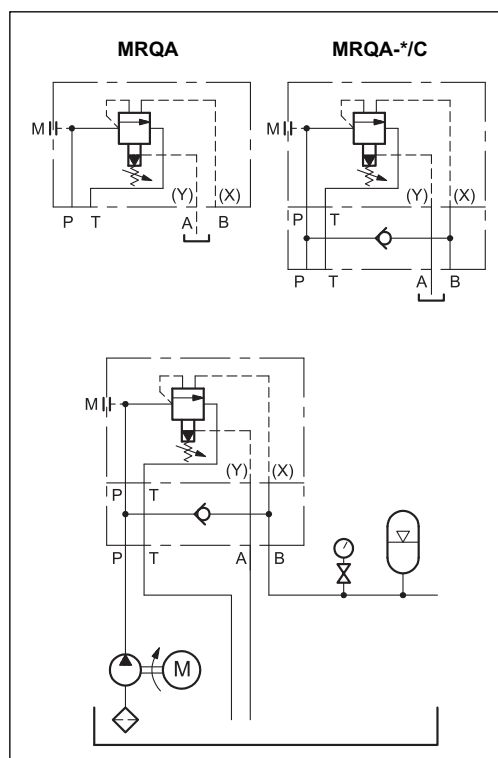
It is recommended to place the accumulator as close as possible to the MRQA, without reducing the connection size.

- The cycle time depends on the pump flow rate, the accumulator capacity and pre-charge, and the flow requirement of the system.

#### MOUNTING SURFACE



#### HYDRAULIC SYMBOLS & DIAGRAM



#### PERFORMANCE RATINGS (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 21/19/16	
Recommended viscosity	cSt	25
Mass: MRQA	kg	3,3
MRQA*/C	kg	4,2



# MRQA

## SERIES 42

### 1 - IDENTIFICATION CODE

<b>M</b>	<b>R</b>	<b>Q</b>	<b>A</b>	<b>-</b>	<b>/</b>	<b>/</b>	<b>/</b>	<b>/</b>	<b>42</b>	<b>/</b>	
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Size ISO 4401-03 (CETOP 03) \_\_\_\_\_

Unloading valve \_\_\_\_\_

Automatic unloading for circuits with accumulator \_\_\_\_\_

Pressure adjustment range: \_\_\_\_\_  
3 = 25 ÷ 70 bar  
5 = 50 ÷ 210 bar  
6 = 100 ÷ 280 bar

Differential pressure (values ± 2.5%)  
1 = pump switch on at 75% of adjustment value  
2 = pump switch on at 63% of adjustment value

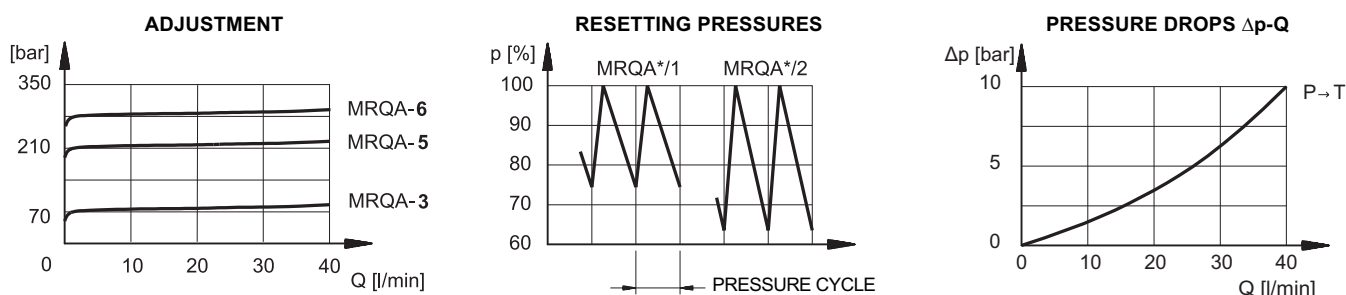
Seals: omit for mineral oils  
V = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)

C = Check valve (omit if not required)

M = Adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)

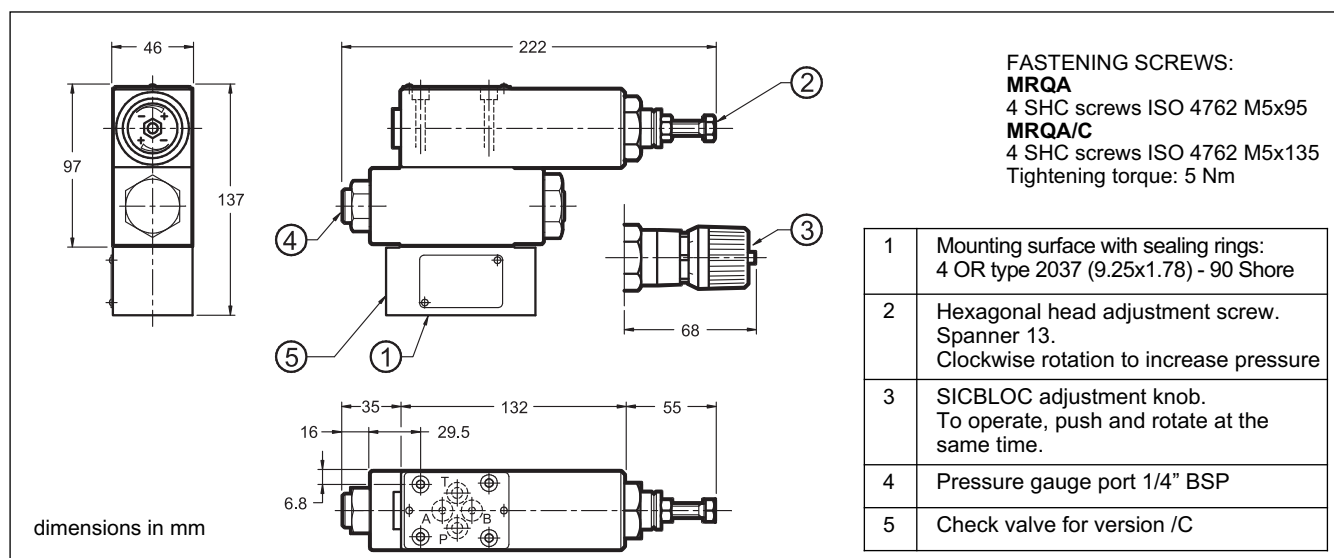
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



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# RQ\*\*-P

## UNLOADING VALVE

(FOR CIRCUITS WITH ACCUMULATOR)

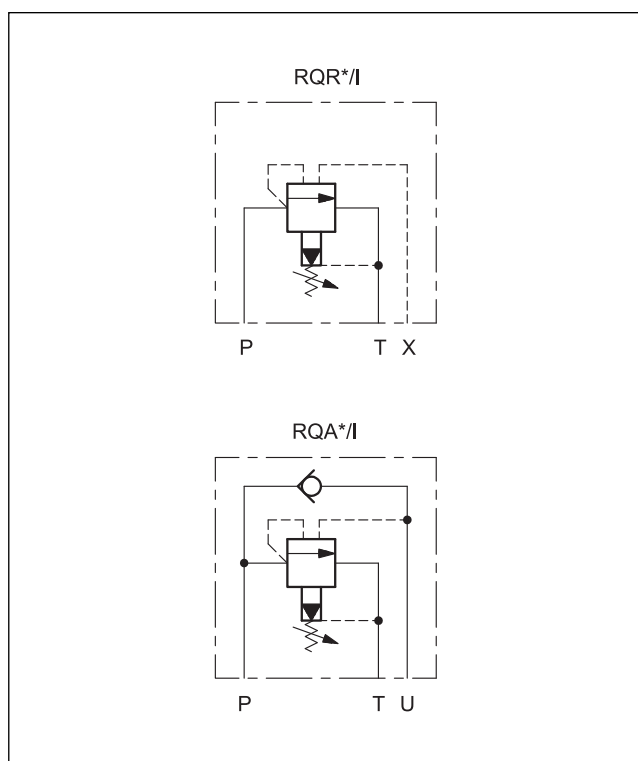
### SERIES 42

**RQR\*-P**  
FOR REMOTE PILOTING

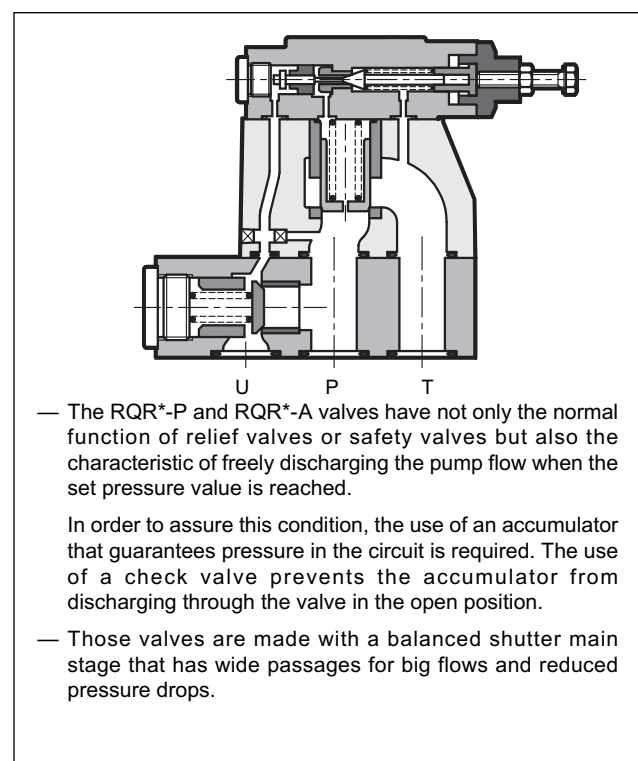
**RQA\*-P**  
WITH INCORPORATED CHECK VALVE

## SUBPLATE MOUNTING

## HYDRAULIC SYMBOLS



## OPERATING PRINCIPLE



## PERFORMANCES

(measured with mineral oil of viscosity 36 cSt at 50°C)

		RQR3-P	RQR5-P	RQR7-P	RQA5-P	RQA7-P
Maximum operating pressure	bar	350				
Maximum flow rate	l/min	200	400	500	400	500
Ambient temperature range	°C	-20 / +50				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15				
Recommended viscosity	cSt	25				
Mass	Kg	3,5	4,3	6,5	10	17

## 1 - IDENTIFICATION CODE

<b>R</b>	<b>Q</b>			<b>-</b>	<b>P</b>		<b>/</b>		<b>/</b>	<b>I</b>	<b>/</b>		<b>/</b>	<b>42</b>	<b>/</b>	
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Unloading valve —

Automated unloading for circuits with accumulator  
**R** = for remote piloting  
**A** = with incorporated check valve (size 3 excluded)

Size: \_\_\_\_\_  
**3** = RQR3-P ISO 6264-06-09-\* -97 (CETOP R06)  
**5** = RQR5-P ISO 6264-08-13-\* -97 (CETOP R08)  
**5** = RQA5-P  
**7** = RQR7-P ISO 6264-10-07-\* -97 (CETOP R10)  
**7** = RQA7-P

Subplate mounting —

Pressure adjustment range: \_\_\_\_\_  
**3** = up to 70 bar  
**5** = up to 210 bar  
**6** = up to 280 bar

Seals: omit for mineral oils  
**V** = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)

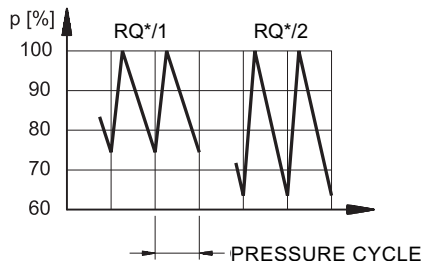
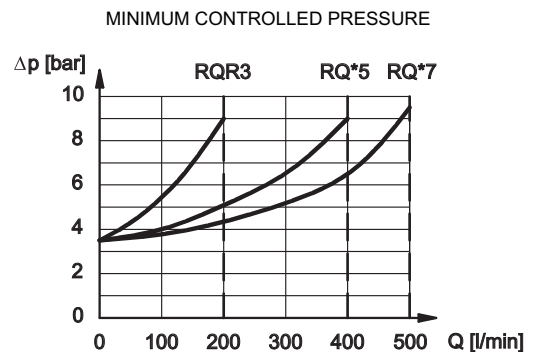
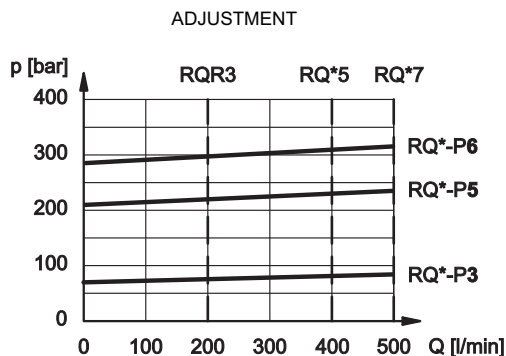
**M** = adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)

Internal drainage

Differential pressure (values  $\pm 2.5\%$ )  
**1** = pump switch on at 75% of the set value  
**2** = pump switch on at 63% of the set value

## 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)

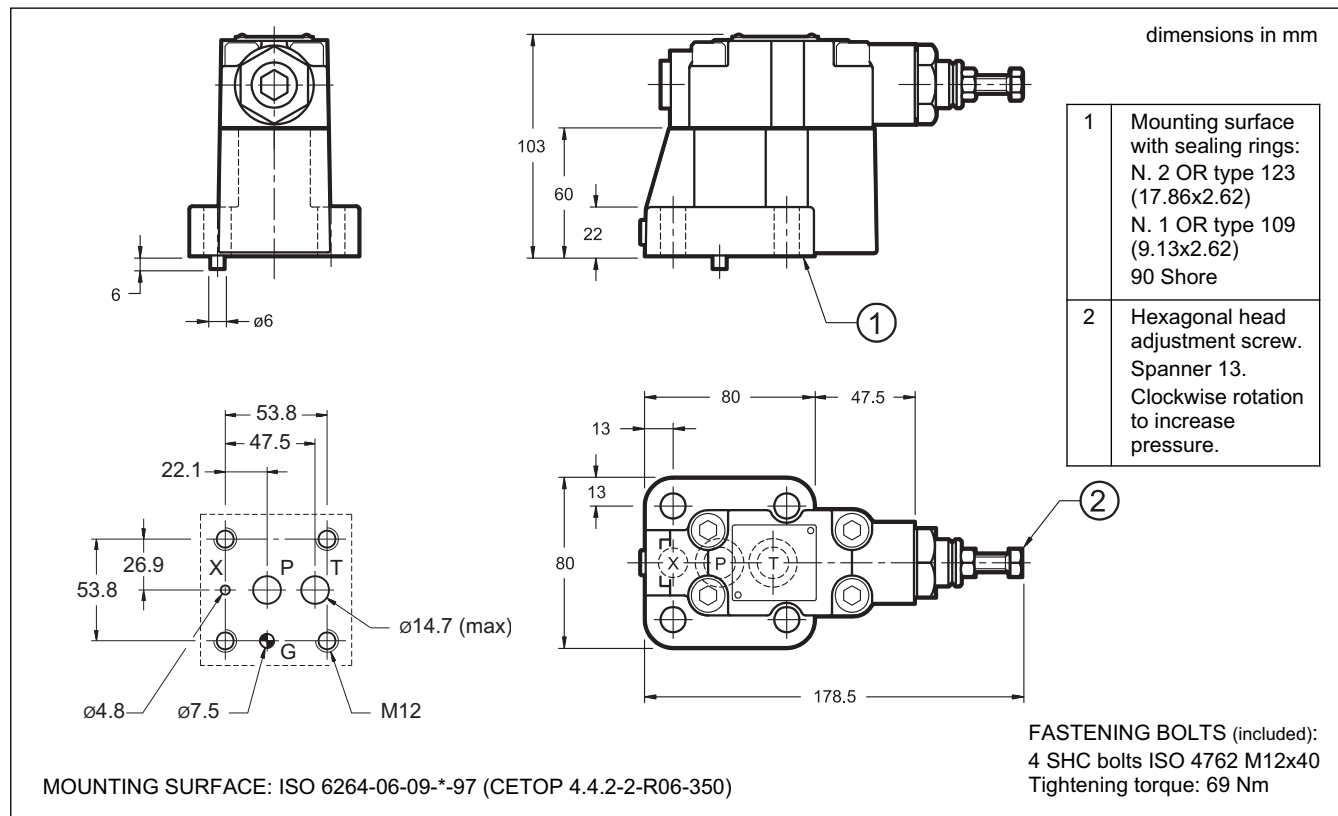


## 3 - HYDRAULIC FLUIDS

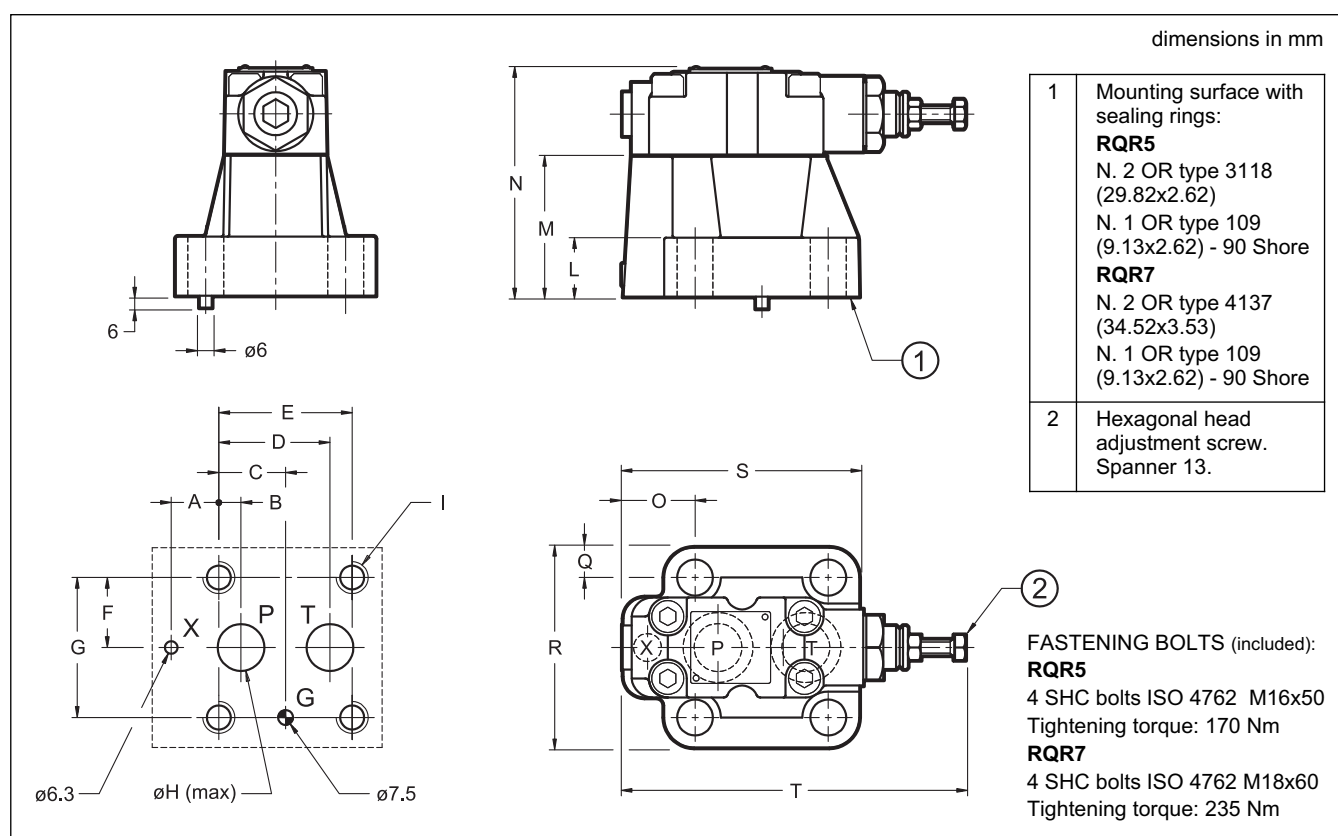
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - RQR3-P OVERALL AND MOUNTING DIMENSIONS



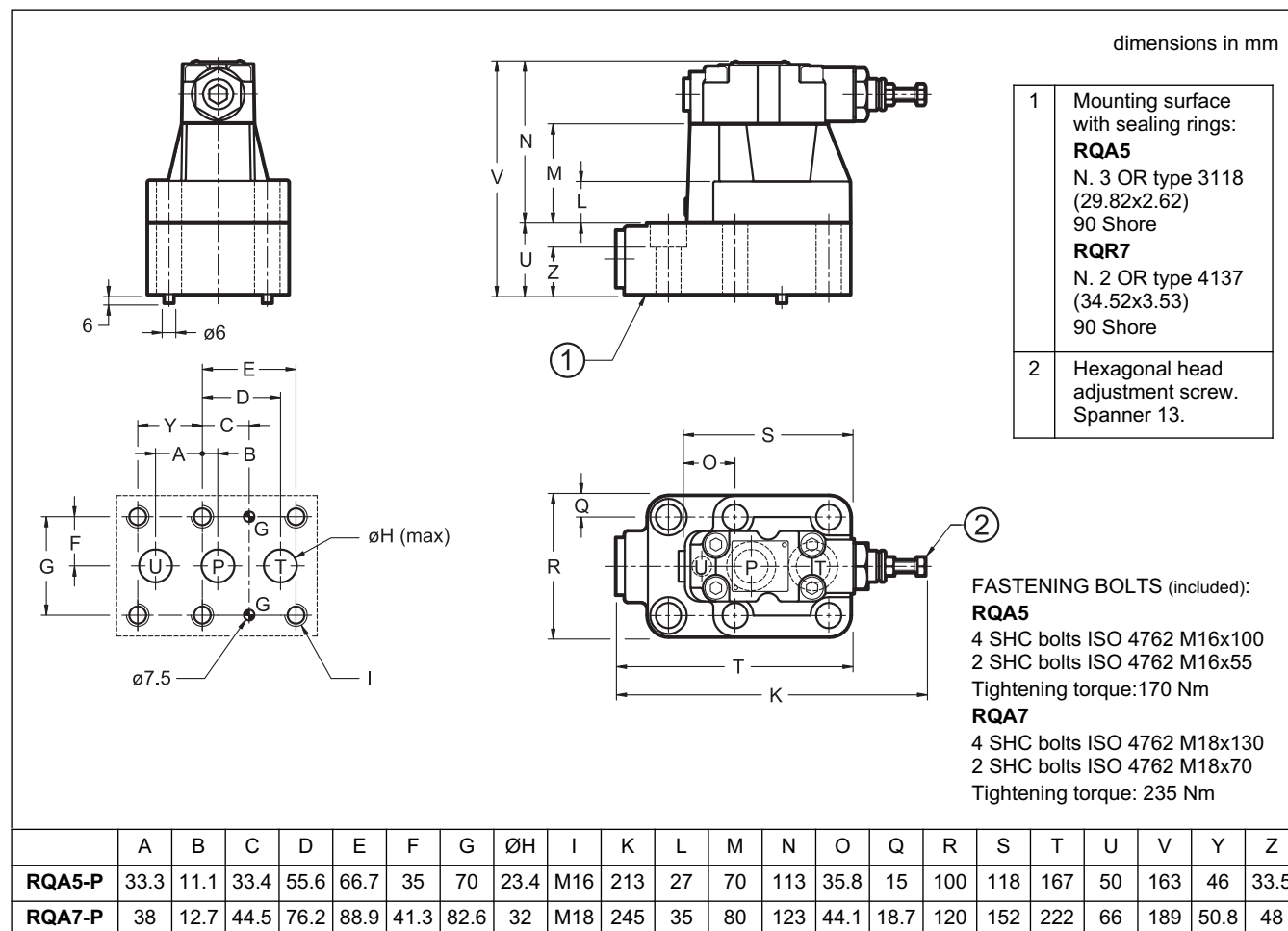
### 5 - RQR5-P AND RQR7-P OVERALL AND MOUNTING DIMENSIONS



	MOUNTING SURFACE	A	B	C	D	E	F	G	ØH	I	L	M	N	O	Q	R	S	T
<b>RQR5-P</b>	ISO 6264-08-13-*97 (CETOP 4.4.2-2-R08-350)	23.8	11.1	33.4	55.6	66.7	35	70	23.4	M16	27	70	113	35.8	15	100	118	170
<b>RQR7-P</b>	ISO 6264-10-17-*97 (CETOP 4.4.2-2-R10-350)	31.8	12.7	44.5	76.2	88.9	41.3	82.6	32	M18	35	80	123	44.1	18.7	120	152	180



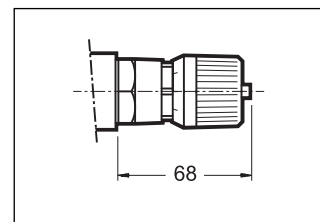
### 6 - RQA5-P AND RQA7P OVERALL AND MOUNTING DIMENSIONS



### 7 - ADJUSTMENT KNOB

The valves can be equipped with a SICBLOC adjustment knob. To operate it, push and rotate at the same time.

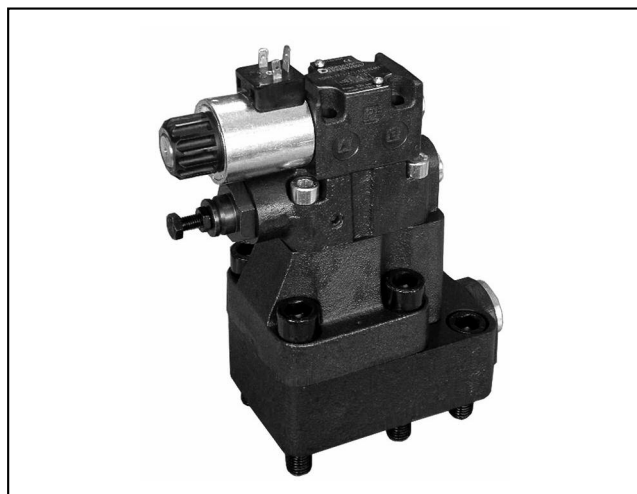
To request this option, add **M** (see paragraph 1) in the proper square.



### 8 - SUBPLATES

(see catalogue 51 000)

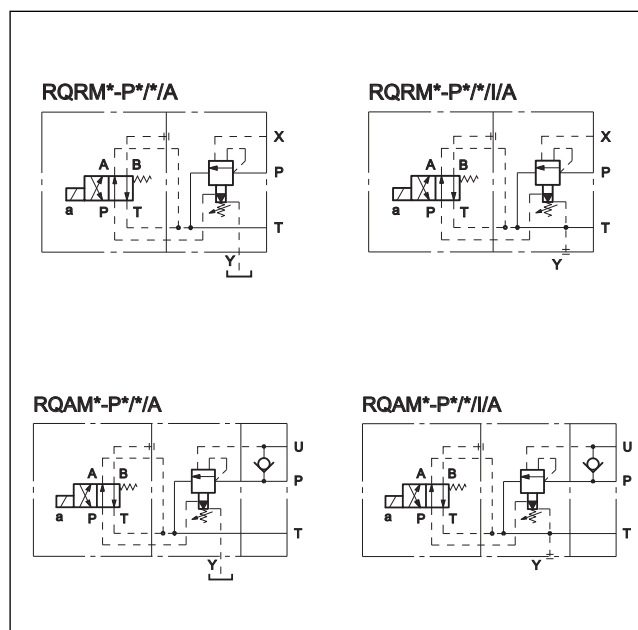
	RQR3-P	RQR5-P	RQR7-P	RQA5-P	RQA7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports	PMRQA5-AI5G rear ports	PMRQA7-AI7G rear ports
P, T, U ports dimensions	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP	3/4" BSP	1" 1/4 BSP
X port dimension	1/4" BSP	1/4" BSP	1/4" BSP	-	-



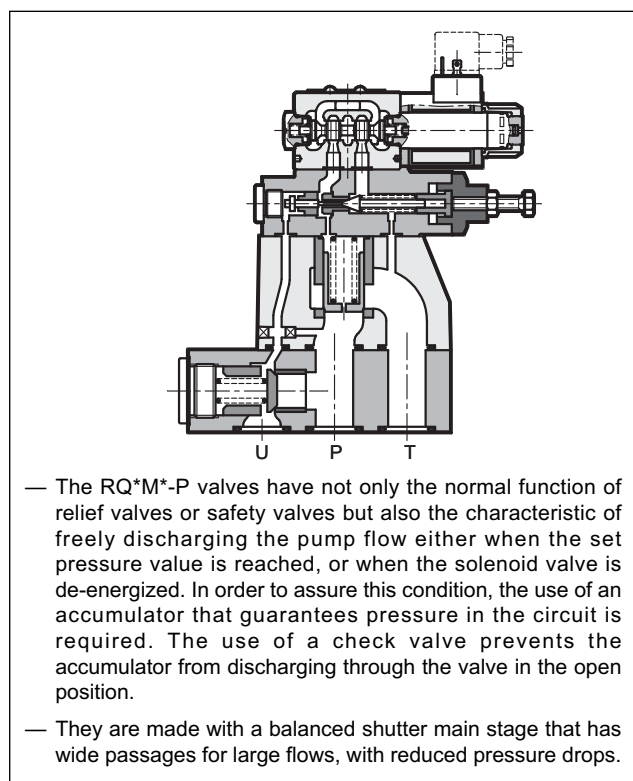
**RQ\*M\*-P**  
UNLOADING VALVE  
WITH AUTOMATIC OR  
SOLENOID OPERATED VENTING  
(FOR CIRCUITS WITH ACCUMULATOR)  
SERIES 51  
**RQRM\*-P**  
FOR REMOTE PILOTING  
**RQAM\*-P**  
WITH INCORPORATED CHECK VALVE

**SUBPLATE MOUNTING**

**HYDRAULIC SYMBOLS**



**OPERATING PRINCIPLE**



**PERFORMANCES**

(measured with mineral oil of viscosity 36 cSt at 50°C)

		<b>RQRM3-P</b>	<b>RQRM5-P</b>	<b>RQRM7-P</b>	<b>RQAM5-P</b>	<b>RQAM7-P</b>
Maximum operating pressure	bar	350				
Maximum flow rate	l/min	200	400	500	400	500
Ambient temperature range	°C	-20 / +50				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15				
Recommended viscosity	cSt	25				
Mass	Kg	5	5,8	8	12	19

**NOTE:** for the solenoid valve DS3 characteristics see catalogue 41 150



# RQ\*M\*-P

## SERIES 51

### 1 - IDENTIFICATION CODE

<b>R</b>	<b>Q</b>	<b>M</b>	<b>-</b>	<b>P</b>	<b>/</b>	<b>/</b>	<b>A</b>	<b>/</b>	<b>/</b>	<b>/</b>	<b>51</b>	<b>-</b>	<b>K1</b>	<b>/</b>	
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	-----------	----------	-----------	----------	--

Unloading valve

Automatic venting for circuits with accumulator  
**R** = for remote piloting  
**A** = with embedded check valve (unavailable on size 3)

Solenoid valve for electrical unloading

Size:  
**3** = (RQRM3-P) ISO 6264-06-09-\*-97 (CETOP R06)  
**5** = (RQRM5-P) ISO 6264-08-13-\*-97 (CETOP R08)  
**5** = (RQAM5-P)  
**7** = (RQRM7-P) ISO 6264-10-17-\*-97 (CETOP R10)  
**7** = (RQAM7-P)

Subplate mounting

Pressure adjustment range:  
**3** = up to 70 bar    **6** = up to 280 bar  
**5** = up to 210 bar

Differential pressure (values  $\pm 2.5\%$ )  
**1** = pump switch on at 75% of the set value  
**2** = pump switch on at 63% of the set value

Unloading with de-energized solenoid

**I** = internal drainage (not possible when the backpressure on the return line is greater than 2 bar). Omit for external drainage.

**CM** = manual override, boot protected.  
Omit for override integrated in the tube (standard)

Coil electrical connection: plug for connector type DIN 43650 (standard)

DC power supply  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
**D220** = 220 V  
**D00** = valve without coils (see NOTE)

AC power supply  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see NOTE)  
**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz

Seals:  
**N** = NBR seals for mineral oil (standard)  
**V** = FPM seals for special fluids

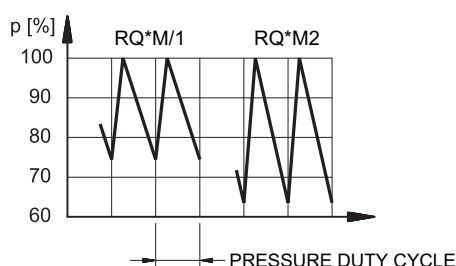
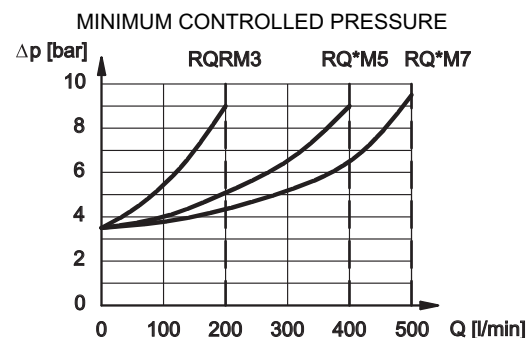
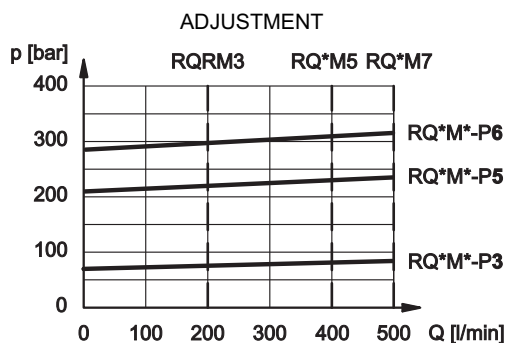
Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

**M** = adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)

**NOTE:** The locking rings of the coils and the relevant O-Rings are supplied together with valves

### 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

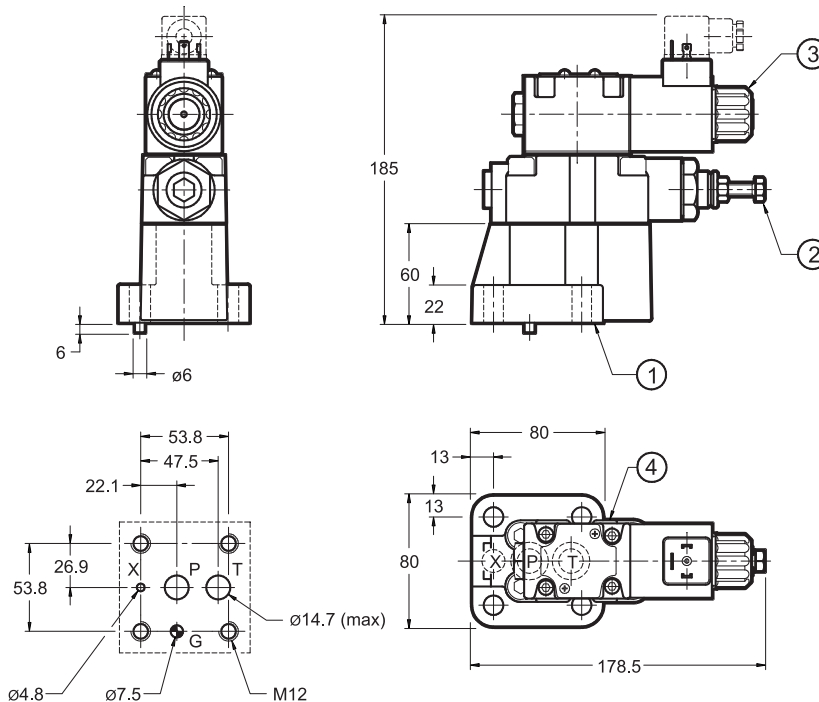
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - RQRM3-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



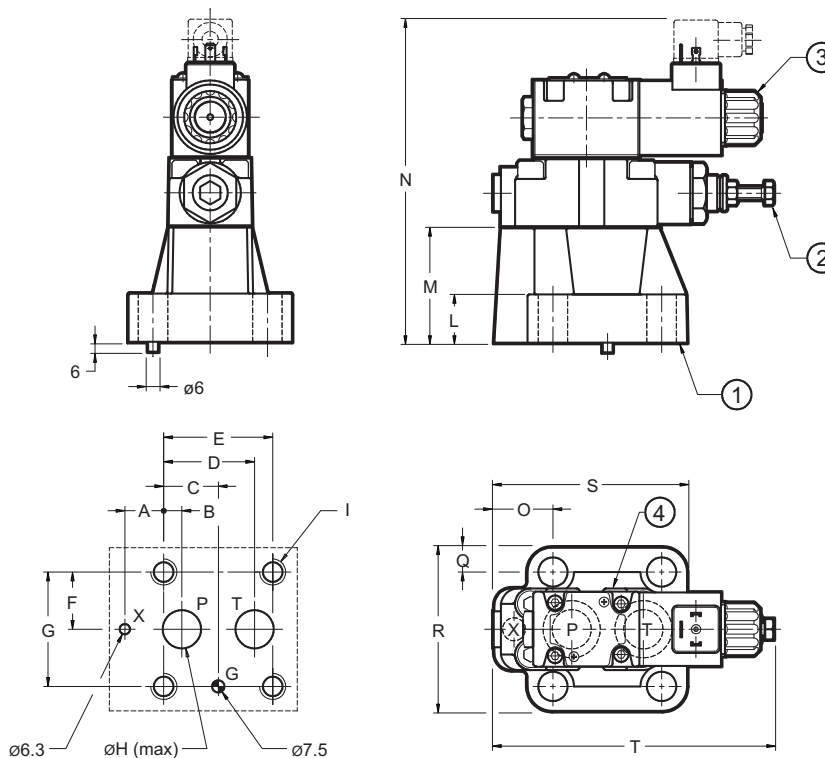
MOUNTING SURFACE: ISO 6264-06-09-\*-97 (CETOP 4.4.2-2-R06-350)

1	Mounting surface with sealing rings: N. 2 OR type 123 (17.86x2.62) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head main pressure adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	ISO 4401-03 (CETOP 03) solenoid valve for unloading
4	External drainage port Y 1/8" NPT

FASTENING BOLTS:  
4 bolts M12x40 Torque: 69 Nm

### 5 - RQRM5-P AND RQRM7-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

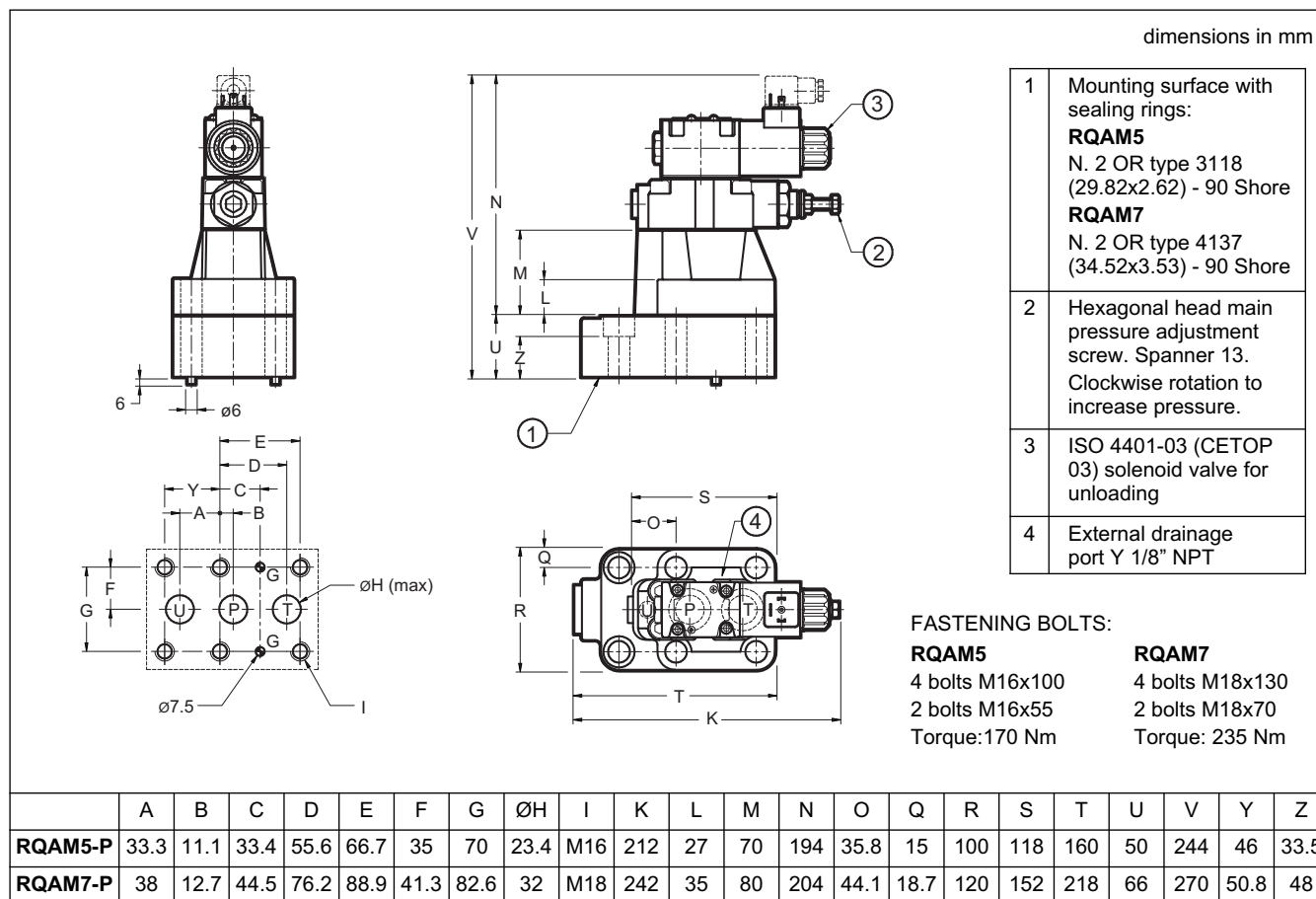


1	Mounting surface with sealing rings: <b>RQRM5</b> N. 2 OR type 3118 (29.82x2.62) - 90 Shore N. 1 OR type 109 (9.13x2.62) - 90 Shore <b>RQRM7</b> N. 2 OR type 4137 (34.52x3.53) - 90 Shore N. 1 OR type 109 (9.13x2.62) - 90 Shore
2	Hexagonal head main pressure adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	ISO 4401-03 (CETOP 03) solenoid valve for unloading
4	External drainage port Y 1/8" NPT

FASTENING BOLTS:  
**RQRM5**  
4 bolts M16x50 Torque: 170 Nm  
**RQRM7**  
4 bolts M18x60 Torque: 235 Nm

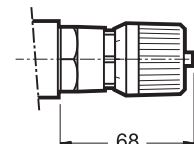
MOUNTING SURFACE		A	B	C	D	E	F	G	ØH	I	L	M	N	O	Q	R	S	T
<b>RQRM5-P</b>	ISO 6264-08-13-*-97 (CETOP 4.4.2-2-R08-350)	23.8	11.1	33.4	55.6	66.7	35	70	23.4	M16	27	70	194	35.8	15	100	118	170
<b>RQRM7-P</b>	ISO 6264-10-17-*-97 (CETOP 4.4.2-2-R10-350)	31.8	12.7	44.5	76.2	88.9	41.3	82.6	32	M18	35	80	204	44.1	18.7	120	152	180

### 6 - RQAM5-P AND RQAM7-P OVERALL AND MOUNTING DIMENSIONS



### 7 - ADJUSTMENT KNOB

The RQ\*M\*-P valves can be equipped with a SICBLOC adjustment knob. To operate it, push and rotate at the same time. To request this option, add: /M (see paragraph 1).



### 8 - ELECTRIC CONNECTORS

The solenoid valves are never supplied with connectors. Connectors must be ordered separately, please see catalogue 49 000.

### 9 - MANUAL OVERRIDE, BOOT PROTECTED: CM

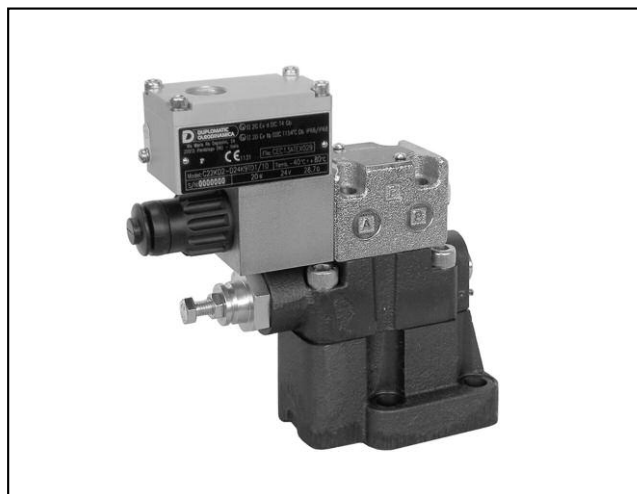
Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override, boot protected is recommended. Add the suffix **CM** to request this device (see paragraph 1).

For overall dimensions see catalogue 41 150.

### 10 - SUBPLATES

(see catalogue 51 000)

	RQRM3-P	RQRM5-P	RQRM7-P	RQAM5-P	RQAM7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports	PMRQA5-AI5G rear ports	PMRQA7-AI7G rear ports
P, T, U ports dimensions	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP	3/4" BSP	1" 1/4 BSP
X port dimensions	1/4" BSP	1/4" BSP	1/4" BSP	-	-



# RQM\*K\*-P

## EXPLOSION-PROOF SOLENOID OPERATED PRESSURE RELIEF VALVES WITH UNLOADING AND PRESSURE SELECTION ATEX, IECEx, INMETRO SERIES 10

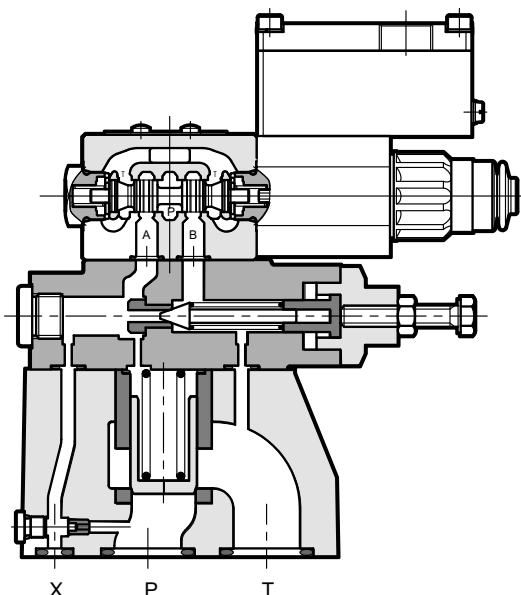
### SUBPLATE MOUNTING

**RQM3K\*-P ISO 6264-06**

**RQM5K\*-P ISO 6264-08**

**RQM7K\*-P ISO 6264-10**

### OPERATING PRINCIPLE



- The RQM\*K\*-P are explosion-proof pressure relief valves for subplate mounting ISO 6264. They are available in three nominal sizes for flows up to 500 l/min.
- They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- They are available in five versions that allow the unloading of the total flow or the selection of up to three pressure values (see paragraph 2 - Versions) by means of a solenoid valve.
- They are supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob on the main pressure control.
- The adjustment of the second and third pressure values is obtained by a pressure relief valve placed between the main stage and the solenoid valve.
- The valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body. Upon request we can supply these valves completely with zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		RQM3K*-P	RQM5K*-P	RQM7K*-P
Maximum operating pressure	bar	350		
Maximum flow rate	l/min	200	400	500
Temperature range (ambient and fluid)		see data sheet 02 500		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25		



# RQM\*K-P

## SERIES 10

### 1 - IDENTIFICATION CODE

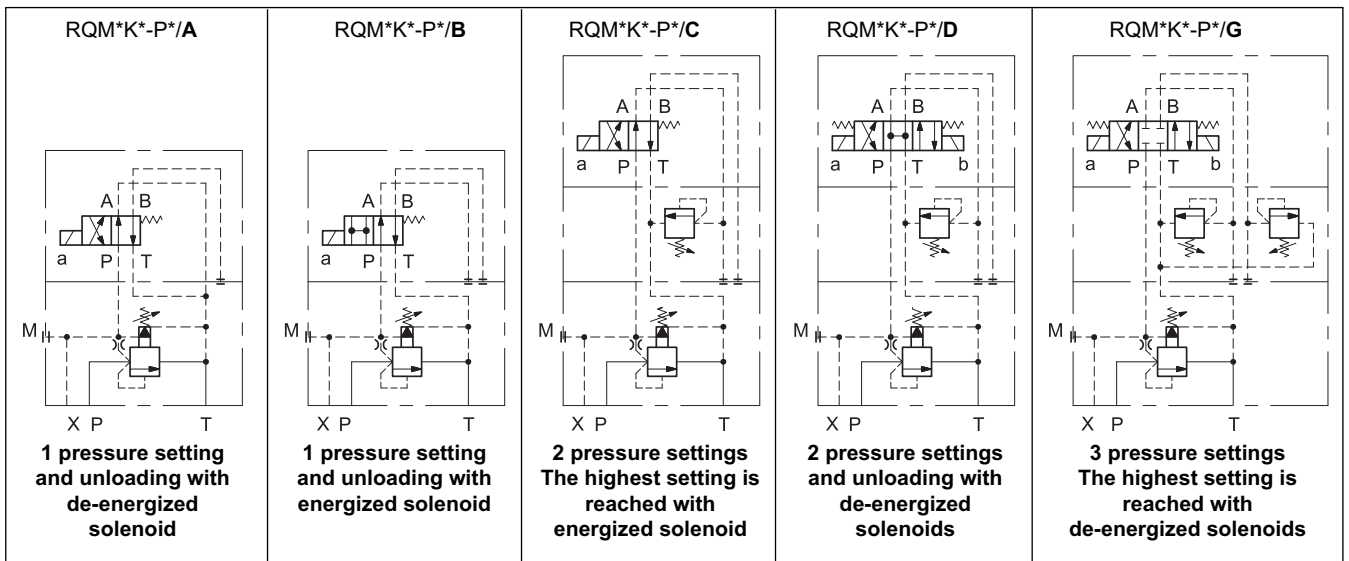
R	Q	M			-	P	/	/	/	10	-	K9	/										
Pilot operated pressure relief valve			Solenoid valve for unloading / pressure selection			Size: _____ 3 = ISO 6264-06 5 = ISO 6264-08 7 = ISO 6264-10			Explosion-proof certification: <b>See table 1.1</b>			Subplate mounting _____			Pressure adjustment range: _____ 3 = up to 70 bar 5 = up to 210 bar 6 = up to 350 bar								
Versions: <table border="0"><tr><td>A</td><td rowspan="5">} see description in the table 2 - versions</td></tr><tr><td>B</td></tr><tr><td>C</td></tr><tr><td>D</td></tr><tr><td>G</td></tr></table>			A	} see description in the table 2 - versions	B	C	D	G	M = adjustment with SICBLOC knob _____ available only on the main pressure control Omit for adjustment with hexagonal head screw			Series No. _____ (the overall and mounting dimensions remain unchanged from 10 to 19)			Seals: _____ For temperature range -20 / +80 °C N = NBR seals for mineral oil ( <b>standard</b> ) V = FPM seals for special fluids For temperature range -40 / +80 °C NL = seal for low temperatures (for mineral oil)			Option: surface treatment not standard. Omit if not required (see <b>NOTE</b> )			Option: /T5 version in T5 temperature class. Omit if not required.		
A	} see description in the table 2 - versions																						
B																							
C																							
D																							
G																							
Manual override: <b>CM</b> = boot protected <b>standard for both N and V seals</b> not available for NL seals <b>CB</b> = blind ring nut <b>standard for NL seals</b> available upon request for both N and V seals see at par. 12			Connection type for cable gland upper connection: <b>T01</b> = M20x1.5 - ISO 261 <b>T02</b> = Gk 1/2 - UNI EN 10226-2 not available for INMETRO <b>T03</b> = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1) side connection: <b>S01</b> = M20x1.5 - ISO 261 <b>S02</b> = Gk 1/2 - UNI EN 10226-2 not available for INMETRO <b>S03</b> = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1) <b>S04</b> = M16x1.5 - ISO 261			Coil electrical connection: by terminal block			Power supply: Direct current (DC) <b>D12</b> = 12 V <b>D24</b> = 24 V <b>D48</b> = 48 V <b>D110</b> = 110 V Alternate current with built-in rectifier bridge (RAC) <b>R120</b> = 120 V <b>R240</b> = 240 V														
<b>NOTE:</b> the valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body. Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards). For full zinc-nickel surface treatment add the suffix <b>/W7</b> at the end of the identification code.																							

### 1.1 - Names of valves per certification

	ATEX		IECEX		INMETRO	
for gases for dusts	<b>KD2</b>	II 2GD	<b>KXD2</b>	IECEX Gb IECEX Db	<b>KBD2</b>	INMETRO Gb INMETRO Db
for mines	<b>KDM2</b>	I M2	<b>KXDM2</b>	IECEX Mb	<b>KBDM2</b>	INMETRO Mb

**NOTE:** Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

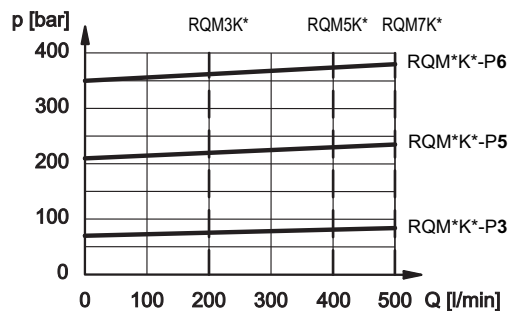
### 2 - VERSIONS



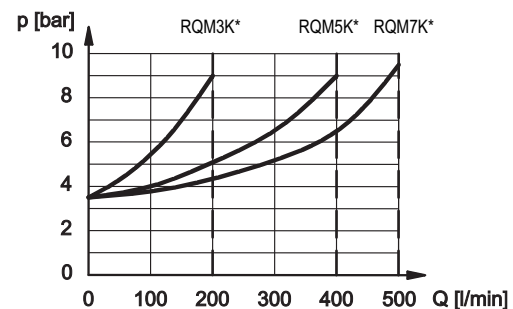
### 3 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



MINIMUM CONTROLLED PRESSURE





## 4 - ELECTRICAL CHARACTERISTICS

(values  $\pm 5\%$ )

Coil type	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]
D12	12	7,2	1,7	20
D24	24	28,7	0,83	20
D48	48	115	0,42	20
D110	110	549	0,2	22

Coil type (NOTE)	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [VA]
R120	110V-50Hz 120V-60Hz	50/60	489,6	0,19	21
				0,21	25
R240	230V-50Hz 240V-60Hz	50/60	2067,7	0,098	22,5
				0,1	24

**NOTE:** type R\* coils are for alternating current supply for both 50 or 60 Hz. For R\* coils the resistance can not be measured in the usual way because of the presence of diodes bridge inside the coil.

<b>VOLTAGE SUPPLY FLUCTUATION (ripple included)</b>	$\pm 10\% V_{nom}$
<b>MAX SWITCH ON FREQUENCY</b>	6.000 ins/hour
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2014/30/EU
<b>CLASS OF PROTECTION:</b> Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

### 4.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

**The electrical connection is polarity-independent.**

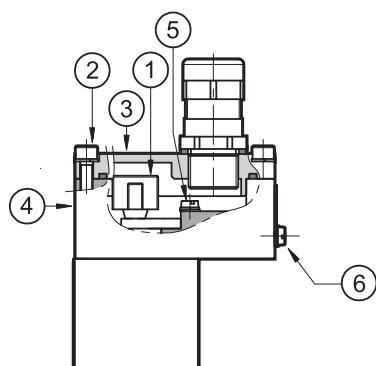
By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

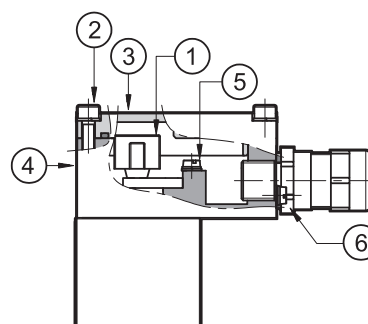
At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9÷6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.

Characteristics of the cables connectable for wiring are indicated in the table below:



K9T\*



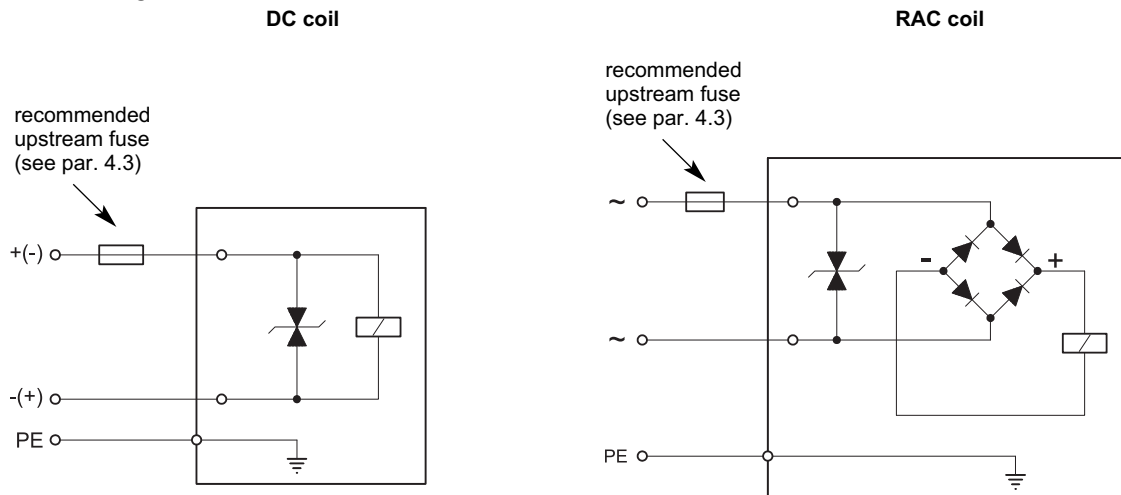
K9S\*

Function	Cable section
Operating voltage cables connection	max 2.5 mm <sup>2</sup>
Connection for internal grounding point	max 2.5 mm <sup>2</sup>
Connection for external equipotential grounding point	max 6 mm <sup>2</sup>

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 12) allow to use cables with external diameter between 8 and 10 mm.

### 4.2 - Electrical diagrams



### 4.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x I<sub>n</sub> according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

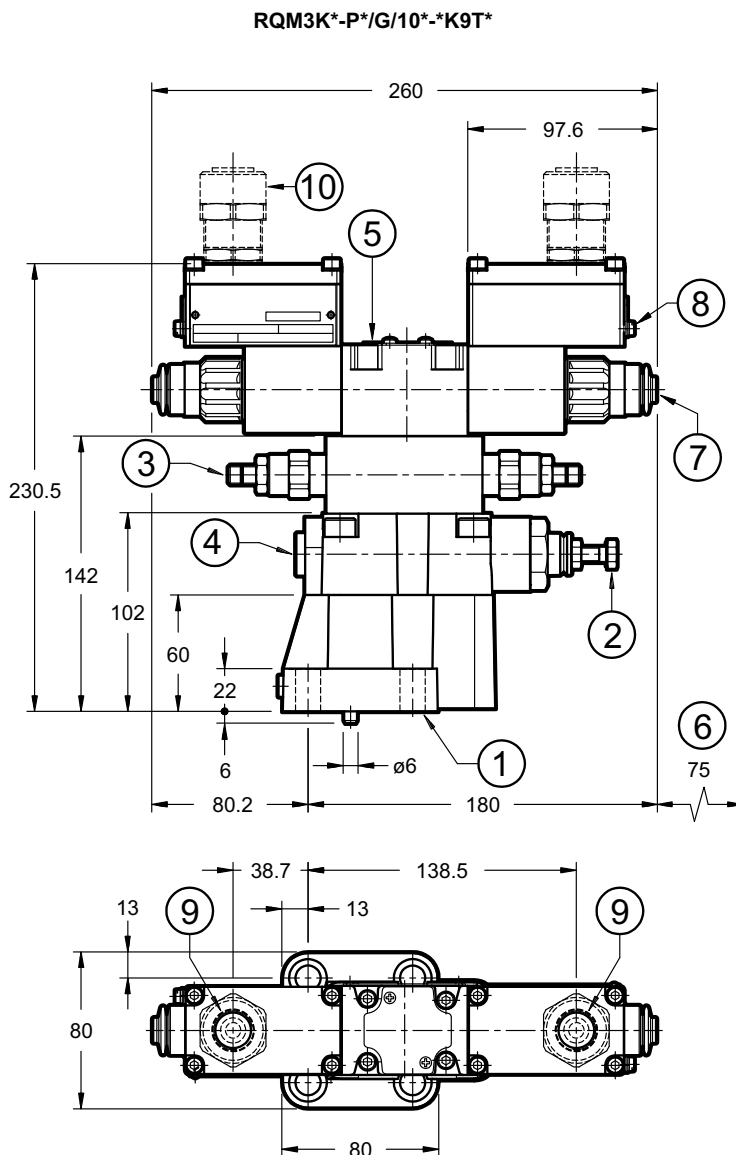
In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]	Maximum voltage value upon switch off [V]	Suppressor circuit
<b>D12</b>	12	1,7	2,5	- 49	Transient voltage suppressor bidirectional
<b>D24</b>	24	0,83	1,25	- 49	
<b>D48</b>	48	0,42	0,6	- 81	
<b>D110</b>	110	0,2	0,3	- 309	
<b>R120</b>	120	0,21	0,3	- 3	
<b>R240</b>	240	0,1	0,15	- 3	

## 5 - RQM3K\*-P OVERALL AND MOUNTING DIMENSIONS

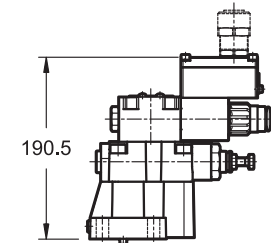
dimensions in mm



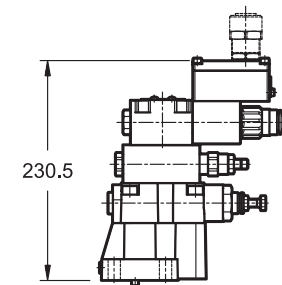
**NOTE:** for side port cable gland see paragraph 8.

**RQM3K\*-P\*/A/10\*-\*K9T\***

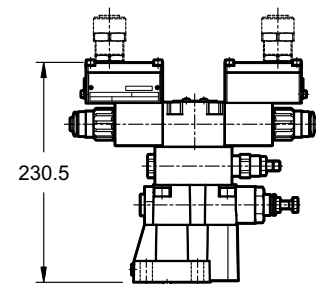
**RQM3K\*-P\*/B/10\*-\*K9T\***



**RQM3K\*-P\*/C/10\*-\*K9T\***



**RQM3K\*-P\*/D/10\*-\*K9T\***



1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) 90 Shore 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw for main pressure value: spanner 13 Clockwise rotation to increase pressure
3	Second pressure value adjustment: Socket hex adjustment screw: Allen key 5 Clockwise rotation to increase pressure
4	Pressure gauge port 3/8" BSP

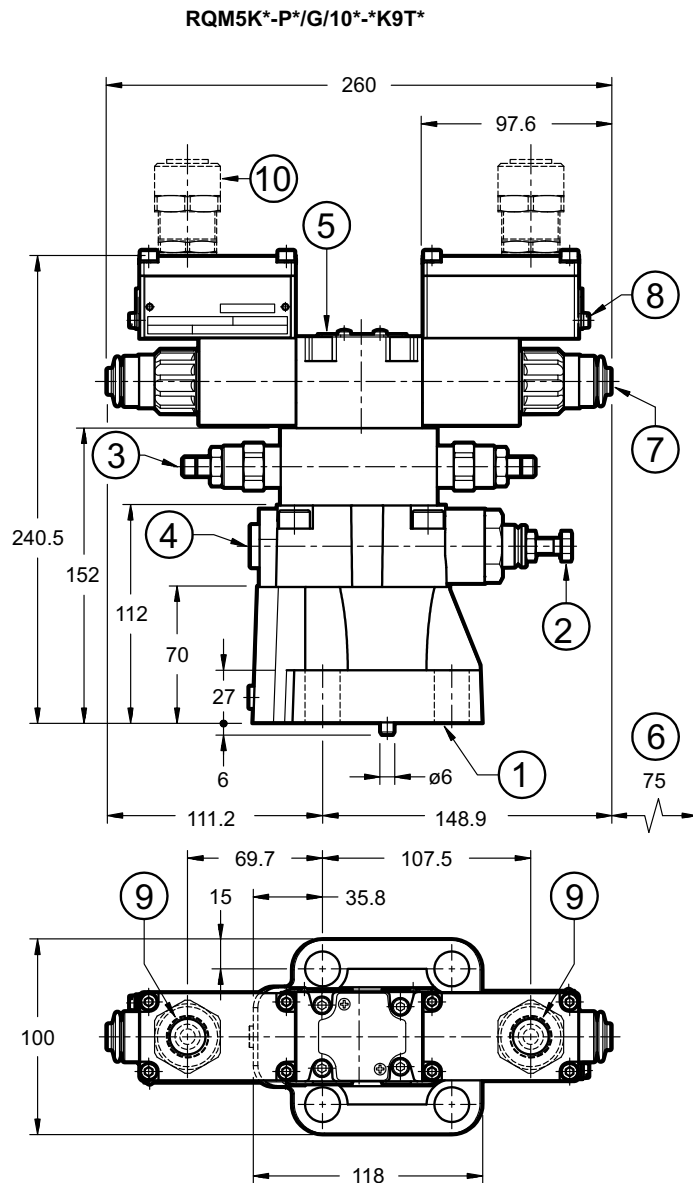
5	ISO 4401-03 solenoid valve for pressure selection / unloading with explosion-proof coils
6	Minimum clear space required
7	Manual override, boot protected <b>standard for both N and V seals</b> For blind ring nut dimensions (standard for NL seals) see par. 12
8	Terminal for supplementary earth connection
9	Upper port for cable gland
10	Cable gland . To be ordered separately, see paragraph 14

Valve	Mass
<b>RQM3K*-P*/A and RQM3K*-P*/B</b>	5,3
<b>RQM3K*-P*/C</b>	6,4
<b>RQM3K*-P*/D</b>	7,3
<b>RQM3K*-P*/G</b>	7,4

Valve fastening: N. 4 SHC screws M12x40 ISO 4762
Tightening torque: 69 Nm (A8.8 screws)
Threads of mounting holes: M12x20

## 6 - RQM5K\*-P OVERALL AND MOUNTING DIMENSIONS

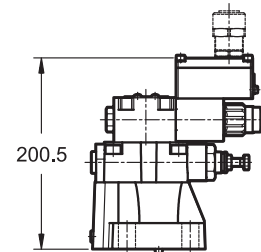
dimensions in mm



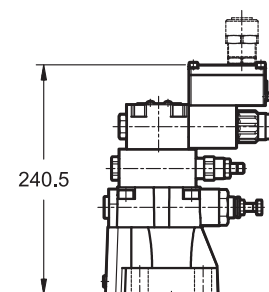
**NOTE:** for side port cable gland see paragraph 8.

**RQM5K\*-P\*/A/10\*-K9T\***

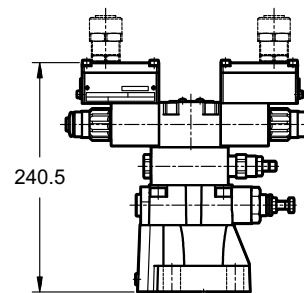
**RQM5K\*-P\*/B/10\*-K9T\***



**RQM5K\*-P\*/C/10\*-K9T\***



**RQM5K\*-P\*/D/10\*-K9T\***



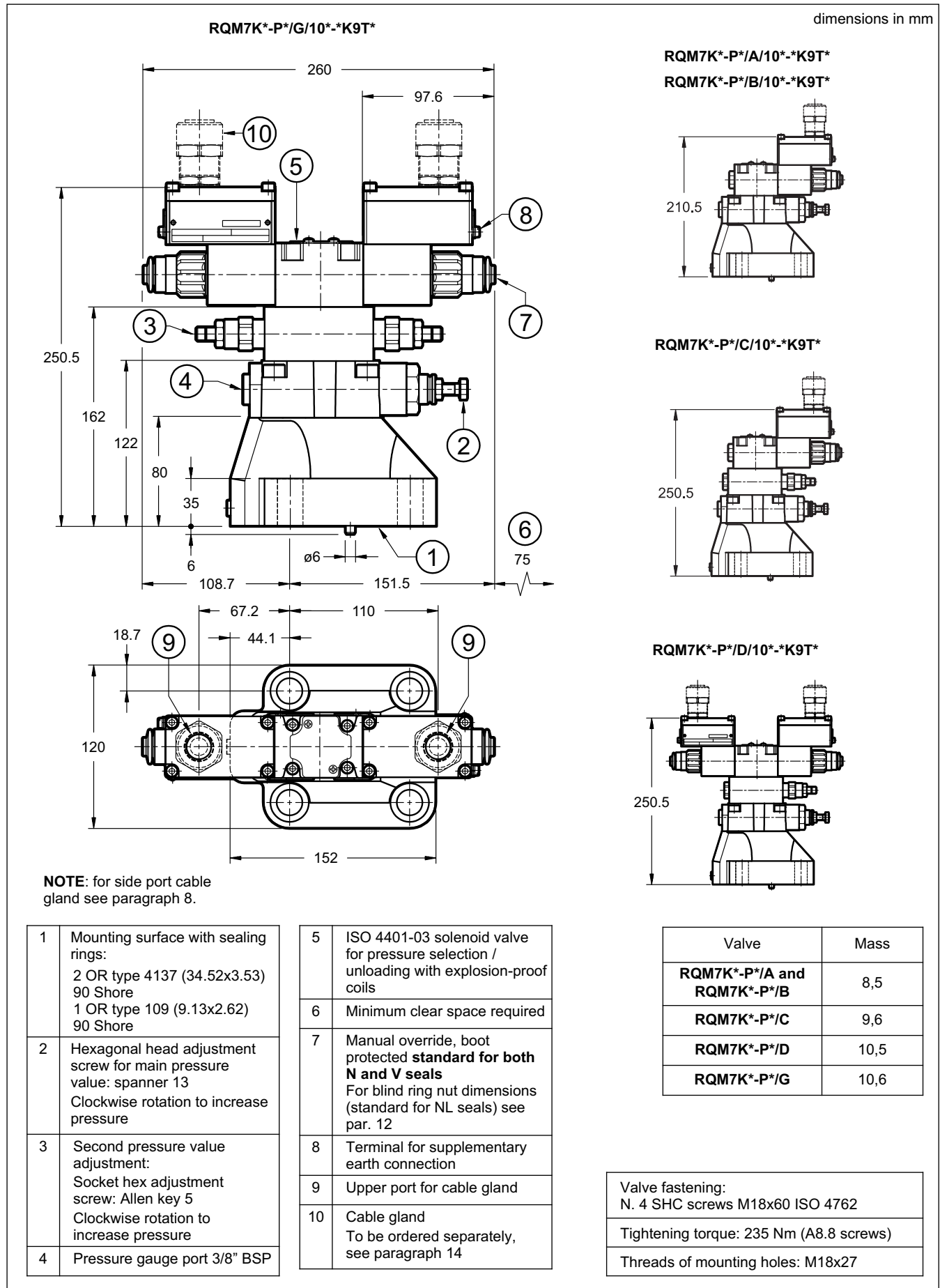
1	Mounting surface with sealing rings: 2 OR type 3118 (29.82x2.62) 90 Shore 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw for main pressure value: spanner 13 Clockwise rotation to increase pressure
3	Second pressure value adjustment: Socket hex adjustment screw: Allen key 5 Clockwise rotation to increase pressure
4	Pressure gauge port 3/8" BSP

5	ISO 4401-03 solenoid valve for pressure selection / unloading with explosion-proof coils
6	Minimum clear space required
7	Manual override, boot protected <b>standard for both N and V seals</b> For blind ring nut dimensions (standard for NL seals) see par. 12
8	Terminal for supplementary earth connection
9	Upper port for cable gland
10	Cable gland. To be ordered separately, see paragraph 14

Valve	Mass
<b>RQM5K*-P*/A and RQM5K*-P*/B</b>	6,3
<b>RQM5K*-P*/C</b>	7,4
<b>RQM5K*-P*/D</b>	8,3
<b>RQM5K*-P*/G</b>	8,4

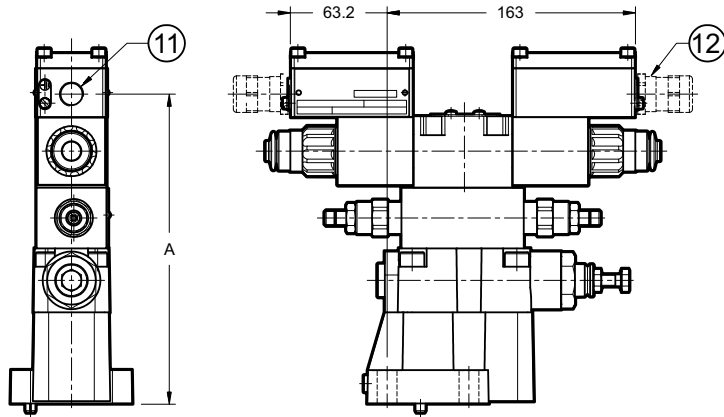
Valve fastening: N. 4 SHC screws M16x50 ISO 4762
Tightening torque: 170 Nm (A8.8 screws)
Threads of mounting holes: M16x25

## 7 - RQM7K\*-P OVERALL AND MOUNTING DIMENSIONS



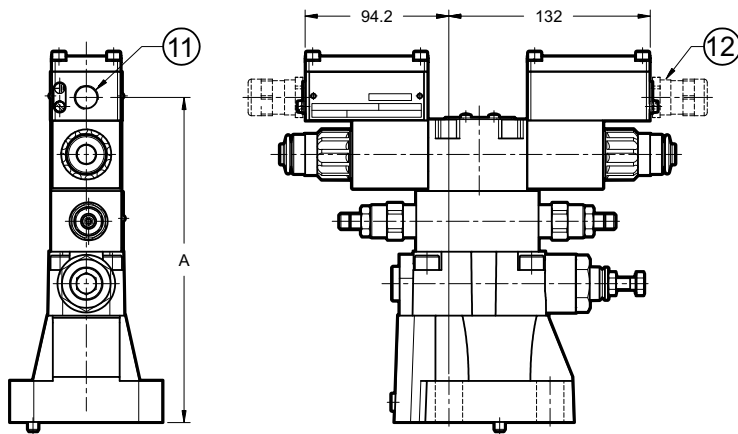
### 8 - RQM\*K\*-P\* SIDE CONNECTION OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



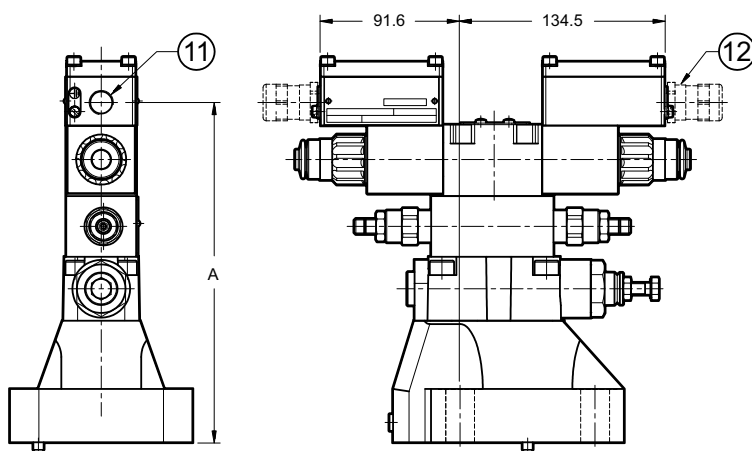
**RQM3K\*-P\*/10\*-K9S\***

Side port type	Dimension A	
	RQM3K*-P*/A RQM3K*-P*/B	RQM3K*-P*/C RQM3K*-P*/D RQM3K*-P*/G
<b>S01, S04</b>	162.5	202.5
<b>S02, S03</b>	162	202



**RQM5K\*-P\*/10\*-K9S\***

Side port type	Dimension A	
	RQM5K*-P*/A RQM5K*-P*/B	RQM5K*-P*/C RQM5K*-P*/D RQM5K*-P*/G
<b>S01, S04</b>	172.5	212.5
<b>S02, S03</b>	172	212

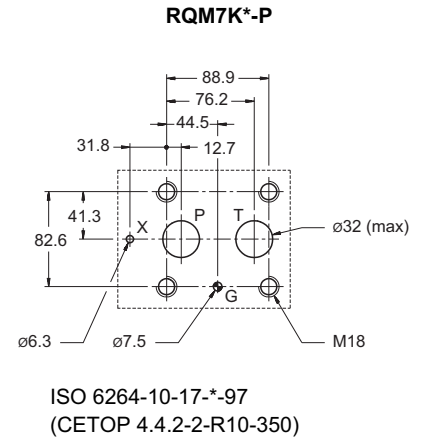
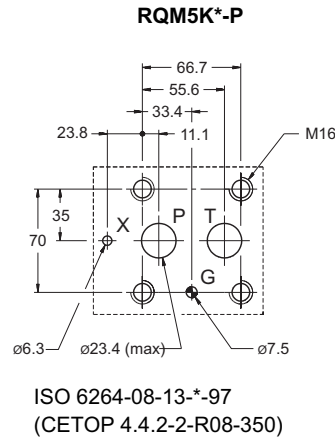
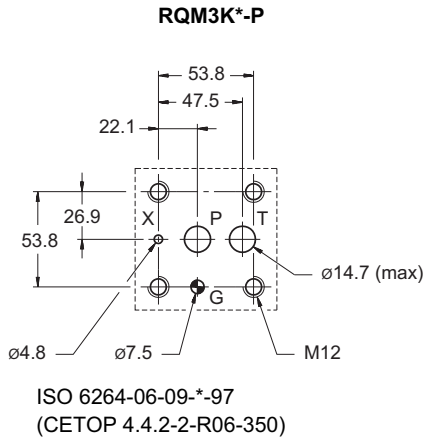


**RQM7K\*-P\*/10\*-K9S\***

Side port type	Dimension A	
	RQM7K*-P*/A RQM7K*-P*/B	RQM7K*-P*/C RQM7K*-P*/D RQM7K*-P*/G
<b>S01, S04</b>	182.5	222.5
<b>S02, S03</b>	182	222

11	Side port
12	Cable gland To be ordered separately, see par. 14

### 9 - MOUNTING SURFACES



### 10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 11 - INSTALLATION

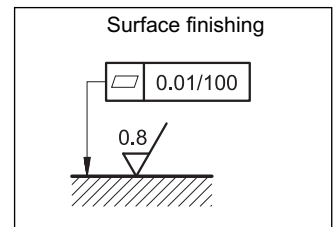


**Installation must adhere to instructions reported in the *Use and Maintenance manual*, always supplied with the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.**

The valves can be installed in any position without impairing correct operation.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



### 12 - MANUAL OVERRIDE CB

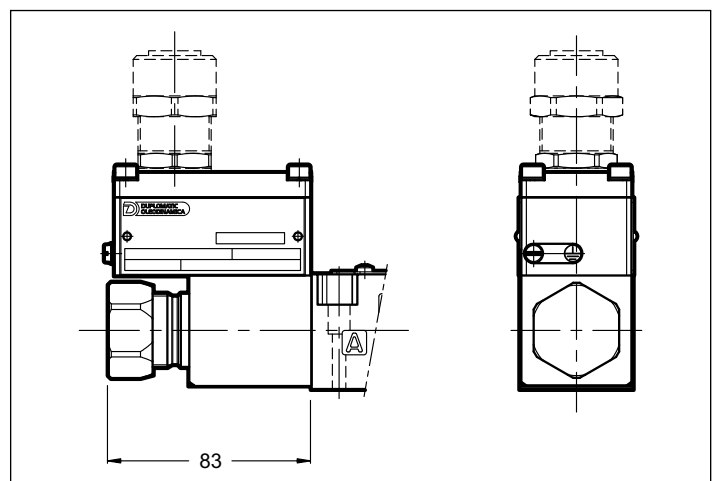
#### CB - Blind ring nut

The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

To access the manual override loosen the ring nut and remove it; then reassemble hand tightening, until it stops.

**Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.**

More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.

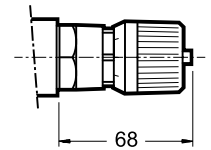




### 13 - ADJUSTMENT KNOB

The valves can be equipped with a SICBLOC adjustment knob, only on the main pressure regulation. To operate it, push and rotate at the same time.

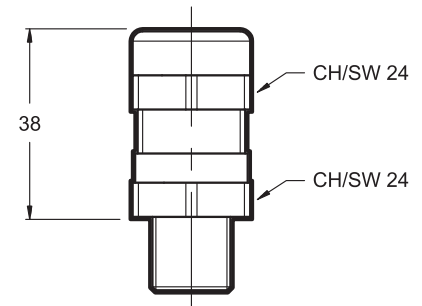
To request this option, add: /M (see paragraph 1).



### 14 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø 8÷10 mm cables);
- ATEX II 2GD, I M2; IECEX Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68



To order the desired cable glands, specify description, code and quantity.

**Description: CGK2/NB-01/10**

**Code: 3908108001**

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

**Description: CGK2/NB-03/10**

**Code: 3908108003**

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-02/10**

**Code: 3908108002**

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-04/10**

**Code: 3908108004**

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

### 15 - SUBPLATES

(see catalogue 51 000)

	RQM3K*-P	RQM5K*-P	RQR7K*-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T ports dimension	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimension	1/4" BSP	1/4" BSP	1/4" BSP

**NOTE:** Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a rate higher than the value allowed by norms according to ATEX directive for category II 2GD and I M2.

The user will bear to do the complete assessment of the ignition risk that can occur from the relative use in potentially explosive environments.





# RQM\*K-P

SERIES 10



**DUPLOMATIC  
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# Z\*-P

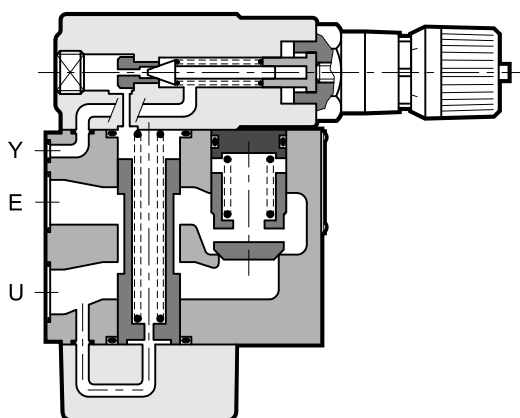
## PRESSURE REDUCING VALVES SERIES 22

### SUBPLATE MOUNTING

**Z3-P ISO 5781-06 (CETOP 06)**

**Z5-P ISO 5781-08 (CETOP 08)**

### OPERATING PRINCIPLE



- The Z\*-P type valves are used when a branch with a lower pressure than the main one is desired in the hydraulic circuits.

Being normally open, they allow passage of oil up to the point when the outlet pressure is less than that set on the valve; the valve closes and keeps the outlet pressure constant when it reaches the set value. The intake pressure fluctuation, for values greater than the set values, does not affect the reduced outlet pressure, and furthermore the particular design of the valve prevents exceeding the set value even in transients.

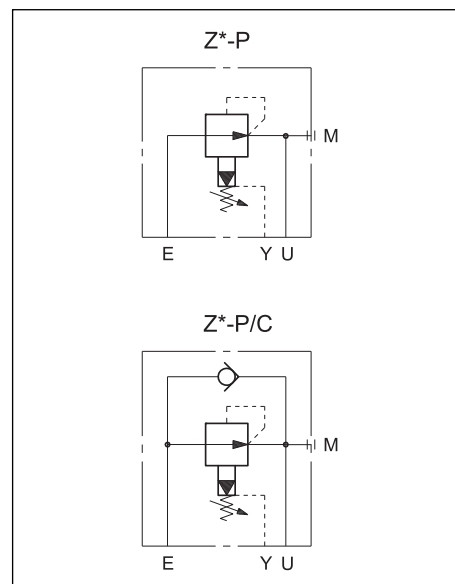
The drainage, to be connected directly to the tank, discharges about 0,8 l/min. The valves are available, upon request, with reduced drainage (0,4 l/min).

- Available even with incorporated check valve upon request, with cracking pressure of 0,5 bar.

### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		Z3-P	Z5-P
Maximum operating pressure	bar	250	
Maximum flow rate	l/min	40	110
Drain flow rate:    for Z*-P for Z*-P*R	l/min	0,8 0,4	
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 classe 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	3,9	6,1

### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<b>Z</b>		<b>-</b>	<b>P</b>	<b>5</b>		<b>/</b>		<b>/</b>	<b>22</b>	<b>/</b>	
----------	--	----------	----------	----------	--	----------	--	----------	-----------	----------	--

Pressure reducing valve \_\_\_\_\_

Size: \_\_\_\_\_  
**3** = ISO 5781-06-07-\*00 (CETOP 4.4.5-2-06-250)  
**5** = ISO 5781-08-10-\*00 (CETOP 4.4.5-2-08-250)

Subplate mounting \_\_\_\_\_

Pressure adjustment range: \_\_\_\_\_  
 5 ÷ 210 bar

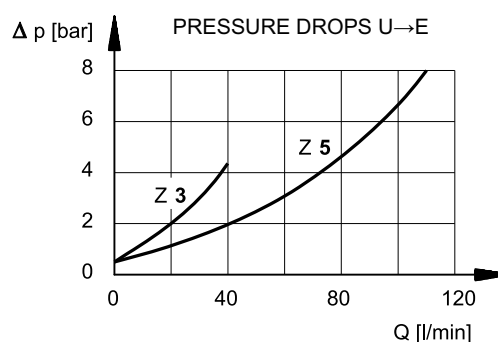
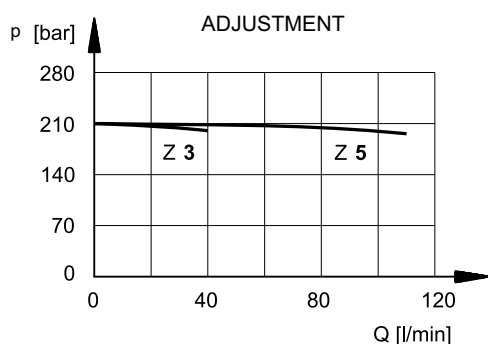
**R** = Reduced drainage (omit if not required) \_\_\_\_\_

Seals:  
 omit for mineral oils  
**V** = viton for special fluids

Series No.  
 (the overall and mounting dimensions remain unchanged from 20 to 29)

**C** = check valve for free flow from U→E  
 Cracking pressure 0,5 bar  
 (omit if not required)

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

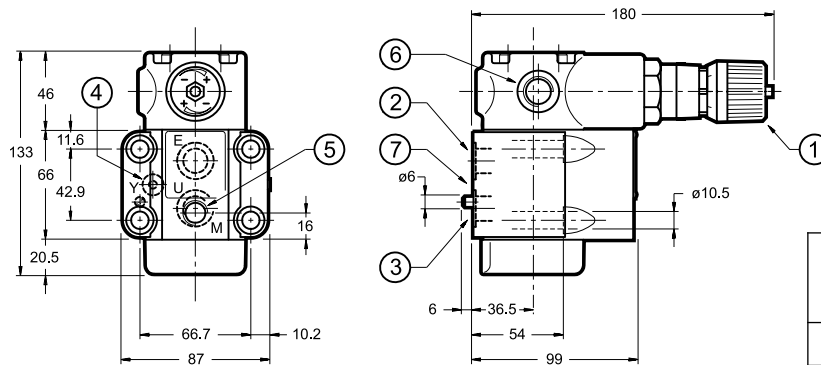
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

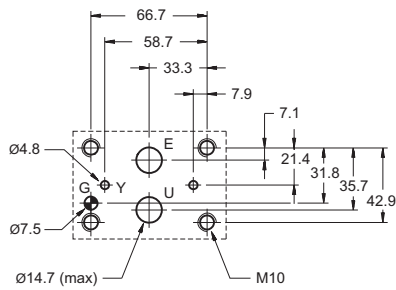
The fluid must be preserved in its physical and chemical characteristics.

### 4 - Z3-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



MOUNTING SURFACE:  
ISO 5781-06-07-\*00 (CETOP 4.4.5-2-06-250)



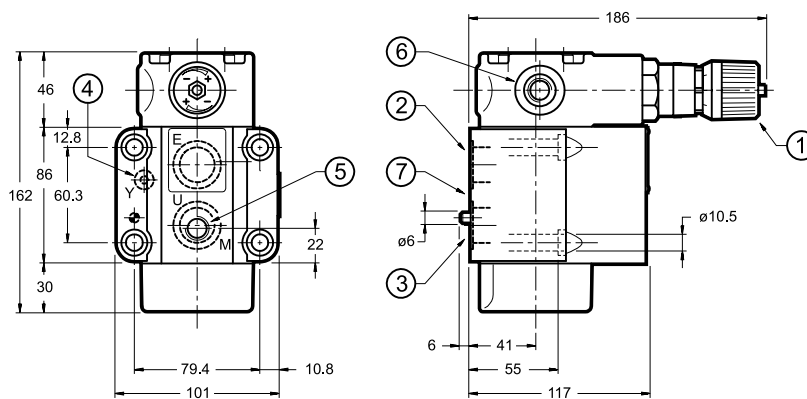
**NOTE:** the position of the Y port corresponds to the position of the X port provided for by the ISO Standard

1	SICBLOC adjustment knob. To operate, push and rotate at the same time.
2	Intake
3	Outlet port
4	Drainage port
5	Pressure gauge port 1/4" NPT
6	Supplementary tube port for drainage 1/4" BSP
7	Mounting surface with sealing rings: N. 2 OR type 3068 (17.13x2.62) N. 2 OR type 2021 (5.28x1.78) 90 Shore

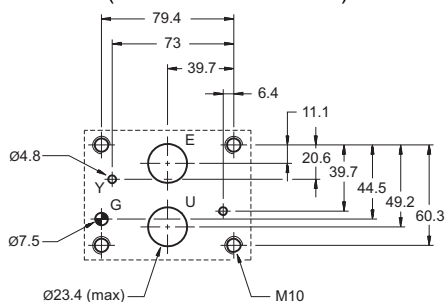
FASTENING BOLTS:  
4 bolts M10x70  
Tightening torque: 40 Nm

### 5 - Z5-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



MOUNTING SURFACE:  
ISO 5781-08-10-\*00 (CETOP 4.4.5-2-08-250)



**NOTE:** the position of the Y port corresponds to the position of the X port provided for by the ISO Standard

1	SICBLOC adjustment knob. To operate, push and rotate at the same time.
2	Intake
3	Outlet port
4	Drainage port
5	Pressure gauge port 1/4" NPT
6	Supplementary plug for drainage 1/4" BSP
7	Mounting surface with sealing rings: N. 2 OR type 3100 (25.07x2.62) 90 Shore N. 2 OR type 2021 (5.28x1.78) 90 Shore

FASTENING BOLTS:  
4 bolts M10x70  
Tightening torque: 40 Nm



**6 - SUBPLATES** (see catalogue 51 000)

	<b>Z3-P</b>	<b>Z5-P</b>
Type	PMSZ3-AI4G with rear ports	PMSZ5-AI6G with rear ports
Port dimensions: - E, U - X, Y	1/2" BSP 1/4" BSP	1" BSP 1/4" BSP



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**S\*-P**  
**SEQUENCE VALVE**

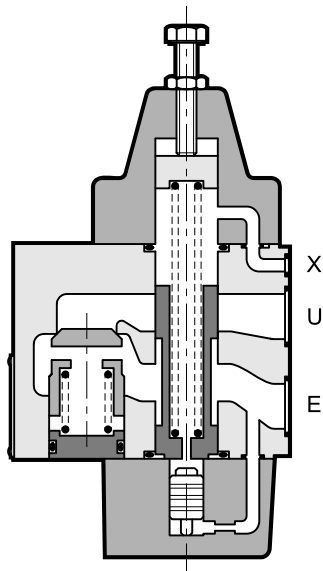
**U\*-P**  
**UNLOADING VALVE**

**T\*-P**  
**BACKPRESSURE VALVE**

**X\*-P**  
**BALANCING VALVE**

**SERIES 20**

### OPERATING PRINCIPLE

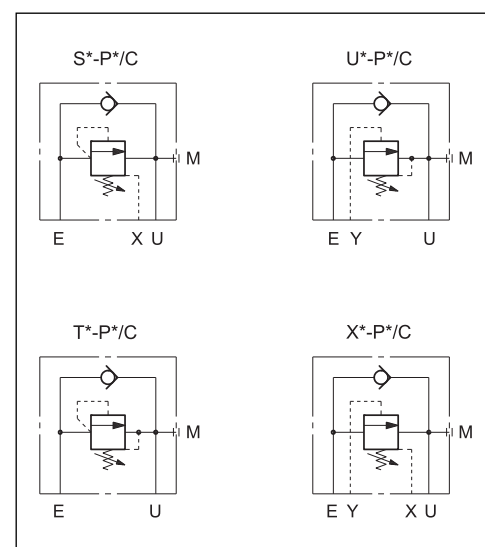


- The S U T X sequence valves are used for pressure control. They are direct-acting and normally closed.
  - They are available in two nominal sizes for flows up to 150 l/min and in four pressure adjustment ranges.
  - Opening takes place by means of a pilot pressure that, acting on a small piston, resists the force of the adjustment spring.
  - The valve can be easily modified to get any one of the four versions **S**, **U**, **T**, **X**, turning the upper and the bottom covers in order to obtain the X and Y internal connections, as indicated in par. 7.
- The figure represents the section of a type S valve.

### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		size 3	size 5
Maximum operating pressure	bar	320	250
Maximum flow rate	l/min	4060	150
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	5,8	6,7

### HYDRAULIC SYMBOLS





# SUTX-P

## SERIES 20

### 1 - IDENTIFICATION CODE

			-	P		/		/	20	/	
--	--	--	---	---	--	---	--	---	----	---	--

Valve type: \_\_\_\_\_  
**S** = sequence valve  
**U** = unloading valve  
**T** = backpressure valve  
**X** = balancing valve

Size: \_\_\_\_\_  
**3** = ISO 5781-06 (CETOP 06)  
**5** = ISO 5781-08 (CETOP 08)

Subplate mounting \_\_\_\_\_

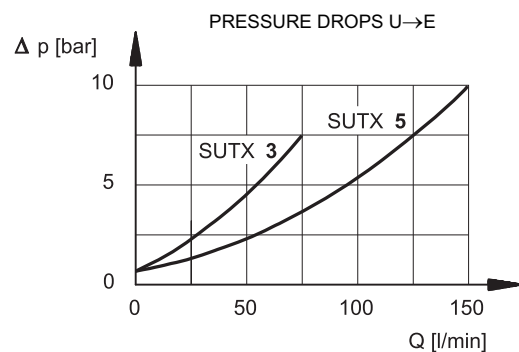
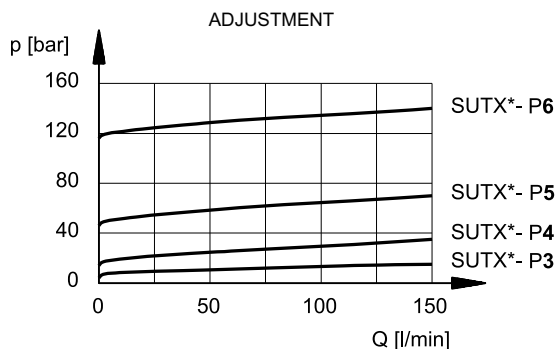
Pressure adjustment range: \_\_\_\_\_  
**3** = 5 ÷ 20 bar  
**4** = 10 ÷ 35 bar  
**5** = 15 ÷ 70 bar  
**6** = 35 ÷ 140 bar

Seals:  
omit for mineral oils  
**V** = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 20 to 29)

**C** = check valve for free flow from U to E.  
Cracking pressure 0,5 bar.  
(omit for version without check valve)

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

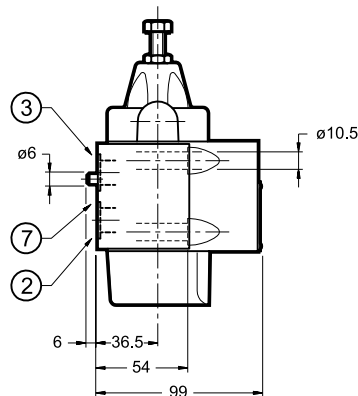
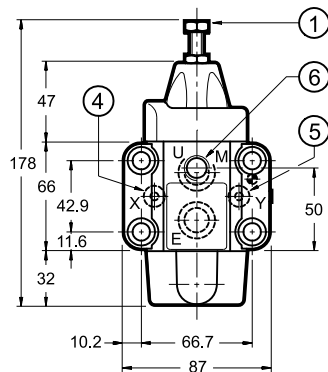


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

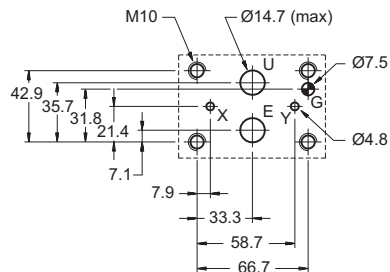
The fluid must be preserved in its physical and chemical characteristics.

## 4 - SUTX 3-P OVERALL AND MOUNTING DIMENSIONS



FASTENING BOLTS:  
4 bolts M10x70  
Tightening torque: 40 Nm

MOUNTING SURFACE:  
ISO 5781-06-07-\*00 (CETOP 4.4.4-2-06-320)

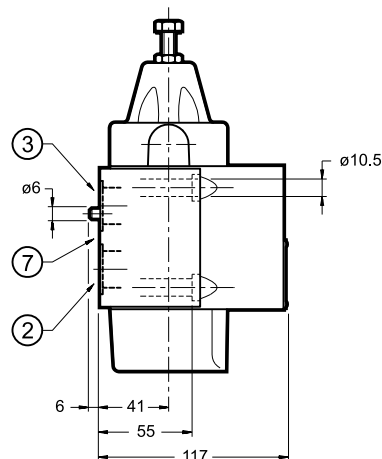
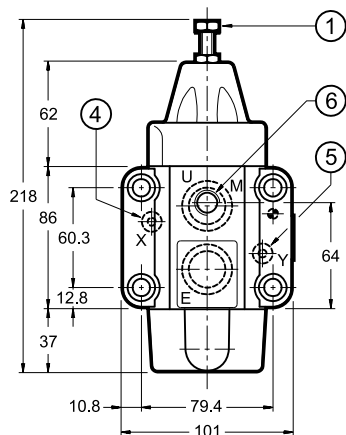


**NOTE:** the positions of the X and Y ports are reversed from the requirements of the ISO Standard

dimensions in mm

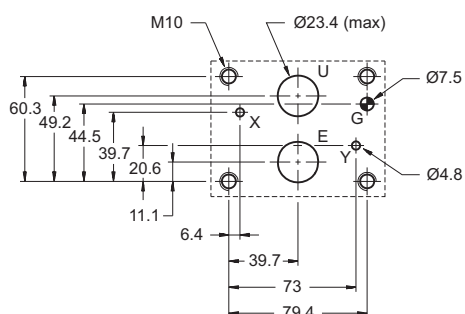
1	Hexagonal head adjustment screw. Spanner 13.
2	Intake port
3	Outlet port
4	External drainage port
5	External piloting port
6	Pressure gauge port 1/4" NPT
7	Mounting surface with sealing rings: N. 2 OR type 3068 (17.13x2.62) - 90 Shore N. 2 OR type 2021 (5.28x1.78) - 90 Shore

## 5 - SUTX 5-P OVERALL AND MOUNTING DIMENSIONS



FASTENING BOLTS:  
4 bolts M10x70  
Tightening torque: 40 Nm

MOUNTING SURFACE:  
ISO 5781-08-10-\*00 (CETOP 4.4.5-2-08-320)



**NOTE:** the positions of the X and Y ports are reversed from the requirements of the ISO Standard

dimensions in mm

1	Hexagonal head adjustment screw. Spanner 13.
2	Intake port
3	Outlet port
4	External drainage port
5	External piloting port
6	Pressure gauge port 1/4" NPT
7	Mounting surface with sealing rings: N. 2 OR type 3100 (25.07x2.62) - 90 Shore N. 2 OR type 2021 (5.28x1.78) - 90 Shore



### 6 - APPLICATIONS

**“S”** The type “S” sequence valve is normally used to successively command two or more actuators: when the pressure in the primary circuit reaches the set value on the valve, it opens and allows the fluid to feed the second circuit branch, keeping the pressure in the first branch.

The valve remains open until the pressure at the intake falls below the set value; under these conditions, the maximum pressure setting on the first circuit branch will be achieved also at the outlet.

It is also used to keep a circuit under pressure when simultaneous supply of various users, requiring the total delivery of the pump, would make the pressure value decrease.

**“U”** This is normally used in automatic circuits (high-low pressure) for unloading the low pressure pump; this occurs when the pressure in the circuit reaches the set value of the valve.

In this manner it is possible to utilize the total flow of the two pumps for fast movements at low pressure, with electric power saving, using high pressure only for working movements.

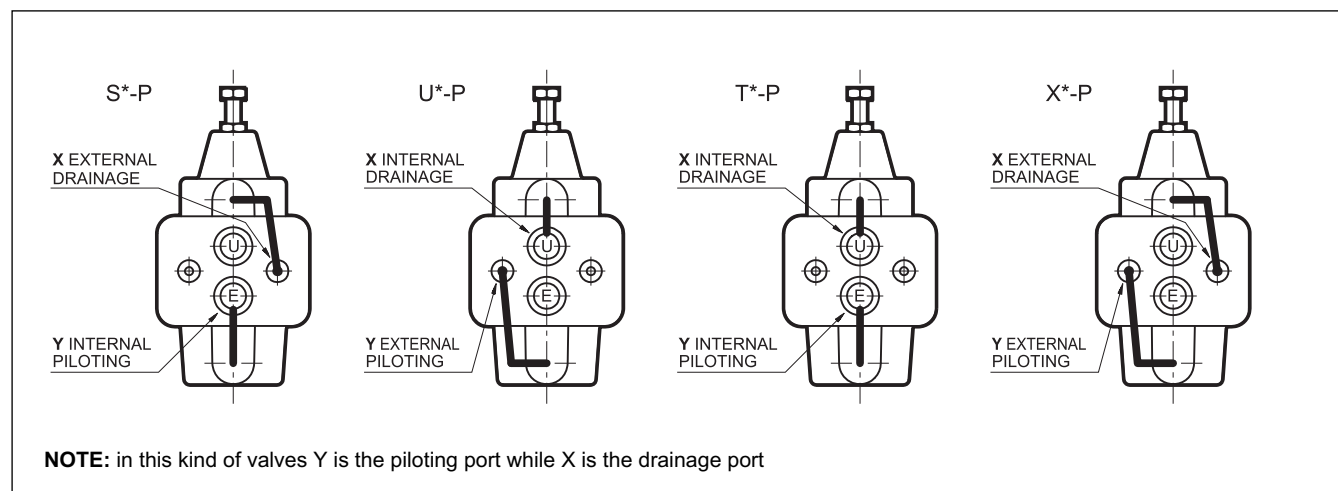
Furthermore, it is used to allow quick discharge of the large chamber of a high differential cylinder which the directional valve would not be able to drain; in this case the valve piloting is connected to the small chamber of the cylinder.

**“T”** Normally this is used to create hydraulic resistance (back pressure) to prevent uncontrolled movements, especially in the case of suspended loads.

The valve, normally closed, opens only when the set pressure is reached, and thus the descent of the load occurs in a controlled manner and the descending speed depends on the delivery of the pump.

**“X”** This is mainly used for load balancing. The piloting pressure can be taken from any point in the plant. The valve stays closed until the pilot pressure reaches the set value.

### 7 - COVER ORIENTATION FOR ALL THE VERSIONS S, U, T, X



### 7 - SUBPLATES (see catalogue 51 000)

	SIZE 3	SIZE 5
Type with rear ports	PMSZ3-AI4G	PMSZ5-AI5G
Ports dimensions:	1/2" BSP 1/4" BSP	1" BSP 1/4" BSP



# ZC2

## BALANCING VALVES

### SERIES 51

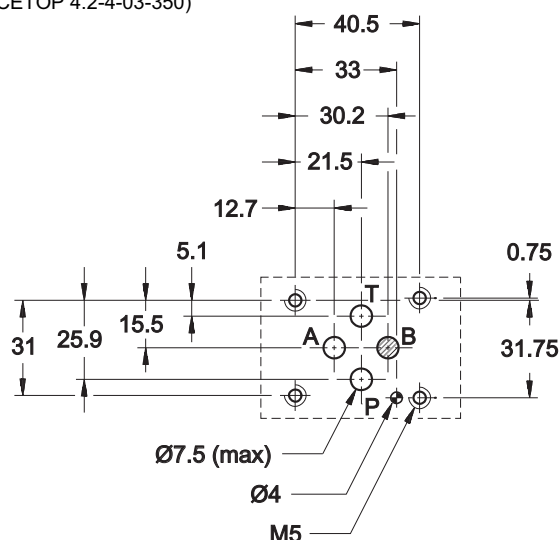
#### SUBPLATE MOUNTING ISO 4401-03 (CETOP 03)

**p** max **350** bar

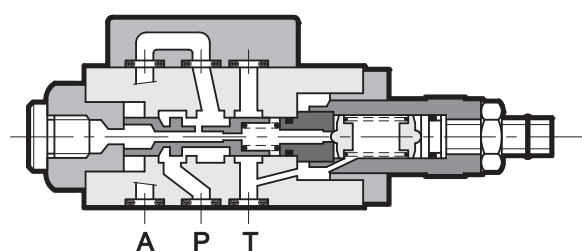
**Q** max **25** l/min

#### MOUNTING INTERFACES

ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



#### OPERATING PRINCIPLE

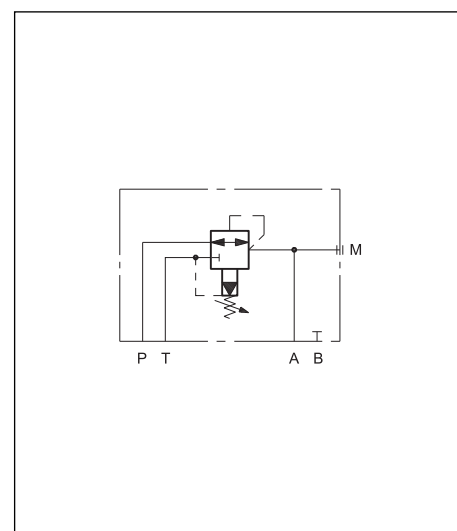


- The type ZC2 balancing valves act as pressure reducing valves that, besides reducing the pressure from line P to user A, allow the flow to return from user A to discharge T when a pressure greater than the set value is generated in the downstream circuit (user A). (A typical case of hydraulic counterweight or load balancing)
- They have a mounting surface in accordance with ISO 4401 (CETOP RP121H) standards. Port B is never used.

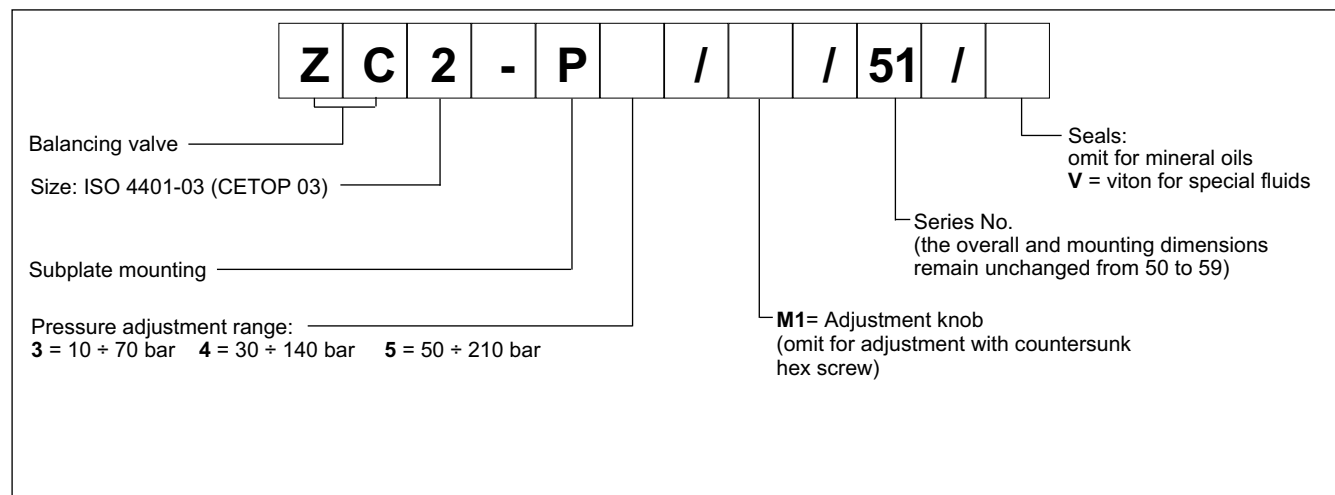
#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	25
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,3

#### HYDRAULIC SYMBOL

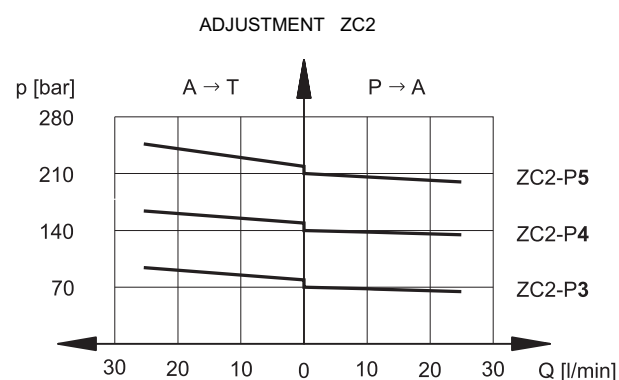


## 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)

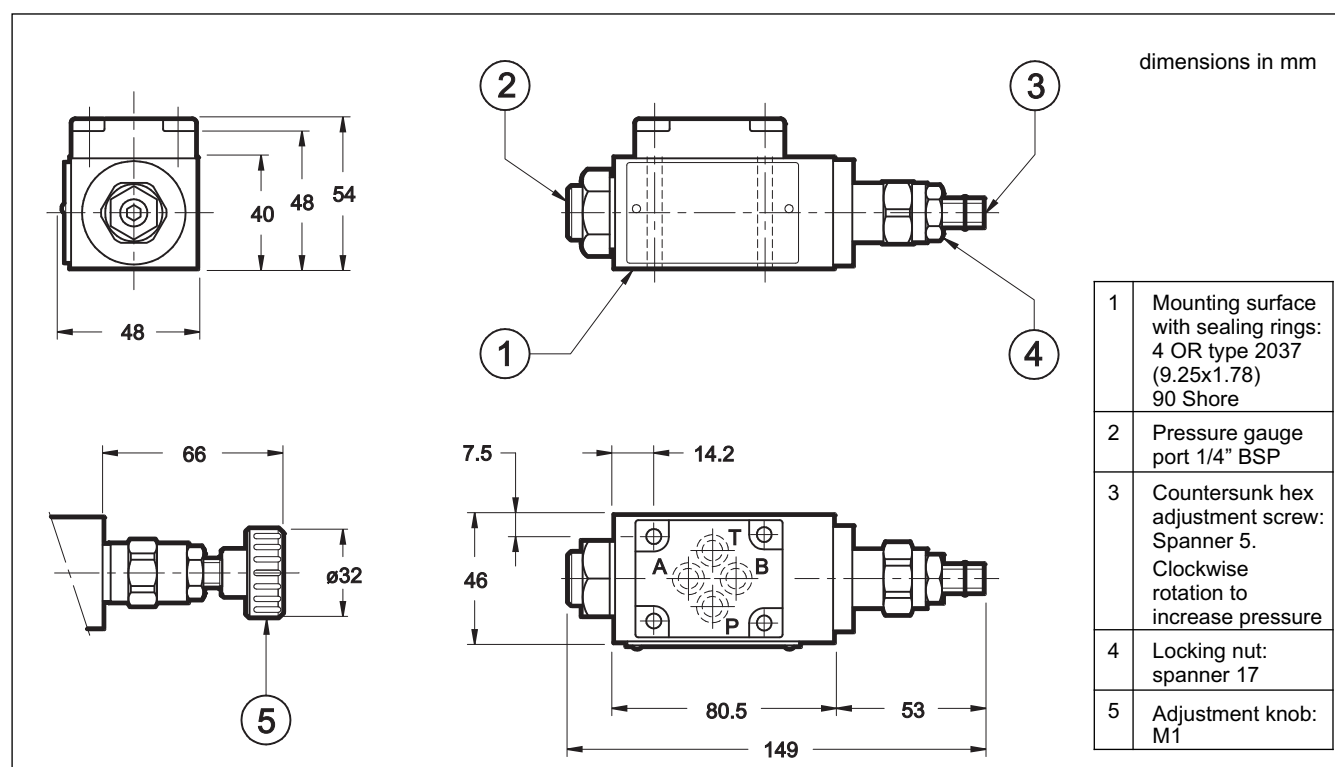


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

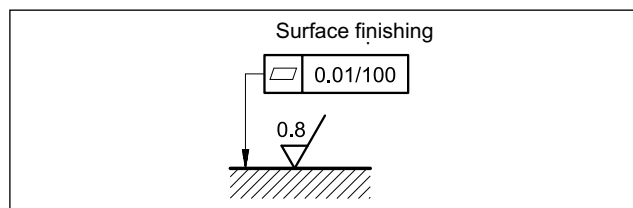
#### 4 - ZC2 OVERALL AND MOUNTING DIMENSIONS



## 9 - INSTALLATION

The ZC2 valves can be installed in any position without impairing correct operation.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 6 - FASTENING BOLTS

N. 4 bolts M5x55
Tightening torque: 5Nm ( A screws 8.8)

## 7 - SUBPLATES (see cat. 51 000)

Type PMMD-AI3G ports on rear 3/8" BSP
Type PMMD-AL3G side ports 3/8" BSP



**ZC2**  
SERIES 51



**DUPLOMATIC  
OLEODINAMICA**

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Fax +39 0331.895.339

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# DZC\*

## PRESSURE REDUCING VALVES SERIES 12



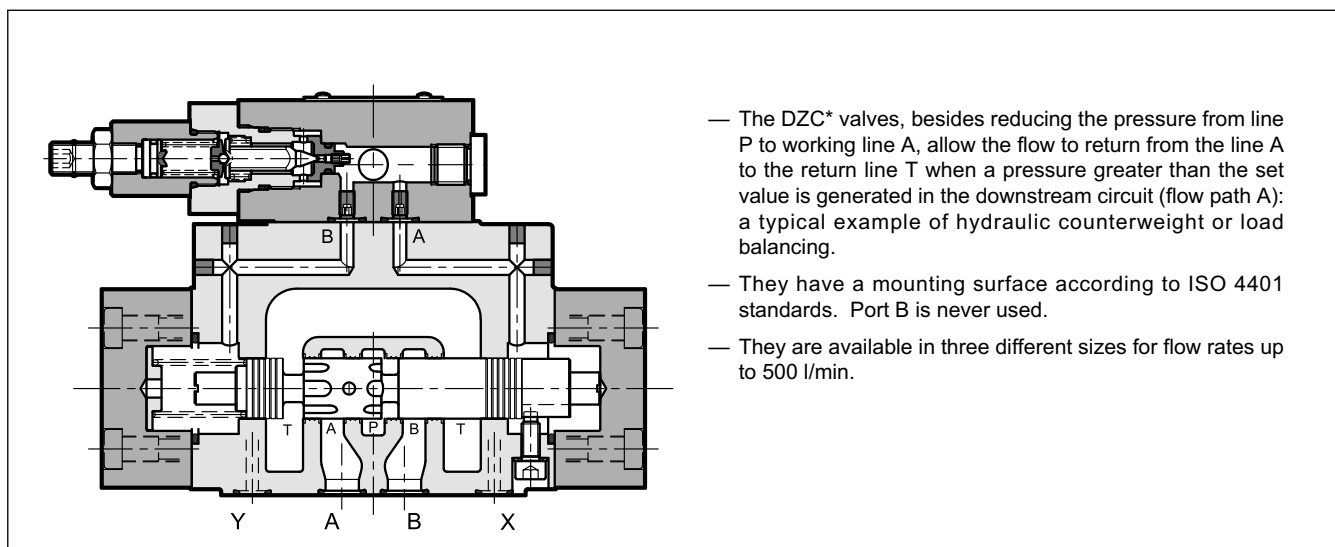
**DZC5**  
**DZC5R**  
**DZC7**  
**DZC8**

**CETOP P05**  
**ISO 4401-05**  
**ISO 4401-07**  
**ISO 4401-08**

**p** max **350** bar

**Q** max (see table of performances)

### OPERATING PRINCIPLE



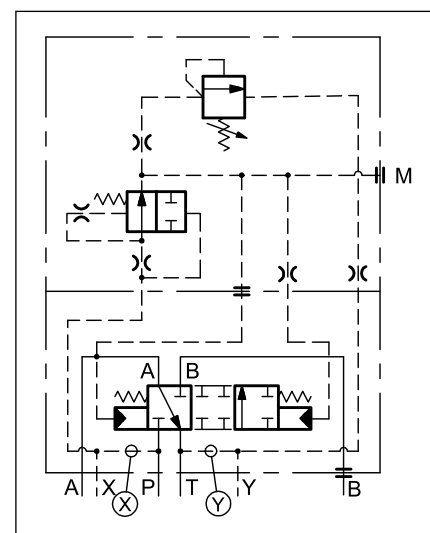
- The DZC\* valves, besides reducing the pressure from line P to working line A, allow the flow to return from the line A to the return line T when a pressure greater than the set value is generated in the downstream circuit (flow path A): a typical example of hydraulic counterweight or load balancing.
- They have a mounting surface according to ISO 4401 standards. Port B is never used.
- They are available in three different sizes for flow rates up to 500 l/min.

### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C )

		DZC5 DZC5R	DZC7	DZC8
Maximum operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Ambient temperature range	°C	-20 / +50		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		
Mass:	kg	6,3	8,6	15

### HYDRAULIC SYMBOL



## 1 - IDENTIFICATION CODE

<b>D</b>	<b>Z</b>	<b>C</b>		<b>-</b>		<b>/</b>	<b>12</b>	<b>-</b>		<b>/</b>	
----------	----------	----------	--	----------	--	----------	-----------	----------	--	----------	--

Pressure reducing valve \_\_\_\_\_

Nominal size: \_\_\_\_\_

**5** = CETOP P05 (**NOTE**)

**5R** = ISO 4401-05

**7** = ISO 4401-07

**8** = ISO 4401-08

Pressure control range \_\_\_\_\_

**070** = 5 ÷ 70 bar

**140** = 5 ÷ 140 bar

**210** = 5 ÷ 210 bar

Series No.  
(the overall and mounting dimensions remain unchanged from 10 to 19)

**NOTE:** This version is interchangeable with the previous model ZC4 Duplomatic

**K1** = Adjustment knob (omit for adjustment with socket hex screw)

Drainage: **I** = internal  
**E** = external

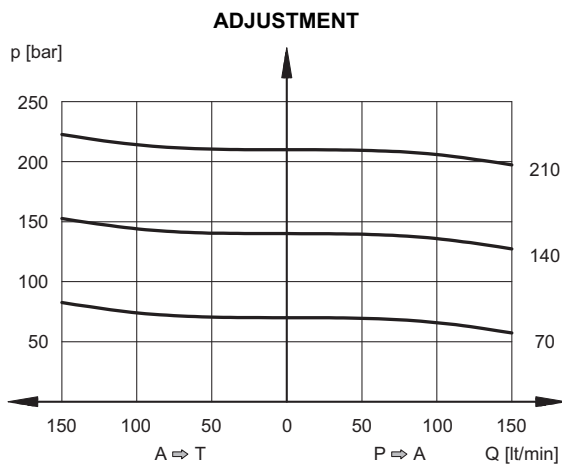
Piloting: **I** = internal  
**E** = external

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

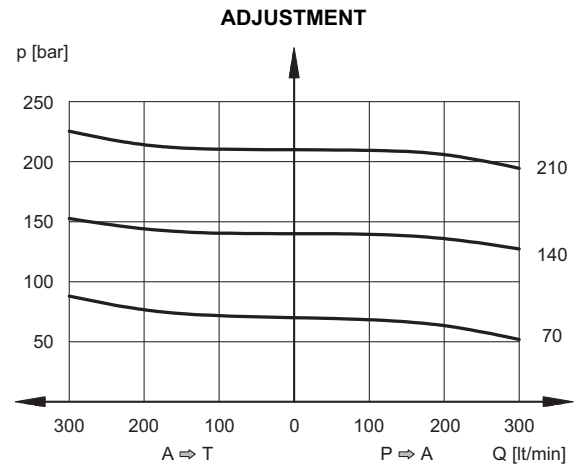
## 2 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

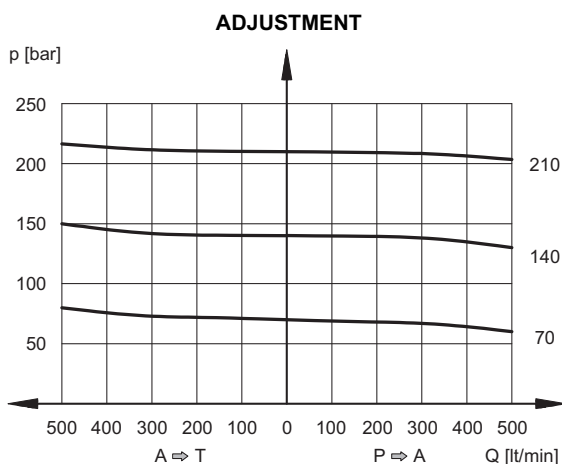
### 2.1 - Characteristic curves DZC5 and DZC5R



### 2.2 - Characteristic curves DZC7



### 2.3 - Characteristic curves DZC8



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

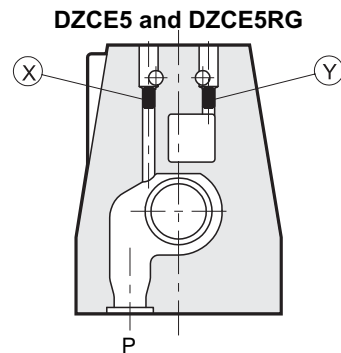
### 4 - PILOTING AND DRAINAGE

The valves are available with piloting and drainage, both internal and external. The version with external drainage allows a higher backpressure on the unloading.

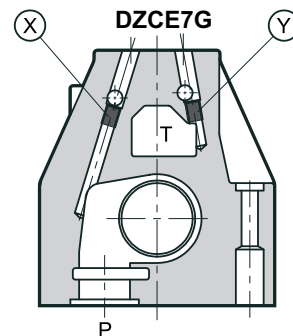
TYPE OF VALVE		Plug assembly	
		X	Y
<b>IE</b>	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b>	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b>	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b>	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

#### PRESSURES (bar)

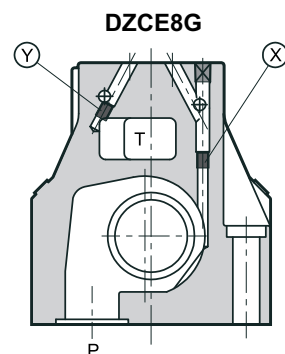
Pressure	MIN	MAX
Pilot pressure on port X	30	210
Pressure on T port with internal drain	-	2
Pressure on T port with external drain	-	250



**X:** M5x6 plug for external pilot  
**Y:** M5x6 plug for external drain



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

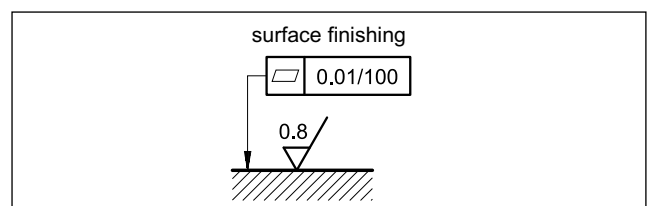
### 5 - INSTALLATION

The DZC\* valves can be installed in any position without impairing correct operation.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

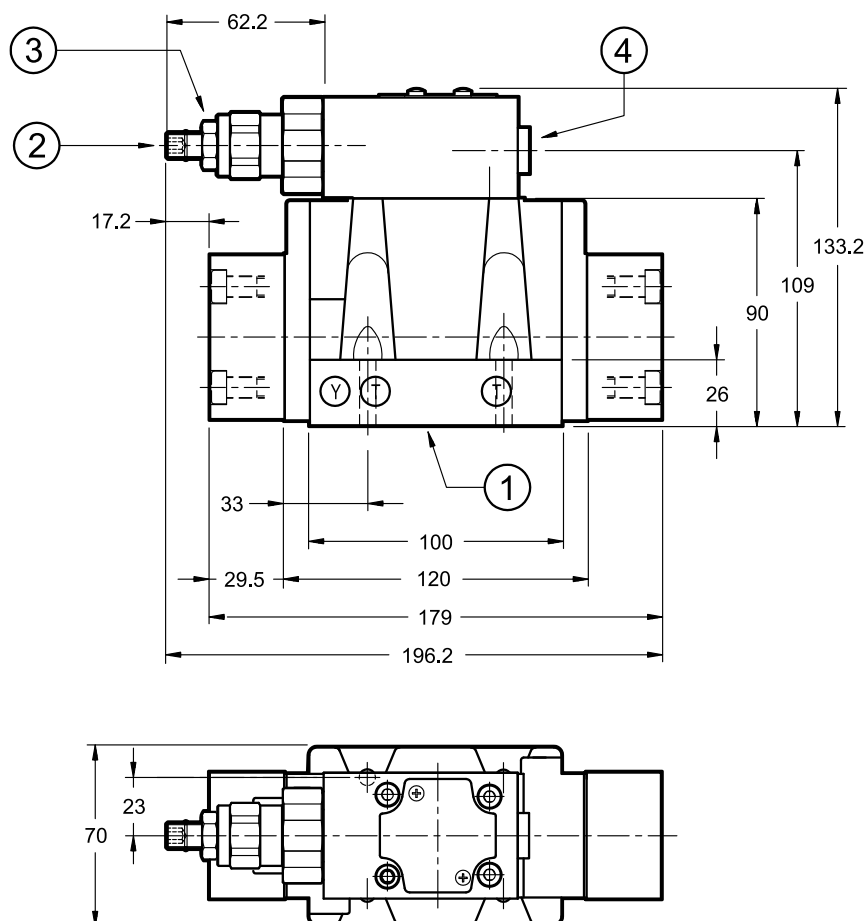
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.





## 6 - DZC5 AND DZC5R OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

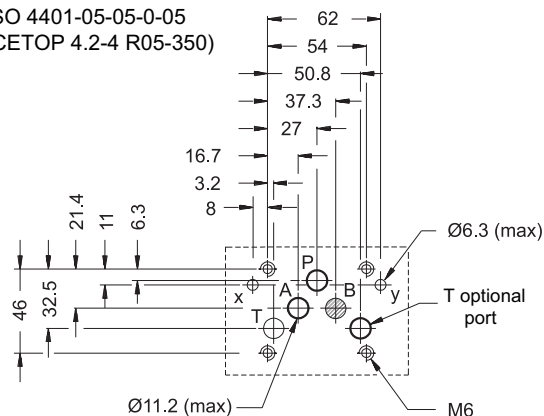


Valve fastening: N. 4 bolts SHC ISO 4762 M6x35
Tightening torque: 8 Nm (A 8.8 bolts)
Thread of mounting holes: M6x10

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Socket hex adjustment screw: Allen key 5. Clockwise rotation to increase pressure
3	Locking nut: spanner 17
4	Pressure gauge port 1/4" BSP

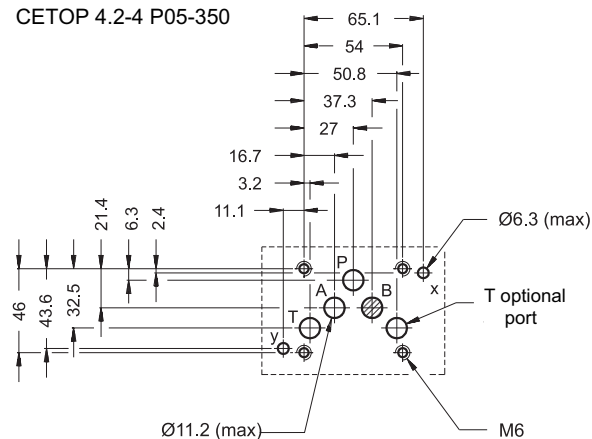
## DZC5R MOUNTING SURFACE

ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



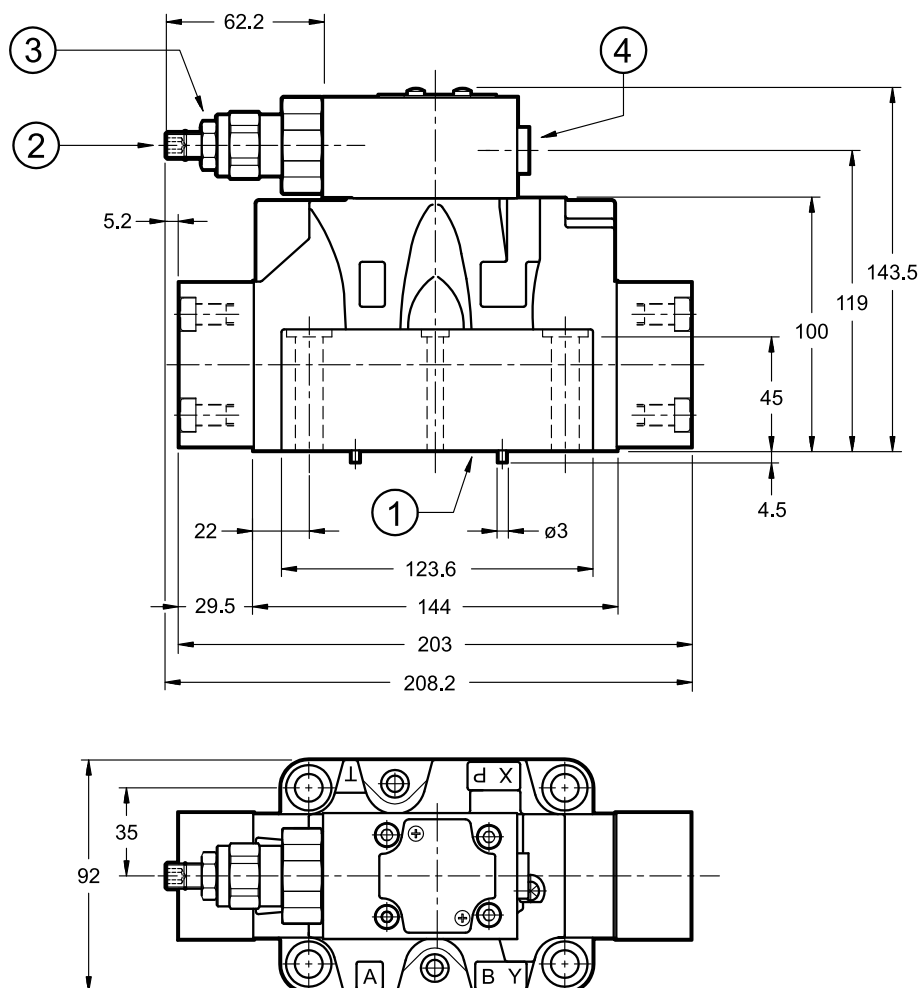
## DZC5 MOUNTING SURFACE

CETOP 4.2-4 P05-350



**7 - DZC7 OVERALL AND MOUNTING DIMENSIONS**

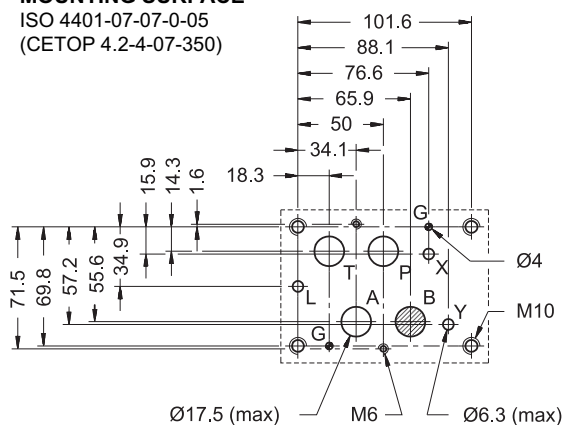
dimensions in mm



1	Mounting surface with sealing rings: N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Socket hex adjustment screw: Allen key 5. Clockwise rotation to increase pressure
3	Locking nut: spanner 17
4	Pressure gauge port 1/4" BSP

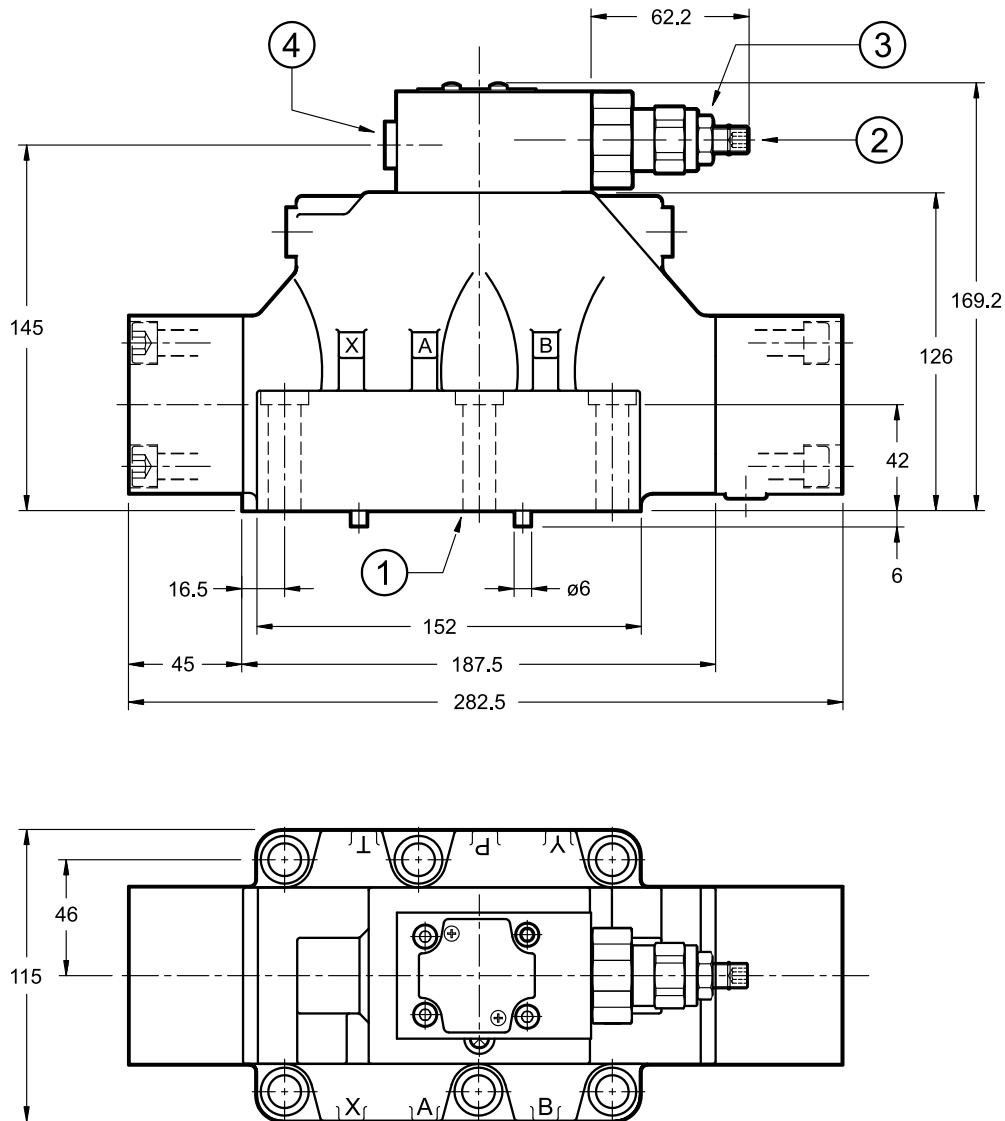
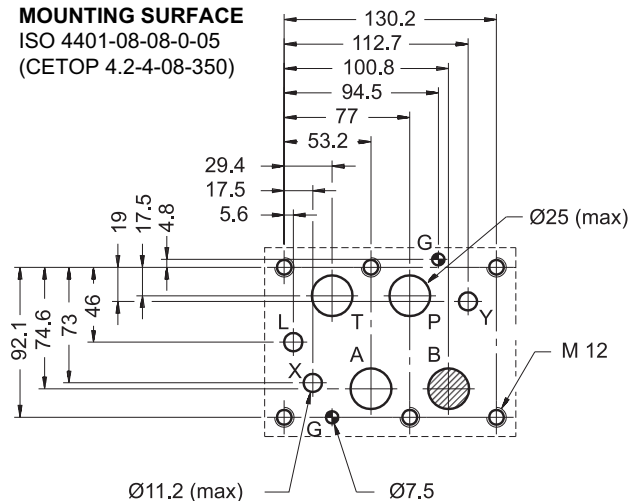
Single valve fastening: N. 4 SHC bolts ISO 4762 M10x60 N. 2 SHC bolts ISO 4762 M6x60
Tightening torque M10x60: 40 Nm (A 8.8 bolts) M6x60: 8 Nm (A 8.8 bolts)
Thread of mounting holes: M6x18; M10x18

**MOUNTING SURFACE**

 ISO 4401-07-07-0-05  
 (CETOP 4.2-4-07-350)


**8 - DZC8 OVERALL AND MOUNTING DIMENSIONS**

dimensions in mm


**MOUNTING SURFACE**  
 ISO 4401-08-08-0-05  
 (CETOP 4.2-4-08-350)


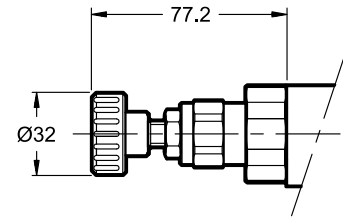
1	Mounting surface with sealing rings: N. 4 OR type 3118 (29.82x2.62) - 90 Shore N: 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Socket hex adjustment screw: Allen key 5. Clockwise rotation to increase pressure
3	Locking nut: spanner 17
5	Pressure gauge port 1/4" BSP

Valve fastening: N. 6 SHC bolts ISO 4762 M12x60
Tightening torque: 69 Nm (A 8.8 bolts)
Thread of mounting holes: M12x20



## 9 - OPTIONS

The valves can be equipped with adjustment knob instead of the standard socket head screw.  
Add **K1** at the identification code end (see par.1).



## 10 - SUBPLATES

(See catalogue 51 000)

	DZC5	DZC7	DZC8
Model with rear ports	PME4-AI5G	PME07-AI6G	-
Model with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports:	P - T - A - B X - Y	3/4" BSP 1/4" BSP	1 1/2" BSP 1/4" BSP



**DZC\***  
SERIES 12



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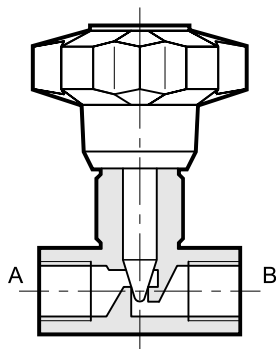
# **RS\***

## **DOUBLE-ACTING THROTTLE FLOW CONTROL VALVE SERIES 30**

### **THREADED PORTS CARTRIDGE TYPE**

**p** max (see table of performances)  
**Q** max (see table of performances)

### **OPERATING PRINCIPLE**



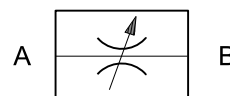
- The RS\* and RS\*-I valves are throttle flow control valves for in-line mounting, directly in the line or as a cartridge complete with threading for in-block mounting.
- Adjustment is obtained with a conical throttle that operates in a cylindrical seat and allows a good linearity of the adjusted flow.
- They are also used as flow shut-off valves since they guarantee good sealing when completely closed.
- The valves are always supplied with an adjustment knob that can be locked in any position with a transverse positioned grub screw, as may be required.

### **PERFORMANCES** (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Valve code	Port dimensions BSP	Nominal flow rate [l/min]	Mass [kg]	Max. operating pressure [bar]
RS2	1/4"	15	0,2	400
RS3	3/8"	30	0,4	
RS4	1/2"	50	0,6	
RS5	3/4"	80	1,3	
RS6	1"	150	2,6	320
RS7	1 1/4"	200	3,0	
RS8	1 1/2"	220	4,2	
RS2-I	—	15	0,15	320
RS3-I	—	30	0,2	
RS4-I	—	50	0,3	
RS5-I	—	80	0,6	
RS6-I	—	150	1,2	

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

### **HYDRAULIC SYMBOL**



### 1 - IDENTIFICATION CODE

<div><div>R</div><div>S</div><div></div><div>-</div><div></div><div>/</div><div>30</div><div>/</div><div></div></div>										
Throttle flow control valve									Seals: omit for mineral oils <b>V</b> = viton for special fluids	
Nominal dimension:									Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)	
<b>2</b> = 1/4" <b>5</b> = 3/4" <b>3</b> = 3/8" <b>6</b> = 1" <b>4</b> = 1/2" <b>7</b> = 1 1/4" <b>8</b> = 1 1/2"									<b>I</b> = In-block cartridge version, available only in dimensions 2-3-4-5-6 Omit for version with threaded ports	

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 3 - OVERALL AND MOUNTING DIMENSIONS RS\*

dimensioni in mm		Valve	A BSP	B	C	∅ D	E max	Ø F
		RS2	1/4"	12,5	49	20	78	50
		RS3	3/8"	12,5	59	25	93	70
		RS4	1/2"	15,5	68	30	107	80
		RS5	3/4"	17	86	40	132,5	100
		RS6	1"	20	105	50	167,5	120
		RS7	1 1/4"	22	120	55	172,5	120
		RS8	1 1/2"	24	134	65	181	120

### 4 - OVERALL AND MOUNTING DIMENSIONS RS\*-I

OVERALL AND MOUNTING DIMENSIONS (mm)

dimensioni in mm

\* "BONDED SEAL"  
seal excluded from the supply

sigla valvola	ØF	G max	H	L 6H	ØM + 0.2 0	N	P min	R ± 0.2	S + 0.2 0	ØT H8	ØU max	V ± 0.2	Z min	CH	OR type	BK type	BS* type
RS2-I	50	49.5	26.5	M20x1.5	27	1	12	16.5	1	14	5	13.3	27	27	2043	2043	400-513
RS3-I	70	57.5	30.5	M20x1.5	27	1	12	20	1.2	16	8	15.2	32	27	2050	2050	400-513
RS4-I	80	66.5	40	M27x2	33	1.3	18	28	1.2	19	10	22	41	32	2062	2062	400-520
RS5-I	100	76.5	44	M33x2	40	1.3	18	30.5	1.2	27	12	23	45.5	41	130	130	400-515
RS6-I	120	102	52.5	M42x2	50	1.3	21.5	36.5	1.5	35	16	28.5	55	50	3118	3118	400-516



# RSN\*

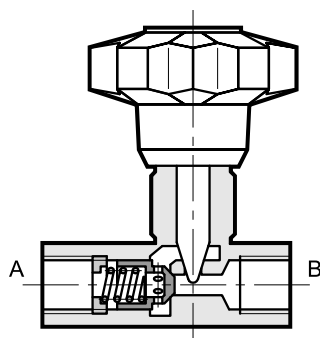
## SINGLE-ACTING THROTTLE FLOW CONTROL VALVE

### SERIES 30

#### THREADED PORTS CARTRIDGE TYPE

**p** max (see table of performances)  
**Q** max (see table of performances)

#### OPERATING PRINCIPLE



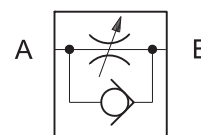
- The RSN\* and RSN\*-I valves are single-acting throttle flow control valves for in-line mounting, directly in the line or as a cartridge complete with threading for in-block mounting.
- Adjustment is obtained with a conical throttle that operates in a cylindrical seat and allows a good linearity of the adjusted flow.
- They are also used as single direction flow shut-off valves since they guarantee good sealing when completely closed. They also allow a free return in the opposite direction.
- The valves are always supplied with an adjustment knob that can be locked in any position with a transverse positioned grub screw, as may be required.

#### PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Valve Code	Port dimensions BSP	Nominal flow rate [l/min]	Max. flow with open flow [l/min]	Mass [kg]	Max. operating pressure [bar]
RSN2	1/4"	15	35	0,25	400
RSN3	3/8"	30	80	0,5	
RSN4	1/2"	50	150	0,75	
RSN5	3/4"	80	200	1,6	
RSN6	1"	150	300	3,05	320
RSN7	1 1/4"	200	400	3,75	
RSN8	1 1/2"	220	500	5,75	
RSN2-I	—	15	35	0,13	320
RSN3-I	—	30	80	0,25	
RSN4-I	—	50	150	0,34	
RSN5-I	—	80	200	0,62	

Direct check valve opening pressure	bar	0,35
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

#### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE

<div><div>R</div><div>S</div><div>N</div><div></div><div>-</div><div></div><div>/</div><div>30</div><div>/</div><div></div></div>									
Single-acting throttle flow control valve					Seals: omit for mineral oils <b>V</b> = viton for special fluids				
Nominal dimension: <b>2</b> = 1/4" <b>5</b> = 3/4" <b>3</b> = 3/8" <b>6</b> = 1" <b>4</b> = 1/2" <b>7</b> = 1 1/4" <b>8</b> = 1 1/2"					Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)				
I = in-block cartridge version, available only in dimensions 2-3-4-5 Omit for version with threaded ports									

## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - OVERALL AND MOUNTING DIMENSIONS RSN\*

Valve	A BSP	B	C	∅ D	E max	∅ F
<b>RSN2</b>	1/4"	12,5	66	20	78	50
<b>RSN3</b>	3/8"	12,5	79	25	93	70
<b>RSN4</b>	1/2"	15,5	94,5	30	107	80
<b>RSN5</b>	3/4"	17	115	40	132,5	100
<b>RSN6</b>	1"	20	138,5	50	167,5	120
<b>RSN7</b>	1 1/4"	22	157	55	172,5	120
<b>RSN8</b>	1 1/2"	24	190	65	181	120

## 4 - OVERALL AND MOUNTING DIMENSIONS RSN\*-I

Valve	∅ F	G max	H	L 6H	∅ M +0.2 0	N	P min	R ±0.2	S +0.2 0	∅ T H8	∅ U max	V ±0.2	Z min	CH	OR type	BK type	BS* type
<b>RSN2-I</b>	50	49	30.5	M20x1.5	27	1	12	20	1.2	16	8	15.2	32	27	2050	2050	400-513
<b>RSN3-I</b>	70	56	40	M27x2	33	1.3	18	28	1.2	19	10	22	41	32	2062	2062	400-520
<b>RSN4-I</b>	80	70	44.5	M33x2	40	1.3	18	30.5	1.2	27	12	23	45.5	41	130	130	400-515
<b>RSN5-I</b>	100	80	52.5	M42x2	50	1.3	21.5	36.5	1.5	35	16	28.5	55	50	3118	3118	400-516

# RPC1

## PRESSURE AND TEMPERATURE COMPENSATED FLOW CONTROL VALVE

### SERIES 41

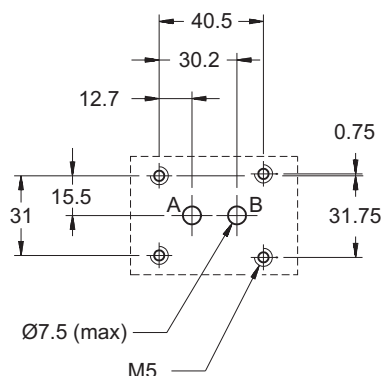
#### SUBPLATE MOUNTING ISO 6263-03 (CETOP 03)

**p** max **250** bar

**Q** max (see table of performances)

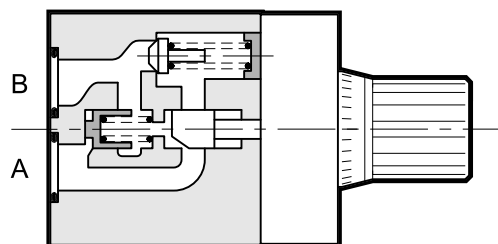
#### MOUNTING INTERFACE

ISO 6263-03-03-03-97  
(CETOP 4.5.2-2-03-250)



**NOTE:** The RPCED1 mounting interface, with CETOP 03 holes, must not have P and T ports or must have the 0113388 subplate (see paragraph 9)

#### OPERATING PRINCIPLE

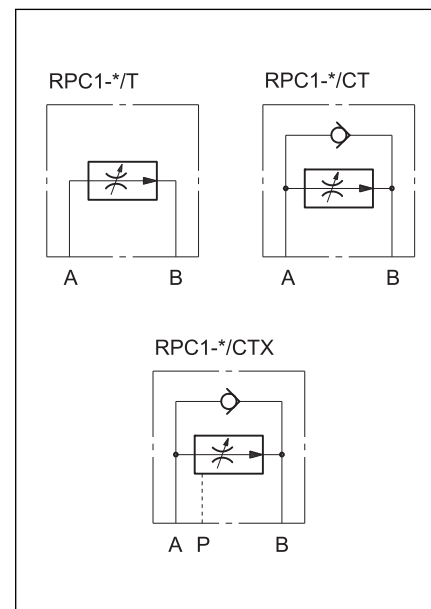


- The RPC1 valve is a pressure and temperature compensated flow control valve.
- The flow is adjusted by a calibrated knob that modulates the opening of the control gap and can be locked in any adjustment position. Adjustment is made with three turns, and upon request one-turn adjustment, RPC1\*/M, is available.
- It is available in seven different flow rate adjustment ranges from 0,5 l/min up to 30 l/min.

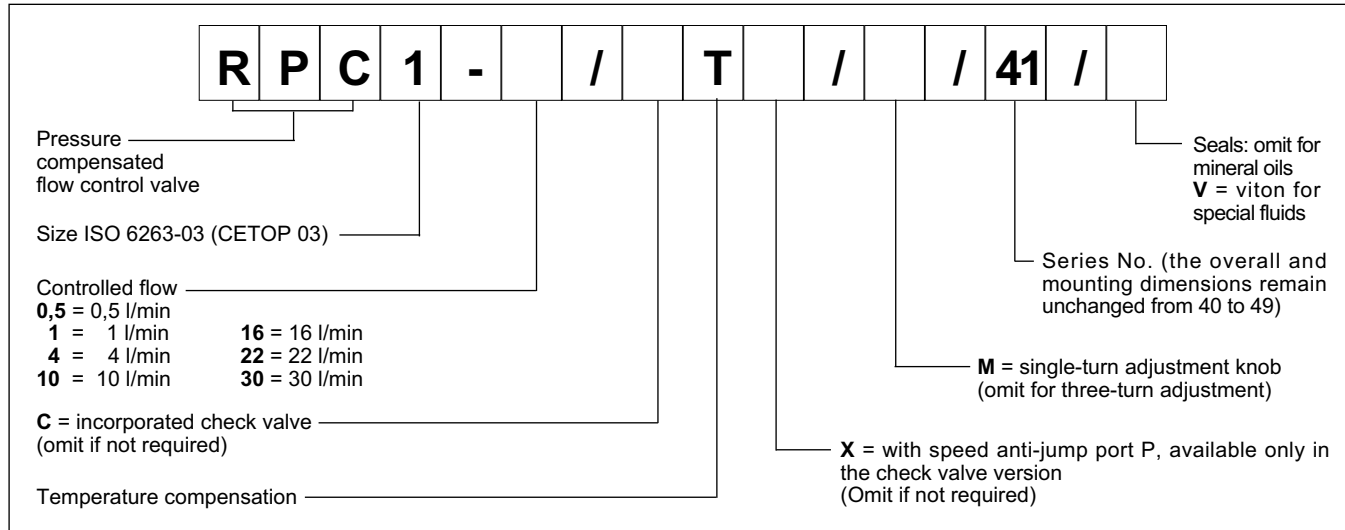
#### PERFORMANCE RATINGS (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure	bar	250
Minimum pressure difference between A and B	bar	10
Check valve cracking pressure	bar	0,5
Maximum controlled flow rates	l/min	0,5-1-4-10-16-22-30
Minimum controlled flow rate (for 0,5-1 and 4 l/min)	l/min	0,025
Maximum flow rate in free flow direction	l/min	40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Fluid contamination degree for flows < 0,5 l/min	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,3
Number of adjustment knob turns	RPC1	3
	RPC1-*/M	1

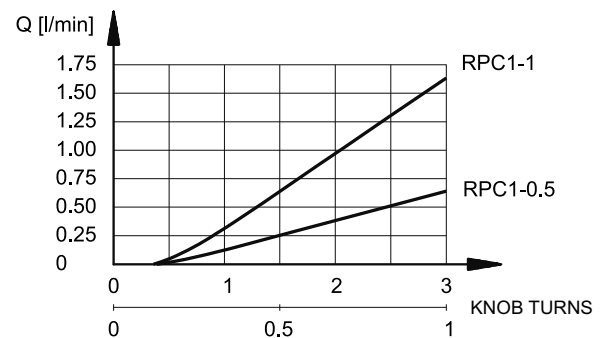
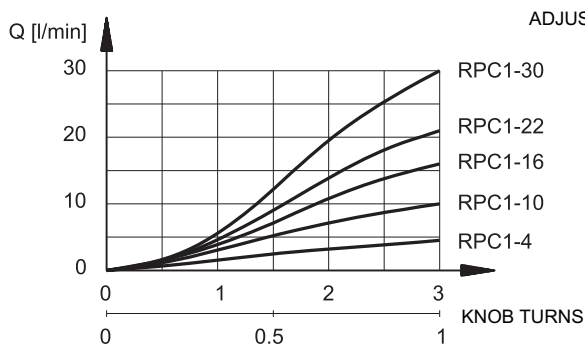
#### HYDRAULIC SYMBOLS



## 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 4 - PRESSURE COMPENSATION

Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of  $\pm 2\%$  of the maximum flow controlled by the valve for maximum pressure variation between the intake and outlet chambers of the valve.

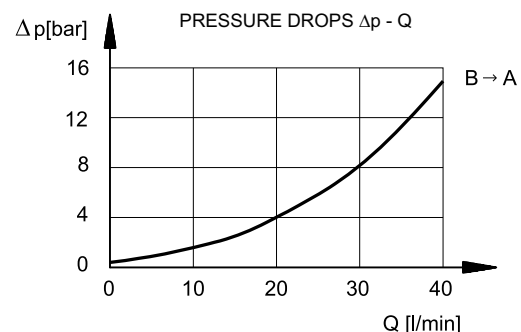
## 5 - TEMPERATURE COMPENSATION

The valve temperature compensation is obtained with the principle of fluid passage across a thin wall orifice in which the flow rate is not substantially influenced by the oil viscosity fluctuations. For controlled flows of less than 0,5 l/min and with a temperature difference of 50 °C, flow is increased by about 13% of the set flow value. For higher flow rates, and with the same temperature difference, the flow increase is about 4% of the maximum flow controlled by the valve.

## 6 - REVERSE FREE FLOW

The RPC1 valve, upon request, is supplied with an incorporated check valve to allow free flow in the direction opposite to the controlled flow, B→A.

In this case the valve code becomes RPC1-\*/CT.

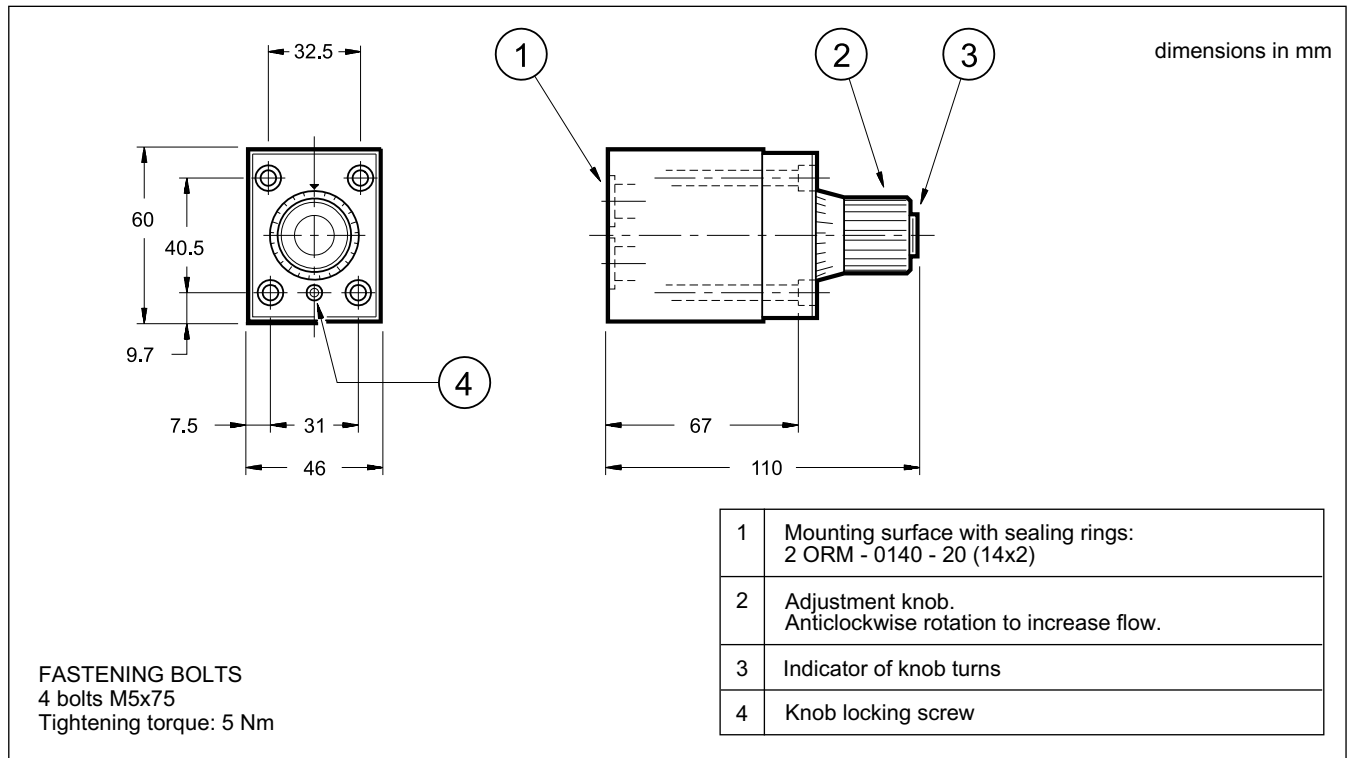


## 7 - RPC1-\*/CTX

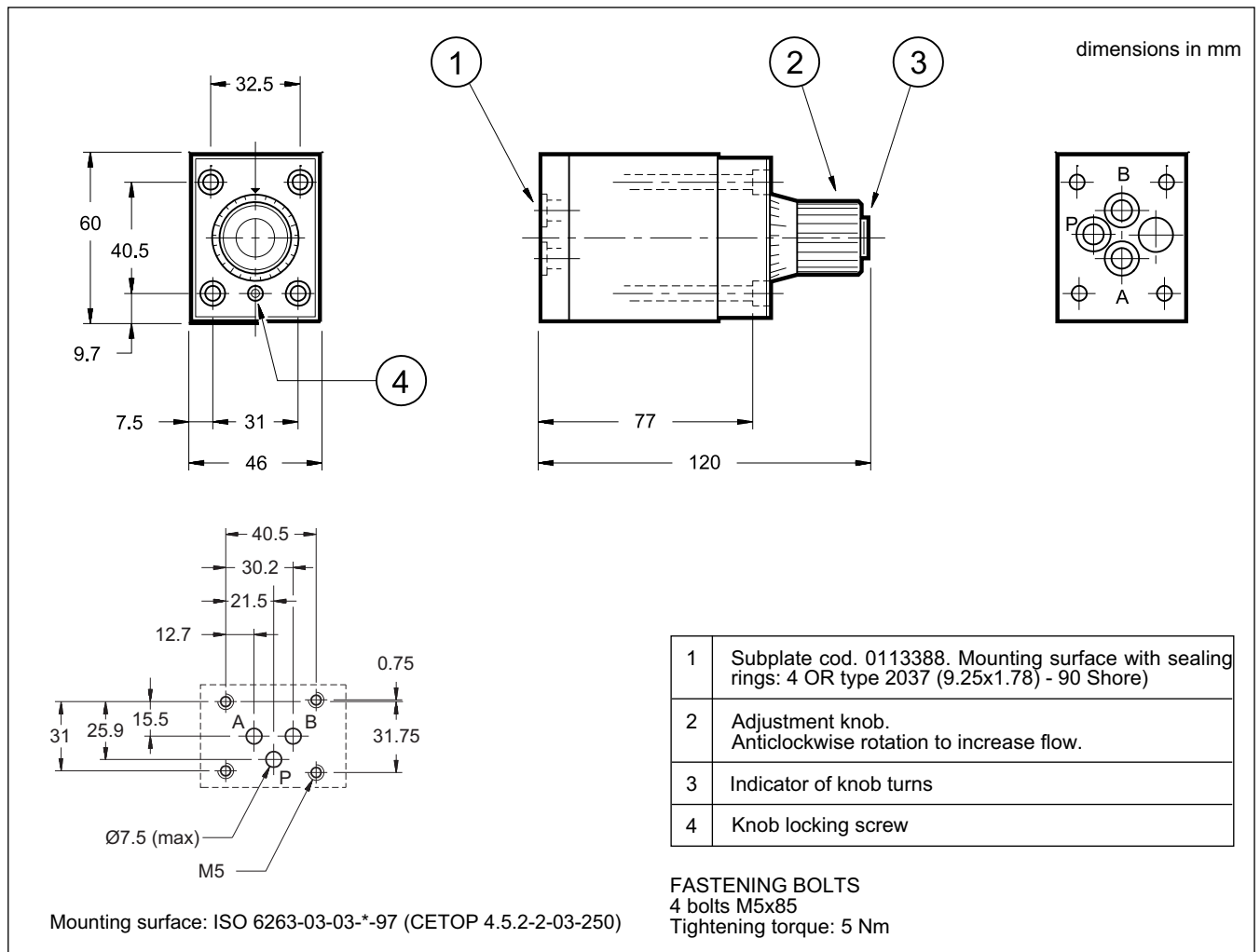
This valve is normally used for intake control and is positioned downstream of the directional valve.

The piloting connection "P" keeps the compensator in the closed position, thus avoiding the initial speed jump that occurs at the time the distributor sends oil to the valve (see the application diagram, paragraph 11).

## 8 - RPC1-\* OVERALL AND MOUNTING DIMENSIONS



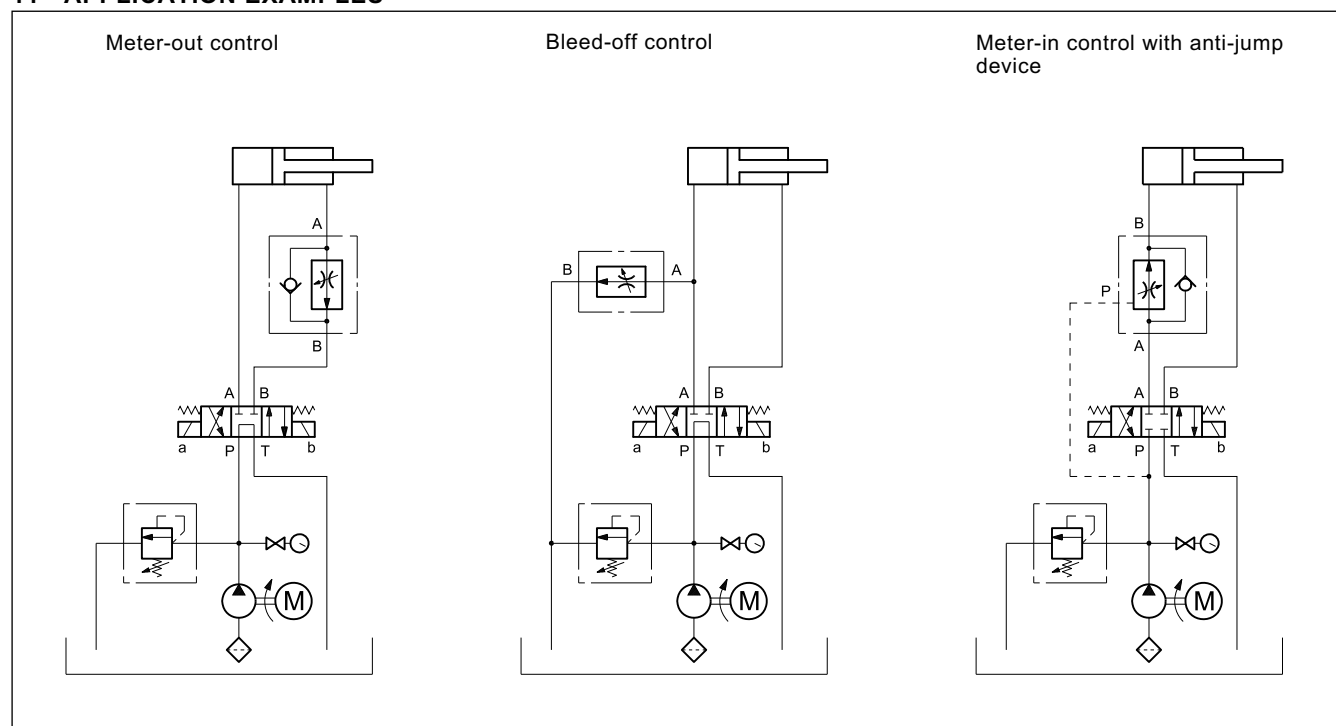
## 9 - RPC1-\*/CTX OVERALL AND MOUNTING DIMENSIONS



**10 - SUBPLATES** (look at datasheet 51 000)

Type	PMRPC1-AI3G with rear ports  PMRPC1-AL3G with side ports	
Type	PMMD-AI3G with rear ports, with user T plugged  PMMD-AL3G with side ports, with user T plugged	only for valve RPC1-*/CTX
Port dimension	3/8" BSP	

## 11 - APPLICATION EXAMPLES





# RPC1-T3

## PRESSURE AND TEMPERATURE COMPENSATED THREE-WAY FLOW CONTROL VALVE SERIES 41

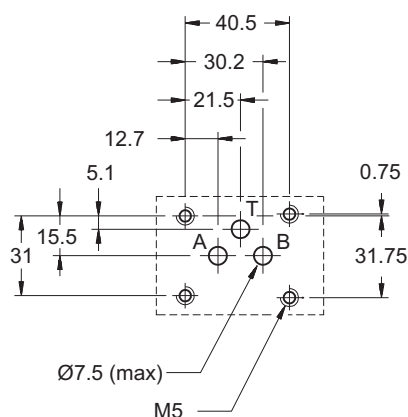
### SUBPLATE MOUNTING ISO 6263-03 (CETOP 03)

**p** max **250** bar

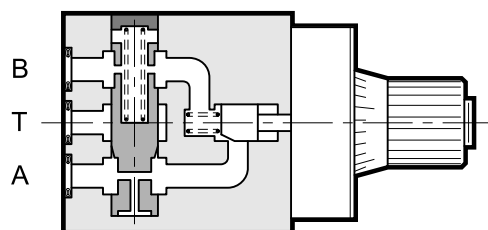
**Q** max (see table of performances)

### MOUNTING INTERFACE

ISO 6263-03-03-\*97  
(CETOP 4.5.2-3-03-250)



### OPERATING PRINCIPLE

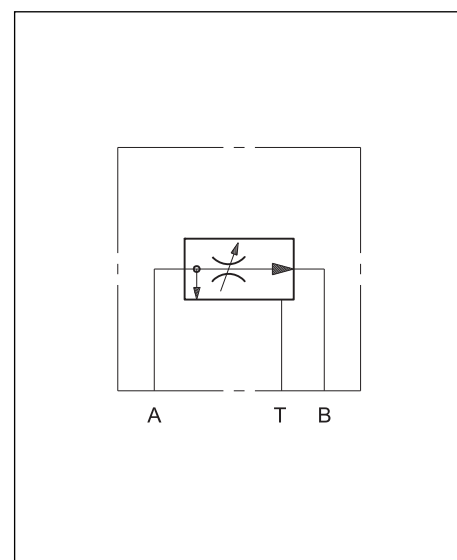


- The pressure and temperature compensated three-way flow control valves serve to control the flow sent to the actuator and to discharge it, which exceeds that required, back to tank at system pressure rather than at relief value pressure.
- The flow rate adjustment range is carried out with three turns of the knob and an indicator shows the number of turns made. A one-turn adjustment on the knob, RPC1\*/M, is available upon request.
- The adjustment knob can be locked in any position in the adjustment range by a screw.

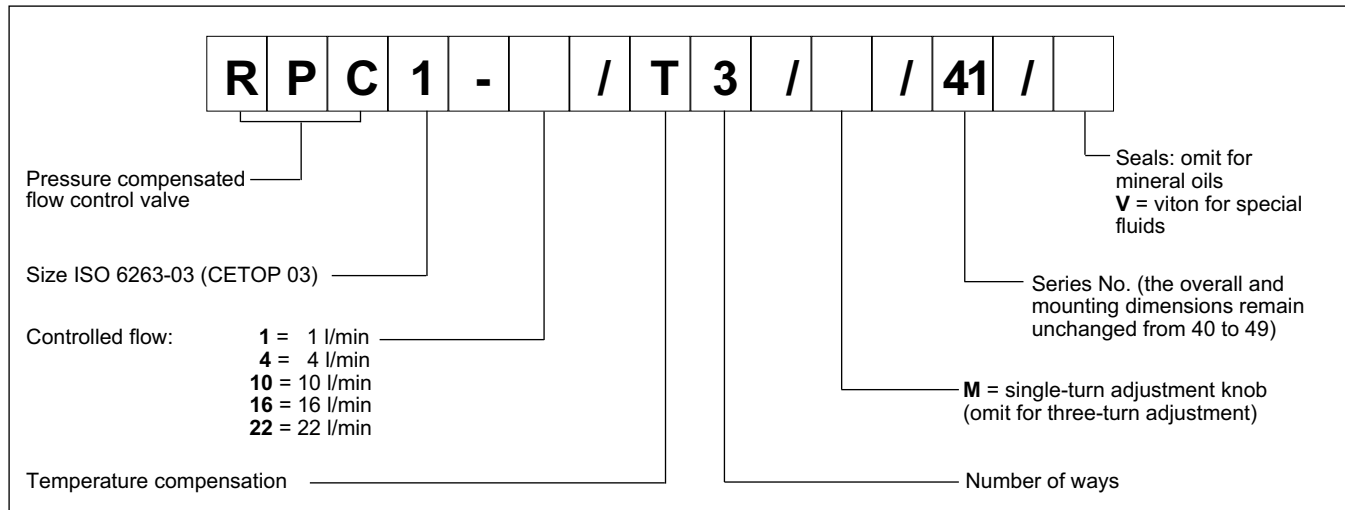
### PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure	bar	250
Minimum pressure difference between A and B		12
Maximum controlled flow rates	l/min	1-4-10-16-22
Minimum controlled flow rate (for 1 and 4 l/min)		0,035
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Fluid contamination degree for flows < 0,5 l/min	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,5
Number of adjustment knob turns	RPC1/T3	3
	RPC1-/T3/M	1

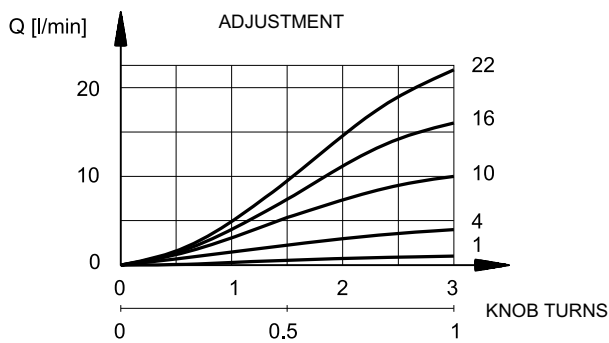
### HYDRAULIC SYMBOL



## 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 4 - PRESSURE COMPENSATION

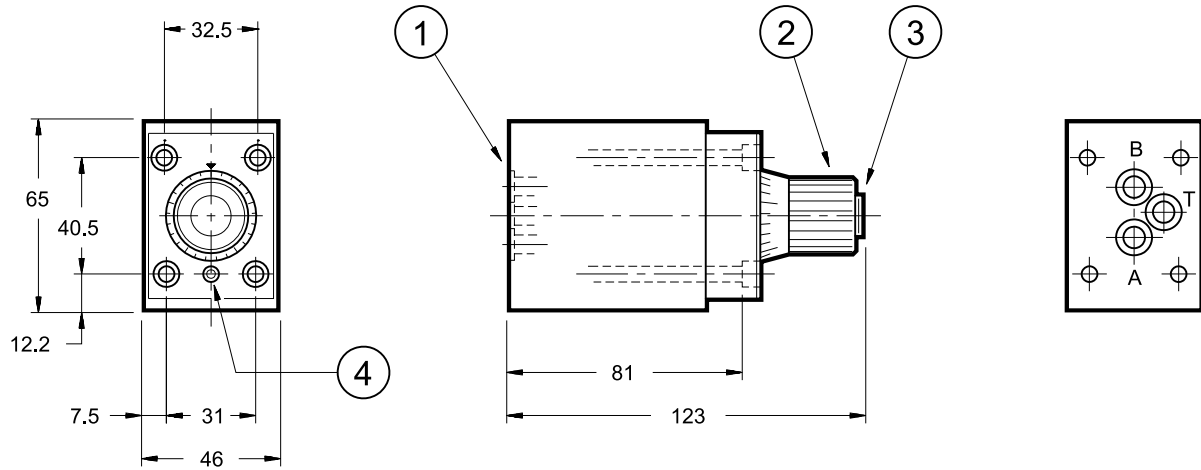
Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of  $\pm 2\%$  of the maximum flow controlled by the valve for maximum pressure variation between the intake and outlet chambers of the valve.

## 5 - TEMPERATURE COMPENSATION

The valve temperature compensation is obtained with the principle of fluid passage across a thin wall orifice in which the flow rate is not substantially influenced by the oil viscosity fluctuations. For controlled flows of less than 0,5 l/min and with a temperature difference of 50 °C, flow is increased by about 13% of the set flow value. For higher flow rates, and with the same temperature difference, the flow increase is about 4% of the maximum flow controlled by the valve.

## 6 - OVERALL AND MOUNTING DIMENSIONS

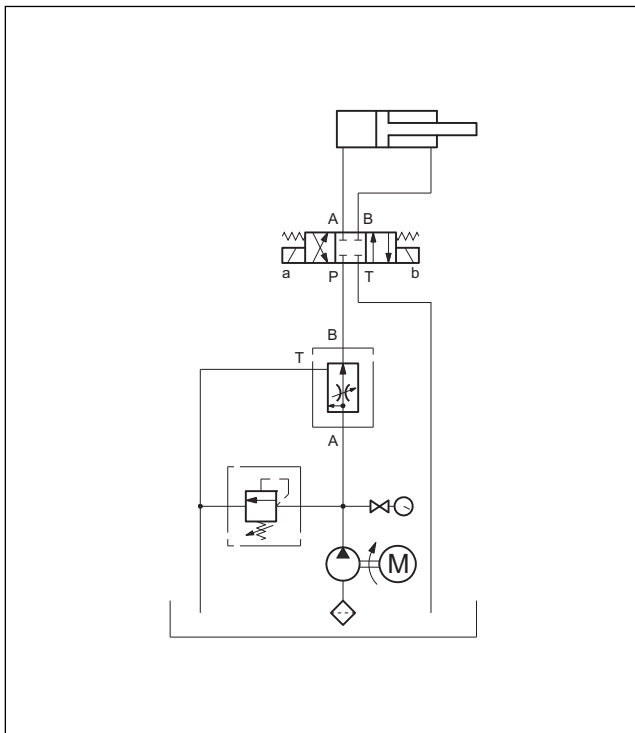
dimensions in mm



**FASTENING BOLTS**  
4 bolts M5x90  
Tightening torque: 5 Nm

1	Mounting surface with sealing rings: 3 OR type 2037 (9.25x1.78) - Shore 90
2	Adjustment knob
3	Indicator of knob turns
4	Knob locking screw

## 7 - APPLICATION EXAMPLE



## 8 - SUBPLATES (see datasheet 51 000)

Type	PMMD-AI3G with rear ports with user P plugged
Type	PMMD-AL3G with side ports with user P plugged
Port dimension	3/8" BSP





# RPC1-T3

SERIES 41



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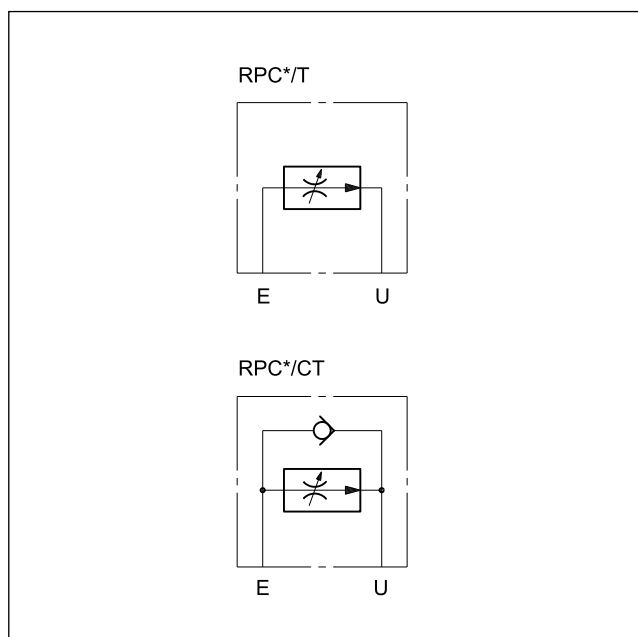
# RPC\*

## PRESSURE AND TEMPERATURE COMPENSATED FLOW CONTROL VALVES

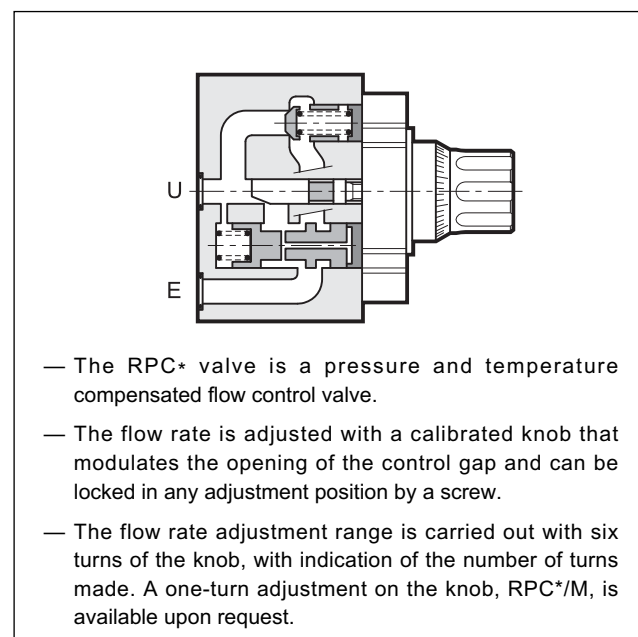
### SUBPLATE MOUNTING

<b>RPC2</b>	<b>ISO 6263-06 (CETOP 06)</b>
<b>RPC3</b>	<b>ISO 6263-07 (CETOP 07)</b>

### HYDRAULIC SYMBOL

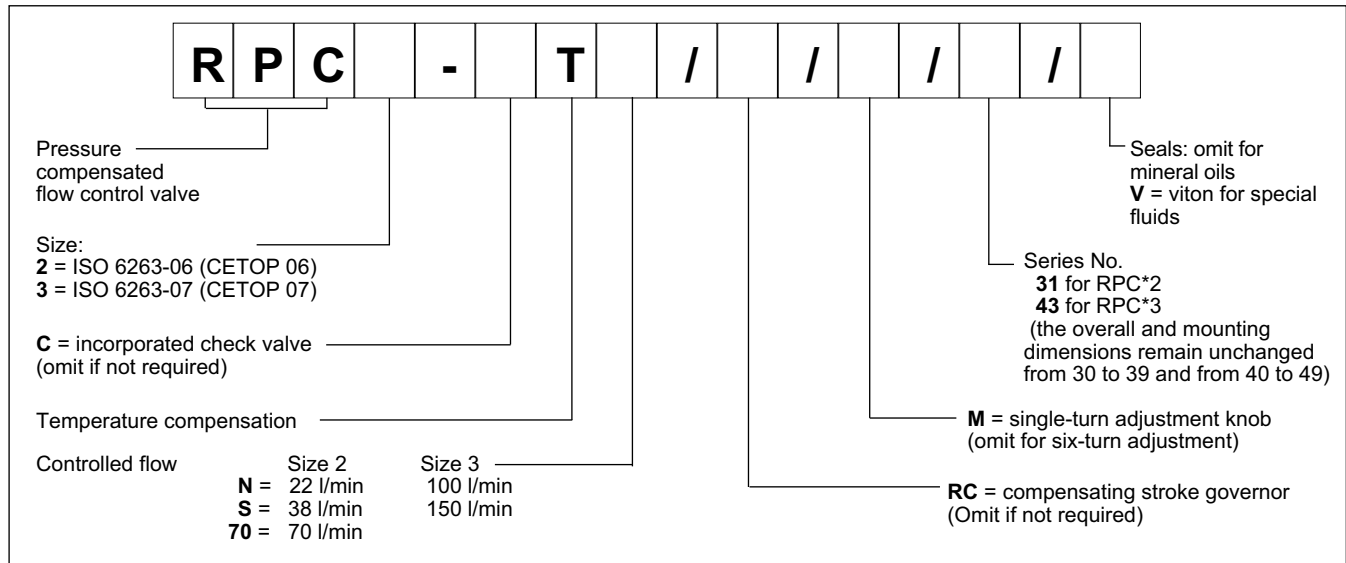


### OPERATING PRINCIPLE

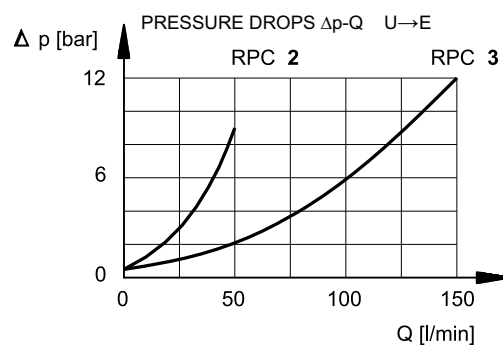
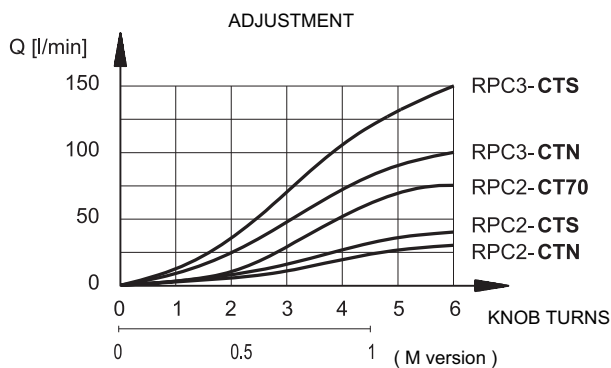


<b>PERFORMANCES</b> (obtained with mineral oil with viscosity of 36 cSt at 50°C)		<b>RPC2</b>	<b>RPC3</b>
Maximum operating pressure	bar	320	250
Check valve cracking pressure		0,5	0,5
Minimum pressure difference between E and U		10	12
Maximum controlled flow rates	l/min	22 - 38 - 70	100 - 150
Minimum controlled flow rate		0,050	0,120
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25	
Mass	kg	3,6	7,8

## 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 4 - PRESSURE COMPENSATION

Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of  $\pm 3\%$  of the maximum flow controlled by the valve for the maximum pressure variation between inlet and outlet chambers of the valve.

## 5 - TEMPERATURE COMPENSATION

A device located on the first throttle which is sensitive to the temperature fluctuations corrects the position keeping the controlled flow more or less unaltered even should the oil viscosity change.

The fluctuation of the set flow rate stays within  $\pm 2,5\%$  of the maximum flow controlled by the valve.

## 6 - REVERSE FREE FLOW

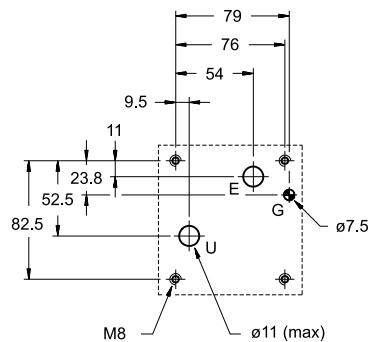
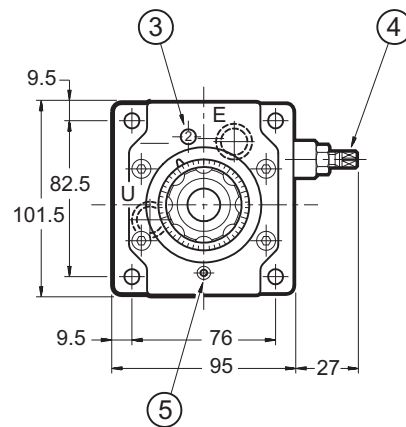
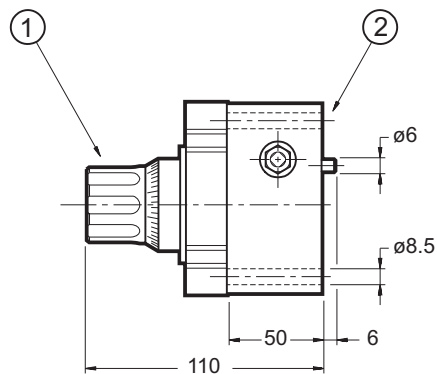
The RPC\* valves, upon request, are supplied with an incorporated check valve to allow free flow in the direction opposite of the controlled flow. In this case the valve code becomes RPC\*-CT.

## 7 - COMPENSATING STROKE GOVERNOR

In order to avoid jumps in the actuator when it is started, the RPC valve can be equipped with a special accessory that controls the compensating stroke, thus preventing it from making uncontrolled movements.

Add the suffix **RC** to the identification code to request this governor. See paragraph 1.

## 8 - RPC2 SERIES 31 OVERALL AND MOUNTING DIMENSIONS

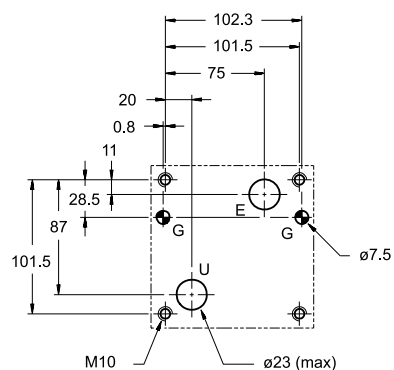
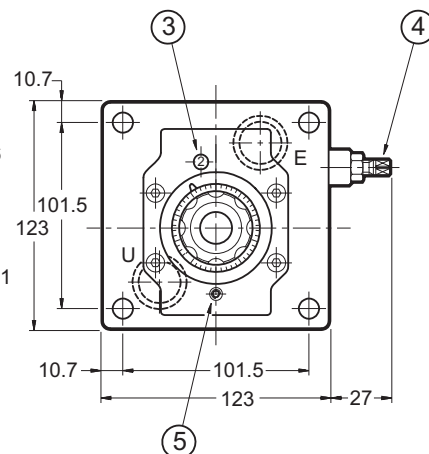
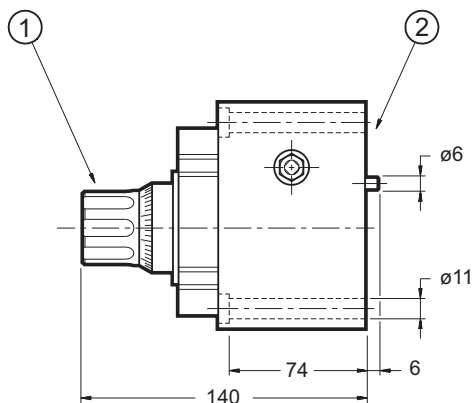


1	Adjustment knob. Anticlockwise rotation to increase flow rate
2	Mounting surface with sealing rings: n° 2 OR type 119 (15.08x2.62)
3	Indicator of number of knob turns
4	Compensating stroke governor (optional)
5	Knob locking screw

FASTENING BOLTS:  
4 SHC bolts ISO 4762 M8x60  
Tightening torque: 20 Nm

MOUNTING SURFACE: ISO 6263-06-05-\*-97 (CETOP 4.5.2-2-06-320)

## 9 - RPC3 SERIES 43 OVERALL AND MOUNTING DIMENSIONS



1	Adjustment knob. Anticlockwise rotation to increase flow rate
2	Mounting surface with sealing rings: n° 2 OR type 3106 (26.65x2x62)
3	Indicator of number of knob turns
4	Compensating stroke governor (optional)
5	Knob locking screw

FASTENING BOLTS:  
4 SHC bolts ISO 4762 M10x90  
Tightening torque: 40 Nm

MOUNTING SURFACE: ISO 6263-07-09-\*97 (CETOP 4.5.2-2-07-250)



## 10 - SUBPLATES (see catalogue 51 000)

	RPC2	RPC3
Type	PMRPC2-AI4G rear ports	PMRPC3-AI6G rear ports
Port dimensions	1/2" BSP	1" BSP



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# RPC\*-T3

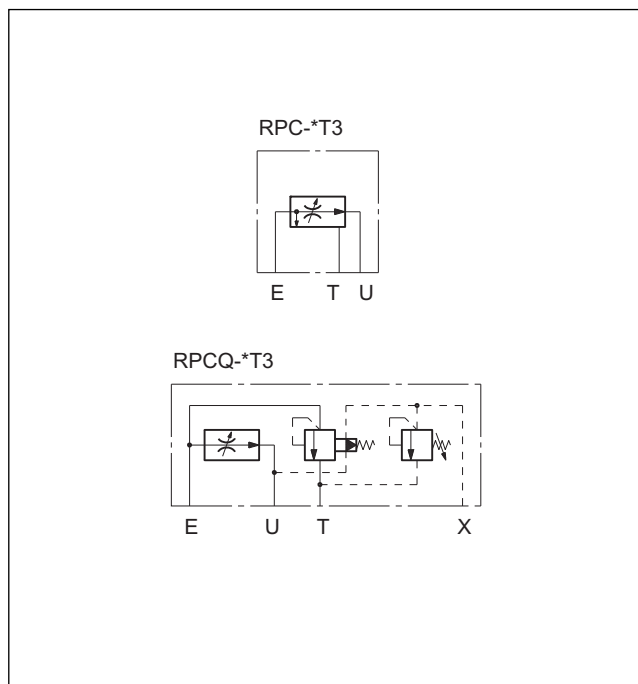
## PRESSURE AND TEMPERATURE COMPENSATED THREE-WAY FLOW CONTROL VALVES

### SUBPLATE MOUNTING

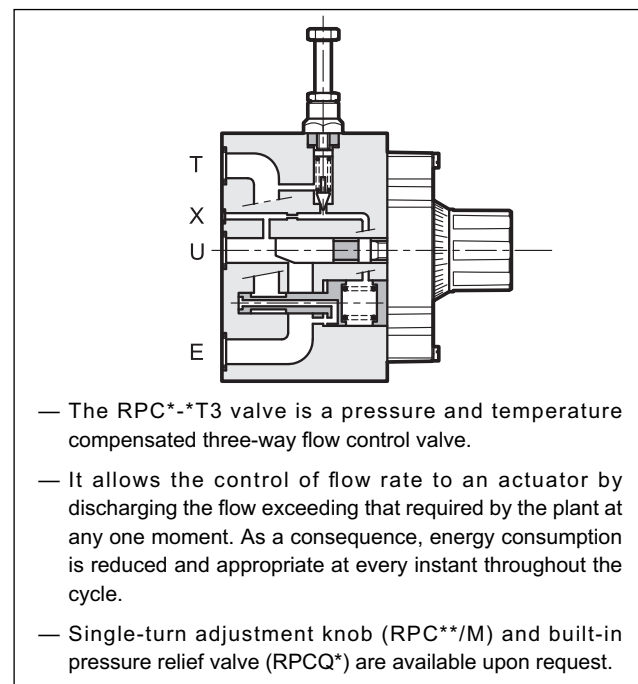
**RPC-2T3** ISO 6263-06 (CETOP 06)

**RPC-3T3** ISO 6263-07 (CETOP 07)

### HYDRAULIC SYMBOLS



### OPERATING PRINCIPLE



### PERFORMANCE RATINGS (obtained with mineral oil with viscosity of 36 cSt at 50°C)

		RPC*-2T3	RPC*-3T3
Maximum operating pressure	bar	320	250
Minimum pressure difference between E and U		10	12
Maximum controlled flow rate	l/min	50	150
Minimum controlled flow rate		0,060	0,130
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15	
Fluid contamination degree for flow rate <0,5 l/min		According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25	
Mass	kg	4,7	9

## 1 - IDENTIFICATION CODE

<b>R</b>	<b>P</b>	<b>C</b>		<b>-</b>		<b>T</b>	<b>3</b>	<b>/</b>		<b>/</b>		<b>/</b>	
----------	----------	----------	--	----------	--	----------	----------	----------	--	----------	--	----------	--

Pressure compensated flow control valve

**Q** = with pressure relief valve adjustment range: 10 ÷ 210 bar (omit if not required)

Size: \_\_\_\_\_  
**2** = ISO 6263-06 (CETOP 06)  
**3** = ISO 6263-07 (CETOP 07)

Temperature compensation \_\_\_\_\_

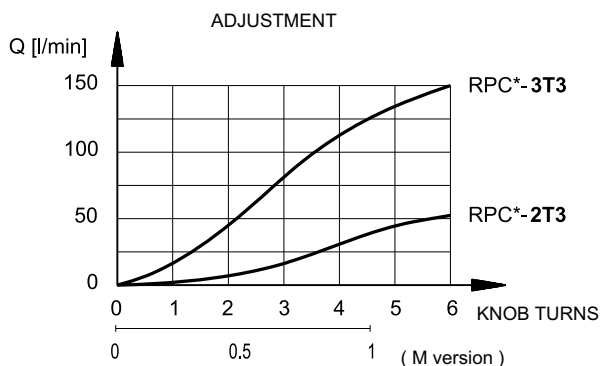
Number of ways \_\_\_\_\_

Seals: omit for mineral oils  
**V** = viton for special fluids

Series No. **31** for RPC\* - 2T3  
**43** for RPC\* - 3T3  
 (the overall and mounting dimensions remain unchanged from 30 to 39 and from 40 to 49)

**M** = single-turn adjustment knob (omit for six-turn adjustment)

## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 4 - PRESSURE COMPENSATION

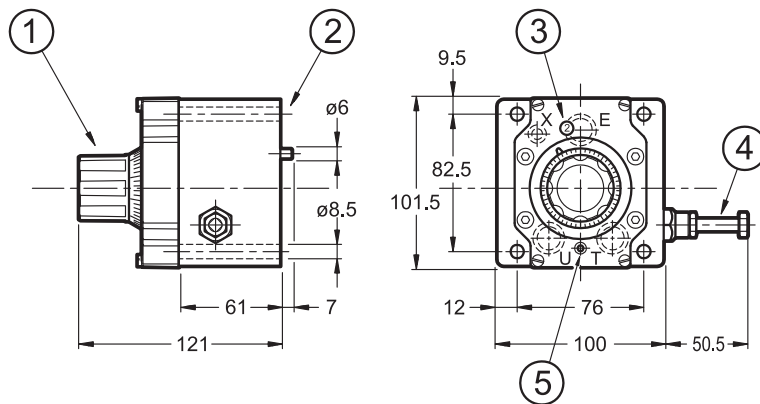
Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of  $\pm 3\%$  of the maximum flow controlled by the valve for maximum pressure variation between the intake and outlet chambers of the valve.

## 5 - TEMPERATURE COMPENSATION

A device located on the first throttle which is sensitive to the temperature fluctuations corrects the position keeping the controlled flow more or less unaltered even should the oil viscosity change.

The fluctuation of the set flow rate stays within  $\pm 2,5\%$  of the maximum flow controlled by the valve.

## 6 - RPC\*-2T3 SERIES 31 OVERALL AND MOUNTING DIMENSIONS

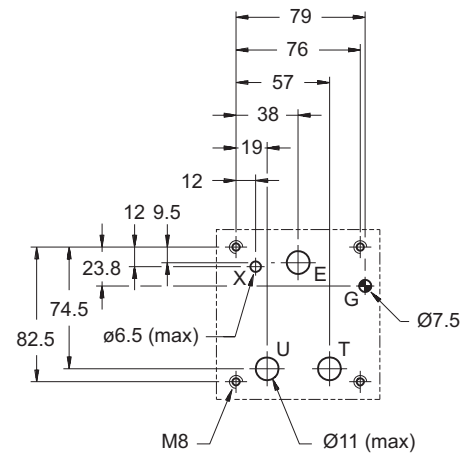


1	Adjustment knob with setting range in 6 turns. Anticlockwise rotation to increase flow rate
2	Mounting surface with sealing rings: N. 3 OR type 3068 (17.13x2.62) N. 1 OR type 109 (9.13x2.62)
3	Indicator of number of knob turns
4	Pressure adjustment screw RPCQ
5	Knob locking screw

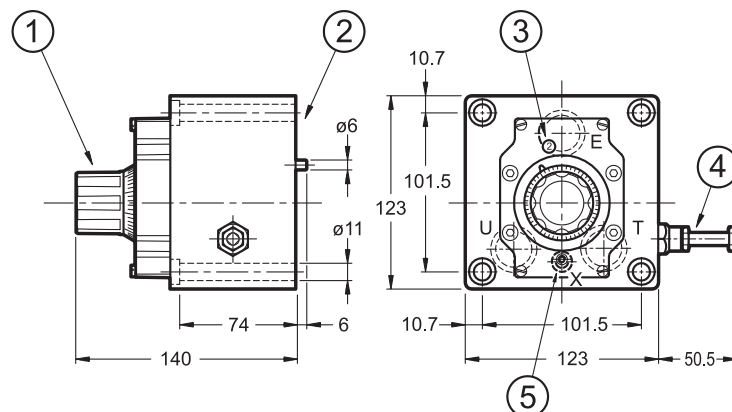
FASTENING BOLTS: 4 SHC bolts ISO 4762 M8x75  
Tightening torque: 20 Nm

dimensions in mm

MOUNTING SURFACE:  
ISO 6263-06-07-\*-97  
(CETOP 4.5.2-3-06-320)



## 7 - RPC\*-3T3 SERIES 43 OVERALL AND MOUNTING DIMENSIONS

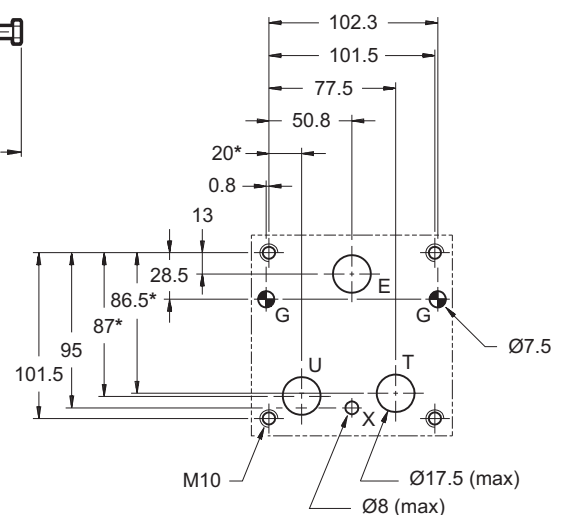


1	Adjustment knob with setting range in 6 turns. Anticlockwise rotation to increase flow rate
2	Mounting surface with sealing rings: N. 3 OR type 3106 (26.65x2.62) N. 1 OR type 3043 (10.78x2.62)
3	Indicator of number of knob turns
4	Pressure adjustment screw RPCQ
5	Knob locking screw

FASTENING BOLTS: 4 SHC bolts ISO 4762 M10x90  
Tightening torque: 40 Nm

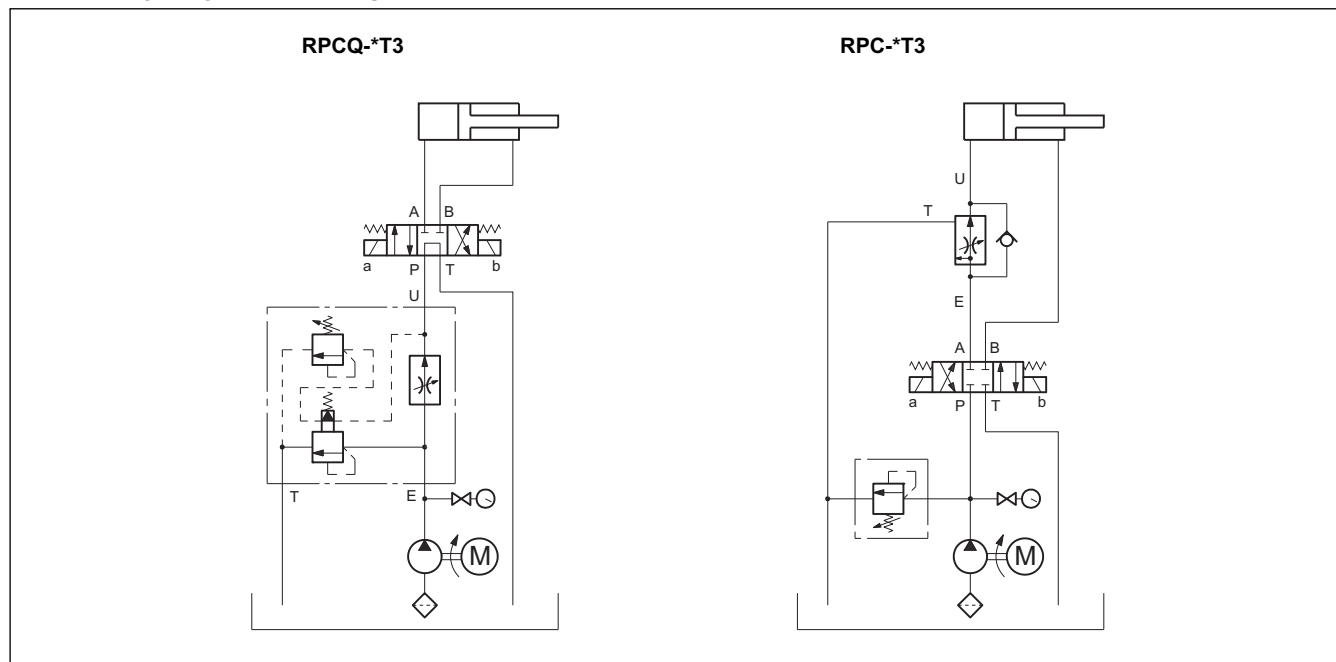
dimensions in mm

MOUNTING SURFACE:  
ISO 6263-07-11-\*97  
(CETOP 4.5.2-3-07-250)





## 11 - APPLICATION EXAMPLES



## 12 - SUBPLATES (see catalogue 51 000)

	RPC* - 2T3	RPC* - 3T3
Type	PMRPCQ2-AI4G rear ports	PMRPCQ3-AI6G rear ports
E, U, T port dimensions	1/2" BSP	1" BSP
X port dimensions	1/4" BSP	1/4" BSP



# CP1R\*-W

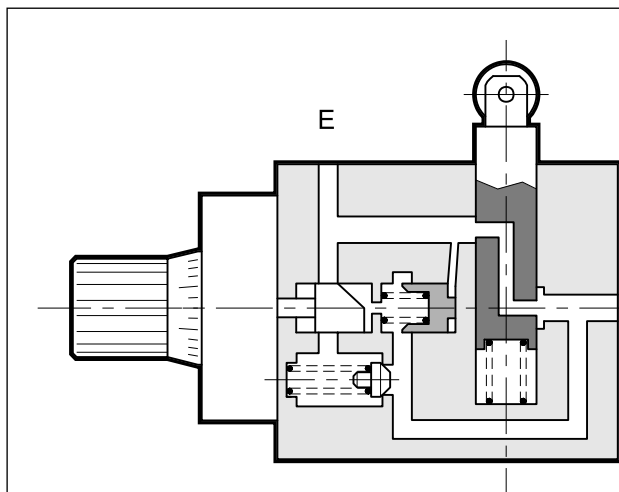
## ROLLER OPERATED FAST/SLOW SPEED SELECTION VALVE

SERIES 21

### THREADED PORTS

**p** max 70 bar  
**Q** max 40 l/min

### OPERATING PRINCIPLE



- The CP1R\*-W valve is used for the selection and control of fast/slow speed of hydraulic axis by mechanical roller operation.
- The slow working speed adjustment is obtained by using a pressure compensated flow control valve.  
The special shape of the control openings allows fine adjustment even with very low flow rates.
- Adjustment of the flow rate is carried out with three turns of the knob that can be locked in any position with a screw.
- It is available in two configurations:  
normally open CP1RA,  
normally closed CP1RC.
- It is supplied with an incorporated check valve that allows free passage of the reverse flow.

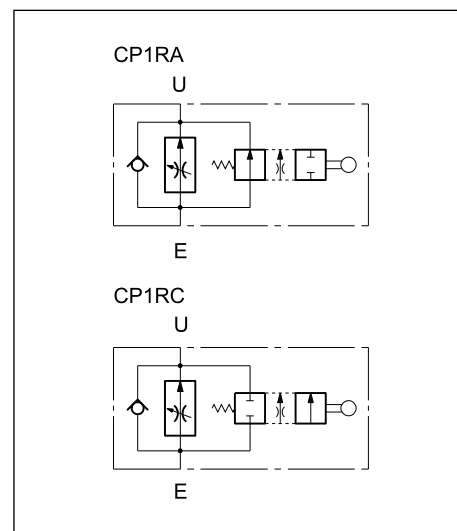
### CONFIGURATIONS (see Hydraulic symbols table)

- CP1RA-W: normally open - fast movement with roller in rest position and controlled slow movement with roller in operation.
- CP1RC-W: normally closed - controlled slow movement with roller in rest position and fast movement with roller in operation.

### PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure	bar	70
Fast movement maximum flow rate	l/min	40
Controlled slow movement flow rate	max	l/min 4 - 10 - 16
	min	l/min 0,1
Roller working movement	mm	6
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Massa	kg	3,2

### HYDRAULIC SYMBOLS

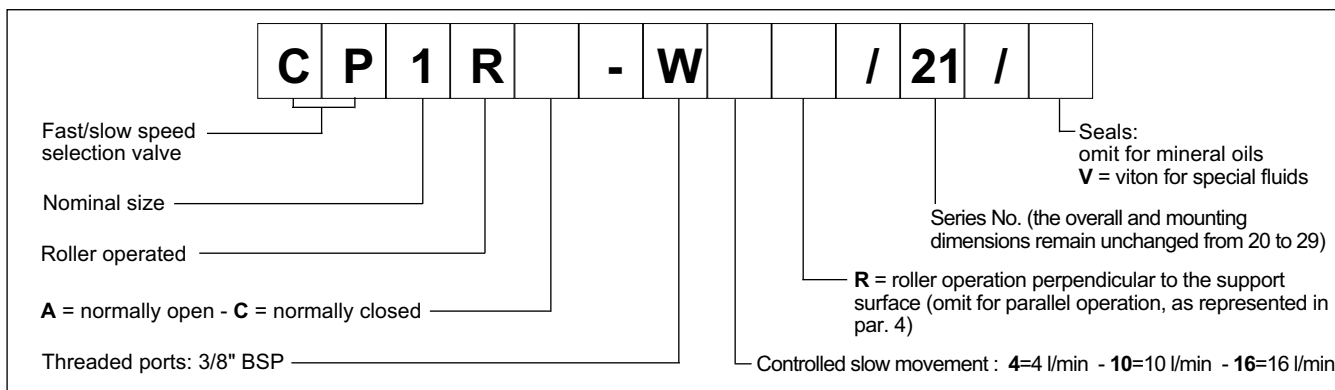




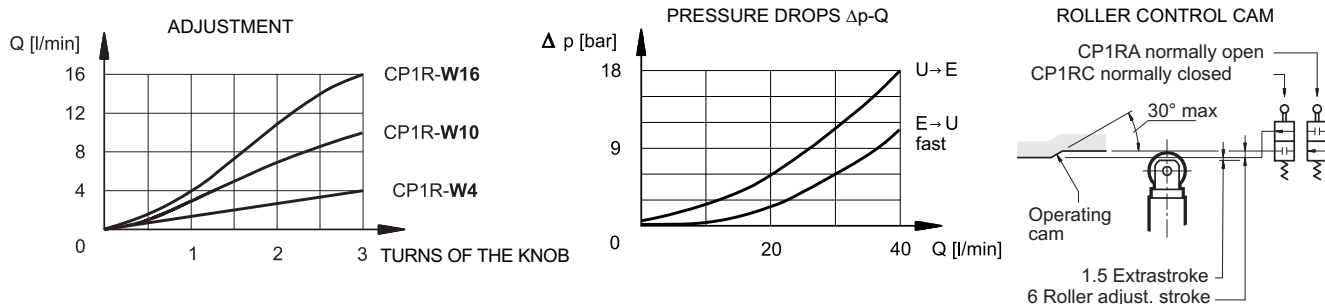
# CP1R\*-W

## SERIES 21

### 1 - IDENTIFICATION CODE



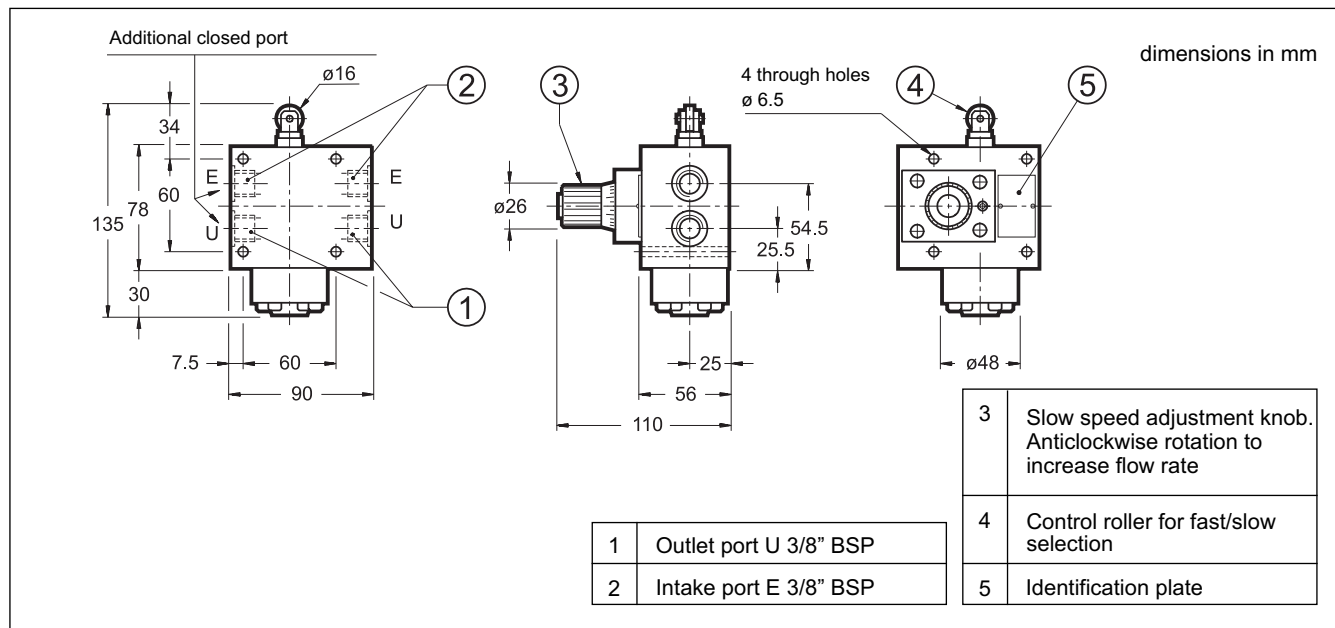
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



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# K4WA/C

## DECELERATION VALVE

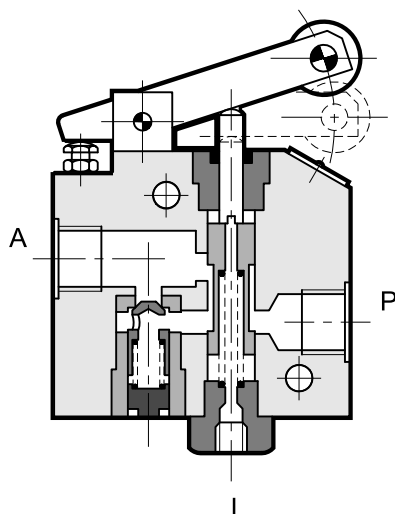
### SERIES 10

#### THREADED PORTS

**p** max **150** bar

**Q** max **40** l/min

#### OPERATING PRINCIPLE



— The K4WA/C valve is a mechanically operated decelerating valve with BSPP threaded ports for in-line mounting on hydraulic lines.

— It is normally used to change the movement speed of the hydraulic axis, such as changing from fast to slow, or for slow stops.

— The valve is normally open in the free condition and allows free flow passage from port P to port A.

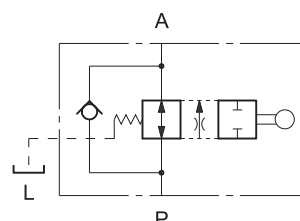
The flow is partially or completely shut off by operating the mechanical drive of the valve.

— It is always supplied with a built in check valve that allows reverse free flow from port A to port P.

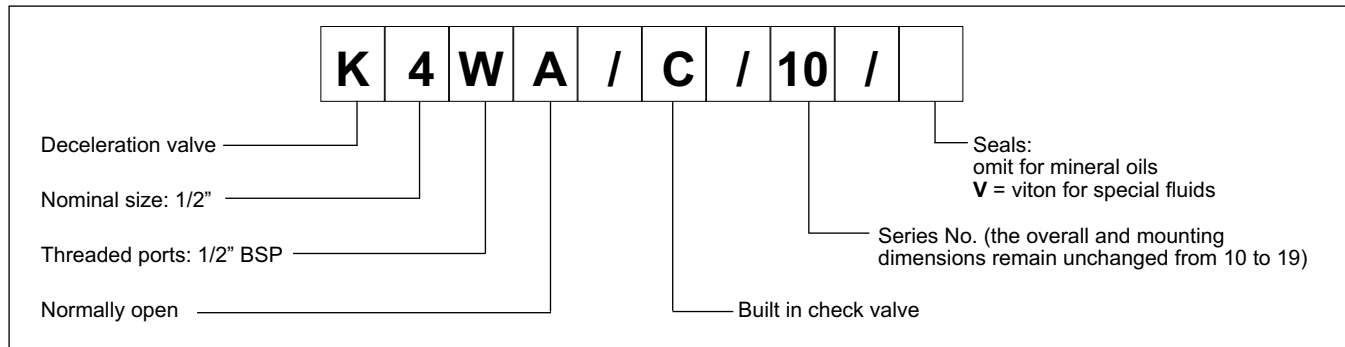
#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	150
Cracking pressure of the check valve	bar	0,5
Maximum flow rate	l/min	40
Needed force on the lever to operate: - at beginning - at end stroke	Kg	6,8 12,0
Maximum leakage with closed valve ( $\Delta p$ 100 bar)	l/min	0,05
Stroke (from all open to completely closed)	mm	20
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	2,5

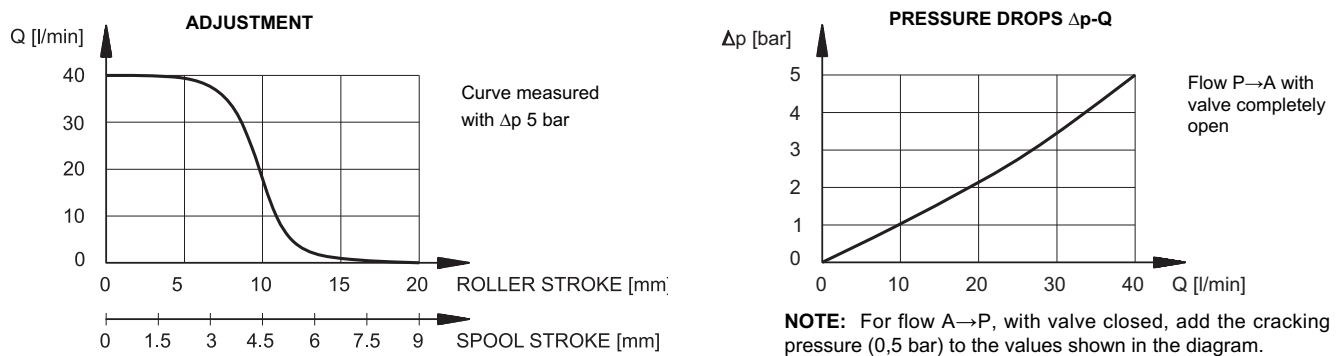
#### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE



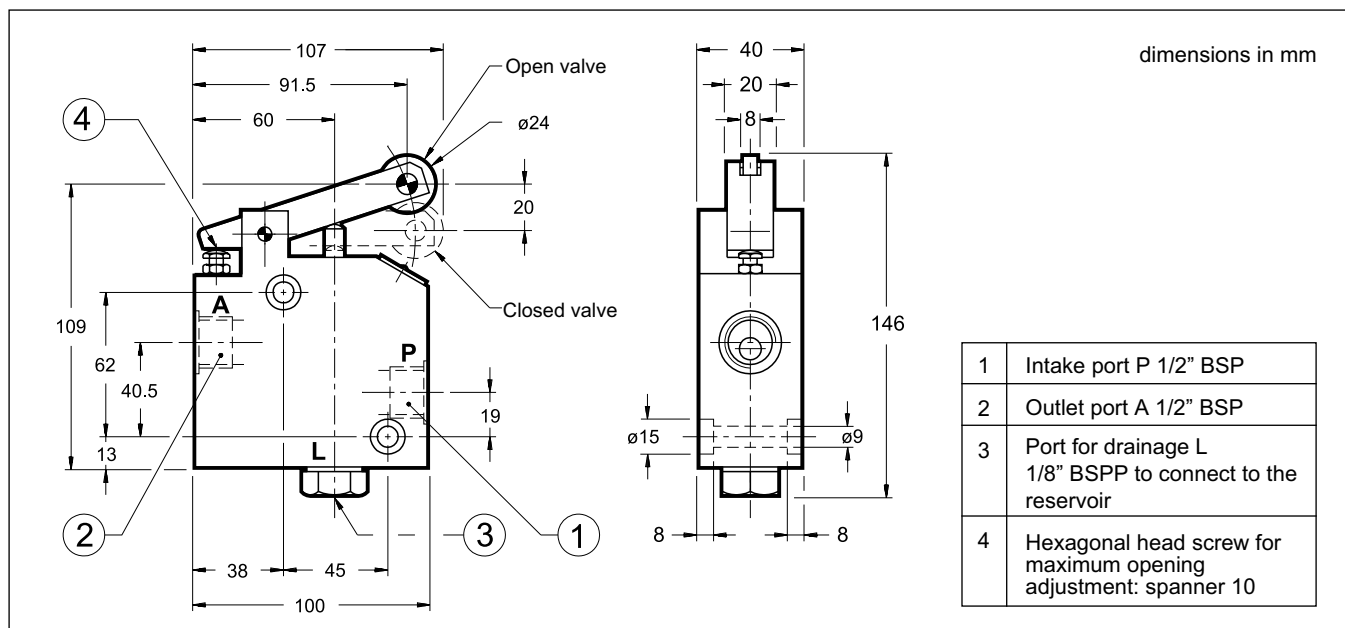
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# DL2

## SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

### SERIES 10

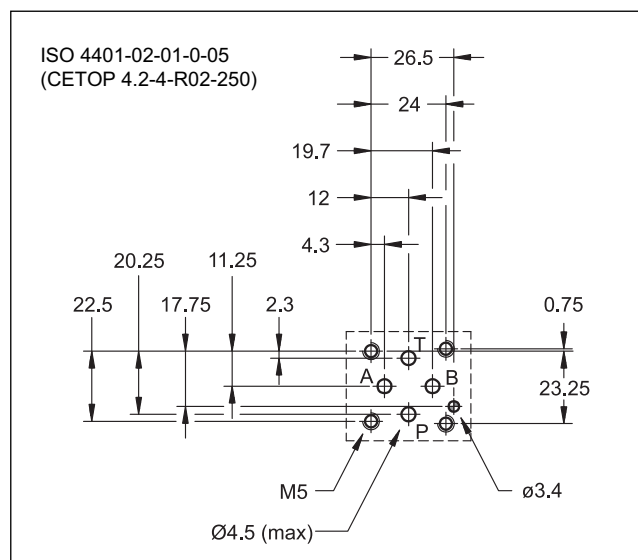
## SUBPLATE MOUNTING

### ISO 4401-02 (CETOP R02)

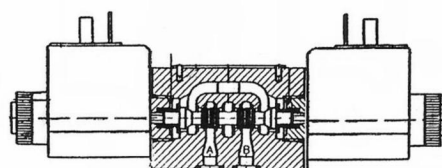
**p** max **250** bar

**Q** max **20 l/min**

## MOUNTING SURFACE



## OPERATING PRINCIPLE



- Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-02 (CETOP RP 121H) standards.
- Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.
- The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

## PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure: - ports P - A - B - port T	bar	250 160
Maximum flow rate	l/min	20
Pressure drop $\Delta p$ -Q	see paragraph 4	
Operating limits	see paragraph 5	
Electrical features	see paragraph 7	
Electrical connections	DIN 43650	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Masse: single solenoid valve double solenoid valve	kg	0,8 1,1

- The valve is supplied with 4 way designs, with 2 or 3 positions and with several interchangeable spools with different porting arrangements.
- The valve is available with DC or rectified current solenoids.

## 1 - IDENTIFICATION CODE

	<b>D</b>	<b>L</b>	<b>2</b>	-		/	<b>10</b>		-		<b>K1</b>
--	----------	----------	----------	---	--	---	-----------	--	---	--	-----------

Solenoid operated directional control valve

Compact version

ISO 4401-02 (CETOP R02) size

Spool type (see paragraph 2):

**S\***      **TA**  
**SA\***    **TB**  
**SB\***

Series no.: \_\_\_\_\_  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Coil electrical connection:  
 plug for connector type  
 DIN 43650 (**standard**)

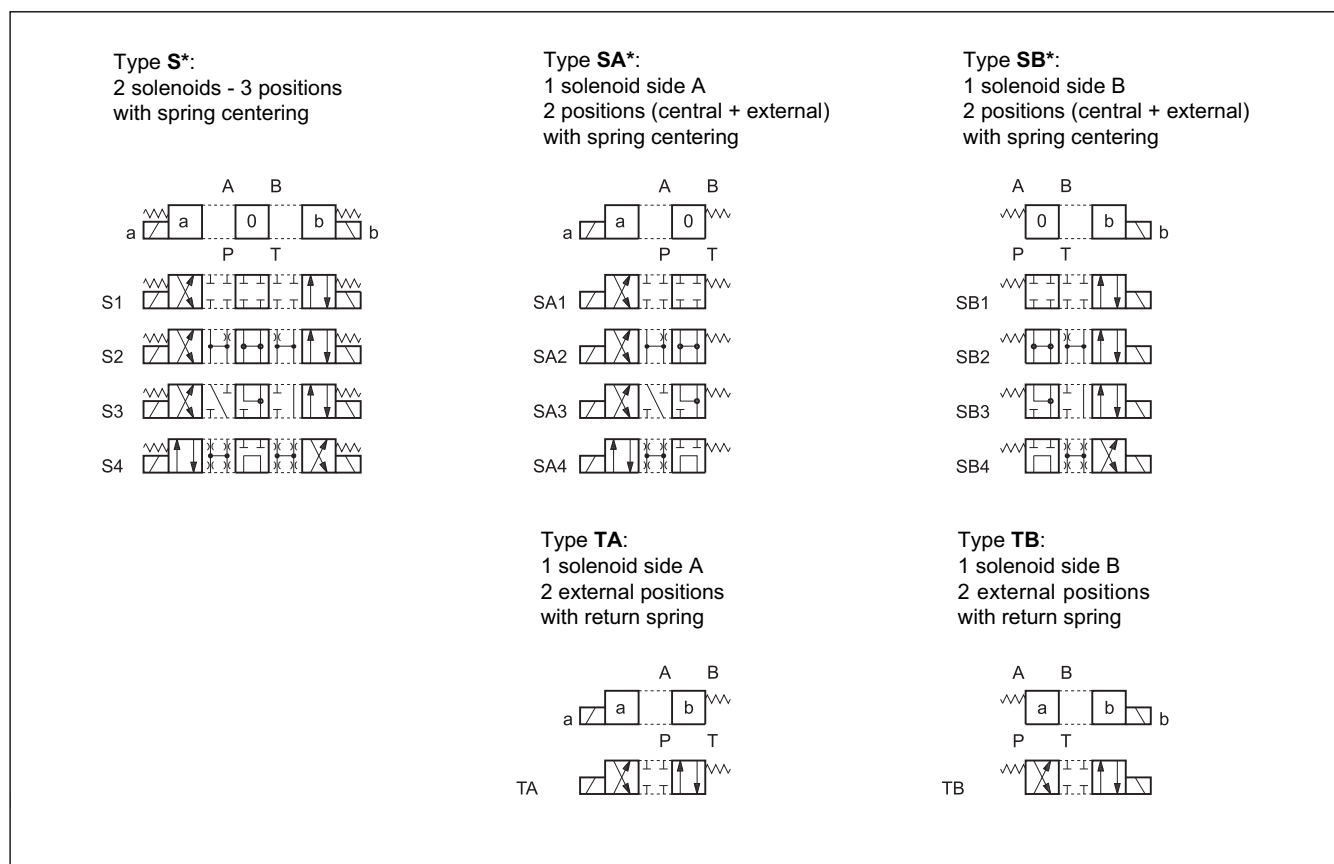
Power supply  
**D12** = 12 V } direct current  
**D24** = 24 V }

**R110** = 110 V } rectified current  
**R230** = 230 V }

**D00** = valve without coils (see **NOTE**)

**NOTE:** Coils locking ring and related OR are supplied together with valves.

## 2 - SPOOL TYPE



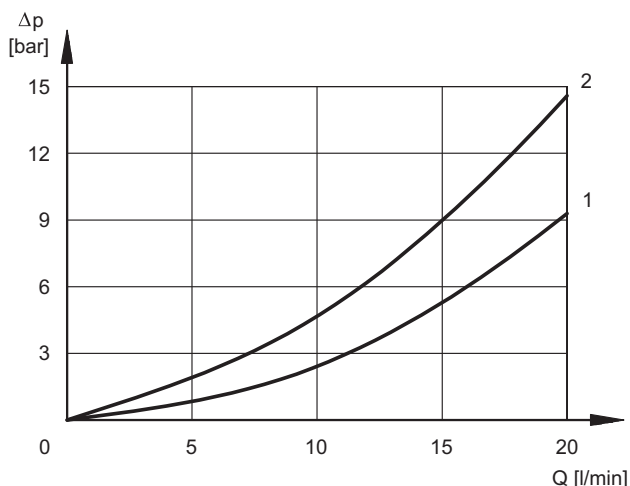
### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - PRESSURE DROPS $\Delta p$ -Q

(obtained with viscosity of 36 cSt at 50 °C)



#### ENERGIZED VALVE

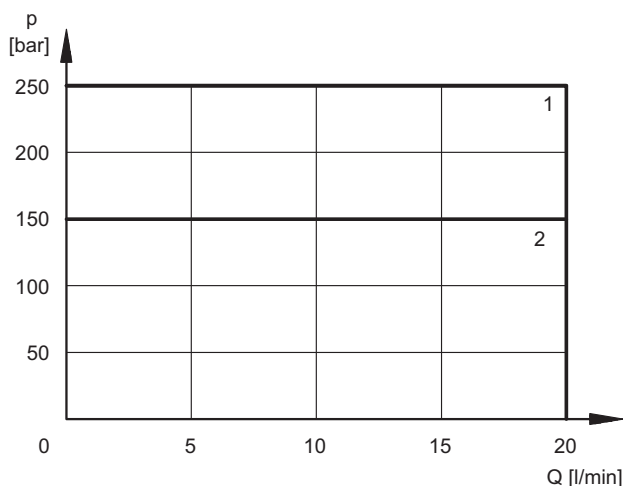
SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1, SA1, SB1	1	1	1	1
S2, SA2, SB2	1	1	1	1
S3, SA3, SB3	1	1	1	1
S4, SA4, SB4	2	2	2	2
TA, TB	1	1	1	1

For the pressure drop with a de-energized valve P→T of the spools S2 and S4 refer to the curve 1.

### 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, S3, S4, TA, TB	1
S2	2

### 6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES (±10%) [ms]	
ENERGIZING	DE-ENERGIZING
25 ÷ 75	15 ÷ 25



## 7 - ELECTRICAL FEATURES

### 7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

**NOTE:** In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

<b>SUPPLY VOLTAGE FLUCTUATION</b>	+5% -10% V <sub>nom</sub>
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95 EC
<b>CLASS OF PROTECTION :</b> Atmospheric agents CEI EN 60529 Coil insulation (VDE 0580) Impregnation:	IP 65* class H class F

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

### 7.2 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law:  $V = R \times I$

'R' coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the "D" type connector (see cat. 49 000).

The table shows current and power consumption values for DC and rectified current coil types.

	Nominal voltage [V]	Resistance at 20°C (±1%) [Ω]	Current consumption (±5%) [A]	Power consumption (+5% -10%) [W] [VA]		Coil code
<b>D12</b>	12	6.7	2.4	28.8		1903320
<b>D24</b>	24	24	1.2	28.8		1903321
<b>R110</b>	110	350	0.3		29.7	1903322
<b>R220</b>	230	1500	0.15		31	1903323

## 8 - ELECTRIC CONNECTORS

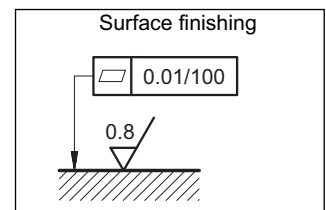
**The solenoid valves are not supplied with connector. Connectors must be ordered separately.** For the identification of the connector type to be ordered, please see catalogue 49 000.

## 9 - INSTALLATION

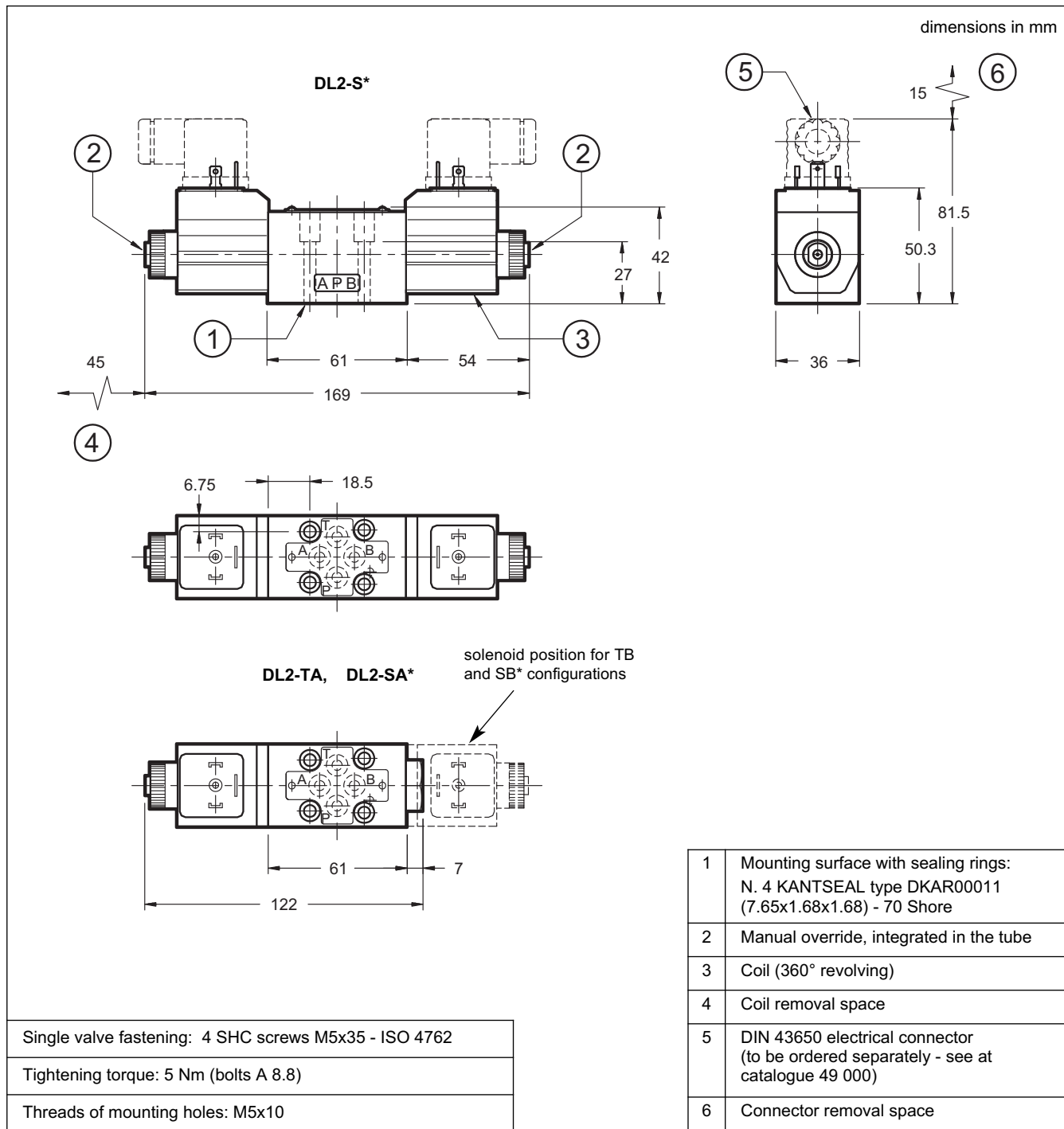
Configurations with centering and return springs can be mounted in any position.

Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



## 10 - DL2 OVERALL AND MOUNTING DIMENSIONS





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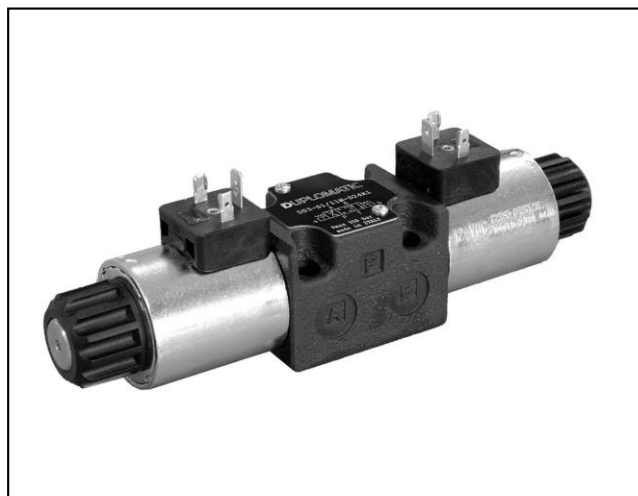
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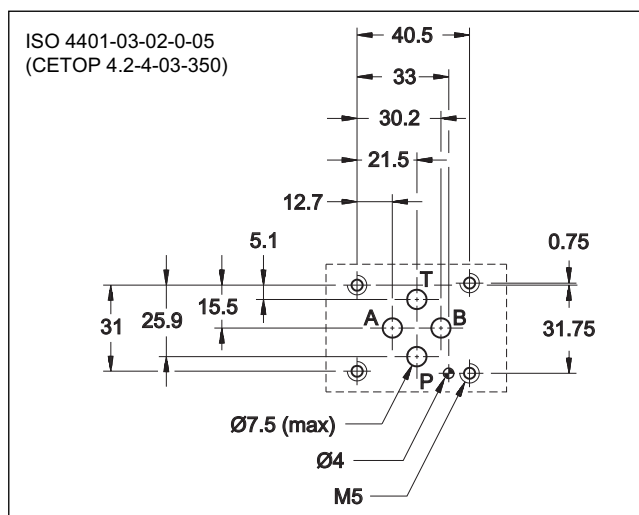
# DS3

## SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

### SUBPLATE MOUNTING ISO 4401-03

**p** max **350** bar  
**Q** max **100** l/min

### MOUNTING INTERFACE



### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure: - P - A - B ports - T port	bar	CC	CA
		350 210	160
Maximum flowrate	l/min	100	
Pressure drops Δp-Q	see paragraph 4		
Operating limits	see paragraph 6		
Electrical features	see paragraph 7		
Electrical connections	see paragraph 11		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass:	kg	1,5	1,4
single solenoid valve double solenoid valve		2	2

### OPERATING PRINCIPLE

- Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 standards.
- The valve is supplied with 3 or 4 ways design, with 2 or 3 positions with a wide range of spools.
- The valve body is made with high strength iron castings provided with wide internal paths in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see par. 7).
- The valve is available with DC or AC solenoids. DC solenoids can also be fed with AC power supply, by using connectors with a built-in rectifier bridge (see paragraphs 6.4 and 7.2).
- The DC valve is also available in a soft-shifting version (see par. 14).
- The DC valve is also available with zinc-nickel coating that ensures a salt spray resistance up to 600 hours .
- It is available a version with UL certified 24V DC coils for Canada and the United States. (see par. 15).
- Alternative to the standard manual override there are lever, push, knob, push and twist, boot and mechanical detent devices.

## 1 - IDENTIFICATION CODE

<b>D</b>	<b>S</b>	<b>3</b>	<b>-</b>		<b>/</b>	<b>11</b>		<b>-</b>			<b>/</b>		
----------	----------	----------	----------	--	----------	-----------	--	----------	--	--	----------	--	--

Directional valve, solenoid operated

ISO 4401-03 size

Spool type (see paragraph 3)

<b>S*</b>	<b>RSA*</b>	<b>TA</b>	<b>RK</b>
<b>SA*</b>	<b>RSB*</b>	<b>TB</b>	
<b>SB*</b>		<b>TA*</b>	
		<b>TB*</b>	

Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

DC power supply

**D12** = 12 V  
**D14** = 14 V  
**D24** = 24 V  
**D28** = 28 V  
**D48** = 48 V  
**D110** = 110 V  
**D125** = 125 V  
**D220** = 220 V  
**D00** = valve without coils (see **NOTE 1**)

AC power supply

**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A100** = 100 V - 50 Hz / 100 V - 60 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see **NOTE1**)  
**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz

**NOTE 1:** Coils locking ring and related OR are supplied together with valves.

**NOTE 2:** The standard valve is supplied with surface treatment of phosphating black.  
The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to **240** hours.  
For a salt spray resistance up to **600** hours refer to **paragraph 17**.  
(test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE 2**)  
Omit if not required

Manual override:  
omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected  
**CH** = lever manual override (only for DC version)  
The device is not available for TB, TB\* and RSB\* spools.  
RSA\* spools: available only for RSA1 and RSA2.  
**CP** = push manual override (only for DC version)  
**CK1** = turning knob override (only for DC version)  
**CK2** = push and twist knob override (only for DC version)  
**CPK** = push manual override with mechanical retention (only for DC version)

Coil electrical connection (see par. 11):  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)  
**K2** = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

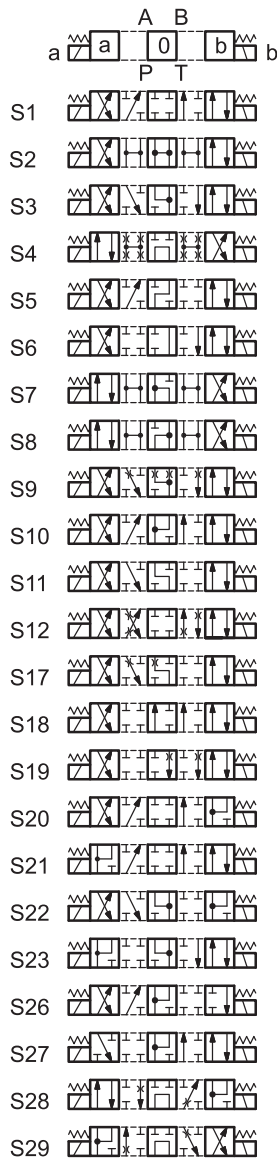
## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

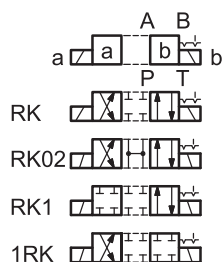
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - SPOOL TYPE

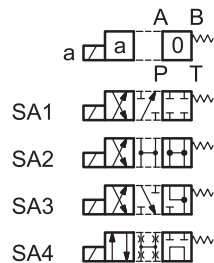
**Type S\*:**  
2 solenoids - 3 positions  
with spring centering



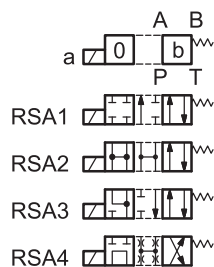
**Type RK:**  
2 solenoids - 2 positions  
with mechanical retention



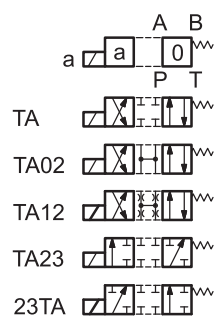
**Type SA\*:**  
1 solenoid side A  
2 positions (central + external)  
with spring centering



**Type RSA\*:**  
1 solenoid side A  
2 positions (external + central)  
with return spring



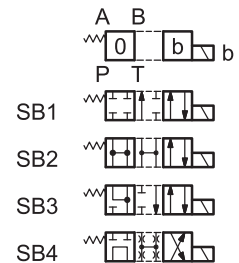
**Type TA:**  
1 solenoid side A  
2 external positions  
with return spring



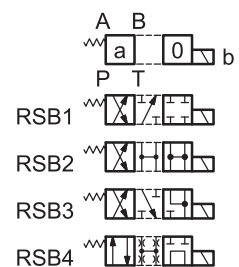
**Type TA\*:**  
1 solenoid side A  
2 positions with return spring



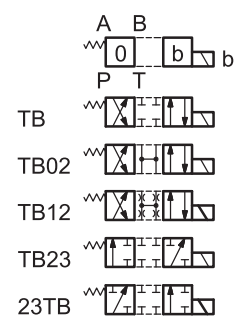
**Type SB\*:**  
1 solenoid side B  
2 positions (central + external)  
with spring centering



**Type RSB\*:**  
1 solenoid side B  
2 positions (external + central)  
with return spring



**Type TB:**  
1 solenoid side B  
2 external positions  
with return spring



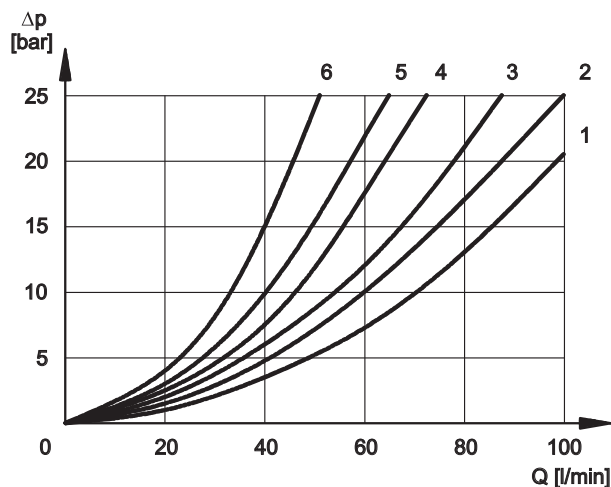
**Type TB\*:**  
1 solenoid side B  
2 positions with return spring



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

## 4 - PRESSURE DROPS $\Delta p$ -Q

(obtained with viscosity 36 cSt at 50 °C)



### ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3, RSA3, RSB3	3	3	1	1
S4, SA4, SB4, RSA4, RSB4	5	5	5	5
S5	2	1	3	3
S6	2	2	3	1
S7, S8	4	5	5	5
S9	2	2	3	3
S10	1	3	1	3
S11	2	2	1	3
S12, S17, S19	2	2	3	3
S18	1	2	3	3
S20, S22	1	5	2	
S21, S23	5	1		2
S28	6	5	-	6
S29	5	6	6	-
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
RK, RK02, RK1, 1RK	2	2	2	2

For pressure drops between A and B lines of spools S10, S20, S21, S22 and S23, which are used in the regenerative diagram, refer to curve 5.

### DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3, RSA3, RSB3			3	3	
S4, SA4, SB4, RSA4, RSB4					3
S5		4			
S6				3	
S7, S8			6	6	3
S10	3	3			
S11			3		
S18	4				
S22, S23			3	3	
S28, S29				6	

## 5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

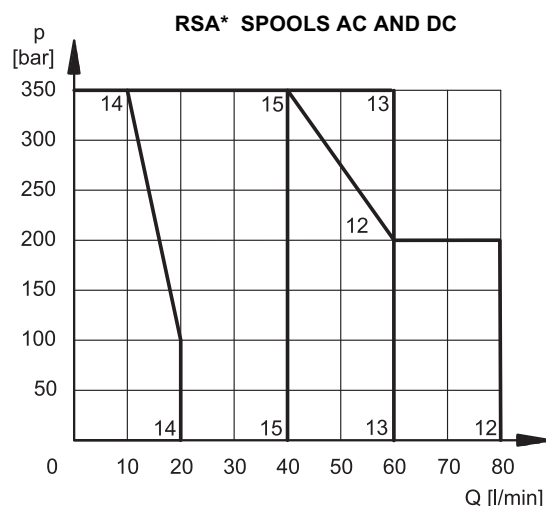
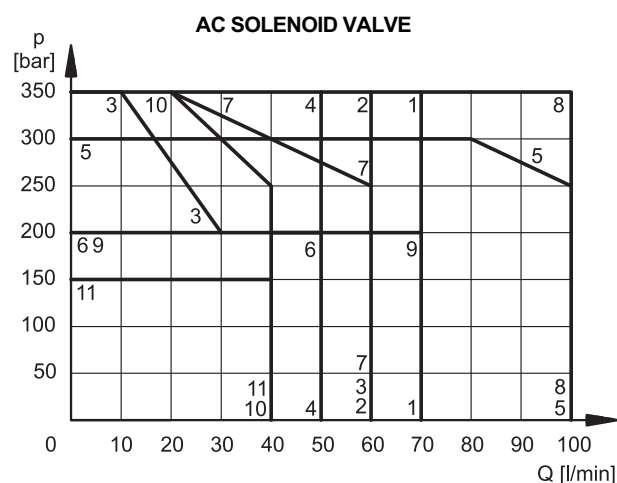
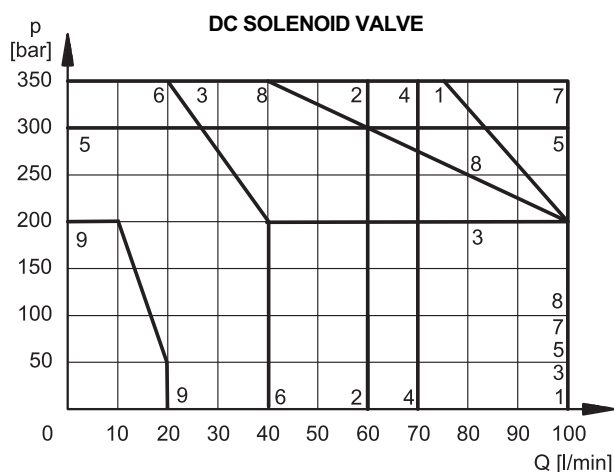
SPOOL TYPE	TIMES [ms]	
	ENERGIZING	DE-ENERGIZING
CC	25 ÷ 75	15 ÷ 25
CA	10 ÷ 25	15 ÷ 40

## 6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page. The performance of the DC solenoid powered by AC with rectifier connectors are at par. 6.4. The performances of the soft-shift valve are shown at par. 14.

### 6.1 - Valves in standard operation



**DC SOLENOID VALVE**

SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2,SA2,SB2	2	2
S3,SA3,SB3	3	3
S4,SA4,SB4	4	4
S5	5	5
S6	4	6
S7	4	4
S8	4	4
S9	7	7
S10	7	7
S11	4	6
S12	1	1
S17	4	4
S18	5	5
S19	4	4
S20	6*	6
S21	6	6*
S22	6	6
S23	6	6
S28	9*	9*
S29	9*	9*
TA, TB	7	7
TA02, TB02	8	8
TA23, TB23	2	2
TA 30	1	-
RK	7	7
RK02	8	8
RK1, 1RK	7	7

**AC SOLENOID VALVE**

SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2,SA2,SB2	2	2
S3,SA3,SB3	3	3
S4,SA4,SB4	2	2
S5	5	5
S6	6	6
S7	4	4
S8	4	4
S9	7	7
S10	8	8
S11	6	6
S12	2	2
S17	7	7
S18	5	5
S19	7	7
S20	10*	10
S21	10	10*
S22	10*	10
S23	10	11*
S28		
S29		
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	2	2
TA 30	5	-
RK	8	8
RK02	9	9
RK1, 1RK	8	8

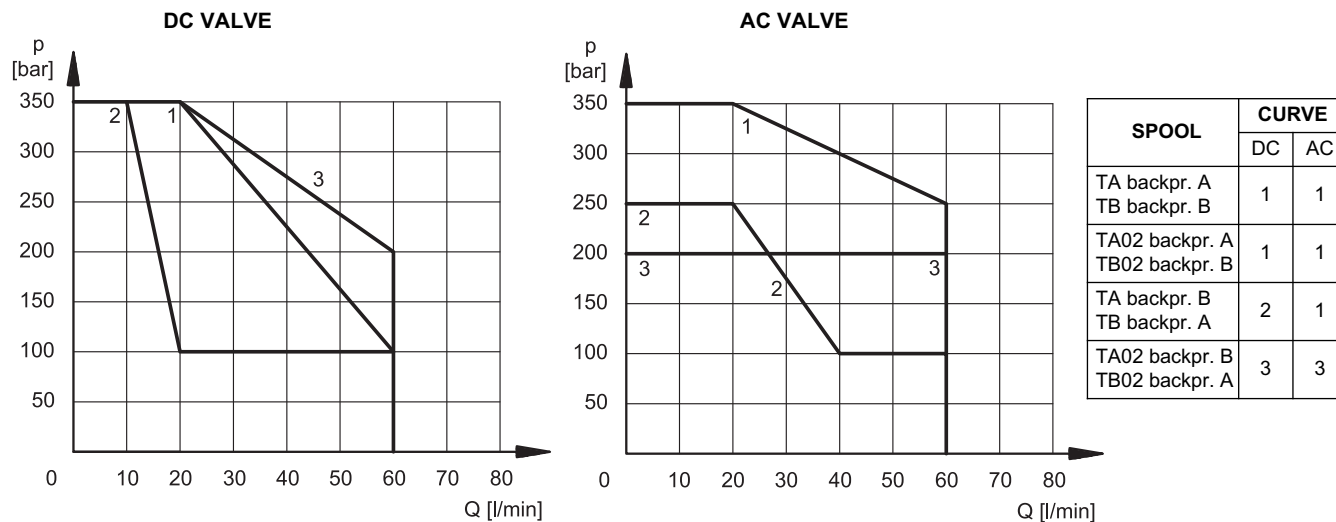
\* Performance obtained for a valve with A and B lines connected the one to the piston-side chamber and the other to the rod-side chamber of a double-acting cylinder with area ratio 2:1.

SPOOL	CURVE
RSA1	12
RSA2	13
RSA3	14
RSA4	15

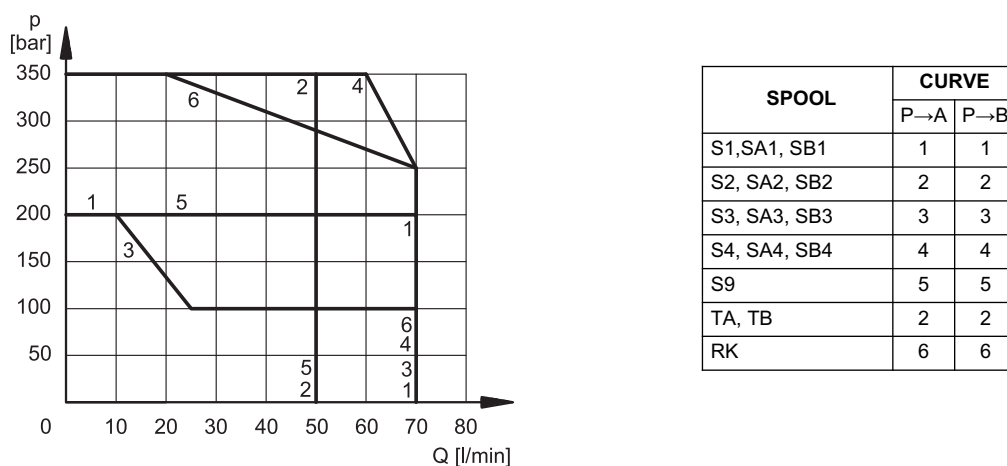


## 6.2 - 4-way valve in 3-way operation

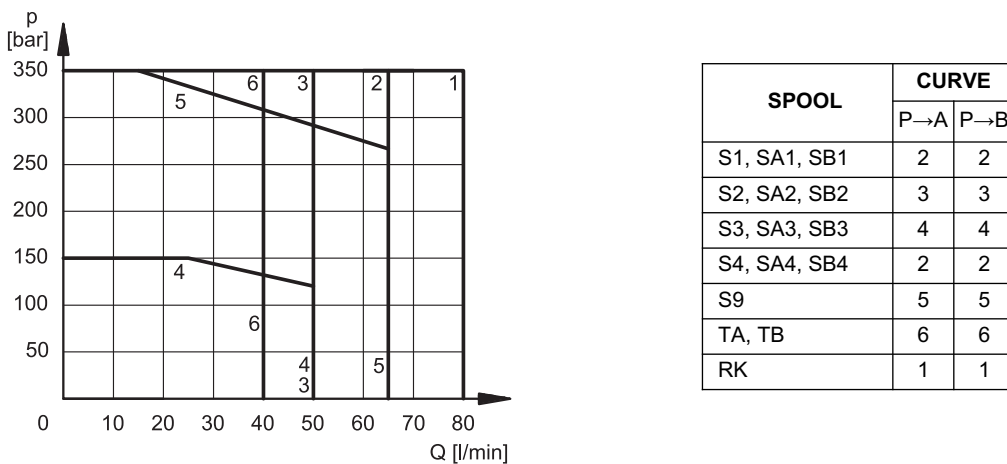
Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.



## 6.3 - AC solenoid valve with coil A110 fed with 110V - 60 Hz



## 6.4 - Operating limits for DC solenoid valves fed with AC with rectifier connectors



## 7 - ELECTRICAL FEATURES

### 7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

#### Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP grade, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
K1 EN 175301-803 (ex DIN 43650)	IP65	IP65
K2 AMP JUNIOR	IP65/67	
K7 DEUTSCH DT04 male	IP65/67	

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	18.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)</b>	In compliance with 2014/30/EU
<b>LOW VOLTAGE</b>	In compliance with 2014/35/EU
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation: DC valve AC valve	class H class F class H

**NOTE:** In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

### 7.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values of the DC coils.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits (see diagram at section 6.4).

#### Coils for direct current (values ± 10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code		
					K1	K2	K7
<b>D12</b>	12	4,4	2,72	32,7	1903080	1903100	1902940
<b>D14</b>	14	7,2	1,93	27	1903086		
<b>D24</b>	24	18,6	1,29	31	1903081	1903101	1902941
<b>D28</b>	28	26	1,11	31	1903082		
<b>D48</b>	48	78,6	0,61	29,5	1903083		
<b>D110</b>	110	423	0,26	28,2	1903464		
<b>D125</b>	125	550	0,23	28,6	1903467		
<b>D220</b>	220	1692	0,13	28,2	1903465		

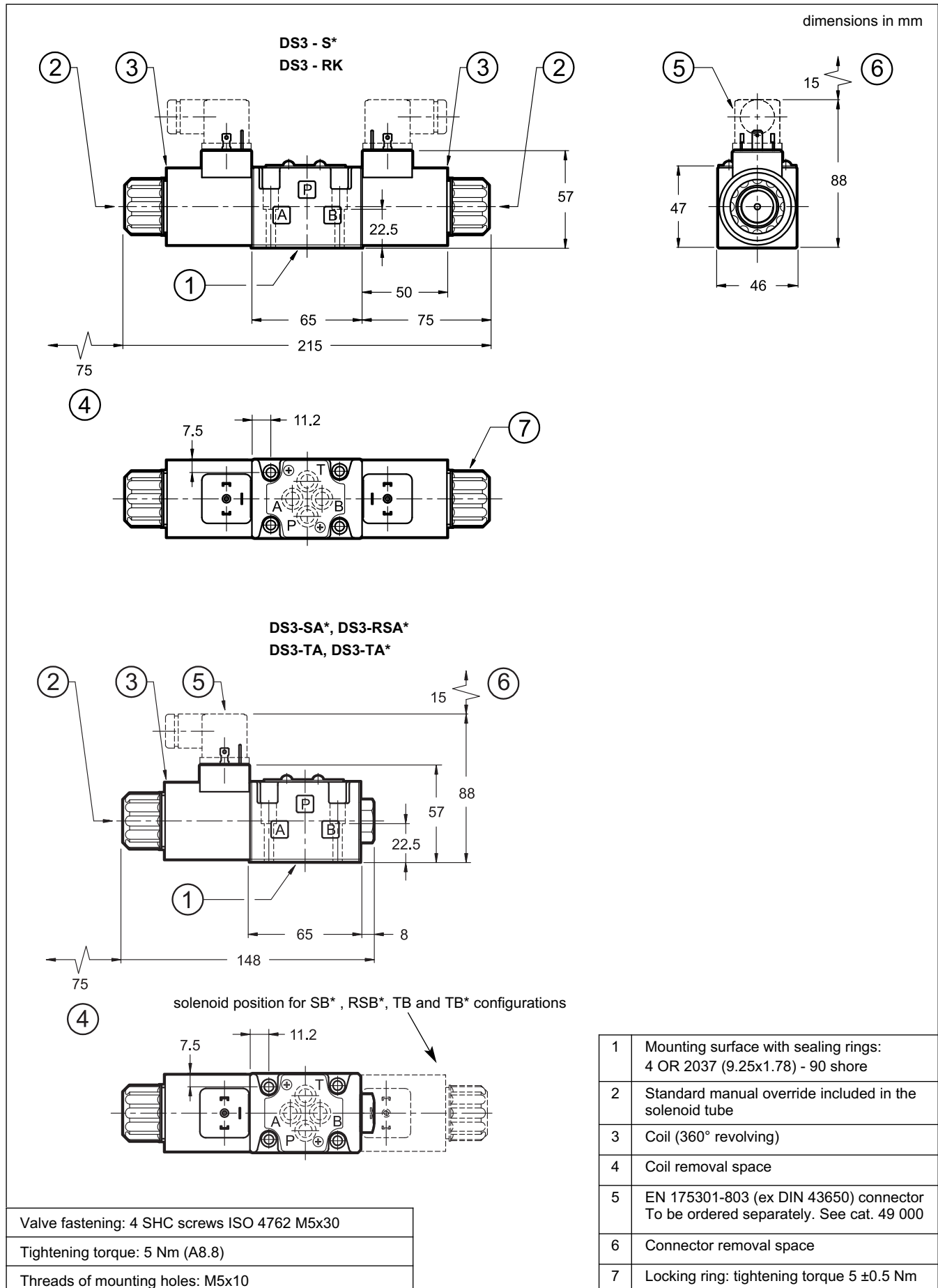
### 7.3 - Current and absorbed power for AC solenoid valve

The table shows current and power consumption values at inrush and at holding, for AC coils.

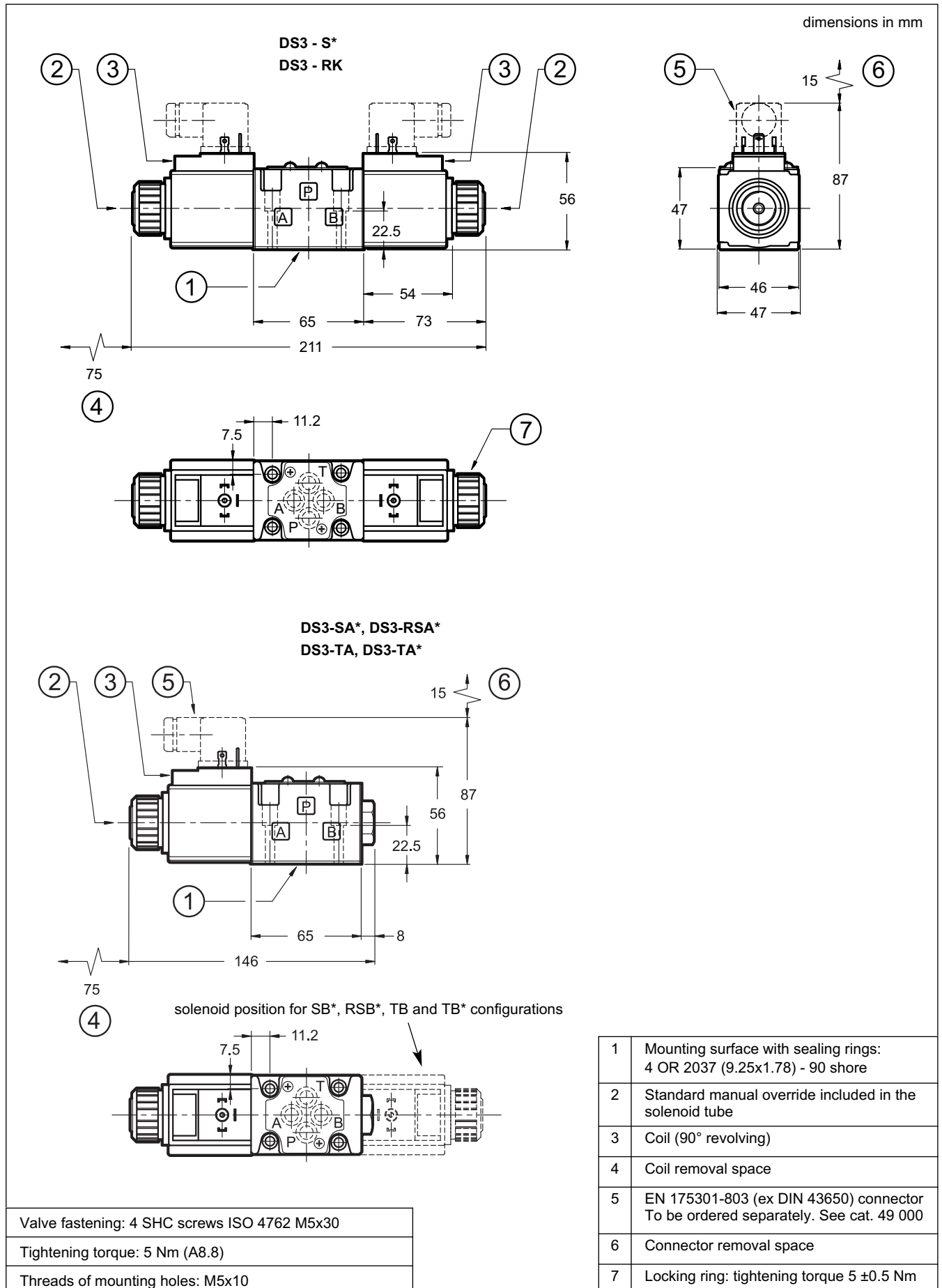
#### Coils for alternating current (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil Code K1
<b>A24</b>	24	50	1,69	5,81	1,32	139	32	1902830
<b>A48</b>	48		6,02	3,78	0,86	182	41	1902831
<b>A100</b>	100V-50Hz 100V-60Hz	50/60	23,3	2,11	0,48	211	48	1902836
				1,63	0,37	163	37	
<b>A110</b>	110V-50Hz 120V-60Hz		33	1,76	0,40	194	44	1902832
				1,54	0,35	185	42	
<b>A230</b>	230V-50Hz 240V-60Hz		135	0,92	0,21	213	48	1902833
				0,79	0,18	190	43	
<b>F110</b>	110	60	28,5	1,45	0,33	160	36	1902834
<b>F220</b>	220		103	0,92	0,21	203	46	1902835

## 8 - OVERALL AND MOUNTING DIMENSIONS FOR DC SOLENOID VALVES



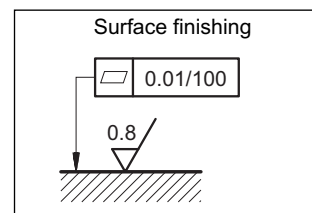
## 9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOID VALVES



## 10 - INSTALLATION

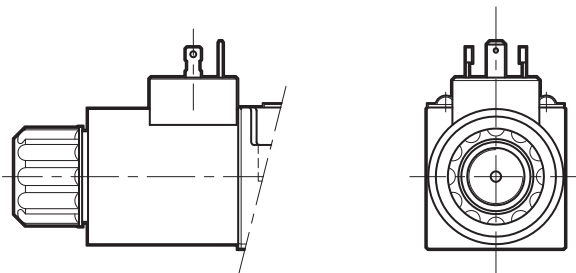
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

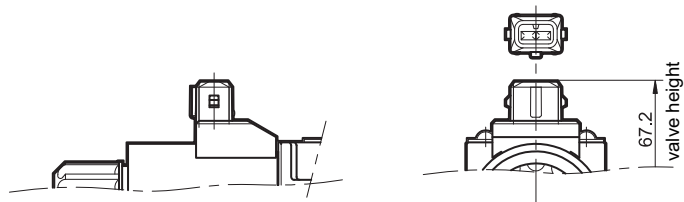


## 11 - ELECTRIC CONNECTIONS

connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**  
code **WK1** (W7 version only)



connection for AMP JUNIOR  
connector  
code **K2**



connection for  
DEUTSCH DT06-2S male connector  
code **K7**



connection for  
DEUTSCH DT06-2S male connector  
code **WK7** (W7 version only)  
code **WK7D** (W7 version only - coil  
with diode)

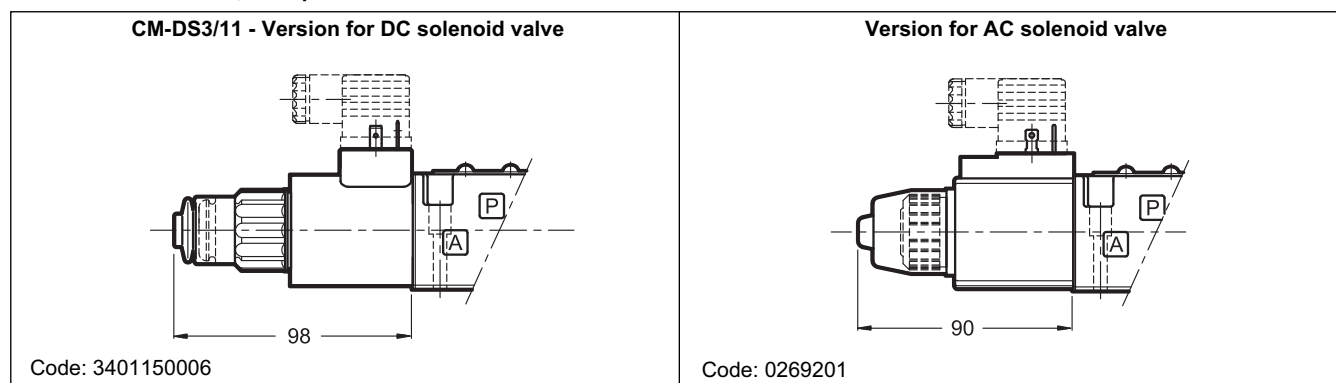


## 12 - ELECTRIC CONNECTORS

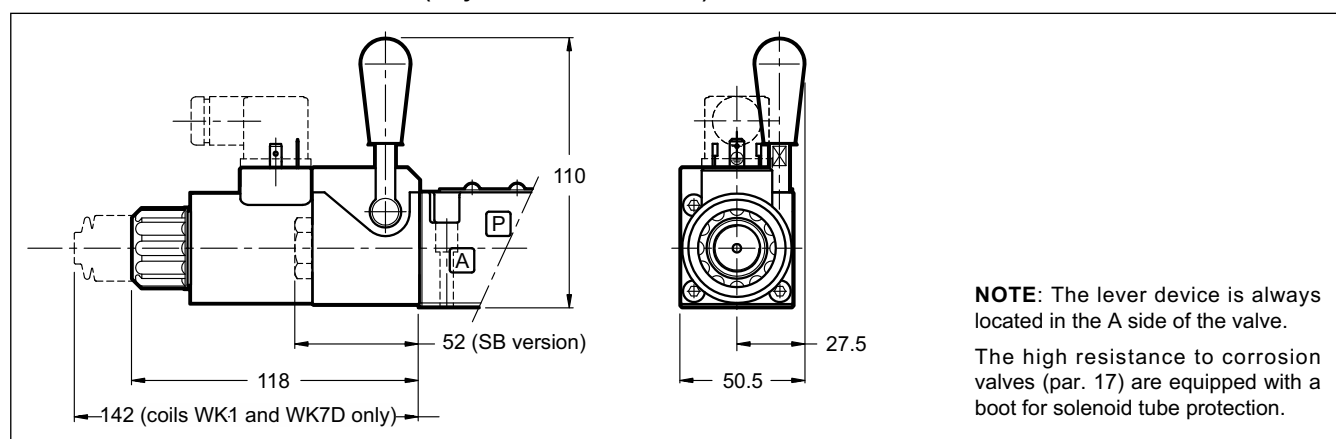
Valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 connections can be ordered separately. See catalogue 49 000.

## 13 - MANUAL OVERRIDES

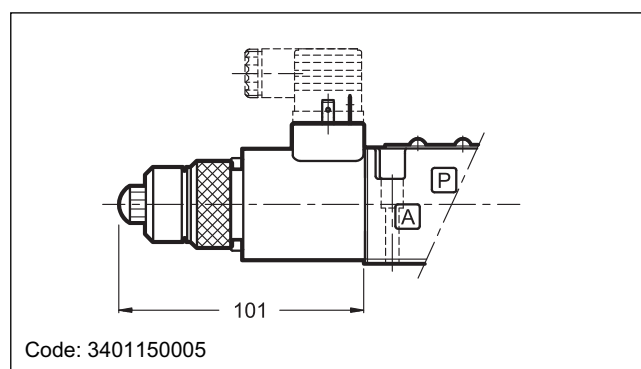
### 13.1 - Manual override, boot protected



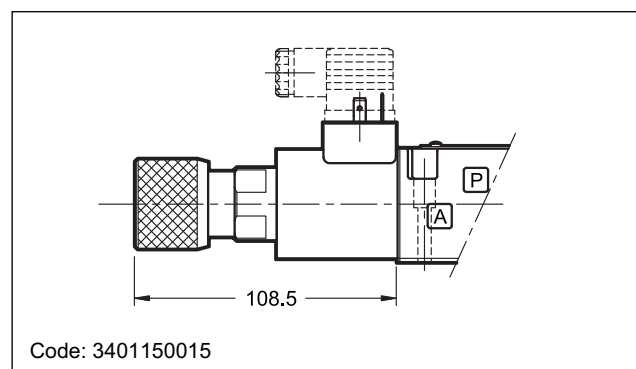
### 13.2 - CH-DS3/11 Lever manual override (only for DC solenoid valve)



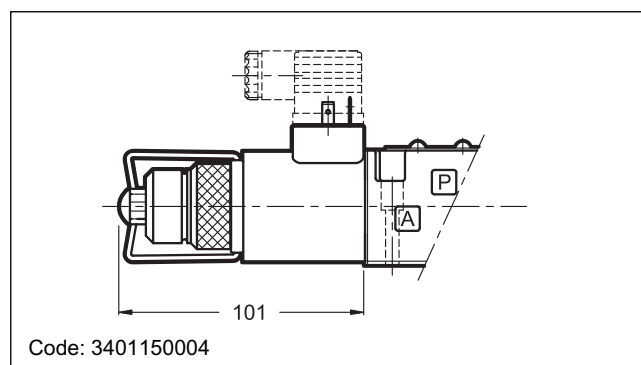
### 13.3 - CP-DS3/10 Push manual override (only for DC solenoid valve)



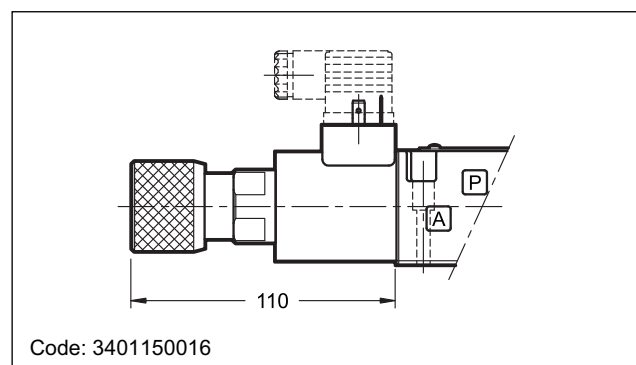
### 13.4 - CK1-DS3/11 knob manual override, turning (only for DC solenoid valve)



### 13.5 - CPK-DS3/10 Push manual override with mechanical retention (only for DC solenoid valve)



### 13.6 - CK2-DS3/11 Push and twist manual override (only for DC solenoid valve)



## 14 - SOFT-SHIFT VERSION FOR DC VALVE

### 14.1 - Identification code

<b>D</b>	<b>S</b>	<b>3</b>	<b>-</b>	<b>/</b>	<b>13</b>	<b>-</b>	<b>/</b>	<b>F</b>	<b>/</b>	<b>W7</b>
----------	----------	----------	----------	----------	-----------	----------	----------	----------	----------	-----------

Solenoid operated directional control valve

ISO 4401-03 size \_\_\_\_\_

Spool type \_\_\_\_\_  
The hydraulic symbols of S2F and S4F are identical to those of S2 and S4 spools (p.2)

<b>S1</b>	<b>TA12</b>
<b>S2F</b>	<b>TB12</b>
<b>S4F</b>	<b>TA23</b>
<b>S9</b>	<b>TB23</b>
<b>S12</b>	

Series: \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Option:  
**/ W7** = see par. 1

Manual override  
(see par.1 and 13)

**Soft-shifting**

Coil electrical connection  
(see par. 11):  
**K1** = plug for connector type  
EN 175301-803 (ex DIN 43650) (**standard**)  
**K2** = plug for connector type AMP JUNIOR  
(available on **D12** and **D24** coils only)  
**K7** = plug DEUTSCH DT04-2P for male  
connector type DEUTSCH DT06-2S  
(available on **D12** and **D24** coils only)

DC power supply  
**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V  
**D110** = 110 V  
**D220** = 220 V

This version enables hydraulic actuators to perform a smooth start and stop by reducing the speed of movement of the valve spool.

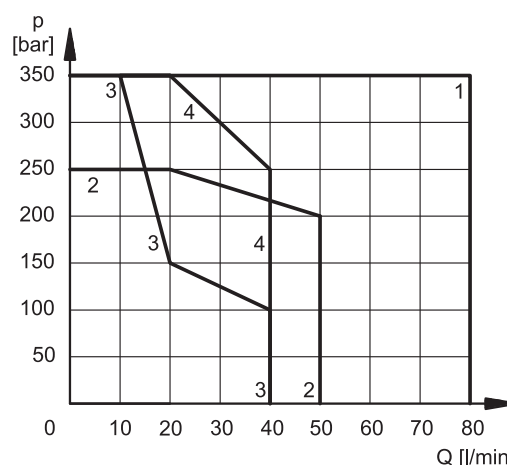
In this version, the S9 spool must be used instead of the S3 type.

The diagram on the side shows the operating limits of the spools available in the soft-shifting version, while the table shows the switching times.

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

The shifting time and characteristics curves are influenced by the viscosity (and thus by the temperature) of the operating fluid. Moreover, times can vary according to the flow rate and operating pressure values of the valve.

For correct operation of the soft-shifting ensure the solenoid tubes are always filled with oil. At this matter, we recommend to install a backpressure valve set at 1 ÷ 2 bar on T line.



SPOOL	CURVE	TIMES [ms]	
		ENERGIZING	DE-ENERGIZING
S1, S12	1	350	200 ÷ 300
S2F	2	400	100 ÷ 250
S4F	4	350	150 ÷ 300
S9	1	400	200 ÷ 300
TA12, TB12	3	180	200 ÷ 300
TA23, TB23		300	200 ÷ 300

## 15 - VERSION WITH UL CERTIFIED COILS

### 15.1 - Identification code

D	S	3	-		/	11		-	D24	UL	K1	/	
Solenoid operated directional control valve												Manual override: omit for override integrated in the tube ( <b>standard</b> ) <b>CM</b> = manual override, boot protected	
ISO 4401-03 size												Coil electrical connection for connector type EN 175301-803 (ex DIN 43650)	
Spool type												<b>LISK coil, UL certified to United States and Canada. Class 155 (F)</b>	
See paragraph 3												Power supply DC 24 V	
Series:													
(the overall and mounting dimensions remain unchanged from 10 to 19)													
Seals:													
<b>N</b> = NBR seals for mineral oil ( <b>standard</b> )													
<b>V</b> = FPM seals for special fluids													

### 15.2 - UL file number

The UL database website provides informations about the certification, by entering the code MH29222 in the 'UL file number' field.

### 15.3 - Electrical features

(values  $\pm 10\%$ )

	Nominal voltage [V]	Resistance at 20°C [ $\Omega$ ]	Current consumpt. [A]	Power consumpt [W]	Coil code
<b>D24ULK1</b>	24	19.2	1.25	30	1903341

**NOTE:** Valves with UL coils must be ordered complete. **The UL coils are not interchangeable with those of standard valves.**

### 15.4 - Overall and mounting dimensions

		dimensions in mm	
Valve fastening: 4 SHC screws ISO 4762 M5x30		1	Standard manual override included in the solenoid tube
Tightening torque: 5 Nm (A8.8)		2	CM version: boot manual override, rubber
Threads of mounting holes: M5x10			



## 16 - VERSION WITH FIXING INTERCHANGEABLE WITH 4WE6\*6X REXROTH

### 16.1 - Identification code

D	S	3	R	-		/	11	-		/		
---	---	---	---	---	--	---	----	---	--	---	--	--

Directional valve, solenoid operated

ISO 4401-03 size

Fastening screws interchangeable with Rexroth 4WE6\*6X valve.

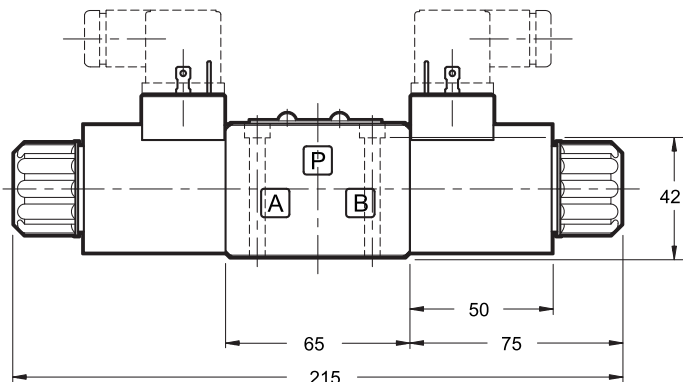
Spool type (see paragraph 3)

S*	RSA*	TA	RK
SA*	RSB*	TB	
SB*		TA*	
		TB*	

Complete the identification code configuration as for in paragraph 1.

Series:  
(the overall and mounting dimensions remain unchanged from 10 to 19)

### 16.2 - Overall and mounting dimensions for DC solenoid valves

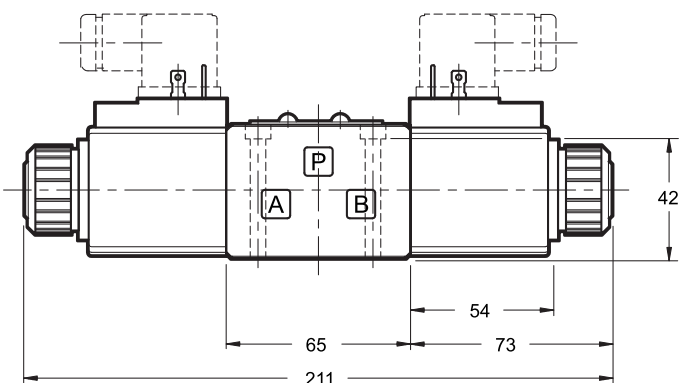


dimensions in mm

Please refer to the standard valve at paragraph 8 for non-quoted dimensions.

Valve fastening: 4 SHC screws ISO 4762 M5x50
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

### 16.3 - Overall and mounting dimensions for AC solenoid valves



dimensions in mm

Please refer to the standard valve at paragraph 9 for non-quoted dimensions.

Valve fastening: 4 SHC screws ISO 4762 M5x50
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

## 17 - HIGH IP AND CORROSION RESISTANCE VERSION

### 17.1 - Identification code

<b>D</b>	<b>S</b>	<b>3</b>	<b>-</b>		<b>/</b>			<b>-</b>			<b>/</b>		<b>/</b>	<b>W7</b>
----------	----------	----------	----------	--	----------	--	--	----------	--	--	----------	--	----------	-----------

Solenoid operated directional control valve

ISO 4401-03 size

Spool type  
See paragraph 3 or 14.

Series: (See paragraph 1 or 14)  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Manual override:  
**CM** = manual override, boot protected (**standard**)  
**CH** = lever manual override  
**CP** = push manual override  
**CK1** = turning knob override  
**CK2** = push and twist knob (only for DC version)  
**CPK** = push manual override with mechanical retention

Coil electrical connection  
**WK1** = plug for connector type EN 175301-803 (ex DIN 43650)  
**WK7** = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.  
**WK7D** = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.

DC power supply  
**D12** = 12 V  
**D24** = 24 V

### 17.2 - Corrosion resistance

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600** hours (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

### 17.3 - DC coils

The coils feature a zinc-nickel surface treatment.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

(values  $\pm 10\%$ )

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code		
					WK1	WK7	WK7D
<b>D12</b>	12	4,4	2,72	32,7	1903590	1903580	1903600
<b>D24</b>	24	18,6	1,29	31	1903591	1903581	1903601

### 17.4 - Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP grade, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
WK1 EN 175301-803 (ex DIN 43650)	IP66	IP66
WK7 DEUTSCH DT04 male	IP66/IP68/IP69 IP69K*	IP66/IP68/IP69 IP69K*
WK7D DEUTSCH DT04 male	IP66/IP68/IP69 IP69K*	IP66/IP68/IP69 IP69K*

(\*) The IP69K protection degree is not taken into account in IEC 60529 but it is included in ISO 20653.

**NOTE:** As regards the liquid ingress protection (second digit), there are three means of protection.

Codes from 1 to 6 are related to water jets.

Rates 7 and 8 are related to immersion.

Rate 9 is reserved for high pressure and temperature water jets.

This means that IPX6 covers all the lower steps, rate IPX8 covers IPX7 but not IPX6 and lower, instead IPX9 does not cover any of them.

Whether a device meets two types of protection requirements it must be indicated by listing both the tests separated by a slash.

(E.g. a marking of an equipment covered both by temporary immersion and water jets is IP66/IP68).

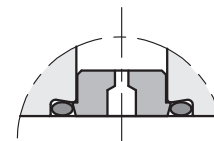
## 18 - PORT RESTRICTORS

Port restrictors are recommended if flow variations which exceed the valve performance limit during the switching processes occur, or for circuit dampening.

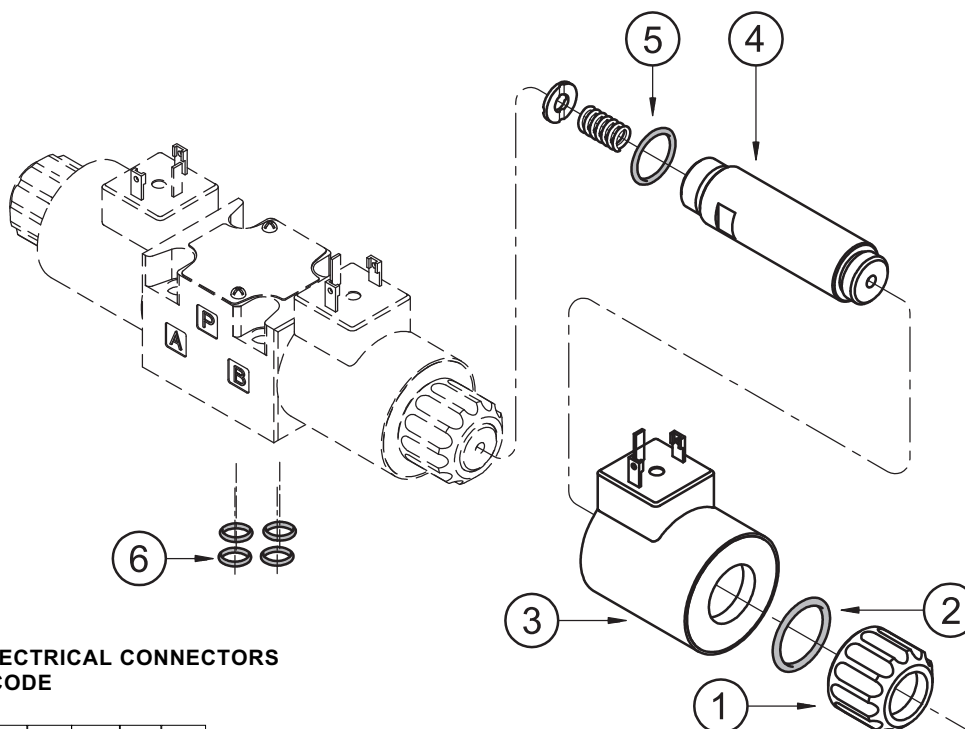
Port restrictor plugs can be ordered separately with the part numbers shown at left.

Ø (mm)	part number
blank	<b>0144162</b>
0.6	<b>0144163</b>
0.8	<b>0144033</b>
1	<b>0144034</b>

Ø (mm)	part number
1.2	<b>0144035</b>
1.5	<b>0144036</b>
1.8	<b>0144164</b>
2	<b>0144165</b>



## 19 - SPARE PARTS FOR DC SOLENOID VALVE



### DC COILS AND ELECTRICAL CONNECTORS IDENTIFICATION CODE

**C 22S3 - /**

Supply voltage

**D12** = 12 V  
**D14** = 14 V  
**D24** = 24 V  
**D28** = 28 V  
**D48** = 48 V  
**D125** = 125 V  
**D110** = 110 V  
**D220** = 220 V

Series no.:

**10** = for K7 and WK7  
**11** = for K1 up to D48 and K2  
**12** = for K1 D110, D125, D220, WK1 and WK7D

Coil electrical connection (see par. 11):

**K1** = plug for connector type EN 175301-803 (ex DIN 43650)

**D12** and **D24** coils only:

**K2** = plug for connector AMP JUNIOR  
**K7** = plug DEUTSCH DT04-2P for male connector DEUTSCH DT06-2S

**WK1** = plug for connector type EN 175301-803 (ex DIN 43650)

**WK7** = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S

**WK7D** = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode

1	Coil locking ring with seal included cod. 0119412 Tightening torque 5 ±0.5 Nm
2	ORM type 0220-20 (22x2) - 70 Shore
3	Coil (see identification code)
4	Solenoid tube for standard version: TD22-DS3/10N (NBR seals) TD22-DS3/10V (FPM seals) Solenoid tube for version with soft-shifting: TD22-DS3F/10N (NBR seals) TD22-DS3F/10V (FPM seals) <b>NOTE:</b> OR n°5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	4 OR type 2037 (9.25x1.78) - 90 Shore

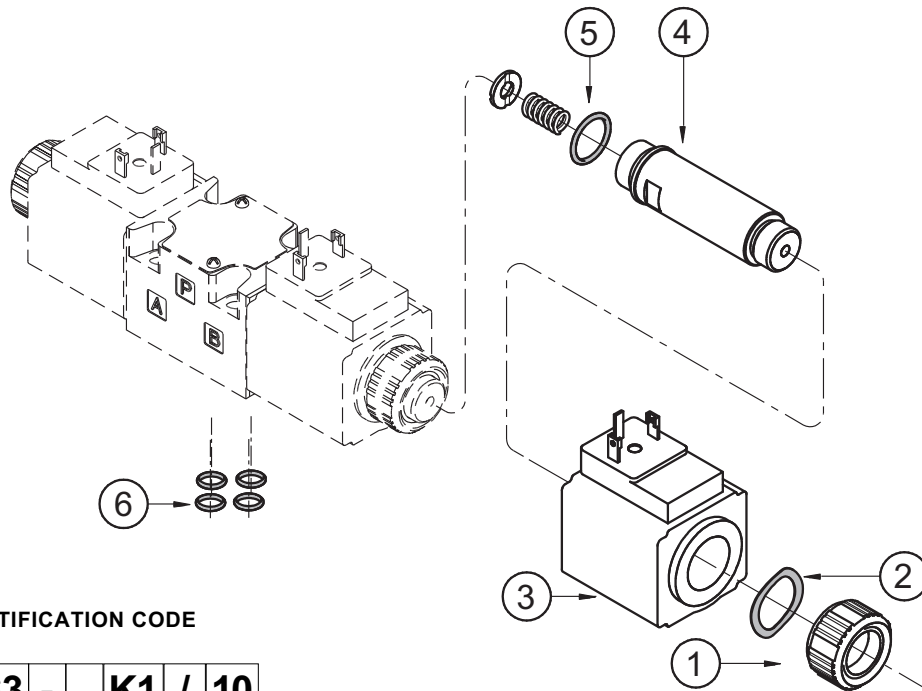
### SEALS KIT

The codes include the O-Ring n° 2, 5 and 6.

**Cod. 1985406** NBR seals  
**Cod. 1985410** FPM (viton) seals

**NOTE:** You can also order coils using the coil codes in paragraphs 7.2 and 17.3.

## 20 - SPARE PARTS FOR AC SOLENOID VALVE



### AC COILS IDENTIFICATION CODE

**C 20.6S3 - K1 / 10**

Supply voltage

**A24** = 24 V - 50 Hz

**A48** = 48 V - 50 Hz

**A100** = 100 V - 50 Hz  
100 V - 60 Hz

**A110** = 110 V - 50 Hz  
120 V - 60 Hz

**A230** = 230 V - 50 Hz  
240 V - 60 Hz

**F110** = 110 V - 60 Hz

**F220** = 220 V - 60 Hz

Series no.:

(the overall and mounting dimensions remain unchanged from 10 to 19)

Plug for connector type  
EN 175301-803  
(ex DIN 43650)

1	Coil locking ring cod. 0119333 Tightening torque $5 \pm 0.5$ Nm
2	Snap ring cod. 0550483
3	Coil (see identification code on the side)
4	Solenoid tube : TA20.6-DS3/10N (NBR seals) TA20.6-DS3/10V (FPM seals) <b>NOTE:</b> OR n° 5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

### SEALS KIT

The codes include the OR nr. 5 and 6.

**Cod. 1985406** NBR seals

**Cod. 1985410** FPM (viton) seals

**NOTE:** You can also order coils using the coil codes in paragraph 7.3

## 21 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8" BSP

Type PMMD-AL3G with side ports 3/8" BSP



# DS3

**DUPLOMATIC**  
MOTION SOLUTIONS

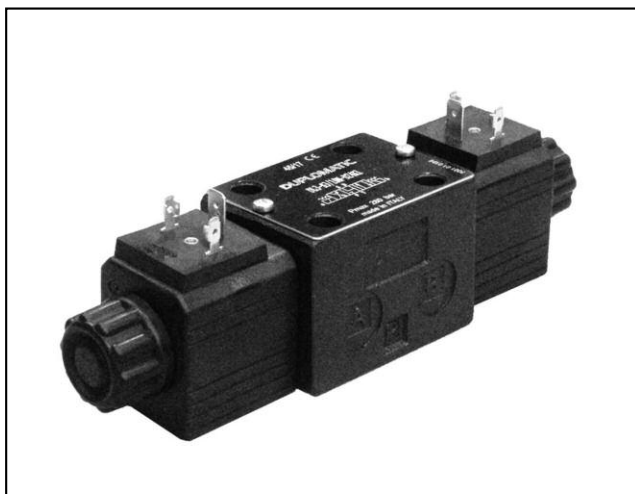
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

[www.duplomatic.com](http://www.duplomatic.com) • e-mail: [sales.exp@duplomatic.com](mailto:sales.exp@duplomatic.com)



# DL3

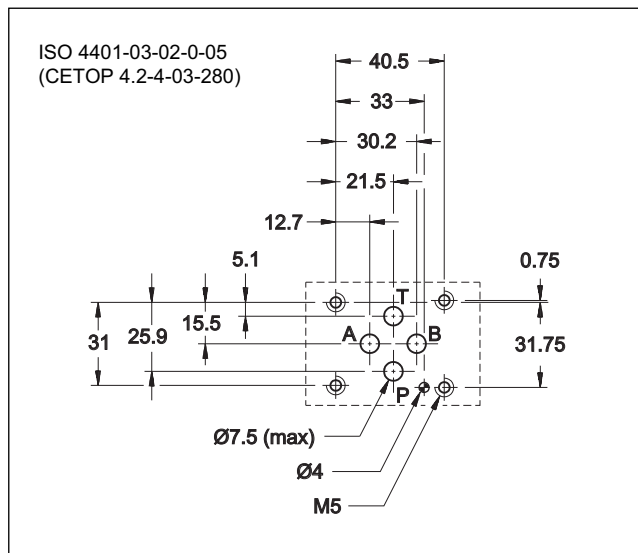
## SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

### SUBPLATE MOUNTING ISO 4401-03

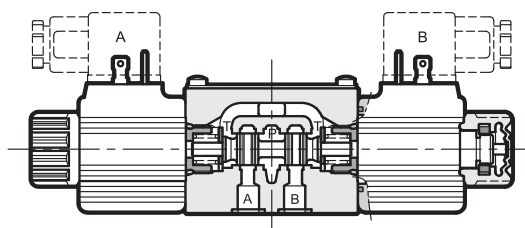
**p** max **280** bar

**Q** max **50** l/min

### MOUNTING SURFACE



### OPERATING PRINCIPLE



- Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 standards.
- Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.
- The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

— The valve is available with DC or AC current solenoids and with several types of electrical connections to cover various installation requirements (see paragraphs 7 and 11).

— The DC valve comes with boot protected manual override which ensures a protection degree IP69K for connections types WK7 and WK8.

— It is available also with zinc-nickel surface treatment, that ensures a salt spray resistance up to 600 hours.

### PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure: - ports P - A - B - port T	bar	CC	CA
		280 250	160
Maximum flow rate	l/min	50	
Pressure drop Δp-Q	see paragraph 4		
Operating limits	see paragraph 5		
Electrical features	see paragraph 7		
Electrical connections	see paragraph 11		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Masse: single solenoid valve double solenoid valve	kg	1,1 1,4	

## 1 - IDENTIFICATION CODE

<b>D</b>	<b>L</b>	<b>3</b>	<b>-</b>		<b>/</b>			<b>-</b>			<b>/</b>		
----------	----------	----------	----------	--	----------	--	--	----------	--	--	----------	--	--

Solenoid operated directional control valve

Compact version

ISO 4401-03 size

Spool type (see paragraph 3):

<b>S*</b>	<b>TA</b>
<b>SA*</b>	<b>TB</b>
<b>SB*</b>	<b>RK</b>

Series no.:

**10** = for direct current valves  
**11** = for alternate current valves  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:

**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Option:  
 Surface treatment non standard.  
 Omit if not required (see **NOTE 2**)

Manual override (see par. 13)  
 on **DC** version:  
 omit for boot manual override integrated in the coil locking ring  
**CK1** = knob manual override  
**CPK** = push manual override with mechanical retention  
 on **AC** version:  
 omit for manual override integrated in the tube  
**CM** = manual override boot protected

Coil electrical connection:  
 (see paragraph 11)  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)

For **D12** and **D24** coils only:  
**K2** = plug for connector type AMP JUNIOR  
**K4** = outgoing cables  
**WK7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S  
**WK8** = plug for connector type AMP SUPER SEAL

DC power supply

<b>D12</b> = 12 V	} direct current
<b>D24</b> = 24 V	
<b>D28</b> = 28 V	
<b>D48</b> = 48 V	} rectified current
<b>R110</b> = 110 V	
<b>R230</b> = 230 V	

**D00** = valve without coils (see **NOTE 1**)

AC power supply

**A24** = 24 V - 50 Hz  
**A110** = 110 V - 50 Hz  
**A230** = 230 V - 50 Hz  
**A00** = valve without coils (see **NOTE 1**)

**NOTE 1:** Coils locking ring and related OR are supplied together with valves.

**NOTE 2:** The standard surface treatment is phosphating black. On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to **600** hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)

Add **/W7** at the end of the identification code.

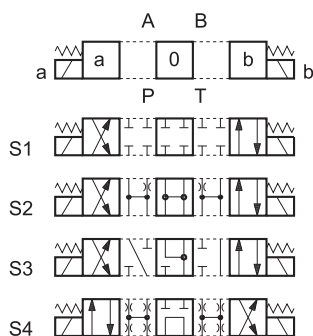
## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

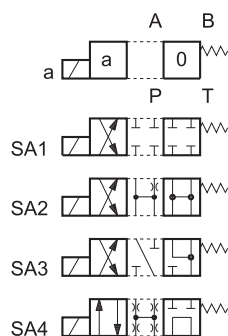
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - SPOOL TYPE

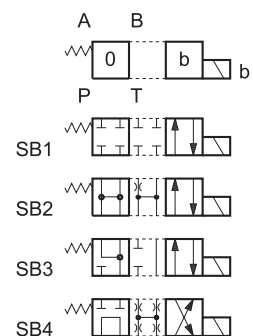
**Type S\*:**  
2 solenoids - 3 positions  
with spring centering



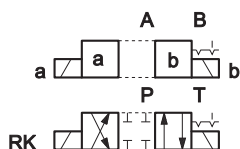
**Type SA\*:**  
1 solenoid side A  
2 positions (central + external)  
with spring centering



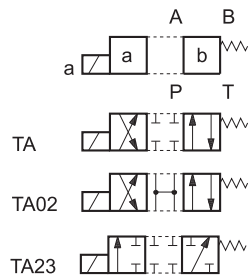
**Type SB\*:**  
1 solenoid side B  
2 positions (central + external)  
with spring centering



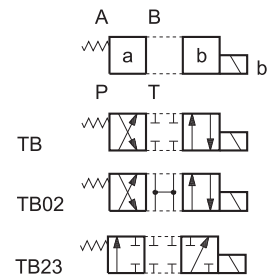
**Type RK:**  
2 solenoids - 2 positions  
with mechanical retention



**Type TA:**  
1 solenoid side A  
2 external positions  
with return spring



**Type TB:**  
1 solenoid side B  
2 external positions  
with return spring

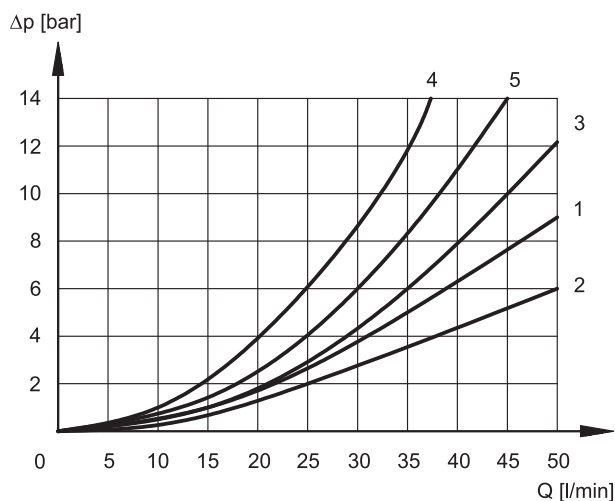


**NOTE:** Others spools available on request only.



## 4 - PRESSURE DROPS $\Delta P-Q$

(obtained with viscosity of 36 cSt at 50 °C)



### ENERGIZED VALVE

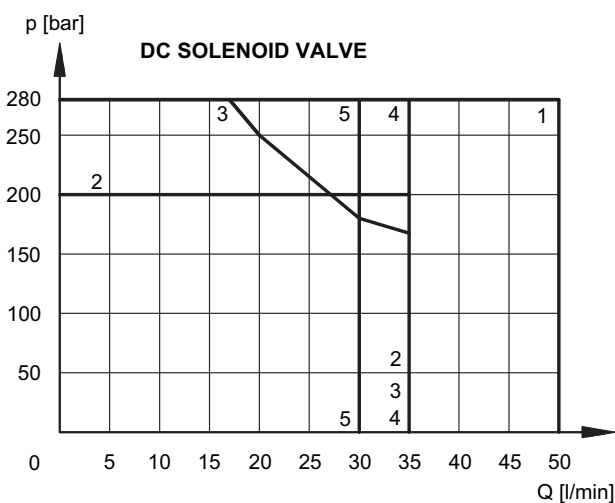
SPOOL	FLOW DIRECTIONS				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S1	1	1	1	1	-
S2	1	1	2	2	3
S3	3	3	2	2	-
S4	4	4	4	4	5
RK	1	1	1	1	-
TA	3	3	3	3	-

## 5 - OPERATING LIMITS

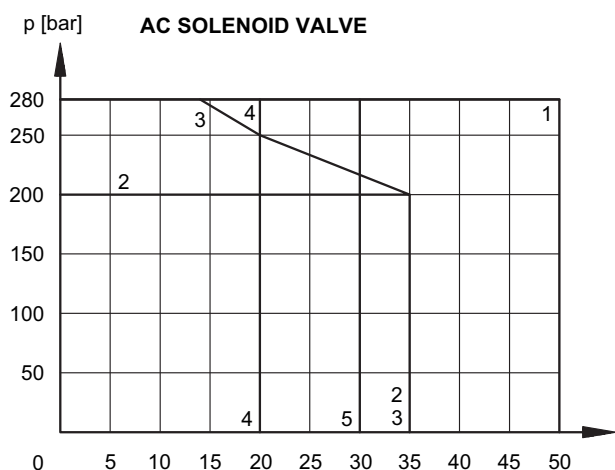
The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve.

**The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.**

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, TA	1
S2	2
S3	3
S4	4
RK	5



SPOOL	CURVE
S1, TA	1
S2	2
S3	3
S4	4
RK	5

## 6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	25 ÷ 75	15 ÷ 25
AC	10 ÷ 25	15 ÷ 30

## 7 - ELECTRICAL FEATURES

### 7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated +/- 90°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

### Protection from atmospheric agents IEC 60529

The IP protection degree is intended for the whole valve. It is guaranteed only with both valve and connectors of an equivalent IP grade, correctly connected and installed.

Electric connection	IP65	IP66	IP67	IP68	IP69 IP69K (*)
K1 EN 175301-803	x	x			
K2 AMP JUNIOR	x		x		
K4 outgoing cables	x				
WK7 DEUTSCH DT04 male	x		x	x	x
WK8 AMP SUPER SEAL	x	x	x	x	x

(\*) The protection degree IP69K is not taken into account in IEC 60529 but it is included in both ISO 20653.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION Coil insulation (VDE 0580) Impregnation	class H class H

**NOTE:** In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

### 7.2 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law:  $V = R \times I$

"R" coils have to be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the "D" type connector (see cat. 49 000).

The table shows current and power consumption values for DC and RC coil types.

#### Coils for direct current (values ±5%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption		Coil code				
				[W]	[VA]	K1	K2	K4	WK7	WK8
D12	12	5,4	2,2	26,5		1902740	1902750	1902770	1903510	1903520
D24	24	20,7	1,16	27,8		1902741	1902751	1902771	1903511	1903521
D28	28	27,5	1,02	28,5		1902744				
D48	48	82	0,58	28		1902745				
R110	110	363	0,25		27,2	1902742				
R230	230	1640	0,11		26,4	1902743				

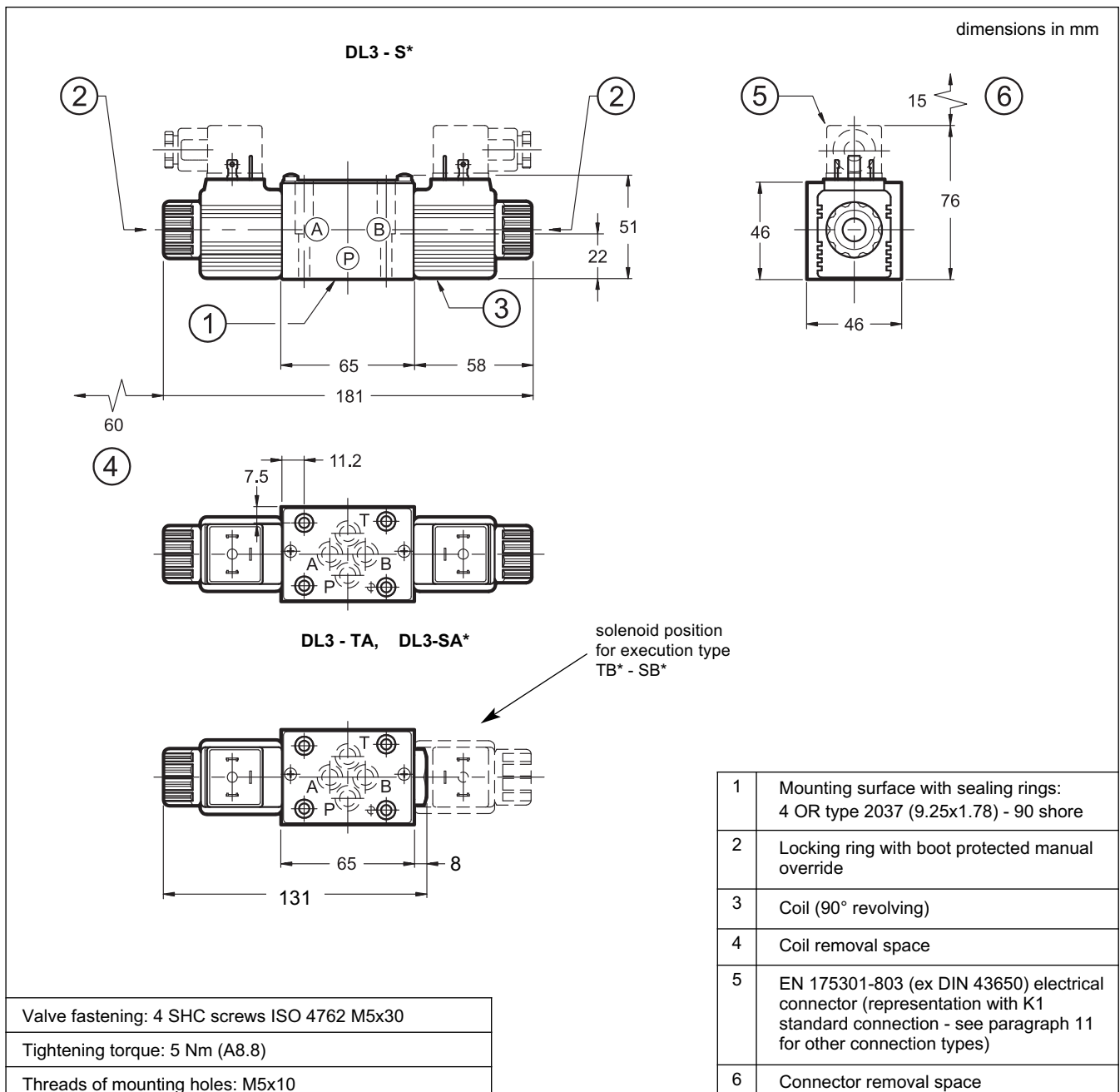
## 7.3 - AC valve - Current and power consumption

In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end. The table shows the values of absorption at the inrush and at holding.

### Coils for alternating current (values $\pm 10\%$ )

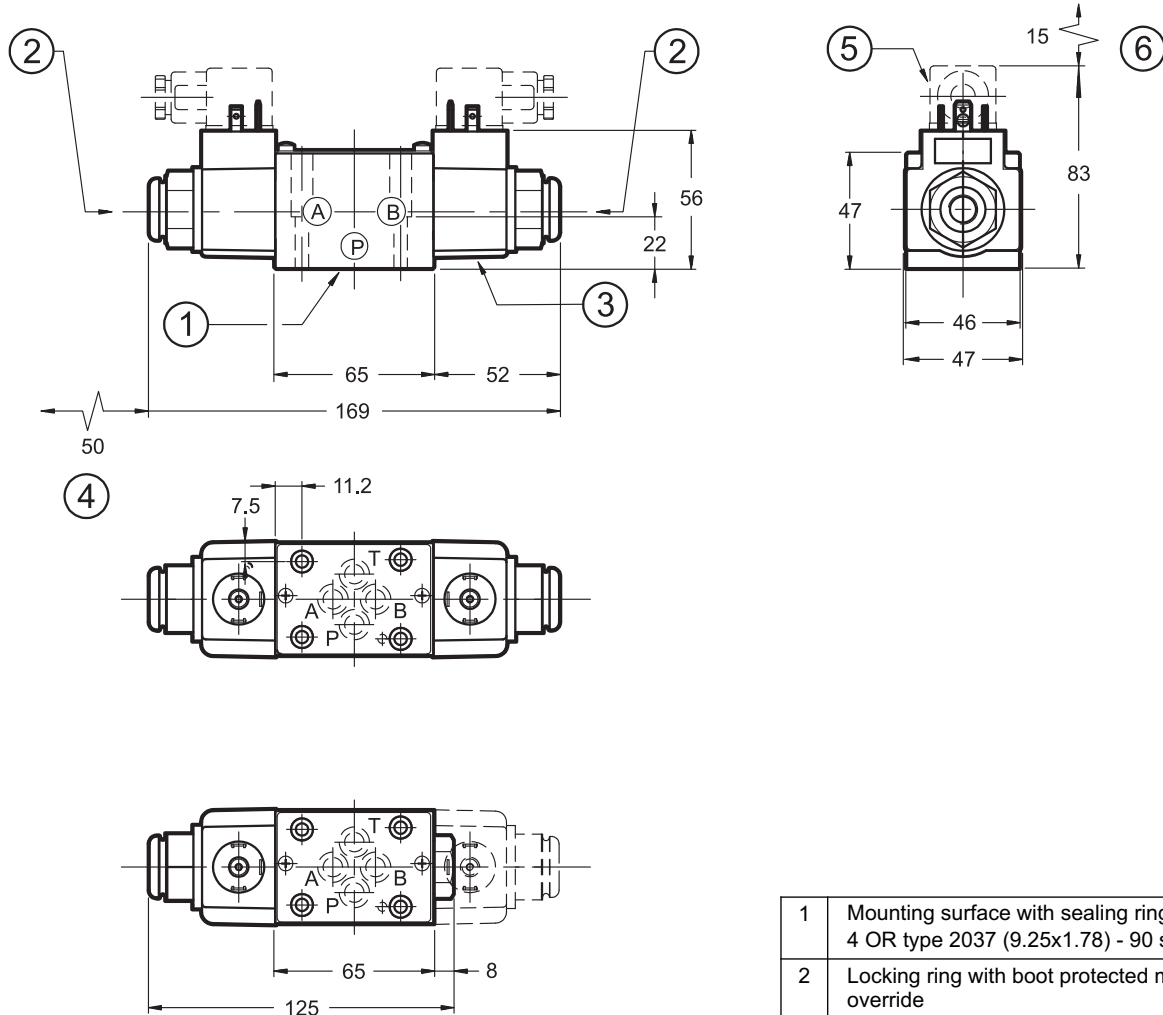
	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil code K1
<b>A24</b>	24	50	2,7	4,5	1,47	109,2	35,3	1903190
<b>A110</b>	110		73,4	1,0	0,31	107,8	34,1	1903192
<b>A230</b>	230		320	0,5	0,16	112,7	36,8	1903193

## 8 - DL3 DC OVERALL AND MOUNTING DIMENSIONS



## 9 - DL3 AC OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

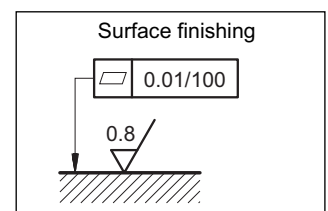
1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Locking ring with boot protected manual override
3	Coil
4	Coil removal space
5	EN 175301-803 (ex DIN 43650) electrical connector
6	Connector removal space

## 10 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

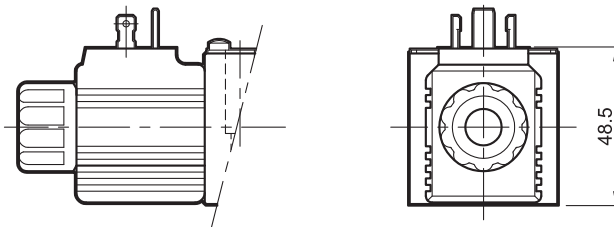
Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



## 11 - ELECTRIC CONNECTIONS

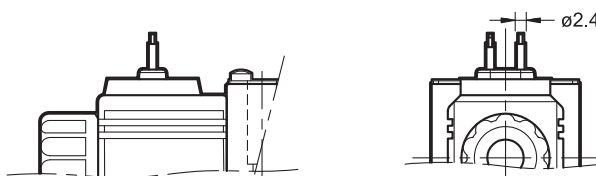
connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**



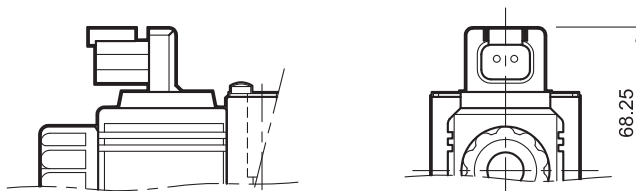
connection for AMP JUNIOR  
connector type  
code **K2**



outgoing cable connections  
cable length = 1 mt  
code **K4**



connection for DEUTSCH DT04-2P  
for male connector type DEUTSCH DT06  
code **WK7**



connection for AMP SUPER SEAL  
(two contacts) connector type  
code **WK8**



## 12 - ELECTRIC CONNECTORS

Solenoid operated valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 connections can be ordered separately. See catalogue 49 000. We do not delivery connectors for connections K2, WK7 and WK8.

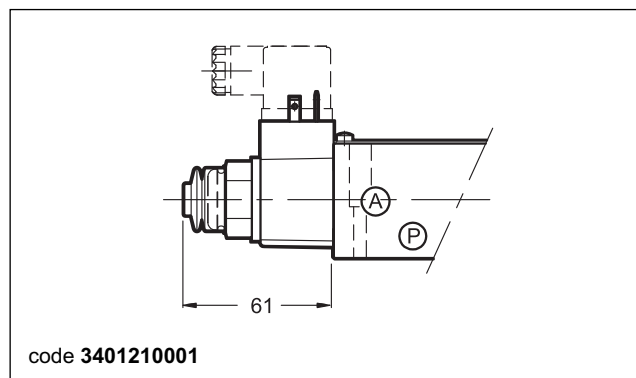
## 13 - OPTIONAL MANUAL OVERRIDES

### 13.1 - Boot protected manual override

On the DC version the boot override is integrated in the coil locking ring, as standard.

On the AC version, however, the boot override can be ordered by entering the code **CM** in the identification code at par. 1, or is available as option to be ordered separately.

code **3401210001**.



### 13.2 - Knob manual override

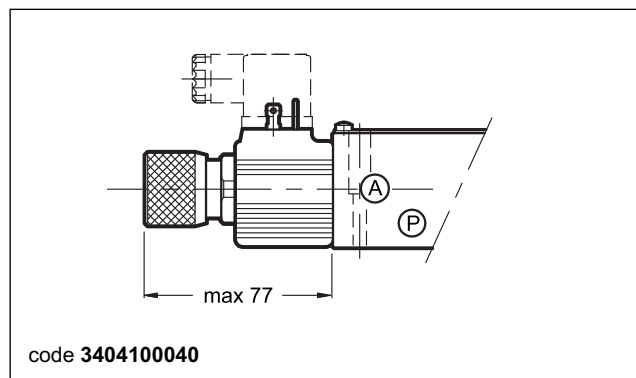
Available only for DC version

Max stroke: 4.5 mm

mm per turn: 1

The knob override can be ordered by entering the code **CK1** in the identification code at par. 1, or is available as option to be ordered separately.

code **3404100040**.

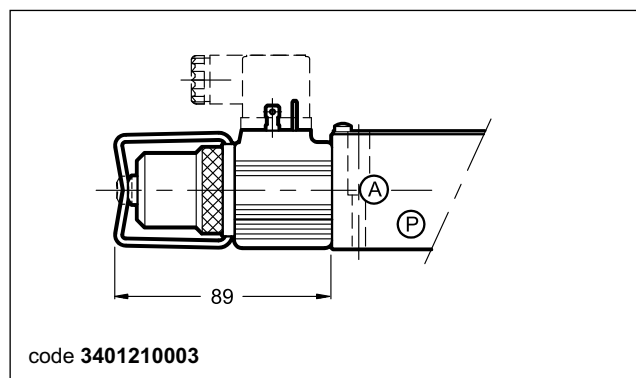


### 13.3 - Push manual override with mechanical retention

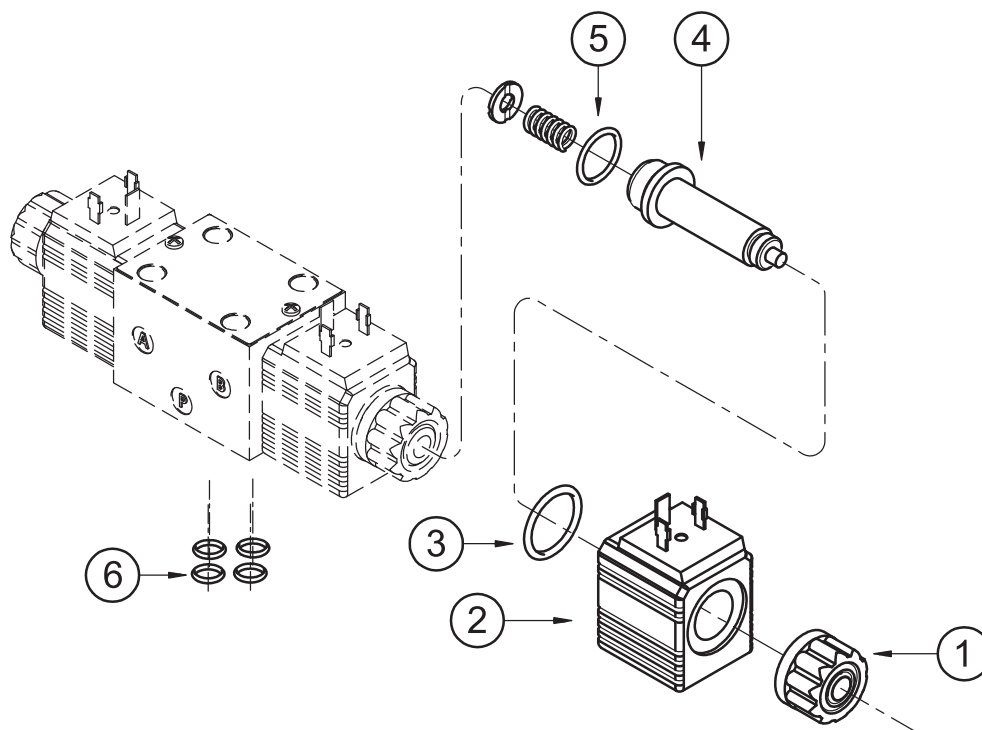
Available only for DC version

The push manual override with mechanical retention can be ordered by entering the code **CPK** in the identification code at par. 1, or is available as option to be ordered separately.

code **3401210003**.



## 14 - SPARE PARTS FOR DC SOLENOID VALVE



### IDENTIFICATION CODE FOR DC AND RC COILS

**C 14 L3 - / 10**

Supply voltage \_\_\_\_\_

**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V  
**D48** = 48 V  
**R110** = 110 V  
**R230** = 230 V

direct  
 current

rectified  
 current

Series no.:  
 (the overall and  
 mounting dimensions  
 remain unchanged  
 from 10 to 19)

Coil electrical connection:  
**K1** = plug for connector type  
 EN 175301-803 (ex DIN 43650)

**D12** and **D24** coils only:

**K2** = plug for connector type  
AMP JUNIOR

**K4** = outgoing cables

**WK7** = plug DEUTSCH DT04-2P  
for male connector type  
DEUTSCH DT06-2S

**WK8** = plug for connector type  
AMP SUPER SEAL

1	Coil locking ring - code 0119382 tightening torque: 3 ÷ 3.4 Nm
2	Coil (see identification code)
3	OR type 2112 (28.3x1.78)
4	Solenoid tube: TD14-M18/11N (NBR seals) TD14-M18/11V (FPM seals) (OR n° 5 included)
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

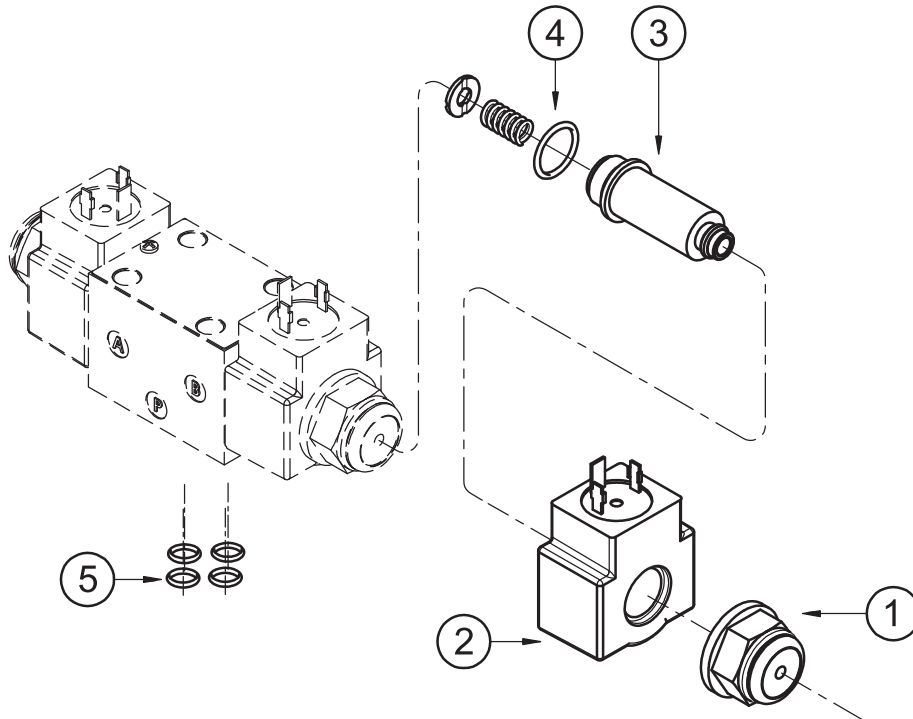
### SEAL KIT

The codes included the OR n° 5 and 6.

**Cod. 1984435** NBR seals

**Cod. 1984436** FPM seals

## 15 - SPARE PARTS FOR AC SOLENOID VALVE



### IDENTIFICATION CODE FOR AC COILS

**C 18 L3 - K1 / 11**

Supply voltage

**A24** = 24 V - 50 Hz

**A110** = 110 V - 50 Hz

**A230** = 230 V - 50 Hz

Series no.:  
(the overall and  
mounting dimensions  
remain unchanged from  
10 to 19)

Coil electrical connection:  
plug for connector type  
EN 175301-803 (ex DIN 43650)

1	Coil locking ring - code. 0119469 tightening torque: 3 ÷ 3.4 Nm
2	Coil (see identification code)
3	Solenoid tube: TA18-M18/11N (NBR seals) TA18-M18/11V (FPM seals) <b>NOTE:</b> OR n° 4 included.
4	OR type 2062 (15.6x1.78) - 70 Shore
5	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

### SEAL KIT

The codes included the OR n° 4 and 5.

**Cod. 1984435** NBR seals

**Cod. 1984436** FPM seals

## 16 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports
Type PMMD-AL3G with side ports
P, T, A, B port threading: 3/8" BSP





# DL3

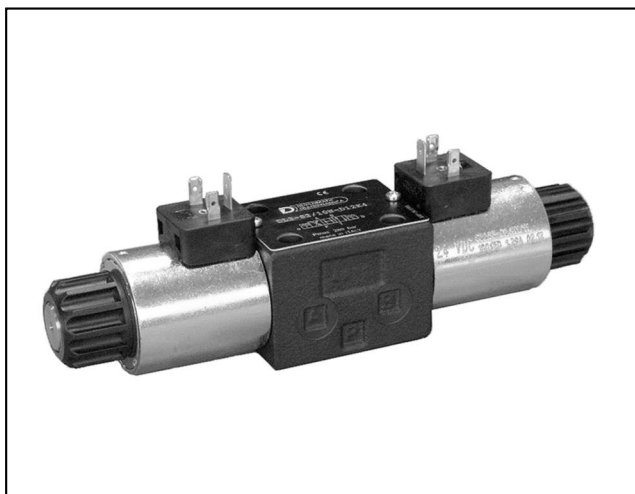


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# DL3B

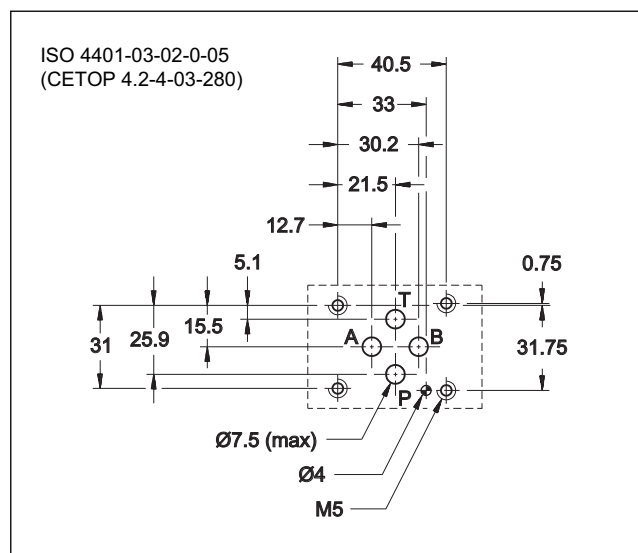
# 8 WATT SOLENOID OPERATED DIRECTIONAL CONTROL VALVE SERIES 10

## SUBPLATE MOUNTING ISO 4401-03 (CETOP 03)

**p max 280 bar**

**Q max 60 l/min**

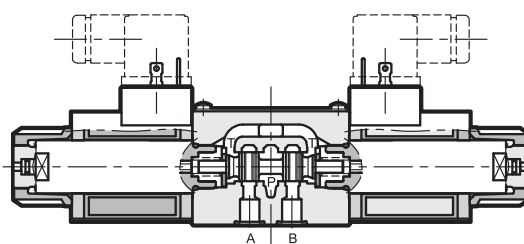
## MOUNTING SURFACE



## PERFORMANCES

(with mineral oil of viscosity of 36 cSt at 50°C)

## OPERATING PRINCIPLE



- 8 watt direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 (CETOP RP 121H) standards.
- Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.
- The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see par. 7).

Maximum operating pressure: - ports P - A - B - port T	bar	280 210
Maximum flow rate	l/min	50
Pressure drop $\Delta p$ -Q	see paragraph 4	
Operating limits	see paragraph 5	
Electrical features	see paragraph 7	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,5 2

- The valve is supplied with 4 way designs and with several interchangeable spools with different porting arrangements.
- It is available also with zinc-nickel surface treatment, that ensures a salt spray resistance up to 240 hours.
- The valve is available with DC current solenoids with 24 V power supply.

## 1 - IDENTIFICATION CODE

<b>D</b>	<b>L</b>	<b>3</b>	<b>B</b>	<b>-</b>		<b>/ 10</b>		<b>- DL24</b>	<b>K1</b>	
----------	----------	----------	----------	----------	--	-------------	--	---------------	-----------	--

Solenoid operated directional control valve

Compact version

ISO 4401-03 (CETOP 03) size

Spool type (see paragraph 3):

**S\***      **TA**  
**SA\***    **TB**  
**SB\***    **RK**

Series N. \_\_\_\_\_  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Option:  
 Surface treatment not standard.  
 Omit if not required (see **NOTE**)

Coil electrical connection:  
 plug for connector type DIN 43650 (**standard**)

DC power supply 24 V

**NOTE:** Standard surface treatment is phosphating black.  
 On request we can supply these valves with zinc-nickel finishing, suitable to ensure a salt spray resistance up to 240 h (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)  
 Add **/W7** at the end of the code.

## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

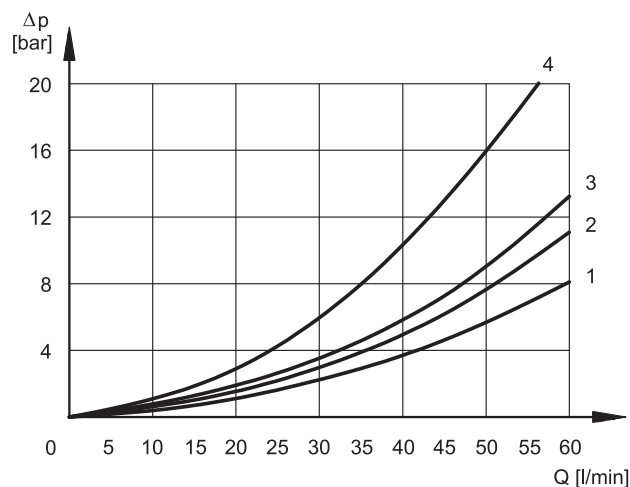
## 3 - SPOOL TYPE

<p><b>Type S*:</b>          2 solenoids - 3 positions          with spring centering</p>	<p><b>Type SA*:</b>          1 solenoid side A          2 positions (central + external)          with spring centering</p>	<p><b>Type SB*:</b>          1 solenoid side B          2 positions (central + external)          with spring centering</p>
<p><b>Type RK:</b>          2 solenoids - 2 positions          with mechanical retention</p>	<p><b>Type TA:</b>          1 solenoid side A          2 external positions          with return spring</p>	<p><b>Type TB:</b>          1 solenoid side B          2 external positions          with return spring</p>

**NOTE:** Others spools available on request only.

### 4 - PRESSURE DROPS $\Delta P-Q$

(obtained with viscosity of 36 cSt at 50 °C)



### ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1	2	3	3	2
S2	1	1	1	1
S3	3	3	1	1
S4	4	4	4	4
RK	3	3	3	3
TA, TB	3	3	3	3
TA02, TB02	1	1	1	1

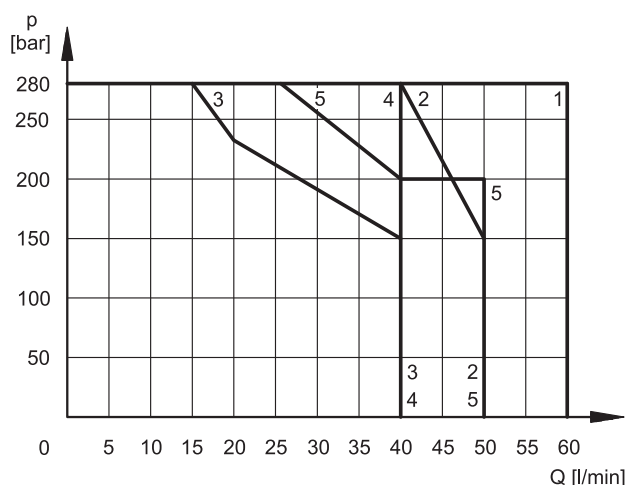
For the pressure drop with a de-energized valve P→T of the spools S2 and S4 refer to the curve 3; for the spool S4 refer to the curve 4.

### 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page.



SPOOL	CURVE
S1	1
S2	1
S3	3
S4	4
TA, TB	5
TA02, TB02	2
RK	4

### 6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES (±10%) [ms]	
ENERGIZING	DE-ENERGIZING
25 ÷ 75	15 ÷ 25



## 7 - ELECTRICAL FEATURES

### 7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% V <sub>nom</sub>
<b>MAX SWITCH ON FREQUENCY</b>	7.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95 EC
<b>CLASS OF PROTECTION :</b> Atmospheric agents IEC EN 60529 Coil insulation (VDE 0580) Impregnation	IP 65 ( <b>NOTE</b> ) class H class F

**NOTE:** The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

### 7.2 - Current and absorbed power for solenoid valve

The table shows current and power consumption values relevant to the 24 VDC coil.

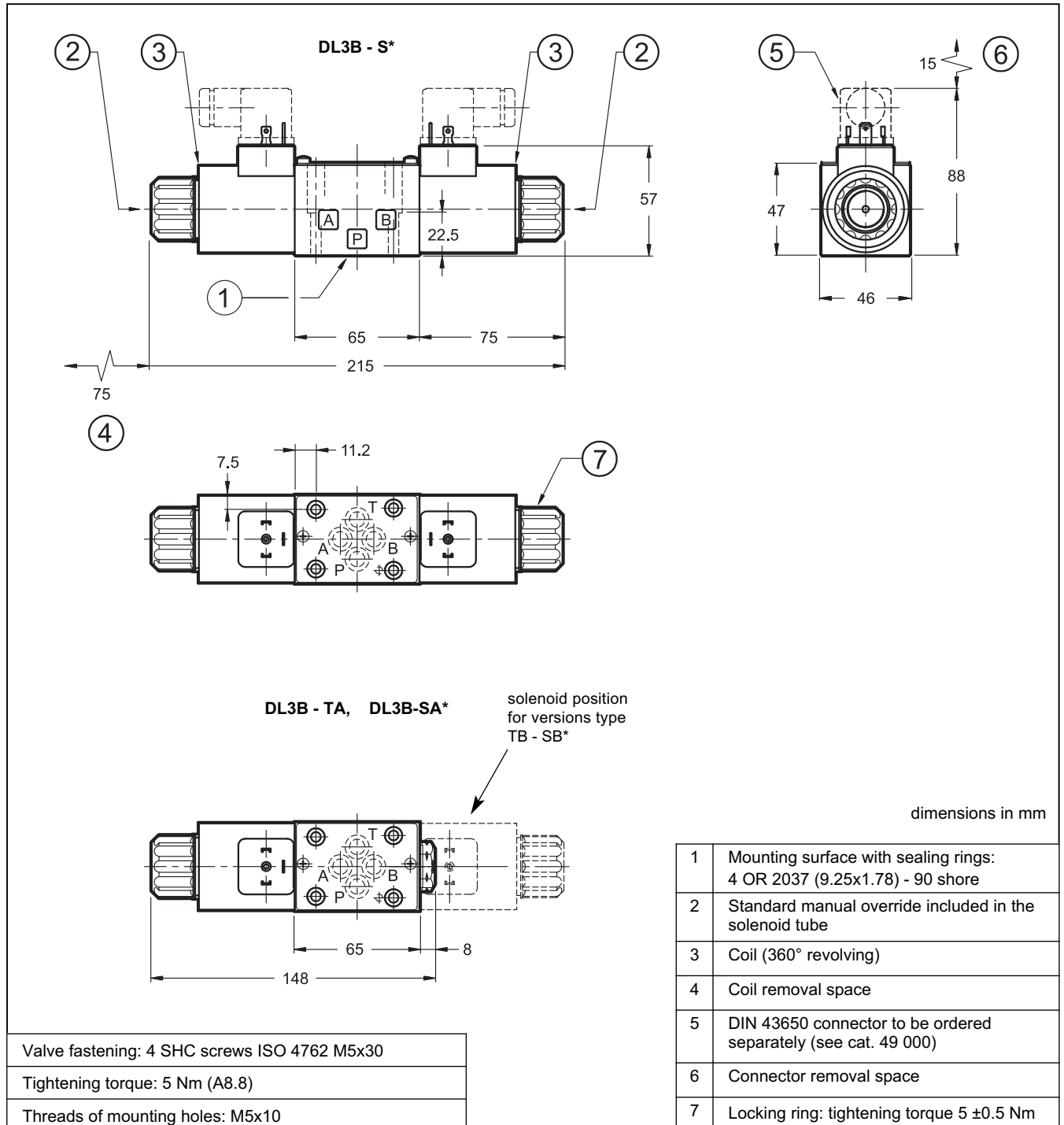
#### Coil for direct current (values ± 10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
<b>DL24</b>	24	64.6	0.37	8.92	1903291

## 8 - ELECTRIC CONNECTORS

Connectors must be ordered separately. See catalogue 49 000.

## 9 - DL3B OVERALL AND MOUNTING DIMENSIONS

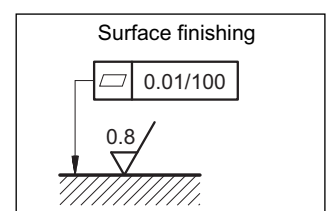


## 10 - INSTALLATION

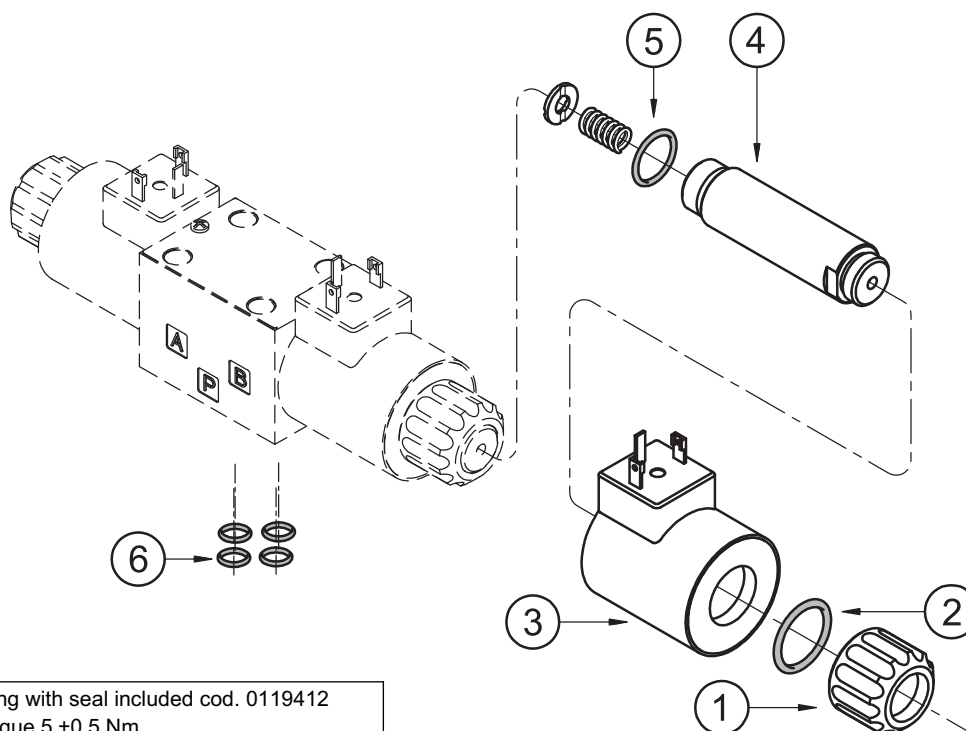
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



## 11 - SPARE PARTS FOR SOLENOID VALVE



1	Coil locking ring with seal included cod. 0119412 Tightening torque $5 \pm 0.5$ Nm
2	ORM type 0220-20 (22x2) - 70 Shore
3	Coil C22L3B-DL24K1/11
4	Solenoid tube for standard version: TD22-DL3B/10N (NBR seals) TD22-DL3B/10V (FPM seals) <b>NOTE:</b> OR n°5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

### SEALS KIT

The codes include the O-Ring n° 2, 5 and 6.

**Cod. 1985406** NBR seals

**Cod. 1985410** FPM (viton) seals

## 12 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8" BSP
Type PMMD-AL3G with side ports 3/8" BSP



# MDS3

## SOLENOID OPERATED SWITCHING VALVE

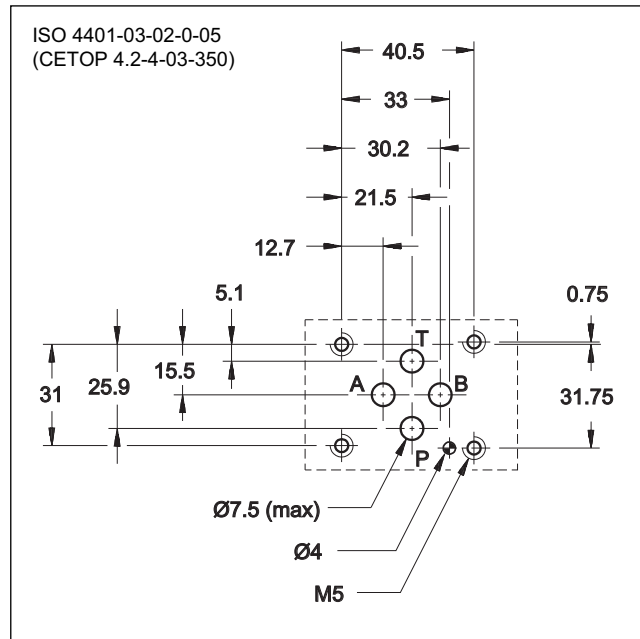
### SERIES 10

#### MODULAR VERSION ISO 4401-03

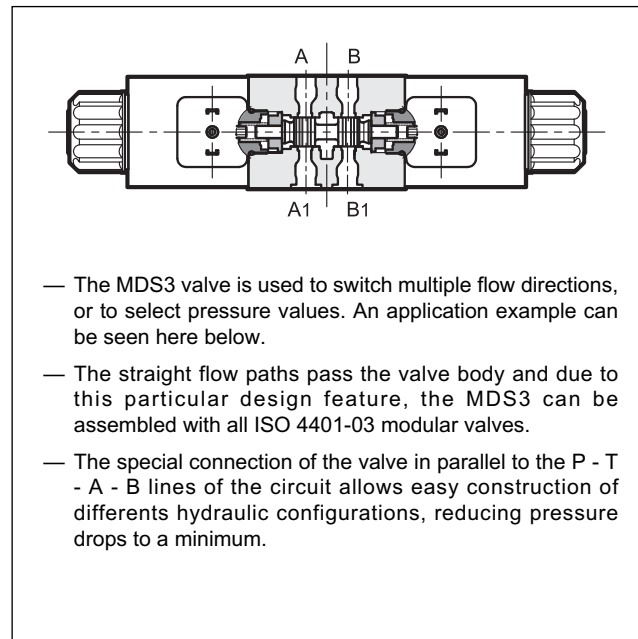
**p** max **350 bar**

**Q** max **50 l/min**

#### MOUNTING INTERFACE



#### OPERATING PRINCIPLE

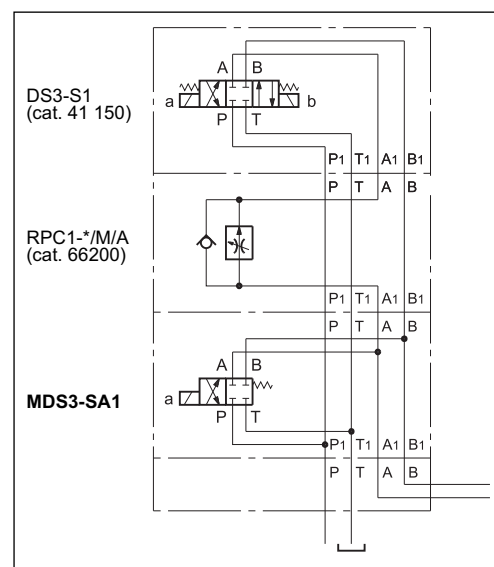


#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C )

Max operating pressure:		
P - A - B ports	bar	350
T port (DC version)		210
T port (AC version)		140
Maximum flow on P - A - B ports	l/min	50
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: double solenoid	kg	2
single solenoid		1,5

#### APPLICATION EXAMPLE





## 1 - IDENTIFICATION CODE

<b>MDS</b>	<b>3</b>	-		<b>/ 10</b>	-		<b>/</b>	
------------	----------	---	--	-------------	---	--	----------	--

Modular switching valve

Size: ISO 4401-03

Spools (see paragraph 3):

<b>S*</b>	<b>SA*</b>	<b>SB*</b>	<b>TA</b>
	<b>RSA1</b>	<b>RSB1</b>	<b>TB</b>
			<b>TA31</b> DC only
			<b>TB31</b> DC only

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_

**N** = NBR seals for mineral oils (**standard**)

**V** = FPM seals for special fluids

Manual override (see at paragraph 12):  
Omit for override integrated in the tube (**standard**)

Coil electrical connection :  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K7** = plug for connector type DEUTSCH DT04-2P male (available on **D12** and **D24** coils only)

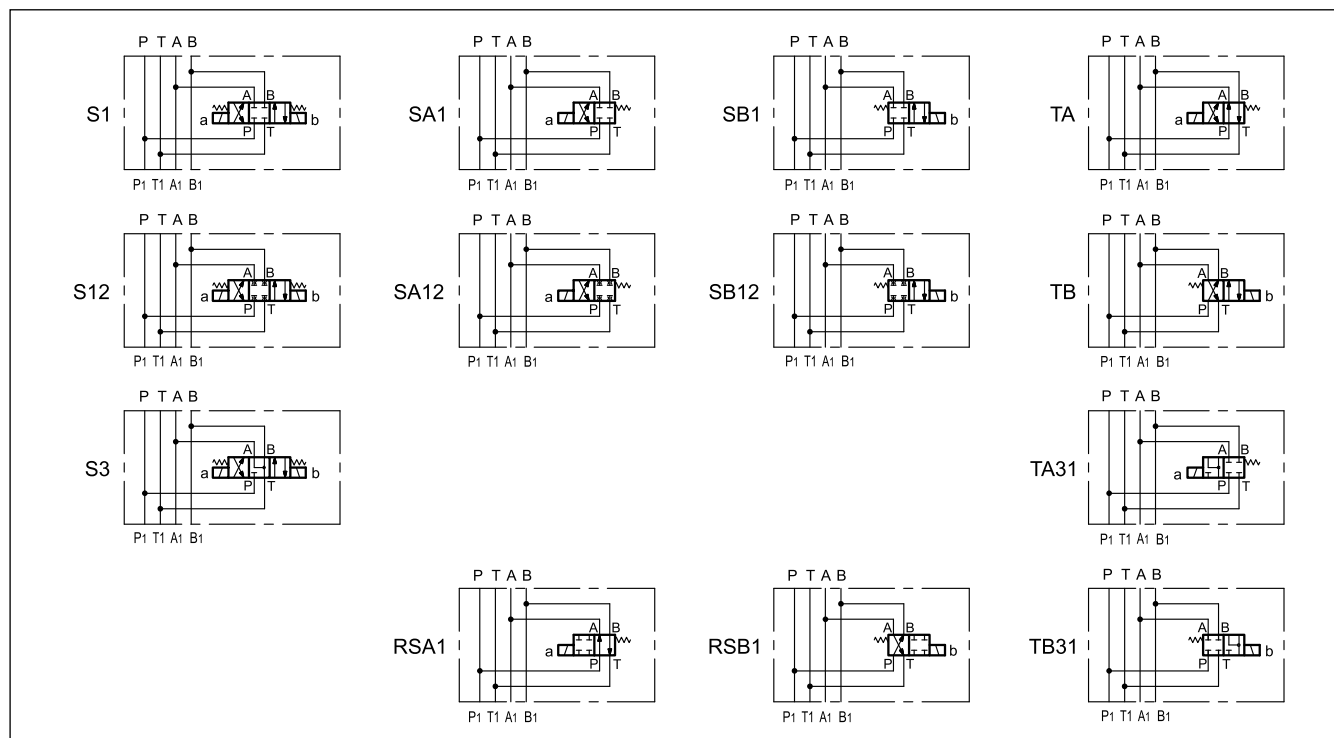
DC power supply

**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V  
**D48** = 48 V  
**D110** = 110 V  
**D220** = 220 V

AC power supply

**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A220** = 220 V - 50 Hz / 240 V - 60 Hz

## 2 - SPOOLS TYPES

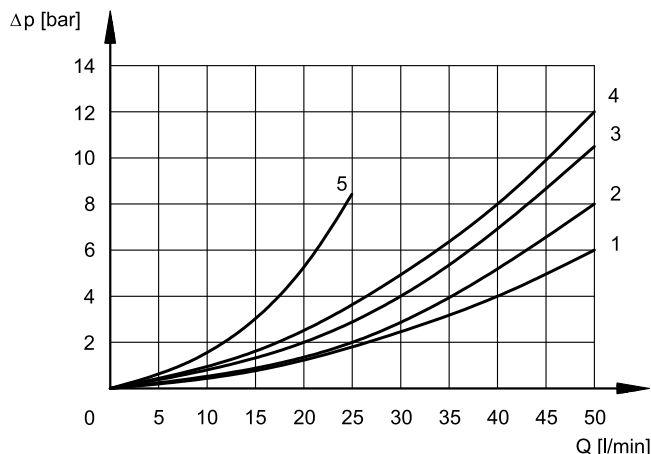


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - PRESSURE DROPS $\Delta p$ -Q



SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1, S12	2	2	3	3
S3 (*)	2	2	1	1
RSA1	2			2
TA	3	4	4	4
TA31			3	

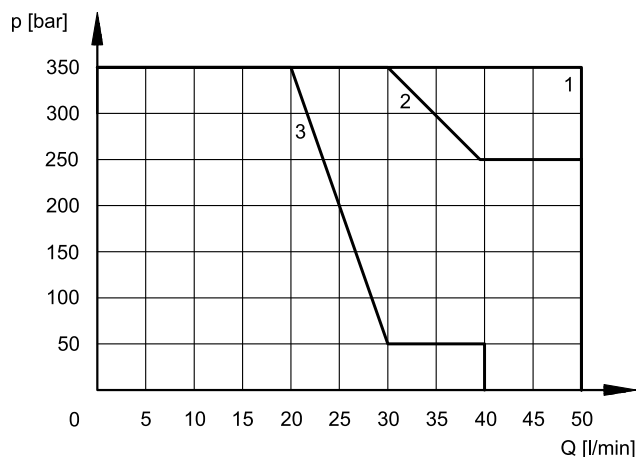
(\*) the limit for central position of S3 spool is 25 l/min (curve 5)

### 5 - OPERATING LIMITS

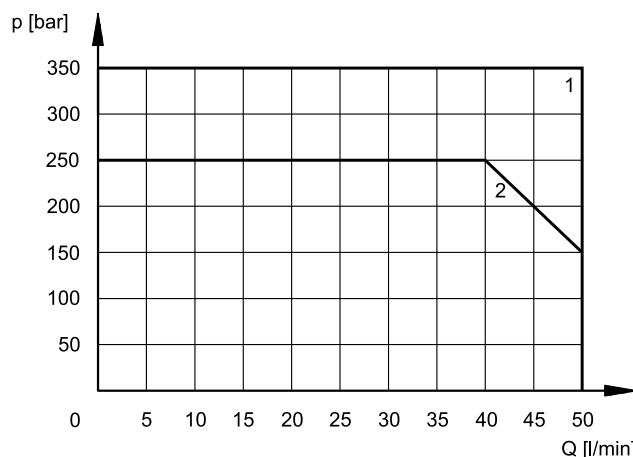
The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve.

**The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.**

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, S12, RSA1, TA	1
S3	2
TA31	3



SPOOL	CURVE
S1, S12, RSA1, TA	1
S3	2

### 6 - SWITCHING TIMES

The values indicated are obtained, according to ISO 6403 standards, with mineral oil viscosity 36 cSt at 50°C.

	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	80 - 150	15 - 25
AC	25 - 50	20 - 40



## 8 - ELECTRICAL FEATURES

### 8.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated to suit the available space.

#### Protection from atmospheric agents EN 60529

Connector	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K7 DEUTSCH DT04 male	x	x	x (*)

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b> DC valve AC valve	18.000 ins/hr 10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95 EC
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation	class H class F

**NOTE:** In order to further reduce the emissions is recommended the use of type H connectors. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

### 8.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values relevant to the DC coils.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits .

#### Available DC coils (values ±5%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code	
					K1	K7
<b>D12</b>	12	4,4	2,72	32,6	1903080	1902940
<b>D24</b>	24	18,6	1,29	31	1903081	1902941
<b>D28</b>	28	26	1,11	31	1903082	
<b>D48</b>	48	78,6	0,61	29,3	1903083	
<b>D110</b>	110	436	0,26	28,6	1903464	
<b>D220</b>	220	1758	0,13	28,6	1903465	

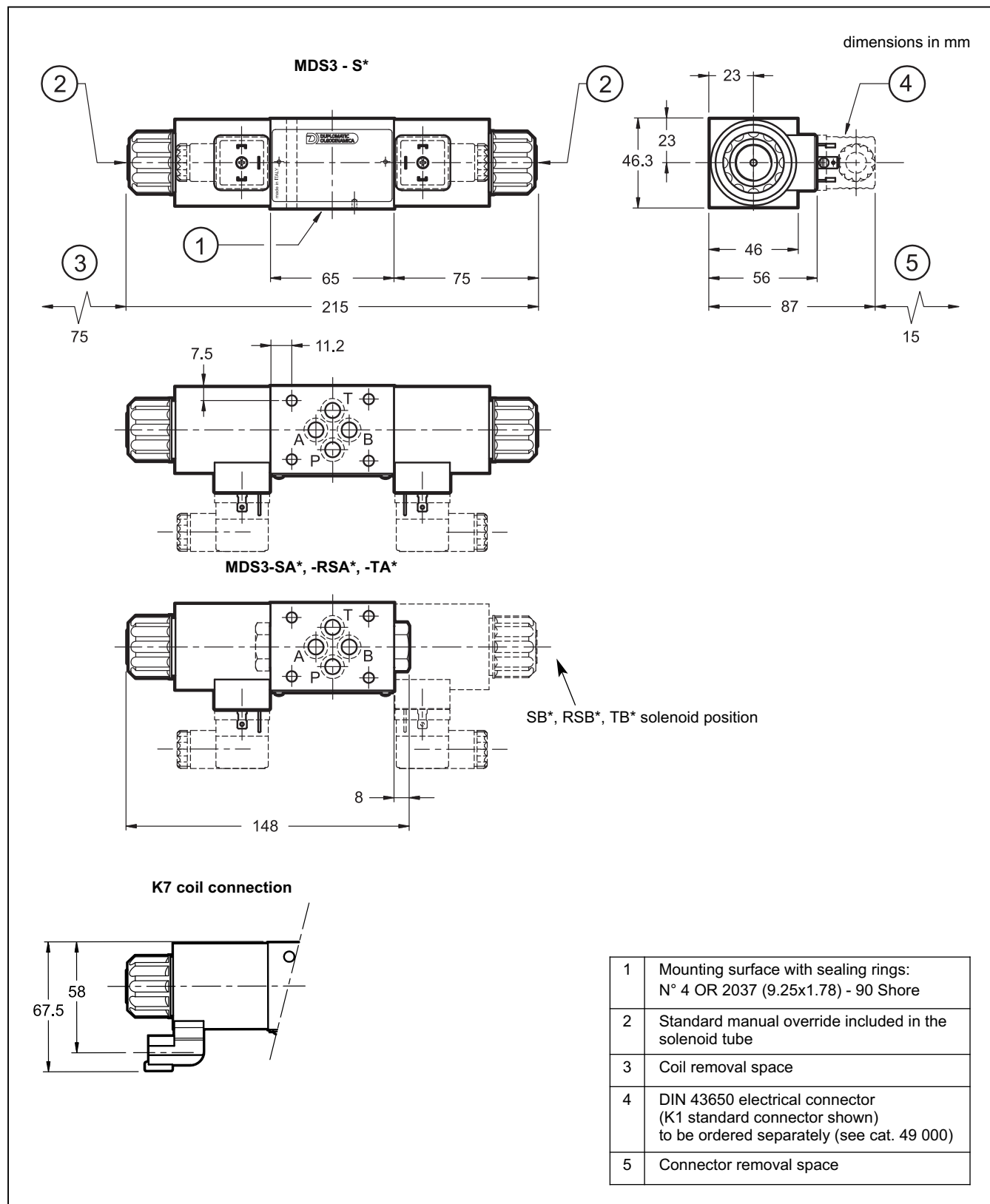
### 8.3 - Current and absorbed power for AC solenoid valve

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

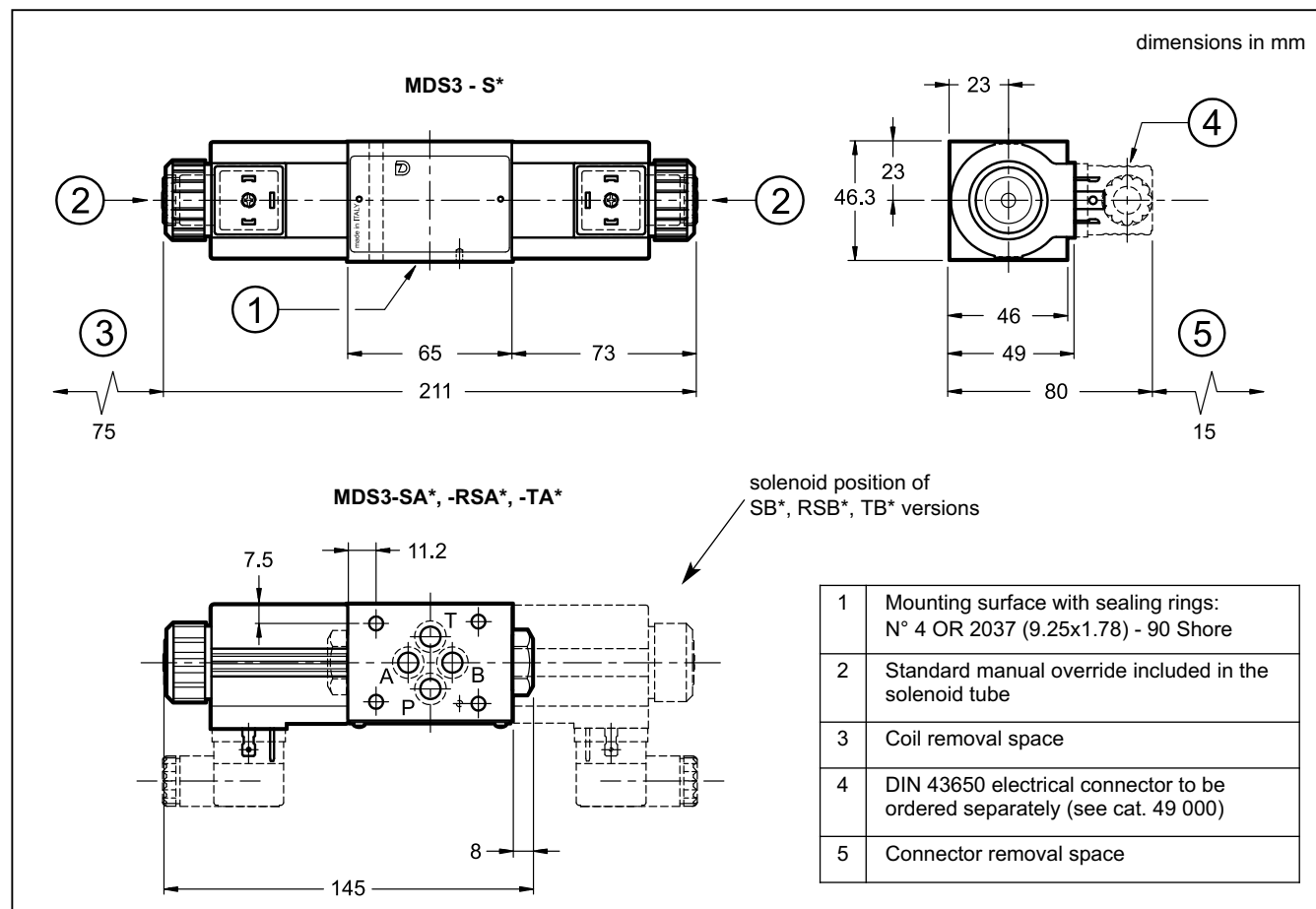
#### Available AC coils (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω] (±1%)	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil Code K1
A24	24	50	0.88	8.7	2.35	209	56.5	1902660
A48	48		3.2	4.5	1.25	216	60	1902661
A110	110V-50Hz 120V-60Hz	50/60	17.5	1.9	0.48	209	52.8	1902677
				1.8	0.45	216	54	
A220	220V-50Hz 240V-60Hz		70	0.95	0.23	209	50.6	1902678
				0.87	0.21		50.4	

## 8 - DC VALVE - OVERALL AND MOUNTING DIMENSIONS



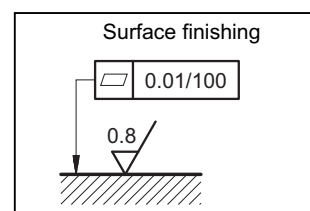
## 9 - DC VALVE - OVERALL AND MOUNTING DIMENSIONS



## 10 - INSTALLATION

The valve can be mounted in any position. Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



## 11 - ELECTRIC CONNECTORS

The solenoid valves are supplied without connectors. For coils with standard electrical connection K1 type (DIN 43650) the connectors can be ordered separately: see catalogue 49 000.

## 12 - MANUAL OVERRIDES

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

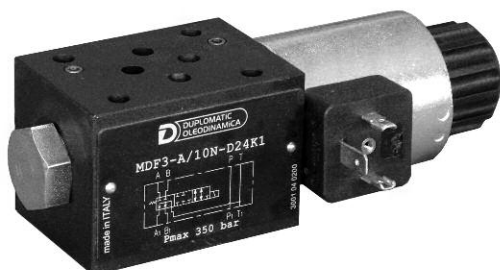
Three different manual override versions are available upon request: **CM**: boot protected; **CP**: Push (for DC valves only); **CPK**: Push manual override with mechanical retention (for DC valves only).

**For more information about these manual overrides, see the catalogue 41150.**

# MDF3

## SHUT-OFF SOLENOID VALVE

### SERIES 10

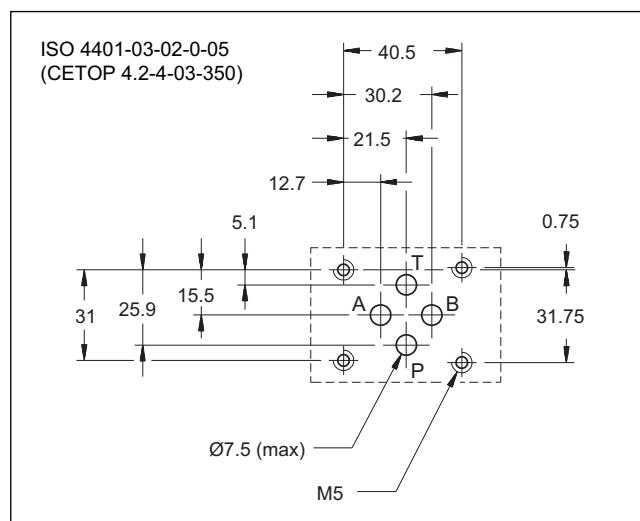


### MODULAR VERSION ISO 4401-03

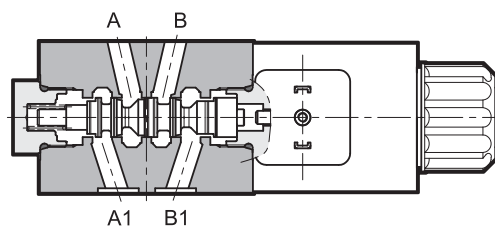
**p** max **350** bar

**Q** max **50** l/min

### MOUNTING INTERFACE



### OPERATING PRINCIPLE



- Shut-off solenoid valve, direct-acting, available in two versions at rest: with lines blocked and with unloading lines.
- It is used with directional control servovalves to guarantee the circuit's safety if there is a power failure.
- Wet armature solenoids with interchangeable coils are used (for further information see par. 6).

### SPOOL TYPE

(see hydraulic symbols table)

Type "A": it is used to unload the lines, with the valve at rest.

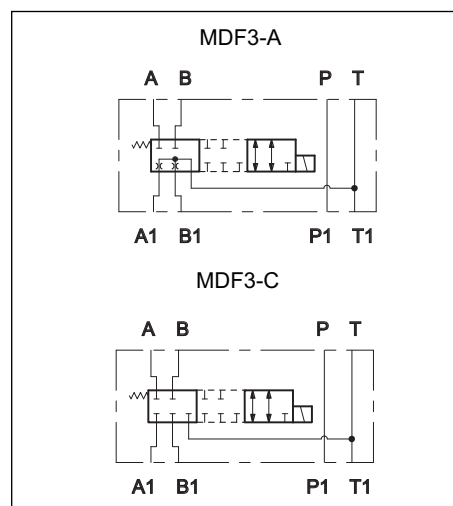
Type "C": it is used to block the lines, with the valve at rest.

### PERFORMANCE RATINGS

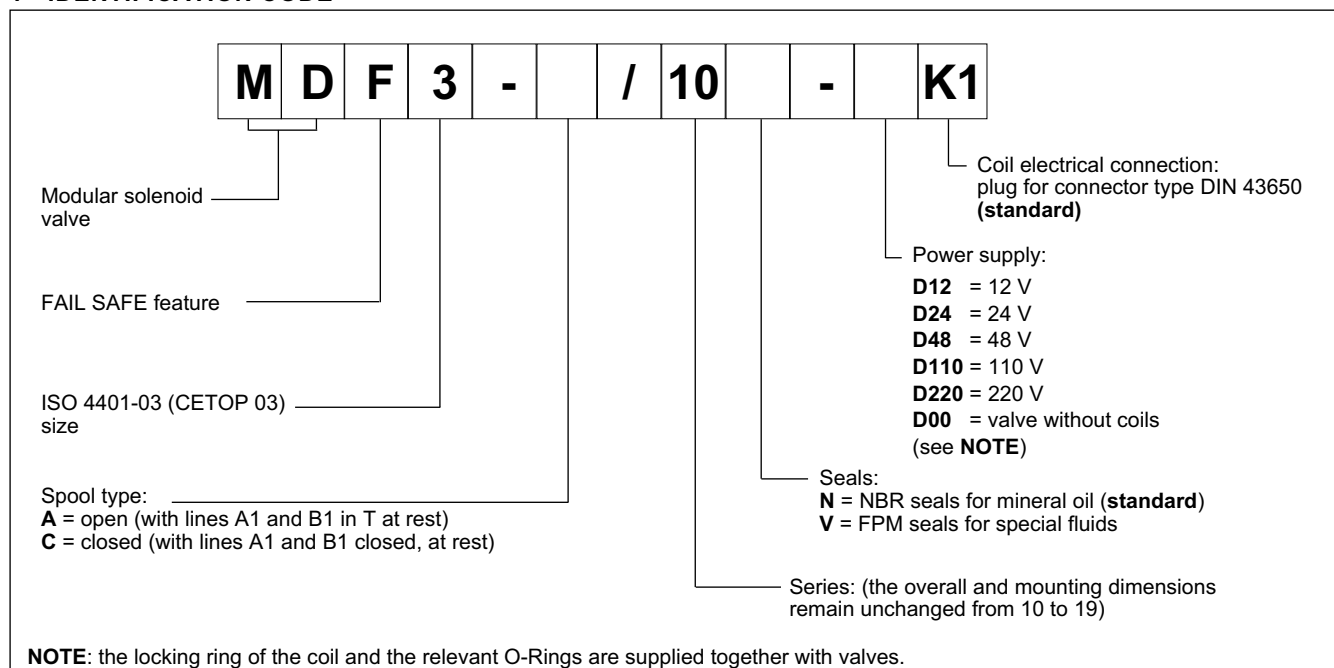
(working with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	50
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,5

### HYDRAULIC SYMBOLS



## 1 - IDENTIFICATION CODE

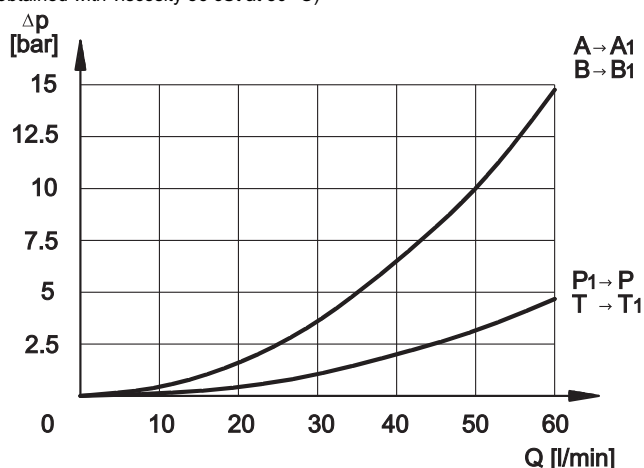


## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - PRESSURE DROPS $\Delta p$ -Q

(obtained with viscosity 36 cSt at 50 °C)



## 4 - SWITCHING TIMES

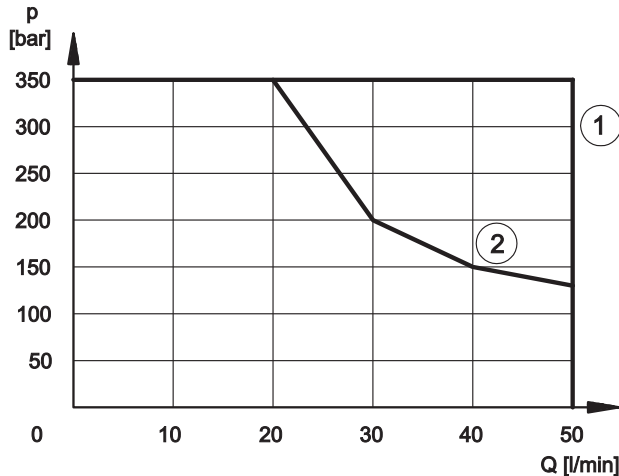
The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES	
ENERGIZING	DE-ENERGIZING
60 ÷ 90 ms	20 ÷ 50 ms

### 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/15.



- 1) Curve related to the de-energizing of the solenoid valve  
Curve related to the energizing of the solenoid valve, without any flow in A and B lines
- 2) Curve related to the energizing of the solenoid valve, with flow in A and B lines

### 6 - ELECTRICAL FEATURES

#### 6.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated, to suit the available space.

**NOTE 1:** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

**NOTE 2:** The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

<b>VOLTAGE SUPPLY FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	18.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95/EC
<b>CLASS OF PROTECTION:</b> Atmospheric agents (IEC EN 60529) Coil insulation (VDE 0580) Impregnation	IP 65 ( <b>NOTE 2</b> ) class H class F

#### 6.2 - Current and absorbed power

The table shows current and power consumption values relevant to the different coil types for DC.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits of about 5-10%.

#### Coils for direct current (values ± 5%)

Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]	Coil code
<b>D12</b>	12	4,4	2,72	32,6	1903080
<b>D24</b>	24	18,6	1,29	31	1903081
<b>D48</b>	48	78,6	0,61	29,3	1903083
<b>D110</b>	110	436	0,26	28,6	1903464
<b>D220</b>	220	1758	0,13	28,6	1903465

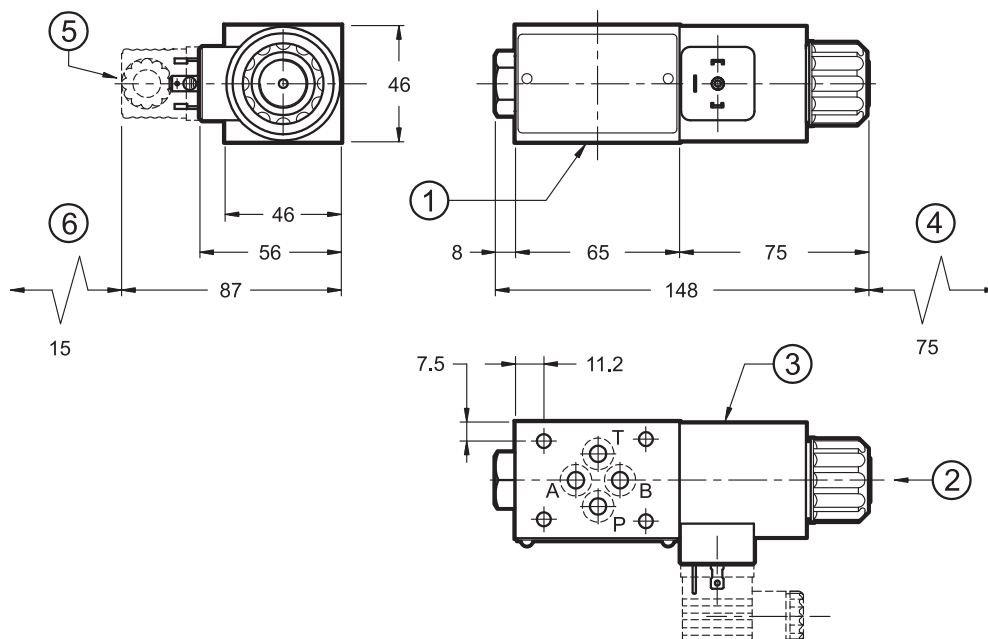


## 7 - ELECTRIC CONNECTORS

The solenoid operated valves are delivered without the connectors. They must be ordered separately.  
For the identification of the connector type to be ordered, please see catalogue 49 000.

## 8 - OVERALL AND MOUNTING DIMENSIONS

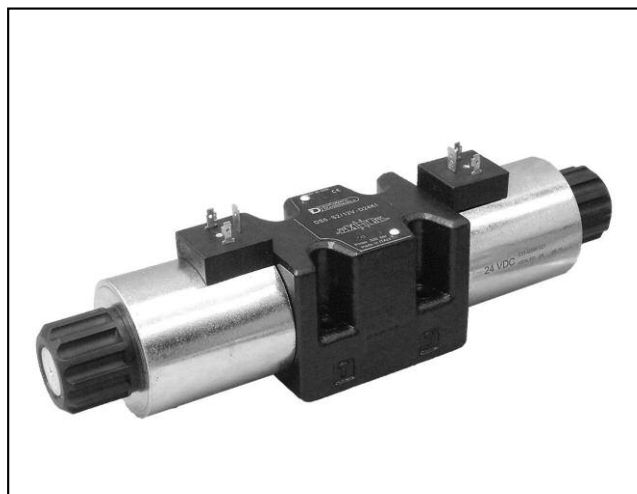
dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil 360° revolving (to suit the available space)
4	Coil removal space
5	DIN 43650 electrical connector to be ordered separately (see cat. 49 000)
6	Connector removal space

# DS5

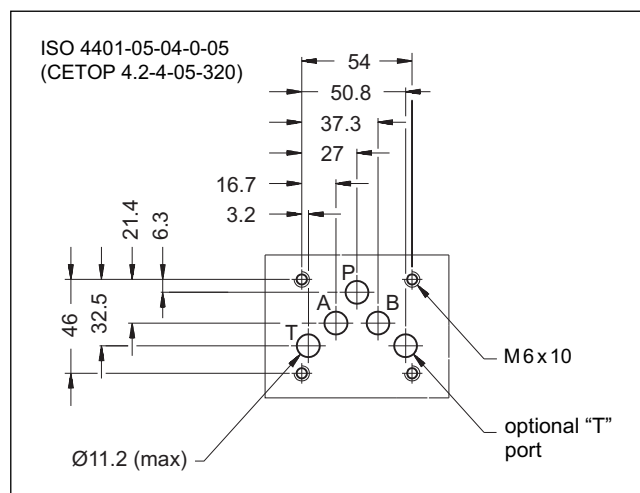
## SOLENOID OPERATED DIRECTIONAL CONTROL VALVE



### SUBPLATE MOUNTING ISO 4401-05

**p** max **320** bar  
**Q** max **150** l/min

### MOUNTING SURFACE

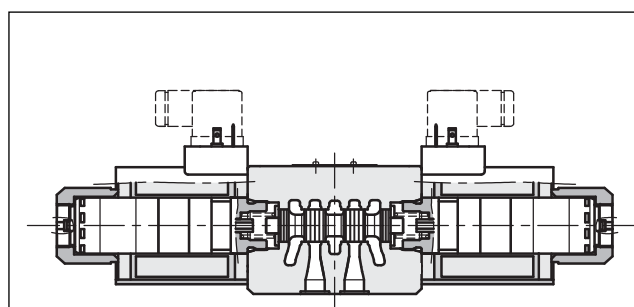


### PERFORMANCES

(with mineral oil of viscosity of 36 cSt at 50°C)

		DC	AC
Maximum operating pressure	bar	320	
P - A - B ports		210	140
T port - standard version		320	-
T port - version with Y port (ext.drain)			
Maximum flow rate	l/min	150	120
Pressure drops $\Delta p$ -Q		see paragraph 4	
Operating limits		see paragraph 6	
Electrical features		see paragraph 7	
Electrical connections		see paragraph 11	
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25	
Mass:	kg	4,5	3,6
single solenoid valve		6,1	4,3
double solenoid valve			

### OPERATING PRINCIPLE



- Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401.
- The valve is designed for 3 or 4 way and with several interchangeable spools, with different porting arrangements.

— The valve body is made with high strength iron castings provided with wide internal passages, in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (see paragraph 7).

— The valve is available with DC or AC solenoids. DC solenoids can also be fed with AC power supply, by using connectors with a built-in rectifier bridge (see paragraph 7.2).

— The DS5 direct current version is available in the following special versions:

- with Y external subplate drain port, (see par. 13.1 and 13.2).
- with soft-shifting (see par. 13.3 and 13.4)
- with adjustable "soft-shift" device (see paragraph 13.5)

## 1 - IDENTIFICATION CODE

<b>D</b>	<b>S</b>	<b>5</b>	<b>-</b>		<b>/</b>		<b>-</b>		<b>/</b>	
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Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)

<b>S*</b>	<b>TA</b>
<b>SA*</b>	<b>TB</b>
<b>SB*</b>	<b>RK</b>

Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

**14** = for DC valves with K1 electrical connection  
DC valves without coils D00

**12** = for AC valves  
DC valves with K7 electrical connection

Seals: **N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

DC power supply

**D12** = 12 V  
**D24** = 24 V  
**D110** = 110 V  
**D220** = 220 V  
**D00** = valve without coils (see **NOTE 1**)

AC power supply

**A24** = 24 V - 50 Hz.  
Not available for S4, SA4, SB4, S7 and S8 spools

**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see **NOTE 1**)

**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz

**NOTE 1:** Coils locking ring and related OR are supplied together with valves.  
**NOTE 2:** The standard surface treatment is phosphating black.  
On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)  
Add **/W7** at the end of the identification code.

Option: Surface treatment not standard. Omit if not required (see **NOTE 2**)

Manual override: omit for override integrated in the tube (**standard**)

**CM** = manual override, boot protected (only for DC version)  
**CK** = knob manual override (only for DC version)

Coil electrical connection (see par. 11):  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available for D24 coils only)

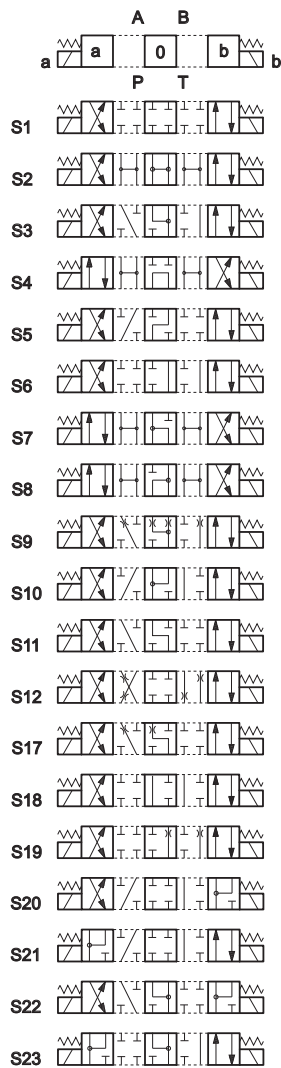
## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

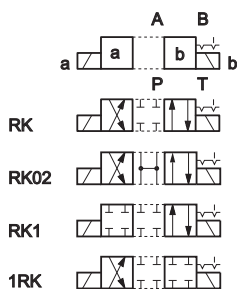
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 3 - SPOOL TYPE

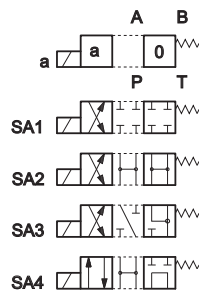
Type **S\***:  
2 solenoids - 3 positions  
with spring centering



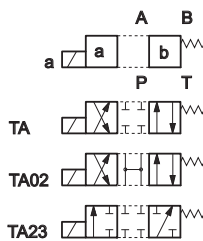
Type **RK**:  
2 solenoids - 2 positions  
with mechanical retention



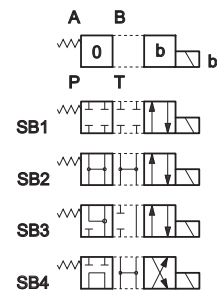
Type **SA\***:  
1 solenoid side A  
2 positions (central + external)  
with spring centering



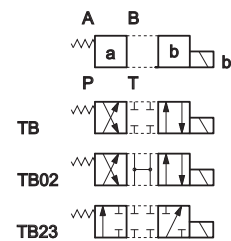
Type **TA**:  
1 solenoid side A  
2 external positions  
with return spring



Type **SB\***:  
1 solenoid side B  
2 positions (central + external)  
with spring centering



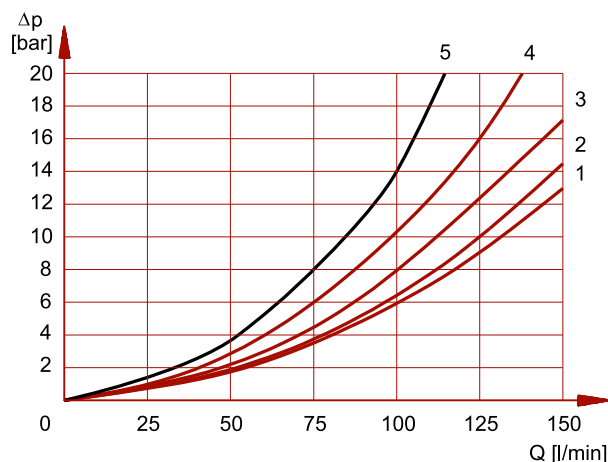
Type **TB**:  
1 solenoid side B  
2 external positions  
with return spring



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

## 4 - PRESSURE DROPS $\Delta p$ -Q

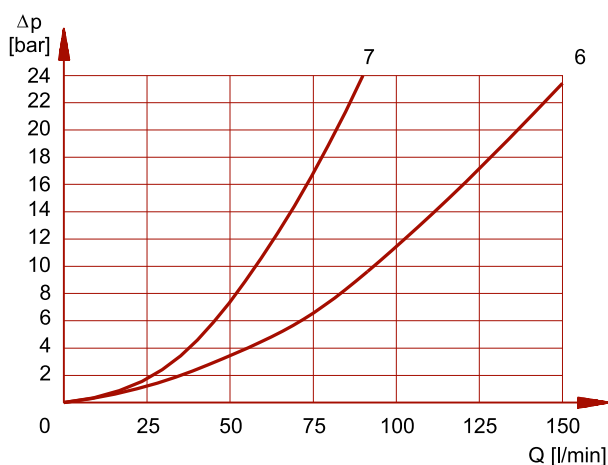
(obtained with viscosity 36 cSt at 50 °C)



### PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	1	1
S2, SA2, SB2	3	3	1	1
S3, SA3, SB3	3	3	2	2
S4, SA4, SB4	1	1	2	2
S5	2	1	1	1
S6, S11	3	3	2	2
S7, S8	1	1	2	2
S9	3	3	2	2
S10	1	1	3	3
S12	2	2	1	1
S17, S19	2	2	1	1
S18	1	2	1	1
S20, S22	2	4	4	-
S21, S23	4	2	-	4
TA, TB	3	3	2	2
TA02, TB02	3	3	2	2
TA23, TB23	4	4		
RK	3	3	2	2
RK02	3	3	2	2
RK1, 1RK	3	3	2	2

For pressure drops between A and B lines of S10, S20, S21, S22 spools which are used in the regenerative diagram, refer to curve 5.



### PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					6
S3, SA3, SB3			7	7	
S4, SA4, SB4					6
S5		3			
S6				7	
S7					6
S8					6
S10	3	3			
S11			7		
S18	3				
S22			7	7	

## 5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50 °C.

COIL TYPE	TIMES [ms]	
	ENERGIZING	-ENERGIZING
DC	100 ÷ 150 ms	20 ÷ 50 ms
AC	15 ÷ 30 ms	20 ÷ 50 ms

## 6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

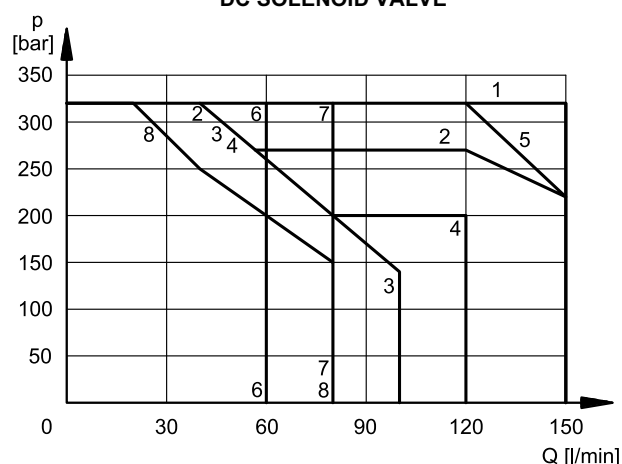
The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13 and are relevant to the standard solenoid valve.

**The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.**

For flow and pressure performances of soft-shifting configuration (options F) see par. 13.4.

Flow and pressure performances of adjustable soft-shifting device configurations (options S, par. 13.5) are influenced by the set shifting time.

DC SOLENOID VALVE

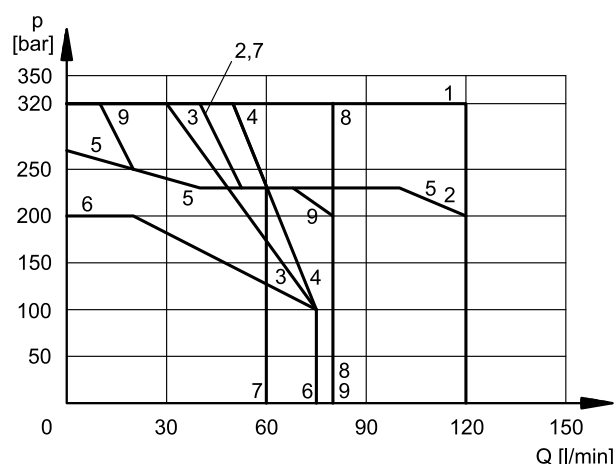


SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	2	2
S4, SA4, SB4	3	3
S5	1	1
S6	2	1
S7	3	3
S8	3	3
S9	1	1
S10	3	3
S11	1	2
S12	1	1

SPOOL	CURVE	
	P→A	P→B
S17	1	4
S18	1	1
S19	4	1
S20	8*	7
S21	7	8*
S22	6*	6
S23	6	6*
TA, TB	5	5
TA02, TB02	4	4
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

\* Performance obtained for a valve with A and B lines connected the one to the piston-side chamber and the other to the rod-side chamber of a double-acting cylinder with area ratio 2:1.

AC SOLENOID VALVE



SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	2	2
S4, SA4, SB4	4	4
S5	1	1
S6	2	1
S7	3	3
S8	3	3
S9	2	2
S10	1	1
S11	1	2
S12	1	1

SPOOL	CURVE	
	P→A	P→B
S17	1	5
S18	1	1
S19	5	1
S20	9*	8
S21	8	9
S22	7	7
S23	7	7
TA, TB	1	1
TA02, TB02	5	5
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

## 7 - ELECTRICAL FEATURES

### 7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated, to suit the available space.

#### Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors correctly connected and installed.

connection type	electric connection protection	whole valve protection
K1 DIN 43650	IP65	IP65
K7 DEUTSCH DT04 male	IP65/IP67/IP69 IP69K (*)	

(\*) The IP69K protection degree is not taken into account in IEC 60529 but it is included in ISO 20653.

<b>VOLTAGE SUPPLY FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	15.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)</b>	In compliance with 2014/30/EU
<b>LOW VOLTAGE</b>	In compliance with 2014/35/EU
<b>CLASS OF PROTECTION:</b> Coil insulation (VDE 0580) Impregnation:	class H class F

**NOTE 1:** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see catalogue 49 000).

### 7.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values relevant to the coil types for DC.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 110V voltage) with alternating current (50 or 60 Hz).

However, when supplying the valve with rectified current, it is necessary to consider a reduction of the operating limits by 15-20% approx.

#### Coils for direct current (values ± 5%)

Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]	Coil code	
					K1	K7
<b>D12</b>	12	3,2	3,75	45	1903550	
<b>D24</b>	24	12	2	48	1903551	1903221
<b>D110</b>	110	250	0,44	48	1903554	
<b>D220</b>	220	1050	0,21	47	1903555	

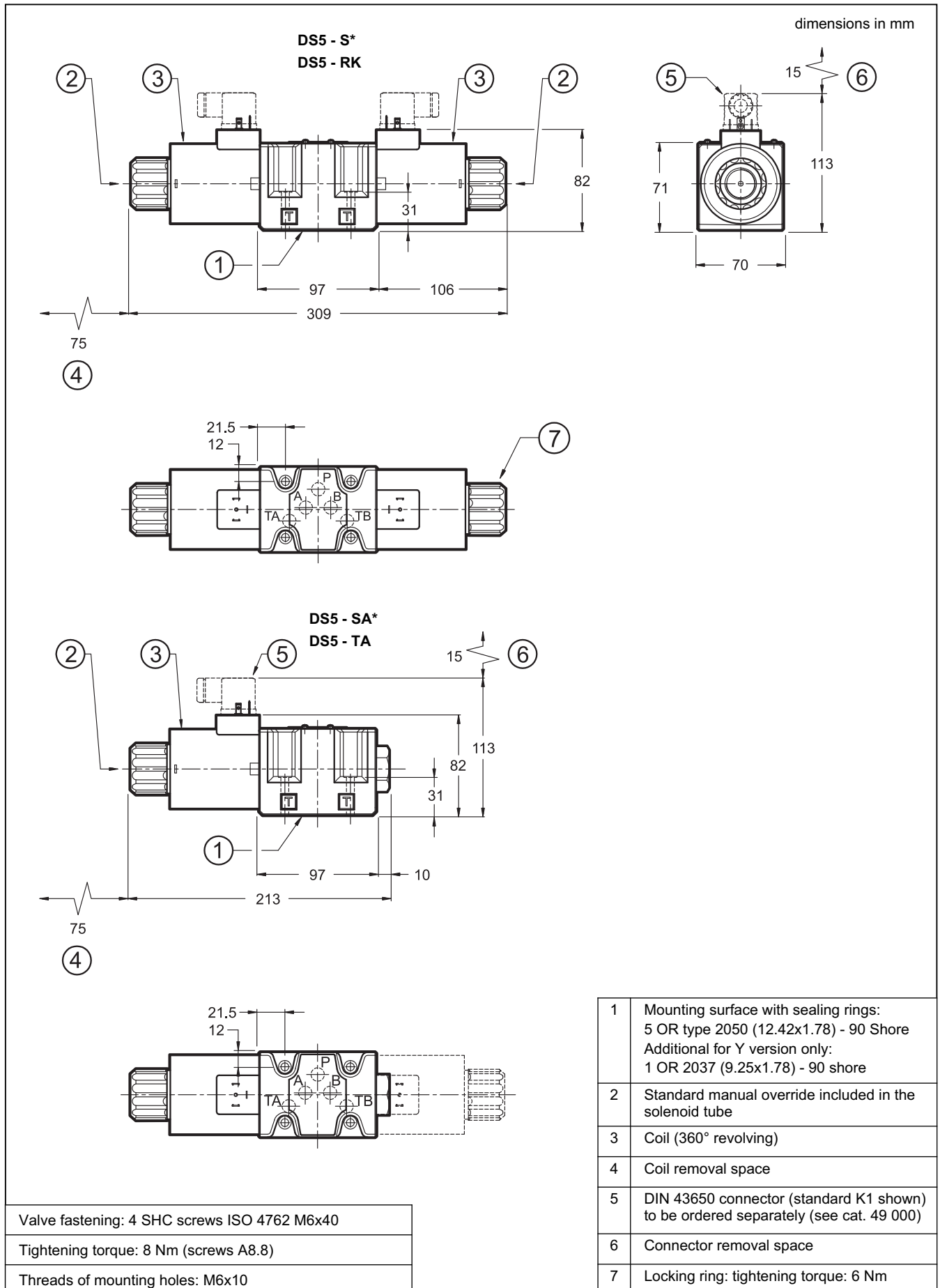
### 7.3 - Current and absorbed power for AC solenoid valve

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

#### Coils for alternating current (values ± 5%)

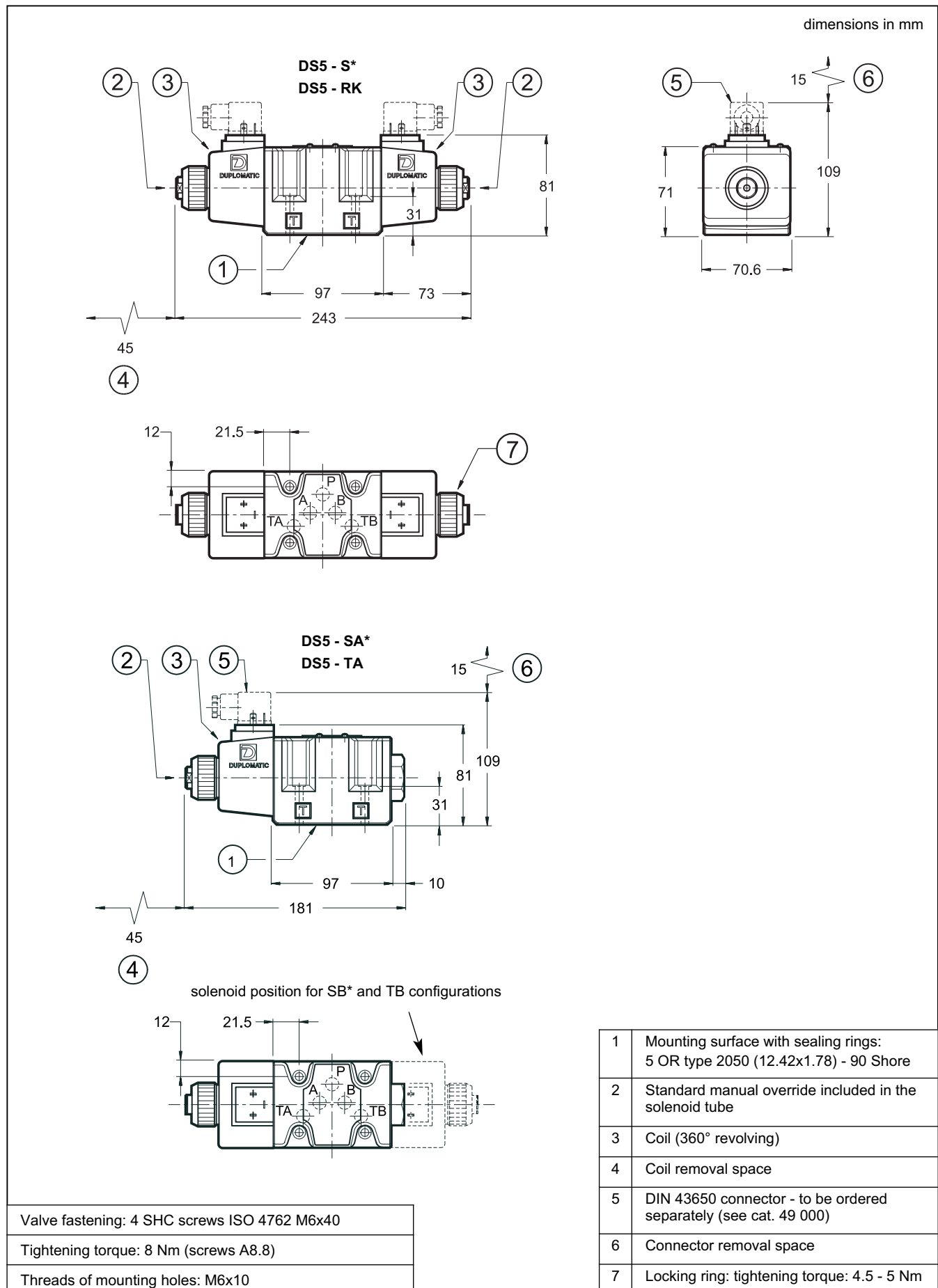
Suffix	Nominal voltage [V]	Frequency [Hz]	Resistance at 20°C [ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil code
<b>A24</b>	24	50	0,53	25	3,96	600	95	1902890
<b>A48</b>	48		2,09	12,5	2,3	600	110	1902891
<b>A110</b>	110V-50Hz	50/60	10,9	5,2	0,96	572	105	1902892
	120V-60Hz		10,9	5,2	0,89	572	105	
<b>A230</b>	230V-50Hz		52,7	2,8	0,46	644	105	1902893
	240V-60Hz		52,7	2,8	0,38	644	105	
<b>F110</b>	110	60	8,80	5,2	0,95	572	105	1902894
<b>F220</b>	220		35,2	2,7	0,48	594	105	1902895

## 8 - OVERALL AND MOUNTING DIMENSIONS FOR DC SOLENOID VALVES





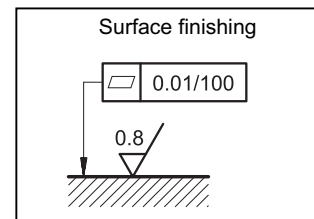
## 9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOID VALVES



## 10 - INSTALLATION

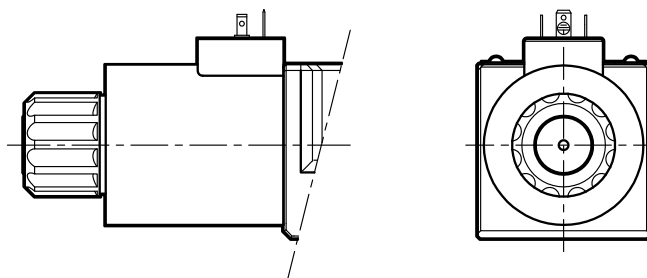
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

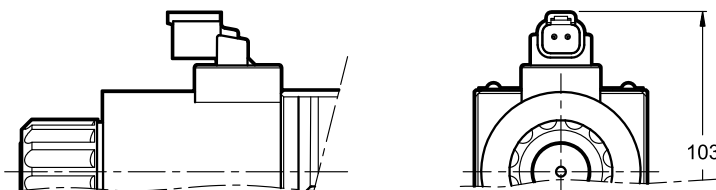


## 11 - ELECTRIC CONNECTIONS

connection for DIN 43650 connector type code **K1 (standard)**



connection for DEUTSCH DT06-2S male connector type code **K7**



## 12 - ELECTRIC CONNECTORS

Solenoid operated valves are delivered without connectors. Connectors for coils with standard electrical connections K1 type (DIN 43650) can be supplied separately. See catalogue 49 000.

## 13 - SPECIAL VERSIONS FOR DC SOLENOID VALVE

### 13.1 - Identification code for external drain version

<b>D</b>	<b>S</b>	<b>5</b>	<b>-</b>		<b>/ 14</b>	<b>-</b>		<b>K1</b>	<b>/</b>	<b>Y</b>		
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Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)

Series n.:  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Coil type  
**D12** = 12 V  
**D24** = 24 V  
**D110** = 110 V  
**D220** = 220 V

Option: Surface treatment not standard. Omit if not required (see **NOTE**)

Manual override: omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected  
**CK** = knob manual override

Port for subplate external drain

Coil electrical connection type DIN 43650 (see par. 11):

**NOTE** :The standard surface treatment is phosphating black.

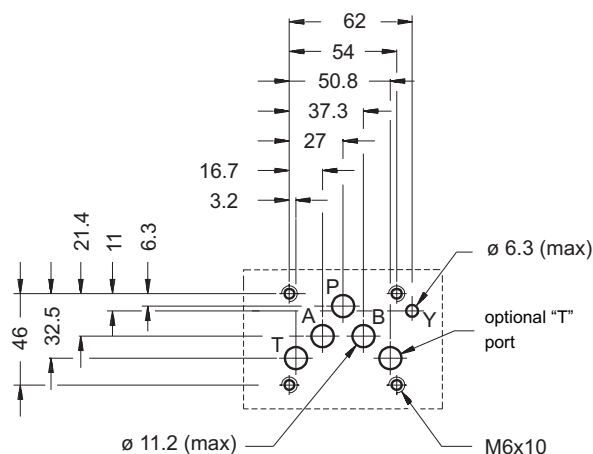
On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)

Add **/W7** at the end of the identification code.

### 13.2 - Subplate external drain port (option Y)

This version allows the operation with pressures up to 320 bar on the valve T port.

It is a drain port Y realized on the valve mounting interface in compliance with ISO 4401-05-05-0-05. The Y port is connected with the solenoid chamber: in this way the tubes are not stressed by the pressure operating on the valve T port.



### 13.3 - Identification code for soft-shifting versions

<b>D</b>	<b>S</b>	<b>5</b>	<b>-</b>		<b>/</b>	<b>14</b>		<b>-</b>		<b>K1</b>	<b>/</b>		
----------	----------	----------	----------	--	----------	-----------	--	----------	--	-----------	----------	--	--

Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)

<b>S1</b>	<b>S4</b>	<b>TA</b>
<b>S2</b>	<b>S7</b>	<b>TB</b>
<b>S9</b>	<b>S8</b>	<b>TA02</b>
<b>S12</b>		<b>TB02</b>

Series n.:  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Power supply  
**D12** = 12 V  
**D24** = 24 V  
**D110** = 110 V  
**D220** = 220 V

Manual override:  
omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected  
**CK** = knob manual override

**Options:**  
**F** = soft-shifting (see par. 13.4)  
**S** = adjustable soft-shifting device (see par 13.5)

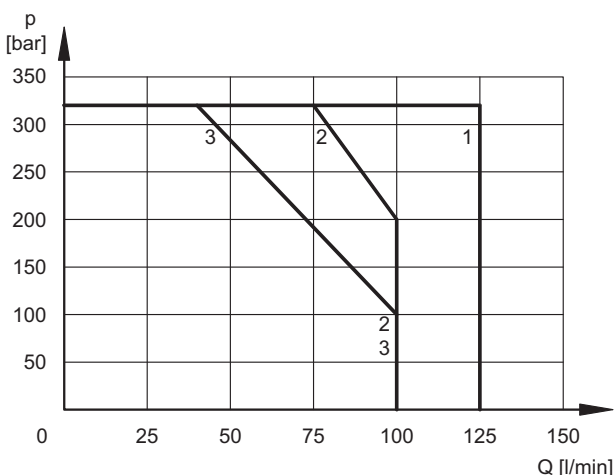
Coil electrical connection type DIN 43650 (see par. 11):

### 13.4 - Fixed restrictor for soft-shifting (option F)

This version enables hydraulic actuators to perform a smooth start and stop, by reducing the speed of movement of the valve spool.

The diagram below shows the operating limits for available spools in the soft-shifting version (Note: for this version, the S9 spool must be used instead of the S3 one). The table on the side shows the switching times. Indicated values are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

Both shifting time and characteristics curves are influenced by the viscosity (and thus by the temperature) of the operating fluid. Moreover, times can vary according to the flow rate and operating pressure values of the valve.



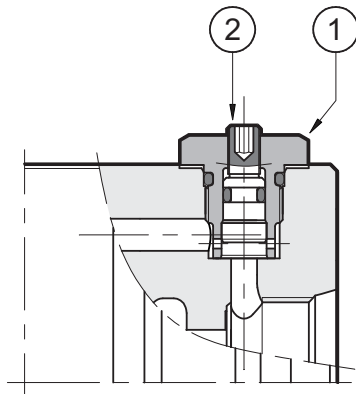
SPOOL TYPE	CURVE		TIMES	
	P-A	P-B	ENERGIZING	DE-ENERGIZING
S1, S12	1	1	300 ÷ 500	300 ÷ 500
S2	2	2	450	200 ÷ 300
S4, S7, S8	3	3	400	400 ÷ 200
S9	1	1	300 ÷ 500	300 ÷ 500
TA, TB	2	2	300 ÷ 400	300 ÷ 400
TA02, TB02	2	2	400	200 ÷ 300

## 13.5 - Directional solenoid valve with adjustable “soft-shifting” device (option S)

This solenoid valve is supplied with a suitable device, adjustable by the user, which enables the control of the valve spool shifting time.

In this way the hydraulic actuators can perform smooth movements, by controlling the valve switching time according to the machine cycle and the inertia of the moving parts.

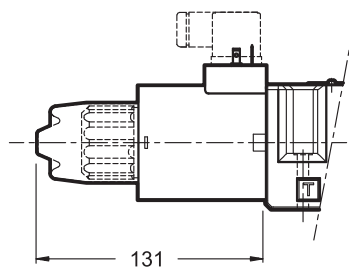
**NOTE:** during the first start-up the valve body must be filled with the operating fluid through the tap (1) .



1	Spanner for plug: 17 mm - tightening torque 20 Nm
2	Socket hex adjustment screw for shifting time: spanner 2,5 mm

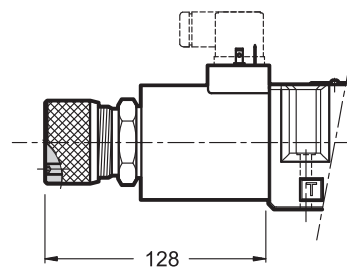
## 14 - MANUAL OVERRIDES FOR DC SOLENOID VALVES

### 14.1 - CM - Manual override, boot protected



Code: valves in series 12 = 0239050  
valves in series 14 = 0239051

### 14.2 - CK-DS5/10 - Knob manual override

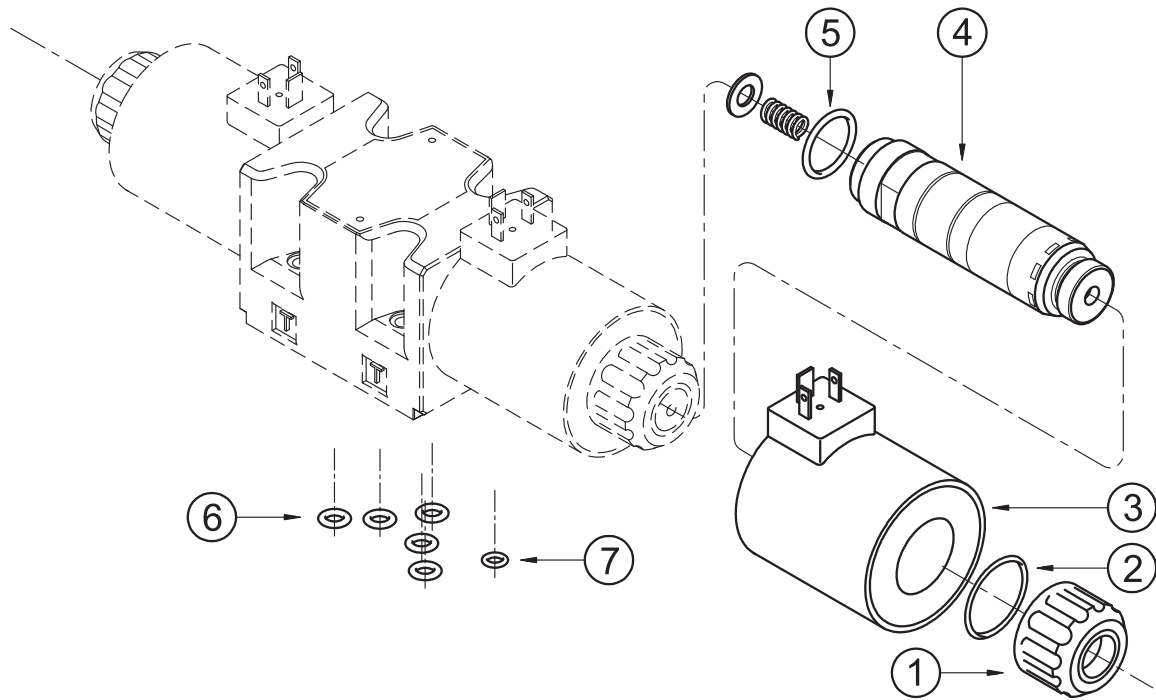


When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.

Spanner: 3 mm

Code: 3401150003

# 15 - SPARE PARTS FOR DC SOLENOID VALVE



## DC COILS IDENTIFICATION CODE

C 31 - /

Supply voltage  
**D12** = 12 V  
**D24** = 24 V  
**D110** = 110 V  
**D220** = 220 V

Series no.:  
**22** = for K1 coils  
**21** = for K7 coils

Coil electrical connection (see par. 11):  
**K1** = plug for connector type  
 DIN 43650 (**standard**)  
**K7** = plug DEUTSCH DT04-2P  
 for male connector type DEUTSCH  
 DT06-2S (available for D24 coils only)

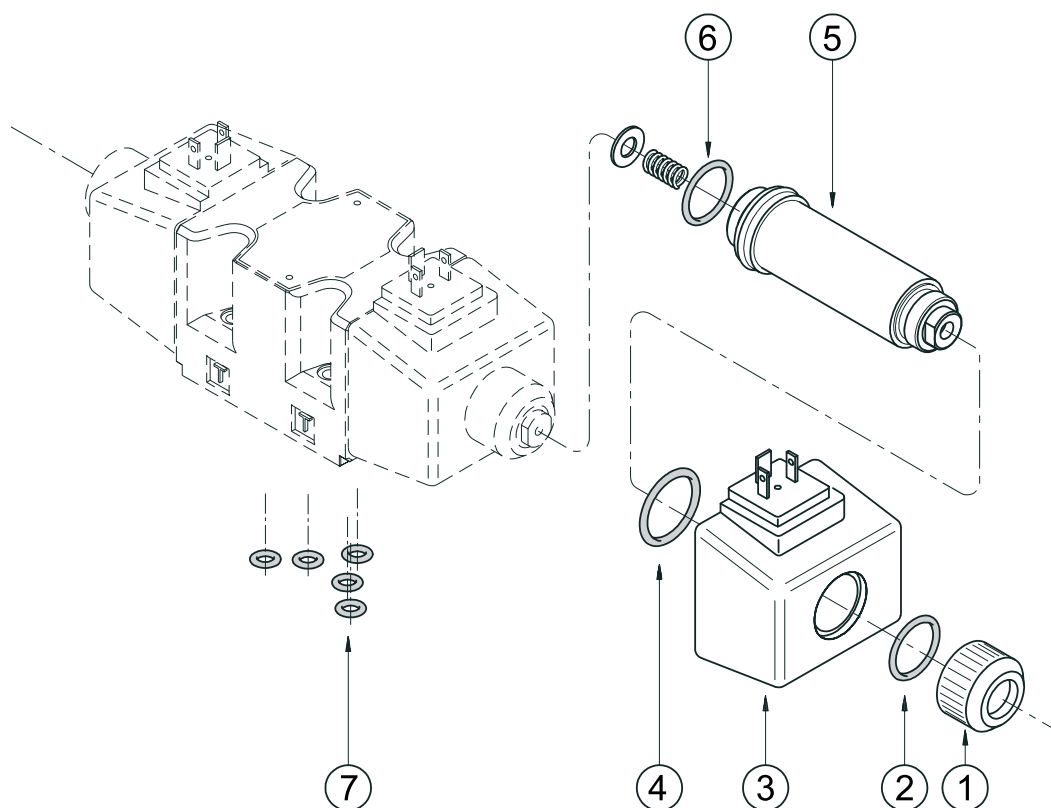
1	Coil locking ring with seal included cod. 0119383 tightening torque: 6 Nm
2	ORM type 0320 - 25 (32x2.5) - 70 Shore
3	Coil (see identification code)
4	Solenoid tube TD31-M27/20N (NBR seals) TD31-M27/20V (FPM seals) <b>NOTE:</b> OR n° 5 supplied with.
5	OR type 3-912 (23.47x2.95) - 70 Shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore
7	For version with external subplate drain only (Y option): OR type 2037 (9.25x1.78) - 90 Shore

## SEALS KIT

The codes here below include O-Rings ref. 2, 5, 6 and 7.

**Cod. 1984418** NBR seals  
**Cod. 1984419** FPM (viton) seals

## 16 - SPARE PARTS FOR AC SOLENOID VALVE



### AC COILS IDENTIFICATION CODE

<b>C</b>	<b>25.4</b>	<b>-</b>	<b>K1</b>	<b>/</b>	<b>11</b>
----------	-------------	----------	-----------	----------	-----------

Supply voltage

**A24** = 24 V - 50 Hz

**A48** = 48 V - 50 Hz

**A110** = 110 V - 50 Hz

120 V - 60 Hz

**A230** = 230 V - 50 Hz

240 V - 60 Hz

**F110** = 110 V - 60 Hz

**F220** = 220 V - 60 Hz

Series no.:

(the overall and mounting dimensions remain unchanged from 10 to 19)

plug for connector type DIN 43650 (**standard**)

### SEALS KIT

The codes here below include O-Rings ref. 2, 4, 6 and 7.

**Cod. 1984420** NBR seals

**Cod. 1984421** FPM (viton) seals

1	Coil locking ring cod. 0119402 tightening torque: 4.5 - 5 Nm
2	OR type 4100 (24.99x3.53) - 90 Shore
3	Coil (see identification code)
4	OR type 2112 (28.30x1.78) - 90 Shore
5	Solenoid tubes: TA25.4-M27/11N (NBR seals) TA25.4-M27/11V (FPM seals) <b>NOTE:</b> OR n°6 supplied with.
6	OR type 3-912 (23.47x2.95) - 70 Shore
7	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

## 17 - SUBPLATES

(see catalogue 51 000)

Type PMD4-AI4G with rear ports 1/2" BSP

Type PMD4-AL4G with side ports 1/2" BSP

**D** **DUPLOMATIC**  
**OLEODINAMICA**

**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

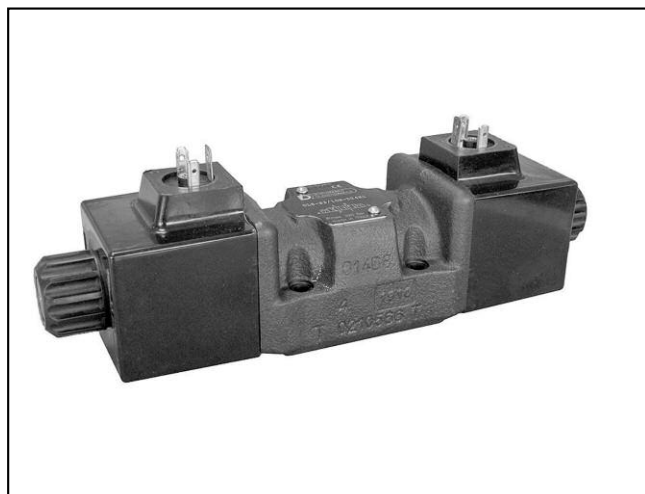
Tel. +39 0331.895.111

Fax +39 0331.895.339

www.duplomatic.com • e-mail: sales.exp@duplomatic.com

# DL5

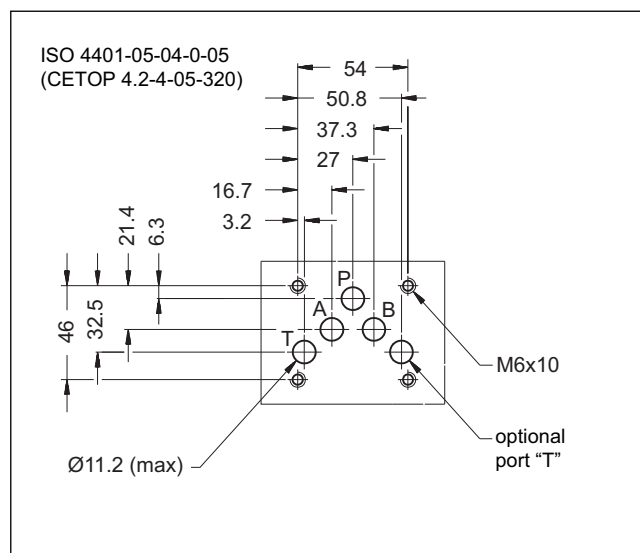
## SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION SERIES 10



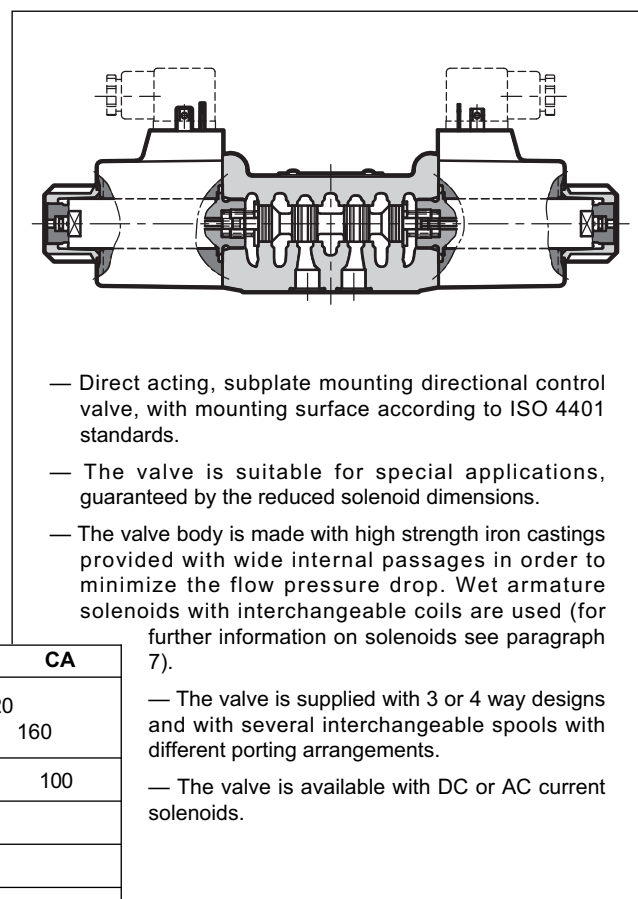
### SUBPLATE MOUNTING ISO 4401-05

**p** max **320** bar  
**Q** max **125** l/min

### MOUNTING INTERFACE



### OPERATING PRINCIPLE



### PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure: - ports P - A - B - port T	bar	CC	CA
		320 210	160
Maximum flow rate	l/min	125	100
Pressure drop Δp-Q	see paragraph 4		
Operating limits	see paragraph 5		
Electrical features	see paragraph 7		
Electrical connections	DIN 43650		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Masse: single solenoid valve double solenoid valve	kg	2,8 3,7	





## 1 - IDENTIFICATION CODE

<b>D</b>	<b>L</b>	<b>5</b>	<b>-</b>		<b>/</b>	<b>10</b>		<b>-</b>		<b>K1</b>	<b>/</b>		
----------	----------	----------	----------	--	----------	-----------	--	----------	--	-----------	----------	--	--

Solenoid operated directional control valve

Model in compact execution

ISO 4401-05 (CETOP 05) size

Spool type (see paragraph 3):

**S\***      **TA\***  
**SA\***      **TB\***  
**SB\***      **RK**

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:

**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Option:  
**/ W7** = Zinc-nickel surface treatment.  
Omit if not required (see **NOTE 2**)

Manual override - see par. 12  
Omit for override integrated in the tube (**standard**)  
**CM** = boot protected.  
For DC version only.  
**CK** = knob.  
For DC version only.

Coil electrical connection:  
plug for connector type  
DIN 43650 (**standard**)

DC power supply  
**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V  
**D00** = valve without coils (see **NOTE 1**)

AC power supply  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz  
**A230** = 230 V - 50 Hz  
**A00** = valve without coils (see **NOTE 1**)

**NOTE 1:** Coils locking ring and related OR are supplied together with valves.

**NOTE 2:** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

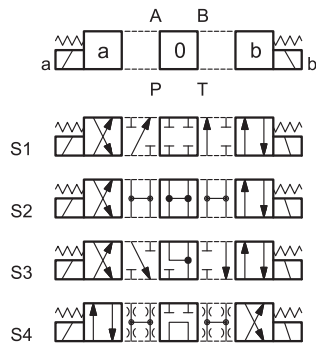
## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

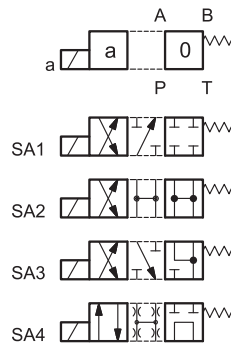
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - SPOOL TYPE

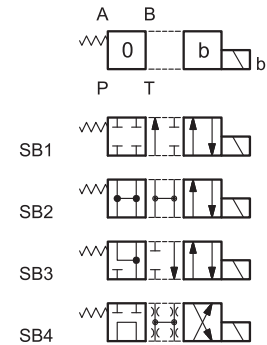
**Type S\*:**  
2 solenoids - 3 positions  
with spring centering



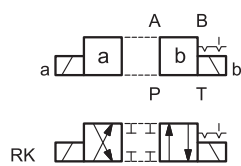
**Type SA\*:**  
1 solenoid side A  
2 positions (central + external)  
with spring centering



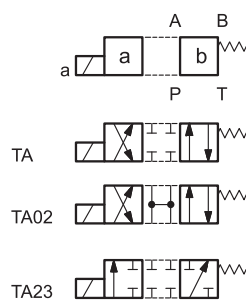
**Type SB\*:**  
1 solenoid side B  
2 positions (central + external)  
with spring centering



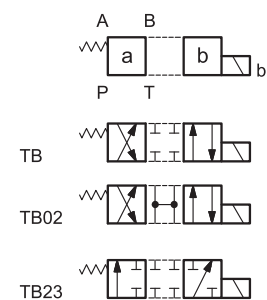
**Type RK:**  
2 solenoids - 2 positions  
with mechanical retention



**Type TA:**  
1 solenoid side A  
2 external positions  
with return spring

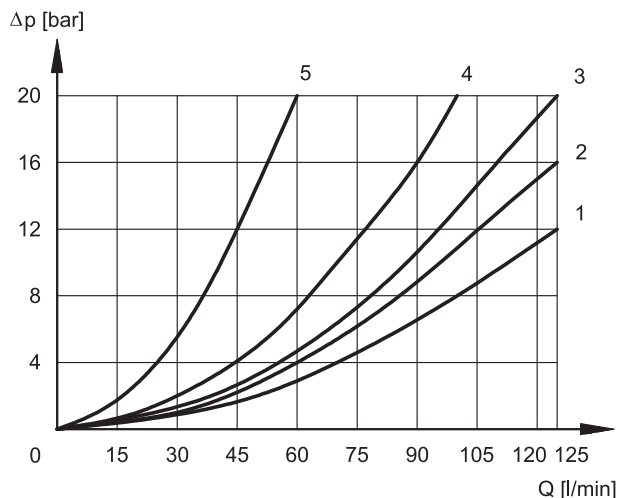


**Type TB:**  
1 solenoid side B  
2 external positions  
with return spring



**NOTE:** Others spools available on request only.

### 4 - PRESSURE DROPS $\Delta p$ -Q (obtained with viscosity of 36 cSt at 50 °C)



#### ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

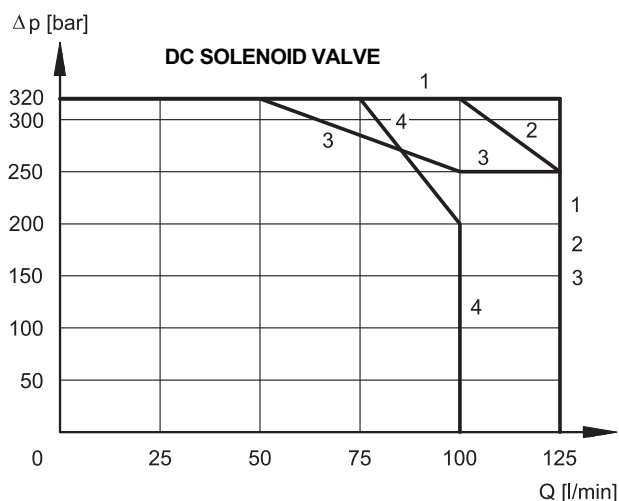
#### DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

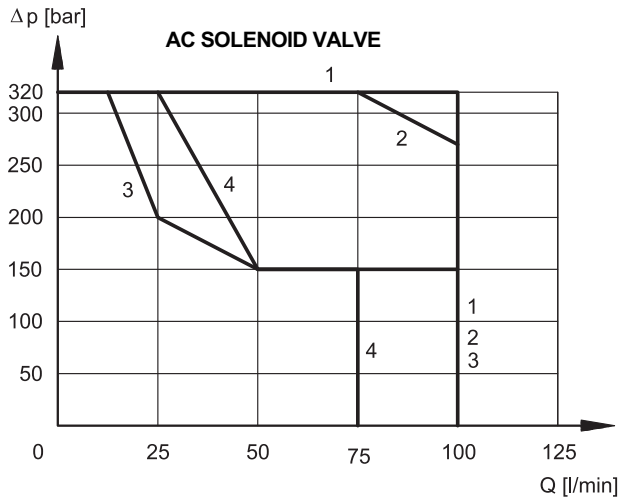
### 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

#### 5.1 - Standard operating limits



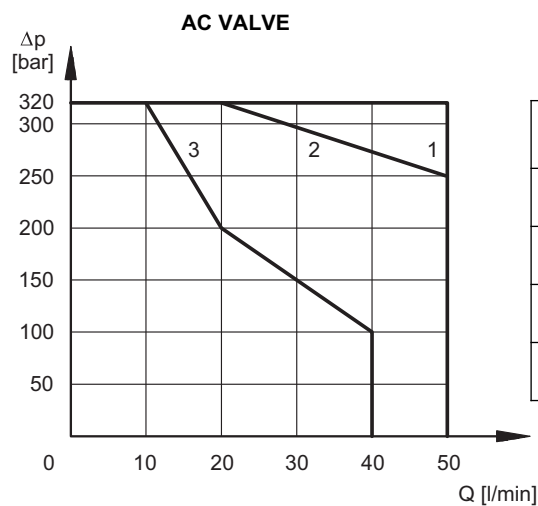
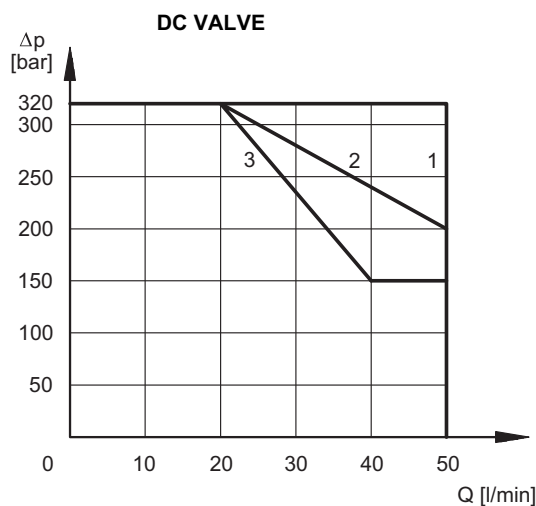
SPOOL	CURVE
S1, S2, RK, TA, TA23	1
S9, TA02	2
S3	3
S4	4



SPOOL	CURVE
S1, RK, TA, TA02, TA23	1
S2	2
S3, S9	3
S4	4

### 5.2 - 4-way valve in 3-way operation

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.



SPOOL	CURVE	
	DC	AC
TA backpr. A TB backpr. B	2	1
TA02 backpr. A TB02 backpr. B	1	1
TA backpr. B TB backpr. A	3	3
TA02 backpr. B TB02 backpr. A	2	2

### 6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	40 ÷ 90	20 ÷ 50
AC	15 ÷ 30	20 ÷ 50

## 7 - ELECTRICAL FEATURES

### 7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded ring, and can be rotated +/- 90°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) - NOTE</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95/EC
<b>CLASS OF PROTECTION : ATMOSPHERIC AGENTS EN 60529</b> Coil insulation (VDE 0580) Impregnation:	IP 65 (*) class H class H

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

**NOTE:** In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

### 7.2 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law:  $V = R \times I$

The table shows current and power consumption values for DC types.

	Resistance at 20°C [Ω] (±5%)	Current consumption [A] (±10%)	Power consumption [W] (±10%)	Coil code K1
<b>C22L5-D12K1</b>	2,9	4,14	50	1903150
<b>C22L5-D24K1</b>	12,3	1,95	47	1903151
<b>C22L5-D28K1</b>	16,8	1,67	47	1903152

### 7.3 - AC valve - Current and power consumption

In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end.

The table shows the values of absorption at the inrush and at holding.

	Freq. [VAC/Hz] (±10%)	Resistance at 20°C [Ω] (±5%)	Current consumption at inrush [A] (±10%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±10%) [VA]	Power consumption at holding (±10%) [VA]	Coil code K1
<b>C26L5-A24K1</b>	24/50	0,58	15,1	2,84	362,4	68,2	1931600
<b>C26L5-A48K1</b>	48/50	2,34	7,4	1,29	355,2	61,9	1931610
<b>C26L5-A110K1</b>	110/50-120/60	12,3	3,6 - 3,3	0,64 - 0,62	396	70,4 - 74,4	1931620
<b>C26L5-A230K1</b>	230/50-240/60	51,6	1,8 - 1,6	0,31 - 0,28	414 - 384	71,3 - 67,2	1931630

## 8 - ELECTRIC CONNECTORS

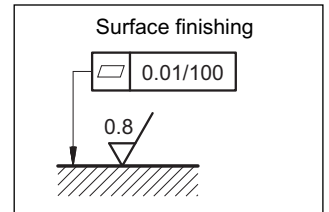
**The solenoid valves are not supplied with connector. Connectors must be ordered separately.**

For the identification of the connector type to be ordered, please see catalogue 49 000.

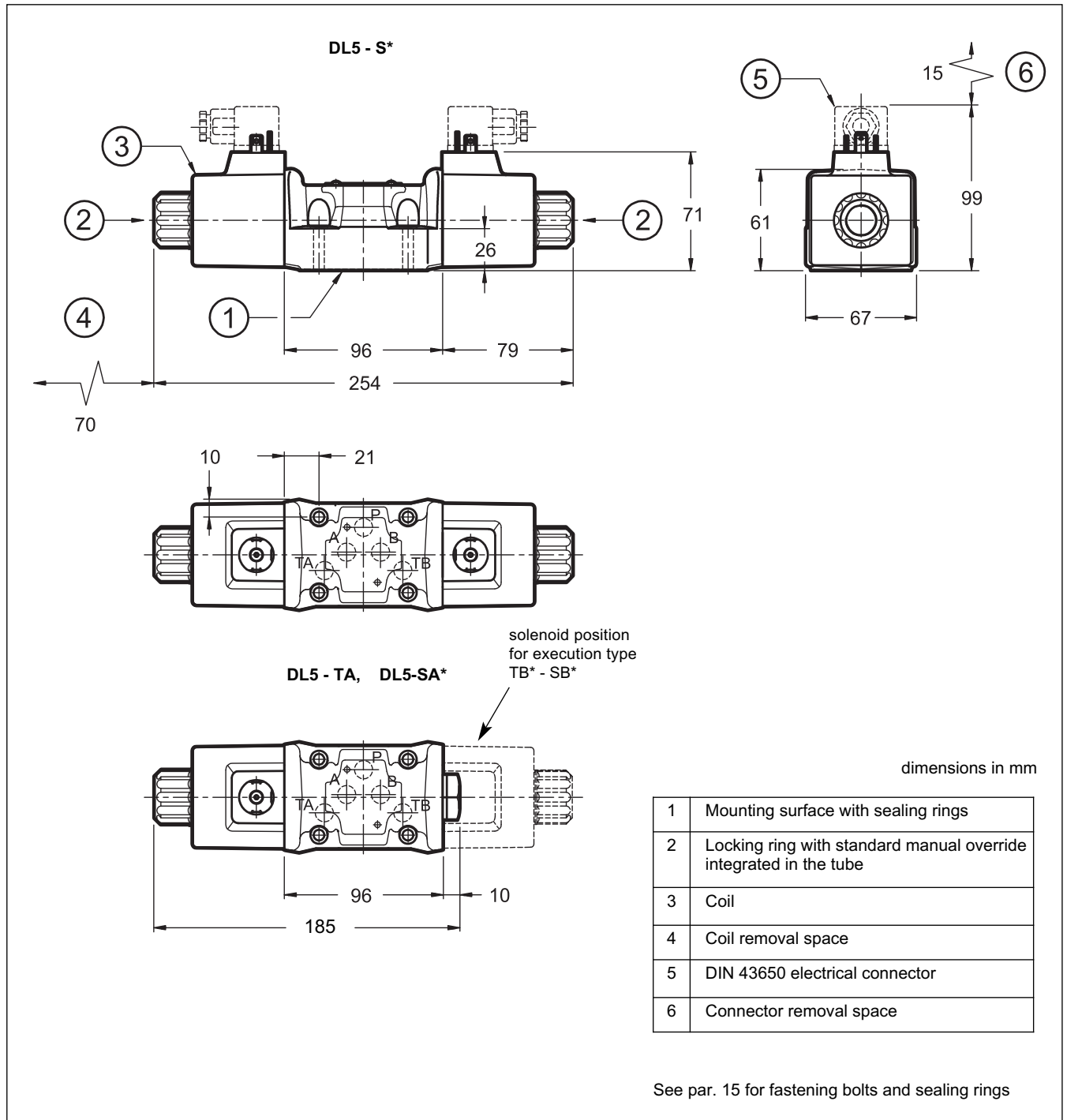
### 9 - INSTALLATION

The configuration with centering and return springs can be mounted in any position.

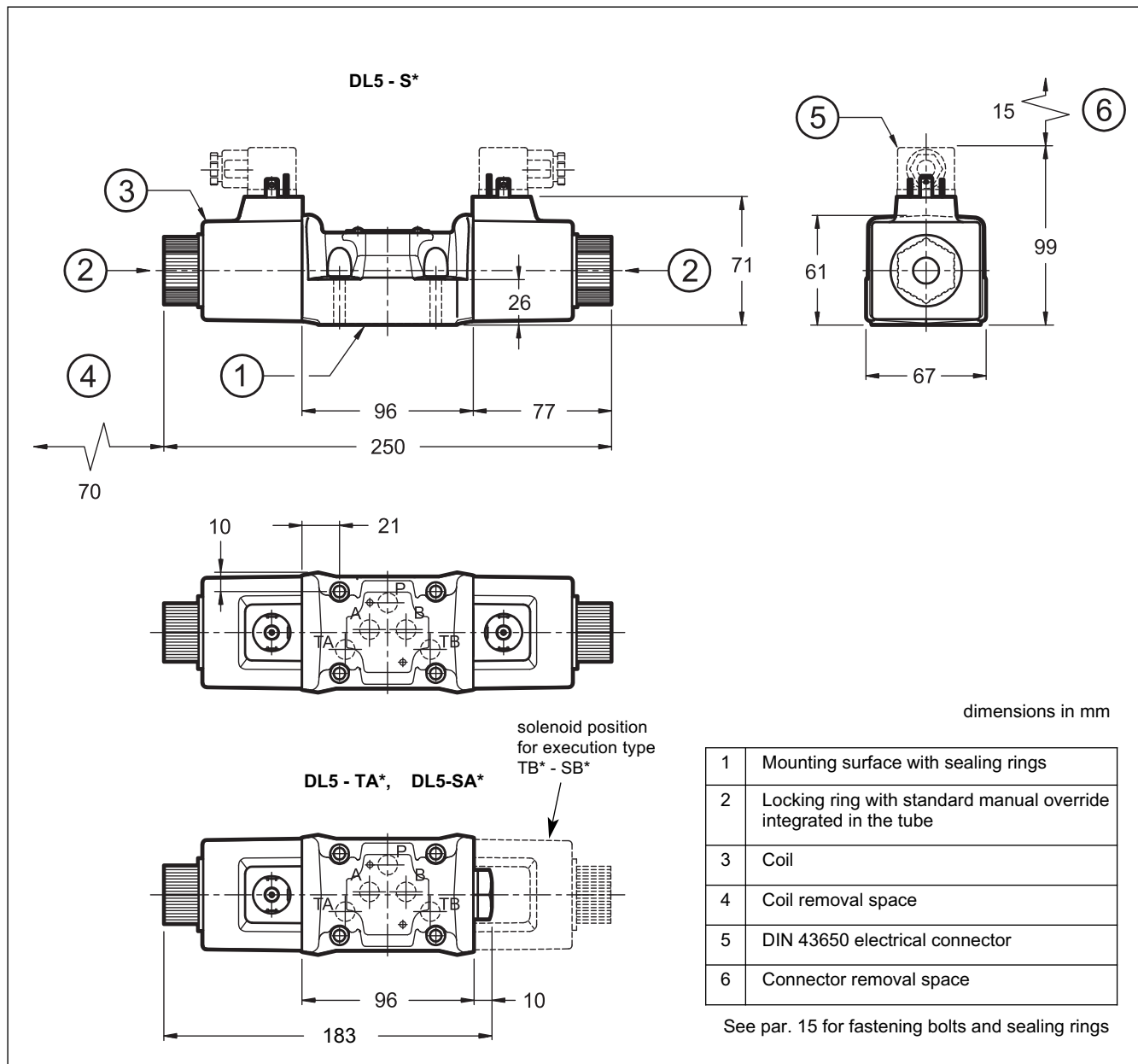
Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



### 10 - DL5 DC OVERALL AND MOUNTING DIMENSIONS



## 11 - DL5 AC OVERALL AND MOUNTING DIMENSIONS



## 12 - OPTIONAL MANUAL OVERRIDES

### 12.1 - Boot protected manual override (only for DC solenoid valve)

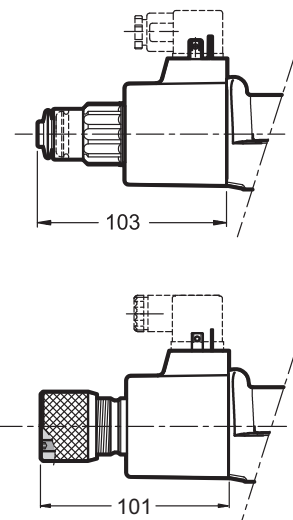
It can be ordered by entering the code **CM** in the identification code at par. 1, or is available as option to be ordered separately: code **3401150006**.

### 12.2 - Knob manual override (only for DC solenoid valve)

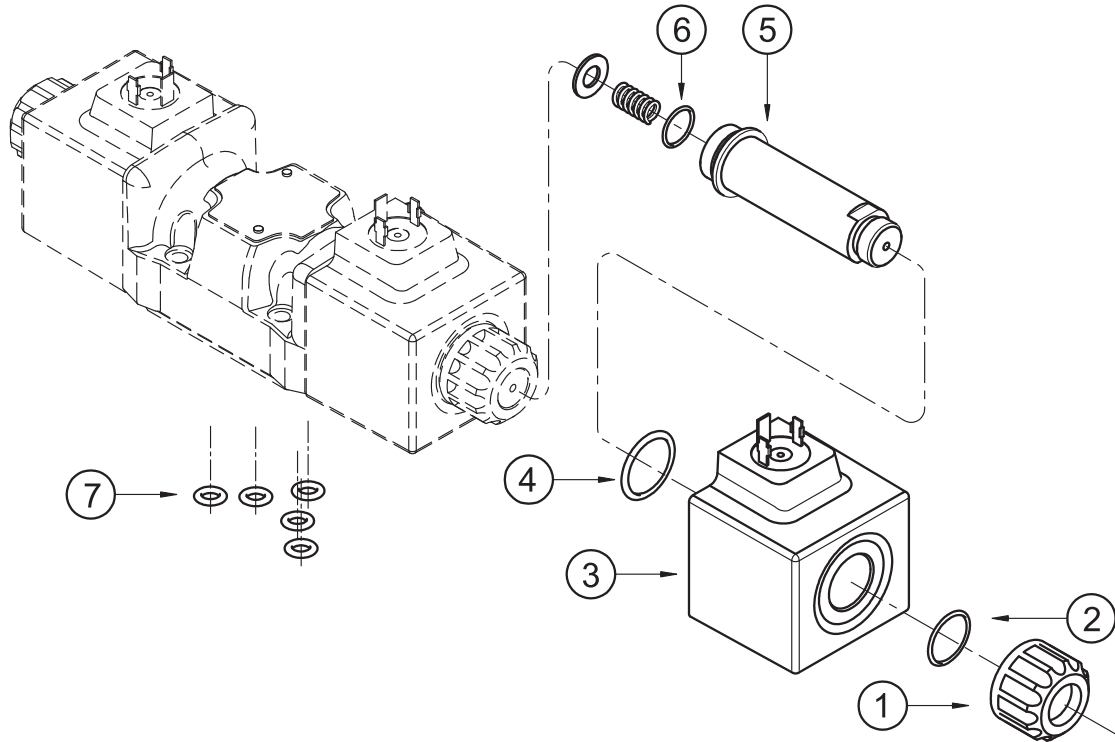
When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.

Spanner: 3 mm

The knob override can be ordered by entering the code **CK** in the identification code at par. 1, or is available as option to be ordered separately: code **3401150009**.



## 13 - SPARE PARTS FOR DC SOLENOID VALVE



### IDENTIFICATION CODE FOR DC AND RC COILS

**C 22 L5 - K1 / 10**

Supply voltage

**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V

Series no.:  
 (the overall and  
 mounting dimensions  
 remain unchanged  
 from 10 to 19)

Coil electrical connection:  
 plug for connector type  
 DIN 43650 (**standard**)

1	Coil locking ring - code 0119412
2	ORM-0220-20 - 70 shore
3	Coil (see identification code)
4	ORM-0296-24 (29.6x2.4) - 70 shore
5	Solenoid tube: TD22-DL5/10N (NBR seals) TD22-DL5/10V (FPM seals) (OR n° 6 included)
6	OR type 3.910 (19.18x2.46) - 70 shore
7	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

### SEAL KIT

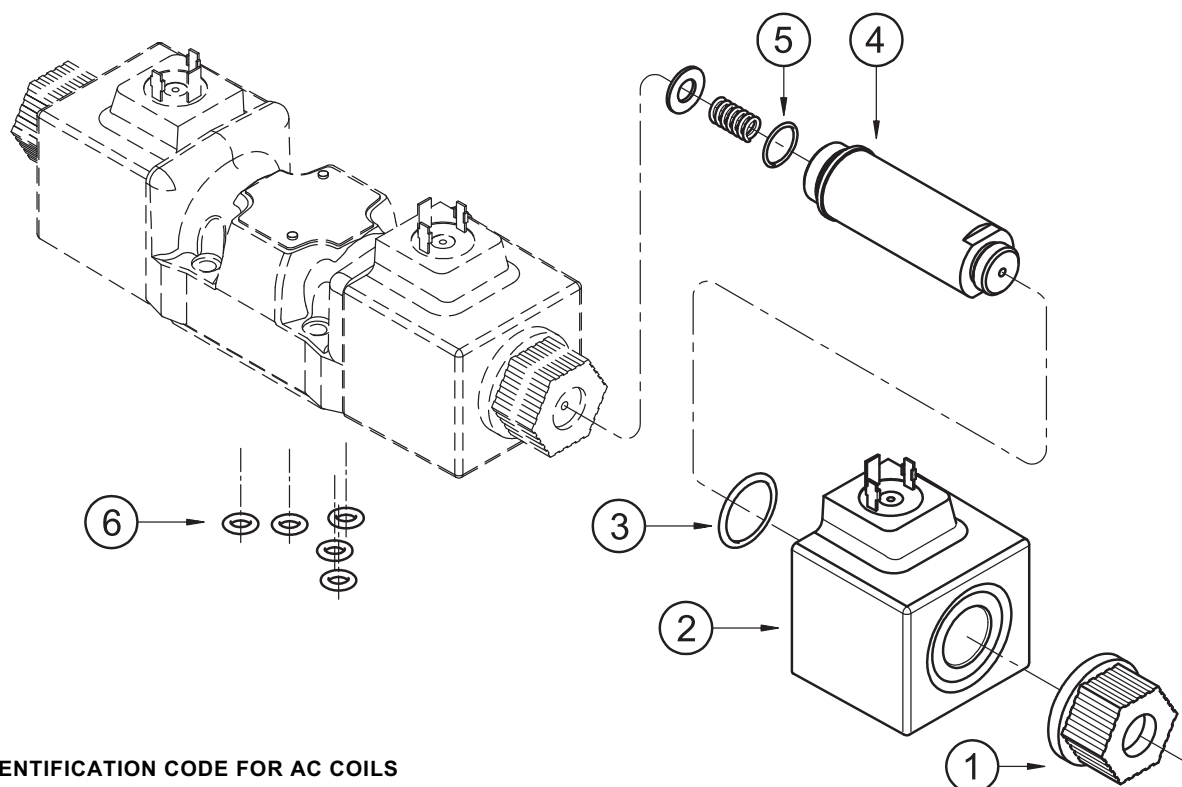
The codes included the OR n° 2, 4, 6 and 7.

**Cod. 1985447** NBR seals

**Cod. 1985448** FPM seals



## 14 - SPARE PARTS FOR AC SOLENOID VALVE



### IDENTIFICATION CODE FOR AC COILS

**C 26 L5 - K1 / 10**

Series no.:  
(the overall and  
mounting dimensions  
remain unchanged from  
10 to 19)

Coil electrical connection:  
plug for connector type  
DIN 43650 (standard)

Supply voltage

**A24** = 24 V - 50 Hz

**A48** = 48 V - 50 Hz

**A110** = 110 V - 50 Hz / 120 V - 60 Hz

**A230** = 230 V - 50 Hz / 240 V - 60 Hz

1	Coil locking ring - code. 0119480
2	Coil (see identification code)
3	ORM-0296-24 (29.6x2.4) - 70 shore
4	Solenoid tube: TA26-DL5/10N (NBR seals) TA26-DL5/10V (FPM seals) (OR n° 5 included)
5	OR type 3.910 (19.18x2.46) - 70 shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

### SEAL KIT

The codes included the OR n° 3, 5 and 6.

**Cod. 1985449** NBR seals

**Cod. 1985450** FPM seals

## 15 - FASTENING BOLTS AND SEALING RINGS

Single valve fastening: 4 SHC screws ISO 4762 M6x35

Tightening torque: 8 Nm

Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore

## 16 - SUBPLATES (see catalogue 51 000)

Type PMD4-AI4G with rear ports - port threading: 3/4" BSP

Type PMD4-AL4G with side ports - port threading: 1/2" BSP

**DIPLOMATIC**  
**OLEODINAMICA**

**DIPLOMATIC OLEODINAMICA S.p.A.**

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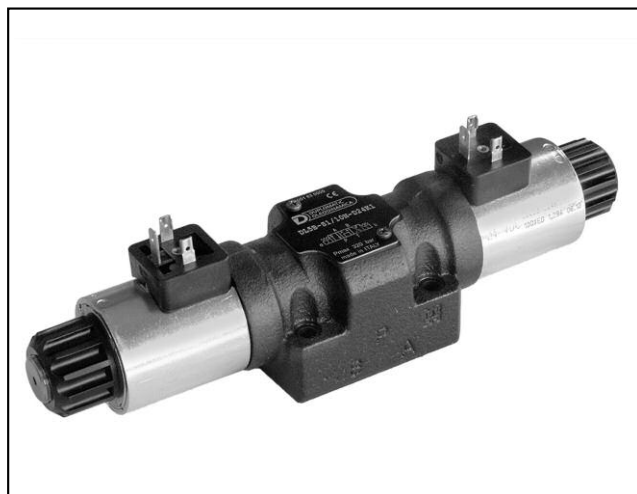
Tel. +39 0331.895.111

Fax +39 0331.895.339

www.diplomatic.com • e-mail: sales.exp@diplomatic.com

# DL5B

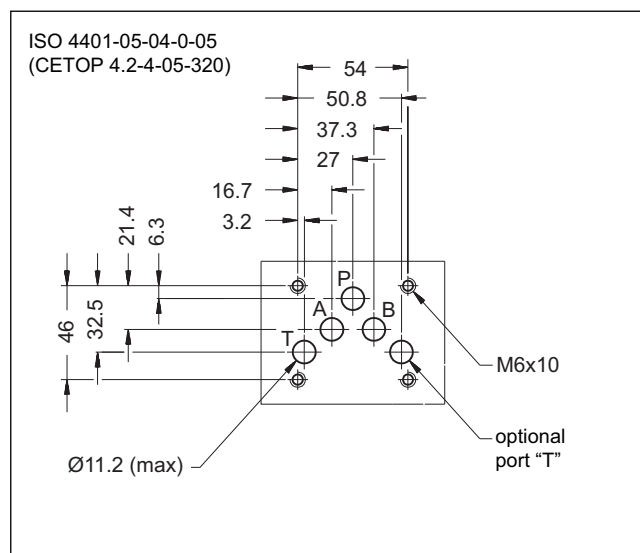
## SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION SERIES 10



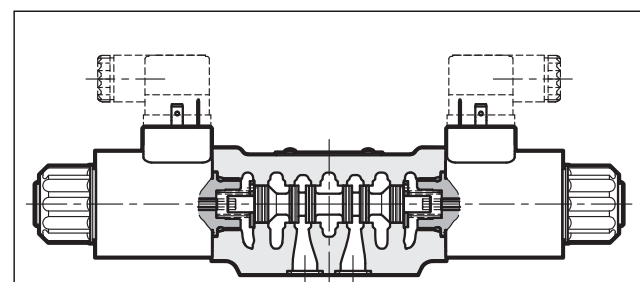
### SUBPLATE MOUNTING ISO 4401-05 (CETOP 05)

**p** max 320 bar  
**Q** max 125 l/min

### MOUNTING SURFACE



### OPERATING PRINCIPLE



- Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 (CETOP RP 121H) standards.
- The valve is suitable for special applications, guaranteed by the reduced solenoid dimensions.
- The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

### PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure: - ports P - A - B - port T	bar	320 210
Maximum flow rate	l/min	125
Pressure drop $\Delta p_Q$	see paragraph 4	
Operating limits	see paragraph 6	
Electrical features	see paragraph 7	
Electrical connections	see paragraph 9	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Masse: single solenoid valve double solenoid valve	kg	2,4 3

- The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.
- The valve is available with DC current solenoids only.
- The valve is also available with zinc-nickel coating that ensures a salt spray resistance up to 600 hours.
- Alternative to the standard manual override there are push, boot, knob and mechanical detent devices.



## 1 - IDENTIFICATION CODE

### 1.1 - Standard version

<b>D</b>	<b>L</b>	<b>5</b>	<b>B</b>	<b>-</b>		<b>/</b>	<b>10</b>		<b>-</b>			<b>/</b>		
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Solenoid operated directional control valve

Compact version

ISO 4401-05 (CETOP 05) size

Spool type (see paragraph 3):

**S\***      **TA\***  
**SA\***      **TB\***  
**SB\***      **RK**

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:

**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

**NOTE:** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to 240 hours.

For a salt spray resistance up to 600 hours order the high corrosion resistance version.

Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE**)  
Omit if not required

Manual override:  
Omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected  
**CP** = push manual override  
**CK** = knob manual override  
**CPK** = push manual override with mechanical retention

Coil electrical connection (see par. 9):  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K2** = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

DC power supply  
**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V  
**D00** = valve without coils (coils locking ring and related OR are supplied together with the valves.)

### 1.2 - High corrosion resistance version

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are specific for this version, featuring a zinc-nickel surface treatment. The coil for DEUTSCH connector has a diode inside. Electrical features at paragraph 7.2

The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it

<b>D</b>	<b>L</b>	<b>5</b>	<b>B</b>	<b>-</b>		<b>/</b>	<b>10</b>		<b>-</b>			<b>/</b>		<b>/</b>	<b>W7</b>
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Choices as in standard identification code

DC power supply  
**D12** = 12 V  
**D24** = 24 V

Coil electrical connection  
**WK1** = plug for connector type DIN 43650  
**WK7D** = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.  
Coil with diode.

Manual override:  
**CM** = manual override, boot protected (**standard**)  
**CP** = push manual override  
**CK** = knob manual override  
**CPK** = push manual override with mechanical retention

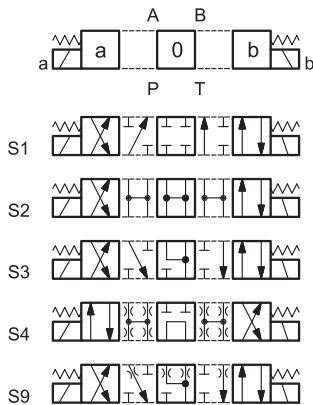
## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

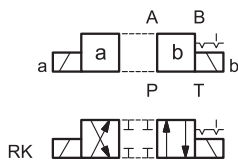
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - SPOOL TYPE

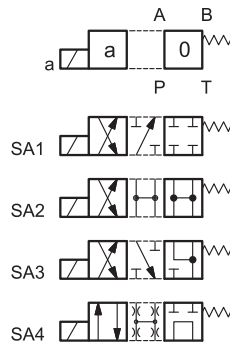
**Type S\*:**  
2 solenoids - 3 positions  
with spring centering



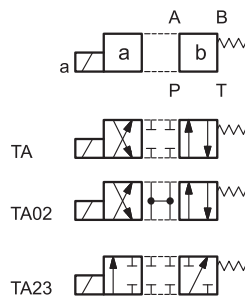
**Type RK:**  
2 solenoids - 2 positions  
with mechanical retention



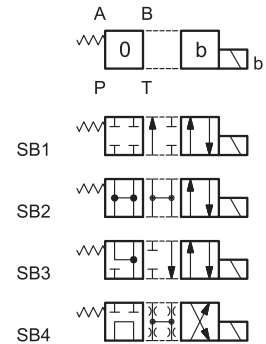
**Type SA\*:**  
1 solenoid side A  
2 positions (central + external)  
with spring centering



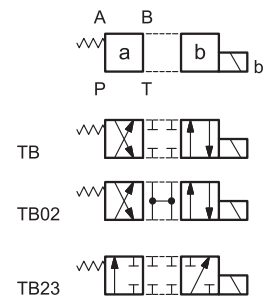
**Type TA:**  
1 solenoid side A  
2 external positions  
with return spring



**Type SB\*:**  
1 solenoid side B  
2 positions (central + external)  
with spring centering



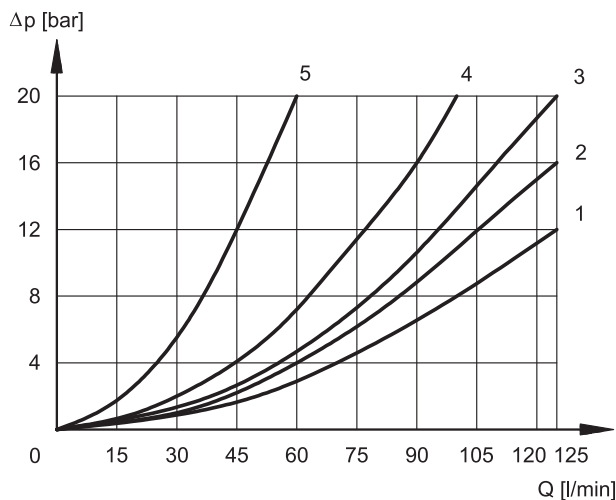
**Type TB:**  
1 solenoid side B  
2 external positions  
with return spring



**NOTE:** Others spools available on request only.

### 4 - PRESSURE DROPS $\Delta P-Q$

(obtained with viscosity of 36 cSt at 50 °C)



#### ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
S9	1	1	1	1
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

#### DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

### 5 - SWITCHING TIMES

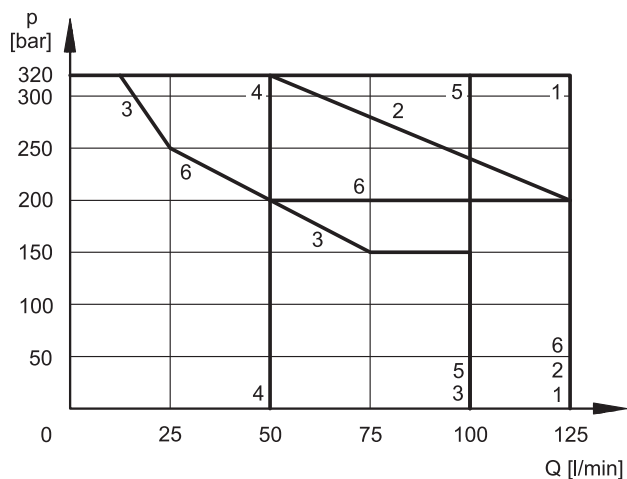
The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES ( $\pm 10\%$ ) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	70 ÷ 100	15 ÷ 20

### 6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

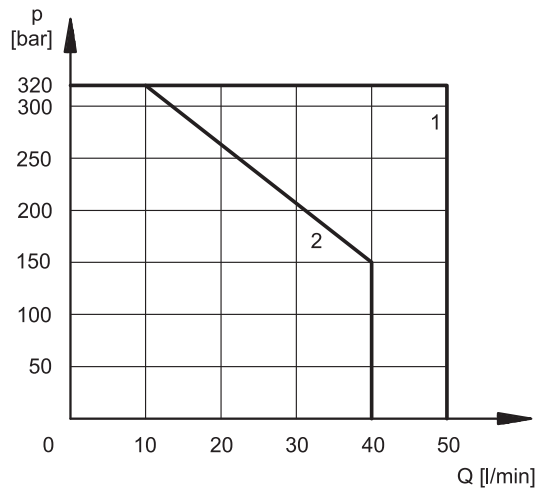
The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page.



SPOOL	CURVE
S1, S2, RK	1
TA02	2
S3	3
S4	4
TA, TA23	5
S9	6

### 6.1 - 4-way valve in 3-way operation

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.



SPOOL	CURVE
TA	1
TA02	2

## 7 - ELECTRICAL FEATURES

### 7.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring. The coils are interchangeable.

#### Protection from atmospheric agents EN 60529

Plug-in type	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K2 AMP JUNIOR	x	x (*)	
K7 DEUTSCH DT04 male	x	x	x (*)

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

**NOTE:** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95/EC
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation:	class H class F

### 7.2 Coils - current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law:  $V = R \times I$

The WK1 and WK7D are coils specific for the high corrosion resistance version of the valve.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

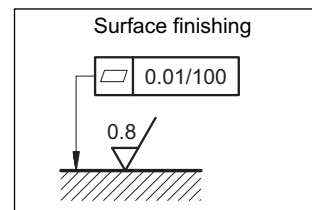
(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code				
					K1	WK1	K2	K7	WK7D
<b>D12</b>	12	4,4	2,72	32,7	1903080	1903050	1903100	1902940	1903400
<b>D24</b>	24	18,6	1,29	31	1903081	1903051	1903101	1902941	1903401
<b>D28</b>	28	26	1,11	31	1903082			-	

### 8 - INSTALLATION

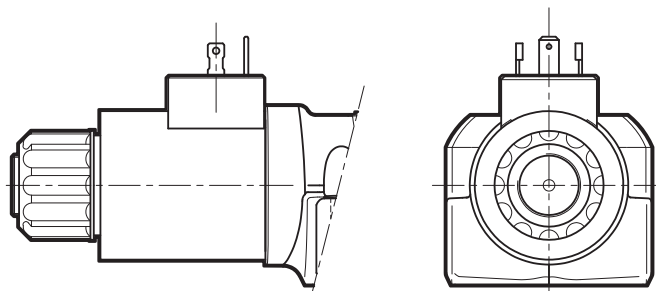
The configuration with centering and return springs can be mounted in any position.

Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

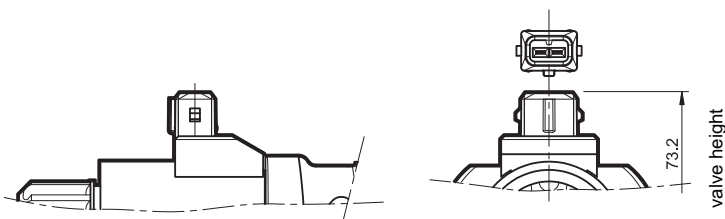


### 9 - ELECTRIC CONNECTIONS

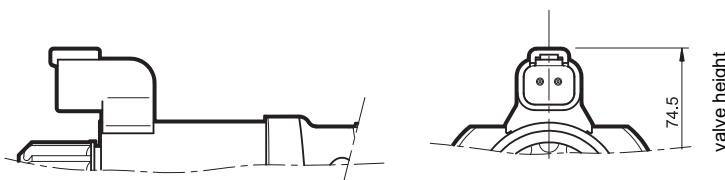
connection for DIN 43650  
connector  
code **K1** (standard)  
code **WK1** (W7 version only)



connection for AMP JUNIOR  
connector  
code **K2**



connection for  
DEUTSCH DT06-2S male connector  
code **K7**



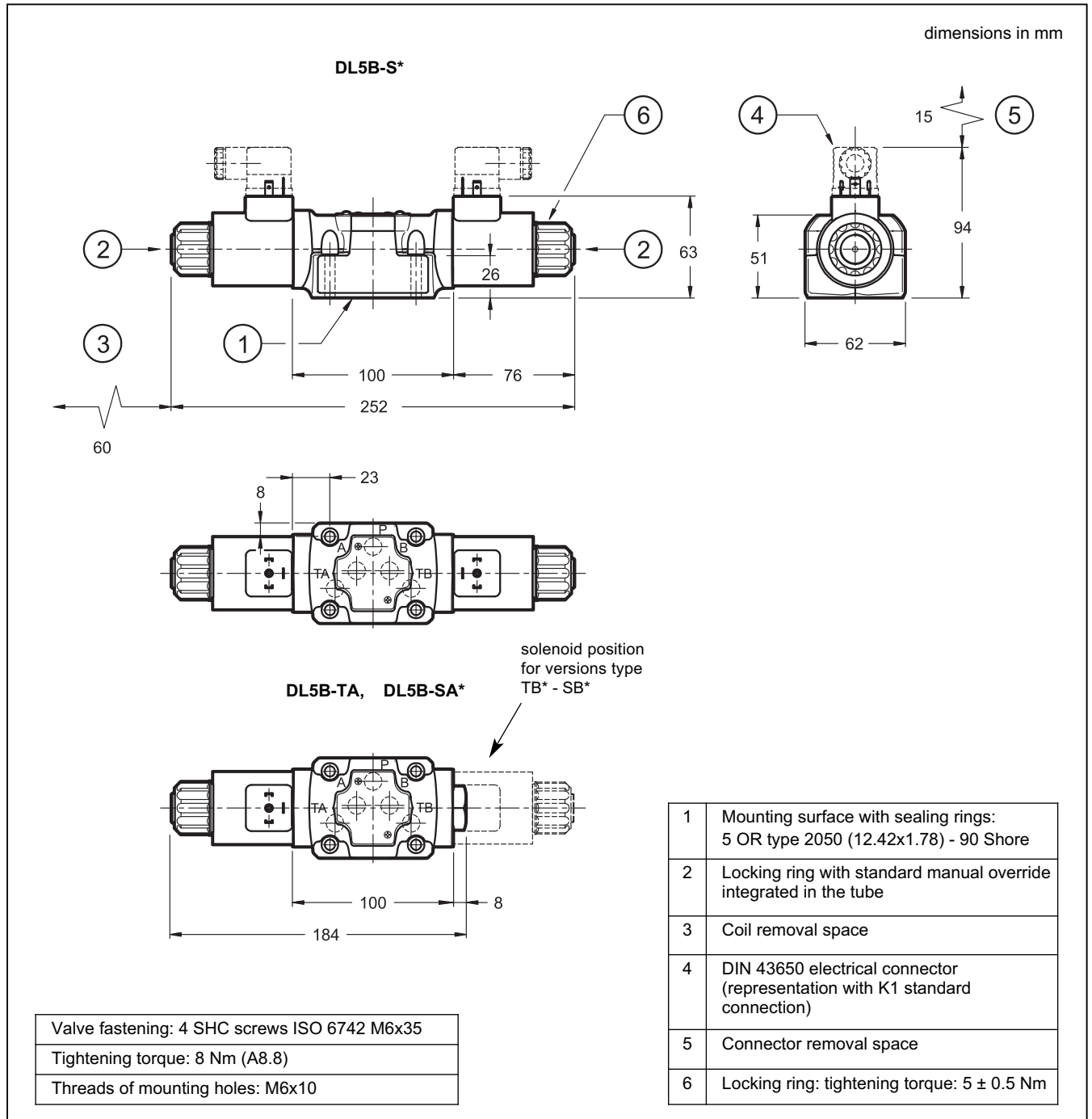
connection for  
DEUTSCH DT06-2S male  
connector - coil with diode  
code **WK7D** (W7 version only)



### 10 - ELECTRIC CONNECTORS

The valves are delivered without connector. Connectors for K1 connections (DIN 43650) can be ordered separately. See catalogue 49 000.

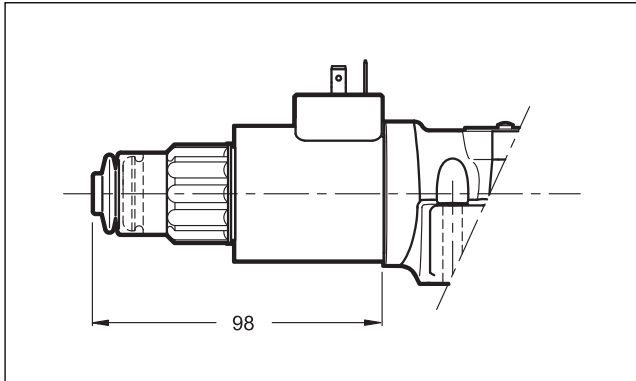
## 11 - DL5B OVERALL AND MOUNTING DIMENSIONS



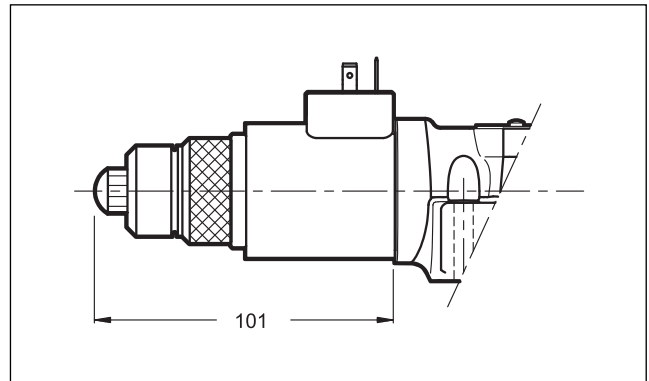


## 12 - MANUAL OVERRIDES

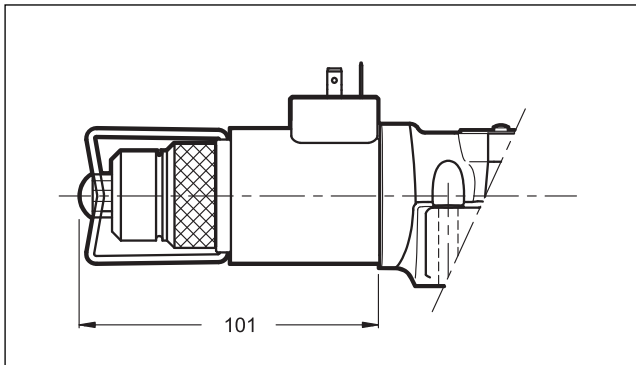
### 12.1 - CM manual override, boot protected



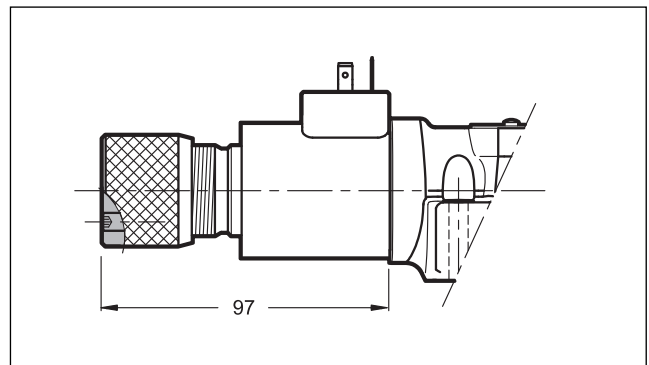
### 12.2 - CP Push manual override



### 12.3 - CPK Push manual override with mechanical retention



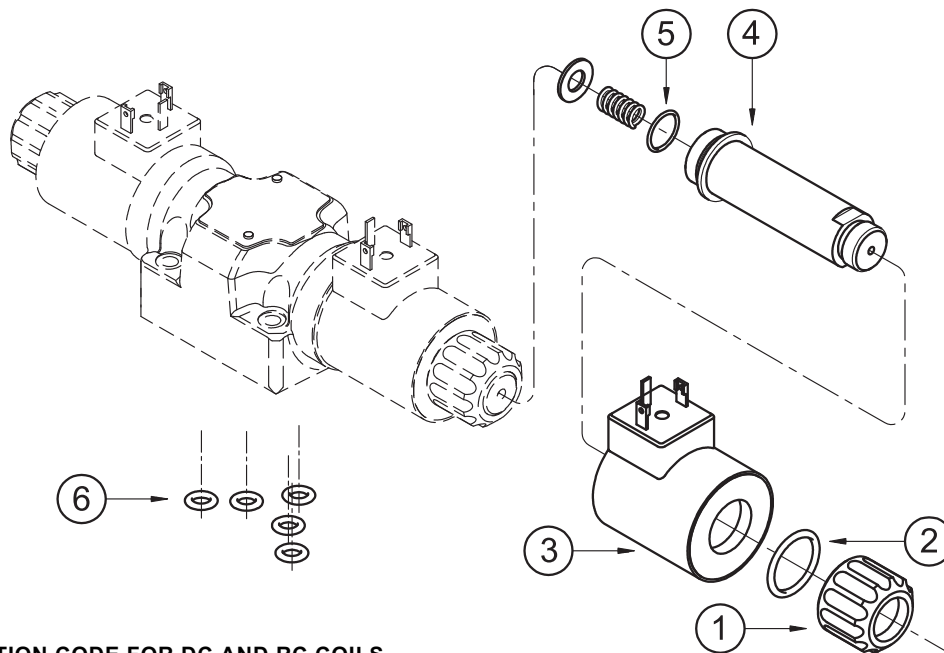
### 12.4 - CK Knob manual override



When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Spanner: 3 mm

## 13 - SPARE PARTS FOR DC SOLENOID VALVE



### IDENTIFICATION CODE FOR DC AND RC COILS

**C 22 S3 - /**

Supply voltage

**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V

Series no.:

**10** = for K7  
**11** = for K1, WK1, K2 and WK7D  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

Coil electrical connection (see par. 9):

**K1** = plug for connector DIN 43650  
**K2** = plug for connector AMP JUNIOR (available on **D12** and **D24** coils only)  
**K7** = plug DEUTSCH DT04-2P for male connector DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

**For W7 version only (D12 and D24 only)**

**WK1** = plug for connector DIN 43650  
**WK7D** = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.

1	Coil locking ring - code 0119412 tightening torque: 5 ±0.5 Nm
2	ORM-0220-20 - 70 shore
3	Coil (see identification code)
4	Solenoid tube: TD22-DL5/10N (NBR seals) TD22-DL5/10V (FPM seals) (OR n° 6 included)
5	OR type 3.910 (19.18x2.46) - 70 shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

### SEAL KIT

The codes included the OR n° 2, 5, and 6.

**Cod. 1985461** NBR seals

**Cod. 1985462** FPM seals

## 14 - SUBPLATES

(See catalogue 51 000)

Type PMD4-AI4G with rear ports - threading: 3/4" BSP

Type PMD4-AL4G with side ports - threading: 1/2" BSP



# DL5B

SERIES 10



**DUPLOMATIC  
OLEODINAMICA**

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# MDS5

## SOLENOID OPERATED SWITCHING VALVE

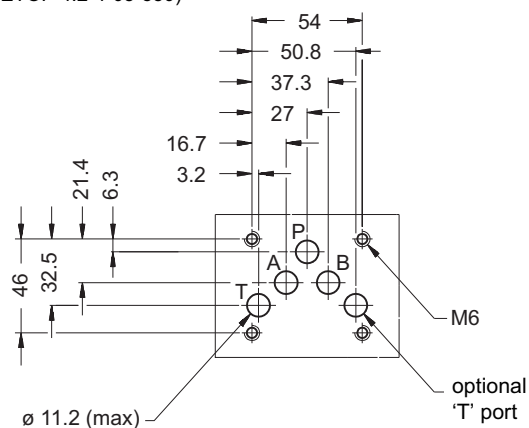
### SERIES 10

#### MODULAR VERSION ISO 4401-05

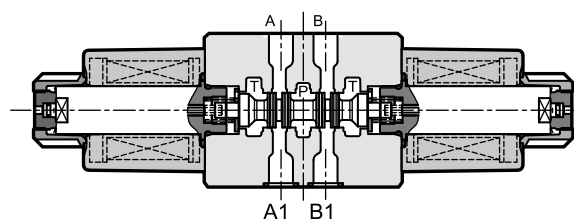
**p** max **350** bar  
**Q** max **100** l/min

#### MOUNTING INTERFACE

ISO 4401-05-04-0-05  
(CETOP 4.2-4-05-350)



#### OPERATING PRINCIPLE



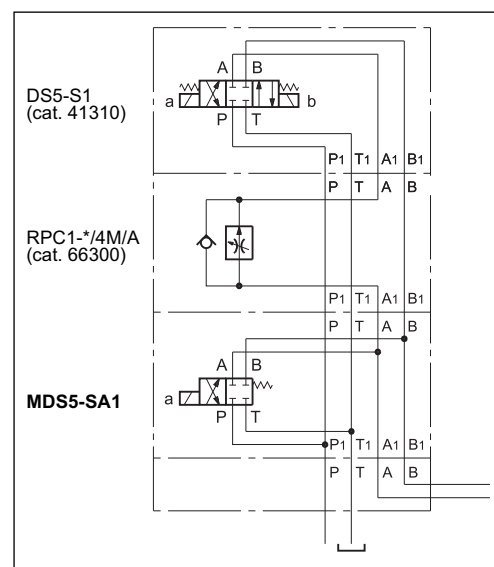
- The MDS5 valve is used to switch multiple flow directions, or to select pressure values. Application example here below.
- The flow paths pass right through the entire valve body and due to this particular design, the MDS5 can be assembled with all ISO 4401-05 modular valves.
- The special connection of the valve in parallel to the P - T A - B lines of the circuit allows easy construction of different hydraulic configurations, reducing the pressure drops to a minimum.

#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C )

Max operating pressure:		
P - A - B ports	bar	350
T port (DC version)		210
T port (AC version)		160
Maximum flow on P - A - B ports	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: double solenoid	kg	4,6
single solenoid		3,7

#### APPLICATION EXAMPLE



## 1 - IDENTIFICATION CODE

<b>MDS</b>	<b>5</b>	-		/ 10	-		<b>K1</b>	/	
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Modular switching valve \_\_\_\_\_

Size: ISO 4401-05 \_\_\_\_\_

Spools (see paragraph 2): \_\_\_\_\_

**S1**      **SA1**      **SB1**  
**TA**      **TB**

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19) \_\_\_\_\_

Seals: \_\_\_\_\_

**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Option : manual override  
Omit for override integrated in the tube (**standard**)  
For DC version only:  
**CM** = boot protected.  
**CK** = knob  
**Details in catalogue 41 330.**

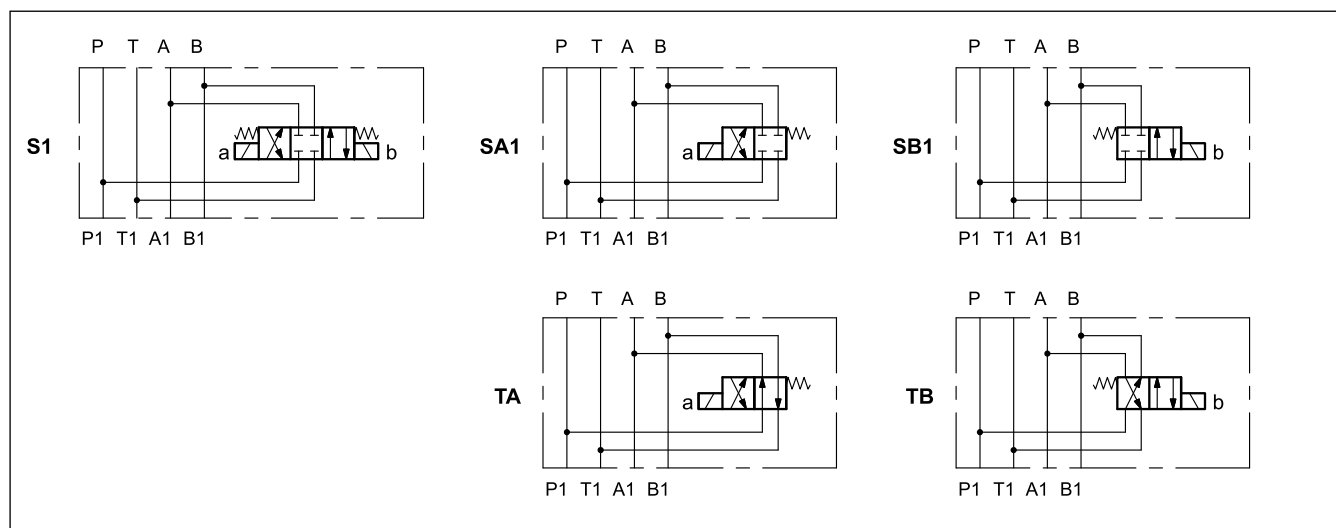
Coil electrical connection  
plug for connector type DIN 43650

Power supply:  
**Details of electrical features are in catalogue 41 330.**

DC power supply  
**D12** = 12 V  
**D24** = 24 V

AC power supply  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz

## 2 - SPOOLS



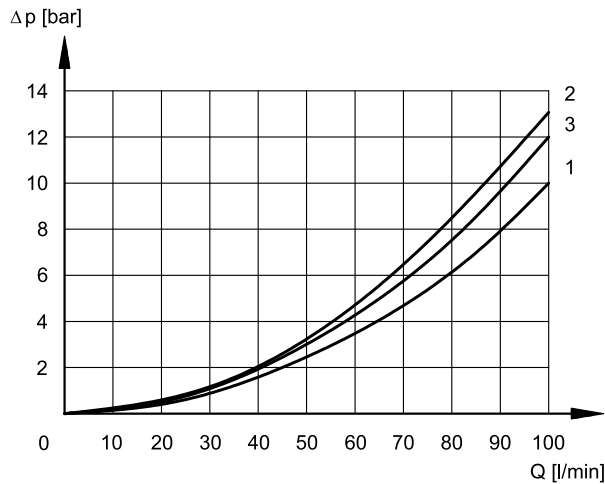
## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

#### 4 - PRESSURE DROPS $\Delta P-Q$

(obtained with viscosity of 36 cSt at 50 °C)



#### ENERGIZED VALVE

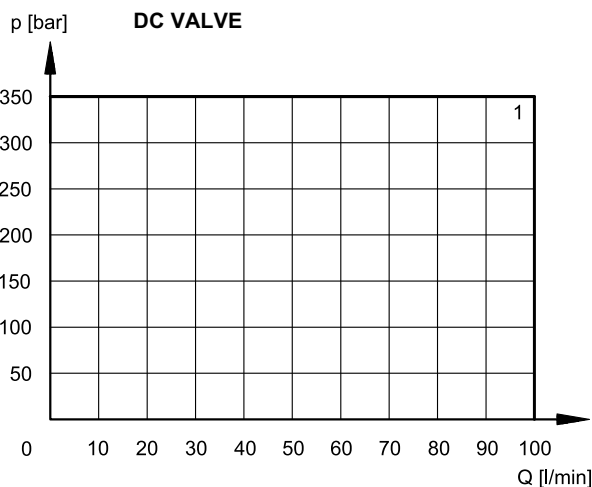
SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	3	2	1	1

#### 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve.

**The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.**

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, TA	1

#### 6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

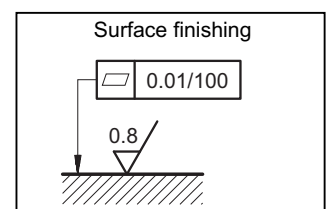
SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	40 ÷ 90	20 ÷ 50
AC	15 ÷ 30	20 ÷ 50

#### 7 - INSTALLATION

The valve can be mounted in any position.

Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

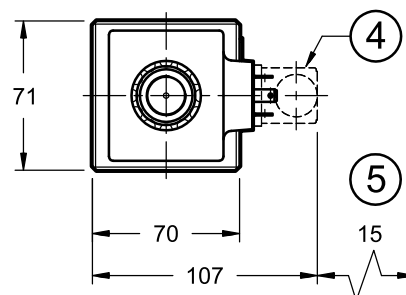
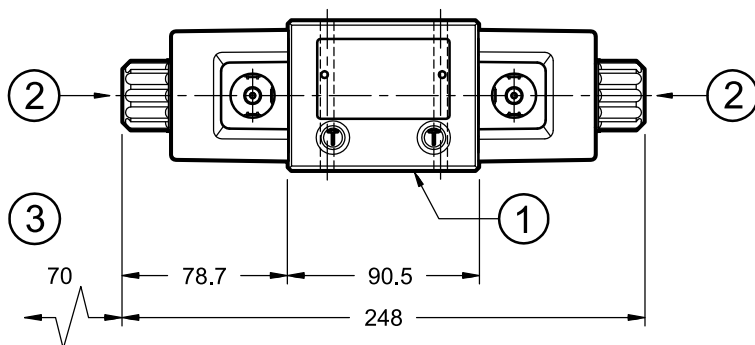
If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



## 8 - OVERALL AND MOUNTING DIMENSIONS

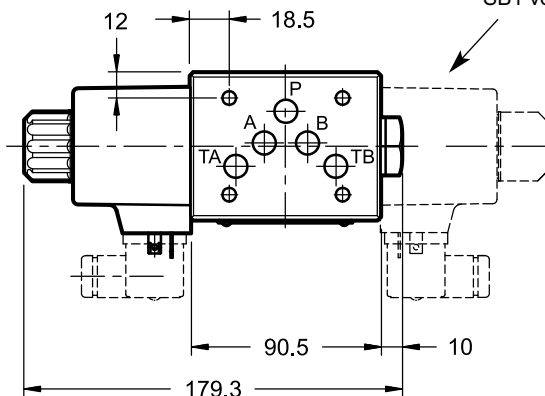
dimensions in mm

**MDS5-S1/10\*-D\***

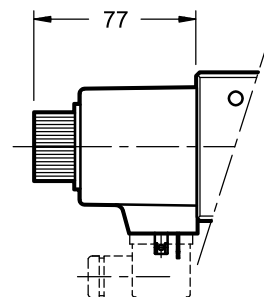


**MDS5-TA/10\*-D\***

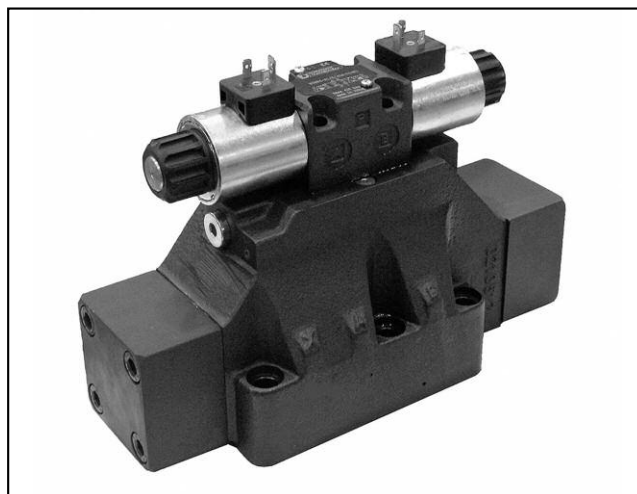
solenoid position for TB,  
SB1 version



**MDS5-\*/10\*-A\***



1	Mounting surface with sealing rings: N° 5 OR 2050 (12.42x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil removal space
4	DIN 43650 electrical connector to be ordered separately (see cat. 49 000)
5	Connector removal space



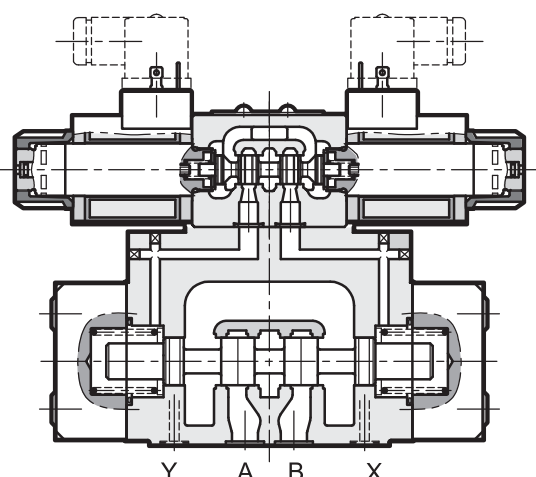
# E\*P4

## PILOT OPERATED DISTRIBUTOR SOLENOID OR HYDRAULIC (C\*P4) CONTROLLED

**E4P4 CETOP P05**  
**E4R4 ISO 4401-05**  
**E5 ISO 4401-08**

**p** max (see table of performances)  
**Q** max (see table of performances)

### OPERATING PRINCIPLE



- The E\*P4 piloted valves are constituted of a 4-way hydraulic operated distributor with a mounting surface in accordance with the ISO 4401 standards, operated by a ISO 4401-03 solenoid directional valve.
- They are made in CETOP P05 and ISO 4401-05 sizes with flow rates up to 150 l/min, and in ISO 4401-08 size with flow rates up to 600 l/min.
- They are available with different spool types (see par. 2) and with some options for the opening control.
- They are available with both the solenoid and the hydraulic control from the X and Y ways.
- A version for high pressures (H) is available.
- It is available also with zinc-nickel surface treatments, that ensures a salt spray resistance up to 600 hours.

### PERFORMANCES

(obtained with mineral oil of viscosity of 36 cSt at 50°C)

		E4*4	E4HP4	E5P4	E5HP4
Maximum operating pressure - ports P - A - B - port T (external drainage) - port T (internal drainage) (DC / AC)	bar	320 210 210 / 160	420 350 210 / 160	320 210 210 / 160	420 350 210 / 160
Maximum flow rate from port P to A - B - T	l/min	150		600	
Ambient temperature range	°C	-20 / +50			
Fluid temperature range	°C	-20 / +80			
Fluid viscosity range	cSt	10 ÷ 400			
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15				
Recommended viscosity	cSt	25			
Mass: E*P4-S, RK E*P4-TA/TC	kg	7 6,4		15,6 15,0	



## 1 - IDENTIFICATION CODE FOR SOLENOID CONTROLLED DISTRIBUTOR

<b>E</b>		<b>P</b>	<b>4</b>	<b>-</b>		<b>/</b>				<b>/</b>		<b>-</b>			<b>/</b>	
----------	--	----------	----------	----------	--	----------	--	--	--	----------	--	----------	--	--	----------	--

Directional valve, solenoid controlled, pilot operated

Size: \_\_\_\_\_

**4** = CETOP P05  
**5** = ISO 4401-08 (CETOP 08)

Option \_\_\_\_\_

(Omit for standard version)  
**H** = high pressure version  
p<sub>max</sub> = 420 bar  
**E4HP4-S4 not available**

**P** = Subplate mounting  
**R** = Mounting interface  
ISO 4401-05-05-0-05  
(for E4 only - not available for high pressure version H)

Number of ways \_\_\_\_\_

Spool type (see par. 2): \_\_\_\_\_

**S\***      **TA\***  
**\*TA**      **TC\***  
**\*TC**      **RK\***

Options - see par. 10 (omit if not required): \_\_\_\_\_

**C** = main spool stroke control  
**D** = main spool shifting speed control  
**G** = main spool stroke and shifting speed control  
**PF** = subplate with restrictor Ø0,8 on port P placed under solenoid valve

Piloting: \_\_\_\_\_

Omit for internal piloting  
**E** = external pilot  
Mandatory for spools types: S2 - S4 - S7 - S8 - TA002 - TC002 - RK002.  
With these spools the internal piloting is possible only with E5 valve with C3 option.

Drainage: \_\_\_\_\_

Omit for external drainage, which is recommended when the valve is used with backpressure on the tank line.  
**I** = internal drainage

Option: \_\_\_\_\_

**/ C3** = Check valve incorporated on line P setting 5 bar  
**Option available for E5 valves only. See paragraph 8.1**

Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE 2**)  
Omit if not required

Manual override:  
omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected (see paragraph 16)

Coil electrical connection (see par. 14):  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on D12 and D24 coils only)

Power supply (see paragraph 9)  
direct current  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
**D220** = 220 V  
**D00** = valve without coils (see **NOTE 1**)

alternate current  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see **NOTE 1**)  
**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Series No.:  
**50** - for valve E4  
**40** - for valve E5  
(the overall and mounting dimensions within the same ten remain unchanged)

**NOTE 1:** Coils locking ring and related OR are supplied together with valves.

**NOTE 2:** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body (both main and pilot) makes the valve suitable to ensure a salt spray resistance up to **240** hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For a salt spray resistance up to **600** hours refer to paragraph 1.1.

## 1.1 - High corrosion resistance version

This version, available for the basic valve (without option of par. 10) features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are DC only and specific for this version, featuring a zinc-nickel surface treatment. The coil for DEUTSCH connector has a diode inside. Electrical features at paragraph 9.2. The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it

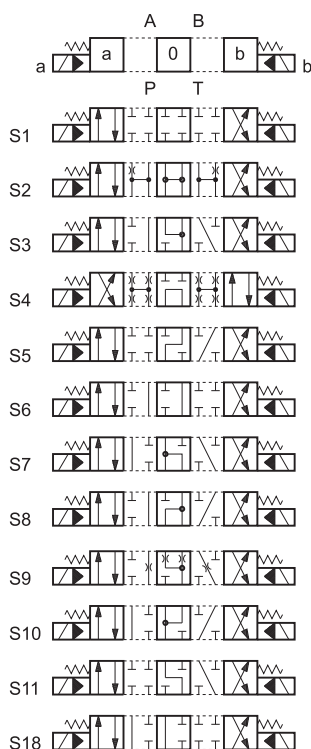
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>E....</b> </div> <p>Choices as in standard identification code</p> <p>DC power supply</p> <p><b>D12</b> = 12 V      <b>D24</b> = 24 V</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>/</b> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>/</b> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>CM</b> </div> <p>Manual override, boot protected</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>/</b> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>W7</b> </div> <p>Coil electrical connection (see par. 15)  <b>WK1</b> = plug for connector type DIN 43650  <b>WK7D</b> = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.</p>
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## 2 - SPOOLS TYPES

Symbols are referred to the solenoid valve **E\***. For the hydraulic operated version **C\*** please verify the connection scheme (see par. 4).

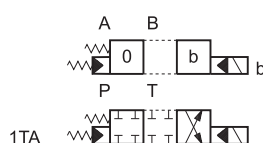
### Type S:

3 positions with spring centering



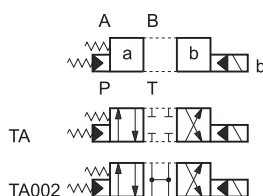
### Type \*TA:

2 positions (central + external) with spring centering



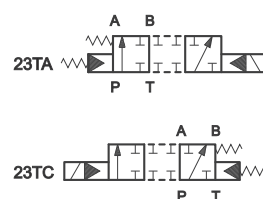
### Type TA:

2 external positions with return spring



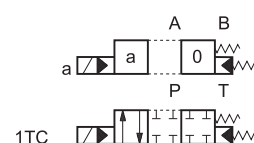
### Type 23 (TA/TC):

3-way, 2 external positions with return spring



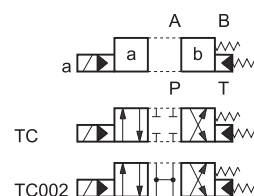
### Type \*TC:

2 positions (central + external) with spring centering



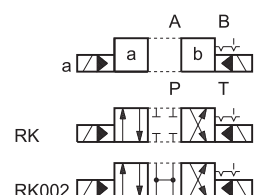
### Type TC:

2 external positions with return spring



### Type RK:

2 positions with mechanical detent on pilot valve



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

## 3 - IDENTIFICATION CODE FOR HYDRAULIC CONTROLLED DISTRIBUTOR C\*P4

<b>C</b>			<b>P</b>	<b>4</b>	-			/	<b>E</b>	/		
----------	--	--	----------	----------	---	--	--	---	----------	---	--	--

Hydraulic operated directional valve through X and Y lines

Size: \_\_\_\_\_  
**4** = CETOP P05  
**5** = ISO 4401-08 (CETOP 08)

Option (Omit for standard version) \_\_\_\_\_  
**H** = high pressure version pmax = 420 bar  
**C4HP4-S4 not available**

Mounting: \_\_\_\_\_  
**P** = Subplate mounting  
**R** = Mounting interface ISO 4401-05-05-0-05 (CETOP R05) only for C4 standard valve.

Number of ways \_\_\_\_\_

Spool type (see paragraph 2) \_\_\_\_\_  
**S\***      **TA\***  
**\*TA**      **TC\***  
**\*TC**

Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE**)  
 Omit if not required

Seals:  
 omit for mineral oils (**standard**)  
**V** = FPM seals for special fluids

Series No.:  
**43** - for valve C4  
**34** - for valve C5  
 (the overall and mounting dimensions within the same ten remain unchanged)

External piloting  
 External drainage  
 (see paragraph 8)

**Spool type**  
 The distributor is delivered with short-circuit subplate. The X and Y ports are used for the hydraulic control of the valve.

C\*P4-S\*

C\*P4-TA

C\*P4-TC

**Overall dimensions**

## 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N for solenoid controlled distributors, omit for hydraulic controlled). For fluids HFDR type (phosphate esters) use FPM seals (code V).

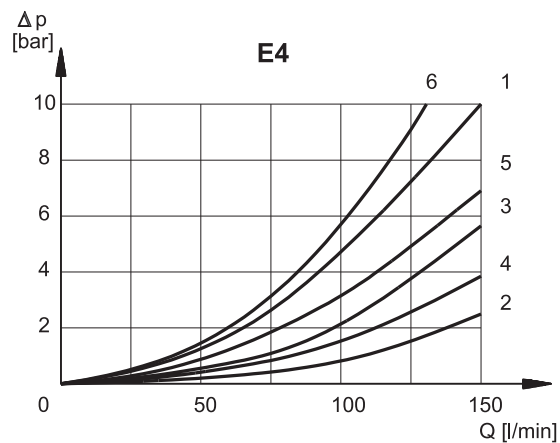
For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 5 - PRESSURE DROPS $\Delta p$ -Q

(values obtained with viscosity 36 cSt at 50 °C)

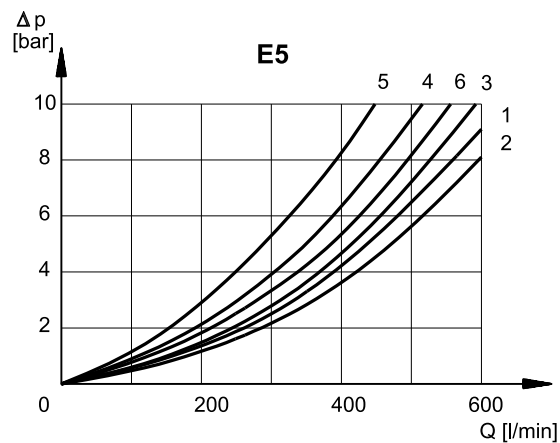
### 5.1 - Pressure drops E4P4



SPOOL TYPE	SPOOL POSITION	E4					
		CONNECTIONS					
		P → A	P → B	A → T	B → T	P → T	
		CURVES ON GRAPH					
S1	Energized	1	1	2	3		
S2	De-energized Energized	5	5	2	4	6*	
S3	De-energized Energized	1	1	1* 2	1° 4		
S4	De-energized Energized	6	6	3	5	6	
S5	De-energized Energized	1	1 5	2	3		
S6	De-energized Energized	1	1	2	1 4		
S7	De-energized Energized	6	6	3	5	6°	
S8	De-energized Energized	6	6	3	5	6*	
S9	Energized	1	1	2	2		
S10	De-energized Energized	1° 5	1° 5	2	3		
S11	De-energized Energized	1	1	1 2	3		
S18	De-energized Energized	5 5	1	2	3		
TA	De-energized Energized	1	1	4	3		
RK	Energized	1	1	4	3		

\* A-B blocked • B blocked ° A blocked

### 5.2 - Pressure drops E5P4



SPOOL TYPE	SPOOL POSITION	E5				
		CONNECTIONS				
		P → A	P → B	A → T	B → T	P → T
		CURVES ON GRAPH				
S1	Energized	1	1	2	3	
S2	De-energized Energized	2	2	1	2	6*
S3	De-energized Energized	1	1	4* 1	4° 2	
S4	De-energized Energized	6	6	3	4	5
S5	De-energized Energized	1	4 2	2	3	
S6	De-energized Energized	1	1	2	4 2	
S7	De-energized Energized	6	6	3	4	5°
S8	De-energized Energized	6	6	4	3	5*
S9	Energized	1	1	2	3	
S10	De-energized Energized	4* 2	4° 2	2	3	
S11	De-energized Energized	1	1	3 1	3	
S18	De-energized Energized	4 2	1	2	3	
TA	De-energized Energized	1	1	2	3	
RK	Energized	1	1	2	3	

\* A-B blocked • B blocked ° A blocked

## 6 - SWITCHING TIMES

### 6.1 - E4P4

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

E4				
TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
CA solenoid	35	25	35	25
DC solenoid	60	50	50	40

### 6.2 - E5P4

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

E5				
TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
CA solenoid	70	40	70	40
DC solenoid	100	70	80	50

## 7 - PERFORMANCE CHARACTERISTICS

E4 - PRESSURES [bar]	E4*4	E4HP4	C4*4	C4HP4
Max pressure in P, A, B ports	320	420	320	420
Max pressure in T line with external drainage	210	350	210	350
Max pressure in T line with internal drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Max pressure in Y line with external drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Min piloting pressure <b>NOTE 1</b>	5 ÷ 12			
Max piloting pressure	210	350	210	350

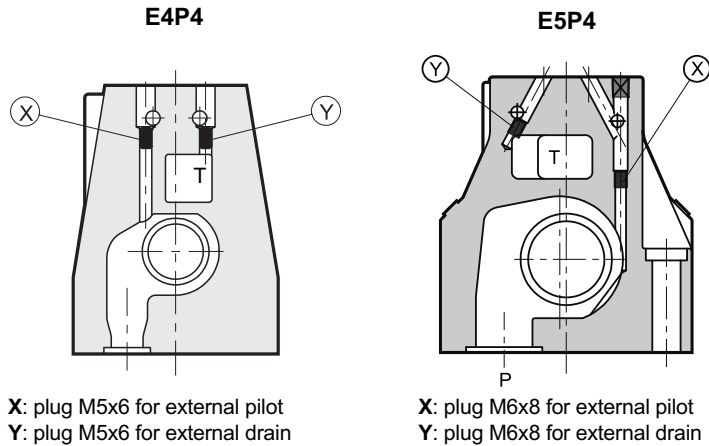
E5 - PRESSURES [bar]	E4*4	E4HP4	C4*4	C4HP4
Max pressure in P, A, B ports	320	420	320	420
Max pressure in T line with external drainage	210	350	210	350
Max pressure in T line with internal drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Max pressure in Y line with external drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Min piloting pressure <b>NOTE 1</b>	5 ÷ 12			
Max piloting pressure	210	350	210	350

**NOTE 1** minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

MAXIMUM FLOW RATES [l/min]	E4		E5	
Spool type	PRESSURES			
	at 210 bar	at 320 bar	at 210 bar	at 280 bar
S4, S7, S8	120	100	500	450
All other spools	150	120	600	500

## 8 - PILOTING AND DRAINAGE

The E\*P4 valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

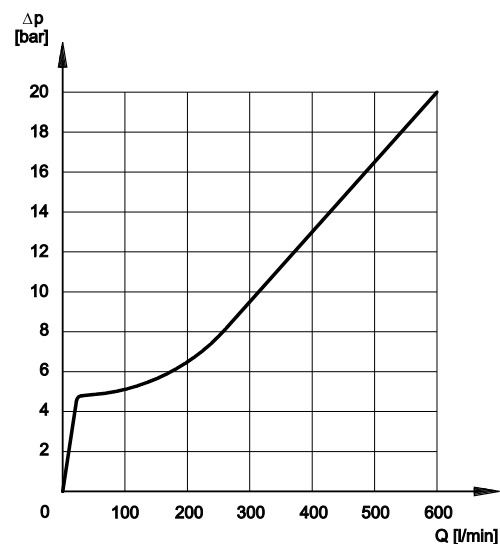
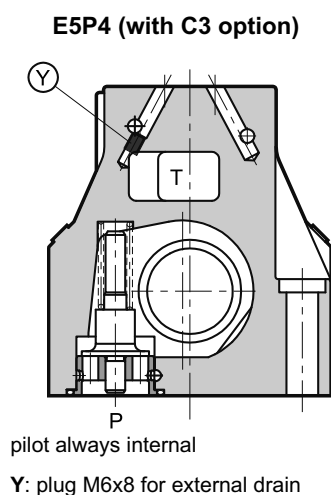
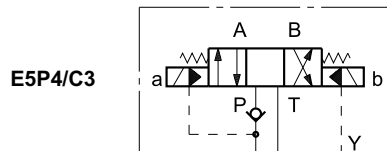


TYPE OF VALVE		Plug assembly	
		X	Y
E*P4-**	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
E*P4-**/I	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
E*P4-**/E	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
E*P4-**/EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

### 8.1 - Backpressure valve incorporated on line P available for E5 valve only)

Valve E5 is available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in the rest position, has the line P connected to the T outlet (spools S2 - S4 - S7 - S8 - TA002 - TC002 - RK002). The cracking pressure is of 5 bar.

Add **C3** to the identification code for this request (see paragraph 1). In the **C3** version the piloting is always internal.



**NOTE:** the backpressure valve can't be used as direct check valve because it doesn't assure the seal.

The curve refers to the pressure drop (body part only) with backpressure valve energized to which the pressure drop of the reference spool must be added. (see paragraph 5)

## 9 - ELECTRICAL FEATURES

### 9.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

**NOTE 1:** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see catalogue. 49 000).

#### Protection from atmospheric agents IEC 60529

Connection	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K7 DEUTSCH DT04 male	x	x	x (*)

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

<b>VOLTAGE SUPPLY FLUCTUATION</b>	±10% Vnom
<b>MAX SWITCH ON FREQUENCY</b> E4 E5	10.000 ins/hr 8.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)</b>	According to 2004/108/EC
<b>LOW VOLTAGE</b>	According to 2006/95/EC
<b>CLASS OF PROTECTION:</b> Atmospheric agents (IEC 60529) Coil insulation (VDE 0580) Impregnation: DC valve AC valve	IP 65 ( <b>NOTE 2</b> ) class H class F class H

### 9.2 - DC coils

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law:  $V = R \times I$ .

The WK1 and WK7D are coils specific for the high corrosion resistance version of the valve.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits by approximately 5 ÷ 10%.

The table shows current and power consumption values relevant to DC coils.

(values ±10%)

	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code			
				K1	WK1	K7	WK7D
<b>D12</b>	4,4	2,72	32,7	1903080	1903050	1902940	1903400
<b>D24</b>	18,6	1,29	31	1903081	1903051	1902941	1903401
<b>D48</b>	78,6	0,61	29,5	1903083			
<b>D110</b>	436	0,26	28,2	1903464			
<b>D220</b>	1758	0,13	28,2	1903465			

### 9.3 - AC coils

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

#### Coils for alternating current (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ohm] (±1%)	Current consumption at inrush [A] (±5%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±5%) [VA]	Power consumption at holding (±5%) [VA]	Coil Code
A24	24	50	1,46	8	2	192	48	1902830
A48	48		5,84	4,4	1,1	204	51	1902831
A110	110V-50Hz 120V-60Hz	50/60	32	1,84	0,46	192	48	1902832
				1,56	0,39	188	47	
A230	230V-50Hz 240V-60Hz		140	0,76	0,19	176	44	1902833
				0,6	0,15	144	36	
F110	110	60	26	1,6	0,4	176	44	1902834
F220	220		106	0,8	0,2	180	45	1902835

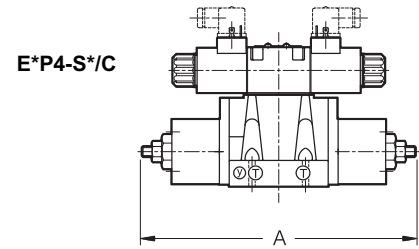
## 10 - OPTIONS

### 10.1 - Control of the main spool stroke: C

It is possible to introduce special stroke controls in the heads of the hydraulic pilot operated valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

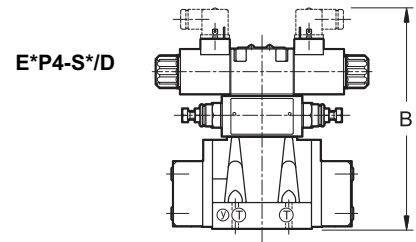
Add the letter **C** to the identification code to request this device (see paragraph 1).



### 10.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the hydraulic operated valve, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 1).



### 10.3 - Subplate with throttle on line P

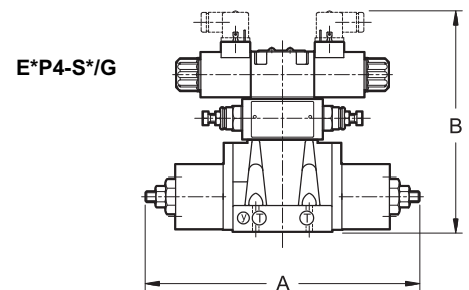
It is possible to introduce a subplate with a restrictor of  $\varnothing 0,8$  on line P between the pilot solenoid valve and the main distributor.

Add **PF** to the identification code to request this option (see paragraph 1).

### 10.4 - Control of the main spool stroke and shifting speed: G

It is possible to have the valve fitted with both the spool stroke device and the piloting flow rate control device.

Add the letter **G** to the identification code to request this solution (see paragraph 1).



dimensions in mm

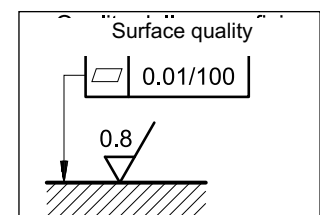
	E4	E5
A	280	401,5
B	218	254

## 11 - INSTALLATION

Configurations with centering and recall springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

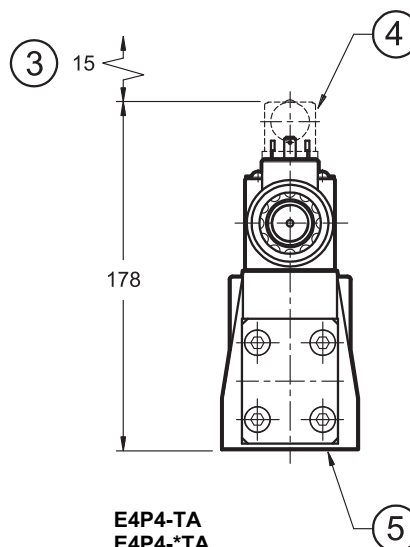
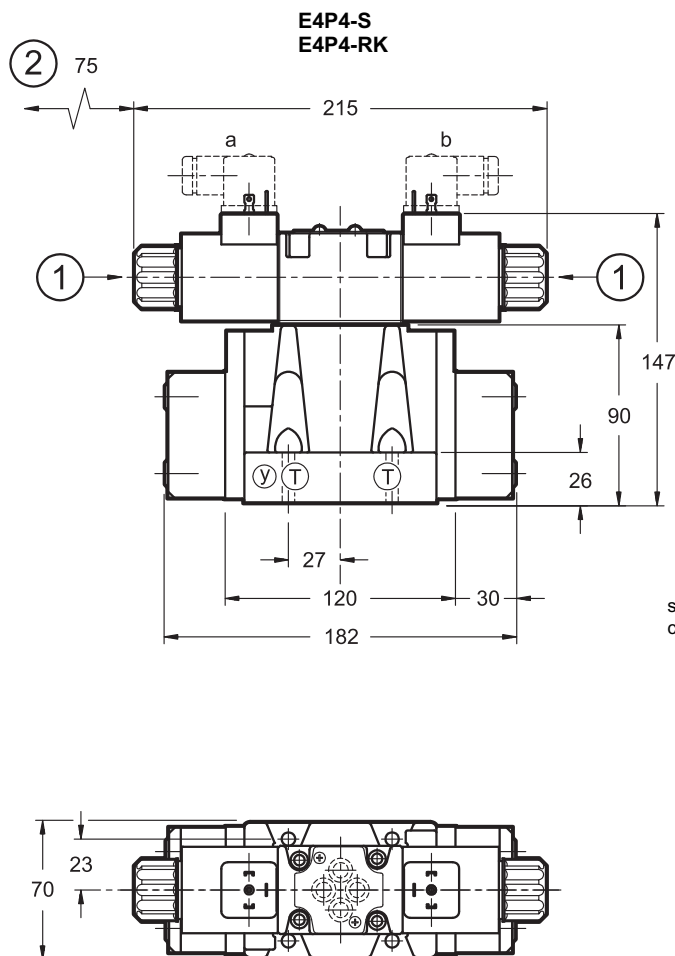
Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

**NOTE:** Use of class 10.9 fastening screws is recommended for valves in version H (high pressure).

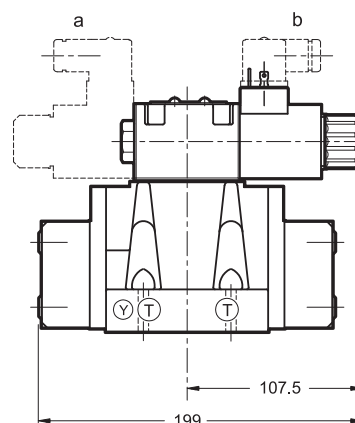




## 12 - E4 OVERALL AND MOUNTING DIMENSIONS



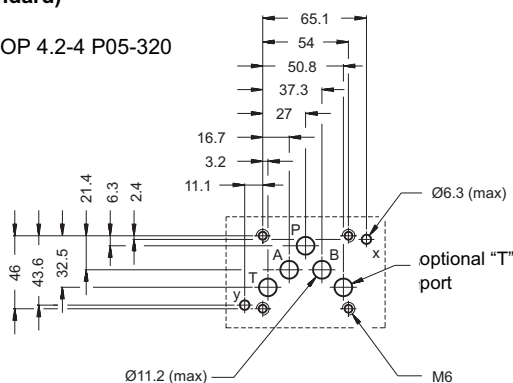
solenoid position  
configuration TC/\*TC



## MOUNTING INTERFACES

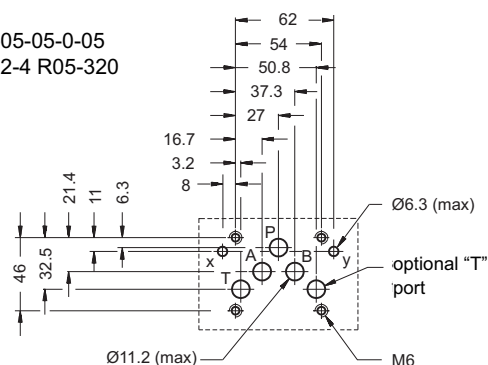
(standard)

CETOP 4.2-4 P05-320



Valves with ISO 4401-05-05-0-05 mounting interface are available upon request. See par. 1 for their identification.

ISO 4401-05-05-0-05  
CETOP 4.2-4 R05-320

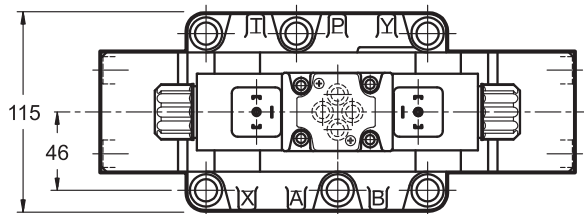
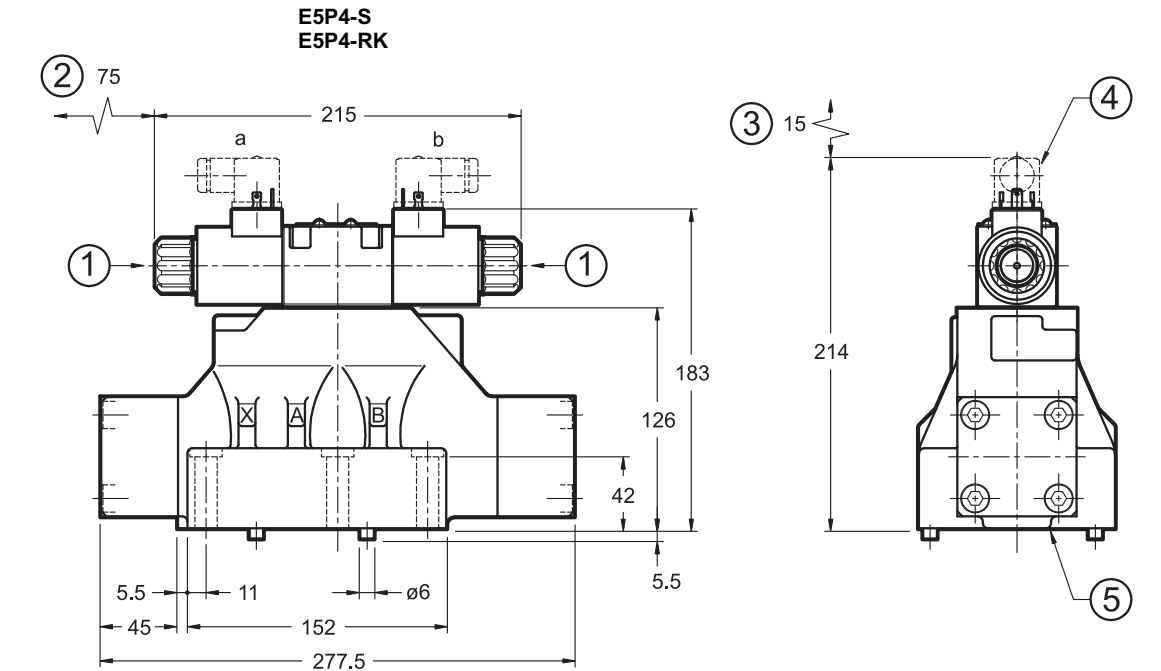


dimensions in mm

Valve fastening: 4 SHCS ISO 4762 M6x35 (see par. 11, <b>NOTE</b> )
Tightening torque: 8 Nm (bolt A 8.8) - 12 Nm (bolt A 10.9)
Threads of mounting holes: M6x10
Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore

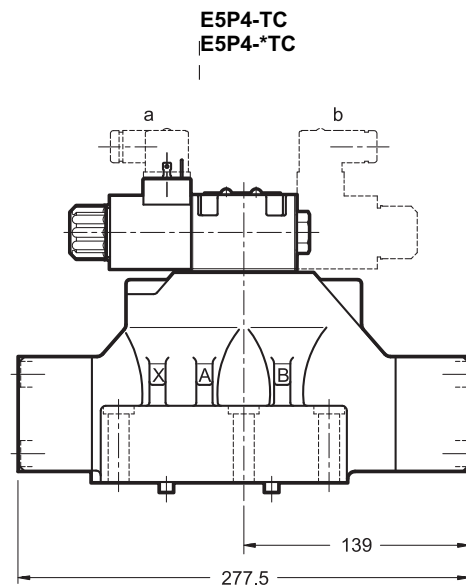
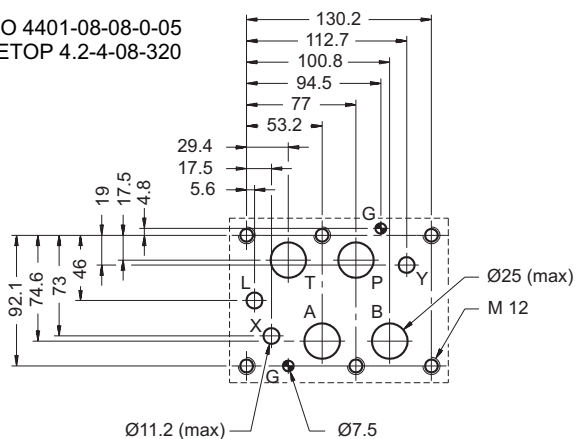
1	Manual override
2	Coil removal space
3	Connector removal space
4	Electric connector (to be ordered separately)
5	Mounting surface with sealing rings

## 13 - E5 OVERALL AND MOUNTING DIMENSIONS



### MOUNTING INTERFACE

ISO 4401-08-08-0-05  
CETOP 4.2-4-08-320



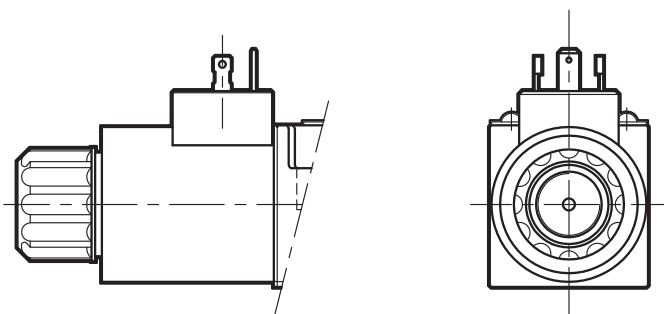
dimensions in mm

Valve fastening: 6 SHCS ISO 4762 M12x60 (see par. 11, <b>NOTE</b> )
Tightening torque: 69 Nm (bolt A 8.8) - 115 Nm (bolt A 10.9)
Threads of mounting holes: M12x20
Sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore

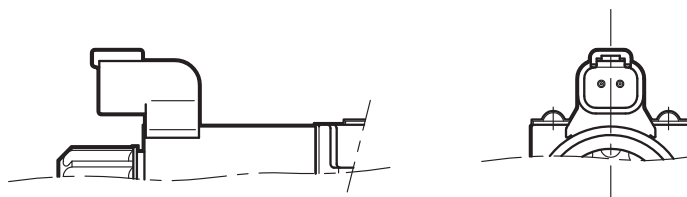
1	Manual override
2	Coil removal space
3	Connector removal space
4	Electric connector (to be ordered separately)
5	Mounting surface with sealing rings

## 14 - ELECTRIC CONNECTIONS

connection for DIN 43650  
connector  
code **K1 (standard)**  
code **WK1** (W7 version only)



connection for  
DEUTSCH DT06-2S male  
connector type  
code **K7**



connection for  
DEUTSCH DT06-2S male  
connector - coil with diode  
code **WK7D** (W7 version only)



## 15 - ELECTRIC CONNECTORS

The valves are delivered without connectors. Connectors for K1/ WK1 connections (DIN 43650) can be ordered separately. See catalogue 49000.

## 16 - MANUAL OVERRIDE

Whenever the solenoid valve installation may involve exposure to atmospheric agents or use in tropical climates, the manual override, boot protection is recommended. For overall dimensions see catalogue 41 150.

Add the suffix **CM** to request this device (see paragraph 1).

## 17 - SUBPLATES

(see catalogue 51 000)

These plates are not suitable for high pressure valves E4HP4 and E5HP4..

	E4	E5
Type with rear ports	PME4-AI5G	
Type with side ports	PME4-AL5G	PME5-AL8G
P, T, A, B, port dimensions	3/4"	1½" BSP
X, Y port dimensions	1/4" BSP	1/4" BSP



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# DSP7

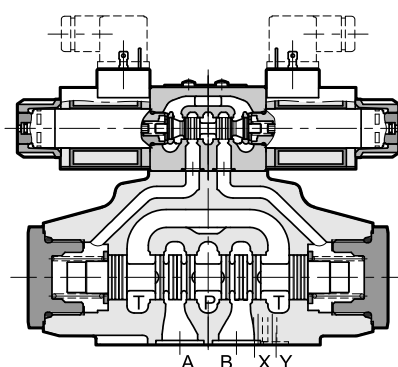
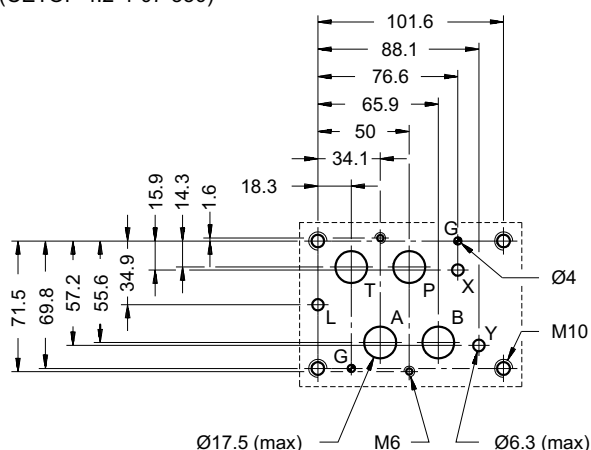
## PILOT OPERATED DISTRIBUTOR SOLENOID OR HYDRAULIC (DSC7) CONTROLLED

**SUBPLATE MOUNTING**  
**ISO 4401-07 (CETOP 07)**

**p** max **350** bar  
**Q** max **300** l/min

### MOUNTING SURFACE

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



- The DSP7 piloted valve is made up of a 4-way hydro-piloted distributor with mounting surface according to ISO 4401-07 (CETOP 07) standards, operated by an ISO 4401-03 (CETOP 03) solenoid directional valve.
- It is available with different spool types (see par. 2), with some options for the opening control.
- It is available with both the solenoid and the hydraulic control from the X and Y ways.
- A version for high pressures (H) is available.
- It is available also with zinc-nickel surface treatments, that ensures a salt spray resistance up to 600 hours.

### PERFORMANCES

(obtained with mineral oil of viscosity of 36 cSt at 50°C)

		DSP7	DSP7H
Maximum operating pressure - ports P - A - B - port T (external drainage) - port T (internal drainage)	bar	350 250 210 (DC) / 160 (AC)	420 350 210 (DC) / 160 (AC)
Maximum flow rate from port P to A - B - T	l/min	300	
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass: DSP7-S, RK DSP7-T*, SA*, SB* DSC7	kg	8,6 8,0 6,6	

## 1 - IDENTIFICATION CODE FOR DSP7 SOLENOID VALVES

D	S	P	7	-	/	20	-	/	/	/	/	/
---	---	---	---	---	---	----	---	---	---	---	---	---

Directional valve,  
Solenoid controlled,  
Pilot operated

---

Size: \_\_\_\_\_  
ISO 4401-07 (CETOP 07)

---

Option: \_\_\_\_\_  
(omit for standard version)  
**H** = high pressure version  
      pmax = 420 bar

---

Spool type (see paragraph 2) \_\_\_\_\_

<b>S*</b>	<b>TA</b>
<b>SA*</b>	<b>TB</b>
<b>SB*</b>	<b>RK</b>

---

Series: (the overall and mounting dimensions remain unchanged from 20 to 29) \_\_\_\_\_

---

Seals: \_\_\_\_\_

**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

---

Piloting (see paragraph 9): \_\_\_\_\_

**I** = internal (not available for spools S2 - S4 - S7 - S8 - TA02 - TB02 RK02 - S\*2 - S\*4. If internal pilot is required, choose pilot type C)  
**C** = internal piloting with backpressure valve  
**Z** = internal piloting with 30 bar fixes adjustment pressure reducing valve (see paragraph 8)  
**E** = external

---

Drainage (see paragraph 9): \_\_\_\_\_

**I** = Internal  
**E** = External

---

Control options (see paragraph 11): \_\_\_\_\_

**C** = Main spool stroke control  
**D** = Main spool switching speed control  
**P08** = Subplate placed under solenoid valve with restrictor of Ø0.8 on port P  
**S2** = Distributor delivered with pilot solenoid valve with spool S2

Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE 2**)  
 Omit if not required

Manual override:  
 omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected (see paragraph 17)

Coil electrical connection (see par. 15):  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on D12 and D24 coils only)

Power supply (see paragraph 10)  
 direct current  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
**D220** = 220 V  
**D00** = valve without coils (see **NOTE 1**)

alternate current  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see **NOTE 1**)  
**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz

### 1.1 - High corrosion resistance version

This version, available for the basic valve (without option of par. 13) features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are DC only and specific for this version, featuring a zinc-nickel surface treatment. The coil for DEUTSCH connector has a diode inside. Electrical features at paragraph 10.2. The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>DSP7....</b> </div> <p>Choices as in standard identification code</p> <p>DC power supply</p> <p><b>D12</b> = 12 V      <b>D24</b> = 24 V</p>	<b>/</b>	<b>/</b>	<b>CM</b>	<b>/</b>	<b>W7</b>
<div style="display: flex; justify-content: space-between;"> <div> <p>Manual override, boot protected</p> </div> <div> <p>Coil electrical connection (see par. 15)</p> <p><b>WK1</b> = plug for connector type DIN 43650</p> <p><b>WK7D</b> = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.</p> </div> </div>					

## 2 - SPOOL TYPE FOR DSP7

<p><b>Type S*:</b> 2 solenoids - 3 positions with spring centring</p> <div style="text-align: center; margin-bottom: 10px;"> </div> <p><b>S1</b> </p> <p><b>S2</b> </p> <p><b>S3</b> </p> <p><b>S4</b> </p> <p><b>S6</b> </p> <p><b>S7</b> </p> <p><b>S8</b> </p> <p><b>S9</b> </p> <p><b>S10</b> </p> <p><b>S11</b> </p> <p><b>S12</b> </p> <p><b>S20</b> </p> <p><b>S21</b> </p>	<p><b>Type SA*:</b> 1 solenoid side A 2 positions (central + external) with spring centring</p> <div style="text-align: center; margin-bottom: 10px;"> </div> <p><b>SA1</b> </p> <p><b>SA2</b> </p> <p><b>SA3</b> </p> <p><b>SA4</b> </p>	<p><b>Type SB*:</b> 1 solenoid side B 2 positions (central + external) with spring centring</p> <div style="text-align: center; margin-bottom: 10px;"> </div> <p><b>SB1</b> </p> <p><b>SB2</b> </p> <p><b>SB3</b> </p> <p><b>SB4</b> </p>
<p><b>Type RK:</b> 2 solenoids - 2 positions with mechanical retention</p> <div style="text-align: center; margin-bottom: 10px;"> </div> <p><b>RK</b> </p> <p><b>RK02</b> </p>	<p><b>Type TA:</b> 1 solenoid side A 2 external positions with return spring</p> <div style="text-align: center; margin-bottom: 10px;"> </div> <p><b>TA</b> </p> <p><b>TA02</b> </p>	<p><b>Type TB:</b> 1 solenoid side B 2 external positions with return spring</p> <div style="text-align: center; margin-bottom: 10px;"> </div> <p><b>TB</b> </p> <p><b>TB02</b> </p>
<p><b>Type 23TA / 23TB</b> three-way valve - 1 solenoid - 2 external positions, return spring</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>23TA</b></p> </div> <div style="text-align: center;"> <p><b>23TB</b></p> </div> </div>		

Besides the diagrams shown, special versions are available: consult our technical dept. for their identification, feasibility and operating limits.

### 3 - IDENTIFICATION CODE AND SPOOL TYPE FOR DSC7 - HYDRAULIC OPERATED VALVE

D	S	C	7		-		/	10		-	E	E	
---	---	---	---	--	---	--	---	----	--	---	---	---	--

Directional valve, hydraulic controlled pilot operated through X and Y ports.

Size: ISO 4401-07 (CETOP 07 )

Option: (omit for standard version)  
**H** = high pressure version  
pmax = 420 bar

Spool type (see paragraph 2 and below)

<b>S*</b>	<b>TA</b>
<b>SA*</b>	<b>TB</b>
<b>SB*</b>	<b>R</b>

Option:  
/ **W7** = Zinc-nickel surface treatment (see **NOTE**)  
Omit if not required

External drain (see par. 9)

External pilot (see par. 9)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

**Spool type**

The distributor is delivered with short-circuit subplate. The X and Y ports are used for the hydraulic control of the valve.

DSC7-S\*

DSC7-TA

DSC7-TB

**NOTE :** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to **600** hours. (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

### 4 - HYDRAULIC FLUIDS

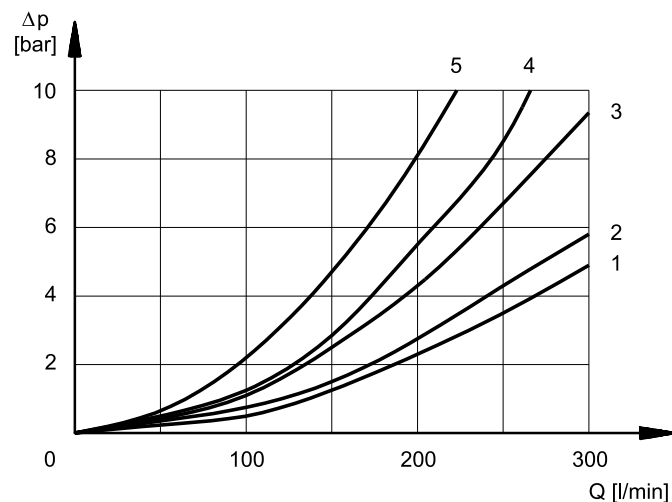
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

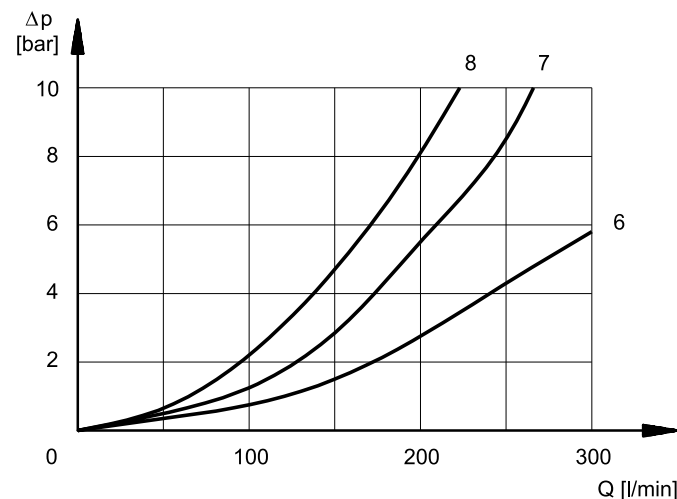
## 5 - PRESSURE DROPS $\Delta P$ -Q

(values obtained with viscosity 36 cSt at 50 °C)



PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	3	4
S2, SA2, SB2	1	1	4	4
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	4	5
S6	1	1	3	4
S7	1	1	4	4
S8	1	1	3	4
S9	1	1	3	4
S10	1	1	3	4
S11	1	1	3	4
S12	1	1	3	4
S20	1	1	3	4
S21	1	1	4	4
TA, TB	1	1	3	4
TA02, TB 02	1	1	4	4
RK	1	1	3	4



PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					6
S3, SA3, SB3			7	7	
S4, SA4, SB4					7
S6				7	
S7					8
S8					8
S10			7	7	
S11			7		

## 6 - SWITCHING TIMES

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections. The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
AC solenoid	45	30	45	30
DC solenoid	75	60	60	45

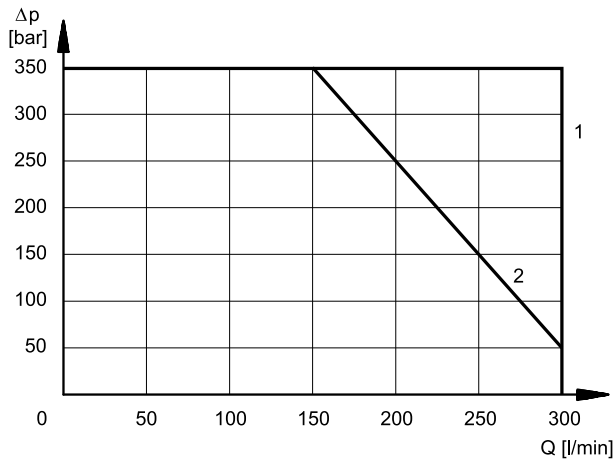


## 7 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure for the different spool types.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The values have been obtained with mineral oil, viscosity 36 cSt at 50 °C, and filtration ISO 4406:1999 class 18/16/13.



SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	1	1
S4, SA4, SB4	2	2
S6	1	1
S7	2	2
S8	2	2
S9	1	1
S10	1	1
S11	1	1
S12	1	1
S20	1	1
S21	1	1

SPOOL	CURVE	
	P→A	P→B
TA, TB	1	1
TA02, TB02	1	1
23TA, 23TB	1	1
RK	1	1

## 8 - PERFORMANCE CHARACTERISTICS

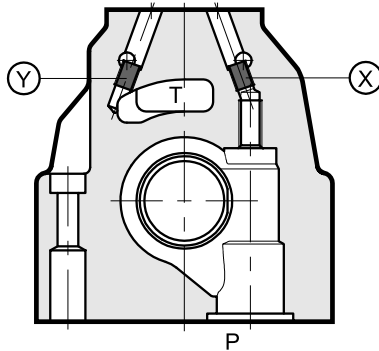
PRESSURES [bar]	DSP7	DSP7H	DSC7	DSC7H
Max pressure in P, A, B ports	350	420	350	420
Max pressure in T line with external drainage	250	350	250	350
Max pressure in T line with internal drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Max pressure in Y line with external drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Min piloting pressure <b>NOTE 1</b>	5 ÷ 12			
Max piloting pressure <b>NOTE 2</b>	210	350	210	420

**NOTE 1** minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

**NOTE 2** If the valve operates at higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve can be ordered with internal pilot and pressure reducing valve with 30 bar fixed adjustment (pilot type Z, see identification code)

## 9 - PILOTING AND DRAINAGE

The DSP7 valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain

TYPE OF VALVE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

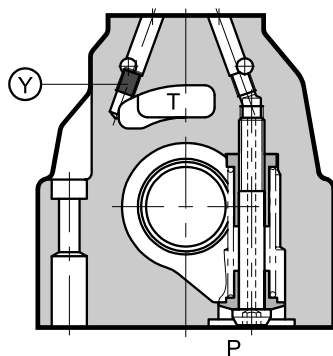
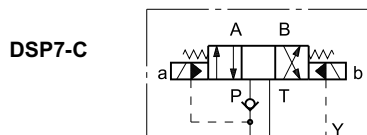
### 9.1 - Backpressure valve incorporated on line P

Valves DSP7 are available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in rest position, has the line P connected to the T port (spools S2, S4, S7, S8, S\*2, S\*4, TA02, TB02, RK02). The cracking pressure is of 5 bar with a minimum flow rate of 15 l/min.

Add **C** to the identification code for this request (see paragraph 1).

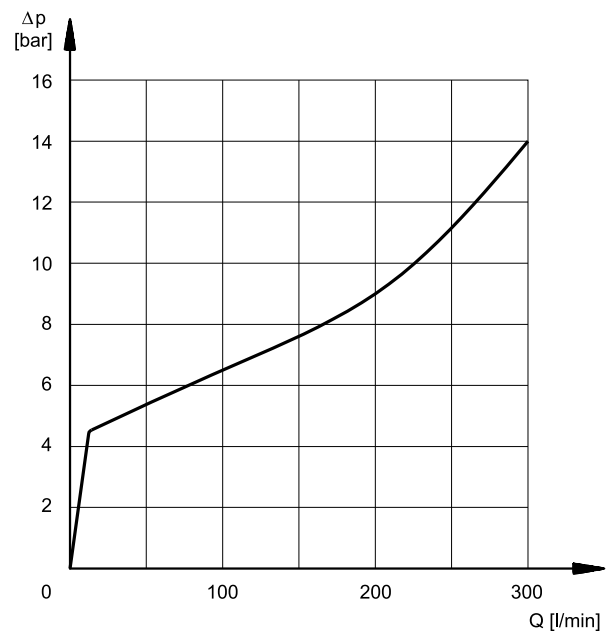
**In the C version the piloting is always internal.**

The backpressure valve can be also delivered separately and it can be easily mounted on line P of the main control valve. Specify the code **0266577** to order the backpressure valve separately.



pilot always internal  
Y: plug M6x8 for external drain

**NOTE:** the backpressure valve can't be used as check valve because it doesn't assure the seal.



The curve refers to the pressure drop (body part only) with backpressure valve energized to which the pressure drop of the reference spool must be added. (see paragraph 5)

## 10 - ELECTRICAL FEATURES

### 10.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

**NOTE:** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see data sheet 49 000).

#### Protection from atmospheric agents IEC EN 60529

Connection	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K7 DEUTSCH DT04 male	x	x	x (*)

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hour
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95/EC
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation: (DC valve) (AC valve)	class H class F class H

### 10.2 - DC coils

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law:  $V = R \times I$ .

The WK1 and WK7D are coils specific for the high corrosion resistance version of the valve.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits by approximately 5 ÷ 10%.

The table shows current and power consumption values for DC coils.

(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code			
					K1	WK1	K7	WK7D
<b>D12</b>	12	4,4	2,72	32,7	1903080	1903050	1902940	1903400
<b>D24</b>	24	18,6	1,29	31	1903081	1903051	1902941	1903401
<b>D48</b>	48	78,6	0,61	29,5	1903083			
<b>D110</b>	110	436	0,26	28,2	1903464			
<b>D220</b>	220	1758	0,13	28,2	1903465			

### 10.3 - AC coils

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

#### Coils for alternating current (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ohm] (±1%)	Current consumption at inrush [A] (±5%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±5%) [VA]	Power consumption at holding (±5%) [VA]	Coil Code
<b>A24</b>	24	50	1,46	8	2	192	48	1902830
<b>A48</b>	48		5,84	4,4	1,1	204	51	1902831
<b>A110</b>	110V-50Hz 120V-60Hz	50/60	32	1,84	0,46	192	48	1902832
				1,56	0,39	188	47	
<b>A230</b>	230V-50Hz 240V-60Hz		140	0,76	0,19	176	44	1902833
				0,6	0,15	144	36	
<b>F110</b>	110	60	26	1,6	0,4	176	44	1902834
<b>F220</b>	220		106	0,8	0,2	180	45	1902835

## 11 - OPTIONS

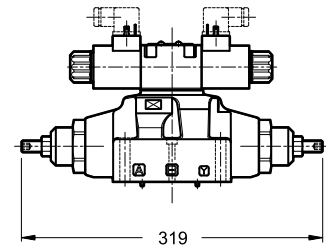
### 11.1 - Control of the main spool stroke: C

With the help of special side plugs, it is possible to introduce stroke controls in the heads of the piloted valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

Add the letter **C** to the identification code to request this device (see paragraph 1).

DSP7-S\*/C

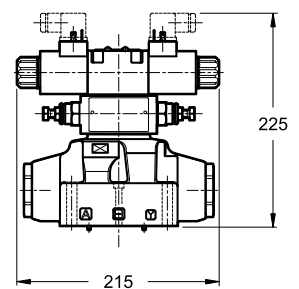


### 11.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the main distributor, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 1).

DSP7-S\*/D

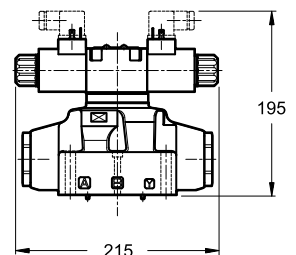


### 11.3 - Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor of  $\varnothing 0,8$  on line P between the pilot solenoid valve and the main distributor.

Add **P08** to the identification code to request this option (see paragraph 1).

DSP7-S\*/P08



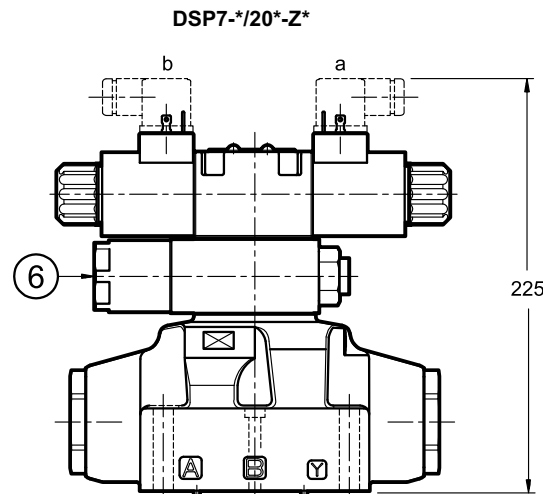
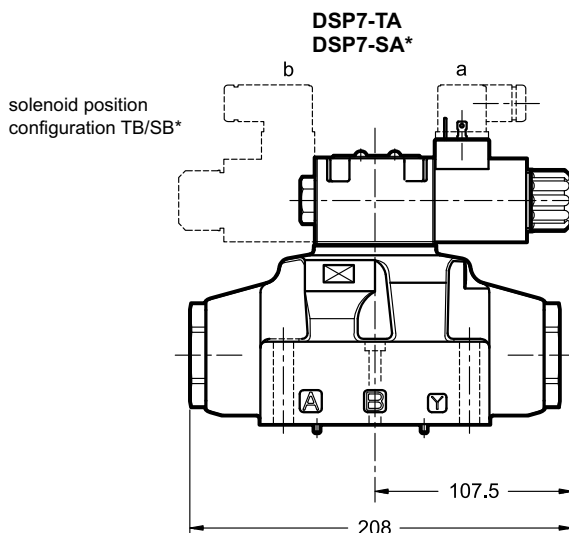
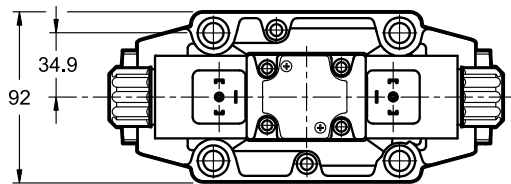
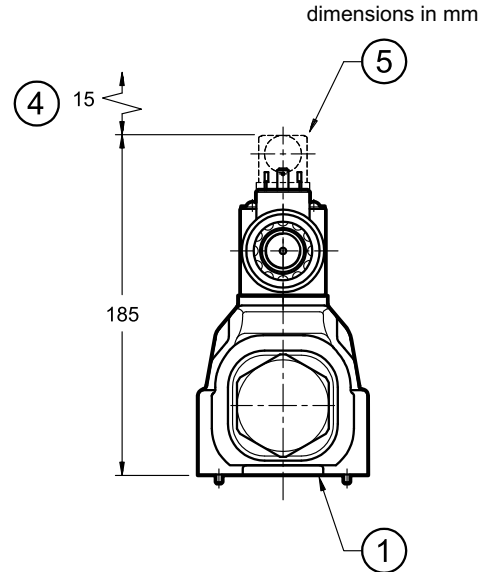
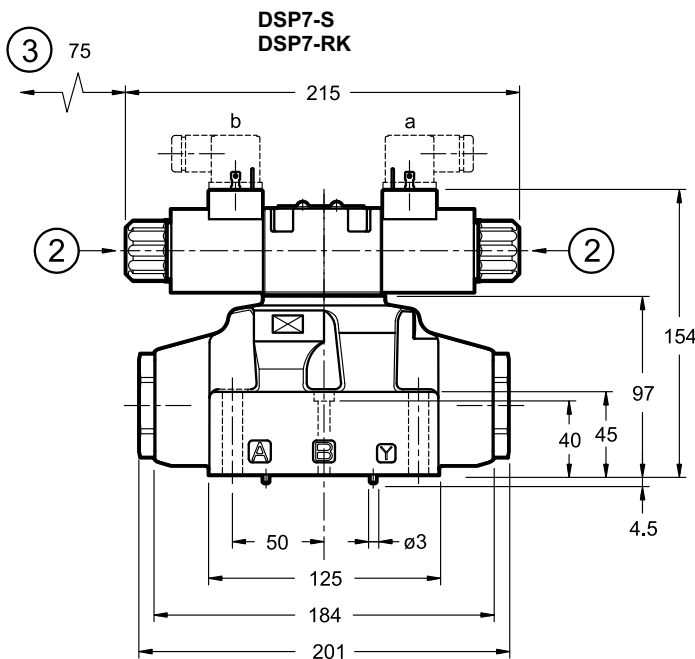
### 11.4 - Solenoid operated distributor with pilot valve in configuration S2

It is possible to deliver the solenoid operated distributor with pilot valve in configuration S2 (all the ports at outlet). With this option the piloting is necessarily external.

Add **S2** to the identification code to request this option (see paragraph 1).

This configuration is used with external piloting in order to allow the unloading of the piloting line when the solenoid operated valve is in rest position.

## 12 - DSP7 OVERALL AND MOUNTING DIMENSIONS FOR SOLENOID DISTRIBUTOR



**NOTE:** Use of fastening screws class A10.9 is recommended for valves in version **H** (high pressure)

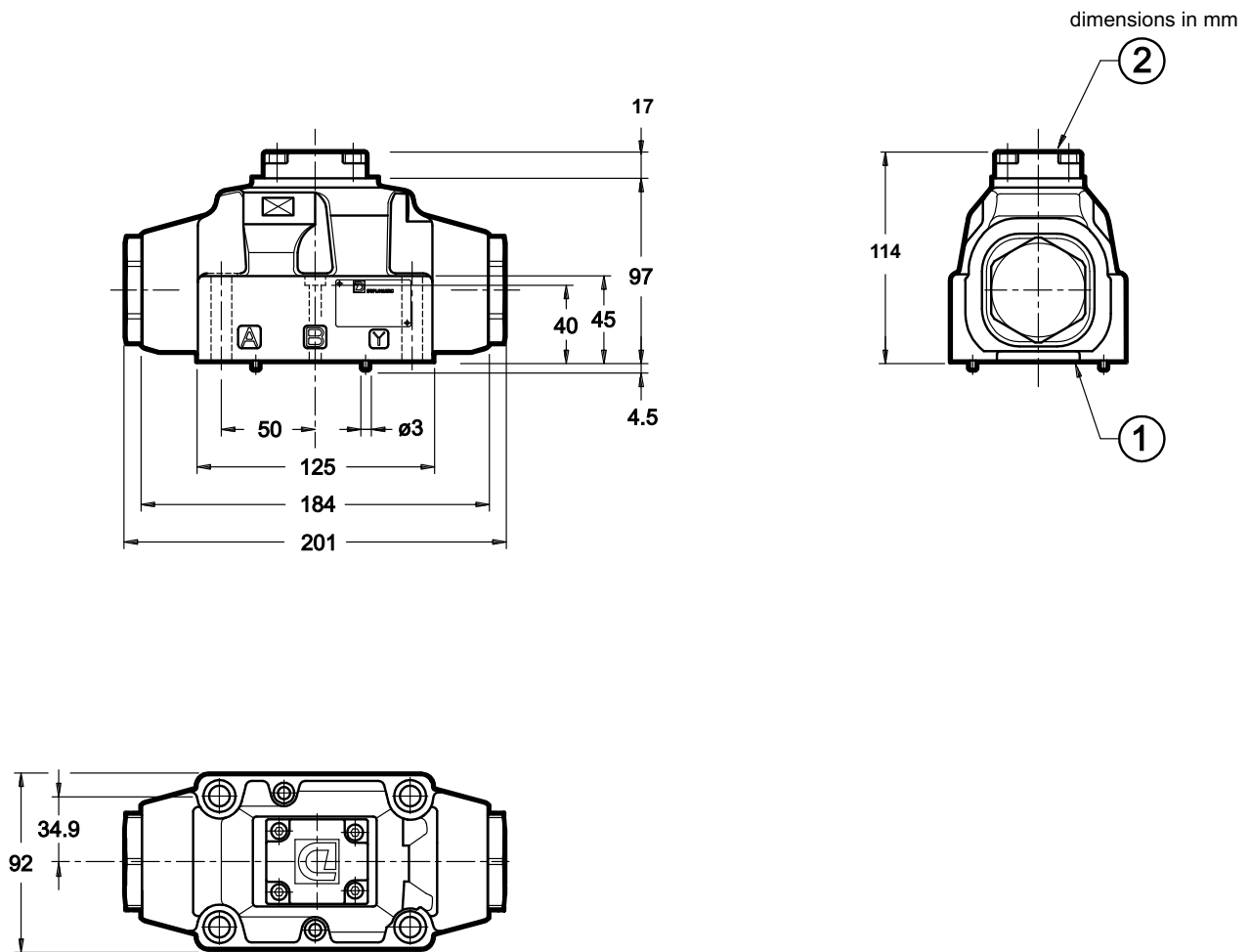
Fastening of single valve: 4 SHC screws ISO 4762 M10x60  
2 SHC screws ISO 4762 M6x50

Tightening torque: M10x60: 40 Nm (A8.8) - 57 Nm (A10.9)  
M6x50: 8 Nm (A8.8) - 12 Nm (A10.9)

Threads of mounting holes: M6x12; M10x18

1	Mounting surface with sealing rings 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Manual override
3	Coil removal space
4	Connector removal space
5	Electric connector to be ordered separately (see cat. 49 000)
6	Reducing valve with fixed adjustment 30 bar

### 13 - DSC7 OVERALL AND MOUNTING DIMENSIONS FOR HYDRAULIC DISTRIBUTOR DSC7



**NOTE:** Use of fastening screws class A10.9 is recommended for valves in version **H** (high pressure)

Fastening of single valve:	4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x50
Tightening torque:	M10x60: 40 Nm (A8.8) - 57 Nm (A10.9) M6x50: 8 Nm (A8.8) - 12 Nm (A10.9)
Threads of mounting holes:	M6x12; M10x18

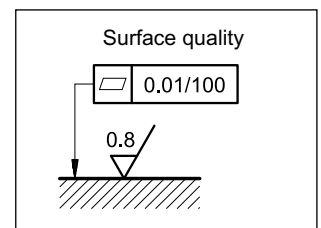
1	Mounting surface with sealing rings: 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Short-circuit subplate

### 14 - INSTALLATION

Configurations with centring and recall springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

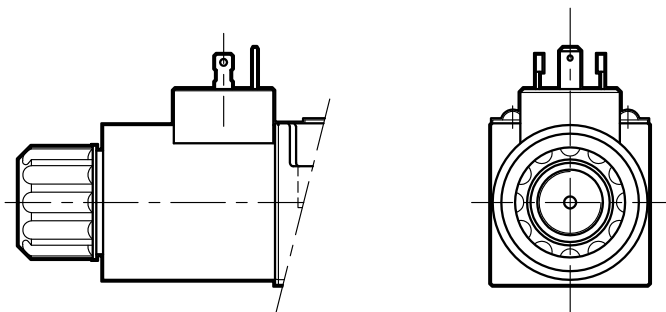
Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

**NOTE:** Use of fastening screws class 10.9 is recommended for valves in version **H** (high pressure).

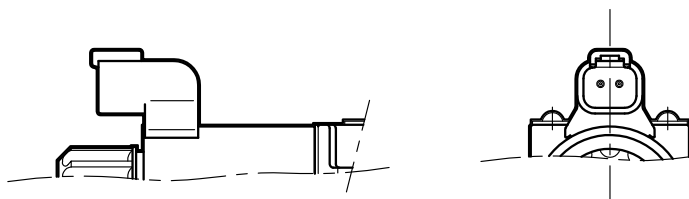


## 15 - ELECTRIC CONNECTIONS

connection for DIN 43650  
connector  
code **K1 (standard)**  
code **WK1** (W7 version only)



connection for  
DEUTSCH DT06-2S male  
connector type  
code **K7**



connection for  
DEUTSCH DT06-2S male  
connector - coil with diode  
code **WK7D** (W7 version only)



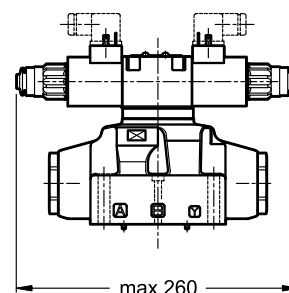
## 16 - ELECTRIC CONNECTORS

The valves are delivered without connectors. Connectors for K1/ WK1 connections (DIN 43650) can be ordered separately. See catalogue 49000.

## 17 - MANUAL OVERRIDE

Whenever the solenoid valve installation may involve exposure to atmospheric agents or use in tropical climates, the manual override, boot protection is recommended.

Add the suffix **CM** to request this device (see paragraph 1).



## 18 - SUBPLATES

(see catalogue 51 000)

These plates are not suitable for high pressure valves DSP7H.

Type with rear ports	PME07-AI6G
Type with side ports	PME07-AL6G
P, T, A, B, port dimensions X, Y; L port dimensions	1" BSP 1/4" BSP



**DIPLOMATIC OLEODINAMICA S.p.A.**  
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www.diplomatic.com • e-mail: sales.exp@diplomatic.com



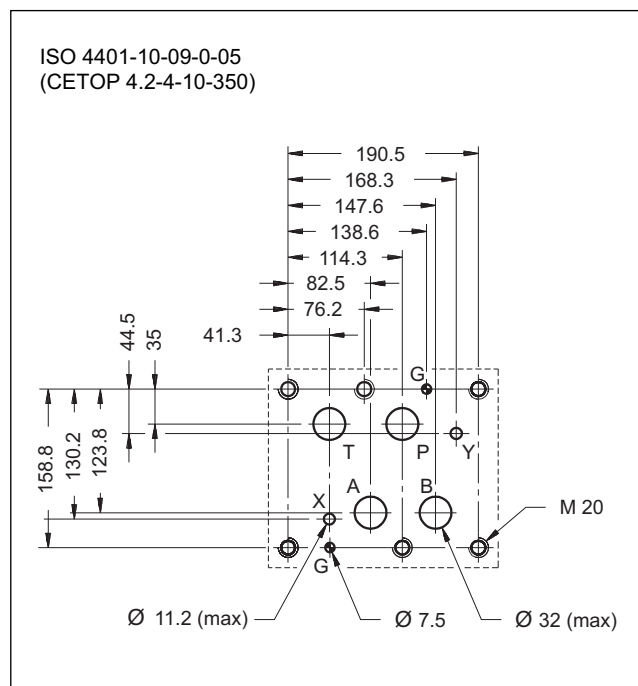
# DSP10

## PILOT OPERATED DISTRIBUTOR SOLENOID OR HYDRAULIC (DSC10) CONTROLLED

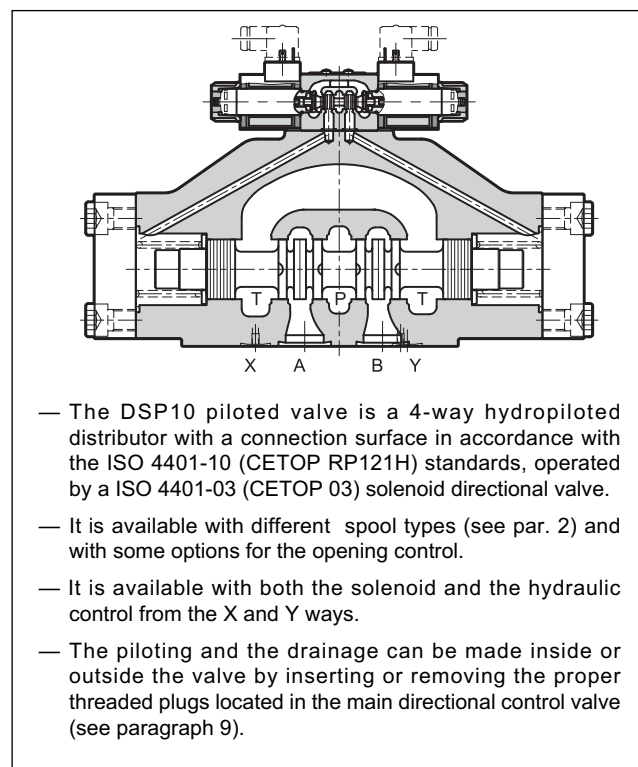
### SUBPLATE MOUNTING ISO 4401-10 (CETOP 10)

**p** max **350** bar  
**Q** max **1100** l/min

### MOUNTING INTERFACE



### OPERATING PRINCIPLE



### PERFORMANCES

(obtained with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure		
- ports P - A - B ( <b>standard</b> version)		350
- port T (external drainage)	bar	210
Maximum flow rate from port P to A - B - T	l/min	1100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: DSP10	kg	50
DSC10		48





## 1 - IDENTIFICATION CODE FOR SOLENOID DISTRIBUTOR DSP10

<b>D</b>	<b>S</b>	<b>P</b>	<b>10</b>	<b>-</b>		<b>/</b>	<b>20</b>	<b>-</b>		<b>/</b>	<b>/</b>	<b>K1</b>	<b>/</b>	
----------	----------	----------	-----------	----------	--	----------	-----------	----------	--	----------	----------	-----------	----------	--

Solenoid operated directional valve

ISO 4401-10 (CETOP 10) size

Spool type (see paragraph 2)

**S\***      **TA**  
**SA\***    **TB**  
**SB\***    **RK\***

Series: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Piloting (see paragraph 9): \_\_\_\_\_  
**I** = internal (not available for spools S2 - S4 - TA02 - TB02 - RK02 S\*2 - S\*4)  
**E** = external  
**Z** = internal piloting with 30 bar fixed adjustment pressure reducing valve

Drainage (see paragraph 9): \_\_\_\_\_  
**I** = Internal  
**E** = External

Controls (see paragraph 13): \_\_\_\_\_  
**C** = Main spool stroke control  
**D** = Main spool switching speed control  
**P15** = Subplate placed under solenoid valve with restrictor of Ø1.5 on port P

Manual override:  
omit for override integrated in the tube (**standard**)  
**CM** = manual override, boot protected (see paragraph 17)

Coil electrical connection:  
plug for connector type DIN 43650

Power supply (see paragraph 10)

direct current  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
**D220** = 220 V  
**D00** = valve without coils (see **NOTE 1**)

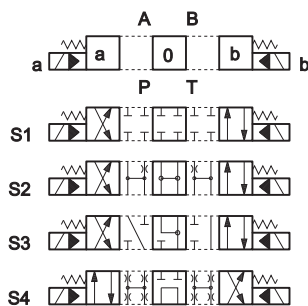
alternate current  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see **NOTE 1**)  
**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz

**NOTE:** The locking rings of the coils and the relevant O-Rings are supplied together with valves

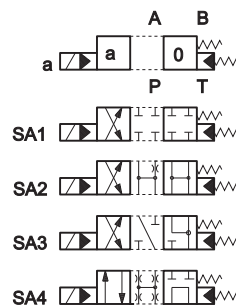
## 2 - SPOOL TYPE

NOTE: Symbols refers to the **DSP10** solenoid valve. For the **DSC10** hydraulic control version, please verify the connection scheme (see par. 3).

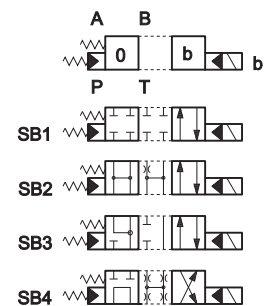
**Type S\*:**  
2 solenoids - 3 positions  
with spring centering



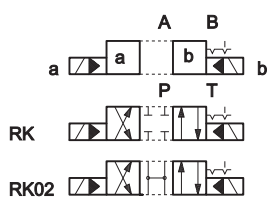
**Type SA\*:**  
1 solenoid side A  
2 positions (central + external)  
with spring centering



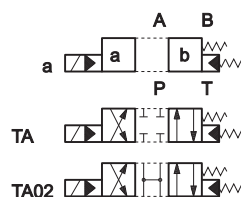
**Type SB\*:**  
1 solenoid side B  
2 positions (central + external)  
with spring centering



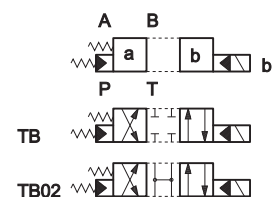
**Type RK:**  
2 solenoids - 2 positions  
with mechanical retention



**Type TA:**  
1 solenoid side A  
2 external positions  
with return spring

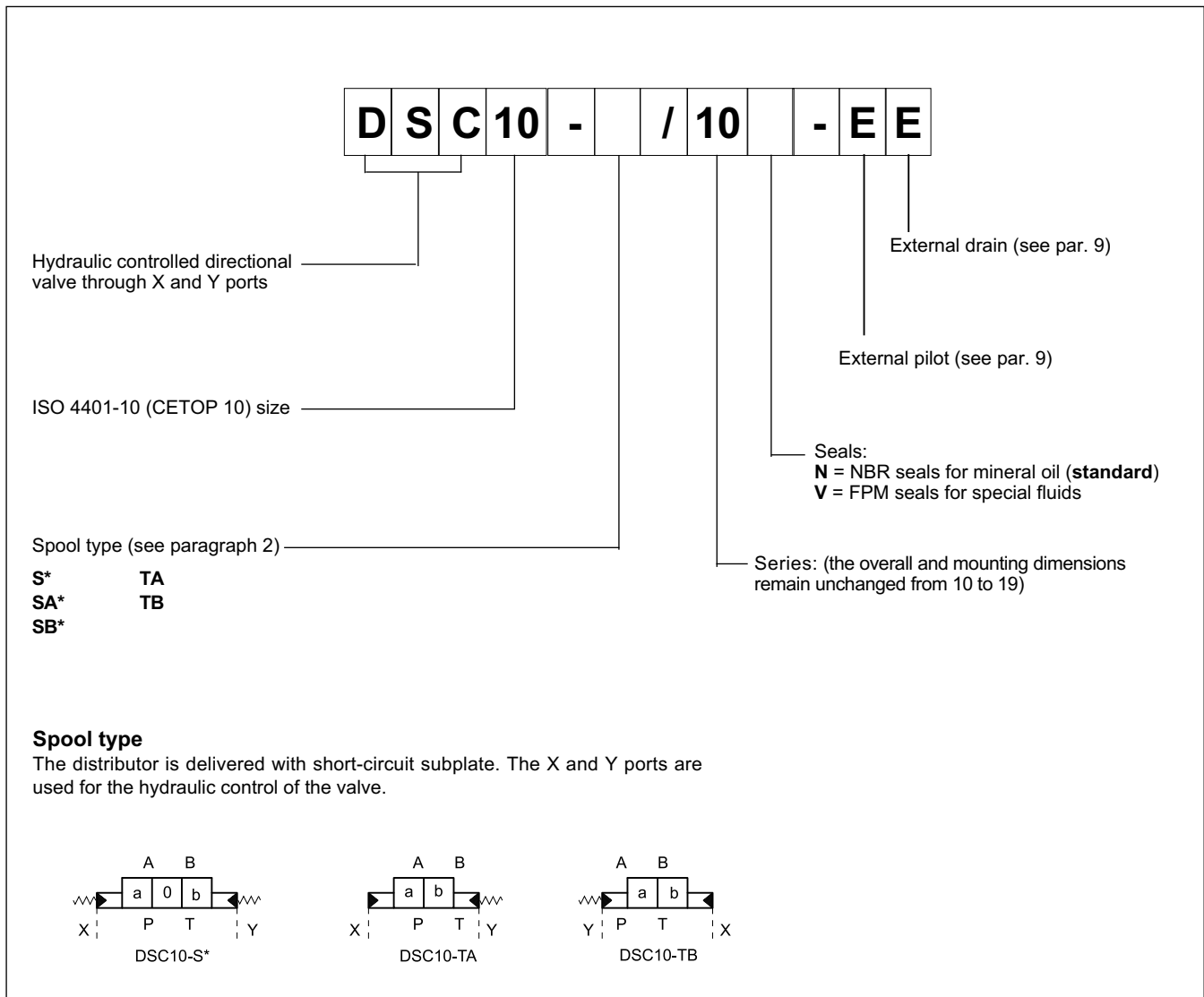


**Type TB:**  
1 solenoid side B  
2 external positions  
with return spring



If other spool types are necessary please consult our Technical Department

### 3 - IDENTIFICATION CODE FOR HYDRAULIC DISTRIBUTOR DSC10



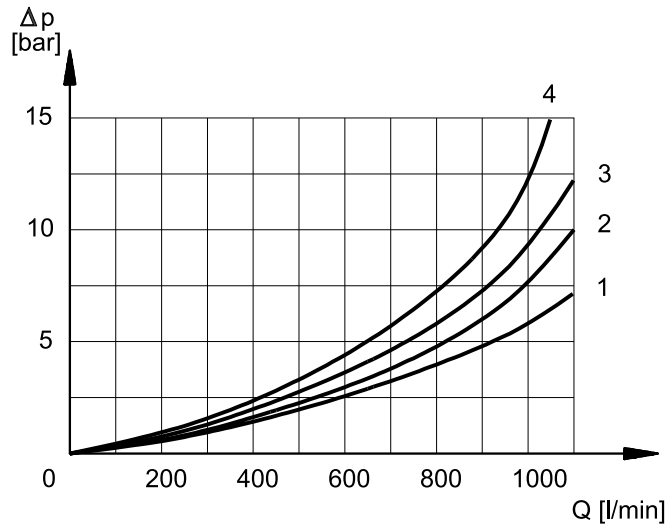
### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code V). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 5 - PRESSURE DROPS $\Delta P$ -Q

(values obtained with viscosity 36 cSt at 50 °C)



### PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	1	1
S2, SA2, SB2	2	2	2	2
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	2	2
TA, TB	1	1	1	1
TA02, TB 02	1	1	1	1
RK	1	1	1	1

### PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					3
S3, SA3, SB3			4	4	
S4, SA4, SB4					4

## 6 - SWITCHING TIMES

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

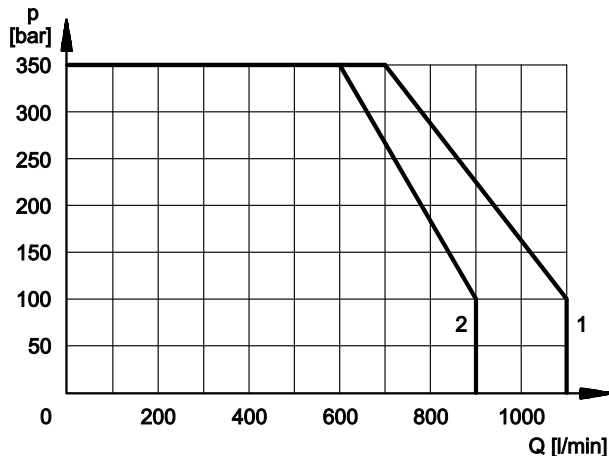
The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
AC solenoid	90	60	90	60
DC solenoid	130	100	90	60

## 7 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406.1999 class 18/16/13.



SPOOL TYPE	CURVE	
	P-A	P-B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	1	1
S4, SA4, SB4	2	2
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	1	1
RK	1	1

## 8 - PERFORMANCE CHARACTERISTICS

PRESSURES [bar]	DSP10
Max pressure in P, A, B ports	350
Max pressure in T line with external drainage	250
Max pressure in T line with internal drainage	210 (DC) / 160 (AC)
Max pressure in Y line with external drainage	210 (DC) / 160 (AC)
Min piloting pressure <b>NOTE 1</b>	6 ÷ 12
Max piloting pressure <b>NOTE 2</b>	280

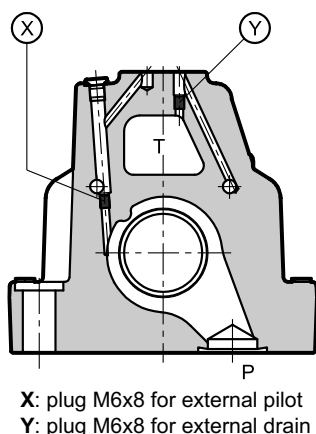
**NOTE 1** minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

**NOTE 2** If the valve operates at higher pressures it is necessary to use the version with external piloting and reduced pressure.

Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered (Piloting type **Z**, see dimensions at par. 11)

## 9 - PILOTING AND DRAINAGE

These valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.



TYPE OF VALVE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

## 10 - ELECTRICAL FEATURES

### 10.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

**NOTE 1:** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see CAT. 49 000).

**NOTE 2:** The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

<b>VOLTAGE SUPPLY FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	6.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95/EC
<b>CLASS OF PROTECTION:</b> Atmospheric agents (CEI EN 60529) Coil insulation (VDE 0580) Impregnation: DC valve AC valve	IP 65 ( <b>NOTE 2</b> ) class H class F class H

### 10.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values of the DC coils.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits by 5 ÷ 10% approx.

(values ± 10%)

	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code K1
<b>D12</b>	4,4	2,72	32,7	1903080
<b>D24</b>	18,6	1,29	31	1903081
<b>D48</b>	78,6	0,61	29,5	1903083
<b>D110</b>	436	0,26	28,2	1903464
<b>D220</b>	1758	0,13	28,2	1903465

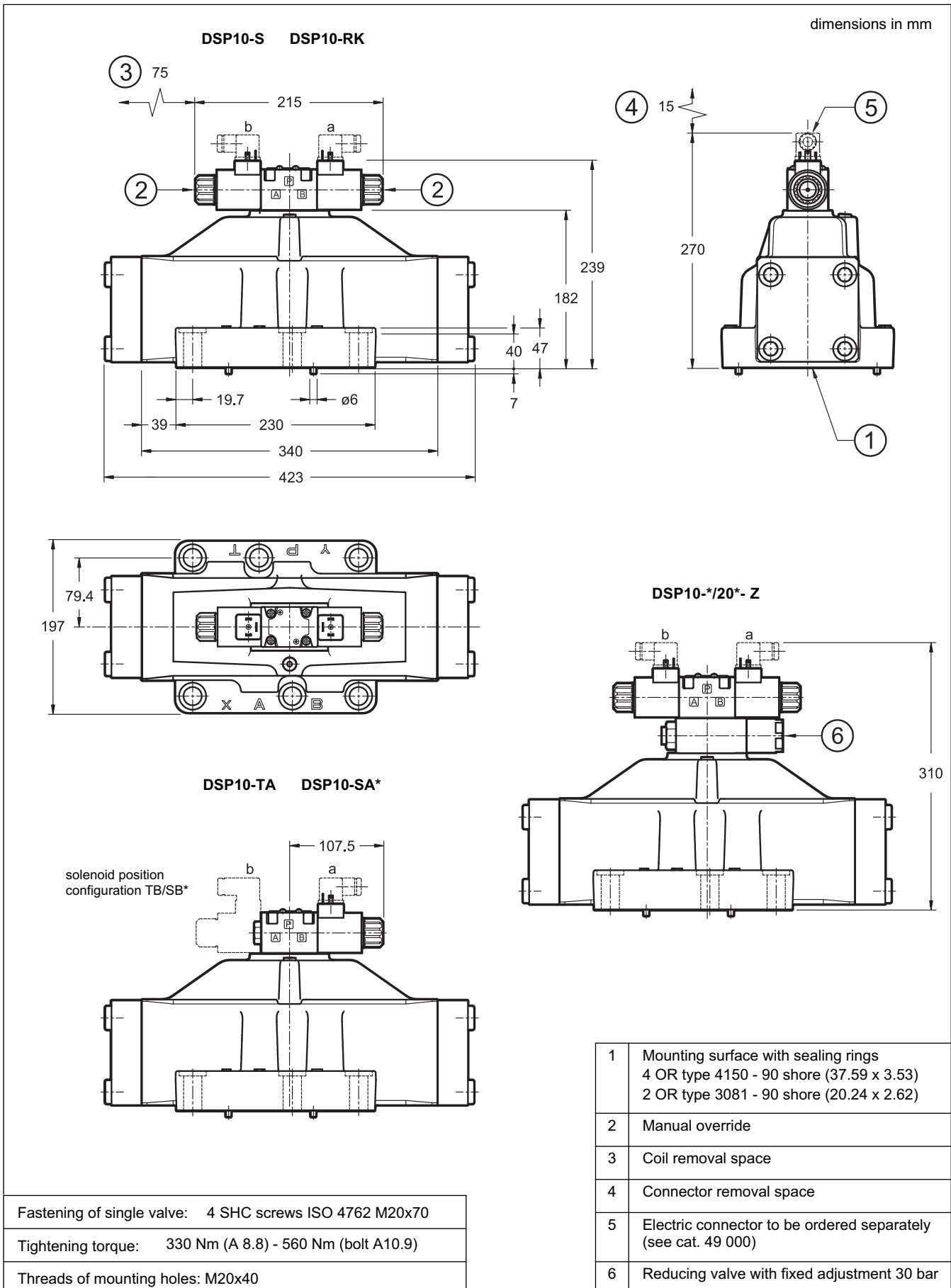
### 10.3 - Current and absorbed power for AC solenoid valve

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

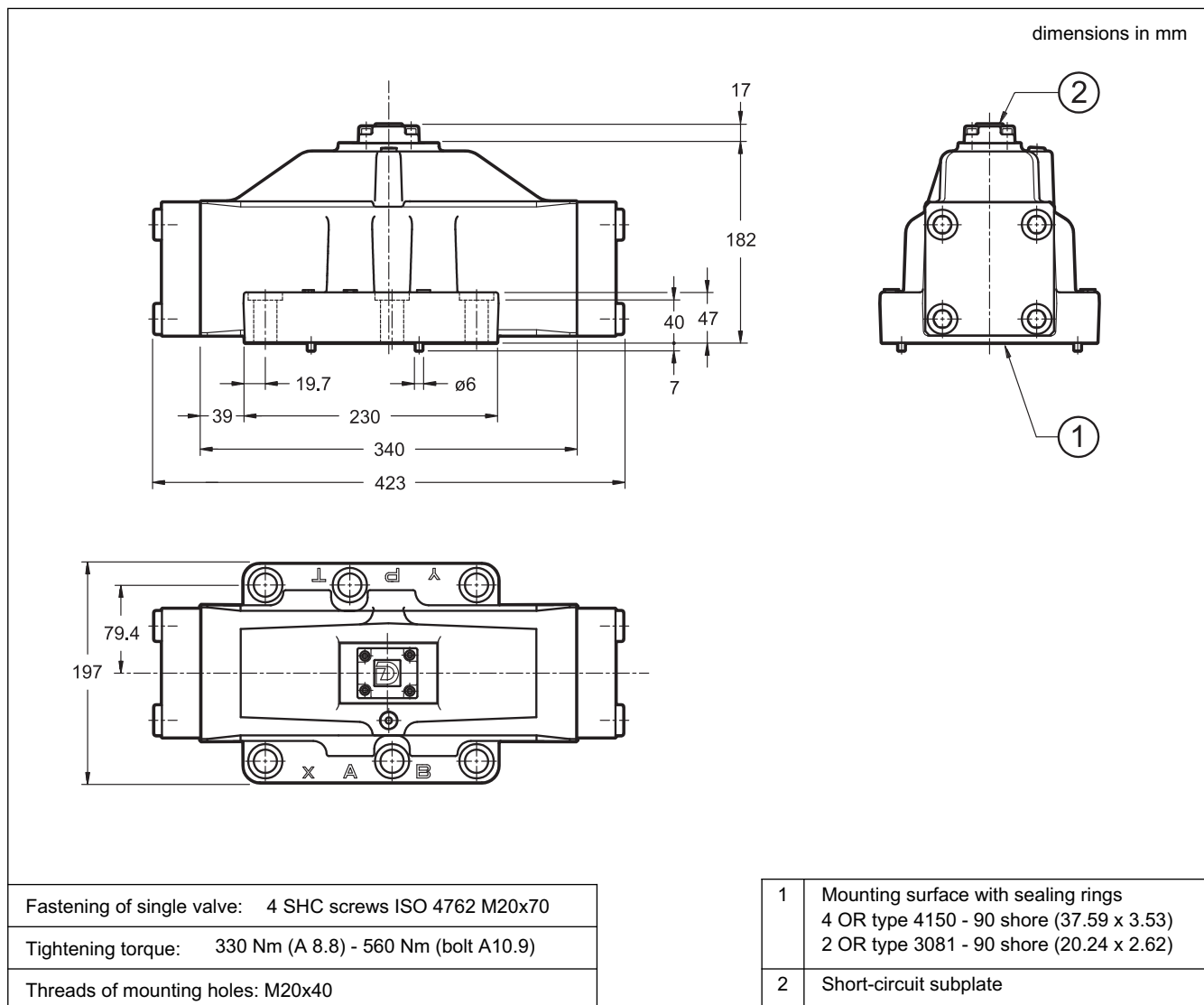
(values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil Code
<b>A24</b>	24	50	1,46	8	2	192	48	1902830
<b>A48</b>	48		5,84	4,4	1,1	204	51	1902831
<b>A110</b>	110V-50Hz 120V-60Hz	50/60	32	1,84	0,46	192	48	1902832
				1,56	0,39	188	47	
<b>A230</b>	230V-50Hz 240V-60Hz		140	0,76	0,19	176	44	1902833
				0,6	0,15	144	36	
<b>F110</b>	110	60	26	1,6	0,4	176	44	1902834
<b>F220</b>	220		106	0,8	0,2	180	45	1902835

## 11 - OVERALL AND MOUNTING DIMENSIONS FOR DSP10



## 12 - OVERALL AND MOUNTING DIMENSIONS FOR DSC10



## 13 - OPTIONS

### 13.1 - Control of the main spool stroke: C

With the help of special side plugs, it is possible to introduce stroke controls in the heads of the piloted valve so as to vary the maximum spool clearance opening.

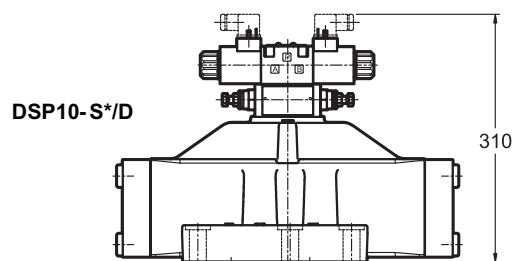
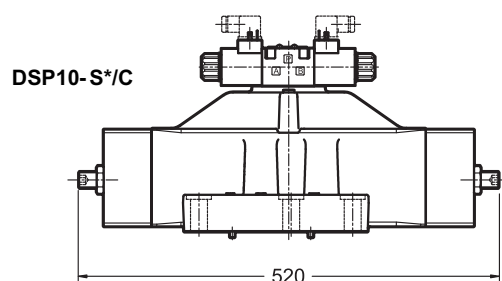
This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

Add the letter **C** to the identification code to request this device (see paragraph 1).

### 13.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the main distributor, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 1).



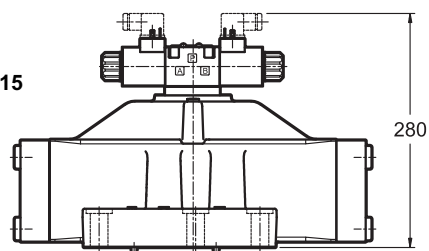


### 13.3 - Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor of Ø1,5 on line P between the pilot solenoid valve and the main distributor.

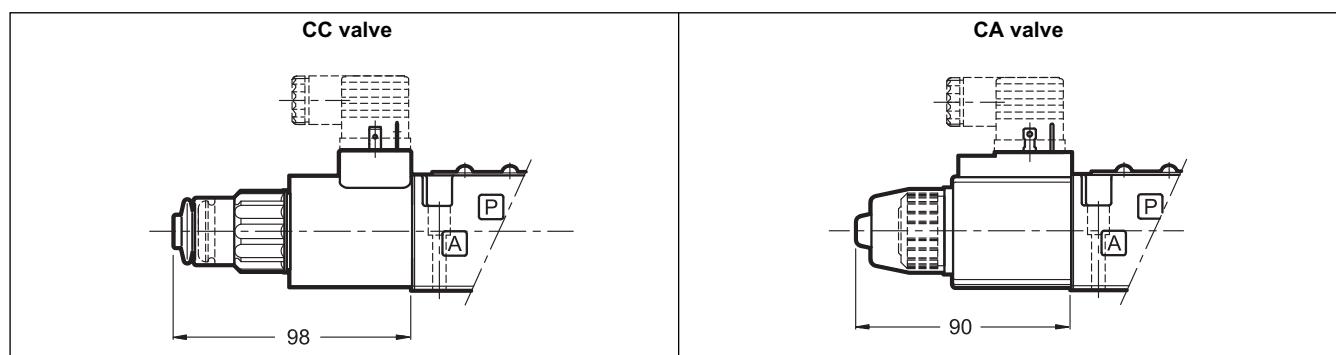
Add **P15** to the identification code to request this option (see paragraph 1).

DSP10-S\*/P15



### 14 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or use in tropical climates, the manual override, boot protection is recommended. Add **/CM** at the end of the identification code to request this device (see paragraph 1).



### 15 - ELECTRIC CONNECTORS

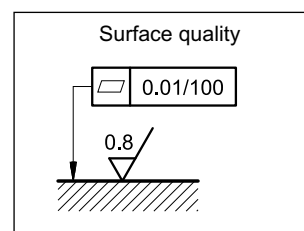
The valves are delivered without connector. Connectors for K1 connections (DIN 43650) can be ordered separately. See catalogue 49 000.

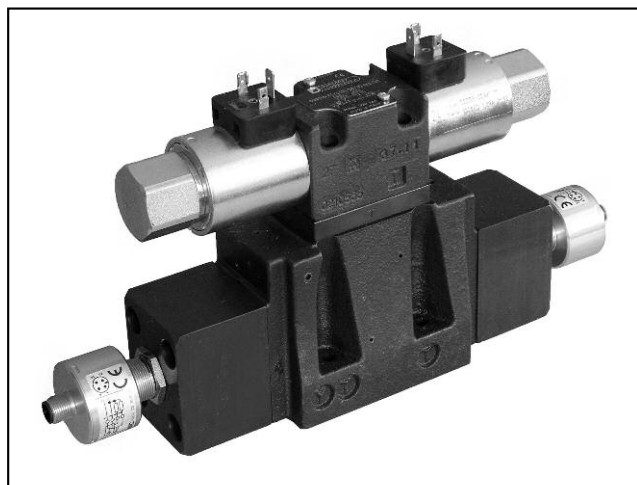
### 16 - INSTALLATION

Configurations with centering and recall springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.





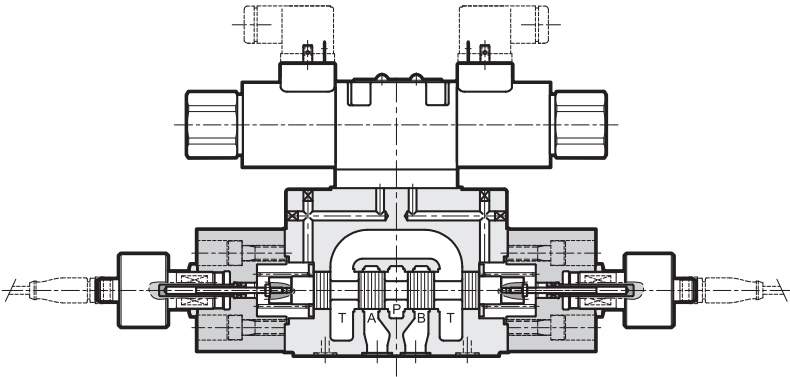
# DS(P)\*M

## DIRECTIONAL VALVES WITH SPOOL POSITION MONITORING

**DS3M**      **ISO 4401-03**  
**DS5M**      **ISO 4401-05**

**DSP5RM**    **ISO 4401-05**  
**DSP5M**      **CETOP P05**  
**DSP7M**      **ISO 4401-07**  
**DSP8M**      **ISO 4401-08**  
**DSP10M**     **ISO 4401-10**

### OPERATING PRINCIPLE



- These solenoid operated directional valves are equipped with position sensors that monitor the main spool position. The switching position is indicated by a binary signal.
- TÜV certification body certifies the compliance of DS(P)\*M valves with the EC safety standards ISO 4413:2012, UNI EN 12622:2014, UNI EN 693:2001 +A2:2001, UNI EN 201:2010 and UNI EN 422:2009 with certificate TÜV IT 14 MAC 0043 .
- The valves are available in direct current versions only (see paragraph 8).
- These valves do not have manual override and can not be disassembled, because of their characteristics and their possible use on machinery subject to safety requirements. Moreover, their components are not interchangeable. Read the *Use and Maintenance manual* for instructions on operation, safe use and repair of the product

### PERFORMANCES

(working with mineral oil of viscosity of 36 cSt at 50°C)

		DS3M	DS5M	DSP5M DSP5RM	DSP7M	DSP8M	DSP10M
Maximum operating pressure: P - A - B ports	bar	350	320	320	350	350	350
T port		210		see performance limits at paragraph 5.5			
Maximum flow rate from P to A - B - T	l/min	80	120	150	300	600	1100
Ambient temperature range	°C	-20 / +50					
Fluid temperature range	°C	-20 / +80					
Fluid viscosity range	cSt	10 ÷ 400					
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15					
Recommended viscosity	cSt	25					
Mass: single solenoid valve	kg	1,8	5	7,1	8,7	15,6	50
double solenoid valve		2,2	-	8	9,6	16,6	50.5

## MACHINE DIRECTIVE CERTIFICATION

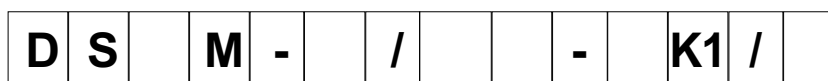
All solenoid valves and solenoid operated valves of the DS(P)\*M family were tested on a voluntary basis by TÜV and found to comply with the applicable requirements of the following standards:



- UNI EN ISO 4413:2012 - Hydraulic fluid power – General rules and safety requirements for systems and their components
- UNI EN 12622:2014 - Safety of machine tools - Hydraulic press brakes
- UNI EN 693:2001+A2:2011 - Machine tools – Safety – Hydraulic presses
- UNI EN 201:2010 - Plastics and rubber machines - Injection moulding machines - Safety requirements
- UNI EN 422:2009 - Rubber and Plastic machines – Safety requirements

## 1 - IDENTIFICATION OF SOLENOID VALVES DIRECT OPERATED

### 1.1 - Identification code



Directional control valve  
solenoid operated

3 = ISO 4401-03 size  
5 = ISO 4401-05 size

Monitoring of the spool position

Spool type (see par. 1.2)

**S1 SA1 SB1 TA TB**  
**S3 TA02 TB02**  
**S4 SA4 SB4 TA100 TB100**

Series No.

**20** = for DS5M

**21** = for DS3M

(the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:

**N** = NBR seals for mineral oil (**standard**)

**V** = FPM seals for special fluids

Monitored position:  
(see par. 16 for switching logic)

**R0** = monitored rest position

**MA** = monitored position 'a'

**MB** = monitored position 'b'

Coil electrical connection:  
plug for connector type  
DIN 43650 (**standard**)

DC power supply

**D12** = 12 V

**D24** = 24 V

**D110** = 110 V

**D220** = 220 V

**NOTE:** To be compliant with the EN 693:2011 standard, the valves have no manual override.

**NOTE:** Verify spool and sensor type availability in the tables below

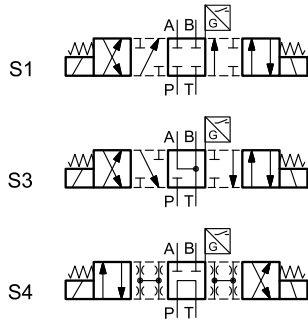
DS3		SPOOLS				
		S*	SA*	SB*	TA TA100	TB TB100
SENSOR TYPE	R0	x				
	MA		x	x	x	x
	MB		x	x	x	x

DS5		SPOOLS					
		S*	SA*	SB*	TA TA100	TA02 TB02	TB TB100
SENSOR TYPE	R0	x					
	MA		x	x	x	x	x
	MB		x	x	x	x	x

## 1.2 - Spool types for DS3M and DS5M

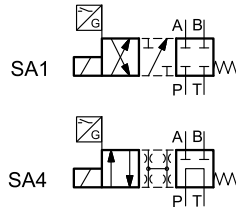
**Type S\*:**  
2 solenoids - 3 positions  
with spring centering

**Sensor RO**



**Type SA\*:**  
1 solenoid side A  
2 positions (central + external) with spring centering

**Sensor MA**

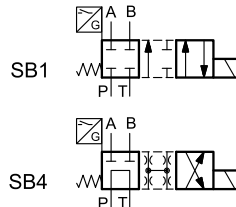


**Sensor MB**

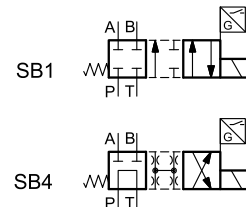


**Type SB\*:**  
1 solenoid side B  
2 positions (central + external) with spring centering

**Sensor MA**

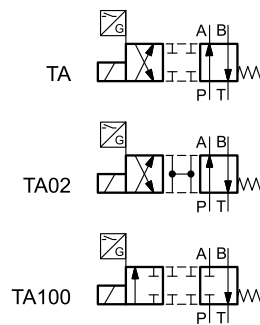


**Sensor MB**

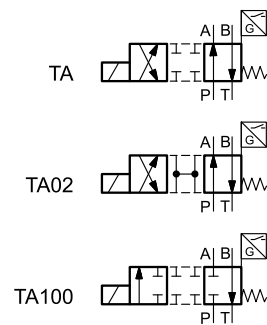


**Type TA:**  
1 solenoid side A  
2 external positions with return spring

**Sensor MA**

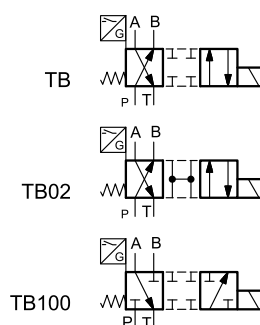


**Sensor MB**

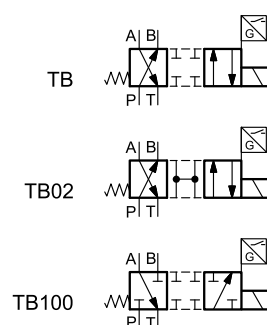


**Type TB:**  
1 solenoid side B  
2 external positions with return spring

**Sensor MA**



**Sensor MB**

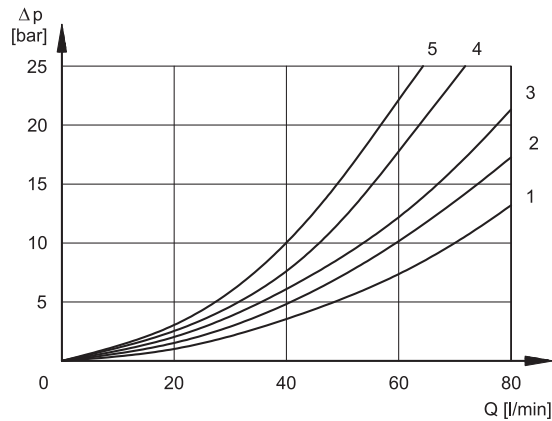




## 2 - CHARACTERISTIC CURVES OF DIRECT OPERATED SOLENOID VALVES

(obtained with viscosity 36 cSt at 50 °C)

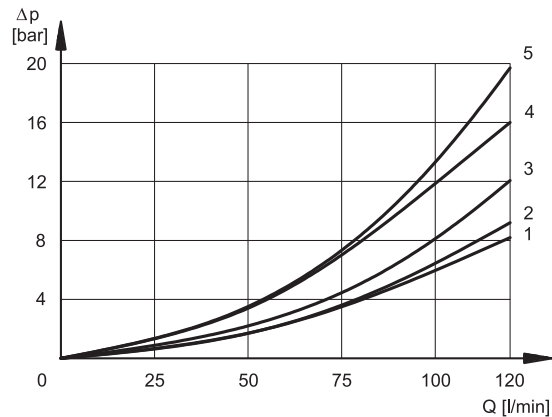
### 2.1 - DS3M - Pressure drops $\Delta p$ -Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1; SB1	2	2	3	3	-
S3	3	3	1	1	-
S4, SA4	5	5	5	5	3
TA, TB	2	2	2	2	-
TA100, TB100	4	4	4	4	-

For S3 in central position B→T refer to curve 3.

### 2.2 - DS5M - Pressure drops $\Delta p$ -Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1, SB1	2	2	1	1	
S3	2	1	2	3	
S4, SA4, SB4	1	1	2	2	4
TA, TB, TA02, TB02	3	3	2	2	-
TA100, TB100	2	2	2	2	-

For S3 in central position B→T refer to curve 5.

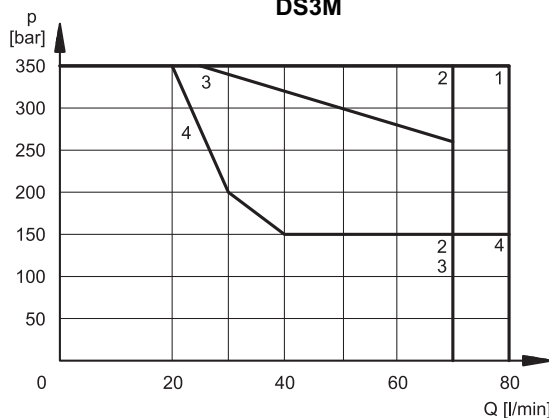
### 2.3 - Performance limits for DS3M and DS5M solenoid valves

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

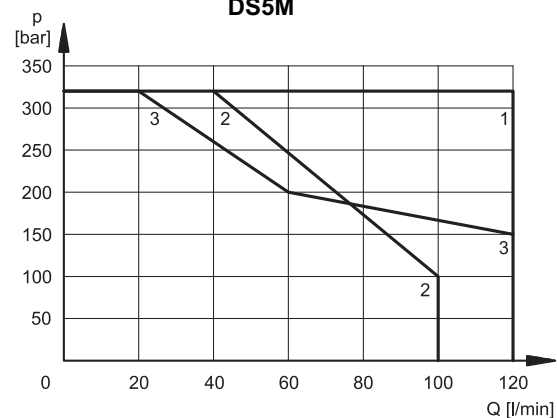
The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

DS3M



SPOOL	CURVE	
	P→A	P→B
S1,SA1	1	1
S3,	4	4
S4, SA4	2	2
TA, TB	1	1
TA100, TB100	3	3

DS5M



SPOOL	CURVE	
	P→A	P→B
S1	1	1
S3	3	3
S4	2	2
TA02	1	1
TA, TA100	1	1

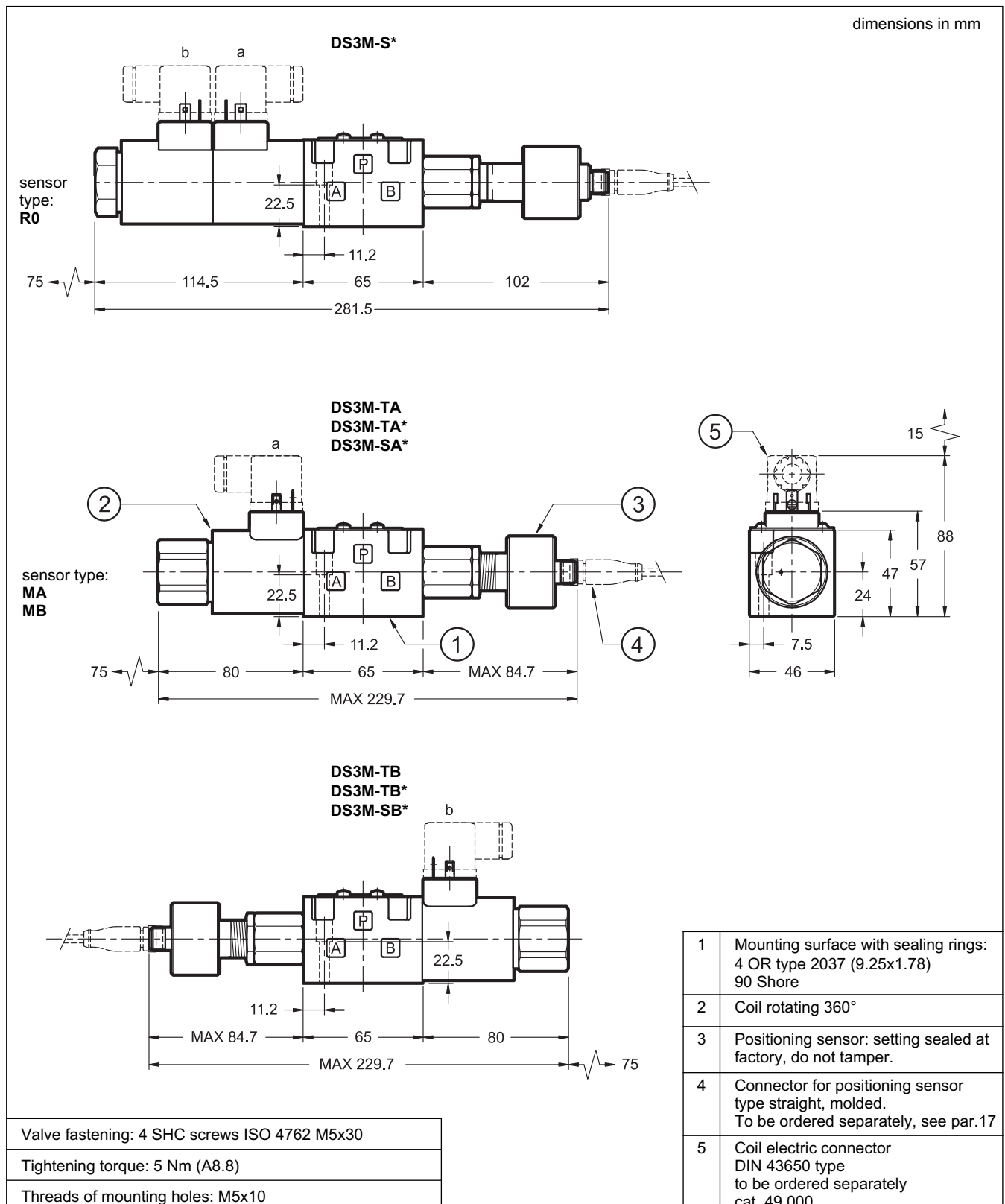
## 2.4 - Switching times

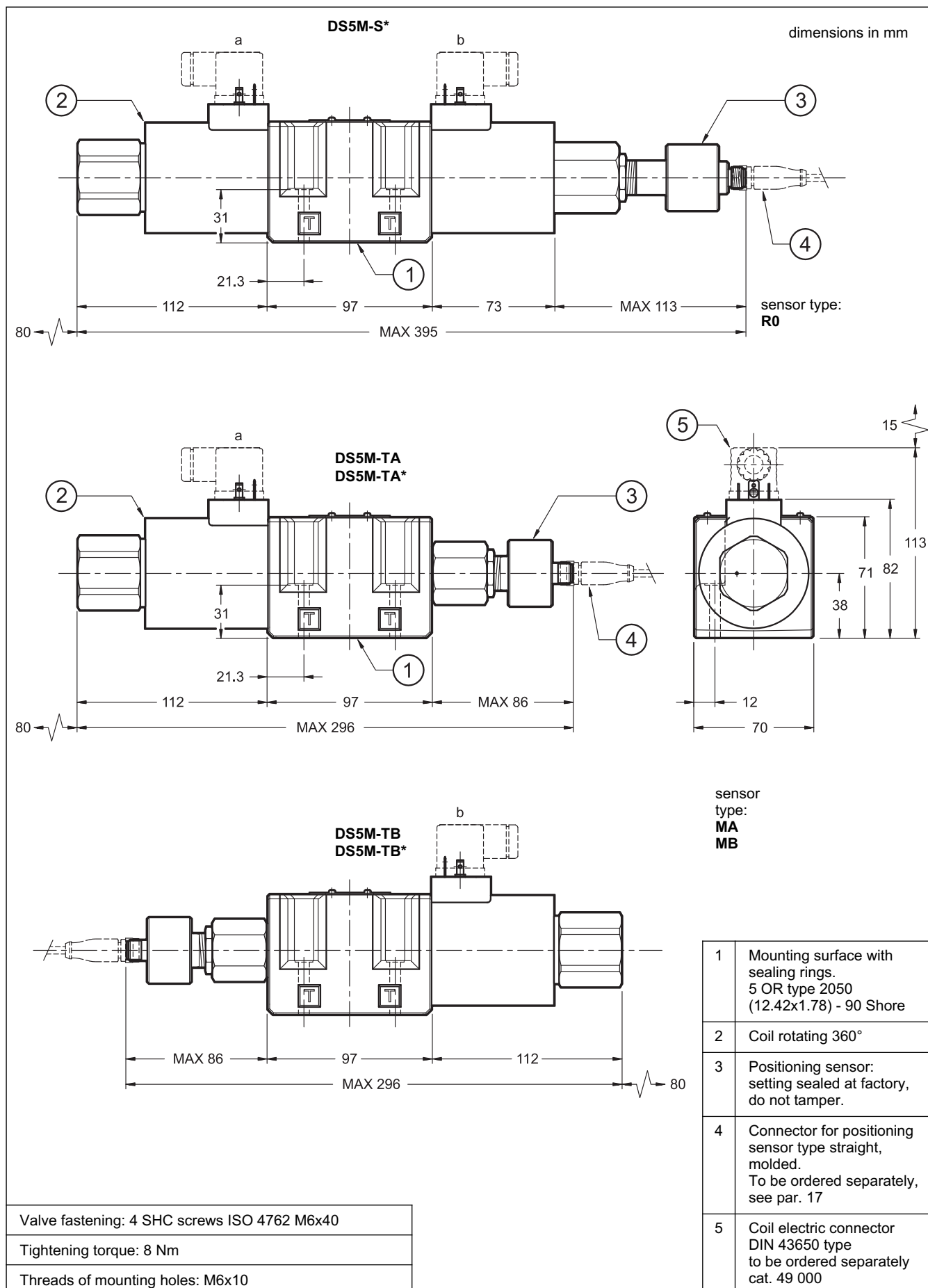
The indicated values had obtained according to ISO 6403 standards, using mineral oil with viscosity 36 cSt at 50 °C.

TIMES [ms]	ENERGIZING	DE-ENERGIZING
<b>DS3M</b>	25 ÷ 75	15 ÷ 25

TIMES [ms]	ENERGIZING	DE-ENERGIZING
<b>DS5M</b>	100 ÷ 150	20 ÷ 50

## 3 - OVERALL AND MOUNTING DIMENSIONS FOR DIRECT OPERATED VALVES





## 4 - IDENTIFICATION OF PILOT OPERATED SOLENOID VALVES

### 4.1 - Identification code

<b>D</b>	<b>S</b>	<b>P</b>	<b>M</b>	-	/	-	/	/	<b>K1</b>	/
----------	----------	----------	----------	---	---	---	---	---	-----------	---

Directional valve,  
Solenoid controlled  
Pilot operated

Size: \_\_\_\_\_  
**5** = CETOP P05  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08  
**10** = ISO 4401-10

Monitoring of the spool position \_\_\_\_\_

Spool type (see paragraph 4.2) \_\_\_\_\_  
**S1**   **SA1**   **SB1**   **TA**   **TB**  
**S3**   **TA100**   **TB100**  
**S4**  
**RK**

Series: \_\_\_\_\_  
**10** = for DSP5M, DSP5RM and DSP8M  
**20** = for DSP7M  
**30** = for DSP10M  
 (the overall and mounting dimensions within the same ten remain unchanged)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Piloting (see paragraph 6): \_\_\_\_\_  
**I** = internal (not available for S4 spool)  
**E** = external  
**C** = internal piloting with backpressure valve  
       (available on DSP7 and DSP8 only)  
**Z** = internal piloting with 30 bar fixed adjustment pressure reducing valve  
       (see par. 5.5)

Monitored position:  
(see par. 16 for switching logic)  
**1 positioning sensor**  
**R0** = rest position monitored  
**MA** = position 'a' monitored  
**MB** = position 'b' monitored  
**2 positioning sensor**  
**M0** = rest position monitored  
**MAB** = 'a' and 'b' positions monitored

Coil electrical connection:  
plug for connector type  
DIN 43650 (**standard**)

DC power supply  
**D12** = 12 V                      **D110** = 110 V  
**D24** = 24 V                      **D220** = 220 V

**P** = Subplate with restrictor on port P placed under the pilot valve  
 (omit for valves with piloting type Z and for valves with option D - control of the shifting speed of the main spool)  
**D** = shifting speed of the main spool (see par. 7)

Drainage (see paragraph 6):  
**I** = Internal  
**E** = External

**Verify spool and sensor type availability in the table below**

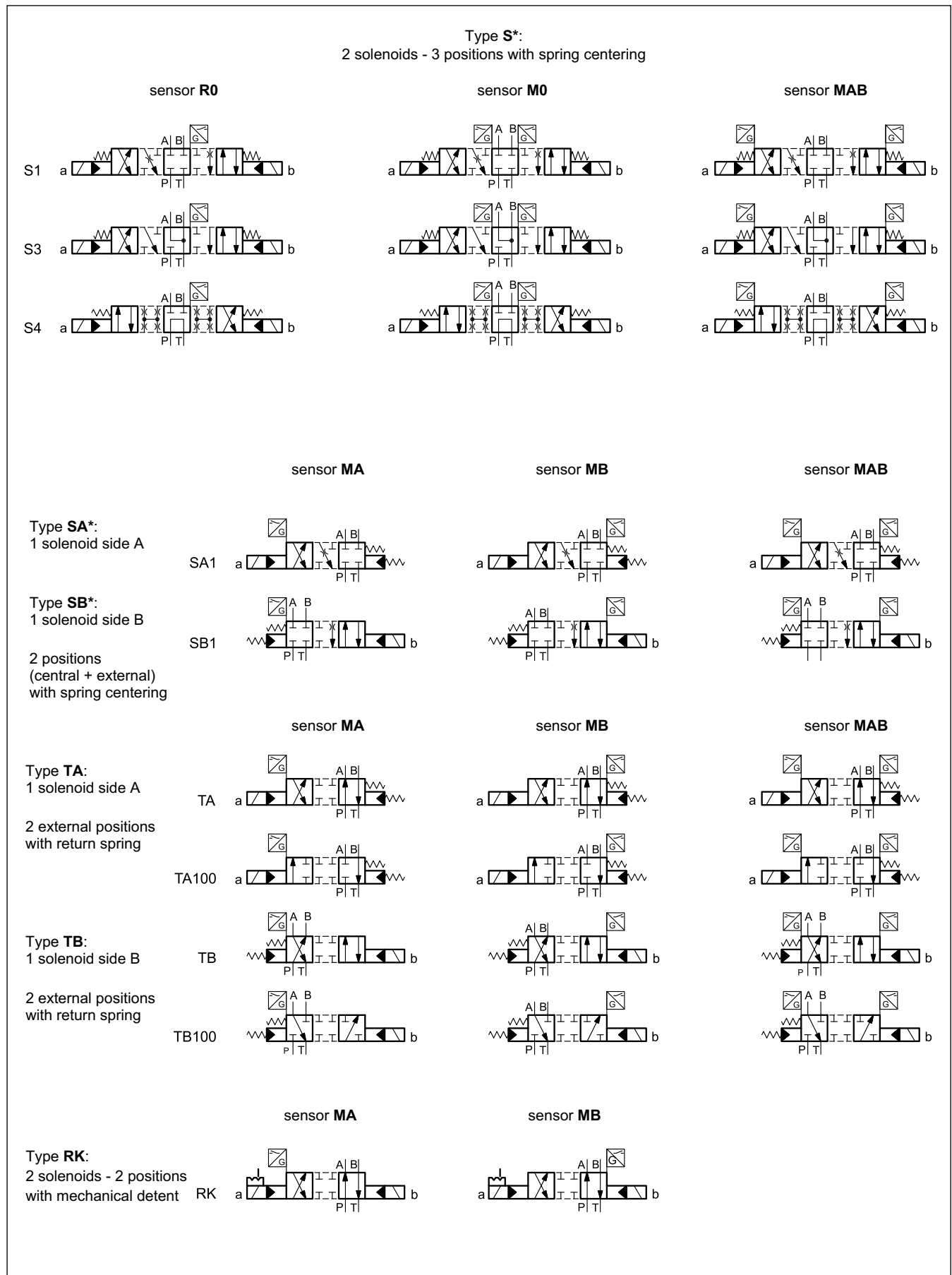
		SPOOLS				
		S*	SA* SB*	TA TB	TA100 TB100	RK
SENSOR TYPE	R0	x				
	MA		x	x	x	x
	MB		x	x	x	x
	M0	x				
	MAB	x	x	x	x	

**NOTE: DSP10M available with spools S1 or S4, with monitored position R0 or M0 only.**

**NOTE: To be compliant with the EN 693:2011 standard, the valves have no manual override.**



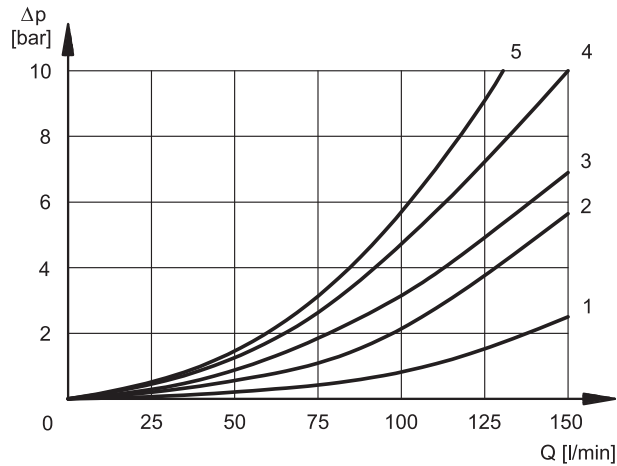
## 4.2 - Spool types for DSP5M, DSP5RM, DSP7M and DSP8M



## 5 - CHARACTERISTIC CURVES AND PERFORMANCES

(values obtained with viscosity 36 cSt at 50 °C)

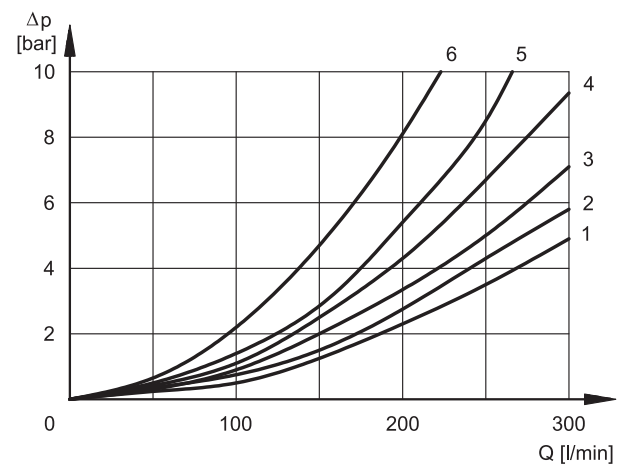
### 5.1 - DSP5M and DSP5RM - Pressure drops $\Delta p$ -Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1	4	4	1	1	-
S3	4	4	1	1	-
S4	5	5	2	3	5
TA, TB	4	4	1	1	-
TA100, TB100	3	3	1	1	-
RK	4	4	1	1	-

For pressure drops of the S3 spool in central position refer to the curve 4.

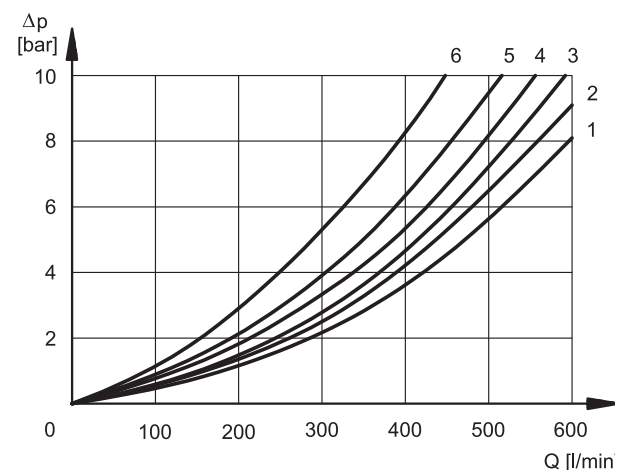
### 5.2 - DSP7M - Pressure drops $\Delta p$ -Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1	1	1	4	5	-
S3	1	1	5	5	-
S4	2	2	5	6	5
TA, TB	1	1	4	5	-
TA100, TB100	3	3	3	5	-
RK	1	1	4	5	-

For pressure drops of the S3 spool in central position refer to the curve 5.

### 5.3 - DSP8M - Pressure drops $\Delta p$ -Q

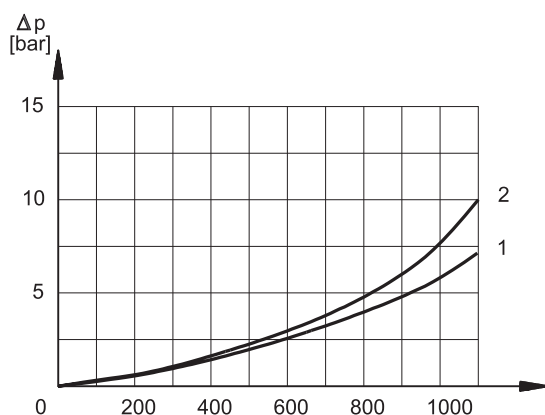


SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1	2	2	3	3	-
S3	2	2	2	1	-
S4	4	4	3	5	6
TA, TB	2	2	3	3	-
TA100, TB100	5	5	5	5	-
RK	2	2	3	3	-

For pressure drops of the S3 spool in central position refer to the curve 4.



## 5.4 - DSP10M - Pressure drops $\Delta p$ -Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1	1	1	1	1	-
S4	2	2	2	2	-

## 5.5 - Performance limits for pilot operated valves

PRESSURES	DSP5M DSP5RM	DSP7M	DSP8M	DSP10M
Max pressure in P, A, B ports	320	350	350	350
Max pressure in T line	210	210	210	210
Max pressure in Y line	210	210	210	210
Min piloting pressure <b>NOTE 1</b>	5 ÷ 10	5 ÷ 12	7 ÷ 14	6 ÷ 12
Max piloting pressure <b>NOTE 2</b>	210	210	210	280

**NOTE 1:** minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

**NOTE 2:** if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

Add the letter **Z** to the identification code to order this option (see par. 4.1).

MAXIMUM FLOW RATES		DSP5M DSP5RM		DSP7M		DSP8M		DSP10M	
Spool type		PRESSURES							
		210 bar	320 bar	210 bar	350 bar	210 bar	350 bar	210 bar	350 bar
S4 - TA100	[l/min]	120	100	200	150	500	450	750	600
S1 - S3 - TA - RK		150	120	300	300	600	500	900	700

## 5.6 - Switching times

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

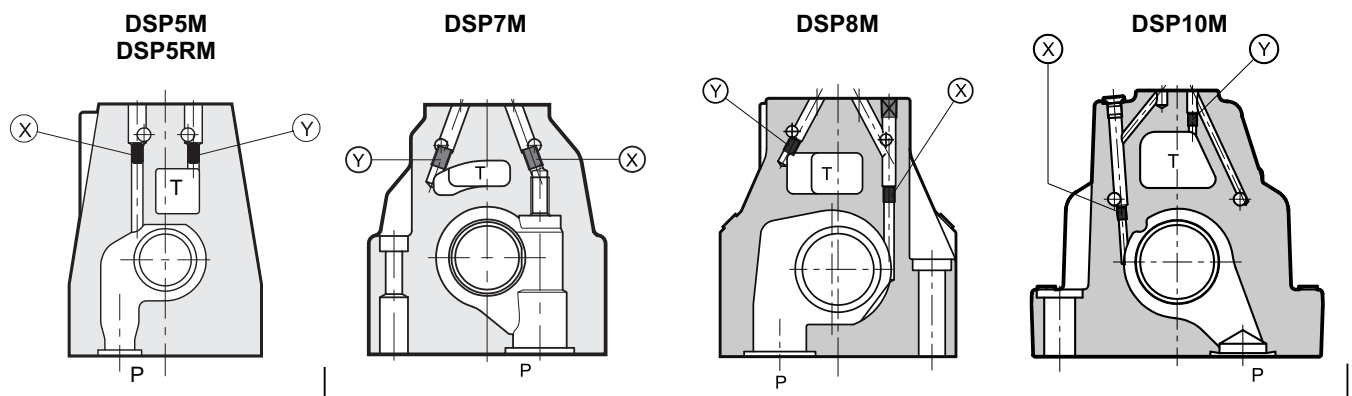
The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

TIMES (± 10%) [ms]	ENERGIZING		DE-ENERGIZING	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
DSP5M - DSP5RM	60	50	50	40
DSP7M	75	60	60	45
DSP8M	100	70	80	50
DSP10M	-	100	-	140

## 6 - PILOTING AND DRAINAGE

These valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

TYPE OF VALVE		Plug assembly	
		X	Y
<b>IE</b>	internal pilot and external drain	NO	YES
<b>II</b>	Internal pilot and internal drain	NO	NO
<b>EE</b>	external pilot and external drain	YES	YES
<b>EI</b>	external pilot and internal drain	YES	NO



**X:** plug M5x6 for external pilot  
**Y:** plug M5x6 for external drain

**X:** plug M6x8 for external pilot  
**Y:** plug M6x8 for external drain

### 6.1 - Backpressure valve incorporated on line P (C option)

DSP7M and DSP8M valves are available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in rest position, has the line P connected to the T port (spools S4).

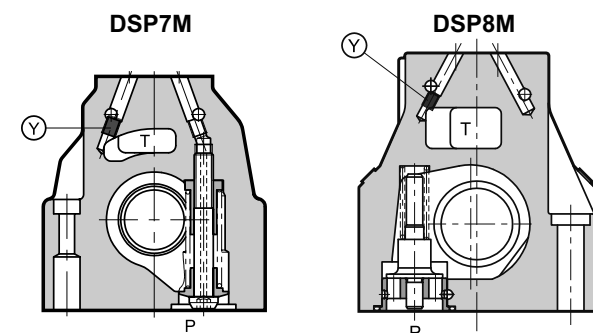
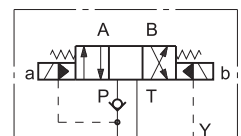
The cracking pressure is of 5 bar with a minimum flow rate of 15 l/min.

**In the C version the piloting is always internal.**

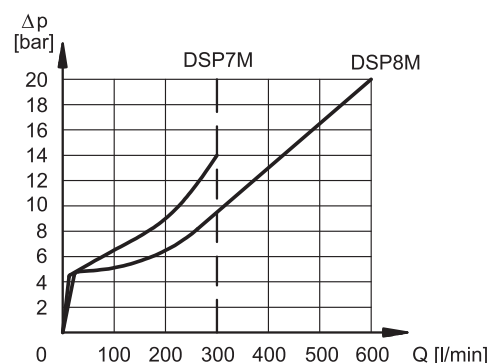
**NOTE:** the backpressure valve can't be used as check valve because it doesn't assure the seal.

Add **C** to the identification code for this request (see paragraph 4.1).

**For DSP7M only**, the backpressure valve can be also delivered separately and it can be easily mounted on line P of the main control valve. Ask for code **0266577** to order the backpressure valve.



pilot always internal  
**Y:** plug M6x8 for external drain



The curve refers to the pressure drop (body part only) with backpressure valve inside, to which the pressure drop of the reference spool must be added. (see par. 5)

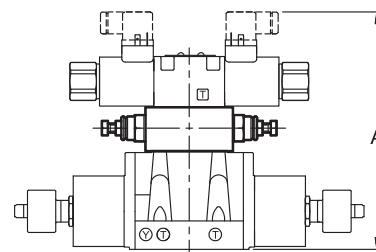


## 7 - OPTIONS

### 7.1 - Option D : control of the main spool shifting speed

By placing a MERS type double flow control valve between the pilot solenoid valve and the hydropiloted valve, the piloted flow rate can be controlled and therefore the change over smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 4.1).



dimensions in mm

	DSP5	DSP7	DSP8	DSP10
A	218	225	254	307

## 8 - ELECTRICAL FEATURES

### 8.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated and locked to suit the available space.

**NOTE 1 :** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see catalogue 49 000).

**NOTE 2:** The IP65 protection degree is intended for the whole valve. It is guaranteed only with valve and connectors correctly connected and installed.

<b>VOLTAGE SUPPLY FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b> DS3M DS5M DSP5M - DSP5RM DSP7M DSP8M DSP10M	 15.000 ins/hr 13.000 ins/hr 5.000 ins/hr 5.000 ins/hr 4.000 ins/hr 3.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)</b>	In compliance with 2014/30/EU
<b>LOW VOLTAGE</b>	In compliance with 2014/35/EU
<b>CLASS OF PROTECTION:</b> Atmospheric agents (IEC 60529) Coil insulation (VDE 0580) Impregnation	<b>IP65 (NOTE 2)</b> class H class F

### 8.2 - Current and absorbed power

The tables shows current and power consumption values relevant to the different coil types for DC.

**DS3M, DSP5M, DSP5RM, DSP7M, DSP8M and DSP10M**  
(values ± 10%)

Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
<b>D12</b>	12	4,4	2,72	32,7	1903080
<b>D24</b>	24	18,6	1,29	31	1903081
<b>D110</b>	110	436	0,26	28,2	1903464
<b>D220</b>	220	1758	0,13	28,2	1903465

**DS5M (values ± 5%)**

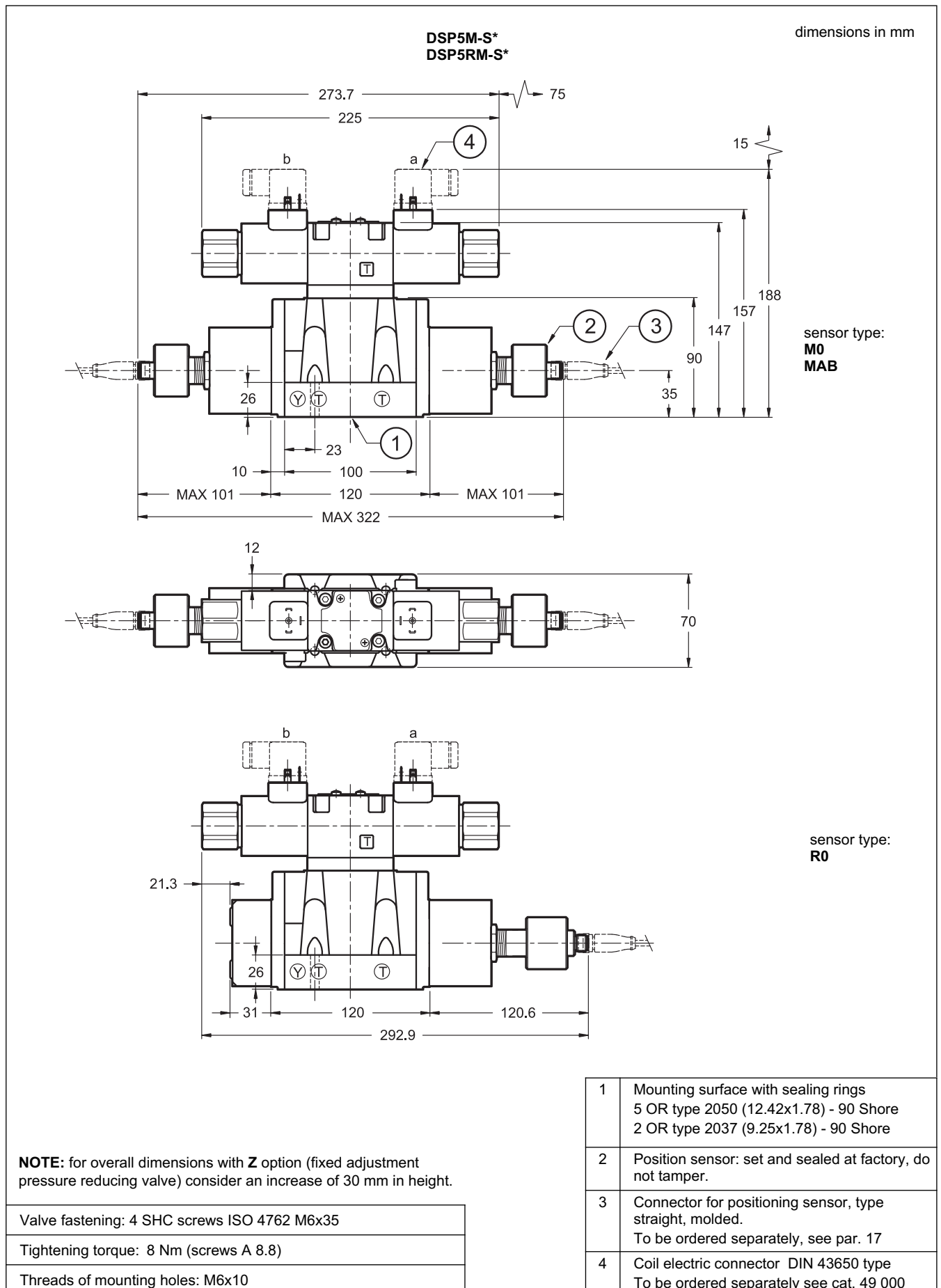
Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
<b>D12</b>	12	3,2	3,75	45	1903550
<b>D24</b>	24	12	2	48	1903551
<b>D110</b>	110	250	0,44	48	1903554
<b>D220</b>	220	1050	0,21	47	1903555

## 9 - COIL CONNECTORS

The solenoid operated valves are delivered without the connectors. They can be ordered separately.

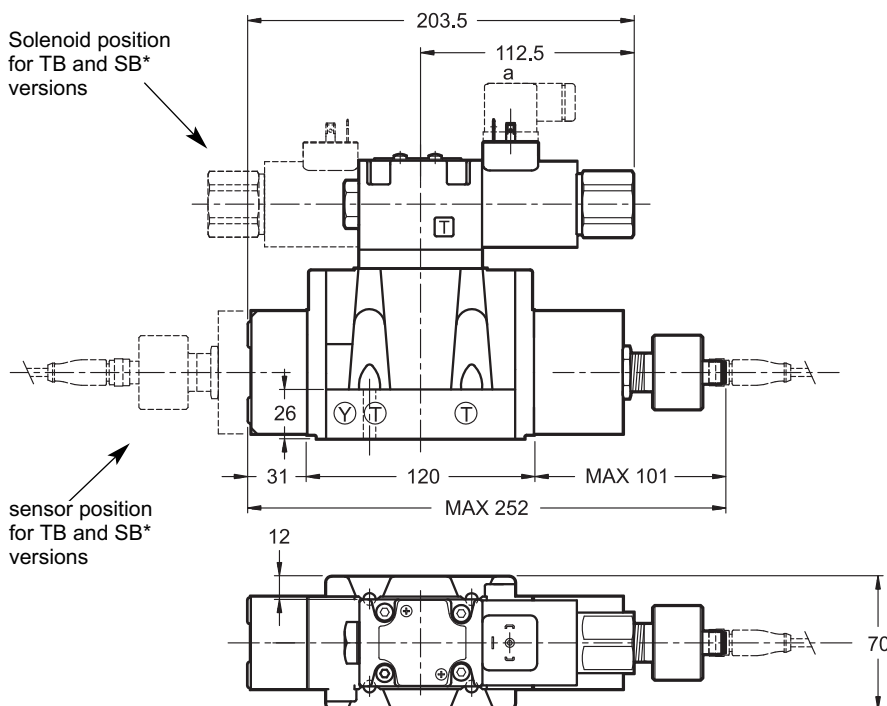
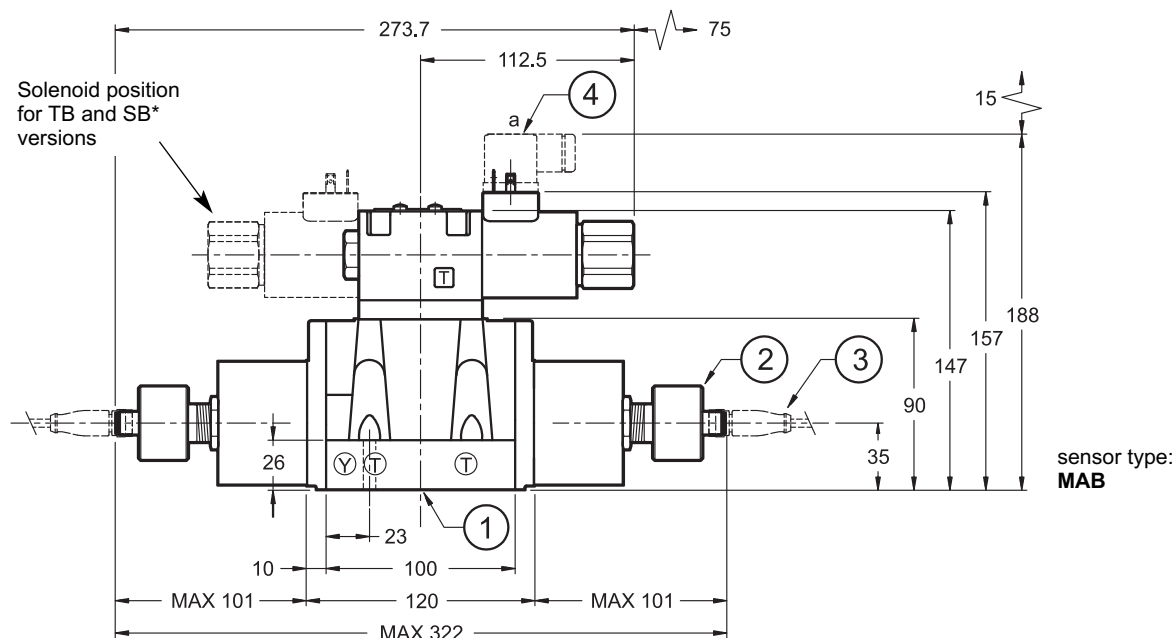
For the identification of the connector type to be ordered, please see catalogue 49 000.

**10 - DSP5M AND DSP5RM OVERALL AND MOUNTING DIMENSIONS**



**DSP5M-TA, TA100, SA1**  
**DSP5RM-TA, TA100, SA1**

dimensions in mm

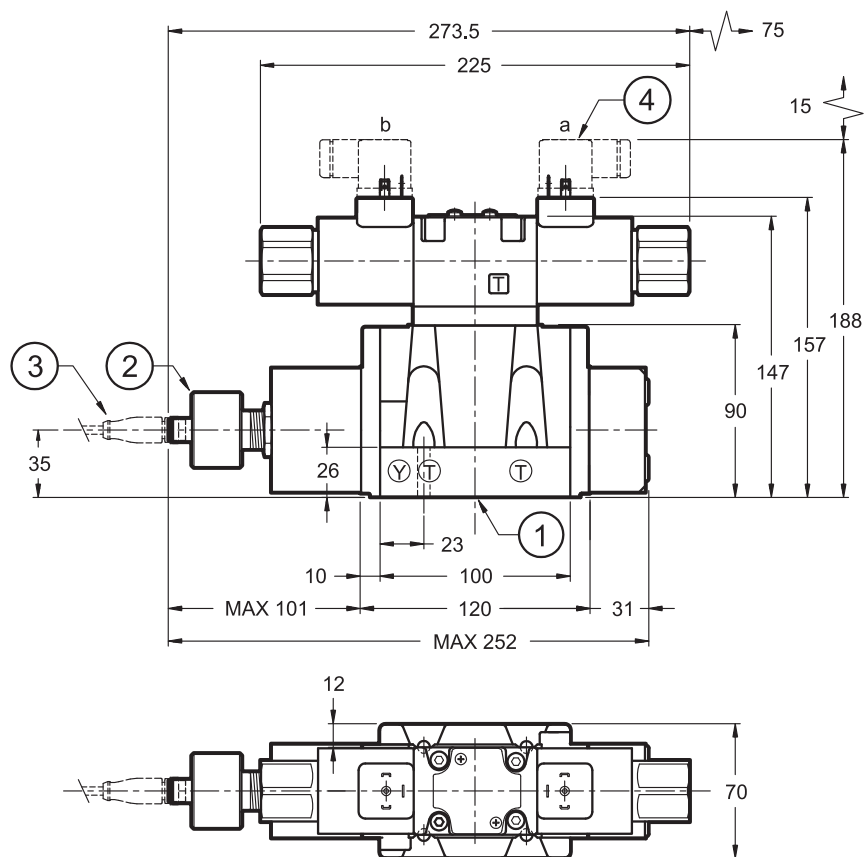


**NOTE:** for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

1	Mounting surface with sealing rings 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

dimensions in mm

DSP5M-RK  
DSP5RM-RK



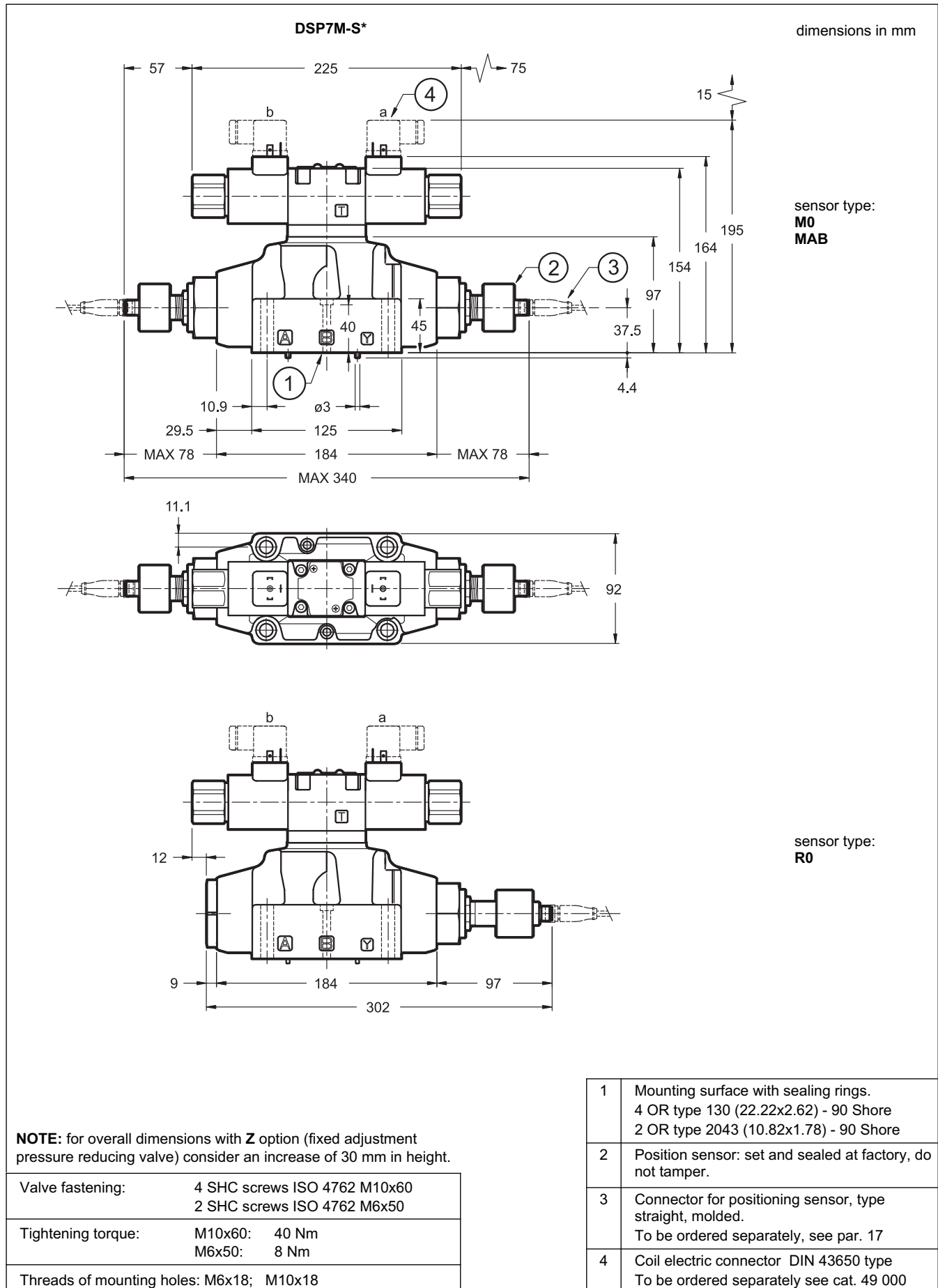
sensor type:  
**MA**  
**MB**

**NOTE:** for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

1	Mounting surface with sealing rings 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

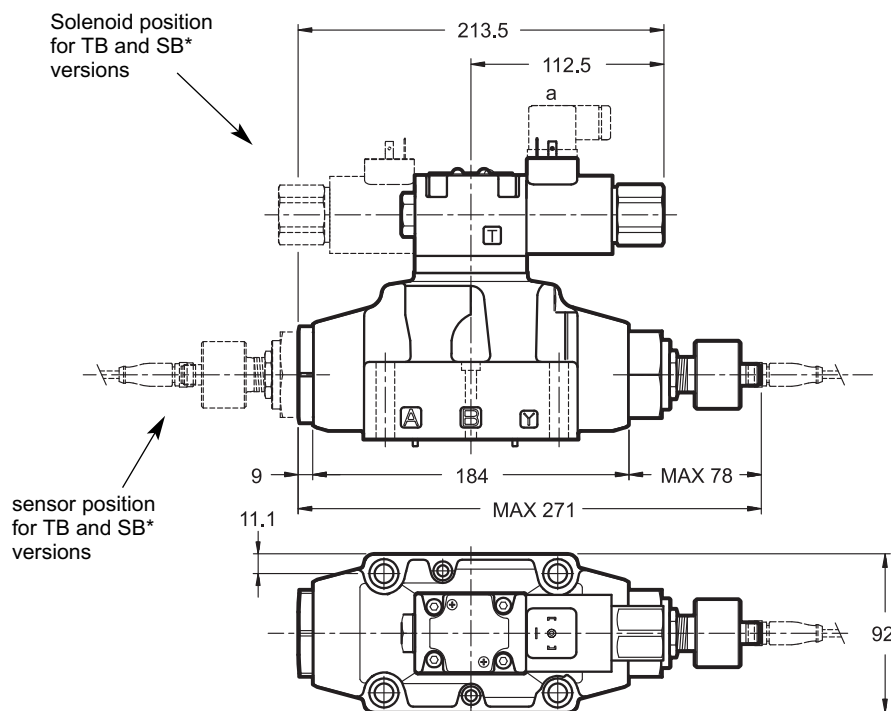
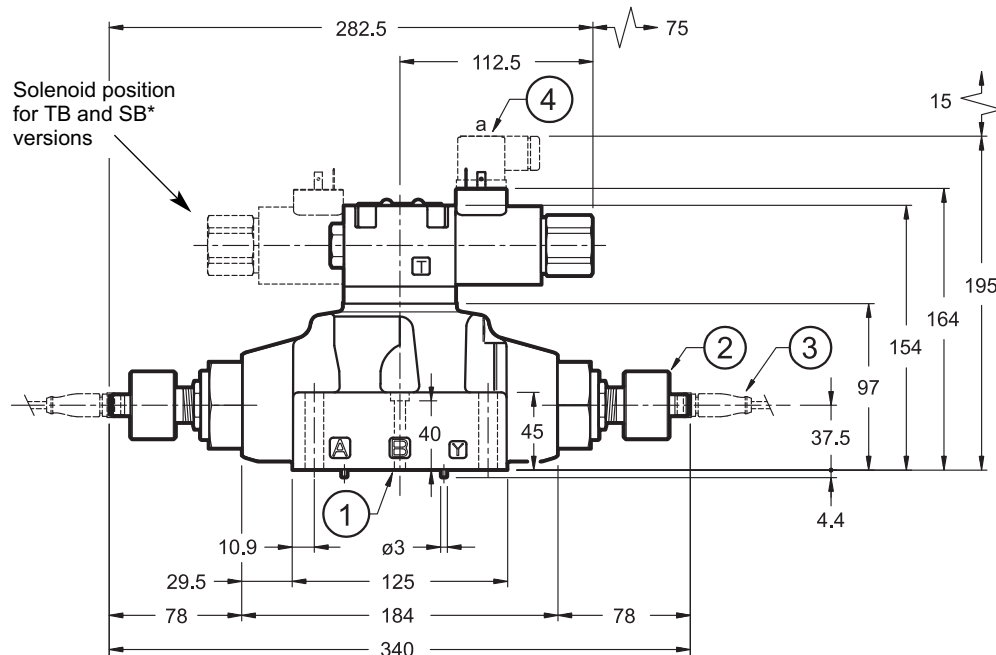


## 11 - DSP7M OVERALL AND MOUNTING DIMENSIONS



**DSP7M-TA, TA100, SA1**

dimensions in mm

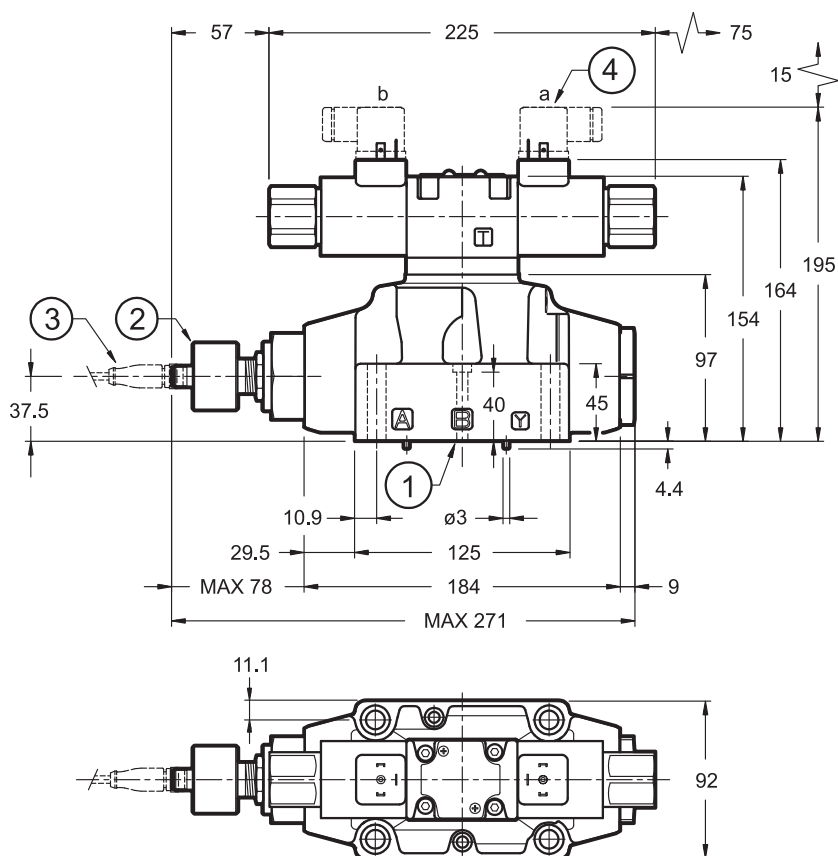


**NOTE:** for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

1	Mounting surface with sealing rings. 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

dimensions in mm

**DSP7M-RK**

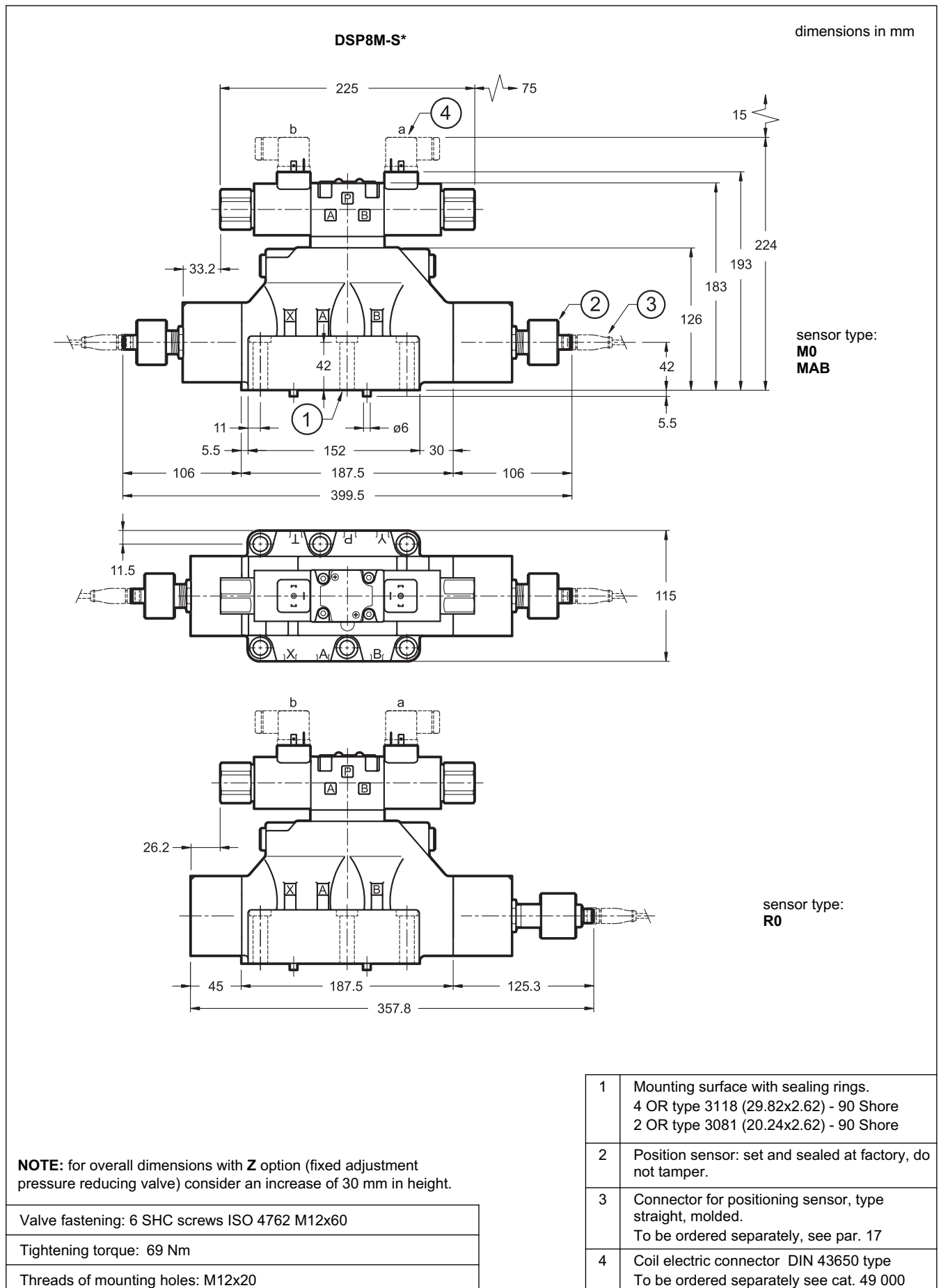


sensor type:  
MA  
MB

**NOTE:** for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

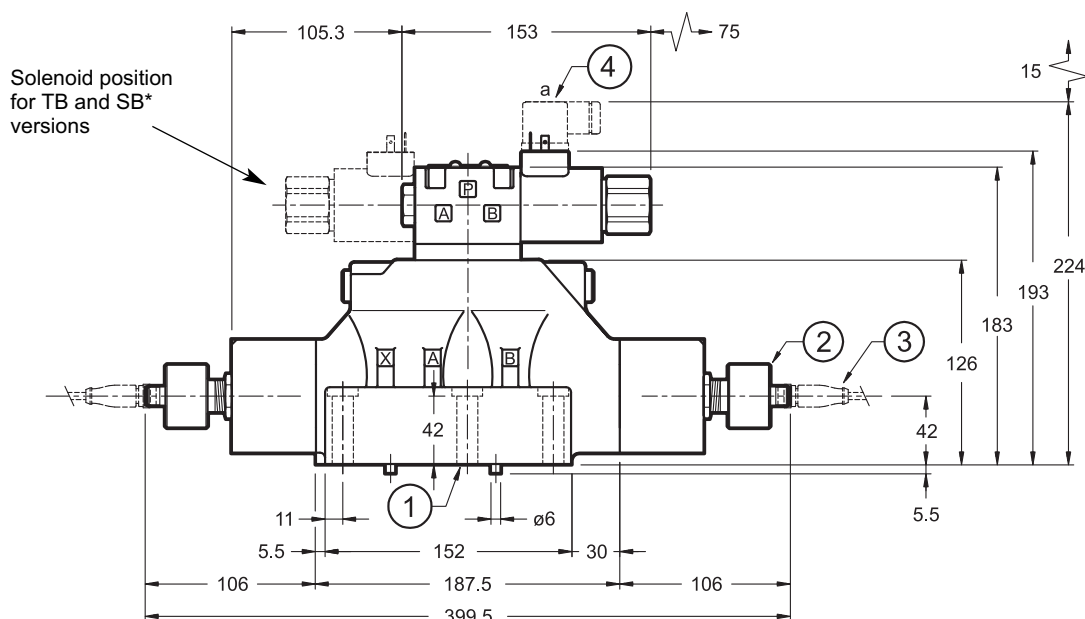
1	Mounting surface with sealing rings. 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

## 12 - DSP8M OVERALL AND MOUNTING DIMENSIONS

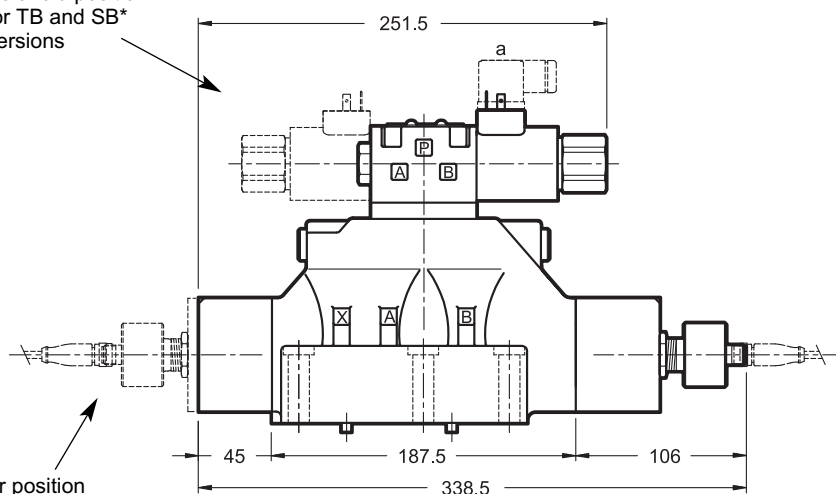


**DSP8M-TA, TA100, SA1**

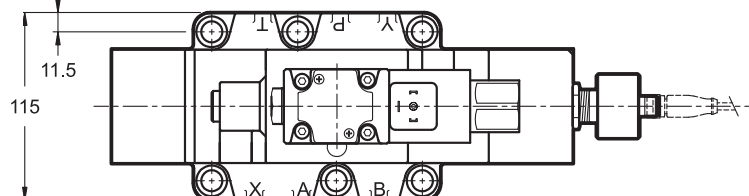
dimensions in mm



Solenoid position for TB and SB\* versions



sensor position for TB and SB\* versions

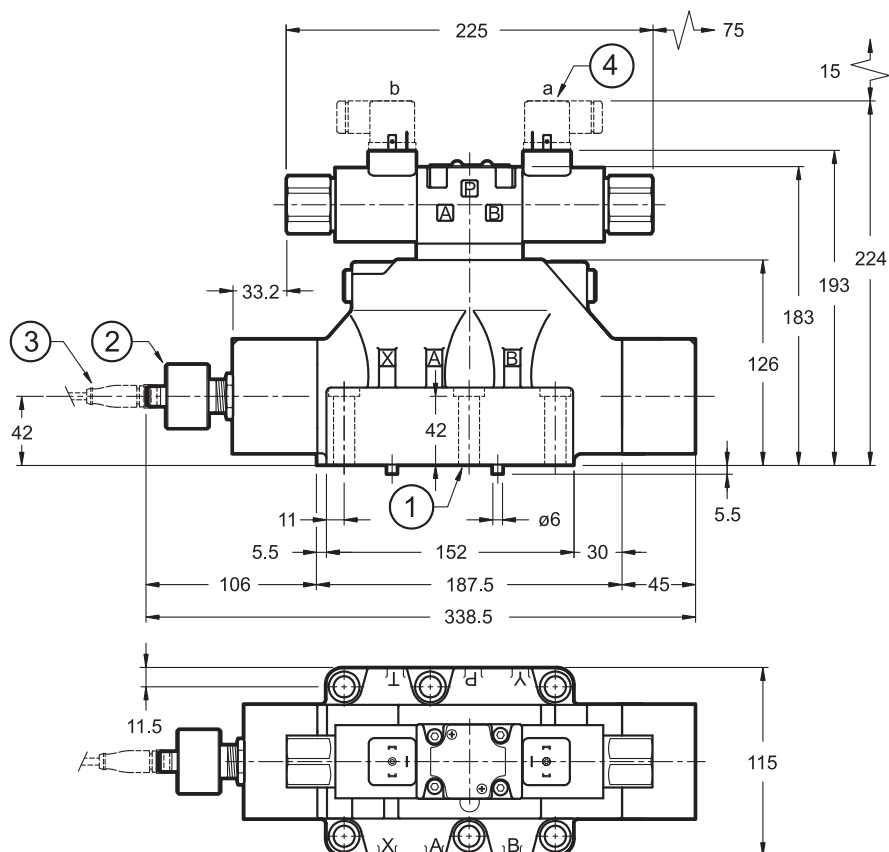


**NOTE:** for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

1	Mounting surface with sealing rings. 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

**DSP8M-RK**

dimensions in mm

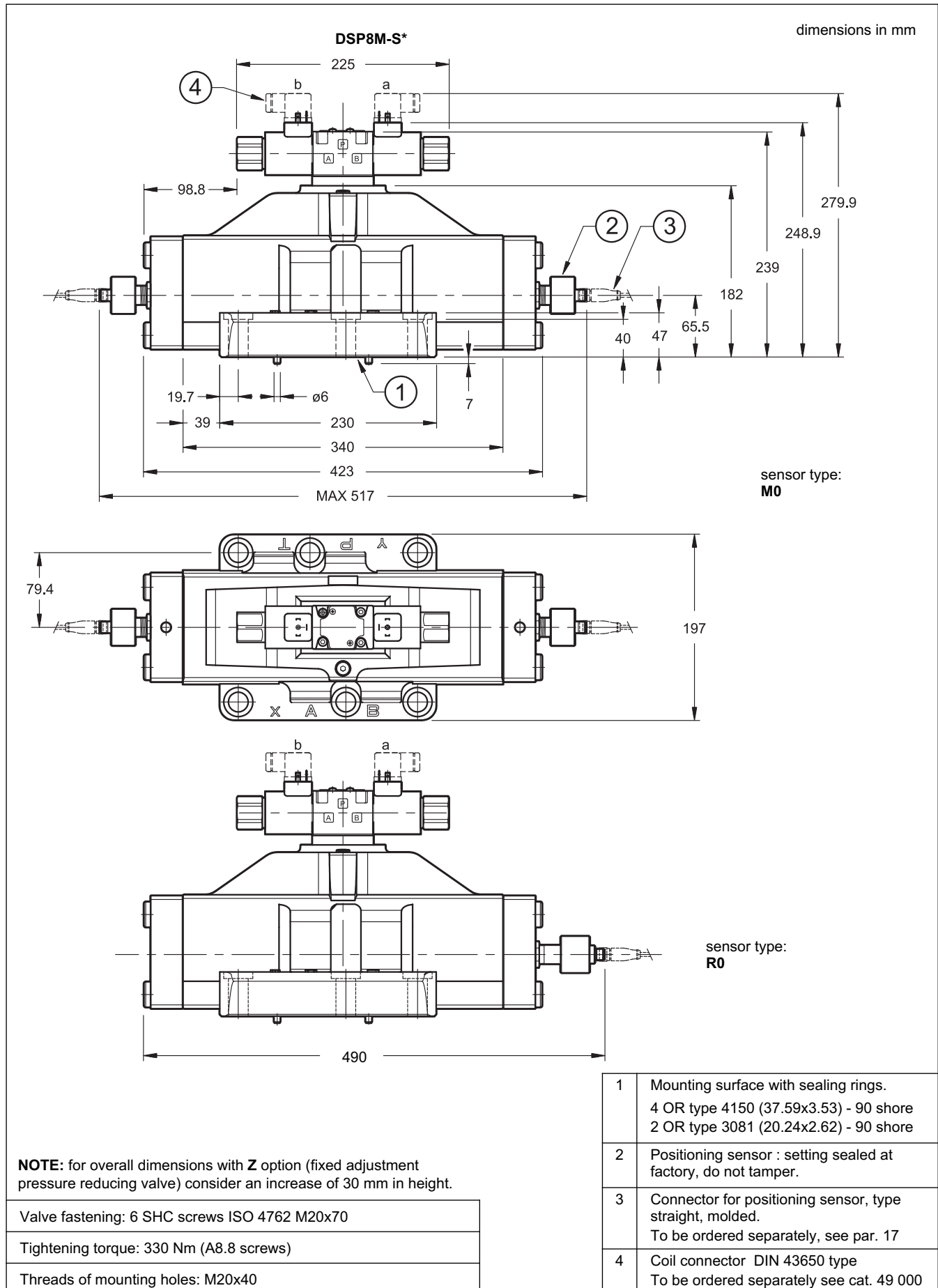


sensor type:  
**M0**  
**MAB**

**NOTE:** for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

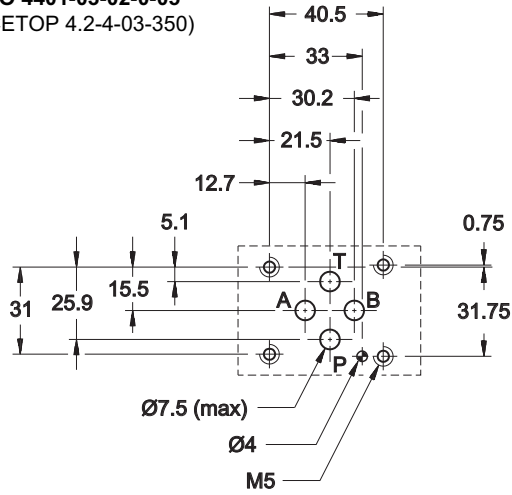
1	Mounting surface with sealing rings. 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

## 13 - DSP10M OVERALL AND MOUNTING DIMENSIONS

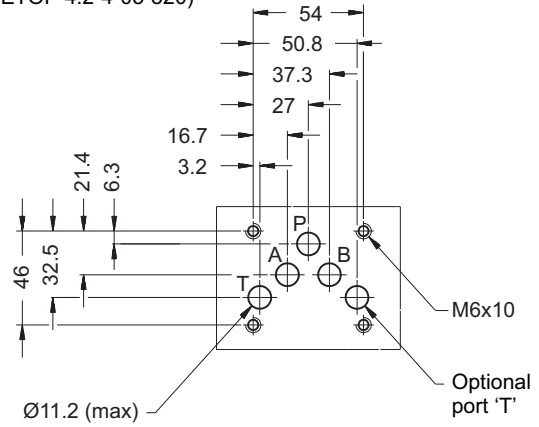


## 14 - MOUNTING SURFACES

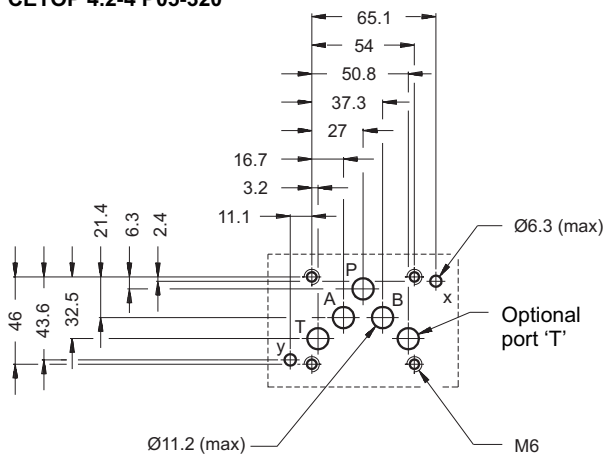
**DS3M**  
ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



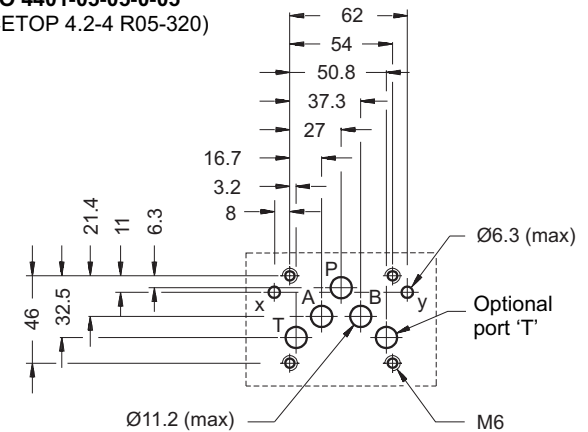
**DS5M**  
ISO 4401-05-04-0-05  
(CETOP 4.2-4-05-320)



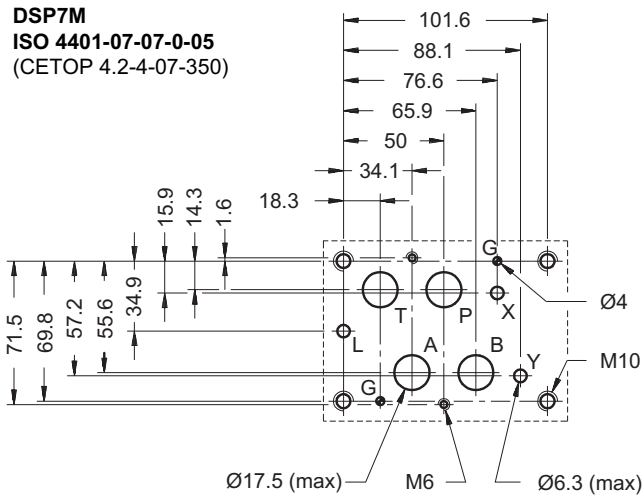
**DSP5M**  
CETOP 4.2-4 P05-320



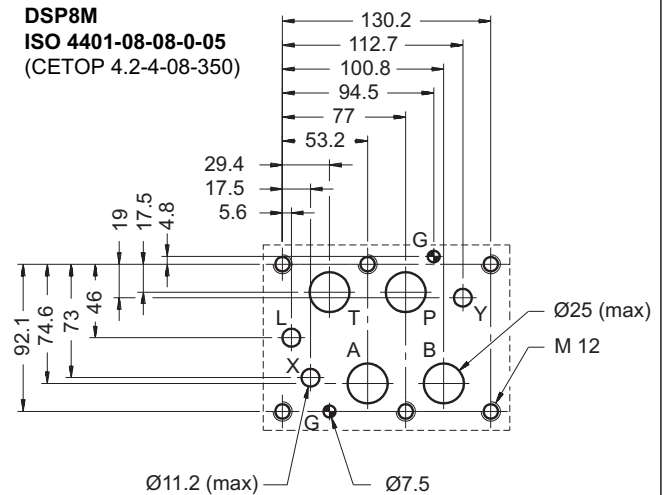
**DSP5RM**  
ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-320)



**DSP7M**  
ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)

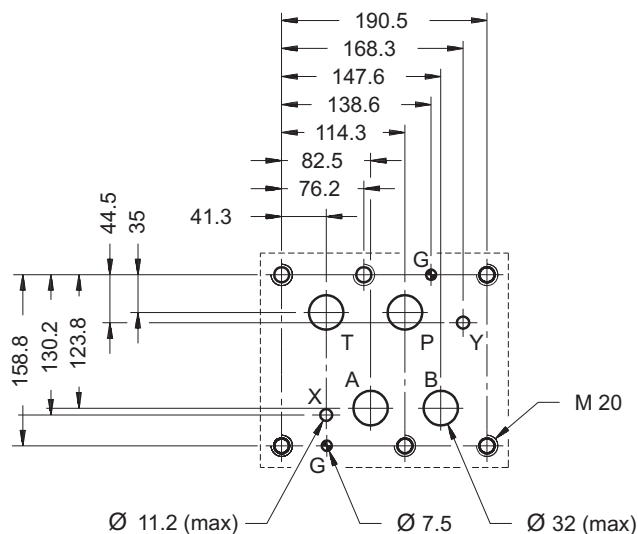


**DSP8M**  
ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)





**DSP10M**  
**ISO 4401-10-09-0-05**  
 (CETOP 4.2-4-10-350)



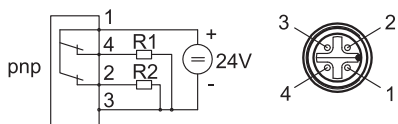
## 15 - POSITIONING SENSORS



**WARNING ! The disassembly of the valve is not allowed. The sensors must not be unscrewed or tampered with in any way.**

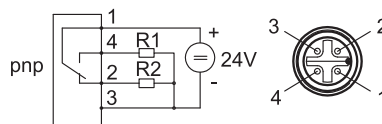
The M0 and MAB versions have two positioning sensors; consider that the connection scheme shown must be done for each sensor.

### R0 CONNECTION SCHEME



Pin	Values	Function
1	+24 V	Supply
2	NC	Normal Closed -
3	0 V	-
4	NC	Normal Closed +

### M\* CONNECTION SCHEME



Pin	Values	Function
1	+24 V	Supply
2	NC	Normal Closed
3	0 V	-
4	NO	Normal Open

ELECTRICAL CHARACTERISTICS		
Operating voltage range	V DC	20 ÷ 32
Absorbed current	A	0.4
Max output load	mA	400
Output		2 PNP
Electric protections	polarity inversion short circuit	
Hysteresis	mm	≤ 0.1
Operating temperature range	°C	-25 / +80
Class of protection from atmospheric agents (IEC 60529)		IP65
EMC Electromagnetic compatibility	In compliance with 2014/30/EU	

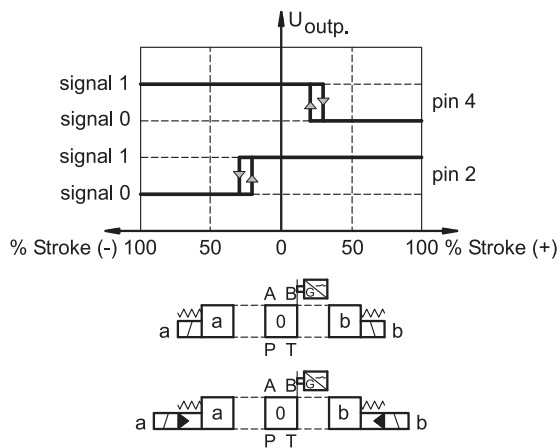
## 16 - SWITCHING LOGICS

Duplomatic offers a wide range of available positions to be monitored, and for the pilot operated valve there are even monitoring with redundant signal.

### 16.1 - R0 monitoring

Central position monitored with one positioning sensor.

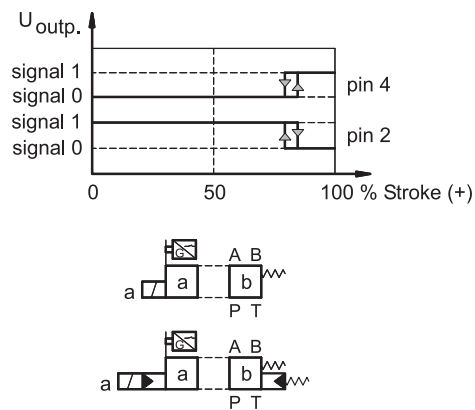
Available on both direct and pilot operated valves;  
spool type S\*



### 16.2 - MA monitoring

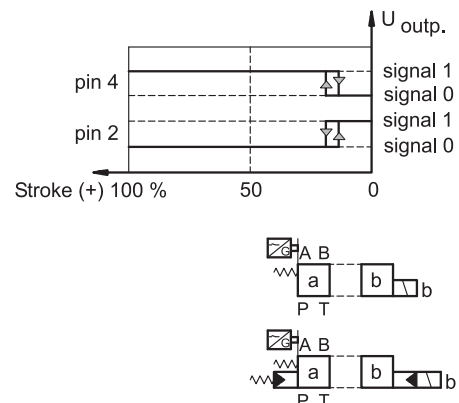
Energized position monitored with one positioning sensor.

Available on both direct and pilot operated valves;  
spool type SA\*, TA, TA02, TA100



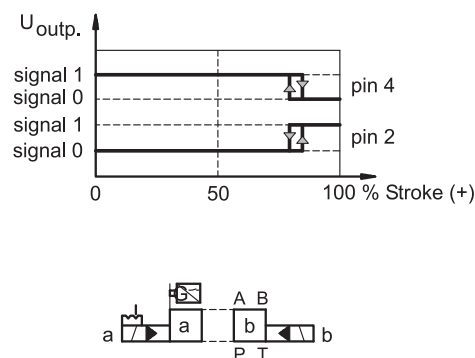
De-energized position monitored with one positioning sensor.

Available on both direct and pilot operated valves;  
spool type SB\*, TB, TB02, TB100



Position 'a' monitored with one positioning sensor.

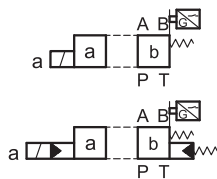
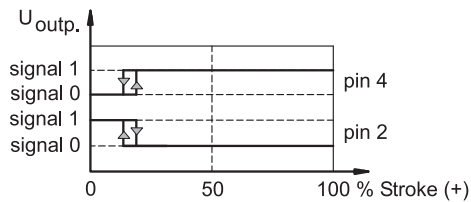
Available on pilot operated valves only;  
spool type RK



## 16.3 - MB monitoring

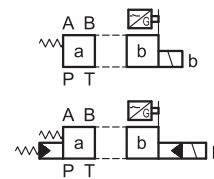
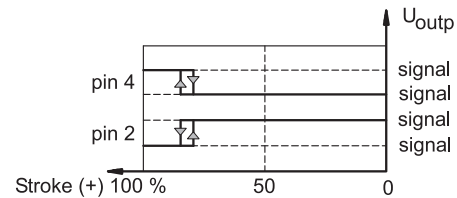
De-energized position monitored with one positioning sensor.

Available on both direct and pilot operated valves;  
spool type SA\*, TA, TA02, TA100



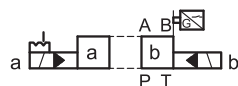
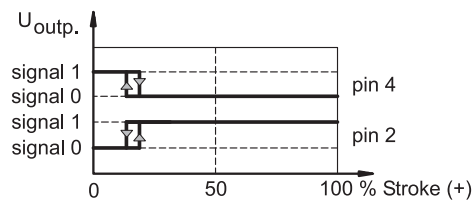
Energized position monitored with one positioning sensor.

Available on both direct and pilot operated valves;  
spool type SB\*, TB, TB02, TB100



Position 'b' monitored with one positioning sensor.

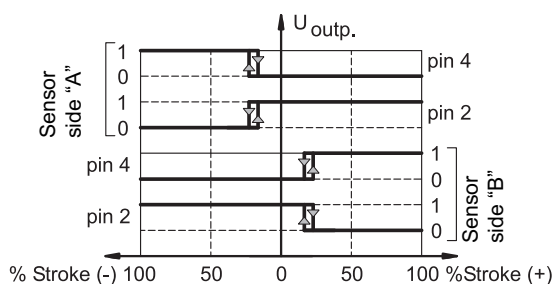
Available on pilot operated valves only;  
spool type RK



## 16.4 - M0 monitoring

Central position monitored by two separate positioning sensors.

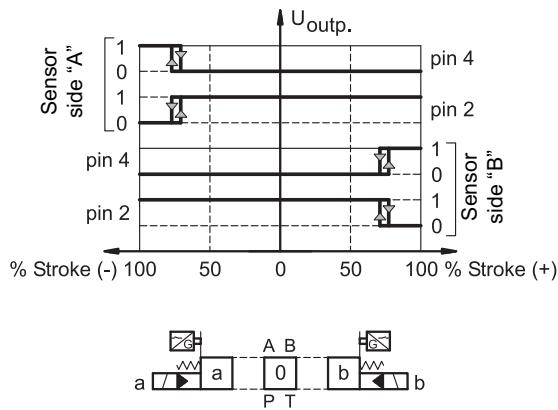
Available on pilot operated valves only;  
spool type S\*



## 16.5 - MAB monitoring

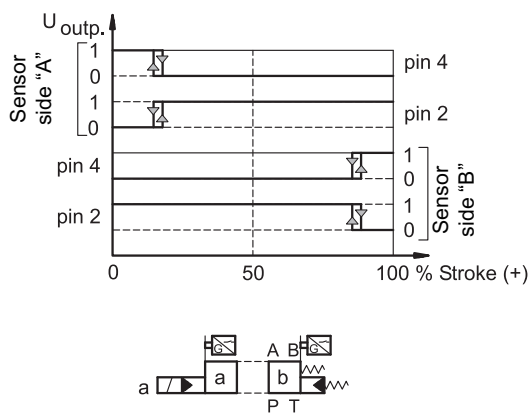
Both external positions monitored by two separate positioning sensors.

Available on pilot operated valves only;  
spool type S\*



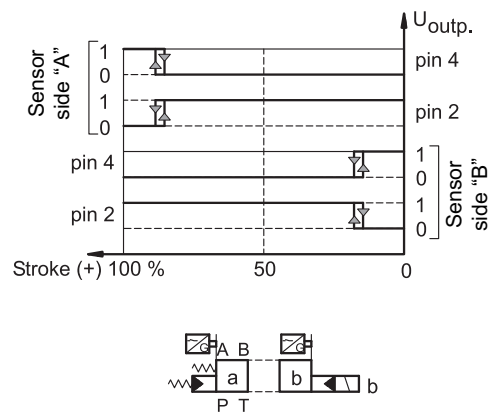
De-energized position monitored on side A.  
Energized position monitored on side B.

Available on pilot operated valves only;  
spool type SA1, TA, TA100



Energized position monitored on side A.  
De-energized position monitored on side B.

Available on pilot operated valves only;  
spool type SB1, TB, TB100



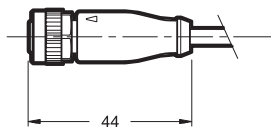
## 17 - SENSOR CONNECTORS

The female connectors for position switches can be ordered separately, by specifying the descriptions here below, depending on the desired type.

### STRAIGHT CONNECTOR, MOLDED CABLE, PRE-WIRED

description: ECM4S/M12L/10

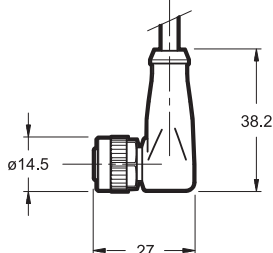
Protection class: IP68  
Cable: 4 conductors 0.34 mm<sup>2</sup>  
length 5 mt - Ø 4.7 mm  
Cable material: polyurethane resin (oil resistant)  
Without LED.



### ANGLED CONNECTOR, MOLDED CABLE, PRE-WIRED

description: ECM4S/M12S/10

Protection class: IP68  
Cable: 4 conductors 0.34 mm<sup>2</sup>  
length 5 mt - Ø 4.7 mm  
Cable material: polyurethane resin (oil resistant)  
Without LED.

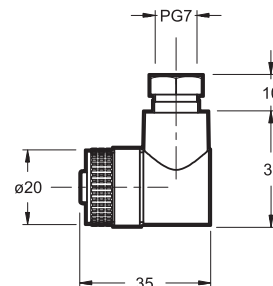


### ANGLED CONNECTOR, UNASSEMBLED

Circular connector with screw locking; strain relief by means of clamping cage.

description: EC4S/M12S/10

Protection class: IP67  
IEC 61076-2-101 (Ed. 1)  
IEC 60947-5-2  
Conductor size: max 0.75 mm<sup>2</sup>  
Cable gland: PG7  
suitable cables: 4 ÷ 6 mm<sup>2</sup>  
Case material: polyamide (nylon)  
Without LED.



## 18 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 19 - INSTALLATION

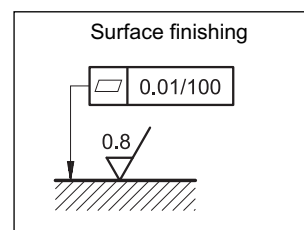


**WARNING! These valves must be installed and commissioned by qualified personnel only. Before starting any installation, commissioning or maintenance is mandatory read the manual of use and maintenance, delivered together with the valve.**

Configurations with centering and recall springs can be mounted in any position; The RK versions, without springs and with mechanical detent, must be mounted with the longitudinal axis horizontal.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



## 20 - SUBPLATES

(see catalogue 51 000)

	DS3M	DS5M	DSP5M	DSP7M	DSP8M
Type with rear ports	PMMD-AI3G	PMD4-AI4G	PME4-AI5G	PME07-AI6G	-
Type with side ports	PMMD-AL3G	PMD4-AL4G	PME4-AL5G	PME07-AL6G	PME5-AL8G
P, T, A, B ports dimensions	3/8" BSP	3/4" BSP (PMD4-AI4G) 1/2" BSP (PMD4-AL4G)	3/4" BSP	1" BSP	1 1/2" BSP
X, Y ports dimensions	-	-	1/4" BSP	1/4" BSP	1/4" BSP



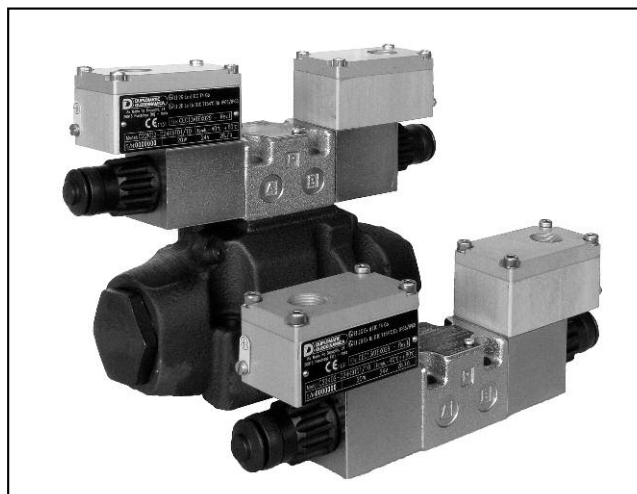
**DIPLOMATICO OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

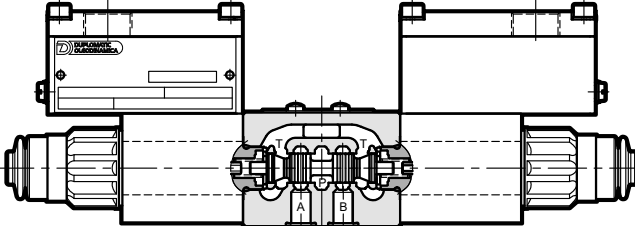
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



# **D\*K\*** **EXPLOSION-PROOF** **SOLENOID OPERATED** **DIRECTIONAL CONTROL VALVES** **ATEX, IECEx, INMETRO**

<b>DS3K*</b>	<b>ISO 4401-03</b>
<b>DL5BK*</b>	<b>ISO 4401-05</b>
<b>DSP5K*</b>	<b>CETOP P05</b>
<b>DSP5RK*</b>	<b>ISO 4401-05</b>
<b>DSP7K*</b>	<b>ISO 4401-07</b>
<b>DSP8K*</b>	<b>ISO 4401-08</b>
<b>DSP10K*</b>	<b>ISO 4401-10</b>

## OPERATING PRINCIPLE



- The direct operated directional valves are available in ISO 4401-03 and ISO 4401-05 size; available pilot operated sizes are: CETOP P05, ISO 4401-05, ISO 4401-07, ISO 4401-08 and ISO 4401-10.
- They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- DS3K\* and DL5BK\* valves are supplied with a zinc-nickel finishing surface treatment that ensures a salt spray resistance up to 600 h; for DSP\*K\* valves, this treatment is available upon request.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

## PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		<b>DS3K*</b>	<b>DL5BK*</b>	<b>DSP5K*</b> <b>DSP5RK*</b>	<b>DSP7K*</b>	<b>DSP8K*</b>	<b>DSP10K*</b>
Maximum operating pressure							
P - A - B ports	bar	350	320	320	350	350	350
T port		210	210	see operating limits at paragraph 6			
Maximum flow from P port to A - B - T	l/min	80	125	150	300	600	1100
Operating temperatures (ambient and fluid)	°C	see data sheet 02 500					
Fluid viscosity range	cSt	10 ÷ 400					
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15					
Recommended viscosity	cSt	25					
Mass							
single solenoid valve	kg	1,8	2,7	6,8	8,6	15,5	52
double solenoid valve		2,8	3,8	7,8	9,6	16,5	53

## 1 - IDENTIFICATION OF DIRECT OPERATED SOLENOID VALVES

### 1.1 - Identification code

<b>D</b>			<b>-</b>		<b>/ 10</b>		<b>-</b>		<b>K9</b>	<b>/</b>	
----------	--	--	----------	--	-------------	--	----------	--	-----------	----------	--

Direct operated solenoid valve

Size: \_\_\_\_\_  
**S3** = ISO 4401-03  
**L5B** = ISO 4401-05

Explosion-proof certification: \_\_\_\_\_  
**See table 1.2**

Spool type (see par. 1.3) \_\_\_\_\_  
**S\***    **TA**    **TB**    **RK**  
**SA\***   **TA02**   **TB02**  
**SB\***   **TA23**   **TB23**

Series No.: \_\_\_\_\_  
(the overall and mounting dimensions do not change from 10 to 19)

Seals: \_\_\_\_\_  
For temperature range -20 / +80 °C  
**N** = NBR seals for mineral oil (standard)  
**V** = FPM seals for special fluids  
For temperature range -40 / +80 °C  
**NL** = seal for low temperatures (for mineral oil)

Option: **/T5**  
version in T5 temperature class.  
Omit if not required.

Manual override:  
**CM** = boot protected  
**standard for both N and V seals**  
not available for NL seals  
**CB** = blind ring nut  
**standard for NL seals**  
available upon request for both N and V seals  
**CK** = knob manual override  
(only for DC version)  
**CH** = lever manual override.  
Not available for DLB5K\*  
Dimensions for CB and CH at par. 16

Connection type for cable gland  
upper connection:  
**T01** = M20x1.5 - ISO 261  
**T02** = Gk 1/2 - UNI EN 10226-2  
not available for INMETRO  
**T03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
side connection:  
**S01** = M20x1.5 - ISO 261  
**S02** = Gk 1/2 - UNI EN 10226-2  
not available for INMETRO  
**S03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
**S04** = M16x1.5 - ISO 261

Coil electrical connection: by terminal block

Power supply:  
Direct current (DC)  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
Alternate current with built-in rectifier bridge (RAC)  
**R120** = 120 V  
**R240** = 240 V

**NOTE:** the zinc-nickel standard finishing surface treatment is suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards)

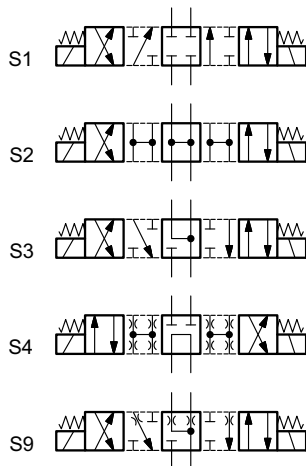
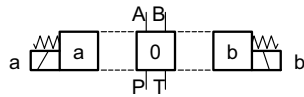
### 1.2 - Names of valves per certification

	ATEX		IECEX		INMETRO	
for gases for dusts	<b>KD2</b>	II 2GD	<b>KXD2</b>	IECEX Gb IECEX Db	<b>KBD2</b>	INMETRO Gb INMETRO Db
for mines	<b>KDM2</b>	I M2	<b>KXDM2</b>	IECEX Mb	<b>KBDM2</b>	INMETRO Mb

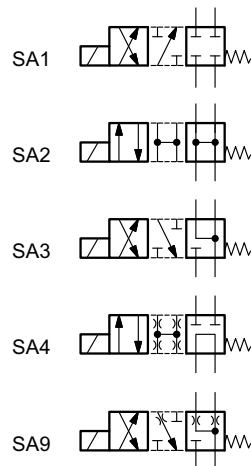
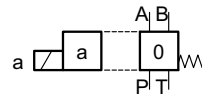
**NOTE:** Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

## 1.3 - Available spools

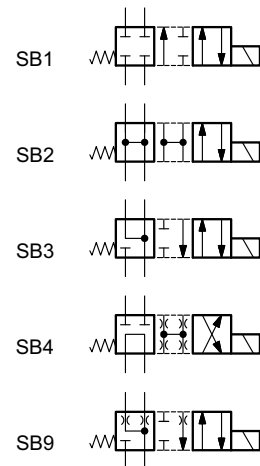
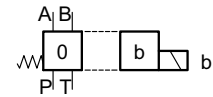
Version **S\***:  
2 solenoids - 3 positions  
with spring centering



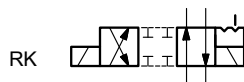
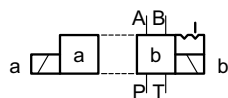
Version **SA\***:  
1 solenoid side A  
2 positions (central + external)  
with spring centering



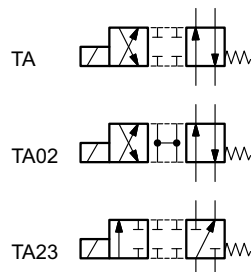
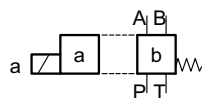
Version **SB\***:  
1 solenoid side B  
2 positions (central + external)  
with spring centering



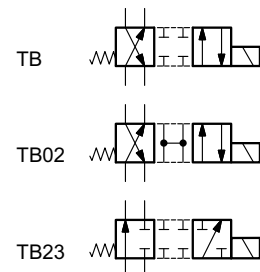
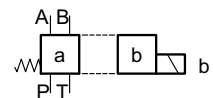
Version **RK**:  
2 solenoids - 2 positions  
with mechanical detent



Version **TA**:  
1 solenoid side A  
2 external positions  
with return spring



Version **TB**:  
1 solenoid side B  
2 external positions  
with return spring



**NOTE:** TA02/TB02  
spools are not available  
for RAC solenoid valves.

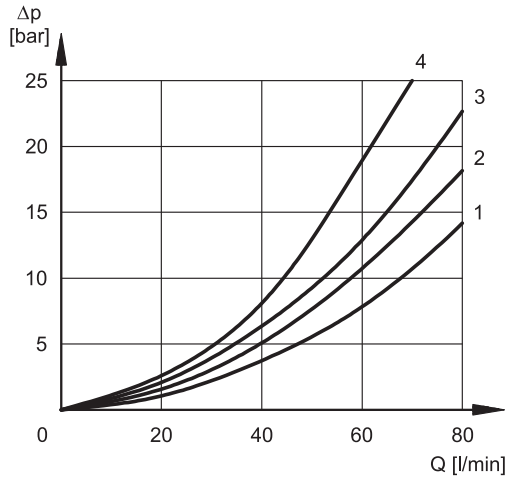




## 2 - CHARACTERISTIC CURVES AND PERFORMANCES OF DIRECT OPERATED SOLENOID VALVES

### 2.1 - Pressure drops $\Delta p$ -Q

(values obtained with viscosity 36 cSt at 50 °C)



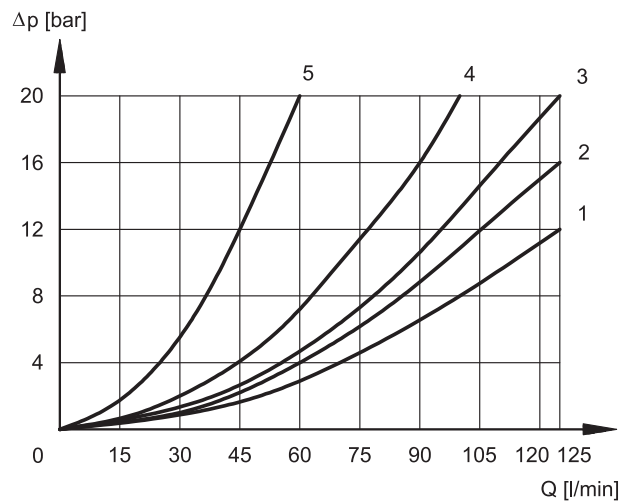
DS3K\*

#### ENERGIZED VALVE

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB2	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	4	4	4	4
S9, SA9, SB9	2	2	3	3
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3	-	-
RK	2	2	2	2

#### DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	2
S3, SA3, SB3	-	-	3	3	-
S4, SA4, SB4	-	-	-	-	3



DL5BK\*

#### ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
S9	1	1	1	1
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

#### DE-ENERGIZED VALVE

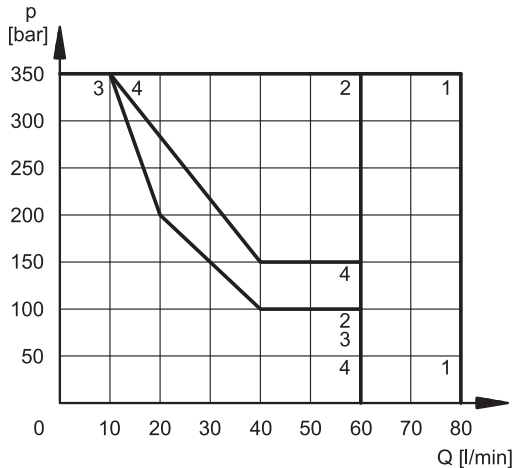
SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

## 2.2 - Performance limits

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage, with mineral oil with viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

### DS3K\*



#### DC SOLENOID VALVE

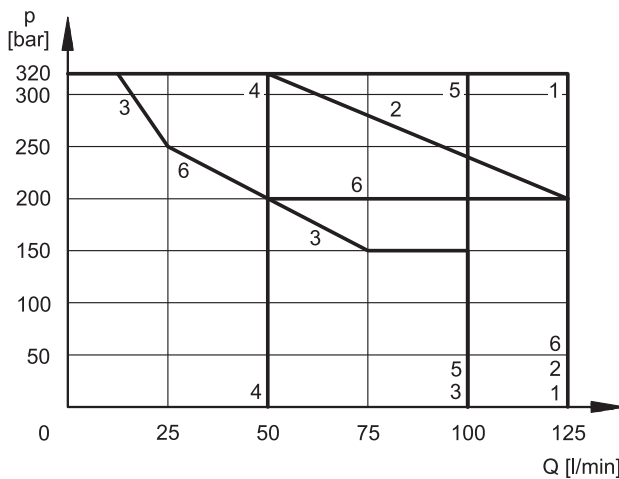
SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	2	2
S9, SA9, SB9	1	1
TA, TB	1	1
TA02, TB02	4	4
TA23, TB23	4	4
RK	1	1

#### RAC SOLENOID VALVE

SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	4	4
S9, SA9, SB9	1	1
TA, TB	1	1
TA02 *, TB02 *		
TA23, TB23	4	4
RK	1	1

\* not available

### DL5BK\*



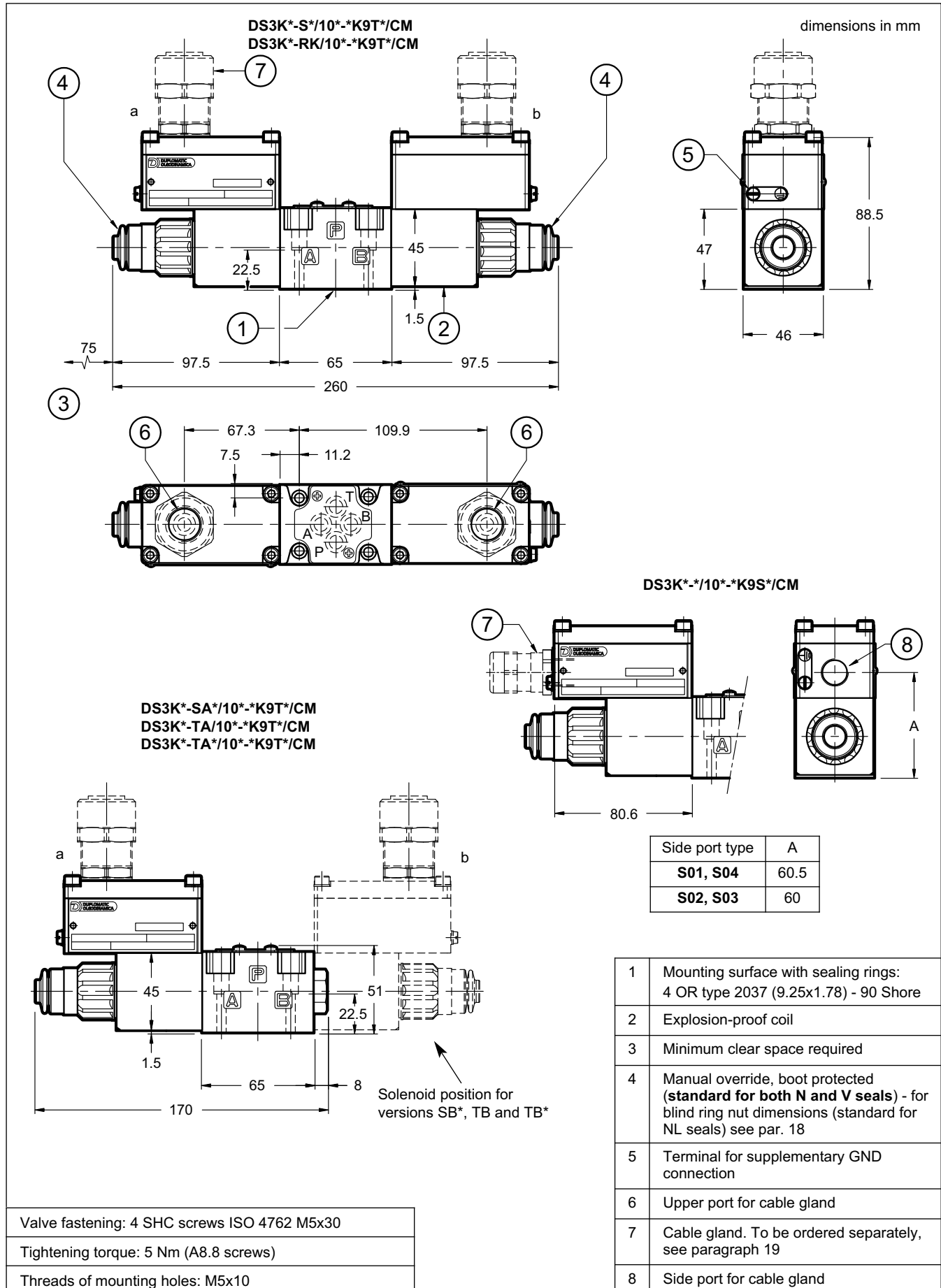
SPOOL	CURVE
S1, S2, RK	1
TA02	2
S3	3
S4	4
TA, TA23	5
S9	6

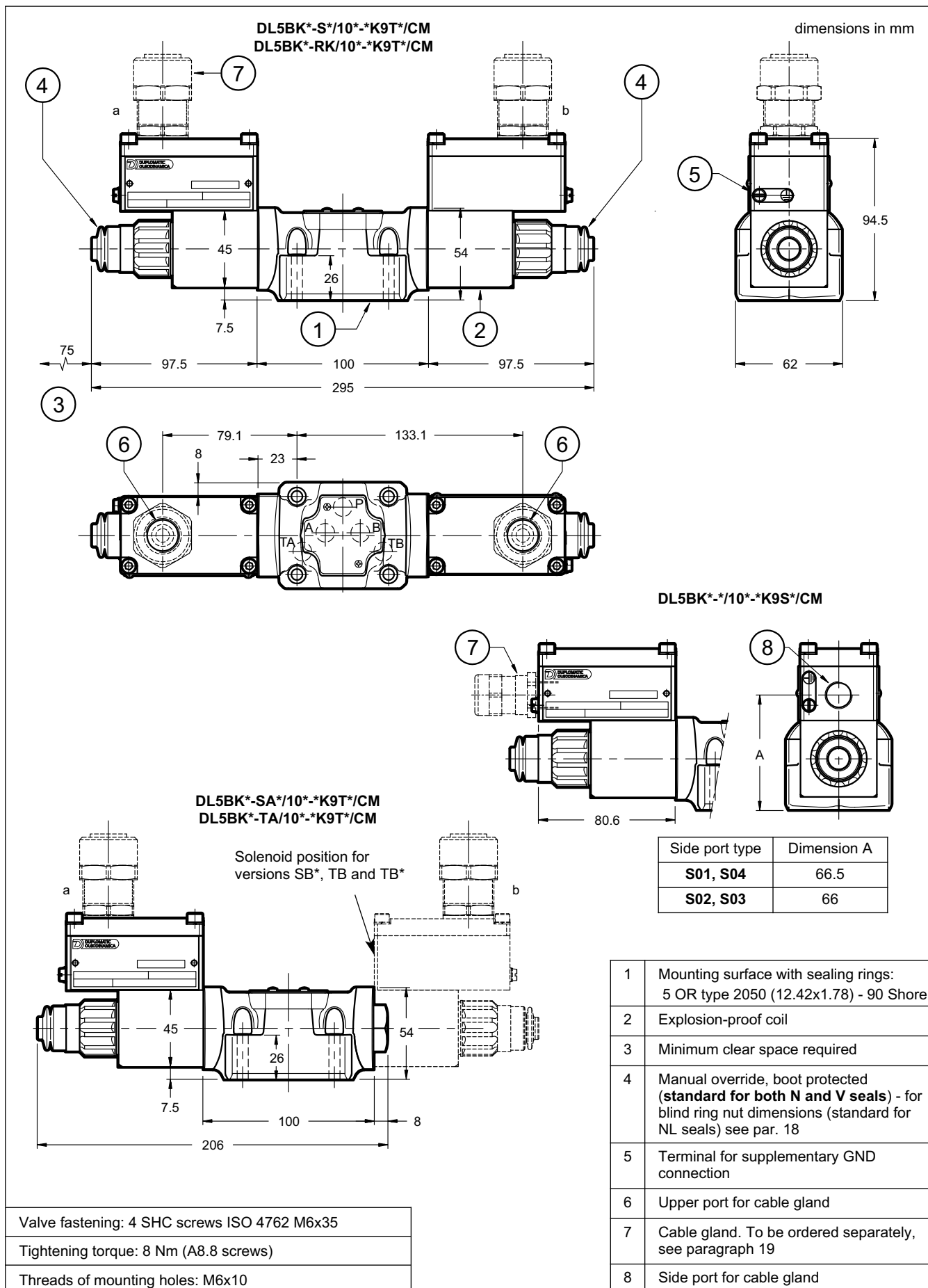
## 2.3 - Switching times

The indicated values are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES [ms]	DS3K*		DL5BK*	
	ENERGIZING	DE-ENERGIZING	ENERGIZING	DE-ENERGIZING
DC	60	40	70 ÷ 100	15 ÷ 20
RAC	60	140	70 ÷ 100	140

### 3 - OVERALL AND MOUNTING DIMENSIONS OF DIRECT OPERATED VALVES





## 4 - IDENTIFICATION OF PILOT OPERATED SOLENOID VALVES DSP\*K\*

### 4.1 - Identification code

<b>DSP</b>		<b>-</b>	<b>/</b>	<b>10</b>	<b>-</b>		<b>/</b>	<b>/</b>	<b>K9</b>	<b>/</b>		
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Pilot operated directional valve

Size: \_\_\_\_\_  
**5** = CETOP P05  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08  
**10** = ISO 4401-10

Explosion-proof certification:  
**See table 1.2**

Spool type (see par. 6.2) \_\_\_\_\_  
**S\***    **TA**    **TB**    **RK**  
**SA\***   **TA02**   **TB02**  
**SB\***

Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
For temperature range -20 / +80 °C  
**N** = NBR seals for mineral oil (standard)  
**V** = FPM seals for special fluids  
For temperature range -40 / +80 °C  
**NL** = seal for low temperatures (for mineral oil)

Piloting: \_\_\_\_\_  
**I** = internal (not available for spools S2, S4, TA02, TB02, S\*2 and S\*4. If internal piloting should be necessary, choose piloting type C)  
**E** = external  
**C** = internal piloting with backpressure valve (available on DSP7 and DSP8)  
**Z** = internal piloting with 30 bar fixed adjustment pressure reducing valve

Drainage: \_\_\_\_\_  
**I** = Internal  
**E** = External

Options: \_\_\_\_\_  
**C** = main spool stroke control  
**D** = main spool shifting speed control  
**P08** = Subplate with restrictor Ø0,8 on port P placed under the solenoid valve - for valves DSP5 - DSP5R - DSP7 - DSP8  
**P15** = subplate with restrictor Ø1,5 on port P placed under the solenoid valve - only for valves DSP10

Option: surface treatment not standard.  
Omit if not required (see **NOTE**)

Option: **/T5**  
version in T5 temperature class.  
Omit if not required.

Manual override:  
**CM** = boot protected **standard for both N and V seals** not available for NL seals  
**CB** = blind ring nut **standard for NL seals** available upon request for both N and V seals  
see dimensions at paragraph 16

Connection type for cable gland  
upper connection:  
**T01** = M20x1.5 - ISO 261  
**T02** = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
**T03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
side connection:  
**S01** = M20x1.5 - ISO 261  
**S02** = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
**S03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
**S04** = M16x1.5 - ISO 261

Coil electrical connection: by terminal block

Power supply:  
Direct current (DC)  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
Alternate current with built-in rectifier bridge (RAC)  
**R120** = 120 V  
**R240** = 240 V

A version suitable for an operating pressure value of **420 bar** on ports P - A - B is available upon request, except for DSP5K\*-S4 / DSP5RK\* and DSP10K\* valves. On this version, the maximum pressure value on port T with external drain and the pilot pressure are equal to 350 bar. The maximum pressure on port T with internal drainage is 210 bar.

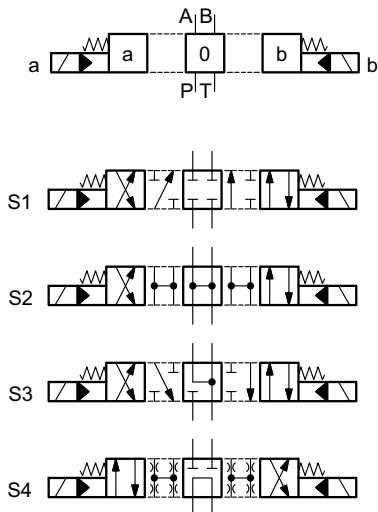
Add the letter **H** to request this version (ex. DSP7HK\*).

**NOTE:** the valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body. Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

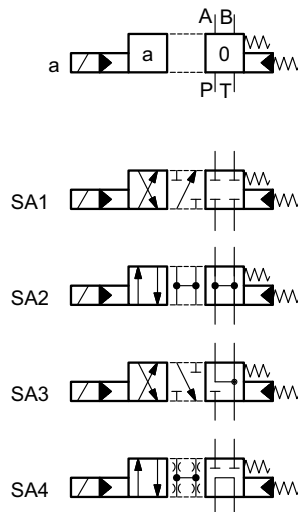
For full zinc-nickel surface treatment add **/W7** at the end of the identification code.

#### 4.2 - Spool types

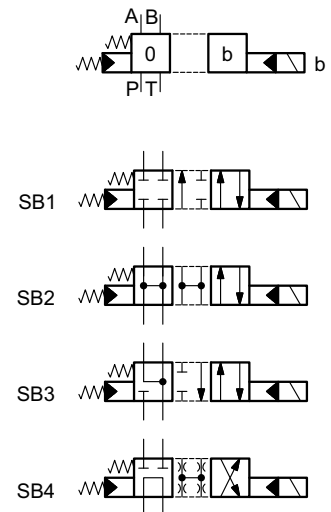
**Version S\*:**  
2 solenoids - 3 positions  
with spring centering



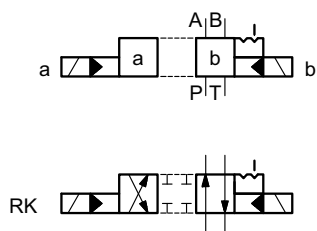
**Version SA\*:**  
1 solenoid side A  
2 positions (central + external)  
with spring centering



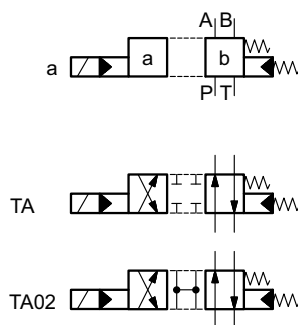
**Version SB\*:**  
1 solenoid side B  
2 positions (central + external)  
with spring centering



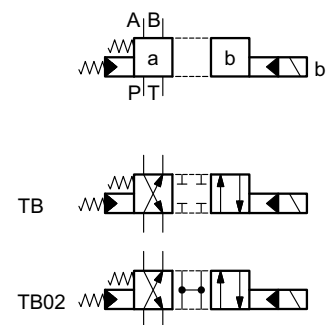
**Version RK:**  
2 solenoids - 2 positions  
with mechanical retention



**Version TA:**  
1 solenoid side A  
2 external positions  
with return spring



**Version TB:**  
1 solenoid side B  
2 external positions  
with return spring

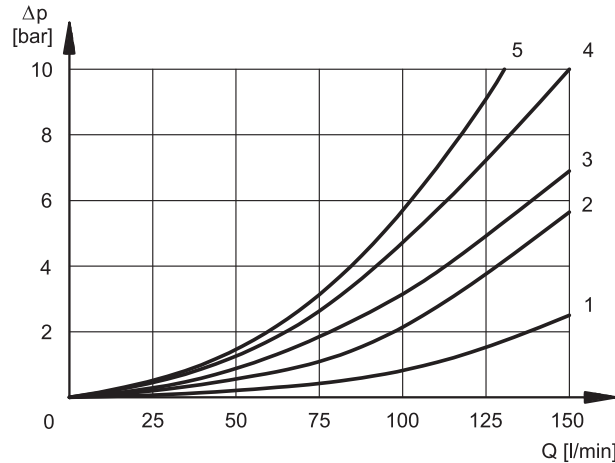


### 5 - CHARACTERISTIC CURVES AND PERFORMANCES OF PILOT OPERATED SOLENOID VALVES

#### 5.1 - Pressure drops $\Delta p$ -Q

(values obtained with viscosity 36 cSt at 50 °C)

#### DSP5K\* - DSP5RK\*



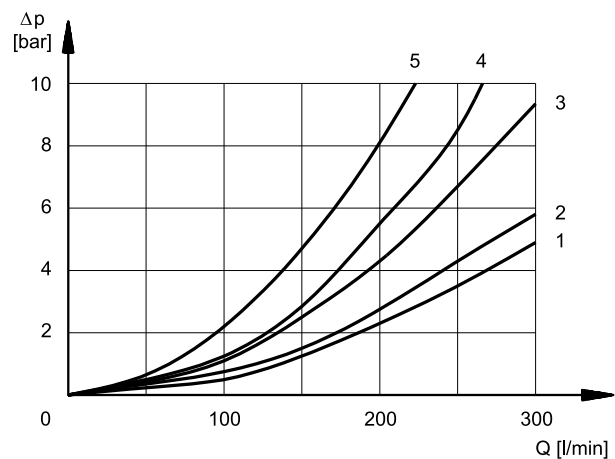
#### ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	4	4	1	1
S2, SA2, SB2	3	3	1	2
S3, SA3, SB3	4	4	1	1
S4, SA4, SB4	5	5	2	3
TA, TB	4	4	1	1
TA02, TB02	3	3	1	1
RK	4	4	1	1

#### DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	5
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	5

#### DSP7K\*



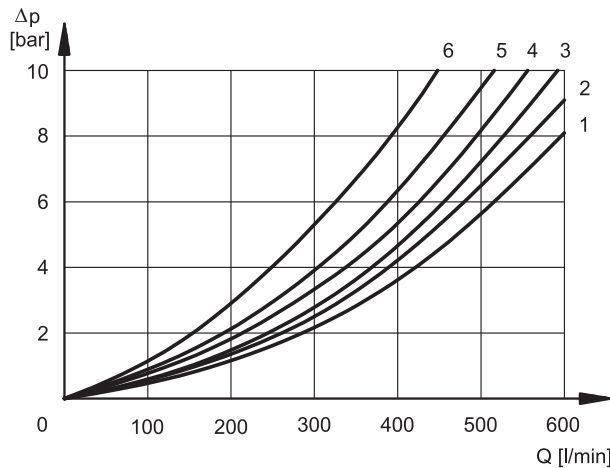
#### ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	3	4
S2, SA2, SB2	1	1	4	4
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	4	5
TA, TB	1	1	3	4
TA02, TB02	1	1	4	4
RK	1	1	3	4

#### DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	2
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	4

## DSP8K\*



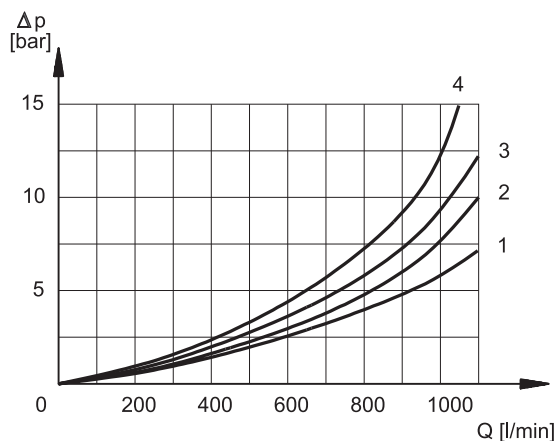
### ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	2	1
S3, SA3, SB3	2	2	2	1
S4, SA4, SB4	4	4	3	5
TA, TB	2	2	3	3
TA02, TB02	2	2	3	3
RK	2	2	3	3

### DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	4
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	6

## DSP10K\*



### ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	1	1
S2, SA2, SB2	2	2	2	2
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	2	2
TA, TB	1	1	1	1
TA02, TB02	1	1	1	1
RK	1	1	1	1

### DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	3
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	4



## 5.2 - Switching times

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

TIMES (± 10%) [ms]	ENERGIZING	DE- ENERGIZING	
	DC - RAC	DC	RAC
DSP5K* - DSP5RK*	70	60	160
DSP7K*	80	70	170
DSP8K*	90	70	170
DSP10K*	120	90	190

## 6 - HYDRAULIC CHARACTERISTICS

PRESSURES (bar)	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
Max pressure in P, A, B ports	320	350	350	350
Max pressure in T line with external drainage	210	250	210	210
Max pressure in T line with internal drainage	210	210	210	210
Max pressure in Y line with external drainage	210	210	210	210
Min piloting pressure <b>NOTE 1</b>	5 ÷ 12			6 ÷ 12
Max piloting pressure <b>NOTE 2</b>	210	210	210	280

**NOTE 1:** minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

**NOTE 2:** if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

Add the letter **Z** to the identification code to order this option (see par. 4.1). Consider that, by adding the pressure reducing valve, the overall dimensions increase 40 mm in height.

MAXIMUM FLOW RATES		DSP5K* DSP5RK*		DSP7K*		DSP8K*		DSP10K*	
Spool type	[l/min]	PRESSURES							
		at 210 bar	at 320 bar	at 210 bar	at 350 bar	at 210 bar	at 350 bar	at 210 bar	at 350 bar
S4 - SA4 - SB4		120	100	200	150	500	450	750 (NOTE)	600 (NOTE)
Other spools		150	120	300	300	600	500	900	700

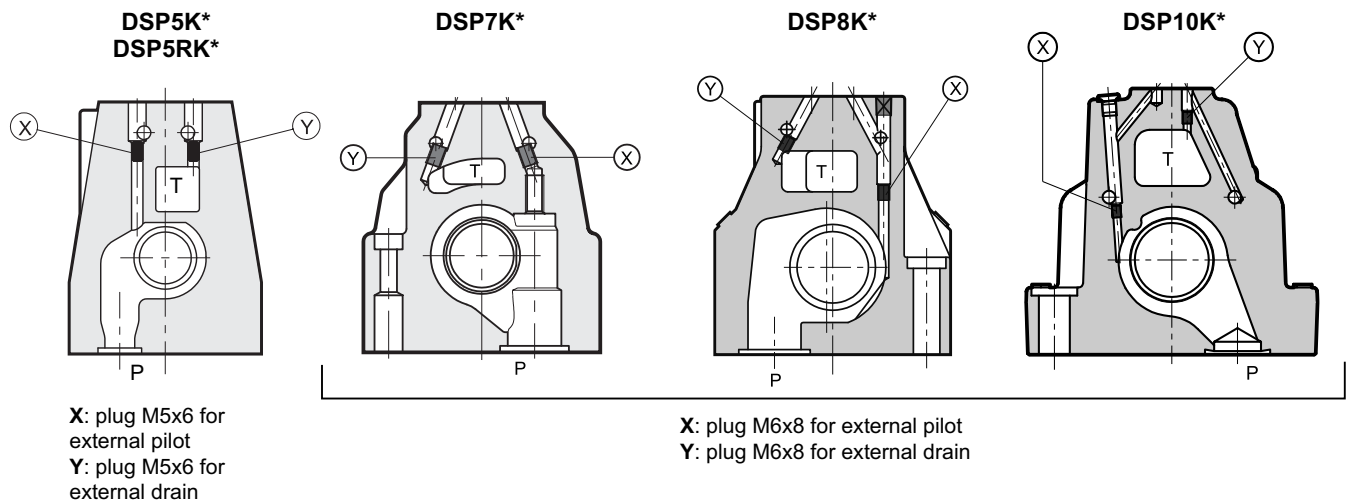
**NOTE:** for the DSP10K\* valve these values are the same even for S2 - SA2 - SB2 spools.

### 7 - PILOT AND DRAIN

DSP\*K\* valves are available with piloting and drainage, both internal and external.

The version with external drainage allows for a higher back pressure on the outlet.

TYPE OF VALVE		Plug assembly	
		X	Y
<b>IE</b>	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b>	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b>	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b>	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO



#### 7.1 - Backpressure valve incorporated on line P (C option)

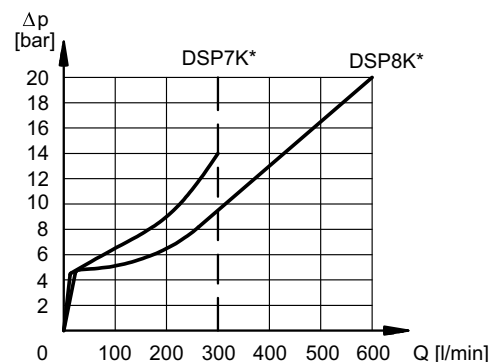
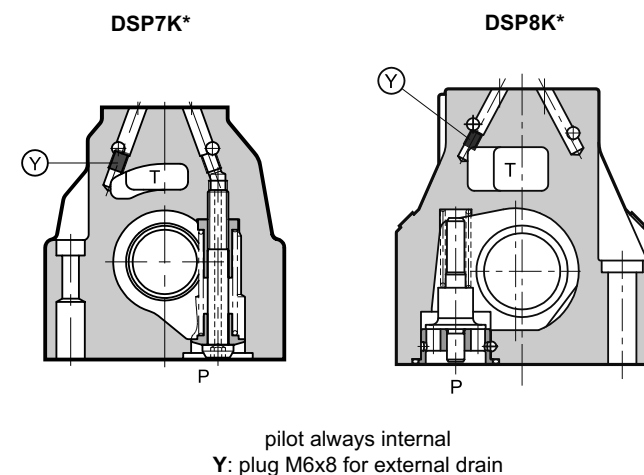
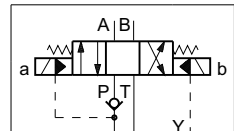
DSP7K\* and DSP8K\* valves are available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in rest position, has the line P connected to the T port (spools S2 - S4 - S\*2 - S\*4 - T\*02). The cracking pressure is of 5 bar with a minimum flow rate of 15 l/min.

In the C version the piloting is always internal.

**NOTE:** the backpressure valve can't be used as check valve because it doesn't assure the seal.

Add **C** to the identification code for this request (see paragraph 4.1).

**For DSP7K\* only**, the backpressure valve can be also delivered separately and it can be easily mounted on line P of the main control valve. Ask for code **0266577** to order the backpressure valve.



The curve refers to the pressure drop (body part only) with backpressure valve energized to which the pressure drop of the reference spool must be added (see paragraph 5).

## 8 - ELECTRICAL CHARACTERISTICS

(values  $\pm 5\%$ )

Coil type	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]
<b>D12</b>	12	7,2	1,7	20
<b>D24</b>	24	28,7	0,83	20
<b>D48</b>	48	115	0,42	20
<b>D110</b>	110	549	0,2	22

Coil type (NOTE)	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [VA]
<b>R120</b>	110V-50Hz 120V-60Hz	50/60	489,6	0,19	21
				0,21	25
<b>R240</b>	230V-50Hz 240V-60Hz	50/60	2067,7	0,098	22,5
				0,1	24

<b>VOLTAGE SUPPLY FLUCTUATION</b> (ripple included)	$\pm 10\% V_{nom}$
<b>MAX SWITCH ON FREQUENCY</b> DS3K*, DL5BK* DSP5K*, DSP5RK* DSP7K* DSP8K* DSP10K*	8.000 ins/hr 6.000 ins/hr 6.000 ins/hr 4.000 ins/hr 3.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2014/30/EU
<b>CLASS OF PROTECTION:</b> Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

**NOTE:** type R\* coils are for alternating current supply for both 50 or 60 Hz. For R\* coils the resistance can not be measured in the usual way because of the presence of diodes bridge inside the coil.

### 8.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

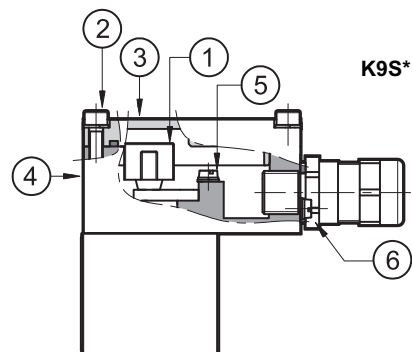
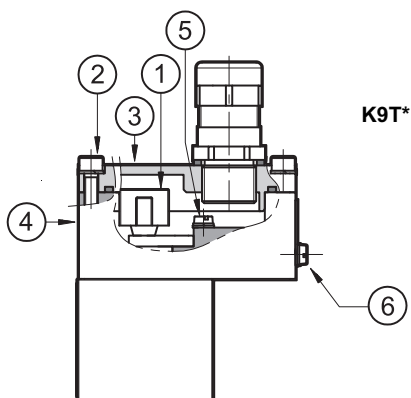
**The electrical connection is polarity-independent.**

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of  $4.9 \pm 6$  Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.



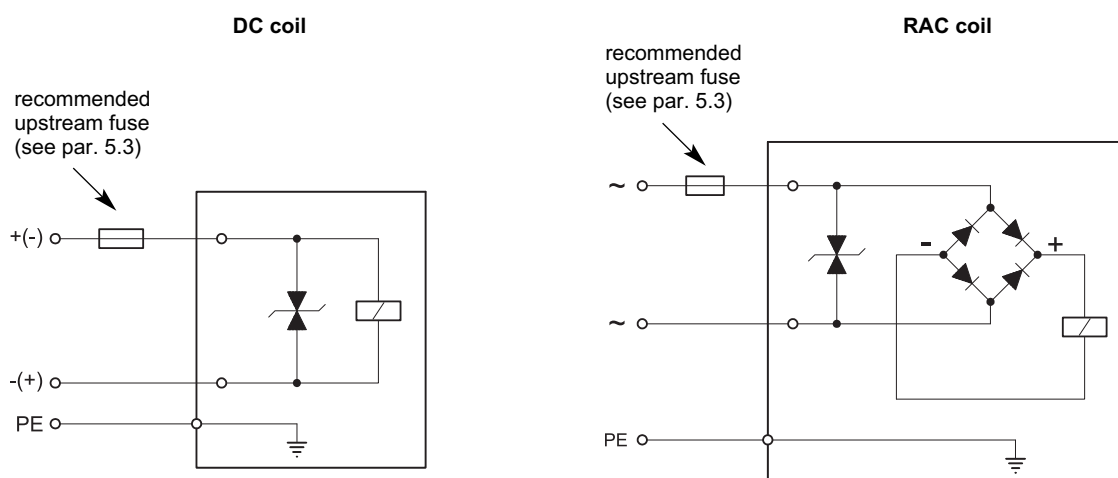
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm <sup>2</sup>
Connection for internal grounding point	max 2.5 mm <sup>2</sup>
Connection for external equipotential grounding point	max 6 mm <sup>2</sup>

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 19) allow to use cables with external diameter between 8 and 10 mm.

## 8.2 - Electrical diagrams



## 8.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x I<sub>n</sub> according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]	Maximum voltage value upon switch off [V]	Suppressor circuit
<b>D12</b>	12	1,7	2,5	- 49	Transient voltage suppressor bidirectional
<b>D24</b>	24	0,83	1,25	- 49	
<b>D48</b>	48	0,42	0,6	- 81	
<b>D110</b>	110	0,2	0,3	- 309	
<b>R120</b>	120	0,21	0,3	- 3	
<b>R240</b>	240	0,1	0,15	- 3	

### 9 - OPTIONS

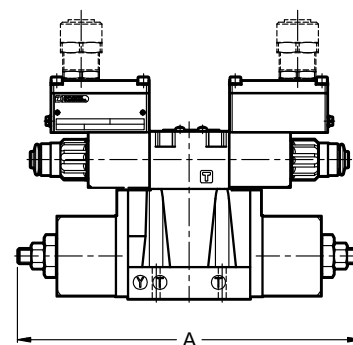
#### 9.1 - Control of the main spool stroke: C

With the help of special side plugs, it is possible to introduce stroke controls in the heads of the piloted valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

Add the letter **C** to the identification code to request this device (see paragraph 4.1).

DSP\*K\*-/C



dimensions in mm

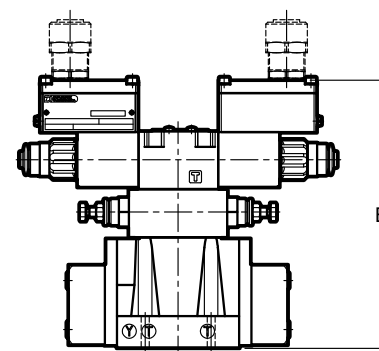
	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
A	280	319	401.5	520

#### 9.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the main distributor, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 4.1).

DSP\*K\*-/D



dimensions in mm

	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
B	218.5	225.5	254.5	310.5

#### 9.3 - Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor on line P between the pilot solenoid valve and the main distributor.

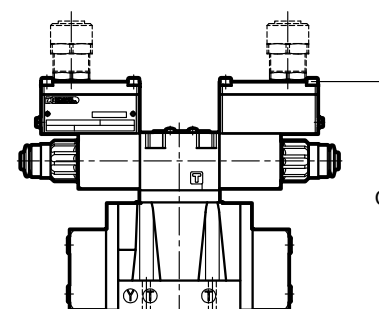
restrictor Ø0.8 for DSP5K\*, DSP5RK\*, DSP7K\* e DSP8K\*  
restrictor Ø1.5 for DSP10K\*:

To request include in the code (par. 4.1):

**P08** for DSP5K\*, DSP5RK\*, DSP7K\* and DSP8K\*

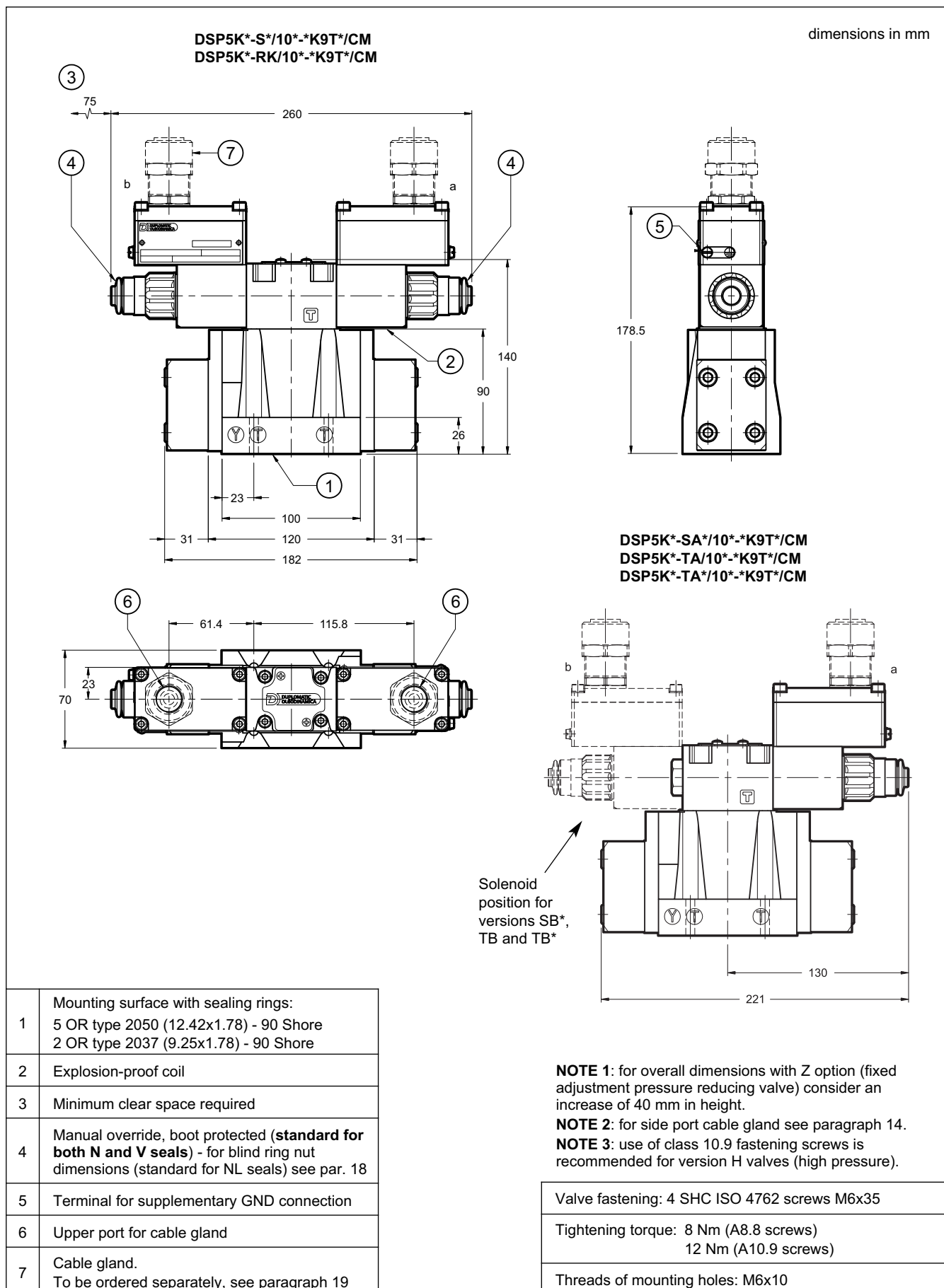
**P15** for DSP10K\*

DSP\*K\*-/P\*

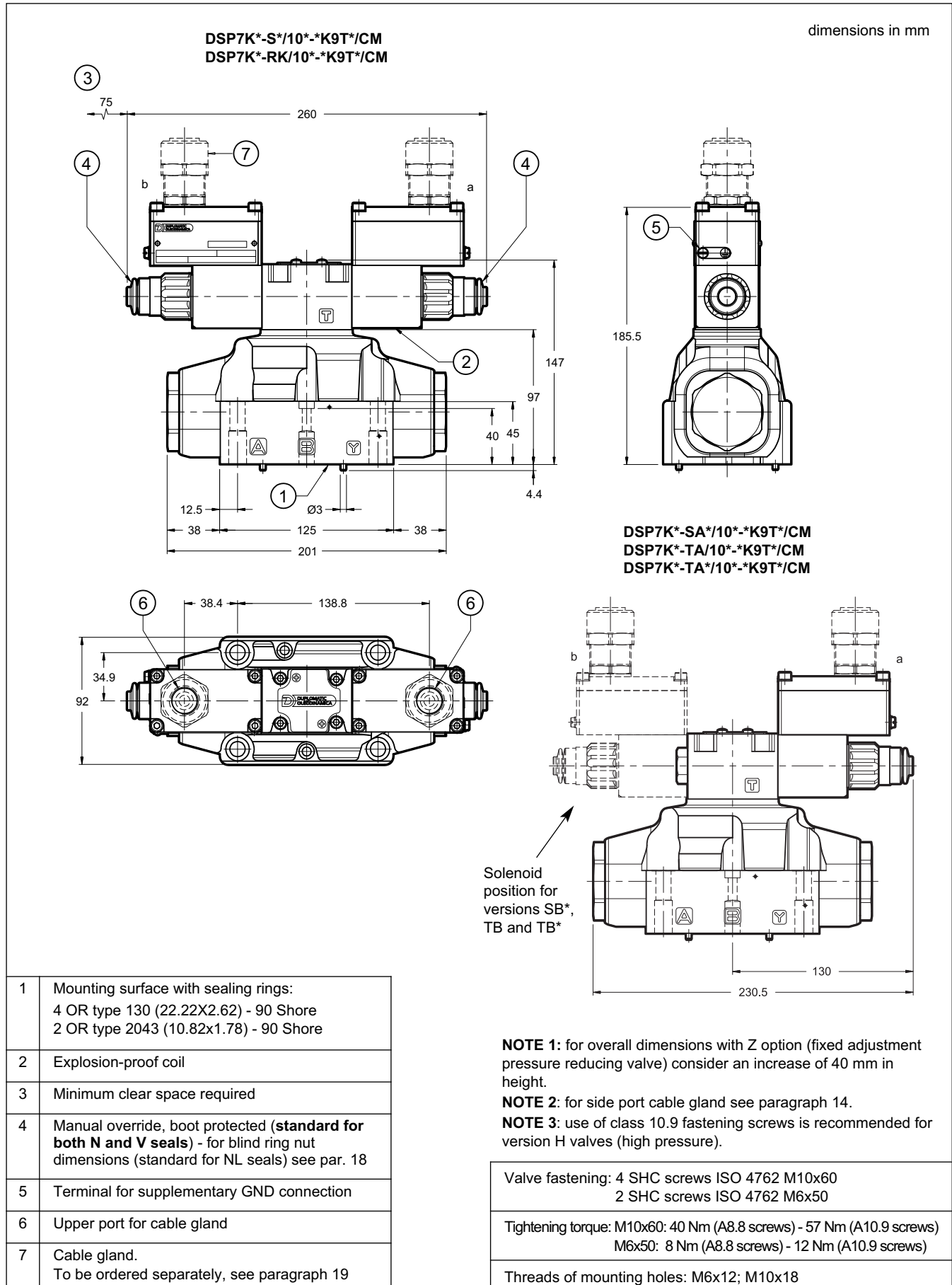


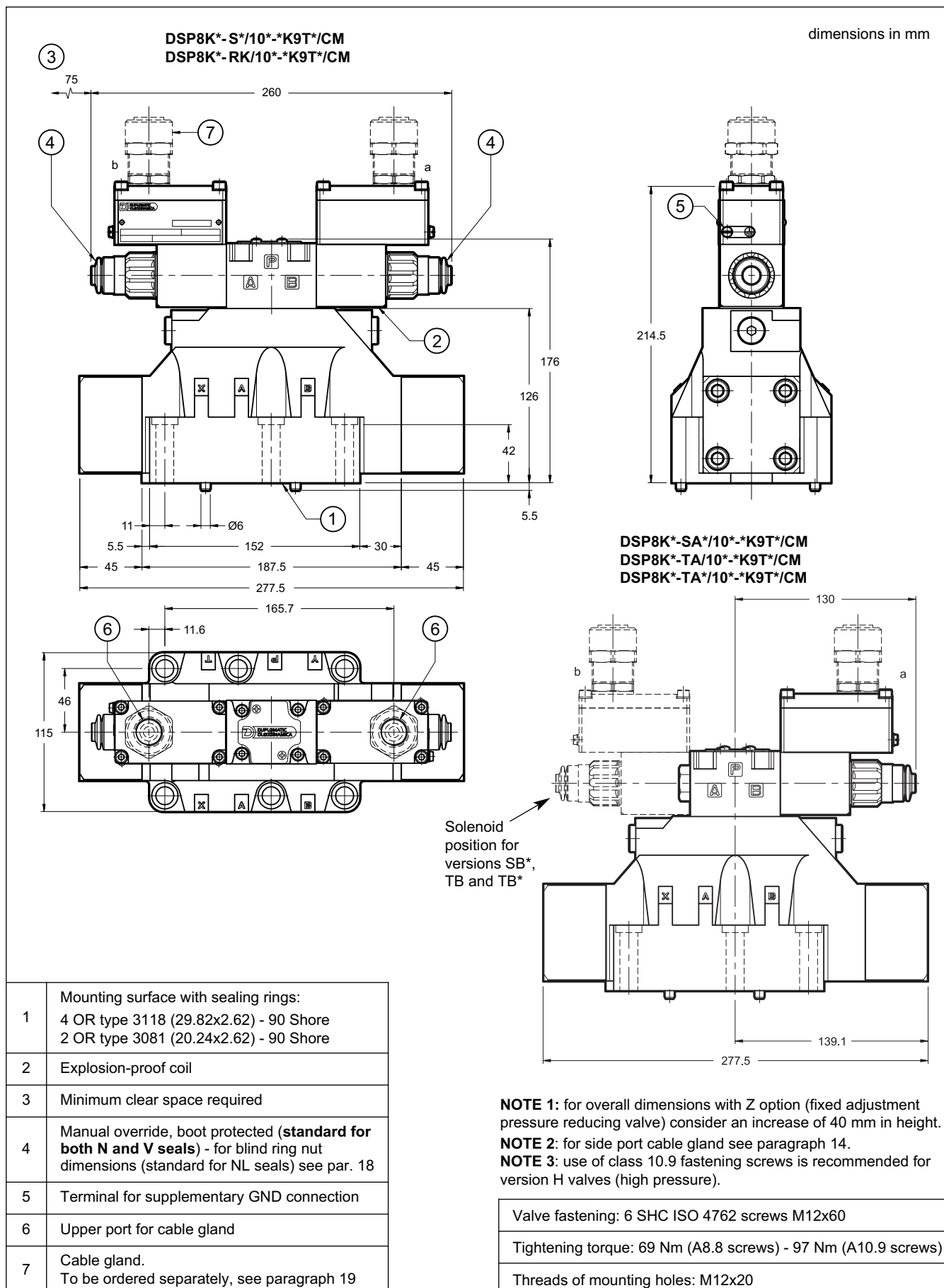
dimensions in mm

	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
C	188.5	195.5	224.5	280.5

**10 - DSP5K\* AND DSP5RK\* OVERALL AND MOUNTING DIMENSIONS**


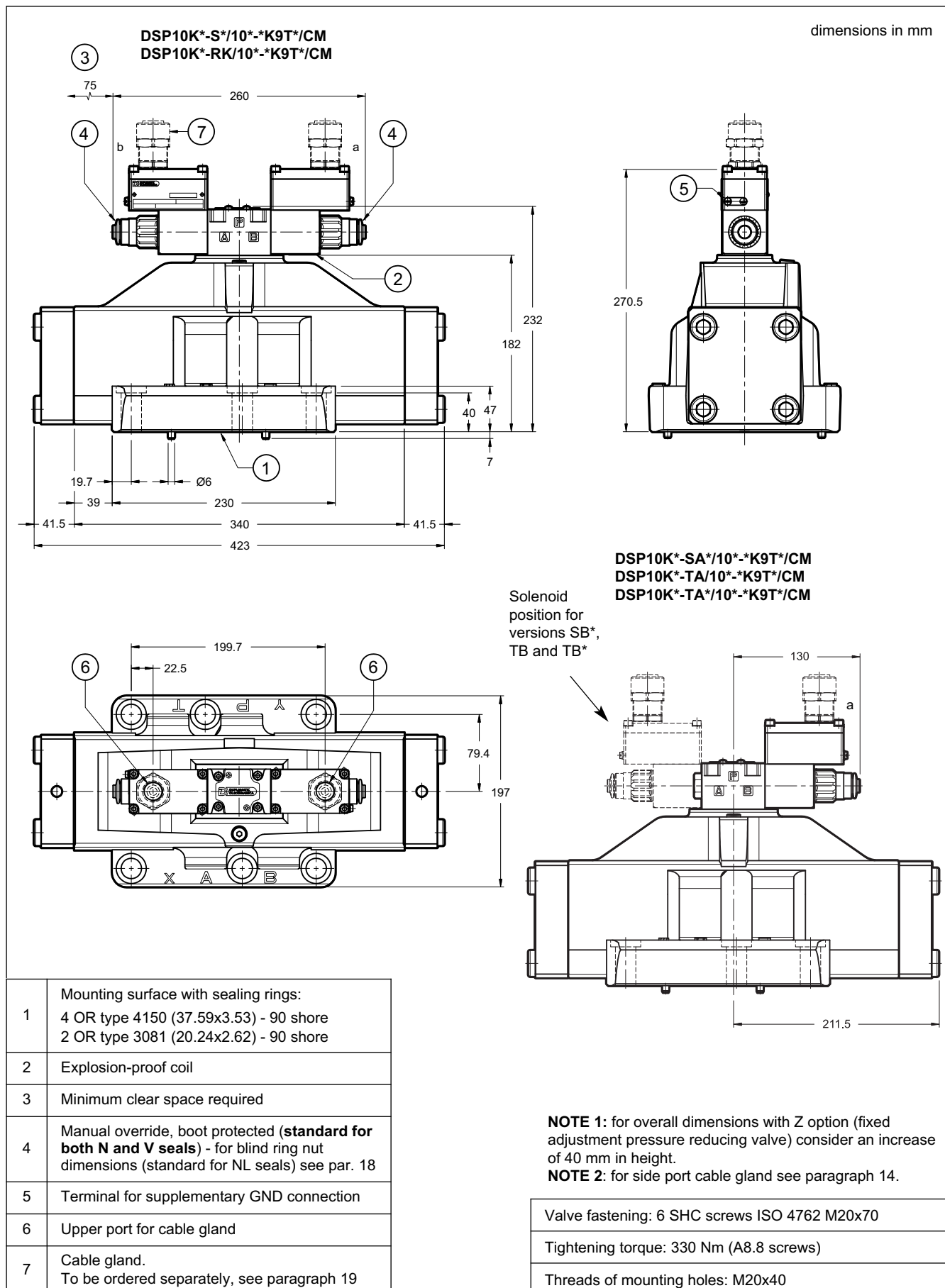
## 11 - DSP7K\* OVERALL AND MOUNTING DIMENSIONS



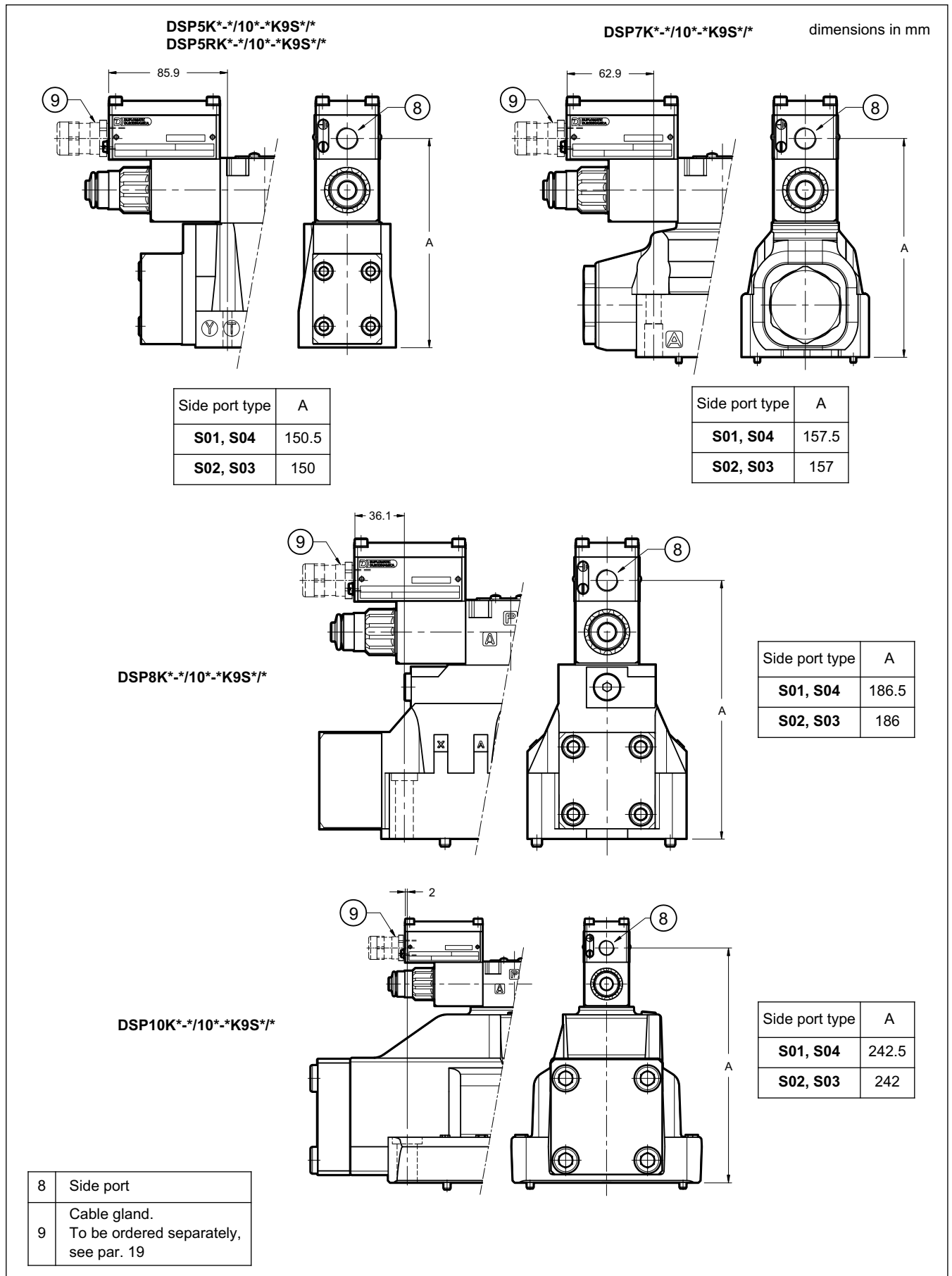
**12 - DSP8K\* OVERALL AND MOUNTING DIMENSIONS**




## 13 - DSP10K\* OVERALL AND MOUNTING DIMENSIONS



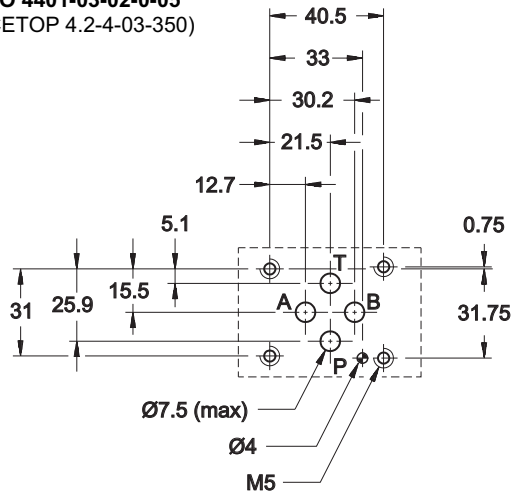
## 14 - OVERALL AND MOUNTING DIMENSIONS OF DSP\*K\* WITH SIDE CONNECTION



## 15 - MOUNTING SURFACES

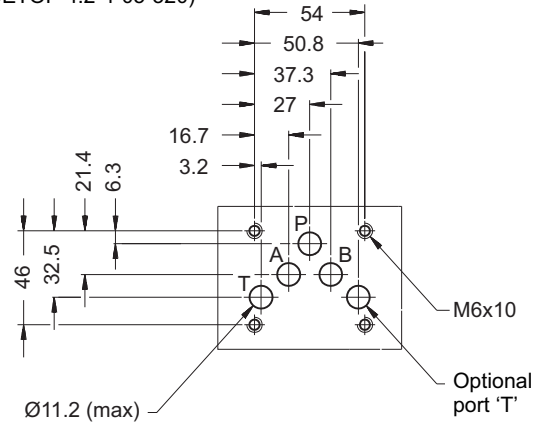
### DS3K\*

ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



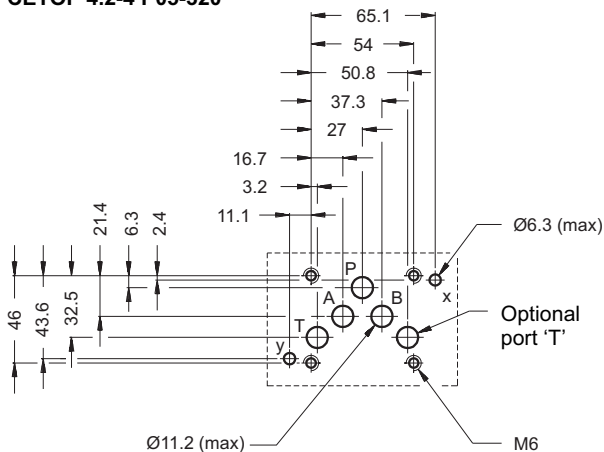
### DL5BK\*

ISO 4401-05-04-0-05  
(CETOP 4.2-4-05-320)



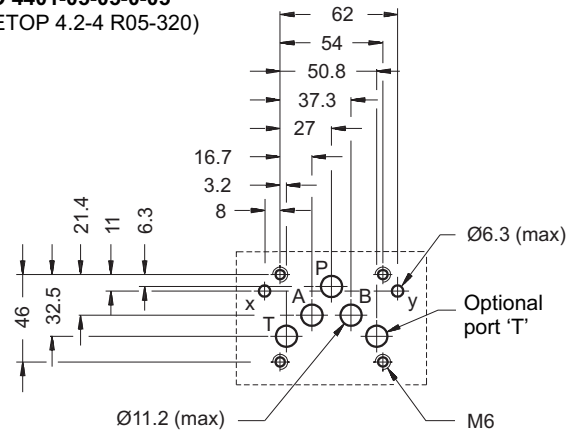
### DSP5K\*

CETOP 4.2-4 P05-320



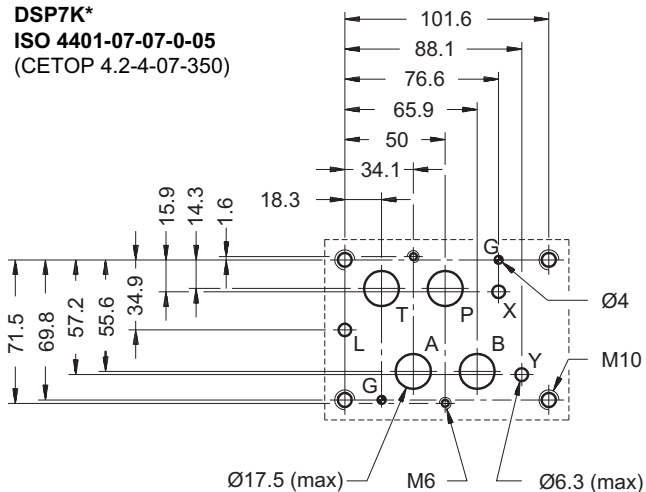
### DSP5RK\*

ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-320)



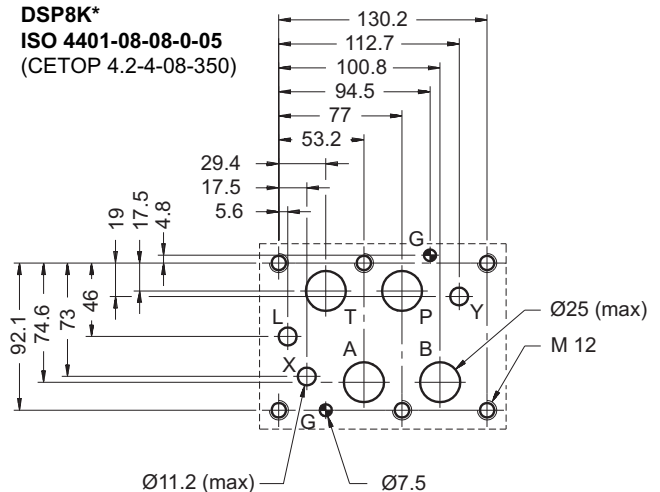
### DSP7K\*

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)

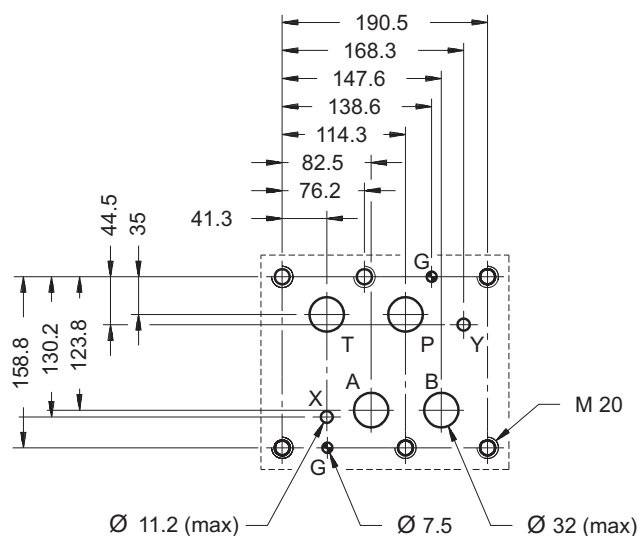


### DSP8K\*

ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



**DSP10K\***  
**ISO 4401-10-09-0-05**  
 (CETOP 4.2-4-10-350)



## 16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 17 - INSTALLATION

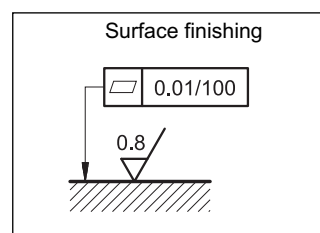


**Installation must adhere to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.**

Configurations with centering and recall springs can be mounted in any position; The RK versions, without springs and with mechanical detent, must be mounted with the longitudinal axis horizontal.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



## 18 - MANUAL OVERRIDES

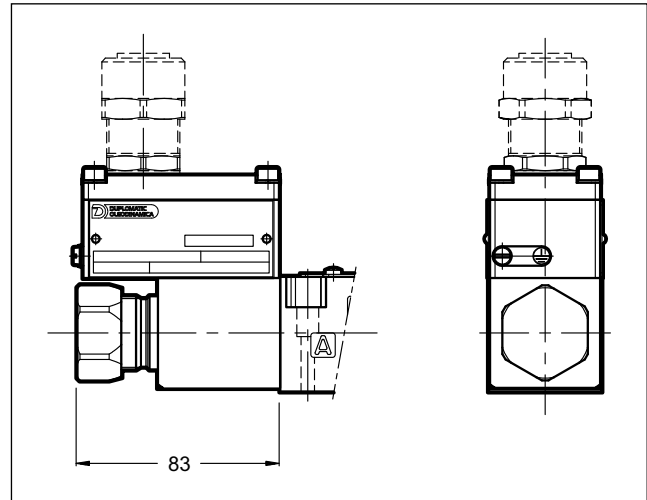
### 18.1 - CB - Blind ring nut

The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

To access the manual override loosen the ring nut and remove it; then reassemble hand tightening, until it stops.

**Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.**

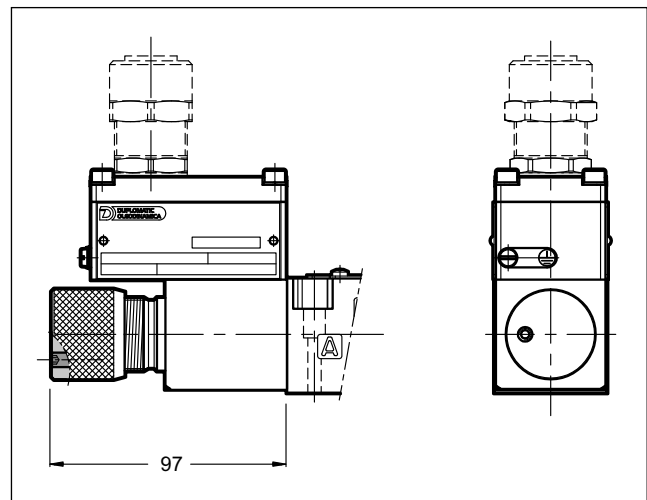
More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.



### 18.2 - CK - Knob manual override

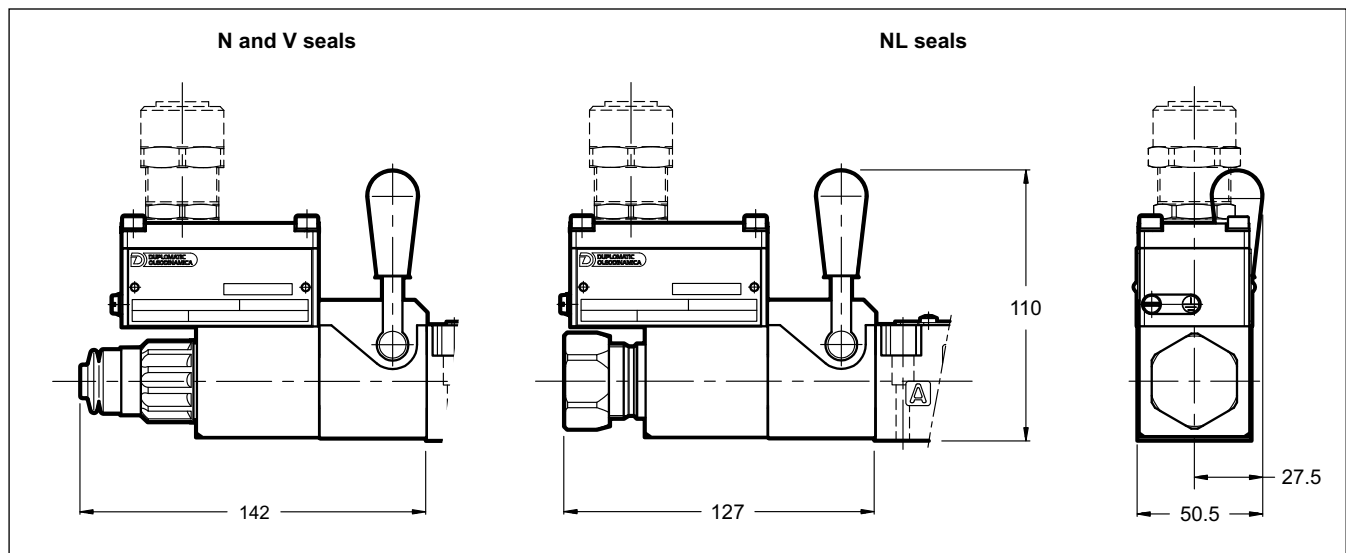
When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob losing.

Spanner: 3 mm



### 18.3 - CH - Lever manual override

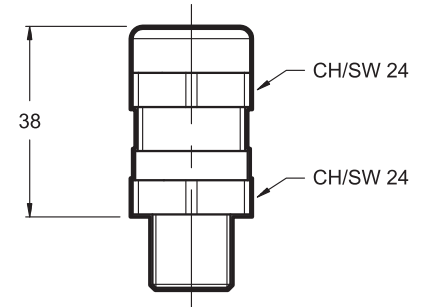
The lever manual override is available for DSE3K only. The seals choice leads the type of the standard ring nut to be mounted. The lever device is always placed at side A.



## 19 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø 8÷10 mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68



To order the desired cable glands, specify description, code and quantity.

**Description: CGK2/NB-01/10**

**Code: 3908108001**

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

**Description: CGK2/NB-02/10**

**Code: 3908108002**

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-03/10**

**Code: 3908108003**

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-04/10**

**Code: 3908108004**

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

## 20 - SUBPLATES

(see catalogue 51 000)

	DS3K*	DL5BK*		DSP5K*	DSP7K*	DSP8K*
Type with rear ports	PMMD-AI3G	PMD4-AI4G	-	PME4-AI5G	PME07-AI6G	-
Type with side ports	PMMD-AL3G	-	PMD4-AL4G	PME4-AL5G	PME07-AL6G	PME5-AL8G
P, T, A, B ports dimensions	3/8" BSP	3/4" BSP	1/2" BSP	3/4" BSP	1" BSP	1 1/2" BSP
X, Y ports dimensions	-	-	-	1/4" BSP	1/4" BSP	1/4" BSP

**NOTE:** Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a rate higher than the value allowed by norms according to ATEX directive for category II 2GD and I M2.

The user will bear to do the complete assessment of the ignition risk that can occur from the relative use in potentially explosive environments.



**D\*K\***  
**SERIES 10**



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# DSH\*

## LEVER OPERATED DIRECTIONAL CONTROL VALVE

### MOUNTING SURFACES

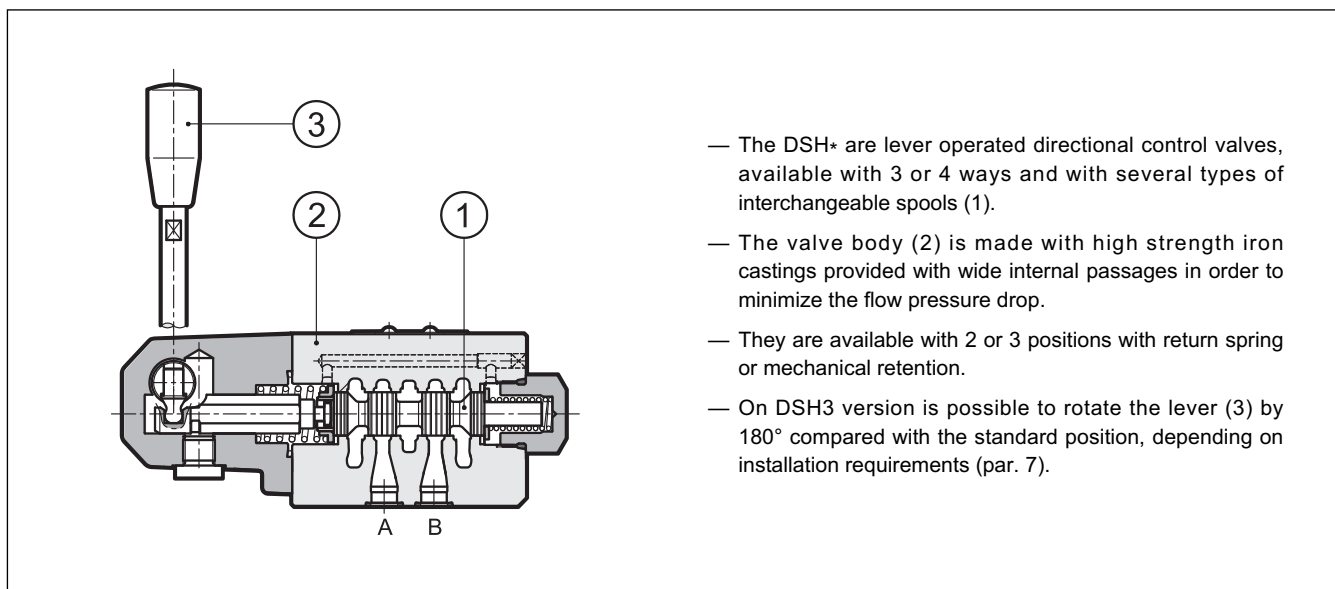
**DSH3** ISO 4401-03 (CETOP 03)

**DSH5** ISO 4401-05 (CETOP 05)

**p** max (see performances table)

**Q** nom (see performances table)

### OPERATING PRINCIPLE

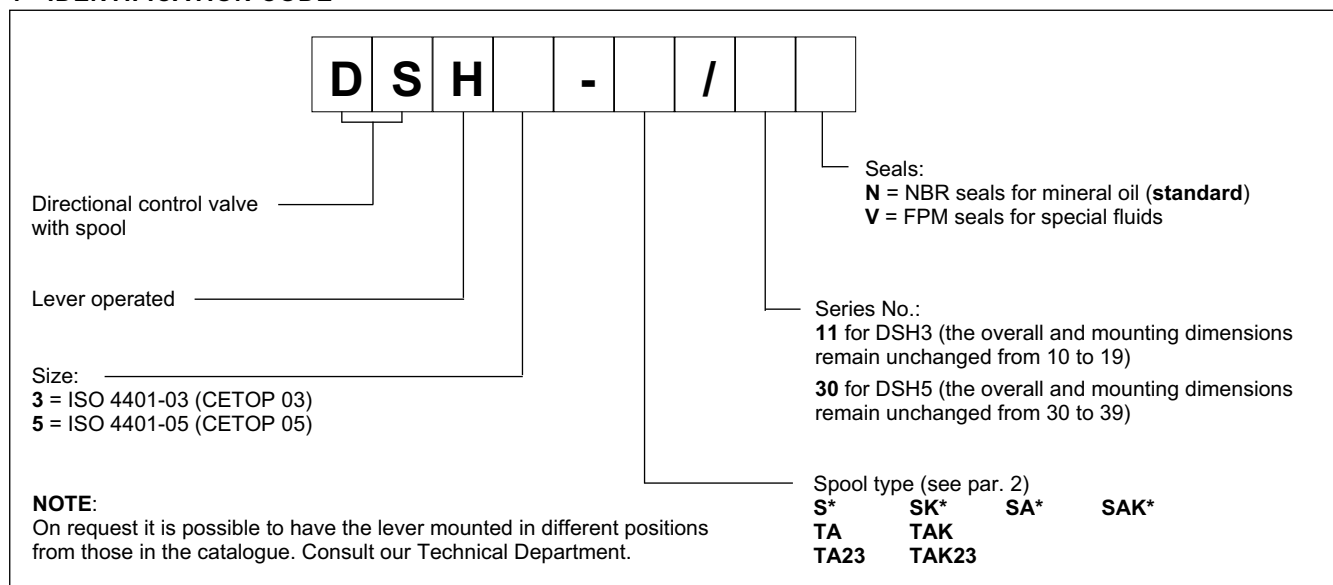


### PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

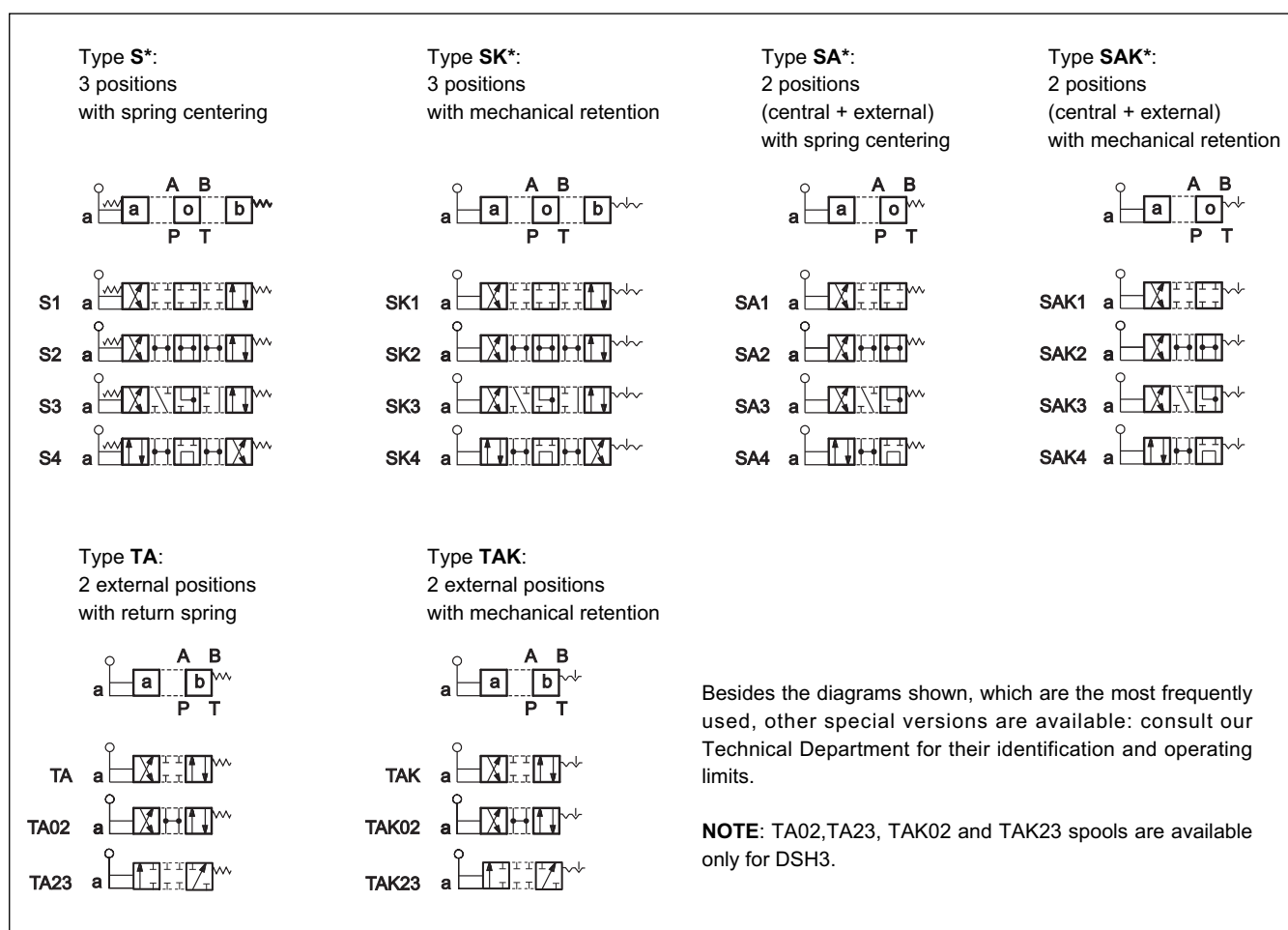
		DSH3	DSH5
Maximum working pressure:			
- P - A - B ports	bar	350	320
- T port		210	160
Nominal flow rate	l/min	75	150
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25	
Mass	kg	2.1	4.2



## 1 - IDENTIFICATION CODE



## 2 - SPOOL TYPE



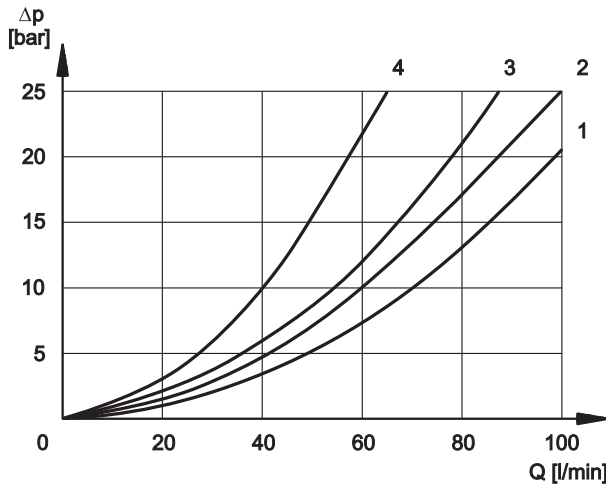
## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 4 - PRESSURE DROPS $\Delta p$ -Q (values obtained with viscosity 36 cSt at 50 °C)

### 4.1 - DSH3



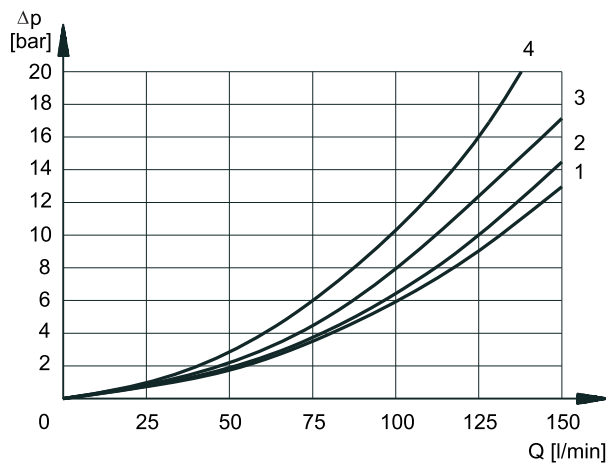
#### VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SAK1	2	2	3	3
S2, SA2, SAK2	1	1	3	3
S3, SA3, SAK3	3	3	1	1
S4, SA4, SAK4	4	4	4	4
TA, TAK	3	3	3	3
TA02, TAK02	2	2	2	2
TA23, TAK23	3	3		

#### VALVE IN DE-ENERGIZED POSITION

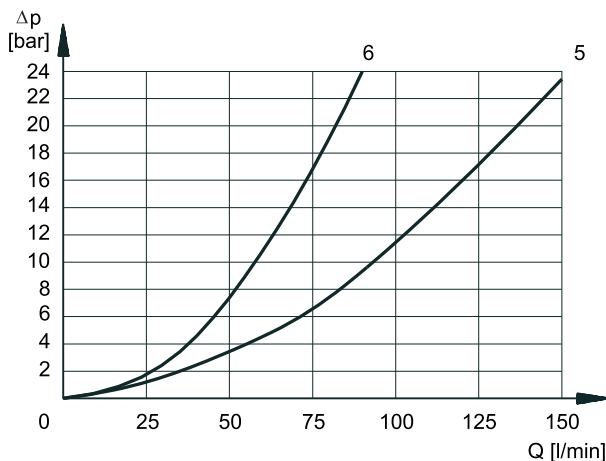
SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SAK2					2
S3, SA3, SAK3			3	3	
S4, SA4, SAK4					3

### 4.2 - DSH5



#### VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SK1	2	2	1	1
S2, SK2	3	3	1	1
S3, SK3	3	3	2	2
S4, SK4	1	1	2	2
TA, TAK	3	3	2	2



#### VALVE IN DE-ENERGIZED POSITION

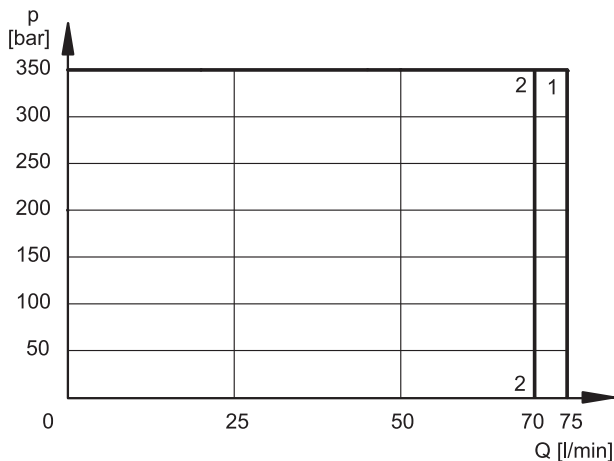
SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SK2					5
S3, SK3			6	6	
S4, SK4					5

## 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration ISO 4406:1999 class 18/16/13.

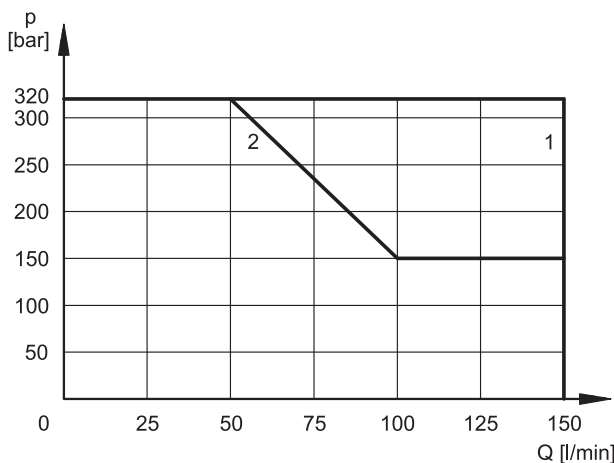
### 5.1 - DSH3



SPOOL TYPE	CURVE	
	P→A	P→B
S1, SK1, SA1, SAK1	1	1
S2, SK2, SA2, SAK2	1	1
S3, SK3, SA3, SAK3	1	1
S4, SK4, SA4, SAK4	2	2

SPOOL TYPE	CURVE	
	P→A	P→B
TA, TAK	1	1
TA02, TAK02	1	1
TA23, TAK23	1	1

### 5.2 - DSH5



SPOOL TYPE	CURVE	
	P→A	P→B
S1, SK1, SA1, SAK1	1	1
S2, SK2, SA2, SAK2	1	1
S3, SK3, SA3, SAK3	1	1
S4, SK4, SA4, SAK4	2	2

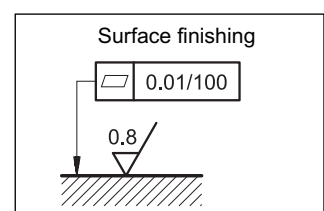
SPOOL TYPE	CURVE	
	P→A	P→B
TA, TAK	1	1

**NOTE:** Values in the graphs are relevant to the standard valve. The operating limits can be considerably reduced if a 4-way valve is used with port A or B plugged.

## 6 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; valves with mechanical detent must be mounted with the longitudinal axis horizontal.

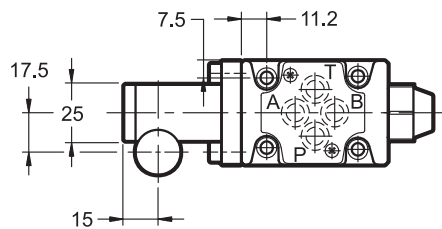
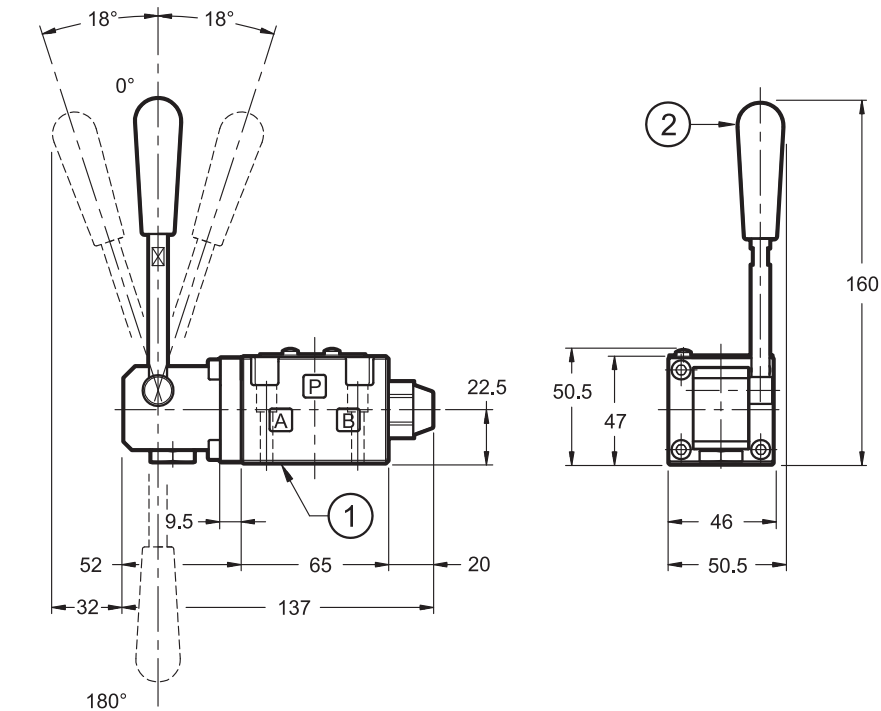
Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.



## 7 - OVERALL AND MOUNTING DIMENSIONS DSH3

DSH3 - S\*  
DSH3 - SK\*

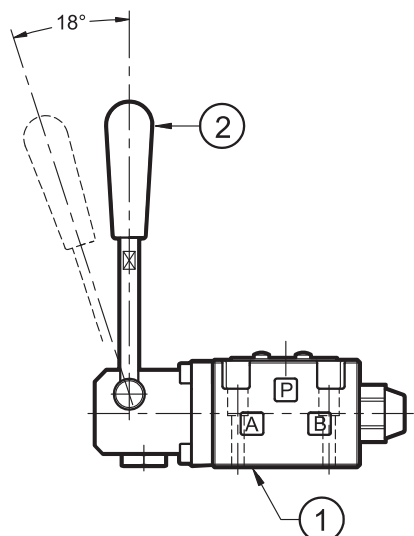
dimensions in mm



DSH3-TA  
DSH3-TAK

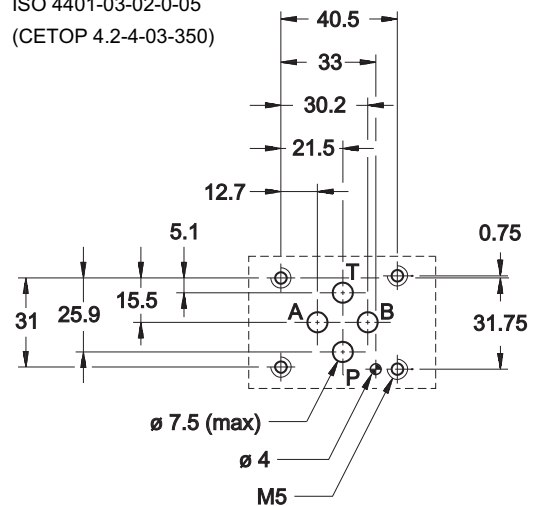
DSH3-TA23  
DSH3-TAK23

DSH3-SA\*  
DSH3-SAK\*



### DSH3 MOUNTING SURFACE

ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)

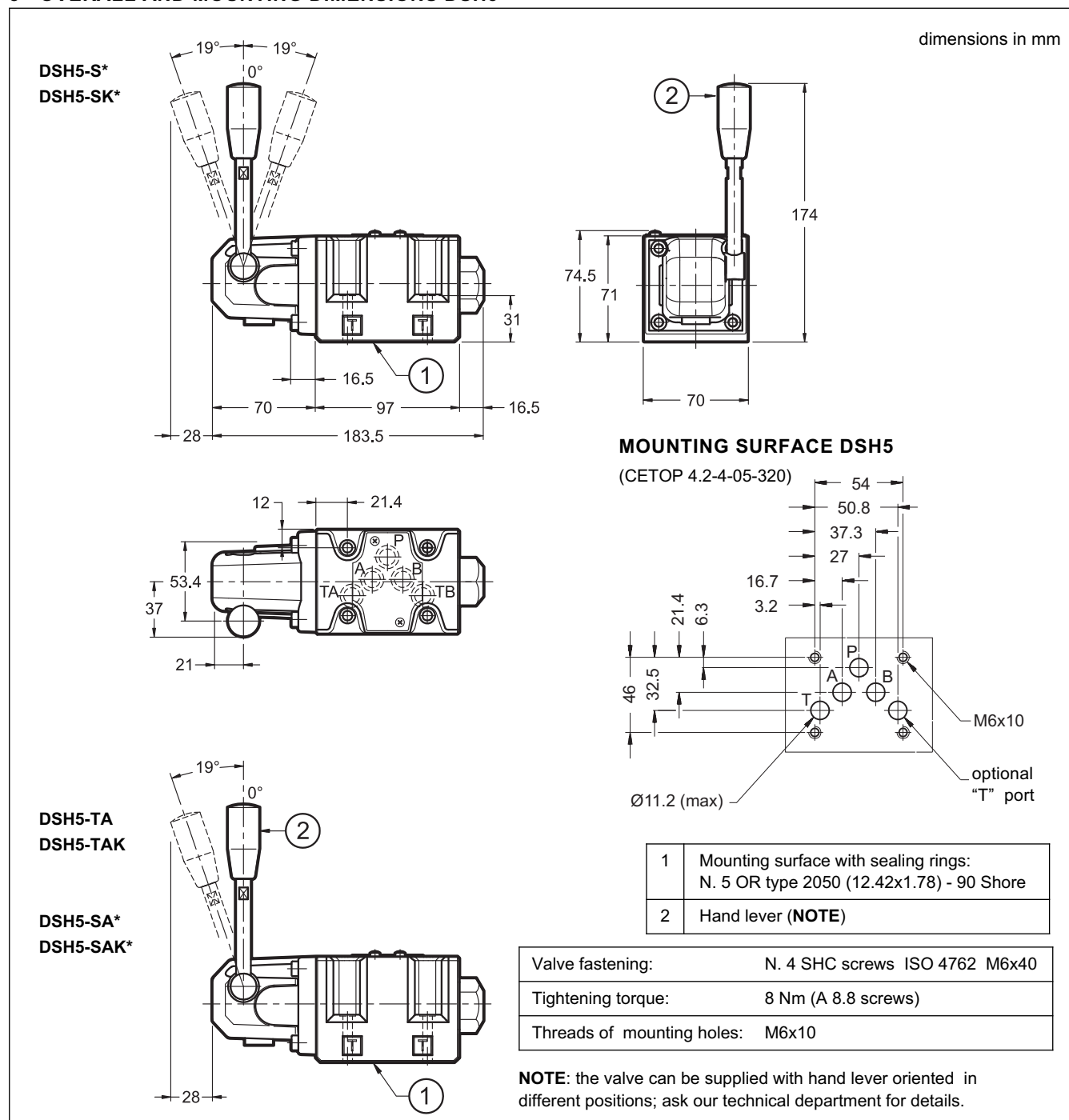


1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Hand lever ( <b>NOTE</b> )

Valve fastening:	N. 4 SHC screws M5x30 ISO 4762
Tightening torque:	5 Nm (bolts A 8.8)
Threads of mounting holes:	M5x10

**NOTE:** The valve is supplied with the hand lever oriented in a perpendicular position with respect to the mounting surface (as indicated in the above drawing). For installation needs the hand lever can be oriented by the user directly at 180° to the standard position, simply by unscrewing the lever and re-screwing it in the desired position.

## 8 - OVERALL AND MOUNTING DIMENSIONS DSH5



## 9 - SUBPLATES (See catalogue 51 000)

	DSH3	DSH5
Type with rear ports	PMMD-AI3G	PMD4-AI4G - 3/4" BSP threaded
Type with side ports	PMMD-AL3G	PMD4-AL4G - 1/2" BSP threaded
P, T, A and B threads	3/8" BSP	



# DSH3L

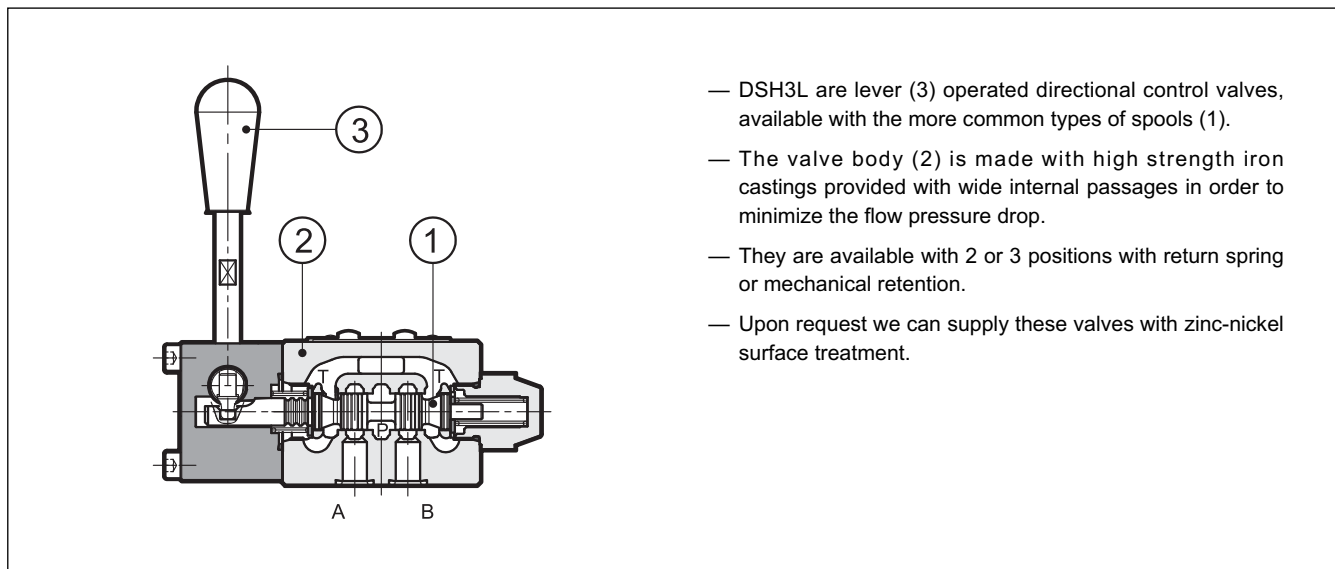
## LEVER OPERATED DIRECTIONAL CONTROL VALVE

### SERIES 10

**MOUNTING SURFACE**  
**ISO 4401-03 (CETOP 03)**

**p** max (see performances table)  
**Q** nom **60 l/min**

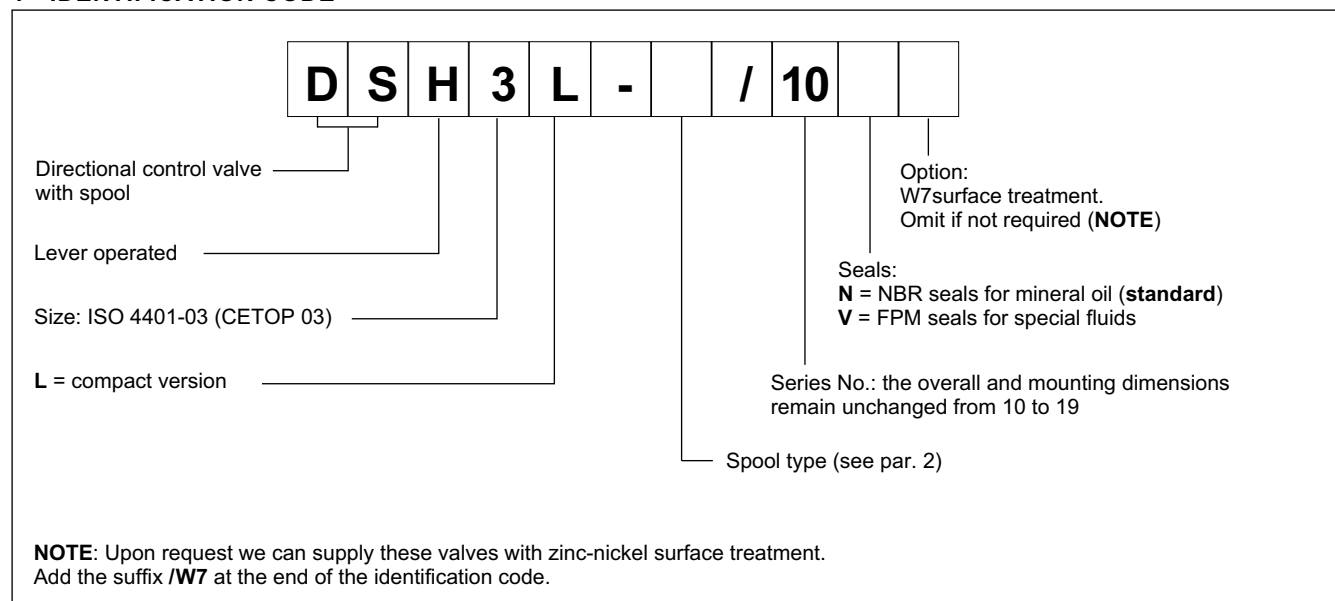
#### OPERATING PRINCIPLE



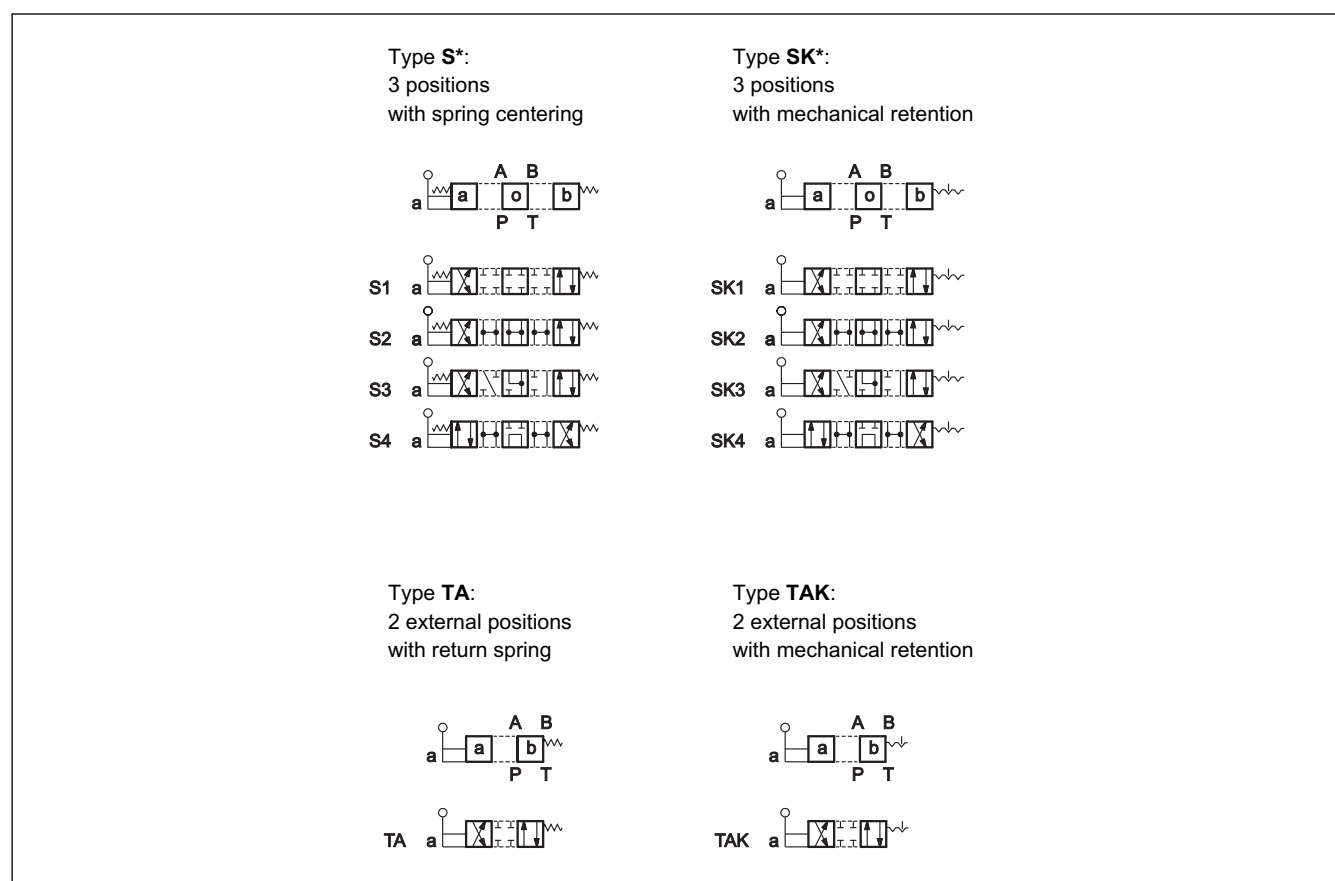
#### PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum working pressure: - P - A - B ports - T port	bar	350 210
Nominal flow rate	l/min	60
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15
Recommended viscosity	cSt	25
Mass	kg	1.4

## 1 - IDENTIFICATION CODE



## 2 - SPOOL TYPE

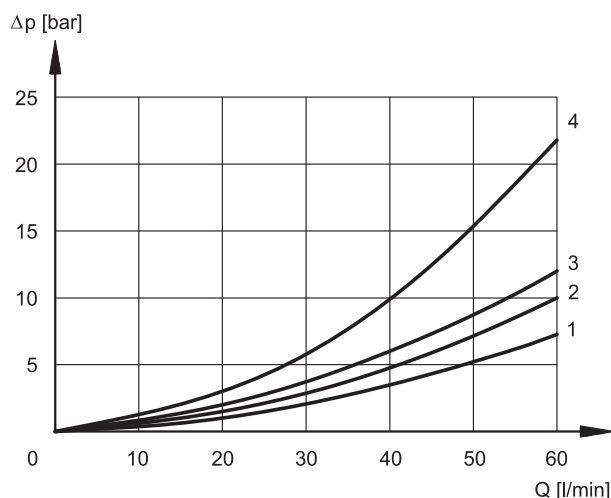


## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - PRESSURE DROPS $\Delta p$ -Q (values obtained with viscosity 36 cSt at 50 °C)



#### VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SK1	2	2	3	3
S2, SK2	1	1	3	3
S3, SK3	3	3	1	1
S4, SK4	4	4	4	4
TA, TAK	3	3	3	3

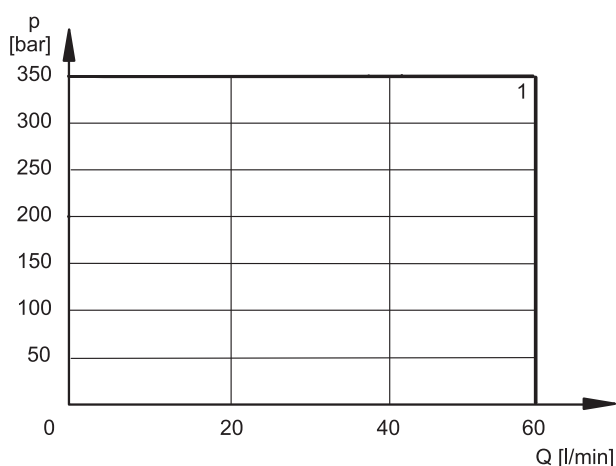
#### VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SK2					2
S3, SK3			3	3	
S4, SK4					3

### 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration ISO 4406:1999 class 18/16/13.



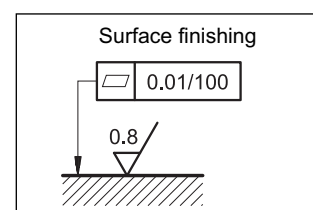
SPOOL TYPE	CURVE	
	P→A	P→B
S1, SK1	1	1
S2, SK2	1	1
S3, SK3	1	1
S4, SK4	1	1

SPOOL TYPE	CURVE	
	P→A	P→B
TA, TAK	1	1

### 6 - INSTALLATION

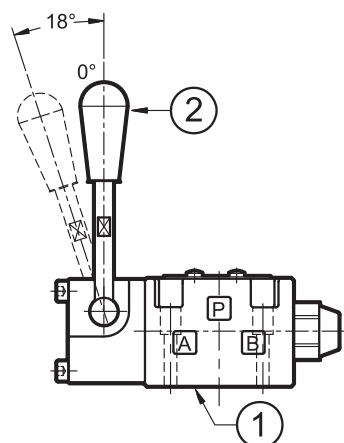
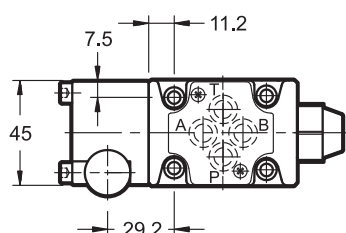
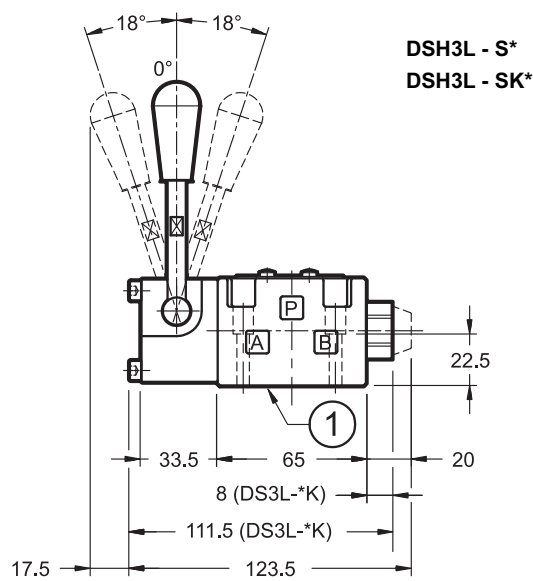
Configurations with centering and return springs can be mounted in any position; valves with mechanical detent must be mounted with the longitudinal axis horizontal.

Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.



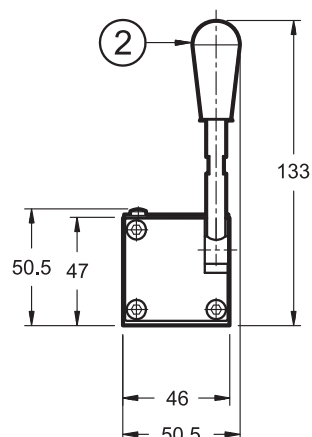


## 7 - OVERALL AND MOUNTING DIMENSIONS



DSH3L-TA  
DSH3L-TAK

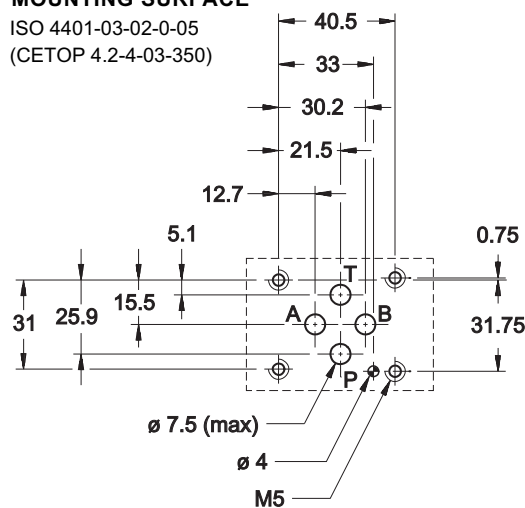
dimensions in mm



## MOUNTING SURFACE

ISO 4401-03-02-0-05

(CETOP 4.2-4-03-350)



1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Hand lever

Valve fastening: N. 4 SHC screws M5x30 - ISO 4762

Tightening torque: 5 Nm (A 8.8 screws)

Threads of mounting holes: M5x10

## 8 - SUBPLATES (see catalogue 51 000)

Type with rear ports: PMMD-AI3G
Type with side ports: PMMD-AL3G
P, T, A and B threads: 3/8" BSP



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# DSR3

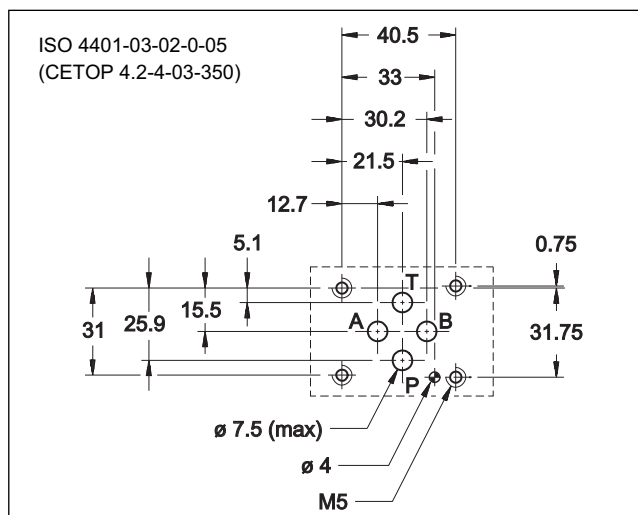
## ROLLER CAM OPERATED DIRECTIONAL CONTROL VALVE SERIES 11

### SUBPLATE MOUNTING ISO 4401-03 (CETOP 03)

**p** max **350** bar

**Q** nom **75** l/min

### MOUNTING INTERFACE

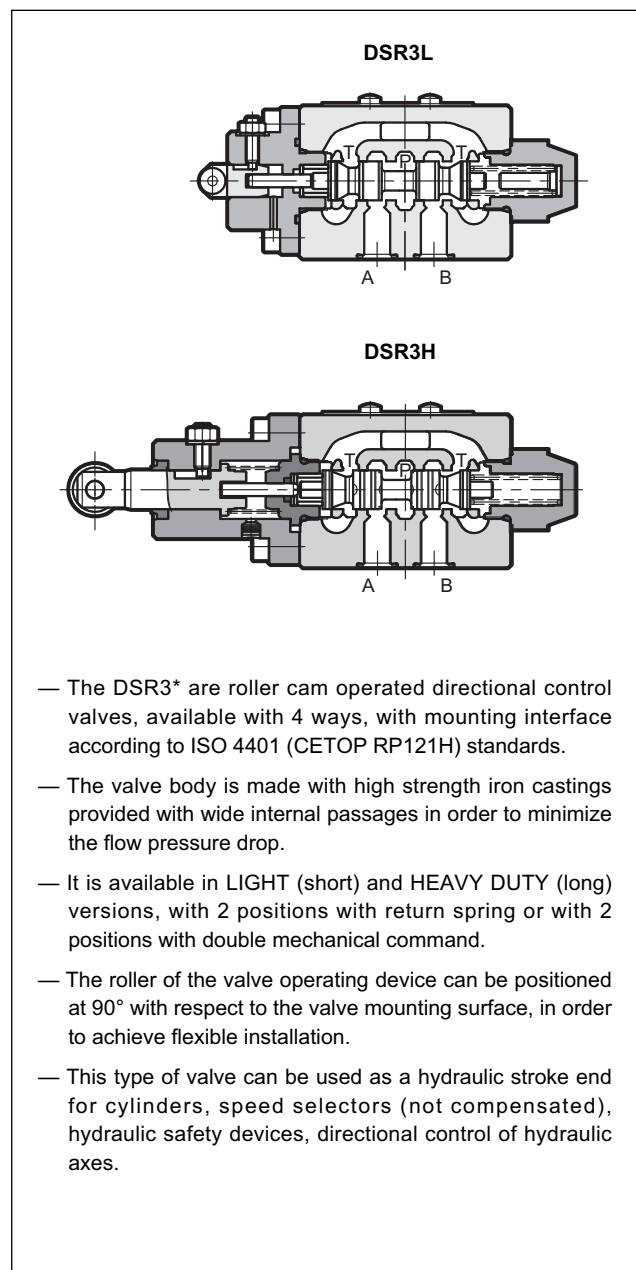


### PERFORMANCE RATINGS

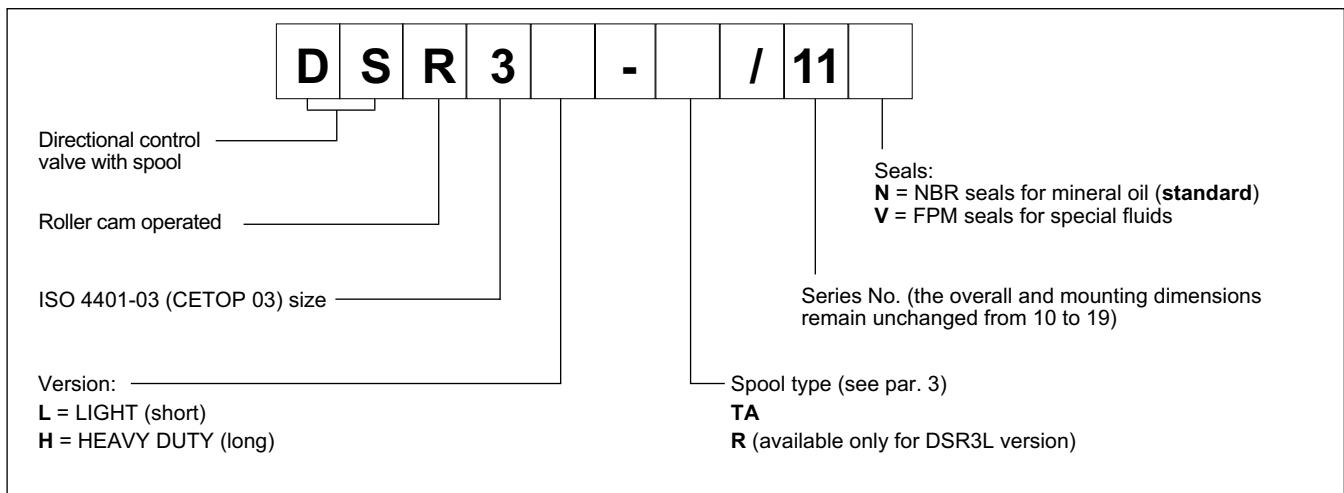
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure: - P A B ports - T ports	bar	350 25
Nominal flow rate	l/min	75
Pressure drop $\Delta p_Q$	see par. 4	
Operating limits	see par. 5	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406: 1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: DSR3L-TA DSR3L-R DSR3H-TA	kg	1,1 1,2 1,2

### OPERATING PRINCIPLE



## 1 - IDENTIFICATION CODE

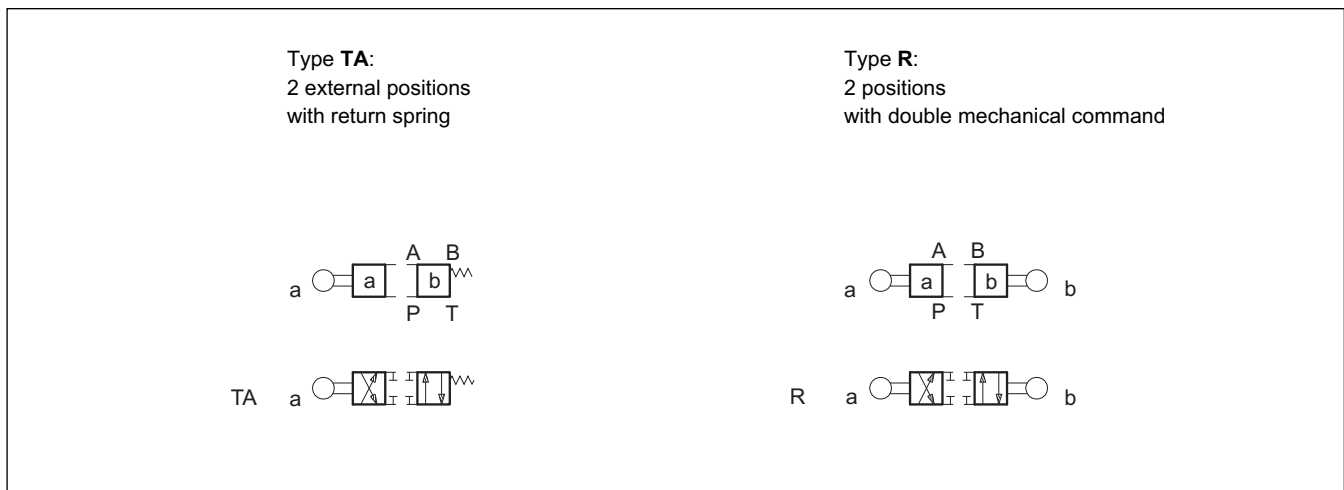


## 2 - HYDRAULIC FLUIDS

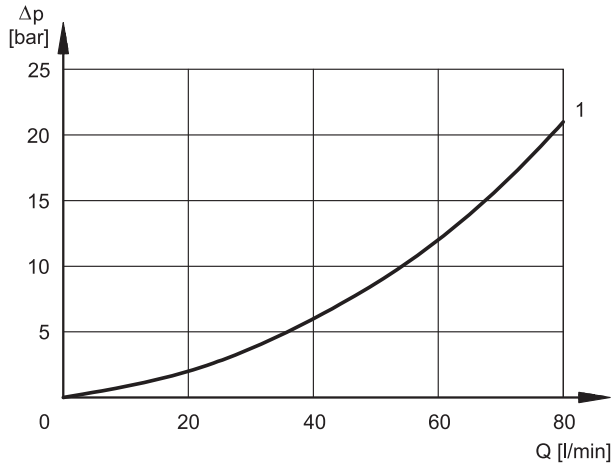
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - SPOOL TYPE



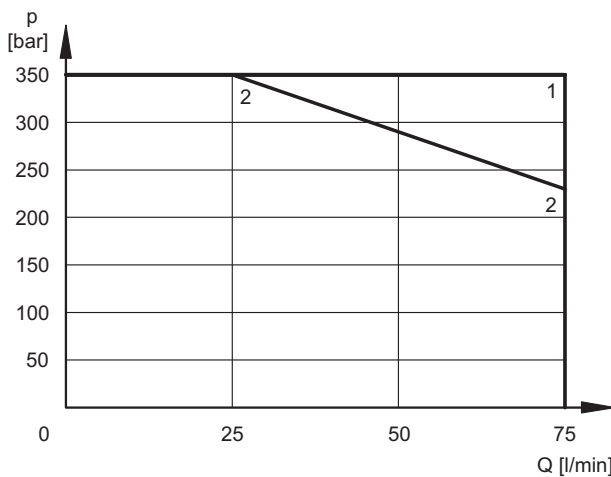
#### 4 - PRESSURE DROPS $\Delta p$ -Q (obtained with viscosity 36 cSt at 50 °C)



SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
DSR3L-TA	1	1	1	1
DSR3L-R	1	1	1	1
DSR3H-TA	1	1	1	1

#### 5 - OPERATING LIMITS

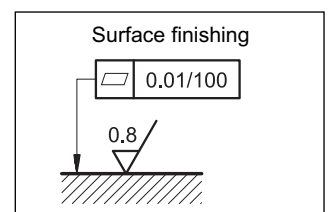
The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



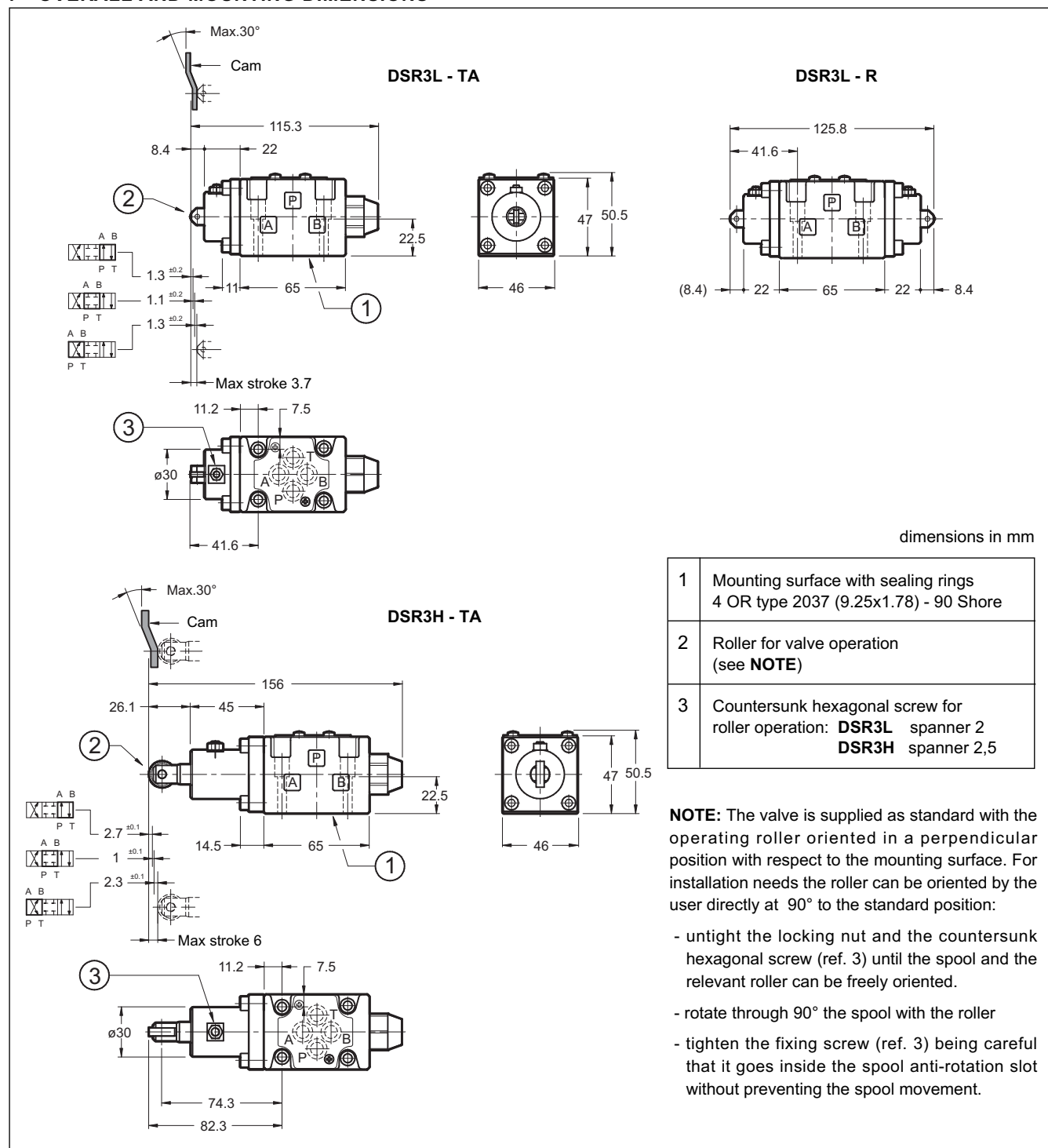
SPOOL TYPE	CURVE	
	P→A	P→B
DSR3L-TA	2	2
DSR3L-R	1	1
DSR3H-TA	1	1

#### 6 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type R valves - without springs - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.



### 7 - OVERALL AND MOUNTING DIMENSIONS



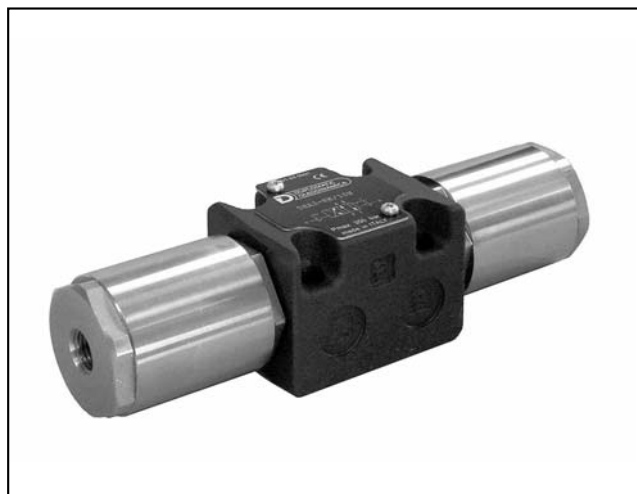
### 8 - VALVE FASTENING BOLTS

N. 4 fastening bolts SHC ISO 4762 M5x30  
Tightening torque 5 Nm (bolts A 8.8)

### 9 - SUBPLATES (see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8" BSP

Type PMMD-AL3G with side ports 3/8" BSP



# DSA\*

## PNEUMATICALLY OPERATED DIRECTIONAL CONTROL VALVE

### SUBPLATE MOUNTING

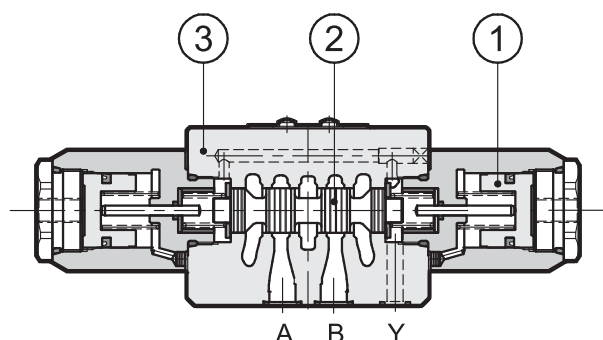
**DSA3** ISO 4401-03 (CETOP 03)

**DSA5** ISO 4401-05 (CETOP R05)

**p** max (see performances table)

**Q** nom (see performances table)

### OPERATING PRINCIPLE

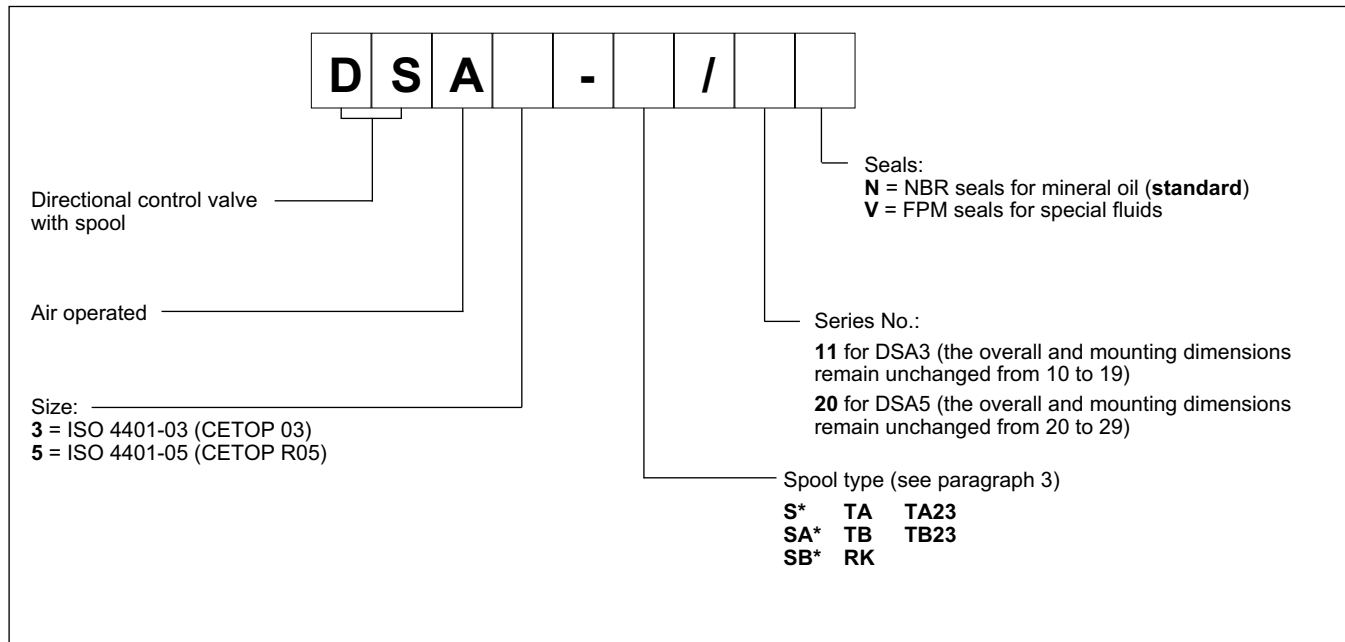


- The DSA\* are pneumatically operated (1) directional control valves, available with 3 or 4 ways with several interchangeable spools (2) and with mounting interface according to ISO 4401 (CETOP RP121H) standards.
- The valve body (3) is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop.
- It is available with 2 or 3 positions with return spring, or with 2 positions with mechanical retention.
- The Y external drain is available (standard) for the ISO 4401-05 (CETOP R05) size and it must be connected when there is backpressure higher than 25 bar on the T port.

### PERFORMANCES (with mineral oil of viscosity 36 cSt at 50°C)

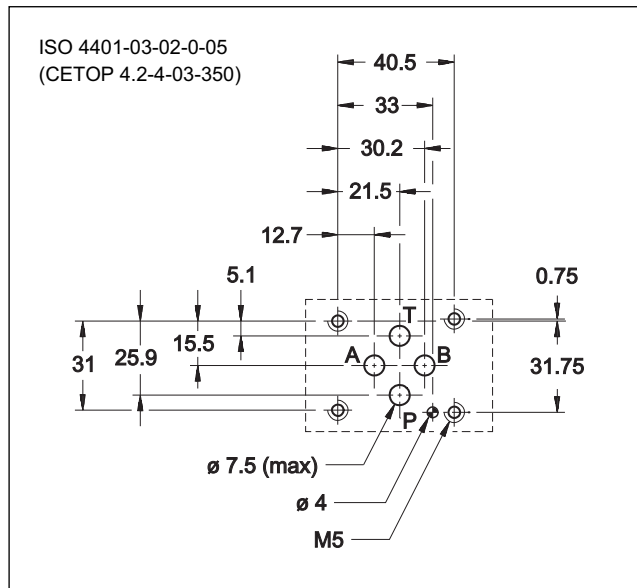
		DSA3	DSA5
Maximum working pressure: - P, A, B ports - T port without Y external drain - T port with Y external drain (available for DSA5 only)	bar	350 25 -	320 25 320
Piloting pressure: - min - max	bar	4 12	4,5 12
Nominal flow rate	l/min	75	120
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass:     single operator valve dual operator valve	kg	1,3 1,7	3,2 4,0

## 1 - IDENTIFICATION CODE

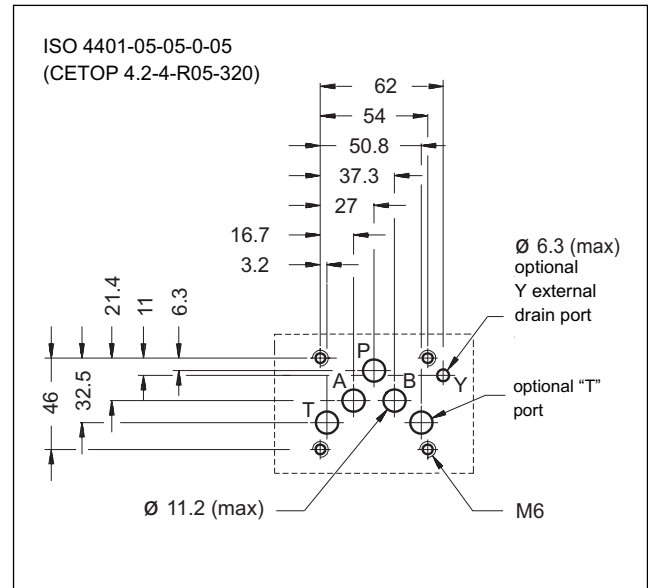


## 2 - MOUNTING INTERFACE

### DSA3



### DSA5



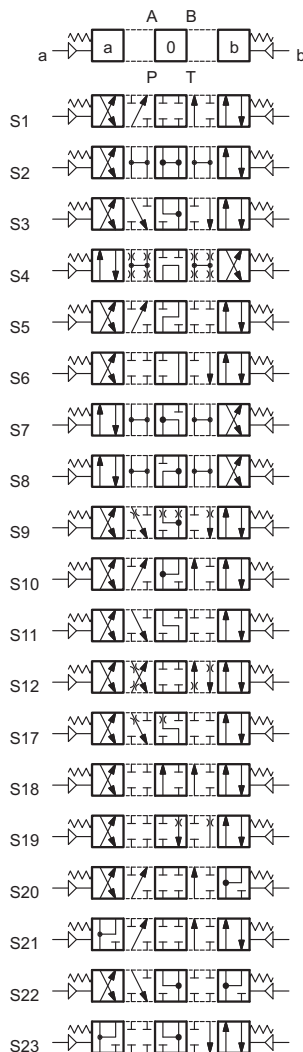
## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

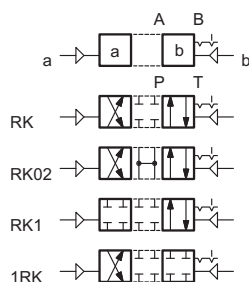
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 4 - SPOOL TYPE

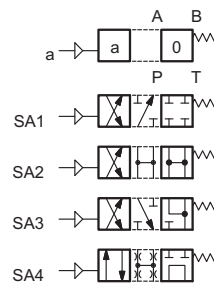
**Type S\*:**  
2 operations - 3 positions  
with spring centering



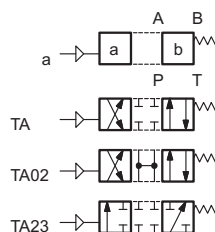
**Type RK:**  
2 operations - 2 positions  
with mechanical retention



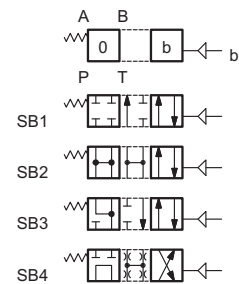
**Type SA\*:**  
1 operation side A  
2 positions (central + external)  
with spring centering



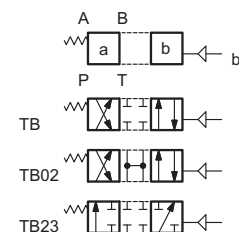
**Type TA:**  
1 operation side A  
2 external positions  
with return spring



**Type SB\*:**  
1 operation side B  
2 positions (central + external)  
with spring centering



**Type TB:**  
1 operation side B  
2 external positions  
with return spring



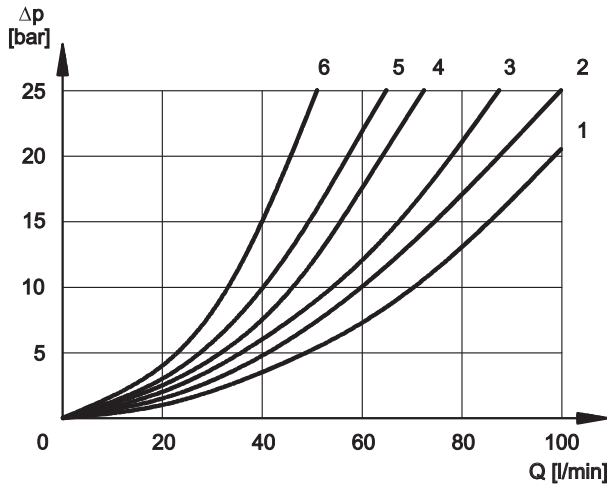
Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification and operating limits.





## 5 - PRESSURE DROPS $\Delta p$ -Q (values obtained with viscosity 36 cSt at 50 °C)

### 5.1 - DSA3



For pressure drops between A and B lines of spools S10, S20, S21, S22 and S23, which are used in the regenerative diagram, refer to curve 5.

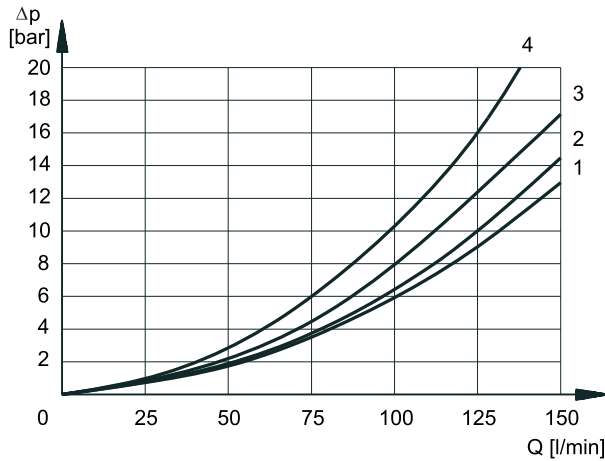
### PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	5	5	5	5
S5	2	1	3	3
S6	2	2	3	1
S7, S8	4	5	5	5
S9	2	2	3	3
S10	1	3	1	3
S11	2	2	1	3
S12	2	2	3	3
S17	2	2	3	3
S18	1	2	3	3
S19	2	2	3	3
S20	1	5	2	
S21	5	1		2
S22	1	5	2	
S23	5	1		2
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
RK	2	2	2	2
RK02	2	2	2	2
RK1, 1RK	2	2	2	2

### PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

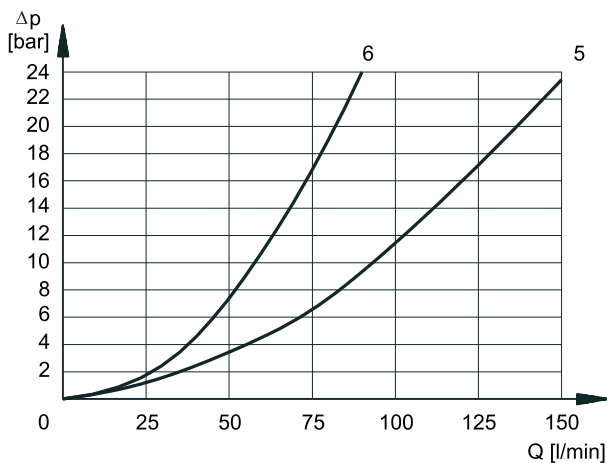
SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3			3	3	
S4, SA4, SB4					5
S5		4			
S6				3	
S7, S8			6	6	5
S10	3	3			
S11			3		
S18	4				
S22			3	3	
S23			3	3	

## 5.2 - DSA5



### PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	1	1
S2, SA2, SB2	3	3	1	1
S3, SA3, SB3	3	3	2	2
S4, SA4, SB4	1	1	2	2
S5	2	1	1	1
S6, S11	3	3	2	2
S7, S8	1	1	2	2
S9	3	3	2	2
S10	1	1	1	1
S12	2	2	1	1
S17, S19	2	2	1	1
S18	1	2	1	1
S20, S21				
S22, S23				
TA, TB	3	3	2	2
TA02, TB02	3	3	2	2
TA23, TB23	4	4		
RK	3	3	2	2
RK02	3	3	2	2
RK1, 1RK	3	3	2	2



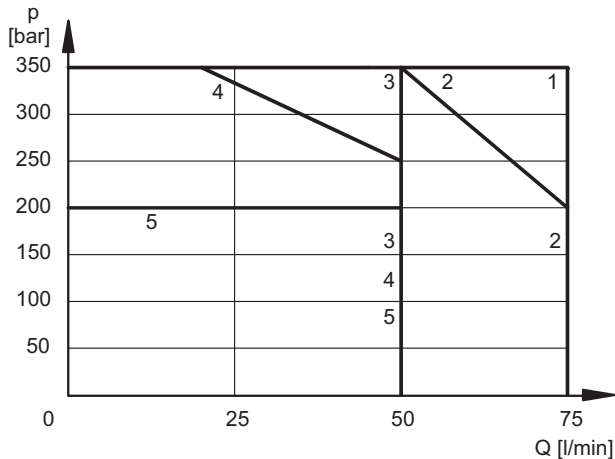
### PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					5
S3, SA3, SB3			6	6	
S4, SA4, SB4					5
S5		3			
S6				6	
S7					5
S10	3	3			
S11			6		
S18	3				
S22					
S23					

## 6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

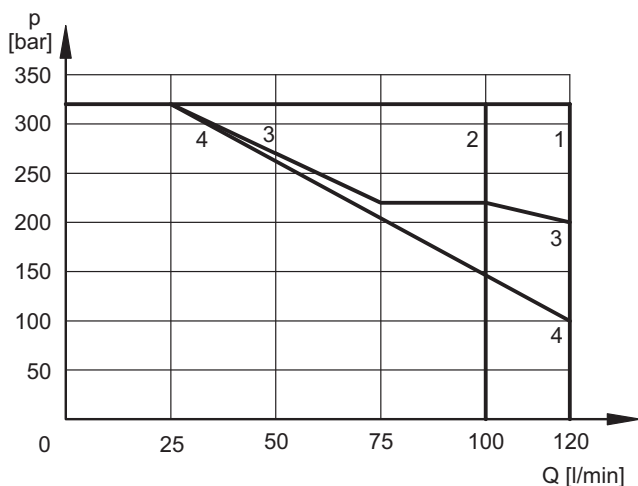
### 6.1 - DSA3



SPOOL TYPE	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	2	2
S4, SA4, SB4	3	3
S5	1	1
S6	3	2
S7	3	3
S8	3	3
S9	1	1
S10	1	1
S11	2	3
S12	1	1

SPOOL TYPE	CURVE	
	P→A	P→B
S17	1	1
S18	1	1
S19	1	1
S20	4	4
S21	4	4
S22	5	4
S23	4	5
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

### 6.2 - DSA5



SPOOL TYPE	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	3 *	3 *
S4, SA4, SB4	4	4
S5		
S6		
S7		
S8		
S9		
S10		
S11		
S12		

SPOOL TYPE	CURVE	
	P→A	P→B
S17		
S18		
S19		
S20		
S21		
S22		
S23		
TA, TB	2 *	2 *
TA02, TB02		
TA23, TB23		
RK		
RK02		
RK1, 1RK		

\* **NOTE:** for spools S3 and TA, the curve has been obtained with a min. piloting pressure of 4,5 bar. If the minimum piloting pressure used is 5,5 bar, refer to the curve n° 1 (320 bar - 120 l/min).

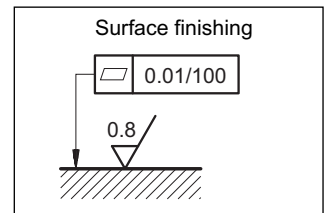
**NOTE:** The values indicated in the graphs are relevant to the standard valve. The operating limits can be considerably reduced if a 4-way valve is used with port A or B plugged or without flow.

## 7 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

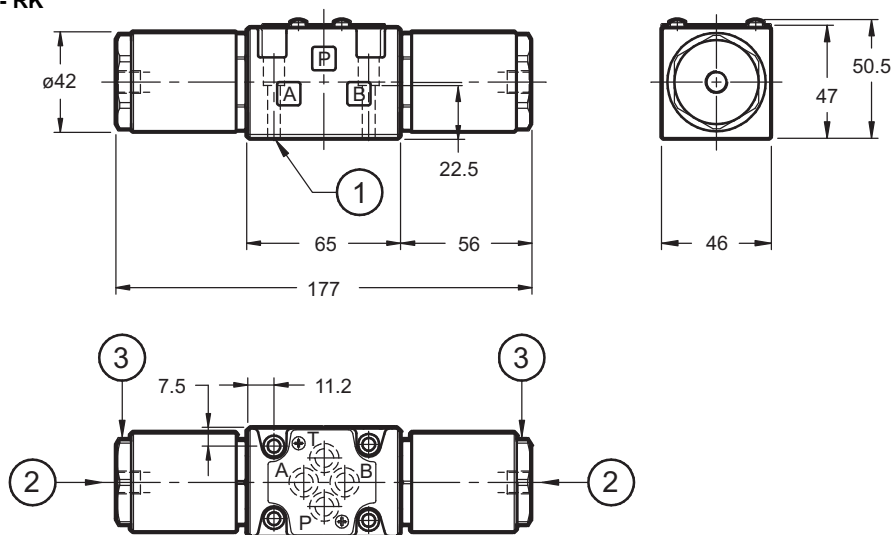
Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

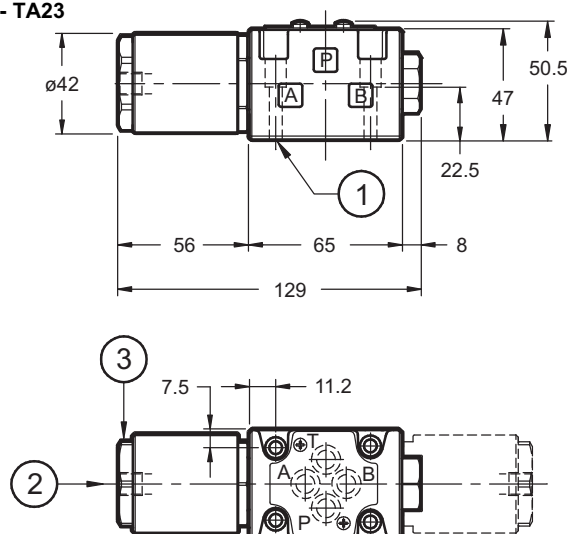


## 8 - DSA3 OVERALL AND MOUNTING DIMENSIONS

**DSA3 - S\***  
**DSA3 - RK**



**DSA3 - TA**  
**DSA3 - SA\***  
**DSA3 - TA23**



dimensions in mm

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	1/4" BSP connection for pneumatic operator
3	Hexagon: spanner 38 Tightening torque 35 ÷ 40 Nm

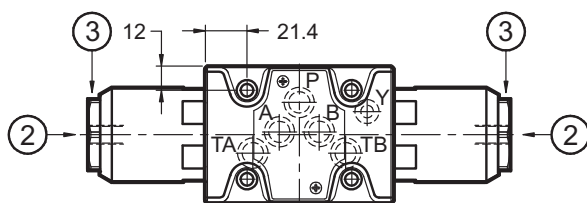
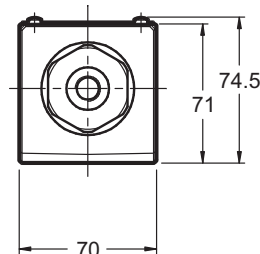
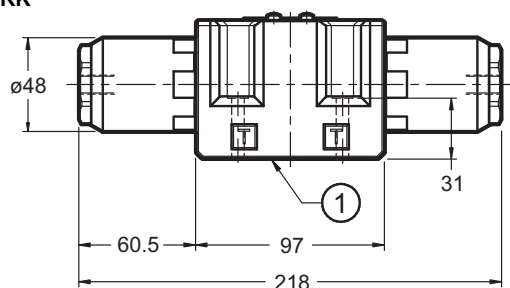
Valve fastening:	N. 4 SHC screws ISO 4762 - M5x30
Tightening torque:	5 Nm (bolts A 8.8)
Threads of mounting holes:	M5x10

operation position configuration SB\*, TB and TB23

## 9 - DSA5 OVERALL AND MOUNTING DIMENSIONS

DSA5 - S\*

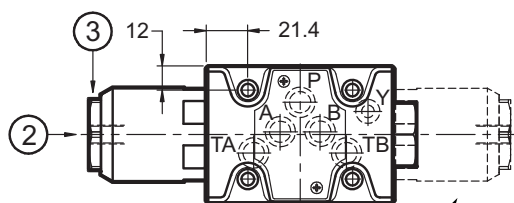
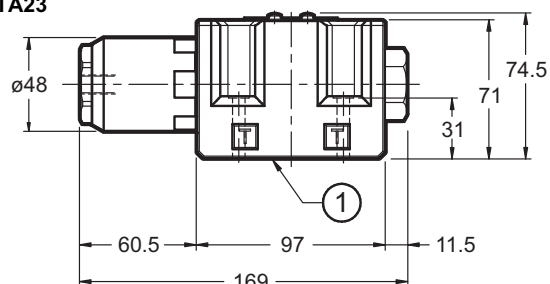
DSA5 - RK



DSA5 - TA

DSA5 - SA\*

DSA5 - TA23



operation position configuration SB\*, TB and TB23

dimensions in mm

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) 90 Shore N. 1 OR type 2037 (9.25x1.78) 90 Shore
2	1/4" BSP connection for pneumatic operator
3	Hexagon: spanner 38 Tightening torque 35 ÷ 40 Nm

Valve fastening:	N. 4 SHC screws ISO 4762 - M6x40
Tightening torque:	8 Nm (bolts A 8.8)
Threads of mounting holes:	M6x10

## 10 - SUBPLATES (see catalogue 51 000)

	DSA3	DSA5
Type with rear ports	PMMD-AI3G	PMD4-AI4G - 3/4" BSP threaded
Type with side ports	PMMD-AL3G	PMD4-AL4G - 1/2" BSP threaded
Threading of ports P, T, A and B	3/8" BSP	

**D** **DUPLOMATIC**  
**OLEODINAMICA**

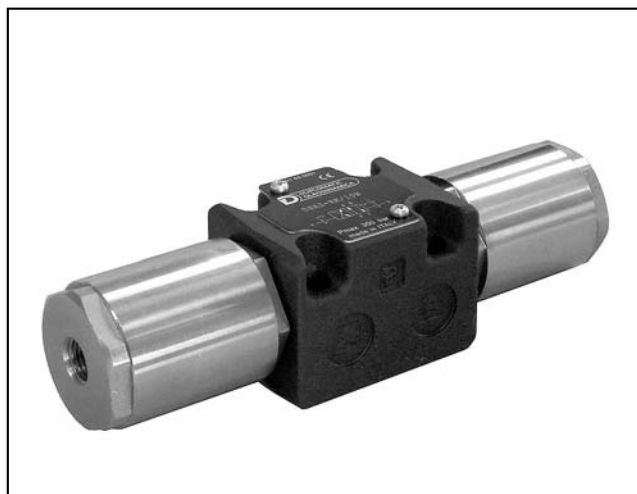
**DUPLOMATIC OLEODINAMICA S.p.A.**

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Fax +39 0331.895.339

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# DSC3

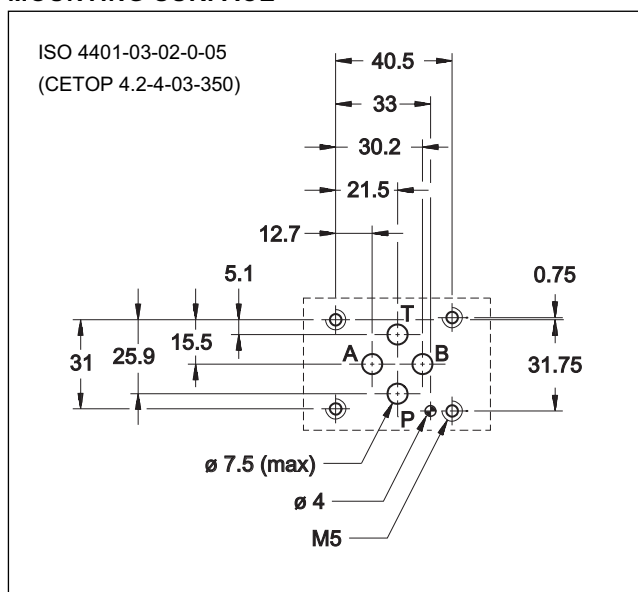
## HYDRAULICALLY OPERATED DIRECTIONAL CONTROL VALVE

### SERIES 11

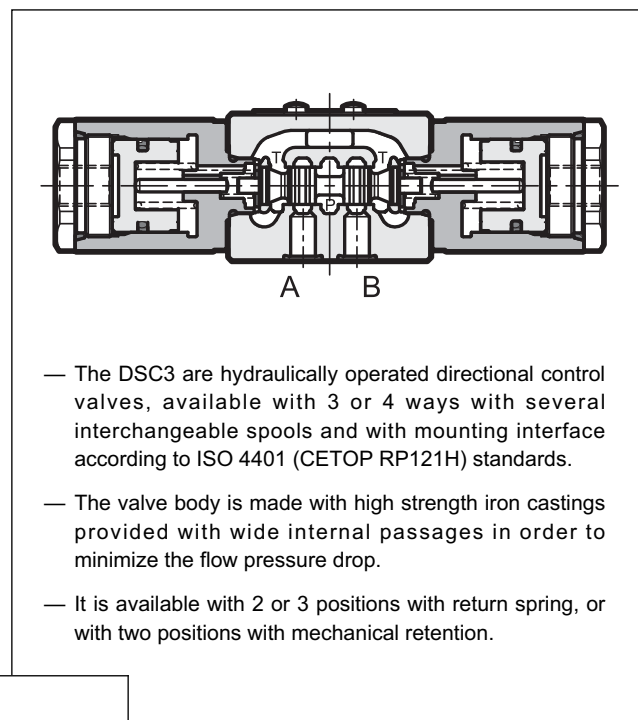
#### SUBPLATE MOUNTING ISO 4401-03 (CETOP 03)

**p** max (see performances table)  
**Q** nom (see performances table)

#### MOUNTING SURFACE



#### OPERATING PRINCIPLE

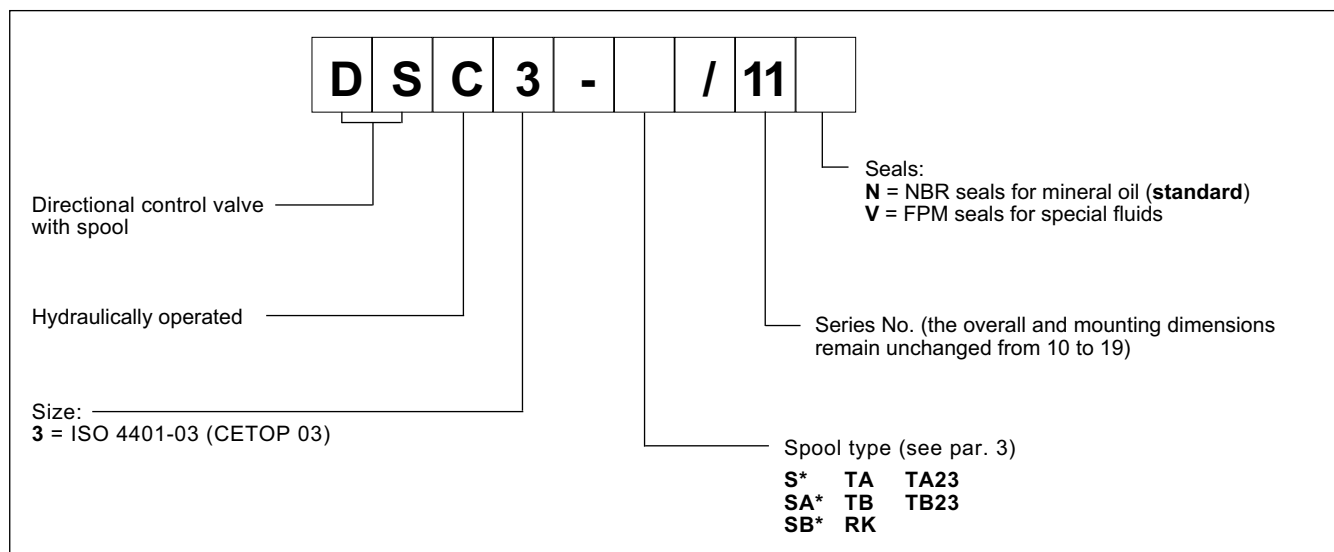


#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum working pressure: - P A B ports - T port	bar	350 25
Piloting pressure - min - max	bar	15 (NOTE 1) 210
Nominal flowrate	l/min	75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: single operation valve double operation valve	kg	1,3 1,7

**NOTE 1:** The piloting pressure must be higher than the counterpressure on T port, of 15 bar at least: to allow the cursor reversal at middle the piloting pressure has to lower quickly at 0 bar.  
The piston return spring generates a minimum backpressure of 0.5 bar on the piloting line.

### 1 - IDENTIFICATION CODE

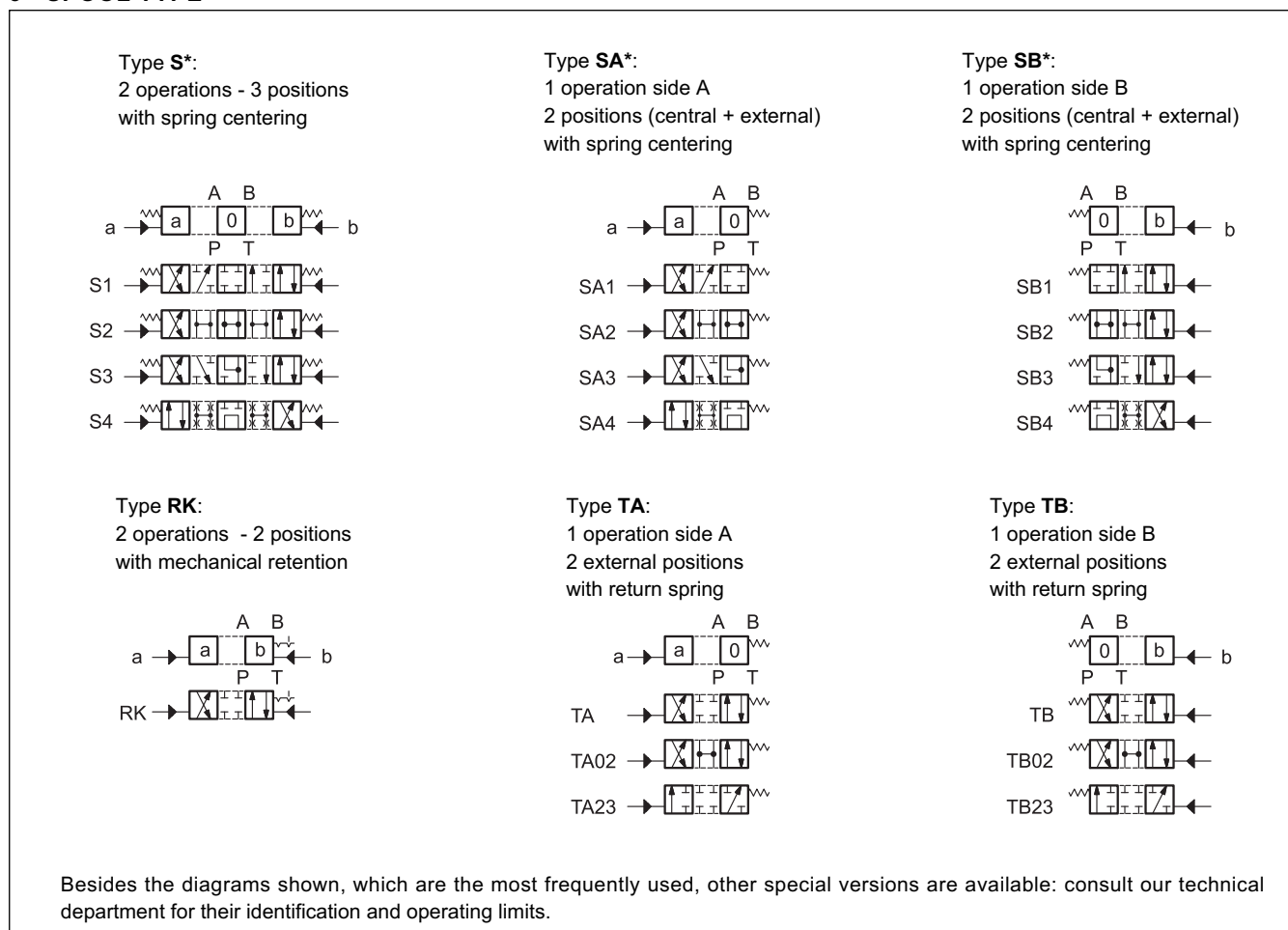


### 2 - HYDRAULIC FLUIDS

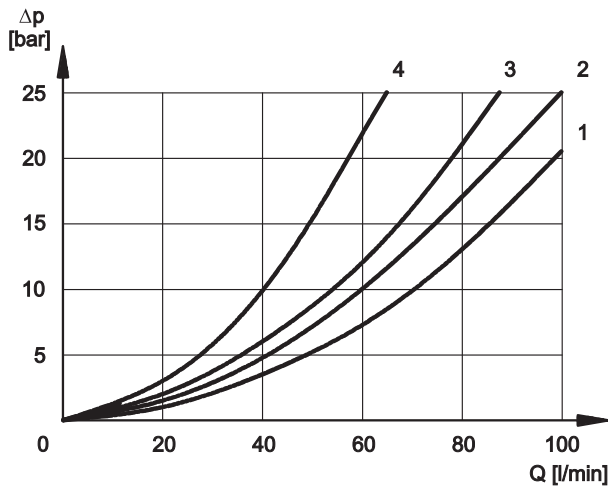
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 3 - SPOOL TYPE



### 4 - PRESSURE DROPS $\Delta p$ -Q (values obtained with viscosity 36 cSt at 50 °C)



#### PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

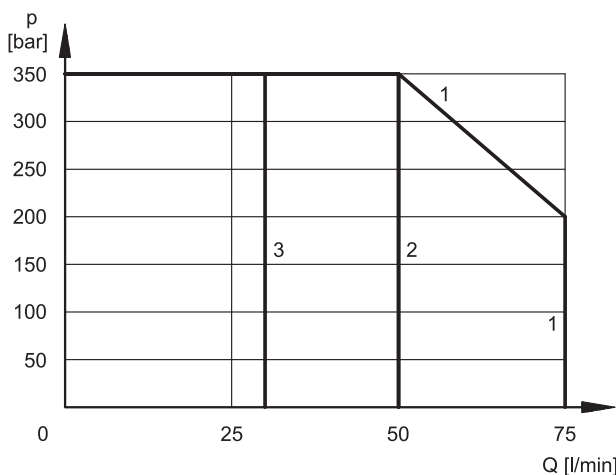
SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	4	4	4	4
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
RK	2	2	2	2

#### PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3			3	3	
S4, SA4, SB4					3

### 5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow. The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



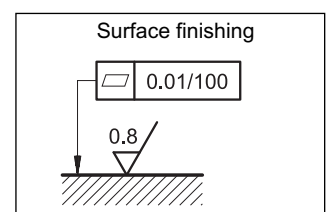
SPOOL TYPE	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	1	1
S4, SA4, SB4	2	2

SPOOL TYPE	CURVE	
	P→A	P→B
TA, TB	1	1
TA02, TB02	2	2
TA23, TB23	1	1
RK	3	3

**NOTE:** The values indicated in the graphs are relevant to the standard valve. The operating limits can be considerably reduced if a 4-way valve is used with port A or B plugged or without flow.

### 6 - INSTALLATION

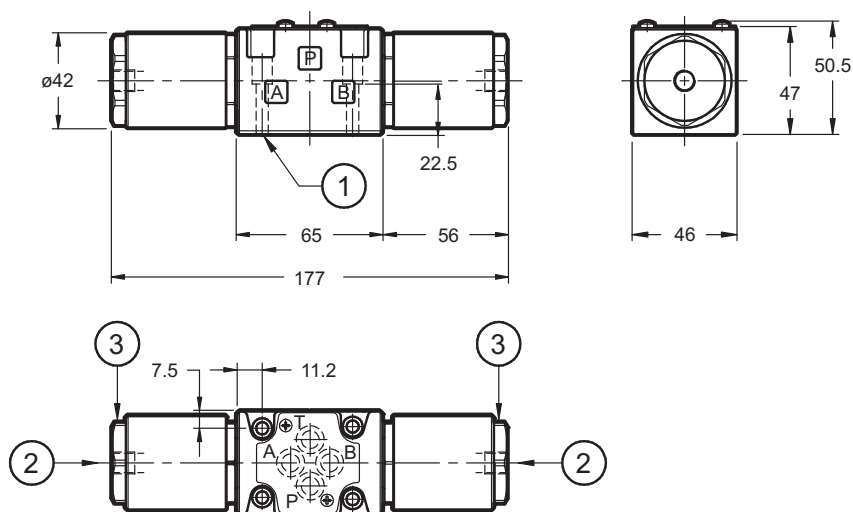
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.



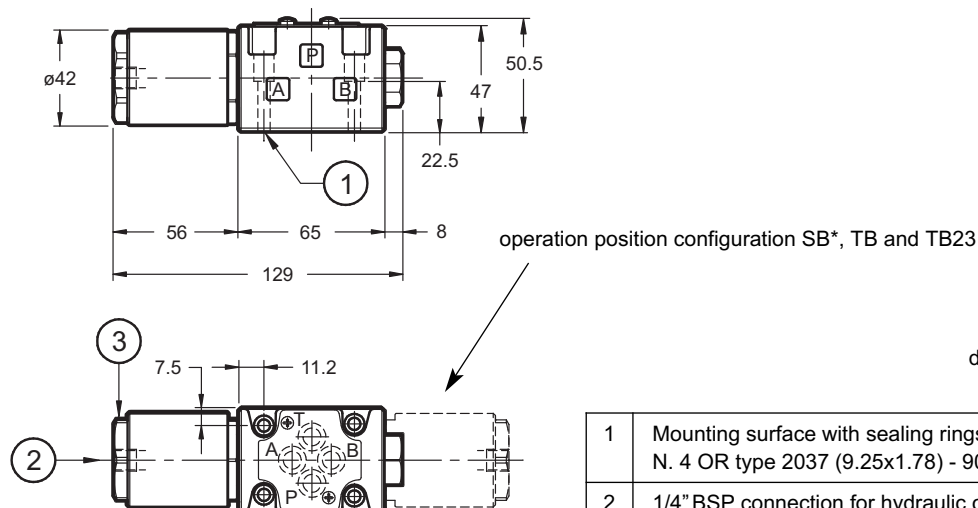


## 7 - OVERALL AND MOUNTING DIMENSIONS

DSC3 - S\*  
DSC3 - RK



DSC3 - TA  
DSC3 - SA\*  
DSC3 - TA23



dimensions in mm

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	1/4" BSP connection for hydraulic operation
3	Hexagon: spanner 38 Tightening torque 35 ± 40 Nm

## 8 - VALVE FASTENING BOLTS

N. 4 fastening bolts SHC ISO 4762 M5x30  
Tightening torque 5 Nm (bolts A 8.8)

## 9 - SUBPLATES (see cat. 51 000)

PMMD-AI3G Type with rear ports

PMMD-AL3G Type with side ports

Threading of ports P, T, A, B: 3/8" BSP



# DSB\*

## SELF-REVERSING VALVE

### SERIES 10

#### MOUNTING SURFACES

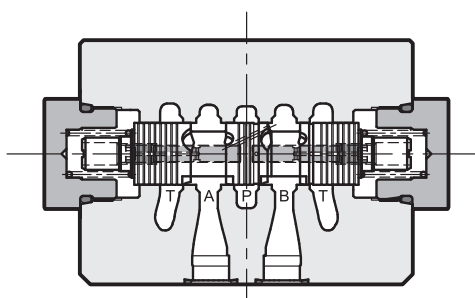
**DSB3** ISO 4401-03 (CETOP 03)

**DSB5** ISO 4401-05 (CETOP 05)

**p** max (see performances table)

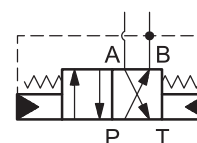
**Q** nom (see performances table)

#### OPERATING PRINCIPLE



- The DSB\* are directional control valves with self-reversing spool and mounting interface according to ISO 4401-03 and 4401-05 (CETOP RP121H) standards.
- The valves realize the reciprocation of the flow direction when the flowrate stops in A or B line (f.e., when a cylinder reaches the end stroke). The reversing process is independent of the line pressure.

#### HYDRAULIC SYMBOL

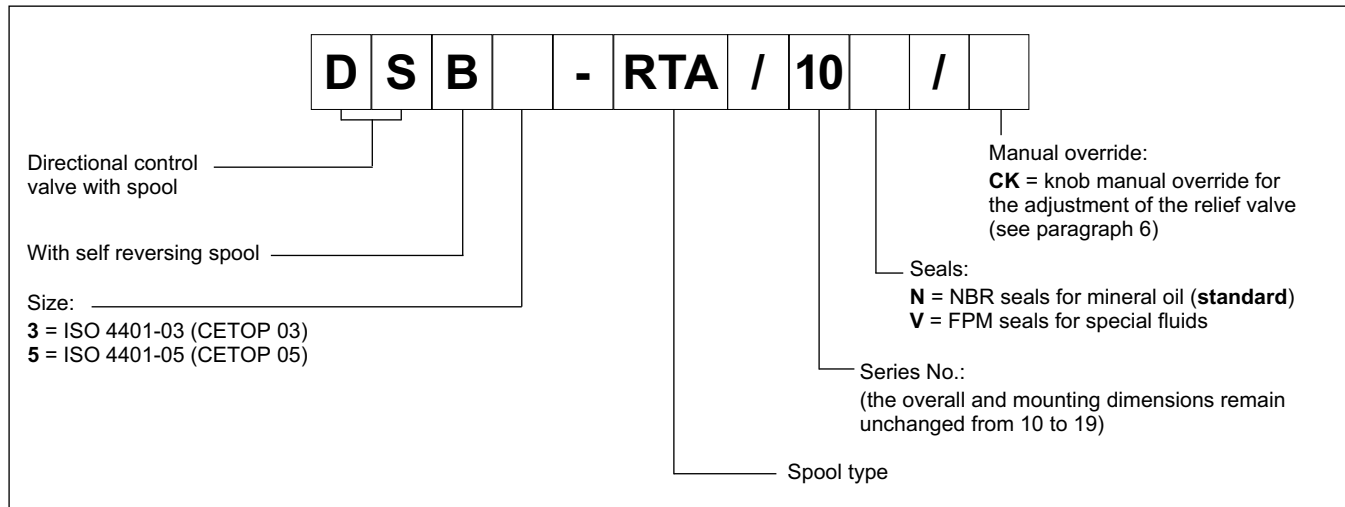


#### PERFORMANCES

(measured with mineral oil of viscosity 36 cSt at 50°C)

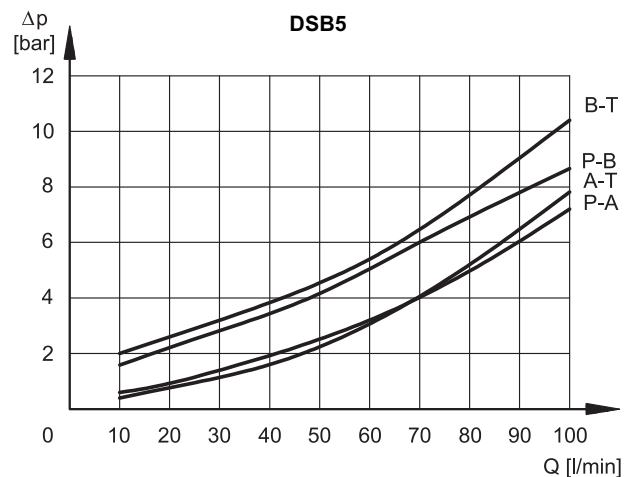
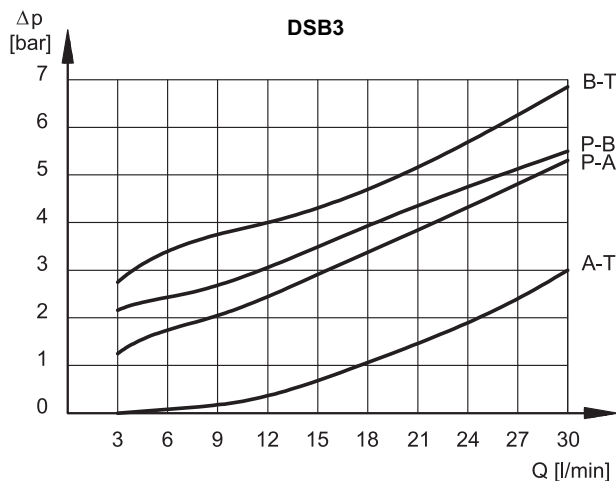
		<b>DSB3</b>	<b>DSB5</b>
Maximum operating pressure on port P	bar	350	320
Minimum allowed pressure	bar	50	60
Maximum flow rate	l/min	30	100
Minimum allowed flow rate	l/min	3	10
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Recommended viscosity	cSt	25	
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15	
Mass	kg	0,9	2,8
Surface finishing		zinc-nickel surface treatment	

### 1 - IDENTIFICATION CODE



### 2 - PRESSURE DROPS $\Delta p$ -Q

(values obtained with viscosity 36 cSt at 50 °C)



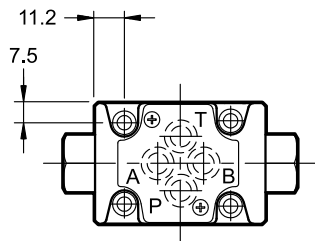
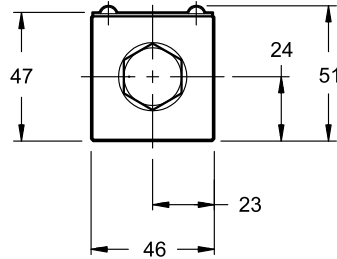
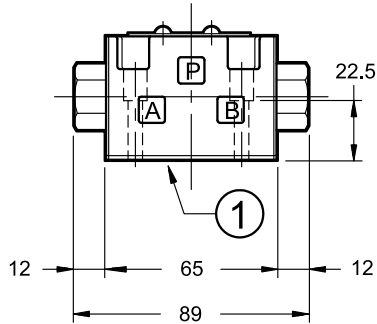
### 3 - HYDRAULIC FLUIDS

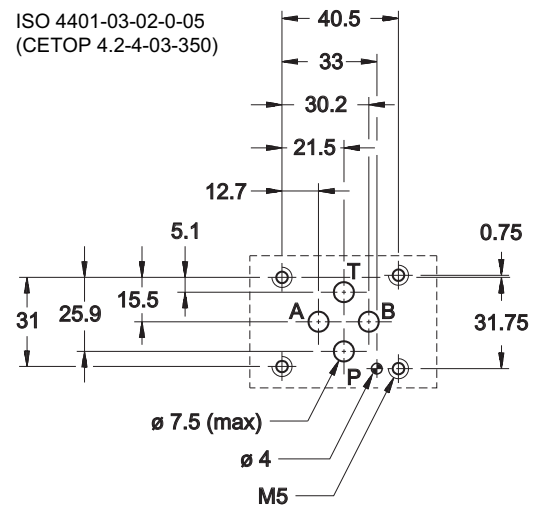
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

**5 - OVERALL AND MOUNTING DIMENSIONS DSB3**

dimensions in mm


**MOUNTING INTERFACE**

 ISO 4401-03-02-0-05  
 (CETOP 4.2-4-03-350)


Valve fastening: N. 4 bolts SHC M5x30 - ISO 4762

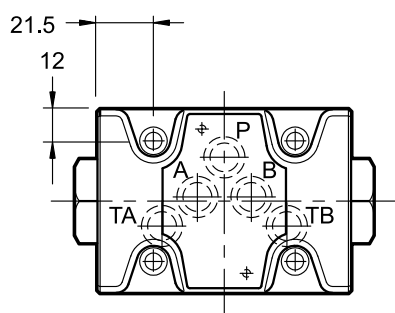
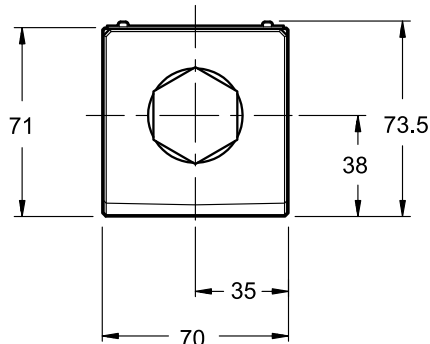
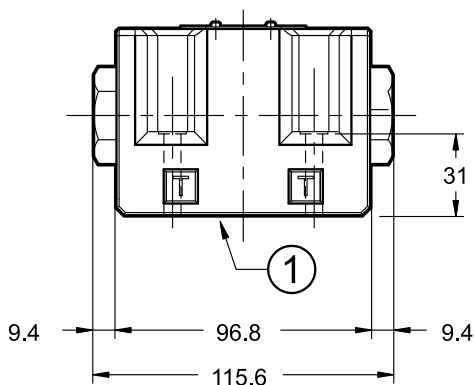
Tightening torque: 5 Nm (bolts A 8.8)

Threads of mounting holes: M5x10

 1 Mounting surface with sealing rings:  
 N. 4 OR type 2037 (9.25x1.78)  
 90 shore

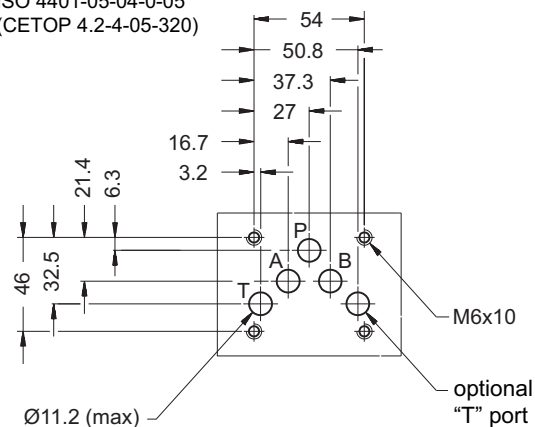
### 5 - OVERALL AND MOUNTING DIMENSIONS DSB5

dimensions in mm



#### MOUNTING INTERFACE

ISO 4401-05-04-0-05  
(CETOP 4.2-4-05-320)



Valve fastening: N. 4 bolts SHC M6x40 - ISO 4762

Tightening torque: 8 Nm (bolts A 8.8)

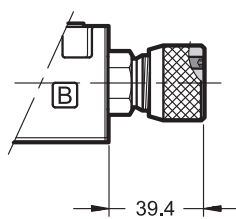
Threads of mounting holes: M6x10

1 Mounting surface with sealing rings:  
N. 5 OR type 2050 (12.42x1.78)  
90 shore

### 6 - KNOB MANUAL OVERRIDE

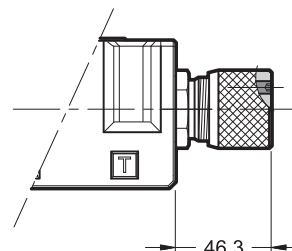
The knob manual override **CK** allows to set the pressure of the relief valve without using shut-off valves.

#### CK for DSB3



Allen key for set screw: 2,5 mm

#### CK for DSB5

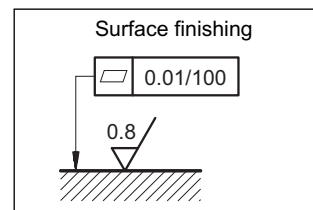


Allen key for set screw: 3 mm

## 7 - INSTALLATION

The valves can be mounted in any position. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

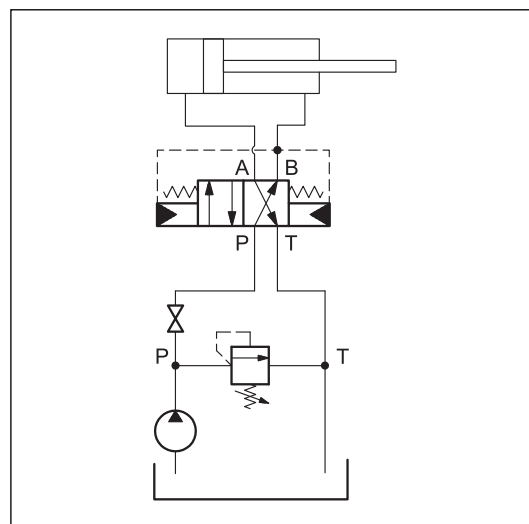


We suggest to use the circuits shown, connecting the A port with the rear chamber of the cylinder. In this way, with the start of the pump, the valve places itself, so as to retract the rod. To work properly the valve needs an area ratio of the cylinder chambers included between 1:1,25 and 1:2.

### 7.1 - Standard valve

To set the system relief valve correctly, the self-reversing function must be inactive.

To do so, close the shut-off valve, start the pump, set the pressure relief valve and stop the pump. Then, open the shut-off valve and restart the pump.



### 7.2 - Valve with knob manual override

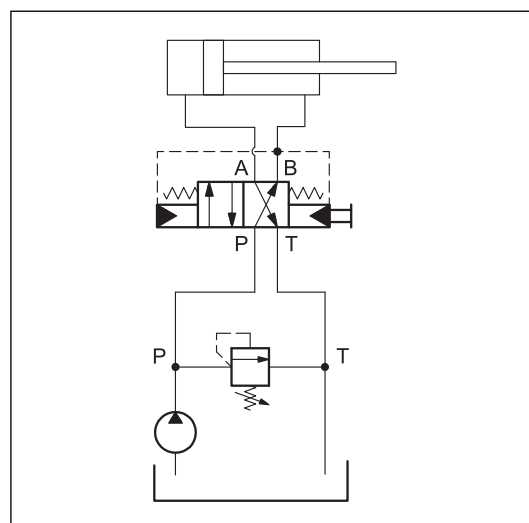
To set the system relief valve correctly, the self-reversing function must be inactive.

To do so, completely unscrew the set screw then tighten the knob until it is at mechanical stop. The spool is now clamped in position  $P \rightarrow B$  and  $A \rightarrow T$ . Start the pump, set the pressure of the relief valve and then stop the pump. Re-establish the working conditions of the valve, unscrewing almost completely the knob and screwing the set screw, until its point is aligned with the edge of the knob.

The valve is in normal working conditions when the knob is tightened and the point of the set screw is aligned with the edge of the knob.



**Do not use the manual override when the valve is on: if it is necessary stop the pump.**





**8 - SUBPLATES** (see catalogue 51 000)

	<b>DSB3</b>	<b>DSB5</b>
Type with rear ports	PMMD-AI3G	PMD4-AI4G - 3/4" BSP threaded
Type with side ports	PMMD-AL3G	PMD4-AL4G - 1/2" BSP threaded
Threading of ports P, T, A, B	3/8" BSP	-



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# DT03

## POPPET TYPE SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

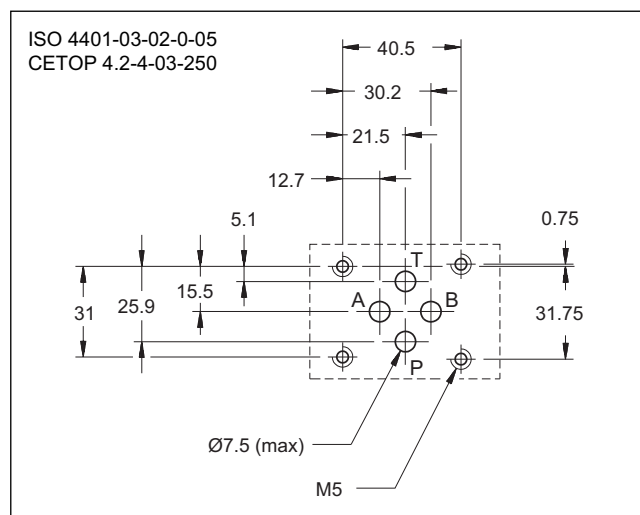
### SERIES 10

#### SUBPLATE MOUNTING ISO 4401-03 (CETOP 03)

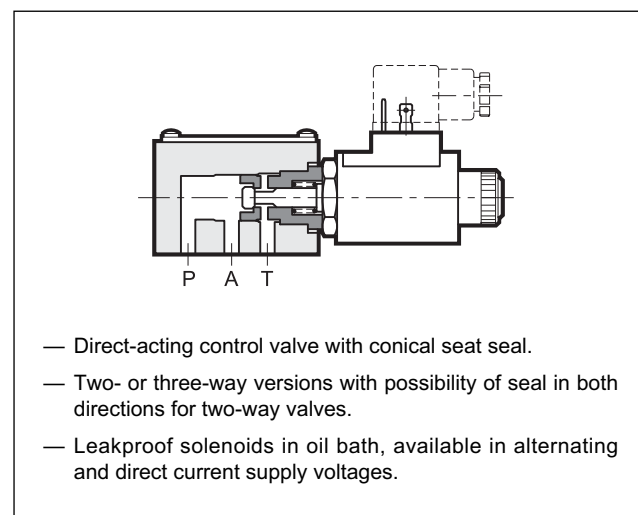
**p** max **250** bar

**Q** max **25** l/min

#### MOUNTING INTERFACE



#### OPERATING PRINCIPLE

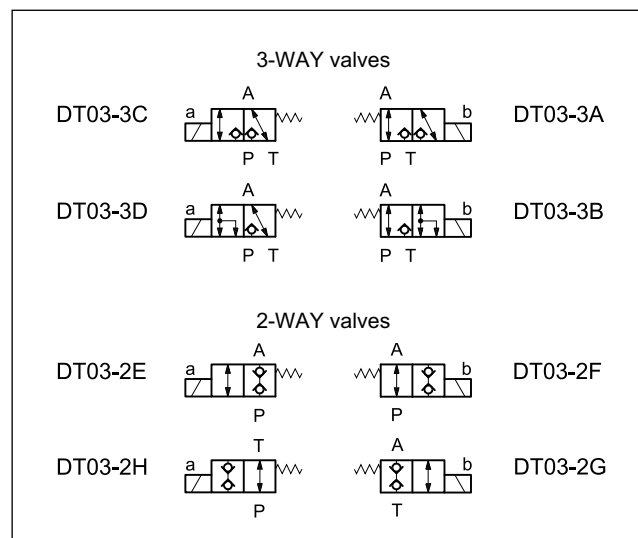


#### PERFORMANCES

(measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate	l/min	25
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,3

#### HYDRAULIC SYMBOLS





### 1 - IDENTIFICATION CODE

<b>D</b>	<b>T</b>	<b>03</b>	<b>-</b>			<b>/</b>		<b>/</b>	<b>10</b>	<b>/</b>		<b>/</b>	
----------	----------	-----------	----------	--	--	----------	--	----------	-----------	----------	--	----------	--

Poppet type solenoid operated directional control valve

Size: ISO 4401-03 (CETOP 03)

Number of ways:   
**2** = 2-way  
**3** = 3-way

Type of configuration:   
**A - B - C - D**: 3-way, 2-position solenoid valve  
**E - F - G - H**: 2-way, 2-position solenoid valve

Variant on line P (omit if not required):   
**D08** = orifice Ø0.8  
**D10** = orifice Ø1.0

Seals: omit for mineral oils  
**V** = viton for special fluids

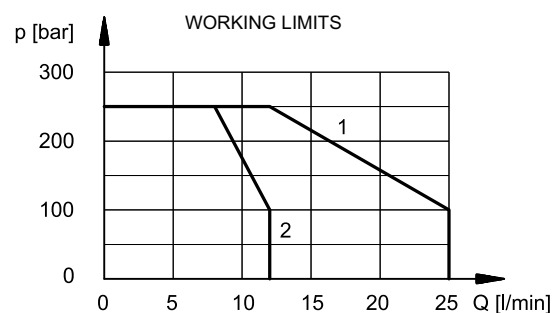
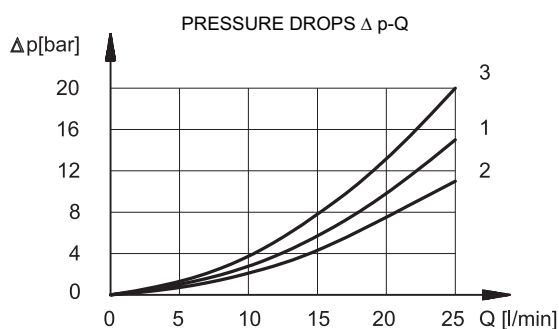
Supply voltage   
**12V-CC** = 12 V  
**24V-CC** = 24 V } direct current

**24RAC** = 24 V  
**110RAC** = 110 V  
**220RAC** = 220 V } alternating current

Series No.  
 (The overall and mounting dimensions remain unchanged from 10 to 19)

### 2 - CHARACTERISTIC CURVES

(values obtained with viscosity 36 cSt at 50 °C)



valve	Curve on graph	
	De-energized solenoid	Energized solenoid
DT03-3A	1	3
DT03-3B	2	3
DT03-3C	1	3
DT03-3D	2	3
DT03-2E	-	3
DT03-2F	1	-
DT03-2G	-	3
DT03-2H	1	-

valve	Curve on graph
DT03-3A	2
DT03-3B	1
DT03-3C	1
DT03-3D	1
DT03-2E	1
DT03-2F	2
DT03-2G	1
DT03-2H	1

### 3 - FLOW LIMITATION

When the solenoid valve is fed by an accumulator or by high delivery pumps it is necessary to limit the flow to the working limits by means of orifices. The orifice must be located on the accumulator side always.



**WARNING!** During the transition from one to the other end position all ports are interconnected. This means that during the switching the oil will be flowing from the accumulator to the tank through the valve, until the swithing is completed.

That is why the maximum flow should be limited up to 12 l/min by placing orifices.

### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 5 - ELECTRICAL FEATURES

#### 5.1 - Solenoids

These are essentially made up of two parts: tube and coil.

The tube is threaded onto the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded nut, and can be turned 360° on its axis, compatible with space available.

The interchangeability of coils of different voltages is allowed within the same type of supply current: alternating or direct (DC / RAC).

**NOTE:** The protection degree is guaranteed only with connector correctly mated and installed.

<b>VOLTAGE SUPPLY FLUCTUATION</b>	± 10% Vnom
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95/EC
<b>CLASS OF PROTECTION:</b> Atmospheric agents (EN 60529) Coil insulation (VDE 0580) Impregnation	IP 65 ( <b>NOTE</b> ) class H class F

#### 5.2 - Current and power consumption

The table shows the consumption values for the different coil type.

It is necessary to always use "D" type connectors (with rectifier incorporated) and RAC coils for alternating current supply.

Rectified current supply takes place by using a bridge rectifier bridge, externally or fitted within the "D" type connectors, between the alternating current source (24V or 110V, /50 or /60 Hz) and the coil.

Coil	Voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]	Coil code
<b>12V-CC</b>	12	5,6	2,14	25,7	1902050
<b>24V-CC</b>	24	21,8	1,10	26,4	1902051
<b>24RAC</b>	24	17	1,23	26	1902052
<b>110RAC</b>	110	420	0,23	22	1902053
<b>220RAC</b>	220	1750	0,11	22	1902054

#### 5.3 - Switching times

The values indicated refer to a flow rate of Q = 10 l/min, p = 210 bar working with mineral oil at a temperature of 50°C, a viscosity of 36 cSt and supply voltage equal to 90% of the nominal voltage.

TIMES (±10%)	ENERGIZING	DE-ENERGIZING
	30 ms	50 ms

#### 5.4 - Electric connectors

The solenoid valves are never supplied with connector.

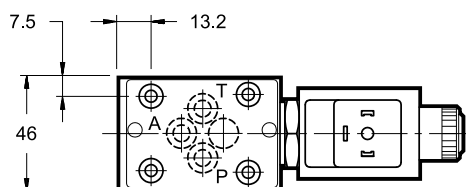
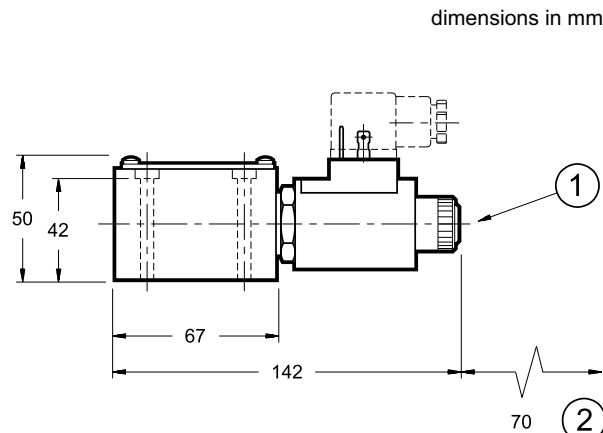
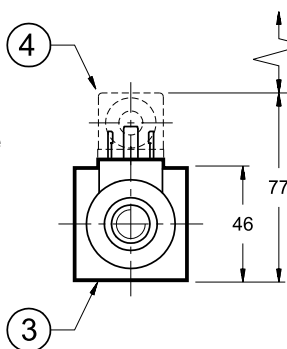
Connectors must be ordered separately. See catalogue 49 000.

## 6 - OVERALL AND MOUNTING DIMENSIONS

**NOTE:** The solenoid position here shown is for A-B-F-G versions.

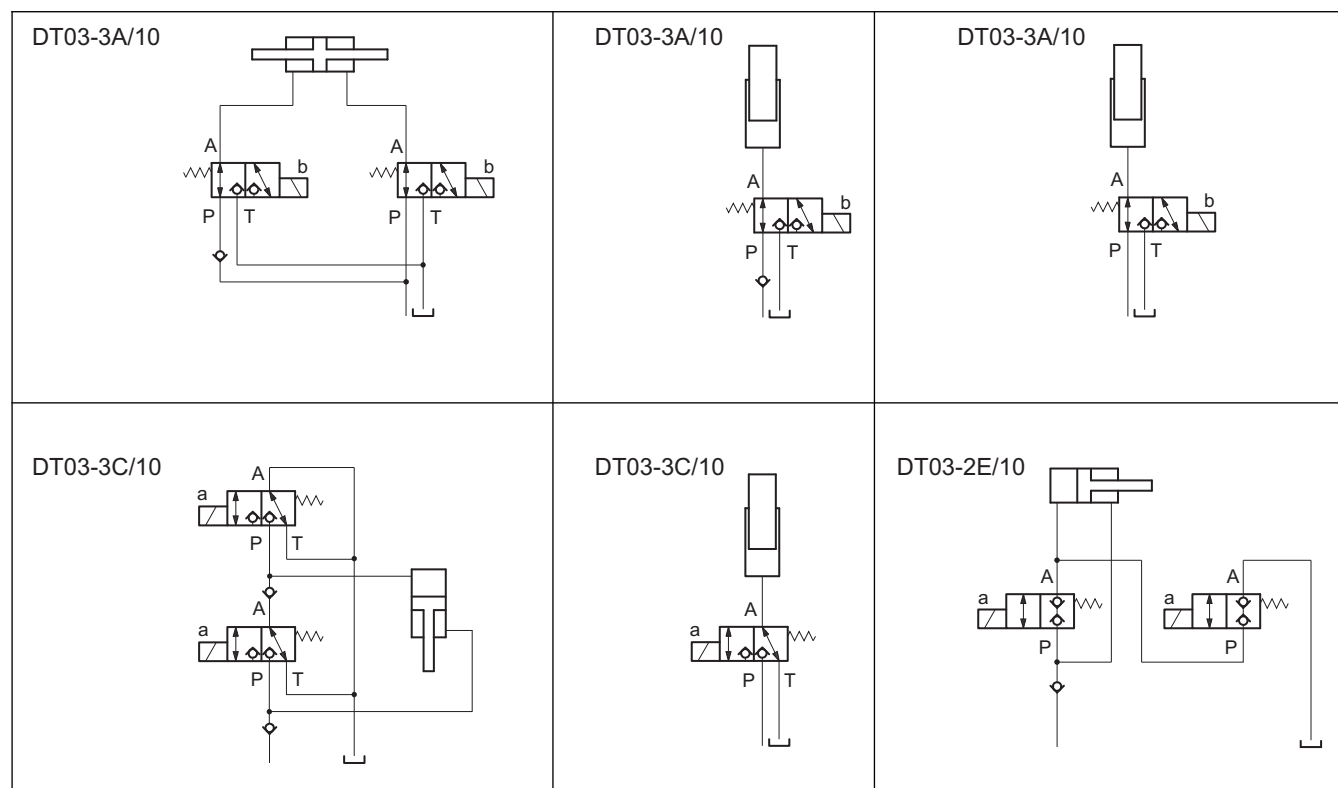
For the other versions the solenoid is on the opposite side.

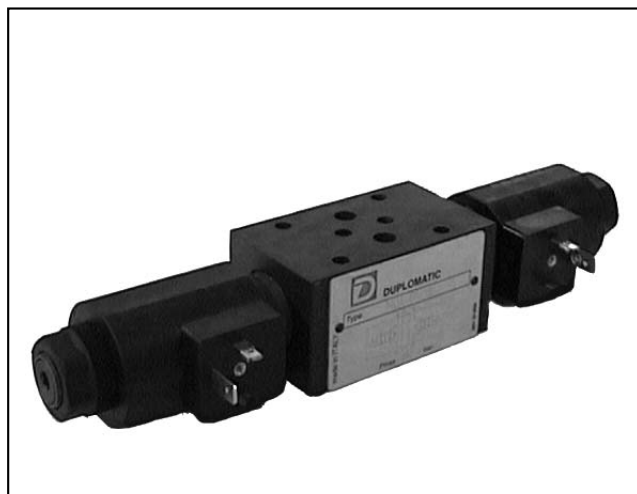
Fastening bolts:  
4 bolts M5 x 50  
Torque: 5 Nm



1	Manual override
2	Coil removal space
3	Mounting surface with sealing rings: 4 OR type 2037 (9.25X1.78) - 90 Shore
4	Electric connector to be ordered separately (see cat. 49 000)
5	Connector removal space

## 7 - APPLICATION EXAMPLES





# MDT

## POPPET TYPE SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

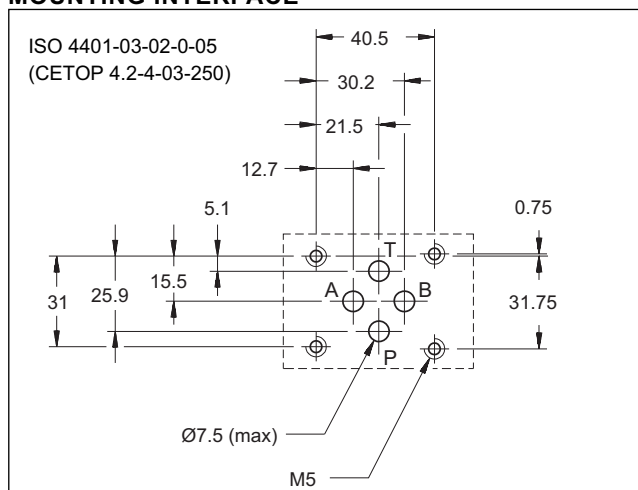
### SERIES 10

**MODULAR VERSION**  
**ISO 4401-03 (CETOP 03)**

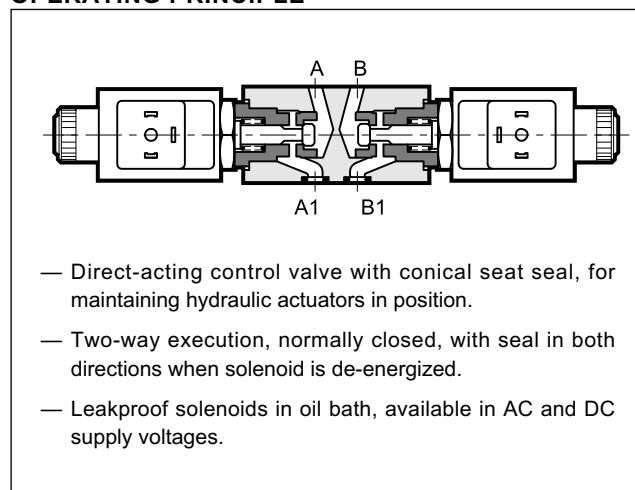
**p** max **250** bar

**Q** max **25** l/min

#### MOUNTING INTERFACE



#### OPERATING PRINCIPLE



#### VALVE CONFIGURATIONS (see Hydraulic symbols table)

Configuration "SA": utilized when line A flow is to be controlled.

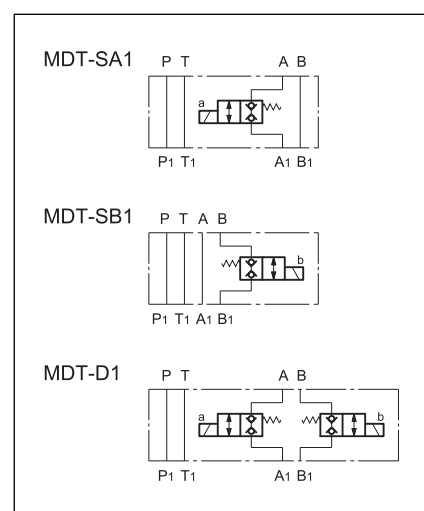
Configuration "SB": utilized when line B flow is to be controlled.

Configuration "D": utilized when flows of lines A and B are to be controlled

#### PERFORMANCE RATINGS (working with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate in controlled lines	l/min	25
Maximum flow rate in free lines		65
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass MDT-D	kg	1,7
MDT-SA/SB		1,2

#### HYDRAULIC SYMBOLS

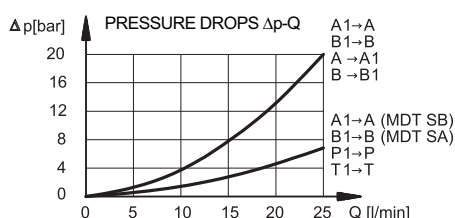
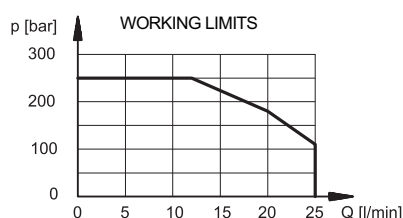


### 1 - IDENTIFICATION CODE

<b>M</b>	<b>D</b>	<b>T</b>	<b>-</b>		<b>1</b>	<b>/</b>	<b>10</b>	<b>-</b>		<b>/</b>	
Modular valve ISO 4401-03 (CETOP 03 size)				Poppet type solenoid operated directional control valve				Seals: omit for mineral oils <b>V</b> = viton for special fluids			
Configurations: <b>SA</b> = control on line A <b>SB</b> = control on line B <b>D</b> = control on lines A and B				Supply voltages: see par. 3 Direct current: <b>12V DC</b> <b>24V DC</b> Alternating current: <b>110 RAC</b> <b>220 RAC</b>				Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)			
double seal - normally closed											

**NOTE:** The solenoid valves are never supplied with connector. Connectors must be ordered separately. To identify the connector type to be ordered, please see catalogue 49 000.

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity 36 cSt at 50°C)



### 3 - SUPPLY VOLTAGES

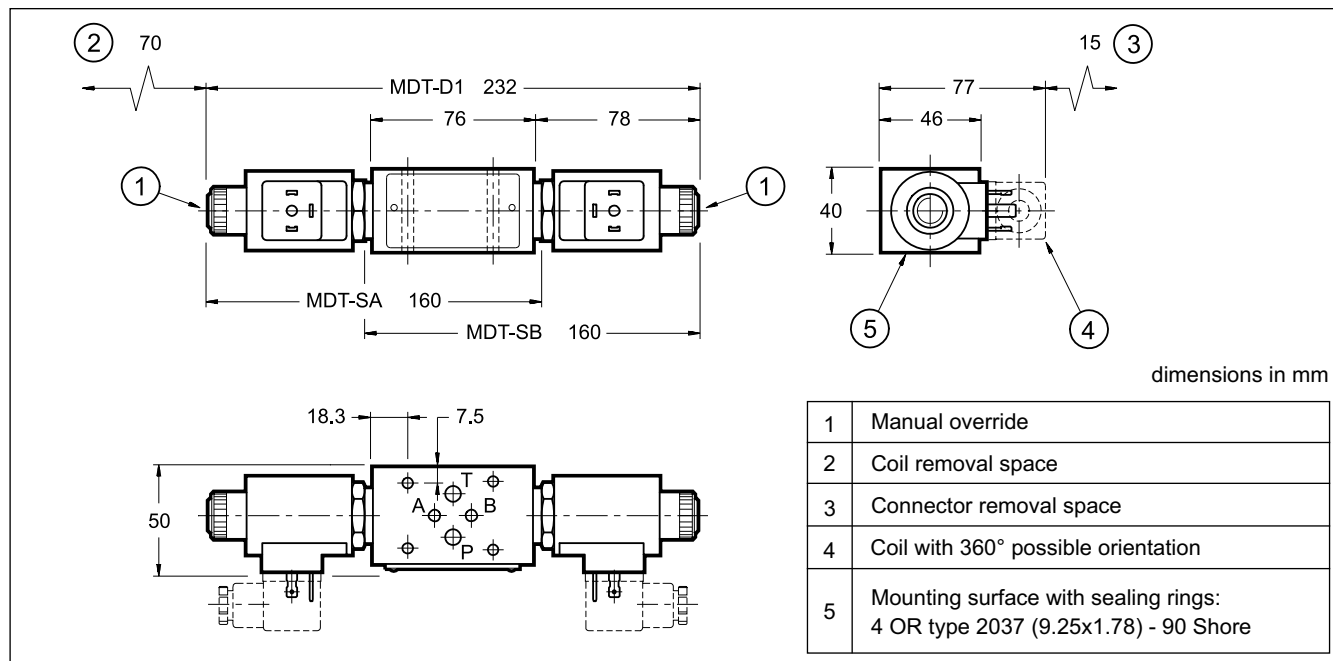
A connector with bridge rectifier and RAC coils are always used for alternating current supply.

<b>Times ±10%</b>	
Energizing	30 ms
De-energizing	50 ms

### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 5 - OVERALL AND MOUNTING DIMENSIONS



# KT08

## CARTRIDGE SOLENOID VALVE

### SERIES 10



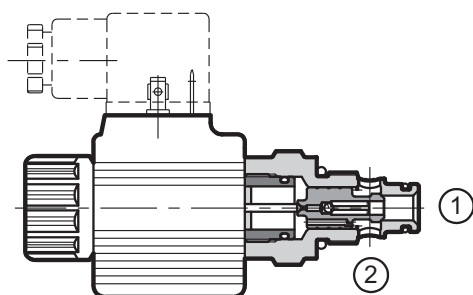
### CARTRIDGE TYPE

seat 3/4-16 UNF-2B ISO 725

**p** max **350** bar

**Q** nom **50** l/min

### OPERATING PRINCIPLE



- The KT08 is a 2-ways solenoid valve, poppet type, cartridge execution, available in normally closed version (NC) and normally open version (NO) with nominal flow rate of 50 l/min.
- It ensures a low internal leakage, which decreases while the pressure increases.
- The valve can be ordered with direct current or rectified current solenoids and with five different types of electrical connections, in order to cover many installation requirements (see paragraph 7).
- For every version, the emergency manual override is an available option (see paragraph 9).

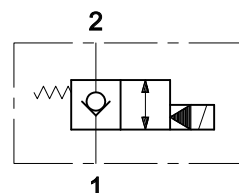
### PERFORMANCES

(working with mineral oil of viscosity of 36 cSt at 50°C)

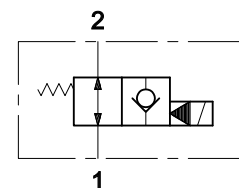
Maximum operating pressure	bar	350
Nominal flow rate	l/min	50
Pressure drops $\Delta p - Q$	see paragraph 3	
Electrical characteristics	see paragraph 5	
Electrical connections	see paragraph 7	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,32
Surface treatment with white colour zinc	According to ISO 2081 Fe/Zn12/A	

### HYDRAULIC SYMBOLS

KT08-2NC



KT08-2NO





## 1 - IDENTIFICATION CODE

K	T	08	-		/	10	-			/	
---	---	----	---	--	---	----	---	--	--	---	--

Cartridge \_\_\_\_\_  
solenoid valve

Valve type \_\_\_\_\_  
**T** = poppet type

Nominal dimension \_\_\_\_\_  
**08** = mounting interface 3/4-16 UNF-2B ISO 725

Spool types: \_\_\_\_\_  
**2NC** = 2-way normally closed  
**2NO** = 2-way normally open

Series no.: \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

See **NOTE 2**

Coil electrical connection:  
(see paragraph 7)  
**K1** = plug for connector type  
EN 175301-803 (ex DIN 43650)  
(**standard**)

For **DC** supply only:  
**K2** = plug for connector type  
AMP JUNIOR  
**K4** = outgoing cables  
**WK7** = plug DEUTSCH DT04-2P  
for male connector type  
DEUTSCH DT06-2S  
**WK8** = plug for connector type  
AMP SUPER SEAL

Coil type:  
**D12** = 12 V } direct current  
**D24** = 24 V } (**standard**)  
**R110** = 110 V } rectified  
**R230** = 230 V } current  
**D00** = valve without coil (see **NOTE 1**)

**NOTE 1:** The coil locking ring and the relevant seals are included in the supply.  
**NOTE 2:** The manual override **CM** is available as an option (see paragraph 9).

### 1.1 - Coil identification code

C	14	L3	-		/	10
---	----	----	---	--	---	----

Power supply \_\_\_\_\_

**D12** = 12 V } direct current  
**D24** = 24 V } (**standard**)  
**R110** = 110 V } rectified  
**R230** = 230 V } current

Series no.: \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Coil electrical connection (see paragraph 7)  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)  
For **D12** and **D24** coils only:  
**K2** = plug for connector type AMP JUNIOR  
**K4** = outgoing cables  
**WK7** = plug DEUTSCH DT04-2P for male connector type  
DEUTSCH DT06-2S  
**WK8** = plug for connector type AMP SUPER SEAL

## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

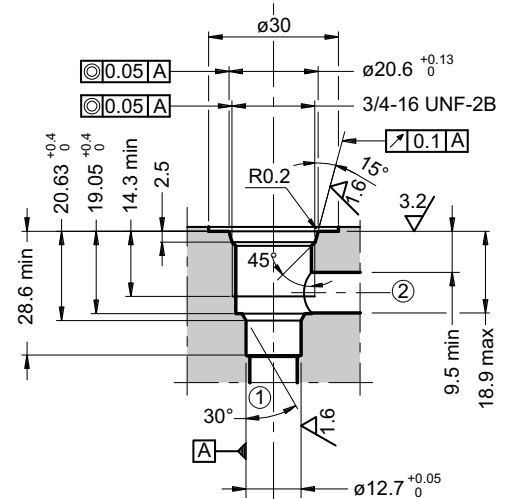
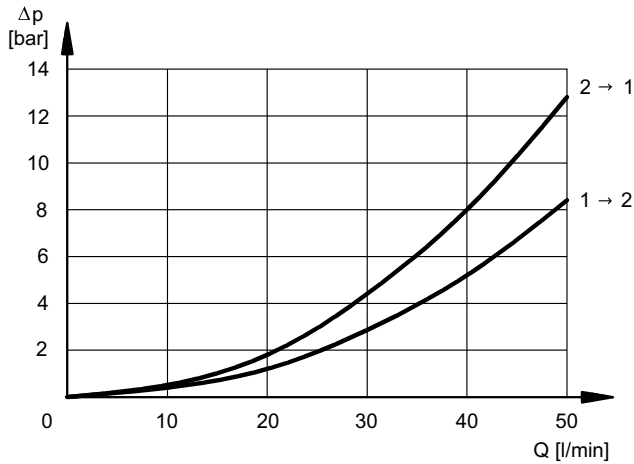
### 3 - PRESSURE DROPS $\Delta p$ -Q

(obtained with viscosity of 36 cSt at 50 °C)

The values in graphs refer to both NC and NO valves and they differ for the mounting interface used.

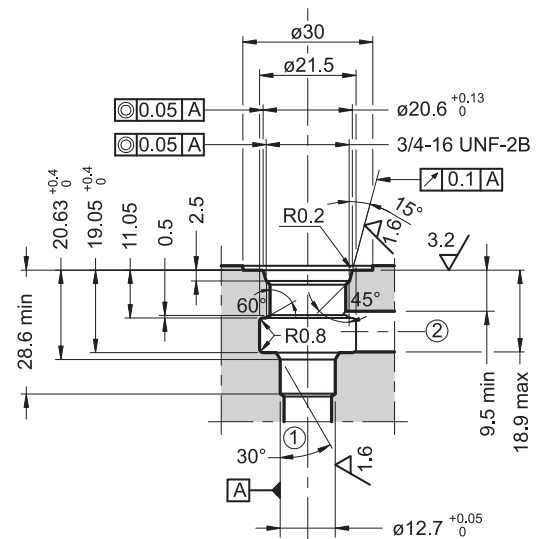
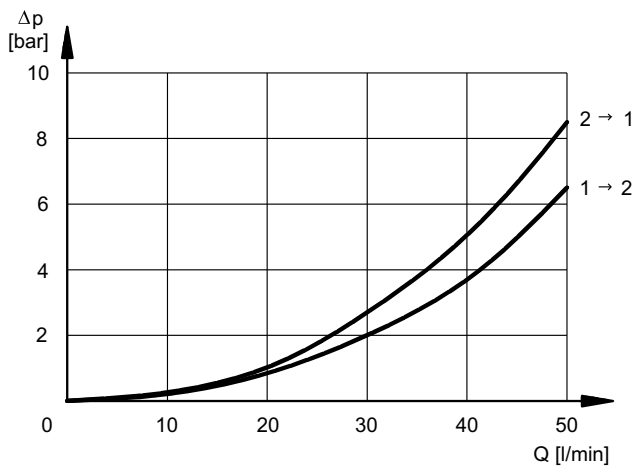
**standard mounting interface dimensions**  
3/4-16 UNF-2B ISO 725

dimensions in mm



**oversize mounting interface dimensions**  
3/4-16 UNF-2B ISO 725

dimensions in mm



## 4 - SWITCHING TIMES

The values indicated refer to a valve tested with  $Q = 25 \text{ l/min}$ ,  $p = 350 \text{ bar}$ , working with mineral oil at a temperature of  $50^\circ\text{C}$  and a viscosity of  $36 \text{ cSt}$ .

TIMES (±10%)		
	ENERGIZING	DE-ENERGIZING
KT08-2NC	60 ms	85 ms
KT08-2NO	85 ms	60 ms



### 5 - ELECTRICAL FEATURES

#### 5.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded onto the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded nut, and can be rotated according to the available space.

The interchangeability of coils of different voltages both D or R type is possible without removing the tube.

#### Protection from atmospheric agents IEC 60529

The IP protection degree is intended for the whole valve. It is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

Versions with CM manual override are IP65 always.

Electric connection	IP65	IP66	IP67	IP68	IP69 IP69K (*)
K1 EN 175301-803	x	x			
K2 AMP JUNIOR	x		x		
K4 outgoing cables	x				
WK7 DEUTSCH DT04 male	x		x	x	x
WK8 AMP SUPER SEAL	x	x	x	x	x

(\*) The protection degree IP69K is not taken into account in IEC 60529 but it is included in both ISO 20653.

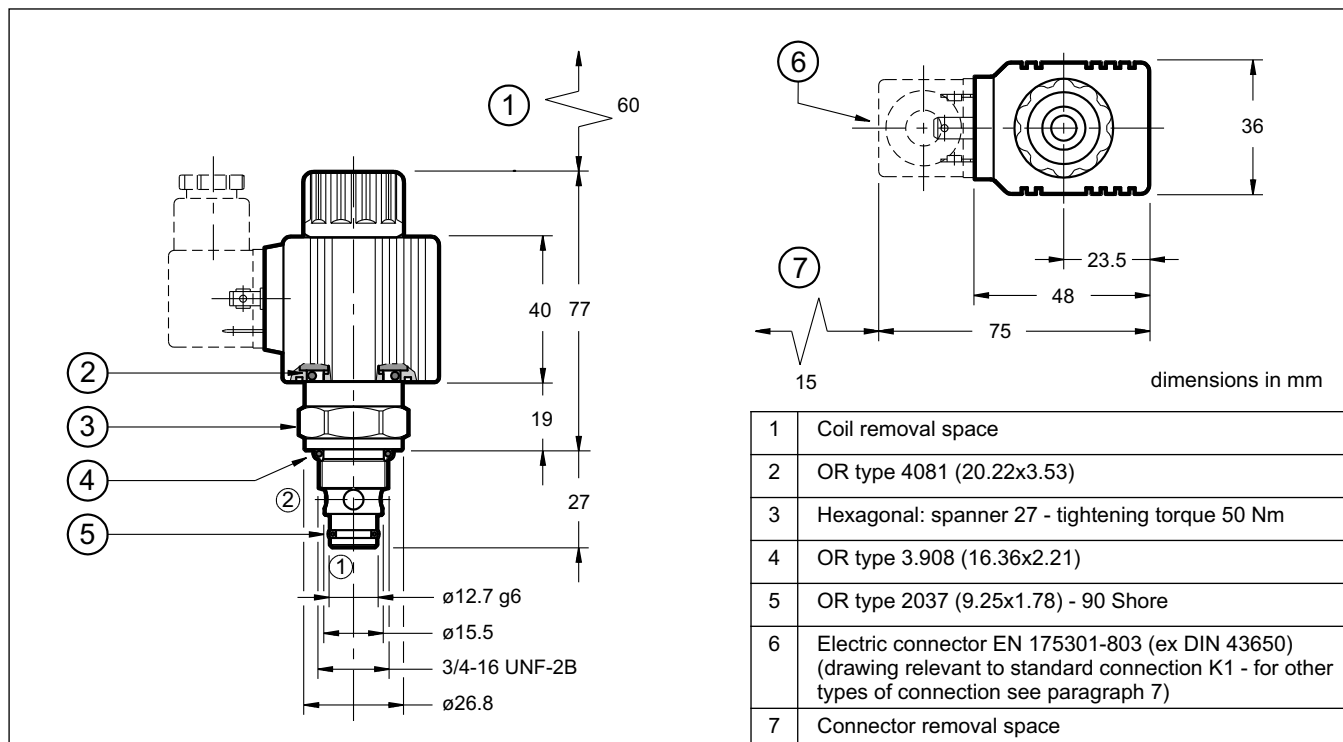
<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	In compliance with 2014/30/EU
<b>LOW VOLTAGE</b>	In compliance with 2014/35/EU
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation:	class H class H

#### 5.2 - Current and absorbed power

In the table are shown current and power consumption values relevant to the different coil types. "R" coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the "D" type connector (see cat. 49 000).

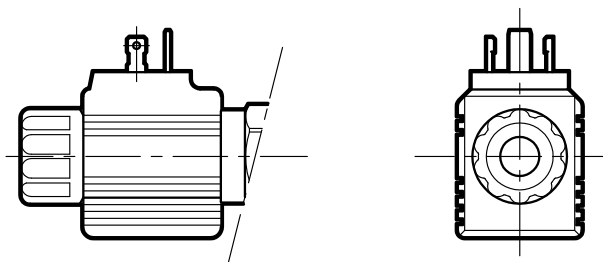
	Resistance at 20°C [Ω] (±1%)	Absorbed current [A] (±5%)	Absorbed power (±5%) [W] [VA]	Coil code				
				K1	K2	K4	WK7	WK8
<b>D12</b>	5,4	2,2	26,5	1902740	1902750	1902770	1903510	1903520
<b>D24</b>	20,7	1,16	27,8	1902741	1902751	1902771	1903511	1903521
<b>R110</b>	363	0,25		1902742				
<b>R230</b>	1640	0,11		1902743				

### 6 - OVERALL AND MOUNTING DIMENSIONS

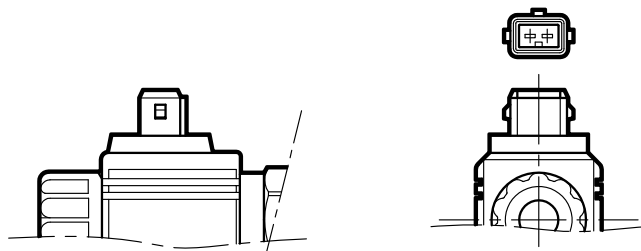


## 7 - ELECTRIC CONNECTIONS

connection for EN 175301-803  
(ex DIN 43650) connector type  
code **K1 (standard)**



connection for AMP JUNIOR  
connector type  
code **K2**



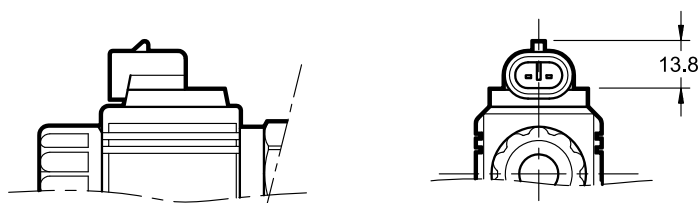
outgoing cable connections  
cable length = 1 mt  
code **K4**



connection for DEUTSCH DT04-2P  
for male connector type DEUTSCH DT06  
code **WK7**



connection for AMP SUPER SEAL  
(two contacts) connector type  
code **WK8**

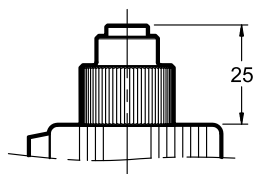


## 8 - ELECTRIC CONNECTORS

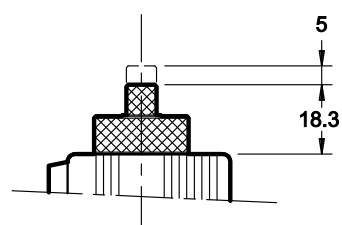
Solenoid valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 connection can be ordered separately. See catalogue 49 000.

## 9 - MANUAL OVERRIDE

CM for NO version (pushing type)

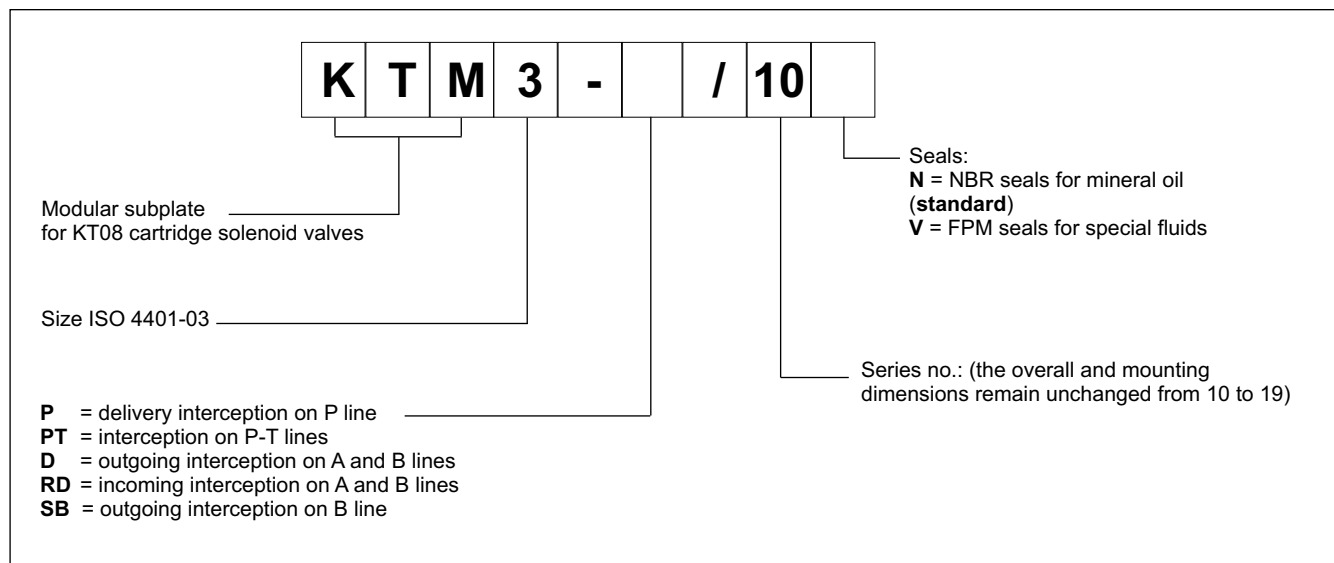


CM for NC version (screw type)

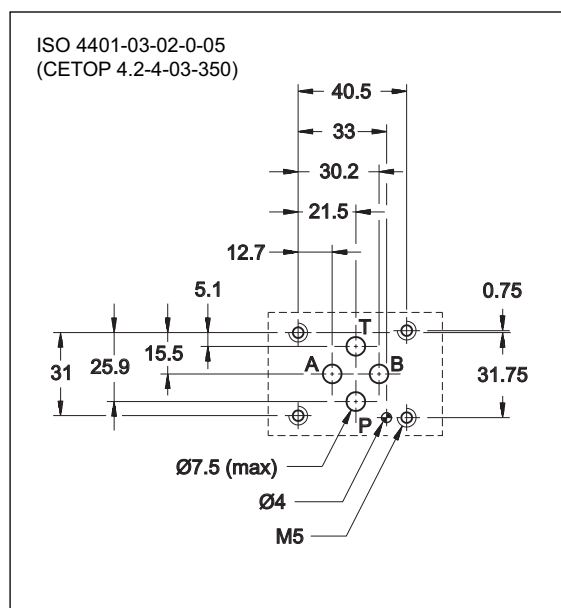


## 10 - SUBPLATES FOR MODULAR MOUNTING

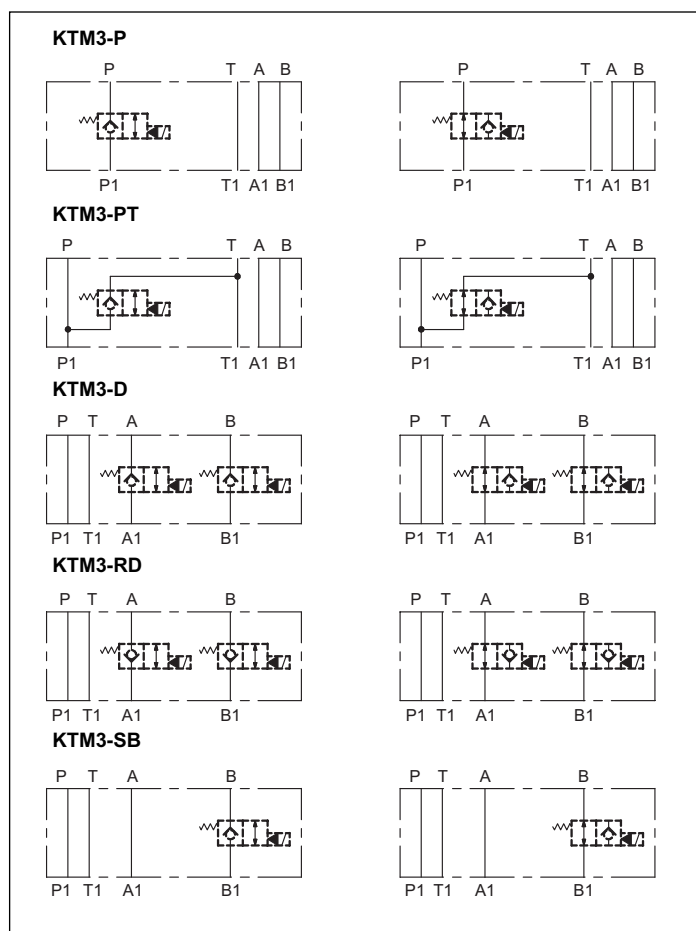
### 10.1 - Identification code



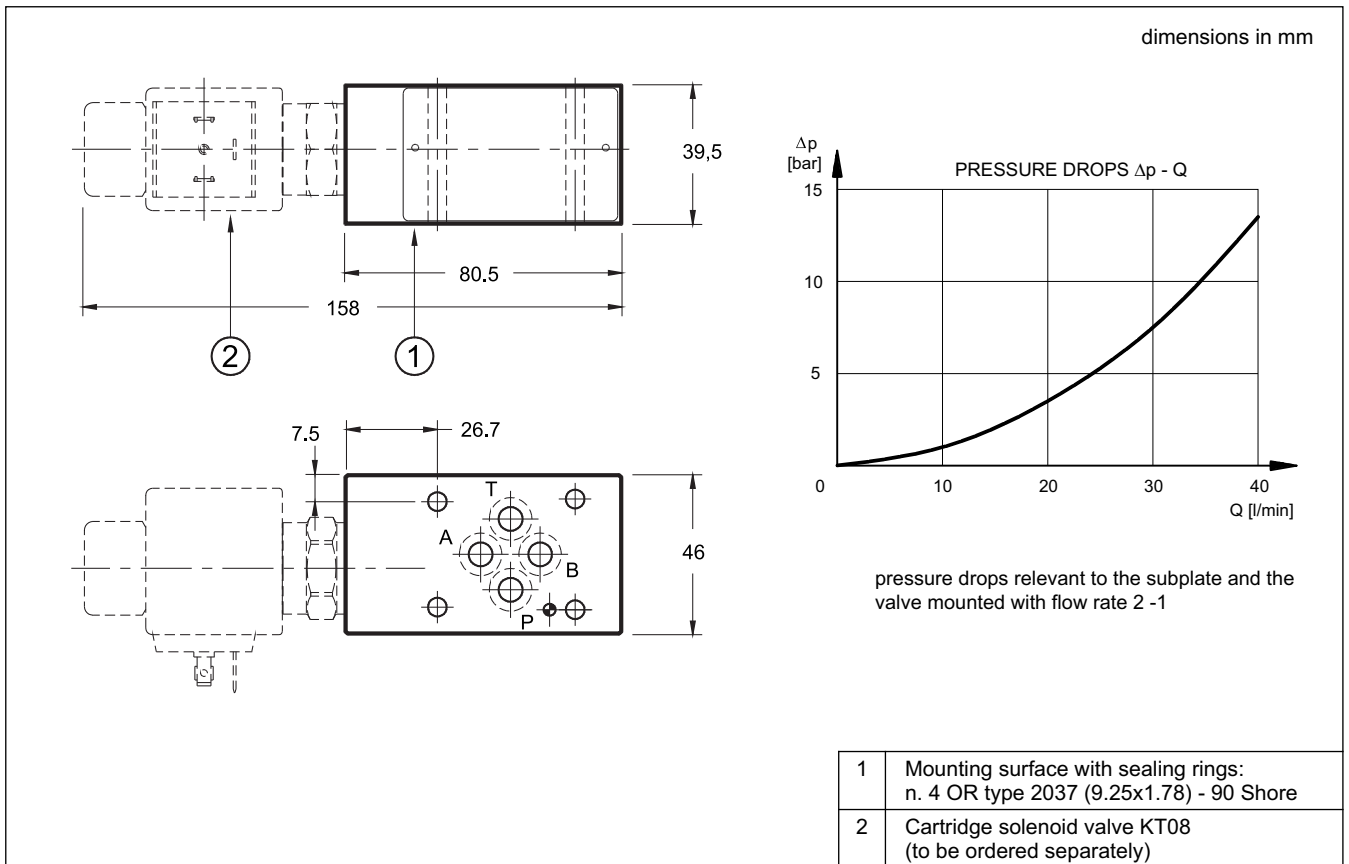
### MOUNTING INTERFACE



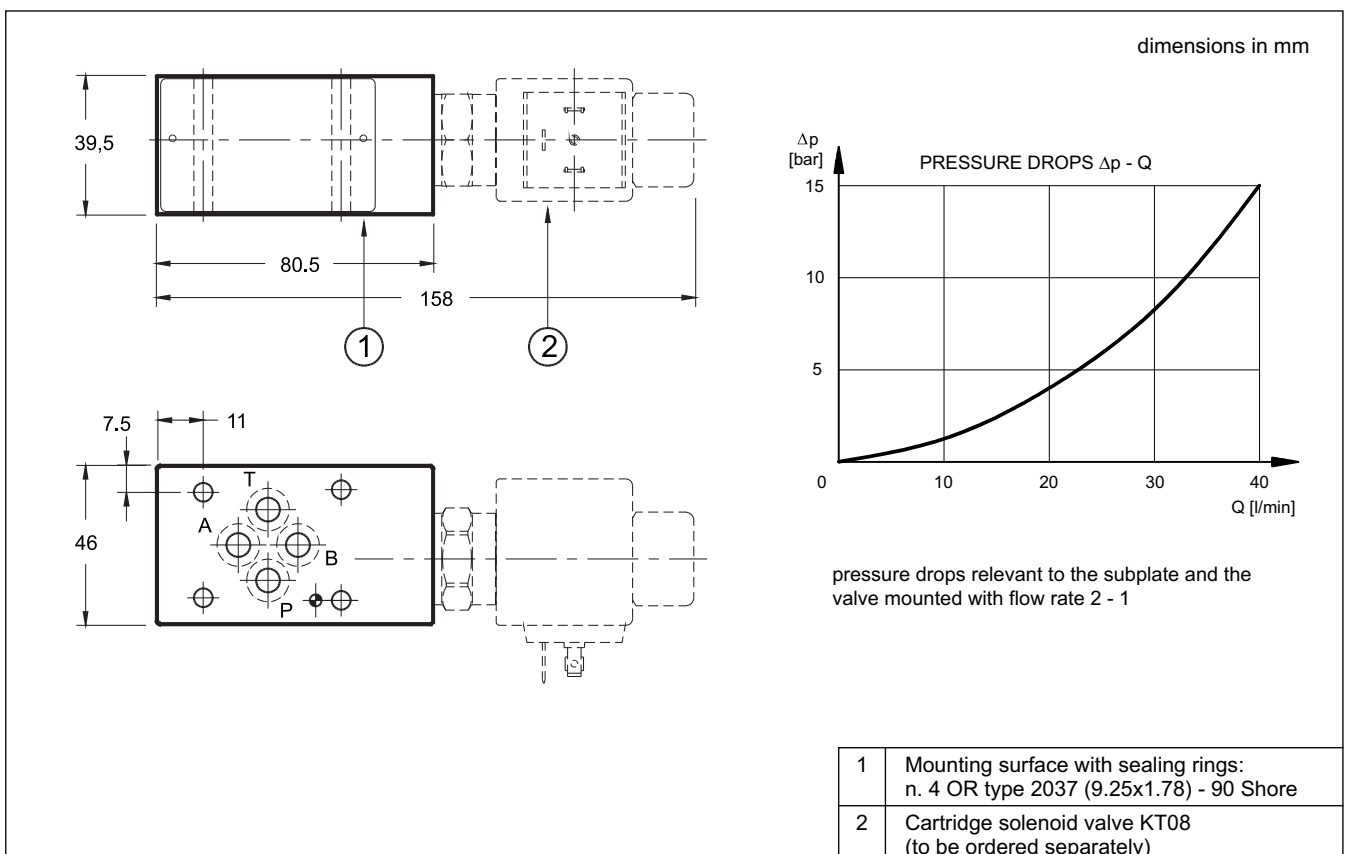
### HYDRAULIC SYMBOLS



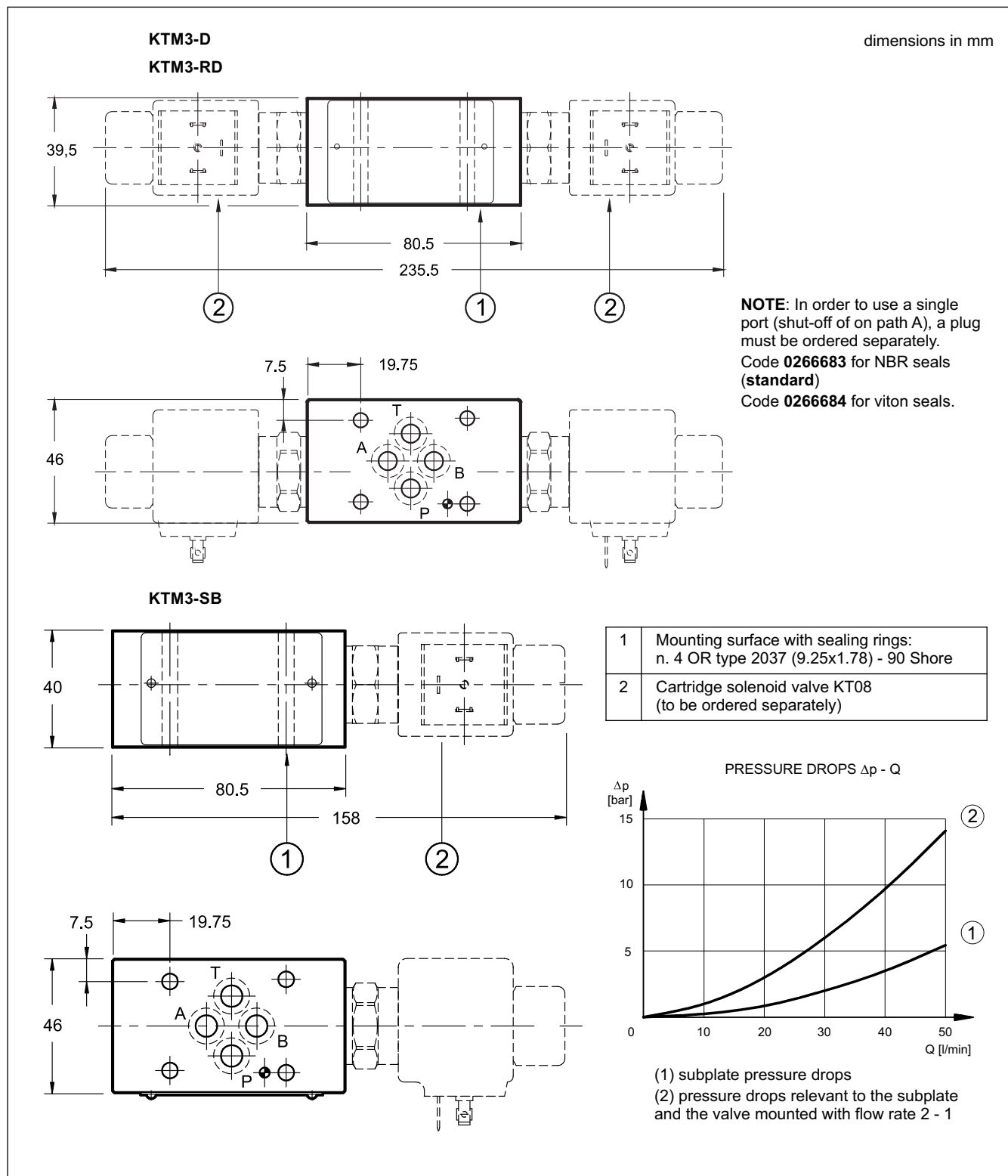
## 10.2 - Overall and mounting dimensions KTM3-P

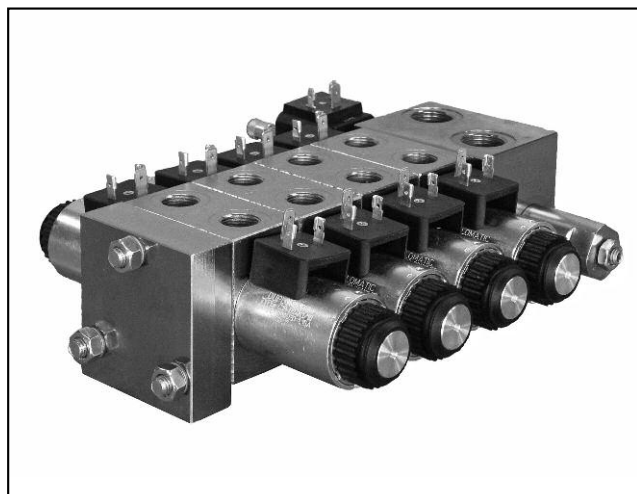


## 10.3 - Overall and mounting dimensions KTM3-PT



## 10.4 - Overall and mounting dimensions KTM3-D, KTM3-RD and KTM3-SB



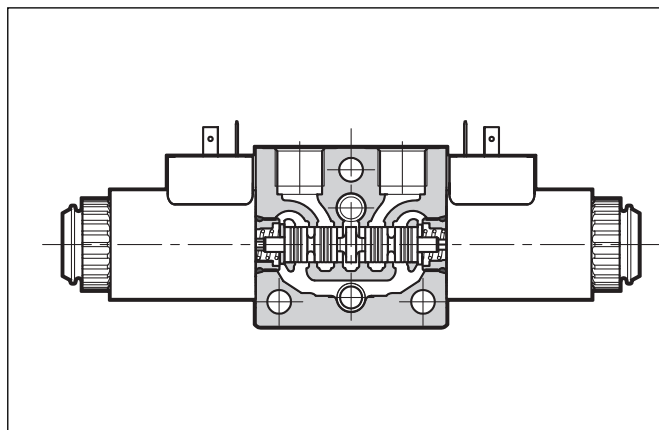


# BD\*

## STACKABLE DIRECTIONAL CONTROL VALVE SERIES 10

**p** max (see table of performances)  
**Q** max (see table of performances)

### OPERATING PRINCIPLE



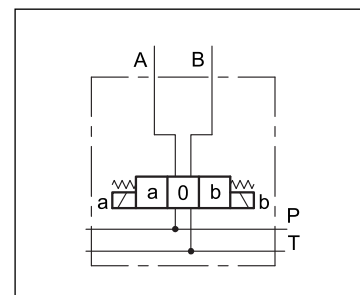
- BDL, BDM and BDS are stacked valve assemblies, very well-rounded thanks to their modular design.
- Elements have been designed to be assembled in parallel connection, mounting up to 10 stackable valves. The same elements allow to create series circuits by inserting plugs in order to divert the oil path.
- Elements specifically designed for BD\*2 series circuits complete the BD\* range.
- BD\* assemblies are suitable for compact applications in the mobile and in mini-power pack industries.
- Directional valve elements are available in two thicknesses, with working ports 3/8" BSP, 1/2" BSP, SAE-06 and SAE-08 threaded.

### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		BDL	BDM	BDS
Maximum operating pressure: - P-A-B ports - T / T1 ports	bar	280 280	320 250	320 250
Maximum flowrate: - parallel - series	l/min	40 40	50 40	60 50
Pressure drops Δp - Q	see paragraph 3			
Electrical characteristics	see paragraph 6			
Operating limits	see paragraph 4			
Electrical connections	see paragraph 7			
Ambient temperature range	°C	-20 / +50		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		
Mass (BDS3-B38-S)	kg	1,57	1,73	2,1
Surface treatment of inlet and outlet elements and valves bodies	zinc-nickel			

### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODES OF SEPARATE ELEMENTS

Here below are shown the identification codes for the separate elements of the stackable valve. Parallel circuits can be assembled with these elements. The same elements allow to create series circuits by inserting plugs in order to divert the oil path.

#### 1.1 - Directional valve element

<b>BD</b>			-		-		/	10		-		/	
-----------	--	--	---	--	---	--	---	----	--	---	--	---	--

Stack directional valve element, on-off

Solenoid tube (mm): \_\_\_\_\_  
**L** = 14  
**M** = 19  
**S** = 22 (only size 3)

Size : \_\_\_\_\_  
**2** = thickness 38 mm  
**3** = thickness 46 mm

Ports: \_\_\_\_\_  
**B38** = 3/8" BSP  
**B12** = 1/2" BSP (only for size 3)  
**S06** = 9/16" 18 UNF (SAE 06)  
**S08** = 3/4" 16 UNF (SAE 08) (only for size 3)

Spool type \_\_\_\_\_  
 (see point 1.2)

Series no. \_\_\_\_\_  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Manual override (see par. 10.6 - 10.8):  
 for **BDL**:  
 omit for manual override boot protected integrated in the coil locking ring (**standard**)  
 for **BDM** and **BDS**:  
 omit for pin manual override integrated in the tube (**standard**).  
**CM** = manual override boot protected  
 for **BDL**, **BDM** and **BDS**  
**CK1** = turning knob override  
**CHL** = light duty hand lever. p max 50 bar in T line (not available for series circuits)

Coil electrical connection:  
**See below for availability, see section 6 and 7 for details**  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)  
**K2** = plug for connector type AMP JUNIOR  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S  
**WK8** = plug for connector type AMP SUPER SEAL

Coil type:  
 DC coils  
**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V  
**D48** = 48 V  
**D00** = valve without coil supplied with locking ring

**NOTE:** Variants are available. See paragraph 10.1

**Available coils**

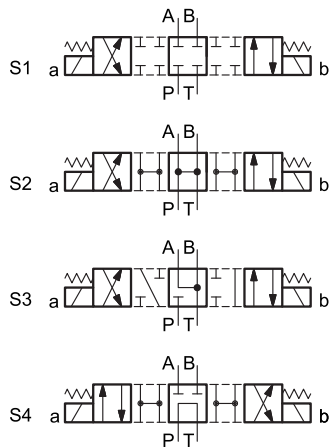
	BDL				BDM			BDS						
	K1	K2	WK7	WK8	K1	K2	K7	K1	K2	K7	WK1	WK7	WK7D	
<b>D12</b>	■	■	■	■	■	■	■	■	■	■	■	■	■	
<b>D24</b>	■	■	■	■	■	■	■	■	■	■	■	■	■	
<b>D28</b>	■	-	-	-	-	-	-	■	-	-	-	-	-	
<b>D48</b>	■	-	-	-	-	-	-	■	-	-	-	-	-	

The letter 'W' identifies coils with an high IP degree. This IP degree is reached by specific surface treatments and / or design adaptations.

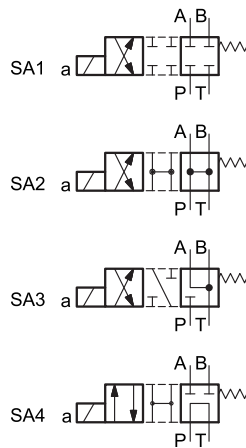
**NOTE:** A galvanic surface treatment zinc-nickel is applied to body elements and plates, making the assembly suitable to withstand a salt spray exposure time of **600** hours (test carried out according to the UNI EN ISO 9227 and assessment test carried out according to UNI EN ISO 10289).

## 1.2 - Available spools

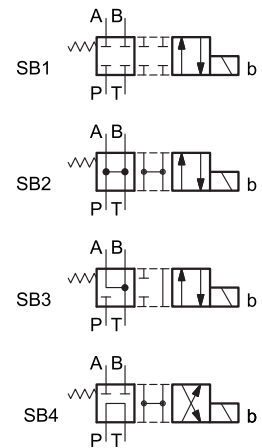
**Type S:**  
 2 solenoids - 3 positions  
 spring centring



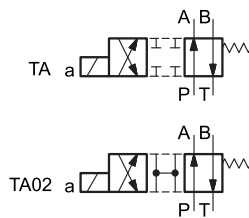
**Type SA\*:** 1 solenoid side A  
 2 positions (central + external)  
 spring centring



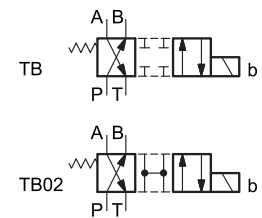
**Type SB\*:** 1 solenoid side B  
 2 positions (central + external)  
 spring centring



**Type TA\*:**  
 1 solenoid side A  
 2 external positions  
 with return spring



**Type TB\*:**  
 1 solenoid side B  
 2 external positions  
 with return spring

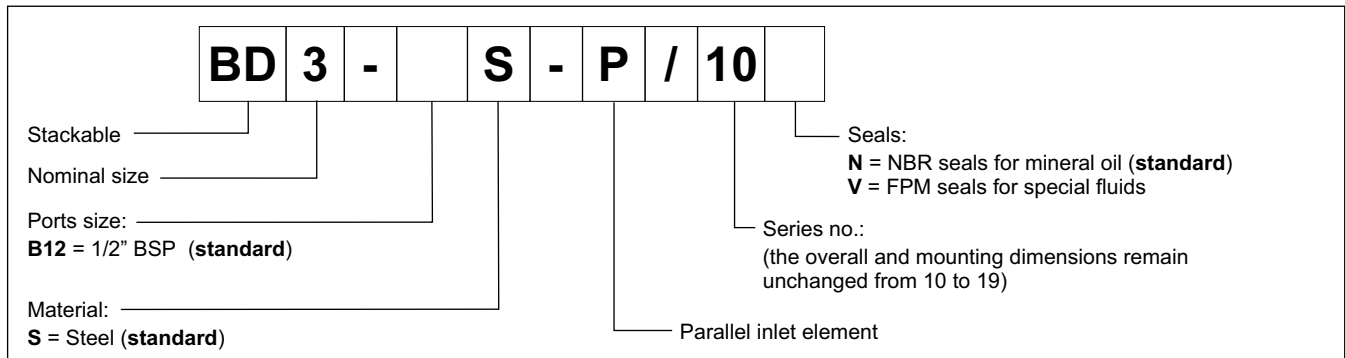


**NOTE 1:** BDS valves use spools of DS3 solenoid valve. Please refer to catalogue 41150 for others spools.

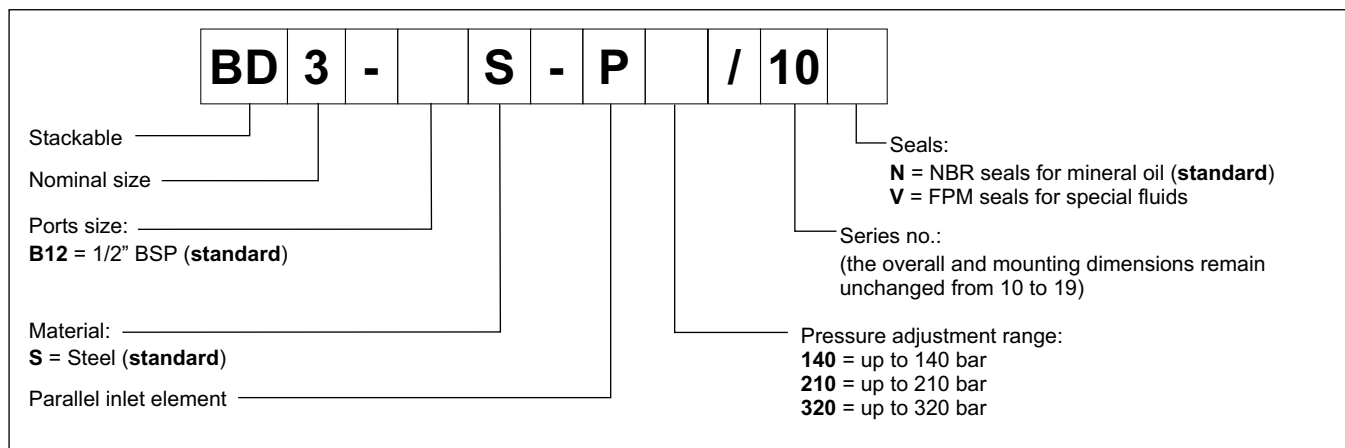
**NOTE 2:** Further spools for BDL and BDM are upon request. Please contact our technical department.



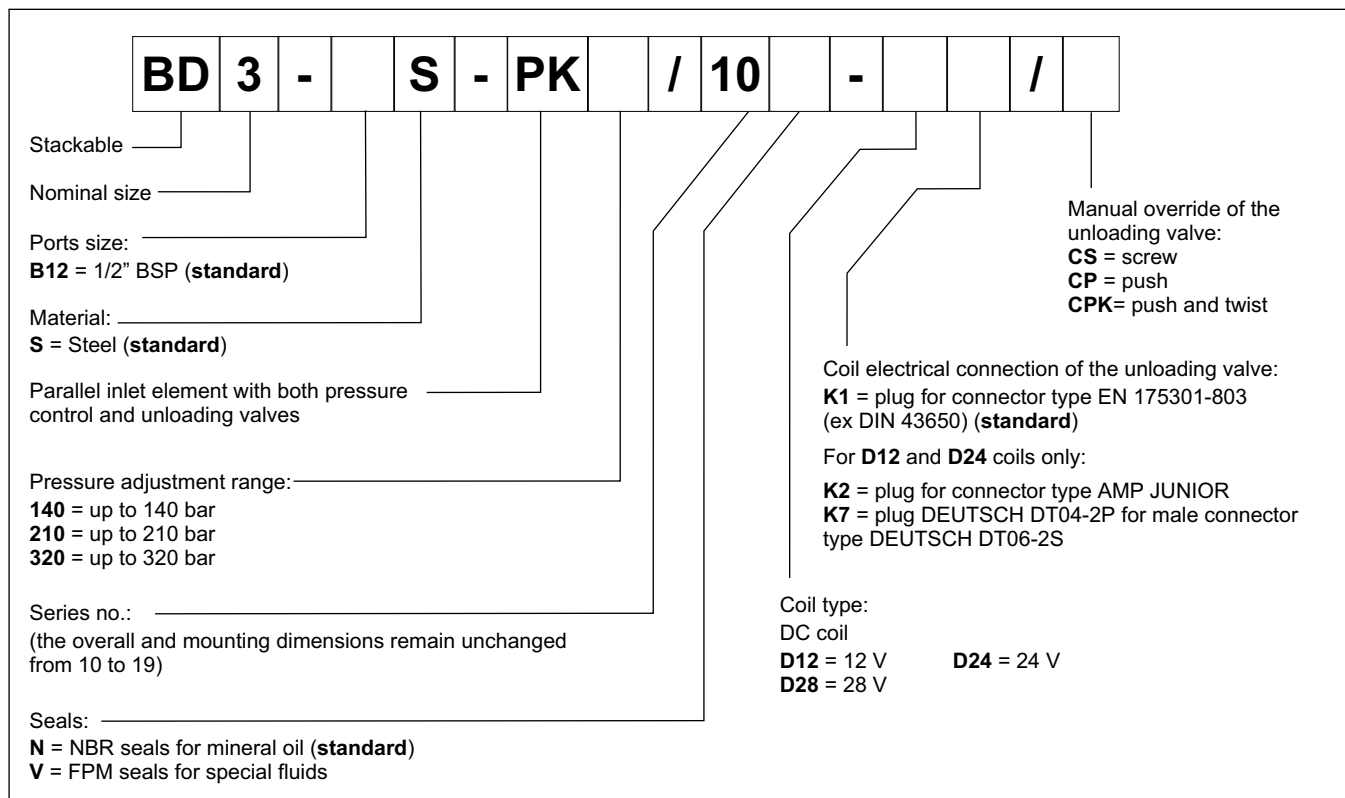
### 1.3 - Inlet element without pressure control valve



### 1.4 - Inlet element with pressure control valve



### 1.5 - Inlet element with both pressure control and unloading valves



## 1.6 - Inlet element for flow control valve

BD	3	-	B38	S	-	P			-	Q	/	10		-			/	
----	---	---	-----	---	---	---	--	--	---	---	---	----	--	---	--	--	---	--

Stackable

Nominal size

Ports size: \_\_\_\_\_  
3/8" BSP (**standard**)

Material: \_\_\_\_\_  
**S** = Steel (**standard**)

Parallel inlet element with pressure relief valve

**K** = with unloading valve. Omit if not required.

Pressure relief valve adj. range: \_\_\_\_\_  
**140** = up to 140 bar  
**210** = up to 210 bar  
**320** = up to 320 bar

**Mounting interface ISO 6263-03 style for flow control valve**  
(to be ordered separately, see catalogue 82220).

Series no.: \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Manual override of the unloading valve:  
**CS** = screw  
**CP** = push  
**CPK** = push and twist

Coil electrical connection of the unloading valve:  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)  
For **D12** and **D24** coils only:  
**K2** = plug for connector type AMP JUNIOR  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

Coil type of the unloading valve:  
DC coil  
**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V

**NOTE:** if no unloading valve is needed, the identification code ends with seals digit.  
Example: BD3-B38S-P140-Q/10N

## 1.7 - Outlet elements

BD	3	-		S	-	R		/	10
----	---	---	--	---	---	---	--	---	----

Stackable

Nominal size

Ports size: \_\_\_\_\_  
Omit for blind plate  
**B38** = 3/8" BSP

Material: \_\_\_\_\_  
**S** = Steel (**standard**)

Outlet element (rear)

Series no.: \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Outlet port:  
**00** = blind plate  
(not to be used in stack assemblies for series connection)  
**01** = outlet port P  
**02** = outlet port T  
**03** = outlet port both for P and T

## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

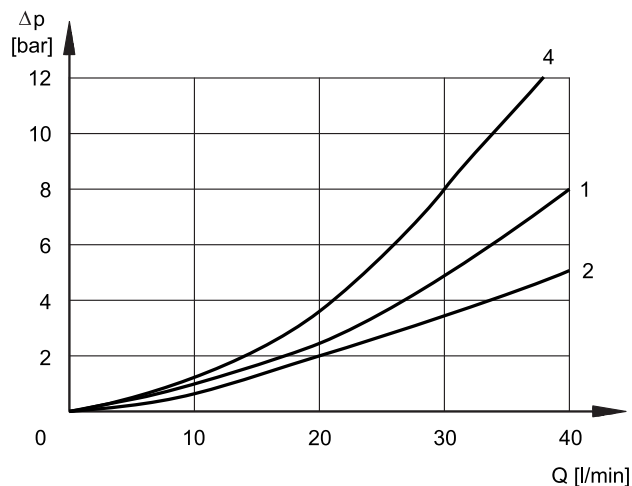


### 3 - CHARACTERISTIC CURVES

(values obtained with viscosity 36 cSt at 50 °C)

#### 3.1 - BDL

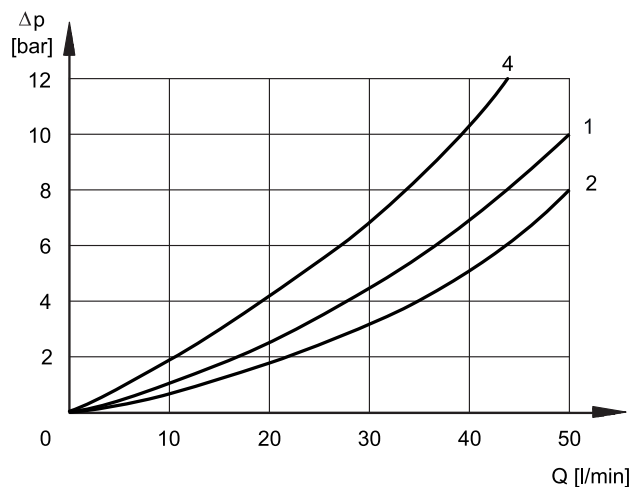
Values obtained with one element BDL2-B38A (thickness 38, ports 3/8" BSP)



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S1, SA1, SB1	1	1	1	1	-
S2, SA2, SB2	2	2	2	2	2
S3, SA3, SB3	1	1	2	2	-
S4, SA4, SB4	4	4	4	4	1
TA, TB	1	1	1	1	-
TA02, TB02	1	1	1	1	-

#### 3.2 - BDM

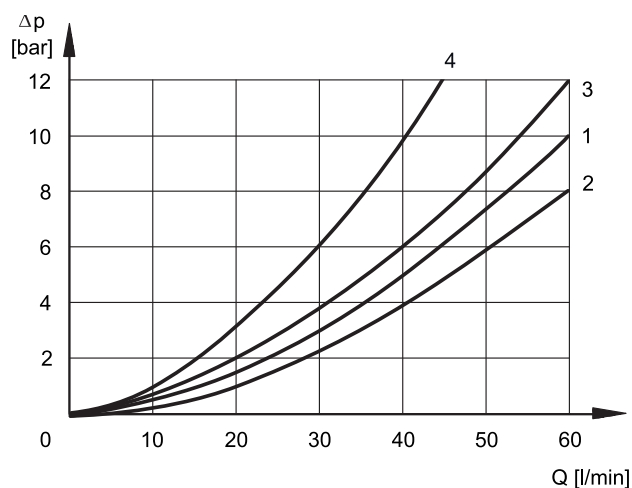
Values obtained with one element BDM3-B38 (thickness 46, ports 3/8" BSP)



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S1, SA1, SB1	1	1	1	1	-
S2, SA2, SB2	2	2	2	2	2
S3, SA3, SB3	1	1	2	2	-
S4, SA4, SB4	4	4	4	4	1
TA, TB	2	2	2	2	-
TA02, TB02	1	1	1	1	-

#### 3.3 - BDS

Values obtained with one element BDS3-B12 (thickness 46, ports 1/2" BSP)



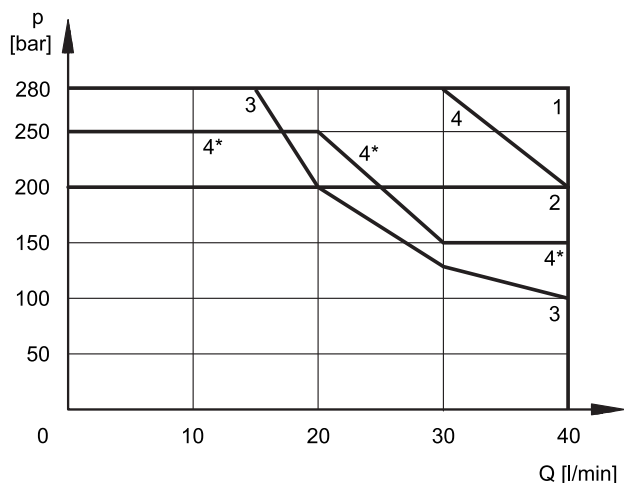
SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S1, SA1, SB1	1	1	3	3	-
S2, SA2, SB2	2	2	1	1	2
S3, SA3, SB3	3	3	2	2	-
S4, SA4, SB4	4	4	4	4	1
TA, TB	3	3	3	3	-
TA02, TB02					

#### 4 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

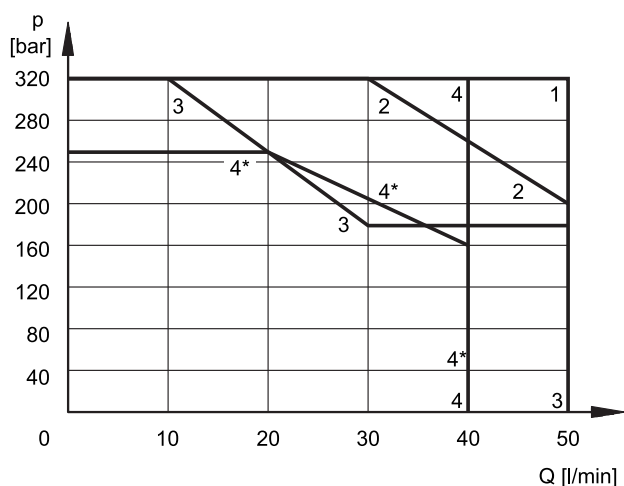
Values obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

##### 4.1 - BDL



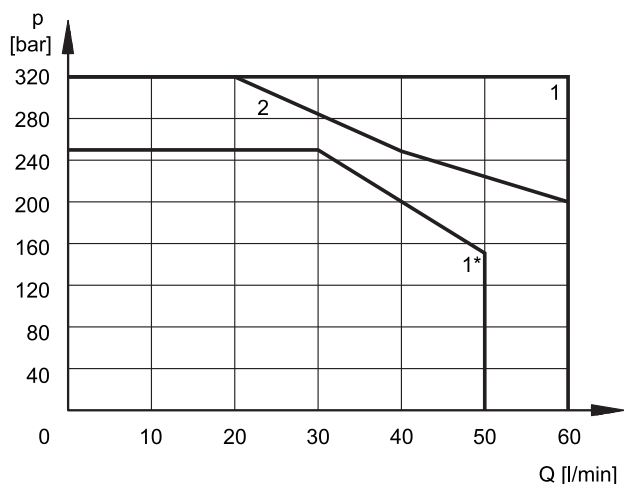
SPOOL TYPE	
S1, SA1, SB1	1
S2, SA2, SB2	2
S3, SA3, SB3	3
S4, SA4, SB4	4
S4, SA4, SB4 reverse flow	4*
TA, TB	4
TA02, TB02	1

##### 4.2 - BDM



SPOOL TYPE	
S1, SA1, SB1	1
S2, SA2, SB2	2
S3, SA3, SB3	3
S4, SA4, SB4	4
S4, SA4, SB4 reverse flow	4*
TA, TB	2
TA02, TB02	1

##### 4.3 - BDS



SPOOL TYPE	
S1, SA1, SB1	1
S2, SA2, SB2	1
S3, SA3, SB3	2
S4, SA4, SB4	1
S4, SA4, SB4 reverse flow	1*
TA, TB	1
TA02, TB02	1

**NOTE:** The reverse flow condition occurs in series circuits made with elements for parallel connection, in even-position elements only.

See scheme at par. 13.2



## 5 - SWITCHING TIMES

Values obtained according to ISO 6403, with mineral oil with viscosity 36 cSt at 50°C.

TIMES [ms] (±10%)	ENERGIZING	DE-ENERGIZING
<b>BDL</b>	25 ÷ 75	15 ÷ 25
<b>BDM</b>	25 ÷ 75	15 ÷ 25
<b>BDS</b>	25 ÷ 75	15 ÷ 25

## 6 - ELECTRICAL FEATURES

### 6.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded ring, and can be rotated to suit the available space.

### 6.2 - Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

The protection degree IP69K is not taken into account in IEC 60529 but it is included in ISO 20653.

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	In compliance with 2014/30/EU
<b>LOW VOLTAGE</b>	In compliance with 2014/35/EU
<b>CLASS OF PROTECTION</b> Coil insulation (VDE 0580) Impregnation	class H class F

### 6.3 - BDL (solenoid tube Ø14)

#### IP degrees

protection referred to	electrical connection / whole valve				
	IP65	IP66	IP67	IP68	IP69 IP69K
K1 EN 175301-803	x	x			
K2 AMP JUNIOR	x		x		
WK7 DEUTSCH DT04 male	x		x	x	x
WK8 AMP SUPER SEAL	x	x	x	x	x

#### Current and absorbed power

(values ±5 %)

	Resistance 20°C [Ω]	Absorbed current [A]	Absorbed power [W]	Coil code			
				K1	K2	WK7	WK8
<b>D12</b>	5,4	2,2	26,5	1902740	1902750	1903510	1903520
<b>D24</b>	20,7	1,16	27,8	1902741	1902751	1903511	1903521
<b>D28</b>	27,5	1,02	28,5	1902744			
<b>D48</b>	82	0,58	28	1902745			

#### 6.4 - BDM (solenoid tube Ø19)

##### IP degrees

protection referred to	electrical connection whole valve
	IP65
K1 EN 175301-803	x
K2 AMP JUNIOR	x
K7 DEUTSCH DT04 male	x

##### Current and absorbed power

(values ±10 %)

	Resistance 20°C [Ω]	Absorbed current [A]	Absorbed power [W]	Coil code		
				K1	K2	K7
<b>D12</b>	4.98	2.41	28.9	1903560	1903640	1903650
<b>D24</b>	21	1.15	28	1903561	1903641	1903651

#### 6.5 - BDS (solenoid tube Ø22)

Coils with letter 'W' feature a zinc-nickel surface treatment, that makes them resistant to exposure to the salt spray for 600 hours (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The WK7D coils include a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coils and to 58.9 V in the D24 coils.

##### IP degrees

protection referred to	electrical connection					whole valve				
	IP65	IP66	IP67	IP68	IP69 IP69K	IP65	IP66	IP67	IP68	IP69 IP69K
K1 EN 175301-803 (ex DIN 43650)	x					x				
WK1 EN 175301-803 (ex DIN 43650)	x	x				x	x			
K2 AMP JUNIOR	x		x			x				
K7 DEUTSCH DT04 male	x		x			x				
WK7 / WK7D DEUTSCH DT04 male	x	x	x	x	x	x	x	x	x	x

##### Current and absorbed power

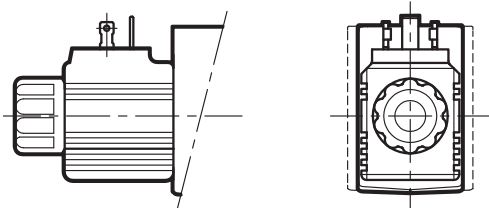
(values ±10 %)

	Resistance at 20°C [Ω]	Absorbed current [A]	Absorbed power [W]	Coil code					
				K1	K2	K7	WK1	WK7	WK7D
<b>D12</b>	4,4	2,72	32,7	1903080	1903100	1902940	1903050	1903580	1903600
<b>D24</b>	18,6	1,29	31	1903081	1903101	1902941	1903051	1903581	1903601
<b>D28</b>	26	1,11	31	1903082					
<b>D48</b>	78,6	0,61	29,5	1903083					

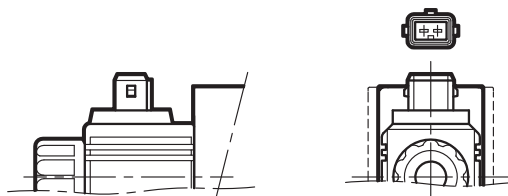
## 7 - ELECTRICAL CONNECTIONS

### 7.1 - BDL

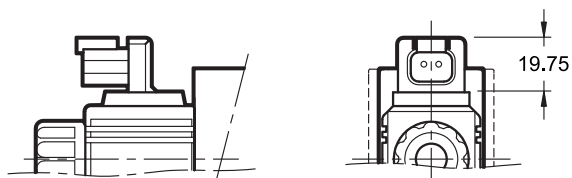
connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**



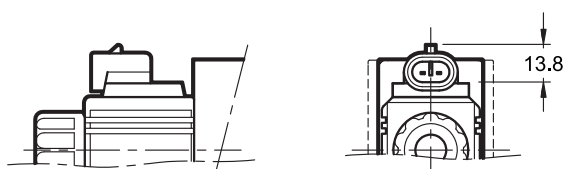
connection for AMP JUNIOR connector  
code **K2**



DEUTSCH DT04-2P connection for DEUTSCH  
DT06-2S male connector  
code **WK7**

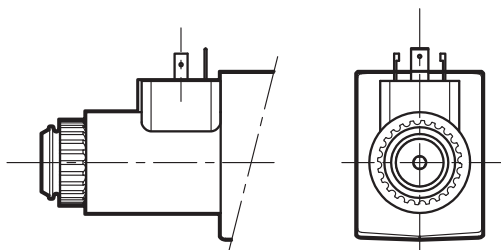


connection for AMP SUPER SEAL  
(two contacts) connector type  
code **WK8**



### 7.2 - BDM

connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**



connection for AMP JUNIOR connector  
code **K2**

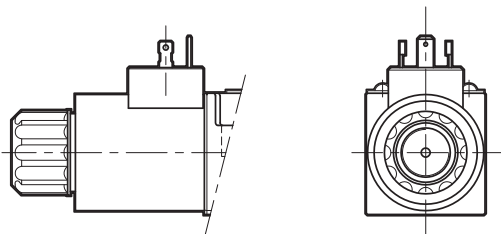


DEUTSCH DT04-2P connection for DEUTSCH  
DT06-2S male connector  
code **K7**

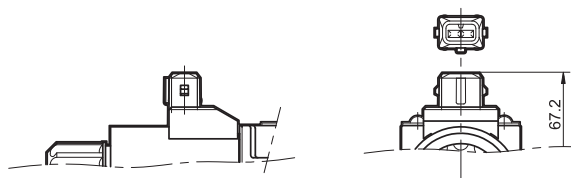


### 7.3 - BDS

connection for EN 175301-803 (ex DIN 43650) connector  
code **K1 (standard)**  
code **WK1** (W7 version only)



connection for AMP JUNIOR connector  
code **K2**



connection for DEUTSCH DT06-2S male connector  
code **K7**



connection for DEUTSCH DT06-2S male connector  
code **WK7** (W7 version only)  
code **WK7D** (W7 version only - coil with diode)



## 8 - ELECTRICAL CONNECTORS

The solenoid valves are supplied without connectors. Connectors for electrical connections K1 and WK1 (EN 175301-803, ex DIN 43650) can be ordered separately. See catalogue 49 000.

## 9 - INSTALLATION

The stacked valve assembly can be installed in any position without impair the proper functioning.

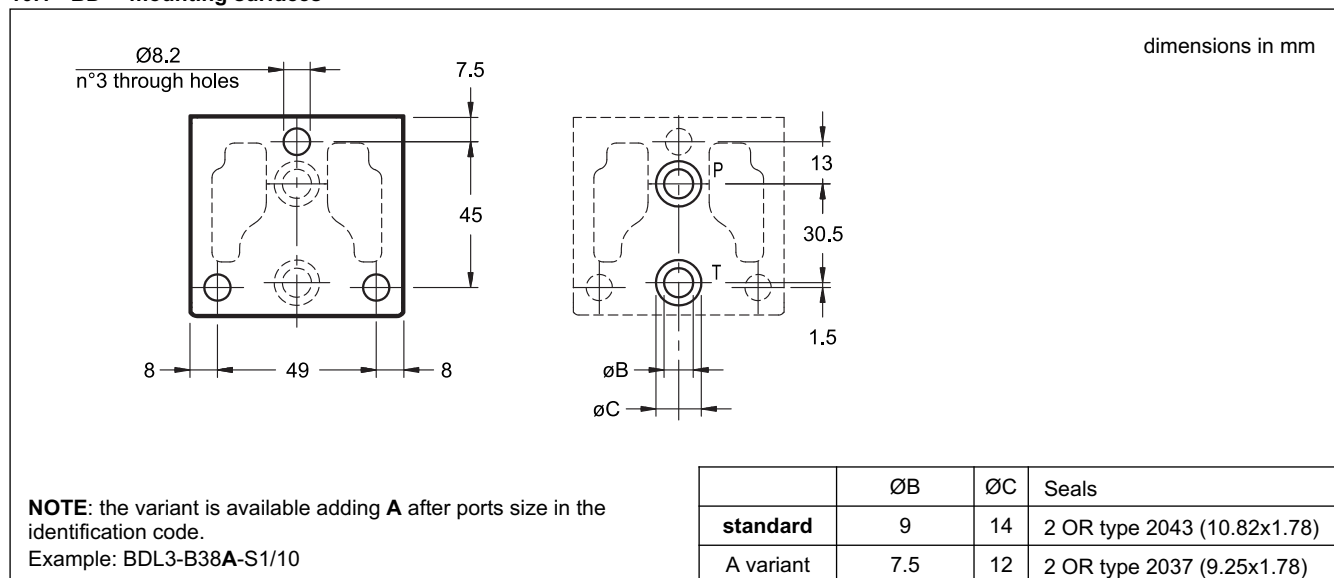
### 9.1 - Fixing and tie-rods

Fixing kit are available. Please contact the technical dept. for dimensional check and ordering codes.

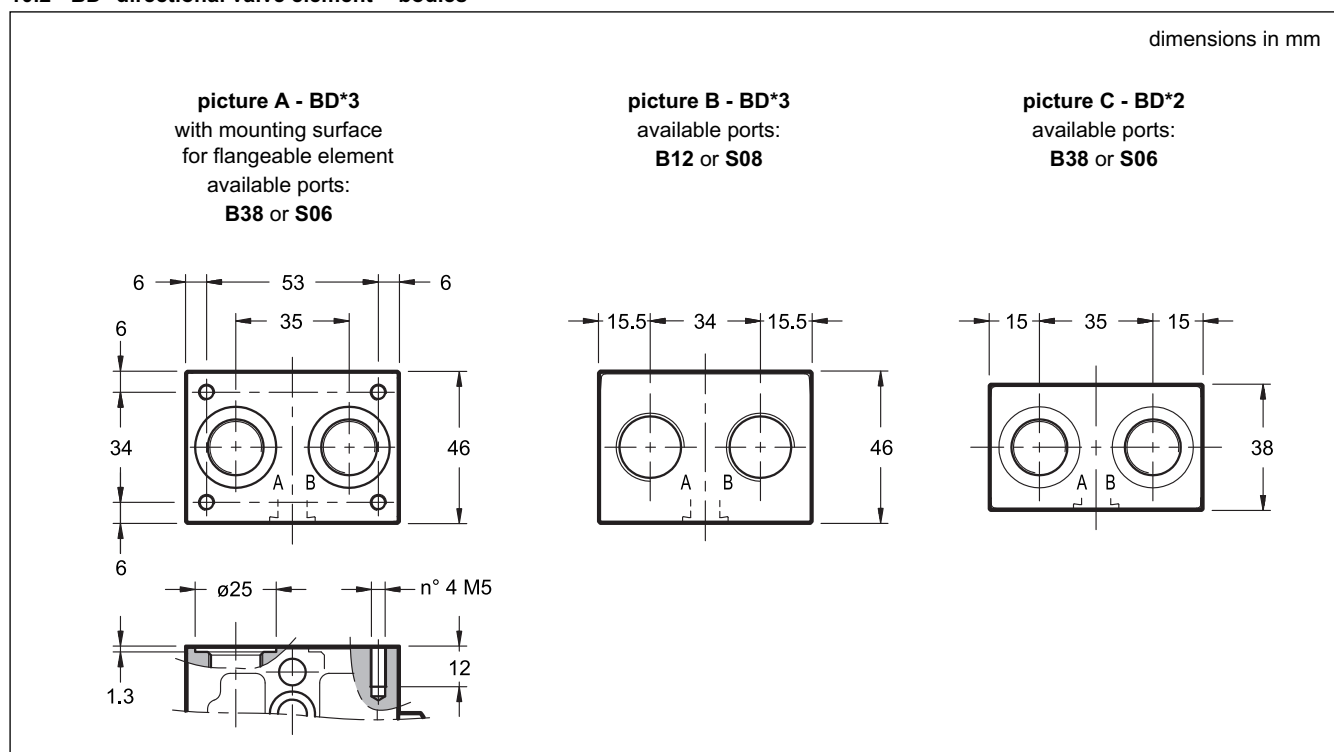


## 10 - OVERALL AND MOUNTING DIMENSIONS OF DIRECTIONAL VALVES

### 10.1 - BD\* - mounting surfaces

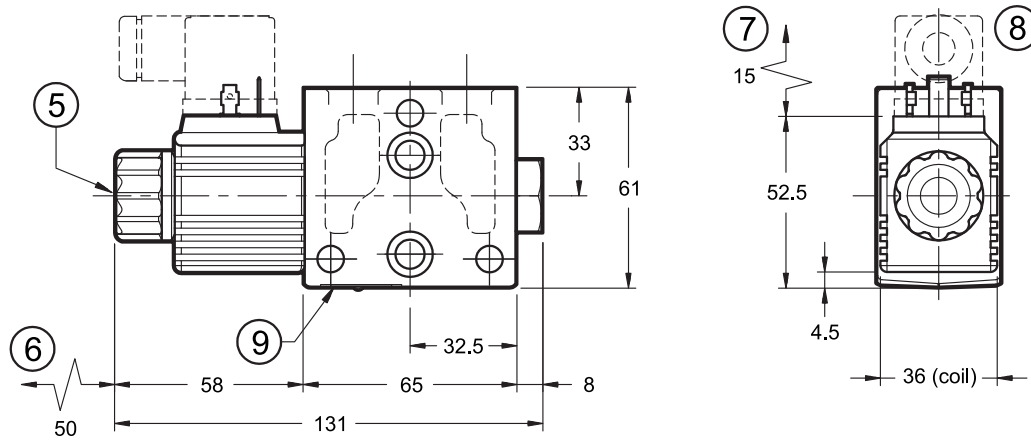
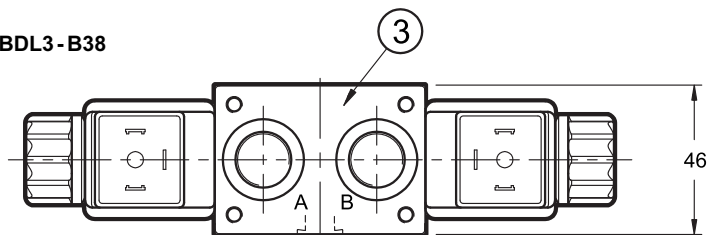
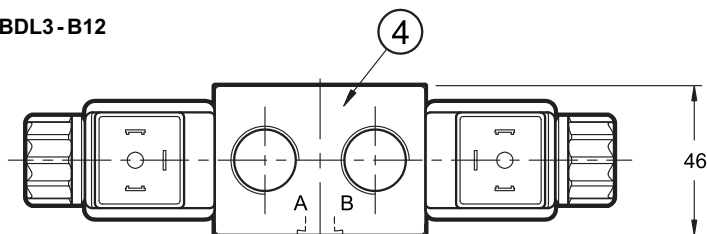


### 10.2 - BD\* directional valve element - bodies



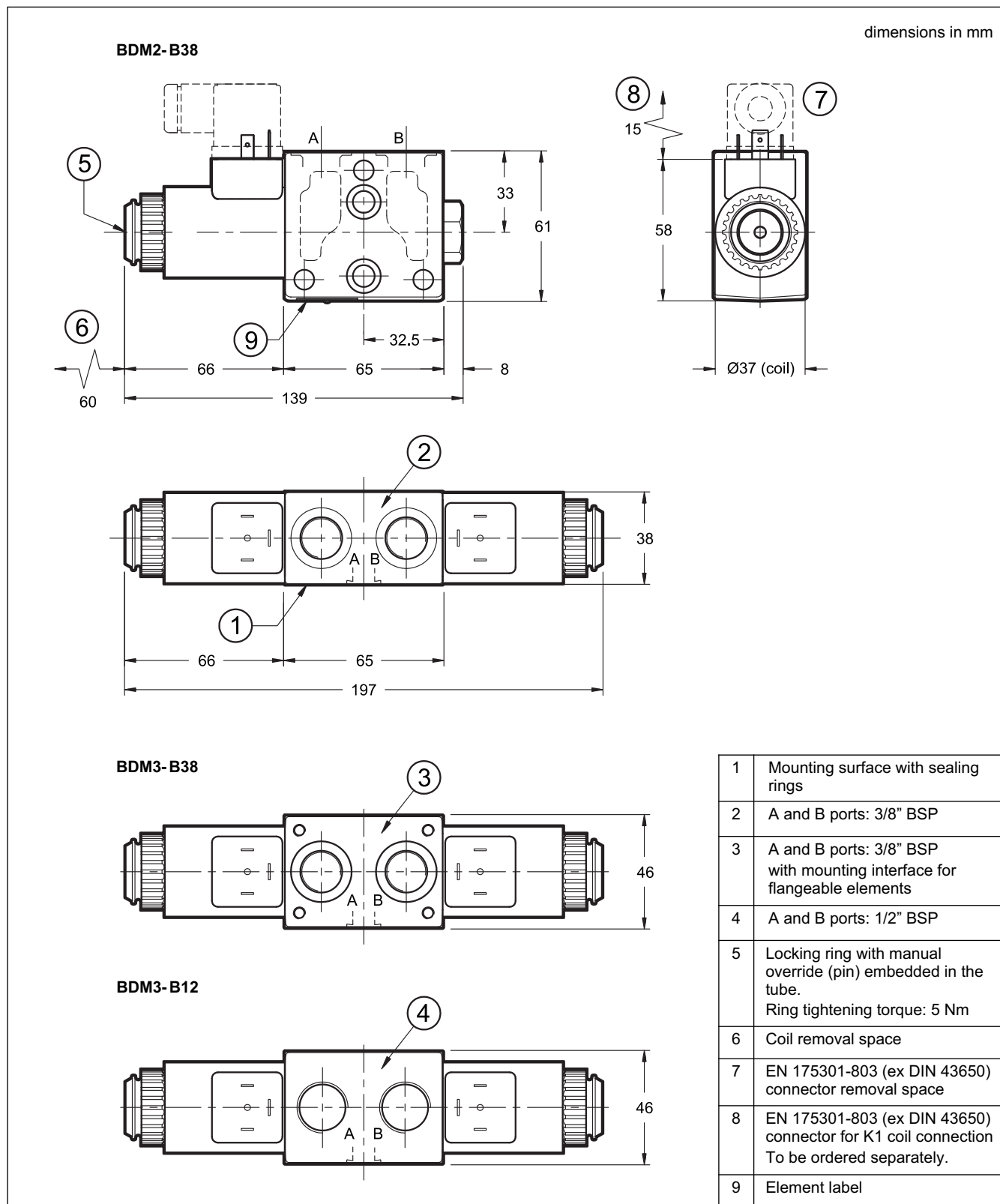
**10.3 - BDL - Directional valve element - solenoid tube  $\varnothing 14$** 

dimensions in mm

**BDL2-B38**

**BDL3-B38**

**BDL3-B12**


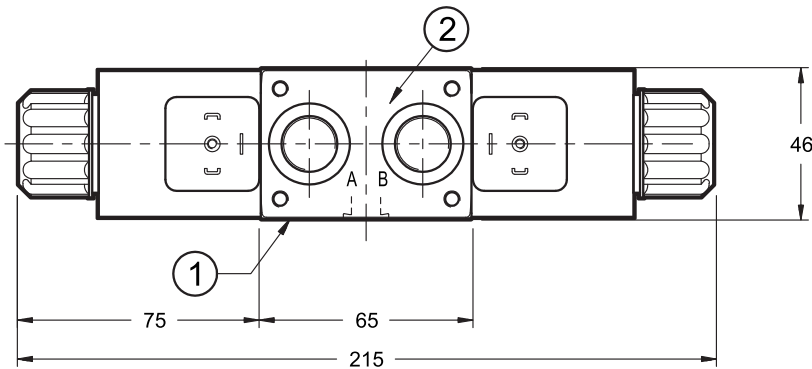
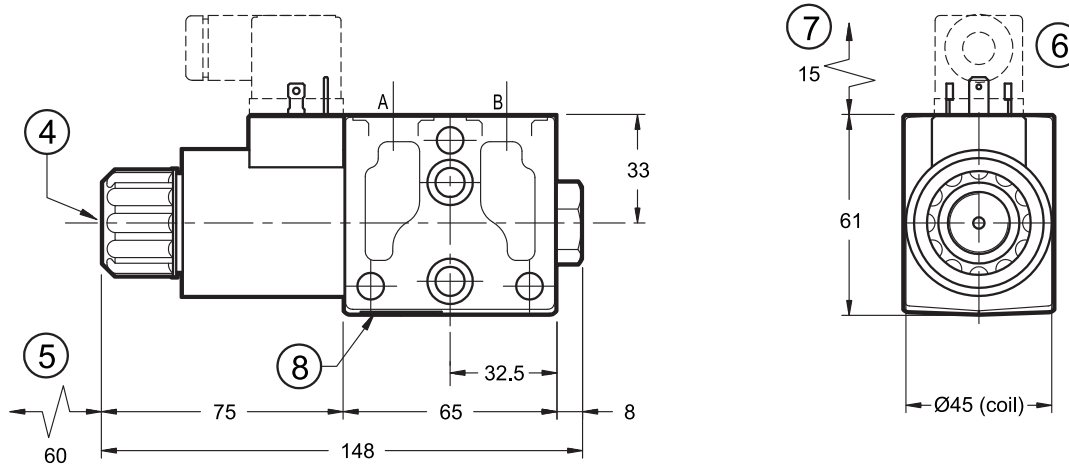
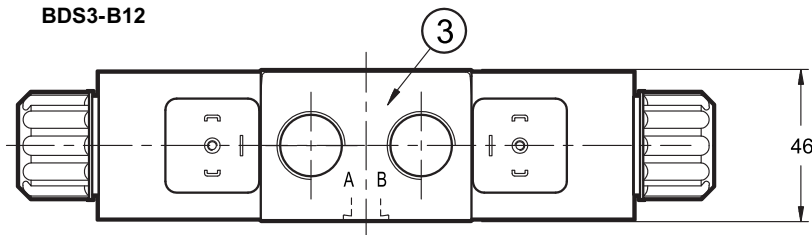
1	Mounting surface with sealing rings
2	A and B ports: 3/8" BSP
3	A and B ports: 3/8" BSP with mounting interface for flangeable elements
4	A and B ports: 1/2" BSP
5	Locking ring with embedded boot manual override. ring tightening torque: 3 Nm
6	Coil removal space
7	EN 175301-803 (ex DIN 43650) connector removal space
8	EN 175301-803 (ex DIN 43650) connector for K1 coil connection To be ordered separately.
9	Element label

## 10.4 - BDM - Directional valve element - solenoid tube $\varnothing 19$



**10.5 - BDS - Directional valve element - solenoid tube  $\varnothing 22$** 

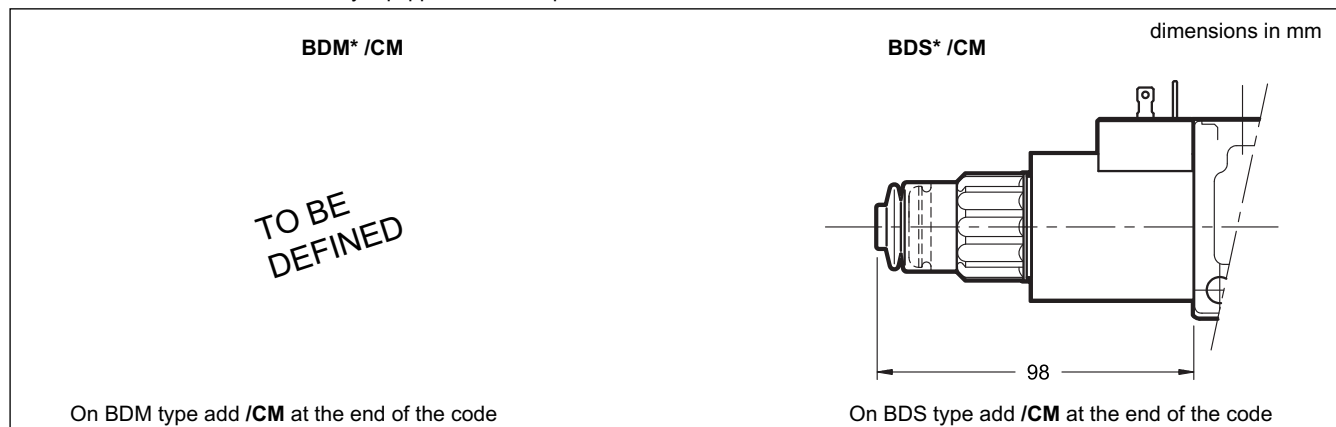
dimensions in mm

**BDS3-B38**

**BDS3-B12**


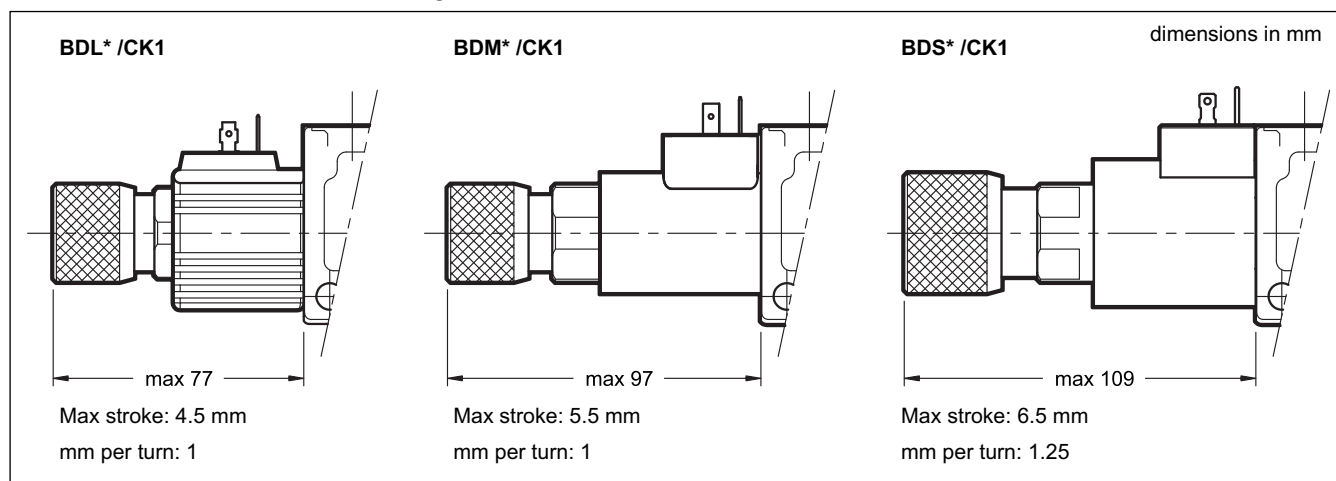
1	Mounting surface with sealing rings
2	A and B ports: 3/8" BSP with mounting interface for flangeable elements
3	A and B ports: 1/2" BSP
4	Locking ring with manual override (pin) embedded in the tube. Ring tightening torque: 5 Nm
5	Coil removal space
6	EN 175301-803 (ex DIN 43650) connector removal space
7	EN 175301-803 (ex DIN 43650) connector for K1 coil connection To be ordered separately.
8	Element label

## 10.6 - CM - boot protected

The BDL standard element is already equipped with boot protection of the solenoid tube.



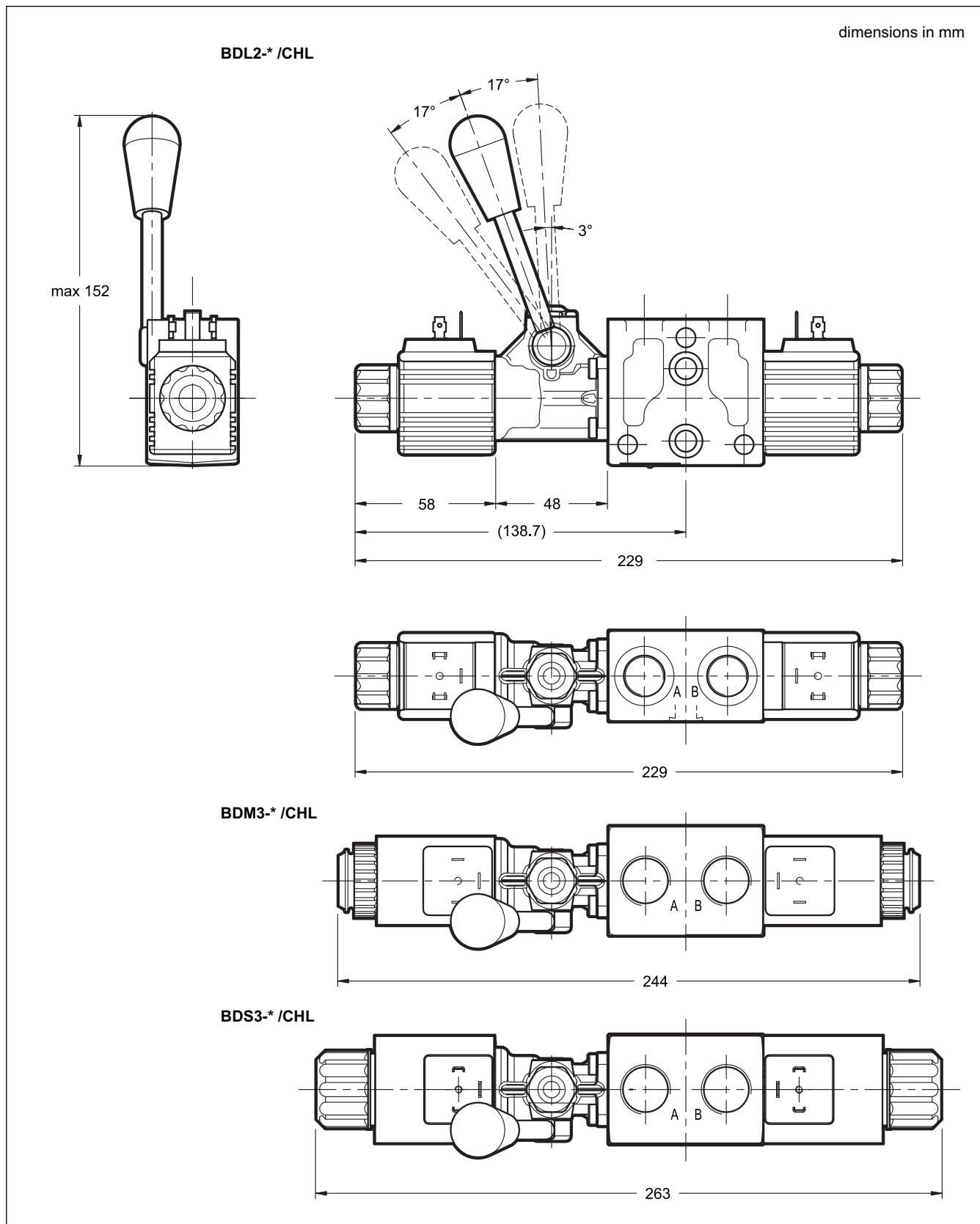
## 10.7 - CK1 - knob manual override, turning



### 10.8 - CHL light duty lever manual override

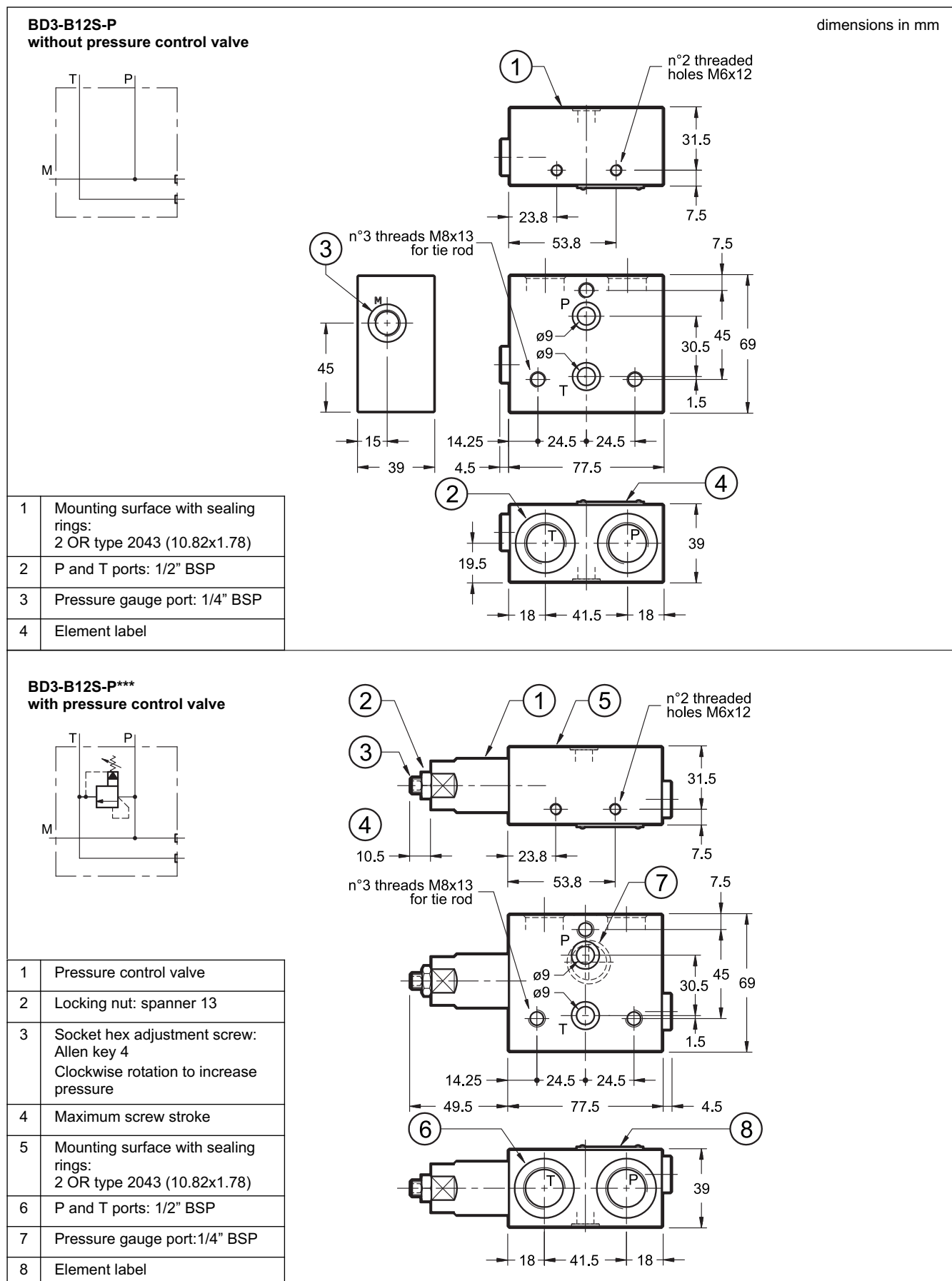
Devices are placed on side A. Please contact our technical depth for other positions. For non-quoted dimensions, please refer to the overall tables in previous pages.

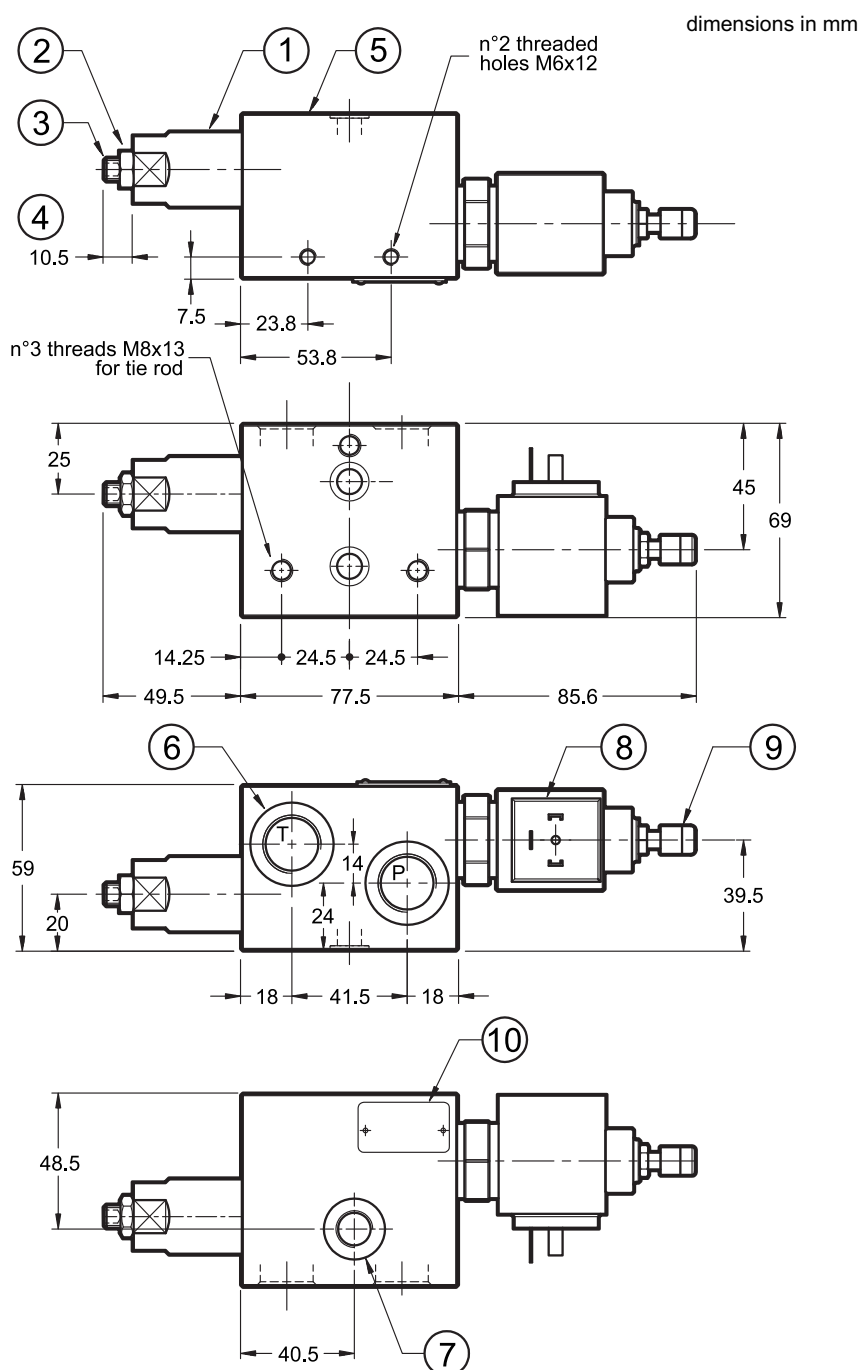
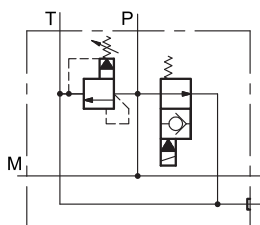
The CHL lever device can work with a maximum pressure in line T up to 50 bar, therefore it is not suitable for series circuits.



# 11 - DIMENSIONS OF INLET AND OUTLET ELEMENTS FOR PARALLEL CIRCUITS

## 11.1 - Inlet elements



**BD3-B12S-PK\*\*\***  
**with pressure control and**  
**unloading valve**


1	Pressure control valve
2	Locking nut: spanner 13
3	Socket hex adjustment screw: Allen key 4 Clockwise rotation to increase pressure
4	Maximum screw stroke
5	Mounting surface with sealing rings: 2 OR type 2043 (10.82x1.78)
6	P and T ports: 1/2" BSP
7	Pressure gauge port: 1/4" BSP
8	Unloading valve Here shown with K1 connection
9	Push and twist manual override: see identification codes for further choices.
10	Element label

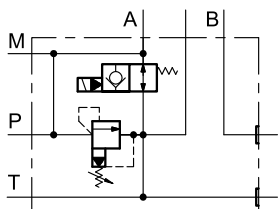
**NOTE:** for missing dimensions of mounting interface  
please refer to par. 10.1 'mounting surfaces'.



## 11.2 - Inlet elements for flow control valve

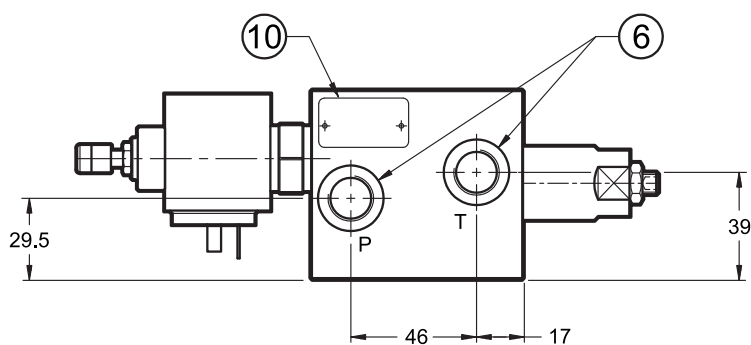
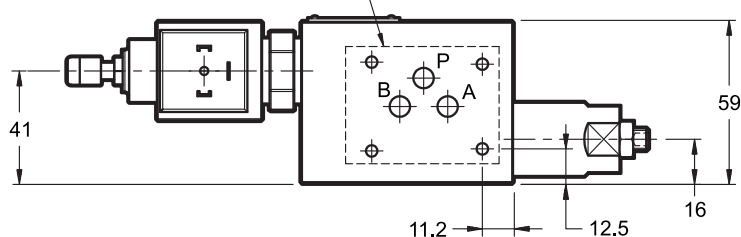
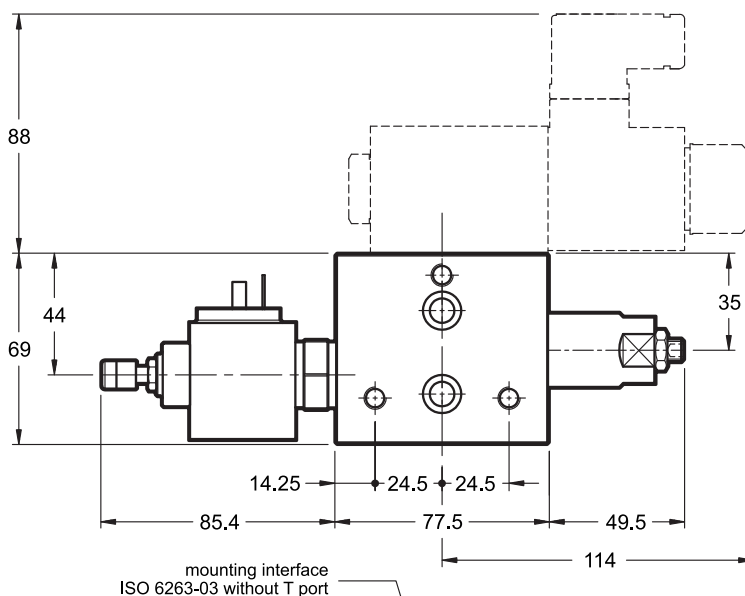
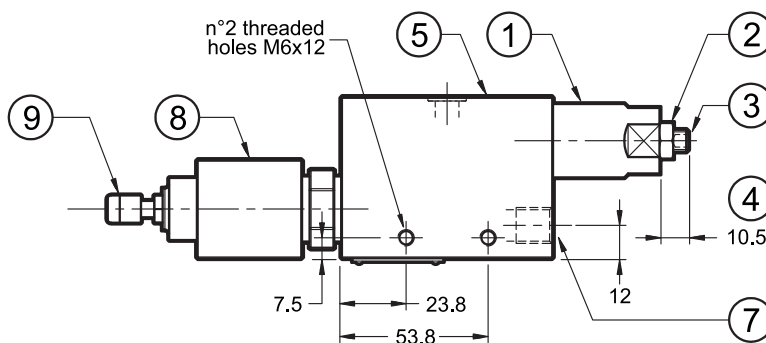
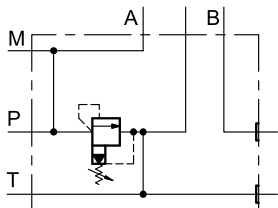
### BD3-B38S-PK\*\*\*-Q with pressure control and unloading valves

dimensions in mm



**NOTE** :The same component  
without part no. 8 is:

### BD3-B38S-P\*\*\*-Q with pressure control without unloading valve



1	Pressure control valve
2	Locking nut: spanner 13
3	Socket hex adjustment screw: Allen key 4 Clockwise rotation to increase pressure
4	Maximum screw stroke
5	Mounting surface with sealing rings: 2 OR type 2043 (10.82x1.78)
6	P and T ports: 3/8" BSP
7	Pressure gauge port: 1/4" BSP
8	Unloading valve Here shown with K1 connection
9	Push and twist manual override: see identification codes for further choices.
10	Element label

**NOTE:** for missing dimensions of mounting interface  
please refer to par. 10.1 'mounting surfaces'.

### 11.3 - Outlet elements

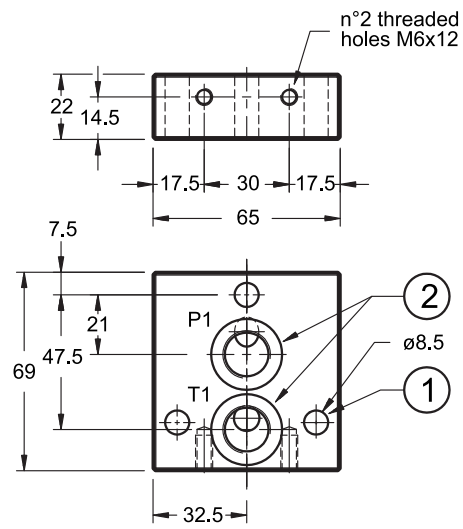
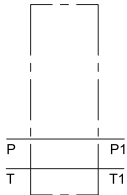
<b>BD3-S-R00</b> blind plate		<p>n°2 threaded holes M6x12</p> <p>22 14.5 17.5 30 17.5 65</p> <p>69 32.5</p> <p>Ø8.5</p> <p>1</p> <p><b>NOTE:</b> for missing dimensions of mounting interface please refer to par. 10.1 'mounting surfaces'.</p>	dimensions in mm
1	n° 3 through holes for stack assembly tie-rods		

<b>BD3-B38S-R01</b> plate with P1 outlet		<p>n°2 threaded holes M6x12</p> <p>22 14.5 17.5 30 17.5 65</p> <p>7.5 21 69 32.5</p> <p>P1</p> <p>Ø8.5</p> <p>1 2</p>	
1	n° 3 through holes for stack assembly tie-rods		
2	P1 port: 3/8 BSP		

<b>BD3-B38S-R02</b> plate with T1 outlet		<p>n°2 threaded holes M6x12</p> <p>22 14.5 17.5 30 17.5 65</p> <p>7.5 43.5 39 32.5</p> <p>T1</p> <p>Ø8.5</p> <p>1 2</p>	
1	n° 3 through holes for stack assembly tie-rods		
2	P1 port: 3/8 BSP		

**BD3-B38S-R03**  
plate with P1 and T1 outlet

dimensions in mm



1	n° 3 through holes for stack assembly tie-rods
2	P1 and T1 ports: 3/8 BSP

**NOTE:** for missing dimensions of mounting interface please refer to par. 10.1 'mounting surfaces'.

## 12 - IDENTIFICATION CODE FOR STACKED VALVE ASSEMBLY

BD			-		/	10		-		/	XXXXX
----	--	--	---	--	---	----	--	---	--	---	-------

Stacked valve assembly

Solenoid tube (mm):  
**L** = 14  
**M** = 19  
**S** = 22 (only size 3)

Size: \_\_\_\_\_  
**2** = thickness 38 mm  
**3** = thickness 46 mm

Circuit type: \_\_\_\_\_  
**P** = parallel  
**S** = series (parallel elements with plugs)  
**C** = series (series elements)  
 Available for size 2 only

No. of directional valves \_\_\_\_\_

Configuration code (5 digits), assigned by Duplomatic

Coil electrical connection:  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)  
**K2** = plug for connector type AMP JUNIOR  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S  
**K8** = plug for connector type AMP SUPER SEAL

Coil type:  
 DC coils  
**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V  
**D00** = valve without coil supplied with locking ring

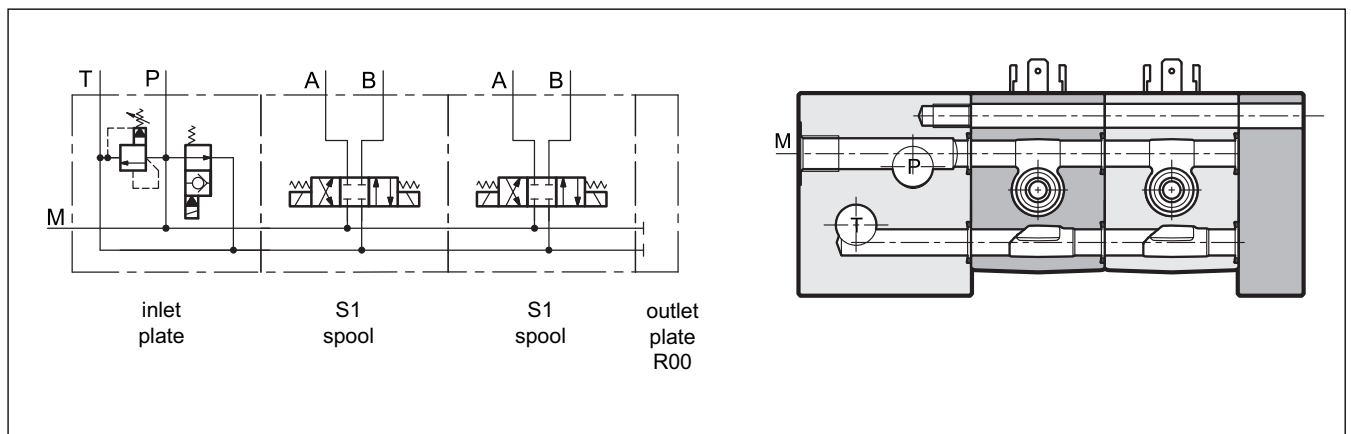
Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series no.:  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

## 13 - CONNECTION SCHEMES EXAMPLES

### 13.1 - BD\*\*-P parallel connection

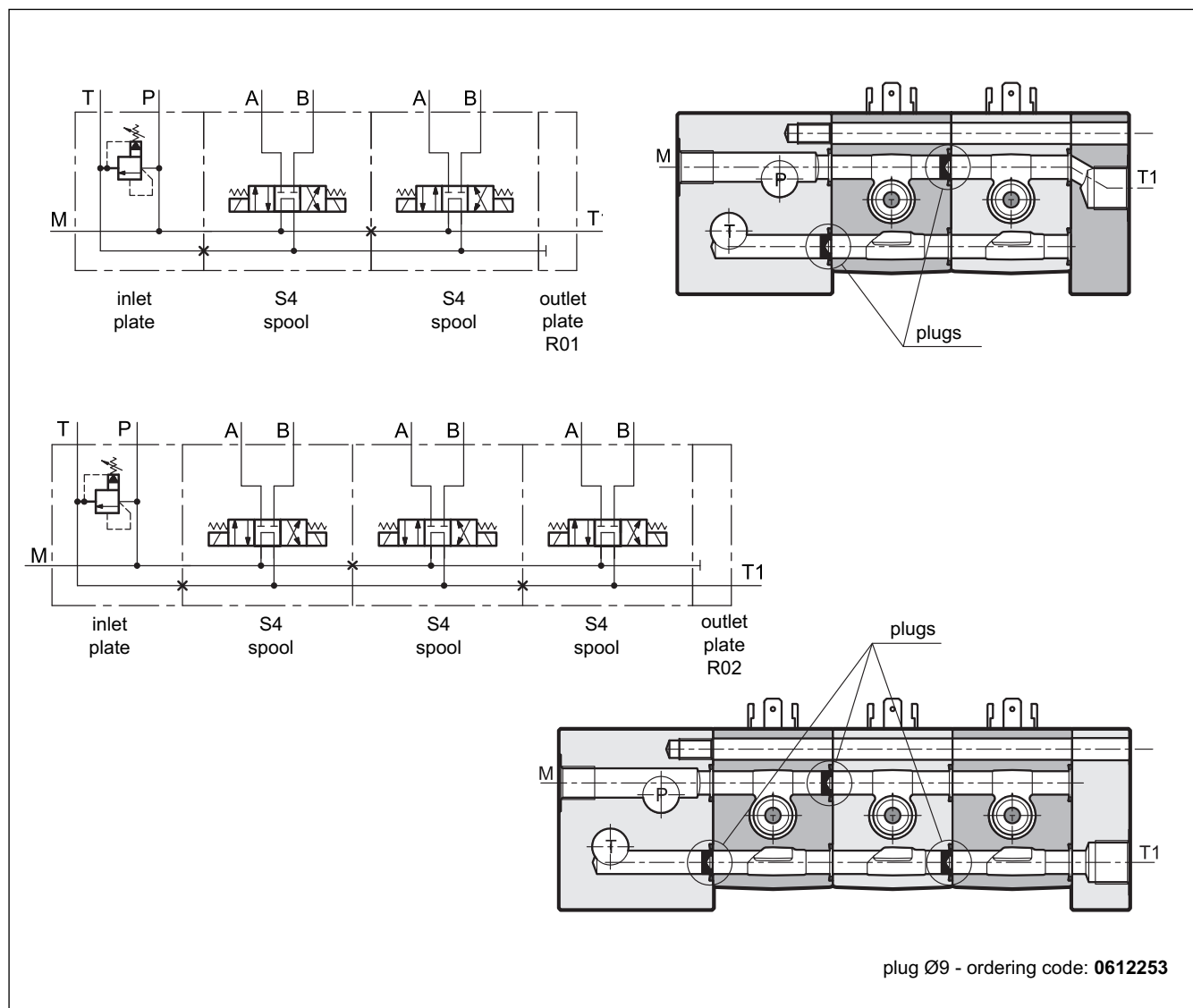
Parallel circuit is obtained with elements for parallel connection (see par.1).



### 13.2 - BD\*-S series connection

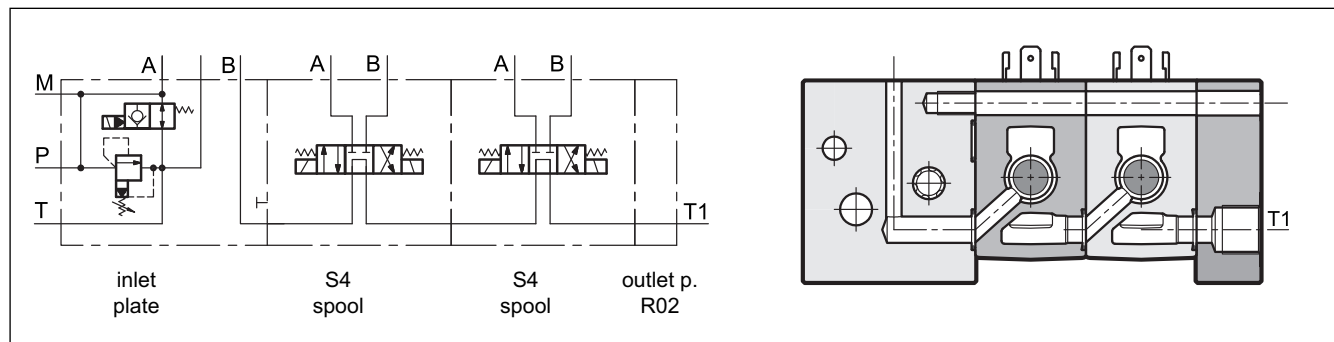
Series circuit is obtained by inserting plugs in elements for parallel connection (see par. 1).

Please note that this kind of configuration requires a different outlet plate, depending on the number (even or odd) of directional valves in the assembly.



### 13.3 - BDL2-C and BDM2-C series connection

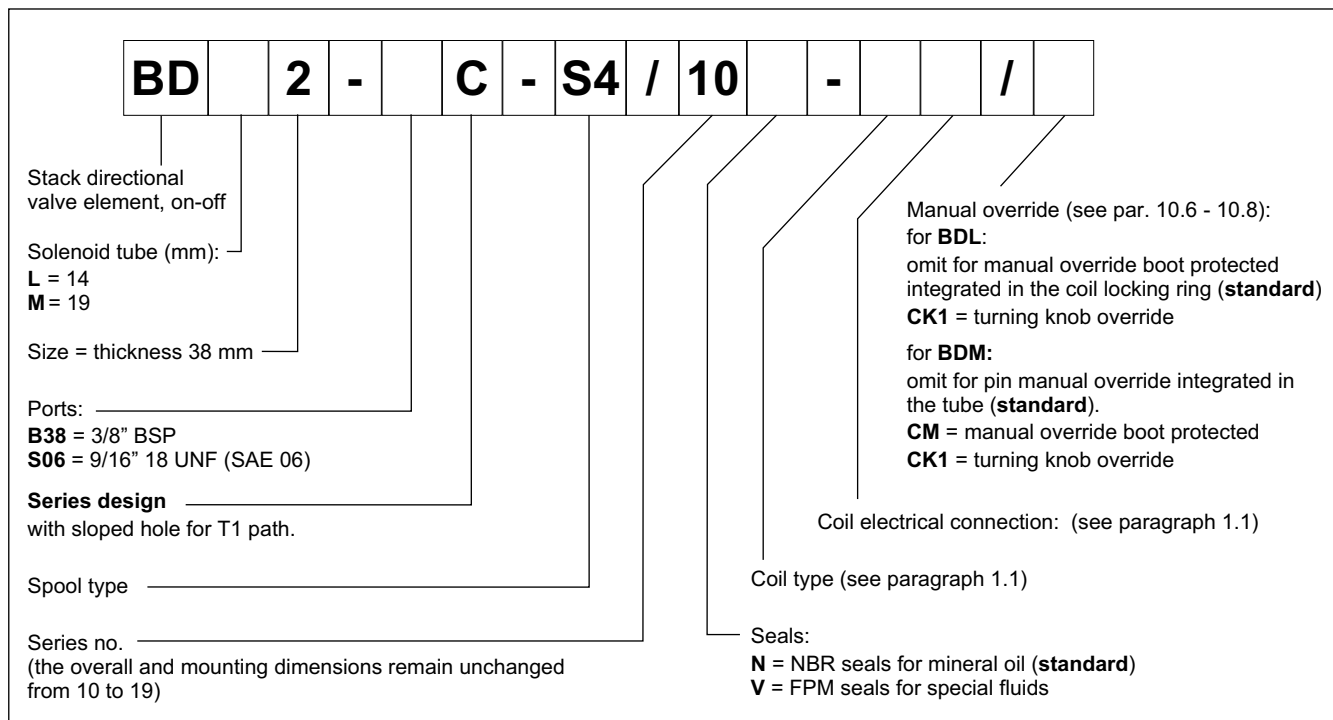
BD\*2-C series connection is obtained with elements designed for series (see par. 14). The series elements are available in size 2 only.



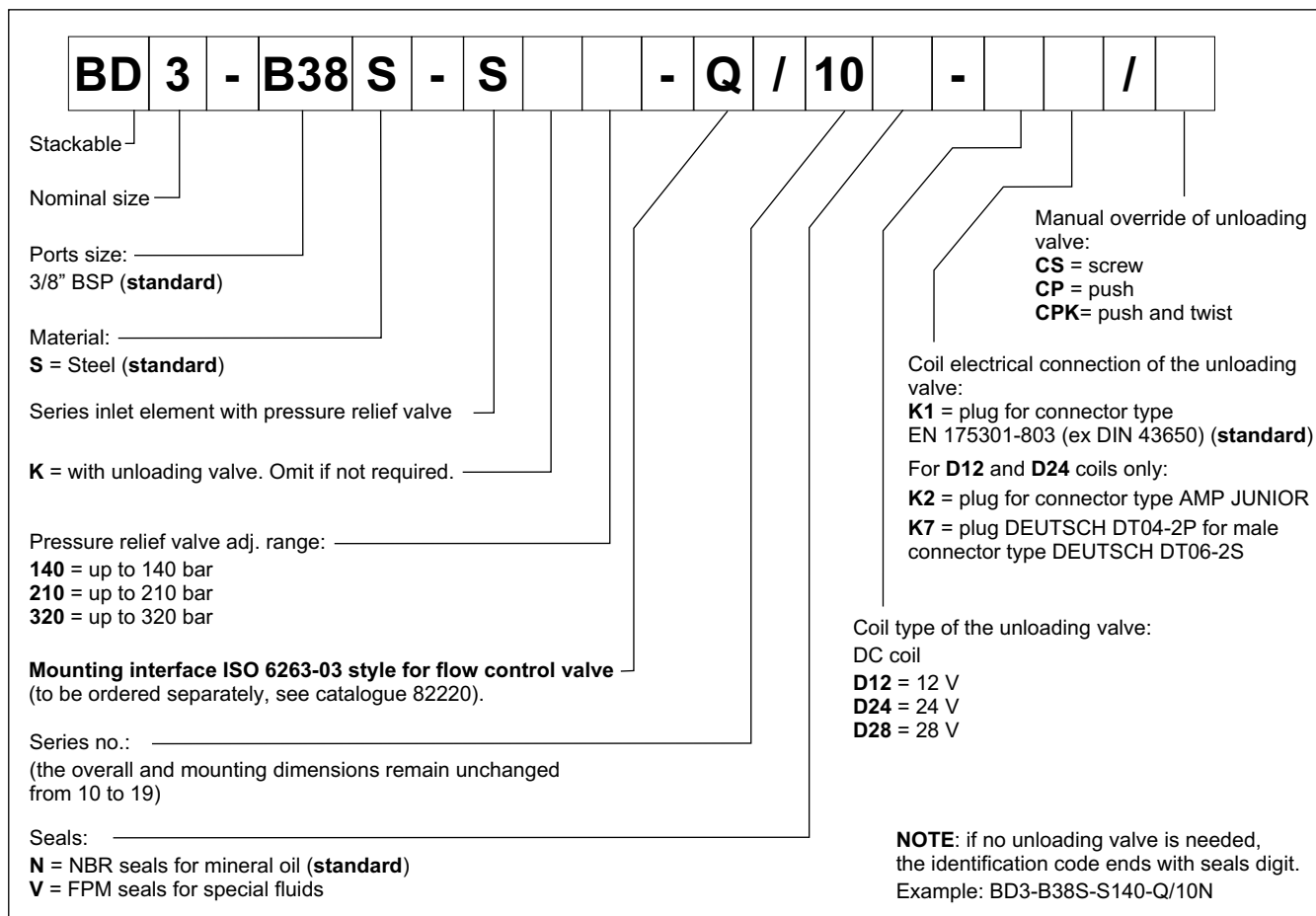
## 14 - IDENTIFICATION CODES OF SEPARATE ELEMENTS FOR BDL2 AND BDM2 SERIES CIRCUITS

### 14.1 - Directional valve element

This code identifies BD\*2 elements, designed for series connection. Series circuits with BD\*3 modules are feasible by inserting plugs to divert the oil path (see paragraph 13.2).



### 14.2 - Inlet elements for flow control valve



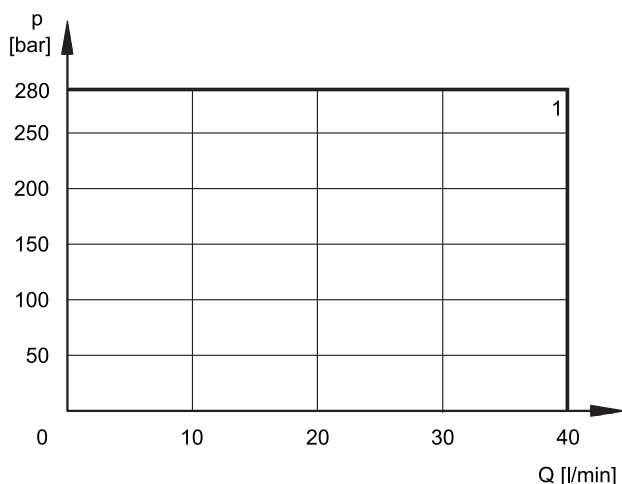
### 14.3 - Outlet elements

Please choose the proper outlet element amongst those in paragraph 1.7. Overall dimensions are at paragraph 11.3.

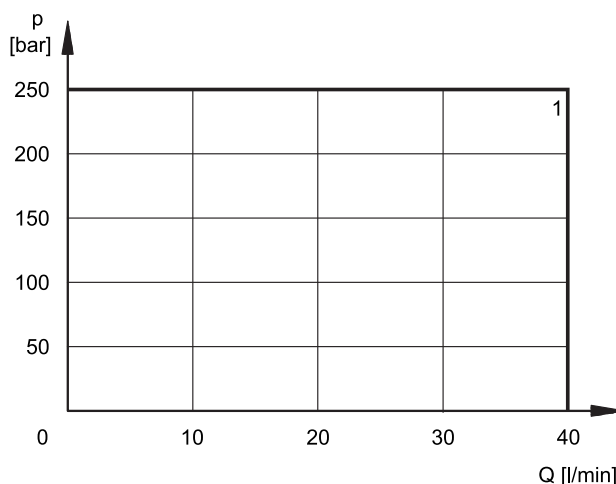
## 15 - CHARACTERISTIC CURVES AND OPERATING LIMITS FOR SERIES

Please refer to diagrams at par. 3 for pressure drops, whereas operating limits are here below.

### 15.1 - BDL2-B38C-S4



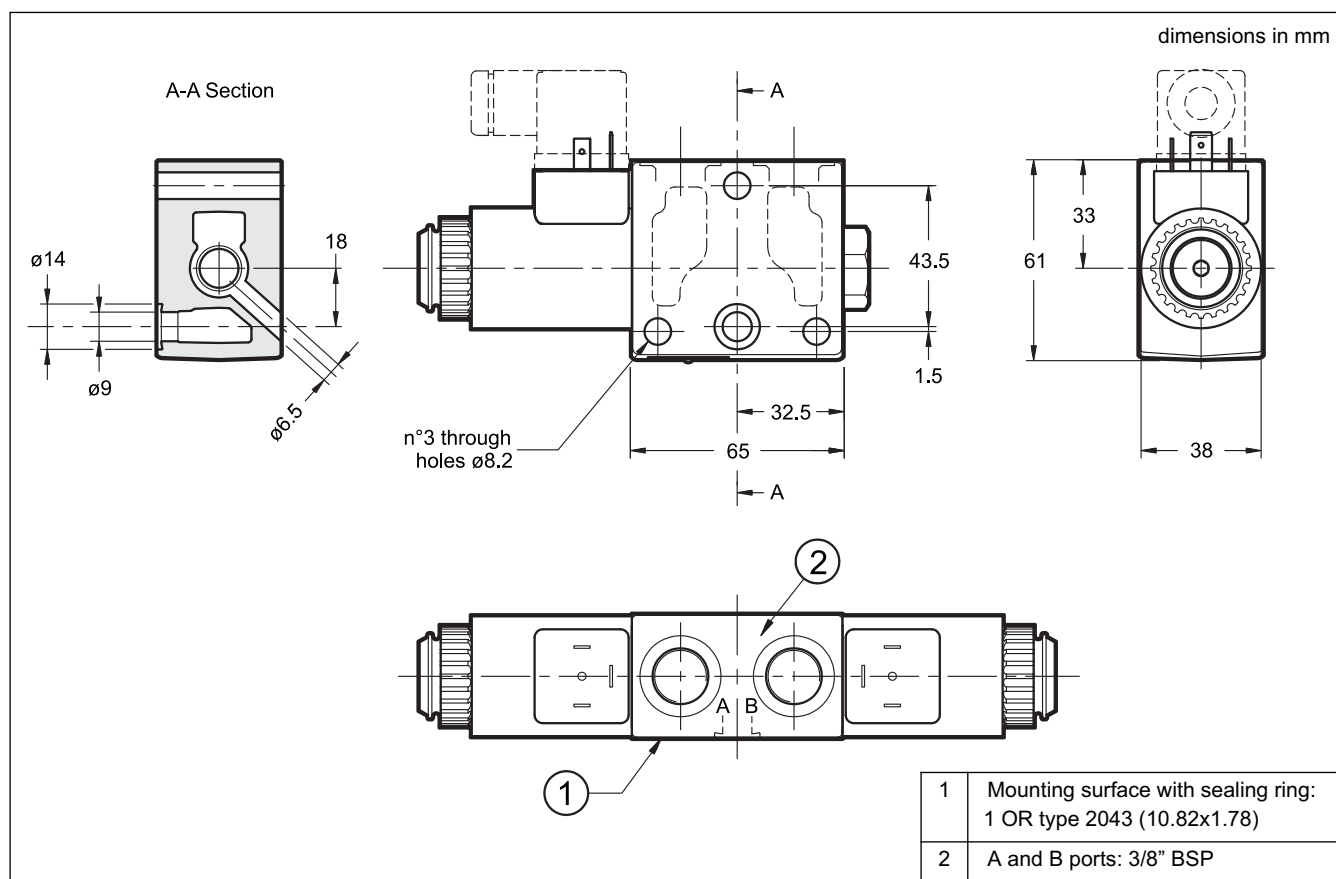
### 15.2 - BDM2-B38C-S4



## 16 - DIMENSIONS OF ELEMENTS FOR SERIES CONNECTION

### 16.1 - BD\*2-B38C-S4/10\* - directional valve element

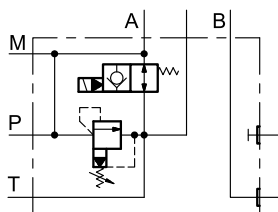
The BDM2 configuration is showed here. The same directional valve is available as BDL2. For non-quoted dimensions, please refer to the drawings for parallel circuits. Overall dimensions are the same.



## 16.2 - Inlet elements for flow control valve

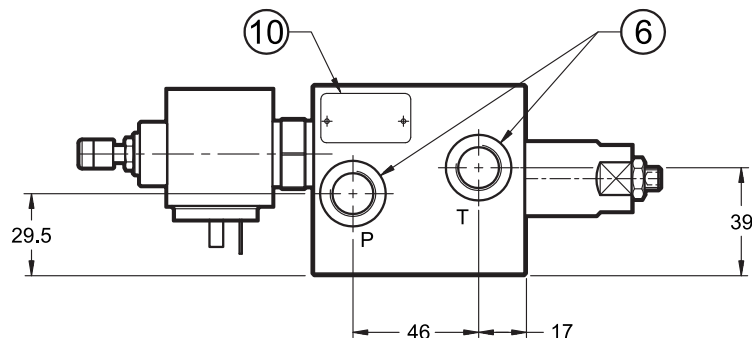
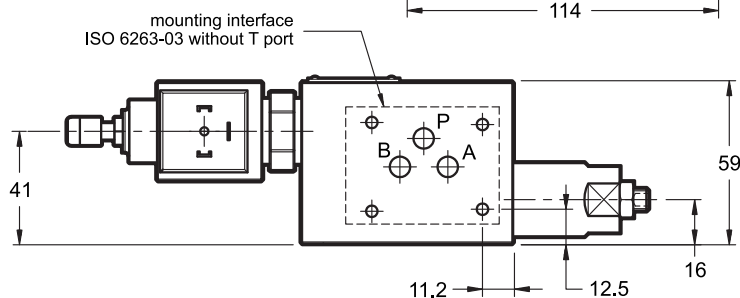
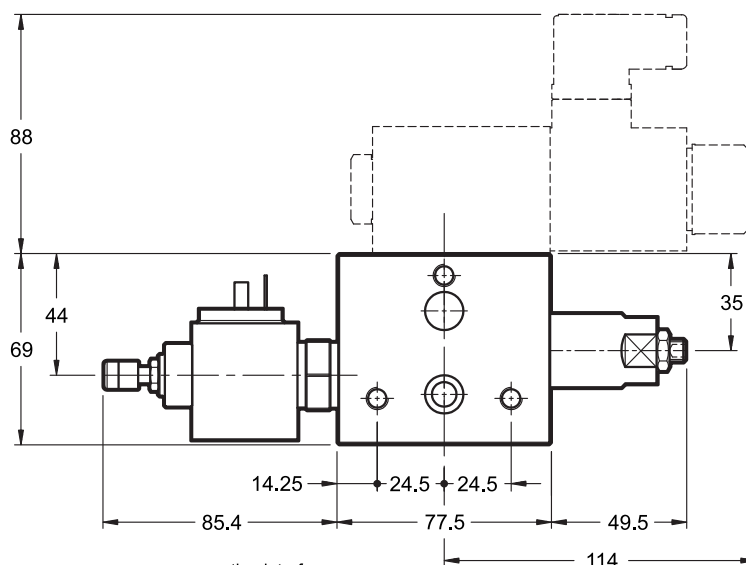
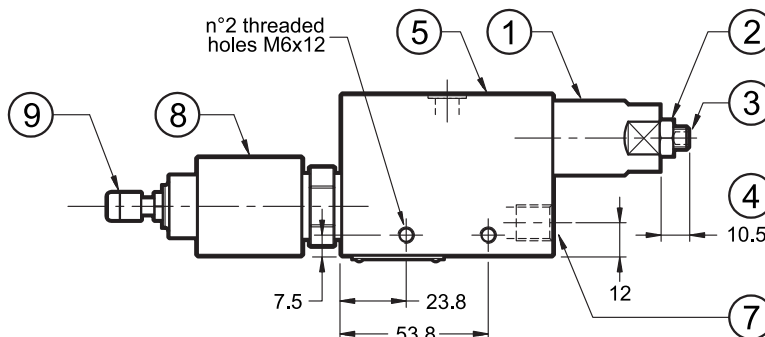
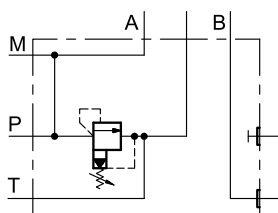
### BD3-B38S-SK\*\*\*-Q with pressure control and unloading valves

dimensions in mm



**NOTE** :The same component  
without part no. 8 is:

### BD3-B38S-S\*\*\*-Q with pressure control without unloading valve



1	Pressure control valve
2	Locking nut: spanner 13
3	Socket hex adjustment screw: Allen key 4 Clockwise rotation to increase pressure
4	Maximum screw stroke
5	Mounting surface with sealing rings: 2 OR type 2043 (10.82x1.78)
6	P and T ports: 3/8" BSP
7	Pressure gauge port: 1/4" BSP
8	Unloading valve Here shown with K1 connection
9	Push and twist manual override: see identification codes for further choices.
10	Element label

**NOTE:** for missing dimensions of mounting interface  
please refer to the section 10.1 'mounting surfaces'.



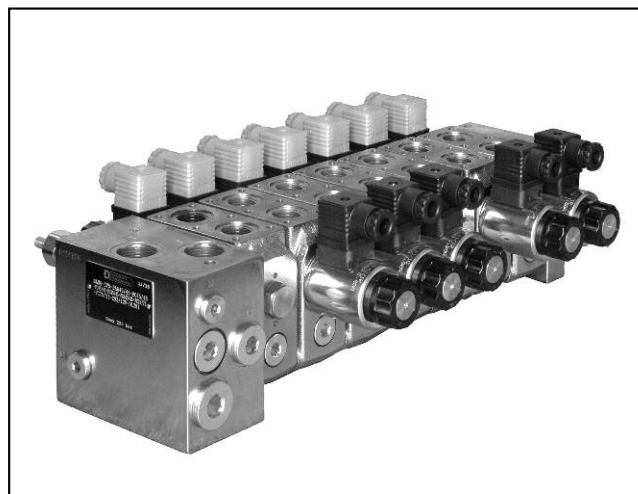


**BD\***  
**SERIES 10**

**DUPLOMATIC**  
MOTION SOLUTIONS

**DUPLOMATIC MS S.p.A.**

via M. Re Depaolini 24 ▪ 20015 PARABIAGO (MI) ▪ ITALY  
tel. +39 0331.895.111 ▪ [www.diplomatic.com](http://www.diplomatic.com) ▪ e-mail: [sales.exp@diplomatic.com](mailto:sales.exp@diplomatic.com)



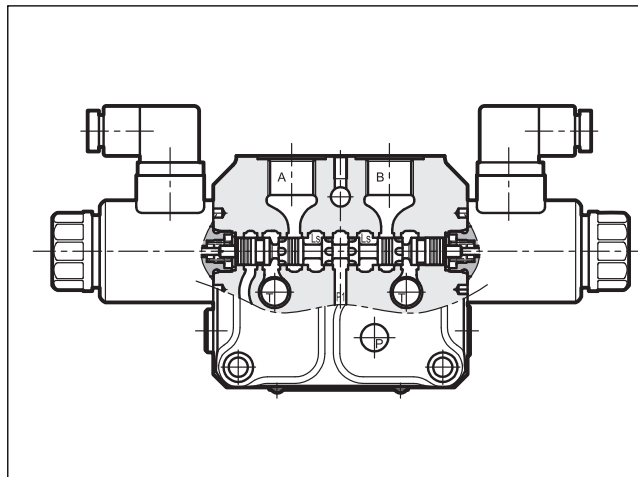
# BLS6

## BANKABLE LOAD SENSING PROPORTIONAL CONTROL VALVE

### SERIES 12

**p** max **300** bar  
**Q** max **120** l/min

#### OPERATING PRINCIPLE



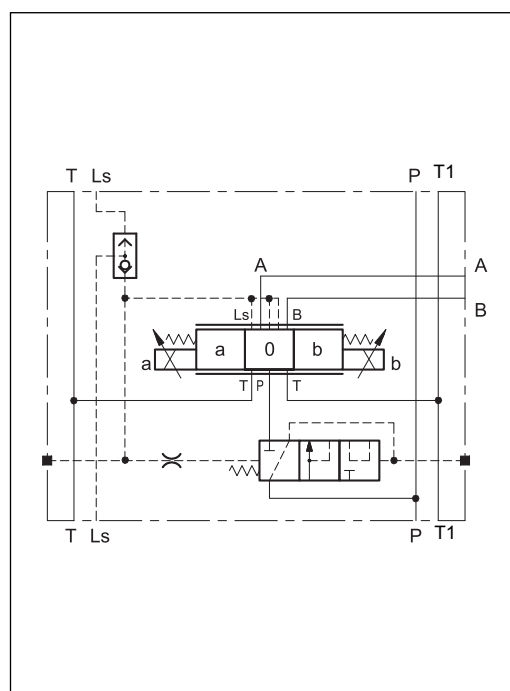
- The BLS6 directional control valve is stackable and can be assembled up to 8 different proportional and on/off modules .
- Each module is equipped with a meter-in compensator that keep constant the flow, independently from load changes.
- Sections with pressure compensators are not influenced in any way by other operated functions, provided that sufficient pump capacity is available. To correctly work, the sum of the flows contemporarily used must not overcome the 90% of the inlet flow.
- Working ports A and B are threaded 1/2" BSP. On the inlet module the ports P1, P2 and T1 are threaded 3/4" BSP.
- The manual lever override is available as option.

#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C )

Maximum operating pressure: - A and B ports - P1 and P2 ports - T1 port	bar	300 250 20
Maximum flowrate: - A and B ports - P1 and P2 ports - T1 port	l/min	45 100 120
Electrical characteristics	see paragraph 4	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Single body mass	kg	4,5
Surface treatment of body and plates	galvanic, zinc-nickel	

#### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODES FOR LOOSE MODULES

Here below are shown the identification codes of all the loose components of the bankable valve. To order a whole assembled valve, please use the codes at paragraphs 9 and 10.

The inlet section is available in different versions for fixed pumps and for systems with Load Sensing pump.

#### 1.1 - Proportional module

BLS	6	-				/	12	V	-			/	
-----	---	---	--	--	--	---	----	---	---	--	--	---	--

Compensated direct operated directional valve with proportional control

Size \_\_\_\_\_

Spool type: \_\_\_\_\_  
**PC** = closed centers  
**PA** = open centers

Solenoid position: \_\_\_\_\_  
 (omit for configuration with two solenoids)  
**A** = 1 solenoid on side A  
**B** = 1 solenoid on side B

Spool nominal flow (see below) \_\_\_\_\_

Manual override (see par. 11)

Coil electrical connection: (see paragraph)  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K7** = plug for connector type DEUTSCH DT04-2P male

Coil type:  
**D12** = Nominal solenoid voltage 12V DC  
**D24** = Nominal solenoid voltage 24V DC

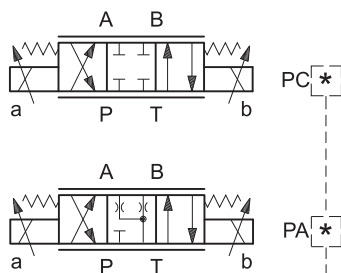
Seals:  
**V** = FPM seals (**standard**)

Series no. (the overall and mounting dimensions remain unchanged from 10 to 19)

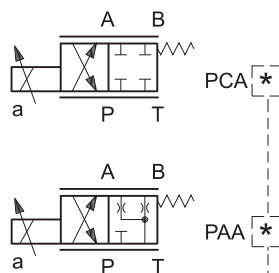
#### SPOOLS

Valve configuration depends on the combination of the following elements:  
 number of proportional solenoids, spool type, nominal flow rate.

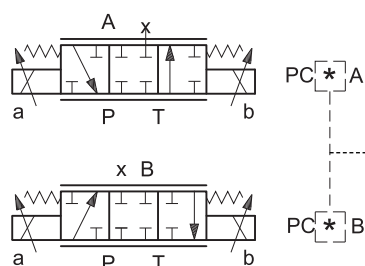
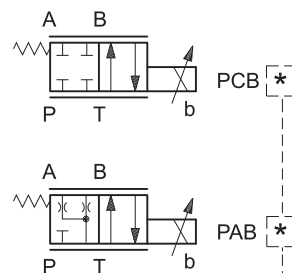
2 solenoids configuration:  
 3 positions with spring centering



1 solenoid on side A.  
 2 positions (central + external) with spring centering



1 solenoid on side B.  
 2 positions (central + external) with spring centering



SYMMETRICAL	
max flow	$\Delta p$
05/05	4
09/09	8
15/15	4
25/25	8
30/30	4
45/45	8

ASYMMETRICAL	
max flow	$\Delta p$
09/06	8
15/10	4
25/15	8
30/20	4
45/30	8

SINGLE FLOW	
max flow	$\Delta p$
30	4
45	8

### 1.2 - On-off modules

Proportional and on-off modules can be used together. In this case, the description for the spool type in the identification code has to be as follow:

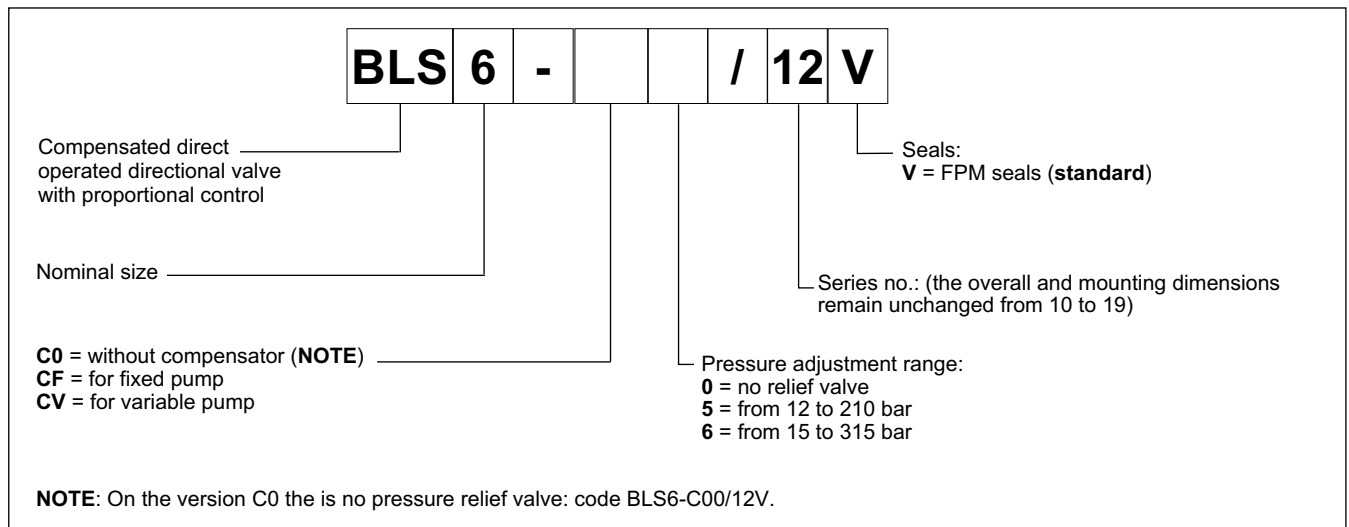
**SC** = closed center with on-off solenoid

**SA** = open center with on-off solenoid

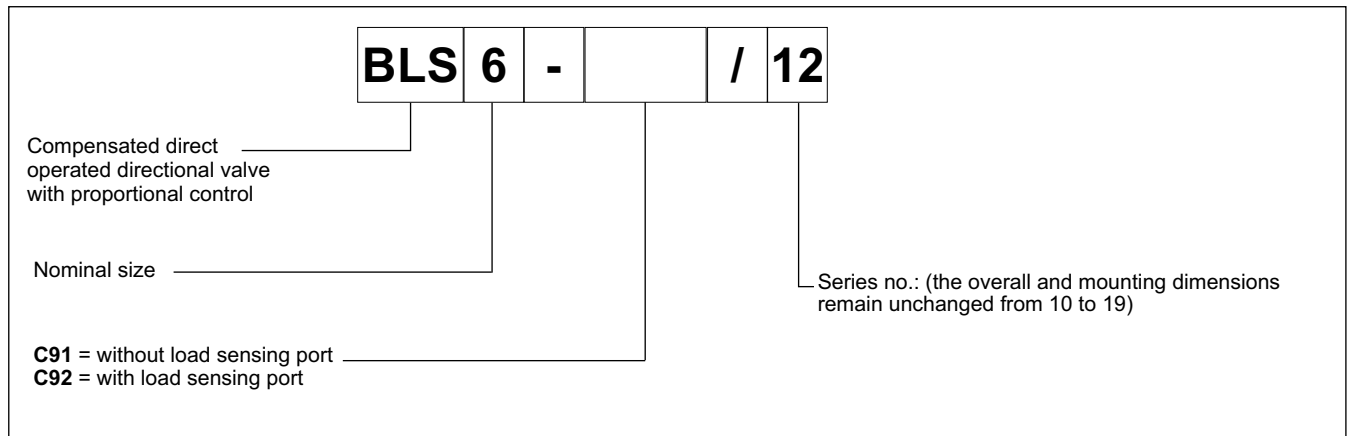
Two spools for high flow rates are available: SC60/60 and SA60/60.

### 1.3 - Inlet plates

The inlet section is available in different versions, for fixed and for variable pumps with load sensing. The version for fixed pump can be easily converted to work with variable pumps and vice versa.



### 1.4 - End plates



## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4 or fluids HFDR type. For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

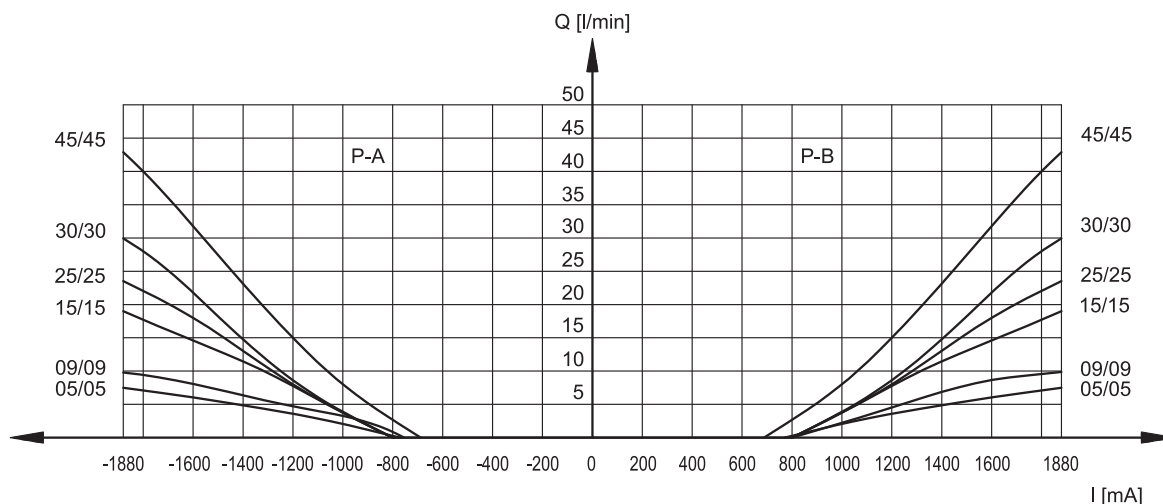
The fluid must be preserved in its physical and chemical characteristics.

### 3 - CHARACTERISTIC CURVES

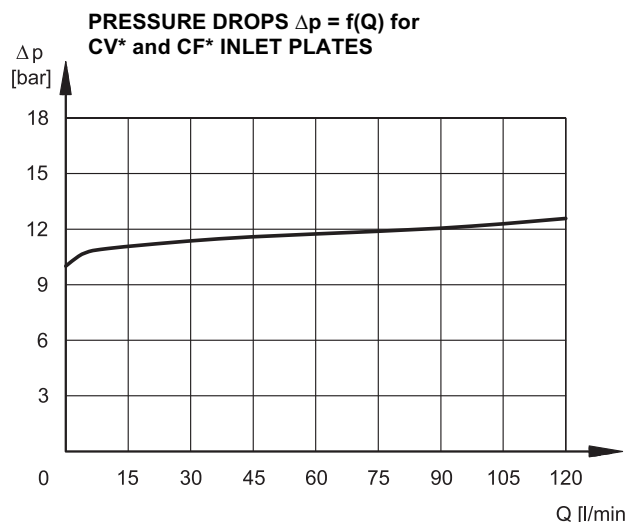
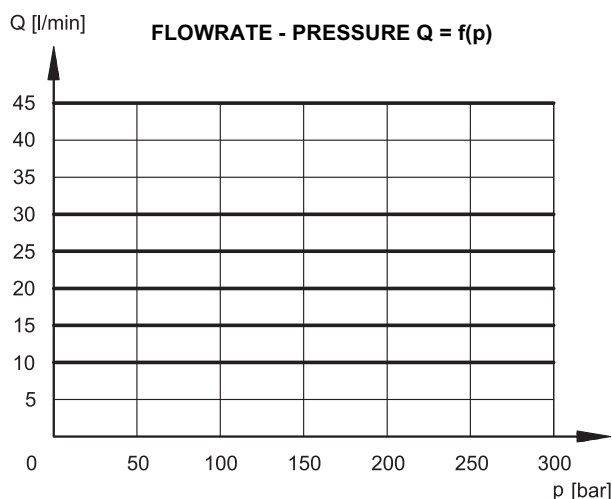
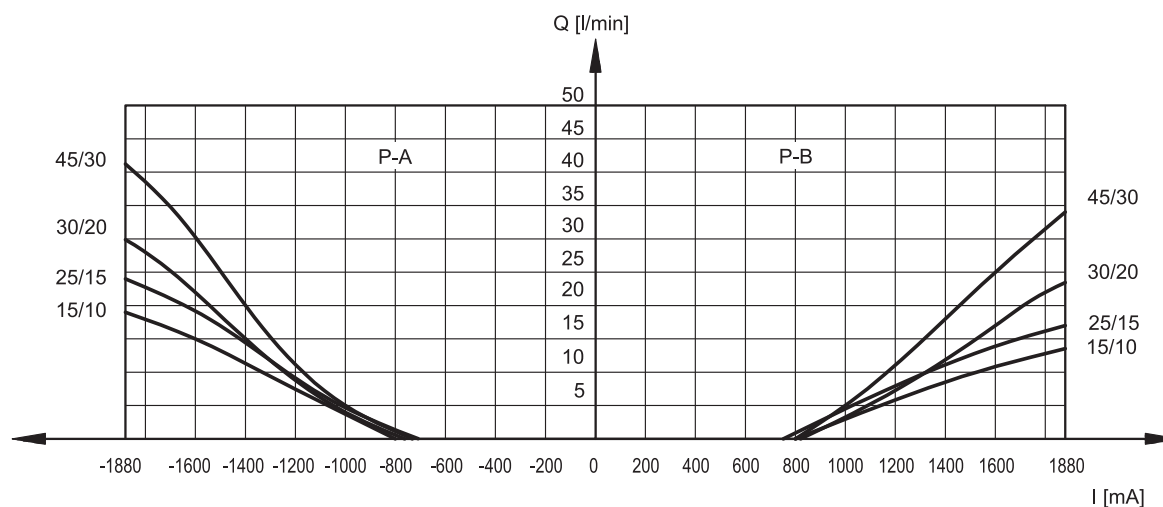
(values obtained with viscosity 36 cSt at 50 °C)

Typical constant flow rate obtained through the embedded compensator, and current with 12V solenoid type (for D24 version the maximum current is 860 mA), measured for the various spool types available.

**PROPORTIONAL MODULES PRESSURE DROPS  $\Delta p$ -Q  
SYMMETRICAL FLOWS - PC AND PA SPOOLS**



**ASYMMETRICAL FLOWS - PC and PA SPOOLS**



### 4 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>	<b>24</b>
<b>RESISTANCE (at 20°C)</b> <b>K1 coil</b> <b>K7 coil</b>	Ω	3.66 4	17.6 19
<b>NOMINAL CURRENT</b>	A	1.88	0.86
<b>DUTY CYCLE</b>		100%	
<b>PWM FREQUENCY</b>	Hz	200	100
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2004/108/EC		
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation:	class H class F		

#### Protection from atmospheric agents IEC EN 60529

Plug-in type	IP 65	IP 69 K
K1 DIN 43650	x (*)	
K7 DEUTSCH DT04 male	x	x (*)

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

### 5 - STEP RESPONSE

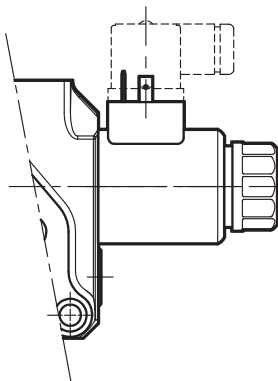
(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control units)

Step response is the time (delay) taken for the valve to reach 90% of the set position value following a step change of the reference signal.

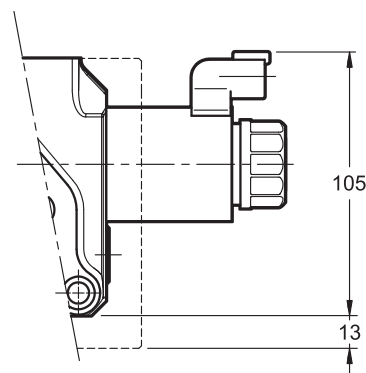
Reference signal step	0 →100%	100 →0%
STEP RESPONSE [ms]		
<b>BLS6</b>	50	40

### 6 - ELECTRIC CONNECTIONS

connection for DIN 43650 connector  
code **K1 (standard)**



connection for DEUTSCH DT04-2P connector type  
code **K7**

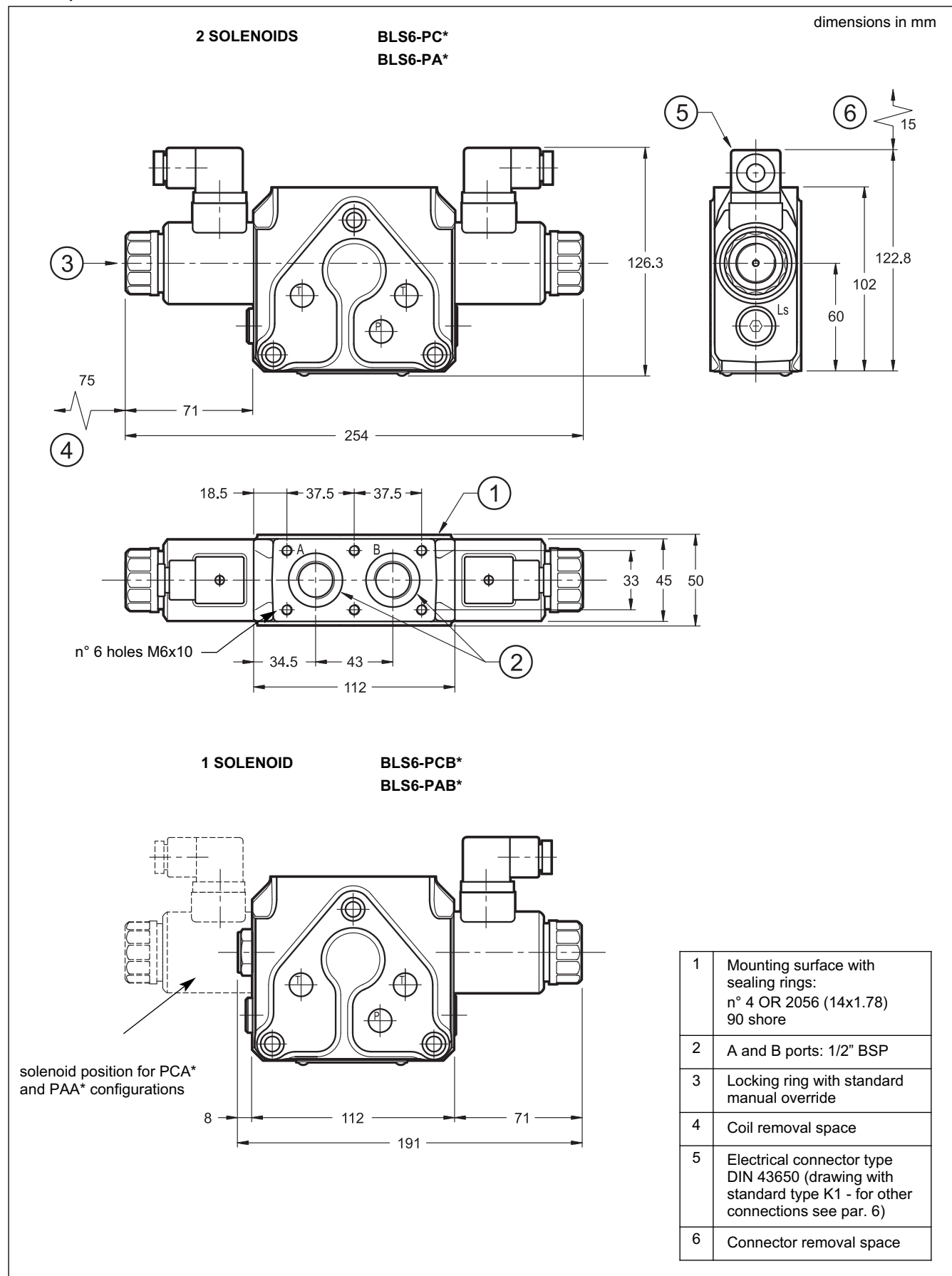


### 7 - ELECTRIC CONNECTORS

The on-off modules are supplied without connectors. For on-off coils with standard electrical connection K1 type (DIN 43650) the connectors can be ordered separately: see catalogue 49 000.

## 8 - OVERALL AND MOUNTING DIMENSIONS

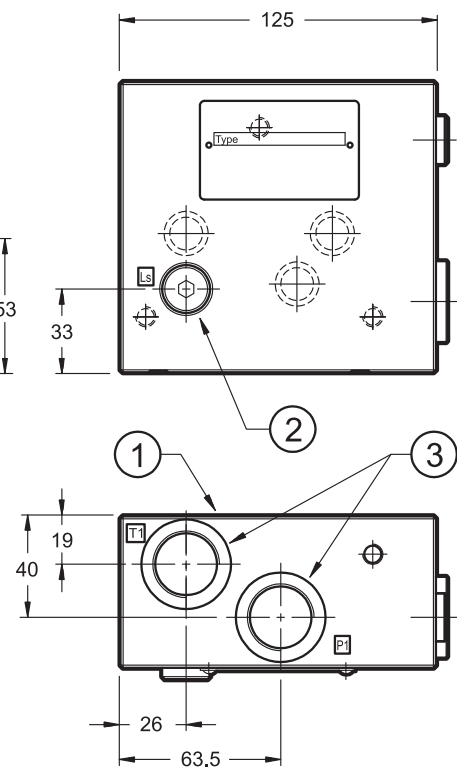
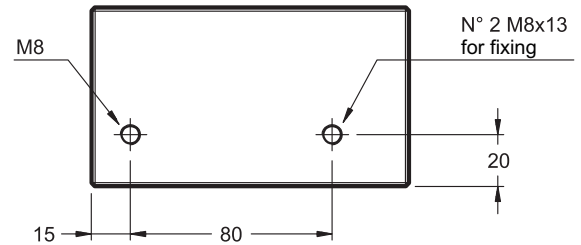
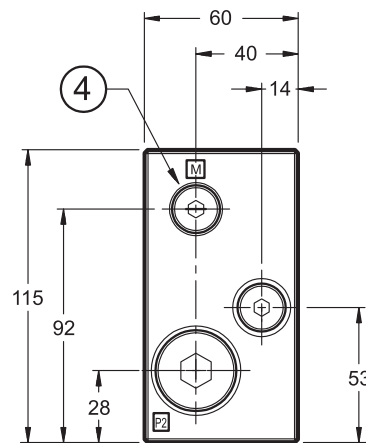
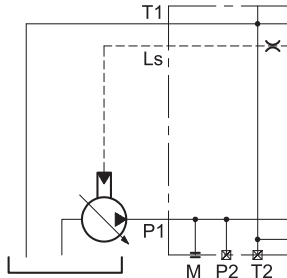
### 8.1 - Proportional module



## 8.2 - Inlet plates

dimensions in mm

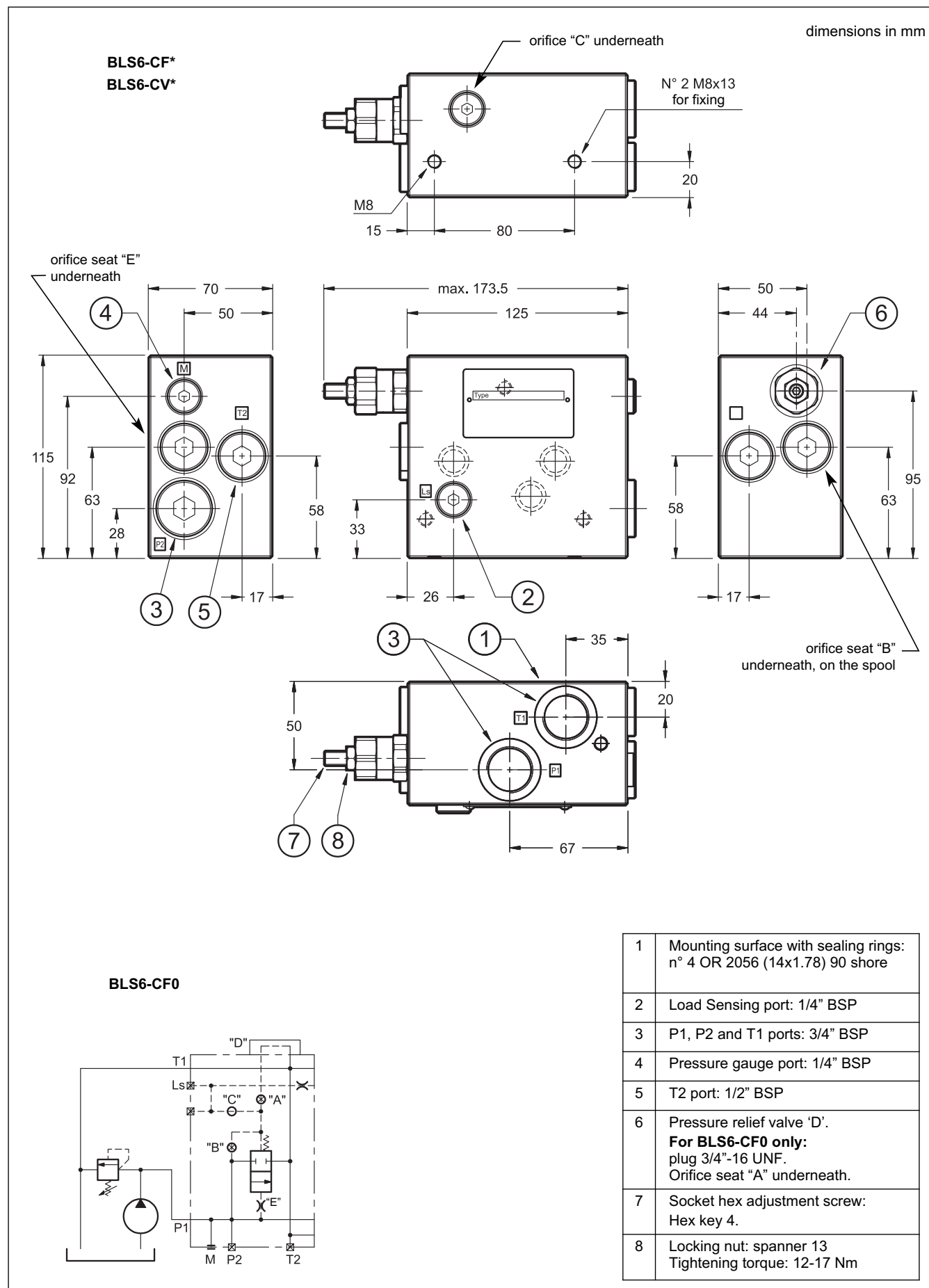
**BLS6-C00**

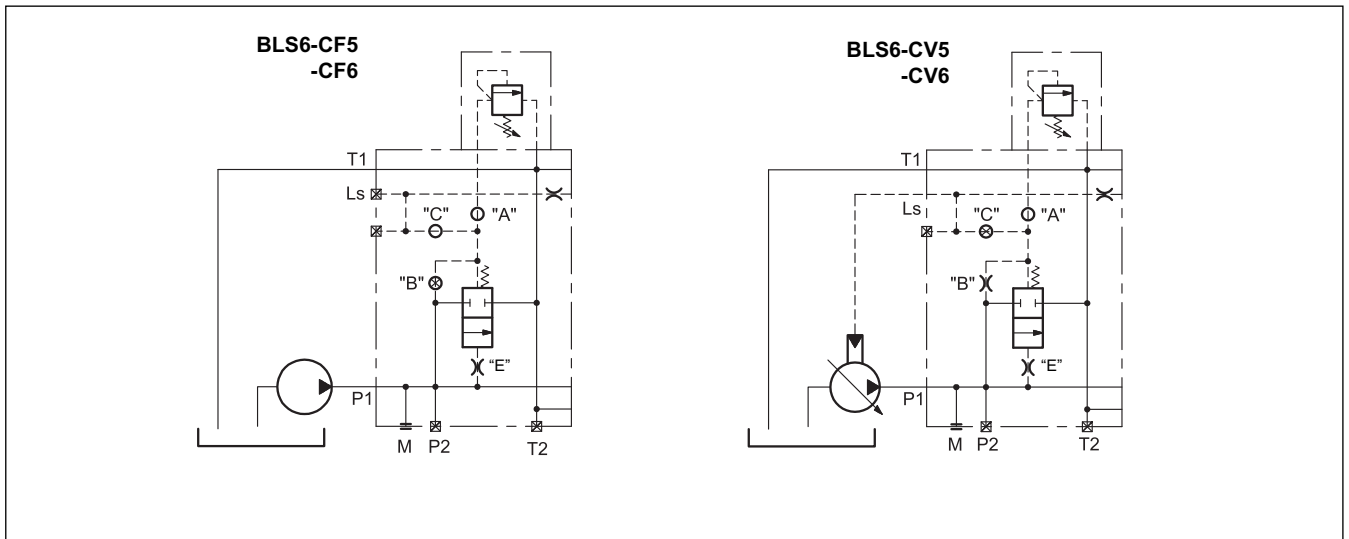


1	Mounting surface with sealing rings: n° 4 OR 2056 (14x1.78) 90 shore
2	Load Sensing port: 1/4" BSP with orifice
3	P1, P2 and T1 ports: 3/4" BSP
4	Pressure gauge port: 1/4" BSP

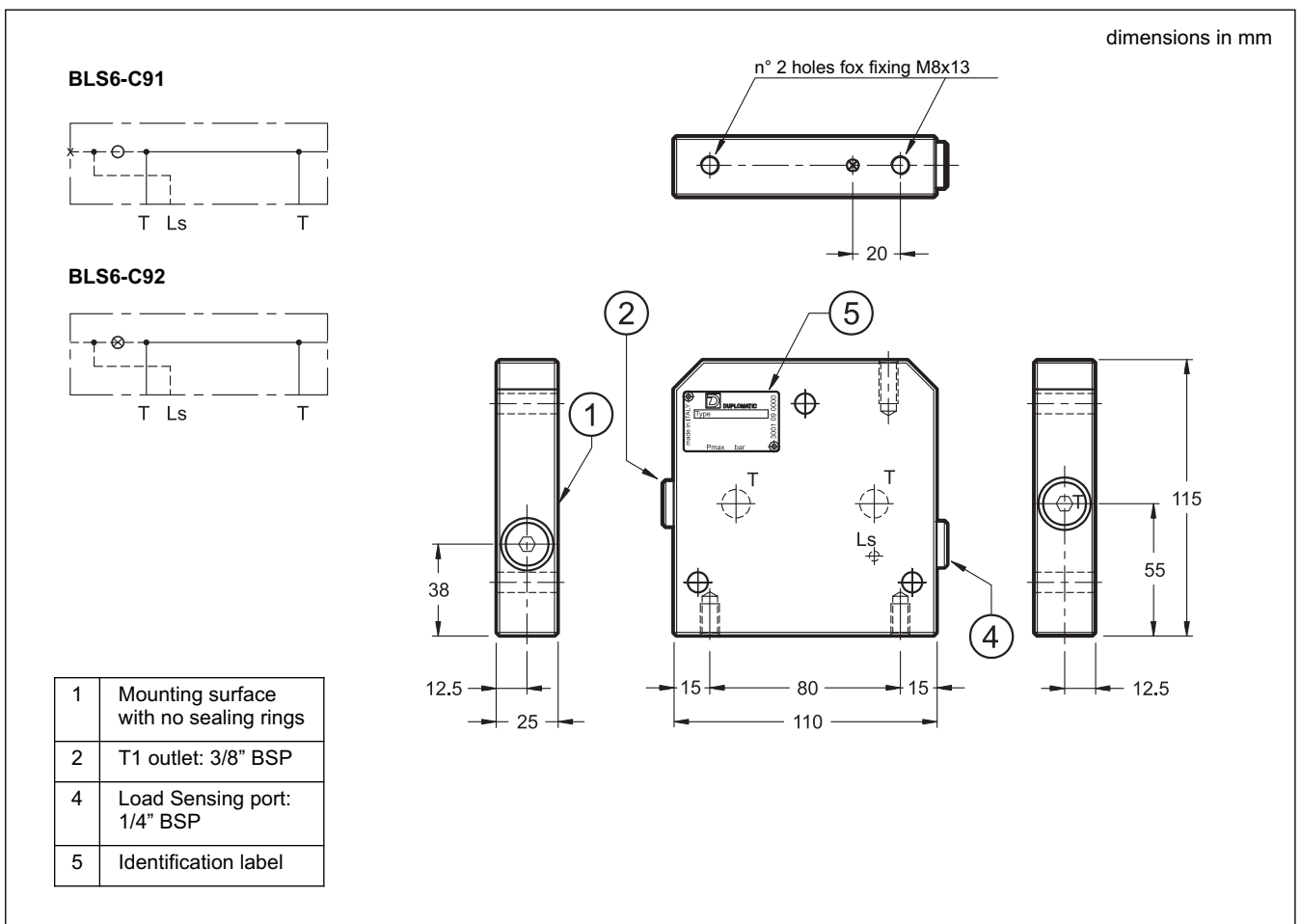


### 8.2 - Inlet plates





### 8.3 - End plates



## 9 - IDENTIFICATION CODE OF ASSEMBLED VALVE

BLS6	-			-		-		-		/ 12 V	-		/	
------	---	--	--	---	--	---	--	---	--	--------	---	--	---	--

Compensated direct operated directional valve with proportional control

Inlet module: \_\_\_\_\_  
**C0** = without compensator (**NOTE**)  
**CF** = for fixed pump  
**CV** = for variable pump

Pressure adjustment range: \_\_\_\_\_  
**0** = no relief valve  
**5** = from 12 to 210 bar  
**6** = from 15 to 315 bar

Proportional module: \_\_\_\_\_  
 Choose open or closed center, and then the spool type, like code in par. 1.1  
 Repeat for each proportional module required, max 8 modules.

End plate: \_\_\_\_\_  
**C91** = without load sensing port  
**C92** = with load sensing port

Manual override on all proportional modules (see par. 11)

Coil electrical connection: (see paragraph 6)  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K7** = plug for connector type DEUTSCH DT04-2P male

Coil type:  
**D12** = Nominal solenoid voltage 12V DC  
**D24** = Nominal solenoid voltage 24V DC

Seals:  
**V** = FPM seals (**standard**)

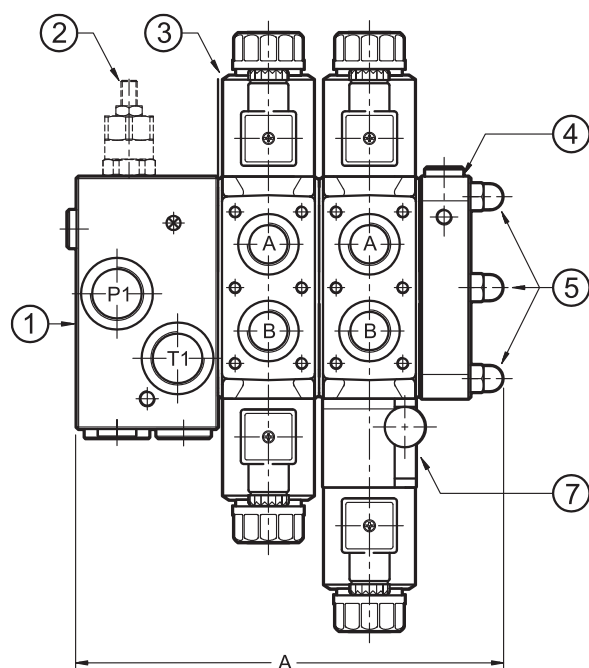
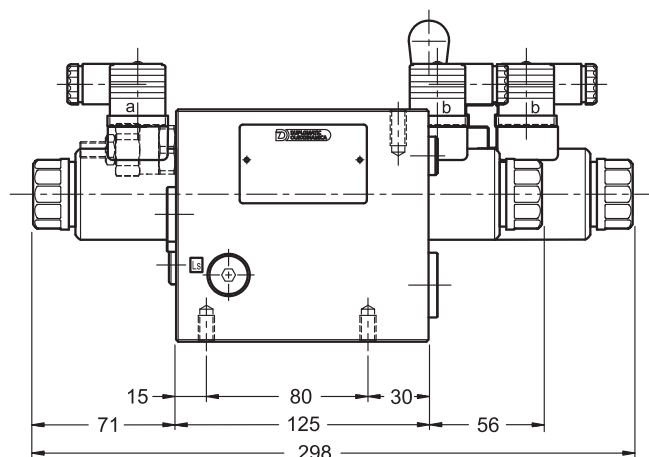
Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

**NOTE:** The version C0 is available only without the pressure relief valve, with code BLS6-C00/12V.

**Coding example:**  
**BLS6-C00-PC30/30-PC30/30-C92/12V-D24K1:** assembled valve includes: inlet module without 3 way compensator; 2 prop. modules with closed center flow 30/30; end plate without load sensing port; FPM seals, 24V DC coils and K1 connection.  
**BLS6-CF5-PA45/30-PA45/30-PC30/30-PAB15/15-C91/12V-D12K1:** assembled valve includes: inlet module for fixed pump, with pressure max 210 bar; 2 prop. modules with open center flow 45/30, 1 prop. module with close center, flow 30/30 and 1 prop. module with open center and solenoid only on side B, flow 15/15; end plate with load sensing port; FPM seals, 12V DC coils and K1 connection.

**NOTE:** To obtain the best performances, we suggest to mount the spool with the max flow first, and then the others decreasing.

dimensions in mm



Modules	A (NOTE)	B
2	212	132,5
3	262	182,5
4	312	232,5
5	362	282,5
6	412	332,5
7	462	382,5
8	512	432,5

**NOTE:** with the inlet plate BLS6-C00 the dimension is 10 mm shorter.

### Fixing kit

The fixing kit includes,  
all zinc-coated

3 studs,  
3 self locking nuts  
3 washers

To order it please use the following codes:

1	Inlet module
2	Pressure relief valve
3	Proportional modules
4	End plate
5	Fixing studs
6	Fixing holes
7	Manual lever override module

No. of body modules	Code
2	3404150010
3	3404150011
4	3404150012
5	3404150013
6	3404150014
7	3404150015
8	3404150016

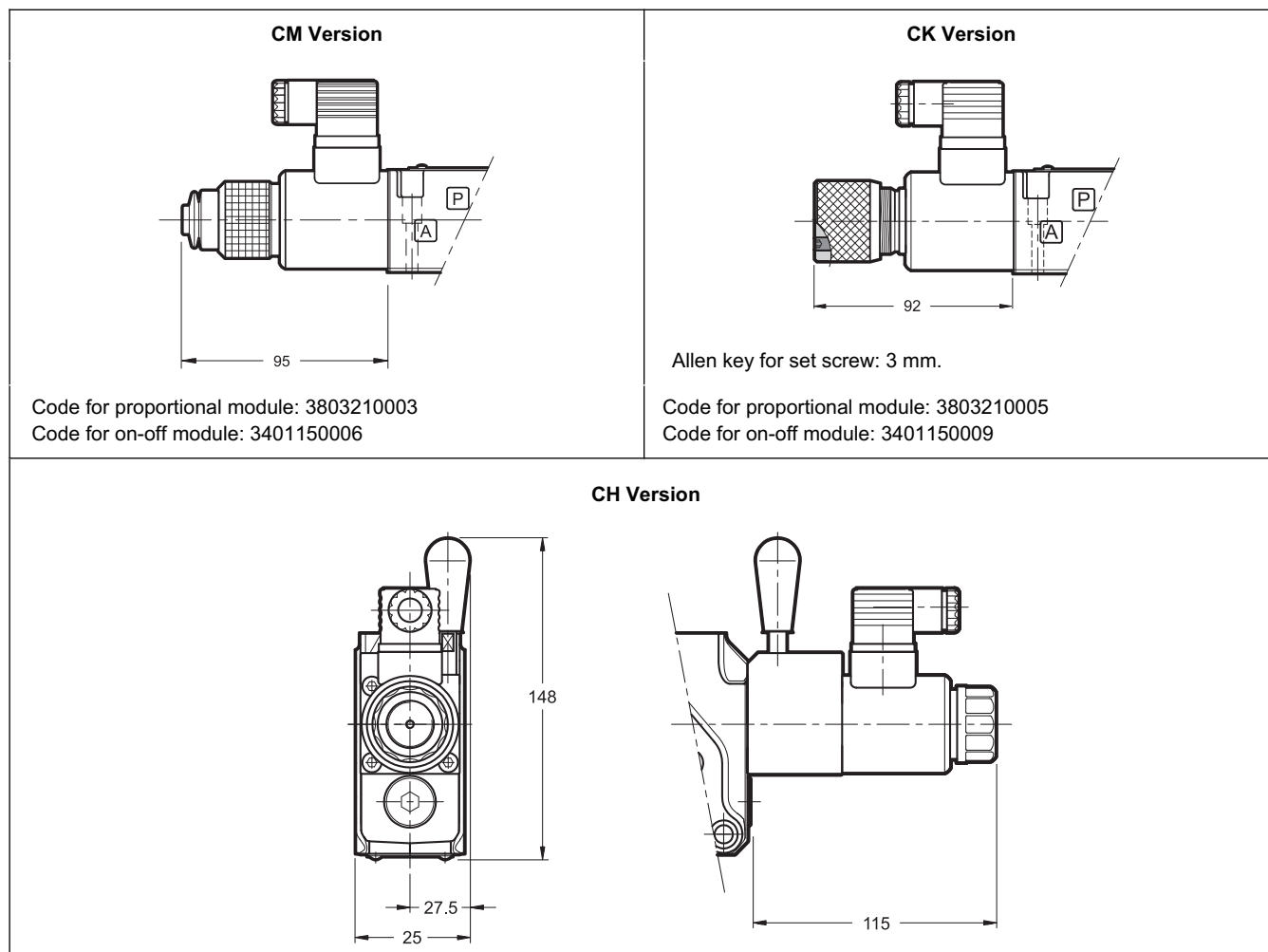
Tightening torque: 25 Nm

## 11 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Three different manual overrides are available upon request:

- **CM** manual override, boot protected.
- **CH** lever manual override.
- **CK** knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.



**NOTE:** The overall dimension shown in the drawings is for the proportional modules; In ON-OFF modules consider an increase of 5 mm compared to the reported dimensions.

### 12 - ELECTRONIC CONTROL UNITS

#### One solenoid

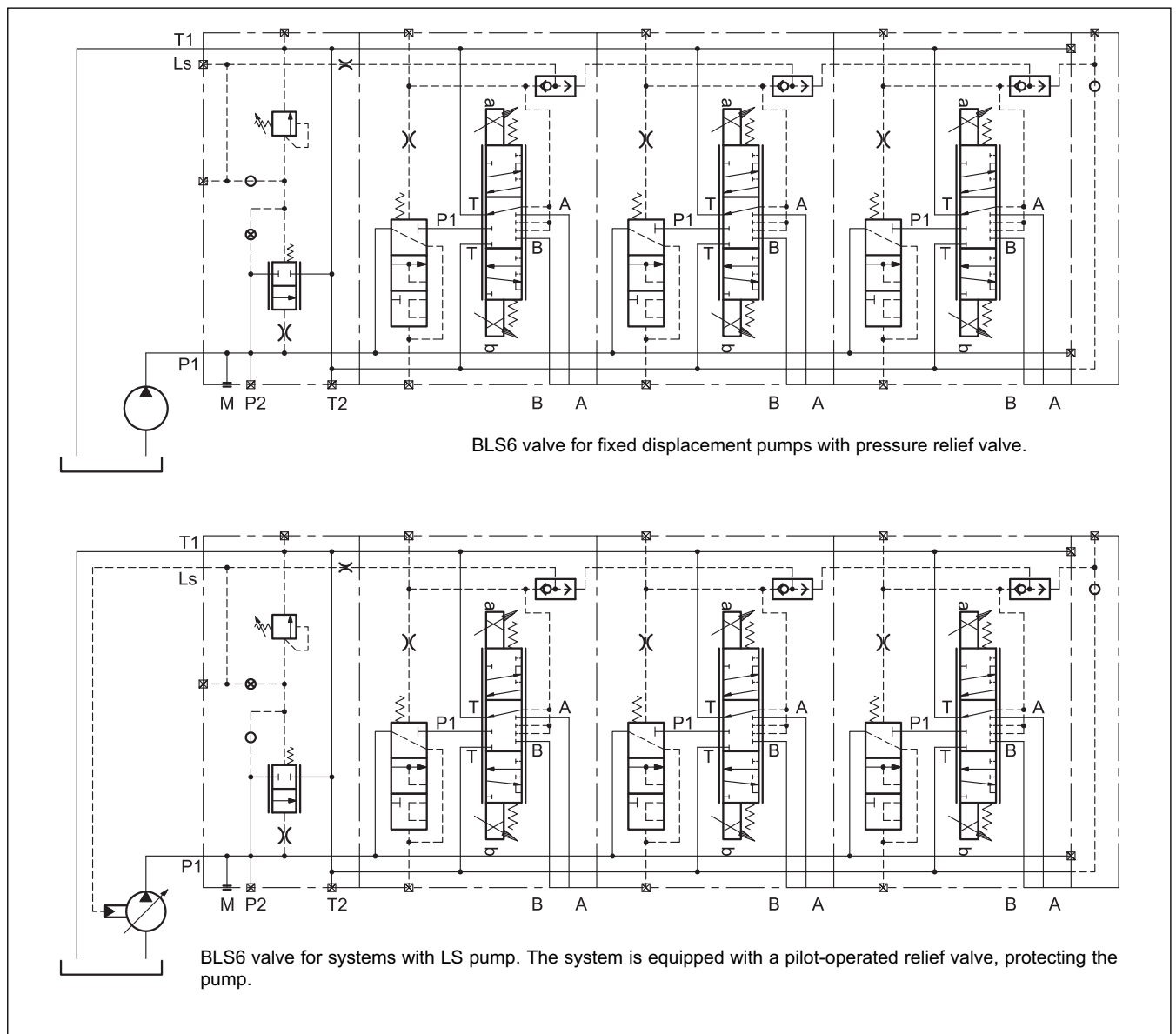
<b>EDC-111</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-141</b>	for solenoid 12V DC		
<b>EDM-M111</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M141</b>	for solenoid 12V DC		

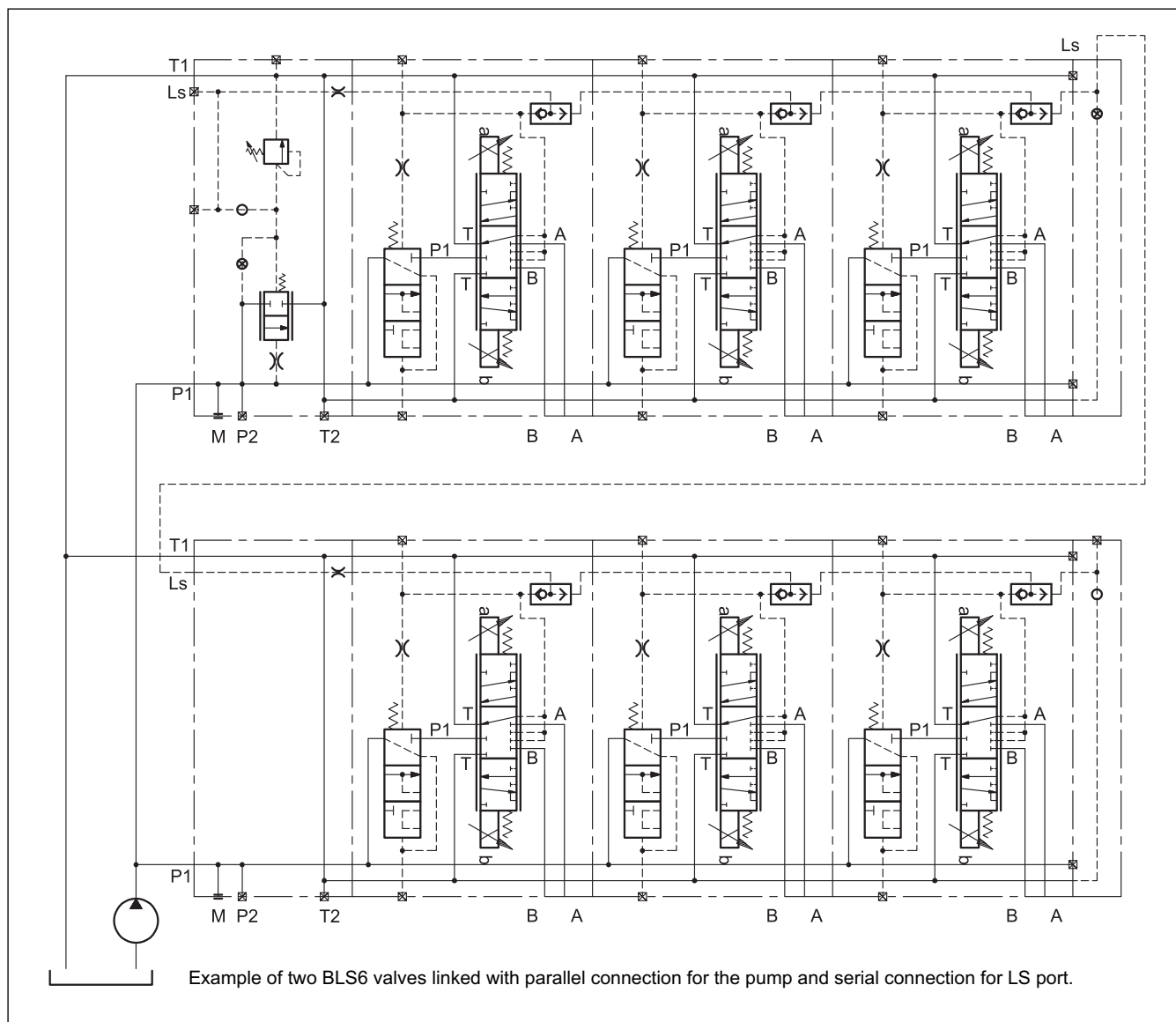
These cards drive only a module at once.  
Every module to be driven with electronic card must have its one.

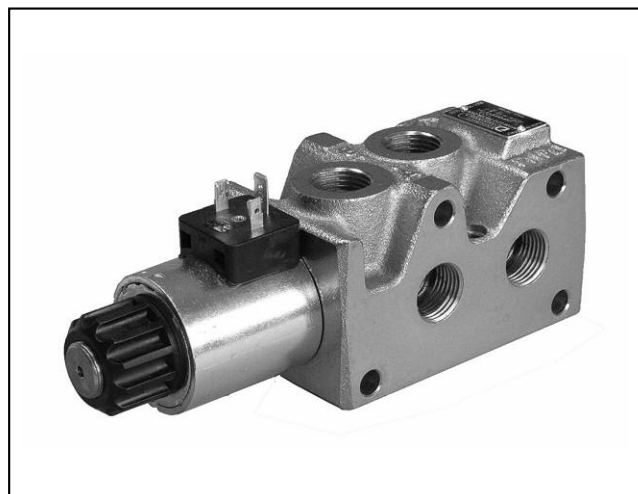
#### Two solenoids

<b>EDM-M211</b>	for solenoid 24V DC	rail mounting DIN EN 50022	see cat. 89 250
<b>EDM-M241</b>	for solenoid 12V DC		

### 13 - EXAMPLES OF APPLICATION







# **BFD\***

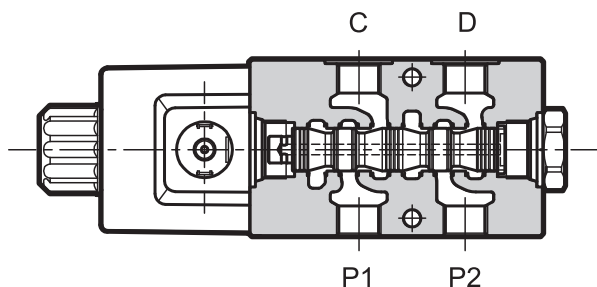
## **SIX WAYS BANKABLE FLOW DIVERTER**

### **SERIES 10**

**p** max **320** bar

**Q** max **90** l/min

#### OPERATING PRINCIPLE



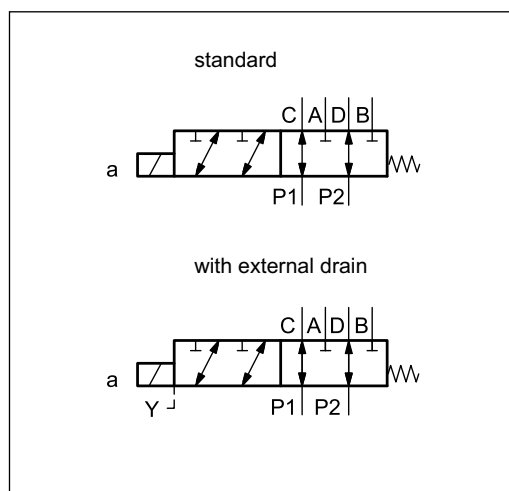
- BFD\* is a 6 ways bankable flow diverter that allows the simultaneous connection of two utilities, alternating the direction of flow through a solenoid operated directional valve.
- It is available in two sizes, depending on the requested flow, and is used mainly for compact applications for the mobile sector.
- The BFD\* valve is also suitable for series mounting, lining up to max 5 modules.
- The external drain is available as an option on both sizes.
- The BFD\* diverters are supplied with a finishing surface treatment zinc-nickel, suitable to ensure a salt spray resistance up to 240 hours. Versions with plastic coil or with zinc-nickel finished coil reach 600 hour resistance.

#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		BFD06	BFD10
Maximum operating pressure: - with drain Y	bar	250 320	
Maximum flow	l/min	60	90
Pressure drops Δp - Q	see paragraph 3		
Electrical features	see paragraph 6		
Operating limits	see paragraph 4		
Electrical connections	see paragraph 11		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	3	4,2
Surface treatment	zinc-nickel		

#### HYDRAULIC SYMBOL







## 1 - IDENTIFICATION CODE

<b>BFD</b>		<b>-</b>		<b>-</b>	<b>TA6</b>	<b>/</b>	<b>10</b>		<b>-</b>			<b>/</b>		
------------	--	----------	--	----------	------------	----------	-----------	--	----------	--	--	----------	--	--

Bankable 6 ways flow diverter

Nominal size \_\_\_\_\_  
**06** = 60 l/min  
**10** = 90 l/min

Ports: (see **NOTE 1**) \_\_\_\_\_  
**G038** = 3/8" BSP (for BFD06 only)  
**G012** = 1/2" BSP

Spool type \_\_\_\_\_

Series: \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Option:  
**Y** = External drain  
(see par. 13.1)

Manual override: (see par. 14)  
Omit for override integrated in the tube (**standard**)  
**CM** = boot protected  
**CK** = knob

Coil electrical connection  
**K1** = plug for DIN 43650 connector (**standard**)  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available only for BFD06)  
**NOTE fo BFD06:** to obtain a salt spray resistance up to 600 hours buy coil type:  
**WK1** = plug for DIN 43650 connector  
**WK7D** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S, with diode.  
These versions include the CM manual override to protect the solenoid tube.  
WK1 e WK7D connections are available for D12 and S24 coils only.  
(see sections 6 and 11)

Coil type  
**D12** = 12 V  
**D24** = 24 V  
**D28** = 28 V (BFD06 only)  
**D00** = valve without coils (see **NOTE 2**)

**NOTE 1:** On BFD06 are available upon request for the threads 3/4" 16 UNF (**S08**).

**NOTE 2:** The locking rings of the coils and the relevant O-Rings are supplied together with valves.

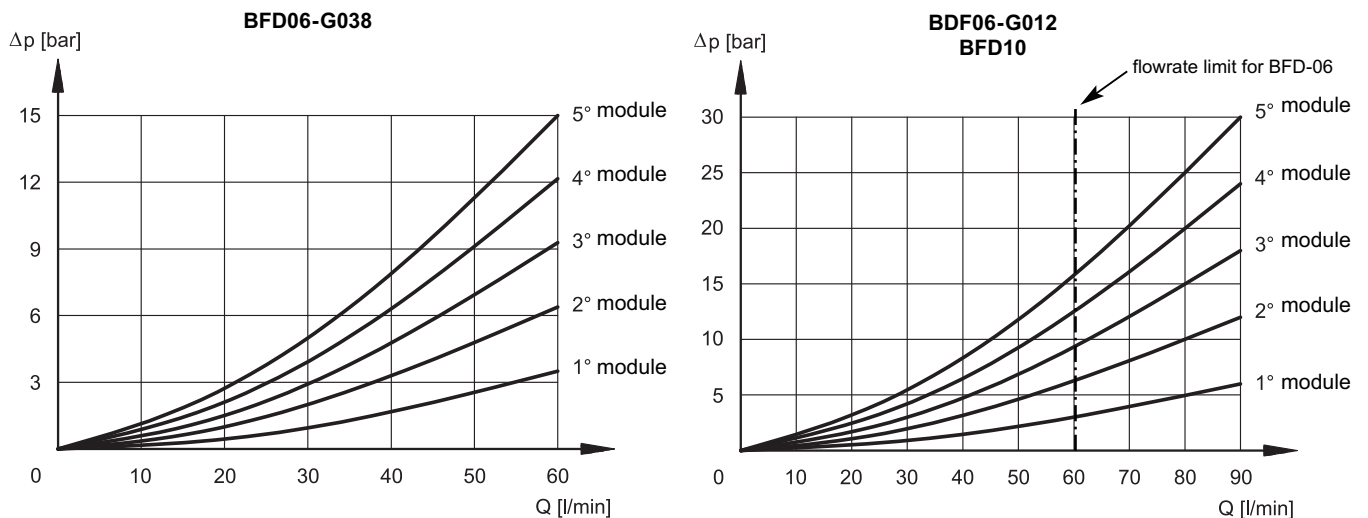
## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - CHARACTERISTIC CURVES

(obtained with viscosity 36 cSt at 50 °C)

### 3.1 - Pressure drops $\Delta p$ -Q at initial position

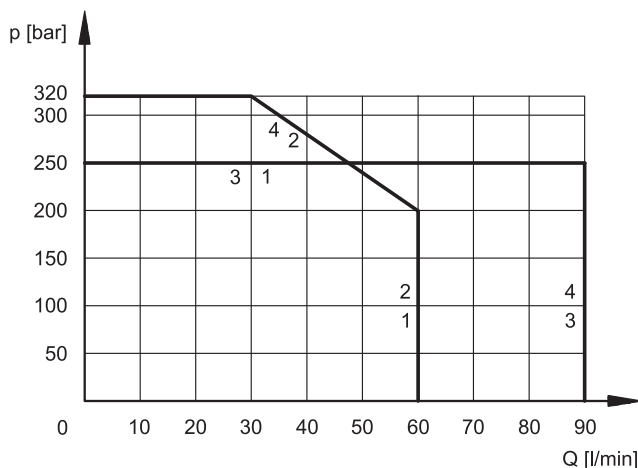


## 4 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



VALVE	CURVE
BFD06	1
BFD06*/Y	2
BFD10	3
BFD10*/Y	4

## 5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES ms ( $\pm 10\%$ )	ENERGIZING	DE-ENERGIZING
<b>BFD06</b>	25 ÷ 75	20 ÷ 50
<b>BFD10</b>	50 ÷ 100	20 ÷ 40



## 6 - ELECTRICAL CHARACTERISTICS

### 6.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

#### Protection from atmospheric agents EN 60529

Plug-in type	IP
K1 DIN 43650	IP 65
K7 DEUTSCH DT04 male	IP 69 K

**NOTE:** The protection degree is guaranteed only with the connector correctly connected and installed.

**NOTE 2:** In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 2)</b>	In compliance with 2004/108/EC
<b>LOW VOLTAGE</b>	In compliance with 2006/95/EC
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation	class H class F (BFD06) class H (BFD10)

### 6.2 - Current and absorbed power

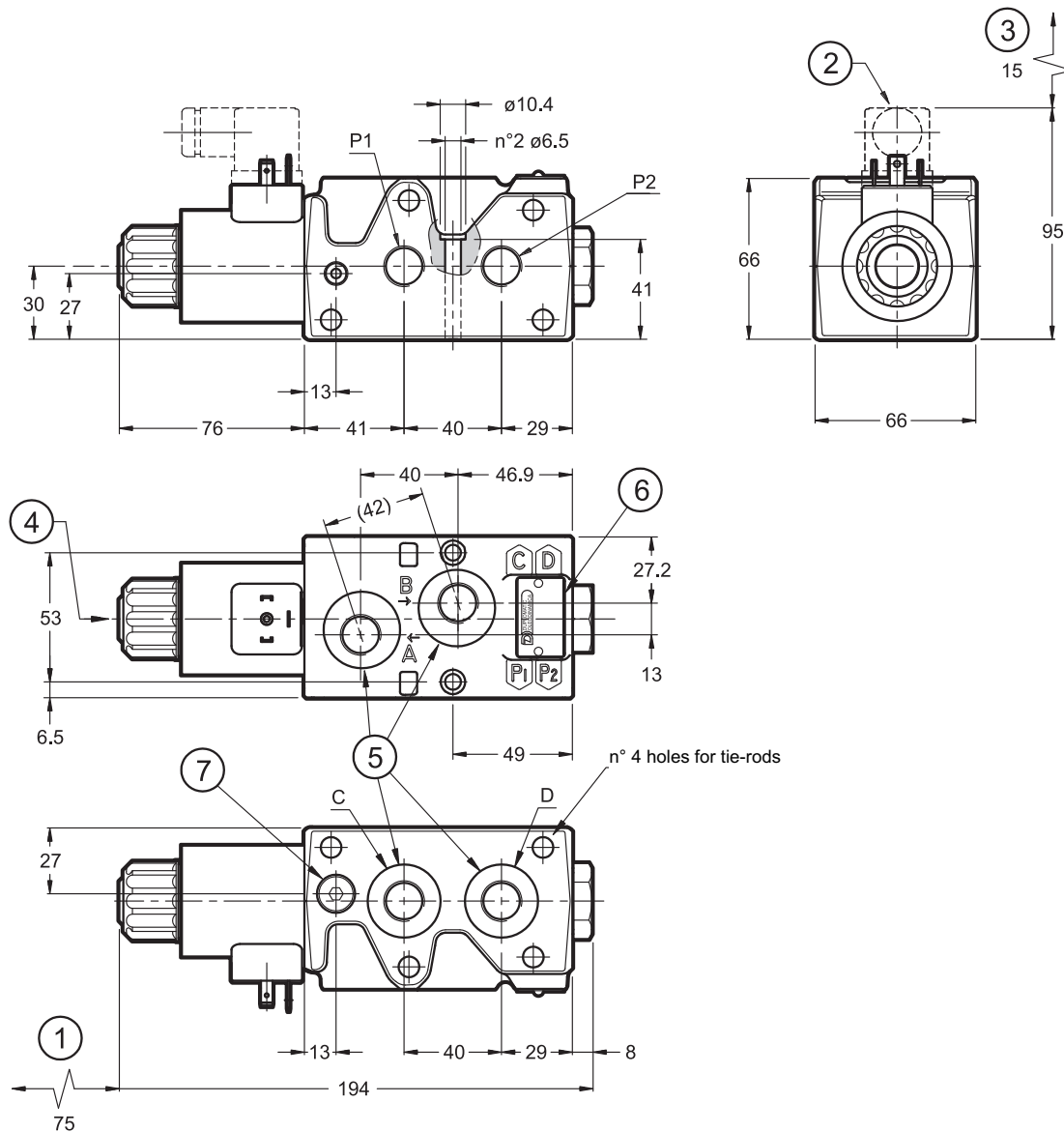
WK1 and WK7D coils have a zinc-nickel surface treatment and are specific for the high resistant version to salt spray.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

Valve	Coil	Resistance at 20°C [Ω] (±5%)	Current consumption [A] (±10%)	Absorbed power [W] (±10%)	Coil code			
					K1	WK1	K7	WK7D
<b>BFD06*</b>	<b>D12</b>	4 ÷ 5	2,72	32,7	1903080	1903050	1902940	1903400
	<b>D24</b>	18 ÷ 19,5	1,29	31	1903081	1903051	1902941	1903401
	<b>D28</b>	24,5 ÷ 27	1,11	31	1903082	-		
<b>BFD10*</b>	<b>D12</b>	2,9	4,14	50	1903150	-		
	<b>D24</b>	12,3	1,95	47	1903151	-		

## 7 - BFD06-G038 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

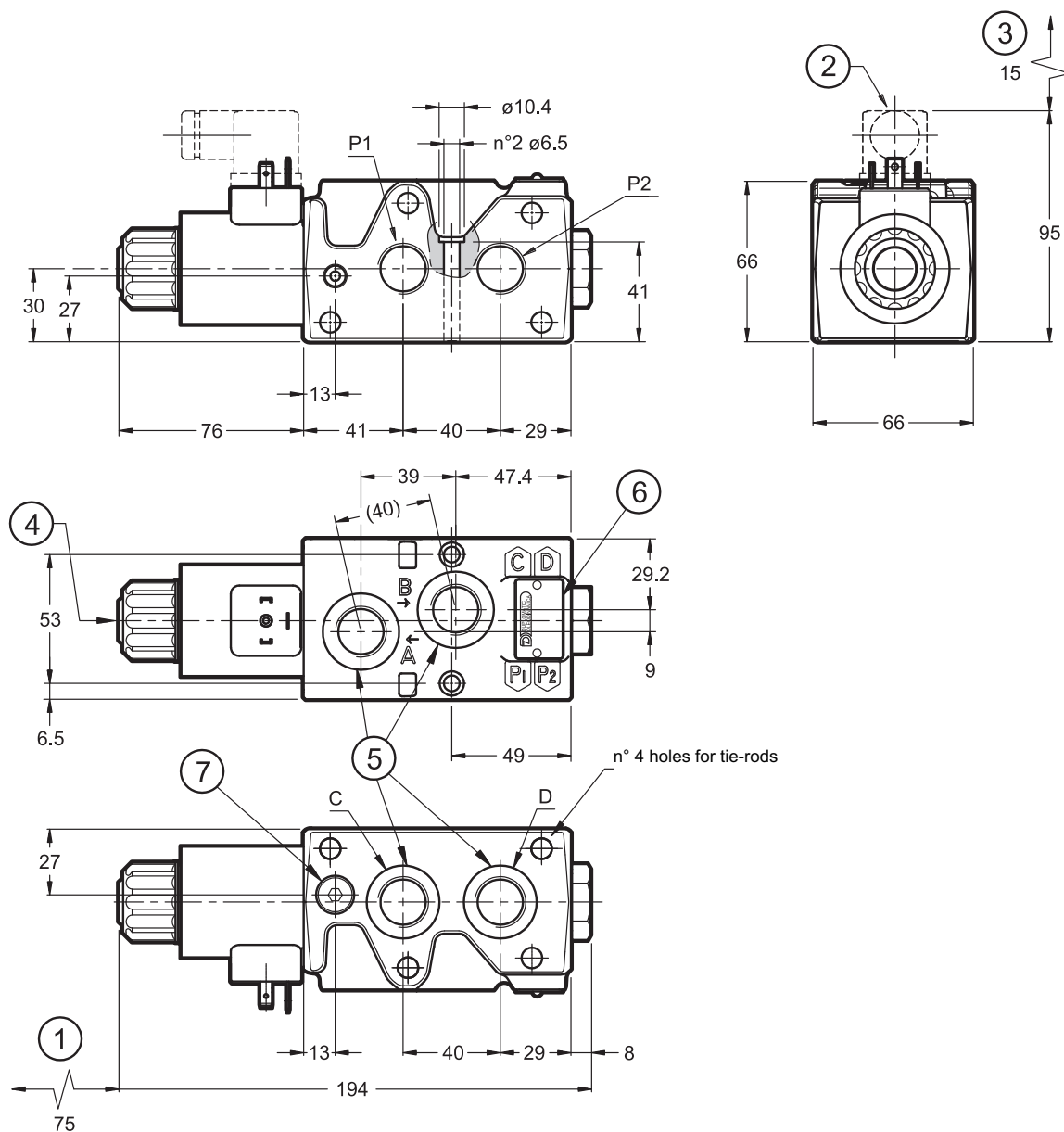


1	Coil removal space
2	DIN 43650 electrical connector
3	Connector removal space (representation with standard connection type K1 - for connection K7 see par. 11)
4	Standard manual override included in the solenoid tube
5	Ports: 3/8" BSP
6	Identification label
7	Option: external drain port Y 1/8" BSP

Fastening of single valve: 4 SHC screws ISO 4762 M6x50
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x12

## 8 - BFD06-G012 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

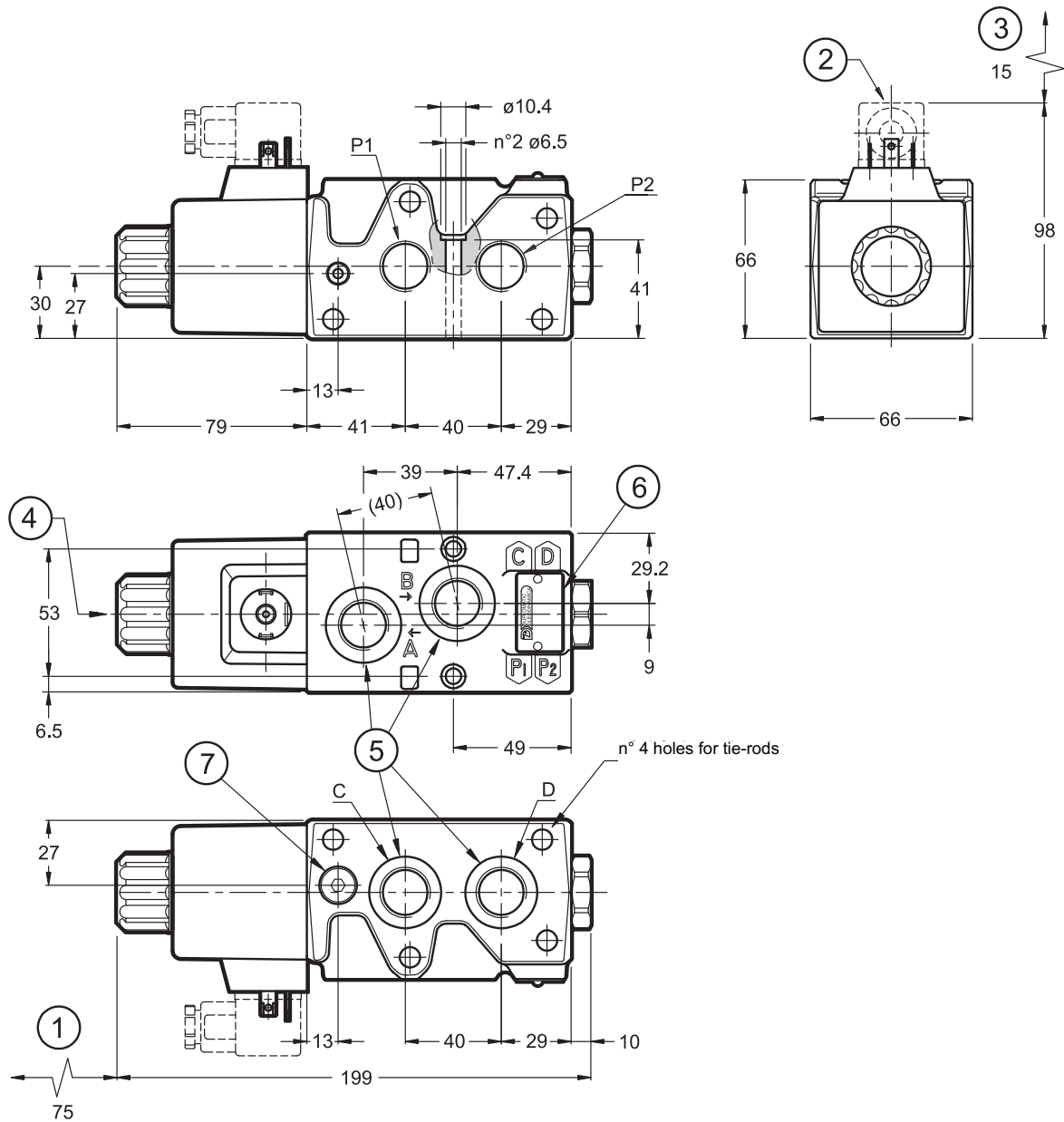


1	Coil removal space
2	DIN 43650 electrical connector
3	Connector removal space (representation with standard connection type K1 - for connection K7 see par. 11)
4	Standard manual override included in the solenoid tube
5	Ports: 1/2" BSP
6	Identification label
7	Option: external drain port Y 1/8" BSP

Fastening of single valve: 4 SHC screws ISO 4762 M6x50
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x12

## 9 - BFD10 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Fastening of single valve: 4 SHC screws ISO 4762 M6x50

Tightening torque: 8 Nm (A8.8 screws)

Threads of mounting holes: M6x12

1	Coil removal space
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override included in the solenoid tube
5	Ports: 1/2" BSP
6	Identification label
7	Option: external drain port Y 1/8" BSP

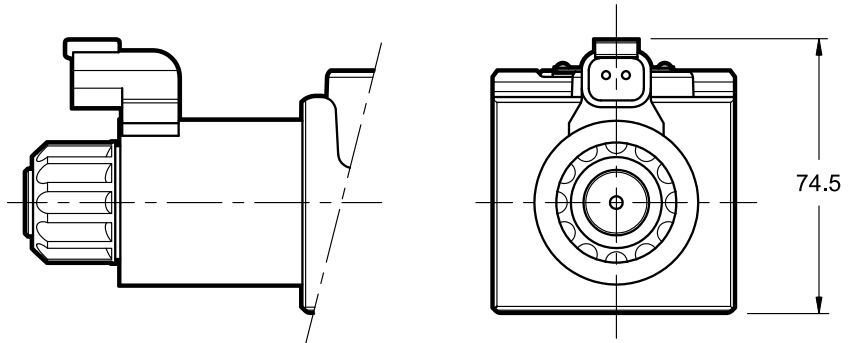
### 10 - INSTALLATION

The solenoid operated valve can be installed in any position without undermining the proper functioning.

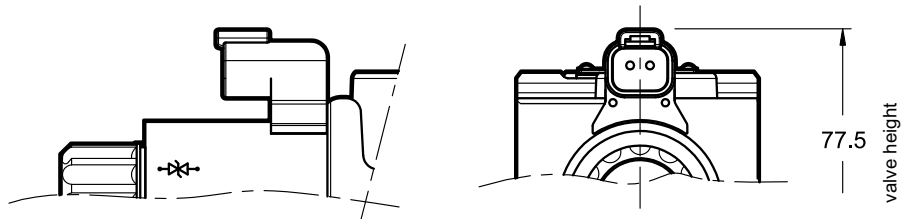
### 11 - ELECTRICAL CONNECTIONS

The standard connection K1 (for connector DIN 43650) is described in the dimension drawings. The K7 and WK7D connections are only available for BFD06\* valves.

connection for plug DEUTSCH DT04-2P  
for male connector type DEUTSCH  
DT06-2S  
code **K7**



connection for plug DEUTSCH DT04-2P  
for male connector type DEUTSCH  
DT06-2S  
code **WK7D** (W7 version only)



### 12 - ELECTRICAL CONNECTORS

The solenoid valves are supplied without connectors. For coils with standard electrical connection K1 type (DIN 43650) the connectors can be ordered separately: see catalogue 49 000.

### 13 - OPTIONS

#### 13.1 - Subplate external drain port (option Y)

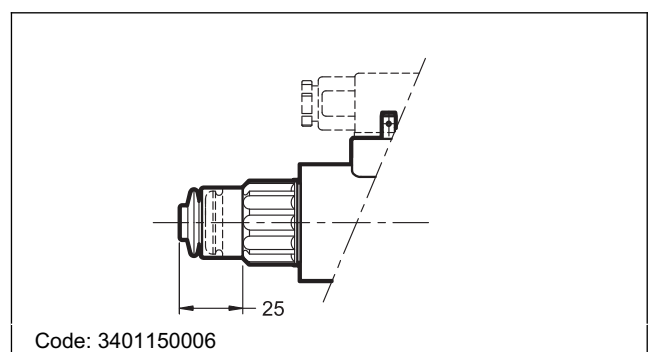
This version allows the operation with pressures up to 320 bar on the ports.

It consists in a Y drain hole realized on the valve coupling interface, where the Y port is connected with the solenoid tubes: in this way the tubes are not stressed by the pressure operating on the valve ports.

### 14 - MANUAL OVERRIDES

#### 14.1 - Boot manual override

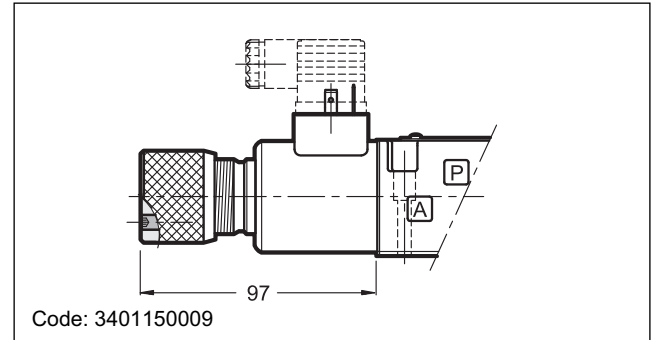
The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface. Option is available on both versions.



#### 14.2 - Knob

When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.

Spanner: 3 mm

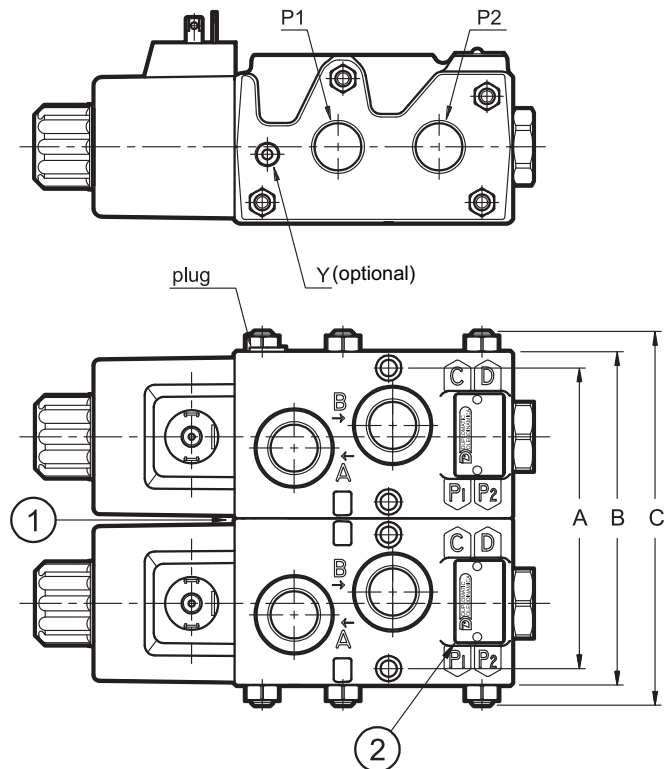
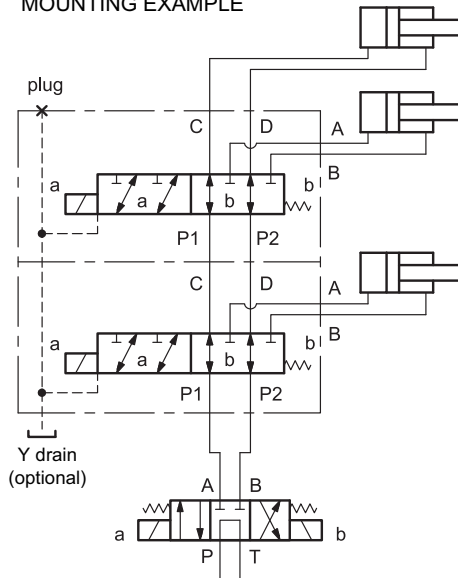


### 15 - SERIES CONFIGURATION

The BFD\* valve can also be assembled in series, bundled up to 5 individual modules. The fixing kit must be ordered separately. It includes: rods and screws, nuts, security washers and OR, as indicated in the table below.

#### 15.1 - Hydraulic scheme, dimensions and installation

##### MOUNTING EXAMPLE



1	Mounting surface with sealing rings: OR 2106 (26.7x1.78) 90 shore additional just for Y version: OR 2050 (12.42x1.78) 90 shore
2	Identification label

Tightening torque: 17 Nm

modules no.	ways no.	A	B	C	bolts or tie-rods	nuts & washers	Qty. OR 2106	Qty. OR 2050	kit BFD*/10N	kit BFD*/10V
2	8	119	132	156	4 bolts M8x145	4+4	2	1	3404200002	3404200012
3	10	185	198	220	4 tie-rods M8x200	8+8	4	2	3404200003	3404200013
4	12	251	264	285	4 tie-rods M8x265	8+8	6	3	3404200004	3404200014
5	14	317	330	350	4 tie-rods M8x330	8+8	8	4	3404200005	3404200015





**BFD\***  
SERIES 10



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# VR\*-I

## CHECK VALVES

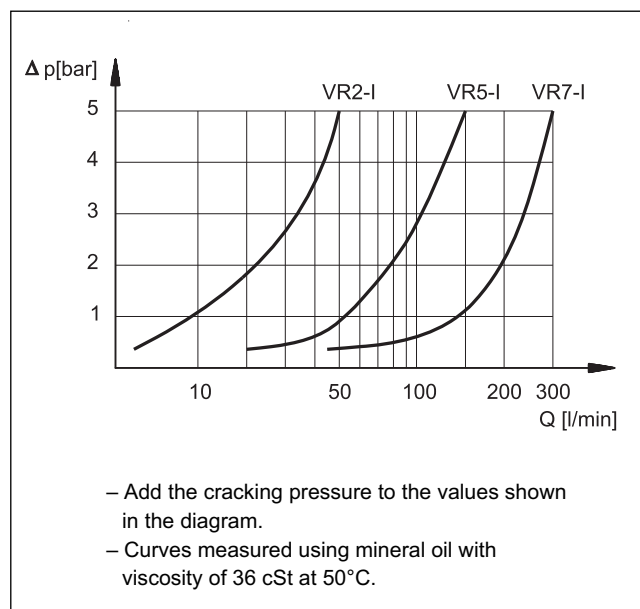
### SERIES 32

#### CARTRIDGE TYPE

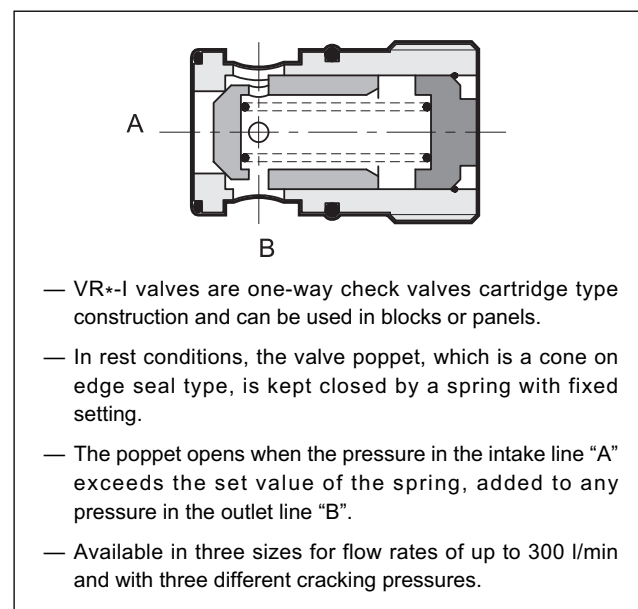
**p** max (see table of performances)

**Q** max (see table of performances)

#### PRESSURE DROP $\Delta P$ -Q



#### OPERATING PRINCIPLE

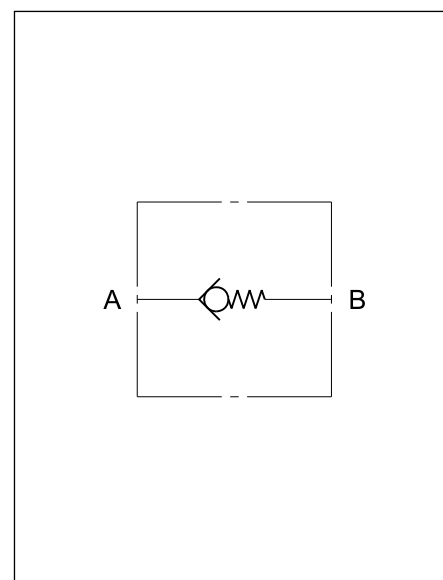


#### PERFORMANCES

valve code	nominal dimension	maximum flow rate [l/min]	mass [kg]	max operating pressure [bar]	
				continuous	peak
VR 2- I	1/4"	50	0,1	320	320
VR 5- I	3/4"	150	0,2	250	320
VR 7- I	1 1/4"	300	0,8		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Viscosità raccomandata	cSt	25

#### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE

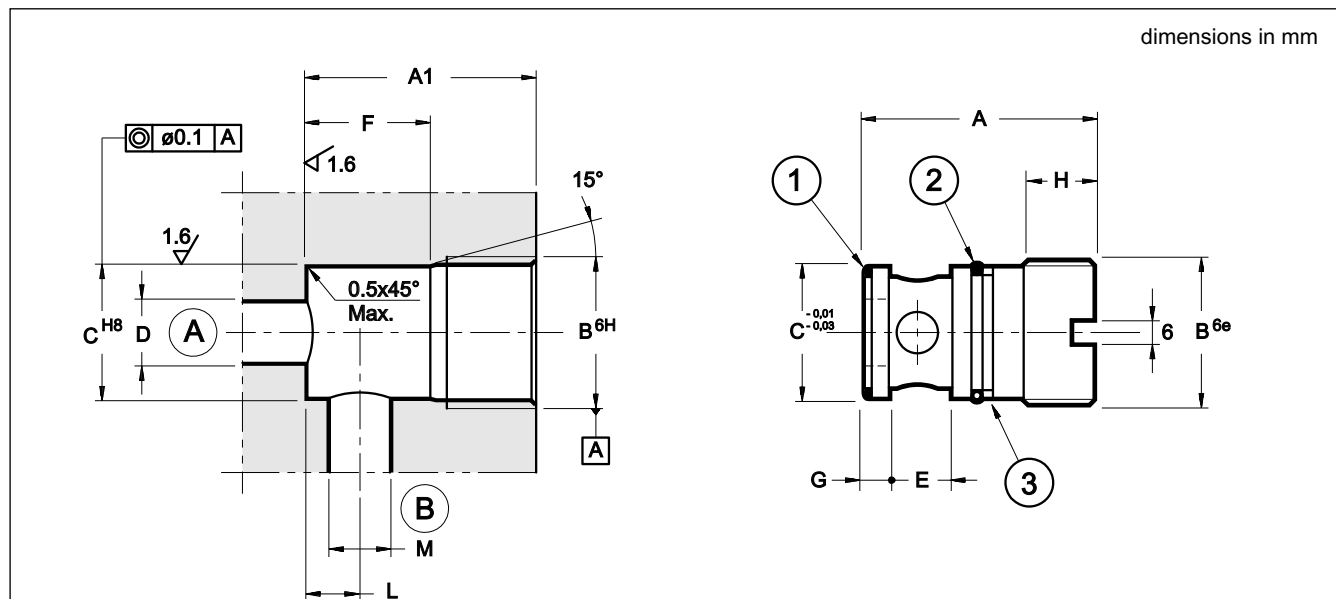
	V	R		-	I		/	32	/	
Check valve										
Nominal dimension: 2 = 1/4"    5 = 3/4"    7 = 1 1/4"										
Cartridge type										
							Seals: omit for mineral oils V = viton for special fluids			
							Series No.: (the overall and mounting dimensions remain unchanged from 30 to 39)			
							Cracking pressure: 1 = 0,5 bar    3 = 5 bar    4 = 10 bar			

### 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 3 - OVERALL AND MOUNTING DIMENSIONS



**NOTE:** the dimension **A1** must be at least 1 mm higher than the dimension **A** indicated in the table herebelow.

	A	B	ØC	ØD max	E	F	G	H	L	ØM max	1	2	3	tightening torque
VR 2 - I	41	M24x1,5	22	9	10	22	4	14	9	9	OR 119 (15.08x2.62)	OR 3068 (17.13x2.62)	Parbak 8-115	25 Nm
VR 5 - I	43	M30x1,5	27	15	13,5	26	4,5	12	11	12	OR 3081 (20.24x2.62) 90 Shore	OR 2093 (23.52x1.78)	Parbak 8-021	50 Nm
VR 7 - I	72	M45x2	41	21	20	40	7,5	22	16,5	16	OR 3137 (34.60x2.62)	OR 4137 (34.52x3.53) 90 Shore	Parbak 8-220	80 Nm



# **VSK\***

## **SHUTTLE VALVE**

### **SERIES 10**

#### **CARTRIDGE TYPE**

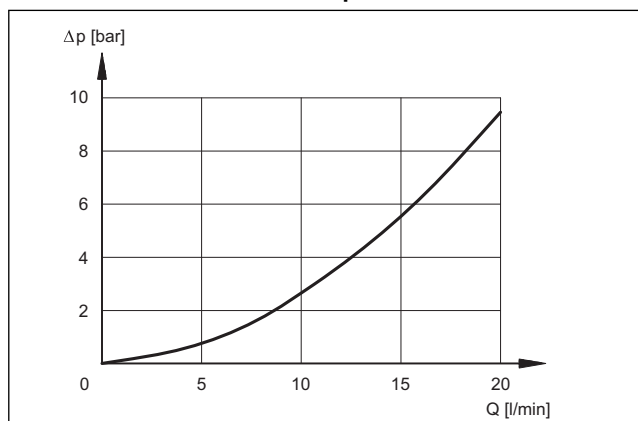
**p** max **350** bar

**Q** max (see table of performances)

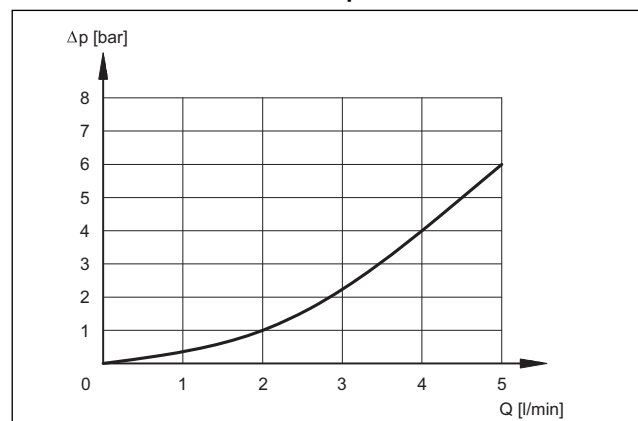
#### **OPERATING PRINCIPLE**

- The VSK\* valves are shuttle type, cartridge version and it can be used in panels and blocks.
- The valve select the higher pressure signal between “1” and “3” through the output port “2”
- The VSK1 reaches flows up to 20 l/min.
- The VSK2 is a shuttle valve for pilot signals up to a 3 l/min flows.

#### **VSK1 PRESSURE DROPS $\Delta p$ -Q**



#### **VSK2 PRESSURE DROPS $\Delta p$ -Q**

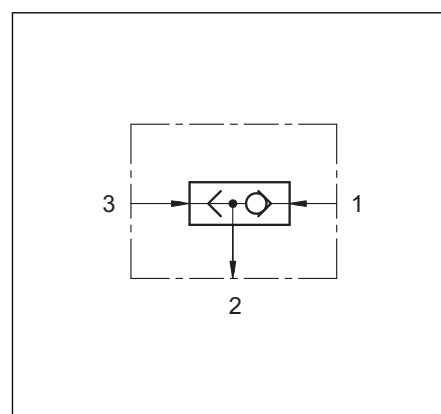


#### **PERFORMANCES**

valve	max flow [l/min]	mass [kg]
<b>VSK1</b>	20	0,013
<b>VSK2</b>	3	0,013

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

#### **HDRAULIC SYMBOL**



## 1 - IDENTIFICATION CODE

V	S	K	/	10
---	---	---	---	----

Shuttle valve \_\_\_\_\_

Cartridge type \_\_\_\_\_

Nominal size: \_\_\_\_\_

1 = shuttle for flows up to 20 l/min  
2 = shuttle for piloting signals up to 3 l/min

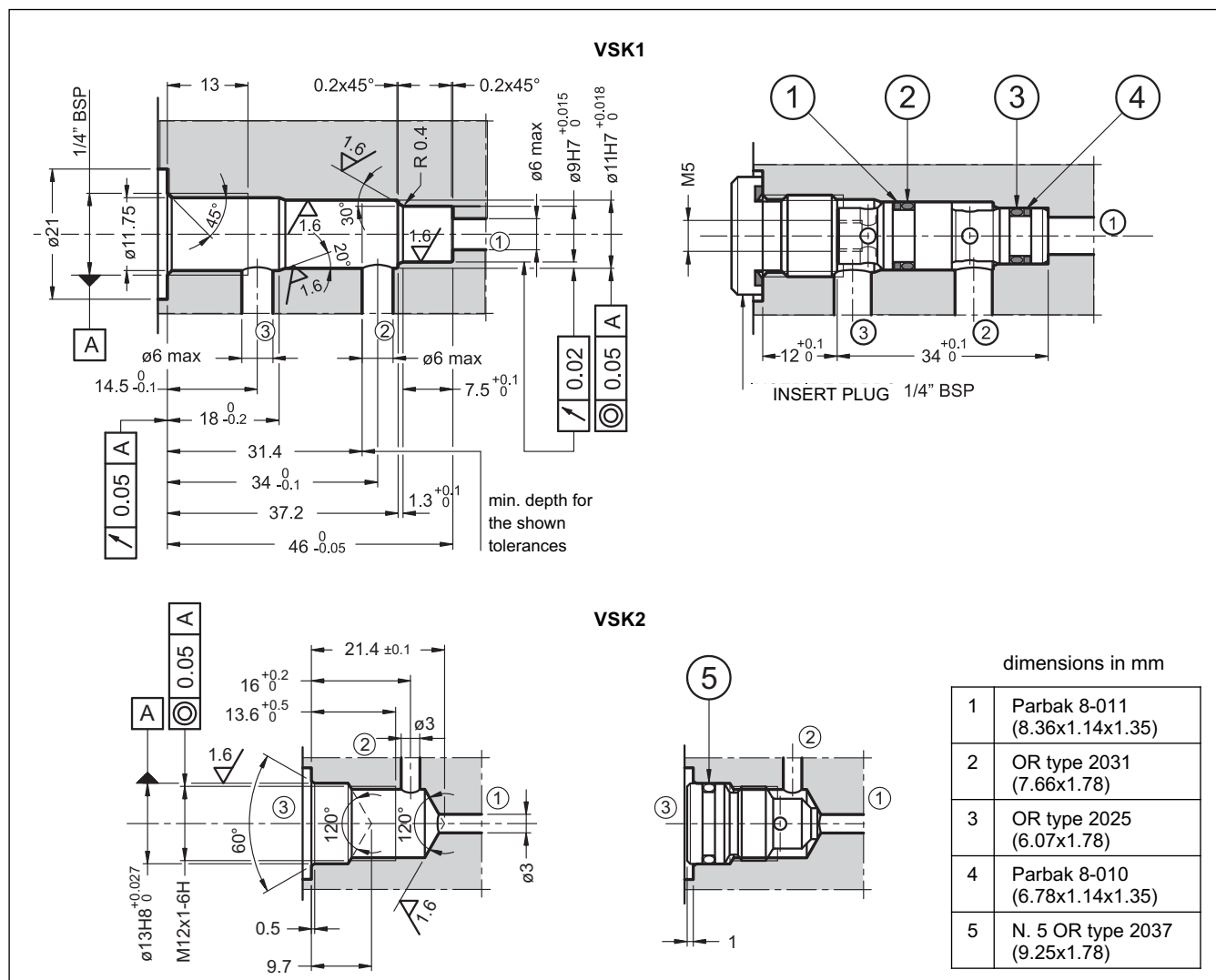
Seals:  
N = for mineral oils (**standard**)  
V = viton for special fluids

Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)

## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - OVERALL AND MOUNTING DIMENSIONS





## VD\*-W\*

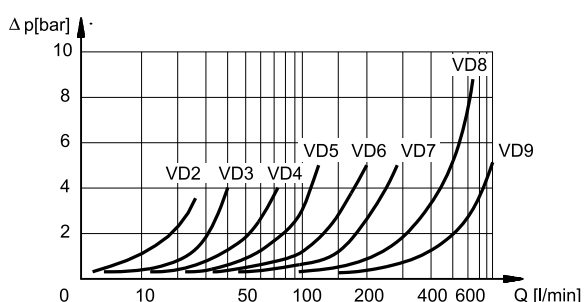
### CHECK VALVES

### SERIES 30

**p** max **400** bar

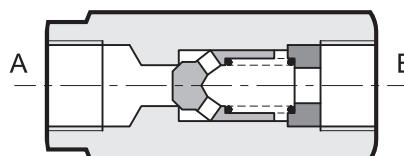
**Q** max (see table of performances)

#### PRESSURE DROPS $\Delta p$ -Q



- Add the cracking pressure to the values shown in the diagram.
- Curves measured using mineral oil with viscosity of 36 cSt at 50°C.

#### OPERATING PRINCIPLE



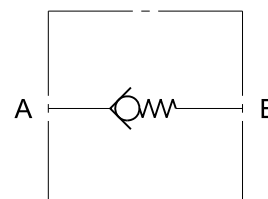
- VD\*-W\* valves are check valves with threaded “BSP” ports for mounting in-line on hydraulic lines.
- They allow the flow to pass freely in one direction, blocking it in the opposite direction.
- In rest conditions, the valve poppet is kept closed by a spring. The poppet opens when the pressure in the intake line “A” exceeds the set value of the spring, added to any pressure in the outlet line “B”.
- Available in eight sizes for flow rates of up to 850 l/min and with five different cracking pressures.

#### PERFORMANCES

Valve	BSP port dimension	Maximum flow rate [l/min]	Mass [kg]	Max operating pressure [bar]
VD2-W*	1/4"	25	0,17	400
VD3-W*	3/8"	40	0,26	
VD4-W*	1/2"	75	0,41	
VD5-W*	3/4"	125	0,6	
VD6-W*	1"	200	1,2	320
VD7-W*	1 1/4"	280	1,8	
VD8-W*	1 1/2"	650	3,2	
VD9-W*	2"	850	4,8	

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	acc. to ISO 4406:1999 class 20/18/15	

#### HYDRAULIC SYMBOL





# VD\*-W\*

## SERIES 30

### 1 - IDENTIFICATION CODE

V		D		-		W		/		30
Check valve		Nominal dimension		Series No.: (The overall and mounting dimensions remain unchanged from 30 to 39)		Cracking pressure:		BSP threaded ports		
2 = 1/4"		3 = 3/8"		4 = 1/2"		5 = 3/4"		6 = 1"		1 = 0,35 bar
7 = 1 1/4"		8 = 1 1/2"		9 = 2"						2 = 2 bar
										T4 = 4 bar
										3 = 6 bar
										4 = 10 bar

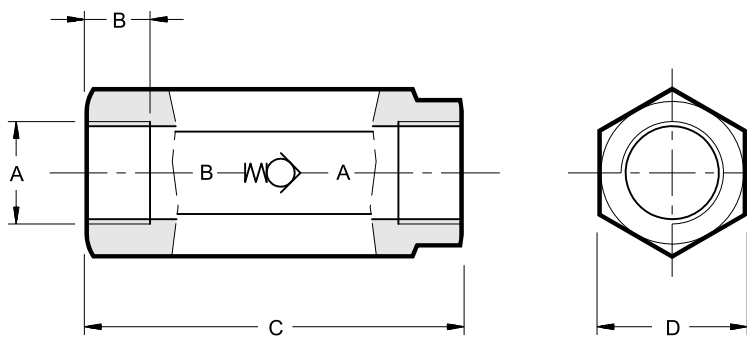
### 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 3 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm				
				
Valve	A BSP	B	C	D
VD2-W*	1/4"	12,5	63	22
VD3-W*	3/8"	12,5	69	27
VD4-W*	1/2"	15,5	80,5	32
VD5-W*	3/4"	17	99,5	36
VD6-W*	1"	20	117	46
VD7-W*	1 1/4"	22	134,5	55
VD8-W*	1 1/2"	24	159	65
VD9-W*	2"	31	198	75



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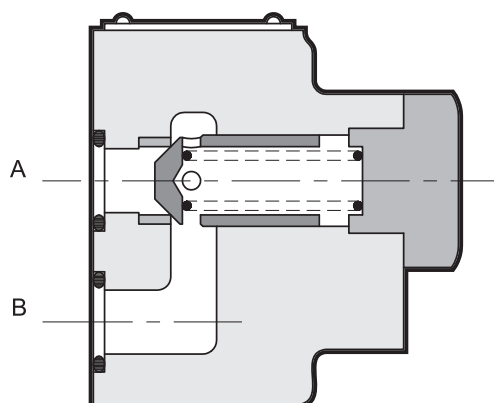


# VR\*-P CHECK VALVES

## SUBPLATE MOUNTING

**p** max (see table of performances)  
**Q** max (see table of performances)

## OPERATING PRINCIPLE



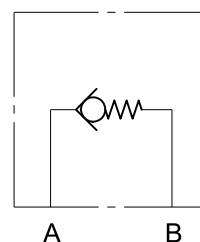
- VR\*-P valves are one-way check valves constructed in the subplate mounting version.
- In rest conditions, the valve poppet, which is a cone on edge seal type, is kept closed by a spring with fixed setting.
- The shutter opens when the pressure in the intake line "A" exceeds the set value of the spring, added to any pressure in the outlet line "B".
- Available in three sizes for flow rates up to 400 l/min and with three different cracking pressures.

## TECHNICAL SPECIFICATIONS

Valve code	Nominal dimension	Maximum flow rate [l/min]	Mass [kg]	Max. operating pressure [bar]
<b>VR3 - P</b>	3/8"	100	2,3	350
<b>VR5 - P</b>	3/4"	200	4,8	350
<b>VR7 - P</b>	1 1/4"	400	9	250

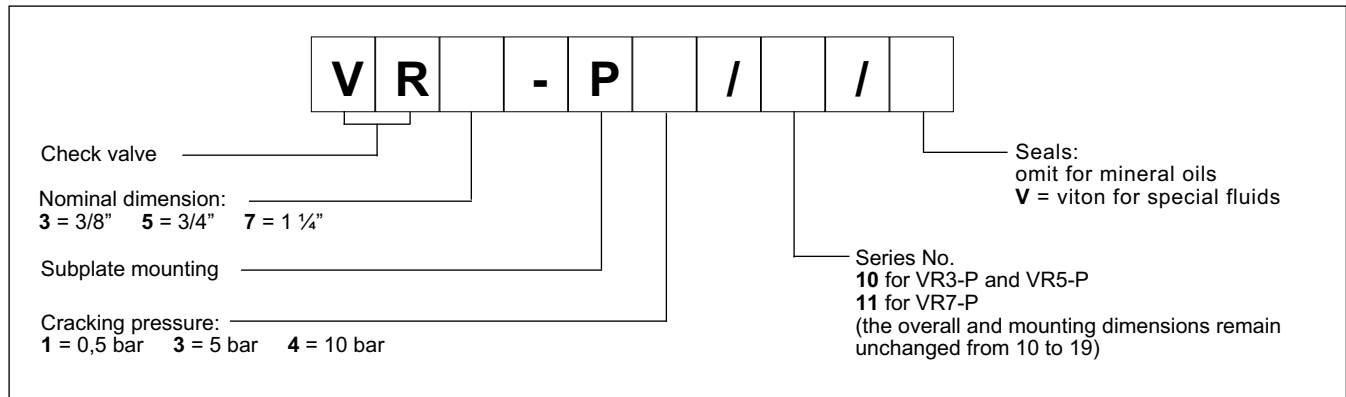
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

## HYDRAULIC SYMBOL

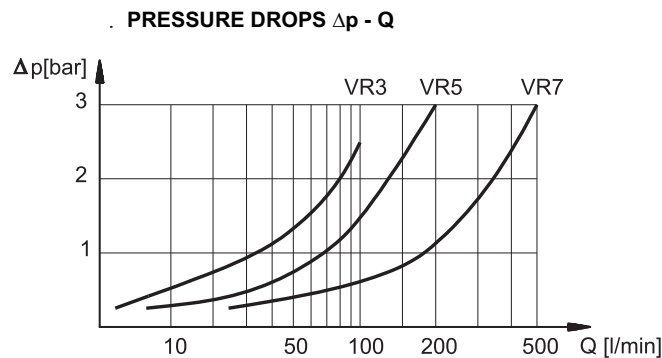




## 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES (values obtained with viscosità 36 cSt at 50°C)

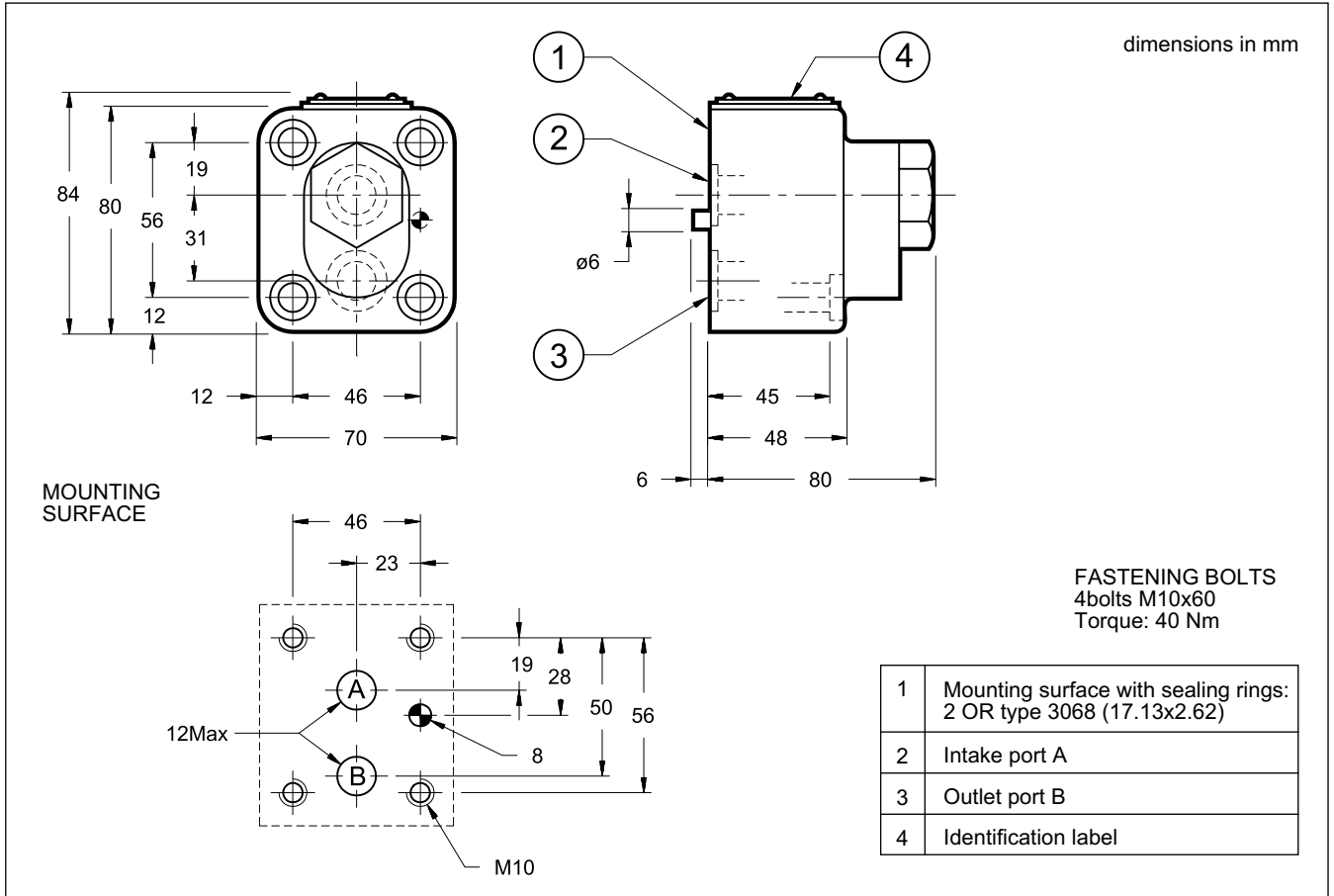


**NOTE:** Add the cracking pressure to the values shown in the diagram.

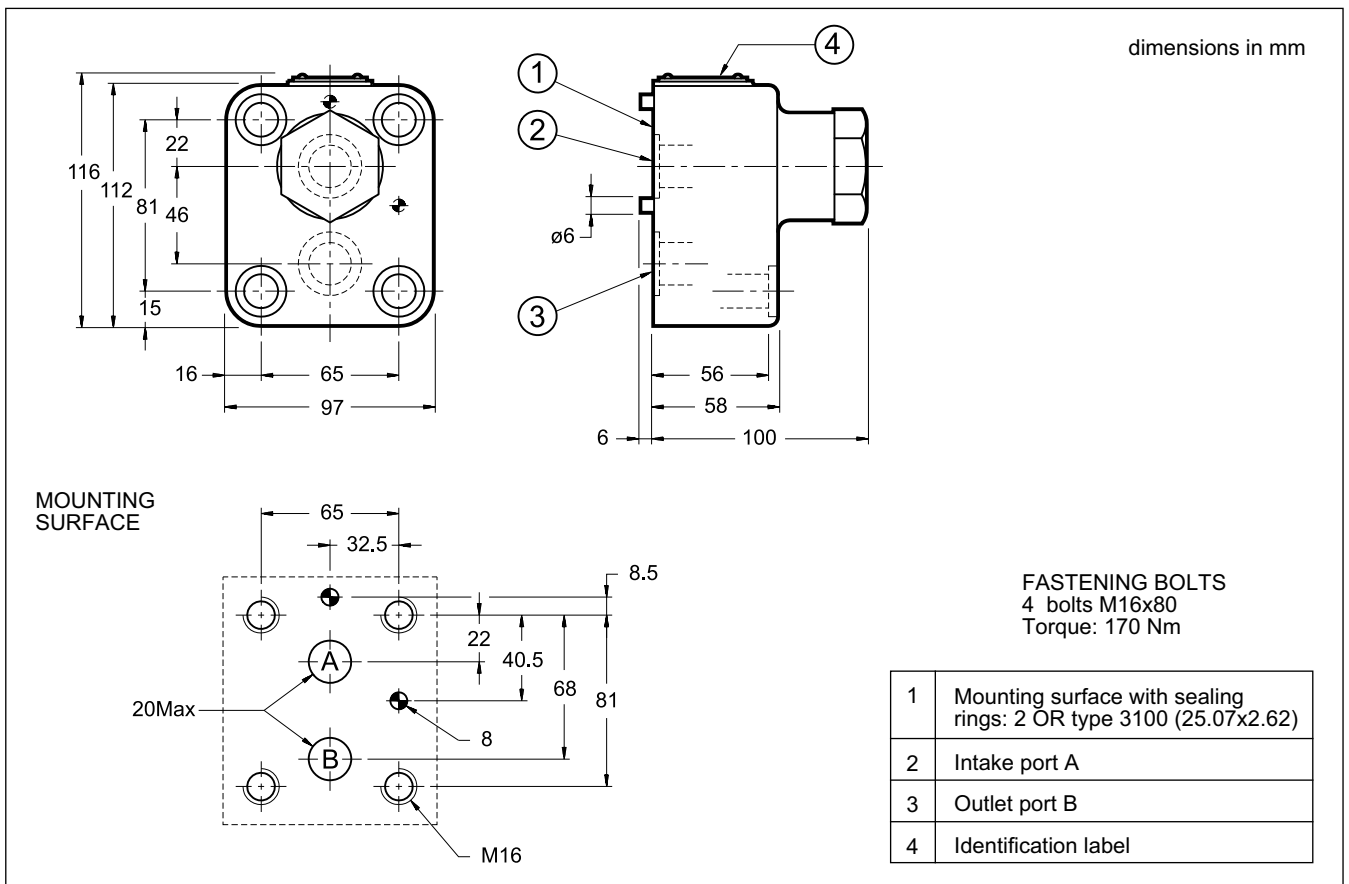
## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

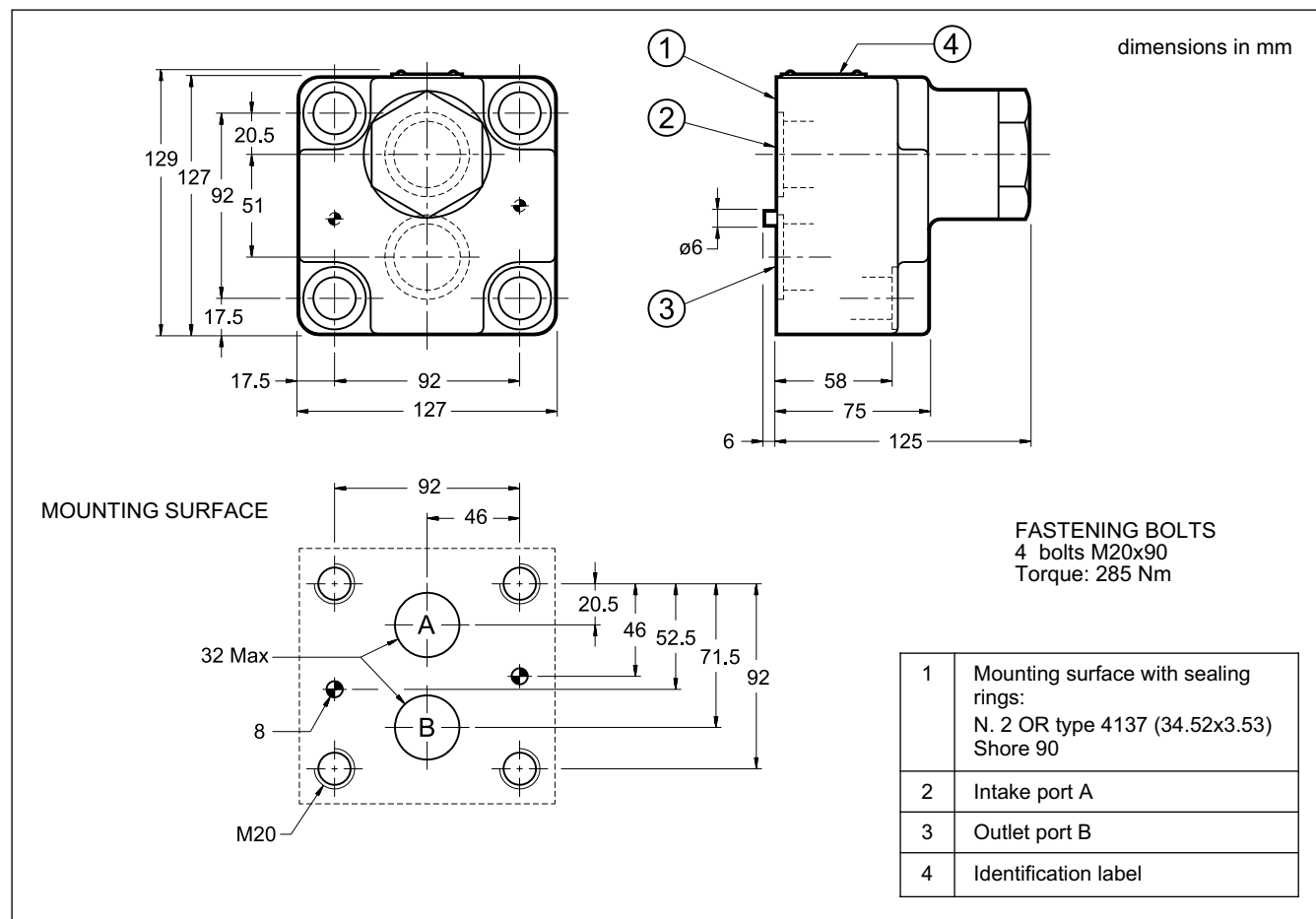
## 4 - VR3-P OVERALL AND MOUNTING DIMENSIONS



## 5 - VR5-P OVERALL AND MOUNTING DIMENSIONS



## 6 - VR7-P OVERALL AND MOUNTING DIMENSIONS





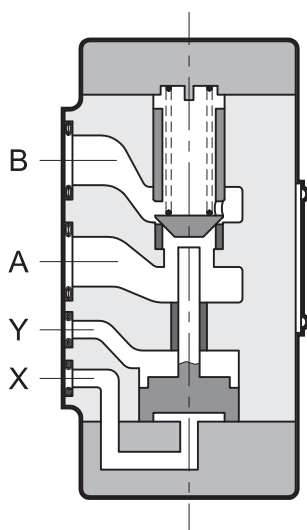
# VP\*-P\*-MU

## HYDRO-PILOT OPERATED CHECK VALVES SERIES 12

### SUBPLATE MOUNTING ISO 5781 (CETOP 06 07)

**p** max **320** bar  
**Q** max (see table of performances)

### OPERATING PRINCIPLE

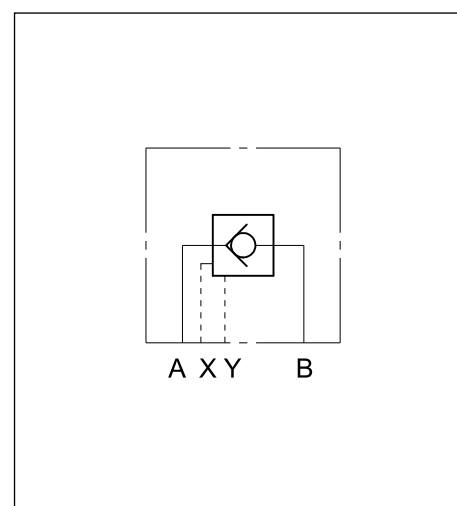


- VP\*-P\*-MU valves are check valves with hydraulic release, constructed in a version with subplate mounting in accordance with ISO 5781 (CETOP RP 121H) standards.
- They incorporate the functions of a normal one-way check valve with the facility, by means of external piloting, to release the poppet and allow the oil to pass also in the direction opposite to the free flow, from B to A.
- In rest conditions, the valve poppet, which is a cone on edge seal type, is kept closed by a spring with fixed setting. When piloting pressure is sent to port X, the release piston is operated, thus opening the main poppet and allowing the free flow from B to A.
- The drainage port Y isolates the front face of the control piston from chamber A.
- They are available in two sizes for flow rates up to 100 l/min and with different cracking pressures in the free flow direction.

### PERFORMANCES (working with mineral oil of viscosity of 36 cSt at 50°C)

		VP3	VP5
Maximum operating pressure	bar	320	320
Nominal flow rate	l/mn	50	100
Piloting ratio between release piston and sealed chamber areas	VP*-P*-MU	3,4:1	2,7:1
Piloting ratio with decompression device	VP*-P*/P-MU	12:1	14:1
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	3,7	6

### HYDRAULIC SYMBOL





# VP\*-P\*-MU

## SERIES 12

### 1 - IDENTIFICATION CODE

V	P		-	P		/		-	M	U	/	12	/	
---	---	--	---	---	--	---	--	---	---	---	---	----	---	--

Hydropilot operated check valve

Nominal size: \_\_\_\_\_  
3 = ISO 5781-06 (CETOP 06)  
5 = ISO 5781-08 (CETOP 08)

Subplate mounting \_\_\_\_\_

Cracking pressure with A→B free flow: \_\_\_\_\_  
2 = 3,5 bar  
3 = 5 bar

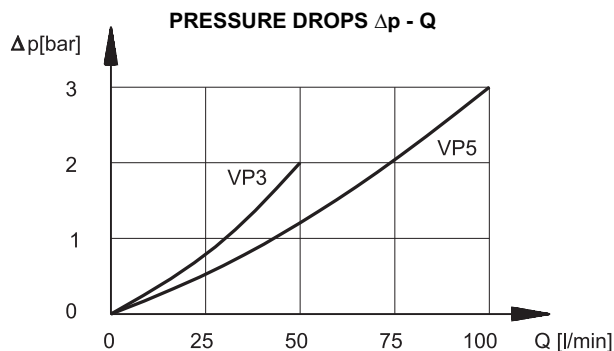
P = decompression device \_\_\_\_\_  
(omit if not required)

Seals: omit for mineral oils  
V = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Release piloting with external drainage

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity 36 cSt at 50°C)



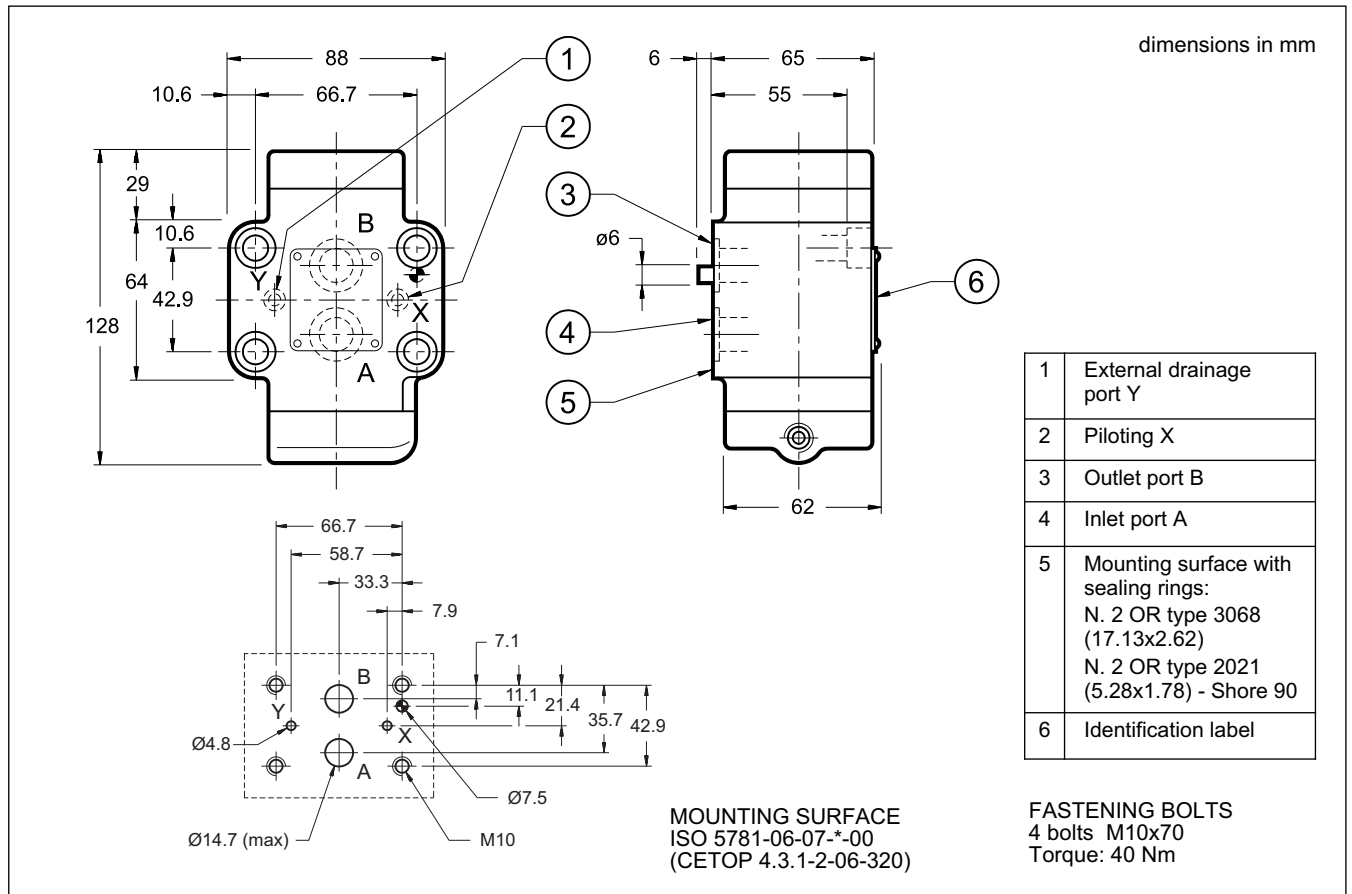
**NOTE:** The curves shown in the graph refer to B→A and A→B flow with the valve released hydraulically.  
For A→B flow, with the valve not released hydraulically, add the cracking pressure to the values shown.

### 3 - HYDRAULIC FLUIDS

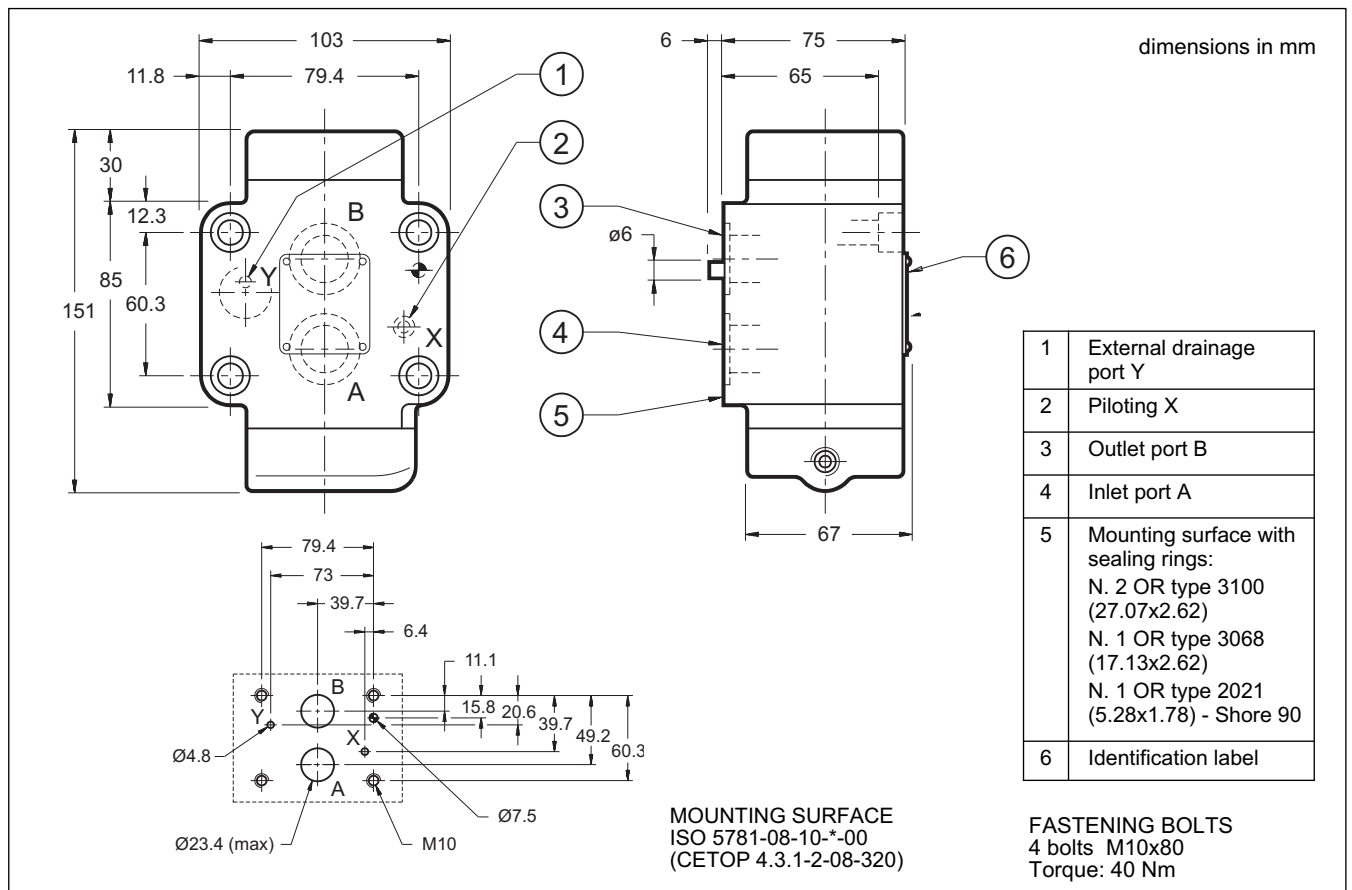
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - VP3-P\*-MU OVERALL AND MOUNTING DIMENSIONS



### 5 - VP5-P\*-MU OVERALL AND MOUNTING DIMENSIONS





# VP\*-P\*-MU

## SERIES 12

### 6 - USE

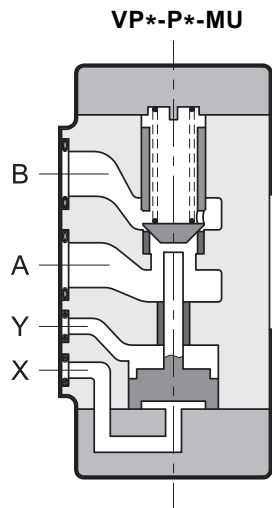
The VP\*-P\*-MU check valves with hydraulic release are used in circuits where the position of the actuators must be maintained even in the absence of hydraulic power.

They are available in two versions with the following characteristics:

#### VP\*-P\*-MU

The VP\*-P\*-MU valves are check valves with hydraulic release that incorporate the functions of a normal one-way check valve with the possibility to release the poppet by means of external piloting, thus allowing flow of the oil also in the opposite direction of the free flow, from B to A. The valve poppet, a cone on edge seal type, is kept closed by a spring with fixed setting during rest conditions. When pilot pressure is sent to port X, the release piston is activated and opens the main poppet, thus allowing the reverse flow.

These valves have hydraulic isolation of the front face of the release piston from chamber A of the valve, by external drainage Y. This solution eliminates problems which can occur if, during the release phase of the valve, pressure builds up in chamber A near to or greater than the piloting pressure X, causing a backward movement of the piston and thus unwanted closure of the valve.



#### VP\*-P\*/P-MU

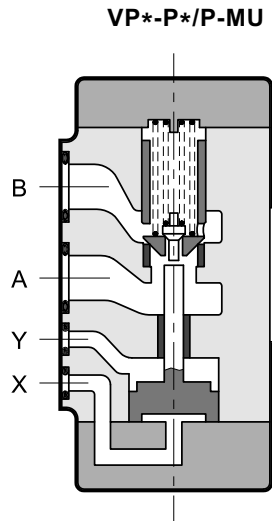
The VP\*-P\*/P-MU valves are check valves with hydraulic release that, in addition to the characteristics of the preceding version, are equipped with a decompression device.

They are recommended when operating with high working pressures or with high loads that act as pressure multipliers.

The circuit (chamber B) is decompressed prior to complete opening of the valve during the release phase.

This prevents pressure shocks in the circuit and because of the high ratio existing between the areas of the control piston and the decompression device, release can occur even at a low piloting pressure.

Pilot pressure to port X operates the release piston which first opens the pre-opening poppet, causing decompression of the sealed chamber, it then opens the main poppet, allowing free flow from B to A.



### 7 - SUBPLATES (see catalogue 51 100)

	VP 3	VP 5
Type	PMSZ3 - Al 4G with rear ports	PMSZ5 - Al6G with rear ports
A - B port dimensions	1/2" BSP	1" BSP
X - Y port dimensions	1/4" BSP	1/4" BSP



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# CFP

## FILLING VALVES

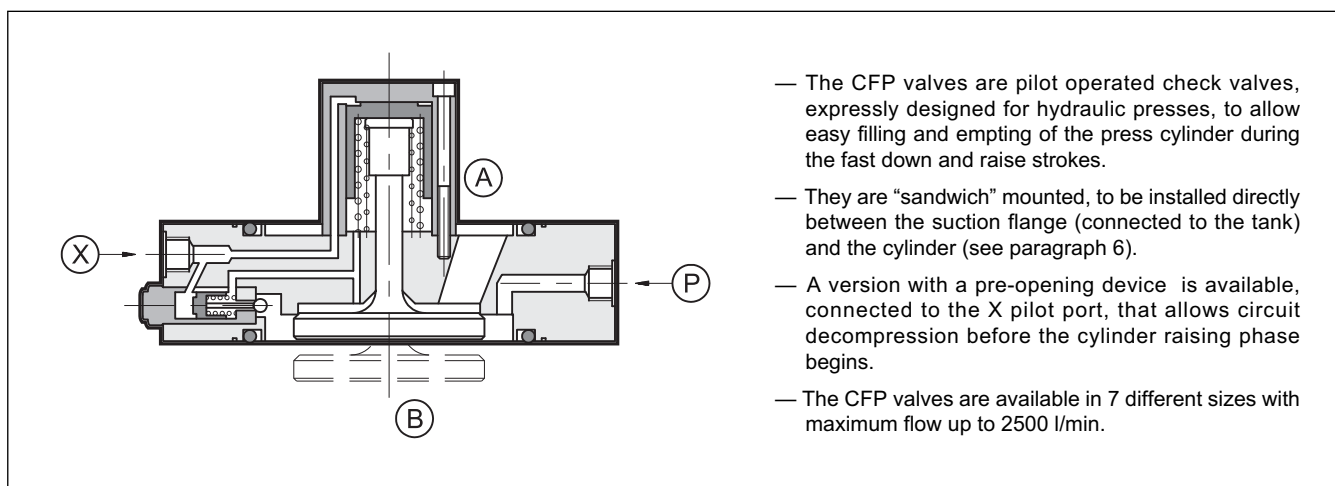
### SERIES 10

#### SANDWICH MOUNTING

**p** max **350** bar

**Q** max (see table of performances)

#### OPERATING PRINCIPLE

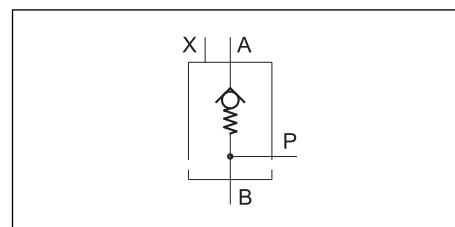


#### PERFORMANCES

VALVE CODE			CFP-S032	CFP-S040	CFP-S050	CFP-S063	CFP-S080	CFP-S100	CFP-S125
Nominal size			DN-32	DN-40	DN-50	DN-63	DN-80	DN-100	DN-125
Maximum flow (with $\Delta p = 0,3$ bar and viscosity 36 cSt)		l/min	160	250	400	600	1000	1600	2500
Maximum pressure	Ports P and B	bar	350						
	Port X	bar	100						
	Port A	bar	16						
Cracking and pilot pressure			see paragraph 4						
Mass		kg	1,2	1,7	2,5	3,5	5,2	12	20

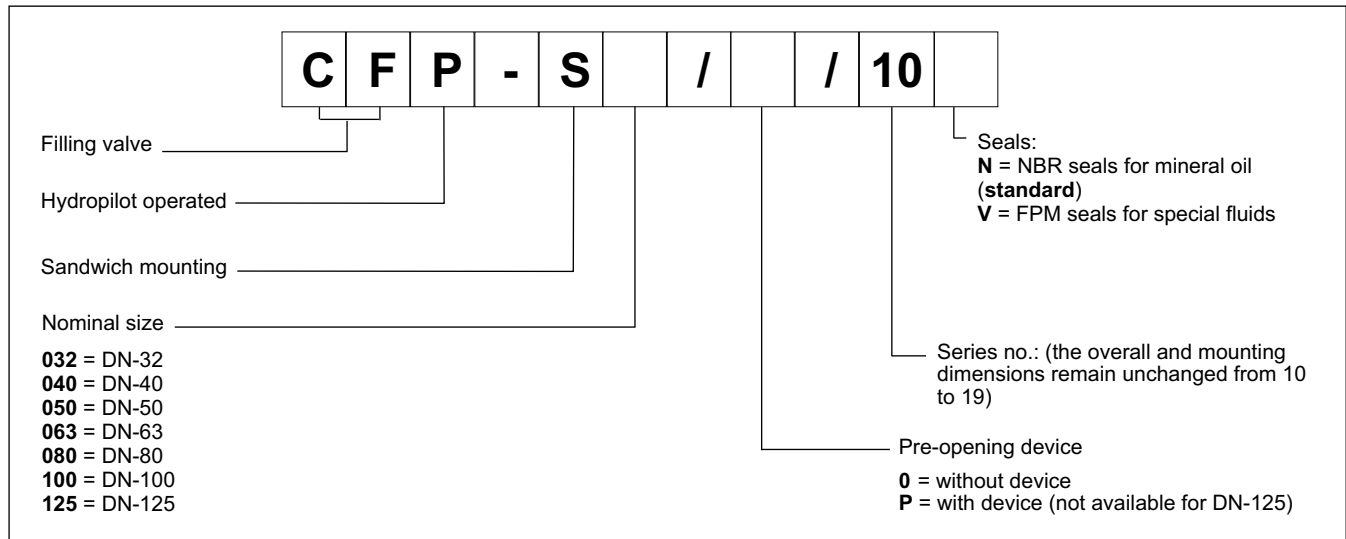
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	

#### HYDRAULIC SYMBOL





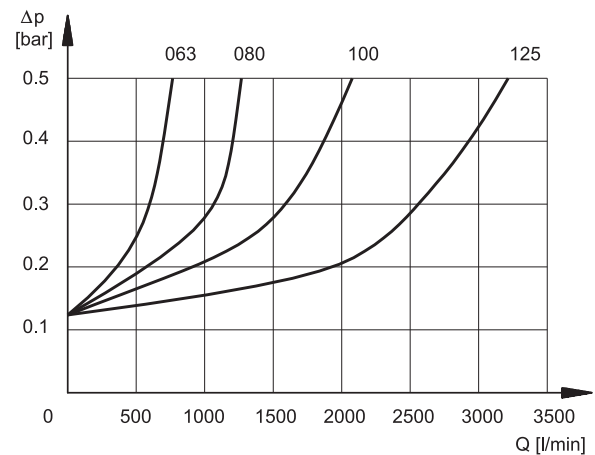
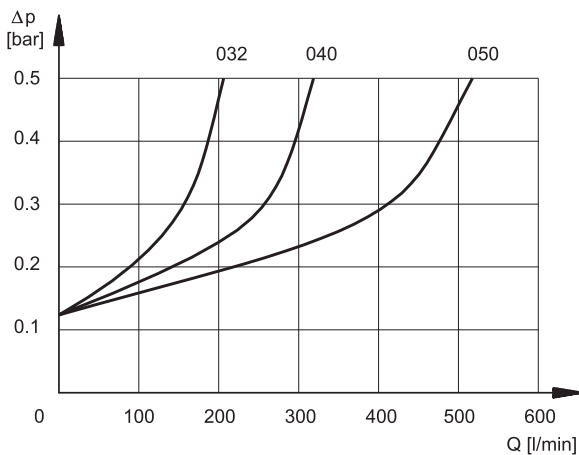
### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES

(values measured with viscosity of 36 cSt at 50°C)

$\Delta p$  - Q characteristic with flow A → B.



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

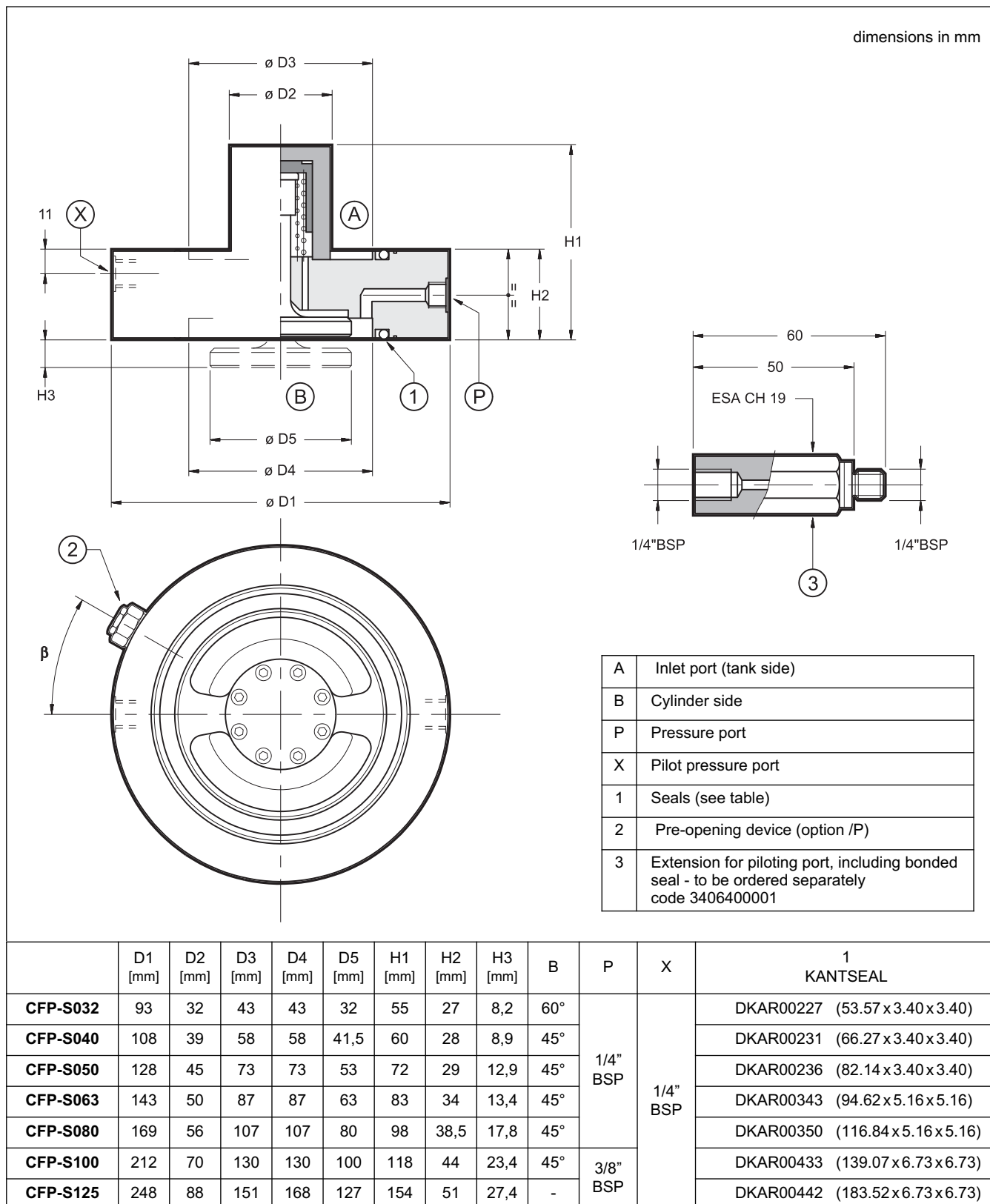
### 4 - OPENING AND PILOTING PRESSURES

Valve code	Cracking pressure A - B [bar]	Minimum pilot pressure [bar]	Pilot pressure ratio p (B) / p (X)	Pre-opening pressure (option /P) [bar]	Pilot volume for opening valve [cm³]
CFP-S032	0,12	8,0	3,6	p(X) = 0,18 x p(B) + 7	1,22
CFP-S040			3,9		2,36
CFP-S050			4,2		4,91
CFP-S063	4,2		8,13		
CFP-S080	4,5		12,72		
CFP-S100	4,3		28,63		
CFP-S125			4,3	-	67,86

## 5 - INSTALLATION

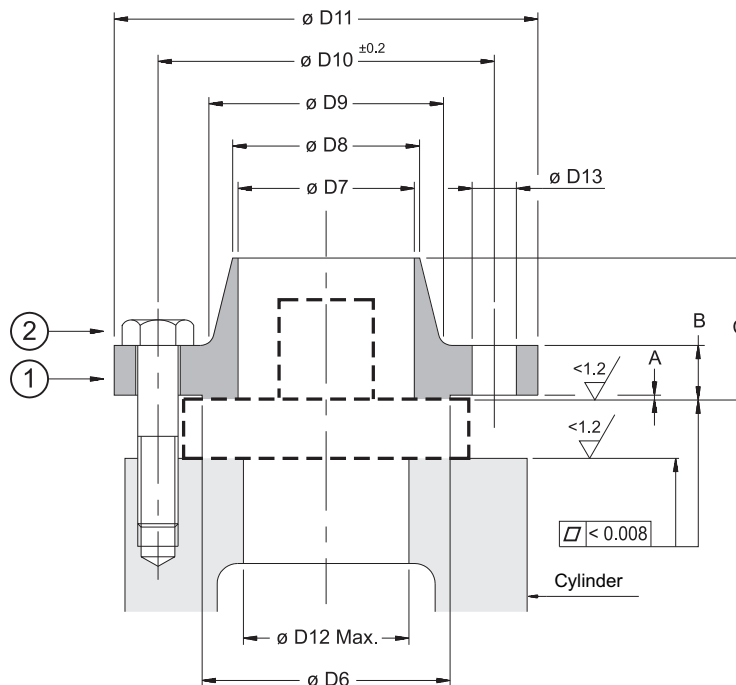
The valves up to size 63 can be mounted in any position. For the larger sizes (ND 80, ND 100 and ND 125) is required the vertical mounting.

## 6 - OVERALL DIMENSIONS



### 7 - CONNECTION FLANGE - INSTALLATION AND DIMENSIONS

dimensions in mm



Recommended building material: C22

	(1) Suggested dimensions for connection flange (see NOTE 2)											Max pressure on port B [bar]	(2)		
	D6 [mm]	D7 [mm]	D8 [mm] NOTE 1	D9 [mm]	D10 [mm]	D11 [mm]	D12 [mm]	D13 [mm]	A [mm]	B [mm]	C [mm]		Fastening bolts (type A10.9)	Q.ty	Tightening torque [Nm]
CFP-S032	88	42	48,3	88	110	150	46	18	3	22	45	350	M16	4	285
CFP-S040	102	53	60,3	102	125	165	58	18	3	29	62		M16	4	285
CFP-S050	122	69	76,1	122	145	185	71	18	3	34	68		M16	8	285
CFP-S063	138	82	88,9	138	160	200	86	18	3	43	72		M16	8	285
CFP-S080	162	107	114,3	162	190	235	108	22	3	51	78		M20	8	560
CFP-S100	188	131	139,7	188	240	295	132	29	3	62	105		M27	8	1400
CFP-S125	218	160	168,3	218	280	345	170	32	3	79	115		M30	8	1900

**NOTE 1:** Calculated diameters for PN 16 - DIN 2448 steel pipes

**NOTE 2:** For application with standard connection flange type UNI2284 - UNI2285 - UNI2286, special bushings to fit on fastening bolts must be provided in order to ensure a correct valve mounting.

For information about the installation with UNI connector flange, please consult our technical department.



## LOGIC ELEMENTS

**LC\*** CARTRIDGE VALVES  
ISO 7368 - DIN 24342

**LP\*** COVERS

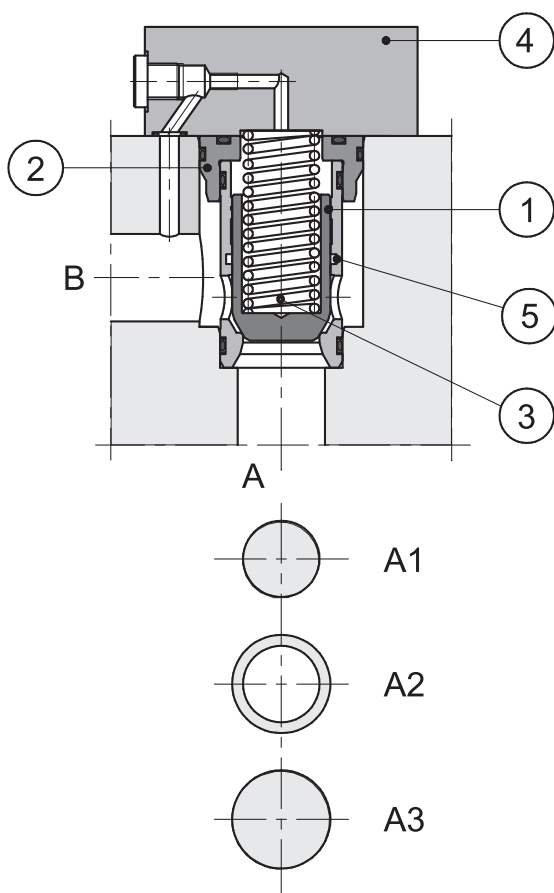
**LCM\*** MONITORED LOGIC EL.

**ND 16 - 25 - 32 - 40 - 50 - 63**

**p max 420 bar**

**Q max (see table of performances)**

### OPERATING PRINCIPLE



— Logic elements are cartridge valves suitable for installation in blocks or manifolds. They are available in five different sizes: ND 16 - 25 - 32 - 40 - 50 - 63.

— They are designed to perform complex hydraulic circuits, using functional compact blocks, with high flow rates and low pressure drops.

— They are made of a cartridge valve with ISO 7368 / DIN 24342 cavity bore and a control cover (4). The cover includes the cartridge valves pilot lines; some versions are designed for the installation of ISO 4401-03 valves, to realise different control functions (see paragraph 8 for diagrams and function descriptions). A low leakage version, obtained inserting a seal into the seat no. 5, is also available.

— The cartridge valves are composed of a jacket (2), a poppet (1), and a closing spring (3). The poppet can either be standard (S) or with a damping nose (D), suitable for a smooth flow control during the valve opening and closing phases.

— Two types of cartridge valves are available:

- **Q type**: used for flow and directional control and as a check valve.

The areas involved are:

A1 - corresponding to the seat diameter area, considered as reference area = 1

A3 - corresponding to the jacket internal diameter area.

A2 - corresponding to the difference between A3 - A1

The area ratio A1/A3 is 1/1,66.

The valve opens when the pressure, acting either on area A1 (flow from A to B) or on area A2 (flow from B to A), is higher than the pressure acting on area A3 (added to the spring load value).

- **P type**: used for pressure control.

In this case the areas A1 and A3 are equivalent (area ratio 1:1) and the valve enables the flow direction from A to B only.

— **LCM\*** are monitored logic elements used for directional control, piloting and as check valve. They are certified by TÜV. Available sizes are ND 16, 25, 32, 40 and 50.

## 1 - IDENTIFICATION CODE FOR CARTRIDGE VALVES

<b>L</b>	<b>C</b>		<b>-</b>			<b>/</b>		<b>N</b>	<b>/</b>	
----------	----------	--	----------	--	--	----------	--	----------	----------	--

**LL** = Low leakage version, with seal between C and B.  
Not available for QS0.5 and LC16-PS\*  
Omit if not required.

Seals:  
NBR seals for mineral oil

**20** - for ND 16, 25, 32, 40 and 50  
**21** - for ND 63  
(the overall and mounting dimensions remain unchanged from 20 to 29)

Nominal cracking pressure on section A1:  
Verify the versions availability in the table below. Other cracking pressure values are available on request.  
**0.5** = 0,5 bar  
**1** = 1 bar  
**2** = 2 bar  
**4** = 4 bar

Cartridge valve

Shutter type:  
(area ratio A1 / A3):  
**QS** = flow rate control (1:1,66)  
**QD** = flow rate control with damping nose (1:1,66)  
**PS** = pressure control (1:1)

AVAILABLE NOMINAL SIZES						VERSIONS	SYMBOL
16 ND16	25 ND25	32 ND32	40 ND40	50 ND50	63 ND63		
x	x	x	x	x		<b>QS0.5</b>	
x	x	x	x	x	x	<b>QS2</b>	
x	x	x	x	x		<b>QD4</b>	
					x	<b>PS1</b>	
x	x	x	x	x		<b>PS2</b>	

## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 3 - TECHNICAL CHARACTERISTICS

(cartridge valve with control cover)

Max operating pressure LC cartridge valve	bar	420
Max operating pressure limit of covers type DP*, DPE*, DF1, DF2, LCM	bar	350
Max operating pressure with distributor installed on cover	See technical characteristics of the distributor	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

#### 3.1 - Cartridge valves type Q performances

(flow control function)

			NOMINAL SIZE					
			16	25	32	40	50	63
Area A1	cm <sup>2</sup>		1,54	3	6	8,76	14,8	24,6
Area A2	cm <sup>2</sup>		1	2	4	5,76	9,7	16,1
Area A3	cm <sup>2</sup>		2,54	4,9	10	14,3	24,3	40,7
Version S:	opening stroke h	cm	0,8	1	1,25	1,6	1,8	2,3
	opening volume	cm <sup>3</sup>	2,03	4,9	12,5	22,88	43,74	96,26
	max recommended flow	l/min	250	500	900	1300	2000	3000
Version D:	opening stroke h	cm	0,8	1,15	1,5	1,8	2,2	2,7
	opening volume	cm <sup>3</sup>	2,03	5,63	15	25,74	53,46	110
	max recommended flow	l/min	200	450	800	1100	1700	2700
Cracking pressure	A→B	spring 0,5	bar	0,5	0,5	0,5	0,5	-
		spring 2		2	2	2	2	2
		spring 4		4	4	4	4	-
	B→A	spring 0,5		0,9	1,1	0,7	0,76	0,8
		spring 2		3,1	3	3,1	3	3,2
		spring 4		6,15	5,9	5,4	5,9	-
Mass	Kg		0,25	0,5	1,1	1,9	3,9	7,8

#### 3.2 - Cartridge valves type P performances

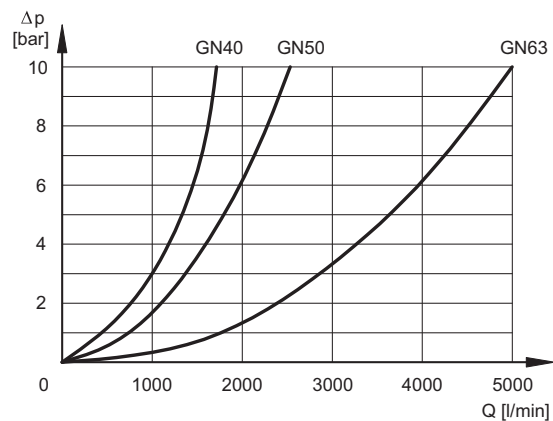
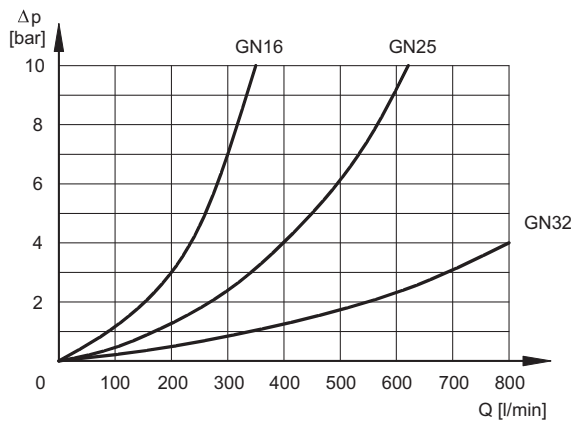
(pressure control function)

			NOMINAL SIZE					
			16	25	32	40	50	63
Area A1 = Area A3	cm <sup>2</sup>		2,54	4,9	10	14,4	24,3	40,7
Version S: max recommended flow	l/min		200	400	900	1000	1500	2500
Cracking pressure	spring 1	bar	-	-	-	-	-	1
	spring 2		2	2	2	2	2	-
Mass	Kg		0,25	0,5	1,1	1,9	3,9	7,8

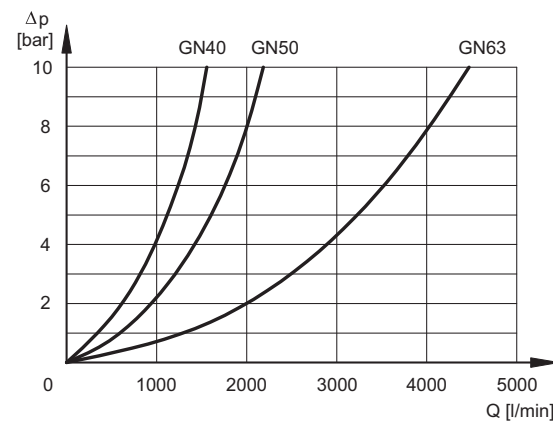
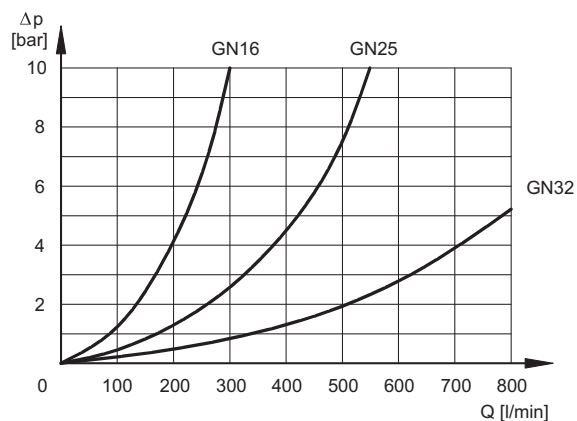
## 4 - CHARACTERISTIC CURVES

(values obtained with viscosity 36 cSt at 50°C)

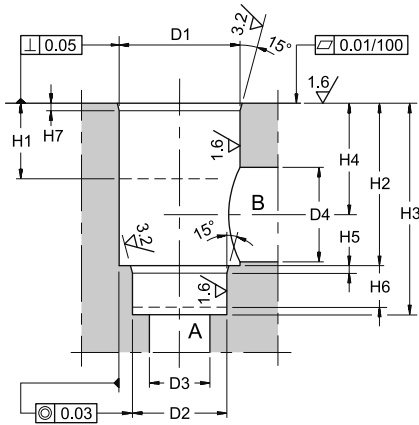
### 4.1 - LC\*- QS flow control function and LC\*-PS pressure control function



### 4.2 - Flow control function with damping nose LC\*- QD

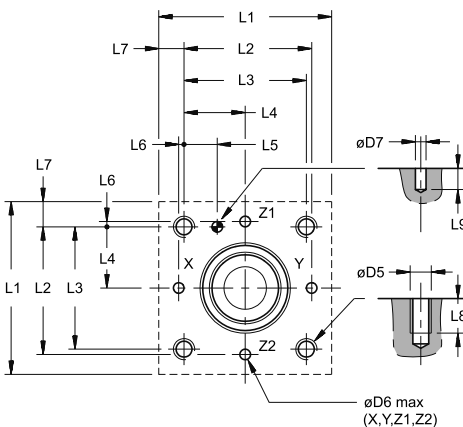


## 5 - LC CARTRIDGE VALVES SEAT DIMENSIONS ACCORDING TO ISO 7368 / DIN 24342



	LC CARTRIDGE VALVES NOMINAL SIZE					
	16	25	32	40	50	63
$\varnothing D1^{H7}$	32	45	60	75	90	120
$\varnothing D2^{H7}$	25	34	45	55	68	90
$\varnothing D3 \text{ max}$	16	25	32	40	50	63
$\varnothing D4$	16	25	32	40	50	63
$\varnothing D4 \text{ max}$	25	32	40	50	63	80
H1 min	20	30	30	30	35	40
H2 $\pm 0,1$	43	58	70	87	100	130
H3 $+0,1$ 0	56	72	85	105	122	155
H4 referred to diameter $\varnothing D4$	34	44	52	64	72	95
H4 referred to diameter $\varnothing D4 \text{ max}$	29,5	40,5	48	59	65,5	86,5
H5	2	2,5	2,5	3	3	4
H6 min	11	12	13	15	17	20
H7	2	2,5	2,5	3	4	4

## 6 - LP CONTROL COVERS INTERFACE DIMENSIONS ACCORDING TO ISO 7368 / DIN 24342

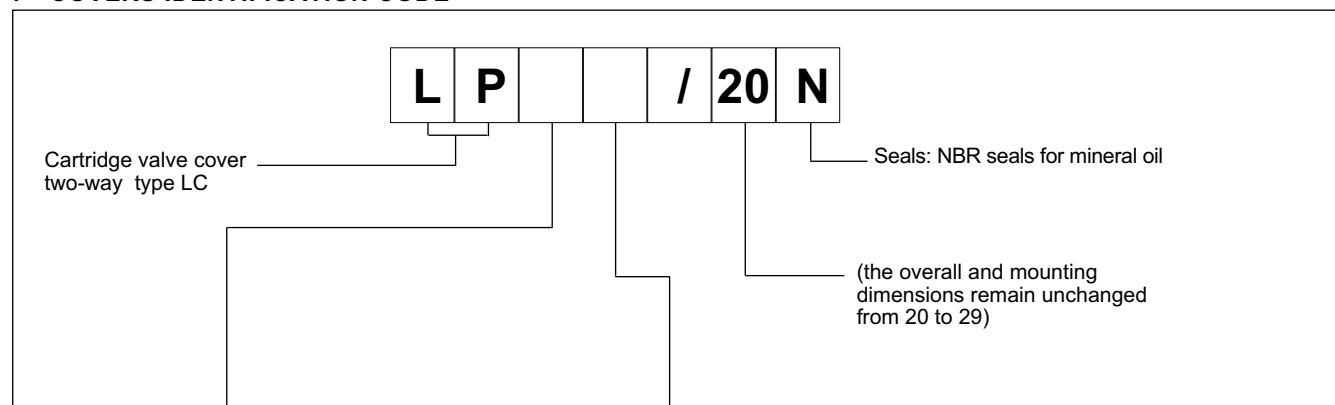


	LP CONTROL COVERS NOMINAL SIZE					
	16	25	32	40	50	63
$\varnothing D5$	M8	M12	M16	M20	M20	M30
$\varnothing D6 \text{ max}$	4	6	8	10	10	12
$\varnothing D7^{H13}$	4	6	6	6	8	8
L1	*	85	102	125	140	180
L2 $\pm 0,1$	48	62	76	92,5	108	137,5
L3 $\pm 0,1$	46	58	70	85	100	125
L4 $\pm 0,1$	23	29	35	42,5	50	62,5
L5 $\pm 0,1$	12,5	13	18	19,5	20	24,5
L6 $\pm 0,1$	2	4	6	7,5	8	12,5
L7	*	13,5	16	20	20	27,5
L8 min	15	20	28	35	35	52
L9 min	8	8	8	8	8	8

\* = cover with special dimensions (see par. 10.2 + 10.7)



## 7 - COVERS IDENTIFICATION CODE



AVAILABLE NOMINAL SIZES						COVER NAME	SYMBOL	DIAGRAM PARAGRAPH	OVERALL DIMENSIONS PARAGRAPH
16 ND16	25 ND25	32 ND32	40 ND40	50 ND50	63 ND63				
x	x	x			x	<b>R</b>		8.1	10.1
x	x	x	x	x	x	<b>D</b>		8.2	10.2
x	x	x	x			<b>DZ</b>		8.3	10.3
x	x	x	x	x		<b>DF1</b>		8.4	10.4
x	x	x	x			<b>DF2</b>		8.5	10.5
x	x	x	x	x	x	<b>Q</b>		8.6	10.6
x	x	x	x	x	x	<b>DP*</b>		8.7	10.7
x	x	x	x	x		<b>DPE*</b>		8.8	10.7

## 8 - FUNCTIONAL DIAGRAMS

### 8.1 - R cover for directional control and check valve function with external pilot X

Functional diagrams	Description
	<p>Piloting of the cartridge valve through the X port, available on the mounting surface or with pipe connection 1/4" BSP.</p> <p>For ND 40 and ND 50 sizes, the external piloting function can be realised by using control cover type D, with blanking plate code <b>1950751</b> (to be ordered separately).</p>

### 8.2 - D cover for directional control and check valve function

Functional diagrams	Description
	<p>Piloting of the cartridge valve by means of solenoid valve type <b>DS3-TA</b> (to be ordered separately - see catalogue 41 150)</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = A ↔ B intercepted flow</li> <li>- solenoid valve ON = A ↔ B free flow</li> </ul>

### 8.3 - DZ cover for directional control with possibility to pilot other cartridges in line

Functional diagrams	Description
	<p>The DZ cover enables the piloting of its cartridge valves and also of other valves connected to Z1 and Z2 pilot lines.</p> <p>The solenoid valve type <b>DS3-S10</b> must be ordered separately (see catalogue 41 150).</p>

### 8.4 - DF1 cover for directional control and check function with double pilot line

Functional diagrams	Description
	<p>The DF1 cover gives the possibility of a double pilot line through X and Z1 ports.</p> <p>The solenoid valve type <b>DS3-TA</b> must be ordered separately (see catalogue 41 150).</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = A ↔ B intercepted flow</li> <li>- solenoid valve ON = A → B free flow, B → A intercepted (if pilot line X is connected with B and if Z1 is connected with A).</li> </ul>

### 8.5 - DF2 cover for directional control and check function with priority piloting from two external lines

Functional diagrams	Description
	<p>The cartridge valve can be simultaneously piloted from X and Z1 lines.</p> <p>The shuttle valve, integrated in the cover, enables the automatic selection of the pilot line which has the higher pressure (priority line).</p> <p>The solenoid valve type <b>DS3-TA</b> must be ordered separately (see catalogue 41 150).</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = A ↔ B intercepted flow</li> <li>- solenoid valve ON = A ↔ B free flow</li> </ul>

### 8.6 - Q cover for flow control function

Functional diagrams	Description
	<p>Flow control function by means of cover with stroke limiter.</p> <p>For a better flow control and to avoid the wear of the valve seat, this cover is normally used with a QD4 cartridge type.</p>

### 8.7 - DP\* cover for pressure control function

Functional diagrams	Description
	<p>Pressure control function with a built-in relief valve.</p> <ul style="list-style-type: none"> <li>- max. adjustment pressure <b>DP4</b> = 140 bar - <b>DP6</b> = 350 bar</li> </ul> <p>The top blanking plate code 1950591 must be ordered separately.</p>
	<p>Pressure control function with electrical unloading by means of <b>DS3-SA2</b> solenoid valve (to be ordered separately - see catalogue 41 150).</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = unloading at minimum pressure</li> <li>- solenoid valve ON = pressure controlled by the built-in relief valve.</li> </ul>
	<p>Pressure control function with electrical unloading and two step pressure by means of the solenoid valves <b>DS3-S2</b> (to be ordered separately - see catalogue 41 150), <b>MCI*-SAT/10</b> (for 16, 25 and 32 sizes - to be ordered separately) and <b>MCD*-SAT</b> (for 40, 50 and 63 sizes to be ordered separately - see catalogue 61 200)</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = unloading at minimum pressure</li> <li>- solenoid valve ON side a = pressure controlled by the relief valve integrated in the cover</li> <li>- solenoid valve ON side b = pressure controlled by the relief valve (<b>MCI*</b> or <b>MCD*</b>)</li> </ul>

	<p>Pressure control function with electrical control and three steps pressure by means of the solenoid valves <b>DS3-S3</b> (to be ordered separately - see catalogue 41 150), <b>MCI*-DT/10</b> (for 16 - 25 and 32 sizes - to be ordered separately) and <b>MCD*-DT/51</b> (for 40 and 50 sizes - to be ordered separately - see catalogue 61 200)</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = pressure controlled by the cover relief valve.</li> <li>- solenoid valve ON side a = pressure controlled by the relief valve on side b.</li> <li>- solenoid valve ON side b = pressure controlled by the relief valve on side a.</li> </ul>
--	--

### 8.8 - DPE\* cover for pressure control function

Functional diagram	Description
	<p>Pressure control function by means of <b>PRED3</b> proportional valve (to be ordered separately see catalogue 81 210).</p> <ul style="list-style-type: none"> <li>- max. adjustment pressure <b>DPE4</b> = 140 bar - <b>DPE6</b> = 350 bar</li> <li>- proportional valve OFF = unloading at minimum pressure</li> <li>- proportional valve ON = proportional control of pressure</li> </ul>

## 9 - TIGHTENING TORQUES FOR COVERS

Tightening torques in the chart below were calculated for screws with class A10.9, applying a total friction coefficient  $\mu = 0,15$ .

We recommend these tightening torques for screws suitable for the specified friction coefficient and for tightenings done with manual torque wrench.

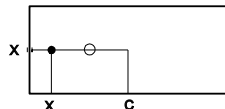
Size	Screws type (no. 4 pcs.)	Tightening torque ( $\pm 10\%$ ) [Nm]
<b>16</b>	M8	32
<b>25</b>	M12	110
<b>32</b>	M16	270
<b>40</b>	M20	530
<b>50</b>	M20	530
<b>63</b>	M30	1900

**NOTE:** Screws characteristics for each type of cover are described in paragraph 10.

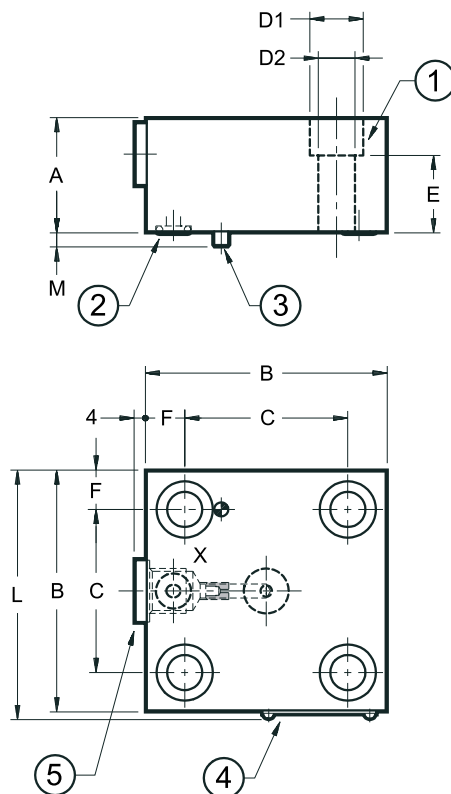
### 10 - OVERALL AND MOUNTING DIMENSIONS FOR CONTROL COVERS

#### 10.1 - R type covers

dimensions in mm



LP16R  
LP25R  
LP32R  
LP63R



	NOMINAL SIZE			
	16	25	32	63
A	30	30	40	70
B	65	85	102	180
C	46	58	70	125
D1	13,5	19	25	46
D2	8,5	13	17	31
E	19	17	22	35
F	9,5	13,5	16	27,5
L	67,5	87,5	104,5	182,5
M	4	5	5	5

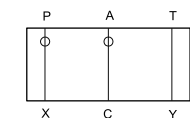
ports ready for restrictors	port X		
restrictors	M6x8		M10x10
Mass [kg]	1,20	2,30	4,00

1	N. 4 fastening bolts ( <b>NOTE</b> ): 16 = M8x30 25 = M12x35 32 = M16x45 63 = M30x80
2	N. 1 sealing ring 90 Shore: 16 = OR type 2025 (6.07x1.78) 25 = OR type 2037 (9.25x1.78) 32 = OR type 2043 (10.82x1.78) 63 = OR type 3062 (15.54x2.62)
3	Locating pin: 16 = Ø3x10      25 = Ø5x14 32 = Ø5x14      63 = Ø6x14
4	Identification label
5	Plug X: 1/4" BSP

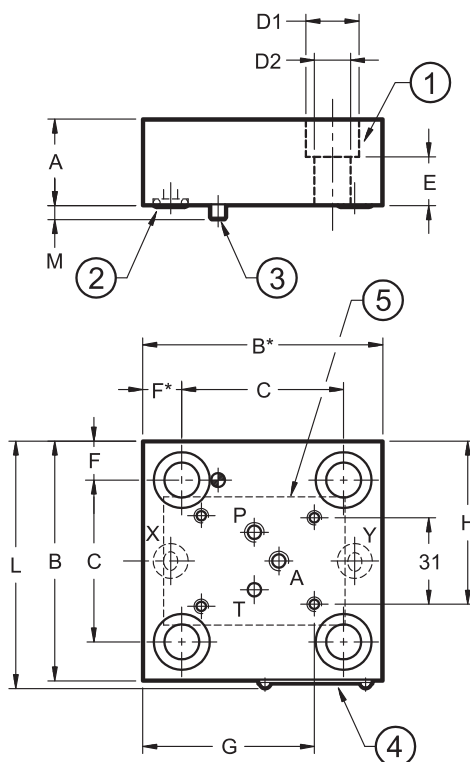
**NOTE:** Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately).  
Tightening torques at par. 9

## 10.2 - Covers type D

dimensions in mm



LP16D  
LP25D  
LP32D  
LP40D  
LP50D  
LP63D



	NOMINAL SIZE					
	16	25	32	40	50	63
A	30	30	40	40	50	70
B	65	85	102	125	140	180
B*	75	85	102	125	140	180
C	46	58	70	85	100	125
D1	13,5	19	25	31	31	46
D2	8,9	13	17	21	21	31
E	19	17	22	30	30	35
F	9,5	13,5	16	20	20	27,5
F*	19,5	13,5	16	20	20	27,5
G	52	60,2	68,7	73,2	82,7	111,5
H	48	58	66,5	78	85,5	105,5
L	67,5	87,5	104,5	127,5	142,5	182,5
M	4	5	5	5	5	7

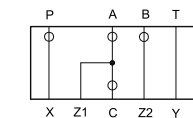
ports ready for restrictors	P, A					
restrictors	M6x8					M8x8
Mass [kg]	1,20	2,30	4,00	4,80	7,6	17,5

1	N. 4 fastening bolts ( <b>NOTE</b> ): <b>16</b> = M8x30 <b>25</b> = M12x35 <b>32</b> = M16x45 <b>40</b> = M20x50 <b>50</b> = M20x60 <b>63</b> = M30x80
2	n° 2 sealing rings 90 Shore : <b>16</b> = OR type 2025 (6.07x1.78) <b>25</b> = OR type 2037 (9.25x1.78) <b>32</b> = OR type 2043 (10.82x1.78) <b>40</b> = OR type 2050 (12.42x1.78) <b>50</b> = OR type 2050 (12.42x1.78) <b>63</b> = OR type 3062 (15.54x2.62)
3	Locating pin: <b>16</b> = Ø3x10 <b>25</b> = Ø5x14 <b>32</b> = Ø5x14 <b>40</b> = Ø5x14 <b>50</b> = Ø6x14 <b>63</b> = Ø6x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)

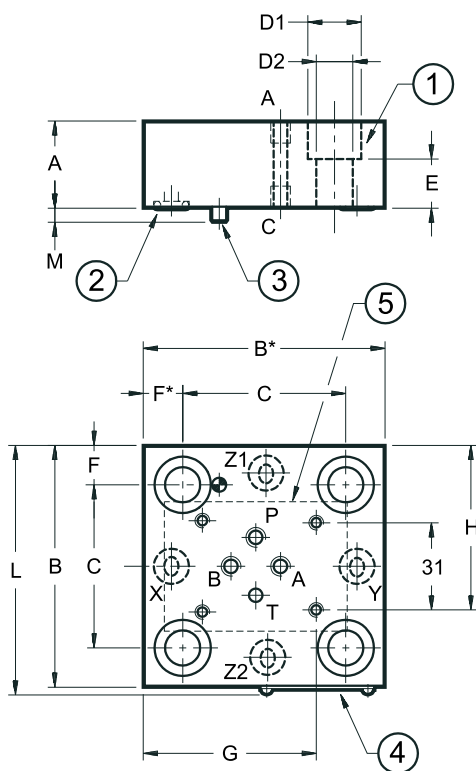
**NOTE:** Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately).  
Tightening torques at par. 9

### 10.3 - Covers type DZ

dimensions in mm



LP16DZ  
LP25DZ  
LP32DZ  
LP40DZ



	NOMINAL SIZE			
	16	25	32	40
A	30	30	40	40
B	65	85	102	125
B*	75	85	102	125
C	46	58	70	85
D1	13,5	19	25	31
D2	8,9	13	17	21
E	19	17	22	20
F	9,5	13,5	16	20
F*	19,5	13,5	16	20
G	52	60,2	66,2	73,2
H	48	58	66,5	78
L	67,5	87,5	104,5	127,5
M	4	5	5	5

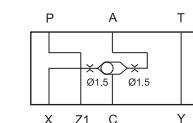
ports ready for restrictors M6x8	P, A, B, C			
Mass [kg]	1,2	2,3	2,8	4,1

1	N. 4 fastening bolts ( <b>NOTE</b> ): <b>16</b> = M8x30 <b>25</b> = M12x35 <b>32</b> = M16x45 <b>40</b> = M20x50
2	n° 4 sealing rings 90 Shore : <b>16</b> = OR type 2025 (6.07x1.78) <b>25</b> = OR type 2037 (9.25x1.78) <b>32</b> = OR type 2043 (10.82x1.78) <b>40</b> = OR type 2050 (12.42x1.78)
3	Locating pin: <b>16</b> = Ø3x10 <b>25</b> = Ø5x14 <b>32</b> = Ø5x14 <b>40</b> = Ø5x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)

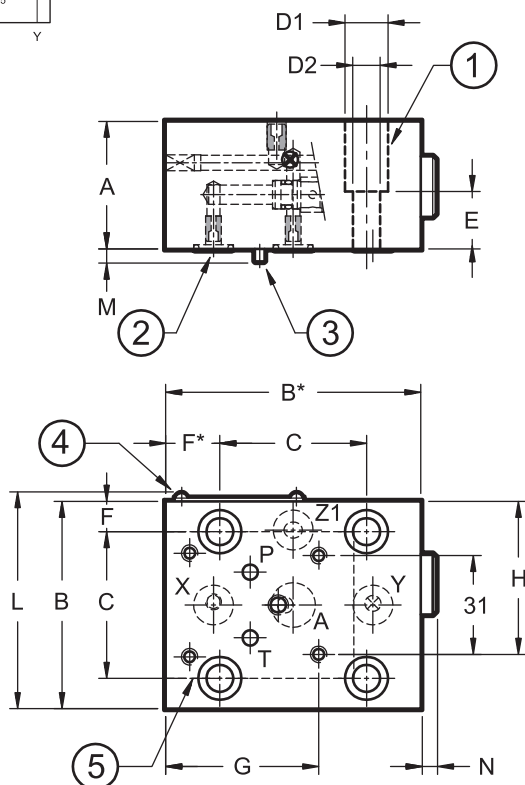
**NOTE:** Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately). Tightening torques at par. 9

### 10.4 - Covers type DF1

dimensions in mm



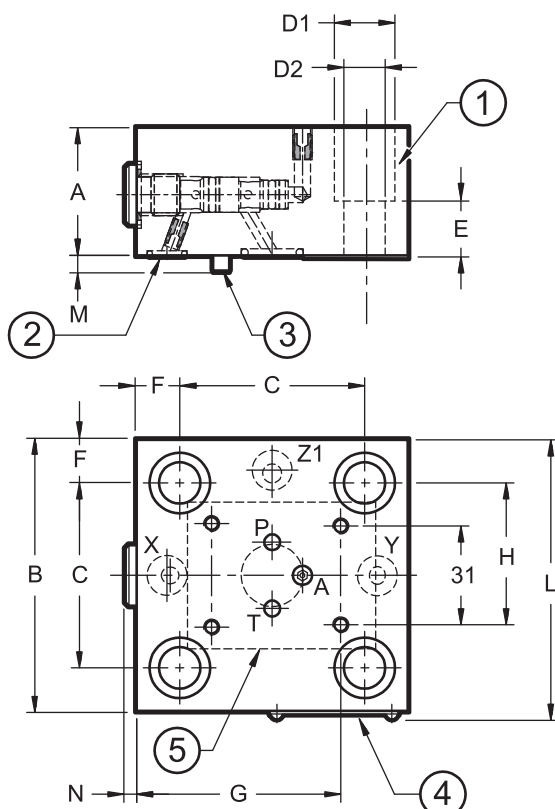
LP16DF1



	NOMINAL SIZE				
	16	25	32	40	50
A	40	40	40	50	50
B*	80	85	102	125	140
B	65	85	102	125	140
C	46	58	70	85	100
D1	13,5	19	25	31	31
D2	8,5	13	17	21	21
E	18	17	22	30	30
F*	17	13,5	16	20	20
F	9,5	13,5	16	20	20
G	47,5	64	72,5	84	91,5
H	48	58	66,5	78	85,5
L	67,5	87,5	104,5	127,5	142,5
M	4	5	5	5	5
N	4,5	3,5	3,5	-	-

Mass [kg]	1,8	2,3	3	6,7	7,6
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LP25DF1  
LP32DF1  
LP40DF1  
LP50DF1



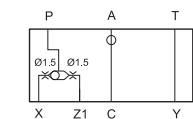
1	N. 4 fastening bolts ( <b>NOTE</b> ): <b>16</b> = M8x30 <b>25</b> = M12x35 <b>32</b> = M16x45 <b>40</b> = M20x60 <b>50</b> = M20x60
2	N° 3 sealing rings 90 Shore : <b>16</b> = OR type 2037 (9.25x1.78) <b>25</b> = OR type 2037 (9.25x1.78) <b>32</b> = OR type 2043 (10.82x1.78) <b>40</b> = OR type 2050 (12.42x1.78) <b>50</b> = OR type 2050 (12.42x1.78)
3	Locating pin <b>16</b> = Ø3x10 <b>40</b> = Ø5x14 <b>25</b> = Ø5x14 <b>50</b> = Ø6x14 <b>32</b> = Ø5x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)

**NOTE:** Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately).  
Tightening torques at par. 9

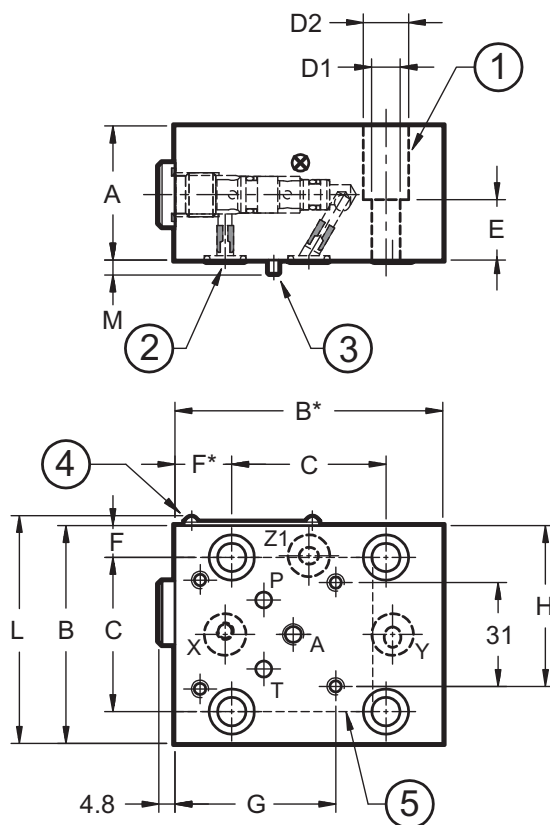


### 10.5 - Covers type DF2

dimensions in mm



LP16DF2  
LP25DF2  
LP32DF2  
LP40DF2



	NOMINAL SIZE			
	16	25	32	40
A	40	40	40	50
B	65	85	102	125
B*	80	85	102	125
C	46	58	70	85
D1	13,5	19	25	31
D2	8,5	13	17	21
E	18	17	22	30
F	9,5	13,5	16	20
F*	17	13,5	16	20
G	48	61	68,7	81
H	48	58	71.2	73
L	67,5	87,5	104.5	127.5
M	4	5	5	5

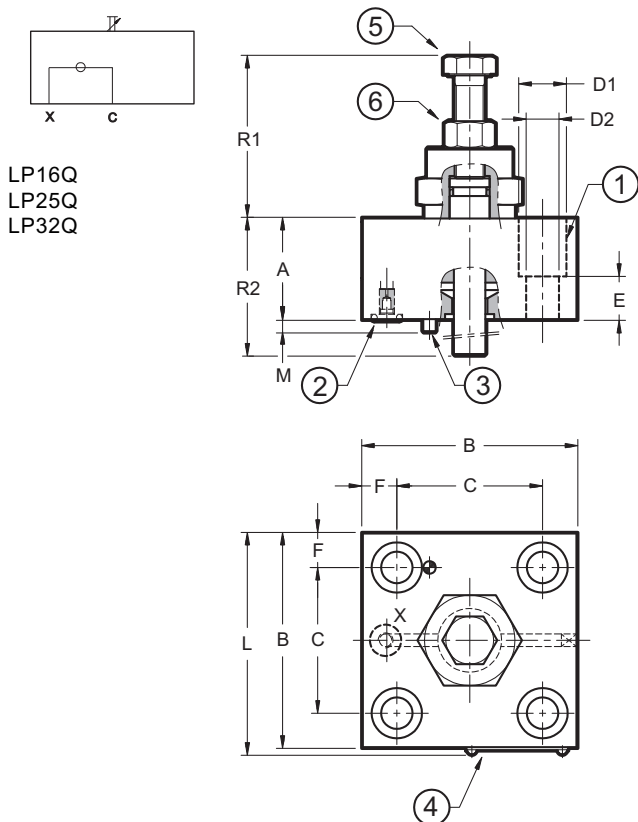
ports ready for restrictors M6x8	A			
Mass [kg]	1,8	2,3	3	6,7

1	N. 4 fastening bolts ( <b>NOTE</b> ): <b>16</b> = M8x30 <b>25</b> = M12x35 <b>32</b> = M16x45 <b>40</b> = M20x60	
2	N° 3 sealing rings 90 Shore: <b>16, 25</b> = OR type 2037 (9.25x1.78) <b>32</b> = OR type 2043 (10.82x1.78) <b>40</b> = OR type 2050 (12.42x1.78)	
3	Locating pin <b>16</b> = Ø3x10 <b>32</b> = Ø5x14 <b>25</b> = Ø5x14 <b>40</b> = Ø5x14	
4	Identification label	
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)	

**NOTE:** Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately).  
Tightening torques at par. 9

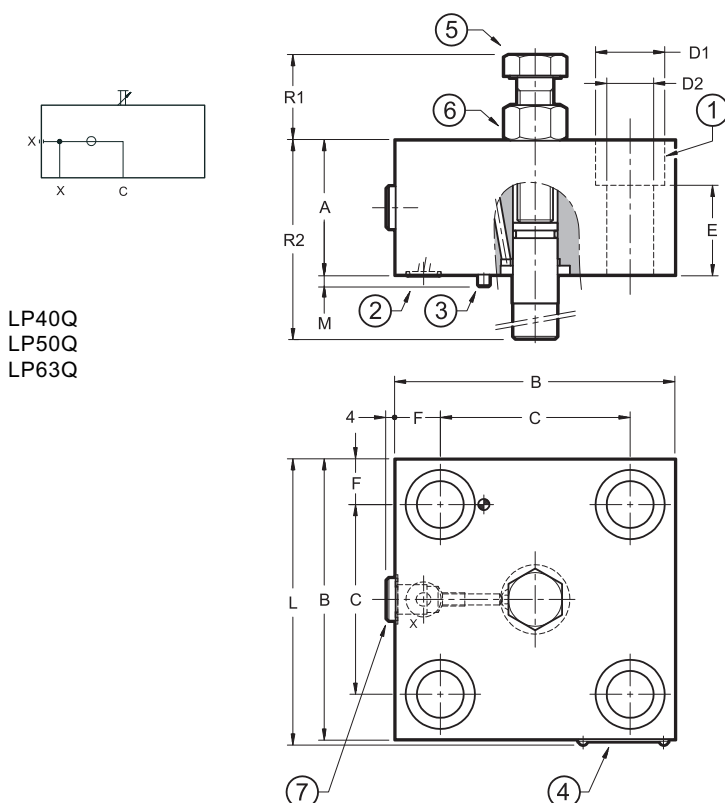
### 10.6 - Covers type Q

dimensions in mm



	NOMINAL SIZE					
	16	25	32	40	50	63
A	35	40	40	60	60	80
B	65	85	102	125	140	180
C	46	58	70	85	100	125
D1	13,5	19	25	31	31	46
D2	8,5	13	17	21	21	31
E	18	17	22	30	30	45
F	9,5	13,5	16	20	20	27,5
L	67,5	87,5	104,5	127,5	142,5	182,5
M	4	5	5	5	5	5
R1	55,5 ÷ 63,5	62,5 ÷ 74	58,5 ÷ 73,5	38,5 ÷ 57	44,5 ÷ 66,5	52 ÷ 81
R2	45 ÷ 51,5	45 ÷ 51,5	45 ÷ 51,5	44 ÷ 52	44 ÷ 52	165 ÷ 194

ports ready for restrictors	port X					
	M5x8	M6x8			M10x10	
Mass [kg]	1,6	3	5	8,9	11,7	18

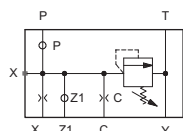


1	N. 4 fastening bolts ( <b>NOTE</b> ): 16 = M8x30      25 = M12x35 32 = M16x35    40 = M20x70 50 = M20x70    63 = M30x90
2	n° 1 sealing ring 90 Shore: 16 = OR type 2025 (6.07x1.78) 25 = OR type 2037 (9.25x1.78) 32 = OR type 2043 (10.82x1.78) 40 = OR type 2050 (12.42x1.78) 50 = OR type 2050 (12.42x1.78) 63 = OR type 3062 (15.54x2.62)
3	Locating pin: 16 = Ø3x10      25 = Ø5x14 32 = Ø5x14      40 = Ø5x14 50 = Ø6x14      63 = Ø6x14
4	Identification label
5	Stroke limiter clockwise rotation to reduce stroke 16 = 1 turn: 1,25 mm - spanner 18 25 = 1 turn: 1,25 mm - spanner 18 32 = 1 turn: 1,25 mm - spanner 18 40 = 1 turn: 2,00 mm - spanner 24 50 = 1 turn: 2,50 mm - spanner 30 63 = 1 turn: 2,00 mm - spanner 36
6	Locking nut: 16 = spanner 18    25 = spanner 18 32 = spanner 18    40 = spanner 24 50 = spanner 30    63 = spanner 36
7	Plug X: 40 = 1/4" BSP 50 = 1/4" BSP 63 = 1/4" BSP

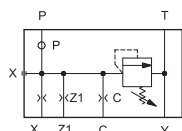
**NOTE:** Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately).  
Tightening torques at par. 9

### 10.7 - Covers type DP\* and DPE\*

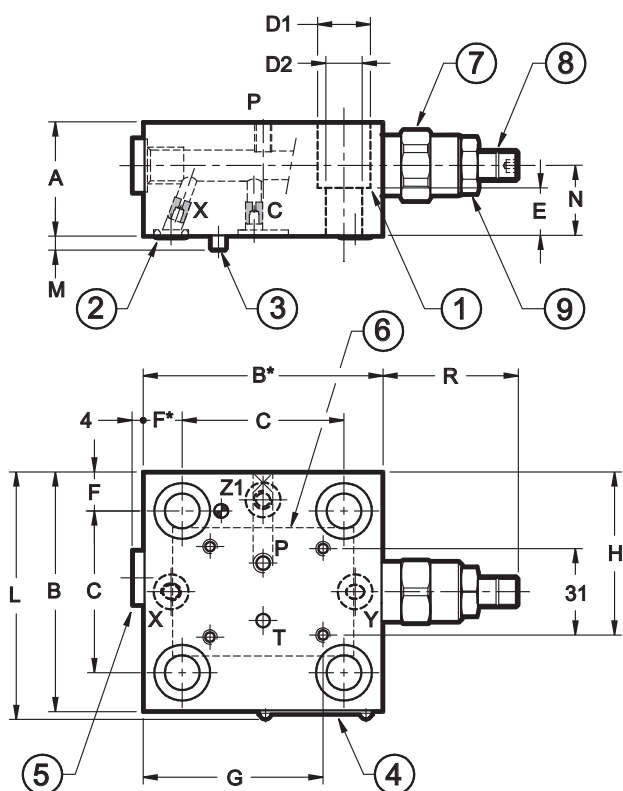
dimensions in mm



LP16DP\*  
LP25DP\*  
LP32DP\*  
LP40DP\*  
LP50DP\*  
LP63DP\*



LP16DPE\*  
LP25DPE\*  
LP32DPE\*  
LP40DPE\*  
LP50DPE\*



	NOMINAL SIZE					
	16	25	32	40	50	63
A	40	40	40	50	50	70
B	65	85	102	125	140	180
B*	75	85	102	125	140	180
C	46	58	70	85	100	125
D1	13,5	19	25	31	31	46
D2	8,5	13	17	21	21	31
E	18	17	22	30	30	35
F	9,5	13,5	16	20	20	27,5
F*	19,5	13,5	16	20	20	27,5
G	52	64	72,5	84	91,5	111,5
H	48	58	66,5	78	85,5	105,5
L	67,5	87,5	104,5	127,5	142,5	182,5
M	4	5	5	5	5	5
N	24	25	25	25	25	35
R	45÷ 51,5	45÷ 51,5	45÷ 51,5	44 ÷ 52	44 ÷ 52	44 ÷ 52

Mass [kg]	1,36	2,46	4,16	7,40	10,50	17,5
-----------	------	------	------	------	-------	------

#### DP\* restrictors

	M5x6	M6x8				M8x8
X	Ø1,2	Ø1,2	Ø1,2	Ø2,0	Ø2,0	Ø2,0
C	Ø0,7	Ø0,7	Ø1,5	Ø1,2	Ø1,5	Ø1,5

#### DPE\* restrictors

	M5x6	M6x8	M6x8	M6x8	M6x8
X	Ø0,8	Ø0,7	Ø1	Ø1	Ø1
C	Ø0,6	Ø0,6	Ø0,8	Ø0,8	Ø0,8
Z1	Ø6	Ø6	Ø6	Ø6	Ø6

1	N. 4 fastening bolts ( <b>NOTE</b> ): 16 = M8x30      25 = M12x35 32 = M16x45      40 = M20x50 40 = M20x60      63 = M30x80
2	n° 3 90 Shore sealing rings : 16 = OR type 2025 (6.07x1.78) 25 = OR type 2037 (9.25x1.78) 32 = OR type 2043 (10.82x1.78) 40 and 50 = n° 3 OR type 2050 (12.42x1.78) 63 = OR type 3062 (15.54x2.62)
3	Locating pin:    16 = Ø3x10 25, 32 and 40 = Ø5x14 50 and 63 = Ø6x14

4	Identification label
5	Plug X: 1/4" BSP
6	Mounting surface ISO 4401-03
7	Pressure control valve
8	Countersunk hex adjustment screw. Clockwise rotation to increase pressure 16, 25 and 32 = spanner 5 40, 50 and 63 = spanner 6
9	Locking nut: 16, 25 and 32 = spanner 17 40, 50 and 63 = spanner 19

**NOTE:** Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately).  
Tightening torques at par. 9

## 11 - MONITORED LOGIC ELEMENTS

Monitored logic elements are made of a directional function cartridge valve and a cover with built-in inductive proximity sensor. The PNP type sensor with closed contact states the condition of A↔B intercepted flow.

The LCM\* monitored logic elements were tested on a voluntary basis by TÜV and found to comply with the applicable requirements of the following standards:

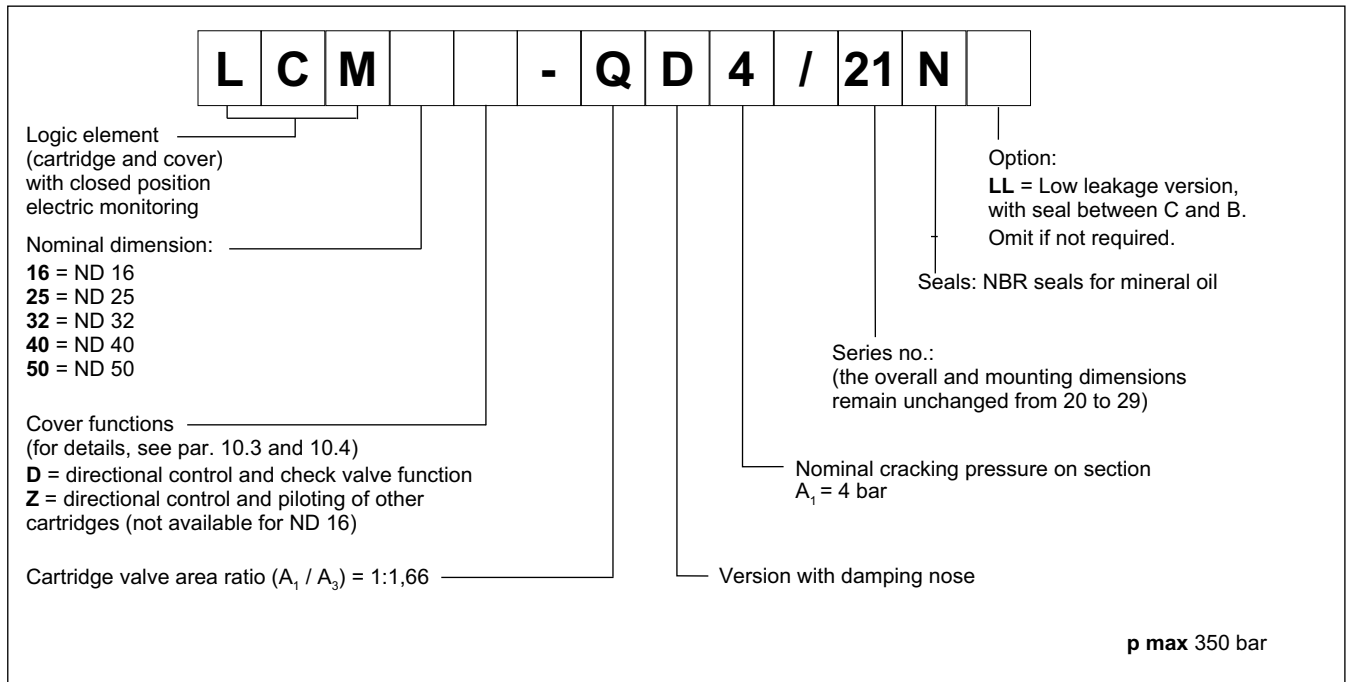
- UNI EN ISO 4413:2012 - Hydraulic fluid power – General rules and safety requirements for systems and their components
- UNI EN 12622:2014 - Safety of machine tools - Hydraulic press brakes
- UNI EN 693:2001+A2:2011 - Machine tools – Safety – Hydraulic presses
- UNI EN 201:2010 - Plastics and rubber machines - Injection moulding machines - Safety requirements
- UNI EN 422:2009 - Rubber and Plastic machines – Safety requirements

Certificate: TÜV IT 14 MAC 0042



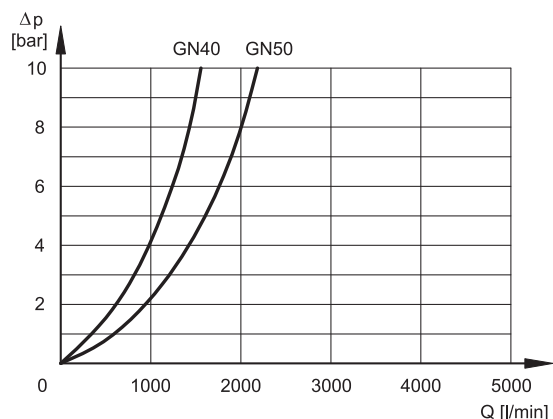
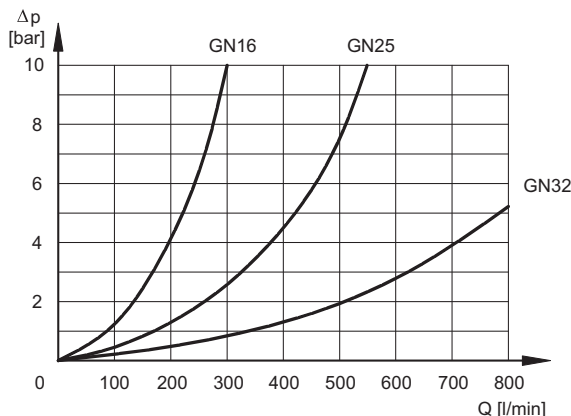
**WARNING!** These valves must be installed and commissioned by qualified personnel only. Before starting any installation, commissioning or maintenance is mandatory read the *manual of use and maintenance*, delivered together with the valve.

### 11.1 - Identification code of monitored logic elements



### 11.2 - Characteristic curves

(values obtained with viscosity 36 cSt at 50°C)



### 11.3 - Functional diagram of cover D for directional control and check valve function

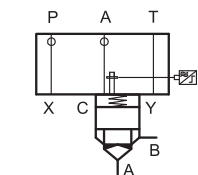
Functional diagram	Description
	<p>Piloting of cartridge valve by means of solenoid valve type DS3-TA (to be ordered separately - see catalogue 41 150)</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = A → B intercepted flow</li> <li>- solenoid valve ON = A ↔ B free flow</li> </ul>
	<p>Piloting of cartridge valve by means of connection plate code 1950751 to be ordered separately.</p>

### 11.4 - Functional diagrams for cover Z for directional control and piloting of other cartridges

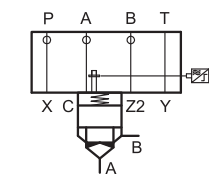
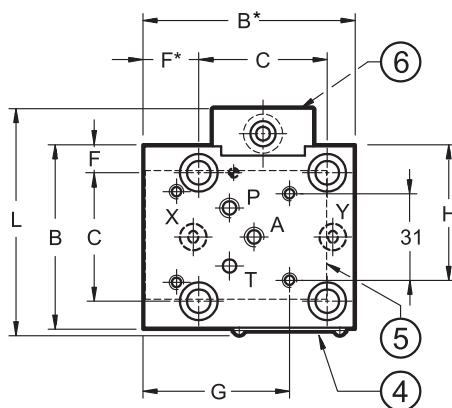
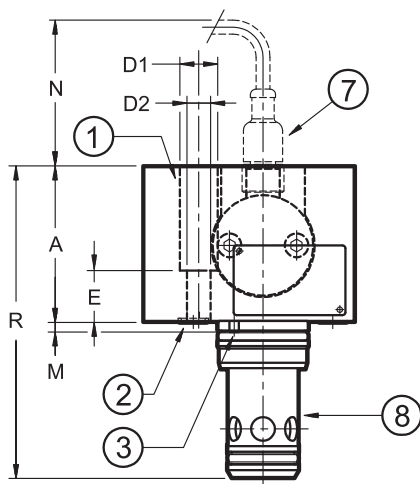
Functional diagram	Description
	<p>Piloting of cartridge valve by means of solenoid poppet valve type <b>DT03-3A</b> (to be ordered separately - see catalogue 42 200). ISO 4401-03 manifold type <b>DN6</b> (cod.0294329 - to be ordered separately ) that allows to intercept the flow from two lines, obtaining a tight or the free flow.</p> <ul style="list-style-type: none"> <li>- solenoid valve OFF = sealing tight - A ↔ B locked flow</li> <li>- solenoid valve ON = flow A ↔ B free flow</li> </ul>
	<p>Piloting of cartridge valve by means of connection plate code 1950751 to be ordered separately.</p>

### 11.5 - overall and mounting dimensions of monitored logic elements

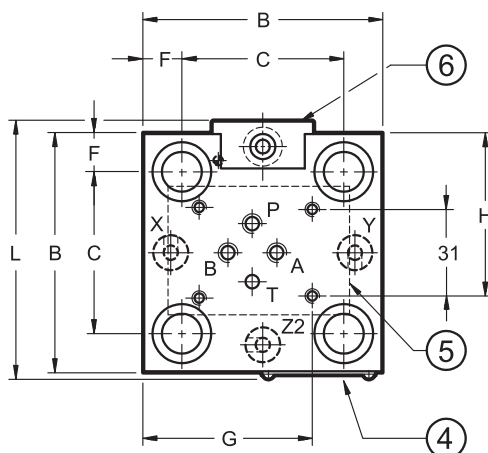
dimensions in mm



LCM16D-QD4  
LCM25D-QD4  
LCM32D-QD4  
LCM40D-QD4  
LCM50D-QD4



LCM25Z-QD4  
LCM32Z-QD4  
LCM40Z-QD4  
LCM50Z-QD4



	NOMINAL SIZE				
	16	25	32	40	50
A	55	60	70	75	90
B	65	85	102	125	140
B*	75	-	-	-	-
C	46	58	70	85	100
D1	13,5	19	25	31	31
D2	8,5	12,5	17	21	21
E	18	17	22	30	30
F*	19,5	-	-	-	-
F	9,5	13,5	16	20	20
G	52	60,2	68,7	80,2	87,7
H	48	58	66,5	105	85,5
L	81	92	104,5	127,5	142,5
M	4	5	5	5	5
N	70	70	65	60	55
R	111	132	155	180	212

ports ready for restrictors M6x8.5	P, A B (on cover Z only)				
Mass [kg]	2,1	3,3	5,3	9,5	14,5

1	N. 4 fastening bolts ( <b>NOTE 1</b> ): 16 = M8x30      40 = M20x60 25 = M12x35      50 = M20x60 32 = M16x45
2	n° 3 sealing rings 90 Shore : 16 = OR type 2025 (6.07x1.78) (for ND 16 there are only 2 OR) 25 = OR type 2037 (9.25x1.78) 32 = OR type 2043 (10.82x1.78) 40 and 50 = OR type 2050 (12.42x1.78)
3	Locating pin: 16 = Ø3x10      40 = Ø5x14 25 = Ø5x14      50 = Ø6x14 32 = Ø5x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)
6	Proximity sensor
7	Connector for proximity sensor (to be ordered separately see par. 10.6)
8	Cartridge valve always supplied with the cover

**NOTE 1:** standard dimensions at par. 6.

**NOTE 2:** fastening bolts class 10.9 ISO 4762 are recommended for cover installation (to be ordered separately). Tightening torques at par. 9

**NOTE 3:** for dimensions of the cartridge valve seat see par. 5

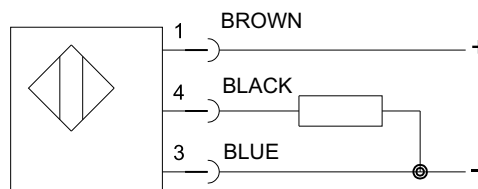
## 11.6 - Technical characteristics of proximity sensor and connector

### PROXIMITY SENSOR

#### PNP TYPE

Rated voltage	V DC	24
Power supply voltage range	V DC	10 ÷ 30
Absorbed current	mA	200
Output	normally open contact	
Electric protection	polarity inversion short circuit overvoltage	
Electric connection	with connector	
Max operating pressure	bar	350
Operating temperature range	°C	-25 / +80
Class of protection according to IEC EN 60529 standards (atmospheric agents)		IP68
Spool position LED		NO

### CONNECTION SCHEME



valve closed = closed contact (A↔B intercepted flow)  
valve open = open contact (A↔B free flow)

### SIGNAL STATUS

According to the safety standards rules, the position signal must change its status before the effective valve opening.

### ELECTRIC CONNECTOR (to be ordered separately)

code: ECM3S/M12L/10

Connector: pre-wired connector M12 - IP68

cable: with 3 conductors 0.34 mm<sup>2</sup> - length 5 mt

cable material: polyurethane resin (oil resistant)

GREEN LED: LED: indicates that there is power supply voltage to the connector. If the LED is off, the connector is not powered.

YELLOW LED: show the valve status:

- valve at initial position      yellow led ON - green led ON
- switched valve                  yellow led OFF - green led ON



# EC

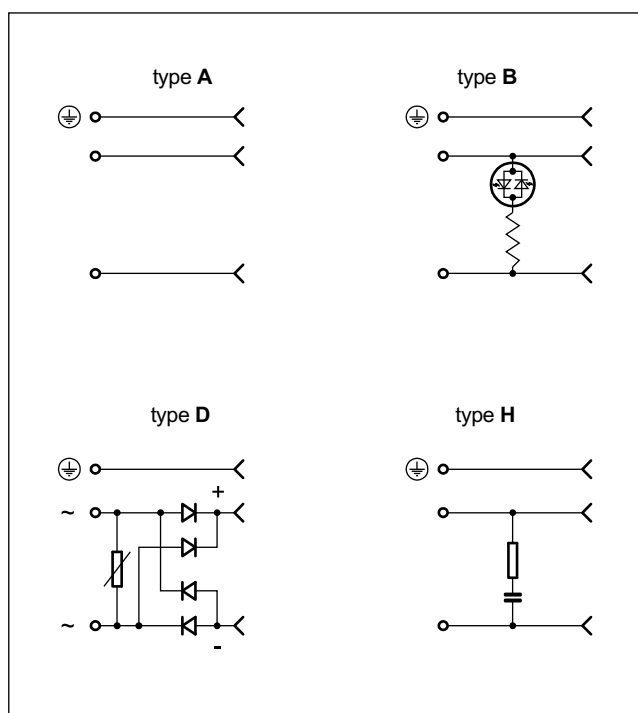
## ELECTRIC CONNECTORS

### SERIES 10

**EN 175301-803**  
**(ex DIN 43650 / ISO 4400 )**

**type A**

#### ELECTRICAL DIAGRAM



#### DESCRIPTION

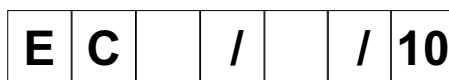
- The EC connectors, are according to EN 175301-803 form "A" and are used for the electrical connection of solenoid vaves.
- When they are correctly installed and coupled they provide protection according to IEC EN 60529 standards, class of protection IP65/67.
- The class of insulation is in compliance with IEC 60664-1 2007 specifications, with operating voltage up to 250 V, overvoltage category II, operating degree 3.
- The wire terminal block is removable from the external housing for simplifying the wire connection to the clamps, and it allow the electrical contacts to be turned through 90° (except version H) if required.
- Four different types with specific functions are available:
  - type A, connector two poles + ground
  - type B\*, with LED  
(available voltages: 10 ÷ 50 and 70 ÷ 250V)
  - type D, with bridge rectifier
  - type H, with RC damping circuit
- Type A is also available in gray colour, to differentiate the solenoids mounted on the side "a" or "b".
- They are supplied with M3 fixing screw and NBR gasket.

#### TECHNICAL CHARACTERISTICS

		type A	type B*	type D	type H
Voltage supply	V DC/AC	up to 230	10 ÷ 50 / 70 ÷ 250	up to 230	up to 230
Number of poles		2 + ground			
Current on connections: nominal maximum	A	10 16			
Contact resistance	mΩ	≤ 4			
Maximum conductor size	mm	1,5			
Cable exit		Pg9 / Pg11 unified			
Electromagnetic compatibility (EMC)		according to 2004/108/CE			
Low voltage		according to 2006/95/CE			
Protection degree		IP 65/67 - IEC 60529			
Insulation class		class C (IEC 60664-1:2007-04)			
Operating temperature	°C	-40 / +90			



### 1 - IDENTIFICATION CODE



Electric connector  
EN 175301-803 (ex DIN 43650 / ISO 4400)

Series No.  
(the overall and mounting dimensions remain unchanged from 10 to 19)

Connector type

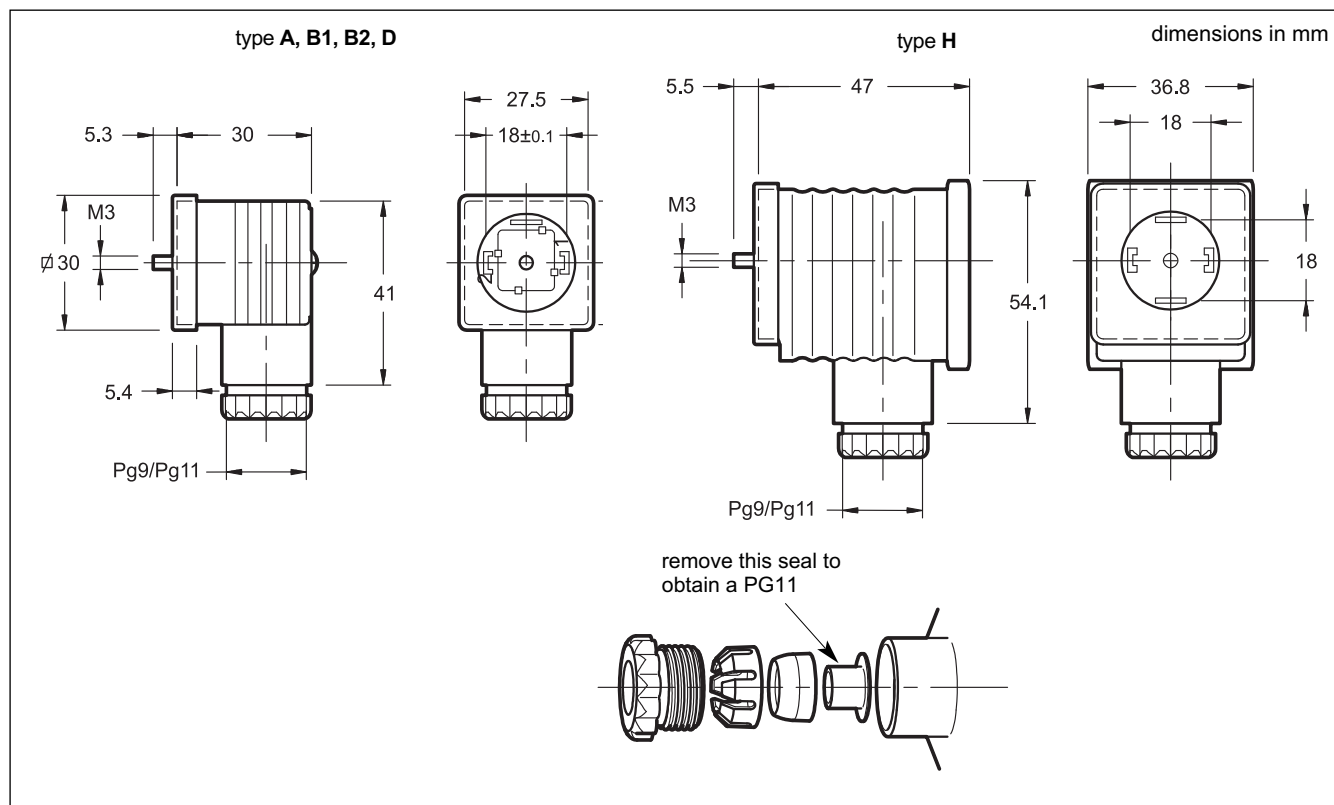
Colour:

- A** = two poles + ground
- B1** = two poles + ground with led which burns when the solenoid is energized  
power supply voltage  $10 \div 50$  V AC/DC
- B2** = two poles + ground with led which burns when the solenoid is energized  
power supply voltage  $70 \div 250$  V AC/DC
- D** = two poles + ground with Graetz bridge rectifier:  
for alternating current power supply source with direct current coils with  
current consumption max 1 ampere.
- H** = two poles + ground with RC damping circuit, to avoid voltage peaks as  
circuit opening, suitable for alternating and direct current coils.

- Type A
  - B** = black (**standard**)
  - A** = grey
- Type B
  - N** = transparent
- Types D, H
  - B** = black

**NOTE:** For the connectors type A - D - H it is not necessary to specify the operating voltage, as the power supply voltage is up to 230 V.

### 2 - OVERALL AND MOUNTING DIMENSIONS



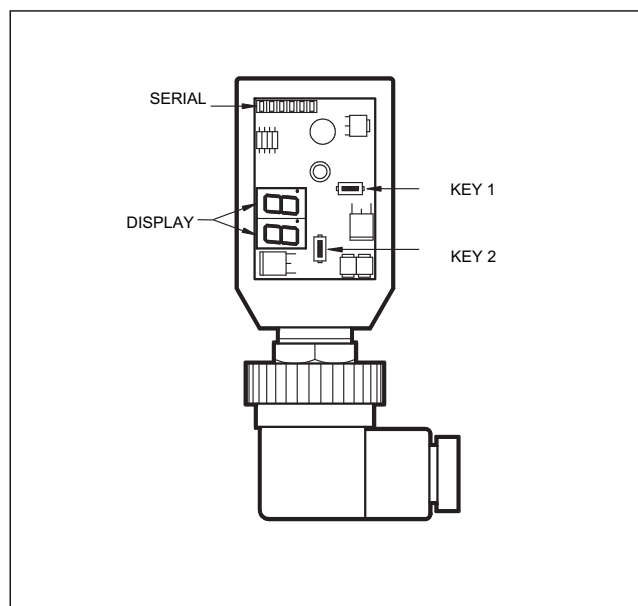
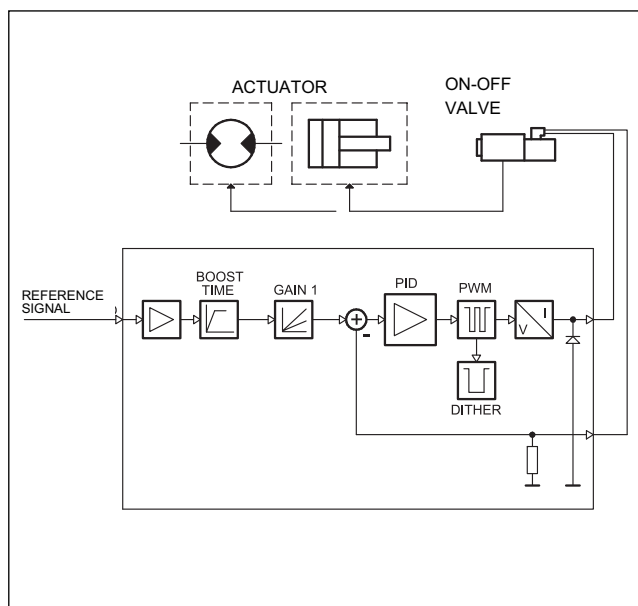


# ECL

## POWER SAVING DEVICE FOR ON-OFF SOLENOID VALVES SERIES 20

### PLUG VERSION

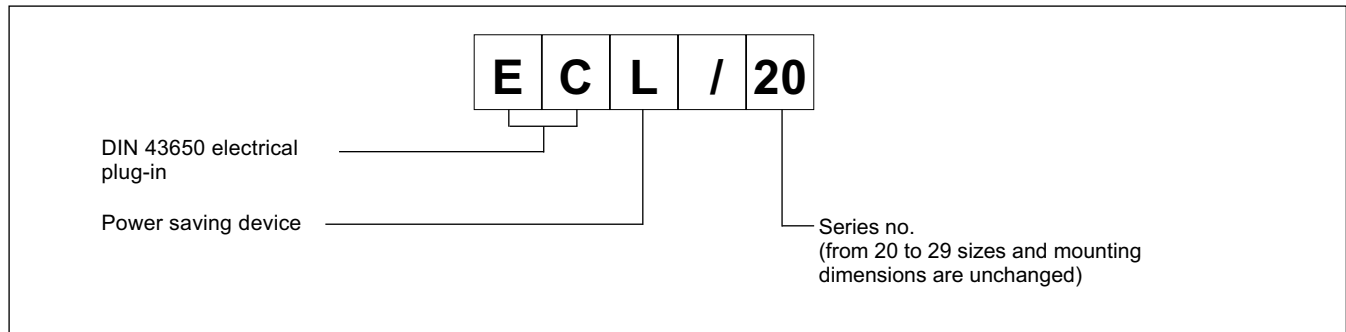
#### OPERATING PRINCIPLE



#### TECHNICAL CHARACTERISTICS

Power supply	V DC	8 ÷ 30 Ripple included
Max current	A	2,60
Absorbed current with valve not switched	mA	40
Current absorbed by the switching command (at 30 VDC)	mA	10 max
Full power feeding time	ms	50
Holding current regulating range	% I MAX	50 ÷ 100
Holding current default	% I MAX	40
Connector type		DIN 43650
Electromagnetic compatibility (EMC) - emissions CEI EN 61000-6-4 - immunity CEI EN 61000-6-2		according to 2004/108/CE standards (see paragraph 5 - <b>NOTE</b> )
Protection to atmospheric agents		IP 65 - 67
Operating temperature range	°C	-20 / +70
Mass	kg	0,10

## 1 - IDENTIFICATION CODE



The ECL connector is a digital amplifier controlling open loop on-off valves directly from PLC.

The unit supplies a set current independently from temperature variations or load impedance.

Setting is possible by buttons and display inside the case, or with a PC by RS232 with the software EDC-PC/10, (see paragraph 6.2).

## 2 - FUNCTIONAL SPECIFICATIONS

### 2.1 - Electric power supply

The connector requires a power supply of 24V DC (pin 1 and 2). The power supply voltage must be rectified and filtered, and it has not to be higher than 6A.

N.B. The value of the power supply voltage on the connector must be higher than the rated working voltage of the solenoid to be controlled.

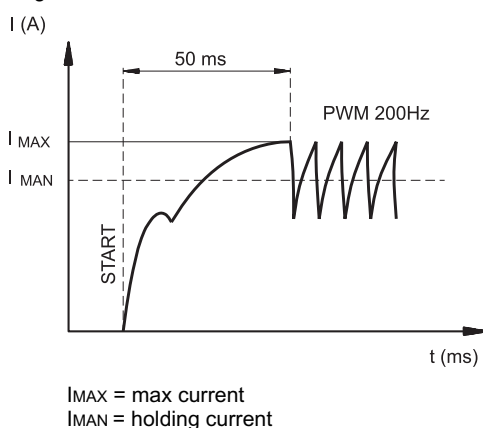
The power required by the card depends on the power supply voltage and on the maximum value of the supplied current.

### 2.2 - Electrical protection

The connector is protected against overvoltage and polarity inversion. On the output a protection against any short circuit is foreseen.

### 2.3 - Functioning

This device operates by feeding the solenoid valve at the max current value for a time sufficient to guarantee the complete valve energizing (50 ms). The current is therefore automatically reduced at holding.



default vales:  $I_{MAN} = 1A$   
threshold : 200 mV  
freq: 200 Hz

## 3 - SIGNALS

### 3.1 - POWER ON (Power supply)

Displays indicate the connector is ON and with +24 V DC.

## 4 - ADJUSTMENTS

There are two way adjustments: variables view and parameters editing. The first one enables the real time monitoring of the control values, for both required and read current, on both channels. The second modality enables the operating parameters view and editing.

### 4.1 - Variables view

The card is switched on at the variables view modality, and it shows the first variable value, that is the C1 parameter, current solenoid.

- C1: current supplied from ECL to the solenoid read on real time
- U1: Threshold reference signal.  
9.9 = Threshold active

### 4.2 - Parameters editing

To access the parameter editing, press the key (2) for at least 3 seconds.

The first parameter displayed is G1. To modify it, press the key (1) for two seconds, until the display starts blinking. Use the key (2) to increase the value and the key (1) to decrease it. To save the new value, press both the keys. The display stops blinking.

Pressing the key (2) again is possible to scroll all the parameters. To modify the other parameters, repeat the steps above-mentioned for the G1 parameter.

The variables that can be selected are:

- G1: "I Max" current, expressed in milliAmpere.  
It sets the maximum current to the solenoid, when the reference signal is at the maximum value. It is used to limit the maximum value of the supplied current.  
Default value of  $I_{max} = 1000$  mA  
Range =  $50 \div 100\%$  of  $I_{max}$
- Fr: PWM frequency, in Hertz.  
It sets the PWM frequency, which is the pulsating frequency of the solenoid current.  
Default value = 200  
Range =  $100 \div 500$  Hz

DISPLAY VIEW EXAMPLE:

REFERENCE (V)	VARIABLE U1 (V)	VARIABLE C1
0	00	40. (mA)
10	10.	2.6 (A)

## 5 - INSTALLATION

The connector type electronic unit is suitable for direct assembly on the solenoid of the relative on-off valve. With the 4-core connector for supply and for the reference signal.

**NOTE:** To observe EMC requirements it's important that the control unit electrical connection is in compliance with the wiring diagram of chapter 7.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources as power wires, electrical motors, inverters and electrical switches.

In environments where there are critical electromagnetic interferences, a complete protection of the connection wires can be requested.

## 6 - START UP, CONTROL SETTINGS AND SIGNAL

### 6.1 - Set up

Settings can be changed by either acting on the (1) and (2) keys located on the card front panel, or using the EDC-PC software kit.

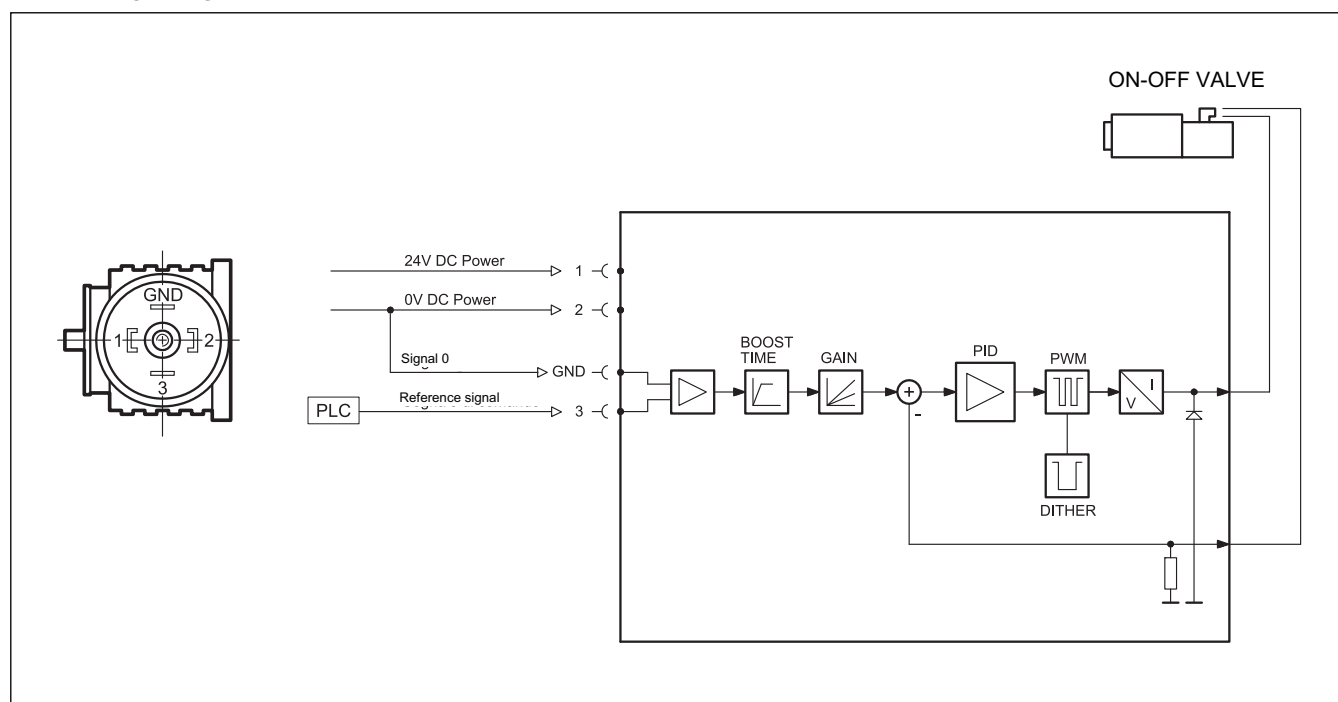
### 6.2 - EDC-PC/10 Software (code 3898301001)

The relevant hardware and software kit (to be ordered separately) allows to read the values and to set the connector easily.

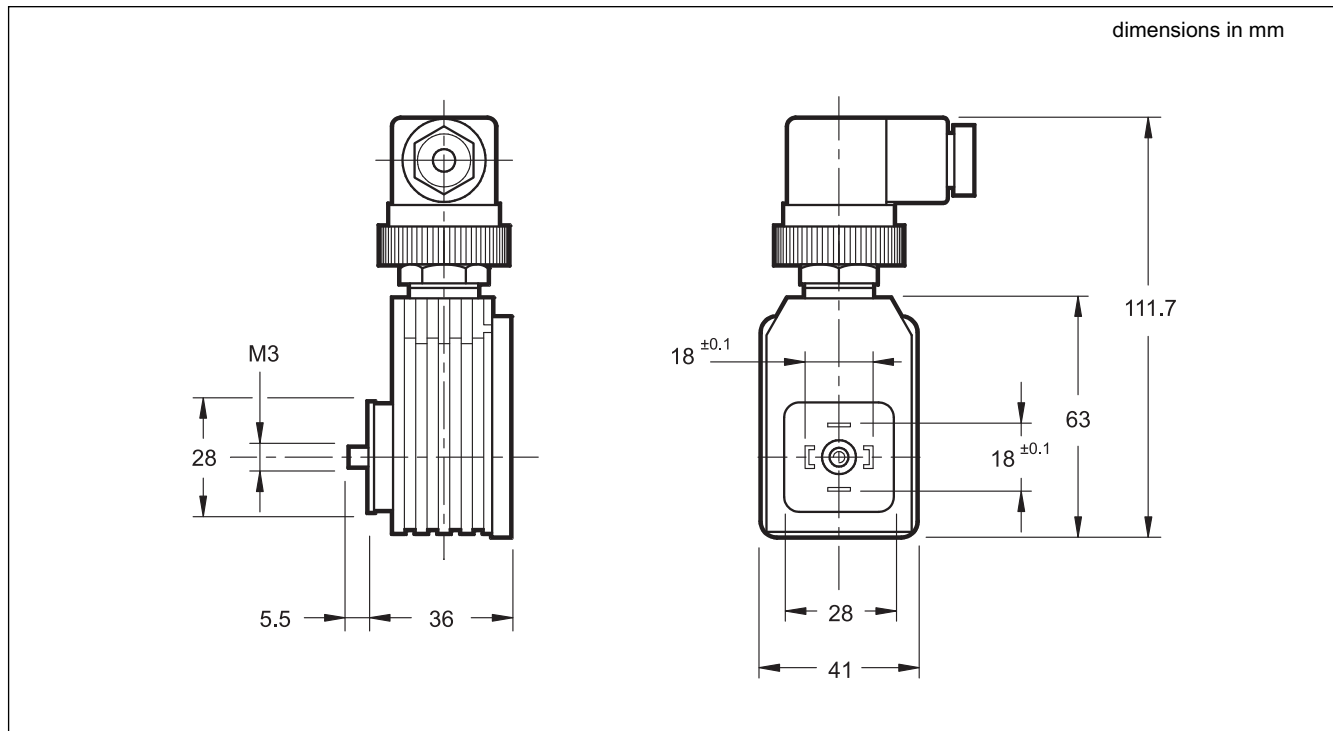
The software communicates, through a flat cable, to the ECL; the connector is behind the protecting gate.

The EDC-PC/10 software compatibility is guaranteed only on Windows XP® operating systems.

## 7 - WIRING DIAGRAM



## 8 - OVERALL AND MOUNTING DIMENSIONS



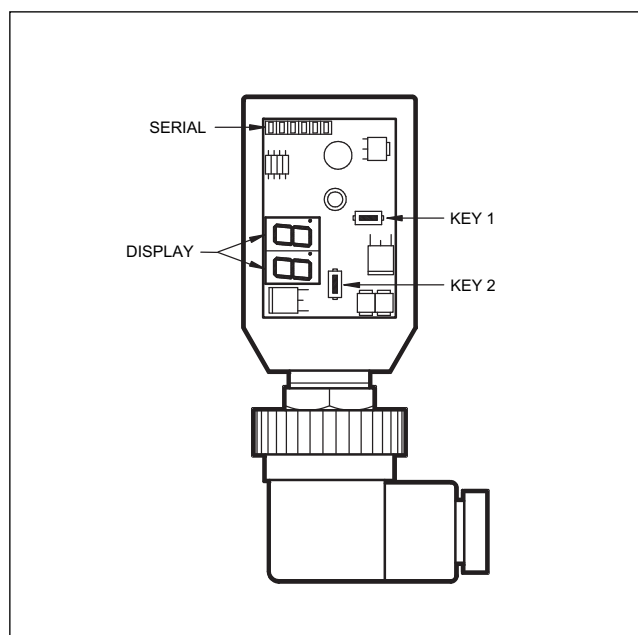
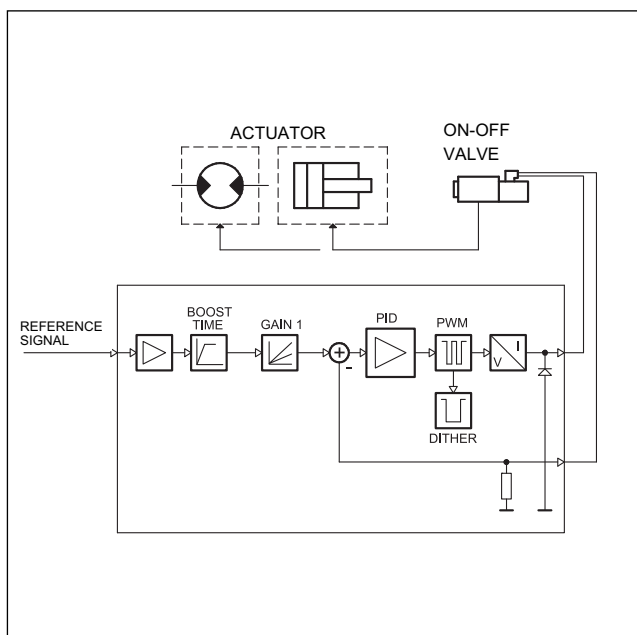
# ECF

## AMPLIFIED CONNECTOR FOR FAST COMMAND (RAPID) ON-OFF VALVES SERIES 20



### PLUG VERSION

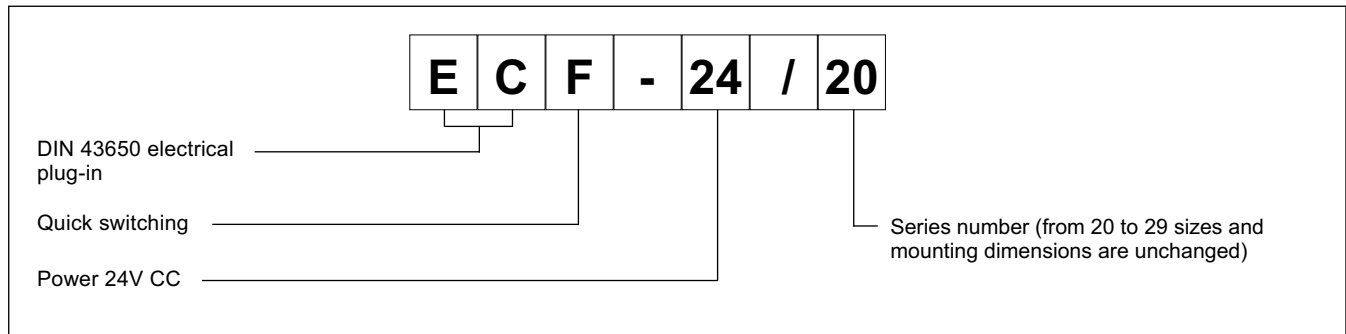
#### OPERATING PRINCIPLE



#### TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included
Required power	W	min 50 - max 150 (see paragraph 2.1)
Output current	mA	max 3000 (see paragraph 1)
Power supply electrical protections		– overload over 33V – polarity inversion
Output electrical protections		Short-circuit
Analogue electrical protections		up to 30 V DC
Reference signal	V DC	24
Connector type		DIN 43650
Electromagnetic compatibility (EMC) - emissions CEI EN 61000-6-4 - immunity CEI EN 61000-6-2		according to 2004/108/CE standards (see paragraph 5 - <b>NOTE 1</b> )
Protection to atmospheric agents		IP 65 - 67
Operating temperature range	°C	-20 / +70
Mass	kg	0,10

### 1 - IDENTIFICATION CODE



The ECF connector is a digital amplifier controlling open loop on-off valves.

The unit supplies a set current independently from temperature variations or load impedance.

A quick solenoid energizing is possible in two different ways, according to the used coil type (12V o 24V)

Setting is possible by buttons and display inside the case, or with a PC by RS232 with the software EDC-PC, (see paragraph 6.2).

### 2 - FUNCTIONAL SPECIFICATIONS

#### 2.1 - Electric power supply

The connector requires a power supply of 24V DC (terminals 1 and 2). The power supply voltage must be rectified and filtered, and it has not to be higher than 6A.

N.B. The value of the power supply voltage on the connector must be higher than the rated working voltage of the solenoid to be controlled.

The power required by the card depends on the power supply voltage and on the maximum value of the supplied current.

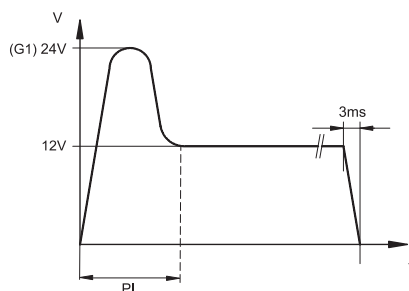
#### 2.2 - Electrical protection

The connector is protected against overvoltage and polarity inversion. On the output a protection against any short circuit is foreseen.

#### 2.3 - Functioning with 12V coils

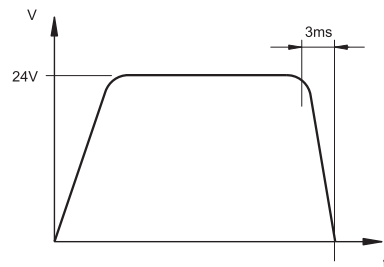
With the employment of 12V coils, the ECF valve allows a quick solenoid energizing (G1), overboosting the solenoid just the time to energize it (PI). Then, the voltage will be lowered at the rated value. The de-energizing is fast, and is 3 ms.

At overboosting time, the power-supply unit must be able to provide a 6 A intensity current strength.



#### 2.4 - Functioning with 24V coils

24V coils do not require overboosting. A quick de-energizing is guaranteed.



### 3 - SIGNALS

#### 3.1 - POWER ON (Power supply)

Displays indicate the connector is ON and with +24 V DC.

### 4 - ADJUSTMENTS

There are two way adjustments: variables view and parameters editing. The first one enables the real time monitoring of the control values, for both required and read current, on both channels. The second modality enables the operating parameters view and editing.

#### 4.1 - Variables view

The card is switched on at the variables view modality, and it shows the first variable value, that is the C1 parameter, current solenoid.

C1: current supplied from ECF to the solenoid read on real time

#### 4.2 - Parameters editing

To access the parameter editing, press the key (2) for at least 3 seconds.

The first parameter displayed is G1. To modify it, press the key (1) for two seconds, until the display starts blinking. Use the key (2) to increase the value and the key (1) to decrease it. To save the new value, press both the keys. The display stops blinking.

Pressing the key (2) again is possible to scroll all the parameters. To modify some the parameter, repeat the steps above-mentioned for the G1 parameter.

DISPLAY VIEW EXAMPLE:

REFERENCE (V)	VARIABLES (Ampere)
0	0.0 (mA)
24	2.6 (A)

The variables that can be selected are:

- G1:** "I Max" current, expressed in Ampere.  
It sets the maximum current to the solenoid, when the reference signal is at the maximum value +24 V. It is used to limit the maximum value of the supplied current.  
Default value = 2000 mA  
Range = 0 ÷ 3000 mA
- PI:** Overboosting time.  
It determines the regulation of solenoid overboosting time and it is measured by milliseconds.  
Default value = 40 ms  
Range = 0 ÷ 500 ms
- Fr:** PWM frequency, in Hertz.  
It sets the PWM frequency, which is the pulsating frequency of the solenoid current.  
Default value = 200  
Range = 100 ÷ 500Hz

## 5 - INSTALLATION

The connector type electronic unit is suitable for direct assembly on the solenoid of the relative on-off valve. With the 4-core connector for supply and for the reference signal.

**NOTE:** To observe EMC requirements it's important that the control unit electrical connection is in compliance with the wiring diagram of chapter 7.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources as power wires, electrical motors, inverters and electrical switches.

In environments where there are critical electromagnetic interferences, a complete protection of the connection wires can be requested.

## 6 - START UP, CONTROL SETTINGS AND SIGNAL

### 6.1 - Set up

Settings can be changed by either acting on the (1) and (2) keys located on the card front panel, or using the EDC-PC software kit.

### 6.2 - EDC-PC Software (code 3898301001)

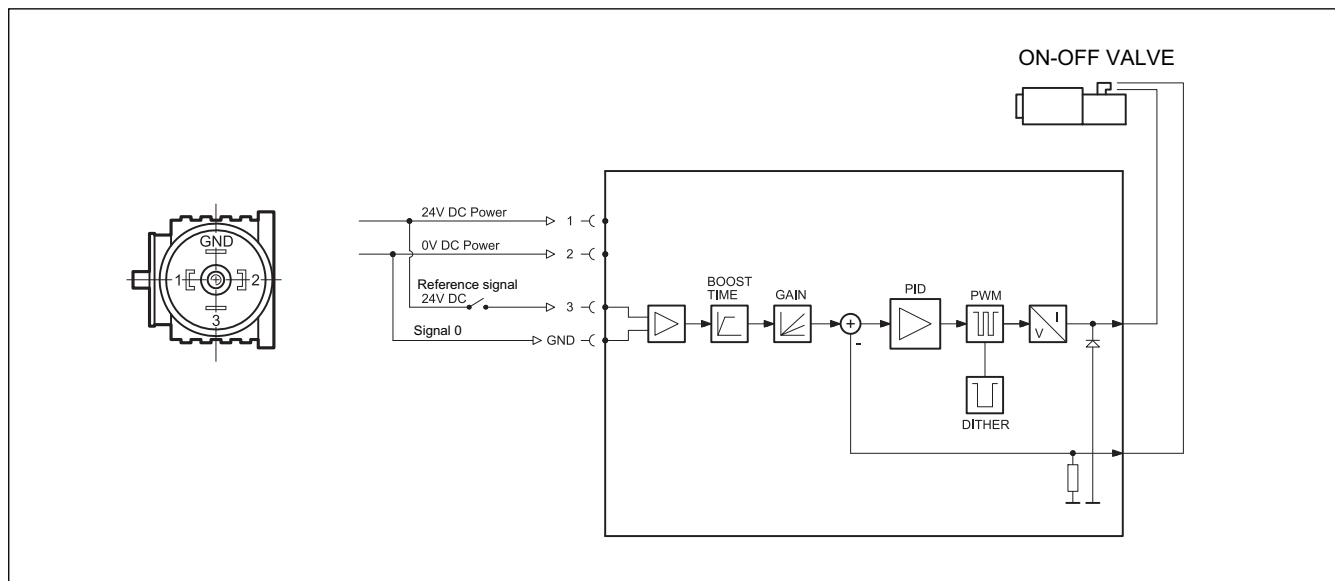
The relevant hardware and software kit (to be ordered separately) allows to read the values and to set the connector easily.

The software communicates, through a flat cable, to the ECF; the connector is behind the protecting gate.

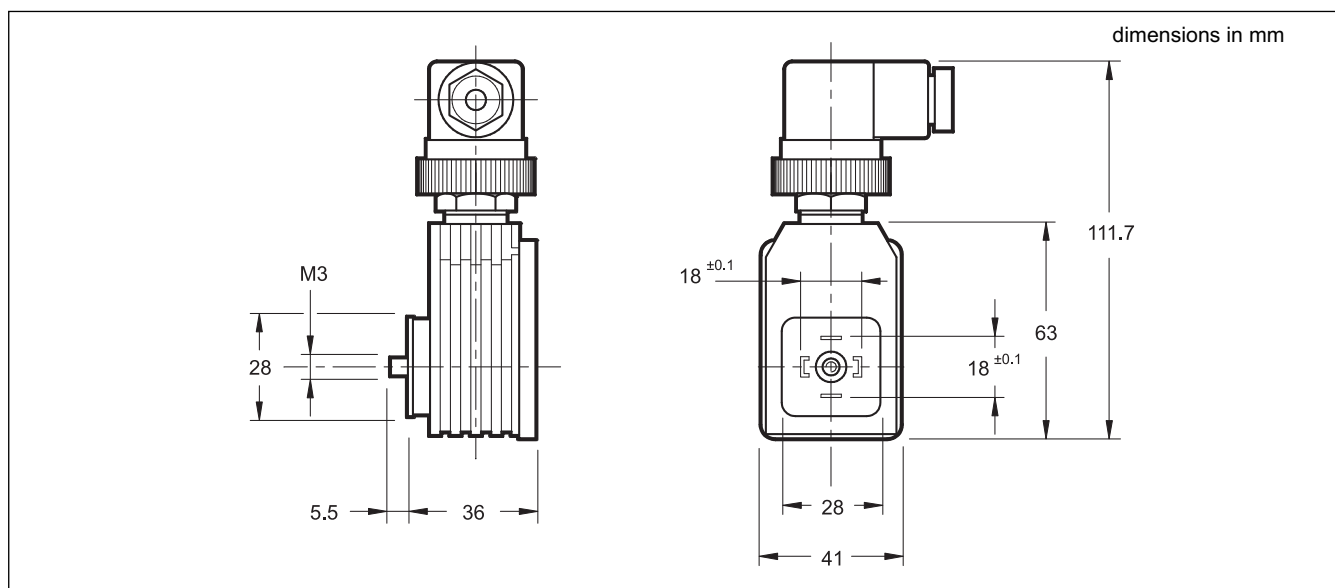
The EDC-PC software compatibility is guaranteed only on Windows XP® operating systems.



## 7 - WIRING DIAGRAM



## 8 - OVERALL AND MOUNTING DIMENSIONS

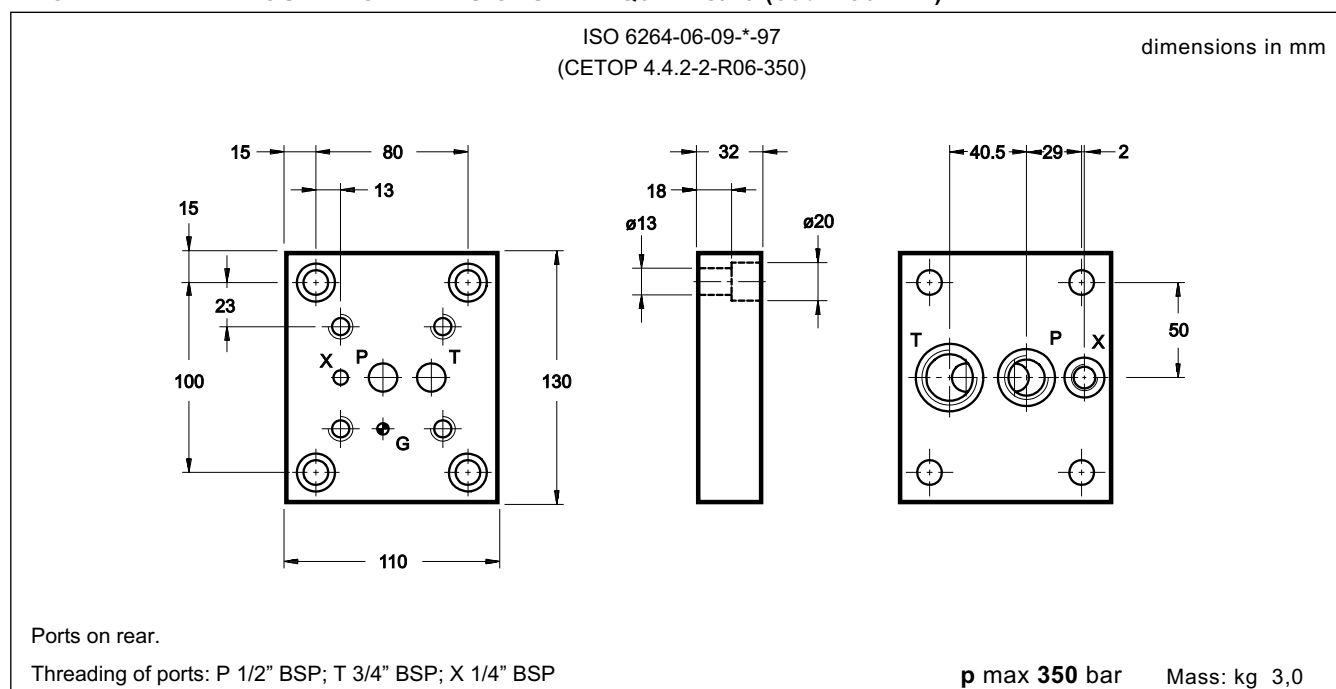


# SUBPLATES

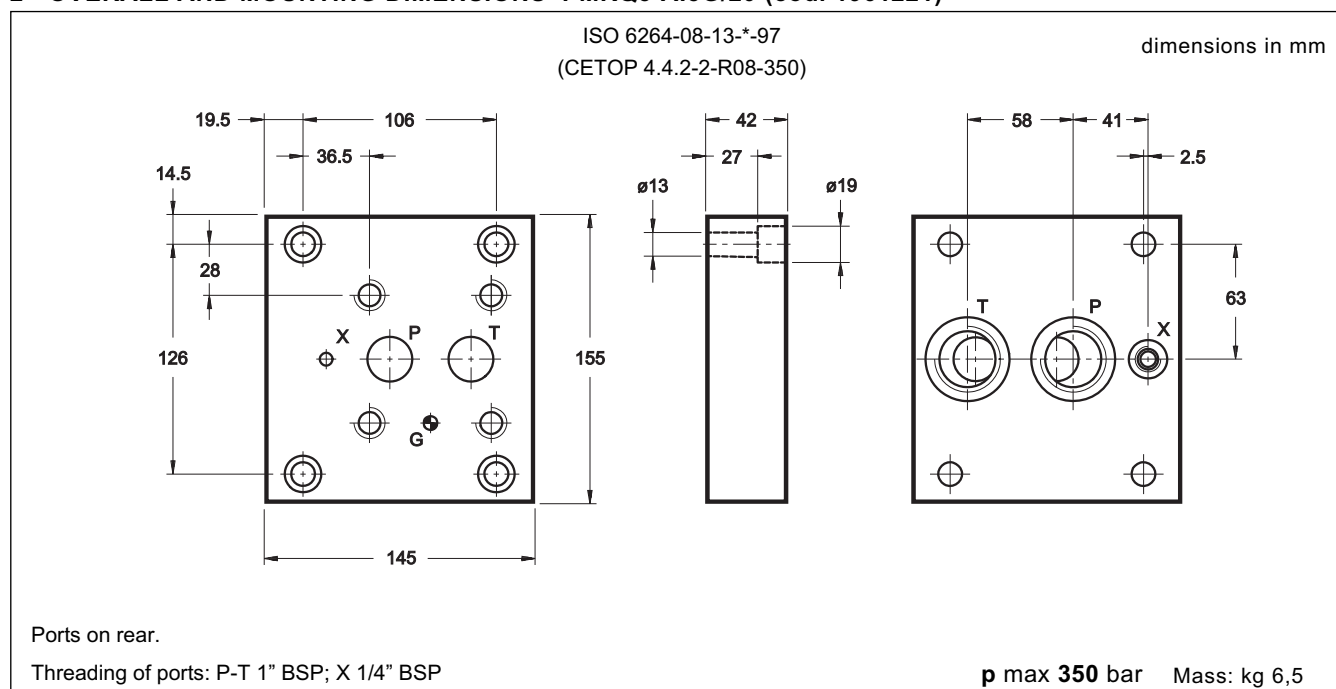
## PMRQ\*

### SUBPLATES FOR PRESSURE CONTROL VALVES

#### 1 - OVERALL AND MOUNTING DIMENSIONS PMRQ3-A14G/20 (cod. 1961211)



#### 2 - OVERALL AND MOUNTING DIMENSIONS PMRQ5-A15G/20 (cod. 1961221)

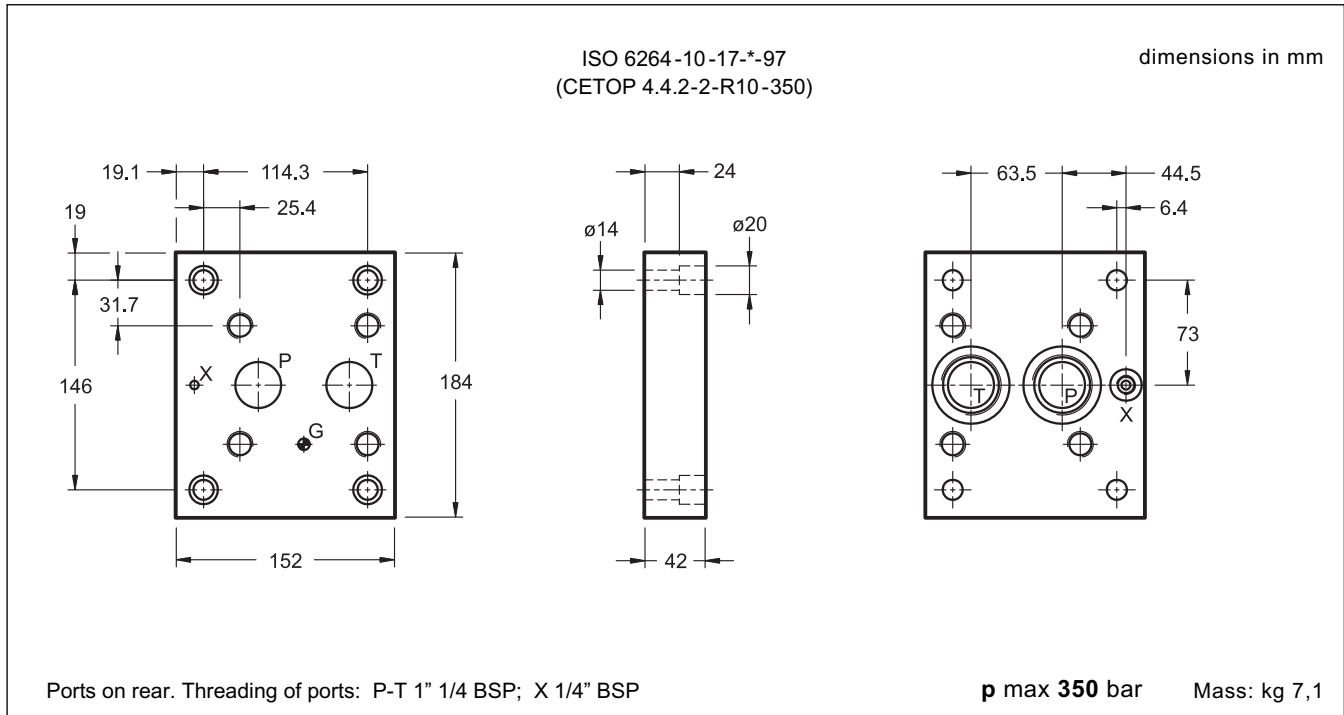




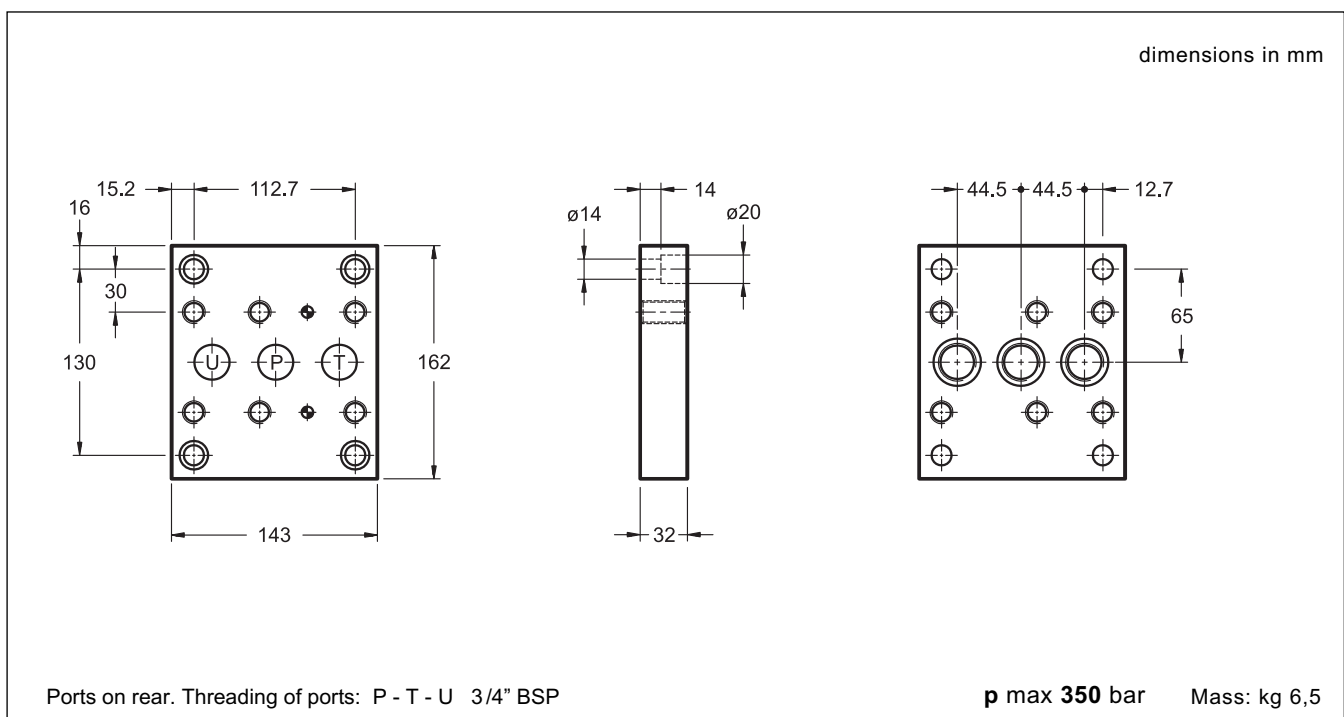
# PMRQ\*

## SUBPLATES FOR PRESSURE CONTROL VALVES

### 3 - OVERALL AND MOUNTING DIMENSIONS PMRQ7-AI7G/10 (cod. 1960051)



### 4 - OVERALL AND MOUNTING DIMENSIONS PMRQA5-AI5G/10 (cod. 1960070)

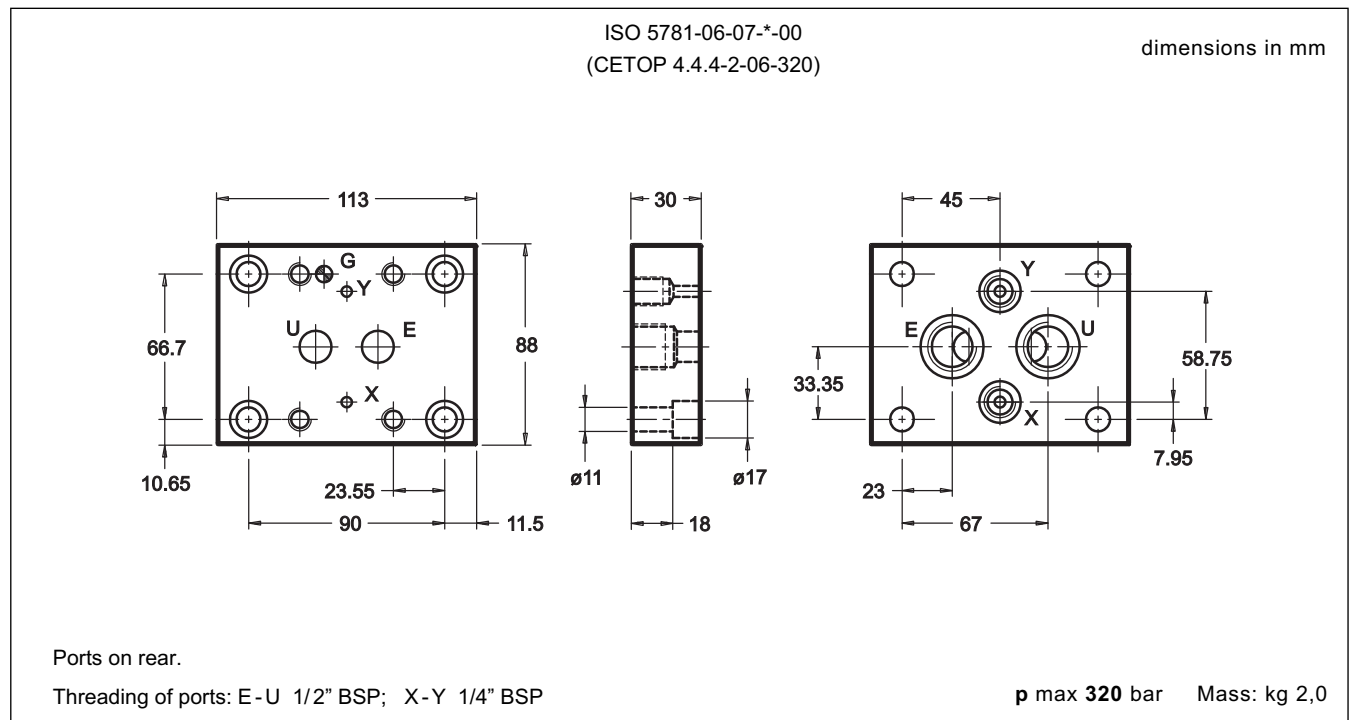




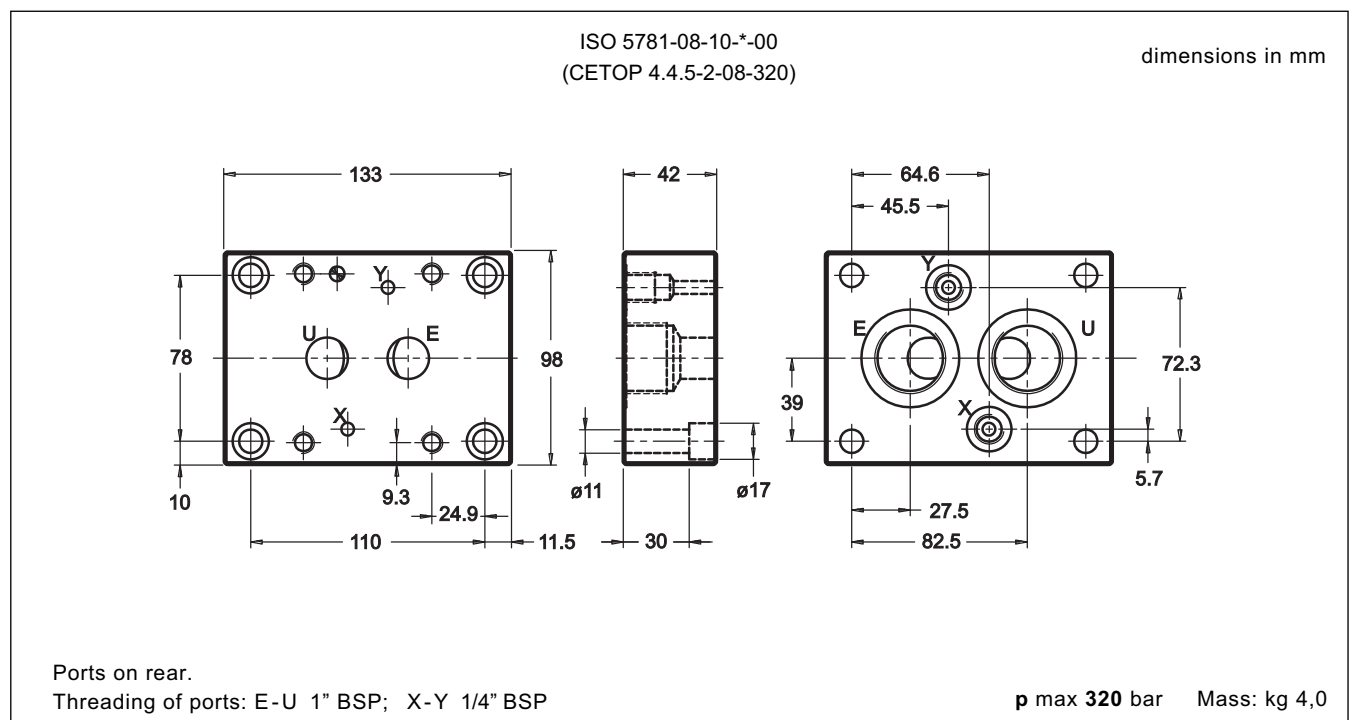
# PMSZ\*

## SUBPLATES FOR S - Z VALVES

### 5 - OVERALL AND MOUNTING DIMENSIONS PMSZ3-AI4G/20 (cod. 1961231)



### 6 - OVERALL AND MOUNTING DIMENSIONS PMSZ5-AI6G/20 (cod. 1961241)



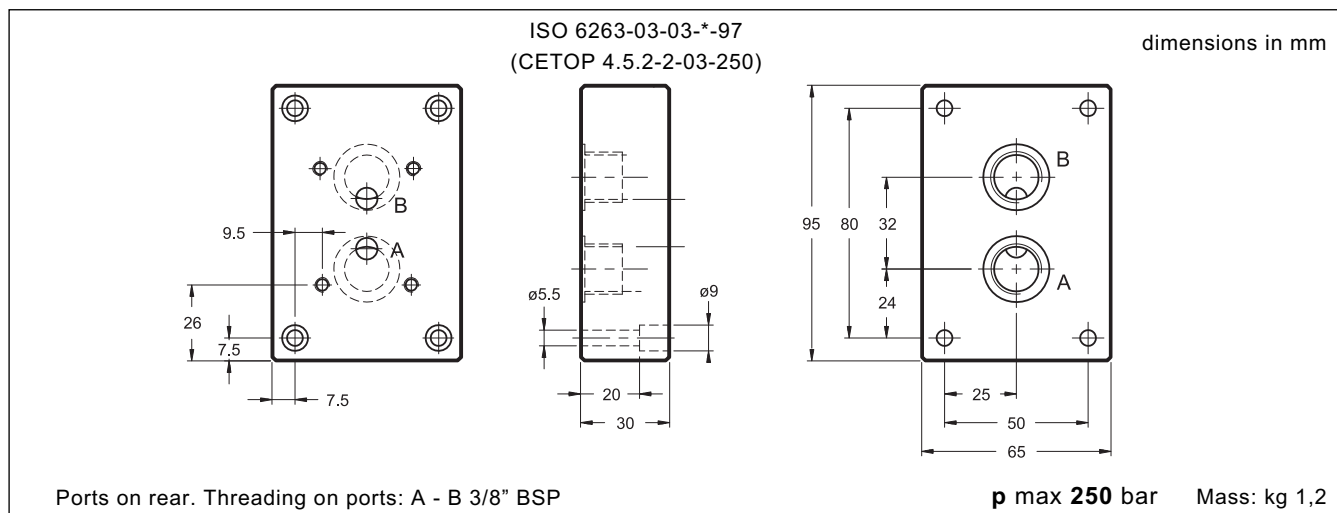


# PMRPC\*

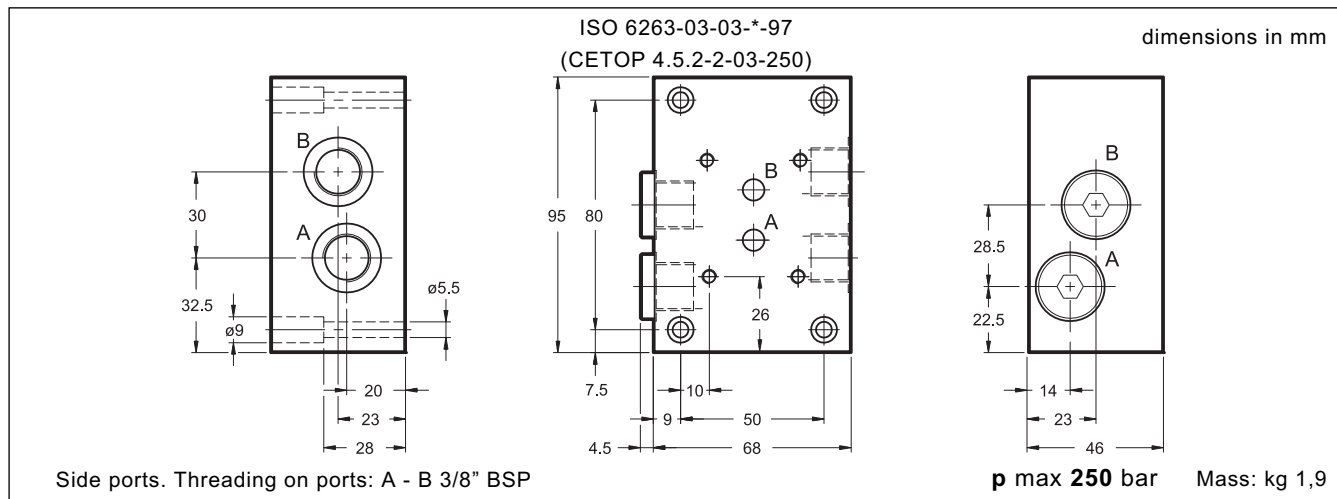
## SUBPLATES

### FOR FLOW CONTROL VALVES

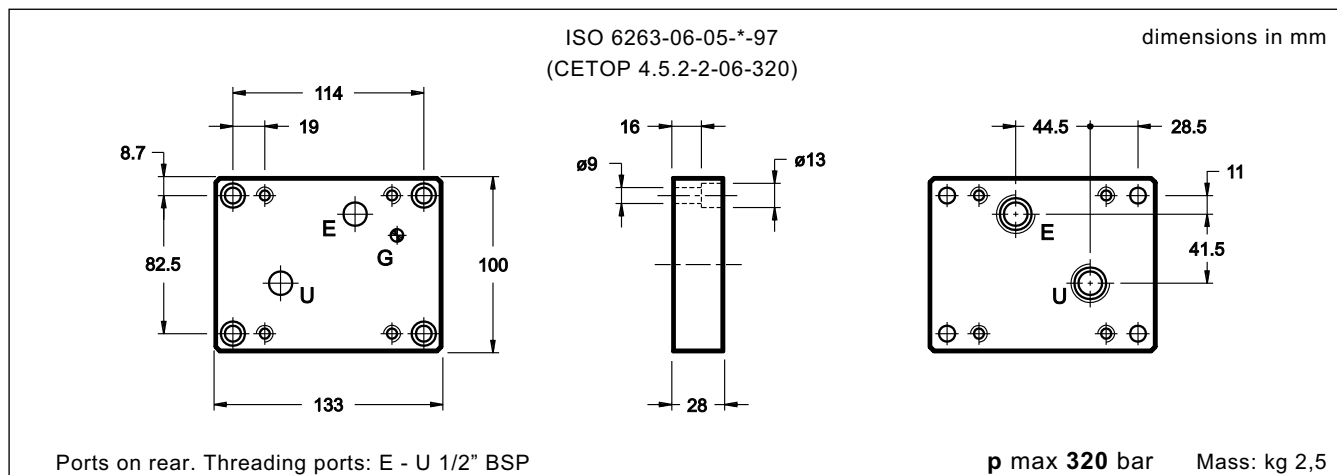
#### 7 - OVERALL AND MOUNTING DIMENSIONS PMRPC1-AI3G/10 (cod. 1961045)



#### 8 - OVERALL AND MOUNTING DIMENSIONS PMRPC1-AL3G/10 (cod. 1961051)



#### 9 - OVERALL AND MOUNTING DIMENSIONS PMRPC2-AI4G/10 (cod. 1960330)



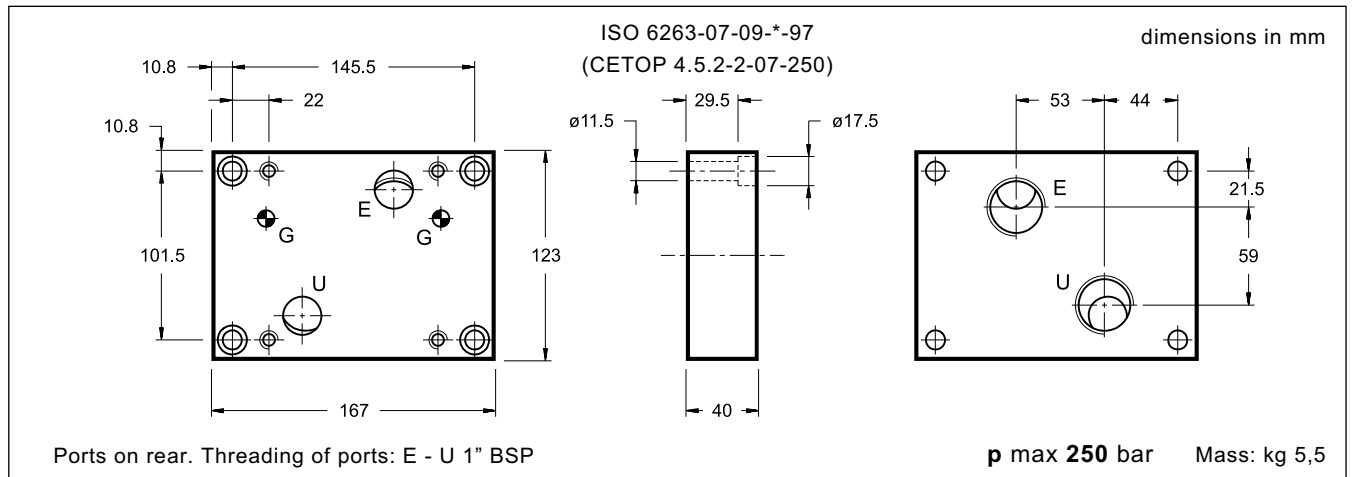


# PMRPC\*

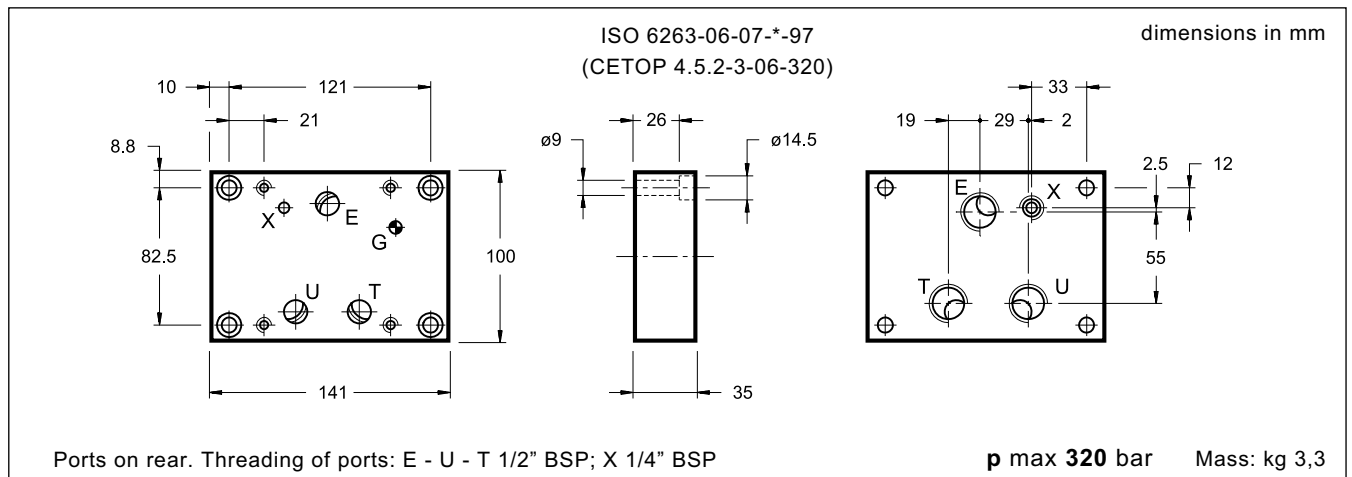
## SUBPLATES

### FOR FLOW CONTROL VALVES

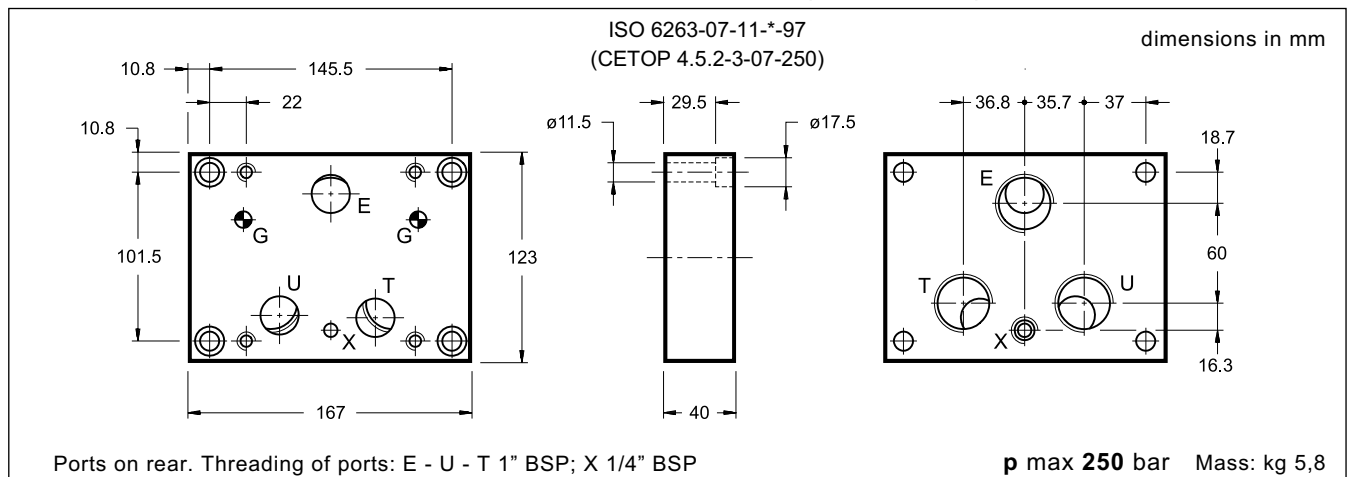
#### 10 - OVERALL AND MOUNTING DIMENSIONS PMRPC3-AI6G/10 (cod. 1960511)



#### 11 - OVERALL AND MOUNTING DIMENSIONS PMRPCQ2-AI4G/10 (cod. 1960526)



#### 12 - OVERALL AND MOUNTING DIMENSIONS PMRPCQ3-AI6G/10 (cod. 1960423)

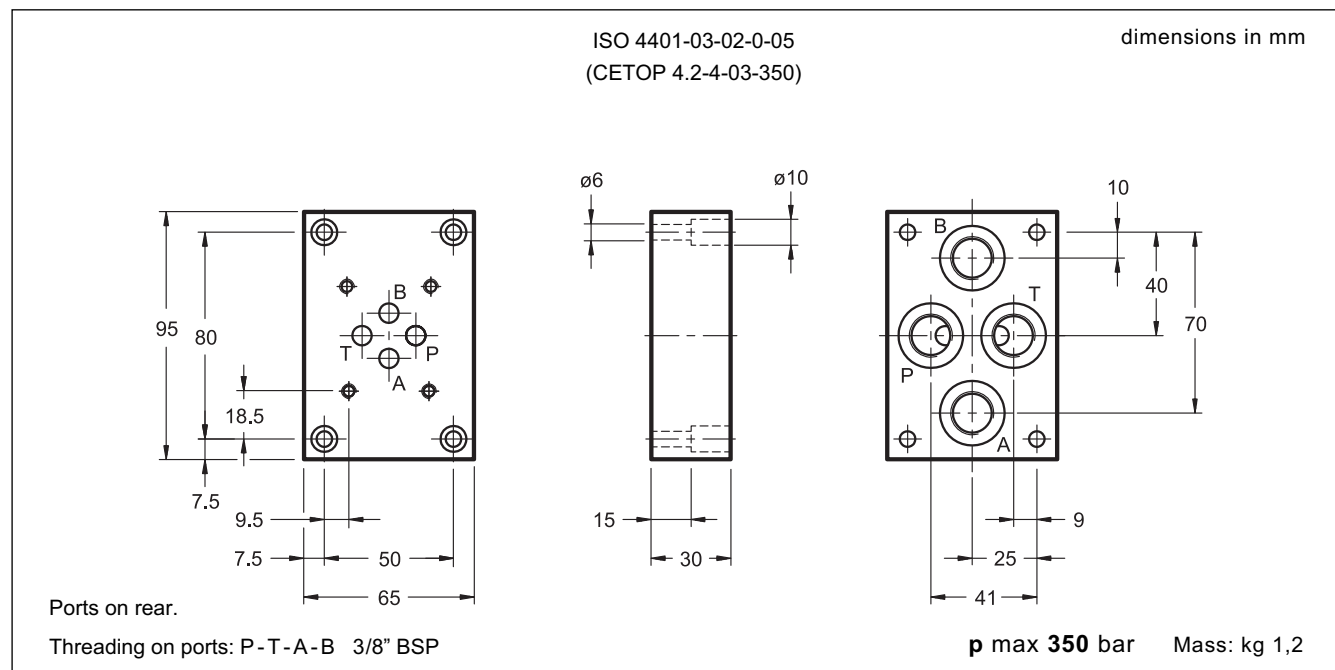




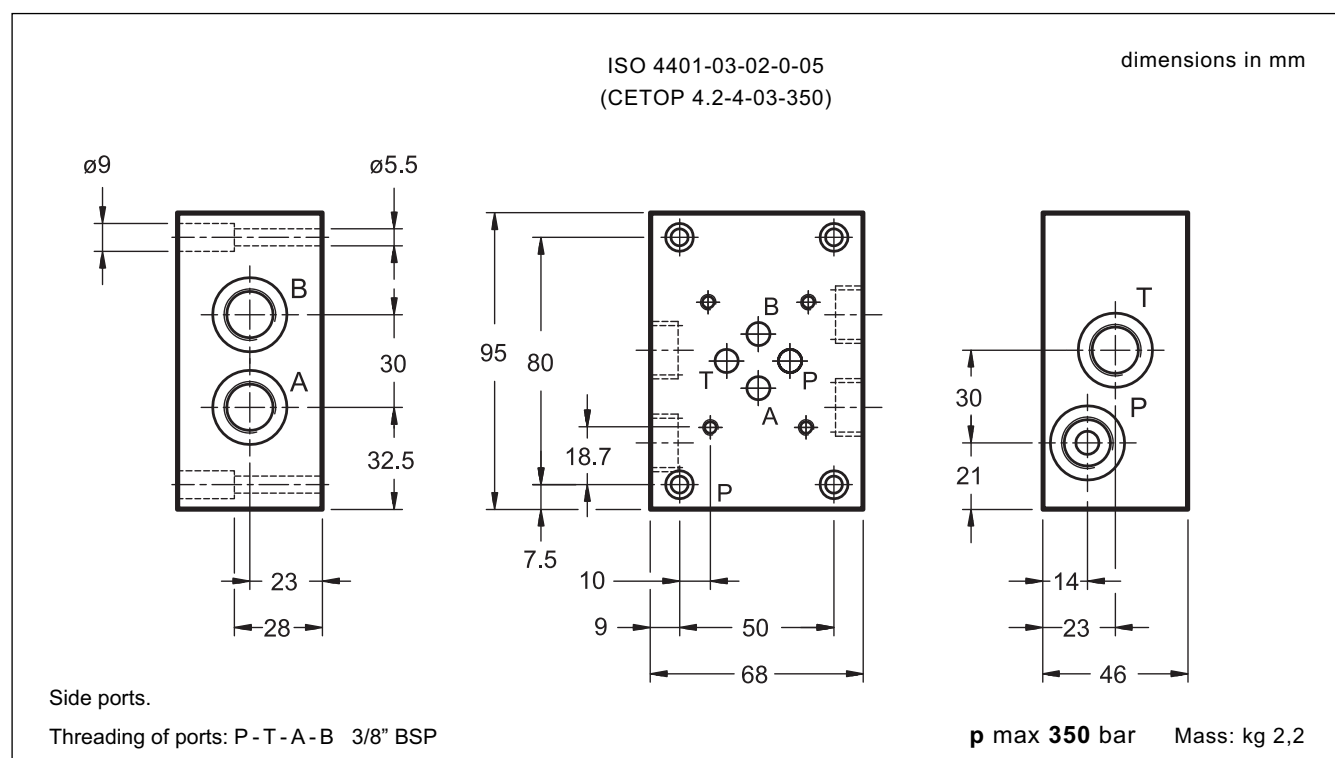
# PMMD

## SUBPLATES FOR ISO 4401-03 (CETOP 03) VALVES

### 13 - OVERALL AND MOUNTING DIMENSIONS PMMD-AI3G/20 (cod. 1961261)



### 14 - OVERALL AND MOUNTING DIMENSIONS PMMD-AL3G/11 (cod. 1961251)

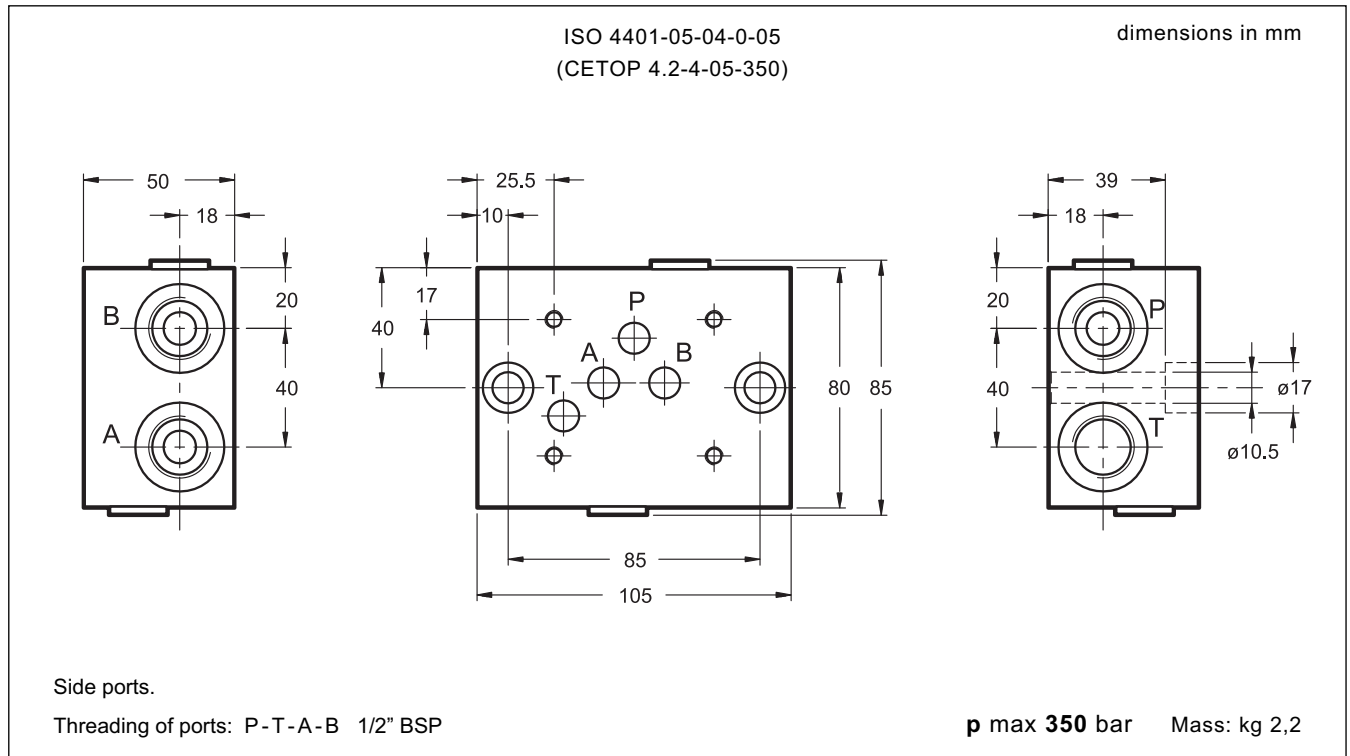




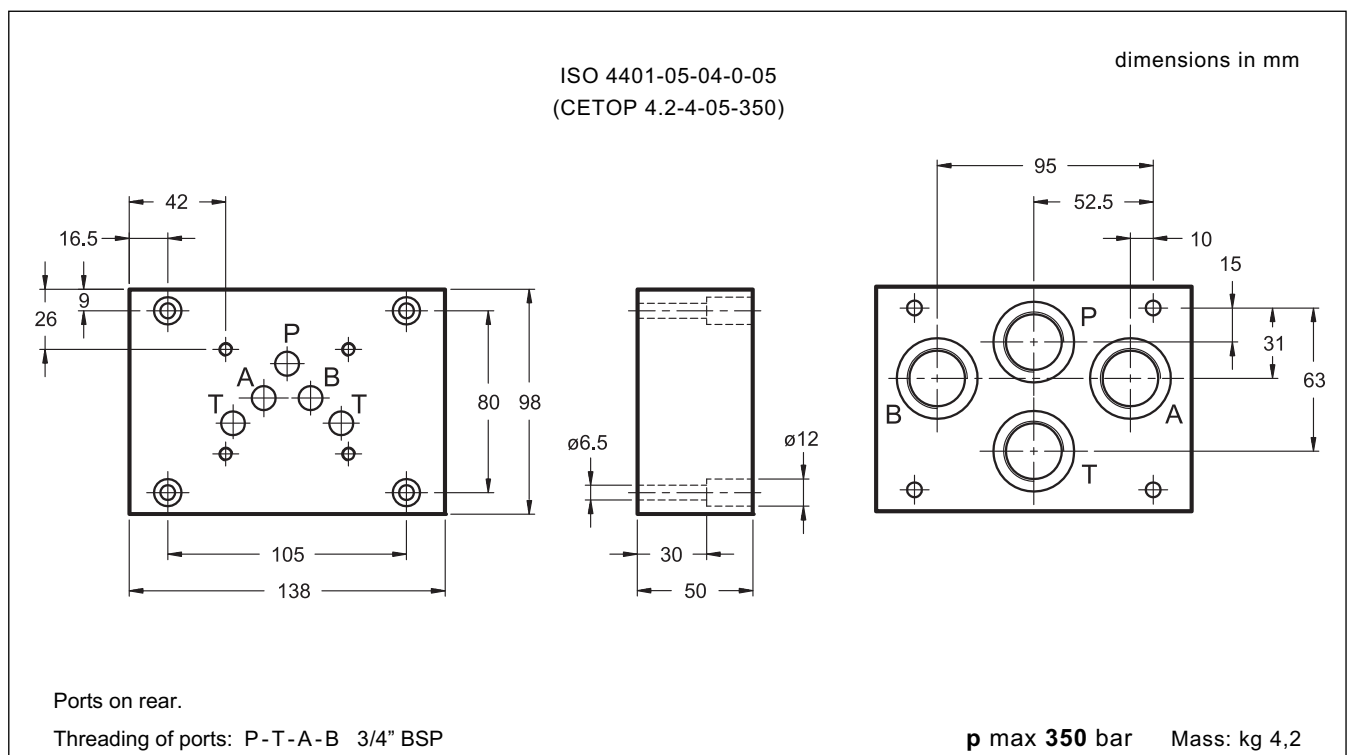
# PMD4

## SUBPLATES FOR ISO 4401-05 (CETOP 05) VALVES

### 15 - OVERALL AND MOUNTING DIMENSIONS PMD4-AL4G/10 (cod. 1960981)



### 16 - OVERALL AND MOUNTING DIMENSIONS PMD4-AI4G/20 (cod. 1961271)







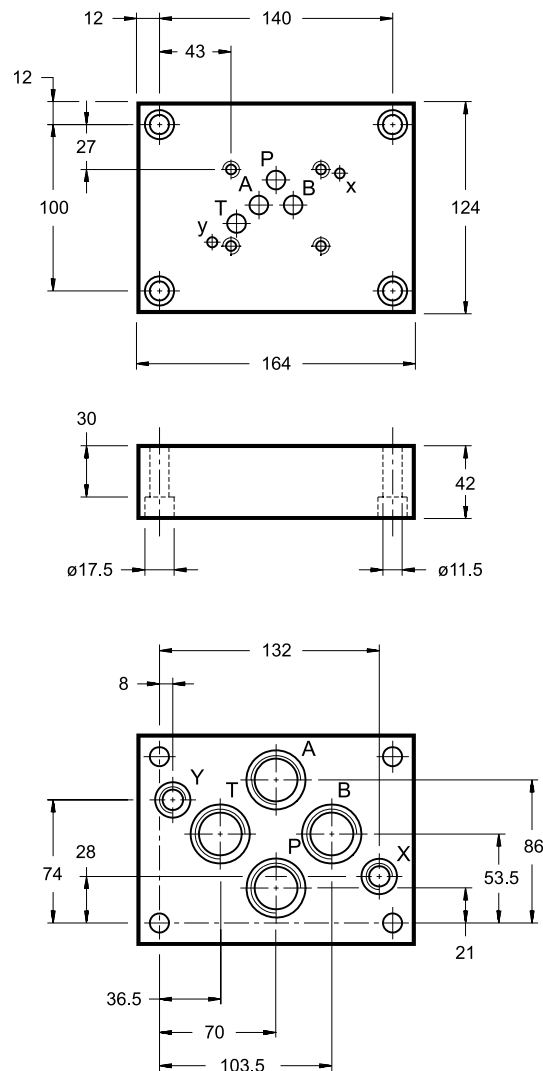
# PME4

## SUBPLATES FOR CETOP P05 VALVES

### 17 - OVERALL AND MOUNTING DIMENSIONS PME4-AI5G/10 (cod. 1961181)

CETOP 4.2-4-P05-320

dimensions in mm



Ports on rear.  
Threading of ports:  
P-T-A-B 3/4" BSP  
X-Y 1/4" BSP

**p max 320 bar** Mass: kg 5,3

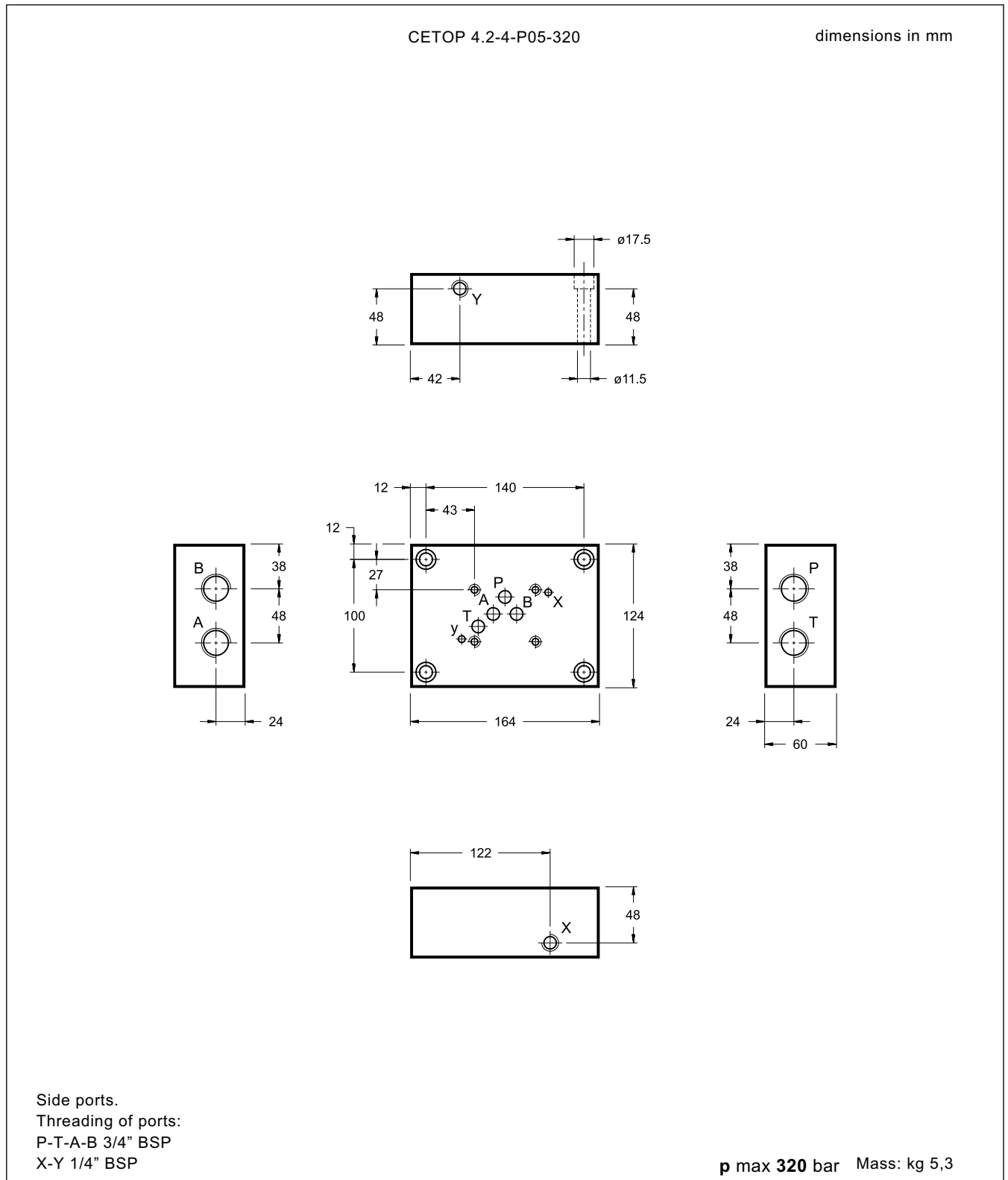


# PME4

## SUBPLATES

### FOR CETOP P05 VALVES

#### 18 - OVERALL AND MOUNTING DIMENSIONS PME4-AL5G/10 (cod. 1961201)





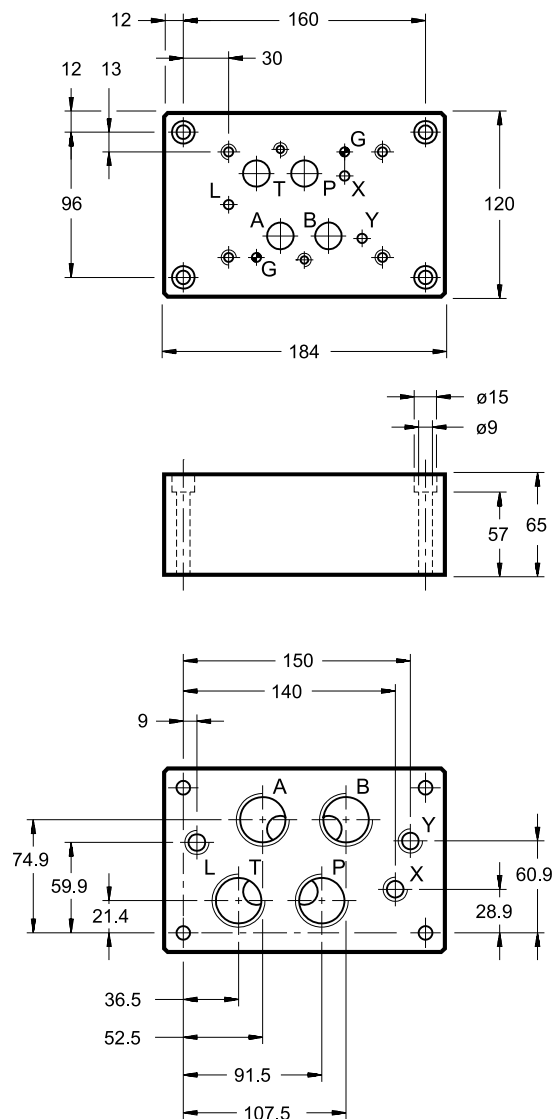
# PME07

## SUBPLATES FOR ISO 4401-07 (CETOP 07) VALVES

### 19 - OVERALL AND MOUNTING DIMENSIONS PME07-AI6G/10 (cod. 1961071)

dimensions in mm

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



Ports on rear.  
Threading of ports:  
P-T-A-B 1" BSP  
X-Y-L 1/4" BSP

**p max 350 bar**

**Mass: kg 9**



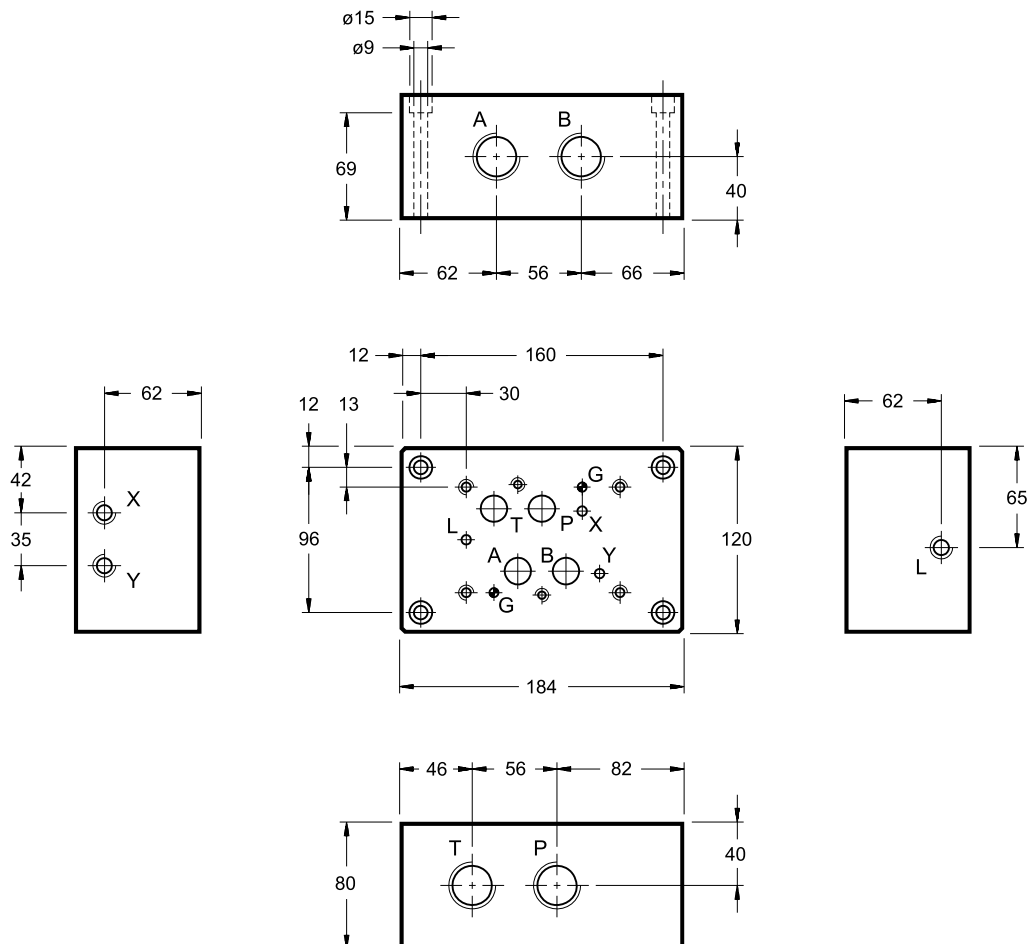
# PME07

## SUBPLATES FOR ISO 4401-07 (CETOP 07) VALVES

### 20 - OVERALL AND MOUNTING DIMENSIONS PME07-AL6G/10 (cod. 1961111)

dimensions in mm

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



Side ports.  
Threading of ports:  
P-T-A-B 1" BSP  
X-Y-L 1/4" BSP

p max 350 bar

Mass: kg 11,5



ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-320)

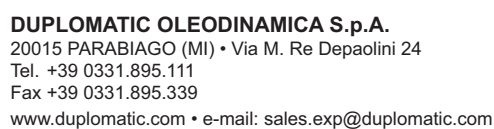
Technical drawing of a mechanical part showing three views: front, top, and side.

**Front View:** A rectangular plate with a height of 100 and a width of 181. It features two circular holes labeled A and B. The distance between the centers of A and B is 76. The distance from the left edge to the center of A is 75, and from the center of B to the right edge is 54. The thickness of the plate is 48. A dimension of  $\phi 13$  is indicated for the holes.

**Top View:** A rectangular plate with a width of 205 and a height of 140. It features two circular holes labeled A and B. The distance between the centers of A and B is 76. The distance from the left edge to the center of A is 75, and from the center of B to the right edge is 54. The distance from the top edge to the center of A is 12, and from the center of B to the top edge is 25. The distance from the bottom edge to the center of A is 116, and from the center of B to the bottom edge is 12. There are several smaller holes labeled L, T, P, Y, X, and G. The distance from the left edge to the center of L is 12, and from the center of T to the left edge is 12. The distance from the top edge to the center of L is 12, and from the center of T to the top edge is 12. The distance from the bottom edge to the center of L is 116, and from the center of T to the bottom edge is 12. The distance from the left edge to the center of X is 12, and from the center of Y to the left edge is 12. The distance from the top edge to the center of X is 12, and from the center of Y to the top edge is 12. The distance from the bottom edge to the center of X is 116, and from the center of Y to the bottom edge is 12. The distance from the left edge to the center of G is 12, and from the center of Y to the left edge is 12. The distance from the top edge to the center of G is 12, and from the center of Y to the top edge is 12. The distance from the bottom edge to the center of G is 116, and from the center of Y to the bottom edge is 12.

**Side View:** A rectangular plate with a width of 82 and a height of 97. It features two circular holes labeled L and X. The distance between the centers of L and X is 68. The distance from the left edge to the center of L is 12, and from the center of X to the right edge is 12. The distance from the top edge to the center of L is 12, and from the center of X to the top edge is 12. The distance from the bottom edge to the center of L is 116, and from the center of X to the bottom edge is 12. The thickness of the plate is 48.

Mass: kg 19



This series of modular subplates has been designed to make hydraulic circuits and can be used directly on power packs or on any other section of the machine.

The subplates are assembled by means of 4 tie-rods with seal seats incorporated in the subplate.

The above assembly achieves compact units (including pressure and discharge manifolds): one face per subplate is used for connection to services and the other to mount ISO 4401-03 (CETOP 03) valves.

Complex circuits can also be set up using modular valves.

The recommended mounting configuration for **P2\*** subplates on hydraulic power packs is with the main axis positioned vertically to obtain the bundle of pipes to utilities in two vertical rows; however assembly is not restricted to this configuration.

# P2\*

## MODULAR SUBPLATES FOR ISO 4401-03 (CETOP 03) VALVES

**p max 350 bar**

**Q max 50 l/min**

### TECHNICAL SPECIFICATIONS

Maximum operating pressure - ports P - A - B - port T	bar	see paragraph 11 140
Maximum flow	l/min	50
Port dimensions: P - pressure T - lower drainage T - upper drainage A/B - users	BSP	3/8" 1/2" 3/8" 3/8"
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

### 1 - IDENTIFICATION CODE

<b>P</b>	<b>2</b>	<b>D</b>	<b>-</b>		<b>/</b>	<b>21</b>
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Subplate \_\_\_\_\_

Dimension for \_\_\_\_\_  
ISO 4401-03 (CETOP 03) valves

Single mounting facility \_\_\_\_\_

Serial No :  
(from 20 to 29 and from 30 to 39 overall and  
mounting dimensions remain unchanged)

Versions: (omit for standard subplate P2D/21)

**F** = with P - T threaded ports and additional pressure port.

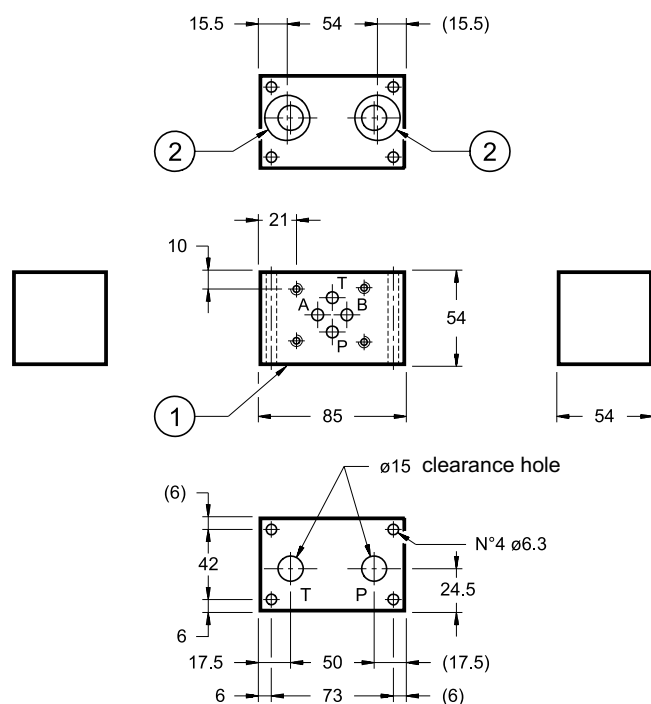
**I** = intermediate with threaded fastening holes to reduce rods  
length and additional pressure port.

**Z** = arranged for the installation of an MZD pressure reducing  
valve

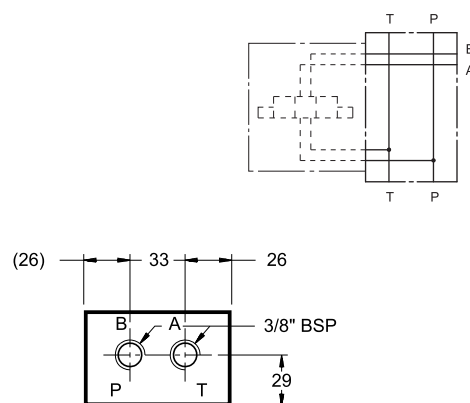
**NOTE: identification code of subplates P2\*-M\*/33 see paragraph 6**

## 2 - OVERALL AND MOUNTING DIMENSIONS P2D/21 (cod. 1560121)

## STANDARD SUPBLATE



Mass: kg 1,5



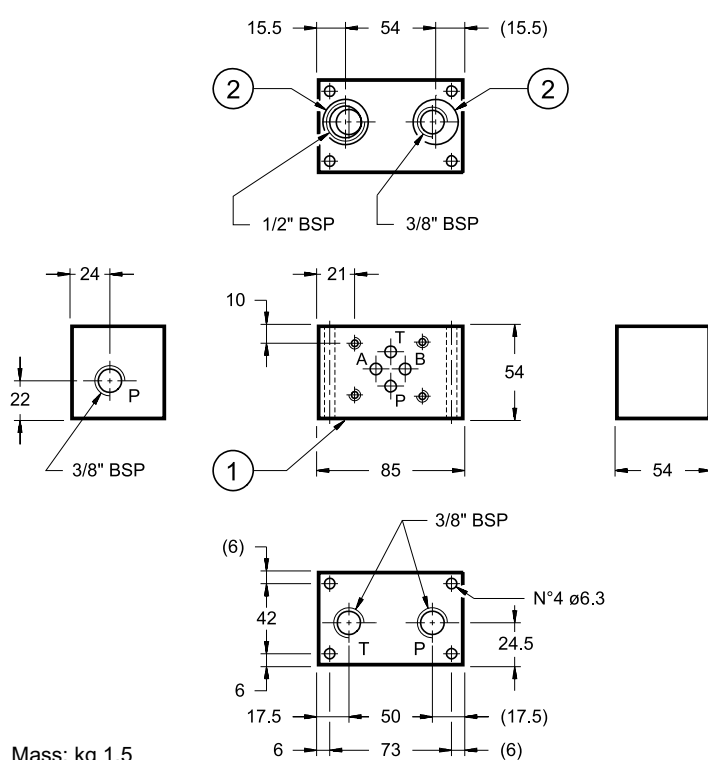
**NOTE: The subplate is supplied with O-Ring  
made of NBR 90 Shore**

dimensions in mm

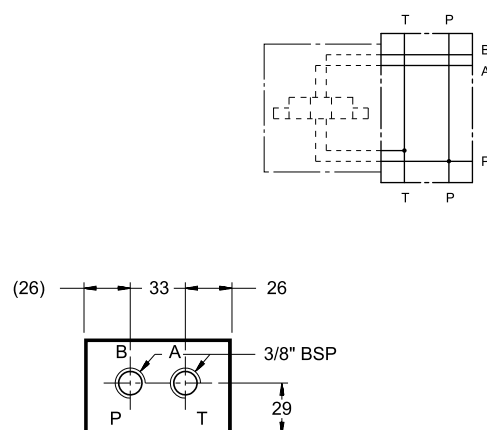
1	Mounting surface
2	OR seats 2093 (23.52x1.78)

### 3 - OVERALL AND MOUNTING DIMENSIONS P2D-F/21 (cod. 1560122)

### P - T THREADED PORTS AND ADDITIONAL PRESSURE PORT SUBPLATE



Mass: kg 1,5



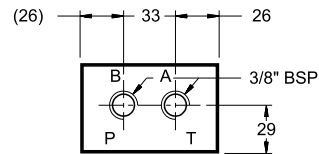
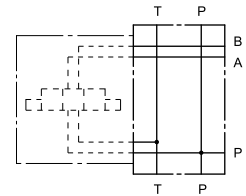
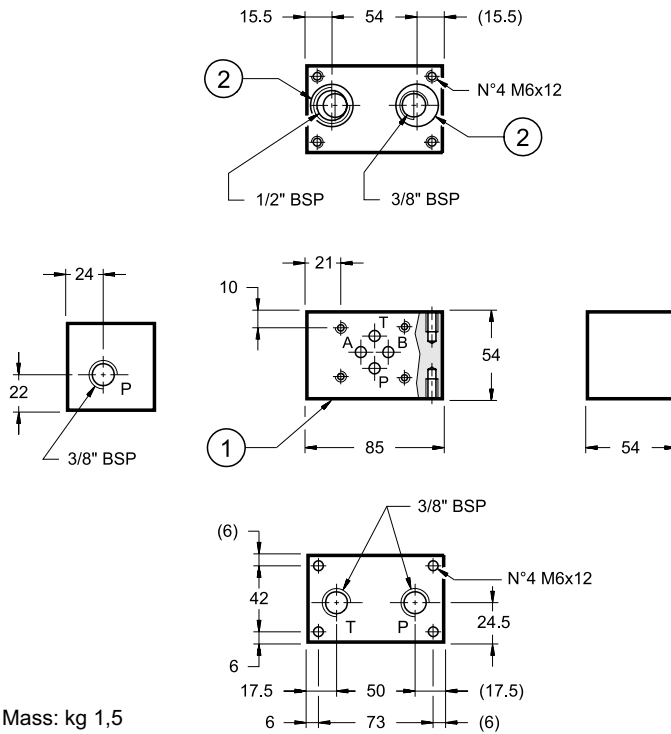
**NOTE: The subplate is supplied with O-Ring made of NBR 90 Shore**

dimensions in mm

1	Mounting surface
2	OR seats 2093 (23.52x1.78)

## 4 - OVERALL AND MOUNTING DIMENSIONS P2D-I/21 (cod. 1560123)

INTERMEDIATE SUBPLATE WITH THREADED FASTENING HOLES TO REDUCE ROD LENGHT AND ADDITIONAL PRESSURE PORT



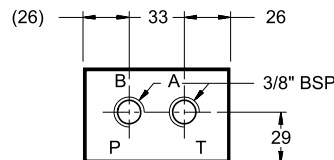
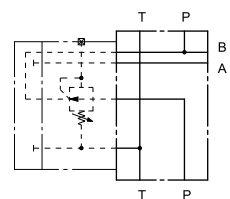
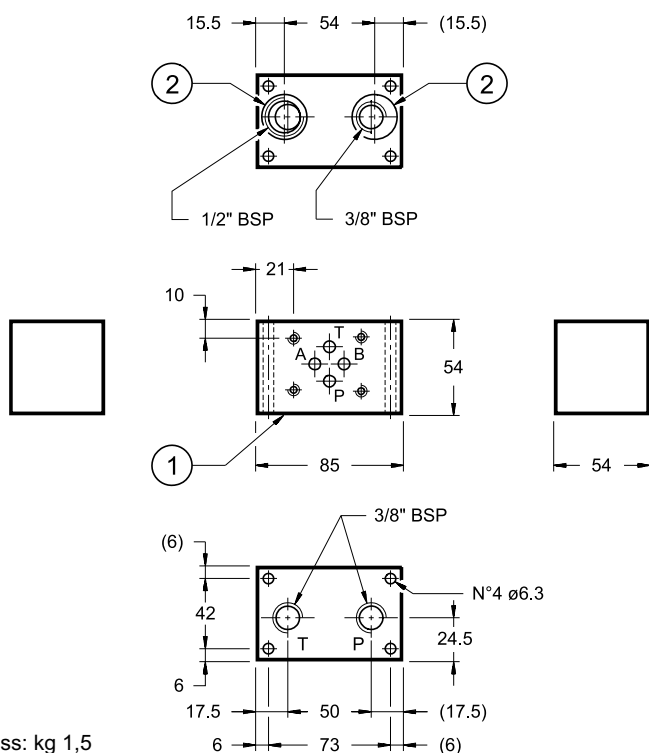
**NOTE: The subplate is supplied with O-Ring made of NBR 90 Shore**

dimensions in mm

1	Mounting surface
2	OR seats 2093 (23.52x1.78)

## 5 - OVERALL AND MOUNTING DIMENSIONS P2D-Z/21 (cod. 1560025)

SUBPLATE ARRANGED FOR THE INSTALLATION OF AN MZD PRESSURE REDUCING VALVE



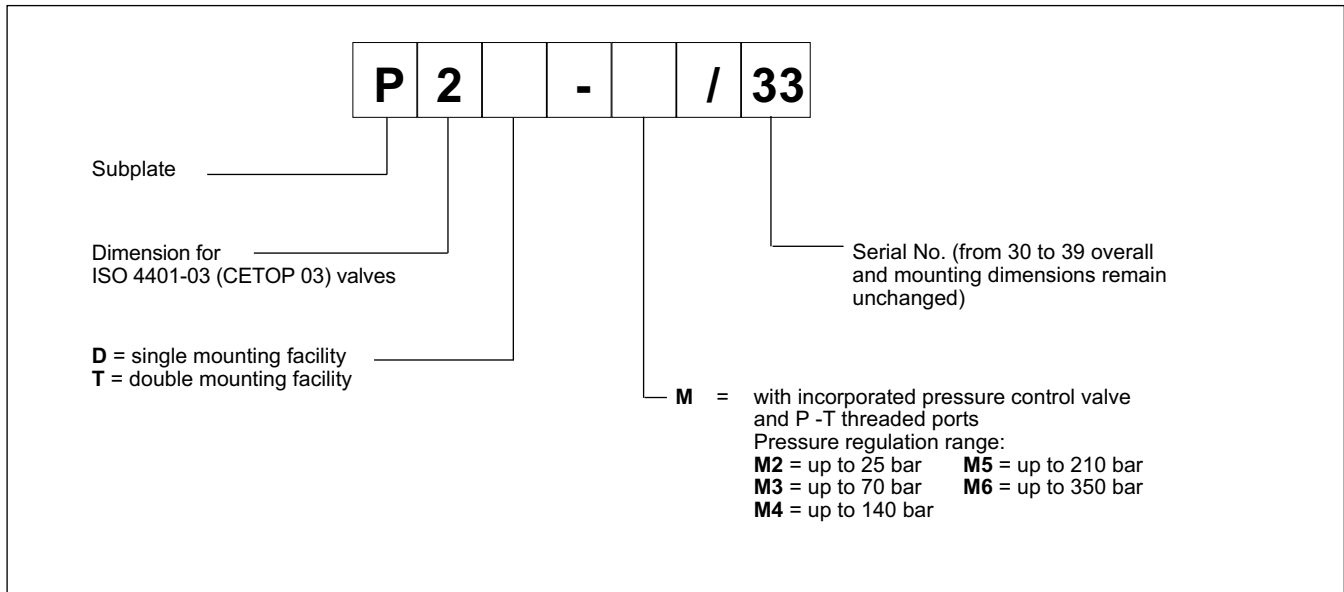
**NOTE: The subplate is supplied with O-Ring made of NBR 90 Shore**

dimensions in mm

1	Mounting surface
2	OR seats 2093 (23.52x1.78)

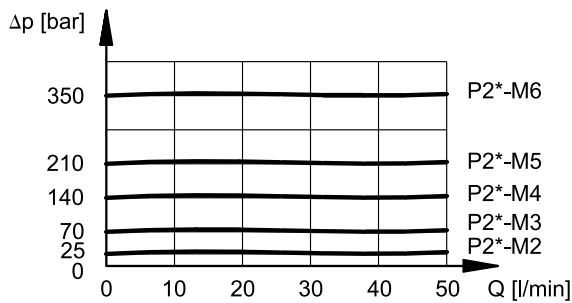


## 6 - IDENTIFICATION CODE subplates with incorporated pressure control valve

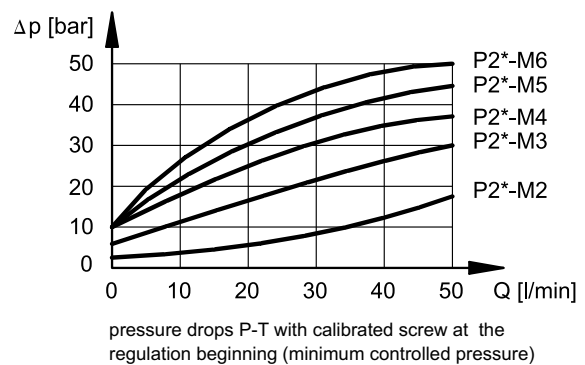


## 7 - CHARACTERISTIC CURVES FOR P2D-M\* E P2T-M\* SUBPLATES WITH PRESSURE CONTROL VALVE INCORPORATED (values obtained with viscosity of 36 cSt at 50°C)

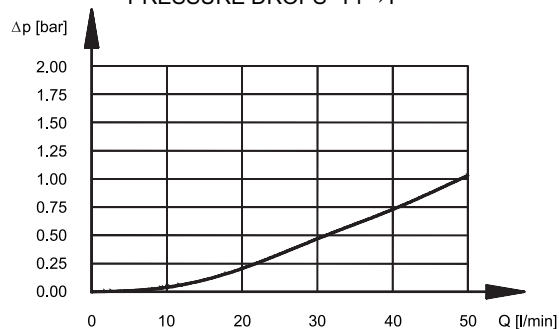
ADJUSTMENT



MINIMUM CONTROLLED PRESSURE



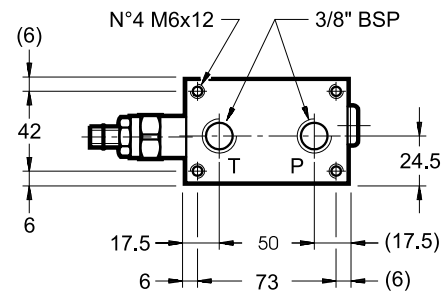
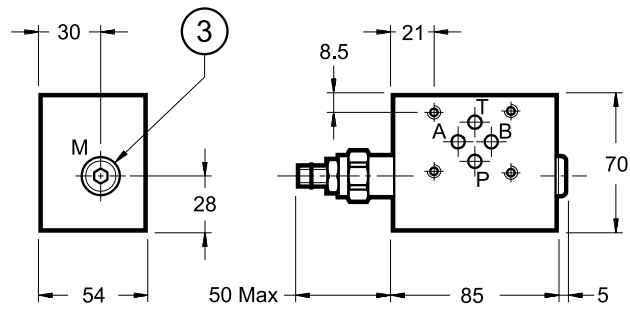
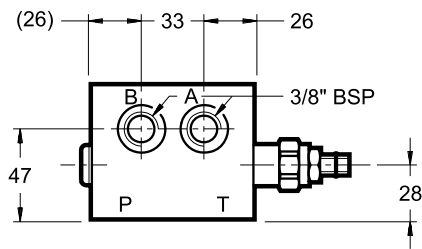
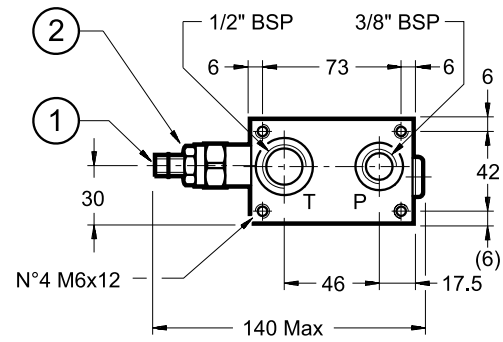
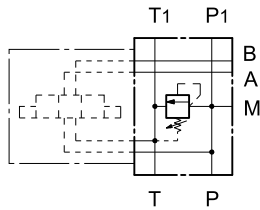
PRESSURE DROPS T1→T



## 8 - OVERALL AND MOUNTING DIMENSIONS P2D-M\*/ 33

SINGLE MOUNTING FACILITY SUBPLATE WITH PRESSURE RELIEF VALVE INCORPORATED

### HYDRAULIC SYMBOL



dimensions in mm

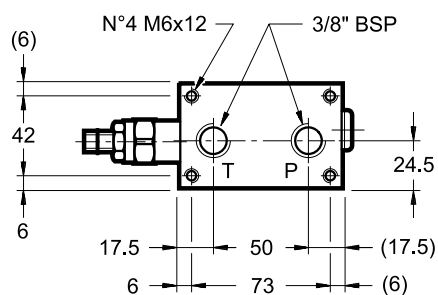
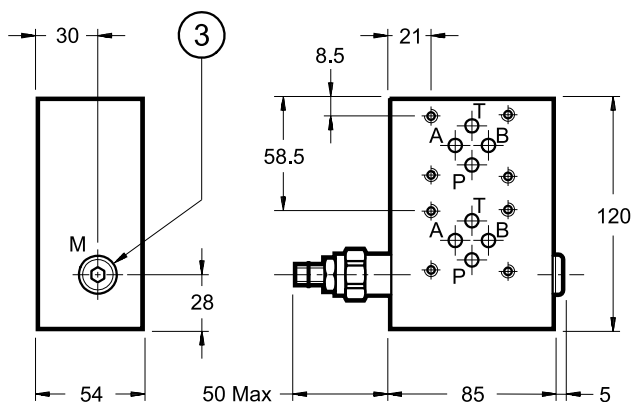
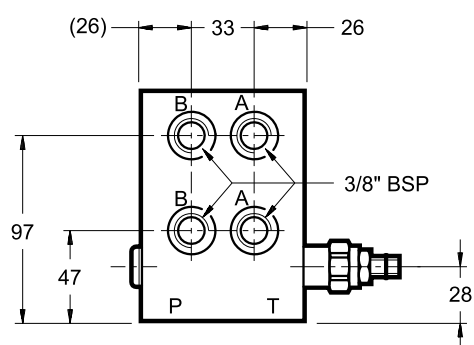
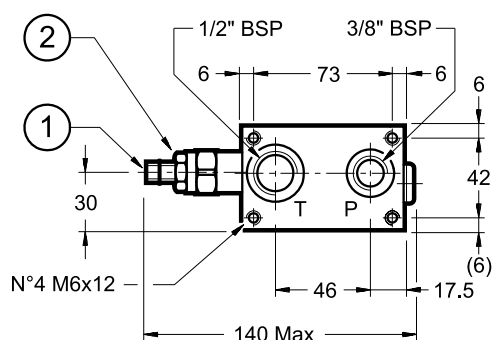
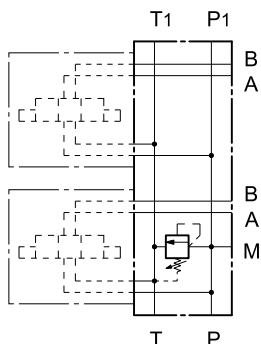
Mass: kg 2,5

1	Countersunk hex. adjustment screw: spanner 6 Clockwise rotation to increase pressure
2	Locking nut: spanner 19
3	Pressure gauge port 1/4" BSP plugged

## 9 - OVERALL AND MOUNTING DIMENSIONS P2T-M\* /33

DOUBLE MOUNTING FACILITY SUBPLATE WITH PRESSURE RELIEF VALVE INCORPORATED

### HYDRAULIC SYMBOL



dimensions in mm

Mass: kg 5

1	Countersunk hex adjustment screw: spanner 6 Clockwise rotation to increase pressure
2	Locking nut: spanner 19
3	Pressure gauge port 1/4" BSP plugged

## 10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 11 - PRESSURE LIMIT ON P

Depending on the tie-rod type and on the number of assembled subplates it is necessary to pay attention to the maximum pressure on P in order to avoid extruding the O-Rings.

n° of assembled subplates	Threaded bar class B7 DIN 975	Stud class 8.8 UNI 5911	Stud class 12.9
2	350 bar	350 bar	350 bar
3	300 bar	350 bar	350 bar
4	250 bar	300 bar	350 bar
5	200 bar	250 bar	300 bar
6	150 bar	200 bar	250 bar
Tightening torque	8 Nm	8 Nm	12 Nm



P2\*



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# P2A\*L

## MANIFOLDS FOR ISO 4401-03 (CETOP 03) VALVES WITH SIDE PORTS SERIES 11

- The P2A\*L series of manifolds is designed for connection in parallel of two or more ISO 4401-03 (CETOP 03) valves.
- The monocast design enables the simple creation of circuits without the use of pipes and fittings, thereby reducing overall dimensions to a minimum.
- All sections feature a common pressure and discharge fitting on both ends of the subplate.
- Maximum flow rate can be increased up to double the output if the sub-plates are powered at both ends.
- Each section is fitted with work ports A and B positioned on the side of the sub-plate.
- Subplates are available in aluminium.

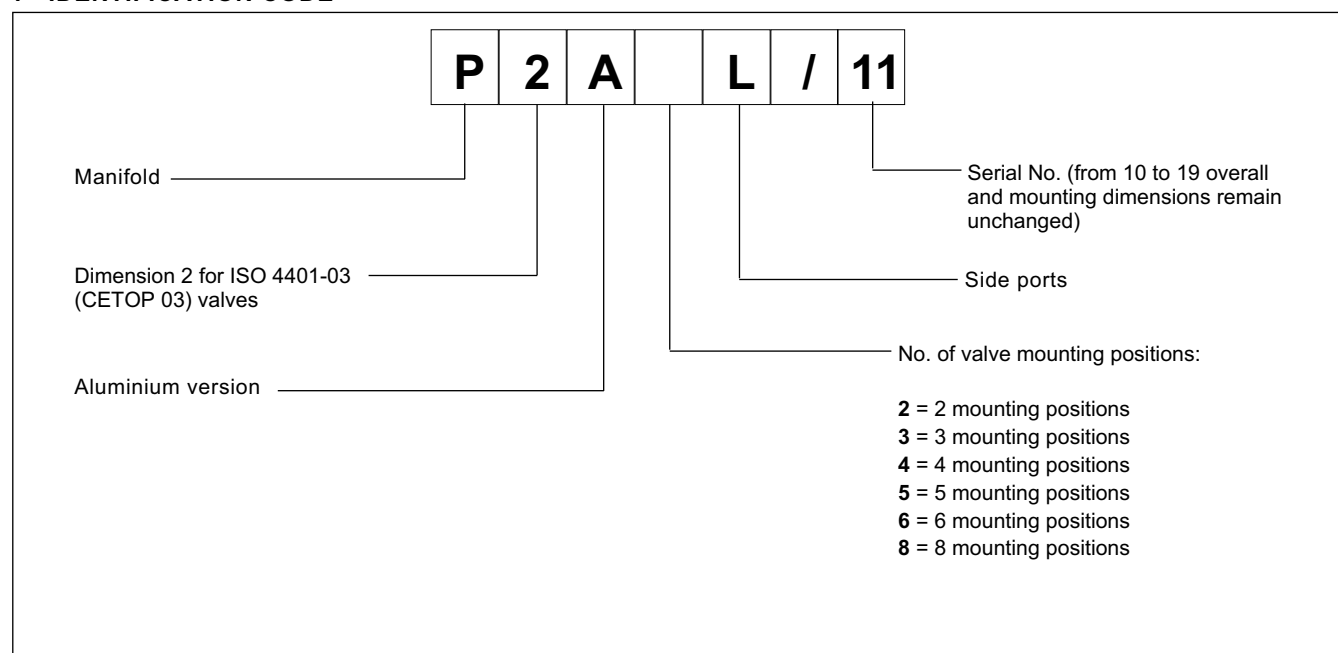
**p max 210 bar**

**Q max 50 l/min**

### TECHNICAL SPECIFICATIONS

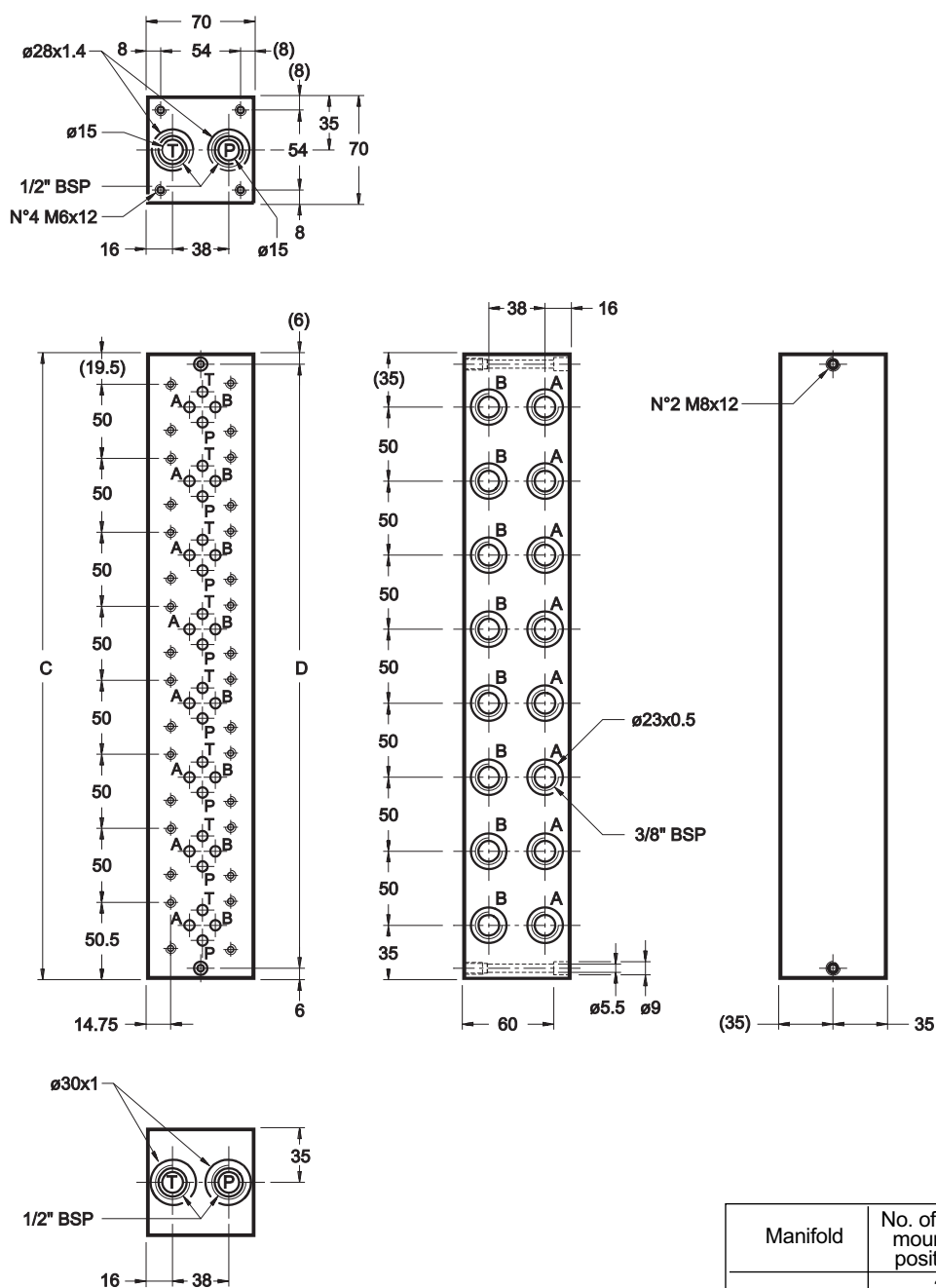
Maximum operating pressure - ports P - A - B - port T	bar	210 140
Maximum flow	l/min	50
Port dimensions: P - pressure T - lower drainage A/B - users	BSP	1/2" 1/2" 3/8"
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

### 1 - IDENTIFICATION CODE





## 2 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

Manifold	No. of valve mounting positions	C	E
	2	120	108
P2A3L	3	170	158
P2A4L	4	220	208
P2A5L	5	270	258
P2A6L	6	320	308
P2A8L	8	420	408



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# P2X\*M

## MANIFOLDS

### FOR ISO 4401-03 (CETOP 03) VALVES WITH PORTS ON REAR

#### SERIES 10

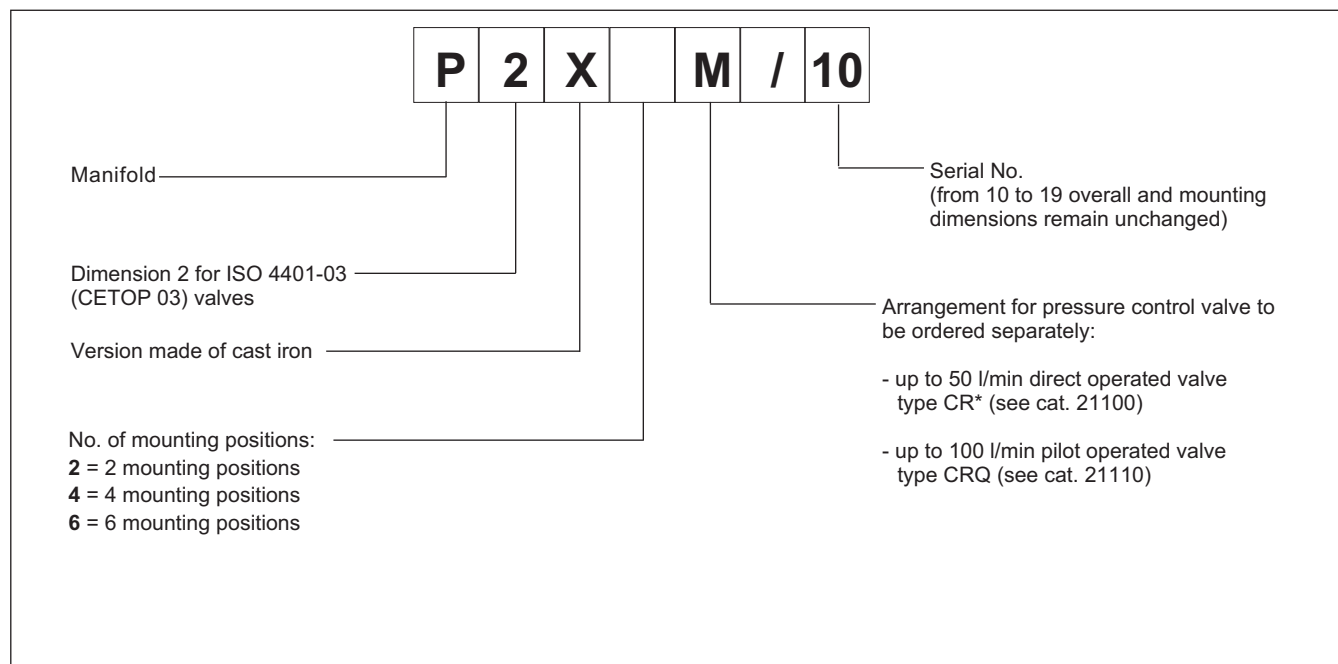
- The P2X\*M series of manifolds is designed for connection in parallel of two or more ISO 4401-03 (CETOP 03) valves.
- The monobloc design enables the simple creation of circuits without the use of pipes and fittings, thereby reducing overall dimensions to a minimum.
- Subplates are arranged for the installation of a pressure control valve with cartridge.
- Each section is fitted with work ports A and B positioned on the rear of the subplate.
- Subplates are fitted with additional rear ports P and T.
- Subplates are made of cast iron.

**p max 350 bar**  
**Q max 100 l/min**

#### TECHNICAL SPECIFICATIONS

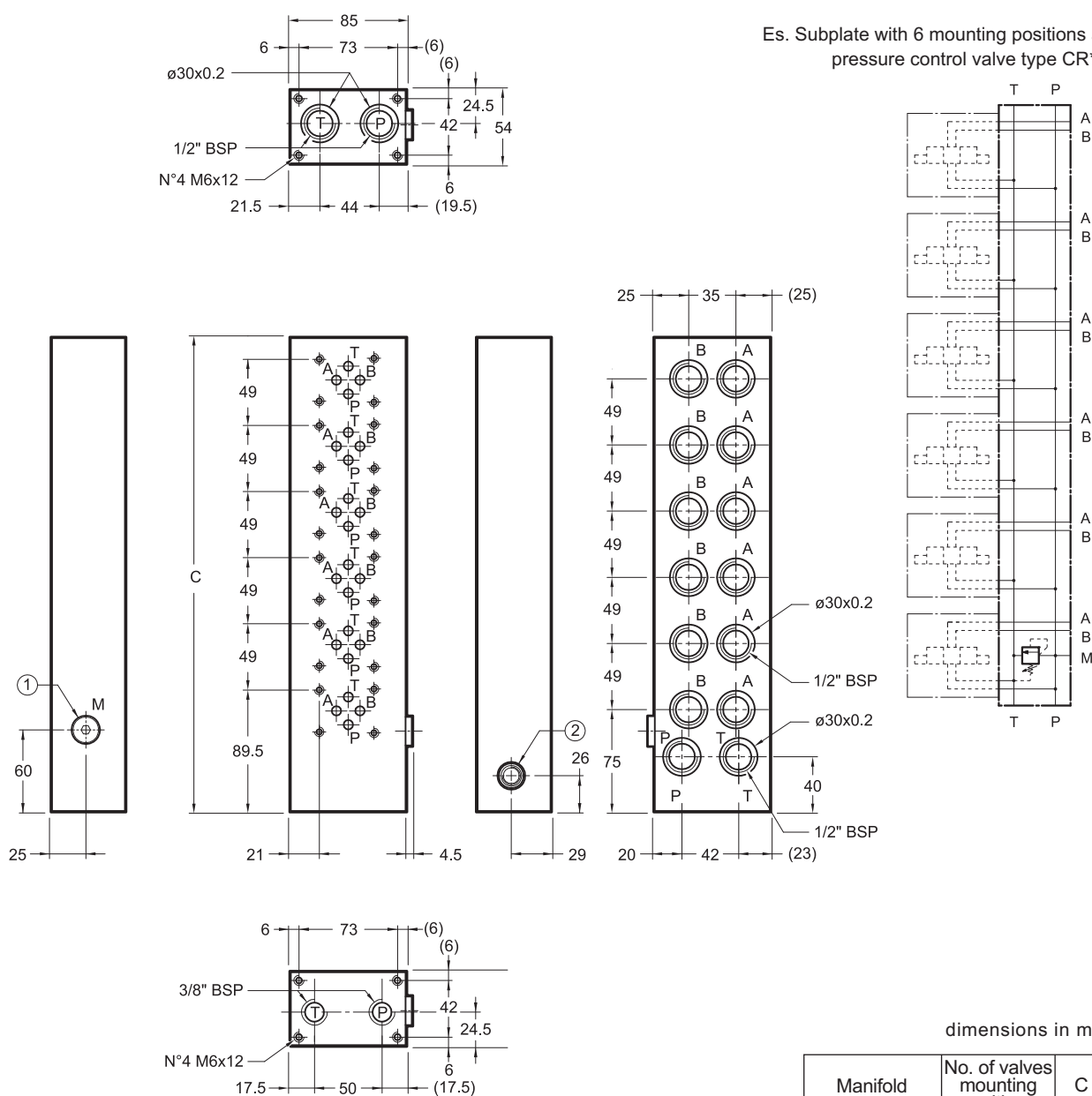
Maximum operating pressure - ports P - A - B - port T	bar	350 140
Maximum flow	l/min	100
Port dimensions: P - pressure T - drainage B - users A - drainage	BSP	1/2"
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

#### 1 - IDENTIFICATION CODE





## 2 - OVERALL AND MOUNTING DIMENSIONS



Manifold	No. of valves mounting positions	C
P2X2M/10	2	150
P2X4M/10	4	250
P2X6M/10	6	350

1	Pressure gauge port 1/4" BSP plugged
2	Arranged for the installation of a pressure control valve (to be ordered separately - see par. 1)

# P4D\*

## MODULAR SUBPLATES FOR ISO 4401-05 (CETOP 05) VALVES

- This series of modular subplates has been designed to make hydraulic circuits and can be used directly on power packs or on any other section of the machine.
- The subplates are assembled by means of 4 tie-rods with seal seats incorporated in the subplate.
- The above assembly achieves compact units (including pressure and discharge manifolds): one face per subplate is used for connection to services and the other to mount ISO 4401-05 (CETOP 05) or ISO 4401-03 (CETOP 03) valves.
- Complex circuits can also be set up using modular valves.
- The recommended mounting configuration for **P4D** subplates on hydraulic power packs is with the main axis positioned vertically to obtain the bundle of pipes to utilities in two vertical rows; however, assembly is not restricted to this configuration.

**p max 350 bar**  
**Q max 100 l/min**

### TECHNICAL SPECIFICATIONS

Maximum operating pressure - ports P - A - B - port T	bar	see paragraph 8 140
Maximum flow	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

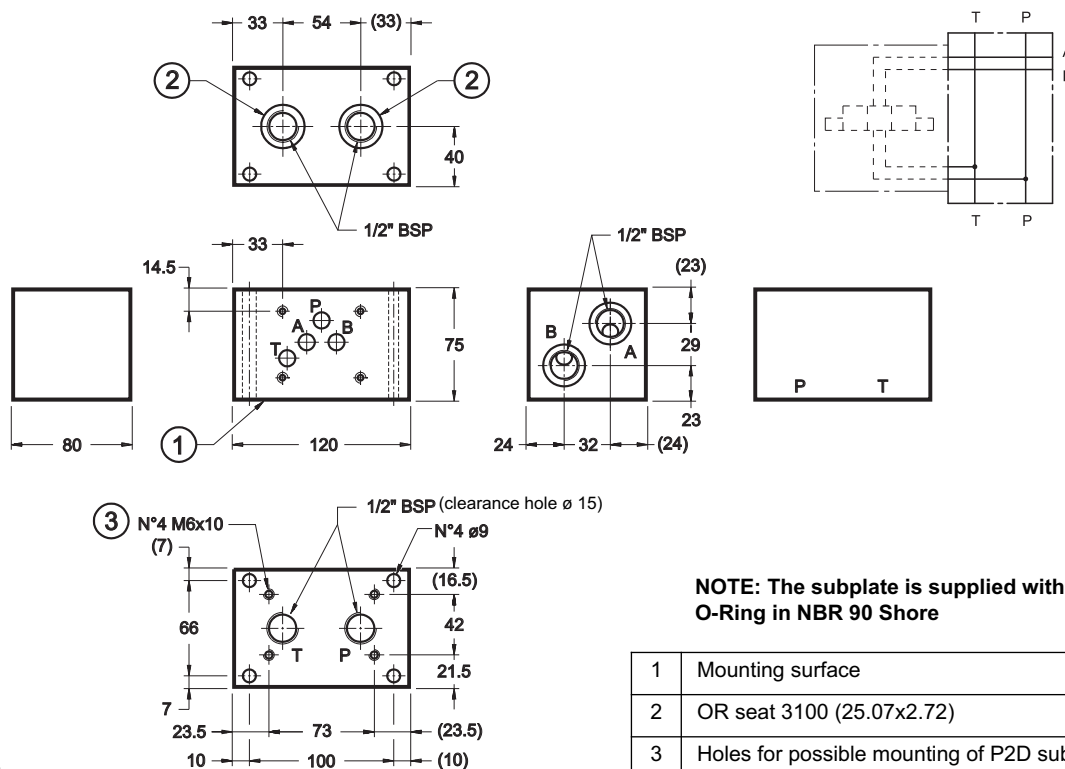
### 1 - IDENTIFICATION CODE

<div style="display: flex; justify-content: space-around; font-weight: bold; font-size: 1.2em;"> <span>P</span><span>4</span><span>D</span><span>-</span><span></span><span>/</span><span></span><span></span> </div>	<p><b>for P4D-M* version only:</b> Seals: <b>N</b> = NBR seals for mineral oil (<b>standard</b>) <b>V</b> = FPM seals for special fluids</p> <p>Series No. <b>30</b> = for P4D-M* <b>21</b> = for all the other versions (Within the same ten dimensions remain unchanged)</p>
Subplate _____	
Dimension for ISO 4401-05 valves _____	
<b>D</b> = single mounting facility _____	
<p>Versions: _____</p> <p><b>F</b> = with P - T threaded ports, mounting interface ISO 4401-05 (CETOP 05) and side ports of 1/2" BSP.</p> <p><b>P</b> = with P - T threaded ports, mounting interface ISO 4401-05 (CETOP 05) and A - B rear ports of 3/4" BSP.</p> <p><b>D3</b> = with P - T threaded ports, mounting interface ISO 4401-03 (CETOP 03) and side ports of 3/8" BSP.</p> <p><b>D3P</b> = with P - T threaded ports, mounting interface ISO 4401-03 (CETOP 03) and A - B rear ports of 1/2" BSP</p> <p><b>M*</b> = with pressure relief valve included and P - T threaded ports. Pressure adjustment range: <b>070</b> = up to 70 bar <b>140</b> = up to 140 bar <b>210</b> = up to 210 bar <b>350</b> = up to 350 bar</p>	

## 2 - OVERALL AND MOUNTING DIMENSIONS P4D-F/21 (COD. 1561441)

P - T THREADED PORTS SUBPLATE, WITH MOUNTING INTERFACE FOR  
ISO 4401-05 (CETOP 05) VALVE AND A-B SIDE PORTS OF 1/2" BSP

dimensions in mm



Mass: kg 4,8

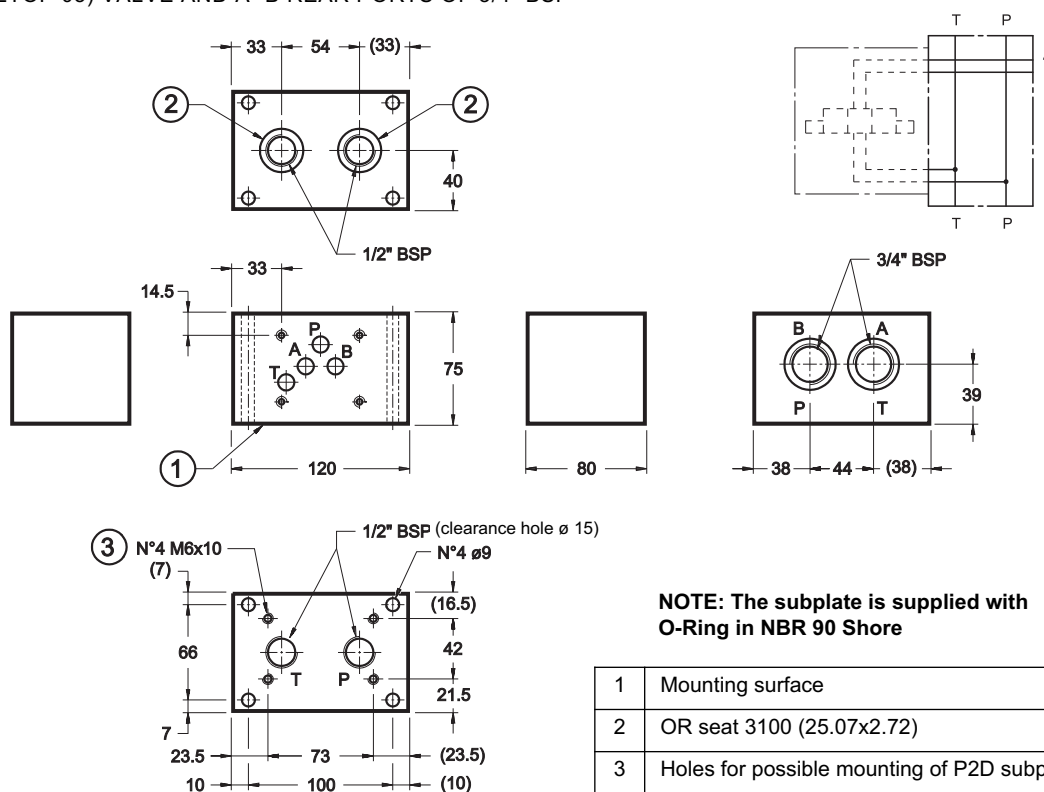
**NOTE: The subplate is supplied with O-Ring in NBR 90 Shore**

1	Mounting surface
2	OR seat 3100 (25.07x2.72)
3	Holes for possible mounting of P2D subplates

### 3 - OVERALL AND MOUNTING DIMENSIONS P4D-P/21 (COD. 1561461)

P - T THREADED PORTS SUBPLATE WITH MOUNTING INTERFACE FOR  
ISO 4401-05 (CETOP 05) VALVE AND A -B REAR PORTS OF 3/4" BSP

dimensions in mm



Mass: kg 4,8

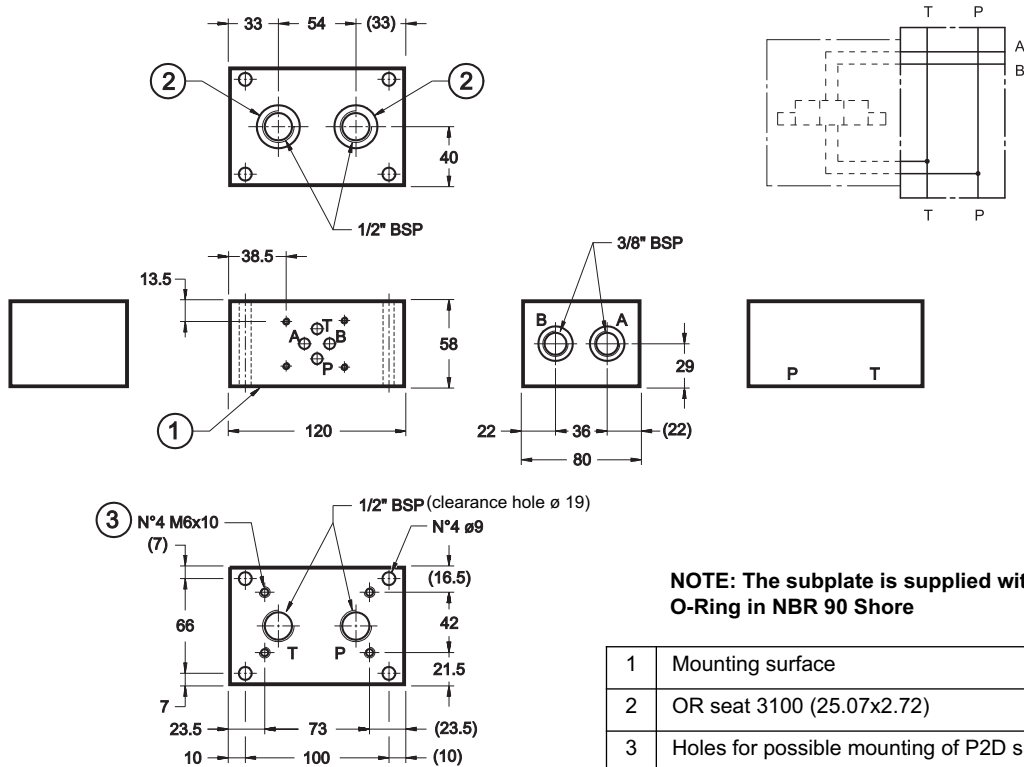
**NOTE: The subplate is supplied with O-Ring in NBR 90 Shore**

1	Mounting surface
2	OR seat 3100 (25.07x2.72)
3	Holes for possible mounting of P2D subplates

## 4 - OVERALL AND MOUNTING DIMENSIONS P4D-D3/21 (COD. 1561451)

P - T THREADED PORTS SUBPLATE, WITH MOUNTING INTERFACE FOR ISO 4401-03 (CETOP 03) VALVE AND SIDE PORTS OF 3/8" BSP

dimensions in mm

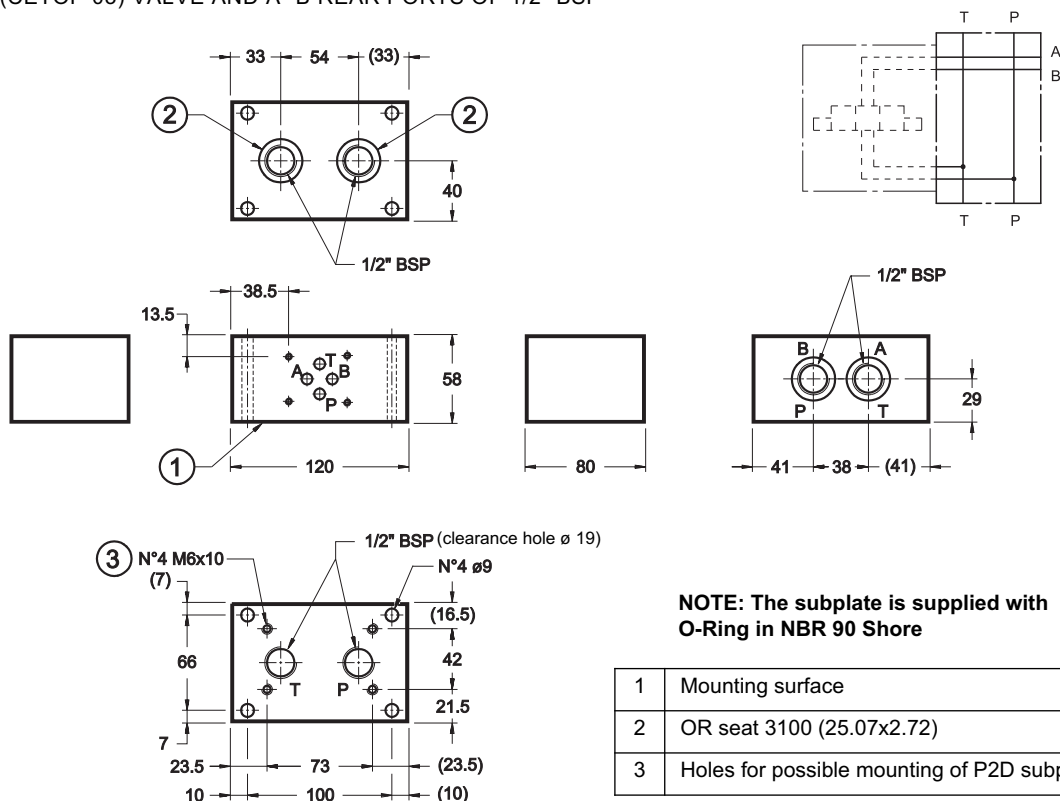


Mass: kg 3,8

## 5 - OVERALL AND MOUNTING DIMENSIONS P4D-D3P/21 (COD. 1561481)

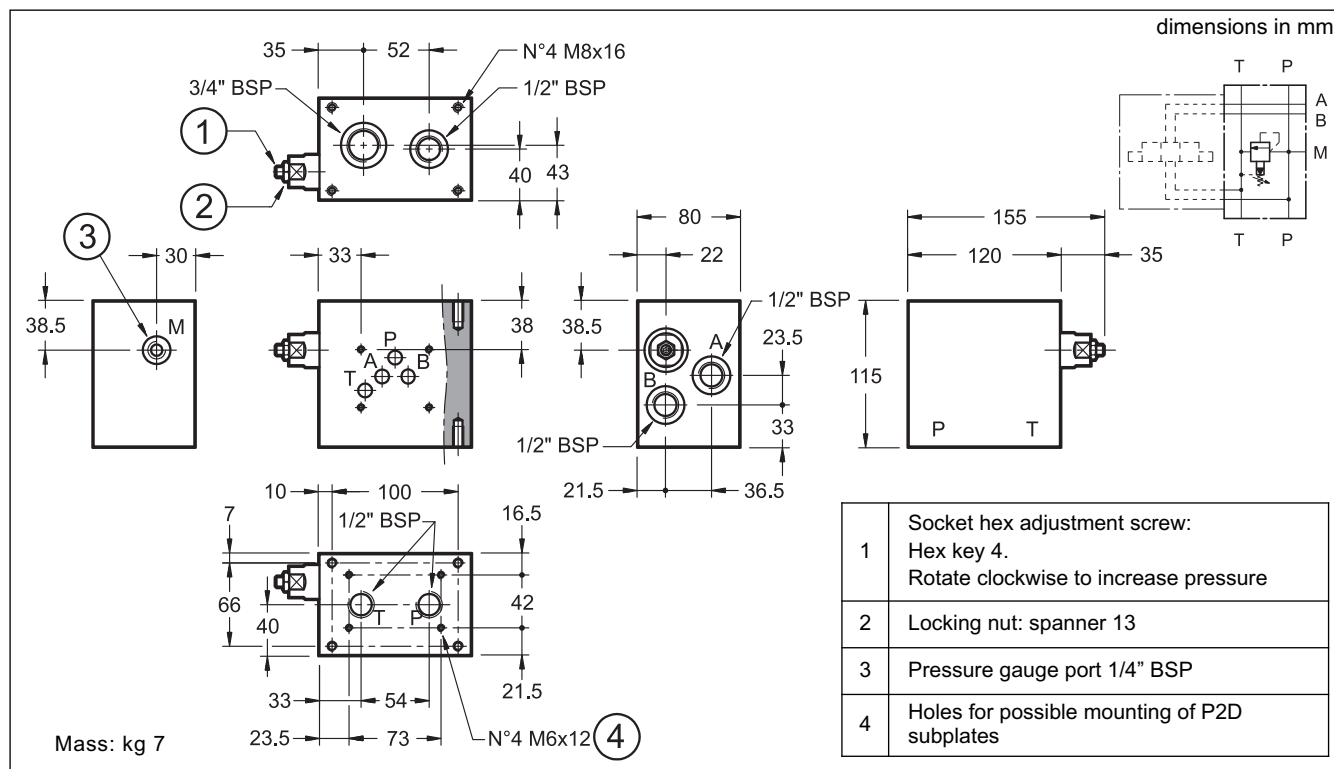
P - T THREADED PORTS SUBPLATE, WITH MOUNTING INTERFACE FOR ISO 4401-03 (CETOP 03) VALVE AND A -B REAR PORTS OF 1/2" BSP

dimensions in mm



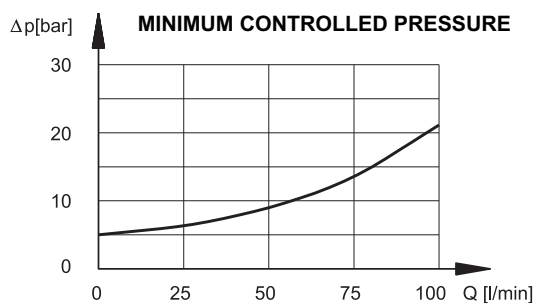
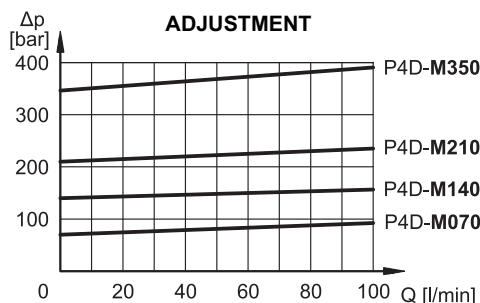
Mass: kg 3,8

## 6 - OVERALL AND MOUNTING DIMENSIONS P4D-M\*/30



## 7 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



## 8 - MAXIMUM PRESSURE ON P

Depending on the tie-rod type and on the number of assembled subplates it is necessary to pay attention to the maximum pressure on P in order to avoid extruding the O-Ring.

No. of assembled subplates	Threaded bar class B7 ISO 6547 (DIN 975)	Stud class 8.8 UNI 5911	Stud class 12.9
2	350 bar	350 bar	350 bar
3	300 bar	350 bar	350 bar
4	250 bar	300 bar	350 bar
5	200 bar	250 bar	300 bar
6	150 bar	200 bar	250 bar
Tightening torque	20 Nm	20 Nm	30 Nm

# RM4-\*-MP

## SUBPLATE WITH PRESSURE RELIEF VALVE

### SERIES 40

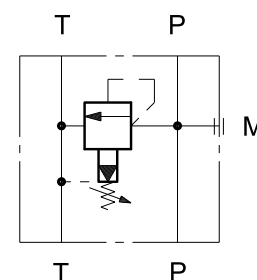
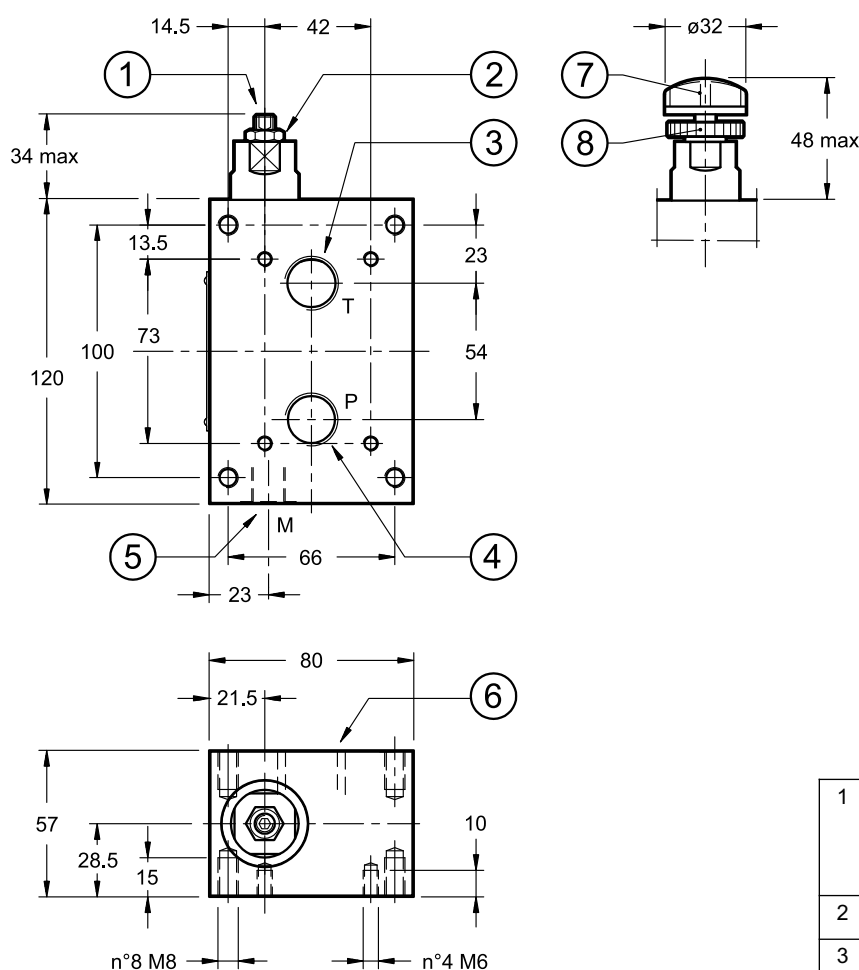
- The RM4-\*-MP subplate includes a pressure relief valve with P and T threaded ports.
- It is used as mounting surface for P2D and P4D subplates on power packs.
- It is available in four pressure adjustment ranges up to 350 bar.
- It is supplied with a socket set screw with locking nut, or alternatively with knob and maximum adjustment limiting device.

#### THREADED PORTS

**p** max 350 bar  
**Q** max 100 l/min

#### 1 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Socket hex adjustment screw: Hex key 4. Rotate clockwise to increase pressure
2	Locking nut: spanner 13
3	Tank port 1/2" BSP
4	Pressure port 1/2" BSP
5	Pressure gauge port 1/4" BSP
6	Tank port 3/4" BSP
7	Locking ring
8	Adjustment knob: K

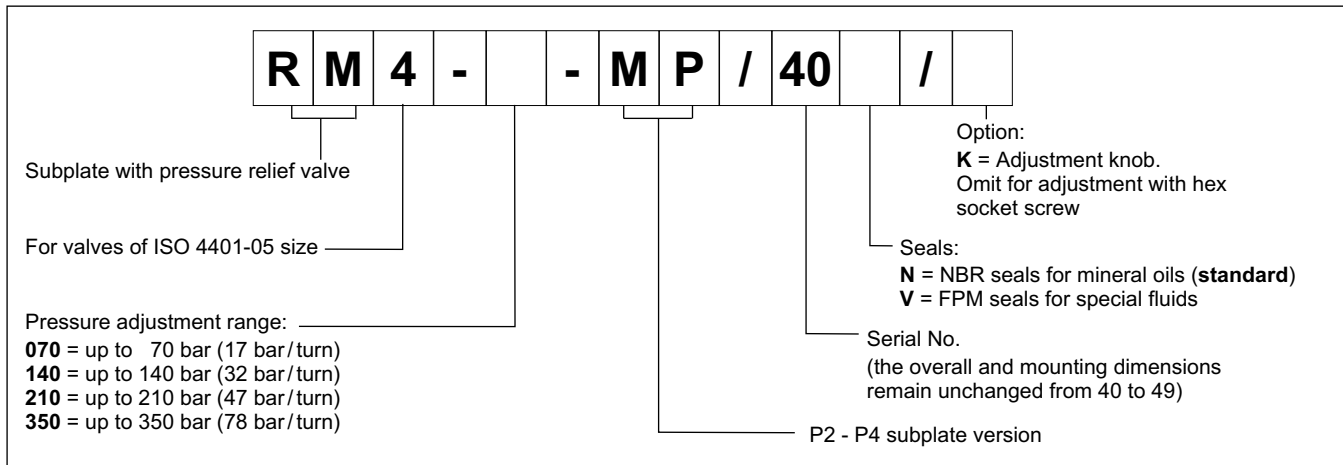
Mass: kg 3,5



# RM4-\*-MP

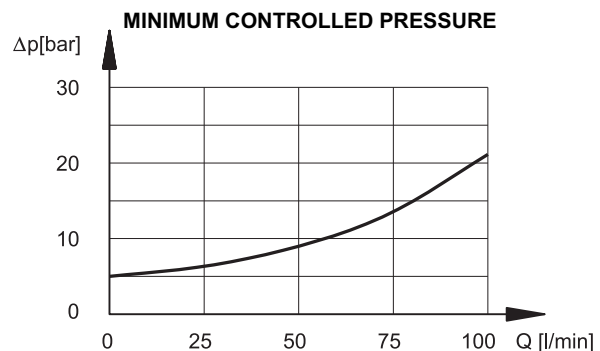
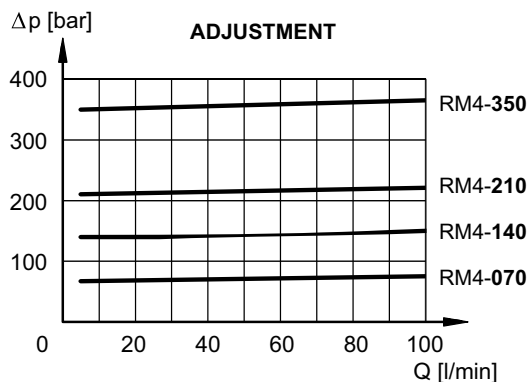
## SERIES 40

### 2 - IDENTIFICATION CODE



### 3 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.



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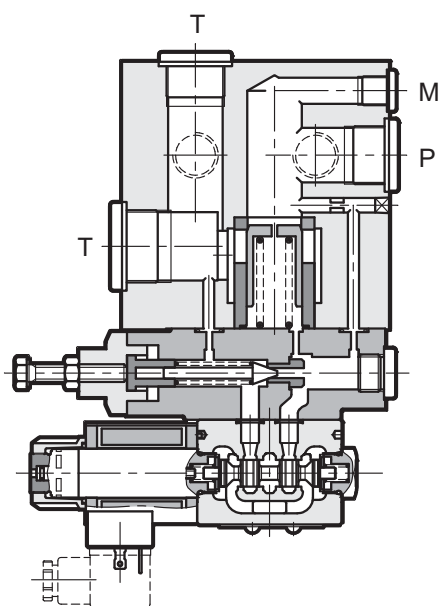
# P4D-RQM5

## MODULAR SUBPLATE WITH PRESSURE RELIEF VALVE AND UNLOADING SOLENOID VALVE

### SERIES 30

**p** max **350** bar  
**Q** max **250** l/min

#### OPERATING PRINCIPLE



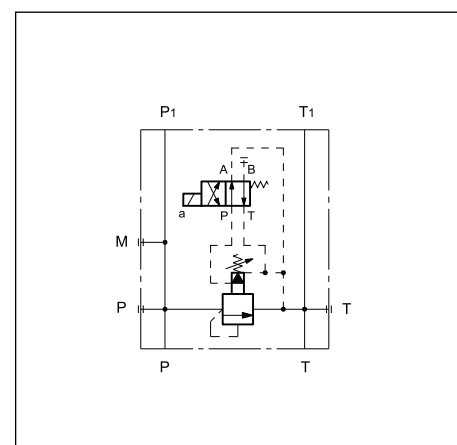
- The P4D-RQM5 is a compact group that includes a pressure relief valve and it is used as mounting surface for P2D and P4D subplates.
- It also includes a solenoid valve for venting of the total flow at a minimum pressure value.
- It is available in two pressure adjustment ranges up to 350 bar.
- It is normally supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob on the main pressure control.

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow on P (3/4") and T(1")	l/min	250
Maximum flow on P <sub>1</sub> and T <sub>1</sub> (1/2")		120
Minimum flow		10
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	10

**NOTE:** for the solenoid valve DS3 characteristics see catalogue 41 150

#### HYDRAULIC SYMBOL







# P4D-RQM5

## SERIES 30

### 1 - IDENTIFICATION CODE

P	4	D	-	R	Q	M	5	-	/	/	30	-	K1	/	
---	---	---	---	---	---	---	---	---	---	---	----	---	----	---	--

Subplate  
ISO 4401-05 (CETOP 05)  
dimension

Pressure relief valve  
with unloading solenoid valve

DN 25 nominal dimension

Pressure adjustment range  
5 = 250 bar 6 = 350 bar

M = SICBLOC adjustment knob  
(omit for hexagonal head  
adjustment screw)

Series: (the overall and mounting dimensions  
remain unchanged from 30 to 39)

Seals:  
N = NBR seals for mineral oil (**standard**)  
V = FPM seals for special fluids

**NOTE:** The locking rings of the coils and the relevant O-Rings are supplied together  
with valves.

Manual override:  
omit for override  
integrated in the  
tube (**standard**)  
**CM** = manual  
override, boot  
protected

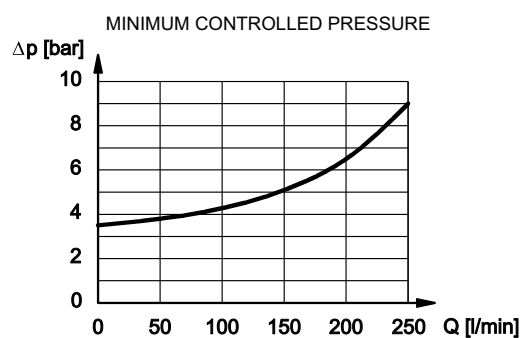
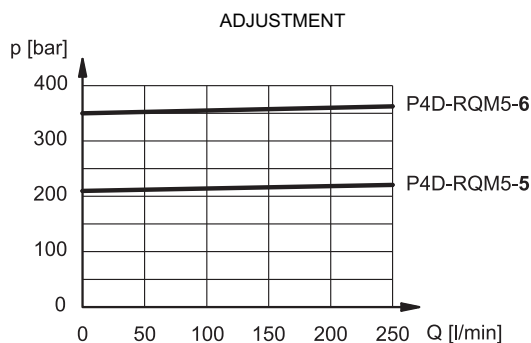
Coil electrical connection:  
plug for connector type DIN  
43650 (**standard**)

DC power supply  
**D12** = 12 V  
**D24** = 24 V  
**D48** = 48 V  
**D110** = 110 V  
**D220** = 220 V  
**D00** = valve without coils (see **NOTE**)

AC power supply  
**A24** = 24 V - 50 Hz  
**A48** = 48 V - 50 Hz  
**A110** = 110 V - 50 Hz / 120 V - 60 Hz  
**A230** = 230 V - 50 Hz / 240 V - 60 Hz  
**A00** = valve without coils (see **NOTE**)

**F110** = 110 V - 60 Hz  
**F220** = 220 V - 60 Hz

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



**NOTE:** The maximum flow deliverable to P<sub>1</sub> port is 120 l/min (for P2D and P4D modular subplates).  
The maximum flow through the pressure relief valve (additional 3/4" BSP P port) is 250 l/min.

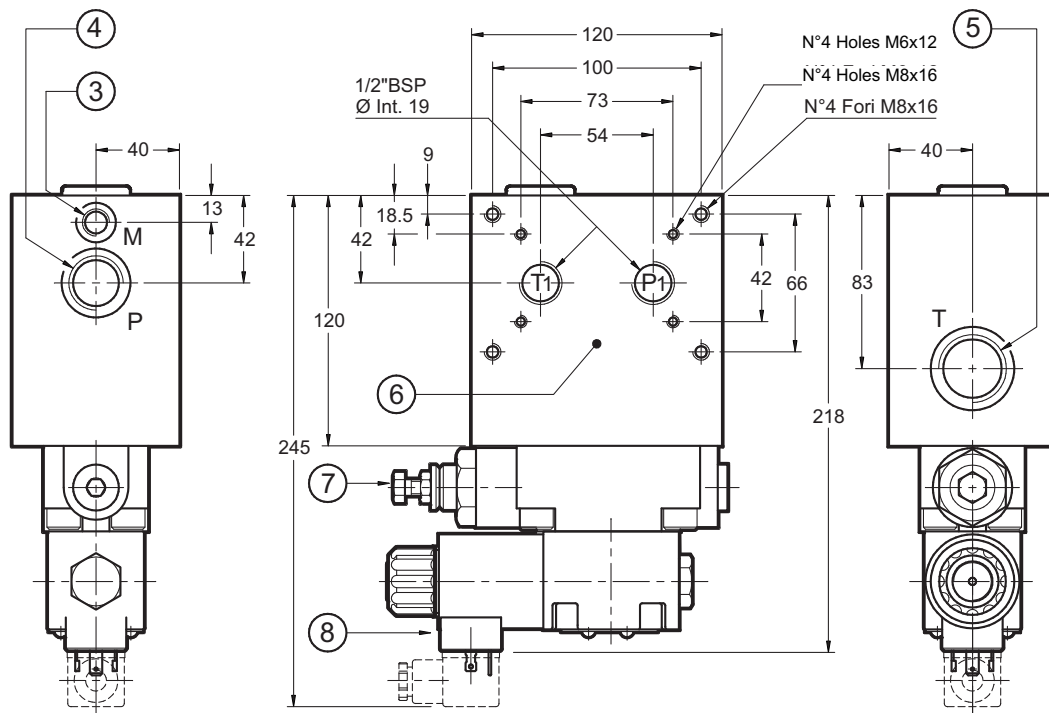
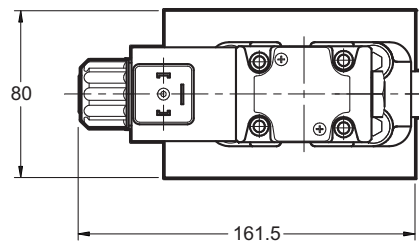
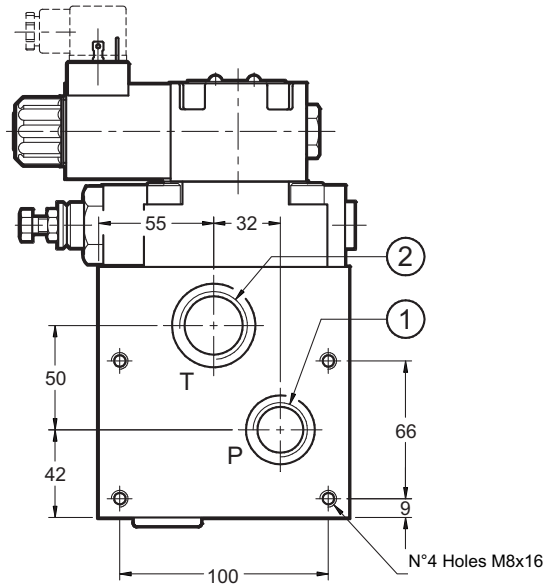
### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 4 - OVERALL AND MOUNTING DIMENSIONS

1	Pressure port P 3/4" BSP
2	Tank port T 1" BSP
3	Pressure gauge port M 1/4" BSP
4	Additional P port 3/4" BSP
5	Additional T port 1" BSP
6	Mounting surface for: P2D ISO 4401-03 (CETOP 03) P4D ISO 4401-05 (CETOP 05)
7	Hexagonal head pressure adjustment screw: spanner 13 Clockwise rotation to increase pressure
8	Unloading solenoid valve

dimensions in mm



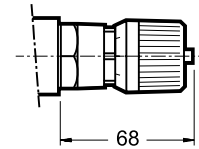


# P4D-RQM5

## SERIES 30

### 5 - ADJUSTMENT KNOB

The P4D-RQM5 valves can be equipped with a SICBLOC adjustment knob.  
To operate it, push and rotate at the same time.  
To request this option, add: /M (see par.1).



### 6 - ELECTRIC CONNECTORS

The solenoid valves are never supplied with connector. Connectors must be ordered separately. For the identification of the connector type to be ordered, please see catalogue 49 000.

### 7 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override, boot protected, is recommended.

Add the suffix **CM** to request this device (see paragraph 1).  
For overall dimensions see catalogue 41 150.



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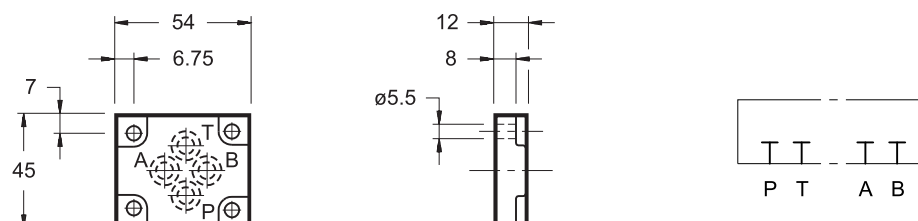
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# PE BLANKING PLATE

**p max 350 bar**

## 1 - OVERALL AND MOUNTING DIMENSIONS PE-MD1/20 (cod. 1950591)

dimensions in mm

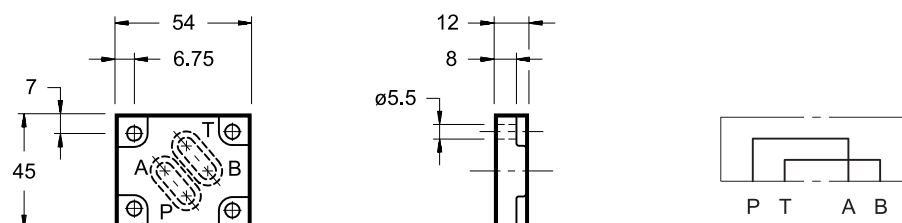


FASTENING BOLTS: 4 bolts M5x16

4 OR type 2037 (9.25x1.78) - 90 Shore

## 2 - OVERALL AND MOUNTING DIMENSIONS PE-C/PA/MD1/20 (cod. 1950751)

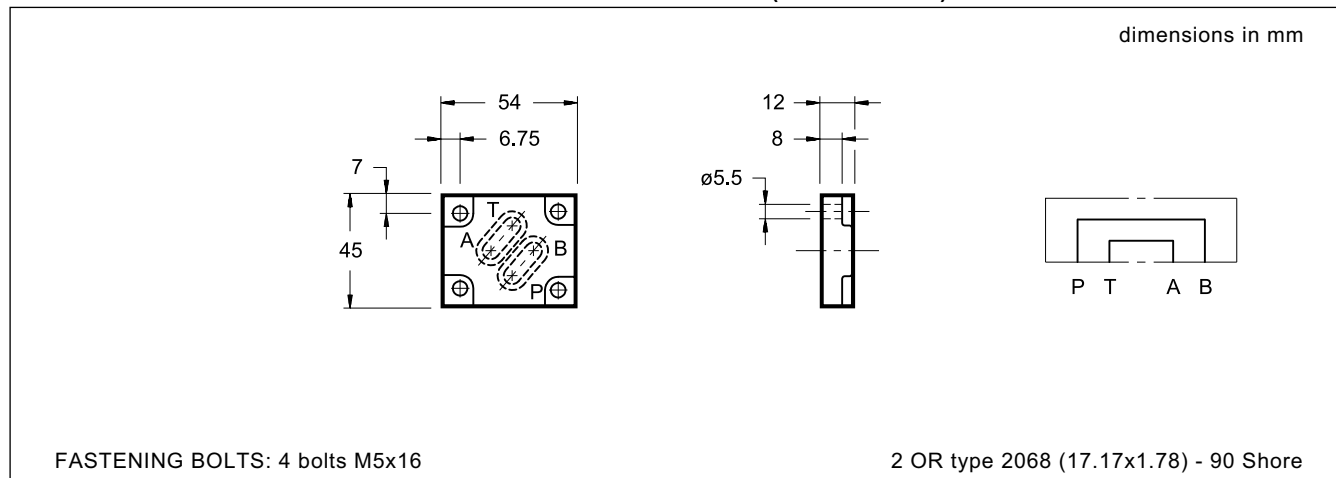
dimensions in mm



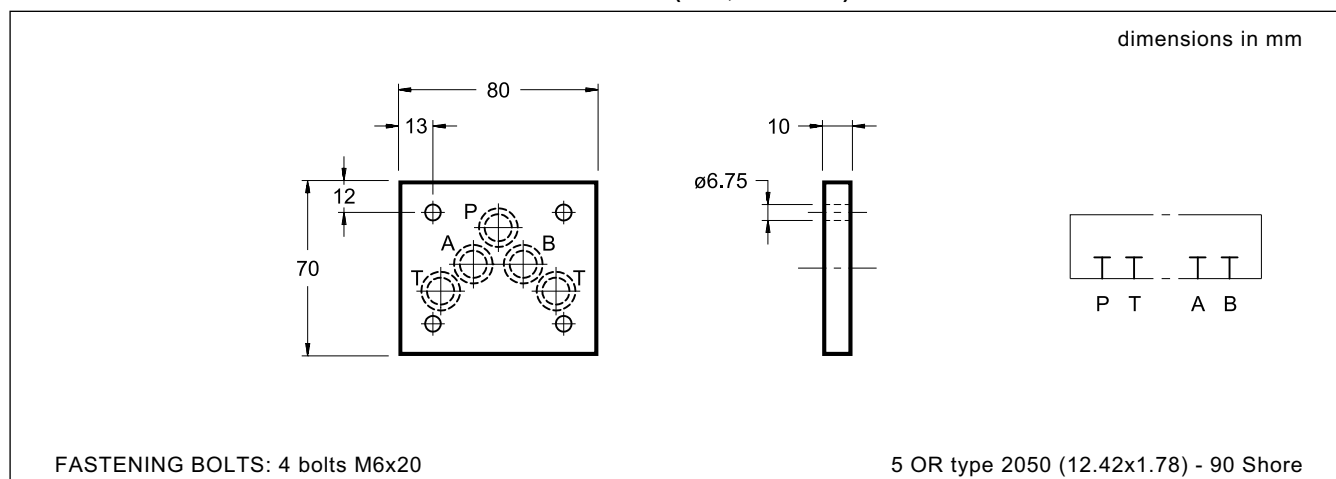
FASTENING BOLTS: 4 bolts M5x16

2 OR type 2068 (17.17x1.78) - 90 Shore

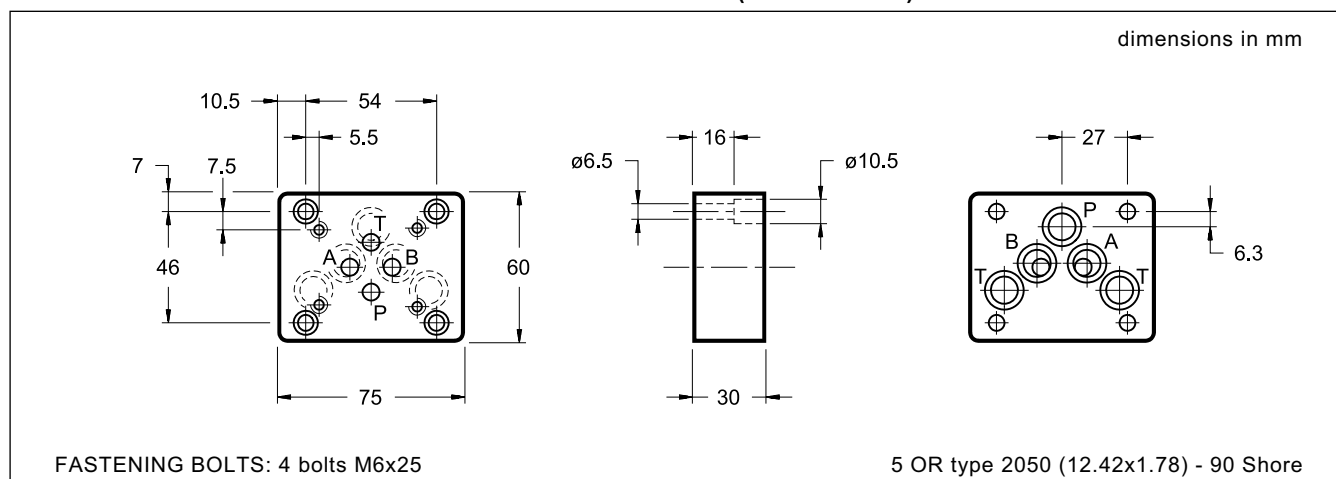
### 3 - OVERALL AND MOUNTING DIMENSIONS PE-C/PB/MD1/20 (cod. 1950601)



### 4 - OVERALL AND MOUNTING DIMENSIONS PE/D4-M (cod. 1950042)



### 5 - OVERALL AND MOUNTING DIMENSIONS PC-D4/MD1-M (cod. 1950222)



**NOTE:** On request, plates can be supplied with the O-Rings in viton. To order it, please indicate the letter /V at the end of the identification code of the plate.



**DUPLOMATIC OLEODINAMICA S.p.A.**  
 20015 PARABIAGO (MI) • Via M. Re Depaolini 24  
 Tel. +39 0331.895.111  
 Fax +39 0331.895.339  
 www.duplomatic.com • e-mail: sales.exp@duplomatic.com



# PRM2

DIRECT OPERATED  
PRESSURE RELIEF VALVE  
SERIES 10

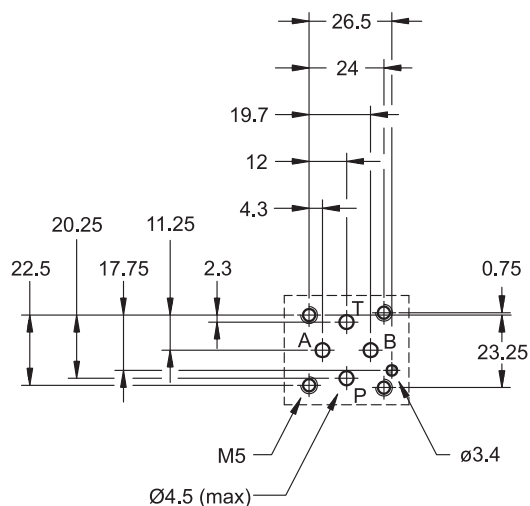
**MODULAR VERSION  
ISO 4401-02**

**p max 320 bar**

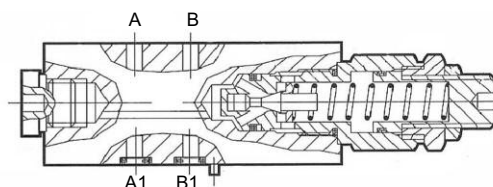
**Q max 20 l/min**

## MOUNTING SURFACE

ISO 4401-02-01-0-05  
(CETOP 4.2-4-R02-320)



## OPERATING PRINCIPLE



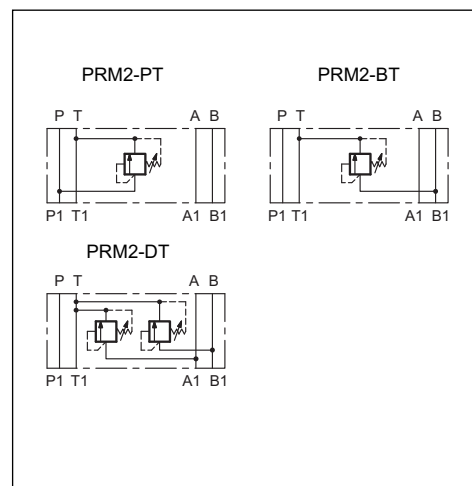
- The PRM2 valve is a direct operated pressure relief valve made as a modular version with mounting surface according to the ISO 4401 standards.
- It can be assembled with all ISO 4401-02 modular valves without use of pipes, using suitable tie-rods or bolts.
- It is available in versions for single relief on P or B with discharge in T, or two independent relief on A and B with discharge in T, all with three different pressure adjustment ranges.
- This valve is normally used as a hydraulic circuit pressure limiting device or as a limiting device of the pressure peaks generated during the movement of hydraulic actuators.
- It is supplied with a countersunk hex adjustment screw and locking nut.

## PERFORMANCES

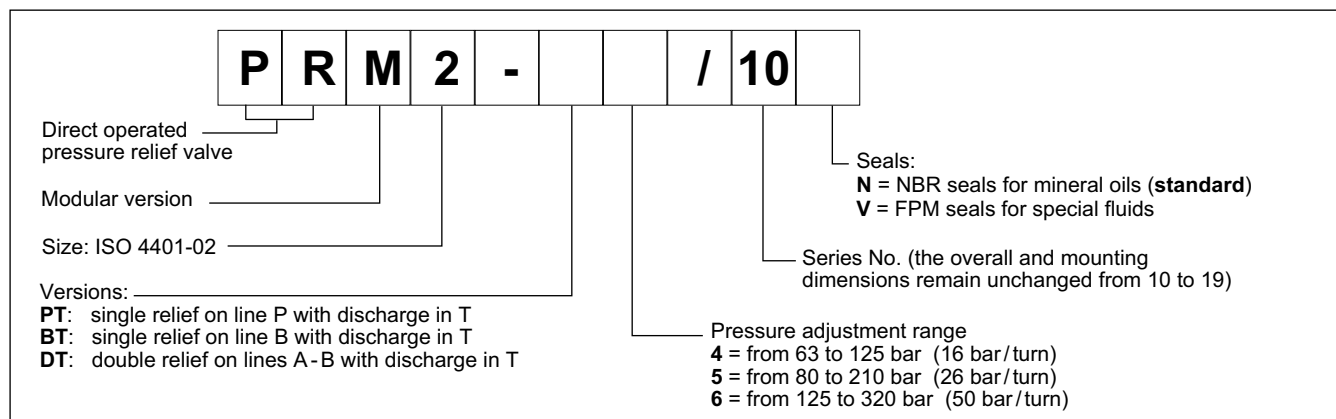
(measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Minimum controlled pressure	see $\Delta p$ diagram.	
Maximum flow rate	l/min	20
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: PRM2-PT and PRM2-BT PRM2-DT	kg	0.85 1

## HYDRAULIC SYMBOLS

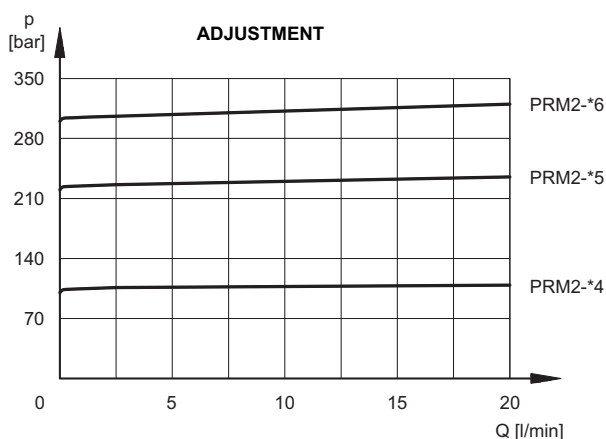


### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

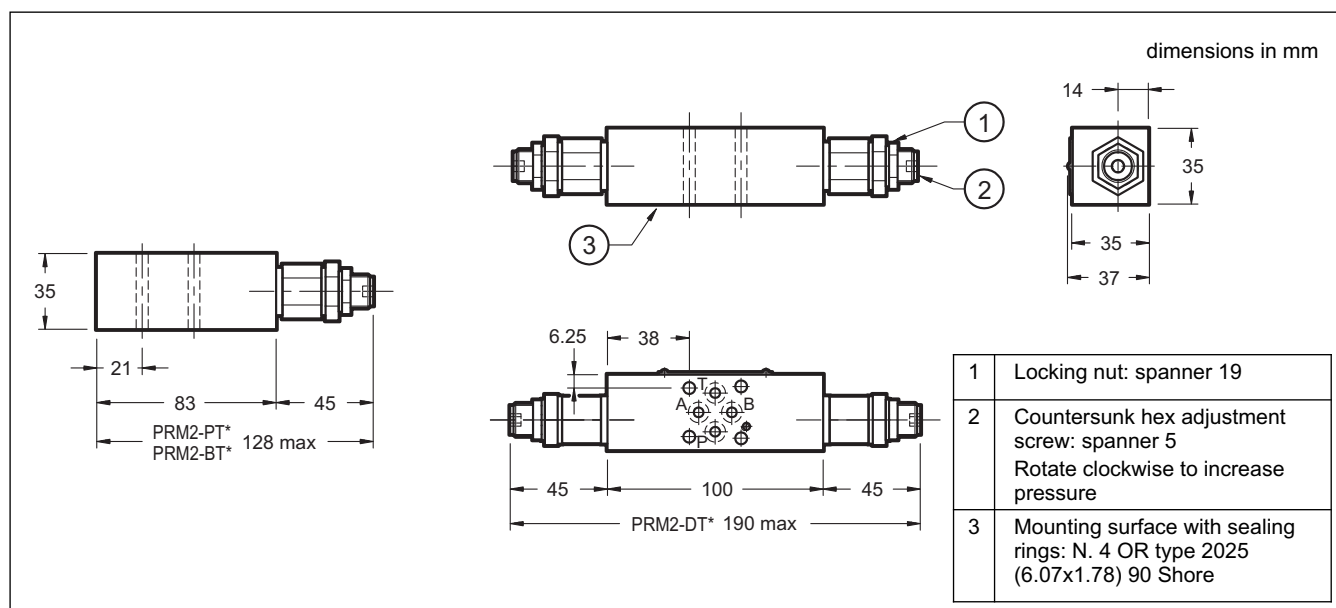
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V).

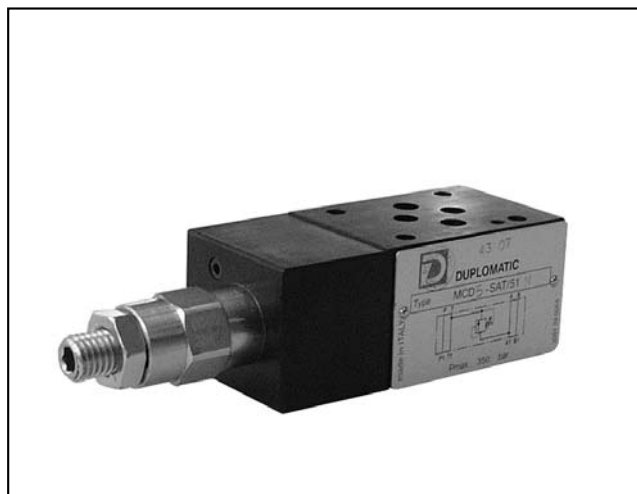
For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





**MCD**  
**DIRECT OPERATED**  
**PRESSURE RELIEF VALVE**  
**SERIES 51**

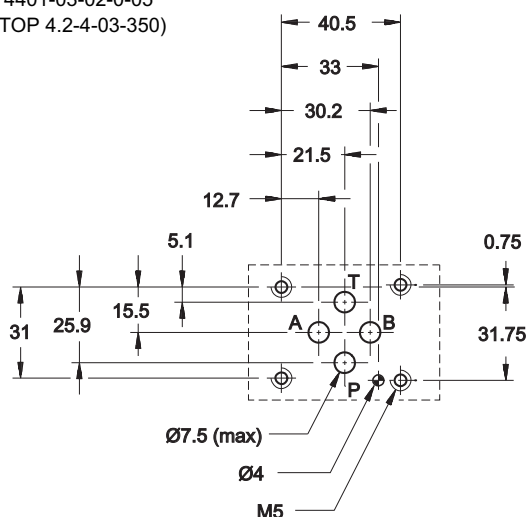
**MODULAR VERSION**  
**ISO 4401-03 (CETOP 03)**

**p max 350 bar**

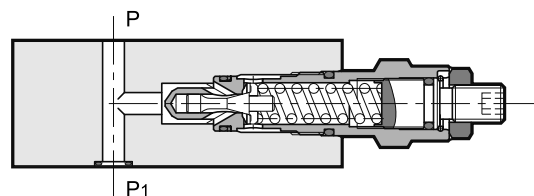
**Q** max (see table of performances)

## MOUNTING INTERFACE

ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



## OPERATING PRINCIPLE



- The MCD valve is a direct operated pressure relief valve made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 121H) standards.
- It can be assembled with all ISO 4401-03 (CETOP 03) modular valves without use of pipes, using suitable tie-rods or bolts.
- It is available in versions for single adjustment on one control line, or dual on two control lines and with four different pressure adjustment ranges.
- This valve is normally used as a hydraulic circuit pressure limiting device or as a limiting device of the pressure peaks generated during the movement of hydraulic actuators.
- It is normally supplied with a hexagonal head adjustment screw, locking nut and limitation of the maximum adjustment travel.

**CONFIGURATIONS** (see Hydraulic symbols table)

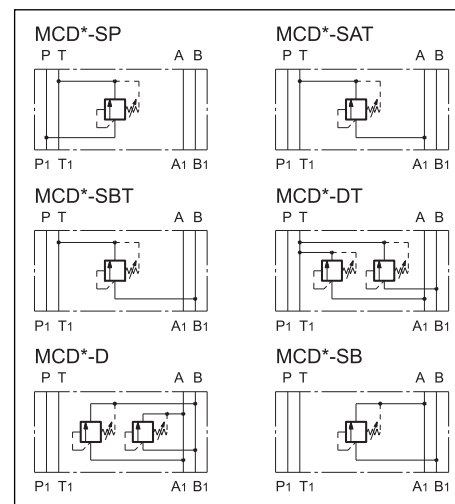
- “SP”: controls the pressure on line P with discharge in T.
- “SAT”: controls the pressure on line A with discharge in T.
- “SBT”: controls the pressure on line B with discharge in T.

- “DT”: controls the pressure on lines A-B with discharge in T.
- “D”: controls the pressure on lines A-B with crossed discharges
- “SB”: controls the pressure on line B with discharge in A.

### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Minimum controlled pressure	see $\Delta p$ diagram.	
Maximum flow rate in controlled lines	l/min	50
Maximum flow rate in the free lines		75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: MCD-SP / MCD-SAT / MCD-SBT / MCD-SB MCD-DT / MCD-D	kg	1,4 2,0

## HYDRAULIC SYMBOLS

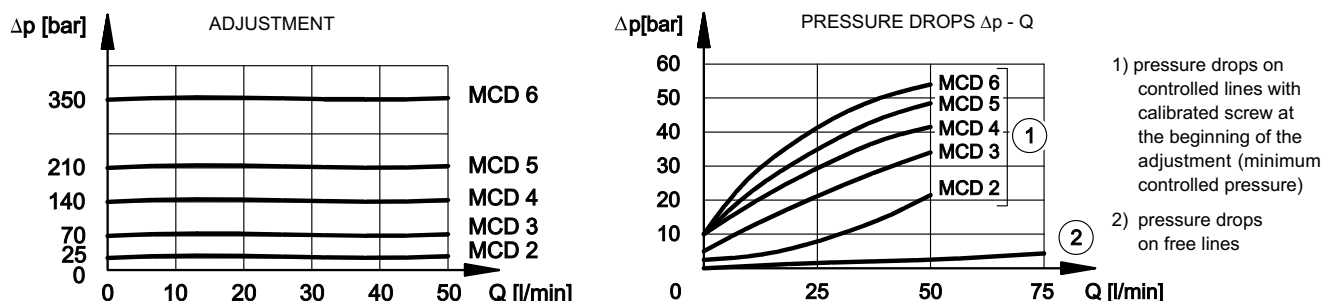




### 1 - IDENTIFICATION CODE

<b>M</b>	<b>C</b>	<b>D</b>	<b>-</b>	<b>/ 51</b>	<b>/</b>	
Size: ISO 4401-03 (CETOP 03). Modular version	Direct operated pressure relief valve	Pressure adjustment range 2 = up to 25 bar 3 = up to 70 bar 4 = up to 140 bar		Seals: N = NBR seals for mineral oils ( <b>standard</b> ) V = FPM seals for special fluids	omit for adjustment with countersunk hex screw - <b>standard</b> K = Adjustment knob	Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)
Configurations: SP: single on line P with discharge in T SAT: single on line A with discharge in T SBT: single on line B with discharge in T			DT: double on lines A-B with discharge in T D: double on lines A-B with crossed discharges SB: single on line B with discharge in A			

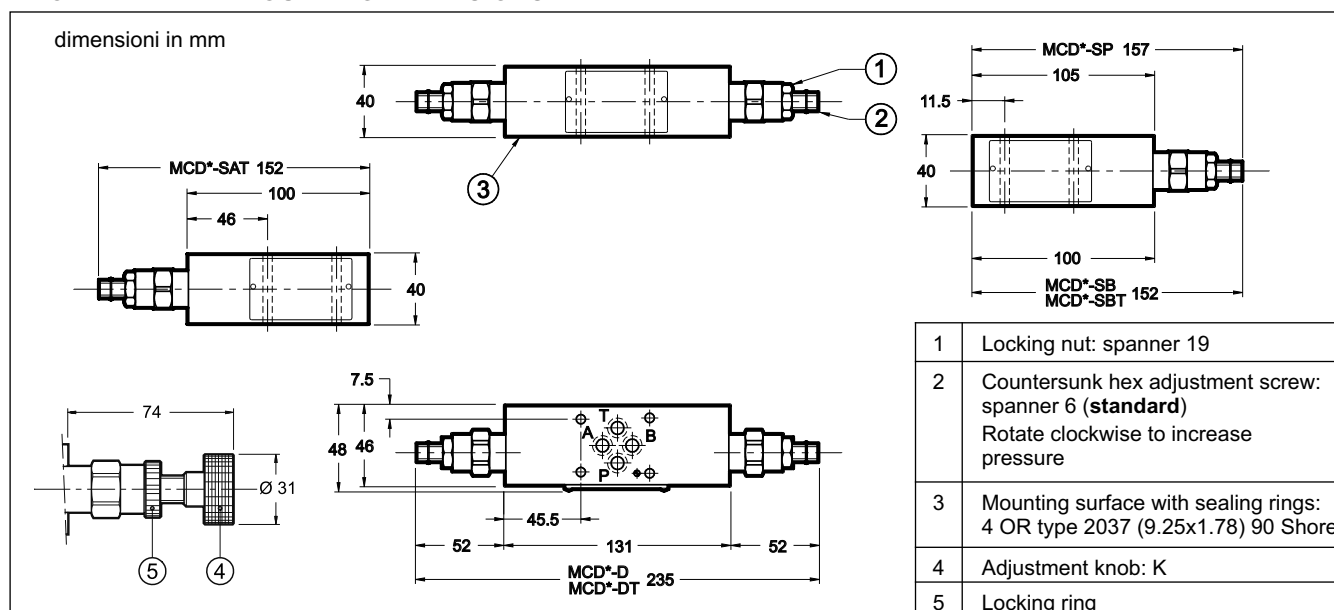
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



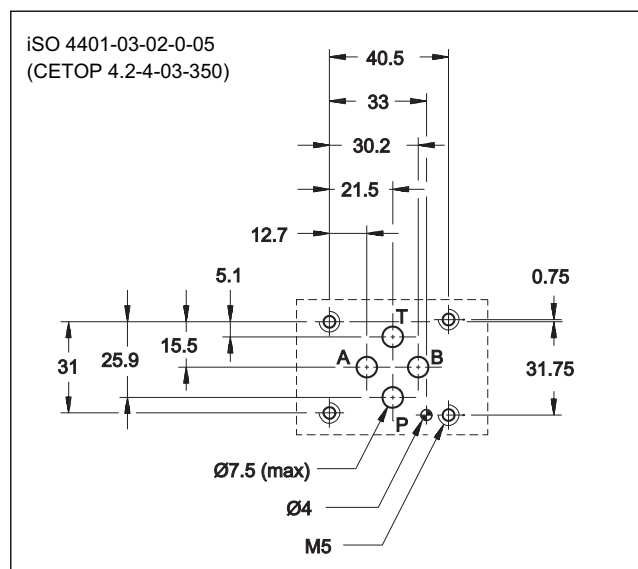


**MRQ**  
**PILOT OPERATED**  
**PRESSURE RELIEF VALVE**  
**SERIES 51**

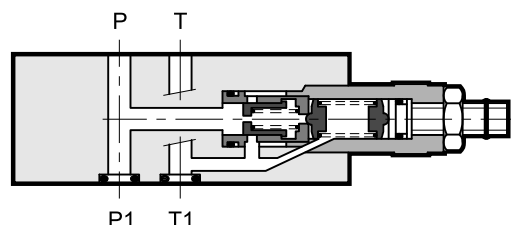
**MODULAR VERSION**  
**ISO 4401-03 (CETOP 03)**

**p** max **350** bar  
**Q** max **75** l/min

## MOUNTING INTERFACE



## OPERATING PRINCIPLE



- The MRQ valve is a pilot operated pressure relief valve made as a modular version with mounting surface according to ISO 4401 (CETOP RP 121H) standards.
- It can be assembled with all ISO 4401-03 (CETOP 03) modular valves without the use of pipes, using suitable tie-rods or bolts.
- It is available in versions for single adjustment on one control line or dual on two control lines and with four different pressure adjustment ranges.
- This valve is normally used as a hydraulic circuit pressure limiting device.
- It is normally supplied with a hexagonal head adjustment screw, locking nut and limitation of the maximum adjustment travel.

**CONFIGURATIONS** (see Hydraulic symbols table)

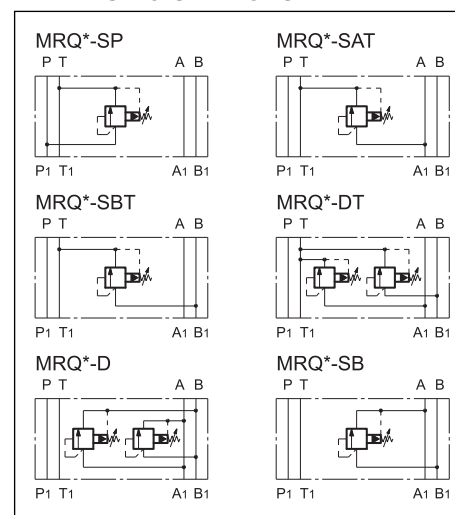
- “SP”: controls the pressure on line P with discharge in T.
- “SAT”: controls the pressure on line A with discharge in T.
- “SBT”: controls the pressure on line B with discharge in T.

- “DT”: controls the pressure on lines A-B with discharge in T.
- “D”: controls the pressure on lines A-B with crossed discharges.
- “SB”: controls the pressure on line B with discharge in A.

### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Minimum controlled pressure	see $\Delta p$ diagram.	
Maximum flow rate in controlled lines and in the free lines	l/min	75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: MRQ-SP / MRQ-SAT / MRQ-SBT / MRQ-SB MRQ-DT / MRQ-D	kg	1,4 2,1

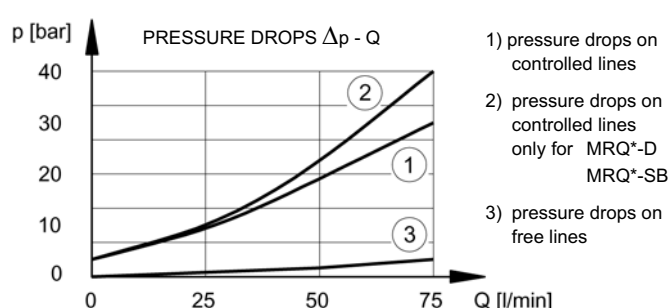
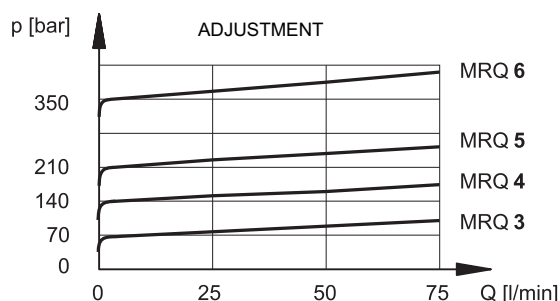
## HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<b>M</b>	<b>R</b>	<b>Q</b>	<b>-</b>	<b>/</b>	<b>/</b>	<b>51</b>	<b>/</b>	
ISO 4401-03 (CETOP 03) size. Modular version						Seals: omit for mineral oils V = viton for special fluids		
Pilot operated pressure relief valve						Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)		
Pressure adjustment range: 3 = up to 70 bar    5 = up to 210 bar 4 = up to 140 bar    6 = up to 350 bar						M1 = Adjustment knob (omit for adjustment with countersunk hex screw)		
Configurations: SP: single on line P with discharge in T SAT: single on line A with discharge in T SBT: single on line B with discharge in T						DT: double on lines A-B with discharge in T D: double on lines A-B with crossed discharges SB: single on line B with discharge in A		

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

1	Locking nut: spanner 19
2	Countersunk hex adjustment screw: spanner 5 Rotate clockwise to increase pressure
3	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
4	Adjustment knob: M1

# PBM3

## BACKPRESSURE VALVE

### SERIES 10



### MODULAR VERSION

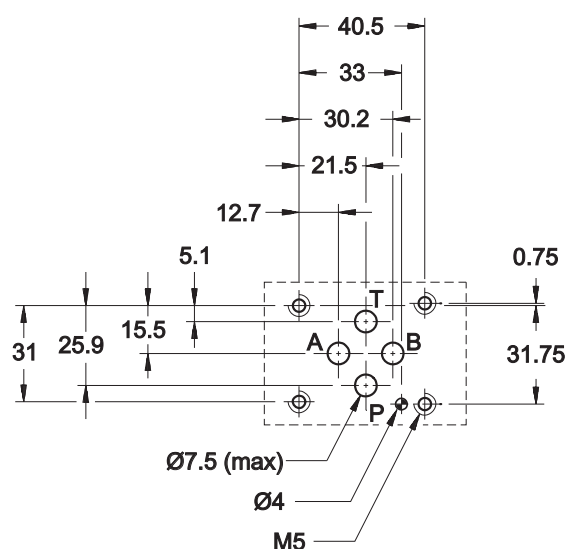
ISO 4401-03 (CETOP 03)

**p** max **350** bar

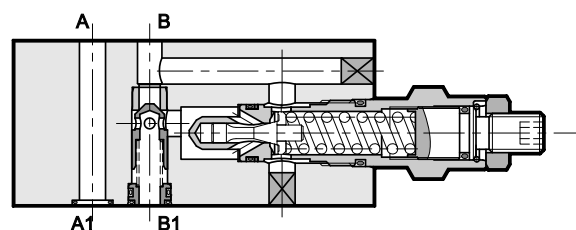
**Q** max (see table of performances)

### MOUNTING INTERFACE

ISO 4401-03-02-0-05  
CETOP 4.2-4-03-350



### OPERATING PRINCIPLE

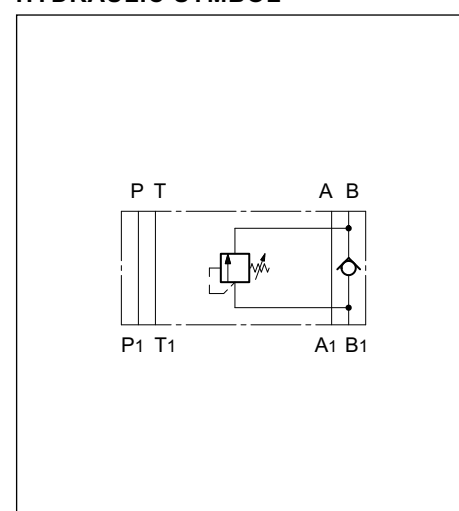


- The valve PBM3 is a direct operated three-way pressure regulator, developed as a modular version with mounting surface according to the ISO 4401 (CETOP RP121H) standards.
- Its aim is to adjust the output backpressure coming from the actuator, so as to allow the input free flow.
- It is normally used on vertically mounted cylinders where the cancellation of a load weighting on the rod of the same cylinder is needed.

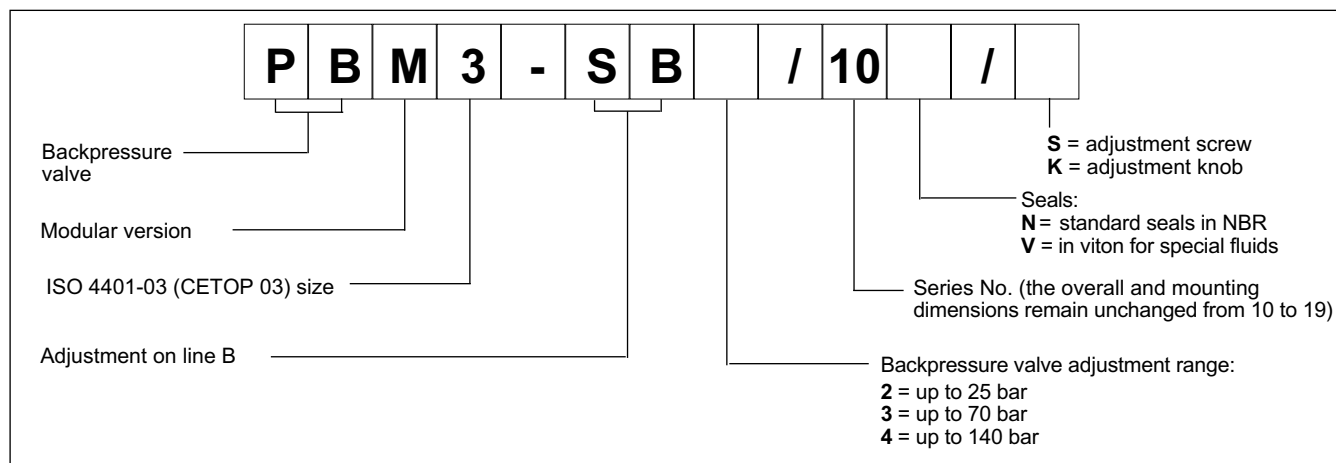
### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Check valve cracking pressure	bar	3,5
Max. flow on check valve B→B1 ( $\Delta p$ 8 bar)	bar	50
Maximum flow rate in controlled line B1→B	l/min	50
Maximum flow rate in the free lines P, A, T		75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,6

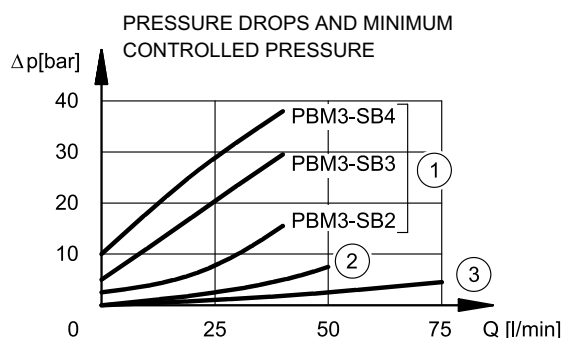
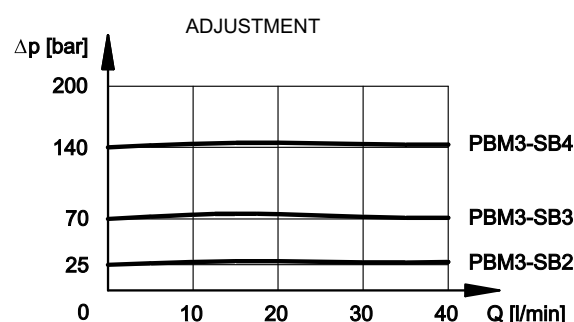
### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

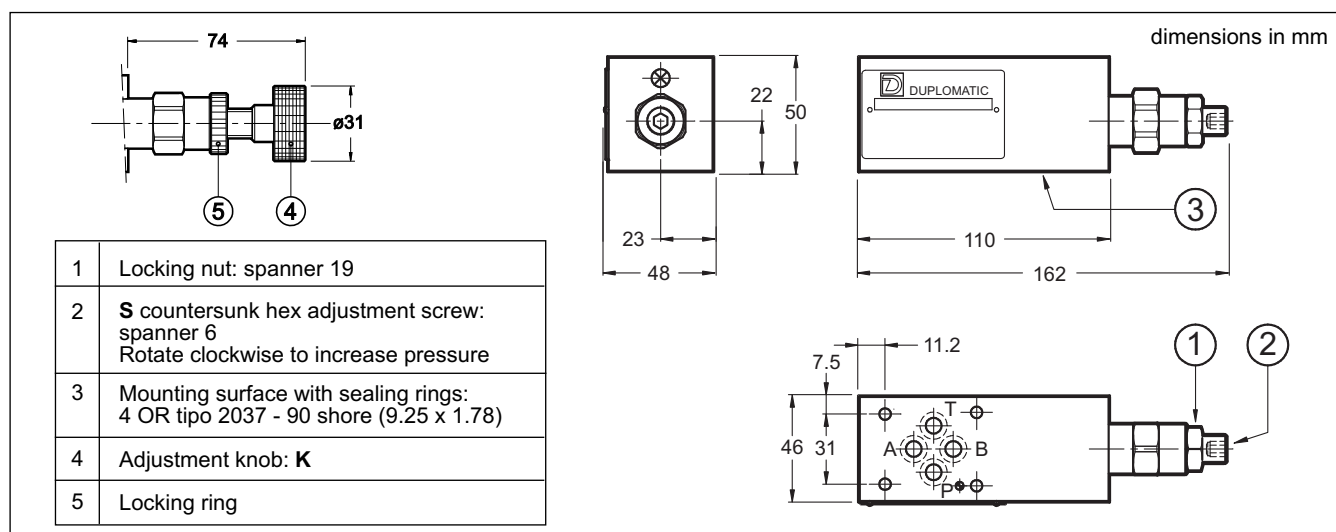


- 1) pressure drops on line B1→B with calibrated screw at the beginning of the adjustment (min. controlled pressure)
- 2) pressure drops on line B→B1 to which the cracking pressure of the check valve is to be added
- 3) pressure drops on free lines

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# PRM5

## PILOT OPERATED PRESSURE RELIEF VALVE

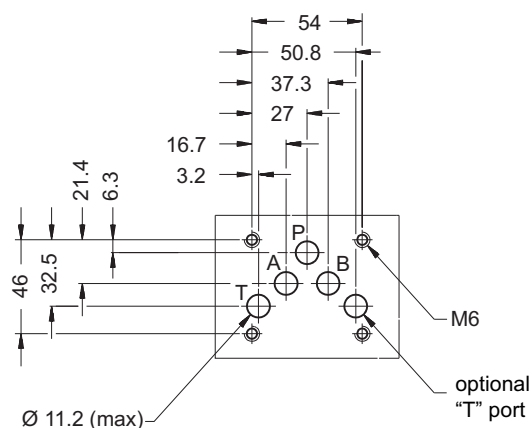
### SERIES 10

#### MODULAR VERSION ISO 4401-05 (CETOP 05)

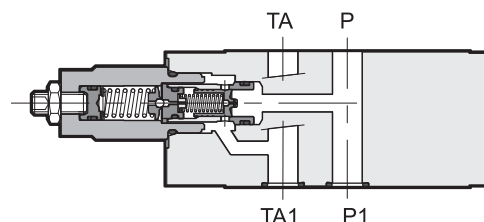
**p** max **350** bar  
**Q** max **120** l/min

#### MOUNTING SURFACE

ISO 4401-05-04-0-05  
CETOP 4.2-4-05-350



#### OPERATING PRINCIPLE

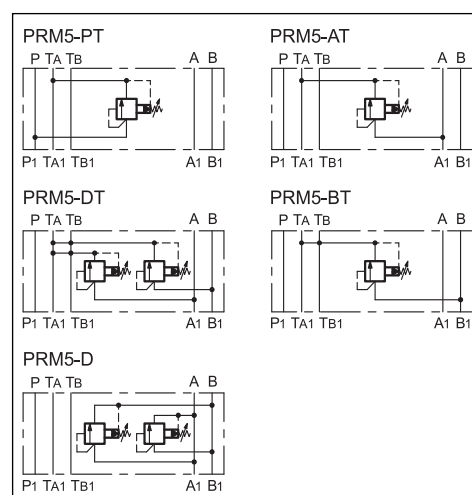


- The PRM5 valve is a pilot operated pressure relief valve made as a modular version with mounting surface according to ISO 4401 (CETOP RP121H) standards.
- It can be assembled with all ISO 4401-05 modular valves without the use of pipes, using suitable tie-rods or bolts.
- Versions are available for single adjustment on one control line, or dual on two control lines and with four different pressure adjustment ranges.
- This valve is used as a hydraulic circuit pressure limiting device.
- It is supplied with an hexagonal head adjustment screw and locking nut. It is also available with knob.

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Minimum controlled pressure	bar	see $\Delta p - Q$ diagram
Max flow	l/min	120
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: PRM5-PT, -AT, -BT PRM5-DT, -D	kg	2,8 3

#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<b>P</b>	<b>R</b>	<b>M</b>	<b>5</b>	<b>-</b>		<b>/ 10</b>	<b>/</b>	
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Pilot operated pressure relief valve

Modular version

ISO 4401-05 (CETOP 05) size

Option: W7 surface treatment. Omit if not required (**NOTE**)

Option: **K** = Adjustment knob. Omit for adjustment with hex socket screw (**standard**)

Seals:  
**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

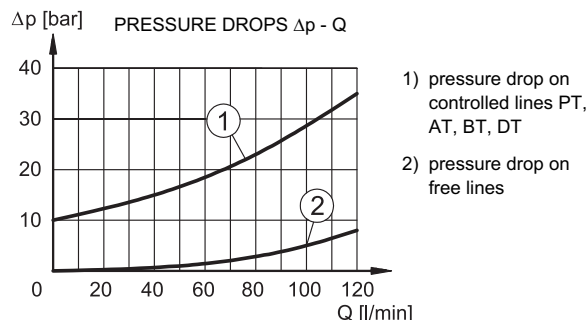
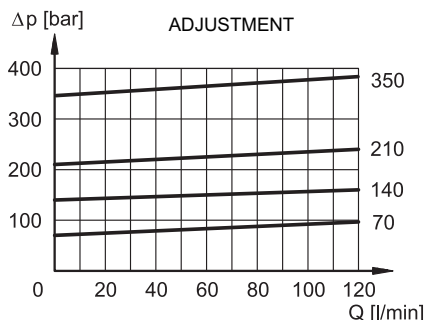
Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

NOTE: Upon request we can supply these valves completely with zinc-nickel surface treatment on the body. Add the suffix **/W7** at the end of the identification code.

Versions:  
**PT**: single on line P with discharge in TA  
**AT**: single on line A with discharge in TA  
**BT**: single on line B with discharge in TA and TB  
**DT**: double on lines A-B with discharge in TA and TB  
**D**: double on lines A-B with cross discharge

Pressure adjustment range:  
**070** = 6 ÷ 70 bar (17 bar/turn)      **210** = 6 ÷ 210 bar (47 bar/turn)  
**140** = 6 ÷ 140 bar (32 bar/turn)      **350** = 6 ÷ 350 bar (78 bar/turn)

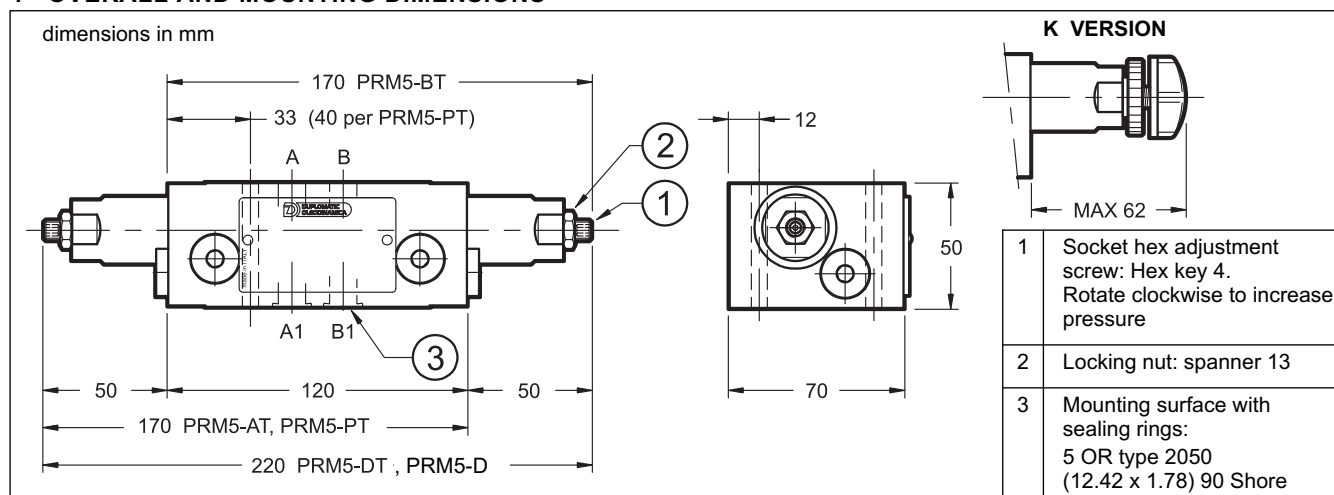
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

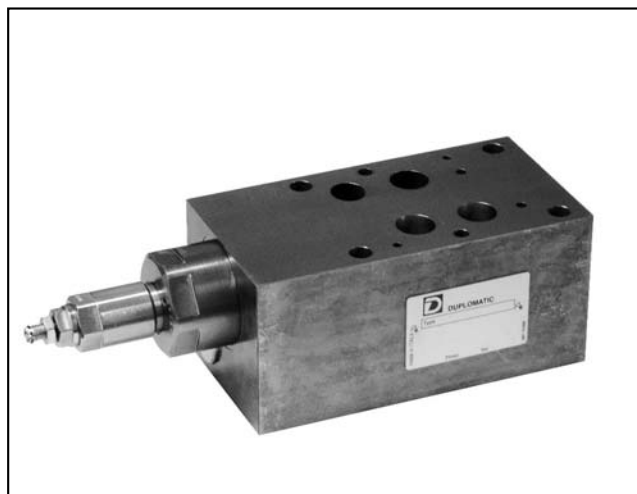


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# PRM7

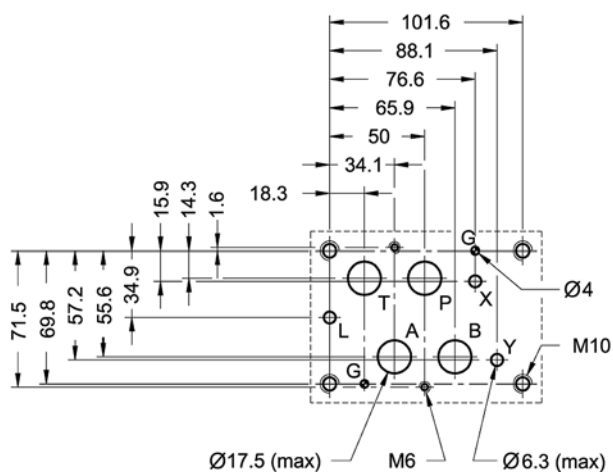
## PILOT OPERATED PRESSURE RELIEF VALVE SERIES 10

### MODULAR VERSION ISO 4401-07 (CETOP 07)

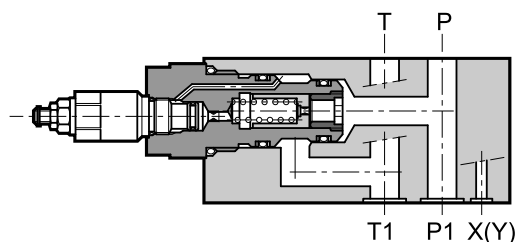
**p** max **350** bar  
**Q** max **300** l/min

### MOUNTING INTERFACE

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07)



### OPERATING PRINCIPLE

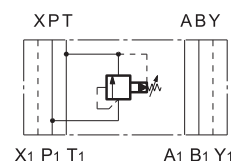


- The PMR7 valve is a pilot operated pressure relief valve made as a modular version with a mounting surface according to ISO 4401 (CETOP RP 121H) standards.
- It can be assembled with all ISO 4401-07 (CETOP 07) modular valves without the use of pipes, using suitable tie-rods or bolts.
- It is available in the type for single adjustment on line P and discharge in T with two pressure adjustment ranges.
- This valve is normally used as a hydraulic circuit pressure limiting device.
- It is normally supplied with an adjustment screw.

### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	300
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	8,5

### HYDRAULIC SYMBOL

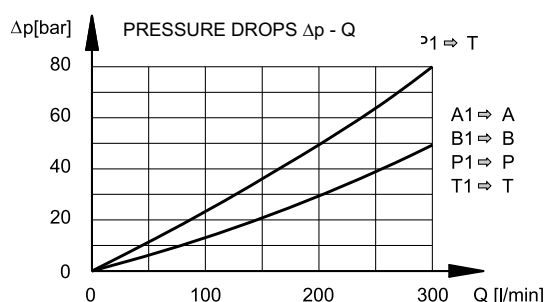
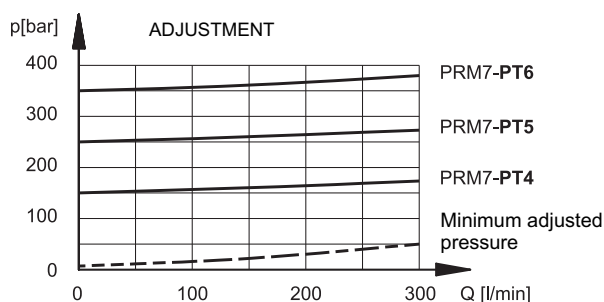




### 1 - IDENTIFICATION CODE

<b>P</b>	<b>R</b>	<b>M</b>	<b>7</b>	<b>-</b>	<b>PT</b>		<b>/</b>	<b>10</b>	<b>/</b>	
Pressure relief valve							S = adjustment screw (standard) K = adjustment knob			
Modular version							Seals: N = standard seals in NBR (standard) V = in viton for special fluids			
ISO 4401-07 (CETOP 07) size							Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)			
Pressure adjustment on line P with discharge in T							Pressure adjustment range: 4 = 15 ÷ 160 bar (30 rpm)    5 = 15 ÷ 250 bar (45 rpm) 6 = 15 ÷ 315 bar (56 rpm)			

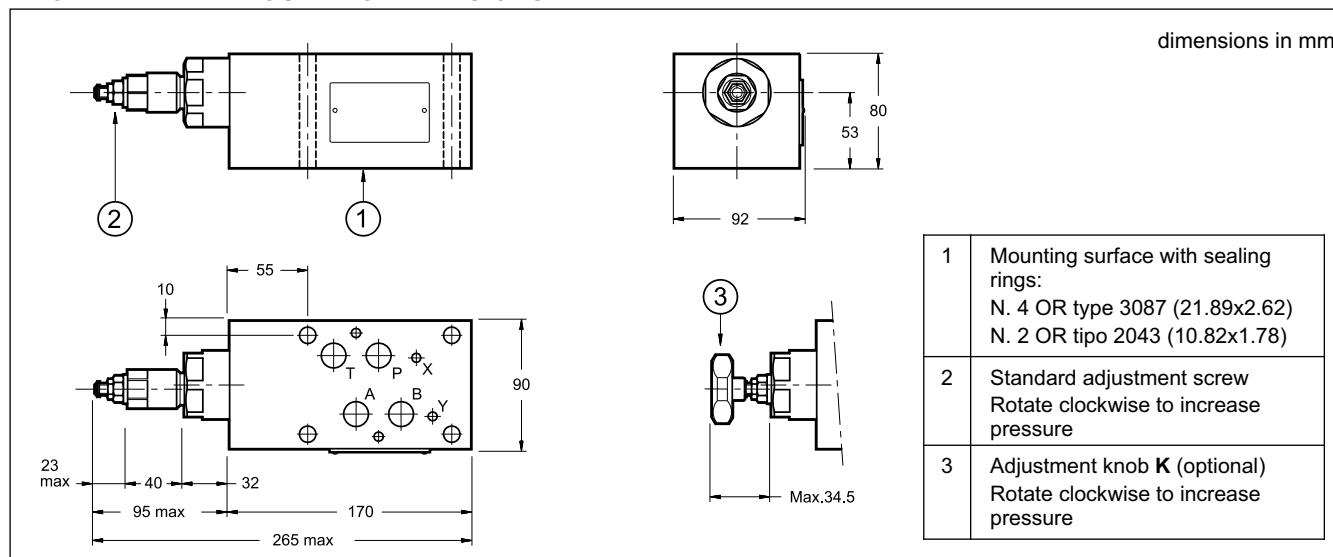
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



# PZM2

## PRESSURE REDUCING VALVE DIRECT OPERATED WITH VARIABLE ADJUSTMENT SERIES 10

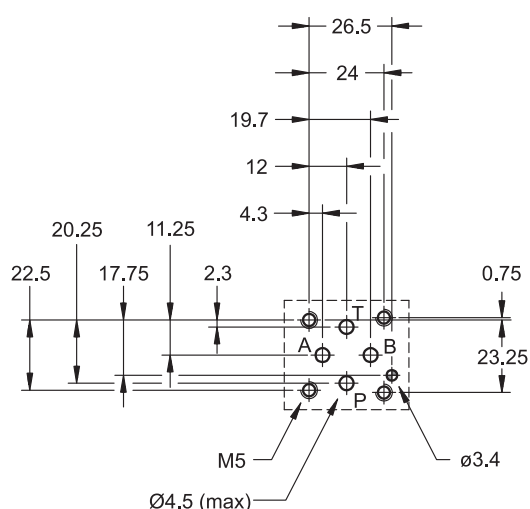
### MODULAR VERSION ISO 4401-02

**p** max **320** bar

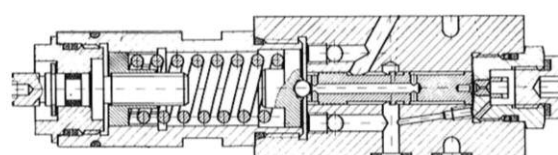
**Q** max **20** l/min

### MOUNTING SURFACE

ISO 4401-02-01-0-05  
(CETOP 4.2-4-R02-320)



### OPERATING PRINCIPLE



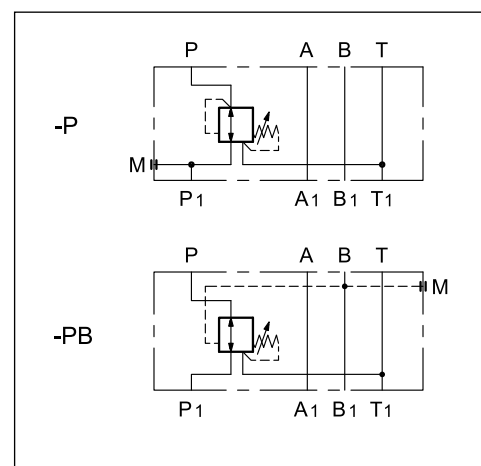
- The PZM2 valve is a three-ports pressure reducing valve, direct operated, spool type, made as modular version, with ports according to the ISO 4401 standards and can be assembled quickly, without use of pipes, under the ISO 4401-02 solenoid valves.
- The PZM2 is a normally open valve. The hydraulic fluid flows freely in the pressure line. When the inlet pressure in P exceeds the value set by the spring, the valve opens the outlet port to the tank line until the outlet pressure has been reduced to the set value.
- The valve construction provides good adjustment sensitivity with reduced drainage flow. The drainage to the tank line is internal.
- The three-ports design provides protection of the secondary circuit from pressure surges since it allows a reverse flow from the actuator to the tank line.

### PERFORMANCES

(measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Maximum pressure on port T		100
Maximum flow rate in the controlled lines	l/min	20
Maximum flow rate in the free lines		30
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,7

### HYDRAULIC SYMBOL

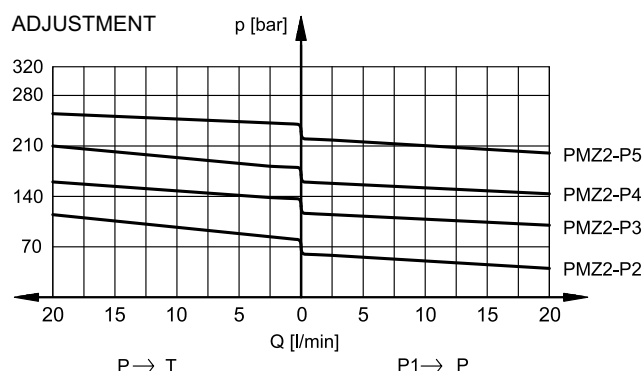


### 1 - IDENTIFICATION CODE

<b>PZ</b>	<b>M</b>	<b>2</b>	<b>-</b>			<b>/ 10</b>		<b>/ S</b>
Pressure-reducing valve, direct operated	Modular version	Size: ISO 4401-02				Adjustment screw		
						Seals: <b>N</b> = NBR seals for mineral oils ( <b>standard</b> ) <b>V</b> = FPM seals for special fluids		
						Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)		
Versions <b>P</b> = pressure reduction on line P <b>PB</b> = pressure reduction on line P with pilot signal from line B						Pressure adj. range: <b>2</b> = 4 ÷ 32 bar <b>3</b> = 5 ÷ 80 bar	<b>4</b> = 10 ÷ 200 bar <b>5</b> = 25 ÷ 250 bar	

### 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

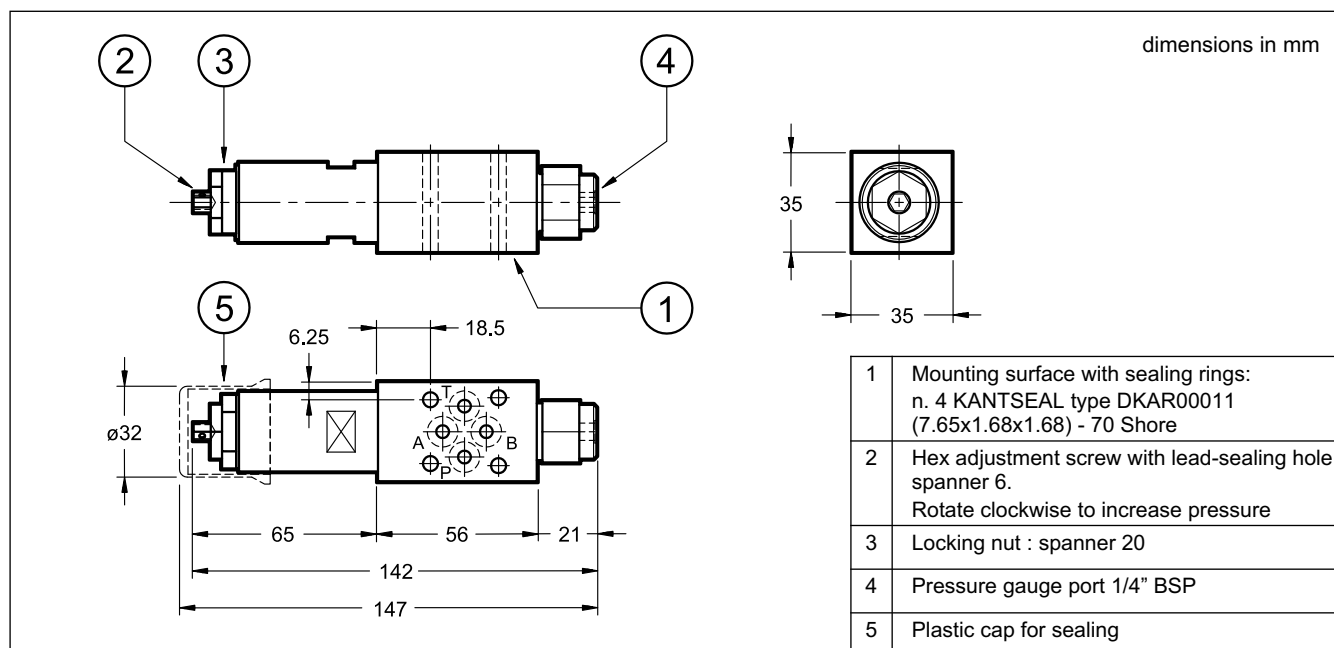
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N).

For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



# MZD

## DIRECT OPERATED THREE-WAY PRESSURE REDUCING VALVE WITH FIXED OR VARIABLE ADJUSTMENT

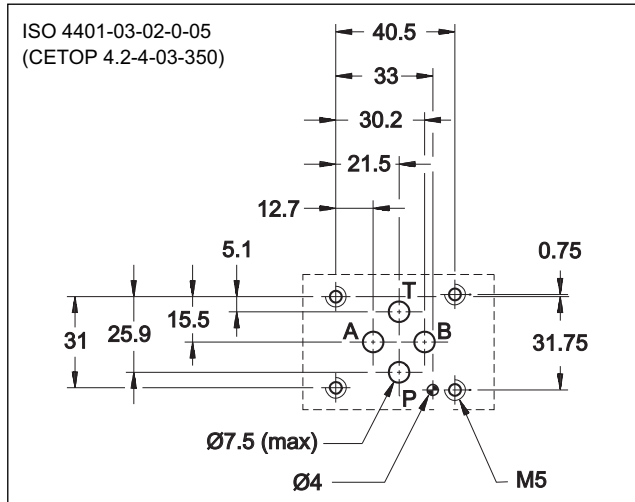
### MODULAR VERSION

ISO 4401-03 (CETOP 03)

p max **350** bar

Q max (see table of performances)

### MOUNTING INTERFACE



### CONFIGURATIONS (see Hydraulic symbols at par.1)

- MZD\*: pressure reduction on line P, drainage connected with line T.
- MZD\*/A and MZD\*/RA: pressure reduction on line A toward the actuator and maximum pressure in line B, drainage connected with line T.
- MZD\*/B and MZD\*/RB: pressure reduction on line B toward the actuator and maximum pressure in line A, drainage connected with line T.

### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum pressure on port T		10
Maximum flow rate in the controlled lines	l/min	50
Maximum flow rate in the free lines		75
Drainage flow rate		≤ 0,08
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,4

### OPERATING PRINCIPLE

- 
- The MZD valve is a three-way spool type direct operated pressure reducing valve. It is normally open in the rest position and the hydraulic fluid passes freely from the P1 line to the P line.
- The spool is subjected to the line P pressure on one side, and on the other side by the adjustment spring. When the pressure in line P exceeds the value set by the spring, the valve closes until the pressure in P (reduced) equals the calibrated value.
- The valve construction provides good adjustment sensitivity with reduced drainage flow. The drainage is connected to line T inside the valve.
  - The three-way design provides protection of the secondary circuit from pressure surges since it allows a reverse flow from the actuator to the T discharge line.
  - It is made as a modular version with ports according to the ISO 4401 (CETOP RP 121H) standards and can be assembled quickly, without use of pipes, under the ISO 4401-03 (CETOP 03) solenoid valves.
  - The variable adjustment version is supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob.
  - The fixed adjustment version is available set at value 20, 25 or 30 bar pressure.

## 1 - IDENTIFICATION CODE OF MZD VARIABLE ADJUSTMENT VERSION

<b>M</b>	<b>Z</b>	<b>D</b>	/	/	/	/
----------	----------	----------	---	---	---	---

Size: ISO 4401-03 (CETOP 03)  
Modular version

Direct operated pressure reducing valve

Pressure adjustment range:

<b>2</b> = 3 ÷ 35 bar	<b>4</b> = 30 ÷ 140 bar
<b>3</b> = 10 ÷ 70 bar	<b>5</b> = 50 ÷ 280 bar

Configurations (omit for MZD with pressure reduction on line P and regulation unit on side B)

**A:** pressure reduction on line A and full pressure on line B with regulation unit on side B

**B:** pressure reduction on line B and full pressure on line A with regulation unit on side B

**RP:** pressure reduction on line P with regulation unit on side A

**RA:** pressure reduction on line A and full pressure on line B with regulation unit on side A

**RB:** pressure reduction on line B and full pressure on line A with regulation unit on side A

Seals:  
omit for mineral oils  
**V** = viton for special fluids

Series No.:  
**50** - for MZD\*, MZD\*/RP, MZD\*/A, MZD\*/RA, MZD\*/B valves  
**51** - for MZD\*/RB valves  
(the overall and mounting dimensions remain unchanged from 50 to 59)

**M** = Adjustment with SICBLOC knob  
(omit for adjustment with hexagonal head screw)

**Hydraulic symbols**

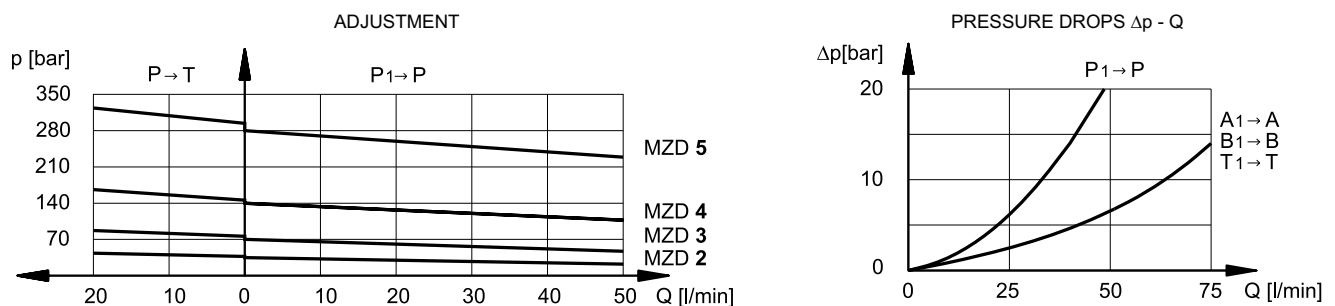
MZD\*  
MZD\*/RP

MZD\*/A  
MZD\*/RA

MZD\*/B  
MZD\*/RB

**NOTE:** the versions RP, RA and RB have been realised with regulation unit on side A, so as to be interchangeable with valves produced by other companies.  
The standard version is equipped with regulation unit on side B.

## 2 - MZD VARIABLE ADJUSTMENT VERSION CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - IDENTIFICATION CODE OF MZD FIXED ADJUSTMENT VERSION

<b>M</b>	<b>Z</b>	<b>D</b>	<b>-</b>		<b>/</b>		<b>/</b>	<b>50</b>	<b>/</b>	
----------	----------	----------	----------	--	----------	--	----------	-----------	----------	--

Size: ISO 4401-03 (CETOP 03)  
Modular version

Direct operated pressure reducing valve

Adjustment:  
**020** = 20 bar      **030** = 30 bar  
**025** = 25 bar

Configurations ————  
 (omit for MZD with pressure reduction on line P and regulation unit on side B)

**A:** pressure reduction on line A and full pressure on line B with regulation unit on side B

**B:** pressure reduction on line B and full pressure on line A with regulation unit on side B

Seals:  
omit for mineral oils  
**V** = viton for special fluids

Series No.:  
(the overall and mounting dimensions remain unchanged from 50 to 59)

**Hydraulic symbols**

MZD-\*

MZD-\*/A

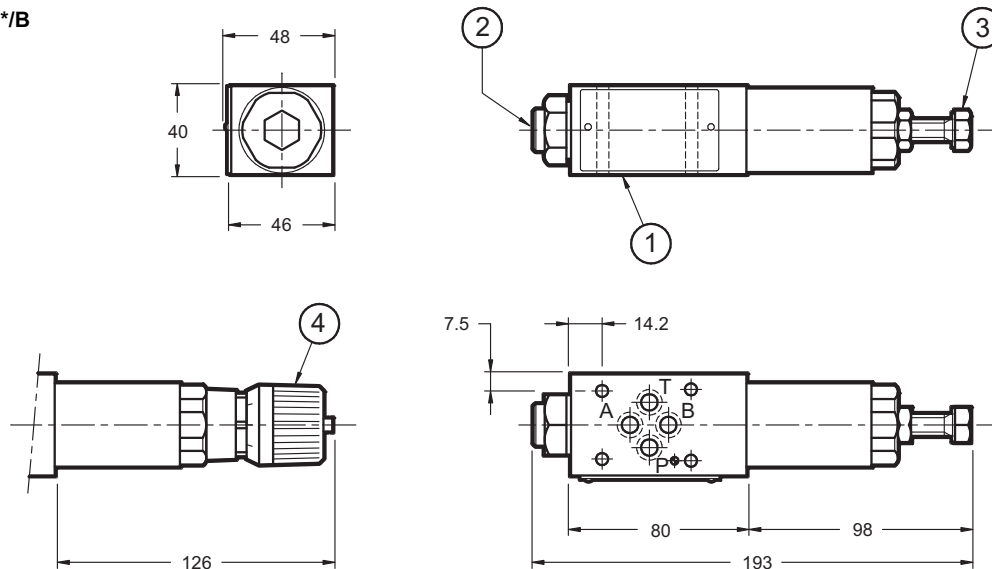
MZD-\*/B

### 4 - HYDRAULIC FLUIDS

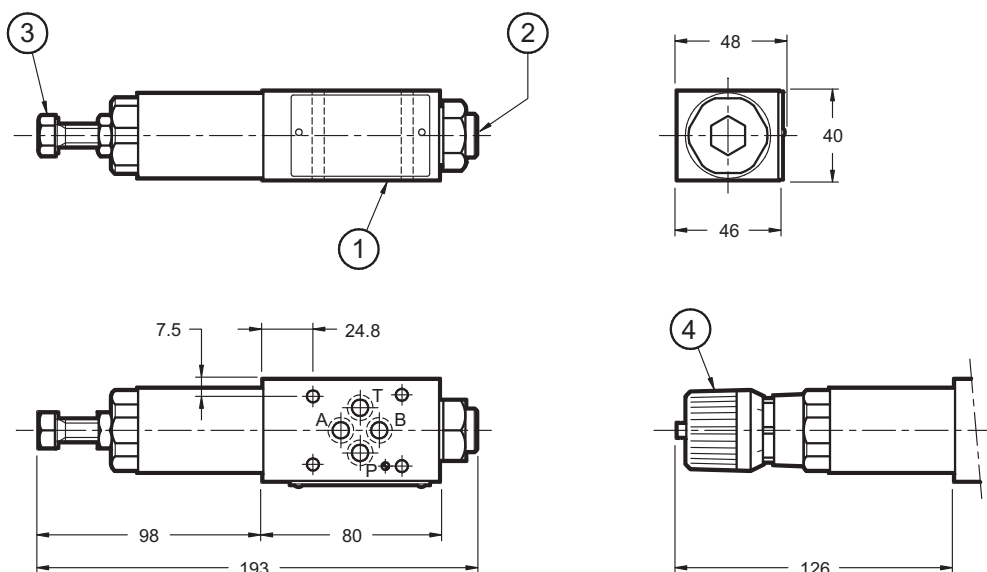
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 5 - OVERALL AND MOUNTING DIMENSIONS VARIABLE ADJUSTMENT VERSION

**MZD\***  
**MZD\*/A**  
**MZD\*/B**



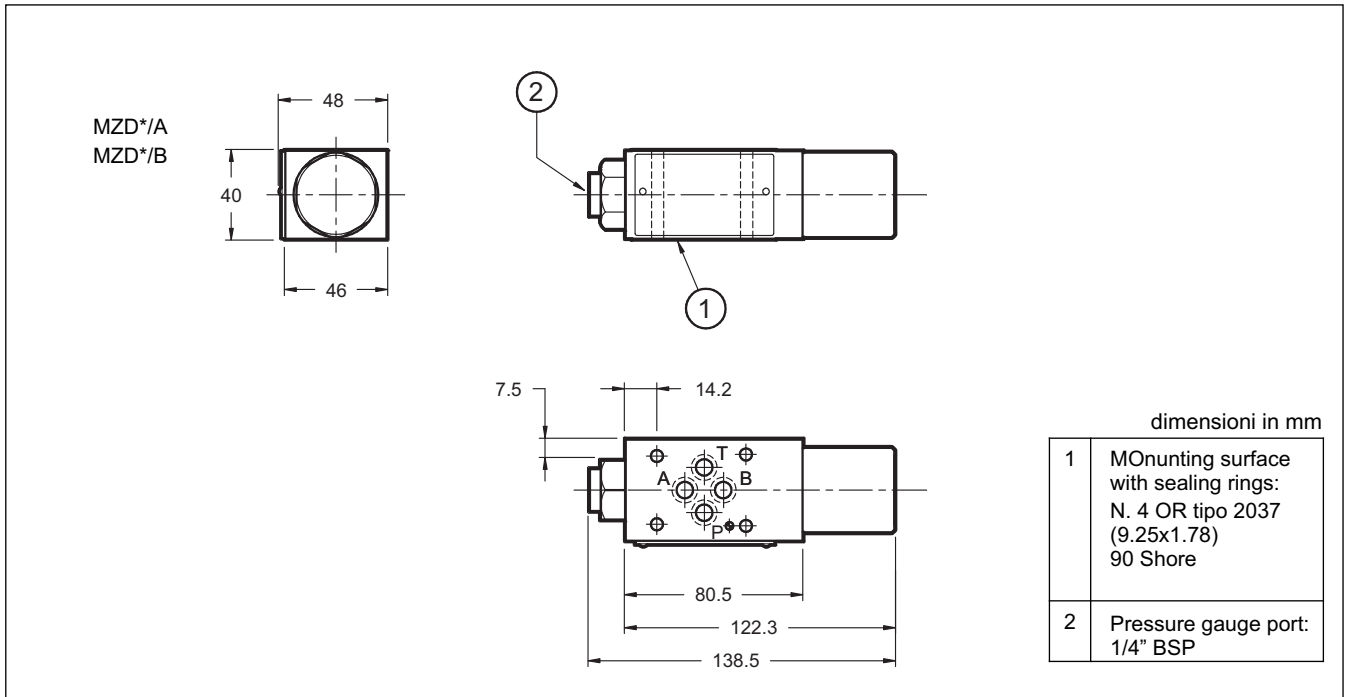
**MZD\*/RP**  
**MZD\*/RA**  
**MZD\*/RB**



dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
2	Pressure gauge port 1/4" BSP
3	Hexagonal head adjustment screw. Spanner 17. Rotate clockwise to increase pressure
4	SICBLOC knob. To operate, push and rotate at the same time.

## 6 - OVERALL AND MOUNTING DIMENSIONS FIXED ADJUSTMENT VERSION







# MZD



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# Z4M

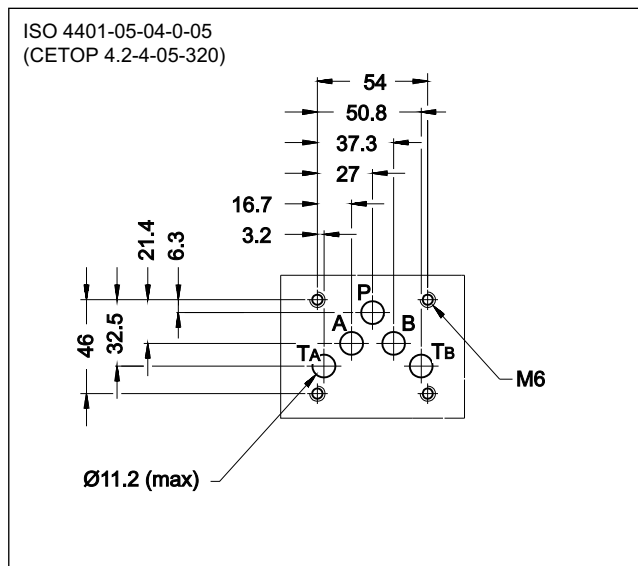
## PILOT OPERATED PRESSURE REDUCING VALVE

### SERIES 50

#### MODULAR VERSION ISO 4401-05

**p** max **320** bar  
**Q** max (see table of performances)

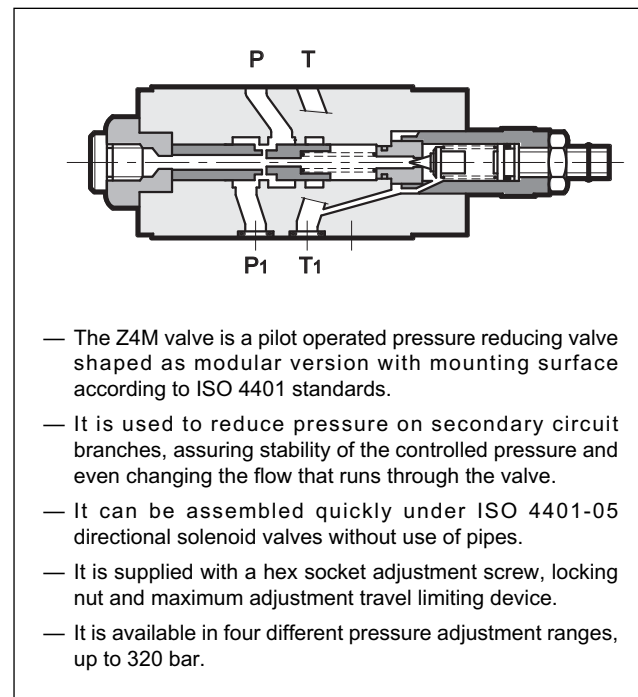
#### MOUNTING INTERFACE



#### CONFIGURATIONS (see hydraulic symbols table)

- Z4M\*-I: pressure reduction on line P - drainage connected to line T<sub>B</sub>.
- Z4M\*-A: pressure reduction on line A and full pressure on line B.
- Z4M\*-B: pressure reduction on line B and full pressure on line A.

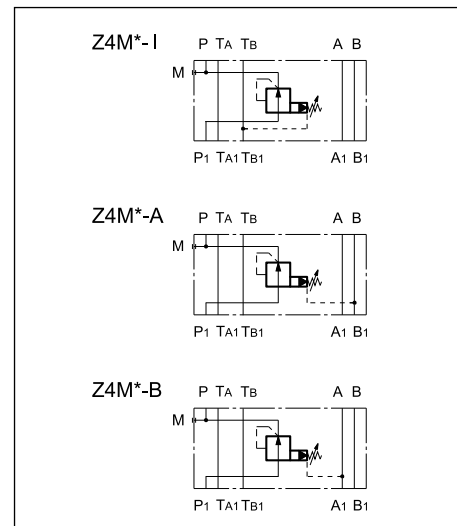
#### OPERATING PRINCIPLE



#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Maximum flow rate in the controlled line P	l/min	80
Maximum flow rate in the free lines		100
Drainage flow rate		≤ 0,07
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	2,7

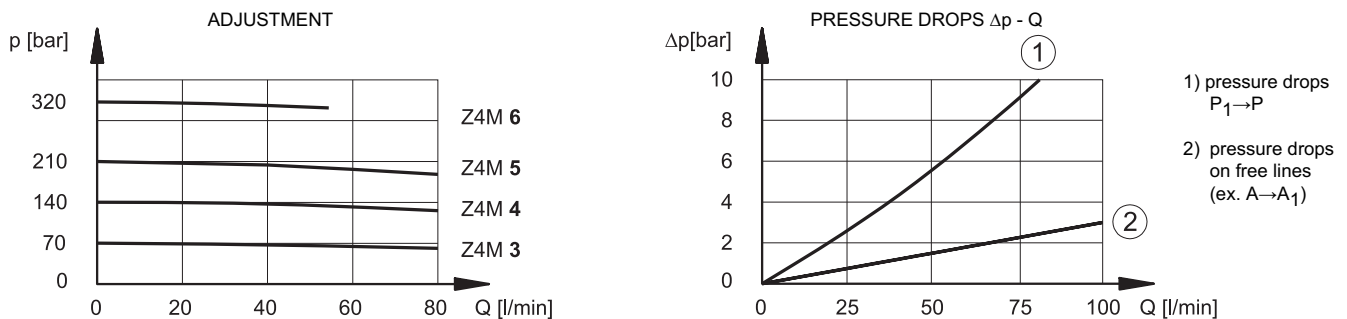
#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<b>Z</b>	<b>4</b>	<b>M</b>	<b>-</b>	<b>/</b>	<b>/</b>	<b>50</b>	<b>/</b>	
Pressure reducing valve	Size: ISO 4401-05	Modular version	Pressure adjustment range:					Seals: omit for mineral oils V = viton for special fluids
			3 = 5 ÷ 70 bar 4 = 8 ÷ 140 bar 5 = 10 ÷ 210 bar 6 = 15 ÷ 320 bar					Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)
								M1 = Adjustment knob (omit for adjustment with countersunk hex screw)
								Configurations: I: pressure reduction on line P. Internal drainage connected to line T <sub>B</sub> A: pressure reduction on line A and full pressure on line B B: pressure reduction on line B and full pressure on line A

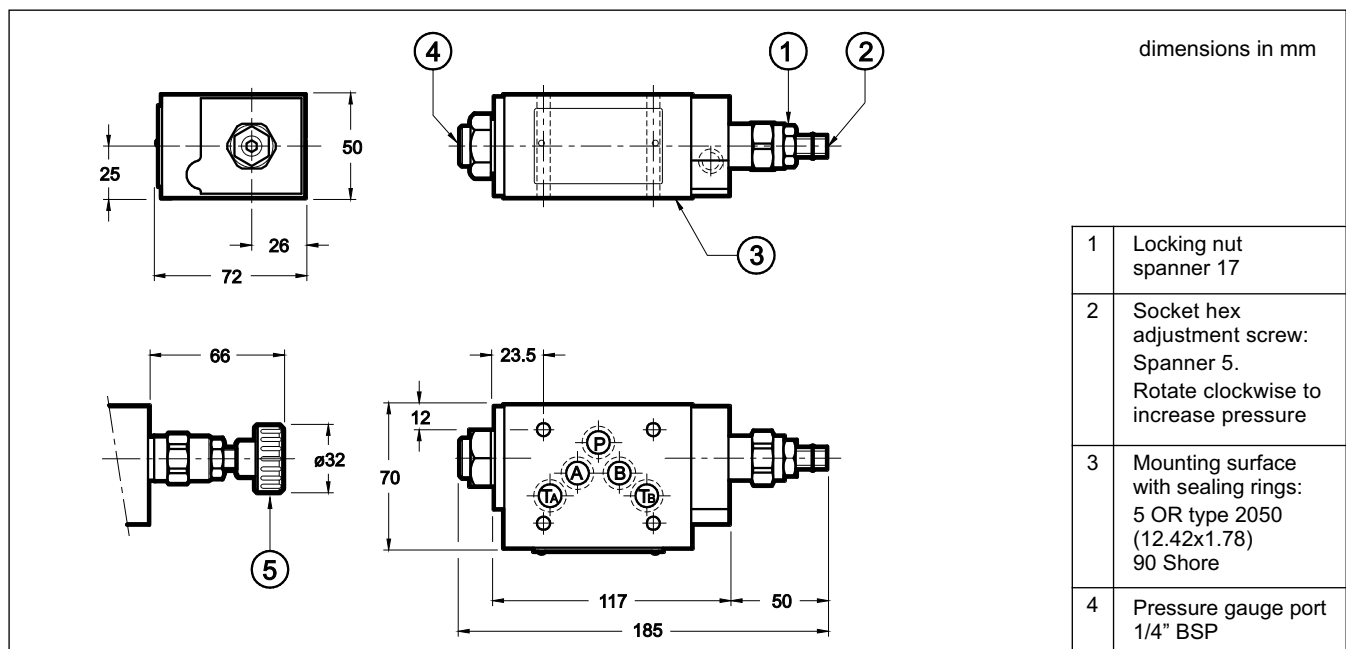
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

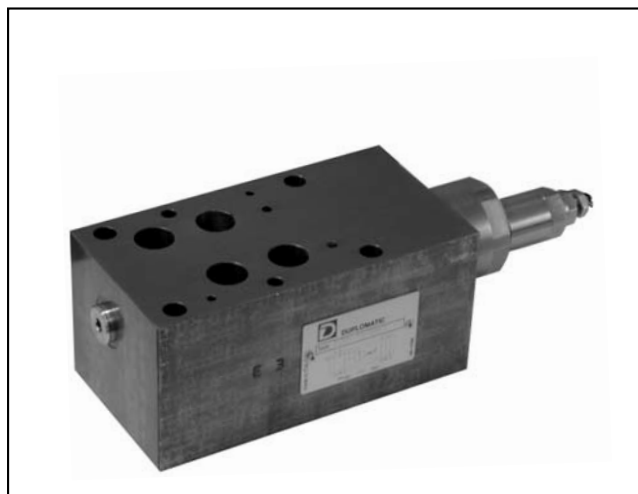


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# PZM7

## PRESSURE REDUCING VALVE

### SERIES 10

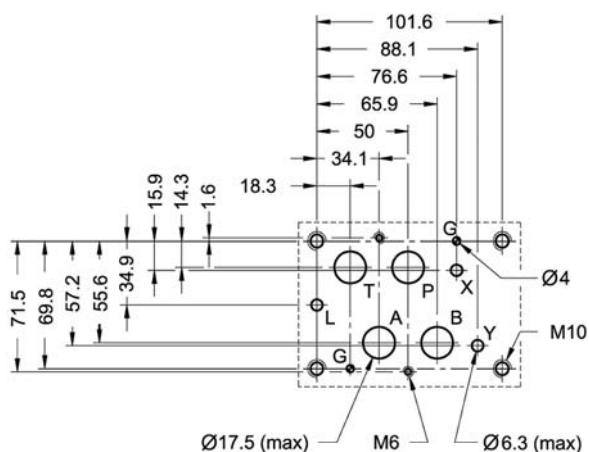
#### MODULAR VERSION

#### ISO 4401-07 (CETOP 07)

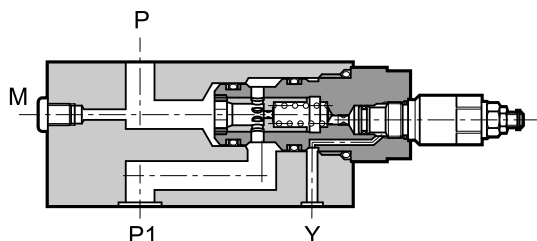
**p** max 350 bar  
**Q** max 250 l/min

#### MOUNTING INTERFACE

ISO 4401-07-07-05  
(CETOP 4.2-4-07)



#### OPERATING PRINCIPLE



- The PZM7 valve is made as a modular valve and has a mounting surface according to the ISO 4401 (CETOP RP 121H) standards.
- It is a two-stage type and is used to assure stability of the controlled pressure, even changing the flow that travels through the valve.
- The PZM7M valve can be assembled quickly under the DSP7 directional valves (see catalogue 41 420) without use of pipes, using suitable tie-rods or bolts, forming compact modular groups.
- It is normally supplied with an adjustment knob.

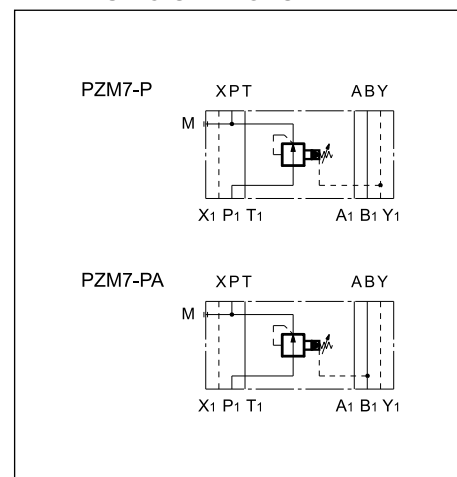
#### CONFIGURATIONS (see Hydraulic symbols table)

- Configuration "PZM7-P": pressure reduction on line P - external drainage.
- Configuration "PZM7-PA": pressure reduction on line A and valve on line P.

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	250
Drainage flow rate	l/min	≤ 0,8
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	Secondo ISO 4406:1999 classe 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	8,65

#### HYDRAULIC SYMBOLS

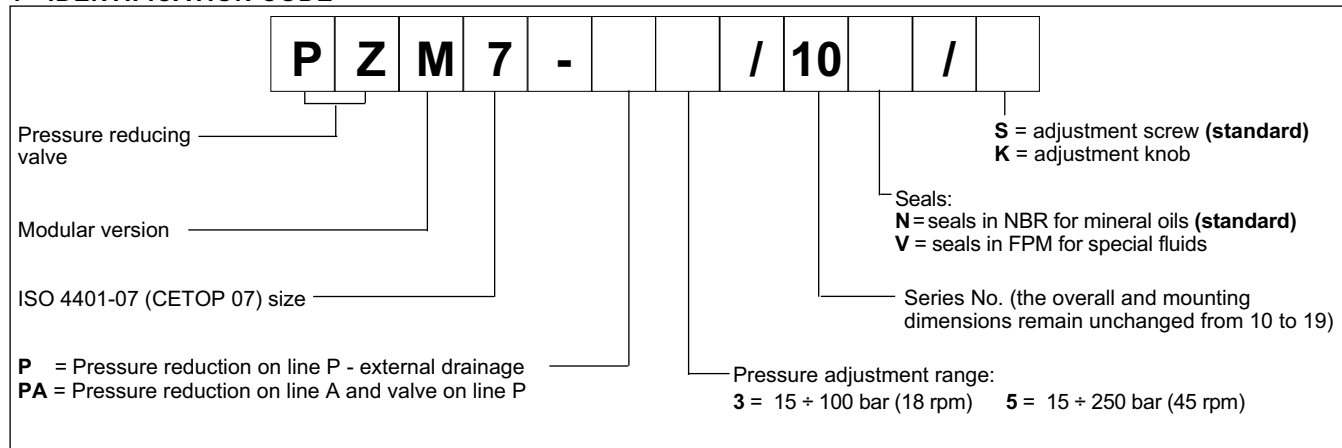




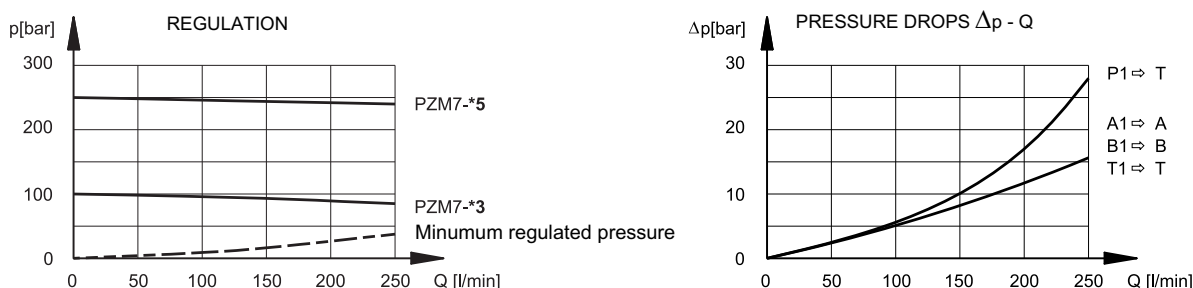
# PZM7

## SERIES 10

### 1 - IDENTIFICATION CODE



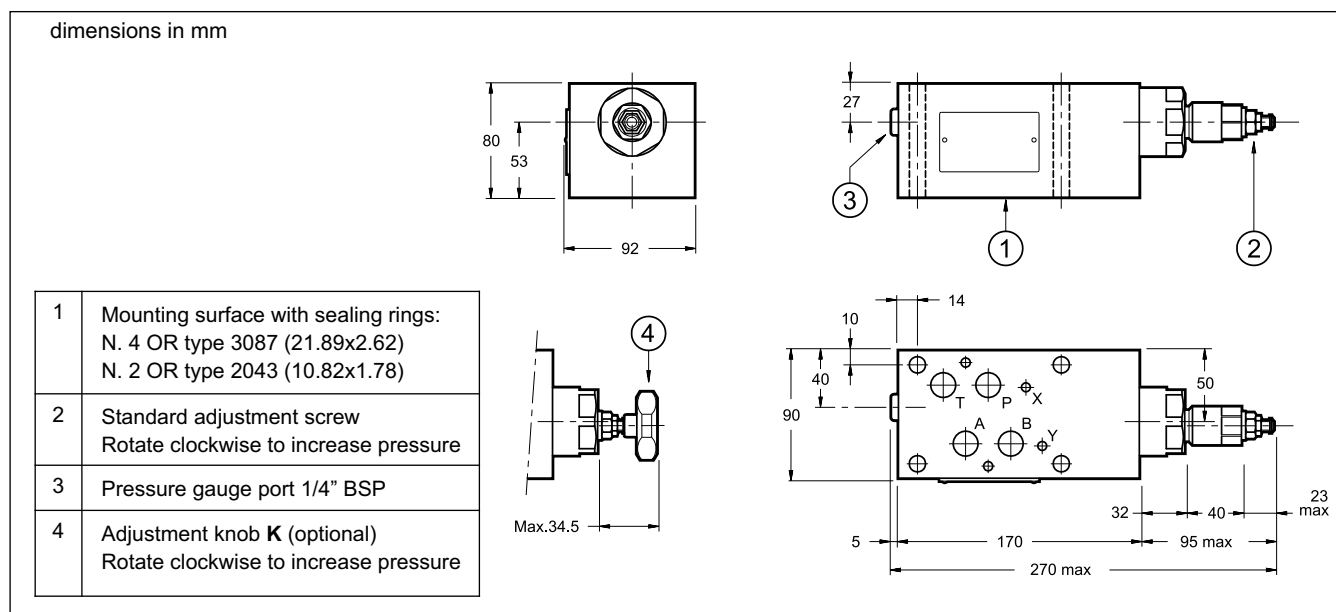
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



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# MSD

## DIRECT OPERATED SEQUENCE VALVE

### SERIES 50

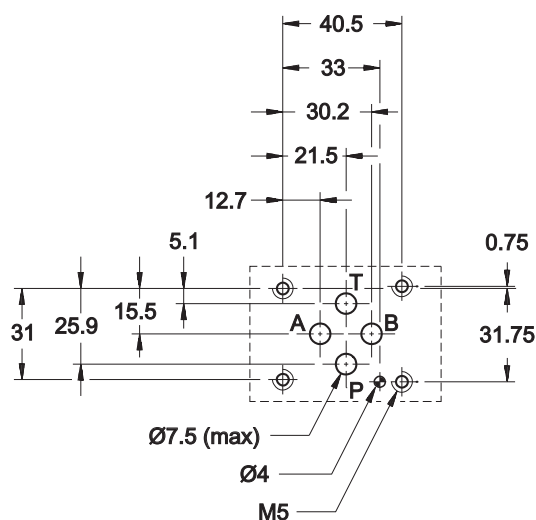
#### MODULAR VERSION ISO 4401-03 (CETOP 03)

**p** max **350** bar

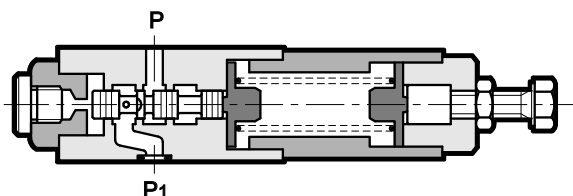
**Q** max (see table of performances)

#### MOUNTING INTERFACE

ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



#### OPERATING PRINCIPLE



— The MSD valve is a direct operated sequence valve of the spool type and is used to control two or more actuators in succession.

At rest position, it is normally closed and the spool is subject to pressure in line P1 on one side and to the adjustment screw on the other side. When the pressure in line P1 reaches the set value of the screw, the valve opens and allows passage of the fluid in the pressure line of the main circuit.

The valve stays open until the pressure in the circuit drops below the calibrated value set by the spring.

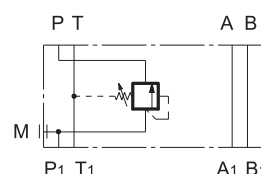
— It is made as a modular version with ports according to the ISO 4401 (CETOP PR 121H) standards and can be assembled quickly without the use of pipes under the ISO 4401-03 (CETOP 03) directional solenoid valves.

— It is normally supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob with micrometric indication and automatic locking.

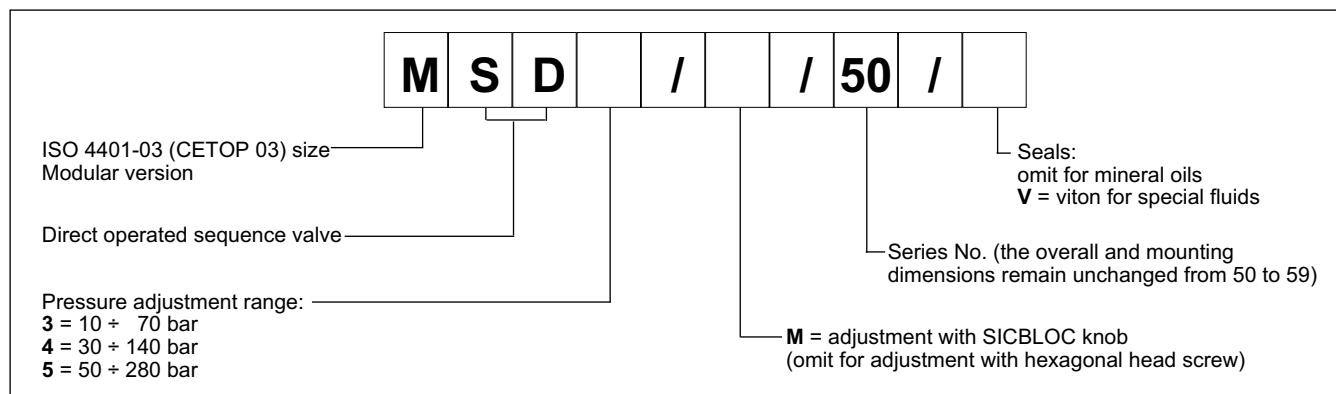
#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
maximum pressure on port T		10
Maximum flow rate in the controlled lines	l/min	50
Maximum flow rate in the free lines		75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,4

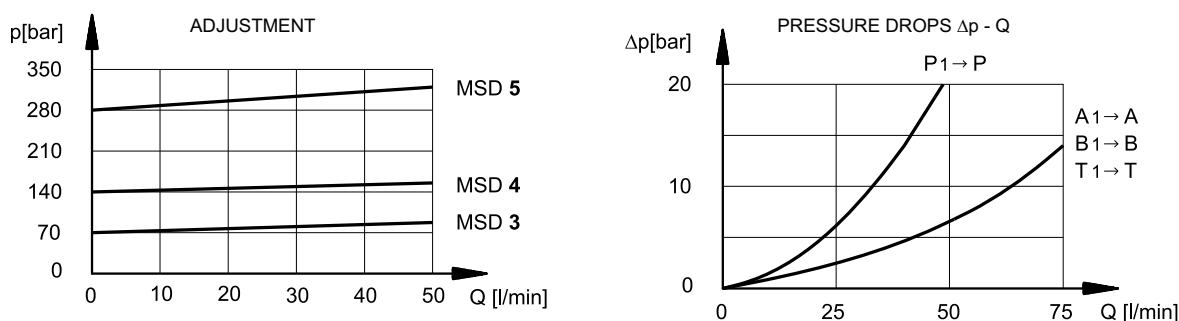
#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE



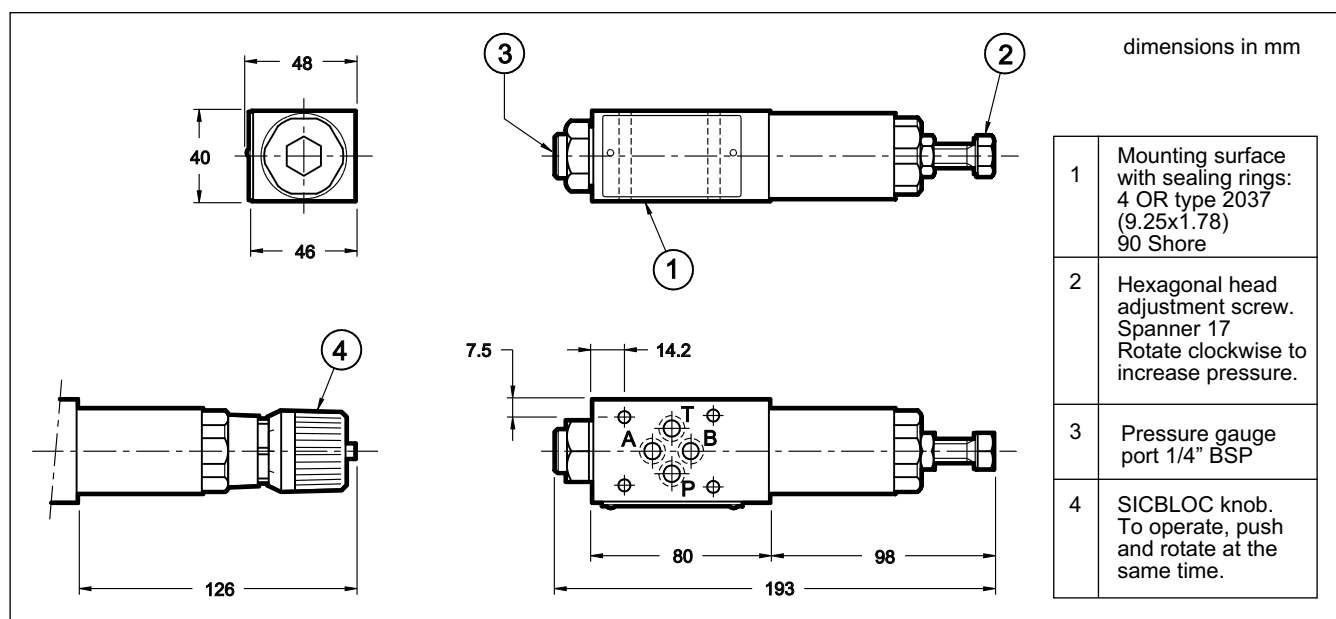
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# SD4M

## DIRECT OPERATED SEQUENCE VALVE

### SERIES 50

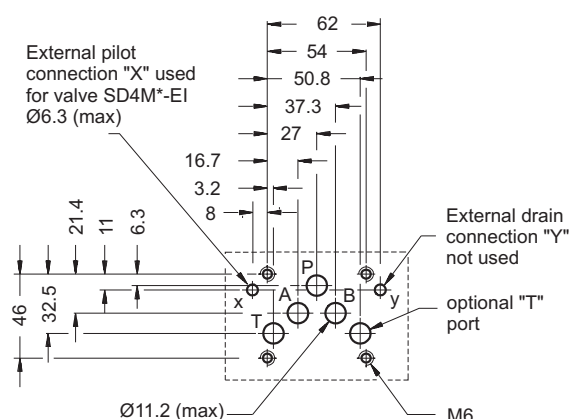
#### MODULAR VERSION ISO 4401-05 (CETOP 05)

**p** max 320 bar

**Q** max (see table of performances)

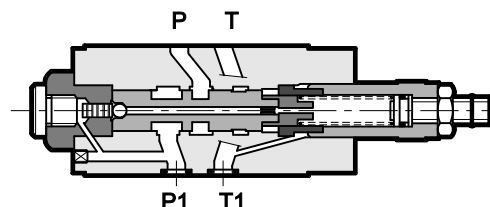
#### MOUNTING INTERFACE

ISO 4401-05-05-0-05  
(CETOP 4.2-4-R05-320)



The internal pilot version of the valve can be installed either on the ISO 4401-05 (CETOP 05) type or ISO 4401-05-05-0-94 (R05) type of mounting interface (ports X and Y of the latter version are not to be used).

#### OPERATING PRINCIPLE



— The SD4M valve is a direct operated sequence valve of the spool type, made as a modular version with a mounting surface according to the ISO 4401 (CETOP RP 121H) standards.

It is normally used to drive two or more actuators in succession. In the rest position, it is normally closed and, on one side, the spool is subjected to the push of a small piston on which the line (P1) pressure acts and, on the other side, to the adjustment spring. When the pressure in line P1 reaches the calibrated value of the spring, the valve opens and allows passage of the fluid in the controlled line (P). The valve stays open until the pressure in the circuit drops below the set calibration value.

— Made in two versions, with internal or external piloting. The piloting port "X" is according to the CETOP 4.2-4-R05 mounting interface for the latter version.

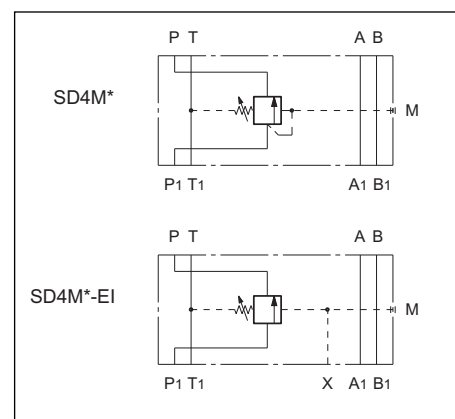
— It can be assembled quickly without use of pipes under the ISO 4401-05 (CETOP 05) directional solenoid valves.

— It is normally supplied with a countersunk hex adjustment screw, locking nut and maximum adjustment travel limiting device.

#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

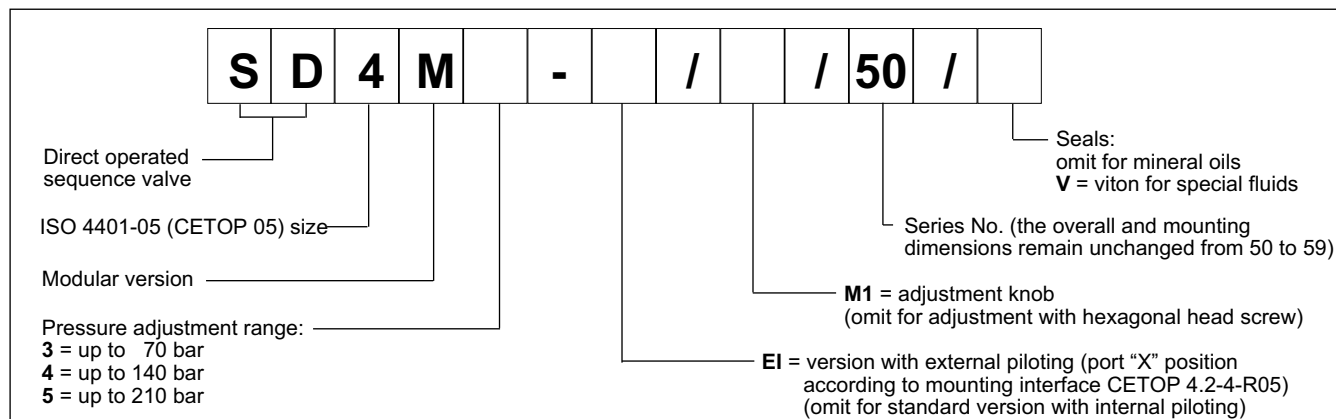
Maximum operating pressure	bar	320
maximum pressure on port T		10
Maximum flow rate in the controlled lines	l/min	80
Maximum flow rate in the free lines		100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	2,7

#### HYDRAULIC SYMBOLS

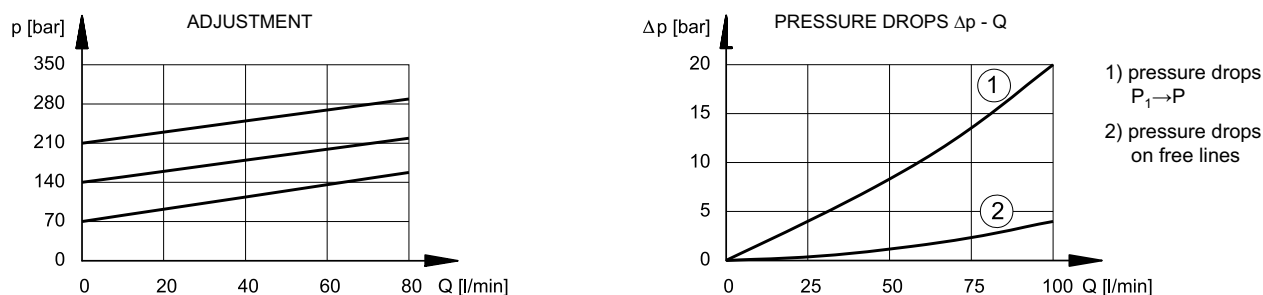




### 1 - IDENTIFICATION CODE



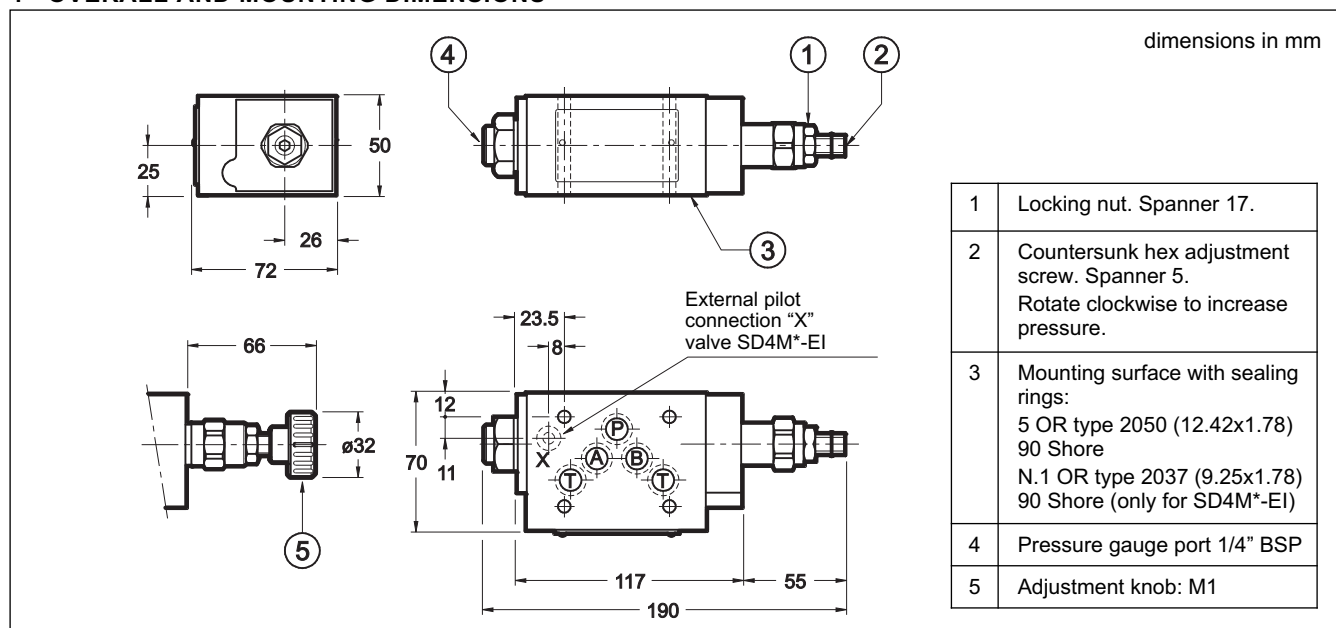
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# PCM3

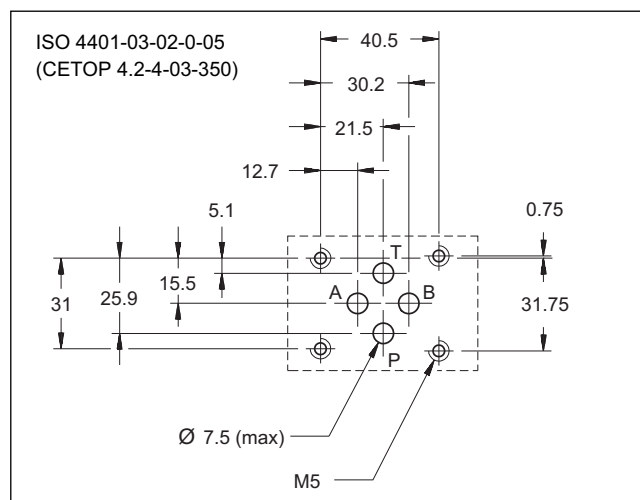
## TWO AND THREE-WAY PRESSURE COMPENSATOR WITH FIXED OR VARIABLE ADJUSTMENT SERIES 10

**MODULAR VERSION**  
**ISO 4401-03 (CETOP 03)**

**p** max **350** bar

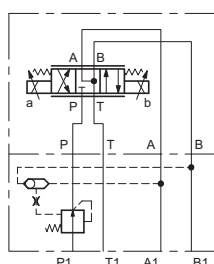
**Q** max **40** l/min

### MOUNTING INTERFACE

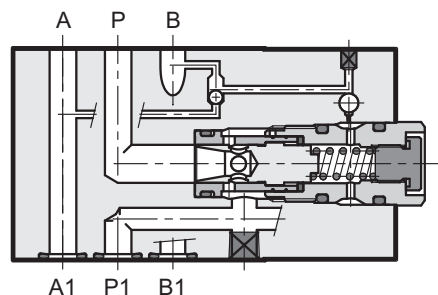


### APPLICATION EXAMPLES

Two-way compensator with fixed adjustment, combined with a proportional valve type DSE3-A\*



### OPERATING PRINCIPLE



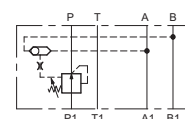
- The PCM3 valve is a two or three-way pressure compensator, developed as a modular version with mounting surface according to the ISO 4401 (CETOP RP121H).
- Its aim is to keep the pressure drop setting (characteristic  $\Delta p$ ) between the line P and alternatively the lines A and B, at a constant level.
- It is normally used together with proportional directional valves, in order to control the flow rate independently of the pressure variations.
- The selection of the piloting pressure on the lines A and B is carried out automatically via a shuttle check valve built into the compensator.
- The setting of the variable adjustment compensator (characteristic  $\Delta p$ ) can be varied from 7 to 33 bar, via a countersunk hex adjustment screw or via an adjustment knob.
- The fixed adjustment compensator is available with setting (characteristic  $\Delta p$ ) of 4 and 8 bar.

### PERFORMANCES (working with mineral oil of viscosity of 36 cSt at 50°C)

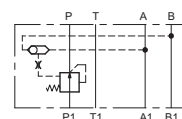
Max operating pressure	bar	350
Characteristic $\Delta p$ : fixed adjustment variable adjustment	bar	4 - 8 7 ÷ 33
Max flow rate	l/min	40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,5

### HYDRAULIC SYMBOLS

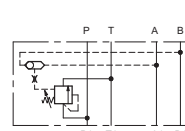
PCM3-PV/10



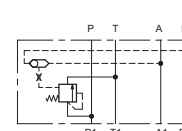
PCM3-P\*/10



PCM3-PTV/10

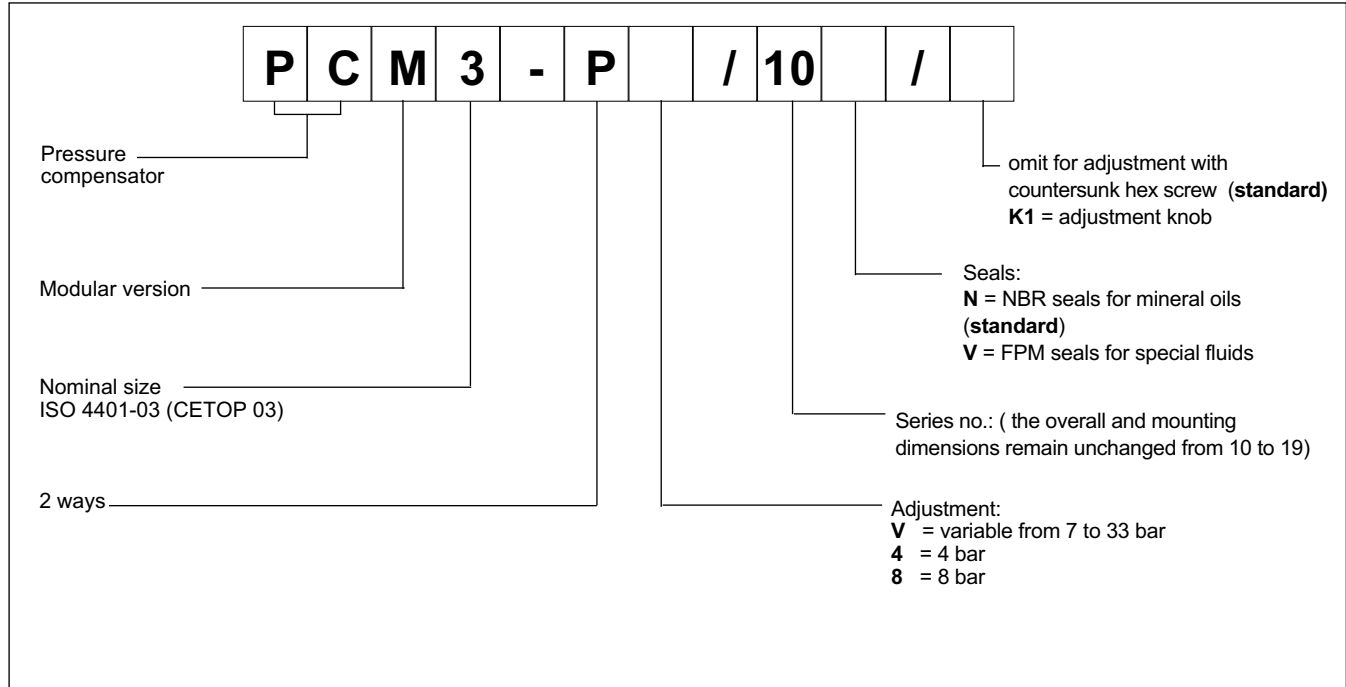


PCM3-PT\*/10

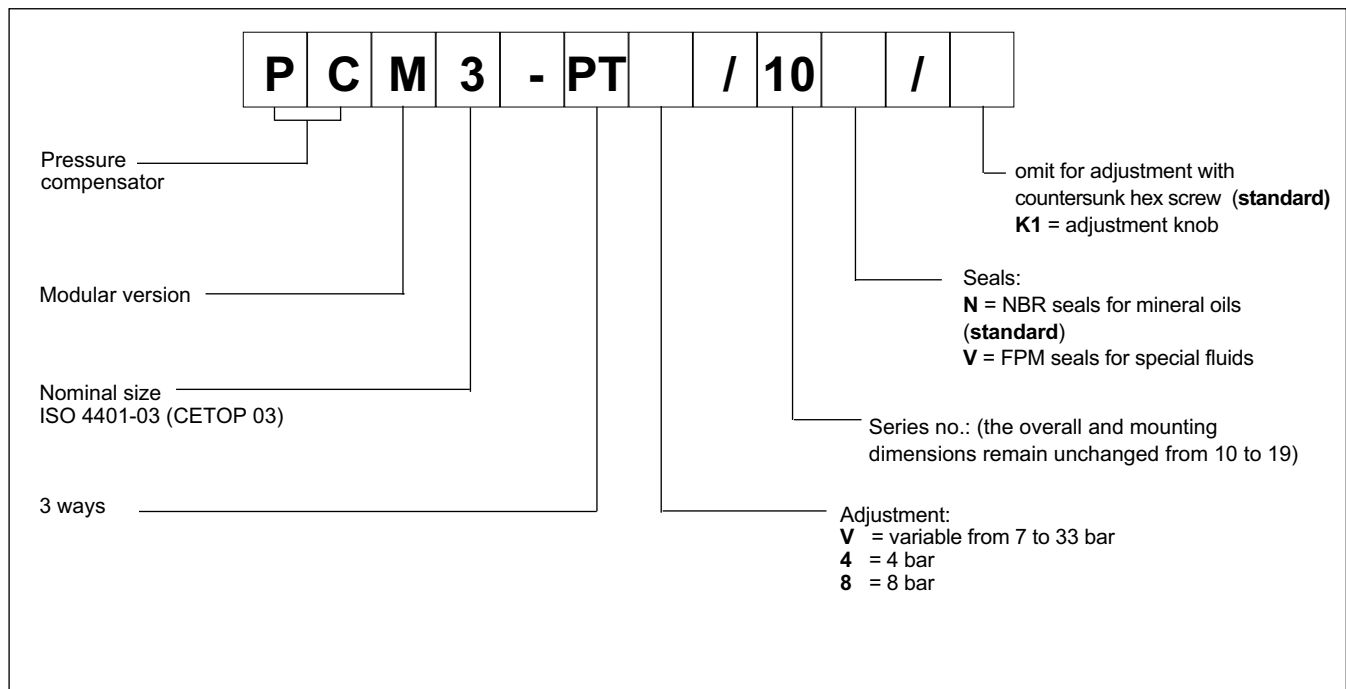


## 1 - IDENTIFICATION CODE

### 1.1 - Two-way compensator identification code



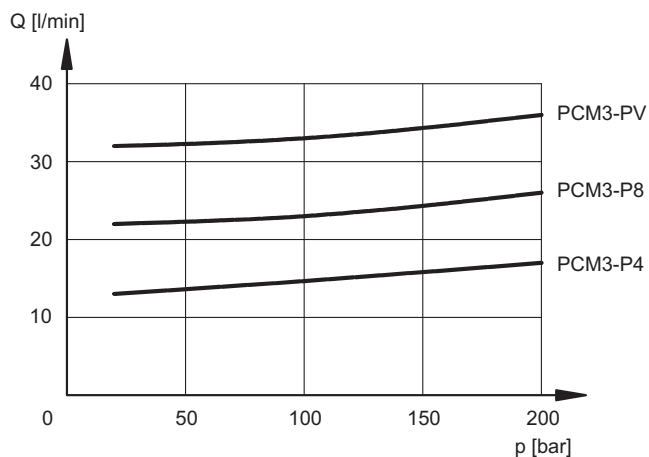
### 1.2 - Three-way compensator identification code



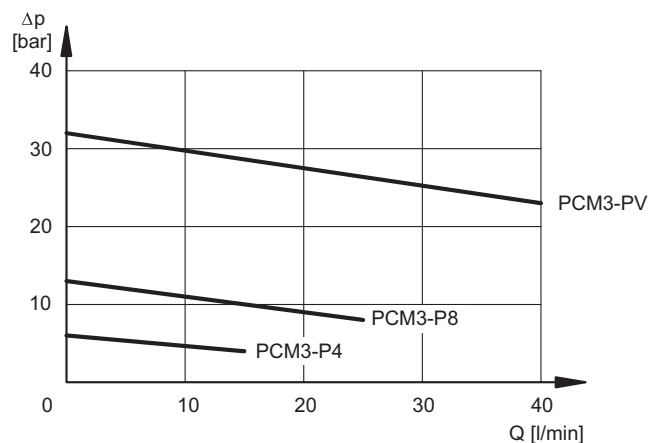
## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

### 2.1 - Two-way compensator characteristic curves

FLOW RATE - PRESSURE  $Q = f(p)$

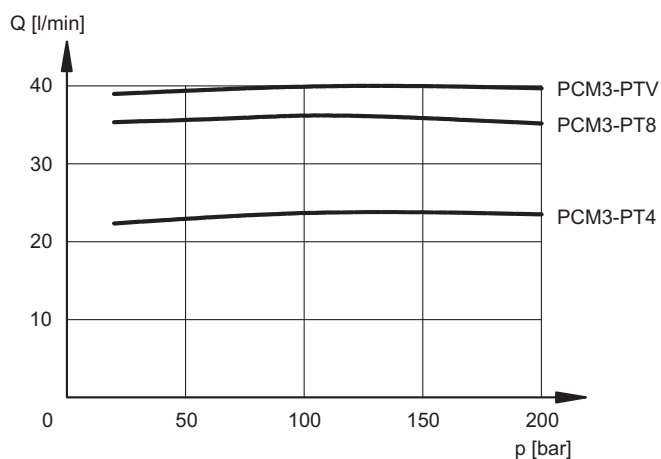


PRESSURE DROPS  $\Delta p = f(Q)$

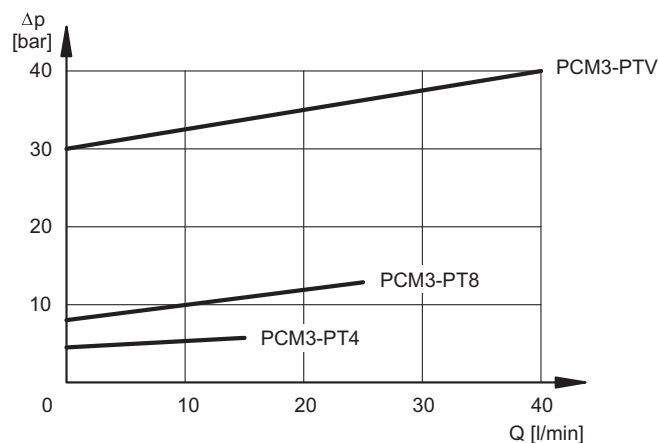


### 2.2 - Three-way compensator characteristic curves

FLOW RATE - PRESSURE  $Q = f(p)$



PRESSURE DROPS  $\Delta p = f(Q)$



## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type. With fluids HFDR type (phosphate esters) use FPM seals (code V).

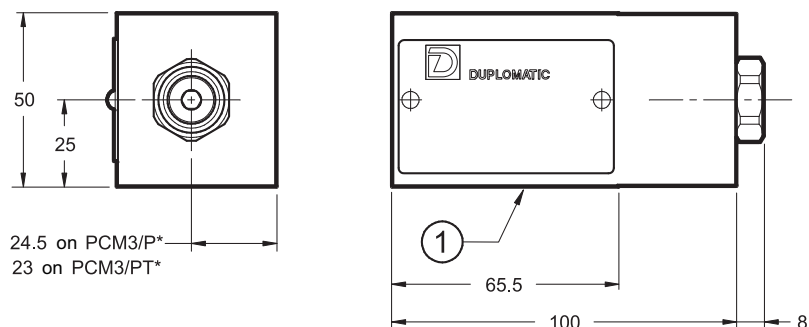
Using other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid itself and of the seals characteristics.

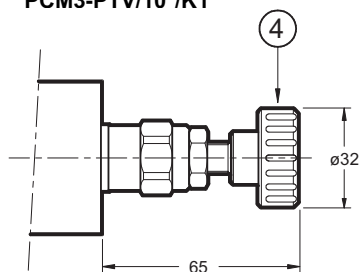
The fluid must be preserved in its physical and chemical characteristics.

## 4 - OVERALL AND MOUNTING DIMENSIONS

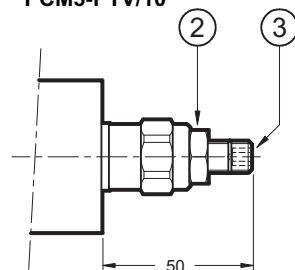
**PCM3-P\*/10**  
**PCM3-PT\*/10**



**PCM3-PV/10\*/K1**  
**PCM3-PTV/10\*/K1**



**PCM3-PV/10**  
**PCM3-PTV/10**



dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 - (9.25x1.78) 90 shore
2	Locking nut: spanner 17
3	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
4	Adjustment knob: <b>K1</b>

# PCM5

## TWO- AND THREE-WAY PRESSURE COMPENSATOR WITH FIXED ADJUSTMENT

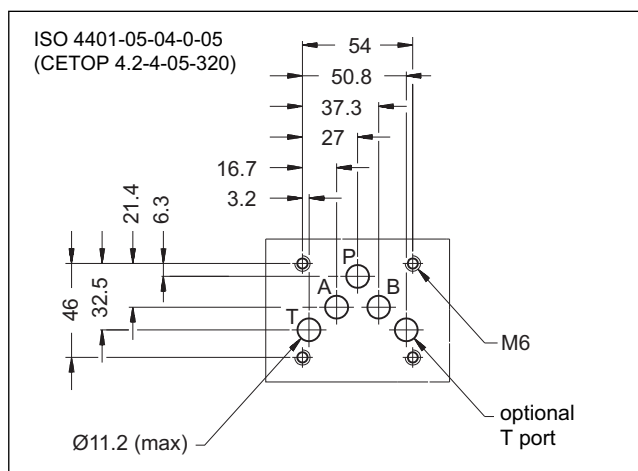
### SERIES 11



### MODULAR VERSION ISO 4401-05

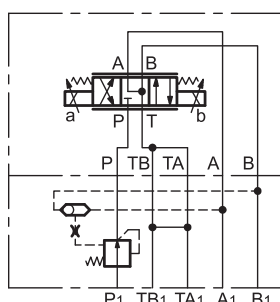
**p** max 320 bar  
**Q** max 100 l/min

### MOUNTING INTERFACE

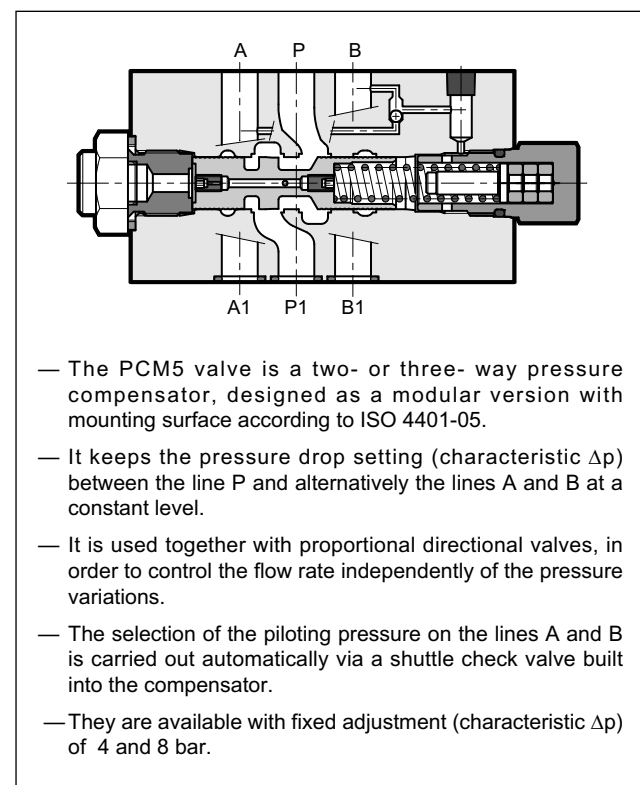


### APPLICATION EXAMPLES

2-way compensator combined with a proportional valve type DSE5-A\*



### OPERATING PRINCIPLE

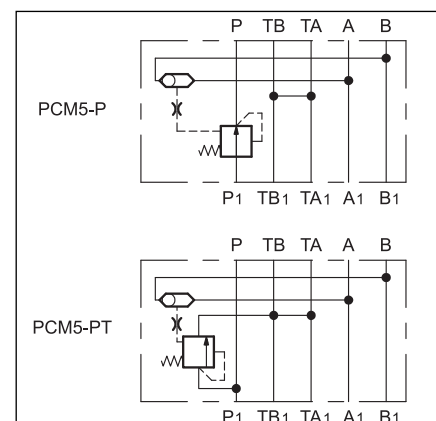


### PERFORMANCES

(working with mineral oil of viscosity of 36 cSt at 50°C)

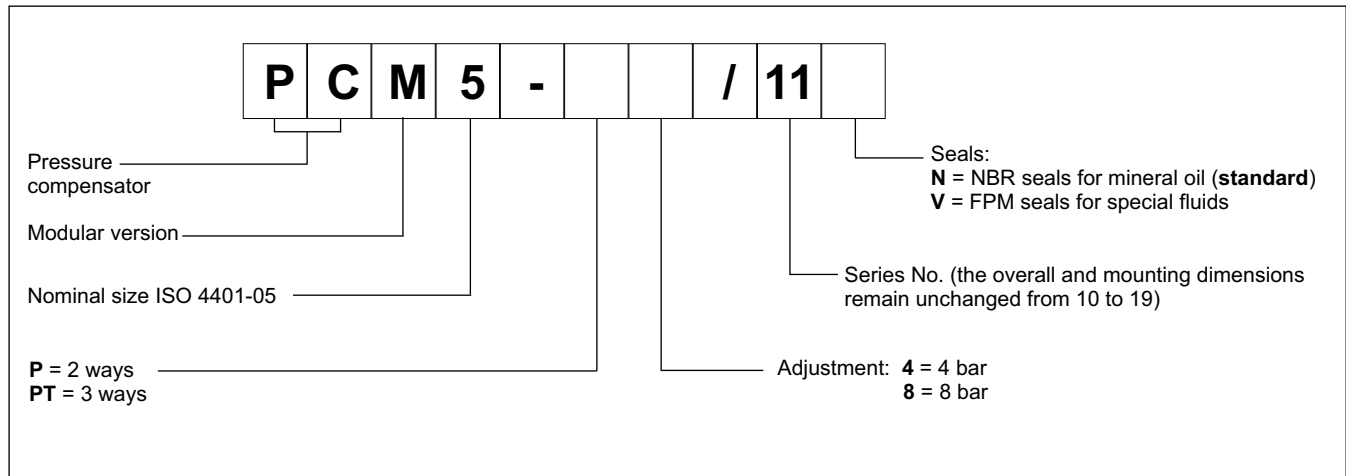
Max operating pressure	bar	320
Characteristic $\Delta p$	bar	4 - 8
Max flow rate	l/min	100
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	2,7

### HYDRAULIC SYMBOL



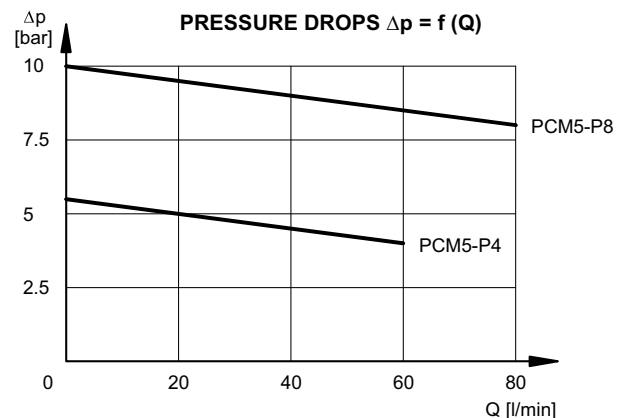
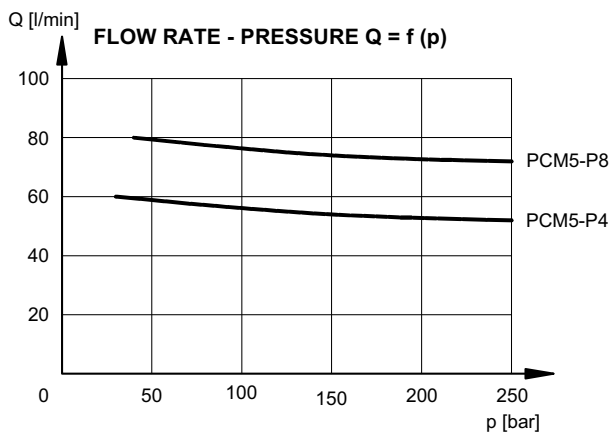


## 1 - IDENTIFICATION CODE



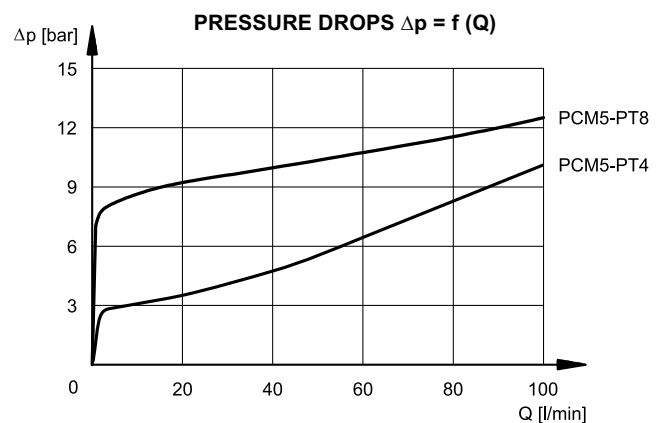
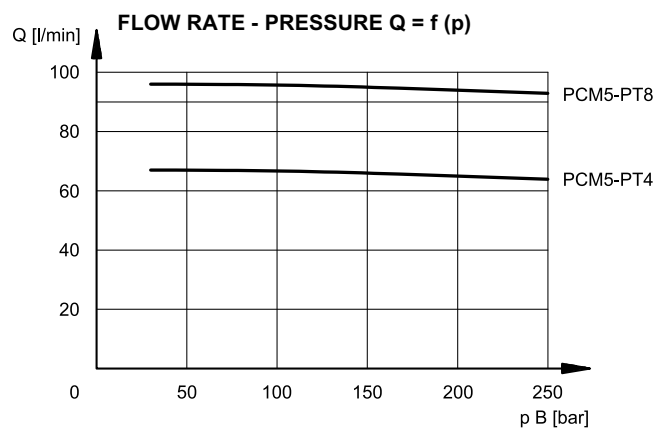
## 2 - CHARACTERISTIC CURVES PCM5-P\* (2-WAY)

(values obtained with viscosity of 36 cSt at 50°C)



## 3 - CHARACTERISTIC CURVES PCM5-PT8 (3-WAY)

(values obtained with viscosity of 36 cSt at 50°C)

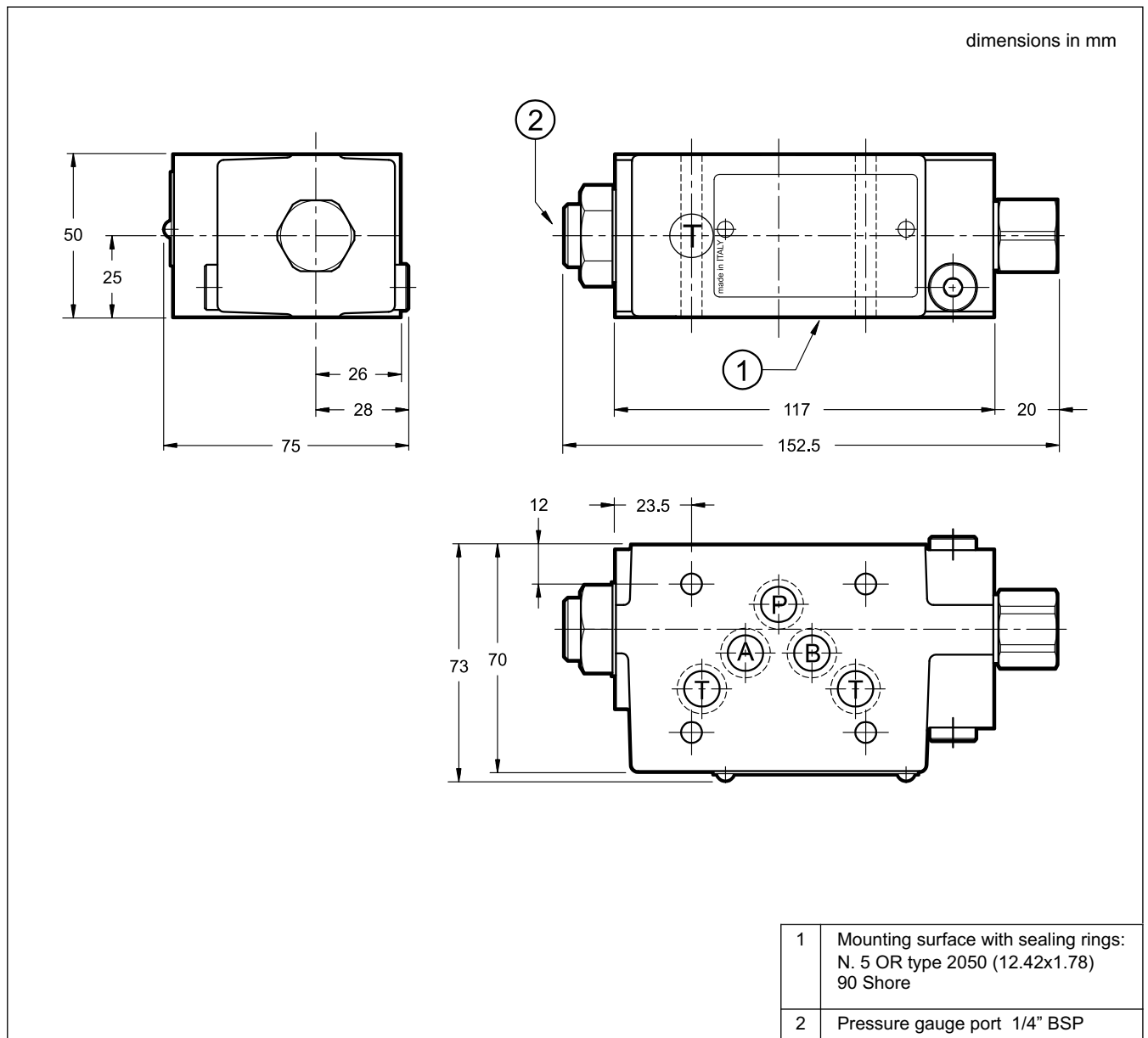


### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 5 - OVERALL AND MOUNTING DIMENSIONS







# PCM5

SERIES 11

**DUPLOMATIC**  
MOTION SOLUTIONS

**DUPLOMATIC MS S.p.A.**

via M. Re Depaolini 24 • 20015 PARABIAGO (MI) • ITALY  
tel. +39 0331.895.111 • [www.diplomatic.com](http://www.diplomatic.com) • e-mail: [sales.exp@diplomatic.com](mailto:sales.exp@diplomatic.com)



# PCM8

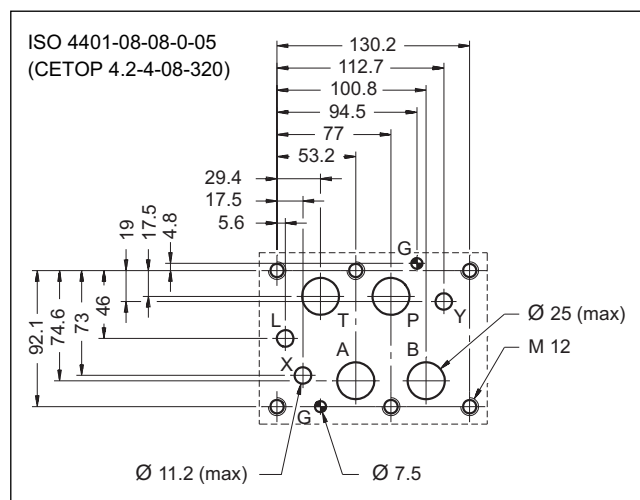
## TWO- AND THREE-WAY PRESSURE COMPENSATOR WITH FIXED ADJUSTMENT

### SERIES 10

**MODULAR VERSION**  
**ISO 4401-08 (CETOP 08)**

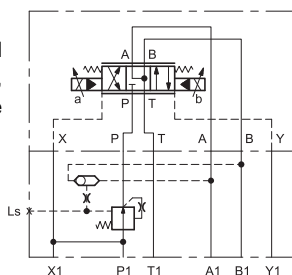
**p** max **320** bar  
**Q** max **300** l/min

#### MOUNTING INTERFACE



#### APPLICATION EXAMPLES

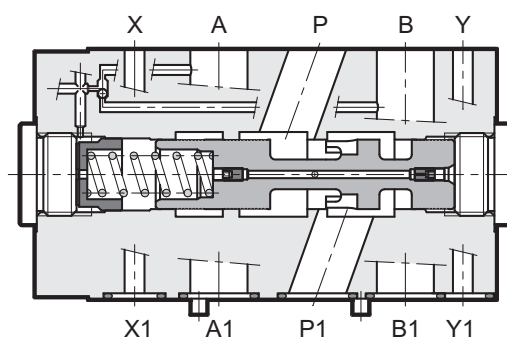
Two-way compensator with fixed adjustment and internal piloting, combined with a proportional valve type E5E-S9\*/E



#### PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Max operating pressure	bar	320
Characteristic $\Delta p$ :	bar	4 - 8
Max flow rate	l/min	300
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	13,5

#### OPERATING PRINCIPLE



- The PCM8 valve is a two or three-way pressure compensator, developed as a modular version with mounting surface according to ISO 4401 (CETOP RP 121H).
- Its function is to keep the pressure drop setting (characteristic  $\Delta p$ ) between the line P and alternatively the lines A and B at a constant level.
- It is normally used together with proportional directional valves, in order to control the flow rate independently of the pressure variations.
- The selection of the piloting pressure on the lines A and B is carried out automatically via a shuttle check valve built into the compensator.
- They are available with fixed adjustment (characteristic  $\Delta p$ ) of 4 and 8 bar.
- The load sensing port can also be used as pressure gauge port or as remote pressure control.

## 1 - IDENTIFICATION CODE

### 1.1 - Two-way compensator identification code

P	C	M	8	-	P	/	E	/	10	
---	---	---	---	---	---	---	---	---	----	--

Pressure compensator

Modular version

Nominal size  
ISO 4401-08 (CETOP 08)

2 ways

Adjustment: **4** = 4 bar  
**8** = 8 bar

Piloting: (relevant to the combined directional valve, that must always have external piloting)  
**I** = internal (withdrawn inside the compensator, upstream the narrowing)  
**E** = external (passing line X)

Seals:  
**N** = NBRseals for mineral oils  
**(standard)**  
**V** = FPM seals for special fluids

Series no.:  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

External drain (passing line Y)

**Hydraulic symbols**

PCM8-P\*/IE/10

PCM8-P\*/EE/10

### 1.2 - Three-way compensator identification code

P	C	M	8	-	PT	/	E	/	10	
---	---	---	---	---	----	---	---	---	----	--

Pressure compensator

Modular version

Nominal size  
ISO 4401-08 (CETOP 08)

3 ways

Adjustment: **4** = 4 bar  
**8** = 8 bar

Piloting: (relevant to the combined directional valve, that must always have external piloting)  
**I** = internal (withdrawn inside the compensator, upstream the narrowing)  
**E** = external (passing line X)

Seals:  
**N** = NBRseals for mineral oils  
**(standard)**  
**V** = FPM seals for special fluids

Series no.: ( the overall and mounting dimensions remain unchanged from 10 to 19)

External drain (passing line Y)

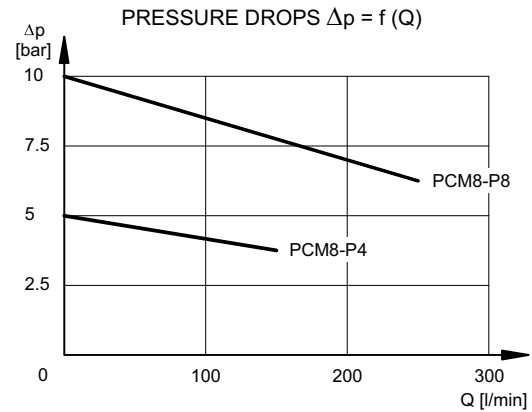
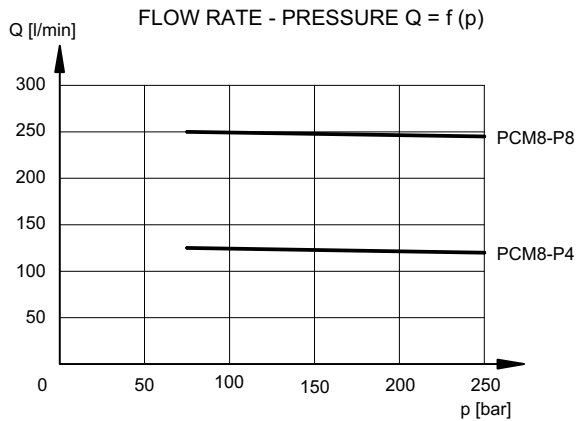
**Hydraulic symbols**

PCM8-PT\*/IE/10

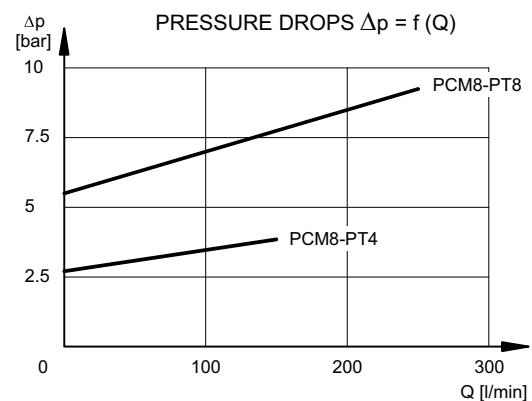
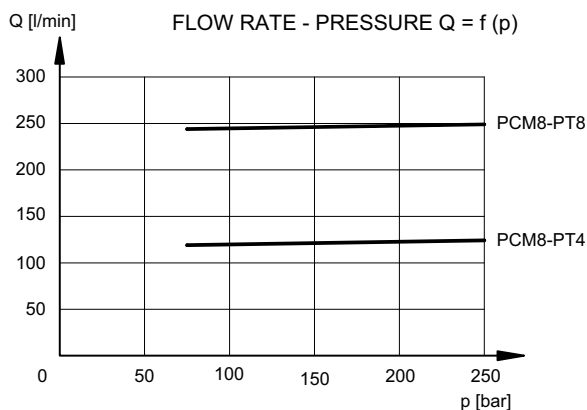
PCM8-PT\*/EE/10

## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

### 2.1 - Two-way compensator characteristic curves



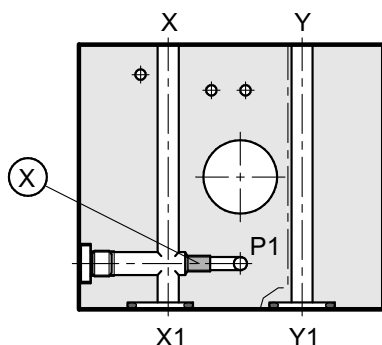
### 2.2 - Three-way compensator characteristic curves



## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 4 - PILOTING AND DRAINAGE



X: plug M6x10 for external piloting  
Drainage always external

The PCM8 compensators are available with the X piloting line both internal and external. The internal piloting line is withdrawn from the P1 line, upstream the narrowing of the compensator, while the external piloting line comes from a separate piloting circuit. Drainage is always external (passing line Y).

**The combined directional valve must always have an external piloting configuration. Drainage can be both internal and external.**

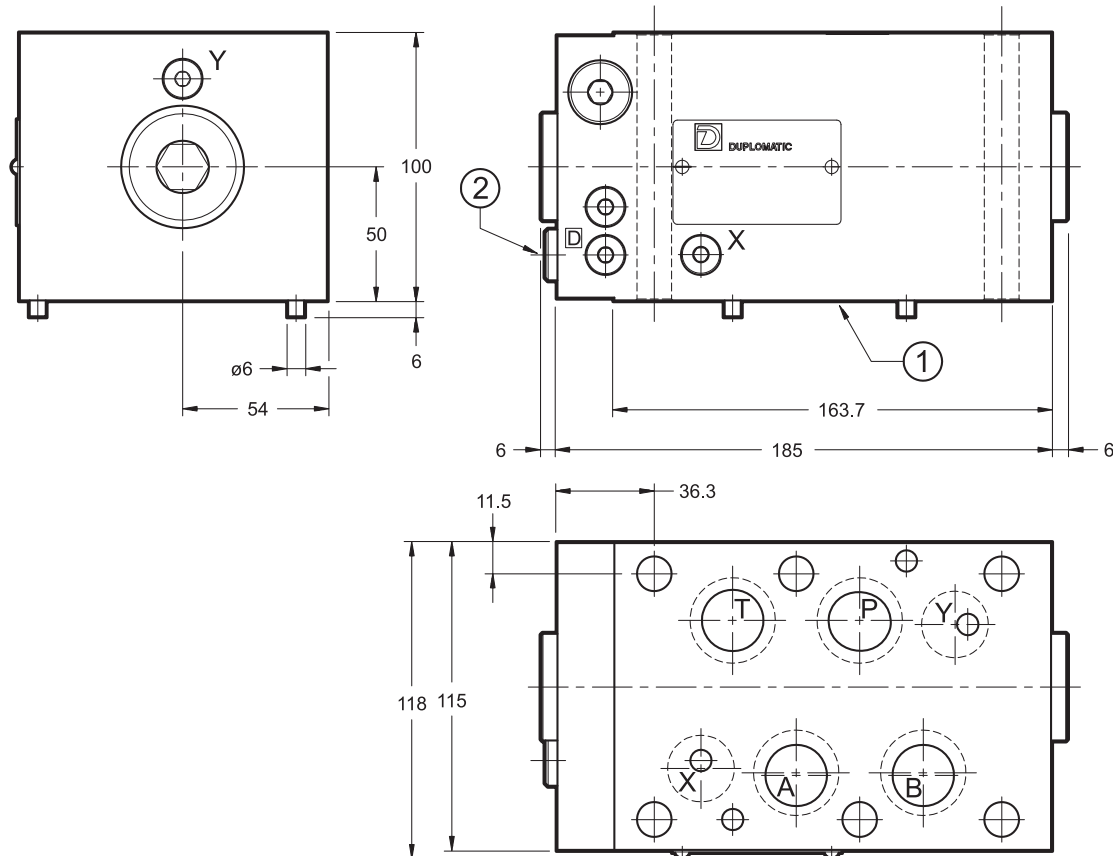
VALVE TYPE		X plug
PCM8-P*/IE	INTERNAL PILOTING AND EXTERNAL DRAINAGE	NO
PCM8-P*/EE	INTERNAL PILOTING AND EXTERNAL DRAINAGE	YES



## 5 - OVERALL AND MOUNTING DIMENSIONS

PCM8-P\*/E/10  
PCM8-PT\*/E/10

dimensions in mm



- |   |  |
|---|--|
| 1 | Mounting surface with sealing rings:<br>4 OR type 3106 (25.65 x 2.62) - 90 Shore<br>2 OR type 3081 (20.24 x 2.62) - 90 Shore |
| 2 | Load Sensing Port 1/4" BSP closed  |



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Fax +39 0331.895.339  
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

# QTM2

## FLOW RESTRICTOR VALVE

### SERIES 10

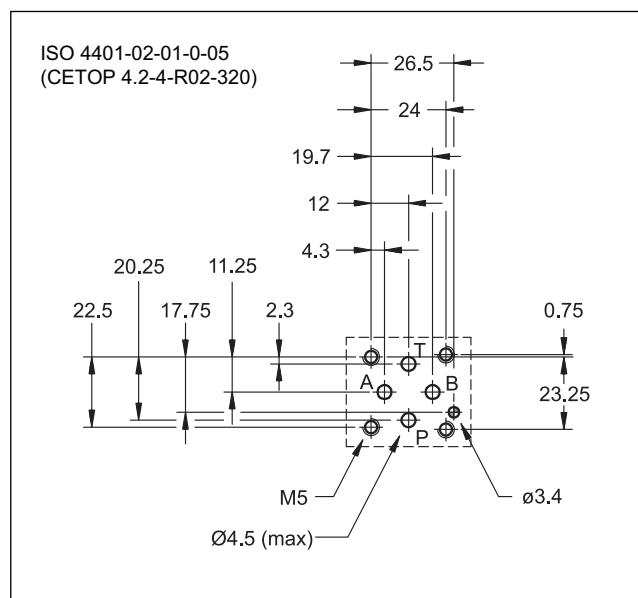


#### MODULAR VERSION ISO 4401-02 (CETOP R02)

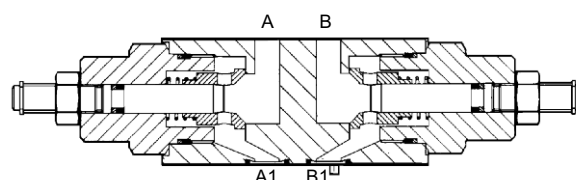
**p** max 320 bar

**Q** max 30 l/min

#### MOUNTING SURFACE



#### OPERATING PRINCIPLE

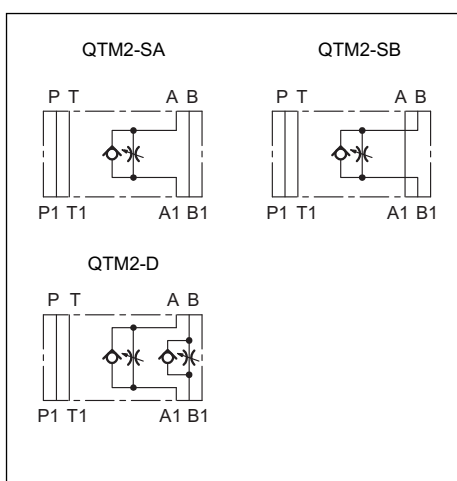


- The QTM2 valve is a flow restrictor valve with built in check valve for reverse free flow, made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 12H) standards.
- It can be assembled with all ISO 4401-02 (CETOP R02) modular valves without use of pipes, using suitable tie-rods or bolts.
- It is supplied with countersunk hex adjustment screw and locking nut. Rotate anticlockwise to increase the flow rate.

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Maximum flow rate	l/min	30
Ambient temperature range	°C	-20 / +50
Check valve opening pressure	bar	0,4
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,8

#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

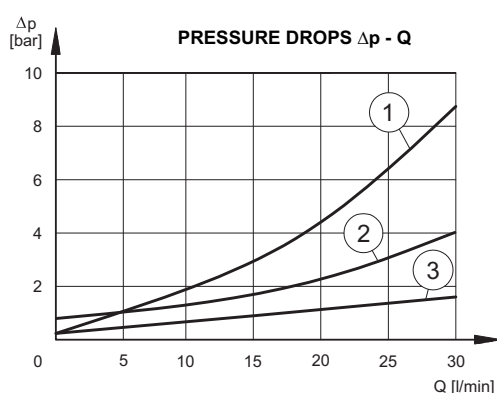
Flow restrictor valve	Q	T	M	2	-		/	10	
Modular version									
ISO 4401-02 (CETOP R02) size									

Seals:  
**N** = Seals in NBR for mineral oils (**standard**)  
**V** = Seals in FPM for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

**D**: meter out control on lines A and B  
**SA**: meter out control on line A  
**SB**: meter out control on line B

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



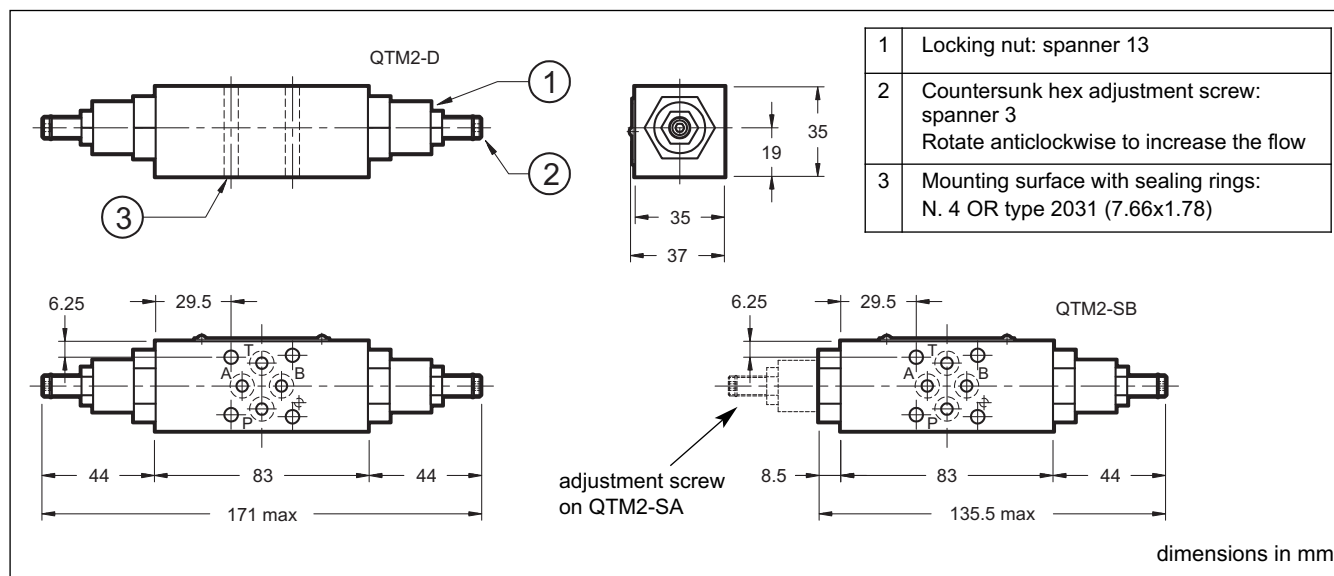
Typical  $\Delta p$  - Q curves obtained with QTM2-D valve, with throttling axis at full retraction.

- 1) pressure drops  $A_1 - A$  ( $B_1 - B$ )
- 2) pressure drops  $A - A_1$  ( $B - B_1$ )
- 3) pressure drops through the free ports

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# MERS

## FLOW RESTRICTOR VALVE

### SERIES 50

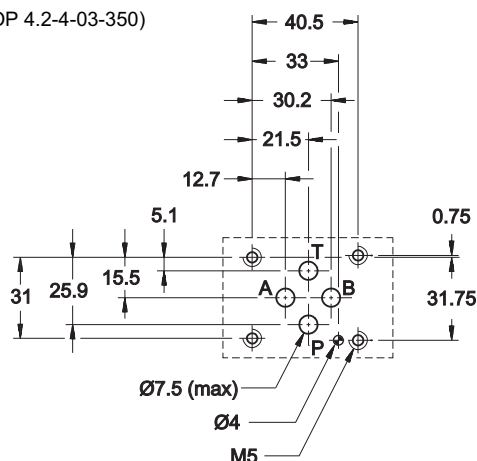
#### MODULAR VERSION

#### ISO 4401-03 (CETOP 03)

**p** max **350** bar  
**Q** max (see table of performances)

#### MOUNTING INTERFACE

ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



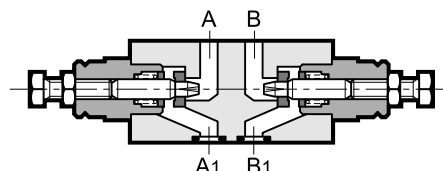
#### CONFIGURATIONS (see hydraulic symbols table)

- “SA”: control of the flow exiting from the actuator on line A .
- “SB”: control of the flow exiting from the actuator on line B.
- “D”: Allows an independent flow control exiting from the two chambers of the actuator. (Standard)
- “RD”: Allows an independent flow control entering in the two chambers of the actuator.
- “G\*”: Reversible valve. See at par. 1

#### PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

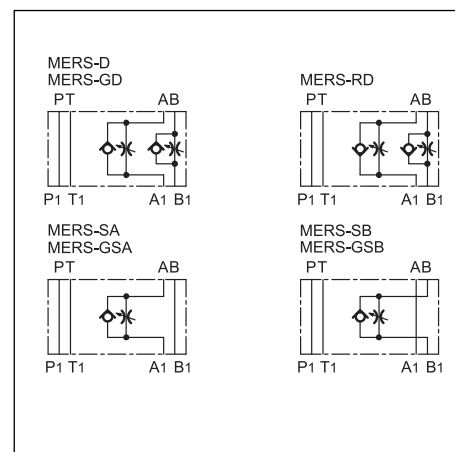
Maximum operating pressure	bar	350
Check valve cracking pressure		0,5
Maximum flow rate in the controlled lines	l/min	50
Maximum flow rate in the free lines		75
Min. controlled flowrate with $\Delta p$ 10 bar		$\leq 0,060$
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,3

#### OPERATING PRINCIPLE



- This is a non-compensated flow control valve with a check valve for reverse free flow. It is made in the modular version and with mounting surface according to the ISO 4401 (CETOP RP 121 H) standards; it can be assembled quickly without use of pipes, but using only suitable tie-rods or bolts, thus forming compact modular groups.
- It is also available as a reversible valve (G\* versions). Meter-in or meter-out control depending on the way of assembly the valve on the OR subplate.
- All the configurations have an incorporated check valve that allows reverse free flow (cracking pressure of 0,5 bar).
- It is normally supplied with a hexagonal head adjustment screw.

#### HYDRAULIC SYMBOLS





## 1 - IDENTIFICATION CODE

M	E	R	S	-		/		/	50	/	
---	---	---	---	---	--	---	--	---	----	---	--

ISO 4401-03 (CETOP 03) size  
Modular version

Flow restrictor valve with  
check valve for reverse free flow

Configurations:

- D:** meter out control on lines A and B (**standard**)
- RD:** meter in control on lines A and B
- SA:** meter out control on line A
- SB:** meter out control on line B

Configurations G\* - reversible valve (**NOTE**)

- GD:** control on lines A and B
- GSA:** control on lines A
- GSB:** control on lines A

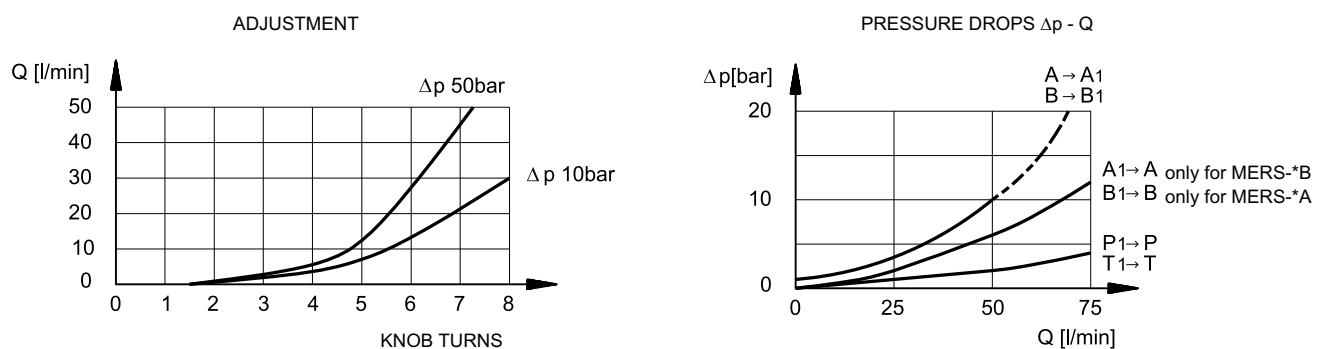
Seals:  
omit for mineral oils  
**V** = viton for special fluids

Series No. (the overall and mounting  
dimensions remain unchanged from 50 to 59)

**M** = Adjustment with SICBLOC knob  
(omit for adjustment with hexagonal head adjustment  
screw)

**NOTE:** the valve body does not provide the OR seats. The mounting interface is achieved by interposition of an OR subplate. The control of flow (meter-in or meter-out) is depending on the way of assembly the valve on the subplate.

## 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

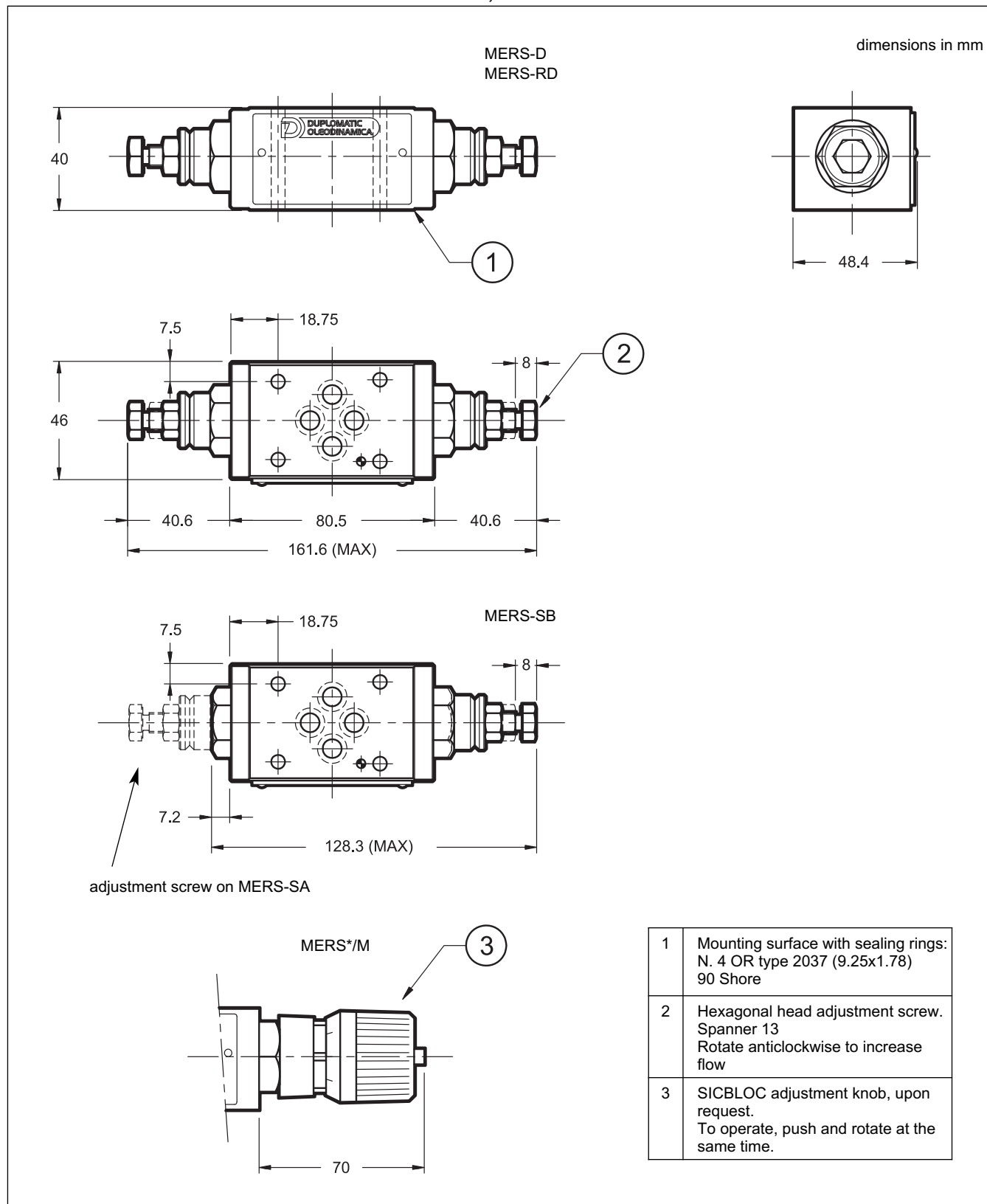


## 3 - HYDRAULIC FLUIDS

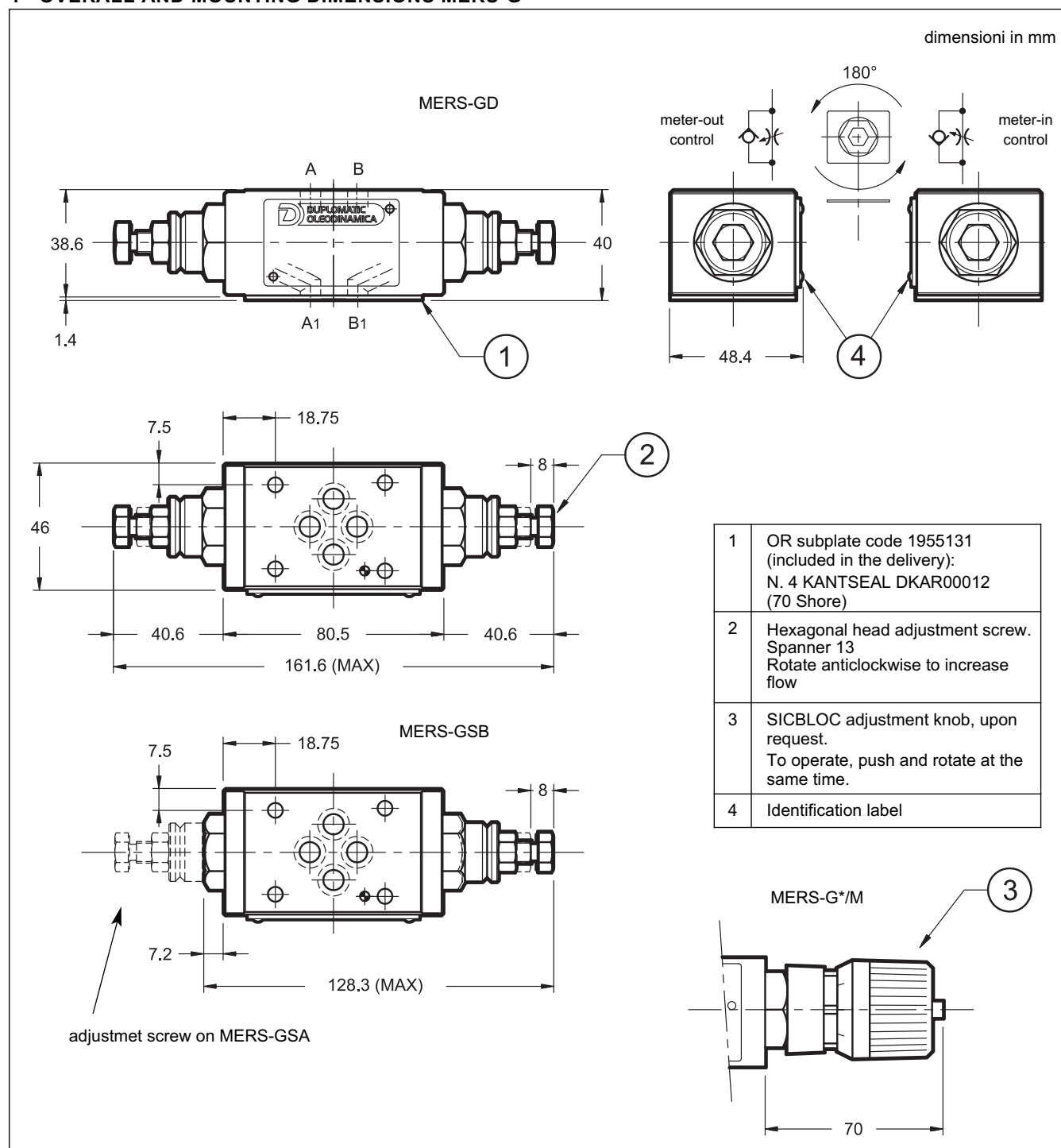
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 4 - OVERALL AND MOUNTING DIMENSIONS MERS -D, -RD and -S\*



## 4 - OVERALL AND MOUNTING DIMENSIONS MERS-G\*





# QTM5

## FLOW RESTRICTOR VALVE

### SERIES 10

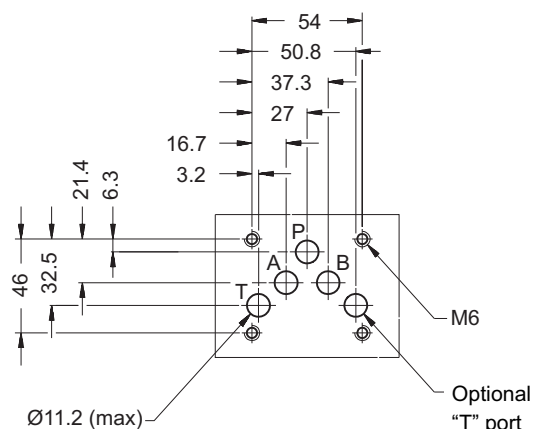
#### MODULAR VERSION

#### ISO 4401-05 (CETOP 05)

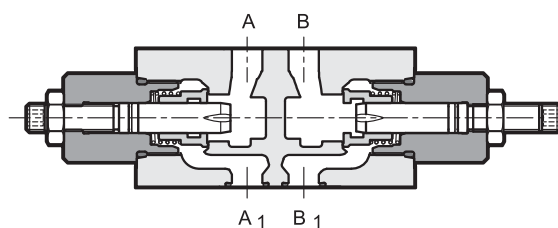
**p** max **350** bar  
**Q** max **120** l/min

#### MOUNTING INTERFACE

ISO 4401-05-04-0-05  
(CETOP 4.2-4-05)



#### OPERATING PRINCIPLE

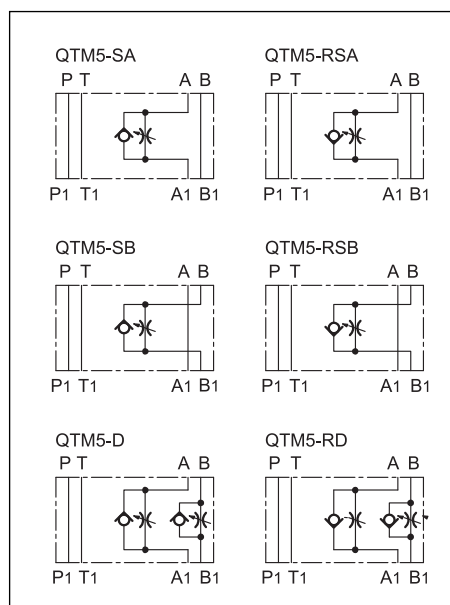


- This is a flow restrictor valve with built in check valve for reverse free flow, made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 12H) standards.
- It can be assembled quickly under all ISO 4401-05 (CETOP 05) modular valves without use of pipes, using suitable tie-rods or bolts, thus forming compact modular groups.
- It is supplied with countersunk hex adjustment screw and locking nut. Rotate anticlockwise to increase the flow rate.

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	120
Cracking pressure	bar	0,5
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Mass: QTM5-SA, -SB, -RSA, -RSB	kg	2,3
QTM5-D, -RD		2,5

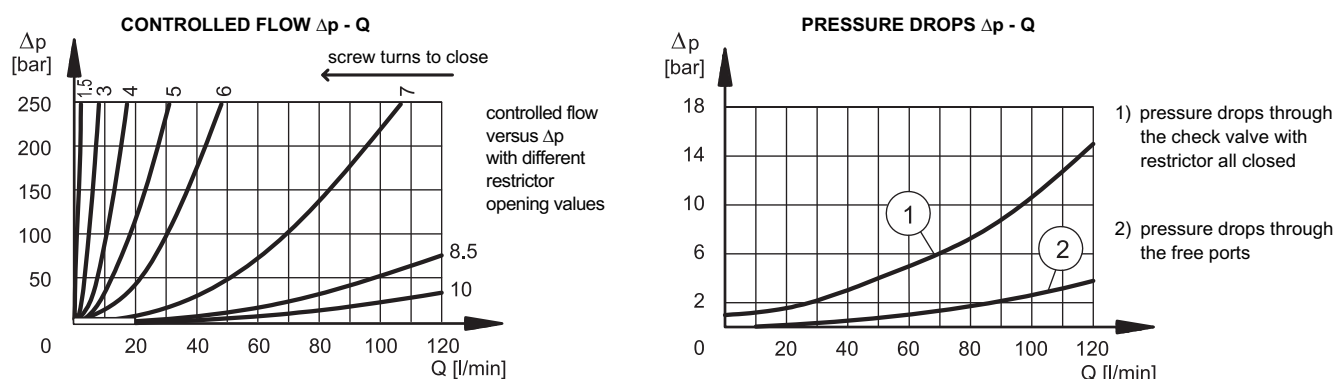
#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<div> <div>Q</div> <div>T</div> <div>M</div> <div>5</div> <div>-</div> <div>/</div> <div>10</div> <div>/</div> <div></div> <div></div> </div>									
Flow restrictor valve					S = adjustment screw (standard) K1 = adjustment knob				
Modular version					Seals: N = Seals in NBR for mineral oils (standard) V = Seals in FPM for special fluids				
ISO 4401-05 (CETOP 05) size					Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)				
Versions for meter-out: D = control on lines A and B SA = control on line A SB = control on line B					Versions for meter-in: RD = control on lines A and B RSA = control on line A RSB = control on line B				

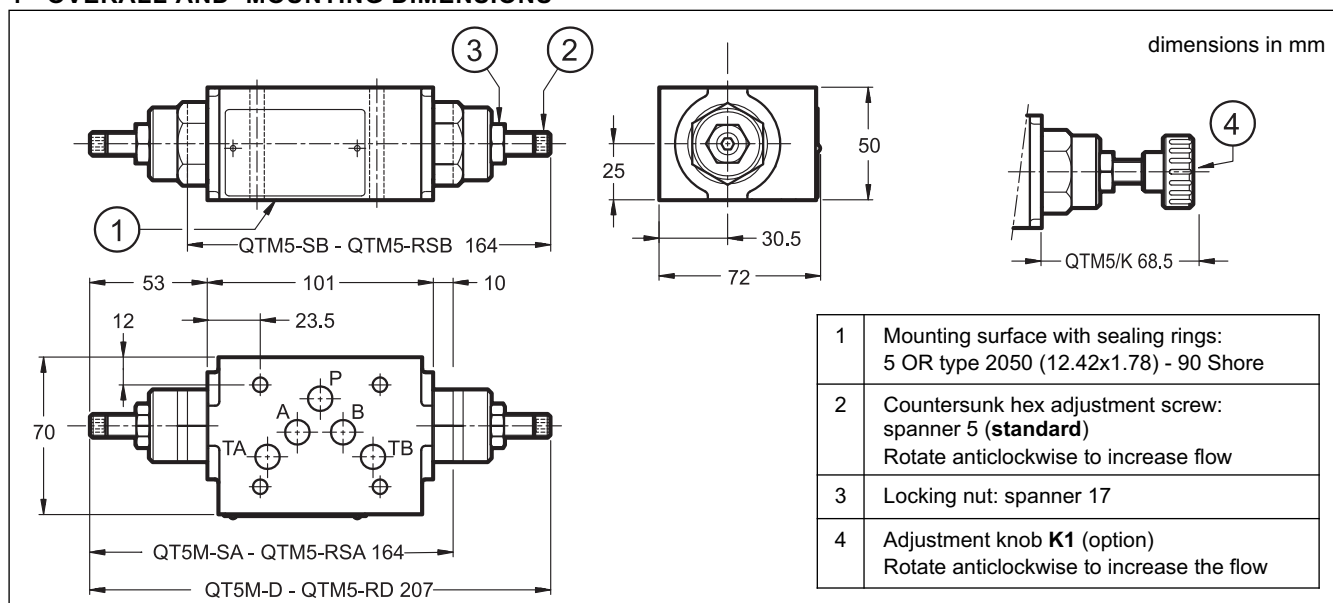
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# QTM7

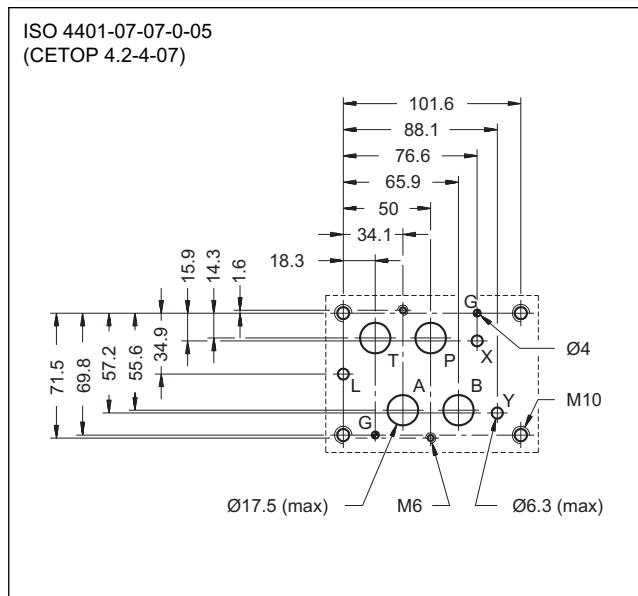
## FLOW RESTRICTOR VALVE

### SERIES 10

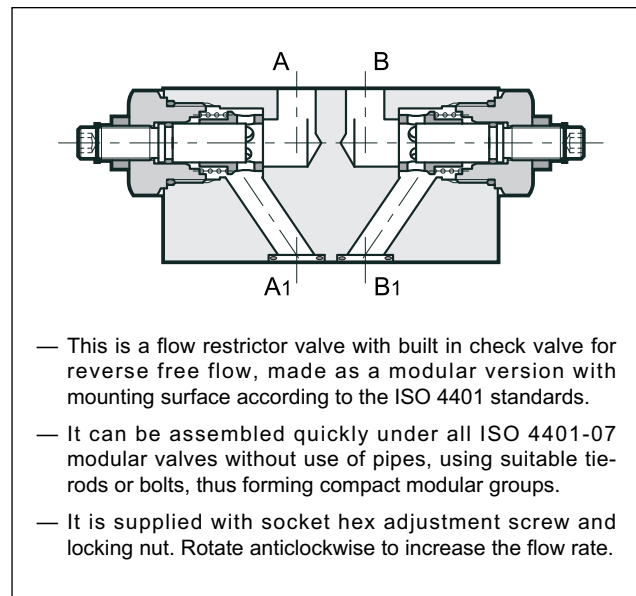
#### MODULAR VERSION ISO 4401-07

**p** max **350** bar  
**Q** max **250** l/min

#### MOUNTING INTERFACE



#### OPERATING PRINCIPLE



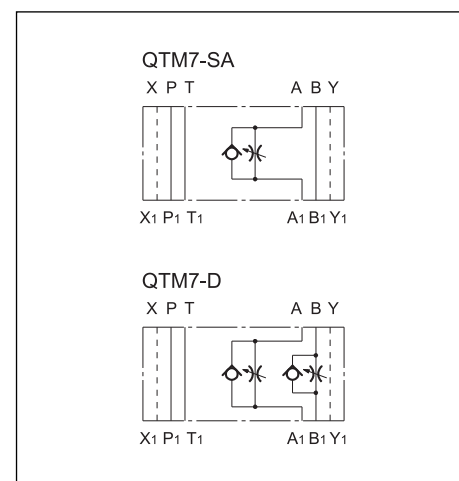
#### CONFIGURATIONS (see hydraulic symbols table)

- Configuration "SA": Allows the flow control exiting from the actuator on line A.
- Configuration "D": Allows independent control of the flow exiting from the chambers A and B of the actuator.
- All the configurations have a built-in check valve that allows free reverse flow (cracking pressure of 0,7 bar).

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	250
Leakage flow with restrictor closed	l/min	≤ 0,5
Check valve opening pressure	bar	0,7
Ambient temperature range	°C	-25 / +80
Fluid temperature range	°C	-25 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: QTM7-SA QTM7-D	kg	7,35 7,7

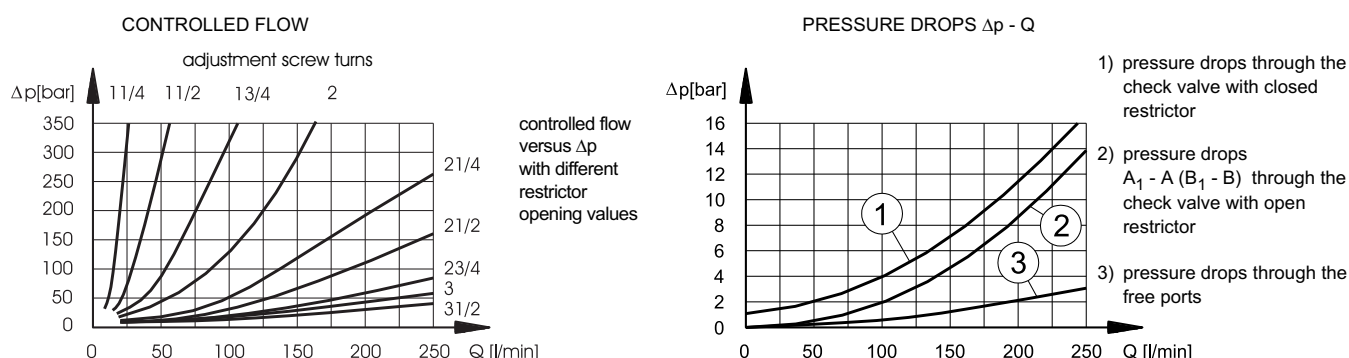
#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<div><div>Q</div><div>T</div><div>M</div><div>7</div><div>-</div><div></div><div>/</div><div>10</div><div></div><div>/</div><div></div></div>										
Flow restrictor valve										
Modular version										
ISO 4401-07 size										
<div><div>SA = meter out control on line A</div><div>D = meter out control on lines A and B</div></div>										
						<div>Seals: N=Seals in NBR for mineral oils (standard) V = Seals in FPM for special fluids</div>				
						<div>Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)</div>				
<div>S = adjustment screw (standard) K = adjustment knob</div>										

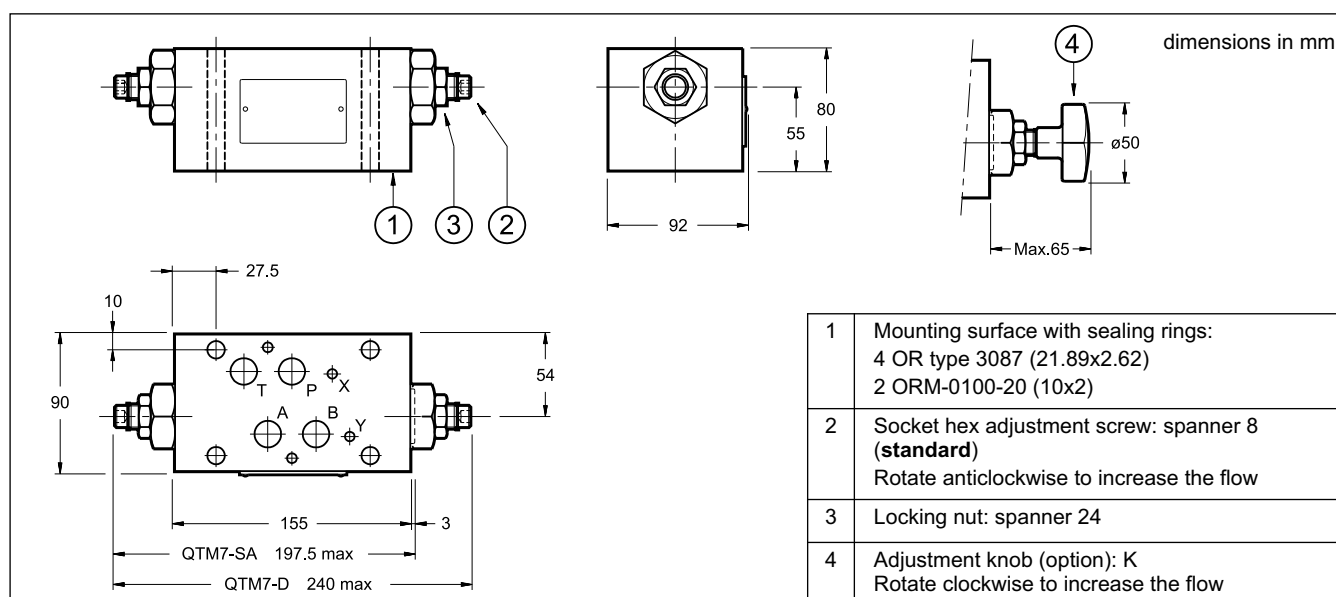
### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# CHM2

## PILOT OPERATED CHECK VALVE

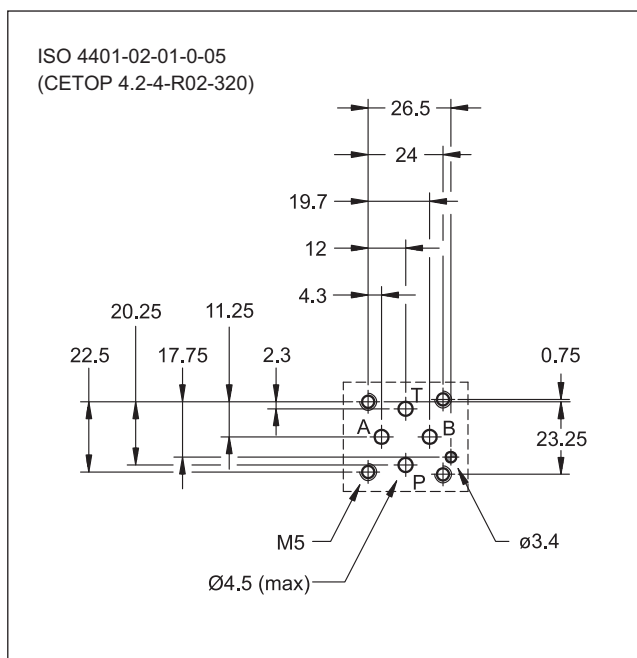
### SERIES 10

#### MODULAR VERSION ISO 4401-02 (CETOP R02)

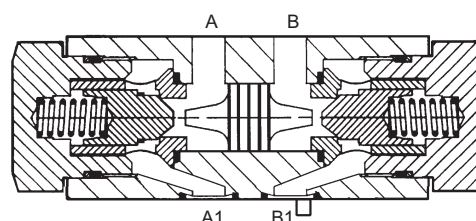
**p** max **320** bar

**Q** max **30** l/min

#### MOUNTING SURFACE



#### OPERATING PRINCIPLE

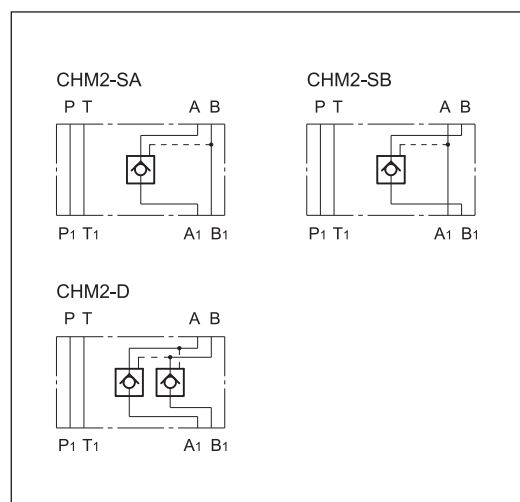


- The CHM2 valve is a hydraulically released check valve with spring closing and with cone on edge seals; the mounting surface is according to the ISO 4401 (CETOP RP 121H) standards.
- Its use allows:
  - prevention of flow in one direction;
  - flow in the same direction, if opened by a pilot pressure;
  - free flow in the other direction.
- The CHM2 valves are always mounted downstream of the DL2 type directional solenoid valves (see cat. 41 100) and can be assembled with all other ISO 4401-02 (CETOP R02) valves.

#### PERFORMANCE RATINGS (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	320
Maximum flow rate	l/min	30
Ratio between pressure of the sealed chamber and the piloting pressure		3.5:1
Opening pressure	bar	2
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0.75

#### HYDRAULIC SYMBOLS



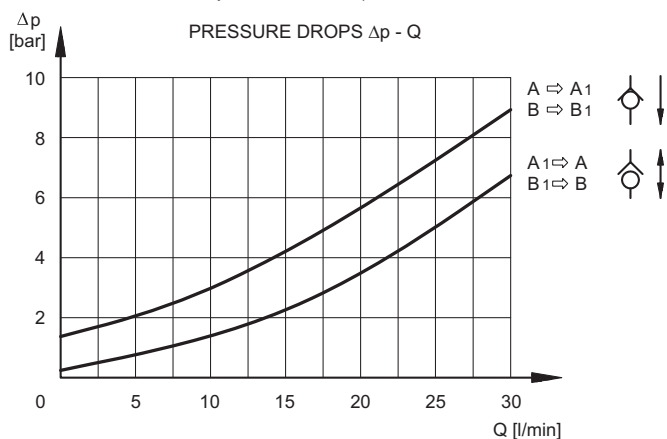


### 1 - IDENTIFICATION CODE

	<b>C</b>	<b>H</b>	<b>M</b>	<b>2</b>	<b>-</b>		<b>/</b>	<b>10</b>	
Pilot operated check valve									Seals: <b>N</b> = Seals in NBR for mineral oils ( <b>standard</b> ) <b>V</b> = Seals in FPM for special fluids
Modular version									Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
ISO 4401-02 (CETOP R02) size									<b>D</b> : seal on lines A e B of the actuator <b>SA</b> : seal on line A of the actuator <b>SB</b> : seal on line B of the actuator

### 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

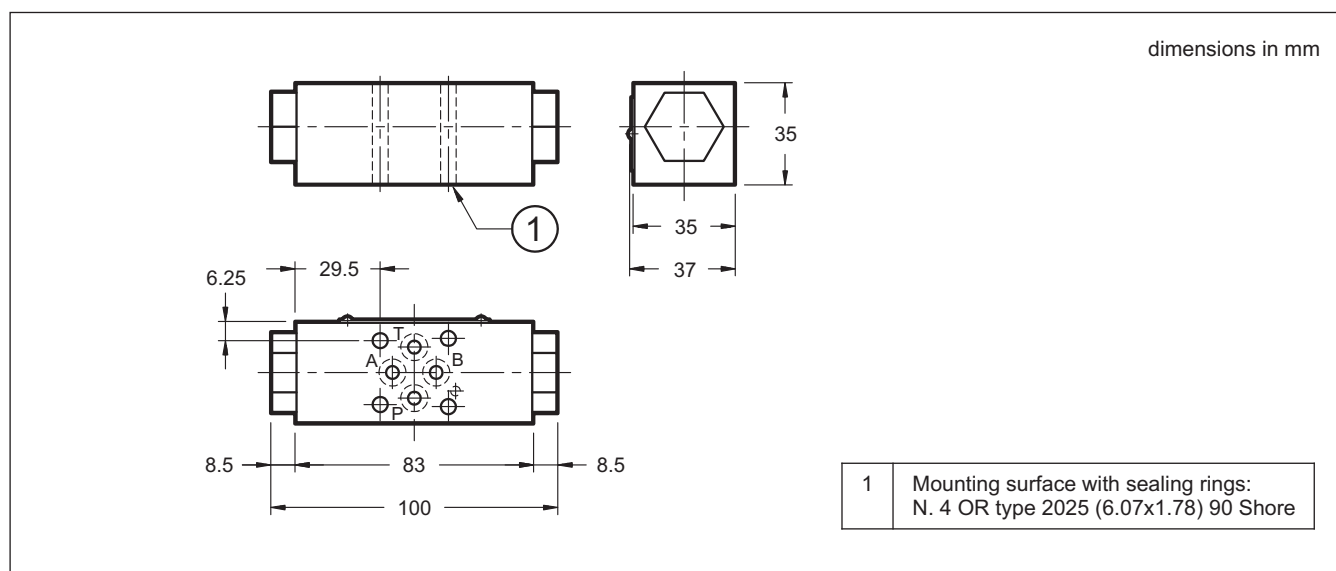
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). With HFDR fluids type (phosphate esters) use FPM seals (code V).

For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid itself and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# MVR

## DIRECT CHECK VALVE

### SERIES 51

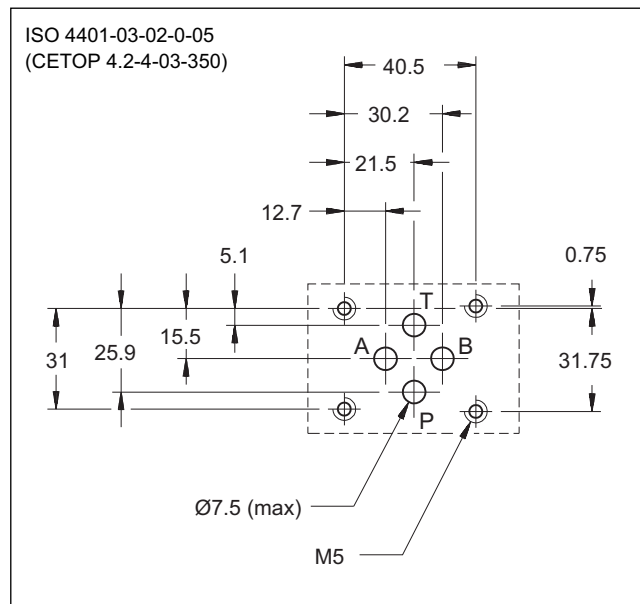
#### MODULAR VERSION

#### ISO 4401-03 (CETOP 03)

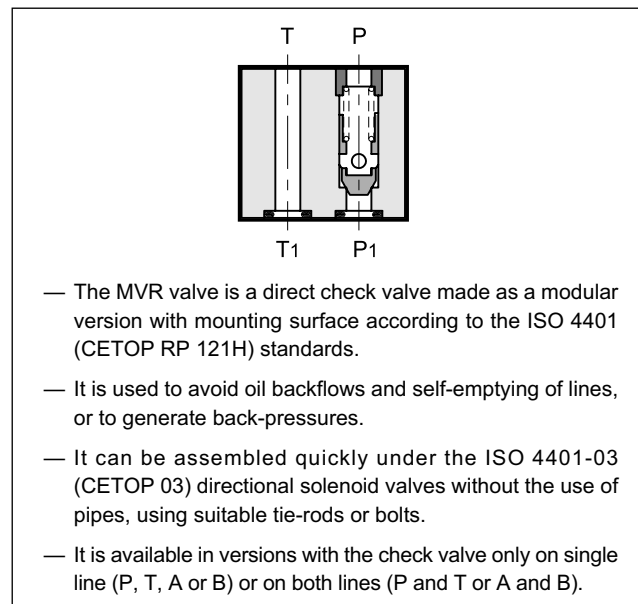
**p** max **350** bar

**Q** max (see table of performances)

#### MOUNTING INTERFACE



#### OPERATING PRINCIPLE



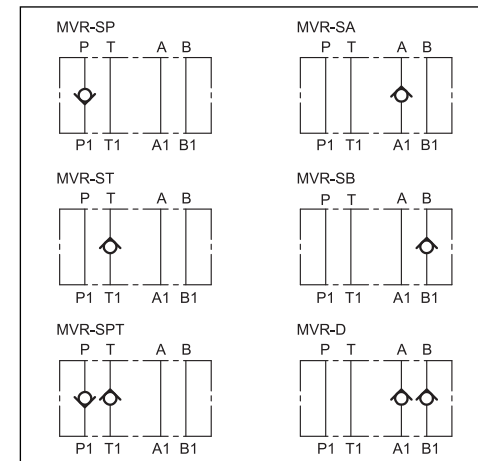
#### CONFIGURATIONS (see Hydraulic symbols table)

- MVR-SP: check valve on line P.
- MVR-SA: check valve on line A.
- MVR-ST: check valve on line T.
- MVR-SB: check valve on line B.
- MVR-SPT: check valve on lines P and T.
- MVR-D: check valve on lines A and B.

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Check valve cracking pressure		3 - 0,5 - 5
Maximum flow rate in controlled lines	l/min	50
Maximum flow rate in the free lines		75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1

#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<b>M</b>	<b>V</b>	<b>R</b>	<b>-</b>	<b>/</b>	<b>51</b>	<b>/</b>	
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Size: ISO 4401-03 (CETOP 03). Modular version.

Check valve

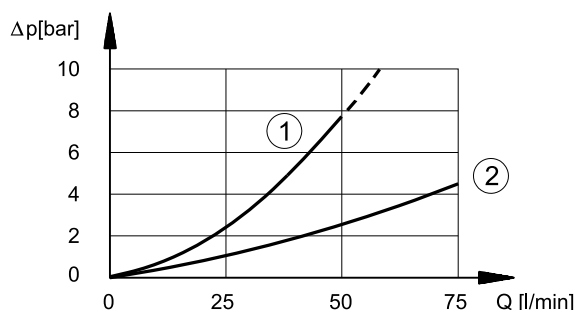
Cracking pressure: omit for standard cracking pressure = 3 bar  
**1** = 0,5 bar  
**3** = 5 bar

Seals: omit for mineral oils  
**V** = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

**SP**: check valve on line P  
**SA**: check valve on line A  
**SB**: check valve on line B  
**ST**: check valve on line T  
**SPT**: check valve on lines P and T  
**D** : check valve on lines A and B

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



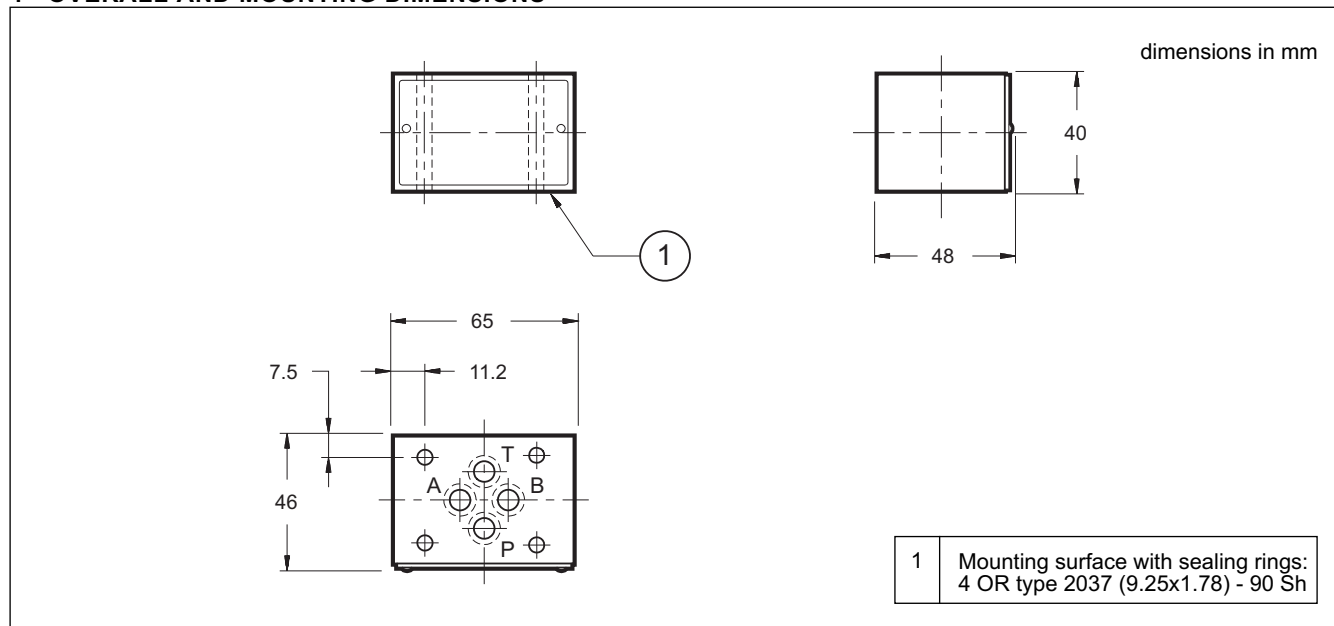
- 1) pressure drops on controlled lines
- 2) pressure drops on free lines

**NOTE:** check valve cracking pressure must be added to the values indicated in the curve 1 in the diagram

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# MVR-RS/P

## DIRECT CHECK VALVE WITH FLOW RESTRICTOR

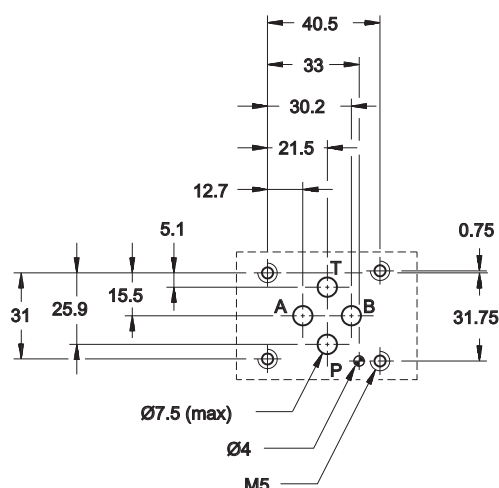
### SERIES 50

#### MODULAR VERSION ISO 4401-03

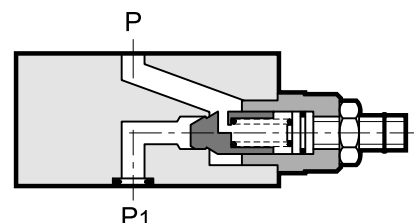
**p** max **350** bar  
**Q** max (see table of performances)

#### MOUNTING INTERFACE

ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



#### OPERATING PRINCIPLE

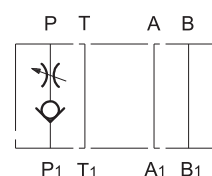


- The MVR-RS/P valve is a check valve that incorporates also the function of flow restriction.
- It is made as a modular version with mounting surface according to the ISO 4401-03 standards.
- It can be quickly assembled under the ISO 4401-03 directional solenoid valves and modular valves, without use of pipes and using suitable tie-rods or bolts.
- It is used when it is necessary to control the flow in a direction and to avoid backflows or the self-emptying of the lines in the opposite direction.
- Control of the flow is obtained with a countersunk hex screw with locking nut.

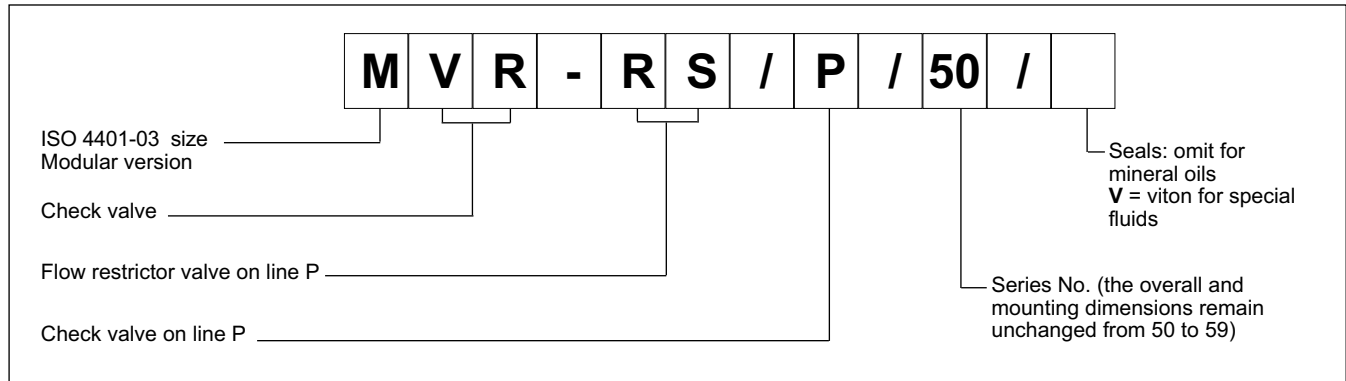
#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Check valve cracking pressure		1
Maximum flow rate in controlled lines	l/min	50
Maximum flow rate in the free lines		75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,1

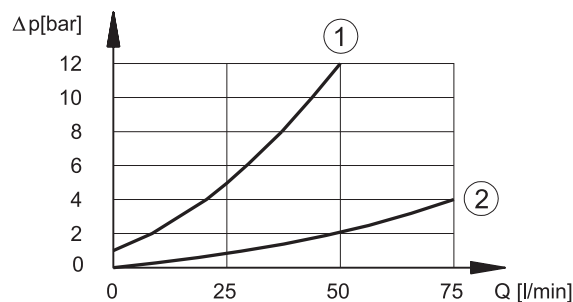
#### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

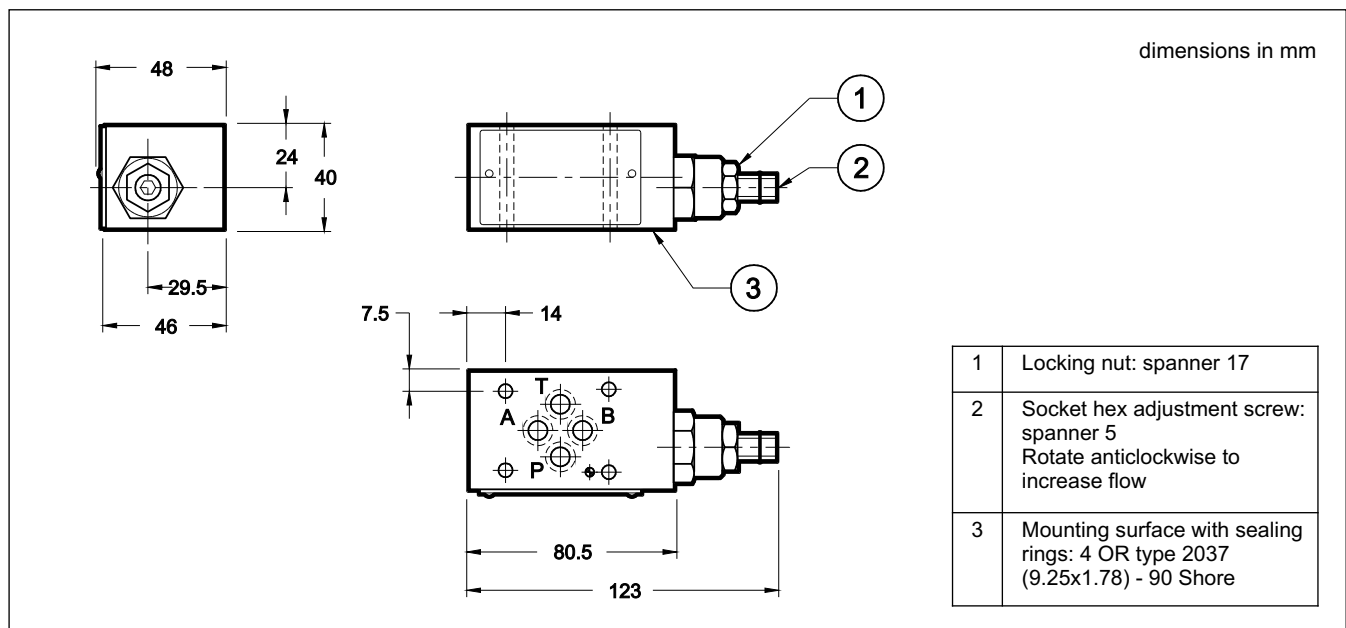


- 1) pressure drops  $P_1 \rightarrow P$   
2) pressure drops on free lines (ex.  $A \rightarrow A_1$ )

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# MVPP

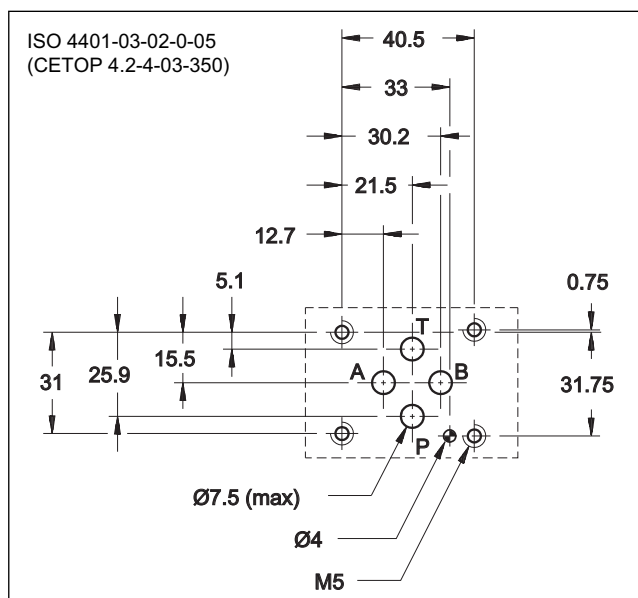
## PILOT OPERATED CHECK VALVE

### SERIES 50

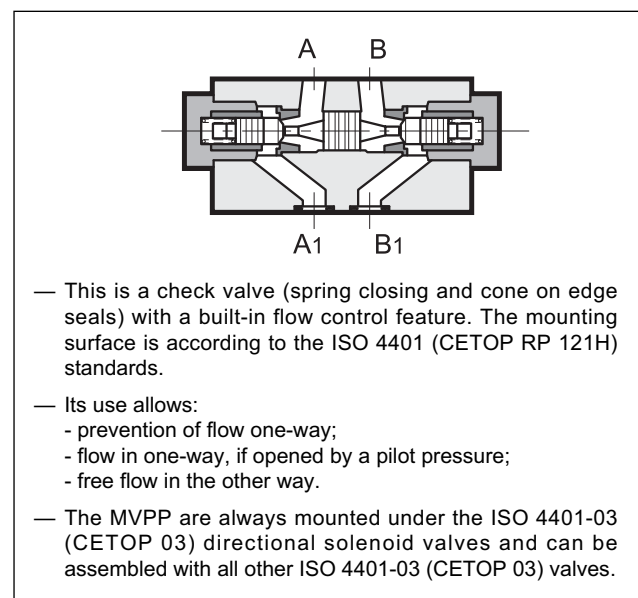
#### MODULAR VERSION ISO 4401-03 (CETOP 03)

**p** max **350** bar  
**Q** max (see table of performances)

#### MOUNTING SURFACE



#### OPERATING PRINCIPLE



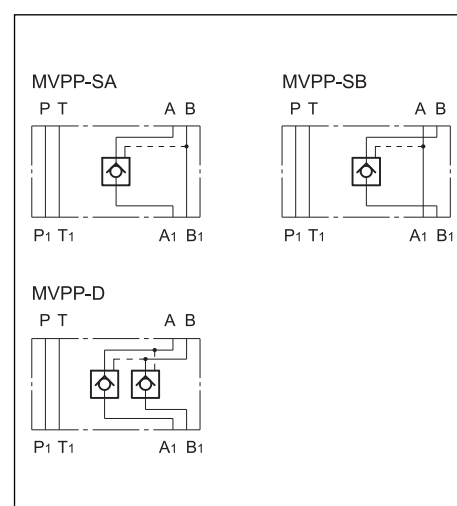
#### CONFIGURATIONS (see hydraulic symbols table)

- Configurations “SA” - “SB”: are used to lock the actuator in one direction
- Configuration “D”: is used to lock the position of the actuator in both directions

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Check valve cracking pressure		3
Maximum flow rate in controlled lines	l/min	50
Maximum flow rate in the free lines		75
Ratio between the pressure in the locked chambers and the piloting pressure		3,4:1
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,3

#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

<b>M</b>	<b>V</b>	<b>P</b>	<b>P</b>	<b>-</b>		<b>/ 50</b>	<b>/</b>		
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ISO 4401-03 (CETOP 03) size \_\_\_\_\_  
Modular version \_\_\_\_\_

Pilot operated check valve \_\_\_\_\_

Configurations: \_\_\_\_\_  
**SA** = seal on line A of the actuator  
**SB** = seal on line B of the actuator  
**D** = seal on lines A and B of the actuator

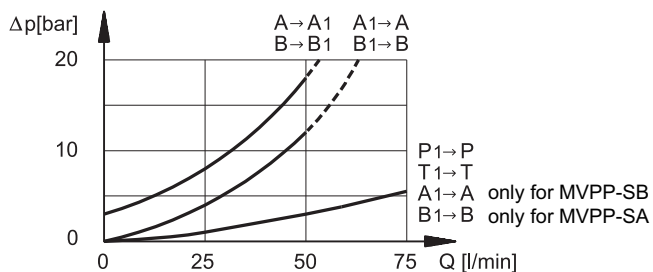
Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE**). Omit if not required.

Seals: omit for mineral oils  
**V** = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

**NOTE:** Standard surface treatment: phosphating. The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 600 hours.

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

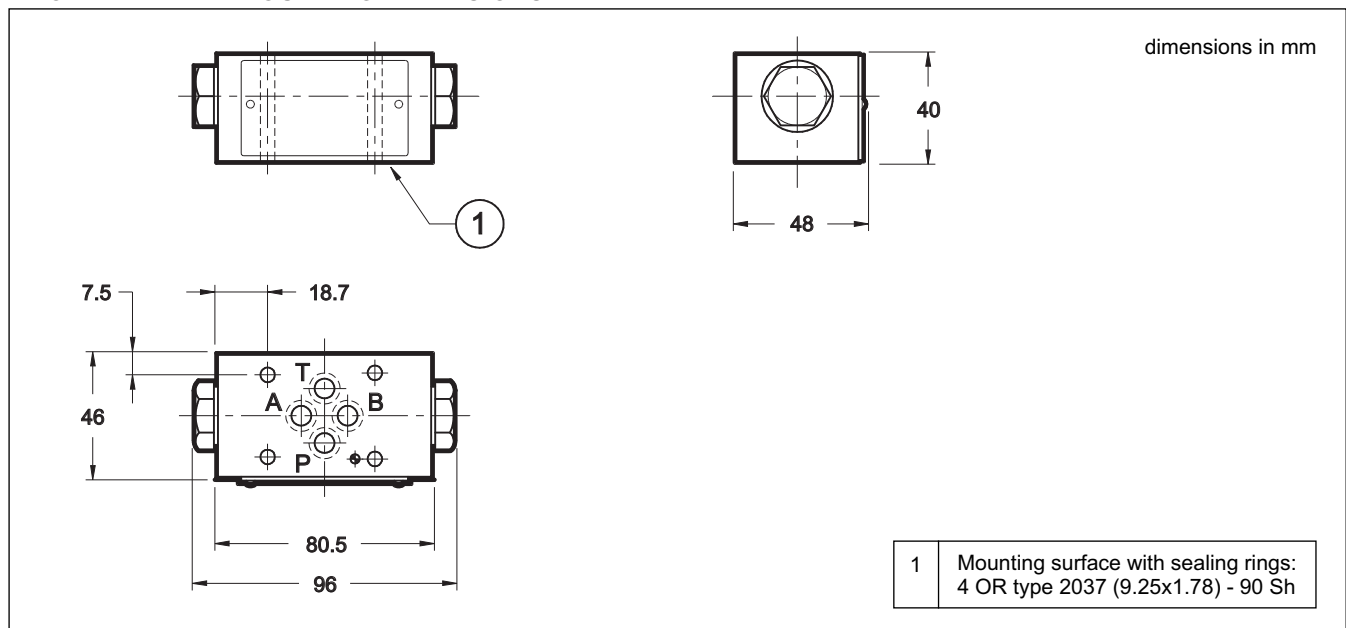


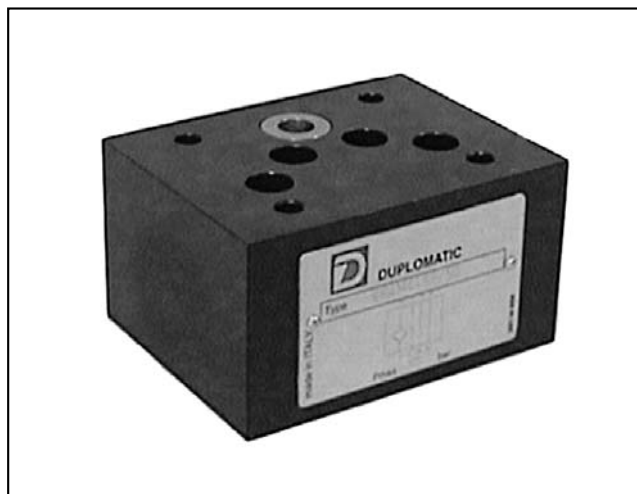
### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# VR4M

## DIRECT CHECK VALVE

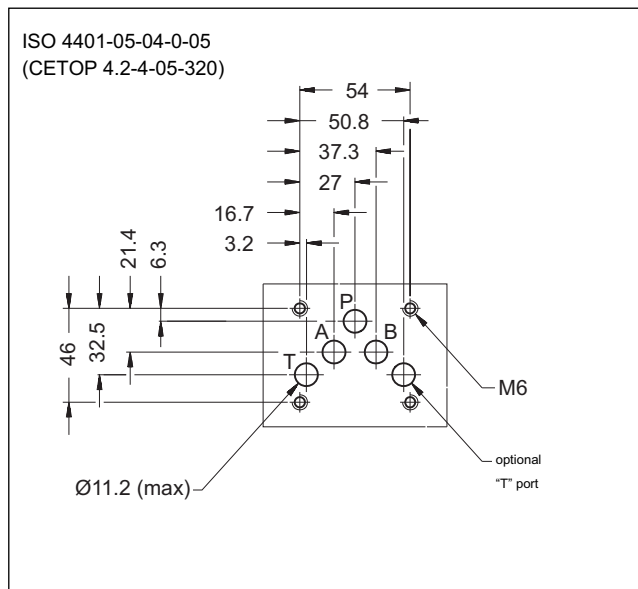
### SERIES 50

#### MODULAR VERSION

#### ISO 4401-05 (CETOP 05)

**p** max **320** bar  
**Q** max **100** l/min

#### MOUNTING INTERFACE



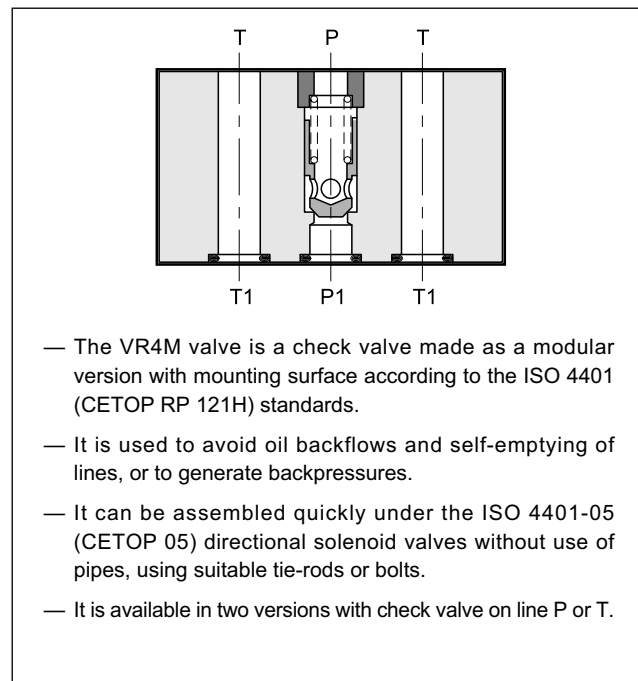
#### CONFIGURATIONS (see Hydraulic symbols table)

- VR4M-SP: check valve on line P.
- VR4M-ST: check valve on line T.

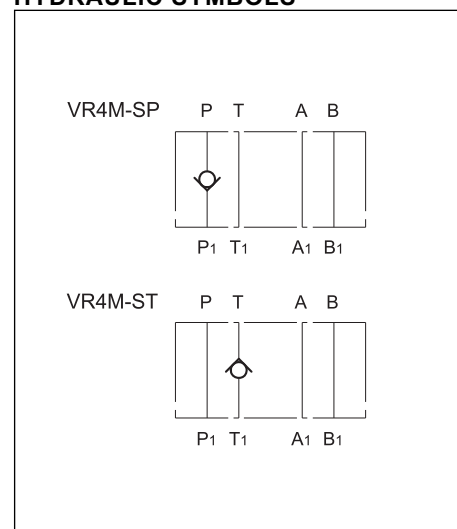
#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Check valve cracking pressure	bar	0,5 - 8
Maximum flow rate in the controlled lines and in the free lines	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Degree of fluid contamination	According to ISO 4406:1999 class 20/18/15	
Mass	kg	2,3

#### OPERATING PRINCIPLE

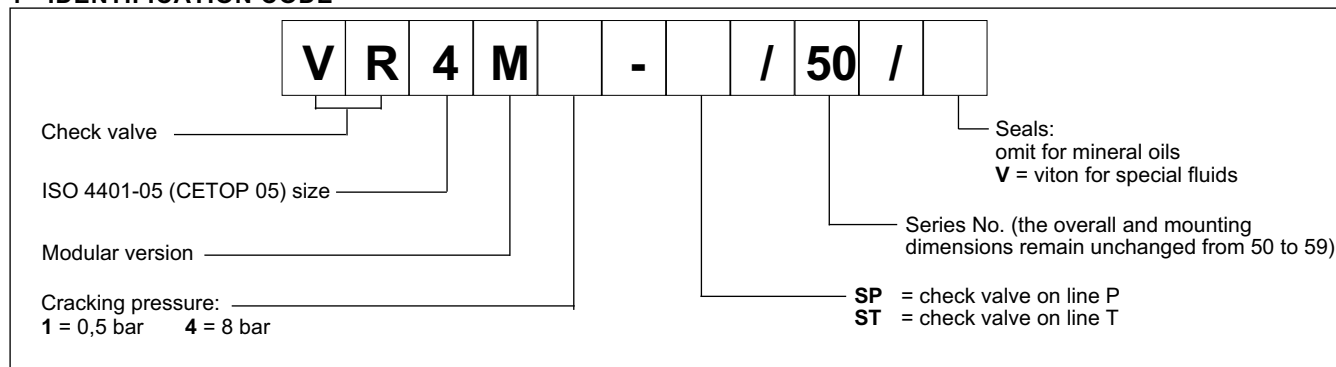


#### HYDRAULIC SYMBOLS

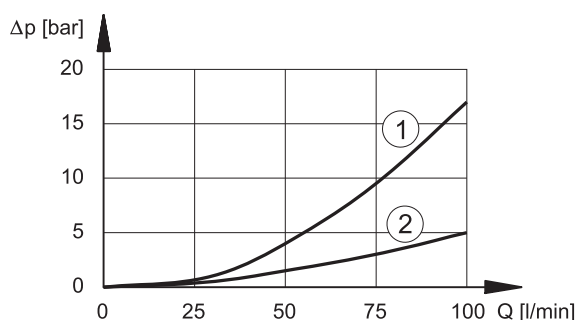




### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



1) pressure drops  $P_1 \rightarrow P$  and  $T \rightarrow T_1$  (controlled lines)

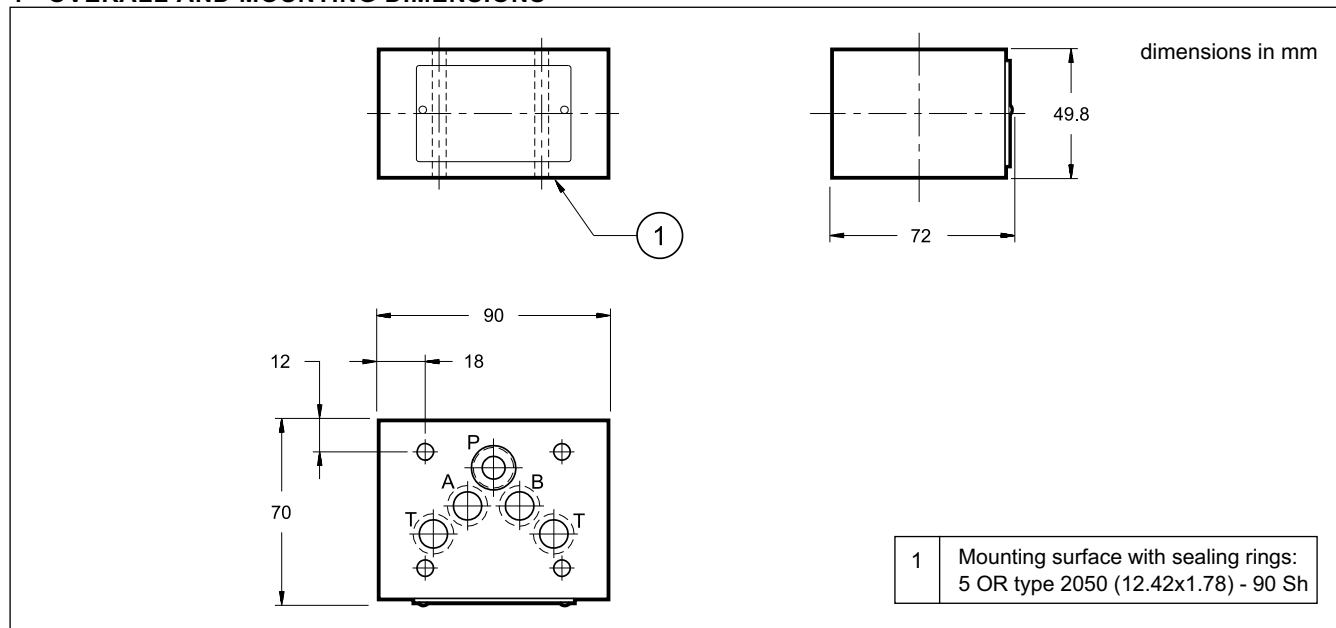
2) pressure drops on free lines (ex.  $A \rightarrow A_1$ )

**NOTE:** Add the valve cracking pressure to the values shown by the curve 1 of the diagram

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# CHM5

## PILOT OPERATED CHECK VALVE

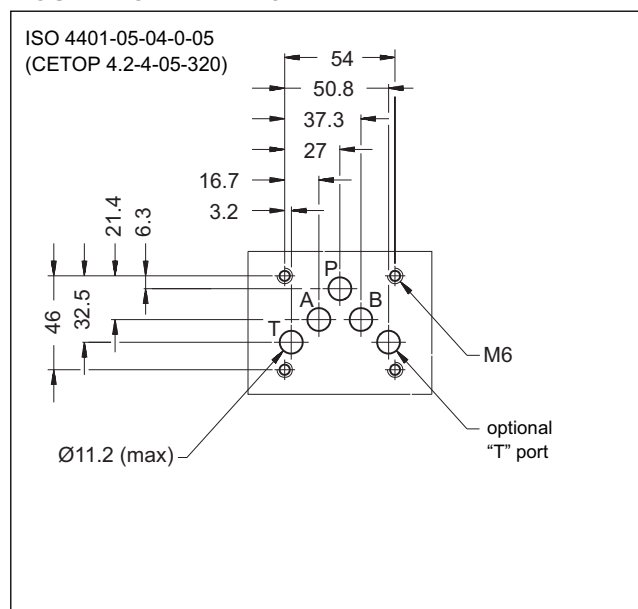
### SERIES 10

#### MODULAR VERSION

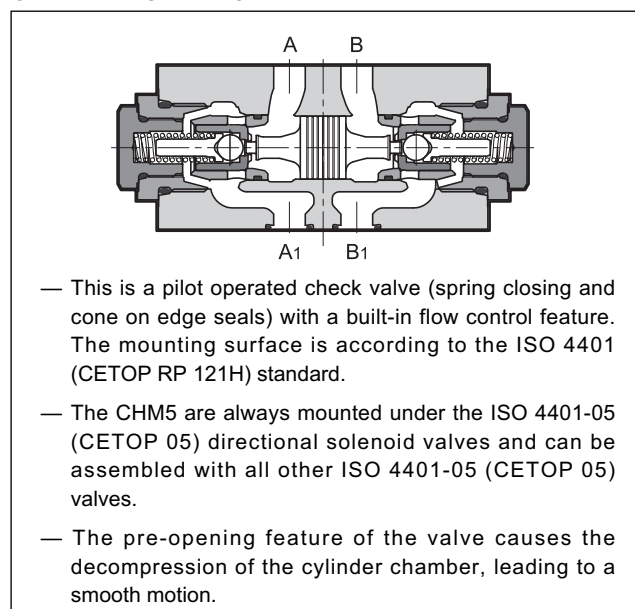
#### ISO 4401-05 (CETOP 05)

**p** max **320** bar  
**Q** max **120** l/min

#### MOUNTING INTERFACE



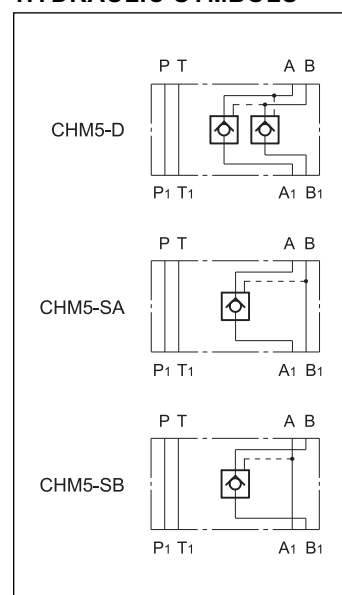
#### OPERATING PRINCIPLE



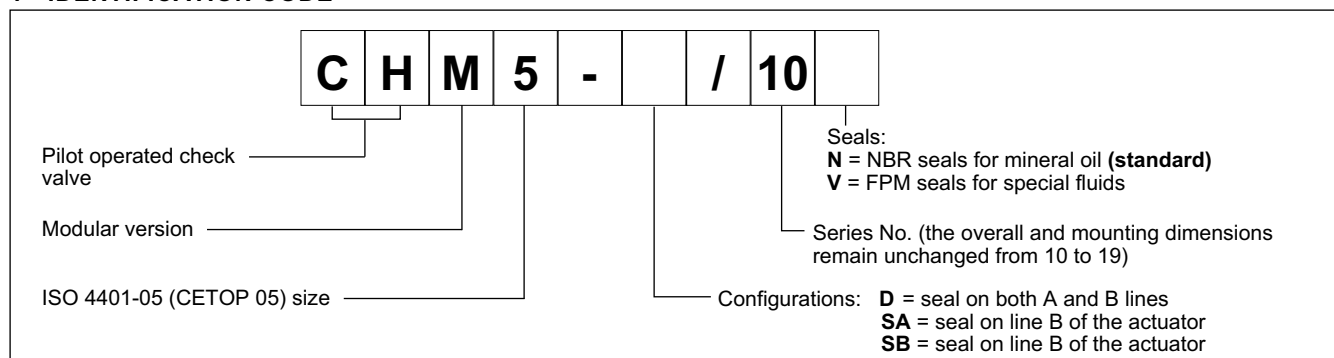
#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Maximum flow rate	l/min	120
Decompression ratio	14,9:1	
Piloting ratio	2,3:1	
Check valve cracking pressure	bar	2
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Mass: CHM5-D CHM5-SA e CHM5-SB	kg	2,2 1,9

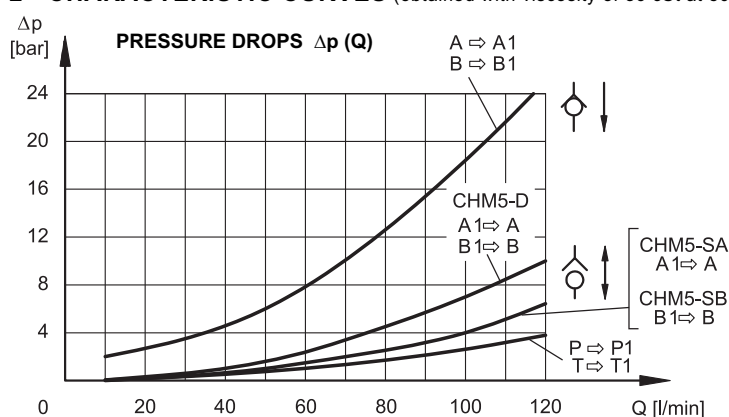
#### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)



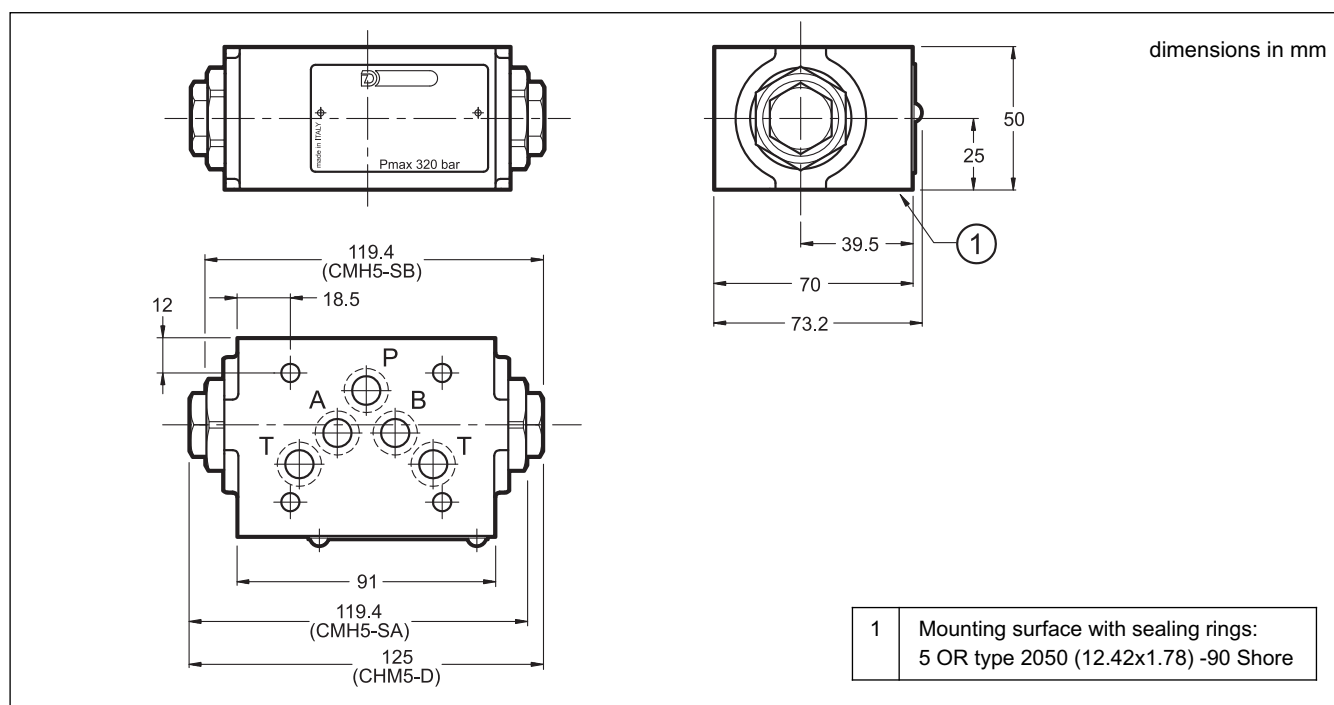
### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

#### 4 - OVERALL AND MOUNTING DIMENSIONS





# CHM7

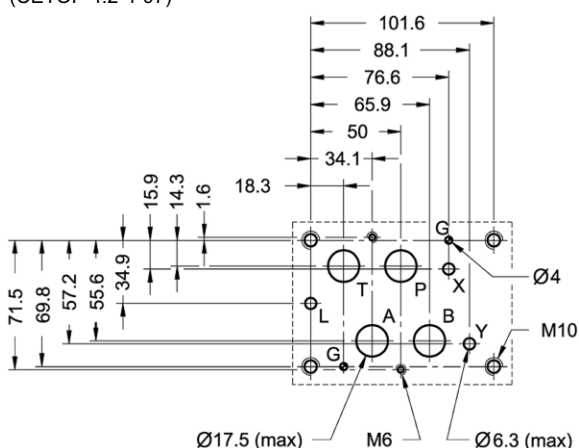
## PILOT OPERATED CHECK VALVE SERIES 11

### MODULAR VERSION ISO 4401-07

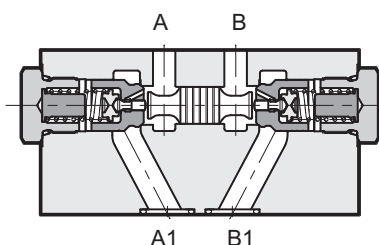
**p** max **350** bar  
**Q** max **300** l/min

### MOUNTING INTERFACE

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07)



### OPERATING PRINCIPLE



- This is a hydraulically released check valve with spring closing and with cone on edge seals; the mounting surface is according to the ISO 4401 standards.
- Its use allows:
  - prevention of flow in one direction;
  - flow in the same direction, if opened by a pilot pressure;
  - free flow in the other direction.
- The CHM7 valves are always mounted downstream of the DSP7 type directional solenoid valves (see cat. 41 420) and can be assembled with all other ISO 4401-07 valves.

### CONFIGURATIONS (see hydraulic symbols table)

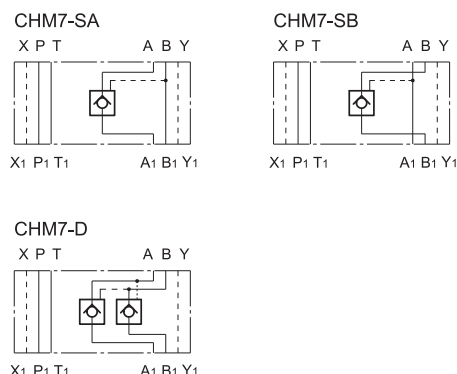
- Configuration "SA" ~ "SB": is used to lock the actuator in one direction.
- Configuration "D": is used to lock the actuator position in both directions.

The opening of the valve is gradual and occurs with the pre-opening of the main shutter that permits the plant decompression.

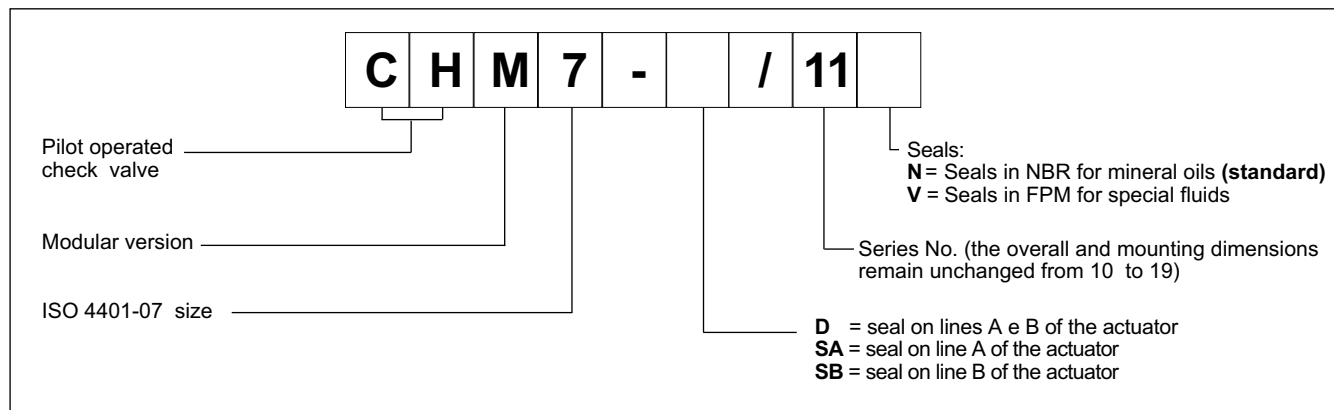
### PERFORMANCE RATINGS (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	300
Ratio between pressure of the sealed chamber and the piloting pressure		13:1
Opening pressure	bar	2
Ambient temperature range	°C	-25 / +80
Fluid temperature range	°C	-25 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: CHM7-S* CHM7-D	kg	7,6 7,7

### HYDRAULIC SYMBOLS

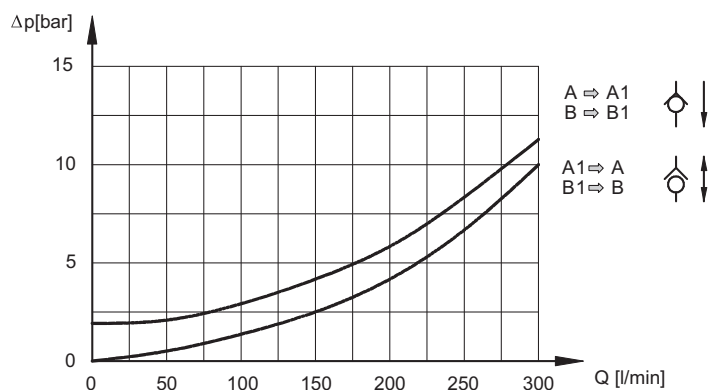


### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

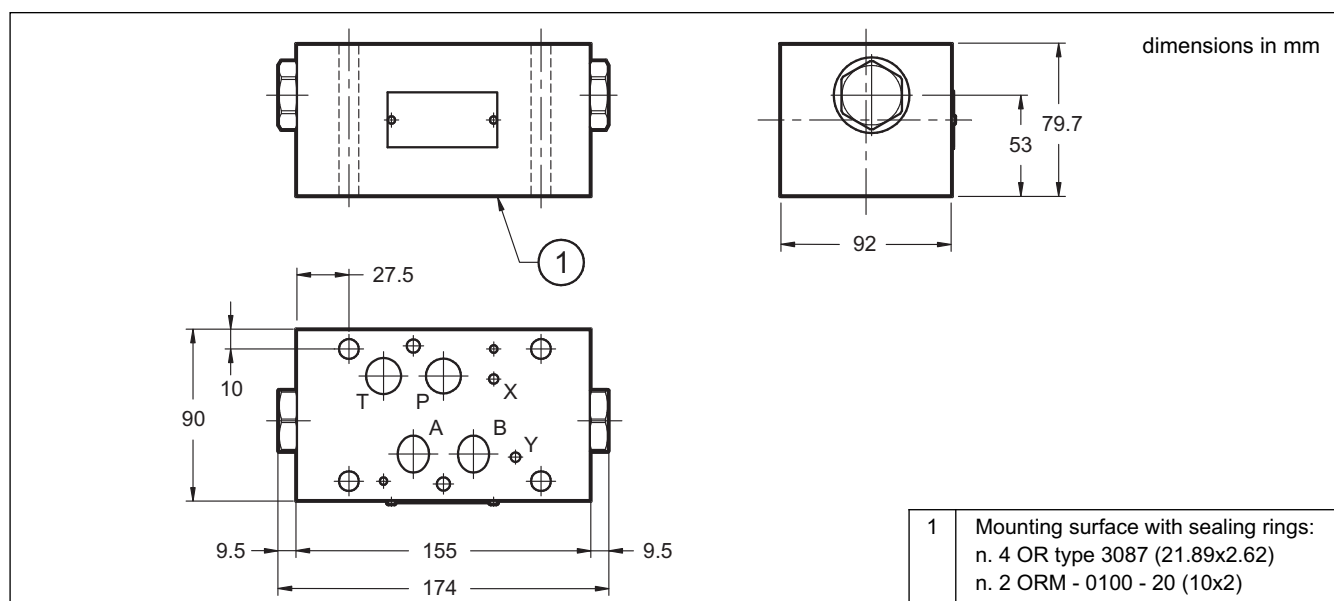
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). With HFDR fluids type (phosphate esters) use FPM seals (code V).

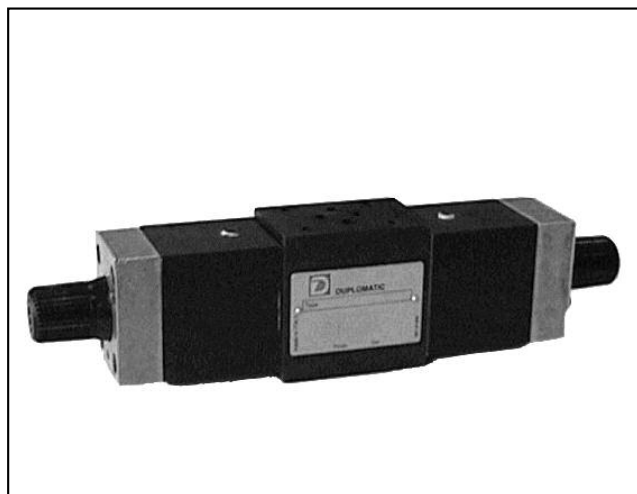
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid itself and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS





# RPC1\*/M

## FLOW CONTROL VALVE

### SERIES 10

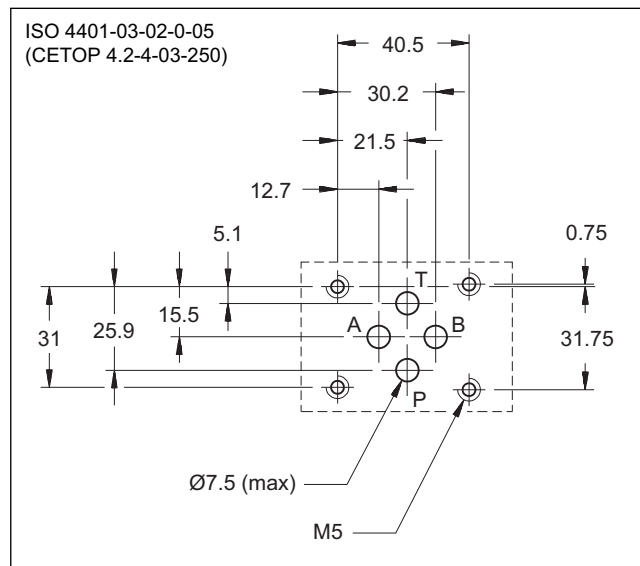
#### MODULAR VERSION

#### ISO 4401-03

**p** max **250** bar

**Q** max (see table of performances)

#### MOUNTING INTERFACE



#### CONFIGURATIONS

(see hydraulic symbols table and identification code - par. 1)

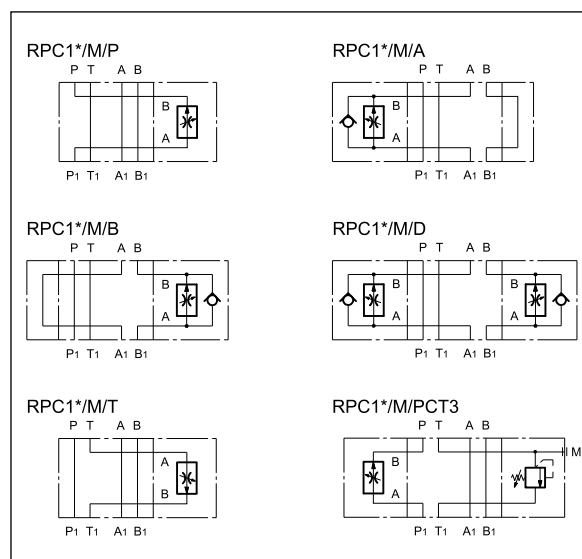
#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate in controlled lines	l/min	1-4-10-16-22-30
Maximum flow rate in the free lines		65
Reverse free flow maximum flowrate		40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	3
RPC1-*/M/ A-B-T-P		4,1
RPC1-*/M/ D		3,7
RPC1-*/M/PCT3		
only modular block ISO 4401-03 without flow control valves:		
RPC1-K/M/*		1,5
RPC1-K/M/PCT3		2,4

#### OPERATING PRINCIPLE

- 
- The RPC1\*/M valve is a flow control valve with pressure and temperature compensation, made as a modular version with mounting surface according to the ISO 4401 standards.
  - It can be assembled quickly under the ISO 4401-03 directional solenoid valves and allows easy execution of hydraulic circuits where control of the speed of the actuators is required.
  - It is available in six flow adjustment ranges up to 30 l/min.
  - Combined with MDS3 type solenoid operated directional control valves (see cat. 41 251), it's possible to obtain circuits for the fast/slow control of the work actuators.

#### HYDRAULIC SYMBOLS



**NOTE:** for detailed information regarding the RPC1 flow control valve, see catalogue 32 200



# RPC1\*/M

## SERIES 10

### 1 - IDENTIFICATION CODE

<b>R</b>	<b>P</b>	<b>C</b>	<b>1</b>	<b>-</b>		<b>/</b>	<b>M</b>	<b>/</b>		<b>-</b>		<b>/</b>	<b>10</b>	<b>/</b>	
----------	----------	----------	----------	----------	--	----------	----------	----------	--	----------	--	----------	-----------	----------	--

Pressure and temperature compensated flow control valve

Flow adjustment range:  
**1** = 1 l/min      **16** = 16 l/min  
**4** = 4 l/min      **22** = 22 l/min  
**10** = 10 l/min    **30** = 30 l/min  
**K** = only ISO 4401-03 (CETOP 03) modular block supplied without flow control valve

Modular version  
size ISO 4401-03 (CETOP 03)

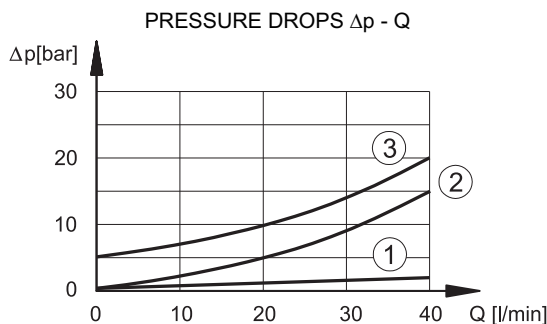
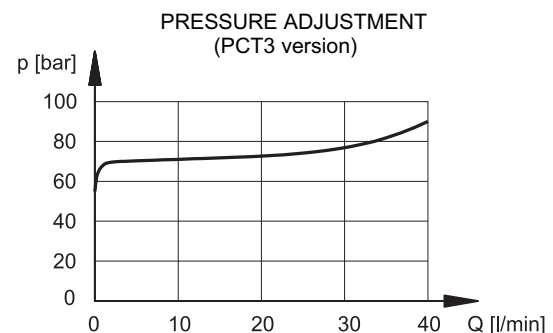
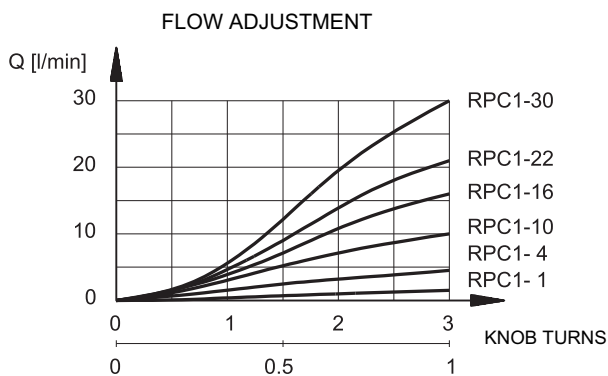
Seals: omit for mineral oils  
**V** = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

**M1** = adjustment knob only for PCT3 version (omit for adjustment with countersunk hex screw)

Configurations:  
**P** = meter in control on line P  
**A** = control from chamber A of the actuator  
**B** = control from chamber B of the actuator  
**D** = control from chambers A and B of the actuator  
**T** = meter out control on line T  
**PCT3** = meter in control on line P with backpressure adjustable on line T up to 70 bar  
(A and B configurations are not available in **K** version)

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



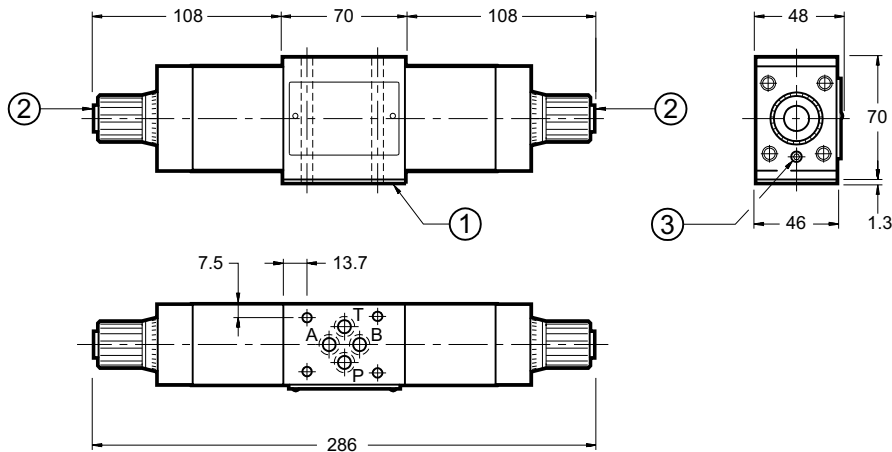
### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

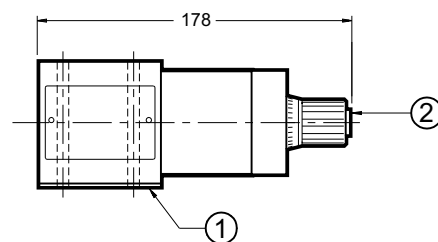
## 4 - OVERALL AND MOUNTING DIMENSIONS RPC1\*/M VALVES

dimensions in mm

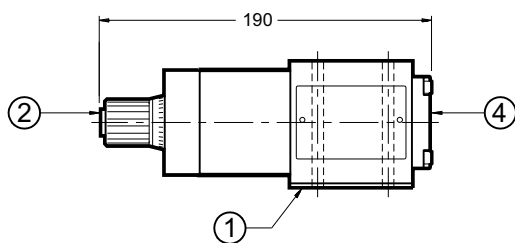
RPC1-\*/M/D



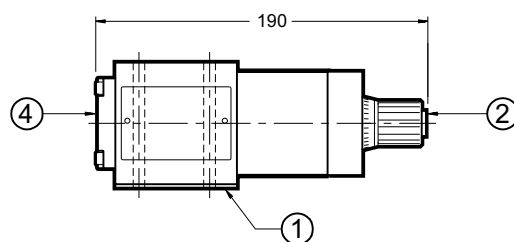
RPC1-\*/M/P  
RPC1-\*/M/T



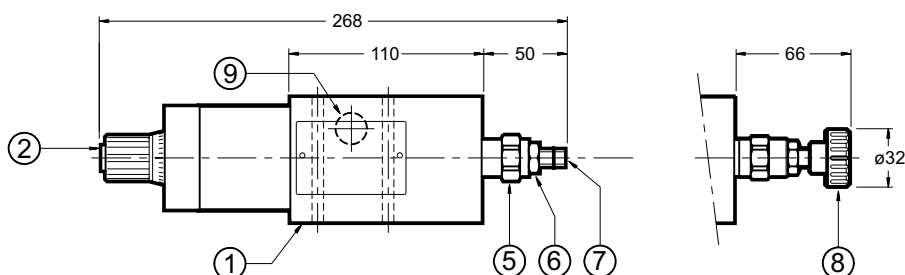
RPC1-\*/M/A



RPC1-\*/M/B



RPC1-\*/M/PCT3



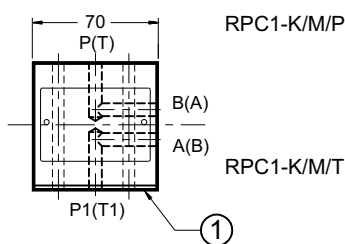
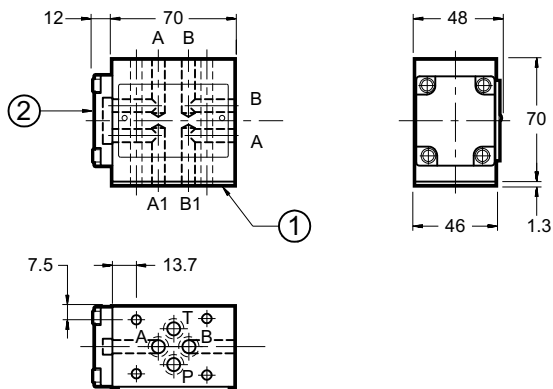
1	Mounting plate with sealing rings: P-OR1L/20N (NBR seals) P-OR1L/20V (Viton seals) For RPC1-*/M/PCT3 without mounting plate: 4 OR 2037 (9.25x1.78) - 90 Shore
2	Flow adjustment knob (3 turns total) Rotate anticlockwise to increase flow.
3	Knob locking screw
4	Cross-connection cover
5	Backpressure valve on line T. Pressure adjustment range up to 70 bar
6	Locking nut: spanner 17
7	Countersunk hex screw: spanner 5 Rotate clockwise to increase pressure
8	Adjustment knob: <b>M1</b>
9	Pressure gauge port 1/4" BSP



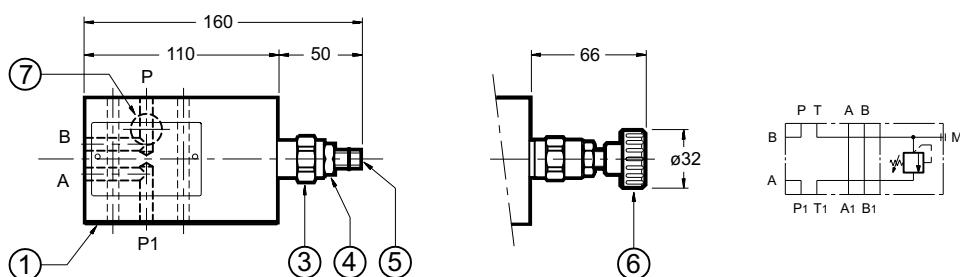
## 5 - OVERALL AND MOUNTING DIMENSIONS OF BLOCKS WITHOUT FLOW CONTROL VALVE

dimensions in mm

RPC1-K/M/D



RPC1-K/M/PCT3



1	Mounting plate with sealing rings: P-OR1L/20N (NBR seals) P-OR1L/20V (Viton seals) For RPC1-*/M/PCT3 without mounting plate: 4 OR 2037 (9.25x1.78) - 90 Shore
2	Cross-connection cover
3	Backpressure valve on line T. Pressure adjustment range up to 70 bar
4	Locking nut: spanner 17
5	Countersunk hex screw: spanner 5 Rotate clockwise to increase pressure
6	Adjustment knob: <b>M1</b>
7	Pressure gauge port 1/4" BSP

# RLM3

## ELECTRIC FAST / SLOW SPEED SELECTION VALVE SERIES 10



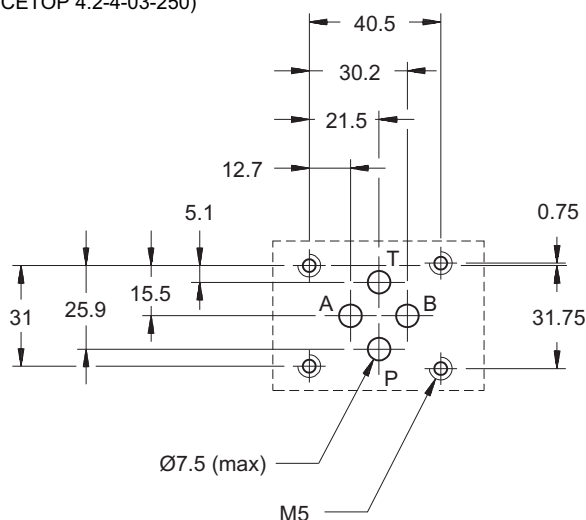
### MODULAR VERSION ISO 4401-03

**p** max **250** bar

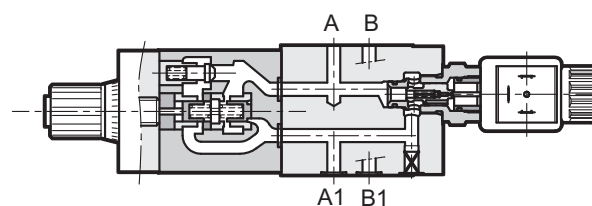
**Q** max (see table of performances)

### MOUNTING SURFACE

ISO 4401-03 -02-0-05  
(CETOP 4.2-4-03-250)



### OPERATING PRINCIPLE



- The RLM3 valve is a compact group that allows control of the fast/slow flow through use of an open/close solenoid valve. The adjustment of the flow is carried out with the RPC1 compensated flow control valves (see catalogue 32 200) with six adjustment ranges.
- The fast/slow speed selection is obtained with the KT08 solenoid cartridge poppet valve (see catalogue 43 100).
- Made as a modular version, the mounting surface is according to iso 4401 standards.
- The RLM3 valve can be assembled quickly under ISO 4401-03 directional solenoid valves without use of pipes, permitting the construction of directional and speed controls for actuators in a single work-station.

### PERFORMANCES

(measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate in controlled lines	l/min	1 - 4 - 10 - 16 - 22 - 30
Maximum flow rate in the free lines		65
Minimum controlled flow rate	l/min	0,025
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	3,1

### CONFIGURATIONS

(see hydraulic symbols)

- Configuration "A": meter-out control from the actuator on chamber A.
- Configuration "T": control on discharge T of the directional solenoid valve for speed control in both directions of movement.

## 1 - IDENTIFICATION CODE

R	L	M	3	-		/	10	-		/	
---	---	---	---	---	--	---	----	---	--	---	--

Electric fast/ slow speed selection valve

Modular version

Size ISO 4401-03

Adjustments:  
**A** = adjustment on chamber A of the actuator;  
**T** = adjustment on discharge T of the directional solenoid valve  
**A** = normally open solenoid valve  
**C** = normally closed solenoid valve

Flow adjustment range:  
**01** = 1 l/min      **16** = 16 l/min  
**04** = 4 l/min      **22** = 22 l/min  
**10** = 10 l/min    **30** = 30 l/min

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

See NOTE 2

Coil electrical connection:  
 (see paragraph 10)  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)

For DC supply only:  
**K2** = plug for connector type AMP JUNIOR  
**K4** = outgoing cables  
**WK7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S  
**WK8** = plug for connector type AMP SUPER SEAL

Coil type:  
**D12** = 12 V } direct current (**standard**)  
**D24** = 24 V }  
**R110** = 110 V } rectified current  
**R230** = 230 V }  
**D00** = valve without coil (see NOTE 1)

Seals:  
**N** = NBR for mineral oils  
**V** = viton for special fluids

**NOTE 1:** The coil locking ring and the relevant seals are included in the supply.  
**NOTE 2:** The manual override **CM** is available as an option (see paragraph 8).

**N.B. :** For further information about the flow control valve see catalogue 32 200; for further information about the cartridge poppet valve see catalogue 43 100.

### 1.1 - Coil identification code

C	14	L3	-		/	10
---	----	----	---	--	---	----

Power supply

Series no.:  
 (the overall and mounting dimensions remain unchanged from 10 to 19)

**D12** = 12 V } direct current  
**D24** = 24 V } (**standard**)  
**R110** = 110 V } rectified current  
**R230** = 230 V }

Coil electrical connection (see paragraph 10)  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)

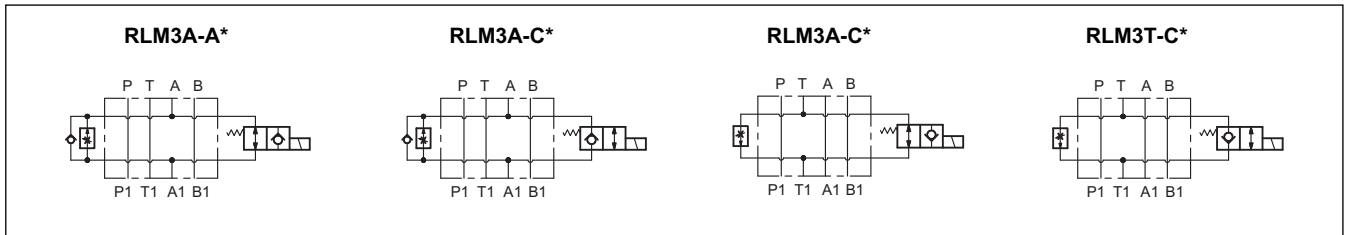
For **D12** and **D24** coils only:  
**K2** = plug for connector type AMP JUNIOR  
**K4** = outgoing cables  
**WK7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S  
**WK8** = plug for connector type AMP SUPER SEAL

## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

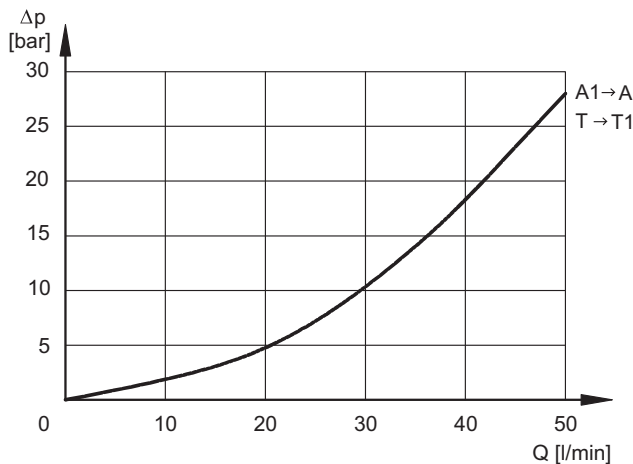
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 3 - HYDRAULIC SYMBOLS



### 4 - PRESSURE DROPS $\Delta P$ -Q

(obtained with viscosity of 36 cSt at 50 °C)



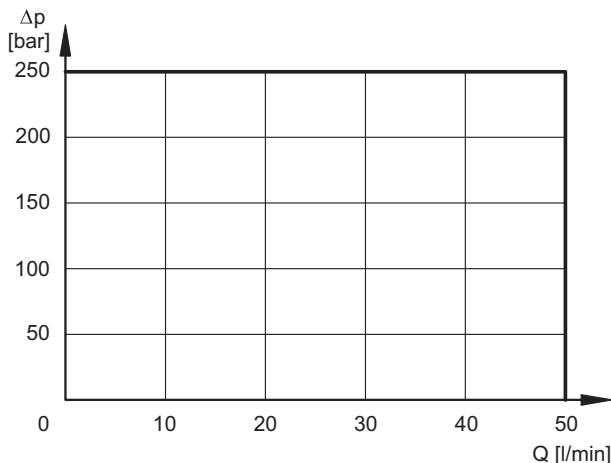
The values in graphs refer to the fast flow through the solenoid valve and are equal for A (normally open) and C (normally closed) versions.

### 5 - SWITCHING TIME

The values are obtained according to the ISO 6403 standard, with mineral oil at 50°C, with viscosity of 36 cSt.

TIMES [ms]	ENERGIZING	DE-ENERGIZING
<b>RLM3*-A*</b>	85	60
<b>RLM3*-C*</b>	60	85

### 6 - OPERATING LIMITS



The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

## 7 - ELECTRICAL FEATURES

### 7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded onto the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded nut, and can be rotated according to the available space.

The interchangeability of coils of different voltages both D or R type is possible without removing the tube.

### Protection from atmospheric agents IEC 60529

The IP protection degree is intended for the whole valve. It is guaranteed only with both valve and connector of an equivalent IP degree, correctly connected and installed.

Versions with CM manual override are IP65 always.

Electric connection	IP65	IP66	IP67	IP68	IP69 IP69K (*)
K1 EN 175301-803	x	x			
K2 AMP JUNIOR	x		x		
K4 outgoing cables	x				
WK7 DEUTSCH DT04 male	x		x	x	x
WK8 AMP SUPER SEAL	x	x	x	x	x

(\*) The protection degree IP69K is not taken into account in IEC 60529 but it is included in both ISO 20653.

<b>SUPPLY VOLTAGE FLUCTUATION</b>	± 10% Vnom
<b>MAX SWITCH ON FREQUENCY</b>	10.000 ins/hr
<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	In compliance with 2014/30/EU
<b>LOW VOLTAGE</b>	In compliance with 2014/35/EU
<b>CLASS OF PROTECTION :</b> Coil insulation (VDE 0580) Impregnation:	class H class H

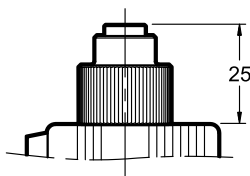
### 7.2 - Current and absorbed power

In the table are shown current and power consumption values relevant to the different coil types. "R" coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the "D" type connector (see cat. 49 000).

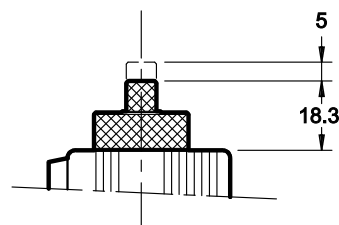
	Resistance at 20°C [Ω] (±1%)	Absorbed current [A] (±5%)	Absorbed power (±5%)		Coil code				
			[W]	[VA]	K1	K2	K4	WK7	WK8
<b>D12</b>	5,4	2,2	26,5		1902740	1902750	1902770	1903510	1903520
<b>D24</b>	20,7	1,16	27,8		1902741	1902751	1902771	1903511	1903521
<b>R110</b>	363	0,25		27,2	1902742				
<b>R230</b>	1640	0,11		26,4	1902743				

## 8 - MANUAL OVERRIDE

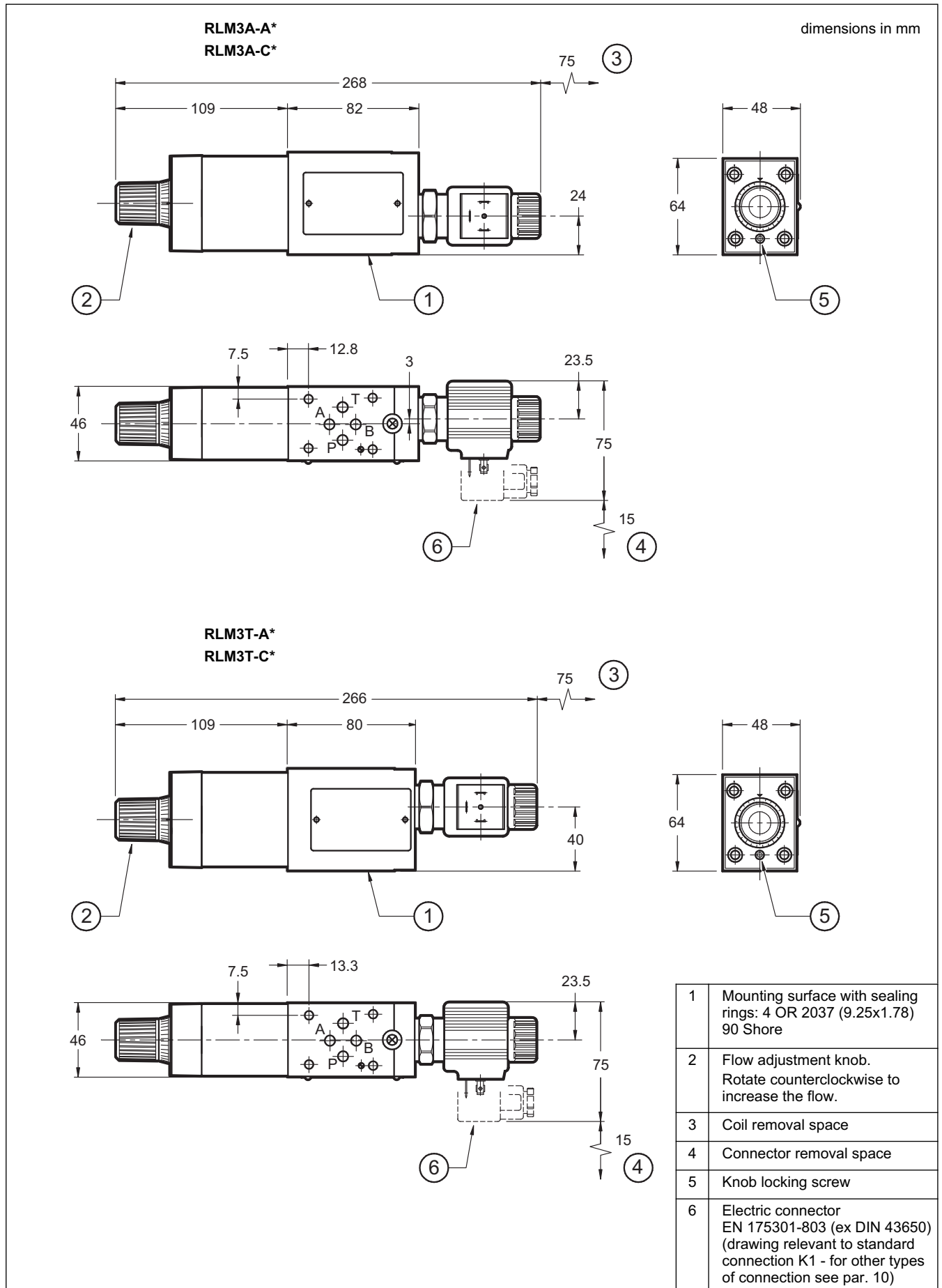
CM for NO version (pushing type)



CM for NC version (screw type)

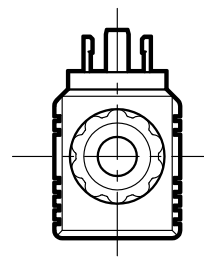
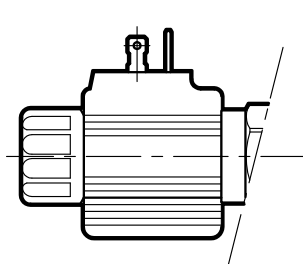


## 9 - OVERALL AND MOUNTING DIMENSIONS

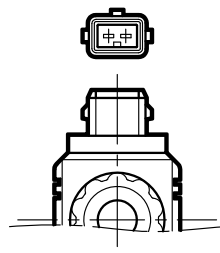
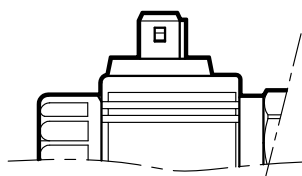


## 10 - ELECTRIC CONNECTIONS

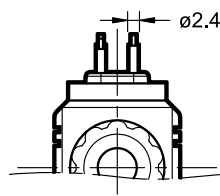
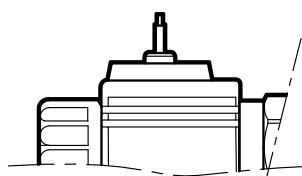
connection for EN 175301-803  
(ex DIN 43650) connector type  
code **K1 (standard)**



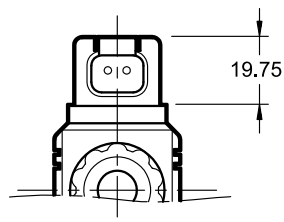
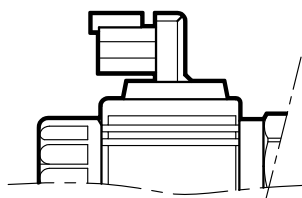
connection for AMP JUNIOR  
connector type  
code **K2**



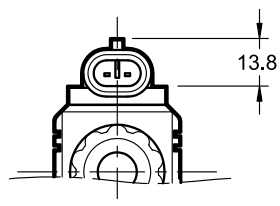
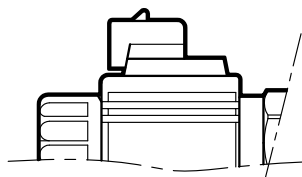
outgoing cable connections  
cable length = 1 mt  
code **K4**



connection for DEUTSCH DT04-2P  
for male connector type DEUTSCH DT06  
code **WK7**



connection for AMP SUPER SEAL  
(two contacts) connector type  
code **WK8**



## 11 - ELECTRIC CONNECTORS

Solenoid valves are delivered without connectors. Connectors type EN 175301-803 (ex DIN 43650) for K1 connection can be ordered separately. See catalogue 49 000.



# RPC1-\*/4M

## FLOW CONTROL VALVE

### SERIES 10

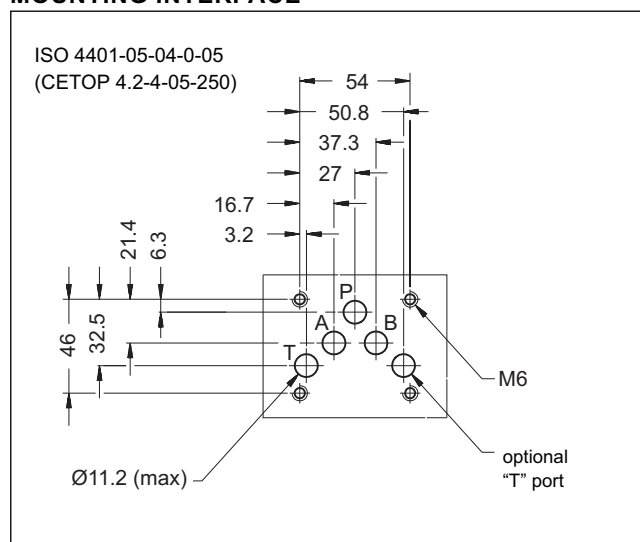
#### MODULAR VERSION

#### ISO 4401-05 (CETOP 05)

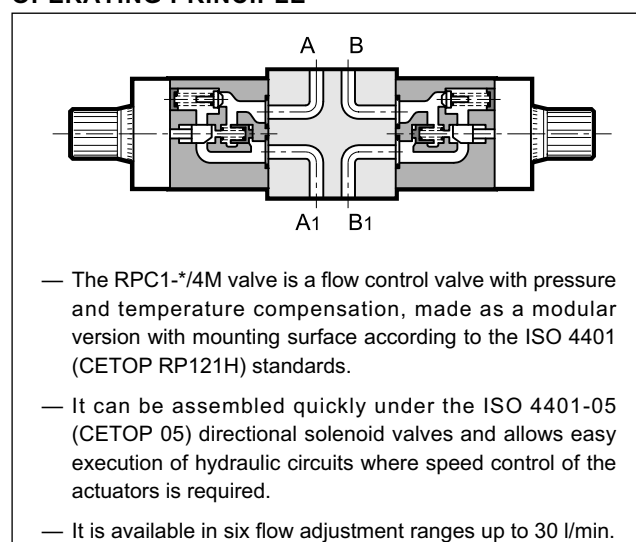
**p** max **250** bar

**Q** max (see table of performances)

#### MOUNTING INTERFACE



#### OPERATING PRINCIPLE

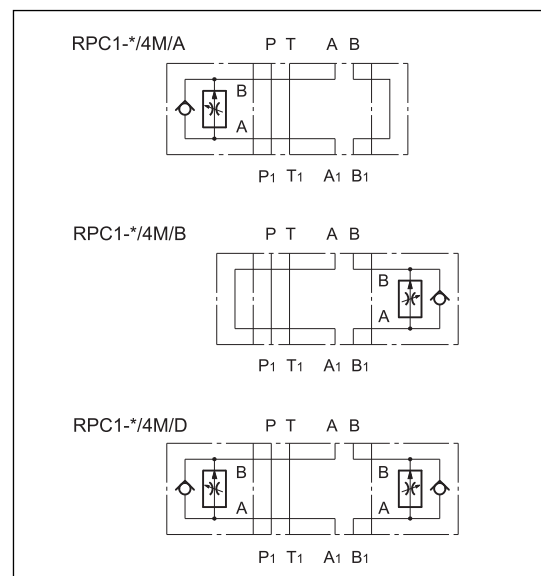


#### CONFIGURATIONS (see Hydraulic symbols table and Identification Code - par. 1)

#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate in controlled lines	l/min	1-4-10-16-22-30
Maximum flow rate in the free lines		100
Reverse free flow maximum flowrate		40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: RPC1-*/4M/ A-B	kg	4,3
RPC1-*/4M/ D		5,6
only modular block ISO 4401-05 without flow control valves: RPC1-K/4M/D		3

#### HYDRAULIC SYMBOLS



**NOTE:** for detailed information regarding the RPC1 flow control valve, see catalogue 32 200.





# RPC1\*/4M

## SERIES 10

### 1 - IDENTIFICATION CODE

<b>R</b>	<b>P</b>	<b>C</b>	<b>1</b>	<b>-</b>		<b>/</b>	<b>4</b>	<b>M</b>	<b>/</b>		<b>/</b>	<b>10</b>	<b>/</b>	
----------	----------	----------	----------	----------	--	----------	----------	----------	----------	--	----------	-----------	----------	--

Pressure and temperature compensated flow control valve

Flow adjustment range: \_\_\_\_\_

**1** = 1 l/min      **16** = 16 l/min  
**4** = 4 l/min      **22** = 22 l/min  
**10** = 10 l/min    **30** = 30 l/min  
**K** = only for ISO 4401-05 (CETOP 05) modular block supplied without flow control valves

Modular version \_\_\_\_\_  
ISO 4401-05 (CETOP 05) size

Seals: omit for mineral oils  
**V** = viton for special fluids

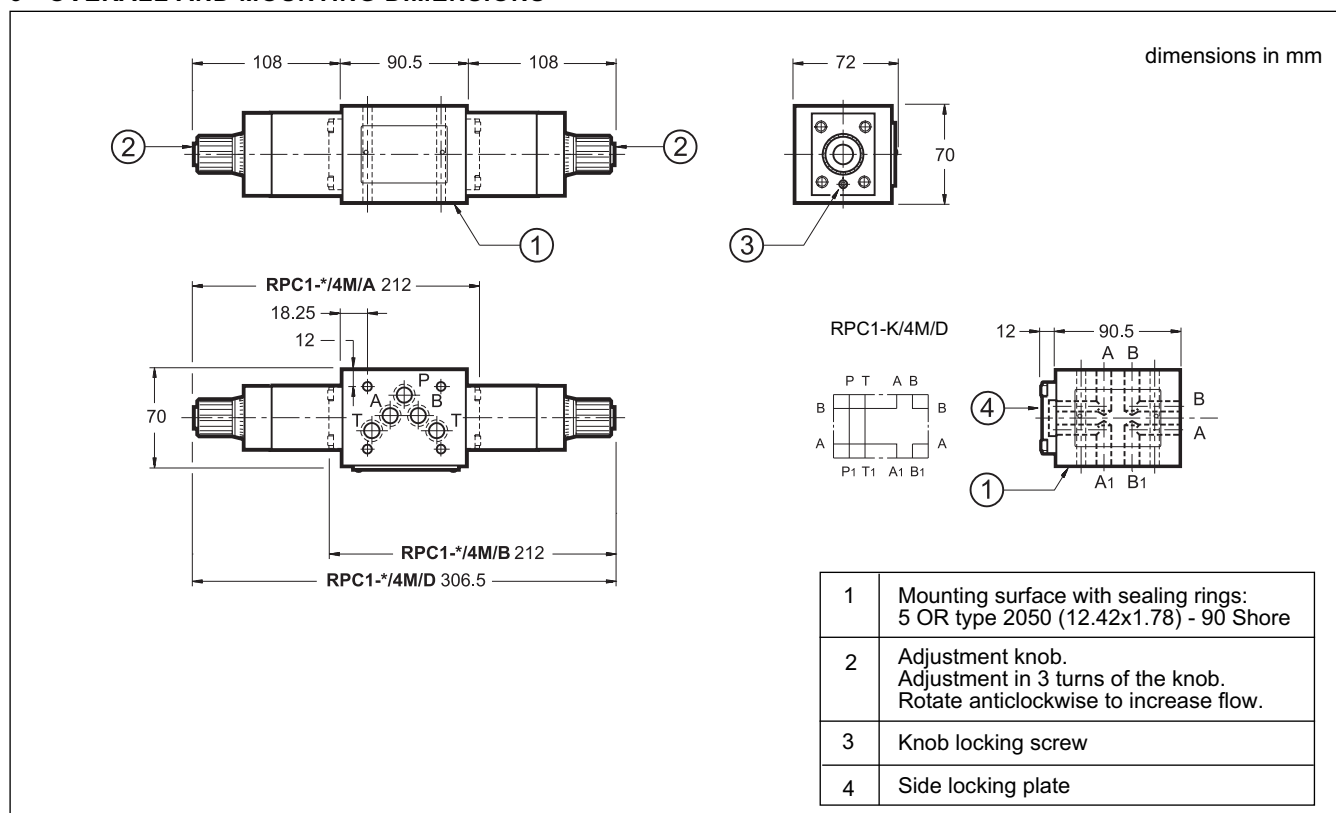
Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

**A** = control from chamber A of the actuator  
**B** = control from chamber B of the actuator  
**D** = control from chambers A and B of the actuator  
(A and B configurations are not available in K version)

### 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 3 - OVERALL AND MOUNTING DIMENSIONS



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# VSM3

## SHUTTLE VALVE

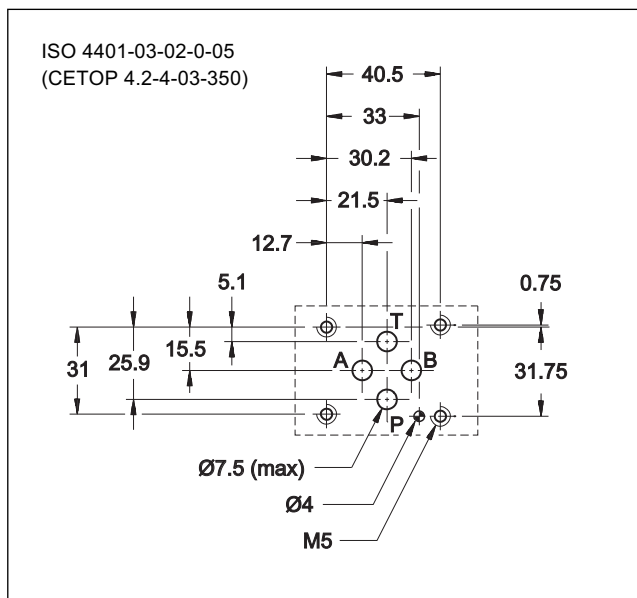
### SERIES 10

#### MODULAR VERSION

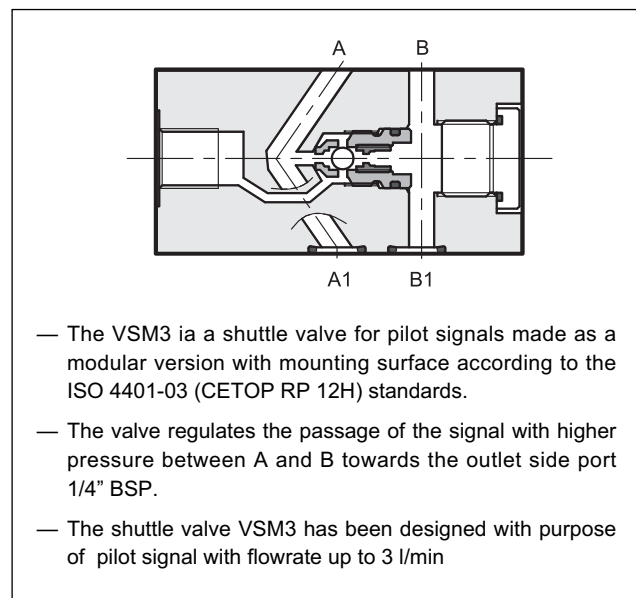
#### ISO 4401-03 (CETOP 03)

**p** max **350** bar  
**Q** max **40** l/min

#### MOUNTING SURFACE



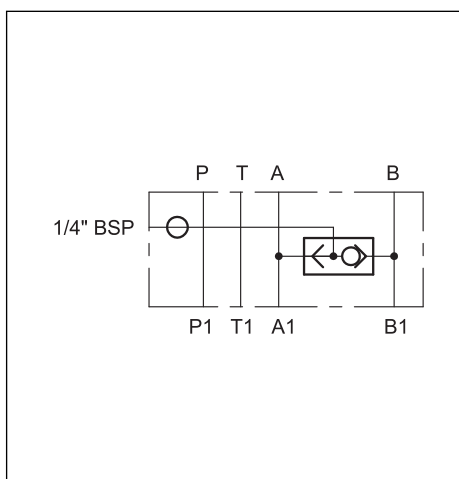
#### OPERATING PRINCIPLE



#### PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate through the cartridge	l/min	3
Maximum flow rate to A, B, P and T port	l/min	40
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,95

#### HYDRAULIC SYMBOL





### 1 - IDENTIFICATION CODE

V	S	M	3	/	10	
---	---	---	---	---	----	--

Shuttle valve \_\_\_\_\_

Modular version \_\_\_\_\_

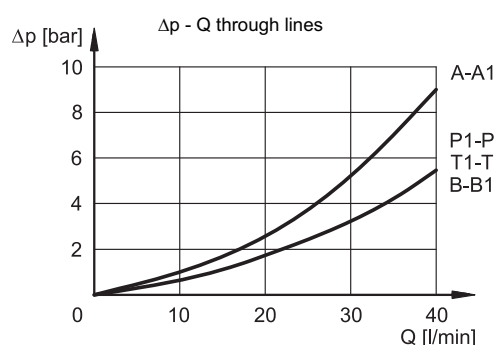
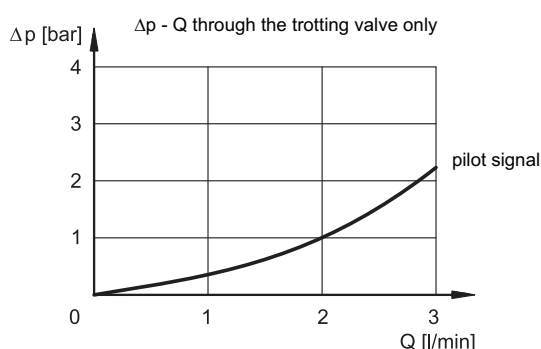
ISO 4401-03 (CETOP 03) size \_\_\_\_\_

Seals:  
**N** = Seals in NBR for mineral oils (**standard**)  
**V** = Seals in FPM for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

### 2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

#### PRESSURE DROPS $\Delta p$ - Q

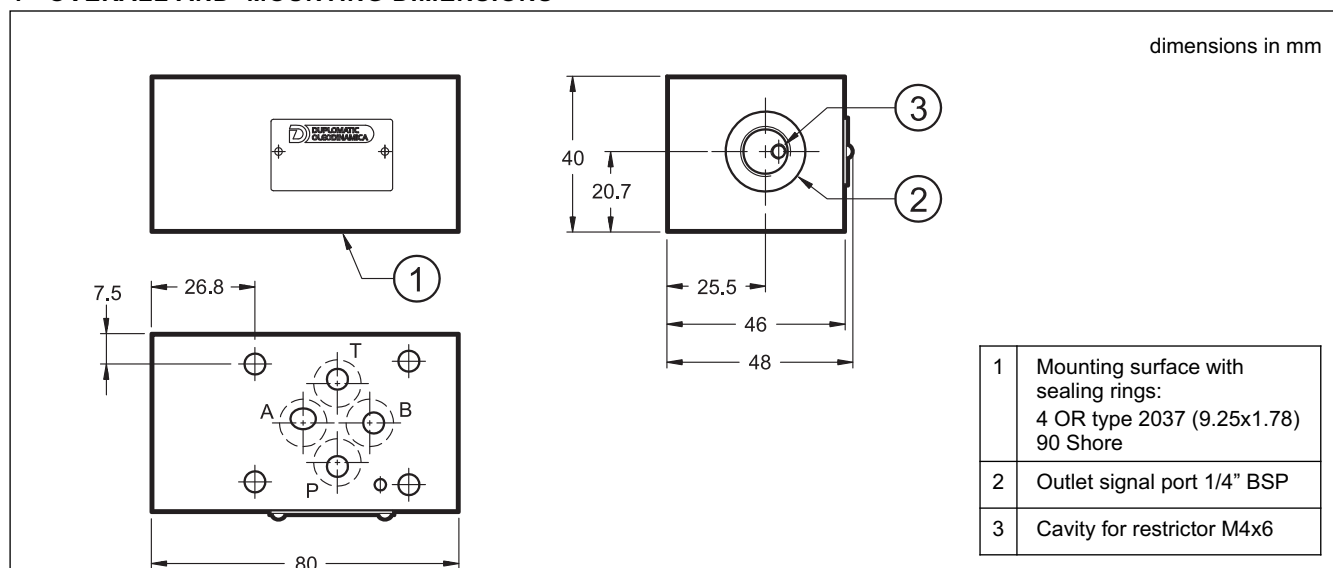


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



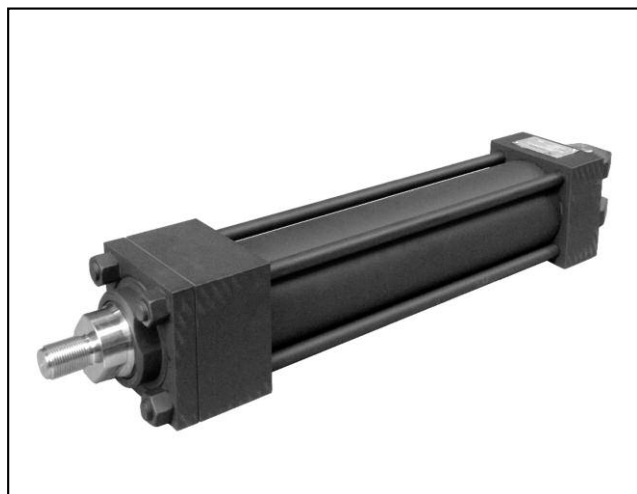
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# HC2

## HYDRAULIC CYLINDERS

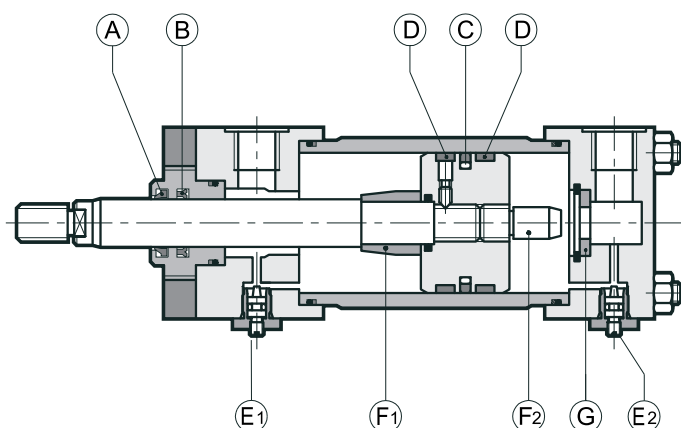
# HCK2

## HYDRAULIC CYLINDERS

**ATEX 2014/34/EU**  
**SERIES 20**

**ISO 6020-2**  
**DIN 24554**

### DESCRIPTION



- Double acting cylinders constructed in compliance with ISO 6020-2 and DIN 24554.
- The compact design of the square ends with tie rods plus the high quality material and seals render these cylinders highly reliable and therefore strongly recommended for all types of industrial applications.
- The cylinder is available with 14 different mounting styles as well as a vast range of accessories to meet all application requirements.

- A - scraper ring
- B - Piston rod seal
- C - Piston seal
- D - Guide rings
- E<sub>1</sub> - Front cushioning adjustment screw
- E<sub>2</sub> - Rear cushioning adjustment screw
- F<sub>1</sub> - Front cushion
- F<sub>2</sub> - Rear cushion
- G - Bushing

ATEX 2014/34/EU rated version for installation in potentially explosive atmospheres is now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified. The declaration of conformity to the up mentioned standards is always supplied with the cylinder. See paragraph 3 for details.

### PERFORMANCES

Nominal operating pressure (continuous service)	bar	160
Maximum operating pressure	bar	210
Peak pressure	bar	250
Maximum speed (standard)	m/s	0,5
Maximum stroke (standard)	mm	5000
Fluid temperature range (standard)	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15
Recommended viscosity	cSt	25
Security factor in relation with nominal pressure		≥ 4

## 1 - CHARACTERISTICS

### 1.1 Bores and piston rods

Ø 25 to Ø 200 mm bores are available to enable a vast choice according to required force.

Three piston rod diameters are available for each bore (with the exception of the Ø 25 mm bore, for which the intermediate piston rod is not available):

- standard piston rod with 1:1.25 area ratio
- intermediate piston rod with 1:1.45 area ratio
- oversized piston rod with 1:2 area ratio

### 1.2 Cushioning

On request, gradual and adjustable cushioning devices can be fitted in the front and/or rear ends of the cylinder without affecting overall dimensions.

The special design of the cushions ensures optimal repeatability also in the event of variations in fluid viscosity.

Cushioning devices are always recommended as they ensure impact-free stopping even at high speed thus reducing pressure surges and impact transferred to the mounting supports.

For all the available bores, cushioning is adjustable by means of a needle.

Rapid piston start-up is guaranteed by the bypass system located inside the front cushioning cone and rear cushioning ring.

The table below shows cushioning cone lengths:

Bore (mm)	25	32	40	50	63	80	100	125	160	200
Front cone length (mm)	17	17	28	28	28	28	30	30	38	45
Rear cone length (mm)	17	17	26	26	26	28	31	30	38	55

### 1.3 Connections

The cylinders are supplied as standard with cylindrical BSP threads and spot facing for seal rings in compliance with ISO 1179. Connections which are oversized compared to those shown in the dimensional tables are available upon request. For further information and for the order identification code, please consult our technical office.

For correct cylinder operation, fluid velocity must not exceed 5 m/s.

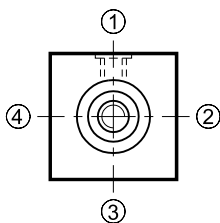
### 1.4 Connection position

Standard positions of the oil ports, cushioning adjustment screws, breathers and end-stroke proximity sensors are shown in the relevant diagram according to the mounting style.

Connection positions different from the standard can be provided upon request.

Other options positions will be rotated accordingly.

For special requests please consult our technical office.



Front view - piston rod side

### 1.5 Seals

The table below illustrates seal characteristics in relation to hydraulic fluid and operating temperatures.

Type	Seal type	Seal material	Hydraulic fluid	Minimum pressure [bar]	Operating pressure [°C]	Max speed [m/s]
K	Standard	nitrile polyurethane	mineral oil	10	-20 / +80	0,5
M	Low friction	nitrile PTFE	Mineral oil Water glycol	20 (note)	-20 / +80	15
V	high temperature and/or aggressive fluid	Viton PTFE	Special fluids	10	-20 / +150	1

**NOTE:** for lower pressure use consult our technical office

### 1.6 Strokes

Standard cylinders are available with strokes up to 6000 mm. Longer cylinder strokes can be supplied on request.

Stroke tolerances are:

- 0 + 1 mm for strokes up to 1000 mm
- 0 + 4 mm for strokes up to 6000 mm

### 1.7 Spacers

If the cylinder stroke exceeds 1000 mm we recommend the use of spacers which can be inserted to reduce loads on the piston rod bushing and prevent the piston from sticking.

Spacers are constructed in hardened and tempered steel with PTFE facing. Every spacer is 50 mm long.

We recommend to insert n° 1 spacer for strokes from 1001 to 1500 mm, with an increment of n° 1 spacer for every 500 mm stroke. Remember that the overall length of the cylinder increases according to the number of inserted spacers (50 mm for each spacer).

### 1.8 Tie rod tightening torque

If cylinder has been disassembled, re-assemble it and tighten the tie rod lock nuts cross-wise applying a gradual torque up to the value indicated in the table below. The values below refer to dry threads.

Bore [mm]	25	32	40	50	63	80	100	125	160	200
Tie rod	<b>M5</b> x0.8	<b>M6</b> x1	<b>M8</b> x1	<b>M12</b> x12.5	<b>M12</b> x12.5	<b>M16</b> x1.5	<b>M16</b> x1.5	<b>M22</b> x1.5	<b>M27</b> x2	<b>M30</b> x2
Torque [Nm]	5	9	20	70	70	160	160	450	820	1150

### 1.9 Breathers

On request cylinder ends can be supplied with breathers for the elimination of air. This is necessary when the entire stroke is not used or when connections are not facing upwards.

### 1.10 Surface finish

Standard cylinders are supplied painted with Duplomatic black opaque colour with a paint thickness of 40µ. The rod is chromed.

MOUNTING STYLES																														
F = front-end T = rear end	A		B		C		D		E		F		G		H		L		N		P		Q		R		T		U	
	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F
Connections	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		2	2		2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Cushioning	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		2	2		2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	*3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Breathers	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	*3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
end-stroke proximity sensors		1	1		1	1	1	1	1	1				1	1	1	1	1			1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Positions indicated in bold style are relevant to the standard, the others to the available options.

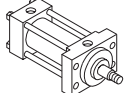
### 2 - IDENTIFICATION CODE

**K** = Explosion-proof version according to ATEX 2014/34/EU (paragraph 3). Omit if not required.

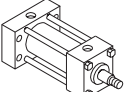
HC	2	-	/	/	-	-	-	-	/	/	20
----	---	---	---	---	---	---	---	---	---	---	----

#### MOUNTING STYLE

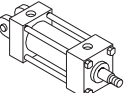
**A** = Front flange (ME5)



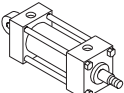
**B** = Rear flange (ME6)



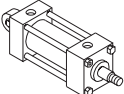
**C** = Female clevis (MP1)



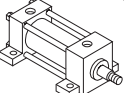
**D** = Male clevis (MP3)



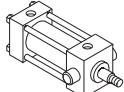
**F** = Spheric swivel (MP5)



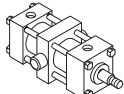
**G** = Feet (MS2)



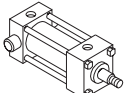
**H** = Front swinging (MT1)



**L** = Mid swinging (MT4)



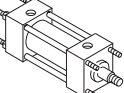
**N** = Rear swinging (MT2)



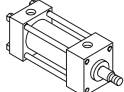
**P** = Front tie rods (MX3)

**Q** = Back tie rods (MX2)

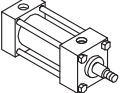
**R** = Front and back tie rods (MX1)



**T** = Front threaded holes (MX5)



**U** = Back threaded holes (MX6)



Series  
(put for  
spare parts  
requests)

Dimension XV for  
"L" mounting  
(omit for other  
mounting styles)

N° of spacers multiple of  
50 mm (omit if not required)  
see par. 1.7

Rear end connection position (1-4)  
(see paragraph 1.4)

Front end connection position (1-4)  
(see paragraph 1.4)

Breathers (see paragraph 1.9)

**0** = without breathers

**S** = front and back breathers

Cushioning (see paragraph 1.2):

**0** = without cushioning

**1** = front

**2** = back

**3** = front and back

Seals (see par. 1.5):

**K** = standard (nitrile + polyurethane)

**M** = low friction (nitrile + PTFE)

**V** = high temperature (viton + PTFE)

Stroke (mm) - (For cylinders with spacers indicate the working stroke)

Double rod threading (omit if not required)

See single rod for type and dimensions

Double rod (omit if not required)

See single rod for dimensions.

Not available with mounting style B - C - D - F - N - Q - U

Rod threading: Male thread (**standard**)

**W** = Female thread

**X** = Light male thread

**Y** = Light female thread (see paragraph 4)

Ø Rod (mm)	Rods available for each bore									
12	•									
14		•								
18	•	•	•							
22		•	•	•						
28			•	•	•					
36				•	•	•				
45					•	•	•			
56						•	•	•		
70							•	•	•	
90								•	•	•
110									•	•
140										•
Bore (mm)	25	32	40	50	63	80	100	125	160	200

### 3 - ATEX 2014/34/EU RATED VERSION

ATEX 2014/34/EU rated version cylinders for installation in potentially explosive atmospheres are now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified.

The supply is always delivered accompanied by:

- the ATEX declaration of conformity
- the operating and maintenance user manual, where are described all the information for the proper use of cylinders in potentially explosive environments.

TYPE EXAMINATION CERTIFICATE N°: **CEC 10 ATEX 138**

#### 3.1 - Identification code

To order the ATEX-rated version, simply insert the letter K in the initial part of the identification code. The description becomes HCK2-\*

For cylinders without end-stroke proximity sensors please order with the identification code shown at paragraph 2.

Example: HCK2C-200/90-500-K3-S-11/20

For cylinders equipped with end-stroke proximity sensors please refer to the identification code shown at paragraph 22.1.

Example: HCK2F-FP22-80/56-200-K3-S-11/20

The ATEX-rated cylinders equipped with end-stroke proximity sensors are compliant with the specifications listed paragraph 22; Also the same limitations described in that paragraph are effective. (NB: for bores Ø160 and Ø200 contact our technical department).

The proximity sensors are compliant with the description and the wiring diagram shown at the paragraph 22.2.

#### 3.2 - Classification

Cylinders without end-stroke proximity sensors have this ATEX mark:

II 2GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/EU directive and related technical specification requests.

II: Group II for surface plants

2: Category 2 high protection, eligible for zone 1 for gases and zone 21 for dust (automatically be eligible for zone 2 category 3 for gases and zone 22 for dust)

GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.

ck: protection by constructional safety and by liquid immersion

IIC: Gas group

(automatically eligible for group IIA and IIB)

T4: Temperature class for gas (max surface temperature)

-20°C Ta +80°C: Ambient temperature range

Cylinders with end-stroke proximity sensors have this ATEX mark:

II 3GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/EU directive and related technical specification requests

II: Group II for surface plants

3: Category 3 standard protection, eligible for zone 2 for gases (zone 22 for dust)

GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.

ck: protection by constructional safety and by liquid immersion

IIC: Gas group

(automatically eligible for group IIA and IIB)

T4: Temperature class for gas (max surface temperature)

-20°C Ta +80°C: Ambient temperature range

#### 3.3 - Operating temperatures

The operating ambient temperature must be between -20°C and +80 °C.

The fluid temperature for the standard version seals (K) and for low friction seals (M) must be between -20°C and +80°C, as for viton (V) seals must be between -20°C and +120 °C.

The actuators are T4 (T135° C) class temperature classified, so they are eligible for operation also at higher class temperature (T3, T2, T1 (T200° C).

#### 3.4 - Admitted velocities

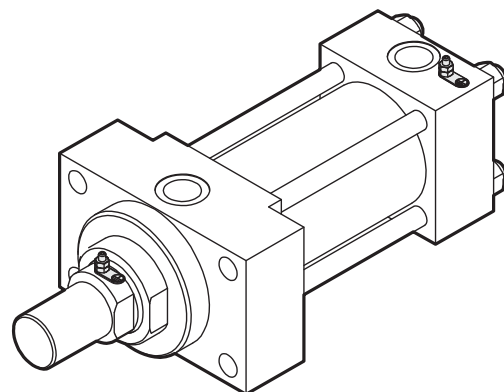
The maximum permissible speed is 0.5 m/s for standard cylinder seals (K) and 1 m/s for actuators with low friction seals (M) or Viton (V).

#### 3.5 - Connectors

The connectors for the end-stroke proximity are available upon request. They are metal, to be wired. The ordering code is **0680961**. One connector per sensor is needed.

#### 3.6 - Grounding points

The ATEX certified actuators are supplied with two grounding points, one on the rear head and one on the rod, for the wire of the cylinder with the ground (M4 screws).

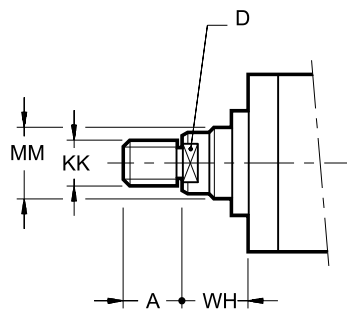


The bottom grounding point must always be connected whereas the connection of the rod grounding point can be avoided in case the whole mechanical stroke is covered during the cylinder operating phase (from the mechanical stop on the cylinder head to the mechanical stop on the bottom), or in case the rod has already been grounded through the mechanical connection between the rod itself and the machine/plan it is installed on.

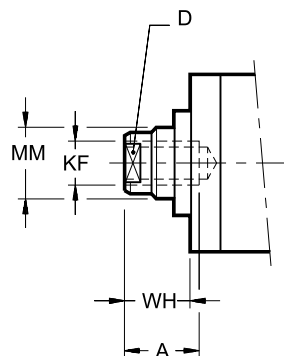
In order to verify such a condition it is necessary to test the equipotentiality of the parts and a maximum resistance equal to 100Ω as per the EN13463-1 norm.

## 4 - OVERALL AND MOUNTING DIMENSIONS

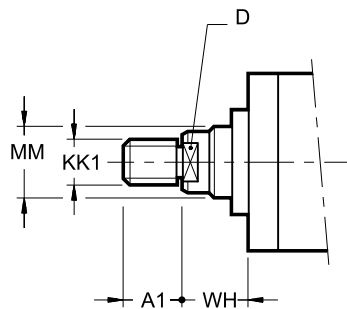
Standard = male thread



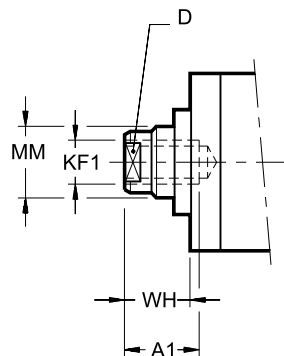
W = female thread



X = light male thread



Y = light female thread



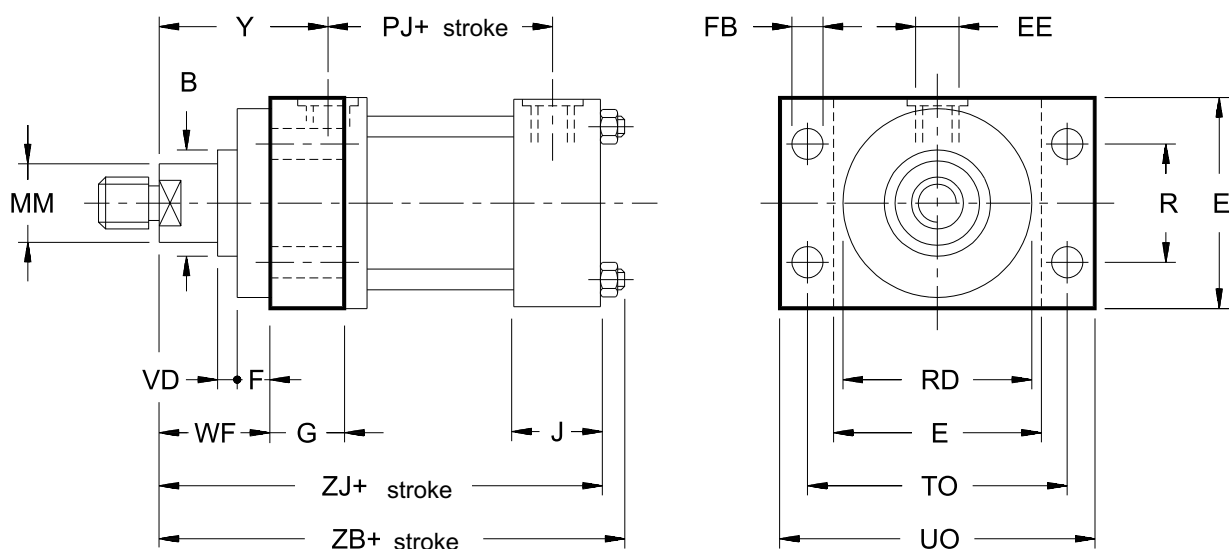
Dimensions in mm

Bore	MM Ø rod	KK	KK1	KF	KF1	A	A1	D	WH
25	12	M10x1.25	-	M8x1	-	14	-	9	15
	18	M14x1.5	M10x1.25	M12x1.25	M8x1	18	14	14	
32	14	M12x1.25	-	M10x1.25	-	16	-	11	25
	18	M14x1.5	M10x1.25	M12x1.25	M8x1	18	14	14	
	22	M16x1.5	M12x1.25	M16x1.5	M10x1.25	22	16	17	
40	18	M14x1.5	M10x1.25	M12x1.25	M8x1	18	14	14	25
	22	M16x1.5	M12x1.25	M16x1.5	M10x1.25	22	16	17	
	28	M20x1.5	M14x1.5	M20x1.5	M12x1.25	28	18	22	
50	22	M16x1.5	M12x1.25	M16x1.5	M10x1.25	22	16	17	26
	28	M20x1.5	M14x1.25	M20x1.5	M12x1.25	28	18	22	
	36	M27x2	M16x1.5	M27x2	M16x1.5	36	22	30	
63	28	M20x1.5	M14x1.5	M20x1.5	M12x1.25	28	18	22	33
	36	M27x2	M16x1.5	M27x2	M16x1.5	36	22	30	
	45	M33x2	M20x1.5	M33x2	M20x1.5	45	28	36	
80	36	M27x2	M16x1.5	M27x2	M16x1.5	36	22	30	31
	45	M33x2	M20x1.5	M33x2	M20x1.5	45	28	36	
	56	M42x2	M27x2	M42x2	M27x2	56	36	50	
100	45	M33x2	M20x1.5	M33x2	M20x1.5	45	28	36	35
	56	M42x2	M27x2	M42x2	M27x2	56	36	50	
	70	M48x2	M33x2	M48x2	M33x2	63	45	60	
125	56	M42x2	M27x2	M42x2	M27x2	56	36	50	35
	70	M48x2	M33x2	M48x2	M33x2	63	45	60	
	90	M64x3	M42x2	M64x3	M42x2	85	56	80	
160	70	M48x2	M33x2	M48x2	M33x2	63	45	60	32
	90	M64x3	M42x2	M64x3	M42x2	85	56	80	
	110	M80x3	M48x2	M80x3	M48x2	95	63	100	
200	90	M64x3	M42x2	M64x3	M42x2	85	56	80	32
	110	M80x3	M48x2	M80x3	M48x2	95	63	100	
	140	M100x3	M64x3	M100x3	M64x3	112	85	130	



### 5 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN ME5

#### A FRONT FLANGE



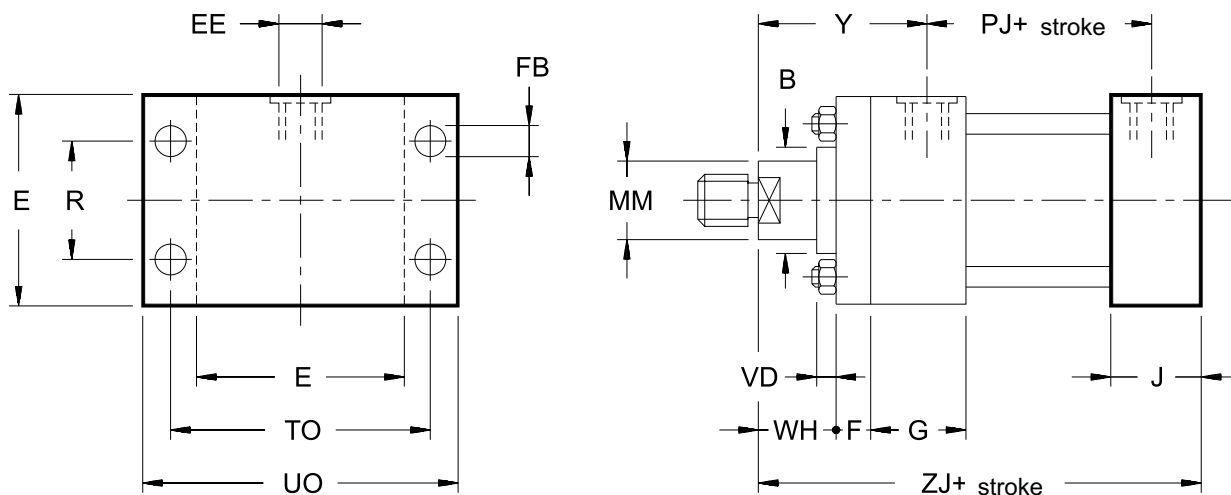
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	ØFB	G	J	PJ	R	ØRD f8	TO	UO max	VD	WF	Y	ZB	ZJ
25	12 18	24 30	40 note	1/4"	10	5.5	35	35	54	27	38	51	65	6	25	50	121	114
32	14 18 22	26 30 34	45 note	1/4"	10	6.6	36	36	57	33	42	58	70	12 6 12	35	60	137	128
40	18 22 28	30 34 42	63	3/8"	10	11	45	45	74	41	62	87	110	6 12 10	35	62	166	153
50	22 28 36	34 42 50	75	1/2"	16	14	45	45	76	52	74	105	130	7 7 10	41	68	176	159
63	28 36 45	42 50 60	90	1/2"	16	14	45	45	80	65	75 88 88	117	145	7 10 14	48	71	185	168
80	36 45 56	50 60 72	115	3/4"	20	18	50	52	93	83	82 105 105	149	180	5 9 9	51	77	212	190
100	45 56 70	60 72 88	130	3/4"	22	18	50	55	101	97	92 125 125	162	200	7 7 10	57	82	225	203
125	56 70 90	72 88 108	165	1"	22	22	55	71	117	126	105 150 150	208	250	7 10 10	57	86	260	232
160	70 90 110	88 108 133	205	1"	25	26	63	63	130	155	125 170 170	253	300	7	57	86	279	245
200	90 110 140	108 133 163	245	1.1/4"	25	33	80	80	165	190	150 210 210	300	360	7	57	98	336	299

## 6 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN ME6

### B REAR FLANGE



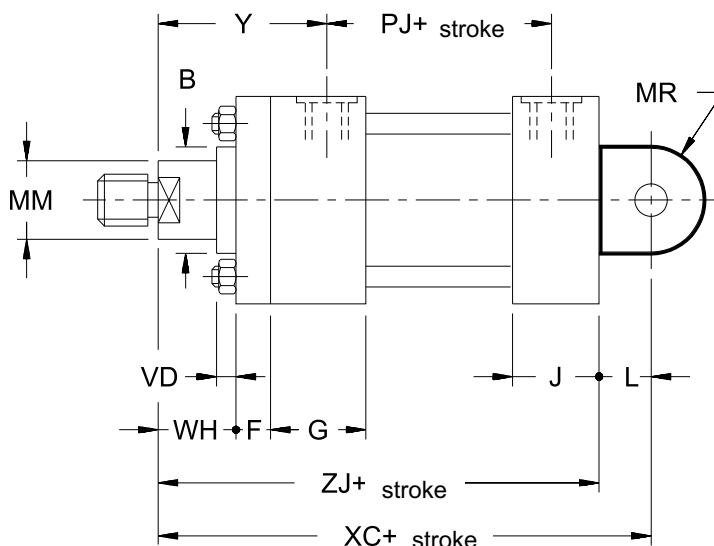
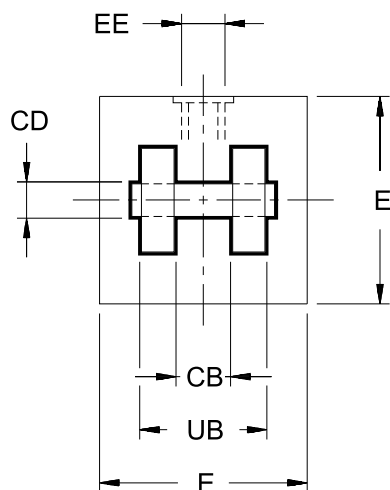
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	ØFB	G	J	PJ	R	TO	UO max	VD	WH	Y	ZJ
<b>25</b>	12 18	24 30	40 note	1/4"	10	5.5	45	35	54	27	51	65	6	15	50	114
<b>32</b>	14 18 22	26 30 34	45 note	1/4"	10	6.6	45	36	57	33	58	70	12 6 12	25	60	128
<b>40</b>	18 22 28	30 34 42	63	3/8"	10	11	55	45	74	41	87	110	6 12 10	25	62	153
<b>50</b>	22 28 36	34 42 50	75	1/2"	15	14	55	45	76	52	105	130	7 7 10	26	68	159
<b>63</b>	28 36 45	42 50 60	90	1/2"	15	14	55	45	80	65	117	145	7 10 14	33	71	168
<b>80</b>	36 45 56	50 60 72	115	3/4"	20	18	65	52	93	83	149	180	5 9 9	31	77	190
<b>100</b>	45 56 70	60 72 88	130	3/4"	22	18	69	55	101	97	162	200	7 7 10	35	82	203
<b>125</b>	56 70 90	72 88 108	165	1"	22	22	78	71	117	126	208	250	7 10 10	35	86	232
<b>160</b>	70 90 110	88 108 133	205	1"	25	26	86	63	130	155	253	300	7	32	86	245
<b>200</b>	90 110 140	108 133 163	245	1.1/4"	25	33	103	80	165	190	300	360	7	32	98	299

### 7 - OVERALL AND MOUNTING DIMENSIONS ISO MP1

#### C FEMALE CLEVIS (with PIN and spring retainers)



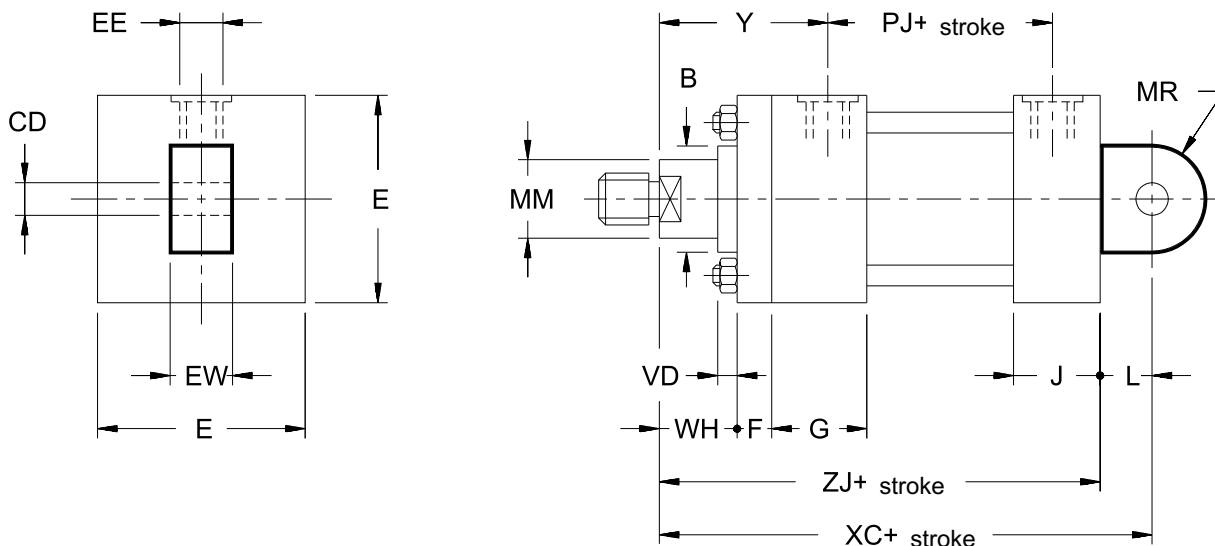
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	CB A16	ØCD f8	E max	EE BSP	F	G	J	L	MR	PJ	UB	VD	WH	XC	Y	ZJ
25	12 18	24 30	12	10	40 note	1/4"	10	45	35	13	12	54	24	6	15	127	50	114
32	14 18 22	26 30 34	16	12	45 note	1/4"	10	45	36	19	17	57	32	12 6 12	25	147	60	128
40	18 22 28	30 34 42	20	14	63	3/8"	10	55	45	19	17	74	40	6 12 10	25	172	62	153
50	22 28 36	34 42 50	30	20	75	1/2"	15	55	45	32	29	76	60	7 7 10	26	191	68	159
63	28 36 45	42 50 60	30	20	90	1/2"	15	55	45	32	29	80	60	7 10 14	33	200	71	168
80	36 45 56	50 60 72	40	28	115	3/4"	20	65	52	39	34	93	80	5 9 9	31	229	77	190
100	45 56 70	60 72 88	50	36	130	3/4"	22	69	55	54	50	101	100	7 7 10	35	257	82	203
125	56 70 90	72 88 108	60	45	165	1"	22	78	71	57	53	117	120	7 10 10	35	289	86	232
160	70 90 110	88 108 133	70	56	205	1"	25	86	63	63	59	130	140	7	32	308	86	245
200	90 110 140	108 133 163	80	70	245	1.1/4"	25	103	80	82	78	165	160	7	32	381	98	299

### 8 - OVERALL AND MOUNTING DIMENSIONS ISO MP3

#### D MALE CLEVIS



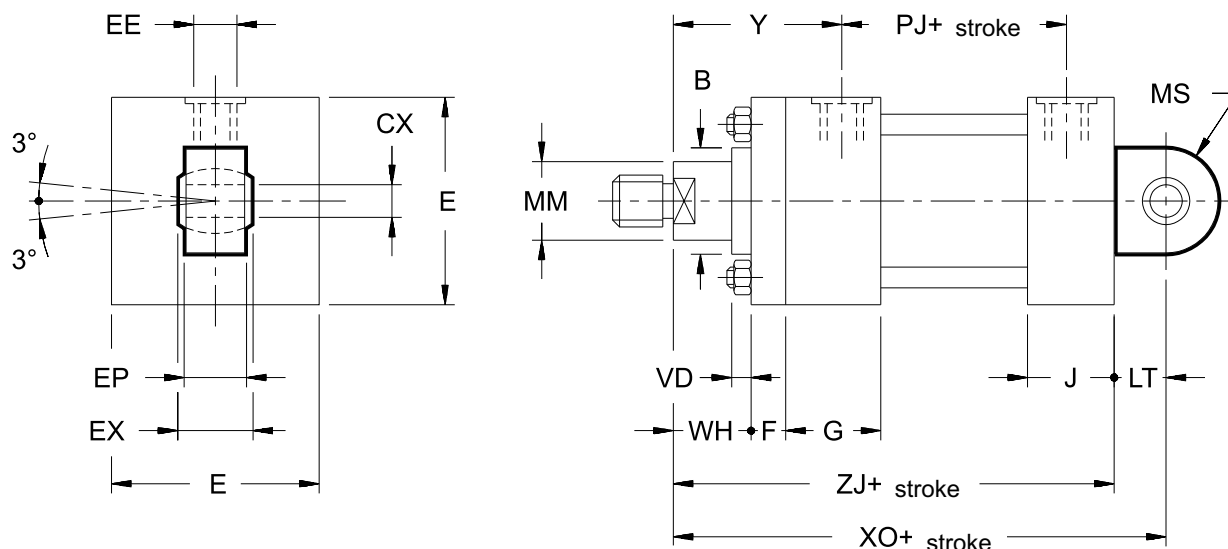
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	ØCD H9	E max	EE BSP	EW h9	F	G	J	L	MR	PJ	VD	WH	XC	Y	ZJ
25	12 18	24 30	10	40 note	1/4"	12	10	45	35	13	12	54	6	15	127	50	114
32	14 18 22	26 30 34	12	45 note	1/4"	16	10	45	36	19	17	57	12 6 12	25	147	60	128
40	18 22 28	30 34 42	14	63	3/8"	20	10	55	45	19	17	74	6 12 10	25	172	62	153
50	22 28 36	34 42 50	20	75	1/2"	30	15	55	45	32	29	76	7 7 10	26	191	68	159
63	28 36 45	42 50 60	20	90	1/2"	30	15	55	45	32	29	80	7 10 14	33	200	71	168
80	36 45 56	50 60 72	28	115	3/4"	40	20	65	52	39	34	93	5 9 9	31	229	77	190
100	45 56 70	60 72 88	36	130	3/4"	50	22	69	55	54	50	101	7 7 10	35	257	82	203
125	56 70 90	72 88 108	45	165	1"	60	22	78	71	57	53	117	7 10 10	35	289	86	232
160	70 90 110	88 108 133	56	205	1"	70	25	86	63	63	59	130	7	32	308	86	245
200	90 110 140	108 133 163	70	245	1.1/4"	80	25	103	80	82	78	165	7	32	381	98	299

## 9 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN MP5

### F SPHERIC SWIVEL

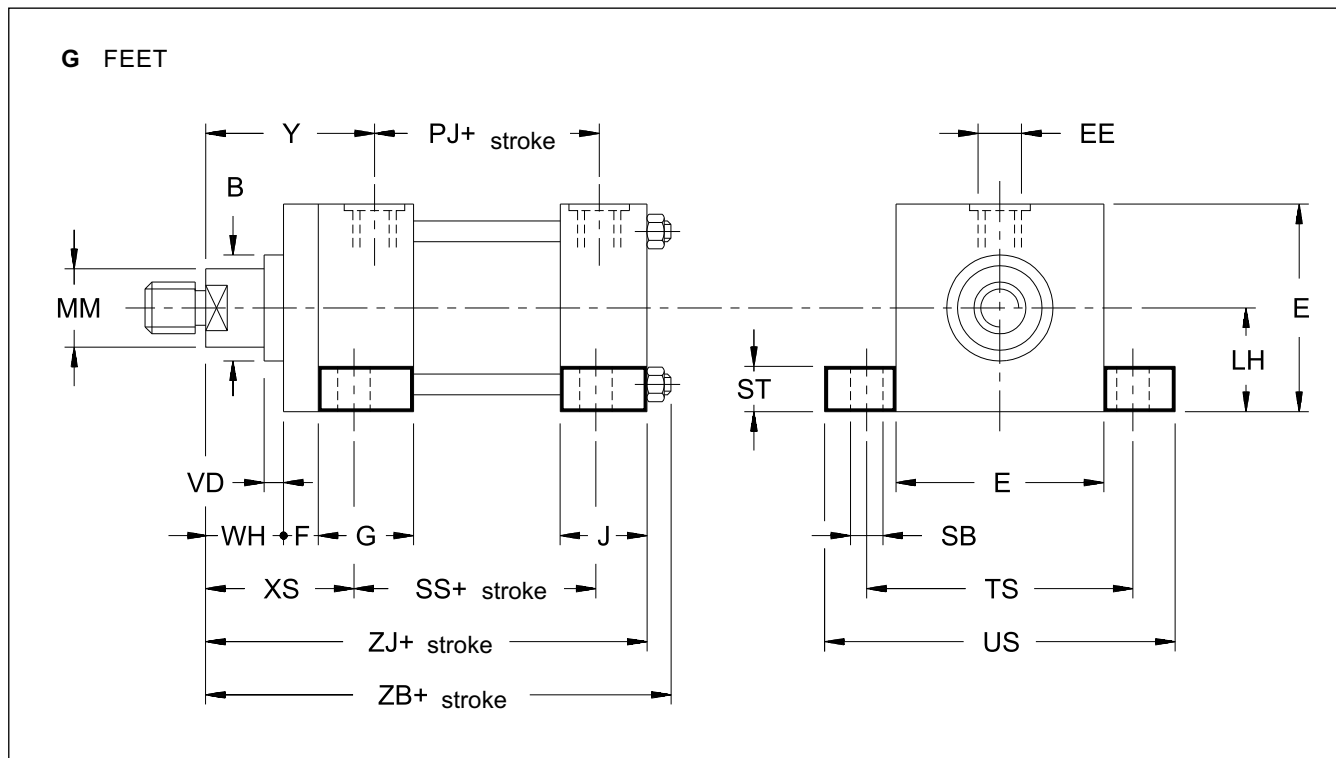


**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	ØCX	E max	EE BSP	EP	EX	F	G	J	LT	MS	PJ	VD	WH	XO	Y	ZJ
25	12 18	24 30	12 <sup>0</sup> <sub>-0.008</sub>	40 note	1/4"	8	10 <sup>0</sup> <sub>-0.12</sub>	10	45	35	16	20	54	6	15	130	50	114
32	14 18 22	26 30 34	16 <sup>0</sup> <sub>-0.008</sub>	45 note	1/4"	11	14 <sup>0</sup> <sub>-0.12</sub>	10	45	36	20	22	57	12 6 12	25	148	60	128
40	18 22 28	30 34 42	20 <sup>0</sup> <sub>-0.012</sub>	63	3/8"	13	16 <sup>0</sup> <sub>-0.12</sub>	10	55	45	25	29	74	6 12 10	25	178	62	153
50	22 28 36	34 42 50	25 <sup>0</sup> <sub>-0.012</sub>	75	1/2"	17	20 <sup>0</sup> <sub>-0.12</sub>	15	55	45	31	33	76	7 7 10	26	190	68	159
63	28 36 45	42 50 60	30 <sup>0</sup> <sub>-0.012</sub>	90	1/2"	19	22 <sup>0</sup> <sub>-0.12</sub>	15	55	45	38	40	80	7 10 14	33	206	71	168
80	36 45 56	50 60 72	40 <sup>0</sup> <sub>-0.012</sub>	115	3/4"	23	28 <sup>0</sup> <sub>-0.12</sub>	20	65	52	48	50	93	5 9 9	31	238	77	190
100	45 56 70	60 72 88	50 <sup>0</sup> <sub>-0.012</sub>	130	3/4"	30	35 <sup>0</sup> <sub>-0.12</sub>	22	69	55	58	62	101	7 7 10	35	261	82	203
125	56 70 90	72 88 108	60 <sup>0</sup> <sub>-0.015</sub>	165	1"	38	44 <sup>0</sup> <sub>-0.15</sub>	22	78	71	72	80	117	7 10 10	35	304	86	232
160	70 90 110	88 108 133	80 <sup>0</sup> <sub>-0.015</sub>	205	1"	47	55 <sup>0</sup> <sub>-0.15</sub>	25	86	63	92	100	130	7	32	337	86	245
200	90 110 140	108 133 163	100 <sup>0</sup> <sub>-0.020</sub>	245	1.1/4"	57	70 <sup>0</sup> <sub>-0.20</sub>	25	103	80	116	120	165	7	32	415	98	299

## 10 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN MS2



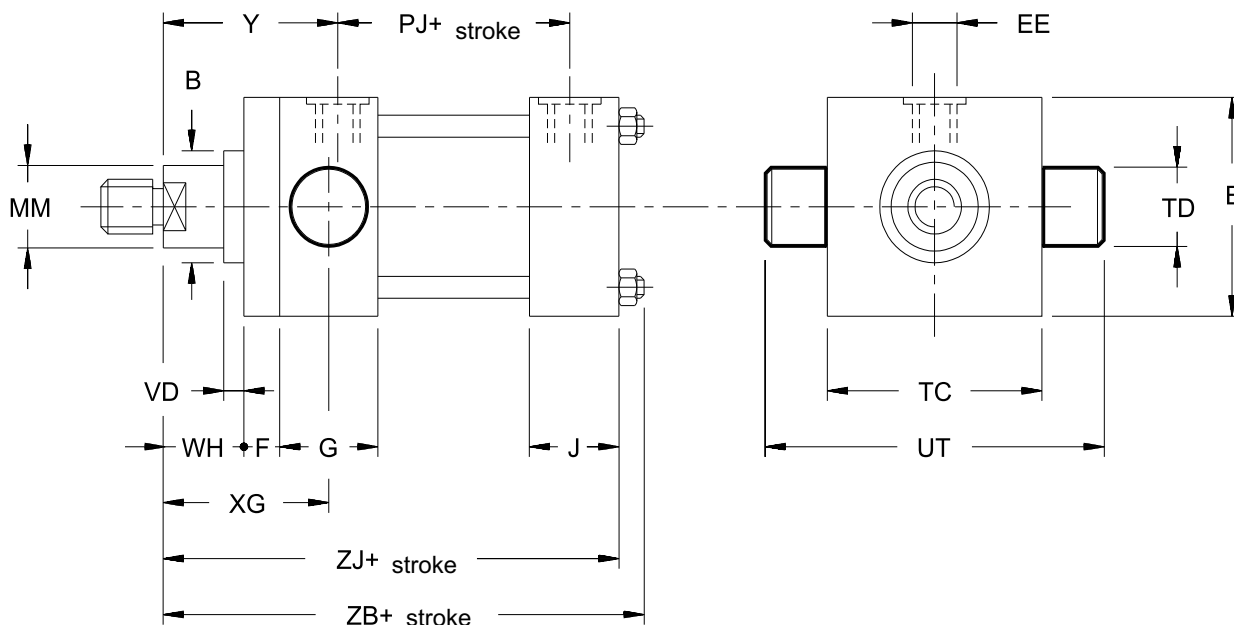
**NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).**

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	G	J	LH h10	PJ	ØSB	SS	ST	TS	US max	VD	WH	XS	Y	ZB	ZJ
<b>25</b>	12 18	24 30	40 note	1/4"	10	45	35	19	54	6.6	73	8.5	54	72	6	15	33	50	121	114
<b>32</b>	14 18 22	26 30 34	45 note	1/4"	10	45	36	22	57	9	73	12.5	63	84	12 6 12	25	45	60	137	128
<b>40</b>	18 22 28	30 34 42	63	3/8"	10	55	45	31	74	11	98	12.5	83	103	6 12 10	25	45	62	166	153
<b>50</b>	22 28 36	34 42 50	75	1/2"	15	55	45	37	76	14	92	19	102	127	7 7 10	26	54	68	176	159
<b>63</b>	28 36 45	42 50 60	90	1/2"	15	55	45	44	80	18	86	26	124	161	7 10 14	33	65	71	185	168
<b>80</b>	36 45 56	50 60 72	115	3/4"	20	65	52	57	93	18	105	26	149	186	5 9 9	31	68	77	212	190
<b>100</b>	45 56 70	60 72 88	130	3/4"	22	69	55	63	101	26	102	32	172	216	7 7 10	35	79	82	225	203
<b>125</b>	56 70 90	72 88 108	165	1"	22	78	71	82	117	26	131	32	210	254	7 10 10	35	79	86	260	232
<b>160</b>	70 90 110	88 108 133	205	1"	25	86	63	101	130	33	130	38	260	318	7	32	86	86	279	245
<b>200</b>	90 110 140	108 133 163	245	1.1/4"	25	103	80	122	165	39	172	44	311	381	7	32	92	98	336	299

### 11 - OVERALL AND MOUNTING DIMENSIONS ISO MT1

#### H FRONT SWINGING



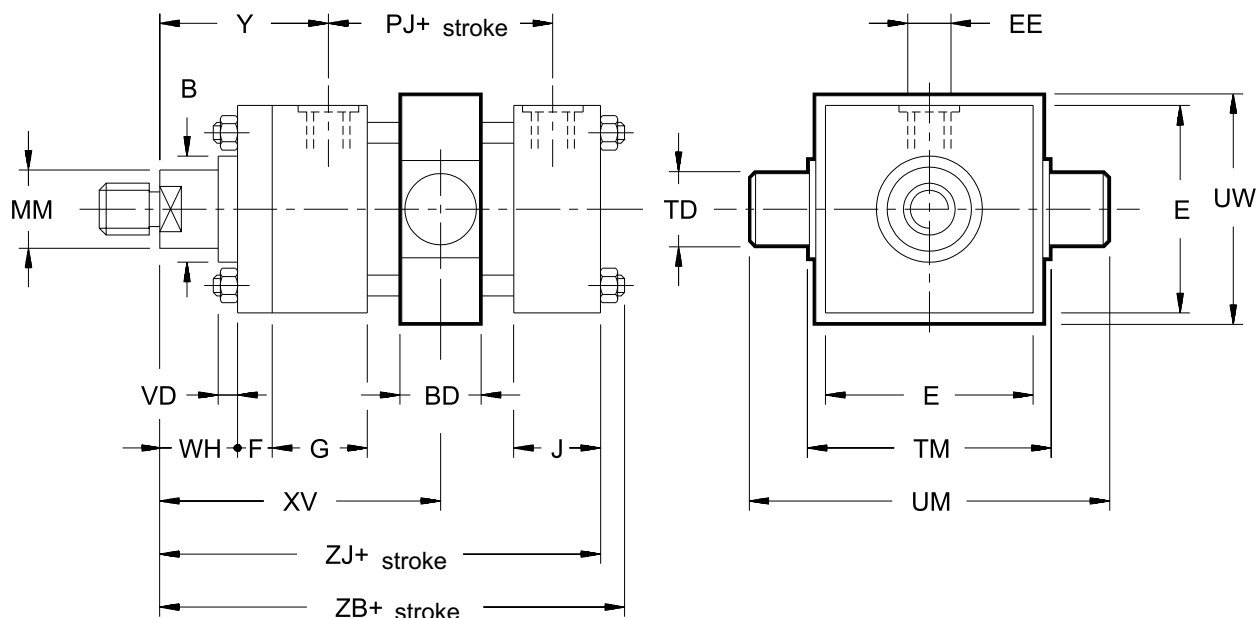
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	G	J	PJ	ØTD f8	TC	UT	VD	WH	XG	Y	ZB	ZJ
25	12 18	24 30	40 note	1/4"	10	45	35	54	12	38	58	6	15	44	50	121	114
32	14 18 22	26 30 34	45 note	1/4"	10	45	36	57	16	44	68	12 6 12	25	54	60	137	128
40	18 22 28	30 34 42	63	3/8"	10	55	45	74	20	63	95	6 12 10	25	57	62	166	153
50	22 28 36	34 42 50	75	1/2"	15	55	45	76	25	76	116	7 7 10	26	64	68	176	159
63	28 36 45	42 50 60	90	1/2"	15	55	45	80	32	89	139	7 10 14	33	70	71	185	168
80	36 45 56	50 60 72	115	3/4"	20	65	52	93	40	114	178	5 9 9	31	76	77	212	190
100	45 56 70	60 72 88	130	3/4"	-	91	55	101	50	127	207	7 7 10	35	71	82	225	203
125	56 70 90	72 88 108	165	1"	-	100	71	117	63	165	265	7 10 10	35	75	86	260	232
160	70 90 110	88 108 133	205	1"	-	111	63	130	80	203	329	7	32	75	86	279	245
200	90 110 140	108 133 163	245	1.1/4"	-	128	80	165	100	241	401	7	32	85	98	336	299

### 12 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN MT4

#### L MID SWINGING



**NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).**

\* dimension to be defined in the order (see par. 2)

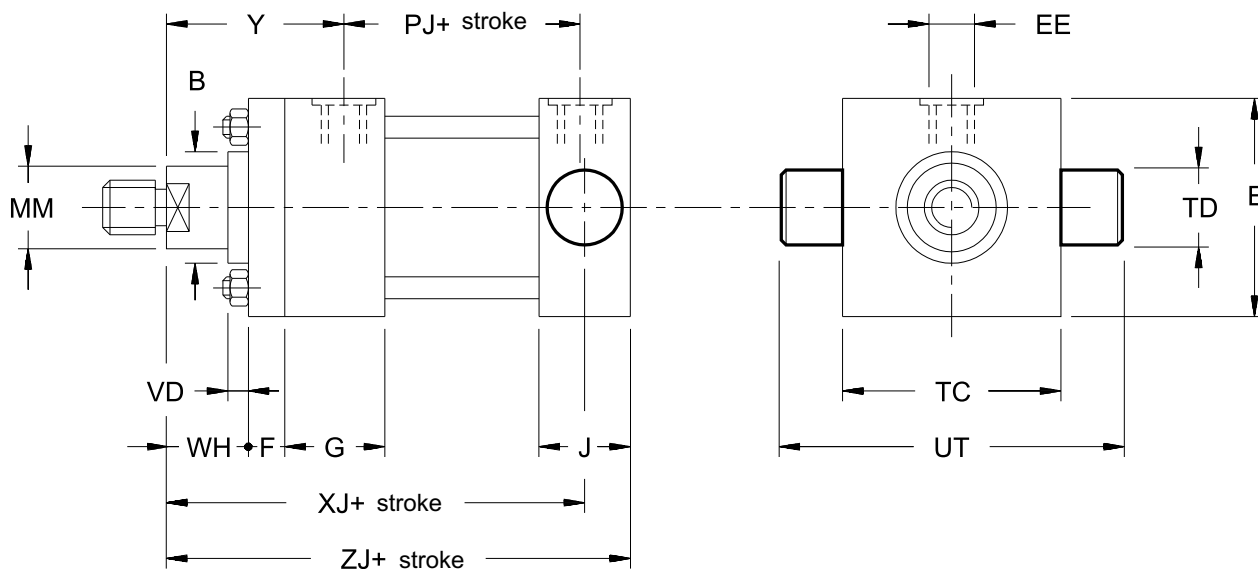
Dimensions in mm

Bore	MM Ø rod	ØB f8	BD	E max	EE BSP	F	G	J	PJ	ØTD f8	TM	UM	UW	VD	WH	XV* min	XV max + stroke	Y	ZB	ZJ	min stroke
25	12 18	24 30	20	40 NOTE	1/4"	10	45	35	54	12	48	68	45	6	15	80	69	50	121	114	11
32	14 18 22	26 30 34	25	45 NOTE	1/4"	10	45	36	57	16	55	79	50	12 6 12	25	93	79	60	137	128	13
40	18 22 28	30 34 42	30	63	3/8"	10	55	45	74	20	76	108	70	6 12 10	25	105	93	62	166	153	12
50	22 28 36	34 42 50	40	75	1/2"	15	55	45	76	25	89	129	85	7 7 10	26	116	94	68	176	159	22
63	28 36 45	42 50 60	40	90	1/2"	15	55	45	80	32	100	150	95	7 10 14	33	123	103	71	185	168	20
80	36 45 56	50 60 72	45	115	3/4"	20	65	52	93	40	127	191	120	5 9 9	31	139	115	77	212	190	23
100	45 56 70	60 72 88	60	130	3/4"	22	69	55	101	50	140	220	130	7 7 10	35	156	118	82	225	203	38
125	56 70 90	72 88 108	70	165	1"	22	78	71	117	63	178	278	170	7 10 10	35	170	126	86	260	232	44
160	70 90 110	88 108 133	90	205	1"	25	86	63	130	80	215	341	205	7	32	188	137	86	279	245	51
200	90 110 140	108 133 163	110	245	1 1/4"	25	103	80	165	100	279	439	275	7	32	215	164	98	336	299	51



## 13 - OVERALL AND MOUNTING DIMENSIONS ISO MT2

### N REAR SWINGING



**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

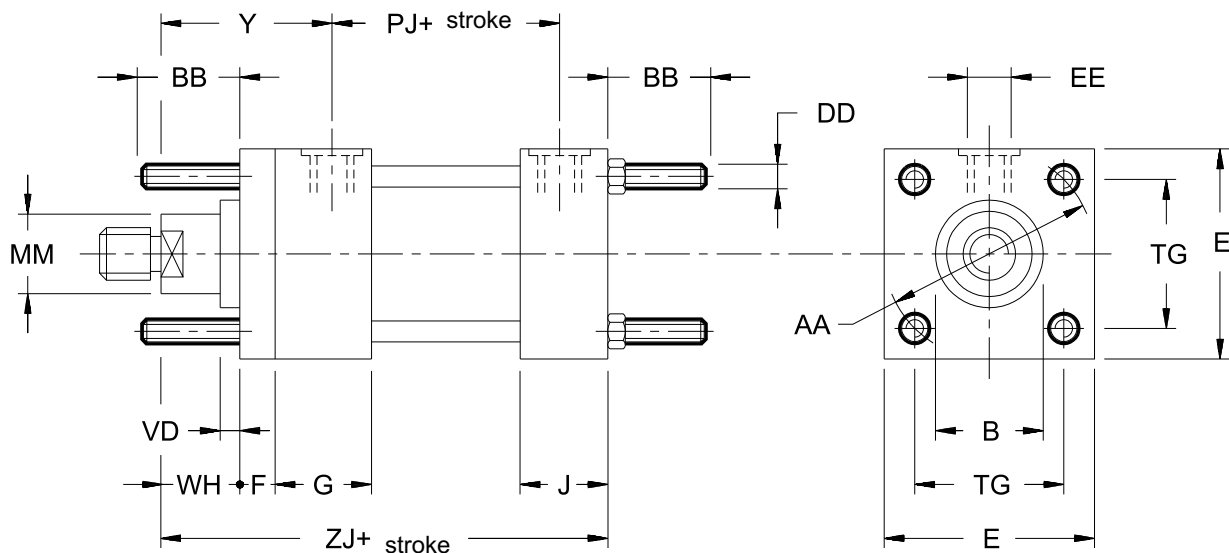
Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	G	J	PJ	ØTD f8	TC	UT	VD	WH	XJ	Y	ZJ
<b>25</b>	12 18	24 30	40 note	1/4"	10	45	35	54	12	38	58	6	15	101	50	114
<b>32</b>	14 18 22	26 30 34	45 note	1/4"	10	45	36	57	16	44	68	12 6 12	25	115	60	128
<b>40</b>	18 22 28	30 34 42	63	3/8"	10	55	45	74	20	63	95	6 12 10	25	134	62	153
<b>50</b>	22 28 36	34 42 50	75	1/2"	15	55	45	76	25	76	116	7 7 10	26	140	68	159
<b>63</b>	28 36 45	42 50 60	90	1/2"	15	55	45	80	32	89	139	7 10 14	33	149	71	168
<b>80</b>	36 45 56	50 60 72	115	3/4"	20	65	52	93	40	114	178	5 9 9	31	168	77	190
<b>100</b>	45 56 70	60 72 88	130	3/4"	22	69	68	101	50	127	207	7 7 10	35	187	82	216
<b>125</b>	56 70 90	72 88 108	165	1"	22	78	85	117	63	165	265	7 10 10	35	209	86	246
<b>160</b>	70 90 110	88 108 133	205	1"	25	86	95	130	80	203	329	7	32	230	86	277
<b>200</b>	90 110 140	108 133 163	245	1.1/4"	25	103	115	165	100	241	401	7	32	276	98	334

## 14 - OVERALL AND MOUNTING DIMENSIONS ISO MX1-MX2-MX3

P FRONT TIE RODS  
Q REAR TIE RODS  
R FRONT AND REAR TIE RODS

MX3  
MX2  
MX1



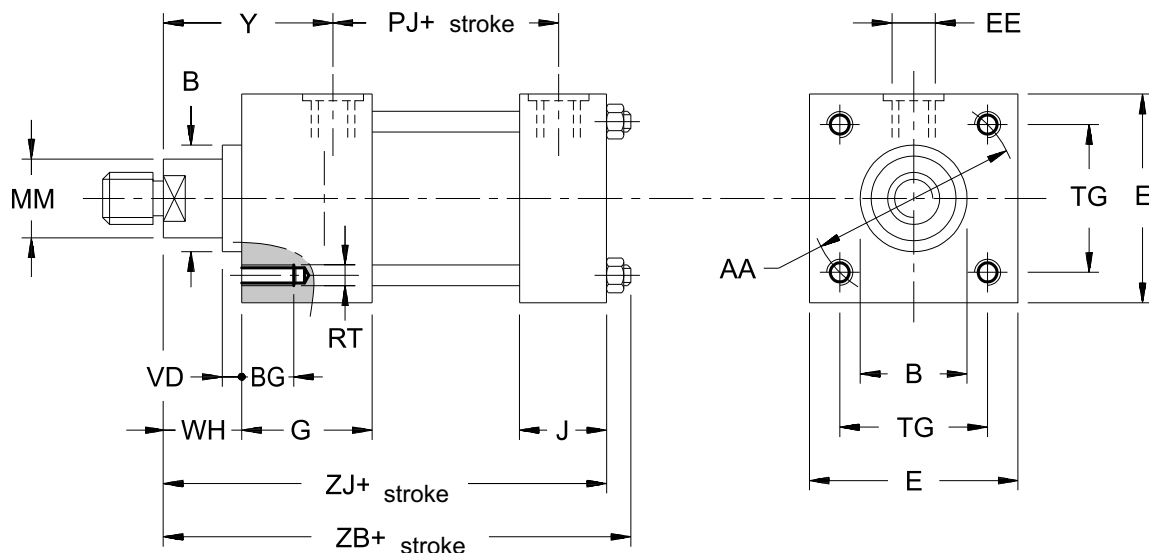
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	AA	ØB f8	BB	DD	E max	EE BSP	F	G	J	PJ	TG	VD	WH	Y	ZJ
25	12 18	40	24 30	19	M5x0.8	40 note	1/4"	10	45	35	54	28.3	6	15	50	114
32	14 18 22	47	26 30 34	24	M6x1	45 note	1/4"	10	45	36	57	33.2	12 6 12	25	60	128
40	18 22 28	59	30 34 42	35	M8x1	63	3/8"	10	55	45	74	41.7	6 12 10	25	62	153
50	22 28 36	74	34 42 50	46	M12x1.25	75	1/2"	15	55	45	76	52.3	7 7 10	26	68	159
63	28 36 45	91	42 50 60	46	M12x1.25	90	1/2"	15	55	45	80	64.3	7 10 14	33	71	168
80	36 45 56	117	50 60 72	59	M16x1.5	115	3/4"	20	65	52	93	82.7	5 9 9	31	77	190
100	45 56 70	137	60 72 88	59	M16x1.5	130	3/4"	22	69	55	101	96.9	7 7 10	35	82	203
125	56 70 90	178	72 88 108	81	M22x1.5	165	1"	22	78	71	117	125.9	7 10 10	35	86	232
160	70 90 110	219	88 108 133	92	M27x2	205	1"	25	86	63	130	154.9	7	32	86	245
200	90 110 140	269	108 133 163	115	M30x2	245	1.1/4"	25	103	80	165	190.2	7	32	98	299

## 15 - OVERALL AND MOUNTING DIMENSIONS ISO MX5

### T FRONT THREADED HOLES



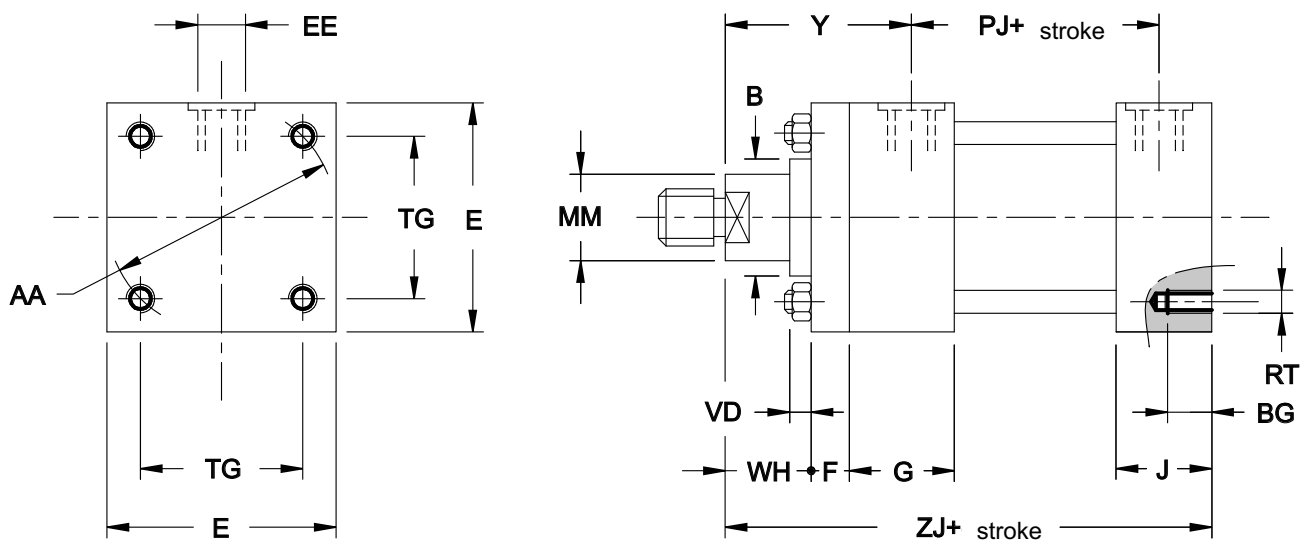
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	AA	ØB f8	BG	E max	EE BSP	G	J	PJ	RT	TG	VD	WH	Y	ZB	ZJ
25	12 18	40	24 30	8	40 <b>NOTE</b>	1/4"	45	35	54	M5x0.8	28.3	6	15	50	121	114
32	14 18 22	47	26 30 34	9	45 <b>NOTE</b>	1/4"	45	36	57	M6x1	33.2	12 6 12	25	60	137	128
40	18 22 28	59	30 34 42	12	63	3/8"	55	45	74	M8x1.25	41.7	6 12 10	25	62	166	153
50	22 28 36	74	34 42 50	18	75	1/2"	55	45	76	M12x1.75	52.3	7 7 10	26	68	176	159
63	28 36 45	91	42 50 60	18	90	1/2"	55	45	80	M12x1.75	64.3	7 10 14	33	71	185	168
80	36 45 56	117	50 60 72	24	115	3/4"	65	52	93	M16x2	82.7	5 9 9	31	77	212	190
100	45 56 70	137	60 72 88	24	130	3/4"	69	55	101	M16x2	96.9	7 7 10	35	82	225	203
125	56 70 90	178	72 88 108	27	165	1"	78	71	117	M22x2.5	125.9	7 10 10	35	86	260	232
160	70 90 110	219	88 108 133	32	205	1"	86	63	130	M27x3	154.9	7	32	86	279	245
200	90 110 140	269	108 133 163	40	245	1 1/4"	103	80	165	M30x3.5	190.2	7	32	98	336	299

## 16 - OVERALL AND MOUNTING DIMENSIONS ISO MX6

### U REAR THREADED HOLES



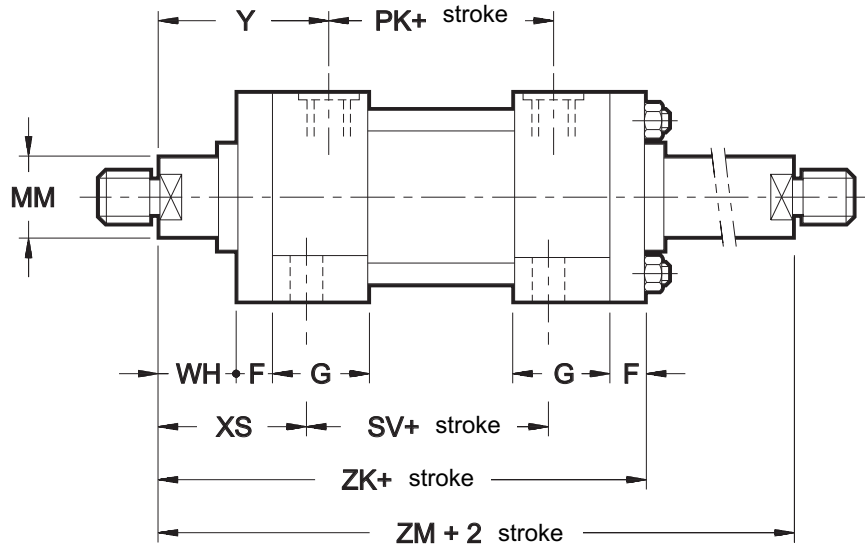
**NOTE:** The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	AA	ØB f8	BG	E max	EE BSP	F	G	J	PJ	RT	TG	VD	WH	Y	ZJ
25	12 18	40	24 30	8	40 note	1/4"	10	45	35	54	M5x0.8	28.3	6	15	50	114
32	14 18 22	47	26 30 34	9	45 note	1/4"	10	45	36	57	M6x1	33.2	12 6 12	25	60	128
40	18 22 28	59	30 34 42	12	63	3/8"	10	55	45	74	M8x1.25	41.7	6 12 10	25	62	153
50	22 28 36	74	34 42 50	18	75	1/2"	15	55	45	76	M12x1.75	52.3	7 7 10	26	68	159
63	28 36 45	91	42 50 60	18	90	1/2"	15	55	45	80	M12x1.75	64.3	7 10 14	33	71	168
80	36 45 56	117	50 60 72	24	115	3/4"	20	65	52	93	M16x2	82.7	5 9 9	31	77	190
100	45 56 70	137	60 72 88	24	130	3/4"	22	69	55	101	M16x2	96.9	7 7 10	35	82	203
125	56 70 90	178	72 88 108	27	165	1"	22	78	71	117	M22x2.5	125.9	7 10 10	35	86	232
160	70 90 110	219	88 108 133	32	205	1"	25	86	63	130	M27x3	154.9	7	32	86	245
200	90 110 140	269	108 133 163	40	245	1.1/4"	25	103	80	165	M30x3.5	190.2	7	32	98	299

## 17 - OVERALL AND MOUNTING DIMENSIONS

### DOUBLE ROD



Dimensions in mm

For other dimensions and mounting styles please see single rod cylinder tables.  
Not available for mounting styles B-C-D-F-N-Q-U

Bore	MM Ø rod	F	G	PK	SV	WH	XS	Y	ZM	ZK
25	12 18	10	45	49	88	15	33	50	154	134
32	14 18 22	10	45	52	88	25	45	60	178	147
40	18 22 28	10	55	74	105	25	45	62	195	173
50	22 28 36	15	55	76	99	26	54	67	207	184
63	28 36 45	15	55	84	93	33	65	71	223	193
80	36 45 56	20	65	100	110	31	68	77	246	223
100	45 56 70	22	69	110	107	35	79	82	265	239
125	56 70 90	22	78	124	131	35	79	86	288	261
160	70 90 110	25	86	130	130	32	86	86	302	270
200	90 110 140	25	103	160	172	32	92	98	356	324

**NOTE:** Double rod cylinders are developed with two separate rods, fixed together by means of threading. Because of this mounting style, the rod with female threading is less resistant than the other.

To simplify the identification of the more resistant rod, the "M" marking is stamped on its end.

We recommend the use of the weaker rod for the less demanding applications.

## 18 - ROD DIAMETER SELECTION

To ensure adequate stability, cylinders must be calculated for maximum compressive load according to the following simplified procedure:

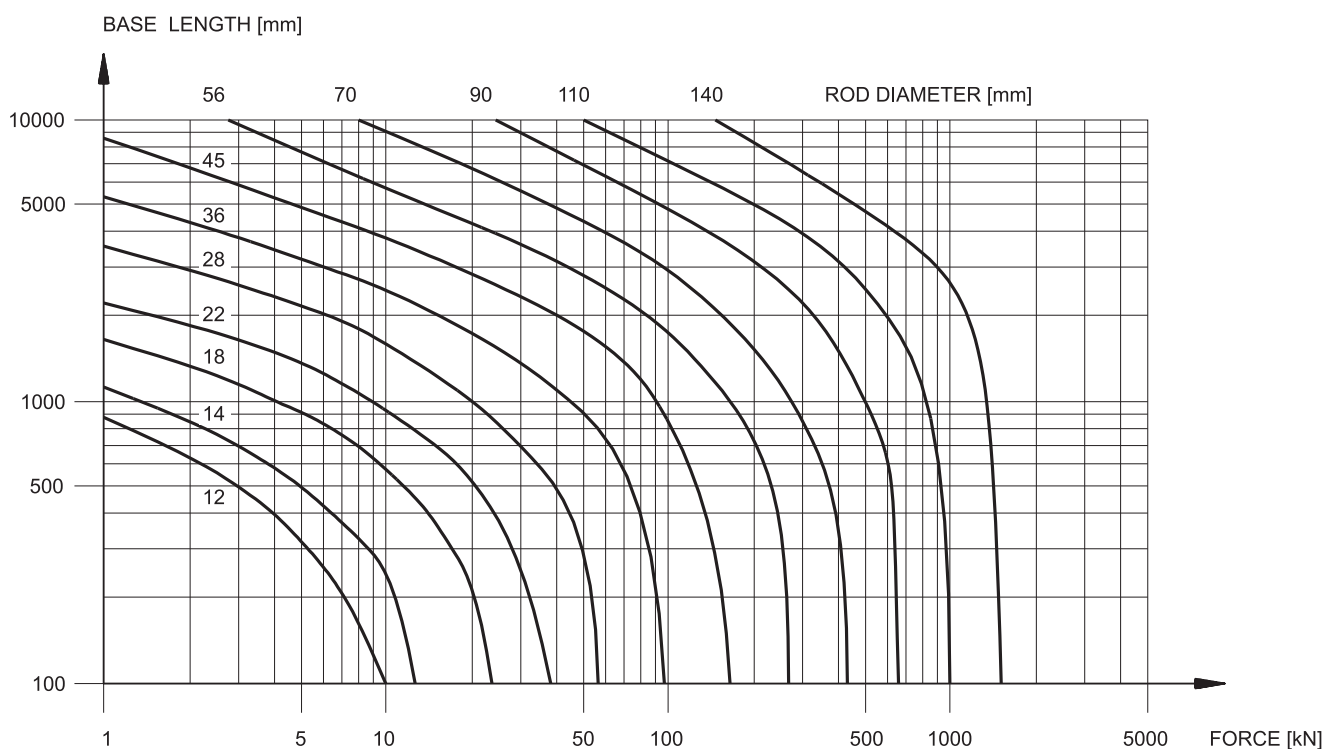
- Refer to the table to identify the stroke factor according to the mounting style.
- To calculate the reference length, multiply the working stroke by the stroke factor.

- To calculate the thrust force, multiply the total cylinder area by the operating pressure.
- On the diagram, find the point of intersection between the thrust force and reference length.
- Identify the minimum rod diameter on the curve above the previous point of intersection.

Cylinders with rod diameters smaller than the value plotted in the diagram will not guarantee sufficient rigidity.

Mounting style	Rod connection	Mounting	Stroke factor
A-P-R-T	Fixed and supported		2
	Fixed and rigidly guided		0.5
	Jointed and rigidly guided		0.7
B-Q-U	Fixed and supported		4
	Fixed and rigidly guided		1
	Jointed and rigidly guided		1.5
H	Jointed and rigidly guided		1

Mounting style	Rod connection	Mounting	Stroke factor
C-D-F-N	Jointed and supported		4
	Jointed and rigidly guided		2
G	Fixed and supported		2
	Fixed and rigidly guided		0.5
	Jointed and rigidly guided		0.7
L	Jointed and supported		3
	Jointed and rigidly guided		1.5



### 19 - THEORETICAL FORCES

Push force

$$F_s = P \cdot A_t$$

Pull force

$$F_t = P \cdot A_a$$

$F_s$  = Force (extension) in N

$F_t$  = Force (retraction) in N

$A_t$  = Total area in mm<sup>2</sup>

$A_a$  = Annular area in mm<sup>2</sup>

$P$  = Pressure in MPa

1 bar = 0.1 MPa

1 kgf = 9.81 N

Bore mm	Ø rod mm	Total area mm <sup>2</sup>	Annular area mm <sup>2</sup>
25	12	491	378
	18		236
32	14	804	650
	18		550
	22		424
40	18	1 257	1 002
	22		876
	28		641
50	22	1 964	1 583
	28		1 348
	36		946
63	28	3 117	2 502
	36		2 099
	45		1 527
80	36	5 027	4 009
	45		3 437
	56		2 564
100	45	7 854	6 264
	56		5 391
	70		4 006
125	56	12 272	9 809
	70		8 424
	90		5 910
160	70	20 106	16 258
	90		13 744
	110		10 603
200	90	31 416	25 054
	110		21 913
	140		16 022

### 20 - THEORETICAL VELOCITY

#### Configuration 1

The diagram illustrates a conventional cylinder application: the fluid is delivered by means of a directional control valve in alternation to the front chamber while the rear chamber is connected to tank and vice versa.

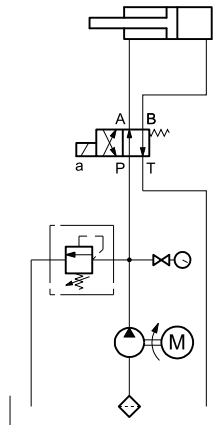
To calculate velocity and force, proceed as follows:

$$\text{Velocity (extension)} \quad V = \frac{Q \cdot 1000}{A_t \cdot 60}$$

$$\text{Velocity (retraction)} \quad V = \frac{Q \cdot 1000}{A_a \cdot 60}$$

$$\text{Force (extension)} \quad F = P \cdot A_t$$

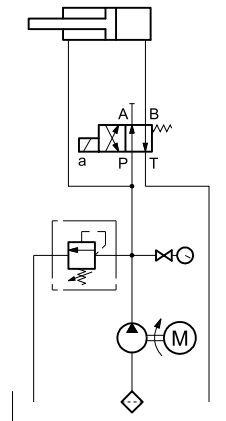
$$\text{Force (retraction)} \quad F = P \cdot A_a$$



#### Configuration 2

When the system requires high velocity with relatively low forces, we recommend using a regenerative circuit. The diagram 2 illustrates the simplest version of this type of set-up.

The annular chamber is permanently connected to the pump while the full bore end is connected alternately to the pump, in which case the piston rod extends as a result of the differential areas (both chambers are supplied at the same pressure), and to tank, in which case the piston rod retracts.



$$\text{Velocity (extension)} \quad V = \frac{Q \cdot 1000}{A_s \cdot 60}$$

$$\text{Velocity (retraction)} \quad V = \frac{Q \cdot 1000}{A_a \cdot 60}$$

$$\text{Force (extension)} \quad F = P \cdot A_s$$

$$\text{Force (retraction)} \quad F = P \cdot A_a$$

$V$  = Velocity in m/s  
 $Q$  = Flow rate in l/min  
 $A_t$  = Total area (piston bore) in mm<sup>2</sup>  
 $A_a$  = Annular area ( $A_t - A_s$ ) in mm<sup>2</sup>  
 $F$  = Force in N  
 $P$  = Pressure in MPa  
 $A_s$  = Rod area ( $A_t - A_a$ ) in mm<sup>2</sup>  
 $Q_d$  = Flow rate through directional control valve ( $Q$ +return flow rate from small chamber) in l/min

**NOTE:** In regenerative circuits, the sizing of the directional control valve is fundamental. Flow rate through the directional control valve is calculated according to the following formula:

$$Q_d = \frac{V \cdot A_t \cdot 60}{1000}$$

1 bar = 0.1 MPa

1 kgf = 9.81 N



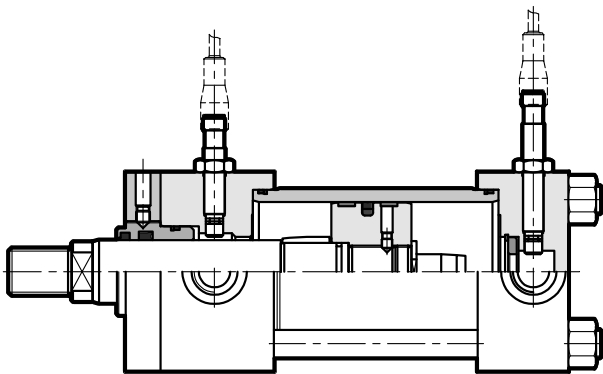
## 21 - MASSES

Bore	Ø rod	Mass for null stroke						Mass for 10 mm stroke
		Mounting style						
		P-Q-R-T-U	G	A-B	C-D-F	H-N	L	
mm	mm	kg	kg	kg	kg	kg	kg	kg
25	12	1.2	1.3	1.4	1.4	1.4	1.5	0.04
	18	1.2	1.3	1.4	1.4	1.4	1.5	0.06
32	14	1.6	1.8	1.9	1.9	1.7	1.9	0.06
	18	1.6	1.8	1.9	1.9	1.7	1.9	0.07
	22	1.7	1.8	1.9	1.9	1.7	1.9	0.08
40	18	3.7	3.9	4.6	4.2	3.9	4.6	0.1
	22	3.7	3.9	4.6	4.2	3.9	4.6	0.11
	28	3.8	4	4.7	4.3	4	4.7	0.12
50	22	5.9	6.4	7.1	7.1	6.3	7.9	0.14
	28	6	6.5	7.2	7.2	6.4	8	0.17
	36	6.1	6.6	7.3	7.3	6.5	8.1	0.18
63	28	8.5	9.7	10	10.1	8.8	10.5	0.19
	36	8.6	9.8	10.1	10.3	8.9	10.6	0.22
	45	8.7	9.9	10.2	10.4	9.1	10.7	0.26
80	36	16	17.2	18.8	19.5	16.6	19	0.27
	45	16.2	17.4	19	19.6	16.7	20	0.32
	56	16.3	17.6	19.1	19.8	16.9	22	0.39
100	45	22	23	25	28.1	22.8	26	0.4
	56	22.5	24	25.5	28.5	23.1	27	0.48
	70	23	25	26	29	23.4	28	0.58
125	56	41.5	44	47.5	53	42.5	48	0.65
	70	42.5	44.5	48	54	43	49	0.76
	90	44	45	49	55	44	50	0.96
160	70	69	72	79	89.5	71	84	1
	90	70	73	80	91	72	85	1.2
	110	71	74	81	92	72.5	86	1.4
200	90	122	128.5	137	157	127	152	1.6
	110	123	129.5	139	158	128.5	153	1.8
	140	124	131	140	159	129.5	155	2.2



### 22 - END-STROKE PROXIMITY SENSORS

On request, cylinders can be supplied with end-stroke proximity sensors type PNP, with normally open output. They are mounted on the front and rear end of the cylinder and they supply an electric signal when the piston rod reaches the stroke end.



They are available for all cylinder mounting styles, from Ø40, with the following limits:

#### bore Ø40:

mounting	A-H	available on rear end only
mounting	B-N	available on front end only

#### bore Ø50:

mounting	H	available on rear end only
mounting	N	available on front end only

#### bores Ø80 and Ø100:

mounting	N	available on front end only
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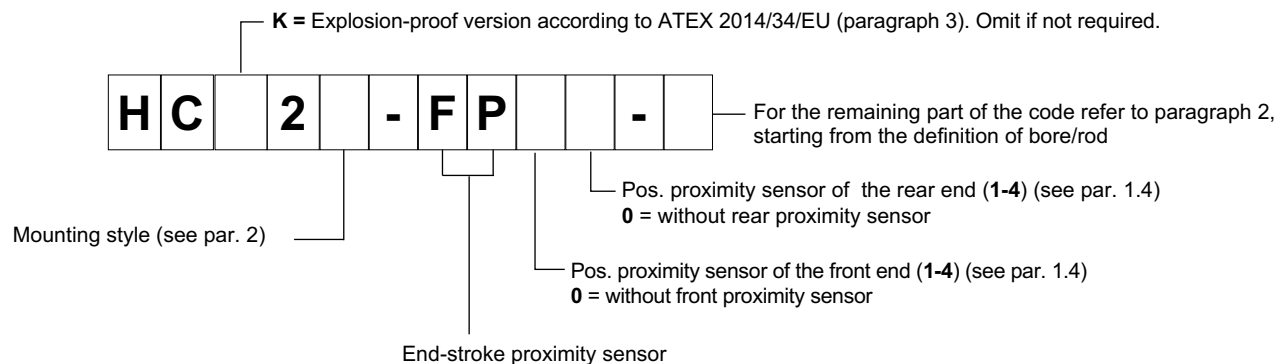
#### bores Ø125/56, Ø160 and Ø200:

mounting	A	available on rear end only
mounting	B	available on front end only

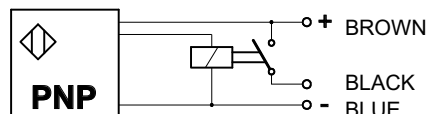
In order to ensure the correct functioning of the system, cylinders must be equipped with cushionings.

These sensors can be only used to provide the switching signal and not to control voltage loads.

#### 22.1 - Identification code



#### 22.2 - Technical characteristics and electrical connection



Rated voltage	VDC	24
Power supply voltage range	VDC	10 ÷ 30
Absorbed current	mA	200
Output	normally open contact	
Electric protection	polarity inversion short circuit overvoltage	
Electric connection	with connector	
Maximum operating pressure	bar	500
Operating temperature range	°C	-25 / +80
Class of protection according IEC EN 60529 (atmospheric ag.)	IP68	
Piston position LED (NOTE)	NO (it's on the connector)	

#### 22.3 - Connectors

Connectors for proximity sensors must be ordered separately, by specifying the code: **ECM3S/M12L/10**

**NOTE: These connectors are not suitable for ATEX-rated cylinders. The connectors for the ATEX-rated cylinders are described at paragraph 3.5.**

Connector: pre-wired connector M12 - IP68  
Cable: with 3 conductors 0.34 mm<sup>2</sup> - length 5 mt.  
Cable material: polyurethane resin (oil resistant)

The connector has two LEDs, one green and one yellow.

GREEN: Connector power supply.  
The LED burn when the connector is supplied.

YELLOW: position signal.  
ON - piston at stroke end  
OFF - piston not at stroke end

### 23 - MAGNETIC END-STROKE SENSORS

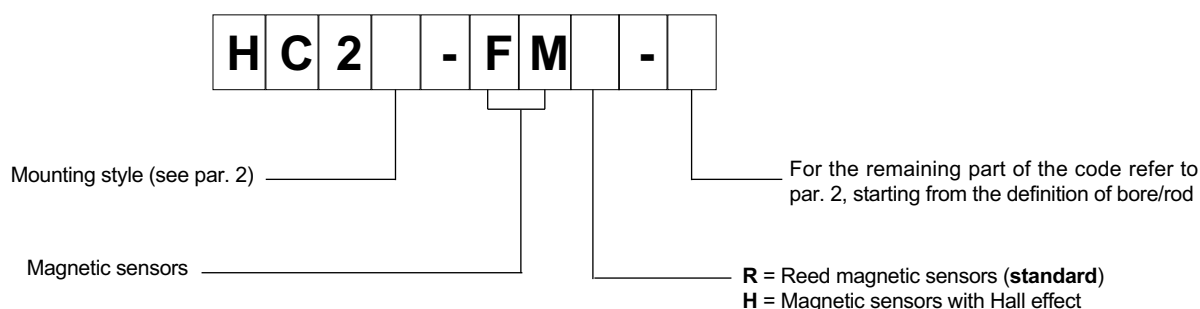
Upon request, cylinders can be supplied with adjustable magnetic sensors, mounted on tie rods, which allow the reading in every position of the piston, both intermediate and end stroke. The "switching zone" of these sensors can reach about 30÷40 mm, depending on piston speed and cylinder bore. Therefore, if the Client needs to read with precision only the signal of the stroke end, and not of other positions, we recommend the use of end-stroke proximity sensors (see par. 22), rather than magnetic sensors.

Magnetic sensors are available for bores Ø 25 to Ø 125 included. For cylinders with strokes under 80 mm and for cylinders with mid swinging mounting type, we recommend to consult our technical office, because, in some applications, magnetization problems of cylinder parts could happen, affecting the correct functioning of the system. Moreover we recommend to use these cylinders with operating pressure lower than 160 bar (peak free) and not to use them as mechanical stop; for this reason, consider a stroke of 15÷20 mm more than necessary.

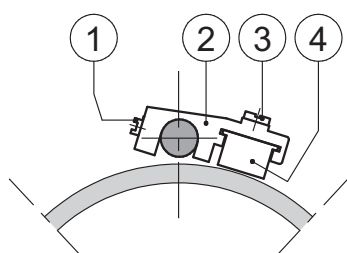
Cylinders are supplied with 2 magnetic sensors, already mounted on tie rods, which can be of two types:

- Reed magnetic sensors (**standard**): they are sensors with normally open contact, which commute exploiting the magnetic field generated by the plastroferrite ring inserted in the piston. They have a long electric life and a switching power which allows to control voltage loads directly.
- Magnetic sensors with Hall effect: they are sensors which read the voltage variation generated by the piston movement, by means of a normally open electronic semiconductor type PNP. Because of the absence of moving parts inside the sensors, they guarantee a much longer electric life than that of Reed sensors, a high sensitivity and switching reliability. As opposed to Reed sensors, these sensors can be used only to provide the switching signal and not to control voltage loads.

#### 23.1 - Identification code



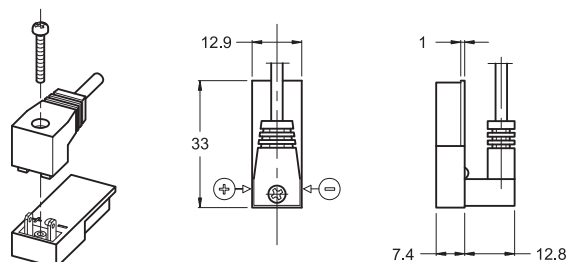
#### 23.2 - Mounting and overall dimensions



Reed sensors for Ø 25 and Ø 32 bore and sensors with Hall effect

1	Bracket fastening screw
2	Socket for fastening to the tie rod
3	Bracket for fastening to the tie rod
4	Sensor fastening screw
5	Magnetic sensor

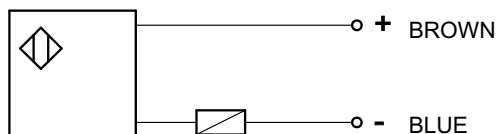
Reed sensors for Ø 40 ÷ Ø 125 bore



## 23.3 - Technical Characteristics And Electrical Connection

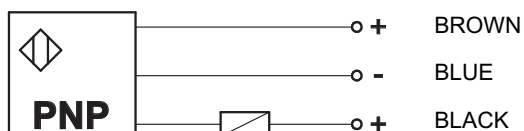
### Reed sensors (FMR)

		Reed sensor without connector (for 25 and 32 bores)	Reed sensor with connector (for 40, 50, 63, 80, 100 and 125 bores)
Sensor version		Reed	Reed
Contact		normally open	normally open
Maximum power	W	20	50
Maximum voltage	V AC/DC	130	250
Minimum voltage	V AC/DC	3	3
Voltage drop	V	2,5	2,5
Maximum power	mA	300	1000
Wiring		2 cables	2 cables
Connection		cable (L = 2 m)	connector (with cable L = 2 m)
Cable section	mm <sup>2</sup>	0,25	0,25
Varistor	V	-	250
Sheath material		PVC	PVC
Contact indicator		red led	red led
Operating temperature range	°C	-20 / +80	-20 / +80



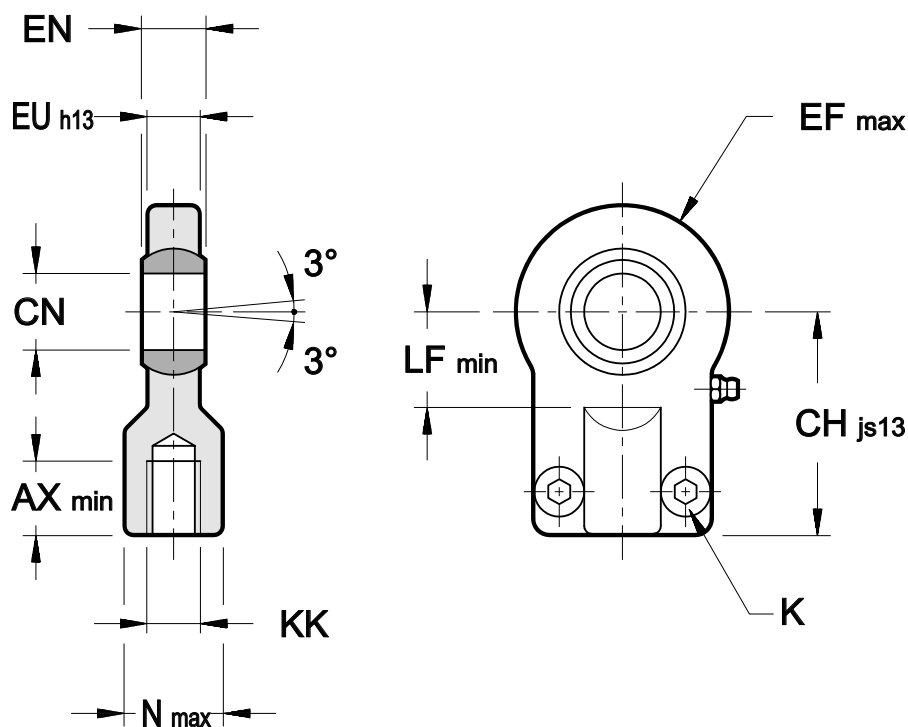
### Hall effect sensors (FMH)

Sensor version		Hall effect
Contact		normally open
Sensor type		PNP
Maximum voltage	V AC/DC	30
Minimum voltage	V AC/DC	10
Voltage drop	V	0,5
Maximum power	mA	200
Wiring		3 cables
Connection		cable (L = 2 m)
Cable section	mm <sup>2</sup>	0,14
Wire covering material		PVC
Contact indicator		red led
Operating temperature range	°C	-20 / +80



## 24 - OVERALL AND MOUNTING DIMENSIONS

### SPHERICAL SWIVEL ISO 8133 / DIN 24555



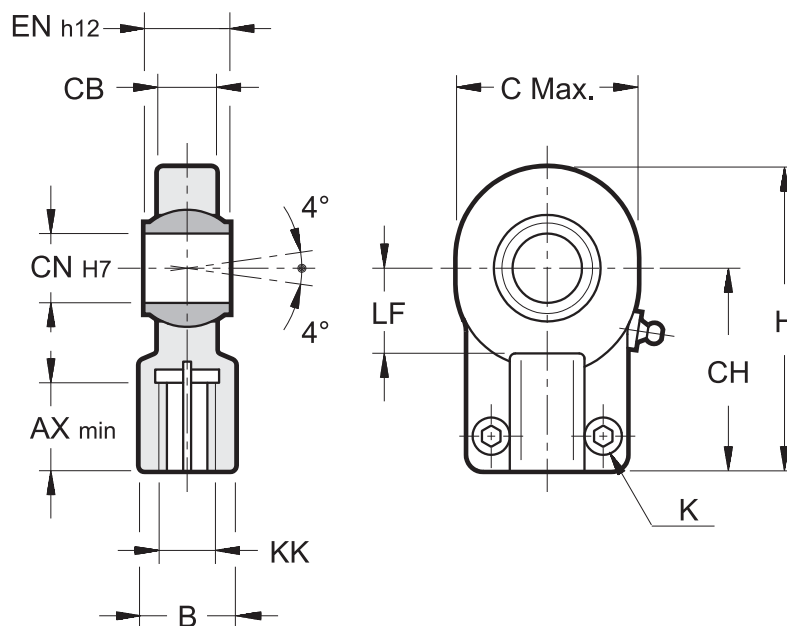
**NOTE: no lubricator on SSF-12. On SSF-14 and SSF-18 sizes the injection of the lubricant takes place through a hole.**

Dimensions in mm

Type	Ø cylinder rod		AX	CH	Ø CN	EF	EN	EU	KK	LF	N	K bolt	Torque	Max load	Mass
	standard thread	light thread	min	js13		max		h13		min	max	UNI 5931	Nm	kN	kg
<b>SSF-12</b>	12	18	15	42	12 <sup>0</sup> <sub>-0.008</sub>	20	10 <sup>0</sup> <sub>-0.12</sub>	8	M10x1.25	16	17	M6x14	10	8	0.2
<b>SSF-14</b>	14	22	17	48	16 <sup>0</sup> <sub>-0.008</sub>	22.5	14 <sup>0</sup> <sub>-0.12</sub>	11	M12x1.25	20	21	M6x14	10	12.5	0.3
<b>SSF-18</b>	18	28	19	58	20 <sup>0</sup> <sub>-0.010</sub>	27.5	16 <sup>0</sup> <sub>-0.12</sub>	13	M14x1.5	25	25	M8x18	25	20	0.4
<b>SSF-22</b>	22	36	23	68	25 <sup>0</sup> <sub>-0.010</sub>	32.5	20 <sup>0</sup> <sub>-0.12</sub>	17	M16x1.5	30	30	M8x18	25	32	0.7
<b>SSF-28</b>	28	45	29	85	30 <sup>0</sup> <sub>-0.010</sub>	40	22 <sup>0</sup> <sub>-0.12</sub>	19	M20x1.5	35	36	M10x20	49	50	1.2
<b>SSF-36</b>	36	56	37	105	40 <sup>0</sup> <sub>-0.012</sub>	50	28 <sup>0</sup> <sub>-0.12</sub>	23	M27x2	45	45	M10x25	49	80	2.2
<b>SSF-45</b>	45	70	46	130	50 <sup>0</sup> <sub>-0.012</sub>	62.5	35 <sup>0</sup> <sub>-0.12</sub>	30	M33x2	58	55	M12x30	86	125	4.2
<b>SSF-56</b>	56	90	57	150	60 <sup>0</sup> <sub>-0.015</sub>	80	44 <sup>0</sup> <sub>-0.15</sub>	38	M42x2	68	68	M16x40	210	200	8.3
<b>SSF-70</b>	70	110	64	185	80 <sup>0</sup> <sub>-0.015</sub>	102.5	55 <sup>0</sup> <sub>-0.15</sub>	47	M48x2	92	90	M20x50	410	320	19
<b>SSF-90</b>	90	140	86	240	100 <sup>0</sup> <sub>-0.020</sub>	120	70 <sup>0</sup> <sub>-0.20</sub>	57	M64x3	116	110	M24x60	710	500	28

## 25 - OVERALL AND MOUNTING DIMENSIONS

### SPHERICAL SWIVEL ISO 6982 / DIN 24338



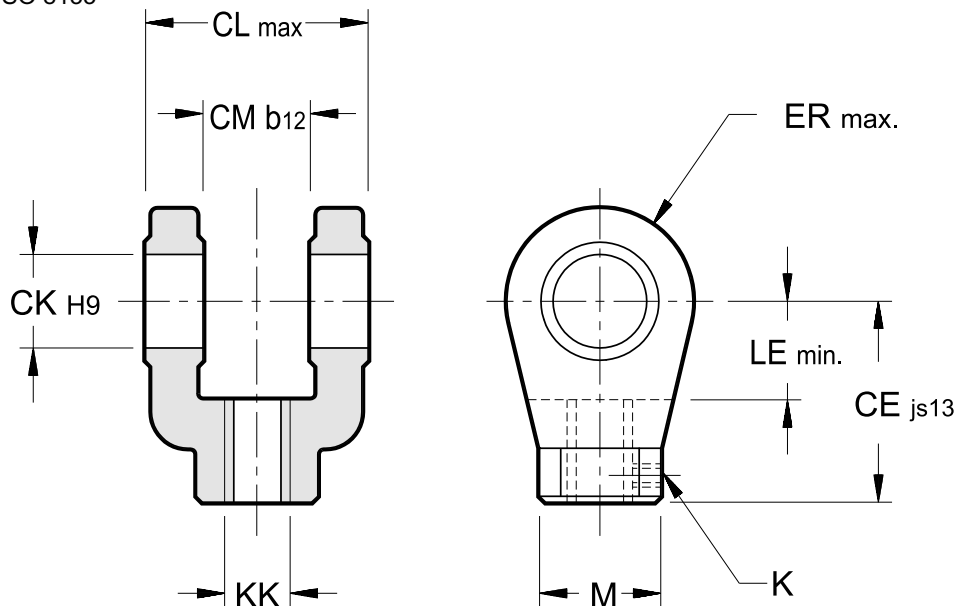
**NOTE:** no lubricator on LSF-14. On LSF-18 the injection of the lubricant takes place through a hole.

Dimensions in mm

Type	Ø rod		AX	B	C	CB	CH	Ø CN	EN	H	KK	LF	K bolt	Torque	Max load	Mass
	standard thread	light thread	min		max			H7	h12				UNI 5931	Nm	kN	kg
<b>LSF-14</b>	14	22	17	16	32	11	38	12	12	54	M12x1.25	14	M5x16	6	10.8	0.10
<b>LSF-18</b>	18	28	19	21	40	14	44	16	16	64	M14x1.5	20	M6x14	10	17.6	0.21
<b>LSF-22</b>	22	36	23	25	47	18	52	20	20	75	M16x1.5	22	M8x20	25	30	0.35
<b>LSF-28</b>	28	45	29	30	58	22	65	25	25	96	M20x1.5	27	M8x20	25	48	0.62
<b>LSF-36</b>	36	56	37	38	71	28	80	32	32	119	M27x2	32	M10x25	49	67	1.17
<b>LSF-45</b>	45	70	46	47	90	33	97	40	40	146	M33x2	41	M10x30	49	100	2.15
<b>LSF-56</b>	56	90	57	58	109	41	120	50	50	180	M42x2	50	M12x35	86	156	3.75
<b>LSF-70</b>	70	110	64	70	132	53	140	63	63	212	M48x2	62	M16x40	210	255	7.00
<b>LSF-90</b>	90	140	86	90	170	67	180	80	80	271	M64x3	78	M20x50	410	400	13.8

## 26 - OVERALL AND MOUNTING DIMENSIONS

### FEMALE CLEVIS ISO 8133

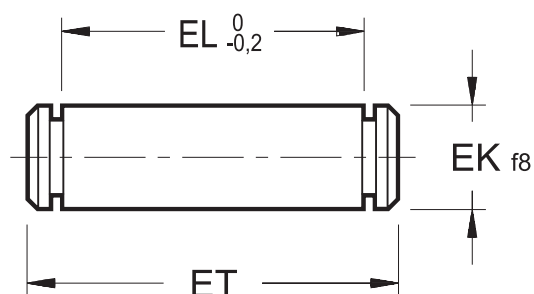


Dimensions in mm

Type	Ø cylinder rod		M	CE	Ø CK	CL	CM	ER	KK	LE	K bolt	Max load kN	Mass
	standard thread	light thread	CH	js13	H9	max	b12	max		min			kg
FRC-12	12	18	19	32	10	26	12	12	M10x1.25	13	M5x5	8	0.1
FRC-14	14	22	21	36	12	34	16	17	M12x1.25	19	M5x5	12.5	0.2
FRC-18	18	28	21	38	14	42	20	17	M14x1.5	19	M5x5	20	0.2
FRC-22	22	36	32	54	20	62	30	29	M16x1.5	32	M6x6	32	0.5
FRC-28	28	45	32	60	20	62	30	29	M20x1.5	32	M6x6	50	1
FRC-36	36	56	40	75	28	83	40	34	M27x2	39	M6x6	80	1.8
FRC-45	45	70	55	99	36	103	50	50	M33x2	54	M8x8	125	3.7
FRC-56	56	90	56	113	45	123	60	53	M42x2	57	M8x8	200	5.6
FRC-70	70	110	75	126	56	143	70	59	M48x2	63	M12x12	320	9.3
FRC-90	90	140	95	168	70	163	80	78	M64x3	83	M12x12	500	20

## 27 - OVERALL AND MOUNTING DIMENSIONS

### FEMALE CLEVIS PIN ISO 8133 with spring retainers

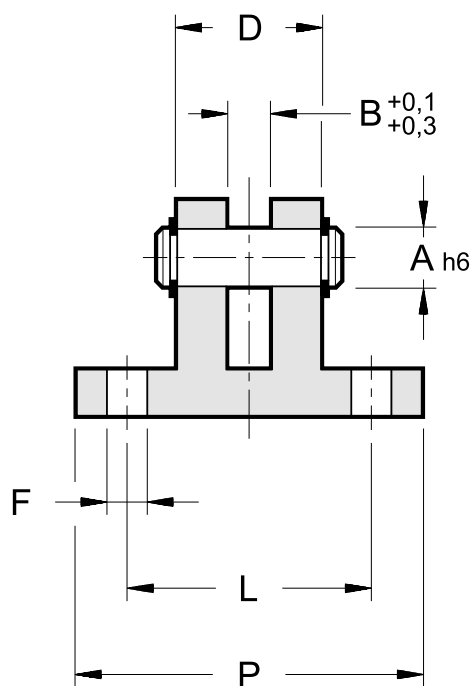
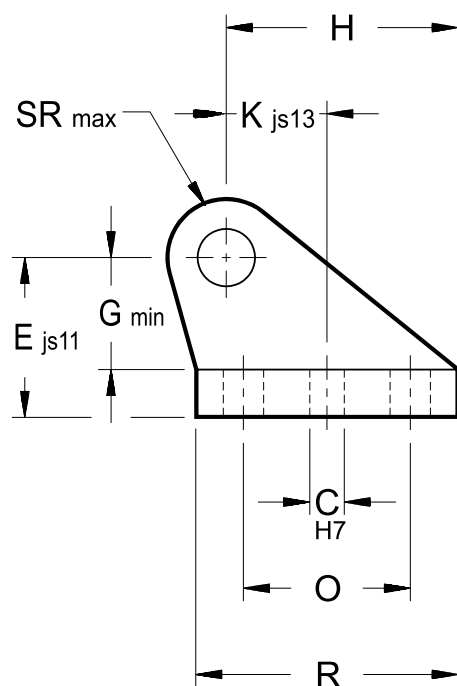


Dimensions in mm

Type	Ø EK f8	EL 0/-0.2	ET
PNF-12	10	29	37
PNF-14	12	37	45
PNF-18	14	45	53
PNF-22	20	66	75
PNF-28	20	66	75
PNF-36	28	87	96
PNF-45	36	107	120
PNF-56	45	129	144
PNF-70	56	149	164
PNF-90	70	169	187

## 28 - OVERALL AND MOUNTING DIMENSIONS

### FEMALE CLEVIS FLANGE FOR SPHERIC SWIVEL DIN 24554 (with PIN and spring retainers)

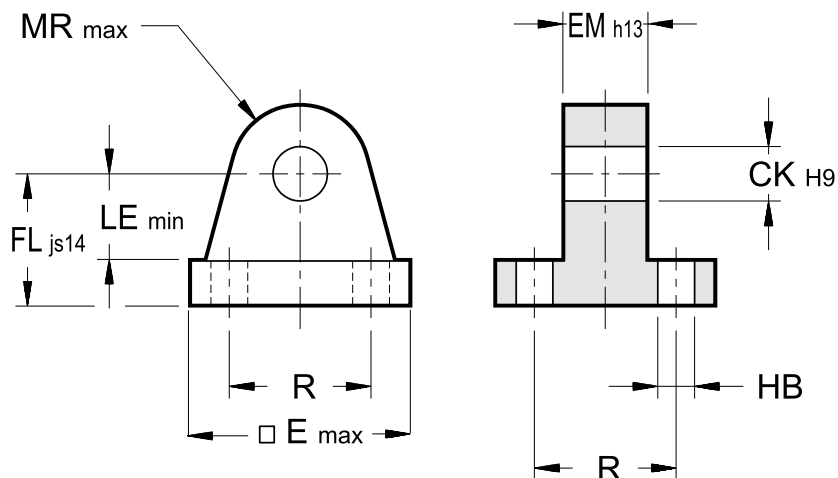


Dimensions in mm

Type	Cylinder bore	ØA h6	B +0.1 +0.3	ØC H7	D	E js11	ØF	G min	H	K js13	L	O	P	R	SR max	Max load kN	Mass kg
FLF-25	25	12	10	8	30	40	9	28	56	26	55	40	75	60	12	8	0.5
FLF-32	32	16	14	10	40	50	11	37	74	34	70	55	95	80	16	12.5	1
FLF-40	40	20	16	12	50	55	14	39	80	35	85	58	120	90	20	20	1.7
FLF-50	50	25	20	12	60	65	16	48	98	43	100	70	140	110	25	32	2.7
FLF-63	63	30	22	16	70	85	18	62	120	52	115	90	160	135	30	50	5.2
FLF-80	80	40	28	20	80	100	22	72	148	63	135	120	190	170	40	80	9.3
FLF-100	100	50	35	25	100	125	30	90	190	82	170	145	240	215	50	125	18.5
FLF-125	125	60	44	40	120	150	39	108	225	95	200	185	270	260	60	200	35
FLF-160	160	80	55	40	160	190	45	140	295	125	240	260	320	340	80	320	63
FLF-200	200	100	70	45	200	210	48	150	335	135	300	300	400	400	100	500	110

## 29 - OVERALL AND MOUNTING DIMENSIONS

### MALE CLEVIS FLANGE ISO 8133



Dimensions in mm

Type	Cylinder bore	ØCK H9	E max	EM h13	FL js14	ØHB	LE min	MR max	R	Load max kN	Mass kg
FLC-25	25	10	40	12	23	5.5	13	12	28.3	8	0.3
FLC-32	32	12	45	16	29	6.6	19	17	32.2	12.5	0.5
FLC-40	40	14	63	20	29	9	19	17	41.7	20	0.9
FLC-50	50	20	75	30	48	13.5	32	29	52.3	32	1.3
FLC-63	63	20	90	30	48	13.5	32	29	64.3	50	1.9
FLC-80	80	28	115	40	59	17.5	39	34	82.7	80	4
FLC-100	100	36	130	50	79	17.5	54	50	96.9	125	6.3
FLC-125	125	45	165	60	87	24	57	53	125.9	200	11.4
FLC-160	160	56	205	70	103	30	63	59	154.9	320	20
FLC-200	200	70	245	80	132	33	82	78	190.2	500	38

## 30 - SEAL KIT IDENTIFICATION CODE

S	K	/	H	C	2	-	/	/	-	/	20
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Seal kit \_\_\_\_\_

Bore (mm) \_\_\_\_\_

Rod (mm) \_\_\_\_\_

Series no. indicated on cylinder \_\_\_\_\_

Seals: **K** = standard (nitrile + polyurethane)  
**M** = low friction (nitrile + PTFE)  
**V** = high temperature (viton + PTFE)

Double rod (omit if not required) \_\_\_\_\_

**NOTE:** the seal kit includes all the seals of a cylinder with cushionings.





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# HC3

## HYDRAULIC CYLINDERS

# HCK3

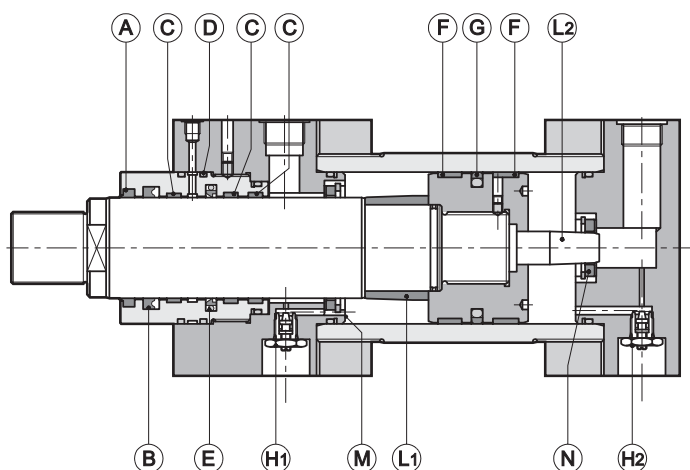
## HYDRAULIC CYLINDERS

### ATEX 2014/34/UE

### SERIES 10

**ISO 6022**  
**DIN 24333**

#### DESCRIPTION



- Double acting cylinders constructed in compliance with ISO 6022 and DIN 24333.
- The materials used to make these cylinders are particularly resistant and make them suitable for applications in the iron and steel sector.
- The cylinder is available with 5 different mounting styles as well as a range of accessories to meet all application requirements.

A - scraper ring  
B - piston rod seal  
C - guide ring  
D - drain seal (O-Ring)  
E - piston rod seal  
F - guide ring  
G - piston seal  
H1 - front cushioning adjustment screw  
H2 - rear cushioning adjustment screw  
L1 - front cushion  
L2 - rear cushion  
M - front cushioning bushing  
N - rear cushioning bushing

ATEX 2014/34/UE rated version for installation in potentially explosive atmospheres is now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified. The declaration of conformity to the up mentioned standards is always supplied with the cylinder. See paragraph 3 for details.

#### PERFORMANCES

Nominal operating pressure (continuous service)	bar	250
Maximum operating pressure	bar	320
Maximum speed (standard)	m/s	0,5
Maximum stroke (standard)	mm	5000
Fluid temperature range (standard)	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15
Recommended viscosity	cSt	25

## 1 - CHARACTERISTICS

### 1.1 - Bores and piston rods

Ø 50 to Ø 400 mm bores are available to enable a vast choice according to required force.

Two piston rod diameters are available for each bore:

- reduced piston rod with area ratio 1:1.65
- standard piston rod with area ratio 1:2

### 1.2 - Cushionings

On request, gradual and adjustable cushioning devices can be fitted in the front and/or rear ends of the cylinder without affecting overall dimensions.

The special design of the cushions ensures optimal repeatability also in the event of variations in fluid viscosity.

Cushioning devices are always recommended as they ensure impact-free stopping even at high speed thus reducing pressure surges and impact transferred to the mounting supports.

The cylinder ends of bores higher than 160mm with cushioning can have an additional port connected directly with the braking chamber. This connection must be used in case of application, near the cylinder, of a pressure relief valve set at 350 bar, to limit overpressures during braking. For further information and for the order identification code, please consult our technical office.

The table below shows cushioning cone lengths:

Bore (mm)	50	63	80	100	125	140	160	180	200	250	320	400
Front cone length (mm)	38	40	50	50	60	60	75	75	80	100	100	110
Rear cone length (mm)	34	42	58	49	64	64	68	73	69	101	99	108

### 1.3 - Connections

The cylinders are supplied as standard with cylindrical BSP threads and spot facing for seal rings in compliance with ISO 1179.

Connections which are oversized compared to those shown in the dimensional tables are available upon request. For further information and for the order identification code, please consult our technical office.

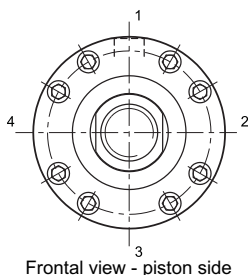
For correct cylinder operation, fluid velocity must not exceed 5 m/s.

### 1.4 - Connection position

Standard positions of the oil ports, cushioning adjustment screws, breathers, optional external drain and optional end-stroke proximity sensors, are indicated in the table below.

Connection positions different from the standard are available upon request. As a consequence, the other options positions will be rotated.

For special requests, please consult our technical office.



Frontal view - piston side

	POSITION
Connections	1
Cushioning adjustment	3
Breathers	4
Drainage	1
Proximity end stroke	2
Optional port (see par. 1.2)	4

### 1.5 - Seals

The table below illustrates seal characteristics in relation to hydraulic fluid and operating temperatures.

**NOTE:** for lower pressure use consult our technical office.

Type	Seal type	Seal material	Hydraulic fluid	Minimum pressure [bar]	Operating pressure [°C]	Max speed [m/s]
K	Standard	nitrile polyurethane	mineral oil	10	-20 / +80	0,5
M	Low friction	nitrile PTFE	Mineral oil Water glycol	20 (note)	-20 / +80	15
V	high temperature and/or aggressive fluid	Viton PTFE	Special fluids	10	-20 / +150	1

### 1.6 - Strokes

Standard cylinders are available with strokes up to 5000 mm. Longer cylinder strokes can be supplied on request.

Stroke tolerances are:

- 0 + 1 mm for strokes up to 1000 mm
- 0 + 4 mm for strokes up to 5000 mm.

### 1.7 - Spacers

In the case of cylinder strokes above 1000 mm we recommend the use of spacers which can be inserted to reduce loads on the piston rod bushing and prevent the piston from sticking.

Spacers are constructed in hardened and tempered steel with PTFE facing.

Every spacer is 50 mm long. We recommend to insert 1 spacer for strokes from 1001 to 1500 mm, with an increment of 1 spacer for every 500 mm stroke.

You must remember that the overall length of the cylinder increases according to the number of inserted spacers (50 mm for each spacer).

### 1.8 - Drainage

A connection for external drainage on the front end (even on the back end for double-rod cylinders) can be supplied upon request, for fluid drops recovery of the first seal of the rod, without any modification to the overall dimensions.

Connection: 1/8" BSP for bore up to Ø 100 included - 1/4" BSP for higher bores.

### 1.9 - Breathers

On request cylinder ends can be supplied with breathers for the elimination of air. This is necessary when the entire stroke is not used or when connections are not facing upwards.

### 1.10 - Surface finish

The cylinders are supplied painted with Duplomatic black opaque colour with a paint thickness of 40µ. The rod is chromed.

### 2 - IDENTIFICATION CODE

K = Explosion-proof version according to ATEX 2014/34/UE (paragraph 3). Omit if not required.

HC		3		-		/		/		-		-		-		-		/		-		/		/	10
----	--	---	--	---	--	---	--	---	--	---	--	---	--	---	--	---	--	---	--	---	--	---	--	---	----

Series  
(indicate for  
spare parts  
requests)

Dimension XV  
for "L" mounting  
(omit for other  
mounting styles)

N. of spacers multiple of 50  
mm (omit if not required)  
(see par. 1.7)

Back end connection position (1-4)  
(see par. 1.4)

Front end connection position (1-4)  
(see par. 1.4)

Drainage for second rod. Omit if not required  
(see par. 1.8)

0 = without drainage  
E = external drainage with connection  
on the back end

Drainage (see par. 1.8)

0 = without drainage  
E = external drainage with connection on the front end

Breathers (see par. 1.9)

0 = without breathers  
S = front and back breathers

Cushioning (see par. 1.2):

0 = without cushioning      1 = front  
2 = back      3 = front and back

Seals (see par. 1.5):

K = standard (nitrile + polyurethane)  
M = low friction (nitrile + PTFE)  
V = high temperature (viton + PTFE)

Stroke (mm) - For cylinders with spacers indicate the working stroke.

Double rod threading (omit if not required).  
See single rod for dimensions

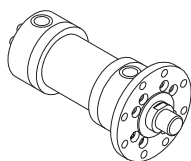
Double rod (omit if not required)

See single rod for dimensions. Not available with mounting style B-D-F.

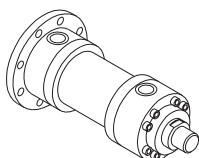
Rod threading: Male thread (standard)

W = Female thread (see par. 4)

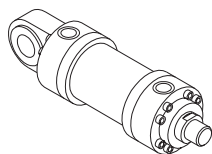
#### MOUNTING STYLE



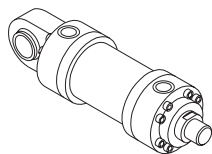
A= Front flange (MF3)



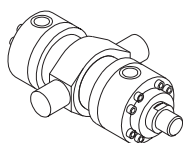
B= Rear flange (MF4)



D= Male clevis (MP3)



F= Spheric swivel (MP5)



L= Mid swinging (MT4)

\* Bores not  
considered by  
the standard  
ISO 6022

Ø rod (mm)		Rods available for each bore												
32	36	•												
40	45		•											
50	56			•										
63	70				•									
80	90					•								
90	100						•							
100	110							•						
110	125								•					
125	140									•				
160	180										•			
200	220											•		
250	280												•	
Bore (mm)		50	63	80	100	125	140*	160	180*	200	250	320	400	

### 3 - ATEX 2014/34/UE RATED VERSION

ATEX 2014/34/UE rated version cylinders for installation in potentially explosive atmospheres are now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified.

The supply is always delivered accompanied by:

- the ATEX declaration of conformity
- the operating and maintenance user manual, where are described all the information for the proper use of cylinders in potentially explosive environments.

TYPE EXAMINATION CERTIFICATE N°: **CEC 10 ATEX 138**

#### 3.1 - Identification code

To order the ATEX-rated version, simply insert the letter K in the initial part of the identification code. The description becomes HCK3-\*

For cylinders without end-stroke proximity sensors please order with the identification code shown at paragraph 2.

Example: HCK3C-200/125-350-K3-S-0-11/20

For cylinders equipped with end-stroke proximity sensors please refer to the identification code shown at paragraph 16.1.

Example: HCK3F-FP22-80/56-225-K3-S-0-11/20

The ATEX-rated cylinders equipped with end-stroke proximity sensors are compliant with the specifications listed paragraph 16; Also the same prescriptions described in that paragraph are effective. (NB: for bores Ø125 and Ø400 feasibility contact our technical department).

The proximity sensors are compliant with the description and the wiring diagram shown at the paragraph 16.2.

#### 3.2 - Classification

Cylinders without end-stroke proximity sensors have this ATEX mark:

II 2GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/UE directive and related technical specification requests.

II: Group II for surface plants

2: Category 2 high protection, eligible for zone 1 for gases and zone 21 for dust (automatically be eligible for zone 2 category 3 for gases and zone 22 for dust)

GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.

ck: protection by constructional safety and by liquid immersion

IIC: Gas group (automatically eligible for group IIA and IIB)

T4: Temperature class for gas (max surface temperature)

-20°C Ta +80°C: Ambient temperature range

Cylinders with end-stroke proximity sensors have this ATEX mark:

II 3GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/UE directive and related technical specification requests

II: Group II for surface plants

3: Category 3 standard protection, eligible for zone 2 for gases (zone 22 for dust)

GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.

ck: protection by constructional safety and by liquid immersion

IIC: Gas group (automatically eligible for group IIA and IIB)

T4: Temperature class for gas (max surface temperature)

-20°C Ta +80°C: Ambient temperature range

#### 3.3 - Operating temperatures

The operating ambient temperature must be between -20°C and +80 °C.

The fluid temperature for the standard version seals (K) and for low friction seals (M) must be between -20°C and +80°C, as for viton (V) seals must be between -20°C and +120 °C.

The actuators are T4 (T135° C) class temperature classified, so they are eligible for operation also at higher class temperature (T3, T2, T1 (T200° C).

#### 3.4 - Admitted velocities

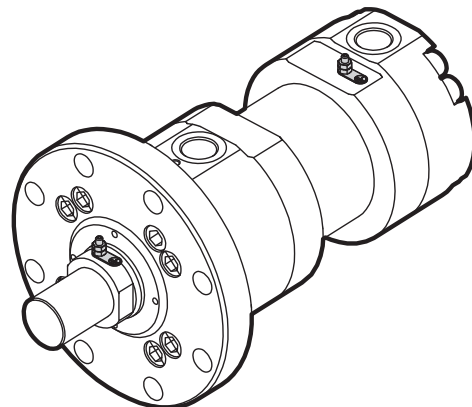
The maximum permissible speed is 0.5 m/s for standard cylinder seals (K) and 1 m/s for actuators with low friction seals (M) or Viton (V).

#### 3.5 - Connectors

The connectors for the end-stroke proximity are available upon request. They are metal, to be wired. The ordering code is **0680961**. One connector per sensor is needed.

#### 3.6 - Grounding points

The ATEX certified actuators are supplied with two grounding points, one on the rear head and one on the rod, for the wire of the cylinder with the ground (M4 screws).



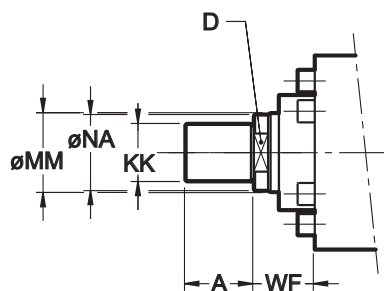
The bottom grounding point must always be connected whereas the connection of the rod grounding point can be avoided in case the whole mechanical stroke is covered during the cylinder operating phase (from the mechanical stop on the cylinder head to the mechanical stop on the bottom), or in case the rod has already been grounded through the mechanical connection between the rod itself and the machine/plan it is installed on.

In order to verify such a condition it is necessary to test the equipotentiality of the parts and a maximum resistance equal to 100Ω as per the EN13463-1 norm.

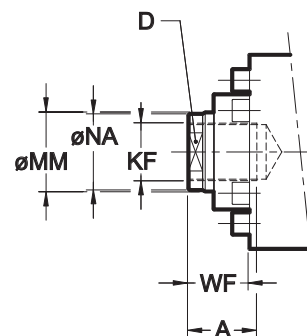
## 4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

Standard = male thread



W = female thread



\* For bores Ø 180 (piston rod Ø 110) and higher, the rod has 4 holes at 90° realized on Ø NA and of Ø shown in the table.

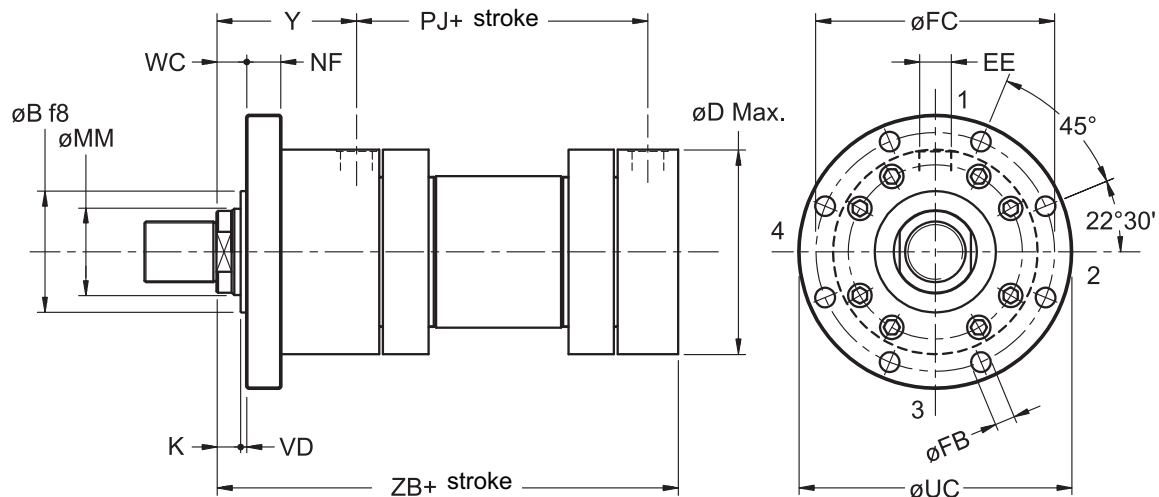
A pin wrench UNI 6752 - DIN 1810 must be used.

Bore	MM Ø rod	KK	Ø NA	KF	A	D	WF
50	32	M27x2	31	-	36	28	47
	36		35	M27x2		32	
63	40	M33x2	38	-	45	34	53
	45		43	M33x2		36	
80	50	M42x2	48	-	56	43	60
	56		54	M42x2		46	
100	63	M48x2	60	-	63	53	68
	70		67	M48x2		60	
125	80	M64x3	77	-	85	65	76
	90		87	M64x3		75	
140	90	M72x3	87	-	90	75	76
	100		96	M72x3		85	
160	100	M80x3	96	-	95	85	85
	110		106	M80x3		95	
180	110	M90x3	106	-	105	95	95
	125		121	M90x3		Ø 12*	
200	125	M100x3	121	-	112	Ø 12*	101
	140		136	M100x3		Ø 12*	
250	160	M125x4	155	-	125	Ø 15*	113
	180		175	M125x4		Ø 15*	
320	200	M160x4	195	-	160	Ø 15*	136
	220		214	M160x4		Ø 15*	
400	250	M200x4	245	-	200	Ø 20*	163
	280		270	M200x4		Ø 20*	

## 5 - OVERALL AND MOUNTING DIMENSIONS ISO MF3

### A FRONT FLANGE

dimensions in mm



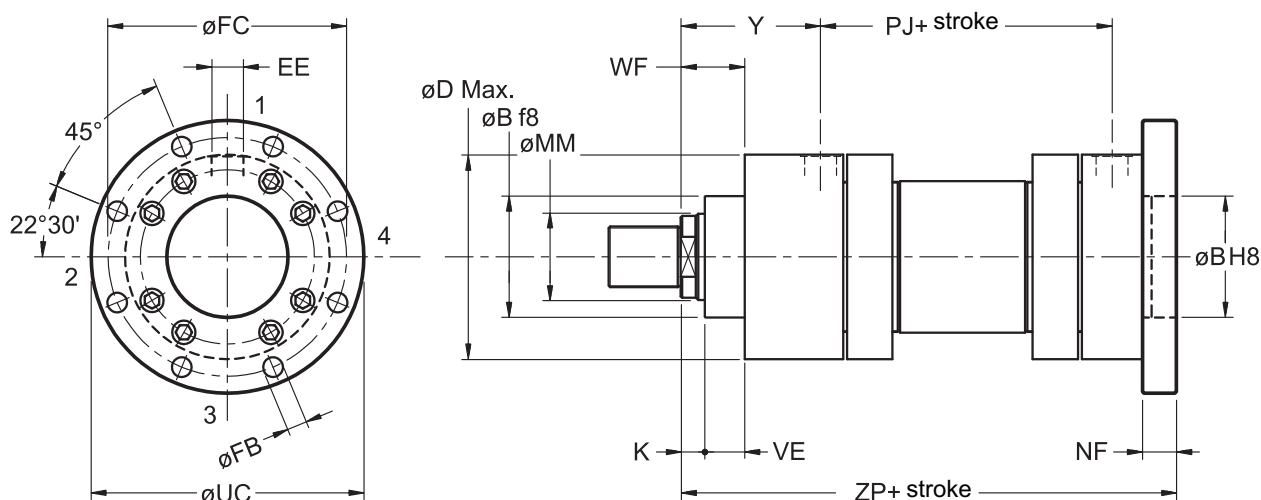
**NOTE:  $\varnothing 400$  bore has 12 equally spaced  $\varnothing FB$  holes in the mounting flange**

Bore	MM $\varnothing rod$	$\varnothing B$ f8	$\varnothing D$ max	EE BSP	$\varnothing FB$	$\varnothing FC$	K	NF	PJ	$\varnothing UC$	VD	WC	Y	ZB
50	32 36	63	105	1/2"	13,5	132	18	25	120	155	4	22	98	244
63	40 45	75	122	3/4"	13,5	150	21	28	133	175	4	25	112	274
80	50 56	90	145	3/4"	17,5	180	24	32	155	210	4	28	120	305
100	63 70	110	175	1"	22	212	27	36	171	250	5	32	134	340
125	80 90	132	210	1"	22	250	31	40	205	290	5	36	153	396
140	90 100	145	255	1. 1/4"	26	300	31	40	208	340	5	36	181	430
160	100 110	160	270	1. 1/4"	26	315	35	45	235	360	5	40	185	467
180	110 125	185	300	1. 1/4"	33	365	40	50	250	420	5	45	205	505
200	125 140	200	330	1. 1/4"	33	385	40	56	278	440	5	45	220	550
250	160 180	250	410	1. 1/2"	39	475	42	63	325	540	8	50	260	652
320	200 220	320	500	2"	45	600	48	80	350	675	8	56	310	764
400	250 280	400	628	2"	45 NOTE	720	53	100	360	800	10	63	333	775

## 6 - OVERALL AND MOUNTING DIMENSIONS ISO MF4

### B BACK FLANGE

dimensions in mm



NOTE: Ø 400 bore has 12 equally spaced ØFB holes in the mounting flange

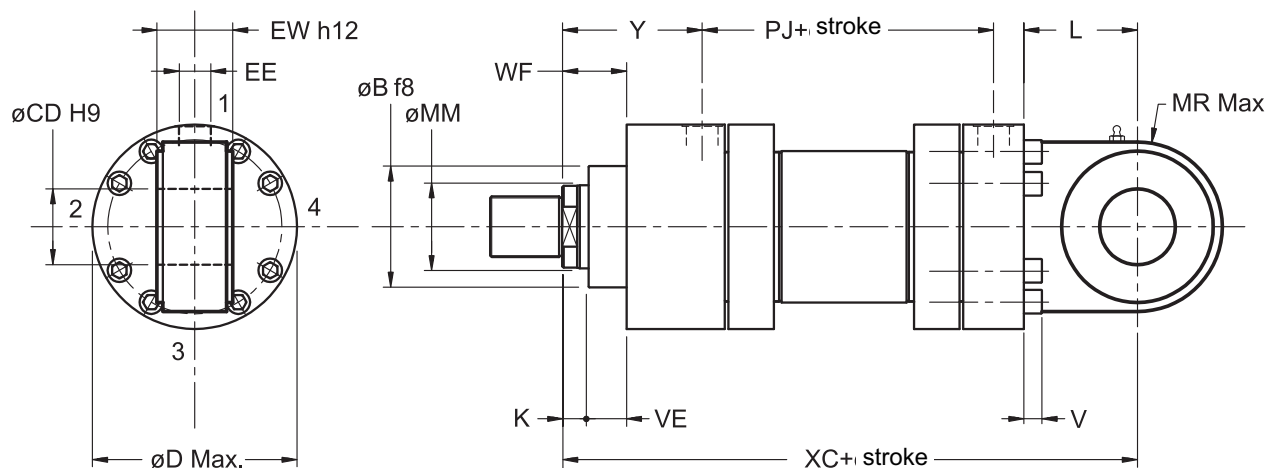
Bore	MM Ø rod	ØB f8	ØD max	EE BSP	ØFB	ØFC	K	NF	PJ	ØUC	VE	WF	Y	ZP
50	32 36	63	105	1/2"	13,5	132	18	25	120	155	29	47	98	265
63	40 45	75	122	3/4"	13,5	150	21	28	133	175	32	53	112	298
80	50 56	90	145	3/4"	17,5	180	24	32	155	210	36	60	120	332
100	63 70	110	175	1"	22	212	27	36	171	250	41	68	134	371
125	80 90	132	210	1"	22	250	31	40	205	290	45	76	153	430
140	90 100	145	255	1. 1/4"	26	300	31	40	208	340	45	76	181	465
160	100 110	160	270	1. 1/4"	26	315	35	45	235	360	50	85	185	505
180	110 125	185	300	1. 1/4"	33	365	40	50	250	420	55	95	205	550
200	125 140	200	330	1. 1/4"	33	385	40	56	278	440	61	101	220	596
250	160 180	250	410	1. 1/2"	39	475	42	63	325	540	71	113	260	703
320	200 220	320	500	2"	45	600	48	80	350	675	88	136	310	830
400	250 280	400	628	2"	45 NOTE	720	53	100	360	800	110	163	333	855



## 7 - OVERALL AND MOUNTING DIMENSIONS ISO MP3

### D MALE CLEVIS (with bushing)

dimensions in mm

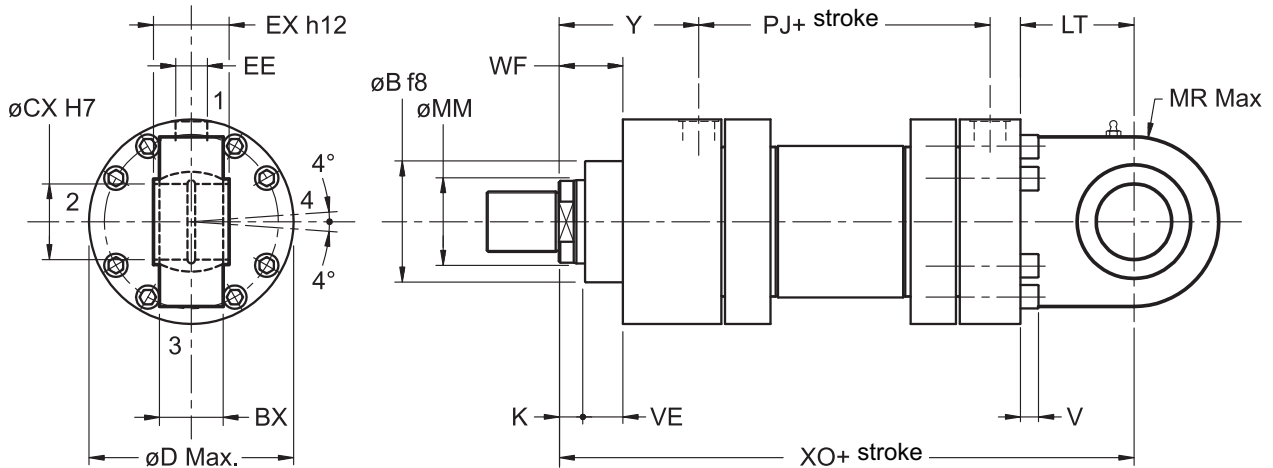


Bore	MM Ø rod	Ø B f8	Ø CD H9	Ø D max	EE BSP	EW h12	K	L	MR max	PJ	V	VE	WF	XC	Y
50	32 36	63	32	105	1/2"	32	18	61	35	120	8	29	47	305	98
63	40 45	75	40	122	3/4"	40	21	74	50	133	10	32	53	348	112
80	50 56	90	50	145	3/4"	50	24	90	61.5	155	12	36	60	395	120
100	63 70	110	63	175	1"	63	27	102	72.5	171	16	41	68	442	134
125	80 90	132	80	210	1"	80	31	124	90	205	16	45	76	520	153
140	90 100	145	90	255	1.1/4"	90	31	150	113	208	24	45	76	580	181
160	100 110	160	100	270	1.1/4"	100	35	150	125	235	24	50	85	617	185
180	110 125	185	110	315	1.1/4"	110	40	185	147.5	250	27	55	95	690	205
200	125 140	200	125	330	1.1/4"	125	40	206	160	278	24	61	101	756	220
250	160 180	250	160	410	1.1/2"	160	42	251	200	325	27	71	113	903	260
320	200 220	320	200	510	2"	200	48	316	250	350	36	88	136	1080	310
400	250 280	400	250	628	2"	250	53	300	320	360	42	110	163	1075	333

## 8 - OVERALL AND MOUNTING DIMENSIONS ISO MP5

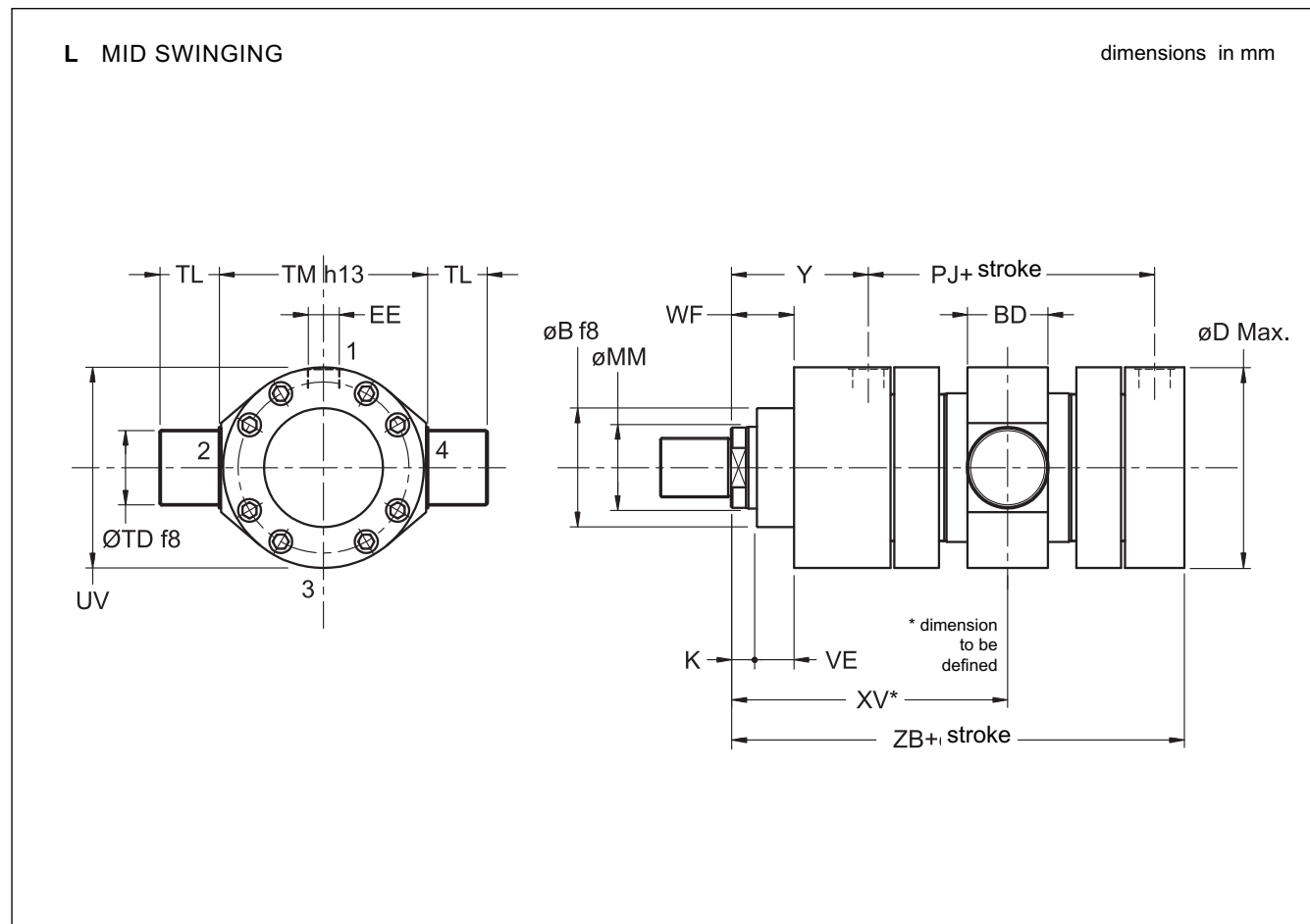
### F SPHERIC SWIVEL

dimensions in mm



Bore	MM $\phi rod$	$\phi B$ f8	BX	$\phi CX$ H7	$\phi D$ max	EE BSP	EX h12	K	LT	MS max	PJ	V	VE	WF	XO	Y
50	32 36	63	27	32	105	1/2"	32	18	61	40	120	8	29	47	305	98
63	40 45	75	35	40	122	3/4"	40	21	74	50	133	10	32	53	348	112
80	50 56	90	40	50	145	3/4"	50	24	90	63	155	12	36	60	395	120
100	63 70	110	50	63	175	1"	63	27	102	71	171	16	41	68	442	134
125	80 90	132	60	80	210	1"	80	31	124	90	205	16	45	76	520	153
140	90 100	145	65	90	255	1.1/4"	90	31	150	113	208	24	45	76	580	181
160	100 110	160	70	100	270	1.1/4"	100	35	150	112	235	24	50	85	617	185
180	110 125	185	80	110	300	1.1/4"	110	40	185	147.5	250	27	55	95	690	205
200	125 140	200	102	125	330	1.1/4"	125	40	206	160	278	24	61	101	756	220
250	160 180	250	130	160	410	1.1/2"	160	42	251	200	325	27	71	113	903	260
320	200 220	320	162	200	500	2"	200	48	316	250	350	36	88	136	1080	310
400	250 280	400	192	250	628	2"	250	53	300	320	360	42	110	163	1075	333

## 9 - OVERALL AND MOUNTING DIMENSIONS ISO MT4

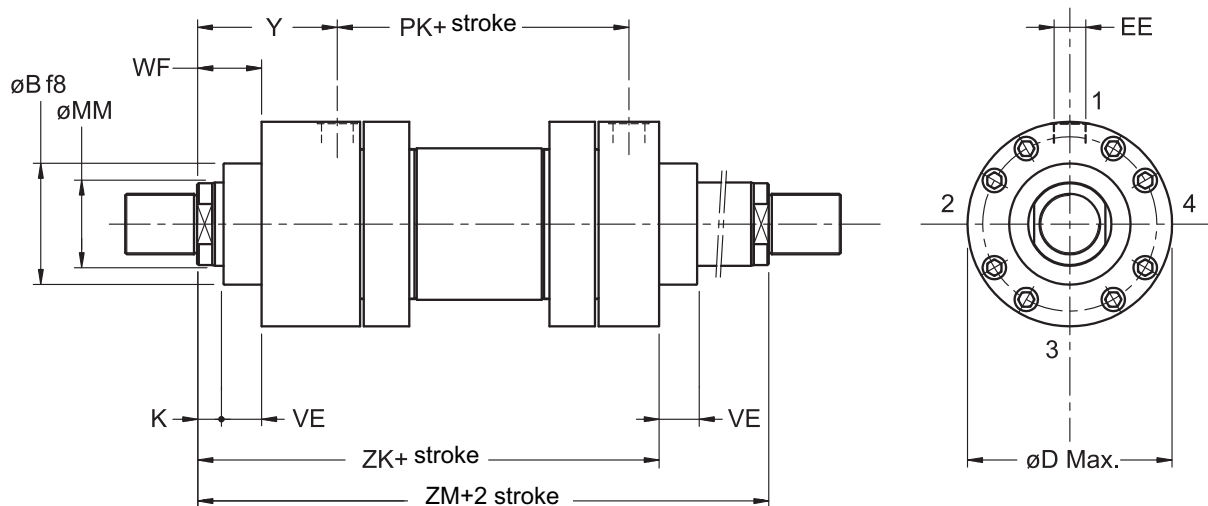


Bore	MM Ø rod	ØB f8	BD	stroke mm	ØD max	EE BSP	K	PJ	ØTD f8	TL	TM h13	ØUV	VE	WF	XV min	XV max + stroke	Y	ZB
50	32 36	63	38	45	105	1/2"	18	120	32	25	112	105	29	47	180	144	98	244
63	40 45	75	48	45	122	3/4"	21	133	40	32	125	122	32	53	195	160	112	274
80	50 56	90	58	60	145	3/4"	24	155	50	40	150	145	36	60	220	175	120	305
100	63 70	110	73	80	175	1"	27	171	63	50	180	175	41	68	245	185	134	340
125	80 90	132	88	95	210	1"	31	205	80	63	224	210	45	76	290	220	153	396
140	90 100	145	98	115	255	1. 1/4"	31	208	90	70	265	255	45	76	330	240	181	430
160	100 110	160	108	115	270	1. 1/4"	35	235	100	80	280	270	50	85	340	255	185	467
180	110 125	185	118	150	300	1. 1/4"	40	250	110	90	320	315	55	95	390	270	205	505
200	125 140	200	133	180	330	1. 1/4"	40	278	125	100	335	330	61	101	430	280	220	550
250	160 180	250	180	220	410	1. 1/2"	42	325	160	125	425	410	71	113	505	320	260	652
320	200 220	320	220	280	500	2"	48	350	200	160	530	510	88	136	590	380	310	764
400	250 280	400	270	420	628	2"	53	360	250	200	630	628	110	163	675	340	333	775

### 10 - OVERALL AND MOUNTING DIMENSIONS

#### DOUBLE ROD

dimensions in mm



For other dimensions and mounting styles please see single rod cylinder tables.

Not available for mounting styles B - D - F.

Bore	MM $\varnothing$ rod	K	$\varnothing D$ max	EE BSP	PK	VE	WF	Y	ZM	ZK
50	32 36	18	105	1/2"	126	29	47	98	322	275
63	40 45	21	122	3/4"	134	32	53	112	358	305
80	50 56	24	145	3/4"	153	36	60	120	393	333
100	63 70	27	175	1"	165	41	68	134	433	365
125	80 90	31	210	1"	204	45	76	153	510	434
140	90 100	31	255	1. 1/4"	208	45	76	181	570	494
160	100 110	35	270	1. 1/4"	225	50	85	185	595	510
180	110 125	40	300	1. 1/4"	250	55	95	205	660	565
200	125 140	40	330	1. 1/4"	271	61	101	220	711	610
250	160 180	42	410	1. 1/2"	308	71	113	260	828	715
320	200 220	48	500	2"	350	88	136	310	970	834
400	250 280	53	628	2"	360	110	163	333	975	812

**NOTE:** Double rod cylinders are developed with two separate rods, fixed together by means of threading.

Because of this mounting style, the rod with female threading is less resistant than the other. To simplify the identification of the more resistant rod, the "M" marking is stamped on its end.

We recommend the use of the weaker rod for the less demanding applications.

### 11 - ROD DIAMETER SELECTION

To ensure adequate stability, cylinders must be calculated for maximum compressive load according to the following simplified procedure:

- Refer to the table to identify the stroke factor according to the mounting style.
- To calculate the reference length, multiply the working stroke by the stroke factor.

- To calculate the thrust force, multiply the total cylinder area by the operating pressure.

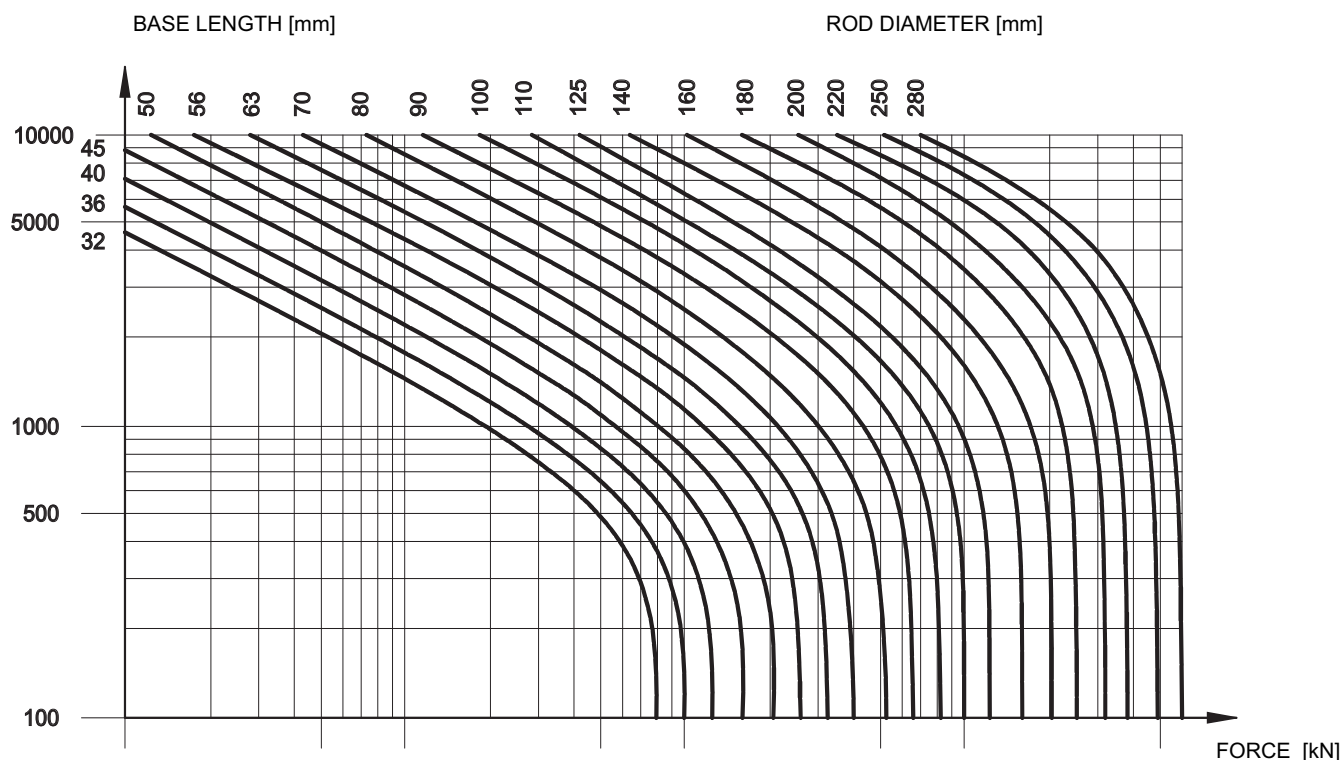
- On the diagram, find the point of intersection between the thrust force and reference length.

- Identify the minimum rod diameter on the curve above the previous point of intersection.

Cylinders with rod diameters smaller than the value plotted in the diagram will not guarantee sufficient rigidity.

Mounting style	Rod connection	Mounting	Stroke factor
A	Fixed and supported		2
	Fixed and rigidly guided		0.5
	Jointed and rigidly guided		0.7
B	Fixed and supported		4
	Fixed and rigidly guided		1
	Jointed and rigidly guided		1.5

Mounting style	Rod connection	Mounting	Stroke factor
D - F	Jointed and supported		4
	Jointed and rigidly guided		2
L	Jointed and supported		3
	Jointed and rigidly guided		1.5



### 12 - THEORETICAL FORCES

Push force

$$F_s = P \cdot A_t$$

Pull force

$$F_t = P \cdot A_a$$

$F_s$  = Force (extension) in N

$F_t$  = Force (retraction) in N

$A_t$  = Total area in  $\text{mm}^2$

$A_a$  = Annular area in  $\text{mm}^2$

$P$  = Pressure in MPa

1 bar = 0.1 MPa

1 kgf = 9.81 N

Bore mm	Ø rod mm	Total area $\text{mm}^2$	Annular area $\text{mm}^2$
50	32 36	1964	1159 946
63	40 45	3117	1861 1527
80	50 56	5027	3063 2564
100	63 70	7854	4737 4006
125	80 90	12272	7245 5910
140	90 100	15394	9032 7540
160	100 110	20106	12252 10603
180	110 125	25447	15943 13175
200	125 140	31416	19144 16022
250	160 180	49087	28981 23640
320	200 220	80425	49009 42412
400	250 280	125664	76576 64089

### 13 - THEORETICAL VELOCITIES

#### Configuration 1

The diagram illustrates a conventional cylinder application: the fluid is delivered by means of a directional control valve in alternation to the front chamber while the rear chamber is connected to tank and vice versa.

To calculate velocity and force, proceed as follows:

Velocity (extension)

$$V = \frac{Q \cdot 1000}{A_t \cdot 60}$$

Velocity (retraction)

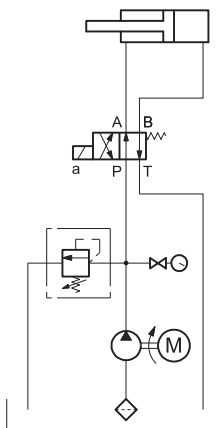
$$V = \frac{Q \cdot 1000}{A_a \cdot 60}$$

Force (extension)

$$F = P \cdot A_t$$

Force (retraction)

$$F = P \cdot A_a$$



#### Configuration 2

When the system requires high velocity with relatively low forces, we recommend using a regenerative circuit. Diagram 2 illustrates the simplest version of this type of set-up.

The annular chamber is permanently connected to the pump while the full bore end is connected alternately to the pump, in which case the piston rod extends as a result of the differential areas (both chambers are supplied at the same pressure), and to tank, in which case the piston rod retracts.

Velocity (extension)

$$V = \frac{Q \cdot 1000}{A_s \cdot 60}$$

Velocity (retraction)

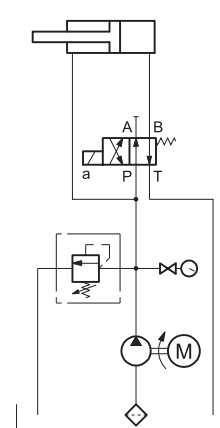
$$V = \frac{Q \cdot 1000}{A_a \cdot 60}$$

Force (extension)

$$F = P \cdot A_s$$

Force (retraction)

$$F = P \cdot A_a$$



$V$  = Velocity in m/s

$Q$  = Flow rate in l/min

$A_t$  = Total area (piston bore) in  $\text{mm}^2$

$A_a$  = Annular area ( $A_t - A_s$ ) in  $\text{mm}^2$

$F$  = Force in N

$P$  = Pressure in MPa

$A_s$  = Rod area ( $A_t - A_a$ ) in  $\text{mm}^2$

$Q_d$  = Flow rate through directional control valve (Q+return flow rate from small chamber) in l/min

1 bar = 0.1 MPa

1 kgf = 9.81 N

**NOTE:** In the case of regenerative circuits, the sizing of the directional control valve is fundamental. Flow rate through the directional control valve is calculated according to the following formula:

$$Q_d = \frac{V \cdot A_t \cdot 60}{1000}$$



### 14 - MASSES

Bore	Ø rod	Mass for null stroke			Mass for 10 mm stroke
		Mounting style			
		A - B	D - F	L	
mm	mm	kg	kg	kg	kg
50	32 36	14	16	17	0,2
63	40 45	28	27	27	0,3
80	50 56	39	38	39	0,5
100	63 70	61	62	63	0,6 0,7
125	80 90	103 104	107 108	110	0,9 1
140	90 100	164	173	175	1,1 1,2
160	100 110	198 199	210	208 209	1,6 1,7
180	110 125	289	296 297	298 299	2 2,2
200	125 140	356 357	365 366	364 365	2,2 2,4
250	160 180	666 667	698 700	685 687	3,2 3,6
320	200 220	1200 1250	1314 1365	1259 1310	5,1 5,6
400	250 280	2180 2250	2259 2330	2249 2320	7 7,5

### 15 - SEAL KIT IDENTIFICATION CODE

<b>S K / H C 3 - / / - / 10</b>											
Seal kit									Series no. indicated on cylinder		
Bore (mm)									Seals: <b>K</b> = standard (nitrile + polyurethane) <b>M</b> = low friction (nitrile + PTFE) <b>V</b> = high temperature (viton + PTFE)		
Rod (mm)									Double rod (omit if not required)		

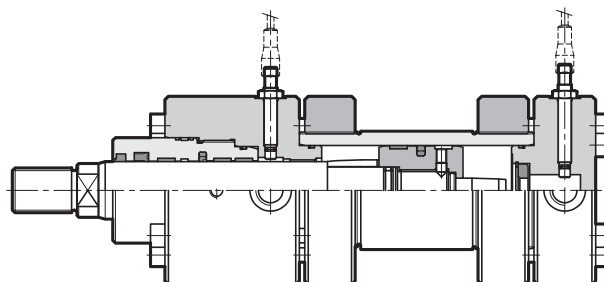
**NOTE:** the seal kit includes all the seals of a full-options cylinder (cushionings and external drain).

### 16 - END-STROKE PROXIMITY SENSORS

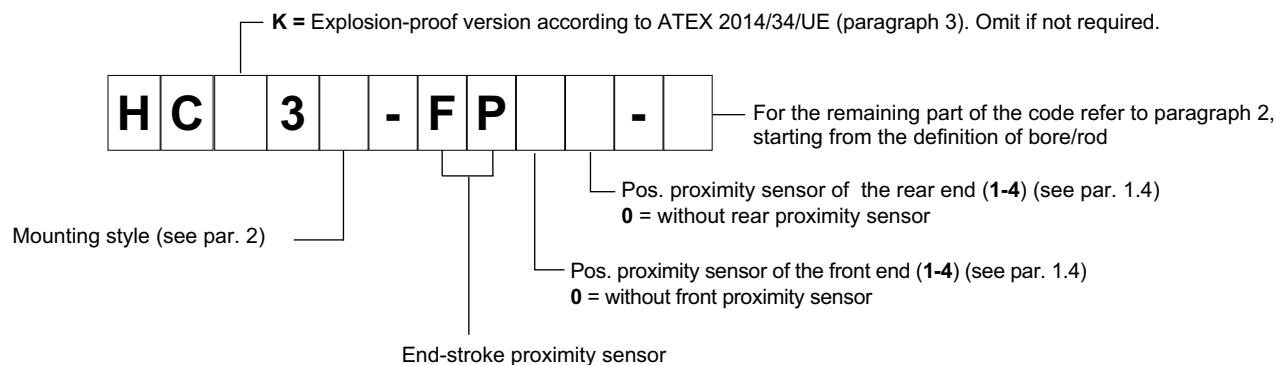
Upon request, cylinders can be supplied with end-stroke proximity sensors type PNP, with normally open output. They are mounted on the front and rear end of the cylinder and they supply an electric signal when the piston rod reaches the stroke end. They are available for all cylinder mounting styles, on both ends and for every available bore.

In order to ensure the correct functioning of the system, cylinders must be equipped with cushionings.

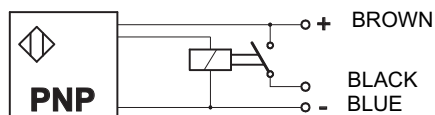
These sensors can be only used to provide the switching signal and not to control voltage loads.



#### 16.1 - Identification code



#### 16.2 - Technical characteristics and electrical connection



Rated voltage	VDC	24
Power supply voltage range	VDC	10 ÷ 30
Absorbed current	mA	200
Output	normally open contact	
Electric protection	polarity inversion short circuit overvoltage	
Electric connection	with connector	
Maximum operating pressure	bar	500
Operating temperature range	°C	-25 / +80
Class of protection according IEC EN 60529 (atmospheric ag.)		IP 68
Piston position LED ( <b>NOTE</b> )		NO (it's on the connector)

#### 16.3 - Connectors

Connectors for proximity sensors must be ordered separately, by specifying the code: **ECM3S/M12L/10**

**NOTE: These connectors are not suitable for ATEX-rated cylinders. The connectors for the ATEX-rated cylinders are described at paragraph 3.5.**

Connector: pre-wired connector M12 - IP68  
Cable: with 3 conductors 0.34 mm<sup>2</sup> - length 5 mt.  
Cable material: polyurethane resin (oil resistant)

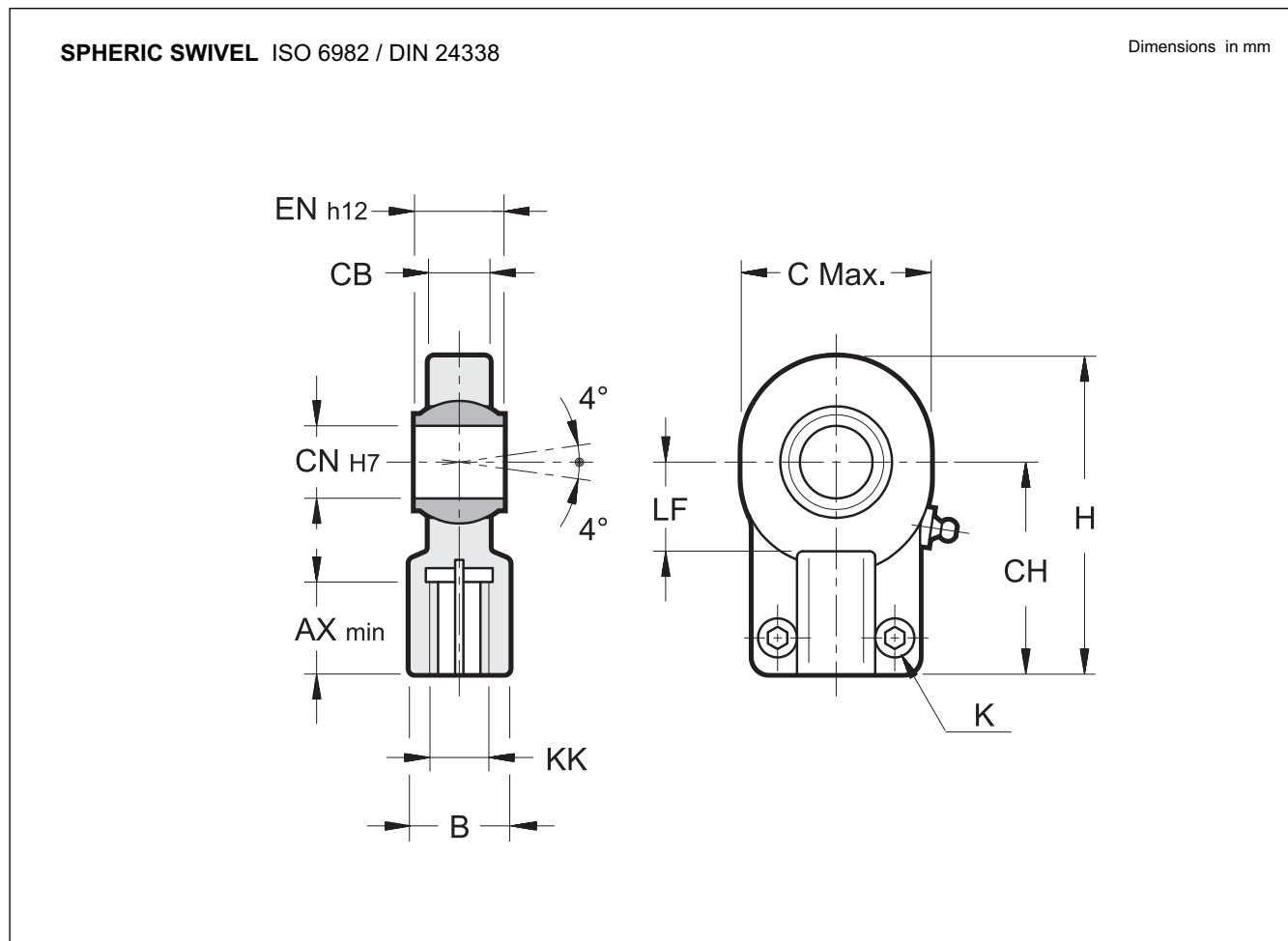
The connector has two LEDs, one green and one yellow.

**GREEN:** Connector power supply.  
The LED burn when the connector is supplied.

**YELLOW:** position signal.  
ON - piston at stroke end  
OFF - piston not at stroke end



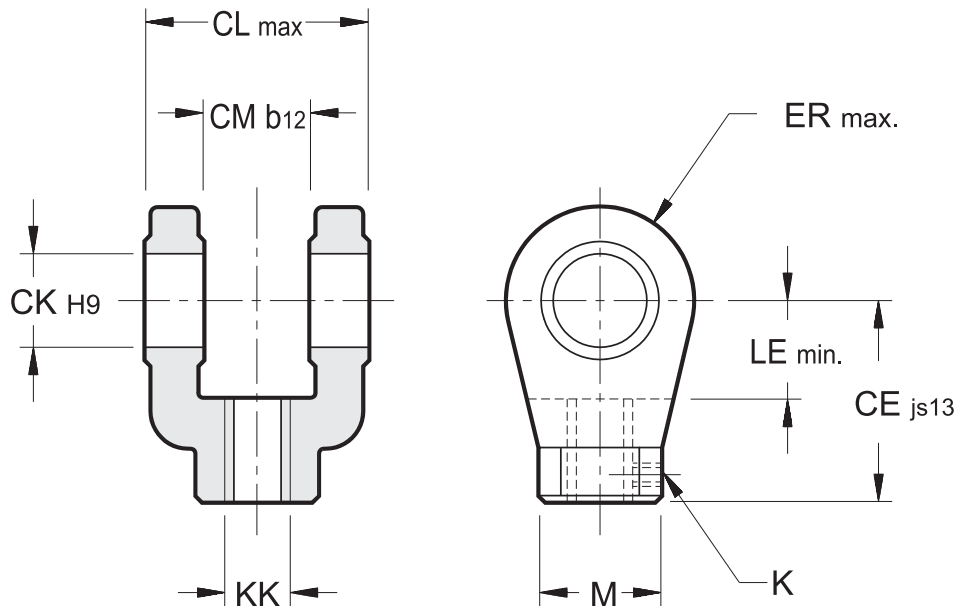
## 17 - OVERALL AND MOUNTING DIMENSIONS



Type	Ø cylinder bore	AX min	B	C max	CB	CH	Ø CN H7	EN h12	H	KK	LF	BOLT K UNI 5931	Torque Nm	Max load kN	Mass Kg
LSF-36	50	37	38	71	28	80	32	32	119	M27x2	32	M10x25	49	67	1.17
LSF-45	63	46	47	90	33	97	40	40	146	M33x2	41	M10x30	49	100	2.15
LSF-56	80	57	58	109	41	120	50	50	180	M42x2	50	M12x35	86	156	3.75
LSF-70	100	64	70	132	53	140	63	63	212	M48x2	62	M16x40	210	255	7
LSF-90	125	86	90	170	67	180	80	80	271	M64x3	78	M20x50	410	400	13.8
LSF-100	140	91	100	185	72	195	90	90	296	M72x3	85	M20x60	410	490	19.1
LSF-110	160	96	110	224	84	210	100	100	322	M80x3	98	M24x60	710	610	25
LSF-125	180	106	125	235	88	235	110	110	364	M90x3	105	M24x60	710	655	32
LSF-140	200	113	135	290	102	260	125	125	405	M100x3	120	M24x70	710	950	46
LSF-180	250	126	165	346	130	310	160	160	480	M125x4	150	M24x80	710	1370	82.5
LSF-220	320	161	215	460	162	390	200	200	620	M160x4	195	M30x100	1500	2120	168

## 18 - OVERALL AND MOUNTING DIMENSIONS

### FEMALE CLEVIS ISO 8133



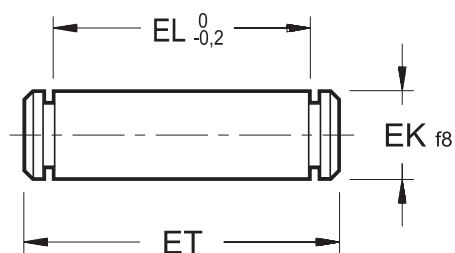
Dimensions in mm

Type	Ø cylinder bore	M	CE	Ø CK	CL	CM	ER	KK	LE	K bolt	Max load kN	Mass kg
		CH	js13	H9	max	b12	max		min			
FRC-36	50	40	75	28	83	40	34	M27x2	39	M6x6	80	1.8
FRC-45	63	56	99	36	103	50	50	M33x2	54	M8x8	125	3.7
FRC-56	80	56	113	45	123	60	53	M42x2	57	M8x8	200	5.6
FRC-70	100	75	126	56	143	70	59	M48x2	63	M12x12	320	9.3
FRC-90	125	95	168	70	163	80	78	M64x3	83	M12x12	500	20
FRC-110	160	95	168	70	163	80	78	M80x3	83	M12x12	500	20

## 19 - OVERALL AND MOUNTING DIMENSIONS

### FEMALE CLEVIS ISO 8133 with spring retainers

Dimensions in mm



Type	Ø EK f8	EL 0 / - 0.2	ET	Mass kg
PNF-36	28	87	96	0.5
PNF-45	36	107	120	1
PNF-56	45	129	144	1.8
PNF-70	56	149	164	3.2
PNF-90	70	169	187	5.6



**HC3**  
SERIES 10



**DUPLOMATIC  
OLEODINAMICA**

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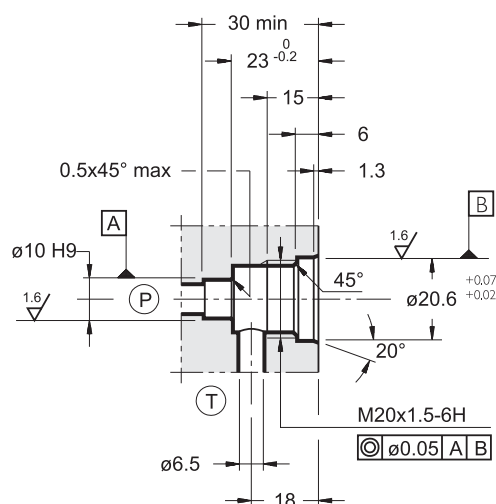


**CRE**  
**DIRECT OPERATED**  
**PRESSURE CONTROL VALVE**  
**WITH ELECTRIC PROPORTIONAL**  
**CONTROL**  
**SERIES 20**

### CARTRIDGE TYPE

**p max 350 bar**

**Q max 1,5 l/min**

**SEAT DIMENSIONS: D-10A**

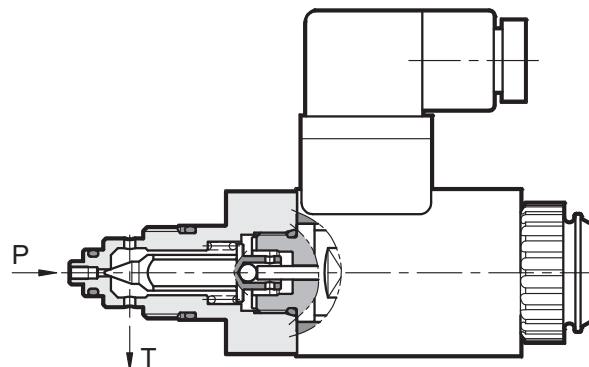
**NOTE:** Provide seat for optional restrictor in T line

## PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Maximum operating pressure: - P port - T port	bar	350 2
Minimum controlled pressure	see $\Delta p$ -Q diagram	
Nominal flow Maximum flow	l/min	0,5 1,5
Step response	see paragraph 5	
Hysteresis (with PWM 200 Hz)	% of p nom	< 5%
Repeatability	% of p nom	< $\pm 1,5\%$
Electrical characteristic	see paragraph 4	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 $\div$ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass:	kg	0.54

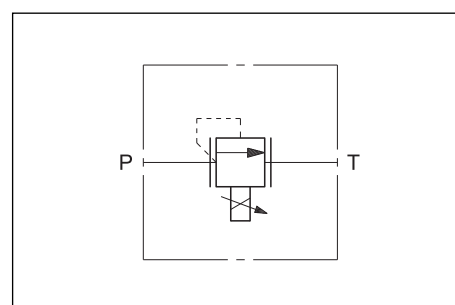
## OPERATING PRINCIPLE



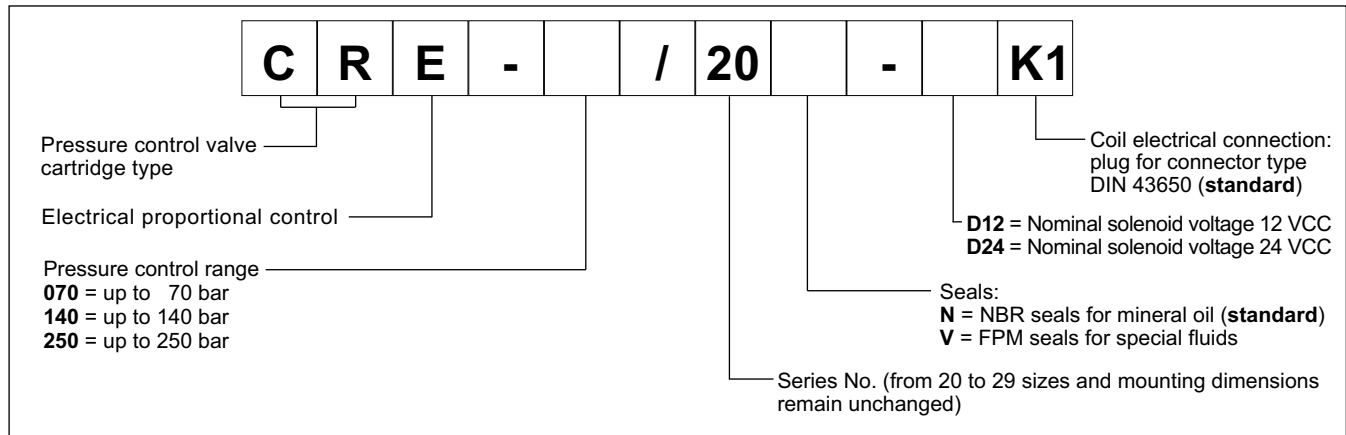
- The CRE valve is a direct operated pressure control valve with electric proportional control with cartridge execution which can be used in blocks and panels with type D-10A seat.
- The valve is suitable as a pilot stage for remote control of two stage pressure control and reducing valves.

- Pressure adjustment can be continuous in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control power supply unit or by means of the relative electronic control units to exploit valve performance to the full (see paragraph 8).
- The valve is available in three pressure control ranges up to 250 bar.

**HYDRAULIC SYMBOL**



### 1 - IDENTIFICATION CODE

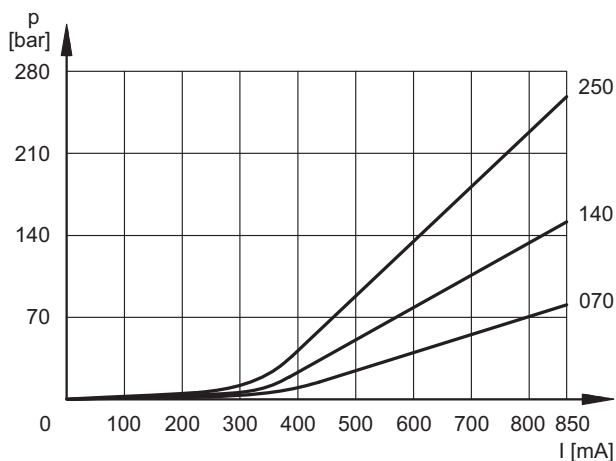


### 2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

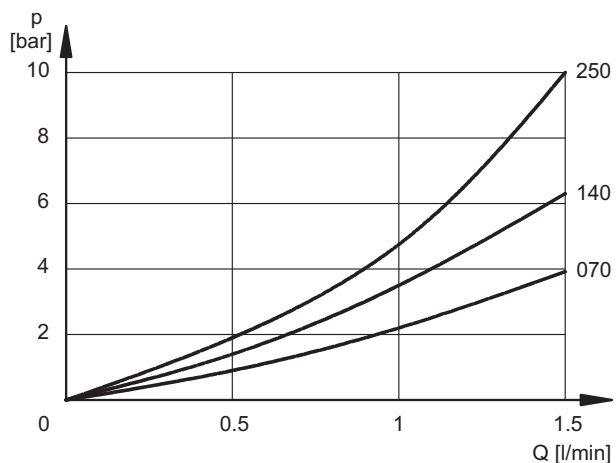
Typical control curves according to the current supplied to the solenoid, measured with input flow rate  $Q=0,5$  l/min.

The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T.

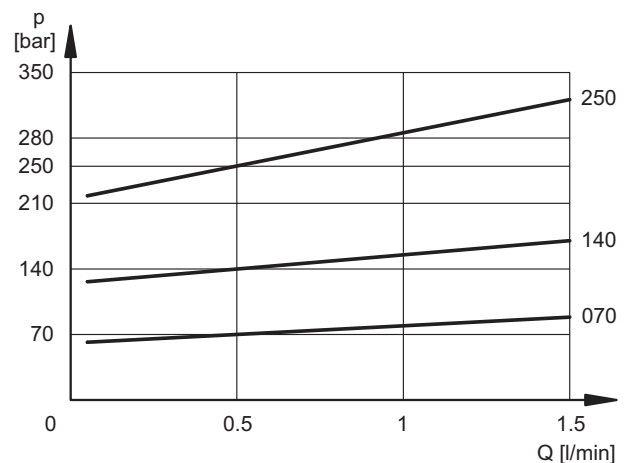
#### PRESSURE CONTROL $p = f(I)$



#### MINIMUM CONTROLLED PRESSURE $p_{min} = f(Q)$



#### PRESSURE VARIATION $p_{max} = f(Q)$



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N).

For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	16.6
MAXIMUM CURRENT	A	1.9	0.85
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CEE		
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65		

### 5 - STEP RESPONSE (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a valve of pressure range up to 140 bar and with input flow rate  $Q = 0,5 \text{ l/min}$ .

<b>REFERENCE SIGNAL STEP</b>	0 → 100%	100 → 0%
Step response [ms]	80	40

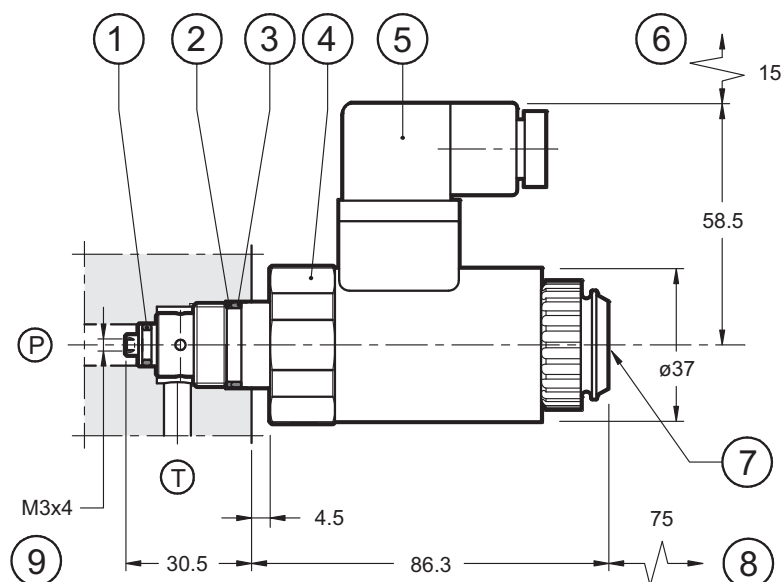
### 6 - INSTALLATION

We recommend to install the CRE valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil (see par. 7). At the end of the operation, make sure of having screwed correctly the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

### 7 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (7) placed at the end of the solenoid tube.

\* The measurement 4,5 mm can be reduced to 0,5 mm by increasing the axial dimensions of the D-10A, seat by 4 mm.

1	OR type 2025 (6.07x1.78)
2	PARBAK type 8-017 (18.01x1.14x1.35)
3	OR type 2068 (17.17x1.78)
4	Hex: spanner 36, torque 45 ÷ 50 Nm
5	DIN 43650 electric connector
6	Connector removal space
7	Breather (male hexagonal spanner 4)
8	Coil removal space
9	Seat for optional calibrated flow restrictor

### 8 - ELECTRONIC CONTROL UNITS

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat.89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		
<b>UEIK-11</b>	for solenoid 24V DC	Eurocard type	see cat. 89 300



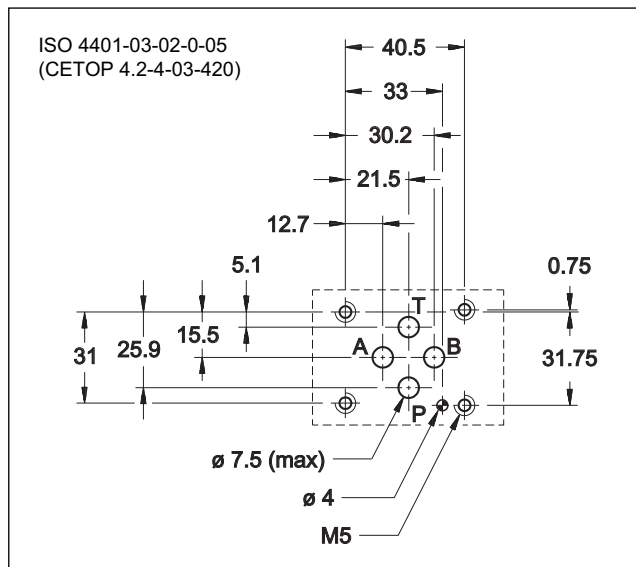
# PDE3

## PROPORTIONAL PRESSURE RELIEF VALVE, DIRECT OPERATED SERIES 10

### SUBPLATE MOUNTING ISO 4401-03

**p** max **420** bar  
**Q** max **2** l/min

### MOUNTING SURFACE



### PERFORMANCES

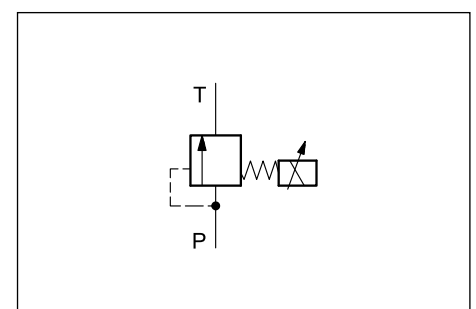
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Maximum operating pressure: - P port - T port	bar	420 2
Minimum controlled pressure	see p min = f(Q) diagram	
Nominal flow Maximum flow (see p min = f(Q) diagram)	l/min	1 2
Step response	see paragraph 6	
Hysteresis (with PWM 200 Hz)	% of p nom	< 5%
Repeatability	% of p nom	< ±1,5%
Electrical characteristic	see paragraph 5	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,6

### OPERATING PRINCIPLE

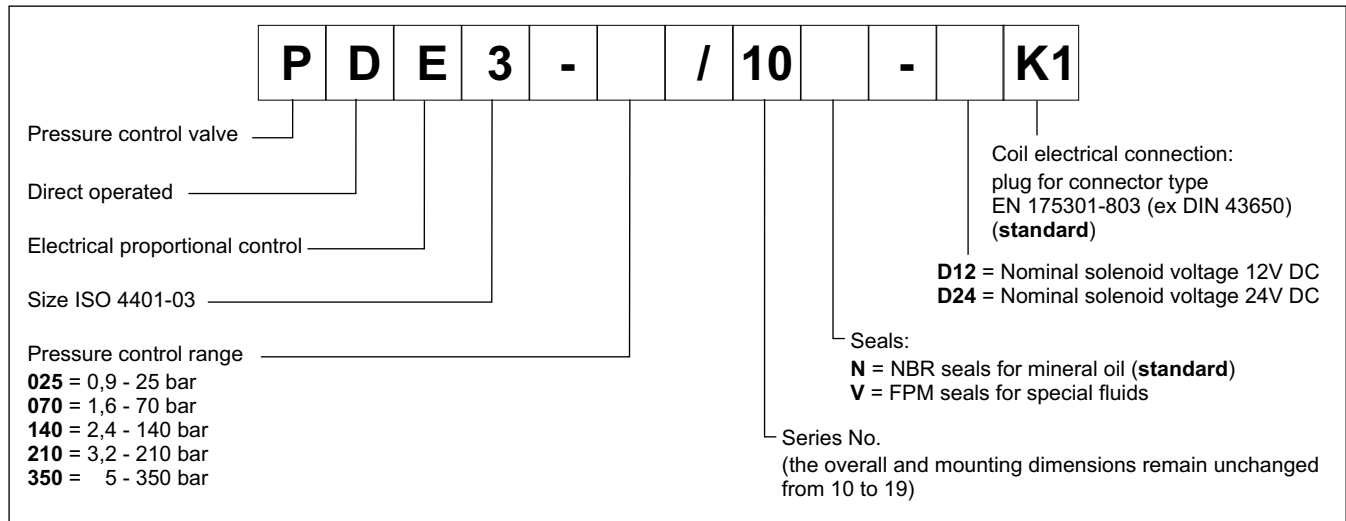
- The PDE3 valve is a direct operated proportional pressure relief valve, with mounting interface in compliance with ISO 4401 standards.
- It is suitable to pilot two-stage valves or for pressure control in hydraulic circuits.
- The design of this valve has a mechanical pressure limitation feature for higher safety of the application.
- The valve can be controlled directly by a current control supply unit or by an electronic control unit, to exploit valve performance to the full (see par. 9).
- The valve is available in five pressure control ranges up to 350 bar.

### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE



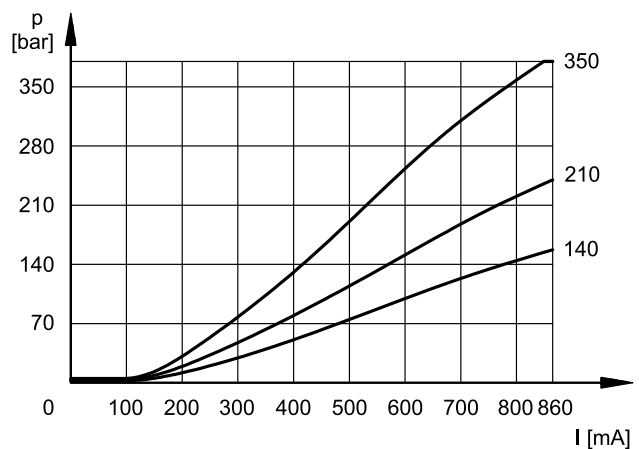
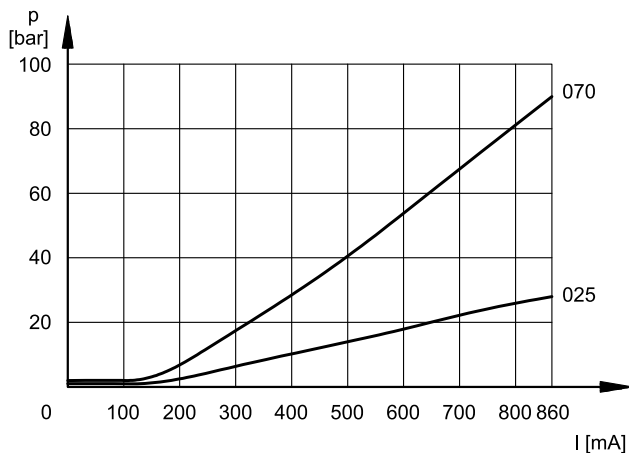
## 2 - CHARACTERISTIC CURVES

(obtained with viscosity of 36 cSt at 50°C, and valves with D24 coil)

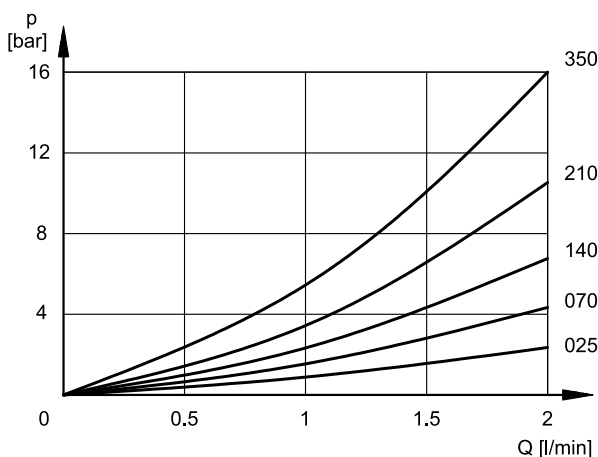
Typical control curves according to the current supplied to the solenoid, measured with input flow rate  $Q = 1$  l/min.

Curves have been obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T. The full scale pressure is set in factory with a flow rate of 1 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram  $p_{max} = f(Q)$ ).

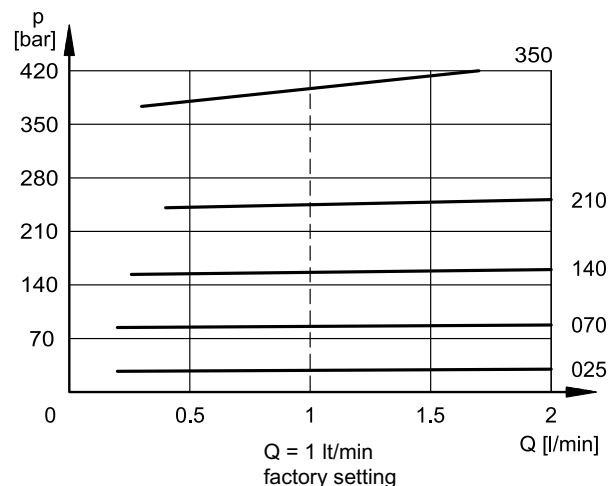
**PRESSURE CONTROL  $p = f(I)$**



**MINIMUM CONTROLLED PRESSURE  $p_{min} = f(Q)$**



**PRESSURE VARIATION  $p_{max} = f(Q)$**



### 3 - MAX PRESSURE VALUES

This valve incorporates a mechanical limit of the maximum pressure, that operates independently of the applied current. This kind of design ensures the pressure cannot rise over even if the solenoid current exceeds the maximum current ( $I > I_{\max}$ ).

Values obtained with oil viscosity of 36 cSt at 50°C,  $Q = 1$  l/min

		PDE3-025	PDE3-070	PDE3-140	PDE3-210	PDE3-350
pressure value at 800 mA	bar	25	77	142	217	360
max pressure value when $I > I_{\max}$	bar	33,5	90	161	252	390

### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 5 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	17.6
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU		
CLASS OF PROTECTION: atmospheric agents (EN 60529) coil insulation (VDE 0580) Impregnation	IP65 class H class F		

### 6 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a PDE3-140 and with an input flow rate of  $Q = 1$  l/min.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	60	70

### 7 - INSTALLATION

We recommend installing these valves with the solenoid downward, either in horizontal or vertical position. If the valve is installed on vertical axis with the solenoid upward, you should consider possible variations of the minimum controlled pressure from those indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In certain applications it might be necessary to vent the air entrapped in the solenoid tube by unfastening the drain screw placed in the solenoid tube.

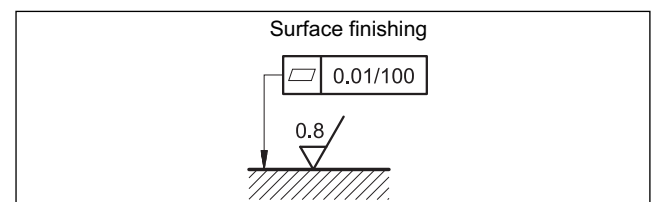
Ensure the solenoid tube is always filled with oil. Make sure the drain screw has been put back correctly at the end of the task.

Connect the valve T port directly to the tank. **Add any backpressure value detected in the T line to the controlled pressure value.**

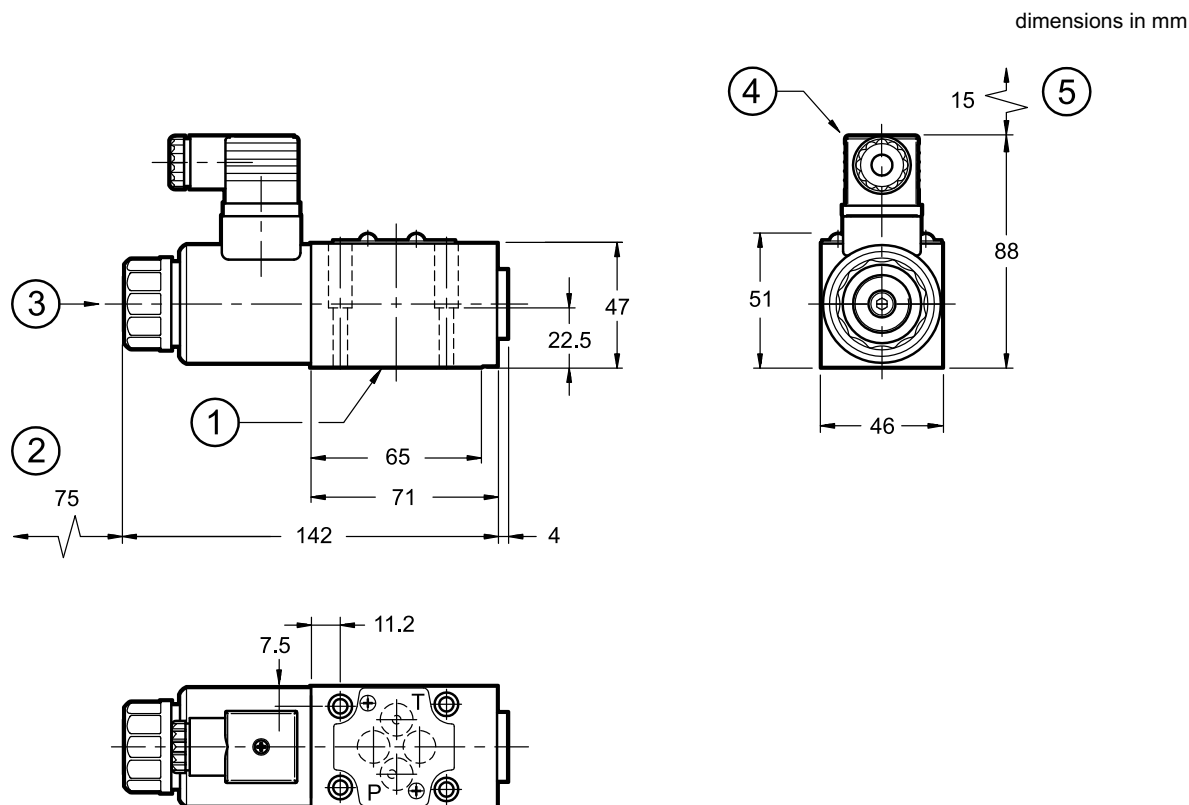
**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols.

If minimum values are not observed, fluid can easily leaks between the valve and support surface.



## 8 - OVERALL AND MOUNTING DIMENSIONS



**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

Valve fastening: 4 SHC screws M5x30 - ISO 4762

Tightening torque: 5 Nm (A 8.8 screws)

Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Coil removal space
3	Breather (Allen key 4)
4	EN 175301-803 (ex DIN 43650) connector, included in the supply
5	Connector removal space

## 9 - ELECTRONIC CONTROL UNITS

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 251
<b>EDM-M142</b>	for solenoid 12V DC		

## 10 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G with ports on rear
PMMD-AL3G with side ports
Ports dimensions: P, T, A, B: 3/8" BSP thread



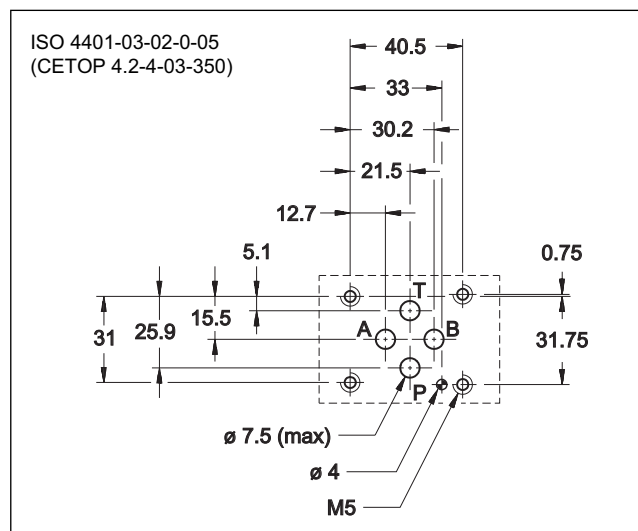
# PRED3G

## PRESSURE CONTROL VALVE WITH PROPORTIONAL CONTROL AND INTEGRAL ELECTRONICS SERIES 31

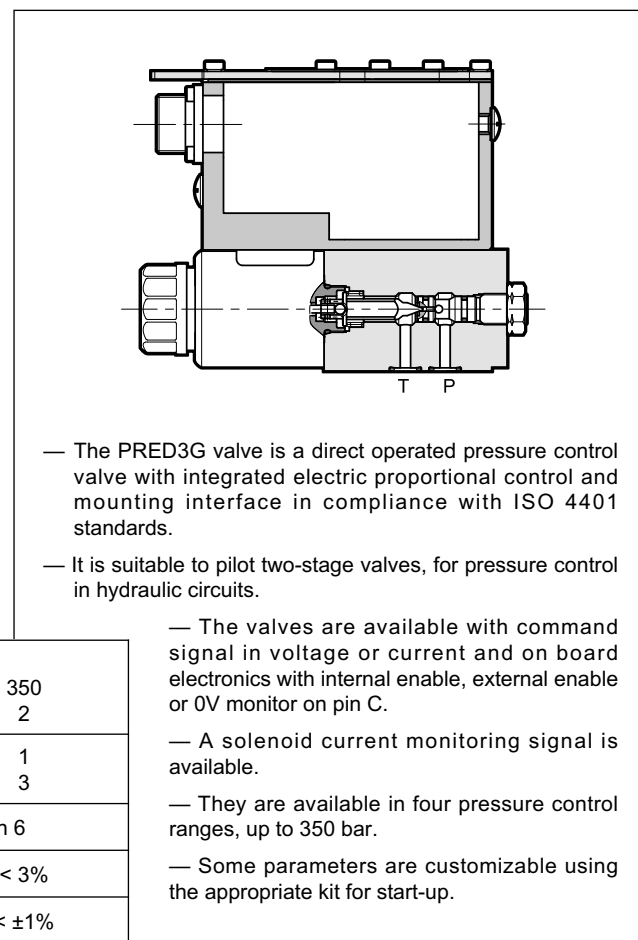
### SUBPLATE MOUNTING ISO 4401-03

**p** max **350** bar  
**Q** max **3** l/min

### MOUNTING INTERFACE



### OPERATING PRINCIPLE

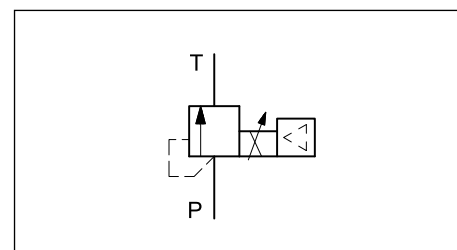


### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P port - T port	bar	350 2
Nominal flow Maximum flow (see diagram p min = f(Q))	l/min	1 3
Step response	see paragraph 6	
Hysteresis	% of p nom	< 3%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	2

### HYDRAULIC SYMBOL

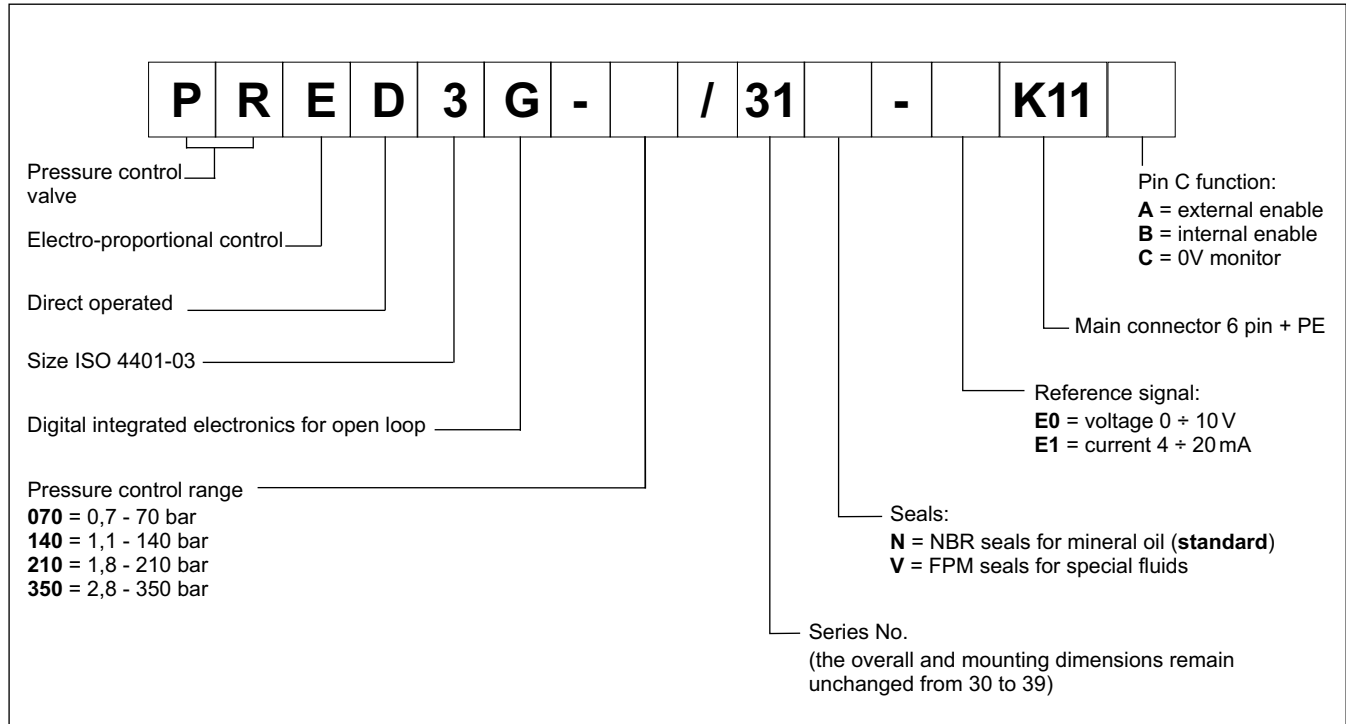




# PRED3G

## SERIES 31

### 1 - IDENTIFICATION CODE





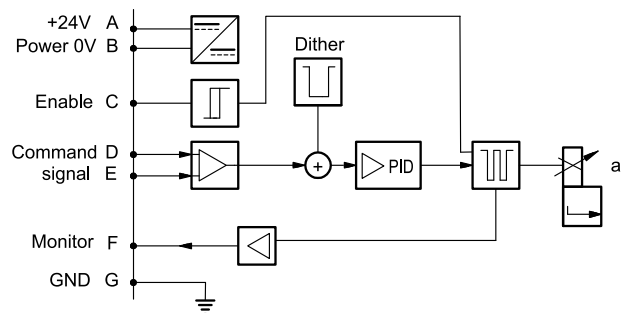
## 2 - ELECTRICAL CHARACTERISTICS

### 2.1 - Electrical on board electronics

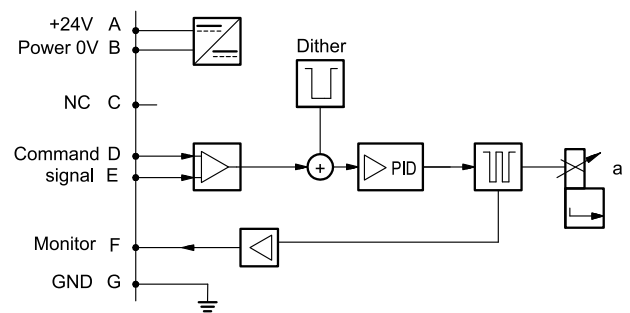
Duty cycle		100% (continuous operation)
Protection class according to IEC 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 2.2 - On-board electronics diagrams

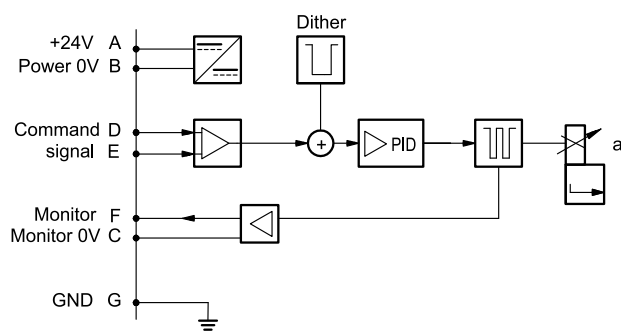
#### VERSION A - External Enable



#### VERSION B - Internal Enable

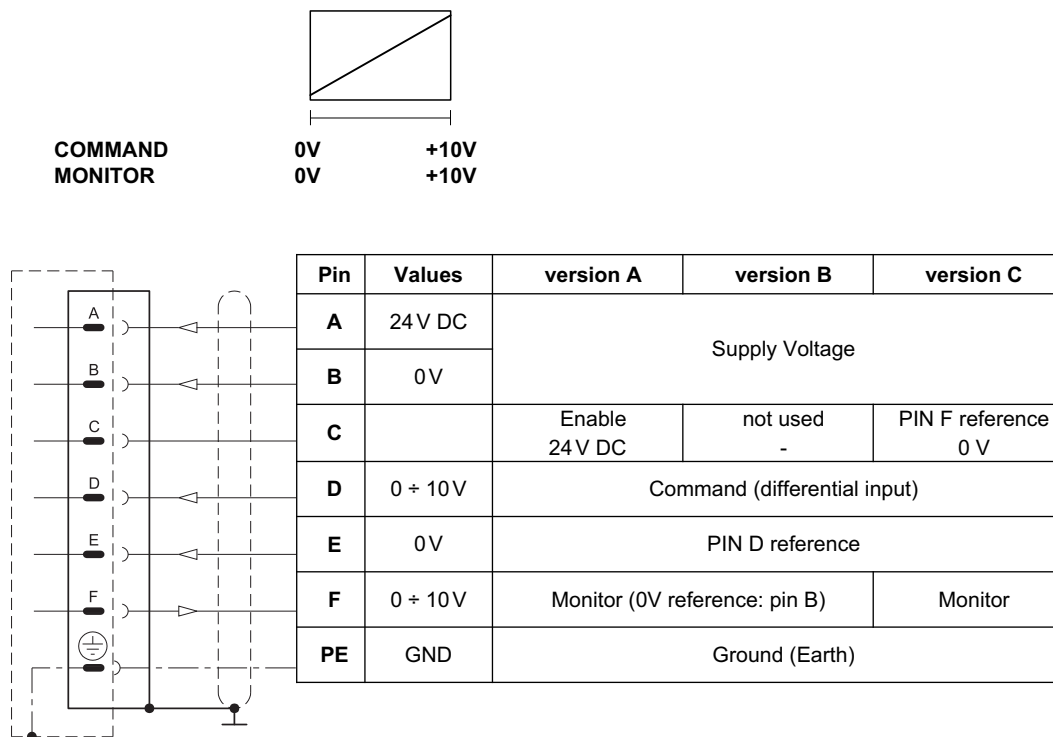


#### VERSION C - 0V Monitor



### 3 - VERSIONS WITH VOLTAGE COMMAND (E0)

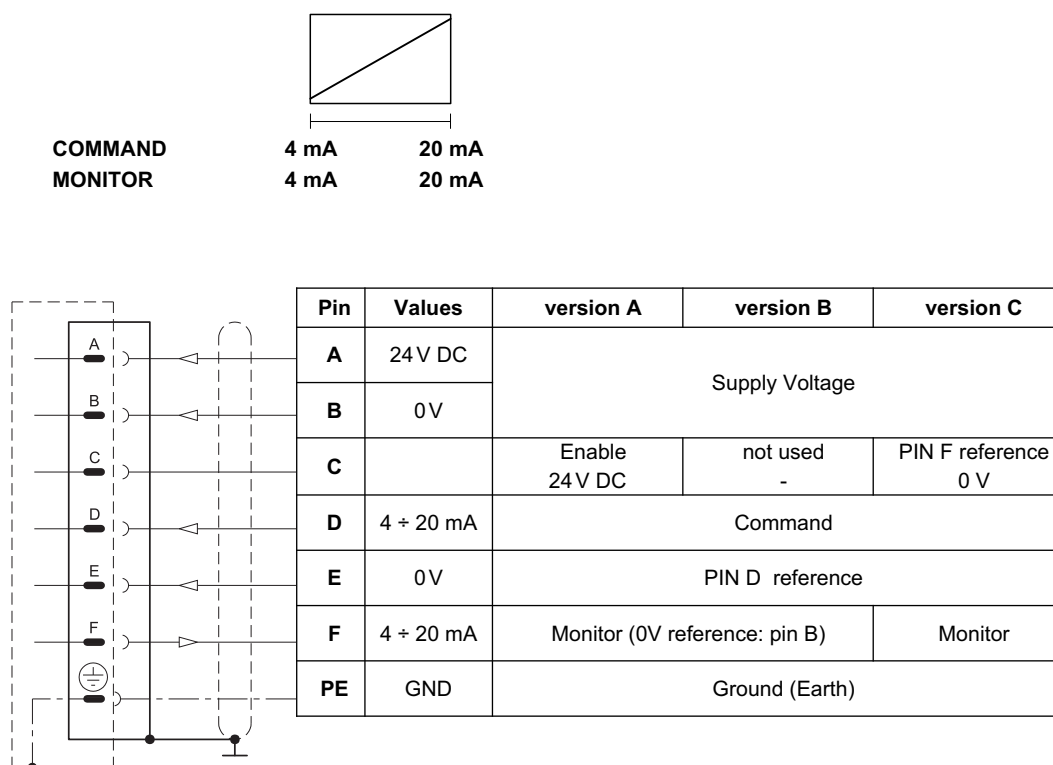
The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



### 4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



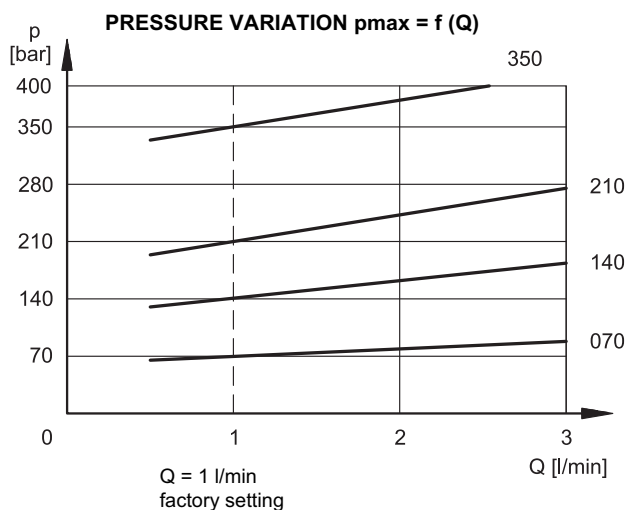
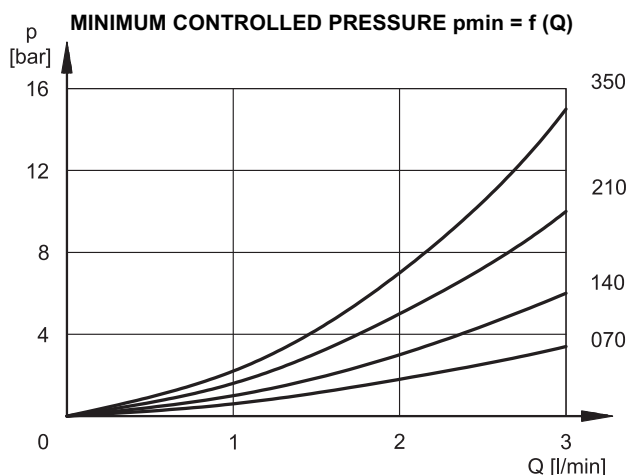
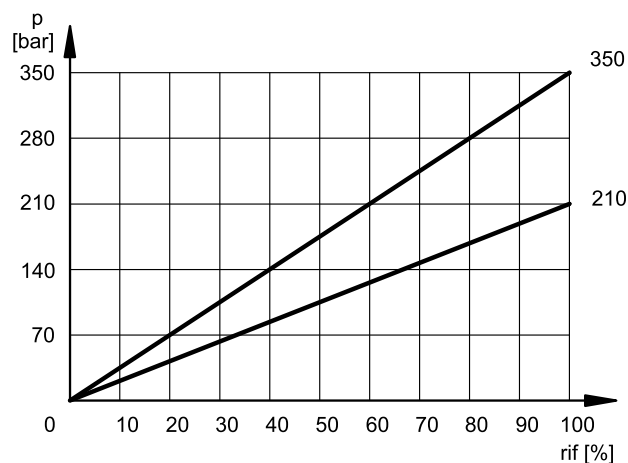
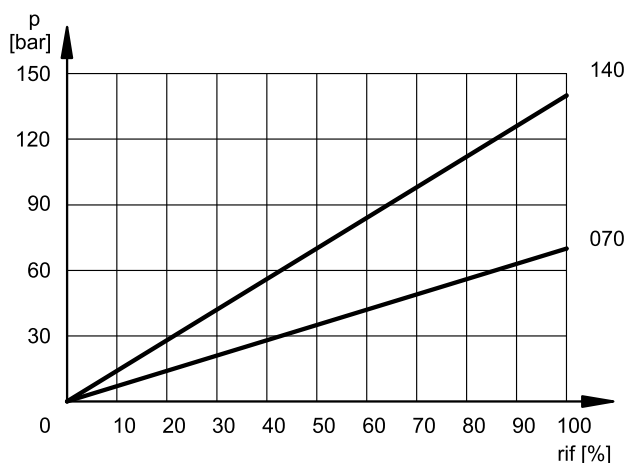
### 5 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

Typical control curves according to the current supplied to the solenoid for pressure control ranges: 070, 140, 210, 350, measured with input flow rate  $Q = 1$  l/min. The curves are obtained after linearization in factory of the characteristic curve through the digital amplifier, and they are measured without any backpressure in T.

The full scale pressure is set in factory with a flow rate of 1 l/min. In case of higher flow rate, the full scale pressure will increase considerably. See diagram  $p_{max} = f(Q)$ .

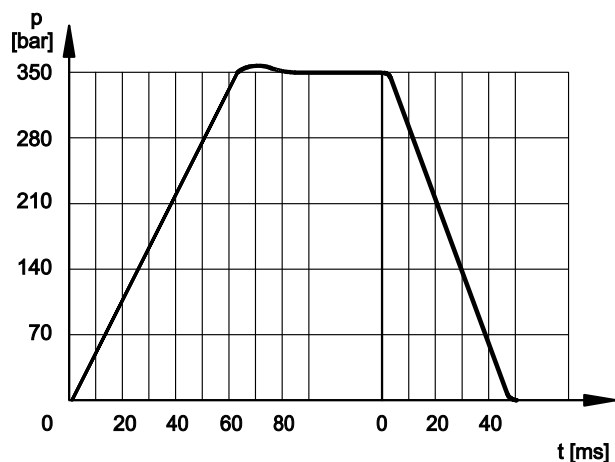
**PRESSURE CONTROL  $p=f(I)$**



### 6 - RESPONSE TIMES

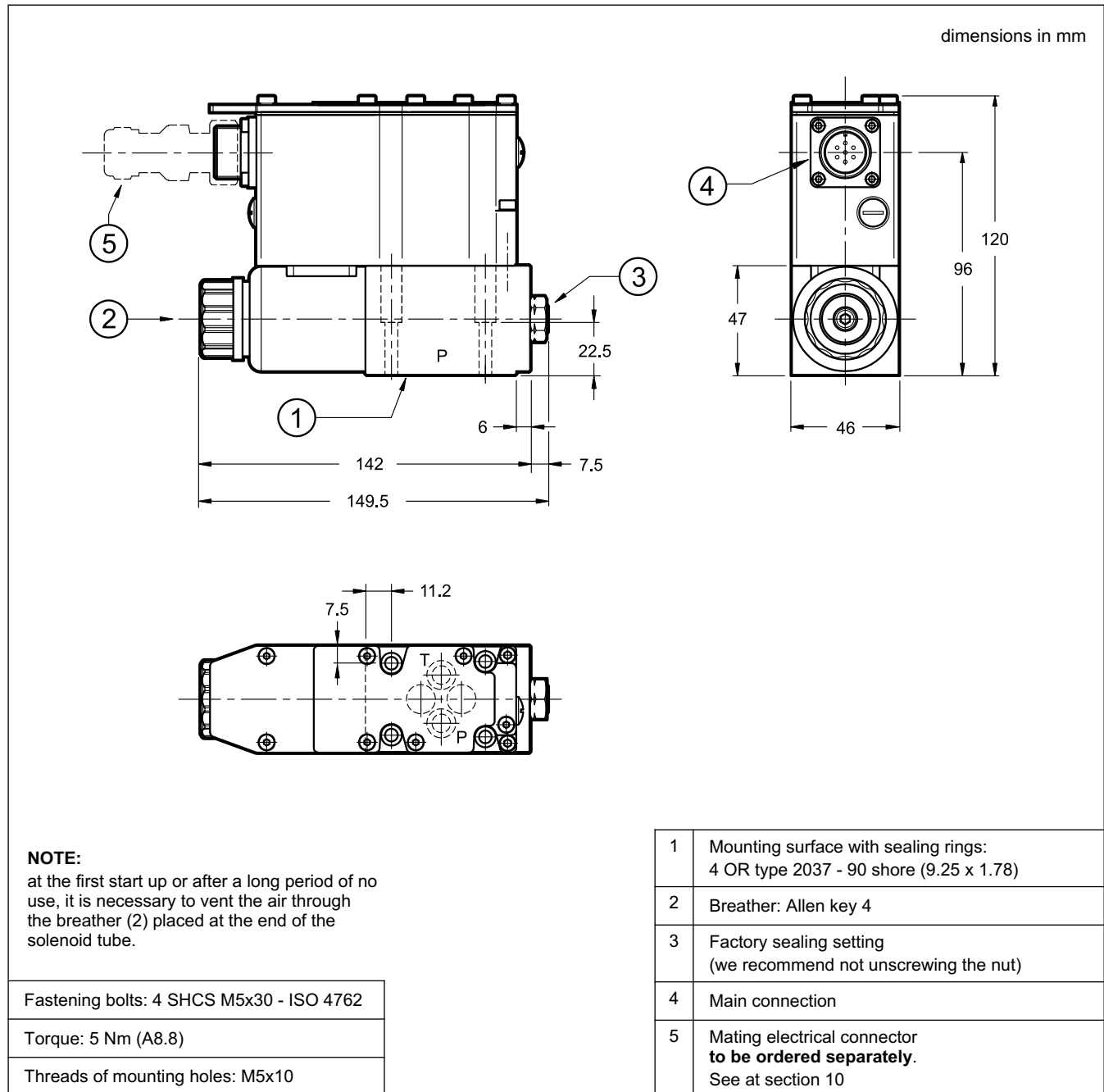
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Response times are obtained by using valves with a full scale of 350 bar, with an input flow rate of 2 l/min and a pressure oil volume of 0,5 lt. The response time is affected both by the flow rate and the oil volume in the pipework.





## 7 - OVERALL AND MOUNTING DIMENSIONS



## 8 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 9 - INSTALLATION

We recommend installing these valves with the solenoid downward, either in horizontal or vertical position. If the valve is installed on vertical axis with the solenoid upward, you should consider possible variations of the minimum controlled pressure from those indicated in paragraph 5.

Ensure that there is no air in the hydraulic circuit. In certain applications it might be necessary to vent the air entrapped in the solenoid tube by unfastening the drain screw placed in the solenoid tube.

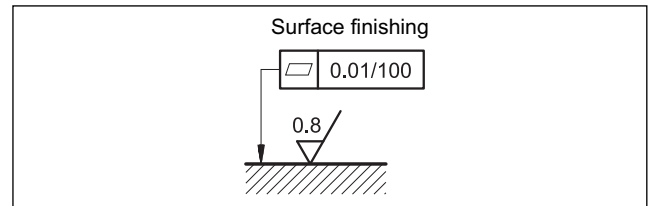
Ensure the solenoid tube is always filled with oil. Make sure the drain screw has been put back correctly at the end of the task.

Connect the valve T port directly to the tank. **Add any backpressure value detected in the T line to the controlled pressure value.**

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols.

If minimum values are not observed, fluid can easily leaks between the valve and support surface.



### 10 - ACCESSORIES

(to be ordered separately)

#### 10.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

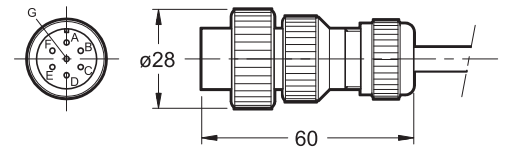


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



#### 10.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

#### 10.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

### 11 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP



# PRED3G

SERIES 31



**DUPLOMATIC  
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# PRED3J

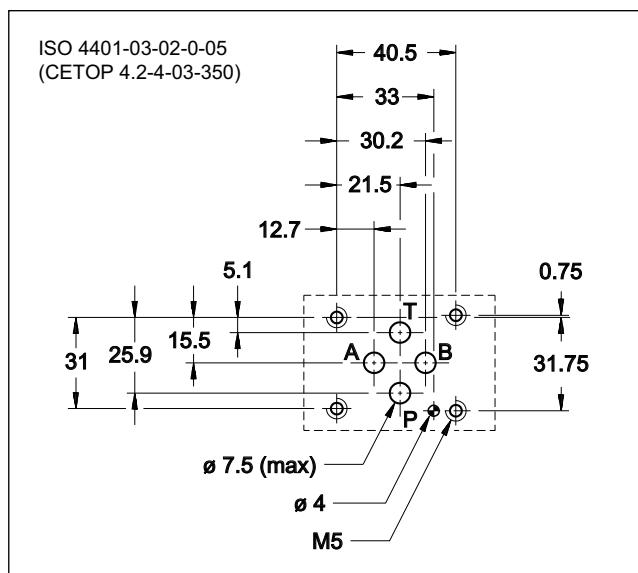
## DIRECT OPERATED PRESSURE CONTROL VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS IN CLOSED LOOP

SERIES 31

SUBPLATE MOUNTING  
ISO 4401-03

**p** max **350** bar  
**Q** max **3** l/min

### MOUNTING INTERFACE

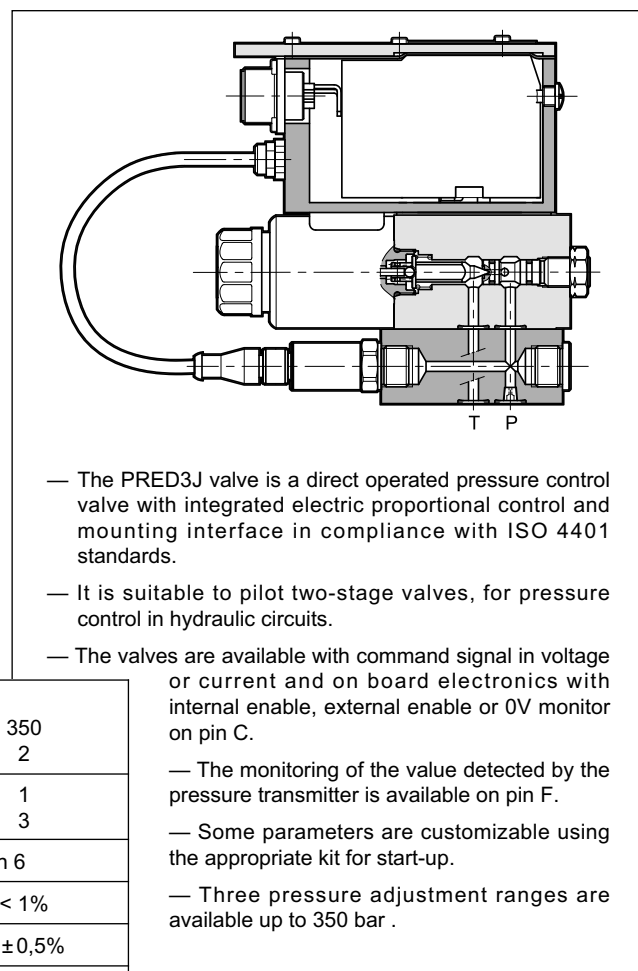


### PERFORMANCES

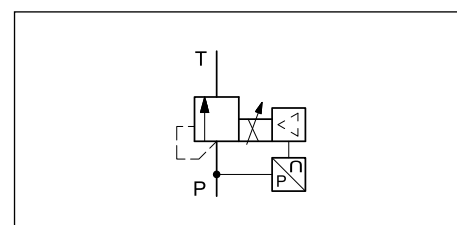
(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P port - T port	bar	350 2
Nominal flow Maximum flow (see p min= f(Q) diagram)	l/min	1 3
Step response	see paragraph 6	
Hysteresis	% of p nom	< 1%
Repeatability	% of p nom	< ±0,5%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	2,5

### OPERATING PRINCIPLE



### HYDRAULIC SYMBOL

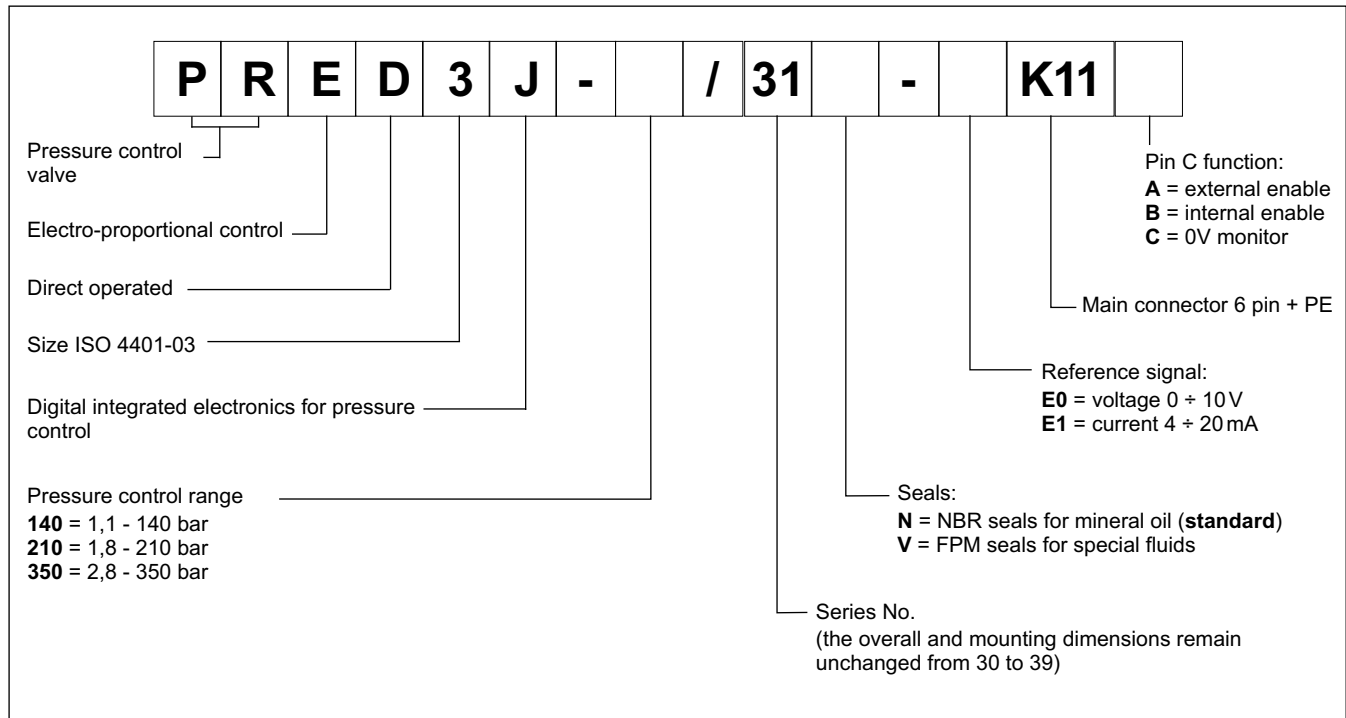




# PRED3J

## SERIES 31

### 1 - IDENTIFICATION CODE





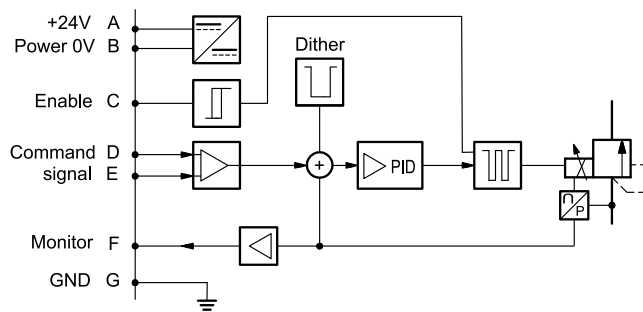
## 2 - ELECTRICAL CHARACTERISTICS

### 2.1 - Electrical on board electronics

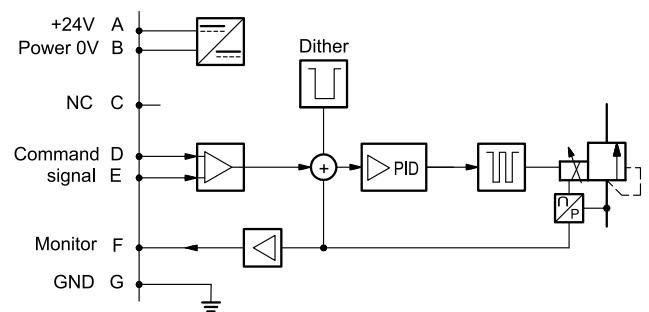
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (pressure at transducer): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 2.2 - On-board electronics diagrams

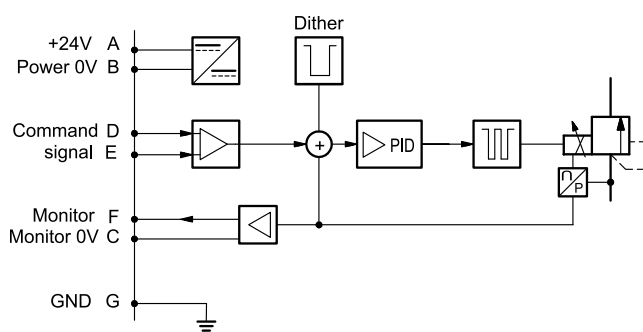
**VERSION A - External Enable**



**VERSION B - Internal Enable**

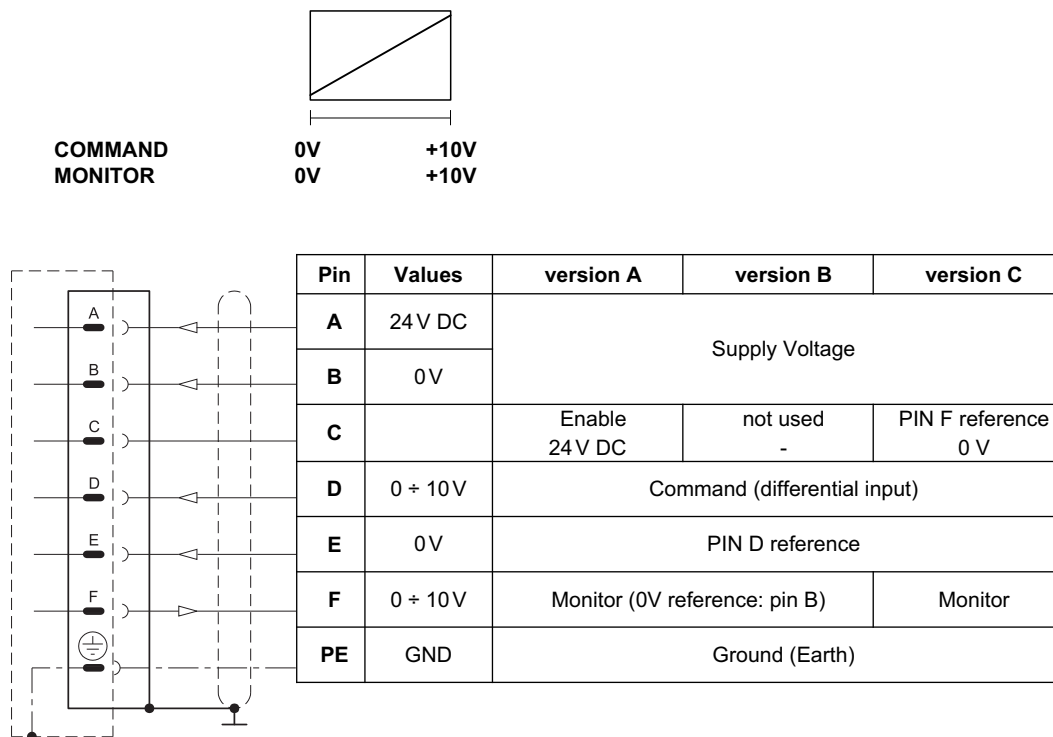


**VERSION C - 0V Monitor**



### 3 - VERSIONS WITH VOLTAGE COMMAND (E0)

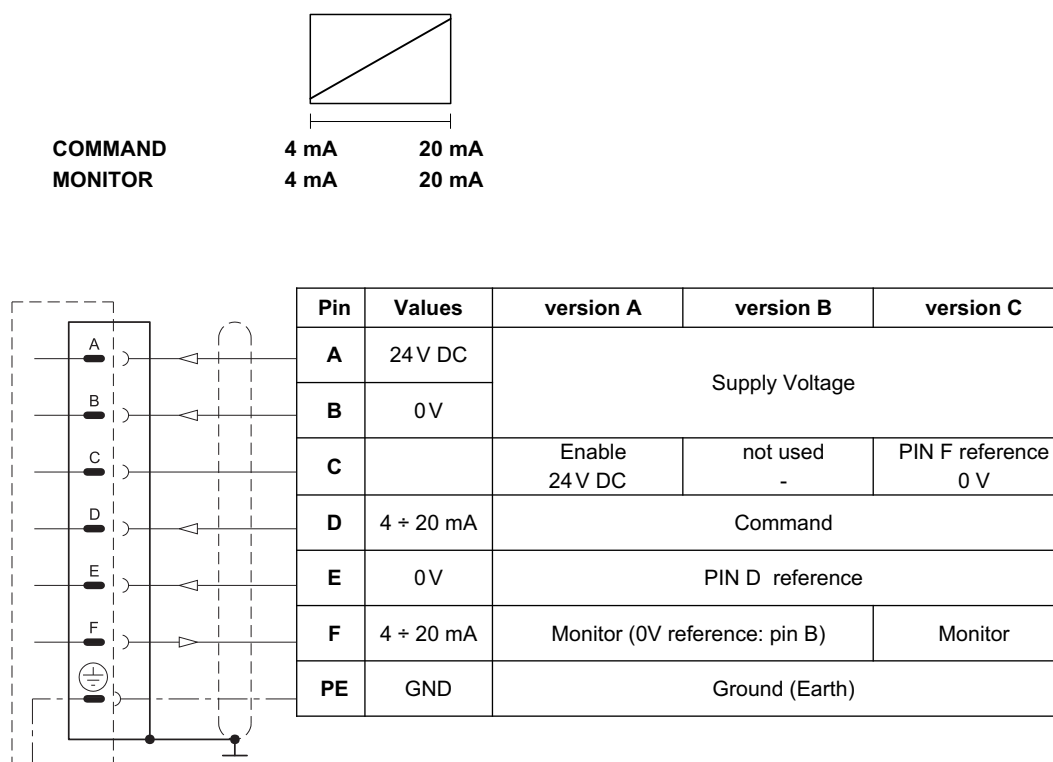
The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



### 4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.

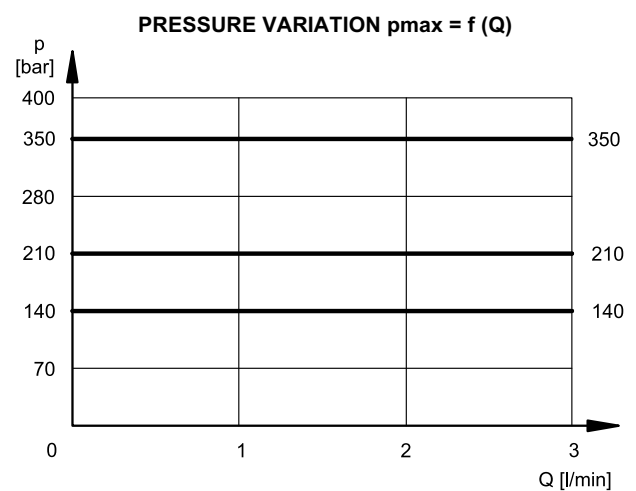
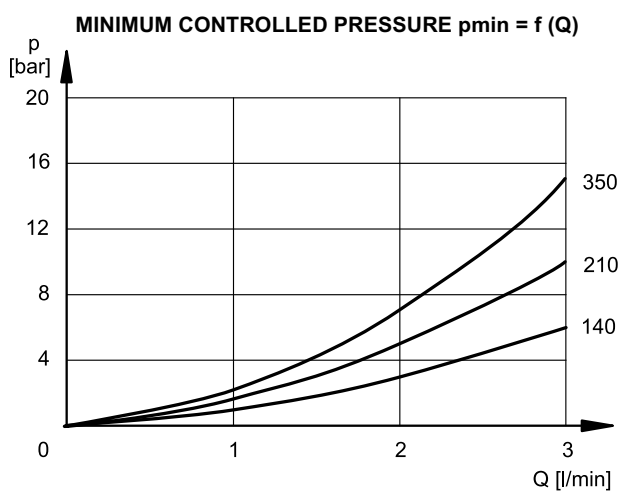
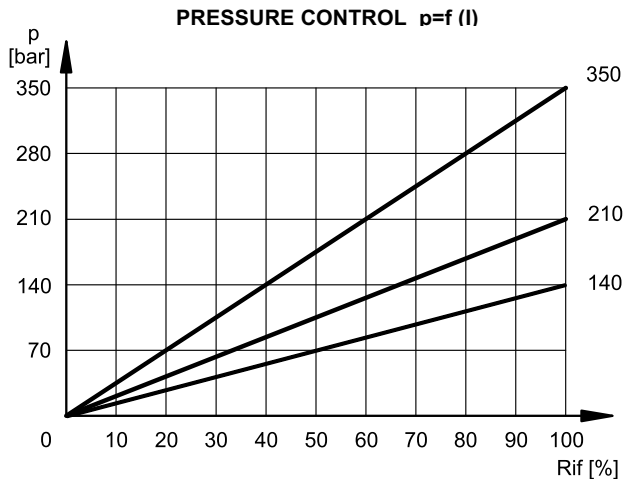


## 5 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

Typical control curves according to the current supplied to the solenoid for pressure control ranges: 140, 210 and 350, measured with input flow rate  $Q = 1$  l/min.

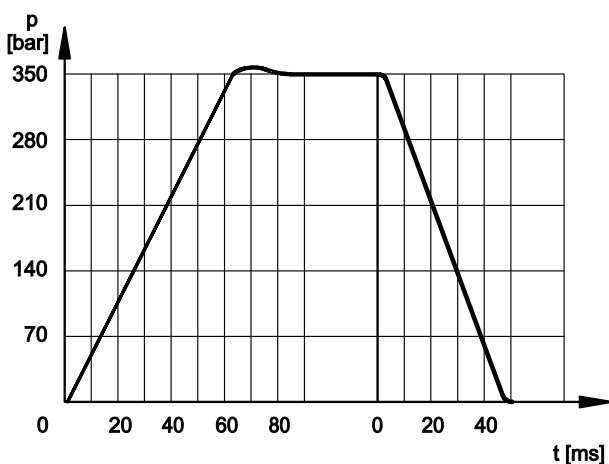
The curves are obtained after linearization in factory of the characteristic curve through the digital amplifier, and they are measured without any backpressure in T.



## 6 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

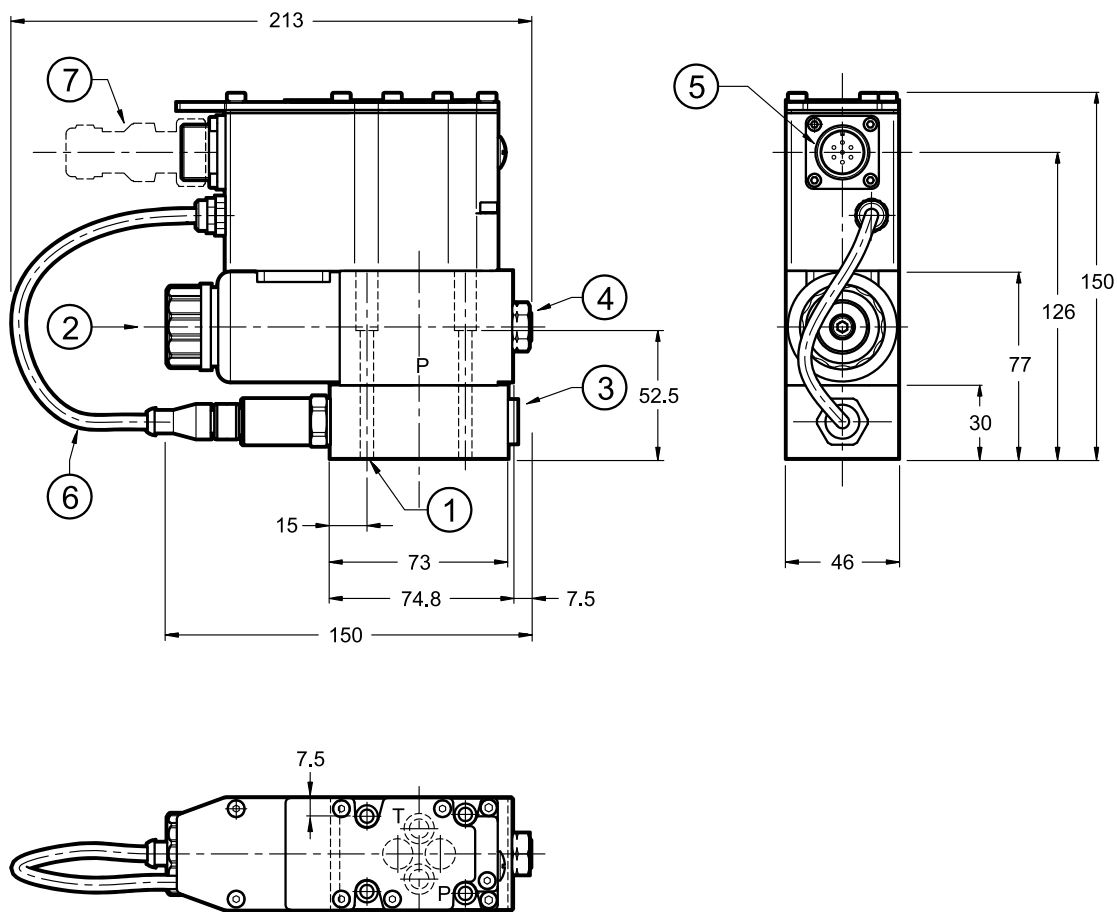
Response time obtained by using valves with con PRED3J-350, with an input flow rate of 2 l/min and a pressure oil volume of 0,5 lt. The response time is affected both by the flow rate and the oil volume in the pipework.





## 7 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

1	Mounting surface with sealing rings: 4 OR type 108 - 90 shore (8.73 x 1.78)
2	Breather: Allen key 4
3	Pressure gauge port 1/4" BSP
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Cable with connector for pressure transducer
7	Mating electrical connector <b>to be ordered separately.</b> See at section 10

Fastening bolts: 4 SHCS M5x60 - ISO 4762

Torque: 5 Nm (A8.8)

Threads of mounting holes: M5x10

## 8 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 9 - INSTALLATION

We recommend installing these valves with the solenoid downward, either in horizontal or vertical position. If the valve is installed on vertical axis with the solenoid upward, you should consider possible variations of the minimum controlled pressure from those indicated in paragraph 5.

Ensure that there is no air in the hydraulic circuit. In certain applications it might be necessary to vent the air entrapped in the solenoid tube by unfastening the drain screw placed in the solenoid tube.

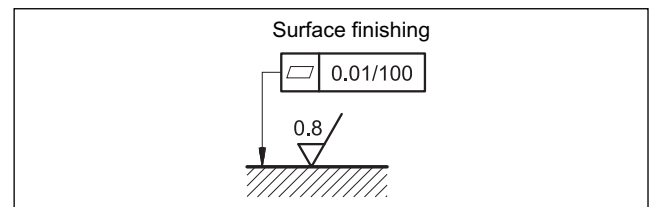
Ensure the solenoid tube is always filled with oil. Make sure the drain screw has been put back correctly at the end of the task.

Connect the valve T port directly to the tank. **Add any backpressure value detected in the T line to the controlled pressure value.**

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols.

If minimum values are not observed, fluid can easily leaks between the valve and support surface.



## 10 - ACCESSORIES

(to be ordered separately)

### 10.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

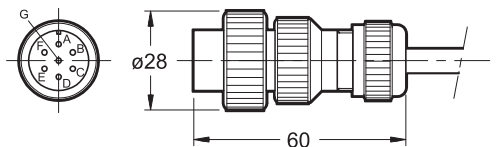


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 10.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 10.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 11 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP



# PRED3J

SERIES 31



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# PRE3

## PILOT OPERATED PRESSURE CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

SERIES 12

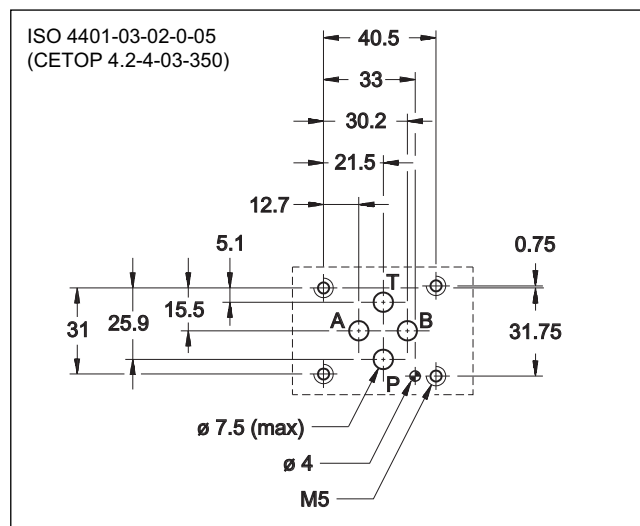


### SUBPLATE MOUNTING ISO 4401-03

**p** max **350** bar

**Q** max **40** l/min

### MOUNTING INTERFACE



### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

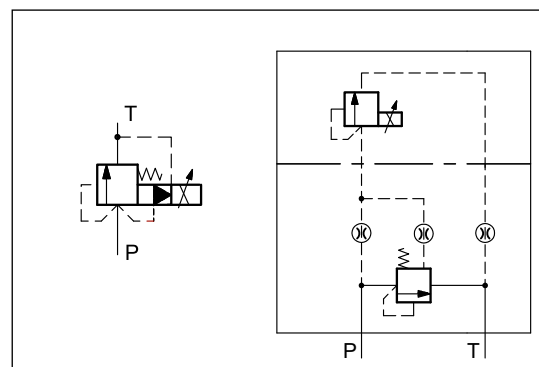
Maximum operating pressure: - P port - T port	bar	350 2
Minimum controlled pressure	see p min = f(Q) diagram	
Minimum flow Maximum flow (see graph p max= f(Q))	l/min	2 40
Step response	see paragraph 5	
Hysteresis (with PWM 200 Hz)	% of p nom	< 5%
Repeatability	% of p nom	< ±1,5%
Electrical characteristic	see paragraph 4	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	3,5

### OPERATING PRINCIPLE

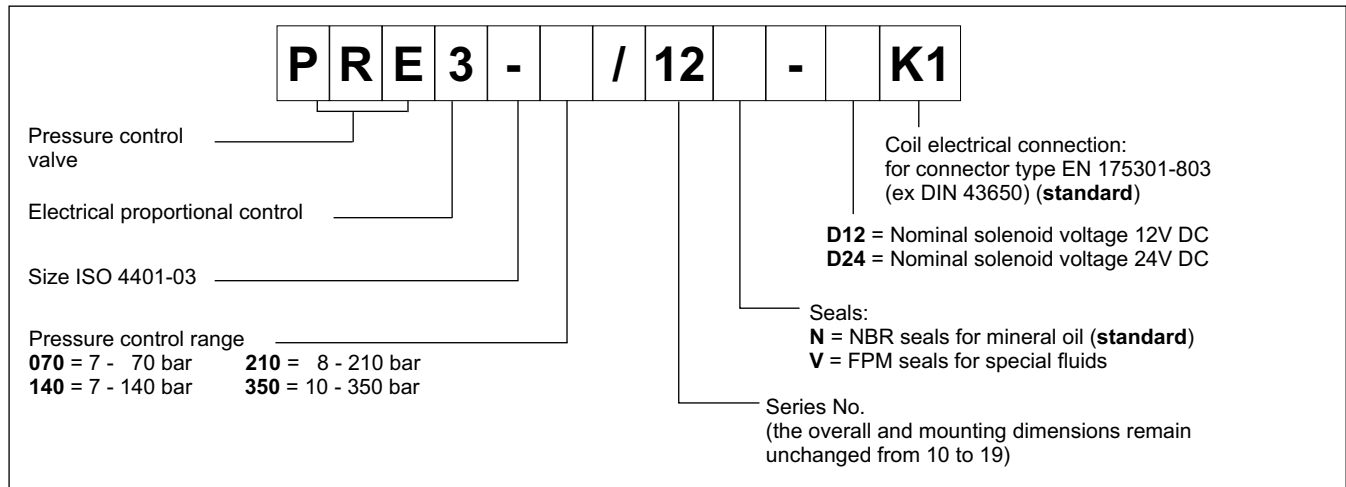
- The PRE3 is a pilot operated pressure control valve with electric proportional control and mounting interface in compliance with ISO 4401 standards.
- It is suitable to modulate the pressure in hydraulic circuits.
- The valve can be controlled directly by a current control supply unit or by an electronic control unit to exploit valve performance to the full (see at paragraph 8).
- Pressure adjustment can be continuous in proportion to the current supplied to the solenoid.
- Four pressure control ranges up to 350 bar are available.

### HYDRAULIC SYMBOL

simplified



### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES

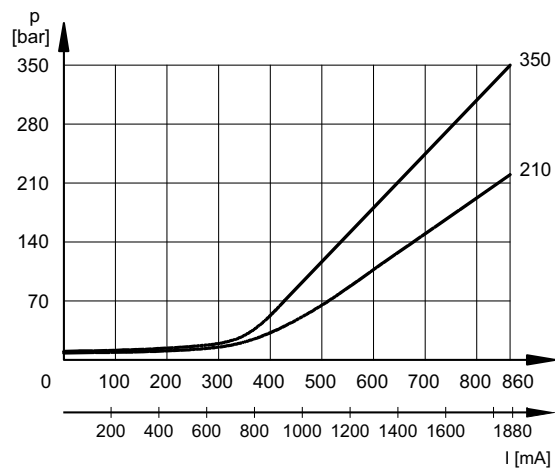
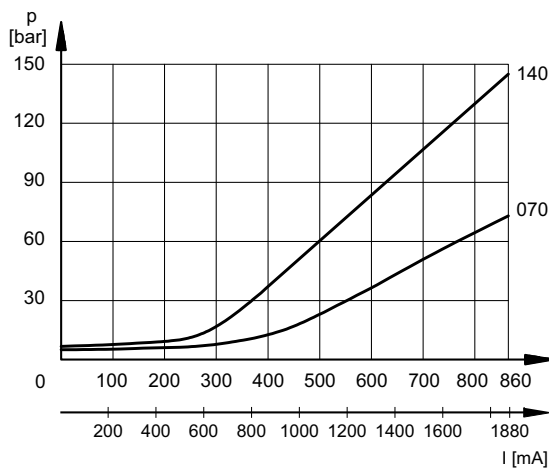
(measured with viscosity of 36 cSt at 50°C)

Typical control curves according to the current supplied to the solenoid (D24 version with maximum current 860 mA) for pressure control ranges: 070, 140, 210, 350, measured with input flow rate  $Q=10$  l/min.

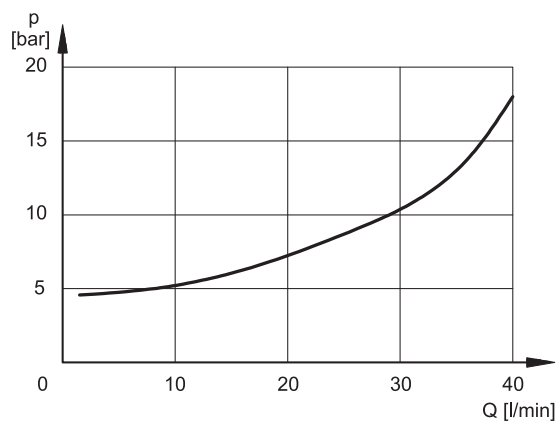
The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T.

The full scale pressure is set in factory with a flow rate of 10 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram  $p_{max} = f(Q)$ ).

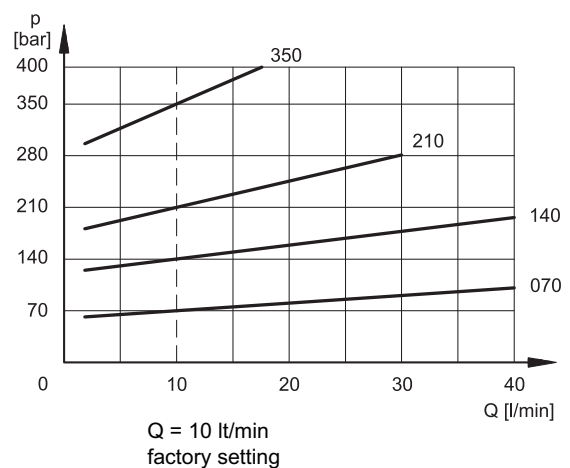
**PRESSURE CONTROL  $p=f(I)$**



**MINIMUM CONTROLLED PRESSURE  $p_{min} = f(Q)$**



**PRESSURE VARIATION  $p_{max} = f(Q)$**



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>	<b>24</b>
<b>RESISTANCE (at 20°C)</b>	Ω	3.66	17.6
<b>MAXIMUM CURRENT</b>	A	1.88	0.86
<b>DUTY CYCLE</b>	100%		
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2014/30/EU		
<b>PROTECTION FROM ATMOSPHERIC AGENTS (IEC 60529)</b>	IP65		
<b>CLASS OF PROTECTION</b> Coil insulation (VDE 0580) Impregnation	class H class F		

### 5 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a valve of pressure range up to 140 bar and with input flow rate Q = 10 l/min.

<b>REFERENCE SIGNAL STEP</b>	0 → 100%	100 → 0%
Step response [ms]	80	40

### 6 - INSTALLATION

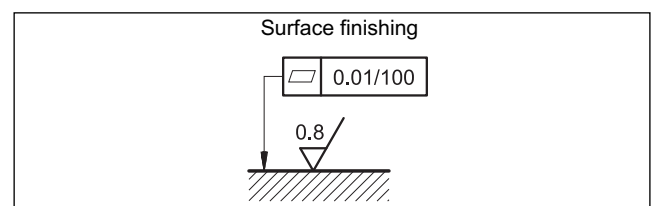
We recommend to install the PRE3 valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil (see par. 7). At the end of the operation, make sure of having screwed correctly the drain screw.

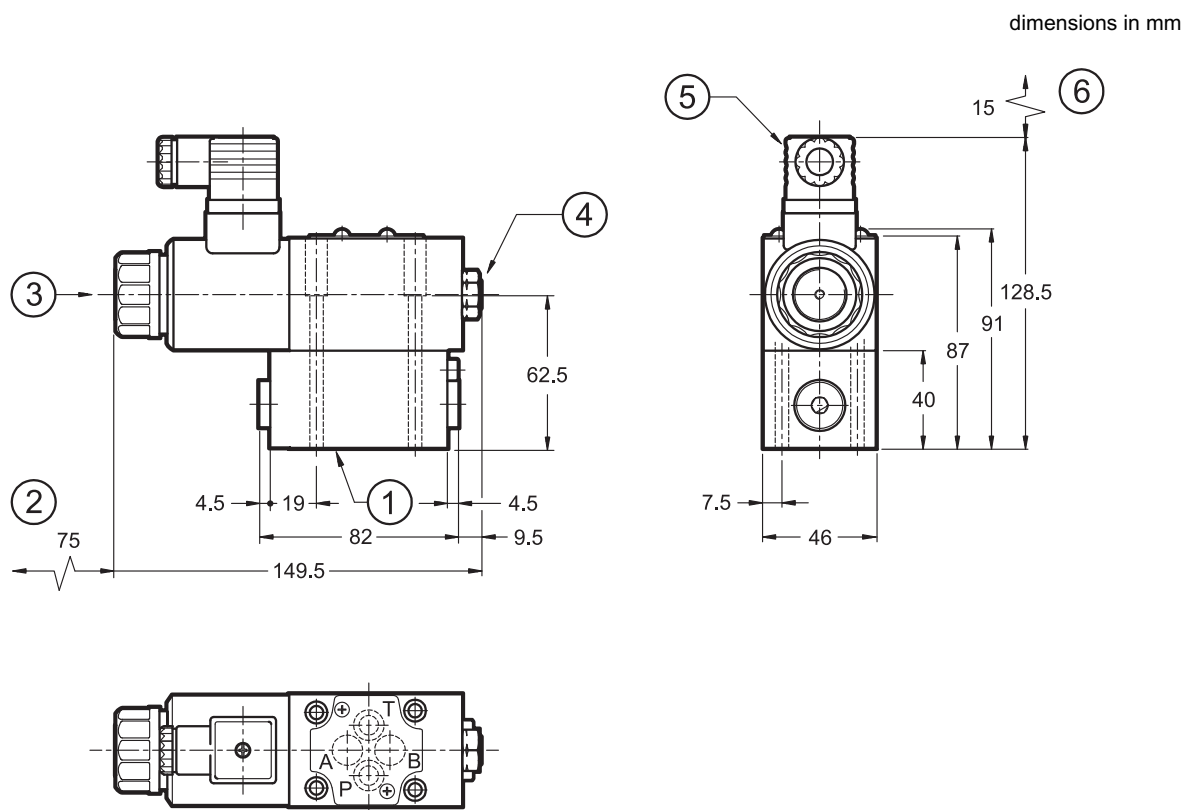
Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 7 - OVERALL AND MOUNTING DIMENSIONS



**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

Fastening bolts: 4 SHC screws M5x70 - ISO 4762

Torque: 5 Nm (A8.8)

Threads of mounting holes: M5x10

## 8 - ELECTRONIC CONTROL UNITS

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		

## 9 - SUBPLATES

(see catalogue 51 000)

PMMD-AL3G with ports on rear

PMMD-AL3G with side ports

Ports dimensions P, T, A and B: 3/8" BSP thread



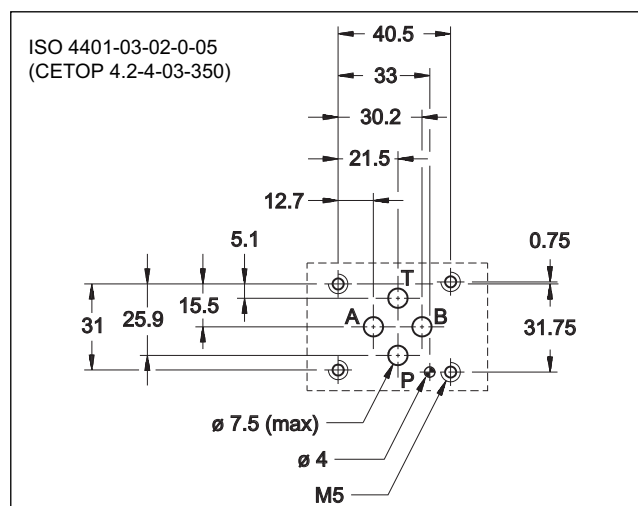
**PRE3G**  
**PILOT OPERATED PRESSURE  
CONTROL VALVE WITH  
PROPORTIONAL CONTROL AND  
INTEGRAL ELECTRONICS**  
**SERIES 31**

## SUBPLATE MOUNTING

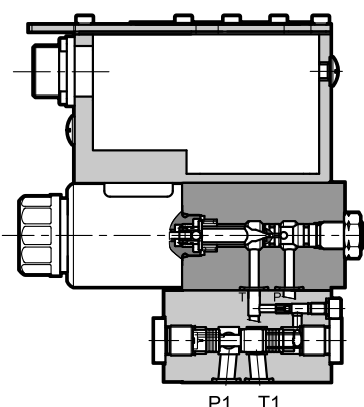
### ISO 4401-03

**p** max **350** bar  
**Q** max **40** l/min

## MOUNTING INTERFACE



## OPERATING PRINCIPLE



- The PRE3G valve is a pilot operated pressure control valve with electric proportional control and mounting surface in compliance with ISO 4401 standards, controlled by an integral digital amplifier.

- It is suitable to modulate the pressure in hydraulic circuits.

## PERFORMANCES

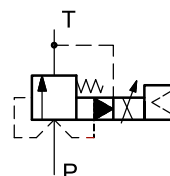
(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P port - T port	bar	350 2
Minimum controlled pressure	see p min= f(Q) diagram	
Minimum flow Maximum flow (see p max = f(Q) diagram)	l/min	2 40
Step response	see paragraph 6	
Hysteresis	% of p nom	< 3%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	3,8

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C. A solenoid current monitoring signal is available.

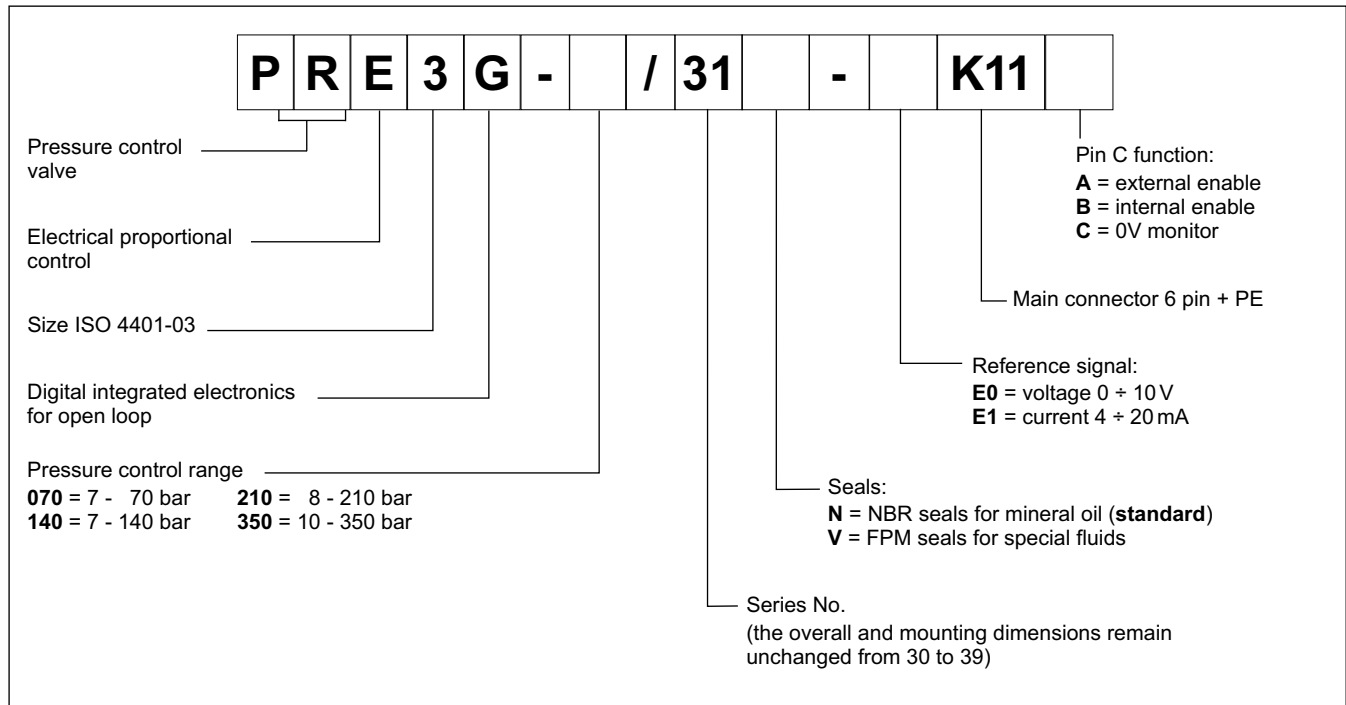
- Valves are easy to install. The driver directly manages digital settings.

## HYDRAULIC SYMBOL

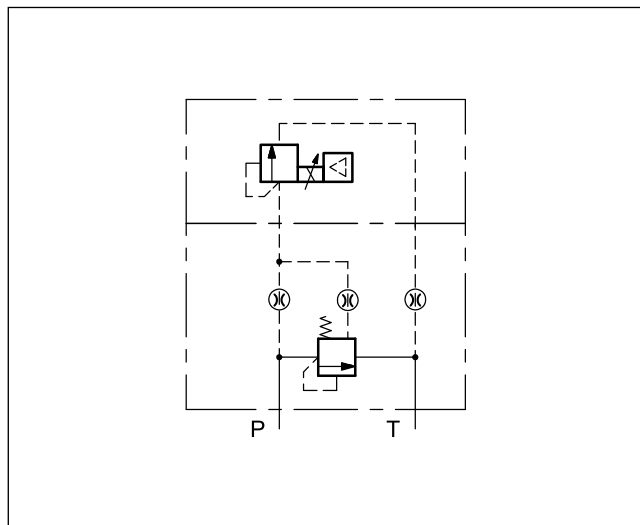




## 1 - IDENTIFICATION CODE



## 2 - DETAILED SYMBOL



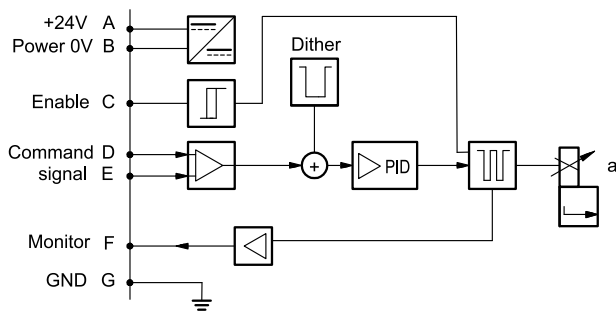
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

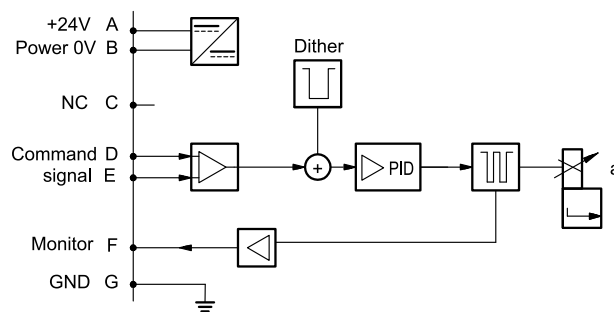
Duty cycle		100% (continuous operation)
Protection class according to IEC 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams

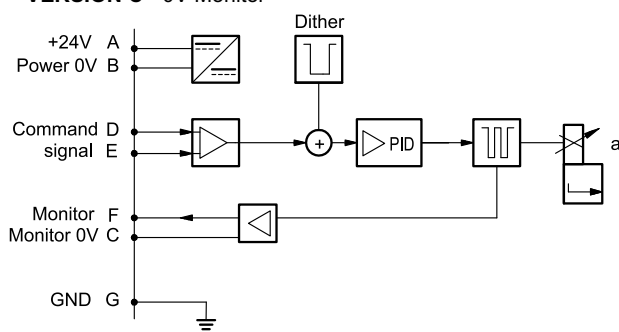
**VERSION A - External Enable**



**VERSION B - Internal Enable**

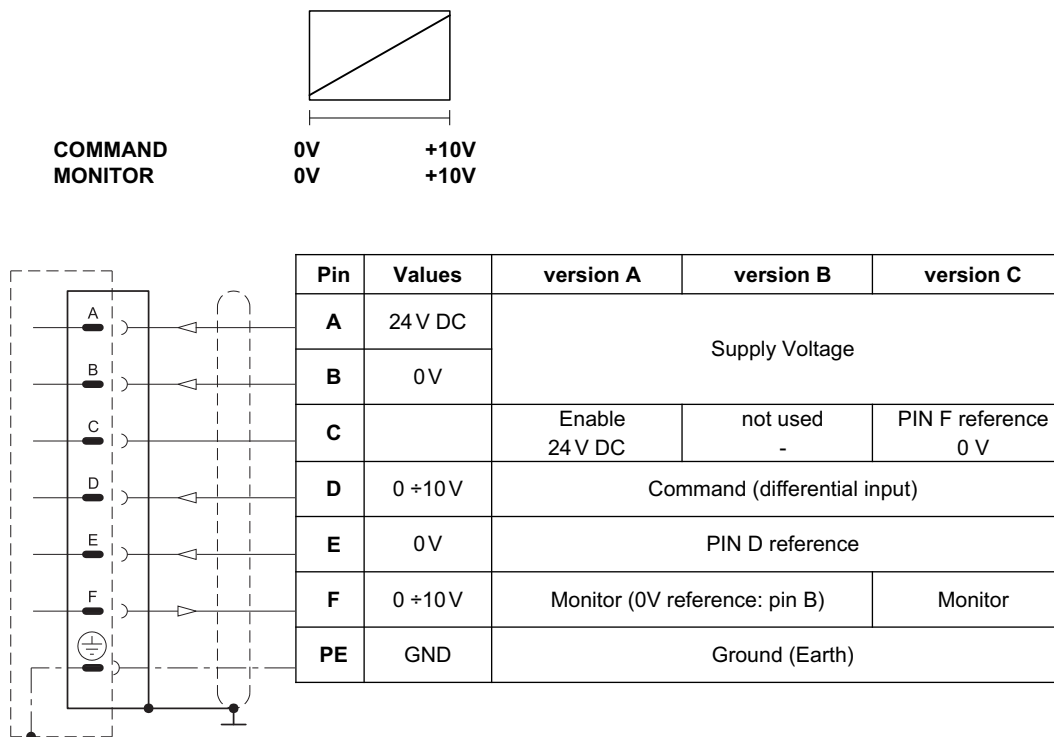


**VERSION C - 0V Monitor**



## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

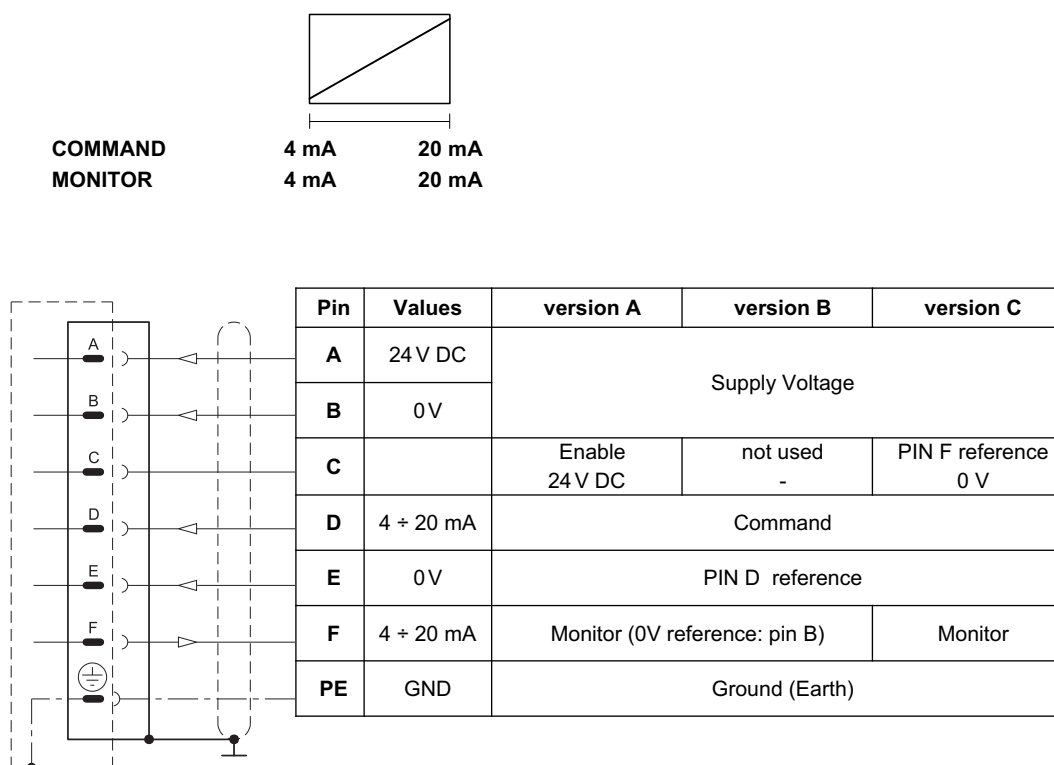
The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



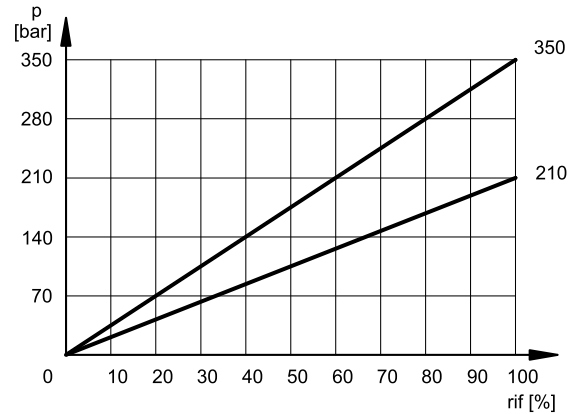
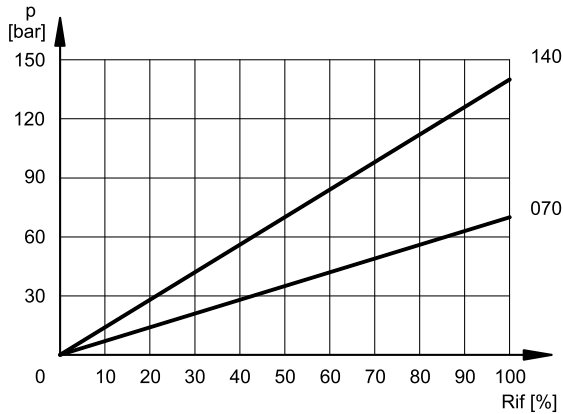
### 6 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

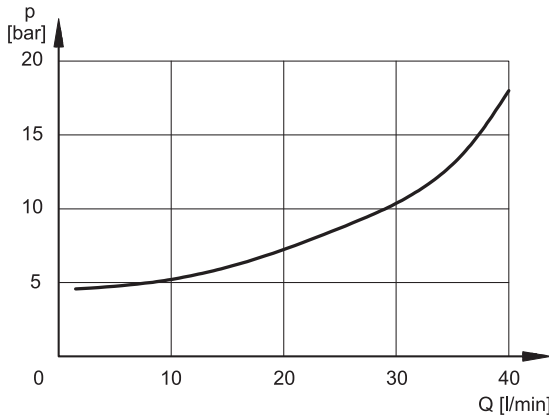
Typical control curves according to the current supplied to the solenoid for pressure control ranges: 070, 140, 210, 350, measured with input flow rate  $Q = 10$  l/min. The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T.

The full scale pressure is set in factory with a flow rate of 10 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram  $p_{max} = f(Q)$ ).

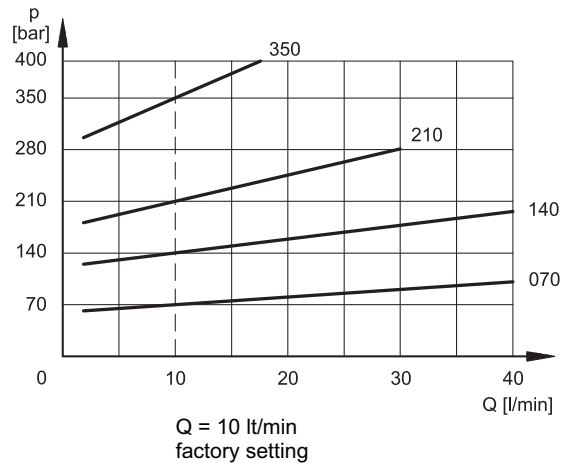
**PRESSURE CONTROL  $p = f(I)$**



**MINIMUM CONTROLLED PRESSURE  $p_{min} = f(Q)$**



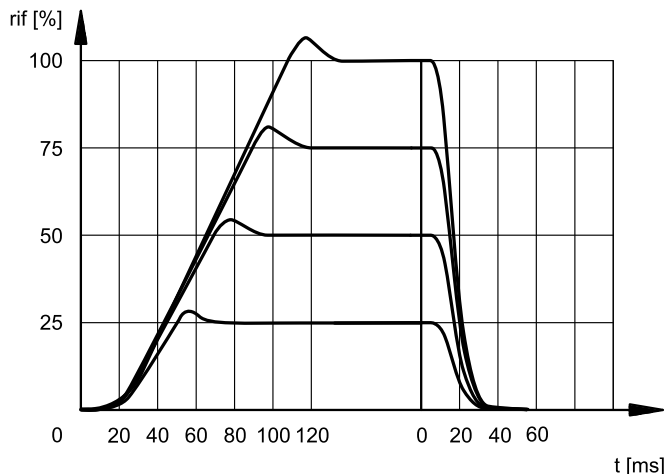
**PRESSURE VARIATION  $p_{max} = f(Q)$**



### 7 - RESPONSE TIMES

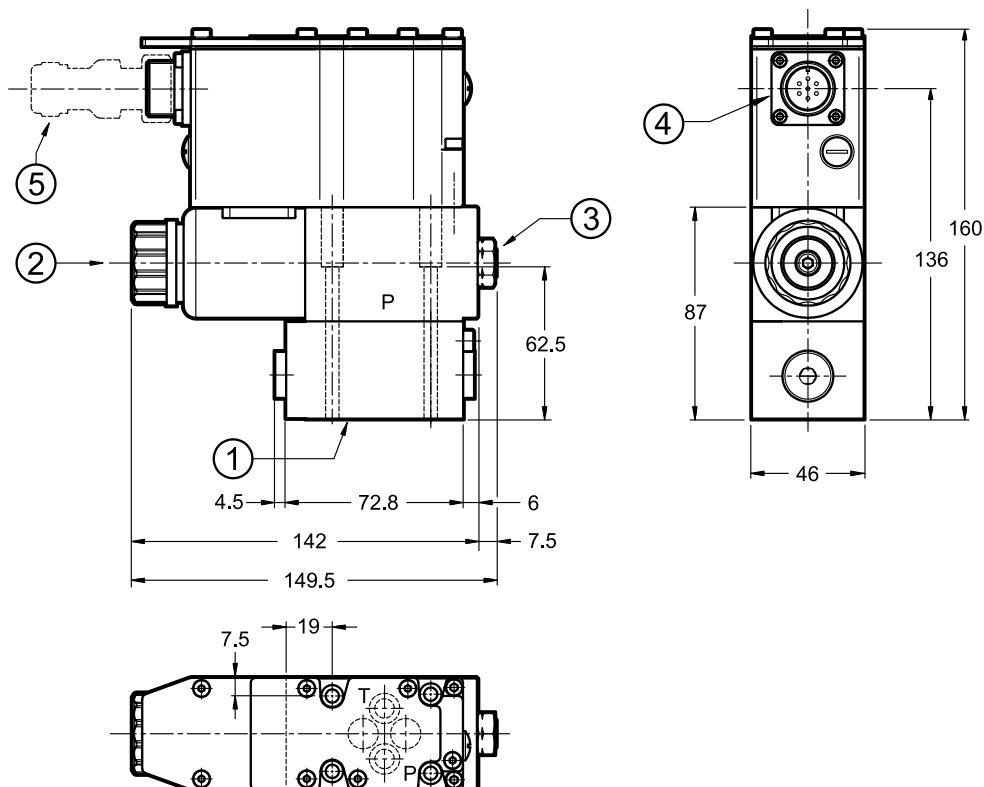
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Response times are obtained by using a PRE3G-210, with an input flow rate of 10 l/min and a pressure oil volume of 0,5 litres. The response time is affected both by the flow rate and the oil volume in the pipework.



## 8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

Fastening bolts: 4 SHC screws M5x70 - ISO 4762

Torque: 5 Nm (A8.8)

Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: 4 OR type 2037 - 90 shore (9.25 x 1.78)
2	Breather: Allen key 4
3	Factory sealing setting (we recommend not unscrewing the nut)
4	Main connection
5	Mating electrical connector <b>to be ordered separately.</b> See at section 11

### 9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 10 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 6.

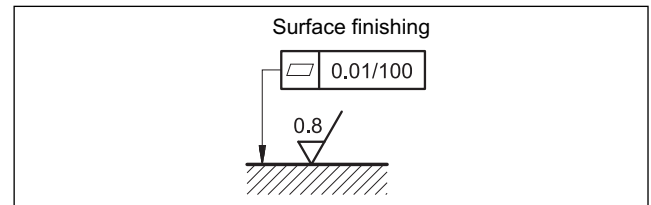
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

**Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.**

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



### 11 - ACCESSORIES

(to be ordered separately)

#### 11.1- Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

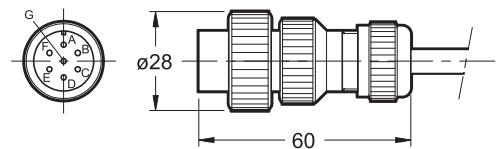


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



#### 11.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

#### 11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

### 12 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G with ports on rear
PMMD-AL3G with side ports
Ports dimensions P, T, A, B: 3/8" BSP thread



# PRE3G

SERIES 31



**DUPLOMATIC  
OLEODINAMICA**

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Fax +39 0331.895.339

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# PRE\*

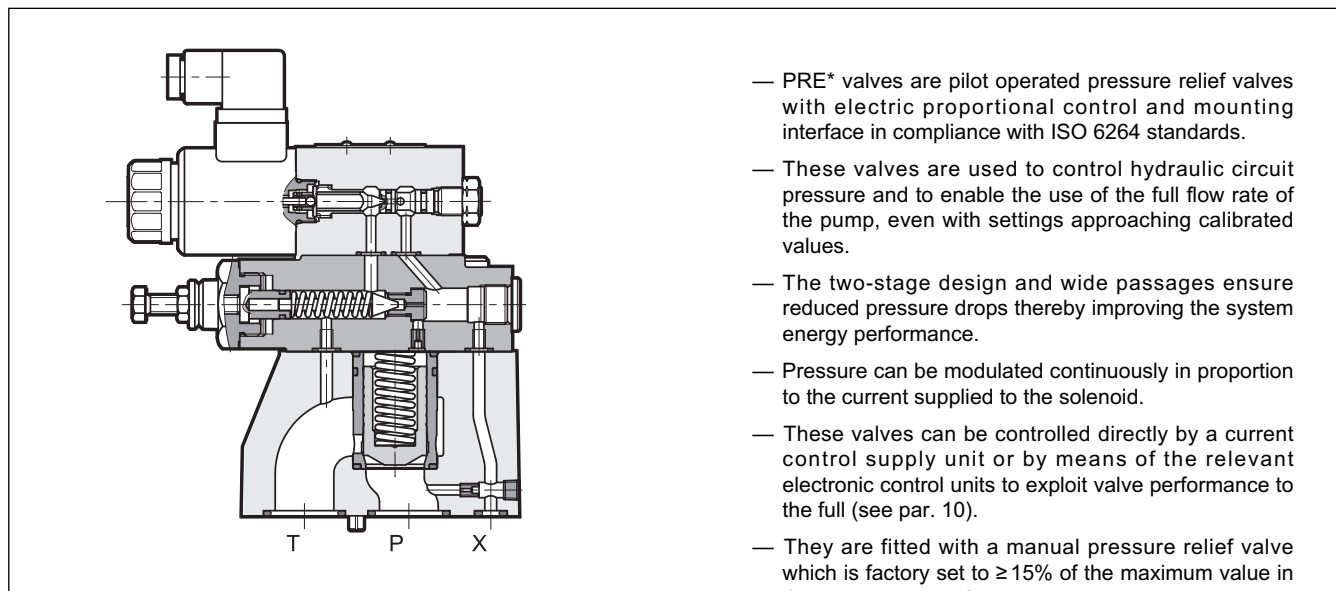
## PILOT OPERATED PRESSURE RELIEF VALVES WITH PROPORTIONAL CONTROL

### SERIES 10

**SUBPLATE MOUNTING**  
**ISO 6264**

**p** max **350** bar  
**Q** max (see table of performances)

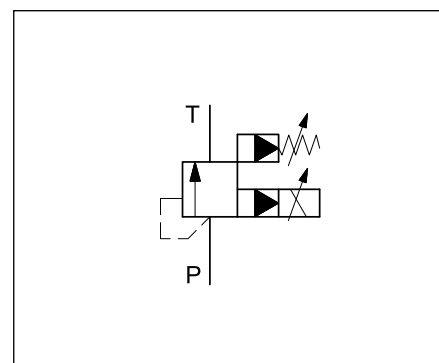
#### OPERATING PRINCIPLE



PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)		PRE10	PRE25	PRE32
Maximum operating pressure:	bar	350		
Minimum controlled pressure		see Δp-Q diagram		
Maximum flow	l/min	200	400	500
Step response		see paragraph 5		
Hysteresis	% of p nom	< 5%		
Repeatability	% of p nom	< ±1,5%		
Electrical characteristic		see paragraph 7		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass:	kg	5	5,8	8

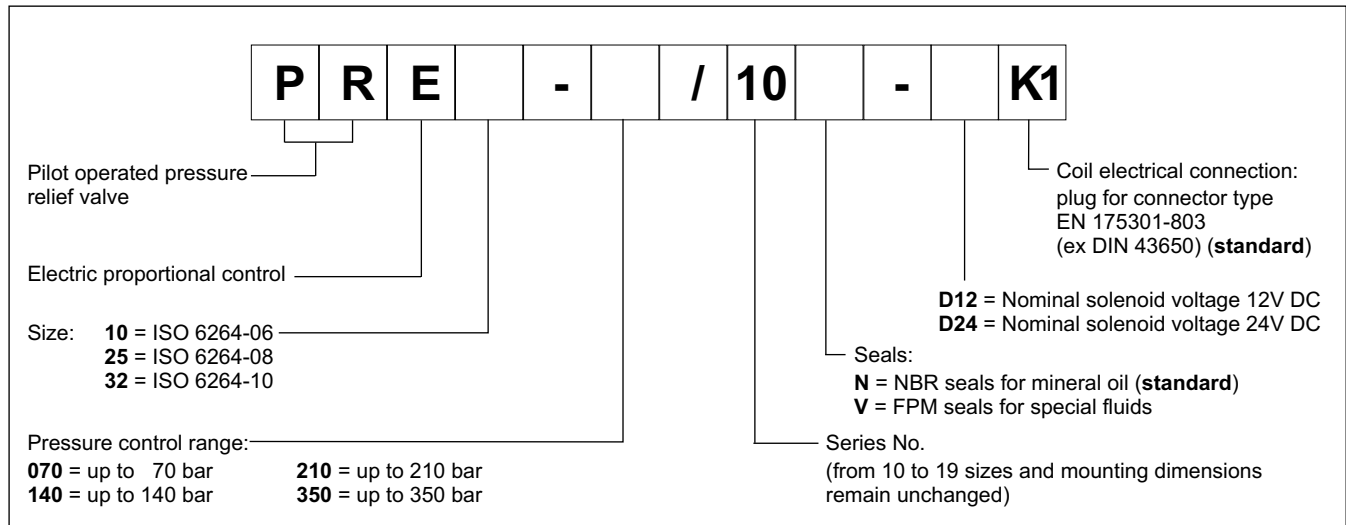
— They are available in three sizes for flow rates up to 500 l/min and in four pressure control ranges up to 350 bar.

#### HYDRAULIC SYMBOL





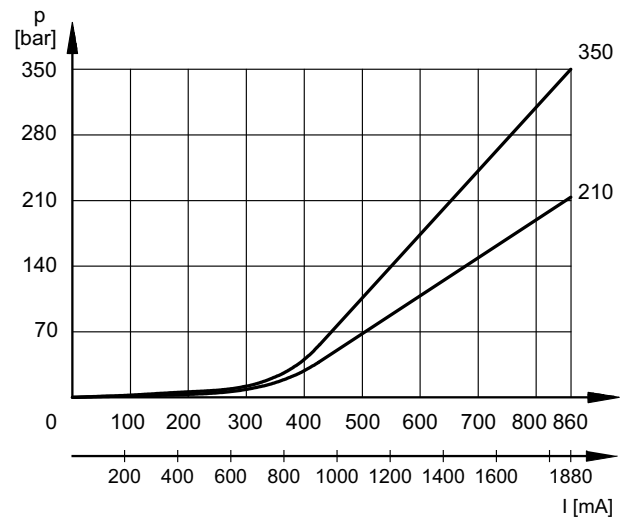
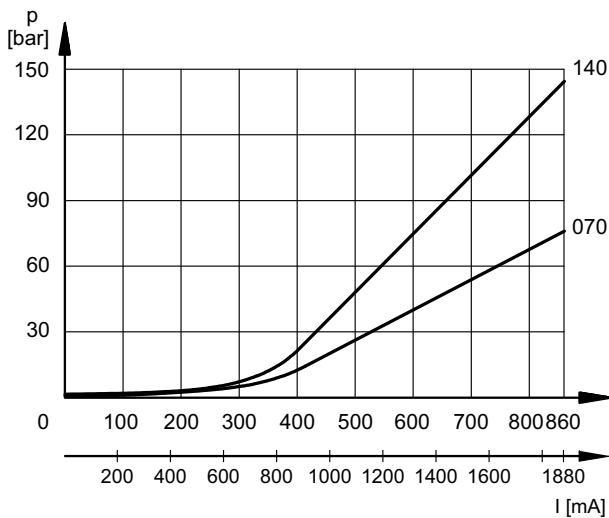
### 1 - IDENTIFICATION CODE



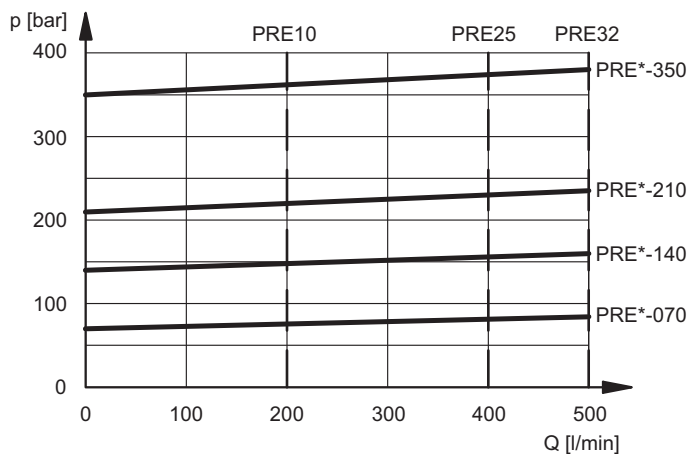
### 2 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

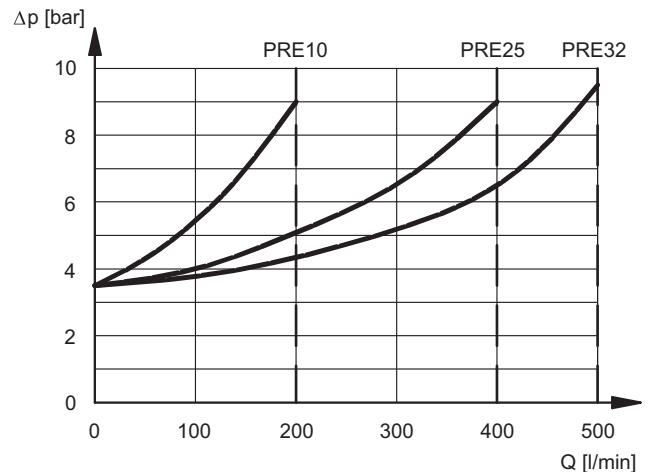
**PRESSURE CONTROL  $p=f(I)$**



**PRESSURE CONTROL  $p=f(Q)$**



**PRESSURE DROP  $\Delta p = f(Q)$**



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>	<b>24</b>
<b>RESISTANCE (at 20°C)</b>	Ω	3.66	17.6
<b>NOMINAL CURRENT</b>	A	1.88	0.86
<b>DUTY CYCLE</b>	100%		
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2014/30/EU		
<b>CLASS OF PROTECTION</b> atmospheric agents (IEC 60529) coil insulation (VDE 0580) impregnation	IP 65 class H class F		

### 5 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with input flow rate of Q = 50 l/min.

<b>REFERENCE SIGNAL STEP</b>	0 → 100%	100 → 0%
Step response [ms]	120	90

### 6 - INSTALLATION

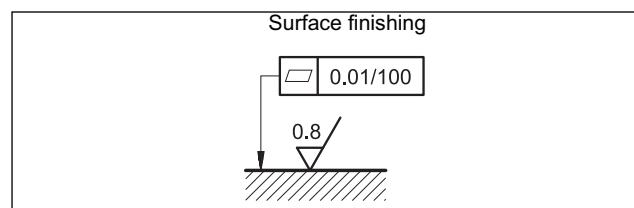
We recommend installing the PRE\* valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped inside the solenoid tube, by using the apposite drain screw (see par. 7 - 8 - 9). At the end of the operation, make sure of having correctly screwed the drain screw.

Connect the T port on the valve directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

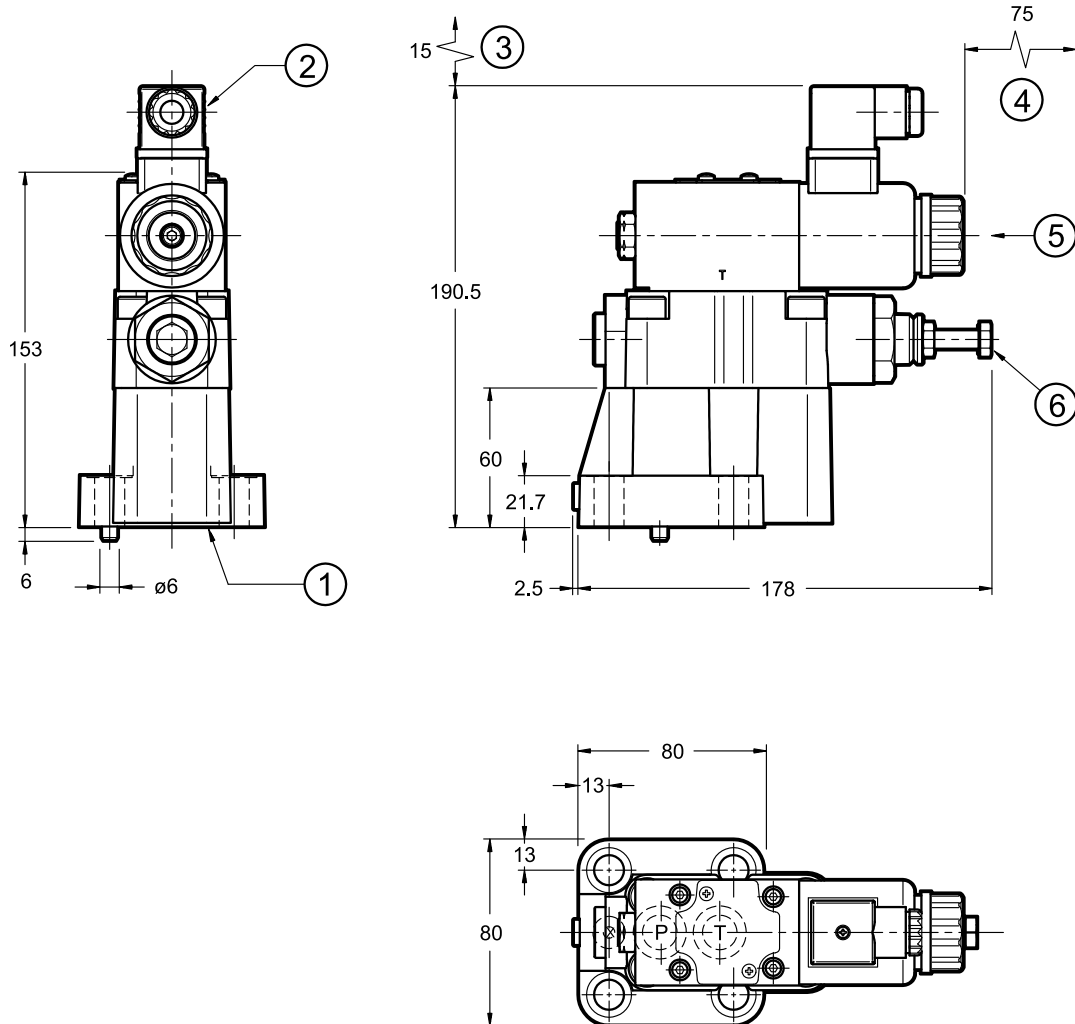
**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



### 7 - PRE10 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



#### NOTE:

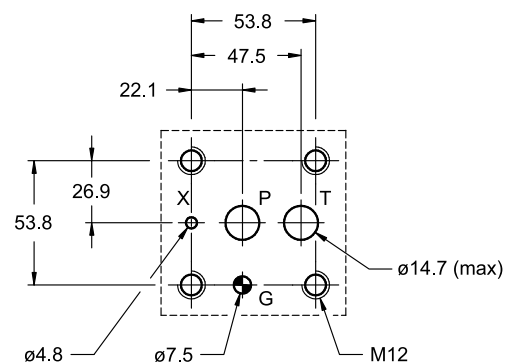
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M12x40 - ISO 4762  
Torque: 69 Nm (viti A8.8)  
Thread of mounting holes: M12x20

#### MOUNTING INTERFACE:

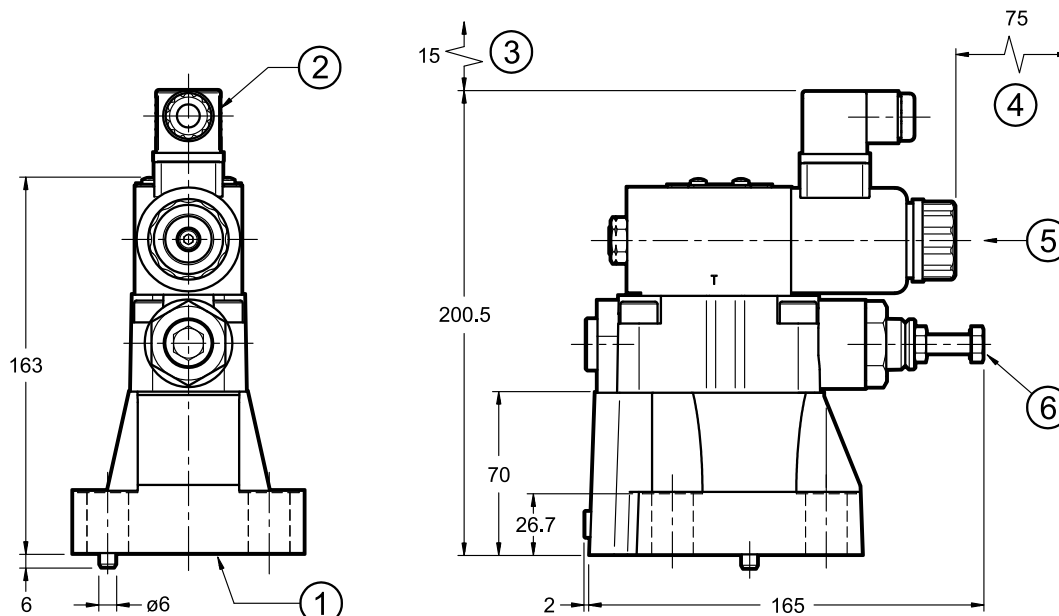
ISO 6264-06-09-\*97  
(CETOP 4.4.2-2-R06-350)

1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	EN 175301-803 (ex DIN 43650) electric connector
3	Connector removal space
4	Coil removal space
5	Factory setting sealing (we recommend to not unscrew the nut)
6	Breather (male hexagonal spanner 4)
7	Pressure relief valve (factory set)



### 8 - PRE25 OVERALL AND MOUNTING DIMENSIONS

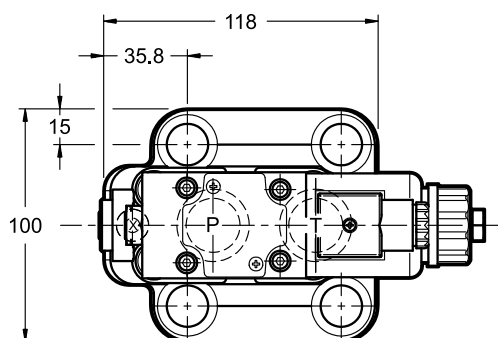
dimensions in mm



#### NOTE:

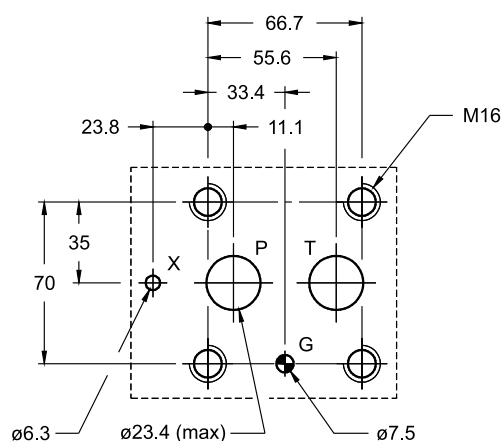
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M16x60 - ISO 4762  
Torque: 170 Nm (viti A8.8)  
Thread of mounting holes: M16x25



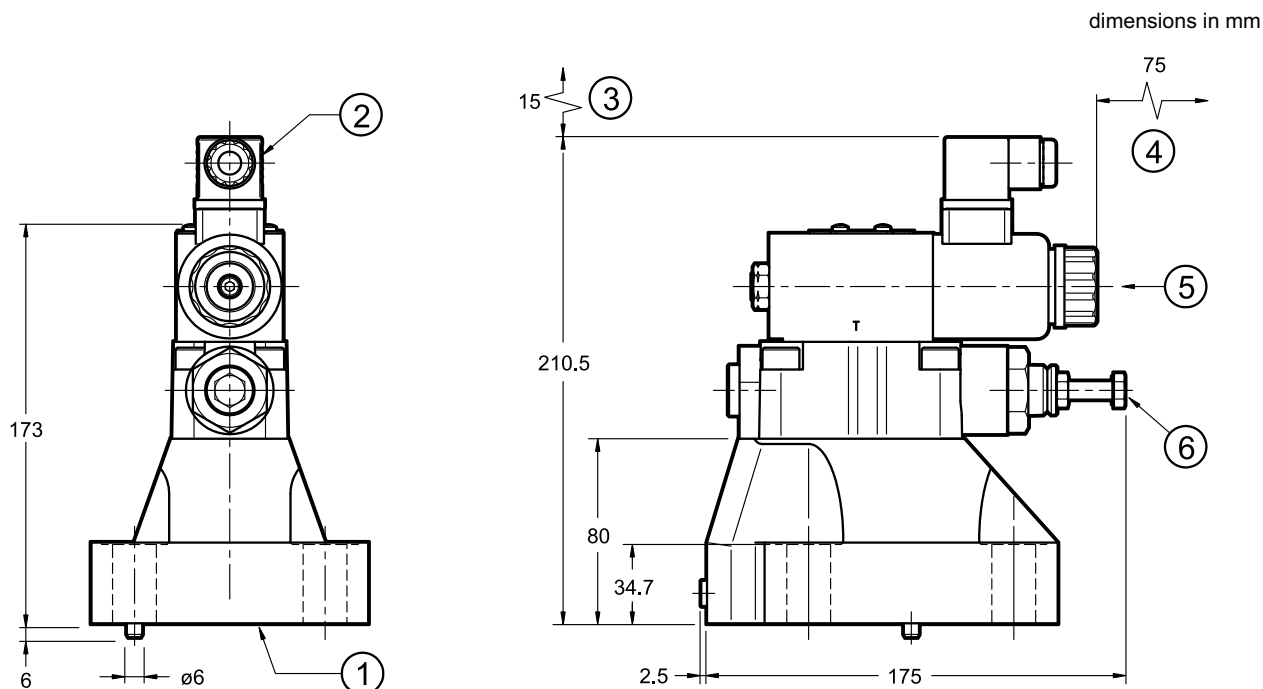
#### MOUNTING INTERFACE:

ISO 6264-08-13-\*97  
(CETOP 4.4.2-2-R08-350)



1	Mounting surface with sealing rings: 2 OR type 3118 (29.82x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	EN 175301-803 (ex DIN 43650) electric connector
3	Connector removal space
4	Coil removal space
5	Factory setting sealing (we recommend to not unscrew the nut)
6	Breather (male hexagonal spanner 4)
7	Pressure relief valve (factory set)

### 9 - PRE32 OVERALL AND MOUNTING DIMENSIONS



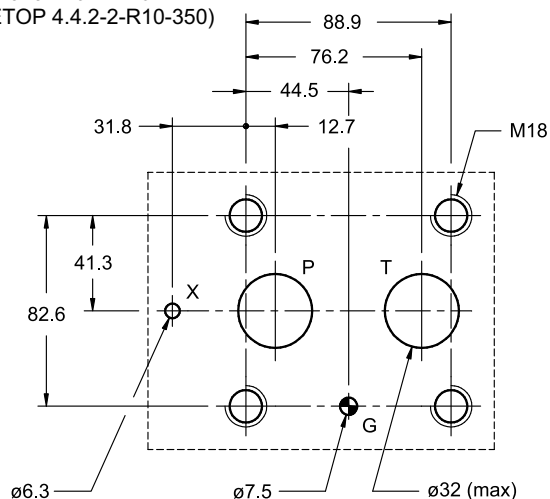
#### NOTE:

at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M18x60 - ISO 4762  
Torque: 235Nm (viti A8.8)  
Thread of mounting holes: M18x27

#### MOUNTING INTERFACE

ISO 6264-10-17-\*97  
(CETOP 4.4.2-2-R10-350)



1	Mounting surface with sealing rings: 2 OR type 4137 (34.52x3.53) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore)
2	EN 175301-803 (ex DIN 43650) electric connector
3	Connector removal space
4	Coil removal space
5	Factory setting sealing (we recommend to not unscrew the nut)
6	Breather (male hexagonal spanner 4)
7	Pressure relief valve (factory set)



## 10 - ELECTRONIC CONTROL UNITS

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		

## 11 - SUBPLATES

(see catalogue 51 000)

	<b>PRE10</b>	<b>PRE25</b>	<b>PRE32</b>
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T ports dimensions	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimensions	1/4" BSP	1/4" BSP	1/4" BSP

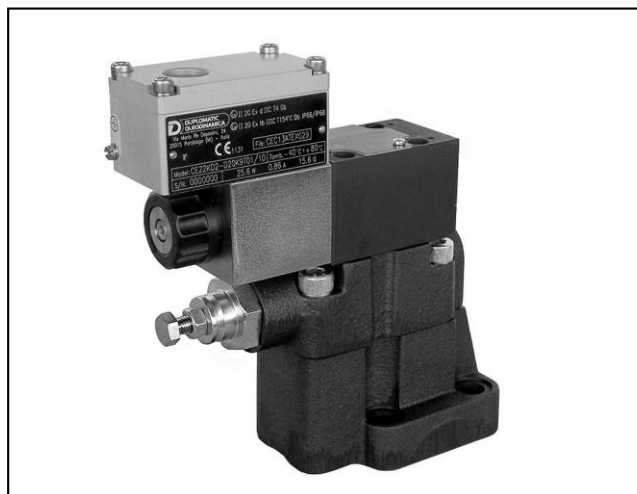


**PRE\***  
SERIES 10



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www.diplomatic.com • e-mail: sales.exp@diplomatic.com

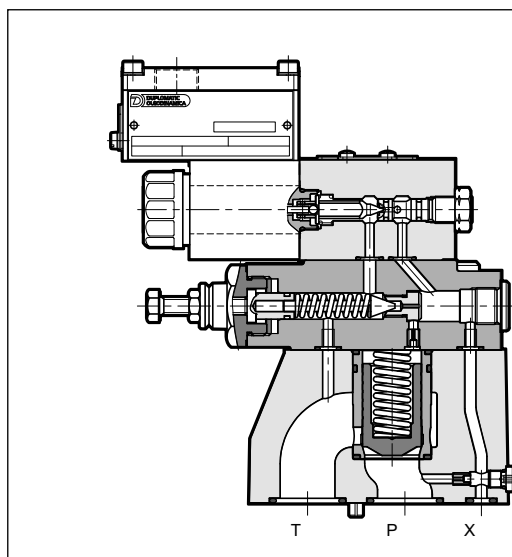


# PRE(D)\*K\*

## EXPLOSION-PROOF PROPORTIONAL PRESSURE RELIEF VALVE, PILOT OPERATED ATEX, IECEx, INMETRO SERIES 10

<b>PRED3K*</b>	<b>ISO 4401- 03</b>
<b>PRE3K*</b>	<b>ISO 4401- 03</b>
<b>PRE10K*</b>	<b>ISO 6264 - 06</b>
<b>PRE25K*</b>	<b>ISO 6264 - 08</b>
<b>PRE32K*</b>	<b>ISO 6264 - 10</b>

### OPERATING PRINCIPLE



- PRED3K\* and PRE\*K\* are explosion-proof pressure relief valves with proportional control.
- They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- The valves can be controlled directly by a current power supply or by means of an electronic control unit, to exploit valve performance to the full (see par. 19).
- Upon request, these valves can be supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 hours.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

		<b>PRED3K*</b>	<b>PRE3K*</b>	<b>PRE10K*</b>	<b>PRE25K*</b>	<b>PRE32K*</b>
Maximum operating pressure - P port - T port	bar	350 2				
Minimum flow Nominal flow Maximum flow	l/min	- 1 3	2 10 40	- - 200	- - 400	- - 500
Step response		see paragraph 8				
Hysteresis	% of p nom	< 5%				
Repeatability	% of p nom	< ±1,5%				
Electrical characteristic		see paragraph 9				
Operating temperatures (ambient and fluid)		see data sheet 02 500				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13				
Recommended viscosity	cSt	25				
Mass	kg	1,8	3,8	5,3	6,1	8,3



## 1 - IDENTIFICATION CODE OF DIRECT OPERATED PROPORTIONAL VALVE PRED3K\*

<b>P</b>	<b>R</b>	<b>E</b>	<b>D</b>	<b>3</b>		<b>-</b>		<b>/</b>	<b>10</b>		<b>-</b>		<b>K9</b>			
----------	----------	----------	----------	----------	--	----------	--	----------	-----------	--	----------	--	-----------	--	--	--

Pressure control valve

Electrical proportional control

Direct operated

Size ISO 4401-03

Explosion-proof certification: **See table 1.1**

Pressure control range

**070** = 0,7 - 70 bar  
**140** = 1,1 - 140 bar  
**210** = 1,8 - 210 bar  
**350** = 2,8 - 350 bar

Series No.

(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:

For temperature range -20 / +80 °C  
**N** = NBR seals for mineral oil (standard)  
**V** = FPM seals for special fluids  
For temperature range -40 / +80 °C  
**NL** = seal for low temperatures (for mineral oil)

**NOTE:** the valves are supplied with standard surface treatment of phosphating black.

Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For full zinc-nickel surface treatment add **/W7** at the end of the identification code.

Option:  
surface treatment not standard.  
Omit if not required (see **NOTE**)

Option: **/T5**  
version in T5 temperature class.  
Omit if not required.

Connection type for cable gland upper connection:  
**T01** = M20x1.5 - ISO 261  
**T02** = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
**T03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
side connection:  
**S01** = M20x1.5 - ISO 261  
**S02** = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
**S03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
**S04** = M16x1.5 - ISO 261

Coil electrical connection:  
by terminal block

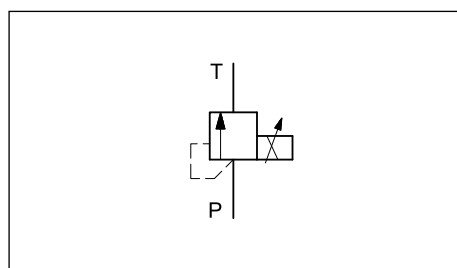
Nominal solenoid voltage:  
**D12** = 12V DC  
**D24** = 24V DC

### 1.1 - Names of valves per certification

	ATEX		IECEX		INMETRO	
for gases for dusts	<b>KD2</b>	II 2GD	<b>KXD2</b>	IECEX Gb IECEX Db	<b>KBD2</b>	INMETRO Gb INMETRO Db
for mines	<b>KDM2</b>	I M2	<b>KXDM2</b>	IECEX Mb	<b>KBDM2</b>	INMETRO Mb

**NOTE:** Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

## 2 - HYDRAULIC SYMBOL





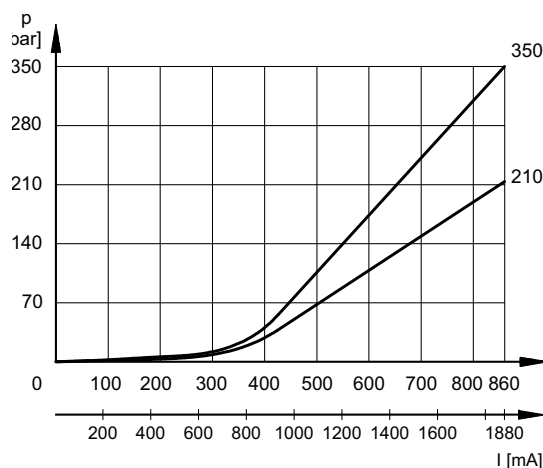
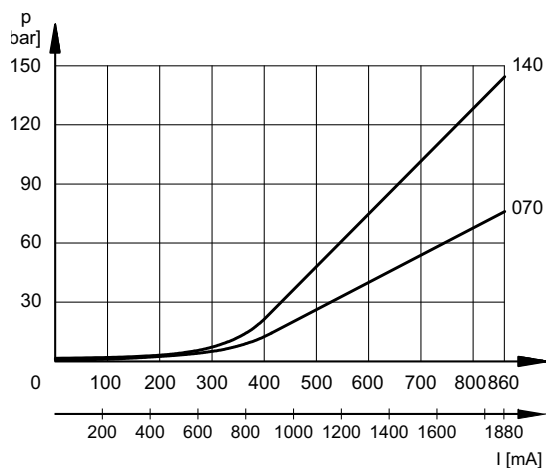
### 3 - CHARACTERISTIC CURVES FOR DIRECT OPERATED PROPORTIONAL VALVE PRED3K\*

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

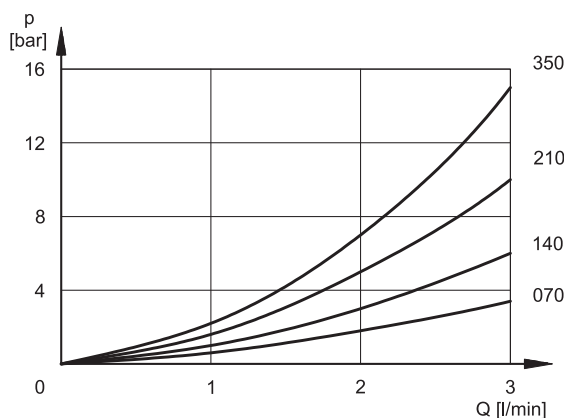
Typical control curves according to the current supplied to the solenoid for pressure control ranges: 070, 140, 210, 350, measured with input flow rate  $Q = 1$  l/min.

The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T. The full scale pressure is set in factory with a flow rate of 1 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram  $p_{max} = f(Q)$ ).

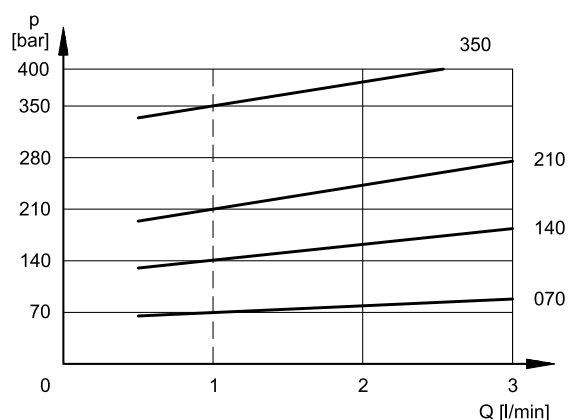
**PRESSURE CONTROL  $p = f(I)$**



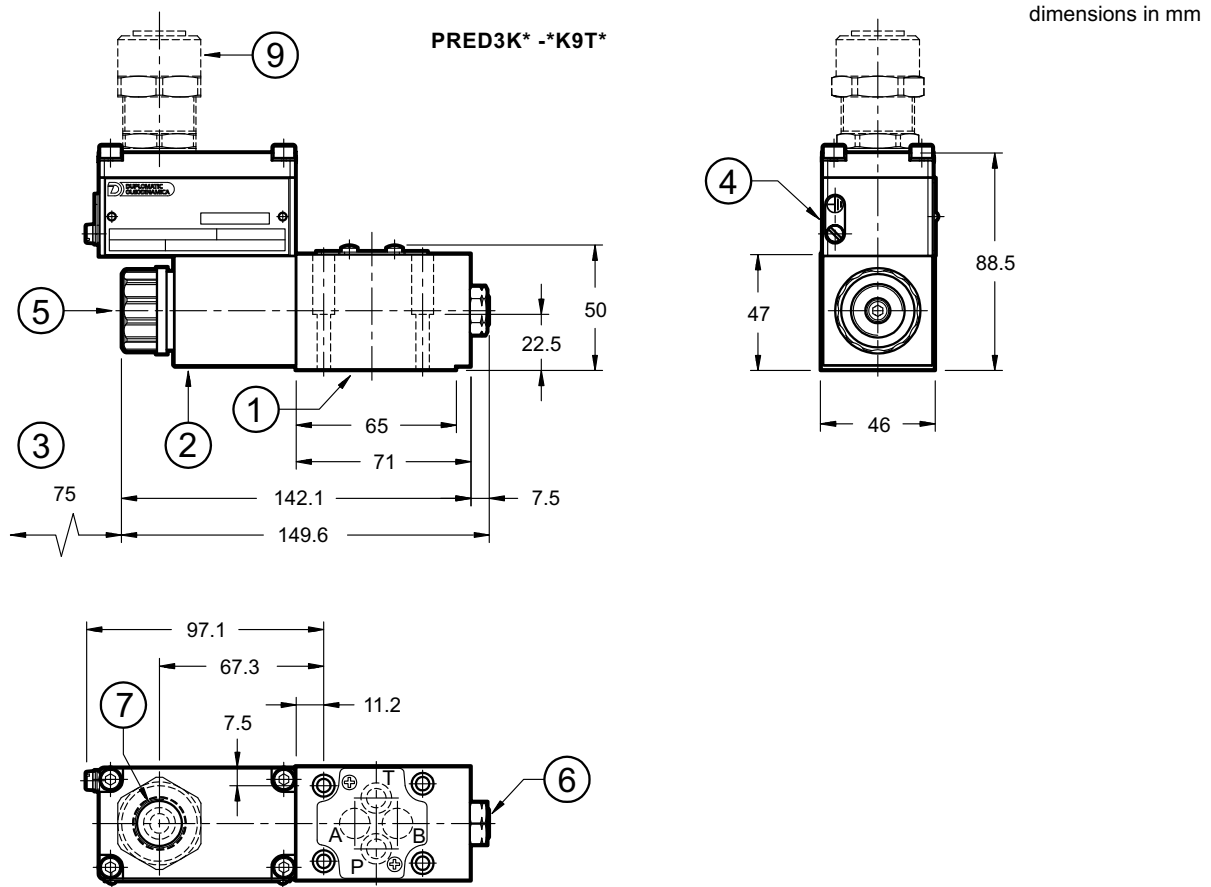
**MINIMUM CONTROLLED PRESSURE  $p_{min} = f(Q)$**



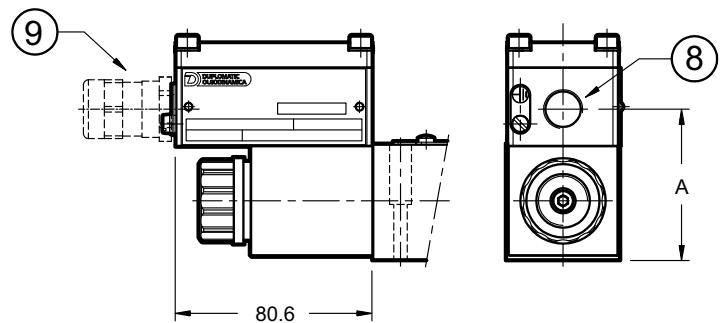
**PRESSURE VARIATION  $p_{max} = f(Q)$**



## 4 - PRED3K\* OVERALL AND MOUNTING DIMENSIONS



**PRED3K\* -\*K9S\***



1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Terminal for supplementary GND connection
5	Breather (Allen key 4)
6	Factory setting sealing (we recommend not unscrewing the nut)
7	Upper port for cable gland
8	Side port for cable gland
9	Cable gland To be ordered separately, see par.18

Side port type	A
<b>S01, S04</b>	60.5
<b>S02, S03</b>	60

**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (5) placed at the end of the solenoid tube.

Fastening of single valve: 4 SHC screws M5x30 - ISO 4762
Tightening torque: 5 Nm (A 8.8 screws)
Threads of mounting holes: M5x10

## 5 - IDENTIFICATION CODE OF PILOT OPERATED PROPORTIONAL VALVES PRE\*K\*

P	R	E			-	/	10		-		K9			
---	---	---	--	--	---	---	----	--	---	--	----	--	--	--

Pilot operated pressure relief valve

Electric proportional control

Size: 3 = ISO 4401-03  
10 = ISO 6264-06  
25 = ISO 6264-08  
32 = ISO 6264-10

Explosion-proof certification: See table 1.1

Pressure control range: PRE3K\*: 070 = 3.5 - 70 bar  
140 = 4 - 140 bar  
210 = 4 - 210 bar  
350 = 5 - 350 bar  
PRE10K\*, PRE25K\* and PRE32K\*: 070 = up to 70 bar  
140 = up to 140 bar  
210 = up to 210 bar  
350 = up to 350 bar

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: For temperature range -20 / +80 °C  
N = NBR seals for mineral oil (standard)  
V = FPM seals for special fluids  
For temperature range -40 / +80 °C  
NL = seal for low temperatures (for mineral oil)

Option: surface treatment not standard. Omit if not required (see NOTE)

Option: /T5 version in T5 temperature class. Omit if not required.

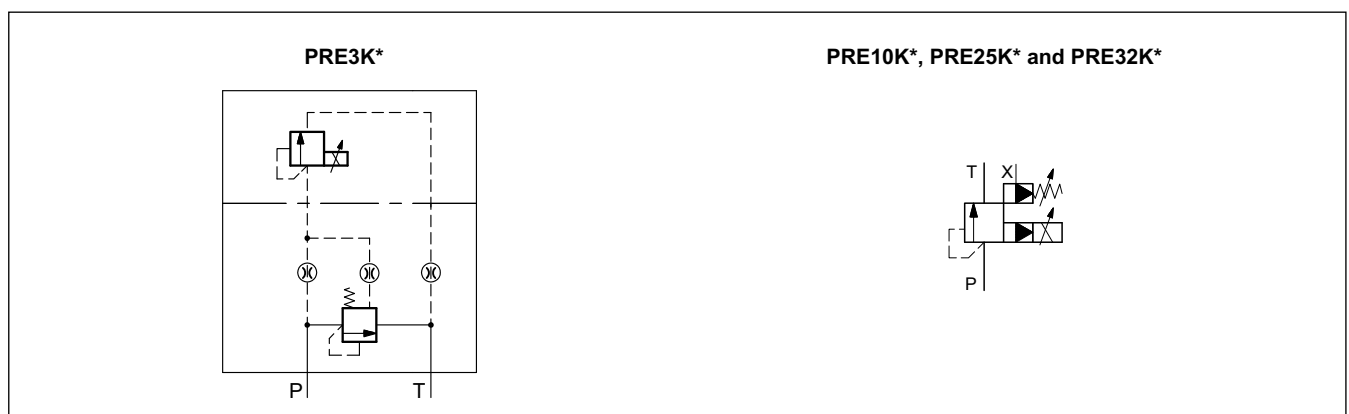
Connection type for cable gland upper connection:  
T01 = M20x1.5 - ISO 261  
T02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
T03 = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
side connection:  
S01 = M20x1.5 - ISO 261  
S02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
S03 = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
S04 = M16x1.5 - ISO 261

Coil electrical connection: by terminal block

Nominal solenoid voltage:  
D12 = 12V DC  
D24 = 24V DC

**NOTE:** the valves are supplied with standard surface treatment of phosphating black.  
Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).  
For full zinc-nickel surface treatment add /W7 at the end of the identification code.

## 6 - HYDRAULIC SYMBOLS

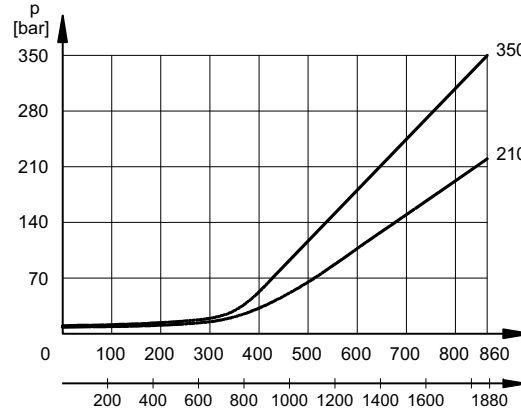
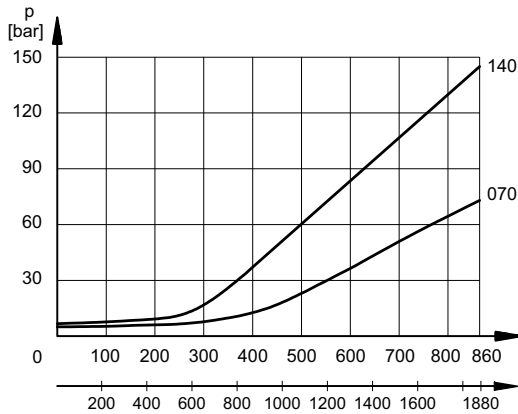


## 7 - CHARACTERISTIC CURVES OF PILOT OPERATED PROPORTIONAL VALVES

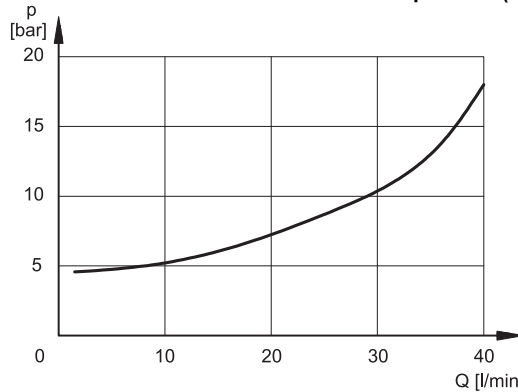
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

### 7.1 - PRE3K\*

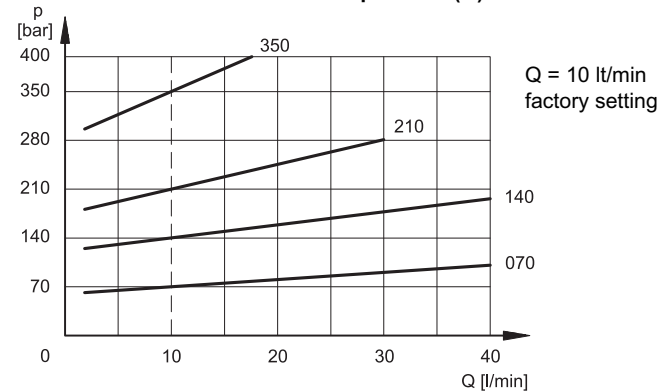
**PRESSURE CONTROL  $p=f(I)$**



**MINIMUM CONTROLLED PRESSURE  $p_{min} = f(Q)$**

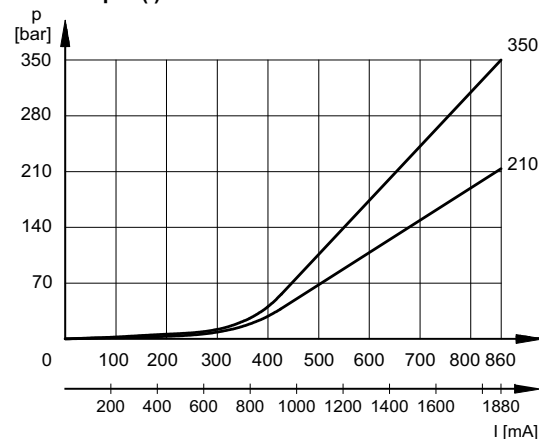
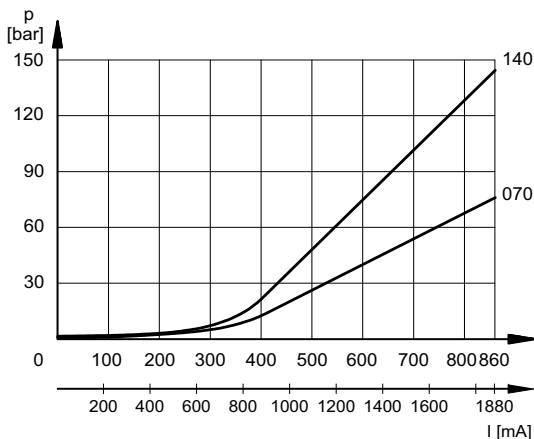


**PRESSURE VARIATION  $p_{max} = f(Q)$**

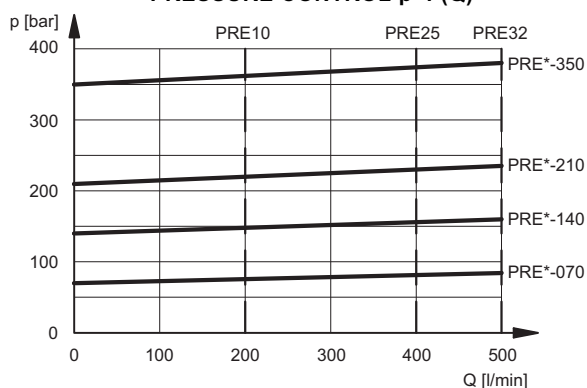


### 7.2 - PRE10K\*, PRE25K\* and PRE32K\*

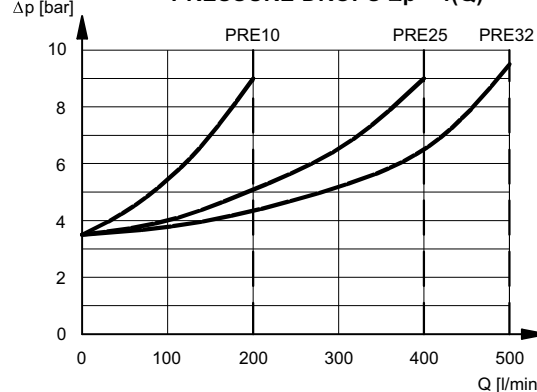
**PRESSURE CONTROL  $p=f(I)$**



**PRESSURE CONTROL  $p=f(Q)$**



**PRESSURE DROPS  $\Delta p = f(Q)$**



### 8 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a valve of pressure range up to 140 bar and with input flow rate of Q = 2 l/min for PRED3K\*, Q = 10 l/min for PRE3K\* and Q = 50 l/min for PRE10K\*, PRE25K\* and PRE32K\*.

REFERENCE SIGNAL	0 → 100%	100 → 0%
	Step response [ms]	
<b>PRED3K*</b>	80	40
<b>PRE3K*</b>	80	40
<b>PRE10K*, PRE25K* and PRE32K*</b>	120	90

### 9 - ELECTRICAL CHARACTERISTICS

(values ± 5%)

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>	<b>24</b>
<b>RESISTANCE (AT 20°C)</b>	Ω	3,4	15,6
<b>NOMINAL CURRENT</b>	A	1,88	0,86

<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2014/30/EU
<b>CLASS OF PROTECTION:</b> Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

#### 9.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

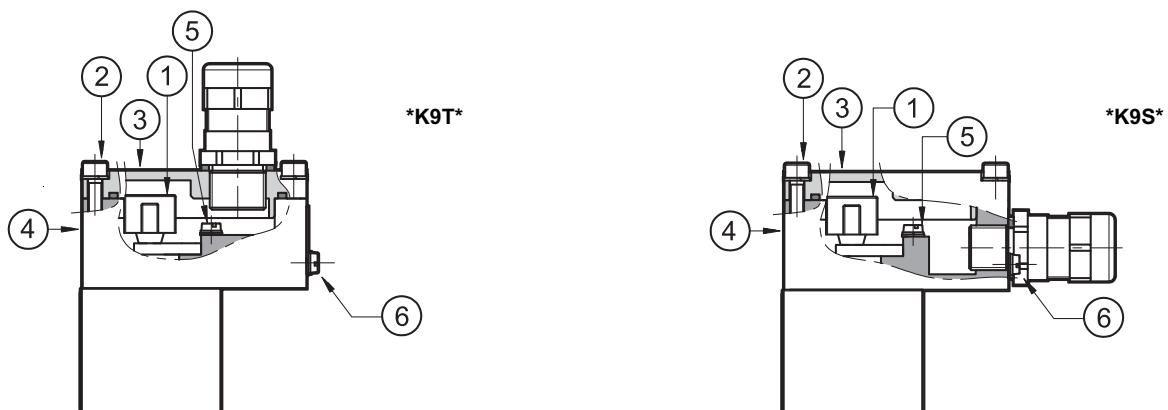
**The electrical connection is polarity-independent.**

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9 ÷ 6 Nm.

Electrical wiring must be done following the instructions of the rules in compliance with standard about protection against explosion hazards.



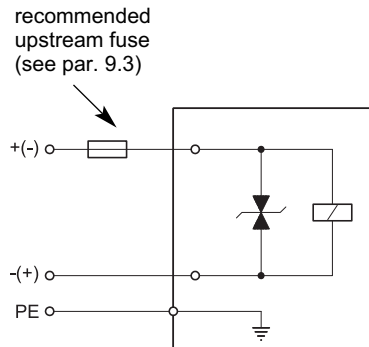
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm <sup>2</sup>
Connection for internal grounding point	max 2.5 mm <sup>2</sup>
Connection for external equipotential grounding point	max 6 mm <sup>2</sup>

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 18) allow to use cables with external diameter between 8 and 10 mm.

## 9.2 - Electrical diagrams



## 9.3 - Overcurrent fuse and switch-off voltage peak

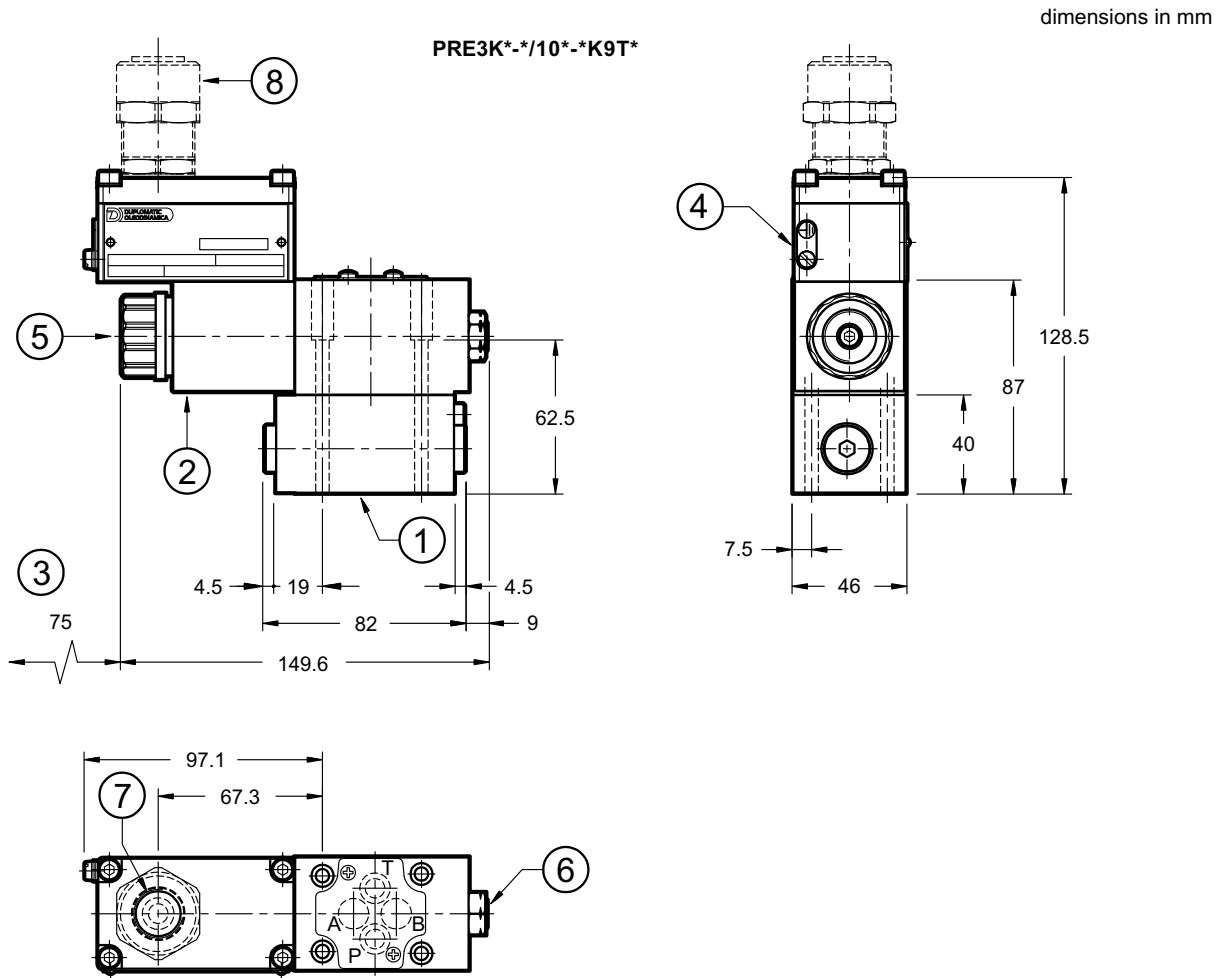
Upstream of each valve, an appropriate fuse (max 3 x I<sub>n</sub> according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]	Maximum voltage value upon switch off [V]	Suppressor circuit
<b>D12</b>	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
<b>D24</b>	24	0,86	1,25	- 49	

## 10 - PRE3K\* OVERALL AND MOUNTING DIMENSIONS



**NOTE 1:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (5) placed at the end of the solenoid tube.

**NOTE 2:** for side connections see paragraph 14.

Fastening of single valve: 4 screws SHC M5x70 - ISO 4762

Tightening torque: 5 Nm (A 8.8 screws)

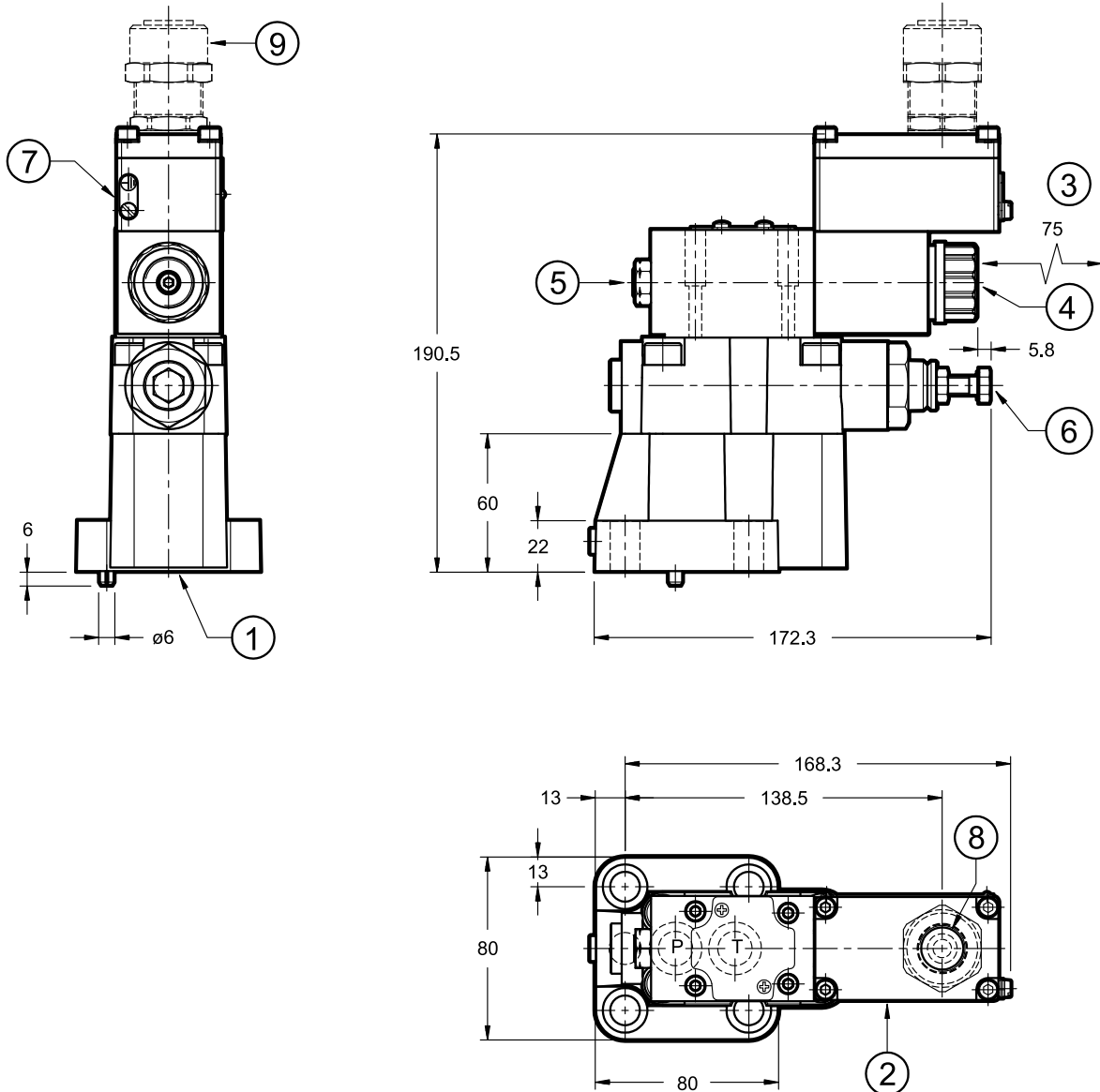
Threads of mounting holes: M5x10



## 11 - PRE10K\* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PRE10K\*-/10\*-\*K9T\*



1	Mounting surface with sealing rings: N. 2 OR type 123 (17.86 x 2.62) - 90 shore N. 1 OR type 109 (9.13 x 2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Pressure relief valve (factory set)
7	Terminal for supplementary GND connection
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 18

**NOTE 1:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

**NOTE 2:** for side connections see paragraph 15.

Fastening of single valve: 4 screws M12x40 - ISO 4762

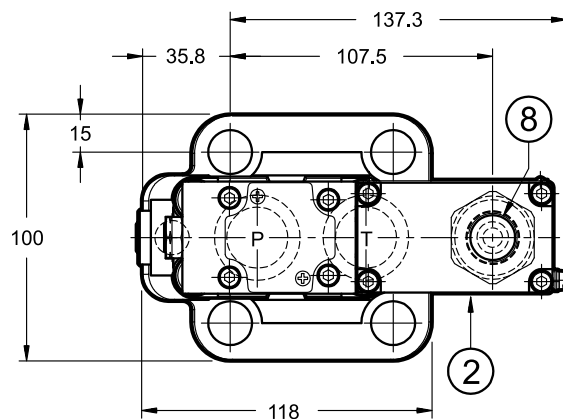
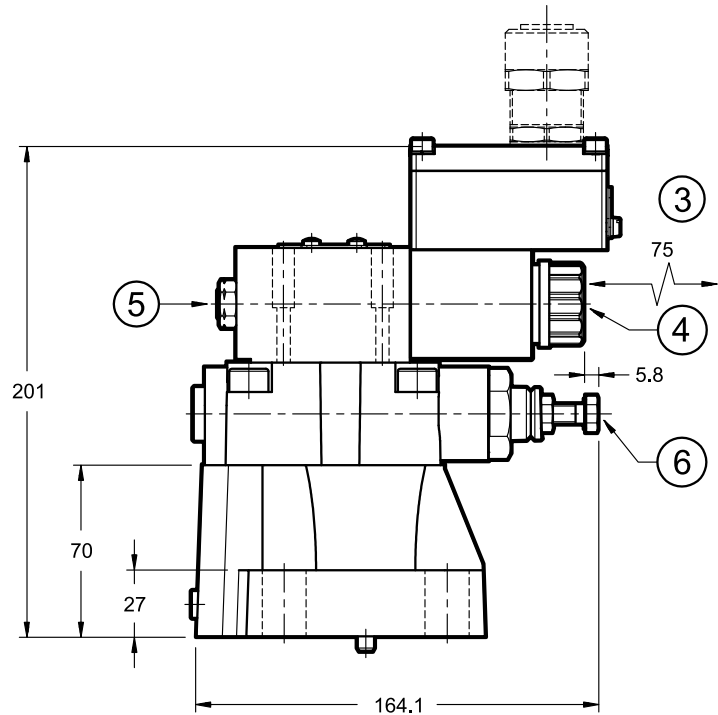
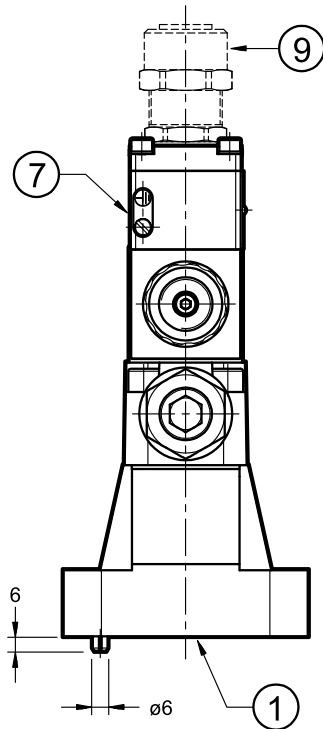
Tightening torque: 69 Nm (A 8.8 screws)

Threads of mounting holes: M12x20

## 12 - PRE25K\* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PRE25K\*-/10\*-\*K9T\*



1	Mounting surface with sealing rings: N. 2 OR type 3118 (29.82 x 2.62) - 90 shore N. 1 OR type 109 (9.13 x 2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Pressure relief valve (factory set)
7	Terminal for supplementary GND connection
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 18

**NOTE 1:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

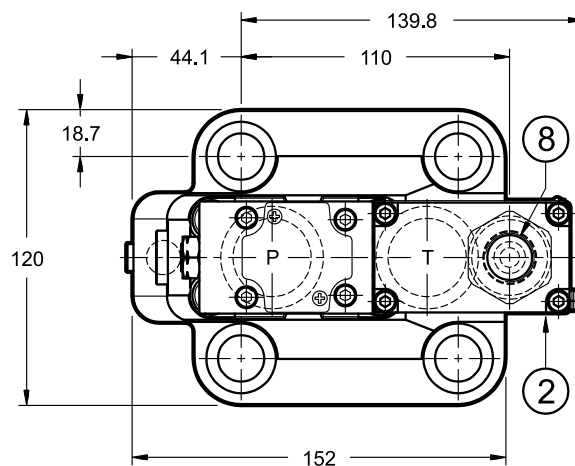
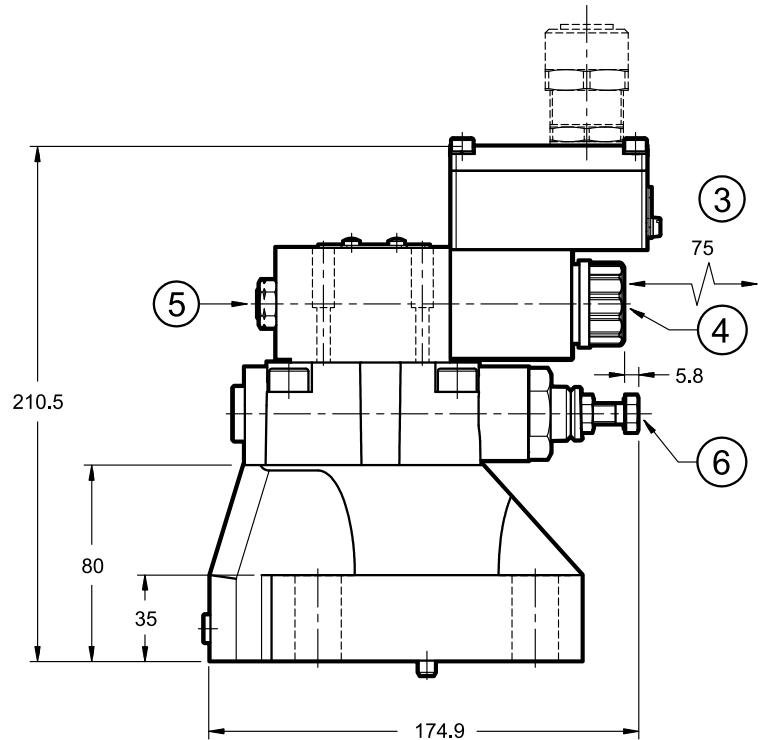
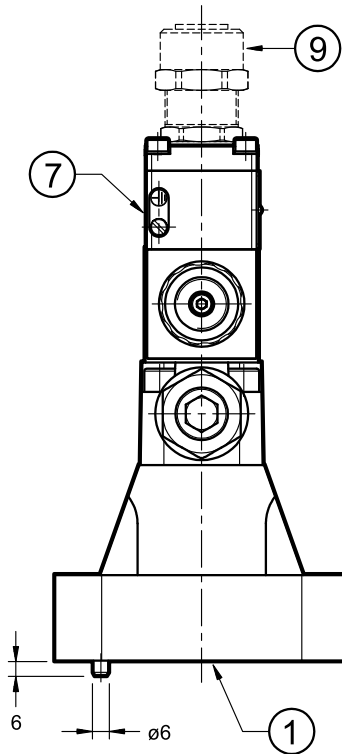
**NOTE 2:** for side connections see paragraph 15.

Fastening of single valve: 4 SHC screws M16x50 - ISO 4762
Tightening torque: 170 Nm (A 8.8 screws)
Threads of mounting holes: M16x25

## 13 - PRE32K\* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PRE32K\*-/10\*-\*K9T\*



1	Mounting surface with sealing rings: N. 2 OR type 4137 (34.52 x 3.53) - 90 shore N. 1 OR type 109 (9.13 x 2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Pressure relief valve (factory set)
7	Terminal for supplementary GND connection
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 18

**NOTE 1:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

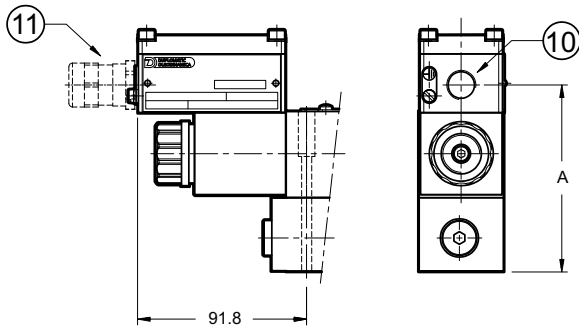
**NOTE 2:** for side connections see paragraph 14.

Fastening of single valve: N. 4 SHC screws M18x60 - ISO 4762
Tightening torque: 235 Nm (A 8.8 screws)
Threads of mounting holes: M18x27

## 14 - PRE\*K\*-/10\*-\*K9S\* (SIDE CONNECTION) OVERALL AND MOUNTING DIMENSIONS

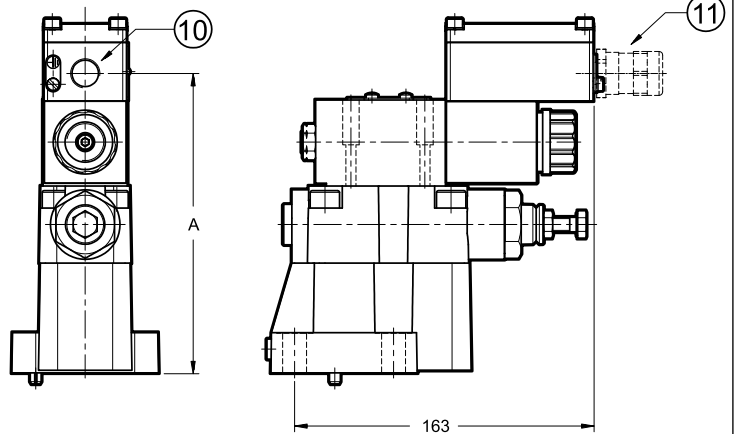
dimensions in mm

PRE3K\*-/10\*-\*K9S\*



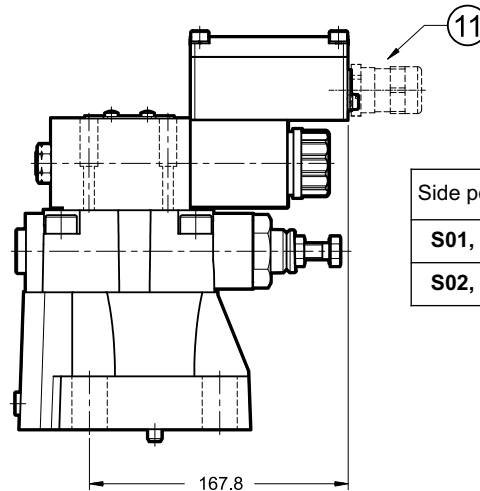
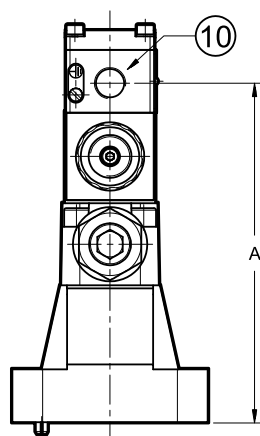
Side port type	A
S01, S04	100.5
S02, S03	100

PRE10K\*-/10\*-\*K9S\*



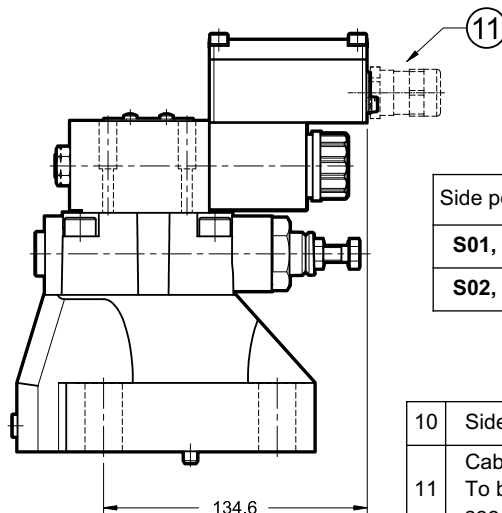
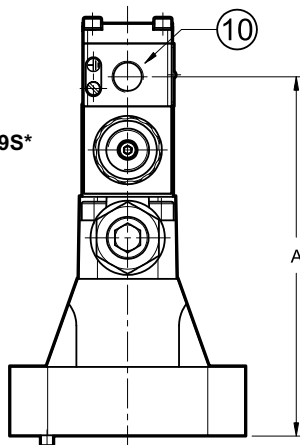
Side port type	A
S01, S04	162.5
S02, S03	162

PRE25K\*-/10\*-\*K9S\*



Side port type	A
S01, S04	172.5
S02, S03	172

PRE32K\*-/10\*-\*K9S\*



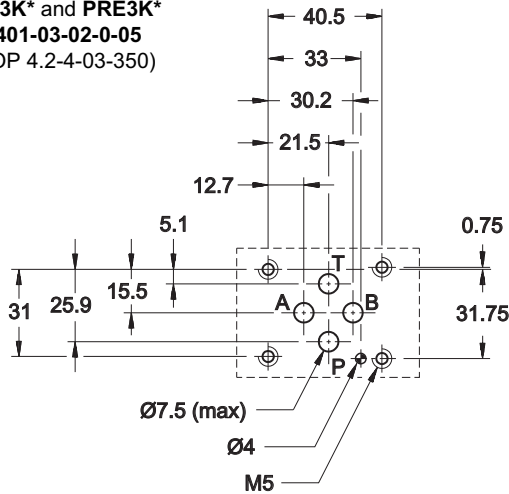
Side port type	A
S01, S04	182.5
S02, S03	182

10	Side port for cable gland
11	Cable gland. To be ordered separately, see par. 16

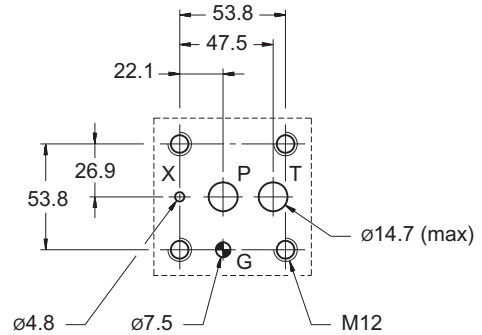


## 15 - MOUNTING SURFACES

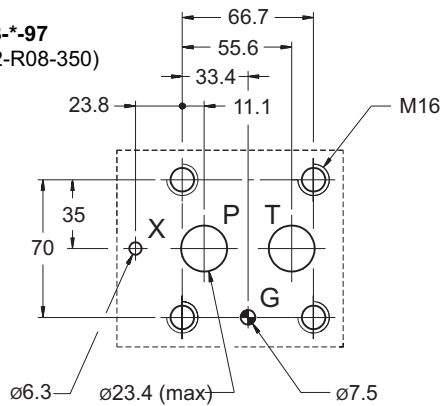
**PRED3K\* and PRE3K\***  
ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



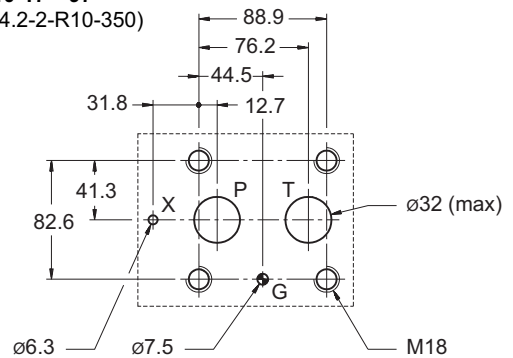
**PRE10K\***  
ISO 6264-06-09-\*97  
(CETOP 4.4.2-2-R06-350)



**PRE25K\***  
ISO 6264-08-13-\*97  
(CETOP 4.4.2-2-R08-350)



**PRE32K\***  
ISO 6264-10-17-\*97  
(CETOP 4.4.2-2-R10-350)



## 16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 17 - INSTALLATION



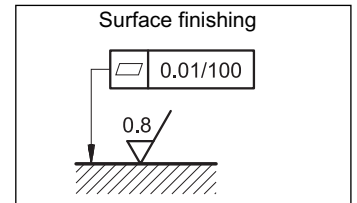
Installation must adhere to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraphs 3 and 7.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air, by using the apposite drain screw in the solenoid tube. At the end of the operation, make sure of having correctly screwed the drain screw.

Connect the T port on the valve directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. **Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

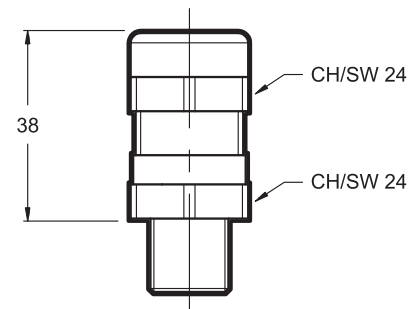
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



### 18 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø8÷10 mm cables);
- ATEX II 2GD, I M2; IECEX Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68



To order the desired cable glands, specify description, code and quantity.

**Description: CGK2/NB-01/10**

**Code: 3908108001**

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

**Description: CGK2/NB-02/10**

**Code: 3908108002**

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-03/10**

**Code: 3908108003**

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-04/10**

**Code: 3908108004**

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm



## 19 - ELECTRONIC CONTROL UNITS

EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

**NOTE:** electronic control units offered are not explosion-proof certified; therefore, they must be installed outside classified areas.

## 20 - SUBPLATES

(see catalogue 51 000)

	PRED3K*	PRE3K*	PRE10K*	PRE25K*	PRE32K*
Type with rear ports	PMMD-AI3G	PMMD-AI3G	PMRQ3-AI4G	PMRQ5-AI5G	PMRQ7-AI7G
Type with side ports	PMMD-AL3G	PMMD-AL3G	-	-	-
P, T ports dimensions	3/8" BSP	3/8" BSP	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimensions	-	-	1/4" BSP	1/4" BSP	1/4" BSP

**NOTE:** Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a rate higher than the value allowed by norms according to ATEX directive for category II 2GD and I M2.

The user will bear to do the complete assessment of the ignition risk that can occur from the relative use in potentially explosive environments.



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# PRE\*G

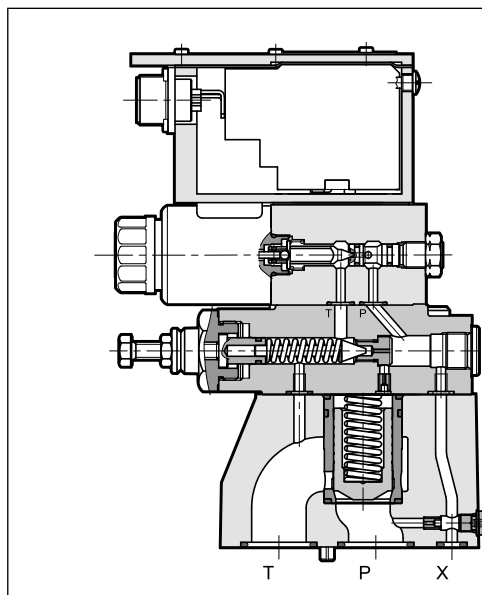
## PILOT OPERATED PRESSURE RELIEF VALVES WITH PROPORTIONAL CONTROL AND INTEGRAL ELECTRONICS

### SERIES 31

**SUBPLATE MOUNTING**  
**ISO 6264**

**p** max **350** bar  
**Q** max (see table of performances)

#### OPERATING PRINCIPLE



- The PRE\*G valves are pilot operated pressure relief valves with integrated electric proportional control and mounting interface in compliance with ISO 6264 standards.
- These valves are used to control hydraulic circuit pressure and enable the use of the full flow rate of the pump, even with settings approaching calibrated values.
- The two-stage design and wide passages ensure reduced pressure drops thereby improving the system energy performance.
- They are fitted with a manual pressure relief valve which is factory set to  $\geq 15\%$  of the maximum value in the pressure control range.
- The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.
- A solenoid current monitoring signal is available.
- The valves are easy to install. The driver directly manages digital settings.

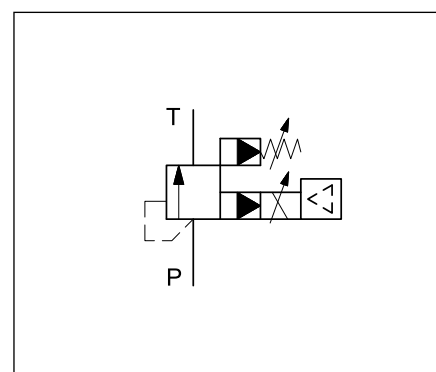
#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		PRE10G	PRE25G	PRE32G
Maximum operating pressure	bar	350		
Maximum flow	l/min	200	400	500
Step response		see paragraph 6		
Hysteresis	% of p nom	< 3%		
Repeatability	% of p nom	< ±1%		
Electrical characteristic		see paragraph 2		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	5,5	6,3	8,5

— They are available in three sizes with flow rates up to 500 l/min and in four pressure control ranges up to 350 bar.

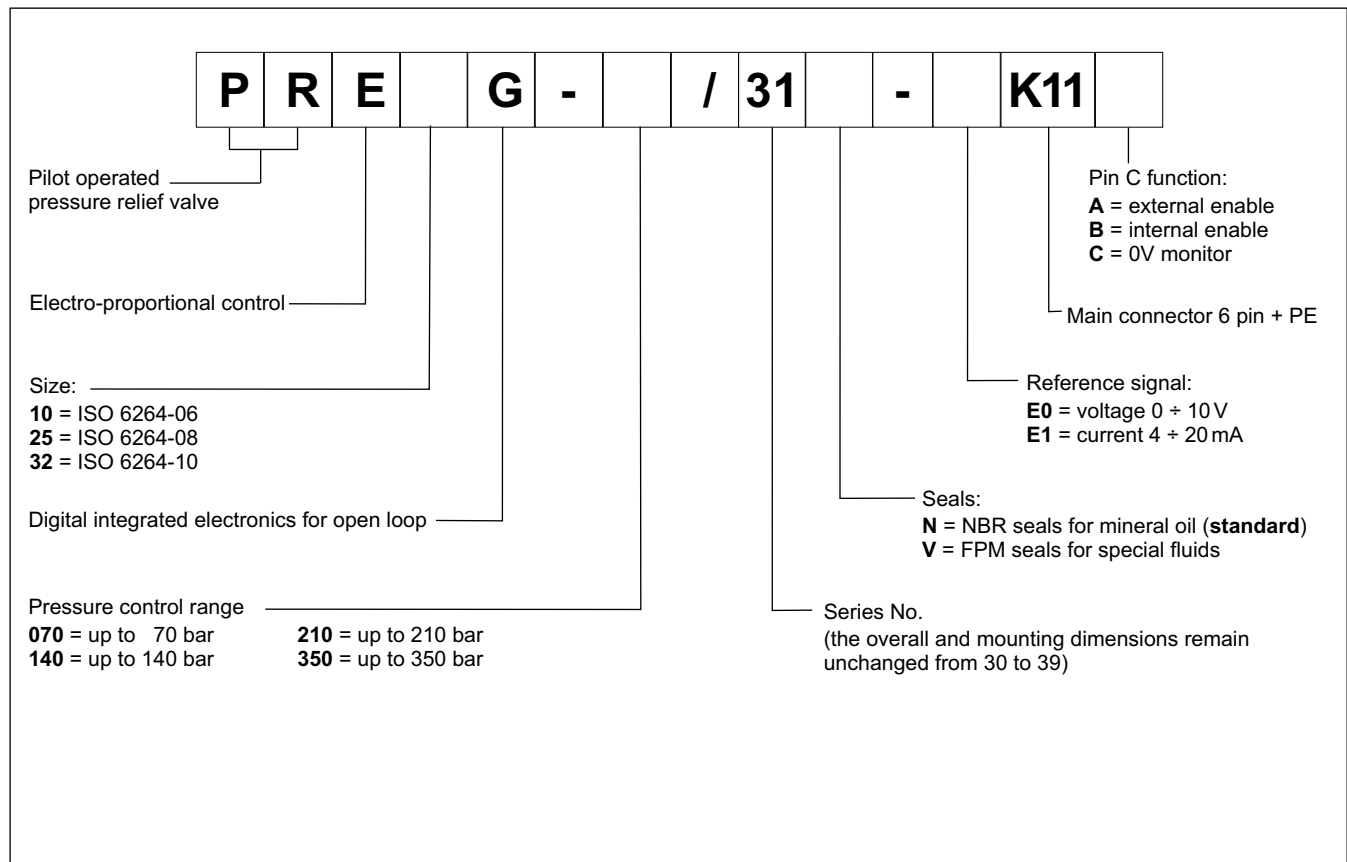
#### HYDRAULIC SYMBOL







## 1 - IDENTIFICATION CODE



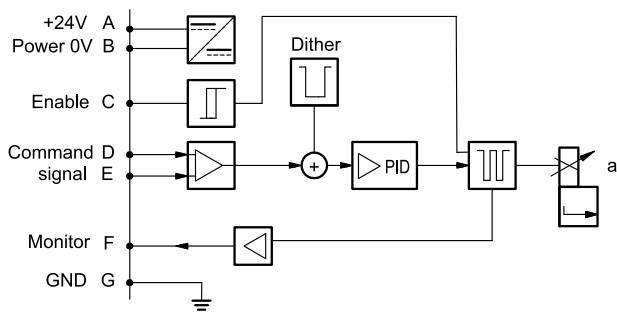
## 2 - ELECTRICAL CHARACTERISTICS

### 2.1 - Electrical on board electronics

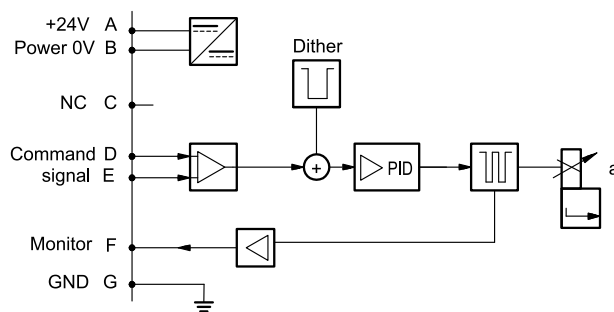
Duty cycle		100% (continuous operation)
Protection class according to IEC 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 2.2 - On-board electronics diagrams

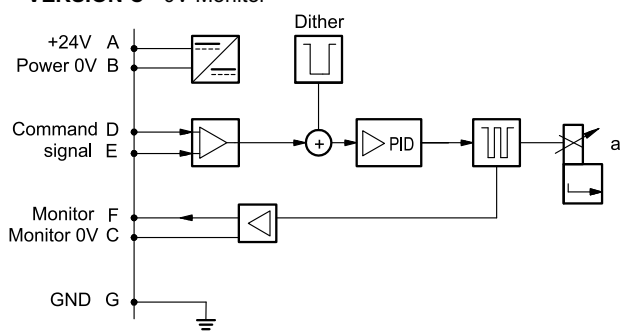
#### VERSION A - External Enable



#### VERSION B - Internal Enable

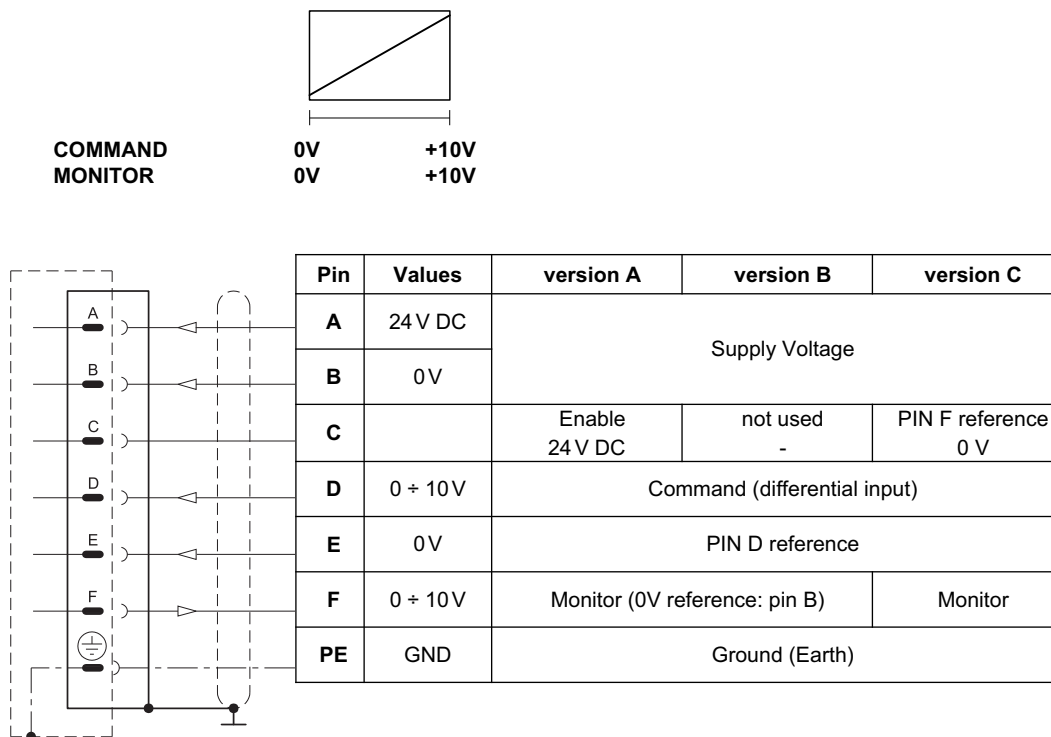


#### VERSION C - 0V Monitor



### 3 - VERSIONS WITH VOLTAGE COMMAND (E0)

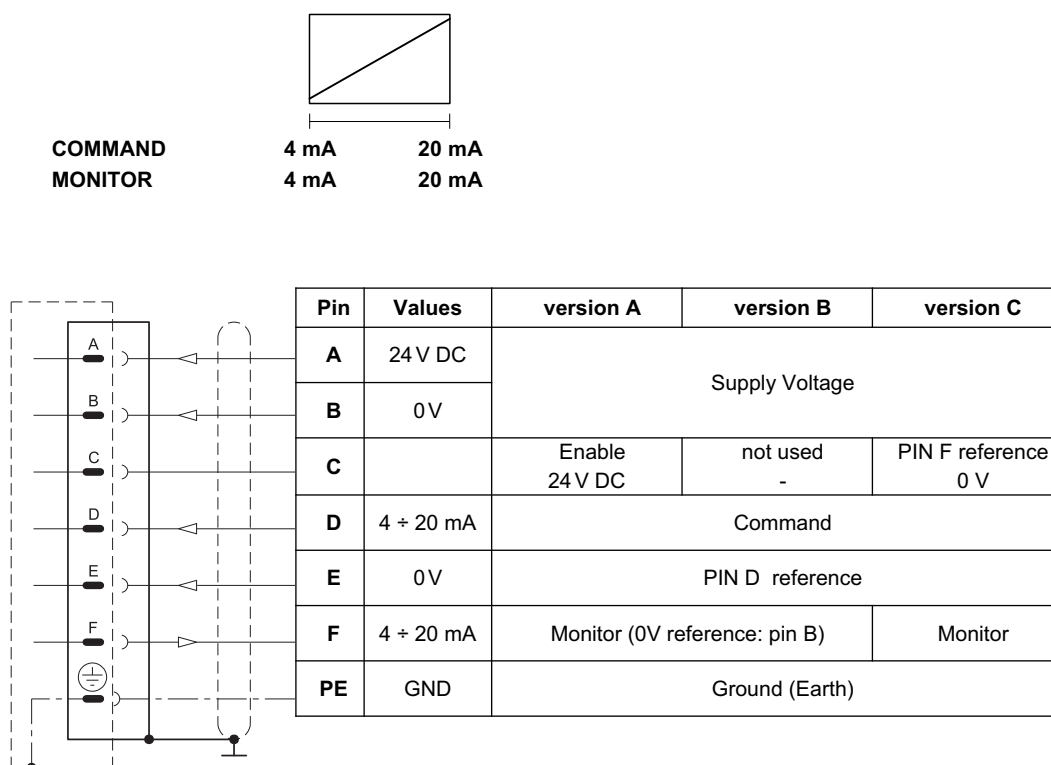
The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



### 4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

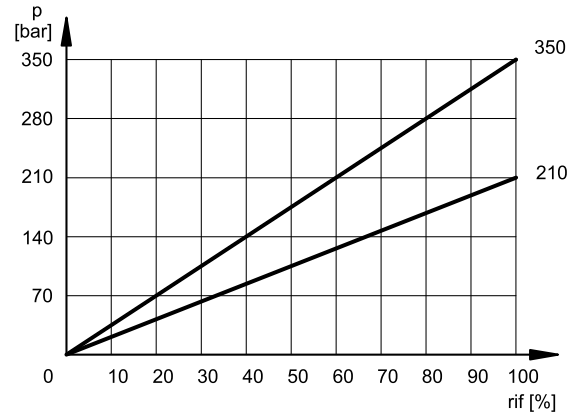
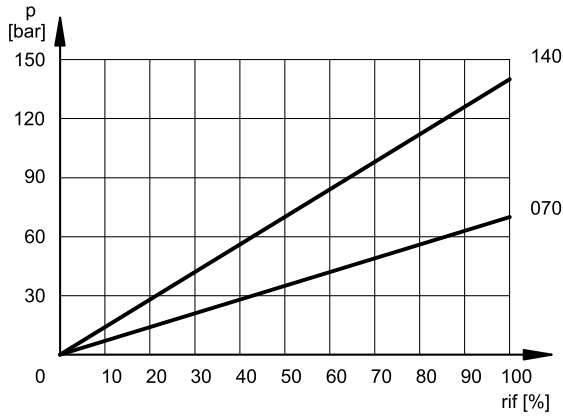
The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



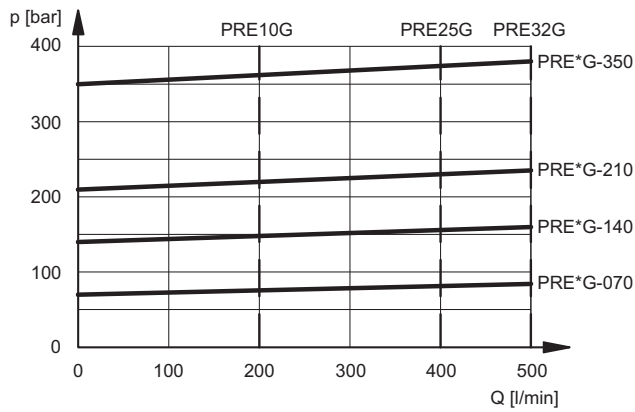
## 5 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

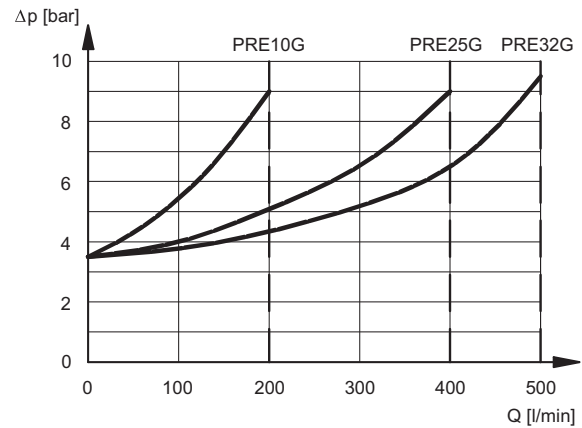
**PRESSURE CONTROL  $p = f(I)$**



**PRESSURE CONTROL  $p = f(Q)$**

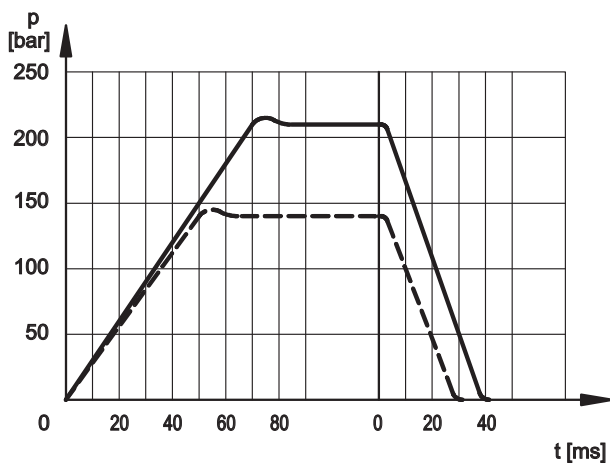


**PRESSURE DROPS  $\Delta p = f(Q)$**



## 6 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

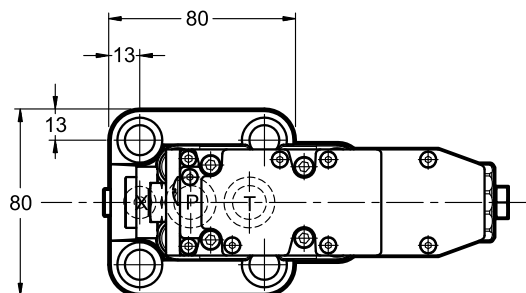
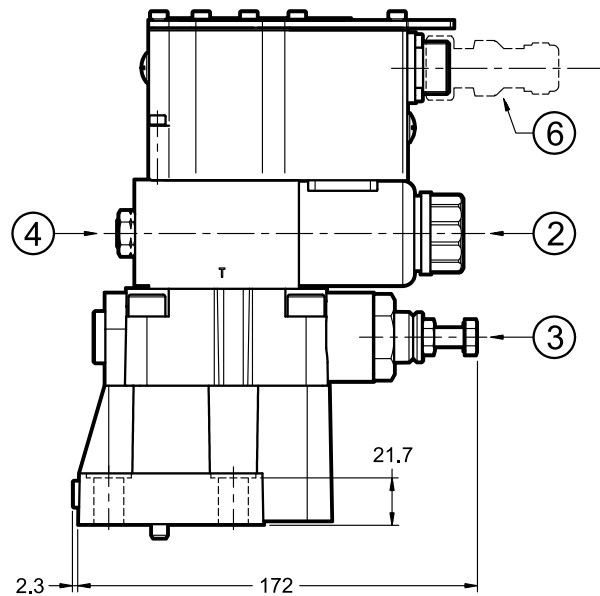
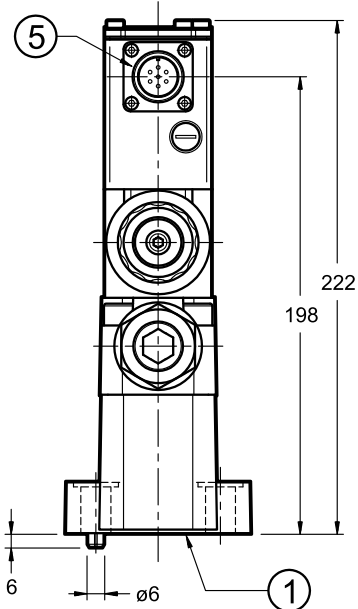


— full-scale 210 bar  
- - - full-scale 140 bar

**NOTE:** Response times are obtained with PRE25G valves.

## 7 - OVERALL AND MOUNTING DIMENSIONS PRE10G

dimensions in mm



### NOTE:

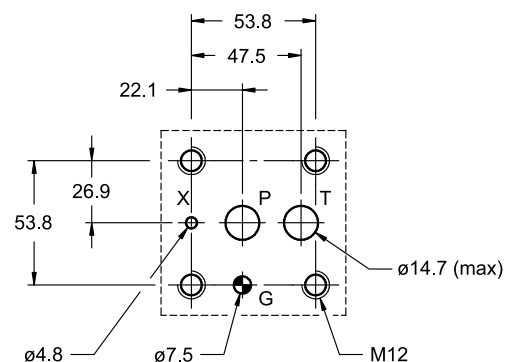
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M12x40 - ISO 4762  
Torque: 69 Nm (viti A8.8)  
Thread of mounting holes: M12x20

### MOUNTING INTERFACE:

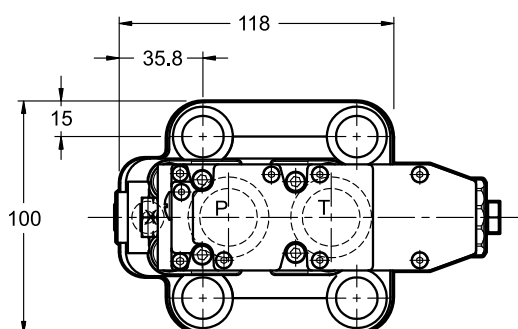
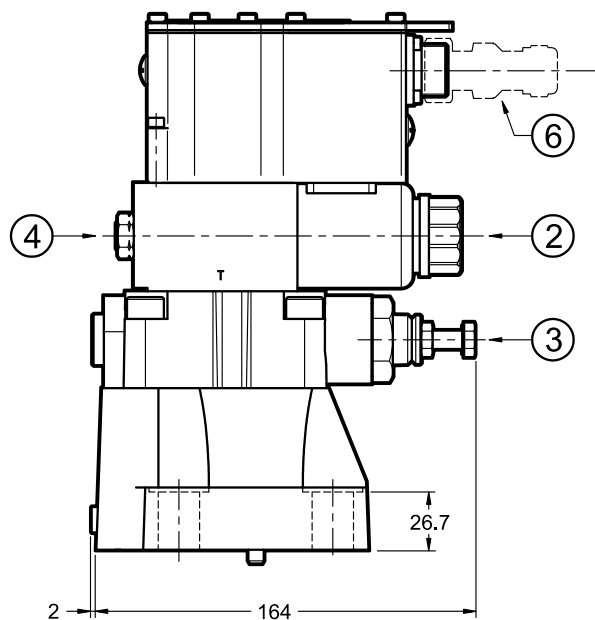
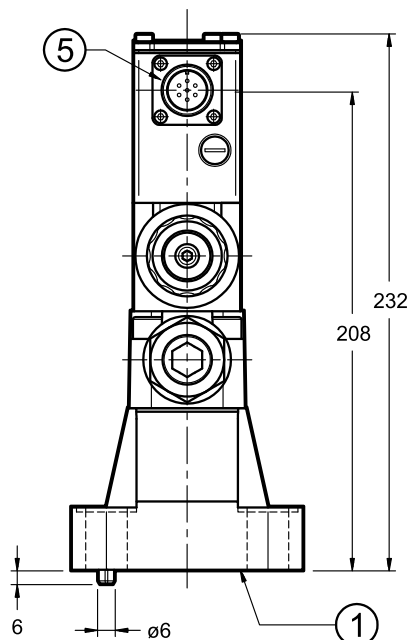
ISO 6264-06-09-\*97  
(CETOP 4.4.2-2-R06-350)

1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector <b>to be ordered separately.</b> See at section 12



### 8 - OVERALL AND MOUNTING DIMENSIONS PRE25G

dimensions in mm



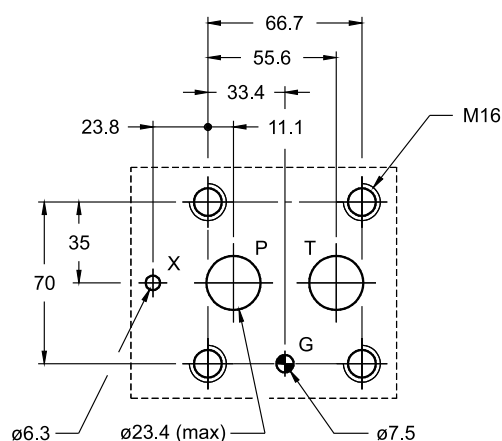
#### NOTE:

at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M16x60 - ISO 4762  
Torque: 170 Nm (viti A8.8)  
Thread of mounting holes: M16x25

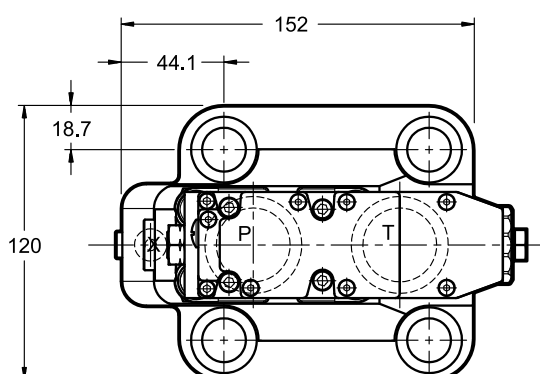
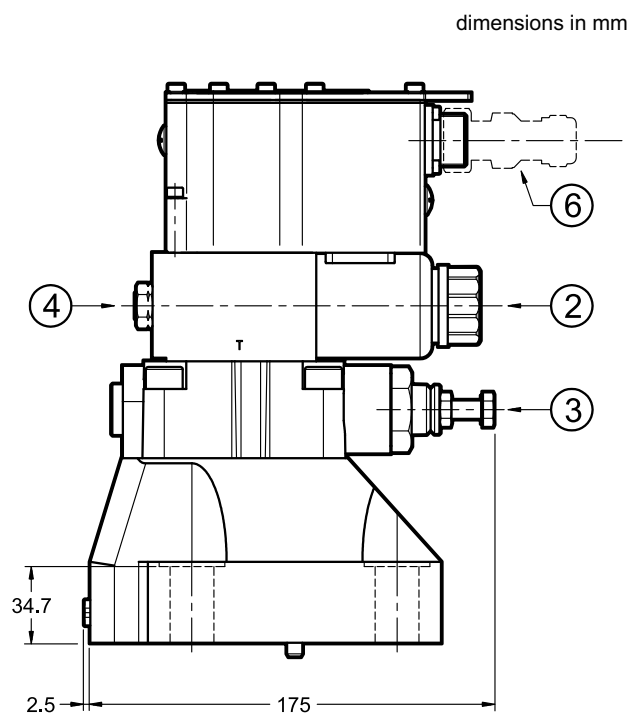
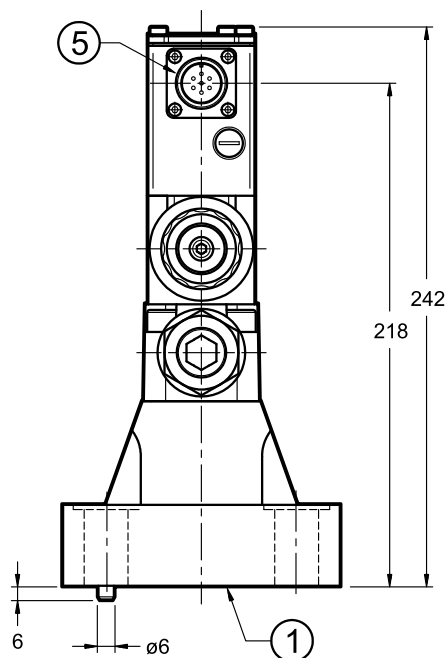
#### MOUNTING INTERFACE:

ISO 6264-08-13-\*97  
(CETOP 4.4.2-2-R08-350)



1	Mounting surface with sealing rings: 2 OR type 3118 (29.82x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector <b>to be ordered separately.</b> See at section 12

## 9 - OVERALL AND MOUNTING DIMENSIONS PRE32G



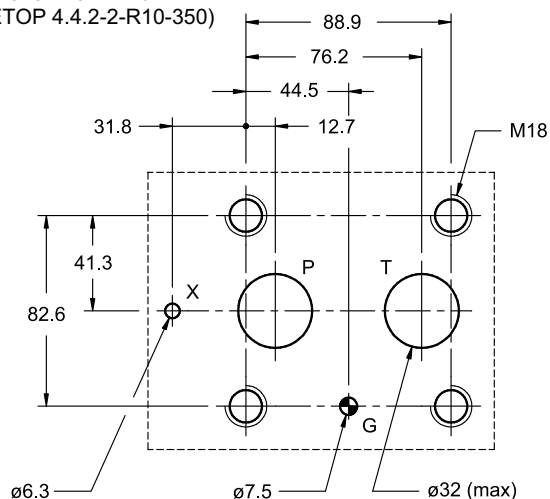
**NOTE:**

at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M18x60 - ISO 4762  
Torque: 235Nm (viti A8.8)  
Thread of mounting holes: M18x27

## MOUNTING INTERFACE

ISO 6264-10-17-\*-97  
(CETOP 4.4.2-2-R10-350)



1	Mounting surface with sealing rings: 2 OR type 4137 (34.52x3.53) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector <b>to be ordered separately.</b> See at section 12

### 10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 11 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

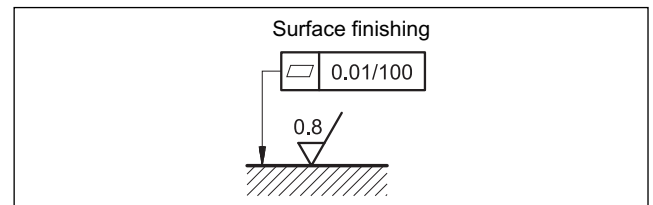
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

**Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.**

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



### 12 - ACCESSORIES

(to be ordered separately)

#### 12.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

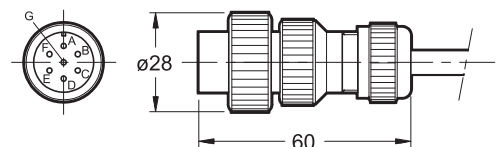


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



#### 12.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

#### 12.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.





## 13 - SUBPLATES

(see catalogue 51 000)

	PRE10G	PRE25G	PRE32G
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T port dimensions	1/2" BSP	1" BSP	1" 1/4 BSP
X port dimensions	1/4" BSP	1/4" BSP	1/4" BSP



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# PRE\*J

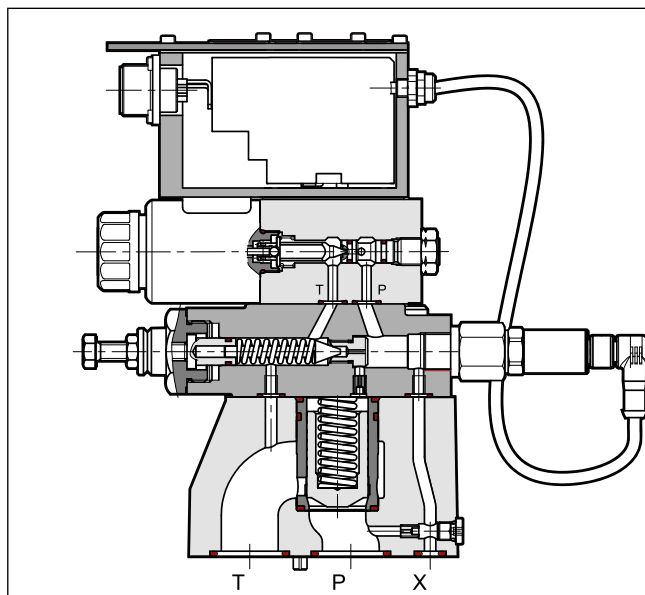
## PILOT OPERATED PRESSURE VALVES IN CLOSED LOOP WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS SERIES 31

### SUBPLATE MOUNTING

**p** max **350** bar

**Q** max (see table of performances)

### OPERATING PRINCIPLE



- PRE\*J valves are pilot operated pressure relief valves with integrated electric proportional control and mounting interface in compliance with ISO 6264 standard.
- These valves are used to control hydraulic circuit pressure and enable the use of the full flow rate of the pump, even with settings approaching calibrated values.
- The two-stage design and wide passages ensure reduced pressure drops thereby improving the system energy performance.
- They are fitted with a manual pressure relief valve which is factory set to  $\geq 15\%$  of the maximum value in the pressure control range.
- The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.
- The monitoring of the value detected by the pressure transmitter is available on pin F.
- They are available in three sizes with flow rates up to 500 l/min and in four pressure control ranges up to 350 bar.

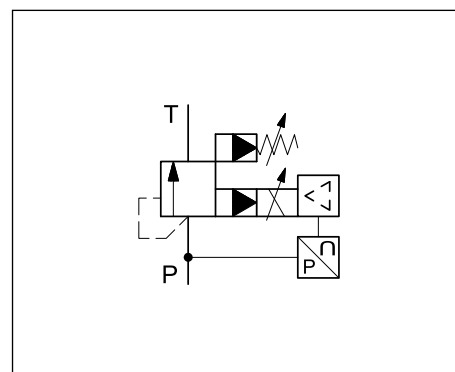
### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)

		PRE10J	PRE25J	PRE32J
Maximum operating pressure	bar	350		
Maximum flow	l/min	200	400	500
Step response		see paragraph 6		
Hysteresis	% of p nom	< 1%		
Repeatability	% of p nom	< ± 0,5%		
Electrical characteristic		see paragraph 2		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	5,5	6,3	8,5

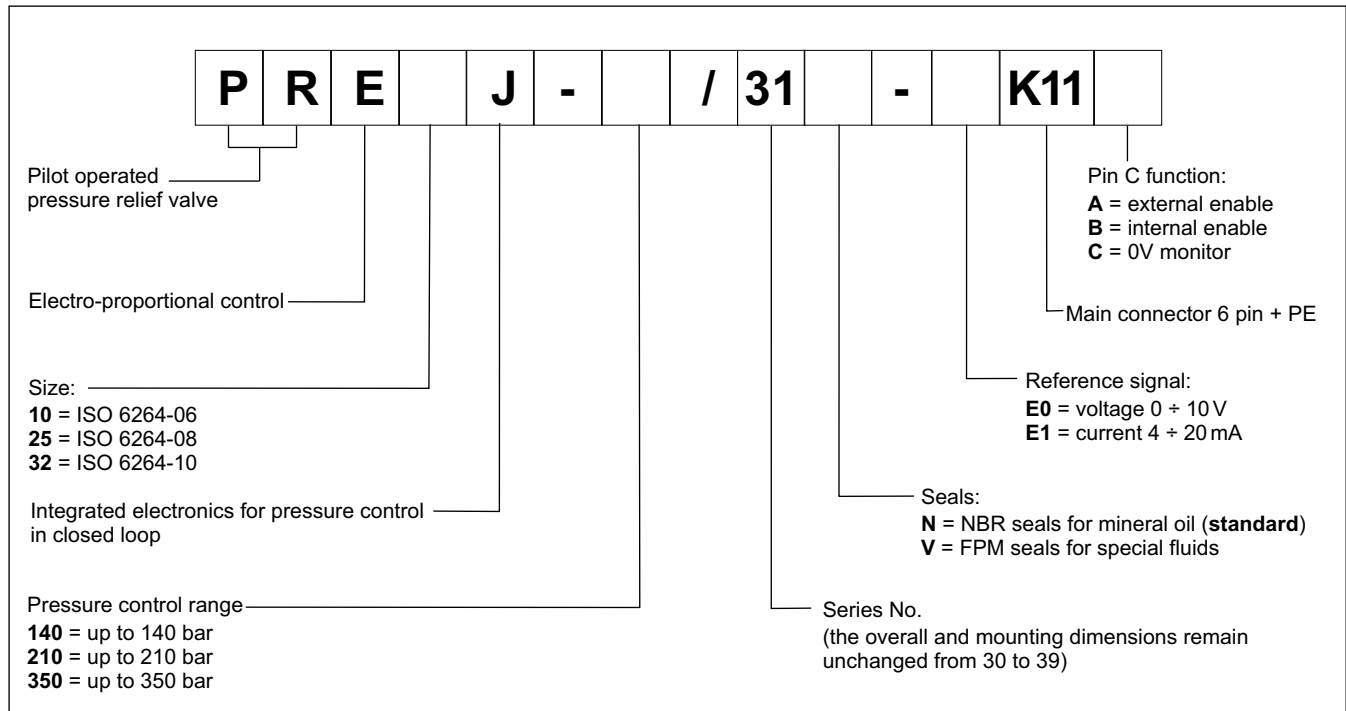
— The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 12.3)

### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE



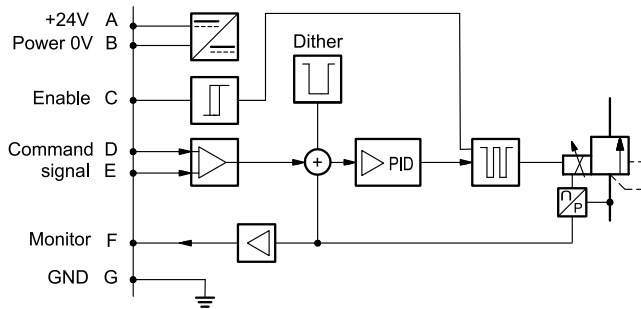
## 2 - ELECTRICAL CHARACTERISTICS

### 2.1 - Electrical on board electronics

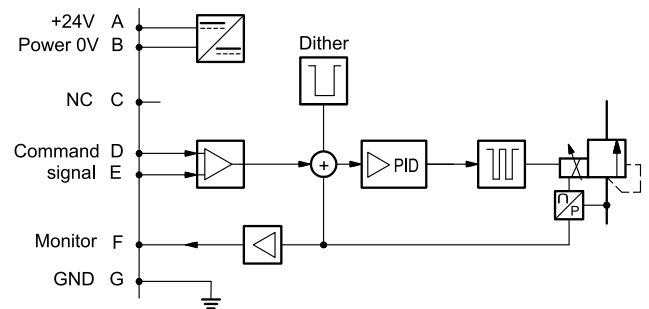
Duty cycle		100% (continuous operation)
Protection class according to IEC 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (pressure at transducer): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 2.2 - On-board electronics diagrams

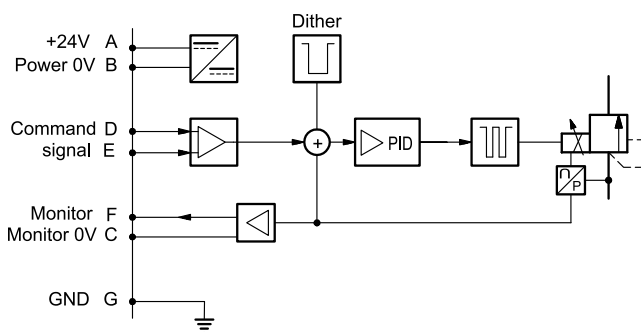
#### VERSION A - External Enable



#### VERSION B - Internal Enable

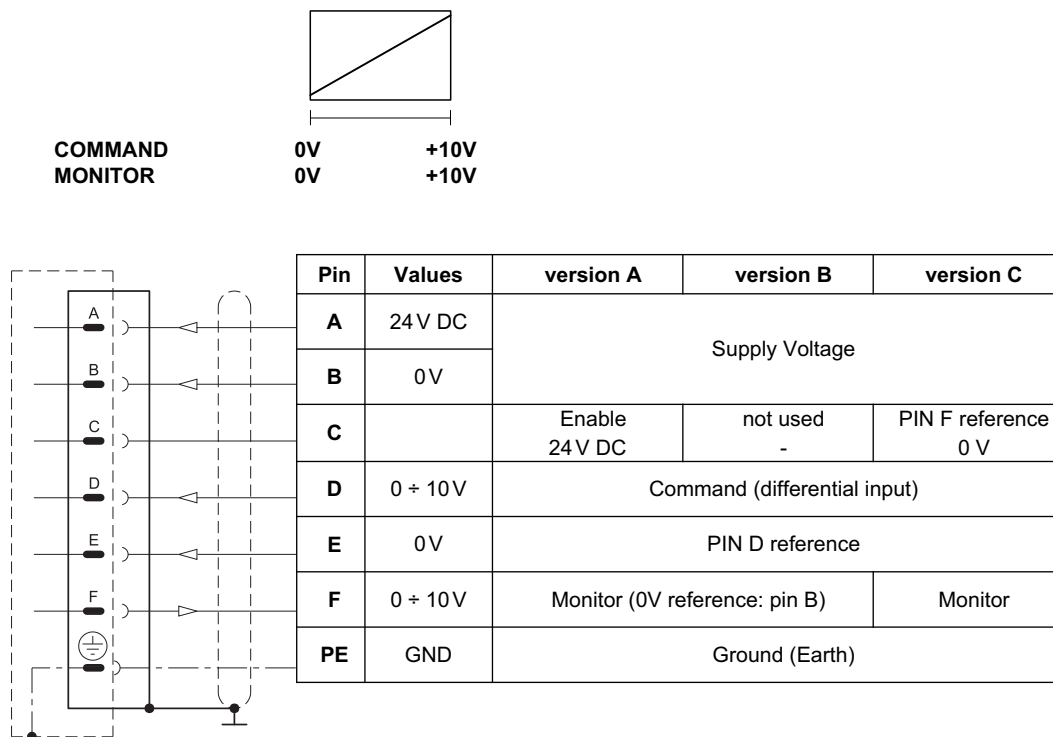


#### VERSION C - 0V Monitor



### 3 - VERSIONS WITH VOLTAGE COMMAND (E0)

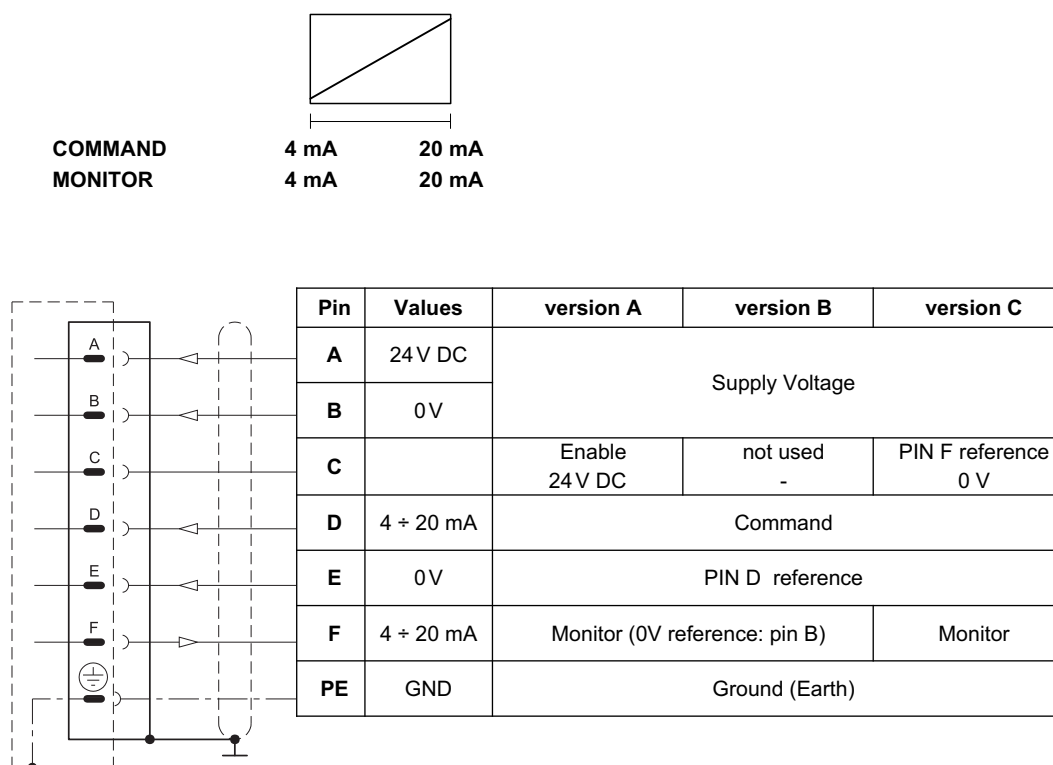
The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



### 4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

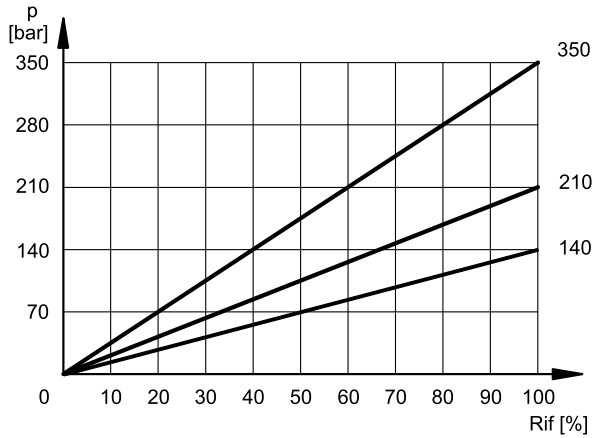
The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



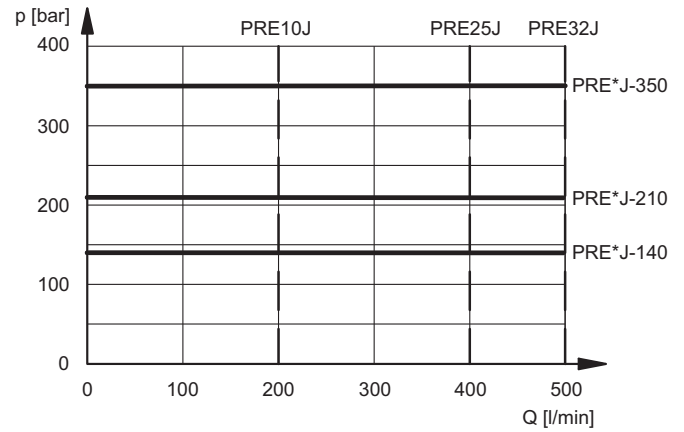
## 5 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

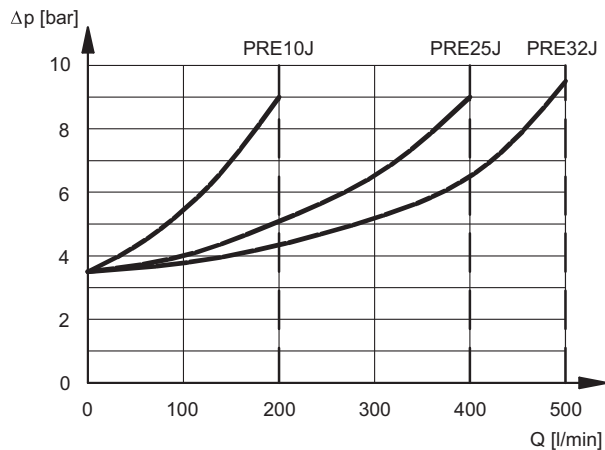
**PRESSURE CONTROL  $p=f(I)$**



**PRESSURE CONTROL  $p=f(Q)$**



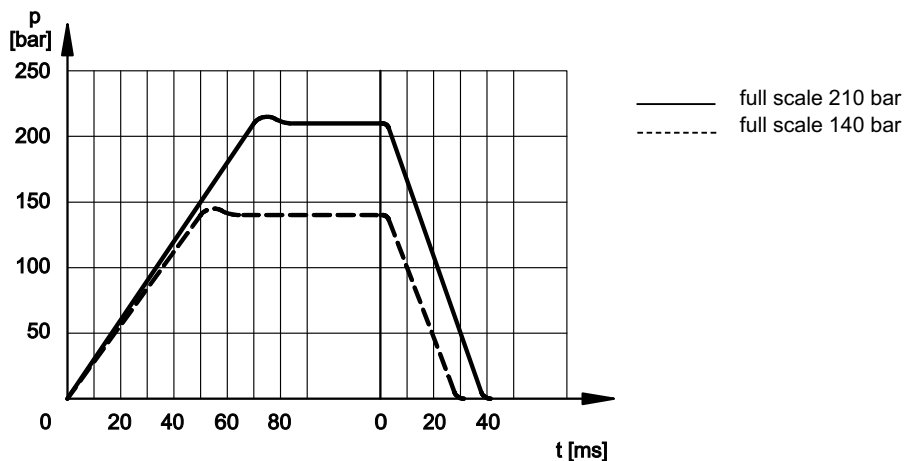
**PRESSURE DROPS  $\Delta p = f(Q)$**



## 6 - STEP RESPONSE

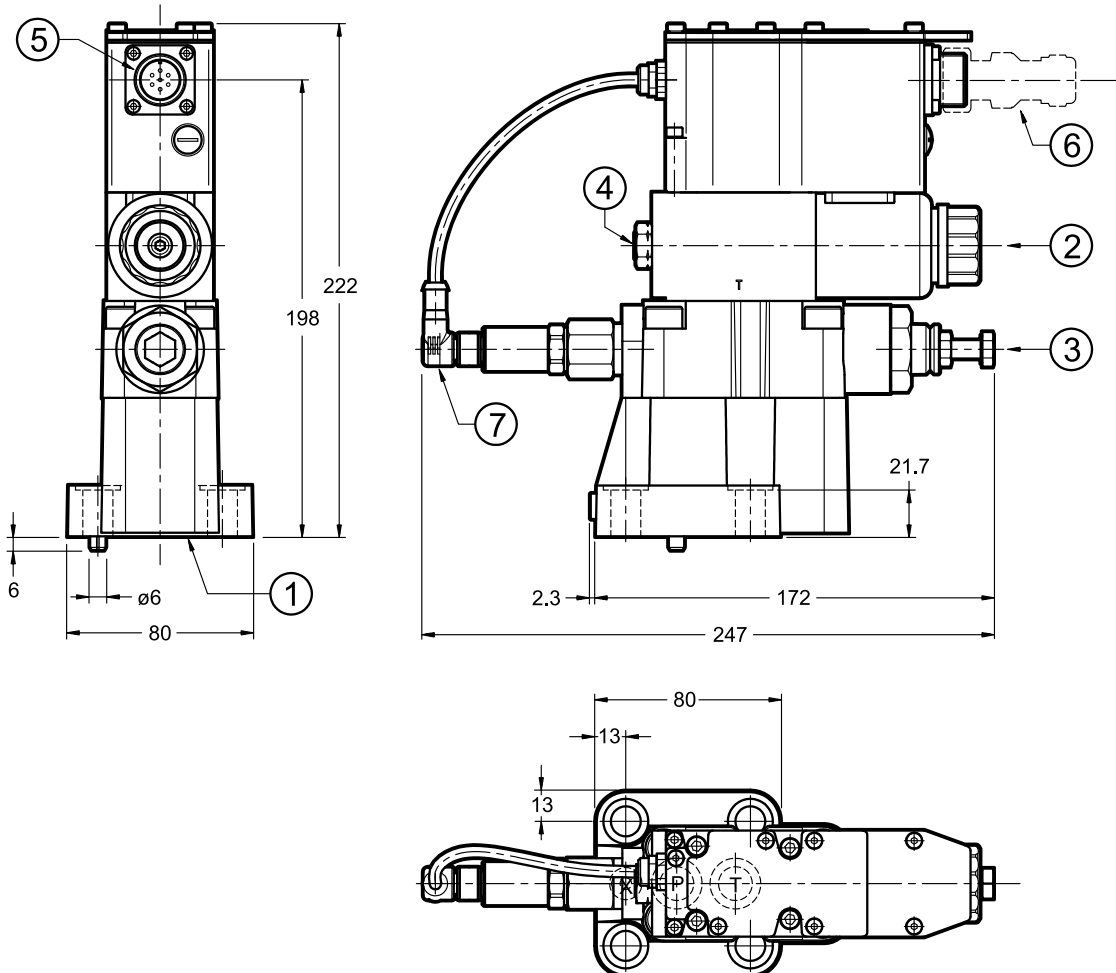
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Response times are obtained from PRE25J valves with a full scale of 140 and 210 bar.



## 7 - OVERALL AND MOUNTING DIMENSIONS PRE10J

dimensions in mm



### NOTE:

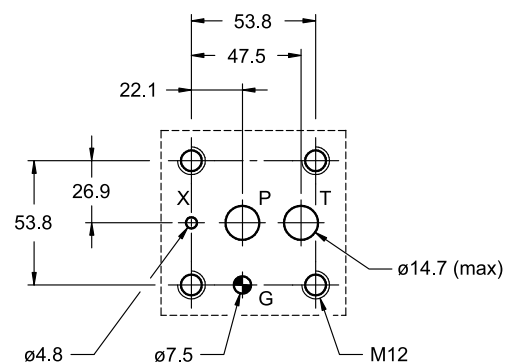
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M12x40 - ISO 4762  
Torque: 69 Nm (screws A8.8)  
Thread of mounting holes: M12x20

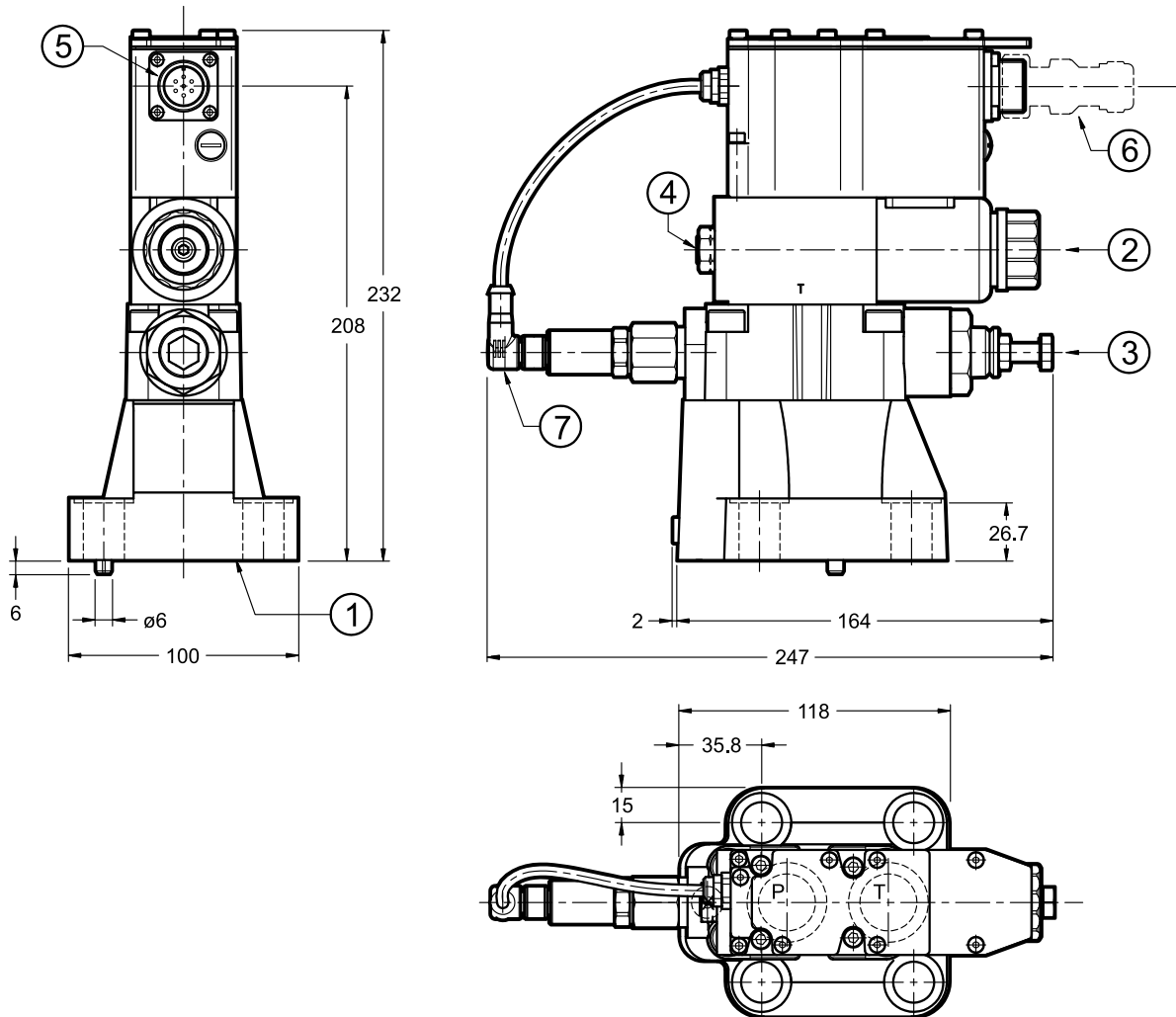
### MOUNTING INTERFACE:

ISO 6264-06-09-\*97  
(CETOP 4.4.2-2-R06-350)

1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector <b>to be ordered separately.</b> See at section 12
7	Connector with cable for pressure transducer



## 8 - OVERALL AND MOUNTING DIMENSIONS PRE25J



### NOTE:

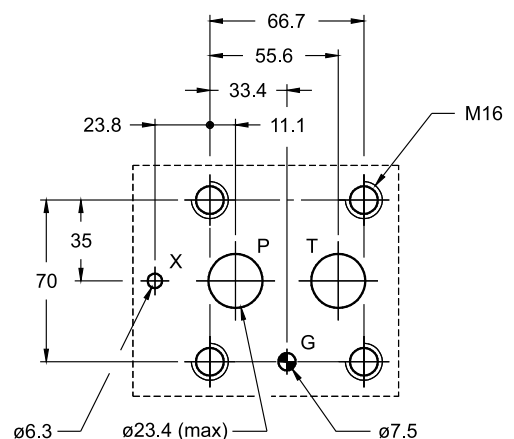
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M16x60 - ISO 4762  
Torque: 170 Nm (screws A8.8)  
Thread of mounting holes: M16x25

### MOUNTING INTERFACE:

ISO 6264-08-13-\*97  
(CETOP 4.4.2-2-R08-350)

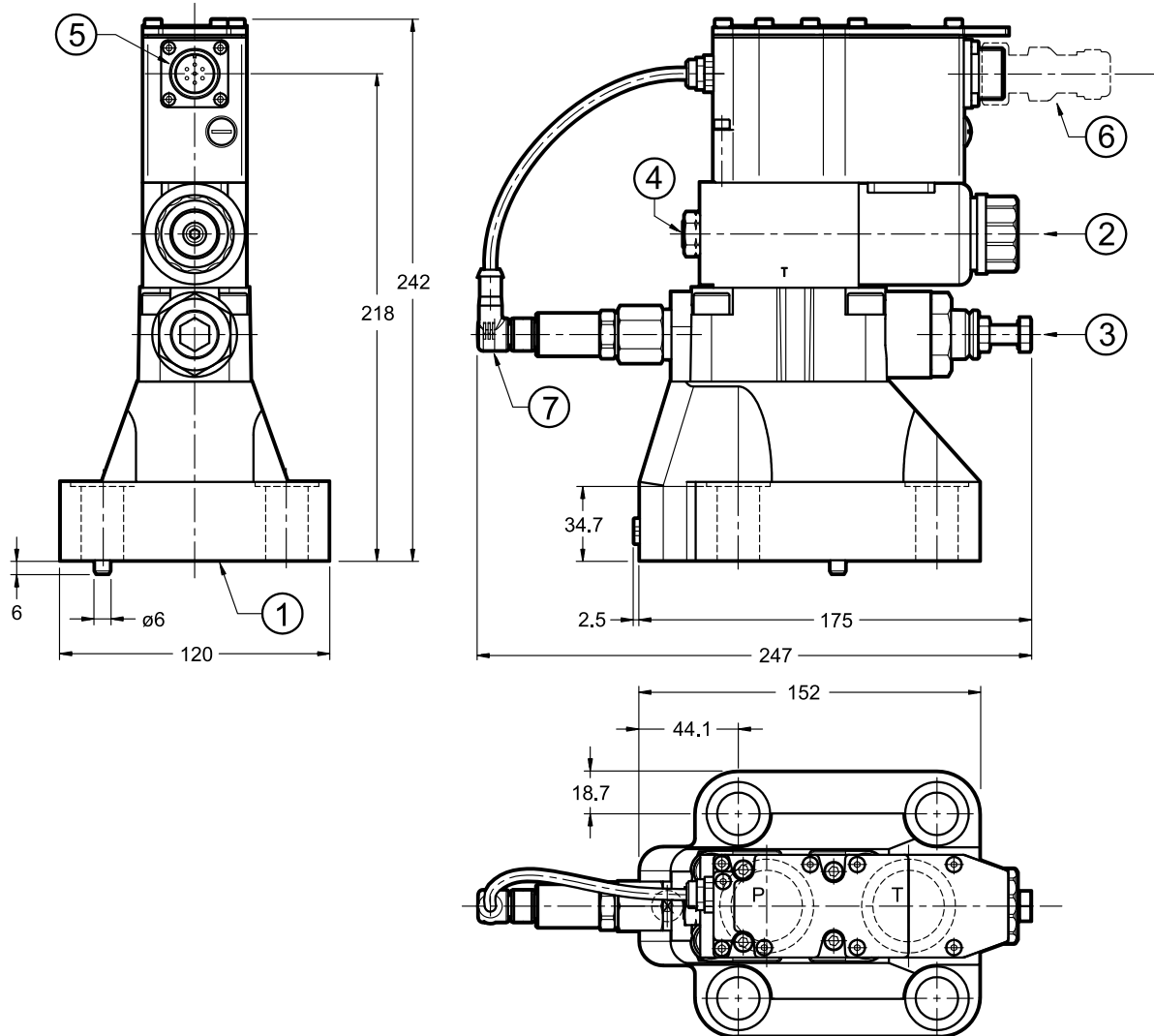
1	Mounting surface with sealing rings: 2 OR type 3118 (29.82x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector <b>to be ordered separately.</b> See at section 12
7	Connector with cable for pressure transducer





## 9 - OVERALL AND MOUNTING DIMENSIONS PRE32J

dimensions in mm



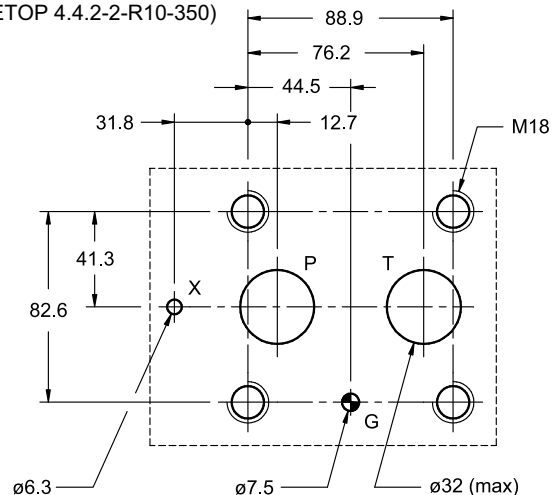
### NOTE:

at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M18x60 - ISO 4762  
Torque: 235 Nm (screws A8.8)  
Thread of mounting holes: M18x27

### MOUNTING INTERFACE:

ISO 6264-10-17-\*97  
(CETOP 4.4.2-2-R10-350)



1	Mounting surface with sealing rings: 2 OR type 4137 (34.52x3.53) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector <b>to be ordered separately.</b> See at section 12
7	Connector with cable for pressure transducer

## 10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 11 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

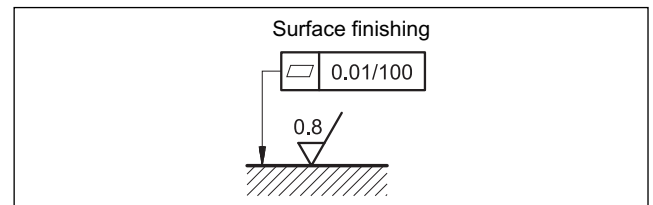
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

**Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.**

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 12 - ACCESSORIES

(to be ordered separately)

### 12.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

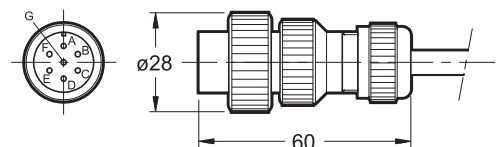


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 12.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 12.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.



## 13 - SUBPLATES

(see catalogue 51 000)

	PRE10J	PRE25J	PRE32J
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T port dimensions	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimensions	1/4" BSP	1/4" BSP	1/4" BSP



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# MZE

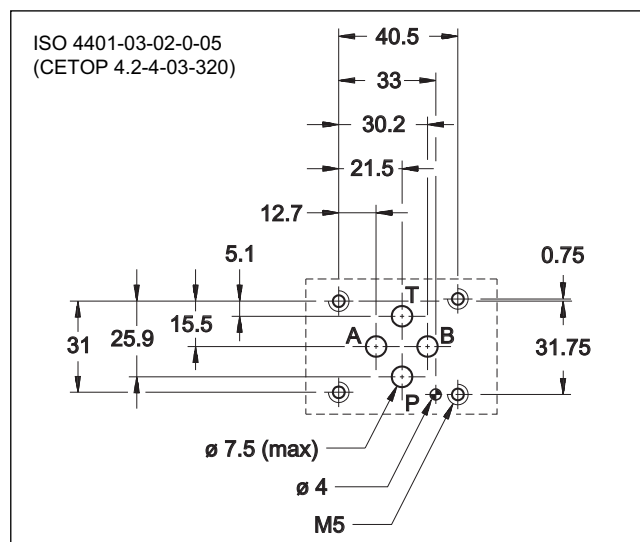
## PILOT OPERATED PRESSURE REDUCING VALVE WITH ELECTRIC PROPORTIONAL CONTROL

### SERIES 58

**MODULAR VERSION**  
**ISO 4401-03 (CETOP 03)**

**p** max **320** bar  
**Q** max (see table of performances)

#### MOUNTING SURFACE

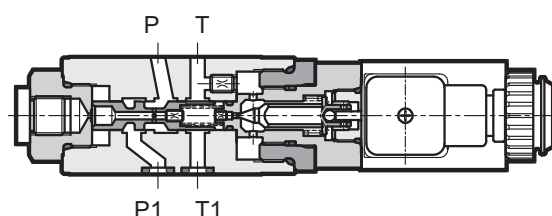


#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

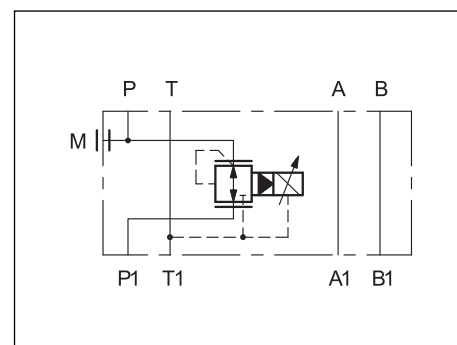
Maximum operating pressure: - P-A-B ports - T port	bar	320 2
Minimum controlled pressure	see $\Delta p$ -Q diagram	
Maximum flow in P line	l/min	30
Maximum flow on passing lines		50
Drain flow		0,4
Step response	see paragraph 5	
Hysteresis (with PWM 200 Hz)	% of p nom	< 3%
Repeatability	% of p nom	< $\pm 1,5\%$
Electrical characteristic	see paragraph 4	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,8

#### OPERATING PRINCIPLE

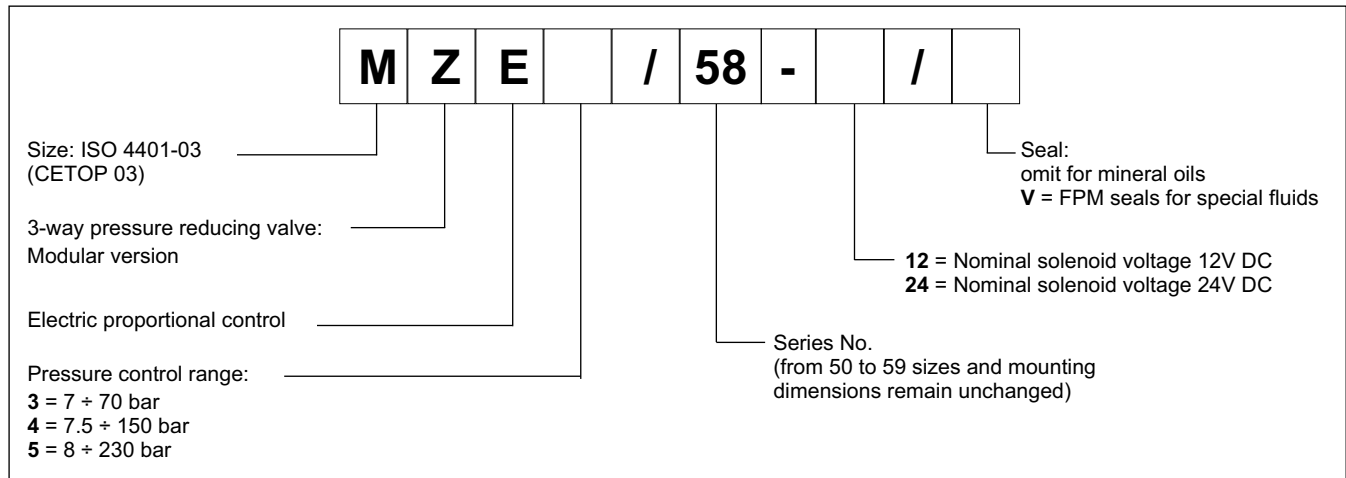


- MZE valves are 3-way pilot operated pressure reducing valves, with electric proportional control, designed as modular versions with mounting interface in compliance with ISO 4401 (CETOP RP121H) standards.
- The valves are used to reduce pressure in the secondary circuit branches thus ensuring stability of controlled pressure in the event of variations of the flow rate through the valve.
- Pressure can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or by an electronic control unit, to exploit valve performance to the full (see par. 8).
- The valve is available in three different pressure reduction ranges of up to 230 bar.
- The valve is available only with internal drain to the T line inside the valve.

#### HYDRAULIC SYMBOL



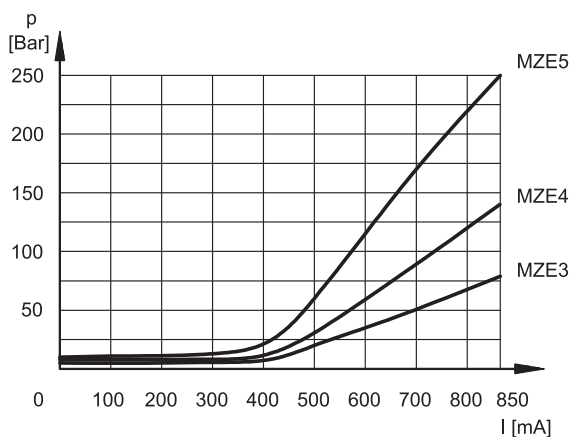
## 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES

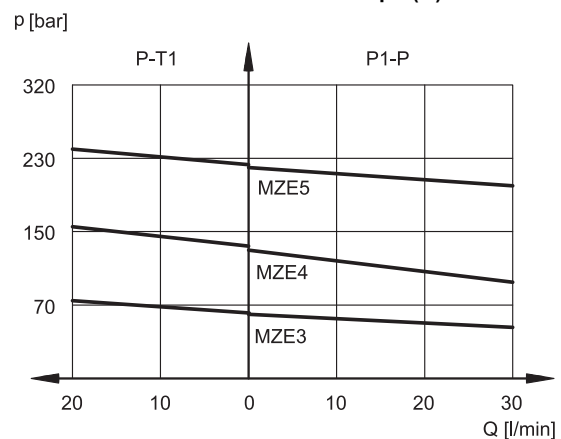
(measured with viscosity 36 cSt at 50°C)

**PRESSURE CONTROL  $p=f(I)$**



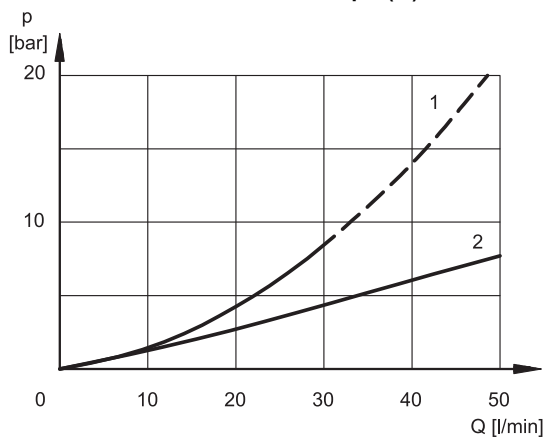
The curves have been obtained with working lines closed (without flow).

**PRESSURE VARIATION  $p=f(Q)$**



The curves have been obtained with inlet pressure 50 bar greater than nominal pressure.  
Pressure values in P1 greater than 50 bar reduce flow values considerably.

**PRESSURE DROP  $\Delta p=f(Q)$**



1. pressure drops  $P1 \rightarrow P$
2. pressure drop in passing lines  
(ex.  $A \leftrightarrow A1$ )

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals.

For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	16.6
MAXIMUM CURRENT	A	1.9	0.85
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65		

### 5 - STEP RESPONSE

(with mineral oil with viscosity of 36 cSt at 50°C in conjunction with the relative electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with input flow rate of Q = 25 l/min.

<b>REFERENCE SIGNAL STEP</b>	0 → 100%	100 → 0%
Step response [ms]	100	80

### 6 - INSTALLATION

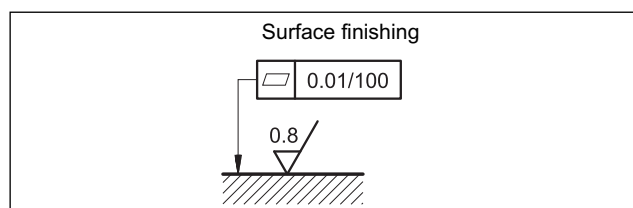
We recommend to install the MZE valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil (see par.7). At the end of the operation, make sure of having screwed correctly the drain screw.

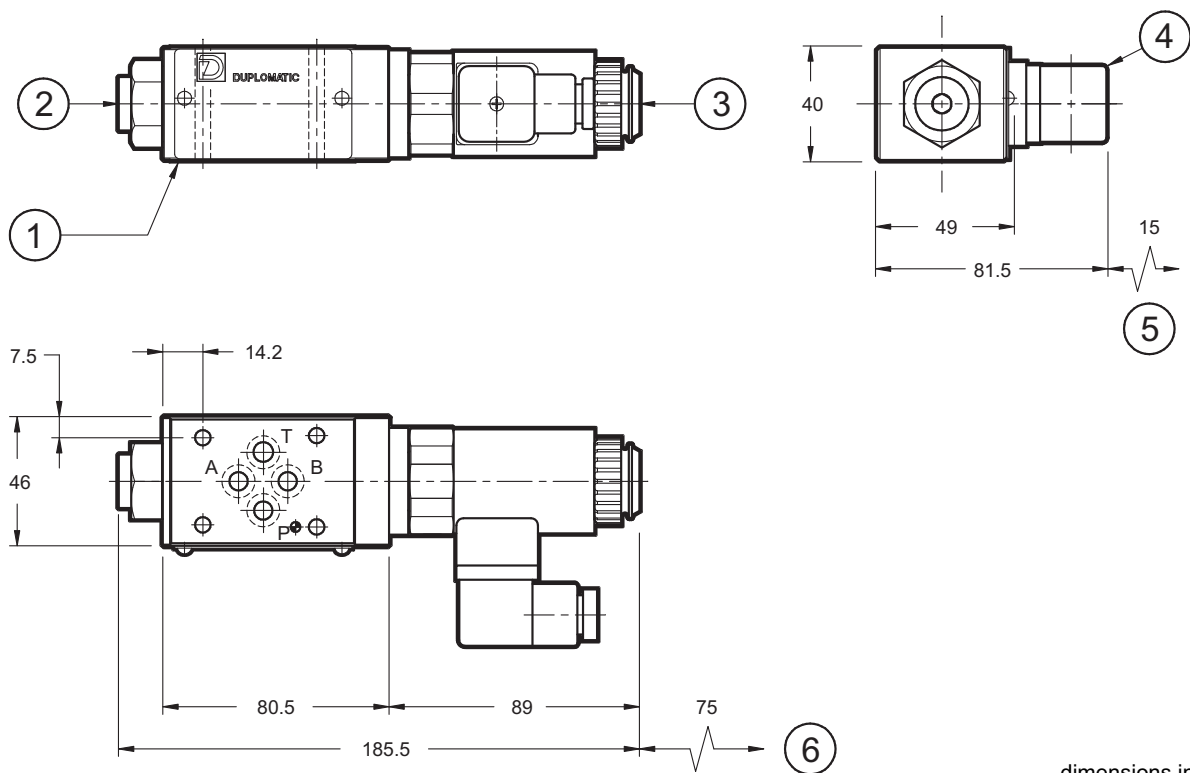
Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

**The maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.



## 7 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

1	Mounting surface with sealing rings: 4 OR type 2037 - 90 shore (9.25x1.78)
2	Pressure gauge port 1/4" BSP
3	Breather (male hexagonal spanner 4)
4	DIN 43650 electric connector (included in the delivery)
5	Connector removal space
6	Coil removal space

## 8 - ELECTRONIC CONTROL UNITS

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		



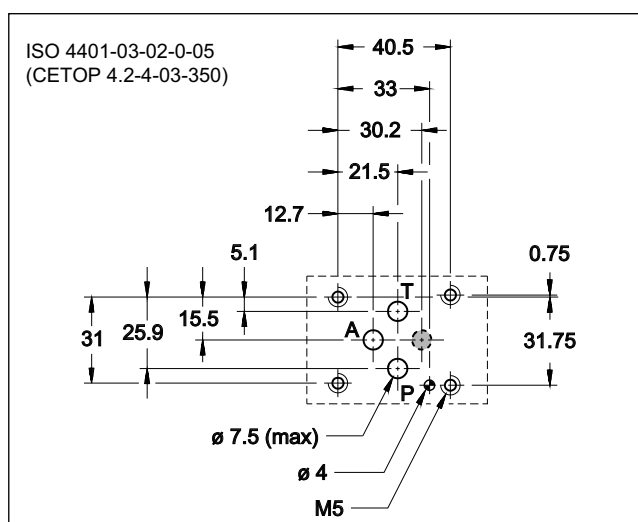
# PZE3

## PROPORTIONAL 3-WAY PRESSURE REDUCING VALVE, PILOT OPERATED SERIES 10

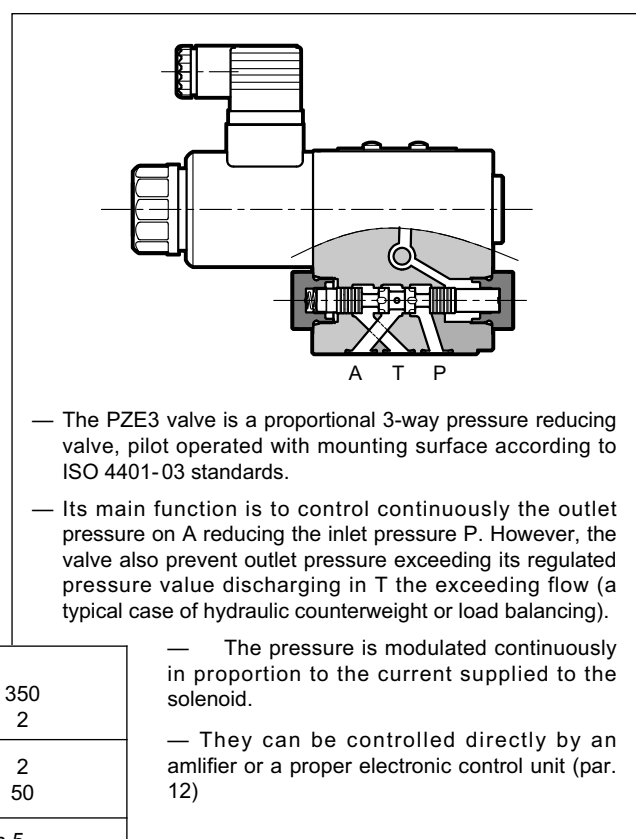
### SUBPLATE MOUNTING ISO 4401-03

**p max 350 bar**  
**Q max 50 l/min**

### MOUNTING SURFACE



### OPERATING PRINCIPLE

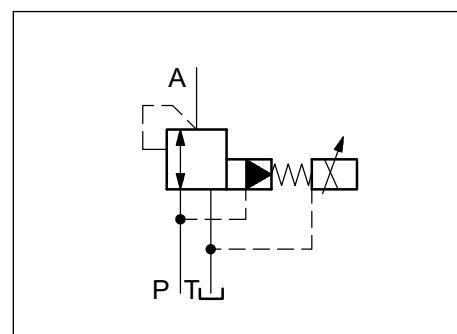


### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

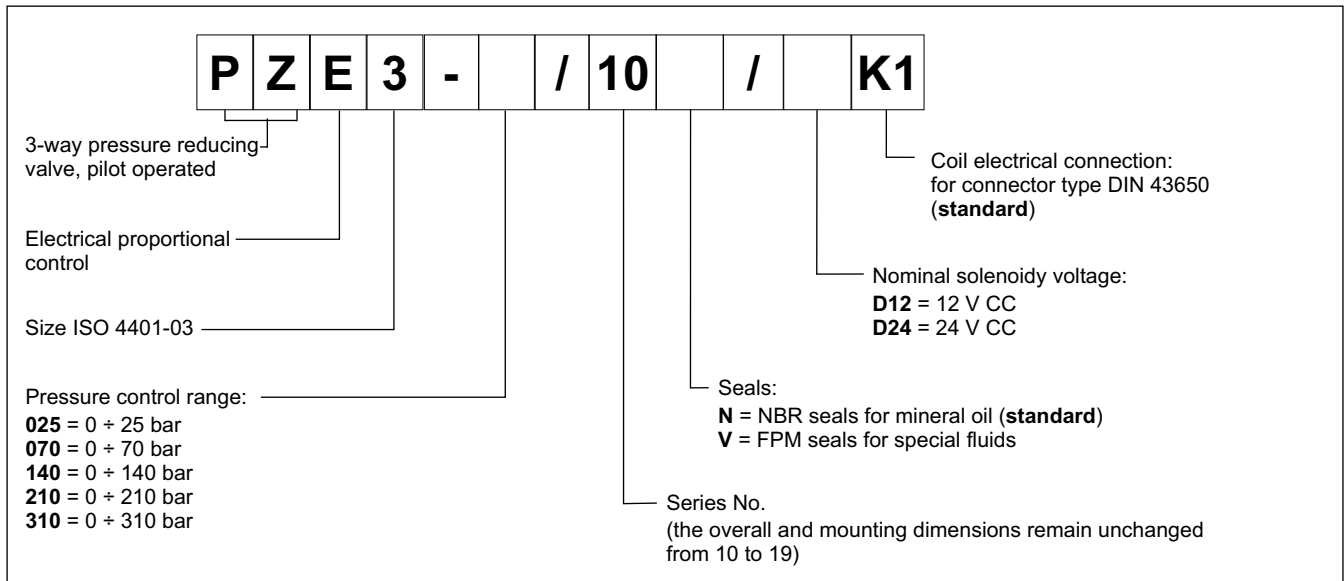
Maximum operating pressure: - P port - T port	bar	350 2
Pilot / drain flow Maximum flow (see p max = f(Q) diagram)	l/min	2 50
Step response	see paragraph 5	
Hysteresis	% of p nom	< 5%
Repeatability	% of p nom	< ±2%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	2,2

### HYDRAULIC SYMBOL



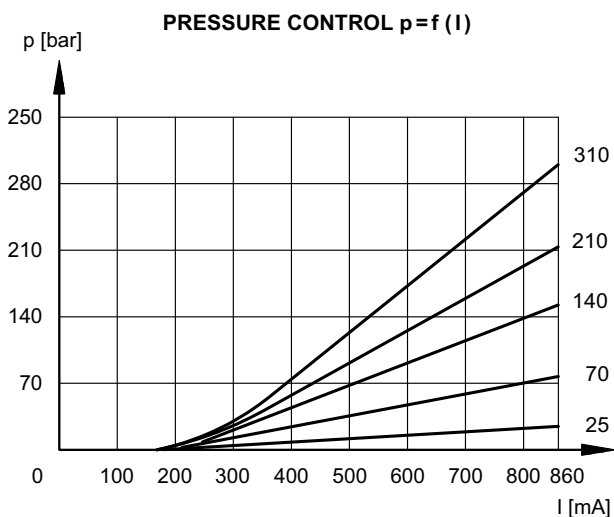
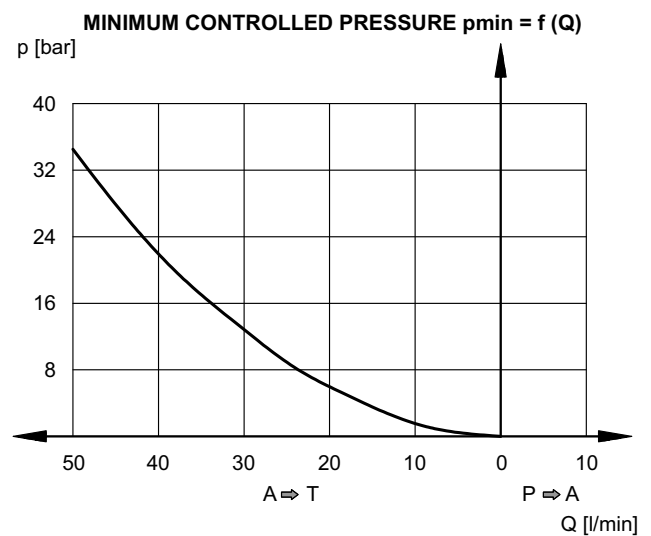
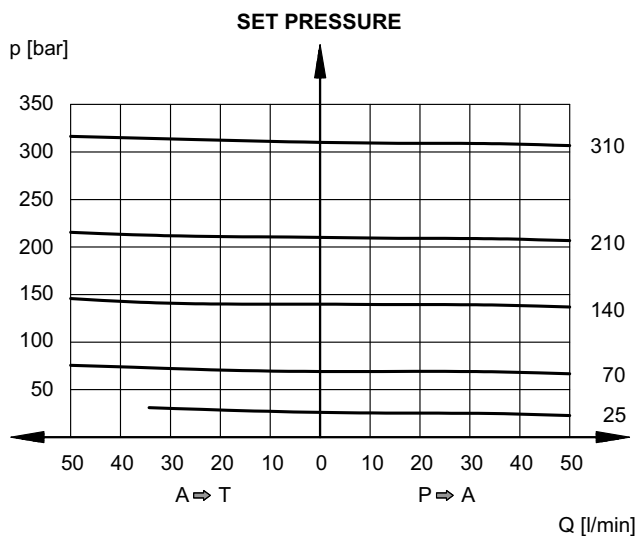


## 1 - IDENTIFICATION CODE



## 2 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 4 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>	<b>24</b>
<b>RESISTANCE (at 20°C)</b>	Ω	3.66	17.6
<b>MAXIMUM CURRENT</b>	A	1.88	0.86
<b>DUTY CYCLE</b>	100%		
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2014/30/EU		
<b>PROTECTION FROM:</b> Atmospheric agents (EN 60529)	IP 65		
<b>CLASS OF PROTECTION:</b> Coil insulation (VDE 0580) Impregnation	class H class F		

### 5 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

<b>REFERENCE SIGNAL STEP</b>	0 → 100%	100 → 0%
Step response [ms]	90	90

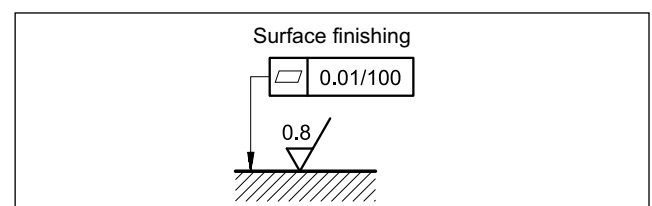
### 6 - INSTALLATION

We recommend to install the PZE3 valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what shown in paragraph 2.

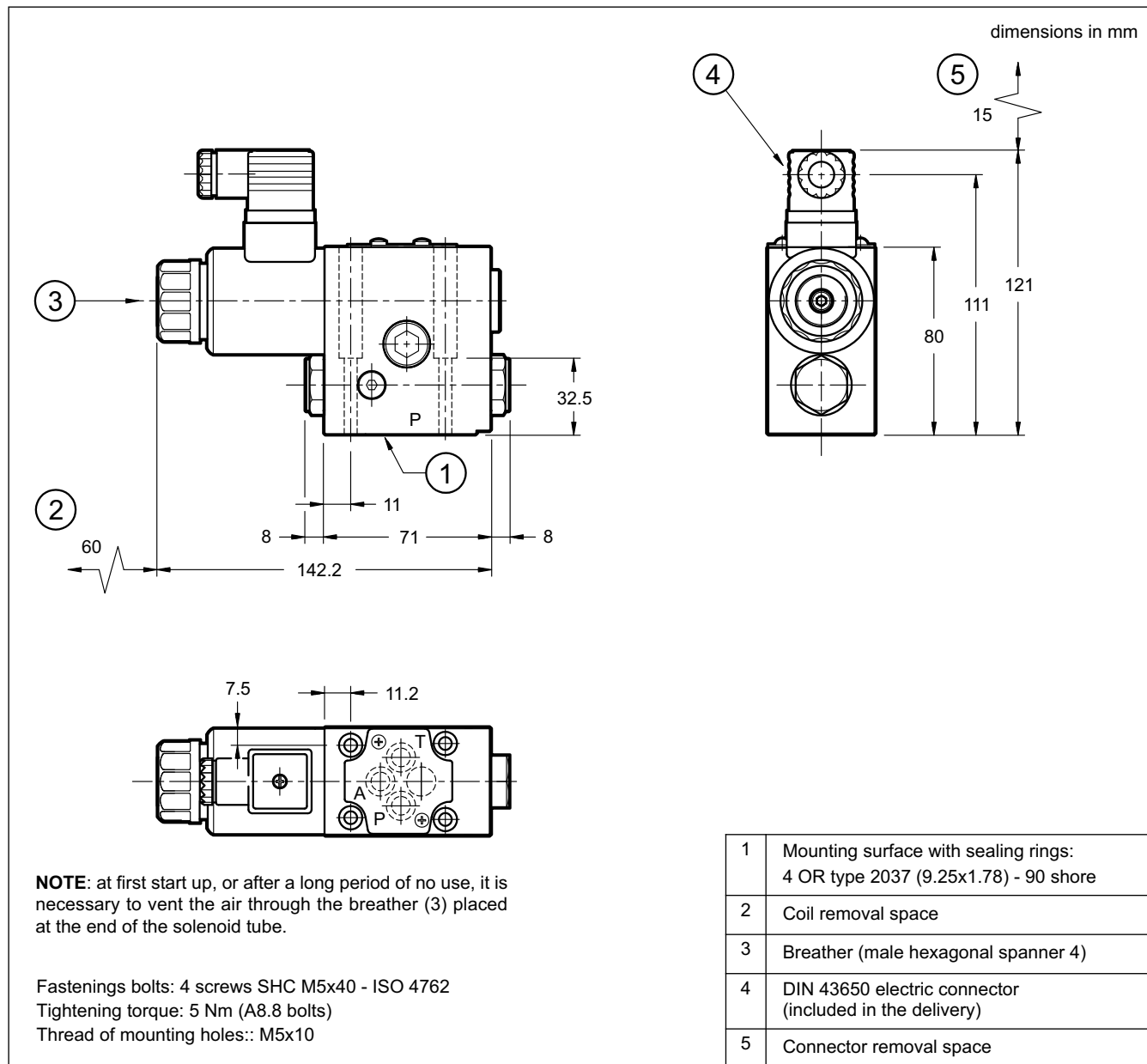
Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil. At the end of the operation, make sure of having screwed correctly the drain screw.

Connect the valve T port directly to the tank. **Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those shown in the relative symbol. If minimum values are not observed, fluid can easily leaks between valve and support surface.



## 7 - OVERALL AND MOUNTING DIMENSIONS



## 8 - ELECTRONIC CONTROL UNITS

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		

## 9 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G with ports on rear
PMMD-AL3G with side ports
Ports dimensions P, T, A and B: 3/8" BSP thread

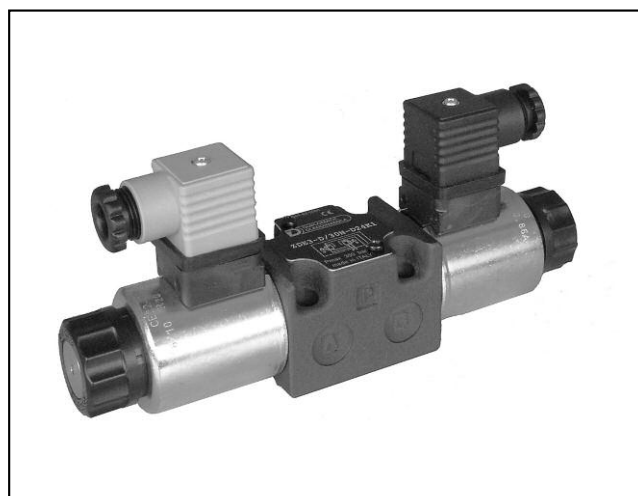
# ZDE3

## DIRECT OPERATED PRESSURE REDUCING VALVE WITH ELECTRIC PROPORTIONAL CONTROL SERIES 30

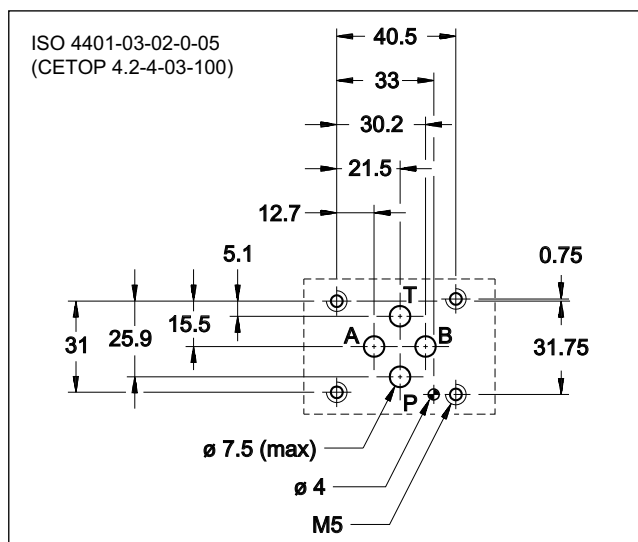
### SUBPLATE MOUNTING ISO 4401-03

**p** max **100 bar**

**Q** max **15 l/min**



### MOUNTING INTERFACE

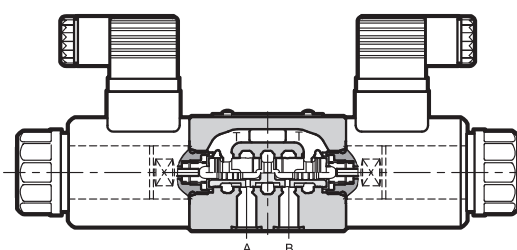


### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

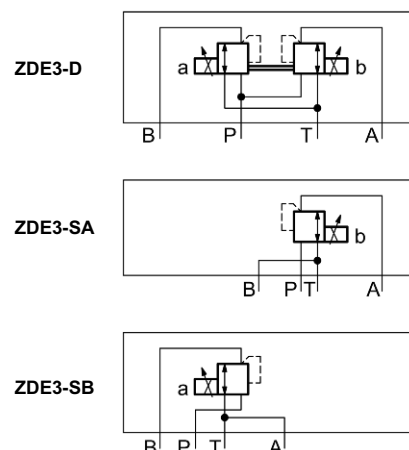
Pressure allowed on P port	bar	30 ÷ 100
Pressure allowed on T port (see par. 3)	bar	0 ÷ 30
Controlled pressure	bar	23
Minimum controlled pressure	see $\Delta p$ -Q diagram	
Maximum flow	l/min	15
Step response	see paragraph 4	
Hysteresis (with PWM 200 Hz)	% of p nom	< 4%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 3	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve	kg	1,6
double solenoid valve	kg	2

### OPERATING PRINCIPLE



- ZDE3 valves are direct operated pressure reducing valves with electric proportional control, with mounting interface in compliance with ISO 4401 standards.
- These valves are used to reduce pressure in the secondary circuit branches thus ensuring stability of controlled pressure in the event of variations of the flow rate through the valve.
- The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 10).

### HYDRAULIC SYMBOLS



### 1 - IDENTIFICATION CODE

Z	D	E	3	-	/	30	-	/
---	---	---	---	---	---	----	---	---

Pressure reducing valve ———

Electric proportional control ———

Size ISO 4401-03 ———

Solenoids: ———

**D** = pressure reduction in A and B ports  
**SA** = pressure reduction in A port (solenoid on side B)  
**SB** = pressure reduction in B port (solenoid on side A)

Series No. ———  
 (from 30 to 39 sizes and mounting dimensions remain unchanged)

**NOTE:** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

Option:  
 / **W7** = Zinc-nickel surface treatment (see **NOTE**)  
 Omit if not required

Manual override (see par. 7)

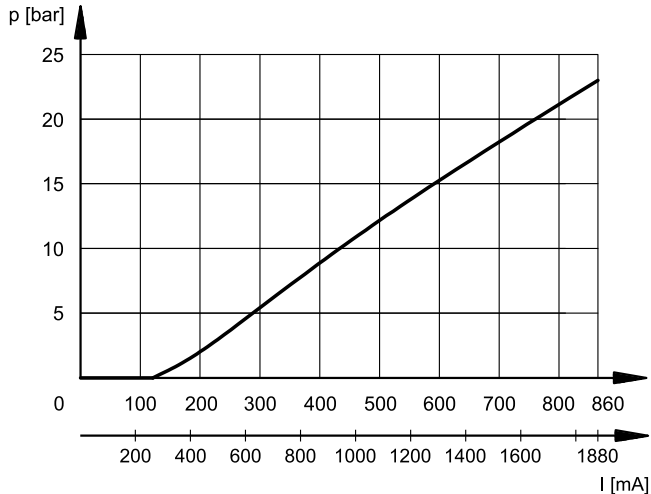
Coil electrical connection:  
 (see paragraph 5)  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)  
**K7** = plug for connector type DEUTSCH DT04-2P male

**D12** = Nominal solenoid voltage 12V DC  
**D24** = Nominal solenoid voltage 24V DC

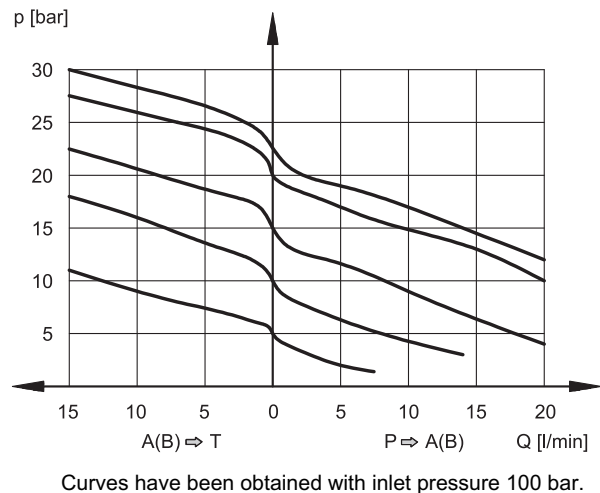
Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

### 2 - CHARACTERISTIC CURVES (obtained with ZDE3-D/30N-D24K1 and oil with viscosity 36 cSt at 50°C)

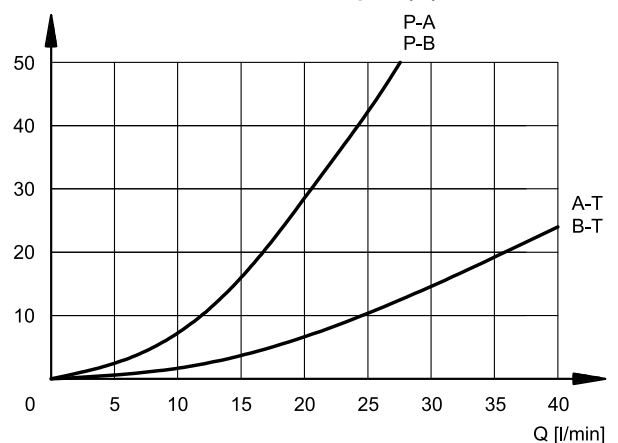
**PRESSURE CONTROL  $p=f(I)$**



**PRESSURE VARIATION  $p=f(Q)$**



**PRESSURE DROP  $\Delta p=f(Q)$**



### 3 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE		V DC	12	24
RESISTANCE (at 20°C)	K1 coil K7 coil	Ω	3.66 4	17.6 19
MAXIMUM CURRENT		A	1.88	0.86
DUTY CYCLE			100%	
PWM FREQUENCY		Hz	200	100
ELECTROMAGNETIC COMPATIBILITY (EMC)		According to 2014/30/EU		
PROTECTION FROM: Atmospheric agents (IEC 60529)		IP65		
CLASS OF PROTECTION: Coil insulation (VDE 0580) Impregnation		class H class F		

### 4 - STEP RESPONSE

(with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

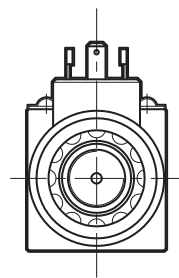
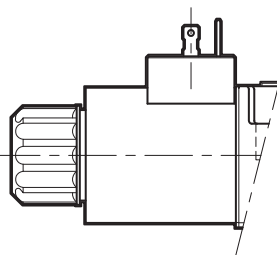
The table illustrates typical step response times measured with input flow rate of Q = 5 l/min and p = 50 bar.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	30	30

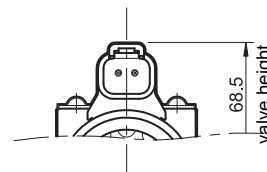
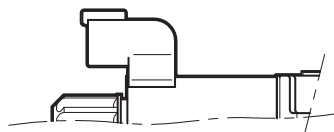
### 5 - ELECTRIC CONNECTIONS

Connectors for standard K1 connection are always supplied with the valve.

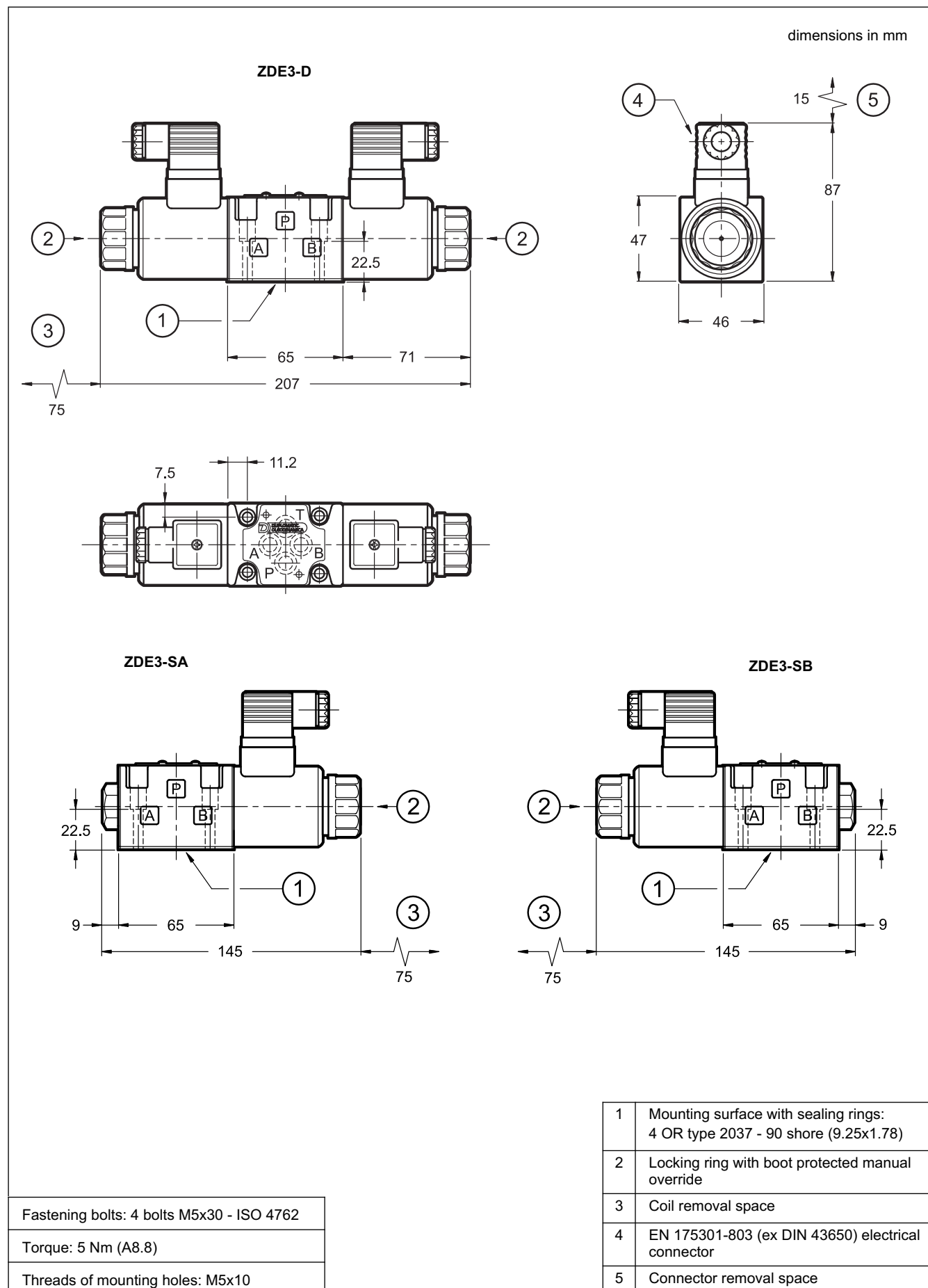
connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**



connection for  
DEUTSCH DT06-2S male connector  
code **K7**



## 6 - OVERALL AND MOUNTING DIMENSIONS



## 7 - MANUAL OVERRIDE

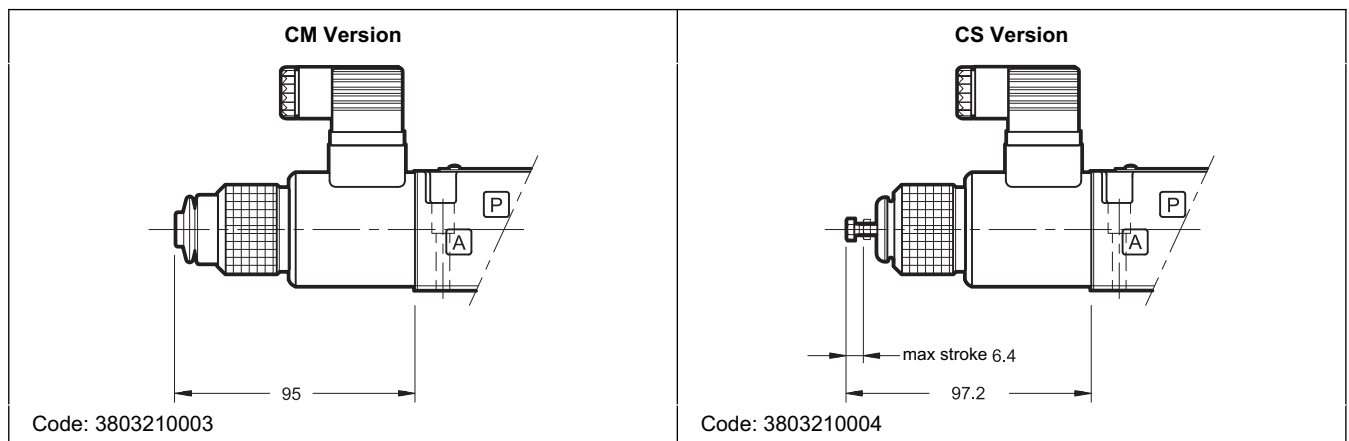
The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.



**CAUTION!:** The manual override use doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.



## 8 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 9 - INSTALLATION

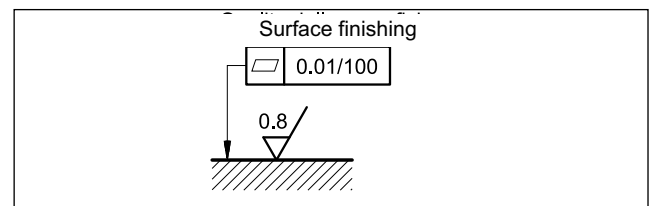
The ZDE3 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

**Maximum admissible backpressure in the T line, under operational conditions, is 30 bar.**







## 10 - ELECTRONIC CONTROL UNITS

### ZDE3-SA\* ZDE3-SB\*

<b>EDC-111</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M111</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		

### ZDE3-D\*

<b>EDM-M211</b>	for solenoid 24V DC	rail mounting DIN EN 50022	see cat. 89 250
<b>EDM-M242</b>	for solenoid 12V DC		

## 11 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports
Type PMMD-AL3G with side ports
P, T, A, B port threading: 3/8" BSP



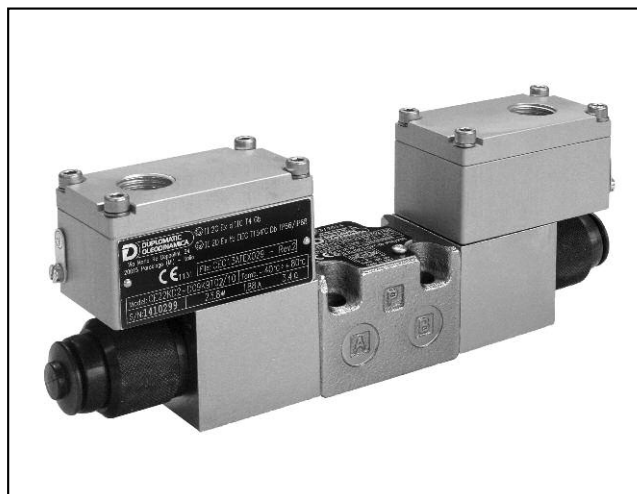
**DIPLOMATIC OLEODINAMICA S.p.A.**

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Tel. +39 0331.895.111

Fax +39 0331.895.339

www.diplomatic.com • e-mail: sales.exp@diplomatic.com



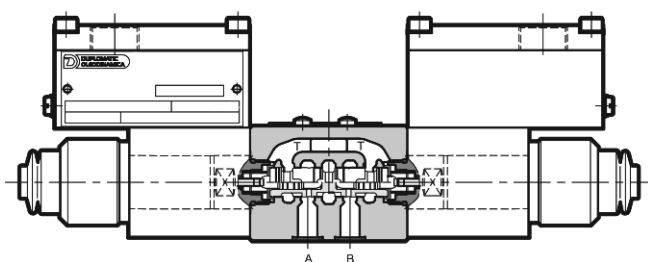
# ZDE3K\*

## EXPLOSION-PROOF PRESSURE REDUCING VALVES ATEX, IECEx, INMETRO SERIES 10

**SUBPLATE MOUNTING  
ISO 4401-03**

**p max 100 bar  
Q max 15 l/min**

### OPERATING PRINCIPLE



- ZDE3K\* are direct operated pressure reducing valves, with electric proportional control, with ISO 4401-03 mounting surface.
- They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- The valves are used to reduce pressure in the secondary circuit branches thus ensuring stability of controlled pressure in the event of variations of the flow rate through the valve.
- ZDE3K\* valves are supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 hours.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

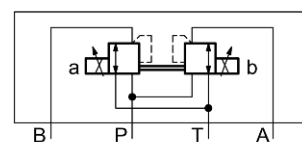
### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

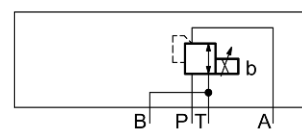
Pressure allowed in P port	bar	30 ÷ 100
Pressure allowed in T port (see par. 3)	bar	0 ÷ 30
Controlled pressure	bar	23
Maximum flow	l/min	15
Step response	ms	30
Hysteresis (with PWM 200 Hz)	% of p nom	< 4%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 4	
Operating temperatures (ambient and fluid)	see data sheet 02 500	
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve	kg	1,9
double solenoid valve	kg	2,8

### HYDRAULIC SYMBOLS

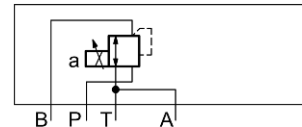
**ZDE3K\*-D**



**ZDE3K\*-SA**



**ZDE3K\*-SB**





# ZDE3K\*

## SERIES 10

### 1 - IDENTIFICATION CODE

<b>Z</b>	<b>D</b>	<b>E</b>	<b>3</b>		<b>-</b>		<b>/</b>	<b>10</b>		<b>-</b>		<b>K9</b>		<b>/</b>	
----------	----------	----------	----------	--	----------	--	----------	-----------	--	----------	--	-----------	--	----------	--

Pressure reducing valve: \_\_\_\_\_

Electric proportional control \_\_\_\_\_

Size ISO 4401-03 \_\_\_\_\_

Explosion-proof certification: \_\_\_\_\_  
**See table 1.1**

Solenoids: \_\_\_\_\_  
**D** = pressure reduction in A and B ports  
**SA** = pressure reduction in A port (solenoid on side B)  
**SB** = pressure reduction in B port (solenoid on side A)

Series No. \_\_\_\_\_  
(from 30 to 39 sizes and mounting dimensions remain unchanged)

Seals: \_\_\_\_\_  
For temperature range -20 / +80 °C  
**N** = NBR seals for mineral oil (standard)  
**V** = FPM seals for special fluids  
For temperature range -40 / +80 °C  
**NL** = seal for low temperatures (for mineral oil)

Option: **/T5**  
version in T5 temperature class.  
Omit if not required.

Manual override:  
**CM** = boot protected  
**standard for both N and V seals**  
not available for NL seals  
**CB** = blind ring nut  
**standard for NL seals**  
available upon request for both N and V seals  
see paragraph 8

Connection type for cable gland  
upper connection:  
**T01** = M20x1.5 - ISO 261  
**T02** = Gk 1/2 - UNI EN 10226-2  
not available for INMETRO  
**T03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
side connection:  
**S01** = M20x1.5 - ISO 261  
**S02** = Gk 1/2 - UNI EN 10226-2  
not available for INMETRO  
**S03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
**S04** = M16x1.5 - ISO 261

Coil electrical connection: by terminal block

Nominal solenoid voltage  
**D12** = 12 V DC  
**D24** = 24 V DC

**NOTE:** zinc-nickel standard finishing surface treatment.  
Test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards.

#### 1.1 - Names of valves per certification

	ATEX		IECEX		INMETRO	
for gases for dusts	<b>KD2</b>	II 2GD	<b>KXD2</b>	IECEX Gb IECEX Db	<b>KBD2</b>	INMETRO Gb INMETRO Db
for mines	<b>KDM2</b>	I M2	<b>KXDM2</b>	IECEX Mb	<b>KBDM2</b>	INMETRO Mb

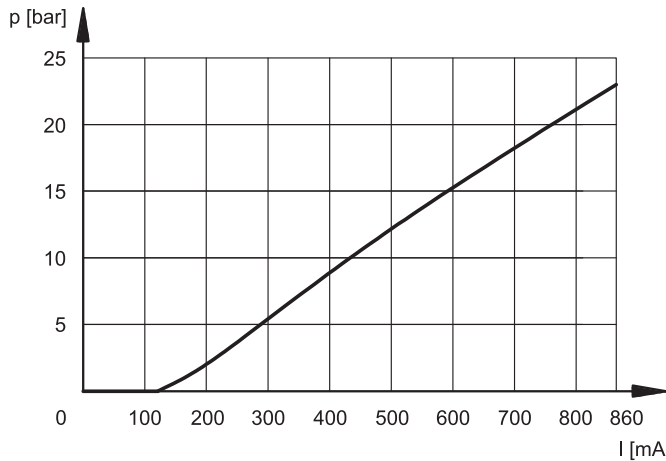
**NOTE:** Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.



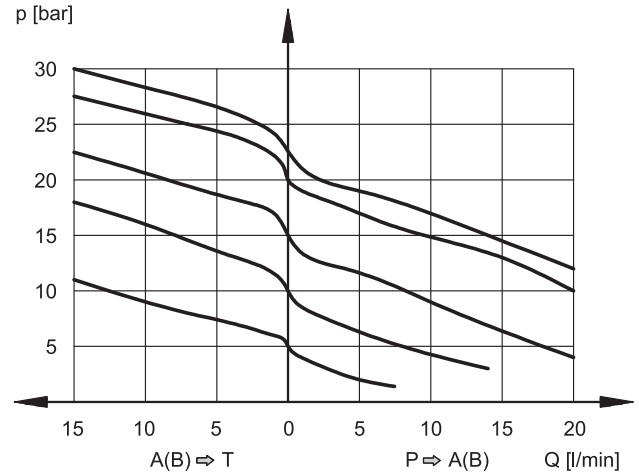
## 2 - CHARACTERISTIC CURVES

(obtained with ZDE3K\*-D/10N-D24K9T01/CM with PWM 100Hz and oil with viscosity 36 cSt at 50°C)

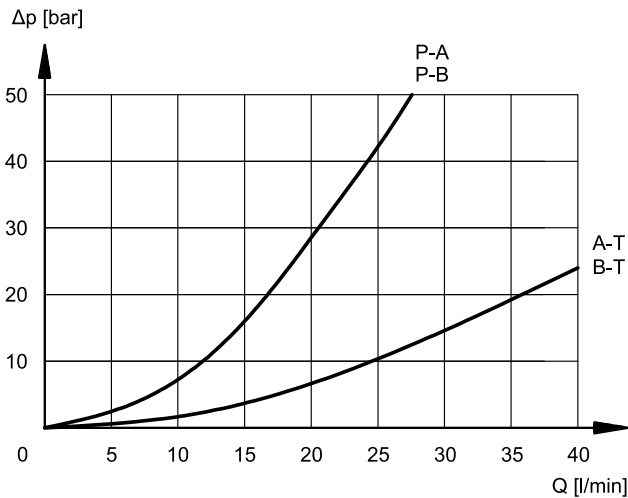
**PRESSURE CONTROL  $p=f(I)$**



**PRESSURE VARIATION  $p=f(Q)$**



**PRESSURE DROP  $\Delta p = f(Q)$**



## 3 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with input flow rate of  $Q = 5$  l/min and  $p = 50$  bar.

REFERENCE SIGNAL STEP	0 → 100%	100% → 0
response time [ms]	30	30

## 4 - ELECTRICAL CHARACTERISTICS

(values  $\pm 5\%$ )

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.4	15.6
NOMINAL CURRENT	A	1.88	0.86
PWM FREQUENCY	Hz	200	100

DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

### 4.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

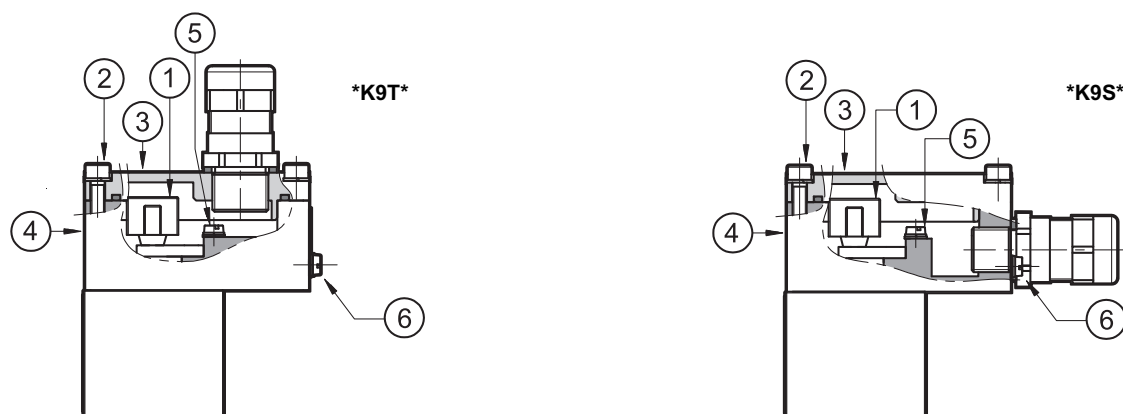
**The electrical connection is polarity-independent.**

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100  $\Omega$ ), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9 + 6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.



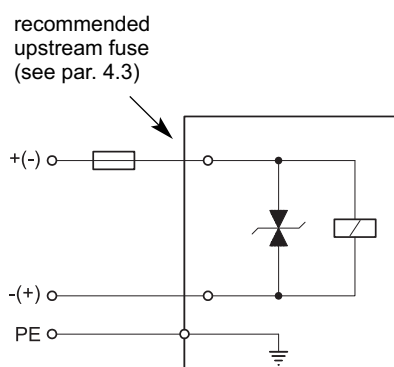
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm <sup>2</sup>
Connection for internal grounding point	max 2.5 mm <sup>2</sup>
Connection for external equipotential grounding point	max 6 mm <sup>2</sup>

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 10) allow to use cables with external diameter between 8 and 10 mm.

### 4.2 - Electrical diagram



### 4.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x I<sub>n</sub> according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source.

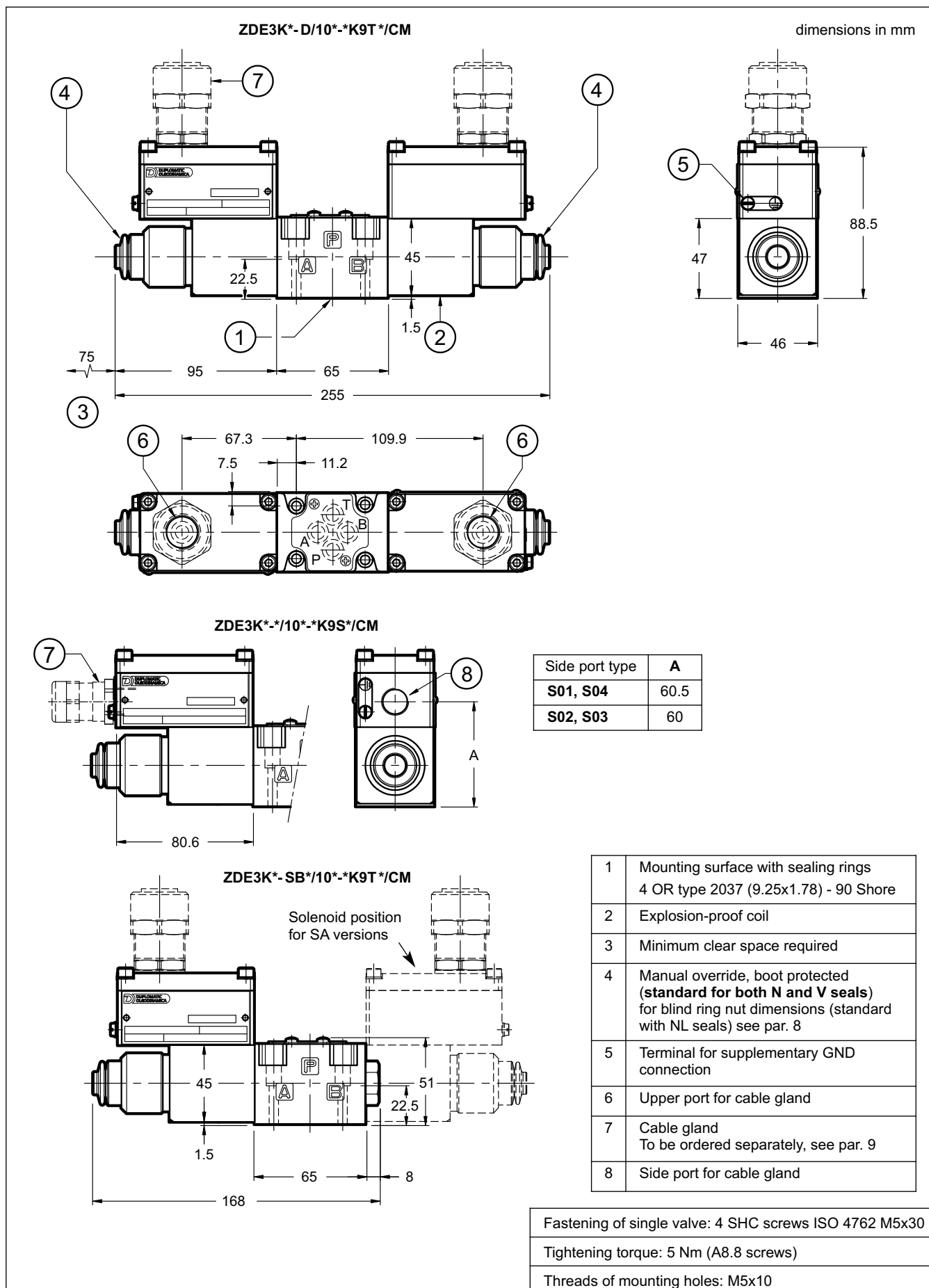
The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,86	1,25	- 49	

## 5 - OVERALL AND MOUNTING DIMENSIONS





## 6 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 7 - INSTALLATION



Installation must adhere to instruction reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

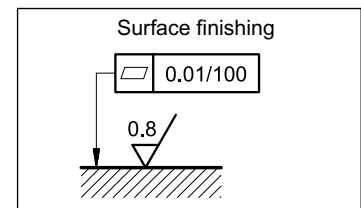
The valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

**In the T line the maximum admissible backpressure is 30 bar, under operational conditions.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.



## 8 - MANUAL OVERRIDE CB

### CB - Blind ring nut

The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

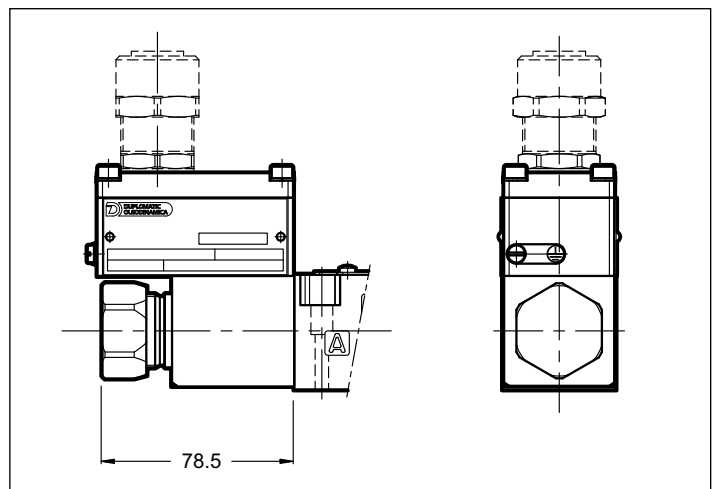
To access the manual override loose the ring nut and remove it; then reassemble hand tightening, until it stops.

**Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.**

More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.



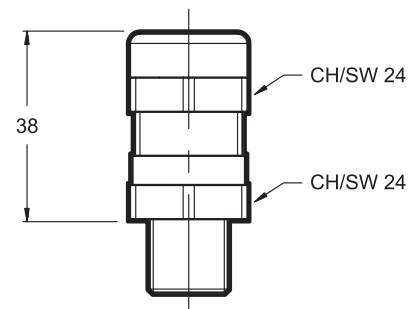
**CAUTION!:** The manual override doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.



### 9 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø 8÷10 mm cables);
- ATEX II 2GD, I M2; IECEX Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68



To order the desired cable glands, specify description, code and quantity.

**Description: CGK2/NB-01/10**

**Code: 3908108001**

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

**Description: CGK2/NB-02/10**

**Code: 3908108002**

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-03/10**

**Code: 3908108003**

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

**Description: CGK2/NB-04/10**

**Code: 3908108004**

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

### 10 - ELECTRONIC CONTROL UNITS

**ZDE3K\*-SA\* ZDE3K\*-SB\***

<b>EDM-M111</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		

**NOTE: electronic control units offered are not explosion proof certified; therefore, they must be installed outside the classified area.**

**ZDE3K\*-D\***

<b>EDM-M211</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M242</b>	for solenoid 12V DC		

### 11 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports
Type PMMD-AL3G with side ports
P, T, A, B port threading: 3/8" BSP

**NOTE:** Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a rate higher than the value allowed by norms according to ATEX directive for category II 2GD and I M2.

The user will bear to do the complete assessment of the ignition risk that can occur from the relative use in potentially explosive environments.





# ZDE3K\*

SERIES 10



**DUPLOMATIC  
OLEODINAMICA**

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Fax +39 0331.895.339

www.duplomatic.com • e-mail: sales.exp@duplomatic.com

# EXPLOSION-PROOF CLASSIFICATION

## for

### SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

#### pressure valves

<b>RQM*K*-P</b>	<b>21 515</b>
<b>PRE(D)*K*</b>	<b>81 315</b>
<b>ZDE3K*</b>	<b>81 515</b>
<b>DZCE*K*</b>	<b>81 605</b>

#### directional valves

<b>D*K*</b>	<b>41 515</b>
<b>DS(P)E*K*</b>	<b>83 510</b>

#### GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

<b>ATEX</b>	<b>II 2G</b>	<b>II 2D</b>	<b>I M2</b>
<b>IECEX</b>	<b>Gb</b>	<b>Db</b>	<b>Mb</b>
<b>INMETRO</b>	<b>Gb</b>	<b>Db</b>	<b>Mb</b>

Instructions for use and maintenance can be found in the related manuals, always supplied together with valves.



## 1 - ATEX CLASSIFICATION AND TEMPERATURES

Diplomatic certifies the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

### 1.1 - ATEX classification for valves

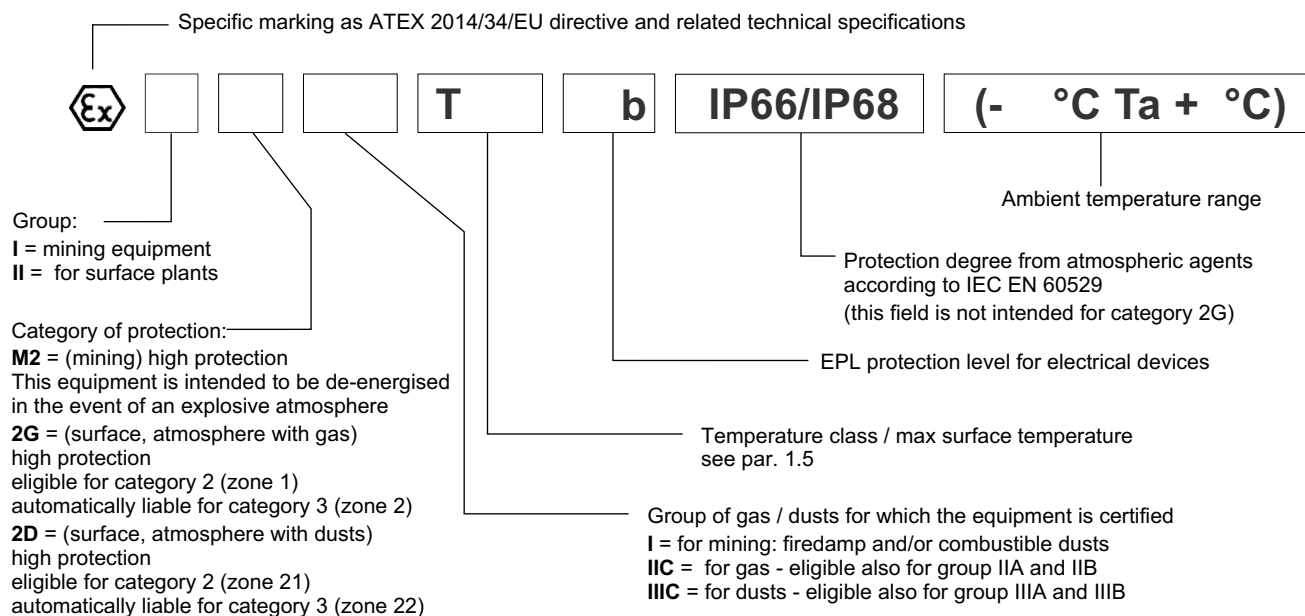
Type examination certificate: CEC 13 ATEX 030-REV.2

The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	<b>*KD2</b>	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	<b>*KDM2</b>	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

### 1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
<b>*KD2</b>	for gas	II 2G IIC T4 Gb (-20°C Ta +80°C)	II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
<b>*KD2 /T5</b>	for gas	II 2G IIC T5 Gb (-20°C Ta +55°C)	II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
<b>*KDM2</b>	mining	I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)










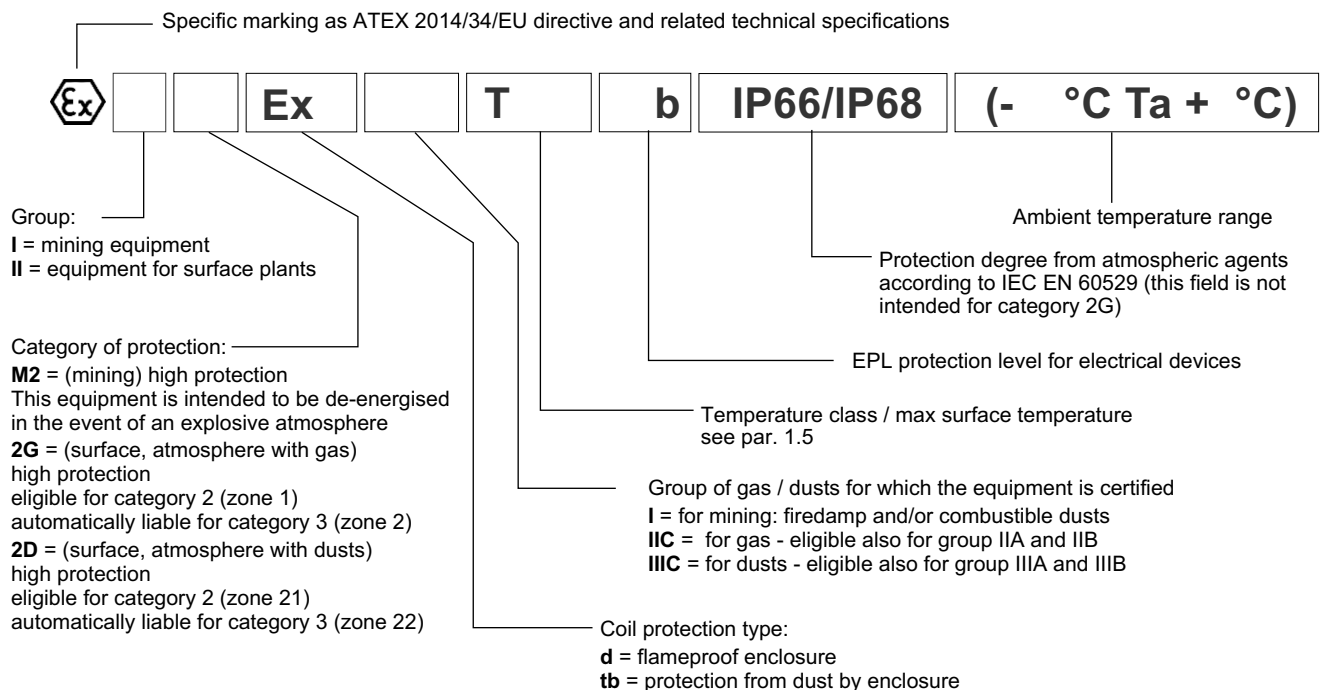
### 1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself and as such is identified with its own tag, carries the relative ATEX marking. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex d" type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

### 1.4 - ATEX marking on coils

for valve type <b>*KD2</b>	for gas  for dusts	 II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)  II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type <b>*KD2 /T5</b>	for gas  for dusts	 II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)  II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type <b>*KDM2</b>	mining	 I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



### 1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	<b>*KD2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas)	T3, T2, T1 T200°C and higher
		of fluid			T154°C (dusts)	
	<b>*KD2 /T5</b>	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas)	T4, T3, T2, T1 T135°C and higher
		of fluid			T129°C (dusts)	
ATEX I M2	<b>*KDM2</b>	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				



## 2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Diplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex db" type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

### 2.1 - IECEx classification

Certificate of conformity (CoC): IECEx TUN 15.0028X

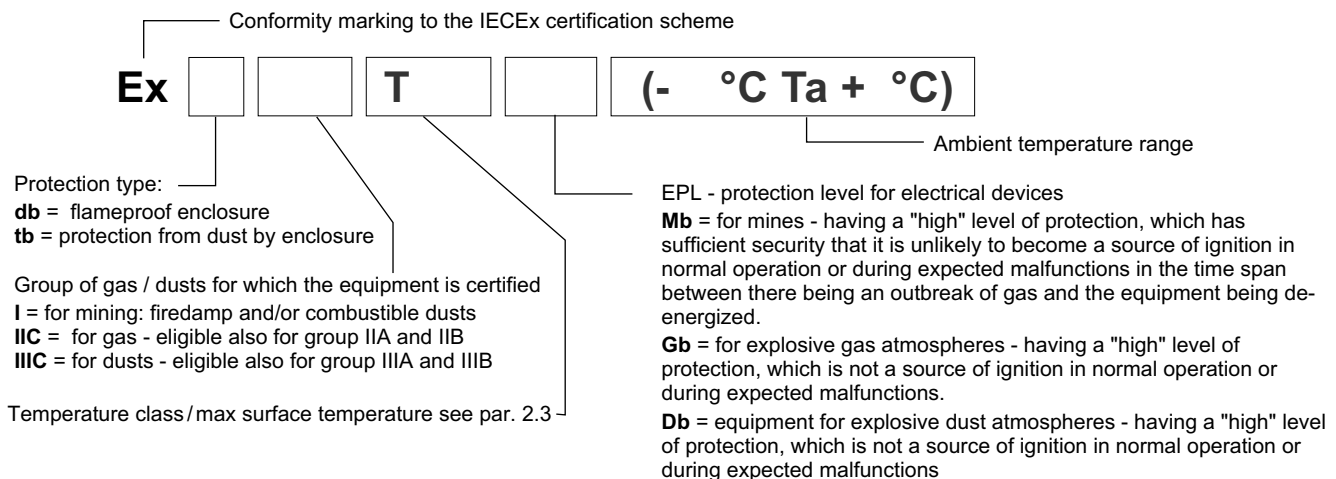
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	<b>*KXD2</b>	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	<b>*KXDM2</b>	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

### 2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

<b>*KXD2</b> valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
<b>*KXD2 /T5</b> valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
<b>*KDM2</b> valves	mining	Ex db I Mb (-40°C Ta +80°C)



### 2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	<b>*KXD2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	<b>*KXD2 /T5</b>	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	<b>*KXDM2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				



### 3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex d" type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

#### 3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X

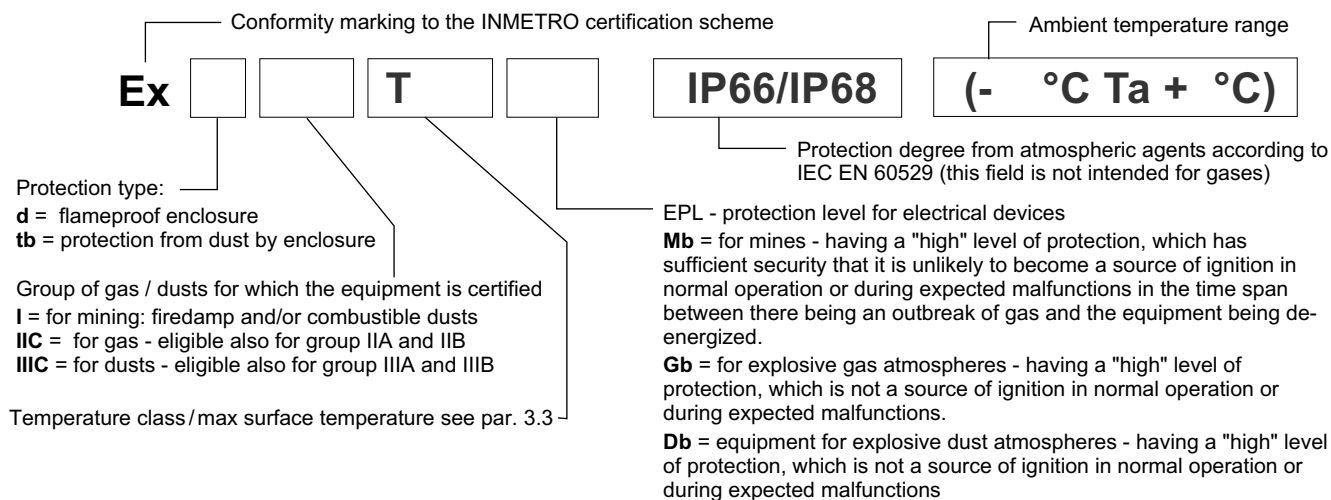
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	<b>*KBD2</b>	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	<b>*KBDM2</b>	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

#### 3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

<b>*KBD2</b> valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
<b>*KBD2 /T5</b> valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
<b>*KBDM2</b> valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)



#### 3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
INMETRO Gb INMETRO Db	<b>*KBD2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas)	T3, T2, T1 T200°C and higher
		of fluid			T154°C (dusts)	
	<b>*KBD2 /T5</b>	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas)	T4, T3, T2, T1 T135°C and higher
		of fluid			T129°C (dusts)	
INMETRO Mb	<b>*KBDM2</b>	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				



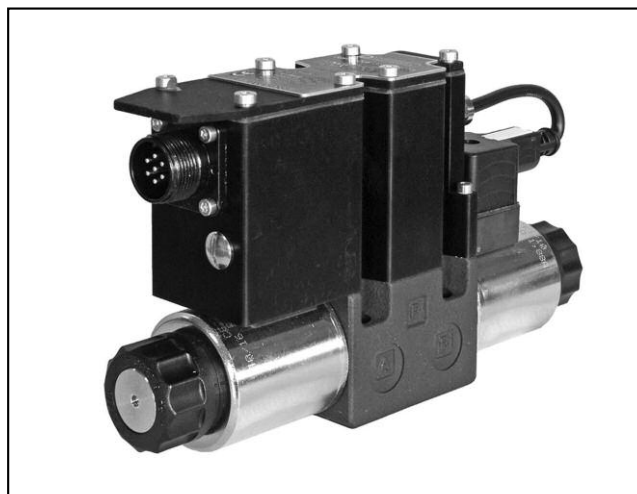
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# ZDE3G

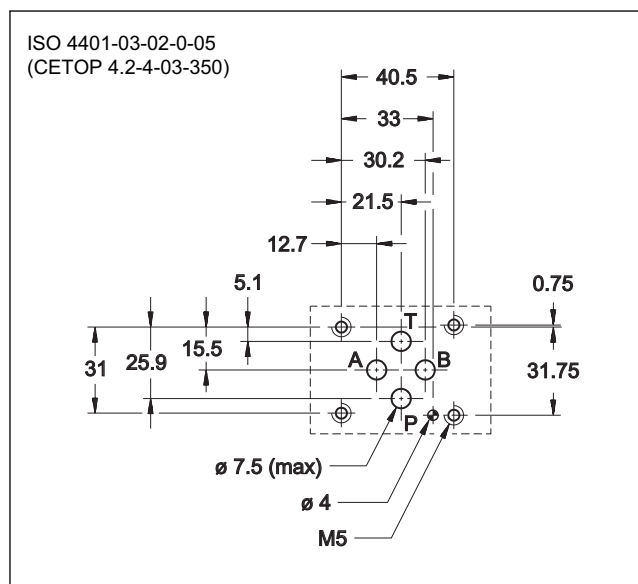
## DIRECT OPERATED PRESSURE REDUCING VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS

SERIES 32

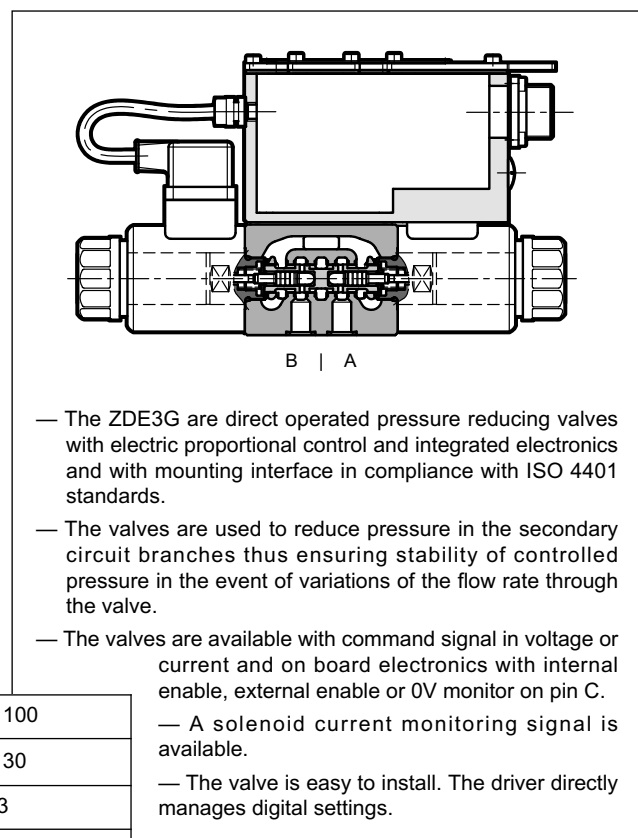
**SUBPLATE MOUNTING**  
**ISO 4401-03**

**p** max **100** bar  
**Q** max **15** l/min

### MOUNTING INTERFACE



### OPERATING PRINCIPLE

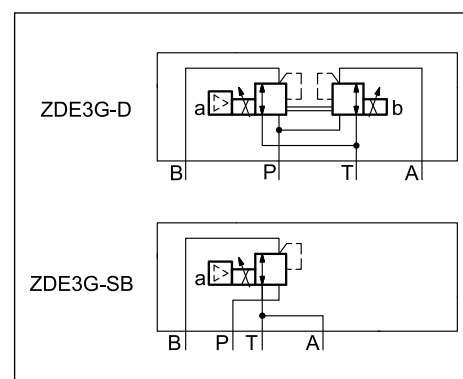


### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Operating pressure range port P	bar	30 ÷ 100
Operating pressure range port T (par. 5)	bar	0 ÷ 30
Controlled pressure	bar	23
Maximum flow	l/min	15
Hysteresis	% Q max	< 3 %
Repeatability	% Q max	< 1 %
Electrical characteristics	see paragraph 2	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve	kg	1,9
double solenoid valve	kg	2,4

### HYDRAULIC SYMBOL



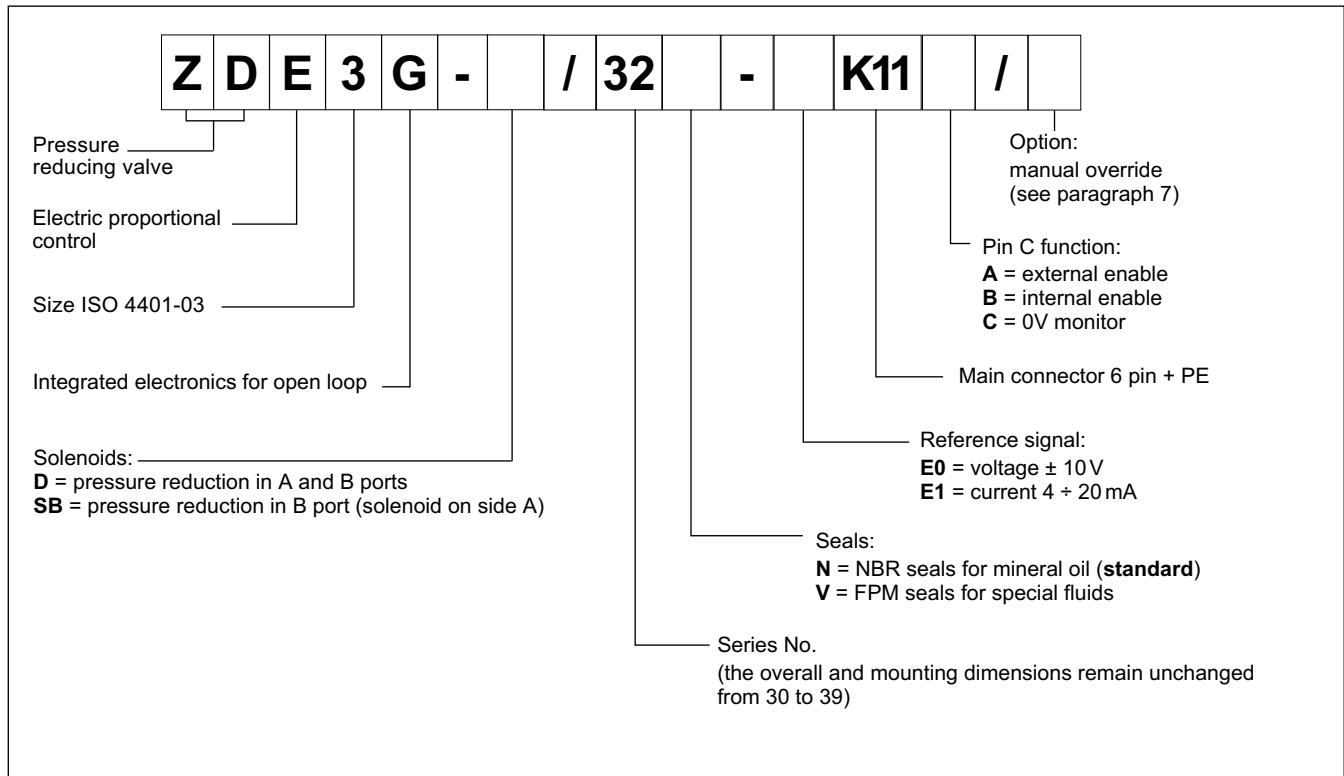




# ZDE3G

## SERIES 32

### 1 - IDENTIFICATION CODE

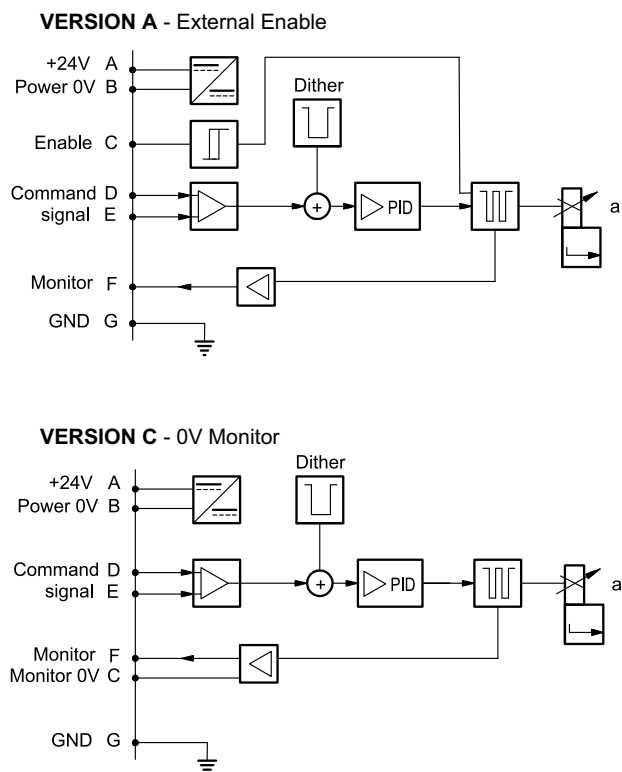


## 2 - ELECTRICAL CHARACTERISTICS

### 2.1 - Electrical on board electronics

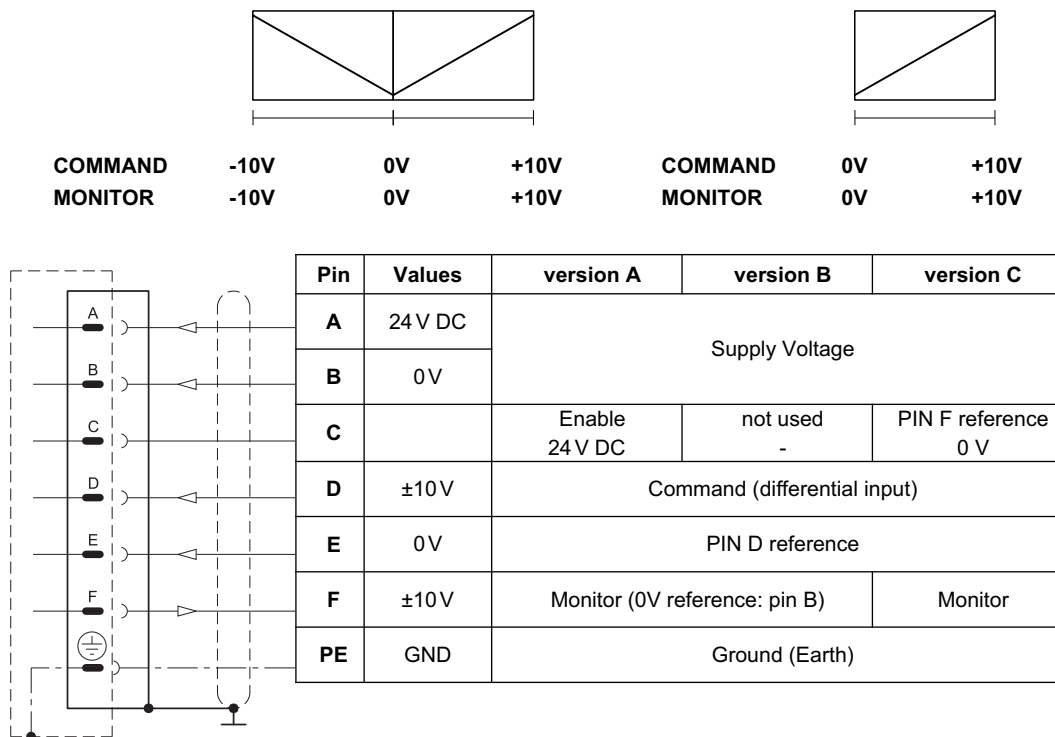
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 2.2 - On-board electronics diagrams



### 3 - VERSIONS WITH VOLTAGE COMMAND (E0)

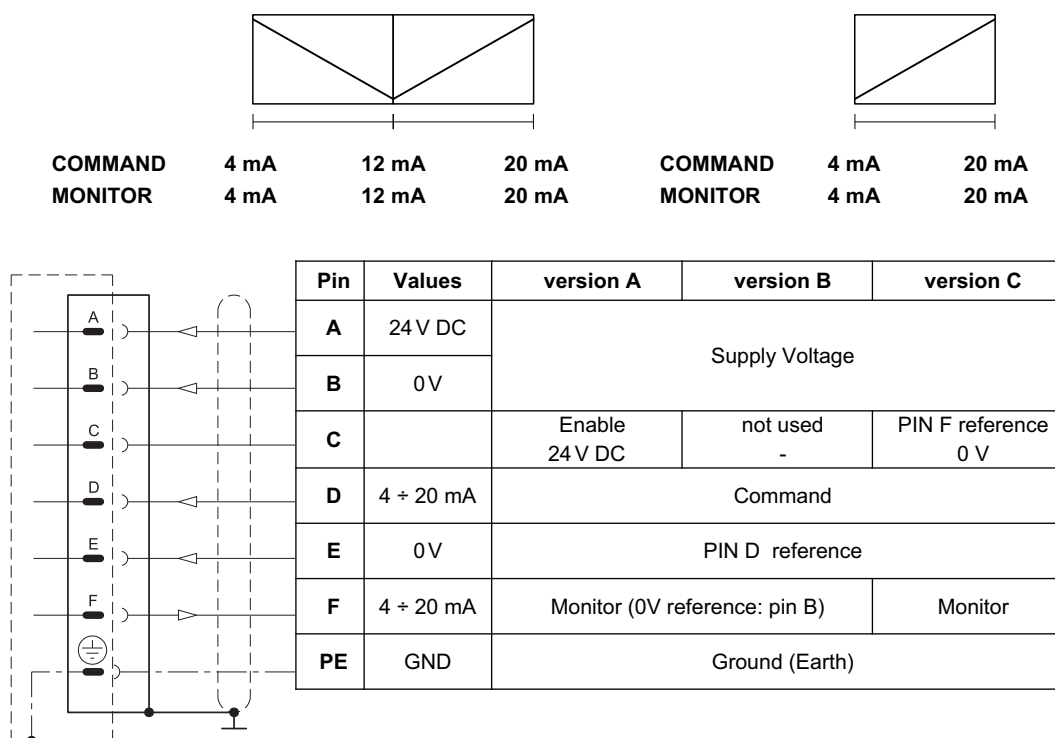
The reference signal is between -10V and +10V on double solenoid valve, and 0 ÷ 10V on single solenoid valves.  
The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



### 4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

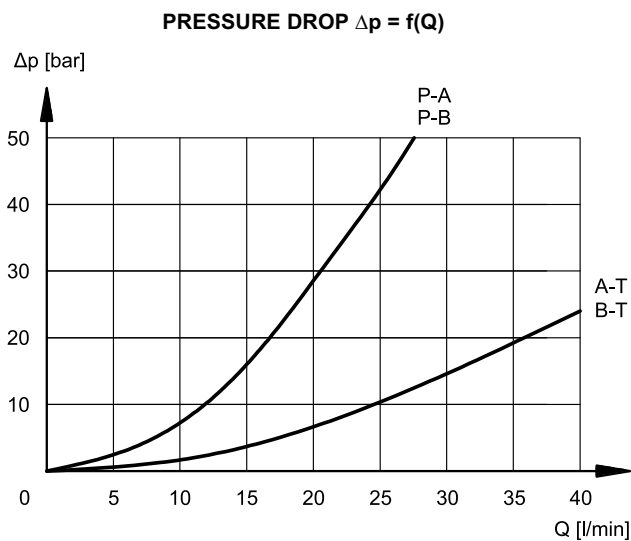
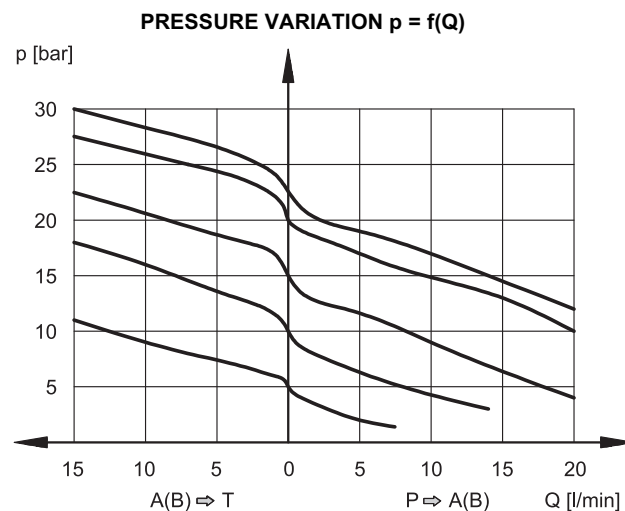
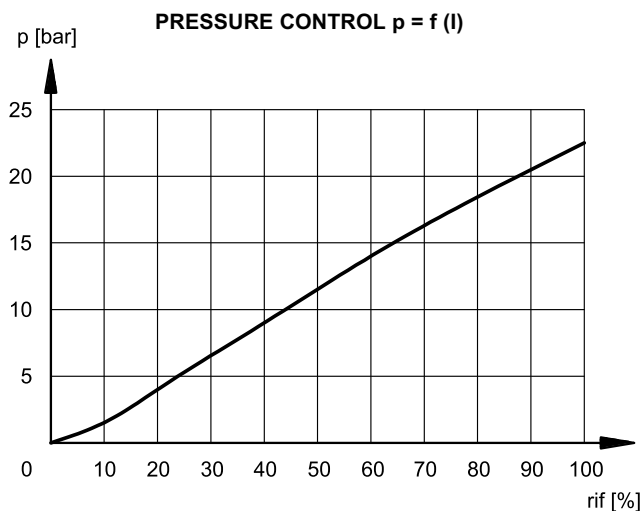
The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - CHARACTERISTIC CURVES

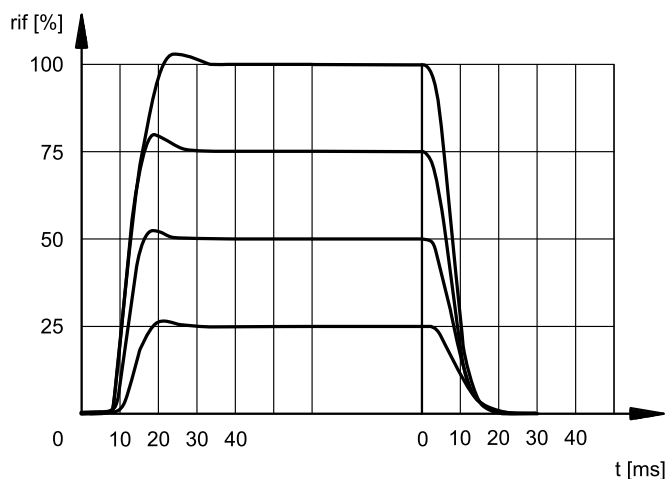
(obtained with oil with viscosity 36 cSt at 50°C)

Adjustment characteristics depending from solenoid current supply, obtained with inlet pressure = 100 bar.



## 6 - STEP RESPONSE

Response times are obtained with an inlet pressure of 100 bar and oil volume of 0,3 litres. The response time is affected both by the flow rate and the oil volume in the pipework.





## 7 - MANUAL OVERRIDE

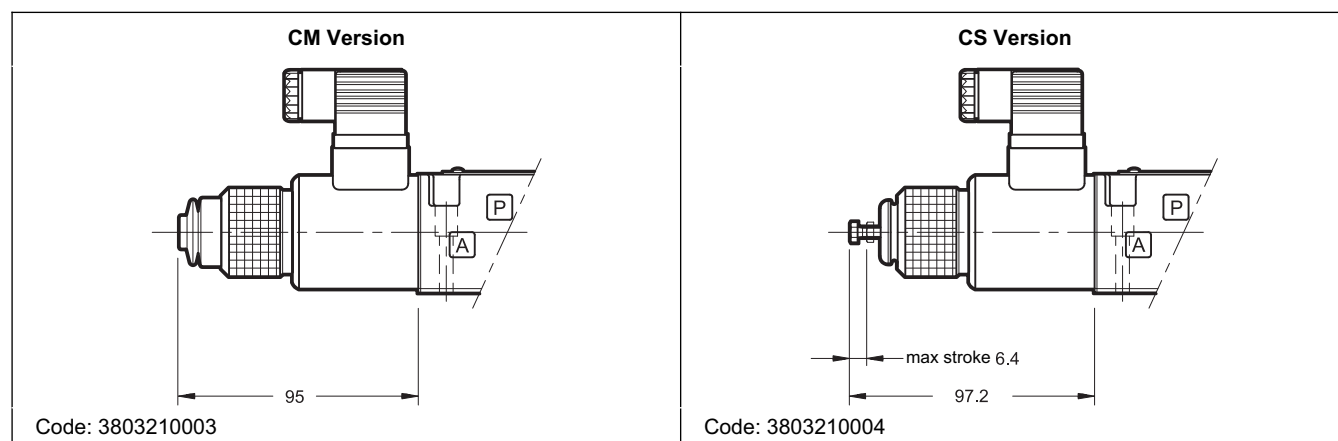
The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

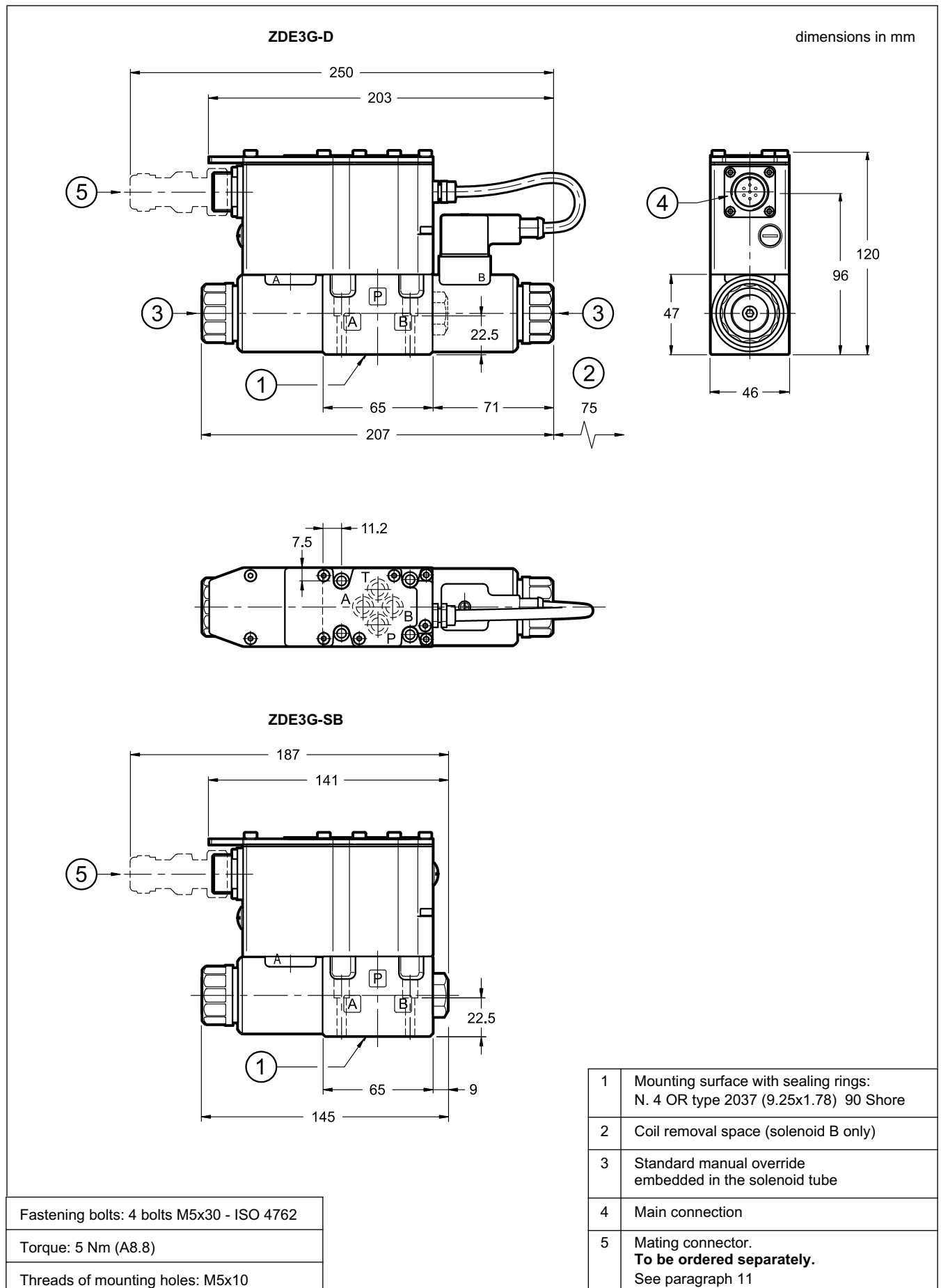
- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.



**CAUTION!:** The manual override use doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.



## 8 - OVERALL AND MOUNTING DIMENSIONS





## 9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 10 - INSTALLATION

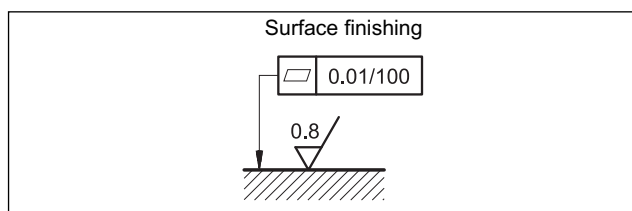
ZDE3G valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

**Maximum admissible backpressure in the T line, under operational conditions, is 30 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 11 - ACCESSORIES

(to be ordered separately)

### 11.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

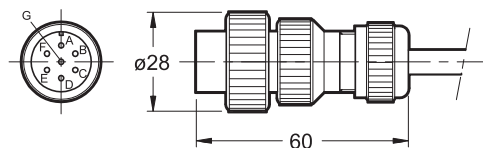


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 11.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 12 - SUBPLATES

(see catalogue 51 000)

PMMD-AL3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP



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# DZCE\*

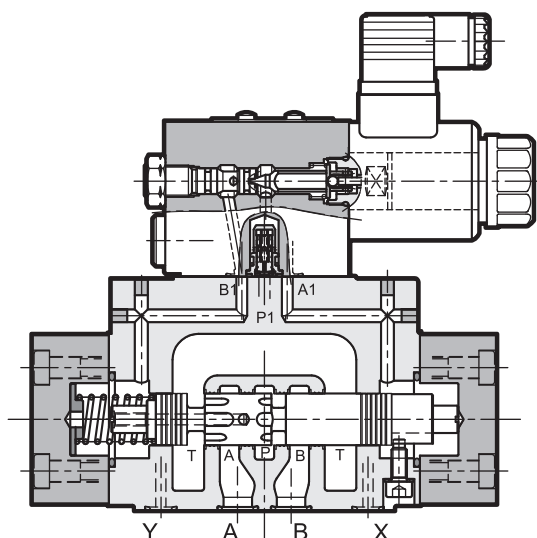
## PRESSURE REDUCING VALVE WITH PROPORTIONAL CONTROL

### SERIES 11

**DZCE5**                      **CETOP P05**  
**DZCE5R**                **ISO 4401-05 (CETOP R05)**  
**DZCE7**                   **ISO 4401-07 (CETOP 07)**  
**DZCE8**                   **ISO 4401-08 (CETOP 08)**

**p** max **350** bar  
**Q** max (see table of performances)

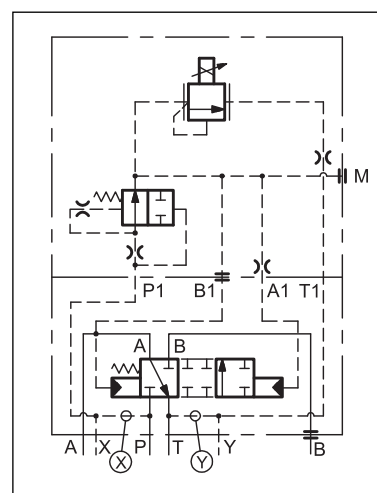
#### OPERATING PRINCIPLE



- The DZCE\* are pressure reducing valves with electric proportional control and mounting interface in compliance with ISO 4401 (CETOP RP121H) standards.
- Those valves, besides reducing the pressure from line P to working line A, allow the flow to return from the line A to the return line T when a pressure greater than the set value is generated in the downstream circuit (flow path A): a typical case of hydraulic counterweight or load balancing.
- The pressure can be modulated continuously in proportion to the current supplied to the solenoid.
- They can be controlled directly by a current control supply unit or by means of the electronic control units (par. 12) to exploit valve performance to the full .
- They are available in CETOP P05, ISO 4401-05 (CETOP R05), ISO 4401-07 (CETOP 07) and ISO 4401-08 (CETOP 08) sizes.
- Every size can be supplied with several controlled flow rates, up to 500 l/min.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)		DZCE5 DZCE5R	DZCE7	DZCE8
Maximum operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Step response		see paragraph 6		
Hysteresis (with PWM 200 Hz)	% of p <sub>max</sub>	< 4%		
Repeatability	% of p <sub>max</sub>	< ±2%		
Electrical characteristic		see paragraph 5		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	7	9,2	15,3

#### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE

D	Z	C	E	-	/	11	-	/	K1
---	---	---	---	---	---	----	---	---	----

Pressure reducing valve

Electric proportional control

Nominal size:   
**5** = CETOP P05 (**NOTE**)  
**5R** = ISO 4401-05 (CETOP R05)  
**7** = ISO 4401-07 (CETOP 07)  
**8** = ISO 4401-08 (CETOP 08)

Pressure control range   
**070** = 1 ÷ 70 bar  
**140** = 1 ÷ 140 bar  
**210** = 1 ÷ 210 bar  
**300** = 1 ÷ 300 bar

Series N. (the overall and mounting dimensions remain unchanged from 10 to 19)

Coil electrical connection: for connector type DIN 43650 (**standard**)

Supply voltage:   
**D12** = voltage 12V DC  
**D24** = voltage 24V DC

Drainage: **I** = internal  
**E** = external

Piloting: **I** = internal  
**E** = external

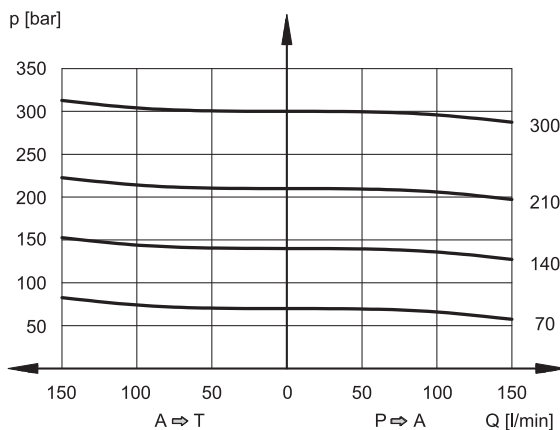
Seals:   
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

**NOTE:** This version is interchangeable with the model ZCE4 Diplomatic.

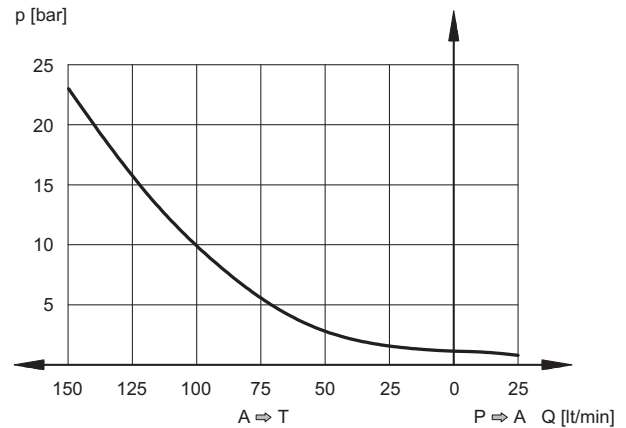
## 2 - CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

### 2.1 - Characteristic curves DZCE5 and DZCE5R

ADJUSTMENT

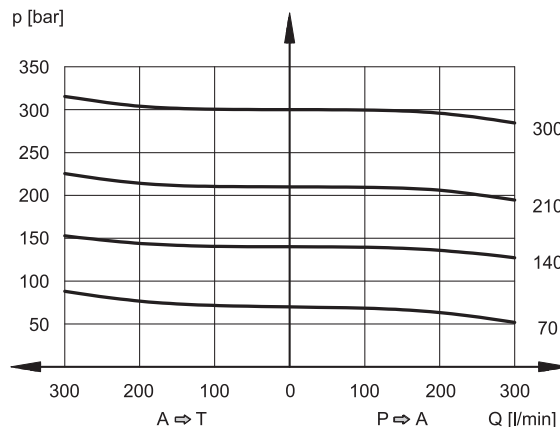


MIN. CONTROLLED PRESSURE  $p_{min} = f(Q)$

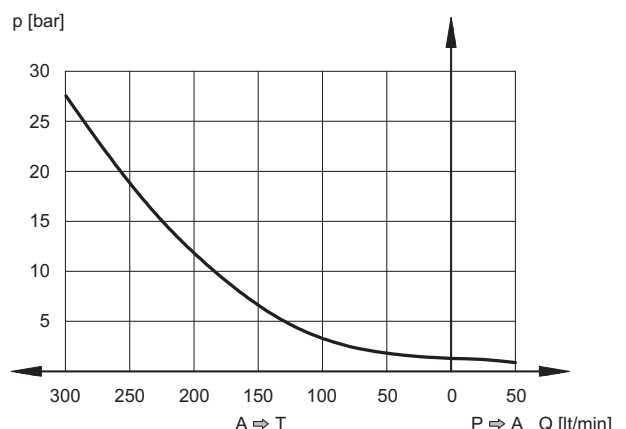


### 2.2 - Characteristic curves DZCE7

ADJUSTMENT

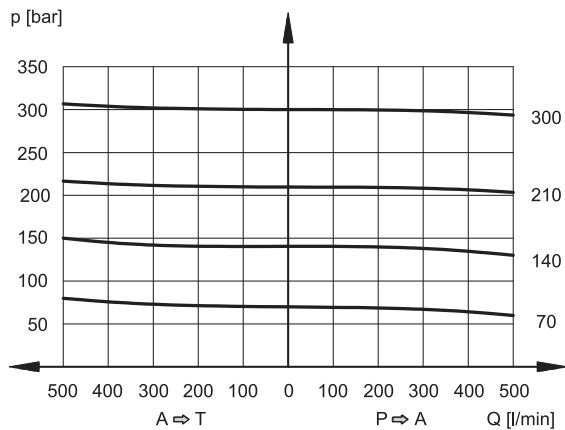


MIN. CONTROLLED PRESSURE  $p_{min} = f(Q)$

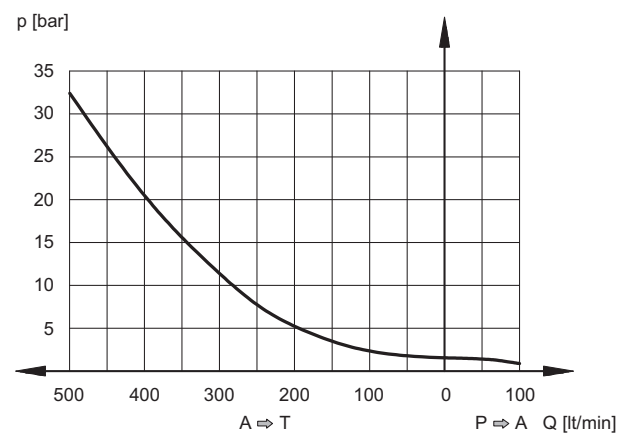


## 2.3 - Characteristic curves DZCE8

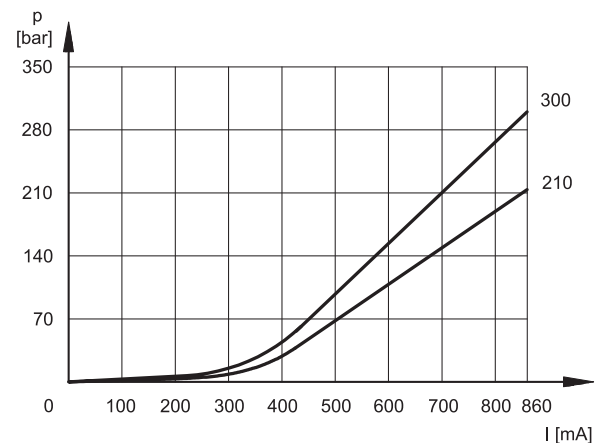
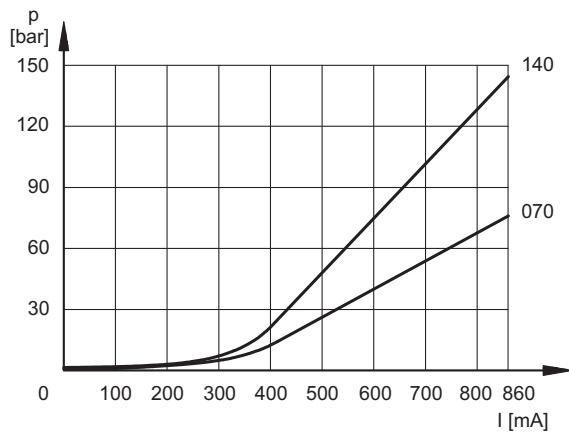
ADJUSTMENT



MIN. CONTROLLED PRESSURE  $p_{min} = f(Q)$



## 2.4 - Pressure control $p = f(I)$ DZCE5, DZCE5R, DZCE7 and DZCE8



## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 6 - PILOTING AND DRAINAGE

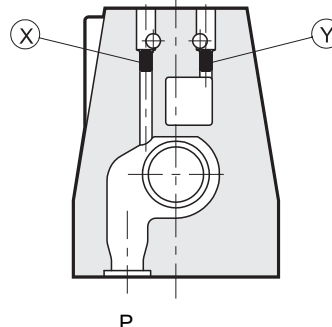
The DZCE\* valves are available with piloting and drainage, both internal and external.  
We suggest to use the version with external drainage that allows a higher backpressure on the unloading.

VALVE TYPE	Plug assembly	
	X	Y
<b>IE</b> INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b> INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b> EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b> EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

#### PRESSURES (bar)

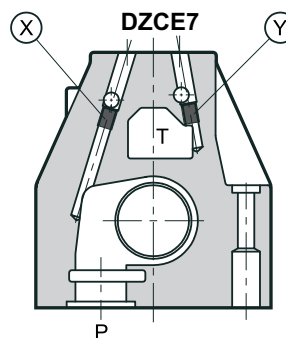
Pressure	MIN	MAX
Piloting pressure on X port	30	350
Pressure on T port with internal drain	–	2
Pressure on T port with external drain	–	250

#### DZCE5 and DZCE5R



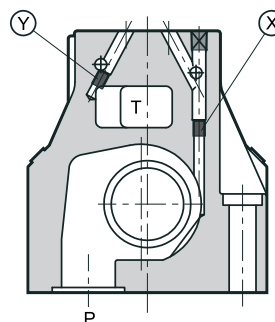
**X:** M5x6 plug for external pilot  
**Y:** M5x6 plug for external drain

#### DZCE7



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

#### DZCE8



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

### 5 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut. It can be rotated through 360° depending on installation clearances.

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>	<b>24</b>
<b>RESISTANCE (at 20°C)</b>	Ω	3.66	17.6
<b>NOMINAL CURRENT</b>	A	1.88	0.86
<b>DUTY CYCLE</b>	100%		
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2004/108/CE		
<b>CLASS OF PROTECTION:</b> atmospheric agents (CEI EN 60529) coil insulation (VDE 0580) Impregnation	IP 65 class H class F		



## 6 - STEP RESPONSE (measured with mineral oil with viscosity of 36 cSt at 50°C with the relative electronic control units)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

REFERENCE SIGNAL STEP	0 →100%	100→0%
response times [ms]		
DZCE5 and DZCE5R	100	70
DZCE7	100	50
DZCE8	100	50

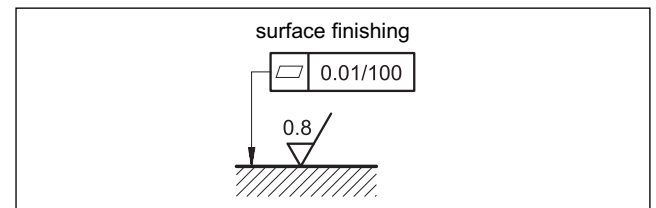
## 7 - INSTALLATION

We recommend to install the DZCE\* valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particulars applications, it can be necessary to vent the air entrapped in the solenoid tube, using the special drain screw and then ensure to screw it correctly.

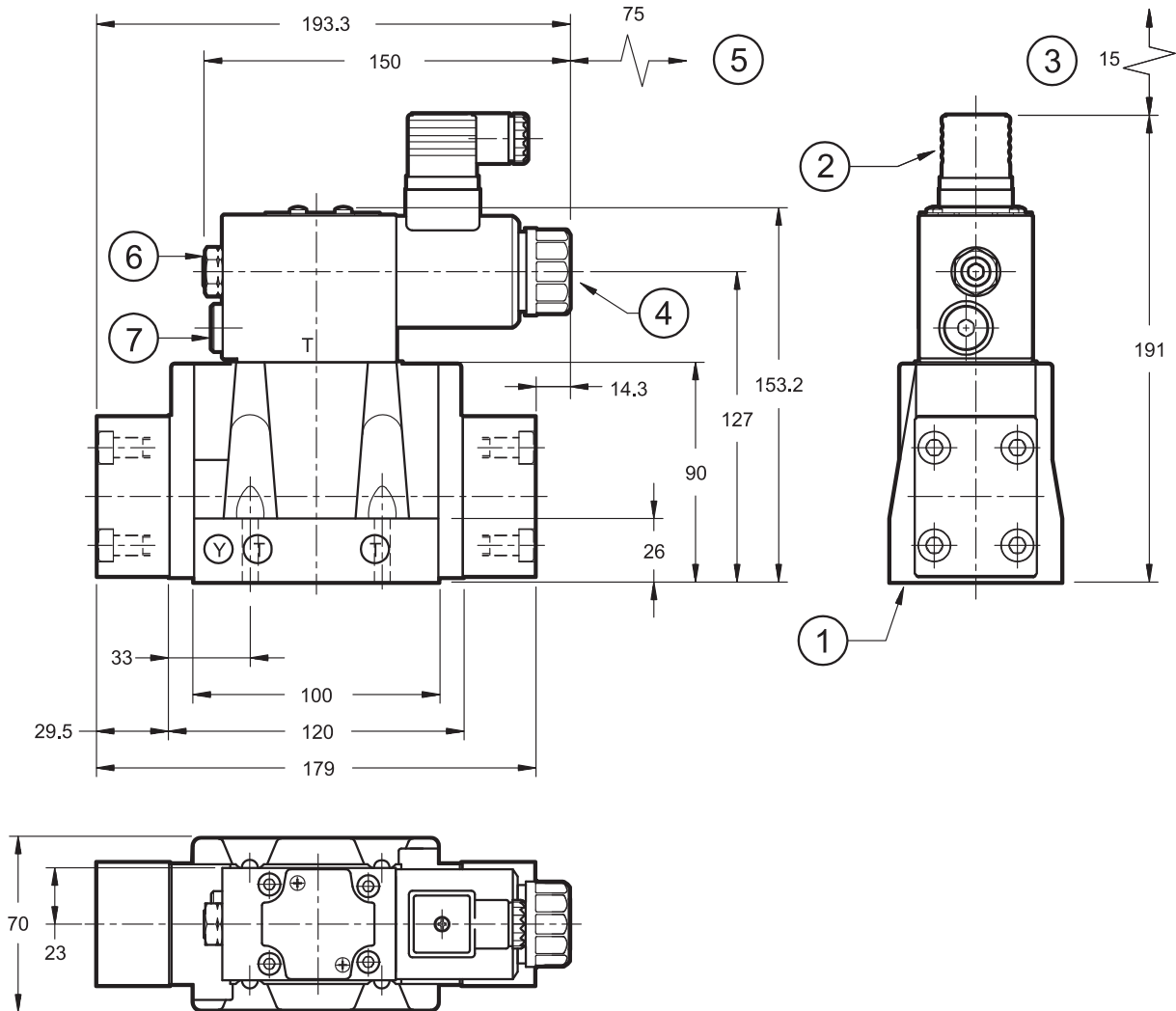
Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 8 - DZCE5 and DZCE5R OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



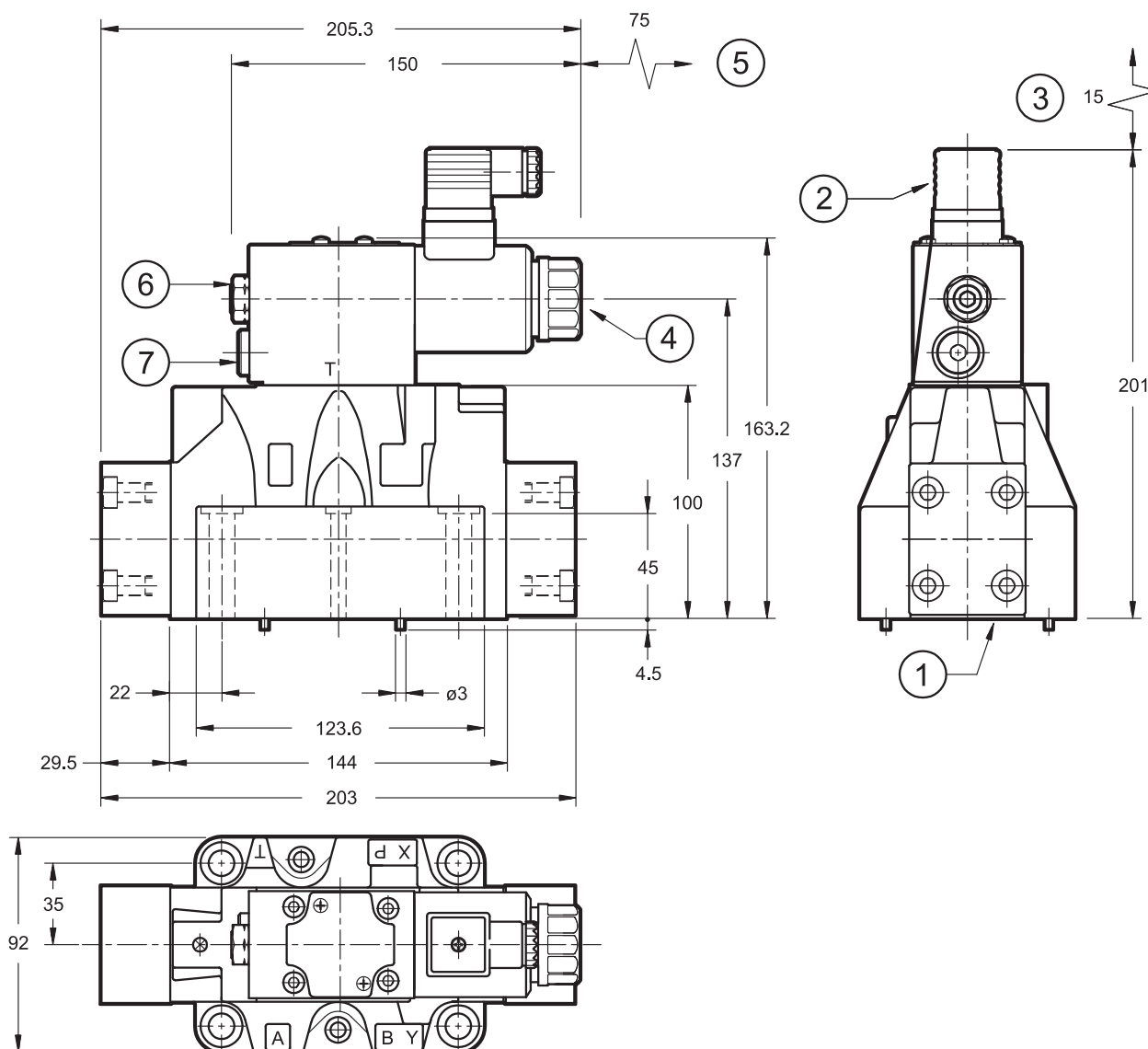
**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

Valve fastening: N. 4 bolts SHC M6x35 - ISO 4762
Tightening torque: 8 Nm (A 8.8 bolts)
Thread of mounting holes: M6x10
Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector (included in the supply)
3	Connector removal space
4	Breather (Allen key 4)
5	Coil removal space
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4" BSP

## 9 - DZCE7 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

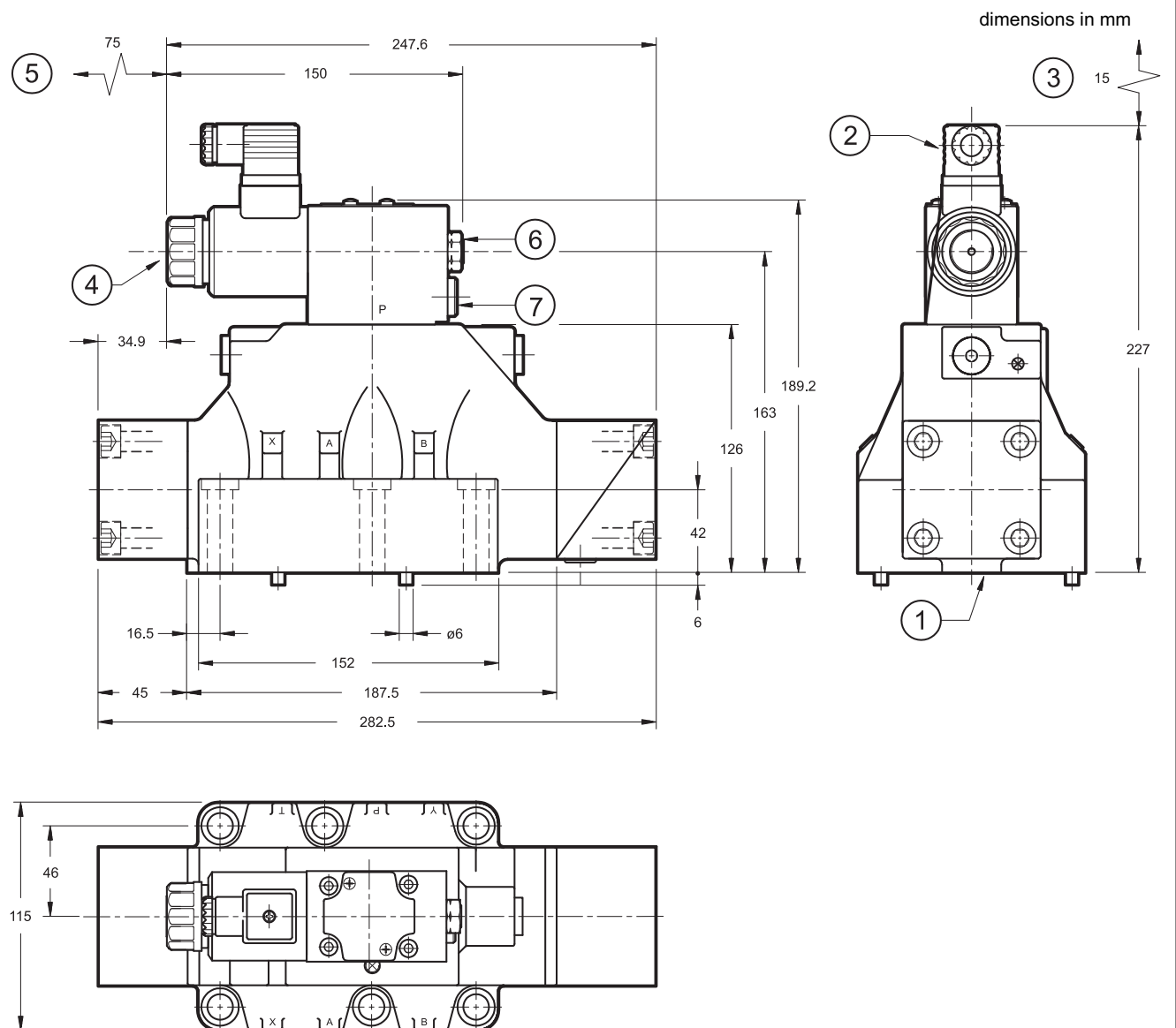


**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

Single valve fastening:	N. 4 SHC M10x60 bolts - ISO 4762 N. 2 SHC M6x60 bolts - ISO 4762
Tightening torque M10x60:	40 Nm (A 8.8 bolts)
M6x60:	8 Nm (A 8.8 bolts)
Thread of mounting holes:	M6x18; M10x18
Sealing rings:	N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector (included in the supply)
3	Connector removal space
4	Breather (Allen key 4)
5	Coil removal space
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4" BSP

## 10 - DZCE8 OVERALL AND MOUNTING DIMENSIONS



**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

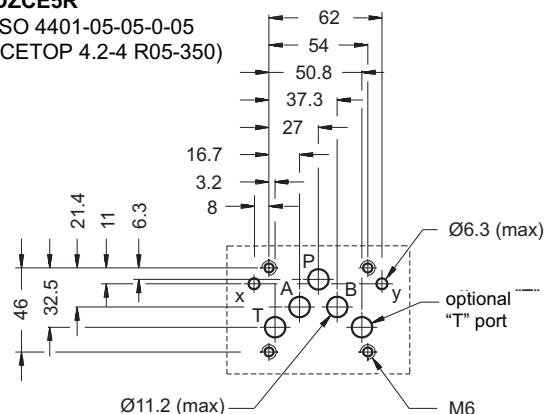
Valve fastening: N. 6 SHC M12x60 screws - ISO 4762
Tightening torque: 69 Nm (A 8.8 bolts)
Thread of mounting holes: M12x20
Sealing rings: N. 4 OR type 3118 (29.82x2.62) - 90 Shore N. 2 OR type 3081 (20.24x2.62) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector (included in the supply)
3	Connector removal space
4	Breather (Allen key 4)
5	Coil removal space
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4" BSP

## 11 - MOUNTING SURFACES

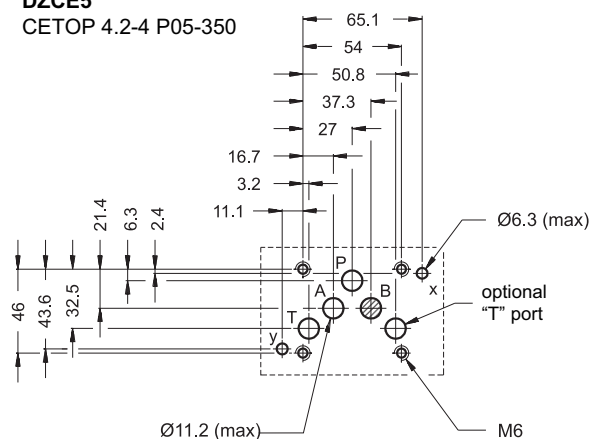
DZCE5R

ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



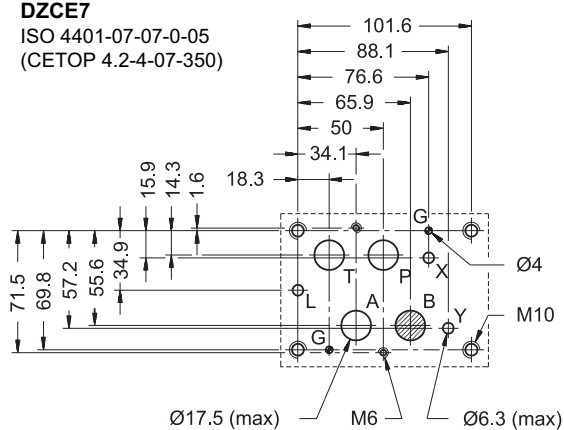
DZCE5

CETOP 4.2-4 P05-350



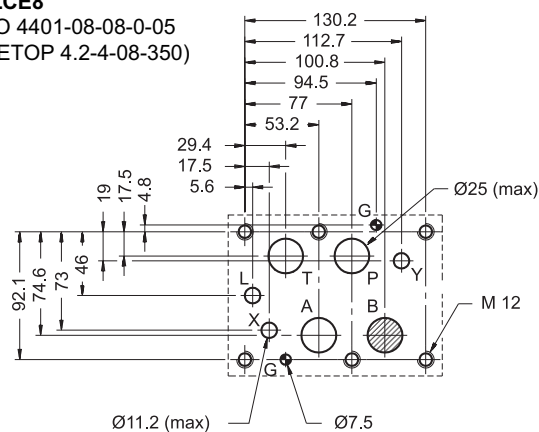
DZCE7

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



DZCE8

ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



## 12 - ELECTRONIC CONTROL UNITS

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat.89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		
<b>UEIK-11</b>	for solenoid 24V DC	Eurocard type	see cat. 89 300

### 13 - SUBPLATES (see catalogue 51 000)

	DZCE5	DZCE7	DZCE8
Model with rear ports	PME4-AI5G	PME07-AI6G	-
Model with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports: P - T - A - B X - Y	3/4" BSP 1/4" BSP	1½" BSP 1/4" BSP	1" BSP 1/4" BSP





**DZCE\***  
SERIES 11



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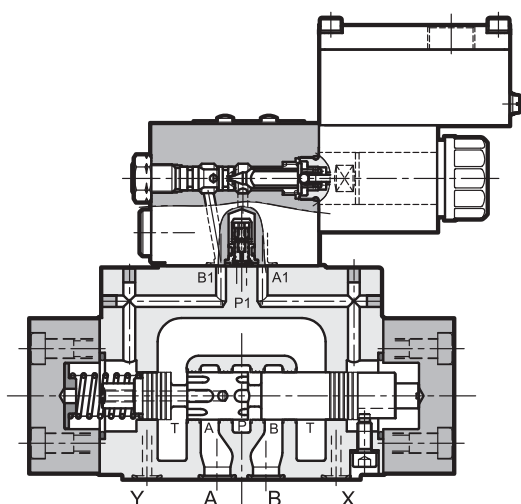


# DZCE\*K\*

## EXPLOSION-PROOF PRESSURE REDUCING VALVE WITH PROPORTIONAL CONTROL ATEX, IECEx, INMETRO SERIES 11

DZCE5K*	CETOP P05
DZCE5RK*	ISO 4401-05
DZCE7K*	ISO 4401-07
DZCE8K*	ISO 4401-08

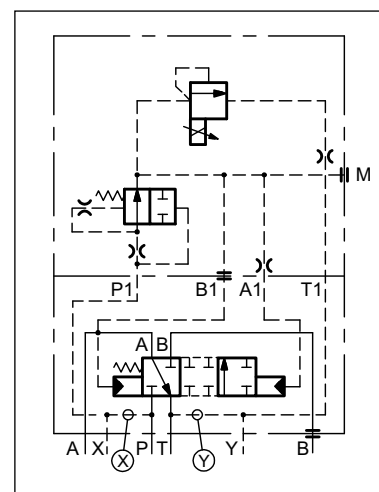
### OPERATING PRINCIPLE



- The DZCE\*K\* are explosion-proof pressure reducing valves, pilot operated, with proportional control, available with CETOP P05, ISO 4401-05, ISO 4401-07 and ISO 4401-08 mounting surfaces.
- They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- They can be controlled directly by a current control supply unit or by means of an electronic card to exploit valve performance to the full (see par. 14).
- Upon request, DZCE\*K\* valves can be supplied with a finishing surface treatment (zinc-nickel) which is suitable to ensure a salt spray resistance up to 600 hours.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C )		DZCE5K* DZCE5RK*	DZCE7K*	DZCE8K*
Maximum operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Step response		see paragraph 4		
Hysteresis (with PWM 200 Hz)	% of p <sub>max</sub>	< 4%		
Repeatability	% of p <sub>max</sub>	< ±2%		
Electrical characteristic		see paragraph 7		
Temperature ranges (ambient and fluid)		see data sheet 02 500		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	7,3	9,5	15,6

### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE

<b>D</b>	<b>Z</b>	<b>C</b>	<b>E</b>		<b>-</b>	<b>/ 11</b>	<b>-</b>	<b>/</b>	<b>K9</b>			
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Pressure reducing valve

Electric proportional control

Nominal size: \_\_\_\_\_  
**5** = CETOP P05  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08

Explosion-proof certification: \_\_\_\_\_  
**See table 1.1**

Pressure control range \_\_\_\_\_  
**070** = 1 ÷ 70 bar  
**140** = 1 ÷ 140 bar  
**210** = 1 ÷ 210 bar  
**300** = 1 ÷ 300 bar

Series N. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: \_\_\_\_\_  
For temperature range -20 / +80 °C  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids  
For temperature range -40 / +80 °C  
**NL** = seal for low temperatures (for mineral oil)

Option: surface treatment not standard.  
Omit if not required (see **NOTE**)

Option: **/T5** version in T5 temperature class.  
Omit if not required.

Connection type for cable gland upper connection:  
**T01** = M20x1.5 - ISO 261  
**T02** = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
**T03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
side connection:  
**S01** = M20x1.5 - ISO 261  
**S02** = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
**S03** = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
**S04** = M16x1.5 - ISO 261

Coil electrical connection: by terminal block

Nominal solenoid voltage:  
**D12** = 12V DC  
**D24** = 24V DC

Drainage: **I** = internal  
**E** = external

Piloting: **I** = internal  
**E** = external

**NOTE:** the valves are supplied with standard surface treatment of phosphating black.

Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standard).

For zinc-nickel surface treatment add **/W7** at the end of the identification code.

### 1.1 - Names of valves per certification

	ATEX		IECEX		INMETRO	
for gases for dusts	<b>KD2</b>	II 2GD	<b>KXD2</b>	IECEX Gb IECEX Db	<b>KBD2</b>	INMETRO Gb INMETRO Db
for mines	<b>KDM2</b>	I M2	<b>KXDM2</b>	IECEX Mb	<b>KBDM2</b>	INMETRO Mb

**NOTE:** Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

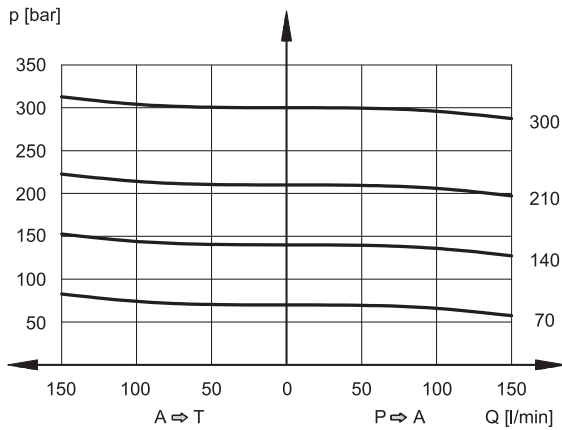


## 2 - CHARACTERISTIC CURVES

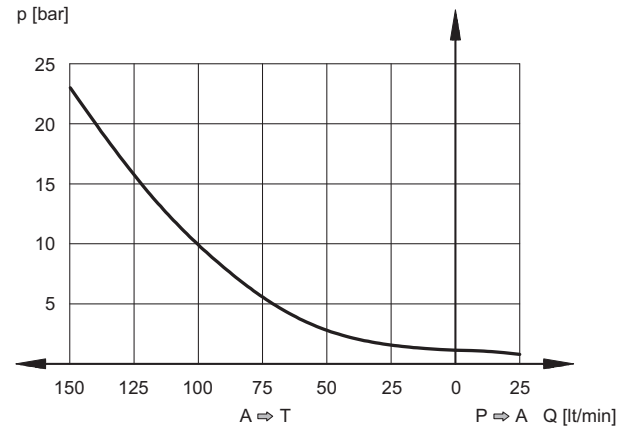
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

### 2.1 - Characteristic curves DZCE5K\* and DZCE5RK\*

ADJUSTMENT

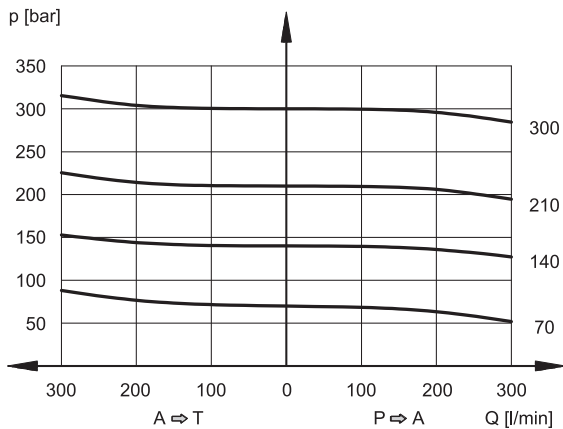


MIN. CONTROLLED PRESSURE  $p_{\min} = f(Q)$

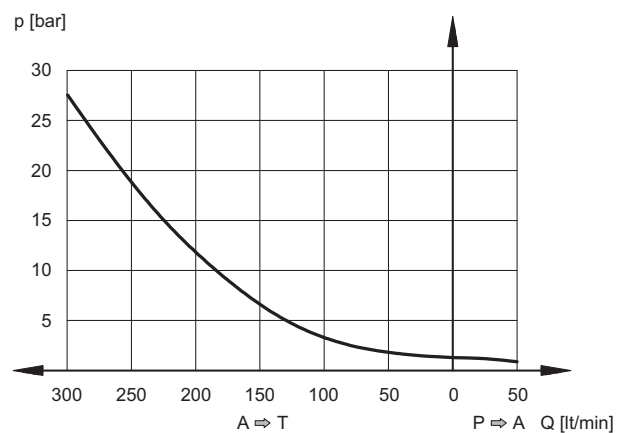


### 2.2 - Characteristic curves DZCE7K\*

ADJUSTMENT

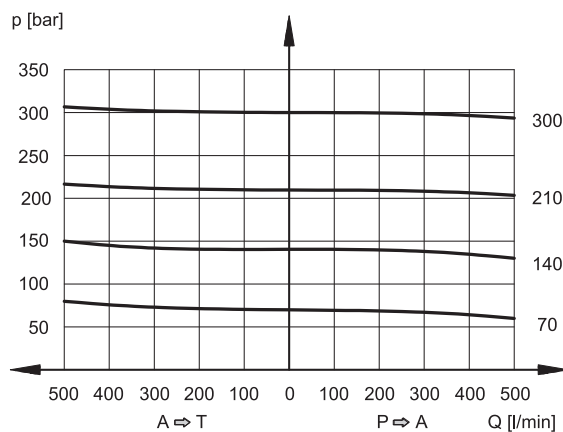


MIN. CONTROLLED PRESSURE  $p_{\min} = f(Q)$

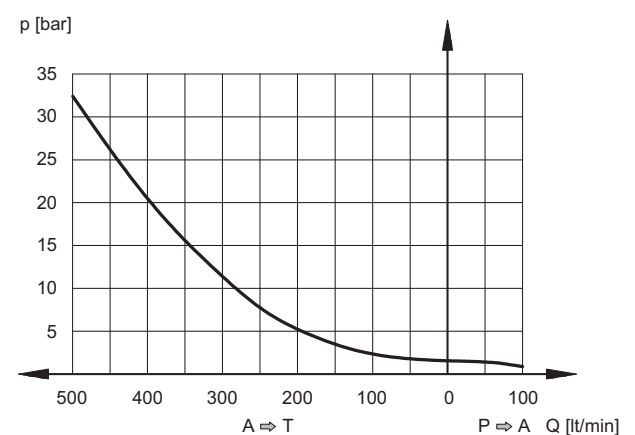


### 2.3 - Characteristic curves DZCE8K\*

ADJUSTMENT

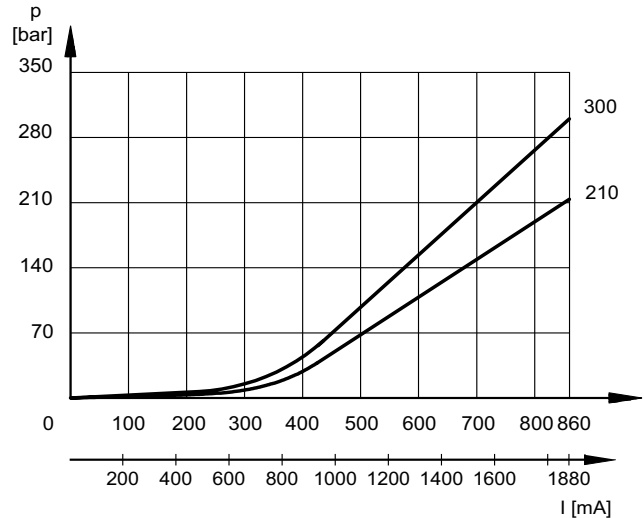
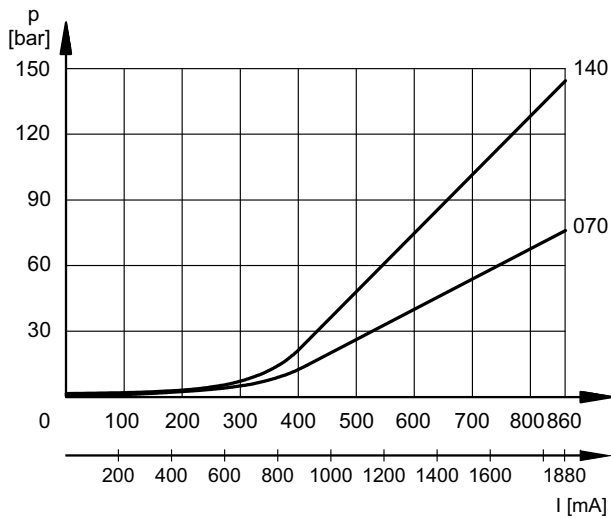


MIN. CONTROLLED PRESSURE  $p_{\min} = f(Q)$





### 2.4 - Pressure control $p = f(I)$ DZCE5K\*, DZCE5RK\*, DZCE7K\* and DZCE8K\*



### 3 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Response times [ms]		
DZCE5K* and DZCE5RK*	100	70
DZCE7K*	100	50
DZCE8K*	100	50

### 4 - ELECTRICAL CHARACTERISTICS

(values  $\pm 5\%$ )

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (AT 20°C)	$\Omega$	3,4	15,6
NOMINAL CURRENT	A	1,88	0,86

DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

#### 4.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

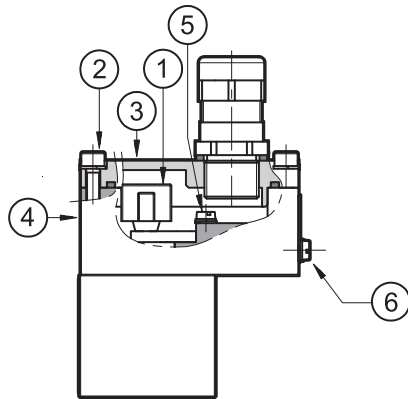
**The electrical connection is polarity-independent.**

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

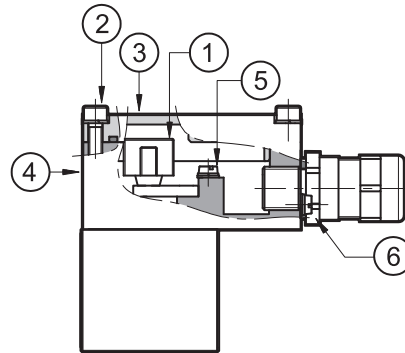
On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100  $\Omega$ ), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9+6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.



K9T\*



K9S\*

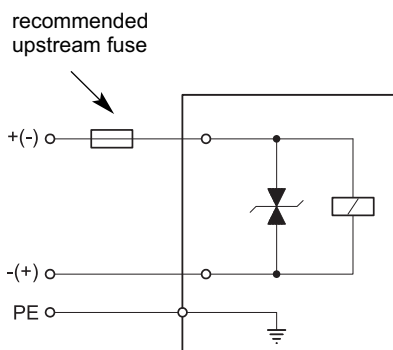
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm <sup>2</sup>
Connection for internal grounding point	max 2.5 mm <sup>2</sup>
Connection for external equipotential grounding point	max 6 mm <sup>2</sup>

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 14) allow to use cables with external diameter between 8 and 10 mm.

## 4.2 - Electrical diagram



## 4.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x I<sub>n</sub> according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,86	1,25	- 49	

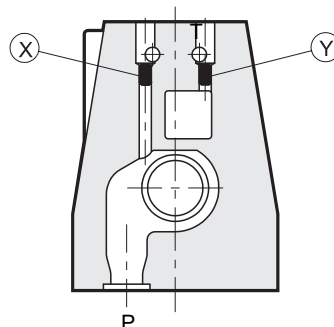
## 5 - PILOT AND DRAIN

The DZCE\*K\* valves are available with piloting and drainage, both internal and external.  
We suggest to use the version with external drainage that allows a higher backpressure on the unloading.

TYPE OF VALVE		Plug assembly	
		X	Y
<b>IE</b>	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b>	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b>	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b>	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

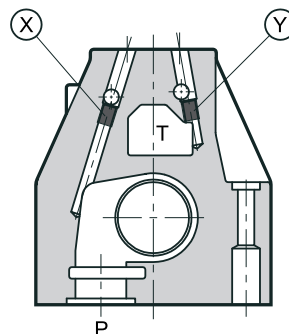
PRESSURES [bar]	MIN	MAX
Piloting pressure on X port	30	350
Pressure in T port with internal drain	-	2
Pressure in T port with external drain	-	250

**DZCE5K\* and DZCE5RK\***



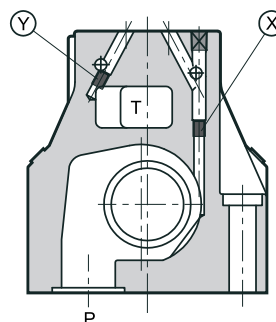
**X:** M5x6 plug for external pilot  
**Y:** M5x6 plug for external drain

**DZCE7K\***



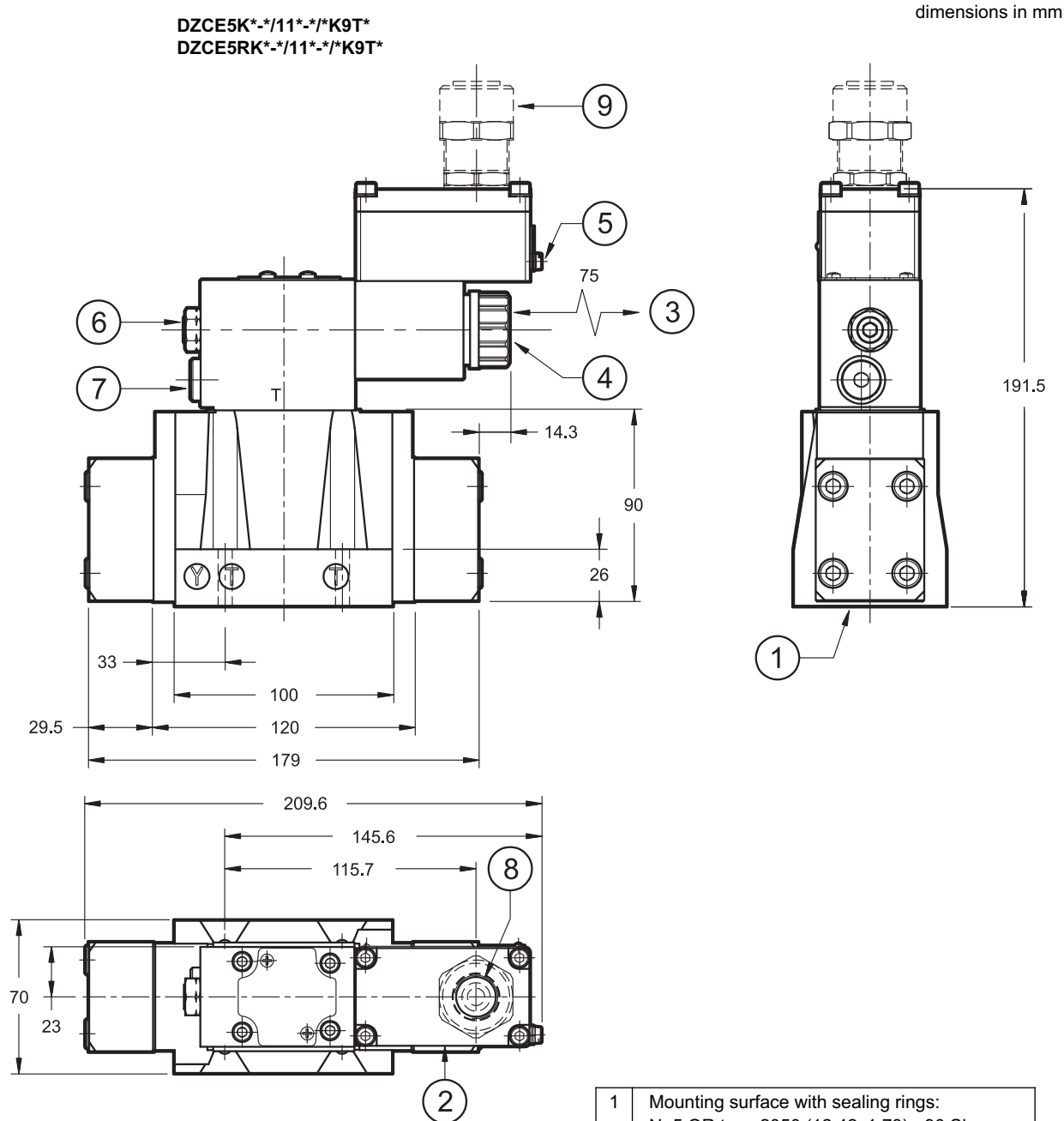
**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

**DZCE8K\***



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

## 6 - DZCE5K\* AND DZCE5RK\* OVERALL AND MOUNTING DIMENSIONS



**NOTE 1:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

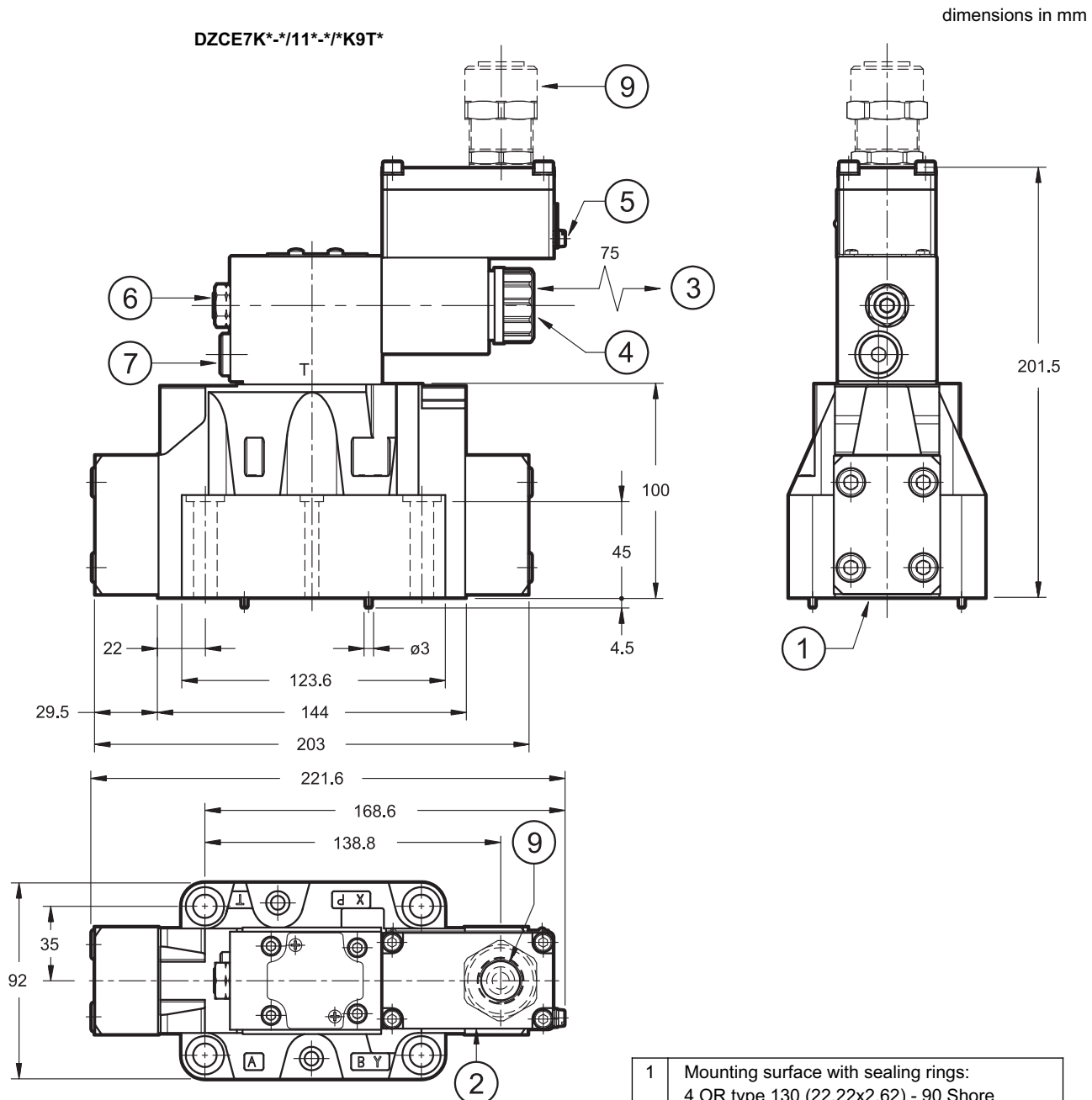
**NOTE 2:** for side port cable gland see paragraph 9.

Valve fastening: N. 4 SHC screws M6x35 - ISO 4762
Tightening torque: 8 Nm (A 8.8 screws)
Thread of mounting holes: M6x10

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Terminal for supplementary earth (GND) connection
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4" BSP
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 13



## 7 - DZCE7K\* OVERALL AND MOUNTING DIMENSIONS



**NOTE 1:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

**NOTE 2:** for side port cable gland see paragraph 9.

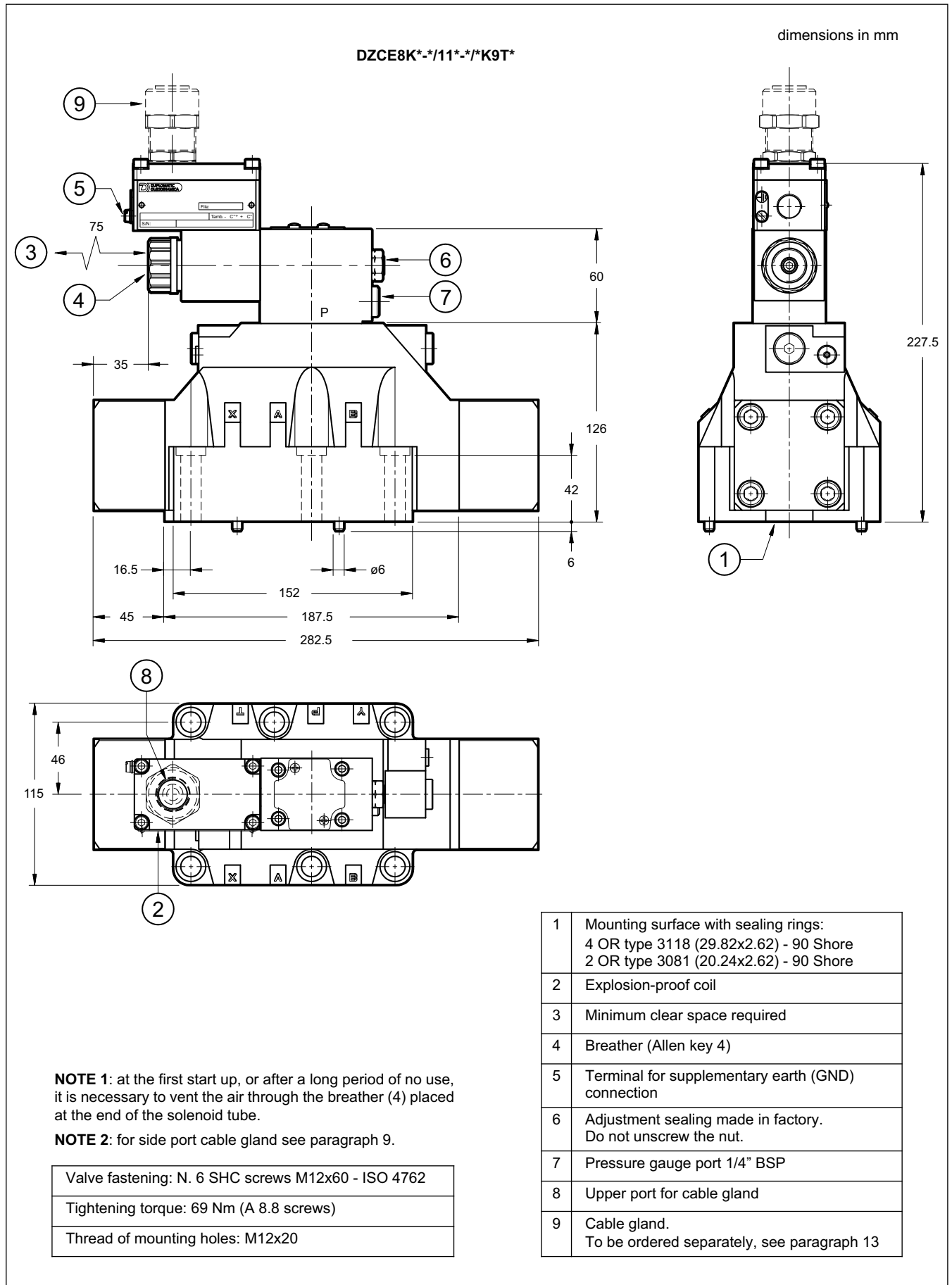
Single valve fastening: N. 4 SHC screws M10x60 - ISO 4762  
N. 2 SHC screws M6x60 - ISO 4762

Tightening torque M10x60: 40 Nm (A 8.8 screws)  
M6x60: 8 Nm (A 8.8 screws)

Thread of mounting holes: M6x18; M10x18

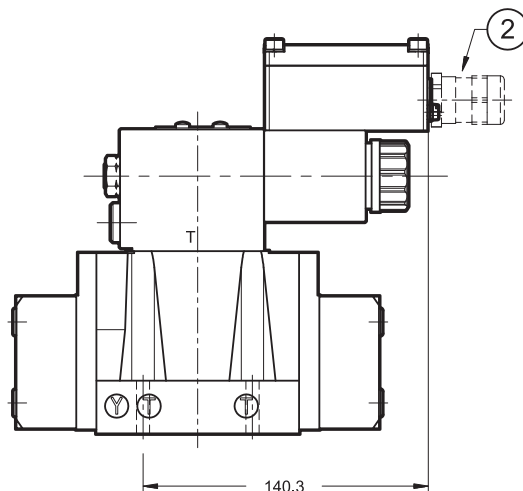
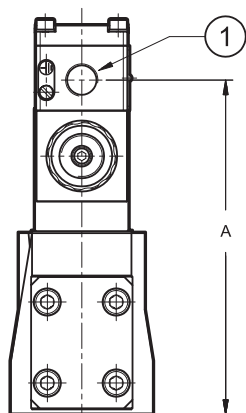
1	Mounting surface with sealing rings: 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Terminal for supplementary earth (GND) connection
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4" BSP
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 13

## 8 - DZCE8K\* OVERALL AND MOUNTING DIMENSIONS



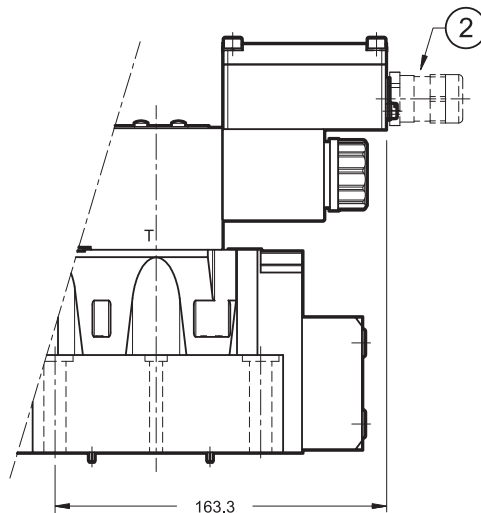
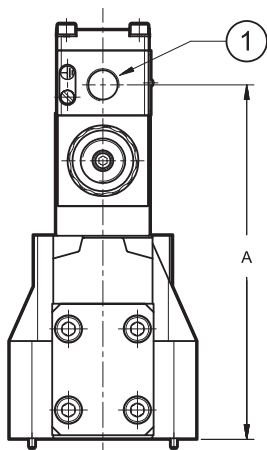
### 9 - DZCE\*K\* WITH SIDE CONNECTION OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



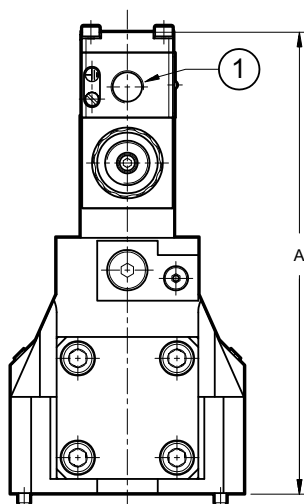
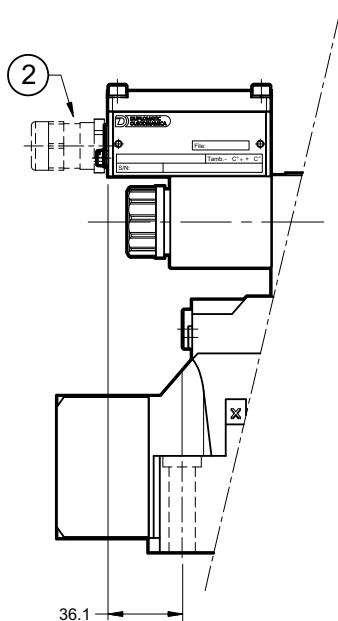
**DZCE5K\*/11\*/K9S\***  
**DZCE5RK\*/11\*/K9S\***

Side port type	Dimension A
<b>S01, S04</b>	180.5
<b>S02, S03</b>	180



**DZCE7K\*/11\*/K9S\***

Side port type	Dimension A
<b>S01, S04</b>	190.5
<b>S02, S03</b>	190



**DZCE8K\*/11\*/K9S\***

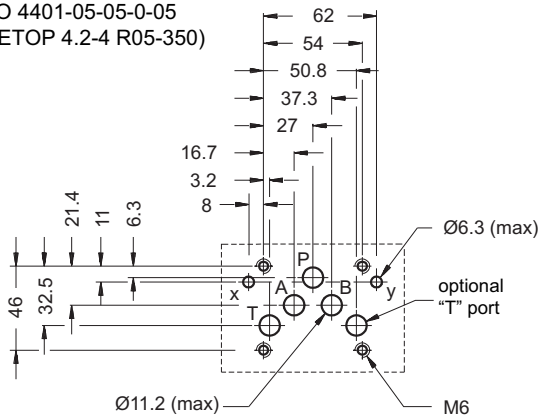
Side port type	Dimension A
<b>S01, S04</b>	226.5
<b>S02, S03</b>	226

1	Side port for cable gland
2	Cable gland. To be ordered separately, see par. 13

## 10 - MOUNTING SURFACES

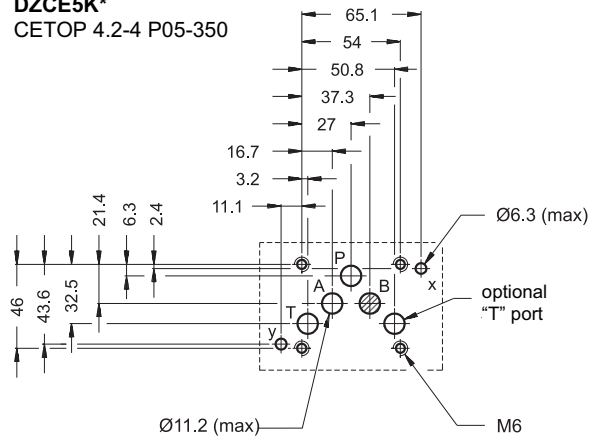
### DZCE5RK\*

ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



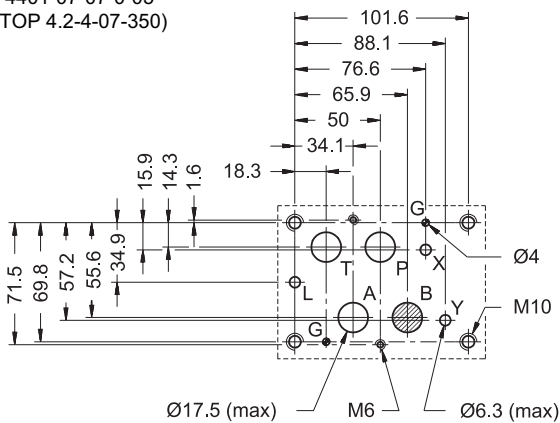
### DZCE5K\*

CETOP 4.2-4 P05-350



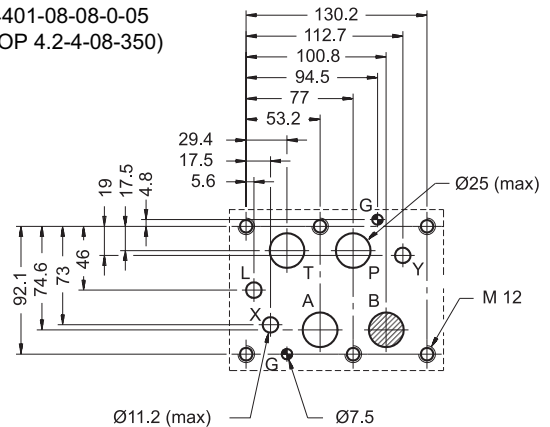
### DZCE7K\*

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



### DZCE8K\*

ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



## 11 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

## 12 - INSTALLATION



**Installation must adhere to instructions reported in the Use and Maintenance manual, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.**

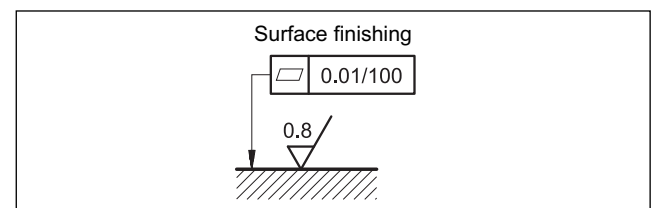
We recommend to install the DZCE\*K\* valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particulars applications, it can be necessary to vent the air entrapped in the solenoid tube, using the special drain screw and then ensure to screw it correctly.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

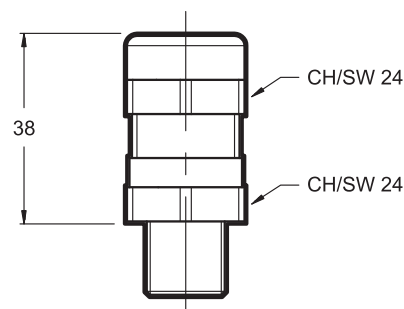




### 13 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø8÷10 mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68



To order the desired cable glands, specify description, code and quantity.

#### Description: CGK2/NB-01/10

Code: 3908108001

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

#### Description: CGK2/NB-02/10

Code: 3908108002

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

#### Description: CGK2/NB-03/10

Code: 3908108003

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque: 20 ÷ 25 Nm

#### Description: CGK2/NB-04/10

Code: 3908108004

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque: 45 ÷ 50 Nm

### 14 - ELECTRONIC CONTROL UNITS

EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

**NOTE: electronic control units offered are not explosion-proof certified; therefore, they must be installed outside classified areas.**

### 15 - SUBPLATES

(see catalogue 51 000)

	DZCE5K*	DZCE7K*	DZCE8K*
Type with rear ports	PME4-AI5G	PME07-AI6G	-
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports:	P - T - A - B X - Y	3/4" BSP 1/4" BSP	1 1/2" BSP 1/4" BSP

**NOTE:** Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a rate higher than the value allowed by norms according to ATEX directive for category II 2GD and I M2.

The user will bear to do the complete assessment of the ignition risk that can occur from the relative use in potentially explosive environments.



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# EXPLOSION-PROOF CLASSIFICATION

## for

### SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

#### pressure valves

<b>RQM*K*-P</b>	<b>21 515</b>
<b>PRE(D)*K*</b>	<b>81 315</b>
<b>ZDE3K*</b>	<b>81 515</b>
<b>DZCE*K*</b>	<b>81 605</b>

#### directional valves

<b>D*K*</b>	<b>41 515</b>
<b>DS(P)E*K*</b>	<b>83 510</b>

#### GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

<b>ATEX</b>	<b>II 2G</b>	<b>II 2D</b>	<b>I M2</b>
<b>IECEX</b>	<b>Gb</b>	<b>Db</b>	<b>Mb</b>
<b>INMETRO</b>	<b>Gb</b>	<b>Db</b>	<b>Mb</b>

Instructions for use and maintenance can be found in the related manuals, always supplied together with valves.



## 1 - ATEX CLASSIFICATION AND TEMPERATURES

Diplomatic certifies the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

### 1.1 - ATEX classification for valves

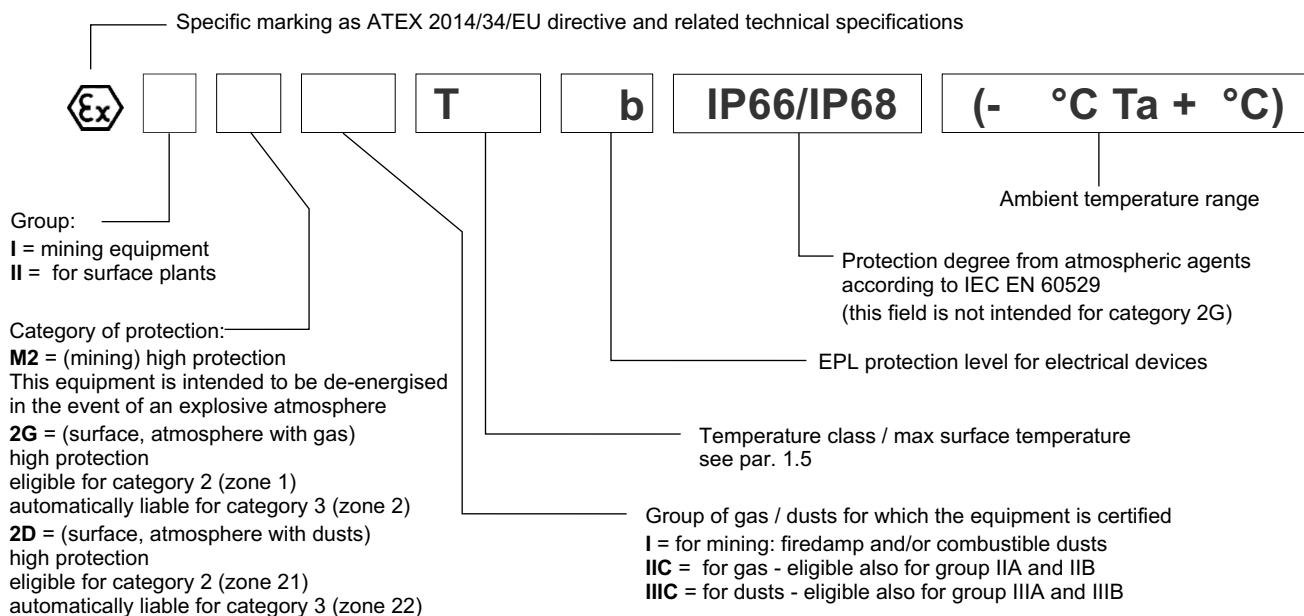
Type examination certificate: CEC 13 ATEX 030-REV.2

The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	<b>*KD2</b>	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	<b>*KDM2</b>	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

### 1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
<b>*KD2</b>	for gas	II 2G IIC T4 Gb (-20°C Ta +80°C)	II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
<b>*KD2 /T5</b>	for gas	II 2G IIC T5 Gb (-20°C Ta +55°C)	II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
<b>*KDM2</b>	mining	I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)










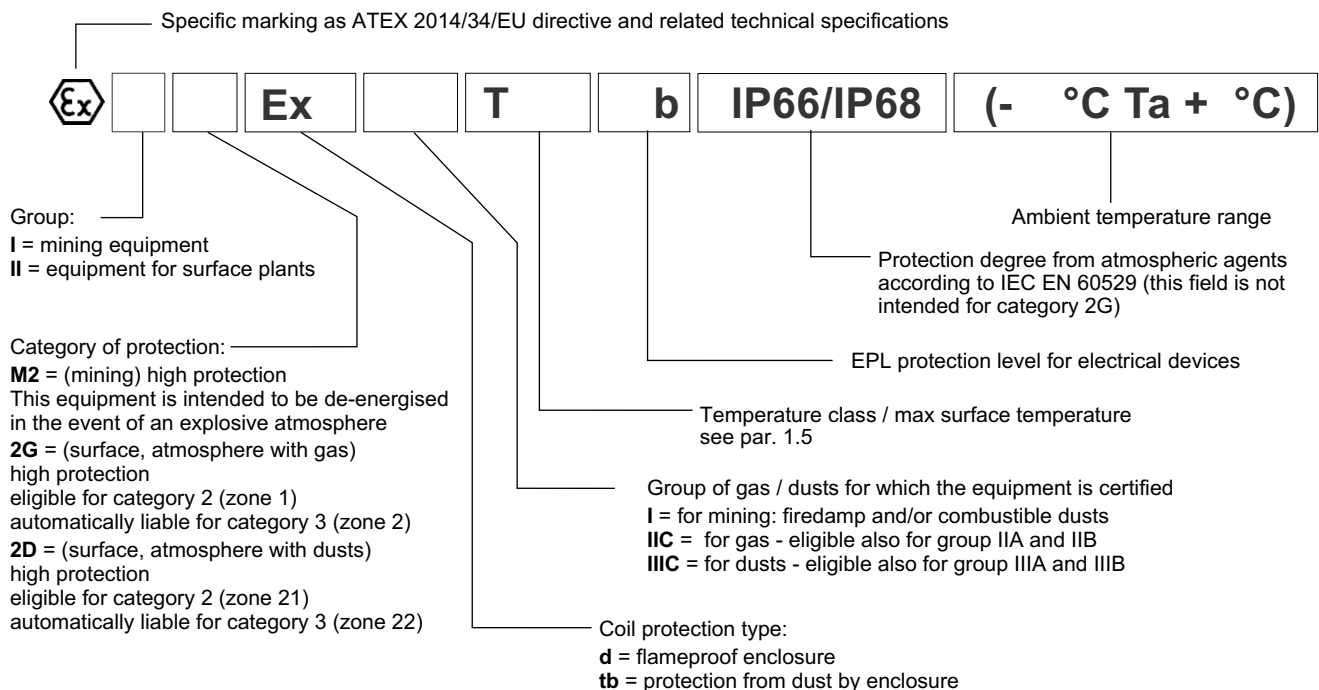
### 1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself and as such is identified with its own tag, carries the relative ATEX marking. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex d" type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

### 1.4 - ATEX marking on coils

for valve type <b>*KD2</b>	for gas	 II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	 II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type <b>*KD2 /T5</b>	for gas	 II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	 II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type <b>*KDM2</b>	mining	 I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



### 1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	<b>*KD2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas)	T3, T2, T1 T200°C and higher
		of fluid			T154°C (dusts)	
	<b>*KD2 /T5</b>	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas)	T4, T3, T2, T1 T135°C and higher
		of fluid			T129°C (dusts)	
ATEX I M2	<b>*KDM2</b>	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				





## 2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Diplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex db" type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

### 2.1 - IECEx classification

Certificate of conformity (CoC): IECEx TUN 15.0028X

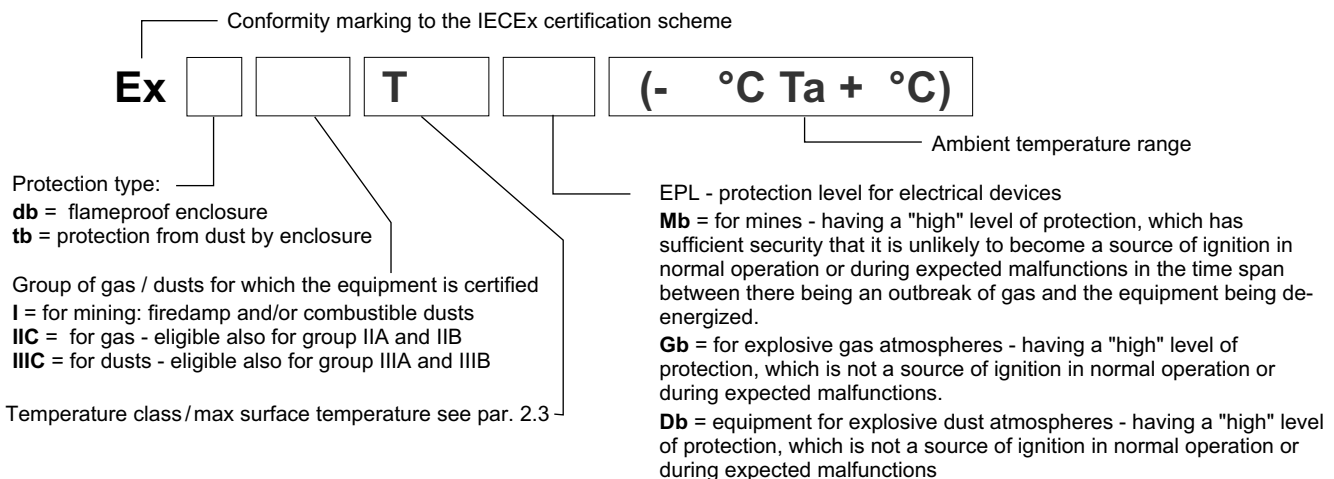
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	<b>*KXD2</b>	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	<b>*KXDM2</b>	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

### 2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

<b>*KXD2</b> valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
<b>*KXD2 /T5</b> valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
<b>*KDM2</b> valves	mining	Ex db I Mb (-40°C Ta +80°C)



### 2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	<b>*KXD2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	<b>*KXD2 /T5</b>	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	<b>*KXDM2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				



### 3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex d" type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

#### 3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X

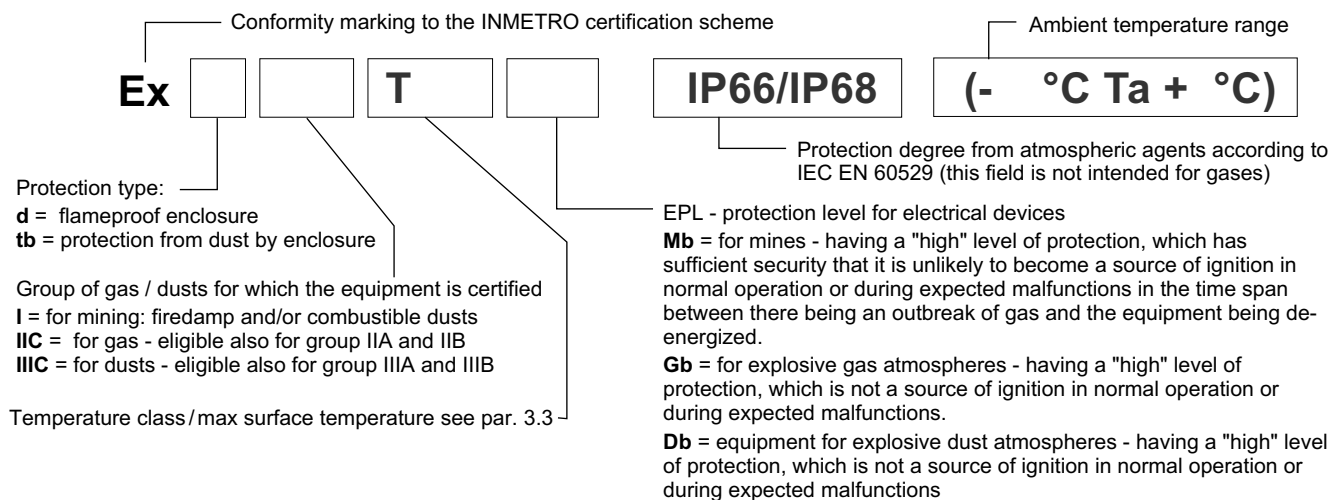
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	<b>*KBD2</b>	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	<b>*KBDM2</b>	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

#### 3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

<b>*KBD2</b> valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
<b>*KBD2 /T5</b> valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
<b>*KBDM2</b> valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)



#### 3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
INMETRO Gb INMETRO Db	<b>*KBD2</b>	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas)	T3, T2, T1 T200°C and higher
		of fluid			T154°C (dusts)	
	<b>*KBD2 /T5</b>	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas)	T4, T3, T2, T1 T135°C and higher
		of fluid			T129°C (dusts)	
INMETRO Mb	<b>*KBDM2</b>	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				



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# DZCE\*G

## PRESSURE REDUCING VALVES WITH PROPORTIONAL CONTROL AND INTEGRAL ELECTRONICS

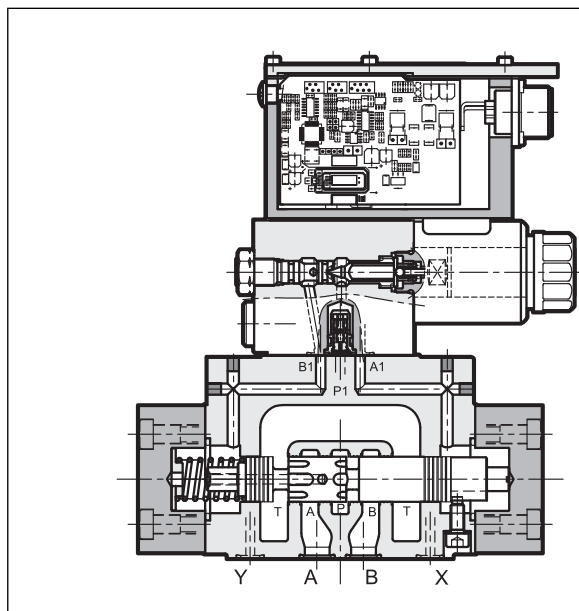
SERIES 31

**DZCE5G**      **CETOP P05**  
**DZCE5RG**    **ISO 4401-05**  
**DZCE7G**      **ISO 4401-07**  
**DZCE8G**      **ISO 4401-08**

**p** max **350** bar

**Q** max (see performance table)

### OPERATING PRINCIPLE



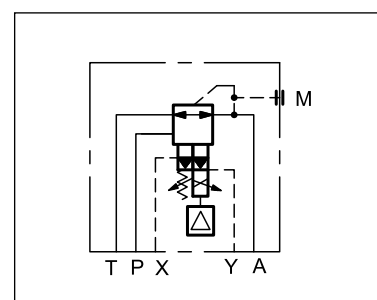
- The DZCE\*G are pressure reducing valves with electric proportional control with integrated electronics, with mounting interface in compliance with ISO 4401 standards.
- Those valves, besides reducing the pressure from line P to working line A, allow the flow to return from the line A to the return line T when a pressure greater than the set value is generated in the downstream circuit (flow path A): a typical case of hydraulic counterweight or load balancing.
- The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.
- A solenoid current monitoring signal is available.
- The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 15.3)

### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C p = 140 bar)

		DZCE5G DZCE5RG	DZCE7G	DZCE8G
Max operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Step response		see paragraph 7		
Hysteresis	% of p <sub>max</sub>	< 2%		
Repeatability	% of p <sub>max</sub>	< ± 2%		
Electrical characteristics		see paragraph 3		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	7,3	9,5	15,6

### HYDRAULIC SYMBOL





## 1 - IDENTIFICATION CODE

<b>D</b>	<b>Z</b>	<b>C</b>	<b>E</b>		<b>G</b>	<b>-</b>	<b>/</b>	<b>31</b>	<b>-</b>		<b>/</b>	<b>K11</b>	
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Pressure reducing valve

Electric proportional control

Nominal size: \_\_\_\_\_  
**5** = CETOP P05  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08

Integrated electronics for open loop

Pressure control range: \_\_\_\_\_  
**070** = 1 ÷ 70 bar  
**140** = 1 ÷ 140 bar  
**210** = 1 ÷ 210 bar  
**300** = 1 ÷ 300 bar

Series No. \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 30 to 39)

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector  
6 pin + PE

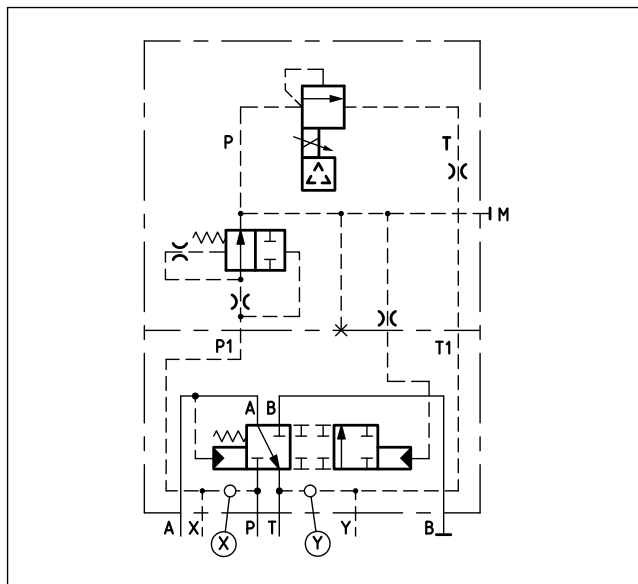
Reference signal:  
**E0** = voltage 0 ÷ 10 V  
**E1** = current 4 ÷ 20 mA

Drainage: **I** = internal  
**E** = external

Piloting: **I** = internal  
**E** = external

Seals:  
**N** = NBR seals for mineral oil (standard)  
**V** = FPM seals for special fluids

## 2 - DETAILED SYMBOL

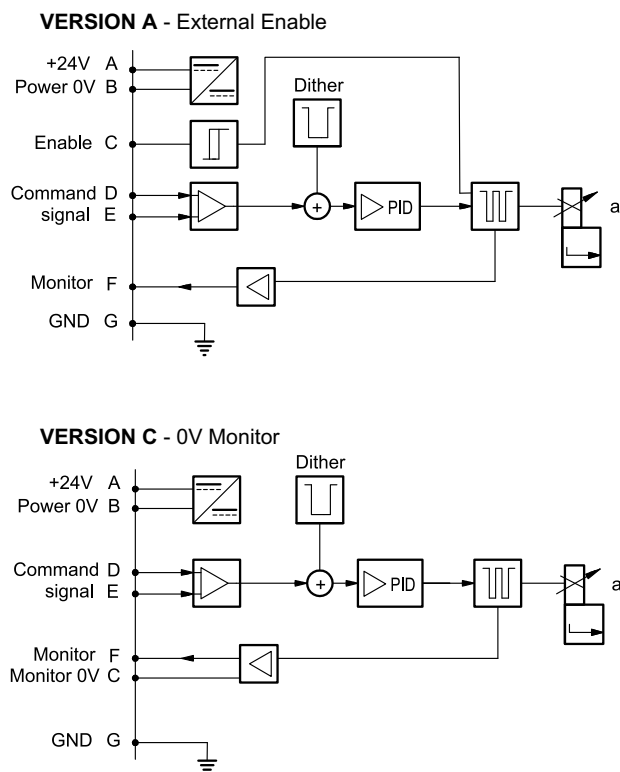


## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

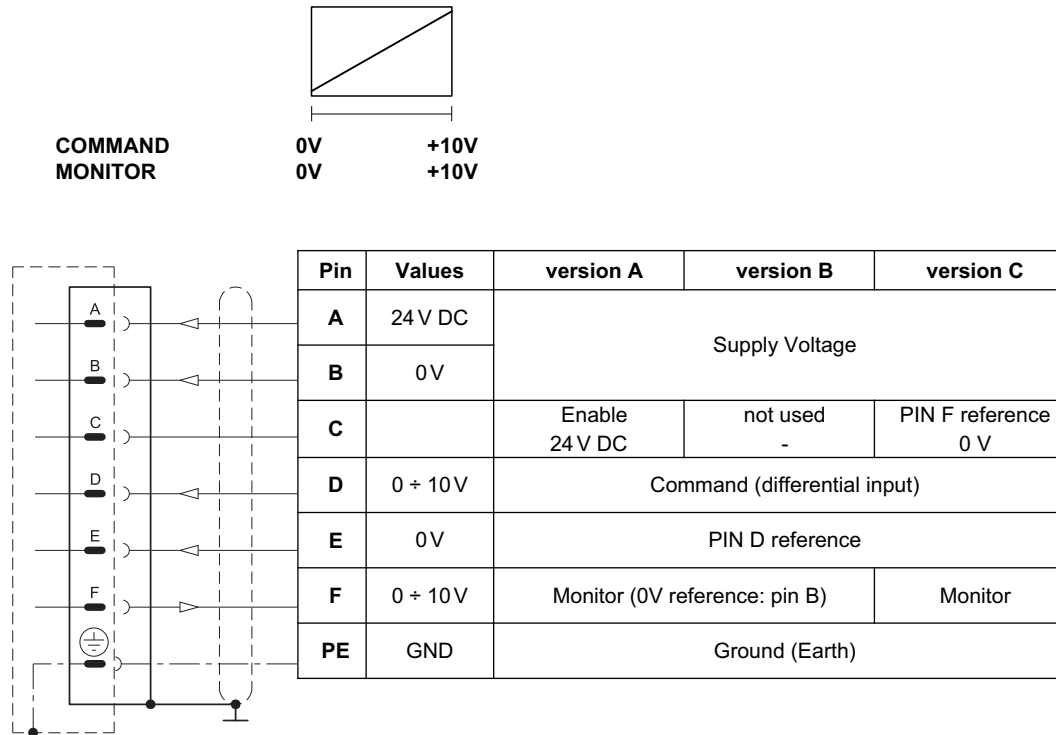
Duty cycle		100% (continuous operation)
Protection class according to IEC 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams



## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

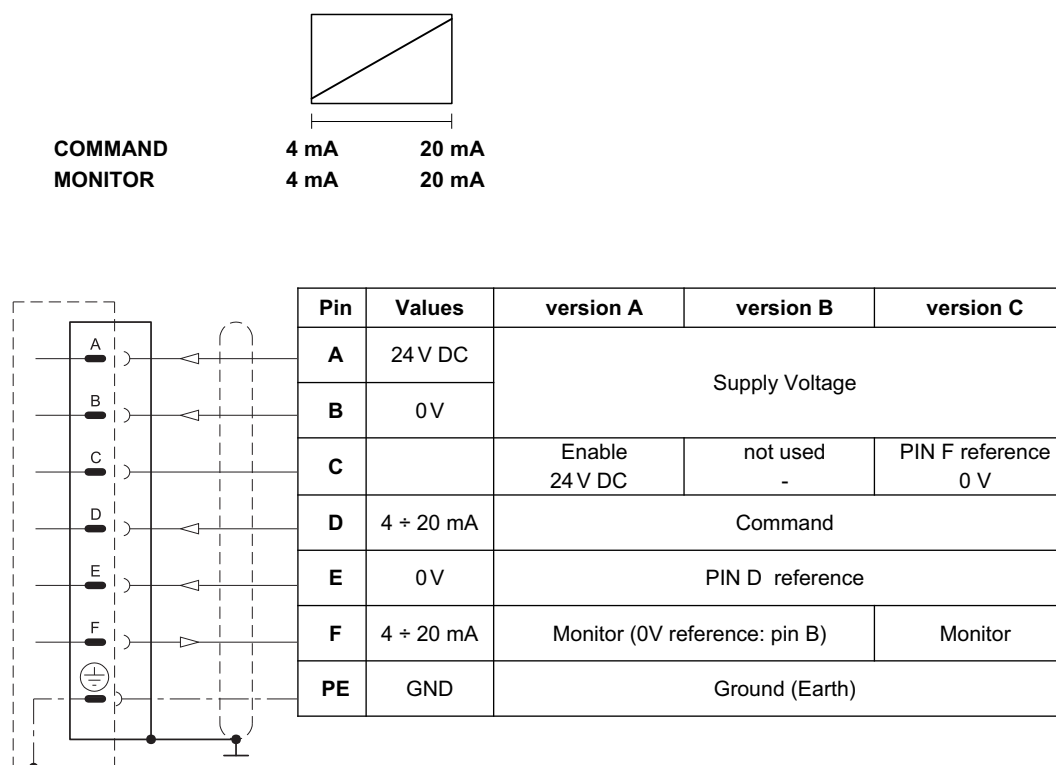
The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.

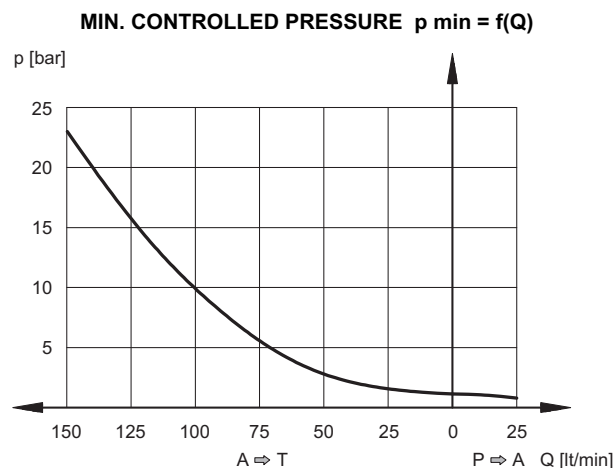
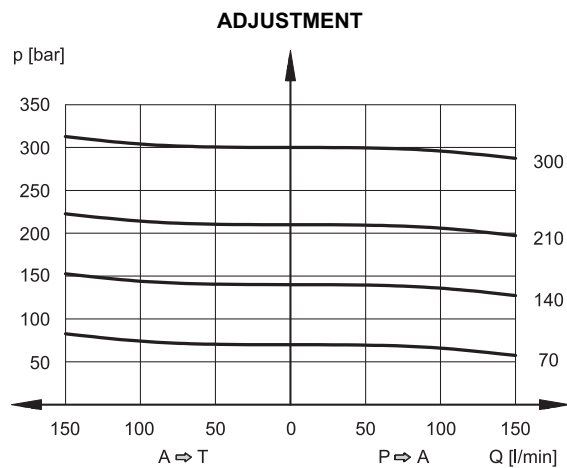




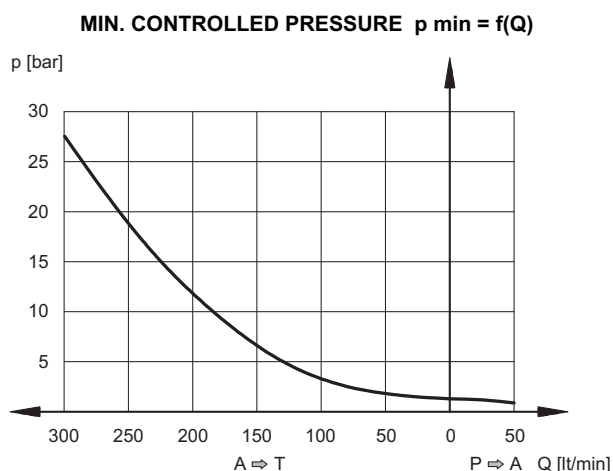
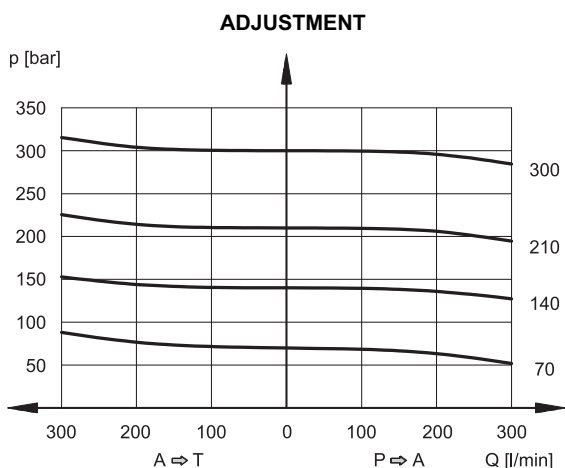
## 6 - CHARACTERISTIC CURVES

(with mineral oil with viscosity of 36 cSt at 50°C)

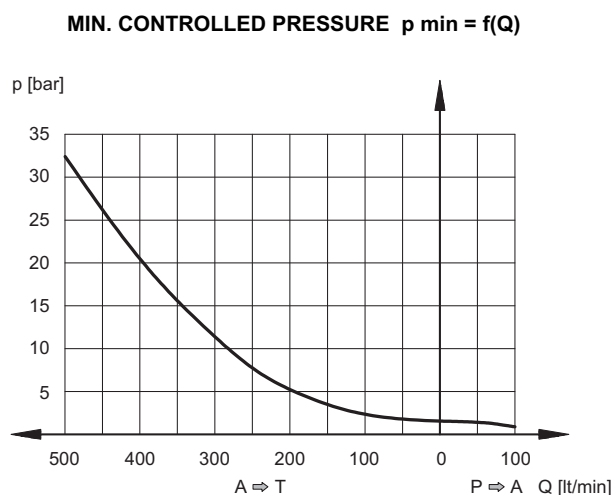
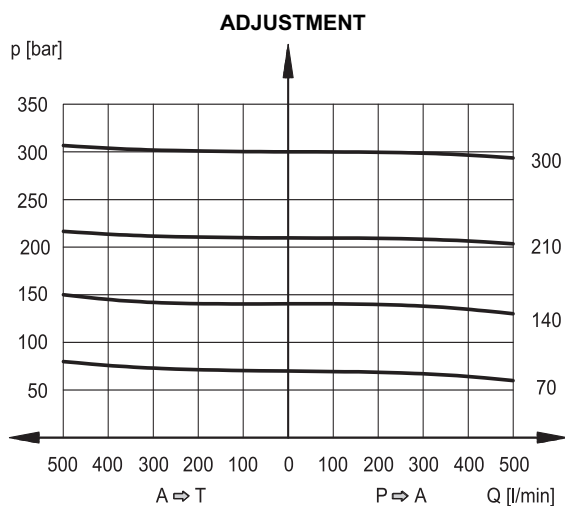
### 6.1 - Characteristic Curves of DZCE5G and DZCE5RG



### 6.2 - Characteristic Curves of DZCE7G



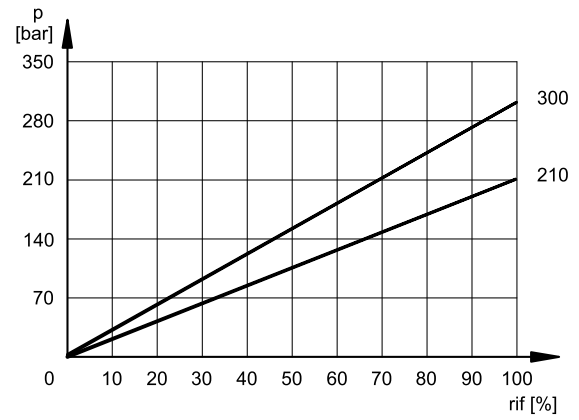
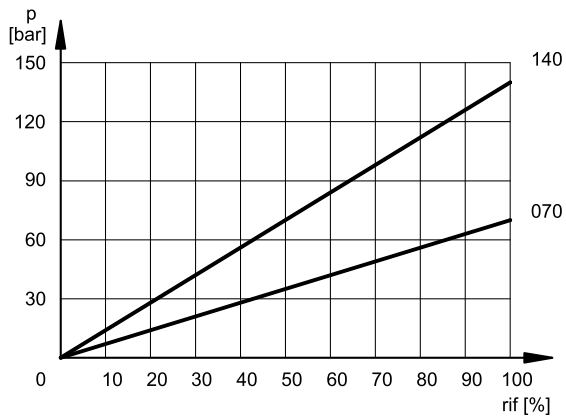
### 6.3 - Characteristic Curves of DZCE8G







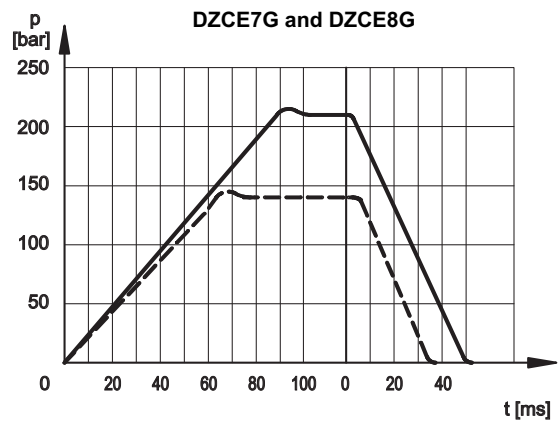
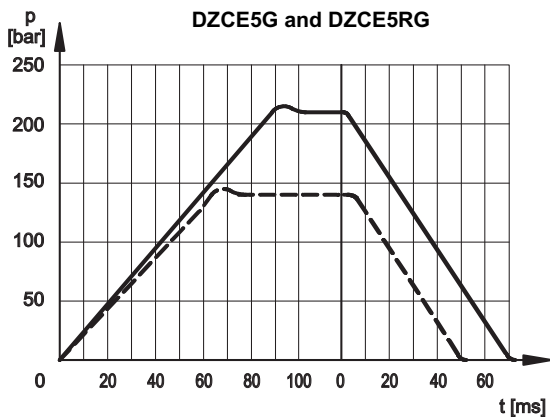
## 6.4 - CONTROLLED PRESSURE $p = f(l)$



## 7 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

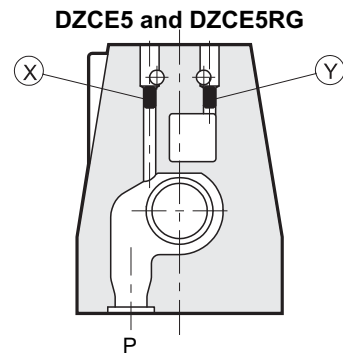
The graphs show the typical step response tested with static pressure 100 bar.



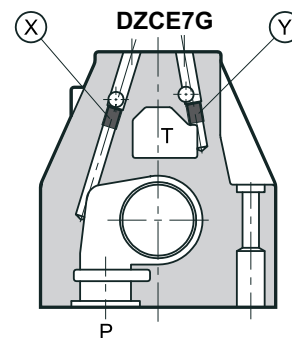
## 8 - PILOTING AND DRAINAGE

The valves are available with piloting and drainage, both internal and external. The version with external drainage allows a higher backpressure on the unloading.

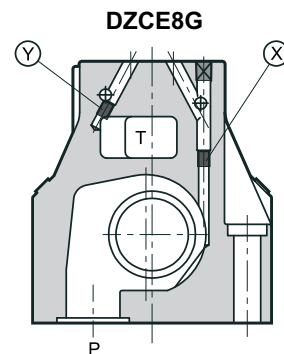
TYPE OF VALVE	Plug assembly	
	X	Y
<b>IE</b> INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b> INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b> EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b> EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO



**X:** M5x6 plug for external pilot  
**Y:** M5x6 plug for external drain

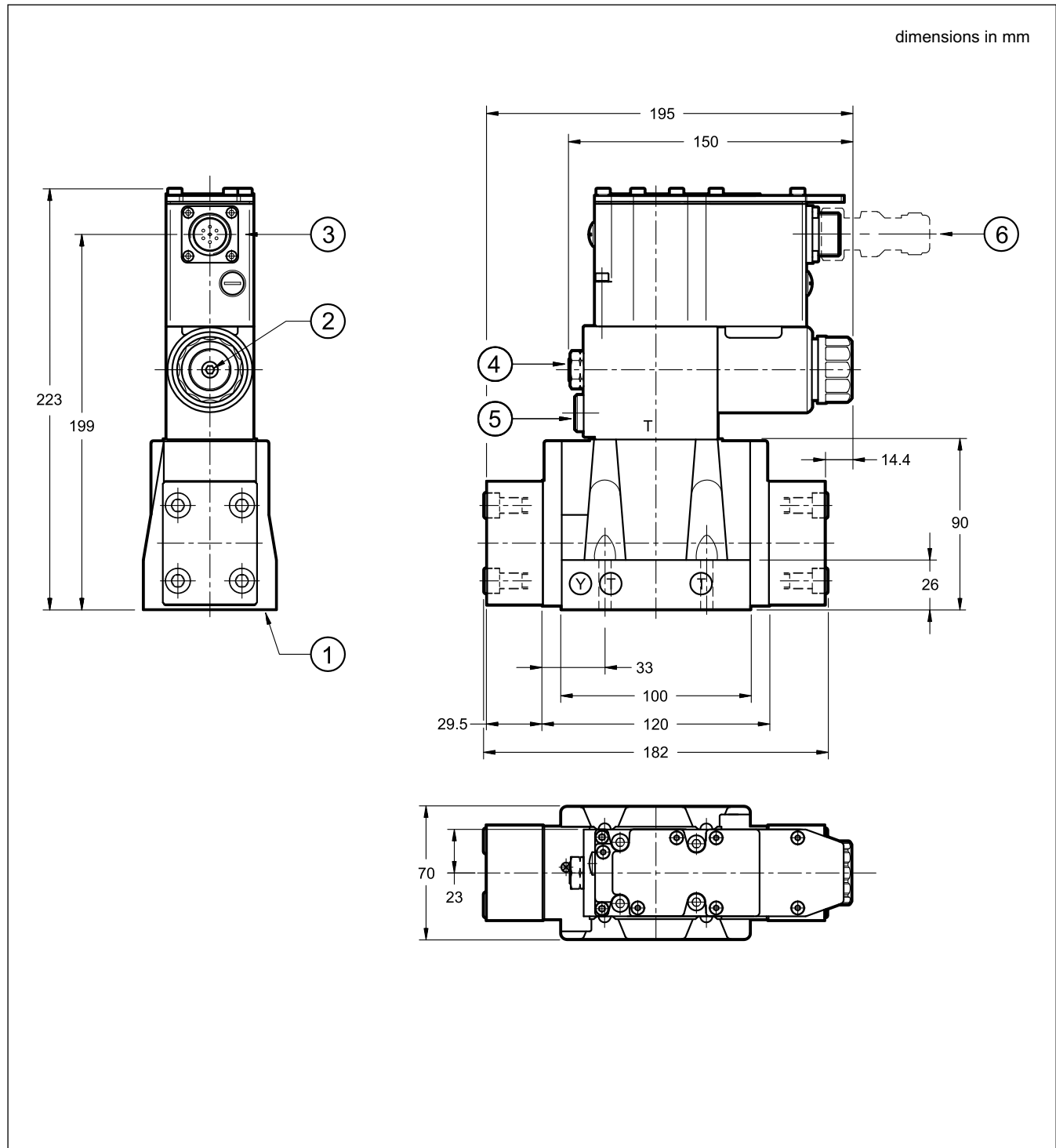


**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

## 9 - OVERALL AND MOUNTING DIMENSIONS DZCE5G AND DZCE5RG



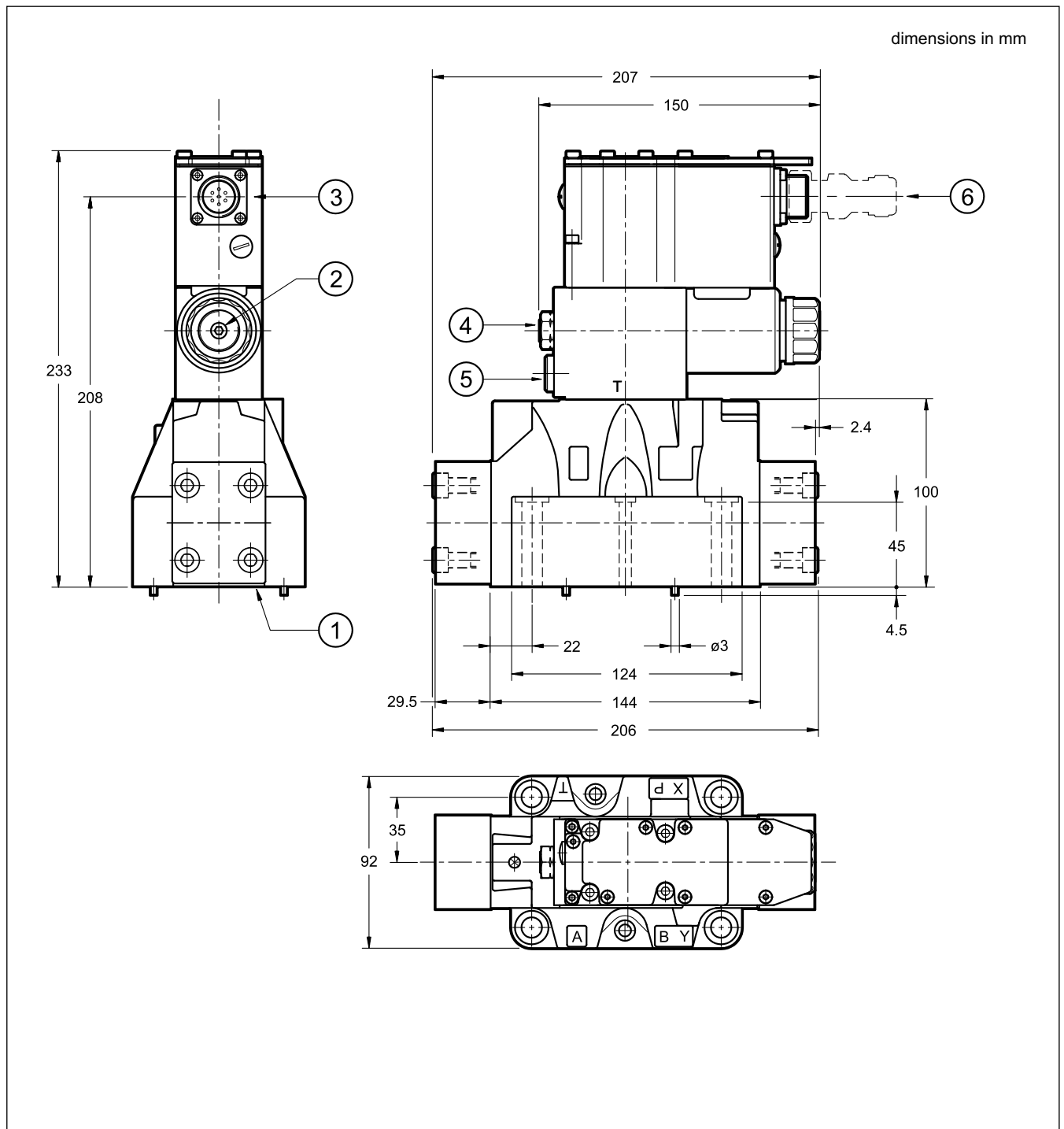
**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Mounting surface shown at paragraph 12.

Valve fastening: N. 4 bolts SHC M6x35 - ISO 4762
Tightening torque: 8 Nm (bolts A 8.8)
Thread of mounting holes: M6x10

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Breather (Allen key 4)
3	Main connection
4	Adjustment seal, set in factory. It is recommended not to unscrew the nut.
5	Pressure gauge port 1/4 BSP"
6	Mating electrical connector <b>to be ordered separately.</b> See at section 15

## 10 - OVERALL AND MOUNTING DIMENSIONS DZCE7G



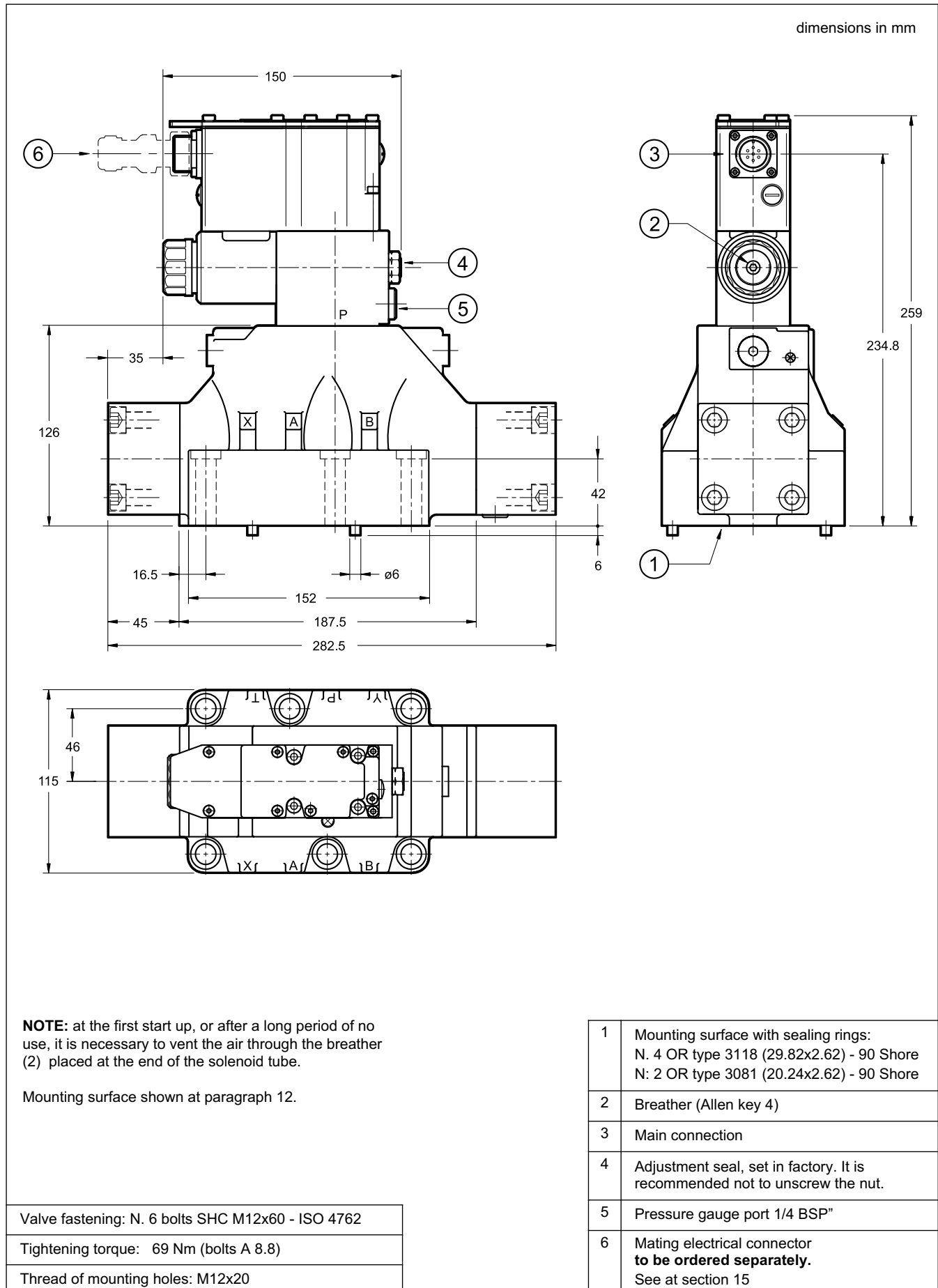
**NOTE:** at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Mounting surface shown at paragraph 12.

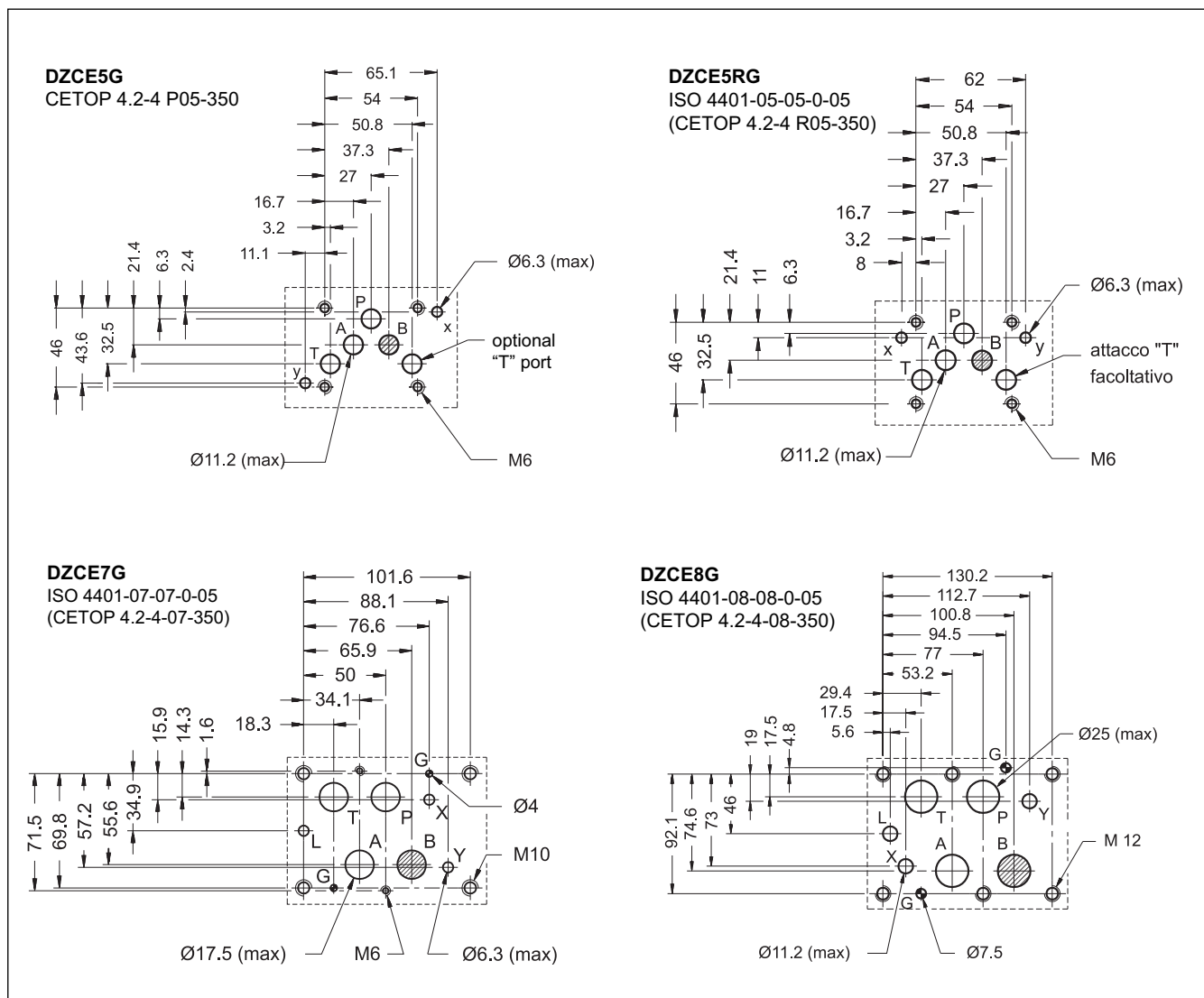
Valve fastening:	N. 4 bolts SHC M10x60 - ISO 4762 N. 2 bolts SHC M6x60 - ISO 4762
Tightening torque:	M10x60: 40 Nm (bolts A 8.8) M6x60: 8 Nm (bolts A 8.8)
Thread of mounting holes:	M6x18; M10x18

1	Mounting surface with sealing rings: N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Breather (Allen key 4)
3	Main connection
4	Adjustment seal, set in factory. It is recommended not to unscrew the nut.
5	Pressure gauge port 1/4 BSP"
6	Mating electrical connector <b>to be ordered separately.</b> See at section 15

## 11 - OVERALL AND MOUNTING DIMENSIONS DZCE8G



## 12 - MOUNTING SURFACES



## 13 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 14 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

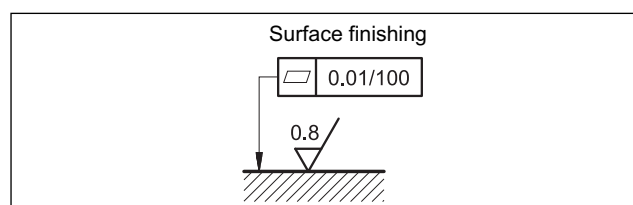
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

**Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.**

**Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.





## 15 - ACCESSORIES

(to be ordered separately)

### 15.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.



So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**

### 15.2 - Connection cables size

Power supply:

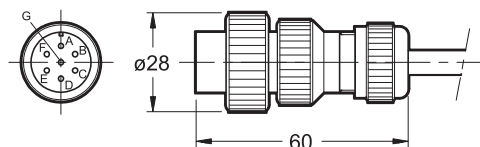
- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 15.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.



## 16 - SUBPLATES

(see catalogue 51 000)

	DZCE5G	DZCE7G	DZCE8G
Type with rear ports	PME4-AI5G	PME07-AI6G	-
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports:	P - T - A - B X - Y	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP



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# RPCED1

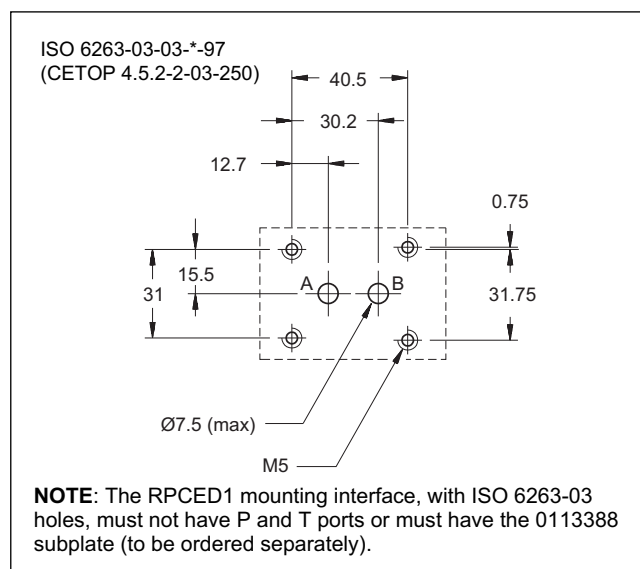
## DIRECT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

### SERIES 52

#### SUBPLATE MOUNTING ISO 6263-03

**p** max **250** bar  
**Q** max (see table of performances)

#### MOUNTING INTERFACE

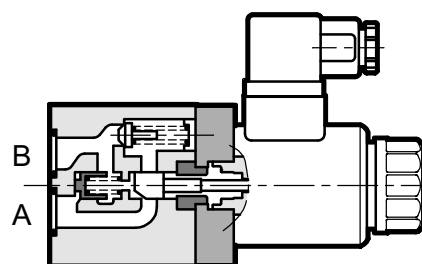


#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

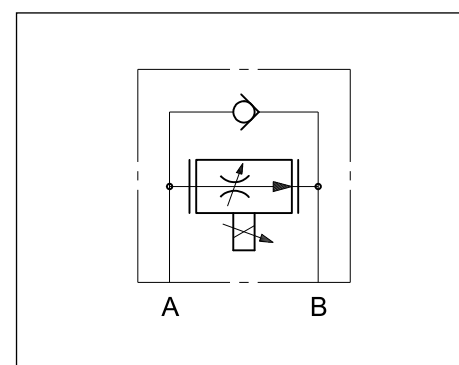
Maximum operating pressure	bar	250
Minimum $\Delta p$ between A and B port		10
Maximum controlled flow	l/min	1,5 - 4 - 8 - 16 - 25
Min. controlled flow (for 1 and 4 l/min. reg.)		0,025
Maximum free-reverse flow		40
Step response	see paragraph 7	
Hysteresis (with PWM 100 Hz)	% of p nom	< 6%
Repeatability	% of p nom	< $\pm 2,5\%$
Electrical characteristic	see paragraph 6	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13 (class 17/15/12 for flows < 0,5 l/min)	
Recommended viscosity	cSt	25
Mass	kg	1,5

#### OPERATING PRINCIPLE



- The RPCED1 valve is a two-way flow control valve with pressure and thermal compensation, electric proportional control, and mounting interface in compliance with ISO 6263 standards.
- It is normally used for flow rate control in hydraulic circuit branches or for speed control of hydraulic actuators.
- Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 10).
- It is available in five flow rate control ranges up to 25 l/min.

#### HYDRAULIC SYMBOLS





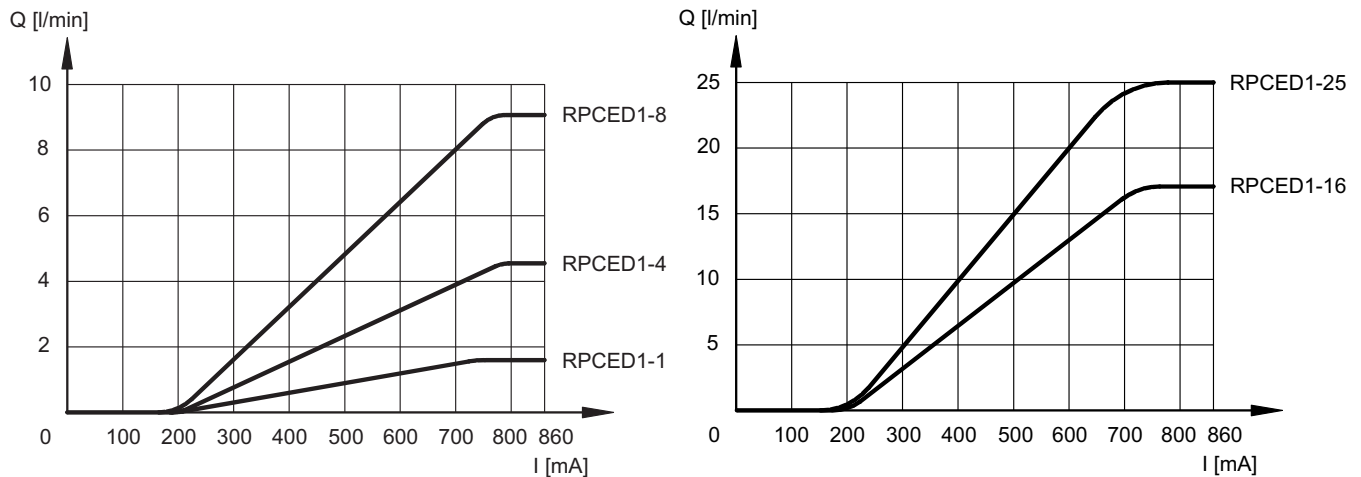
## 1 - IDENTIFICATION CODE

<b>R</b>	<b>P</b>	<b>C</b>	<b>E</b>	<b>D</b>	<b>1</b>	<b>-</b>	<b>/</b>	<b>C</b>	<b>/</b>	<b>52</b>	<b>-</b>	<b>24</b>	<b>/</b>	
Compensated flow control valve				Electric proportional control				Open loop control				Size: ISO 6263-03 (CETOP 03)		
Maximum controlled flow:				Seal: omit for mineral oils <b>V</b> = viton for special fluids				Nominal solenoid voltage 24 V DC				Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)		
<b>1</b> = 1,5 l/min				<b>8</b> = 8 l/min				<b>25</b> = 25 l/min				Built-in check valve		
<b>4</b> = 4 l/min				<b>16</b> = 16 l/min										

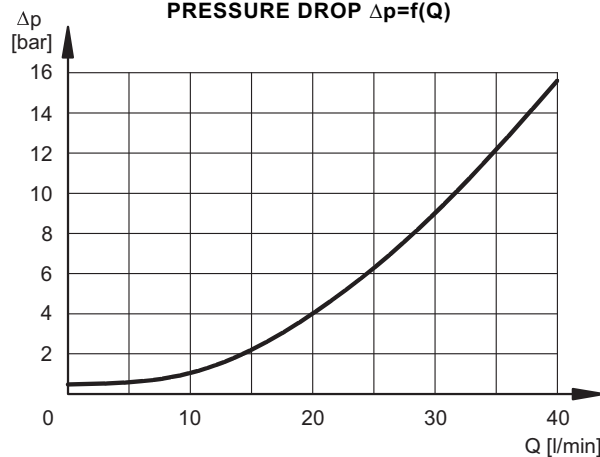
## 2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

Typical curves for flow rate A → B according to the current supplied to the solenoid for controlled flow rate of: 1- 4 - 8 - 16 - 25 l/min.

FLOW CONTROL  $Q=f(I)$



PRESSURE DROP  $\Delta p=f(Q)$



Pressure drop with free flow B → A through check valve.

### 3 - PRESSURE COMPENSATION

The valves are equipped with two restrictors in series. The first one is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance limit of  $\pm 2\%$  of the full scale flow rate for maximum pressure variation between the valve inlet and outlet chambers.

### 4 - THERMAL COMPENSATION

Thermal compensation of the valve is obtained by adopting the principle of restricted fluid passage, so that the fluid is not influenced significantly by variations in oil viscosity.

For controlled flow rates of lower than 0.5 l/min and with a temperature change of 30°C, flow rate varies by approx. 13% of the set value. For higher flow rates and with the same temperature change the flow rate variation is <4% of the set flow rate.

### 5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 6 - ELECTRICAL CHARACTERISTICS

#### 6.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	24
RESISTANCE (at 20°C)	$\Omega$	17.6
MAXIMUM CURRENT	A	0.86
DUTY CYCLE		100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

#### 7 - STEP RESPONSE (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal. The table illustrates typical response times with valve flow rate of 16 l/min and with input pressure of 100 bar.

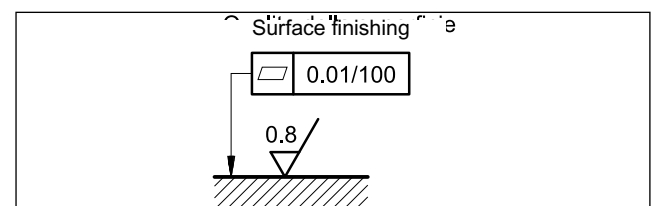
REFERENCE SIGNAL STEP	0 → 100%	100 → 0%	25→75%	75→25%
Step response [ms]	60	80	50	70

### 8 - INSTALLATION

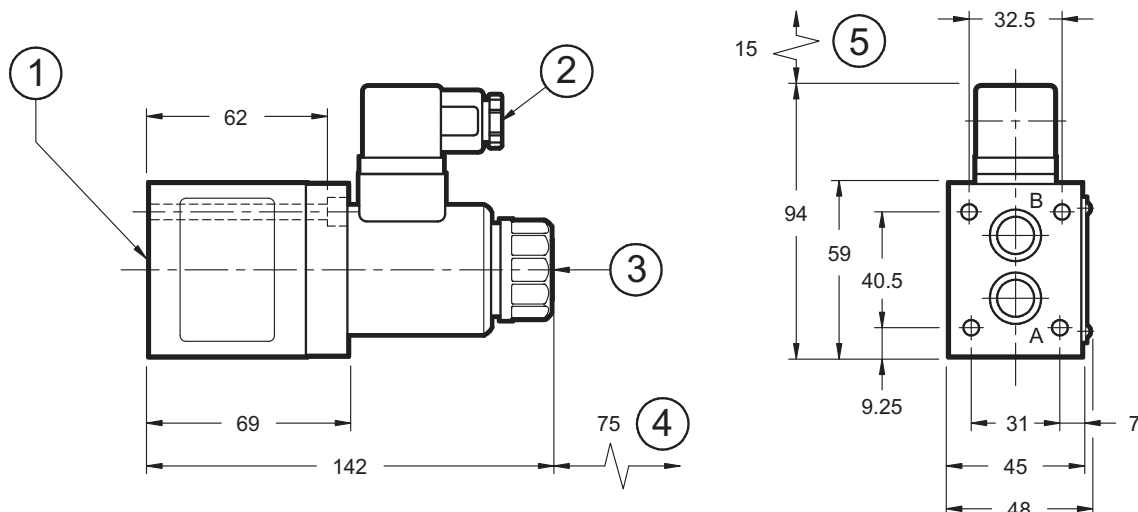
RPCED1 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.



## 9 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

Fastening bolts: 4 bolts M5x70  
Torque: 5 Nm

1	Mounting surface with sealing rings: 2 ORM-0140-20 (14x2)
2	Coil electrical connector DIN 43650
3	Manual override control
4	Coil removal space
5	Connector removal space

## 10 - ELECTRONIC CONTROL UNITS

<b>EDC-111</b>	for solenoid 24V DC	plug version	see cat.89 120
<b>EDM-M111</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

## 11 - SUBPLATES (see cat. 51 000)

Type	PMRPC1-AL3G ports on rear PMRPC1-AL3G side ports
Port dimensions	3/8" BSP



# RPCED1-\*/T3

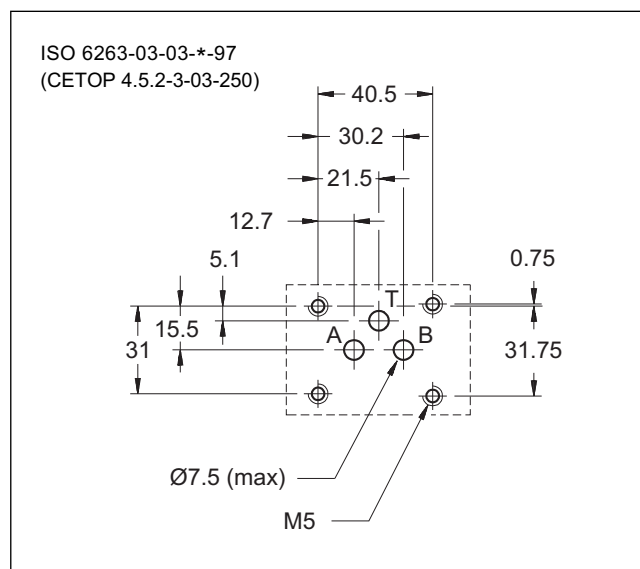
## THREE-WAY DIRECT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

SERIES 52

**SUBPLATE MOUNTING**  
**ISO 6263-03**

**p** max **250** bar  
**Q** max (see table of performances)

### MOUNTING INTERFACE



### OPERATING PRINCIPLE

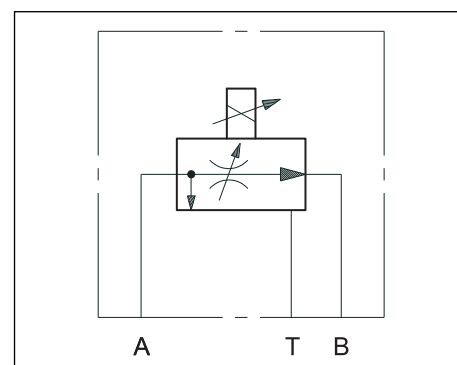
- RPCED1-\*/T3 is a three-way flow control valve, pressure and temperature compensated with electric proportional control and mounting interface in compliance with ISO 6263 standards.
- This valve controls the flow to the circuit, by dumping the exceeding oil flow to the tank.
- Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 10).
- It is available in five flow rate control ranges up to 25 l/min.

### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Maximum operating pressure	bar	250
Minimum $\Delta p$ between A and B port		8
Maximum controlled flow	l/min	1,5 - 4 - 8 - 16 - 25
Min. controlled flow (for 1 and 4 l/min. reg.)		0,025
Step response	see paragraph 7	
Hysteresis (PWM 100)	% of Q max	< 6%
Repeatability	% of Q max	< $\pm 2,5\%$
Electrical characteristic	see paragraph 6	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13 (class 17/15/12 for flows < 0,5 l/min)	
Recommended viscosity	cSt	25
Mass	kg	1,5

### HYDRAULIC SYMBOL

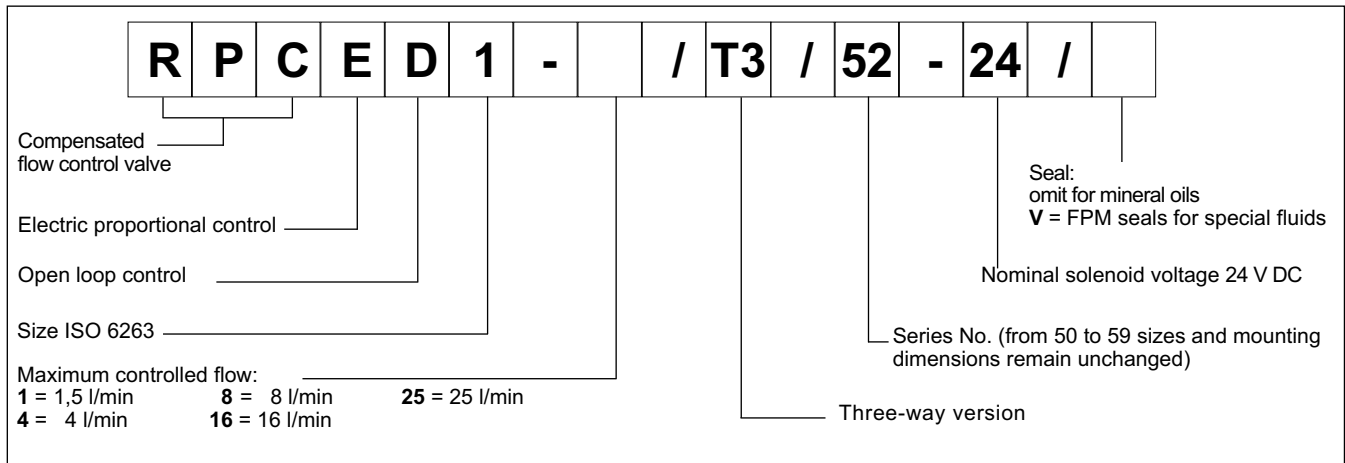




# RPCED1-\*/T3

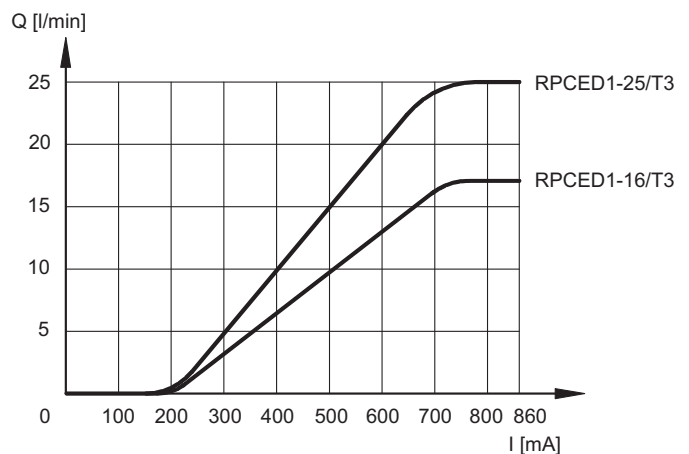
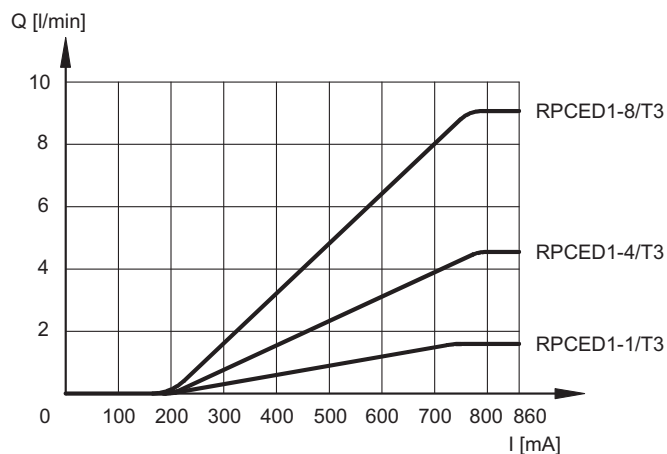
## SERIES 52

### 1 - IDENTIFICATION CODE



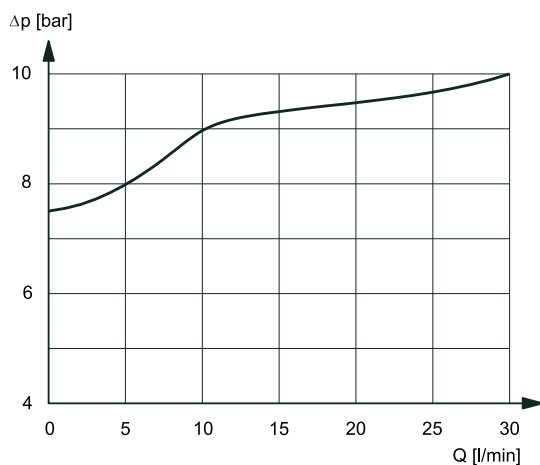
### 2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

FLOW CONTROL  $Q = f(I)$



Typical curves for flow rate A→B according to the current supplied to the solenoid for controlled flow rate of: 1 - 4 - 8 - 16 - 25 l/min.

PRESSURE DROP  $\Delta p = f(Q)$



Pressure drop with flow A → T through the compensator.



### 3 - PRESSURE COMPENSATION

The valves are equipped with two restrictors. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance limit of  $\pm 2\%$  of the set flow rate for maximum pressure variation between the valve inlet and outlet chambers.

### 4 - THERMAL COMPENSATION

Thermal compensation of the valve is obtained by adopting the principle of restricted fluid passage, so that the fluid is not influenced significantly by variations in oil viscosity.

For controlled flow rates of lower than 0.5 l/min and with a temperature change of 30°C, flow rate varies by approx. 13% of the set value.

For higher flow rates and with the same temperature change the flow rate variation is <4% of the set flow rate.

### 5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 6 - ELECTRICAL CHARACTERISTICS

#### 6.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	24
RESISTANCE (at 20°C)	$\Omega$	17.6
MAXIMUM CURRENT	A	0.86
DUTY CYCLE		100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

**7 - STEP RESPONSE** (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical response times with valve flow rate of 16 l/min and with input pressure of 100 bar.

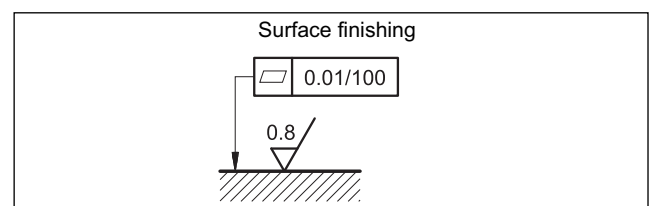
REFERENCE SIGNAL STEP	0 → 100%	100 → 0%	25→75%	75→25%
Step response [ms]	60	80	50	70

### 8 - INSTALLATION

RPCED1-\*/T3 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

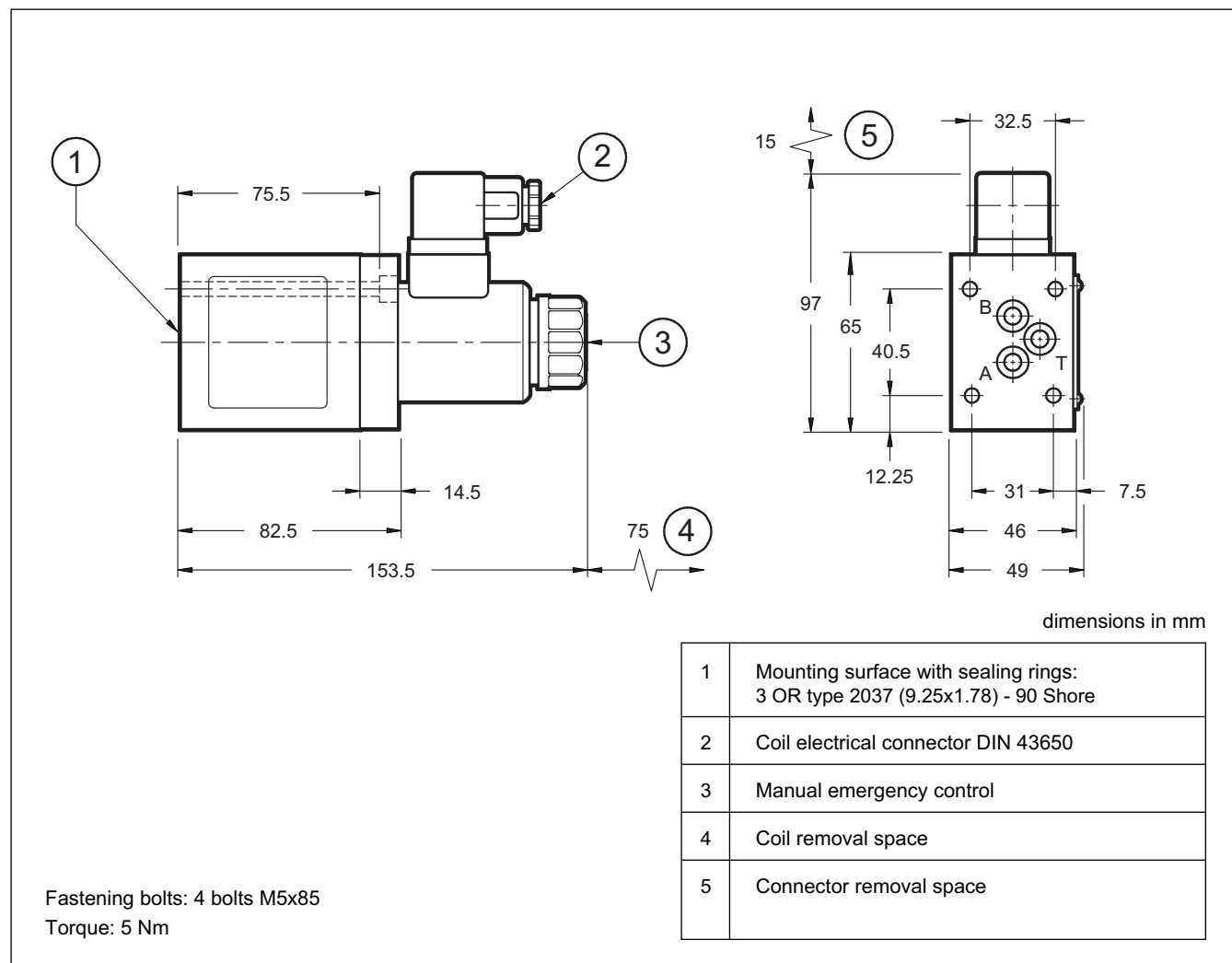




# RPCED1-\*/T3

## SERIES 52

### 9 - OVERALL AND MOUNTING DIMENSIONS



### 10 - ELECTRONIC CONTROL UNITS

EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

### 11 - SUBPLATES (see cat. 51 000)

Type	PMMD-AI3G rear ports with user P plugged PMMD-AL3G side ports with user P plugged
Port dimensions	3/8" BSP



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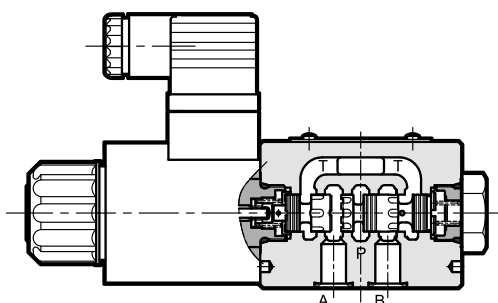
# QDE\*

## PROPORTIONAL FLOW CONTROL VALVE WITH COMPENSATION SERIES 11

**SUBPLATE MOUNTING**  
**ISO 6263-03**  
**ISO 4401-05**

**p max 250 bar**  
**Q max 80 l/min**

### OPERATING PRINCIPLE



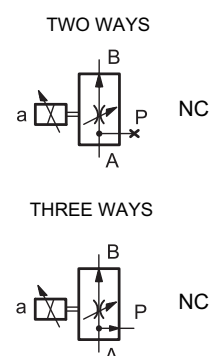
- QDE\* are compensated flow control valves with pressure compensation and proportional electric control, with mounting surface according to ISO 6263-03 and ISO 4401-05, supplied with 2 or 3 way design, depending on the use of port P.
- This valve is used for the flow control in branches of a hydraulic circuit or for the speed control of hydraulic cylinders.
- The valve can be controlled directly by a current control supply unit or by means of an electronic control unit, to exploit valve performance to the full (see paragraph 13).
- QDE\* valves are available in two sizes, for 5 flow adjustment ranges of up to 80 l/min.
- The valve body is zinc-nickel coated.

### PERFORMANCES

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

		QDE3				QDE5
Maximum operating pressure	bar	250				250
Controlled flow (Q <sub>B</sub> )	l/min	14	20	30	40	80
Max input flow (Q <sub>A</sub> ) (3-way)	l/min	40	50	40	50	90
Spring setting in pressure compensator	bar	4	8	4	8	8
Minimum pressure drop A > B	bar	10	22	10	22	22
Hysteresis	% of Q <sub>max</sub>	< 6 %				
Repeatability	% of Q <sub>max</sub>	< ± 1,5 %				< ± 2 %
Electrical characteristics		see paragraph 5				
Fluid temperature range	°C	-20 / +60				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		according to ISO 4406:1999 class 18/16/13				
Recommended viscosity	cSt	25				
Mass	kg	1,4				4,4

### HYDRAULIC SYMBOLS







## 1 - IDENTIFICATION CODE

Q	D	E		-		/	11		-			/	
---	---	---	--	---	--	---	----	--	---	--	--	---	--

Flow control valve direct operated  
Electric proportional control

Size: \_\_\_\_\_  
3 = ISO 6263-03  
5 = ISO 4401-05

Controlled flow: \_\_\_\_\_  
QDE3                      QDE5  
14 = 14 l/min              80 = 80 l/min  
20 = 20 l/min  
30 = 30 l/min  
40 = 40 l/min

Option: manual override  
(see at par. 10)

Coil electrical connection:  
**K1** = plug for connector type  
EN 175301-803 (ex DIN 43650)  
(**standard**)  
**K7** = plug for connector type  
DEUTSCH DT04-2P male

**D12** = Nominal solenoid voltage 12V DC  
**D24** = Nominal solenoid voltage 24V DC

Seals:  
**N** = NBR seals (**standard**)  
**V** = FPM seals for special fluids

Series no. (from 10 to 19 sizes and mounting  
dimensions remains unchanged)

**NOTE:** The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to **240** hours.  
(test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).  
For a salt spray resistance up to 600 hours order the high corrosion resistance version.

### 1.1 - QDE3: high corrosion resistance version

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600** hours (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are specific for this version, featuring a zinc-nickel surface treatment. The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it:

Q	D	E	3	-		/	11		-			/		/	W7
---	---	---	---	---	--	---	----	--	---	--	--	---	--	---	----

Choices as in standard \_\_\_\_\_  
identification code

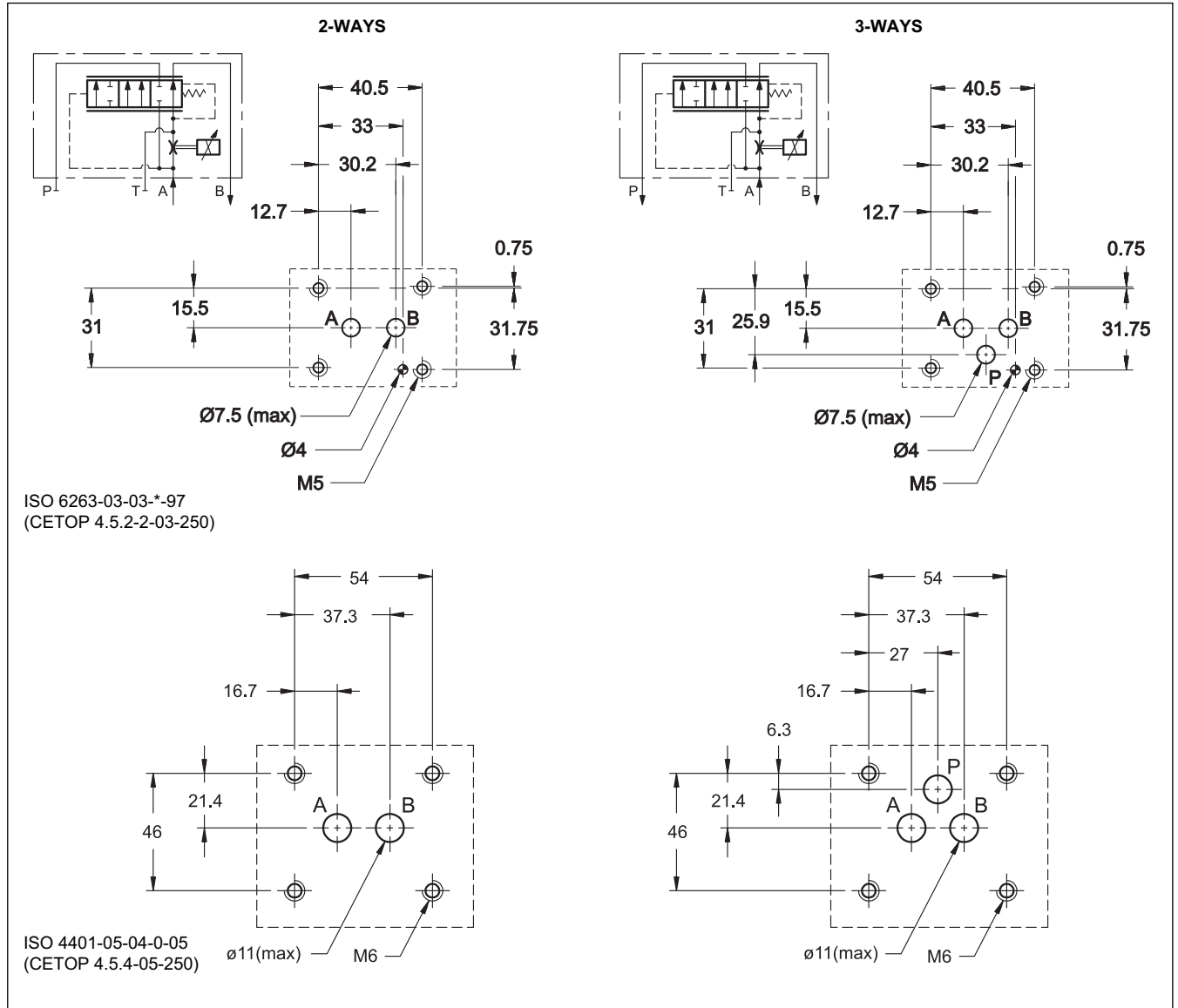
Coil electrical connection \_\_\_\_\_  
**WK1** = plug for connector type EN 175301-803  
(ex DIN 43650)  
**WK7** = plug DEUTSCH DT04-2P,  
for male connector type DEUTSCH DT06-2S.

Manual override:  
(see at par. 10)  
**CM** = manual override, boot  
protected (**standard**)  
**CK1** = knob manual override

## 2 - CONFIGURATIONS AND MOUNTING INTERFACE

The function of two or three ways is obtained realizing the mounting interface according to ISO 6263-03 for QDE3 and ISO 4401-05 for QDE5, using the port P for three way configuration only. The port T will never be used.

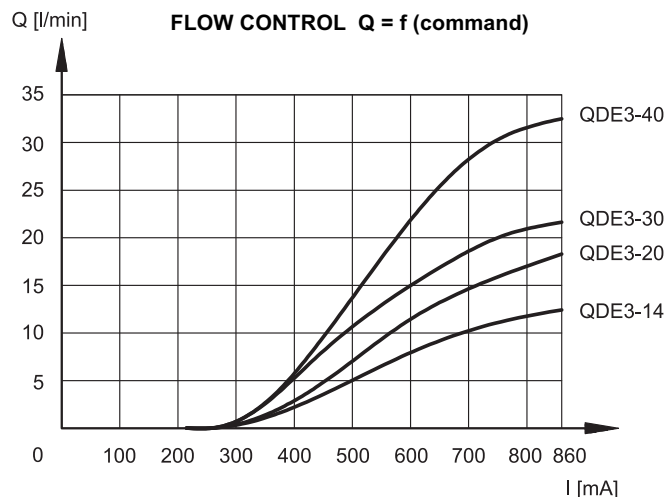
To use the valve in two ways for QDE3 is also possible to interpose a subplate with plug (code 0113388 and 0530384) be ordered separately.



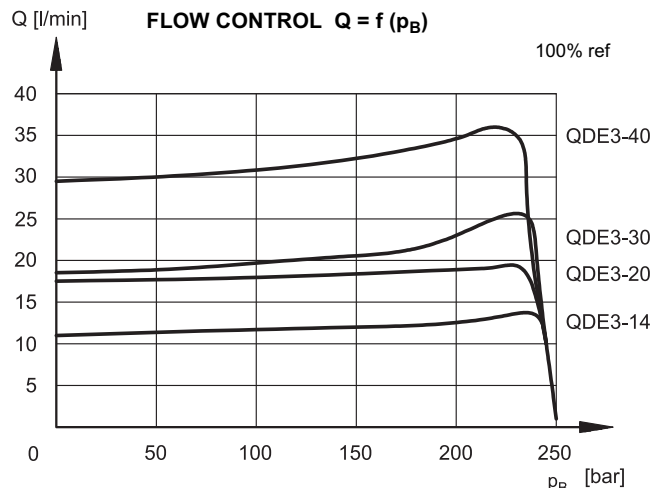
### 3 - CHARACTERISTIC CURVES QDE3

(obtained with viscosity of 36 cSt at 50°C)

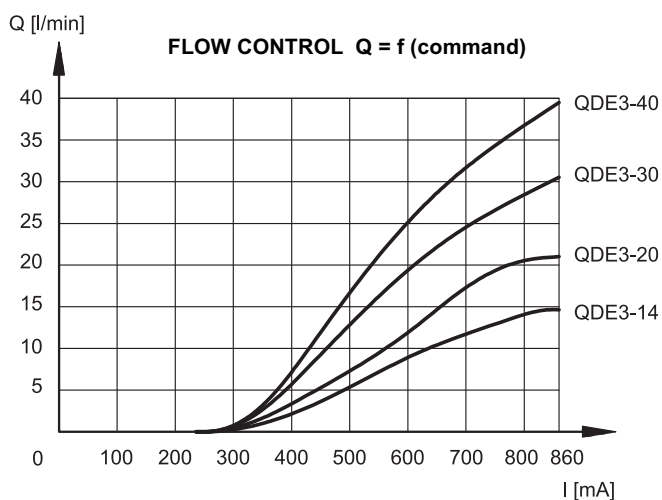
#### 3.1 - Two ways



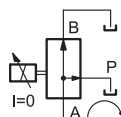
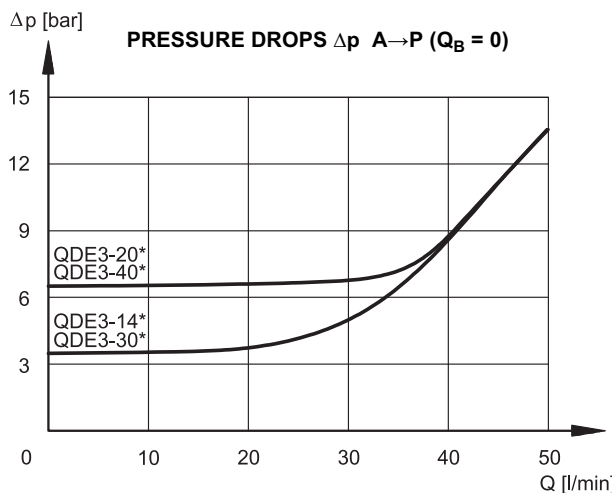
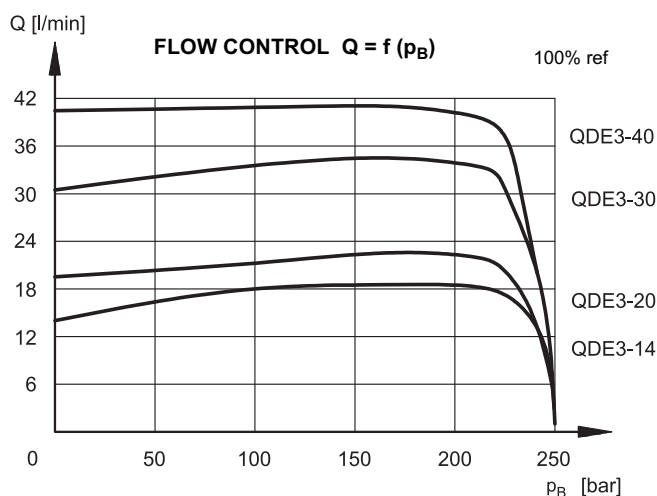
Typical flow rate characteristics A → B for controlled flow rate:  
14 - 20 - 30 - 40 l/min in function of the current supplied to the solenoid (D24 version, maximum current 860 mA, PWM 100 Hz)



#### 3.2 - Three ways



Typical flow rate characteristics A → B for controlled flow rate:  
14 - 20 - 30 - 40 l/min in function of the current supplied to the solenoid (D24 version, maximum current 860 mA, PWM 100 Hz)

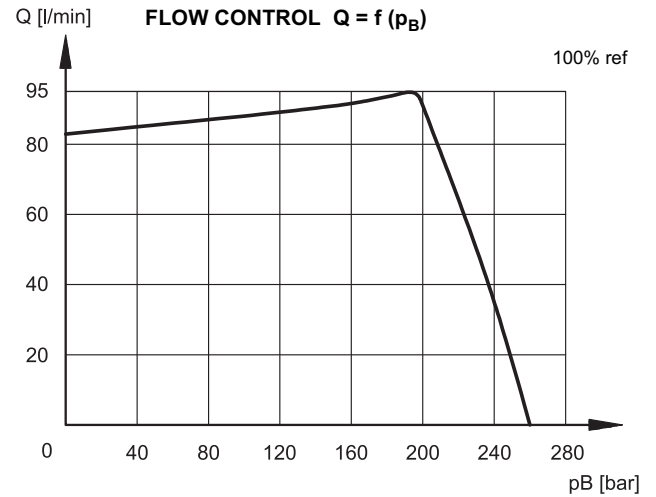
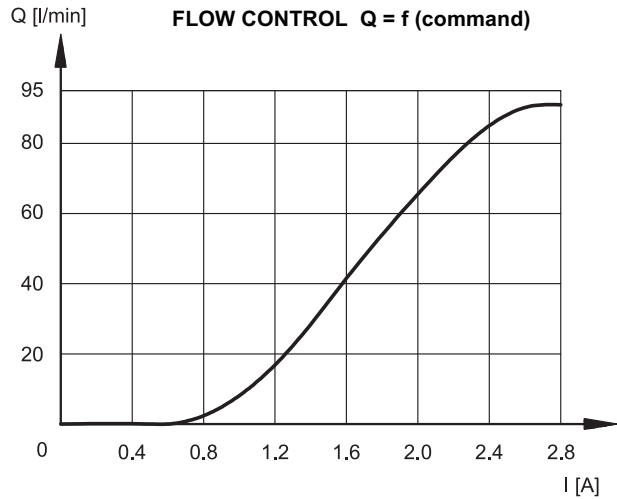


Pressure drops with flow A → P.  
Obtained with  $Q_B = 0$  (no current)

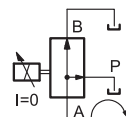
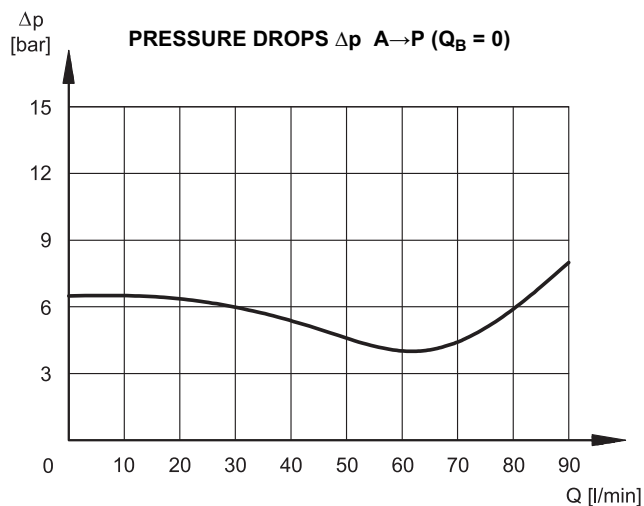
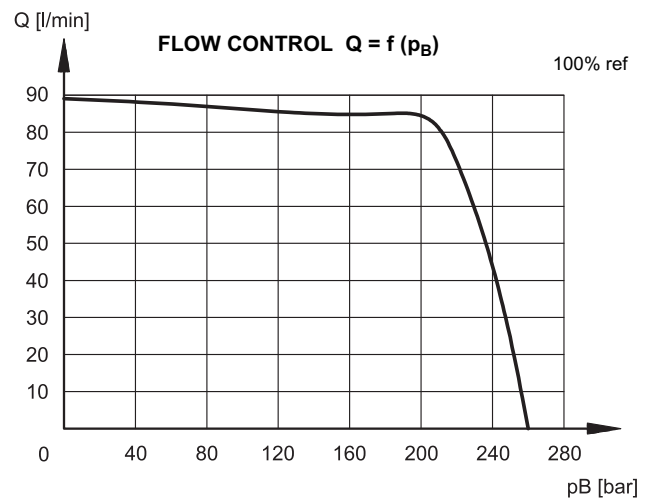
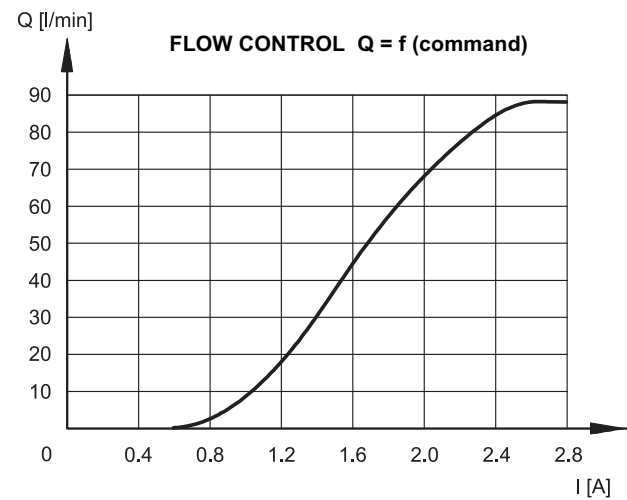
#### 4 - CHARACTERISTIC CURVES QDE5

(obtained with viscosity of 36 cSt a 50°C)

##### 4.1 - Two ways



##### 4.2 - Three ways



Pressure drops with flow A → P.  
 Obtained with  $Q_B = 0$  (no current)



## 5 - ELECTRICAL CHARACTERISTIC

### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

<b>DUTY CYCLE</b>	100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2014/30/EU
<b>CLASS OF PROTECTION:</b> coil insulation (VDE 0580) Impregnation	class H class F

		<b>QDE3</b>		<b>QDE5</b>	
<b>NOMINAL VOLTAGE</b>	V DC	12	24	12	24
<b>RESISTANCE (at 20°C)</b>	ohm	4,4	18,6	3	12
<b>NOMINAL CURRENT</b>	A	1,88	0,86	2,8	1,6
<b>PWM FREQUENCY</b>	Hz	100		100	

### Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP grade correctly connected and installed.

electric connection	electric connection protection	whole valve protection
<b>QDE3</b>		
K1 EN 175301-803	IP65	IP65
K7 DEUTSCH DT04 male	IP65/IP67	
WK1 EN 175301-803	IP66	IP66
WK7 DEUTSCH DT04 male	IP66/IP68/IP69 IP69K*	IP66/IP68/IP69 IP69K*
<b>QDE5</b>		
K1 EN 175301-803	IP65	IP65
K7 DEUTSCH DT04 male	IP65/IP67	

## 6 - STEP RESPONSE

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

Step response is the time taken for the valve to reach 90% of the set flow value following a step change of reference signal.

The table illustrates typical response times with  $\Delta p = 8$  bar.

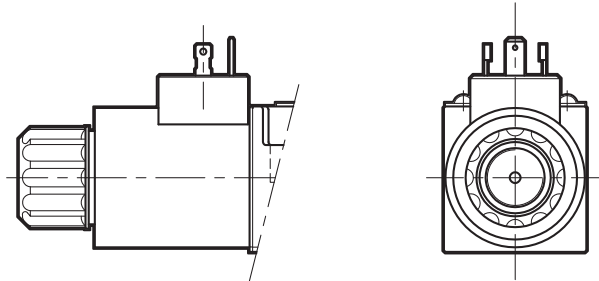
<b>REFERENCE SIGNAL STEP</b>	0 → 100%
Step response [ms]	< 70

## 7 - ELECTRIC CONNECTIONS

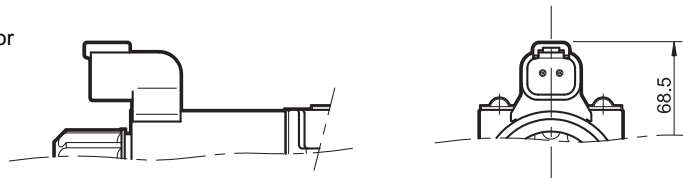
Connectors for K1 and WK1 connections are always delivered together with the valve.

### 7.1 - QDE3

connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**  
code **WK1** (W7 version)



connection for  
DEUTSCH DT06-2S male connector  
code **K7**

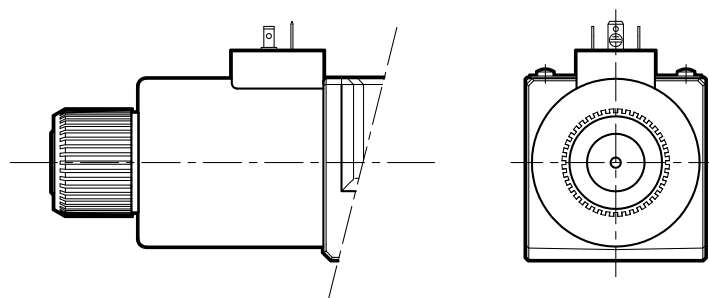


connection for  
DEUTSCH DT06-2S male connector  
code **WK7** (W7 version)

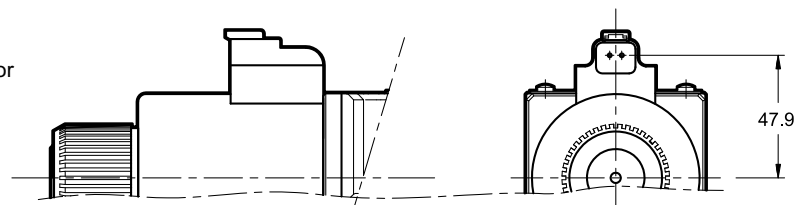


### 7.2 - QDE5

connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**

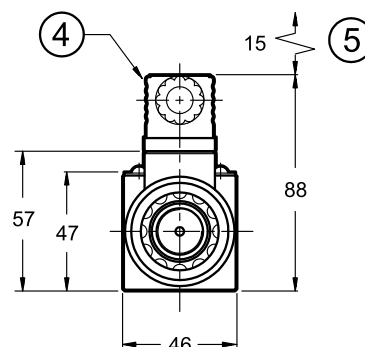
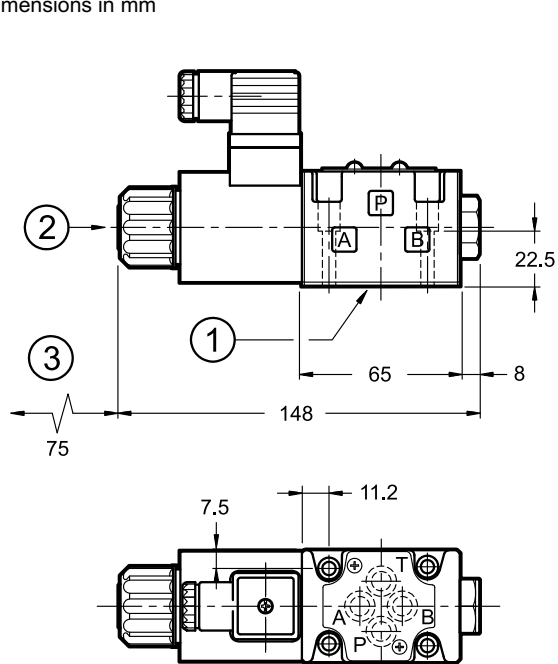


connection for  
DEUTSCH DT06-2S male connector  
code **K7**



## 8 - QDE3 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Fastening bolts: 4 bolts M5x30 - ISO 4762

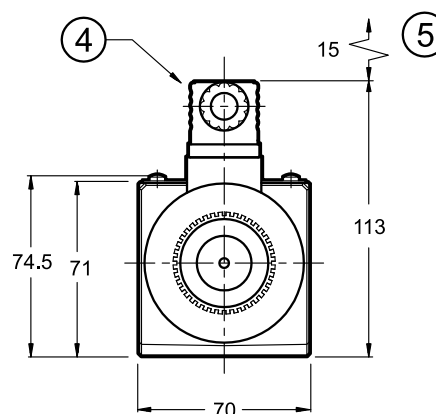
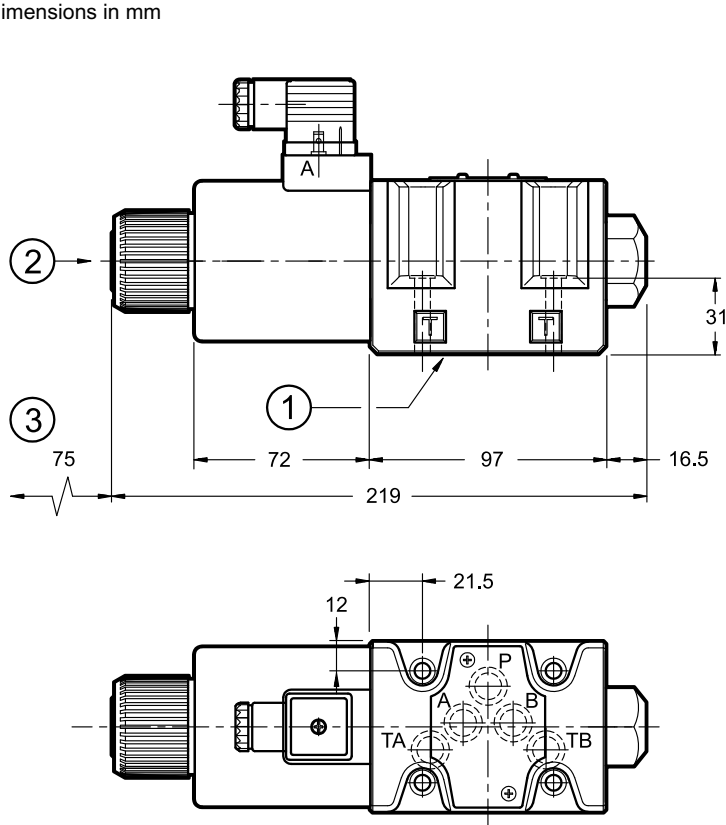
Torque: 5 Nm (A8.8)

Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Standard manual override, integrated in the solenoid tube
3	Coil removal space
4	Electric connector type EN 175301-803 (ex DIN 43650)
5	Connector removal space

## 9 - QDE5 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Fastening bolts: 4 bolts M6x40 - ISO 4762

Torque: 8 Nm (A8.8)

Threads of mounting holes: M6x10

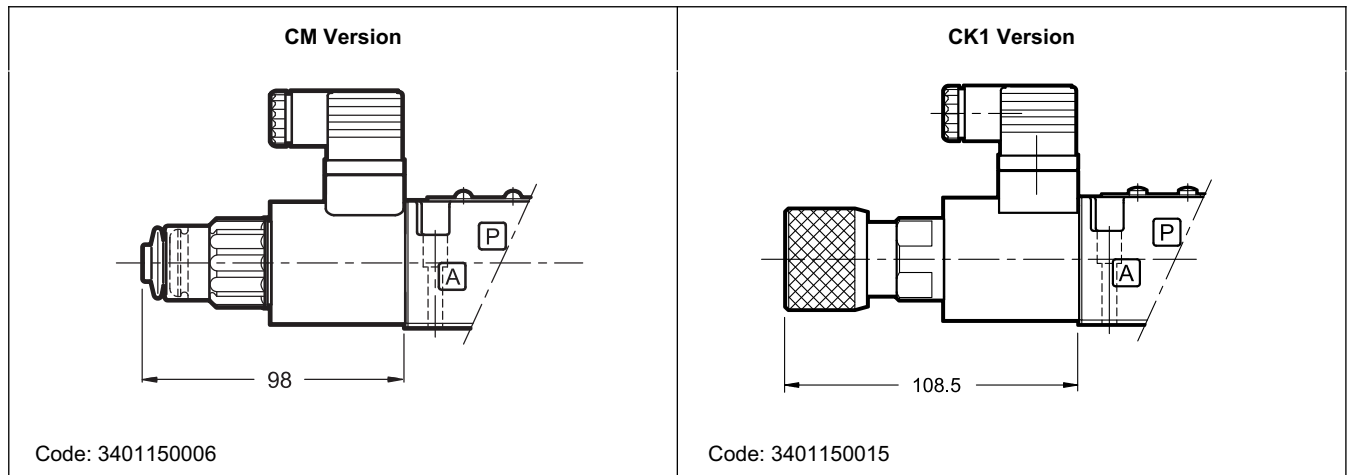
1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Standard manual override, integrated in the solenoid tube
3	Coil removal space
4	Electric connector type EN 175301-803 (ex DIN 43650)
5	Connector removal space

## 10 - MANUAL OVERRIDE

Standard valves have the pin for the manual operation integrated in the solenoid tube. The operation of this override must be executed with a suitable tool, minding not to damage the sliding surface.

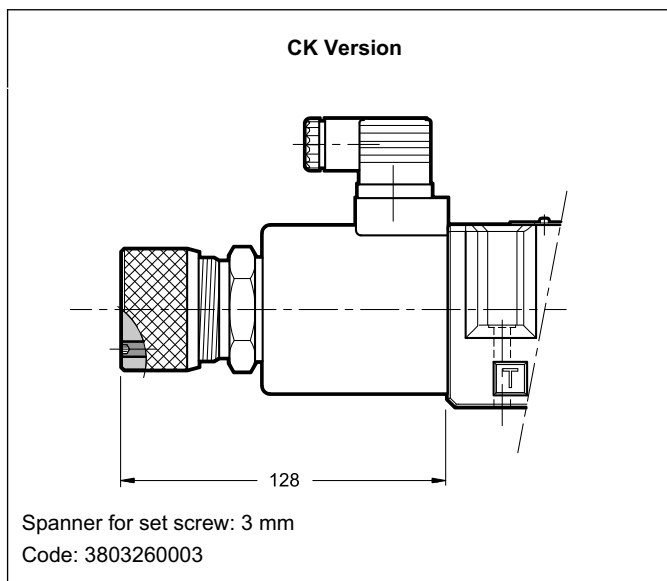
For QDE3 are available:

- **CM**: manual override boot protected (mandatory for WK1 coils).
- **CK1** version, knob.



For QDE5 only available:

- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.





## 11 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

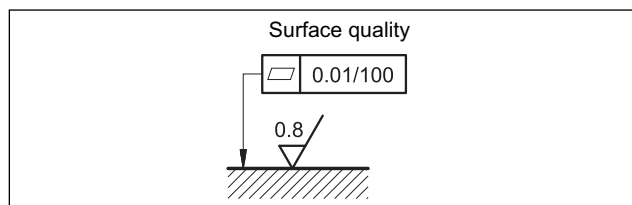
The fluid must be preserved in its physical and chemical characteristics.

## 12 - INSTALLATION

QDE\* valves can be installed in any position without impairing correct operation. Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols.

If minimum values are not observed fluid can easily leak between the valve and support surface.



## 13 - ELECTRONIC CONTROL UNITS

### QDE3

<b>EDM-M111</b>	24V DC solenoids	rail mounting DIN EN 50022	see catalogue 89 251
<b>EDM-M141</b>	12V DC solenoids		
<b>EWM-A-PV</b>	12V / 24V DC software config.		see catalogue 89 620

### QDE5

<b>EDM-M131</b>	24V DC solenoids	rail mounting DIN EN 50022	see catalogue 89 251
<b>EDM-M151</b>	12V DC solenoids		
<b>EWM-A-PV</b>	12V / 24V DC software config.		see catalogue 89 620



# RPCER1

## DIRECT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL AND POSITION FEEDBACK

SERIES 52

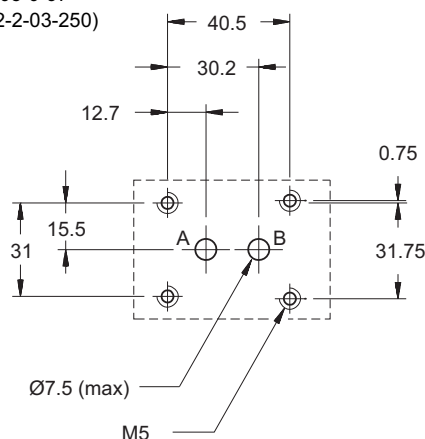
**SUBPLATE MOUNTING**  
**ISO 6263-03 (CETOP 03)**

**p max 250 bar**

**Q max (see performances table)**

### MOUNTING INTERFACE

ISO 6263-03-03-0-97  
(CETOP 4.5.2-2-03-250)

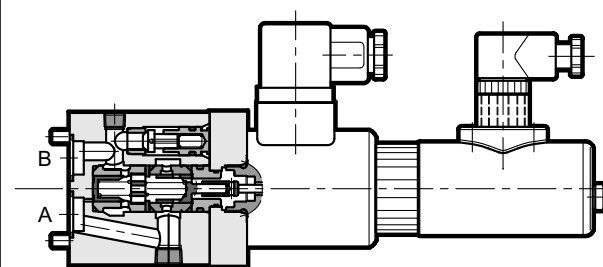


**NOTE:** The RPCER1 mounting interface, with holes according to ISO 6263-03 (CETOP 03), must not have P and T ports

**PERFORMANCES** (obtained with mineral oil with viscosity of 36 cSt at 50°C and UEIK-11RSQ/52-24 electronic card)

Maximum operating pressure	bar	250
Minimum $\Delta p$ between A and B port		10
Maximum controlled flow	l/min	1,5 - 4 - 8 - 16 - 25
Min. controlled flow (for 1 and 4 l/min. reg.)		0,025
Maximum free-reverse flow		40
Step response	see paragraph 7	
Hysteresis	% of Q max	< 2,5%
Repeatability	% of Q max	< $\pm 1\%$
Electrical characteristic	see paragraph 6	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13 (class 17/15/12 for flows < 0,5 l/min)	
Recommended viscosity	cSt	25
Mass:	kg	2,2

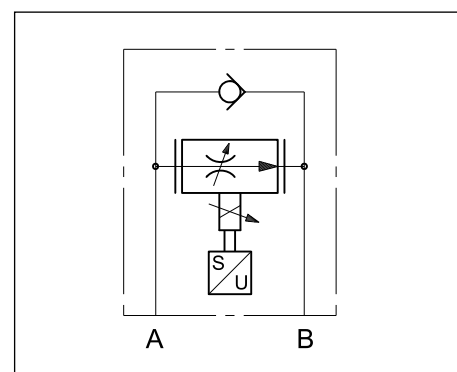
### OPERATING PRINCIPLE



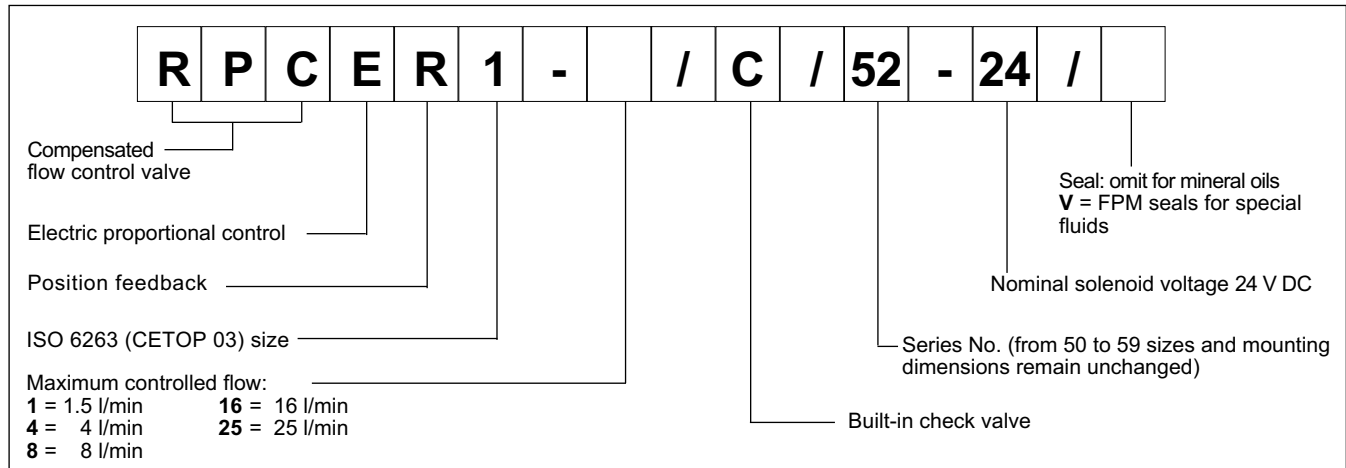
- RPCER1 is a pressure and temperature compensated two-way flow control valve, with electric proportional control and mounting interface in accordance with the ISO 6263 (CETOP RP121H) standards.
- The position feedback of the flow rate controlling throttle gives regulation conditions featuring highly reduced hysteresis and high repeatability.
- It is normally used to control the flow rate into an arm of the hydraulic circuit or the speed of the hydraulic actuators.

- The flow rate can be modulated continuously in proportion to the reference signal sent to the electronic control unit.
- It is available in five flow rate control ranges up to 25 l/min.

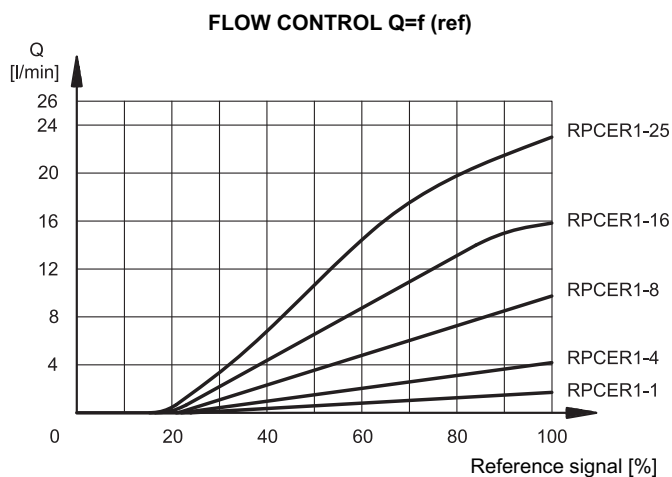
### HYDRAULIC SYMBOLS



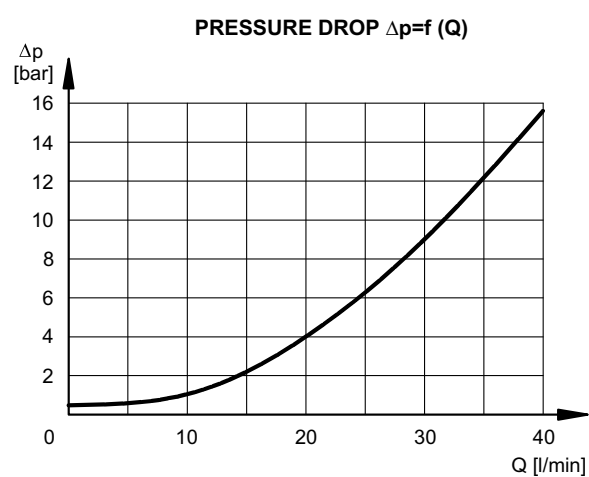
### 1 - IDENTIFICATION CODE



### 2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C and UEIK-11RSQ/52-24 card)



Typical curves for flow rate A → B according to the reference signal sent to the electronic control unit.



Pressure drop with free flow B → A through check valve.

### 3 - PRESSURE COMPENSATION

The valves are equipped with two restrictors in series. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance limit of  $\pm 2\%$  of the full scale flow rate for maximum pressure variation between the valve inlet and outlet chambers.

### 4 - THERMAL COMPENSATION

Thermal compensation of the valve is obtained by adopting the principle of restricted fluid passage, so that the fluid is not influenced significantly by variations in oil viscosity.

For controlled flow rates of lower than 0.5 l/min and with a temperature change of 30°C, flow rate varies by approx. 13% of the set value.

For higher flow rates and with the same temperature change the flow rate variation is <4% of the set flow rate.

### 5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4.

For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 6 - ELECTRICAL CHARACTERISTICS

### 6.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to reduce friction to a minimum thereby reducing hysteresis.

The armature connected to the LVDT transducer core sends the position status to the electronic control unit.

<b>NOMINAL VOLTAGE</b>	V DC	<b>24</b>
<b>RESISTANCE (at 20°C)</b>	Ω	17.6
<b>MAXIMUM CURRENT</b>	A	0.86
<b>DUTY CYCLE</b>	100%	
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2004/108/CE	
<b>CLASS OF PROTECTION:</b> Atmospheric agents (CEI EN 60529)	IP 65	

### 6.2 - Positional transducer

The feedback control version RPCER1 uses an LVDT type positional transducer with amplified signal to enable precise control of the restrictor and the set flow rate, thus improving repeatability and hysteresis characteristics.

The transducer is fitted coaxially on the proportional solenoid and the connector features 360° positioning.

Technical specifications and connections are indicated here beside.

**The transducer is protected against polarity inversion on the power line.**

Position transducer connection		Electronic card connections (see par. 10)
pin 1	supply 18 ÷ 36 V	pin 8c
pin 2	output 2 ÷ 10 V	pin 24a
pin 3	0 V	pin 22c
pin 4	NC	NC

**7 - STEP RESPONSE** (measured with mineral oil with viscosity of 36 cSt at 50°C with UEIK-11RSQ/52-24 electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical response times with valve flow rate of 16 l/min and with input pressure of 100 bar.

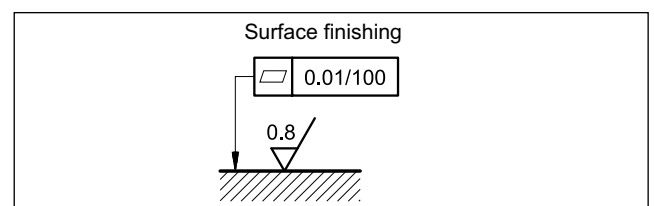
REFERENCE SIGNAL STEP	0 → 100%	100 → 0%	25→100%	100→25%
Step response [ms]	180	150	150	120

## 8 - INSTALLATION

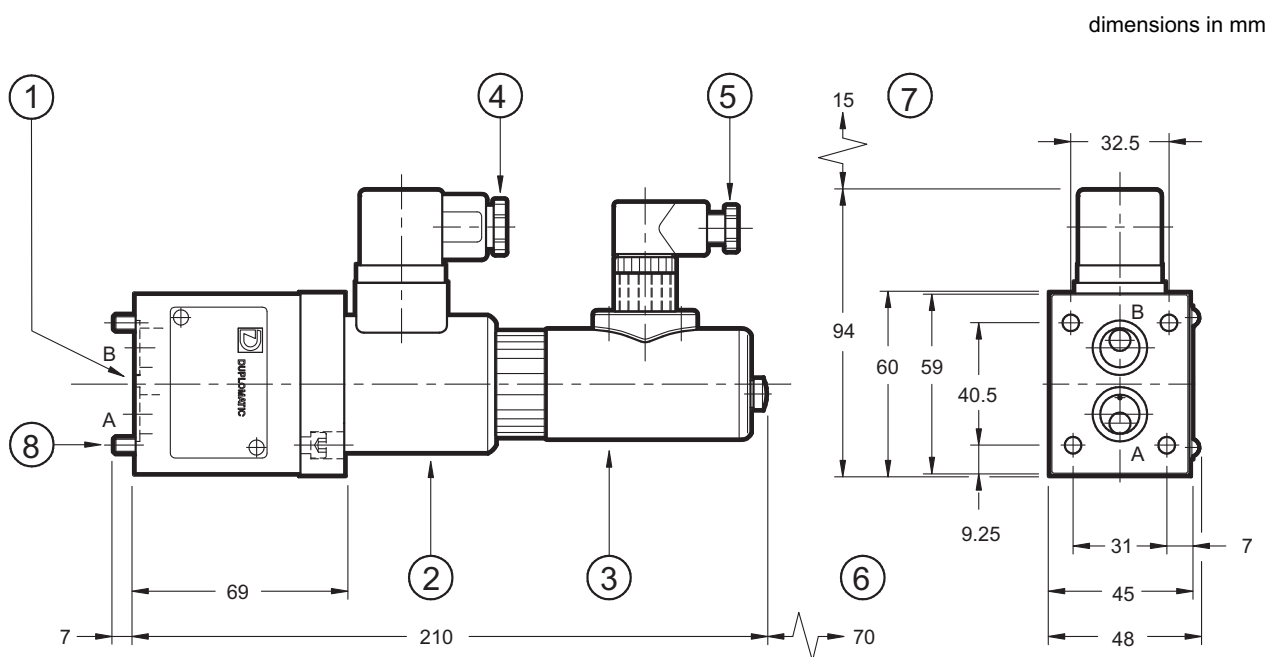
RPCER1 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and mounting surface.



## 9 - OVERALL AND MOUNTING DIMENSIONS



1	Mounting surface with sealing rings: 2 ORM-0140-20 (14 x 2)
2	Proportional solenoid
3	Position transducer
4	DIN 43650 electrical connector for proportional solenoid
5	Electrical connector 4 pin M12 - IP67 PG7 for position transducer
6	Position transducer removal space
7	Connector removal space
8	4 bolts M5 x 65 included in the supply Torque: 5 Nm

Torque: 5 Nm

## 10 - ELECTRONIC CONTROL UNIT

<b>UEIK-11RSQ/52-24</b>	Eurocard format	see cat. 89 315
-------------------------	-----------------	-----------------

**11 - SUBPLATES** (see cat. 51 000)

Type	PMRPC1-AI3G rear ports PMRPC1-AL3G side ports
Port dimensions	3/8" BSP



# RPCE2-\*

## PILOT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

**SERIES 52**

**RPCE2-\*** two-way

**RPCE2- \*-T3** three-way

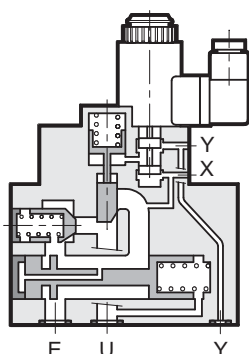
**SUBPLATE MOUNTING**  
**ISO 6263-06 (CETOP 06)**

**p** max **250** bar

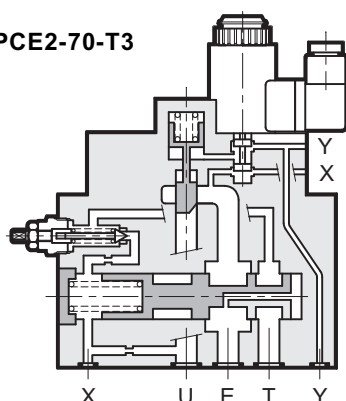
**Q** max (see performances table)

### OPERATING PRINCIPLE

**RPCE2-\***



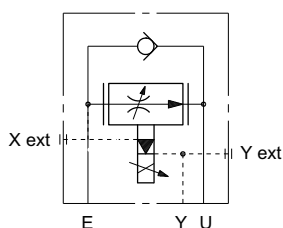
**RPCE2-70-T3**



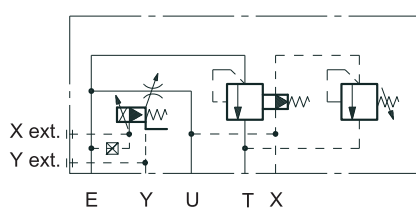
- RPCE2-\* valves are two-way or three-way flow control valves with pressure and thermal compensation and electric proportional control with mounting interface in compliance with ISO 6263 (CETOP RP 121H) standards.
- These valves are normally used for flow rate control in hydraulic circuit branches and for speed control of hydraulic actuators.
- Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units which enable optimal valve performance (see par. 12).
- The valves are available in four flow control ranges: three with progressive gain up to 60 l/min and the fourth with differential gain of 35 l/min.
- To ensure correct valve operation, maintain a minimum pilot control flow rate of 2 l/min and minimum pressure of 20 bar.
- Pilot control can be internal, with intake of oil from line E, or external from a line with 1/4" BSP connection on the pilot body.
- Drainage is always external and must be connected directly to the tank without backpressure by means of subplate connection Y (OR  $\varnothing$  35) or by means of a line (1/4" BSP coupling) on the pilot body.
- The three-way version RPCE2-70-T3 allows flow control to the circuit by dumping the exceeding flow to the tank. Maximum pressure in the circuit is limited by means of a manual adjustment relief valve which operates on the compensator pilot.
- RPCE2-70-T3 valve is also available in M version, which allows, by means of an electric control, to unload the total flow with a minimum pressure drop.

### HYDRAULIC SYMBOLS

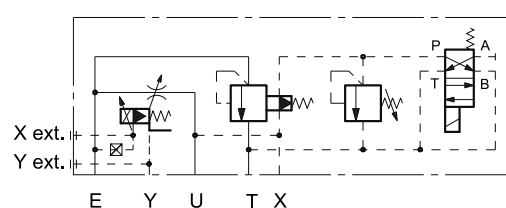
**RPCE2-\***



**RPCE2-70-T3**



**RPCE2-70-T3M**





# RPCE2-\*

## SERIES 52

### 1 - IDENTIFICATION CODES

#### 1.1 - Identification code for two-way valve: RPCE2-\*

<b>R</b>	<b>P</b>	<b>C</b>	<b>E</b>	<b>2</b>	<b>-</b>		<b>/</b>	<b>C</b>	<b>/</b>		<b>/</b>	<b>52</b>	<b>-</b>	<b>24</b>	<b>/</b>	
Compensated flow control valve			Electric proportional control	ISO 6263-06 (CETOP 06) size	Controlled flow rate: <b>35</b> = 37 l/min <b>70</b> = 72 l/min <b>30G</b> = 35 l/min (with differential gain)	Built-in check valve					Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)	Pilot: omit for internal pilot <b>E</b> = external pilot	Seals: omit for NBR seals for mineral oil ( <b>standard</b> ) <b>V</b> = FPM seals for special fluids			Nominal solenoid voltage 24 VDC

#### 1.2 - Identification code for three-way valve: RPCE2-70-T3

<b>R</b>	<b>P</b>	<b>C</b>	<b>E</b>	<b>2</b>	<b>-</b>	<b>70</b>	<b>-</b>	<b>T3</b>	<b>/</b>		<b>/</b>	<b>52</b>	<b>-</b>	<b>24</b>	<b>/</b>	
Compensated flow control valve			Electric proportional control	ISO 6263-06 (CETOP 06) size	Controlled flow rate: <b>70</b> = 80 l/min	Three-way version	Unloading device: omit for version without device ( <b>standard</b> ) <b>M</b> = version with unloading valve	Pilot: omit for internal pilot <b>E</b> = external pilot	Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)	Seals: omit for NBR seals for mineral oil ( <b>standard</b> ) <b>V</b> = FPM seals for special fluids						
Nominal solenoid voltage 24 V DC																

### PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and relevants electronic control units)

Maximum working pressure		250
Minimum $\Delta p$ across E and U ports	bar	10
Piloting pressures: min		20
max		160 ( <b>NOTE 1</b> )
Maximum controlled flow E→U (RPCE2-*)		22 - 35 - 40 - 60
Maximum controlled flow (RPCE2-70-T3)		50 - 60 - 90
Minimum controlled flow with P=100 bar (versions 35 and 70)	l/min	0,5
(version 30G)		0,2
Maximum free reverse flow U→E		60 ( <b>NOTE 2</b> )
Step response	see paragraph 8	
Hysteresis (with PWM 100 Hz)	% of $Q_{max}$	< 8%
Repeatability	% of $Q_{max}$	< ±3%
Electrical features	see paragraph 7	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: RPCE2-*		7,2
RPCE2-70-T3	kg	9
RPCE2-70-T3M		

**NOTE 1:** Pilot must be external if the valve is used with line pressure over 160 bar.

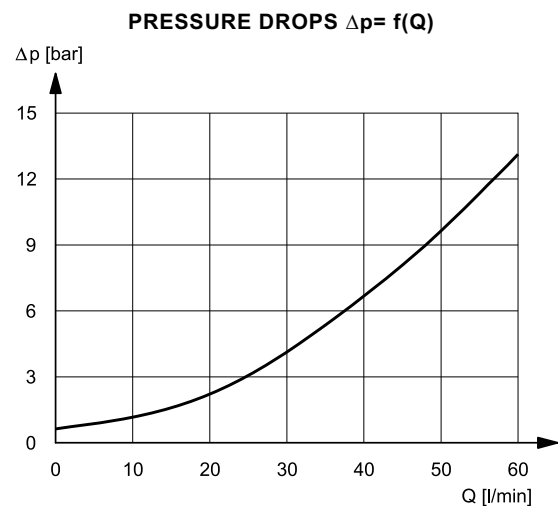
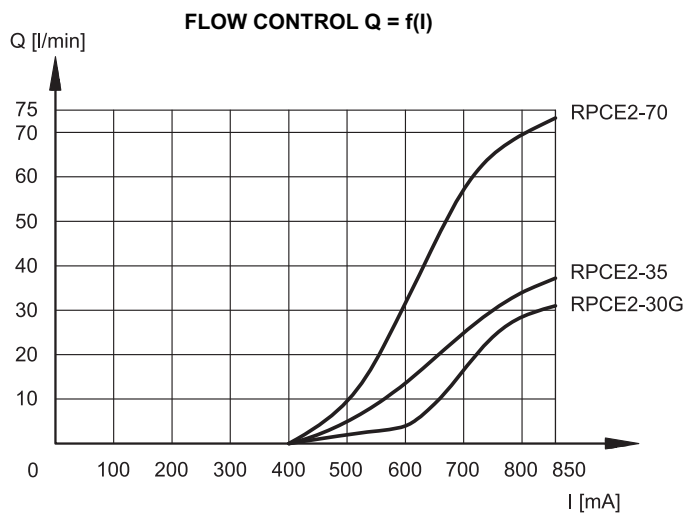
**NOTE 2:** Maximum recommended flow U→E through the check valve (only for two-way version).

## 3 - HYDRAULIC FLUIDS

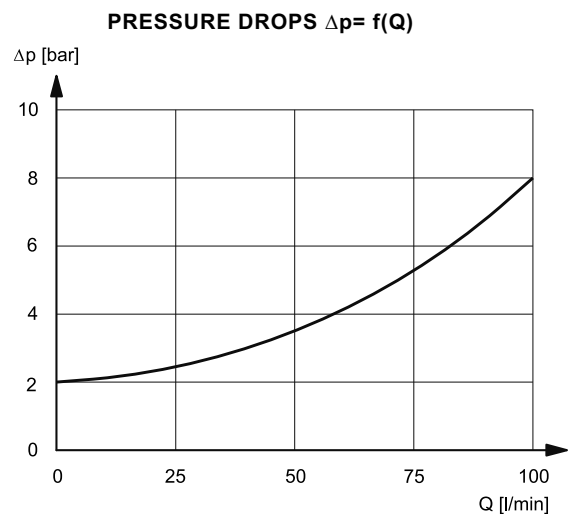
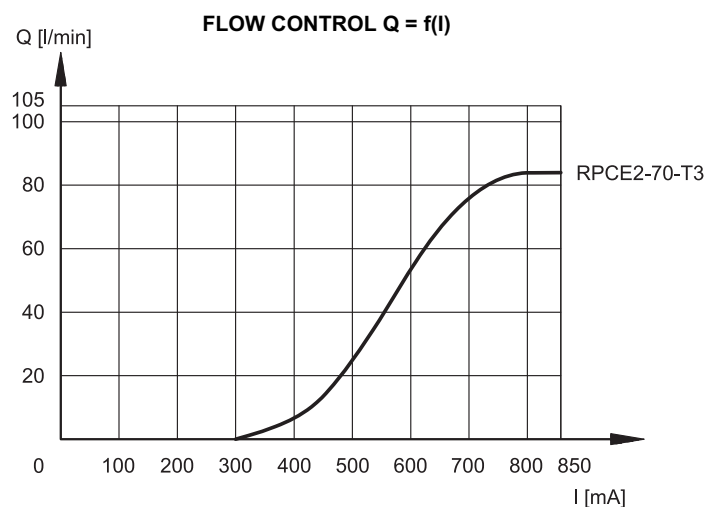
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 4 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

### 4.1 2-way valve



### 4.2 - 3-way valve







## 5 - PRESSURE COMPENSATION

The valves are equipped with two restrictors. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance range of  $\pm 3\%$  of the set flow rate for maximum pressure variation between the valve inlet and outlet chambers.

## 6 - THERMAL COMPENSATION

A temperature-sensitive device installed on the flow control element corrects the position and maintains the set flow rate virtually unchanged, also in the case of fluid viscosity variation.

Flow rate variation remains within 2,5% of the set flow rate, for a fluid temperature variation of 10°C

## 7 - ELECTRICAL CHARACTERISTICS

### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

<b>NOMINAL VOLTAGE</b>	V DC	<b>24</b>
<b>RESISTANCE (at 20°C)</b>	$\Omega$	16.6
<b>MAXIMUM CURRENT</b>	A	0.85
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2004/108 CE	
<b>CLASS OF PROTECTION:</b> Atmospheric agents (CEI EN 60529) Coil insulation (VDE 0580) Impregnation	IP 65 class H class F	

## 8 - STEP RESPONSE (with mineral oil with viscosity of 36 cSt at 50°C and relevants electronic control units)

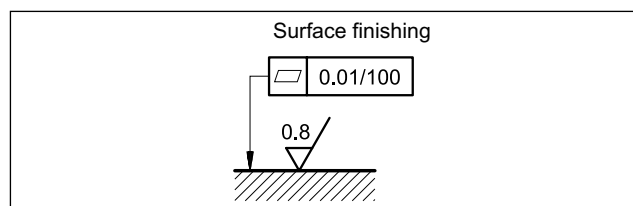
Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal. The table shows typical response times measured with valves "S" (40 l/min) and with an input pressure of 100 bar.

<b>REFERENCE SIGNAL STEP</b>	0 → 100%	100 → 0%
Step response [ms]	250	120

## 9 - INSTALLATION

The RPCE2-\* valve, both two-way or three-way versions, can be installed in any position without impairing correct operation. Ensure that there is no air in the hydraulic circuit.

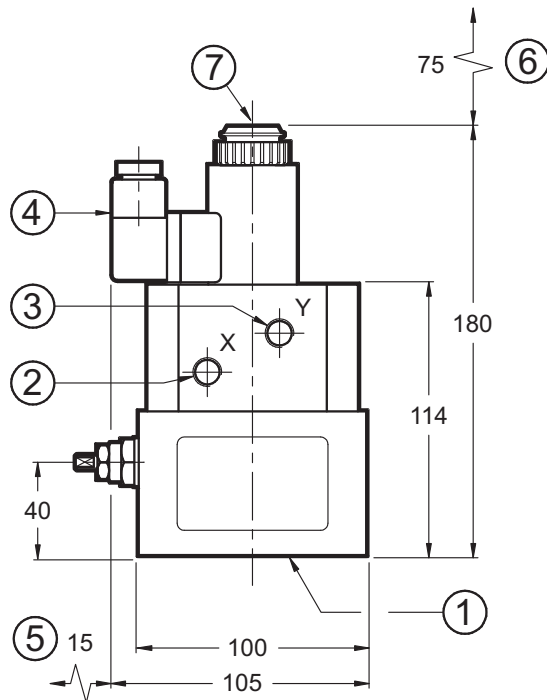
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.



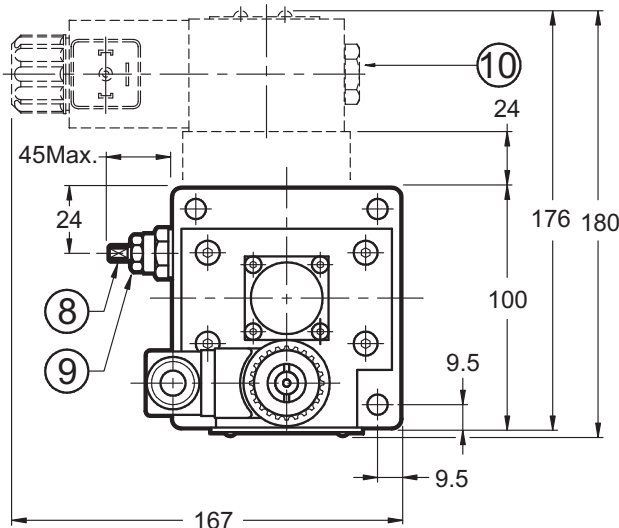
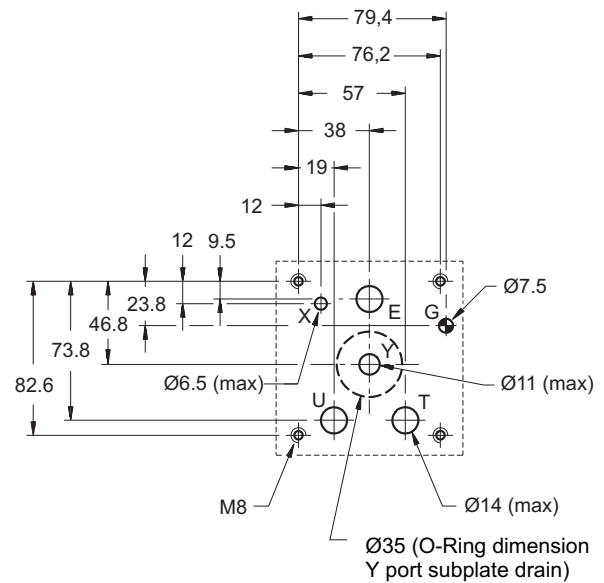
## 10 - ELECTRONIC CONTROL UNITS

<b>EDC-111</b>	for solenoid 24V DC	plug version	see cat.89 120
<b>EDM-M111</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

## 11 - OVERALL AND MOUNTING DIMENSIONS THREE-WAY VALVES RPCE2-70-T3 and RPCE2-70-T3M



MOUNTING SURFACE:  
ISO 6263-06-07-\*97 (CETOP 4.5.2-3-06-250)

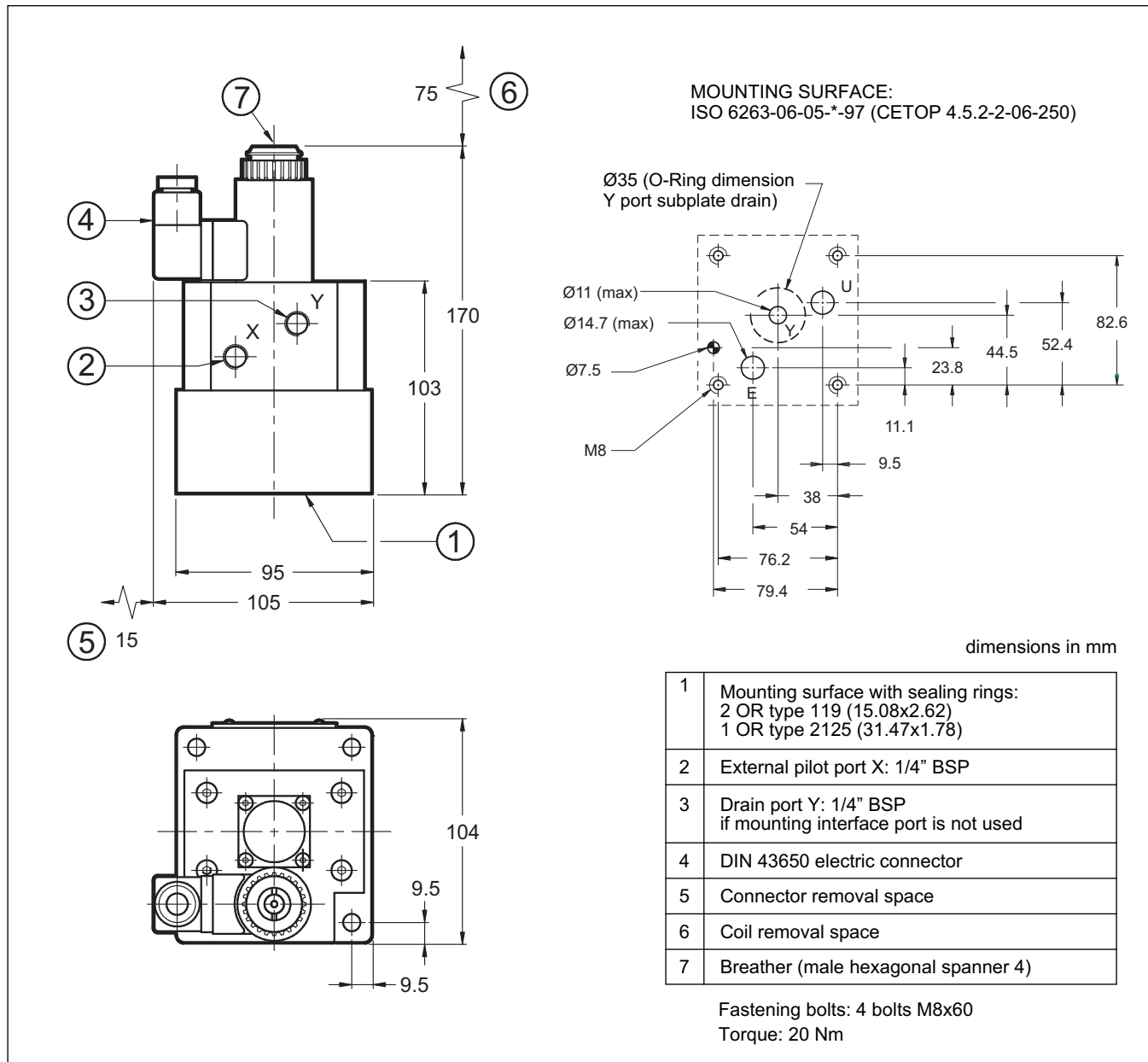


Fastening bolts: 4 bolts M8x75  
Torque: 20 Nm

dimensions in mm

1	Mounting surface with sealing rings: 3 OR type 119 (15.08x2.62) 1 OR type 2125 (31.47x1.78) 1 OR type 109 (19.13x2.62)
2	External pilot port X: 1/4" BSP
3	Drain port Y: 1/4" BSP if mounting interface port is not used
4	DIN 43650 electric connector
5	Connector removal space
6	Coil removal space
7	Breather (male hexagonal spanner 4)
8	Pressure relief valve - adjustment screw: square spanner 6 - pressure adjustment range up to 210 bar - default setting: minimum
9	Locking nut: spanner 13
10	Unloading solenoid valve type DS3-TB (only for version RPCE2 -*T3M) - solenoid valve OFF = flow unloading at minimum pressure - solenoid valve ON = unloading pressure controlled by pressure relief valve 8

## 12 - OVERALL AND MOUNTING DIMENSION TWO-WAY VALVE RPCE2-\*



## 13 - SUBPLATES (see catalogue 51 000)

The valve must have the Y drain with external pipe when using the subplates listed below.

	RPCE2-* two way version	RPCE2-*T3 three way version
Type	PMRPC2-AI4G rear ports	PMRPCQ2-AI4G rear ports
E, U, T ports threading	1/2" BSP	1/2" BSP
X port threading	-	1/4" BSP



# RPCE3-\*

## PILOT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL SERIES 52

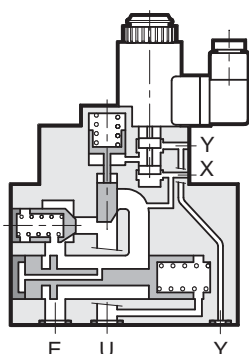
RPCE3- \*                      two-way  
RPCE3-100 -T3            three-way

**SUBPLATE MOUNTING**  
**ISO 6263-07 (CETOP 07)**

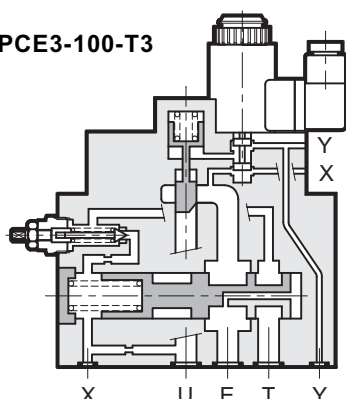
**p** max **250** bar  
**Q** max (see performances table)

### OPERATING PRINCIPLE

**RPCE3-\***



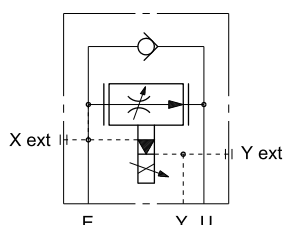
**RPCE3-100-T3**



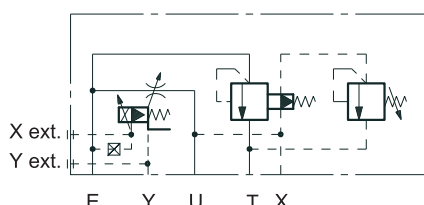
- RPCE3-\* valves are two-way or three-way flow control valves with pressure and thermal compensation and electric proportional control with mounting interface in compliance with ISO 6263 (CETOP RP 121H) standards.
- These valves are normally used for flow rate control in hydraulic circuit branches and for speed control of hydraulic actuators.
- Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units which enable optimal valve performance (see paragraph 12).
- The valves are available in two flow control ranges of 100 l/min, with progressive gain or with differential gain.
- To ensure correct valve operation, maintain a minimum pilot control flow rate of 2 l/min and minimum pressure of 20 bar.
- Pilot control can be internal, with intake of oil from line E, or external from a line with 1/4" BSP connection on the pilot body.
- Drainage is always external and must be connected directly to the tank without backpressure by means of subplate connection Y (OR Ø32) or by means of a line (1/4" BSP coupling) on the pilot body.
- The three-way version RPCE3-100-T3 allows flow control to the circuit by dumping the exceeding flow to the tank. Maximum pressure in the circuit is limited by means of a manual adjustment relief valve which operates on the compensator pilot.
- RPCE3-100-T3 valve is also available in /M version, which allows, by means of an electric control, to unload the total flow with a minimum pressure drop.

### HYDRAULIC SYMBOLS

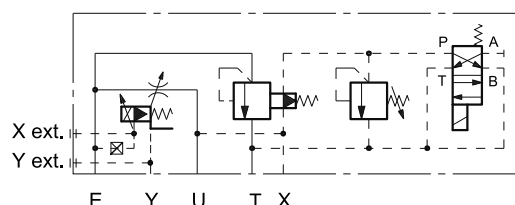
**RPCE3-\***



**RPCE3-100-T3**



**RPCE3-100-T3M**





# RPCE3-\*

## SERIES 52

### 1 - IDENTIFICATION CODES

#### 1.1 - Identification code for two-way valve: RPCE3-\*

<b>R</b>	<b>P</b>	<b>C</b>	<b>E</b>	<b>3</b>	<b>-</b>	<b>/</b>	<b>C</b>	<b>/</b>	<b>/</b>	<b>52</b>	<b>-</b>	<b>24</b>	<b>/</b>	
Compensated flow control valve			Electric proportional control			ISO 6263-07 (CETOP 07) size			Controlled flow rate: <b>100</b> = 100 l/min <b>100G</b> = 100 l/min (with differential gain)			Built-in check valve		
									Seals: omit for NBR seals for mineral oil ( <b>standard</b> ) <b>V</b> = FPM seals for special fluids			Nominal solenoid voltage 24 V DC		
									Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)			Pilot: omit for internal pilot <b>E</b> = external pilot		

#### 1.2 - Identification code for three-way valve: RPCE3-100-T3

<b>R</b>	<b>P</b>	<b>C</b>	<b>E</b>	<b>3</b>	<b>-</b>	<b>100</b>	<b>-</b>	<b>T3</b>	<b>/</b>	<b>/</b>	<b>52</b>	<b>-</b>	<b>24</b>	<b>/</b>		
Compensated flow control valve			Electric proportional control			ISO 6263-07 (CETOP 07) size			Controlled flow rate: <b>100</b> = 100 l/min			Three-way version			Seals: omit for NBR seals for mineral oil ( <b>standard</b> ) <b>V</b> = FPM seals for special fluids	
									Pilot: omit for internal pilot <b>E</b> = external pilot			Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)			Nominal solenoid voltage 24 V DC	
									Unloading device: Omit for version without device ( <b>standard</b> ) <b>M</b> = version with unloading valve							

### PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and the related electronic control units)

Maximum working pressure	bar	250
Minimum $\Delta p$ across E and U ports		10
Piloting pressures: min		20
max		160 ( <b>NOTE 1</b> )
Maximum controlled flow E→U (RPCE3-*)	l/min	100
Minimum controlled flow with P=100 bar (version 100)		1,5
(version 100G)		0,5
Maximum free reverse flow U→E		150 ( <b>NOTE 2</b> )
Step response	see paragraph 8	
Hysteresis (with PWM 100 Hz)	% of $Q_{max}$	< 8%
Repeatability	% of $Q_{max}$	< ±3%
Electrical features	see paragraph 7	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: RPCE3-*	kg	10,8
RPCE3-100-T3 RPCE3-100-T3M		12,6

**NOTE 1:** Pilot must be external if the valve is used with line pressure over 160 bar.

**NOTE 2:** Maximum recommended flow U→E through the check valve (only for two-way version)

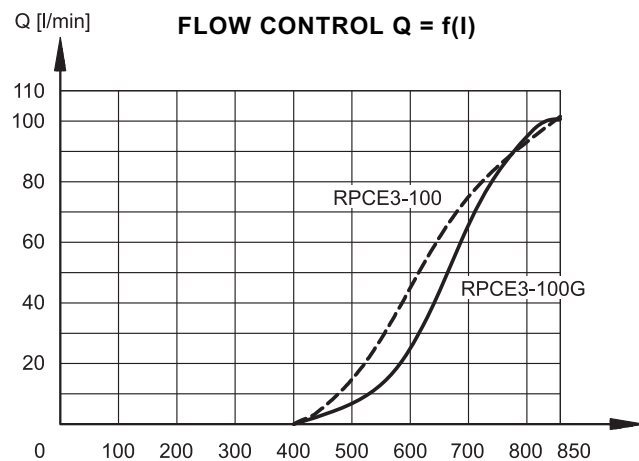
### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

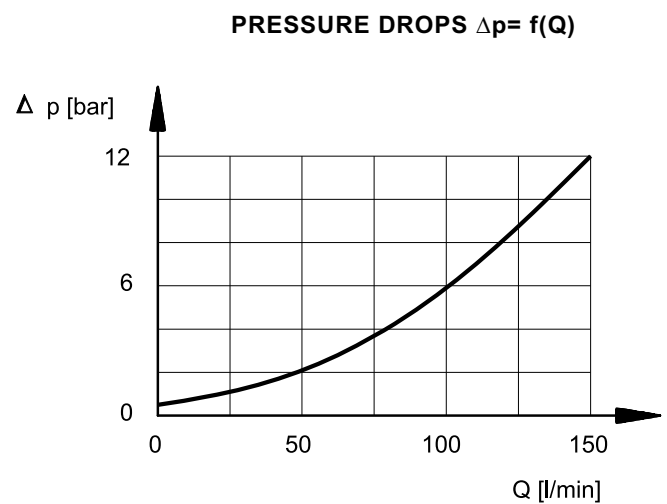
### 4 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

#### 4.1 2-way valve



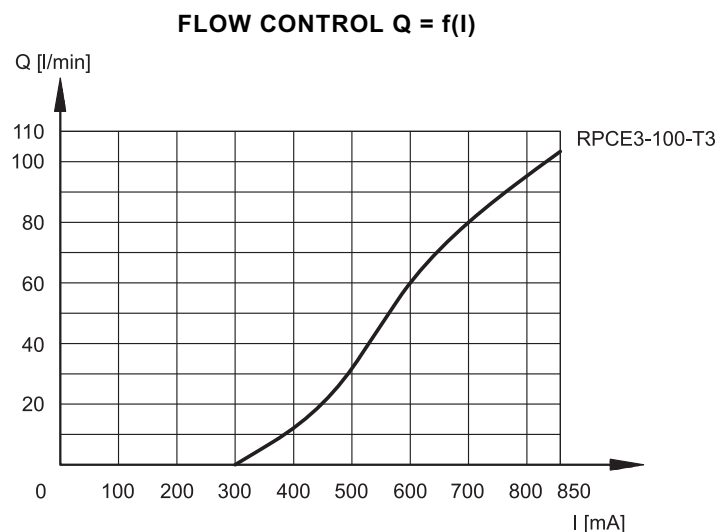
Typical flow control curves for flow rate E→U, according to the current supplied to the solenoid.

The RPCE3-100G version, featuring differential gain control, is particularly suitable for "FAST-SLOW" flow rate control as it ensures high sensitivity at low flow rates while enabling high flow rates for rapid actuator movement.

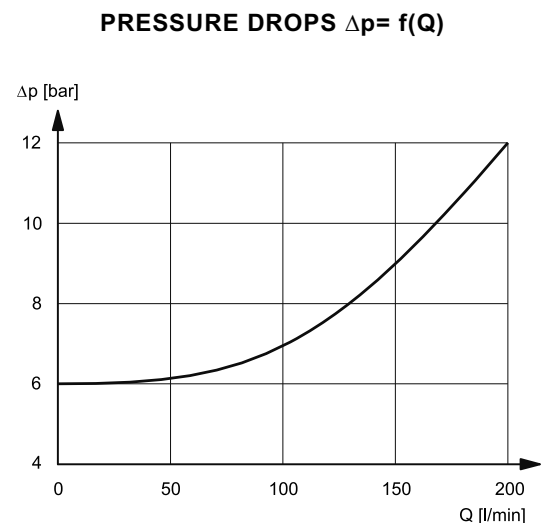


Pressure drops with free flow U→E through the check valve

#### 4.1 3-way valve



Typical flow control curves for flow rate E→U, according to the current supplied to the solenoid.



Pressure drops E→T (only for three-way versions)  
Curve obtained with unloading electrical control (RPCE3-100-T3M)



## 5 - PRESSURE COMPENSATION

The valves are equipped with two restrictors. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance range of  $\pm 3\%$  of the set flow rate for maximum pressure variation between the valve inlet and outlet chambers.

## 6 - THERMAL COMPENSATION

A temperature-sensitive device installed on the flow control element corrects the position and maintains the set flow rate virtually unchanged, also in the case of fluid viscosity variation.

Flow rate variation remains within 2,5% of the set flow rate, for a fluid temperature variation of  $10^{\circ}\text{C}$ .

## 7 - ELECTRICAL CHARACTERISTICS

### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through  $360^{\circ}$  depending on installation clearances.

NOMINAL VOLTAGE	V DC	24
RESISTANCE (at $20^{\circ}\text{C}$ )	$\Omega$	16.6
MAXIMUM CURRENT	A	0.85
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

## 8 - STEP RESPONSE (with mineral oil with viscosity of 36 cSt at $50^{\circ}\text{C}$ with the related electronic control units)

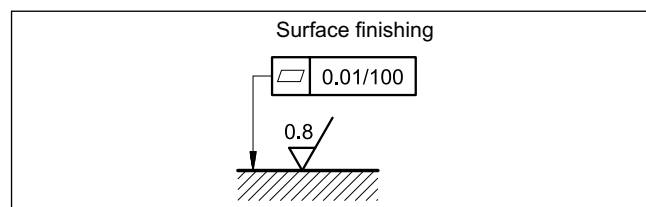
Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal. The table shows typical response times measured with valves "S" (150 l/min) and with an input pressure of 100 bar.

REFERENCE SIGNAL STEP	0 $\rightarrow$ 100%	100% $\rightarrow$ 0
Step response [ms]	250	120

## 9 - INSTALLATION

The RPCE3 valve, both two-way or three-way versions, can be installed in any position without impairing correct operation. Ensure that there is no air in the hydraulic circuit.

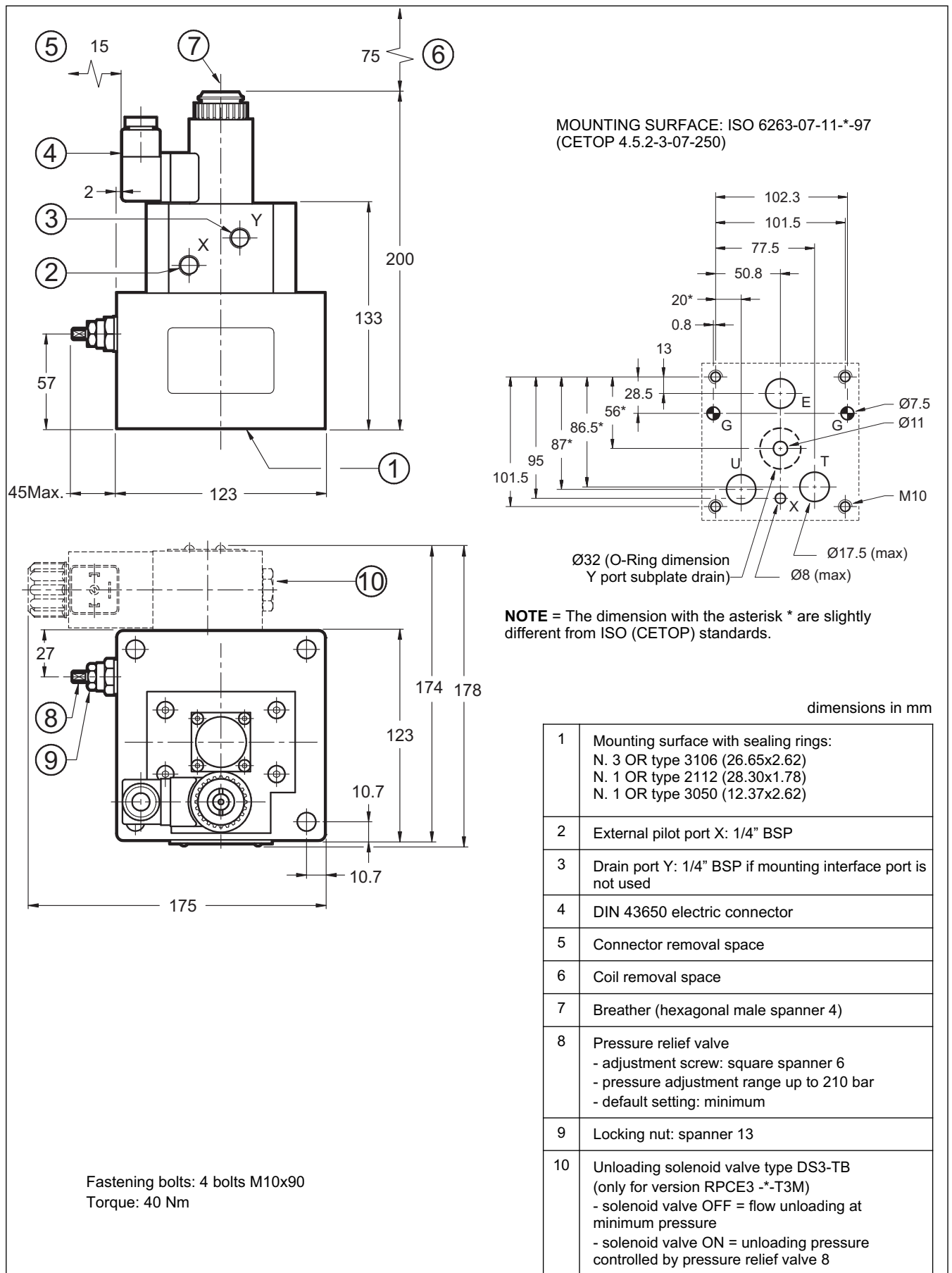
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.



## 10 - ELECTRONIC CONTROL UNITS

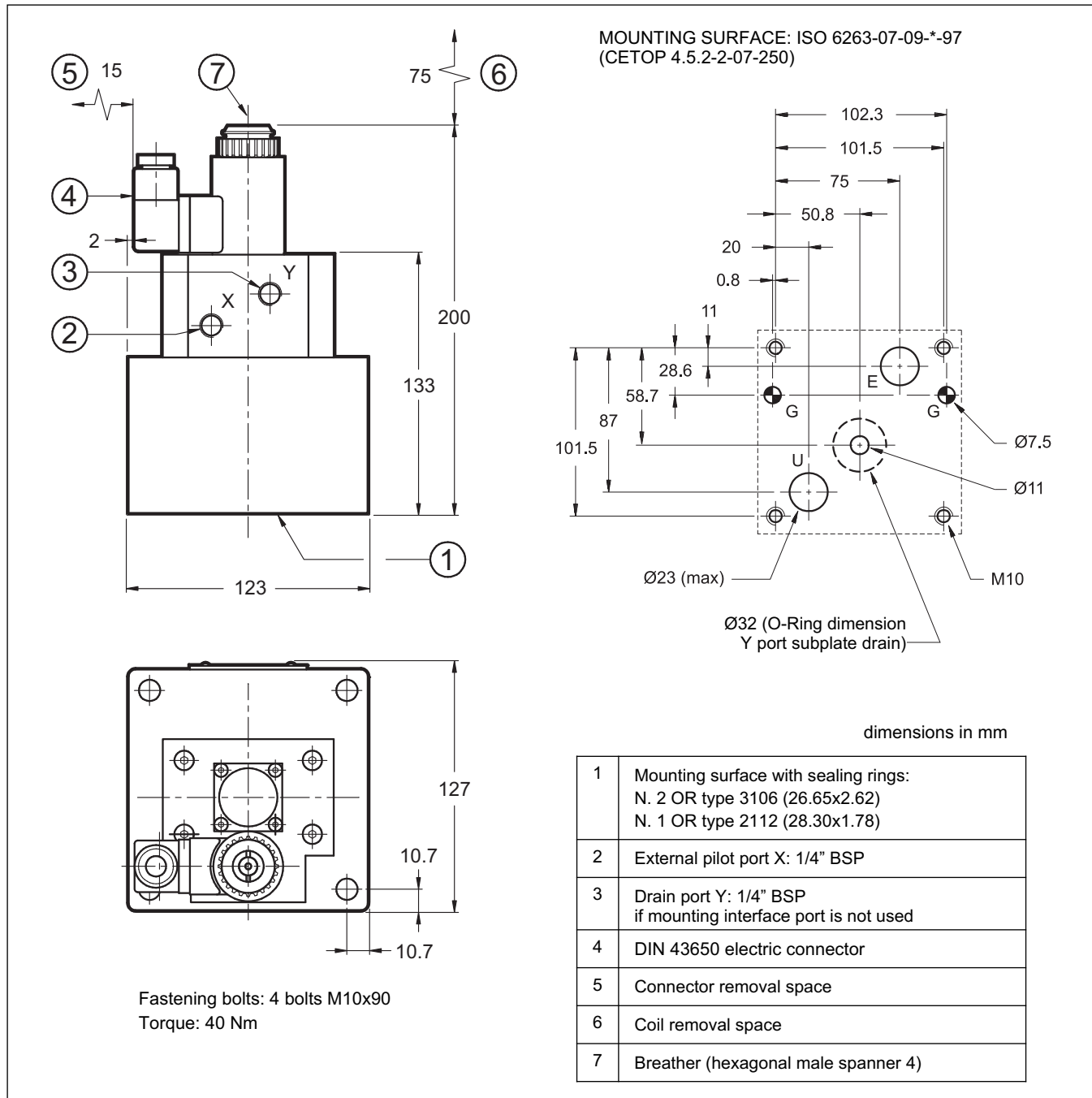
EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

## 11 - OVERALL AND MOUNTING DIMENSIONS THREE-WAY VALVES RPCE3-100-T3 and RPCE3-100-T3M





## 10 - OVERALL AND MOUNTING DIMENSIONS TWO-WAY VALVE RPCE3



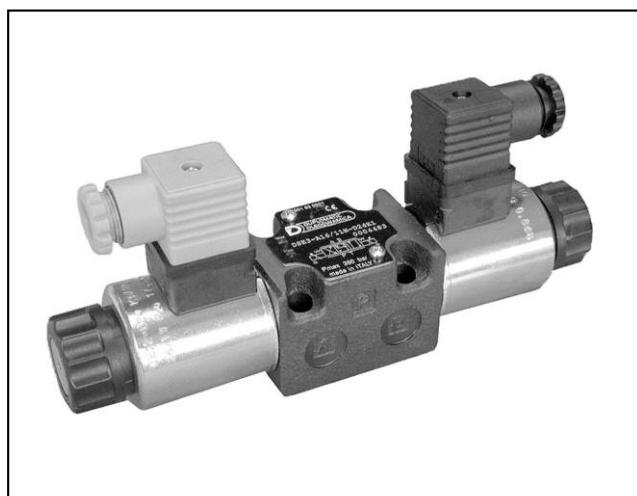
## 13 - SUBPLATES (see catalogue 51 000)

The valve must have the Y drain with external pipe when using the subplates listed below.

	RPCE3-* two way version	RPCE3--T3 three way version
Type	PMRPC3-AI6G rear ports	PMRPCQ3-AI6G rear ports
E, U, T ports threading	1" BSP	1" BSP
X port threading	-	1/4" BSP

# DSE3

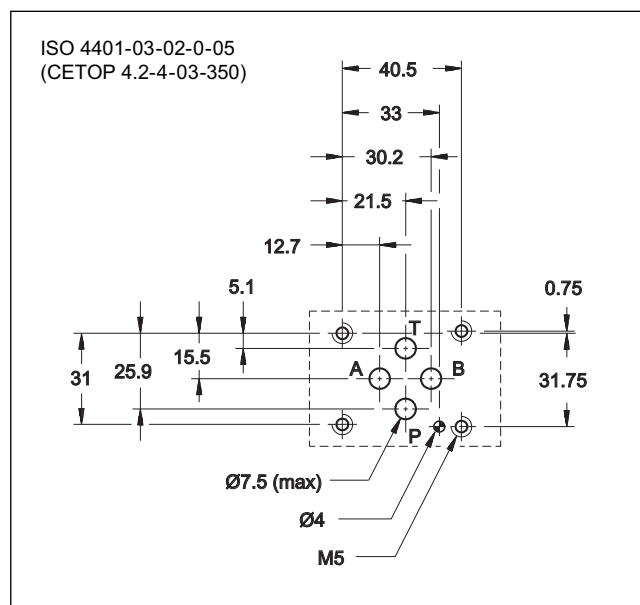
## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL SERIES 11



### SUBPLATE MOUNTING ISO 4401-03

**p** max 350 bar  
**Q** max 40 l/min

### MOUNTING SURFACE

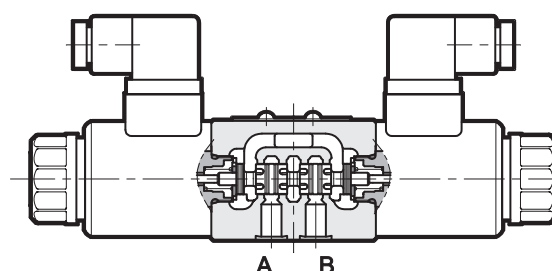


### PERFORMANCES

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

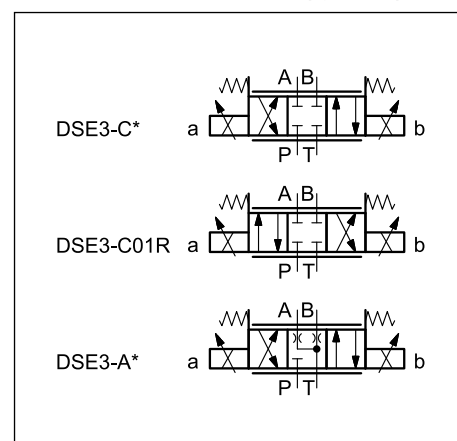
Max operating pressure: P - A - B ports T port	bar	350 210
Maximum flow with $\Delta p$ 10 bar P-T	l/min	1 - 4 - 8 - 16 - 26
Step response		see par. 5
Hysteresis (with PWM 200 Hz)	% $Q_{max}$	< 6%
Repeatability	% $Q_{max}$	< $\pm 1,5\%$
Electrical characteristics		see par. 4
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,6 2,0

### OPERATING PRINCIPLE



- The DSE3 valve is a direct operated directional control valve with electric proportional control and with ports in compliance with ISO 4401 standards.
- It is used for directional and speed control of hydraulic actuators.
- Valve opening and hence flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or by means of the electronic control units to exploit valve performance to the full (see paragraph 11).
- Several manual overrides are available.

### HYDRAULIC SYMBOLS (typical)





## 1 - IDENTIFICATION CODE

D	S	E	3	-				/	11	-			/		
---	---	---	---	---	--	--	--	---	----	---	--	--	---	--	--

Direct operated directional control valve

Electric proportional control

Size ISO 4401-03

Spool type:  
**C** = closed centers  
**A** = open centers

Spool nominal flow. See par. 2

Solenoid position (omit for configuration with two solenoids):  
**SA** = 1 solenoid on A side  
**SB** = 1 solenoid on B side

Option:  
/ **W7** = Zinc-nickel surface treatment (see **NOTE**)  
Omit if not required

Option: manual override (see at par. 8)

Coil electrical connection:  
**K1** = plug for connector type EN 175301-803 (ex DIN 43650) (**standard**)  
**K7** = plug for connector type DEUTSCH DT04-2P male

**D12** = Nominal solenoid voltage 12V DC  
**D24** = Nominal solenoid voltage 24V DC

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

**NOTE:** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to 240 hours. (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For a salt spray resistance up to 600 hours order the high corrosion resistance version.

### 1.1 - High corrosion resistance version

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are specific for this version, featuring a zinc-nickel surface treatment. Electrical features at paragraph 4.

The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it:

D	S	E	3	-		/	11	-			/		/	W7
---	---	---	---	---	--	---	----	---	--	--	---	--	---	----

Choices as in standard identification code

DC power supply  
**D12** = 12 V  
**D24** = 24 V

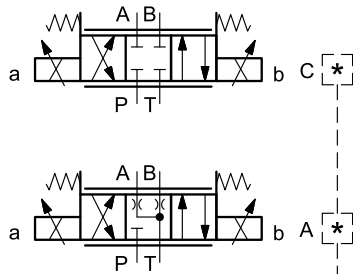
Coil electrical connection  
**WK1** = plug for connector type EN 175301-803 (ex DIN 43650)  
On request: plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.

Manual override:  
**CM** = manual override, boot protected (**standard**)  
**CS** = screw override  
**CH** = lever manual override  
**CK** = knob manual override

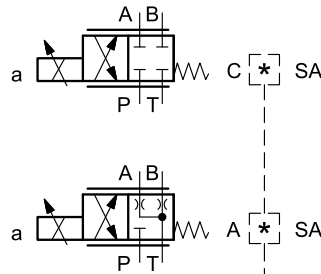
## 2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:  
number of proportional solenoids, spool type, nominal flow rate.

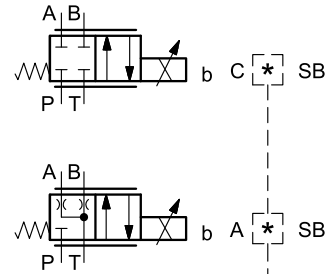
2 solenoids configuration:  
3 positions with spring centering



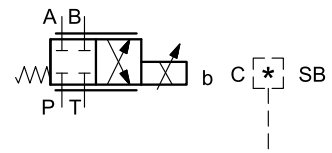
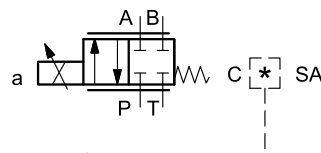
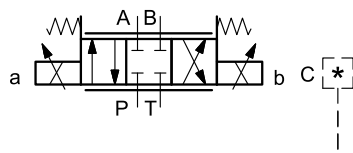
“SA” configuration: 1 solenoid on side A.  
2 positions (central + external) with  
spring centering



“SB” configuration: 1 solenoid on side B.  
2 positions (central + external) with  
spring centering



*	Nominal flow with $\Delta p 10$ bar $P \rightarrow T$
<b>04</b>	4 l/min
<b>08</b>	8 l/min
<b>16</b>	16 l/min
<b>16/08</b>	16 ( $P \rightarrow A$ ) / 08 ( $B \rightarrow T$ ) l/min
<b>26</b>	26 l/min
<b>26/13</b>	26 ( $P \rightarrow A$ ) / 13 ( $B \rightarrow T$ ) l/min

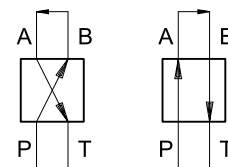


*	Nominal flow with $\Delta p 10$ bar $P \rightarrow T$
<b>01R</b>	1 l/min

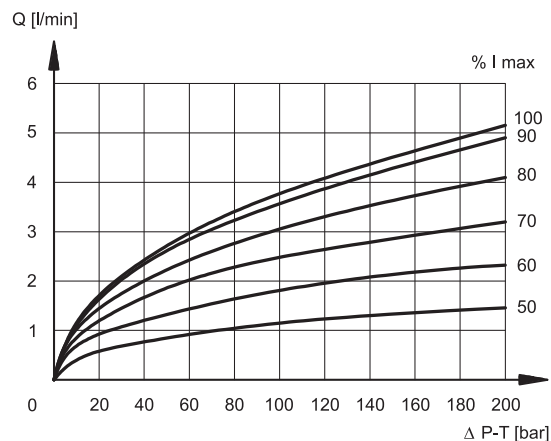
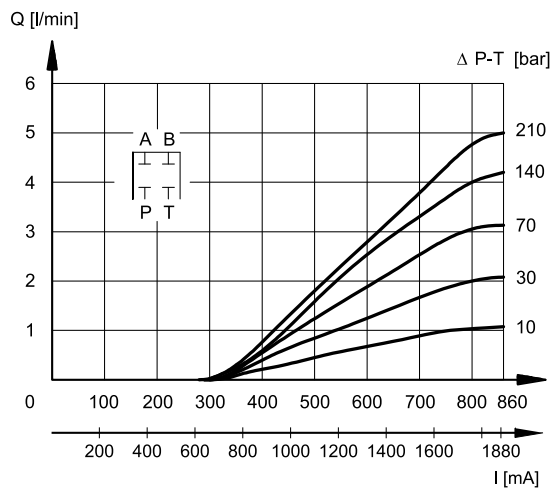
### 3 - CHARACTERISTIC CURVES

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

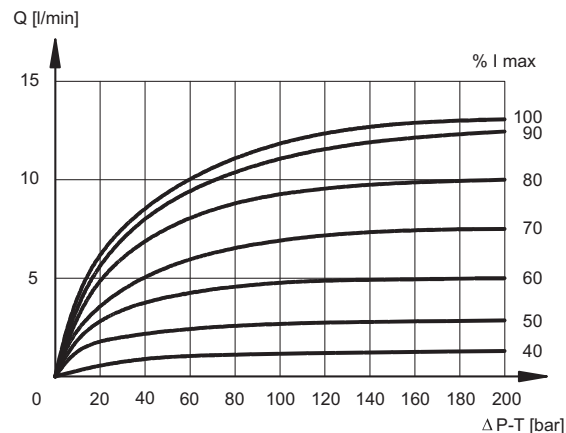
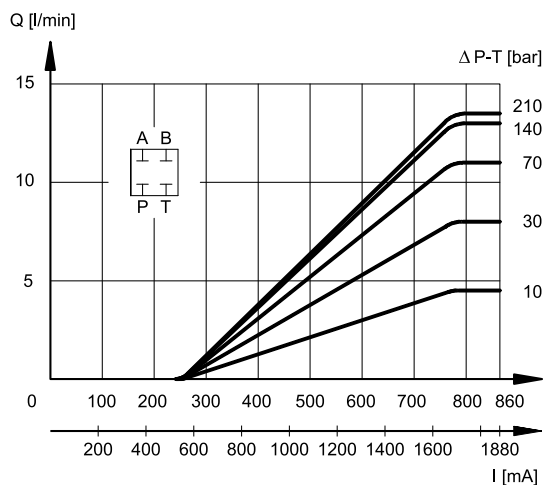
Typical flow rate control curves according to the current supply to solenoid. The reference  $\Delta p$  values are measured between ports P and T on the valve.



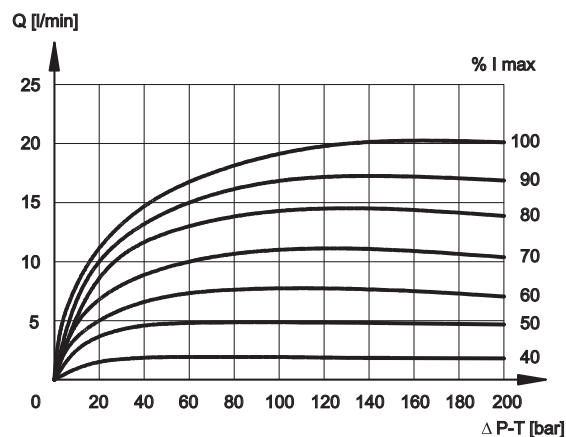
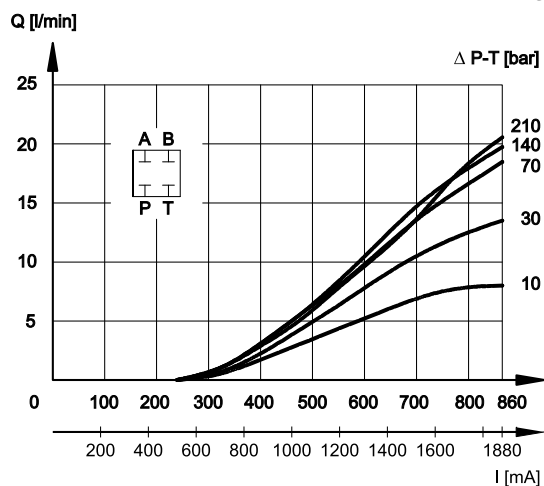
#### SPOOL TYPE C01R



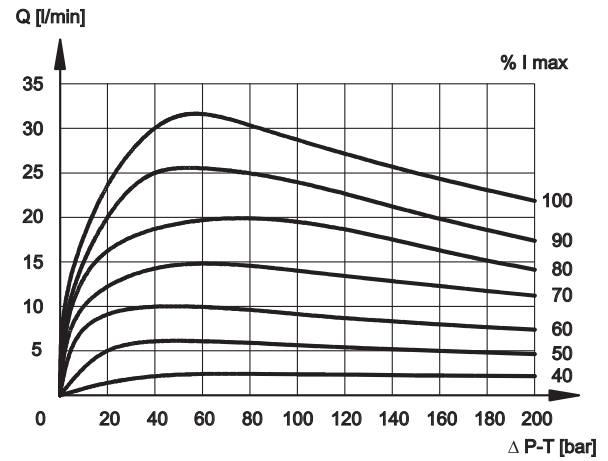
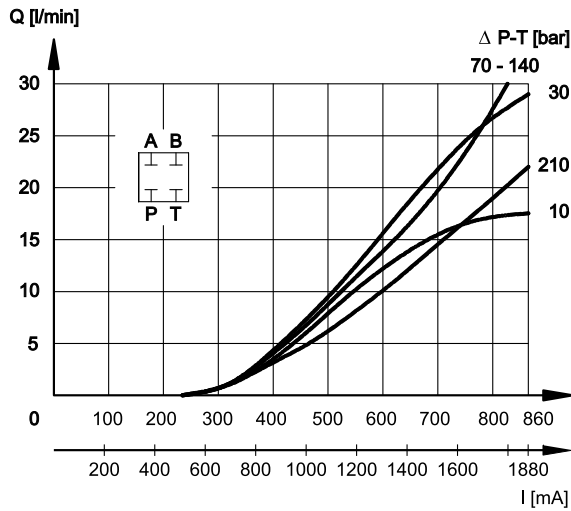
#### SPOOL TYPE C04



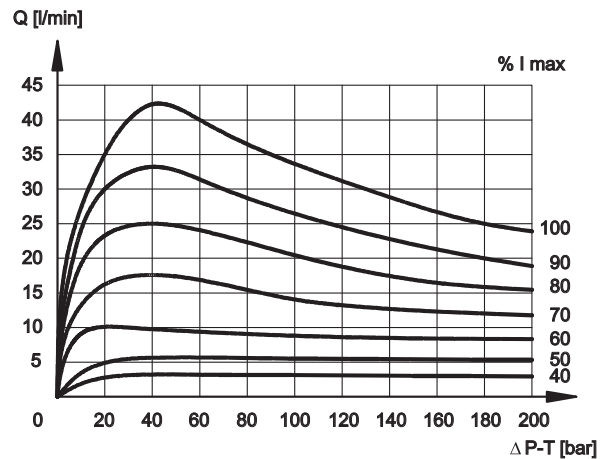
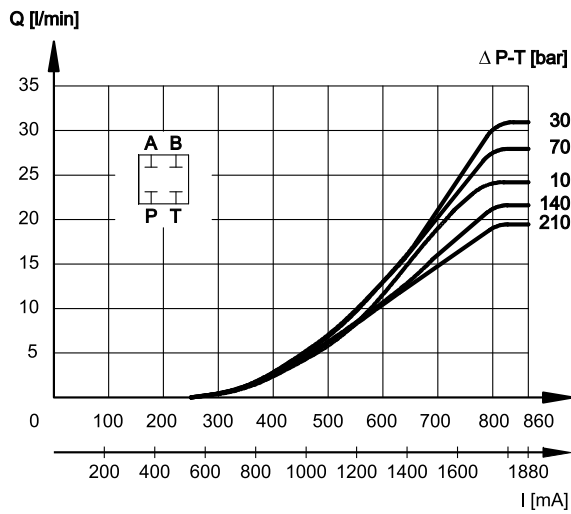
#### SPOOL TYPE C08



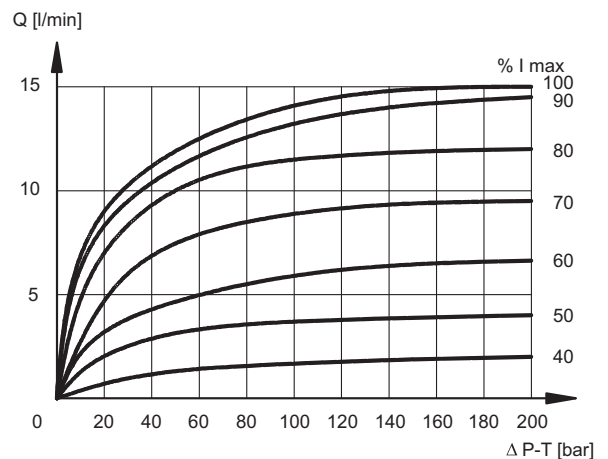
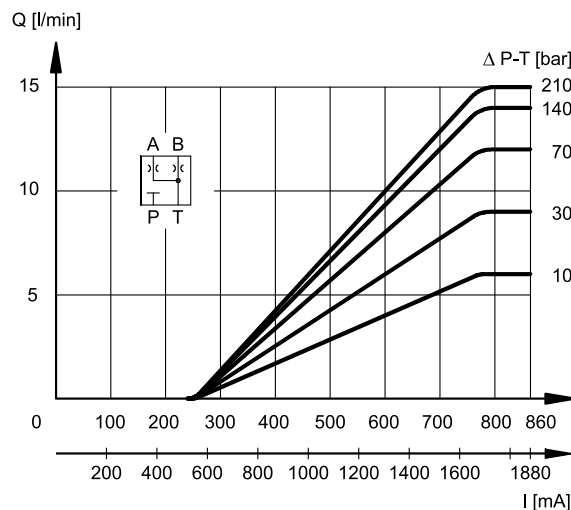
## SPOOL TYPE C16



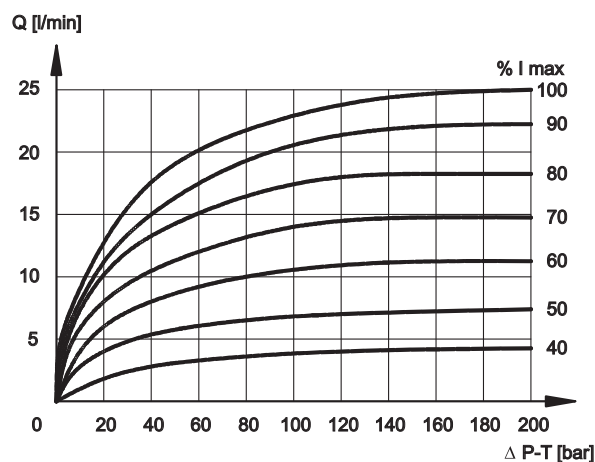
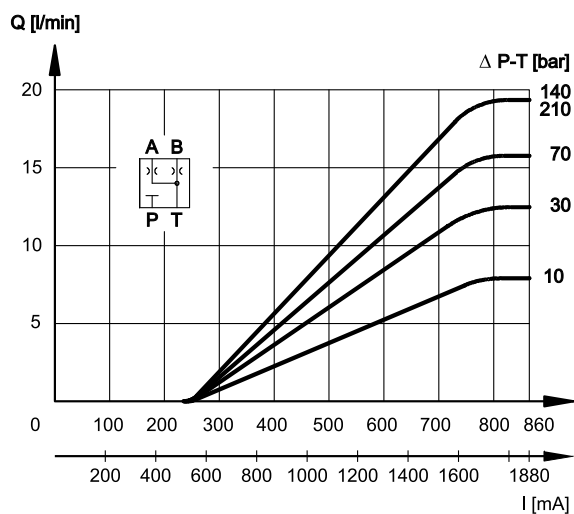
## SPOOL TYPE C26



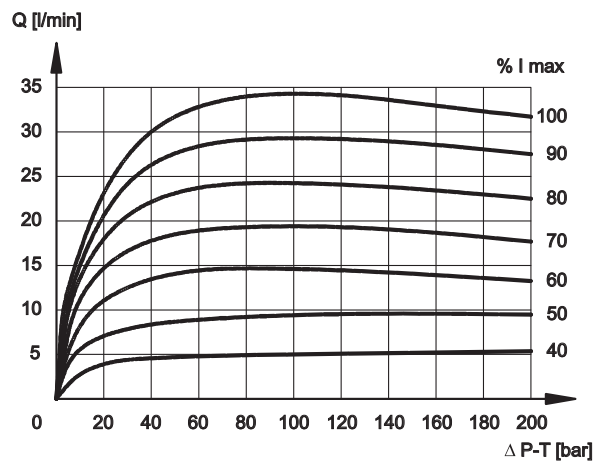
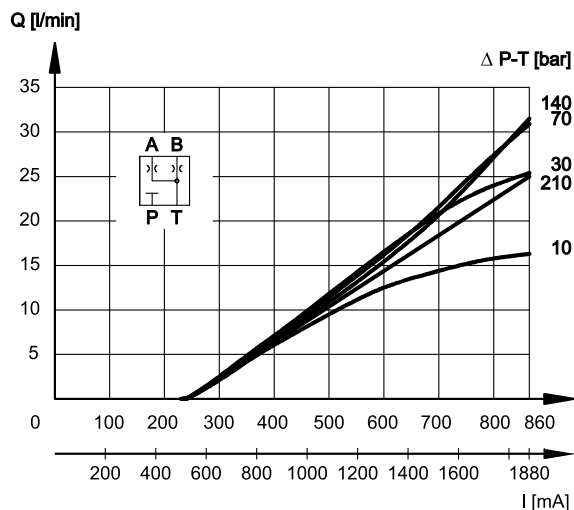
## SPOOL TYPE A04



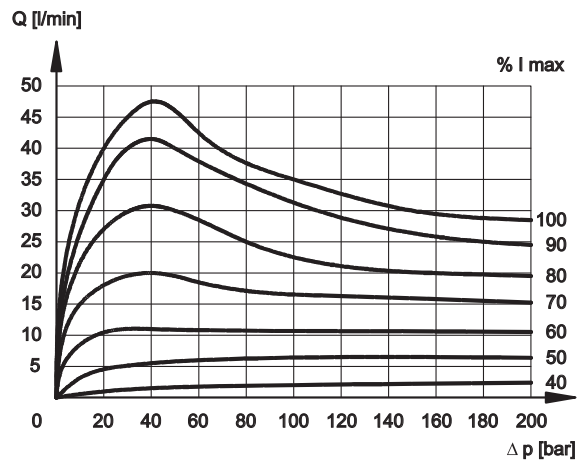
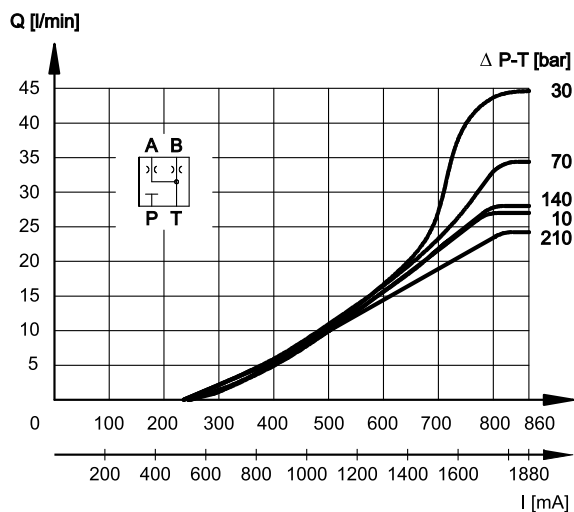
## SPOOL TYPE A08



## SPOOL TYPE A16



## SPOOL TYPE A26



### 4 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

#### Protection from atmospheric agents IEC EN 60529

Plug-in type	IP 65	IP 69 K
K1 EN 175301-803 (ex DIN 43650)	x (*)	
K7 DEUTSCH DT04 male	x	x (*)

(\*) The protection degree is guaranteed only with the connector correctly connected and installed

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C) K1 coil K7 coil	Ω	3.66 4	17.6 19
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU		
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation:	class H class F		

### 5 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control unit)

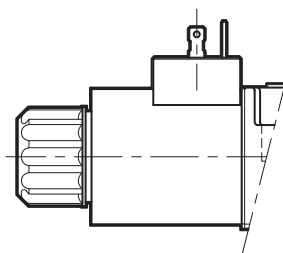
Step response is the time taken for the valve to reach 90% of the setted positioning value, following a step change of reference signal. The table shows typical response times tested with spool type C16 and  $\Delta p = 30$  bar P-T.

REFERENCE SIGNAL STEP	0→100%	100%→0
Step response [ms]		
DSE3-A* DSE3-C*	50	40

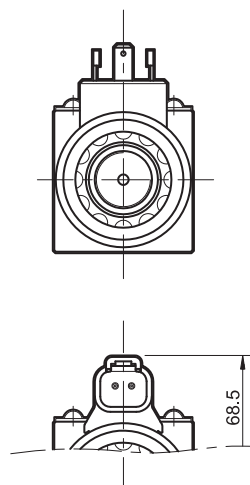
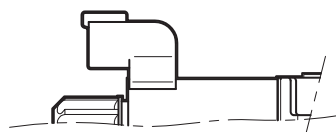
### 6 - ELECTRIC CONNECTIONS

Connectors for K1 connection are always delivered together with the valve.

connection for EN 175301-803  
(ex DIN 43650) connector  
code **K1 (standard)**  
code **WK1** (W7 version only)

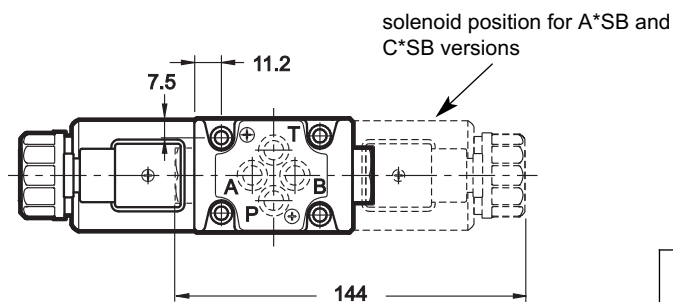
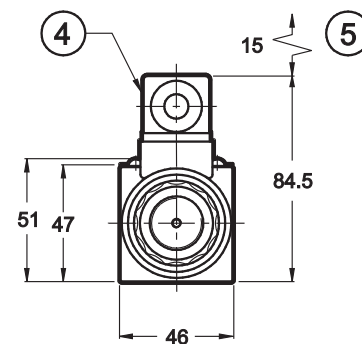
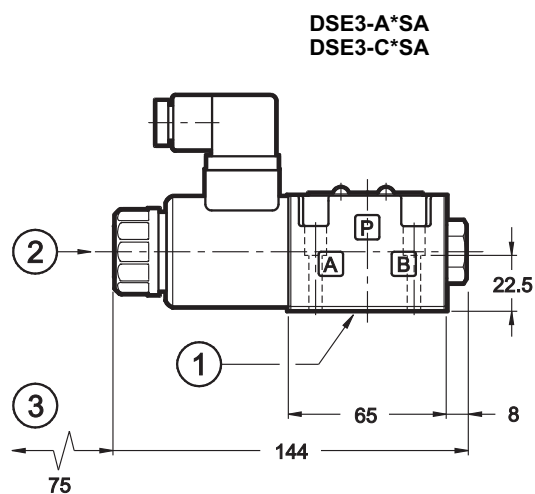
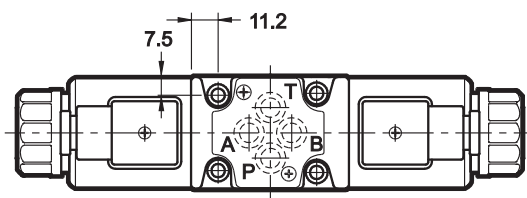
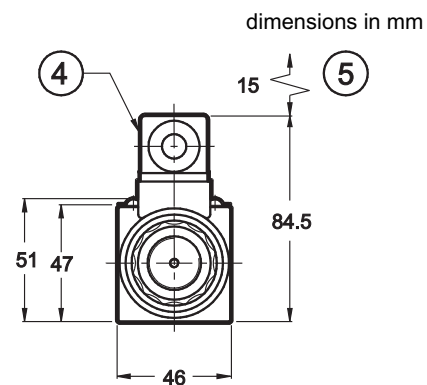
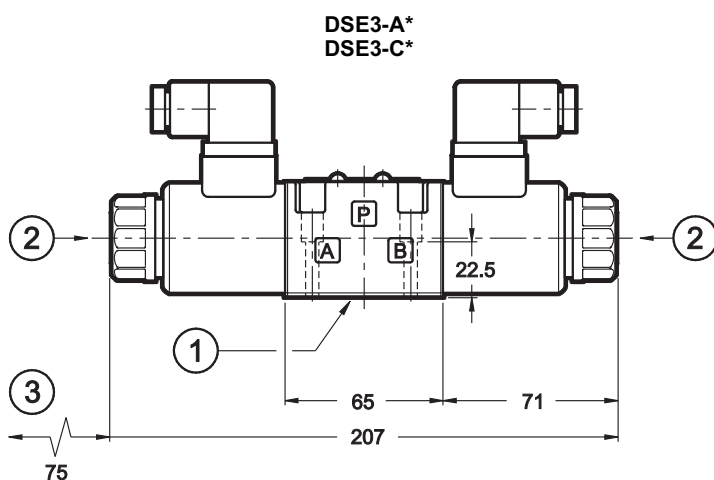


connection for  
DEUTSCH DT06-2S male connector  
code **K7**





## 7 - OVERALL AND MOUNTING DIMENSIONS



Fastening bolts: 4 bolts M5x30 - ISO 4762

Torque: 5 Nm (A8.8)

Threads of mounting holes: M5x10

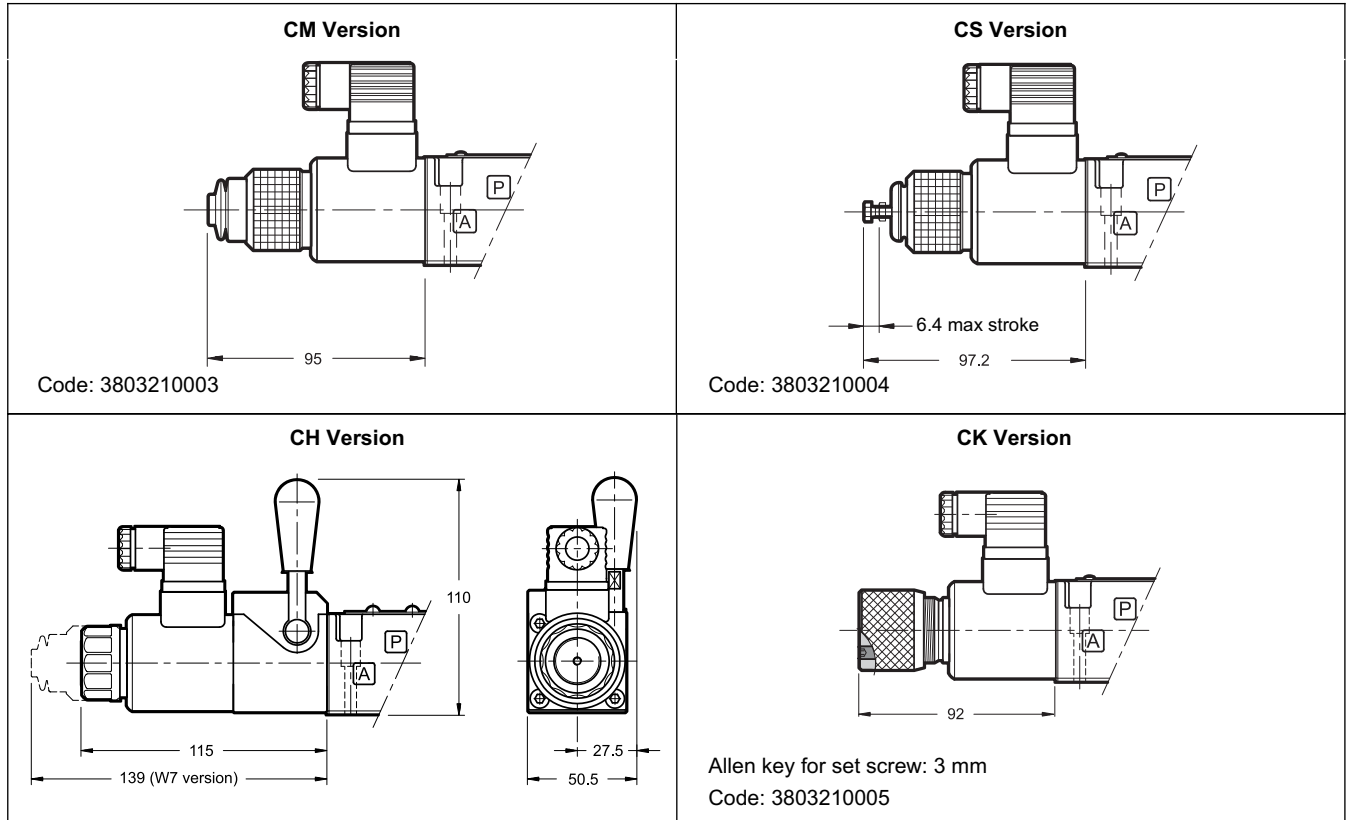
1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Standard manual override, integrated in the solenoid tube
3	Coil removal space
4	Electric connector type EN 175301-803 (ex DIN 43650)
5	Connector removal space

### 8 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this override must be executed with a suitable tool, minding not to damage the sliding surface.

Four different manual override versions are available upon request:

- **CM** version, manual override belt protected.
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.
- **CH** version, lever manual override. The lever device is always placed at the A side of the valve.
- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.



### 9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids like HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). For HFDR fluids type (phosphate esters) use FPM seals (code V). For use with other kind of fluids such as HFA, HFB, HFC please consult our technical department.

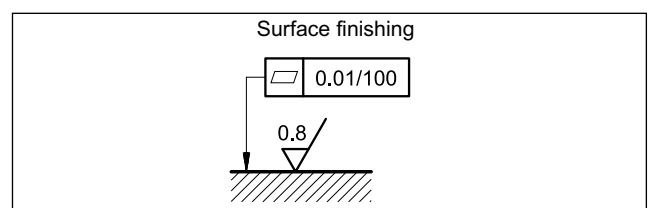
Operation with fluid temperature exceeding 80°C causes premature deterioration of the quality of the fluid and seals. The physical and chemical properties of the fluid must be maintained.

### 10 - INSTALLATION

DSE3 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.





## 11 - ELECTRONIC CONTROL UNITS

### DSE3 - \*\* SA (SB)

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat.89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		

### DSE3 - A\* DSE3 - C\*

<b>EDM-M212</b>	24V DC solenoids	rail mounting DIN EN 50022	see cat. 89 250
<b>EDM-M242</b>	12V DC solenoids		

## 12 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G ports on rear
Type PMMD-AL3G side ports
P, T, A, B port threading: 3/8" BSP



**DUPLOMATIC**  
**OLEODINAMICA**

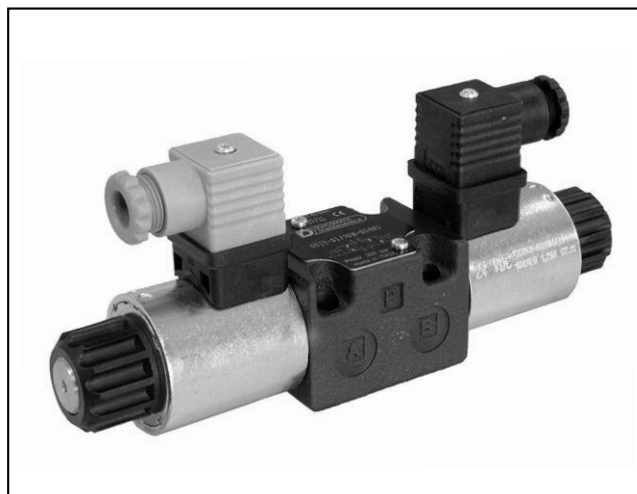
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

www.diplomatic.com • e-mail: sales.exp@diplomatic.com



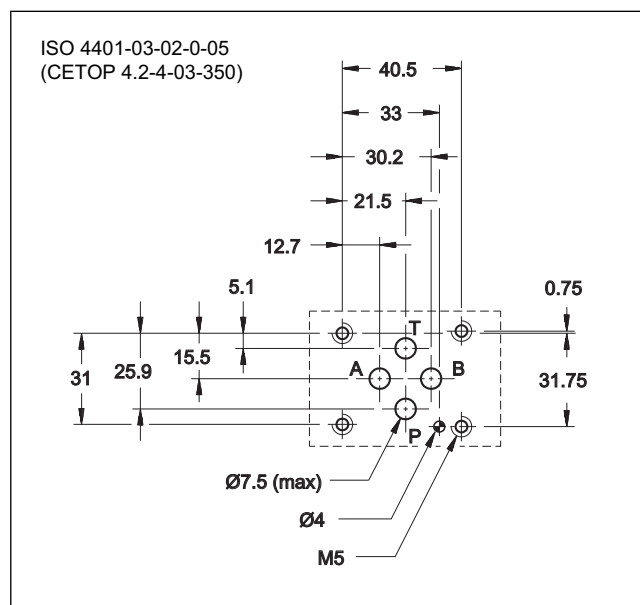
# DSE3B

## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL SERIES 10

### SUBPLATE MOUNTING ISO 4401-03

**p** max **350** bar  
**Q** max **40** l/min

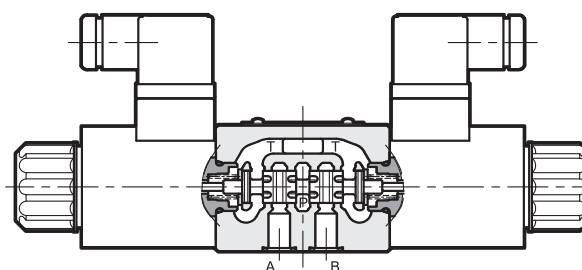
### MOUNTING INTERFACE



**PERFORMANCES** (obtained with mineral oil with viscosity of 36 cSt at 50°C and with electronic control unit)

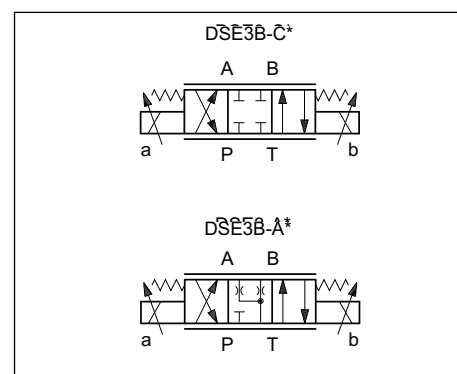
Max operating pressure: P - A - B ports T port	bar	350 160
Nominal flow with $\Delta p$ 10 bar P-T	l/min	8 - 16 - 26
Step response		see chapter 5
Hysteresis (with PWM 200 Hz)	% $Q_{max}$	< 6%
Repeatability	% $Q_{max}$	< $\pm 2\%$
Electrical characteristics		see chapter 4
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,6 2,0

### OPERATING PRINCIPLE



- The DSE3B valve is a directly operated directional control valve with electric proportional control and with ports, in compliance with ISO 4401-03 standards.
- It is used for directional and speed control of hydraulic actuators.
- Valve opening and hence flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or combined with an external electronic card to exploit valve performance to the full (see par. 11).

### HYDRAULIC SYMBOLS (typical)



## 1 - IDENTIFICATION CODE

D	S	E	3	B	-					/ 10	-			/	
---	---	---	---	---	---	--	--	--	--	------	---	--	--	---	--

Directly operated directional control valve

Electric proportional control

Size ISO 4401-03 \_\_\_\_\_

Spool type: \_\_\_\_\_  
**C** = closed centers  
**A** = open centers

Spool nominal flow \_\_\_\_\_  
 (see paragraph 2)

Solenoid position (omit for configuration with two solenoids): \_\_\_\_\_  
**SA** = 1 solenoid on side A  
**SB** = 1 solenoid on side B

Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE**)  
 Omit if not required

Option: manual override (see at par. 8)

Coil electrical connection:  
**K1** = plug for connector type DIN 43650 (**standard**)  
**K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

**D12** = Nominal solenoid voltage 12V DC  
**D24** = Nominal solenoid voltage 24V DC

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

**NOTE:** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to 240 hours. (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For a salt spray resistance up to 600 hours order the high corrosion resistance version.

### 1.1 - High corrosion resistance version

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are specific for this version, featuring a zinc-nickel surface treatment. Electrical features at paragraph 4.

The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it:

D	S	E	3	B	-		/ 10	-		/		/	W7
---	---	---	---	---	---	--	------	---	--	---	--	---	----

Choices as in standard identification code

DC power supply \_\_\_\_\_  
**D12** = 12 V  
**D24** = 24 V

Coil electrical connection \_\_\_\_\_  
**WK1** = plug for connector type DIN 43650  
 On request: plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.

Manual override:  
**CM** = manual override, boot protected (**standard**)  
**CK** = knob manual override

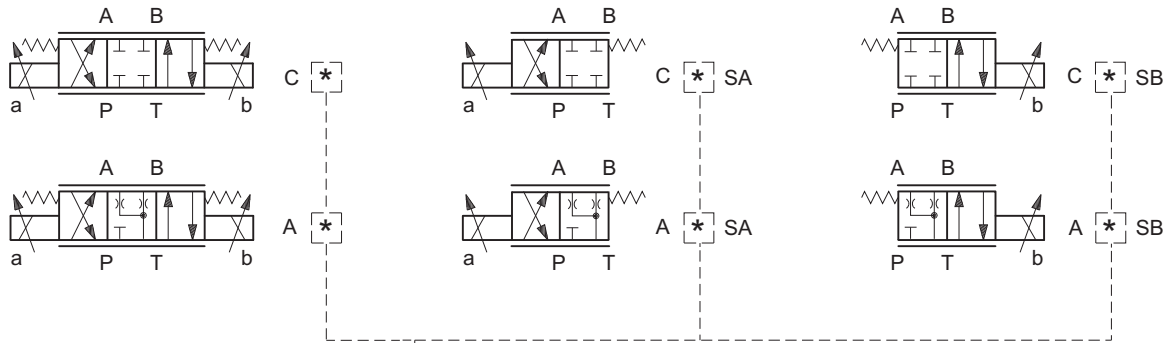
## 2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:  
number of proportional solenoids, spool type, nominal flow rate.

2 solenoids configuration:  
3 positions with spring centering

“SA” configuration: 1 solenoid on side A.  
2 positions (central + external) with  
spring centering

“SB” configuration: 1 solenoid on side B.  
2 positions (central + external) with  
spring centering



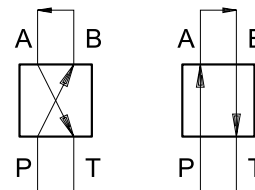
*	Controlled flow with $\Delta p 10$ bar P-T
08	8 l/min
16	16 l/min
26	26 l/min

### 3 - CHARACTERISTIC CURVES

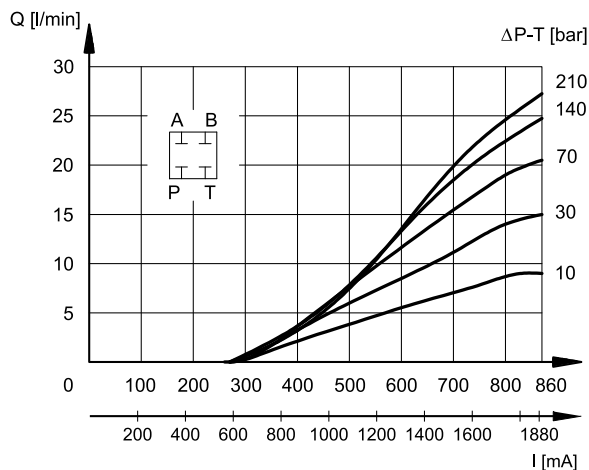
(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

Typical constant flow rate control curves at  $\Delta p$  according to current supply to solenoid (D24 version, maximum current 860 mA), measured for the various spool types available.

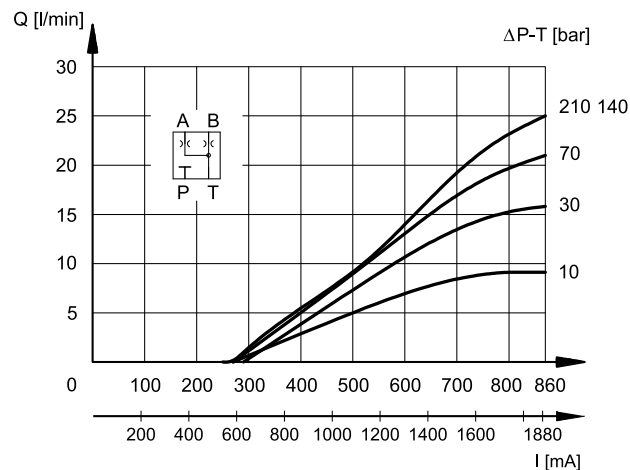
The reference  $\Delta p$  values are measured between ports P and T on the valve.



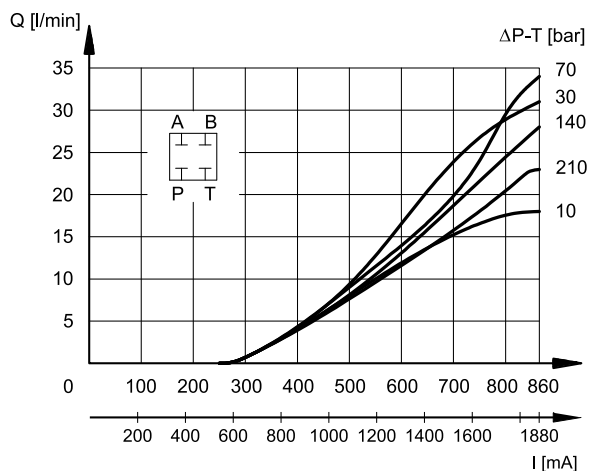
**SPOOL TYPE C08**



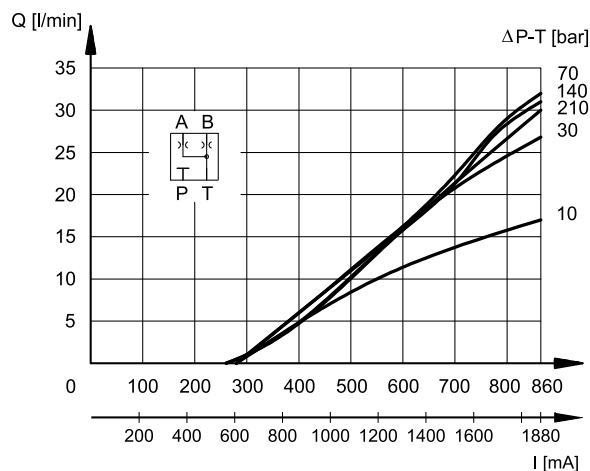
**SPOOL TYPE A08**



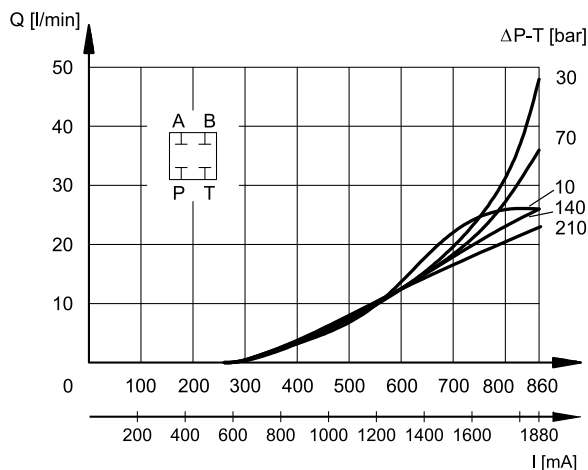
**SPOOL TYPE C16**



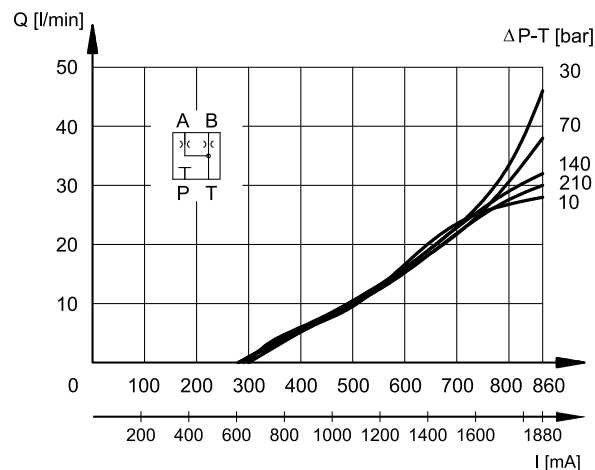
**SPOOL TYPE A16**



**SPOOL TYPE C26**



**SPOOL TYPE A26**



## 4 - ELECTRICAL CHARACTERISTICS

### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

### Protection from atmospheric agents CEI EN 60529

Plug-in type	IP 65	IP 69 K
K1 DIN 43650	x (*)	
K7 DEUTSCH DT04 male	x	x (*)

(\*) The protection degree is guaranteed only with the connector correctly connected and installed.

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>	<b>24</b>
<b>RESISTANCE (at 20°C)</b>	Ω	4,4	18,6
<b>MAXIMUM CURRENT</b>	A	1,88	0,86
<b>DUTY CYCLE</b>	100%		
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	according to 2004/108/EC		
<b>CLASS OF PROTECTION:</b> coil insulation (VDE 0580) impregnation	class H class F		

## 5 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control units)

Step response is the time taken for the valve to reach 90% of the settled positioning value, following a step change of reference signal.

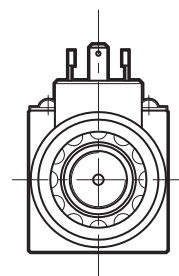
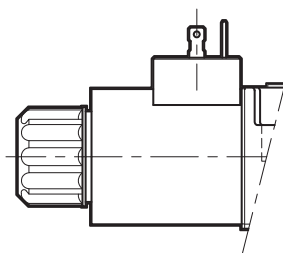
The table shows typical response times tested with spool type C16 and  $\Delta p = 30$  bar P-T.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]		
<b>DSE3B-A*</b> <b>DSE3B-C*</b>	50	40

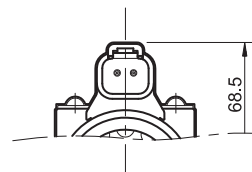
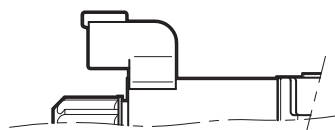
## 6 - ELECTRIC CONNECTIONS

Connectors for K1 connection are always delivered together with the valves.

connection for DIN 43650  
connector  
code **K1 (standard)**  
code **WK1** (W7 version only)



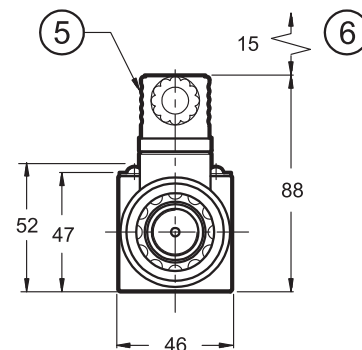
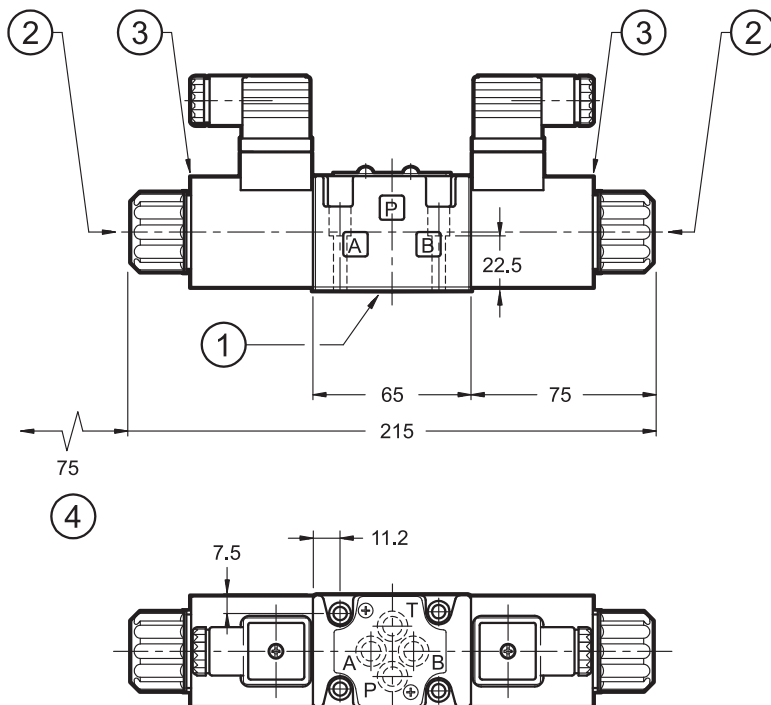
connection for  
DEUTSCH DT06-2S male connector  
code **K7**



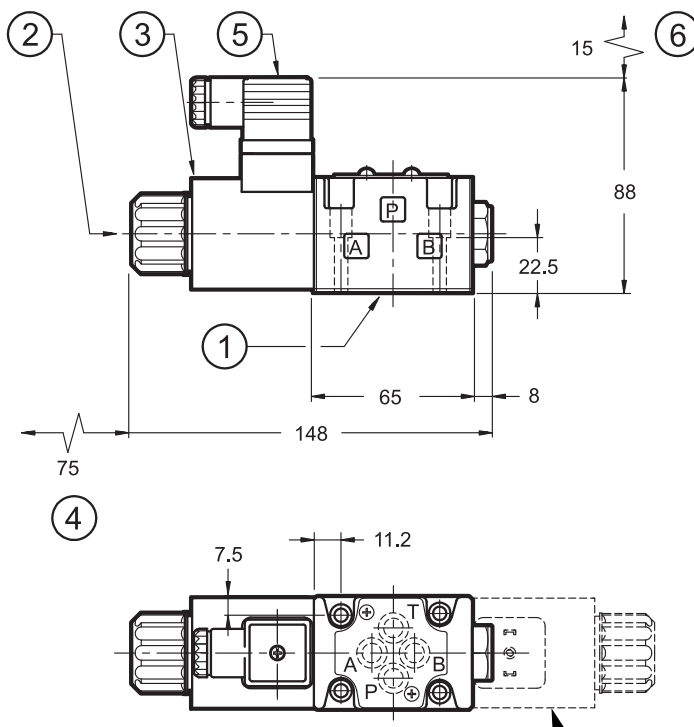


## 7 - OVERALL AND MOUNTING DIMENSIONS

DSE3B-A\*  
DSEB3-C\*



DSE3B-A\*SA  
DSE3B-C\*SA



A\*SB and C\*SB versions solenoid position

dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) 90 shore
2	Standard manual override integrated in the solenoid tube (see par. 8)
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 electric coil connector
6	Connector removal space

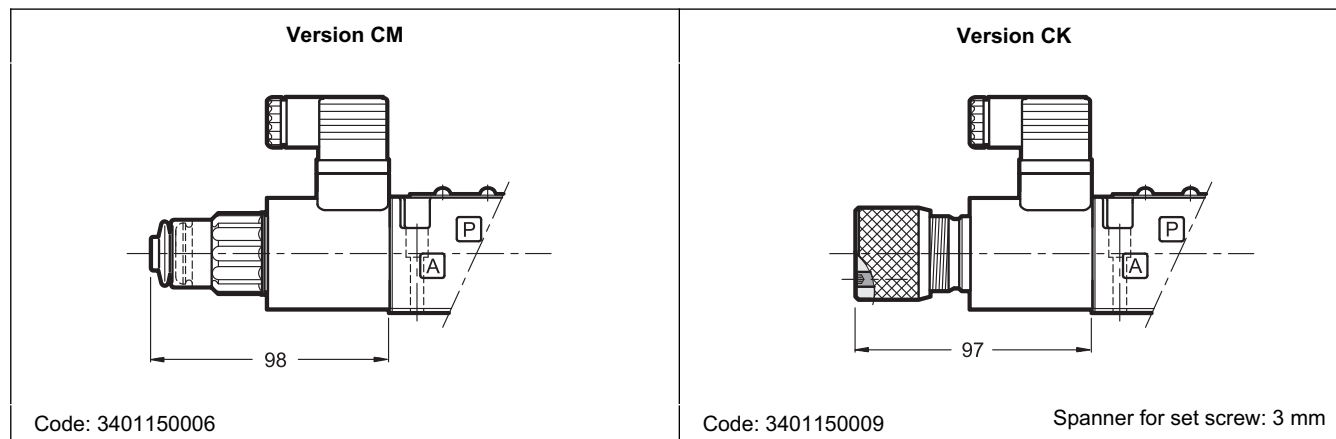
Fastening bolts: 4 SHCS M5x30  
Torque: 5 Nm (A 8.8)  
Threads of mounting holes : M5x10  
Locking ring tightening torque:  
5 ± 0.5 Nm

## 8 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

- **CM** version, manual override belt protected.
- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.



## 9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids like HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). For HFDR fluids type (phosphate esters) use FPM seals (code V). For use with other kind of fluids such as HFA, HFB, HFC please consult our technical department.

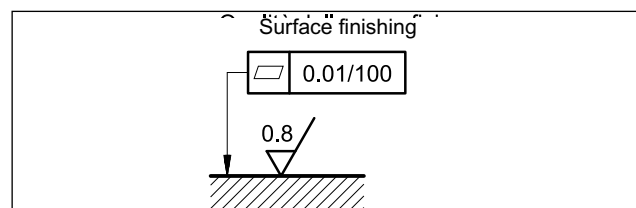
Operation with fluid temperature exceeding 80°C causes premature deterioration of the quality of the fluid and seals. The physical and chemical properties of the fluid must be maintained.

## 10 - INSTALLATION

DSE3B valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.





## 11 - ELECTRONIC CONTROL UNITS

### DSE3B - \*\* SA (SB)

<b>EDC-112</b>	for solenoid 24V DC	plug version	see cat. 89 120
<b>EDC-142</b>	for solenoid 12V DC		
<b>EDM-M112</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M142</b>	for solenoid 12V DC		

### DSE3B - A\*      DSE3B - C\*

<b>EDM-M212</b>	24V DC solenoids	rail mounting DIN EN 50022	see cat. 89 250
<b>EDM-M242</b>	12V DC solenoids		

## 12 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G ports on rear (3/8" BSP threaded)
Type PMMD-AL3G side ports (3/8" BSP threaded)



**DIPLOMATIC OLEODINAMICA S.p.A.**

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Fax +39 0331.895.339

www.diplomatic.com • e-mail: sales.exp@diplomatic.com



# DSE3G

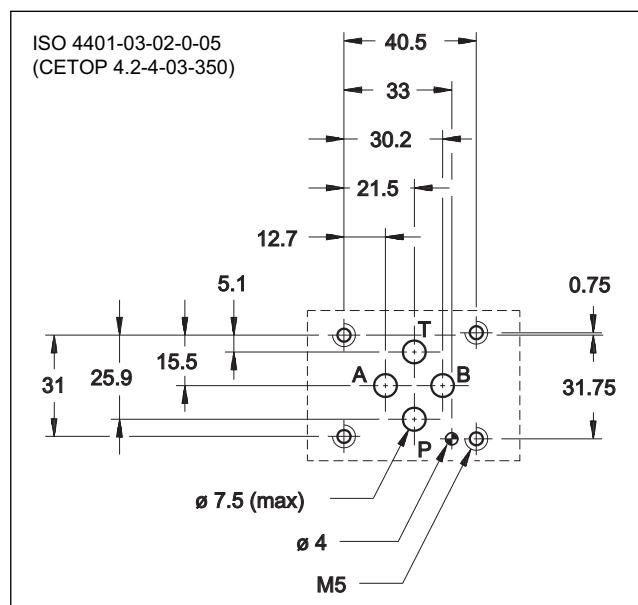
## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS SERIES 31

### SUBPLATE MOUNTING ISO 4401-03

**p max 350 bar**

**Q max 40 l/min**

### MOUNTING INTERFACE

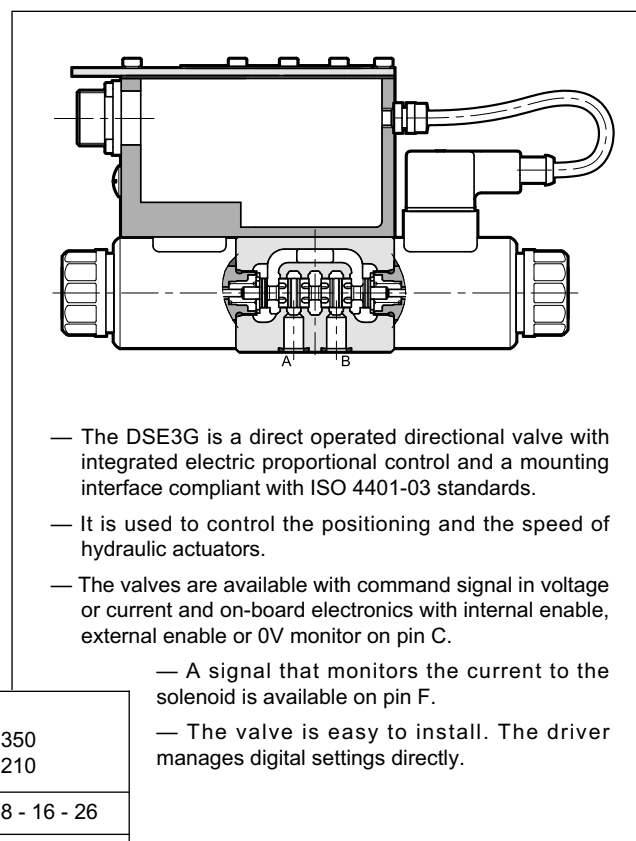


### PERFORMANCES

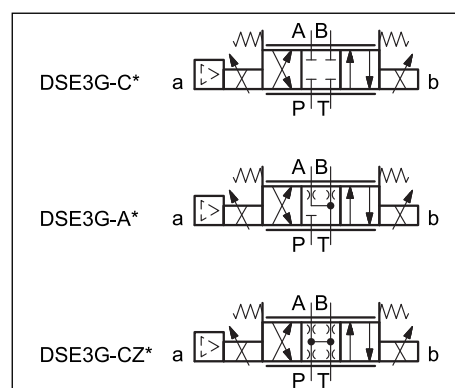
(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Max operating pressure: - P - A - B ports - T port	bar	350 210
Nominal flow with $\Delta p$ 10 bar P-T	l/min	1 - 4 - 8 - 16 - 26
Response times	see paragraph 7	
Hysteresis	% of Q max	< 3%
Repeatability	% of Q max	< $\pm 1\%$
Electrical characteristics	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,9 2,4

### OPERATING PRINCIPLE



### HYDRAULIC SYMBOLS (typical)



## 1 - IDENTIFICATION CODE

<b>D</b>	<b>S</b>	<b>E</b>	<b>3</b>	<b>G</b>	<b>-</b>				<b>/ 31</b>	<b>-</b>		<b>K11</b>	<b>/</b>	
----------	----------	----------	----------	----------	----------	--	--	--	-------------	----------	--	------------	----------	--

Direct operated directional control valve

Electric proportional control

Size ISO 4401-03

Digital integrated electronics for open loop

Spool type:  
**C** = closed centres  
**A** = open centres  
**CZ** = closed centres with overlap jump

Nominal flow rate of the spool (see chart par. 2)

Solenoid position (omit for 2 solenoids configuration):  
**SA** = 1 solenoid on side A

Option:  
manual override (see paragraph 8)

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector 6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10$  V  
**E1** = current  $4 \div 20$  mA

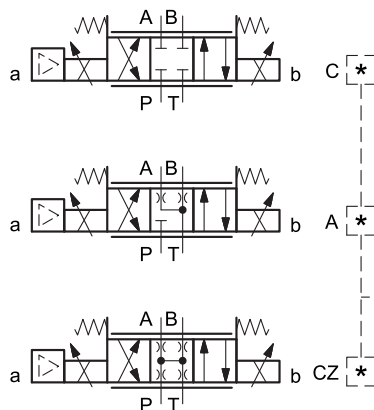
Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No.  
 (the overall and mounting dimensions remain unchanged from 30 to 39)

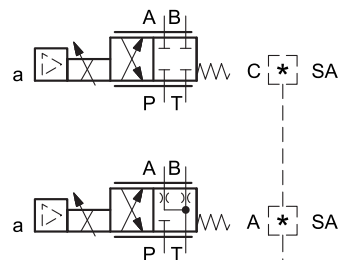
## 2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:  
 number of proportional solenoids, spool type, rated flow.

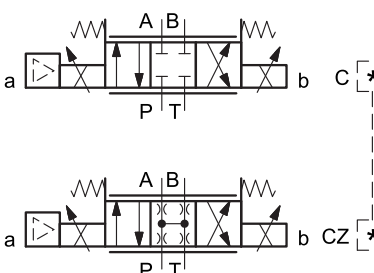
Configuration 2 solenoids :  
 3 positions with spring centering



Configuration 1 solenoid on side A "SA":  
 2 positions (central + external) with spring centering



*	Controlled flow with $\Delta p 10$ bar P-T
<b>04</b>	4 l/min
<b>08</b>	8 l/min
<b>16</b>	16 l/min
<b>16/08</b>	16 (P-A) / 08 (B-T) l/min
<b>26</b>	26 l/min
<b>26/13</b>	26 (P-A) / 13 (B-T) l/min



*	Controlled flow with $\Delta p 10$ bar P-T
<b>01R</b>	1 l/min

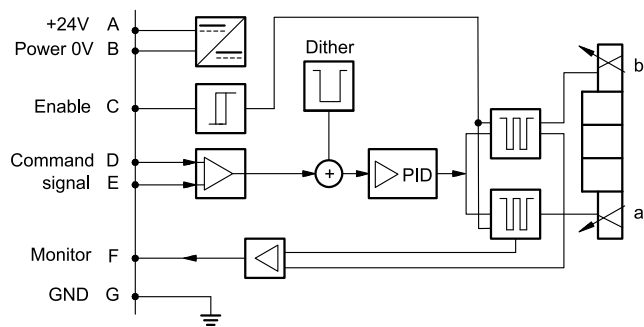
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

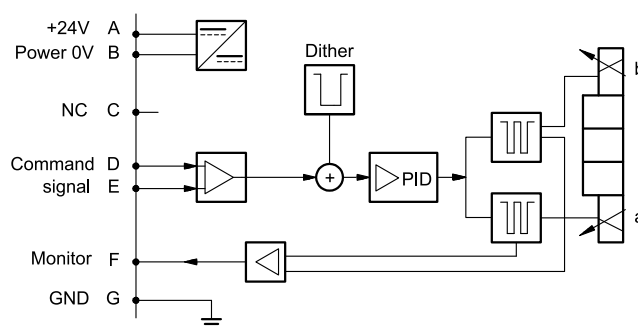
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedence $R_i > 11 \text{ k}\Omega$ ) $4 \div 20$ (Impedence $R_i = 58 \text{ }\Omega$ )
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedence $R_o > 1 \text{ k}\Omega$ ) $4 \div 20$ (Impedence $R_o = 500 \text{ }\Omega$ )
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams

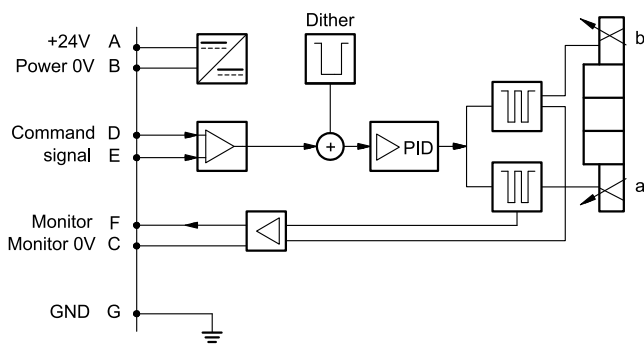
**VERSION A - External Enable**



**VERSION B - Internal Enable**

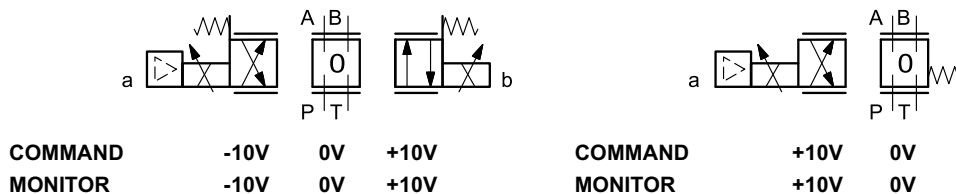


**VERSION C - 0V Monitor**



## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between -10V and +10V on double solenoid valve, and 0 ÷ 10V on single solenoid valve SA. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.

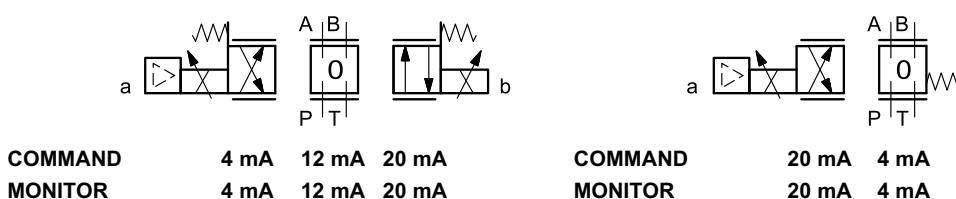


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient restoring the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

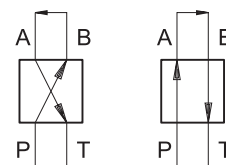
### 6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)

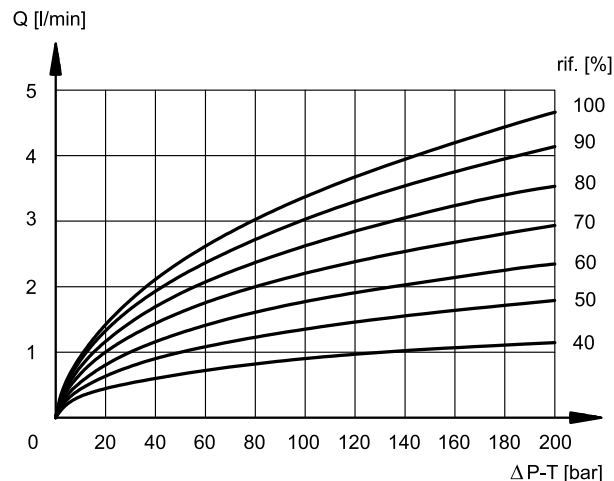
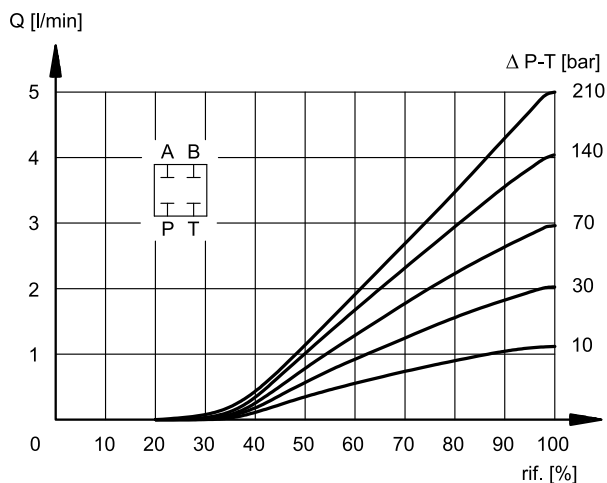
Typical flow rate curves at constant  $\Delta p$  related to the reference signal and measured for the available spools. The  $\Delta p$  values are measured between P and T valve ports.

The curves are obtained after linearization in factory of the characteristic curve through the digital amplifier. The linearization of the curve is performed with a constant  $\Delta p$  of 5 bar and by setting the value of flow start at 20% of the reference signal.

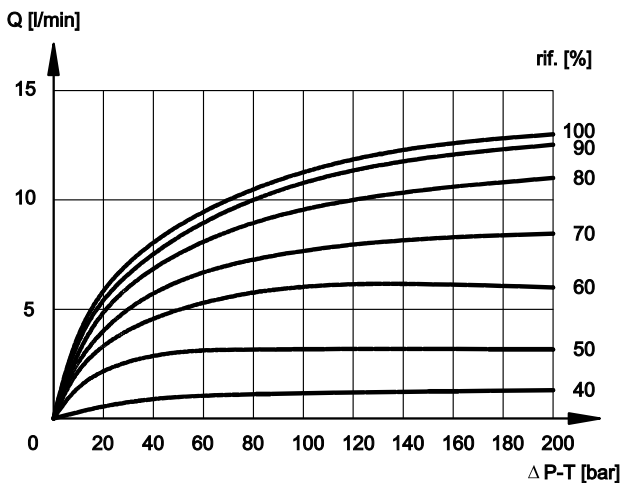
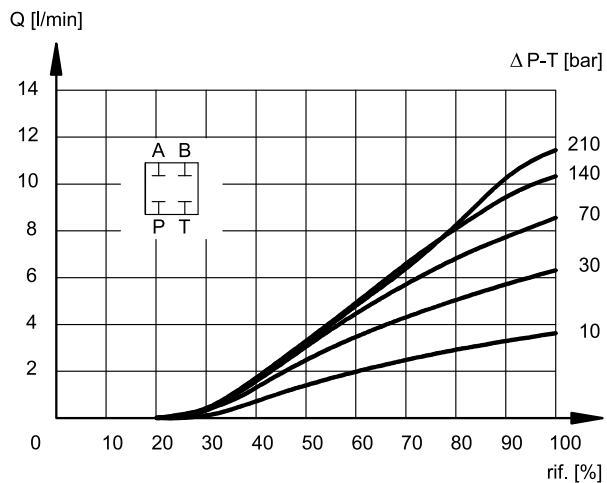
**NOTE:** for the zero overlap spool (Z), please refer to the characteristic curves of C type spool, considering that the starting flow rate value is approx. 150 mV.



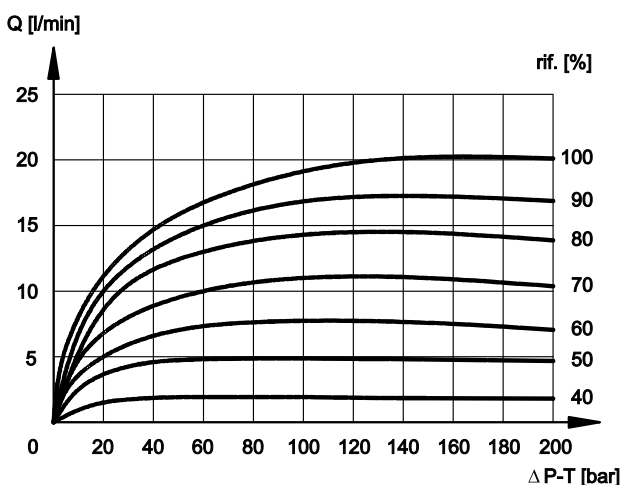
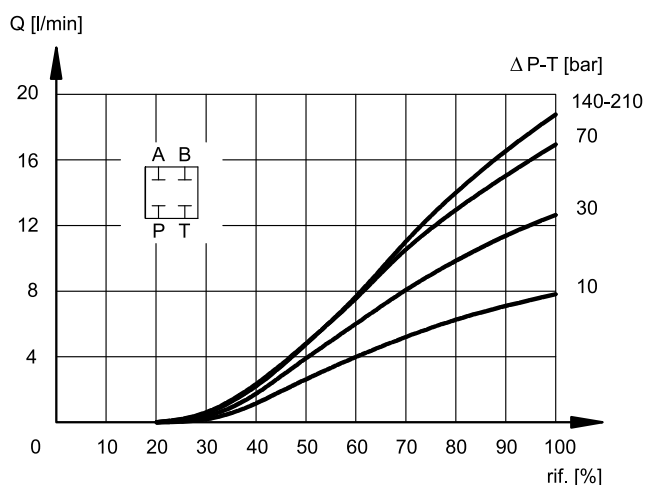
#### SPOOL TYPE C01R



#### SPOOL TYPE C04



#### SPOOL TYPE C08



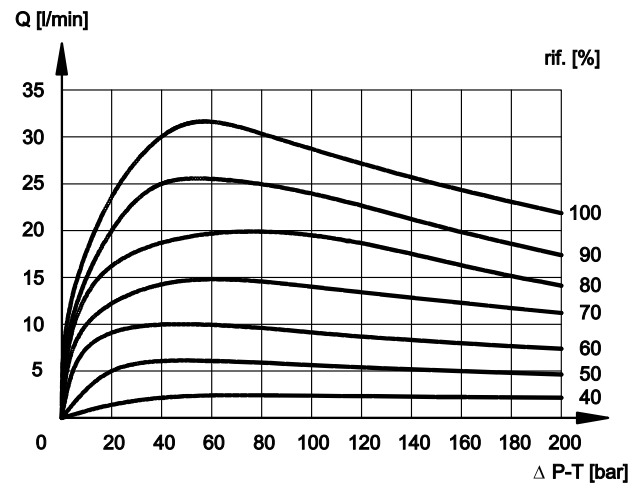
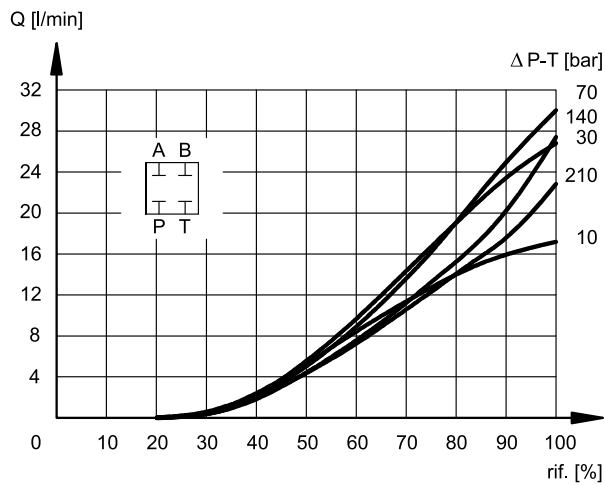




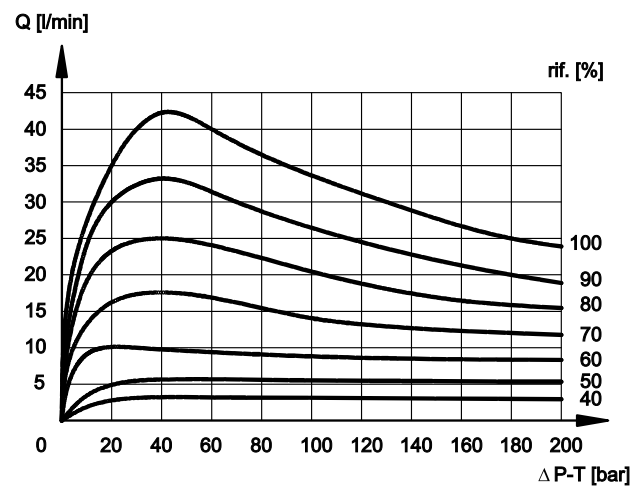
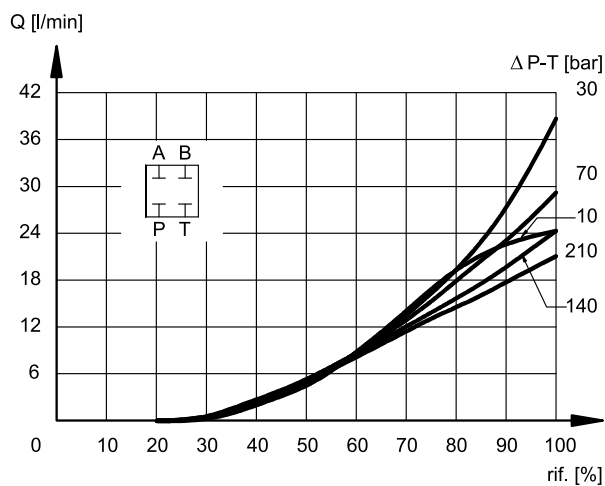
# DSE3G

## SERIES 31

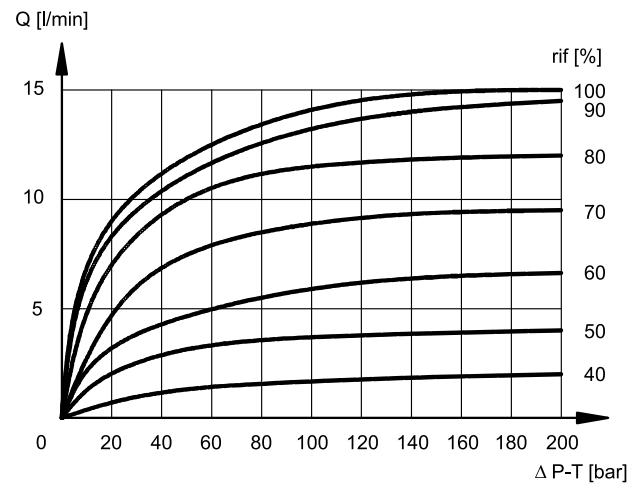
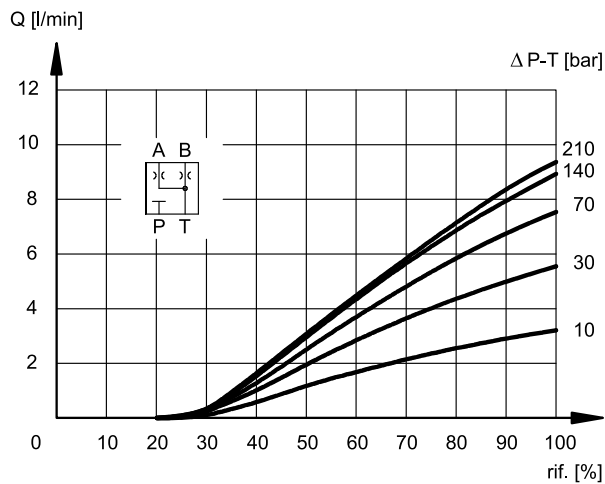
SPOOL TYPE C16



SPOOL TYPE C26

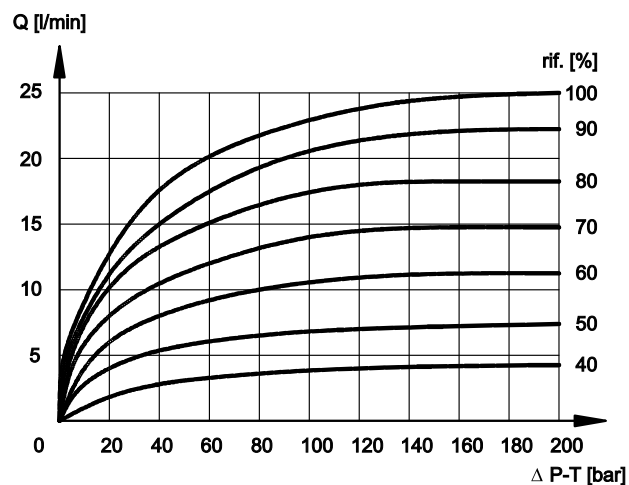
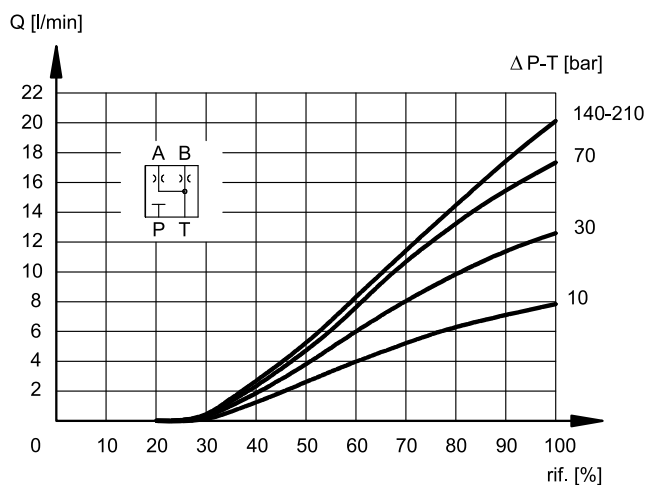


SPOOL TYPE A04

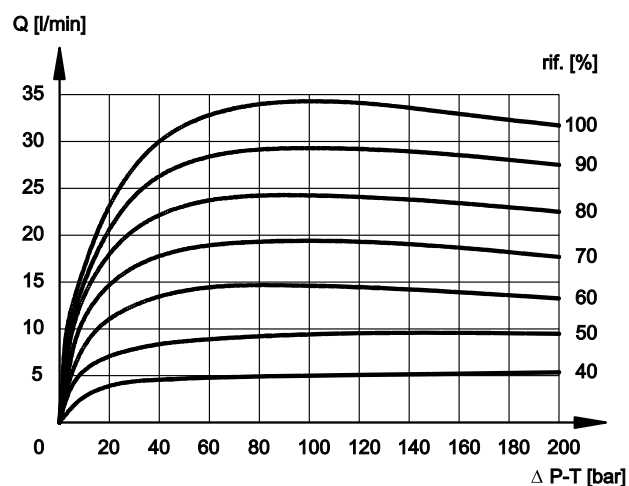
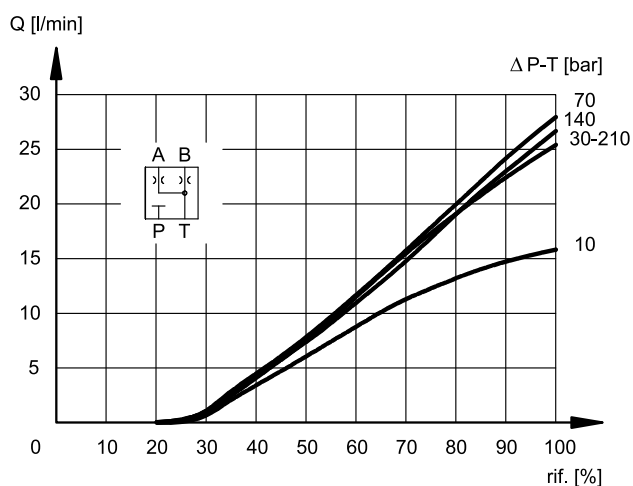




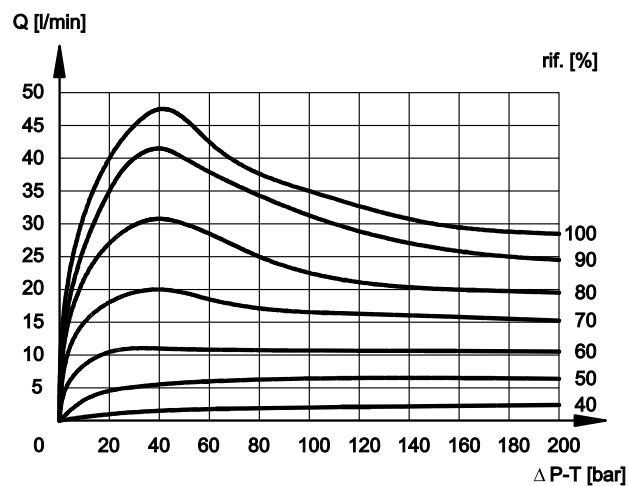
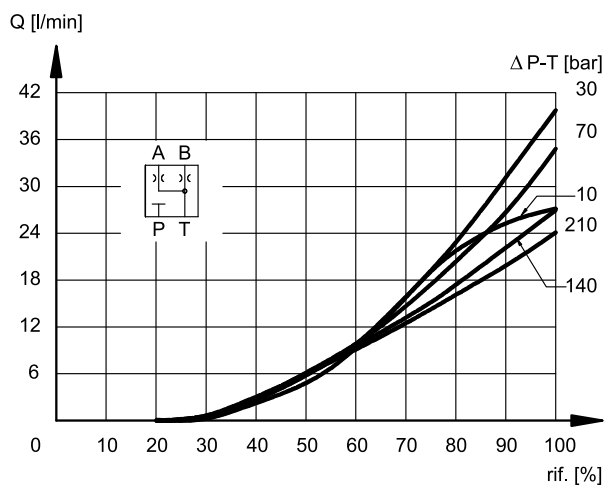
## SPOOL TYPE A08



## SPOOL TYPE A16

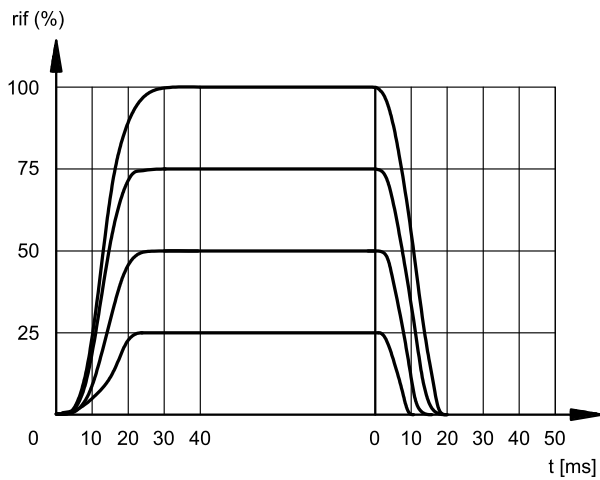


## SPOOL TYPE A26



## 7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)

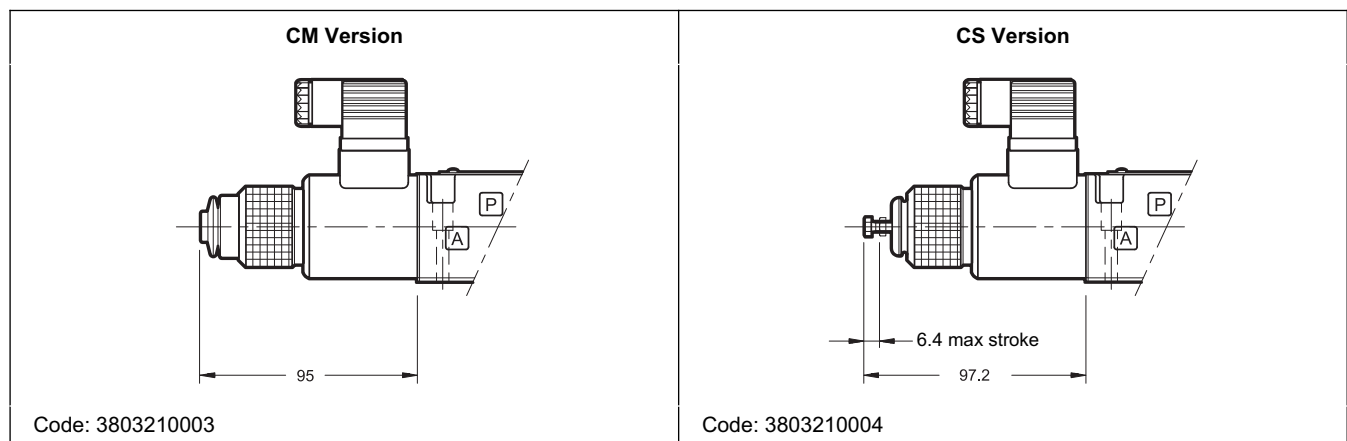


## 8 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The actuation of this override must be executed with a suitable tool, minding not to damage the sliding surface.

Two versions are available upon request:

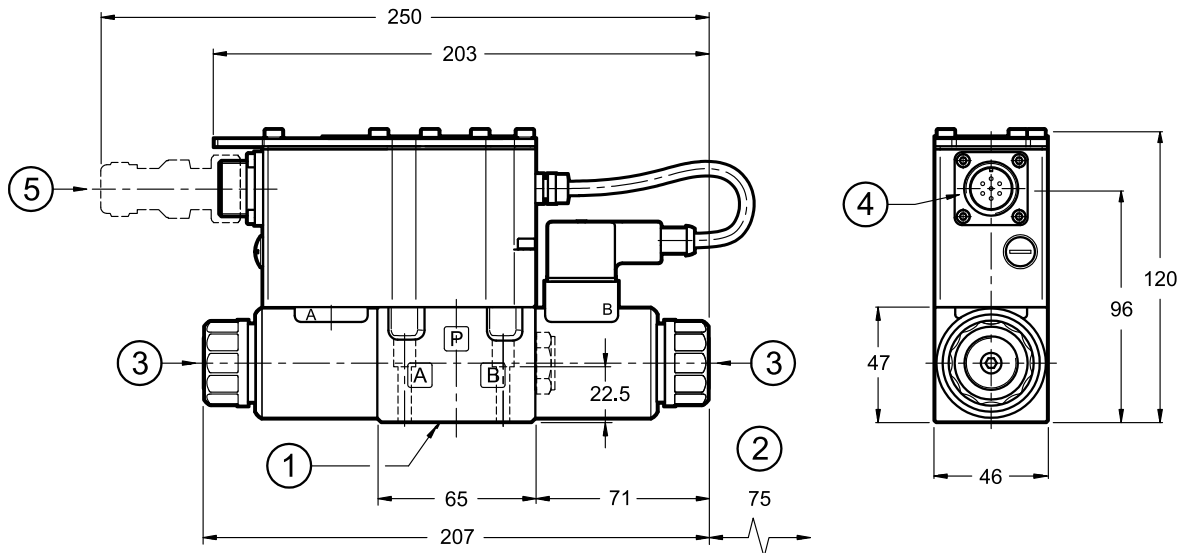
- **CM** version, manual override boot protected.
- **CS** version, with metal locking ring provided with an M4 screw and lock nut to allow the continuous and adjustable mechanical operation.



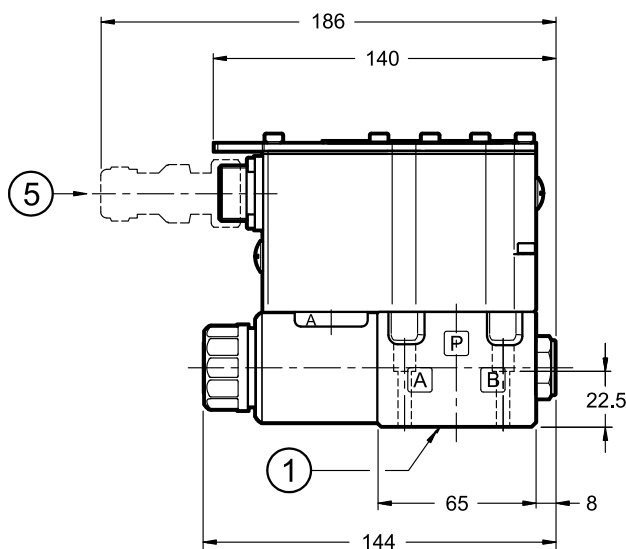
## 9 - OVERALL AND MOUNTING DIMENSIONS

DSE3G-A\*  
DSE3G-C\*  
DSE3G-CZ\*

dimensions in mm



DSE3G-A\* SA  
DSE3G-C\* SA



Fastening bolts: 4 bolts M5x30 - ISO 4762

Torque: 5 Nm (A8.8)

Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space (solenoid B only)
3	Standard manual override embedded in the solenoid tube
4	Main connection
5	Mating connector. <b>To be ordered separately.</b> See paragraph 12



## 10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

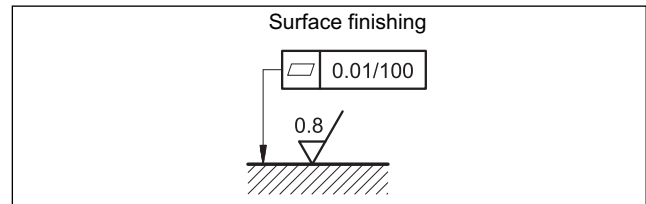
The fluid must be preserved in its physical and chemical characteristics.

## 11 - INSTALLATION

DSE3G valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 12 - ACCESSORIES

(to be ordered separately)

### 12.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

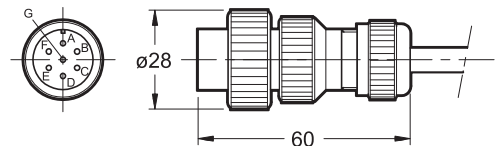


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 12.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 12.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 13 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP

**DUPLOMATIC**  
MOTION SOLUTIONS

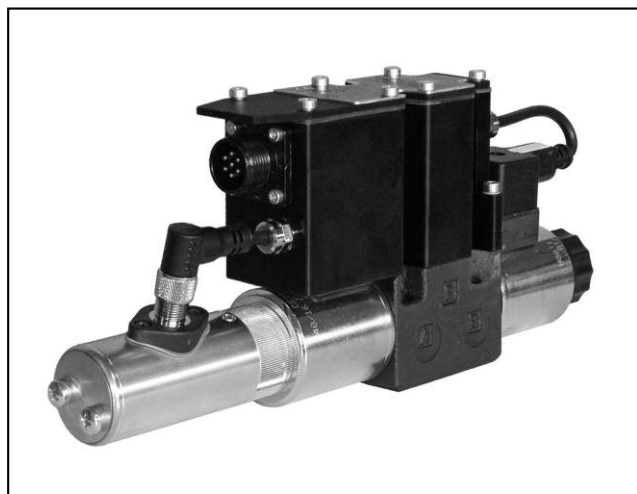
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

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Fax +39 0331.895.339

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# DSE3J

## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL FEEDBACK AND INTEGRATED ELECTRONICS

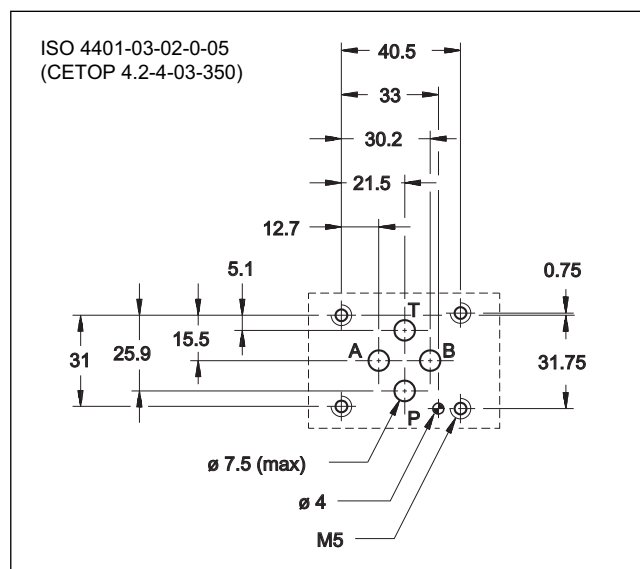
### SERIES 31

#### SUBPLATE MOUNTING ISO 4401-03

**p** max 350 bar

**Q** max 80 l/min

#### MOUNTING INTERFACE



#### PERFORMANCES

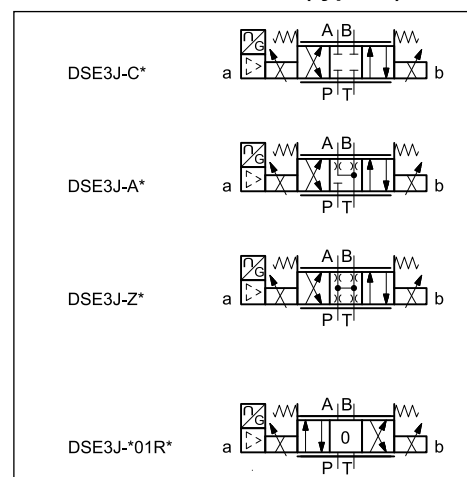
(Mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Max operating pressure: - P - A - B ports - T port	bar	350 210
Nominal flow with $\Delta p$ 10 bar P-T	l/min	1 - 4 - 12 - 30
Response times	see paragraph 7	
Hysteresis	% of Q max	< 0,2%
Repeatability	% of Q max	< 0,2%
Threshold		< 0,1%
Valve reproducibility		≤ 5%
Electrical characteristics	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	2,2 2,7

#### OPERATING PRINCIPLE

- 
- The DSE3J is a direct operated directional valve with integrated electric proportional control, feedback and mounting interface in compliance with ISO 4401 standards.
  - The valve opening and hence flow rate can be modulated continuously in proportion to the reference signal. Transducer and digital card allow a fine control of the positioning of the cursor, reducing hysteresis and response time and optimizing the performance of the valve.
  - It is available with fail safe function (spools type Z).
  - The valve is easy to install. The driver manages digital settings directly. It's possible to customize the settings for special applications using the optional kit (see at par. 11).

#### HYDRAULIC SYMBOLS (typical)



## 1 - IDENTIFICATION CODE

D	S	E	3	J	-				/	31	-		K11	
---	---	---	---	---	---	--	--	--	---	----	---	--	-----	--

Direct operated directional control valve

Electric proportional control

Size ISO 4401-03

Digital integrated electronics for valves with feedback

Spool type: \_\_\_\_\_  
**C** = closed centres  
**A** = open centres  
**Z** = zero overlap

Nominal flow rate of the spool (see chart par. 2) \_\_\_\_\_

**FS** = Fail safe option. (omit if not required). Available on spool Z04, Z12 and Z30 only.

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector 6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10$  V  
**E1** = current  $4 \pm 20$  mA

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

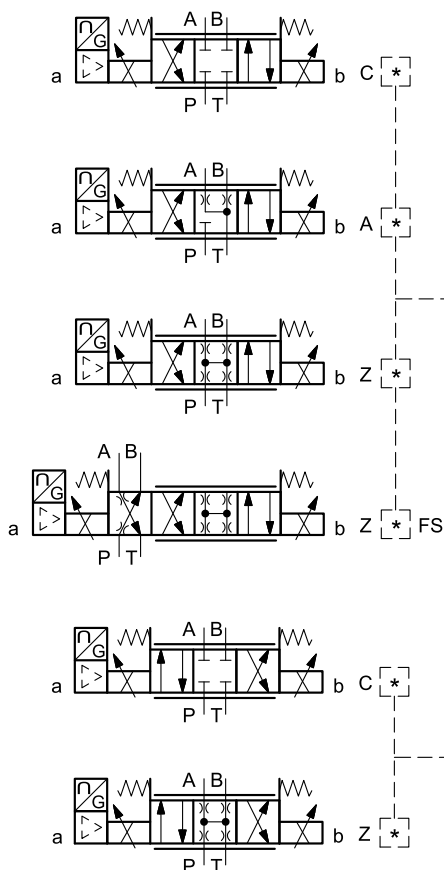
Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

Solenoid position (omit for 2 solenoids configuration):  
**SA** = 1 solenoid on side A

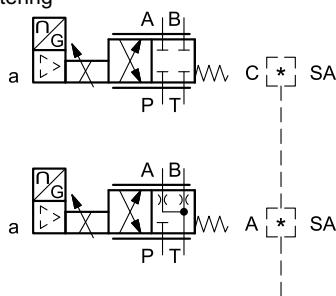
## 2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:  
 number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids :  
 3 positions with spring centering



Configuration 1 solenoid on side A "SA":  
 2 positions (central + external) with spring centering



*	Controlled flow with $\Delta p 10$ bar P-T
<b>04</b>	4 l/min (available for spools Z only)
<b>12</b>	12 l/min
<b>30</b>	30 l/min
<b>30/15</b>	30 (P-A) / 15 (P-B) l/min

*	Controlled flow with $\Delta p 10$ bar P-T
<b>01R</b>	1 l/min

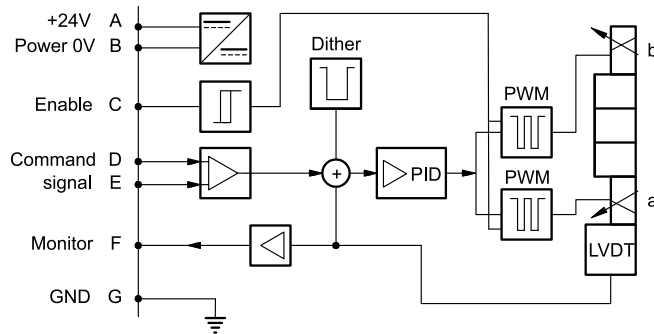
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

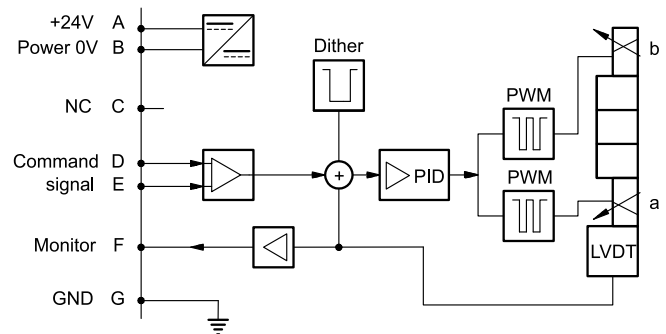
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_i > 11 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_i = 58 \text{ }\Omega$ )
Monitor signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_o > 1 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_o = 500 \text{ }\Omega$ )
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams

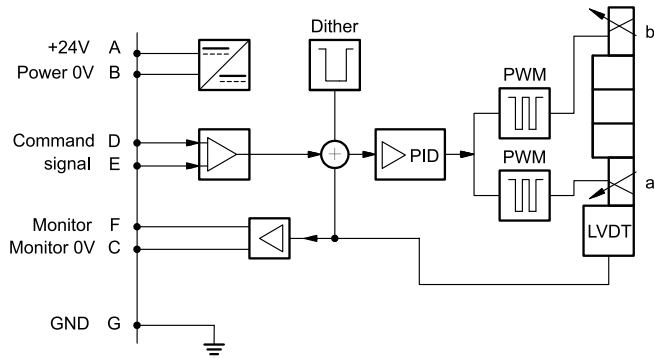
#### VERSION A - External Enable



#### VERSION B - Internal Enable



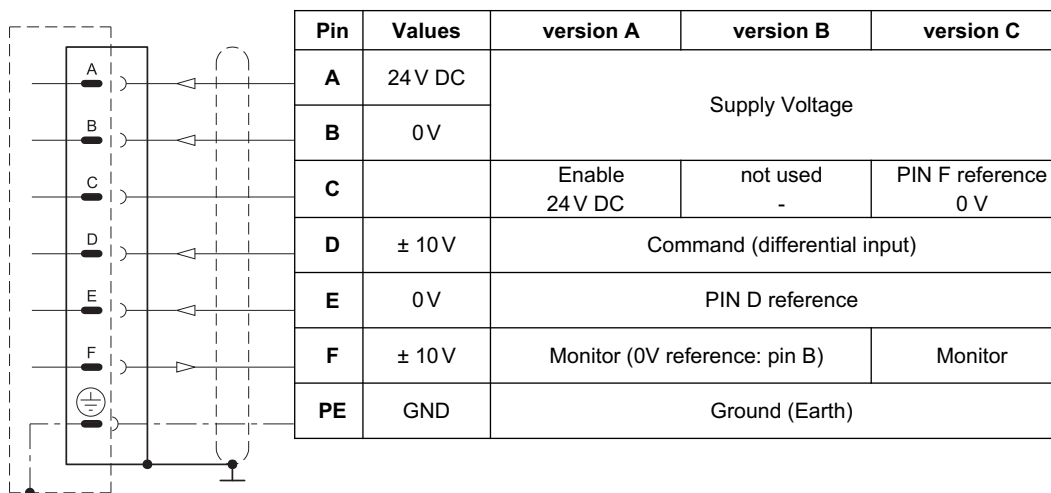
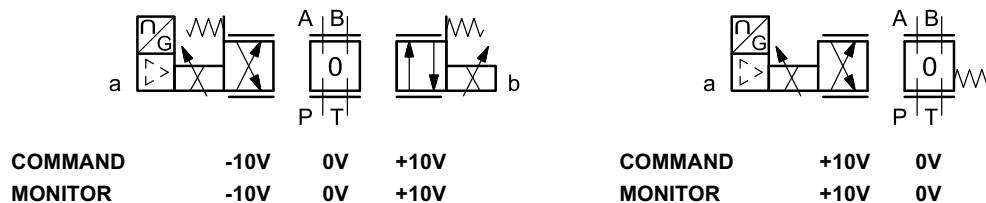
#### VERSION C - 0V Monitor





## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

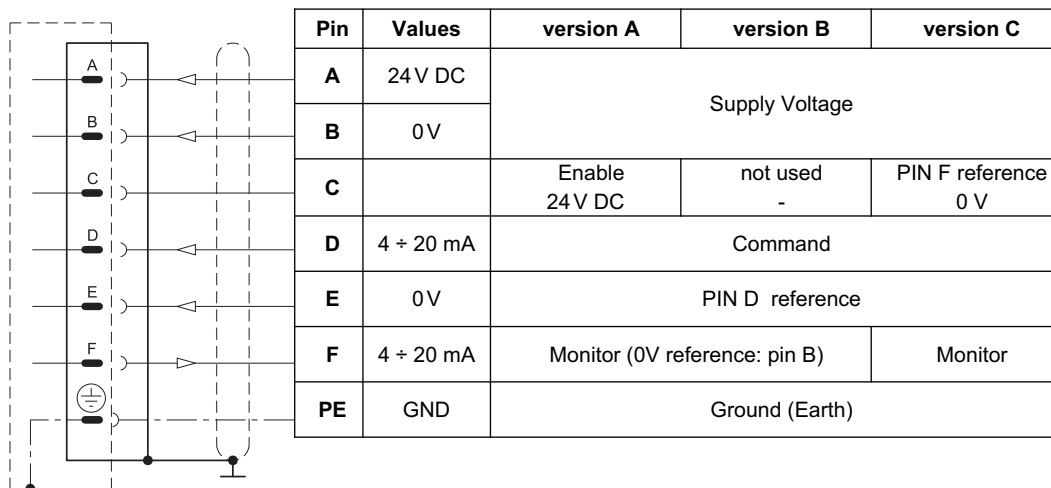
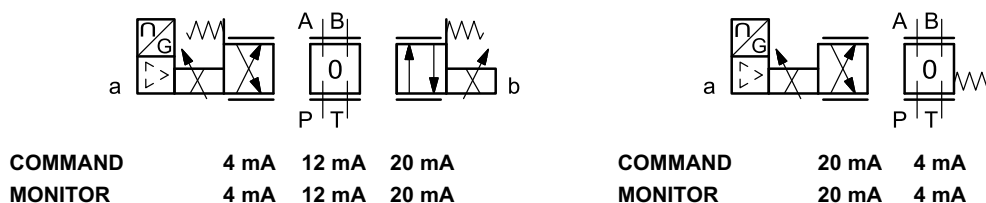
The reference signal is between -10V and +10V on double solenoid valve, and 0 ÷ 10V on single solenoid valve SA.  
The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

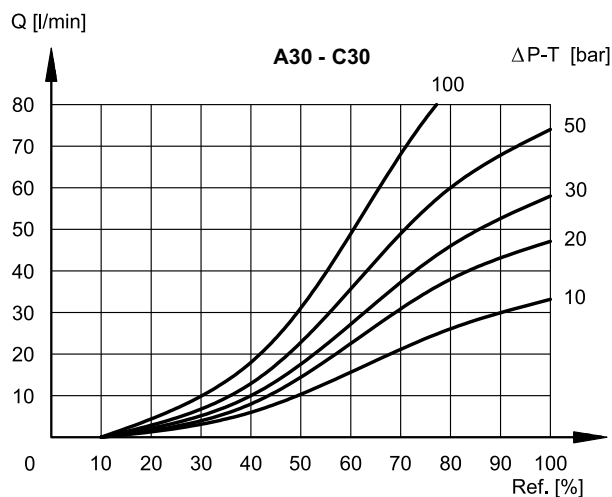
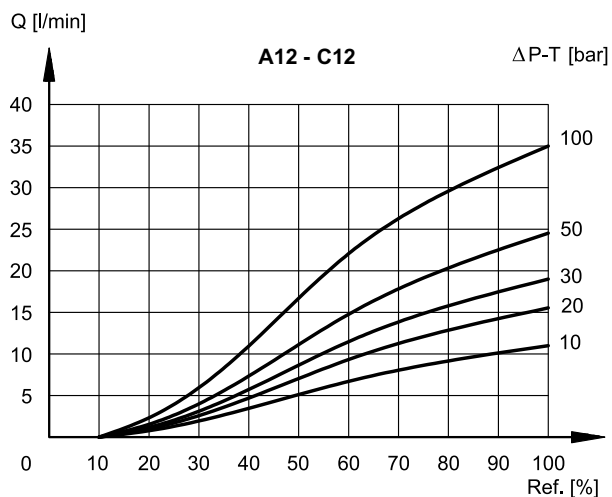
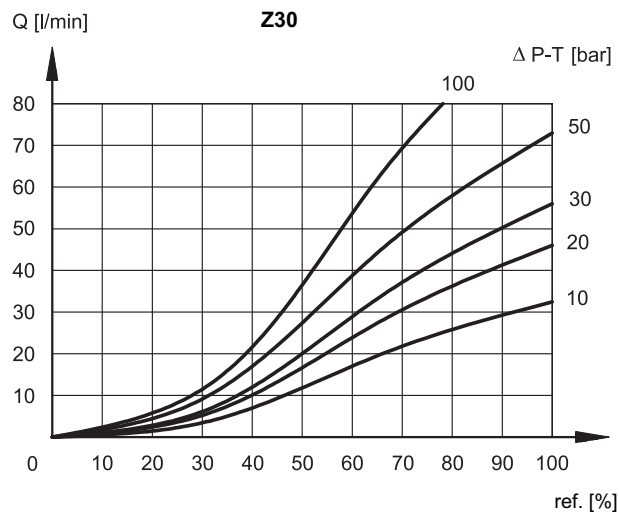
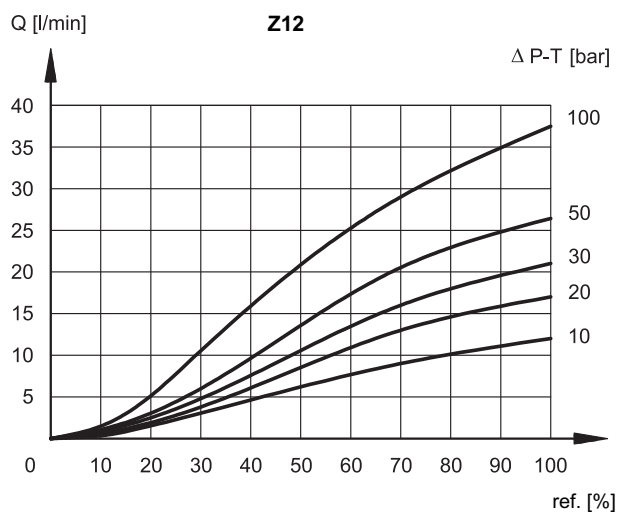
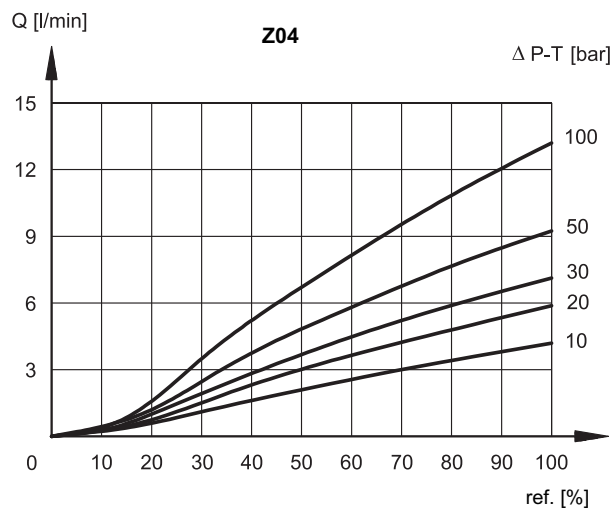
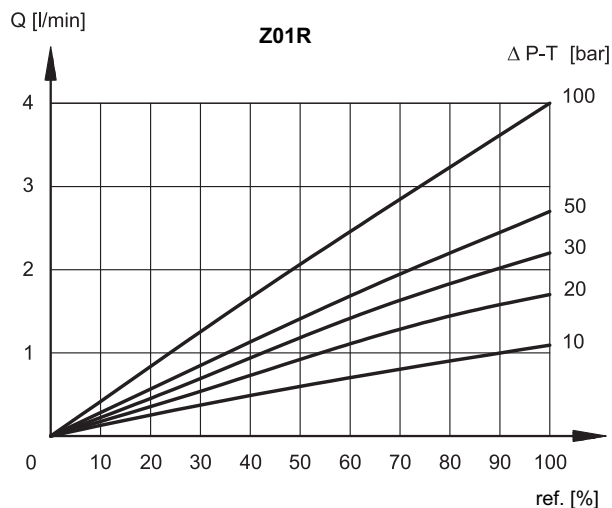
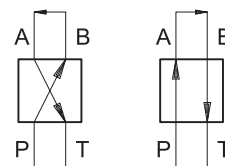
The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



### 6 - CHARACTERISTIC CURVES

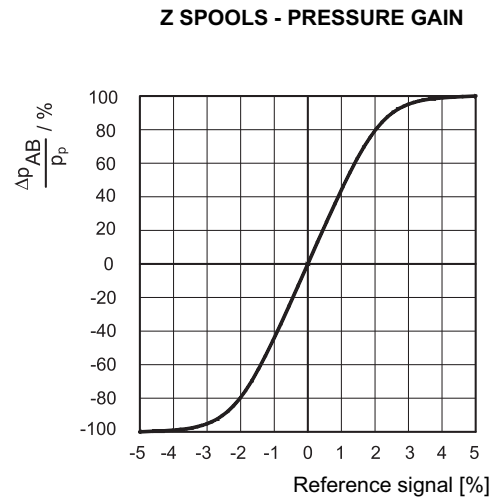
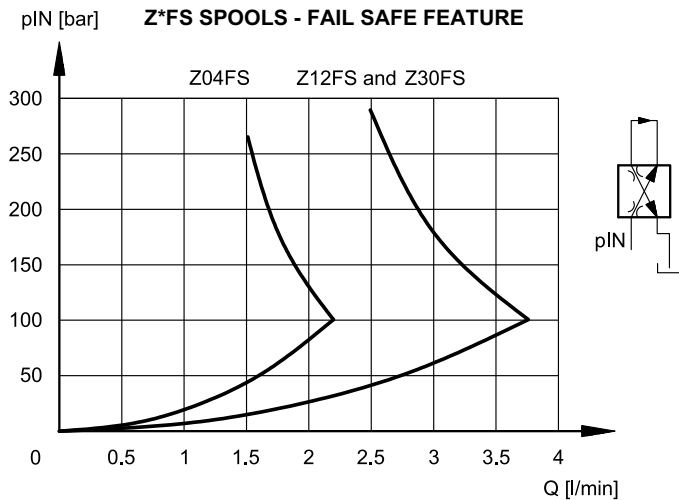
(obtained with mineral oil with viscosity of 36 cSt at 50°C and with digital integrated electronics)

Typical flow rate curves related to the reference signal and measured for the available spools. The  $\Delta p$  values are measured between P and T valve ports.



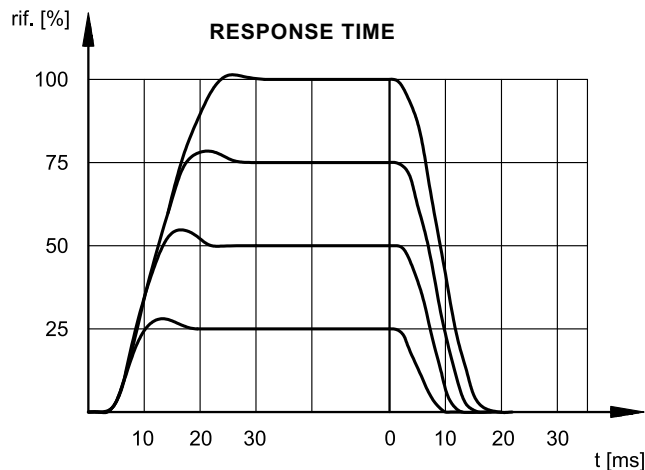
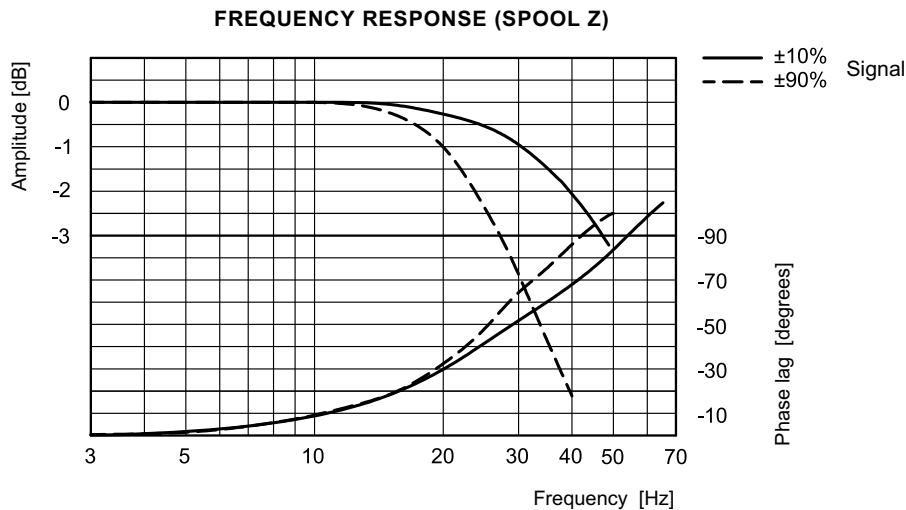
scale for E0K11C version

scale for E0K11C version



## 7 - RESPONSE TIMES

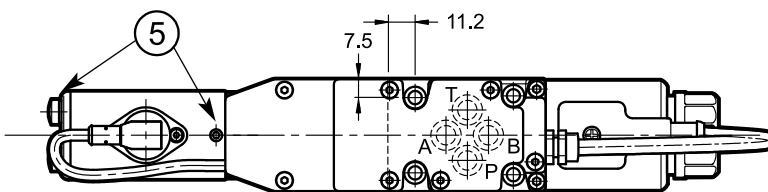
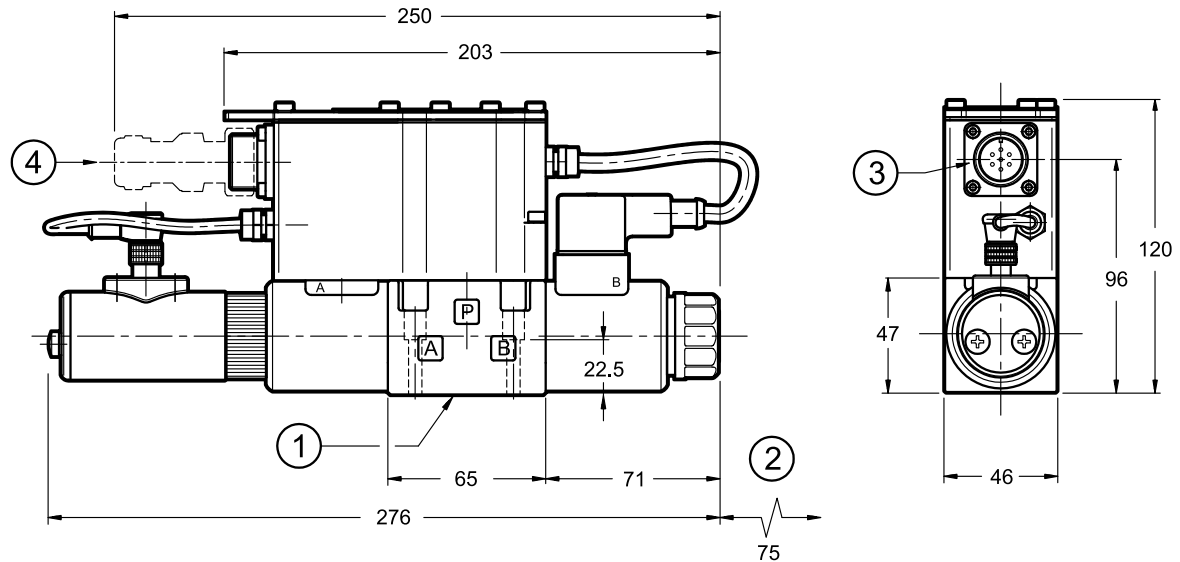
(obtained with mineral oil with viscosity of 36 cSt at 50°C and 140 bar  $\Delta p$  P→T)



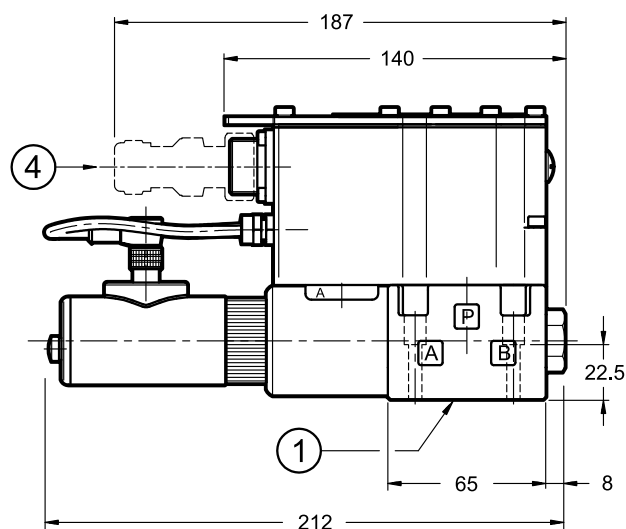
## 8 - OVERALL AND MOUNTING DIMENSIONS

DSE3J-A\*  
DSE3J-C\*  
DSE3J-Z\*

dimensions in mm



DSE3J-A\* SA  
DSE3J-C\* SA



Fastening bolts: 4 bolts M5x30 - ISO 4762

Torque: 5 Nm (A8.8)

Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space (solenoid B only)
3	Main connection
4	Mating connector. <b>To be ordered separately.</b> See paragraph 11
5	Adjustment sealing performed at factory. Do not disassemble the transducer.



## 9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

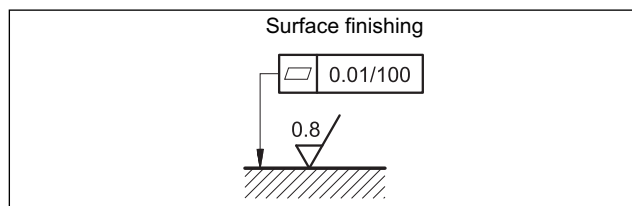
The fluid must be preserved in its physical and chemical characteristics.

## 10 - INSTALLATION

DSE3J valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 11 - ACCESSORIES

(to be ordered separately)

### 11.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

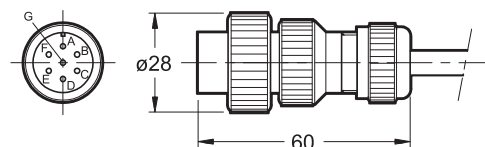


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 11.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 12 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP



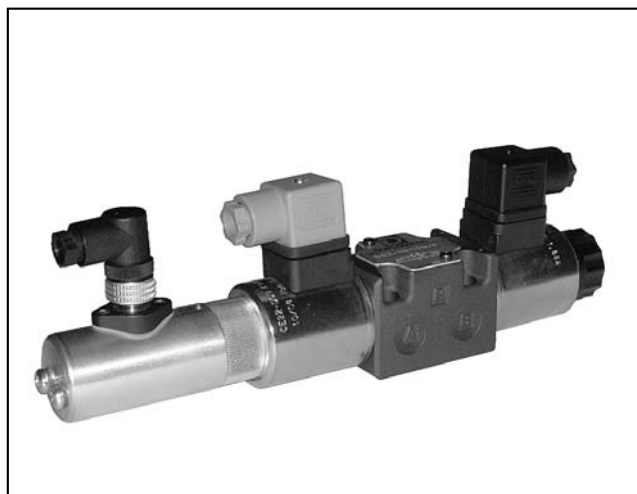
**DUPLOMATIC OLEODINAMICA S.p.A.**

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Fax +39 0331.895.339

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# DSE3F

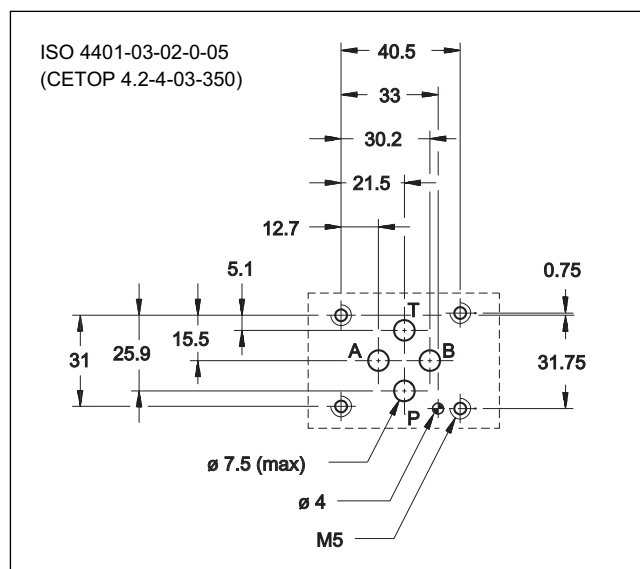
## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL AND ELECTRICAL FEEDBACK SERIES 11

### SUBPLATE MOUNTING ISO 4401-03 (CETOP 03)

**p** max 350 bar

**Q** max 40 l/min

### MOUNTING SURFACE

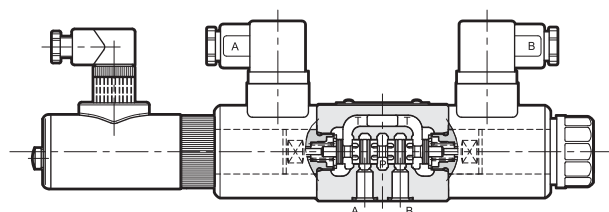


### PERFORMANCES

(Obtained with mineral oil with viscosity of 36 cSt at 50°C and with digital integrated electronic)

Max operating pressure: - P - A - B ports - T port	bar	350 210
Nominal flow with $\Delta p$ 10 bar P-T	l/min	8 - 16 - 26
Response times	see paragraph 6	
Hysteresis	% of $Q_{max}$	< 1,5 %
Repeatability	% of $Q_{max}$	< 1 %
Electrical characteristics, IP	see paragraph 5	
Valve reproducibility		< 5%
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass:	kg	
single solenoid valve		1,9
double solenoid valve		2,3

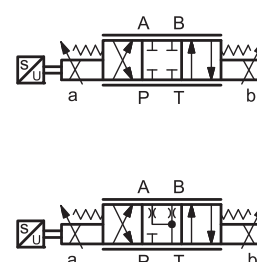
### OPERATING PRINCIPLE



The DSE3F is a direct operated directional valve with proportional control, electrical feedback and mounting interface in compliance with ISO 4401 (CETOP RP 121H) standards.

- It is normally used to control position and the speed of hydraulic actuators.
- The valve opening and hence flow rate can be modulated continuously in proportion to the reference signal.
- The valve must be controlled directly by the UEIK-\*RSD digital card (see par.9), that maximize the valve performances: the input signal and the signal from the valve are compared to obtain an accurate positioning and a reduces hysteresis.

### HYDRAULIC SYMBOLS (typical)



## 1 - IDENTIFICATION CODE

D	S	E	3	F	-				/	11	-	D12	K1
---	---	---	---	---	---	--	--	--	---	----	---	-----	----

Direct operated directional control valve

Electric proportional control

Size ISO 4401-03 (CETOP 03)

Position feedback

Spool type:  
**C** = closed centres  
**A** = open centres

Nominal flow rate:  
**08** = 8 l/min  
**16** = 16 l/min  
**26** = 26 l/min

Solenoid position (omit for configuration with two solenoids):  
**SA** = 1 solenoid on side A

Coil electrical connection:  
 plug for connector type  
 DIN 43650 (**standard**)

Nominal solenoid voltage 12 VDC

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

## 2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:  
 number of proportional solenoids, spool type, rated flow.

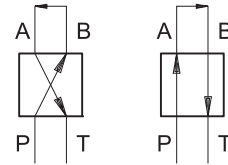
Configuration 2 solenoids :  
 3 positions with spring centering

Configuration 1 solenoid on side A "**SA**":  
 2 positions (central + external) with spring centering

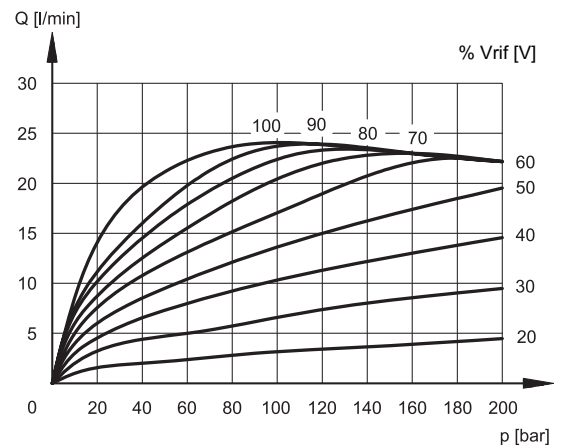
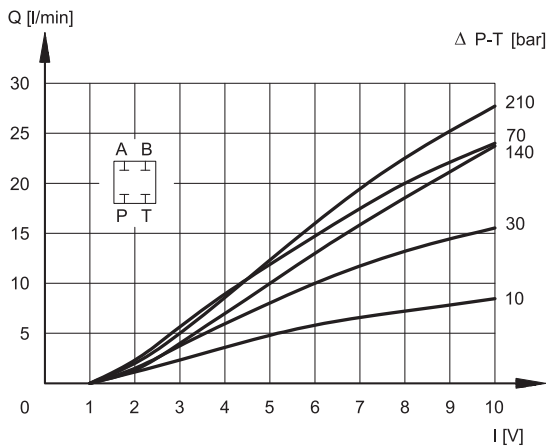
*	Controlled flow with $\Delta p 10$ bar P-T
08	8 l/min
16	16 l/min
26	26 l/min

### 3 - CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 36 cSt at 50°C and with digital integrated electronics)

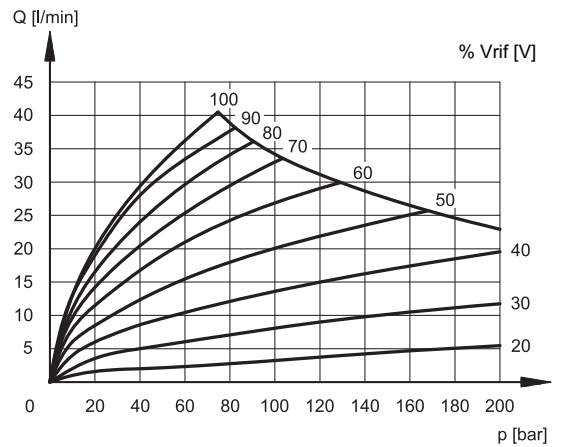
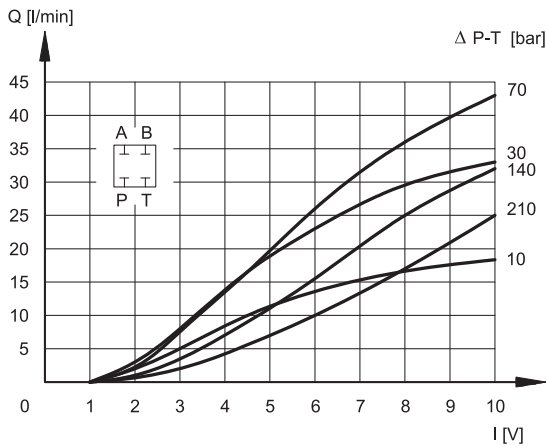
Typical flow rate curves at constant  $\Delta p$  related to the reference signal and measured for the available spools. The  $\Delta p$  values are measured between P and T valve ports.



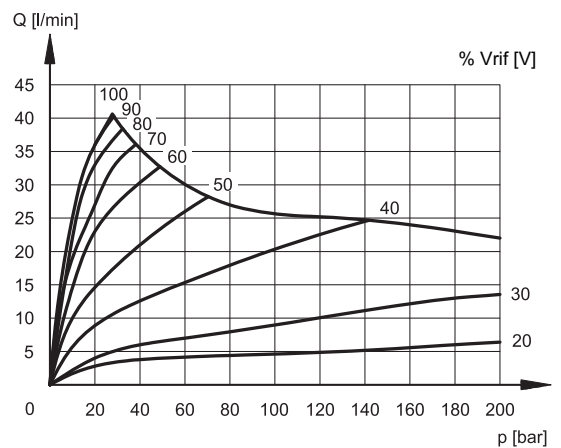
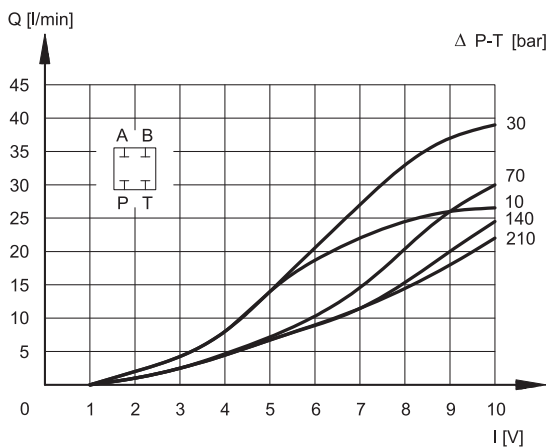
#### SPOOL C08



#### SPOOL C16



#### SPOOL C26



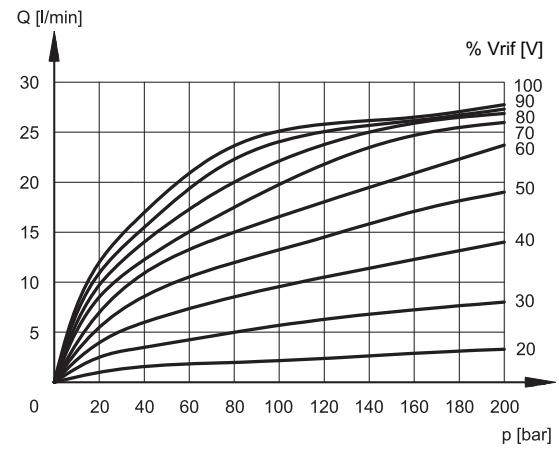
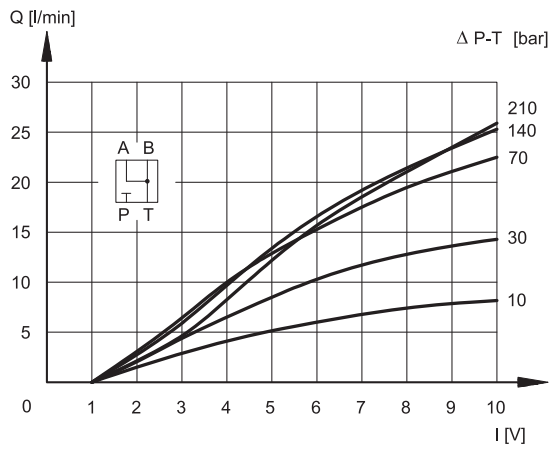




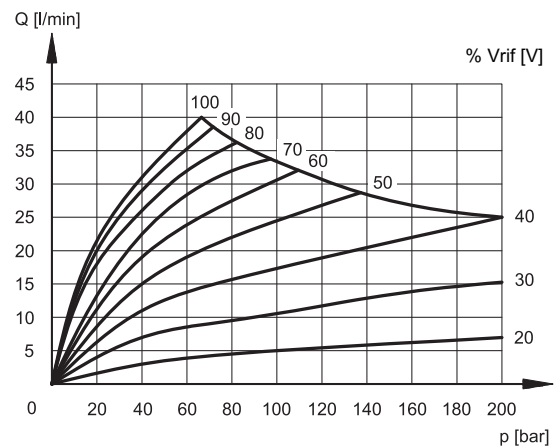
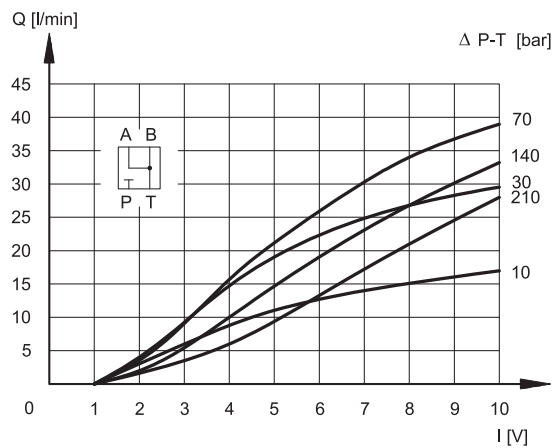
# DSE3F

## SERIES 11

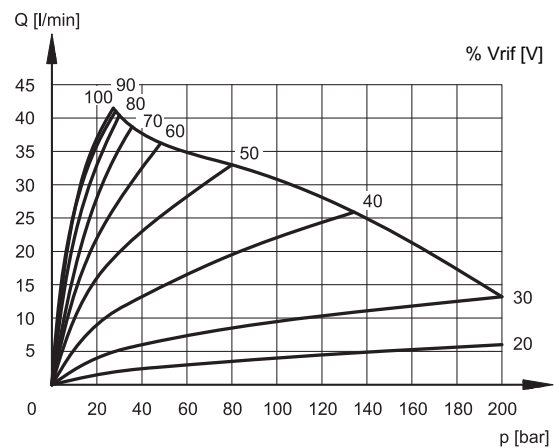
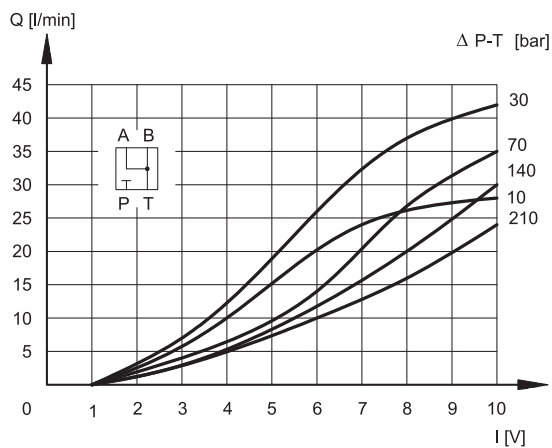
### SPOOL A08



### SPOOL A16



### SPOOL A26



### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 5 - ELECTRICAL CHARACTERISTICS

#### 5.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to reduce friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube and secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

<b>NOMINAL VOLTAGE</b>	V DC	<b>12</b>
<b>RESISTANCE (at 20°C)</b>	Ω	3.66
<b>MAXIMUM CURRENT</b>	A	1.88
<b>DUTY CYCLE</b>		100%
<b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b>	According to 2004/108/CE	
<b>CLASS OF PROTECTION:</b> Atmospheric agents (CEI EN 60529)	IP 65	

#### 5.2 - Positional transducer

The DSE3F valve mounts an LVDT type positional transducer with amplified signal to enable precise control of the restrictor and the set flow rate, thus improving repeatability and hysteresis characteristics.

The transducer is fitted coaxially on the proportional solenoid and the connector features 360° positioning.

We recommend to use a screened cable to avoid interferences. Technical specifications and connections are indicated here beside.

**The transducer is protected against polarity inversion on the power line.**

Position transducer connection		Electronic card connections (see par. 9)
pin 1	supply 18 ÷ 36 V	pin 8c
pin 2	output 2 ÷ 10 V	pin 24a
pin 3	0 V	pin 22c
pin 4	NC	NC

### 6 - STEP RESPONSE (measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical response times with the C13 spool and with  $\Delta p = 30$  bar P-T.

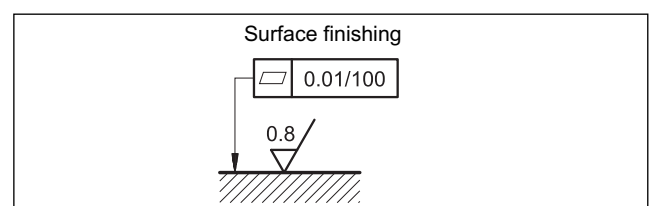
REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	30	25

### 7 - INSTALLATION

DSE3F valves can be installed in any position without impairing correct operation.

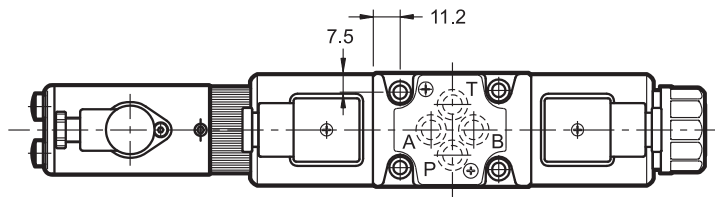
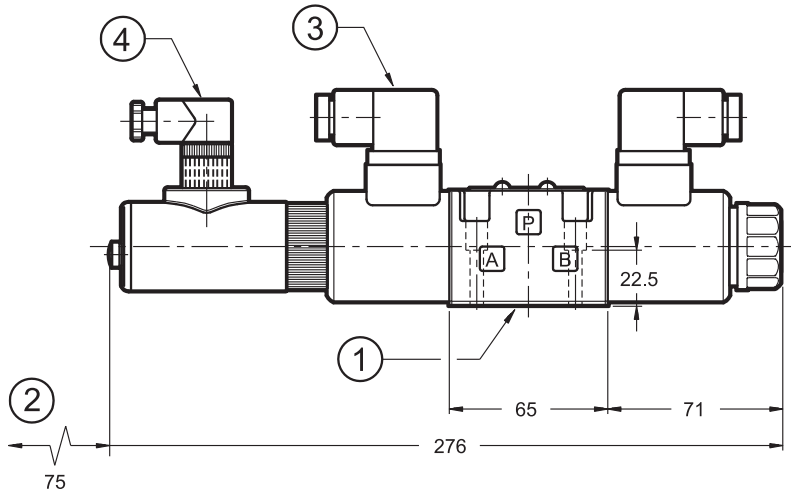
Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and mounting surface.

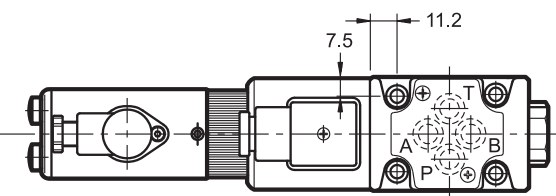
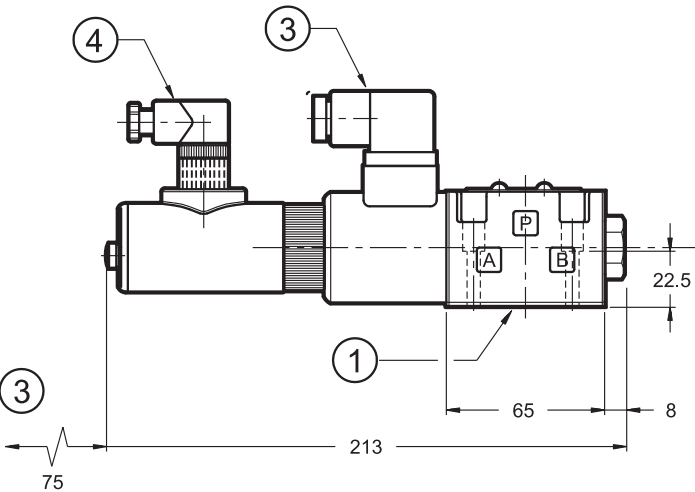


## 9 - OVERALL AND MOUNTING DIMENSIONS

DSE3F-A\*  
DSE3F-C\*



DSE3F-A\* SA  
DSE3F-C\* SA



dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Transducer and coil removal space
3	Main electrical connector DIN 43650
4	Electrical connector 4 pin EC4S/M12S/10 code 3491001002 for position transducer (included)
5	Removal space of the main electrical connector

Fastening bolts: 4 bolts M5x30 - ISO 4762  
Torque: 5 Nm



## 9 - ELECTRONIC CONTROL UNITS

<b>UEIK-21RSD</b>	for two solenoids valves 12V DC	Eurocard format	see cat. 89 335
<b>UEIK-11RSD</b>	for single solenoid valve 12V DC	Eurocard format	see cat. 89 315

A card holder, PSC-32D/20 is available, to be ordered separately with code 3899000001.

## 10 - SUBPLATES (see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP



# DSE3F

SERIES 11



**DUPLOMATIC  
OLEODINAMICA**

**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

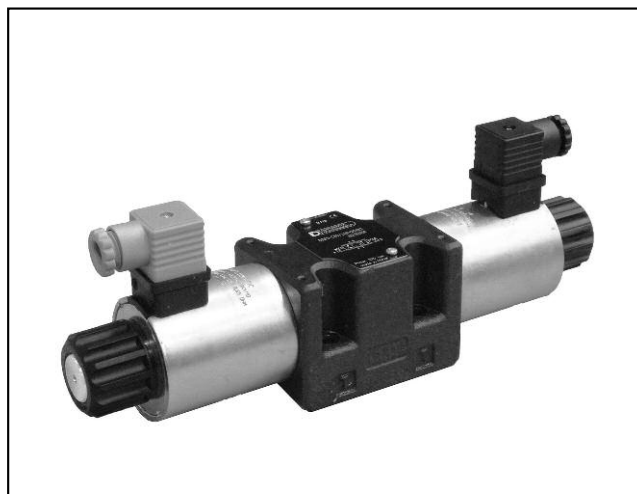
Tel. +39 0331.895.111

Fax +39 0331.895.339

www.duplomatic.com • e-mail: sales.exp@duplomatic.com

# DSE5

## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL SERIES 10

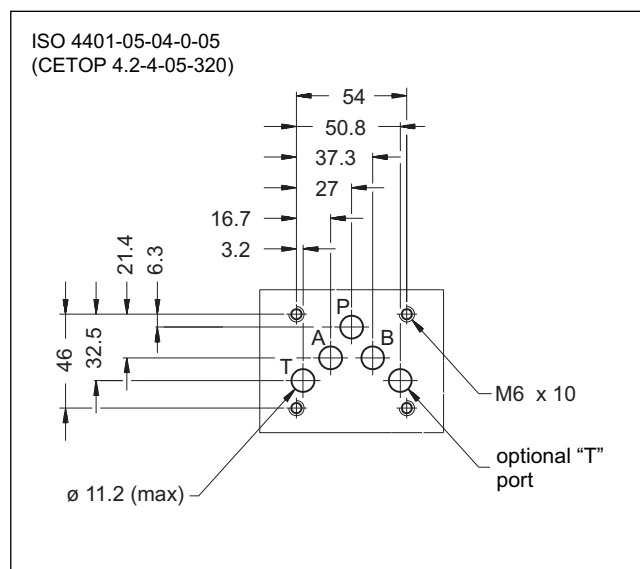


### SUBPLATE MOUNTING ISO 4401-05

**p max 320 bar**

**Q max 90 l/min**

### MOUNTING INTERFACE

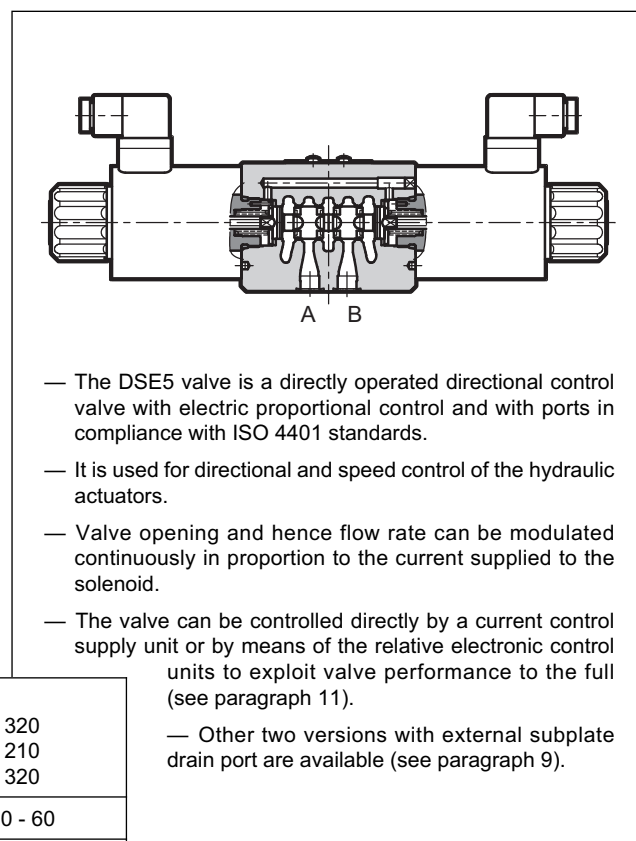


### PERFORMANCES

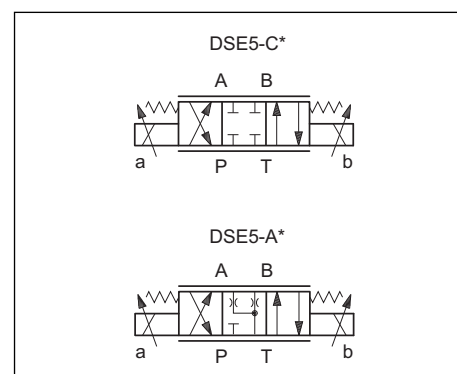
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Maximum operating pressure: - P - A - B ports - T port : standard version version with Y port	bar	320 210 320
Maximum flow with $\Delta p$ 10 bar P-T	l/min	30 - 60
Step response	see paragraph 6	
Hysteresis (with PWM 100 Hz)	% of Q max	< 6%
Repeatability	% of Q max	< $\pm 1,5\%$
Electrical characteristics	see paragraph 5	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	4,4 5,9

### OPERATING PRINCIPLE



### HYDRAULIC SYMBOLS (typical)



## 1 - IDENTIFICATION CODE

<b>D</b>	<b>S</b>	<b>E</b>	<b>5</b>	<b>-</b>				<b>/</b>	<b>10</b>	<b>-</b>			<b>/</b>		
----------	----------	----------	----------	----------	--	--	--	----------	-----------	----------	--	--	----------	--	--

Directly operated directional control valve

Electric proportional control

Size ISO 4401-05

Spool type:  
**C** = closed centers  
**A** = open centers

Spool nominal flow (see table 2)

Solenoid position (omit for configuration with two solenoids):  
**SA** = 1 solenoid on side A  
**SB** = 1 solenoid on side B

Option:  
**/ W7** = Zinc-nickel surface treatment (see **NOTE**)  
 Omit if not required

Option: manual override (see at par. 9)

Coil electrical connection:  
 plug for connector type  
 DIN 43650 (**standard**)

**D12** = Nominal solenoid voltage 12V DC  
**D24** = Nominal solenoid voltage 24V DC

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

**NOTE:** The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

## 2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:  
 number of proportional solenoids, spool type, nominal flow rate.

2 solenoids configuration:  
 3 positions with spring centering

**"SA"** configuration: 1 solenoid on side A.  
 2 positions (central + external)  
 with spring centering

**"SB"** configuration: 1 solenoid on side B.  
 2 positions (central + external)  
 with spring centering

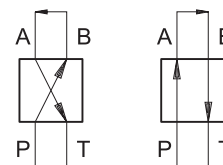
*	Controlled flow with $\Delta p$ 10 bar P-T
<b>30</b>	30 l/min
<b>60</b>	60 l/min
<b>60/30</b>	60 (P-A) / 30 (B-T) l/min

### 3 - CHARACTERISTIC CURVES

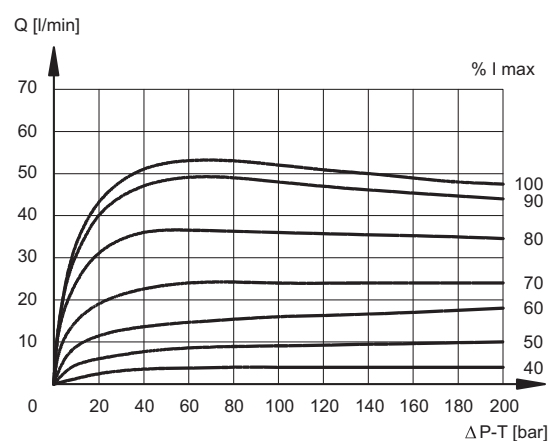
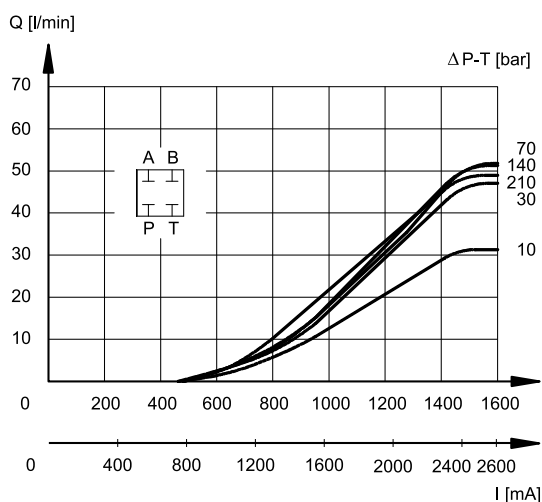
(values measured with oil viscosity of 36 cSt at 50°C and with electronic control unit)

Typical constant flow rate control curves at  $\Delta p$  according to current supply to solenoid (D24 version, maximum current 1600 mA), measured for the various spools types available.

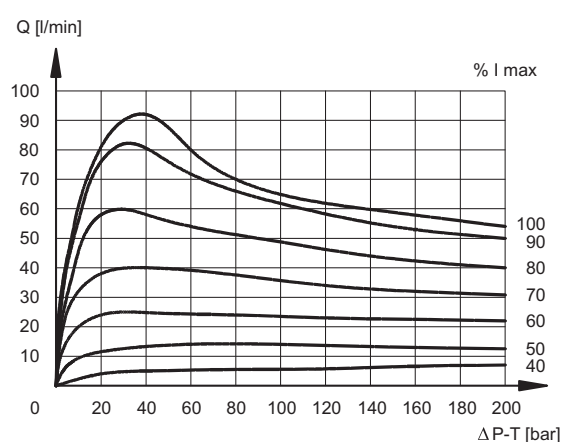
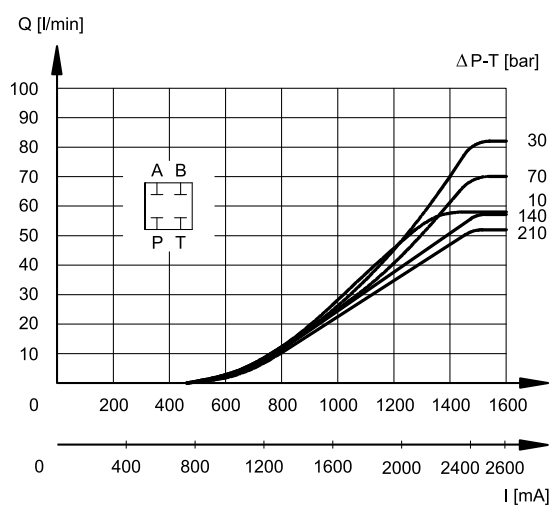
The reference  $\Delta p$  values are measured between ports P and T on the valve.



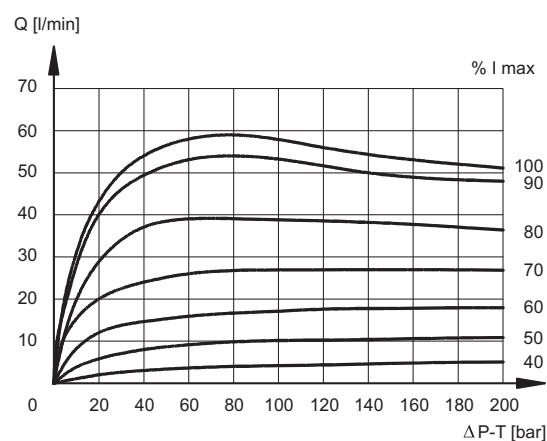
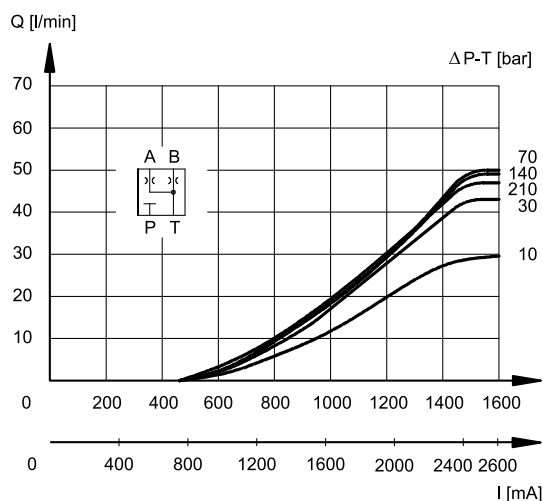
**SPOOL TYPE C30**



**SPOOL TYPE C60**



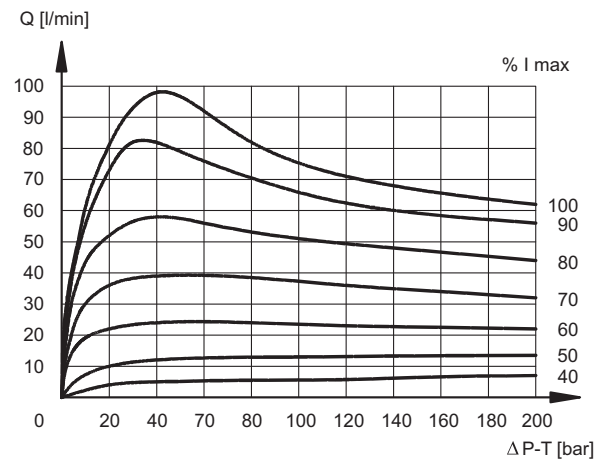
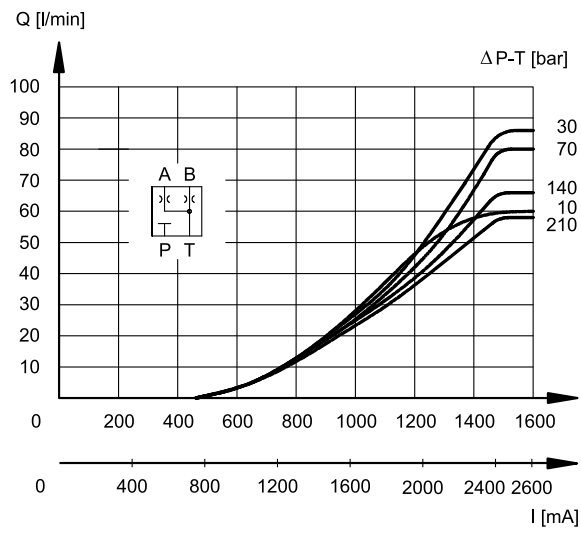
**SPOOL TYPE A30**







## SPOOL TYPE A60



### 4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 5 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	VDC	12	24
RESISTANCE (at 20°C)	Ω	3 - 3.4	8.65
MAXIMUM CURRENT	A	2.6	1.6
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	according to 2004/108/EC		
CLASS OF PROTECTION: atmospheric agents (IEC 60529) coil insulation (VDE 0580) Impregnation	IP 65 class H class F		

### 6 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C and with electronic control unit)

Step response is the time taken for the valve to reach 90% of the set position value following a step change of reference signal.

The table shows typical response times tested with spool type C60 and  $\Delta p = 20$  bar P-T.

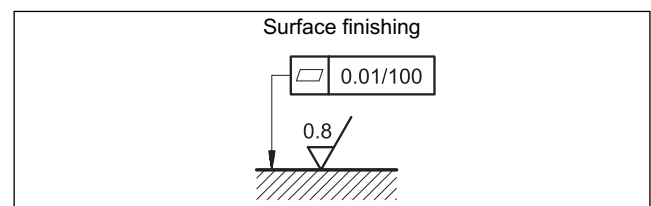
REFERENCE SIGNAL STEP	0→100%	100%→0
Step response [ms]		
DSE5-A* DSE5-C*	50	40

### 7 - INSTALLATION

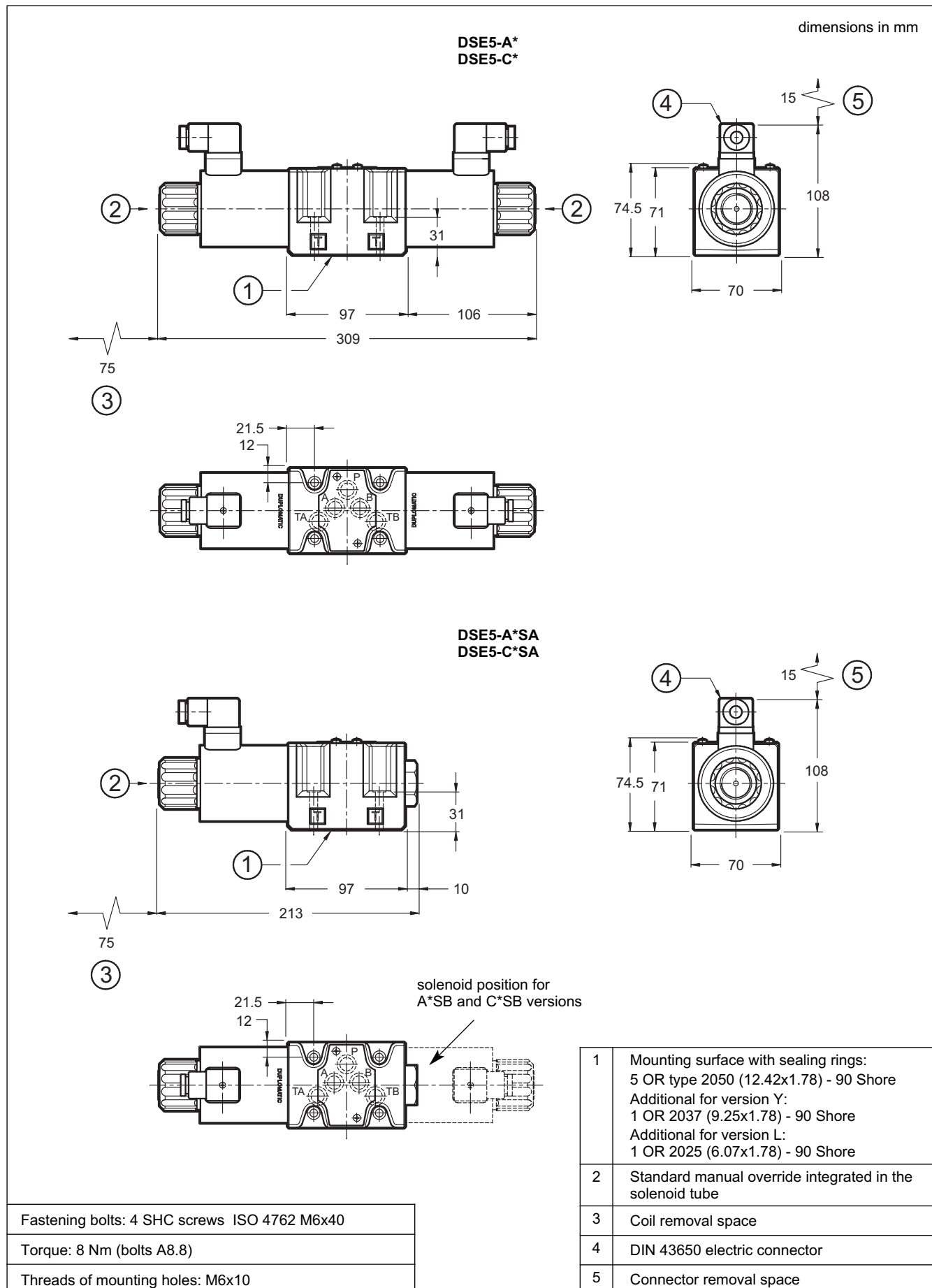
DSE5 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

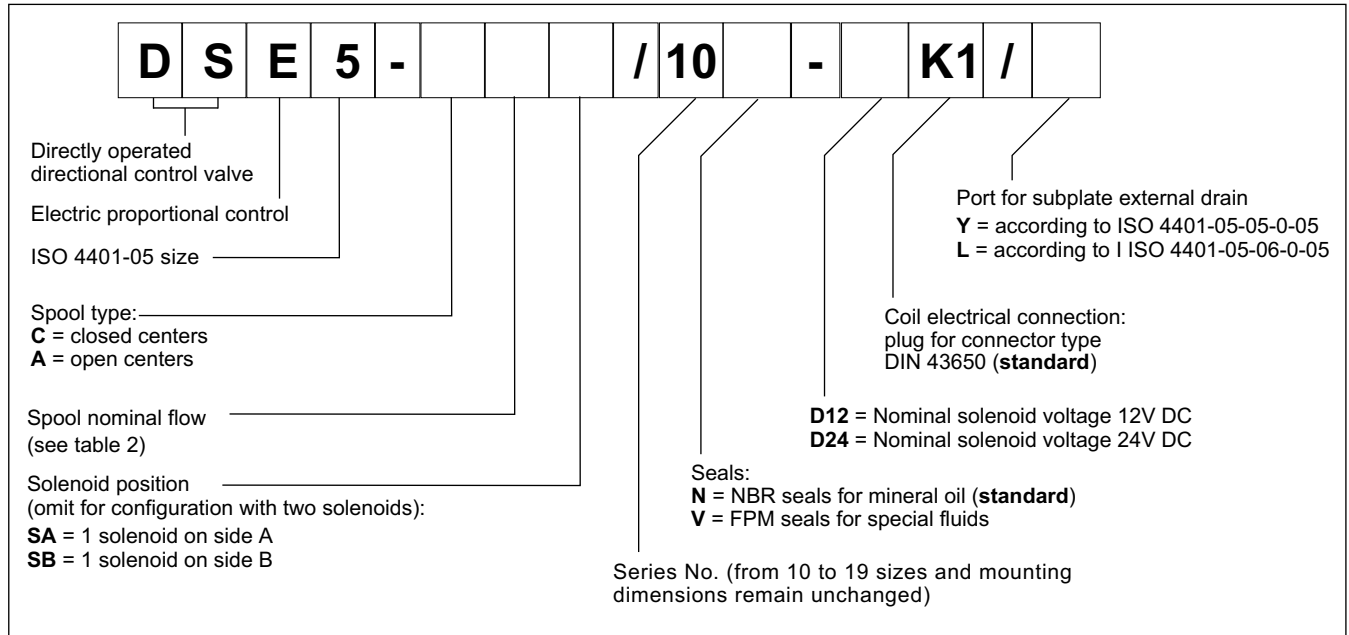


## 8 - OVERALL AND MOUNTING DIMENSIONS



### 9 - VERSIONS WITH EXTERNAL DRAIN PORT

#### 9.1 - Identification Code



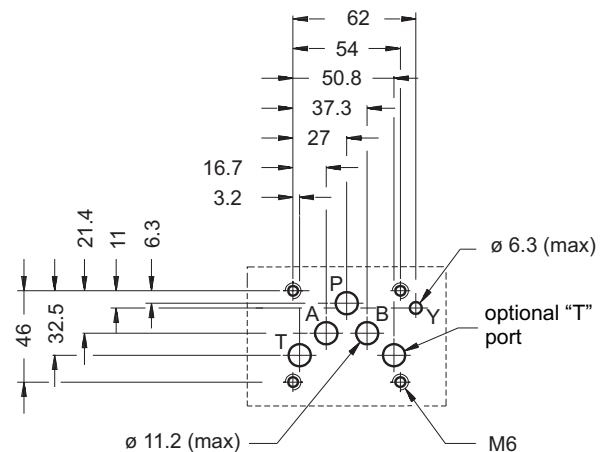
These versions allow the operation with pressures up to 320 bar on T port of the valve .

The additional drain port is connected with the solenoid chamber: in this way the tubes are not stressed by the pressure operating on the T port of the valve.

#### 9.2 - Y Version

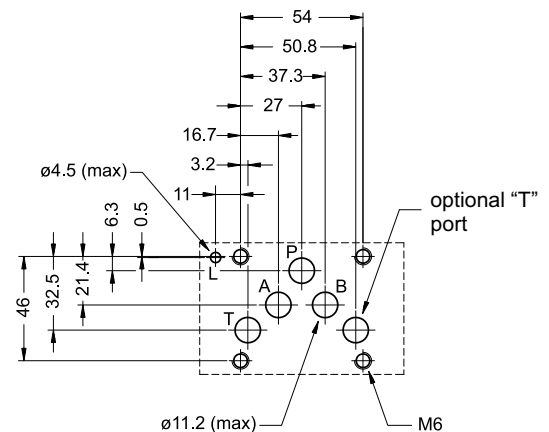
The drain port Y is realized on the valve mounting surface in compliance with ISO 4401-05-05-0-05 standard.

There is no X port.



#### 9.3 - L version

It consists of a drain port on the mounting surface of the valve according to ISO 4401-05-06-0-05 standard

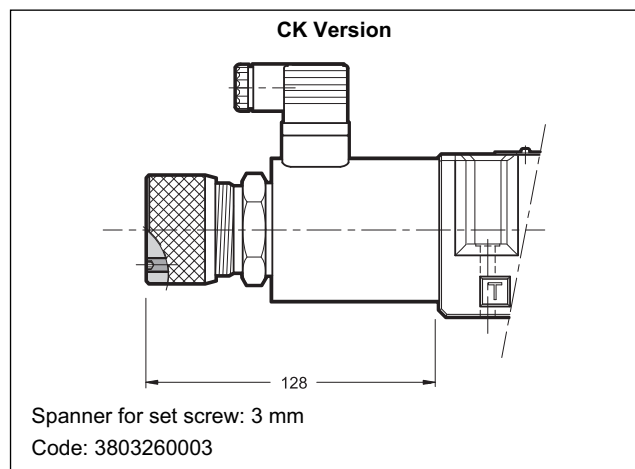


## 10 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

The following manual override is available upon request:

- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.



## 11 - ELECTRONIC CONTROL UNITS

### DSE5- \* \*SA (SB)

<b>EDC-131</b>	for solenoid 24V DC	plug version	see catalogue 89 120
<b>EDC-151</b>	for solenoid 12V DC		
<b>EDM-M131</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see catalogue 89 250
<b>EDM-M151</b>	for solenoid 12V DC		

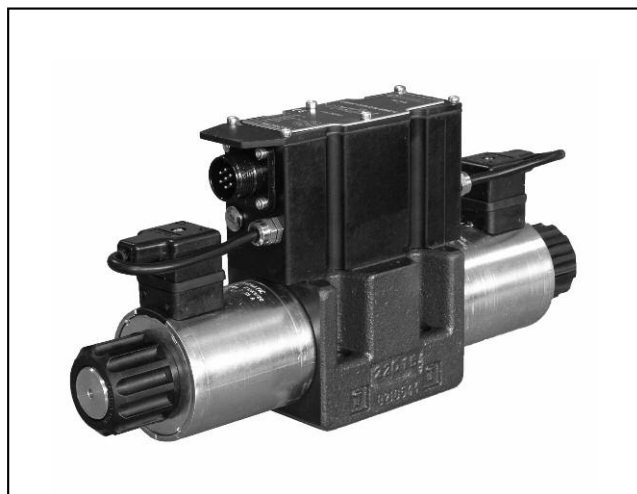
### DSE5- A\*      DSE5-C\*

<b>EDM-M231</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see catalogue 89 250
<b>EDM-M251</b>	for solenoid 12V DC		

## 12 - SUBPLATES

(see cat. 51 000)

Type PMD4-AI4G with rear ports 3/4" BSP
Type PMD4-AL4G with side ports 1/2" BSP



# DSE5G

## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS

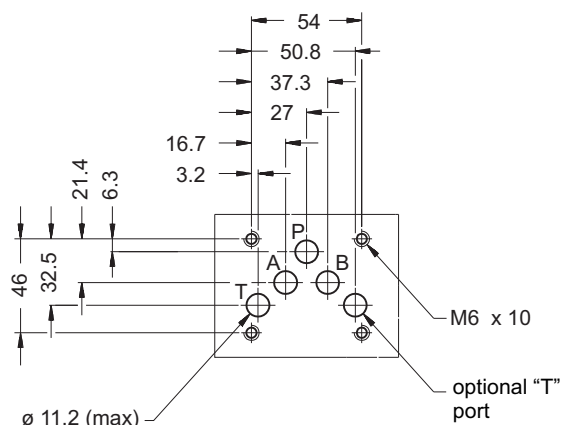
### SERIES 31

#### SUBPLATE MOUNTING ISO 4401-05

**p** max 320 bar  
**Q** max 90 l/min

#### MOUNTING SURFACE

ISO 4401-05-04-0-05  
(CETOP 4.2-4-05-320)

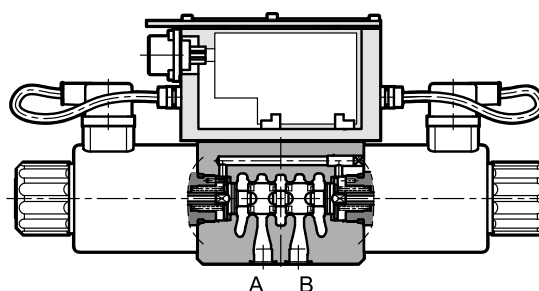


#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P - A - B ports - T port	bar	320 140
Maximum flow with $\Delta p$ 10 bar P-T	l/min	30 - 60
Response times	see paragraph 7	
Hysteresis	% of Q max	< 3%
Repeatability	% of Q max	< $\pm 1\%$
Electrical characteristics	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	5,1 6,6

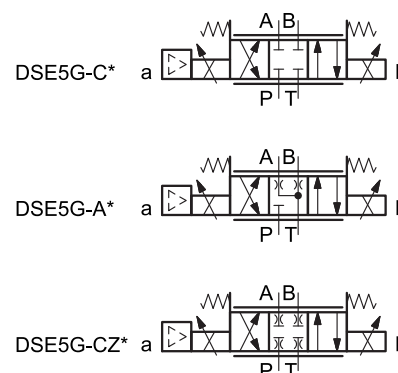
#### OPERATING PRINCIPLE



- The DSE5G is a direct operated directional valve with integrated electric proportional control and mounting interface in compliance with ISO 4401 standards.
- It is used for control the positioning and the speed of hydraulic actuators.
- Valves are available with command signal in voltage or current, and on-board electronics with internal enable, external enable or 0V monitor on pin C.
- A solenoid current monitoring signal is available.

— The valve is easy to install. The driver directly manages digital settings. In the event of special applications, you can customize settings using the optional kit (see par. 11.3).

#### HYDRAULIC SYMBOLS (typical)



## 1 - IDENTIFICATION CODE

D	S	E	5	G	-				/	31		-		K11	
---	---	---	---	---	---	--	--	--	---	----	--	---	--	-----	--

Direct operated directional control valve

Electric proportional control

Size ISO 4401-05

Digital integrated electronics for open loop

Spool type:  
**C** = closed centres  
**A** = open centres  
**CZ** = closed centres with overlap jump

Nominal flow rate of the spool (see chart par. 2)

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector 6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10$  V  
**E1** = current  $4 \pm 20$  mA

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

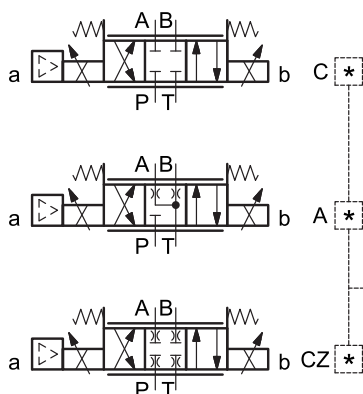
Series No.  
 (the overall and mounting dimensions remain unchanged from 30 to 39)

Solenoid position (omit for 2 solenoids configuration):  
**SA** = 1 solenoid on side A

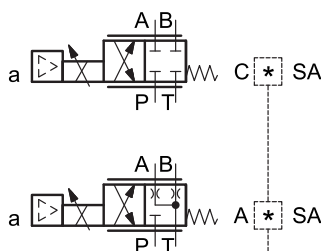
## 2 - CONFIGURATION

The valve configuration depends on the combination of the following elements:  
 number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids :  
 3 positions with spring centering



Configuration 1 solenoid on side A "SA":  
 2 positions (central + external)  
 with spring centering



*	Controlled flow with $\Delta p$ 10 bar P-T
30	30 l/min
60	60 l/min
60/30	60 (P-A) / 30 (P-B) l/min

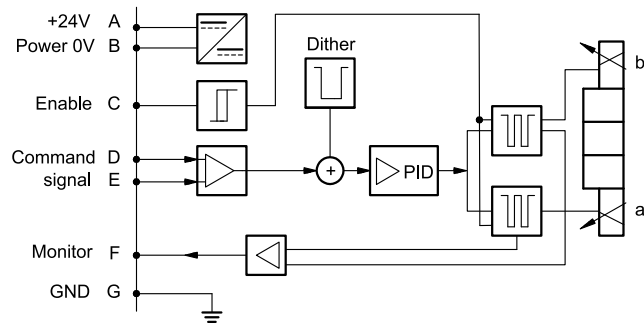
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

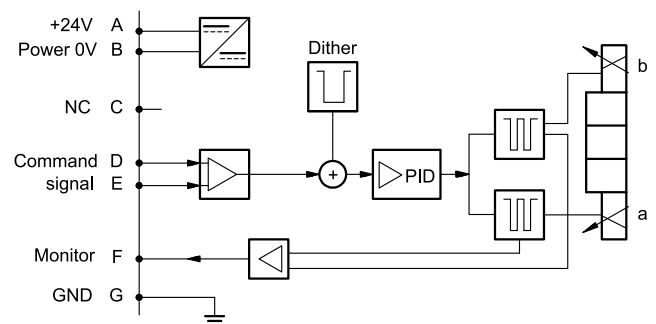
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 35 VDC), ripple max 3 Vpp
Power consumption	VA	40
Maximum solenoid current	A	2.8
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_i > 11 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_i = 58 \text{ }\Omega$ )
Monitor signals (current to solenoid): voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_o > 1 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_o = 500 \text{ }\Omega$ )
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams

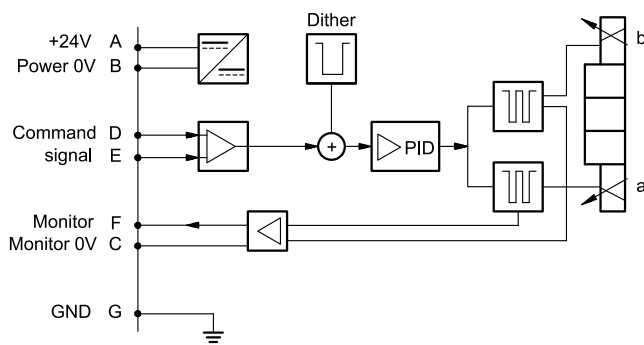
**VERSION A - External Enable**



**VERSION B - Internal Enable**



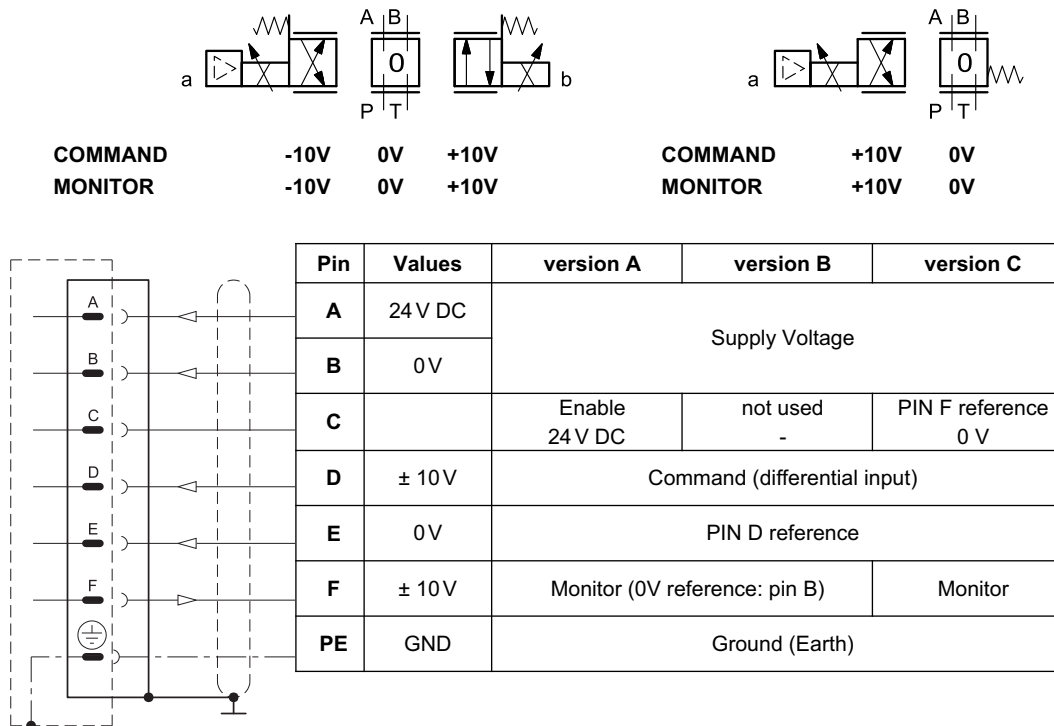
**VERSION C - 0V Monitor**





## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

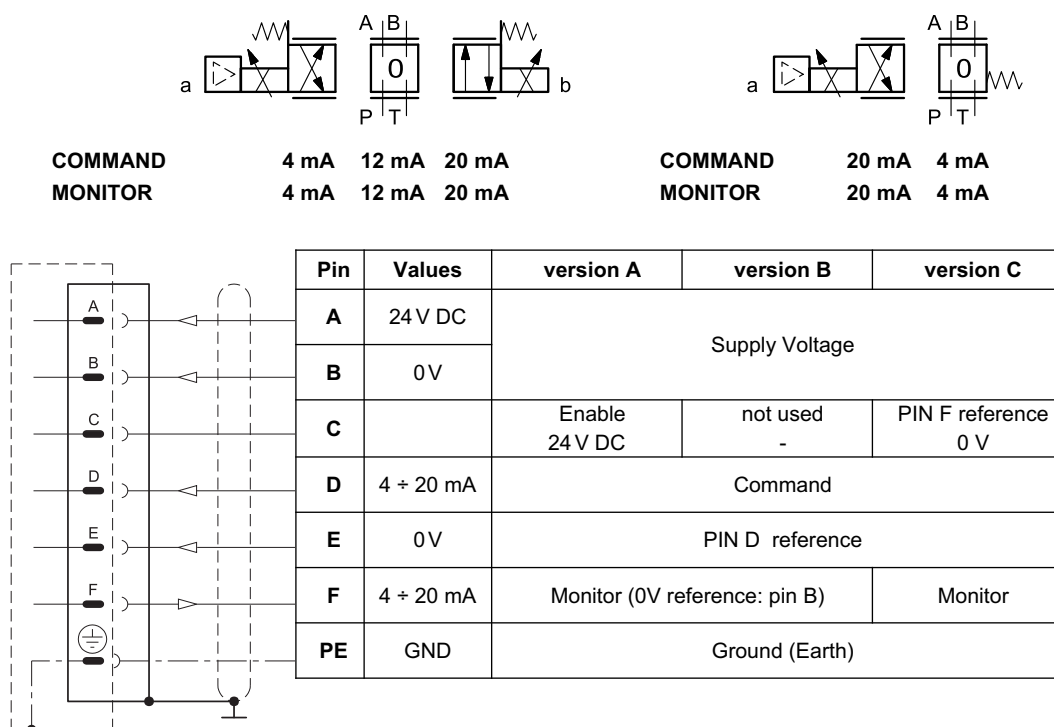
The reference signal is between -10V and +10V on double solenoid valves, and 0 ÷ 10V on single solenoid valves SA. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



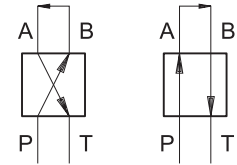
### 6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)

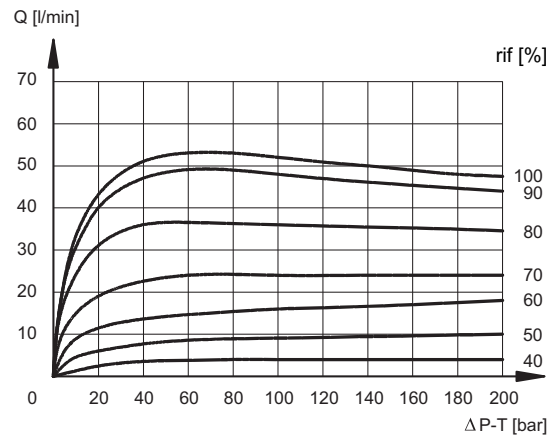
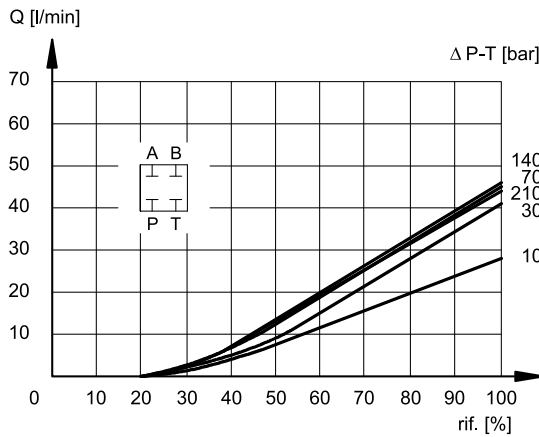
Typical flow rate curves at constant  $\Delta p$  related to the reference signal and measured for the available spools.

The curves are obtained with a constant meter-in with  $\Delta p$  of 5 bar and by setting the value of flow start at 20% of the reference signal.

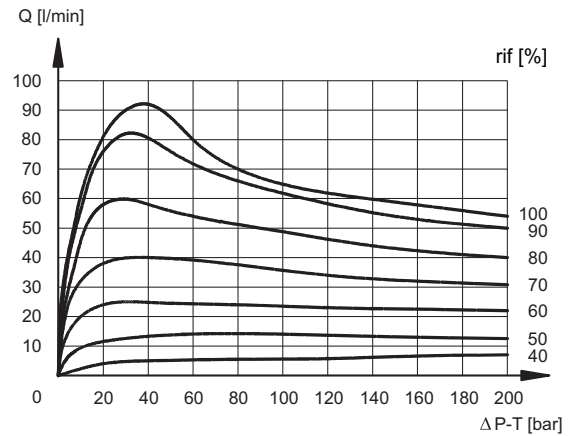
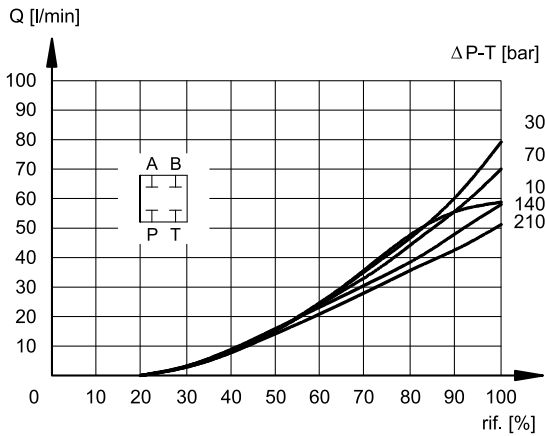
**NOTE:** for spools with overlap jump (Z), please refer to the characteristic curves of spools C type, considering that the starting flow rate value is approx. 150 mV.



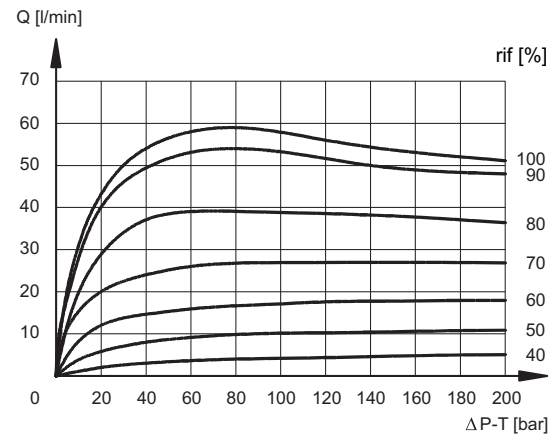
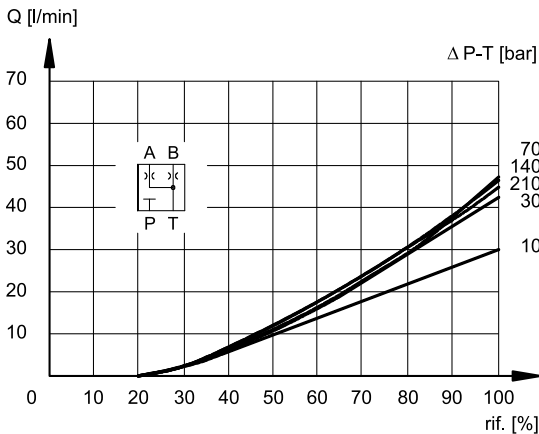
#### SPOOL TYPE C30



#### SPOOL TYPE C60

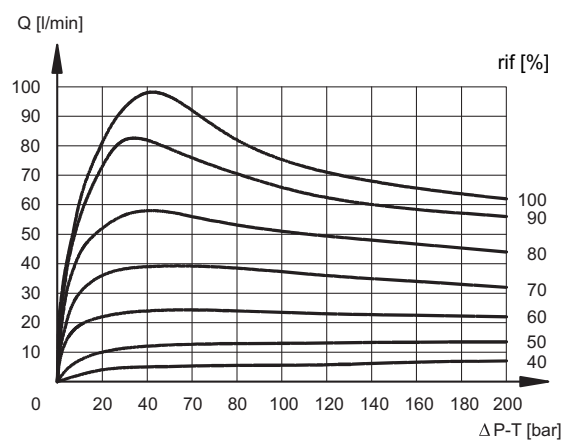
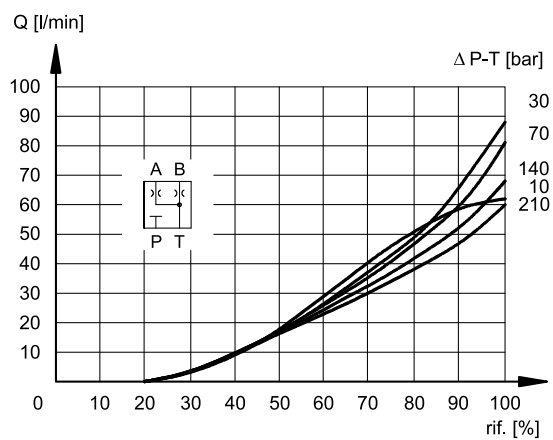


#### SPOOL TYPE A30



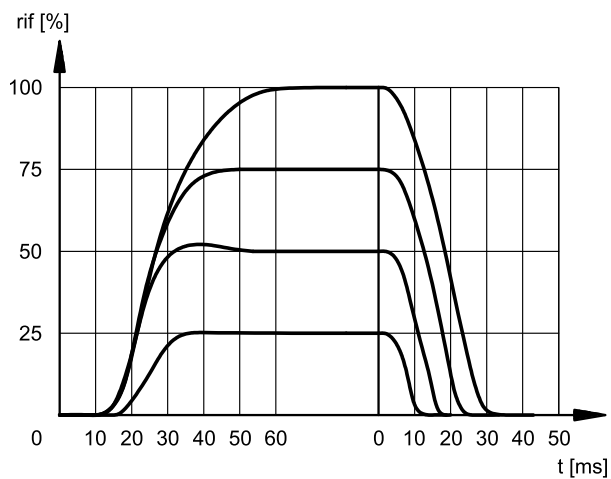


## SPOOL TYPE A60

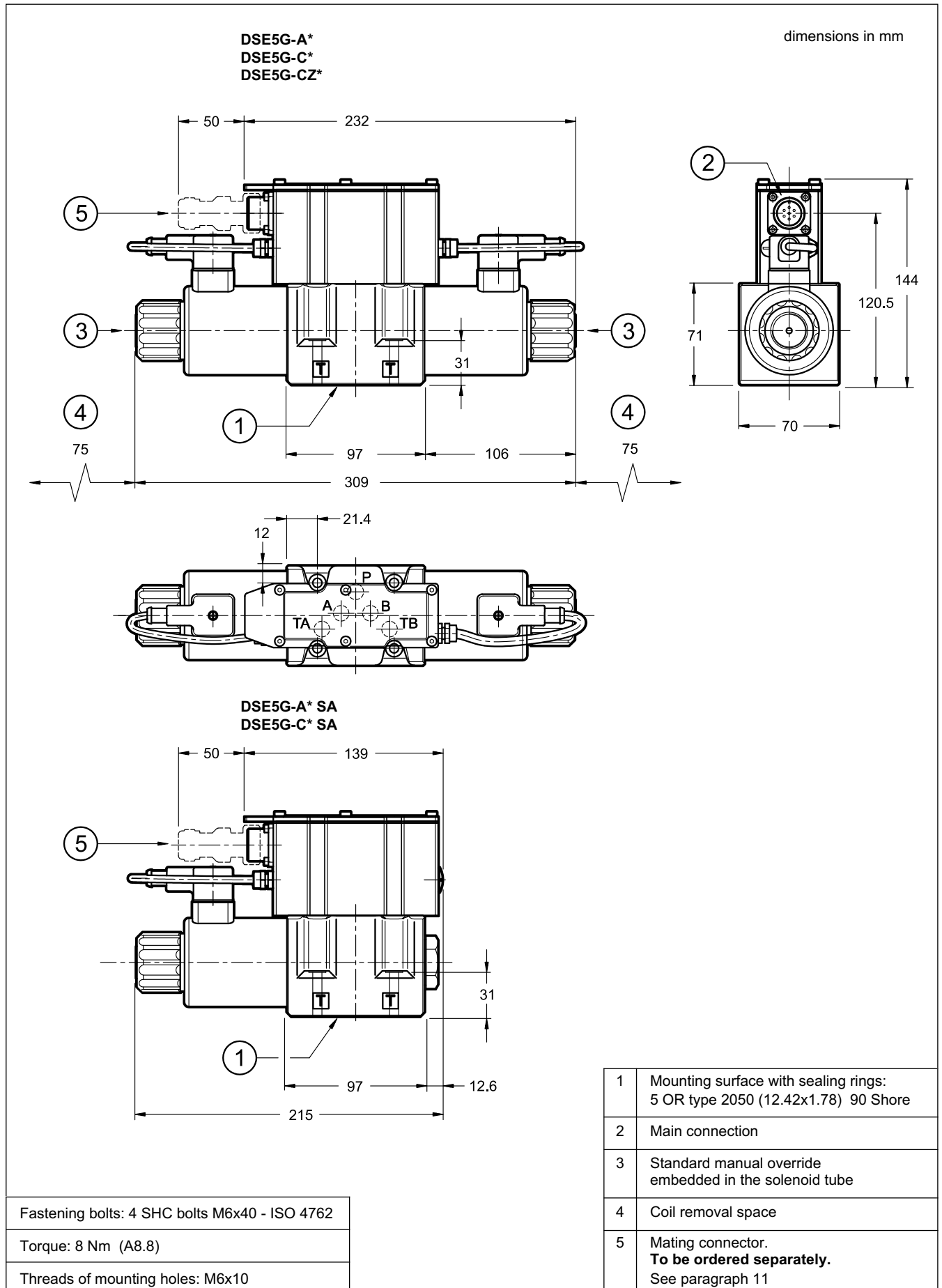


## 7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)



## 8 - OVERALL AND MOUNTING DIMENSIONS



### 9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

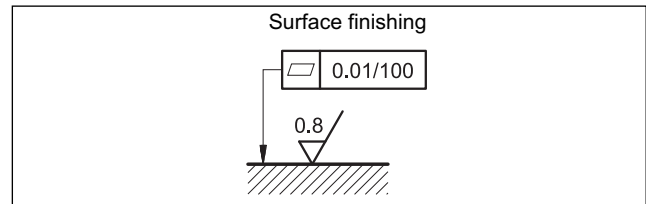
The fluid must be preserved in its physical and chemical characteristics.

### 10 - INSTALLATION

DSE5G valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



### 11 - ACCESSORIES

(to be ordered separately)

#### 11.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

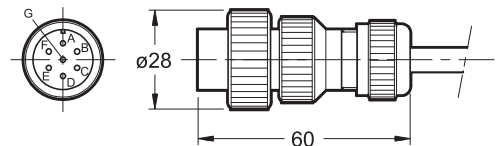


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



#### 11.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

#### 11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

### 12 - SUBPLATES

(see catalogue 51 000)

PMD4-AI4G rear ports 3/4" BSP
PMD4-AL4G side ports 1/2" BSP

**DUPLOMATIC**  
MOTION SOLUTIONS

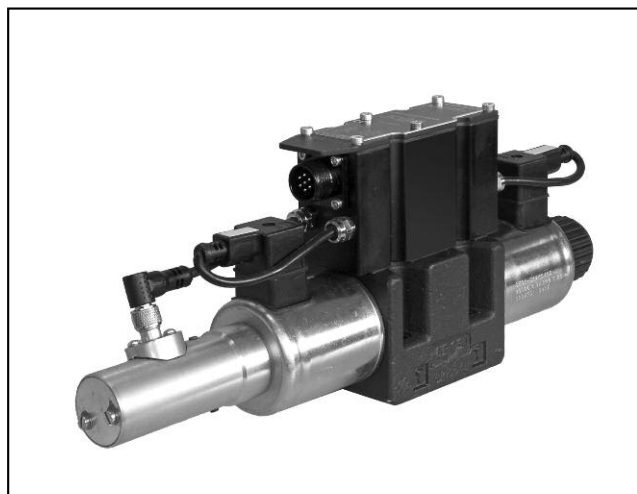
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

www.duplomatic.com • e-mail: sales.exp@duplomatic.com



# DSE5J

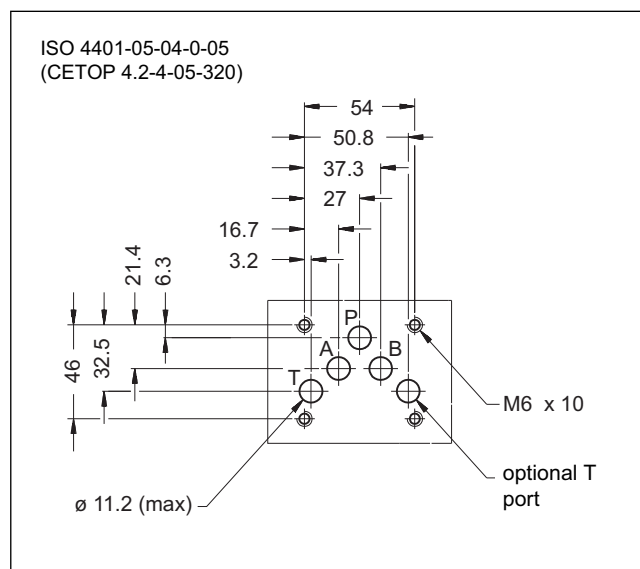
## DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL FEEDBACK AND INTEGRATED ELECTRONICS

### SERIES 31

#### SUBPLATE MOUNTING ISO 4401-05

**p** max 320 bar  
**Q** max 180 l/min

#### MOUNTING INTERFACE



#### PERFORMANCES

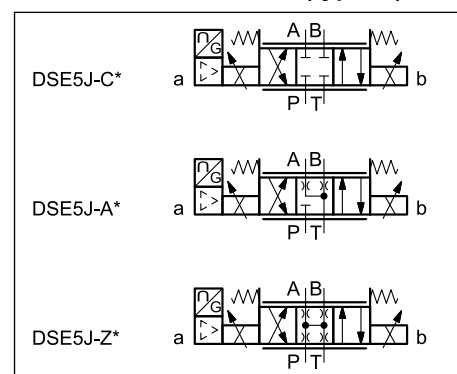
(Obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Max operating pressure: - P - A - B ports - T port	bar	320 210
Nominal flow with $\Delta p$ 10 bar P-T	l/min	50 - 75
Response times	see paragraph 7	
Hysteresis	% of Q max	< 0,2%
Repeatability	% of Q max	< $\pm 0,1\%$
Threshold		< 0,1%
Valve reproducibility		$\leq 5\%$
Electrical characteristics, IP	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	5,6 7,1

#### OPERATING PRINCIPLE

- The DSE5J is a direct operated directional valve with electric proportional control, on-board electronics and feedback, with mounting interface in compliance with ISO 4401 standards.
- It is used to control the direction and the speed of hydraulic actuators.
- Transducer and digital card allow a fine control of the positioning of the cursor, reducing hysteresis and response time and optimizing the performance of the valve.
- The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.
- The monitoring of the spool position is available on pin F.
- The valve is easy to install. The driver directly manages digital settings (see par. 6). In the event of special applications, you can customize the settings using the optional kit (see par. 11).

#### HYDRAULIC SYMBOLS (typical)



## 1 - IDENTIFICATION CODE

<b>D</b>	<b>S</b>	<b>E</b>	<b>5</b>	<b>J</b>	<b>-</b>					<b>/ 31</b>	<b>-</b>	<b>K11</b>	
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Direct operated directional control valve

Electric proportional control

Size ISO 4401-05

Digital integrated electronics for valves with feedback

Spool type:  
**C** = closed centres  
**A** = open centres  
**Z** = zero overlap

Nominal flow rate of the spool (see par. 2)

**FS** = Fail safe option (omit if not required). Available on spools type Z only.

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector 6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10V$   
**E1** = current  $4 \div 20mA$

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

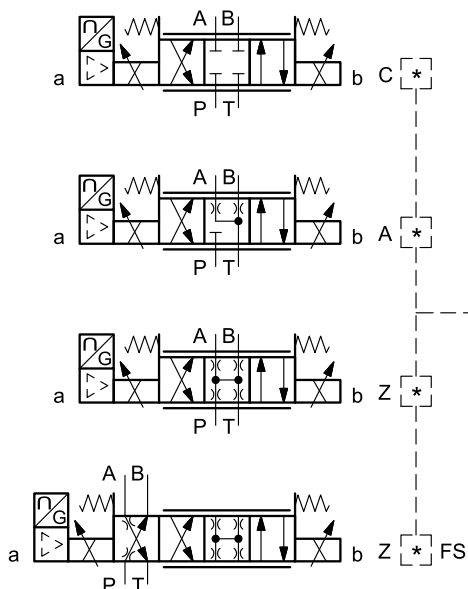
Series N. (the overall and mounting dimensions remain unchanged from 30 to 39)

Solenoid position (omit for 2 solenoids configuration):  
**SA** = 1 solenoid on side A

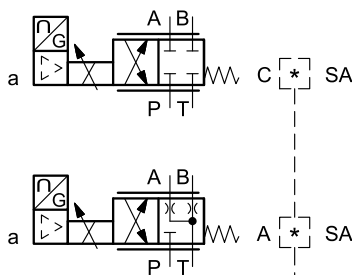
## 2 - CONFIGURATIONS

The valve configuration depends on the combination of the following elements:  
number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids :  
3 positions with spring centering



Configuration 1 solenoid on side A "**SA**":  
2 positions (central + external) with spring centering



*	Controlled flow with $\Delta p$ 10 bar P-T
50	50 l/min
75	75 l/min
70/35	70 (P-A) / 35 (P-B) l/min

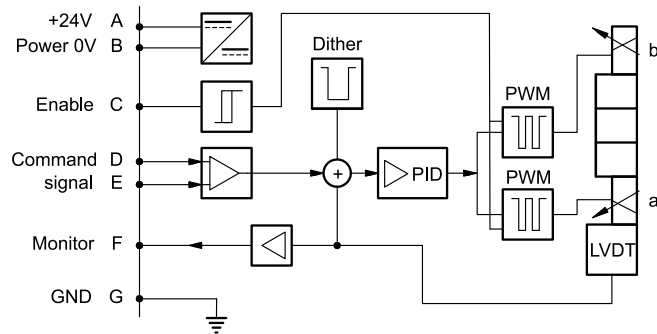
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

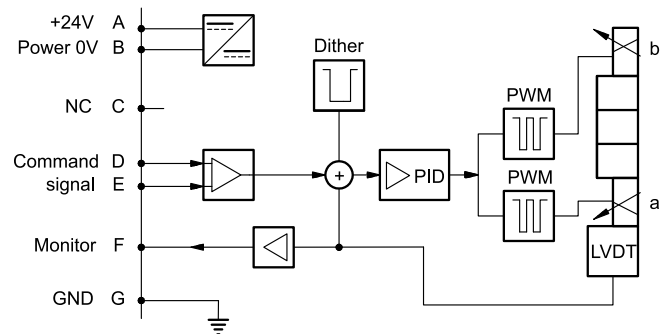
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	40
Maximum solenoid current	A	2.8
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_i > 11 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_i = 58 \text{ }\Omega$ )
Monitor signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_o > 1 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_o = 500 \text{ }\Omega$ )
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams

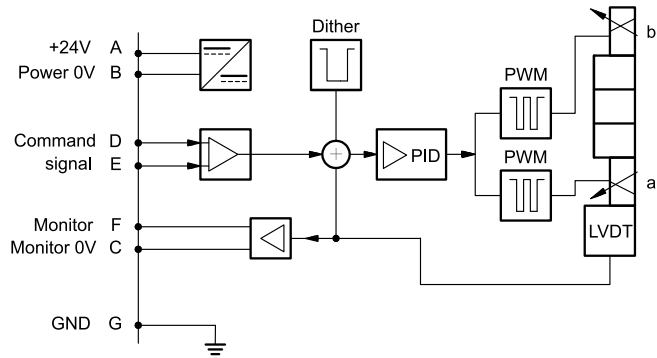
#### VERSION A - External Enable



#### VERSION B - Internal Enable



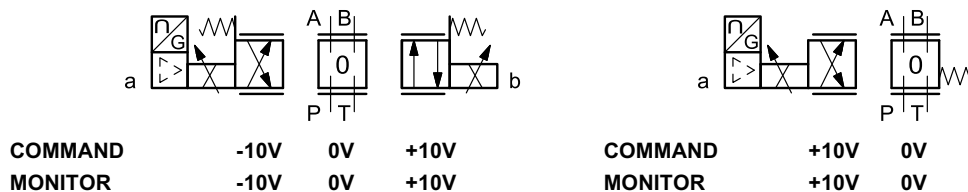
#### VERSION C - 0V Monitor





## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between -10V and +10V on double solenoid valves, and 0 ÷ 10V on single solenoid valves SA. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.

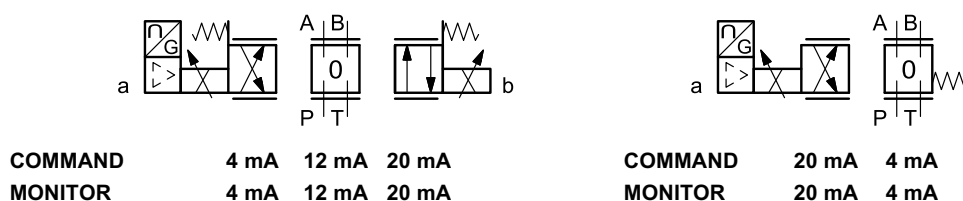


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower ,the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.

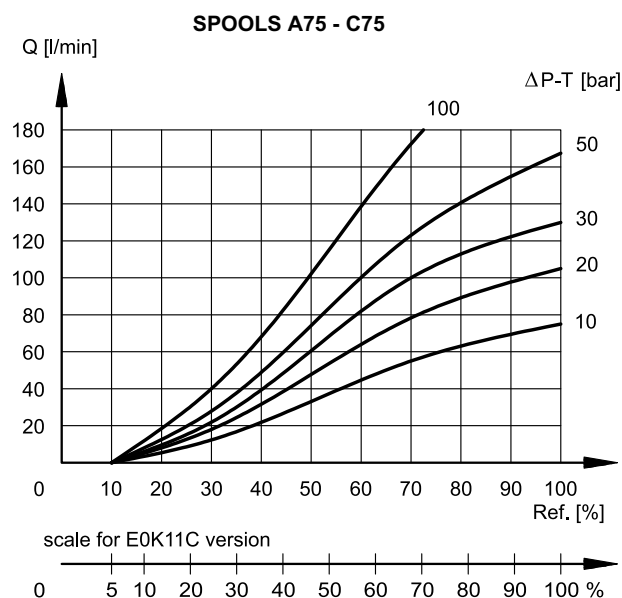
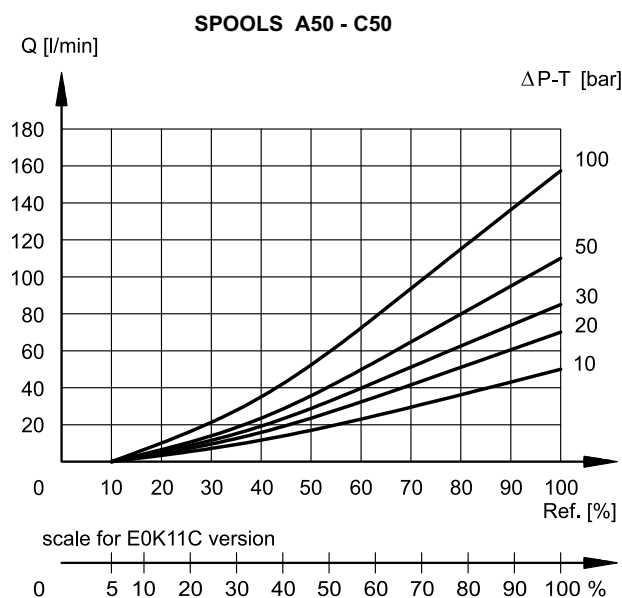
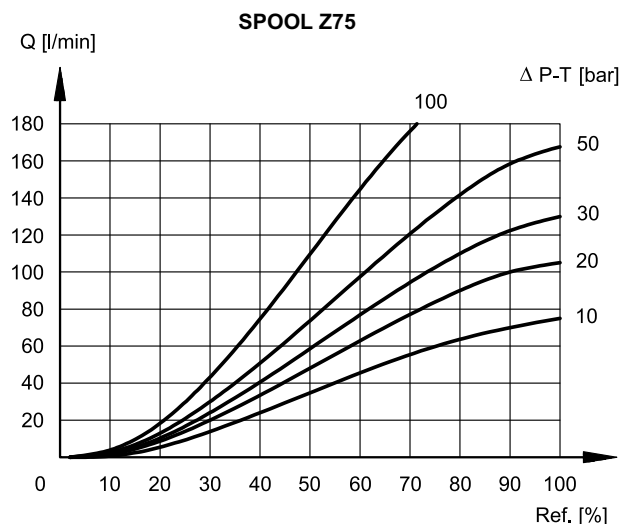
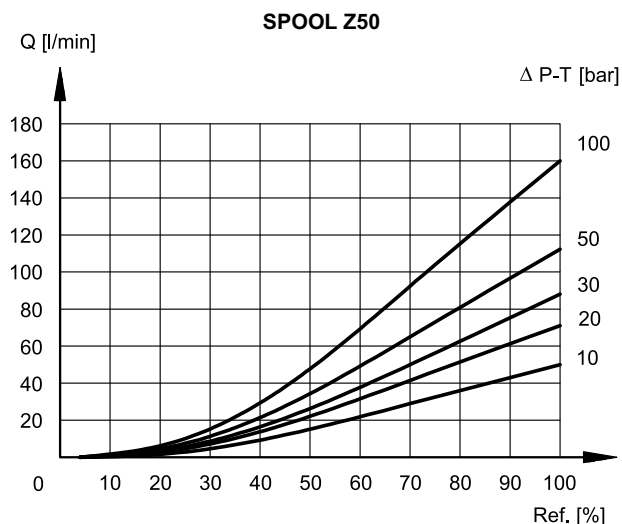
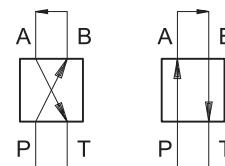


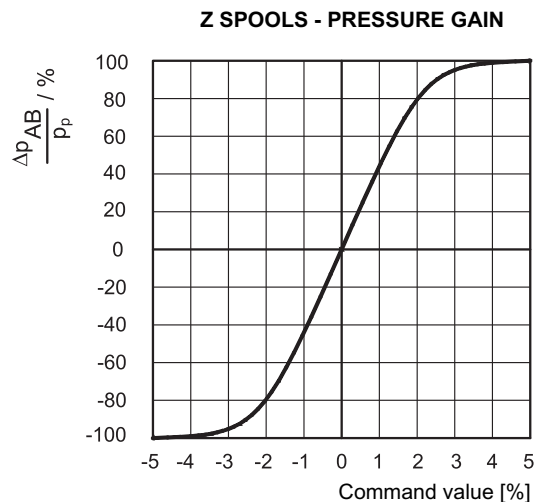
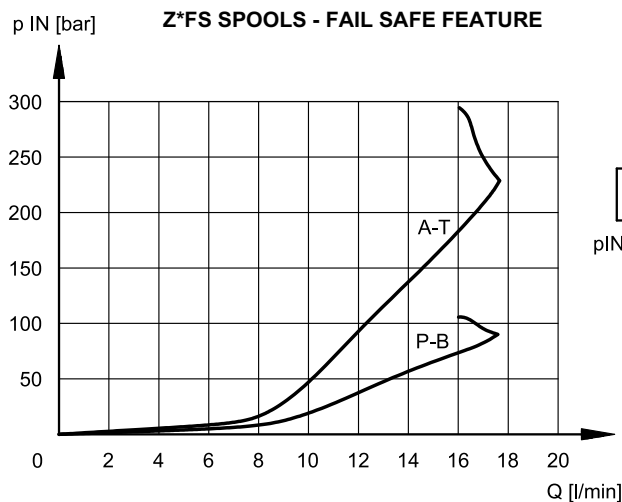
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

### 6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)

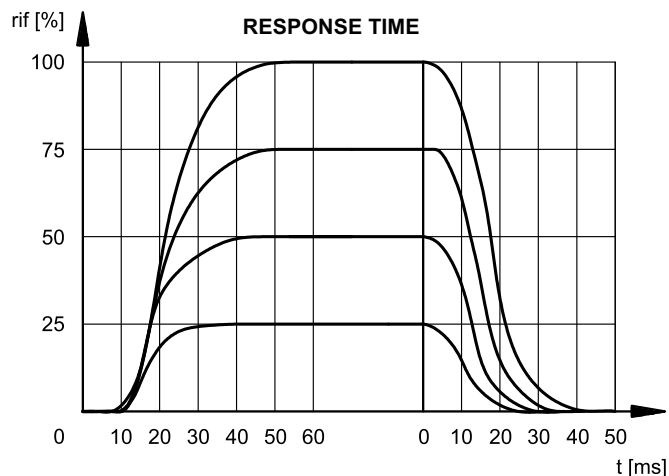
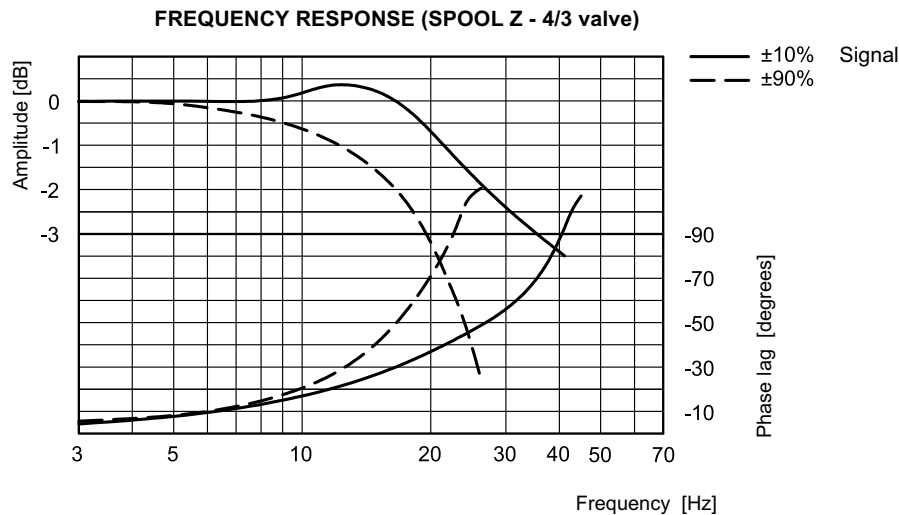
Typical flow rate curves related to the reference signal and measured for the available spools. The  $\Delta p$  values are measured between P and T valve ports.



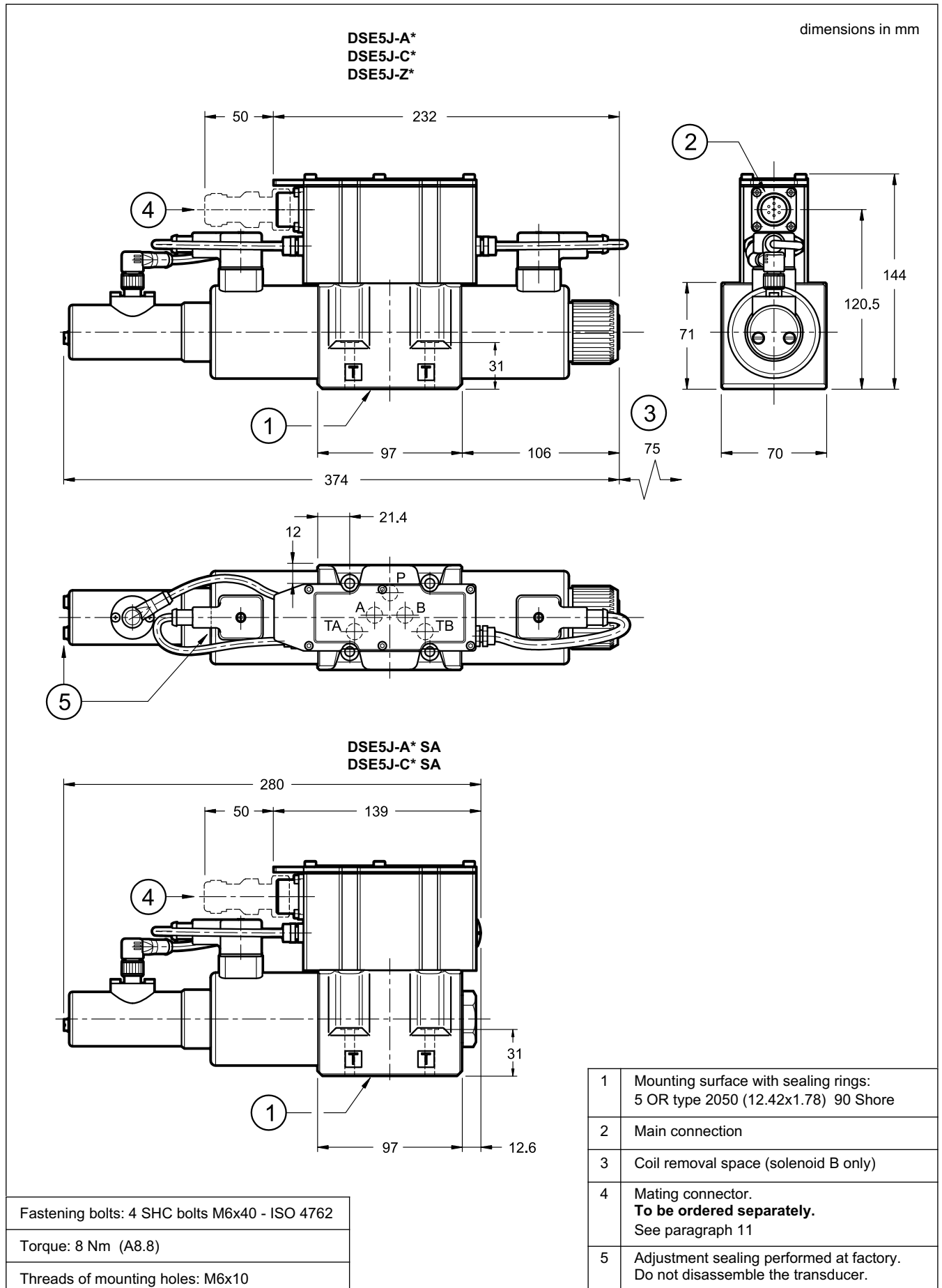


## 7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C 140 bar  $\Delta p$  P→T)



## 8 - OVERALL AND MOUNTING DIMENSIONS



## 9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

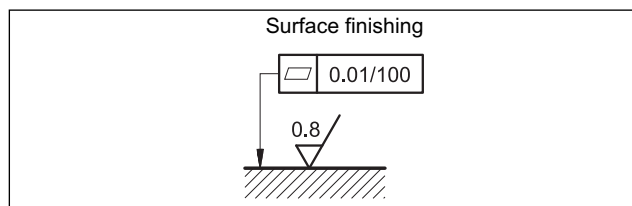
The fluid must be preserved in its physical and chemical characteristics.

## 10 - INSTALLATION

DSE5J valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 11 - ACCESSORIES

(to be ordered separately)

### 11.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

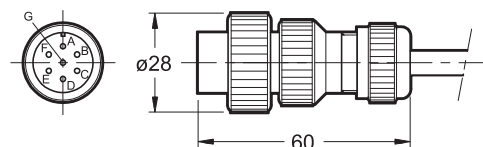


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 11.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

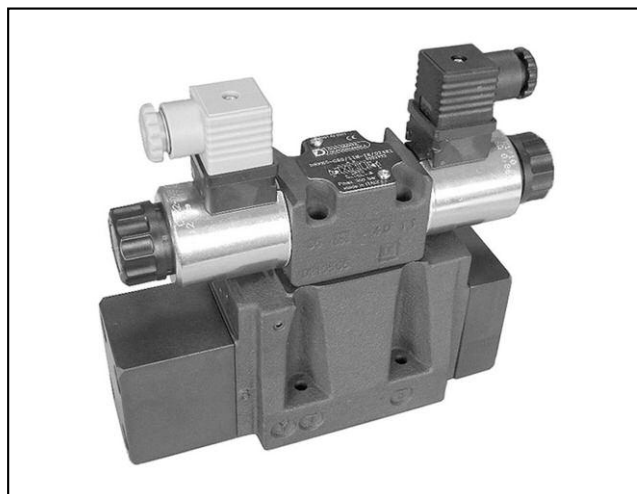
### 11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 12 - SUBPLATES

(see catalogue 51 000)

PMD4-AI4G rear ports 3/4" BSP
PMD4-AL4G side ports 1/2" BSP

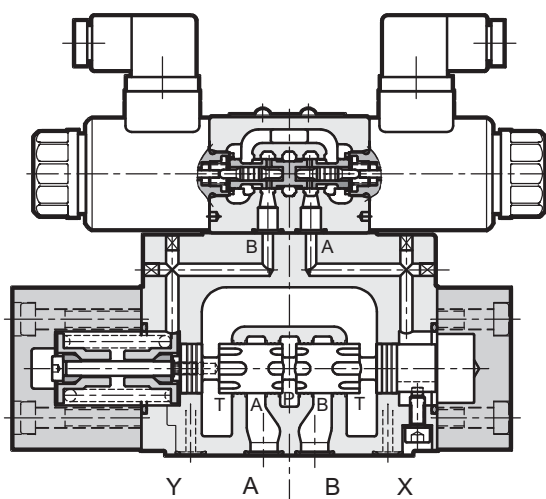


# DSPE\*

## PILOT OPERATED DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL SERIES 11

**DSPE5**                      **CETOP P05**  
**DSPE5R**                **ISO 4401-05 (CETOP R05)**  
**DSPE7**                   **ISO 4401-07 (CETOP 07)**  
**DSPE8**                   **ISO 4401-08 (CETOP 08)**  
**DSPE10**                **ISO 4401-10 (CETOP 10)**  
**p** max (see performances table)  
**Q** max (see performances table)

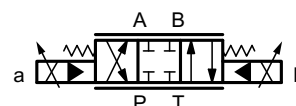
### OPERATING PRINCIPLE



- The DSPE\* are pilot operated directional control valves with electric proportional control and mounting interface in compliance with ISO 4401 standards.
- The valve opening (and hence the flow rate) can be modulated continuously in proportion to the current supplied to the proportional solenoids of the pilot valve.
- They can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 15).
- They are available in CETOP P05, ISO 4401-05 (CETOP R05), ISO 4401-07 (CETOP 07), ISO 4401-08 (CETOP 08) and ISO 4401-10 (CETOP 10) sizes. Every size can be supplied with different controlled flow rates, up to 1600 l/min.

PERFORMANCES (obtained with viscosity of 36 cSt at 50°C with electronic control unit)		DSPE5 DSPE5R	DSPE7	DSPE8	DSPE10
Max operating: - P - A - B ports - T port	bar	350 see paragraph 6			
Controlled flow rate with Δp 10 bar P-T	l/min	see paragraph 2			
Step response		see paragraph 8			
Hysteresis (with PWM 100 Hz)	% Q <sub>max</sub>	< 4%			
Repeatability	% Q <sub>max</sub>	< ±2%			
Electrical characteristics		see paragraph 7			
Ambient temperature range	°C	-20 / +60			
Fluid temperature range	°C	-20 / +80			
Fluid viscosity range	cSt	10 ÷ 400			
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13				
Recommended viscosity	cSt	25			
Mass: single solenoid valve double solenoid valve	kg	7,1 7,5	9,3 9,7	15,6 16	52,5 53

### HYDRAULIC SYMBOL (typical)



### 1 - IDENTIFICATION CODE

<b>D</b>	<b>S</b>	<b>P</b>	<b>E</b>	<b>-</b>				<b>/ 11</b>	<b>-</b>			<b>/</b>	<b>K1</b>	<b>/</b>	
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Pilot operated directional control valve

Electric proportional control

Nominal size:  
**5** = CETOP P05 (**NOTE**)  
**5R** = ISO 4401-05 (CETOP R05)  
**7** = ISO 4401-07 (CETOP 07)  
**8** = ISO 4401-08 (CETOP 08)  
**10** = ISO 4401-10 (CETOP 10)

Spool type:  
**C** = closed centres  
**A** = open centres  
**RC** = regenerative closed centres  
**RA** = regenerative open centres

Spool nominal flow rate (see table par. 2)

Configurations for single solenoid version (omit for double solenoid version):  
**SA** = 1 solenoid for cross configuration  
**SB** = 1 solenoid for parallel configuration

Manual override: (see par. 15)

Coil electrical connection: for connector type DIN 43650  
**D12** = voltage 12V DC  
**D24** = voltage 24V DC

Drainage: **I** = internal  
**E** = external

Piloting: **I** = internal  
**E** = external  
**Z** = internal piloting with 30 bar fixed adj. pressure reducing valve (see par. 6)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

**NOTE:** This version is interchangeable with the model E4E Diplomatic

### 2 - AVAILABLE CONFIGURATIONS

The valve configuration depends on the combination of the following elements:  
number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids:  
3 positions with spring centering

1 solenoid for cross configuration "SA":  
2 positions (central + external) with spring centering

1 solenoid for parallel configuration "SB":  
2 positions (central + external) with spring centering

valve type	*	nominal flow rate with $\Delta p$ 10 bar P-T
DSPE5	<b>80</b>	80 l/min
DSPE5R	<b>80/40</b>	80 (P-A) / 40 (B-T) l/min
DSPE7	<b>100</b>	100 l/min
	<b>150/75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8	<b>200</b>	200 l/min
	<b>300</b>	300 l/min
	<b>300/150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10	<b>350</b>	350 l/min
	<b>500</b>	500 l/min
	<b>500/250</b>	500 (P-A) / 250 (B-T) l/min

RC \*

RA \*

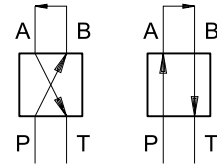
valve type	*	nominal flow rate with $\Delta p$ 10 bar P-T
DSPE7	<b>150/75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8	<b>300/150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10	<b>500/250</b>	500 (P-A) / 250 (B-T) l/min

### 3 - CHARACTERISTIC CURVES

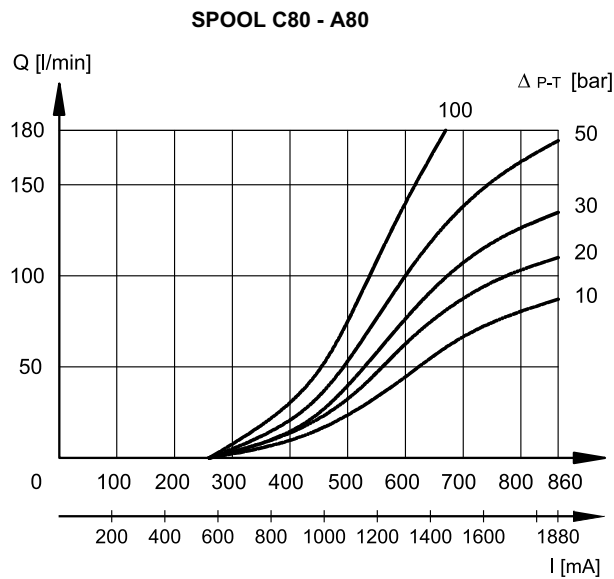
(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

Typical flow rate control curves at constant  $\Delta p$  according to current supply to the solenoid (D24 version, 860 mA max current), measured for the available spool types.

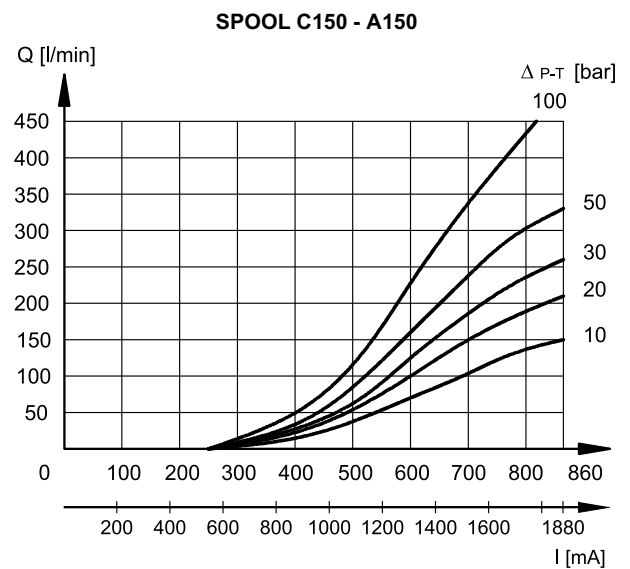
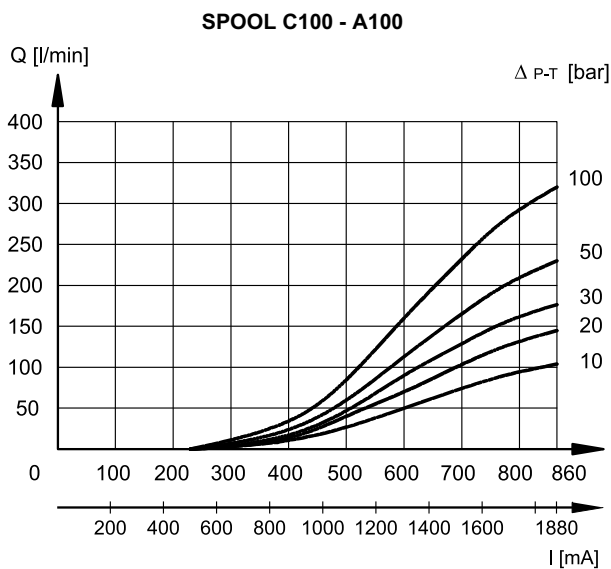
The reference  $\Delta p$  values are measured between valve ports P and T.



#### 3.1 - Characteristic curves DSPE5 e DSPE5R



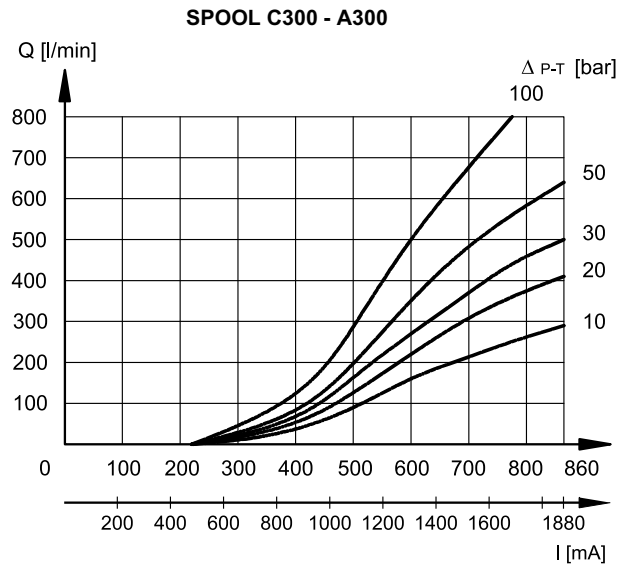
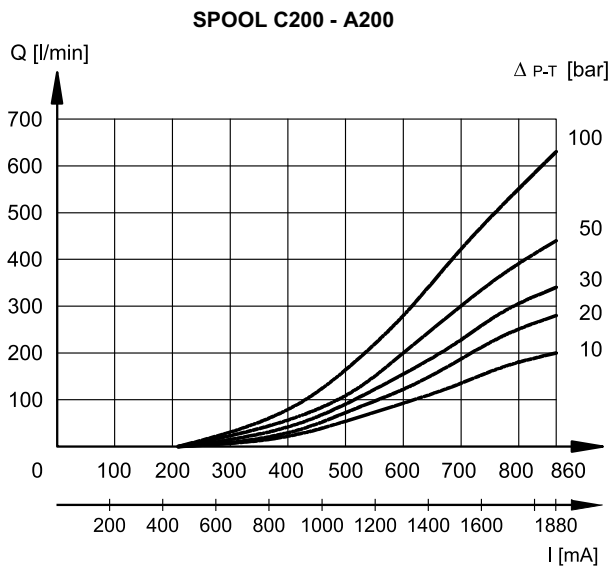
#### 3.2 - Characteristic curves DSPE7



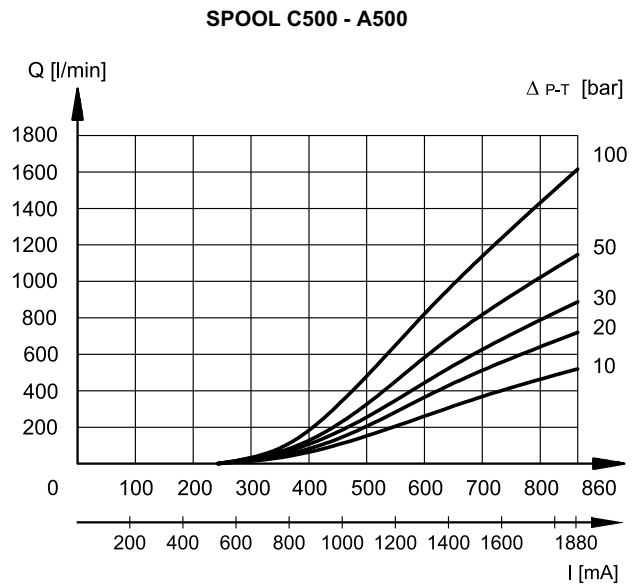
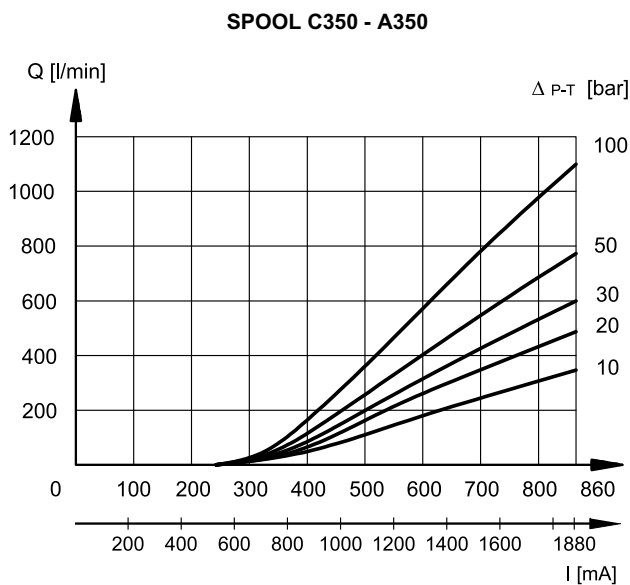




### 3.3 - Characteristic curves DSPE8



### 3.4 - Characteristic curves DSPE10



## 4 - HYDRAULIC CHARACTERISTICS

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

		DSPE5 DSPE5	DSPE7	DSPE8	DSPE10
Max flow rate	l/min	180	450	800	1600
Piloting flow requested with operation 0 → 100%	l/min	3	5	9	13
Piloting volume requested with operation 0 → 100%	cm <sup>3</sup>	1,7	3,2	9,1	21,6

### 5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 6 - PILOTING AND DRAINAGE

The DSPE valves are available with piloting and drainage, both internal and external.

The version with external drainage allows a higher backpressure on the unloading.

VALVE TYPE	Plug assembly	
	X	Y
<b>IE</b> INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b> INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b> EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b> EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

#### PRESSURES (bar)

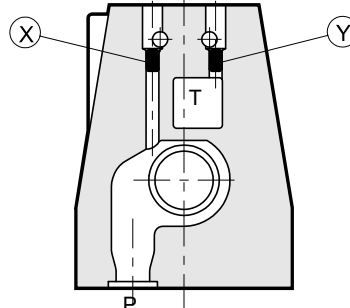
Pressure	MIN	MAX
Piloting pressure on X port	30	210 (NOTE)
Pressure on T port with internal drain	–	10
Pressure on T port with external drain	–	250

**NOTE: the version with external pilot with reduced pressure must be used when higher pressures are needed.**

Otherwise the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

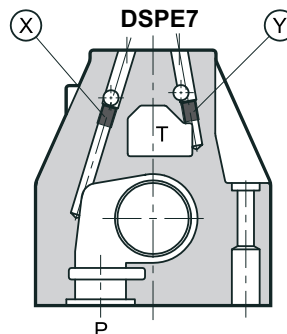
Add the letter Z to the identification code to order this option (see par. 1).

#### DSPE5 and DSPER5



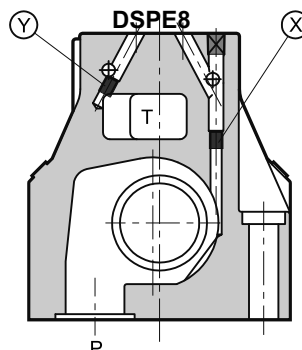
**X:** M5x6 plug for external pilot  
**Y:** M5x6 plug for external drain

#### DSPE7



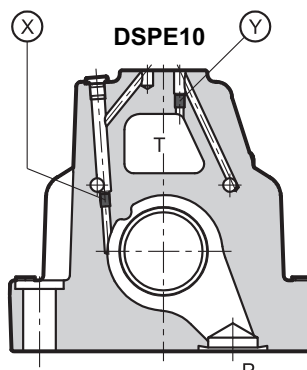
**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

#### DSPE8



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

#### DSPE10



**X:** M6x8 plug for external pilot  
**Y:** M6x8 plug for external drain

### 7 - ELECTRICAL CHARACTERISTICS

#### Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut. It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	17.6
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
CLASS OF PROTECTION: atmospheric agents (CEI EN 60529) coil insulation (VDE 0580) Impregnation	IP 65 class H class F		

### 8 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table shows the typical step response tested with static pressure 100 bar.

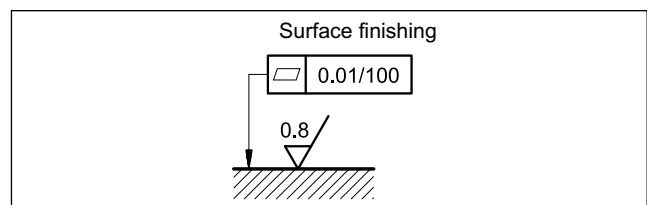
REFERENCE SIGNAL	0 → 100%	100 → 0%
	Step response [ms]	
<b>DSPE5 and DSPE5R</b>	50	40
<b>DSPE7</b>	80	50
<b>DSPE8</b>	100	70
<b>DSPE10</b>	200	120

### 9 - INSTALLATION

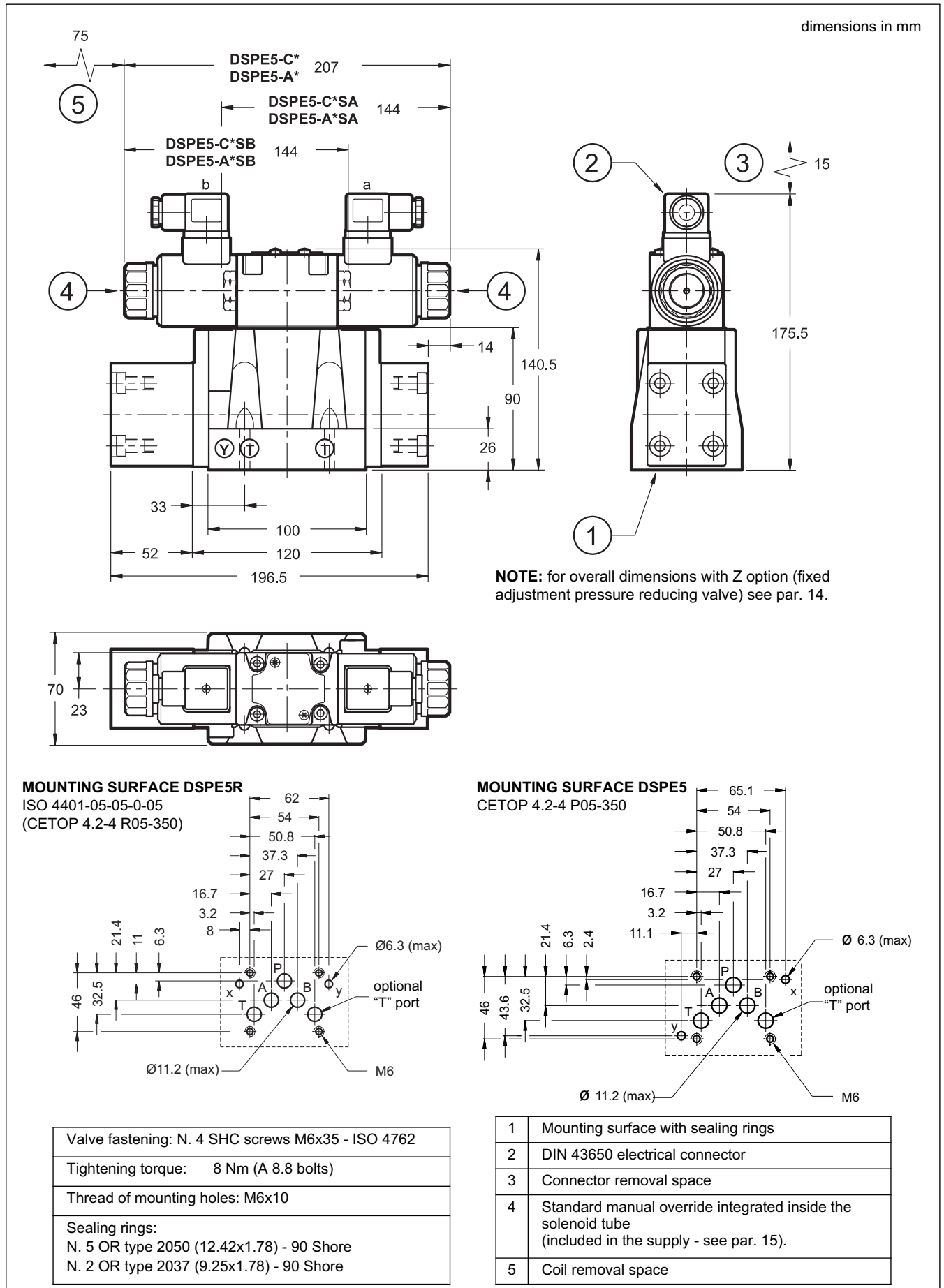
The DSPE\* valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

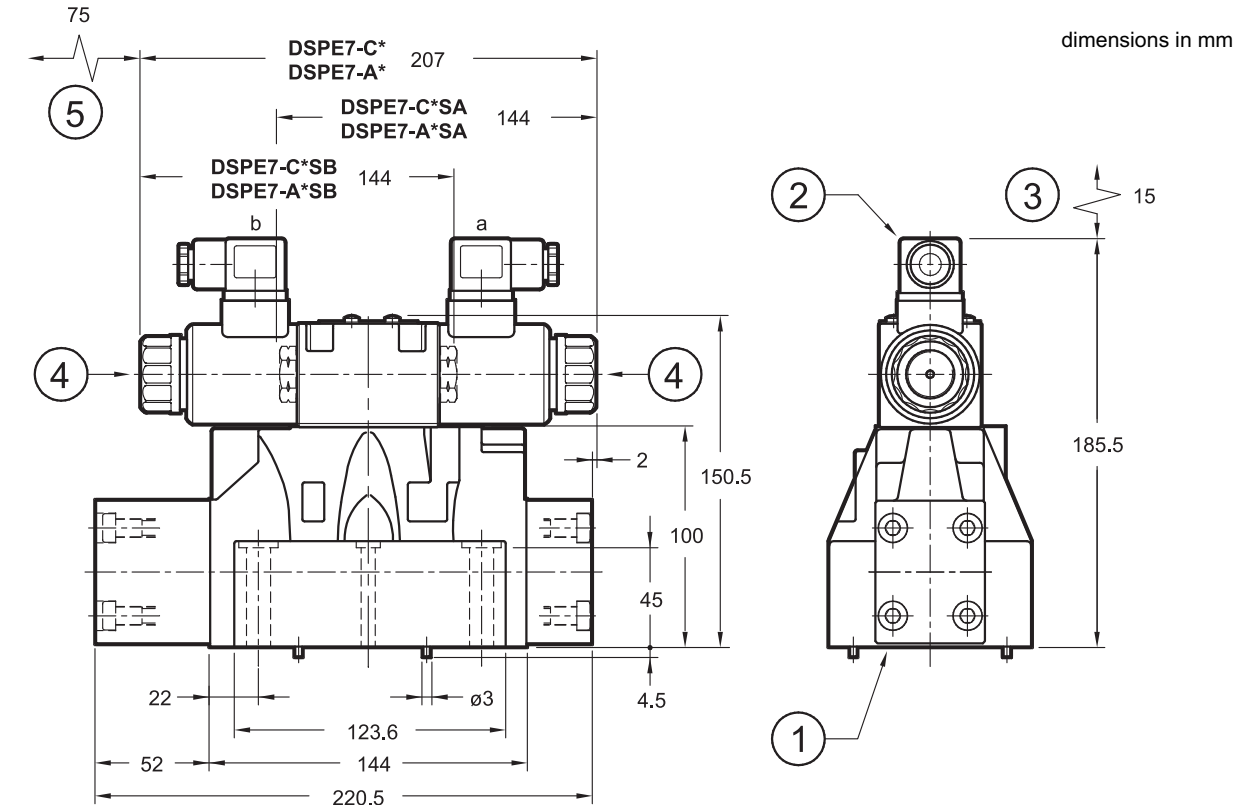
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



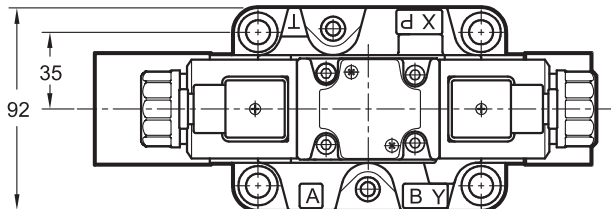
## 10 - OVERALL AND MOUNTING DIMENSIONS DSPE5 AND DSPE5R



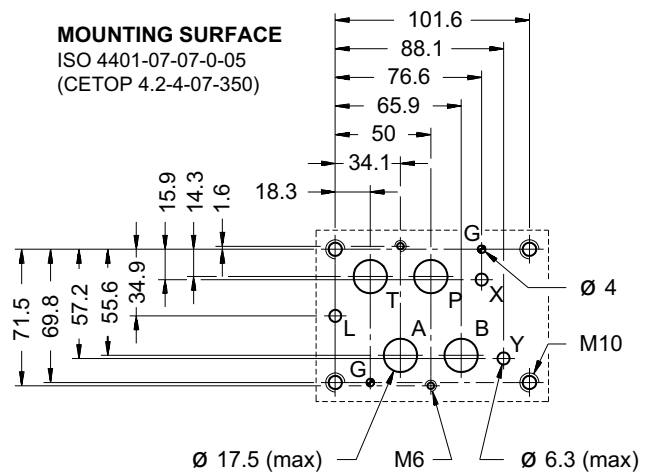
## 11 - OVERALL AND MOUNTING DIMENSIONS DSPE7



**NOTE:** for overall dimensions with Z option (fixed adjustment pressure reducing valve) see par. 14.



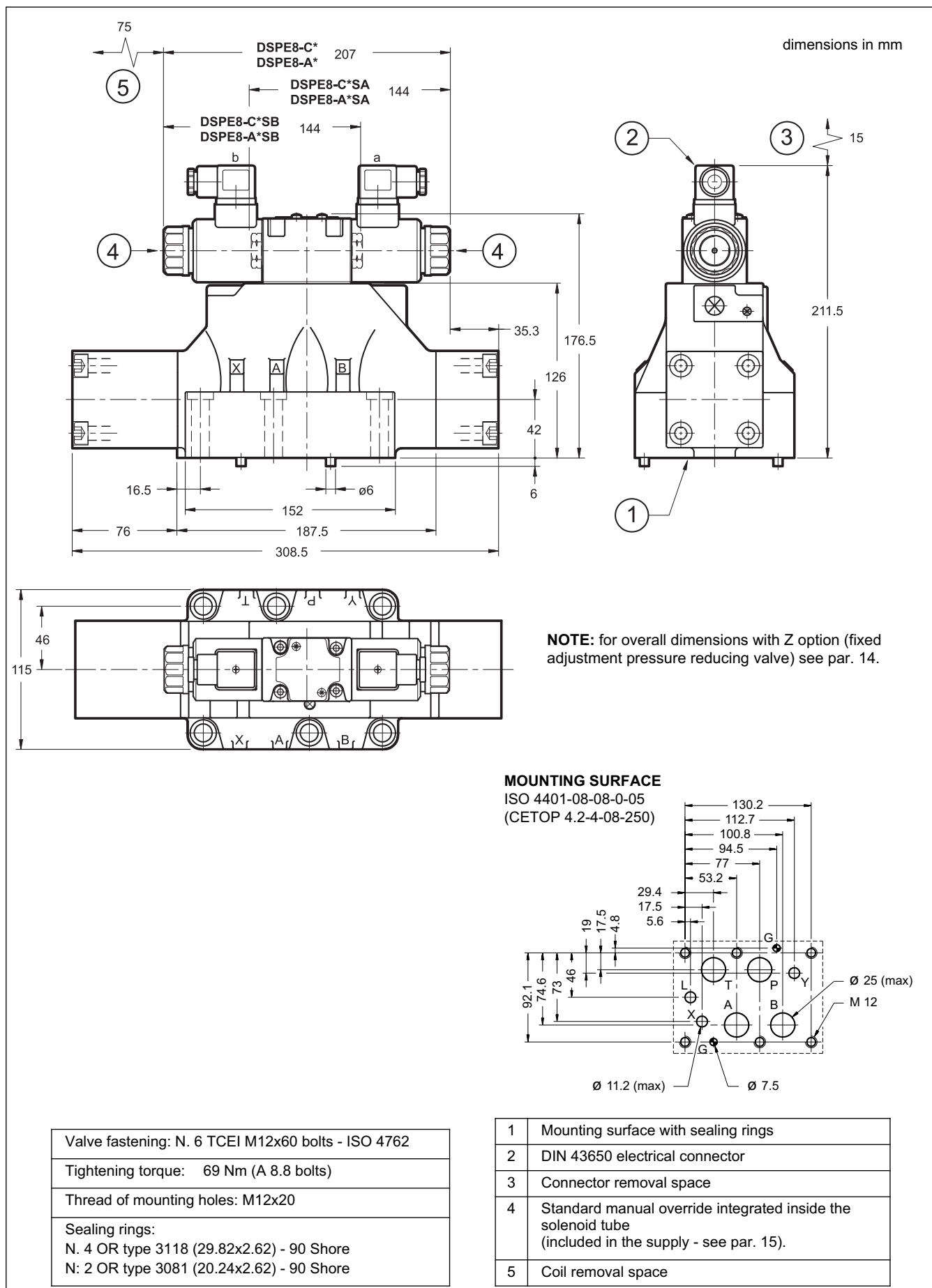
**MOUNTING SURFACE**  
ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



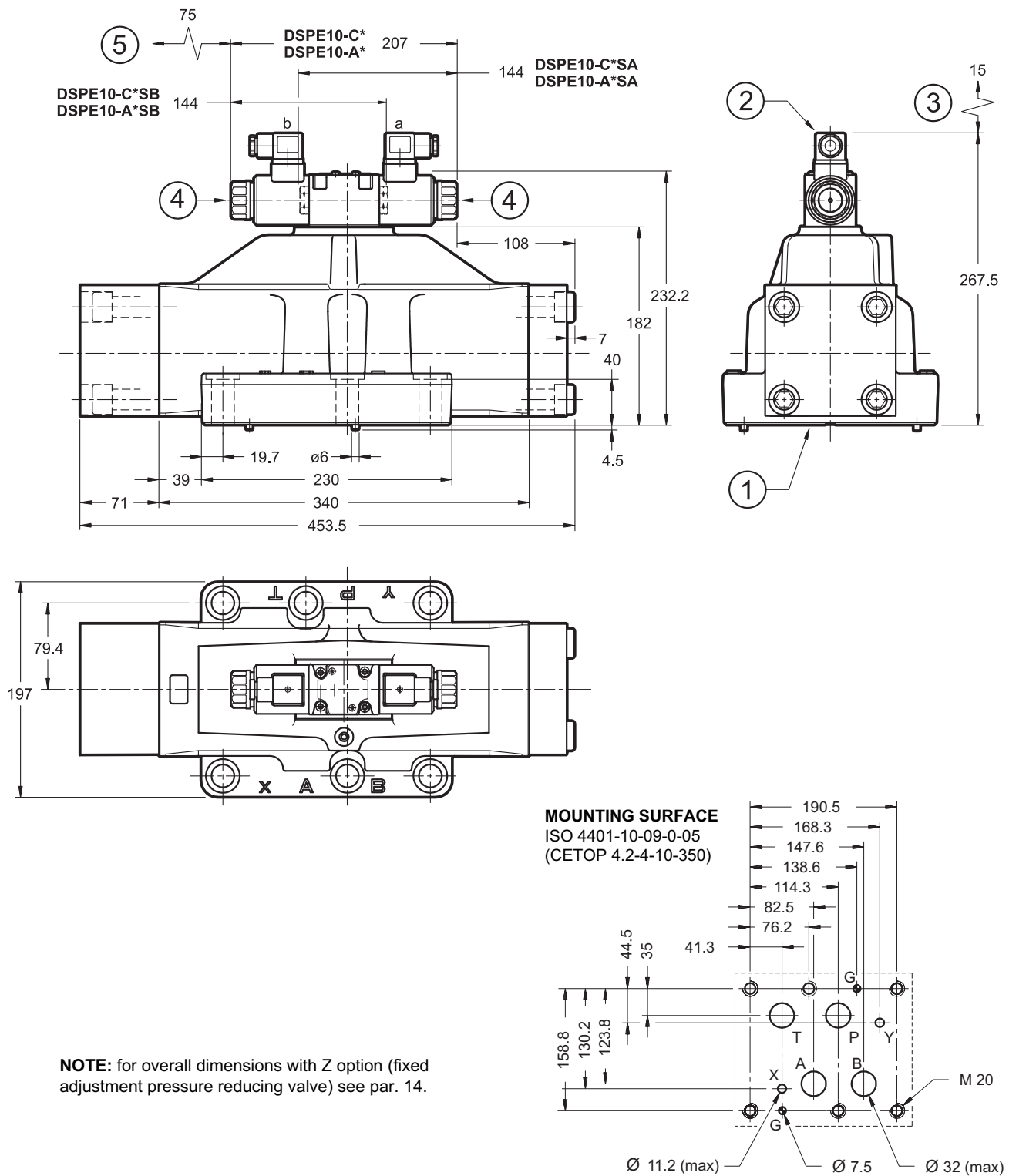
Single valve fastening:	N. 4 TCEI M10x60 bolts - ISO 4762 N. 2 TCEI M6x60 bolts - ISO 4762
Tightening torque M10x60:	40 Nm (A 8.8 bolts)
M6x60:	8 Nm (A 8.8 bolts)
Thread of mounting holes:	M6x18; M10x18
Sealing rings:	N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override integrated inside the solenoid tube (included in the supply - see par. 15).
5	Coil removal space

## 12 - OVERALL AND MOUNTING DIMENSIONS DSPE8



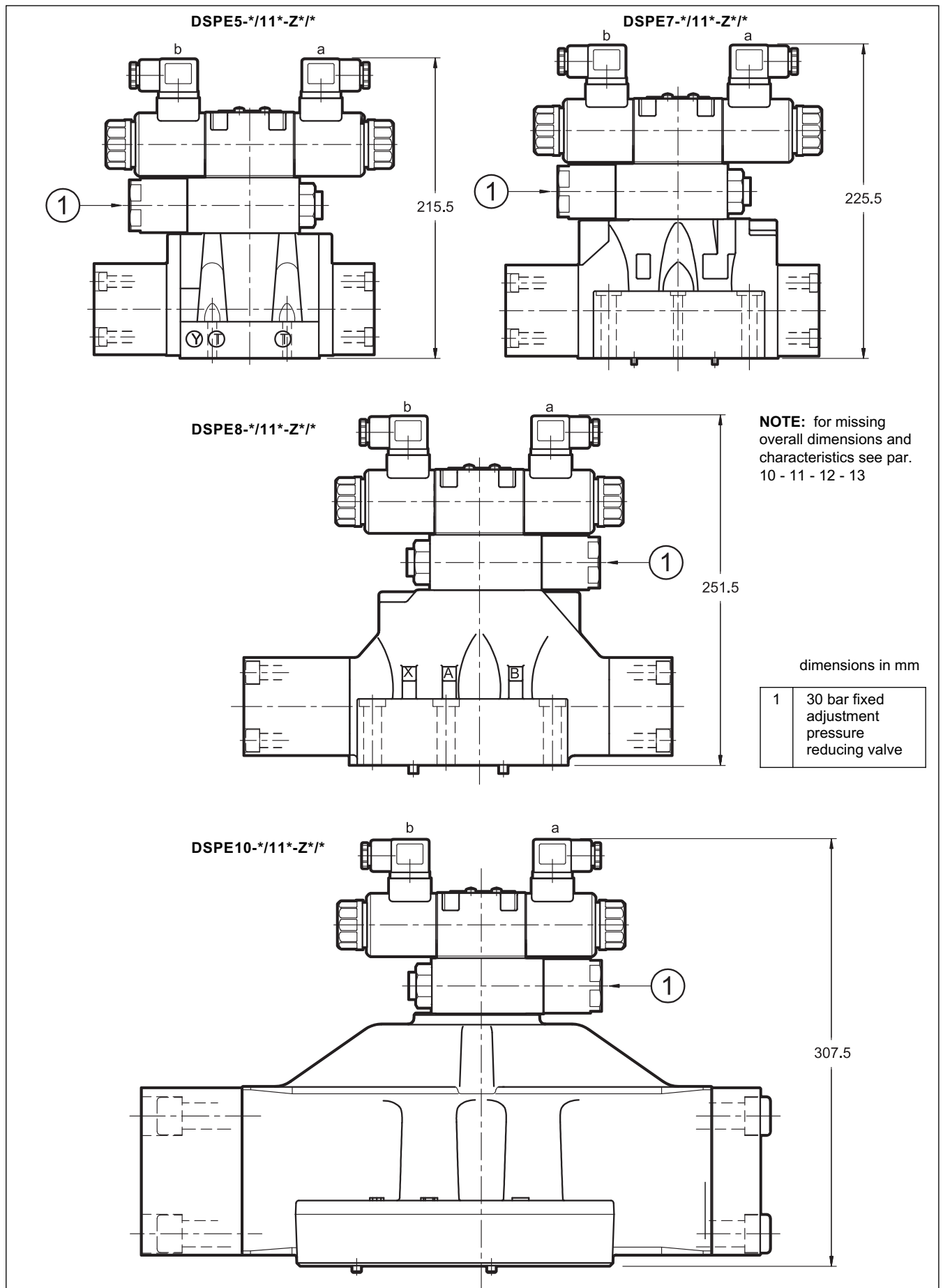
## 13 - OVERALL AND MOUNTING DIMENSIONS DSPE10



Valve fastening: N. 6 TCEI M12x70 bolts - ISO 4762
Tightening torque: 330 Nm (A 8.8 bolts)
Thread of mounting holes: M20x40
Sealing rings: N. 4 OR type 4150 (37.59x3.53) - 90 Shore N. 2 OR type 3081 (20.24x2.62) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override integrated inside the solenoid tube (included in the supply - see par. 15).
5	Coil removal space

## 14 - OVERALL AND MOUNTING DIMENSIONS DSPE\*-/11\*-Z\*/\*





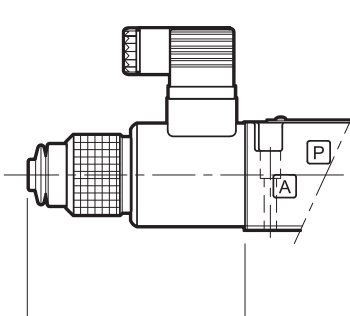
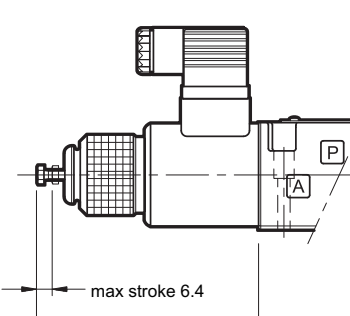
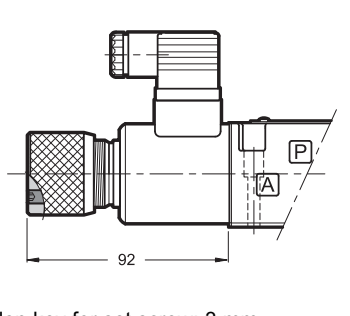
## 15 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Three different manual override version are available upon request:

- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.
- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening.

**NOTE:** The manual override use doesn't allow any proportional regulation; in fact using this kind of override, the main stage spool will open completely and the valve will behave as an on-off valve.

Versione CM	Versione CS	Versione CK
		
Code: 3803210003	Code: 3803210004	Code: 3803210005

## 16 - ELECTRONIC CONTROL UNITS

DSPE\* - \*\* SA (SB)

<b>EDC-111</b>	for solenoid 24V DC	plug version	see cat.89 120
<b>EDC-141</b>	for solenoid 12V DC		
<b>EDM-M111</b>	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
<b>EDM-M141</b>	for solenoid 12V DC		

DSPE\* - A\* DSPE\* - C\*

<b>EDM-M211</b>	for solenoid 24V DC	rail mounting DIN EN 50022	see cat. 89 250
<b>EDM-M241</b>	for solenoid 12V DC		

## 17 - SUBPLATES

(see catalogue 51 000)

	DSPE5	DSPE7	DSPE8	DSPE10
Model with rear ports	PME4-AI5G	PME07-AI6G	-	-
Model with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G	-
Thread of ports:	P - T - A - B X - Y	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP	1 1/2" BSP 1/4" BSP



# DSPE\*G

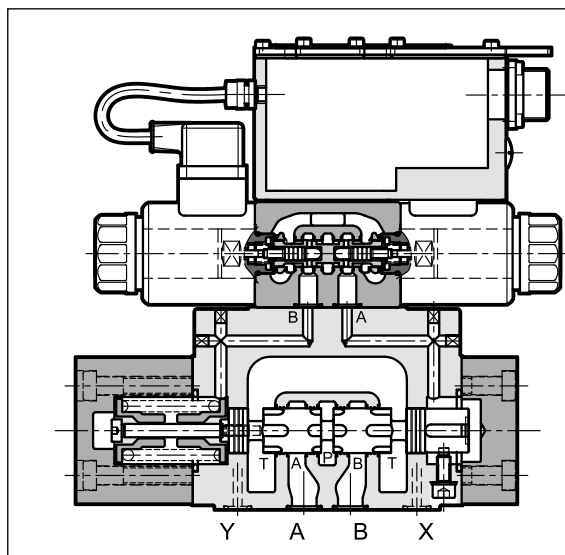
## PROPORTIONAL DIRECTIONAL VALVES, PILOT OPERATED WITH INTEGRATED ELECTRONICS

### SERIES 31

#### SUBPLATE MOUNTING

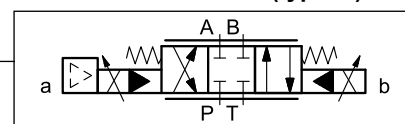
DSPE5R	CETOP P05
DSPE5RG	ISO 4401-05
DSPE7G	ISO 4401-07
DSPE8G	ISO 4401-08
DSPE10G	ISO 4401-10
DSPE11G	ISO 4401-10 oversize ports

#### OPERATING PRINCIPLE



- The DSPE\*G are pilot operated directional control valves with electric proportional control and integrated electronics and with mounting interface in compliance with ISO 4401 standards.
- They are controlled directly by an integrated digital amplifier.
- The valves are available with command signal in voltage or current, and on-board electronics with internal enable, external enable or 0V monitor on pin C.
- A solenoid current monitoring signal is available.
- The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 19)

#### HYDRAULIC SYMBOL (typical)



#### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		DSPE5G DSPE5RG	DSPE7G	DSPE8G	DSPE10G	DSPE11G
Max operating pressure: P - A - B ports T port	bar	350 see paragraph 8				
Max flowrate	l/min	180	450	800	1600	2800
Hysteresis	% Q max	< 2 %				
Repeatability	% Q max	< ± 1%				
Electrical characteristics		see paragraph 3				
Ambient temperature range	°C	-20 / +60				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13				
Recommended viscosity	cSt	25				
Mass: single solenoid valve double solenoid valve	kg	7,4 7,9	9,6 10,1	15,9 16,4	52,8 53,3	52,5 53



## 1 - IDENTIFICATION CODE

D	S	P	E		G	-				/	31		-			/		K11		
---	---	---	---	--	---	---	--	--	--	---	----	--	---	--	--	---	--	-----	--	--

Pilot operated directional valve

Electric proportional control

Nominal size: \_\_\_\_\_  
**5** = CETOP P05  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08  
**10** = ISO 4401-10  
**11** = ISO 4401-10 with oversize ports

Integrated electronics for open loop

Spool type: \_\_\_\_\_  
**C** = closed centres  
**A** = open centres  
**RC** = regenerative closed centers  
**RA** = regenerative open centers

Spool nominal flow rate (see table par. 2) \_\_\_\_\_

Configurations for single solenoid version (omit for double solenoid version) :  
**SA** = 1 solenoid for cross configuration (for DSPE5G, DSPE5RG and DSPE7G only)  
**SB** = 1 solenoid for parallel configuration (for DSPE8G, DSPE10G and DSPE11G only)

Option: manual override (see par. 10)

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector 6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10$  V  
**E1** = current  $4 \pm 20$  mA

Drainage: **I** = internal  
**E** = external

Piloting: **I** = internal  
**E** = external  
**Z** = internal piloting with 30 bar fixed adjustment pressure reducing valve (see par. 8 and 15)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No.  
(the overall and mounting dimensions remain unchanged from 30 to 39)

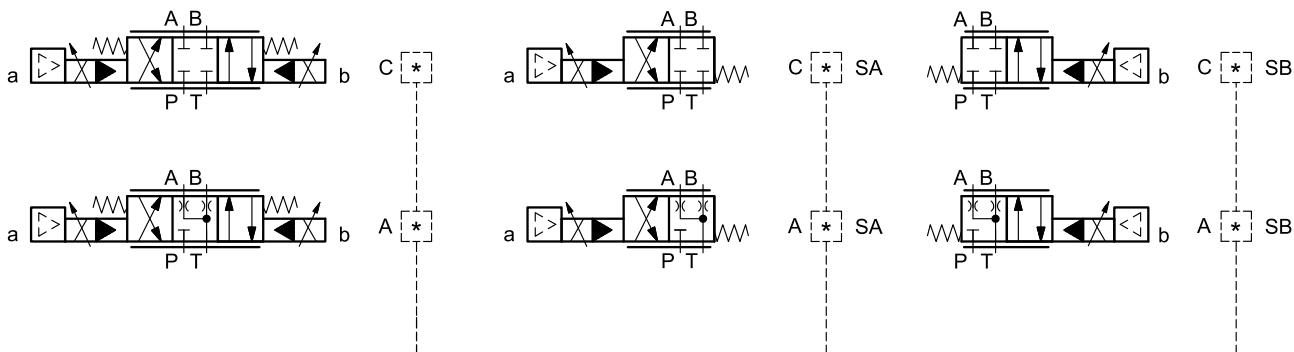
## 2 - AVAILABLE VERSIONS

The valve configuration depends on the combination of number of proportional solenoids, spool type, rated flow.

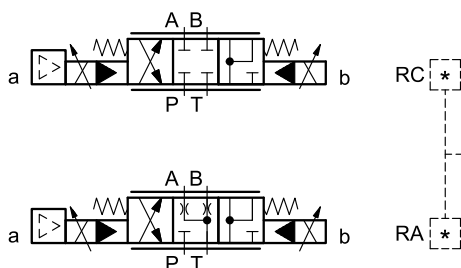
2 solenoids:  
3 positions with spring centering

1 solenoid for cross configuration "SA":  
2 positions (central + external)  
with spring centering  
**for DSPE5G, DSPE5RG and DSPE7G  
only**

1 solenoid for parallel configuration "SB":  
2 positions (central + external)  
with spring centering  
**for DSPE8G, DSPE10G and DSPE11G  
only**



valve type	*	Nominal flow with $\Delta p$ 10 bar P-T
DSPE5G DSPE5RG	<b>80</b>	80 l/min
	<b>80 / 40</b>	80 (P-A) / 40 (B-T) l/min
DSPE7G	<b>100</b>	100 l/min
	<b>150</b>	150 l/min
	<b>150 / 75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8G	<b>200</b>	200 l/min
	<b>300</b>	300 l/min
	<b>300 / 150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10G	<b>350</b>	350 l/min
	<b>500</b>	500 l/min
	<b>500 / 250</b>	500 (P-A) / 250 (B-T) l/min
DSPE11G	<b>800</b>	800 l/min
	<b>800 / 500</b>	800 (P-A) / 500 (B-T) l/min



valve type	*	Nominal flow with $\Delta p$ 10 bar P-T
DSPE7G	<b>150/75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8G	<b>300/150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10G	<b>500/250</b>	500 (P-A) / 250 (B-T) l/min



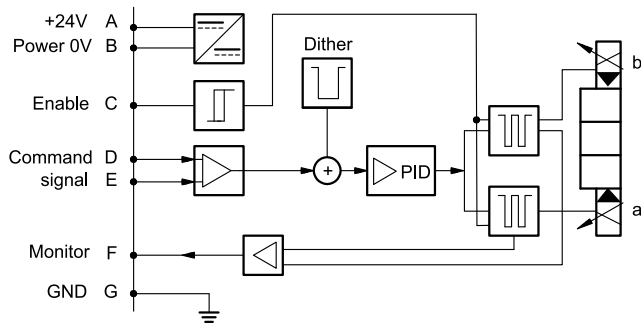
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

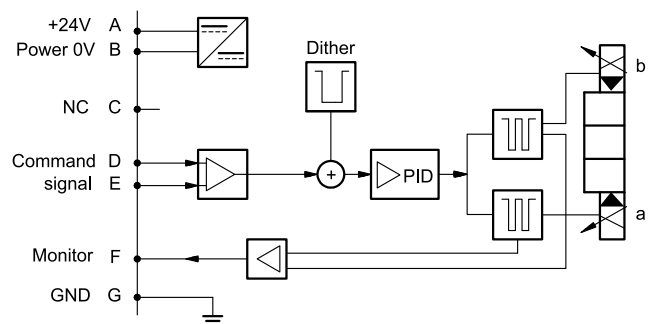
Duty cycle		100% (continuous operation)
Protection class according to IEC 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_i > 11 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_i = 58 \text{ }\Omega$ )
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_o > 1 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_o = 500 \text{ }\Omega$ )
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams

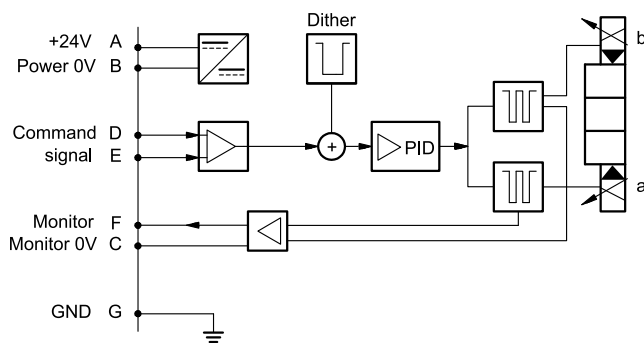
VERSION A - External Enable



VERSION B - Internal Enable

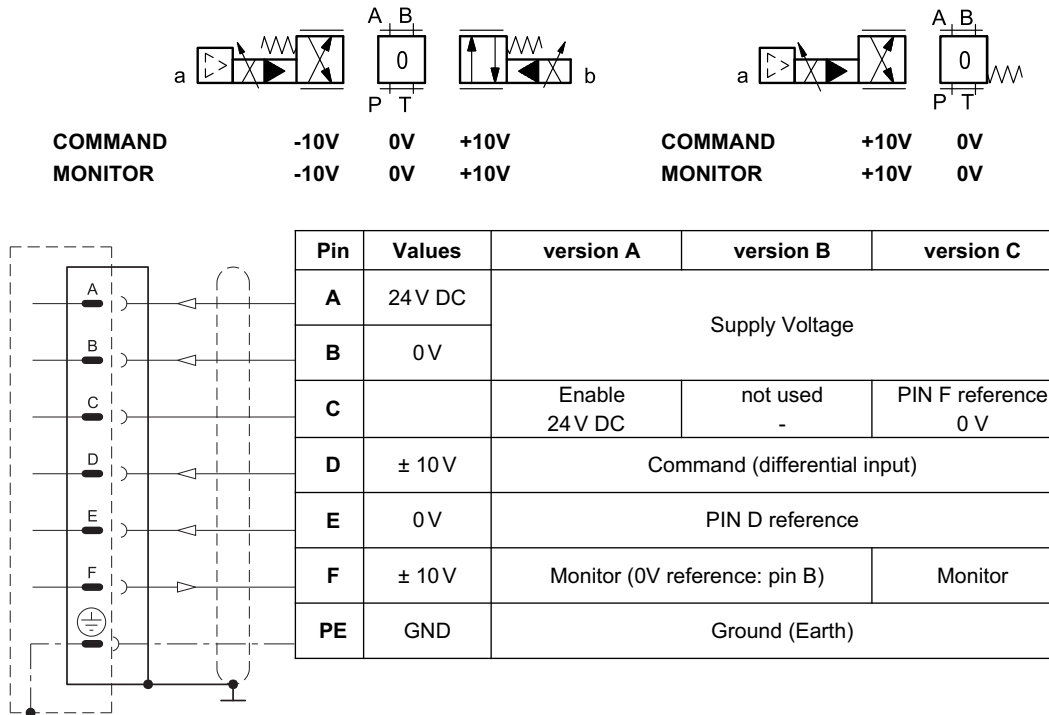


VERSION C - 0V Monitor



## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

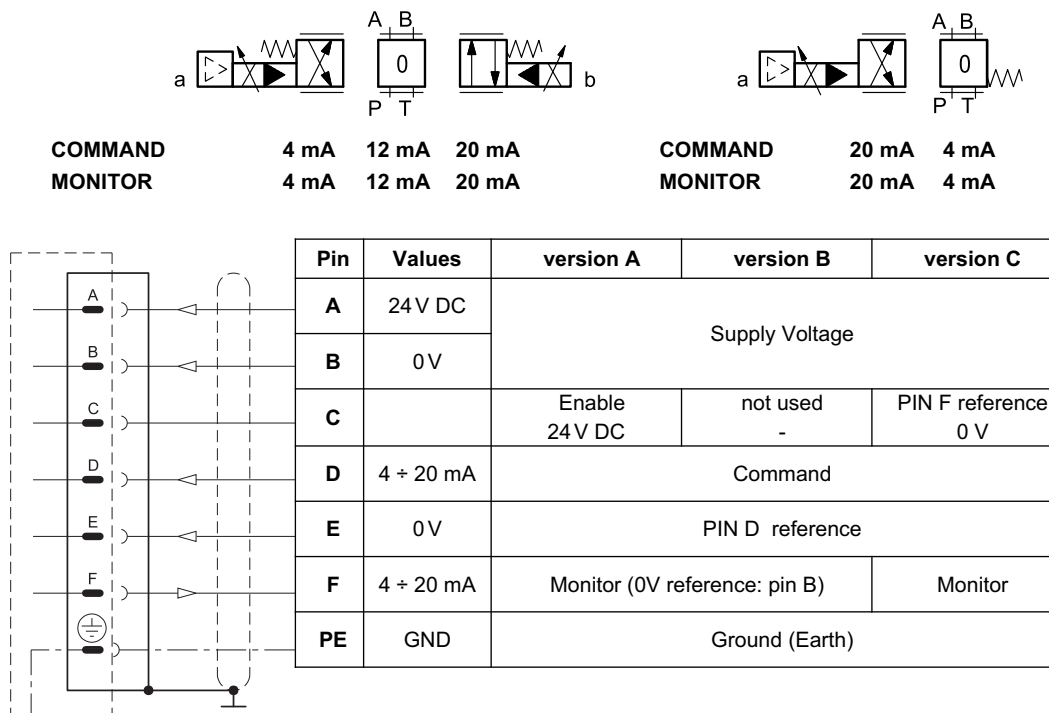
The reference signal is between -10V and +10V on double solenoid valves, and 0 ÷ 10V on single solenoid valves. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.

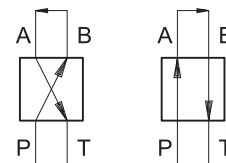


### 6 - CHARACTERISTIC CURVES

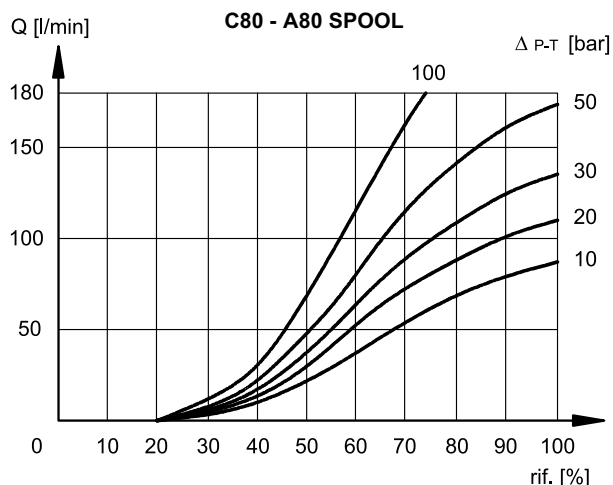
(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)

Typical flow rate curves at constant  $\Delta p$  related to the reference signal and measured for the available spools. The  $\Delta p$  values are measured between P and T valve ports.

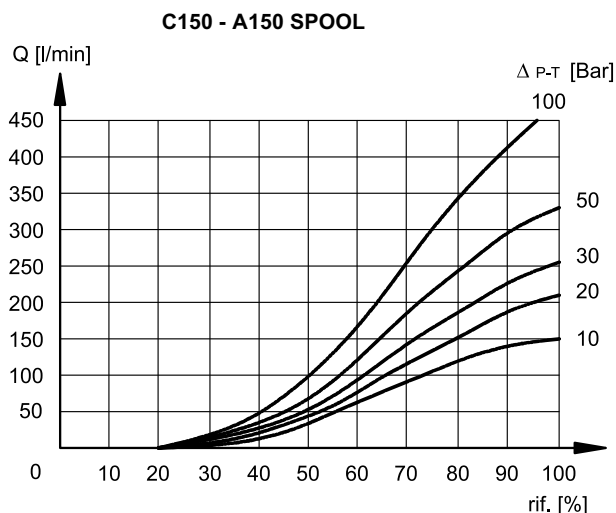
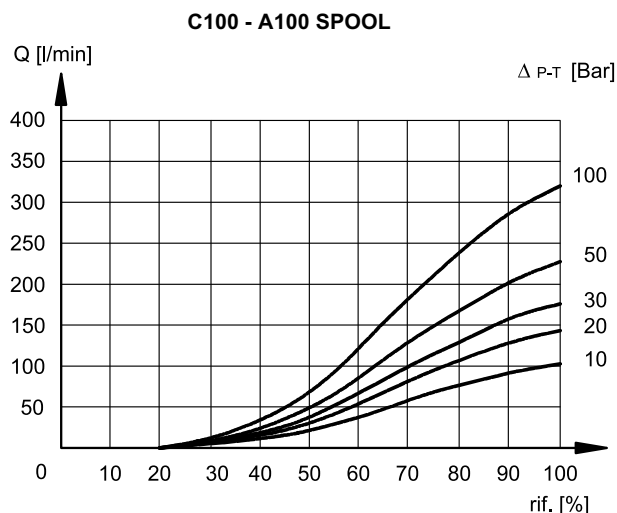
The adjustment of the curve is performed with a constant  $\Delta p$  of 30 bar by setting the value of flow start at 20% of the reference signal.



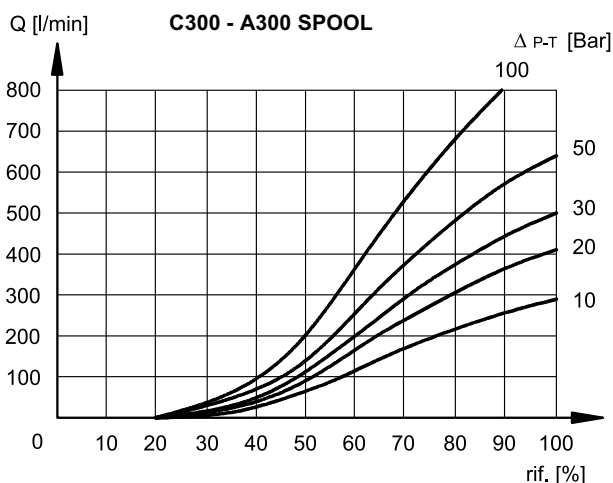
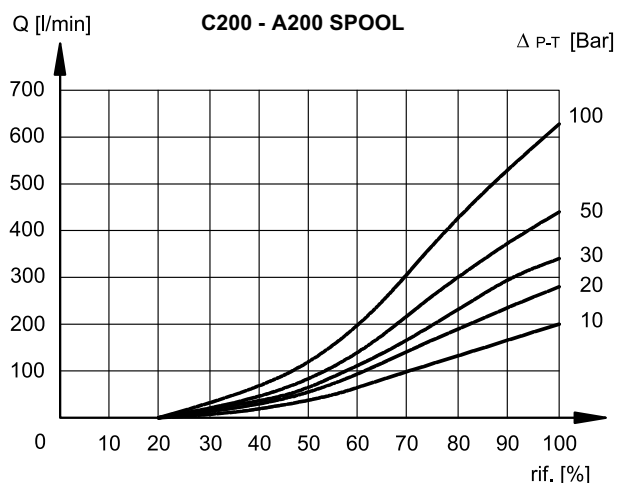
#### 6.1 - Characteristic curves DSPE5G and DSPE5RG



#### 6.2 - Characteristic curves DSPE7G

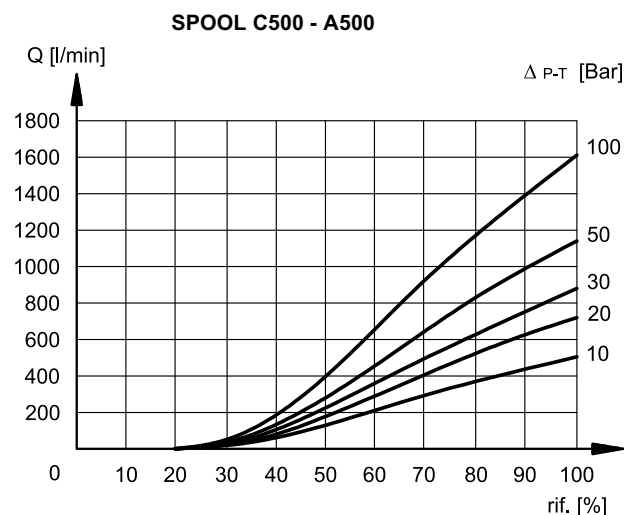
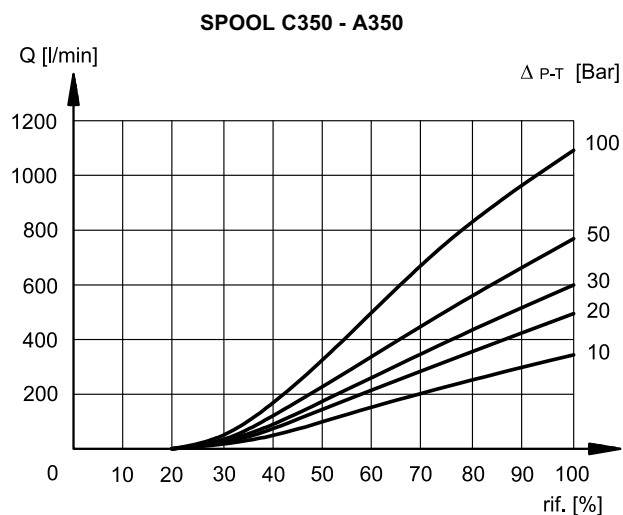


#### 6.3 - Curve Characteristic DSPE8G

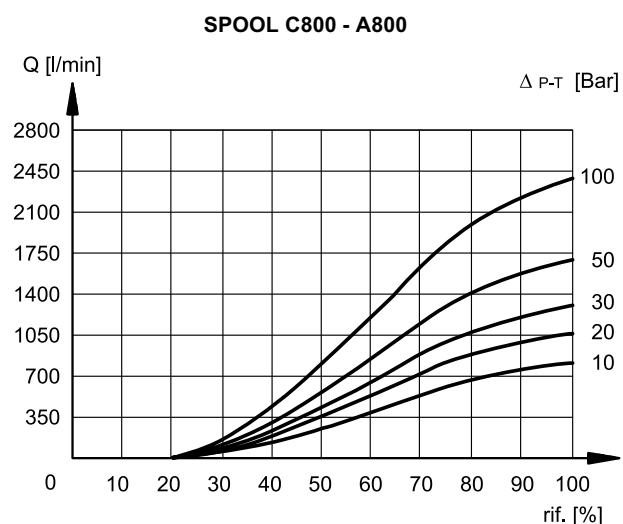




## 6.4 - Characteristic curves DSPE10G



## 6.5 - Characteristic curves DSPE11G

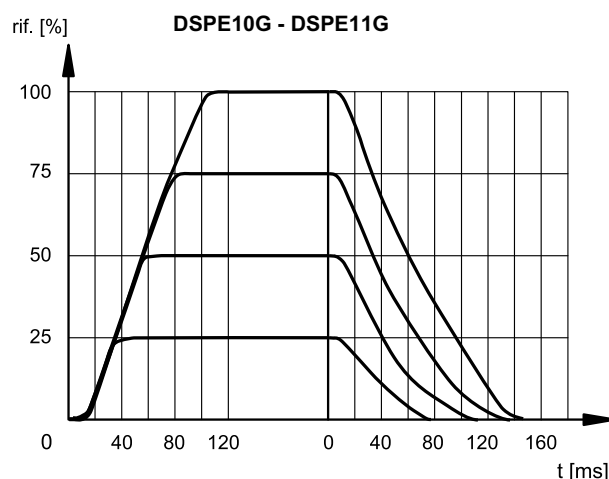
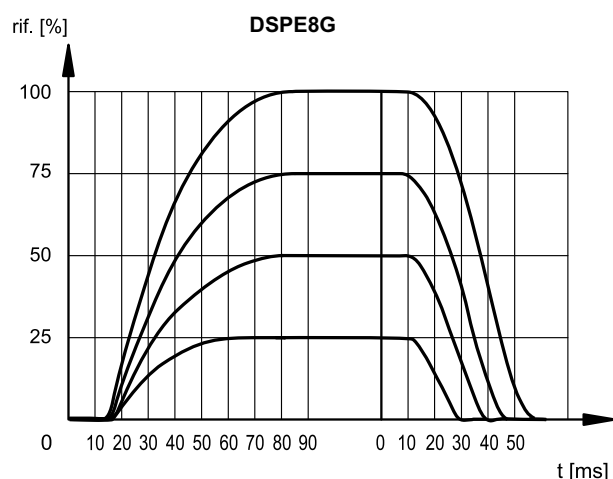
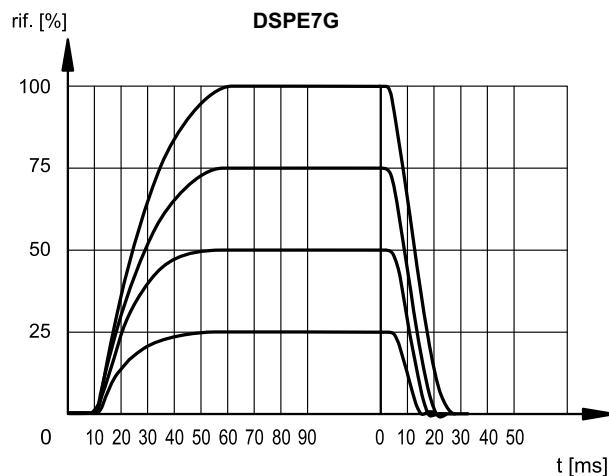
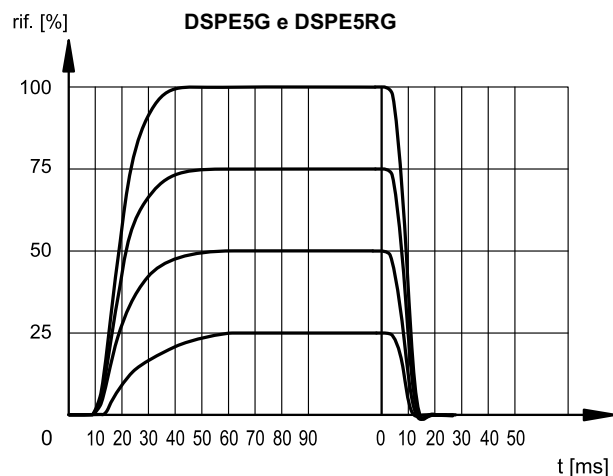






## 7 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and static pressure = 100 bar)



## 8 - HYDRAULIC CHARACTERISTICS

(with mineral oil with viscosity of 36 cSt at 50°C and static pressure = 100 bar)

FLOWRATES		DSPE5G DSPE5RG	DSPE7G	DSPE8G	DSPE10G	DSPE11G
Max flow rate	l/min	180	450	800	1600	2800
Piloting flow requested with operation 0 → 100%	l/min	3,5	4,1	9,2	13,7	13,7
Piloting volume requested with operation 0 → 100%	cm <sup>3</sup>	1,7	3,2	9,1	21,6	21,6

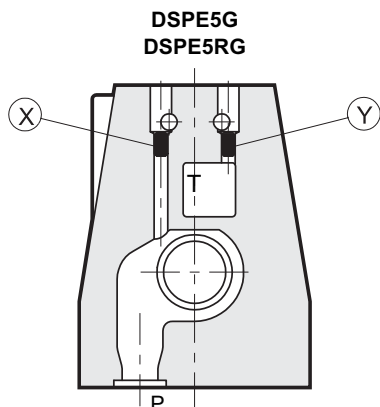
PRESSURES (bar)	MIN	MAX
Piloting pressure on X port	30	210 (NOTE)
Pressure on T port with internal drain	—	10
Pressure on T port with external drain	—	250

**NOTE:** if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure.

Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered (piloting type: Z, see section 1).

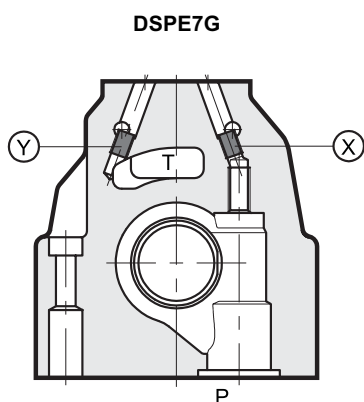
## 9 - PILOTING AND DRAINAGE

DSPE\*G valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

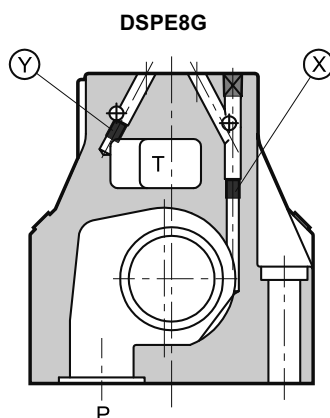


X: plug M5x6 for external pilot  
Y: plug M5x6 for external drain

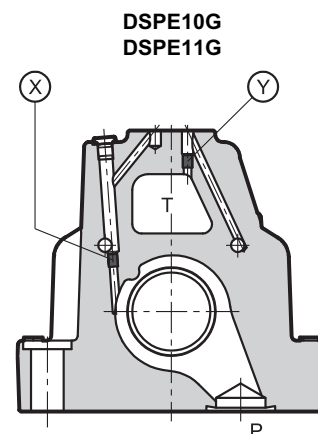
TYPE OF VALVE		Plug assembly	
		X	Y
<b>IE</b>	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b>	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b>	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b>	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain



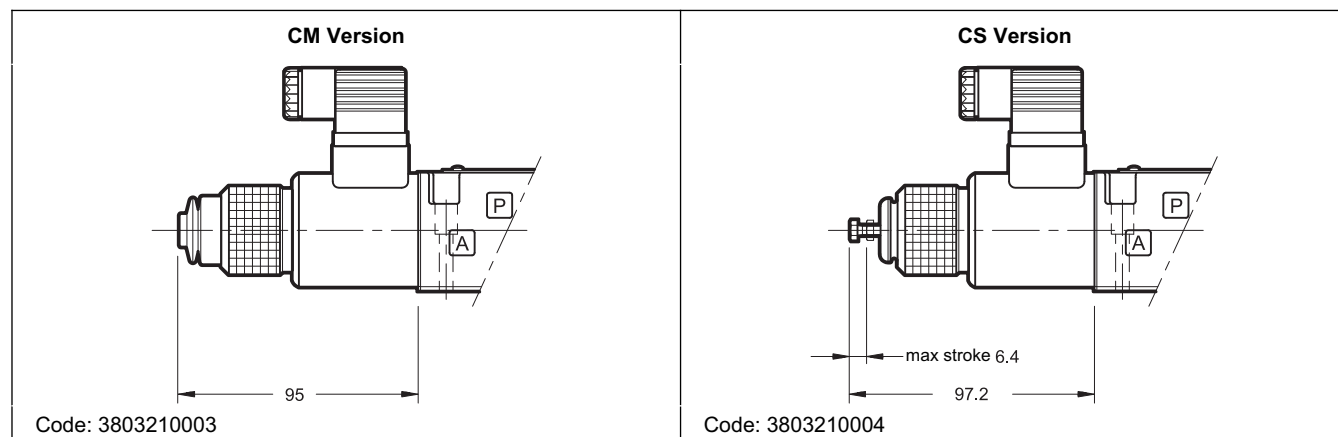
X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain

## 10 - MANUAL OVERRIDE

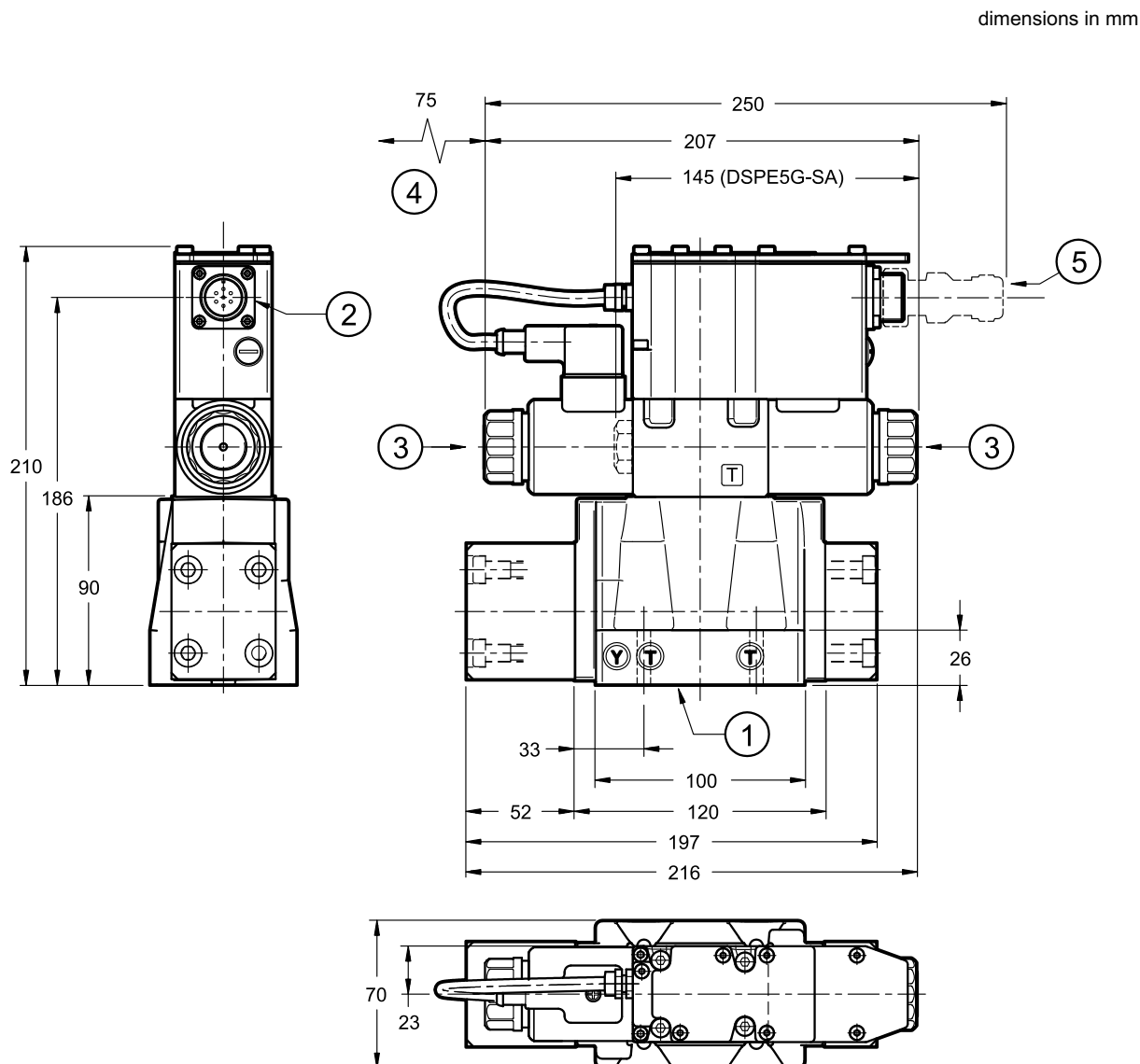
The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.



## 11 - OVERALL AND MOUNTING DIMENSIONS DSPE5G AND DSPE5RG



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

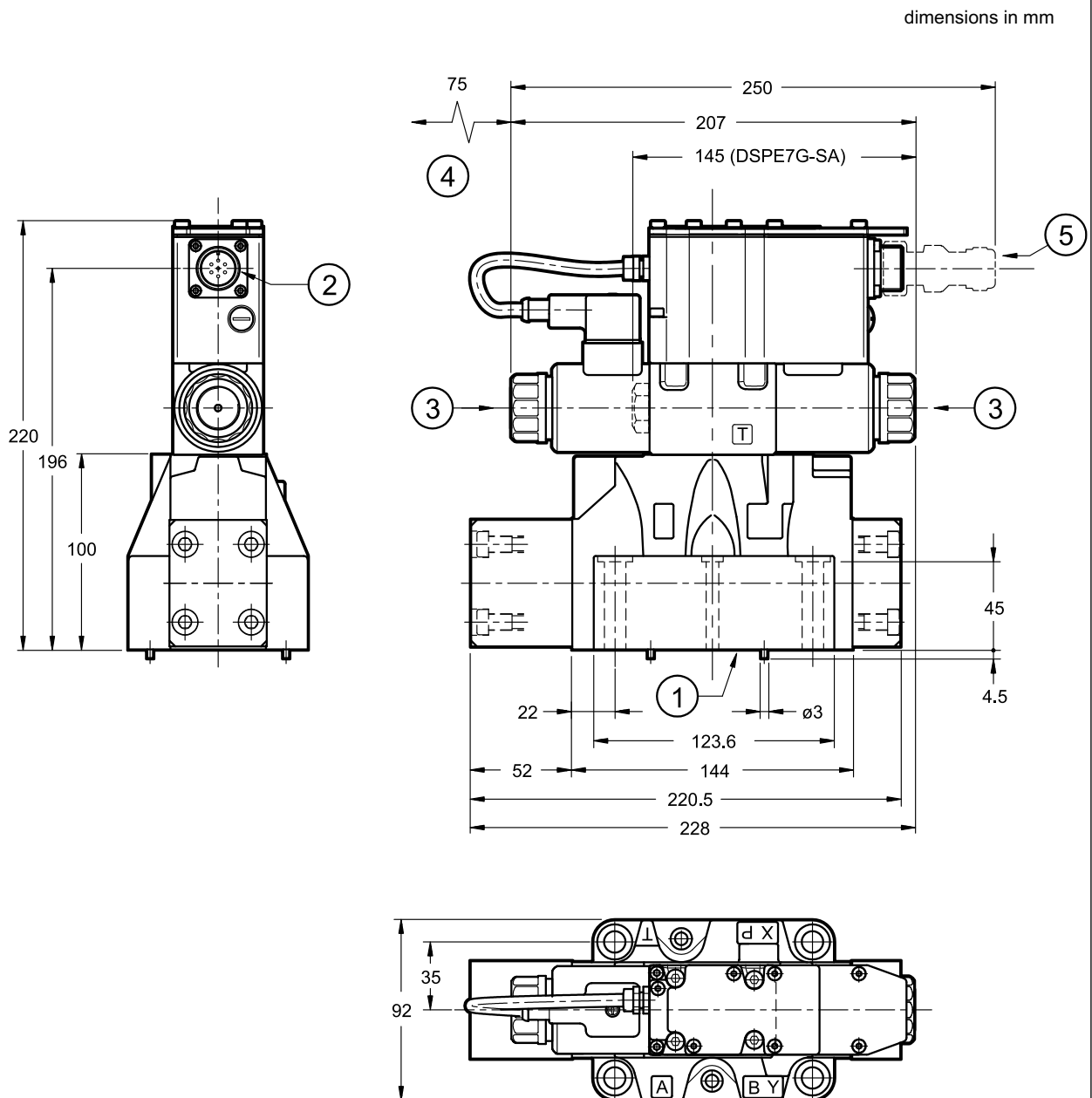
1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. <b>To be ordered separately.</b> See paragraph 19

Valve fastening: 4 SHC ISO 4762 screws M6x35

Tightening torque: 8 Nm (A8.8 screws)

Threads of mounting holes: M6x10

## 12 - OVERALL AND MOUNTING DIMENSIONS DSPE7G



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

Valve fastening: 4 SHC screws ISO 4762 M10x60  
2 SHC screws ISO 4762 M6x60

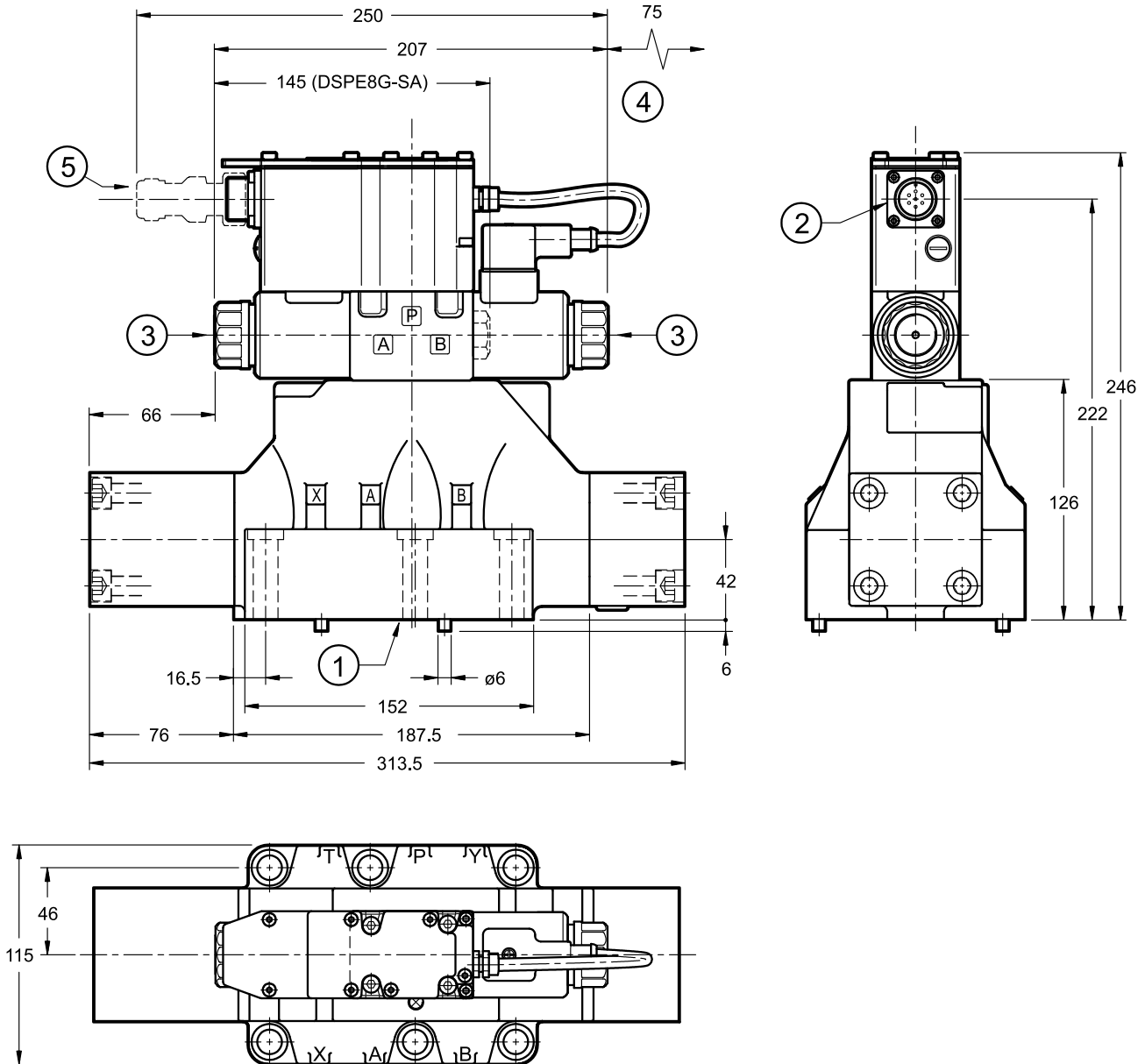
Tightening torque: M10x60: 40 Nm (A8.8 screws)  
M6x60: 8 Nm (A8.8 screws)

Threads of mounting holes: M6x18; M10x18

1	Mounting surface with sealing rings: 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. <b>To be ordered separately.</b> See paragraph 19

## 13 - OVERALL AND MOUNTING DIMENSIONS DSPE8G

dimensions in mm



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. <b>To be ordered separately.</b> See paragraph 19

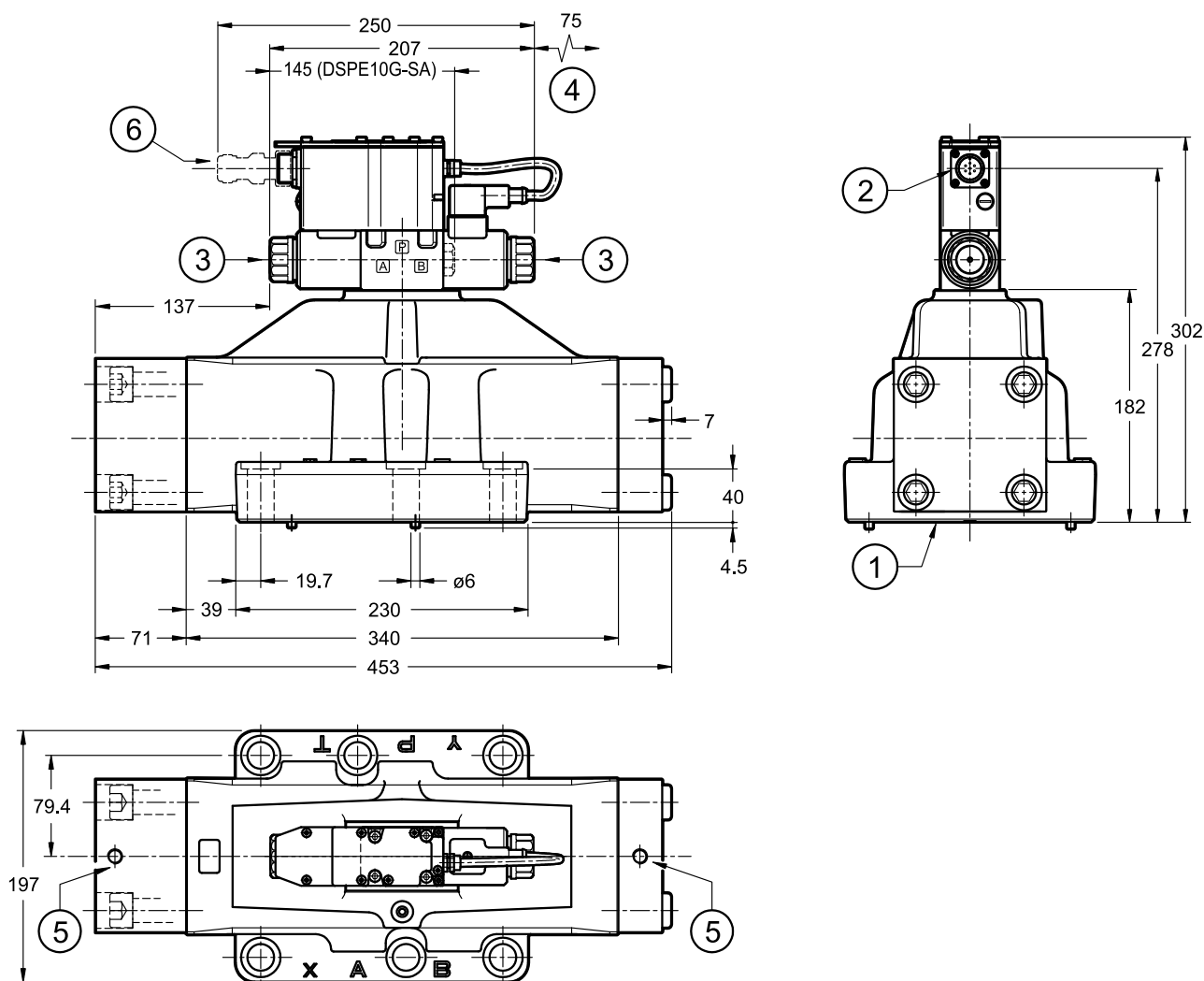
Valve fastening: 6 SHC ISO 4762 screws M12x60

Tightening torque: 69 Nm (A8.8 screws)

Threads of mounting holes: M12x20

## 14 - OVERALL AND MOUNTING DIMENSIONS DSPE10G / DSPE11G

dimensions in mm



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

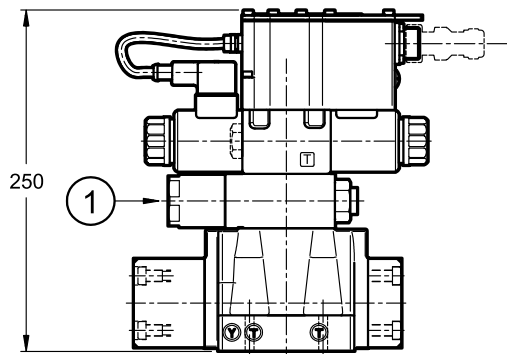
Valve fastening: 6 SHC screws ISO 4762 M20x70
Tightening torque: 330 Nm (A8.8 screws)
Threads of mounting holes: M20x40

1	Mounting surface with sealing rings: <b>DSPE10G</b> 4 OR type 4150 (37.59x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore <b>DSPE11G</b> 4 OR type 4212 (53.57x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	N. 2 M12 holes for eyebolts lifting
6	Mating connector. <b>To be ordered separately.</b> See paragraph 19

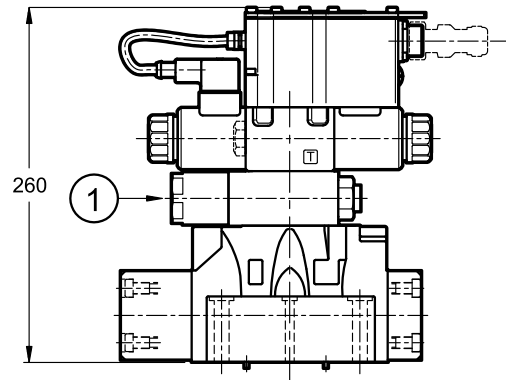
## 15 - OVERALL AND MOUNTING DIMENSIONS OF DSPE\*G WITH PILOTING TYPE Z

dimensions in mm

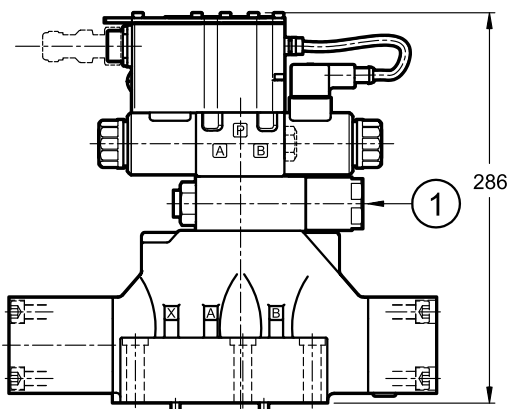
DSPE5G



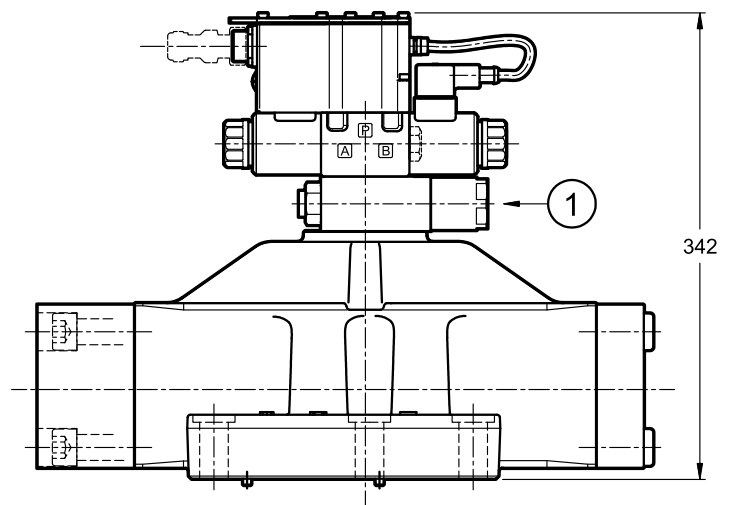
DSPE7G



DSPE8G



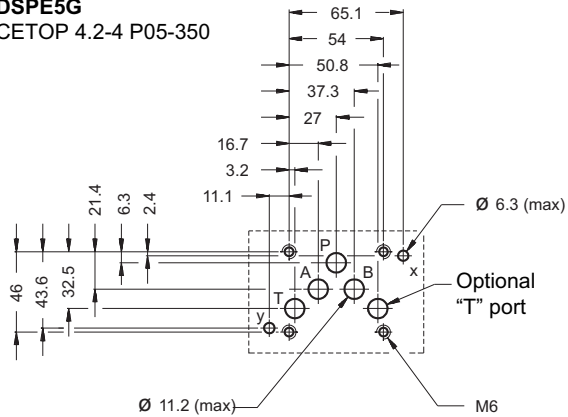
DSPE10G



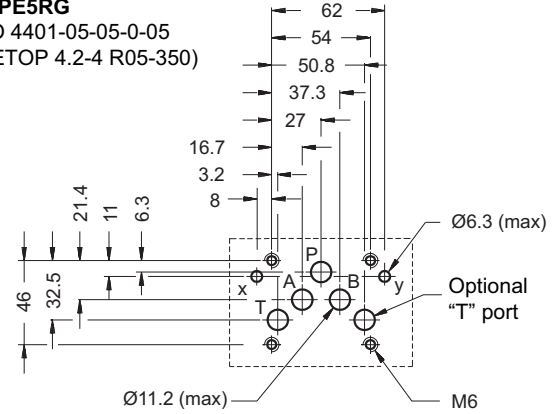
1	30 bar fixed adjustment pressure reducing valve
---	---

## 16 - MOUNTING SURFACES

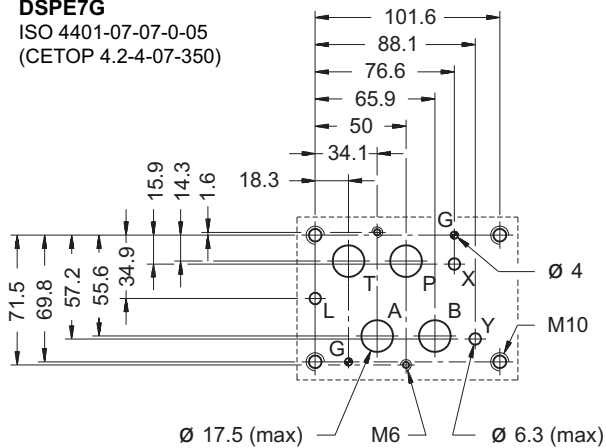
**DSPE5G**  
CETOP 4.2-4 P05-350



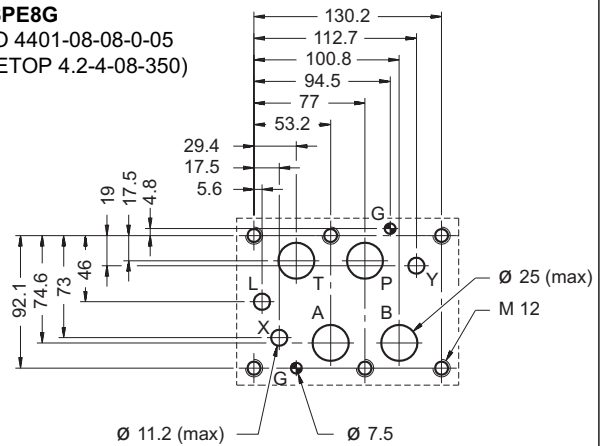
**DSPE5RG**  
ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



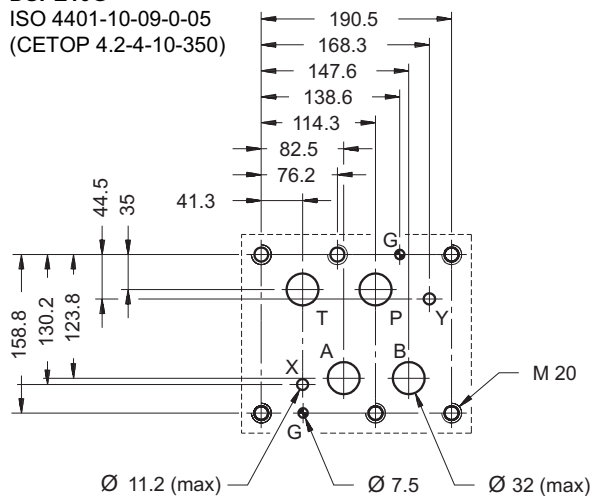
**DSPE7G**  
ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



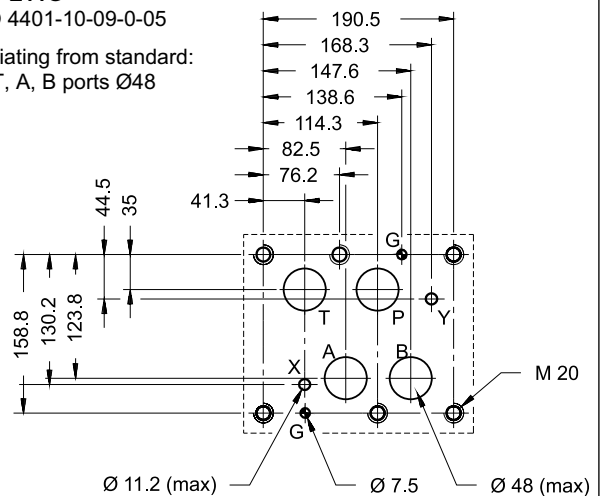
**DSPE8G**  
ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



**DSPE10G**  
ISO 4401-10-09-0-05  
(CETOP 4.2-4-10-350)



**DSPE11G**  
ISO 4401-10-09-0-05  
deviating from standard:  
P, T, A, B ports Ø48







## 17 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

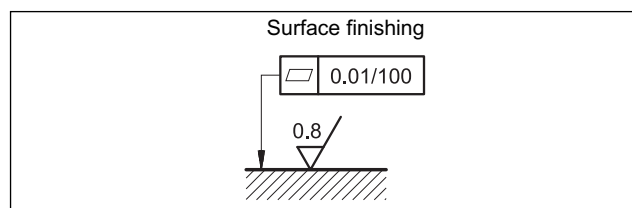
The fluid must be preserved in its physical and chemical characteristics.

## 18 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



## 19 - ACCESSORIES

(to be ordered separately)

### 19.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

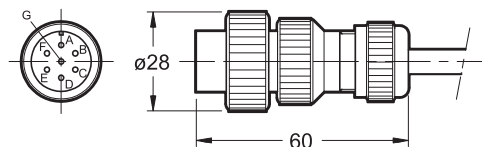


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 19.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 19.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 20 - SUBPLATES

(see catalogue 51 000)

	DSPE5G	DSPE7G	DSPE8G	DSPE10G DSPE11G
Type with rear ports	PME4-AI5G	PME07-AI6G	-	-
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G	-
P, T, A, B ports dimensions	3/4" BSP	1" BSP	1 1/2" BSP	-
X, Y ports dimensions	1/4" BSP	1/4" BSP	1/4" BSP	-



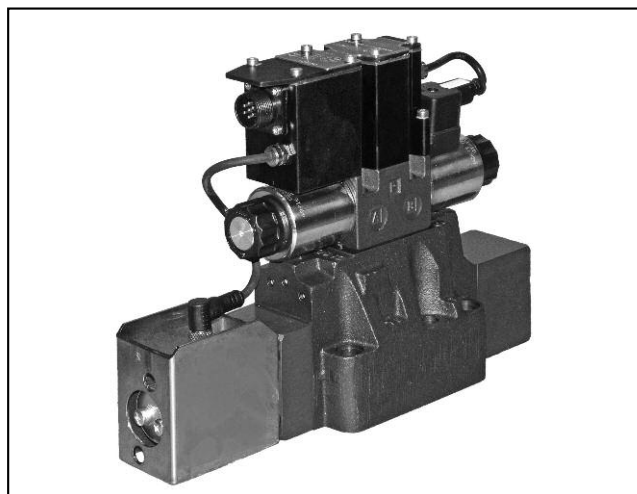
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

www.duplomatic.com • e-mail: sales.exp@duplomatic.com



# DSPE\*J

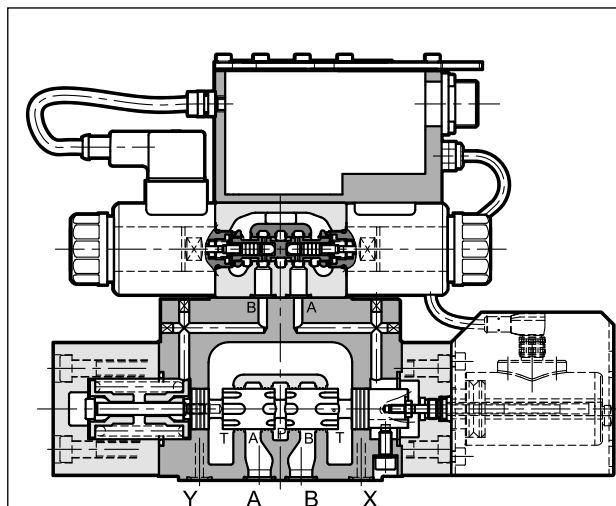
## PROPORTIONAL DIRECTIONAL VALVE PILOT OPERATED WITH FEEDBACK AND INTEGRATED ELECTRONICS

SUBPLATE MOUNTING

SERIES 31

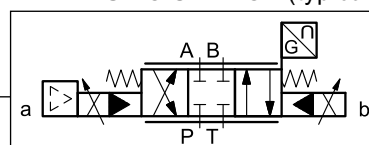
DSPE5J	CETOP P05
DSPE5RJ	ISO 4401-05
DSPE7J	ISO 4401-07
DSPE8J	ISO 4401-08
DSPE10J	ISO 4401-10
DSPE11J	ISO 4401-10 oversize ports

### OPERATING PRINCIPLE



- The DSPE\*J are pilot operated directional control valves with electric proportional control, feedback and integrated electronics and with mounting interface in compliance with ISO 4401 standards.
- They are controlled directly by an integrated digital amplifier. Transducer and digital card allow a fine control of the positioning of the cursor, reducing hysteresis and response times.
- The valves are available with command signal in voltage or current, and on-board electronics with internal enable, external enable or 0V monitor on pin C.
- A monitoring signal of the main spool position is available.
- The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 18)

### HYDRAULIC SYMBOL (typical)



### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		DSPE5J DSPE5RJ	DSPE7J	DSPE8J	DSPE10J	DSPE11J
Max operating pressure: P - A - B ports T port	bar	350 see paragraph 8				
Max flowrate	l/min	180	450	800	1600	2800
Hysteresis	% Q <sub>max</sub>	< 0,5%				
Repeatability	% Q <sub>max</sub>	< ± 0,2%				
Electrical characteristics		see paragraph 3				
Ambient temperature range	°C	-20 / +60				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13				
Recommended viscosity	cSt	25				
Mass: single solenoid valve double solenoid valve	kg	8,5 9	10,5 11	17 17,5	56 56,5	54,5 55



# DSPE\*J

## SERIES 31

### 1 - IDENTIFICATION CODE

D	S	P	E		J	-				/	31		-			/		K11	
---	---	---	---	--	---	---	--	--	--	---	----	--	---	--	--	---	--	-----	--

Pilot operated directional valve

Electric proportional control

Nominal size: \_\_\_\_\_  
**5** = CETOP P05  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08  
**10** = ISO 4401-10  
**11** = ISO 4401-10 with oversize ports

Integrated electronics for closed loop

Spool type: \_\_\_\_\_  
**C** = closed centres  
**A** = open centres  
**RC** = regenerative closed centers  
**RA** = regenerative open centers

Spool nominal flow rate (see table par. 2) \_\_\_\_\_

Configurations for single solenoid version (omit for double solenoid version) :  
**SA** = 1 solenoid for cross configuration (for DSPE5J, DSPE5RJ and DSPE7J only)  
**SB** = 1 solenoid for parallel configuration (for DSPE8J, DSPE10J and DSPE11J only)

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector 6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10$  V  
**E1** = current  $4 \pm 20$  mA

Drain:  
**I** = internal  
**E** = external

Pilot:  
**I** = internal  
**E** = external  
**Z** = internal piloting with 30 bar fixed adjustment pressure reducing valve (see par. 8 and 14)

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No.  
(the overall and mounting dimensions remain unchanged from 30 to 39)

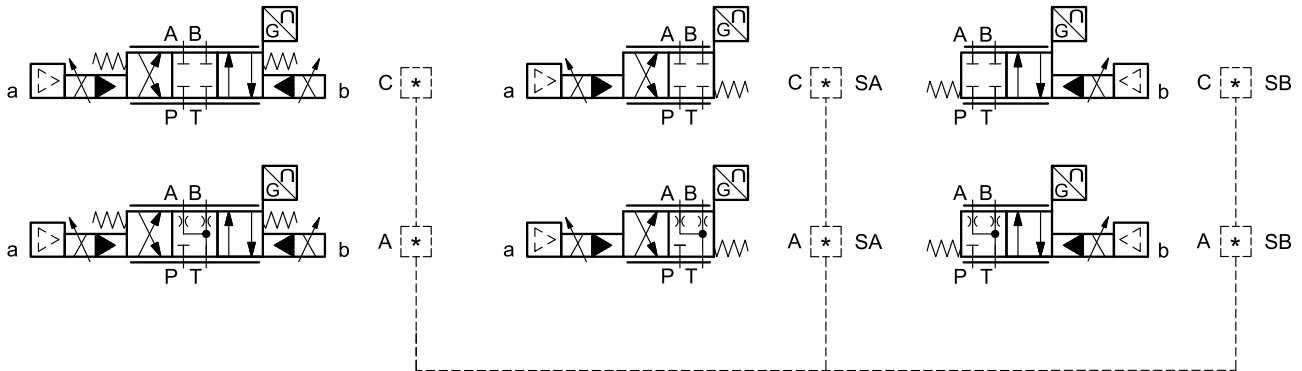
## 2 - AVAILABLE CONFIGURATIONS

The valve configuration depends on the combination of number of proportional solenoids, spool type, rated flow.

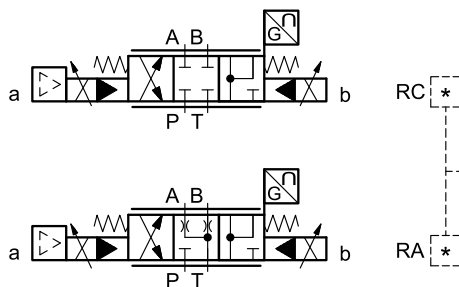
2 solenoids:  
3 positions with spring centering

1 solenoid for cross configuration "SA":  
2 positions (central + external)  
with spring centering  
**for DSPE5J, DSPE5RJ and DSPE7J only**

1 solenoid for parallel configuration "SB":  
2 positions (central + external)  
with spring centering  
**for DSPE8J, DSPE10J and DSPE11J only**



valve type	*	Nominal flow with $\Delta p$ 10 bar P-T
DSPE5J DSPE5RJ	<b>80</b>	80 l/min
	<b>80 / 40</b>	80 (P-A) / 40 (B-T) l/min
DSPE7J	<b>100</b>	100 l/min
	<b>150</b>	150 l/min
	<b>150 / 75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8J	<b>200</b>	200 l/min
	<b>300</b>	300 l/min
	<b>300 / 150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10J	<b>350</b>	350 l/min
	<b>500</b>	500 l/min
	<b>500 / 250</b>	500 (P-A) / 250 (B-T) l/min
DSPE11J	<b>800</b>	800 l/min
	<b>800 / 500</b>	800 (P-A) / 500 (B-T) l/min



valve type	*	Nominal flow with $\Delta p$ 10 bar P-T
DSPE7J	<b>150/75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8J	<b>300/150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10J	<b>500/250</b>	500 (P-A) / 250 (B-T) l/min



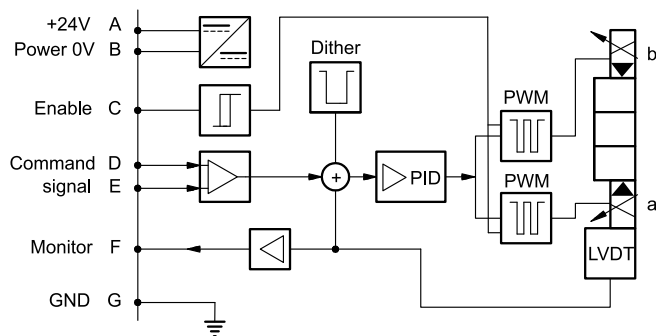
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

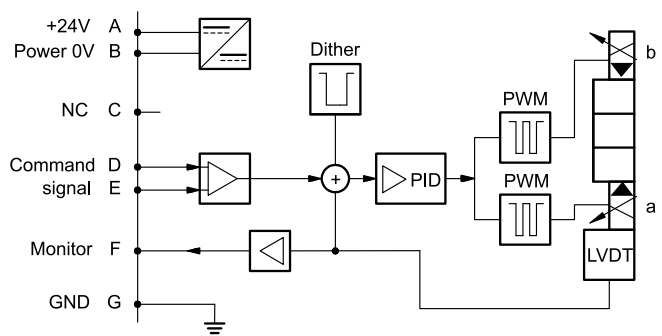
Duty cycle		100% (continuous operation)
Protection class according to IEC 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_i > 11 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_i = 58 \text{ }\Omega$ )
Monitor signal (main spool position): voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_o > 1 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_o = 500 \text{ }\Omega$ )
Managed breakdowns		Overload and electronics overheating, cable breakdown, sensor errors, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/EU standards

### 3.2 - On-board electronics diagrams

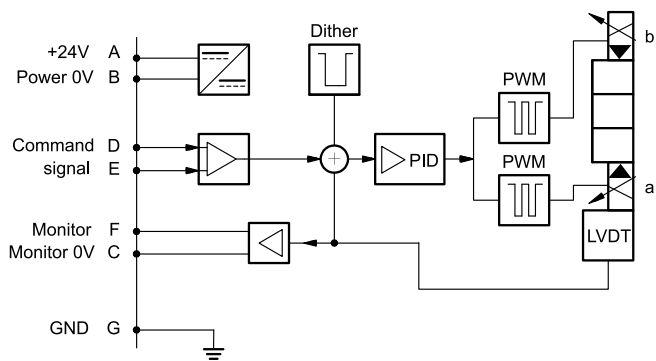
#### VERSION A - External Enable



#### VERSION B - Internal Enable

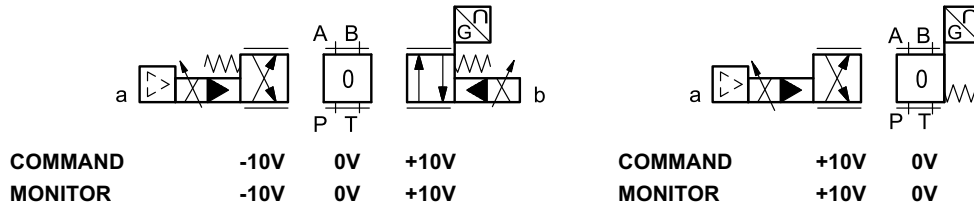


#### VERSION C - 0V Monitor



## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between -10V and +10V on double solenoid valve and 0...10V on single solenoid valves. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.

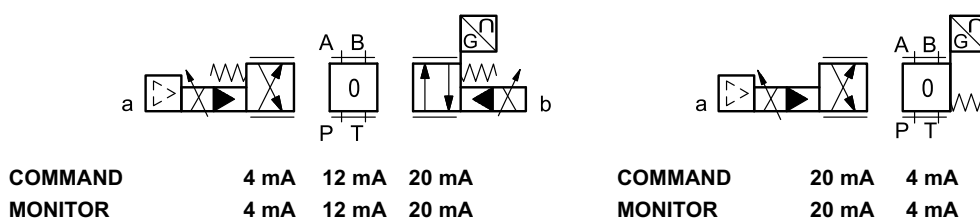


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current  $4 \pm 20$  mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



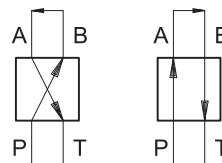
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	$4 \pm 20$ mA	Command		
E	0 V	PIN D reference		
F	$4 \pm 20$ mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		



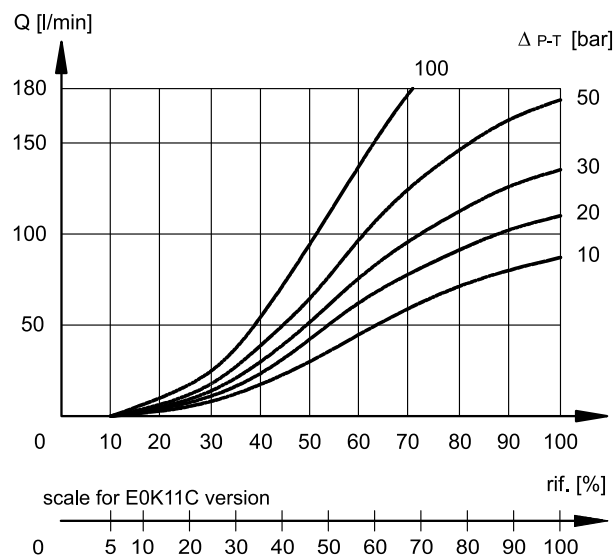
### 6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and  $p = 140$  bar)

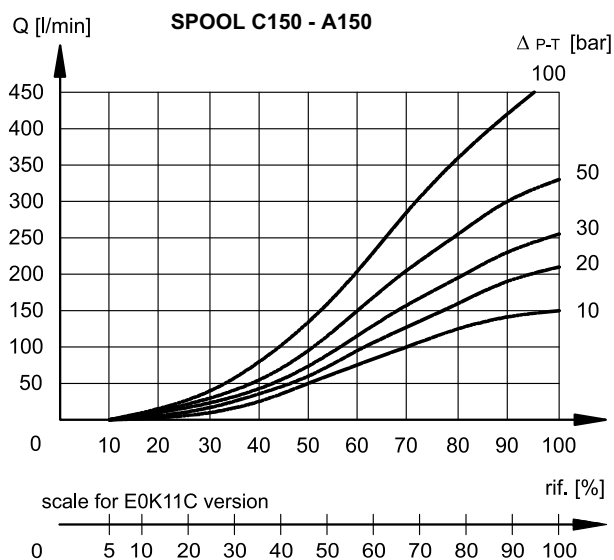
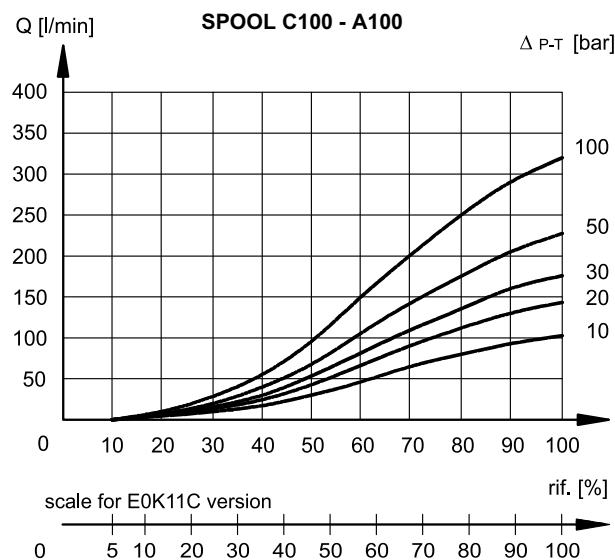
Typical flow rate curves at constant  $\Delta p$  related to the reference signal and measured for the available spools. The  $\Delta p$  values are measured between P and T valve ports.



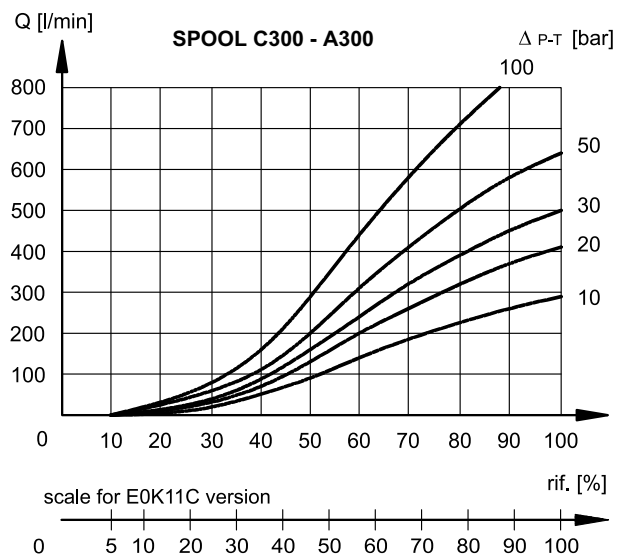
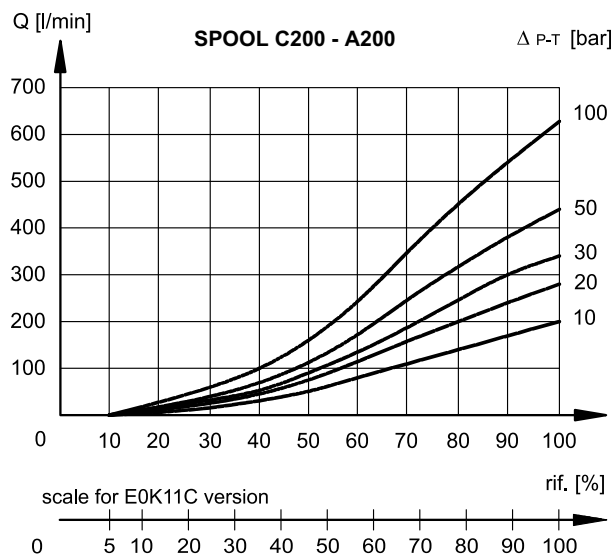
#### 6.1 - Characteristic curves DSPE5J and DSPE5RJ



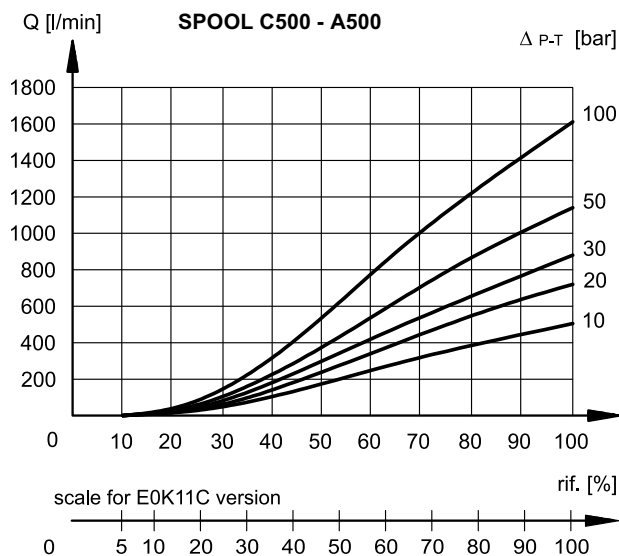
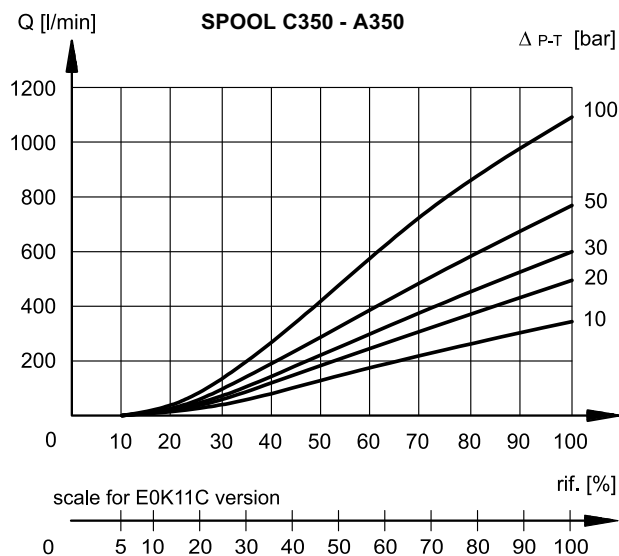
#### 6.2 - Characteristic curves DSPE7J



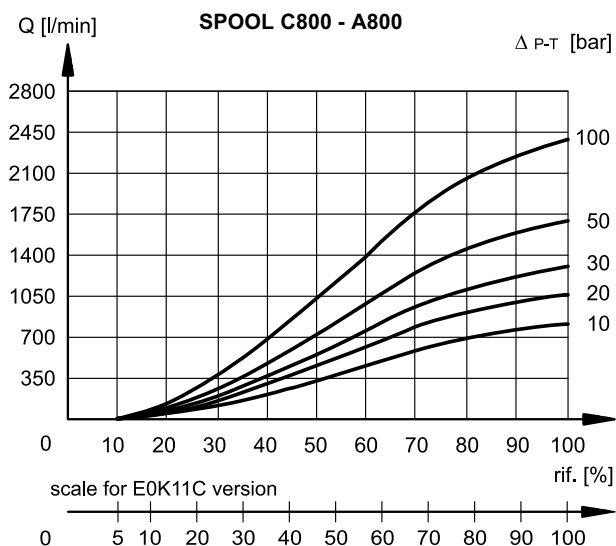
## 6.3 - Characteristic curves DSPE8J



## 6.4 - Characteristic curves DSPE10J



## 6.5 - Characteristic curves DSPE11J

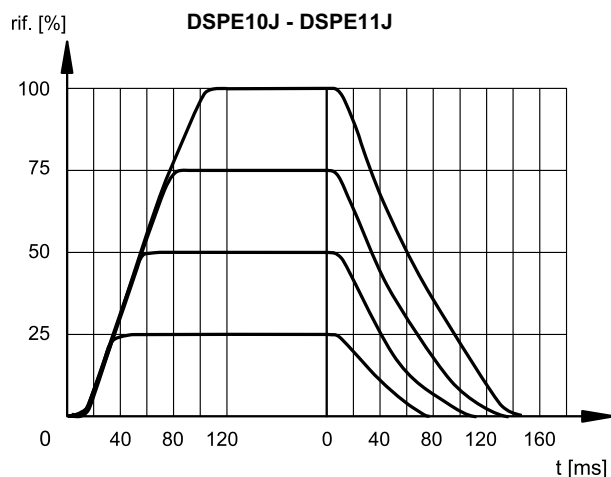
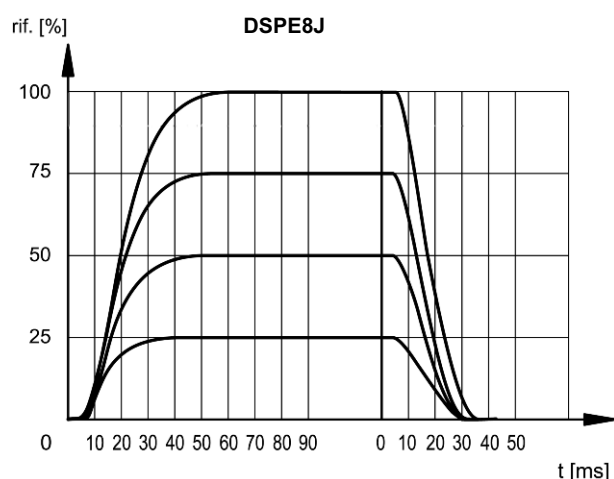
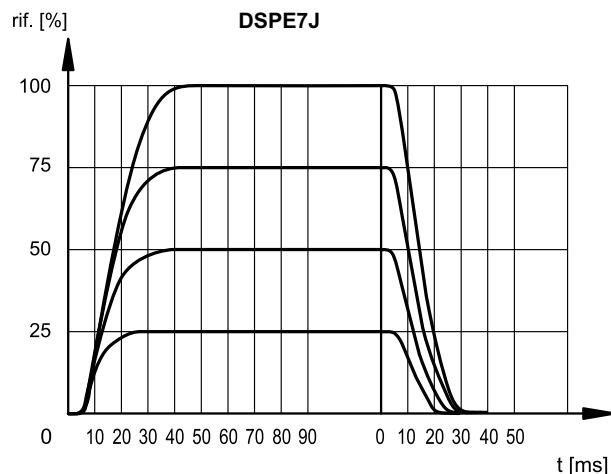
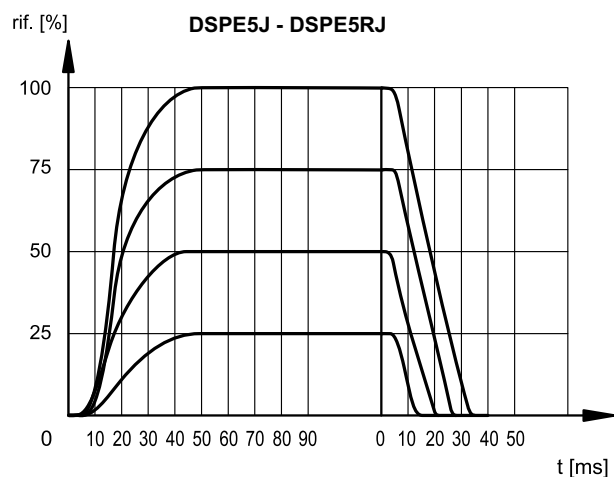






### 7 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and static pressure 100 bar)



### 8 - HYDRAULIC CHARACTERISTICS

(with mineral oil with viscosity of 36 cSt at 50°C)

FLOWRATES		DSPE5J DSPE5RJ	DSPE7J	DSPE8J	DSPE10J	DSPE11J
Max flow rate	l/min	180	450	800	1600	2800
Piloting flow requested with operation 0 → 100%	l/min	3,5	6,4	15,3	13,7	13,7
Piloting volume requested with operation 0 → 100%	cm <sup>3</sup>	1,7	3,2	9,2	21,6	21,6

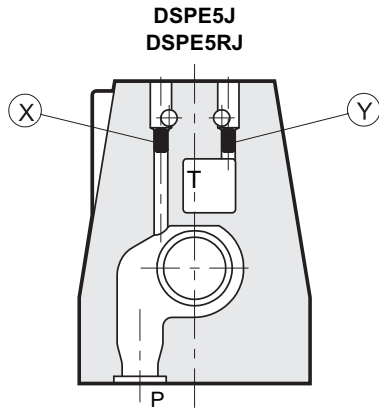
PRESSURES (bar)	MIN	MAX
Piloting pressure on X port	30	210 (NOTE)
Pressure on T port with internal drain	—	10
Pressure on T port with external drain	—	250

**NOTE:** if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure.

Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered (piloting type: Z, see section 1).

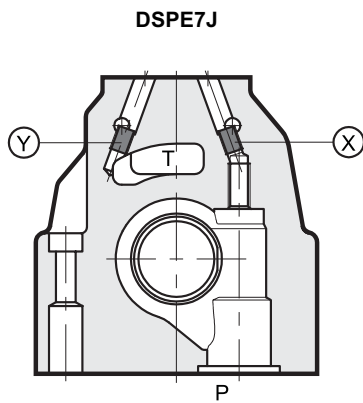
## 9 - PILOTING AND DRAINAGE

DSPE\*J valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

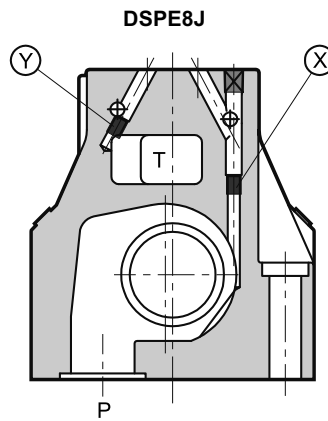


X: plug M5x6 for external pilot  
Y: plug M5x6 for external drain

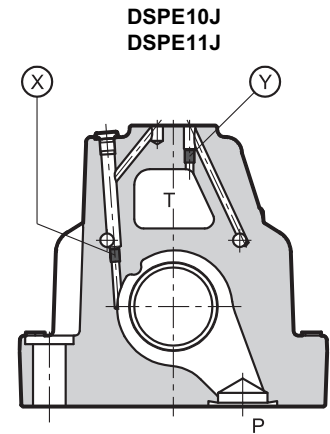
TYPE OF VALVE		Plug assembly	
		X	Y
<b>IE</b>	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b>	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b>	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b>	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain



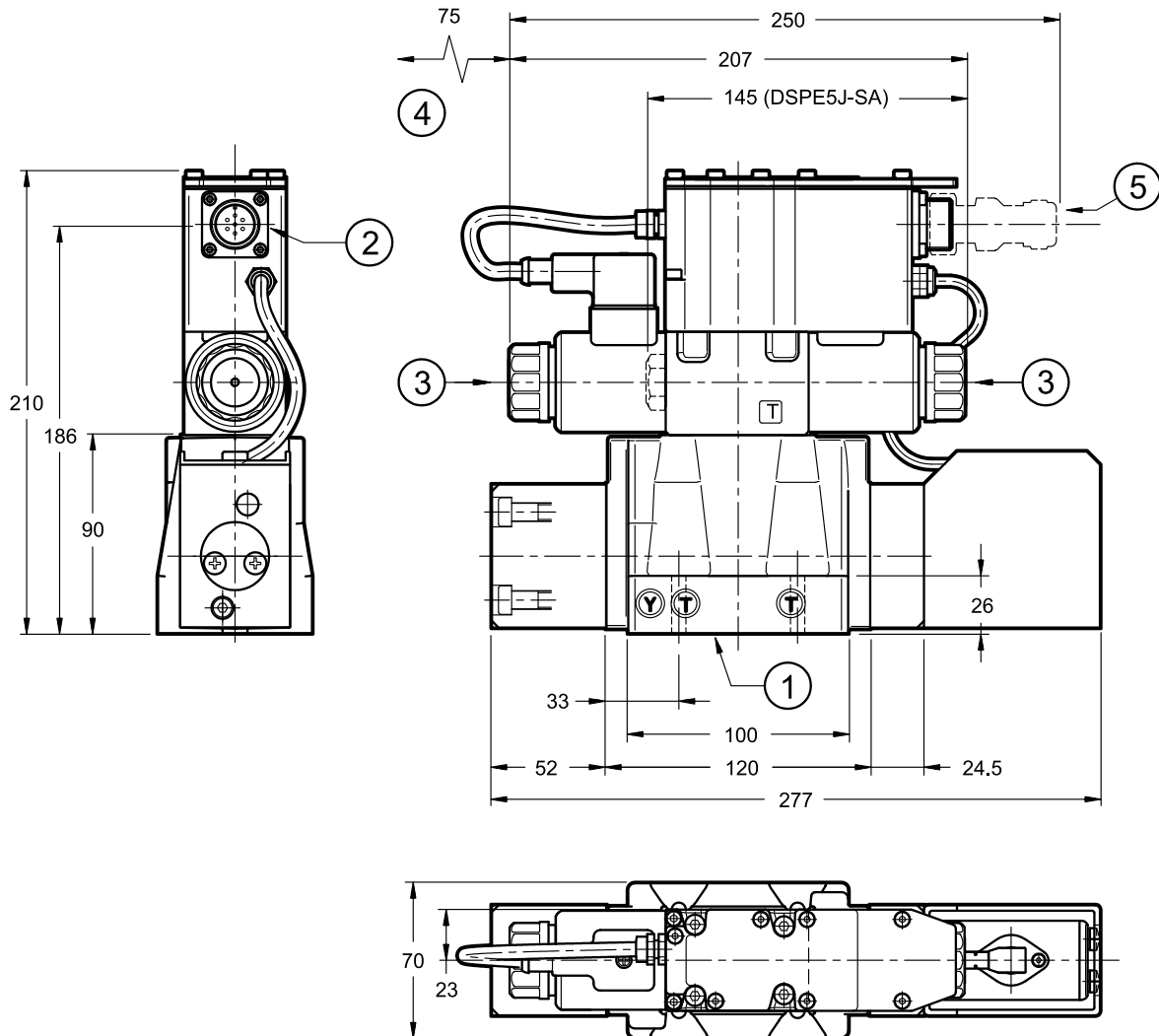
X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain

## 10 - OVERALL AND MOUNTING DIMENSIONS DSPE5J AND DSPE5RJ

dimensions in mm



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. <b>To be ordered separately.</b> See paragraph 18

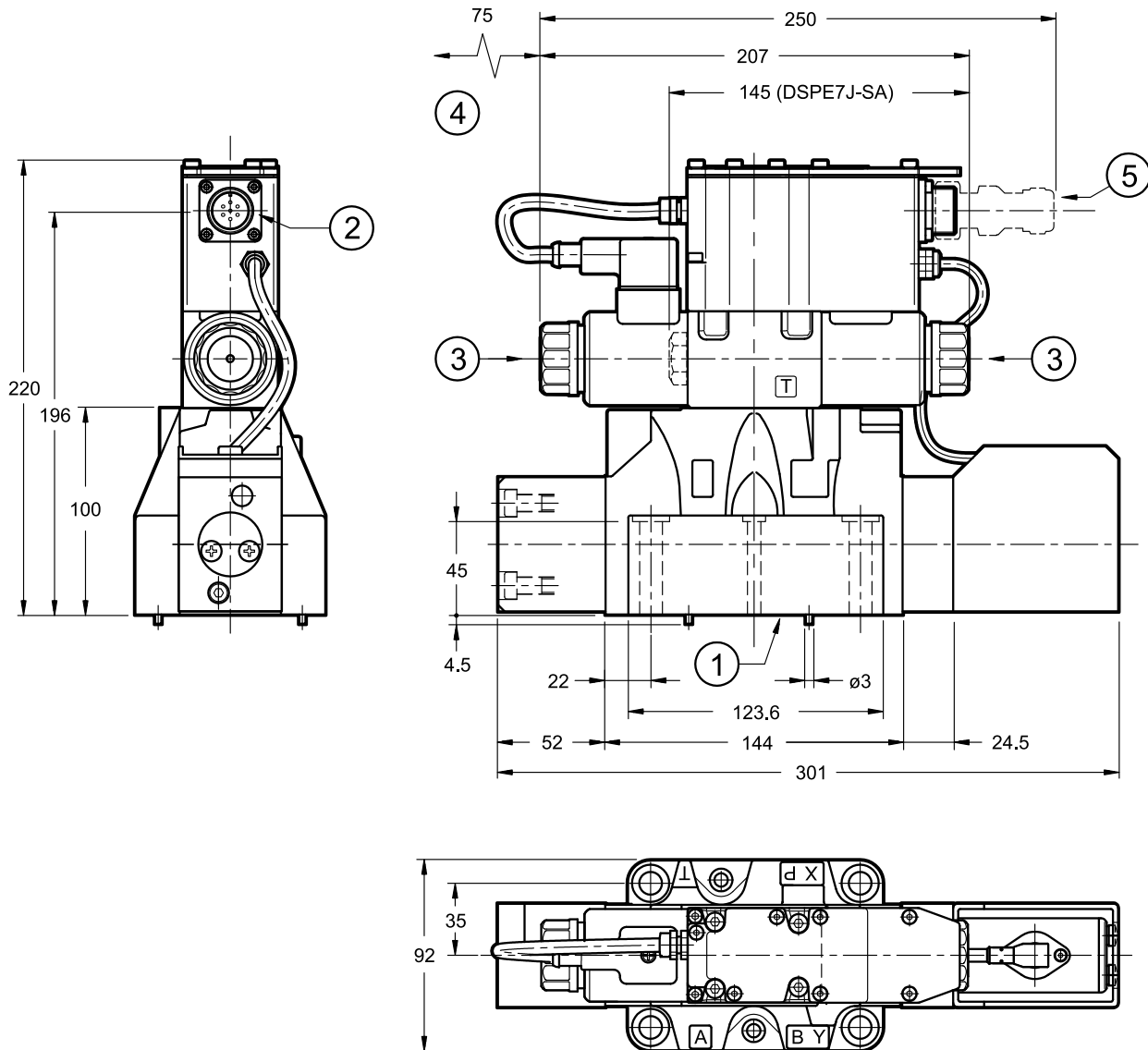
Valve fastening: 4 SHC ISO 4762 screws M6x35

Tightening torque: 8 Nm (A8.8 screws)

Threads of mounting holes: M6x10

## 11 - OVERALL AND MOUNTING DIMENSIONS DSPE7J

dimensions in mm



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

Valve fastening: 4 SHC screws ISO 4762 M10x60  
2 SHC screws ISO 4762 M6x60

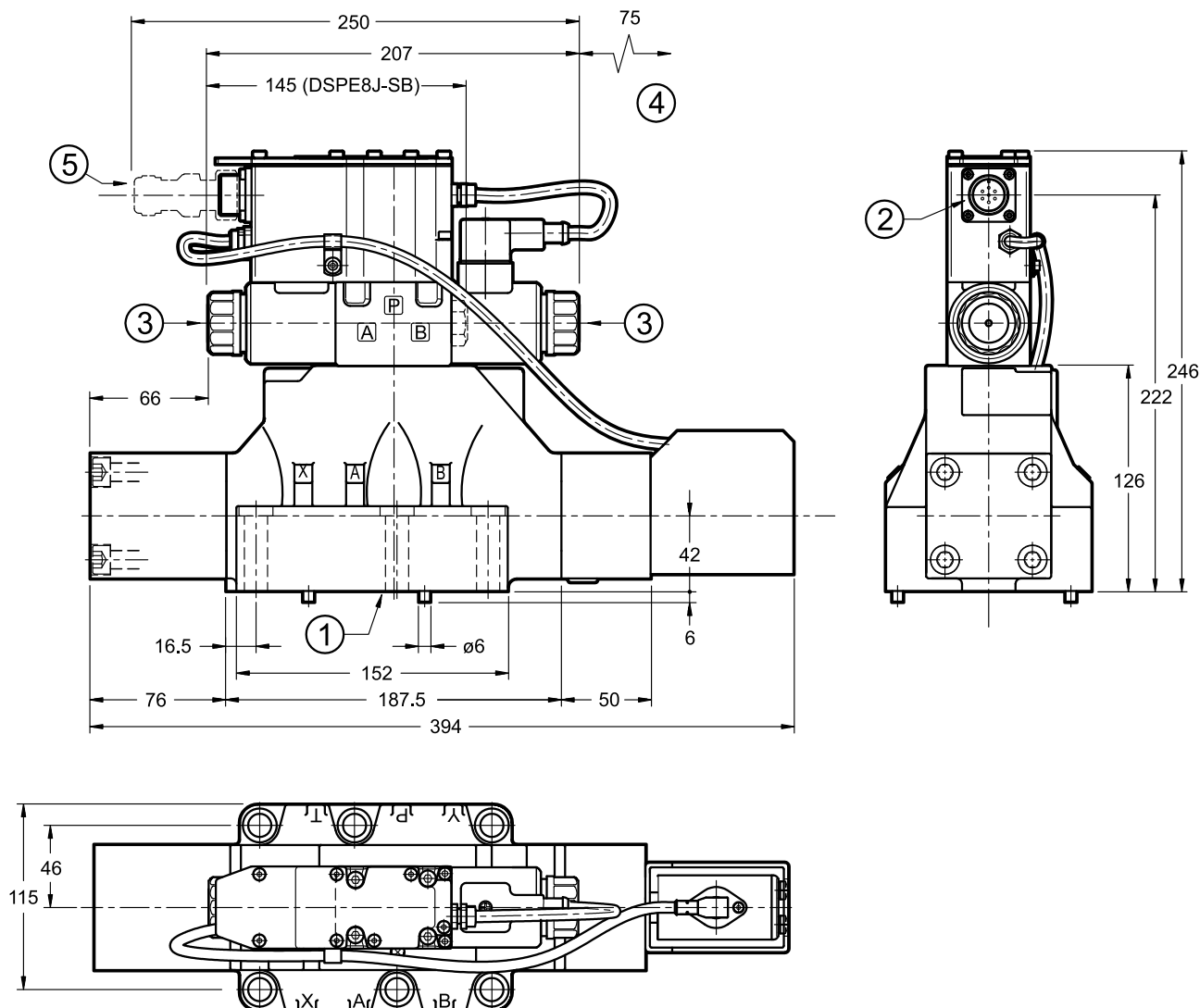
Tightening torque: M10x60: 40 Nm (A8.8 screws)  
M6x60: 8 Nm (A8.8 screws)

Threads of mounting holes: M6x18; M10x18

1	Mounting surface with sealing rings: 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. <b>To be ordered separately.</b> See paragraph 18

## 12 - OVERALL AND MOUNTING DIMENSIONS DSPE8J

dimensions in mm



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. <b>To be ordered separately.</b> See paragraph 18

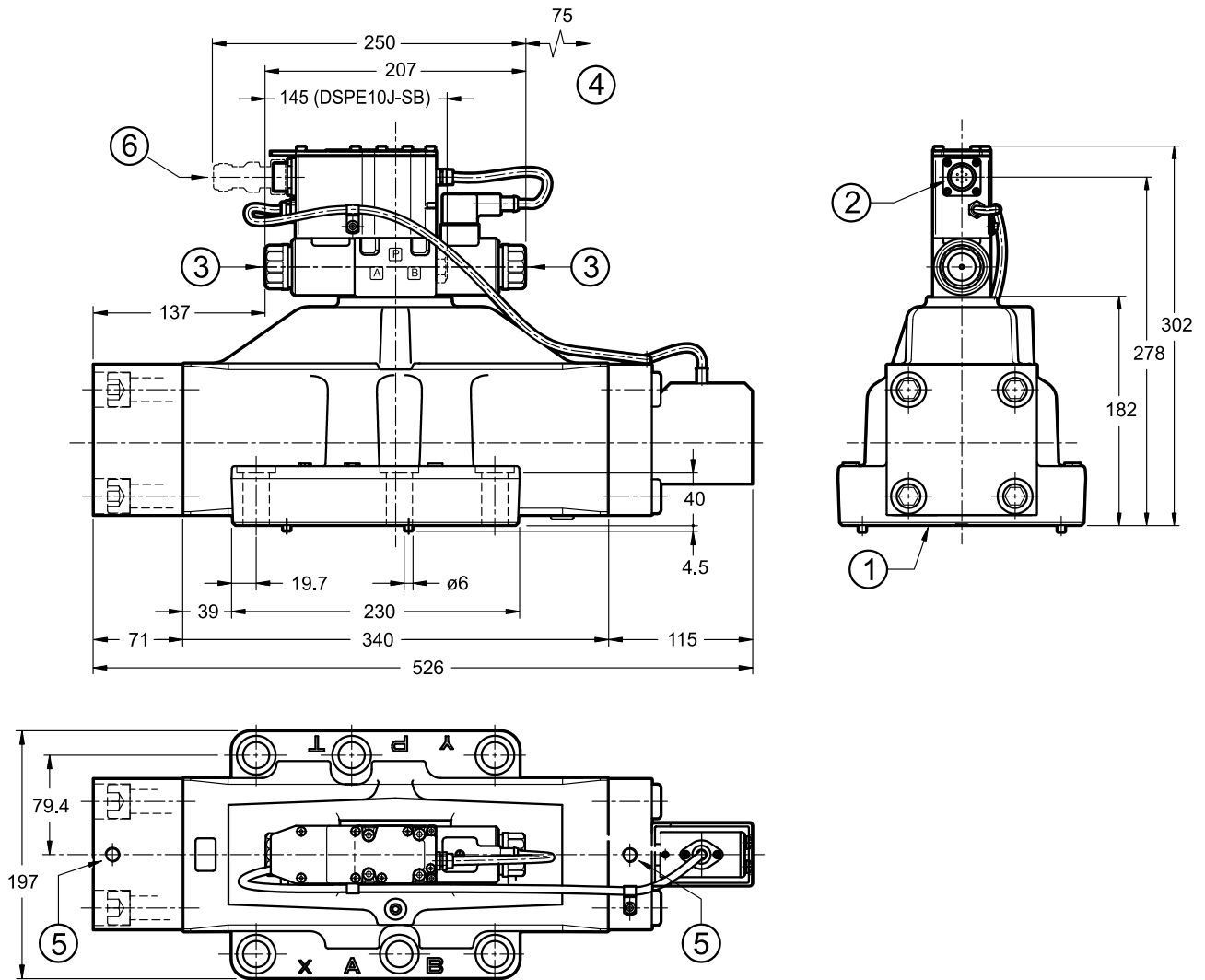
Valve fastening: 6 SHC ISO 4762 screws M12x60

Tightening torque: 69 Nm (A8.8 screws)

Threads of mounting holes: M12x20

## 13 - OVERALL AND MOUNTING DIMENSIONS DSPE10J / DSPE11J

dimensions in mm



### NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

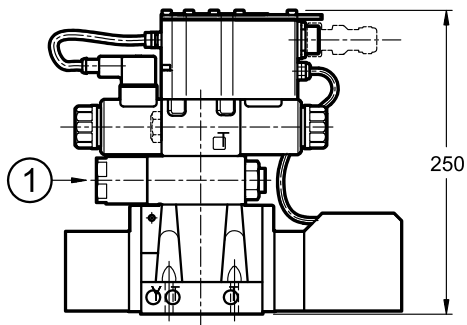
Valve fastening: 6 SHC screws ISO 4762 M20x70
Tightening torque: 330 Nm (A8.8 screws)
Threads of mounting holes: M20x40

1	Mounting surface with sealing rings: <b>DSPE10J</b> 4 OR type 4150 (37.59x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore <b>DSPE11J</b> 4 OR type 4212 (53.57x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	M12 holes for lifting eyebolts
6	Mating connector. <b>To be ordered separately.</b> See paragraph 18

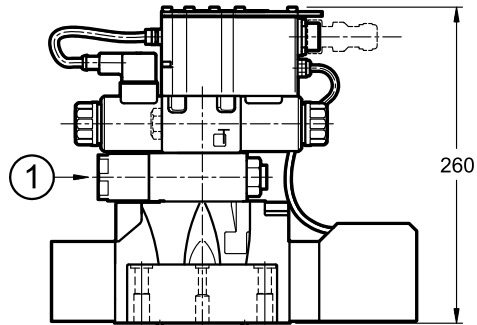
## 14 - OVERALL AND MOUNTING DIMENSIONS OF DSPE\*J WITH PILOT TYPE Z

dimensions in mm

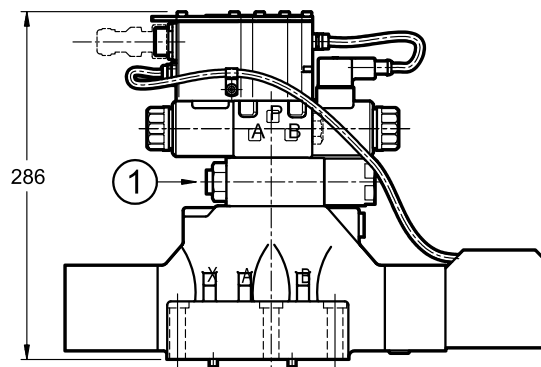
DSPE5J



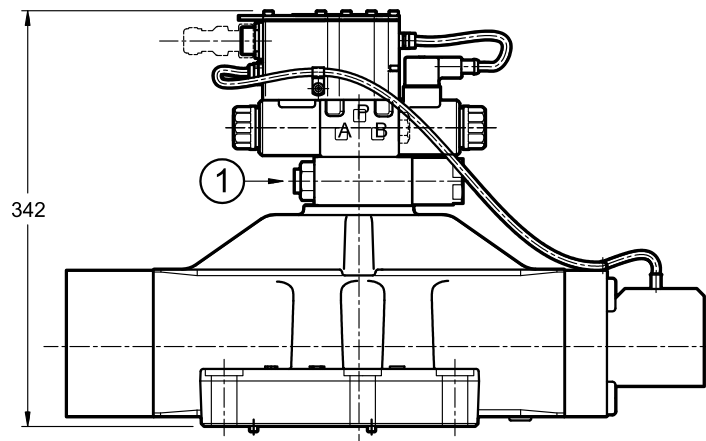
DSPE7J



DSPE8J



DSPE10J / DSPE11J

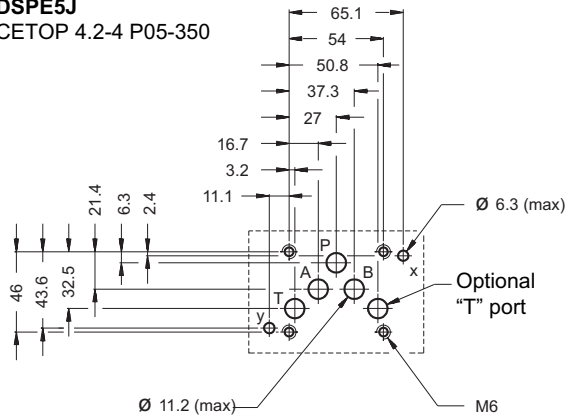


1	30 bar fixed adjustment pressure reducing valve
---	---

## 15 - MOUNTING SURFACES

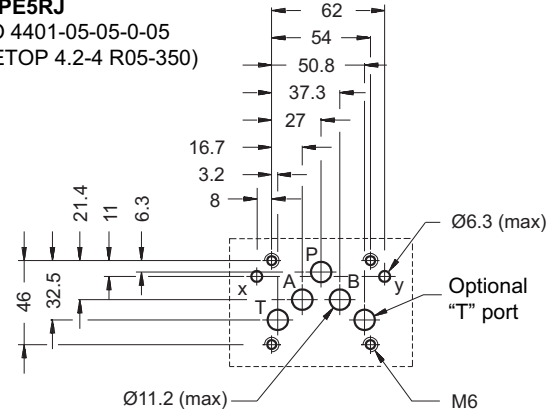
### DSPE5J

CETOP 4.2-4 P05-350



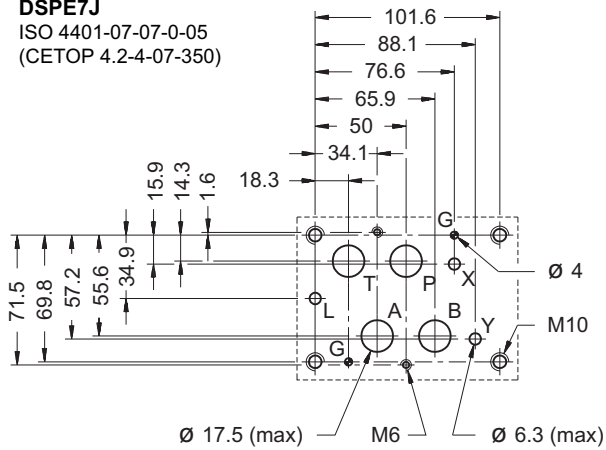
### DSPE5RJ

ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



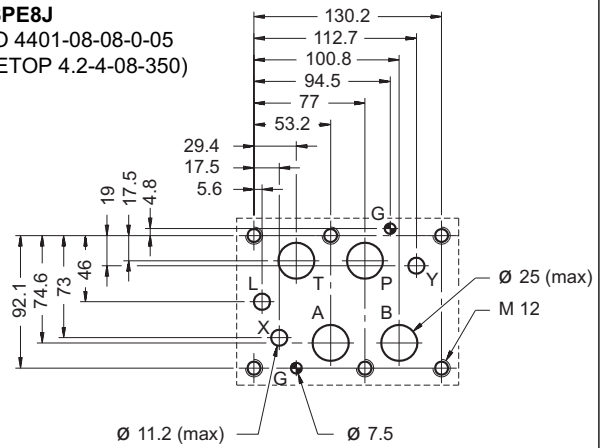
### DSPE7J

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



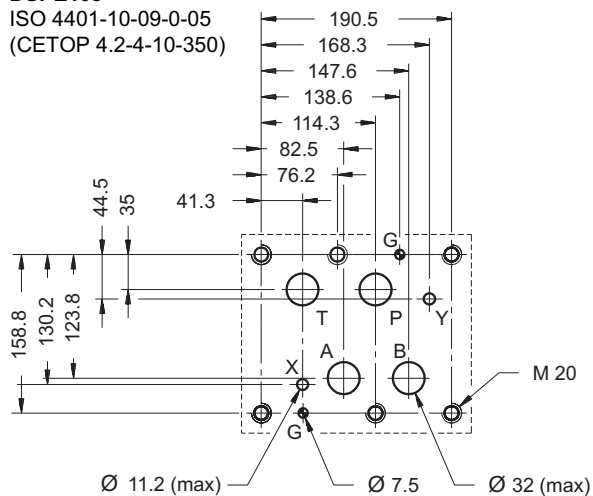
### DSPE8J

ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



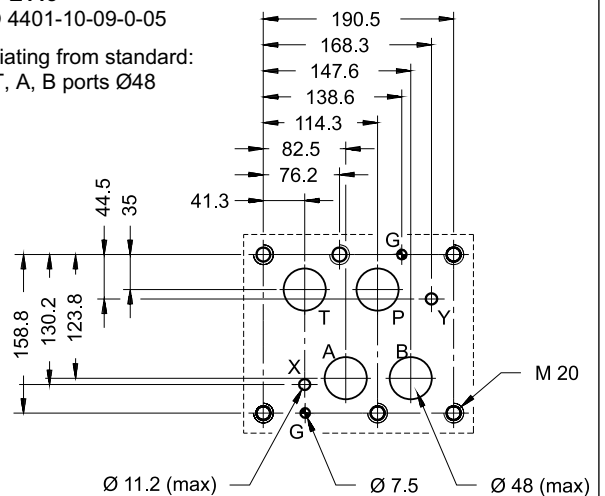
### DSPE10J

ISO 4401-10-09-0-05  
(CETOP 4.2-4-10-350)



### DSPE11J

ISO 4401-10-09-0-05  
deviating from standard:  
P, T, A, B ports  $\varnothing 48$







### 16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

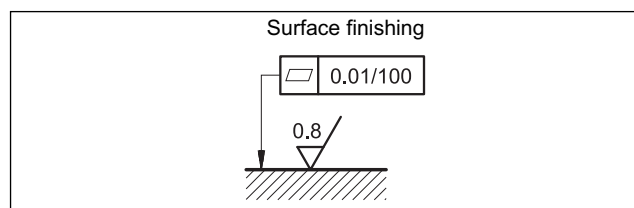
The fluid must be preserved in its physical and chemical characteristics.

### 17 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



### 18 - ACCESSORIES

(to be ordered separately)

#### 18.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

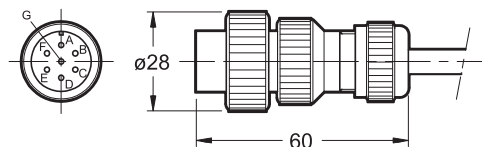


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



#### 18.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

#### 18.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

### 19 - SUBPLATES

(see catalogue 51 000)

	DSPE5J	DSPE7J	DSPE8J	DSPE10J DSPE11J
Type with rear ports	PME4-AI5G	PME07-AI6G	-	-
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G	-
P, T, A, B ports dimensions	3/4" BSP	1" BSP	1 1/2" BSP	-
X, Y ports dimensions	1/4" BSP	1/4" BSP	1/4" BSP	-



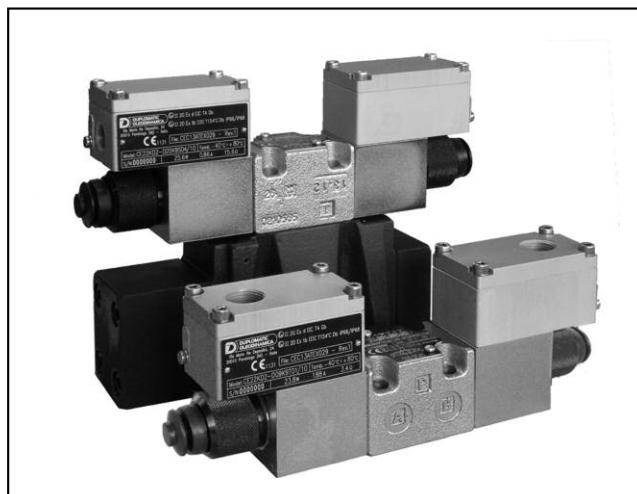
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

www.duplomatic.com • e-mail: sales.exp@duplomatic.com



# DS(P)E\*K\*

## EXPLOSION-PROOF PROPORTIONAL DIRECTIONAL VALVES ATEX, IECEx, INMETRO

DSE3K\* ISO 4401-03

DSPE5K\* CETOP P05

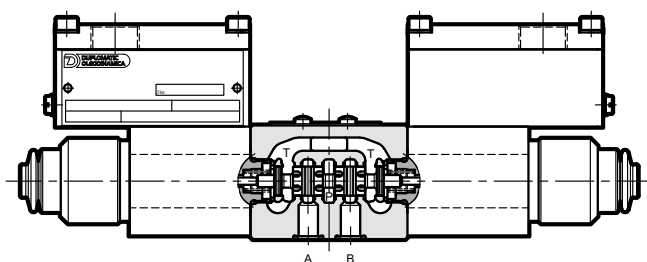
DSPE5RK\* ISO 4401-05

DSPE7K\* ISO 4401-07

DSPE8K\* ISO 4401-08

DSPE10K\* ISO 4401-10

### OPERATING PRINCIPLE



- These explosion proof directional valves are available in size ISO 4401-03 for direct operated type. Pilot operated valves are available in CETOP P05, ISO 4401-05, ISO 4401-07, ISO 4401-08 and ISO 4401-10 sizes.
- They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- The DSE3K\* valves are supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 hours; for DSPE\*K\* valves, this finishing is available upon request.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES		(obtained with viscosity of 36 cSt at 50°C and electronic control card)		DSE3K*	DSPE5K* DSPE5RK*	DSPE7K*	DSPE8K*	DSPE10K*
Max operating pressure: P - A - B ports T ports		bar		350 210	350 see paragraph 7			
Controlled flow rate with Δp 10 bar P-T		l/min		see par. 2	see paragraph 5			
Step response				see paragraph. 6				
Hysteresis		% of Q <sub>max</sub>		<6% (PWM 200Hz)	< 4% (PWM 100 Hz)			
Repeatability		% of Q <sub>max</sub>		< ±1,5%	< ± 2%			
Electrical characteristics				see paragraph 9				
Temperature ranges (ambient and fluid)		°C		see data sheet 02 500				
Fluid viscosity range		cSt		10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13						
Recommended viscosity		cSt		25				
Mass	single solenoid valve double solenoid valve	kg		1,9 2,8	7,5 8,3	9,9 10,7	16,1 16,9	52,8 53,5



## 1 - IDENTIFICATION OF DIRECT OPERATED VALVE DSE3K\*

### 1.1 - Identification code

D	S	E	3		-				/	10		-		K9	/		
---	---	---	---	--	---	--	--	--	---	----	--	---	--	----	---	--	--

Direct operated solenoid valve

Electric proportional control

Size: ISO 4401-03

Explosion-proof certification:  
**See table 1.2**

Spool type: \_\_\_\_\_  
**C** = closed centers  
**A** = open centers

Spool nominal flow rate (see table par. 1.2) \_\_\_\_\_

Solenoid position \_\_\_\_\_  
(omit for double solenoid version):  
**SA** = 1 solenoid for cross configuration  
**SB** = 1 solenoid for parallel configuration

Series No.: \_\_\_\_\_  
(the overall and mounting dimensions do not change from 10 to 19)

Seals: \_\_\_\_\_  
For temperature range -20 / +80 °C  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids  
For temperature range -40 / +80 °C  
**NL** = seal for low temperatures (for mineral oil)

Option: **/T5**  
version in T5 temperature class.  
Omit if not required.

Manual override:  
**CM** = boot protected  
**standard for both N and V seals**  
not available for NL seals  
**CB** = blind ring nut  
**standard for NL seals**  
available upon request for both N and V seals  
**CK** = knob manual override  
(only for DC version)  
**CH** = lever manual override.  
Dimensions for CB and CH at par. 18

Connection type for cable gland  
upper connection:  
**T01** = M20x1.5 - ISO 261  
**T02** = Gk 1/2 - UNI EN 10226-2  
not available for INMETRO  
**T03** = 1/2" NPT - ANSI B1.20.1  
(ex ANSI B2.1)  
side connection:  
**S01** = M20x1.5 - ISO 261  
**S02** = Gk 1/2 - UNI EN 10226-2  
not available for INMETRO  
**S03** = 1/2" NPT - ANSI B1.20.1  
(ex ANSI B2.1)  
**S04** = M16x1.5 - ISO 261

Coil electrical connection: by terminal block

Nominal solenoid voltage:  
**D12** = 12V DC  
**D24** = 24V DC

**NOTE:** The zinc-nickel standard finishing surface treatment is suitable to ensure a salt spray resistance up to 600 hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards)

### 1.2 - Names of valves per certification

	ATEX		IECEX		INMETRO	
for gases for dusts	<b>KD2</b>	II 2GD	<b>KXD2</b>	IECEX Gb IECEX Db	<b>KBD2</b>	INMETRO Gb INMETRO Db
for mines	<b>KDM2</b>	I M2	<b>KXDM2</b>	IECEX Mb	<b>KBDM2</b>	INMETRO Mb

**NOTE:** Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

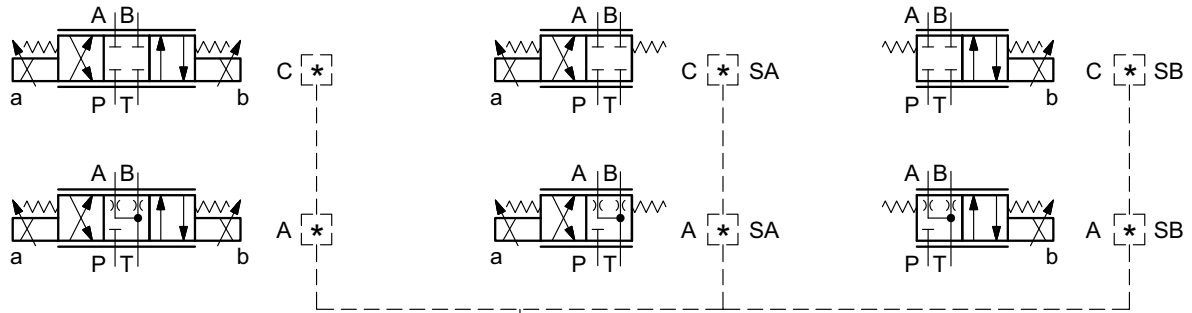
## 1.3 - Available configurations

Valve configuration depends on the combination of the following elements:  
number of proportional solenoids, spool type, nominal flow rate.

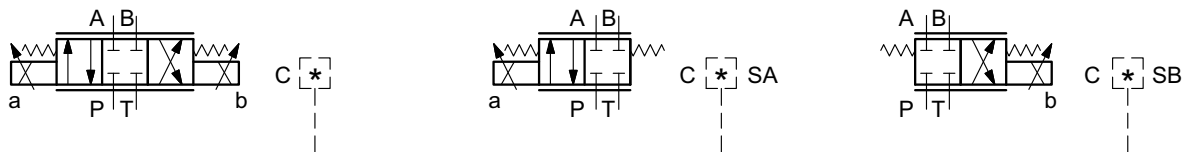
2 solenoids configuration:  
3 positions with spring centering

“SA” configuration: 1 solenoid on side A.  
2 positions (central + external) with  
spring centering

“SB” configuration: 1 solenoid on side B.  
2 positions (central + external) with  
spring centering



*	Nominal flow with $\Delta p 10$ bar P→T
04	4 l/min
08	8 l/min
16	16 l/min
16/08	16 (P→A) / 08 (B→T) l/min
26	26 l/min
26/13	26 (P→A) / 13 (B→T) l/min



*	Nominal flow with $\Delta p 10$ bar P→T
01R	1 l/min



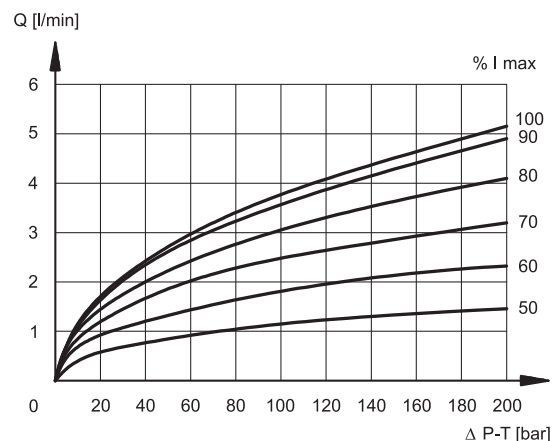
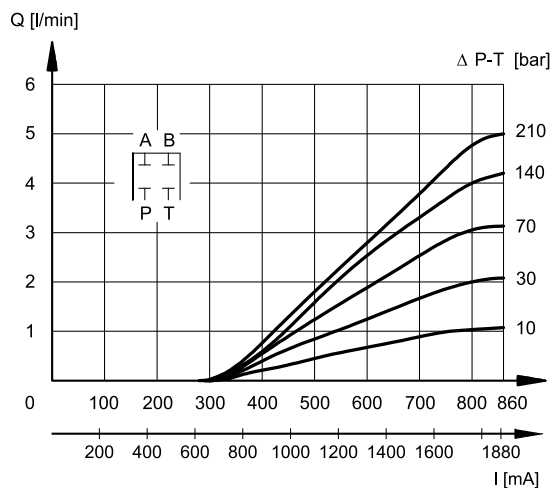
## 2 - DSE3K\* CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

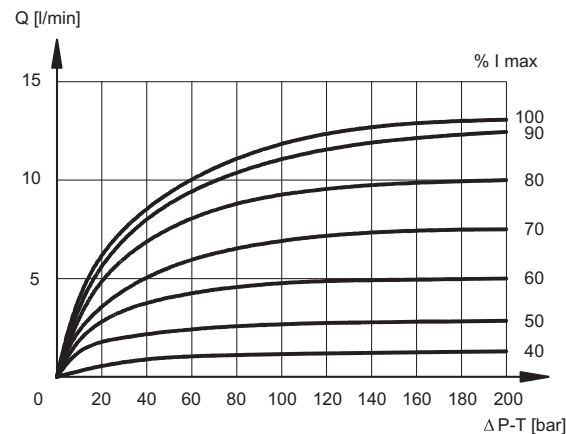
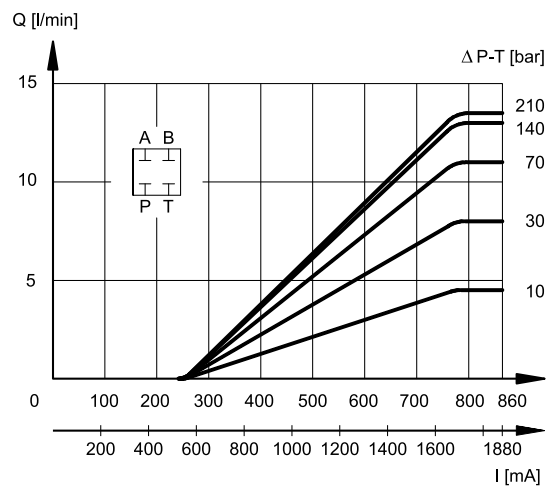
Typical flow control characteristics, according to current supply to the solenoid.

The reference  $\Delta p$  values are measured between ports P and T on the valve.

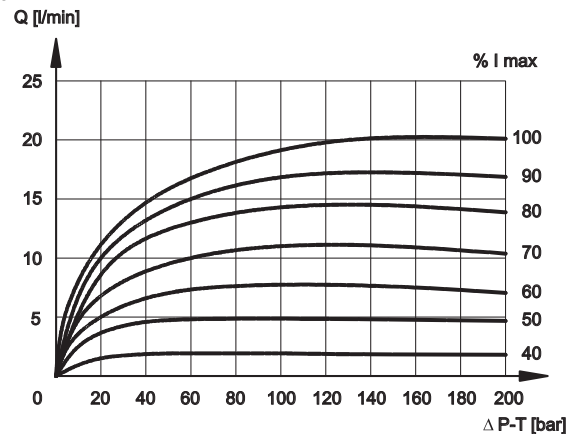
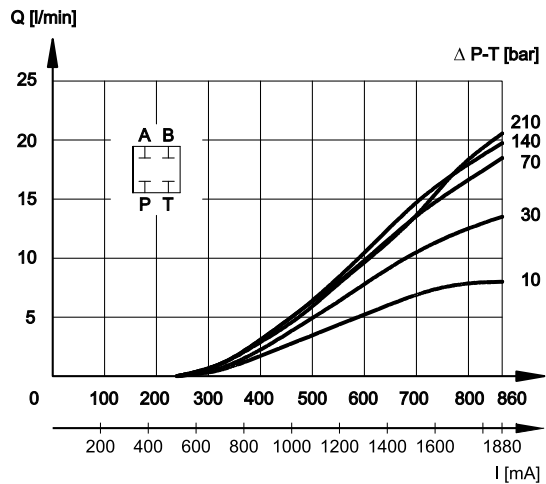
SPOOL TYPE C01R



SPOOL TYPE C04



SPOOL TYPE C08

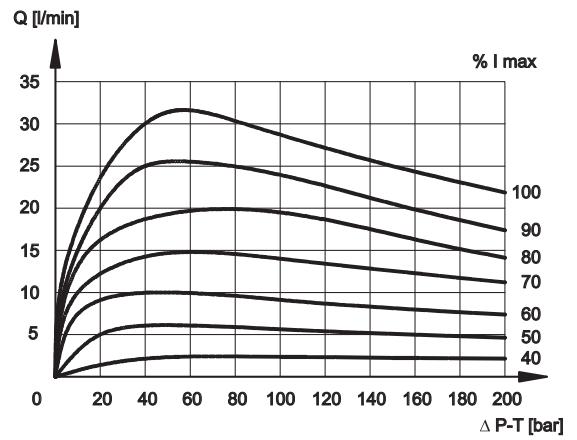
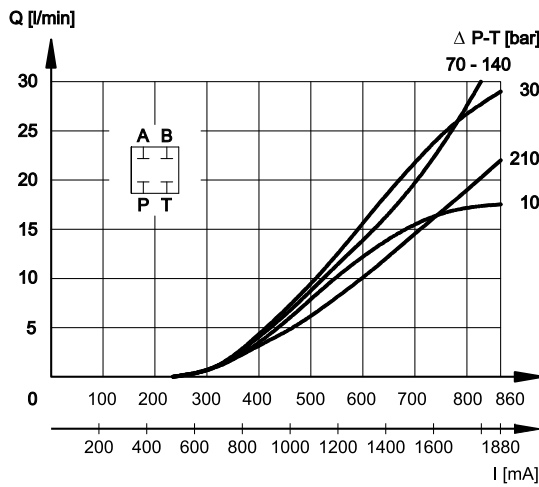




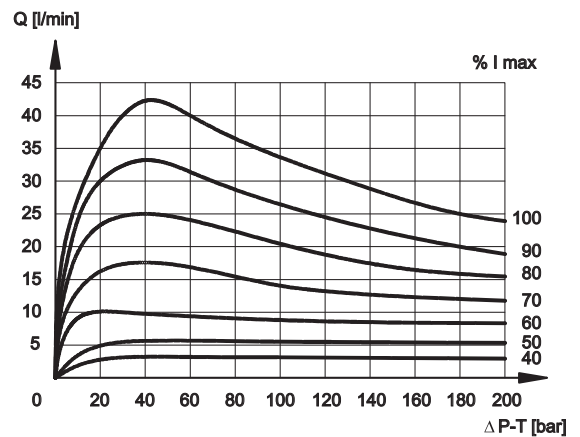
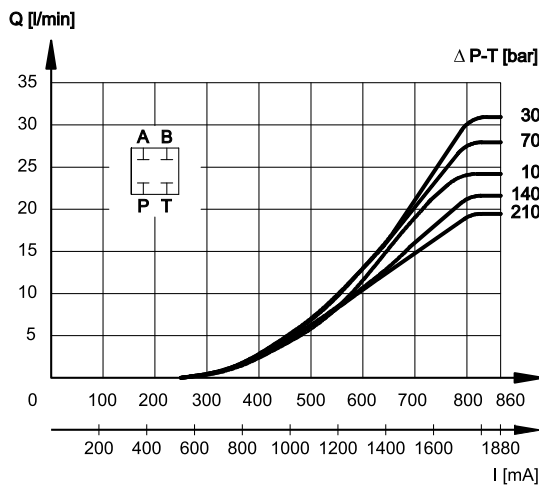
# DS(P)E\*K\*

## SERIES 10

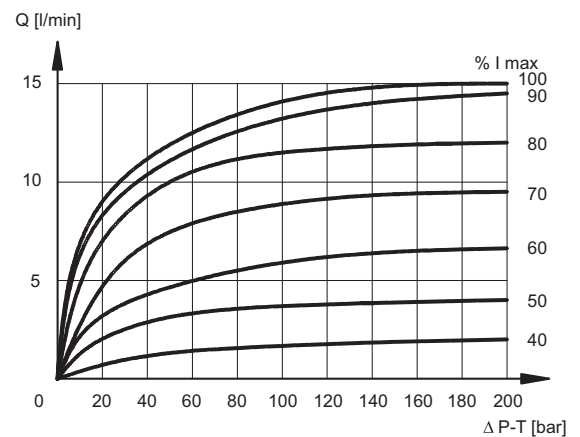
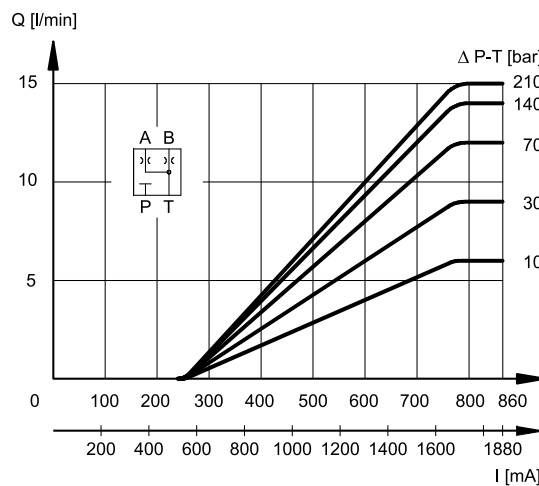
### SPOOL TYPE C16



### SPOOL TYPE C26



### SPOOL TYPE A04

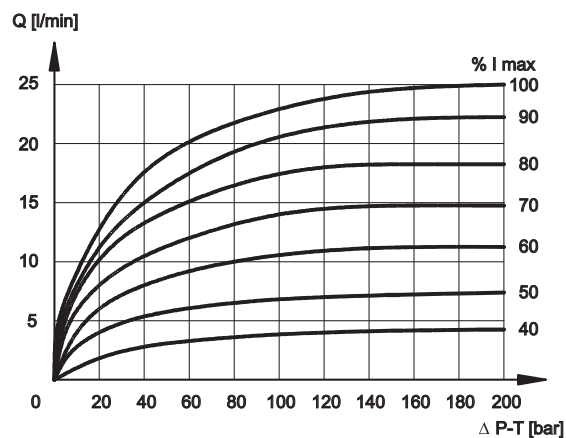
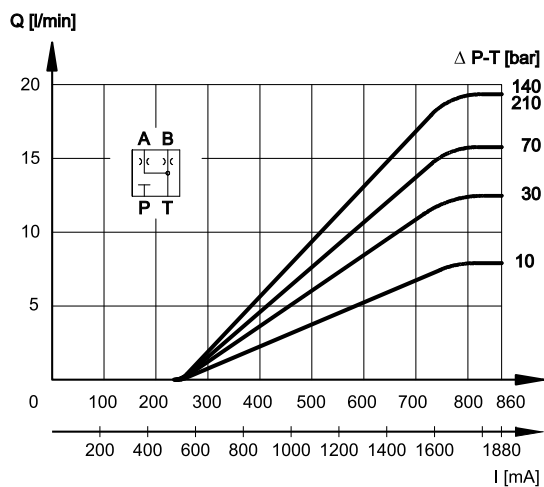




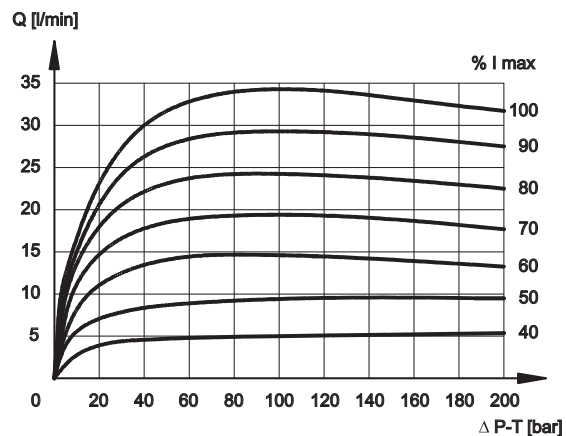
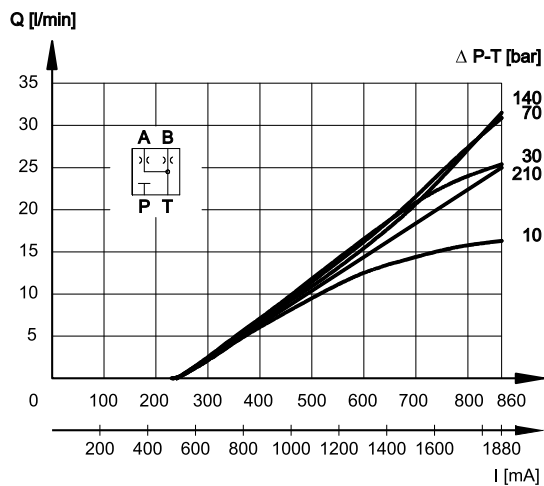
# DS(P)E\*K\*

## SERIES 10

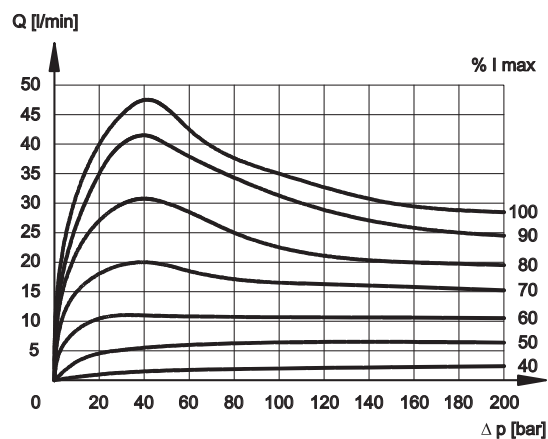
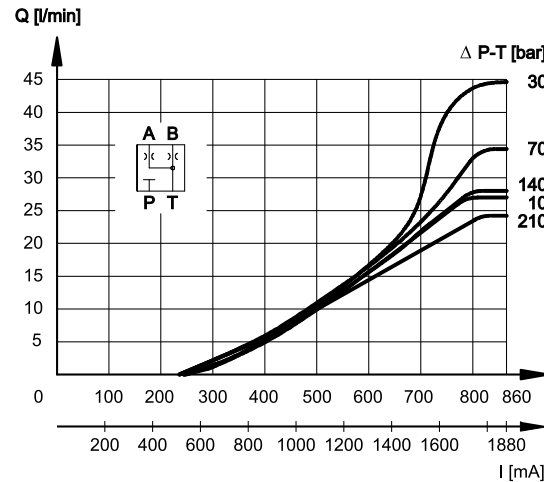
### SPOOL TYPE A08



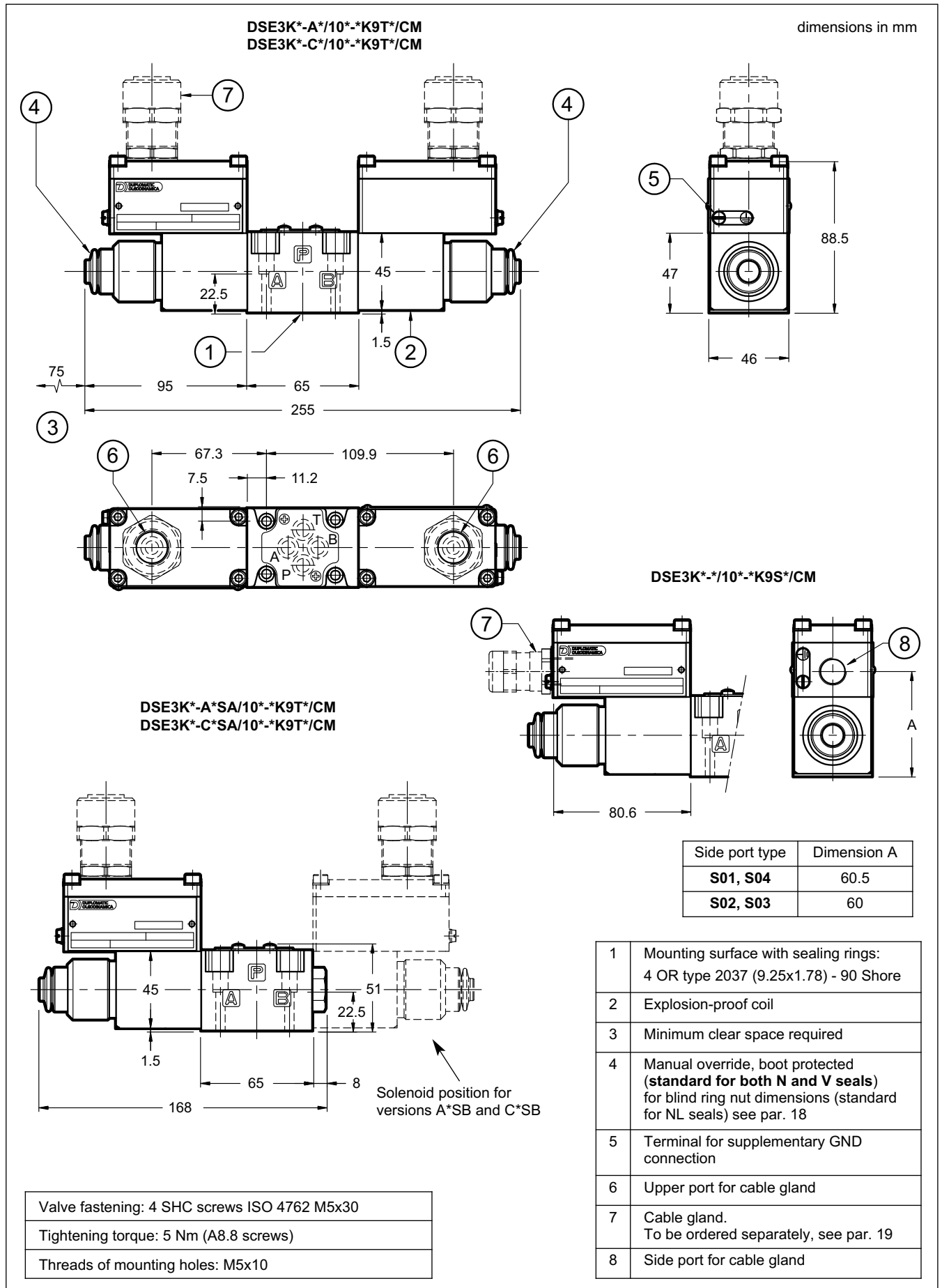
### SPOOL TYPE A16



### SPOOL TYPE A26



## 3 - DSE3K\* OVERALL AND MOUNTING DIMENSIONS







## 4 - IDENTIFICATION OF PILOT OPERATED SOLENOID VALVES DSPE\*K\*

### 4.1 - Identification code

D	S	P	E		-			/	10	-		/	K9	/			
---	---	---	---	--	---	--	--	---	----	---	--	---	----	---	--	--	--

Pilot operated directional valve

Electric proportional control

Size:   
5 = CETOP P05  
5R = ISO 4401-05  
7 = ISO 4401-07  
8 = ISO 4401-08  
10 = ISO 4401-10

Explosion-proof certification:   
See table 1.2

Spool type:   
C = closed centres  
A = open centres  
RC = regenerative closed centres  
RA = regenerative open centres

Spool nominal flow rate (see table par. 4.2)

Configurations for single solenoid version (omit for double solenoid version):  
SA = 1 solenoid for cross configuration  
SB = 1 solenoid for parallel configuration

Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:   
For temperature range -20 / +80 °C  
N = NBR seals for mineral oil (standard)  
V = FPM seals for special fluids  
For temperature range -40 / +80 °C  
NL = seal for low temperatures (for mineral oil)

Piloting:   
I = internal  
E = external  
Z = internal piloting with 30 bar fixed adjustment pressure reducing valve

Drainage:   
I = internal  
E = external

Option: surface treatment not standard. Omit if not required (see NOTE)

Option: /T5 version in T5 temperature class. Omit if not required.

Manual override:   
CM = boot protected standard for both N and V seals not available for NL seals  
CB = blind ring nut standard for NL seals available upon request for both N and V seals see dimensions at paragraph 18

Connection type for cable gland upper connection:   
T01 = M20x1.5 - ISO 261  
T02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
T03 = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
side connection:   
S01 = M20x1.5 - ISO 261  
S02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO  
S03 = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)  
S04 = M16x1.5 - ISO 261

Coil electrical connection: by terminal block

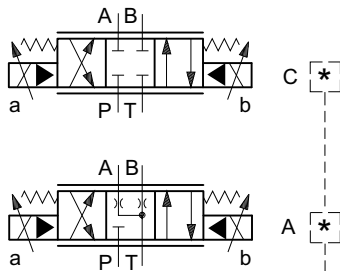
Nominal solenoid voltage:   
D12 = 12V DC  
D24 = 24V DC

**NOTE:** the valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body. Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards). For full zinc-nickel surface treatment add /W7 at the end of the identification code.

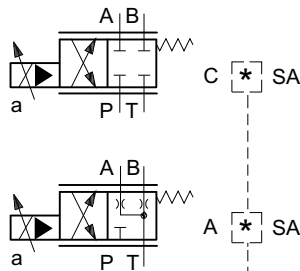
## 4.2 - Configurations

The valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, rated flow.

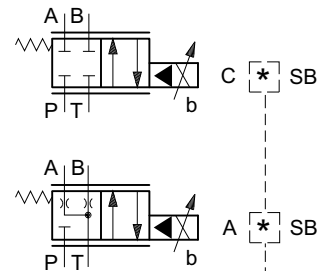
Configuration 2 solenoids:  
3 positions with spring centering



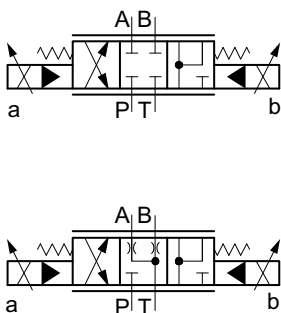
1 solenoid for cross configuration "SA":  
2 positions (central + external)  
with spring centering



1 solenoid for parallel configuration "SB":  
2 positions (central + external)  
with spring centering



valve type	*	nominal flow rate with $\Delta p$ 10 bar P-T
DSPE5K* DSPE5RK*	<b>80</b>	80 l/min
	<b>80/40</b>	80 (P-A) / 40 (B-T) l/min
DSPE7K*	<b>100</b>	100 l/min
	<b>150</b>	150 l/min
	<b>150/75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8K*	<b>200</b>	200 l/min
	<b>300</b>	300 l/min
	<b>300/150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10K*	<b>350</b>	350 l/min
	<b>500</b>	500 l/min
	<b>500/250</b>	500 (P-A) / 250 (B-T) l/min



RC \*

RA \*

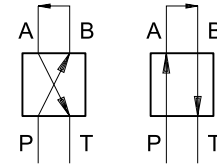
valve type	*	nominal flow rate with $\Delta p$ 10 bar P-T
DSPE7K*	<b>150/75</b>	150 (P-A) / 75 (B-T) l/min
DSPE8K*	<b>300/150</b>	300 (P-A) / 150 (B-T) l/min
DSPE10K*	<b>500/250</b>	500 (P-A) / 250 (B-T) l/min

## 5 - CHARACTERISTIC CURVES OF PILOT OPERATED SOLENOID VALVES DSPE\*K\*

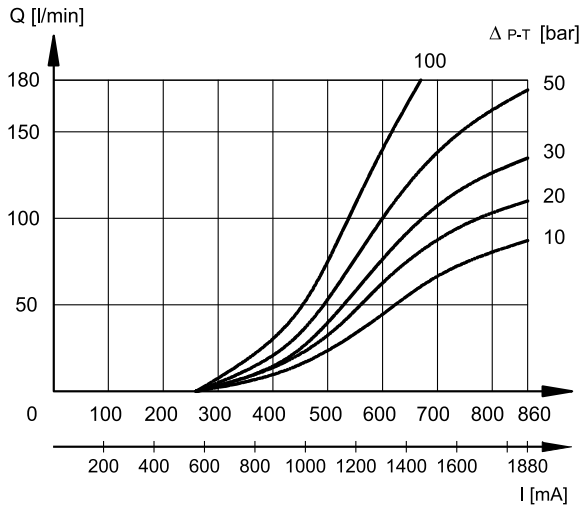
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Typical flow rate control curves at constant  $\Delta p$  according to current supply to the solenoid, measured for the available spool types.

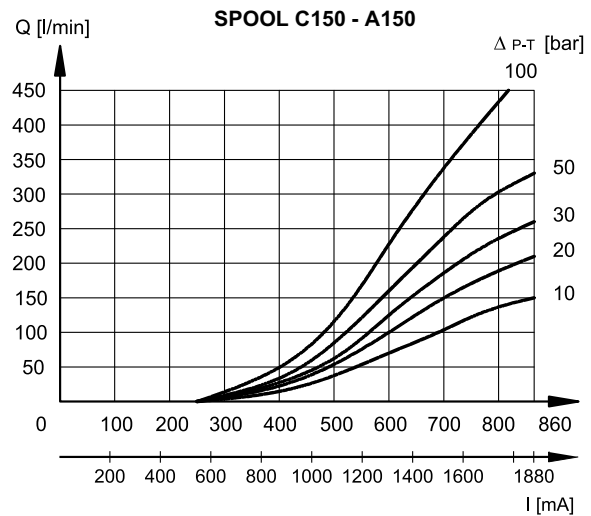
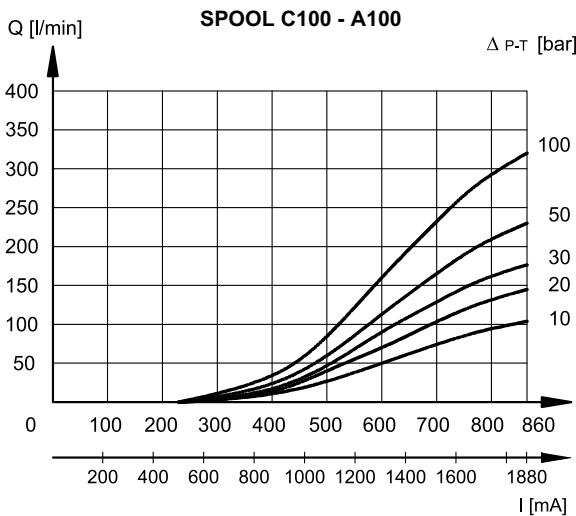
The reference  $\Delta p$  values are measured between valve ports P and T.



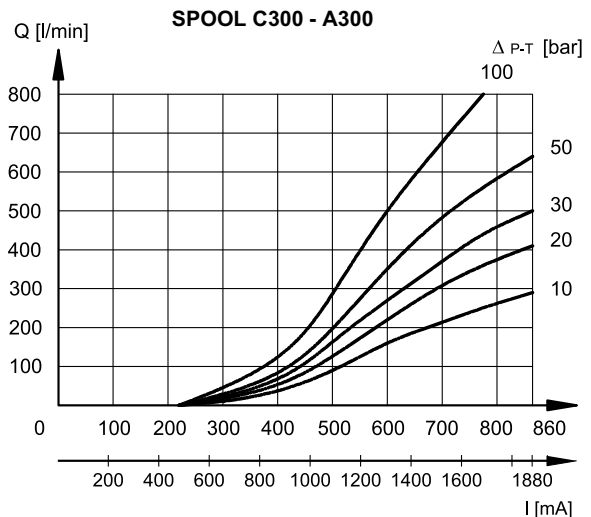
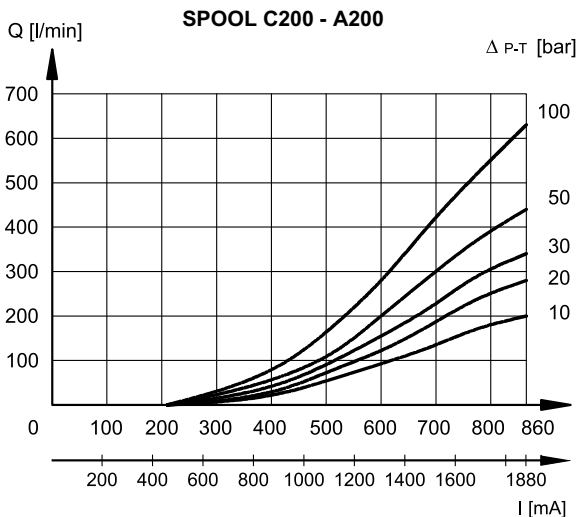
### 5.1 - Characteristic curves DSPE5K\* and DSPE5RK



### 5.2 - Characteristic curves DSPE7K\*

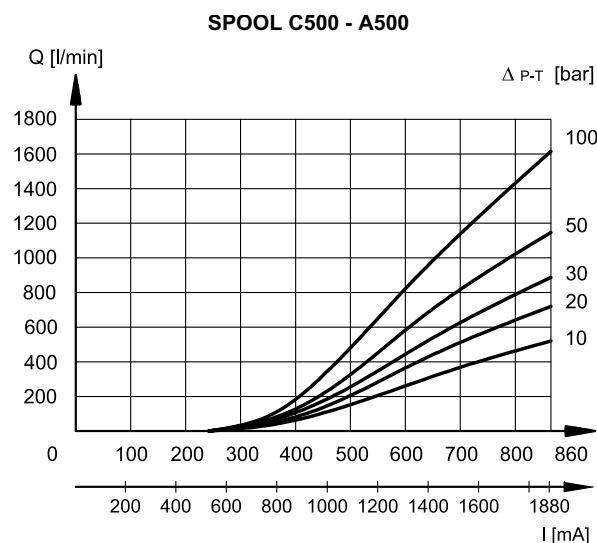
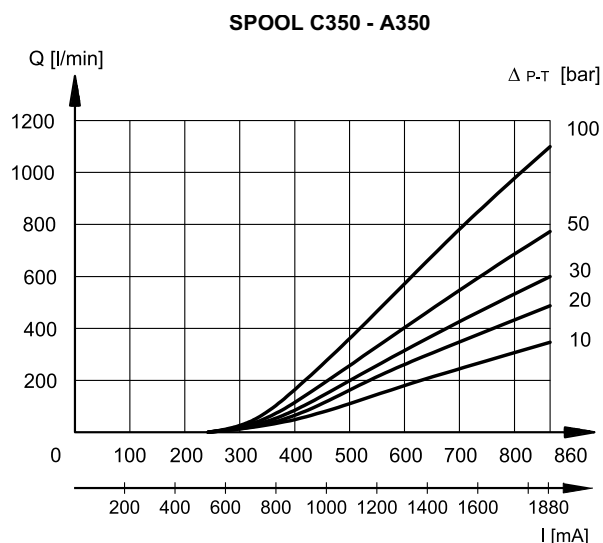


### 5.3 - Characteristic curves DSPE8K\*





## 5.4 - Characteristic curves DSPE10K\*



## 6 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table shows the typical step response tested with static pressure 100 bar.

REFERENCE SIGNAL	0 → 100%	100 → 0%
	Step response [ms]	
DSE3K*	50	40
DSPE5K* and DSPE5RK*	50	40
DSPE7K*	80	50
DSPE8K*	100	70
DSPE10K*	200	120

## 7 - HYDRAULICS CHARACTERISTICS

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

FLOWS		DSPE5K* DSPE5RK*	DSPE7K*	DSPE8K*	DSPE10K*
Max flow rate	l/min	180	450	800	1600
Piloting flow requested with operation 0 → 100%	l/min	3	5	9	13
Piloting volume requested with operation 0 → 100%	cm <sup>3</sup>	1,7	3,2	9,1	21,6

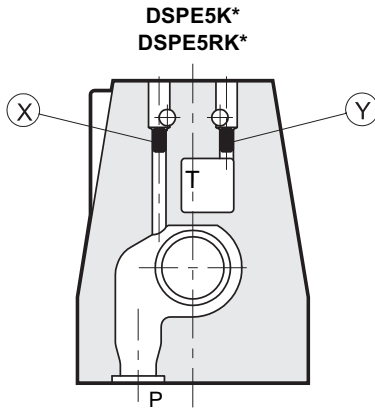
PRESSURES	MIN	MAX
Piloting pressure on X port	30	210 (NOTE)
Pressure on T port with internal drain	–	10
Pressure on T port with external drain	–	250

**NOTE:** if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

Add the letter **Z** to the identification code to order this option (see par. 4.1). Consider that, by adding the pressure reducing valve, the overall dimensions increase 40 mm in height.

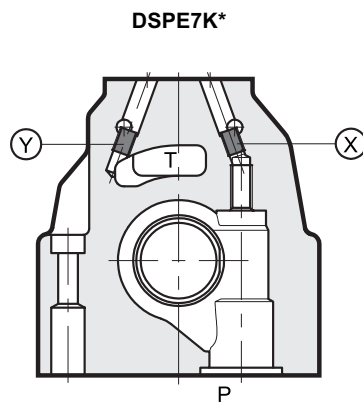
## 8 - PILOTING AND DRAINAGE

DSPE\*K\* valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

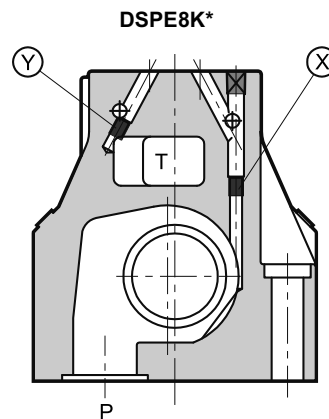


X: plug M5x6 for external pilot  
Y: plug M5x6 for external drain

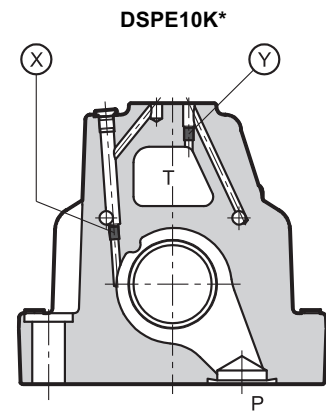
TYPE OF VALVE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain



X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain

## 9 - ELECTRICAL CHARACTERISTICS

(values  $\pm 5\%$ )

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (AT 20°C)	$\Omega$	3,4	15,6
NOMINAL CURRENT	A	1,88	0,86

DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

## 9.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

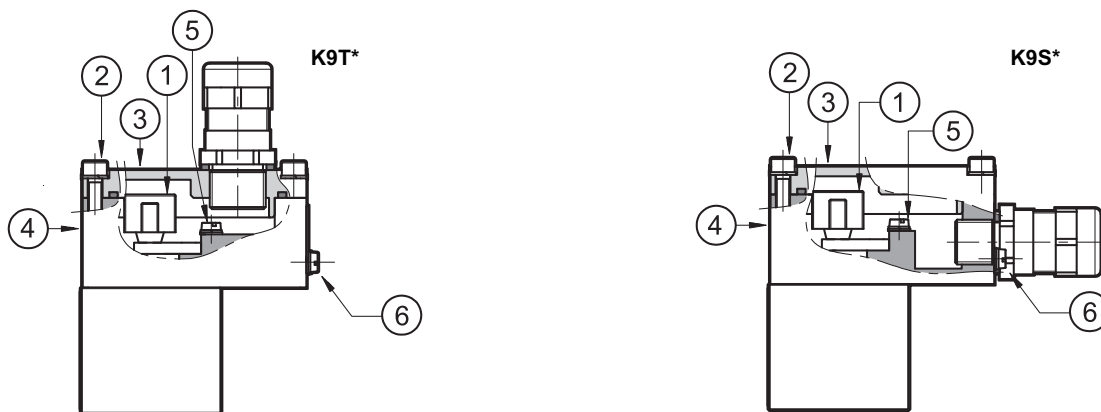
**The electrical connection is polarity-independent.**

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100  $\Omega$ ), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9 ÷ 6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards



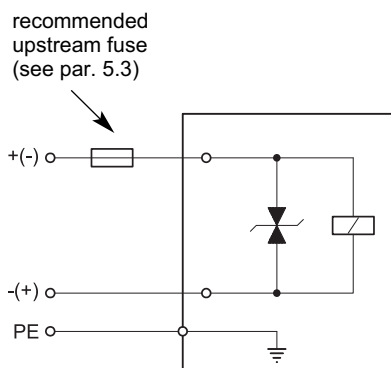
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm <sup>2</sup>
Connection for internal grounding point	max 2.5 mm <sup>2</sup>
Connection for external equipotential grounding point	max 6 mm <sup>2</sup>

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 19) allow to use cables with external diameter between 8 and 10 mm.

## 9.2 - Electrical diagrams



## 9.3 - Overcurrent fuse and switch-off voltage peak

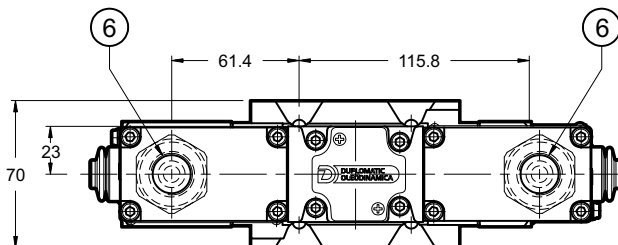
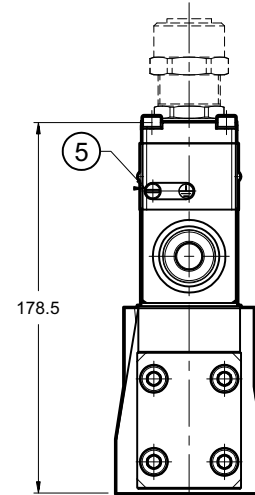
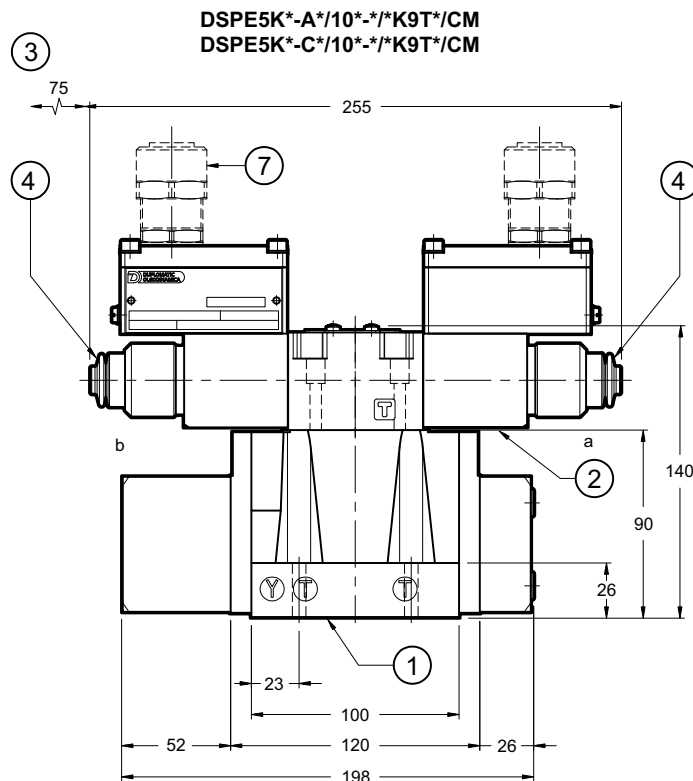
Upstream of each valve, an appropriate fuse (max 3 x I<sub>n</sub> according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

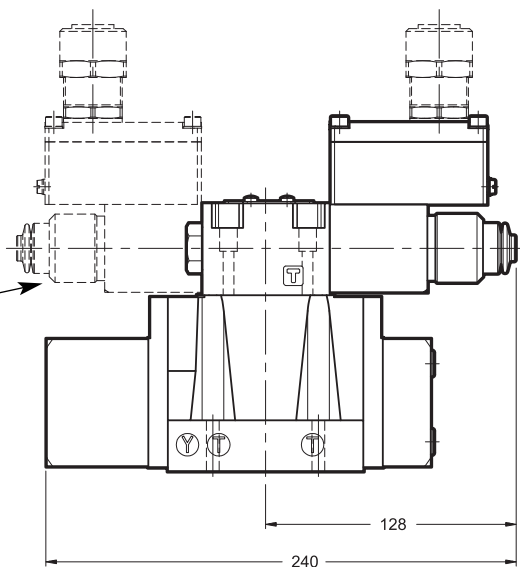
Coil type	Nominal voltage [V]	Rated current [A]	Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,86	1,25	- 49	

## 10 - DSPE5K\* AND DSPE5RK\* OVERALL AND MOUNTING DIMENSIONS



DSPE5K\*-A\*SA/10\*-\*/K9T\*/CM  
DSPE5K\*-C\*SA/10\*-\*/K9T\*/CM

Solenoid position for versions A\*SB and C\*SB



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected ( <b>standard for both N and V seals</b> ) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

**NOTE 1:** for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

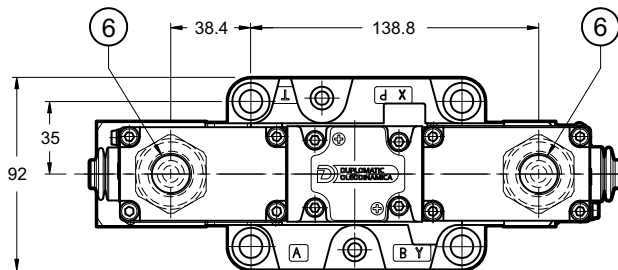
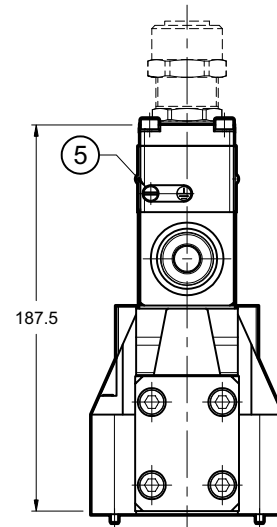
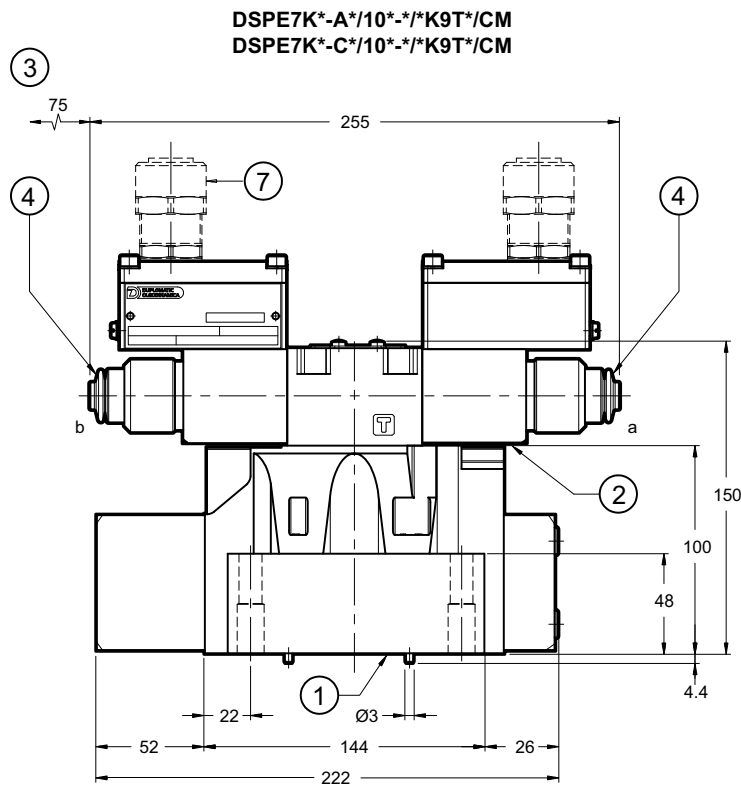
**NOTE 2:** for side port cable gland see paragraph 14.

Valve fastening: 4 SHC ISO 4762 screws M6x35

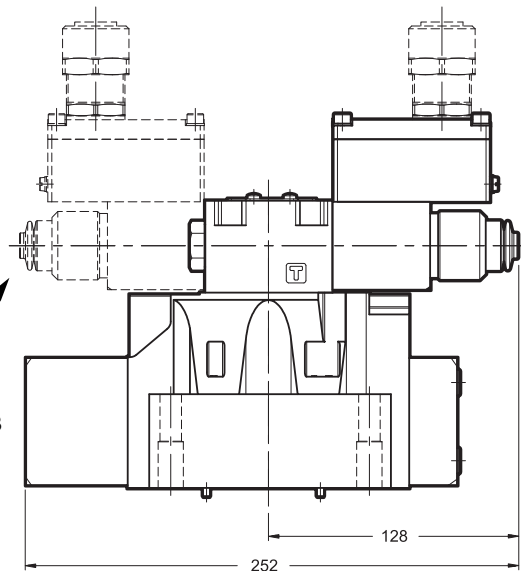
Tightening torque: 8 Nm (A8.8 screws)

Threads of mounting holes: M6x10

## 11 - DSPE7K\* OVERALL AND MOUNTING DIMENSIONS



**DSPE7K\*-A\*SA/10\*-\*/K9T\*/CM**  
**DSPE7K\*-C\*SA/10\*-\*/K9T\*/CM**



**NOTE 1:** for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

**NOTE 2:** for side port cable gland see paragraph 14.

1	Mounting surface with sealing rings: 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected ( <b>standard for both N and V seals</b> ) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

Solenoid position for versions A\*SB and C\*SB

Valve fastening: 4 SHC screws ISO 4762 M10x60  
2 SHC screws ISO 4762 M6x60

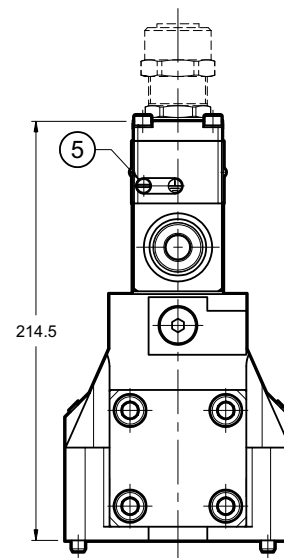
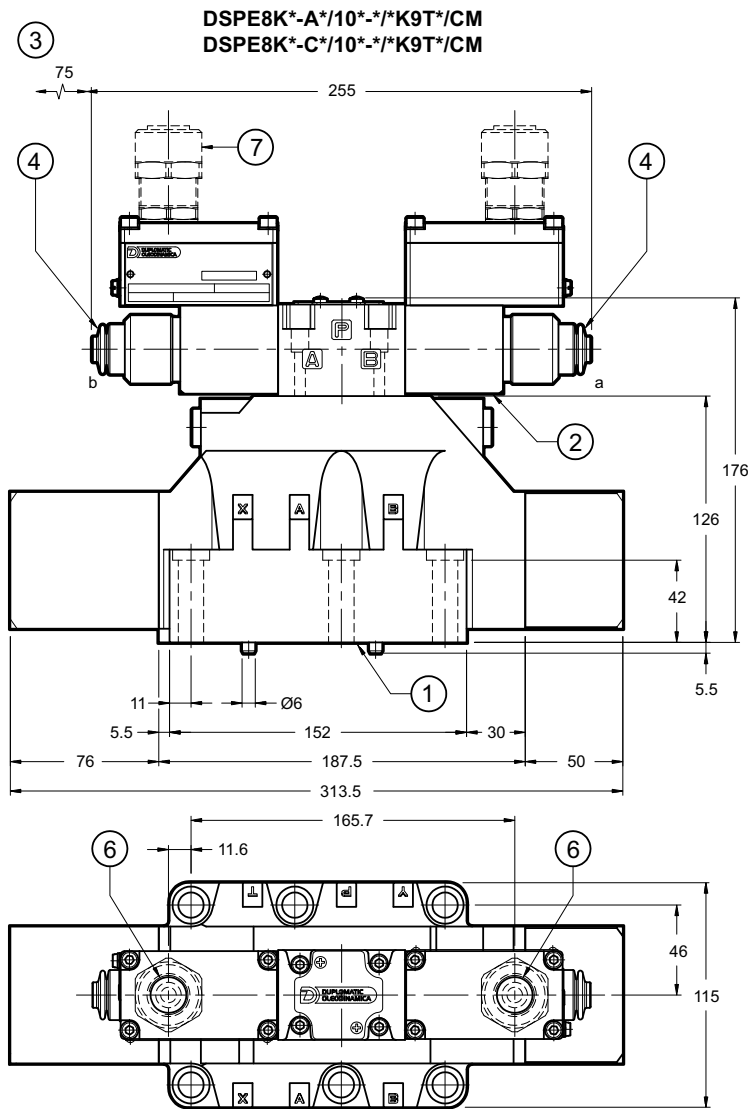
Tightening torque: M10x60: 40 Nm (A8.8 screws)  
M6x60: 8 Nm (A8.8 screws)

Threads of mounting holes: M6x18; M10x18

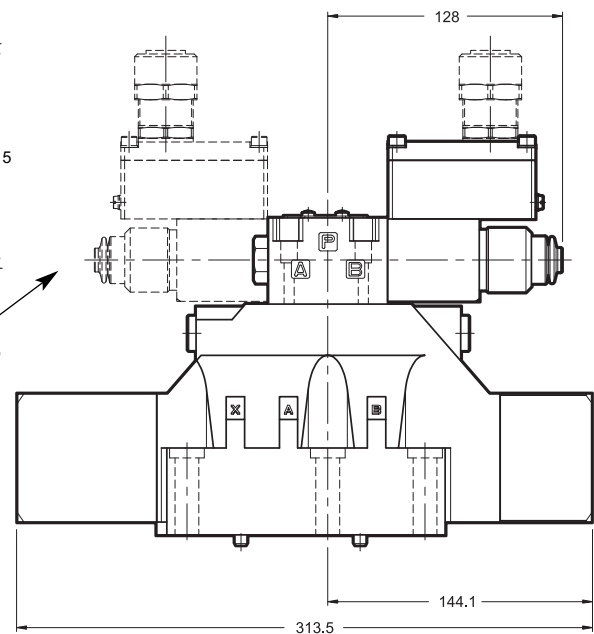


## 12 - DSPE8K\* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



DSPE8K\*-A\*SA/10\*-\*/\*K9T\*/CM  
DSPE8K\*-C\*SA/10\*-\*/\*K9T\*/CM



Solenoid position for versions A\*SB and C\*SB

**NOTE 1:** for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

**NOTE 2:** for side port cable gland see paragraph 14.

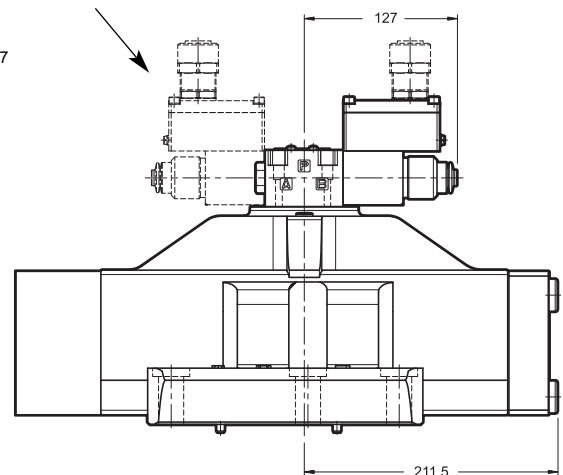
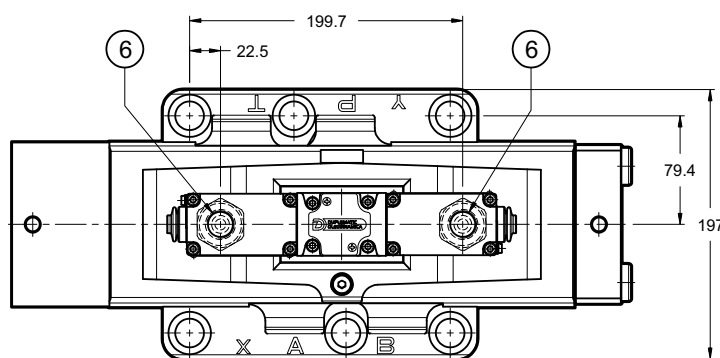
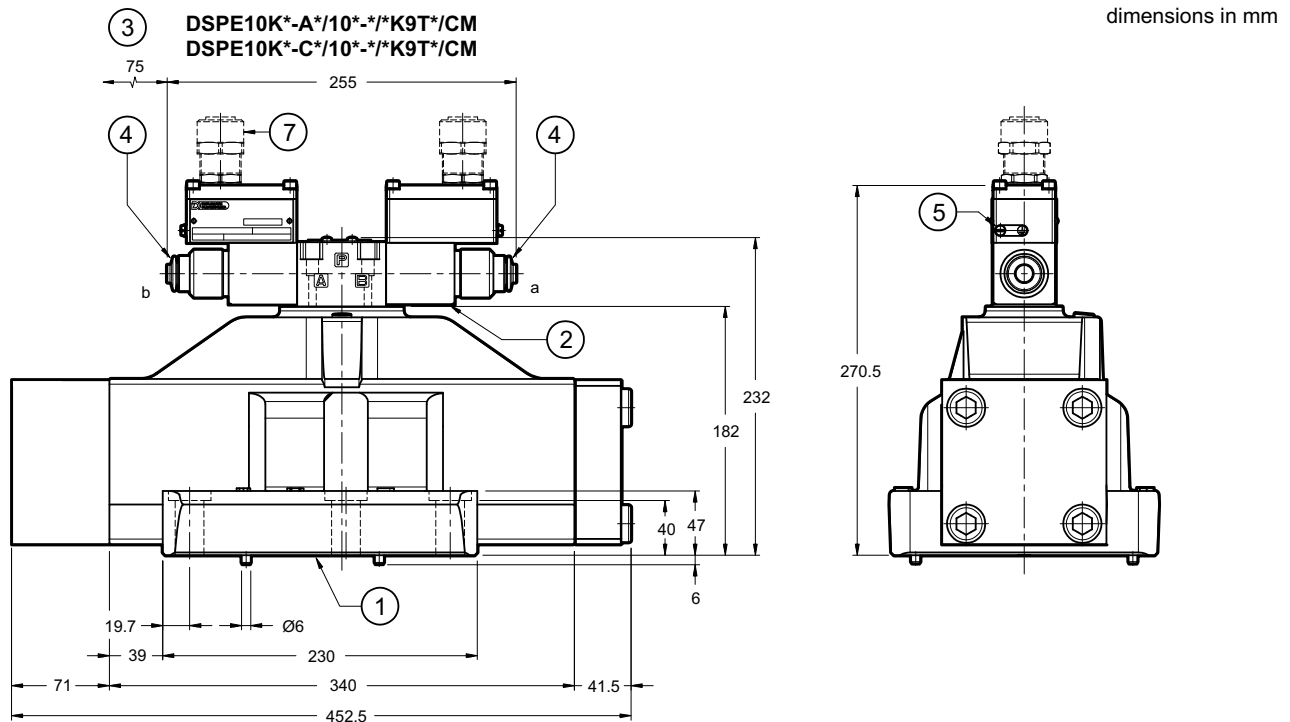
1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected ( <b>standard for both N and V seals</b> ) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

Valve fastening: 6 SHC ISO 4762 screws M12x60

Tightening torque: 69 Nm (A8.8 screws)

Threads of mounting holes: M12x20

## 13 - DSPE10K\* OVERALL AND MOUNTING DIMENSIONS



1	Mounting surface with sealing rings: 4 OR type 4150 (37.59x3.53) - 90 shore 2 OR type 3081 (20.24x2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (standard for both N and V seals) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

**NOTE 1:** for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

**NOTE 2:** for side port cable gland see paragraph 14.

Valve fastening: 6 SHC screws ISO 4762 M20x70

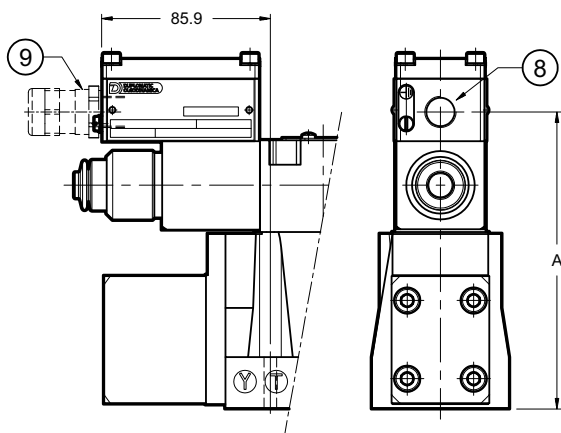
Tightening torque: 330 Nm (A8.8 screws)

Threads of mounting holes: M20x40

## 14 - DSPE\*K\*-\*K9S\* (SIDE CONNECTION) OVERALL AND MOUNTING DIMENSIONS

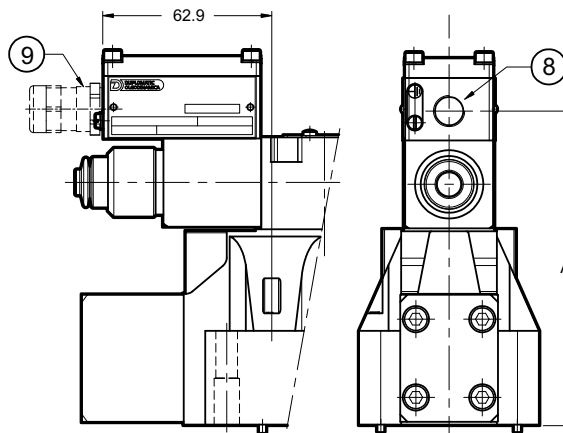
dimensions in mm

**DSPE5K\*-\*K9S\***  
**DSPE5RK\*-\*K9S\***



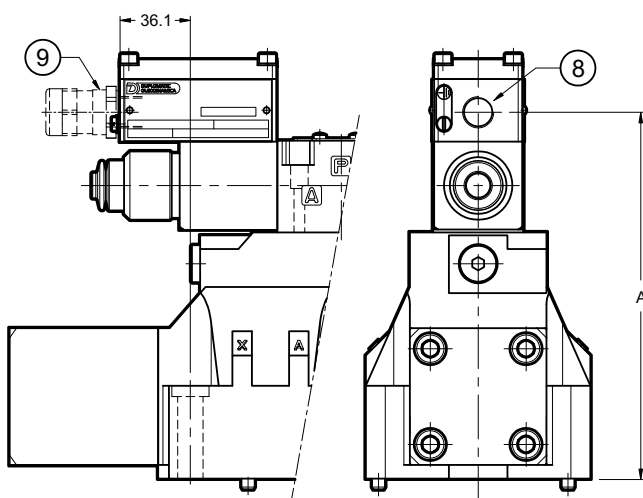
Side port type	Dimension A
<b>S01, S04</b>	150.5
<b>S02, S03</b>	150

**DSPE7K\*-\*K9S\***



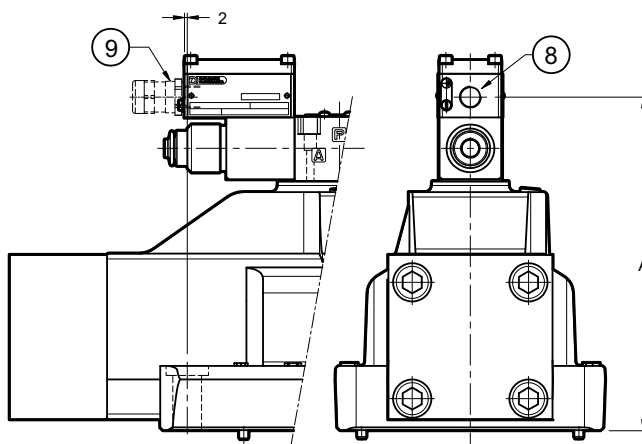
Side port type	Dimension A
<b>S01, S04</b>	157.5
<b>S02, S03</b>	157

**DSPE8K\*-\*K9S\***



Side port type	Dimension A
<b>S01, S04</b>	186.5
<b>S02, S03</b>	186

**DSPE10K\*-\*K9S\***

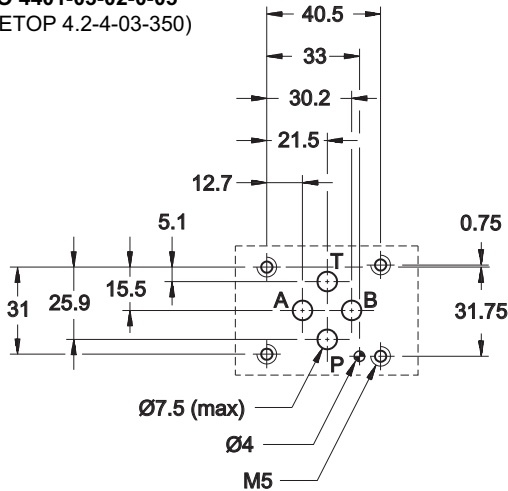


Side port type	Dimension A
<b>S01, S04</b>	242.5
<b>S02, S03</b>	242

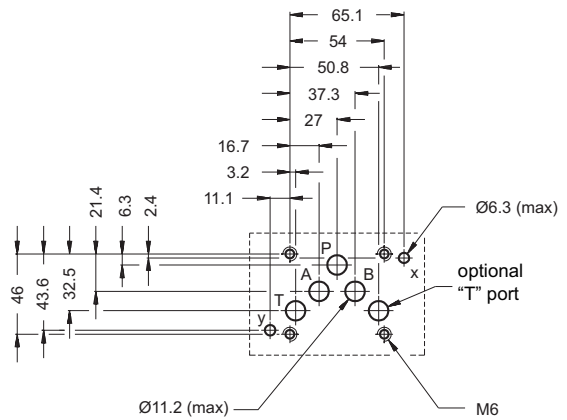
8	Side port for cable gland
9	Cable gland. To be ordered separately, see par. 19

## 15 - MOUNTING SURFACES

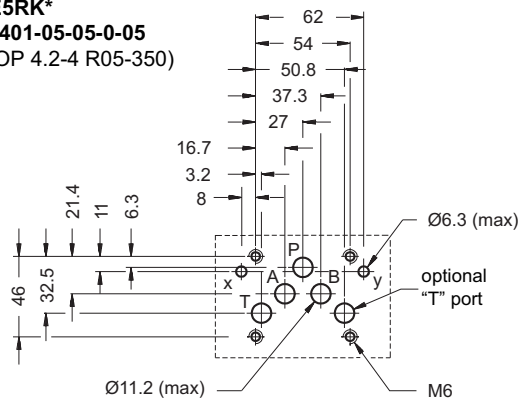
**DSE3K\***  
ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)



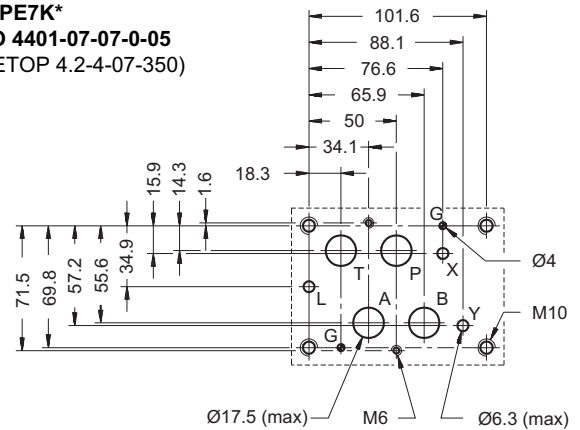
**DSPE5K\***  
CETOP 4.2-4 P05-350



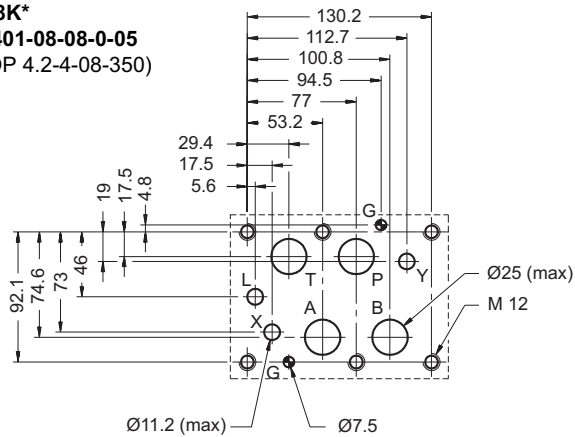
**DSPE5RK\***  
ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



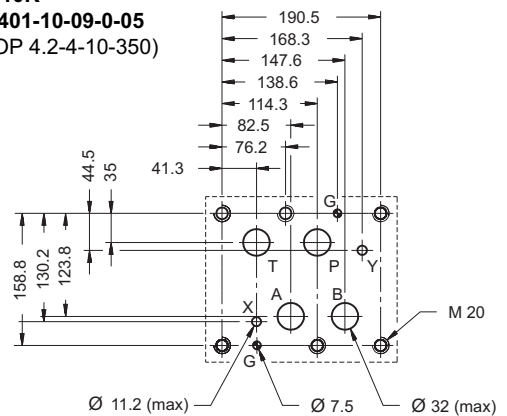
**DSPE7K\***  
ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



**DSPE8K\***  
ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



**DSPE10K\***  
ISO 4401-10-09-0-05  
(CETOP 4.2-4-10-350)



## 16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 17 - INSTALLATION



Installation must adhere to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

The valves can be installed in any position without impairing correct operation.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

## 18 - MANUAL OVERRIDES

### 18.1 - CB - Blind ring nut

The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

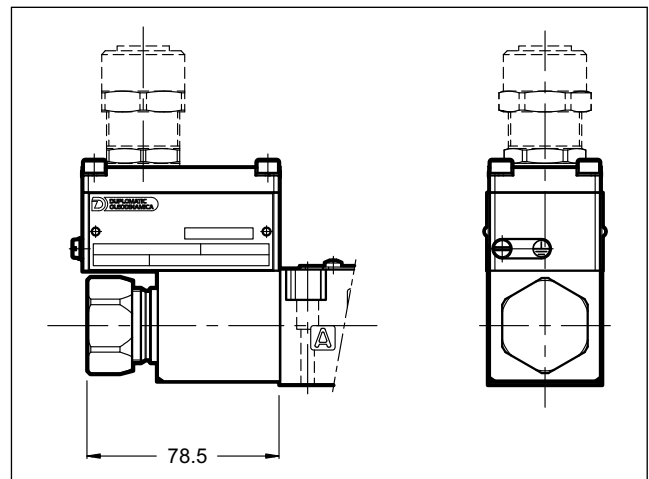
To access the manual override loose the ring nut and remove it; then reassemble hand tightening, until it stops.

**Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.**

More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.



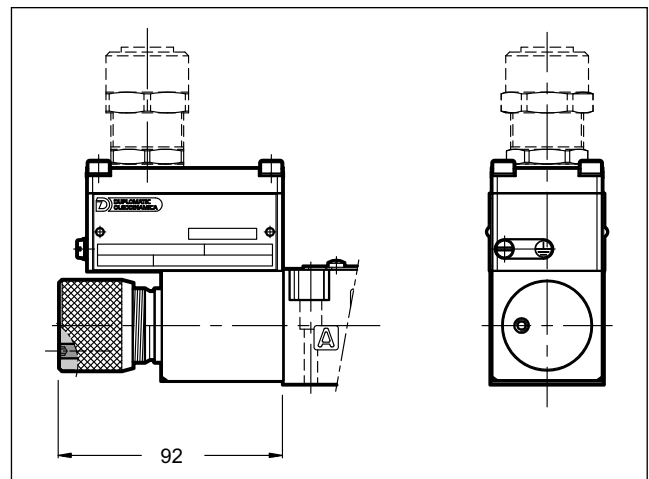
**CAUTION!: The manual override doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.**



### 18.2 - CK Knob manual override

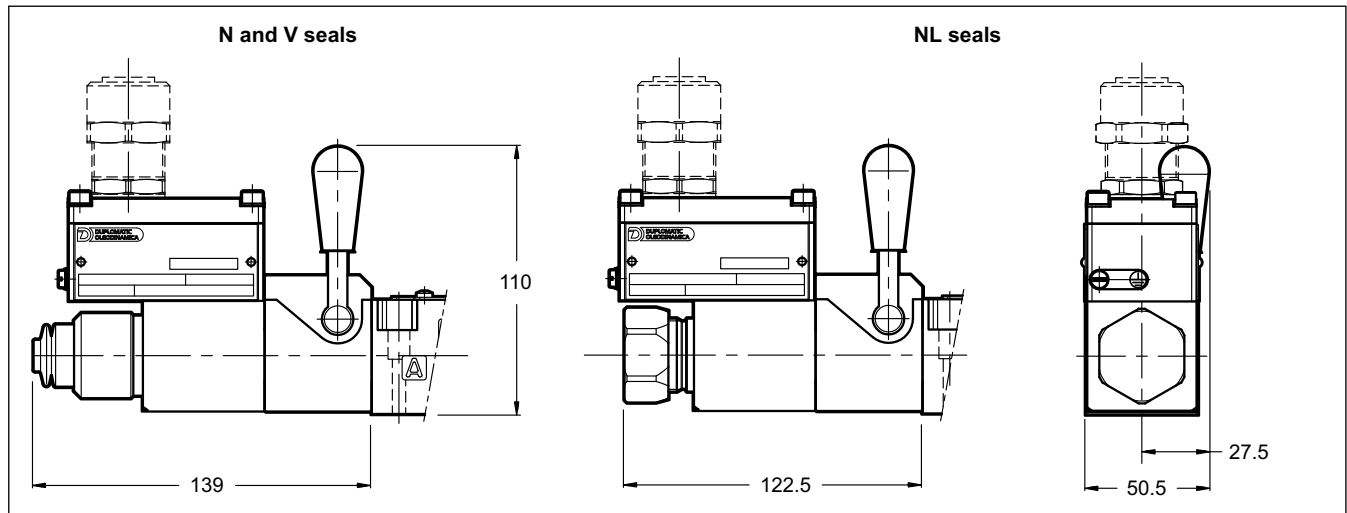
When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosening. Available for DC valves only.

Spanner: 3 mm



### 18.3 - CH - Lever manual override

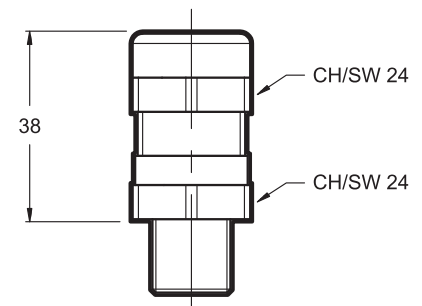
The seals choice leads the type of the standard ring nut to be mounted. The lever device is always placed at valve side A.



### 19 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for  $\varnothing 8 \div 10$  mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range:  $-70\text{ }^{\circ}\text{C} \div +220\text{ }^{\circ}\text{C}$
- protection degree: IP66/IP68



To order the desired cable glands, specify description, code and quantity.

**Description: CGK2/NB-01/10**

**Code: 3908108001**

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque:  $45 \div 50$  Nm

**Description: CGK2/NB-02/10**

**Code: 3908108002**

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque:  $20 \div 25$  Nm

**Description: CGK2/NB-03/10**

**Code: 3908108003**

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Tightening torque:  $20 \div 25$  Nm

**Description: CGK2/NB-04/10**

**Code: 3908108004**

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with copper washer, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Tightening torque:  $45 \div 50$  Nm



## 20 - ELECTRONIC CONTROL UNITS

### DSE3K\* - \*\* SA

### DSE3K\* - \*\* SB

EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

**NOTE:** electronic control units offered are not explosion proof certified; therefore, they must be installed outside the classified area.

### DSE3K\* - A\*

### DSE3K\* - C\*

EDM-M212	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M242	for solenoid 12V DC		

### DSPE\*K\* - \*\* SA

### DSPE\*K\* - \*\* SB

EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M141	for solenoid 12V DC		

### DSPE\*K\* - A\*

### DSPE\*K\* - C\*

EDM-M211	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M241	for solenoid 12V DC		

## 21 - SUBPLATES

(see catalogue 51 000)

	DS3K*	DSP5K*	DSP7K*	DSP8K*
Type with rear ports	PMMD-AI3G	PME4-AI5G	PME07-AI6G	-
Type with side ports	PMMD-AL3G	PME4-AL5G	PME07-AL6G	PME5-AL8G
P, T, A, B ports dimensions	3/8" BSP	3/4" BSP	1" BSP	1 1/2" BSP
X, Y ports dimensions	-	1/4" BSP	1/4" BSP	1/4" BSP

**NOTE:** Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a rate higher than the value allowed by norms according to ATEX directive for category II 2GD and I M2.

The user will bear to do the complete assessment of the ignition risk that can occur from the relative use in potentially explosive environments.



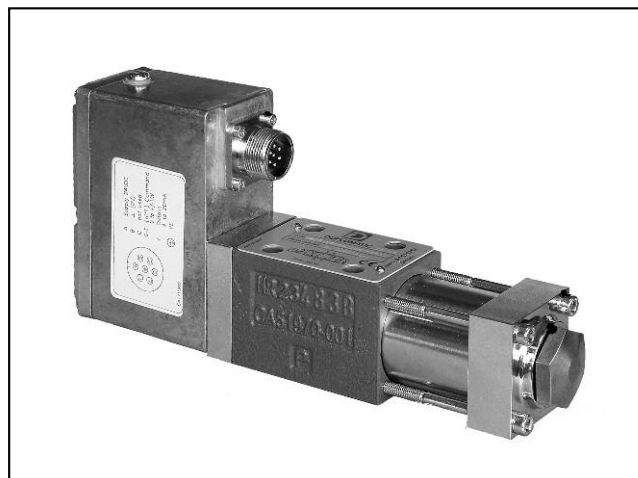
**DIPLOMATICO OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

www.diplomatic.com • e-mail: sales.exp@diplomatic.com



# DXJ3

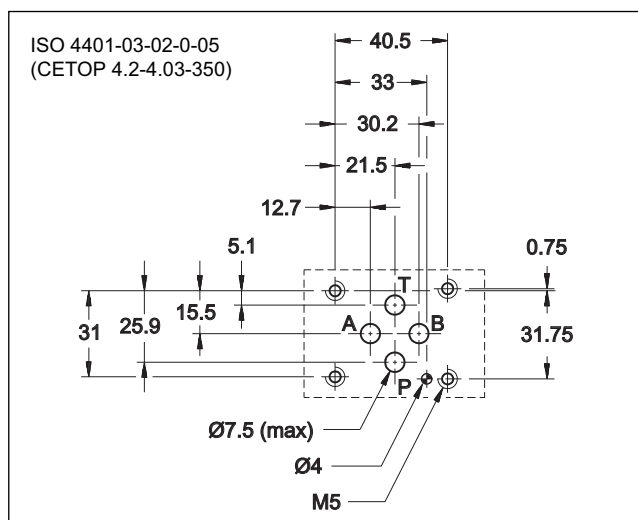
## ELECTRO-HYDRAULIC SERVOVALVE WITH INTEGRATED ELECTRONICS SERIES 10

### SUBPLATE MOUNTING ISO 4401-03 (CETOP 03)

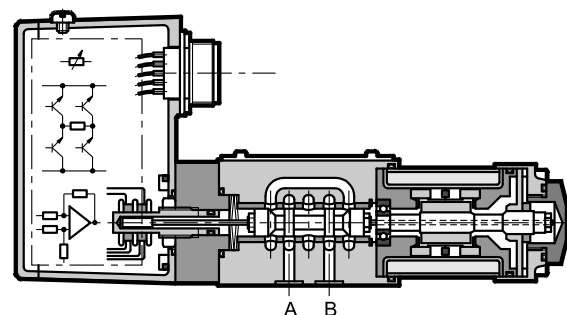
**p** max **350** bar

**Q** max (see performances table)

### MOUNTING SURFACE



### OPERATING PRINCIPLE



— The DXJ3 valve is a four-way servo-proportional valve where the spool moves inside a sleeve. This valve has a direct drive with a linear force motor resulting in high dynamic performances which are independent of system pressure. The spool position is controlled by a linear transducer (LVD) with closed loop which ensures high precision and repeatability.

### PERFORMANCES (with mineral oil of viscosity 36 cSt at 50°C)

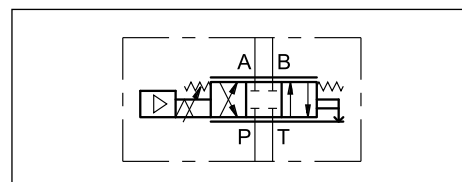
Maximum operating pressure Ports P - A - B Port T	bar	350 50
Rated flow Q nom (with $\Delta p$ 70 bar P - T)	l/min	5 - 10 - 20 - 40
Null leakage flow (with $p = 140$ bar)	l/min	$\leq 3\%$ of Q nom
Hysteresis	% In	$< 0,2$
Threshold	% In	$< 0,1$
Thermal drift (with $\Delta T = 50^\circ\text{C}$ )	% In	$< 1,5$
Response time	ms	$\leq 12$
Vibration on the three axes	g	30
Electric features	see paragraph 3	
Protection degree according CEI EN 60529	IP 65	
Ambient temperature range	$^\circ\text{C}$	-20 / +60
Fluid temperature range	$^\circ\text{C}$	-20 / +80
Fluid viscosity range	cSt	5 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)	
Recommended viscosity	cSt	25
Mass	kg	2,5

— It is available in four different flow rate control ranges up to 40 l/min, with spools with zero overlap and a mounting surface in compliance with ISO 4401 (CETOP RP 121H) standards.

— The valve is featured by integrated electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment other than the possible electronic regulation of the zero.

— Suitable for control applications with closed loop of position, velocity and pressure. With a loss of power or with a zero reference signal, the spool goes automatically at rest-position. In this position the valve has a minimum leakage, depending on the operating pressure (see the performances table).

### HYDRAULIC SYMBOL

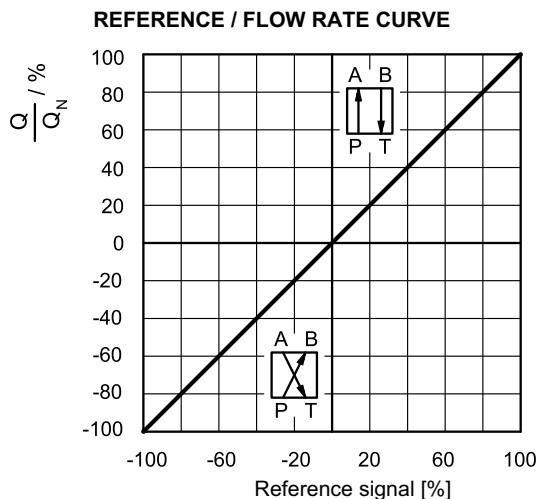




### 1 - IDENTIFICATION CODE

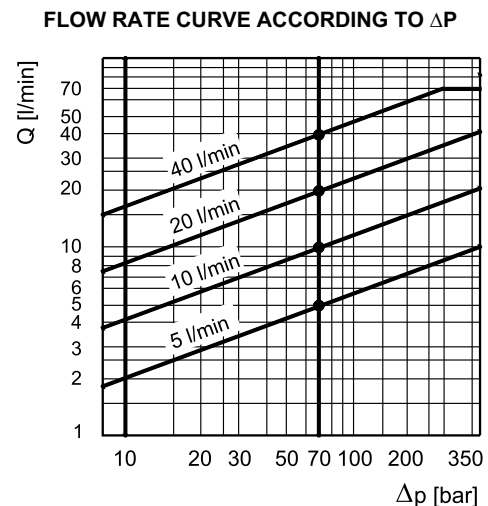
D	X	J	3	-	D	0	L		/	10		/	E0	K11
Servo-proportional valve with bushing spool		Integrated electronics and position feedback		Rated size ISO 4401-03 (CETOP 03)		Symmetric spool		Spool with zero overlap		Spool with a linear flow rate curve		6 + PE pole connector		
Reference signal: ±10V (other signals available on request)														
Seals: N = NBR seals for mineral oil (standard) V = FPM seals for special fluids														
Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)														
Rated flow (with p = 70 bar P - T)														
05 = 5 l/min    20 = 20 l/min														
10 = 10 l/min    40 = 40 l/min														

### 2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

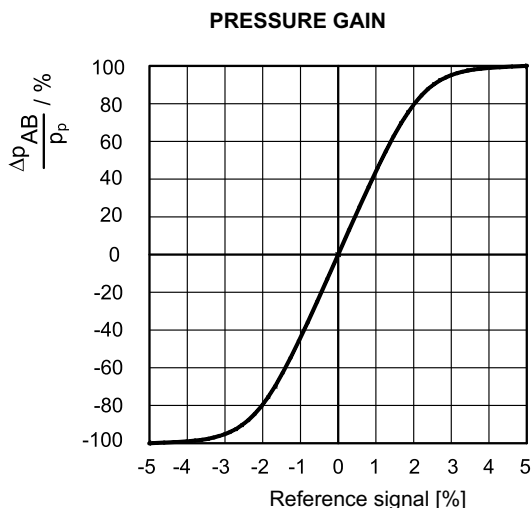


Typical flow rate curves at constant  $\Delta p = 70$  bar P-T according to the reference signal.

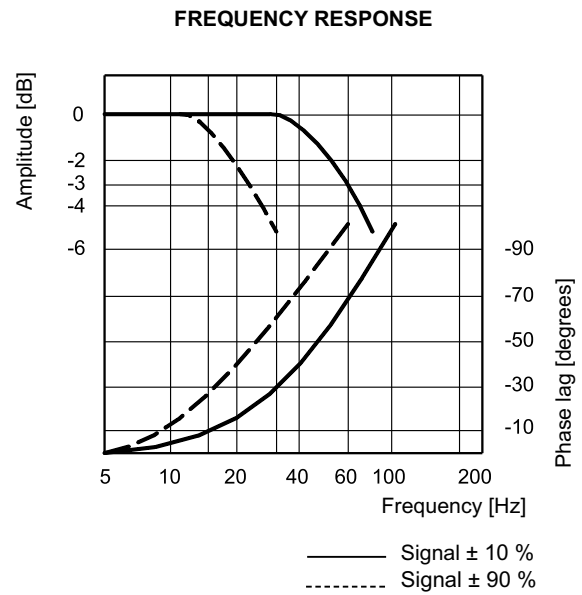
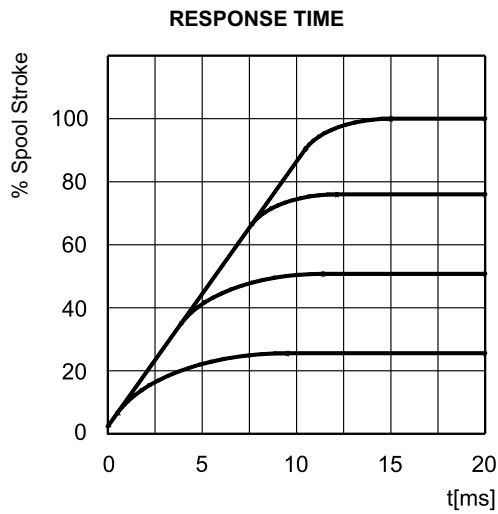
**NOTE:** with positive reference signal connected to pin D the valve regulates P - A / B - T.



The diagram states the maximum valve controlled flow rate according to the pressure drop between the P and T ports.

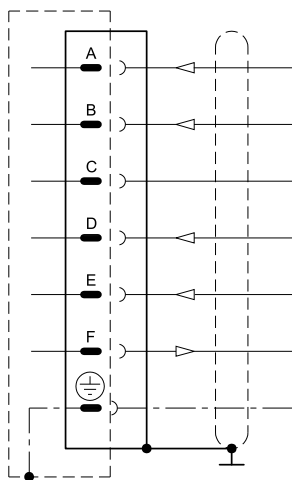


The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B ( $\Delta p_{AB}$ ) and the P system pressure, according to the reference signal. In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.



### 3 - ELECTRICAL FEATURES

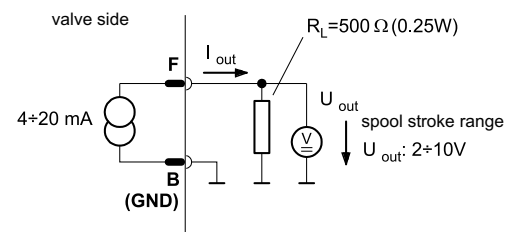
#### CONNECTION WIRING



Pin	Values	Function	NOTES
A	24 VDC	Supply	From 19 to 32 VDC $I_{A\text{ MAX}} = 1,2\text{ A}$
B	0 V	Signal ground	0 V
C	----	Not used	----
D	$\pm 10\text{ V}$	Input rated command	$R_e = 10\text{ k}\Omega$ (see <b>NOTE 1</b> )
E	0 V	Input rated command	----
F	$4 \div 20\text{ mA}$	Spool position	$R_L = \text{from } 300 \text{ to } 500\ \Omega$ (see <b>NOTE 2</b> )
PE	----	Protective earth	----

**NOTE 1:** The input stage is a differential amplifier. With positive reference signal connected to pin D, valve opening P - A e B - T is achieved. With a zero reference signal the spool is in centred position. The spool stroke is proportional to  $U_D - U_E$ . If only one command signal is available (single-end), pin E must be connected to pin B (0V ground).

**NOTE 2:** The spool position value can be measured at pin F (see diagram right). The position signal output goes from 4 to 20 mA. The centered position is at 12 mA, while 20 mA corresponds to 100% valve opening P - A and B - T. This monitoring allows to detect a cable break when  $I_F = 0\text{V}$ .



#### General requirements:

- External fuse = 1,6 A
- Minimum cross-section of all leads  $\approx 0,75\text{ mm}^2$
- When making electric connections to the valve (shield, protective earth) appropriate measures must be taken to ensure that locally different earth potentials do not results in excessive ground currents.
- The differential and the spool position signal lines must be connected to the mating connector housing at valve side and to the 0V (signal ground) at cabinet side.
- **EMC:** meets the requirements of EN 55011:1998, class B, and the immunity regulation according to EN 61000-6-2:1998

### 4 - HYDRAULIC FLUIDS

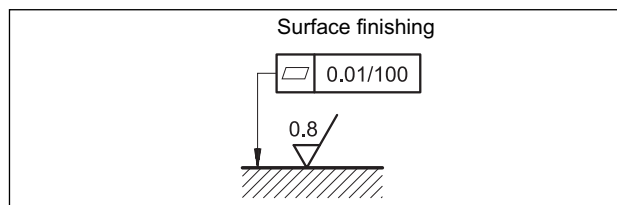
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

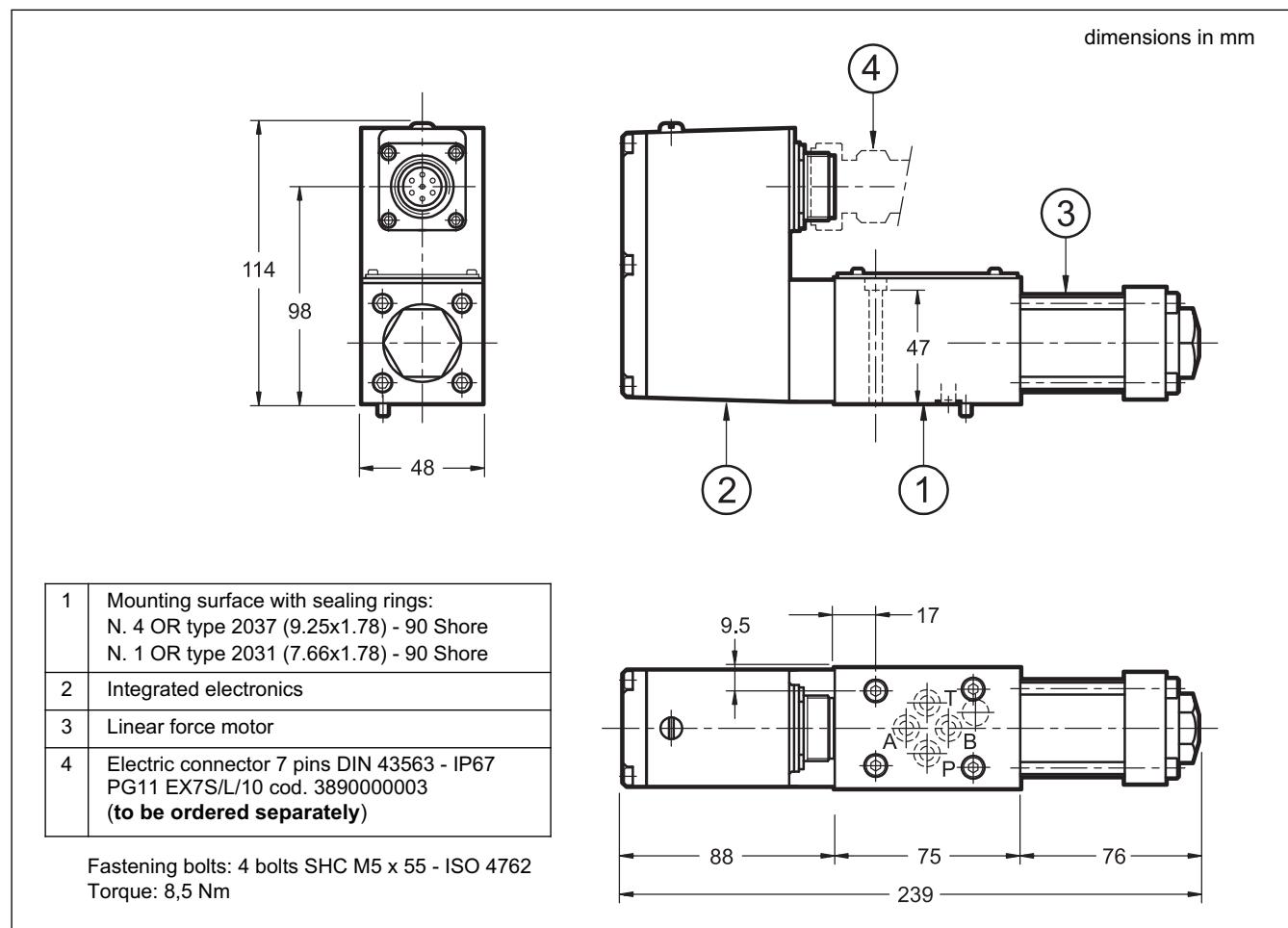
### 5 - INSTALLATION

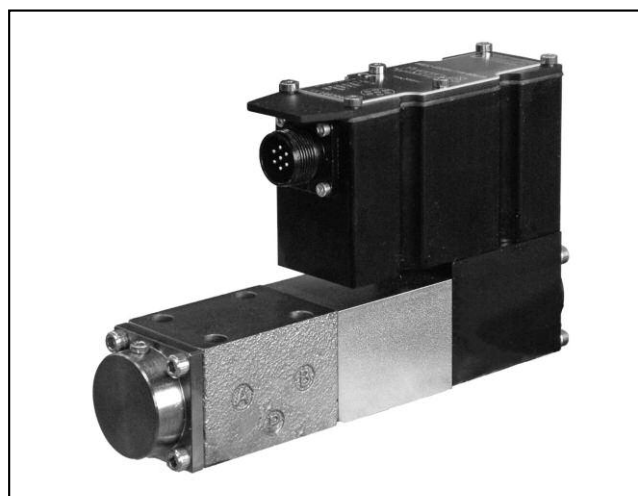
The DXJ3 valve can be installed in any position without impairing its correct operation.

The valve is fixed by means of screws on a flat surface with planarity between 0,01 mm over 100 mm and roughness  $R_a < 0,8 \mu m$ . If the minimum values are not observed, the fluid can easily leak between the valve and the mounting surface. While mounting pay attention to the environment and valve cleanliness.



### 6 - OVERALL AND MOUNTING DIMENSIONS





# DXE3J

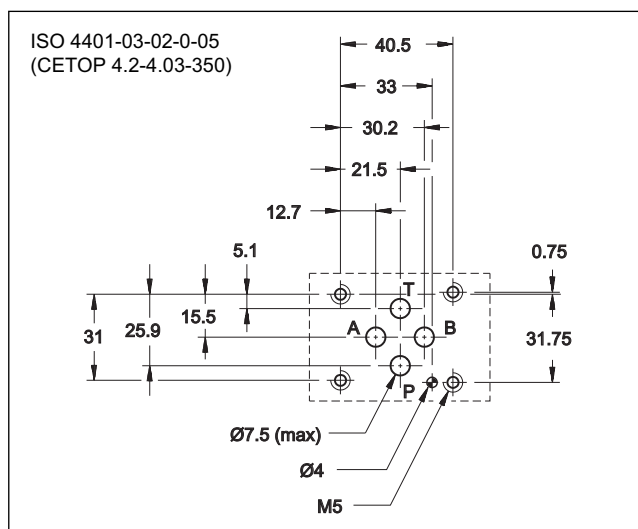
## HIGH RESPONSE SERVO-PROPORTIONAL VALVE WITH FEEDBACK AND INTEGRATED ELECTRONICS SERIES 31

### SUBPLATE MOUNTING ISO 4401-03

**p** max **350** bar

**Q** max **70** l/min

### MOUNTING INTERFACE



### PERFORMANCES

(with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure Ports P - A - B Port T	bar	350 250
Rated flow Q nom (with $\Delta p$ 70 bar P - T)	l/min	1 - 2 - 5 - 10 - 20 - 40
Hysteresis	% In	< 0,2
Threshold	% In	< 0,1
Thermal drift (with $\Delta T = 40$ °C)	% In	< 1,0
Response time (0-100%)	ms	≤ 10
Vibration on the three axes	g	30
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	5 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)	
Recommended viscosity	cSt	25
Mass	kg	2,6

### OPERATING PRINCIPLE

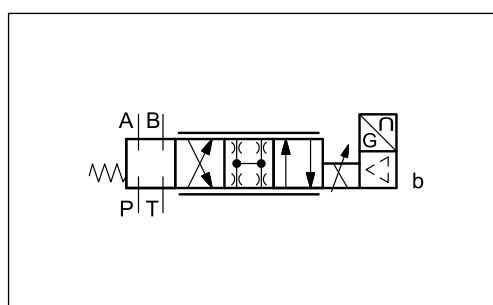
— The DXE3J valve is a four-way (3 + fail-safe position) servo-proportional valve where the spool moves inside a sleeve. It is operated by a proportional solenoid highly dynamic, which achieves high performance and not requires pilot pressure. The spool position is controlled by a linear transducer (LVDT) in closed loop which ensures high precision and repeatability.

— It is available in six different flow ranges up to 40 l/min, with spools with zero overlap.

— The valve is featured by integral electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment other than the possible electronic regulation of the zero.

— Suitable for control applications with closed loop of position, velocity and pressure. With a power down or without the enable input, the spool moves automatically at fail-safe position.

### HYDRAULIC SYMBOL



## 1 - IDENTIFICATION CODE

<b>D</b>	<b>X</b>	<b>E</b>	<b>3</b>	<b>J</b>	<b>-</b>	<b>LZ</b>		<b>/</b>	<b>31</b>	<b>-</b>	<b>K11</b>	
Servo-proportional valve with spool in sleeve							Pin C function: <b>A</b> = external enable <b>B</b> = internal enable <b>C</b> = 0V monitor					
Electric proportional control							6 + PE pole connector					
Size ISO 4401-03							Command value: <b>E0</b> = voltage $\pm 10$ V <b>E1</b> = current $4 + 20$ mA					
On-board electronic and position feedback							Seals: <b>N</b> = NBR seals for mineral oil ( <b>standard</b> ) <b>V</b> = FPM seals for special fluids					
Spools with linear flowrate curve <b>LZ</b> = zero overlap for low leakage ( <b>standard</b> )							Series No. (from 30 to 39 sizes and mounting dimensions remain unchanged)					
Rated flow (with $\Delta p = 70$ bar P - T) <b>01</b> = 1 l/min <b>10</b> = 10 l/min <b>02</b> = 2 l/min <b>20</b> = 20 l/min <b>05</b> = 5 l/min <b>40</b> = 40 l/min												
Fail safe type <b>F1</b> = closed centre <b>F3</b> = float <b>FC</b> = cross centre												

## 2 - SPOOLS

The diagrams illustrate three solenoid valve configurations and their fail-safe positions:

- F1:** A 3/2-way valve with ports A, B, P, and T. The fail-safe position is indicated by a dashed box.
- F3:** A 3/2-way valve with ports A, B, P, and T. The fail-safe position is indicated by a dashed box.
- FC:** A 3/2-way valve with ports A, B, P, and T. The fail-safe position is indicated by a dashed box.

## FAIL SAFE POSITION

When a power failure occurs, the electronics de/energize the solenoid and the spool will take the fail safe position by spring return.

leakage flow in fail safe position at 100 bar [cm <sup>3</sup> /min]		
<b>F1</b>	P → A	20
	P → B	30
	A → T	30
	B → T	30
<b>F3</b>	P → A	20
	P → B	30

flow rate	fail safe type		
	F1	F3	FC
<b>01</b>	■	-	-
<b>02</b>	■	-	-
<b>05</b>	■	■	-
<b>10</b>	■	■	-
<b>20</b>	■	■	■
<b>40</b>	■	■	■

■ available - not available

## 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

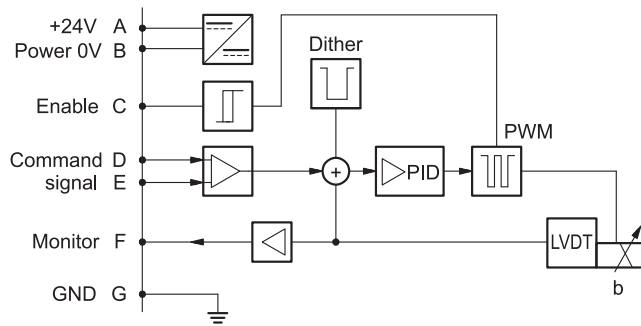
## 4 - ELECTRICAL CHARACTERISTICS

### 4.1 - Electrical on board electronics

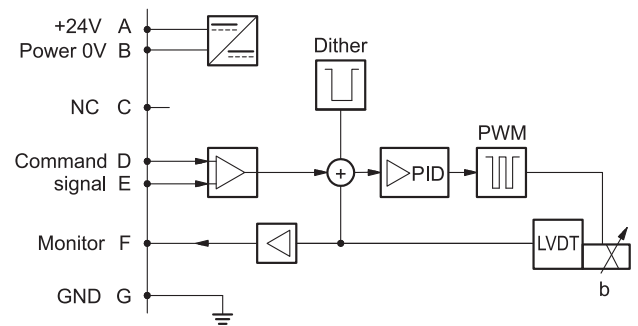
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 35 VDC), ripple max 3 Vpp
Power consumption	VA	35
Maximum solenoid current	A	2.6
Fuse protection, external		(fast), max current 4A
Command signals:	voltage (E0) current (E1)	V DC mA
Monitor signals:	voltage (E0) current (E1)	V DC mA
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC)		According to 2014/30/EU standards (testing accordingly: IEC 61000-6-2, IEC 61000-6-4, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8)

### 4.2 - On-board electronics diagrams

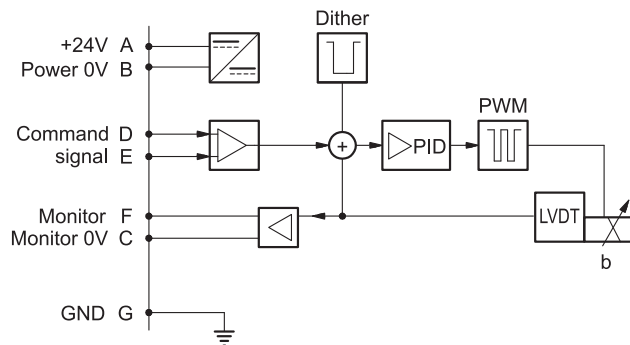
#### VERSION A - External Enable



#### VERSION B - Internal Enable

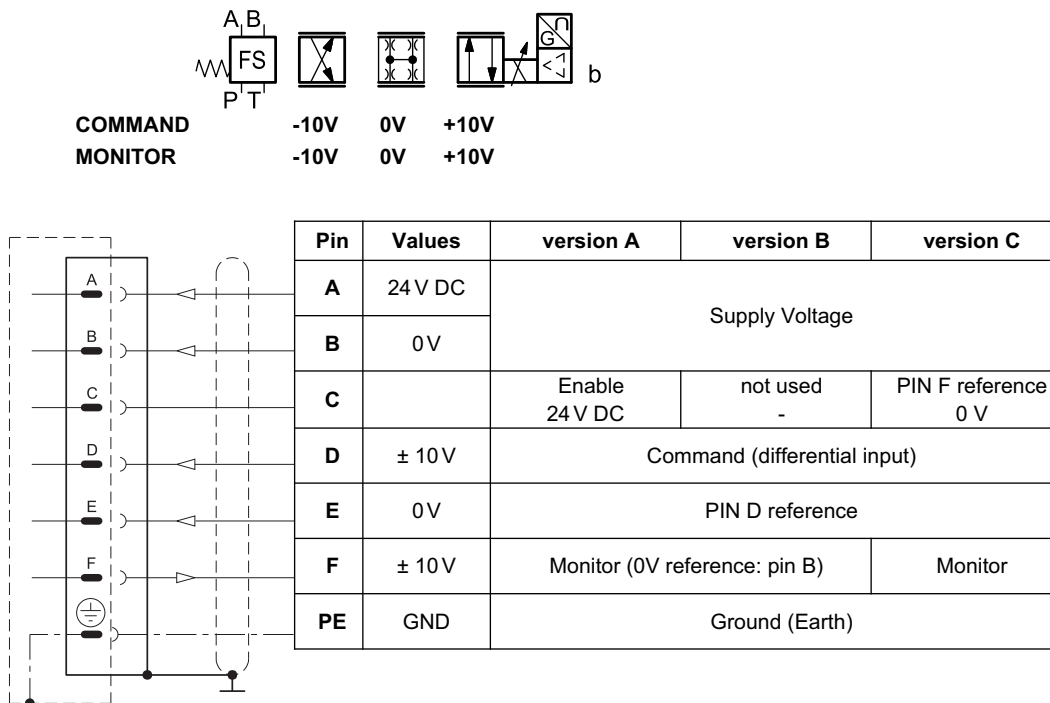


#### VERSION C - 0V Monitor



## 5 - VERSIONS WITH VOLTAGE COMMAND (E0)

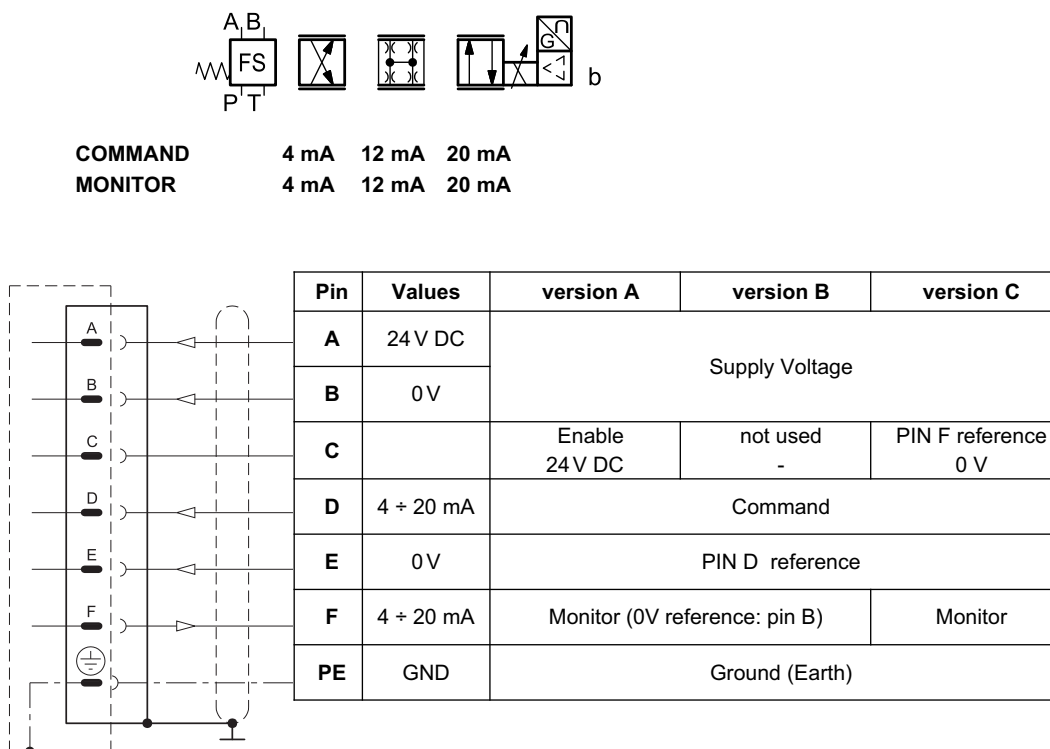
The reference signal must be between -10V and +10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 6 - VERSIONS WITH CURRENT COMMAND (E1)

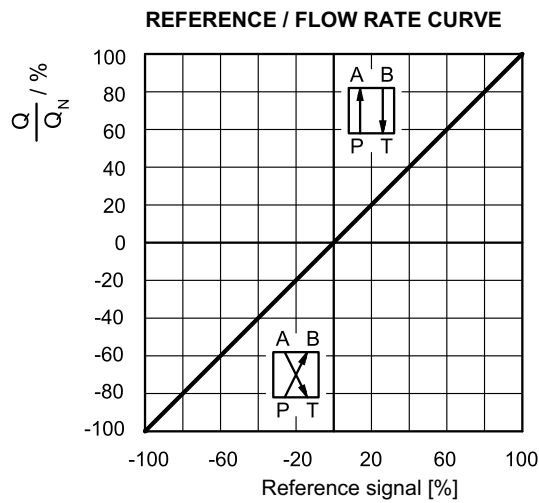
The reference signal is supplied in current  $4 \div 20$  mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



### 7 - CHARACTERISTIC CURVES

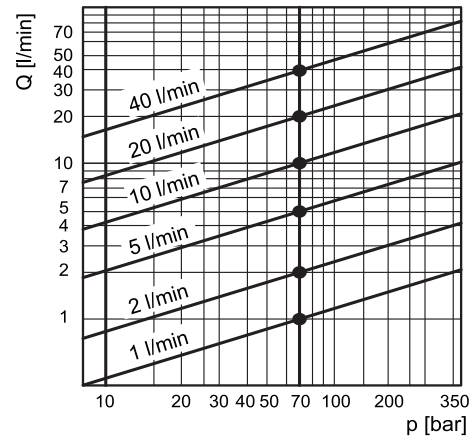
(measured with viscosity of 36 cSt at 50°C)



Typical flow rate curves at constant  $\Delta p = 70$  bar P-T according to the reference signal.

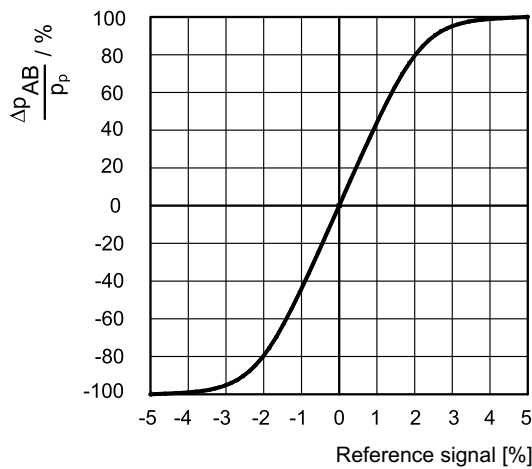
**NOTE:** with positive reference signal connected to pin D the valve regulates P - A / B - T.

**FLOW RATE CURVE ACCORDING TO  $\Delta p$**



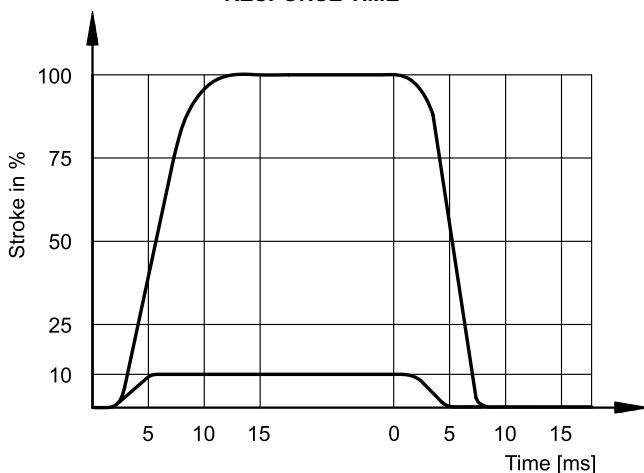
The diagram states the maximum valve controlled flow rate according to the pressure drop between the P and T ports.

**PRESSURE GAIN (LZ)**



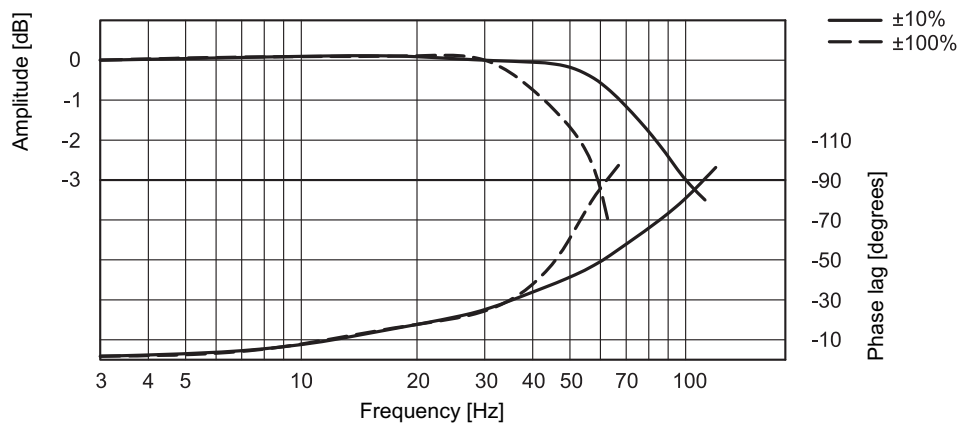
The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B ( $\Delta p_{AB}$ ) and the P system pressure, according to the reference signal. In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

**RESPONSE TIME**

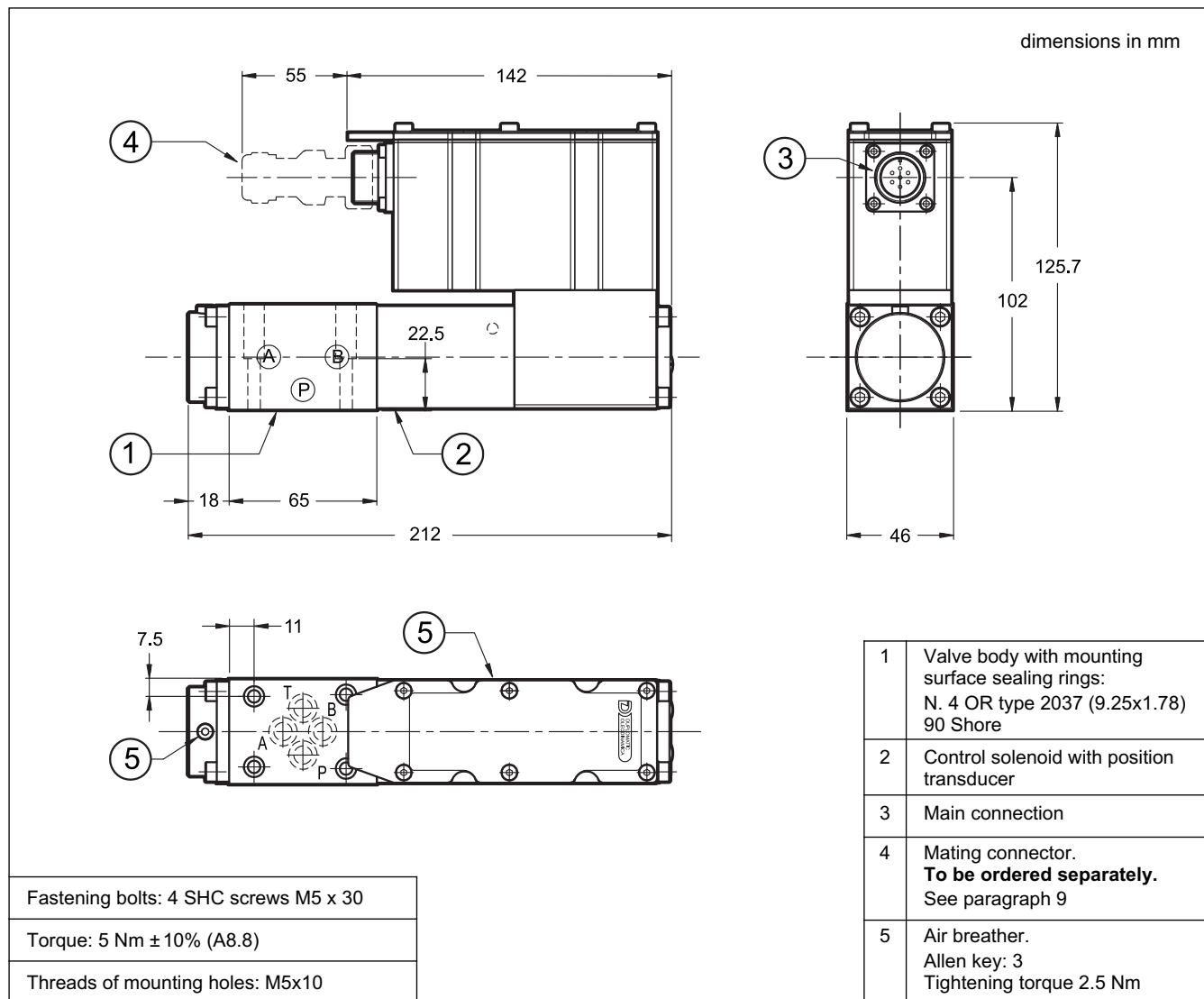




## FREQUENCY RESPONSE



## 8 - OVERALL AND MOUNTING DIMENSIONS

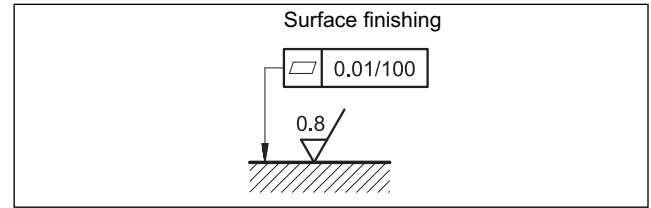


## 9 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Take care to the cleanliness of mounting surfaces and surrounding environment upon installation.



## 10 - ACCESSORIES

(to be ordered separately)

### 10.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

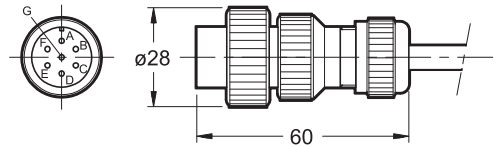


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 10.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 10.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 11 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP



**DXE3J**  
SERIES 31

**DUPLOMATIC**  
MOTION SOLUTIONS

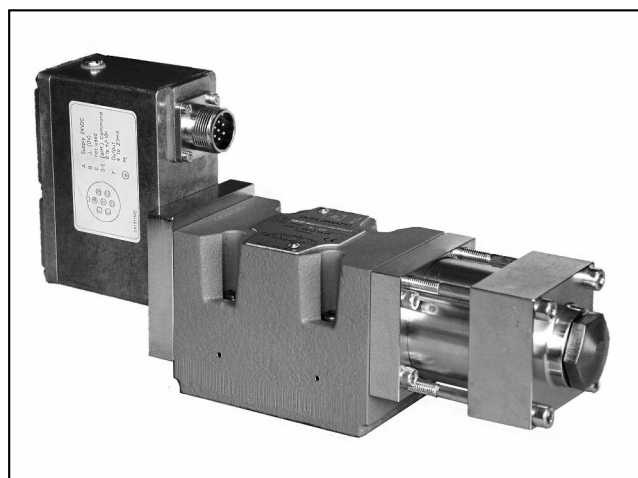
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaolini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

[www.duplomatic.com](http://www.duplomatic.com) • e-mail: [sales.exp@duplomatic.com](mailto:sales.exp@duplomatic.com)



# DXJ5

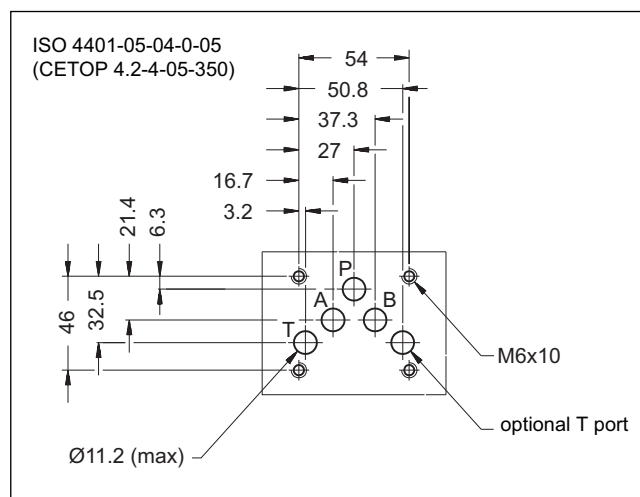
## ELECTRO-HYDRAULIC SERVOVALVE WITH INTEGRATED ELECTRONICS SERIES 10

### SUBPLATE MOUNTING ISO 4401-05 (CETOP R05)

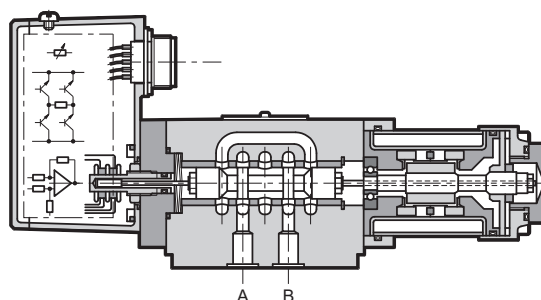
**p** max **350** bar

**Q** max (see performances table)

### MOUNTING SURFACE



### OPERATING PRINCIPLE



— The DXJ5 is a four-way servo-proportional valve where the spool moves inside a sleeve. This valve has a direct drive with a linear force motor resulting in high dynamic performances independent of system pressure. A linear transducer (LVDT) with closed loop controls the spool position, ensuring high precision and repeatability.

### PERFORMANCES (with mineral oil of viscosity 36 cSt at 50°C)

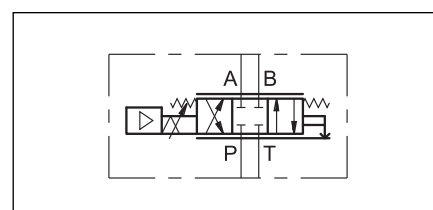
Maximum operating pressure Ports P - A - B Port T	bar	350 50
Rated flow Q nom (with $\Delta p$ 70 bar P - T)	l/min	60 ÷ 100
Null leakage flow (with p=140 bar)	l/min	≤ 3% of Q nom
Hysteresis	% In	< 0,2
Threshold	% In	< 0,1
Thermal drift (with $\Delta T$ = 50°C)	% In	< 1,5
Response time	ms	≤ 20
Vibration on the three axes	g	30
Electric features	see paragraph 3	
Protection degree according CEI EN 60529	IP 65	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	5 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)	
Recommended viscosity	cSt	25
Mass	kg	6,3

— It is available in four different flow rate control ranges up to 100 l/min, with spools with zero overlap and a ISO 4401 (CETOP RP 121H) mounting surface.

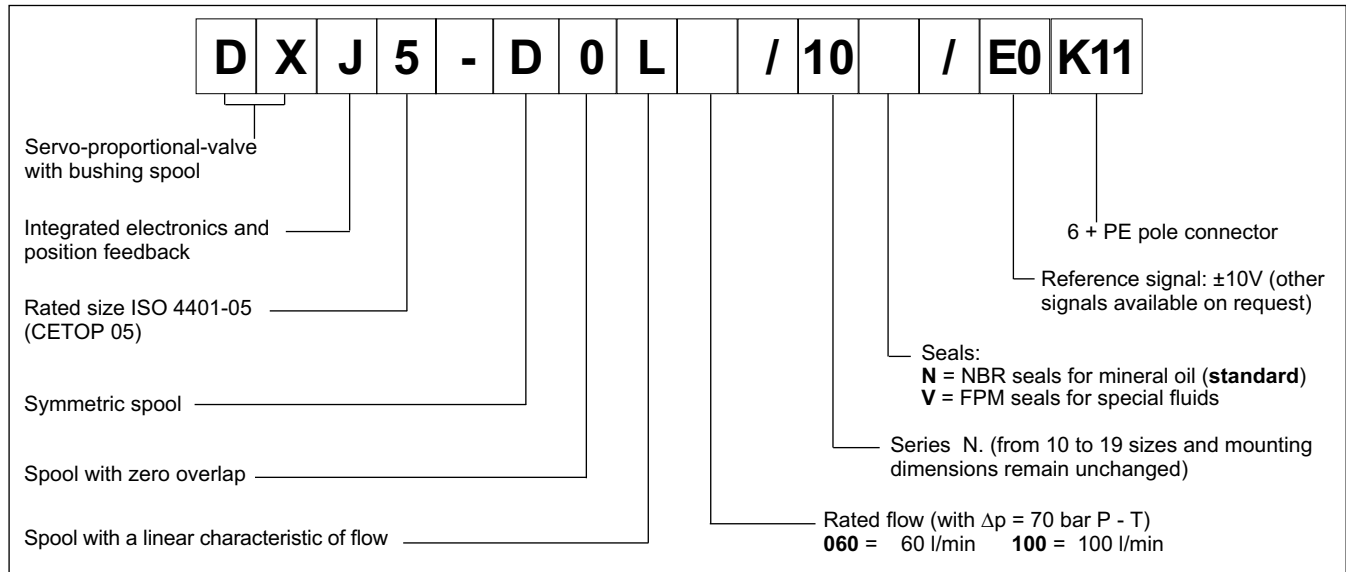
— The valve is featured by integrated electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment other than the possible electronic regulation of the zero.

— Suitable for control applications with closed loop of position, velocity and pressure. With a loss of power or with a zero reference signal, the spool goes automatically at rest-position. In this position the valve has a minimum leakage, depending on the operating pressure (see the performances table).

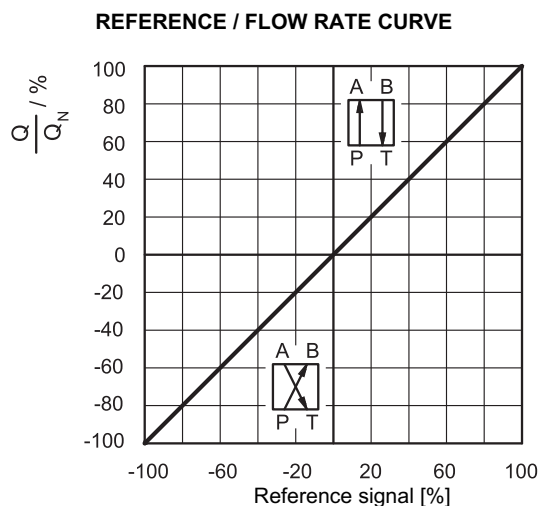
### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE

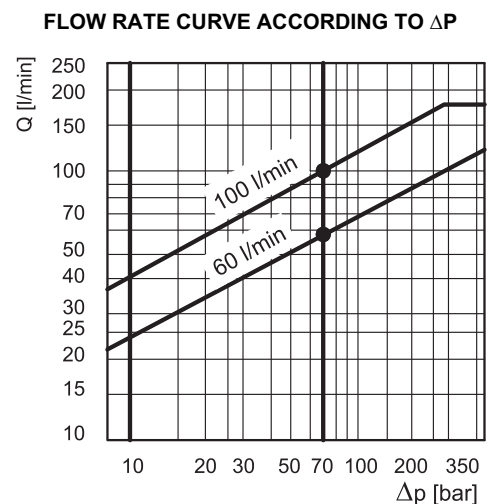


### 2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

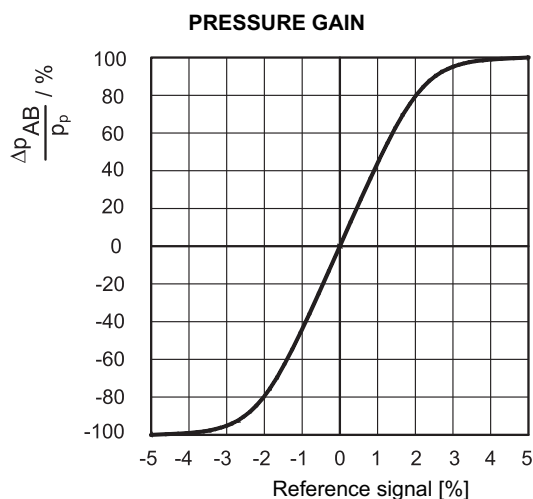


Typical flow rate curves at constant  $\Delta p = 70$  bar P-T according to the reference signal.

**NOTE:** with positive reference signal connected to pin D the valve regulates P - A / B - T.

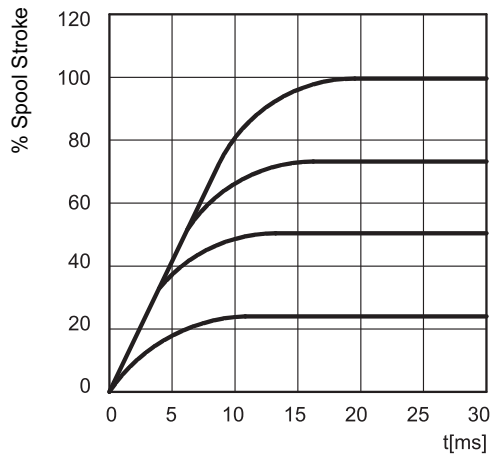


The diagram states the maximum valve controlled flow rate according to the pressure drop between the P and T ports.

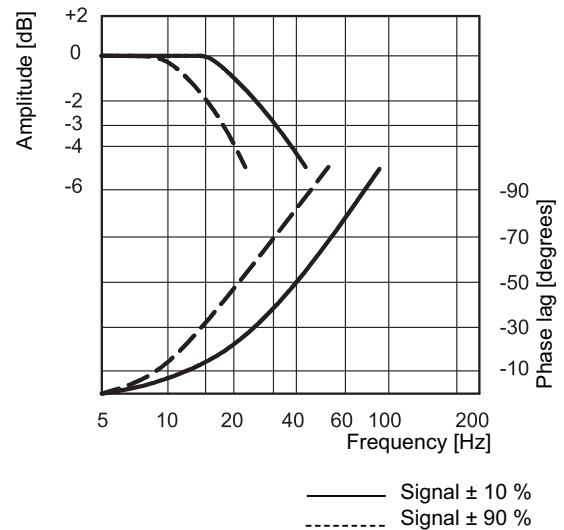


The diagram on the left shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B ( $\Delta p_{AB}$ ) and the P system pressure, according to the reference signal. Practically, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

### STEP RESPONSE

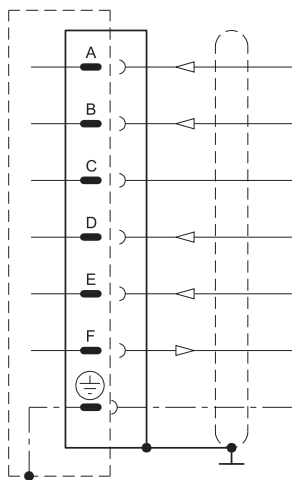


### FREQUENCY RESPONSE



## 3 - ELECTRICAL FEATURES

### CONNECTION WIRING



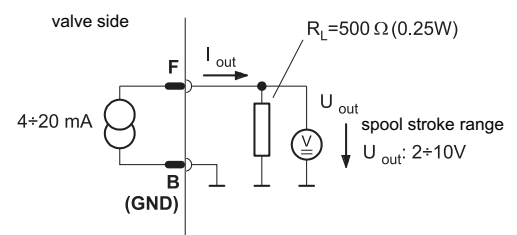
Pin	Values	Function	NOTES
A	24 VDC	Supply	From 19 to 32 VDC $I_{A \text{ MAX.}} = 2,2 \text{ A}$
B	0 V	Signal ground	0 V
C	----	Not used	----
D	$\pm 10 \text{ V}$	Input rated command	$R_e = 10 \text{ k}\Omega$ (see <b>NOTE 1</b> )
E	0 V	Input rated command	----
F	$4 \div 20 \text{ mA}$	Spool position	$R_L = \text{from } 300 \text{ to } 500 \Omega$ (see <b>NOTE 2</b> )
PE	----	Protective earth	----

**NOTE 1:** The input stage is a differential amplifier. With positive reference signal connected to pin D, valve opening P - A e B - T is achieved. With a zero reference signal the spool is in centred position. The spool stroke is proportional to  $U_D - U_E$ . If only one command signal is available (single-end), pin E must be connected to pin B (0V ground).

**NOTE 2:** The spool position value can be measured at pin F (see diagram right). The position signal output goes from 4 to 20 mA. The centered position is at 12 mA, while 20 mA, corresponds to 100% valve opening P - A and B - T. This monitoring allows to detect a cable break when  $I_F = 0\text{V}$ .

### General requirements:

- External fuse = 2,5 A
- Minimum cross-section of all leads  $\approx 0,75 \text{ mm}^2$
- When making electric connections to the valve (shield, protective earth) appropriate measures must be taken to ensure that locally different earth potentials do not results in excessive ground currents.
- The differential and the spool position signal lines must be connected to the mating connector housing at valve side and to the 0V (signal ground) at cabinet side.
- **EMC:** meets the requirements of EN 55011:1998, class B, and the immunity regulation according to EN 61000-6-2:1998

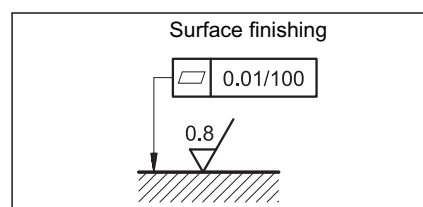


### 4 - HYDRAULIC FLUIDS

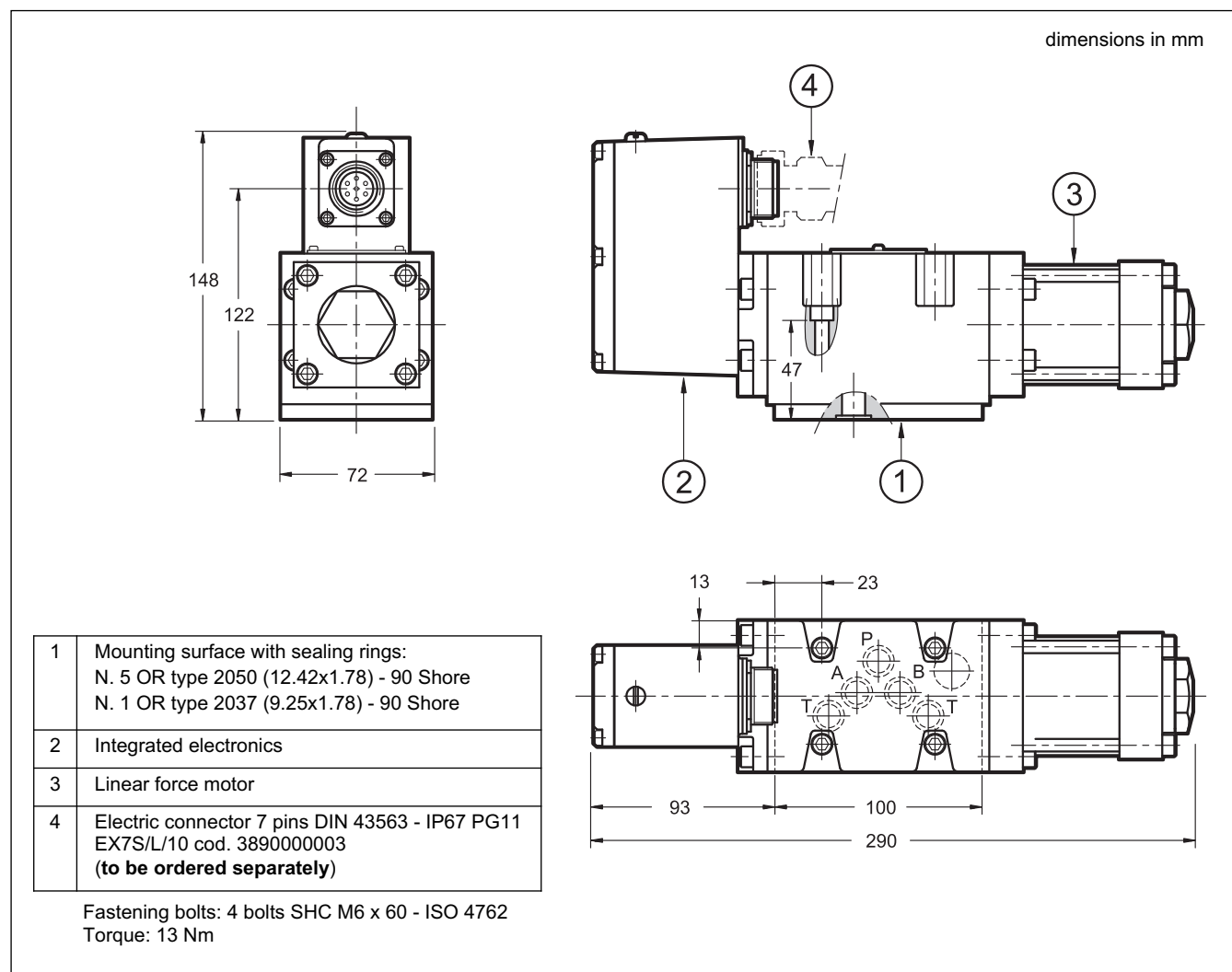
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

### 5 - INSTALLATION

The DXJ5 valve can be installed in any position without impairing its correct operation. The valve is fixed by means of screws on a flat surface with planarity between 0,01 mm over 100 mm and roughness  $R_a < 0,8 \mu\text{m}$ . If the minimum values are not observed, the fluid can easily leak between the valve and the mounting surface. While mounting pay attention to the environment and valve cleanliness.



### 7 - OVERALL AND MOUNTING DIMENSIONS





# DXPE\*J

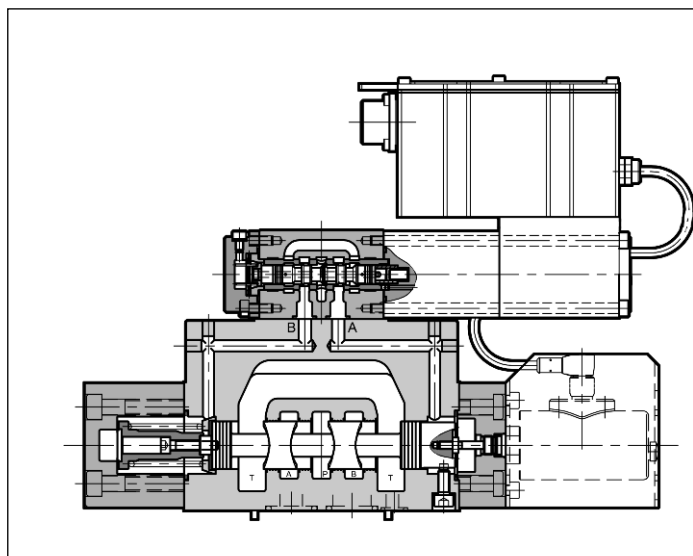
## DIRECTIONAL CONTROL VALVE PILOT OPERATED, WITH OBE AND FEEDBACK SERIES 31

### SUBPLATE MOUNTING

DXPE5J	CETOP P05
DXPE5RJ	ISO 4401-05
DXPE7J	ISO 4401-07
DXPE8J	ISO 4401-08

**p** max (see performance table)  
**Q** max (see performance table)

### OPERATING PRINCIPLE



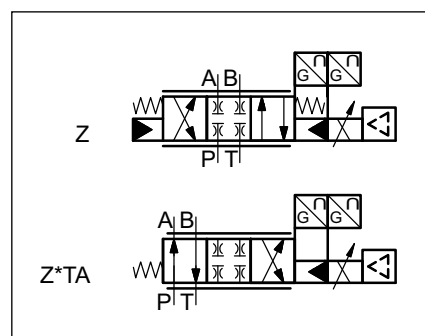
- DXPE\*J are directional control valves operated by a servo-proportional pilot, with mounting surface compliant with ISO 4401 standards.
- The spool position is controlled by a linear transducer LVDT in closed loop, which ensures high precision and repeatability. In the event of switch-off or inactive electronics the main spool is set to a fail-safe position by springs.
- The valve is featured by integral electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment.
- The valve is easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 15.3).

### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		DXPE5J DXPE5RJ	DXPE7J	DXPE8J
Max operating pressure: P - A - B ports T - X - Y ports	bar	350 250		
Controlled flow with $\Delta p$ 10 bar P-T	l/min	100	220	400
Hysteresis	% Q max	< 0,2%		
Repeatability	% Q max	$\pm 0,1\%$		
Electrical characteristics		see paragraph 3		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree		according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)		
Recommended viscosity	cSt	25		
Mass	kg	8	10,5	17

### HYDRAULIC SYMBOLS (typical)







## 1 - IDENTIFICATION CODE

D	X	P	E		J	-			/	31	-			/		K11	
---	---	---	---	--	---	---	--	--	---	----	---	--	--	---	--	-----	--

Proportional directional valve with high-response pilot

Nominal size: \_\_\_\_\_  
**5** = CETOP P05  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08

Digital integrated electronics for valves with feedback

Spool type: \_\_\_\_\_  
**Z\*** = zero overlap  
**Z\*TA** = zero overlap  
See paragraph 2 for operation and available flow rates.  
Other spool types (C, A.. ) are available upon request.

Option:  
/ **W7** = Zinc-nickel surface treatment  
Omit if not required. (see par. 1.1)

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector:  
6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10V$   
**E1** = current  $4 \div 20$  mA

Drainage: **I** = internal  
**E** = external

Piloting: **I** = internal  
**E** = external

Seals:  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Series No.  
(the overall and mounting dimensions remain unchanged from 30 to 39)

### 1.1 - Surface treatments

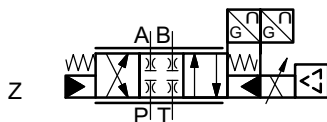
The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to **600** hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

## 2 - AVAILABLE CONFIGURATIONS

The valve configuration depends on the combination of spool type and rated flow.

### 3 positions with spring centering

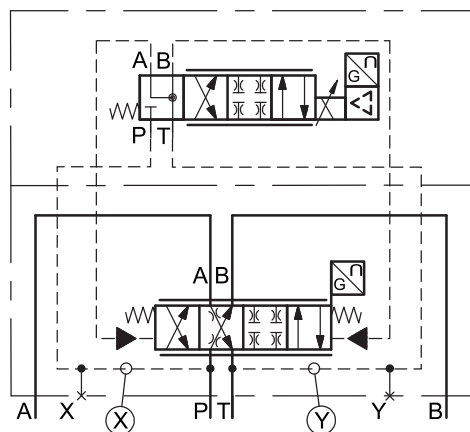


valve type	Z*	Controlled flow with $\Delta p$ 10 bar P-T
DXPE5J DXPE5RJ	100	100 l/min
DXPE7J	120	120 l/min
	220	220 l/min
DXPE8J	250	250 l/min
	400	400 l/min

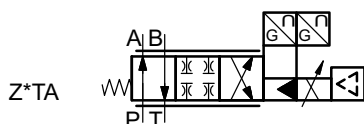
### OFFSET POSITION

After electrical switch-off or Enable signal switch-off (version K11A) the main spool moves to springs offset position, with limited opening (1%...6% of main spool stroke in direction P-B / A-T)

detailed symbol



### 3 positions with spring offset

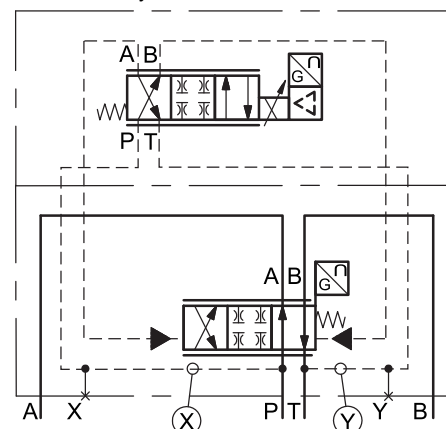


valve type	Z*TA	Controlled flow with $\Delta p$ 10 bar P-T
DXPE5J DXPE5RJ	100	100 l/min
DXPE7J	120	120 l/min
	220	220 l/min
DXPE8J	250	250 l/min
	400	400 l/min

### FAIL SAFE POSITION

After electrical switch-off or Enable signal switch-off (version K11A) the main spool moves by spring to the fail-safe position P - A / B -T, wide open.

detailed symbol





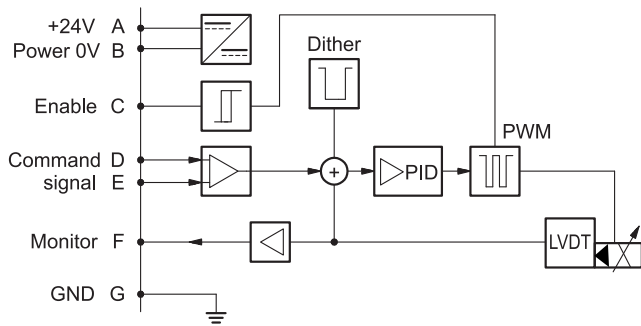
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

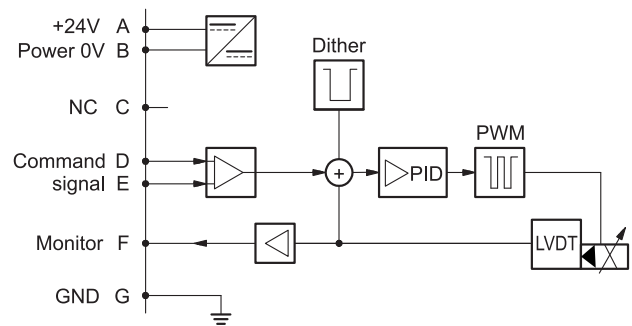
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	35
Maximum solenoid current	A	2.6
Fuse protection, external		fast, max current 4A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_i > 11 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_i = 58 \text{ }\Omega$ )
Monitor signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_o > 1 \text{ k}\Omega$ ) $4 \div 20$ (Impedance $R_o = 500 \text{ }\Omega$ )
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC)		According to 2014/30/EU standards (testing accordingly: IEC 61000-6-2, IEC 61000-6-4, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8)

### 3.2 - On-board electronics diagrams

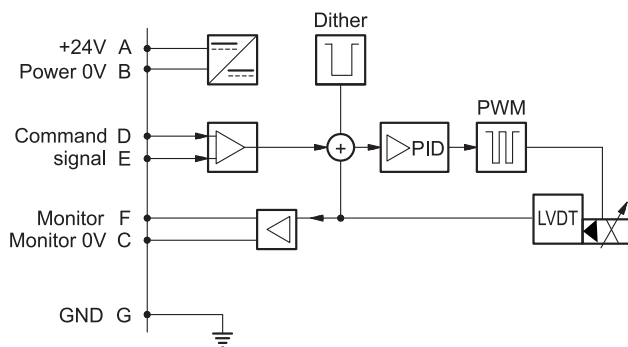
VERSION A - External Enable



VERSION B - Internal Enable

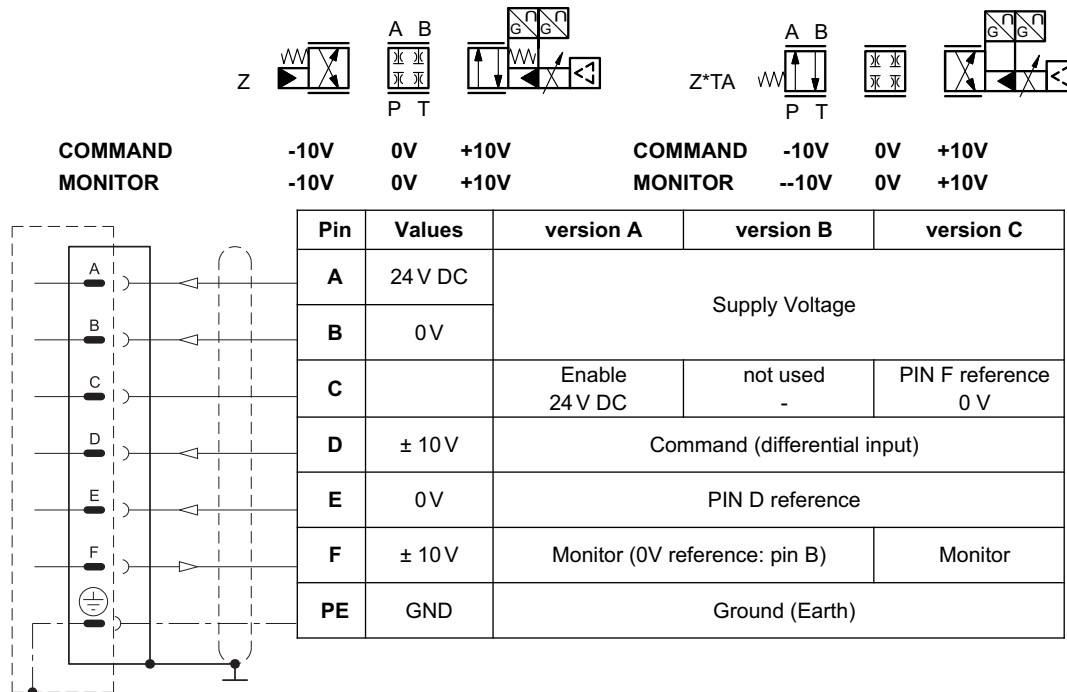


VERSION C - 0V Monitor



## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

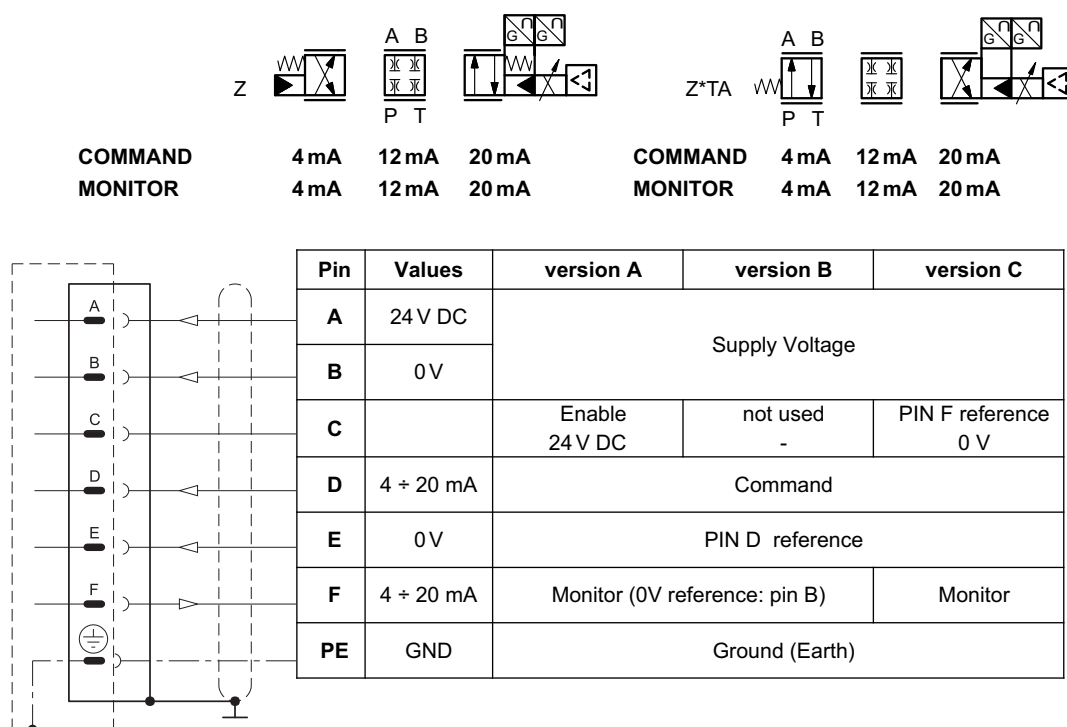
The reference signal must be between -10V and +10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current  $4 \div 20$  mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



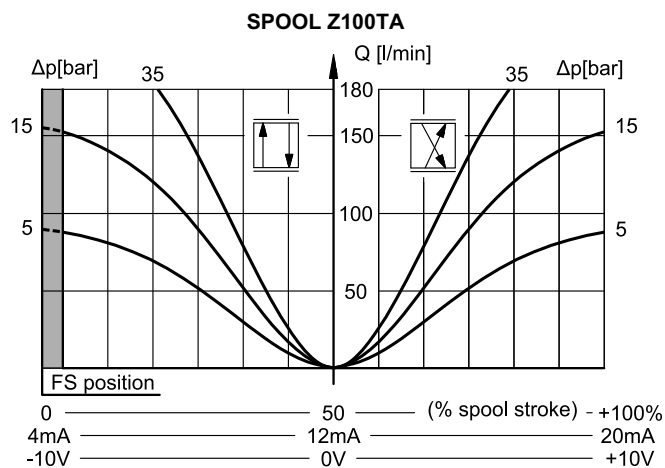
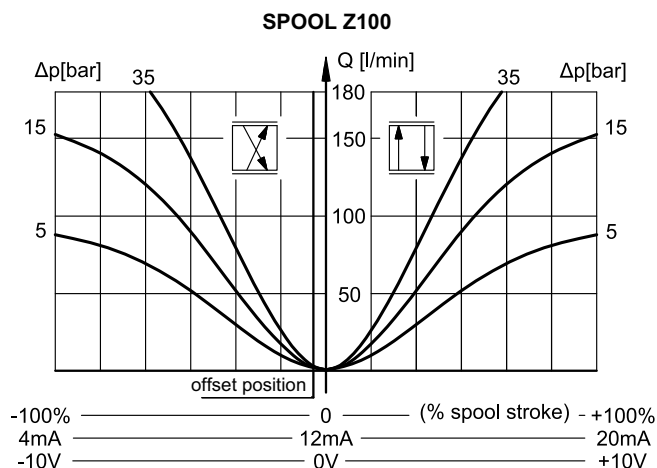


## 6 - CHARACTERISTIC CURVES

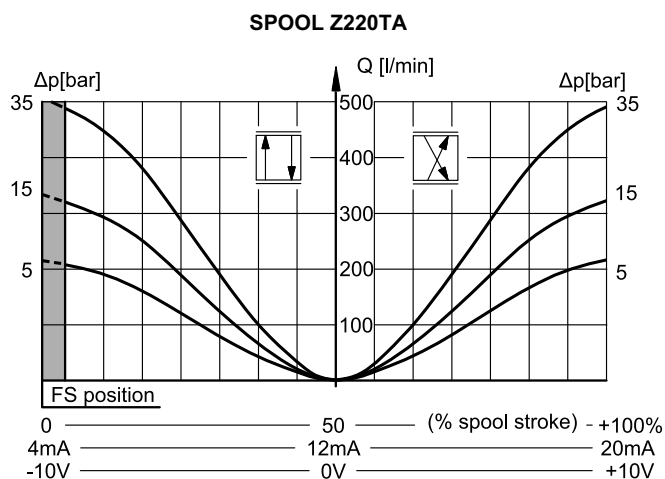
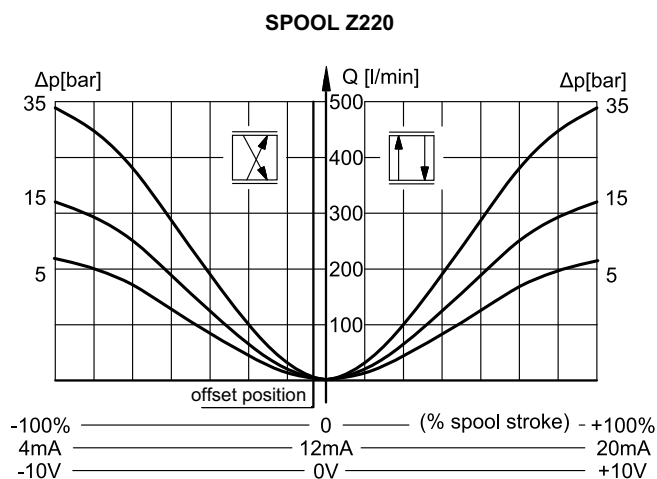
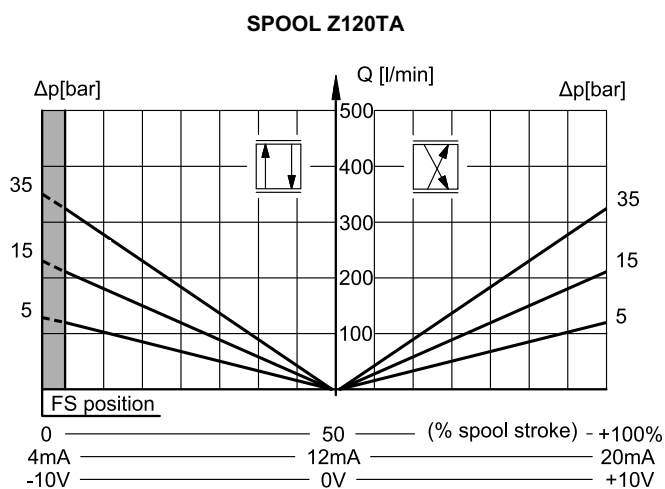
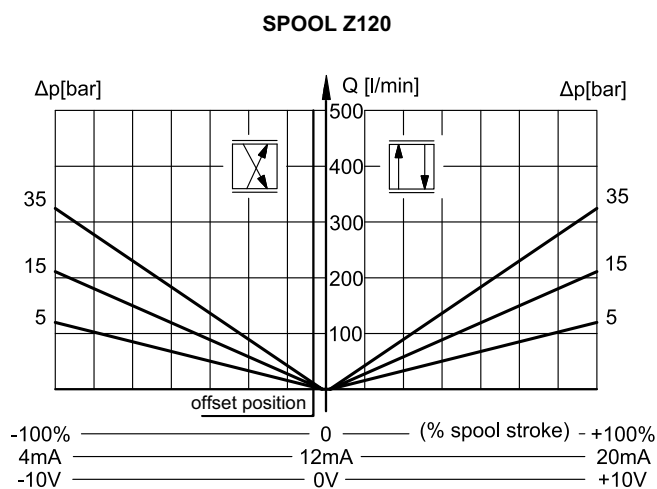
(with mineral oil with viscosity of 36 cSt at 50°C)

Typical flow rate curves at constant  $\Delta p$  related to the reference signal and measured for the available spools.  
The  $\Delta p$  values are measured per land.

### 6.1 - Characteristic curves DXPE5J and DXPE5RJ

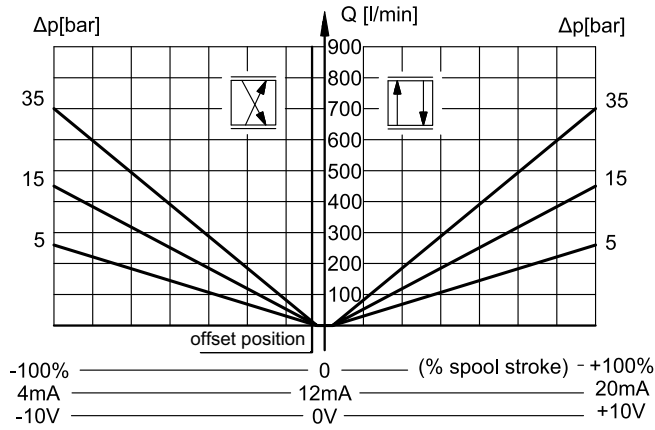


### 6.2 - Characteristic curves DXPE7J

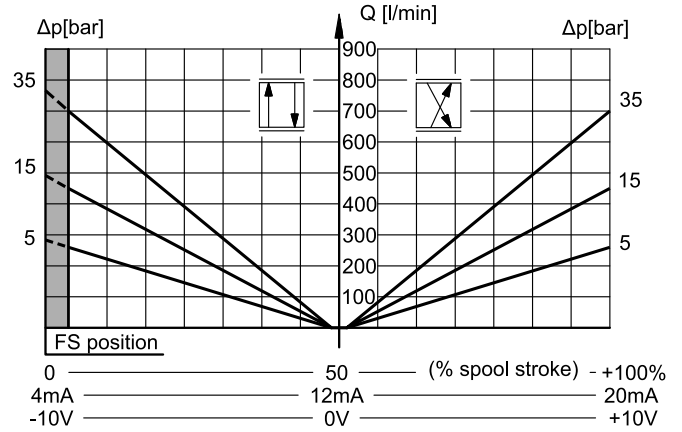


## 6.3 - Characteristic curves DXPE8J

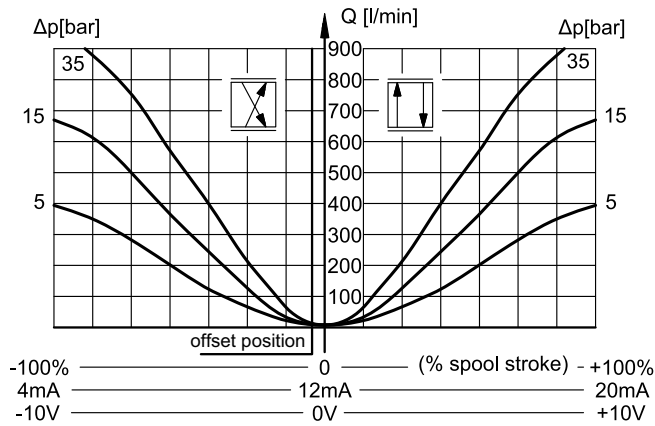
**SPOOL Z250**



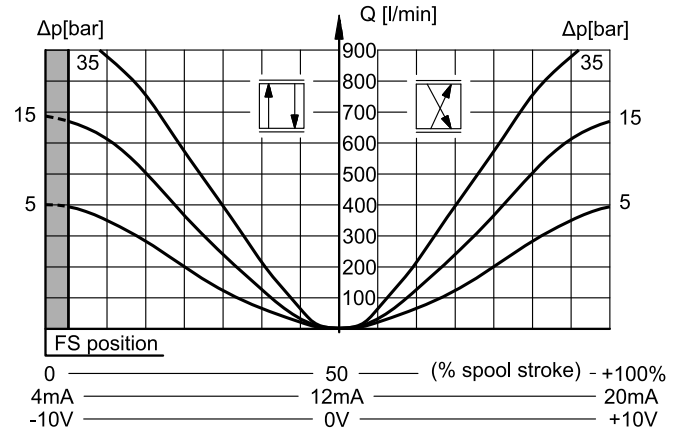
**SPOOL Z250TA**



**SPOOL Z400**



**SPOOL Z400TA**





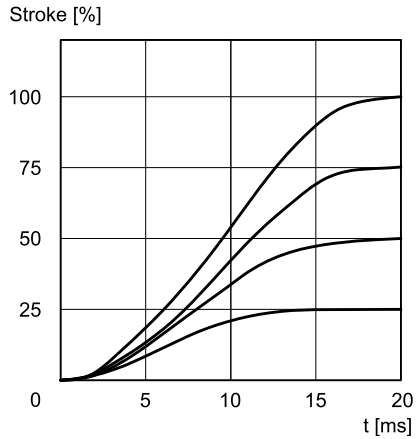
## 7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

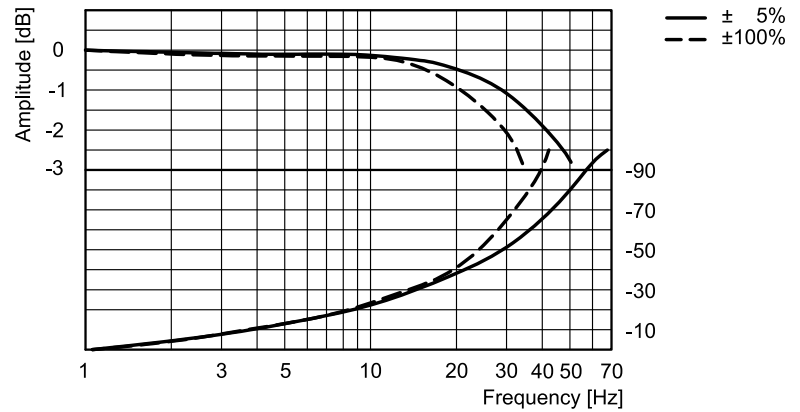
The tables shows the typical step response tested with static pressure 100 bar.

### 7.1 - DXPE5J and DXPE5RJ

RESPONSE TIME

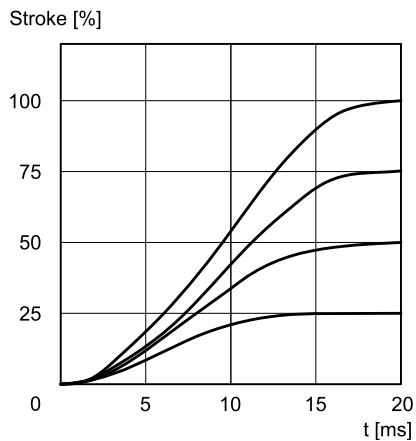


FREQUENCY RESPONSE

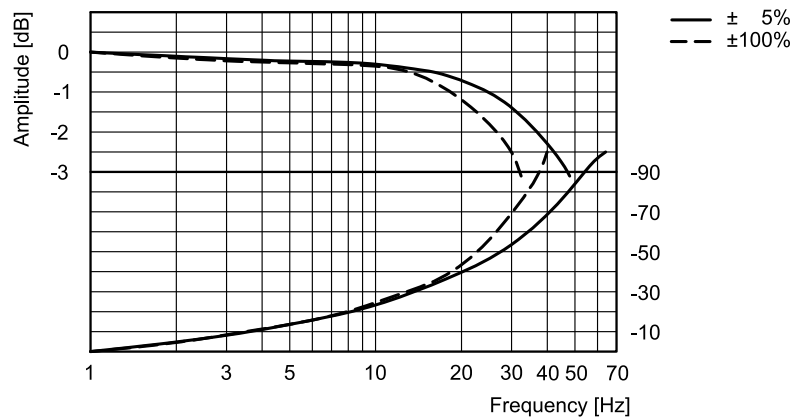


### 7.2 - DXPE7J

RESPONSE TIME

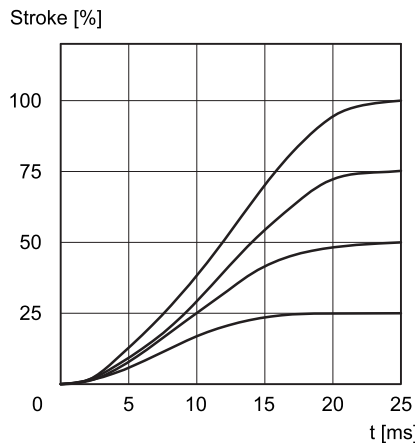


FREQUENCY RESPONSE

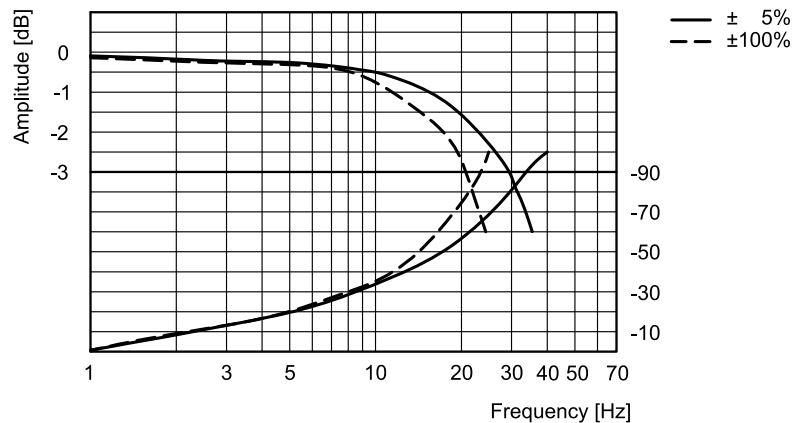


### 7.3 - DXPE8J

RESPONSE TIME



FREQUENCY RESPONSE



## 8 - HYDRAULIC CHARACTERISTICS

(with mineral oil with viscosity of 36 cSt at 50°C)

		DXPE5J DXPER5J	DXPE7J	DXPE8J
Max flow rate	l/min	180	450	900
Piloting flow requested with operation 0 → 100%	l/min	7	13	28
Piloting volume requested with operation 0 → 100%	cm <sup>3</sup>	1,7	3,2	10

### 8.1- Piloting and drainage

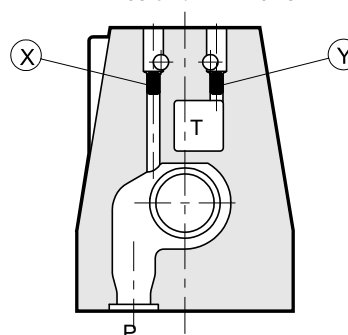
The DXPE\*J valves are available with piloting and drainage, both internal and external. The version with external drainage allows a higher back pressure on the unloading. The version with external pilot with reduced pressure must be used when higher pressures are needed.

TYPE OF VALVE		Plug assembly	
		X	Y
<b>IE</b>	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b>	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b>	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b>	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

### PRESSURES (bar)

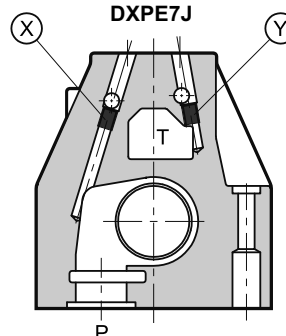
Pressure	MIN	MAX
Piloting pressure on X port	15	250
Pressure on T port with internal drain	-	30
Pressure on T port with external drain	-	250

DXPE5J and DXPER5J



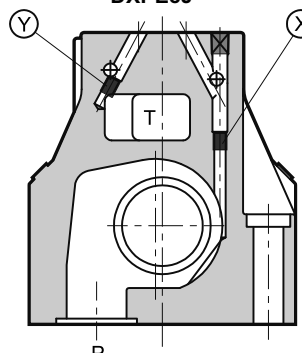
X: M5x6 plug for external pilot  
Y: M5x6 plug for external drain

DXPE7J



X: M6x8 plug for external pilot  
Y: M6x8 plug for external drain

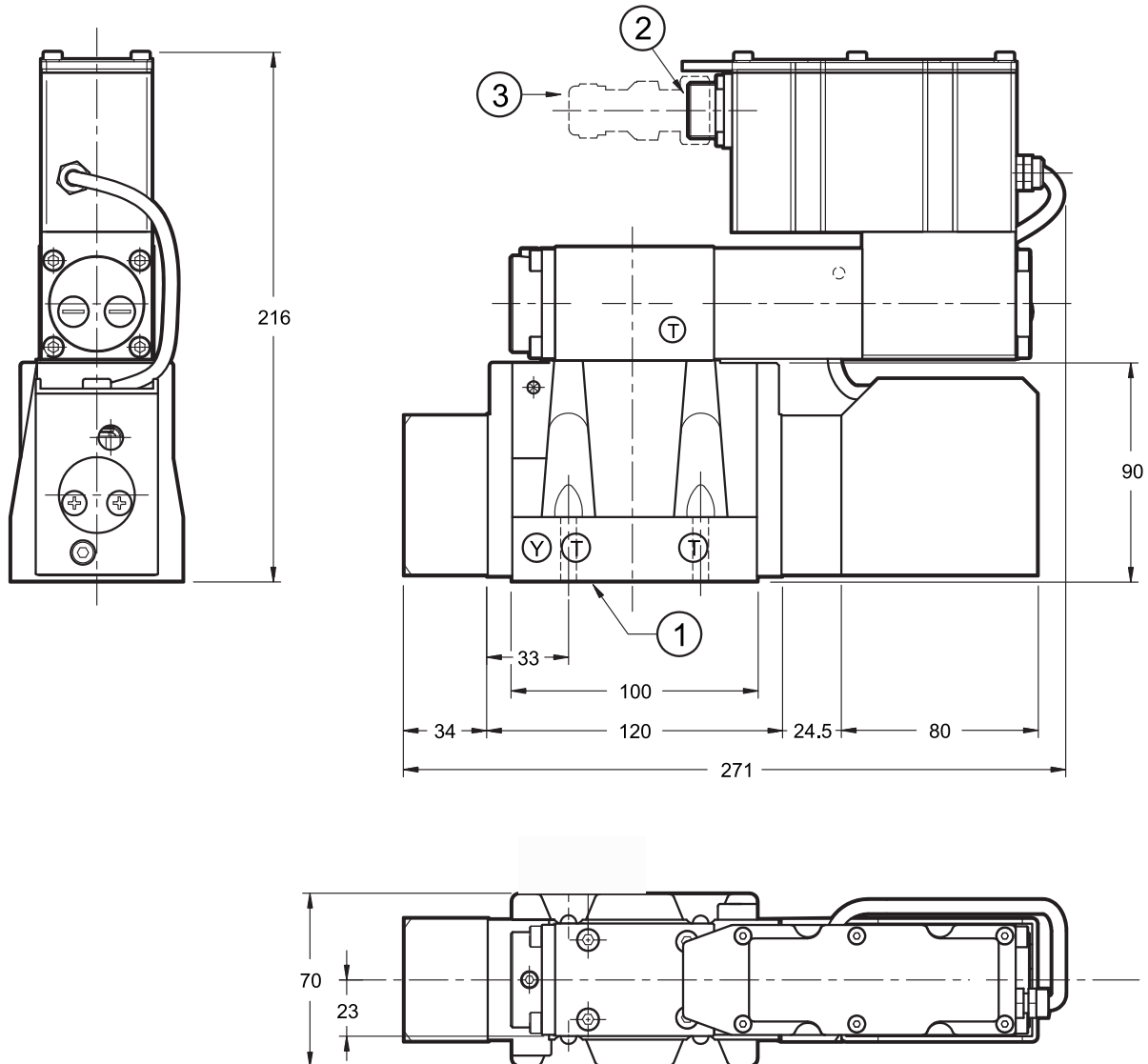
DXPE8J





## 9 - OVERALL AND MOUNTING DIMENSIONS DXPE5J AND DXPE5RJ

dimensions in mm



### NOTES:

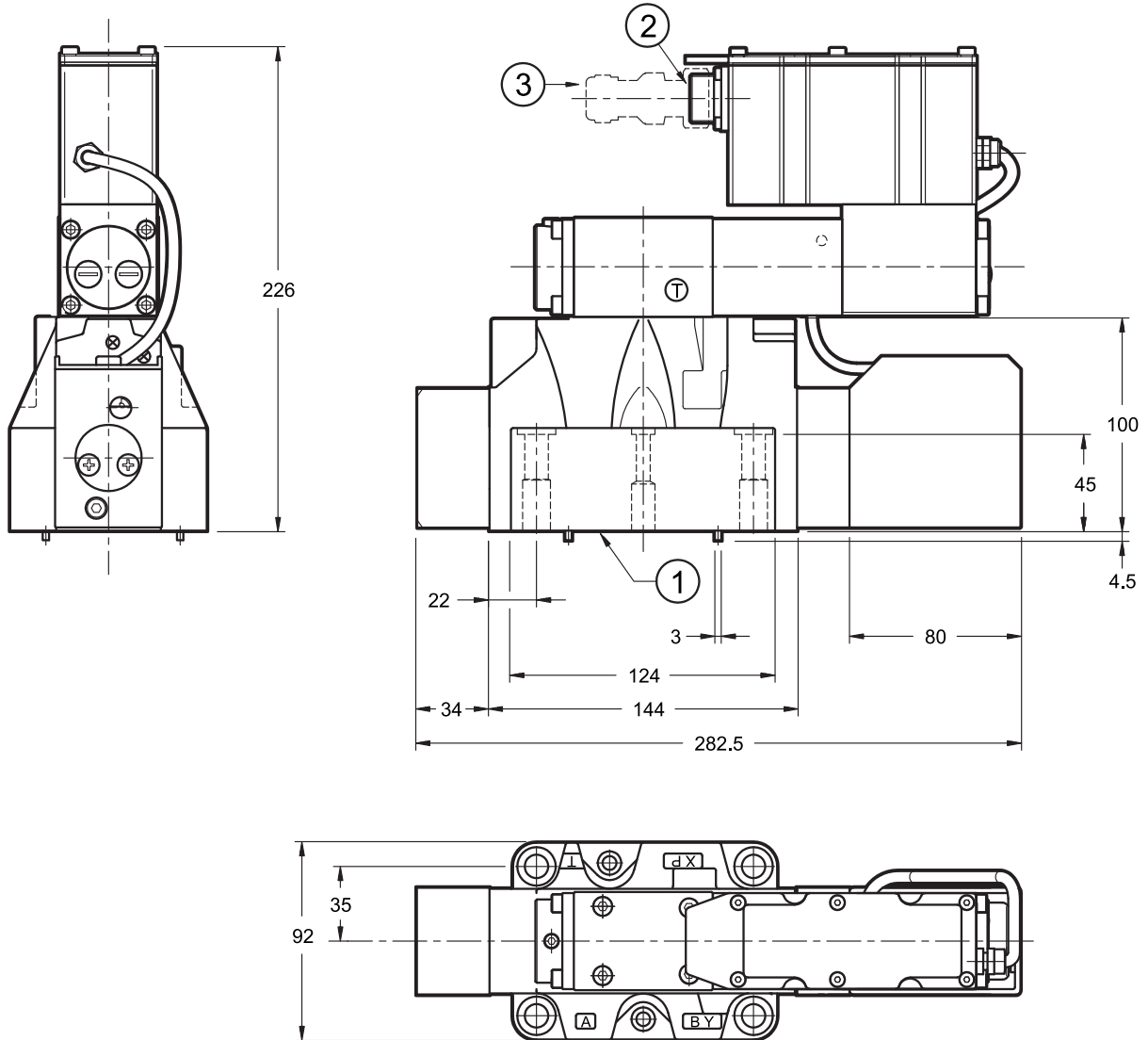
- See mounting surface at paragraph 12.  
- Do not dismantle the transducers.

Valve fastening: N. 4 bolts M6x35 - ISO 4762
Tightening torque: 8 Nm (bolts A 8.8)
Threads of mounting holes: M6x10

1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Main connection
3	Electrical connector 7 pin DIN 43563 - IP67 PG11 EX7S/L/10 code 3890000003 (to be ordered separately)

## 10 - OVERALL AND MOUNTING DIMENSIONS DXPE7J

dimensions in mm



### NOTES:

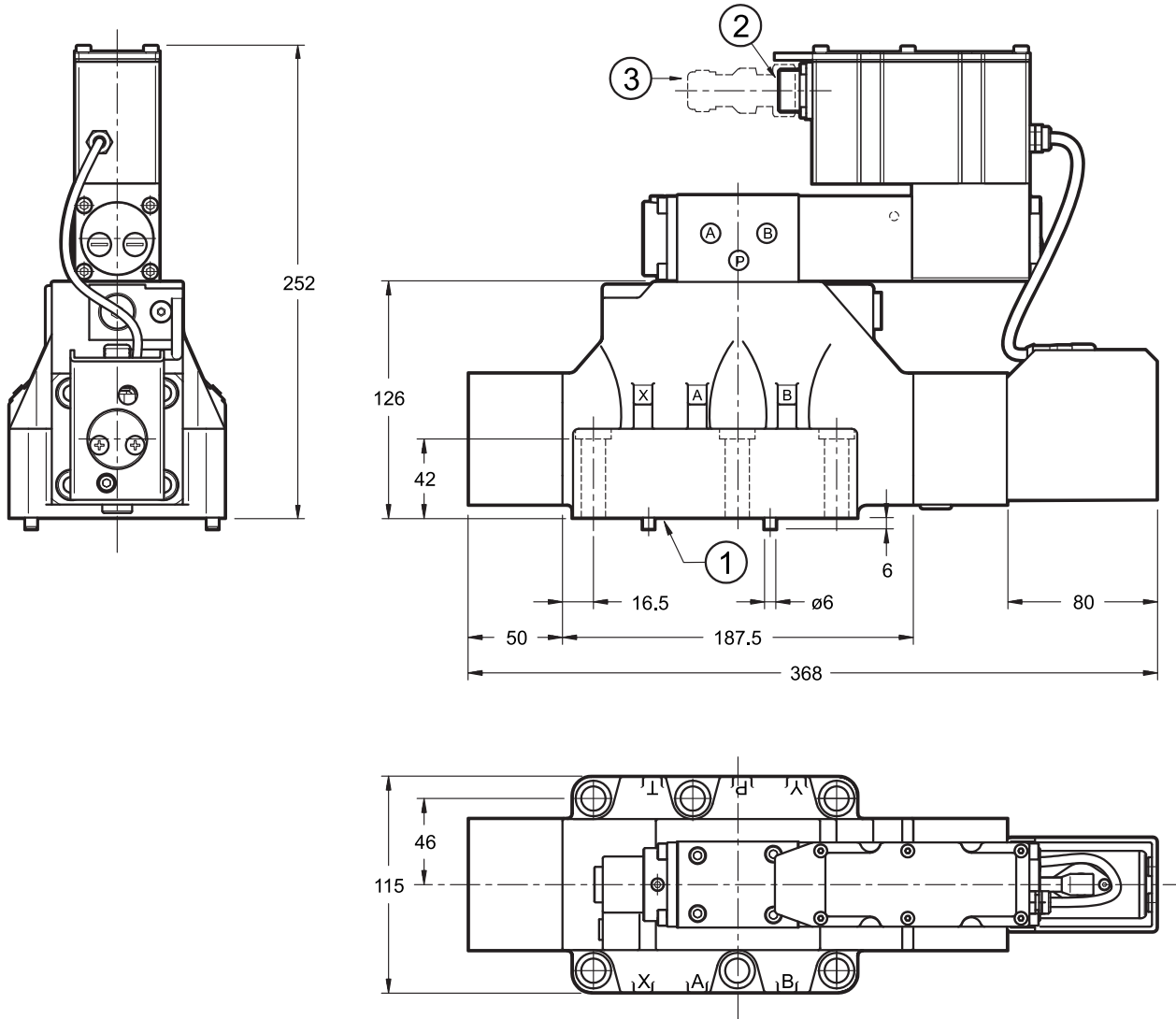
- See mounting surface at paragraph 12.  
- Do not dismantle the transducers.

Valve fastening:	N. 4 bolts M10x60 - ISO 4762 N. 2 bolts M6x60 - ISO 4762
Tightening torque	M10x60: 40 Nm (bolts A 8.8) M6x60: 8 Nm (bolts A 8.8)
Threads of mounting holes:	M6x18; M10x18

1	Mounting surface with sealing rings. 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Main connection
3	Electrical connector 7 pin DIN 43563 - IP67 PG11 EX7S/L/10 code 3890000003 (to be ordered separately)

## 11 - OVERALL AND MOUNTING DIMENSIONS DXPE8J

dimensions in mm



### NOTES:

See mounting surface at paragraph 12.

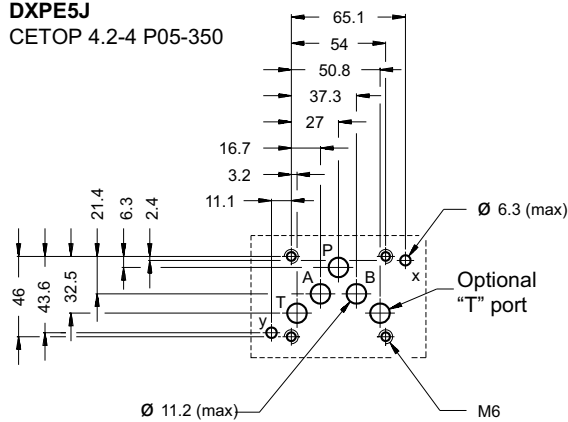
- Do not dismantle the transducers.

Fastening of single valve: N. 6 bolts M12X60 - ISO 4762
Tightening torque: 69 Nm (bolts A 8.8)
Threads of mounting holes: M12X20

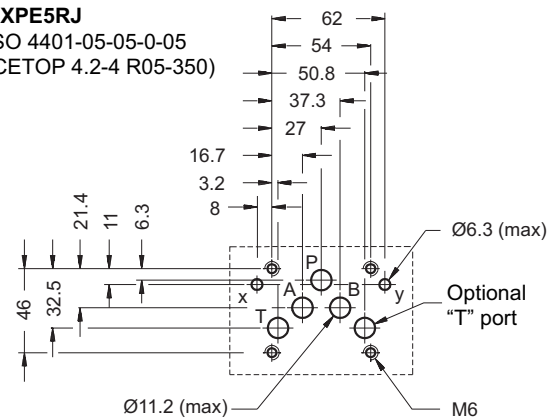
1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Electrical connector 7 pin DIN 43563 - IP67 PG11 EX7S/L/10 code 3890000003 <b>(to be ordered separately)</b>

## 12 - MOUNTING SURFACES

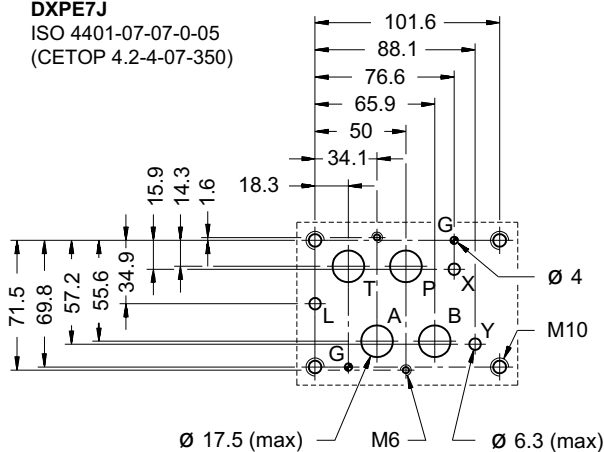
**DXPE5J**  
CETOP 4.2-4 P05-350



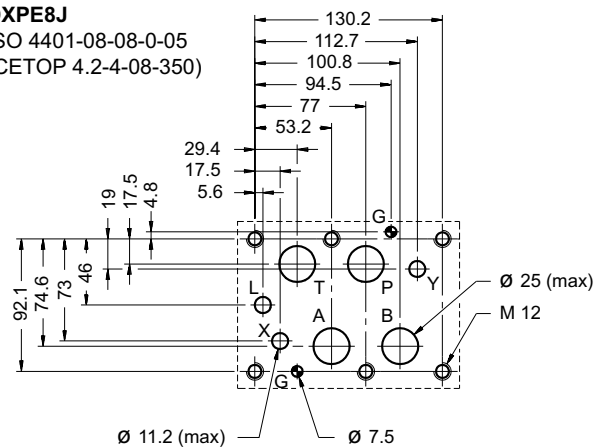
**DXPE5RJ**  
ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



**DXPE7J**  
ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



**DXPE8J**  
ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



## 13 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

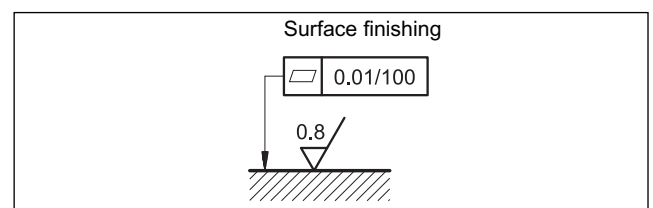
The fluid must be preserved in its physical and chemical characteristics.

## 14 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Take care to the cleanliness of the mounting surfaces and surrounding environment upon installation.





## 15 - ACCESSORIES

(to be ordered separately)

### 15.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

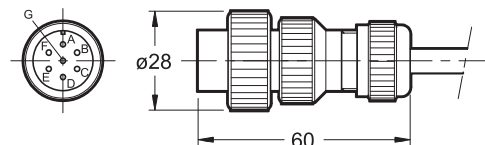


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



### 15.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

### 15.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

## 16 - SUBPLATES

(see catalogue 51 000)

	DXPE5J	DXPE7J	DXPE8J
with rear ports	PME4-AI5G	PME07-AI6G	-
with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
thread of ports:	P - T - A - B X - Y	3/4" BSP 1/4" BSP	1 1/2" BSP 1/4" BSP

**DUPLOMATIC**  
MOTION SOLUTIONS

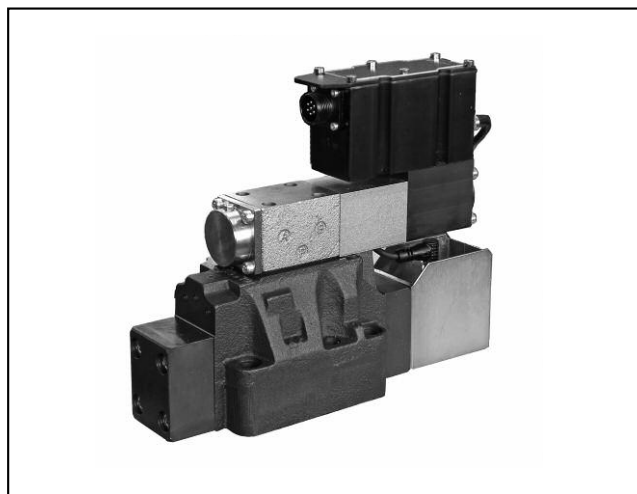
**DUPLOMATIC OLEODINAMICA S.p.A.**

20015 PARABIAGO (MI) • Via M. Re Depaulini 24

Tel. +39 0331.895.111

Fax +39 0331.895.339

www.duplomatic.com • e-mail: sales.exp@duplomatic.com



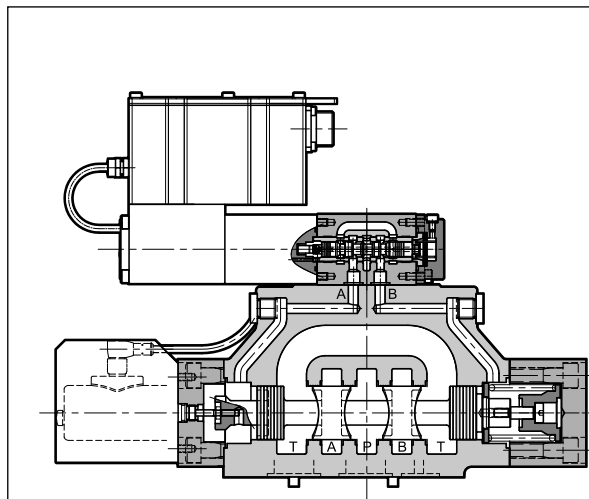
# DXRE\*J

## DIRECTIONAL CONTROL VALVES, PILOT OPERATED, WITH OBE AND FEEDBACK SERIES 31

### SUBPLATE MOUNTING

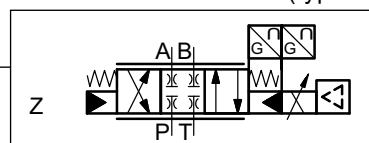
DXRE5RJ	ISO 4401-05
DXRE7J	ISO 4401-07
DXRE8J	ISO 4401-08
DXRE10J	ISO 4401-10
DXRE11J	ISO 4401-10 oversize ports

### OPERATING PRINCIPLE



- DXRE\*J are directional control valves operated by a servo-proportional pilot, with mounting surface compliant with ISO 4401 standards.
- The spool position is controlled by a linear transducer LVDT in closed loop, which ensures high precision and repeatability. In the event of switch-off or inactive electronics the main spool is set to a fail-safe position by springs.
- The valve is featured by integral electronic based on SMD technology which ensures standard settings and simplifies the electric wiring. The unit does not require any adjustment.
- The valve is easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 16.3).

### HYDRAULIC SYMBOL (typical)



### PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p =140 bar)

		DXRE5RJ	DXRE7J	DXRE8J	DXRE10J	DXRE11J
Max operating pressure: P - A - B ports T - X - Y ports	bar	350 250				
Controlled flow with $\Delta p$ 10 bar P-T	l/min	100	220	400	800	1000
Hysteresis	% Q <sub>max</sub>	< 0,2%				
Repeatability	% Q <sub>max</sub>	± 0,1%				
Electrical characteristics		see paragraph 3				
Ambient temperature range	°C	-20 / +60				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13 (16/14/11 for longer life)				
Recommended viscosity	cSt	25				
Mass:	kg	8	10,5	17	56	56



## 1 - IDENTIFICATION CODE

D	X	R	E		J	-			/	31	-			/		K11	
---	---	---	---	--	---	---	--	--	---	----	---	--	--	---	--	-----	--

Proportional directional valve with high-response pilot

Nominal size: \_\_\_\_\_  
**5R** = ISO 4401-05  
**7** = ISO 4401-07  
**8** = ISO 4401-08  
**10** = ISO 4401-10  
**11** = ISO 4401-10 with oversize ports

Digital integrated electronics for valves with feedback

Spool type: \_\_\_\_\_  
**C** = closed centres  
**A** = open centres  
**Z\*** = zero overlap  
**Z\*TB** = zero overlap  
See paragraph 2 for operation and available flow rates.

Series No. \_\_\_\_\_  
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals: \_\_\_\_\_  
**N** = NBR seals for mineral oil (**standard**)  
**V** = FPM seals for special fluids

Option:  
/ **W7** = Zinc-nickel surface treatment  
Omit if not required. (see par. 1.1)

Pin C function:  
**A** = external enable  
**B** = internal enable  
**C** = 0V monitor

Main connector:  
6 pin + PE

Reference signal:  
**E0** = voltage  $\pm 10$  V  
**E1** = current  $4 \pm 20$  mA

Drainage: **I** = internal  
**E** = external

Piloting: **I** = internal  
**E** = external

### 1.1 - Surface treatments

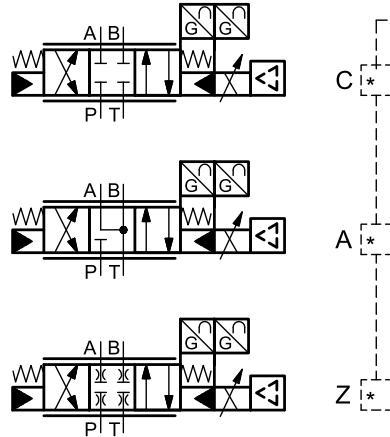
The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to **600** hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

## 2 - AVAILABLE CONFIGURATIONS

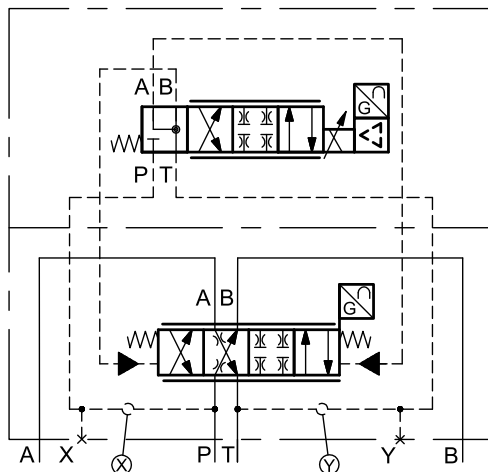
The valve configuration depends on the combination of spool type and rated flow.

### 3 positions with spring centering



valve type	*	Controlled flow with $\Delta p$ 10 bar P-T
DXRE5RJ	100	100 l/min
DXRE7J	120	120 l/min
	220	220 l/min
DXRE8J	250	250 l/min
	400	400 l/min
DXRE10J	800	800 l/min
DXRE11J	1000	1000 l/min

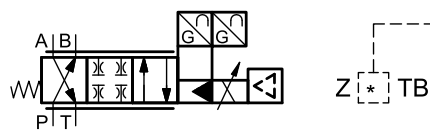
detailed symbol (spool Z)



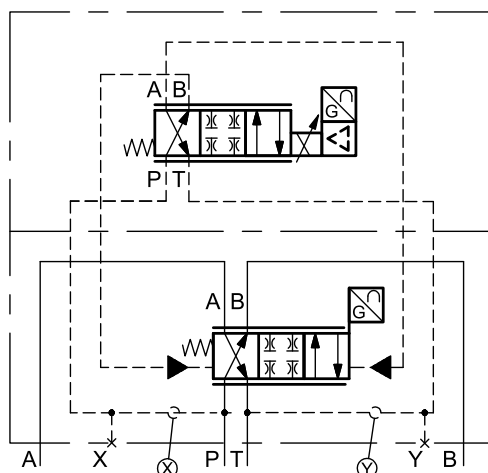
### OFFSET POSITION for Z SPOOLS

After electrical switch-off or Enable signal switch-off (version K11A) the main spool moves to springs offset position, with limited opening (1%... 6% of main spool stroke in direction P-B / A-T)

### 3 positions with spring offset



detailed symbol (spool Z)



valve type	*	Controlled flow with $\Delta p$ 10 bar P-T
DXRE5RJ	100	100 l/min
DXRE7J	120	120 l/min
	220	220 l/min
DXRE8J	250	250 l/min
	400	400 l/min
DXRE10J	800	800 l/min
DXRE11J	1000	1000 l/min

### FAIL SAFE POSITION

After electrical switch-off or Enable signal switch-off (version K11A) the main spool moves by spring to the fail-safe position P-B / A-T wide open.





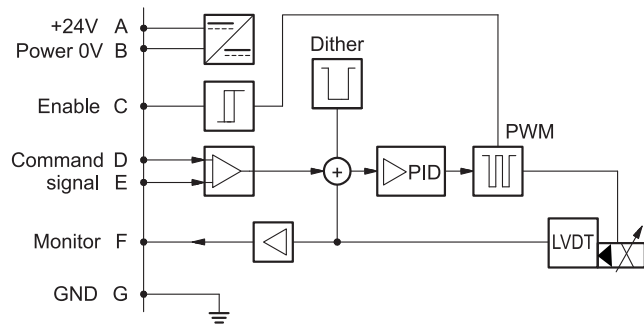
## 3 - ELECTRICAL CHARACTERISTICS

### 3.1 - Electrical on board electronics

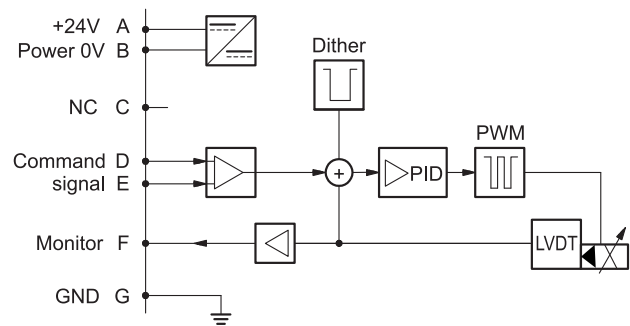
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	35
Maximum solenoid current	A	2.6
Fuse protection, external		(fast), max current 4A
Command signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_i > 11 \text{ kohm}$ ) $4 \div 20$ (Impedance $R_i = 58 \text{ Ohm}$ )
Monitor signals: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance $R_o > 1 \text{ kohm}$ ) $4 \div 20$ (Impedance $R_o = 500 \text{ ohm}$ )
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC)		According to 2014/30/EU standards (testing accordingly: IEC 61000-6-2, IEC 61000-6-4, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8)

### 3.2 - On-board electronics diagrams

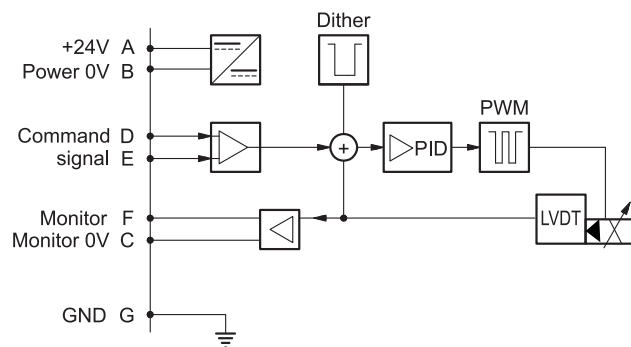
VERSION A - External Enable



VERSION B - Internal Enable

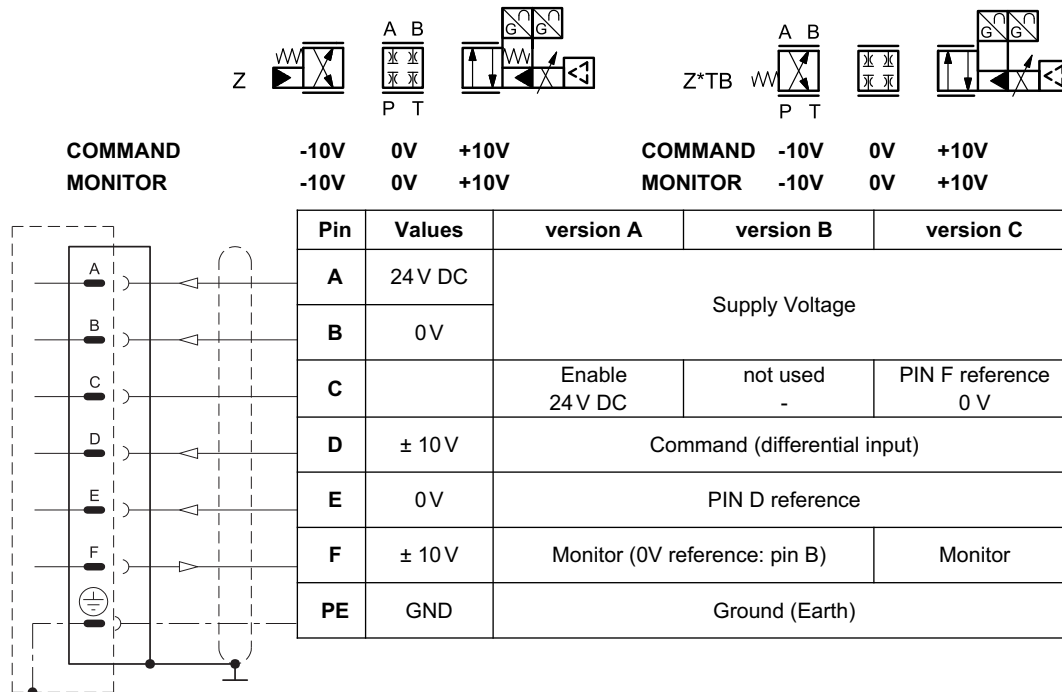


VERSION C - 0V Monitor



## 4 - VERSIONS WITH VOLTAGE COMMAND (E0)

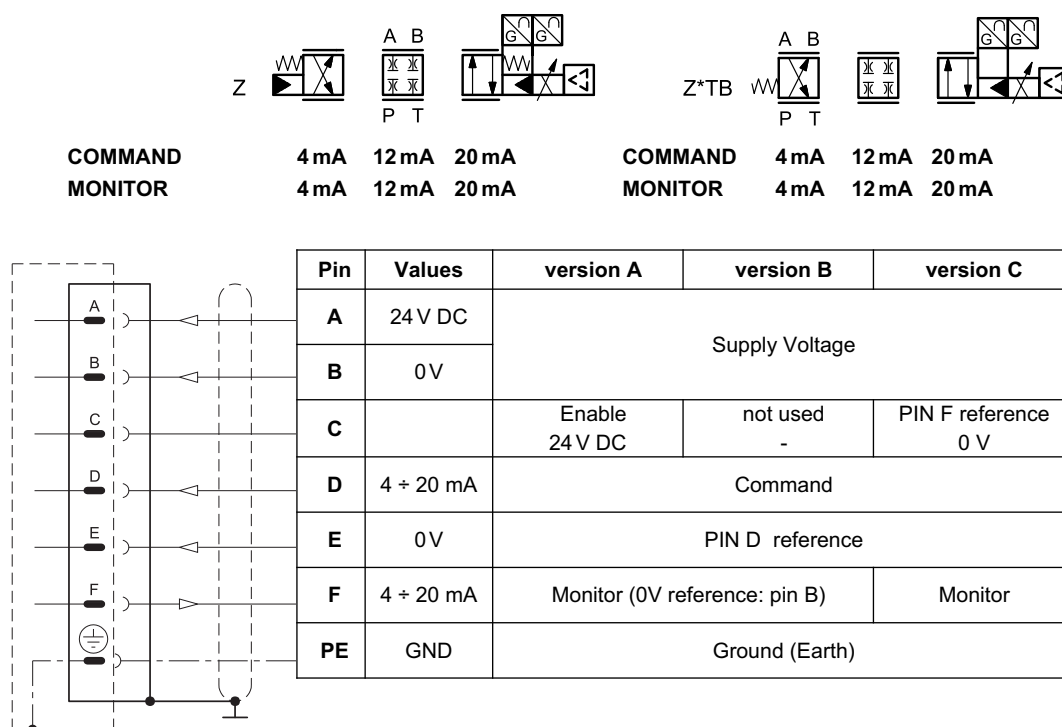
The reference signal must be between -10V and +10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



## 5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current  $4 \div 20$  mA. If the current for command is lower than 4 mA the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



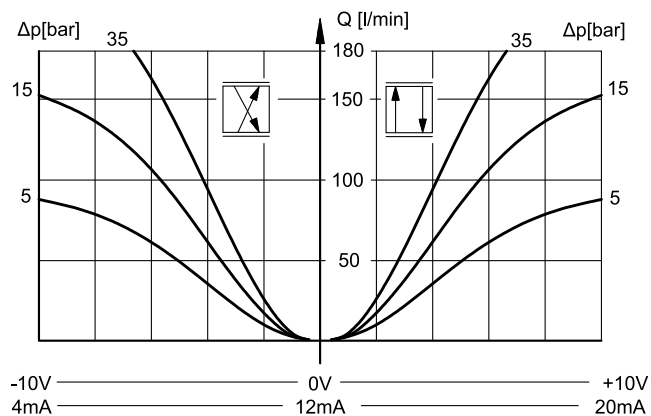
## 6 - CHARACTERISTIC CURVES

(with mineral oil with viscosity of 36 cSt at 50°C)

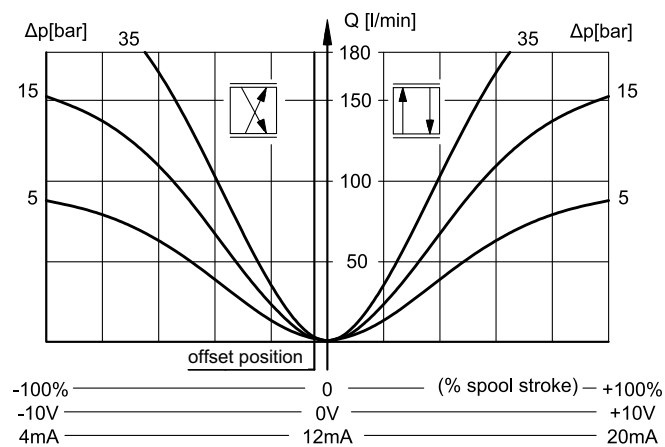
Typical flow rate curves at constant  $\Delta p$  related to the reference signal and measured for the available spools.  
The  $\Delta p$  values are measured per land.

### 6.1 - Characteristic curves DXRE5RJ

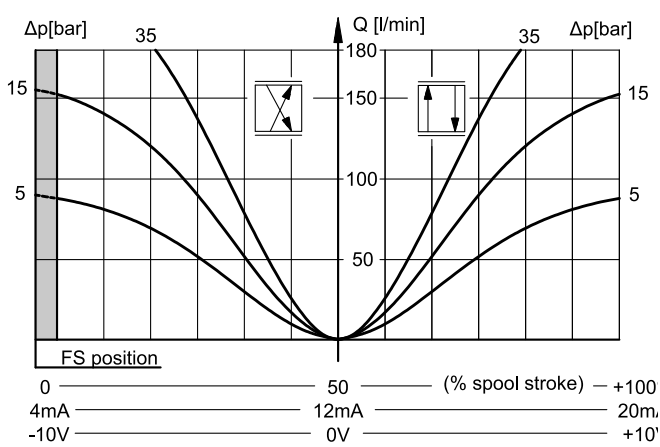
**SPOOL C100 / A100**



**SPOOL Z100**

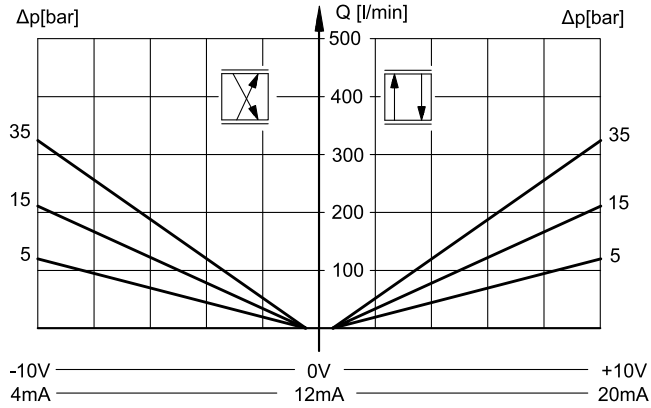


**SPOOL Z100TB**

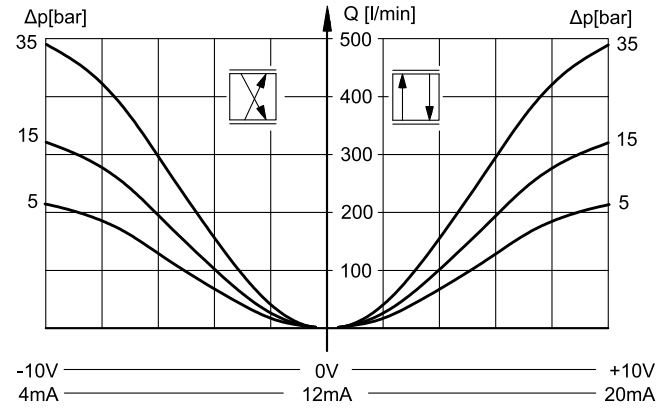


### 6.2 - Characteristic curves DXRE7J

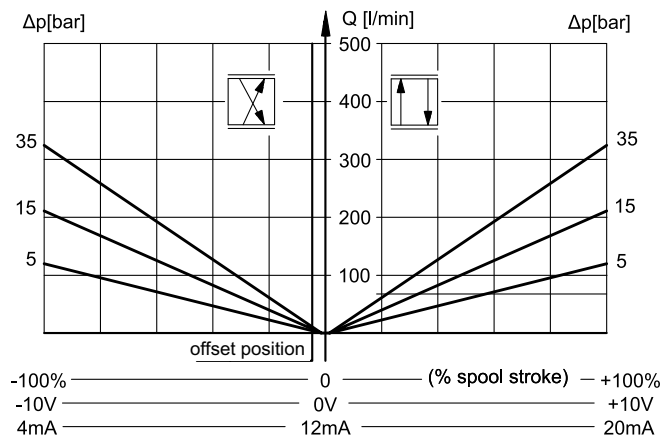
**SPOOL C120 / A120**



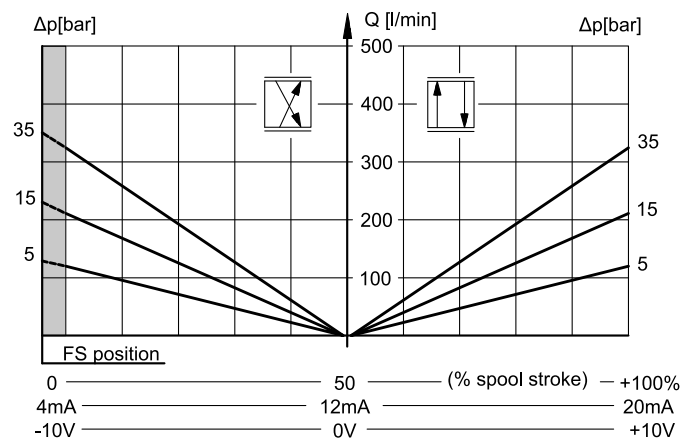
**SPOOL C220 / A220**



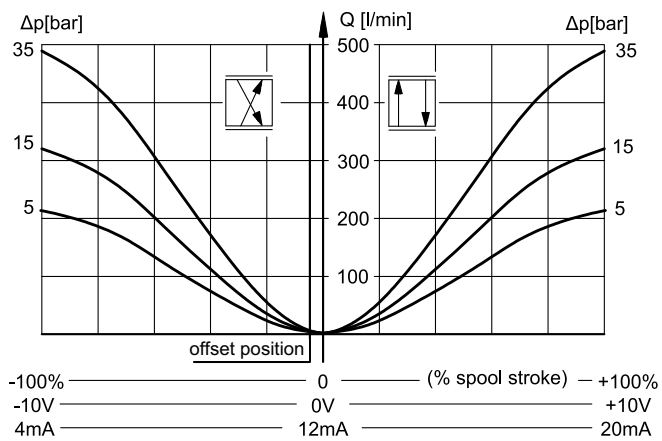
**SPOOL Z120**



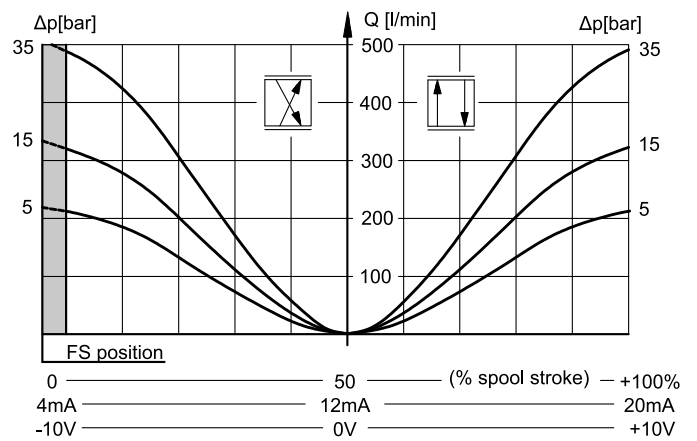
**SPOOL Z120TB**



**SPOOL Z220**

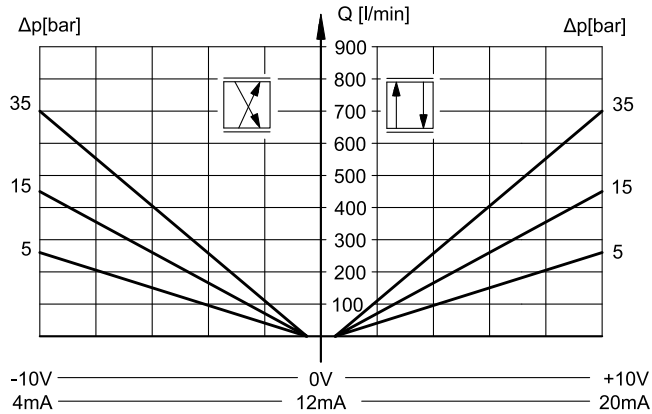


**SPOOL Z220TB**

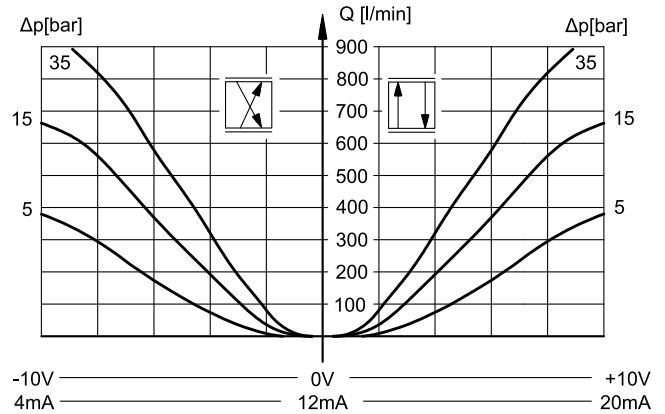


### 6.3 - Characteristic curves DXRE8J

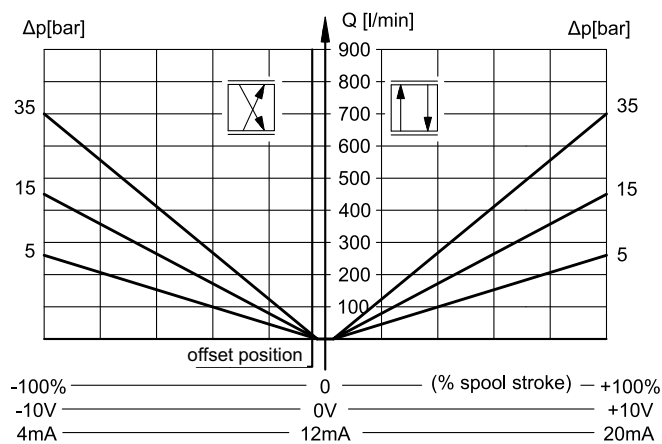
**SPOOL C250 / A250**



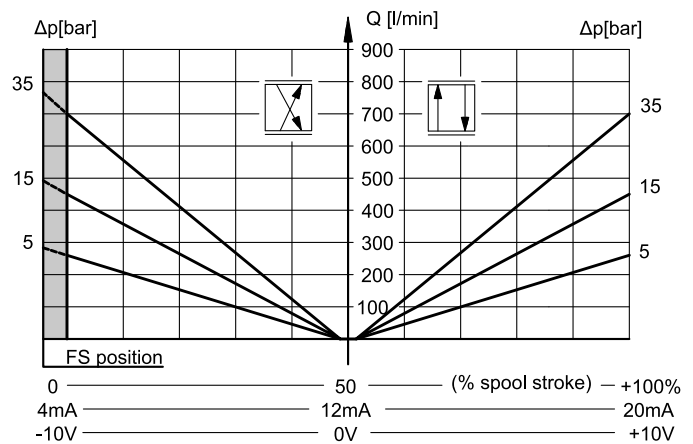
**SPOOL C400 / A400**



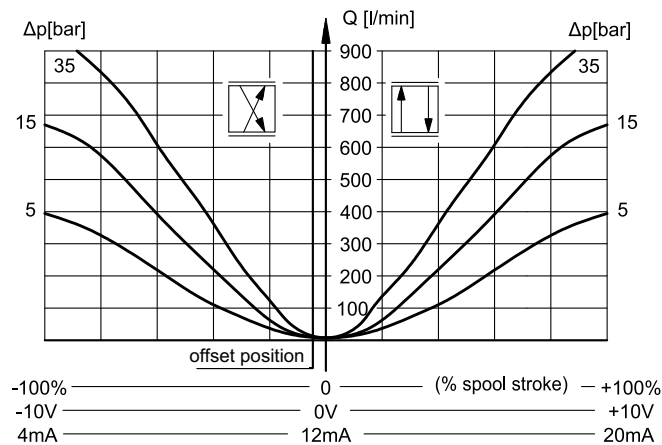
**SPOOL Z250**



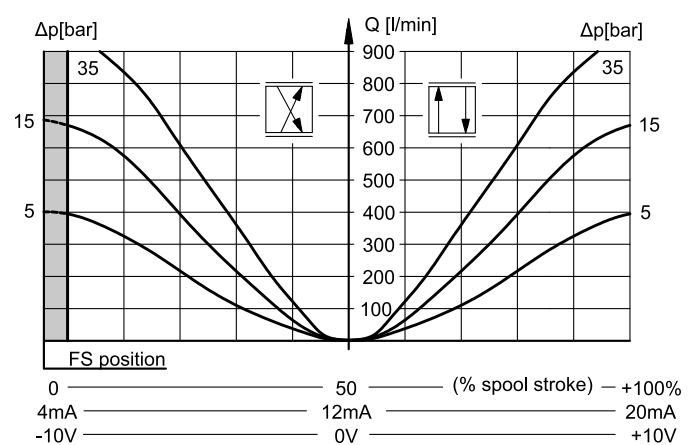
**SPOOL Z250TB**



**SPOOL Z400**

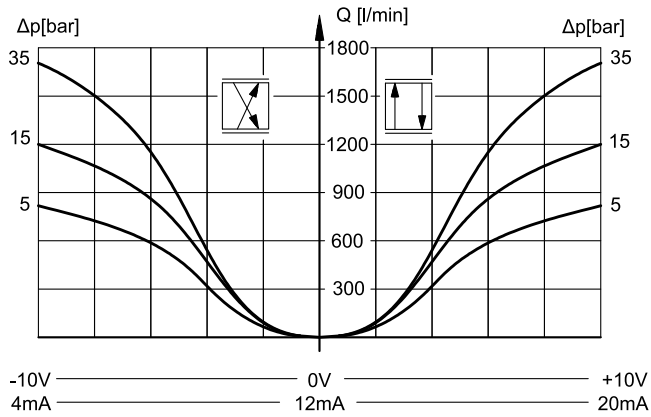


**SPOOL Z400TB**

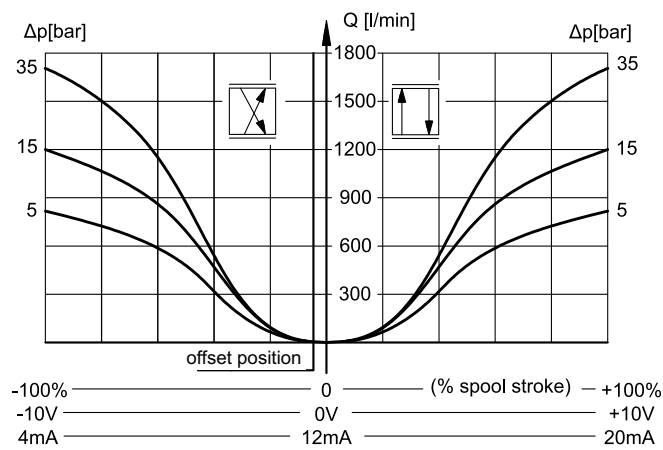


## 6.4 - Characteristic curves DXRE10J

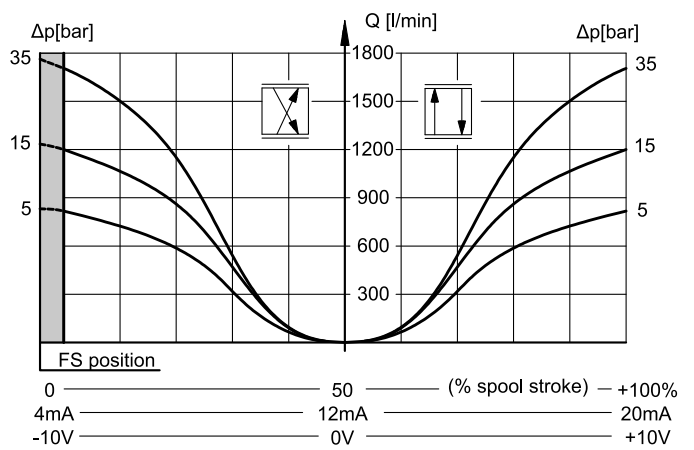
### SPOOL C800



### SPOOL Z800

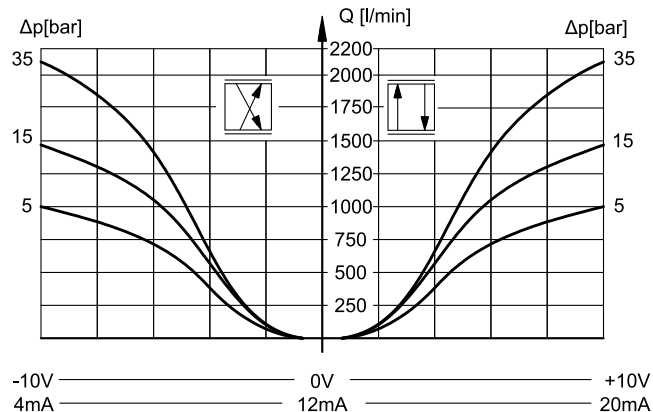


### SPOOL Z800TB

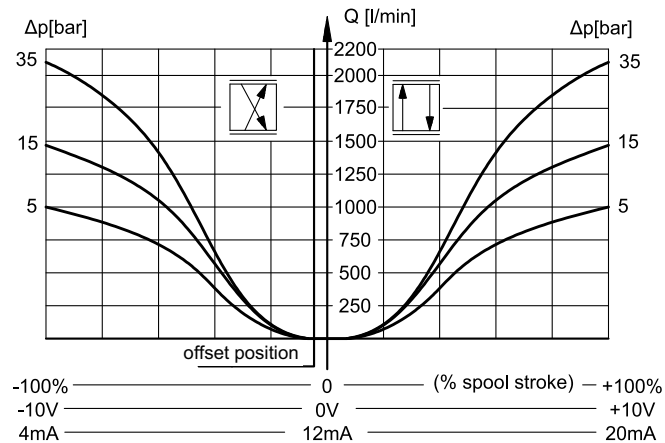


## 6.5 - Characteristic curves DXRE11J

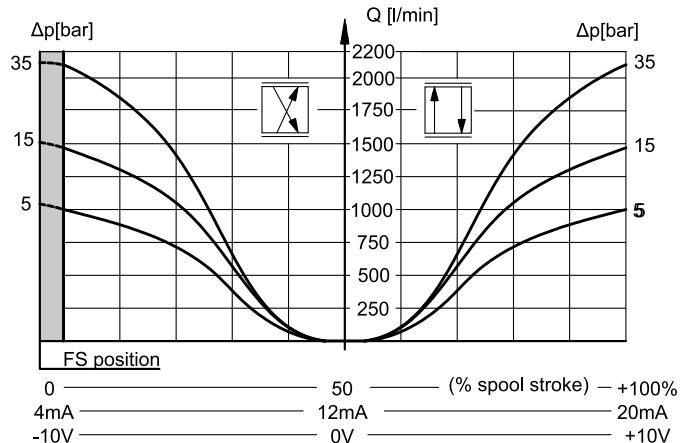
**SPOOL C1000 / A1000**



**SPOOL Z1000**



**SPOOL Z1000TB**



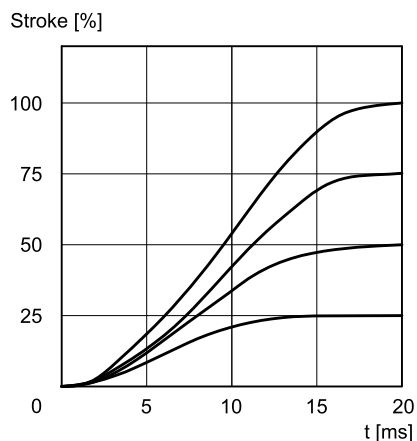
## 7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

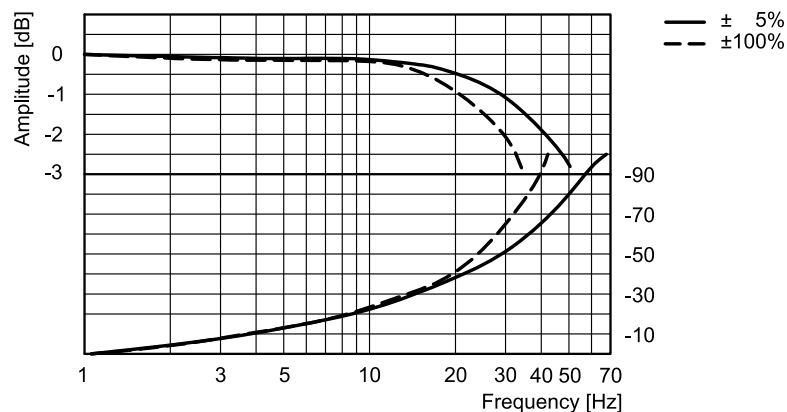
The tables shows the typical step response tested with static pressure 100 bar.

### 7.1 - DXRE5RJ

**RESPONSE TIME**



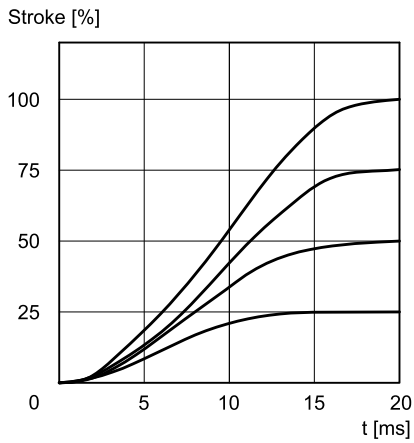
**FREQUENCY RESPONSE**



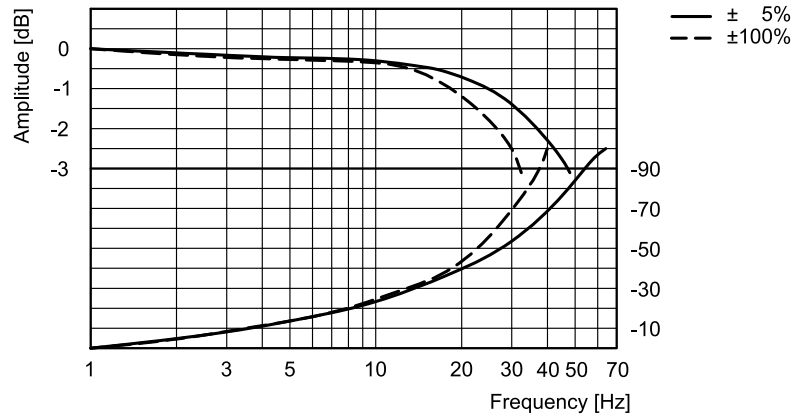


## 7.2 - DXRE7J

RESPONSE TIME

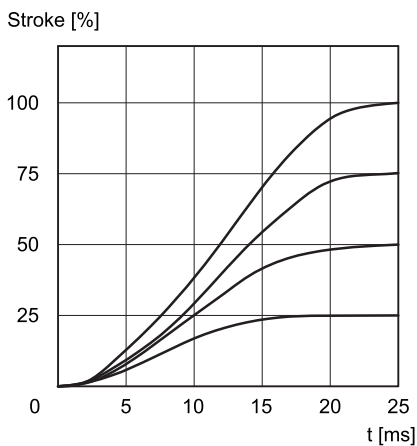


FREQUENCY RESPONSE

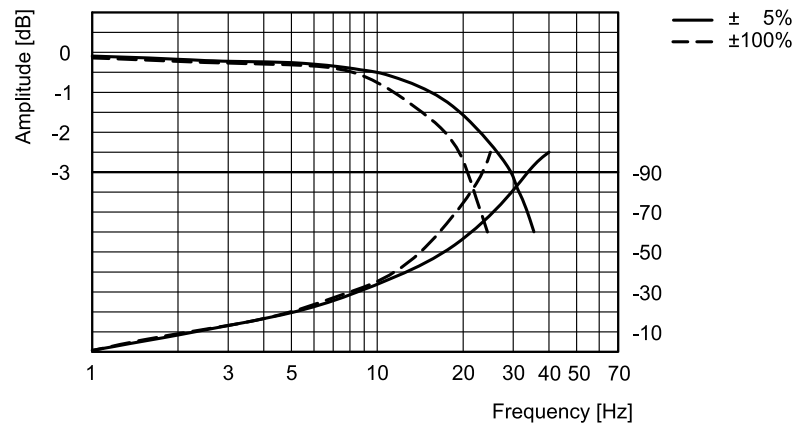


## 7.3 - DXRE8J

RESPONSE TIME

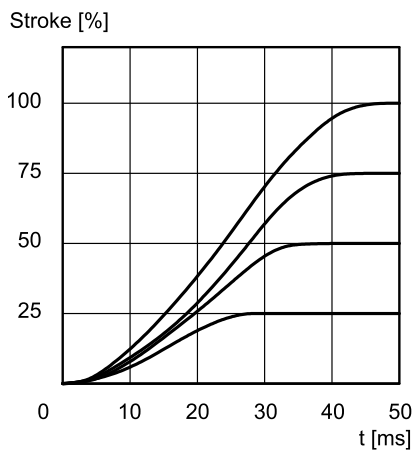


FREQUENCY RESPONSE

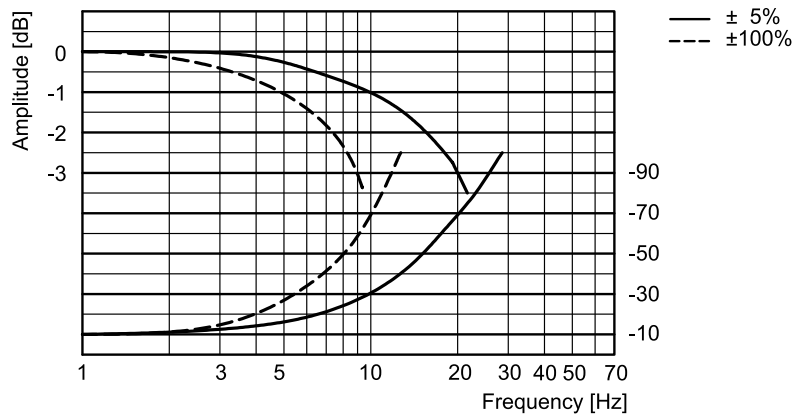


## 7.4 - DXRE10J and DXRE11J

RESPONSE TIME



FREQUENCY RESPONSE







## 8 - HYDRAULIC CHARACTERISTICS

(with mineral oil with viscosity of 36 cSt at 50°C)

		DXRE5RJ	DXRE7J	DXRE8J	DXRE10J	DXRE11J
Max flow rate	l/min	180	450	900	1600	3500
Piloting flow requested with operation 0 → 100%	l/min	7	13	28	35	35
Piloting volume requested with operation 0 → 100%	cm <sup>3</sup>	1,7	3,2	10	22	22

### 8.1 - Pilot and drain

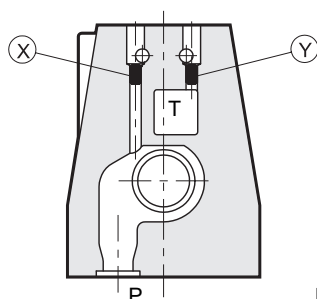
The DXRE\*J valves are available with pilot and drain both internal and external. The version with external drain allows a higher back pressure on the unloading. The version with external pilot with reduced pressure must be used when higher pressures are needed.

#### PRESSURES (bar)

Pressure	MIN	MAX
Piloting pressure on X port	15	250
Pressure on T port with internal drain	-	30
Pressure on T port with external drain	-	250

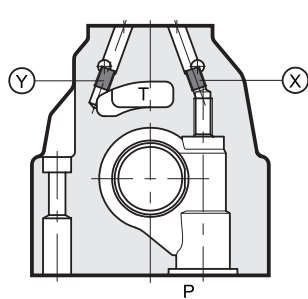
TYPE OF VALVE	Plug assembly	
	X	Y
<b>IE</b> INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
<b>II</b> INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
<b>EE</b> EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
<b>EI</b> EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

DXRE5RJ

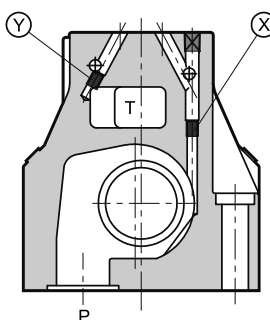


X: plug M5x6 for external pilot  
Y: plug M5x6 for external drain

DXRE7J

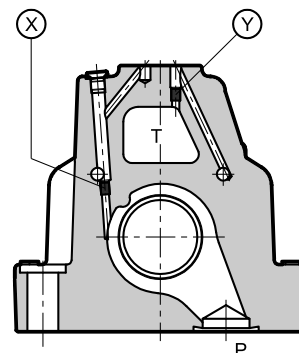


DXRE8J



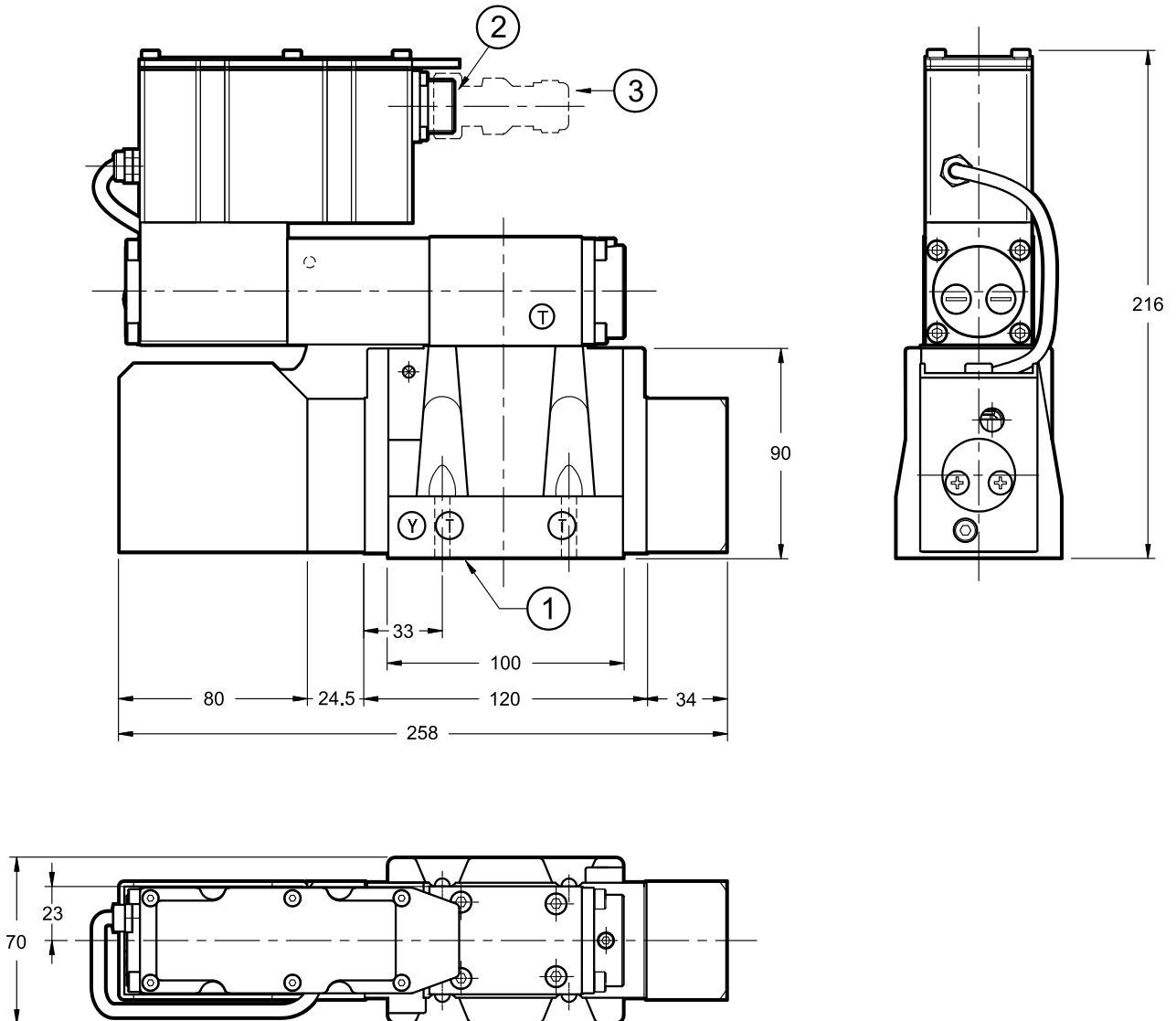
X: plug M6x8 for external pilot  
Y: plug M6x8 for external drain

DXRE10J/DXRE11J



## 9 - OVERALL AND MOUNTING DIMENSIONS DXRE5RJ

dimensions in mm



### NOTES:

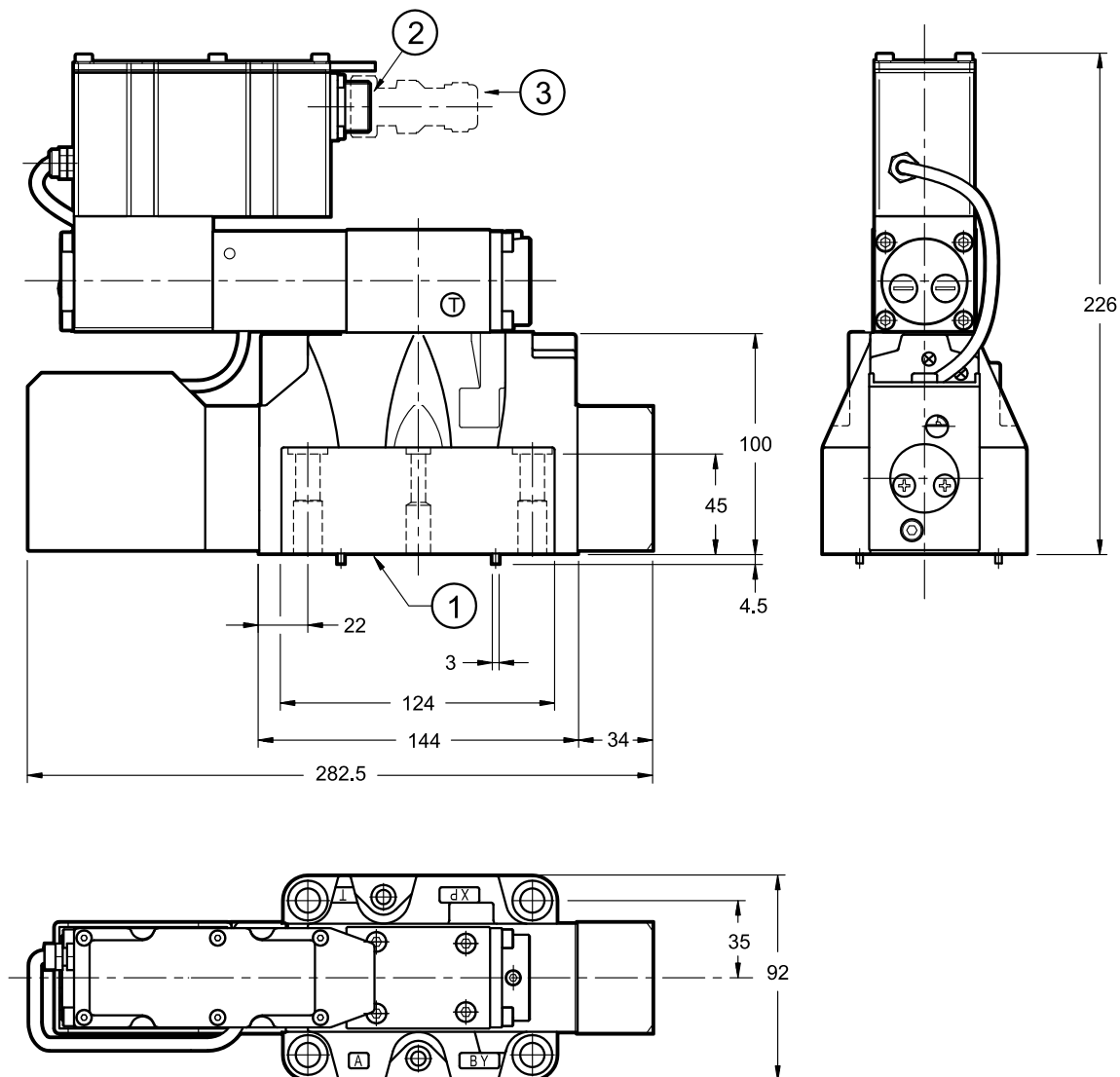
See mounting surface at section 13.

- Do not dismantle the transducers.

Valve fastening: N. 4 bolts M6x35 - ISO 4762	1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 1 OR type 2037 (9.25x1.78) - 90 Shore
Tightening torque: 8 Nm (A8.8 screws)	2	Main connection
Threads of mounting holes: M6x10	3	Electrical connector <b>(to be ordered separately)</b> see paragraph 16

## 10 - OVERALL AND MOUNTING DIMENSIONS DXRE7J

dimensions in mm



### NOTES:

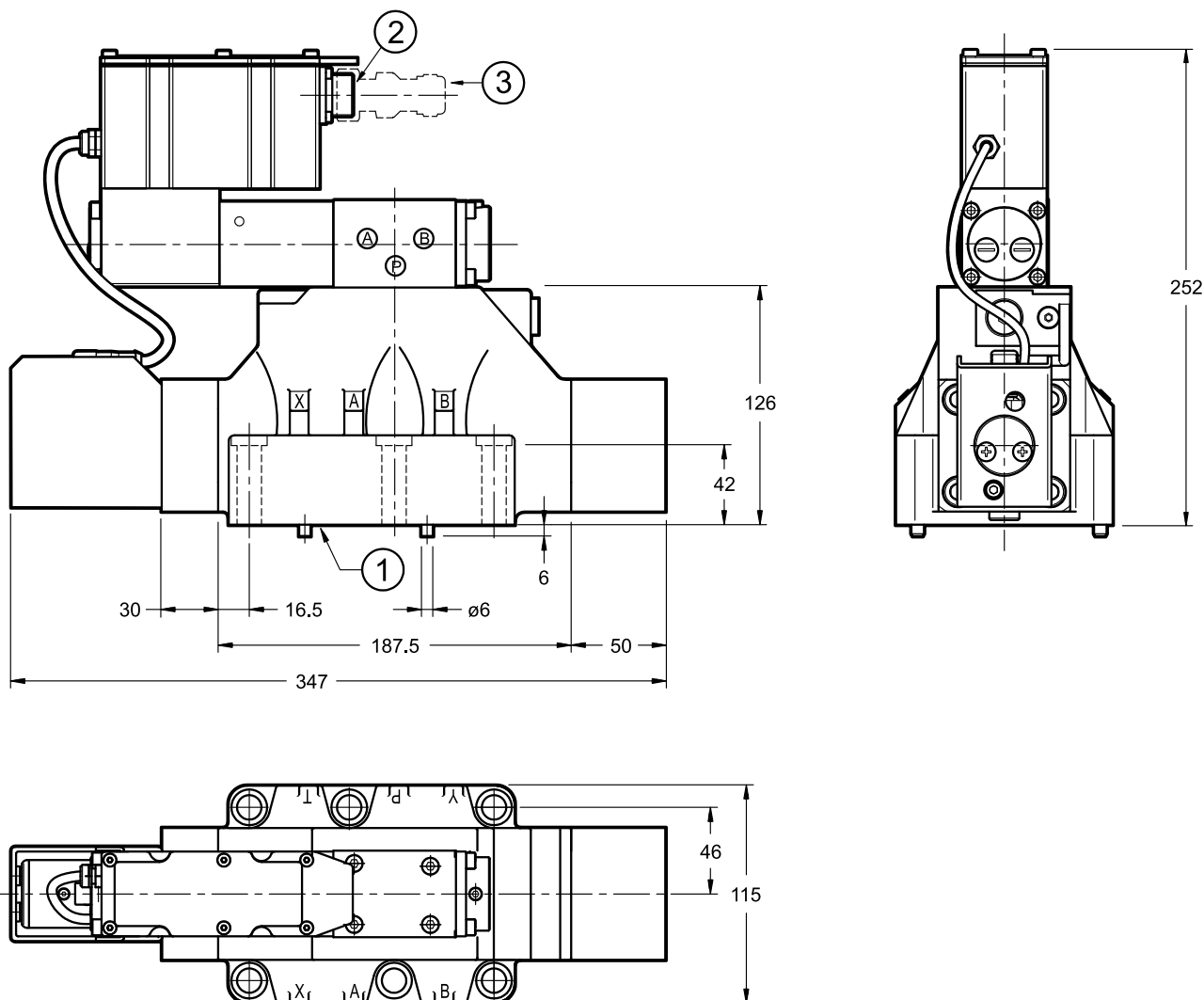
See mounting surface at section 13.

- Do not dismantle the transducers.

Valve fastening:	N. 4 bolts M10x60 - ISO 4762 N. 2 bolts M6x60 - ISO 4762	1	Mounting surface with sealing rings. 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
Tightening torque	M10x60: 40 Nm (A8.8 screws) M6x60: 8 Nm (A8.8 screws)	2	Main connection
Threads of mounting holes:	M6x18; M10x18	3	Electrical connector ( <b>to be ordered separately</b> ) see paragraph 16

## 11 - OVERALL AND MOUNTING DIMENSIONS DXRE8J

dimensions in mm



### NOTES:

See mounting surface at section 13.  
- Do not dismantle the transducers.

Fastening of single valve: N. 6 bolts M12X60 - ISO 4762

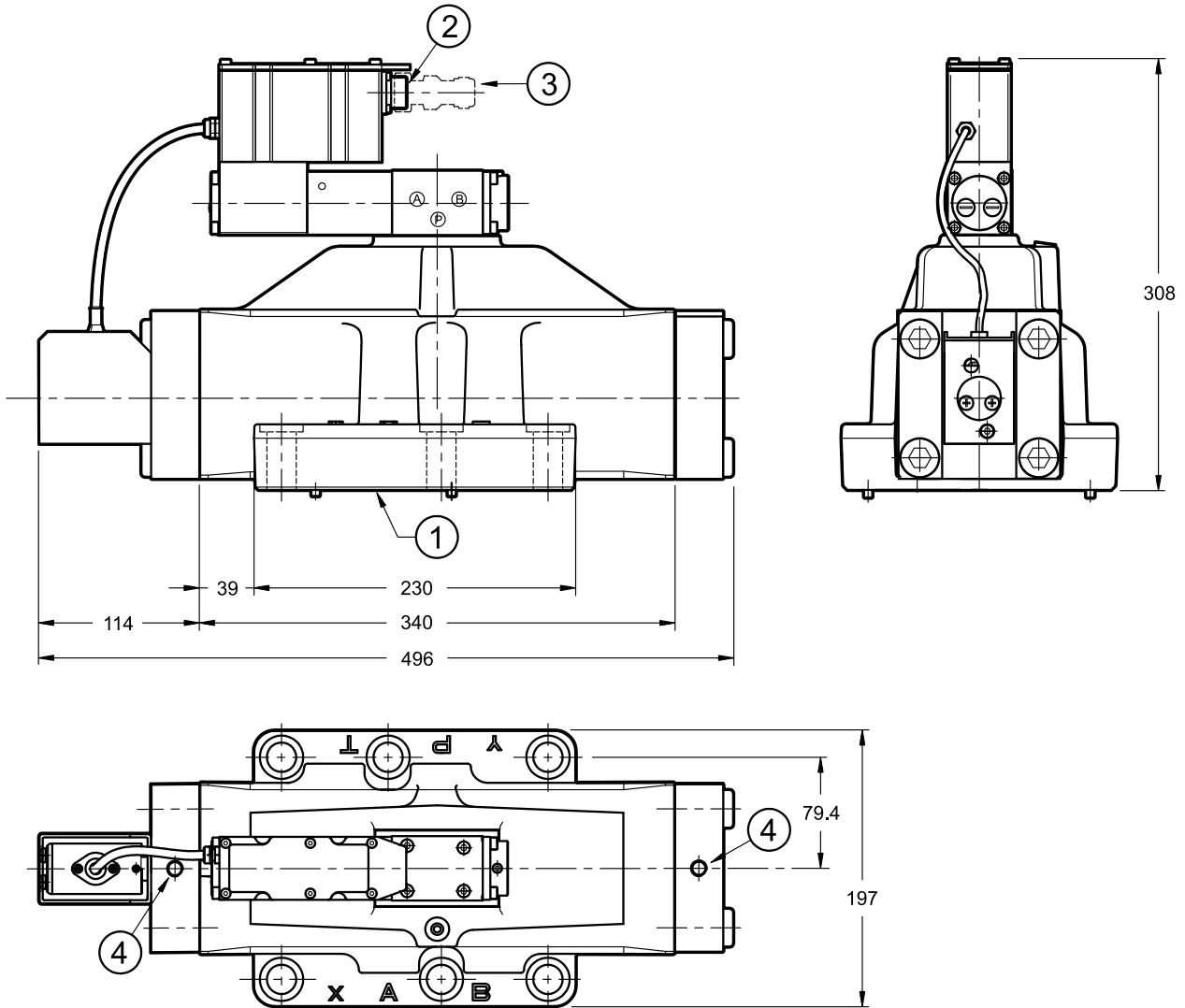
Tightening torque: 69 Nm (A8.8 screws)

Threads of mounting holes: M12X20

1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Electrical connector ( <b>to be ordered separately</b> ) see paragraph 16

## 12 - OVERALL AND MOUNTING DIMENSIONS DXRE10J / DXRE11J

dimensions in mm



### NOTES:

See mounting surface at section 13.  
- Do not dismantle the transducers.

Valve fastening: 6 SHC screws ISO 4762 M20x70

Tightening torque: 330 Nm (A8.8 screws)

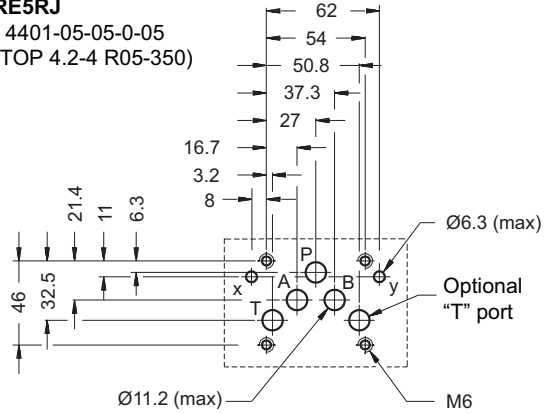
Threads of mounting holes: M20x40

1	Mounting surface with sealing rings: <b>DXRE10J</b> 4 OR type 4150 (37.59x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore <b>DXRE11J</b> 4 OR type 4212 (53.57x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Electrical connector ( <b>to be ordered separately</b> ) see paragraph 16
4	Eyebolt seat for safe lift

## 13 - MOUNTING SURFACES

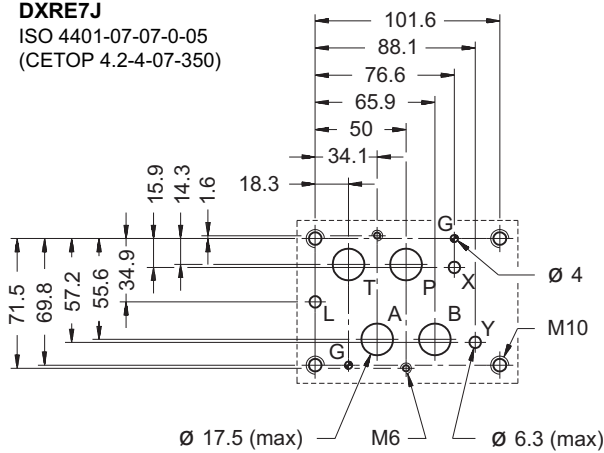
### DXRE5RJ

ISO 4401-05-05-0-05  
(CETOP 4.2-4 R05-350)



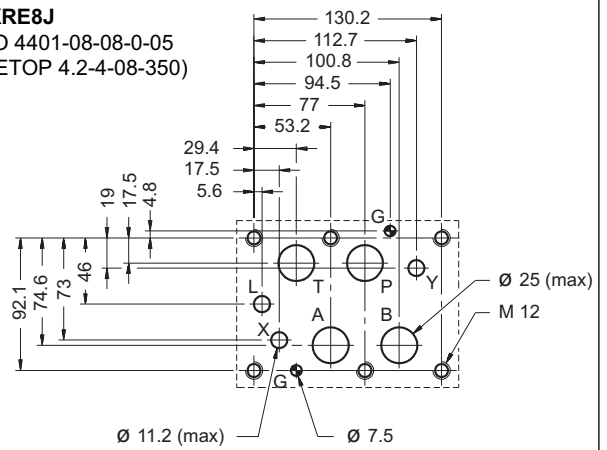
### DXRE7J

ISO 4401-07-07-0-05  
(CETOP 4.2-4-07-350)



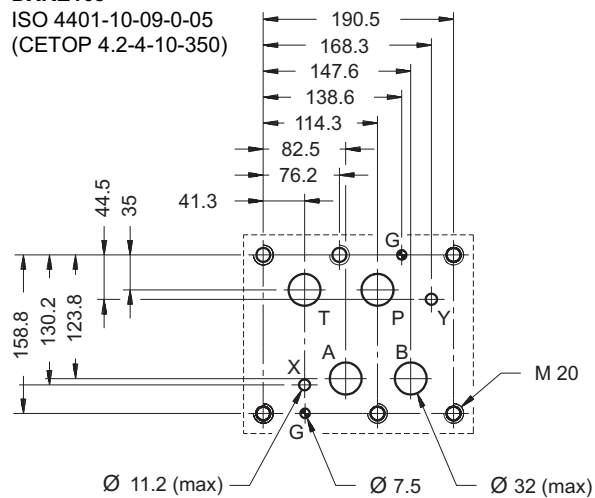
### DXRE8J

ISO 4401-08-08-0-05  
(CETOP 4.2-4-08-350)



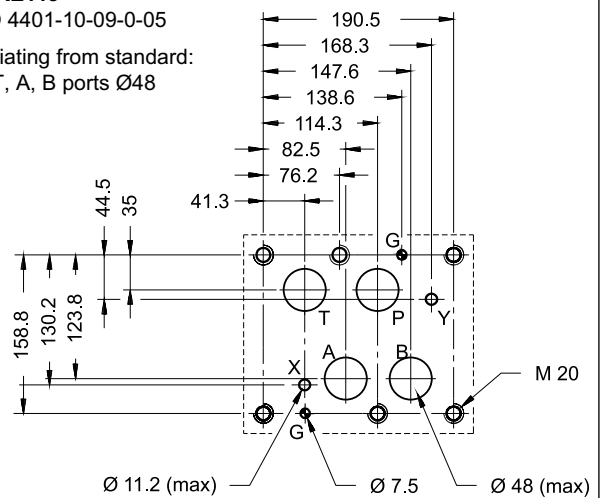
### DXRE10J

ISO 4401-10-09-0-05  
(CETOP 4.2-4-10-350)



### DXRE11J

ISO 4401-10-09-0-05  
deviating from standard:  
P, T, A, B ports Ø48



### 14 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

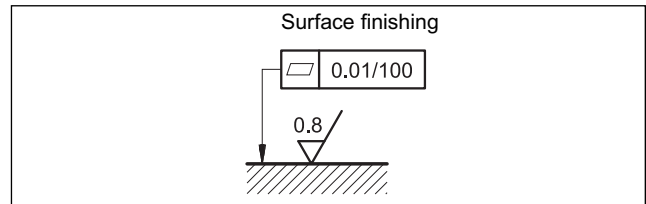
The fluid must be preserved in its physical and chemical characteristics.

### 15 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Take care to the cleanliness of the mounting surfaces and surrounding environment upon installation.



### 16 - ACCESSORIES

(to be ordered separately)

#### 16.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

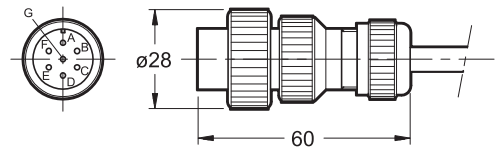


So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



#### 16.2 - Connection cables size

Power supply:

- up to 20 m cable length : 1,0 mm<sup>2</sup>
- up to 40 m cable length : 1,5 mm<sup>2</sup>

Signal: 0,50 mm<sup>2</sup>

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

#### 16.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

### 17 - SUBPLATES

(see catalogue 51 000)

	DXRE5J	DXRE7J	DXRE8J	DXRE10J / DXRE11J
with rear ports	PME4-AI5G	PME07-AI6G	-	-
with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G	-
thread of ports:	P - T - A - B X - Y	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP	1 1/2" BSP 1/4" BSP

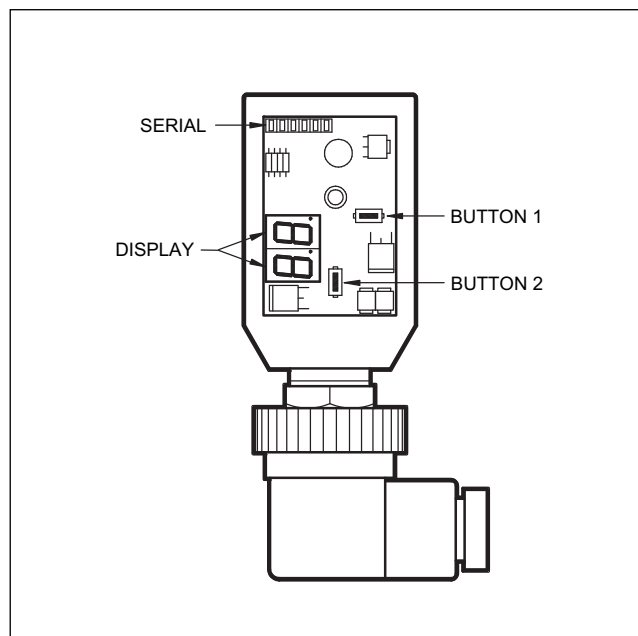
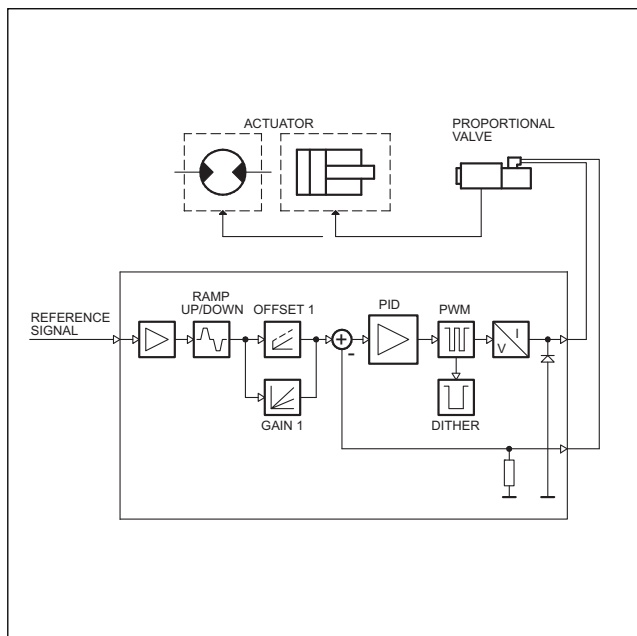


# EDC-1

## DIGITAL ELECTRONIC CONTROL UNIT FOR OPEN-LOOP SINGLE SOLENOID PROPORTIONAL VALVES SERIES 10

### PLUG VERSION

#### OPERATING PRINCIPLE

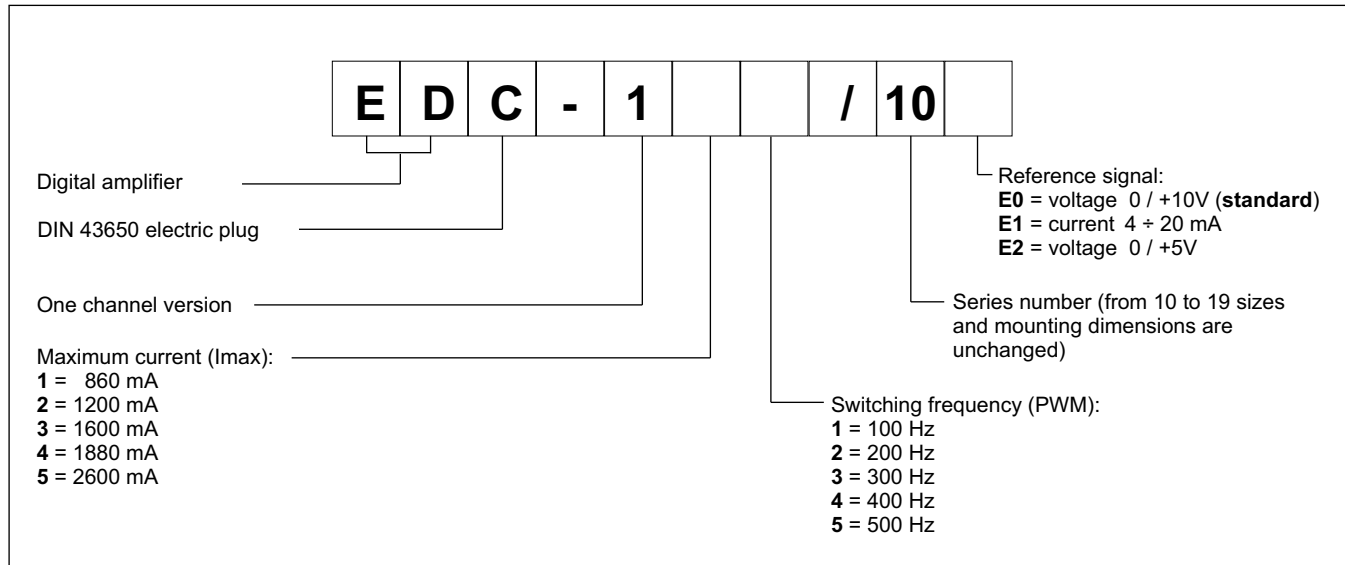


#### TECHNICAL CHARACTERISTICS

Power supply	V DC	10 ÷ 30 - ripple included
Required power	W	min 20 - max 40 (see paragraph 2.1)
Output current	mA	min 800 - max 2600 (see paragraph 1)
Power supply electrical protections		overload over 33V polarity inversion
Output electrical protections		short-circuit
Analogue electrical protections		up to 30 V DC
Available reference signals (selectable from the jumper)	0 ÷ 10V 0 ÷ 5V 4 ÷ 20 mA	input impedance 100 kΩ input impedance 100 kΩ input impedance max 500 Ω
Connector type		DIN 43650
Electromagnetic compatibility (EMC): - EMISSIONS CEI EN 61000-6-4 - IMMUNITY CEI EN 61000-6-2		according to 2004/108/CEE standards (see paragraph 5 - <b>NOTE 1</b> )
Protection to atmospheric agents (CEI EN 60529)		IP 65 - 67
Operating temperature range	°C	-20 / +70
Mass	kg	0,10



### 1 - IDENTIFICATION CODE



The EDC-1 connector is a digital amplifier controlling open loop proportional valves. The unit supplies a variable current proportionally to the reference signal and independently of temperature variations or load impedance, with a resolution of 1% on 2600 mA (the full scale value).

The PWM stage on the solenoid power supply makes it possible to reduce the valve hysteresis thus optimising control precision. The connector is customizable with different maximum current sizes and switching frequencies (PWM), optimized according to the valve to be controlled.

Setting is possible by buttons and display inside the case, or with a notebook by RS232 with the software EDC-PC, (see par. 6.2)

### 2 - FUNCTIONAL SPECIFICATIONS

#### Electric power supply

The connector requires a power supply of 10 ÷ 30 V DC (terminals 1 and 2).

**NOTE: The value of the power supply voltage on the connector must be higher than the rated working voltage of the solenoid to be controlled.**

The power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

The power required by the connector depends on the power supply voltage and on the maximum value of the supplied current (it is determined by the card version). In general a conservative value of the required power can be considered as the product of  $V \times I$ .

Example: a connector with a maximum current = 800 mA and a power supply voltage of 24 V DC requires a power of about 20W. In case of a card with a maximum current = 1600 mA and a power supply voltage of 24 V DC the used power is equal to 38.5 W.

#### 2.2 - Electrical protection

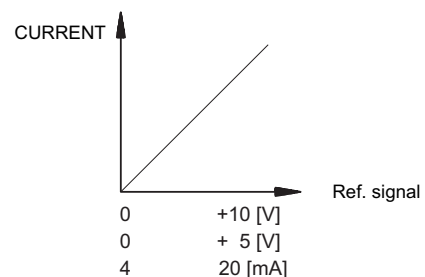
The connector is protected against overvoltage and polarity inversion.

On the output a protection against any short circuit is foreseen.

#### 2.3 - Reference signal

The connector accepts voltage reference signals with 0 ÷ 10V and 0 ÷ 5V, in 4 ÷ 20 mA current, from an external generator (PLC, CNC) or external potentiometer.

See paragraph 7 for electric connections referring to the different connector versions.



### 3 - SIGNALS

#### 3.1 - POWER ON (Power supply)

Display indicate the connector is ON and with +24V DC.

### 4 - ADJUSTMENTS

There are two way adjustments: variables view and parameters editing. The first one enables the real time monitoring of the control values, for both required and read current, on both channels. The second modality enables the operating parameters view and editing.

#### 4.1 - Variables view

The card is switched on at the variables view modality, and it shows the first variable value, that is the U1 parameter (reference signal). Pushing button (1) the current to solenoid is displayed. By means of (1) key, the different variables can be selected. Each time a variable is selected, its short name appears for approximately one second. By briefly pressing the keys, the current variable name appears for approximately one second.

The variables that can be selected are:

- U1:** Reference signal:  
 0 ÷ 10V  
 0 ÷ 5V  
 4 ÷ 20mA (displayed as 2 ÷ 10)
- C1:** current required according to the applied reference signal, expressed in ampere, ranging between 0 and 2.6 A

All the mentioned parameters can be viewed on the two digits display, located on the connector front panel.

The selected value has to be read as follows (example for EDC-15\*/10E\* card):

REFERENCE		DISPLAY U1		DISPLAY C1
(V)	(mA)	(V)		(Ampere)
0	4	0.0	2.0	40 (mA)
5	12	5.0	6.0	13 (A)
10	20	10.	10.	26 (A)

#### 4.2 - PARAMETERS EDITING

To access the parameter editing, press the key (2) for at least 3 seconds.

The first parameter displayed is G1. To modify it, press the key (1) for two seconds, until the display starts blinking. Use the key (2) to increase the value and the key (1) to decrease it. To save the new value, press both the keys. The display stops blinking.

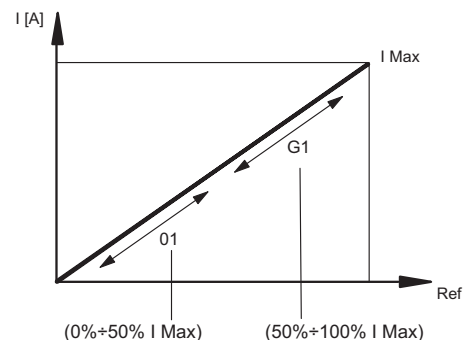
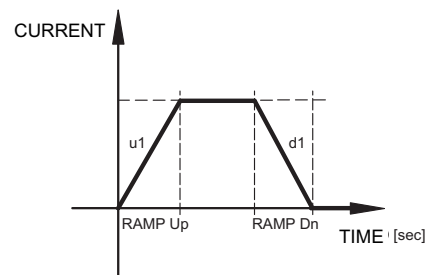
Pressing the key (2) again is possible to scroll all the parameters. To modify some parameters, repeat the steps above-mentioned for the G1 parameter.

The parameters that can be selected are:

- G1:** "I Max" current, expressed in milliampere.  
 It sets the maximum current to the solenoid, when the reference signal is at the maximum value of +10 V (or 20 mA). It is used to limit the maximum value of the hydraulic size controlled by the valve.  
 Default value = I<sub>max</sub>  
 Range = 50 ÷ 100% of I<sub>max</sub>
- o1:** "I Min" current, expressed in milliampere.  
 It sets the offset current to the solenoid, when the reference signal exceeds the limit of 0,1 V (or 0,1 mA). It is used to null the insensitiveness area of the valve (dead band).  
 Default value = 0%  
 Range = 0 ÷ 50% of I<sub>max</sub>
- u1:** "Ramp Up" increasing ramp time, expressed in seconds.  
 It sets the current increasing time, for a variation from 0 to 100% of the input reference.  
 It is used to slow down the valve response time in the case of a sudden variation of the reference signal.  
 Default value = 00 sec.  
 Range = 00 ÷ 50 sec.

- d1:** "Ramp Dn" decreasing ramp time, expressed in seconds.  
 It sets the current decreasing time, for a variation from 100% to 0 of the input reference. It is used to slow down the valve response time in the case of a sudden variation of the reference signal.  
 Default value = 00 sec.  
 Range = 00 ÷ 50 sec.

- Fr:** PWM frequency, in Hertz.  
 It sets the PWM frequency, which is the pulsating frequency of the control current. The PWM decrease improves the valve accuracy, decreasing the regulation stability. The PWM increase improves the regulation stability, causing a higher hysteresis.  
 Default value = PWM (according to version card)  
 Range = 50 ÷ 500Hz



#### 4.3 - ERROR SIGNAL

- EE:** breakdown cable error on 4 ÷ 20 mA signal (threshold 3 mA).  
 Reset the alarm turning off the +24 V DC cable.

### 5 - INSTALLATION

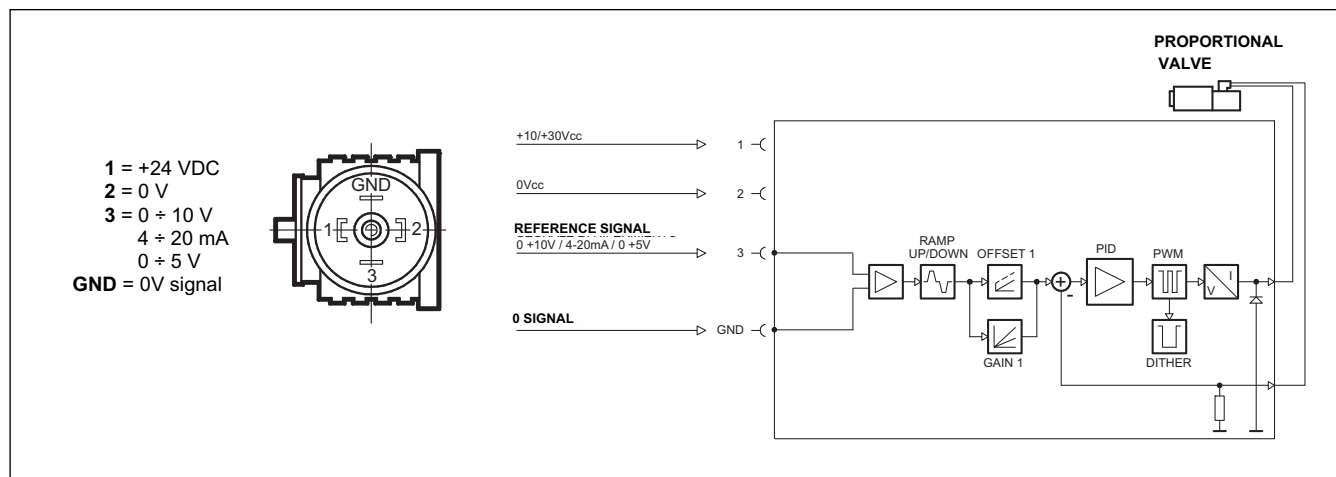
The connector type electronic unit is suitable for direct assembly on the solenoid of the relative proportional valve. The 4-core connection cable (0,5 mm<sup>2</sup> individual wire section) is supplied pre-wired and in a standard length of 2.5 m (DIN 47100 standard).

#### NOTE 1

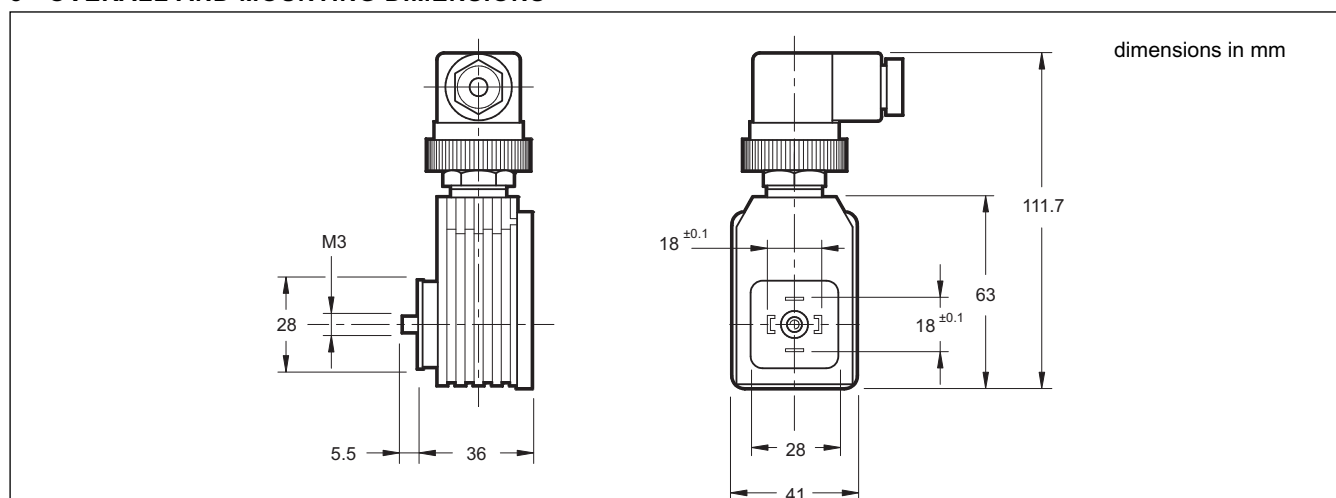
To observe EMC requirements it's important that the control unit electrical connection is in compliance with the wiring diagram of chapter 7. As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electrical motors, inverters and electrical switches).

**In environments where there are critical electromagnetic interferences, a complete protection of the connection wires can be requested.**

### 7 - WIRING DIAGRAM



### 8 - OVERALL AND MOUNTING DIMENSIONS





# EDM-M\*

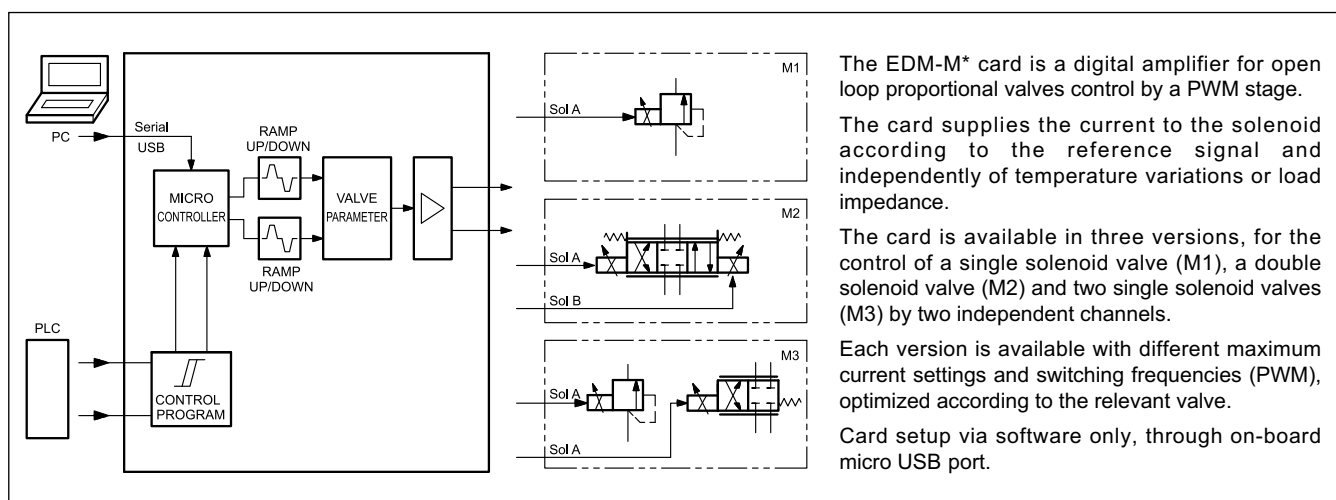
## DIGITAL AMPLIFIER FOR OPEN LOOP PROPORTIONAL VALVES

### SERIES 30

**EDM-M1** single solenoid  
**EDM-M2** double solenoid  
**EDM-M3** two single solenoids  
independent channels

**RAIL MOUNTING TYPE: DIN EN 50022**

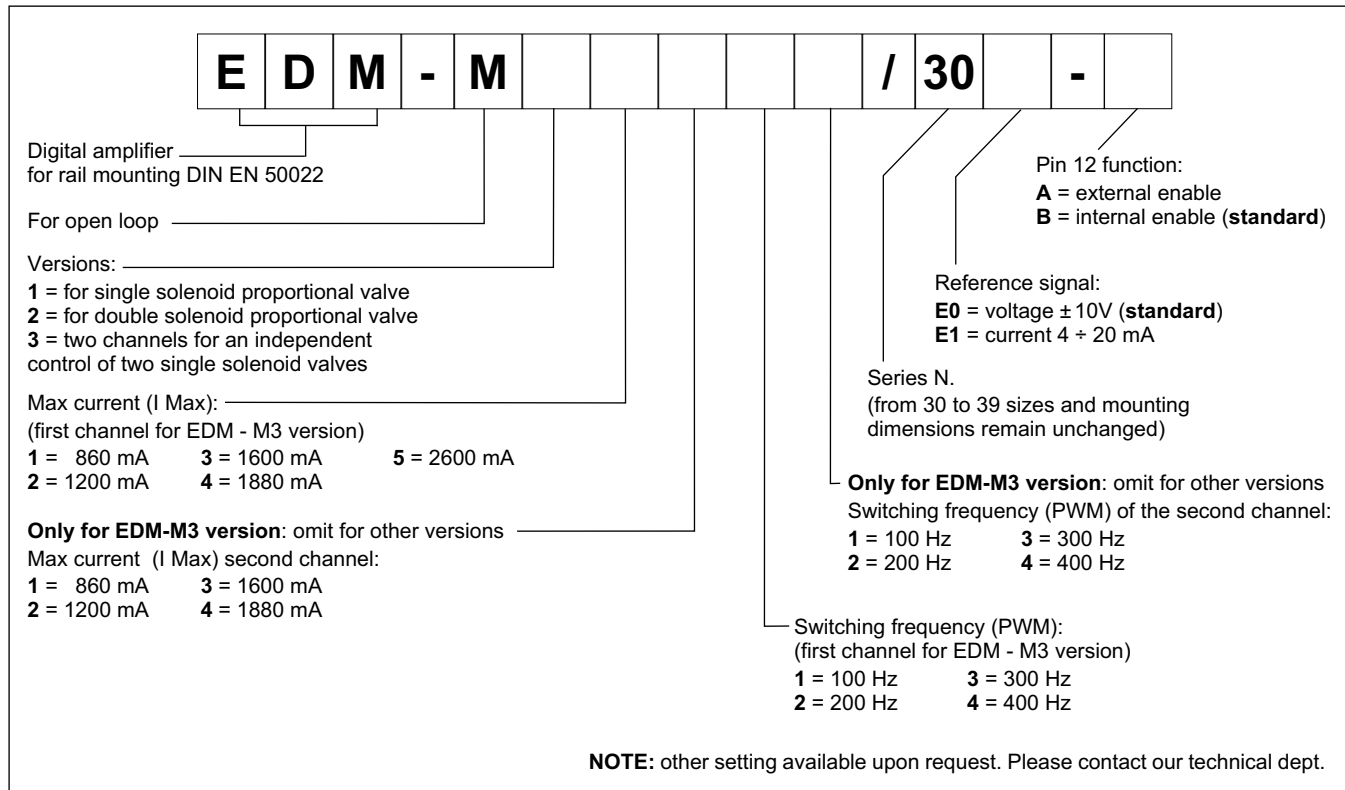
### OPERATING PRINCIPLE



### TECHNICAL CHARACTERISTICS

Operating voltage ( $U_b$ )	V DC	9 ÷ 36 ripple included
Fuse, external	A	6A, medium time lag
Power consumption	W	min 20 - max 60 (see paragraph 5.2)
Output current	A	maximum 4.5 (see paragraph 5.2)
Power supply electrical protections		overload, polarity inversion
Output electrical protections		short-circuit
Available reference signals	V mA	$\pm 10$ , $0 \div 10$ (input resistance 11 kohm) $4 \div 20$ (input resistance 56 ohm)
Additional output aux voltages to external potentiometer	V	+10V DC (50 mA) -10V DC (50 mA)
Electromagnetic compatibility (EMC)		according to 2014/30/EU standards
Housing material		ABS
Housing dimensions	mm	23x98x122
Connector		Plug-in terminal block with tightening screws: 15 poles
Operating temperature range	°C	-20 / +70
Mass	kg	0,15
Protection degree		IP 20

## 1 - IDENTIFICATION CODE



## 2 - FEATURES

### Controller functions

Power amplifier with current controlled by analogue input signal for three different applications:

- M1 : control of 1 single solenoid proportional valve (e.g. throttle, pressure, directional.)
- M2 : control of 1 dual solenoid proportional valve (e.g. directional)
- M3 : control of 2 single solenoid proportional valves, via 2 independent channels
- The current to solenoid is closed loop controlled, so is independent from supply and solenoid resistance.
- Parameters programmable via software: ramps, PWM frequency, offset, gain

### Adaptation of the valve characteristic curve

- Deadband compensation

### Monitoring functions

- The output stage is monitored for cable breakdown, is short circuit proof and disables the power stage in case of an error
- Failure monitoring for current analogue inputs

### Other characteristics

- Scaling of analogue inputs
- Card configuration is made via software, through on-board USB

## 3 - FUNCTIONAL SPECIFICATIONS

### 3.1 - Power supply

This card is designed for 9 to 36 VDC (typical 24 V) of a power supply. This power supply must correspond to the current EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over-voltage protection (varistors or freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

**NOTE: The value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoids to be controlled.**

For EMC requirements the 0V DC of the power supply must be connected to GND on electrical cabinet.

### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 3.3 - Digital Input / Output

The digital input must have a voltage from 12 to 24 V; ON > 8 to  $U_b$ ; OFF < 5V. Input resistance 17 kohm. See block diagrams and wiring for connections.

Digital output: Max current 50 mA.

Low level < 2 V

High level > max  $U_b$ , where  $U_b$  = power supply

### 3.4 - Output value

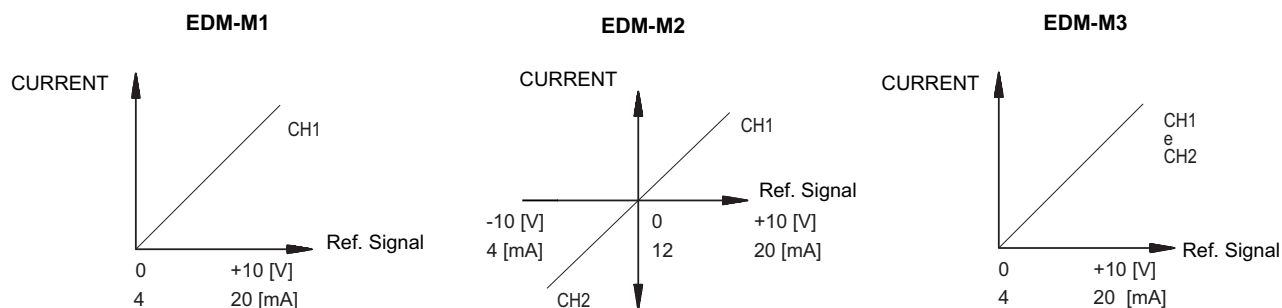
Output value is in current, value range  $800 \div 2600$  mA.

All cables which lead outside must be screened.



### 3.5 - Reference signals

The card accepts voltage reference signals  $0 + 10\text{ V}$  and  $\pm 10\text{ V}$ , current reference signal  $4 + 20\text{ mA}$ , coming from an external generator (PLC, CNC) or from an external potentiometer powered by the card itself. The reference value depends on the card version as stated in diagrams here below.



## 4 - EDM-M, DUPLOMATIC VALVES AND DEFAULT SETTINGS

The card is preset at factory. The following table shows the default settings for the EDM-M standard versions and the Duplomatic valve to be coupled with. As shown in section 1, different settings are possible. Apply for them at our technical dept.

### CARDS FOR 24V SOLENOIDS

CARD				COUPLING VALVES		
				(you can find matches between valves names / catalogue numbers in the group 8 index)		
Name	I Min [mA]	I Max [mA]	PWM [Hz]	Name	single coil	double coil
EDM-M111	200	860	100	DSPE*, RPCED1, RPCED1-T3, RPCE2, RPCE3, BLS6, ZDE3, QDE3	▪	
EDM-M112	200	860	200	DSE3, DSE3B, CRE, PRE*, PRE3, PRED3, MZE, DZCE*, PZE3	▪	
EDM-M131	200	1600	100	DSE5, QDE5	▪	
EDM-M211	200	860	100	DSPE*, ZDE3, BLS6		▪
EDM-M212	200	860	200	DSE3, DSE3B		▪
EDM-M231	200	1600	100	DSE5		▪
EDM-M31111	200 200	860 860	100 100	DSPE*, RPCED1, RPCED1-T3, RPCE2, RPCE3, BLS6, ZDE3, QDE3	▪ ▪	
EDM-M31122	200 200	860 860	200 200	DSE3, DSE3B, CRE, PRE*, PRE3, PRED3, MZE, DZCE*, PZE3	▪ ▪	
EDM-M33112	200 200	1600 860	100 200	VPPM-*PQCE, regulator (DSE5 + CRE)	▪ ▪	

### CARDS FOR 12V SOLENOIDS

CARD				COUPLING VALVES		
				(you can find the matches between valves names and catalogue numbers in the group 8 index)		
Name	I Min [mA]	I Max [mA]	PWM [Hz]	Name	single coil	double coil
EDM-M141	300	1880	100	DSPE*, BLS6	▪	
EDM-M142	300	1880	200	DSE3, DSE3B, CRE, PRE*, PRE3, PRED3, MZE, DZCE*, ZDE3, QDE3, PZE3	▪	
EDM-M151	500	2600	100	DSE5, QDE5	▪	
EDM-M241	300	1880	100	DSPE*, BLS6		▪
EDM-M242	300	1880	200	DSE3, DSE3B, ZDE3		▪
EDM-M251	500	2600	100	DSE5		▪

## 5 - INSTALLATION

### 5.1 - Wires sizing

Suggested cable cross sections for solenoid supply are shown in the table below. However, the sizing has to ensure a voltage to the coil of not less than 90% of its nominal value.

**Suggested cable cross sections for solenoid supply [mm<sup>2</sup>]**

Card supply voltage	Coil type	Cable length		
		< 10 m	10 to 20 m	20 to 30 m
24V	860 mA - 24V	0,5	0,75	1
	1600 mA - 24V	0,5	1	1,5
	1880 mA - 12V	0,5	1	2
	2600 mA - 12V	0,75	1,5	2,5
12V	1880 mA - 12V	0,75	1,5	2
	2600 mA - 12V	1	2	2,5

For signal cables we suggest a cross section of 0.25 mm<sup>2</sup>, up to 10 meter.

As a general rule, the valve and the electronic card connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

### 5.2 - Card power consumption

The power required by the card depends on output current to be supplied (determined by the card version) and on the nominal voltage of the coil to be feed.

A conservative value of the required power can be considered as the product of V x I.

Examples:

an EDM-M111 card with maximum current 860 mA coupled with a coil with nominal voltage 24V requires 20W power.

an EDM-M35411 card with maximum current 4500 mA coupled with a coil with nominal voltage 12V requires 54W power.

The maximum power consumption of the card is 60 W.

### 5.3 - Start-up

To observe EMC requirements it is important that the control card electrical connection is in strict compliance with the wiring diagram.

A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable length > 3 meters.



**WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs. They interfere with the current control and can destroy the output stage.**

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable for the installation of this card.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens at both cable ends have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.



**WARNING! plug / unplug the terminal strip only when the control board is switched-off. Otherwise, the card may be damaged, even important.**

## 6 - DEVICE SETUP

Card set-up is possible via software only.

### 6.1 - EBC Software

The software EBC can be easily downloaded from the Diplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a micro USB cable (type USB A – micro USB B).

Once connected, the software automatically recognizes the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

The software is compliant with Microsoft OS Windows 7, 8 and 10.

### 6.2 - Parameters table

The parameters table is available in English. The parameter setting can be done at different user access levels.

For a complete list of parameters and their settings please refer to the *Technical Manual 89251 ETM*.



## 7 - MAIN FEATURES

### 7.1 - Diagnostics

Activates / deactivates the error detection. Off is useful in troubleshooting tasks.

parameter DIAGNOSTICS (ON|OFF|AUTO)  
default: auto

### 7.3 - Input signal scaling

Set the coefficients for offset and gain of the input signal.

EDM-M1	EDM-M2	EDM-M3
SIGNAL_OFFSET	SIGNAL_OFFSET	SIGNAL1_OFFSET SIGNAL2_OFFSET
range: E0: -2 ... 2V default: 0.00	E1: -4 ... +4 mA	
SIGNAL_GAIN	SIGNAL_GAIN	SIGNAL1_GAIN SIGNAL2_GAIN
range: 0.80 ... 10.00 default: 1.00		

### 7.4 - Curve adaption

Deadband compensation and current input scaling are customizable. Values in percent.

EDM-M1	EDM-M2	EDM-M3
ADJ_MIN	ADJ_MIN_A ADJ_MIN_B	ADJ1_MIN ADJ2_MIN
range: 0 ... 50% default: according to the card version		
ADJ_MAX	ADJ_MAX_A ADJ_MAX_B	ADJ1_MAX ADJ2_MAX
range: ADJ_min ... 100% default: 100		
ADJ_TRIGGER	ADJ_TRIGGER	ADJ1_TRIGGER ADJ2_TRIGGER
range: 0... 20% default: 1.5%		

### 7.5 - Ramps

Parameters for ramp up and ramp down can be set in milliseconds. A and B tag the quadrants. These values set the amount of time that the command signal will take to follow a step change in the reference signal 0 ÷ 100.

EDM-M1	EDM-M2	EDM-M3
RAMP_UP	RAMP_UP_A RAMP_DOWN_A	RAMP1_UP RAMP1_DOWN
RAMP_DOWN	RAMP_UP_B RAMP_DOWN_B	RAMP2_UP RAMP2_DOWN
range: 0 ... 20000 ms default: 0		

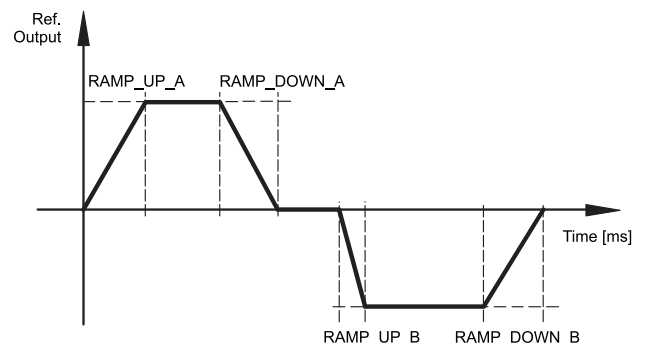
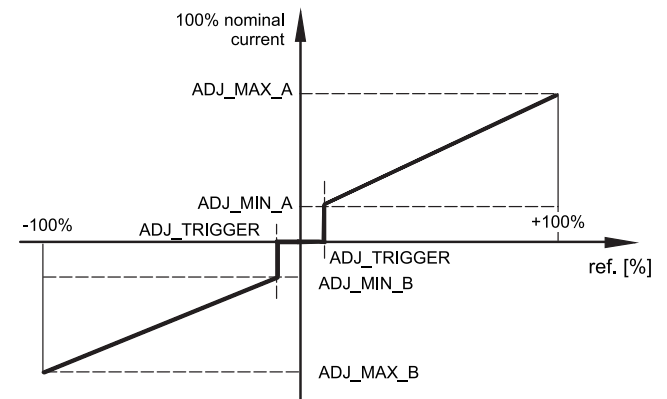
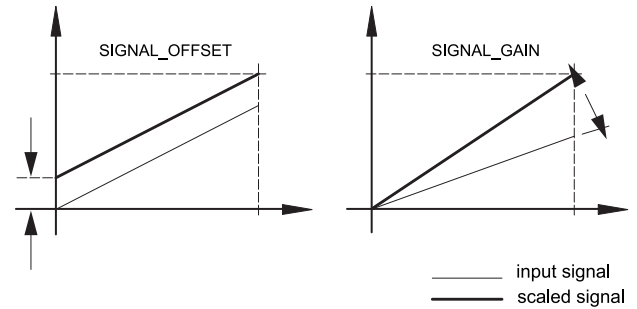
### 7.6 - PWM

Pwm frequencies for current output.

EDM-M1	EDM-M2	EDM-M3
PWM	PWM	PWM1 PWM2
range: 70 ... 500 Hz default: preset value, according to the card version		

### 7.2 - Enable (version A only)

Activates / deactivates the external enable.  
parameter ENABLE (INT|EXT)  
default: EXT

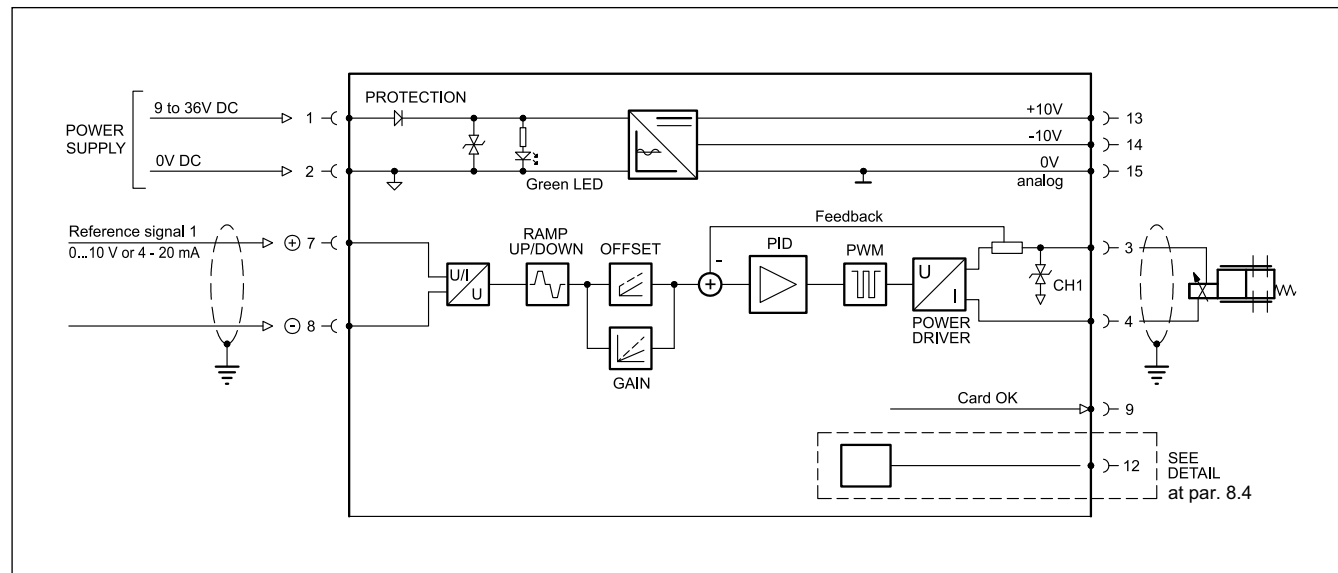




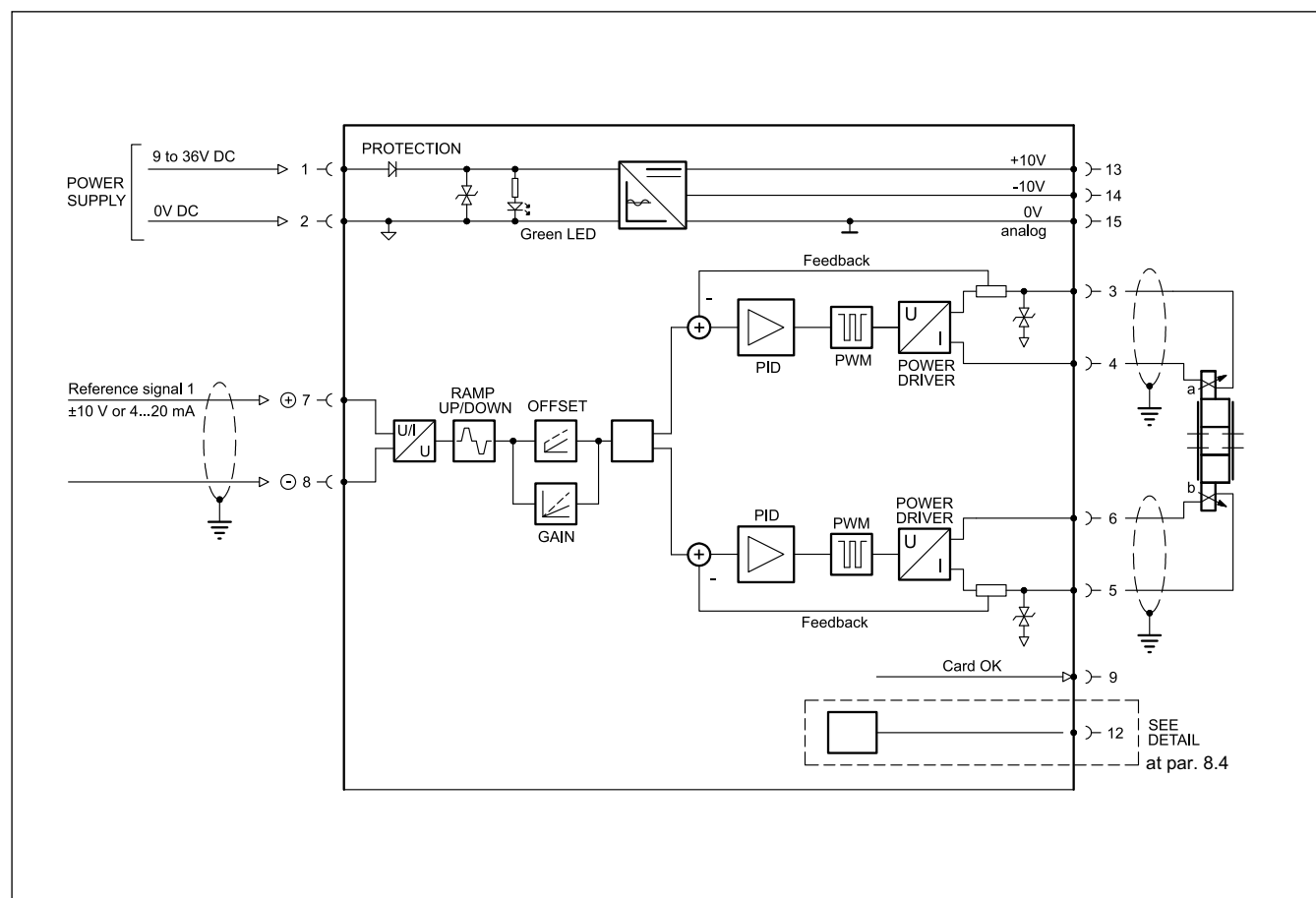
## 8 - CARDS BLOCK DIAGRAMS

The function of PIN12 varies depending on the card version. It can be either ENABLE input (A version) or an auxiliary voltage output (B version).

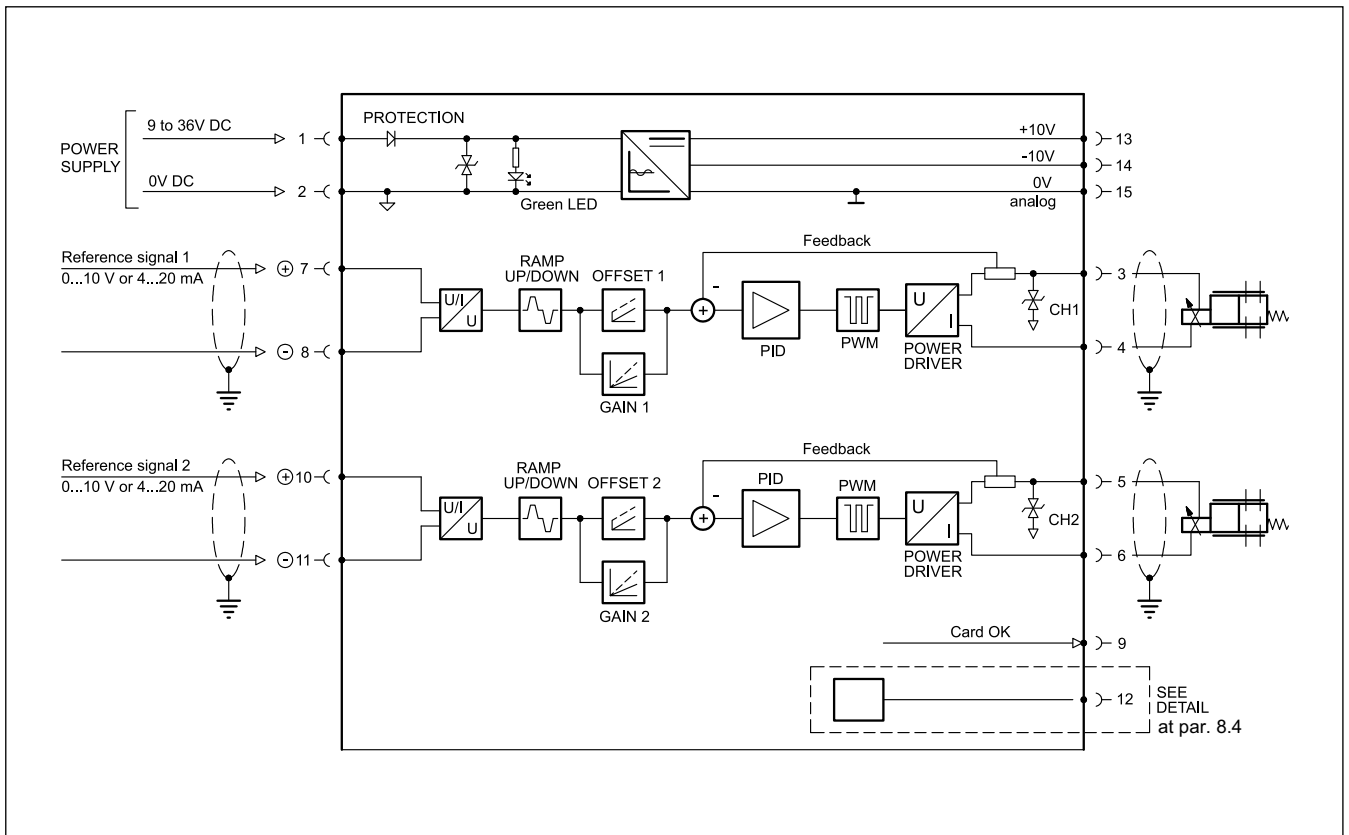
### 8.1 - EDM-M1



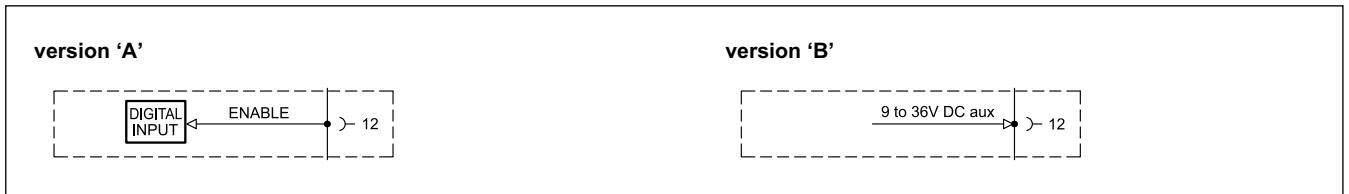
### 8.2 - EDM-M2



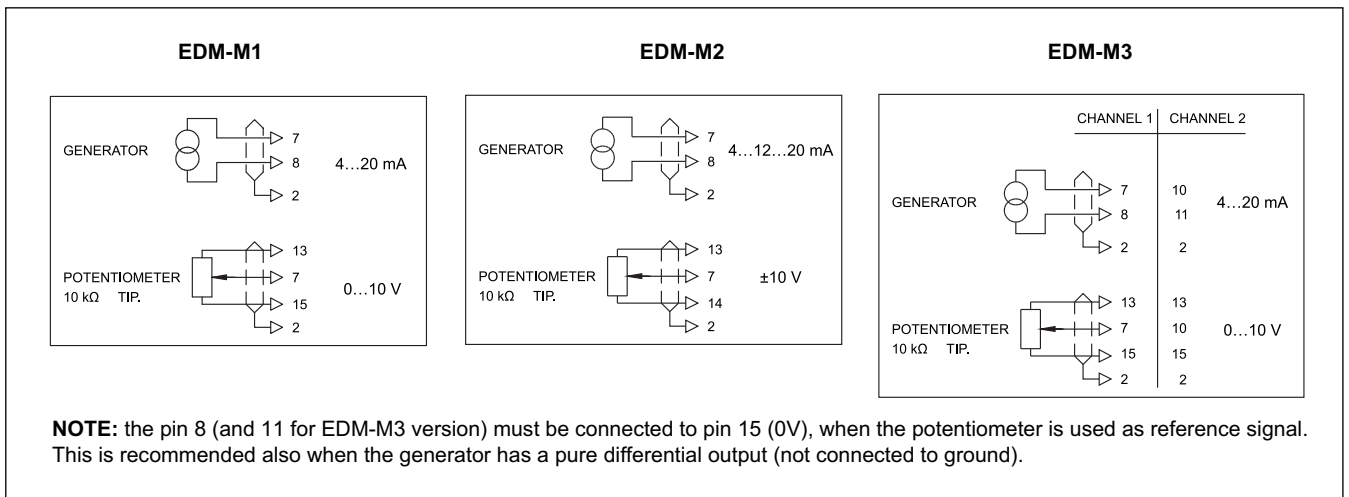
### 8.3 - EDM - M3



### 8.4 - Function of PIN 12

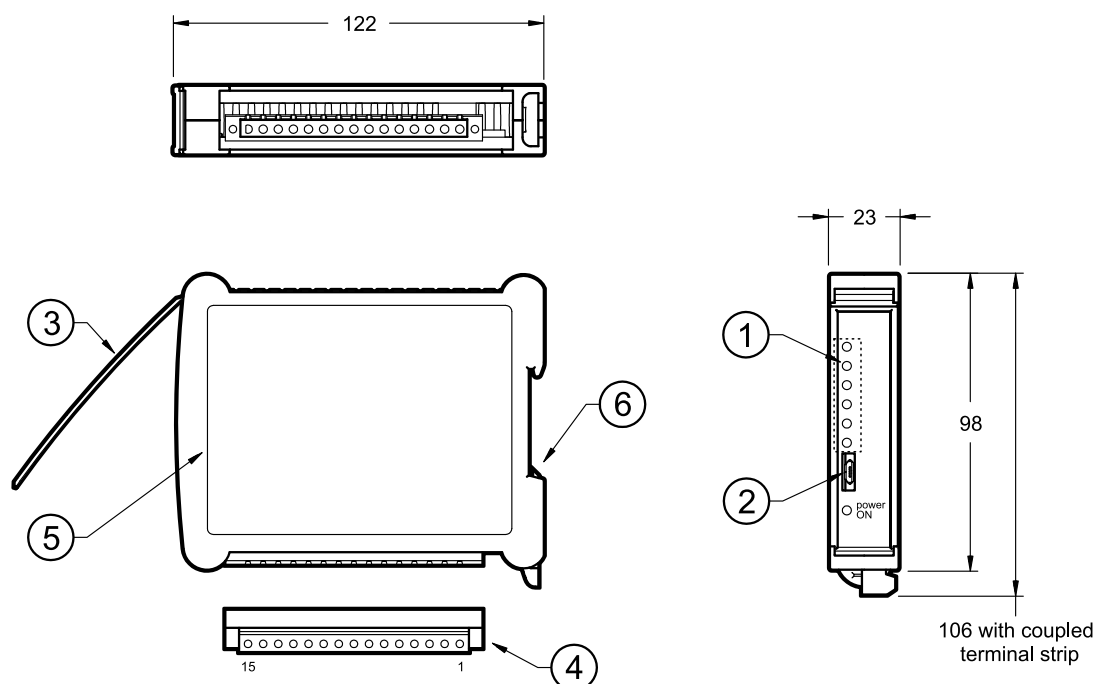


## 9 - WIRING



## 10 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	LED interface
2	Micro USB socket
3	Protection flap
4	Terminal strip, plug-in, 15-pole with downwards cables output and fastening bolts
5	Label with circuit and wiring
6	DIN rail clip



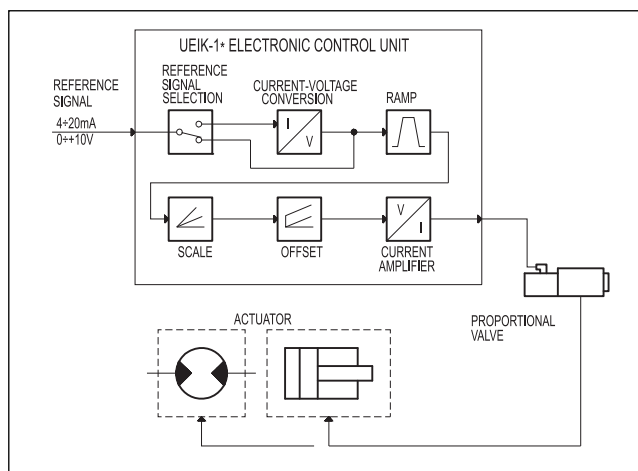
# UEIK-1\*

## ELECTRONIC CONTROL UNIT FOR OPEN LOOP SINGLE SOLENOID PROPORTIONAL VALVE

### SERIES 51

## EUROCARD TYPE

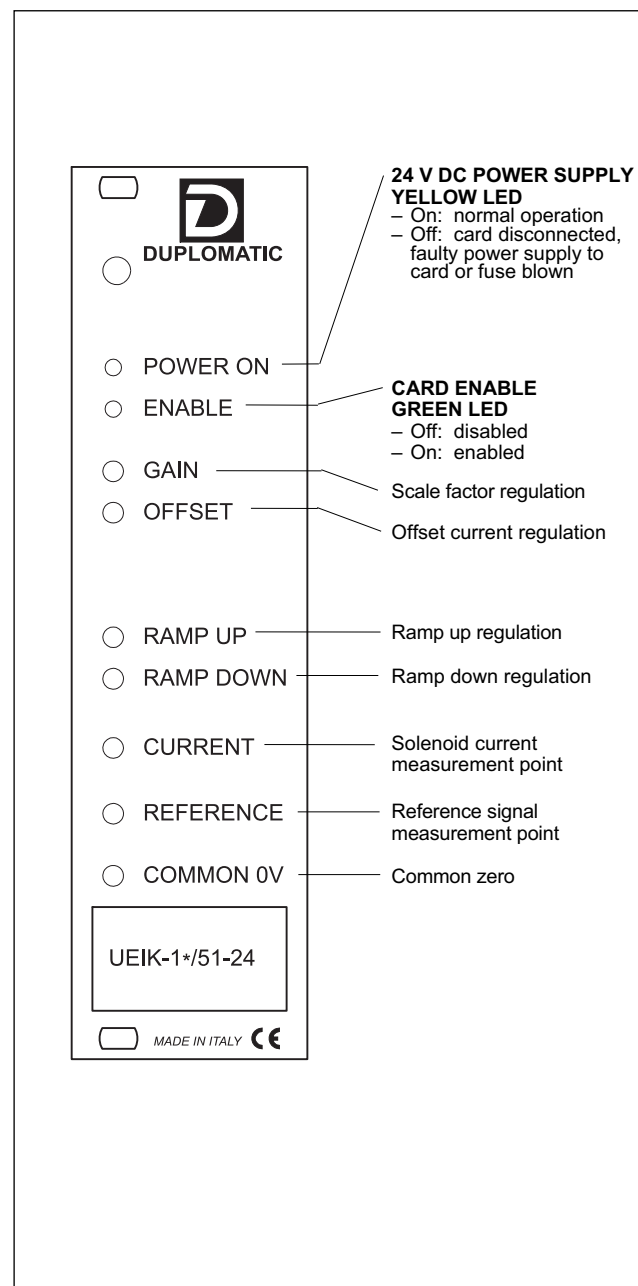
## FUNCTIONAL BLOCK DIAGRAM



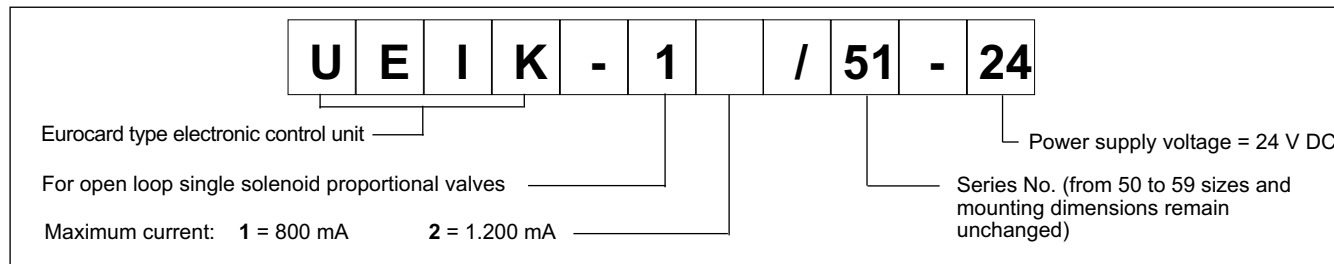
## TECHNICAL CHARACTERISTICS

Power supply	V DC	22 ÷ 30 Ripple included
Required power	See par. 2.1	
Output current	See par. 3.3	
Power supply electrical protection	– overload – polarity inversion	
Reference signal: – Voltage – Current	V mA	0 / +10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	kΩ Ω	10 250
Electromagnetic compatibility (EMC) (see par. 5 - NOTE 1)		in compliance with 2004/108/CE
Card size	Eurocard 100x160x35	
Connector interface	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,20

## FRONT PANEL



## 1 - IDENTIFICATION CODE



The UEIK-1\* card is an electronic control unit Eurocard type for open loop single solenoid proportional valves.

The unit supplies a variable current in proportion to the reference signal and independently of temperature variations or load impedance.

The PWM stage on the solenoid power supply makes it possible to reduce valve hysteresis thus optimising control precision. The front panel is fitted with LEDs to indicate card functions and potentiometers to optimize control.

## 2 - FUNCTIONAL SPECIFICATIONS

### 2.1 - Electric power supply

The card requires a power supply of between 22 and 30 V DC (pin 2a/2c - 4a/4c) and a power of: 20W (UEIK-11) - 29W (UEIK-12). Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

### 2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion. A 2A fast-acting fuse is fitted for power circuit protection.

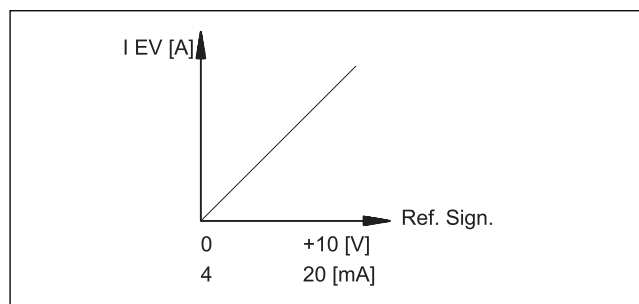
### 2.3 - Reference signal

The card accepts voltage reference signals (0 to +10V) or current reference signals (4+20 mA).

**N.B: If the signal is transmitted by potentiometer, please verify that this has a load of at least 200  $\Omega$ .**

See para. 9 for electrical connections.

The diagram shows characteristics of current supplied according to the reference signal.



## 3 - SIGNALS AND ADJUSTMENT

### 3.1 - POWER ON

The green LED indicates card power supply:

ON - normal power supply

OFF - no power supply, faulty power supply or blown fuse

### 3.2 - ENABLE

A 22 to 30 V DC enable command on pin 24c is required for card operation.

The condition of the card enable is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:

ON - card enabled

OFF - card disabled or failed

### 3.3 - GAIN (Scale factor regulation)

The "GAIN" potentiometer enables regulation of the relation between the set reference value and maximum current supplied to the solenoid and therefore the hydraulic parameter controlled by the valve.

The maximum current of the card is limited to 1,0A (UEIK-11) - 1,2A (UEIK-12). See par. 6 for default values.

Rotate clockwise to increase current.

### 3.4 - OFFSET (Offset current regulation)

The "OFFSET" potentiometer enables regulation of the offset current of the valve. It is used to eliminate the insensitivity zone (dead zone) of the valve.

The regulation field is from 0 to 0,5A (UEIK-11) - from 0 to 0,65A (UEIK-12).

The offset current is activated when the reference signal exceeds the threshold of + 150 mV (or 4,25 mA).

The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

**NOTE:** The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

### 3.5 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulates the time required to reach the supplied current according to a step change of the reference signal up or down.

It is possible, in this way, to control the valve response time, adjusting it to the requirements of the hydraulic circuit and the machine cycle.

Ramps can be inhibited by transmitting a 22 to 30 V DC exclusion command to pin 16a. In this case, the ramp residual time is 10 ms.

Rotate clockwise to increase ramp time.

## 4 - SIGNAL MEASUREMENT

### 4.1 - CURRENT (Solenoid current measurement point)

Enables voltage reading of current supplied to the solenoid.

Reading conversion: 1V DC = 1A (UEIK-11)

0,82V DC = 1A (UEIK-12).

### 4.2 - REFERENCE (Reference signal measurement point)

Enables reading in voltage of reference signal sent to the card.

Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = 0 V      20 mA = - 10V.

## 5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm<sup>2</sup>, depending on their length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

**NOTE 1:** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of par. 9.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

## 6 - DEFAULT CONDITIONS

The electronic unit is supplied factory set.

The setting conditions are:

- "GAIN" regulation: +10V (or 20 mA) reference signal corresponding to a current supply of 0,7 A to the solenoid.
- "OFFSET" regulation: zero
- "RAMP UP" and "RAMP DOWN" regulation: minimum
- position SW1 on V
- position SW2 on S
- position SW3 on AA
- switching frequency (PWM) = 200Hz (UEIK-11)  
100Hz (UEIK-12).

## 7 - START-UP AND CONTROL SETTINGS

If required, it is possible to change the settings as follows:

### a) OFFSET CURRENT ADJUSTMENT

- Set "GAIN" potentiometer to minimum.
- Enter reference signal at maximum value (+10V or 20 mA).
- Set the "OFFSET" potentiometer so that the valve is positioned at the start of the work zone.

### b) SCALE FACTOR ADJUSTMENT

- Enter the reference signal at maximum value (+10V or 20 mA).
- Set "GAIN" potentiometer so that the controlled hydraulic parameter reaches the maximum required value.

**NOTE:** The maximum current value must be compatible with the maximum current prescribed by the technical table of the connected proportional valve.

### c) RAMP REGULATION

- Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain gradual valve operation required with a reference signal variation.

## 8 - CARD CIRCUIT SETTINGS

The overall and mounting dimensions diagram in par. 10 shows three switch banks: SW 1 - SW 2 - SW 3 which enable the card to be set up as required.

**NOTE:** Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL (SW 1 bank comprising three individual switches)

- select V for voltage reference signal
- select I for current reference signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

- select S for single ended reference signal. This condition is obligatory in the case where the reference signal is generated with an external potentiometer fed by the card itself.
- select D for differential reference signal. This condition is preferable in the case where the reference signal comes from a PLC or CNC analogic outlet.

**NOTE:** The SW 3 bank, comprising two individual switches, must always be set at AA as per standard default conditions.

### SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).

The setting range is from 80 to 370 Hz.

An appropriate switching frequency adjustment allows reduction of the valve hysteresis value.

Clockwise rotation to increase the frequency.



The schematic diagram illustrates the internal architecture of the EV-1000 electronic load. It features several input sections on the left: a power input for +24 VDC X 20W with ±10% ripple, a 0 VDC input, and a GND connection. Control inputs include 'CLOSE TO ENABLE' and 'CLOSE TO RAMP INHIBIT'. A 'REFERENCE SIGNAL' section provides current (12a, 12c) and voltage (12a, 12c, 4ac) inputs, along with a potentiometer (10a, 12a, 12c, 4ac) for current adjustment. The main circuit includes a fuse (2A-RAP), a power LED (yellow), and various operational amplifiers and comparators. Key components include a current amplifier, a PWM generator, and a current feedback loop. The output terminals provide a regulated load current (10A, +10V x 0.05A) and a feedback signal (T.P. CURRENT). A potentiometer (10KΩ TYPICAL) is used for current adjustment. The diagram also shows the internal wiring for the reference signal, including current and voltage inputs, and a potentiometer for current adjustment.

Technical drawing of the UEIK-1/51-24 module, showing dimensions and component layout.

**Dimensions:**

- Overall width: 160
- Overall height: 129 (3HE)
- Front panel width: 35 (7TE)
- Front panel height: 100
- Mounting hole spacing: 14 (horizontal), 8 (vertical)

**Component Layout:**

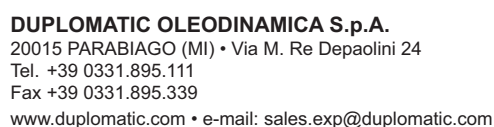
- Front Panel:** POWER ON, ENABLE, GAIN, OFFSET, RAMP UP, RAMP DOWN, CURRENT, REFERENCE, COMMON 0V.
- Internal Components:** SW1 (V), SW2 (S), D, 2A-RAP FUSE, SW3 (AA), PT7 (switching frequency test point).

**Legend:**

- ☐ POWER ON
- ☐ ENABLE
- ☐ GAIN
- ☐ OFFSET
- ☐ RAMP UP
- ☐ RAMP DOWN
- ☐ CURRENT
- ☐ REFERENCE
- ☐ COMMON 0V

**Module Identification:**

- Model: UEIK-1/51-24
- MADE IN ITALY
- CE Marking





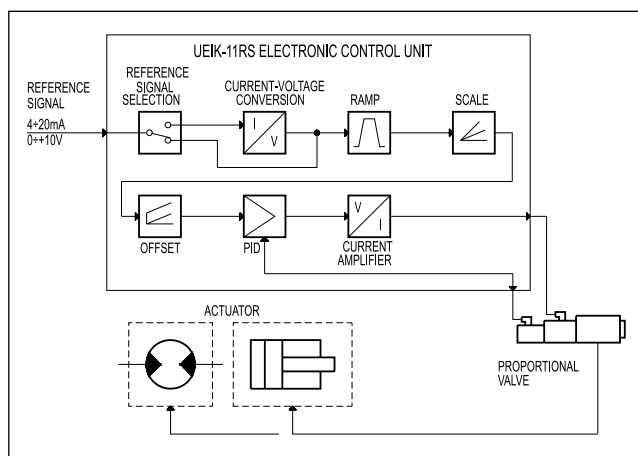
# UEIK-11RS\*

## ELECTRONIC CONTROL UNIT FOR SINGLE SOLENOID PROPORTIONAL VALVE WITH POSITION FEEDBACK

SERIES 52

### EUROCARD TYPE

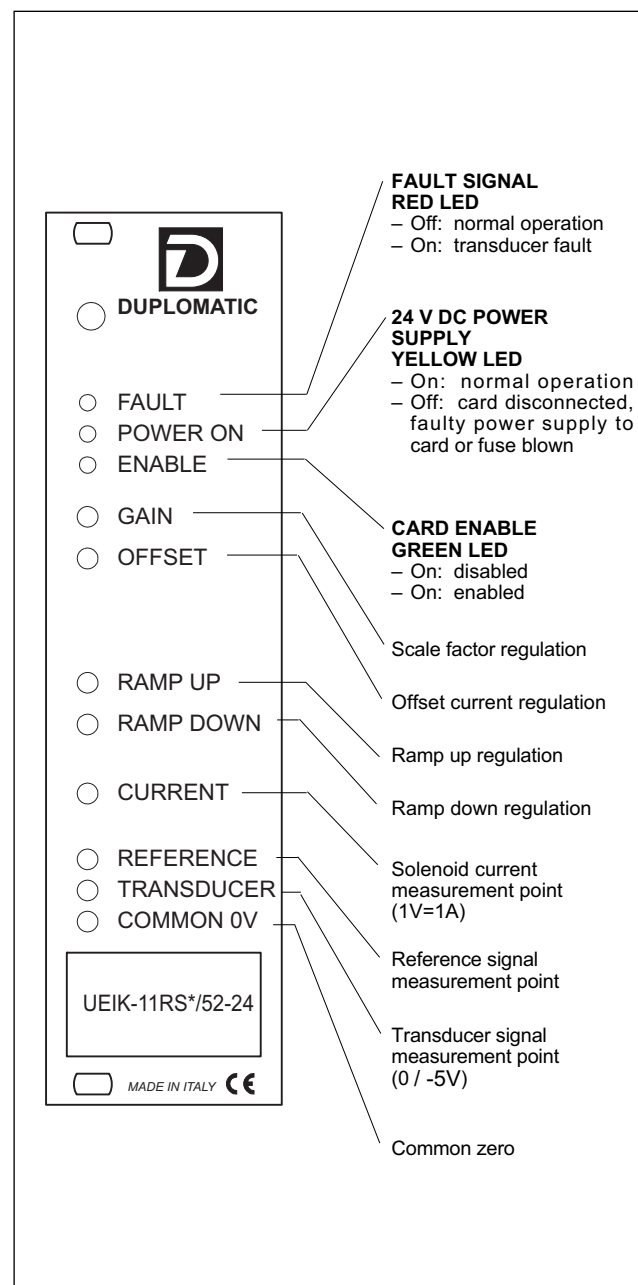
### FUNCTIONAL BLOCK DIAGRAM



### TECHNICAL CHARACTERISTICS

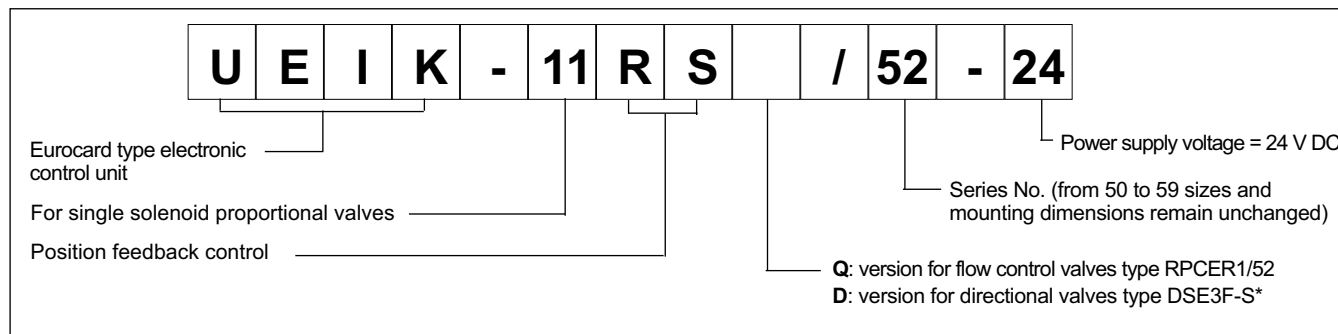
Power supply	V DC	22 ÷ 30 Ripple included
Required power	W	20 ÷ 45
Output current	see par. 3.4	
Power supply electrical protections	– overload – polarity inversion	
Reference signal: – Voltage – Current	V mA	0 ÷ +10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	KΩ Ω	10 250
Electromagnetic compatibility (EMC) (see par. 5 - <b>NOTE 1</b> )	in compliance with 2004/108/CE	
Card size	Eurocard 100x160x35	
Connector edge	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,20

### FRONT PANEL





## 1 - IDENTIFICATION CODE



The UEIK-11RS\*/52 card is an electronic control unit Eurocard type for closed loop control of single solenoid proportional valves with positional feedback control.

The card controls the position of the valve spool according to the reference input signal enabling linear regulation and reduced hysteresis.

The front panel is fitted with LEDs to indicate card functions and potentiometers to optimise control.

## 2 - FUNCTIONAL SPECIFICATIONS

### 2.1 - Electric power supply

The card requires a power supply of 22-30 V DC and 20 ÷ 45 W (pin 2a/2c - 4a/4c).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

### 2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.

A 3,15A fast-acting fuse is fitted for power circuit protection.

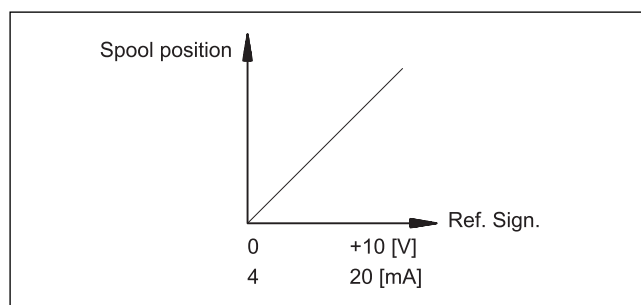
### 2.3 - Reference signal

The card accepts voltage reference signals (0 ÷ +10V) or current signals (4÷20 mA).

**N.B:** If the signal is transmitted by potentiometer, please verify that this has a load of at least 200 Ω.

See par. 9 for electrical connections.

The diagram shows characteristics of valve spool position according to the reference signal.



## 3 - SIGNALS AND ADJUSTMENT

### 3.1 - FAULT

The red LED indicates operation of the position transducer:

OFF - normal operation

ON - transducer fault or electrical connection failure. In this case the current supply to the solenoid is shut off and the valve is set at the rest position, the ENABLE LED switches off and the OK card relay contact opens (6a - 6c pin)

### 3.2 - POWER ON

The yellow LED indicates card power supply:

ON - normal power supply

OFF - no power supply, faulty power supply or blown fuse

### 3.3 - ENABLE

From 22 to 30 V DC (pin 24c) enable command is required for card operation.

The condition of the card enable is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:

ON - card enabled

OFF - card disabled

### 3.4 - GAIN (Scale factor regulation)

The "GAIN" potentiometer enables regulation of the relation between the set reference value and maximum current supplied to the solenoid and therefore the hydraulic parameter controlled by the valve.

The maximum current of the card is limited to 1A for RSQ version and to 1,8A for RSD version. See par. 6 for default values.

Rotate clockwise to increase current.

### 3.5 - OFFSET (Offset current regulation)

The "OFFSET" potentiometer enables regulation of the offset current of the valve. It is used to eliminate the insensitivity zone (dead zone) of the valve.

The regulation field is from 0 to 0,5A for RSQ version and from 0 to 0,9A for RSD version.

The offset current is activated when the reference signal exceeds the threshold of + 150 mV (or 4,25 mA).

The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

**NOTE:** The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

### 3.6 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulates the time required to achieve the supplied current according to a step change of the reference signal up or down.

It is possible, in this way, to control the valve response time, adjusting it to the requirements of the hydraulic circuit and the machine cycle.

Ramps can be inhibited by transmitting a 22 to 30 V DC exclusion command to pin 16a. In this case, the ramp residual time is 10 ms. Rotate clockwise to increase ramp time.

## 4 - SIGNAL MEASUREMENT

### 4.1 - CURRENT (Solenoid current measurement point)

Enables voltage reading of current supplied to the solenoid.

Reading conversion: 1V DC = 1A.

### 4.2 - REFERENCE (Reference signal measurement point)

Enables reading of reference signal sent to the card.

Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = 0V 20 mA = -10V.

### 4.3 - TRANSDUCER (Transducer signal measurement point)

Enables voltage reading of the valve spool position (0 / -5V).

## 5 - INSTALLATION

The card is designed for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm<sup>2</sup>, depending on their length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

**NOTE 1:** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of par. 9.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches). In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

## 6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set. Standard settings are:

- "GAIN" regulation: +10V (or 20 mA) reference signal corresponding to maximum valve opening (transducer = -5V). In open loop "GAIN" regulation corresponds to a current supply of 1 A for RSQ version and 1,8 A for RSD version, to the solenoid with maximum reference signal.
- "OFFSET" regulation: zero
- "RAMP UP" and "RAMP DOWN" regulation: minimum
- position SW1 on V
- position SW2 on S
- position SW3 on AC
- position S1 on N
- switching frequency (PWM) = 230 Hz

## 7 - START-UP AND CONTROL SETTINGS

If required, settings can be adjusted as follows:

### a) OFFSET CURRENT REGULATION

- Set "GAIN" potentiometer to minimum.
- Enter reference signal at maximum value (+10V or 20 mA).
- Set the "OFFSET" potentiometer so that the valve is positioned at the start of the work zone.

### b) SCALE FACTOR REGULATION

- Enter the reference signal at maximum value (+10V or 20 mA).
- Set "GAIN" potentiometer so that the controlled hydraulic parameter reaches the maximum required value.

### c) RAMP REGULATION

- Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain the gradual valve operation required with a reference signal variation.

## 8 - CARD CIRCUIT SETTINGS

The overall and mounting dimension diagram in par. 10 shows four switch banks: SW 1 - SW 2 - SW 3 and S1 which enable the card to be set up as required.

**NB.** Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL (SW 1 bank comprising three individual switches)

- select V for voltage signal
- select I for current signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

- select S for single ended reference signal. This condition is obligatory in the case where the reference signal is generated with an external potentiometer fed by the card itself.
- select D for differential reference signal. This condition is preferable in the case where the reference signal comes from a PLC or CNC analogic outlet.

OPEN OR CLOSED LOOP SELECTION (SW 3 bank comprising two individual switches)

- select AC for closed loop
- select AA for open loop.

TRANSDUCER POLARITY SELECTION (SW 1 bank comprising one individual switch)

- select N for direct operated valve types DSE3F - RPCER1/52
- select D for piloted valves.

**NB.** In the event of transducer malfunction, AA can be selected to proceed with open loop operation. In this case, the ENABLE LED illuminates and the OK relay card contacts close and the FAULT LED remains lit to indicate alarm status.

### SWITCHING FREQUENCY ADJUSTMENT

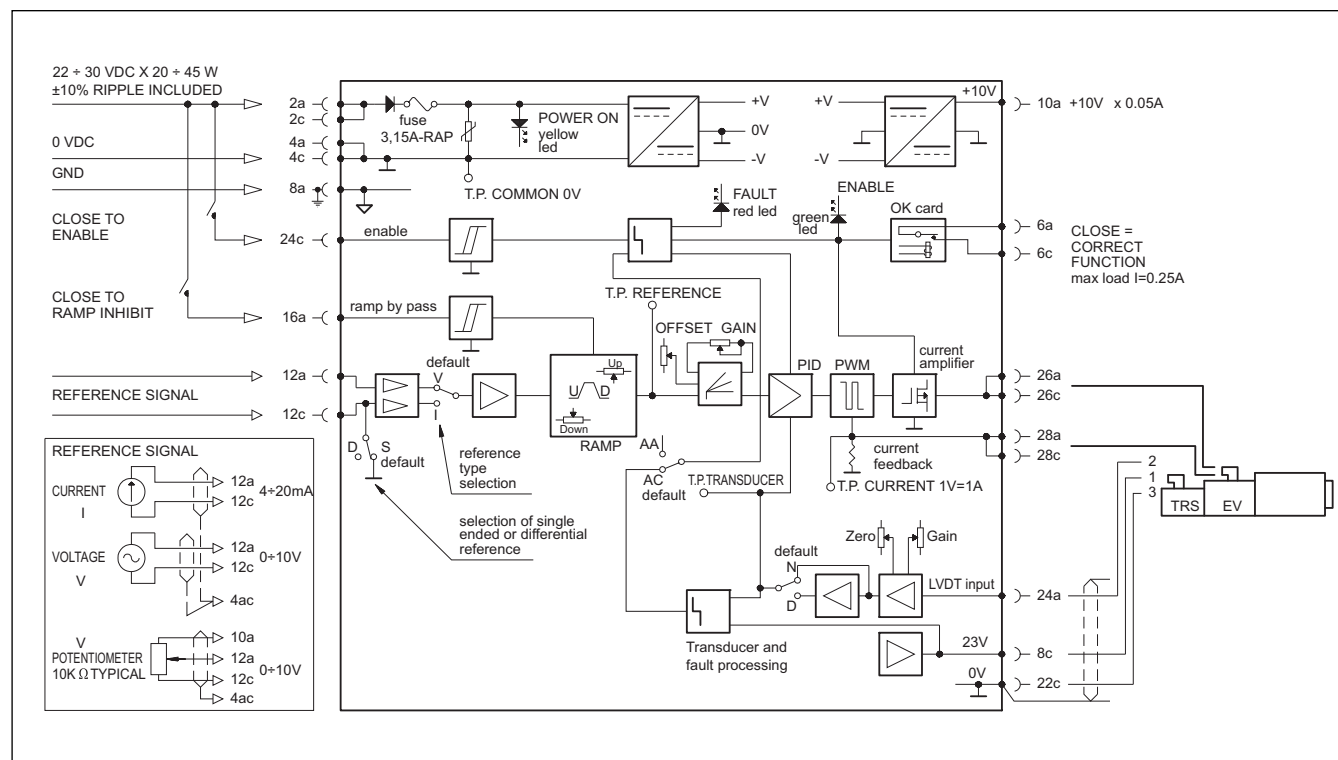
It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).

The setting range is from 80 to 1600 Hz.

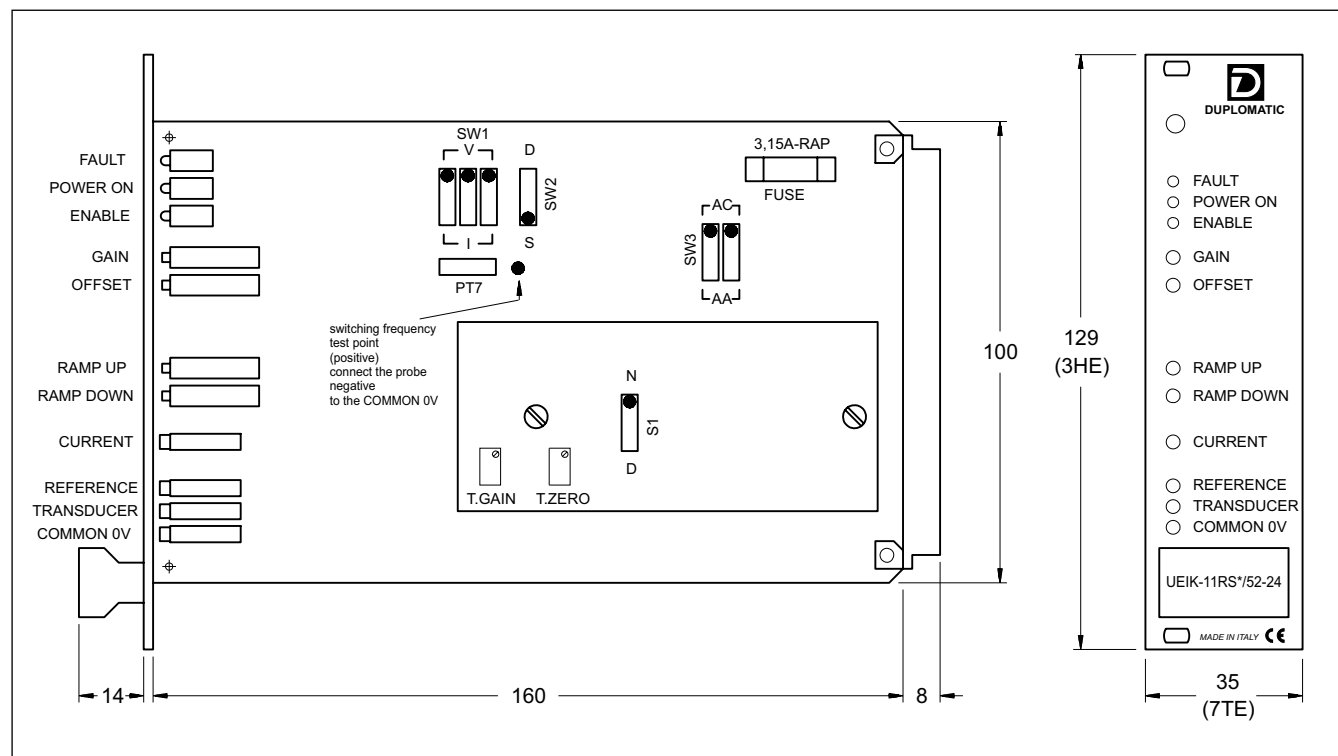
An appropriate switching frequency adjustment allows reduction of the valve hysteresis value.

Clockwise rotation to increase the frequency.

## 9 - CARD CIRCUIT AND WIRING DIAGRAMS



## 10 - OVERALL AND MOUNTING DIMENSIONS





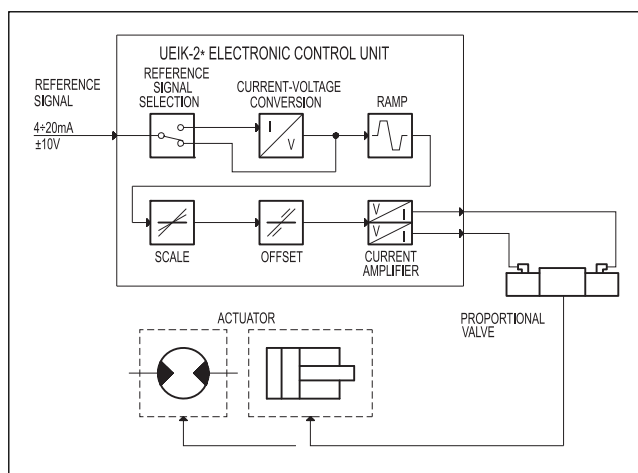
# UEIK-2\*

## ELECTRONIC CONTROL UNIT FOR OPEN LOOP DOUBLE SOLENOID PROPORTIONAL VALVE

### SERIES 51

#### EUROCARD TYPE

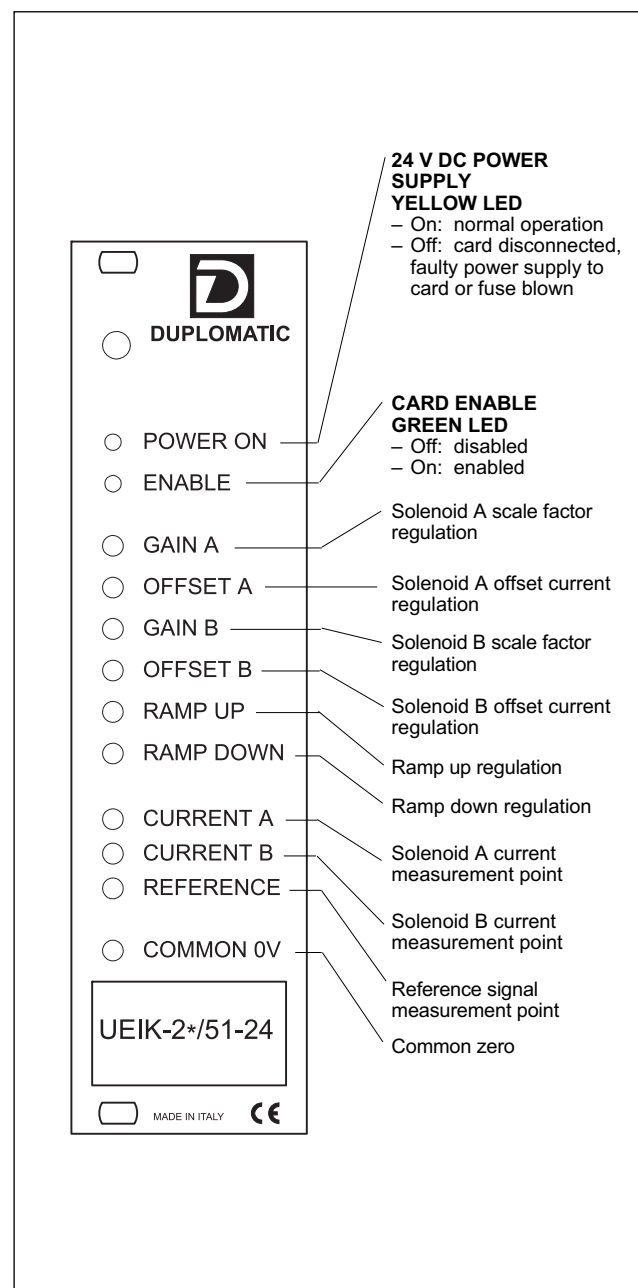
#### FUNCTIONAL BLOCK DIAGRAM



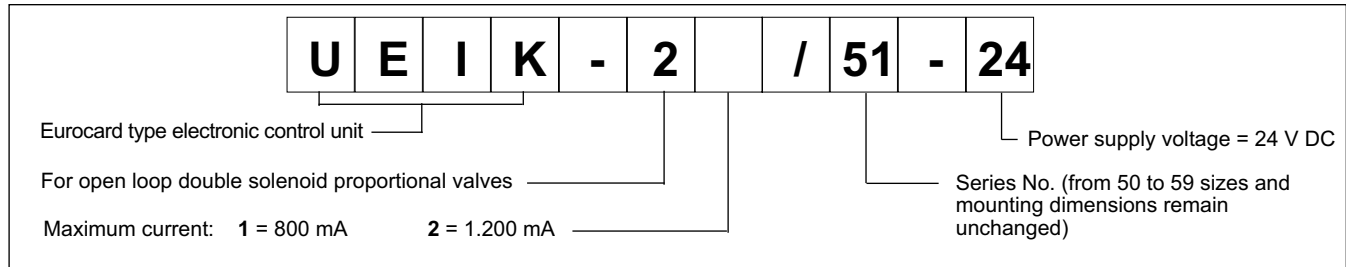
#### TECHNICAL CHARACTERISTICS

Power supply	V DC	22 ÷ 30 Ripple included
Required power	See par. 2.1	
Output current	See par. 3.3	
Power supply electrical protections	– overload – polarity inversion	
Reference signal: – Voltage – Current	V mA	± 10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	kΩ Ω	10 250
Electromagnetic compatibility (EMC) (see par. 5 - <b>NOTE 1</b> )	in compliance with 2004/108/CE	
Card size	Eurocard 100x160x35	
Connector interface	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,27

#### FRONT PANEL



### 1 - IDENTIFICATION CODE



The UEIK-2\* card is an electronic control unit Eurocard type for open loop of double solenoid proportional valves.

The unit supplies a variable current in proportion to the input reference signal and independently of temperature variations or load impedance.

The PWM stage on the solenoid power supply makes it possible to reduce valve hysteresis thus optimising control precision. The front panel is fitted with LEDs to indicate card functions and potentiometers to optimize control.

### 2 - FUNCTIONAL SPECIFICATIONS

#### 2.1 - Electric power supply

The card requires a power supply of between 22 and 30 V DC (pin 2a/2c - 4a/4c) and 20 W (UEIK-21) - 29 W (UEIK-22).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

#### 2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.

A 2A fast-acting fuse is fitted for power circuit protection.

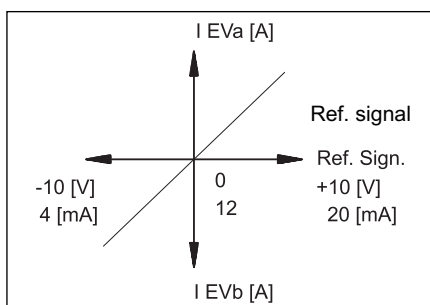
#### 2.3 - Reference signal

The card accepts voltage reference signals ( $\pm 10V$ ) or current reference signals ( $4 \div 20$  mA).

**N.B:** If the signal is transmitted by potentiometer, please verify that this has a load of at least 200 $\Omega$ .

See paragraph 9 for electrical connections.

The diagram shows characteristics of current supplied according to the reference signal.



### 3 - SIGNALS AND ADJUSTMENT

#### 3.1 - POWER ON

The yellow LED indicates card power supply:

ON - normal power supply

OFF - no power supply, faulty power supply or blown fuse

#### 3.2 - ENABLE

A 22 to 30 V DC on pin 24c enable command is required for card operation.

The condition of the enable card is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:

ON - card enabled

OFF - card disabled or failed

#### 3.3 - GAIN A / GAIN B

(Scale factor regulation of solenoids A and B)

"GAIN A" and "GAIN B" potentiometers enable regulation of the ratio between the set reference value and current supplied to solenoids A and B respectively. This enables independent regulation of the controlled parameter in the two valve hydraulic configurations.

The maximum current of the card is limited to 1,0A (UEIK-21) - 1,2A (UEIK-22). See par. 6 for default values.

Rotate clockwise to increase current.

#### 3.4 - OFFSET A / OFFSET B

(Polarization current regulation of solenoids A and B)

"OFFSET A" and "OFFSET B" potentiometers enable regulation of the offset current of the valve solenoids A and B respectively. They are used to eliminate the valve insensitivity zone (dead zone) in the two valve hydraulic figures.

The regulation range is from 0 to 0,5A (UEIK-21) - from 0 to 0,65A (UEIK-22).

The offset current is activated when the reference signal exceeds the threshold of  $\pm 150$  mV.

The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

**NOTE:** The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

#### 3.5 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulate the time taken to achieve the current for a step change of the reference signal up or down. They are independently adjusted and serve both solenoids.

This makes it possible to smooth valve response and adapt it to the requirements of the hydraulic system and the machine cycle.

Rotate clockwise to increase ramp time.

Ramps can be inhibited by transmitting a 22 to 30 V DC command to pin 16a. In this case, the ramp residual time is 10 ms.

## 4 - SIGNAL MEASUREMENT

### 4.1 - CURRENT A / CURRENT B

(Current measurement points of solenoids A and B)

Measurement points for voltage readings of current supplied to solenoids A and B. Reading conversion is 1V DC = 1A (UEIK-21) and 0,82V DC = 1A (UEIK-22).

### 4.2 - REFERENCE (Reference signal measurement point)

Enables reading in voltage of reference signal sent to the card.

Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = +10V      20 mA = -10V.

## 5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm<sup>2</sup>, in function with their length, for power supply and solenoid connections. For other connections, it is recommended to use cables with a screened sheath connected to earth only on the card side.

### NOTE 1

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of para.6.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

## 6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set.

Standard settings are:

- "GAIN A" regulation: +10V (or 20 mA) reference signal corresponding to a current supply of 0,82 A to solenoid A.
- "GAIN B" regulation: -10V (or 4 mA) reference signal corresponding to a current supply of 0,82 A to solenoid B.
- "OFFSET A" or "OFFSET B" regulation: zero
- "RAMP UP" and "RAMP DOWN" regulation: minimum
- position SW1 on V
- position SW2 on S
- position SW3 on AA
- switching frequency (PWM) = 200Hz (UEIK-21)  
100Hz (UEIK-22)

## 7 - START-UP AND FRONTAL SETTINGS

If required, settings can be adjusted as follows:

### a) OFFSET CURRENT REGULATION

(Note: the same procedure applies to channels A and B on the card)

- Set "GAIN A" or "GAIN B" potentiometer to minimum.
- Enter reference signal at maximum value:
  - +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Regulate "OFFSET A" or "OFFSET B" potentiometer so that the valve is positioned at the start of the relative hydraulic configuration work zone.

### b) SCALE FACTOR REGULATION

(NOTE: the same procedure applies to channels A and B on the card)

- Enter the reference signal at maximum value
  - +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Adjust "GAIN A" and "GAIN B" potentiometers until the size controlled in the relative hydraulic configuration reaches the maximum required value.

**NOTE: The maximum current value must be compatible with the maximum current prescribed by the technical table of the connected proportional valve.**

### c) RAMP REGULATION

- Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain the required valve smoothness of movement with a reference variation.

## 8 - CARD CIRCUIT SETTINGS

The overall dimension diagram in par. 10 shows three switch banks: SW 1 - SW 2 - SW 3 which enable card set up as required.

**NB. Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.**

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL (SW 1 bank comprising three individual switches)

- select V for voltage reference signal
- select I for current reference signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

- select S for single ended reference signal. This condition is obligatory in the case that the reference signal is generated with an external potentiometer fed by the card itself.
- select D for differential reference signal. This signal is preferable in the case that the reference signal comes from a PLC or CNC analogic outlet.

**NOTE: The SW 3 bank, comprising two individual switches, must always be set at AA as per standard supply conditions.**

### SWITCHING FREQUENCY ADJUSTMENT

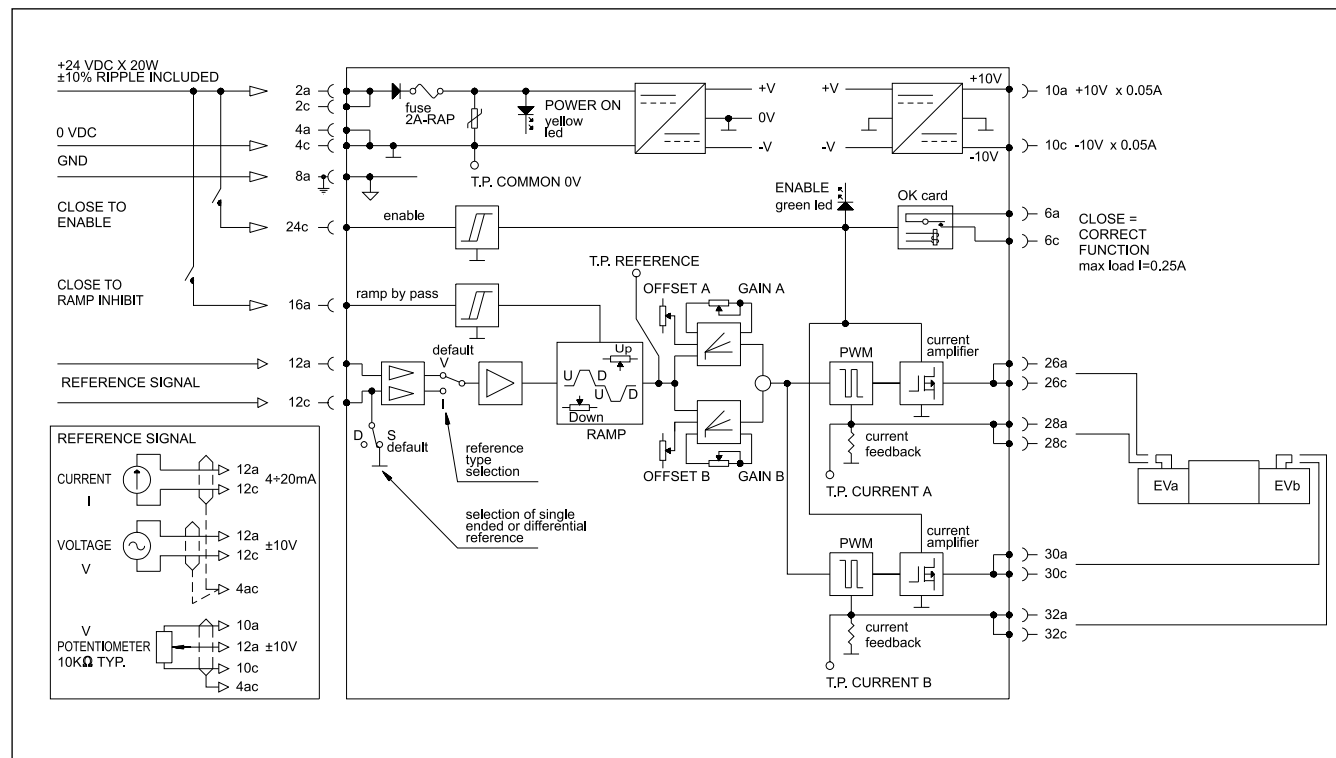
It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).

The setting range is from 80 to 370 Hz.

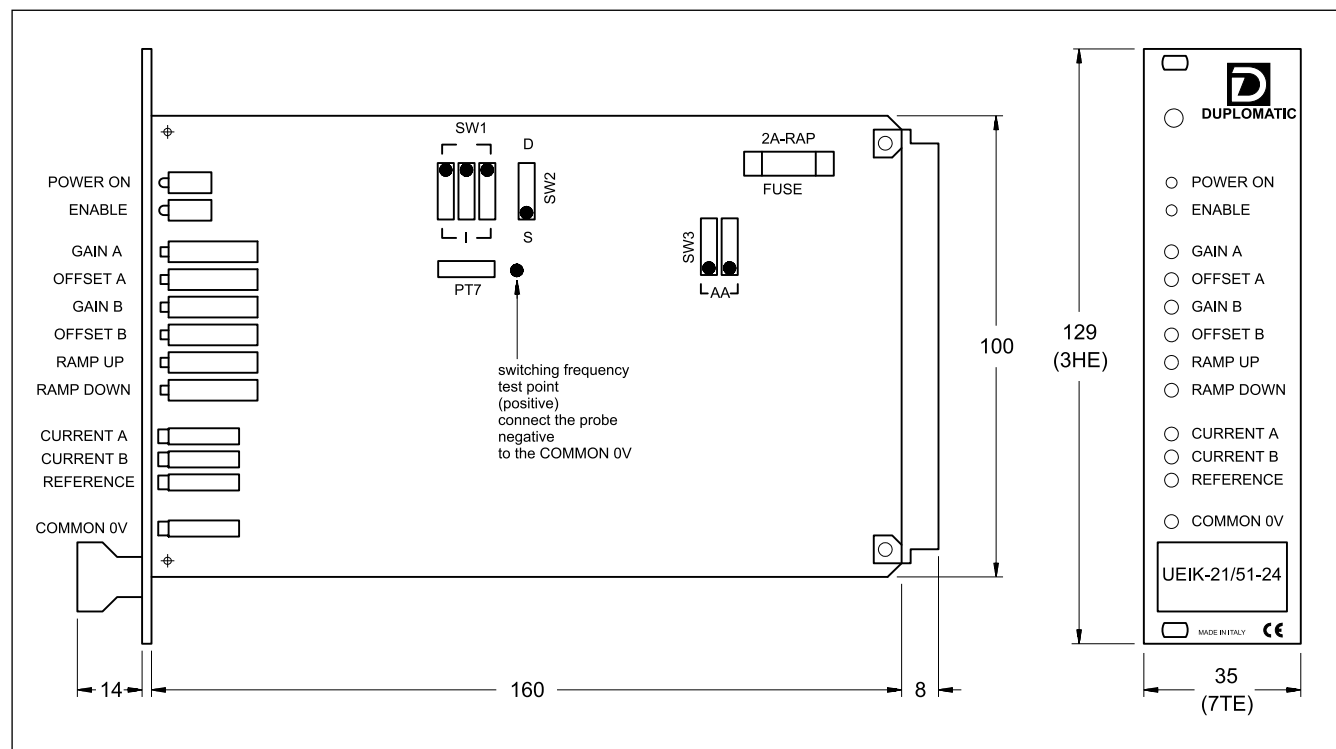
An appropriate switching frequency adjustment allows reduction of the valve hysteresis value.

Clockwise rotation to increase the frequency.

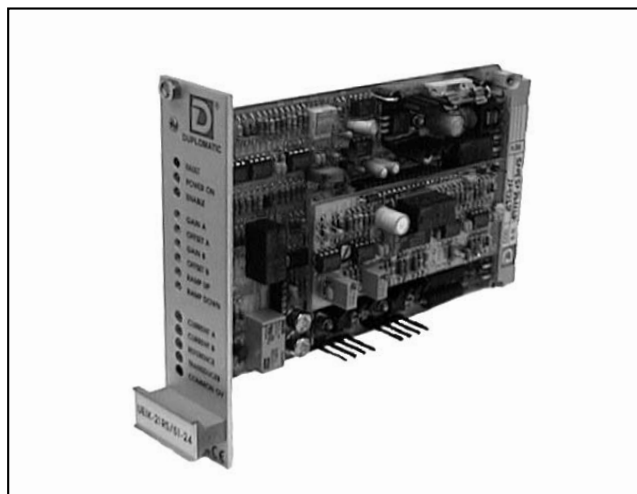
## 9 - CARD CIRCUIT AND WIRING DIAGRAMS



## 10 - OVERALL AND MOUNTING DIMENSIONS







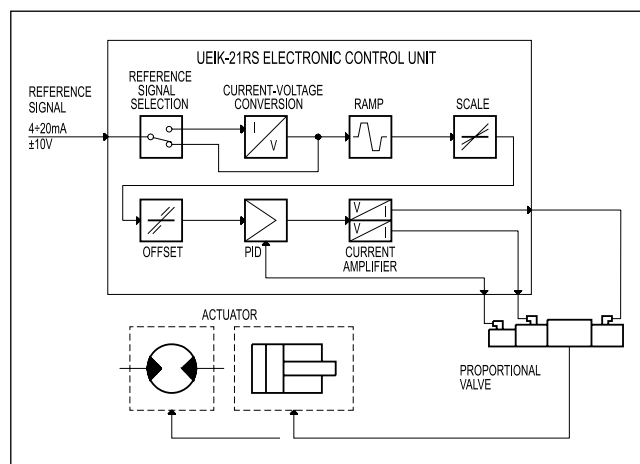
# UEIK-21RSD

## ELECTRONIC CONTROL UNIT FOR DOUBLE SOLENOID PROPORTIONAL VALVES WITH POSITION FEEDBACK

SERIES 52

### EUROCARD TYPE

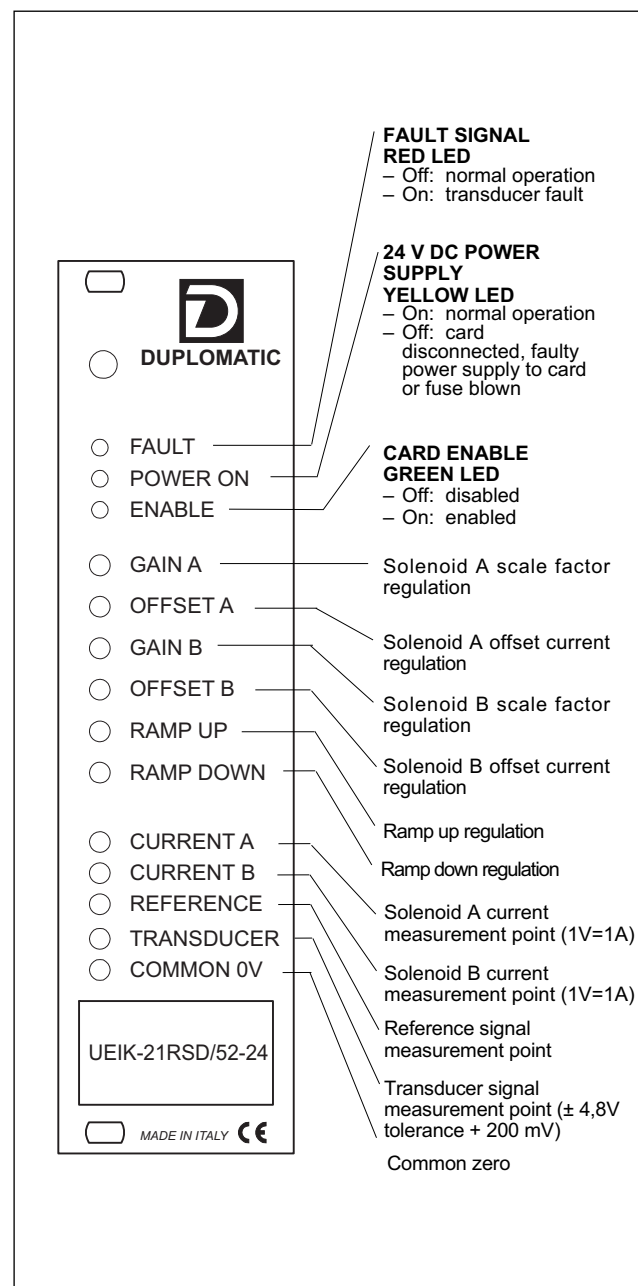
### FUNCTIONAL BLOCK DIAGRAM



### TECHNICAL CHARACTERISTICS

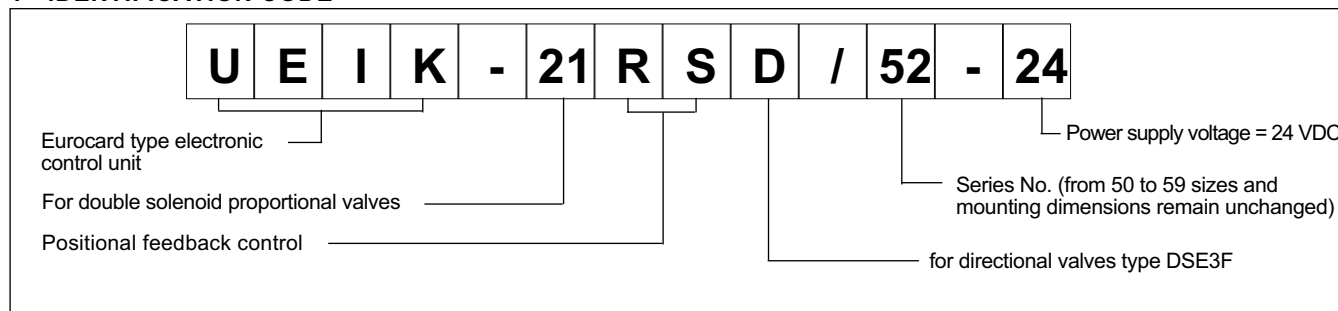
Power supply	V DC	22 ÷ 30 Ripple included
Required power	W	45
Output current	see par. 3.4	
Power supply electrical protections	– overload – polarity inversion	
Reference signal: – Voltage – Current	V mA	±10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	kΩ Ω	10 250
Electromagnetic compatibility (EMC) (see par. 5 - NOTE 1)	in compliance with 2004/108/CE	
Card size	Eurocard 100x160x35	
Connector interface	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,27

### FRONT PANEL





### 1 - IDENTIFICATION CODE



The UEIK-21RS card is an electronic control unit Eurocard type for closed loop control of double solenoid proportional valves with positional feedback control.

The unit controls the position of the valve spool according to the reference input signal ensuring linear regulation with minimum hysteresis.

The front panel is fitted with LEDs to indicate card functions and potentiometers to optimise performance.

### 2 - FUNCTIONAL SPECIFICATIONS

#### 2.1 - Electric power supply

The card requires a power supply of 22 - 30 V DC and 45 W (pin 2a/2c - 4a/4c).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

#### 2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion. A 3,15A fast-acting fuse is fitted for power circuit protection.

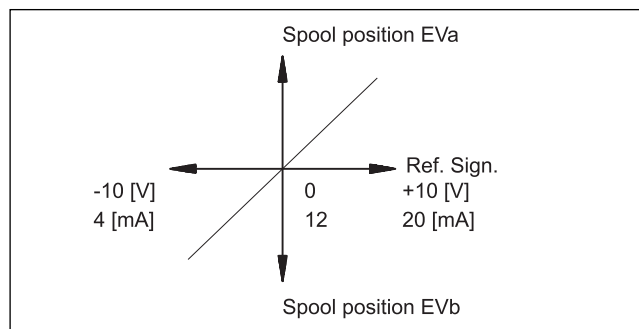
#### 2.3 - Reference signal

The card accepts voltage reference signals ( $\pm 10V$ ) or current reference signals (4-20 mA).

**N.B: If the signal is transmitted by potentiometer, please verify that this has a load of at least 200  $\Omega$ .**

See par. 9 for electrical connections.

The diagram shows valve spool position characteristics according to the reference signal.



### 3 - SIGNALS AND ADJUSTMENT

#### 3.1 - FAULT (Fault signal)

The red LED indicates operation of the positional transducer:

OFF - normal operation  
 ON - transducer fault or power supply failure. In the event of a FAULT, current to the solenoid is shut off and the valve is set at the hydraulic rest configuration, the ENABLE LED switches off and the OK card relay contact opens (6a and 6c pins).

#### 3.2 - POWER ON

The yellow LED indicates card power supply:

ON - normal power supply  
 OFF - no power supply, faulty power supply or blown fuse

#### 3.3 - ENABLE

A 22 to 30 V DC on pin 24c enable command is required for card operation.

The condition of the enable card is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:

ON - card enabled  
 OFF - card disabled or failed

#### 3.4 - GAIN A / GAIN B

(Scale factor regulation of solenoids A and B)

"GAIN A" and "GAIN B" potentiometers enable regulation of the ratio between the set reference value and the valve spool position in the two hydraulic configurations controlled by solenoids A and B.

The maximum current of the card is limited to 1,8A.

See par. 6 for default values.

Rotate clockwise to increase current.

#### 3.5 - OFFSET A / OFFSET B

(Offset current regulation of solenoids A and B)

"OFFSET A" and "OFFSET B" potentiometers enable regulation of the offset current of the solenoids A and B respectively with reference signal set at zero. They are used to eliminate the valve insensitivity zone (dead zone).

The regulation range is from 0 to 0,9A.

The offset current is activated when the reference signal exceeds the threshold of  $\pm 150$  mV.

The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

**NOTE:** The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

### 3.6 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulate the time taken to achieve the current for a step change of the reference signal up or down. They are independently adjusted and serve both solenoids.

This makes it possible to smooth valve response and adapt it to the requirements of the hydraulic system and the machine cycle.

Rotate clockwise to increase ramp time.

Ramps can be inhibited by transmitting a 22 to 30 V DC command to pin 16a. In this case, the ramp residual time is 10 ms.

## 4 - SIGNAL MEASUREMENT

### 4.1 - CURRENT A / CURRENT B

(Current measurement points of solenoids A and B)

Measurement points for voltage readings of current supplied to solenoids A and B. Reading conversion is 1V DC = 1A.

### 4.2 - REFERENCE (Reference signal measurement point)

Enables reading in voltage of reference signal sent to the card.

Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = +10V 20 mA = -10V.

### 4.3 - TRANSDUCER (Transducer signal measurement point)

Enables voltage reading of the valve spool position ( $\pm 4,8V$  - tolerance +200 mV).

## 5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm<sup>2</sup>, in function with their length, for power supply and solenoid connections. For other connections, it is recommended to use cables with a screened sheath connected to earth only on the card side.

**NOTE 1:** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the connection scheme of par. 9.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches). In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

## 6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set. Standard settings are:

- "GAIN A" regulation: +10V (or 20 mA) reference signal corresponding to maximum valve opening in the hydraulic configuration controlled by solenoid A (transducer = -5V).
- "GAIN B" regulation: -10V (or 4 mA) reference signal corresponding to maximum valve opening in the hydraulic configuration controlled by solenoid B (transducer = +5V).
- In open loop "GAIN A" and "GAIN B" regulations correspond to a current supply of 1,8 A to the solenoids A and B with maximum reference signal.
- "OFFSET A" or "OFFSET B" regulation: zero
- "RAMP UP" and "RAMP DOWN" regulation: minimum
- position SW1 on V
- position SW2 on S
- position SW3 on AC
- position S1 on N
- switching frequency (PWM) = 300 Hz

## 7 - START-UP AND CONTROL SETTINGS

### a) OFFSET CURRENT REGULATION

(Note: the same procedure applies to channels A and B on the card)

- Set "GAIN A" and "GAIN B" potentiometers to minimum.
- Enter reference signal at maximum value:
  - +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Regulate "OFFSET A" and "OFFSET B" potentiometers so that the valve is positioned at the start of the corresponding hydraulic configuration work zone.

### b) SCALE FACTOR REGULATION

(Note: the same procedure applies to channels A and B on the card)

- Enter the reference signal at maximum value
  - +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Set "GAIN A" and "GAIN B" potentiometers so that the controlled parameter in the relative hydraulic configuration reaches the maximum required value.

### c) RAMP REGULATION

- Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain the required valve smoothness of movement with a reference position.

## 8 - CARD CIRCUIT SETTINGS

The overall dimension diagram in par. 10 shows four switch banks: SW 1 - SW 2 - SW 3 and S1 which enable card set up as required.

**NB. Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same direction.**

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL (SW 1 bank comprising three individual switches)

- select V for voltage signal
- select I for current signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

- select S for single ended reference signal. This condition is obligatory in the case that the reference signal is generated with an external potentiometer fed by the card itself.
- select D for differential reference signal. This signal is preferable in the case that the reference signal comes from a PLC or CNC analogic outlet.

OPEN OR CLOSED LOOP SELECTION

(SW 3 bank comprising two individual switches)

- select AC for closed loop
- select AA for open loop.

TRANSDUCER POLARITY SELECTION

(SW 1 bank comprising one individual switch)

- select N for direct operated valve types DSE3F
- select D for piloted valves.

**NB. In the event of transducer malfunction, AA can be selected to proceed with open loop operation. In this case, the ENABLE LED illuminates and the OK relay card contacts close and the FAULT LED remains lit to indicate alarm status.**

SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10). The setting range is from 80 to 1600 Hz.

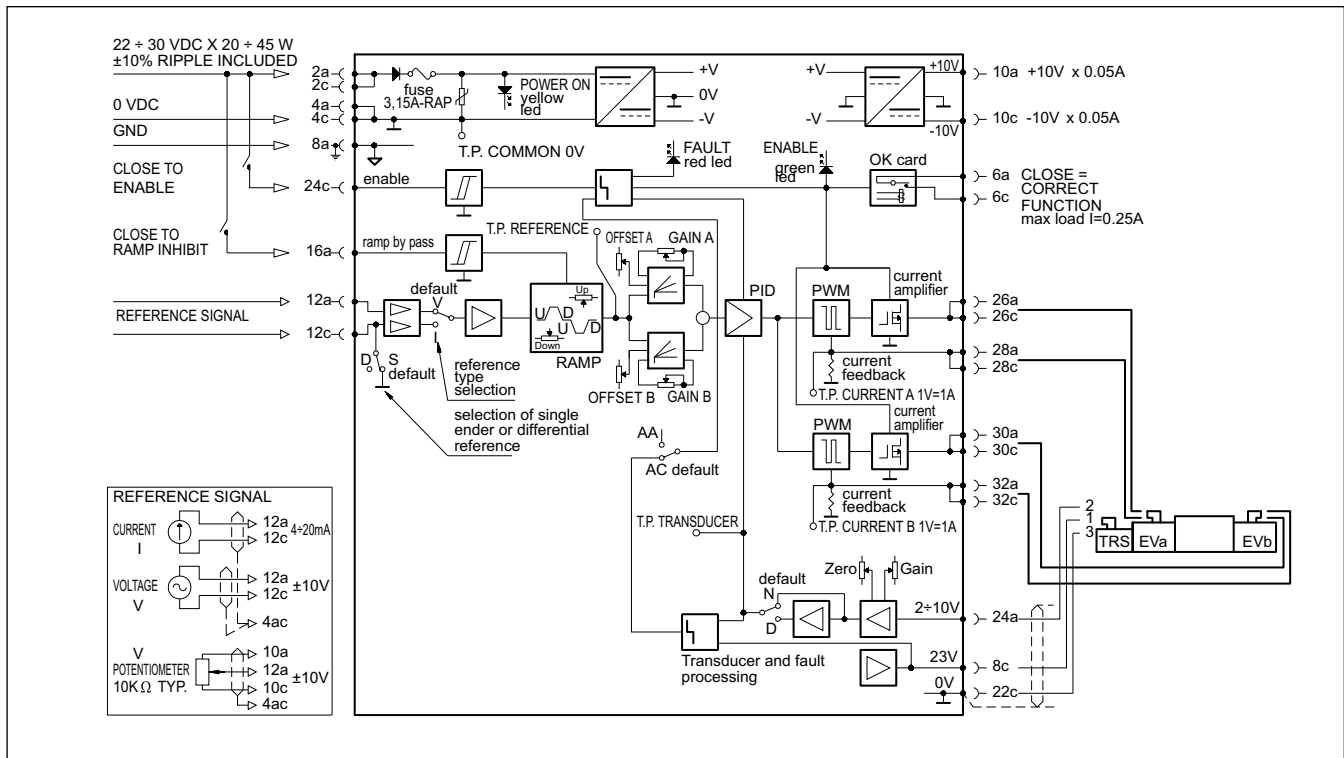
An appropriate switching frequency adjustment allows reduction of the valve hysteresis value. Clockwise rotation to increase the frequency.



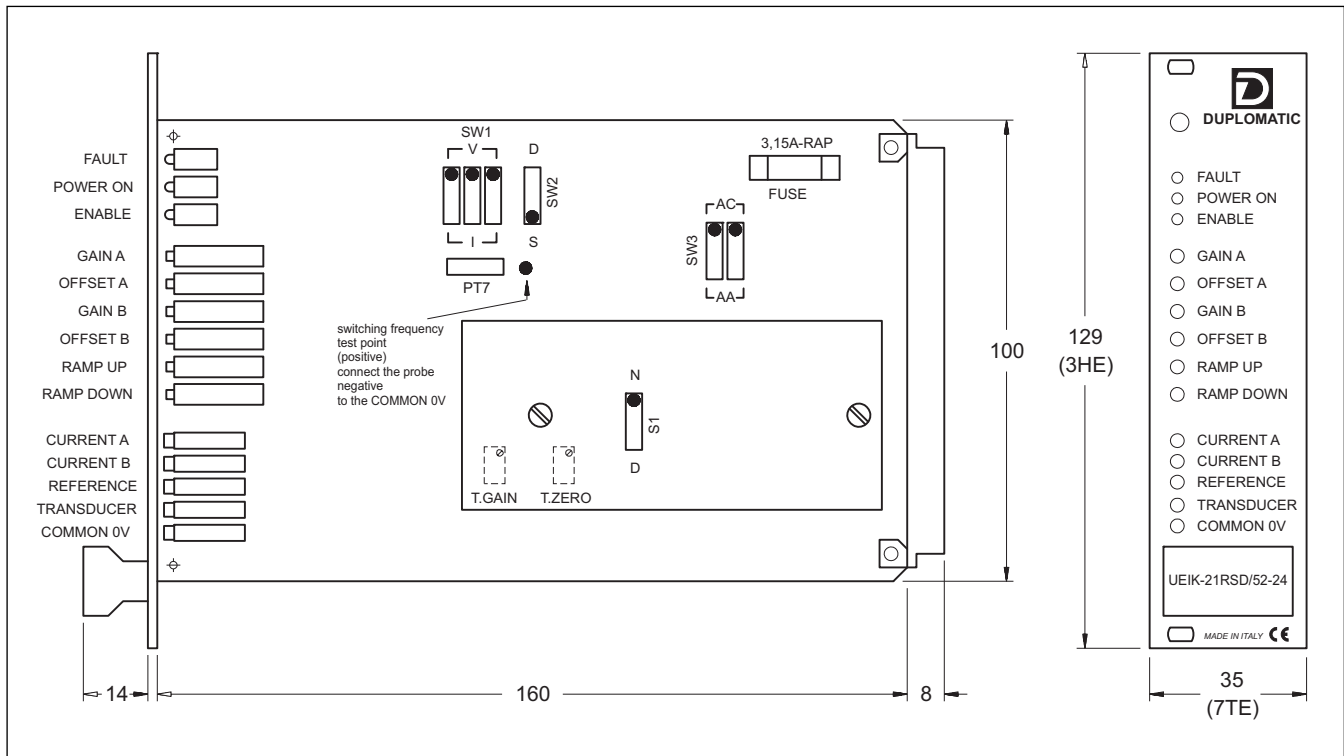
# UEIK-21RSD

## SERIES 52

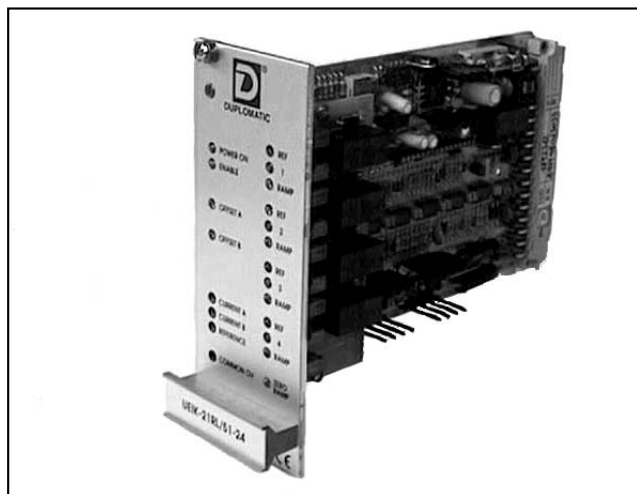
### 9 - CARD CIRCUIT AND WIRING DIAGRAMS



### 10 - OVERALL AND MOUNTING DIMENSIONS



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# UEIK-2\*RL

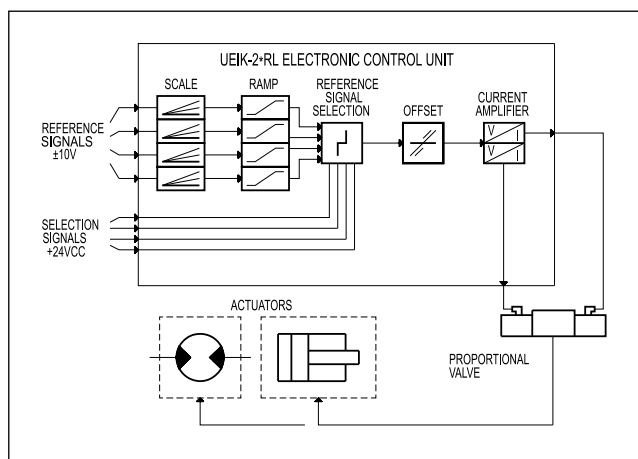
## ELECTRONIC CONTROL UNIT FOR OPEN LOOP DOUBLE SOLENOID PROPORTIONAL VALVE

### SERIES 51

WITH REFERENCE SIGNAL AND RAMP SELECTION

## EUROCARD TYPE

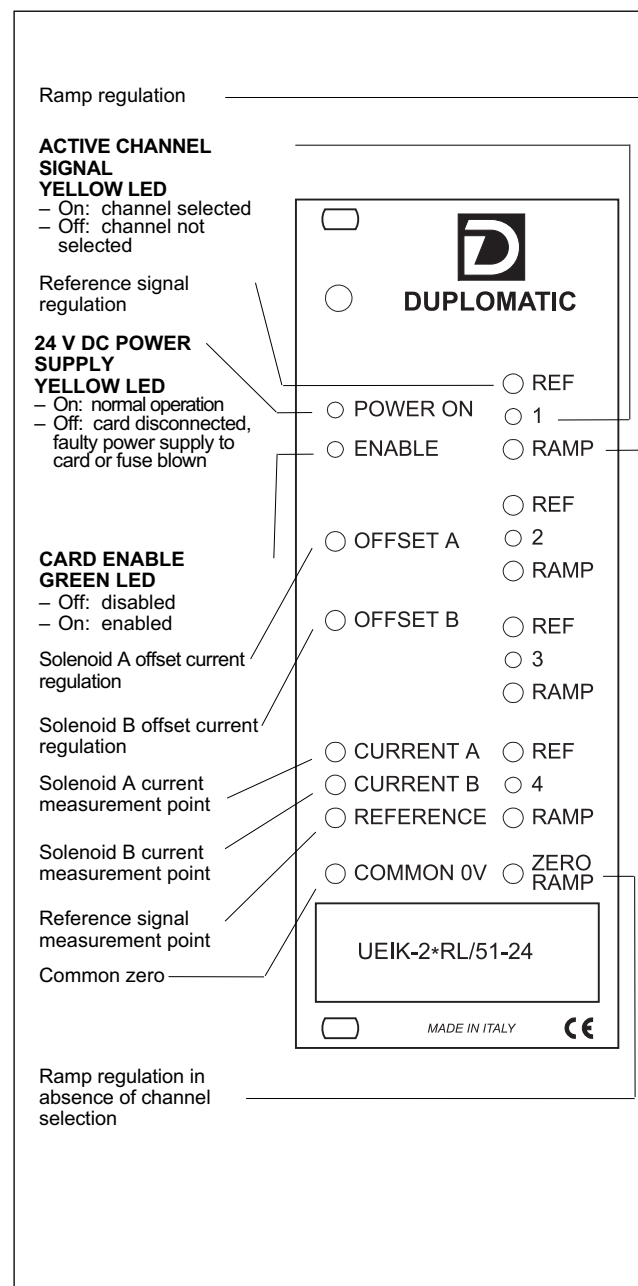
## FUNCTIONAL BLOCK DIAGRAM



## TECHNICAL CHARACTERISTICS

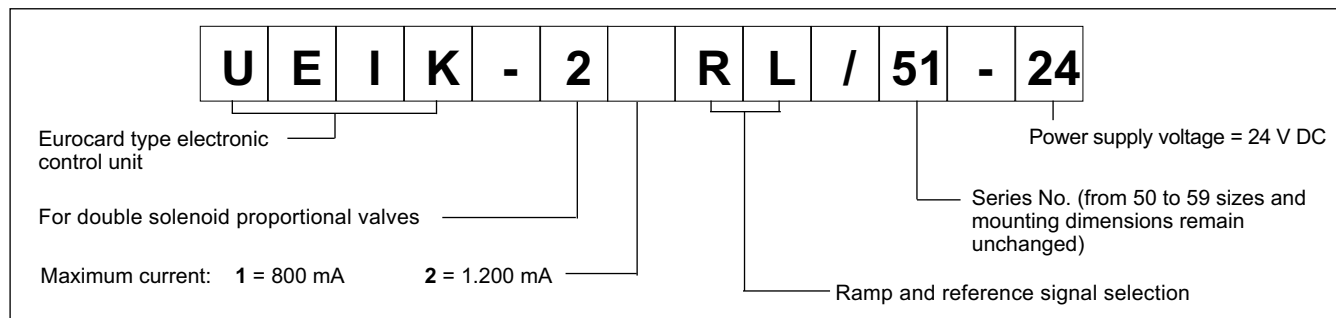
Power supply	V DC	22 ÷ 30 Ripple included
Required power	see par. 2.1	
Output current	see par. 3.4	
Power supply electrical protections	– overload – polarity inversion	
No. of selectable channels	4	
Reference signal	V	± 10 adjustable for each channel
Electromagnetic compatibility (EMC) (see par. 5 - <b>NOTE 1</b> )		in compliance with 2004/108/CE
Card size	Eurocard 100x160x50	
Connector interface	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,3

## FRONT PANEL





## 1 - IDENTIFICATION CODE



The UEIK-2\*RL card is an electronic control unit in Eurocard format for open loop control of double solenoid proportional valves, with selection in sequence of four different reference and ramp time regulation signals.

The unit is suitable for management of "fast-slow" work cycles.

The front panel is fitted with LEDs to indicate card functions and potentiometers to optimise performance.

## 2 - FUNCTIONAL SPECIFICATIONS

### 2.1 - Electric power supply

The card requires a power supply of between 22 and 30 V DC (pin 2a/2c - 4a/4c) and 20 W (UEIK21-RL) - 29 W (UEIK-22-RL).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

### 2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.

A 2A fast-acting fuse is fitted for power circuit protection.

## 3 - SIGNALS AND ADJUSTMENT

### 3.1 - POWER ON

The yellow LED indicates card power supply:

ON - normal power supply

OFF - no power supply, faulty power supply or blown fuse

### 3.2 - ENABLE

A 22 to 30 V DC on pin 24c enable command is required for card operation.

The condition of the enable card is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:

ON - card enabled

OFF - card disabled or failed

### 3.3 - OFFSET A / OFFSET B

#### (Polarization current regulation of solenoids A and B)

"OFFSET A" and "OFFSET B" potentiometers enable regulation of the polarization current of the solenoids A and B respectively. They are used to eliminate the valve insensitivity zone (dead zone) in the two valve hydraulic configurations.

The regulation field is up between 0 and 0,5 A (UEIK-21-RL) and between 0 and 0,65 A (UEIK-22-RL).

The default value is zero.

The offset current is activated when the reference signal exceeds the threshold of  $\pm 150$  mV.

The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

**NOTE:** The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

### 3.4 - REF (Reference signal regulation)

The card enables settings by means of multi-turn potentiometers on the front panel (indicated by "REF") of four different reference signal values (one per channel).

Solenoid A is controlled with positive reference of 0++10V, and solenoid B is controlled with negative reference signal of 0+-10V.

Maximum output current, corresponding to the maximum potentiometers regulation, is limited to 1 A. See par. 6 for default settings.

Rotate clockwise to increase the reference signal by absolute values. See par. 9 for electrical connections.

One of the four channels can be selected automatically by transmitting a +24 V DC command to pin 18c (channel 1) - 18a (channel 2) - 20c (channel 3) - 20a (channel 4).

To obtain correct signal switching and continuous regulation with the selection of channels from 1 to 4, select the new channel before deactivating the previous one. A yellow LED illuminates on the front panel in correspondence to the channel selected.

**NB.** The system manages reference signals and ramp values of the channel with the highest selected number. To enable channel selection in reverse order (4 to 1) all previous channels must be deactivated.

### 3.5 - RAMP (Ramp regulation)

A "RAMP" potentiometer is associated with each of the channels to enable regulation of the time required to reach the current supplied according to the selected reference signal.

The regulation range is from 0,03 to 7 sec.

This makes it possible to smooth valve response and adapt it to the requirements of the hydraulic system and the machine cycle.

The "ZERO RAMP" potentiometer enables regulation of the valve deactivation time (current=0) when all channels are switched off.

Rotate clockwise to increase ramp time.

Ramps can be inhibited by transmitting a 22 to 30 V DC exclusion command to pin 16a. In this case, the ramp residual time is 10 ms.

## 4 - SIGNAL MEASUREMENT

### 4.1 - CURRENT A / CURRENT B

(Current measurement points of solenoids A and B)

Measurement points for voltage readings of current supplied to solenoids A and B.

Reading conversion is 1V DC = 1A (UEIK-21-RL) and

0,82 V DC = 1A (UEIK-22-RL).

### 4.2 - REFERENCE (Reference signal measurement point)

Enables reading of reference signal related to the selected channel, in voltage, but of the opposite sign.

## 5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm<sup>2</sup>, in function with their length, for power supply and solenoid connections. For other connections, it is advisable to use cables with a screened sheath connected to earth only on the card side.

### NOTE 1

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of par. 9.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

## 6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set.

Standard settings are:

- "OFFSET" regulation: zero
- "REF" regulation: corresponding to 0,82A to A and B solenoids
- "RAMP" regulation: minimum
- position SW1 on V
- position SW2 on S
- position SW3 on AA
- switching frequency (PWM) = 200Hz (UEIK-21-RL) - 100Hz (UEIK-22-RL)

## 7 - START-UP AND FRONTAL SETTINGS

Settings can be modified and references can be regulated according to specific work cycles as follows:

### a) OFFSET CURRENT REGULATION

- Select one of the channels connected to positive reference +10V (pin 10a).
- Regulate the relative potentiometer "REF" at a value between 200 and 300 mV (for reference signal see par. 4.2)
- Regulate the "OFFSET A" potentiometer so that the valve is positioned at the start of the work zone controlled by solenoid "A".

Repeat the procedure by selecting a channel connected to the negative reference -10V (pin 10c) and regulate the "OFFSET B" potentiometer.

### b) REFERENCE REGULATION

- Select a channel and regulate the relative "REF" potentiometer to obtain the required actuator speed.
- Repeat the procedure for all four channels to obtain the required speed cycle.

### c) RAMP REGULATION

- Regulate the four "RAMP" potentiometers to obtain the required regulation smoothness during passage from one channel to another.
- Regulate the "ZERO RAMP" potentiometer to obtain regulation smoothness when all four channels are deactivated.

## 8 - CARD CIRCUIT SETTINGS

The overall dimension diagram in par. 10 shows three switch banks: SW 1 - SW 2 - SW 3 which enable card set up as required.

**NB. Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.**

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

- select S for single ended. This condition is obligatory in the case that the reference signal is generated with the four potentiometers inside the card.
- by selecting D (differential), it is possible to add an external reference signal that can control the valve during the manual cycle.

**- SW 1 bank (comprising three individual switches) must always be set on V, as per standard supply conditions.**

**- SW 3 bank (comprising two individual switches) must always be set on AA, as per standard supply conditions.**

### SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).

The setting range is from 80 to 370 Hz.

An appropriate switching frequency adjustment allows reduction of the valve hysteresis value.

Clockwise rotation to increase the frequency.





The schematic diagram illustrates the internal circuitry of the OK card. It features a power input section with a +24 VDC X 20W supply (±10% ripple) and a 0 VDC ground. Control signals include 'CLOSE TO ENABLE' and 'CLOSE TO RAMP INHIBIT'. Reference signals are provided as ±10V (10a/10c) and a +24 VDC supply. The circuit includes a fuse (2A-RAP), a power-on yellow LED, and a T.P. COMMON 0V connection. The main control logic involves an 'enable' signal and a 'ramp by pass' signal, which are processed through various amplifiers and comparators. The output section shows two channels, each with a PWM signal, a current amplifier, and a current feedback loop. The outputs are labeled 10a (+10V x 0.05A), 10c (-10V x 0.05A), 6a, 6c, 26a, 26c, 28a, 28c, 30a, 30c, 32a, and 32c. A note indicates that the 'CLOSE' signal is for a correct function with a maximum load current of 0.25A.

**FRONT VIEW**

Dimensions: 14 (width), 160 (length), 8 (height), 100 (height), 129 (3HE) (height).

Pinout (Left to Right):

- POWER ON
- ENABLE
- OFFSET A
- OFFSET B
- CURRENT A
- CURRENT B
- REFERENCE
- COMMON 0V
- REF 1
- RAMP 1
- REF 2
- RAMP 2
- REF 3
- RAMP 3
- REF 4
- RAMP 4
- ZERO RAMP

Internal Components:

- SW1 (V, D, I, S)
- SW2
- PT7
- SW3 (AA)
- 2A-RAP FUSE

Switching frequency test point (positive) connect the probe neagtive to the COMMON 0V

**REAR VIEW**

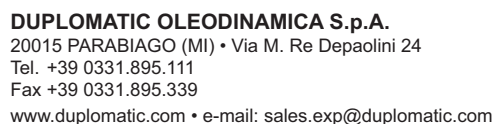
Dimensions: 50 (10TE) (width).

Pinout (Left to Right):

- REF
- 1
- RAMP
- REF
- 2
- RAMP
- REF
- 3
- RAMP
- REF
- 4
- RAMP
- ZERO RAMP

Module Information:

- DUPLOMATIC
- UEIK-21RL/51-24
- MADE IN ITALY
- CE



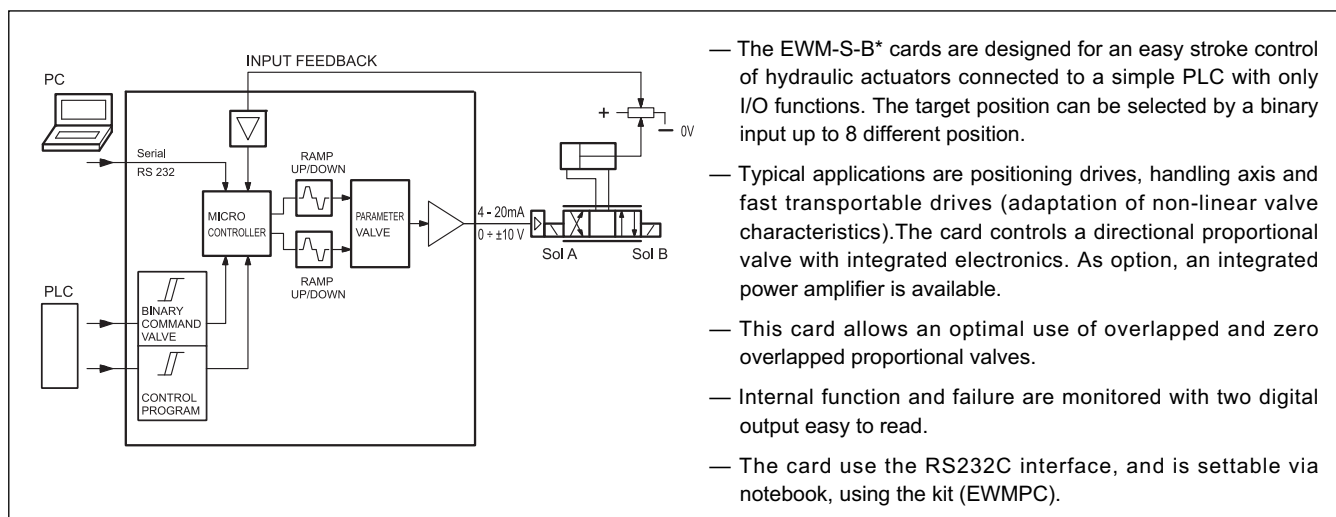


# EWM-S-B\*

## DIGITAL CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS SERIES 10

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE

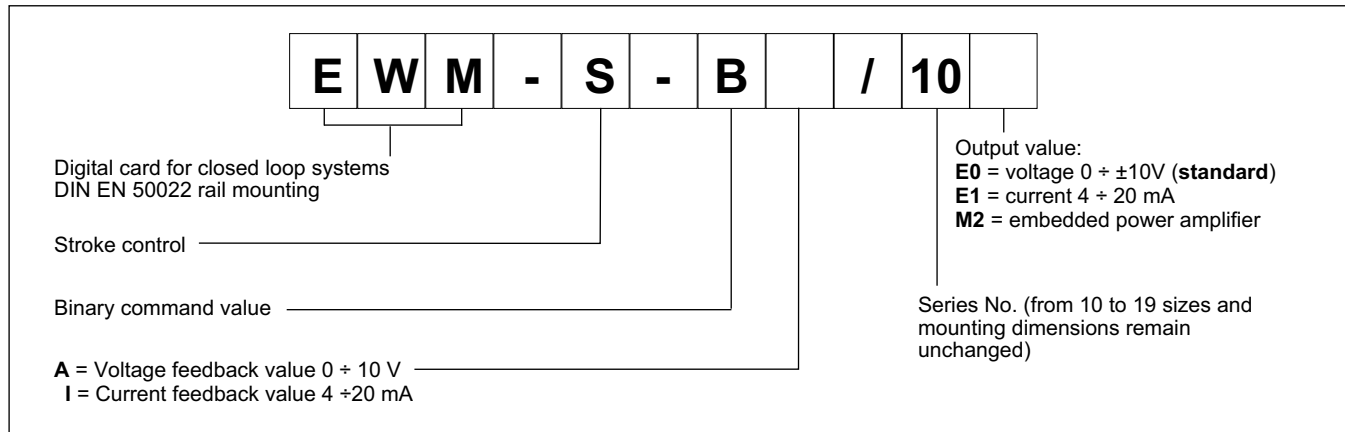


### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ± 30 ripple included external fuse 1,0 A (5 A for M2 version)
Current consumption: - E0 and E1 version - M2 version	mA A	100 + sensor power consumption depending from solenoid current. max 5A
Command value		binary command with 3 bit
Feedback value: - BA version - BI version	V mA	0 ± 10 (R <sub>I</sub> = 90 kΩ) 4 ± 20 (R <sub>I</sub> = 250 kΩ)
Output values: - E0 version - E1 version - M2 version	V mA A	±10 (max load 5 mA) 4 ± 20 (max load 390 Ω) 1,0 - 1,6 - 2,6
Position accuracy	%	0,01
Interface		RS 232 C
Electromagnetic compatibility (EMC) according to 2004/108/CE		Emissions EN 61000-6-3 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 -combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w) or 46 on M2 version
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



## 1 - IDENTIFICATION CODE



This module supports the simple point-to-point positioning with hydraulic drives. Up to eight target positions (with related velocities) can be selected. The deceleration characteristics can be defined with the command CTRL, choosing between linear (LIN) or nearly square root (SQRT1) parameters. See at par.4, Adjustments.

The sampling time of the control loop is 1 ms.

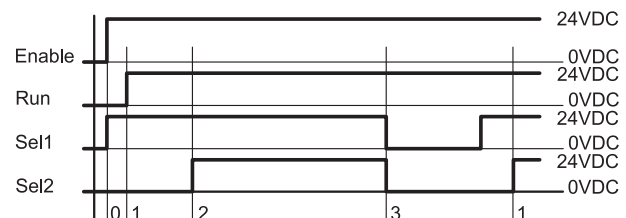
Two operating modes can be selected:

**A** - stroke depending deceleration, that means the control gain will be adjusted with the parameters D:A and D:B. This is a time-optimal positioning structure with very high stability.

**B** - NC mode, where the position value is generated from the following error.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two contradictory requirements (short positioning time and high accuracy) have to be considered in the system design.

Sequence of the positioning with 3 target position achievable with the EWM-S-B\* cards :



S:0 and V:0 - Switching on and placement to parking position.

S:1 and V:1 - Initial positioning in the work cycle

S:2 and V:2 - Second target position

S:3 and V:3 - Return to the first position;

To begin, the external input START (RUN) must be enabled.

## 2 - FUNCTIONAL SPECIFICATIONS

### 2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and the sensors.

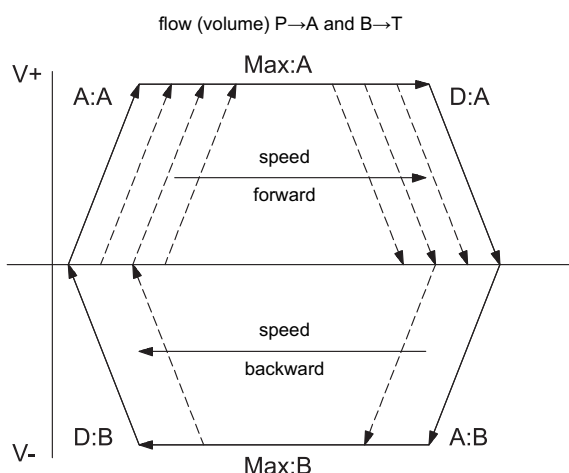
**NOTE: in the type M2 the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.**

### 2.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 2.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V, Low level:  $<4$ V, high level  $>12$ V with current  $<0,1$ A. See the block diagram at paragraph 8 for the electric connections.





### 2.4 - Feedback input values

The card accepts analogue feedback input. The feedback value must be  $0 \div 10$  V for EWM-S-BA\*, and  $4 \div 20$  mA for EWM-S-BI\* version.

### 2.5 - Output values

E0 version: output voltage  $0 \pm 10$  V

E1 version: output current  $4 \div 20$  mA

M2 version: Embedded power stage configurable via software with a value of 1, 1.6 or 2.6 A.

### 2.6 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel

Low level <4V High Level > 10 V Max 50 mA with load 200  $\Omega$

### 3 - LED FUNCTIONS

There are two leds on the card: GREEN and YELLOW.

GREEN: Shows if the card is ready (READY output).

ON - The card is supplied

OFF - No power supply

FLASHING - Failure detected (internal or  $4 \dots 20$  mA).  
Only if SENS = ON

YELLOW: Signal of the control error monitoring. (STATUS output)

ON - No control error

OFF - Error detected, depending of a parameter error.

### 4 - ADJUSTMENTS

On the EWM cards, the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model and shows a table with all the available commands, with their parameters, the default setting, the measuring unit and an explanation of the command and its uses. The parameters changes depending on the card model.

#### STANDARD PARAMETERS TABLE

Commands	Parameter	Defaults	Units	Description
<b>s:i x</b>	i= 0..7 x= 0..10000	- :0	- 0,01%	Definition of the target positions. The value i is related to the input selection (SEL1, SEL2 and SEL4; binary coded).
<b>vc:i x</b>	i= 0..7 x= 0..10000	- :5000	- 0,01%	Definition of the target speeds. The value i is related to the input selection (SEL1, SEL2 and SEL4; binary coded).
<b>dse1 x</b>	x= on off	off	-	Mode of the digital selection inputs. OFF: activation of the target position by a signal change (low to high) of the START input. ON: direct activation by the SELx inputs.
<b>a:i x</b>	i= A B x= 1... 2000	:A 100 :B 100	ms ms	Acceleration time depending on direction. <b>A</b> indicates analogue output 15 and <b>B</b> indicates analogue output 16. Normally <b>A</b> = flow p-A, B-T and <b>B</b> = flow P-B, A-T.
<b>d:i x</b>	i= A B x= 10... 10000	:A 2500 :B 2500	0,01% 0,01%	Deceleration stroke depending on direction. The loop gain is calculated by the deceleration stroke. The shorter the higher. In case of instabilities longer deceleration stroke will be sufficient.
<b>ctrl x</b>	x= lin sqrt1  sqrt2	sqrt1	-	Selection of the control function: <b>lin</b> = standard linear P-control, ( <b>NOTE</b> ) <b>sqrt1</b> = progressive time optimized deceleration curve <b>sqrt2</b> = sqrt1 with a higher gain in position
<b>vramp x</b>	x= 1... 2000	50	ms	Ramp time for velocity input.
<b>vmode x</b>	x= on off	off	-	Activation of the NC-generator. The command position is generated by a velocity profile (internal or external preset of v). The axis drives more or less speed controlled.
<b>th x</b>	x= 100... 60000	5000	ms	Stroke time for 100% velocity and 100% nominal sensor stroke.
<b>hand:i x</b>	i= A B x= -10000... 10000	:A 3300 :B -3300	0,01% 0,01%	Degree of output signal in manual mode
<b>min:i x</b>	i= A B x= 0... 5000	:A 0 :B 0	0,01% 0,01%	Deadband compensation of positive overlapped proportional valves. Good adjustment will increase positioning accuracy.
<b>max:i x</b>	i= A B x= 5000... 10000	:A 10000 :B 10000	0,01% 0,01%	Maximum output range for adapting control range to maximum flow range.
<b>trigger x</b>	x= 0... 2000	200	0,01%	Point to activate the deadband compensation ( <b>min</b> ). Also useful for reduced sensitivity in position with control valves.
<b>inpos x</b>	x= 2... 2000	200	0,01%	Range for the InPos signal (status output). ( <b>NOTE</b> )
<b>offset x</b>	x= -2000... 2000	0	0,01%	The offset will be added to the command value.
<b>pol x</b>	x= + -	+	-	For changing the output polarity. All <b>A</b> and <b>B</b> adjustments depend on the output polarity. The right polarity should be defined first.
<b>save</b>	-	-	-	Storing the programmed parameter in E <sup>2</sup> PROM.
<b>loadback</b>	-	-	-	Reloading the parameter from E <sup>2</sup> PROM in working RAM

help	-	-	-	Help to the commands, for terminal programs only
para	-	-	-	Parameter list with programmed data, for terminal programs only
din	-	-	-	Status of the digital inputs.
w, x, xw, u, v	-	-	-	Actual signals: command value, actual value, process data, control divergence and reference value.
default	-	-	-	Preset values will be set.

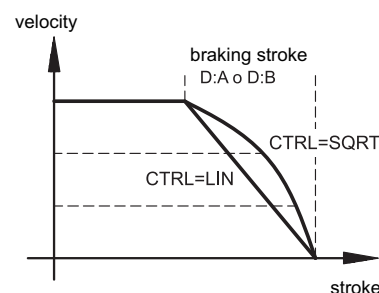
**NOTE about the INPOS command:** The INPOS command defines the window in relation to the stroke where the INPOS message is indicated. The monitored area is derived from the setpoint value minus the half "Inpos" value until setpoint value plus the half "Inpos" value. The positioning process is not influenced by this message. The controller remains active. In NC-mode this message has to be interpreted alternatively as following error.

**NOTE about the CTRL command:** This command controls the braking characteristic of the hydraulic axis. With positive overlapped proportional valves one of both SQRT braking characteristics should be used because of the linearization of the non-linear flow curve typical of these valves. If zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application. The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear braking characteristics (control gain corresponds to: 10000 / d:i).

SQRT\*: Root function for the calculation for the braking curve. SQRT1: with small control error. control gain corresponds to 30000 / d:i ; SQRT2: control gain corresponds to 50000 / d:i



### ADDITIONAL PARAMETERS ON VERSION BI\*

Commands	Parameters	Defaults	Unit	Description
ain:i a, b, c, x	i= X a= 0... 10000 b= 0... 10000 c= -10000... 10000 x= V C	: 1000 : 1000 : 0 : V	- - 0,01% -	Analogue output selection. <b>W</b> and <b>X</b> for the inputs and <b>V</b> = voltage, <b>C</b> = current. With the parameters <b>a</b> , <b>b</b> and <b>c</b> the inputs can be scaled (output = a / b * (input - c)). Because of the programming of the <b>x</b> -value (x = C) the corresponding input will be switched over to current automatically.

### ADDITIONAL PARAMETERS ON VERSION \*M2

Command	Parameter	Defaults	Unit	Description
current x	x=0... 2	0	-	Selection of the output current range: <b>0</b> = 1,0 A <b>1</b> = 1,6 A <b>2</b> = 2,6 A
dfreq x	x= 60... 400	120	Hz	Dither frequency
damp1 x	x= 0... 3000	500	0,01%	Dither amplitude. Typical values between 500 and 1200 (good experience were made with 700).
pwm x	x= 100... 7700	2600	Hz	PWM Frequency. PWM Frequencies of $\geq 2000$ Hz improve the current loop dynamics. PWM Frequencies in the range of 100... 500 Hz will be used for low dynamic valves with high hysteresis. In this case, DAMPL must be zero.
ppwm x ipwm x	x= 0... 30 x= 1... 500	3 40	- -	PI-compensator for the current controller. Changes should be only done with good experience in optimizing of current loops. In some cases a PWM Frequency of $>2500$ Hz; PPWM can be increased to 7... 15. ATTENTION: The dither amplitude must be optimized after that.

## 5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

It is recommended to use cable sections of 0.75 mm<sup>2</sup>, up to 20 m length and of 1.00 mm<sup>2</sup> up to 40m length, for power supply and solenoid connections on version M2. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

### NOTE 1

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

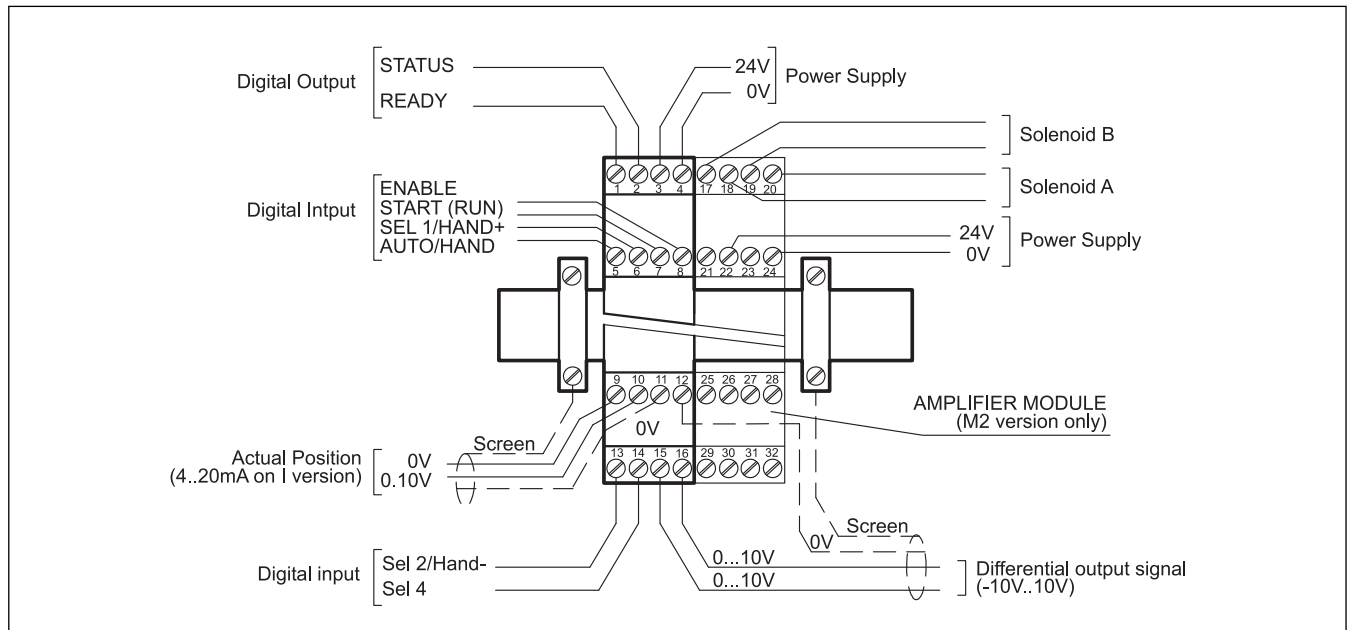
## 6 - SOFTWARE KIT EWMPC/10 (code 3898401001)

The software kit includes a USB cable (2.70 mt length) to connect the card to a PC or notebook and the software. During the identification all information are read out of the module and the table input will be automatically generated. Some functions like baud rate

setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft XP® operating systems.

## 7 - WIRING DIAGRAM OF EWM-S-B\*



### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output.  
This output is high when ENABLE is active and there is no sensor error. This output corresponds with the green led.
- PIN 2** STATUS output.  
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater then the adjusted window.  
The output is only active if START = ON.
- PIN 5** AUTO/HAND input  
ACTIVATED = automatic mode  
DEACTIVATED = hand mode.
- PIN 6** SEL 1/HAND+ input:  
SEL 1 = Selection input 1  
HAND+ = Hand mode (START = OFF), the axis drives with the programmed speed (parameter HAND:A). After the deactivation the command position is set to the actual position.
- PIN 7** START (RUN) input:  
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke
- PIN 8** ENABLE input:  
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

- PIN 13** SEL 2 / HAND- input:  
SEL 2 = Selection input 2  
HAND- = (START = OFF), the axis drives with the programmed speed (parameter HAND:B). After the deactivation the command position is set to the actual position.
- PIN 14** SEL 4- input:  
Selection input 4 - See schemes in the BINARY TABLE below

Address	0	1	2	3	4	5	6	7
SEL 1	0	1	0	1	0	1	0	1
SEL 2	0	0	1	1	0	0	1	1
SEL 4	0	0	0	0	1	1	1	1

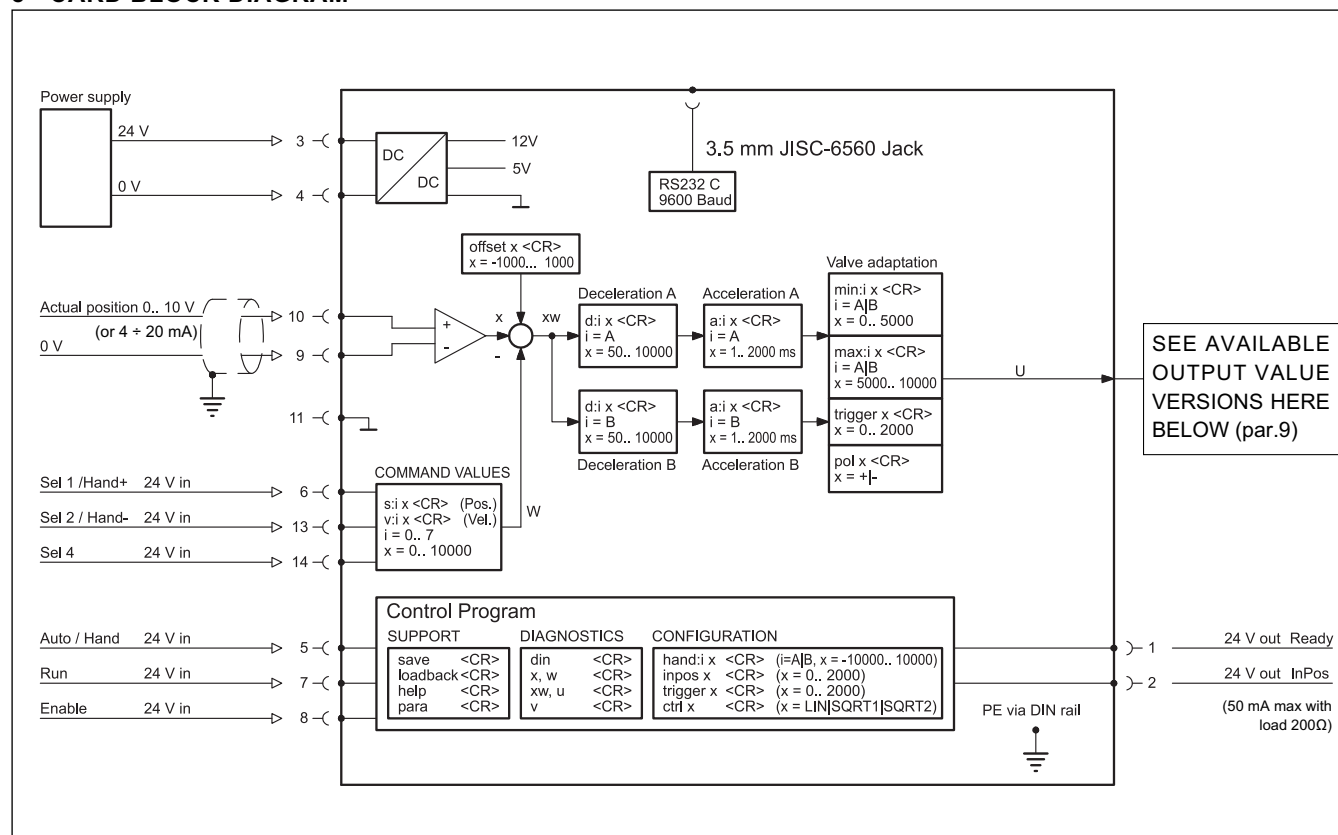
### ANALOGUE INPUT

- PIN 9/10** Actual position (feedback) value (X)  
range 0 ÷ 100% corresponds to 0 ÷ 10V (or 4 ÷ 20 mA)

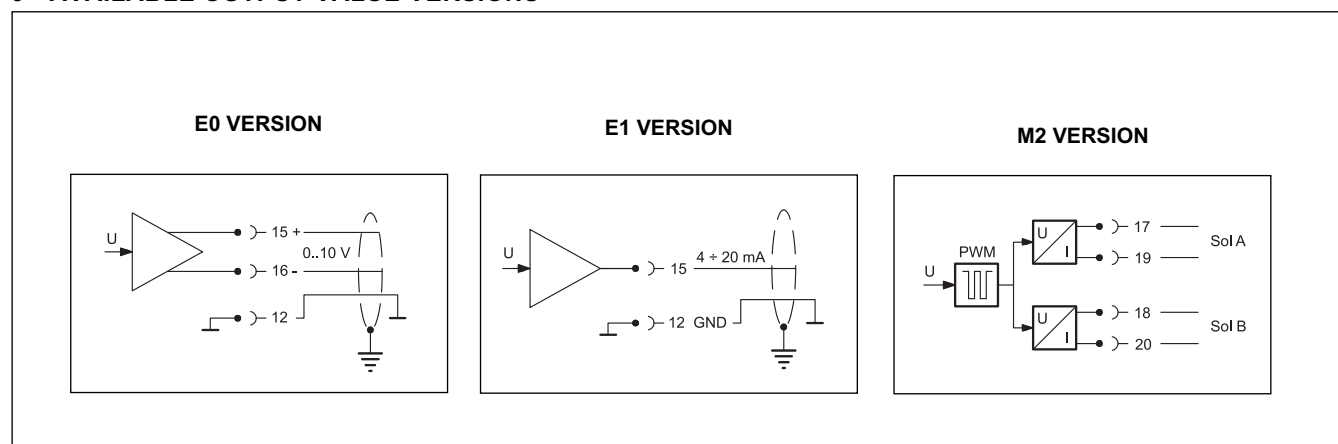
### ANALOGUE OUTPUT

- PIN 15/16** Differential output signal (U)  
± 100% corresponds to ± 10V differential voltage, optionally (I-version) current output ±100% corresponds to 4 ÷ 20 mA (PIN 15 to PIN 12)

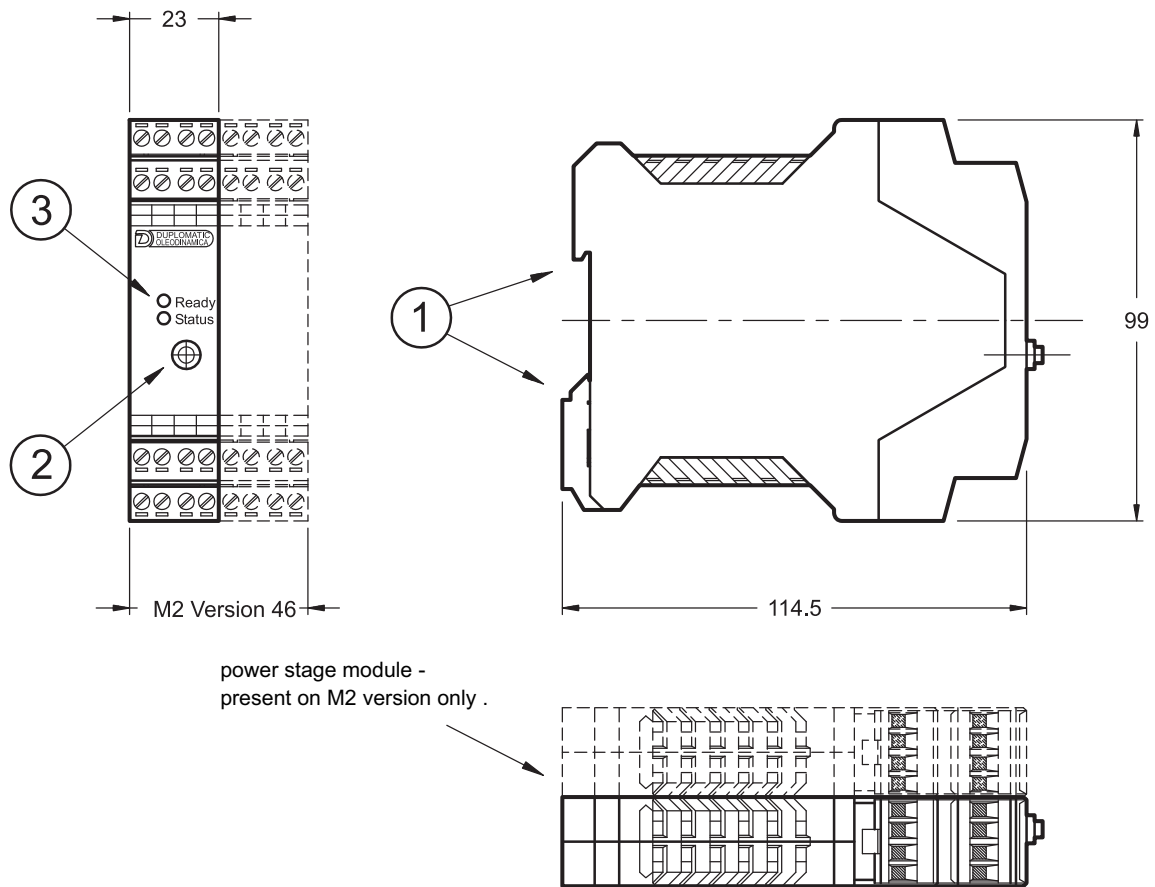
## 8 - CARD BLOCK DIAGRAM



## 9 - AVAILABLE OUTPUT VALUE VERSIONS



## 10 - OVERALL AND MOUNTING DIMENSIONS



power stage module -  
present on M2 version only .

1	DIN EN 50022 rail type fastening
2	Plug for PC cable connection
3	LED for output signals



# EWM-S-B\*

SERIES 10



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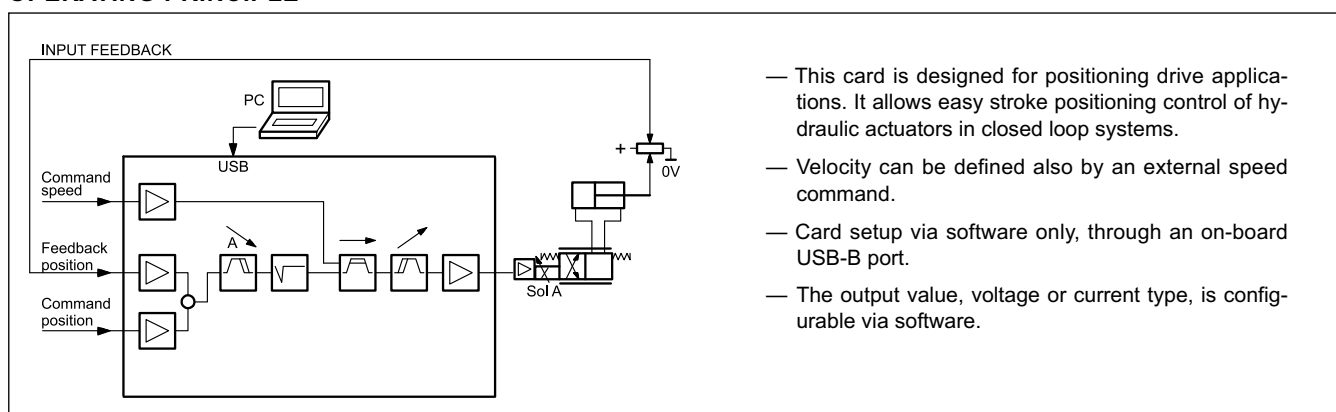


# EWM-S-AA

## ANALOGUE POSITIONING CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS WITH ANALOGUE FEEDBACK SERIES 20

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE

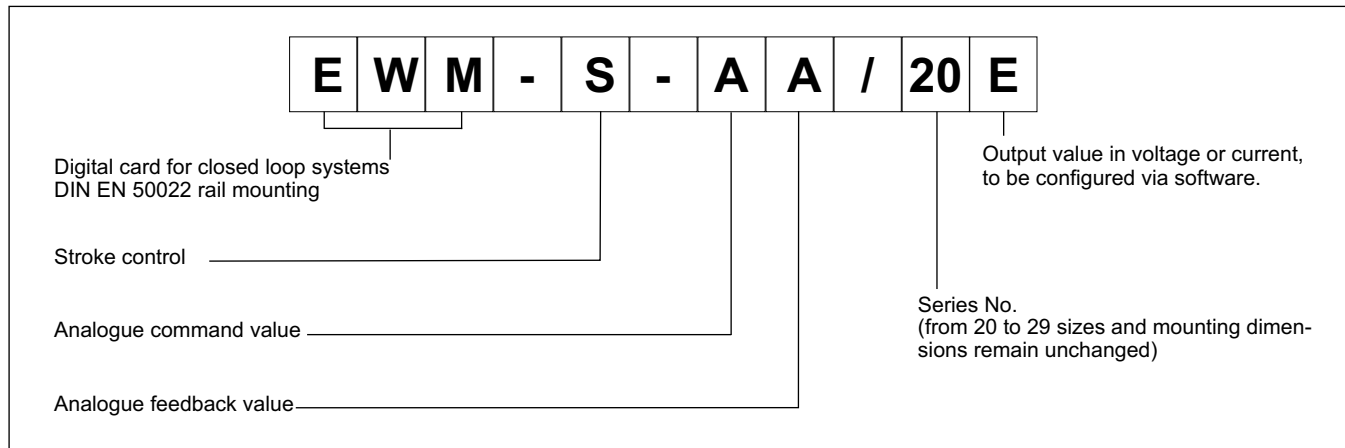


### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
Fuse, external:		1A medium time lag
Current consumption:	mA	100
Command position	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Position accuracy	%	0,003 incl. Oversampling
Command speed	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 90 kΩ)
Feedback value	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Output values	V mA	2x 0 ÷ 10 (max load 10 mA 2 kΩ) 4 ÷ 20 (max load 390 Ω)
Sample time	ms	1
Interface		USB-B 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connections		USB-B (2.0) - 4x poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



## 1 - IDENTIFICATION CODE



## 2 - FEATURES OVERVIEW

### Controller Functions

- Stroke positioning control in closed loop system
- Fine positioning - an accuracy of approx. 0.01% of the sensor stroke can be achieved
- 2 different operating modes:
  - SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  - NC – Numerically Controlled - To follow the position profile
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Emergency function (EOUT)
- Analogue signal command
- Analogue feedback input
- Velocity limited internally or by analogue input
- Simple and intuitive scaling of the sensor

### Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

### Monitoring functions

- In-position error
- Cable break for feedback sensor and command signal
- 2 Digital output to read the status

### Other characteristics

- Current or voltage output to be set via software
- Card configuration via software, through on-board USB port

## 3 - FUNCTIONAL SPECIFICATIONS

### 3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

### 3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.6 - Feedback value

The card accepts analogue feedback input. The feedback value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.7 - Analogue output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output  
(0 ÷ 10 V at PIN 15 and 0 ÷ 10 V at PIN 16).

Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

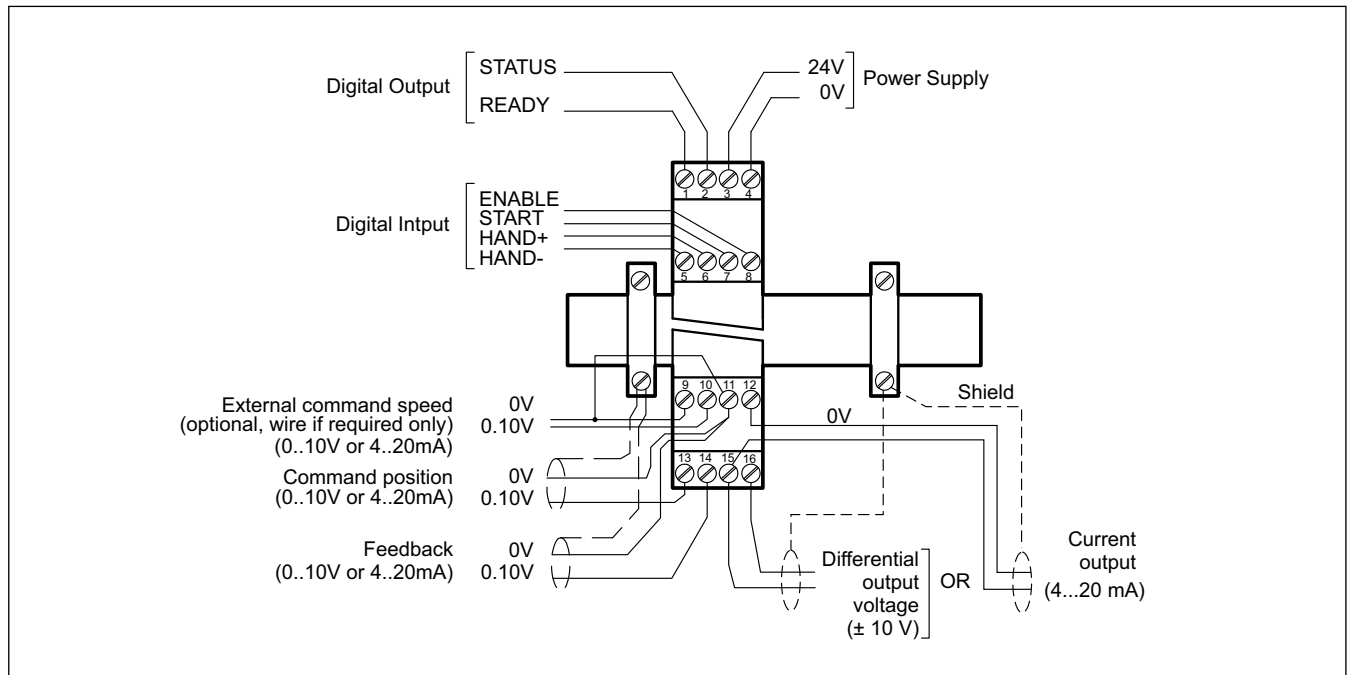
All analogue output have to be wired with screened cables.

### 3.8 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.

Low level < 2 V High Level > 12 V (max 50 mA).

## 4 - WIRING DIAGRAM



### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output.  
General operability, ENABLE is active and there is no sensor error (by use of 4+20 mA sensors). This output corresponds with the green LED.
- PIN 2** STATUS output.  
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window.  
The output is only active if START = ON.
- PIN 5** HAND- input  
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.
- PIN 6** HAND+ input:  
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.
- PIN 7** START (RUN) input:  
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke.
- PIN 8** ENABLE input:  
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

### ANALOGUE INPUT

- PIN 9/10** External command speed (V),  
range 0 ÷ 100 % corresponds to 0 ÷ 10 V or 4 ÷ 20 mA
- PIN 11/13** Command position (W),  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 11/14** Actual (feedback) value (X),  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

### ANALOGUE OUTPUT voltage

- PIN 16/15** Differential output (U)  
± 100% corresponds to ± 10V differential voltage

### current

- PIN 12/15** ±100% corresponds to 4 ÷ 20 mA

### 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches). Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

#### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

### 6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND+ and HAND- to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

#### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplo-matic Oleodinamica website in the section SOFTWARE DOWN-LOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.



**WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

#### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

**For a complete list of the parameters and their settings please refer to the Technical Manual 89410 ETM.**

## 7 - MAIN FEATURES

### 7.1 - Sequence of the positioning

The positioning process will be controlled by switching inputs. After enabling (ENABLE input), the command position is set to the actual position of the sensor and the axis is in closed loop position control mode.

The READY output indicates a general ready to operate.

The axis can be driven in manual mode with the digital inputs HAND+ or HAND- , at programmed velocity.

When the manual mode are switched off, the command position is set to the actual position and the system is in closed loop position control mode.

With START input, the analogue command input is active and new command positions will be taken over. The axis is immediately driving to this new position and indicates on the InPos Output when the axis reaches the position. This output is active as long as the axis is within the InPos window or the START input is active.

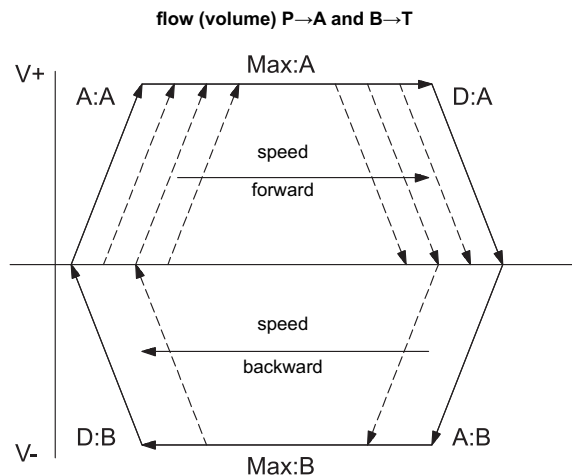
The operating mode can be:

**SDD - stroke depending deceleration** - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

**NC mode** - the position value is generated from the following error.

The actuator position is measured by an analogue transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analogue input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.



### 7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

### 7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

### 7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

The command CTRL controls the braking characteristic curve of the hydraulic axis. The deceleration can be set with linear or nearly square root characteristic.

With positive overlapped proportional valves one of the SQRT characteristics should be used, because of the linearization of the non-linear flow curve typical of these valves; if zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application.

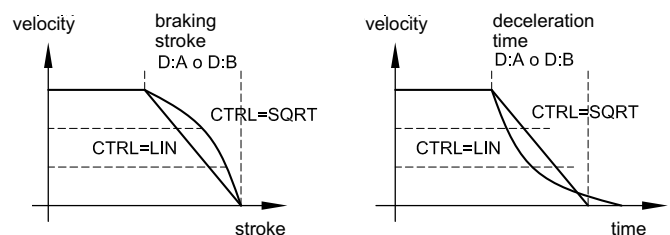
The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear characteristic (control gain corresponds to:  $10000 / d:i$ ).

SQRT1: Root function with small control error. (corresponds to  $30000 / d:i$ );

SQRT2: Root function with higher gain corresponds to  $50000 / d:i$



### 7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

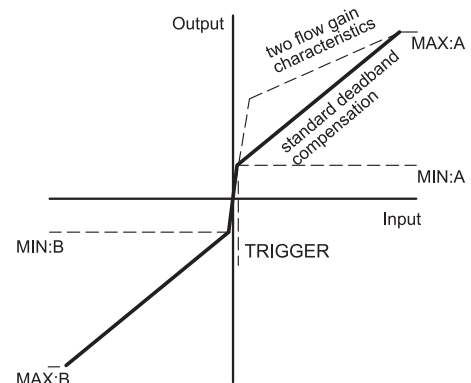
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

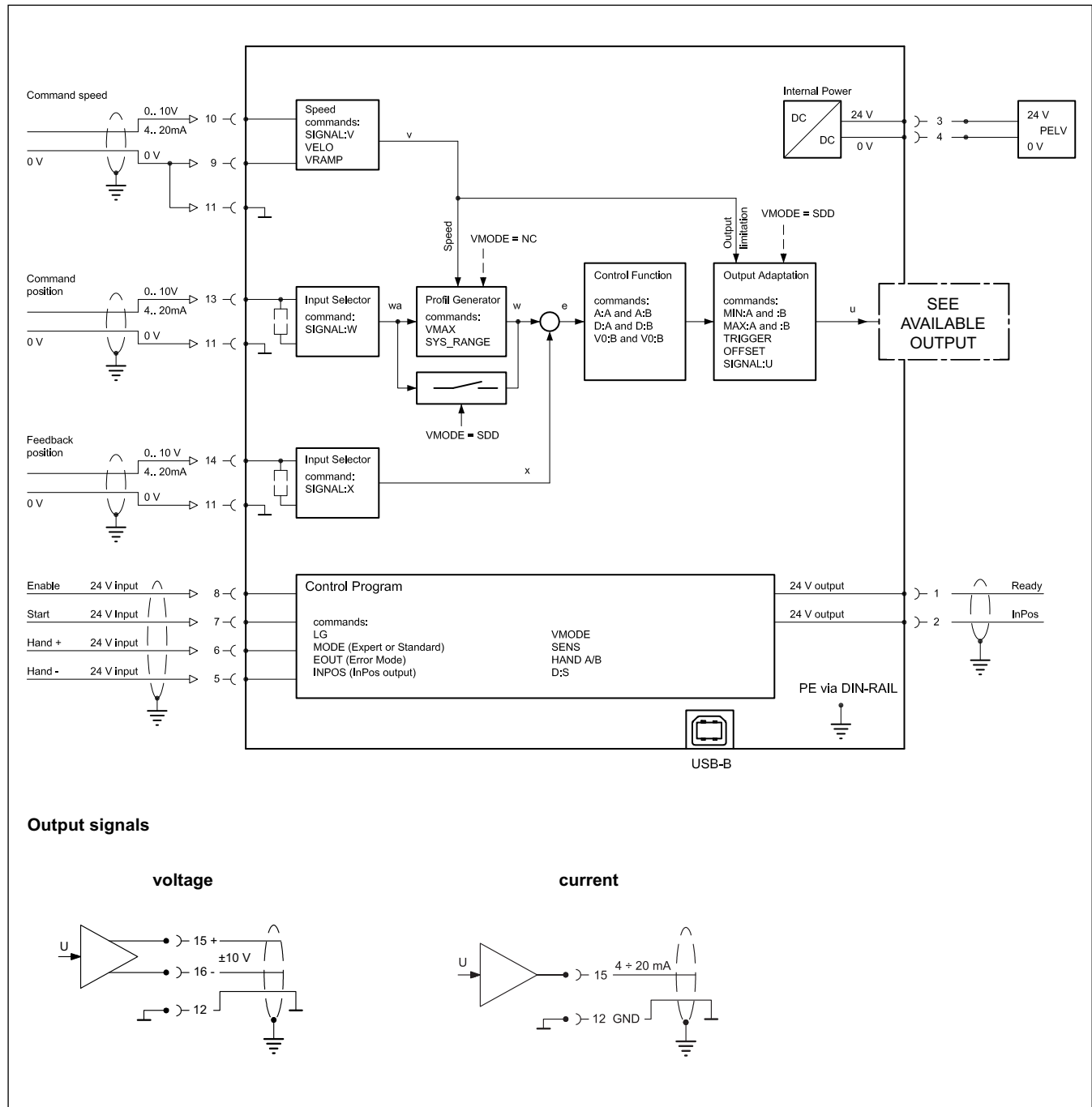
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

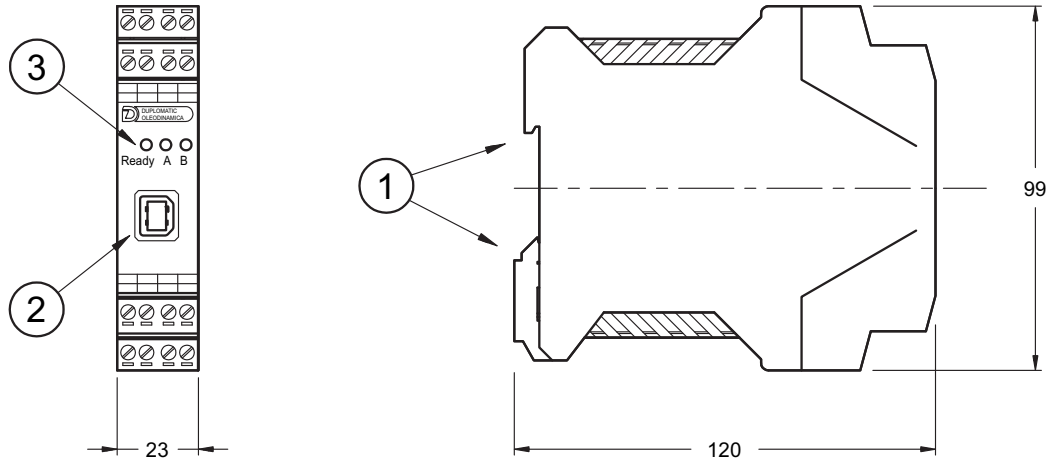
In extreme cases this causes to an oscillating around the closed loop controlled position.



## 8 - CARD BLOCK DIAGRAM



## 9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals



# EWM-S-AA

SERIES 20



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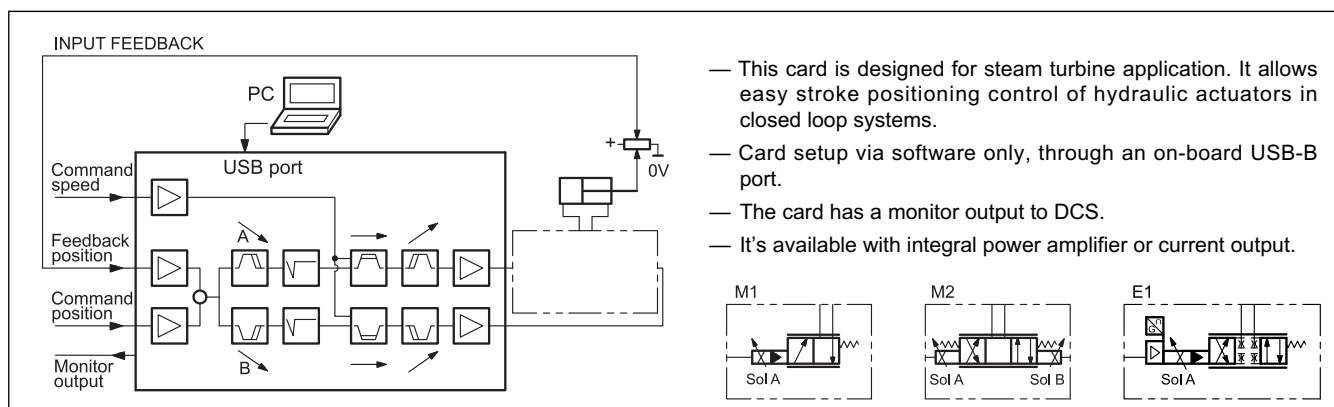
# EWM-ST-AA

## ANALOGUE POSITIONING CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS WITH ANALOGUE FEEDBACK AND DIGITAL SET-UP

SERIES 21

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE

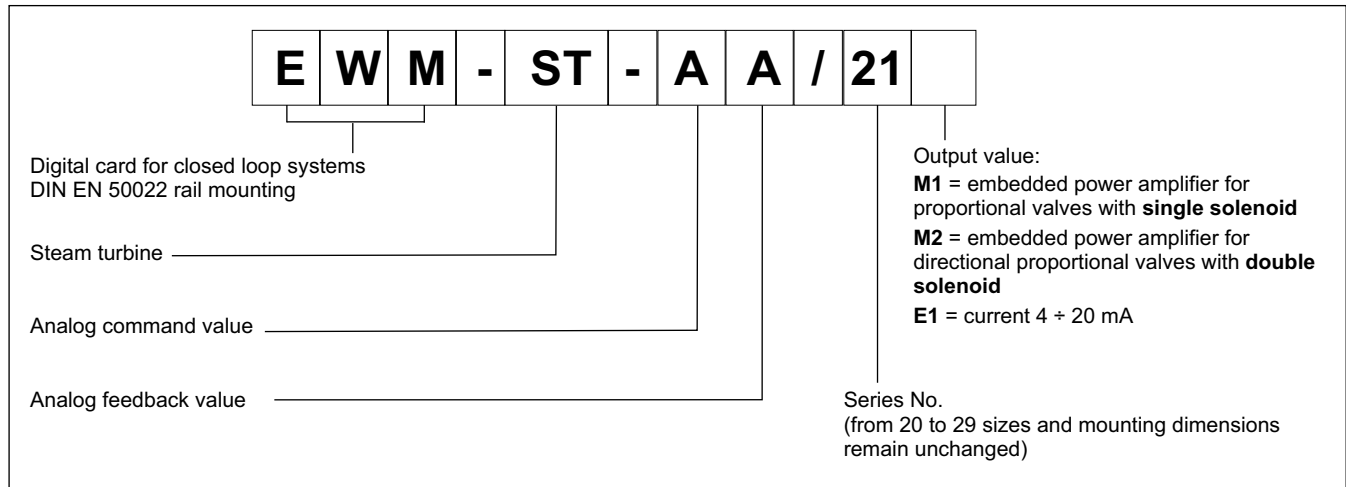


### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
Fuse, external: M1 and M2 E1		3A medium time lag 1A medium time lag
Current consumption: M1 and M2 E1	A mA	3 < 100
Command position	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Position accuracy	%	0,01
Command speed	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 90 kΩ)
Feedback value	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Output value M1 and M2 E1	mA	500 ÷ 2600 4 ÷ 20
Sample time	ms	1
Interface		USB-B (2.0)
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2 Emissions EN 61000-6-4
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 46(w)
Connections		USB - 7x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



## 1 - IDENTIFICATION CODE



## 2 - FEATURES OVERVIEW

### Controller Functions

- Stroke positioning control in closed loop system
- Fine positioning - an accuracy of approx. 0.01% of the sensor stroke can be achieved
- Control mode: SDD – Stroke Depending Deceleration time-optimal positioning structure with very high stability
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Special functions for steam turbines control (CUTOFF)
- Emergency function (EOUT)
- Analog signal command
- Analog feedback input
- Velocity limited internally or by analog input
- Simple and intuitive scaling of the sensor

### Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

### Monitoring functions

- In-position error
- Cable break for feedback sensor and command signal
- Solenoids monitored for M versions
- 2 Digital output to read the status
- Monitor output to DCS

### Other characteristics

- Available with current output or integrated power amplifier
- Card configuration is made via software, through on-board USB

## 3 - FUNCTIONAL SPECIFICATIONS

### 3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

**NOTE: the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.**

### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

### 3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.6 - Feedback value

The card accepts analogue feedback input. The feedback value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.7 - Analog output values

E1 version: analog signal 4 ÷ 20 mA (Rmax = 390 Ω).

M1 and M2 versions: embedded power stage configurable via software with values between 500 and 2600 mA.

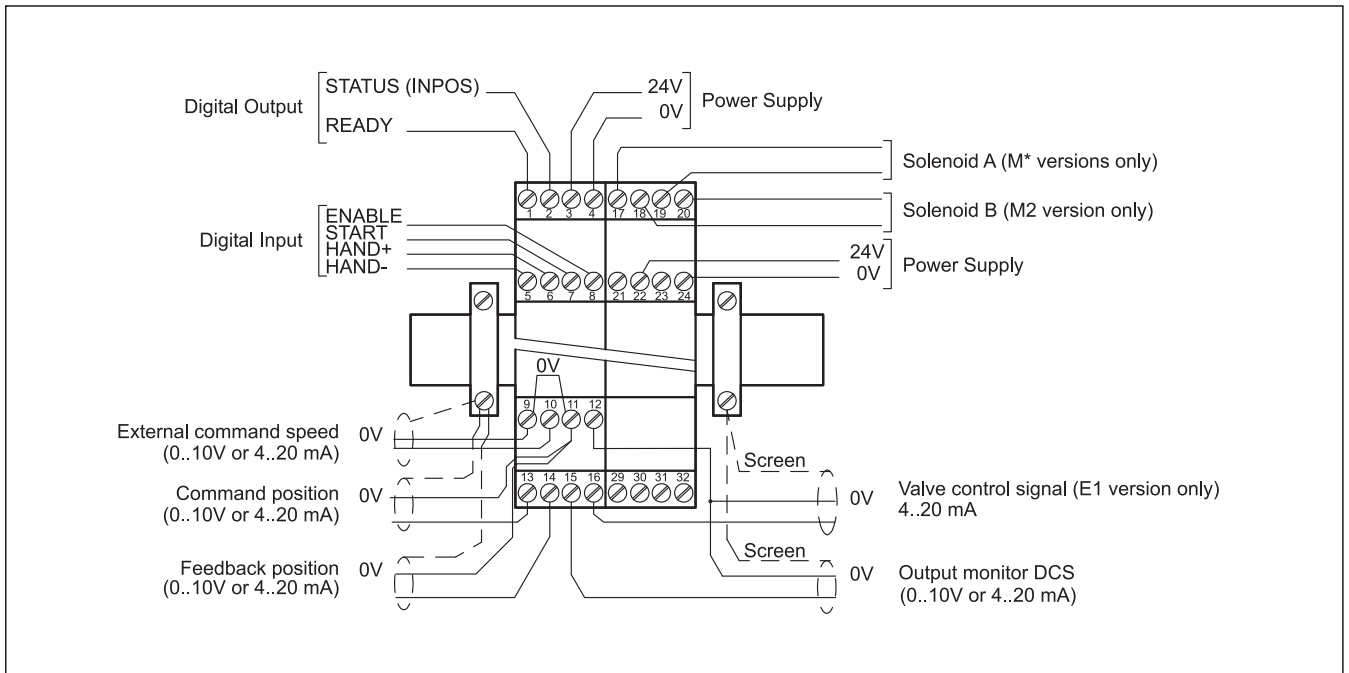
All analogue output have to be wired with screened cables.

### 3.8 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.

Low level < 2 V High Level > 12 V (50 mA).

## 4 - WIRING DIAGRAM



### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output  
ENABLE is active and there is no sensor errors. This output corresponds with the 'Ready' LED.
- PIN 2** STATUS output  
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window.  
The output is only active if START = ON.
- PIN 5** HAND- input  
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.
- PIN 6** HAND+ input  
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.
- PIN 7** START (RUN) input  
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the system stops within the set emergency stopping distance.
- PIN 8** ENABLE input:  
This digital input initializes the application and clear the errors. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

### ANALOGUE INPUT

- PIN 9/10** External command speed (V)  
range 0 ÷ 100 % corresponds to 0 ÷ 10 V or 4 ÷ 20 mA
- PIN 11/13** Command position (W)  
range 0 ÷ 100% corresponds to 0 ÷ 10 V or 4 ÷ 20 mA
- PIN 11/14** Actual (feedback) value (X)  
range 0 ÷ 100% corresponds to 0 ÷ 10 V or 4 ÷ 20 mA

### ANALOGUE OUTPUT

- PIN 12/15** Monitor output to DCS  
current output  $\pm 100\%$  corresponds to 0 ÷ 10 V or 4 ÷ 20 mA
- PIN 12/16** **For E1 version only:**  
current output  $\pm 100\%$  corresponds to 4 ÷ 20 mA

### 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

#### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.



**WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs. They interfere with the current control and can destroy the output stage.**

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

### 6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND+ and HAND- to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

#### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.



**WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

#### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

**For a complete list of the parameters and their settings please refer to the Technical Manual 89411 ETM for series 21.**

## 7 - MAIN FEATURES

### 7.1 - Sequence of the positioning

The positioning process will be controlled by switching inputs. After enabling (ENABLE input), the command position is set to the actual position of the sensor and the axis is in closed loop position control mode.

The READY output indicates a general ready to operate.

The axis can be driven in manual mode with the digital inputs HAND+ or HAND- , at programmed velocity.

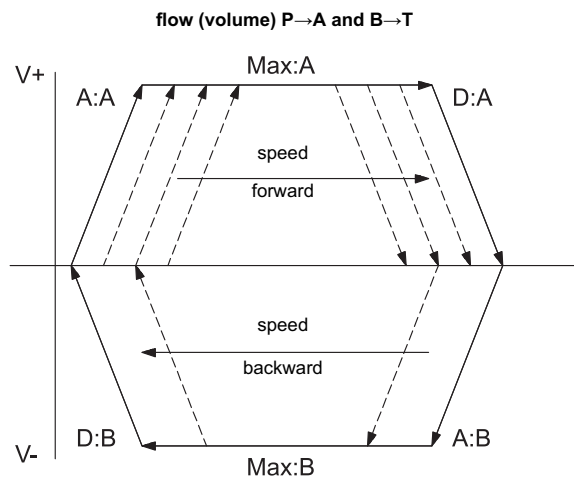
When the manual mode are switched off, the command position is set to the actual position and the system is in closed loop position control mode.

With START input, the analogue command input is active and new command positions will be taken over. The axis is immediately driving to this new position and indicates on the Inpos Output when the axis reaches the position. This output is active as long as the axis is within the InPos window or the START input is active.

The operating mode is SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

The actuator position is measured by an analog transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analog input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.



### 7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

### 7.3 - Forced closure/opening of the cylinder (CUTOFF)

This function handles the forced closure/opening of the cylinder, allowing you to set speed, direction and working area of the function.

### 7.4 - Emergency Output (EOUT and EOUTMODE)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The EOUTMODE parameter selects events which generate the EOUT output.

### 7.5 - Adaptation of the braking characteristic to the valve type (CTRL).

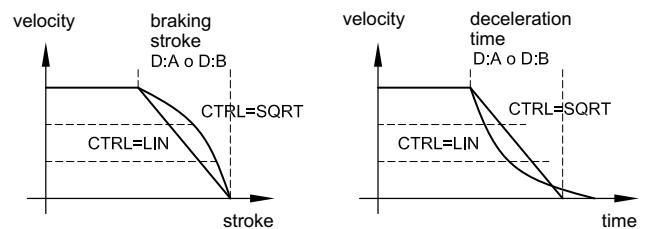
The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

LIN: Linear deceleration characteristic (gain is increased by a factor of 1).

SQRT1: Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

SQRT2: Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.



### 7.6 - Adaptation of the output signal to the valve characteristic (TRIGGER).

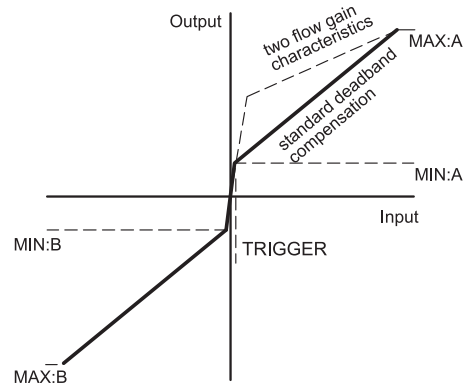
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

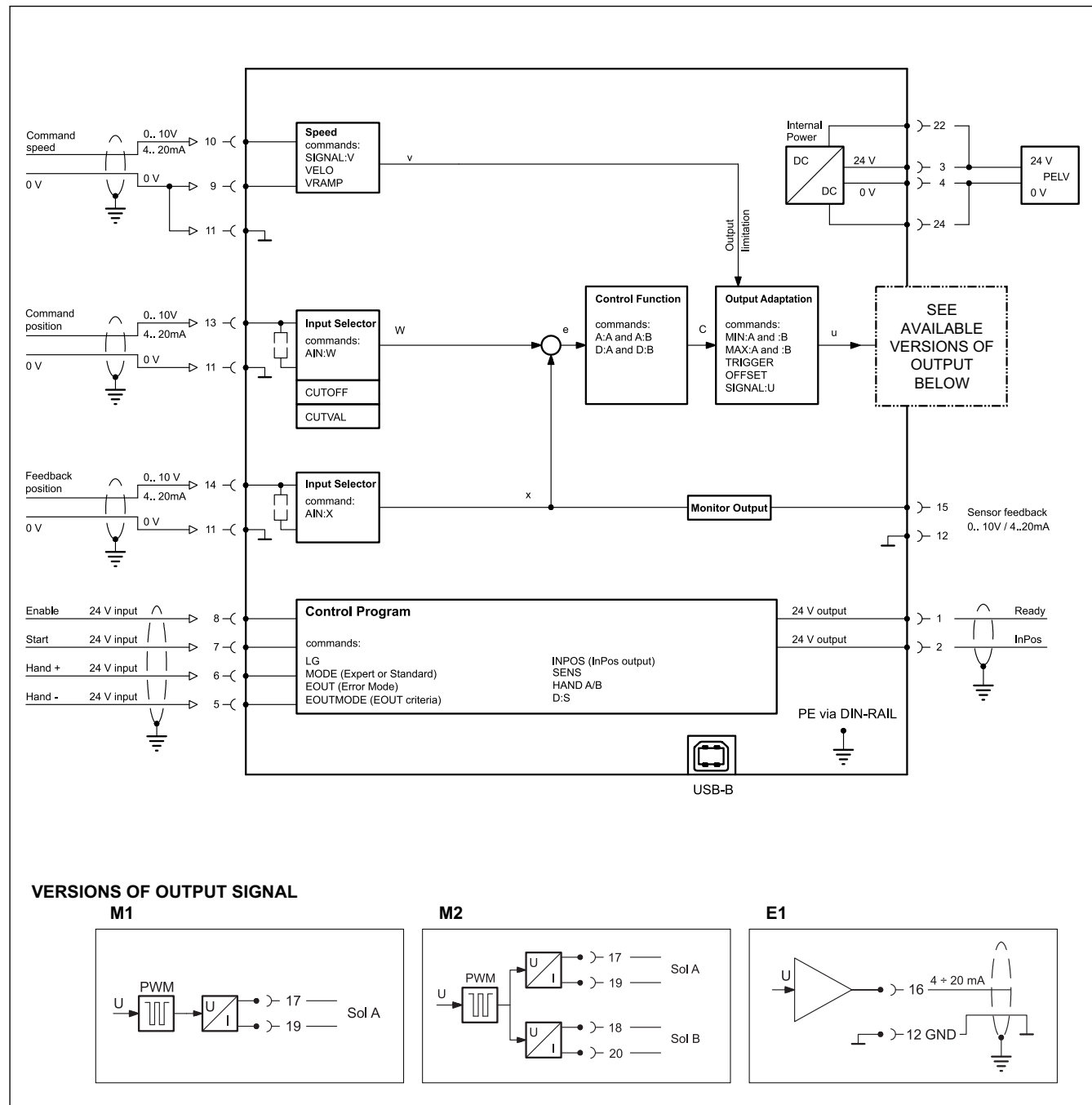
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

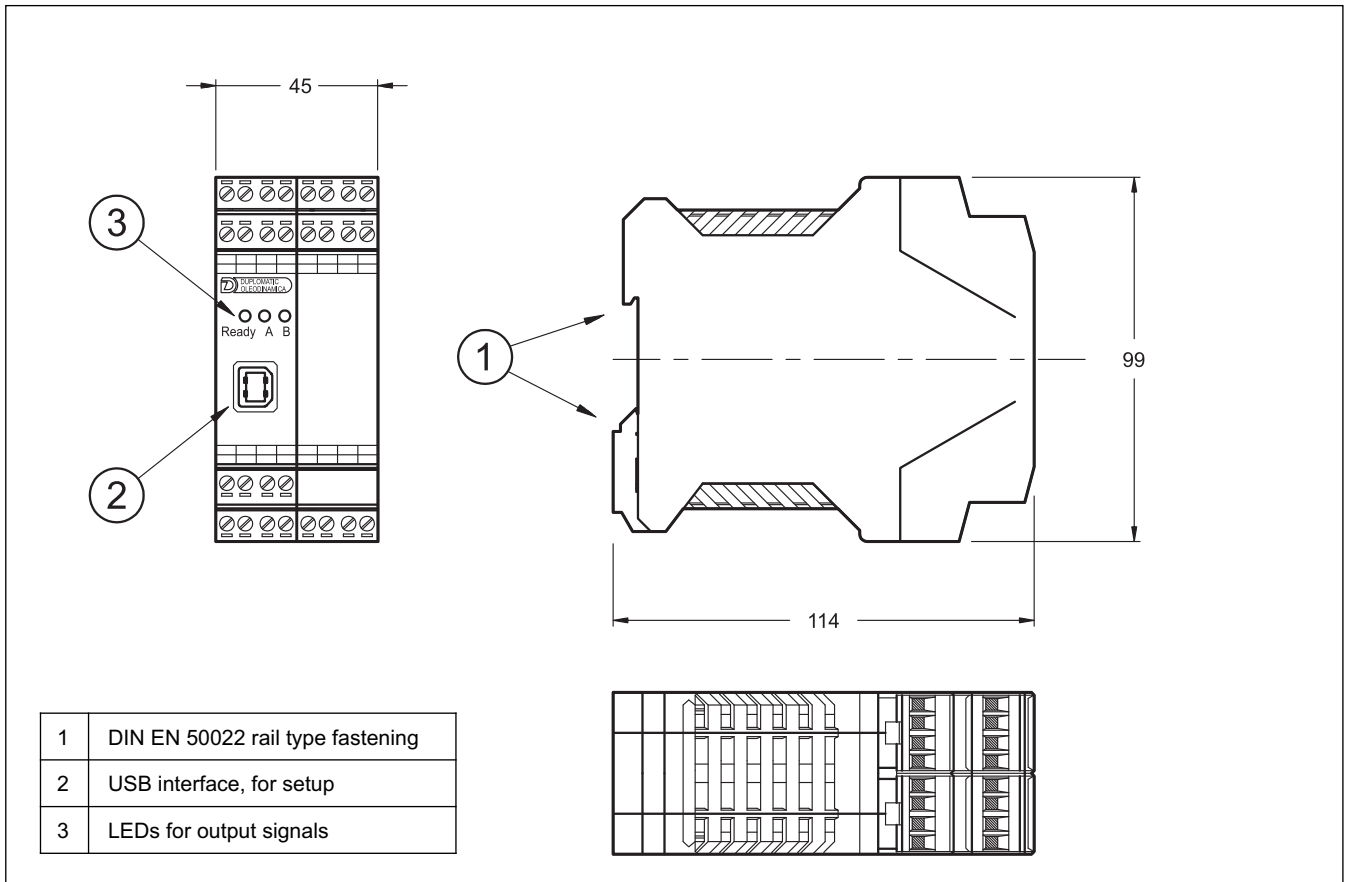
In extreme cases this causes to an oscillating around the closed loop controlled position.



## 8 - CARD CIRCUIT DIAGRAM



## 9 - OVERALL AND MOUNTING DIMENSIONS





# EWM-ST-AA

SERIES 21



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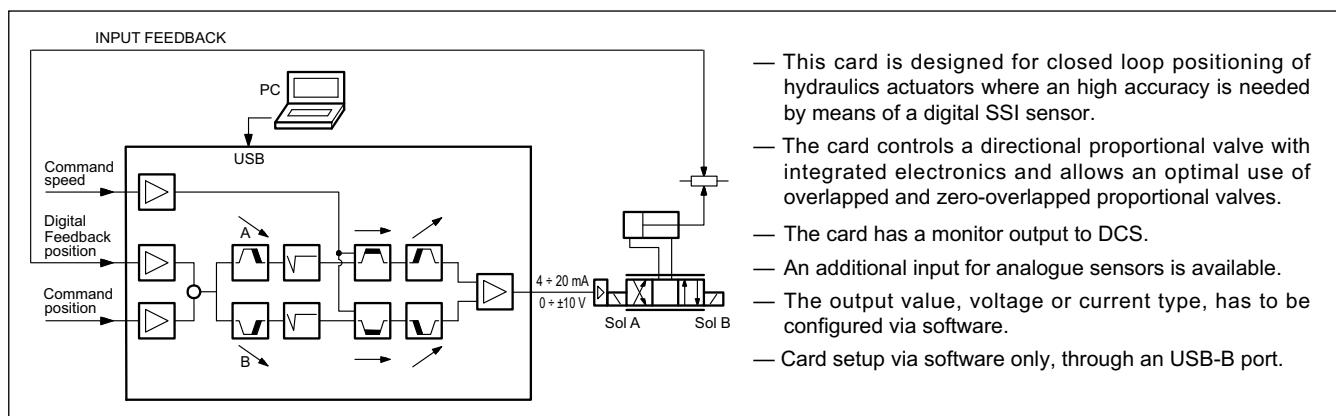


# EWM-S-AD

## ANALOGUE POSITIONING CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS WITH DIGITAL FEEDBACK SERIES 20

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE

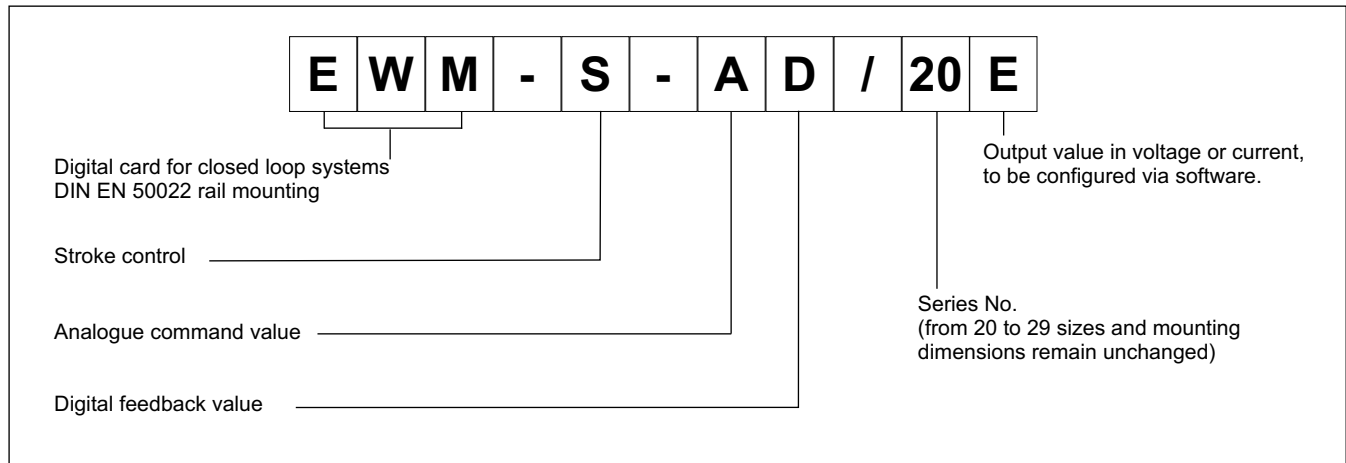


### TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included
Fuse, external	A	1A medium time lag
Current consumption	mA	350 (technical data of the sensor have to be considered)
Command position	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Max position accuracy	µm	1
Command speed	V	0 ÷ 10 (RI = 90 kΩ) 4 ÷ 20 (RI = 240 Ω)
Feedback value		Digital sensor with SSI interface RS-422, 150kBaud
Output value	V mA	differential, ±10 (max load 10 mA 2 kΩ) 4 ÷ 20 (max load 390 Ω)
Interface		USB - B 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 46(w)
Connections		USB-B (2.0) - 7x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



### 1 - IDENTIFICATION CODE



### 2 - FEATURES OVERVIEW

#### Controller Functions

- Stroke positioning control in closed loop system
- Fine positioning - 1µm resolution
- 2 different operating mode:
  - SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  - NC – Numerically Controlled - To follow the position profile
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Emergency function (EOUT)
- Analog signal command
- Digital feedback input
- Velocity limited internally or by analog input
- Safe and error-free data transmission
- As an alternative, the card can be set via software for operate with analogue sensors.
- Simple and intuitive scaling for analogue sensors

#### Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

#### Monitoring functions

- In-position error
- Cable break for command signal and fault of feedback sensor
- 2 Digital output to read the status
- Monitor output to DCS

#### Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB

### 3 - FUNCTIONAL SPECIFICATIONS

#### 3.1 - Power supply

This card is designed for 24 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

#### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

#### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

#### 3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

#### 3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

#### 3.6 - Feedback value

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

The max sensor resolution is 0,001 mm.

Eventually an analog input could be used as feedback. The card accepts a 0 ÷ 10 V (Ri 25 kΩ) or 4 ÷ 20 mA (Ri = 240 Ω)

#### 3.7 - Analog output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output

(0 ÷ 10 V at PIN 15 and 0 ÷ 10 V at PIN 16).

Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

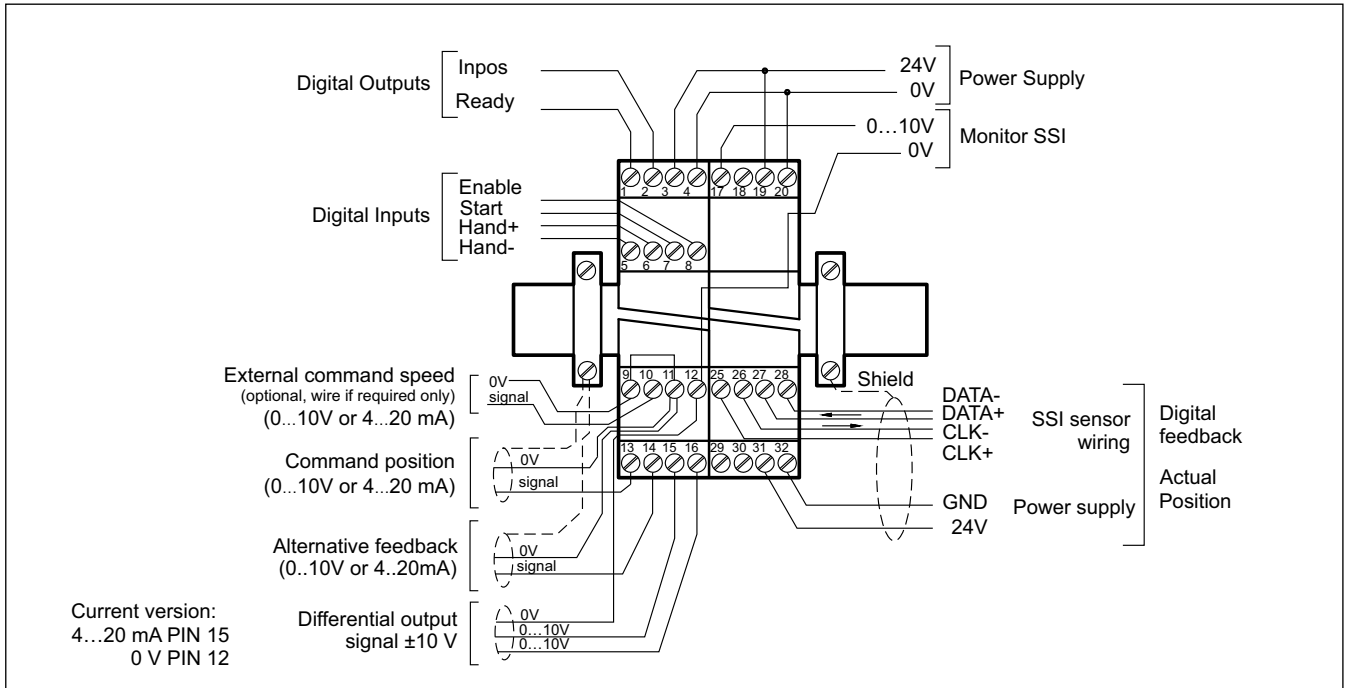
An analogue position value 0 ÷ 10 V (max load 10mA) is available at PIN 17 as sensor monitor reference.

#### 3.9 - Digital Output

Two digital output are available, INPOS and READY, that are displayed by LED on the front panel.

Low level < 2 V High Level > 12 V (50 mA).

### 4 - WIRING DIAGRAM



#### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output.  
General operability, ENABLE is active and there is no sensor error. This output corresponds with the green led.
- PIN 2** STATUS output.  
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window.  
The output is only active if START = ON.
- PIN 5** HAND- input  
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.
- PIN 6** HAND+ input:  
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.
- PIN 7** START input:  
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke.
- PIN 8** Enable input:  
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

#### ANALOGUE INPUT

- PIN 9/10** External command speed (V)  
range 0 ÷ 100 %  
corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 13/11** Command position (WA)  
range 0 ÷ 100%  
corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 11/14** Alternative: analogue feedback value (X)  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

#### ANALOGUE OUTPUT voltage

- PIN 16/15** Differential output (U)  
± 100% corresponds to ± 10V differential voltage

#### current

- PIN 12/15** ±100% corresponds to 4 ÷ 20 mA
- PIN 12/17** Monitor of the SSI sensor position  
0 ÷ 10V

### 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

#### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

### 6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND+ and HAND- to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

#### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.



**WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

#### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

**For a complete list of the parameters and their settings please refer to the Technical Manual 89420-115 ETM.**

## 7 - MAIN FEATURES

### 7.1 - Sequence of the positioning

The positioning process will be controlled by switching inputs. After enabling (ENABLE input), the command position is set to the actual position of the sensor and the axis is in closed loop position control mode.

The READY output indicates a general ready to operate.

The axis can be driven in manual mode with the digital inputs HAND+ or HAND- , at programmed velocity.

When the manual mode are switched off, the command position is set to the actual position and the system is in closed loop position control mode.

With START input, the analogue command input is active and new command positions will be taken over. The axis is immediately driving to this new position and indicates on the InPos Output when the axis reaches the position. This output is active as long as the axis is within the InPos window or the START input is active.

Two operating modes can be selected:

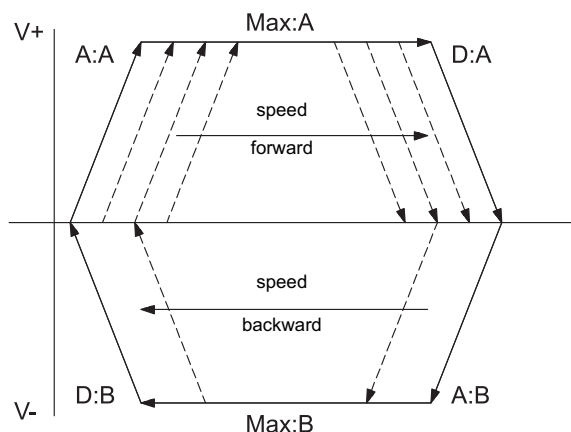
**SDD - stroke depending deceleration** - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

**NC mode** - the position value is generated from the following error.

The actuator position is measured by a transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analog input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

flow (volume) P→A and B→T



### 7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

### 7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

### 7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

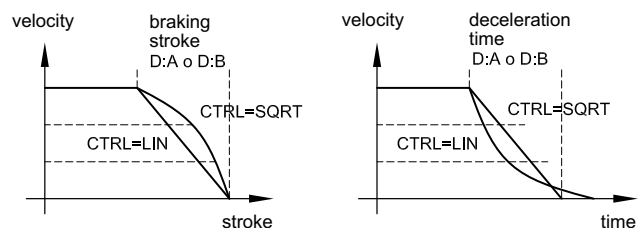
The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

**LIN:** Linear deceleration characteristic (gain is increased by a factor of 1).

**SQRT1:** Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

**SQRT2:** Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.



### 7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

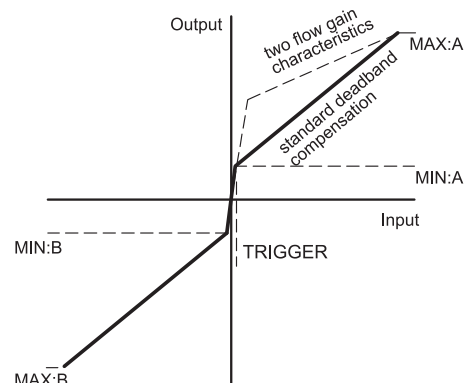
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

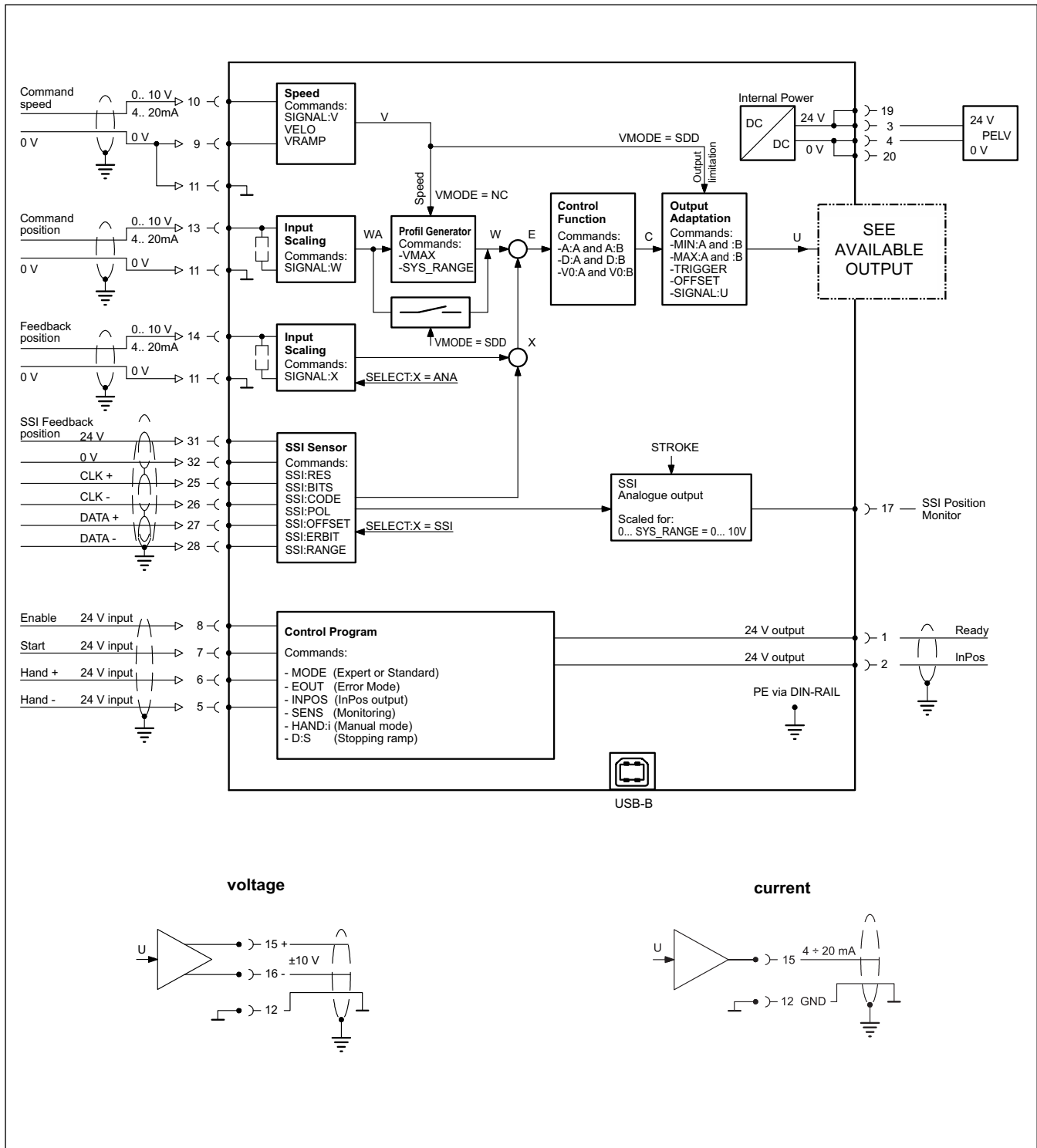
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

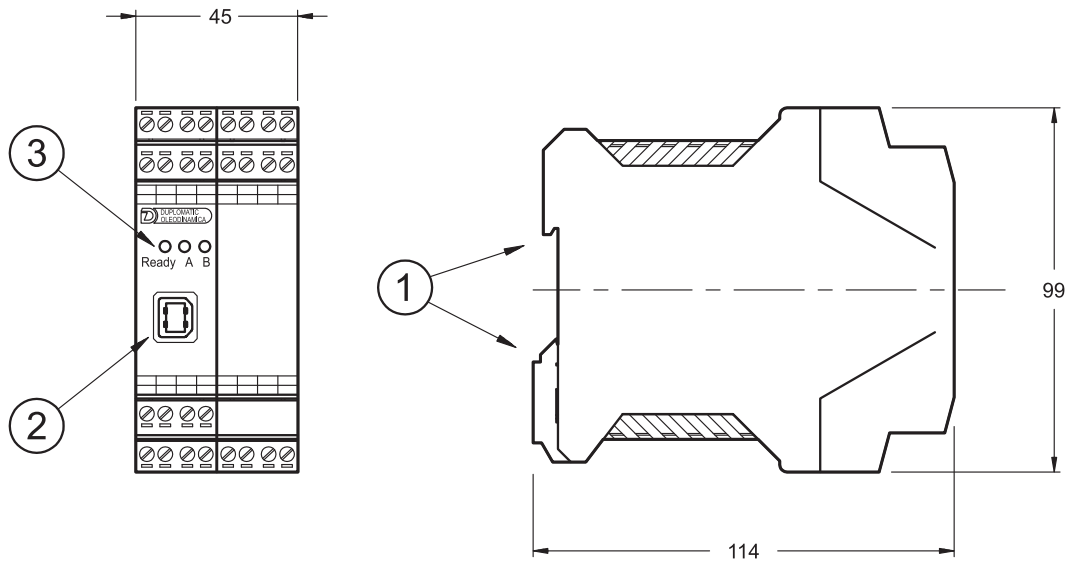
In extreme cases this causes to an oscillating around the closed loop controlled position.



### 8 - STANDARD CARD BLOCK DIAGRAM



## 9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals



# EWM-S-AD

SERIES 20



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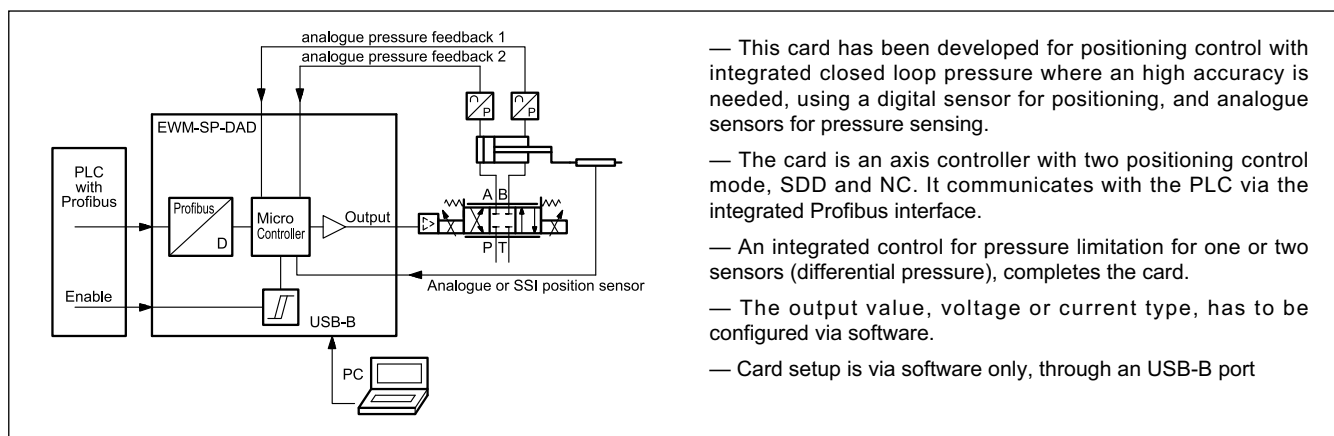


# EWM-SP-DAD

## CARD FOR AXIS CONTROL WITH PRESSURE LIMITATION IN CLOSED LOOP. PROFIBUS INTERFACE SERIES 20

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE

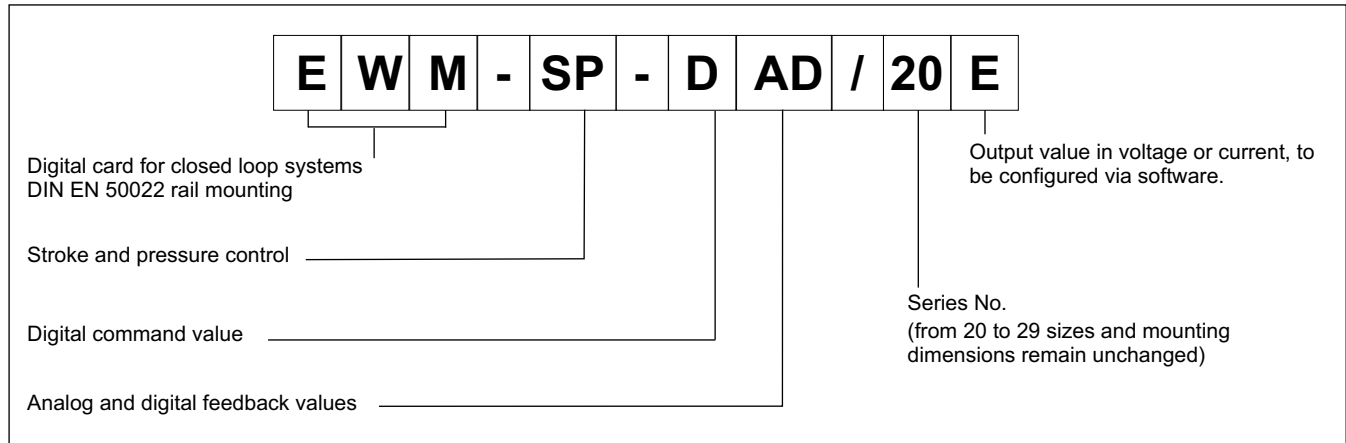


### TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included
Fuse, external	A	1A medium time lag
Current consumption	mA	<350 (technical data of the sensors have to be considered)
Command position		via Profibus DP
Profibus DP data rate	kbit/s	9.6, 19.2, 93.75, 187.5, 500, 1500, 3000, 6000, 12000 - ID number 1810h
Max position accuracy	µm	1
Position feedback values	SSI V mA	digital sensor with any interface SSI - 150 kbit/s 4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Pressure feedback values	V mA	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Output value	V mA	differential, ±10 (max load 10 mA) 4 ÷ 20 (max load 390 Ω)
Interface		USB - B 2.0 / Profibus
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 46(w)
Connections		USB-B (2.0) - 7x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



### 1 - IDENTIFICATION CODE



### 2 - FEATURES OVERVIEW

#### Controller Functions

- Stroke or stroke + pressure limitation control in closed loop system
- Fine positioning - 1µm resolution
- 2 method for positioning control:
  - SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  - NC – Numerically Controlled - To follow the position profile
- Second position and second speed commands available for fast approach / test speed
- Data for lengths and pressures in mm and bar / % respectively
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Emergency function (EOUT)
- Safe and error-free data transmission
- For digital position sensors
- Internal limitation of velocity for position sensors
- As an alternative, the card can be set via software for operate with analogue position sensors.
- Two analogue feedback for differential pressure measurement
- Two sets of PID and ramp parameters for pressure control
- Simple and intuitive scaling for analogue sensors

#### Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

#### Monitoring functions

- In-position error
- Cable break, in-pressure error and fault of feedback sensors
- 2 Digital output to read the status

#### Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB

### 3 - FUNCTIONAL SPECIFICATIONS

#### 3.1 - Power supply

This card is designed for 24 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

#### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

#### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

#### 3.4 - Reference signals

The reference signals run via Profibus, ID number 1810h.

#### 3.5 - Position feedback values

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

The max sensor resolution is 0,001 mm.

Eventually an analog input could be used as feedback. The card accepts a 0 ÷ 10 V (Ri 25 kΩ) or 4 ÷ 20 mA (Ri = 240 Ω).

The analogue resolution is of 0,003 incl. oversampling for a max res. of 1 µm.



Using analog sensors, the SSI parameters in the software assume default preset values that the user must not change.

#### 3.6 - Pressure feedback values

Pressure feedback can be analogue only, 0 ÷ 10 V (Ri 25 kΩ) or 4 ÷ 20 mA (Ri = 240 Ω).

#### 3.7 - Analog output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output PIN 15 and 16

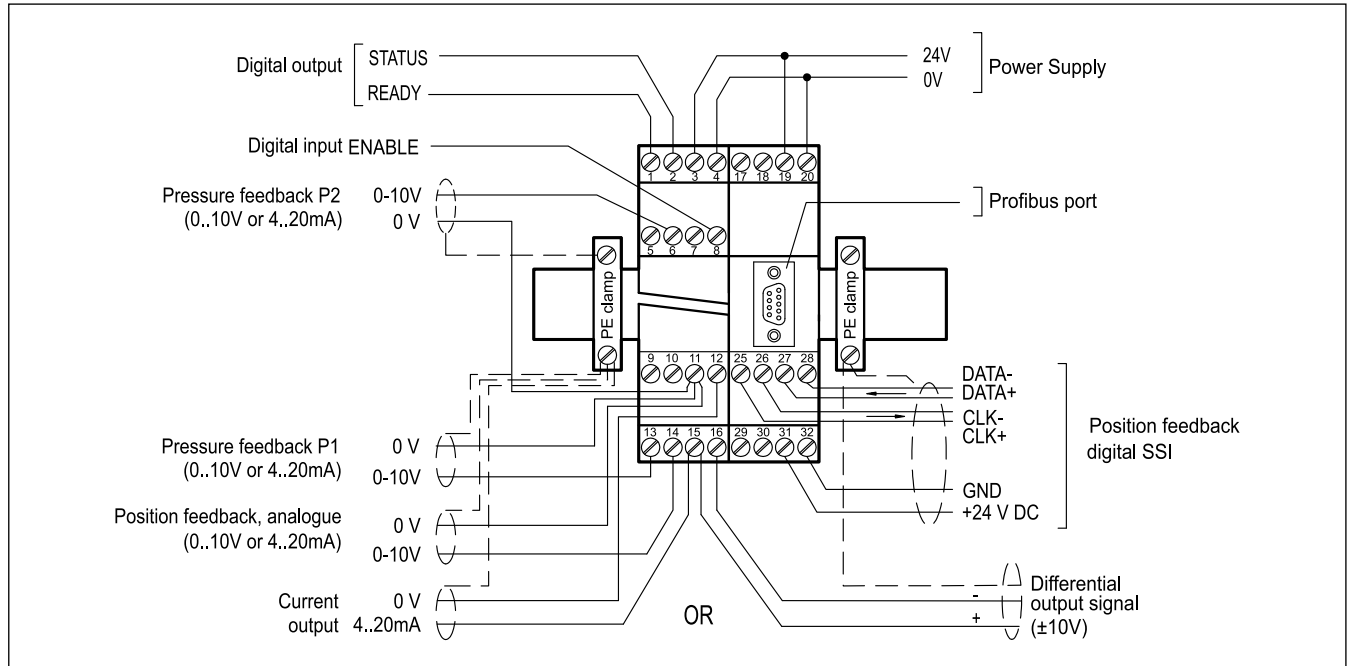
Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

### 3.8 - Digital Output

Two digital output are available, STATUS and READY, that are displayed by LED on the front panel.

Low level < 2 V High Level > 12 V (50 mA).

## 4 - WIRING DIAGRAM



### DIGITAL INPUT AND OUTPUT

- |     |   |
|-----|---|
| PIN | READY output.   |
| 1   | General operationality, ENABLE (PIN 8 and profibus bit) is active and there are no sensor errors. This output corresponds with the green led.   |
| PIN | STATUS output.  |
| 2   | Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window. The output is only active if START bit (Profibus) = ON.   |
| PIN | ENABLE input:   |
| 8   | This digital input signal initializes the application. The controller and the READY signal are activated. The output signal to the control element is enabled. Target position is set to actual position and the drive stays stationary, in closed loop. The Enable bit via profibus must be active, too. |

### ANALOGUE INPUT

- |     |   |
|-----|---|
| PIN | Analogue pressure feedback value (P2), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA |
| 6   |   |
| PIN | Analogue pressure feedback value (P1), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA |
| 13  |   |
| PIN | Analogue position feedback value , range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA     |
| 14  |   |

### ANALOGUE OUTPUT voltage

- |       |  |
|-------|--|
| PIN   | Differential output (U)                          |
| 16/15 | ± 100% corresponds to ± 10V differential voltage |

### current

- |       |                                |
|-------|--------------------------------|
| PIN   | ±100% corresponds to 4 ÷ 20 mA |
| 12/15 |                                |

### SSI SENSOR INTERFACE

- |        |                                    |
|--------|------------------------------------|
| PIN 25 | CLK+ output                        |
| PIN 26 | CLK- output                        |
| PIN 27 | DATA+ input                        |
| PIN 28 | DATA- input                        |
| PIN 31 | 24V Power supply of the SSI sensor |
| PIN 32 | 0V Power supply of the SSI sensor  |

## 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

## 6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND:x, via Profibus only, to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.



**WARNING!** For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in **OPTION / SETTINGS / INTERFACE**.

### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

**For a complete list of the parameters and their settings please refer to the Technical Manual 89440-115 ETM.**

## 7 - MAIN FEATURES

The EWM-SP-DAD is a card for positioning control loop (POS), that can operate also with a pressure limitation control (POS\_PQ).

With only few parameters the controller can be optimized and the movement profile is preset via Profibus (position and velocity).

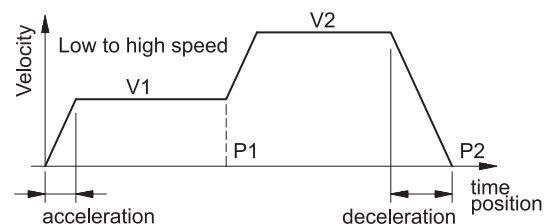
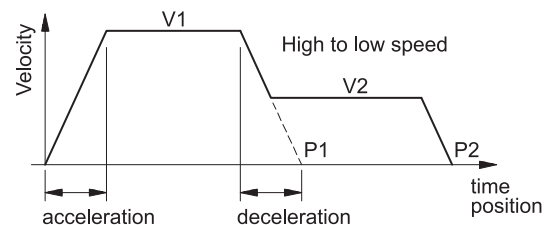
Here below an example of profile with a switch speed:

- the target position is command value 2 (P2) combined with velocity 2 (V2).
- the switch over position is command value 1 (P1), combined with velocity 1 (V1).

The switchpoint from high to low velocity is calculated depending on the speed V2 and the braking.

The switchpoint from low to high speed is made in the P1 position with the ramp acceleration, as shown below.

If the command position P2 is between the current position and the position value of P1, the positioning in P2 can only be driven with V1 velocity.



### 7.1 - Sequence of the positioning

You can switch from the positioning in closed loop to the manual movement in open loop and back via Profibus.

With READY active the system is ready. The open loop control is achieved by using the HAND bits and the speed parameter. When the bit HAND goes low the card assumes the current position as the request and the card is ready to work in closed loop.

With also START bit enabled, the command position parameter (profibus) become active and the new command position will be taken over as a new target.

The axis moves immediately to this new position and indicates on the Inpos Output when it reaches the position. This output is active as long as the axis is within the InPos window or the START bit is active.

Two methods for positioning are available:

**SDD - stroke depending deceleration** - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

**NC mode** - the position value is generated from the following error.

The actuator position is measured by a transducer and compared with a specified target position. The target position and speed are set by Profibus.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

### 7.2 - Pressure limitation control function:

The pressure limitation control requires a dynamic zero-overlapped control valve.

The pressure loop is managed according to the value of pressure measured just in one or in both the two chambers of the cylinder.

The control value for the pressure loop is set via profibus. If the pressure (or force) exceeds, the controller reduces the output signal to the valve (only in a negative scale) until it reaches the preset pressure value.

The switch from 'positioning mode' to 'pressure limitation' is handled automatically.

### 7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

### 7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

**LIN:** Linear deceleration characteristic (gain is increased by a factor of 1).

**SQRT1:** Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

**SQRT2:** Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.

### characteristic (TRIGGER).

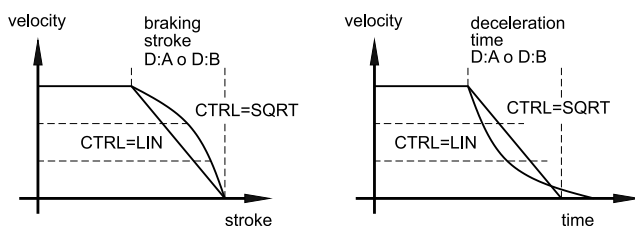
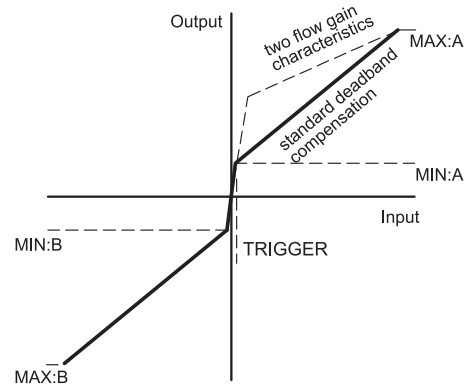
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

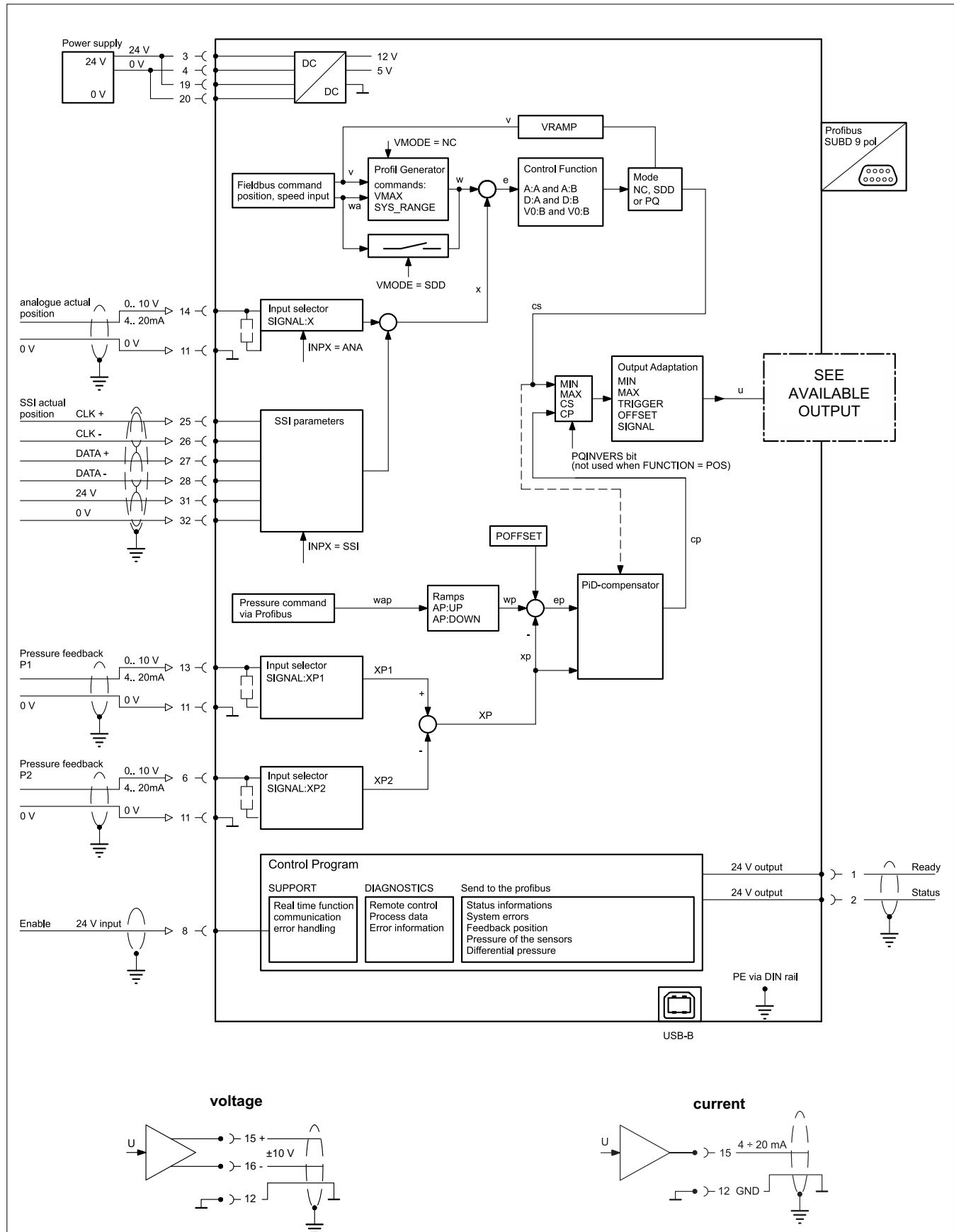
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out either at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

In extreme cases this causes to an oscillating around the closed loop controlled position.

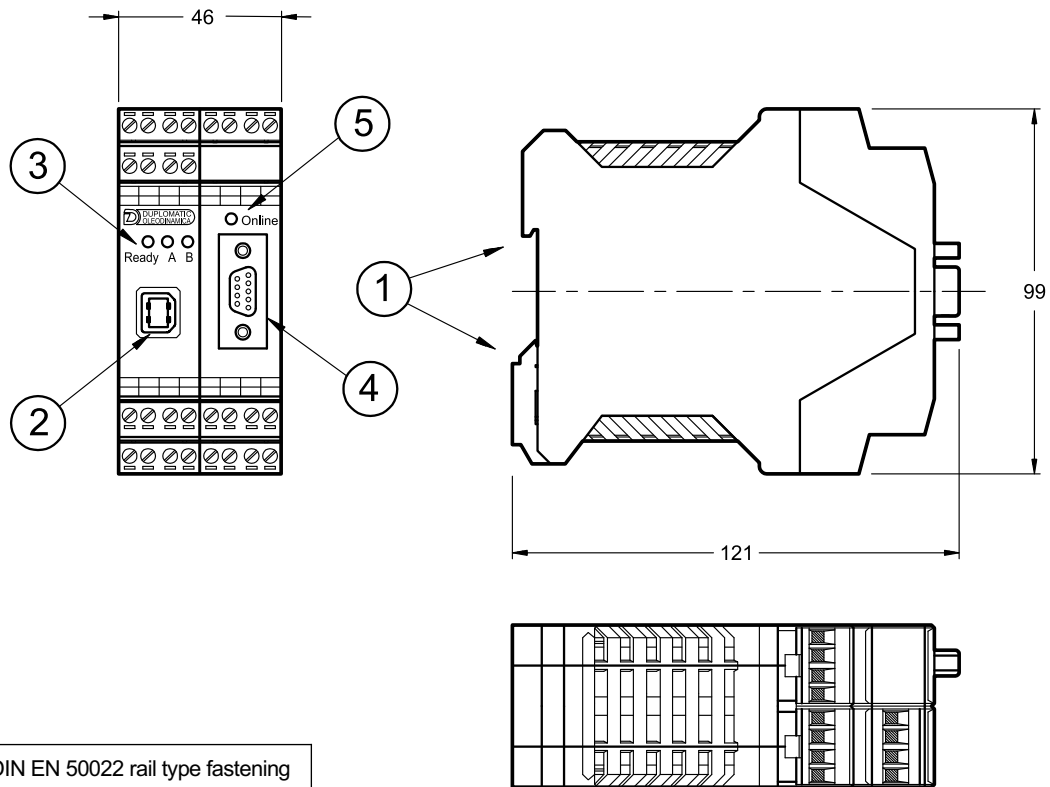


### 8 - CARD BLOCK DIAGRAM



**NOTE:** If the card is configured as simple positioning control without pressure limitation then the output value is calculated just from the output of the position controller (CS) instead of apply MIN and MAX parameters. MIN/MAX are selected by the PQINVERS bit (Profibus).

## 9 - OVERALL AND MOUNTING DIMENSIONS





# EWM-SP-DAD

SERIES 20



**DUPLOMATIC  
OLEODINAMICA**

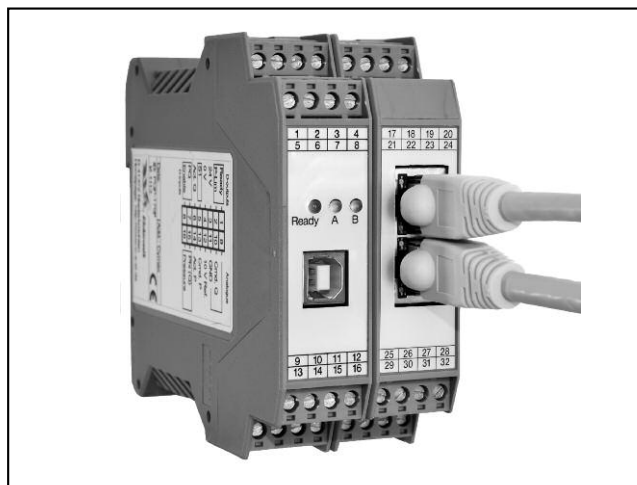
**DUPLOMATIC OLEODINAMICA S.p.A.**

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# EWM-SP-DAD

## WITH ETHERNET INTERFACE

## CARD FOR AXIS CONTROL

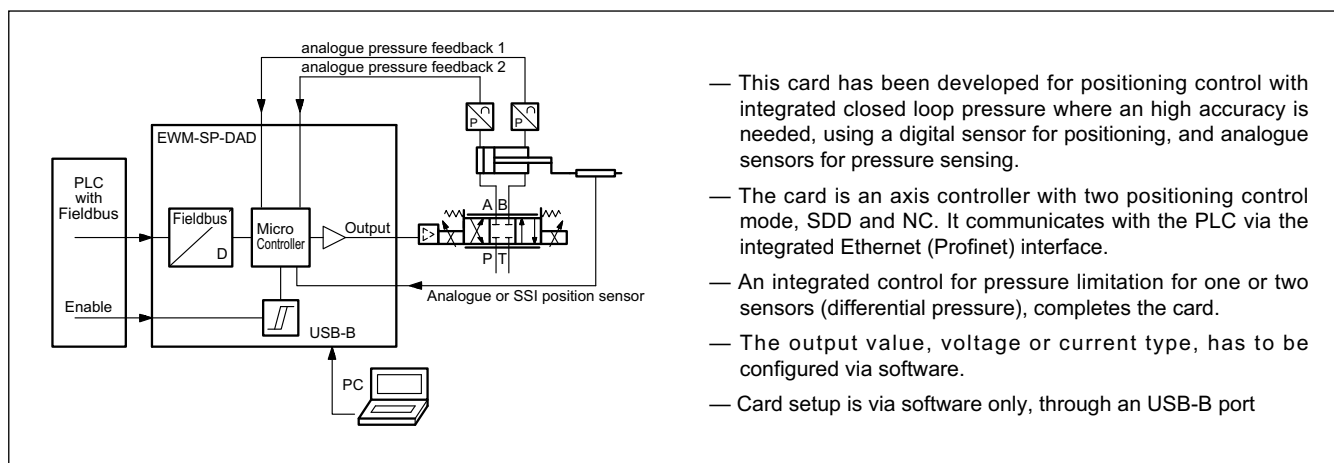
## WITH PRESSURE LIMITATION

## IN CLOSED LOOP

### SERIES 20

**RAIL MOUNTING TYPE:**  
**DIN EN 50022**

### OPERATING PRINCIPLE

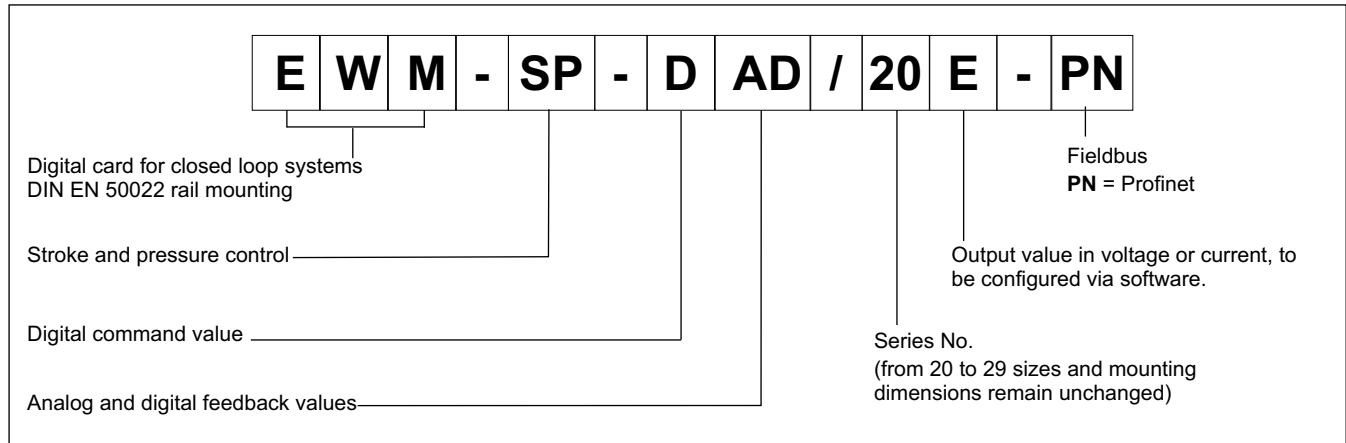


### TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included
Fuse, external	A	1A medium time lag
Current consumption	mA	<350 (technical data of the sensors have to be considered)
Command position		via Fieldbus (Profinet)
Sampling time	ms	1
Max position accuracy	µm	1
Position feedback values	SSI V mA	digital sensor with any interface SSI - 150 kbit/s 4 ÷ 20 (RI = 250 Ω) 0 ÷ 10 (RI = 25 kΩ)
Pressure feedback values	V mA	4 ÷ 20 (RI = 250 Ω) 0 ÷ 10 (RI = 25 kΩ)
Output value	V mA	differential, ±10 (max load 10 mA) 4 ÷ 20 (max load 390 Ω)
Interface		USB-B 2.0 / fast Ethernet 2x100 Mb/s full duplex
Electromagnetic compatibility (EMC)		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Connections		USB - 7x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



### 1 - IDENTIFICATION CODE



### 2 - FEATURES OVERVIEW

#### Controller Functions

- Stroke or stroke + pressure limitation control in closed loop system
- Fine positioning - 1µm resolution
- 2 method for positioning control:
  - SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  - NC – Numerically Controlled - To follow the position profile
- Second position and second speed commands available for fast approach / test speed
- Data for lengths and pressures in mm and bar respectively
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Emergency function (EOUT)
- Safe and error-free data transmission
- For digital position sensors
- Internal limitation of velocity for position sensors
- Alternatively, the card can be set via software for operate with an analogue position sensor.
- Two analogue feedback for differential pressure measurement
- Two sets of PID and ramp parameters for pressure control
- Simple and intuitive scaling for analogue sensors
- Feed forward control for NC mode
- Acceleration feedback obtained from the differential pressure (NC mode)

#### Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

#### Monitoring functions

- In-position error
- Cable break, in-pressure error and fault of feedback sensors
- 1 digital output to read the status

#### Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB
- Parametrization via fieldbus

### 3 - FUNCTIONAL SPECIFICATIONS

#### 3.1 - Power supply

This card is designed for 24 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

#### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

#### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

#### 3.4 - Reference signals

Reference signals run via fieldbus, with Profinet interface.

#### 3.5 - Position feedback values

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

The max sensor resolution is 1 µm.

Eventually an analog input could be used with feedback sensor. The card accepts a 0 ÷ 10 V (Ri 25 kohm) or 4 ÷ 20 mA (Ri = 250 ohm).



Using analog sensors, the SSI parameters in the software assume default preset values that the user must not change.

#### 3.6 - Pressure feedback values

Pressure feedback can be analogue only, 0 ÷ 10 V (Ri 25 kohm) or 4 ÷ 20 mA (Ri = 250 ohm).

#### 3.7 - Analog output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output

(0 ÷ 10 V PIN 15 and 0 ÷ 10 V at PIN 16).

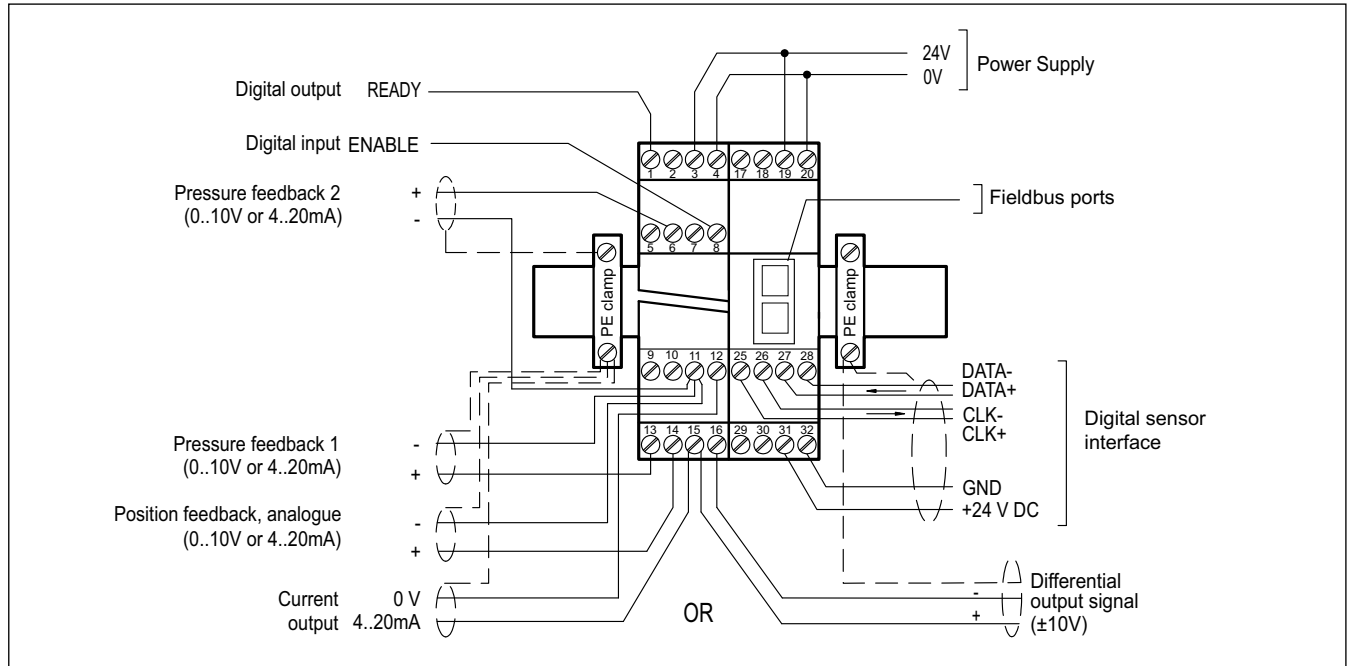
Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

### 3.8 - Digital Output

A READY digital output is available and is displayed by LED on the front panel.

Low level < 2 V High Level > Max voltage supply (50 mA).

### 4 - WIRING DIAGRAM



#### DIGITAL INPUT AND OUTPUT

PIN 1	READY output. General operationality, ENABLE (PIN 8 and fieldbus bit) is active and there are no sensor errors. This output corresponds with the green led.
PIN 8	ENABLE input: This digital input signal initializes the application. The controller and the READY signal are activated. The output signal to the control element is enabled. Target position is set to actual position and the drive stays stationary, in closed loop. The Enable bit via fieldbus must be active too, to activate the module.

#### ANALOGUE INPUT

PIN 6	Analogue pressure feedback value (X2), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
PIN 13	Analogue pressure feedback value (X1), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
PIN 14	Analogue position feedback value (X), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

#### ANALOGUE OUTPUT voltage

PIN 16/15	Differential output (U) ± 100% corresponds to ± 10V differential voltage
-----------	---

#### current

PIN 12/15	±100% corresponds to 4 ÷ 20 mA
-----------	--------------------------------

#### SSI SENSOR INTERFACE

PIN 25	CLK+ output
PIN 26	CLK- output
PIN 27	DATA+ input
PIN 28	DATA- input
PIN 31	24V Power supply of the SSI sensor
PIN 32	0V Power supply of the SSI sensor

### 5 - INSTALLATION

For power supply and solenoid connections are recommended cable cross sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40 m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.**

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

#### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

#### 5.2 - PROFINET IO RT interface

PROFINET is the standard for Industrial Ethernet based on IEEE 802.xx. PROFINET is based on the 100 Mb/s-version of full duplex and switched Ethernet.

Diagnostic LEDs are embedded on each port.

The characteristics of an IO Device are described General Station Description (GSD) file. This describes the structure of the cyclic input and output data transferred between the Programmable Controller and the fielbus IO device

In the configuration of transmission, 32 bytes for input and 32 bytes for output must be pre-adjusted.

The GSDML configuration file is available for download from our website (software download page).

### 6 - DEVICE SETUP

Card set-up is possible via software only, via USB port.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND:x, via Fieldbus only, to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

#### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.

#### 6.2 - Parameters table

The parameters table is available in English or German. The language is settable with LG parameter.

Parameters are grouped together according to their function (e.g. sensor interface, position controller, etc..) in order to make the setting process easier, but they can also be displayed all together (MODE parameter).

**For a complete list of parameters and their settings please refer to the Technical Manual 89445 ETM.**

### 7 - MAIN FEATURES

The EWM-SP-DAD is a card for positioning control loop (POS), that can operate also with a pressure limitation control (PQ\_ACTIVE).

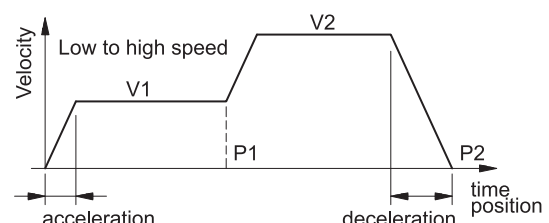
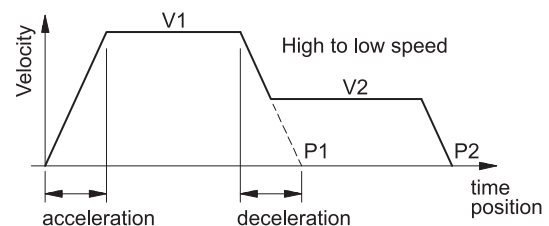
With only few parameters the controller can be optimized and the movement profile is preset via Fieldbus (position and velocity).

Here below an example of profile with a switch speed:

- the target position is command value 2 (P2) combined with velocity 2 (V2).
- the switch over position is command value 1 (P1), combined with velocity 1 (V1).

The switchpoint from high to low velocity is calculated depending on the speed V2 and the braking.

The switchpoint from low to high speed is made in the P1 position with the ramp acceleration, as shown below.



If the command position P2 is between the current position and the position value of P1, the positioning in P2 can only be driven with V1 velocity.

### 7.1 - Sequence of the positioning

You can switch from the positioning in closed loop to the manual movement in open loop and back via Fieldbus.

With READY active the system is ready. The open loop control is achieved by using the HAND bits and the speed parameter. When the HAND bit goes low the card assumes the current position as the request and the card is ready to work in closed loop.

With also START bit enabled, the command position parameter becomes active and the new command position (sent via fieldbus) will be taken over as a new target.

The axis moves immediately to this new position and indicates on the Inpos Output when it reaches the position. This output is active as long as the axis is within the InPos window or the START bit is active.

Two methods for positioning are available:

**SDD - stroke depending deceleration** - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

**NC mode** - the position value is generated from the following error.

The actuator position is measured by a transducer and compared with a specified target position. The target position and speed are set by Fieldbus.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

### 7.2 - Pressure limitation control function:

The pressure limitation control requires a dynamic zero-overlapped control valve.

The pressure loop is managed according to the value of pressure measured just in one or in both the two chambers of the cylinder.

The control value for the pressure loop is set via fieldbus. If the pressure (or force) exceeds, the controller reduces the output signal to the valve (only in a negative scale) until it reaches the preset pressure value.

The switch from 'positioning mode' to 'pressure limitation' is handled automatically.

### 7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or READY disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be disabled.

### 7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

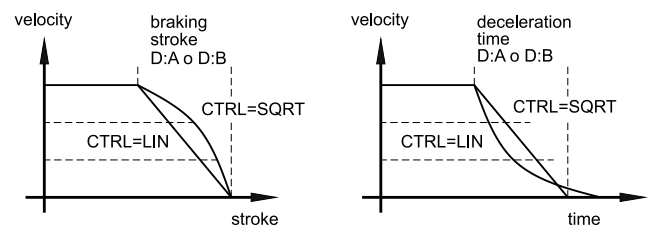
The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

**LIN:** Linear deceleration characteristic (gain is increased by a factor of 1).

**SQRT1:** Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

**SQRT2:** Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.



### 7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

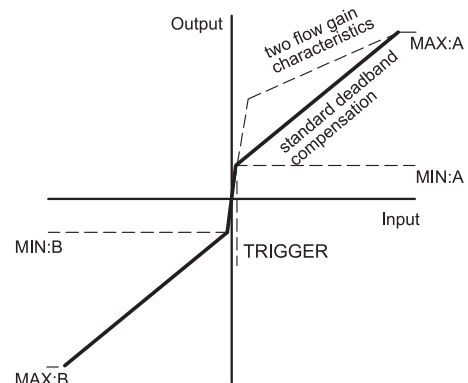
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

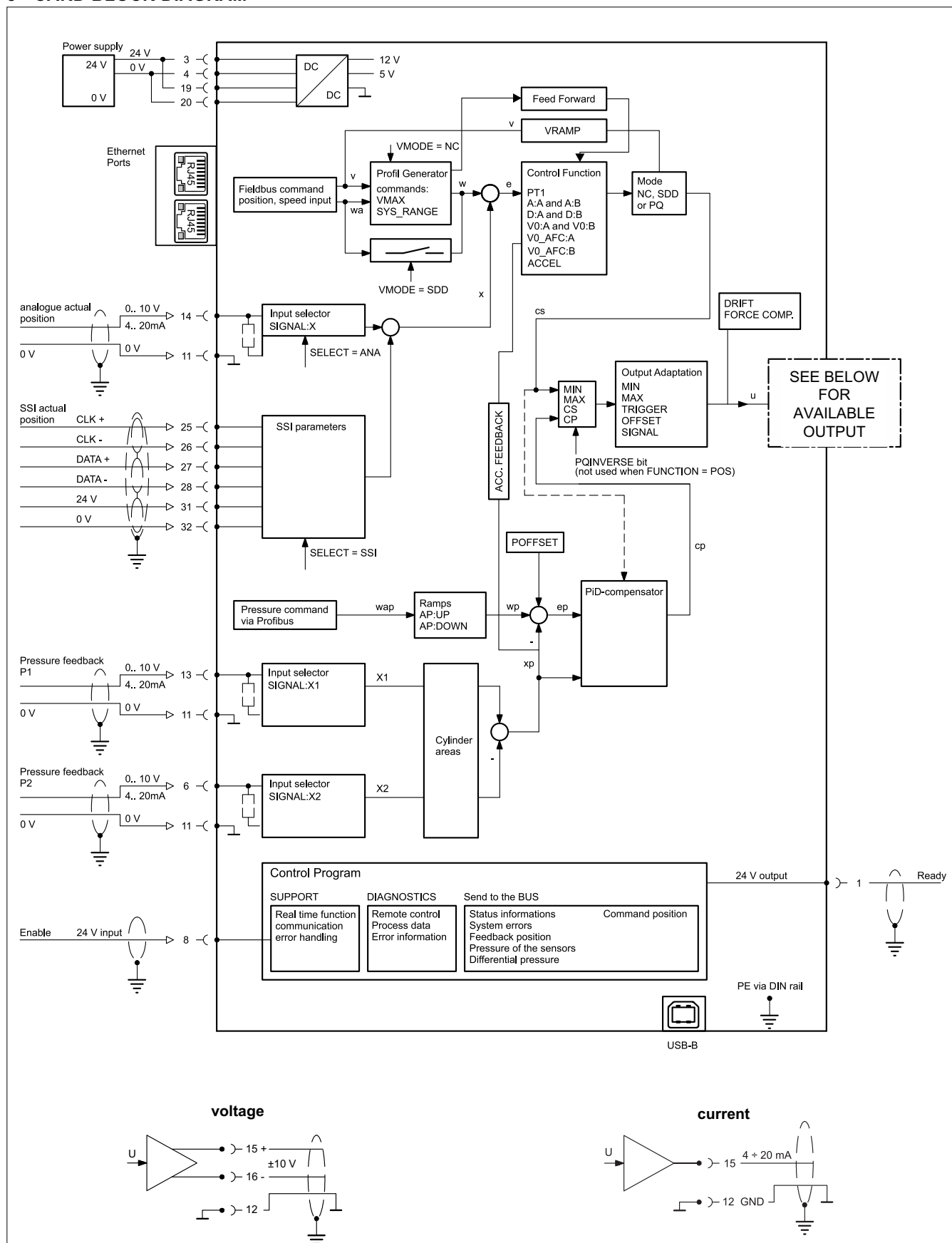
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out either at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

In extreme cases this causes to an oscillating around the closed loop controlled position.

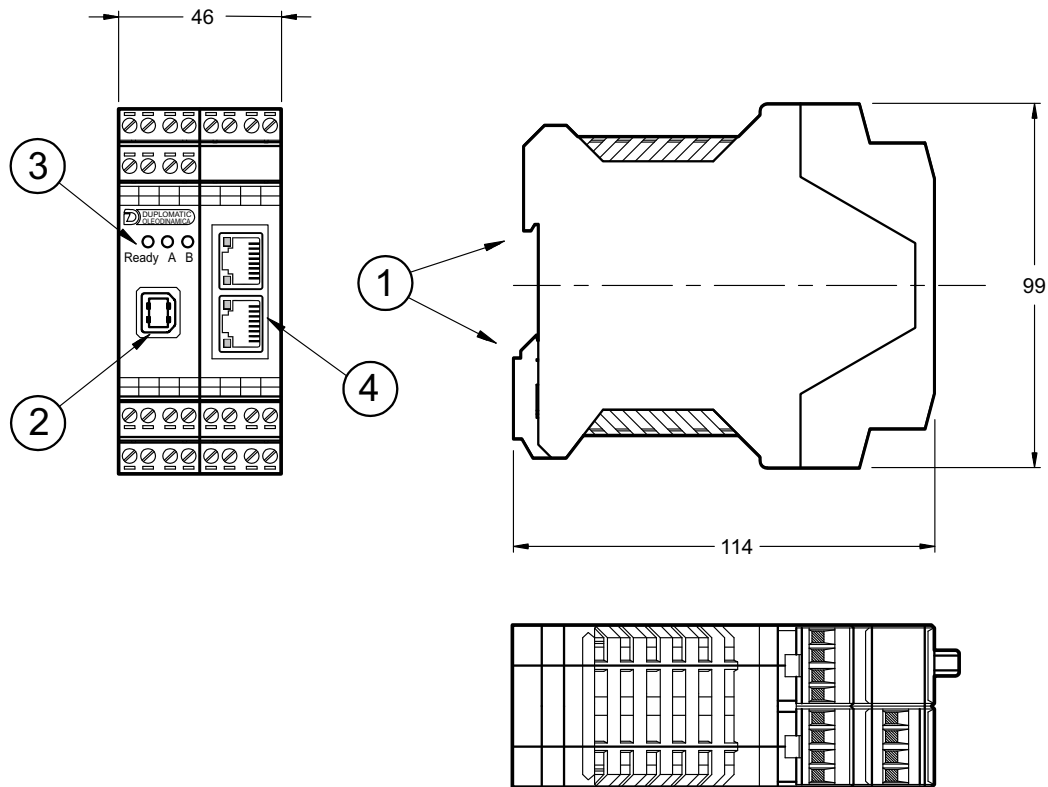


## 8 - CARD BLOCK DIAGRAM



**NOTE:** If the card is configured as simple positioning control without pressure limitation then the output value is calculated just from the output of the position controller (CS) instead of apply MIN and MAX parameters. MIN/MAX are selected by the PQINVERS bit (Fieldbus).

## 9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 type rail fastening
2	USB port for PC connection
3	LED for output signals
4	Fieldbus ports RJ45



# EWM-SP-DAD

SERIES 20



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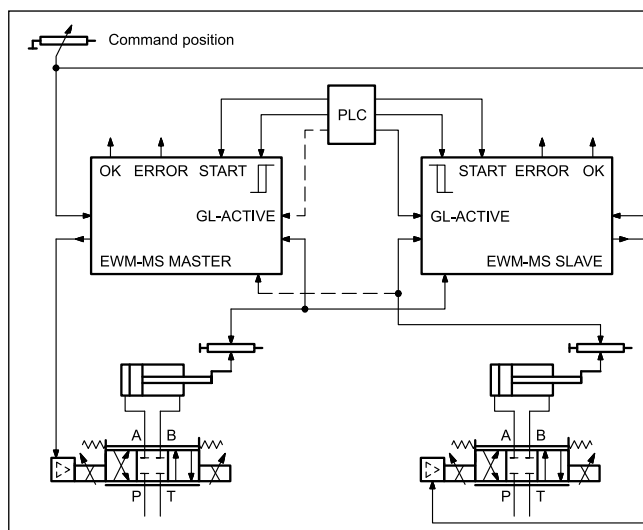


# EWM-MS-AA

## CARD FOR SYNCHRONIZATION CONTROL WITH ANALOGUE SIGNALS SERIES 21

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE



- This card has been developed for an easy synchronization of two actuators (up to 6 axes in master-slave mode) with an overriding synchronization controller.
- The card can drive only an axis; one card per axis is needed.
- Proportional valves with integrated electronics can be driven by the differential output. A version with amplifier is also available.
- Analogue feedback sensors (scalable via software)
- Analogue position input. The axes speed can be limited by an external analogue speed input.
- 2 control mode: SDD and NC
- Card setup via software only, through an on-board USB-B port.

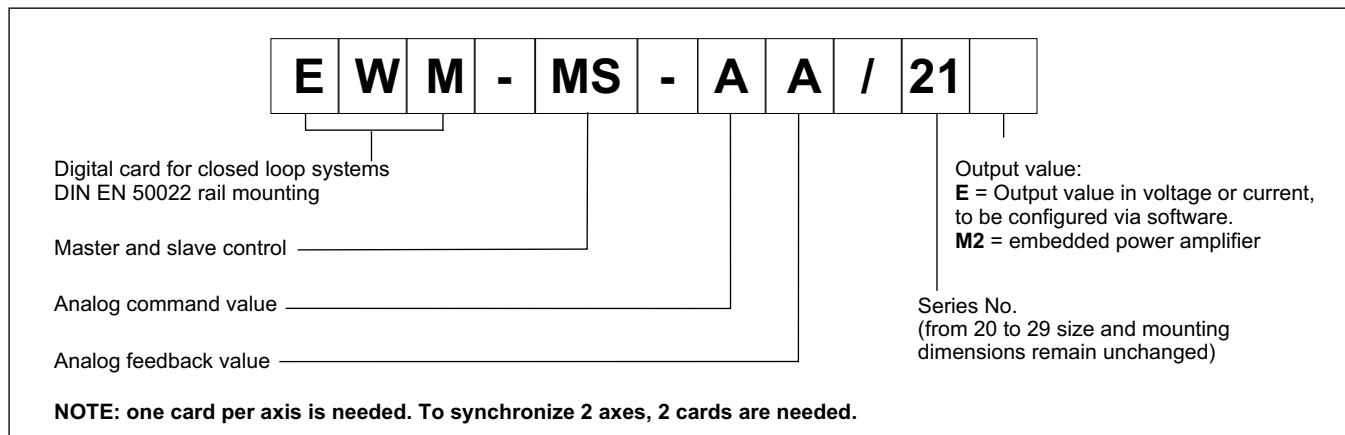
### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included external fuse 1,0 A (3A for M2 version)
Current consumption: - E versions - M2 version	mA W	<100 60 depending on the solenoid
Command value	V mA	0 ÷ 10 ( $R_I = 25 \text{ k}\Omega$ ) 4 ÷ 20 ( $R_I = 240 \Omega$ )
Position input value resolution	%	0,003, 1µm max
Speed input value	V mA	0 ÷ 10 ( $R = 90 \text{ k}\Omega$ ) 4 ÷ 20 ( $R_I = 240 \Omega$ )
Feedback value	V mA	0 ÷ 10 ( $R_I = 25 \text{ k}\Omega$ ) 4 ÷ 20 ( $R_I = 240 \Omega$ )
Output value: - E version, voltage - E version, current - M2 version	V mA A	±10 (max load 10 mA) 4 ÷ 20 (max load 390 $\Omega$ ) 0,5 - 2,6 stepless
Interface		USB B type 2.0
Electromagnetic compatibility (EMC)		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w) (M2 version: w = 46)
Connector		4x4 (4x7 M2 version) poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20





## 1 - IDENTIFICATION CODE



## 2 - FEATURES

### Controller functions

- stroke control and synchronization of axes
- 2 different working mode for synchronization:
  - master-master (2 axis maximum)
  - master-slave (up to 6 axis)
- 2 method for positioning control:
  - SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  - NC – Numerically Controlled - To follow the position profile
- Different gain parameters available via software for SDD and NC control modes
- Command position signal can be single or separate for each card.
- PT1 filter to stabilize the control behaviour
- Command, feedback and speed in mm and mm/s respectively
- Analogue feedback scalable via software
- Analogue command position scalable via software
- Speed limit managed by analogue input or internally
- Emergency function (EOUT)

### Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics

### Monitoring functions

- In-position error
- Cable break, in-position error and fault of feedback sensors
- Solenoids monitored for M2 version
- 2 Digital output to read the status

### Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB

## 3 - FUNCTIONAL SPECIFICATIONS

### 3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

**NOTE: in the M2 version the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoids to be controlled.**

### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

### 3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.6 - Feedback value

The card accepts analogue feedback input. The feedback value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.7 - Analogue output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

E Voltage: ± 10 V Differential output (PIN 15 to PIN 16).

E Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

M2: embedded power stage configurable via software. Value range 0,5 ÷ 2.6 A stepless.

All analogue output have to be wired with screened cables.

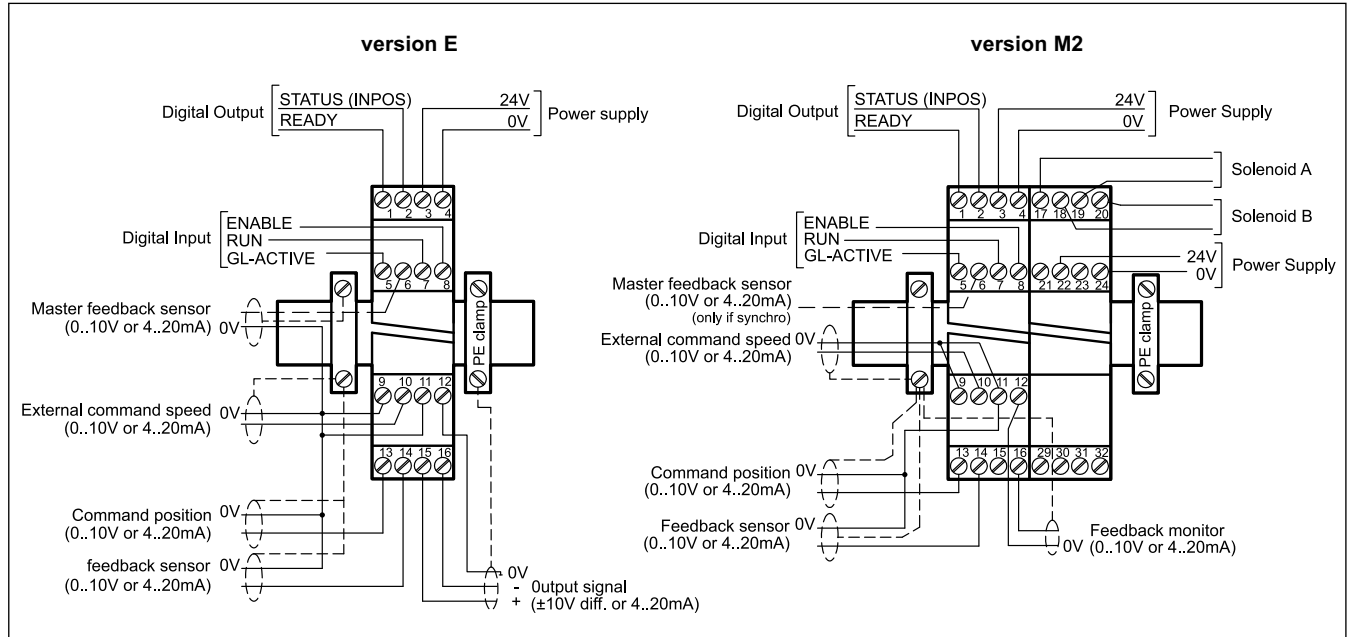
### 3.8 - Digital output

Two digital output are available, STATUS and READY, that are displayed via LEDs on the front panel.

Low level < 2 V High Level > 12 V (max 50 mA).

### 4 - WIRING DIAGRAMS

#### 4.1 - Basic wiring



#### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output.  
General operability, ENABLE is active and there is no sensor error (by use of 4 ÷ 20 mA sensors). This output corresponds with the green LED.
- PIN 2** STATUS output.  
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window. If SC-ACTIVE (pin 5) is on, this output is used to monitor the synchronization error. The output is only active if START = ON.
- PIN 5** GL-ACTIVE:  
Synchronisation controller. If this input is not active, the module works as normal positioning controller.
- PIN 7** START input:  
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke.
- PIN 8** ENABLE input:  
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

#### for M2 version only:

- PIN 16** Feedback monitor (scaled)  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

#### ANALOGUE INPUT

- PIN 6** Feedback value (K) of the master axis  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 9/10** External command speed (V),  
range 0 ÷ 100 % corresponds to 0 ÷ 10 V
- PIN 13** Command position (W),  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 14** Feedback value (X),  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

#### E version - ANALOGUE OUTPUT voltage

- PIN 16/15** Differential output (U)  
± 100% corresponds to ± 10V differential voltage

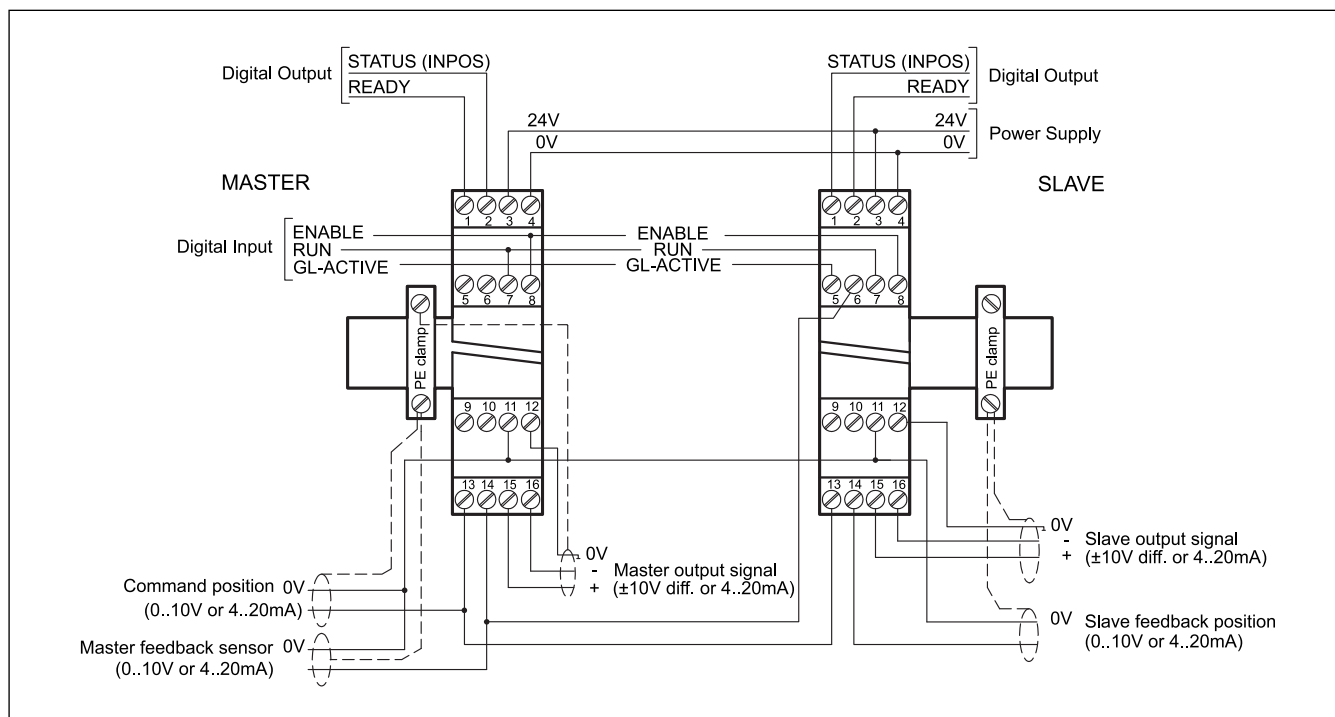
#### current

- PIN 12/15** ±100% corresponds to 4 ÷ 20 mA

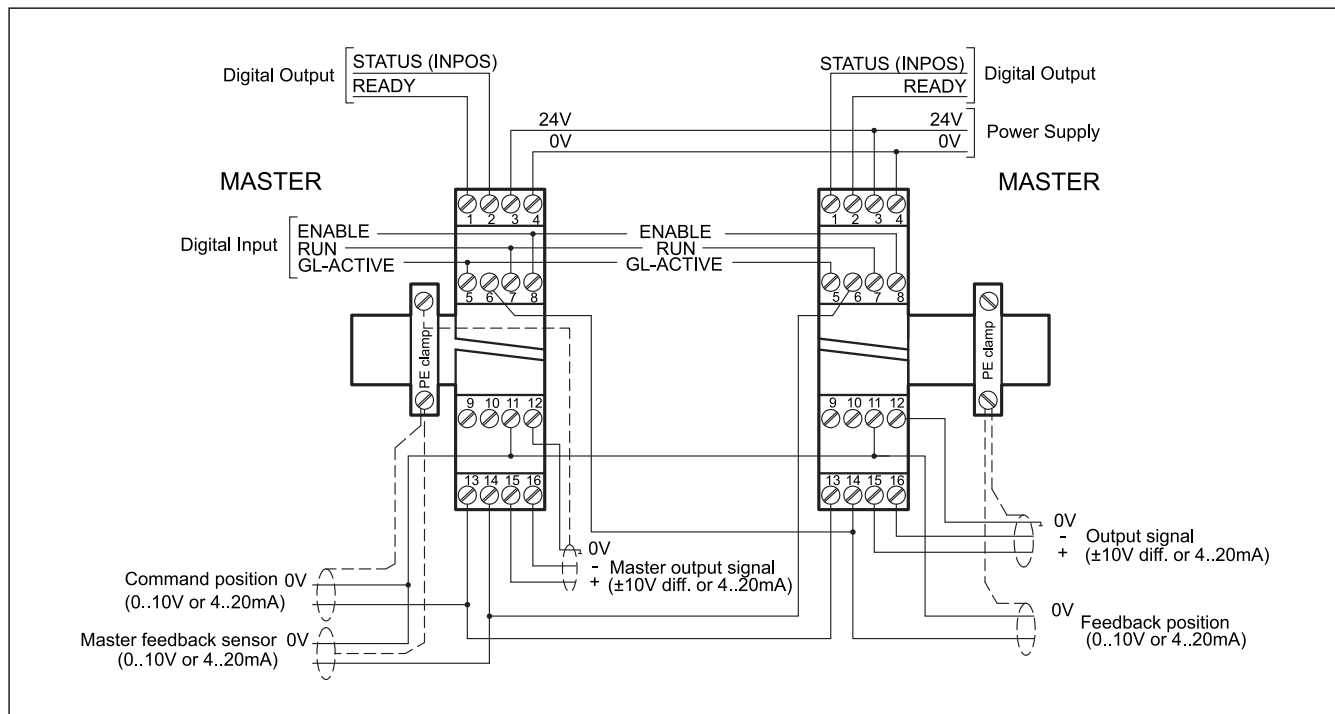
#### M2 version - ANALOGUE OUTPUT current

- PIN 17+19** Solenoid output A
- PIN 18+20** Solenoid output B

## 4.2 - Wiring example for MASTER / SLAVE configuration, output value type E\*, up to 6 axes



## 4.3 - Wiring example for MASTER / MASTER configuration, output value type E, 2 axes only.



### 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches). Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

#### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.



**WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs.**

**They interfere with the current control and can destroy the output stage.**

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

### 6 - DEVICE SETUP

Card set-up is possible via software only.

#### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.



**WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

#### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

**For a complete list of the parameters and their settings please refer to the Technical Manual 89450 ETM.**

## 7 - MAIN FEATURES

This module can be configured for:

- MASTER/MASTER positioning control for 2 axes (both GL input are active) where the positions information will be linked crosswise.
- MASTER/SLAVE positioning control, for up 6 axes, with selectable master function by deactivating of the GL input. If the synchronisation controller is active, it overrides the position control process. When the actual position of the master axis is given to the slave axis all slave axes will follow the master axis.
- INDEPENDENT POSITIONING by deactivation of both GL input and separate command positions at PIN 13.

The function of the STATUS output is - depending on GL input - in position signal or synchronisation error signal

For a reliable function of the synchronisation control the speed of the master axis should be limited to app. 70/80% of maximum speed. The slave axis must be able to increase the speed against the master axis to compensate position failures.

The card sample time is 1 ms.

### 7.1 - Sequence of the positioning

After the pre-parameterization and a successfully electrical verification of the control signals the system can be switched on. The positioning process will be controlled by switching the digital inputs.

After enabling (ENABLE input) the drive stays in the current position (i.e. the actual position is accepted as the required position). If the drive moves to an end position, the polarity is probably wrong.

The READY output indicates a general ready to operate.

The speed can be limited by means of the VELO parameter or the external speed demand (SIGNAL:V).

With the RUN signal the demand value of the analogue input is accepted and the axis moves to the predefined target position. STATUS output indicates if the axis is inside the "in position window".

GL-ACTIVE input has to be activated when a synchronized control is requested.

If each axis can be started-up individually this input has to be activated after the optimisation of the axes.

The operating mode can be:

**SDD - stroke depending deceleration** - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

**NC mode** - the position value is generated from the following error.

The actuator position is measured by an analogue transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analogue input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

### 7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

### 7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

### 7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

The command CTRL controls the braking characteristic curve of the hydraulic axis. The deceleration can be set with linear or nearly square root characteristic.

With positive overlapped proportional valves one of the SQRT characteristics should be used, because of the linearization of the non-linear flow curve typical of these valves; if zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application.

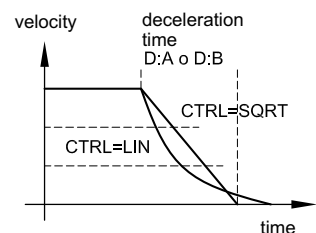
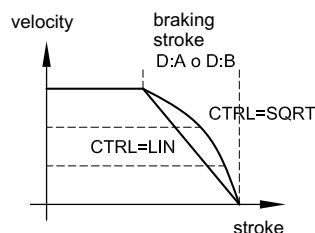
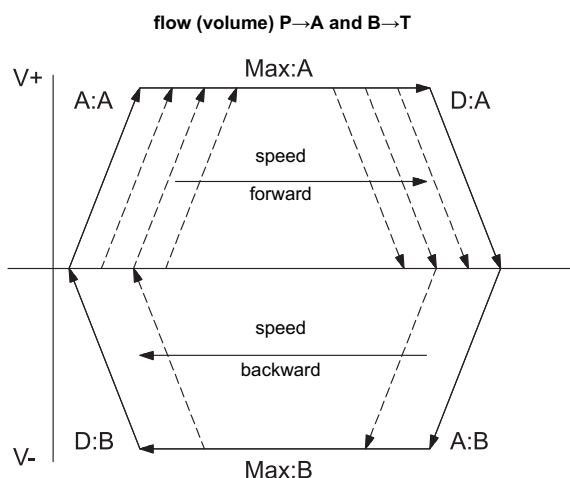
The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear characteristic (control gain corresponds to: 10000 / d:i).

SQRT1: Root function with small control error. (corresponds to 30000 / d:i);

SQRT2: Root function with higher gain corresponds to 50000 / d:i



### 7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

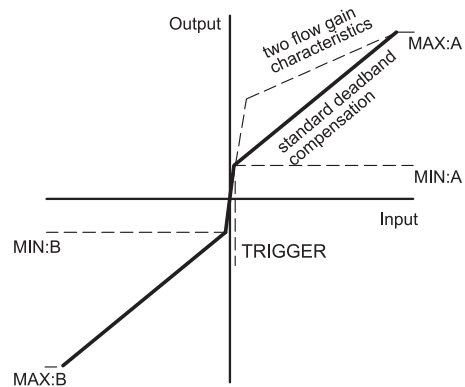
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

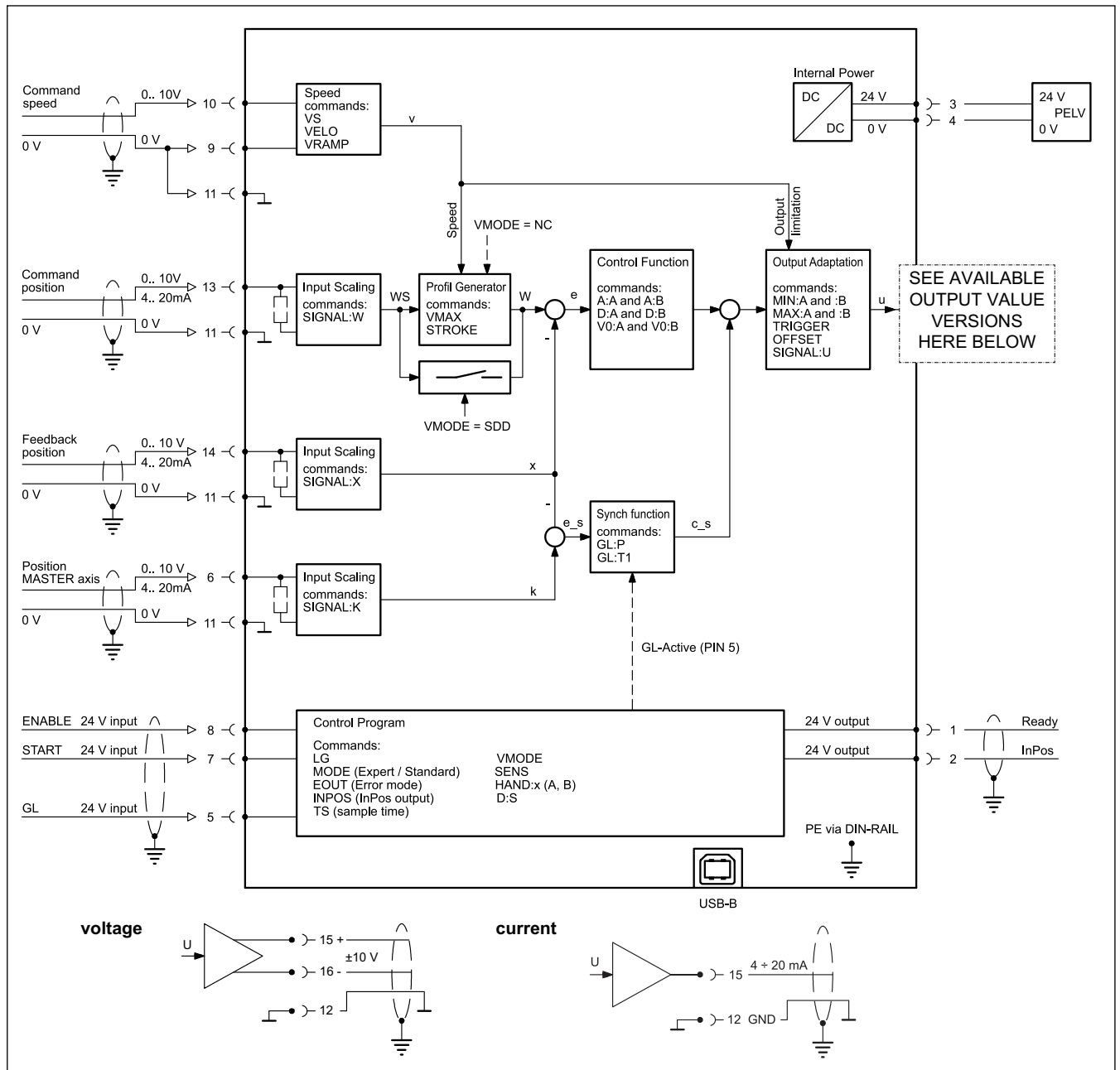
If the deadband compensation value is set too high, it influences the minimal velocity which cannot be adjusted any longer.

In extreme cases this causes to an oscillating around the closed loop controlled position.

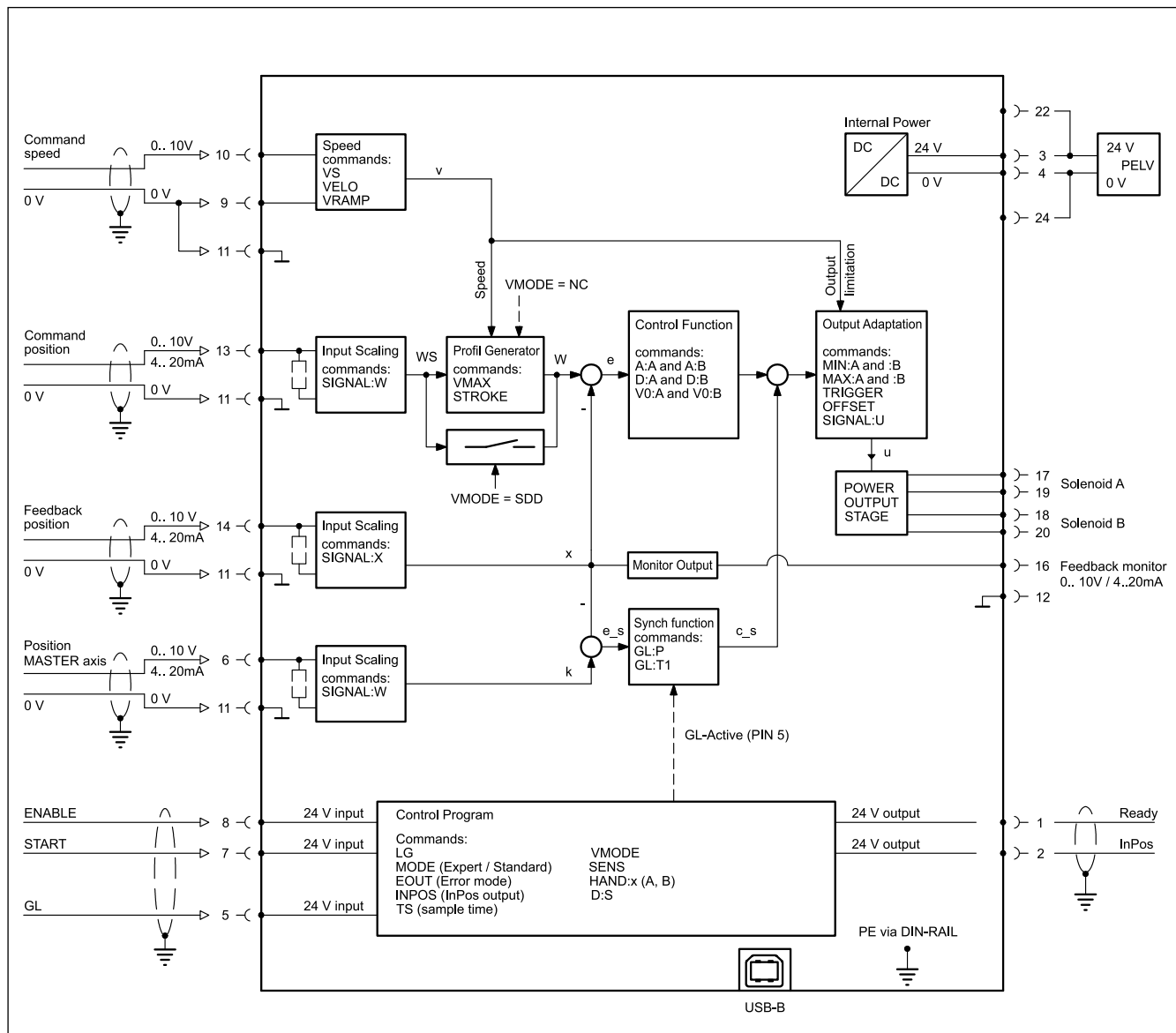


## 8 - CARD BLOCK DIAGRAMS

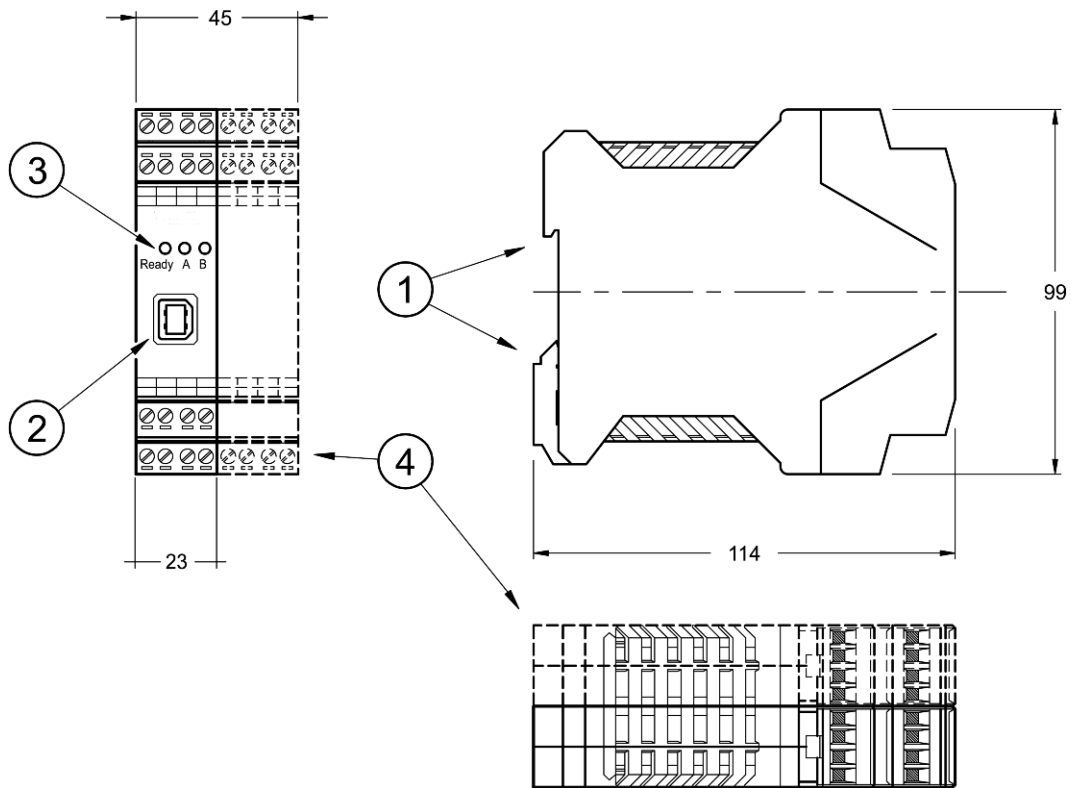
### 8.1 - 'E' version



## 8.2 - M2 version - with output stage



## 9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN rail fastening EN 50022
2	USB interface, for setup
3	LED for output signals
4	Power stage module - present on M2 version only .





# EWM-MS-AA

SERIES 21



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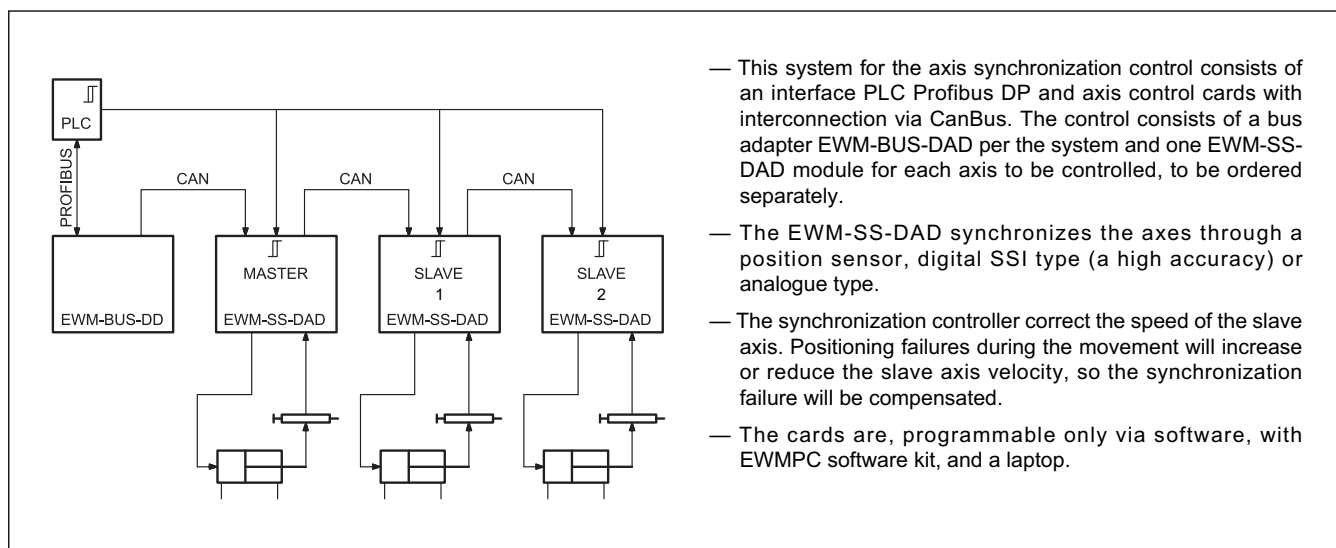


# EWM-SS-DAD

## AXIS SYNCHRONIZATION CONTROL FOR SYSTEMS FROM 2 TO 9 AXES WITH PROFIBUS/CAN COMMUNICATION INTERFACE SERIES 11

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE

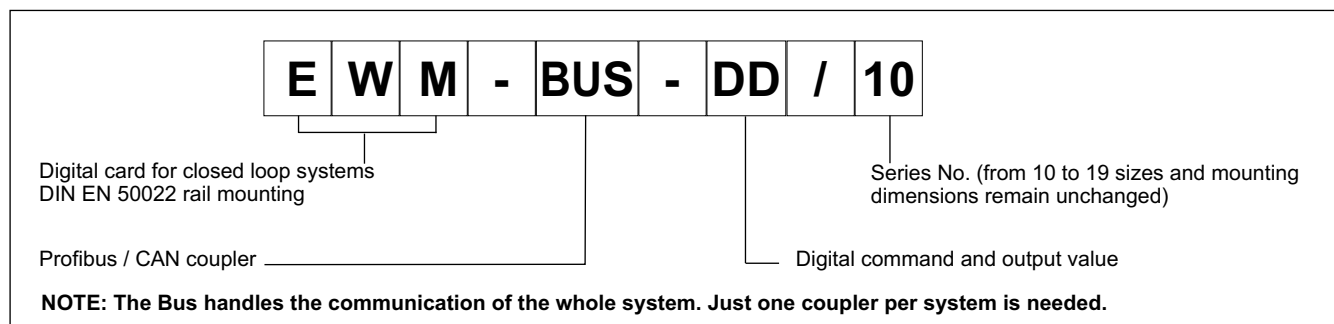


### TECHNICAL CHARACTERISTICS

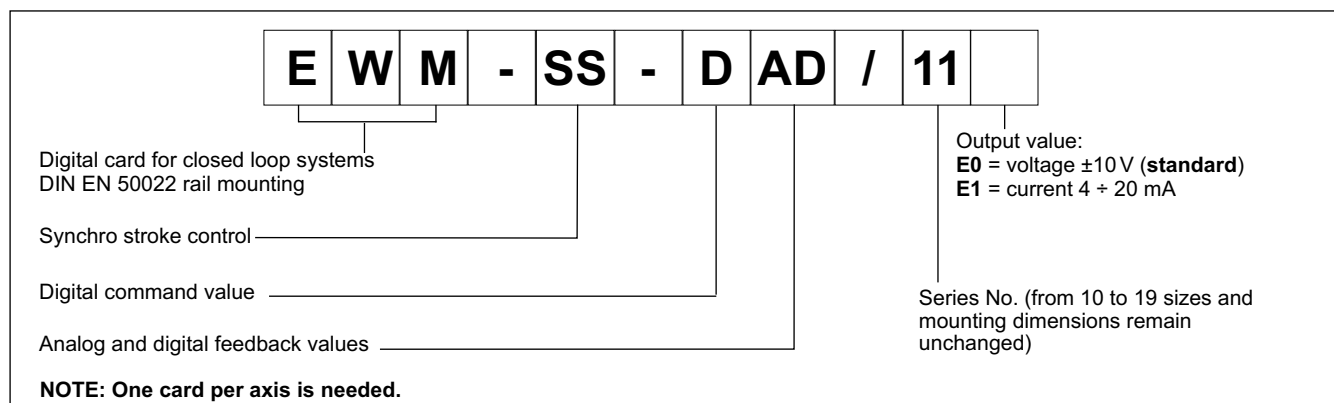
Power supply	V DC	24 ÷ 30 ripple included - external fuse 1,0 A
Current consumption	mA	< 350 + sensor power consumption
Command value		via Profibus DP - ID number 1810h
Speed input value		via Profibus DP - ID number 1810h
Feedback value	SSI V mA	digital sensor with SSI interface 0 ÷ 10 ( $R_I = 25 \text{ k}\Omega$ ) 4 ÷ 20 ( $R_I = 250 \Omega$ )
Output value - E0 version - E1 version	V mA	±10 differential (max load 5 mA) 4 ÷ 20 (max load 390 $\Omega$ )
Position accuracy		± 2 bits of digital sensor resolution
Interface		RS 232 C
Electromagnetic compatibility (EMC): according to 2004/108/CE standards		Emissions EN 61000-6-3:2005 Immunity EN 61000-6-2:2002
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions - EWM-SS-DAD - EWM-BUS-DD	mm	114 x 99(h) x 46(w) 120 x 99(h) x 23(w)
Connectors		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

## 1 - IDENTIFICATION CODES

### 1.1 - Profibus / CAN coupler code



### 1.2 - Code of the axis drive card



This electronic module is developed for controlling of hydraulic drives in synchronization. The communication with the PLC is solved by a standard Profibus DP interface.

#### This system can synchronize up to 9 axes.

A typical repeatable positioning accuracy of  $> 0,01\%$  with analogue sensors or up to  $0,001$  mm with digital SSI sensors can be achieved. Proportional valves with integrated electronics (typically with control valves) can be driven by the analogue differential output.

Internal profile generation (acceleration time, max. velocity and stroke depended deceleration) provides fast and excellent positioning. The drive works in open loop mode and is switched over in closed loop during deceleration. This is a time-optimal positioning structure with very high stability.

Even the Numeric Control mode can be used, for a speed controlled internal profile generation (VMODE = ON).

The synchronization control works as a second overriding velocity/position controller. Failure between the axes will be compensated by adjusting the speed of the slave axis.

The card sample time is 2 ms, up to 5 ms with 9 axes to drive.

## 2 - EWM-SS-DAD FUNCTIONAL SPECIFICATIONS

### 2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the existing EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

### 2.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 2.3 - Digital Input (ENABLE)

The digital input must have a voltage from 12 to 24 V with current 50 mA; Low level:  $< 2$  V, high level  $> 10$  V.

Keep to the block diagram at paragraph 7 for the electric connections. Apply to PIN 8 the 24V to enable hardware.

### 2.4 - Reference signal

The reference signal is run through the card-bus and addressed to the individual modules via Profibus, ID number 1810h (see par. 7 / 8).

### 2.5 - Input feedback values

The card works both with digital (SSI) or analog (ANA) sensors.

SSI: parameters are settable via software (see SSI parameters in the table on next page).

ANA: The analogue signal must be voltage  $0 \pm 10$  V with  $R_I = 25$  k $\Omega$  or current  $4 \pm 20$  mA, with  $R_I = 250$   $\Omega$

The analogue resolution is of  $0,01\%$  of the sensor stroke.



Using analog sensors, the SSI parameters in the software assume default preset values that the user must not change.

### 2.6 - Output values

E0 version: output voltage  $0 \pm 10$  V (max load 5 mA).

E1 version: output current  $4 \pm 20$  mA. (max load 390  $\Omega$ )

### 2.7 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.

Low level  $< 4$  V; High level  $> 10$  V (  $I_{max}$  50 mA with load of 250  $\Omega$ )



### 3 - LED FUNCTIONS

There are two leds on the EWM-SS-DAD card:

GREEN: Shows if the card is ready.

- ON - The card is supplied and ENABLE, hardware, software ON
- OFF - No power supply or the ENABLE HW/SW is inactive
- FLASHING - Error detected (internal or  $4 \pm 20$  mA).
- Only if the parameter SENS is ON

YELLOW: Status signal. Axes position.

- ON - Axis within position.
- OFF - Axis outside position.

### 4 - ADJUSTMENTS

On the EWM cards the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model and shows a table with all the available commands, with their parameters, the default setting, the measuring unit and an explanation of the commands and its uses.

The parameters changes depending on the hardware and mechanic configuration. The hardware setting must be the same for all the axis. The use of symmetrical structures it is strongly recommended.

### PARAMETERS TABLE

Commands	Parameter	Defaults	Units	Description
<b>inpx</b>	X= SSI ANA	SSI	-	Selection of the sensor input channel. The standard is a digital sensor with SSI specification at the corresponding connections (clamps 25 to 28 and 31, 32). Alternatively an analogue input which is indicated in the command as parameters "ANA" can be used. The command AIN is used for input scaling of the analogue input.
<b>ain:i a b c x</b>	i= XL a= -10000... 10000 b= -10000... 10000 c= -10000... 10000 x= V C	: 1000 : 1000 : 0 : V	- - 0,01% -	Analogue input scaling for <b>XL</b> (actual value) analog input signal. <b>V</b> = voltage input and <b>C</b> = current input. With the parameters <b>a</b> , <b>b</b> and <b>c</b> the input can be scaled (output = $a / b * (\text{input} - c)$ ). Because of the programming of the <b>x</b> -value ( <b>x</b> = <b>C</b> ) the corresponding input will be switched over to current automatically. (see <b>NOTE</b> )
<b>num</b>	X= 0... 24	2	-	Number of axes connected to the Profibus (see <b>NOTE</b> at paragraph 9.1.1)
<b>stroke x</b>	X= 2... 5000	200	mm	Full stroke of the sensor (100% of input signal). The stroke of the sensor is needed for the scaling of the analogue input and for the calculation of the braking stroke.
<b>ssioffset x</b>	X= -30000... 30000	0	0,01 mm	Zero point adjustment of the sensor.
<b>ssires x</b>	X= 10... 1000	1000	µm (micron)	Definition of the sensor resolution. The highest resolution (1000) corresponds to 1 µm (0,001 mm). This sensor resolution is always used for the input data via Profibus and is needed for the internal calculations. (see <b>NOTE</b> )
<b>ssibits x</b>	X= 8... 32	24	-	Data protocol length in bits
<b>ssicode x</b>	X= GRAY BIN	GRAY	-	Transmitting code of the sensor.
<b>ssipol x</b>	X= + -	+	-	Sensor polarity. In order to reverse the working direction of the sensor, the polarity can be changed via this command. In any case also the SSIOFFSET has to be adjusted. Ex: Sensor length = 200 mm opposite working direction. SSIPOL is set on "-" and SSIOFFSET on 20000.
<b>a:i x</b>	i= A B x= 1... 2000	:A 200 :B 200	ms ms	Acceleration time depending on direction. The ramp time is separately set for driving out ( <b>A</b> ) and for driving in ( <b>B</b> ). Normally <b>A</b> = flow P-A, B-T and <b>B</b> = flow P-B, A-T.
<b>d:i x</b>	i= A B S X= 50... 10000	:A 2500 :B 2500 :S 1000	0,01% 0,01% 0,01%	Deceleration stroke depending on direction. This parameter is set in 0,01% units of the maximum length of the sensor. The braking distance is set dependent from the direction. The controller gain will be calculated by means of the braking distance. The shorter the braking distance the higher the gain (see command CTRL). In case of instabilities a longer braking distance should be set. The parameter <b>D</b> indicates the ratio between the maximum sensor length and an indicated stopping point; will become active after the removal of the 'START' signal only.
<b>ctrl x</b>	x= lin sqrt1  sqrt2	sqrt1	-	Deceleration curve (see <b>NOTE</b> ): <b>lin</b> = linear curve <b>sqrt1</b> = optimized curve <b>sqrt2</b> = curve optimized for high gain in positioning
<b>syncmode x</b>	X= MS AV	MS		Synchronization mode. <b>MS</b> - Master/Slave: all axes follow the master axis (MASTER = 1) <b>AV</b> - Averages calculation: the command position will be calculated by the averages of all axes.
<b>glp x</b> <b>t1 x</b>	X= -10000... 10000 X= 0... 100	500 10	0,01 ms	Parameters for optimization of the synchronisation controller. (see <b>NOTE</b> ) The SYNC-controller works as a PT1 compensator for optimized controlling of hydraulic drives. Critical drives can be stabilized with the T1 factor.
<b>vramp x</b>	x= 10... 2000	200	ms	Ramp time for the command speed.



# EWM-SS-DAD

## SERIES 11

<b>vmode</b> <b>x</b>	x= on off	off	-	Switching over the control mode. <b>OFF</b> : stroke depended deceleration mode (SDD); It's the default mode. The drive comes to a controlled stop at the target position, then switches to control mode and moves accurately to the desired position. The speed varies with the fluctuating pressure as the system runs under open-loop control. <b>ON</b> : numeric control (NC). A position profile is generated internally. The system always works under control and uses the following error to follow the position profile. For a properly operating it is necessary not to run at 100 % speed, as otherwise the errors cannot be corrected. 80 % of the maximum speed is typical. The stroke time is defined by the parameter VEL.
<b>vel</b> <b>x</b>	X= 1... 20000	50	mm/s	Internal maximum velocity preset when VMODE = ON (numeric control mode).
<b>inpos mode</b> <b>x</b>	X= EPC TRC	TRC	-	Choosing signal for "inpos" message (LED) in NC mode (VMODE = ON only) On master modules yellow led are activated by the INPOS signal. EPC = positioning error in endposition TRC = monitor the tracing error generated by the positioning profile.
<b>min:i</b> <b>x</b>	i= A B x= 0... 5000	:A 0 :B 0	0,01% 0,01%	Deadband compensation for positive overlapped proportional valves. Good adjustment will increase positioning accuracy
<b>max:i</b> <b>x</b>	i= A B X= 5000... 10000	:A 10000 :B 10000	0,01% 0,01%	Limitation / Gain. Maximum output signal. Adapt the control range to maximum flow range.
<b>trigger</b> <b>x</b>	X= 0... 2000	200	0,01%	Response threshold for the MIN parameter. Also useful for reduced sensitivity in position with positive overlapped proportional valves. (see <b>NOTE</b> )
<b>inpos</b> <b>x</b> <b>glerror</b> <b>x</b>	X= 0... 5000 x= 0... 5000	32 32	0,01mm 0,01mm	Defined windows for creating status signals. INPOS = Definition of the range (window) of the related signal in which the INPOS message will be generated. The positioning process will not be influenced by it. The controller remains active. GLERROR = defines the range of the allowed synchronization error for generating this message. In slave modules this signal is given to the status outputs (PIN 2 and corresponding LED) Working in NC mode GLERROR defines the window synchronization error; INPOS the tracking error.
<b>offset</b> <b>x</b>	x= -2000... 2000	0	0,01%	Zero point adjustment. The corresponding OFFSET will be added to the control error (demand value - actual value + offset). With this parameter the zero point failure can be compensated.
<b>pol</b> <b>x</b>	x= + -	+	-	Output polarity. All <b>A</b> and <b>B</b> adjustments depend on the output polarity. The right polarity should be defined first.
<b>sens</b> <b>x</b>	x= on off	on	-	The sensor monitoring can be activated.
<b>save</b>	-	-	-	Storing the programmed parameter in E <sup>2</sup> PROM.
<b>loadback</b>	-	-	-	Reloading the parameter from E <sup>2</sup> PROM in working RAM
<b>help</b>	-	-	-	Listing of all available commands.
<b>copy</b>	-	-	-	Transfer of the parameters into all other modules at the node CAN. The parameters are stored in the EEPROM.
<b>st</b>	-	-	-	Status of the profibus communication, actual sent/received values.
<b>wl</b> <b>xl</b> <b>xw</b> <b>kx</b> <b>kxw</b> <b>v</b> <b>u</b> <b>x:i</b>	Command position Actual position Position error Master position Synchro error Speed limitation Control signal Axis position via index	-	mm mm mm mm mm % % mm	The process data can be read out via software. They show the actual and command values
<b>default</b>	-	-	-	Preset values will be set.

**NOTE about the AIN command:** This command is for analogue sensors only.

With this command each input can be scaled individually. For the scaling function the following linear equation is taken: output signal =  $a / b * (input\ signal - c)$ .

At first the offset (c) will be subtracted from the input signal, then the signal will be multiplied with factor **a / b**. **a** and **b** should always be positive. With these both factors every floating-point value can be simulated (for example:  $1.345 = 1345 / 1000$ ).

With the x parameter value the internal measuring resistance for the current measuring (4... 20 mA) will be activated (V for voltages input and C for current input). ATTENTION: This resistor is never activated at the k input.

	AIN:X	a	b	c	x
i with voltage:	AIN:i	1000	1000	0	V
i with current:	AIN:i	2000	1600	2000	C

**NOTE about the SSIRES command:** the standard of measurement is defined as increment/mm (inkr/mm). The maximum available resolution is equal to 1  $\mu\text{m}$  that corresponds to a value 1000.

Example: A sensor with resolution 5 $\mu\text{m}$  has a resolution (0.005 mm) 5 times lower than the maximum set.

The SSIRES value is calculated as follows:  $1000$  (full scale ink) /  $n$  (sensor resolution in  $\mu\text{m}$ ) =  $1000 / 5 = 200$

with a 2 $\mu\text{m}$  sensor resolution the value will be =  $1000 / 2 = 500$  :

**NOTE about the CTRL command:** This command controls the braking characteristic of the hydraulic axis. With positive overlapped proportional valves one of both SQRT braking characteristics should be used because of the linearization of the non-linear flow curve typical of these valves. If zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application. The progressive gain characteristic of SQRT1 has the better positioning accuracy.

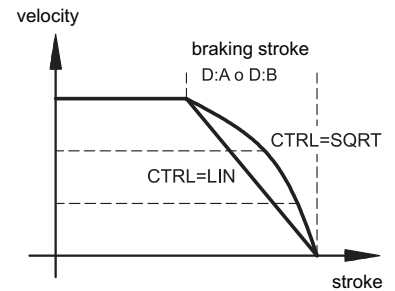
According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear braking characteristics (control gain corresponds to:  $10000 / d:i$ ).

SQRT\*: Root function for the calculation for the braking curve.

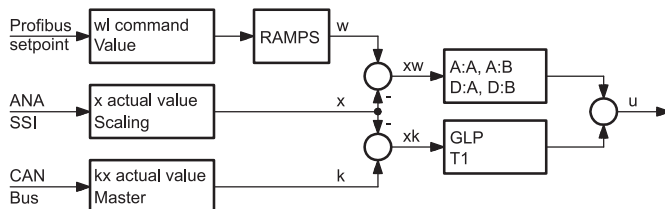
SQRT1: with small control error. control gain corresponds to  $30000 / d:i$  ;

SQRT2: control gain corresponds to  $50000 / d:i$



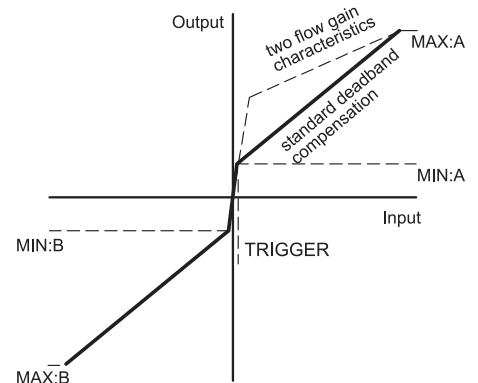
**NOTE about the GLP and T1 command:** Both controllers (sync and positioning) are working parallel. The higher the sync-gain the lower must be the gain of the positioning controller. A time constant value (T1) can be used to damp the sync-controller for better stability.

Simplified control structure:



**NOTE about the TRIGGER command:** With this command, the output signal is adjusted to the valve characteristics. The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stabile positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module. If the MIN value is set too high, it influences the minimal velocity, which cannot be adjusted any longer. In extreme case this causes to an oscillating around the closed loop controlled position.



### 5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm<sup>2</sup>, up to 20 m length and of 1.00 mm<sup>2</sup> up to 40m length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

**NOTE:** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram. As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical for the electromagnetic interference, a complete protection of the connection wires can be requested.

A typical screened Profibus plug (D-Sub 9pol with switchable termination) is mandatory. Also the Profibus cable must be screened.

Every Profibus segment must be provided with an active bus termination at the beginning and at the end. The termination is already integrated in all common Profibus plugs and can be activated by a DIL switch.

#### 5.1 - EWM-BUS-DD settings and installation

The module supports all baud rates from 9,6 kbit/s up to 12000 kbit/s with auto detection of the baud rate. The functionality is defined in IEC 61158. The Profibus address can be programmed by a terminal program, EWMPC/10 or online via the Profibus (default address 3). A display shows the status of the communication between the nodes.

The CAN-side installation of the EWM-BUS-DD is easy and only few steps are necessary.

Wire the CAN Bus of the coupler with the CAN Bus line of the EWM-SS-DAD cards, as shown below:

EWM-BUS-DD	EWM-SS-DAD
pin 1	pin 23
pin 3	pin 21
pin 4	pin 22

Connect the power supply: pin 5 and pin 6 = 24 V  
pin 7 and pin 8 = 0 V

The reference values are preset over the digital Profibus / CAN-Bus that worked with full internal resolution. The position resolution corresponds to the sensor resolution.

**The module EWM-BUS-DD is preconfigured for proper communication with the cards EWM-SS-DAD. The address of the node Canbus (2) and the transmission speed rate (1MBd) must comply with the following configuration:**

1	2	3	4	5	6	7
OFF	ON	OFF	OFF	OFF	ON	ON

The DIL switch is inside the module and it gives the possibility to set address and data transmission speed.

The tables below show the meaning of DIL Switches:

DIL-SWITCH						
1	2	3	4	5	6	7
CANBUS ADDRESS NODE					TRANSMISSION SPEED	

TRANSMISSION SPEED	DIL-SWITCH	
	6	7
125 Kbaud	OFF	OFF
250 Kbaud	ON	OFF
500 Kbaud	OFF	ON
1 Mbaud	ON	ON

#### 5.1.1 - Display

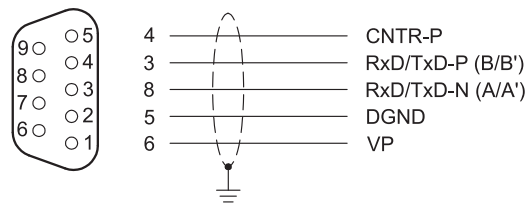
The EWM-BUS-DD has a display that shows the module status:

- everything OK, Profibus and CAN Bus in data exchange
- 1 Error, CAN Bus no data exchange
- 2 Error, Profibus no communication
- 3 Error, Profibus no communication, CAN Bus no data exchange
- 4 Error, Profibus OK, not connected CAN Bus
- 5 Error, Profibus no communication, not connected CAN Bus
- 6 Error, hardware fault

#### 5.1.2- ProfiBUS socket

A shielded typical Profibus connector (9-poles) with internal terminal resistors to be set properly, must be used. The pre addressing of the module can be changed only by Profibus (DEFAULT is 3). The cable is not included.

#### PROFIBUS SOCKET WIRING AND LINKING CONFIGURATION



pin	Signal name	Function
1-2-7-9	not used	-
3	RxD/TxD-P (B-Line)	Receive/Send P data
4	CNTR-P/RTS	Request to Send
5	DGND	Data ground
6	VP	+5 V DC for external bus termination
8	RxD/TxD-N (A-Line)	Receive/Send N data



### 5.2 - EWM-SS-DAD - CAN interface

The CAN interface is wired on all modules in parallel. The terminating resistors have to be activated in the EWM-SS-DAD at the first and last module. Termination is enabled by a bridge between pin 22 and pin 24.



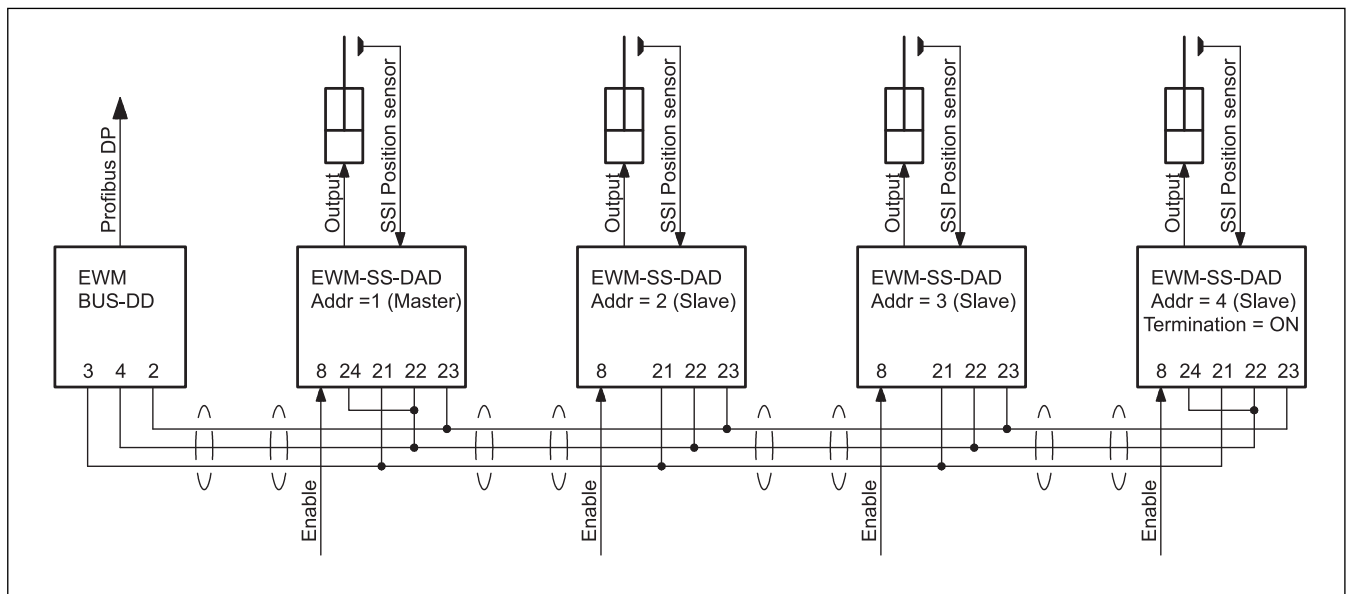
Start the addressing of the EWM-SS-DAD from the number 1, that set the card as MASTER, using the rotary switch on the front panel of the card (use a screwdriver or a small knob of appropriate size).

The MASTER module drives the main axis and takes over the communication with the interface converter EWM-BUS-DD.

The other addresses (2 to 9) set the card as SLAVE.

Upon delivery, the switch is set to zero (no address); you must configure the addressing on each card in the series, depending on the number of axes to be synchronized (see example below).

### 5.3 - Wiring for 4-axes synchronization



## 6 - SOFTWARE

### 6.1 - KIT EWMPC/10 (code 3898401001)

The software kit comprising a USB cable (2 m length) to connect the card to a PC or notebook and the software.

Verify the software version. For correct operating version 3.3 or higher is needed. Latest version is downloadable from our website.

During the identification all information are read out of the module and the table input will be automatically generated.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft XP® operating systems.

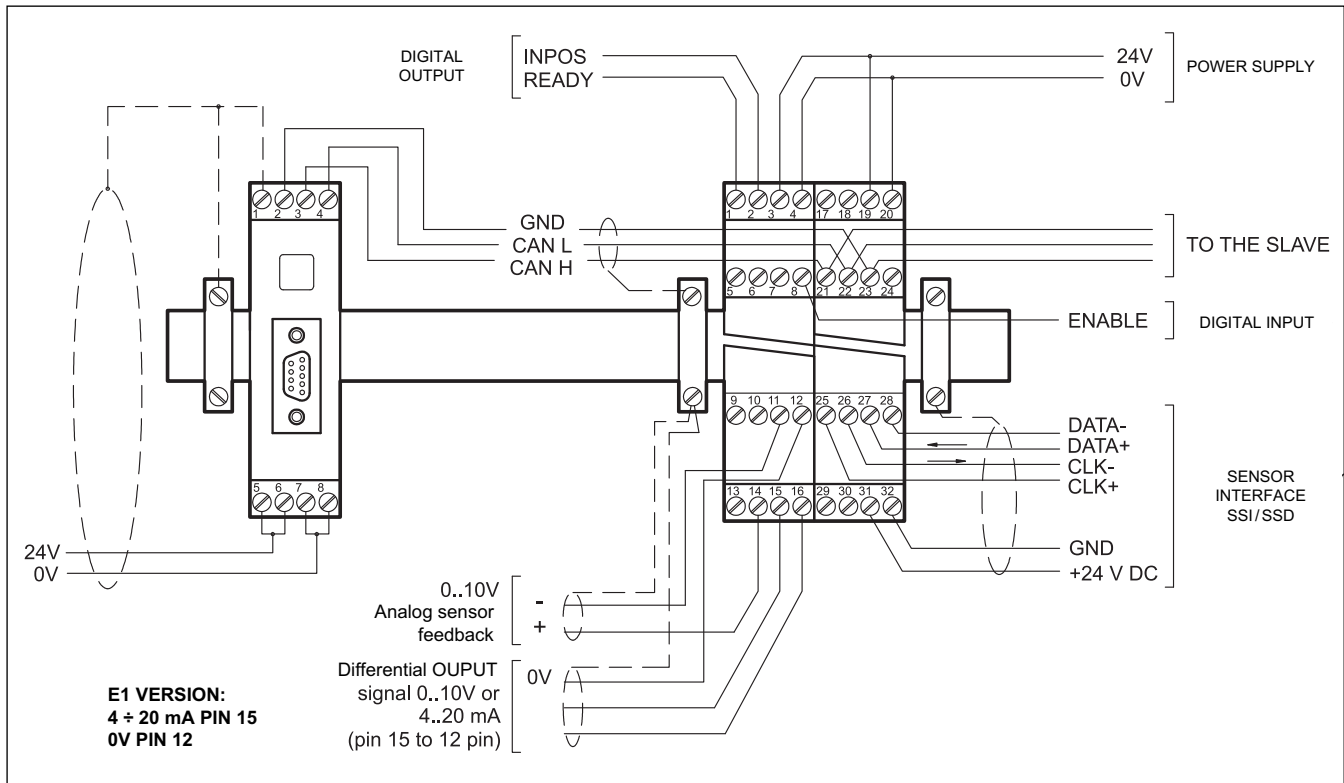
### 6.2 - .GSD file for ProfiBus module

The file is downloadable from our website .

[www.diplomatic.com](http://www.diplomatic.com) , download section.



## 7 - WIRING DIAGRAM FOR EWM-SS-DAD\*E0 AND EWM-BUS-DD



### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output:  
General operationally, ENABLE is active and there is no sensor error (by use of 4 ÷ 20 mA sensors). This output corresponds with the green LED.
- PIN 2** STATUS output:  
STATUS is active when the axis is within the INPOS window of positioning or synchronisation.
- PIN 8** ENABLE input:  
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

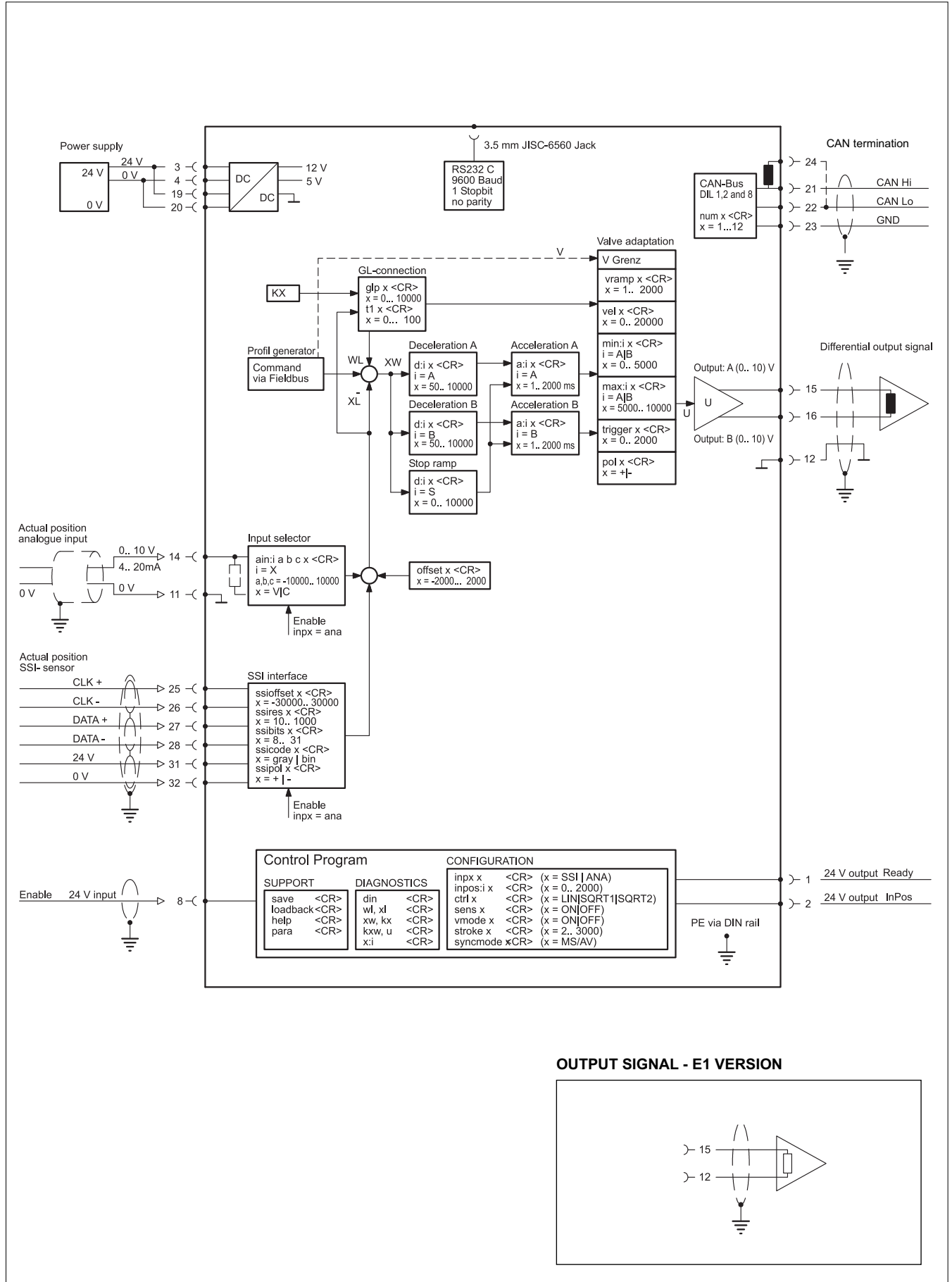
### ANALOGUE SIGNALS

- PIN 14** Analogue feedback value (X),  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 15/16** Differential output (U)  
±100% corresponds to ± 10V differential voltage, optionally (E1 version) current output ±100% corresponds to 4 ÷ 20 mA (PIN 15 to PIN 12)

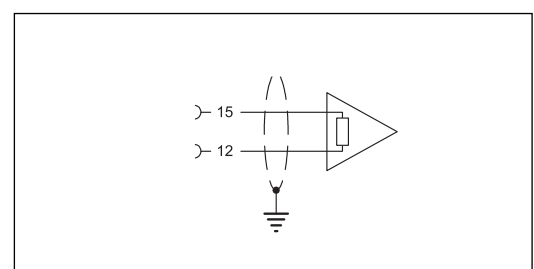
### LOCAL CAN-BUS

- PIN 21..23** CAN LO, CAN HI, and GND
- PIN 24** Termination of the CAN-Bus  
a bridge to pin 22 at 1<sup>st</sup> (master) and last module is necessary.

### 8 - EWM-SS-DAD - CARD BLOCK DIAGRAM E0 version



### OUTPUT SIGNAL - E1 VERSION





### 9 - PROFIBUS COMMUNICATION

The Profibus board controls the modules by sending 8 bytes of data, which contain information on two control words, the command position (position setpoint) and speed control (speed setpoint). The EWM-SS-DAD cards send back to the bus-card two status words, the nominal current position and current actual position, for a total of 24 bytes of data.

Using ST command in EWMPC, those data can be read out. and they appearing in this way:

(high byte / low byte)  
 control word : 1110 1000 / 0000 0000  
 control word 2 : 0010 0000 / 0010 0000  
 status word : 1101 0000 / 1101 0000  
 status word 2 : 0010 0000 / 0010 0000

position setpoint: 22400 (command position in HEX via Profibus)  
 speed setpoint: lfff (command speed in HEX via Profibus)

Enable: enabled (module = enabled (Profibus & Hardware-enable))

#### 9.1 - Data sent to the axes

The EWM-BUS-DD card is set as follows:  
 (Hi = High byte; Lo = low byte)

Byte	Function	Comment
0	control word Hi	unsigned int
1	control word Lo	
2	command position Hi	unsigned long
3	command position..	
4	command position ..	
5	command position Lo	
6	velocity Hi	unsigned int
7	velocity Lo	
8	control word 2 Hi	unsigned int
9	control word 2 Lo	
10 - 23	reserved	no function

##### 9.1.1 - Axes control

Only the first four axes may be activated individually, the further axes must be enabled in groups of four axes at a time, by the x SEL indicator, according to the following:

Address	Controlled axes					
SEL	1 to 4	5 to 8	9 to 12	13 to 16	17 to 20	21 to 24
2	0	0	0	0	1	1
1	0	0	1	1	0	0
0	0	1	0	1	0	1

**NOTE: The module EWM-BUS is a module used also in other synchronization systems that manage a greater number of axes.**

**The system with EWM-SS-DAD cards described in this documentation allows to manage max 9 axes.**

#### 9.1.2 - Control words

The control words contain the following informations:

- ENABLE:** Must be activated in addition to the hardware signal.
- START:** In case of increasing edge the current command position is taken over, in case of deactivated START the system about a brake ramp is stopped.
- GL-ACTIVE:** Over this bit the overlapped synchronism controller is activated.
- SEL x:** Groups of each four modules with the information about status and positions can be read - by the control of the three select-bits -back.

Byte 0 - control word Hi		
bit	Function	
0	Axis START 4	start 1 = active
1	Axis START 3	start 1 = active
2	Axis START 2	start 1 = active
3	Axis START 1	start 1 = active
4	SEL 2	selection 1 = active
5	SEL 1	selection 1 = active
6	SEL 0	selection 1 = active
7	Enable (with which enable hardware links)	operation 1 = active

Byte 1 - control word Lo		
bit	Function	
0	GL- Active ext 2 (axis 9 to 12)	1 = GL active (group 2)
1	GL- Active ext 1 (axis 5 to 8)	1 = GL active (group 1)
2	START ext 2 (axis 9 to 12)	1 = start (group 2)
3	START ext 1 (axis 5 to 8)	1 = start (group 1)
4	GL- Active axis 4	synch 1 = active
5	GL- Active axis 3	synch 1 = active
6	GL- Active axis 2	synch 1 = active
7	GL- Active axis 1	synch 1 = active

Byte 8 - control word 2 Hi		
bit	Function	
0	Reserved	
1	Reserved	
2	Reserved	
3	START ext 5 (start of axis 13 to 16)	1 = start (group 5)
4	START ext 4 (start of axis 17 to 20)	1 = start (group 4)
5	START ext 3 (start of axis 13 to 16)	1 = start (group 3)
6	Reserved	
7	Reserved	



Byte 9 - control word 2 Lo		
bit	Function	
0	Reserved	
1	Reserved	
2	Reserved	
3	GL- Active ext 5 (axis 21 to 24)	1 = GL active (group 5)
4	GL- Active ext 4 (axis 17 to 20)	1 = GL active (group 4)
5	GL- Active ext 3 (axis 13 to 16)	1 = GL active (group 3)
6	Reserved	
7	Reserved	

### 9.1.3 - Position setpoint description

Command position: according to the sensor resolution.

Byte 2 to 5 - command position		
bit	Function defined by the sensor resolution	
from 0 to 7	Command position Lo byte	Byte 5
from 8 to 15	Command position	Byte 4
from 16 to 23	Command position	Byte 3
from 24 to 31	Command position Hi byte	Byte 2

Example of calculation of position control for SSI sensor resolution = 5 µm and 100% stroke = 300 mm.

Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIREs = 100% stroke (dec)

300 • 200 = 60.000 (dec) → EA60 (hex)

50% di 60.000 = 30.000 (dec) → 7530 (hex)

Example of calculation of position control for ANA sensor with 100% stroke = 300 mm. With analog sensors SSIREs value is preset and unchangeable.

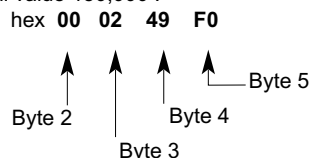
Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIREs = 100% stroke (dec)

300 • 1000 = 300.000 (dec) → 493E0 (hex)

50% di 300.000 = 150.000 (dec) → 249F0 (hex)

Position setpoint to be sent  
with decimal value 150,000 :



### 9.1.4 - Speed setpoint description

Command velocity: 0x3fff corresponds to 100 %.

Byte 6 and 7 - command velocity		
bit	Function max value 0x3FFF	
from 0 to 7	velocity Lo byte	Byte 7
from 8 to 15	velocity Hi byte	Byte 6

### 9.2 - Updating data

The EWM-SS-DAD cards send back to the bus-card two status words, the received setpoint command and the current actual position, totally of 24 bytes of data.

Byte	Function	Comment
0	status word Hi	unsigned int
1	status word Lo	
2	control position* Hi	unsigned long
3	control position*	
4	control position*	
5	control position* Lo	
6	status word 2 Hi	unsigned int
7	status word 2 Lo	
8	actual pos. axes 1,5,9,13,17,21 Hi	unsigned long
9	actual pos. axes 1,5,9,13,17,21	
10	actual pos. axes 1,5,9,13,17,21	
11	actual pos. axes 1,5,9,13,17,21 Lo	
12	actual pos. axes 2,6,10,14,18,22 Hi	unsigned long
13	actual pos. axes 2,6,10,14,18,22	
14	actual pos. axes 2,6,10,14,18,22	
15	actual pos. axes 2,6,10,14,18,22 Lo	
16	actual pos. axes 3,7,11,15,19,23 Hi	unsigned long
17	actual pos. axes 3,7,11,15,19,23	
18	actual pos. axes 3,7,11,15,19,23	
19	actual pos. axes 3,7,11,15,19,23 Lo	
20	actual pos. axes 4,8,12,16,20,24 Hi	unsigned long
21	actual pos. axes 4,8,12,16,20,24	
22	actual pos. axes 4,8,12,16,20,24	
23	actual pos. axes 4,8,12,16,20,24 Lo	

(\*) If the average-value control is active (SYNcMODE = AV) the acknowledged value is the calculated position; If the MASTER / SLAVE (SYNcMODE = MS) is active the acknowledged value will be the command position.

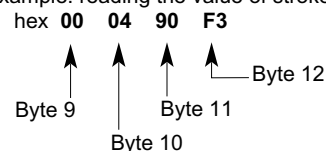
Current command position: is interpreted according to mode differently.

Standard mode : target command position

NC-mode : (VMODE = ON) calculated command position of the generator.

Actual position: according to the sensor resolution.

Example: reading the value of stroke 299251:





### 9.2.1 - Status word descriptions

READY: System is ready.

INPOS: Depending on the mode set, can transmit a position or, in NC mode, the following error control information.

GL-ERROR: The synchronism error is indicated over this bit by the parameter GLERROR dependently.

SENSOR ERROR: When the sensor monitoring is activated, the READY signal is deactivated with a sensor error.

COMERROR: Communication error on the CAN Bus.  
This message will be sent only from the module No. 1. if general communication problems are found or if a module is faulty

Always the hardware enable signal has to be deactivated at a sensor error (READY Signal) or when a COM error appear.

Byte 7 - status word 2 Lo		
bit	Function	
0	reserved	
1	reserved	
2	reserved	
3	reserved	
4	GL-Error axis 4, 8, 12, 16, 20, 24	1= no error Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi
5	GL-Error axis 3, 7, 11, 15, 19, 23	
6	GL-Error axis 2, 6, 10, 14, 18, 22	
7	GL-Error axis 1, 5, 9, 13, 17, 21	

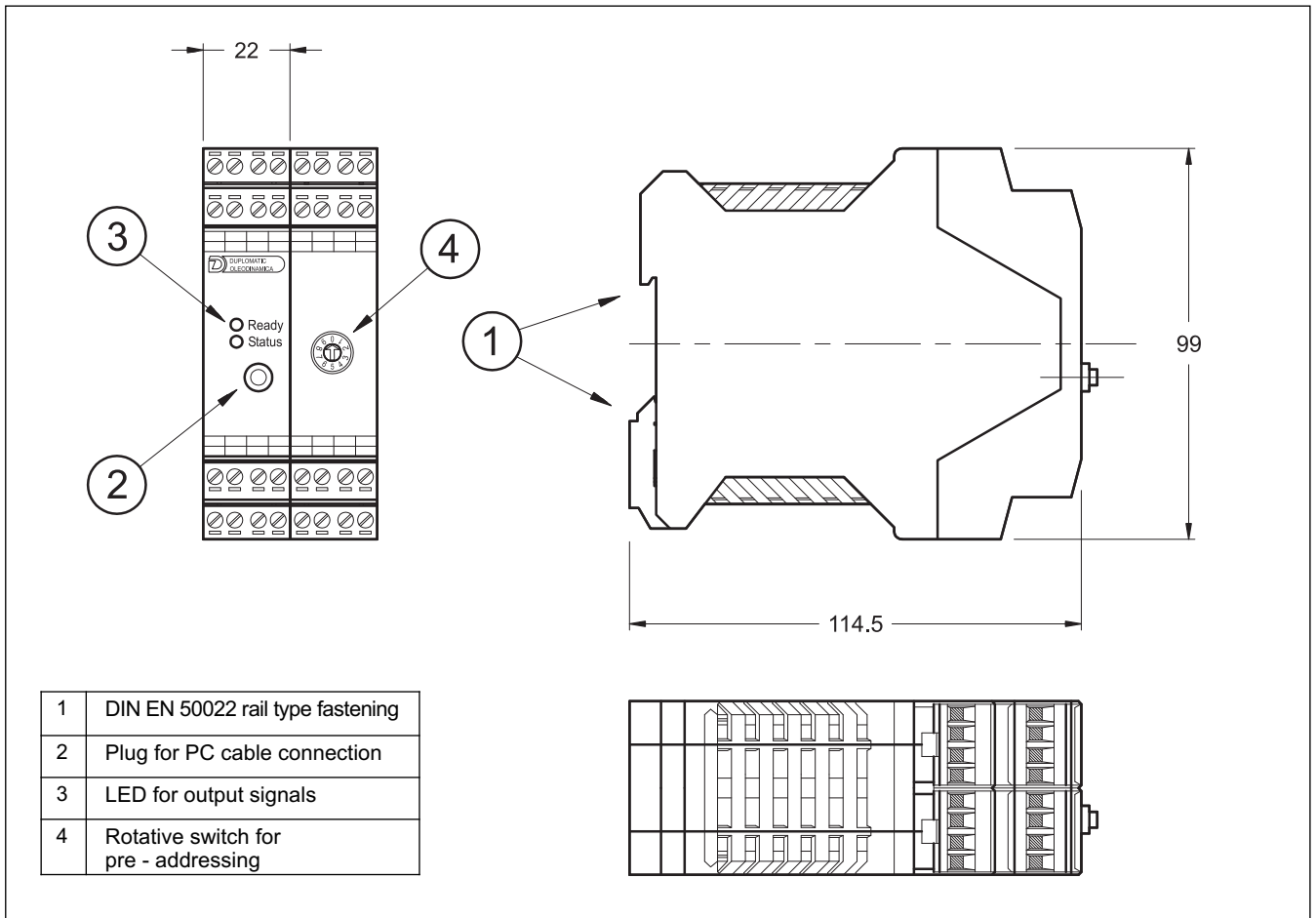
The status word 2 concerns the messages in the EXTENDED mode.

Byte 0 - status word Hi		
bit	Function	
0	INPOS axis 4	1= in position
1	INPOS axis 3	1= in position
2	INPOS axis 2	1= in position
3	INPOS axis 1	1= in position
4	READY axis 4	1= ready
5	READY axis 3	1= ready
6	READY axis 2	1= ready
7	READY axis 1	1= ready

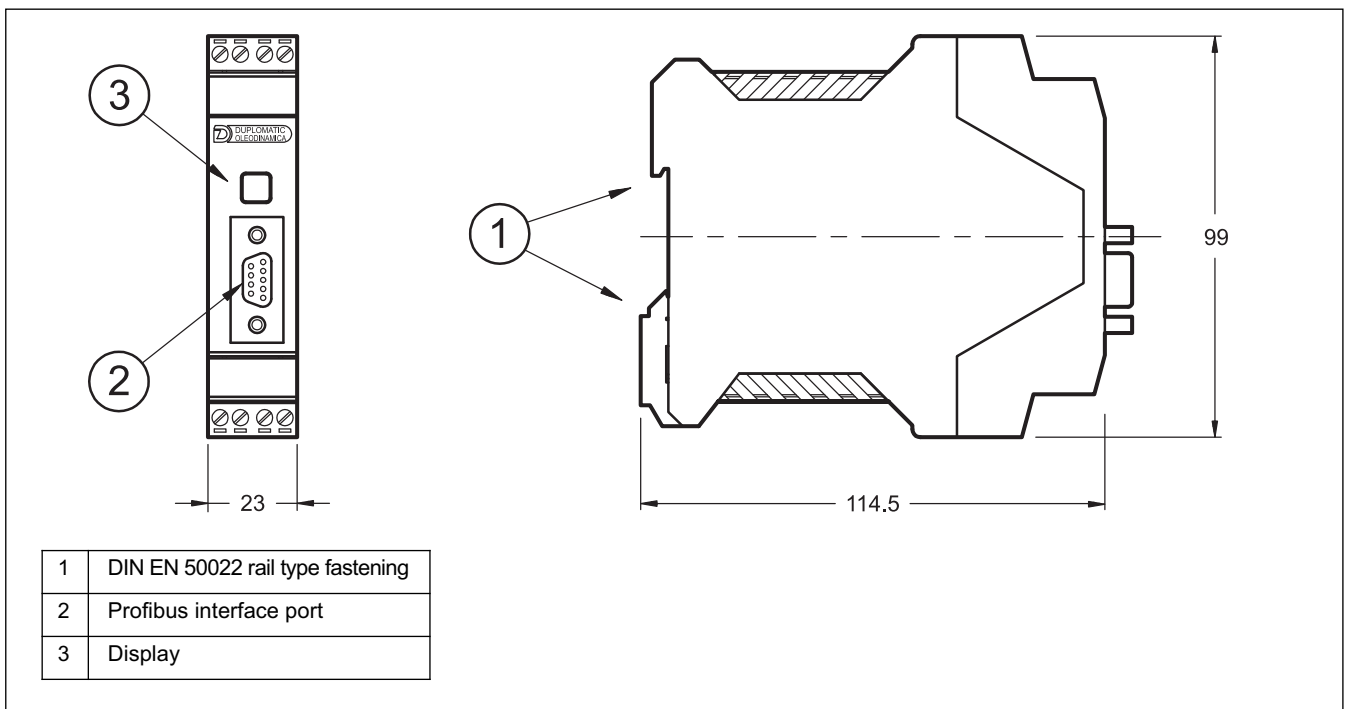
Byte 1 - status word Lo		
bit	Function	
0	COMerror	1 = no error
1	reserved	
2	reserved	
3	reserved	
4	axis GL-Error 4	1 = no error
5	axis GL-Error 3	1 = no error
6	axis GL-Error 2	1 = no error
7	axis GL-Error 1	1 = no error

Byte 6 - status word 2 Hi		
bit	Function	
0	INPOS axis 4, 8, 12, 16, 20, 24	1= no error Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi
1	INPOS axis 3, 7, 11, 15, 19, 23	
2	INPOS axis 2, 6, 10, 14, 18, 22	
3	INPOS axis 1, 5, 9, 13, 17, 21	
4	READY axis 4, 8, 12, 16, 20, 24	1= Ready Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi
5	READY axis 3, 7, 11, 15, 19, 23	
6	READY axis 2, 6, 10, 14, 18, 22	
7	READY axis 1, 5, 9, 13, 17, 21	

## 10 - OVERALL AND MOUNTING DIMENSIONS OF EWM-SS-DAD



## 11 - OVERALL AND MOUNTING DIMENSIONS OF EWM-BUS-DD





# EWM-SS-DAD

SERIES 11



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# EWM-2SS-DAD

## WITH PROFIBUS INTERFACE

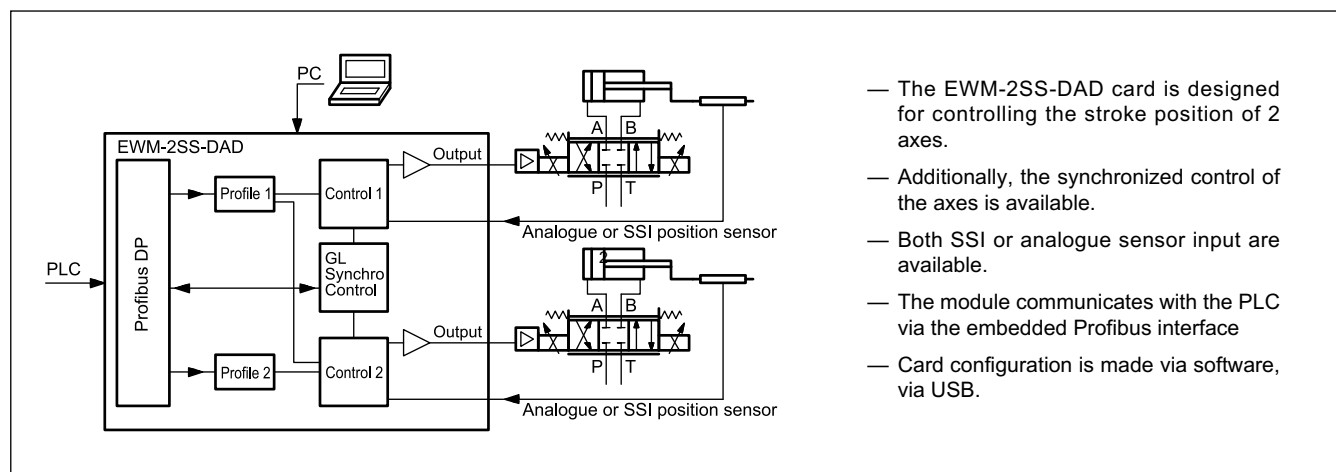
### CARD FOR 2 AXES POSITIONING AND SYNCHRONIZATION

#### IN CLOSED LOOP CONTROL

#### SERIES 20

**RAIL MOUNTING TYPE:**  
**DIN EN 50022**

#### OPERATING PRINCIPLE

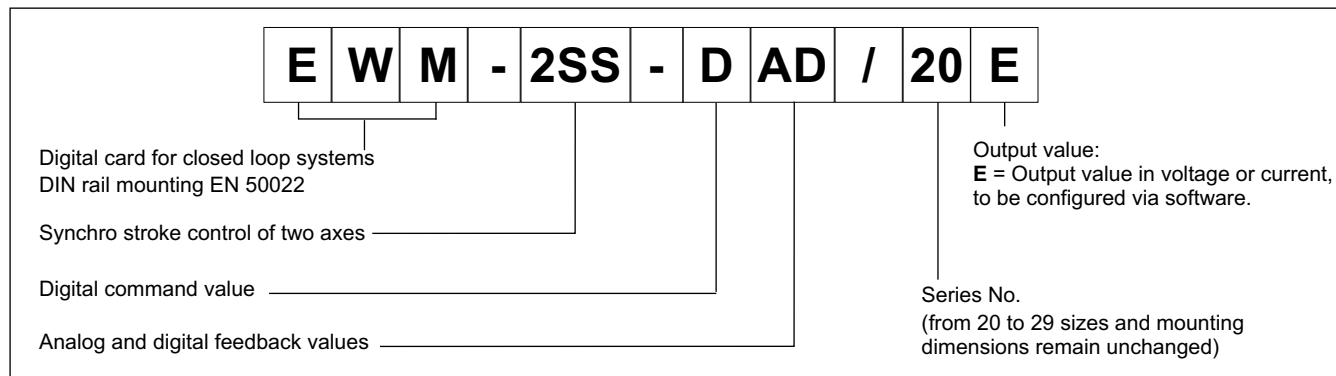


#### TECHNICAL CHARACTERISTICS

Power supply	V DC	24 (±10%)
Fuse, external	A	1A medium time lag
Current consumption	mA	< 500
Command position value		via Profibus DP
Profibus DP data rate	kbit/s	9.6, 19.2, 93.75, 187.5, 500, 1500, 3000, 6000, 12000 - ID number 1810h
Max position accuracy	µm	1
Feedback values	SSI V mA	digital sensor with any interface SSI - 150 kbit/s 4 ÷ 20 (RI = 250 Ω) 0 ÷ 10 (RI = 33 kΩ)
Output value - voltage - current	V mA	±10 differential (max load 5 mA) 4 ÷ 20 (max load 390 Ω )
Resolution of output value	%	0.024
Interface		USB B type 2.0 , Profibus
Electromagnetic compatibility (EMC):		Immunity EN 61000-6-2: 8/2002 - Emissions EN 61000-6-4: 6/2005
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions	mm	121(d) x 99(h) x 68(w)
Connectors		11x4 poles screw terminals PE direct via DIN rail USB-B 2.0 - Profibus D-Sub 9 poles
Operating temperature range	°C	-10 / +50
Protection degree		IP 20



### 1 - IDENTIFICATION CODE



### 2 - FEATURES OVERVIEW

#### Controller Functions

- Synchronized or independent positioning control of two axes in closed loop
- Command position, speed parameters and actual value response via Profibus DP
- Fine positioning - 1µm resolution
- 2 methods for positioning control:  
SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability  
NC – Numerically Controlled - To follow the position profile
- 2 methods for synchronized control:  
Master-slave  
Average value controller
- Data for lengths in mm
- Digital SSI sensor
- As an alternative, the card can be set via software for operate with analogue position sensors
- Analogue sensors scalable via software
- Gain adjustment made via software with independent parameters for SDD and NC modes
- PT1 compensator for optimized control of hydraulic drives
- Emergency function (EOUT)
- Safe and error-free data transmission
- Manual mode available via Profibus.

#### Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics

#### Monitoring functions

- In-position error
- Cable break, in-pressure error and fault of feedback sensors
- 2 Digital output to read the status

#### Other characteristics

- Card configuration is made via software, USB-B socket on the module

### 3 - FUNCTIONAL SPECIFICATIONS

#### 3.1 - Power supply

This card is designed for 24 VDC of a power supply. This power supply must correspond to the existing EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

#### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

#### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

#### 3.4 - Reference signal

The reference signals run via Profibus, ID number 1810h.

#### 3.5 - Position feedback values

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

Use SSI sensors with the same resolution (max 1 µm)

Eventually an analogue input could be used as feedback. The card accepts a 0 ÷ 10 V (Ri 33 kΩ) or 4 ÷ 20 mA (Ri = 250 Ω).

The analogue resolution is of 0,01 % incl. oversampling.



Using analog sensors, the SSI parameters in the software assume default preset values that the user must do not change.

#### 3.6 - Output values

Output values can be in voltage or current and need to be configured via software (SIGNAL parameter).

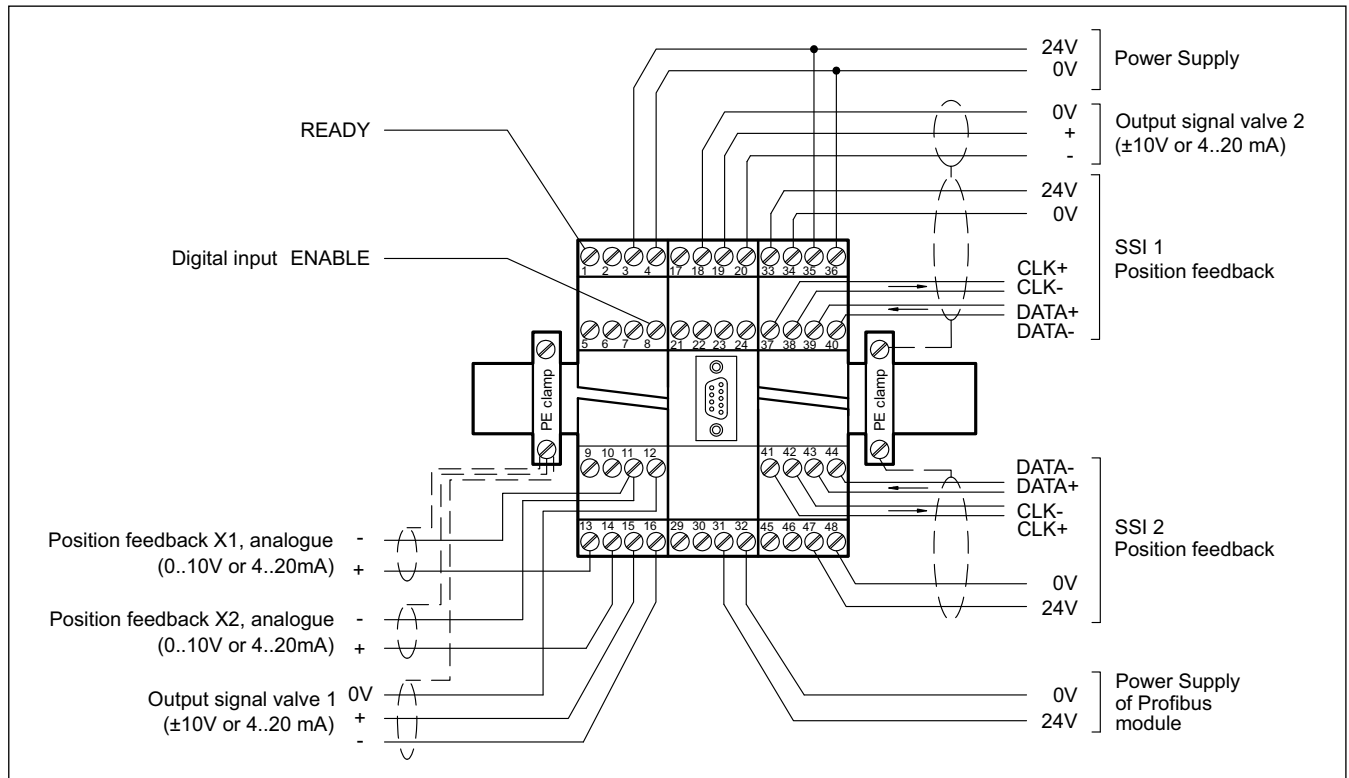
voltage : ± 10 V Differential output	PIN 15 and 16 PIN 19 and 20
current: 4 ÷ 20 mA	PIN 15 to PIN 12 PIN 19 to PIN 18.

#### 3.7 - Digital Output

Two digital output are available, STATUS and READY, that are displayed by LED on the front panel.

Low level < 2 V High Level > = Vsupply (max current 50 mA).

### 4 - WIRING DIAGRAM



#### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output.  
General operability, It's on when ENABLE (PIN 8 and profibus bit) is active and there are no sensor errors. This output corresponds with the green led.
- PIN 8** ENABLE input:  
This digital input signal initializes the application. The controller and the READY signal are activated. The output signal to the control element is enabled. Target position is set to actual position and the drive stays stationary, in closed loop. The Enable bit via profibus must be active, too.

#### ANALOGUE INPUT

- PIN 13** Analogue position feedback value (X1),  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 14** Analogue position feedback value (X2),  
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

#### ANALOGUE OUTPUT

- voltage**
- PIN 16/15** Differential output (U1)  
± 100% corresponds to ± 10V differential voltage
- PIN 19/20** Differential output (U2)  
± 100% corresponds to ± 10V differential voltage
- current**
- PIN 12/15** current output U1:  
±100% corresponds to 4 ÷ 20 mA
- PIN 18/19** current output U2:  
±100% corresponds to 4 ÷ 20 mA

#### SSI SENSOR INTERFACE

position 1		position 2	
PIN 37	CLK+ output	PIN 41	CLK+ output
PIN 38	CLK- output	PIN 42	CLK- output
PIN 39	DATA+ input	PIN 43	DATA+ output
PIN 40	DATA- input	PIN 44	DATA- output
PIN 33	24V Power supply of the SSI sensor	PIN 47	24V Power supply of the SSI sensor
PIN 34	0V Power supply of the SSI sensor	PIN 48	0V Power supply of the SSI sensor

## 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

### 5.2 - Profibus DP interface

Profibus has to be used to control the axis and can also be utilized to set the parameters.

The module supports all baud rates from 9,6 kbit/s up to 12000 kbit/s with auto detection of the baud rate.

The functionality is defined in IEC 61158. The Profibus address can be programmed using the EWMPC/20 or online via the Profibus.

A diagnostic LED indicates the online status.

#### 5.2.1 - Installation and setting

A typical screened Profibus plug (D-Sub 9pol with switchable termination) is mandatory. Every Profibus segment must be provided with an active bus termination at the beginning and at the end. The termination is already integrated in all common Profibus plugs and can be activated by DIL switches.

The Profibus cable must be screened at determined contact clips in the Profibus plug.

The GSD data configuration files are available for download on our website. The communication parameters are 16 bytes (8 words) for IN/OUT variables.

## 6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND:x, via Profibus only, to facilitate the adjustment of the card and its calibration.

### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Diplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.



**WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

### 6.2 - Parameters table

The parameters table is available in English or German.

The language is settable by LG parameter.

Parameters are grouped together according to their function (e.g. sensor interface, position controller, etc..) in order to make the setting process easier, but they can be displayed also all together (MODE parameter).

**For a complete list of parameters and their settings please refer to the Technical Manual 89470\_117 ETM.**

## 7 - MAIN FEATURES

The EWM-2SS-DAD is a card for positioning control loop

With only few parameters the controller can be optimized and the movement profile is preset via Profibus (position and velocity).

### 7.1 - Sequence of the positioning

The positioning is controlled via Profibus.

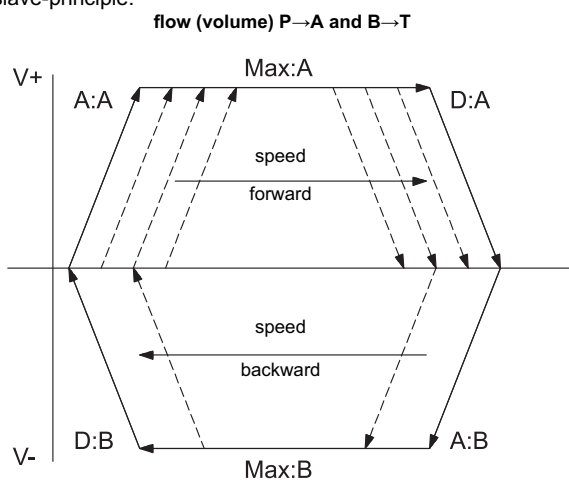
You can switch from the positioning in closed loop to the manual movement in open loop and back via Profibus.

With READY active the system is ready. The open loop control is achieved by using the HAND bits and the speed parameter. When the bit HAND goes low the card assumes the current position as the request and the card is ready to work in closed loop.

With also START bit enabled, the command position parameter (profibus) become active and the new command position will be taken over as a new target.

The axis moves immediately to this new position and indicates on the POSWIN status bit when it reaches the position. This output is active as long as the axis is within the InPos window or the START bit is active.

Setting the synchronous bit (SC) will synchronize both axes and the synchronization controller will work according with the FUNCTION mode selected (Master-slave, Average or Multiplicative Recursive Controller). Axis 2 is now following axis 1 according to the master-slave-principle.



Two methods for positioning are available:

**SDD - stroke depending deceleration** - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

**NC mode** - the position value is generated from the following error.

The actuator position is measured by a transducer and compared with a specified target position. The target position and speed are set by Profibus.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

### 7.2 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate. Different parameters available for each axes.

### 7.3 - Adaptation of the braking characteristic to the valve type (CTRL).

The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

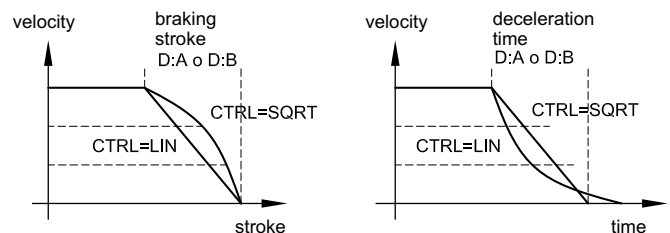
In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

Different parameters available for each axes.

**LIN:** Linear deceleration characteristic (gain is increased by a factor of 1).

**SQRT1:** Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

**SQRT2:** Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.



### 7.4 - Adaptation of the output signal to the valve characteristic (TRIGGER).

With TRIGGER command, the output signal is adapted to the valve characteristics.

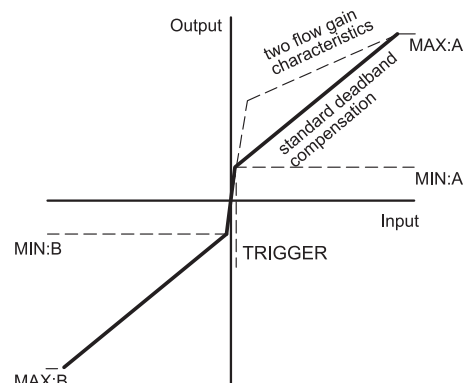
The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out either at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

In extreme cases this causes to an oscillating around the closed loop controlled position.

Different parameters available for each axes.



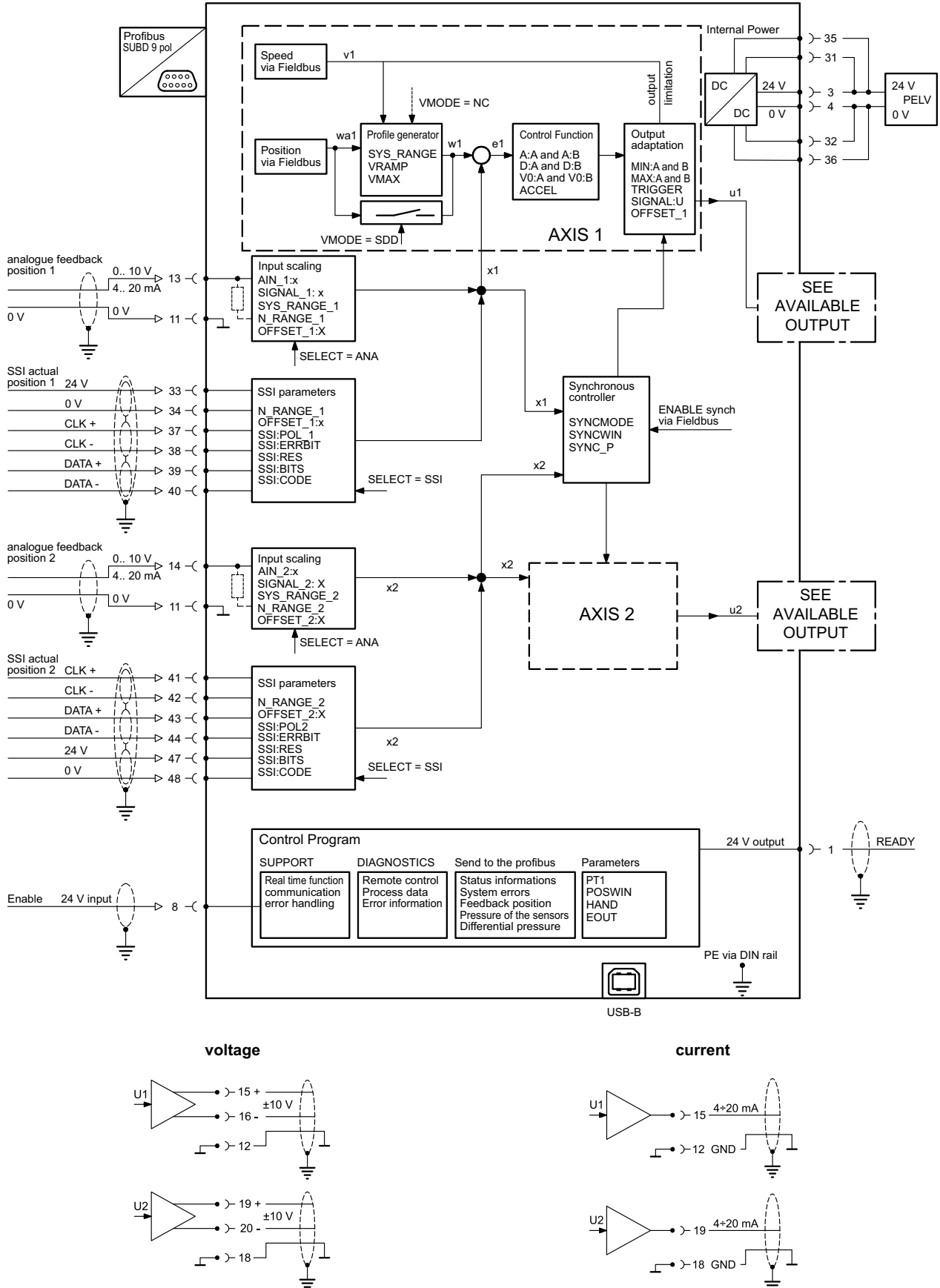


# EWM-2SS-DAD

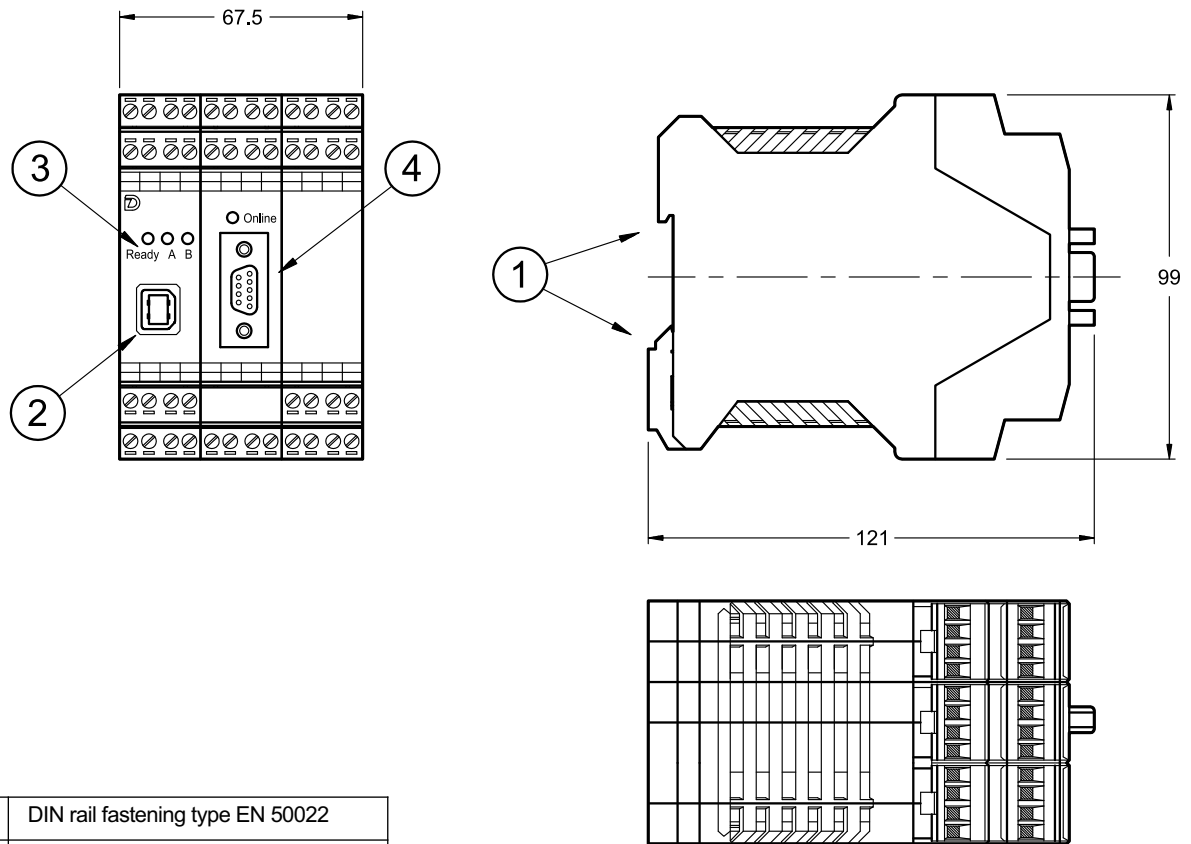
## SERIES 20

### 8 - CARD BLOCK DIAGRAM

**Caution!**, PIN 4 is connected internally to PIN 11 (and also possibly to PIN 12 depending on the model). These connections serve as a reference potential for the analogue sensor or demand value signals.



## 9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN rail fastening type EN 50022
2	USB port for PC cable connection
3	LED for output signals
4	Profibus interface port



# EWM-2SS-DAD

SERIES 20



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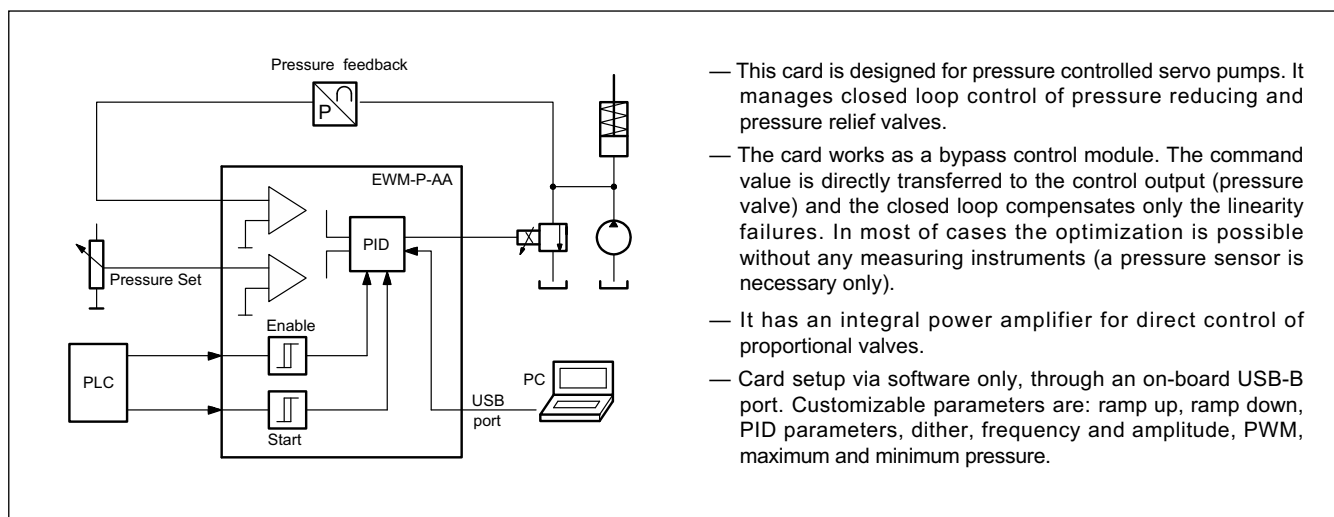


# EWM-P-AA

## DIGITAL CARD FOR PRESSURE (FORCE) CONTROL IN CLOSED LOOP SYSTEMS SERIES 20

**RAIL MOUNTING TYPE:  
DIN EN 50022**

### OPERATING PRINCIPLE

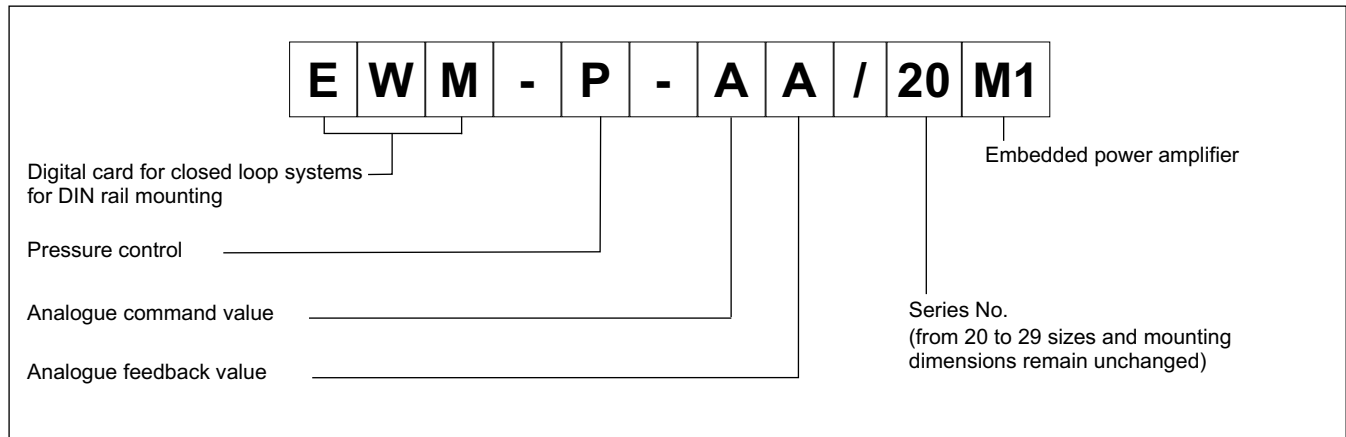


### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
External fuse	A	3,0 (medium time lag)
Current consumption	A	60 + current for solenoid
Command (pressure) value	V mA	0 ÷ 10 ( $R_I = 150 \text{ k}\Omega$ ) 4 ÷ 20 ( $R_I = 390 \Omega$ )
Pressure signals accuracy	%	0,006 oversampling included
Feedback value	V mA	0 ÷ 10 ( $R_I = 90 \text{ k}\Omega$ ) 4 ÷ 20 ( $R_I = 390 \Omega$ )
Output current	A	0.5 ÷ 2.6 stepless
Sample time (pressure)	ms	1
Interface		USB-B (2.0)
Electromagnetic compatibility (EMC)		Immunity EN 61000-6-2 Emissions EN 61000-6-4
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions	mm	120 (d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



## 1 - IDENTIFICATION CODE



## 2 - FEATURES OVERVIEW

### Controller Functions

- Pressure control in closed loop system
- Fine regulation – capable of accuracy not achievable with open loop set-up
- Highly dynamic control loop
- Adjustable PID controller
- Ability to modify command signal ramp times
- Emergency function (EOUT)
- Analog signal command
- Analog feedback input
- Simple and intuitive scaling of the input

### Adaptation to the valve characteristics

- Advanced dead-band compensation – able to define output range and position
- Adjustable sampling time, PWM, dither
- Adjustable command signal response time

### Power amplifier

- Embedded power amplifier
- Fine control of output signal
- PWM current output of up to 2.6A

### Other characteristics

- Card configuration is made via software, through on-board USB

## 3 - FUNCTIONAL SPECIFICATIONS

### 3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

**NOTE: the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.**

### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

### 3.4 - Command input (pressure)

The card accepts analogue command input, with voltage 0÷10V ( $R_i = 150 \Omega$ ) and current 4 ÷ 20 mA ( $R_i = 390 \Omega$ ).

### 3.5 - Feedback value

The card accepts analogue feedback input. The feedback value must be 0 ÷ 10V ( $R_i = 90 \text{ k}\Omega$ ) or 4 ÷ 20 mA ( $R_i = 390 \Omega$ ).

The parameters are settable via software (see the parameter table)

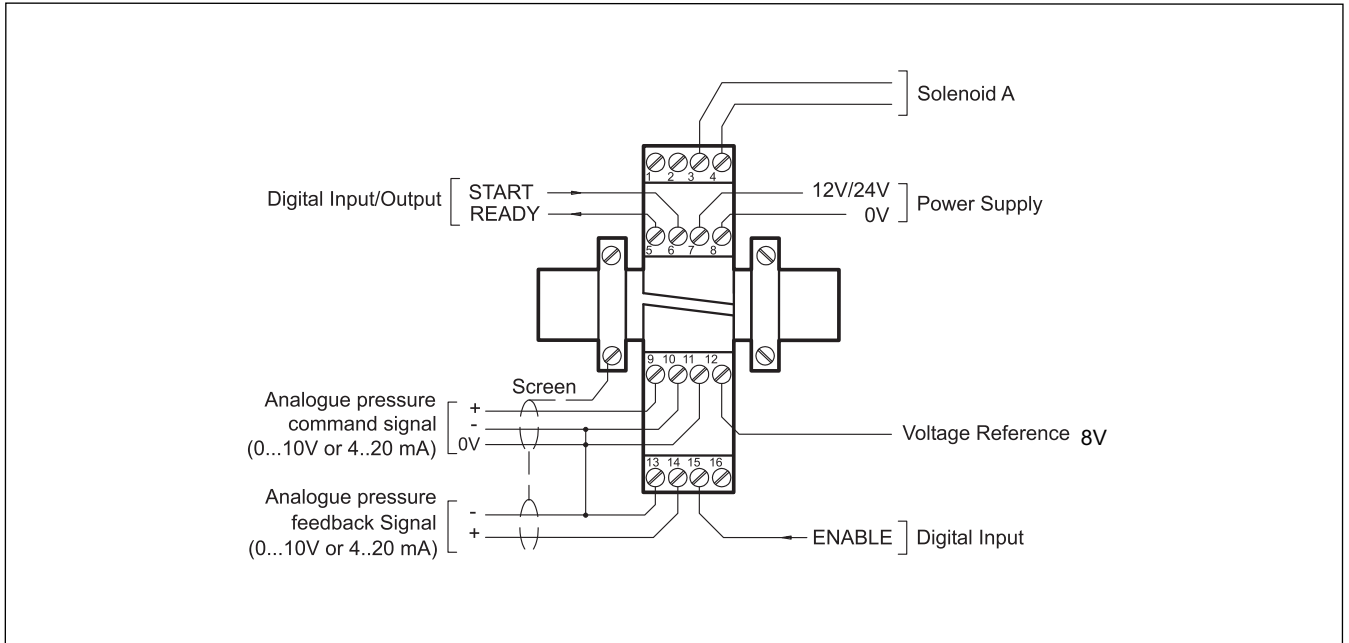
### 3.6 - Output values

The output current value for this card is settable via software. The value range is 0.5 ÷ 2.6 stepless. Broken wire and short circuit monitored. PWM frequency 61 ÷ 2604 Hz.

### 3.7 - Digital Output

A digital output is available (READY) and its signal is displayed from the green led. Low level: <2V, high level >10V (50 mA)

## 4 - WIRING DIAGRAM



### DIGITAL INPUT AND OUTPUT

- PIN 5** READY output:  
If the ENABLE is active and there are no discernable errors then the output is on. Otherwise it is off. This output corresponds with the 'Ready' LED. If the 4+ 20 mA sensor is open an error is generated.
- PIN 6** START Input:  
The controller is active; the external analogue command value is taken over.
- PIN 15** ENABLE Input:  
If the signal is applied (>10V) then the module is active and the power stage is active in closed loop.

### ANALOGUE INPUT

- PIN 9/10** Pressure command (W)  
range 0 ÷ 100%  
corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 13/14** Pressure feedback (X)  
range 0 ÷ 100%  
corresponds to 0 ÷ 10V or 4 ÷ 20 mA

### ANALOGUE OUTPUT

- PIN 12** 8V reference output (max. 25mA)
- PIN 3/4** PWM output for valve control.

## 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.



**WARNING! Plugs with freewheeling diodes and LED cannot be used with current controlled power outputs.**

**They interfere with the current control and they can destroy the output stage.**

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and the signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN rail should be provided. Transient interference voltages at the terminals are discharged via DIN rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

## 6 - DEVICE SETUP

Card set-up is possible via software only.

The system is controlled in closed loop. The integrated power stage makes it easy to set up the system quickly as it can be connected directly to a pressure valve.

### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Diplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving

of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.



**WARNING! In card series 20, the default baud rate to be selected in the software has changed from 9600 baud to 57600 baud.**

**This can be set in OPTION / SETTINGS / INTERFACE.**

### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameters setting can be done at *standard* level, *easier*, or *expert*, where a greater number of parameters is displayed and can be customized.

**For a complete list of parameters and their settings please refer to the Technical Manual 89500 ETM.**

## 7 - MAIN FEATURES

### 7.1 - Applications

This module is useful for a variety of pressure control applications. The control is accomplished by a PID controller carefully optimized for this application. Because of the high stability of this controller, the module is recommended for closed loop applications where an open loop control structure is incapable of achieving the desired accuracy.

The output signal (of up to 2.6A) can control a variety of pressure valves, such as pressure relieve valves and pressure control valves and as such no On-Board Electronics are needed.

Examples of such applications can be pressure control with constant pumps, remote controllable servo pumps and/or force & torque control with cylinders and motor drives.

### 7.2 - Emergency Output (EOUT)

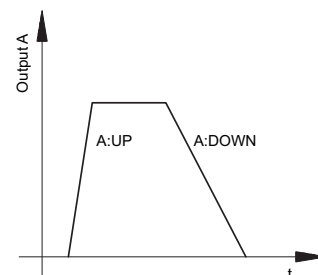
This function is able to set the output at a specific value (degree of valve opening) when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with the programmed ramp. The function can be deactivated.



The output value defined here is stored permanently (independently of the parameter set). The use of this feature should be carefully evaluated according to safety procedures in the system.

### 7.3 - Command Signal Ramp time (RA)

The parameters for ramp up and ramp down can be set in milliseconds. These values are the amount of time that the command signal will take to follow a step change in the reference signal.



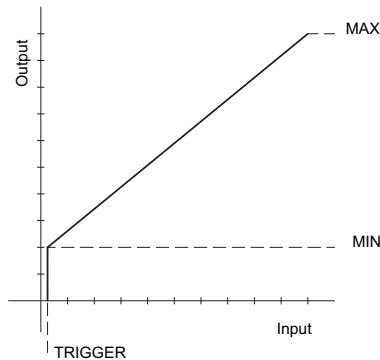
### 7.4 - PID Controller

The PID controller can be parameterized by modifying the relevant parameters, in order to suppress high-frequency noise and a value is also present in order to control the output by the input signal directly.

### 7.5 - Adaption of the output signal to the valve characteristics (TRIGGER)

With the MAX value, the maximum output can be easily defined. With the MIN value, the overlap (dead band of the valve) can be compensated. Via the TRIGGER the activation point of the MIN function is set and so a non-sensitive range around the zero-point can be specified.

If the MIN value is set too high, it influences the minimal pressure, which cannot be adjusted any longer. In extreme case this causes to an oscillating at small input values.



### 7.6 - Sample Time (TS)

The control dynamics can be influenced with the sample time. Changes should only be made by persons who have sufficient knowledge of dynamic systems behavior.

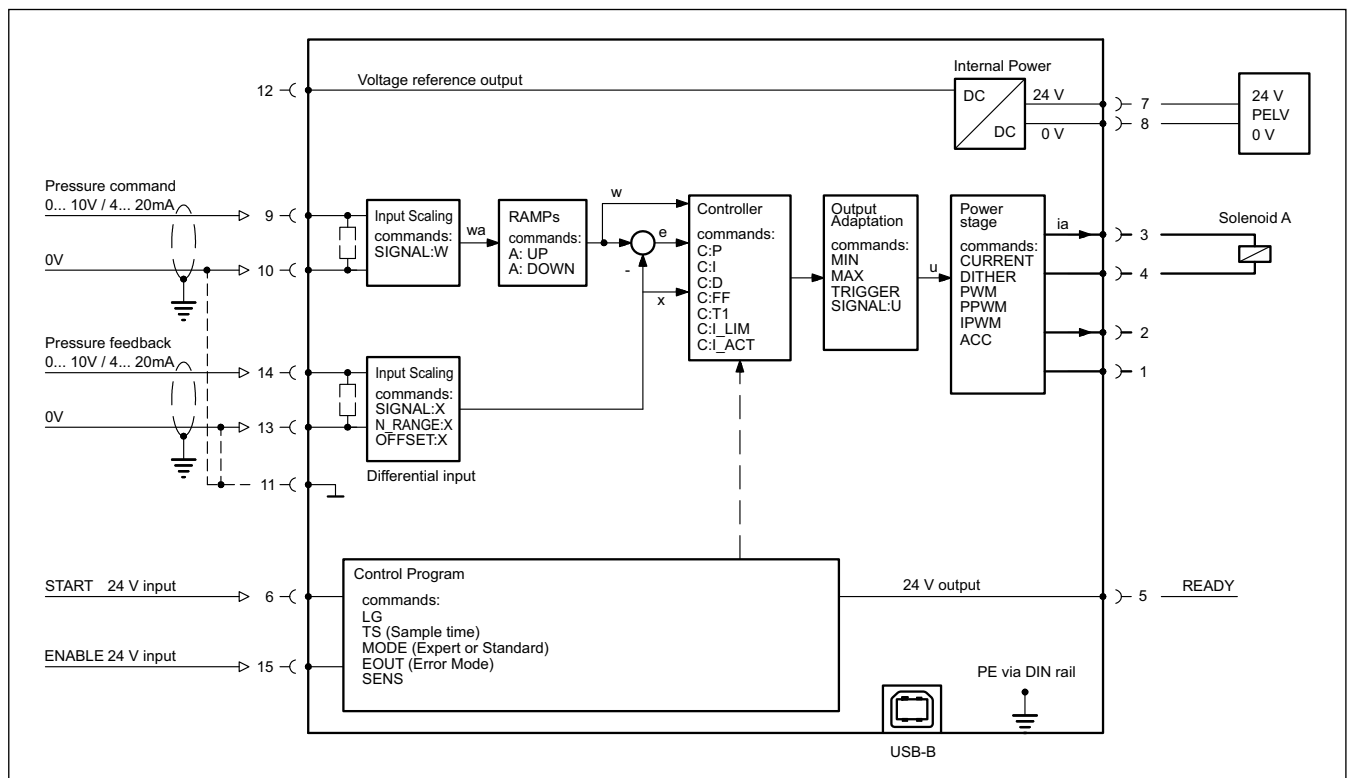
Note that after changing this value all time-dependent parameters must be checked and reset if necessary.

### 7.7 - Power Amplifier

The module comes with an embedded power amplifier that is capable to generate a PWM current signal of up to 2.6A in order to control a pressure valve.

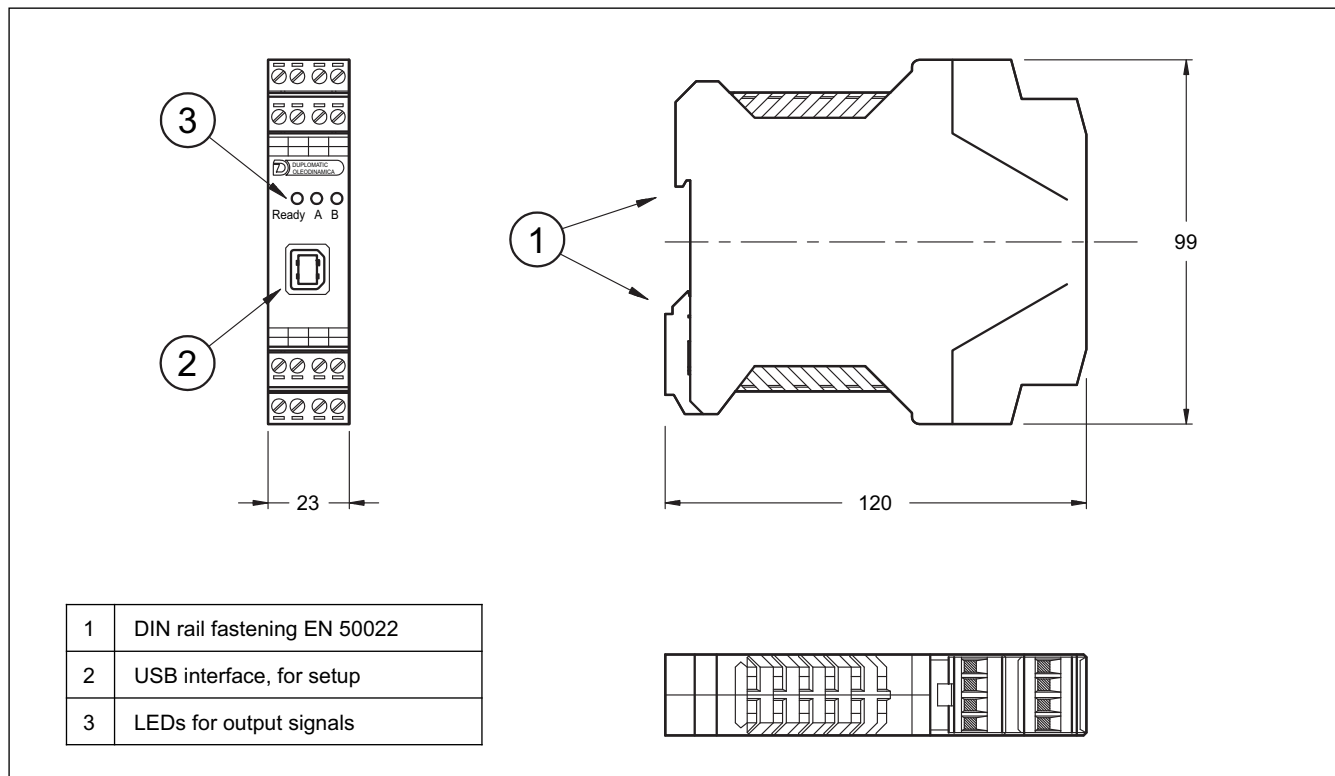
As such the nominal current, dither, frequency and the various parameters of the current loop can be accessed and modified.

## 8 - CARD BLOCK DIAGRAM





## 9 - OVERALL AND MOUNTING DIMENSIONS



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# EWM-PQ-AA

## DIGITAL CARD

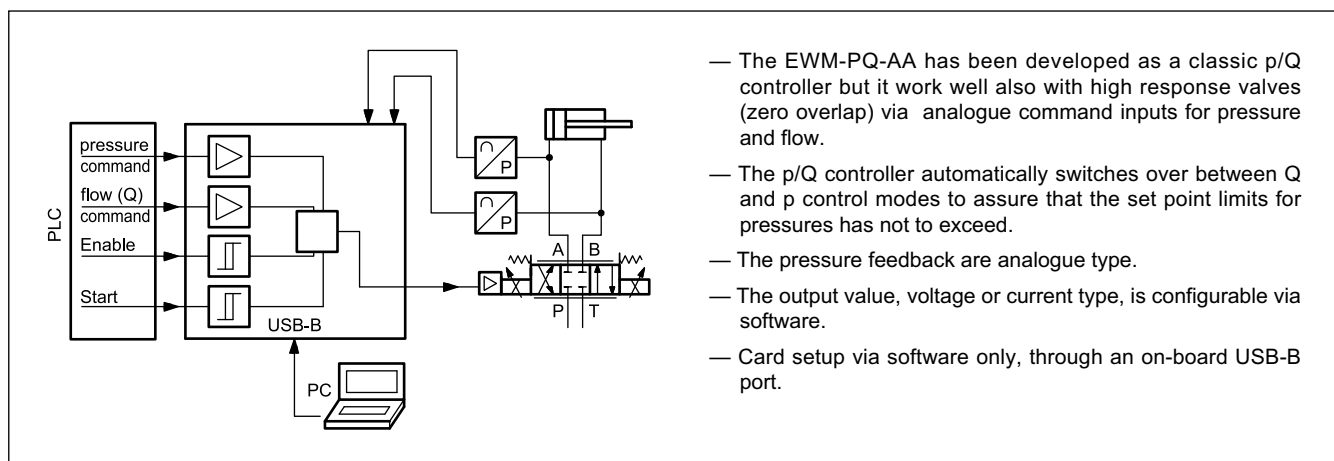
### FOR PRESSURE/FLOW CONTROL

### IN CLOSED LOOP SYSTEMS

#### SERIES 20

**RAIL MOUNTING TYPE:**  
**DIN EN 50022**

#### OPERATING PRINCIPLE

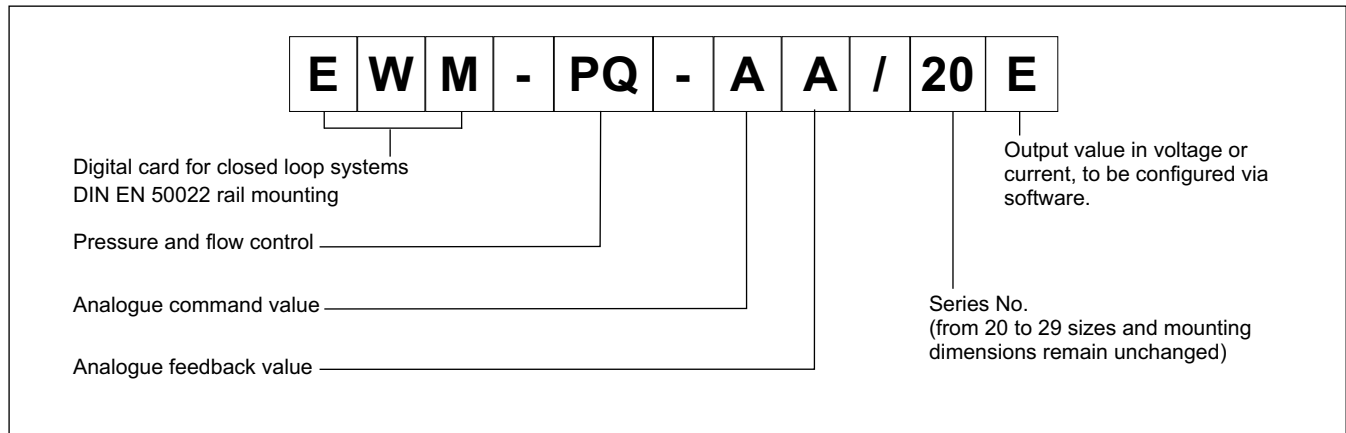


#### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
Fuse, external:		1A medium time lag
Current consumption:	mA	<100
Pressure command (p)	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Flow command (Q)	mA V	4 ÷ 20 (RI = 240 Ω) ± 10 (RI = 90 kΩ)
Pressure feedback values	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Sensor resolution	%	0,003 incl. oversampling
Output values	V mA	± 10 (max load 10 mA 2 kΩ) differential 4 ÷ 20 (max load 390 Ω)
Sample time	ms	1
Interface		USB-B 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connections		USB-B (2.0) - 4x poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



## 1 - IDENTIFICATION CODE



## 2 - FEATURES OVERVIEW

### Controller Functions

- Analogue Q- and p-command signals
- Classical p/Q controller with pressure limitation (automatic switch over)
- PID-controller with 2 sets of parameters switchable by digital input
- Data for pressure set in bar
- Ramps for pressure up and down optionally activated by a digital input
- Force / pressure controller with one sensor
- Differential pressure control with two pressure sensors
- D - gain filter to stabilize the control behaviour
- Emergency function for output signal (EOUT)
- Analogue feedback input
- Flow value (Q) alternative to the analogue input as parameter to be entered via software
- Simple and intuitive scaling and offset of the sensors.

### Monitoring functions

- Monitoring error
- Cable break for feedback sensor and current command signal
- 2 digital outputs to read the status

### Other characteristics

- Current or voltage output to be set via software
- Card configuration via software, through on-board USB port

## 3 - FUNCTIONAL SPECIFICATIONS

### 3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

### 3.4 - Pressure command (p)

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.5 - Flow command (Q)

The card accepts an analogue input signal. The command speed can be ±10 V (RI = 90 kΩ) or 4...12...20 mA (RI = 240 Ω).

### 3.6 - Feedback values

The card accepts up to two analogue feedback inputs, values can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

### 3.7 - Analogue output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output (PIN 15 / PIN 16).

Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

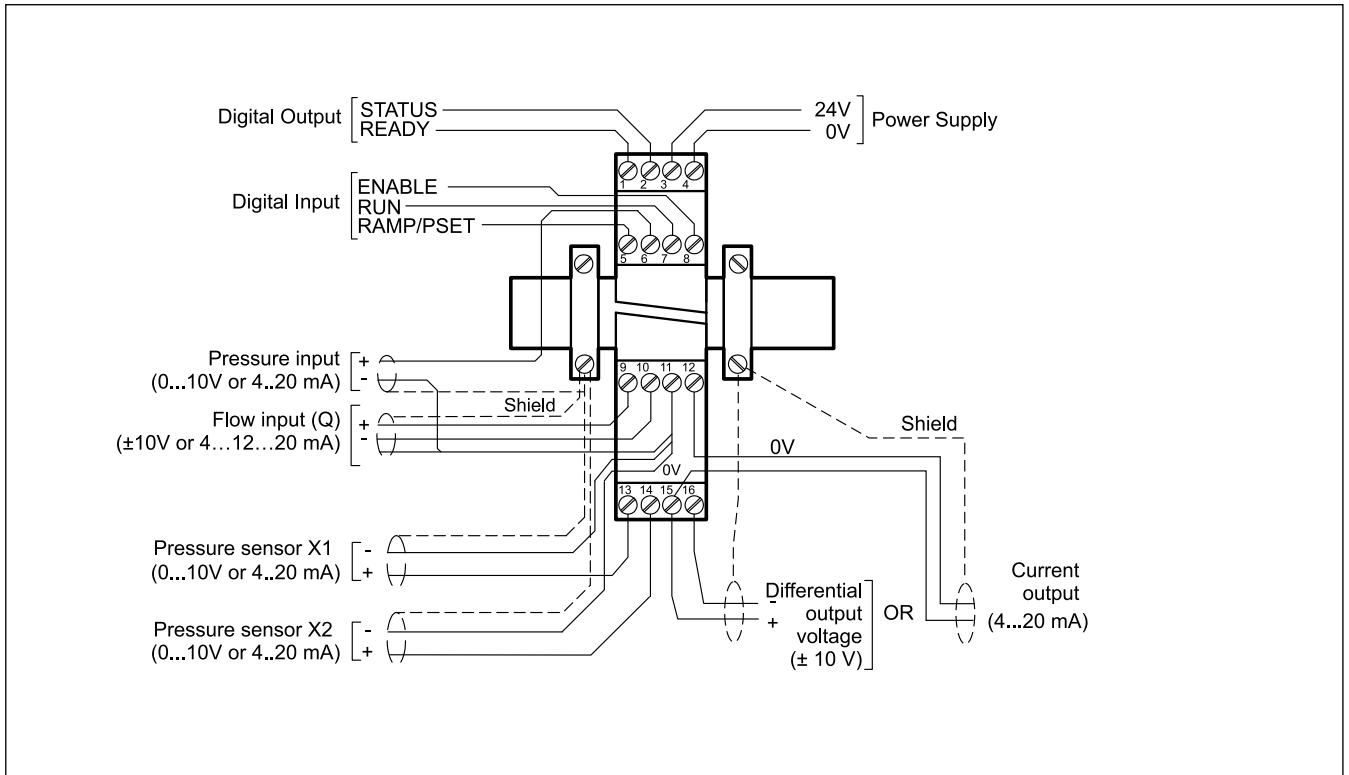
All analogue output have to be wired with screened cables.

### 3.8 - Digital output

Two digital output are available, STATUS and READY, that are displayed by the READY and A leds on the front panel.

Low level < 2 V High Level > 12 V (max 50 mA).

## 4 - WIRING DIAGRAM



### DIGITAL INPUT AND OUTPUT

- PIN 1** READY output:  
General operability, ENABLE is active and there are no sensor / command errors (by use of 4... 20 mA sensors). This output corresponds with the LED READY.
- PIN 2** STATUS output:  
Error monitoring. The status output will be deactivated if the error is greater than the acceptability range. This output corresponds with the LED A.
- PIN 5** RAMP/PSET input:  
According to the setup of the parameter PIN:5, it can be configured as:  
- ramp activation / deactivation  
- switching between the 2 available sets of parameters
- PIN 7** RUN input:  
Controller activation; if the input is OFF and ENABLE is active, the flow command (PIN 9 / 10) is taken over as valve command value.
- PIN 8** ENABLE input:  
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. The Q command signal is controlling the output.

### ANALOGUE INPUT

- PIN 6** Pressure / force command value (p)  
range 0 ÷ 100% of system nominal pressure  
corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 9/10** Flow command value (Q)  
range ±100 % corresponds to ±10V or 4...12...20 mA
- PIN 13** Pressure sensor (feedback) value (X1)  
range 0 ÷ 100% of nominal pressure of sensor  
corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 14** Pressure sensor (feedback) value (X2)  
range 0 ÷ 100% of nominal pressure of sensor  
corresponds to 0 ÷ 10V or 4 ÷ 20 mA

### ANALOGUE OUTPUT

#### voltage

- PIN 16/15** Differential output (U)  
± 100% corresponds to ± 10V differential voltage

#### current

- PIN 12/15** ±100% corresponds to 4 ÷ 20 mA



## 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

## 6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop with the control signal Q, moving the servo cylinder forward and backward, for easy programming of the card and of the system calibration.

### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Diplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up. Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.



**WARNING!** For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in **OPTION / SETTINGS / INTERFACE**.

### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

**For a complete list of the parameters and their settings please refer to the Technical Manual 89550 ETM.**

## 7 - MAIN FEATURES

This module serves to control pressures and forces on hydraulic actuators.

### 7.1 - Sequence of the positioning

The ENABLE signal initializes the application and error messages are deleted. The READY signal gets activated. The output signal to the control element is enabled. The drive can be controlled by the Q value or input. Setting RUN will start the PID controller.

A dynamic zero-overlap control valve is necessary for p/Q control. If the B-side of the cylinder can not be relieved, pressure in both cylinder sides has to be measured.

The cylinder can be driven in both directions (flow control in open loop) with the analogue Q command input value and limits the max velocity.

The pressure limitation control function is only active with a positive Q signal with a closed loop function.

The p command value pre-sets the max differential pressure. If this pressure (or force) exceeds the controller reduces the output signal to the valve (also in the negative range), so that the preset pressure will be kept. To go backwards for keeping the force is possible.

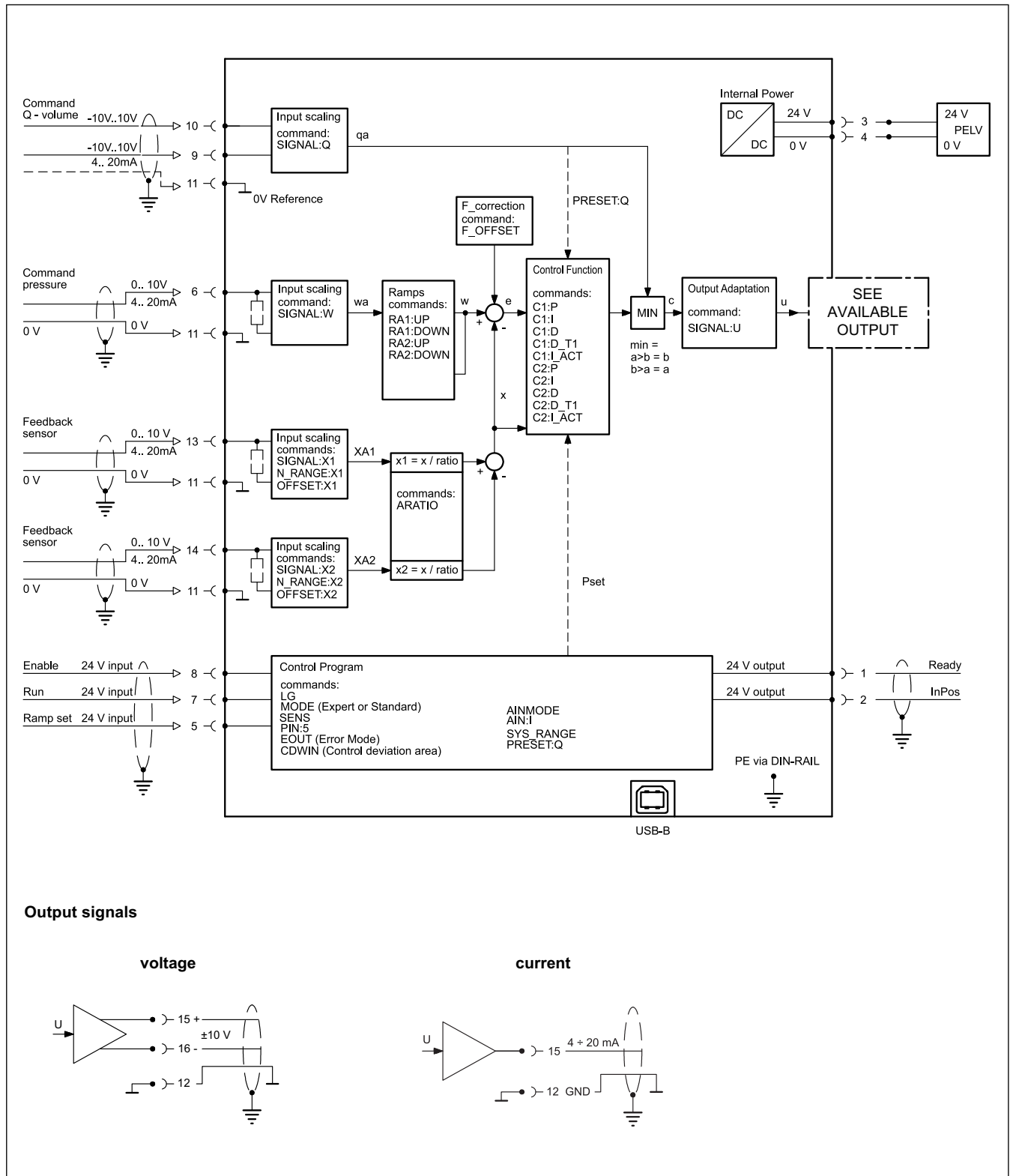
The pressure/force control is determined via the analogue inputs X1 and X2. For differential pressure control the actual value is calculated as X1 – X2.

The output signal is available as a differential output for connection of control valves with integrated electronics.

### 7.2 - Emergency Output (EOUT)

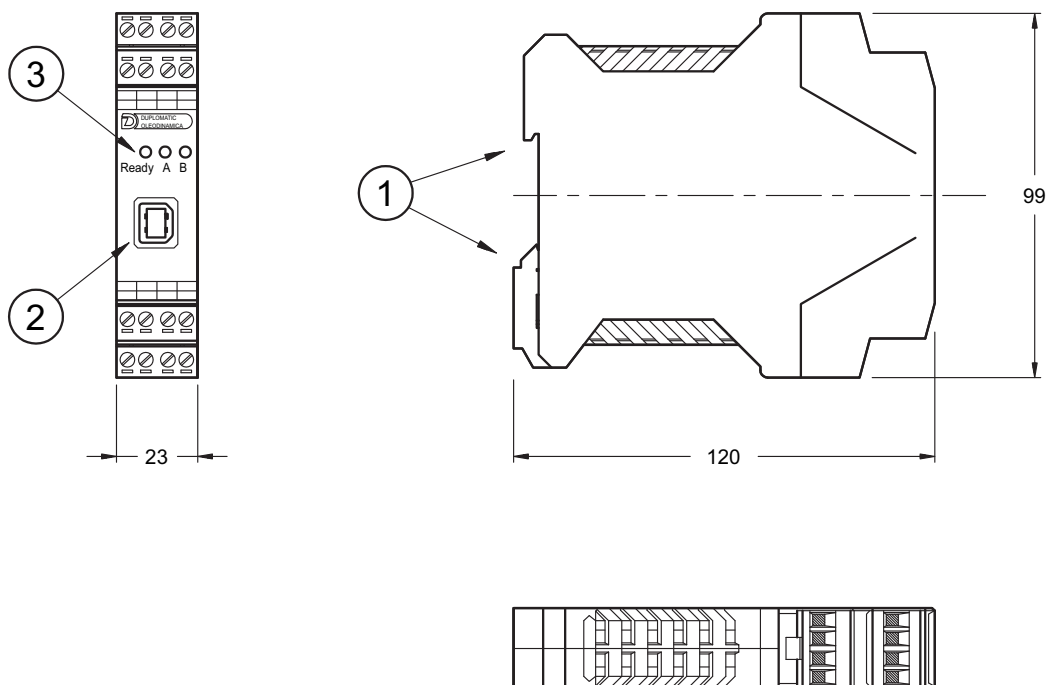
This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

## 8 - CARD BLOCK DIAGRAM





## 9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals



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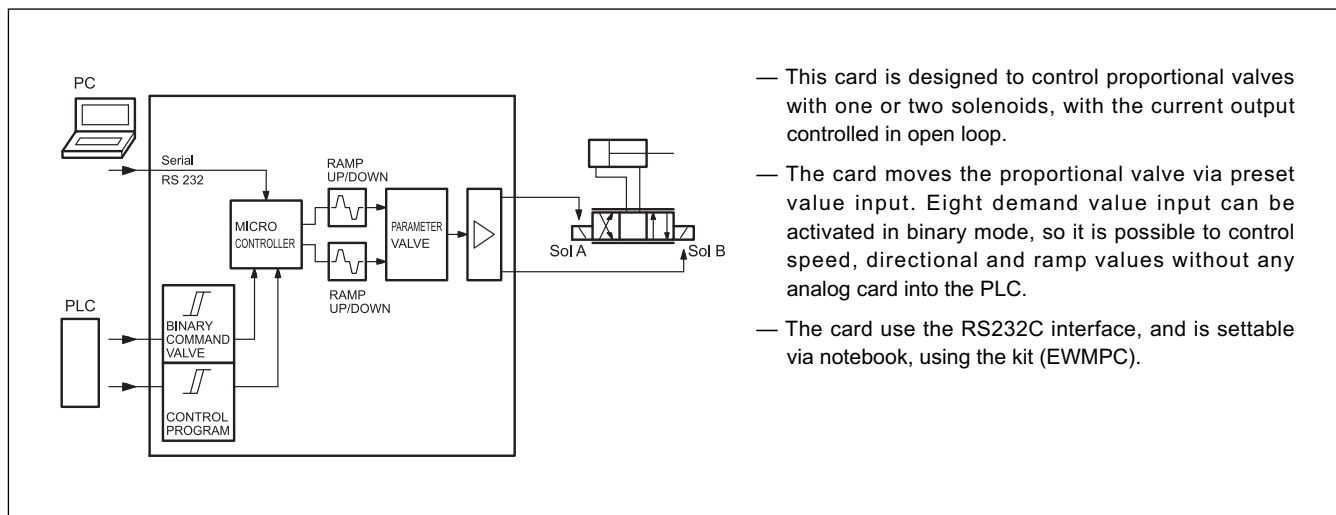
# EWM-A-RL

## DIGITAL CARD FOR FAST/SLOW SPEED CONTROL IN OPEN LOOP SYSTEMS

### SERIES 10

**RAIL MOUNTING TYPE:  
DIN EN 50022**

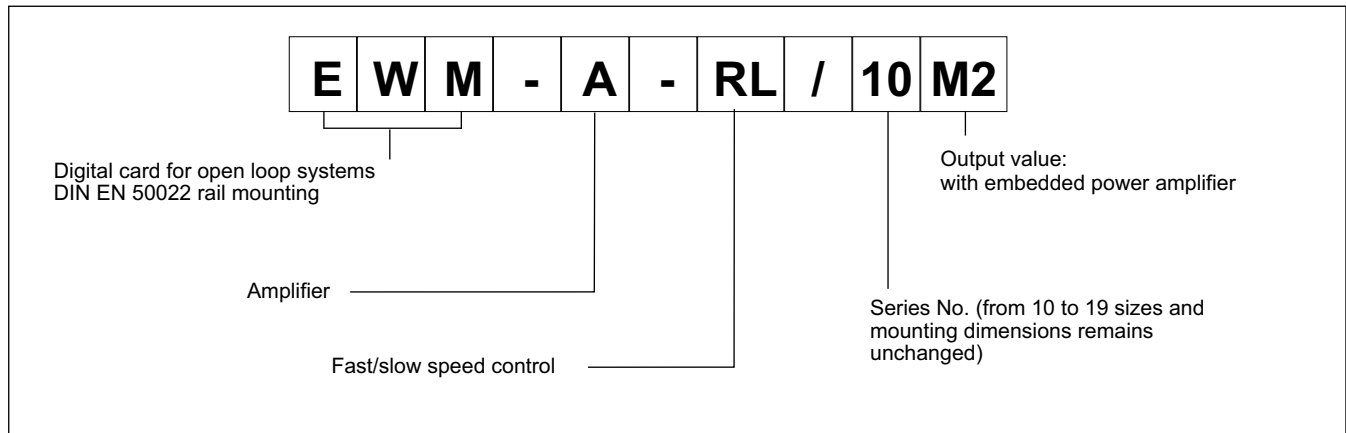
#### OPERATING PRINCIPLE



#### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ± 30 ripple included external fuse 5 A
Current consumption	mA	100 + solenoid current consumption
Command value		binary command with 8 bit
Output current	A	max 2,6
Interface		RS 232 C
Electromagnetic compatibility (EMC): according to 2004/108/CE standards		Emissions EN 61000-6-4 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 -combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

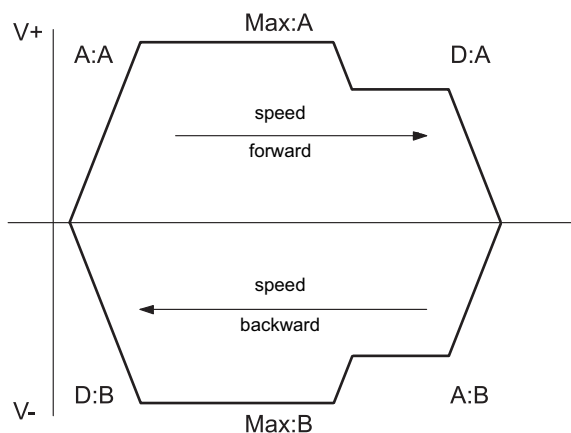
## 1 - IDENTIFICATION CODE



The power amplifier is controlled by an enable input and three switch signals. Therefore 8 demand values can be activated binary.

In case of direct control (non binary) it is par example possible to preset the directions with two inputs and to switch over between rapid and slow speed with the third input.

The output current is closed loop controlled and therefore independent from the supply voltage and the solenoid resistance.



## 2 - FUNCTIONAL SPECIFICATIONS

### 2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and the sensors.

**NOTE: in the type M2 the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.**

### 2.2 - Electrical protections

All inputs and outputs are protected against overvoltage and have filters.

### 2.3 - Reference signal

The card accepts digital input. The digital input must have a voltage from 12 to 24 V with current <0,1A. See the block diagram at paragraph 8 for the electric connections.

### 2.4 - Output values

The card has output values in current, settable via software between 1, 1,6 and 2,6 A.

### 2.5 - Digital Output

The digital output is READY signal, displayed from the green led.

## 3 - LED FUNCTIONS

There are two leds on the card: GREEN and YELLOW.

GREEN: Shows if the card is ready.

ON - The card is supplied

OFF - No power supply

FLASHING - Failure detected

Only if SENS = ON

YELLOW: Indicates the intensity of the output current.

## 4 - ADJUSTMENTS

On the EWM card family, the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model, and shows a table (see example on next page) with all the available parameters, with their commands, the default setting, the measuring unit and an explanation of the command and its uses.

The parameters changes depending on the card model, and they are fully described in the *Overhaul manual*.



EXAMPLE OF PARAMETERS TABLE

Commands	Parameter	Defaults	Units	Description
<b>s:i x</b>	i= 0..7 x= 0..10000	- :0	- 0,01%	Definition of the target positions. The value i is related to the input selection (SEL1, SEL2 and SEL4; binary coded).
<b>rmode x</b>	x= SD 4Q	SD	-	Ramp function: <b>SD</b> = ramp time related to the setpoint value <b>4Q</b> = Four quadrants ramp, ramp-variable RA:1 to RA:4 is used
<b>ra:i x</b>	i= 0... 7 x= 0..600000	100	ms	<b>4Q</b> Ramp <b>RA:1</b> up (solenoid A), <b>RA:2</b> down (solenoid A) <b>RA:3</b> up (solenoid B), <b>RA:4</b> down (solenoid B) <b>SD</b> Ramp <b>RA:0</b> to <b>RA:7</b>
<b>mode x</b>	x= on off	off	-	Activation or deactivation of the linearization defined by the CC command.
<b>cc:i x y</b>	i= -10... 10 x -10000... 10000 y -10000... 10000	5000	0,01% 0,01%	Characteristic linearization.
<b>rcurr x</b>	i= A B x= -10000... 10000	off	-	Real current input. <b>MIN</b> and <b>MAX</b> will be typed in, in mA. If <i>rcurr</i> = on; the command "current" should not be used.
<b>min:i x</b>	i= A x= 0... 5000	0	0,01% / mA	Deadband compensation of positive overlapped proportional valves.
<b>max:i x</b>	i= A x= 300..10000	10000	0,01% / mA	Maximum output range for adapting control range to maximum flow range.
<b>trigger x</b>	x= 0... 2000	200	0,01%	Point to activate the deadband compensation (min). Also useful for reduced sensitivity in position with control valves.
<b>sens x</b>	x= ON OFF	ON	-	Activation of the sensor and internal failure monitoring.
<b>solenoids x</b>	x= 1 2	2	-	Number of used solenoids. Two for directional valves, one for pressure or throttle valves.
<b>current:i x</b>	i= A x= 0, 1, 2	0		Output current range. <b>0</b> = 1,0 A range <b>1</b> = 1,6 A range <b>2</b> = 2,6 A range DO NOT USE THIS COMMAND IF <i>rcurr</i> = ON.
<b>damp1:i x</b>	i= A x= 0..2000	400	0,01%	Parameterizing of the dither amplitude in 0,01 % units of the nominal current range. Typical values between 500 and 1200 (with 700 we always had good experience).
<b>dfreq:i x</b>	i= A x= 60... 400	120	Hz	Preset of the dither frequency
<b>pwm:i x</b>	i= A x= 100..7700	2600	Hz	Preset of the PWM frequency
<b>ppwm:i x</b> <b>ipwm:i x</b>	x= 1... 20 x= 5... 100	7 40	-	P-gain for control dynamics of the current control loop. Changing of these parameters should only be done by expert know how. A higher P-gain increases the control dynamics of the current control and also the effect of the dither adjustment. I-gain for control dynamics of the current control loop. Changing of these parameters should only be done by expert know how.
<b>cmode x</b>	X= ON OFF	ON	-	Function of the output stage: OFF: function for closed loop positioning drives, ON: standard and for only one return line by two solenoids
<b>save</b>	-	-	-	Storing the programmed parameter in E <sup>2</sup> PROM.
<b>loadback</b>	-	-	-	Reloading the parameter from E <sup>2</sup> PROM in working RAM
<b>help</b>	-	-	-	Help to the commands, for terminal programs only
<b>para</b>	-	-	-	Parameter list with programmed data, for terminal programs only
<b>din</b>	-	-	-	Status of the digital inputs.
<b>id</b>	-	-	-	Display the module type, version and revision.
<b>w, c, u, ia, ib</b>	-	-	0,01%	Actual signals: command value, actual value, process data...
<b>default</b>	-	-	-	Preset values will be set.

### 5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm<sup>2</sup>, up to 20 m length and of 1.00 mm<sup>2</sup> up to 40m length, for power supply and solenoid connections on versions it is recommended to use cables with a screened sheath connected to earth only on the card side.

#### NOTE 1

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

### 6 - SOFTWARE KIT EWMPC/10 (code 3898401001)

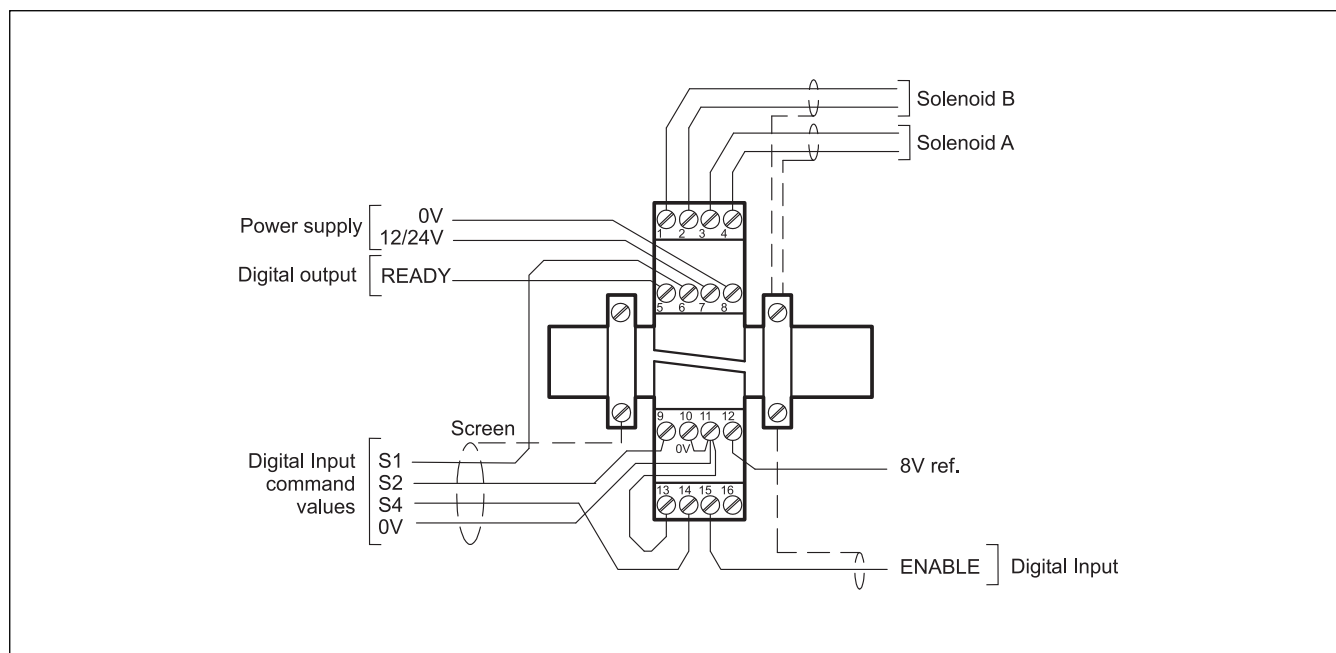
The software kit includes a USB cable (2.70 mt length) to connect the card to a PC or notebook and the software.

During the identification all information are read out of the module and the table input will be automatically generated.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft XP® operating systems.

### 7 - WIRING DIAGRAM



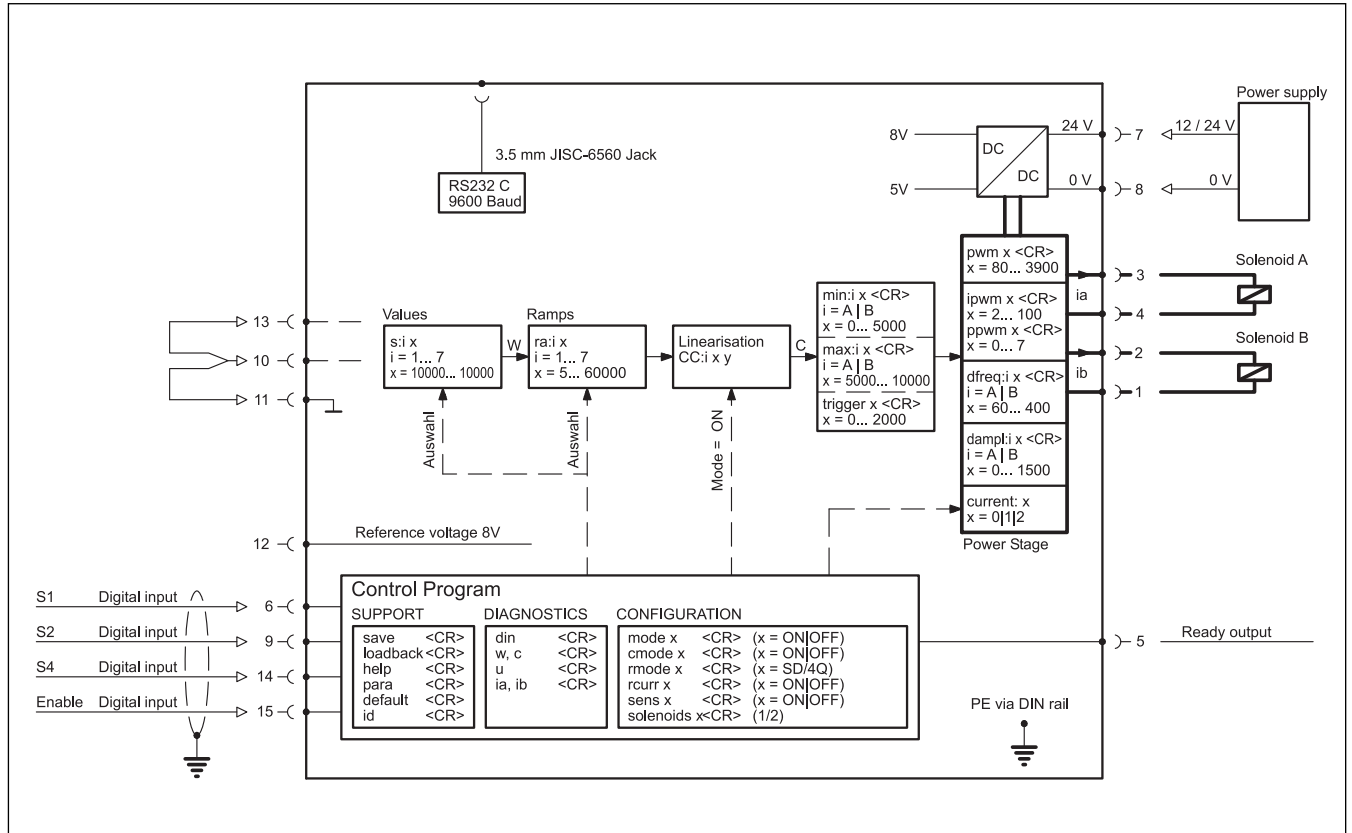
### DIGITAL INPUT AND OUTPUT

- PIN 1/2** PWM outputs for solenoid control. Solenoid B
- PIN 3/4** PWM outputs for solenoid control. Solenoid A  
STATUS output.
- PIN 5** READY output.  
This output is high when ENABLE is active and there is no sensor error. This output corresponds with the green LED.
- PIN 15** ENABLE input:  
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Error conditions are disabling by the ENABLE command.

- PIN 6** Digital control inputs to retrieve the appropriate setpoints. All setpoints, in a storage area be deposited, can be linked binary. S1: Pin 6, S2: Pin 9, S4: Pin 14.
- PIN 9** see the table below.
- PIN 14**

Address	0	1	2	3	4	5	6	7
SEL 1	0	1	0	1	0	1	0	1
SEL 2	0	0	1	1	0	0	1	1
SEL 4	0	0	0	0	1	1	1	1

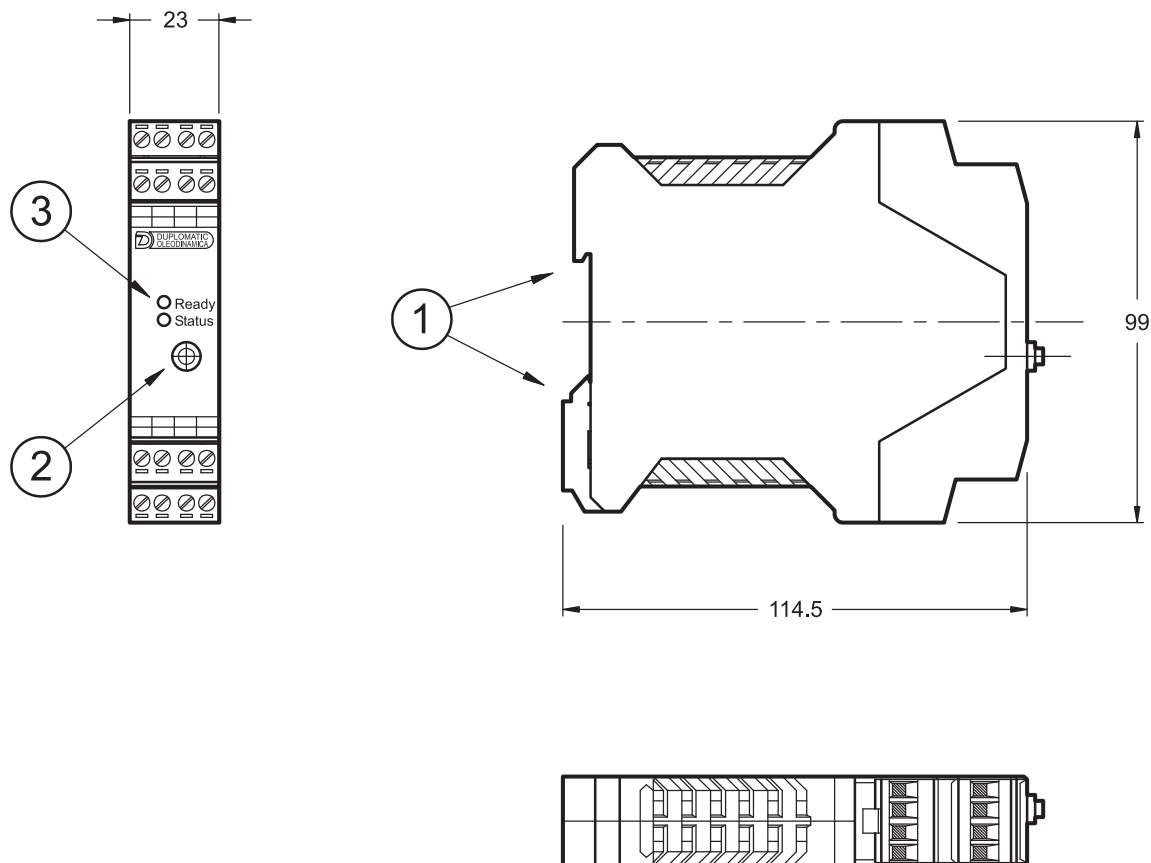
### 8 - CARD BLOCK DIAGRAM







## 9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	Plug for PC cable connection
3	LED for output signals



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# EWM-A-SV

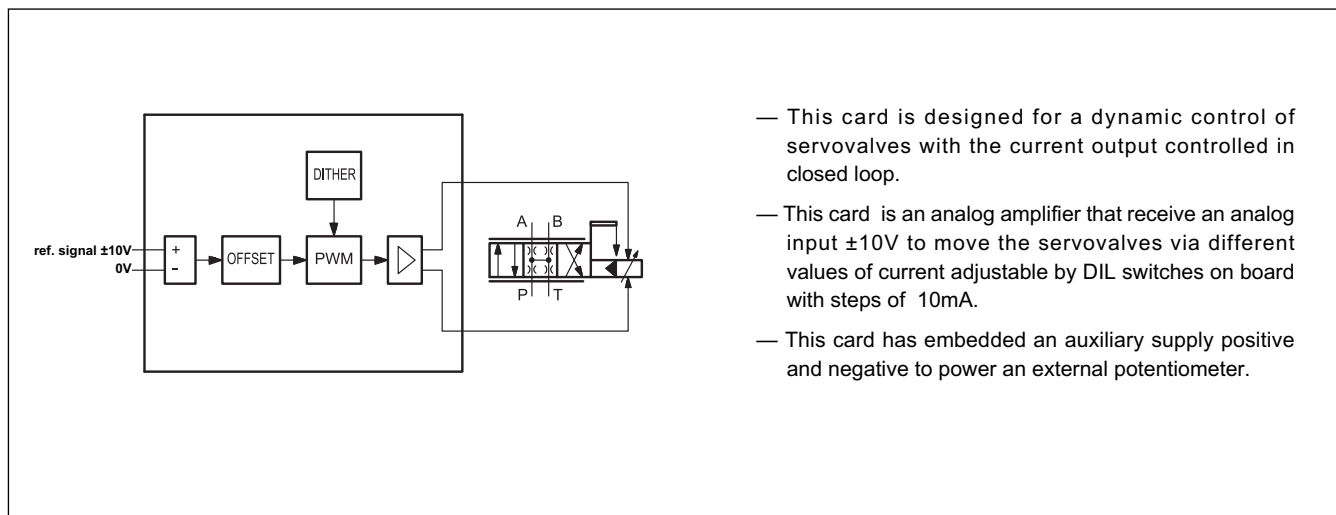
## ANALOG AMPLIFIER CARD

### SERVOVALVE CONTROL

#### SERIES 10

**RAIL MOUNTING TYPE:**  
**DIN EN 50022**

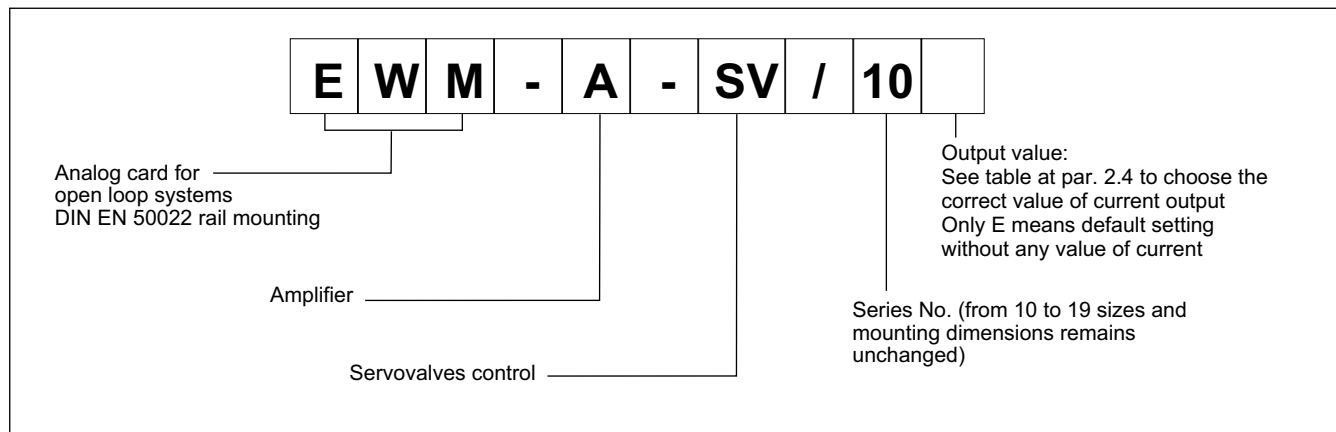
#### OPERATING PRINCIPLE



#### TECHNICAL CHARACTERISTICS

Power supply	V DC	18 ÷ 30 ripple included
Current consumption	mA	100 + solenoid current consumption ( max 300 mA)
Command position value	V	$\pm 10$ ( $R_I = 100 \text{ k}\Omega$ )
Output current	mA	10 to 200 (DIL switches internal selection) ( $R_I = 33 \Omega$ for max I)
Dither Amplitude	Hz %	250 / 100 ( DIL switch internal selection S6) 0...15 (5% pre-adjusted) of current
Offset	%	$\pm 10$
Auxiliary supply	V mA	$\pm 10$ 10
Electromagnetic compatibility (EMC): according to 2004/108/EU standards		Emissions EN 61000-6-4 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 -combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	0 / 50
Protection degree		IP 20

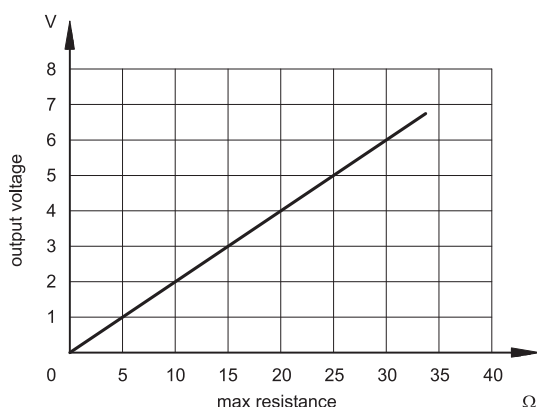
### 1 - IDENTIFICATION CODE



The power amplifier is controlled by an analog input  $\pm 10$  Volt.

The output current is closed loop controlled and therefore independent from the supply voltage and the solenoid resistance.

The diagram below shows as resistance changes in function of output to keep constant current (  $I = 200\text{mA}$  )



### 2 - FUNCTIONAL SPECIFICATIONS

#### 2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode).

#### 2.2 - Electrical protections

All inputs and outputs are protected against overvoltage and have filters.

#### 2.3 - Reference signal

The card accepts an analogue input signal. The command value can be  $\pm 10$  V ( $R_i = 100\text{k}\Omega$ ).

#### 2.4 - Output values

The card has different output values in current between 10mA to 200mA. It is necessary to open the case and inside the card there are internal DIL switches (S1...S5) for the adjustments:

	Current	S1	S2	S3	S4	S5
E	0 mA	OFF	OFF	OFF	OFF	OFF
E10	10 mA	ON	OFF	OFF	OFF	OFF
E20	20 mA	OFF	ON	OFF	OFF	OFF
E30	30 mA	ON	ON	OFF	OFF	OFF
E40	40 mA	OFF	OFF	ON	OFF	OFF
E50	50 mA	ON	OFF	ON	OFF	OFF
E60	60 mA	OFF	ON	ON	OFF	OFF
E70	70 mA	ON	ON	ON	OFF	OFF
E80	80 mA	OFF	OFF	OFF	ON	OFF
E90	90 mA	ON	OFF	OFF	ON	OFF
E100	100 mA	OFF	ON	OFF	ON	OFF
E110	110 mA	ON	ON	OFF	ON	OFF
E120	120 mA	OFF	OFF	ON	ON	OFF
E130	130 mA	ON	OFF	ON	ON	OFF
E140	140 mA	OFF	ON	ON	ON	OFF
E150	150 mA	ON	ON	ON	ON	OFF
E160	160 mA	OFF	OFF	OFF	OFF	ON
E170	170 mA	ON	OFF	OFF	OFF	ON
E180	180 mA	OFF	ON	OFF	OFF	ON
E190	190 mA	ON	ON	OFF	OFF	ON
E200	200 mA	OFF	OFF	ON	OFF	ON

#### 2.5 - Digital Output

The digital output is the POWER ON signal, displayed from the green led.

### 3 - LED FUNCTIONS

There is only one green led.

GREEN: Shows if the card is ready.

- ON - The card is supplied
- OFF - No power supply

## 4 - ADJUSTMENTS

For these cards it is possible the regulation of offset and dither amplitude. It is necessary to open the case and inside the card there are offset and dither potentiometers for the adjustments.

### 4.1 - Offset

With this potentiometer it is possible to adjust the zero point. This module is pre-adjusted, often no further adjustment is necessary.

### 4.2 - Dither

With this potentiometer it is possible to adjust the dither amplitude. The dither amplitude have to be optimised to get best valve or drive performance. Dither adjustment will reduce hysteresis. The frequency range has to be selected by internal DIL switch S6:

S6	Dither
ON	250 Hz
OFF	100 Hz

## 5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm<sup>2</sup>, up to 20 m length and of 1.00 mm<sup>2</sup> up to 40m length, for power supply and solenoid connections on versions it is recommended to use cables with a screened sheath connected to earth only on the card side.

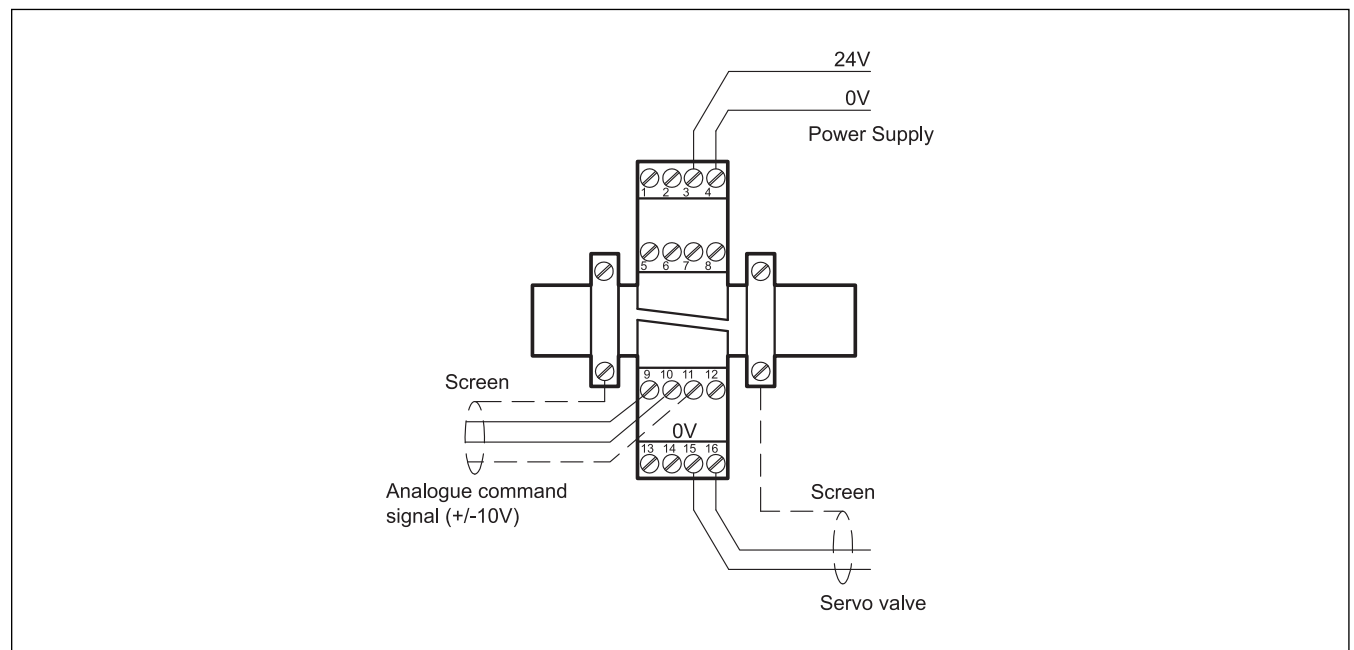
### NOTE

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

## 6 - WIRING DIAGRAM



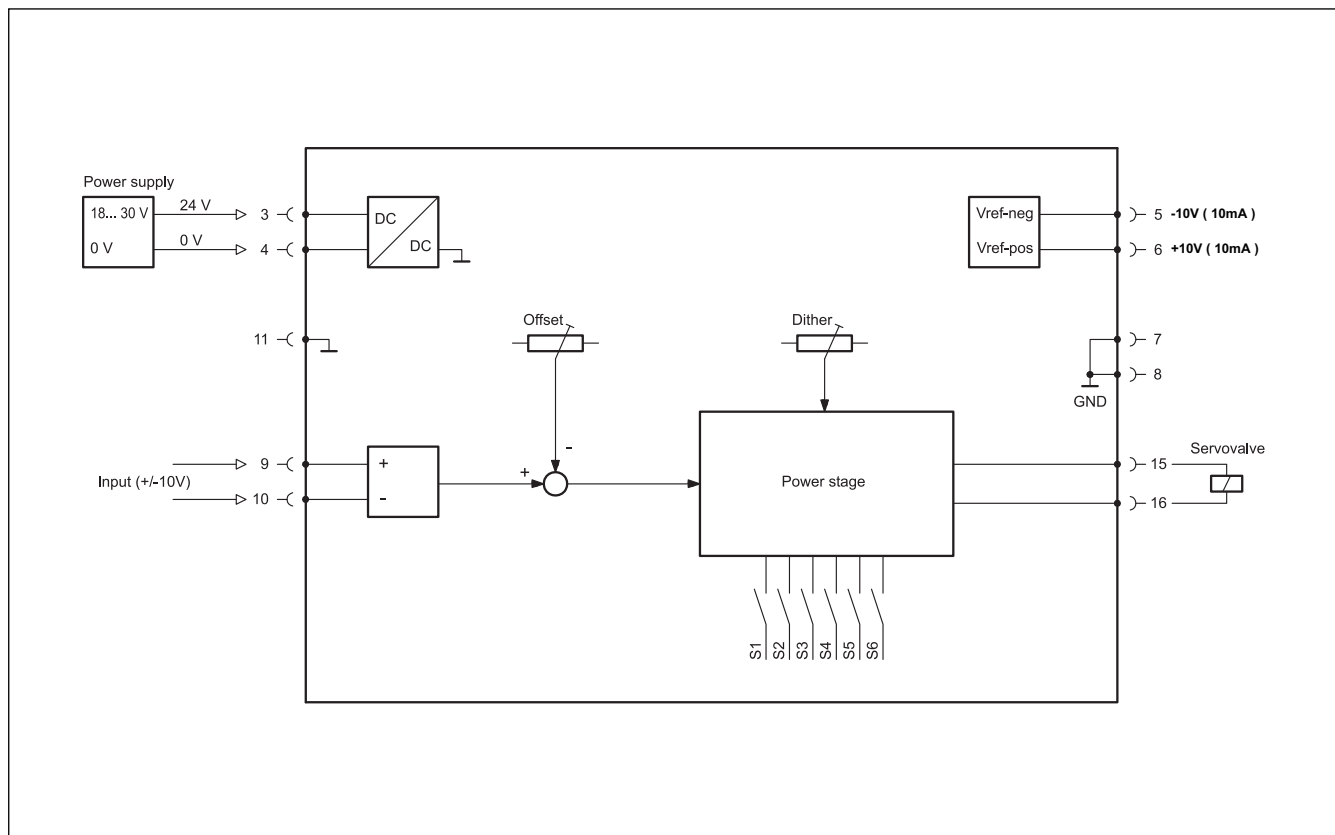
## ANALOG INPUT AND OUTPUT

PIN 15/16 PWM outputs for coils control.

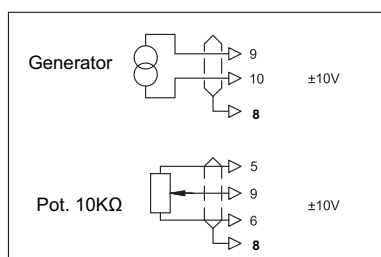
PIN 5/6 Auxiliary supply +10V (PIN 6) and -10V (PIN 5) to power external potentiometer.

PIN 9/10 Reference signal  $\pm 10V$

## 7 - CARD BLOCK DIAGRAM

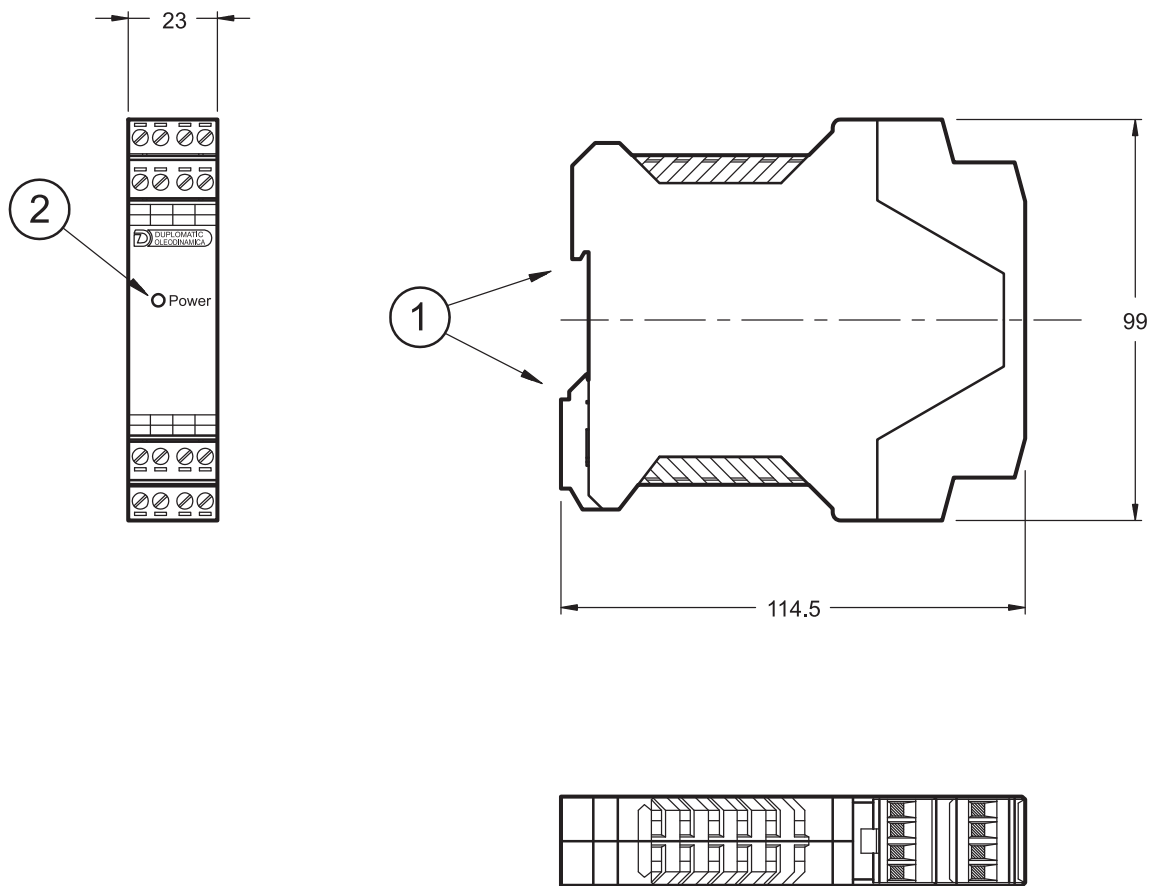


## AVAILABLE COMMAND SIGNALS



**NOTE:** with the potentiometer as reference signal it is necessary to connect PIN 10 with PIN 11.

## 8 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	LED for power on signal



# EWM-A-SV

SERIES 10



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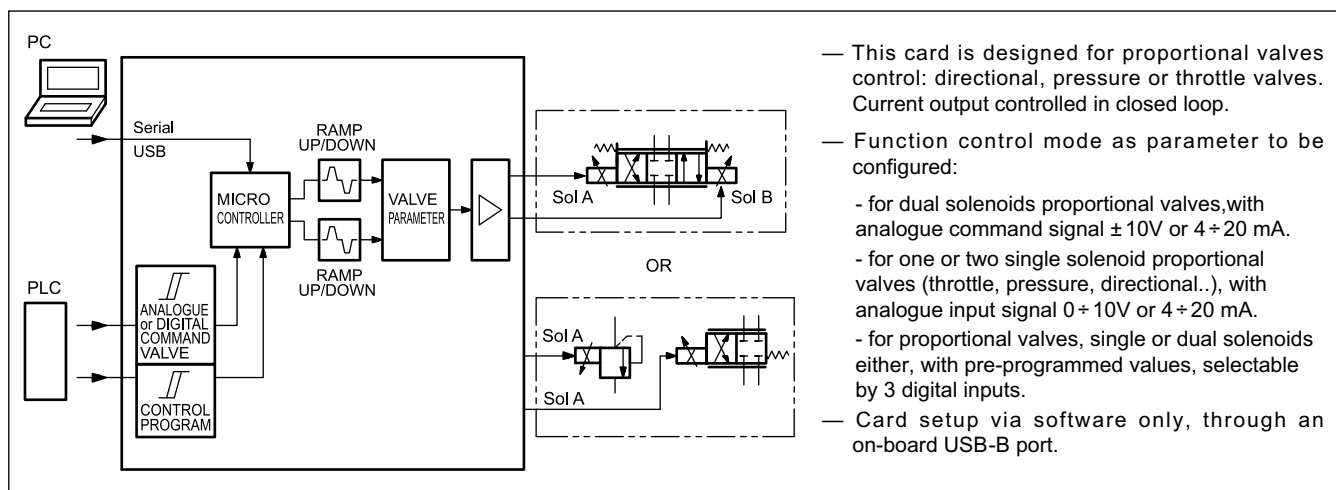
# EWM-A-PV

## UNIVERSAL AMPLIFIER FOR PROPORTIONAL VALVES

### SERIES 20

**RAIL MOUNTING TYPE:  
DIN EN 50022**

#### OPERATING PRINCIPLE

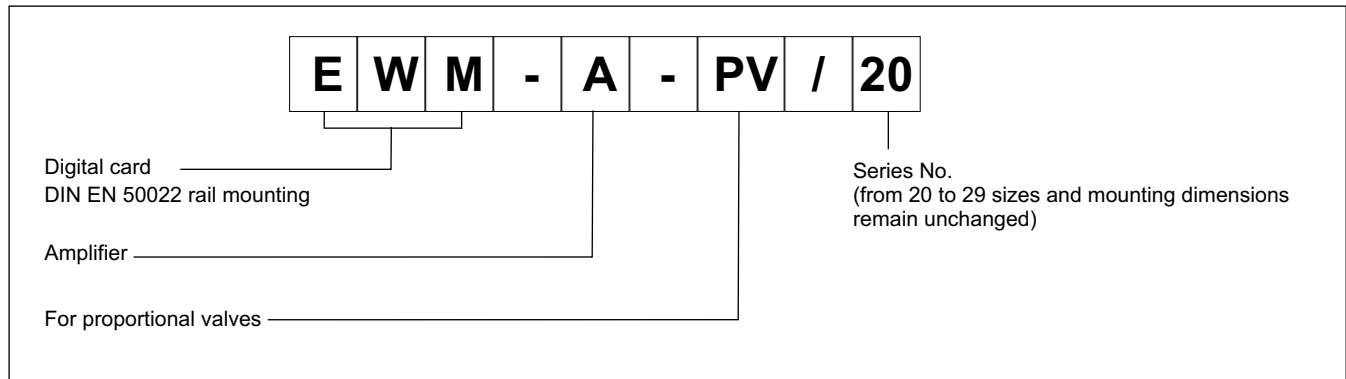


#### TECHNICAL CHARACTERISTICS

Power supply	V DC	12 $\div$ 30 ripple included
Fuse, external	A	3 medium time lag
Current consumption	W	60 depending on type of solenoid, number of operating solenoids
Analogue command values	V mA	$\pm 10$ , $0 \div 10$ ( $R_I = \min 90 \text{ k}\Omega$ ) $4 \div 20$ ( $R_I = 390 \Omega$ )
Analogue inputs value resolution	%	< 0,01
Digital command values	V	OFF: <2V, ON >10V ( $R_I = 25 \text{ k}\Omega$ )
Sample time of solenoid current control	ms	0.125
Sample time	ms	1
Output current	mA	500 $\div$ 2600
PWM frequency	Hz	61 $\div$ 2604 adjustable in prearranged steps
Interface		USB B type 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20



### 1 - IDENTIFICATION CODE



### 2 - FEATURES

#### Controller functions

General power amplifier for 3 different applications:

- control of one proportional directional valve (2 solenoids) with current controlled by analog input signal
- control of one or two single solenoid proportional valves (throttle, pressure, directional..) with output current controlled by analog input signal
- control of proportional valves (with single or double solenoids either) by three digital input signals to select up to eight pre-programmed command and ramp values
- The output current is closed loop controlled: the current to solenoid is closed loop controlled, so is independent from supply and solenoid resistance.
- Parameters programmable via software: Ramps, Dither frequency and amplitude, PWM frequency and PWM gains
- Free scaling of analogue inputs
- Nominal current selectable stepless via software
- The power stage is controlled by an enable input (ENABLE)

#### Adaptation of the valve characteristic curve

- Characteristics linearization of current output via 10 XY-points per direction
- Deadband compensation

#### Monitoring functions

- The output stage is monitored for cable breakdown, is short circuit proof and disables the power stage in case of an error
- Failure monitoring for current analog inputs
- Range monitoring of the input signals (e. g. detecting failures of joystick)

#### Other characteristics

- GL-certification
- Output value in voltage or current, to be configured via software
- Card configuration is made via software, through on-board USB

### 3 - FUNCTIONAL SPECIFICATIONS

#### 3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

**NOTE: The value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoids to be controlled.**

#### 3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

#### 3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; OFF: <2V, ON >10V. Input resistance 25 kΩ. See the block diagrams for the electric connections.

#### 3.4 - Reference signals

This card is broadly customizable and the command value depends on the function mode selected. (FUNCTION parameter). Once the function has been set and the data saved, the input will be configured automatically

##### 3.4.1 - A-PV function, analogue:

± 10V or 4 ÷ 20 mA (one channel, 2 solenoids)

##### 3.4.2 - 2A-PV function, analogue:

0 ÷ 10V or 4 ÷ 20 mA (two independent channels)

##### 3.4.3 -D-RL digital, to be pre-parameterized by parameter

8 pre-programmed values (units %), selectable by 3 digital inputs (8 binary targets).

For both single or dual solenoids proportional valve either.

#### 3.5 - Output value

Output value is in current, value range 500 ÷ 2600 mA.

All cables which lead outside must be screened.

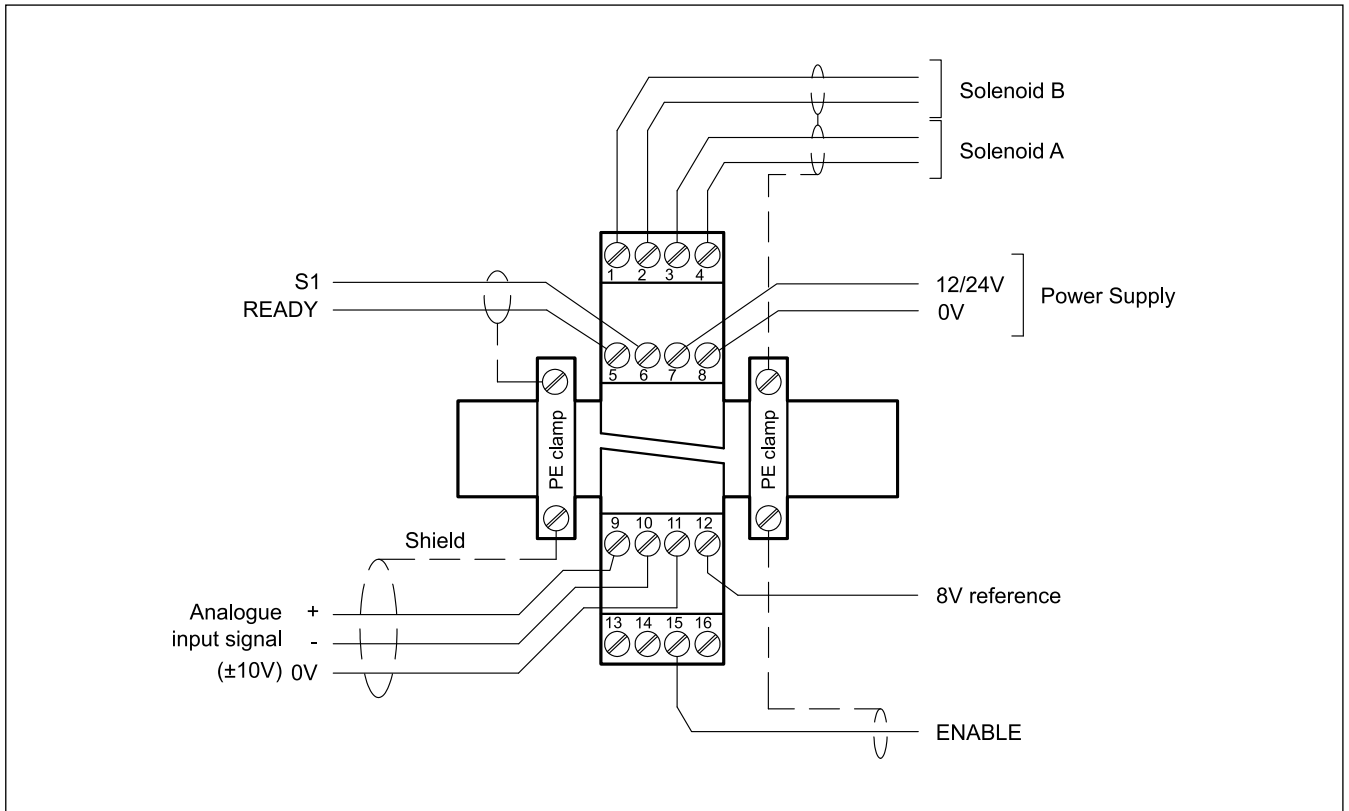
#### 3.6 - Digital outputs

The digital output is READY signal, displayed by the green LED on the front panel.

Low level < 2 V High Level > max V+, where V+ = power supply (max 50 V).

## 4 - WIRING DIAGRAMS

### 4.1 - FUNCT A-PV: analogue signal for dual solenoids directional valve



#### DIGITAL INPUT AND OUTPUT

PIN	READY output.
5	ON: No internal or external errors are detected OFF: ENABLE (PIN 15) is deactivated or an error is detected
PIN	S1 input:
6	Function dependent on parameter PIN:6 (USCALE/RAMP). OFF: Output current depends on parameter USCALE / ramp function is deactivated. ON: Output current is not scaled by USCALE / ramp function is activated.
PIN	ENABLE input
15	This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. By deactivating this input the errors signals are reset.

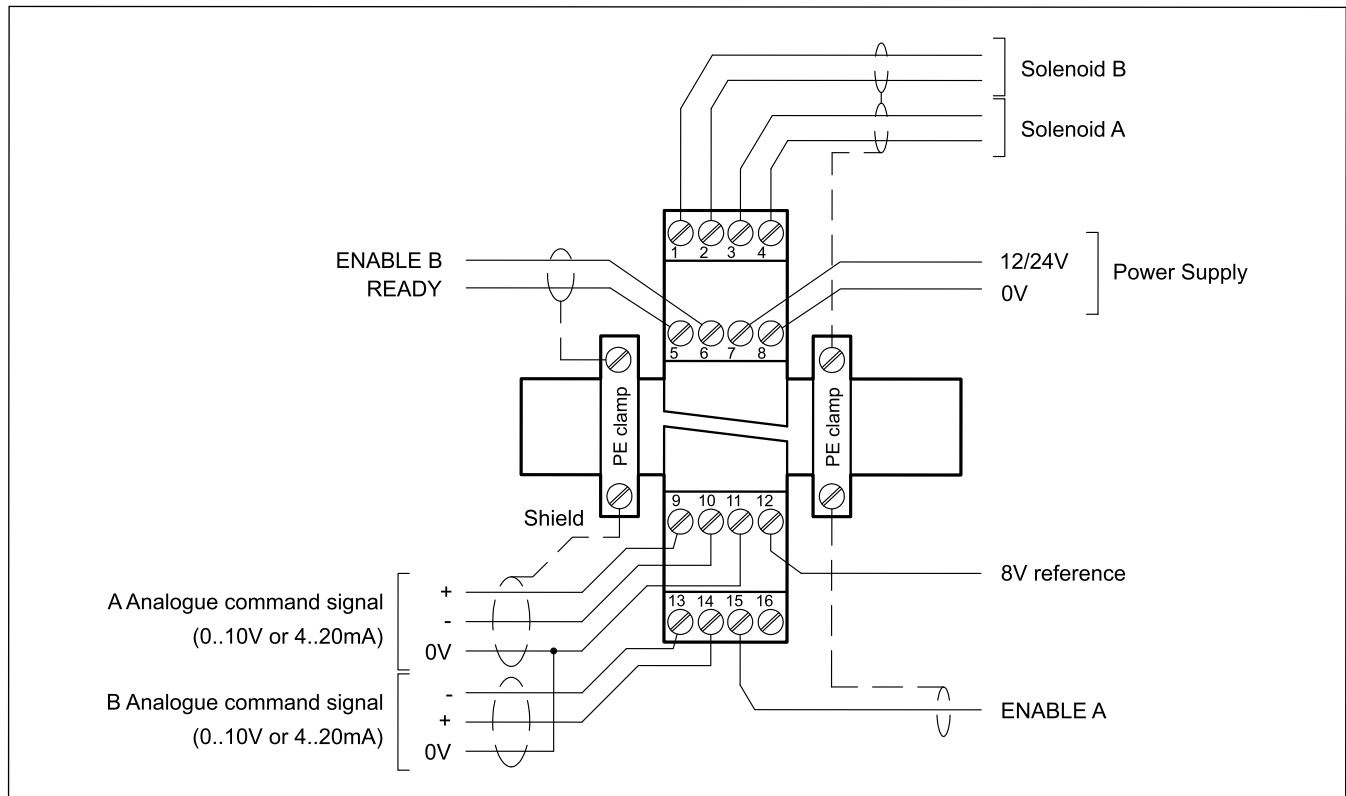
#### ANALOGUE INPUT

PIN	0V reference for the signal inputs.
11	<b>Warning!</b> PIN 11 and PIN 8 are connected internally
PIN	Command input signal (w)
10/9	range -100...+100% corresponds to $\pm 10V$ or $4 \pm 20$ mA

#### POWER OUTPUT

PIN	PWM outputs for solenoid control. Solenoid B
1/2	
PIN	PWM output for valve control.
3/4	
PIN	8V reference output (max. 25mA)
12	

### 4.2 - FUNCTION 2A-PV: analogue signal, two independent channels, for up to two single solenoid valves



#### DIGITAL INPUT AND OUTPUT

- PIN 5** READY output.  
 ON: No internal or external errors are detected.  
 OFF: Both power stages are deactivated or an error is detected.  
 This output is visible on the green LED
- PIN 6** ENABLE Input Channel B (dependent on ENABLE\_B parameter):  
 This digital input signal initializes the application.  
 The output and the READY signal will be activated.  
 By deactivating error signals are reset.
- PIN 15** ENABLE Input channels A/B or channel A either (dependent on ENABLE\_B parameter: if set to OFF, digital input PIN 15 enables both output channels. if ON, the two enable are independent)  
 This digital input signal initializes the application.  
 The output and the READY signal will be activated.  
 By deactivating this input the errors signals are reset.

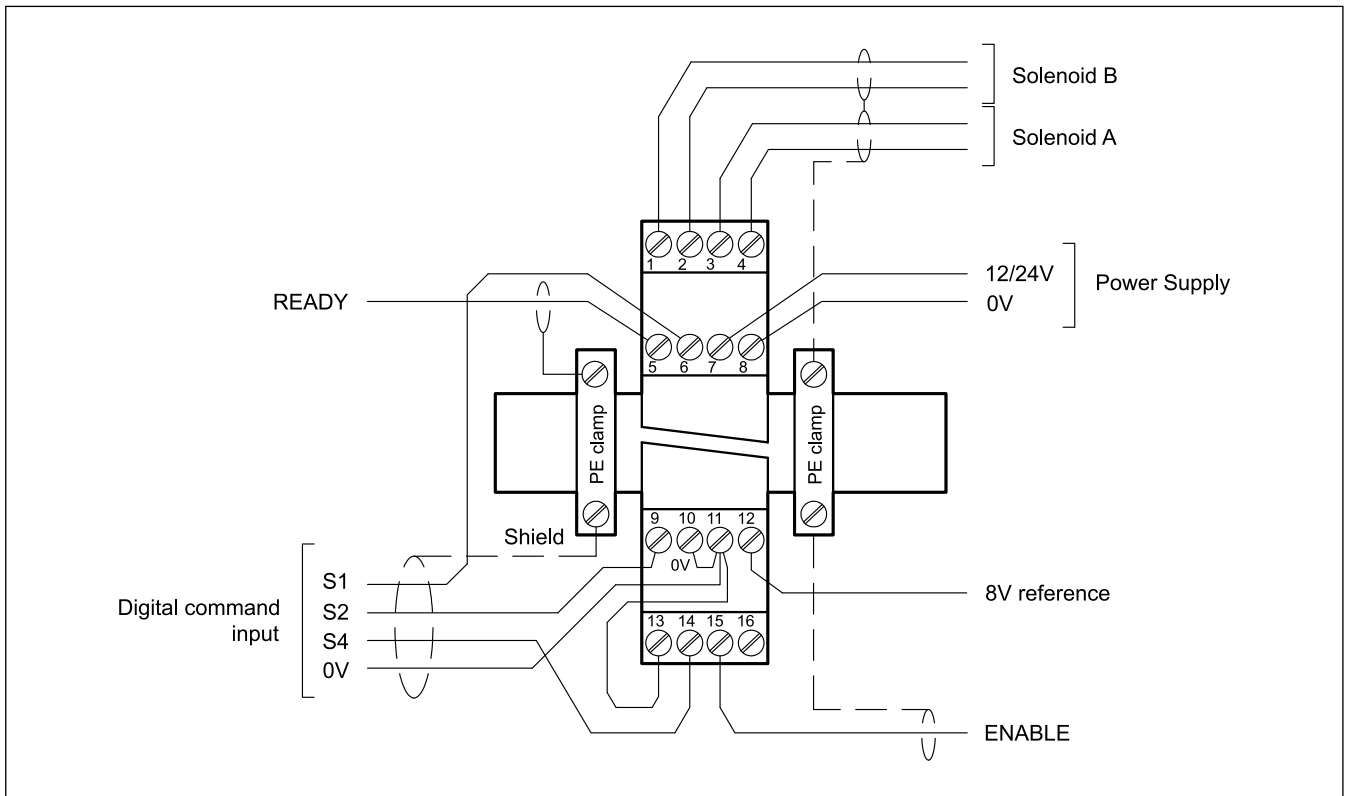
#### ANALOGUE INPUT

- PIN 11** 0V reference for the signal inputs.  
**Warning!** PIN 11 and PIN 8 are connected internally
- PIN 10/9** Command input signal A (wa)  
 range 0 ÷ 100%  
 corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN 13/14** Command input signal B (wb)  
 range 0 ÷ 100%  
 corresponds to 0 ÷ 10V or 4 ÷ 20 mA

#### POWER OUTPUT

- PIN 1/2** PWM outputs for solenoid control. Solenoid B
- PIN 3/4** PWM outputs for solenoid control. Solenoid A
- PIN 12** 8V reference output (max. 25 mA)

## 4.3 - FUNCT D-RL: preset digital inputs



### DIGITAL INPUT AND OUTPUT

- PIN 5** READY output.  
ON: No internal or external errors are detected  
OFF: ENABLE (PIN 15) is deactivated or an error is detected
- PIN 6, 9, 14** Digital gate inputs for selecting the command value:  
PIN 6: S1 PIN 9: S2 PIN 14: S4  
The whole range of set points can be chosen by binary coding of these inputs.  
see the table below.

Address	0	1	2	3	4	5	6	7
<b>S1</b>	0	1	0	1	0	1	0	1
<b>S2</b>	0	0	1	1	0	0	1	1
<b>S4</b>	0	0	0	0	1	1	1	1

- PIN 15** ENABLE input  
This digital input signal initializes the application.  
The output and the READY signal will be activated.  
By deactivating this input the errors signals are reset.

### POWER OUTPUT

- PIN 1/2** PWM outputs for solenoid control. Solenoid B
- PIN 3/4** PWM output for valve control.
- PIN 12** 8V reference output (max. 25mA)

## 5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm<sup>2</sup> up to 20 m length, and of 1.00 mm<sup>2</sup> up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

**NOTE :** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

### 5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.



**WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs. They interfere with the current control and can destroy the output stage.**

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

## 6 - DEVICE SETUP

Card set-up is possible via software only.

### 6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.



**WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

### 6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the *Technical Manual 89620 ETM*.

## 7 - MAIN FEATURES

### 7.1 - Applications

The power amplifier (D-RL function) is controlled by an enable input and three switch signals. Therefore 8 demand values can be activated binary.

In the event of analogue control (A-PV function) it's possible to preset the directions with two inputs and switch over between rapid and slow speed with the third input.

The output current is closed loop controlled and therefore independent from the supply voltage and the solenoid resistance.

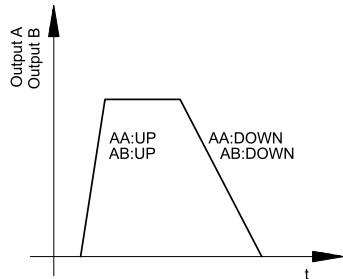
The output signal (of up to 2.6A) can control a variety of valves which need a flexible adaptation of the solenoid control, such as pressure relieve valves and pressure control valves, directional and throttle valves as such no on-board electronics are needed.

### 7.2 - Ramp function /acceleration time

The parameters for ramp up and ramp down can be set in milliseconds. These values are the amount of time that the command signal will take to follow a step change in the reference signal.

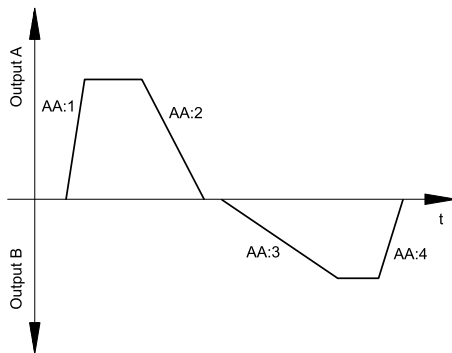
#### for 2A-PV

Two quadrant ramp function.



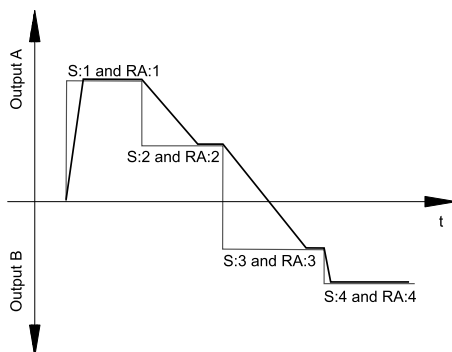
#### for A-PV

Four quadrants ramp function.



#### for D-RL

This configuration can take advantage either of the same four quadrant ramp function of A-PV or assign a ramp time for every command value (parameter RMODE)

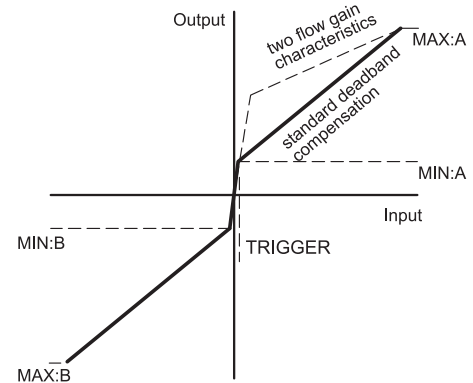


### 7.3 - Adaption of the output signal to the valve characteristics (TRIGGER)

With the MAX value, the maximum output can be easily defined. With the MIN value, the overlap (dead band of the valve) can be compensated. Via the TRIGGER the activation point of the MIN function is set and so a non-sensitive range around the zero-point can be specified.

If the MIN value is set too high, it influences the minimal pressure, which cannot be adjusted any longer. In extreme case this causes to an oscillating at small input values.

The diagram below is valid for A-PV and D-RL configuration. For 2A -PV please consider just the 1st quadrant.



### 7.4 - Linearization (CCA, CCB, CC)

A user defined signal characteristic can be set by switching on the CCMODE parameter.

The influence of the user defined linearization can be estimated via the process data on the monitor or on the oscilloscope on EWMPC/20 software.

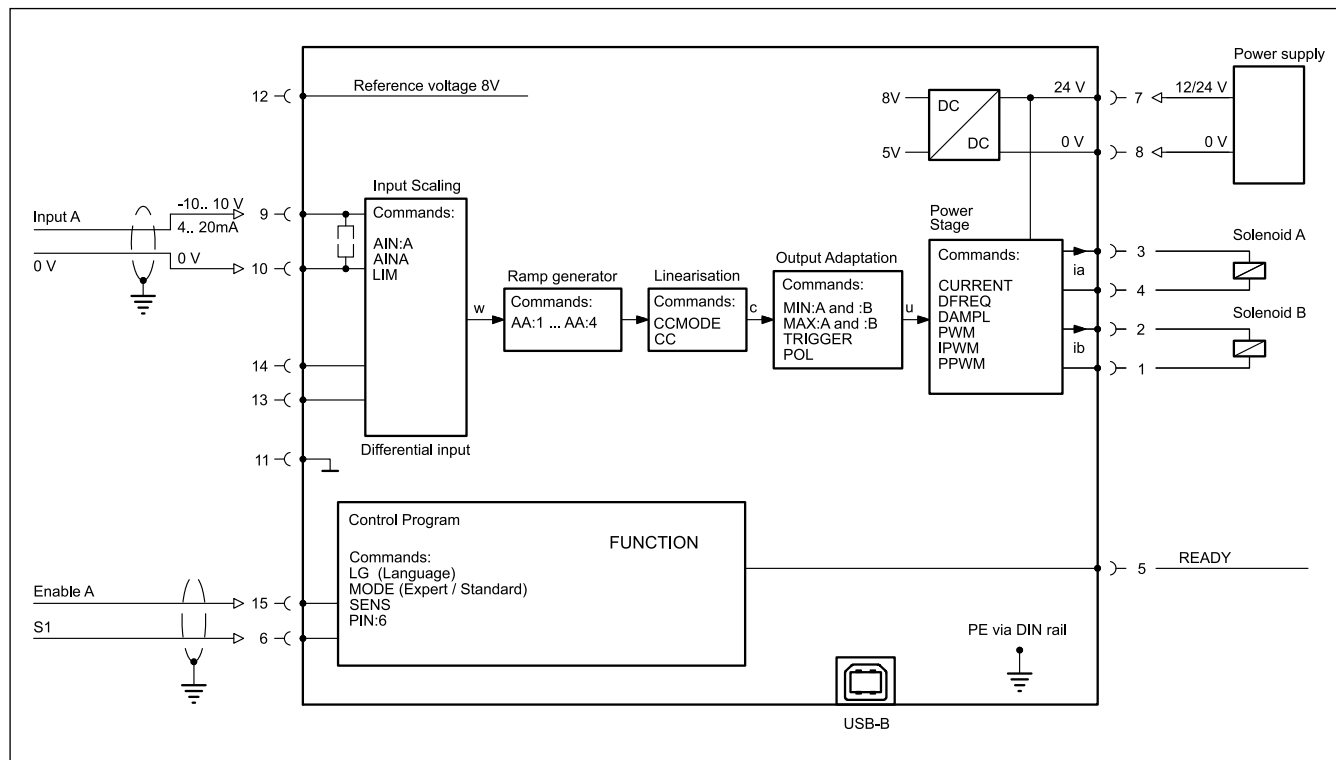
By deactivating CCMODE a simple and quick estimation of the linearization is possible

### 7.5 - Power Amplifier

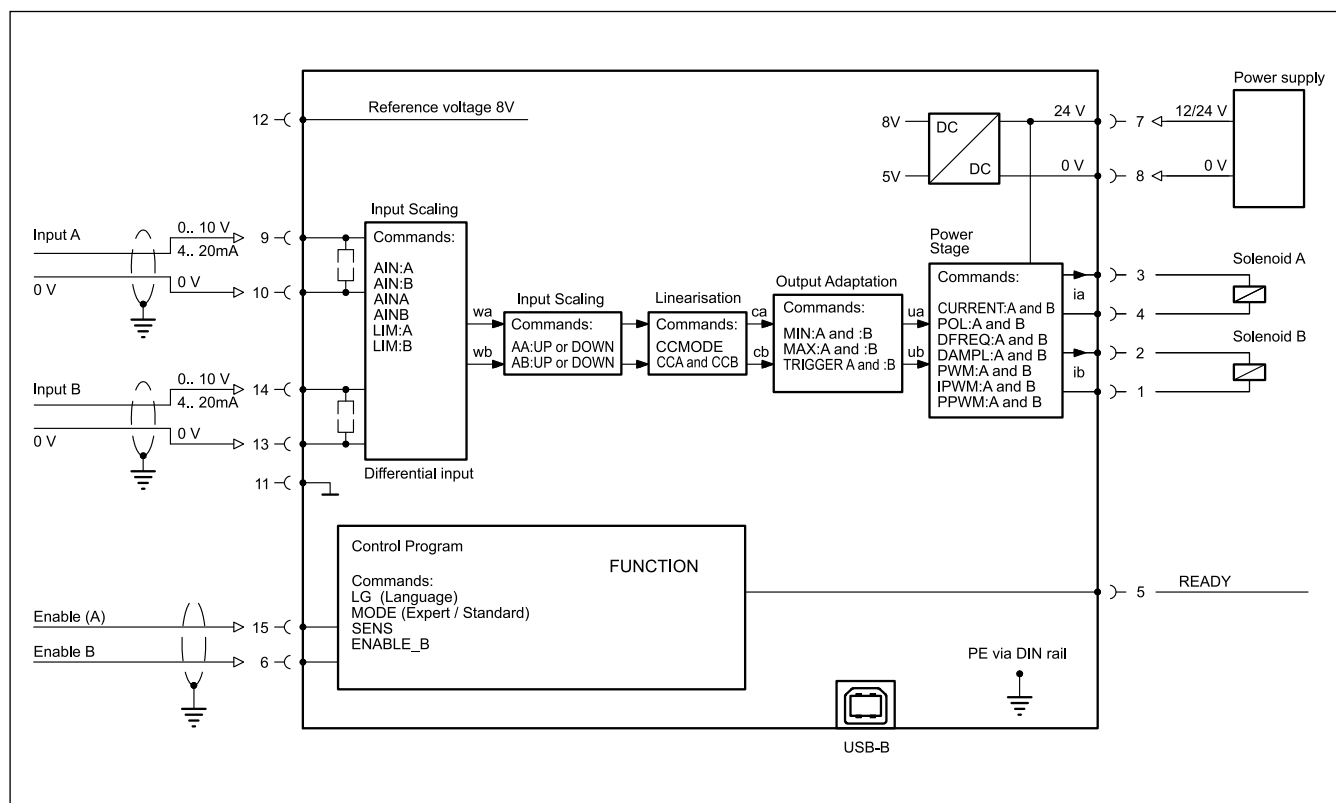
The module comes with an embedded power amplifier that is capable to generating a PWM current signal of up to 2.6A. As such the nominal current, dither, frequency and the various parameters of the current loop can be accessed and modified.

### 8 - CARD BLOCK DIAGRAMS

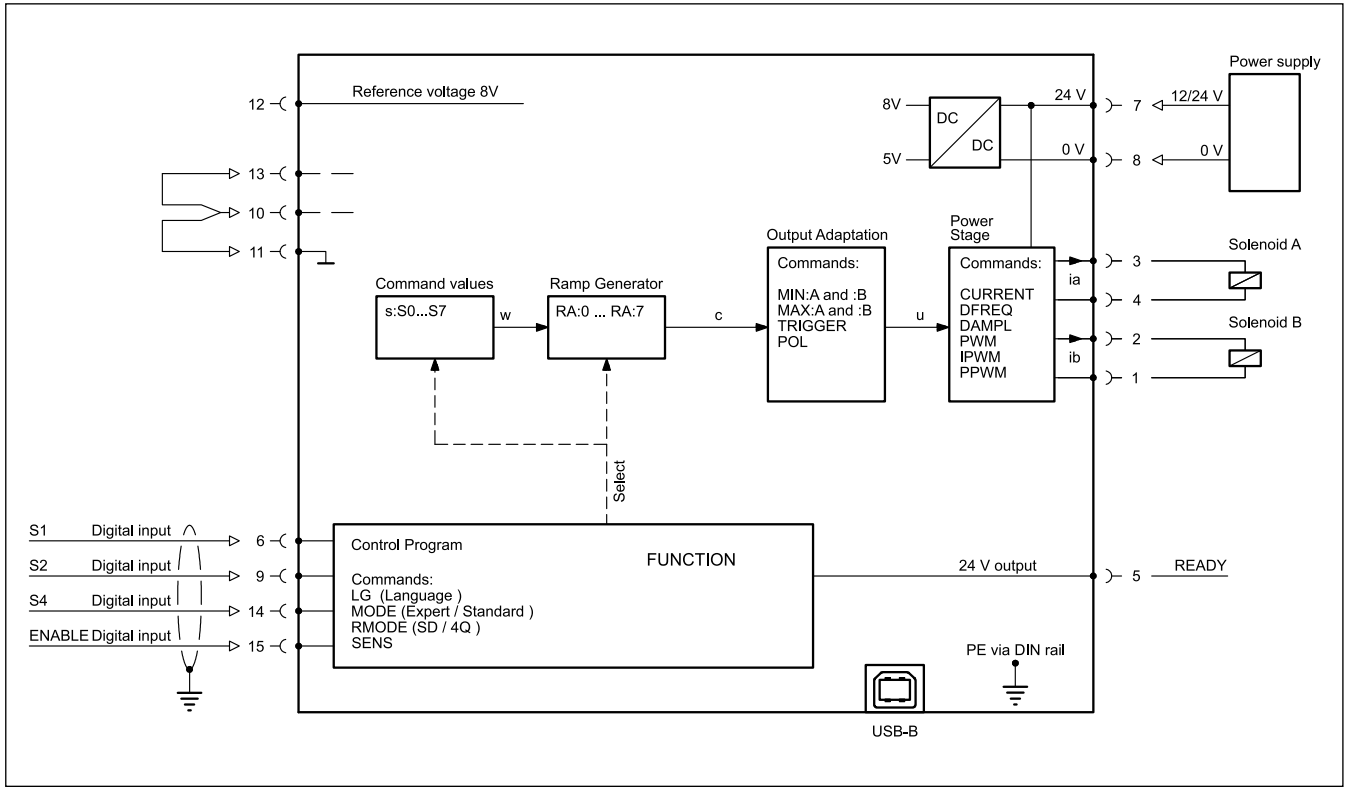
#### 8.1 - function A-PV



#### 8.2 - function 2A-PV



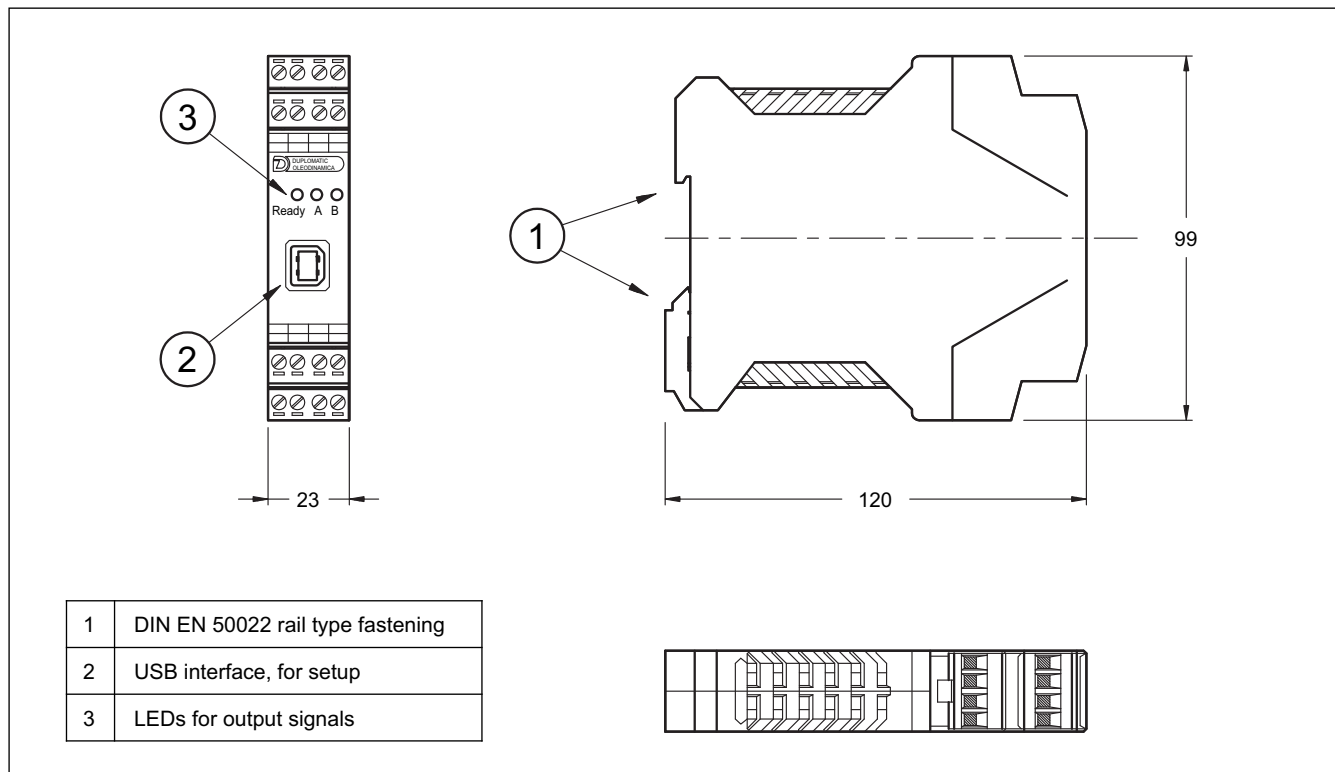
### 8.3 - function D-RL







## 9 - OVERALL AND MOUNTING DIMENSIONS



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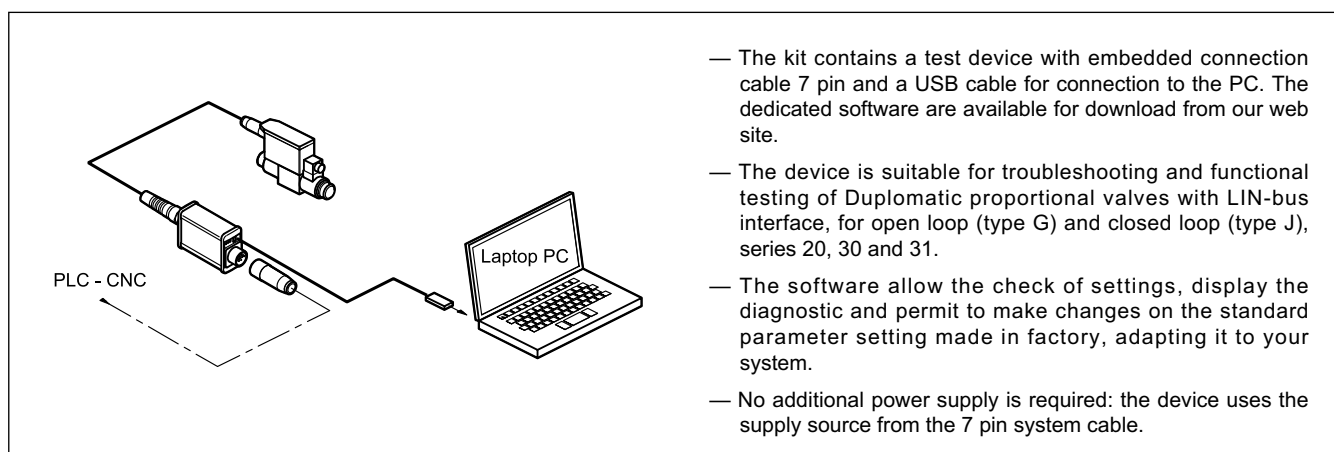


# LINPC-USB

## TEST DEVICE FOR PROPORTIONAL VALVES WITH INTEGRATED ELECTRONICS

### SERIES 30

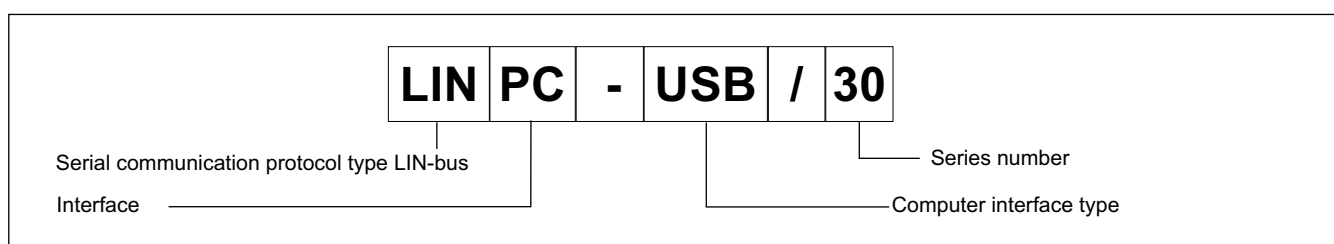
#### OPERATING PRINCIPLE



#### TECHNICAL CHARACTERISTICS

Power supply	V CC	24 (19 + 30)
Current consumption	mA	50
Connector to the valve		7 - pin MIL-C-5015-G (DIN 43563)
Connection cable		USB 2.0
Electromagnetic compatibility (EMC) :		according to 2004/108/EC EN 61000-6-4 (emissions) EN 61000-6-2 (immunity)
Housing dimensions	mm	104x63x38 + 2000 outgoing cable
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

#### 1 - IDENTIFICATION CODE





# LINPC-USB

## SERIES 30

### 2 - DESCRIPTION

The device acts as interface between the PC and the valve on-board electronics. It allows the customization of the parameters via software and diagnostics and troubleshooting, by means of the internal monitors available in the software (EBC for series 30, EWMPC for series 20).

The kit contains:

- test device with integrated 7-pin cable to be connected to the valve
- USB Cable 2.0 A - Male to Micro B (3 m).

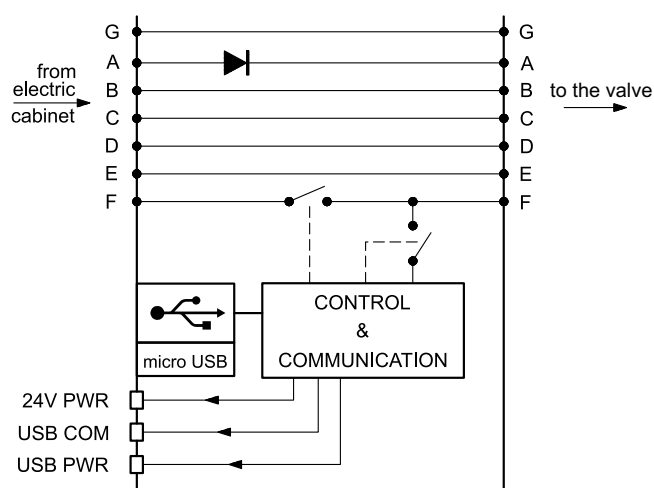
**⚠ The USB cable cannot be longer than 3 m, in order to maintain the communication quality.**

Software and customization Guide are available for download at [www.diplomatic.com](http://www.diplomatic.com), 'Documents & downloads'.

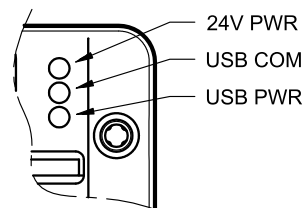
The EBC software is compliant with Windows OS 7, 8 and 10.

More details on device operation are available in the Software Guide.

### 3 - BLOCK DIAGRAM



### 4 - LED

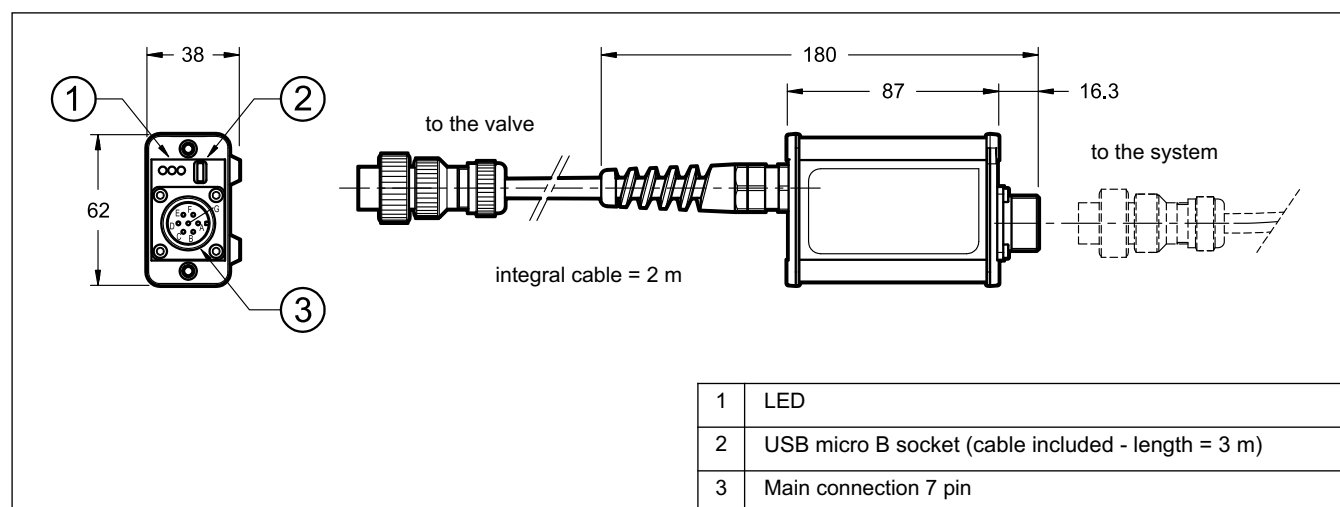


function	description
24V PWR (24V powered)	Main power supply via 24V (pin A) green LED indicates the device is powered by 24 V source on pin A of the 7-pin connector.
USB COM	USB communication red = [TX] transmission green = [RX] receiving
USB PWR (USB powered)	USB supply yellow indicates that the USB section is powered.



**WARNING! Connecting the device will cut off the pin F monitor signal from the valve, in order to allow the LINbus communication. This behaviour can be managed via software.**

### 5 - OVERALL DIMENSIONS



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# PSC

## CARD HOLDERS FOR ELECTRONIC CONTROL UNITS IN EUROCARD FORMAT

### SERIES 20

IEC 60603-2 (DIN 41612)

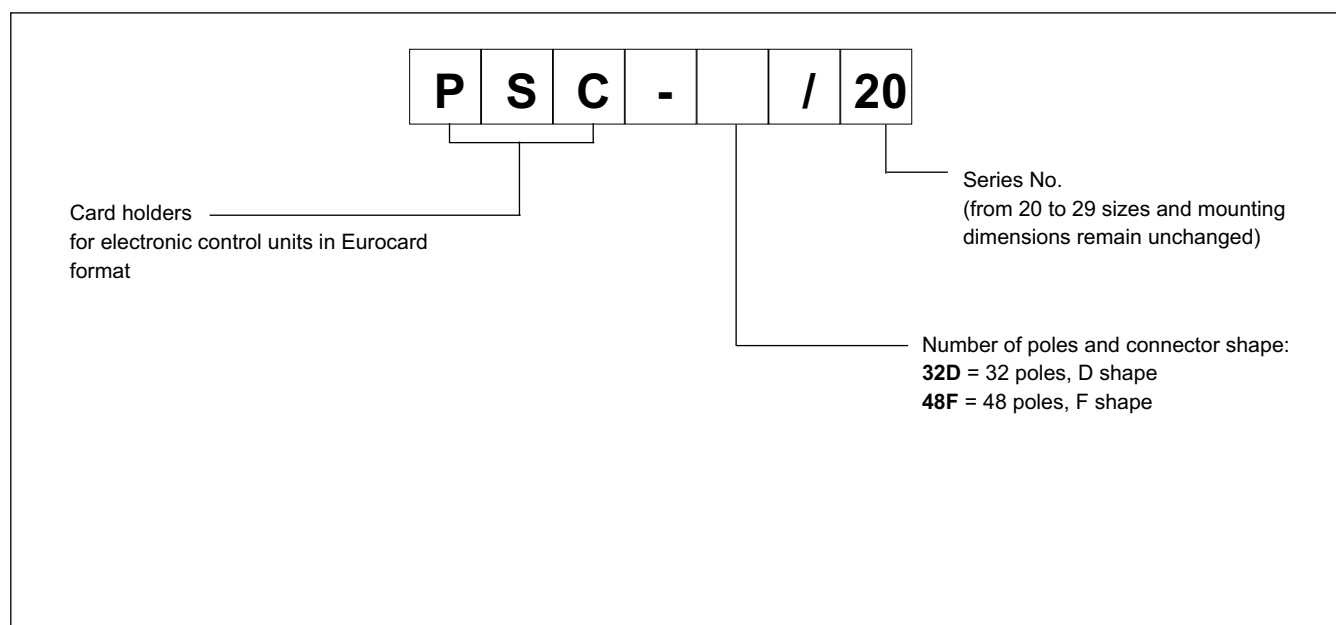
#### TECHNICAL CHARACTERISTICS

CARD HOLDER TYPE		32D	48F
Connector type		IEC 603 / DIN 41612 female	
Number of poles		32	48
Connector shape		D	F
Nominal voltage	V	250	
Nominal current	A	4	
Flexible conductors max section	mm <sup>2</sup>	2,5	
Stiff conductors max section	mm <sup>2</sup>	4	
Conductors wiring		terminal block with fastening bolts	

#### DESCRIPTION

- The card holders type PSC are accessories suitable to be installed on electronic control units type UEIK.
- They are available with a IEC 603 / DIN 41612 connector, with a female fitting, either D shape 32 poles, or F shape 48 poles.
- They are supplied with a special safety locking, which blocks the electronic control unit and prevents any accidental contact loss between the two used connectors.
- The conductor wiring is carried out via a terminal block with fastening bolts.
- They can be installed inside a switchboard and be fixed directly on a plate.

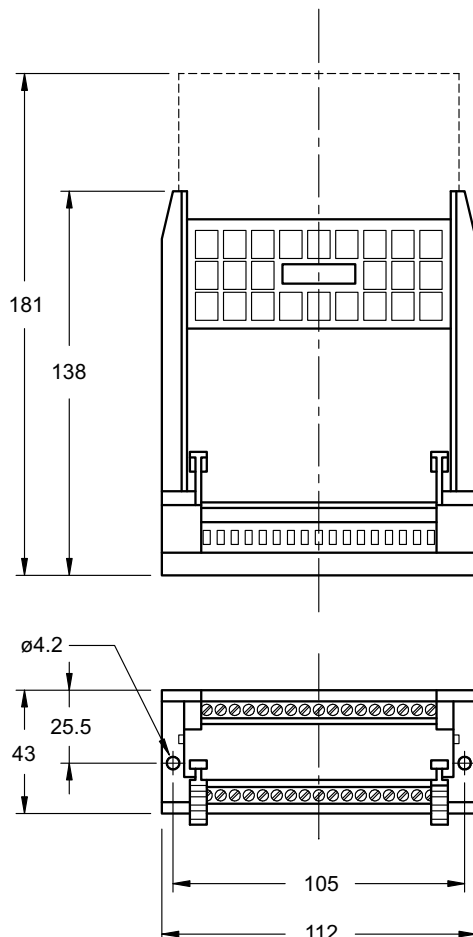
#### 1 - IDENTIFICATION CODE



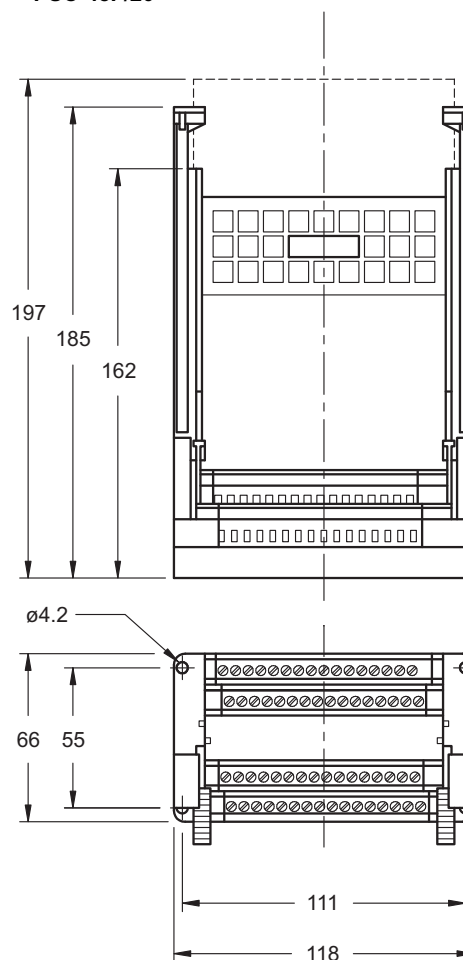
## 2 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

**PSC-32D/20**



**PSC-48F/20**





# M63

## PRESSURE GAUGE

SERIES 10

according to EN 837-1

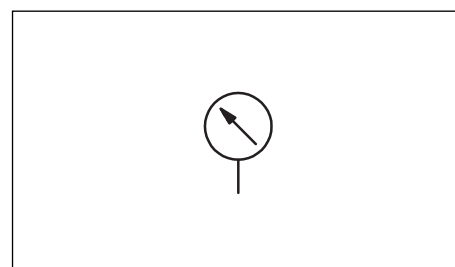
### TECHNICAL CHARACTERISTICS

Nominal diameter	mm	63
Nominal pressure	bar	<div>0 ÷ 6    0 ÷ 10    0 ÷ 16</div> <div>0 ÷ 25    0 ÷ 60    0 ÷ 100</div> <div>0 ÷ 160    0 ÷ 250    0 ÷ 400</div>
Static pressure	3/4 of the end scale value	
Dynamic pressure	2/3 of the end scale value	
Limit pressure	end scale value for short period	
Precision class according to EN 837-1	1,6	
Thermal drift	± 0,4% / 10K in the measure range	
Protection class according to EN 60529 / IEC 60529	IP65	
Ports according to EN 837-1	1/4" BSP	
Ports material	copper alloy	
Sensible element: 0 ÷ 6,    0 ÷ 10,    0 ÷ 16,    0 ÷ 25, 0 ÷ 60. 0 ÷ 100, 0 ÷ 160,    0 ÷ 250,    0 ÷ 400.	copper alloy, type-C, brazing welding spring copper alloy, helical, brazing welding spring	
Movements	copper alloy	
Dial	white plastic with lock pins in black plastic	
Case	stainless steel with natural finishing, and OR between case and shank	
Display	transparent plastic	
Filling liquid	glycerin 85% + distilled water 15%	
CE Marking	in compliance with PED 2014/68/EU	
Working temperature range	°C	-20 / +60
Mass	kg	0,24

### DESCRIPTION

- The pressure gauges M63 are pressure indicators used on hydraulic systems.
- They guarantee a correct pressure measurement also with pulsations and vibrations.
- They are available in 9 different pressure scales and with 2 connection types for mounting with radial port or rear port with flange connector.
- The case is made of stainless steel and the connection is made of copper alloy.
- The filling in liquid is made of 85% glycerin and 15% distilled water.
- The pressure gauges with a end scale of 250 bar and 400 bar are equipped with the CE mark on the dial for the fluid group 1 according to Annex II, scheme 1 of the PED directive 2014/68/EU. All the others do not need the CE marking, as per art. 4, sec. 3 of the same directive.
- The construction and the realisation have been done according to EN 837-1.

### HYDRAULIC SYMBOL



## 1 - IDENTIFICATION CODE

<b>M</b>	<b>63</b>	<b>-</b>		<b>/</b>	<b>10</b>	
----------	-----------	----------	--	----------	-----------	--

Pressure gauge \_\_\_\_\_

Dial nominal diameter \_\_\_\_\_  
**63** = 63 mm

Pressure gauge scale \_\_\_\_\_

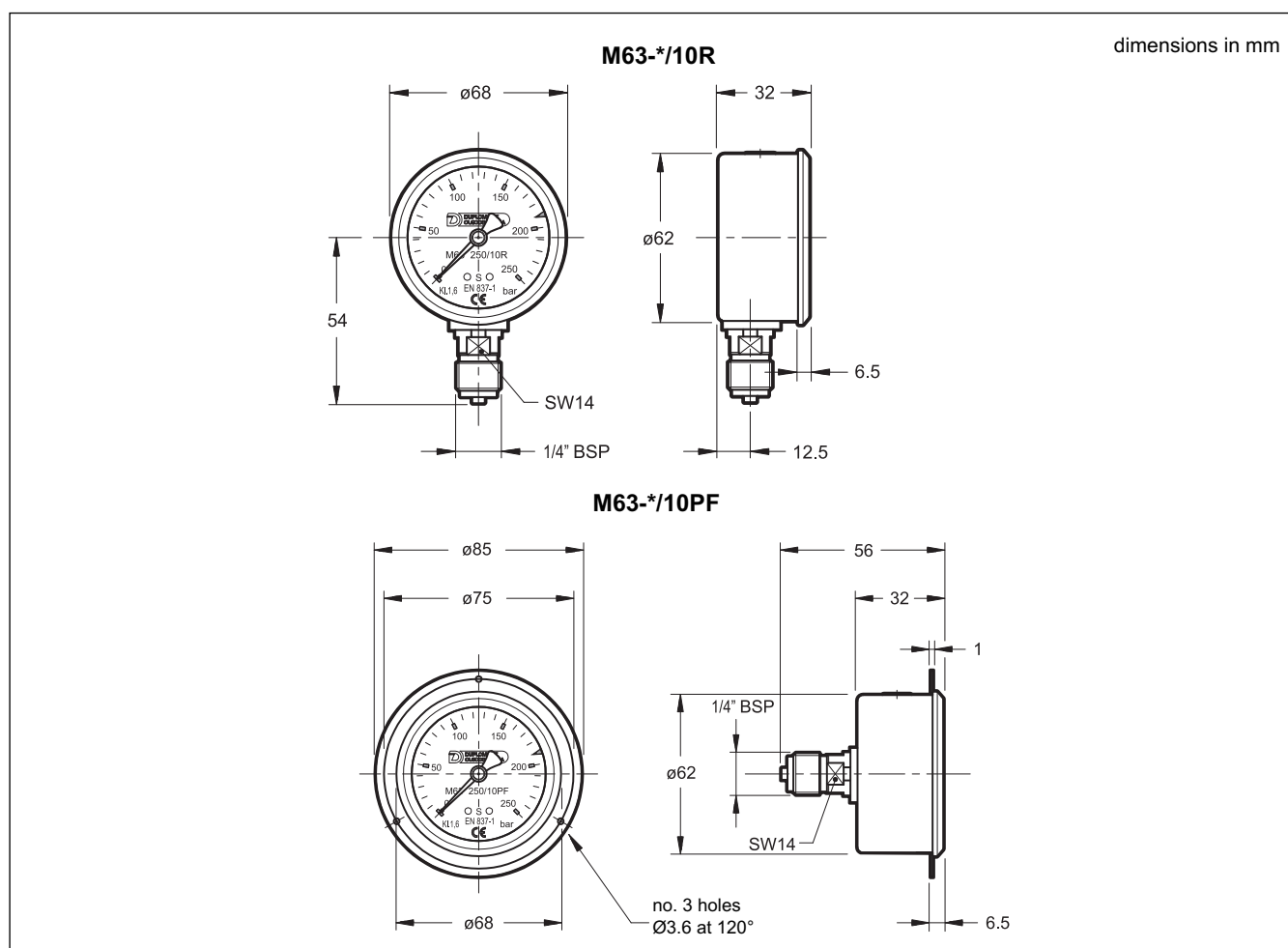
<b>006</b> = 0 ÷ 6 bar	<b>060</b> = 0 ÷ 60 bar	<b>400</b> = 0 ÷ 400 bar
<b>010</b> = 0 ÷ 10 bar	<b>100</b> = 0 ÷ 100 bar	
<b>016</b> = 0 ÷ 16 bar	<b>160</b> = 0 ÷ 160 bar	
<b>025</b> = 0 ÷ 25 bar	<b>250</b> = 0 ÷ 250 bar	

Connection type:  
**R** = radial connector  
**PF** = flange connector

Series No.  
(the overall and mounting dimensions remain unchanged from 10 to 19)

**NOTE:** Models No. 006, 010, 016 and 025 are available with radial connector (**R**) only.

## 2 - OVERALL AND MOUNTING DIMENSIONS





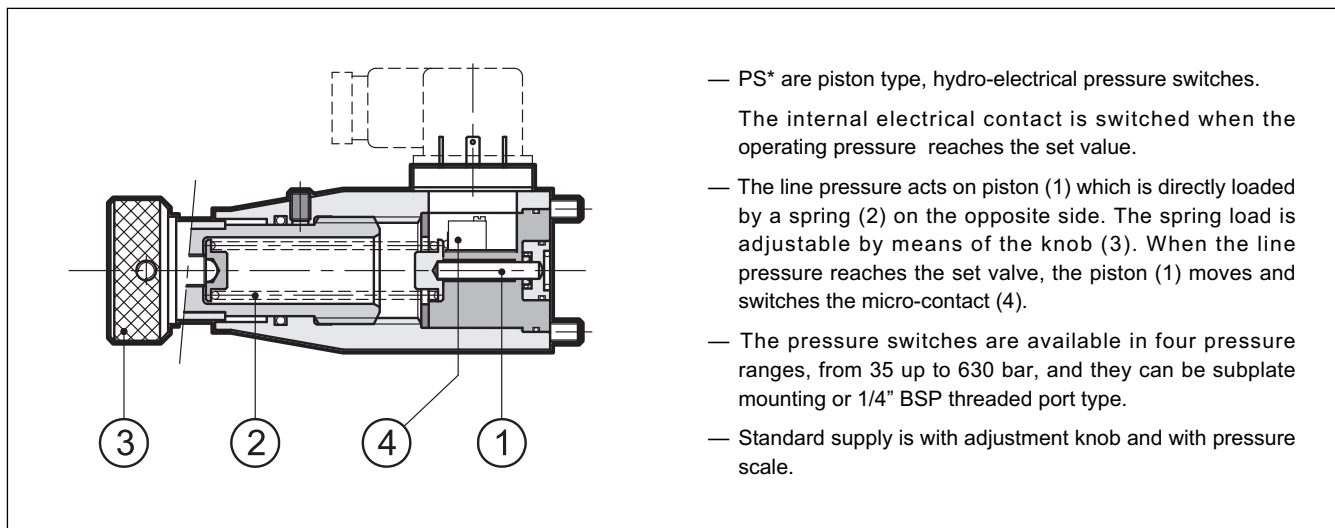
# PS\*

## PISTON TYPE PRESSURE SWITCH

### SERIES 21

**p max 650 bar**  
**max adjustable p 35 - 140 - 350 - 630 bar**

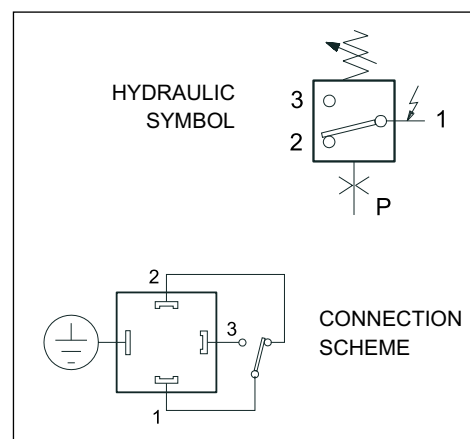
#### OPERATING PRINCIPLE



#### TECHNICAL CHARACTERISTICS

PRESSURE SWITCH		PS*2	PS*4	PS*6	PS*8
Pressure adjustment range	bar	3 ÷ 35	6 ÷ 140	10 ÷ 350	20 ÷ 630
Max operating pressure	bar	350	350	650	650
Hysteresis	see par. 5				
Repeatability	< ± 1 % of set pressure				
Electrical characteristics	see par. 3				
Ambient temperature range	°C	-20 / +50			
Fluid temperature range	°C	-20 / +80			
Fluid viscosity range	cSt	10 ÷ 400			
Recommended viscosity	cSt	25			
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15				
Mass	kg	0,67			

#### SYMBOLS





## 1 - IDENTIFICATION CODE

<b>P</b>		<b>S</b>				<b>/ 21</b>		<b>- K1</b>		<b>/ K</b>	
Piston type pressure switch		Mounting type:						Adjustment knob			
P = subplate mounting		T = threaded port 1/4" BSP						Electrical connection: for DIN 43650 connector (included in the supply)			
Pressure adjustment range:								Seals: <b>N</b> = standard NBR seals for mineral oils ( <b>standard</b> )		<b>V</b> = FPM seals for special fluids	
<b>2</b> = 3 ÷ 35 bar		<b>6</b> = 10 ÷ 350 bar						Series N. (the overall and mounting dimensions remain unchanged from 20 to 29)			
<b>4</b> = 6 ÷ 140 bar		<b>8</b> = 20 ÷ 630 bar									

## 2 - HYDRAULIC FLUIDS

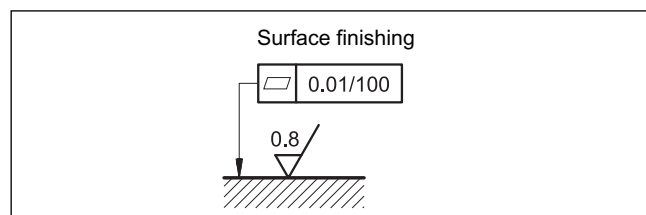
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N).  
For fluids HFDR type (phosphate esters) use FPM seals (code V).  
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.  
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.  
The fluid must be preserved in its physical and chemical characteristics.

## 3 - ELECTRICAL CHARACTERISTICS

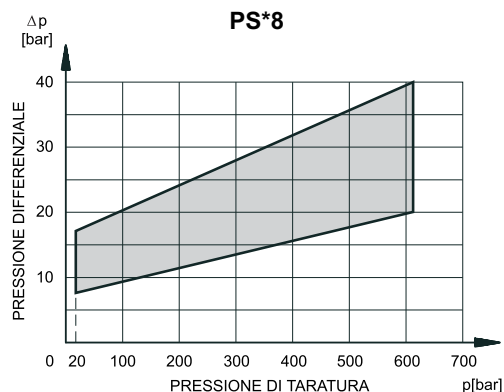
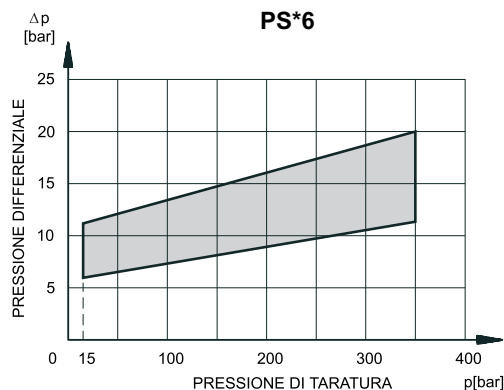
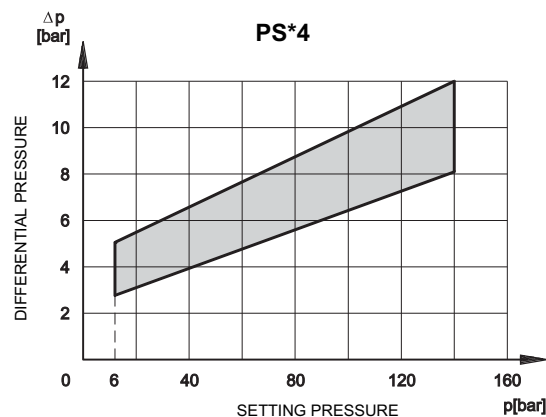
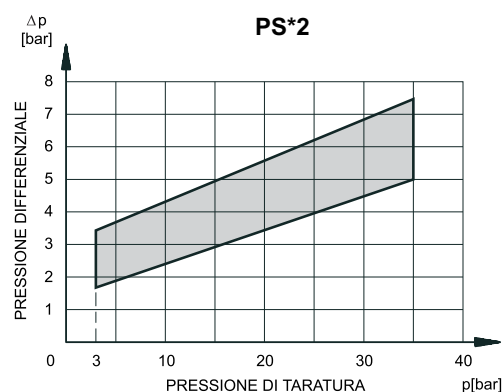
		AC		DC	
Power supply	V	125	250	30	250
Max load on contacts	A	7	5	5	0,2
- resistive		4	2	3	0,02
Electrical insulation (according to CEI EN 60204)		> 1 M Ω at 500 Vdc			
Max switching rate	switches/min	120			
Protection class (according to CEI EN 60529)		IP 65			

## 4 - INSTALLATION

The pressure switches can be installed in any position without impairing its correct operation. Ensure that there is no air in the hydraulic circuit.  
The subplate mounting pressure switch PSP type is fixed by means of screws on a flat surface with planarity and roughness values equal to or better than those indicated in the relative symbols. If the minimum values are not observed, the fluid can easily leak between the valve and the mounting surface.



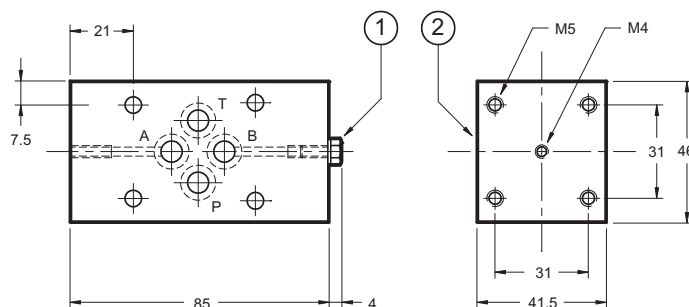
## 5 - HYSTERESIS CHARACTERISTICS (values measured with viscosity of 36 cSt at 50°C)



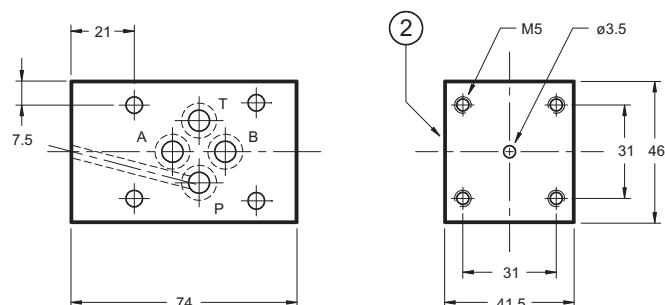
## 6 - SUBPLATES FOR STACK MOUNTING

The PSP pressure switches can be stack mounted by means of ISO 4401-03 (CETOP 03 subplates), code 1950611 and 1950621. The subplate code 1950611 permits the connection between the pressure switch and A and/or B ports, depending on where the bolt (1) is installed. The subplate code 1950621 permits the connection between the pressure switch and the P port.

### SUBPLATE CODE 1950611 (A and B ports connection)

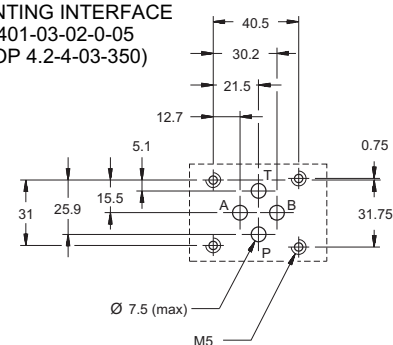


### SUBPLATE CODE 1950621 (P port connection)



### MAX PRESSURE 350 BAR

MOUNTING INTERFACE  
ISO 4401-03-02-0-05  
(CETOP 4.2-4-03-350)

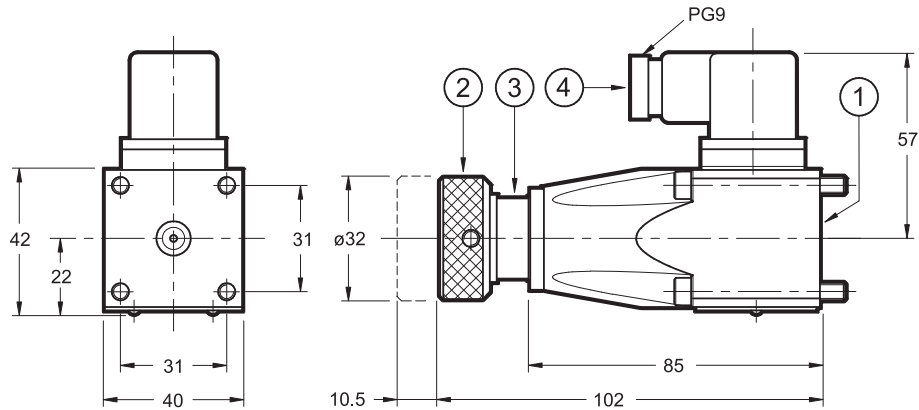


dimensions in mm

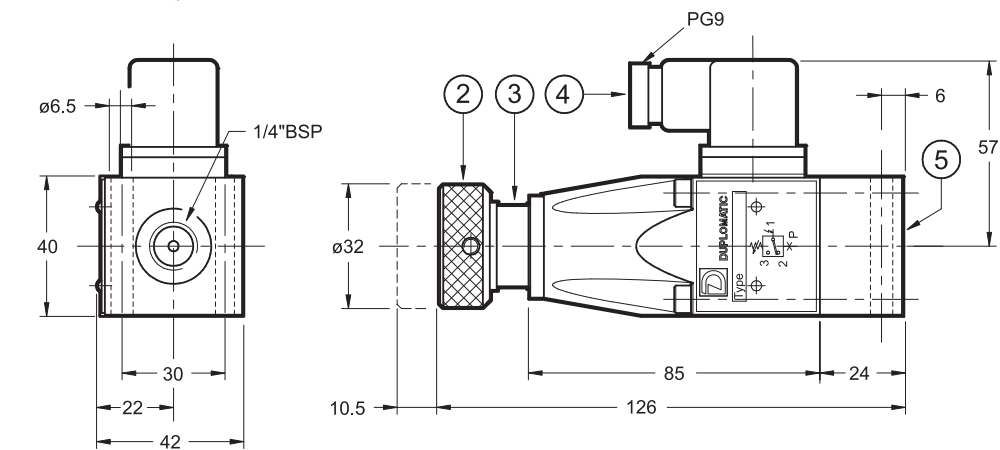
1	Hexagonal head M4x12 bolt with "bonded seal" type 400-002 (Dowty) Unscrew the bolt and its seal from the side where the switch is installed
2	Mounting surface with sealing rings 4 OR type 2037 (9.25x1.78) - 90 Shore

## 7 - OVERALL AND MOUNTING DIMENSIONS

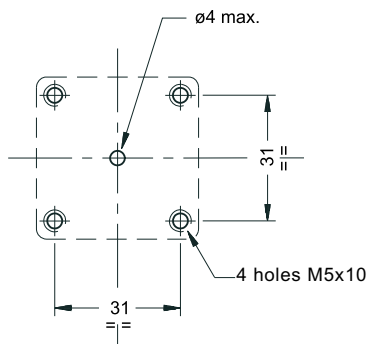
### PSP



### PST



### MOUNTING INTERFACE (PSP version)



dimensions in mm

### fastening bolts (PSP version)

N. 4 bolts M5x45 - ISO 4762 12.9 resistance class (included in the supply)

Tightening torque: 8 Nm

1	Mounting surface with sealing rings: N. 1 OR type 2025 (6.07x1.78) - 90 shore (PSP version)
2	Adjustment knob Clockwise rotation to increase pressure
3	Graduated scale with indication of setting pressure in [bar]
4	DIN 43650 electrical connector 3 poles + ground supplied with pressure switch
5	Interface plate for pipe connection: - 1/4" BSP threaded female connection - 2 clearance holes for possible fixing by means of bolts M5x50 <b>NOTE: the interface plate is already installed on the PST type pressure switch only.</b>



# PTH

## PRESSURE TRANSMITTERS

### SERIES 30

**p nom 40 - 100 - 250 - 400 bar**

#### DESCRIPTION

This series of pressure transmitters has been designed in order to be used for the main industrial applications and on moving machines.

The main feature of this transmitter is to ensure its functioning also in harsh environments, especially for what concerns the fluid temperature range which can go from a minimum of - 40 °C up to a maximum of + 120 °C

The basis of this transmitter is the strain-gauge, which is powered by an electric circuit developed according to the SMT technology which ensures a high reliability and maximum resistance to vibrations and mechanical stress.

Every component into contact with the fluid is made of stainless steel and the pressure sensor is completely fluid-proof.

It's available with current output signal 4 ÷ 20 mA or with voltage output signal 0 ÷ 10 V. Versions also available upon request are 0 ÷ 5 V and 0.5 ÷ 4.5 V, ratiometric. They all are reverse polarity protected.

The protection class of the electrical connection for the version with DIN connector is IP65, while the version with the M12 connector has a protection class IP67.

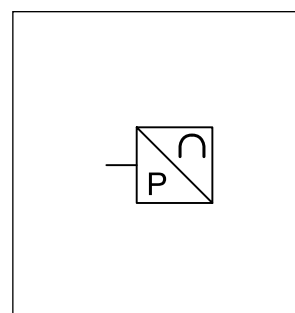
These transmitters are available in 4 different pressure ranges, from 40 to 400 bar.

#### TECHNICAL SPECIFICATIONS

Nominal pressure $P_N$	bar	<b>40</b>	<b>100</b>	<b>250</b>	<b>400</b>
Overpressure - max working pressure	x $P_N$	x 3	x 3	x 3	x 2.5
Burst pressure	x $P_N$	x 7	x 5	x 4	x 5

Accuracy typical at 25 °C	% $P_N$	± 0,5
Output signal : current voltage	mA V	4 ÷ 20 0 ÷ 10, 0 ÷ 5, 0.5 ÷ 4.5
Sensor temperature range:	°C	-40 / +120
Ambient and fluid temperature range: sealing in FPM (standard) NBR EPDM	°C	-20 / +120 -25 / +100 -40 / +125
Rise time (10%...90% of $P_N$ )	ms	1
Hydraulic connection		1/4" BSP with seal
Housing and pressure connection		AISI 304
Mass	g	50

#### HYDRAULIC SYMBOL



## 1 - IDENTIFICATION CODE

P	T	H	-	/	30	-		
---	---	---	---	---	----	---	--	--

Pressure transmitter \_\_\_\_\_

High dynamic performance \_\_\_\_\_

Nominal pressure \_\_\_\_\_

**040** = 40 bar      **250** = 250 bar  
**100** = 100 bar    **400** = 400 bar  
 (other pressure values are available upon request)

Series N. \_\_\_\_\_  
 (the overall and mounting dimensions remain unchanged from 30 to 39)

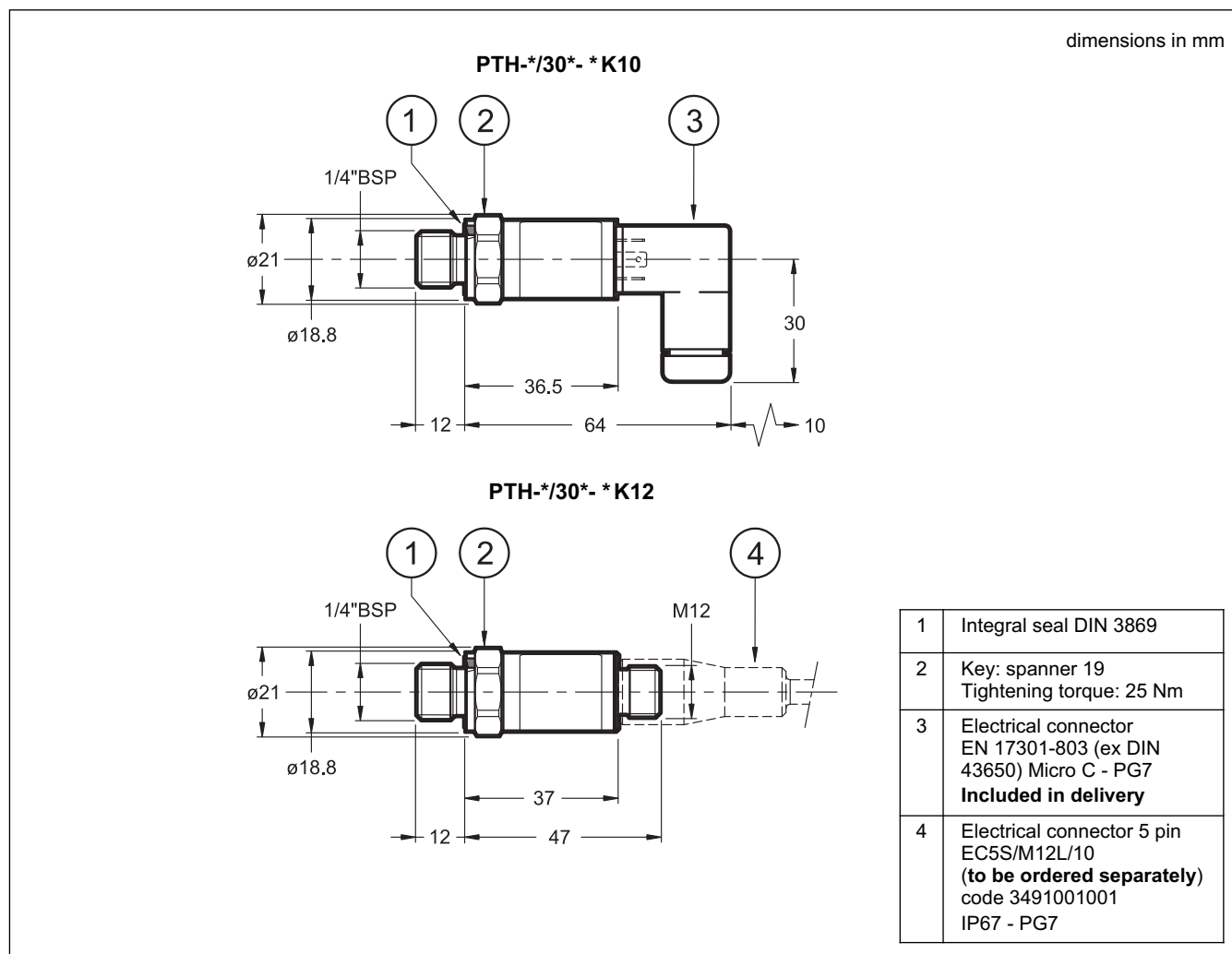
Electrical connection  
**K10** = Reduced electrical connector  
 DIN 43650  
**K12** = electrical connector M12  
 5 pin

Analogue output signal (**standard**)  
**E0** = 0 ÷ 10 V  
**E1** = 4 ÷ 20 mA  
 upon request only:  
**E2** = 0 ÷ 5 V  
**E5** = 0.5 ÷ 4.5 V ratiometric

Seals:  
**V** = FPM seals for special fluids (**standard**)  
**N** = NBR seals for mineral oil  
**EP** = EPDM seals

**WARNING! The EPDM is not suitable for use with mineral oil. Verify the compatibility of EPDM with the used fluid!**

## 2 - OVERALL AND MOUNTING DIMENSIONS



### 3 - TECHNICAL CHARACTERISTICS

#### Electrical data

		<b>E0</b>	<b>E1</b>	<b>E2</b>	<b>E5</b>
Output signal		0 ÷ 10 V	4 ÷ 20 mA	0 ÷ 5 V	0.5 ÷ 4.5 V ratiometric
Supply voltage	V CC	24 (15 ÷ 32)	24 (9 ÷ 32)	24 (9 ÷ 32)	5 (4.75 ÷ 5.25)
Max current consumption	mA	≤ 15	-	≤ 20	≤ 10
Load resistance	kΩ	≥ 5.0	see par. 4.2	≥ 5.0	≥ 5.0

#### Accuracy

Accuracy (typical at 25 °C)	% P <sub>N</sub>	± 0.5
TEB Total error band (-25...+85 °C)	% P <sub>N</sub>	± 1.75
NLH Non linearity and hysteresis (at 25 °C )	% P <sub>N</sub>	± 0.2
TC Temperature coefficient	% P <sub>N</sub>	± 0.03
Stability after 1 million cycles	% P <sub>N</sub>	± 0.2

#### Environmental conditions

Electromagnetic compatibility (EMC): according to 2004/108/IEC		Immunity 61000-6-2 Emissions 61000-6-4
Vibrations		50 G / 11 ms
Class protection according to EN 60529 with connector properly installed.	K10 K12	IP65 IP67

### 4 - TRANSMITTERS SUPPLY

#### 4.1 - Versions in voltage (E0, E2, E5 ratiometric)

These transmitters are equipped with voltage stabilizer which supplies the electric circuit with constant voltage, independently from power supply voltage.

We recommend a stabilized power supply voltage, within proper ranges as in table at par. 3 .

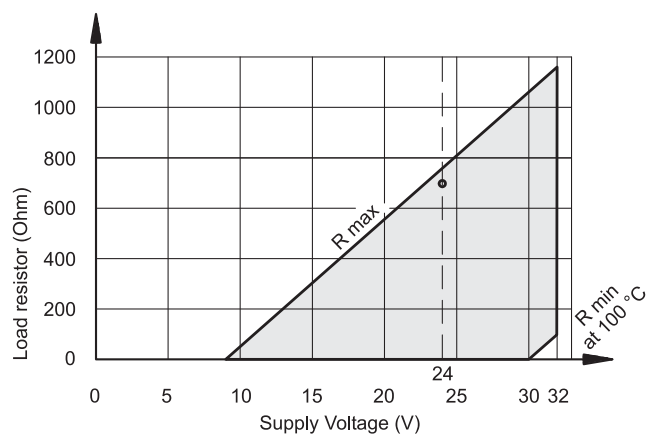
#### 4.2 - Version in current 4 ÷ 20 mA (E1)

The transmitter works properly within an operating area (see diagram) that depends on both the voltage supply value and the external load resistance used to convert the signal.

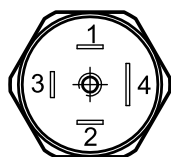
Is recommended to choose values close to the limit R<sub>max</sub>, in order to have a wide signal easier to read.

We suggest supply voltage of 24 VDC and a load resistance of 700 Ohm

**min./max resistor vs. supply voltage E1 version**  
with P<sub>max</sub> = 100%



### 5 - ELECTRIC CONNECTIONS

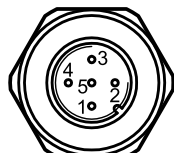


**K10**

Connection DIN 43650 reduced  
3 pin + GND



**WARNING!** Check that the connection cables are suitable for the temperature range intended for use of the device.



**K12**

Connection M12x1  
5 pin

### 6 - WIRING DIAGRAMS - K10 CONNECTION

voltage output - 3 wires + GND	Version			current output - 2 wires + GND	Vers.
	E0	E2	E5		
	24 V 0÷10 V 0 V GND	24 V 0÷5 V 0 V GND	5 V 0.5÷4.5 V 0 V GND		E1 24 V 4 ÷ 20 mA GND



**WARNING!** The pin assignment for the transducer PTH - \*/30\*-E0K10 (DIN 43650 connection) differs from that of the previous series!

### 7 - WIRING DIAGRAMS - K12 CONNECTION

voltage output - 3 wires + GND	Versione			current output - 2 wires + GND	Vers.
	E0	E2	E5		
	24 V 0÷10 V 0 V GND	24 V 0÷5 V 0 V GND	5 V 0.5÷4.5 V 0 V GND		E1 24 V 4 ÷ 20 mA GND



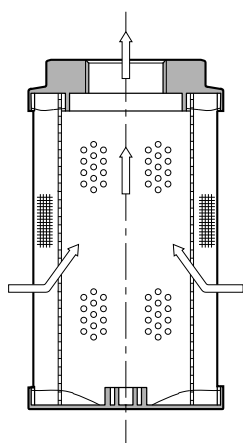
# FSI

## SUCTION FILTER FOR SUBMERGED MOUNTING

### SERIES 10

**Q max** (see performance ratings table)

#### OPERATING PRINCIPLE



- FSI filters are filter elements which function being completely submerged in the tank. They are installed directly at the end of the pump suction line.
- They are aimed at protecting the pump from any possible gross contamination present inside the tank.
- The filter element is a metallic strainer with a 90 µm filtration degree, which grants a good pump protection without compromising the correct fluid supply.
- The filters are designed with a threaded BSP connection, available in the sizes from 3/8" to 3". They are supplied with a hexagonal shank, which allows the filter element to be connected by spanner to the pump suction line.

#### TECHNICAL SPECIFICATIONS

Filter code	BSP port dimensions	Rated flow [l/min] <b>(NOTE 1)</b>	Rated filtration degree [µm]
FSI-TB038	3/8"	9	90
FSI-TB012	1/2"	14	
FSI-TB034	3/4"	25	
FSI-TB100	1"	45	
FSI-TB114	1 ¼"	75	
FSI-TB112	1 ½"	100	
FSI-TB200	2"	160	
FSI-TB212	2 ½"	250	
FSI-TB300	3"	350	

**NOTE 1:** The flow rates stated in the table correspond to a 0.02 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C

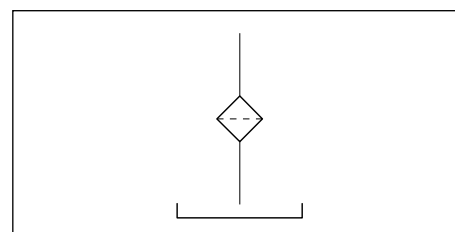
As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the real pressure drop has to be changed according to the following ratio:

$$\text{real } \Delta p \text{ value} = 0.02 \cdot \frac{\text{real } Q}{\text{table } Q} \cdot \frac{\text{real viscosity degree (cSt)}}{36}$$

The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.02 bar.

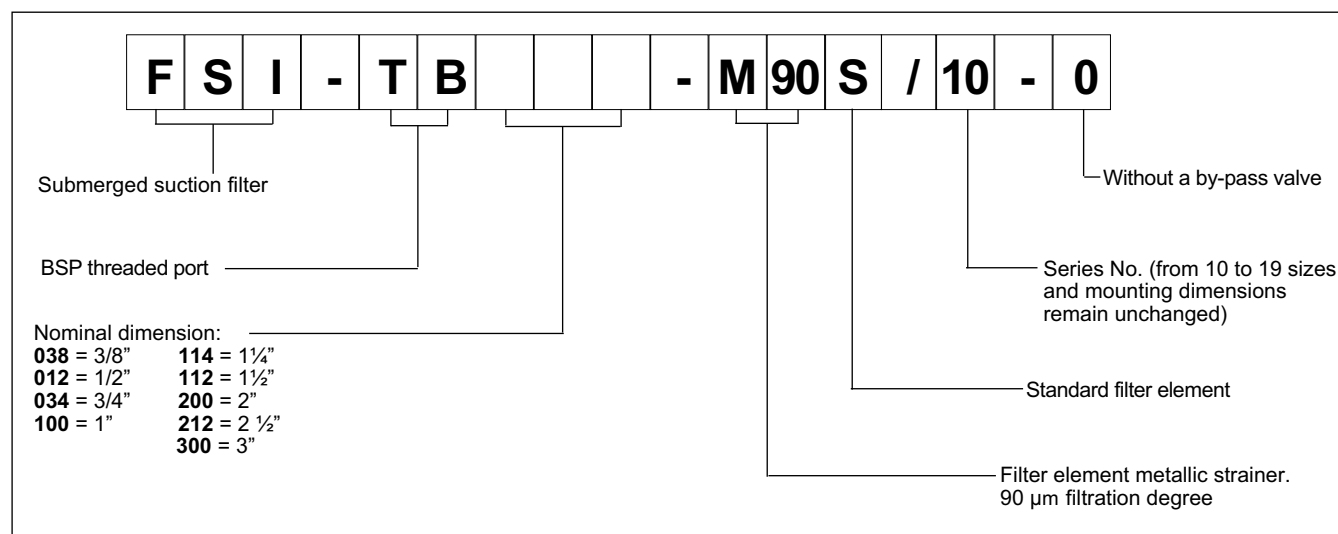
Collapsing differential pressure of the filter element	bar	1.0
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

#### HYDRAULIC SYMBOL





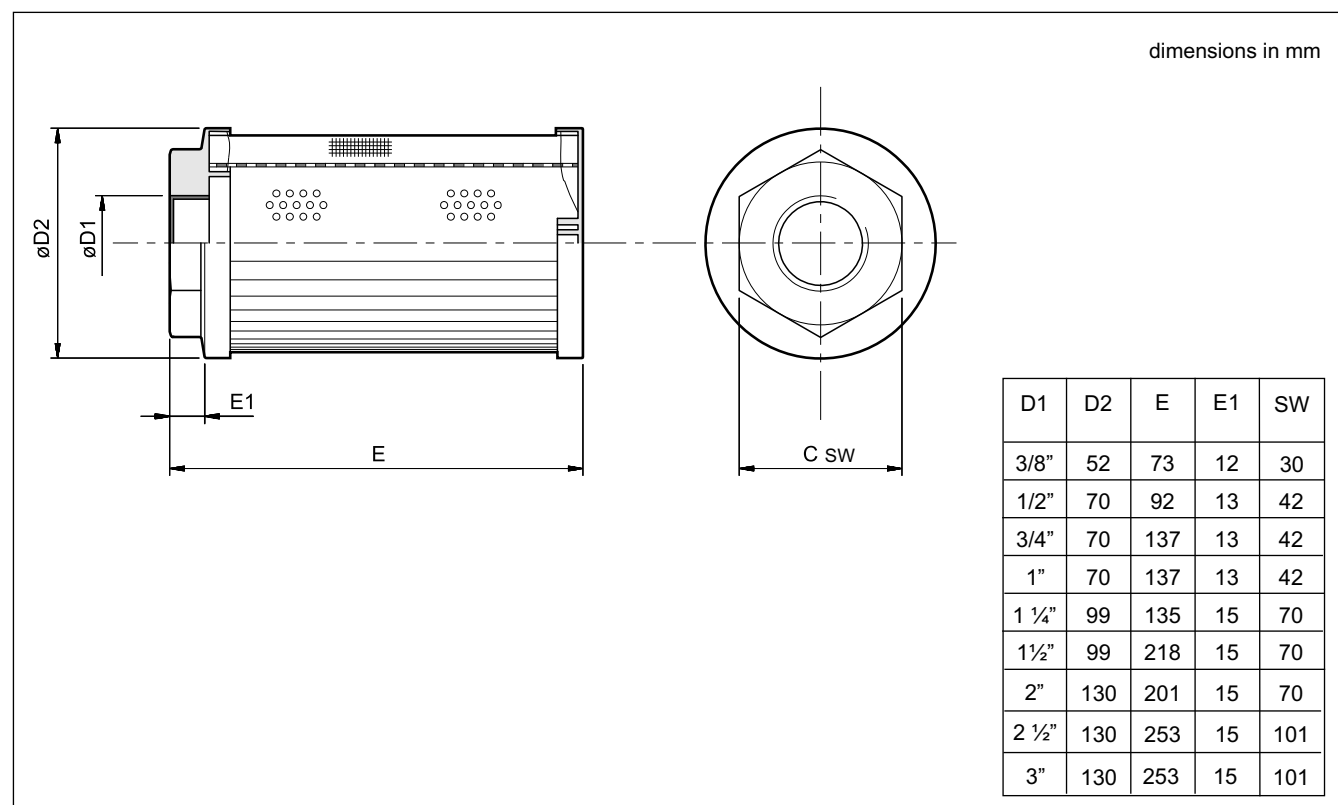
## 1 - IDENTIFICATION CODE



## 2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

## 3 - OVERALL AND MOUNTING DIMENSIONS





# FST

## SUCTION FILTER WITH SEALED FLANGE MOUNTING

### SERIES 10

**Q max** (see performances table)

#### OPERATING PRINCIPLE

Hexagonal head tie rod starting the exclusion valve

Filter element

Check valve to allow replacement of the filter element without emptying the tank

- FST filters are designed for sealed flange mounting. They are assembled directly on to the hydraulic power unit.
- They are aimed at protecting the pump from any possible gross contamination present inside the tank.
- The filter element is made of a metallic strainer with a 90 µm filtration degree, which grants a good pump protection without compromising the correct fluid flow. It can be easily replaced without emptying the tank. See paragraph 6 for its identification code.
- The filters are designed with a SAE flange port with the exception of the smallest size, which uses a BSP threaded port.
- All the FST filters are designed to incorporate an electric or visual clogging indicator, to be ordered separately (see paragraph 5).

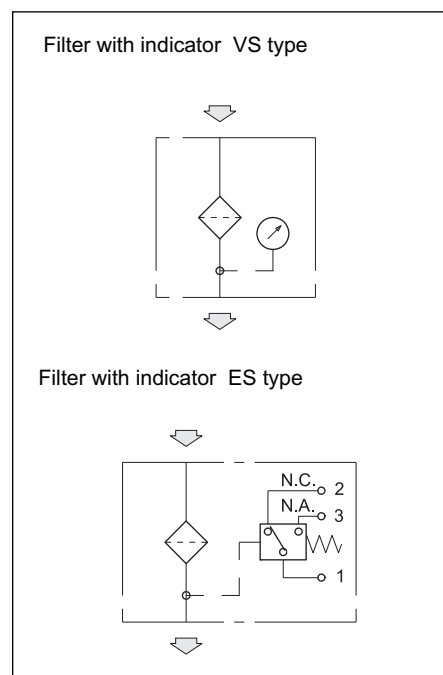
#### PERFORMANCES

Filter code	port dimensions		Mass [kg]	Rated flow (indicative) [l/min]	Rated filtration degree [µm]
	BSP	SAE flange			
<b>FST-TB114</b>	1 1/4"	-	1,6	70	90
<b>FST-FS212</b>	-	2 1/2"	3,0	100	
<b>FST-FS300</b>	-	3"	13,0	200	
<b>FST-FS400</b>	-	4"	16,0	300	

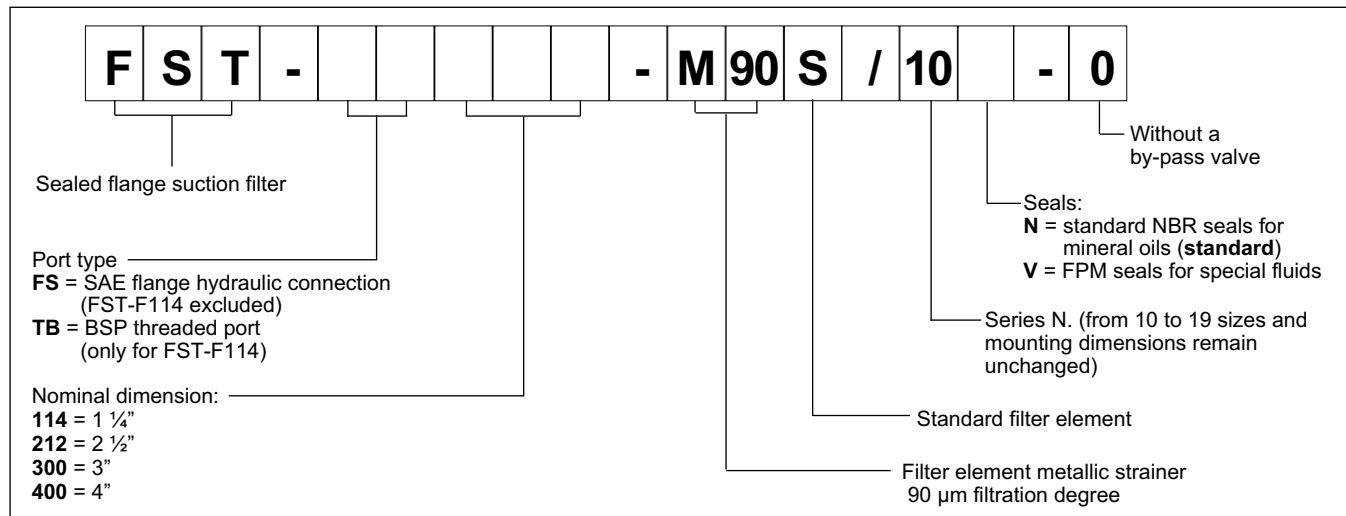
**NOTE 1:** the flow rates stated in the table correspond to a 0.02 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.  
As for a different viscosity range, see NOTE 2 - paragraph 2.2.

Collapsing differential pressure of the filter element	bar	1,0
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

#### HYDRAULIC SYMBOL

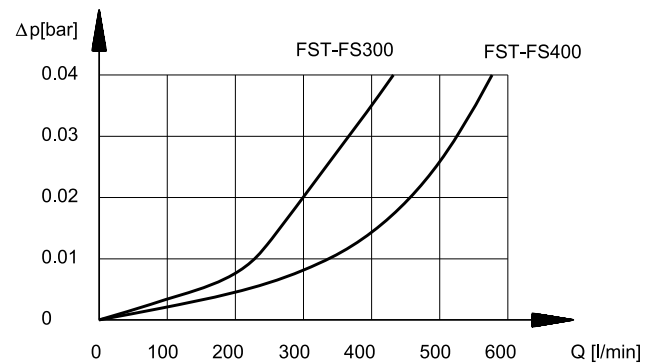
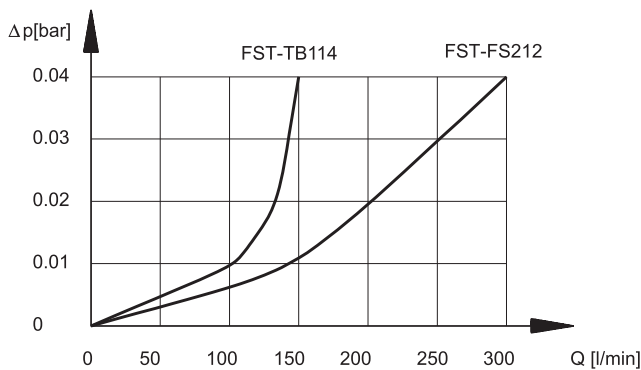


### 1 - IDENTIFICATION CODE

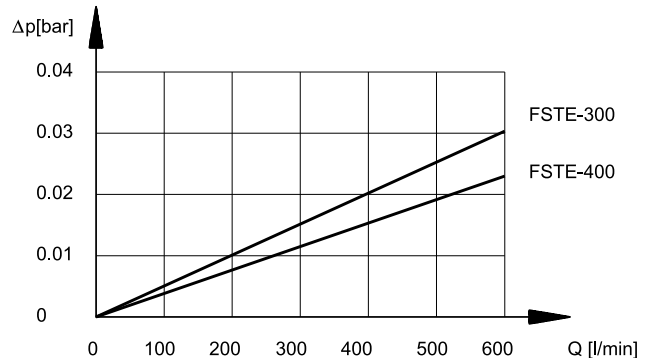
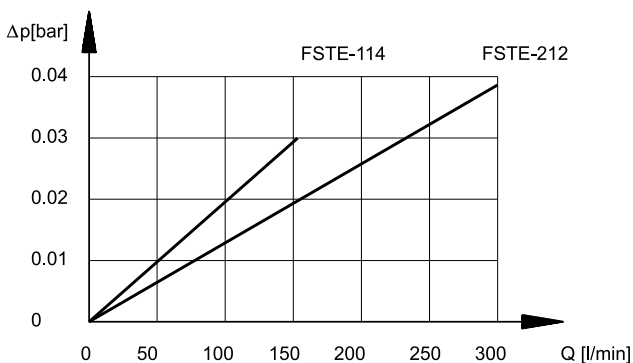


### 2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

#### 2.1 - Pressure drops through the filter body



#### 2.2 - Pressure drops through the FSTE filter element



**NOTE 2: the filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0,02 bar.**

The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element.

As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

total  $\Delta p$  value = body  $\Delta p$  value + (real  $\Delta p$  value of the filter element x real viscosity value (cSt) / 36)

real  $\Delta p$  value of the filter element = value obtainable through the diagrams in paragraph 2.2

Such ratio is valid for a viscosity value up to 200 cSt.

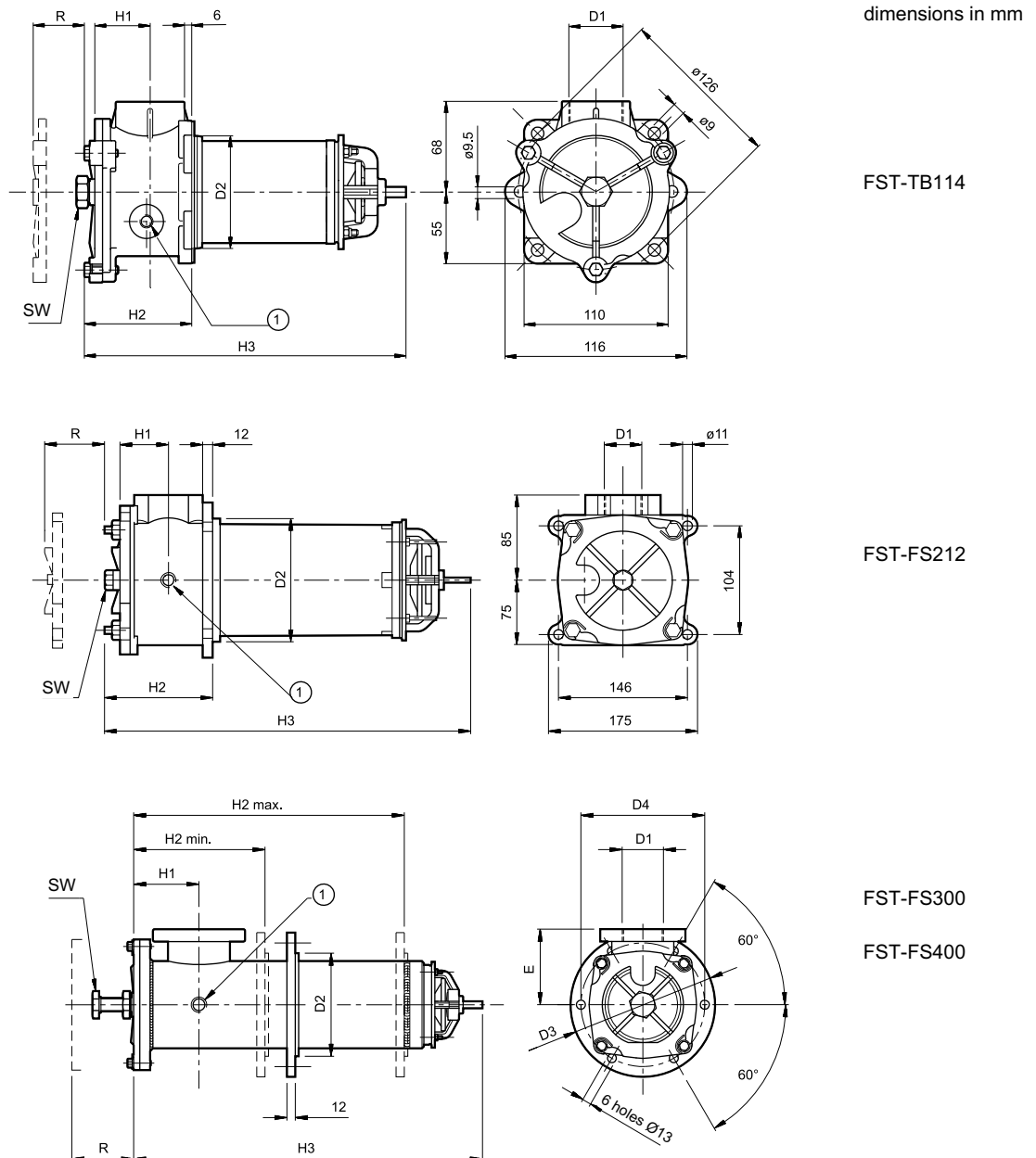
For a higher viscosity please consult our technical department.

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



Filter code	D1	D2 NOTE 3	D3	D4	E	H1	H2 NOTE 4	H3	R*	Ch
<b>FST-TB114</b>	1 1/4" BSP	86	-	-	-	42	80	275	250	22
<b>FST-FS212</b>	2 1/2" SAE	130	-	-	-	66	120	322	300	22
<b>FST-FS300</b>	3" SAE	150	210	180	110	95	174+355	480	500	32
<b>FST-FS400</b>	4" SAE	180	242	210	120	122	250+405	470	500	32

**NOTE 3:** tank hole = D2 + 1 (mm)

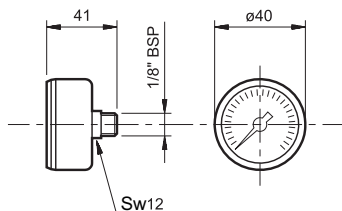
**NOTE 4:** for filters FSU-FS300 and FSU-FS400 the flange is not welded  
R\* = filter element removal space

### 5 - CLOGGING INDICATORS

The filters are designed to incorporate clogging indicators, which have to be ordered separately.

#### 5.1 - Visual indicator for suction filters

Identification code: VS/10



This indicator is a vacuum gauge sensitive to the suction depression.

The indicator is supplied with a 0 ÷ -1 relative bar graduated scale and with a three-colour reading

scale, which informs you about the clogging condition of the filter element:

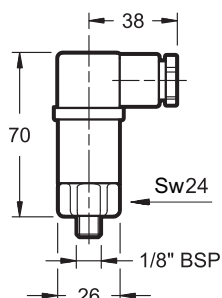
GREEN: efficient filter element (0 / -0.15 bar)

YELLOW: the filter element is wearing out (-0.15 / -0.25 bar)

RED: the filter element has to be replaced (> -0.25 bar)

#### 5.2 - Electric indicator for suction filters

Identification code: ES/10



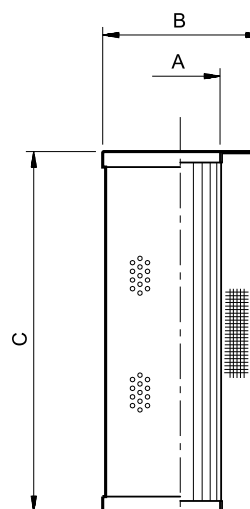
This indicator is a vacuum gauge sensitive to the suction depression, which operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

### TECHNICAL SPECIFICATIONS

Operating pressure	bar	- 0,2
<b>AC power supply</b>		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	3 0,5
<b>DC power supply</b>		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

### 6 - FILTER ELEMENTS



Filter element code	ØA	ØB	C	Average filter surface [cm <sup>2</sup> ]
FSTE - 114	29,5	70	163	1600
FSTE - 212	65	99	198	1845
FSTE - 300	65	99	375	3545
FSTE - 400	93	136	375	5065

### FILTER ELEMENT IDENTIFICATION CODE

**F S T E -      - M 90 S / 10**

Filter element for a FST filter

Nominal dimensions

114 = 1 ¼"      300 = 3"  
212 = 2 ½"      400 = 4"

Filter element metallic strainer 90 µm filtration degree

Standard filter element

Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)



# FRT

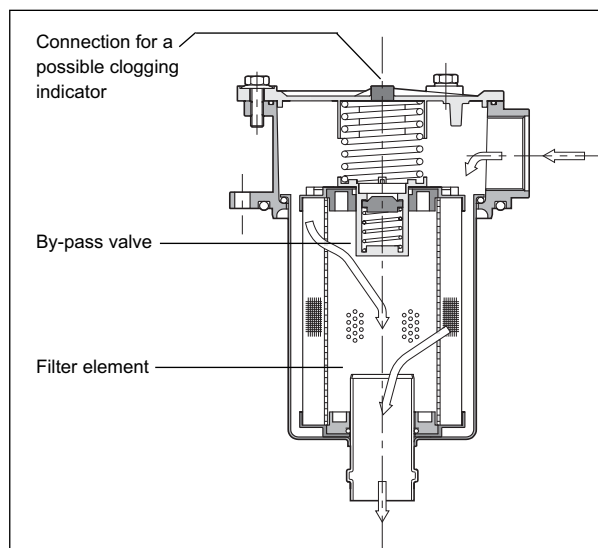
## RETURN FILTER FOR FLANGE MOUNTING ON THE TANK

### SERIES 10

**p** max 3 bar

**Q** max (see performance table)

#### OPERATING PRINCIPLE



- FRT filters are designed to be flange-mounted on the tank cover; the BSP threaded port for the input connection is positioned on the filter head and is therefore very accessible.
- The inspection cover fixed with three or four screws allows easy maintenance; the filter element is supplied with a screw, which makes its removal together with the container easier. In this way, by replacing the filter element, it is possible to clean the contamination present in the bowl of the filter.
- The filter element is made of high efficiency filtering materials and is able to hold high quantities of contamination material. It is available with three different filtration degrees:  
F10 = 10  $\mu$ m absolute ( $\beta_{10} > 100$ ) - ISO 4406:1999 class 18/16/13  
F25 = 25  $\mu$ m absolute ( $\beta_{25} > 100$ ) - ISO 4406:1999 class 19/17/14  
P10 = 10  $\mu$ m nominal ( $\beta_{10} > 2$ ) - ISO 4406:1999 class 21/19/16
- FRT filters are always supplied with a by-pass valve.
- All the FRT filters are designed to incorporate an electric or visual clogging indicator, to be ordered separately (see par. 5).

#### PERFORMANCES

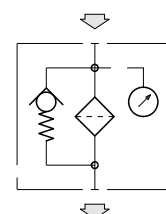
Filter code	BSP port dimensions	Mass [kg]	Rated flow (indicative) [l/min]		
			F10	F25	P10
FRT-TB012	1/2"	0,45	18	25	30
FRT-TB034	3/4"	0,95	50	70	85
FRT-TB100	1"	1,1	65	110	130
FRT-TB114	1 1/4"	2,1	150	190	210
FRT-TB112	1 1/2"	3,1	160	250	290
FRT-TB200	2"	4,1	280	400	430

Maximum pressure	bar	3
Collapsing differential pressure of the filter element	bar	3
Differential pressure for the opening of the by-pass valve ( $\pm 10\%$ )	bar	1,7
Ambient temperature range	$^{\circ}\text{C}$	-25 / +50
Fluid temperature range	$^{\circ}\text{C}$	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

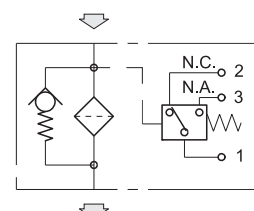
**NOTE:** the flow rates stated in the table correspond to a 0.5 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50 $^{\circ}\text{C}$ .  
As for a different viscosity range, see **NOTE 2** - par. 2.2.

#### HYDRAULIC SYMBOL

Filter with indicator VR type

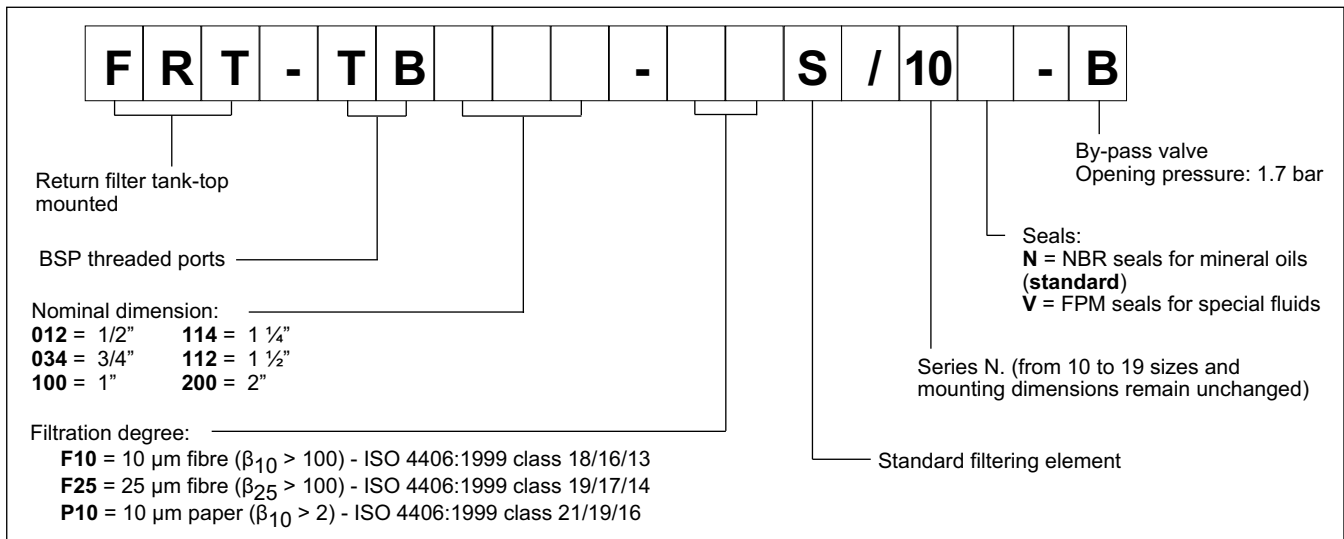


Filter with indicator ER type



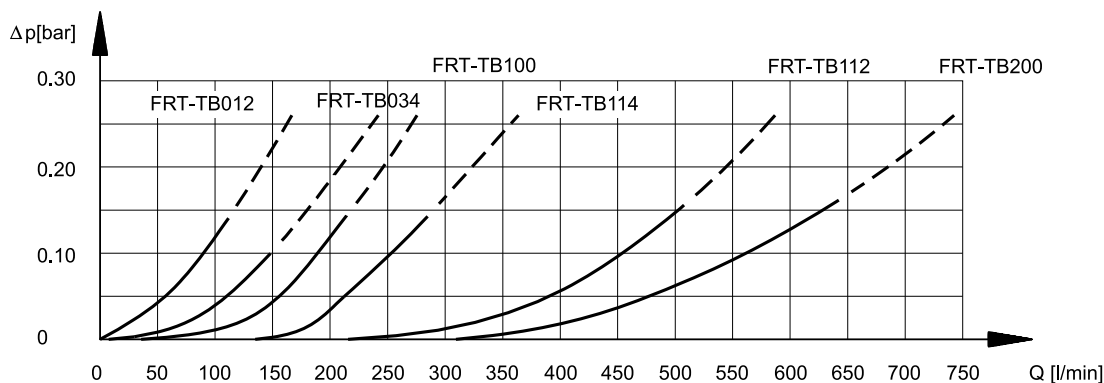


### 1 - IDENTIFICATION CODE

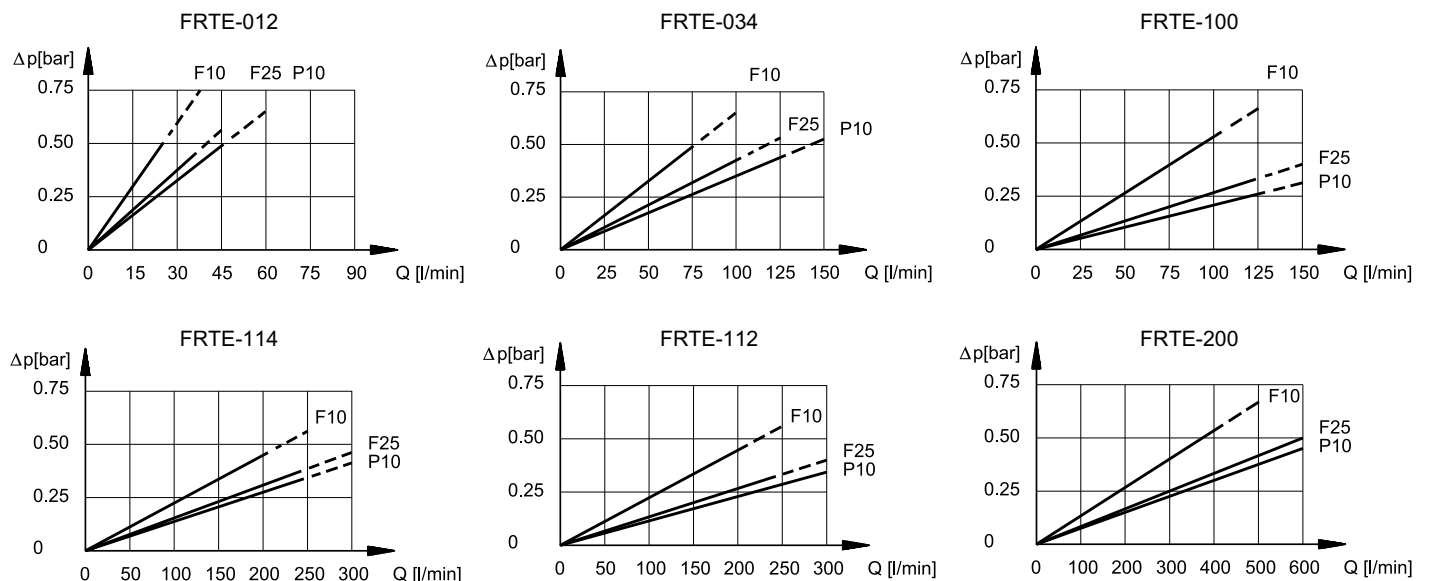


### 2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

#### 2.1 - Pressure drops through the filter body



#### 2.2 - Pressure drops through the FRTE filtering element



**NOTE 2: the filter size has to be calculated so that with the nominal flow rate the pressure drop is lower than 0.5 bar.**

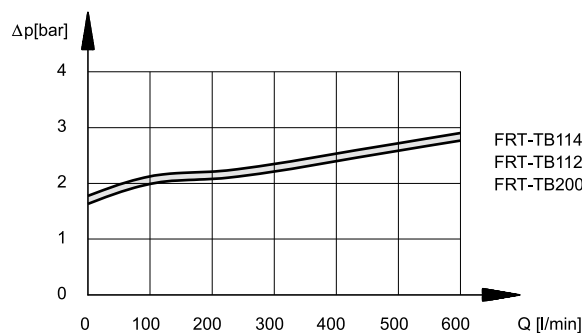
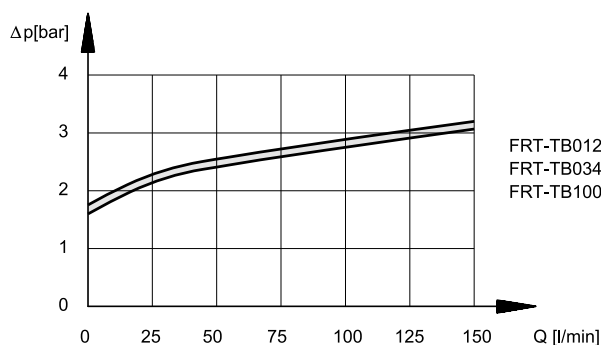
The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

$$\text{total } \Delta p \text{ value} = \text{body } \Delta p \text{ value} + (\text{real } \Delta p \text{ value of the filter element} \times \text{real viscosity value (cSt)} / 36)$$

$$\text{real } \Delta p \text{ value of the filter element} = \text{value obtainable through the diagrams in par. 2.2}$$

Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

### 2.3 - Pressure drops through the by-pass valve



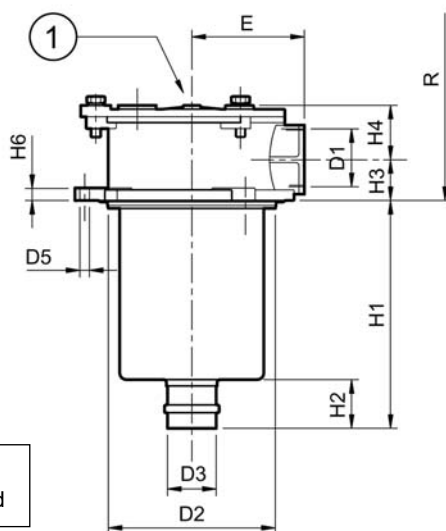
### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

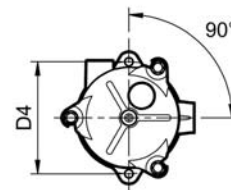


1 Clogging indicator port:  
1/8" BSP usually plugged

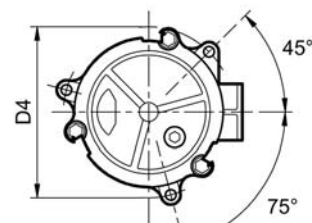
filter	D1	D2	D3	D4	D5	E	H1	H2	H3	H4	H6	R*
FRT - TB012	1/2"	67	24	90	6.5	50	80	20	22	33	9	120
FRT - TB034	3/4"	89	28	115	9	67	150	25	28	47	10	190
FRT - TB100	1"	89	40	115	9	67	234	30	28	47	10	270
FRT - TB114	1 1/4"	126	40	175	10.5	95	248	50	35	56	13	289
FRT - TB112	1 1/2"	174	20	220	10.5	115	178	50	55	69	13	250
FRT - TB200	2"	174	63.5	220	10.5	115	285	50	55	69	13	355

R\* = Filter element removal space starting from the tank surface

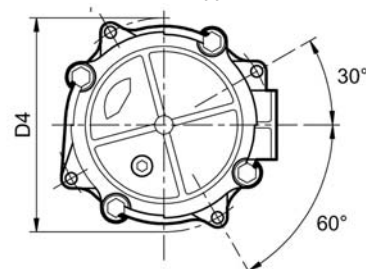
FRT - TB012  
FRT - TB034  
FRT - TB100



FRT - TB114



FRT - TB112  
FRT - TB200



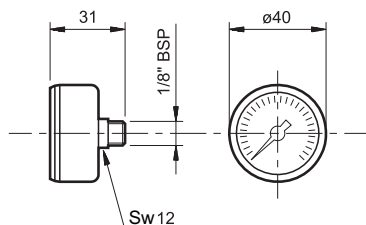


### 5 - CLOGGING INDICATORS

The filters are designed to incorporate clogging indicators, which have to be ordered separately.

#### 5.1 - Visual indicator for return filters

Identification code: VR/10



This indicator is a pressure gauge sensitive to the filter input pressure.

The indicator is supplied with a 0 ÷ 6 bar graduated scale and with a two-colour reading scale, which

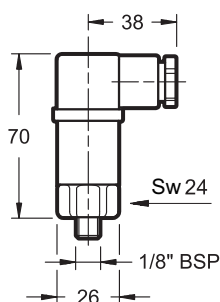
informs you about the clogging condition of the filter element:

GREEN: efficient filter element (0 ÷ 1.7 bar)

RED: the filter element has to be replaced (> 1.7 bar)

#### 5.2 - Electric indicator for return filters

Identification code: ER/11



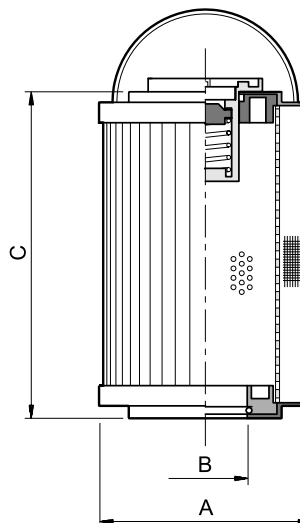
This indicator is a pressure switch sensitive to the filter input pressure, which switches an electrical contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

### TECHNICAL SPECIFICATIONS

Operating pressure	bar	1,5
<b>AC power supply</b>		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	3 0,5
<b>DC power supply</b>		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

### 6 - FILTER ELEMENTS



Filter element code	ØA	ØB	C	Average filtering surface [cm²]	
				P10	F12/F25
FRTE - 012	52	24	70	310	380
FRTE - 034	70	28	130	1000	1600
FRTE - 100	70	40	210	1660	2670
FRTE - 114	99	40	211	3800	4280
FRTE - 112	130	51	140	4140	4360
FRTE - 200	130	63	251	7930	8350

### FILTER ELEMENT IDENTIFICATION CODE

F	R	T	E	-		-		S	/	10
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Filter element for a FRT filter

Nominal dimension  
**012** = 1/2" **114** = 1 1/4"  
**034** = 3/4" **112** = 1 1/2"  
**100** = 1" **200** = 2"

Filtration degree: **F10** = fibre 10 µm  
**F25** = fibre 25 µm  
**P10** = paper 10 µm

Standard filter element

Series N. (from 10 to 19 sizes and mounting dimensions are unchanged)

**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids (upon request)



# FRC

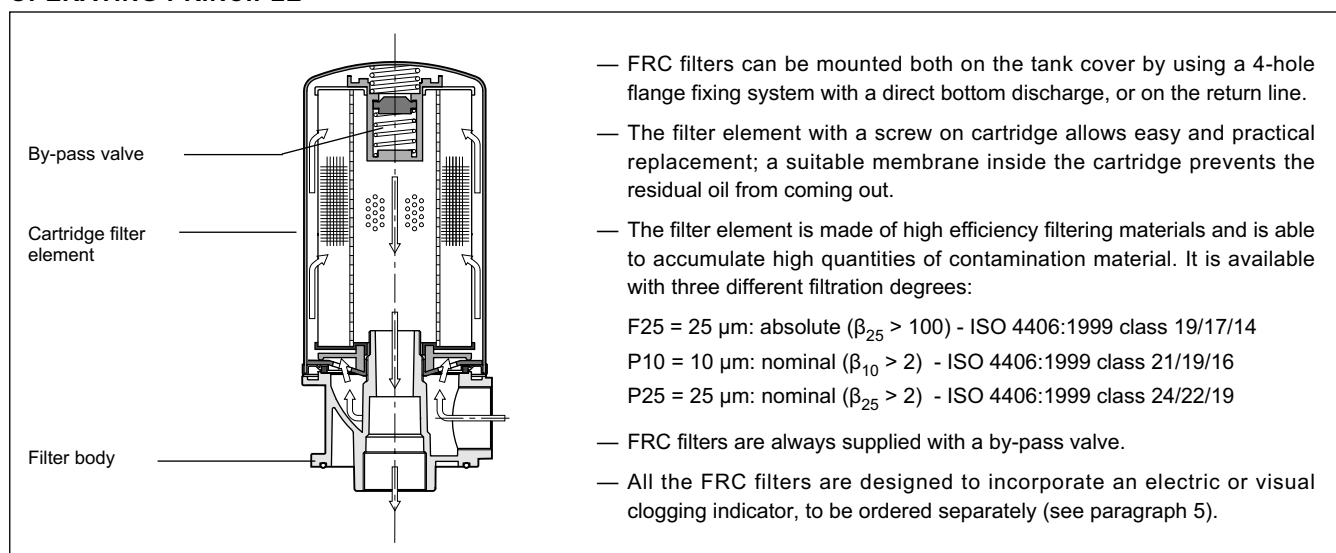
## RETURN LINE FILTER FOR TANK TOP OR LINE MOUNTING

### SERIES 10

**p** max 7 bar

**Q** max (see table of performances)

#### OPERATING PRINCIPLE



#### PERFORMANCES

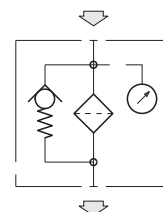
Filter code	BSP port dimensions	Mass [kg]	Rated flow (indicative) [l/min]				
			F25L	P10S	P10L	P25S	P25L
<b>FRC-TB034</b>	3/4"	1.6	65	65	70	70	75
<b>FRC-TB112</b>	1 1/2"	2.2	180	150	200	200	200

**NOTE 1:** the flow rates stated in the table correspond to a 0.5 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.  
As for a different viscosity range, see NOTE 2 - par. 2.2.

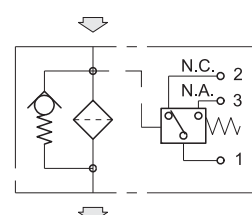
Maximum pressure	bar	7
Collapsing differential pressure of the filter element	bar	3.0
Differential pressure for the opening of the by-pass valve ( $\pm 10$ %)	bar	1,7
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

#### HYDRAULIC SYMBOL

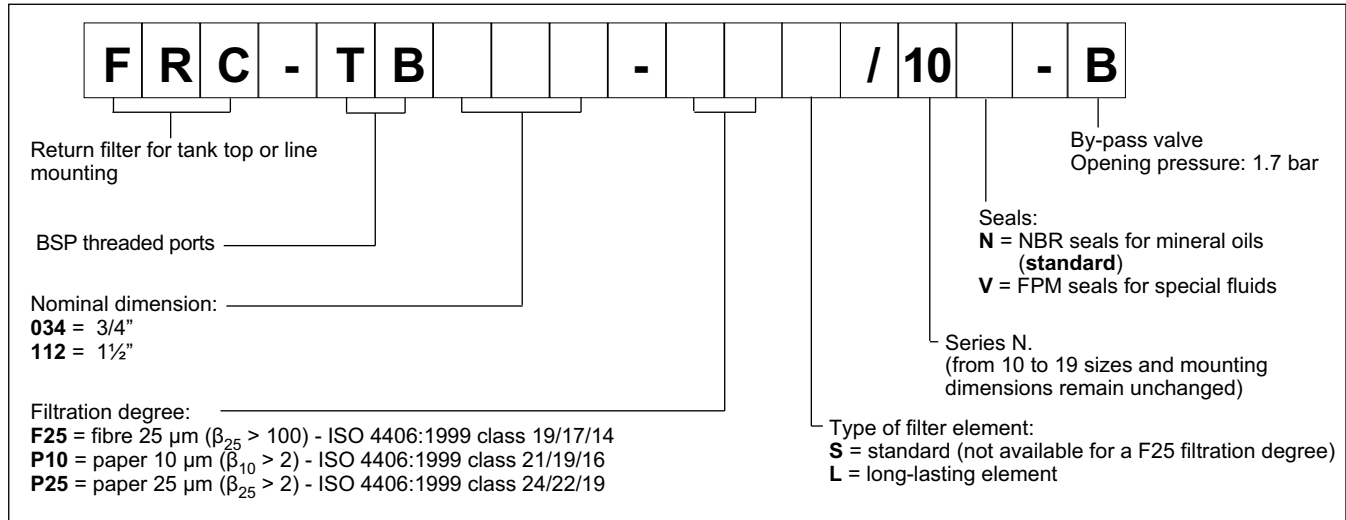
Filter with indicator VR type



Filter with indicator ER type

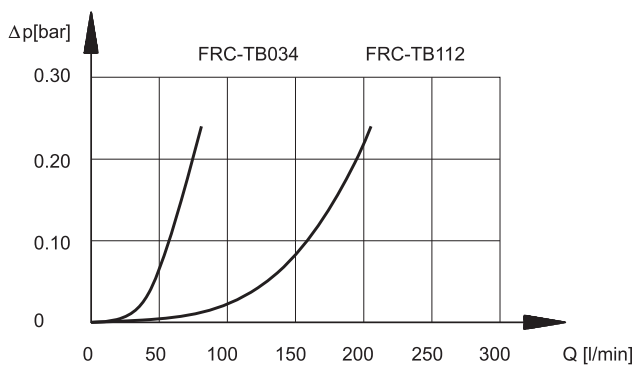


### 1 - IDENTIFICATION CODE

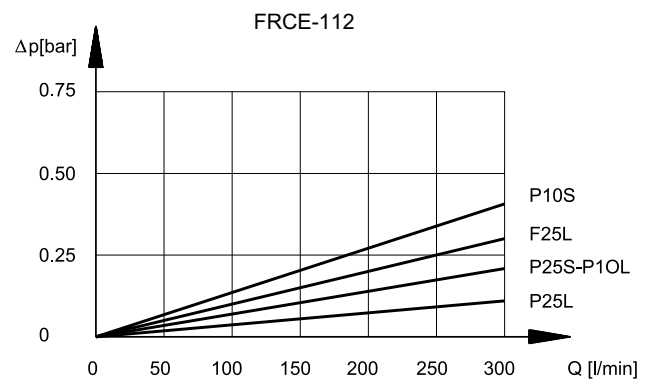
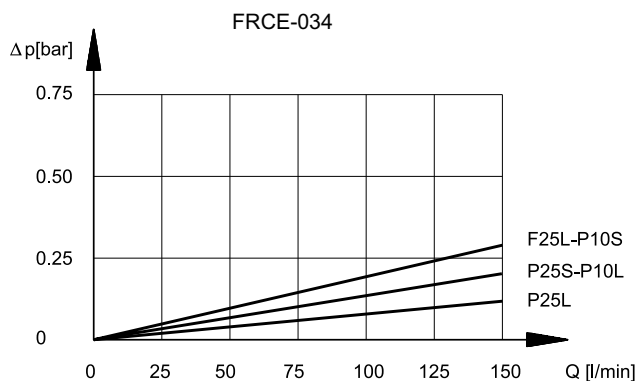


### 2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

#### 2.1 - Pressure drops through the filter body



#### 2.2 - Pressure drops through the FRCE filter element



**NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.5 bar.**

The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element.

As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

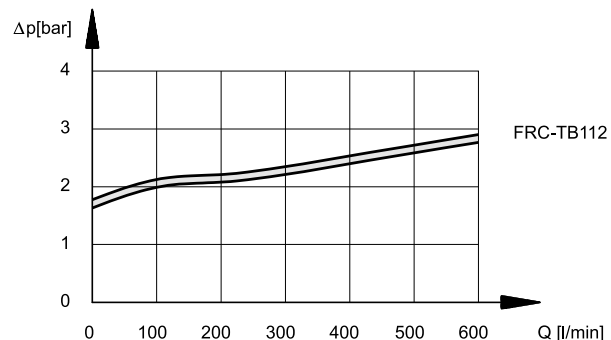
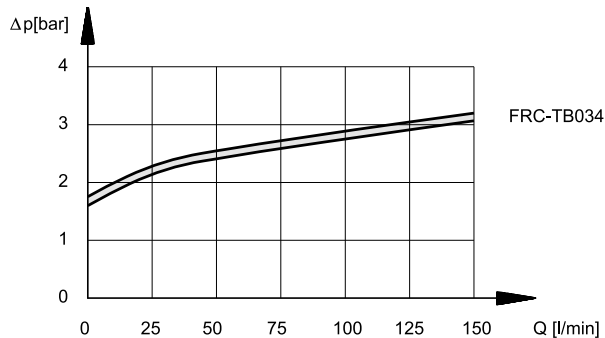
total  $\Delta p$  value = body  $\Delta p$  value + (real  $\Delta p$  value of the filter element x real viscosity value (cSt) / 36)

real  $\Delta p$  value of the filter element = value obtainable through the diagrams in paragraph 2.2

Such ratio is valid for a viscosity value up to 200 cSt.

For a higher viscosity please consult our technical department.

### 2.3 - Pressure drops through the by-pass valve

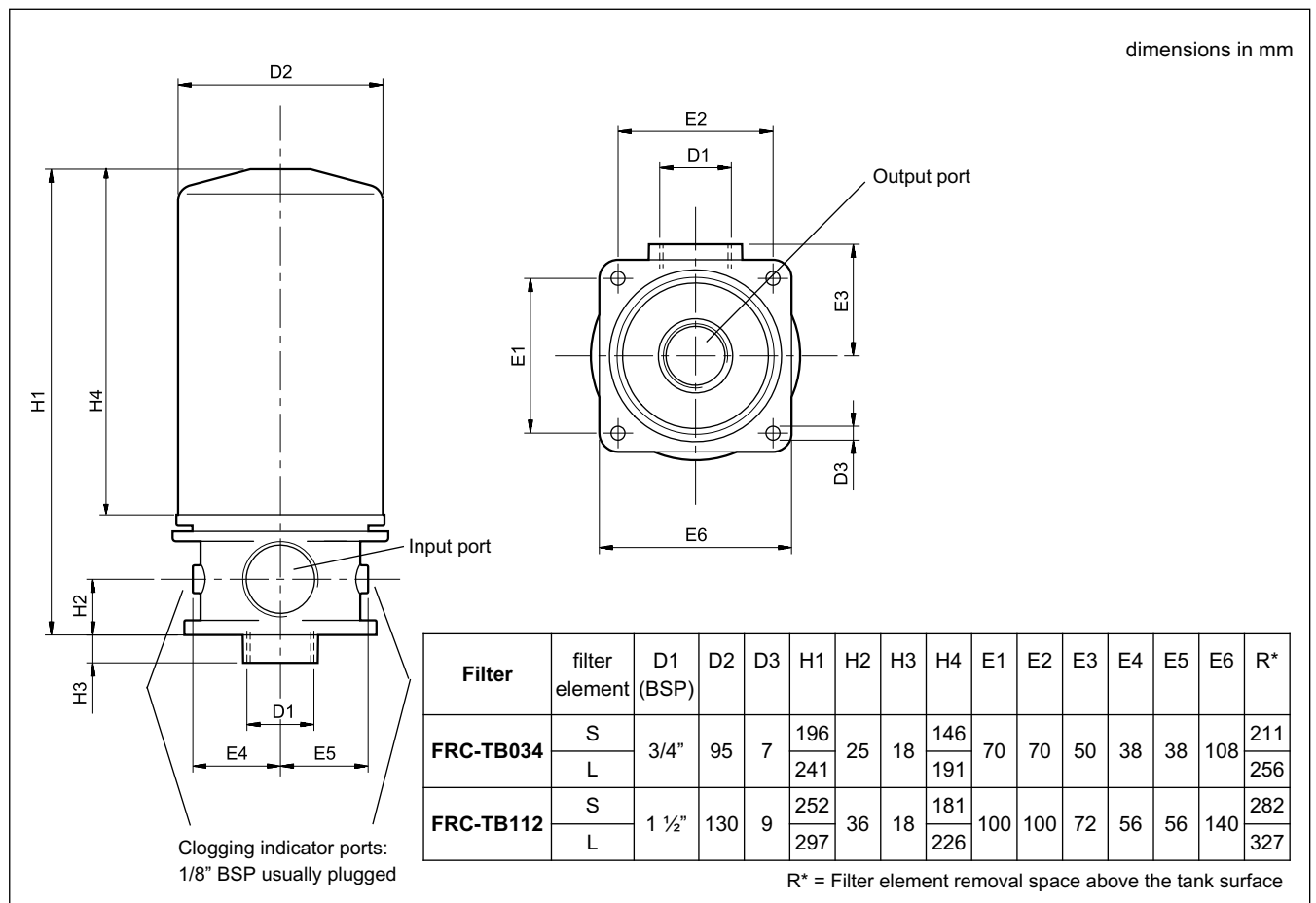


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS

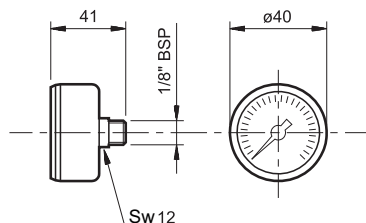


### 5 - CLOGGING INDICATORS

The filters are designed to incorporate clogging indicators, which have to be ordered separately.

#### 5.1 - Visual indicator for return filters

Identification code: VR/10



This indicator is a pressure gauge sensitive to the filter input pressure.

The indicator is supplied with a 0 ÷ 6 bar graduated scale and with a two-colour reading scale, which

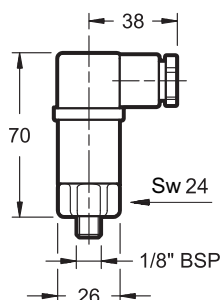
informs you about the clogging condition of the filter element:

GREEN: efficient filter element (0 ÷ 1.7 bar)

RED: the filter element has to be replaced (> 1.7 bar)

#### 5.2 - Electric indicator for return filters

Identification code: ER/11



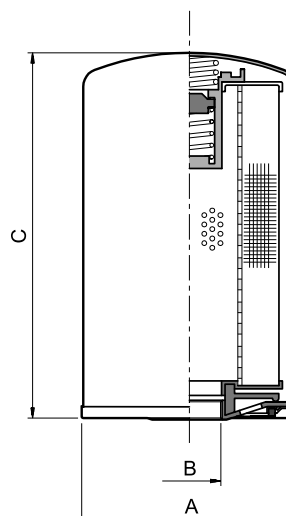
This indicator is a pressure switch sensitive to the filter input pressure, which switches an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

### TECHNICAL SPECIFICATIONS

Operating pressure	bar	1,5
<b>AC power supply</b>		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	3 0,5
<b>DC power supply</b>		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

### 6 - FILTER ELEMENTS



Filter element code	ØA	ØB	C	Average filtering surface [cm²]
FRCE - 034 -P*S	96,5	3/4" BSP	146	3305
FRCE - 034 -P*L	96,5	3/4" BSP	191	4745
FRCE - 034 -F25L	96,5	3/4" BSP	191	3630
FRCE - 112 -P*S	129	1 1/4" BSP	181	5560
FRCE - 112 -P*L	129	1 1/4" BSP	226	7360
FRCE - 112 -F25L	129	1 1/4" BSP	226	5890

### FILTER ELEMENT IDENTIFICATION CODE

<b>F</b>	<b>R</b>	<b>C</b>	<b>E</b>	-		-				/	<b>10</b>
----------	----------	----------	----------	---	--	---	--	--	--	---	-----------

Cartridge filter element for FRC filters

Nominal dimension  
**034** = 3/4" **112** = 1 1/2"

Filtration degree : F25 = fibre 25 µm  
P10 = paper 10 µm  
P25 = paper 25 µm

Type of filter element:  
**S** = standard (not available with a F25 filtration degree)  
**L** = long-lasting element

Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)

**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids upon request



# FPH

## PRESSURE FILTER FOR LINE MOUNTING

### SERIES 11

**p max 420 bar**  
**Q max (see table of performances)**

#### OPERATING PRINCIPLE

- FPH filters are designed to be line-mounted with BSP threaded ports for hydraulic connections. Threaded holes are machined on the head for possible filter bracket fixing.
- The replacement of the filter element can be easily carried out by using a normal hexagon spanner to unscrew the bowl of the filter, which has a suitably shaped end.
- FPH filters are designed to be installed on pressure lines up to 420 bar; the filter elements are made of high efficiency filtering materials and are capable of holding high quantities of contamination particles. They are available with three different filtration degrees:
  - H05 = 5  $\mu\text{m}$ : absolute ( $\beta_5 > 100$  - ISO 4406:1999 class 17/15/12) cartridge with a collapsing differential pressure = 210 bar to be used without a by-pass valve.
  - F10 = 10  $\mu\text{m}$ : absolute ( $\beta_{10} > 100$  - ISO 4406:1999 class 18/16/13)
  - F25 = 25  $\mu\text{m}$ : absolute ( $\beta_{25} > 100$  - ISO 4406:1999 class 19/17/14)
- Those filters with a F10 and F25 filtration degree are supplied with a by-pass valve and have a cartridge with a collapsing differential pressure = 20 bar.
- All the FPH filters are designed to incorporate a visual-differential or a visual-electric clogging indicator to be ordered separately (see par. 5).

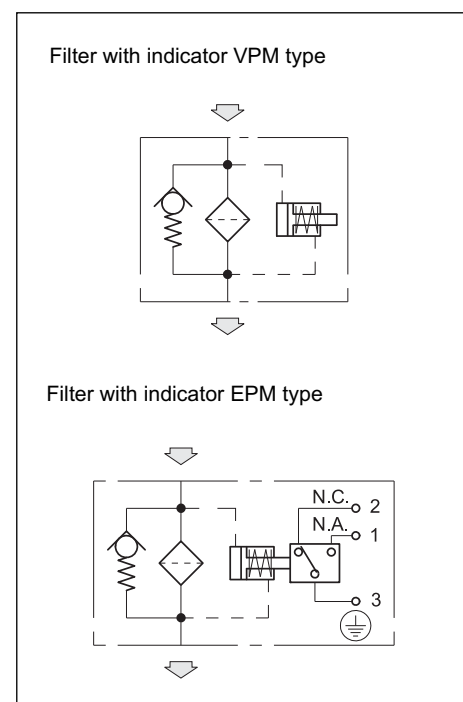
#### PERFORMANCES

Filter code	BSP port dimensions	Mass [Kg]	Rated flow (indicative) [l/min]		
			H05	F10	F25
FPH-TB012	1/2"	4.4	10	27	33
FPH-TB034	3/4"	5.2	19	42	65
FPH-TB100	1"	8.2	40	95	105
FPH-TB114	1 1/4"	14	88	190	230
FPH-TB112	1 1/2"	17.2	120	260	320

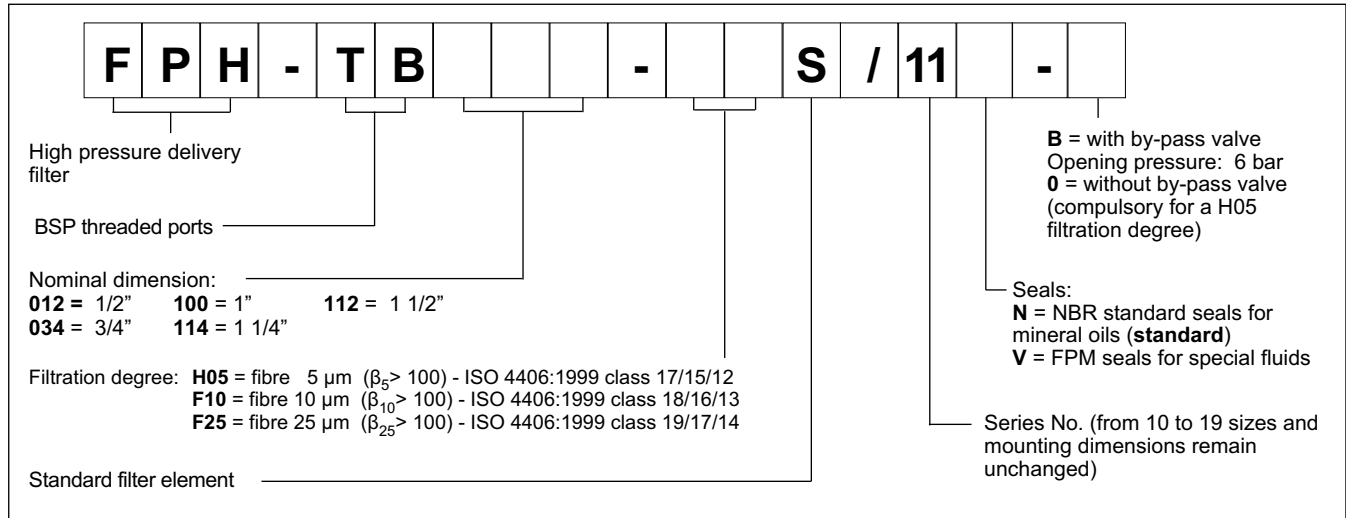
**NOTE 1:** The flow rates stated in the table correspond to a 0.8 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.  
As for a different viscosity range, see NOTE 2 - par. 2.2.

Maximum operating pressure	bar	420
Collapsing differential pressure of the filter element: H05	bar	210
F-10-F25	bar	20
Differential pressure for the opening of the by-pass valve ( $\pm 10\%$ )	bar	6
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

#### HYDRAULIC SYMBOL

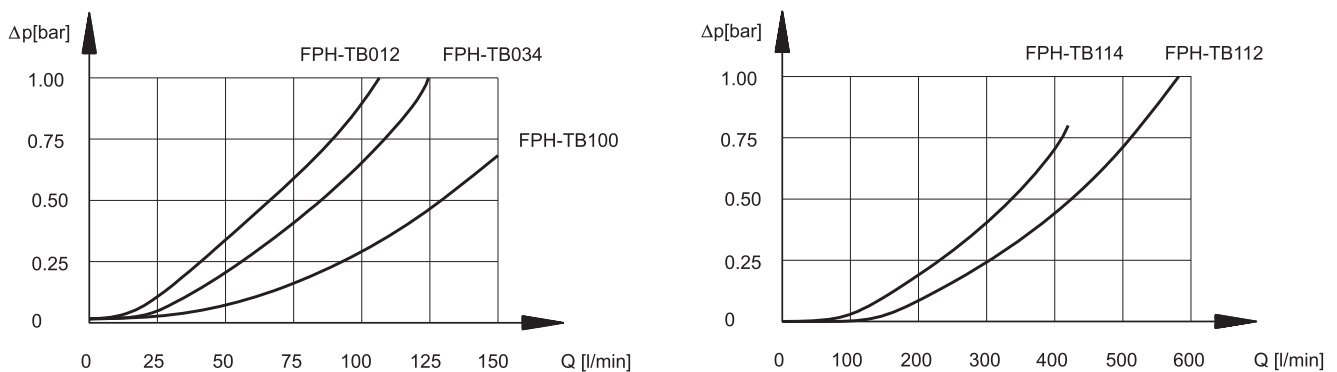


### 1 - IDENTIFICATION CODE

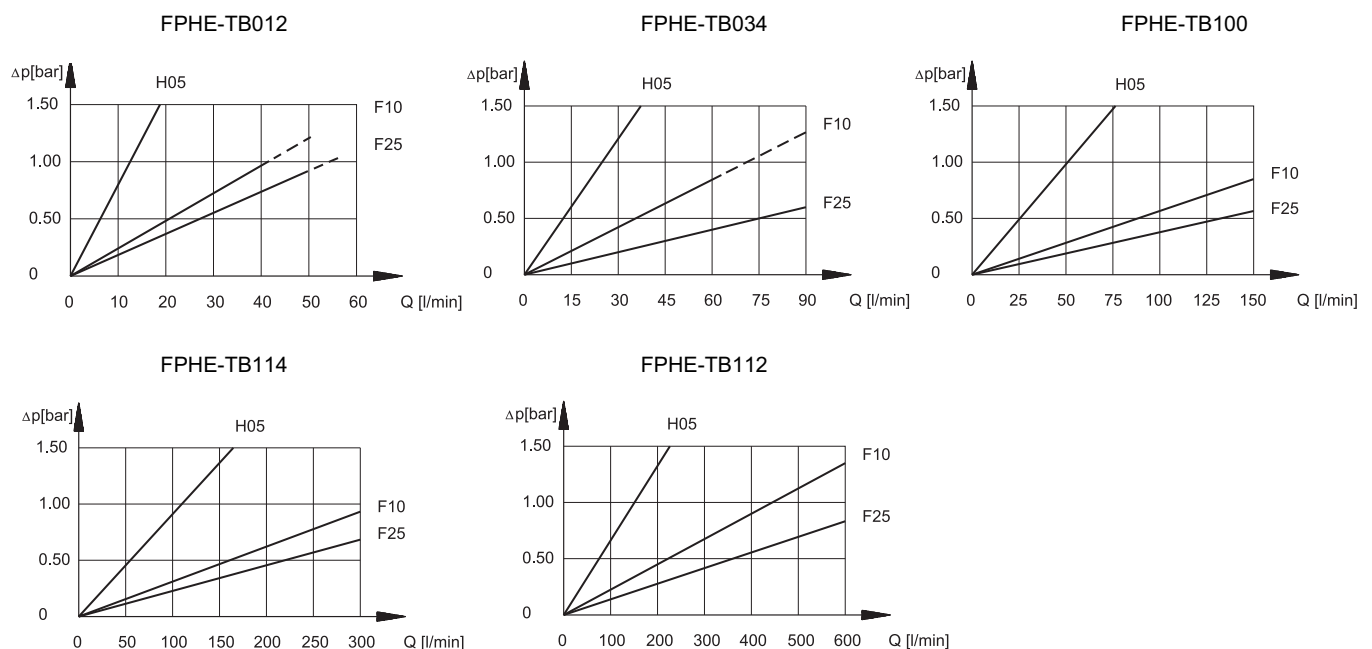


### 2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

#### 2.1 - Pressure drops through the filter body



#### 2.2 - Pressure drops through the FPHE filter element



**NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.8 bar.**

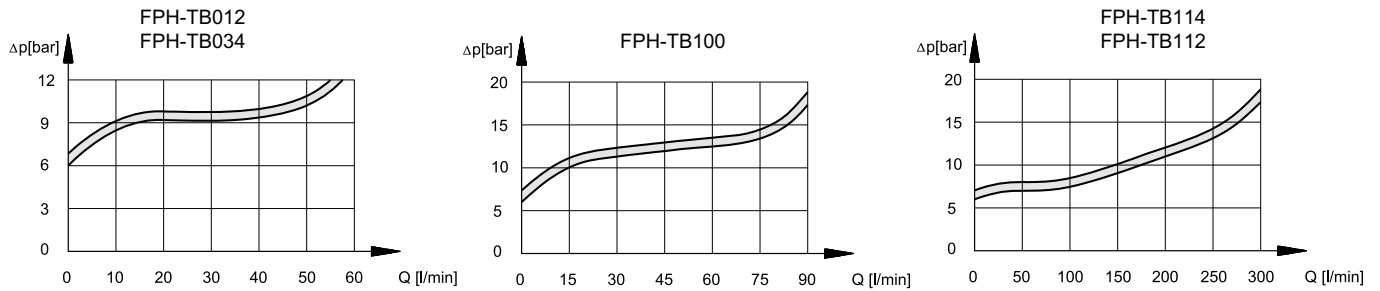
The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

$$\text{total } \Delta p \text{ value} = \text{body } \Delta p \text{ value} + (\text{real } \Delta p \text{ value of the filter element} \times \text{real viscosity value (cSt)} / 36)$$

$$\text{real } \Delta p \text{ value of the filter element} = \text{value obtainable through the diagrams in par. 2.2}$$

Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

### 2.3 - Pressure drops through the by-pass valve

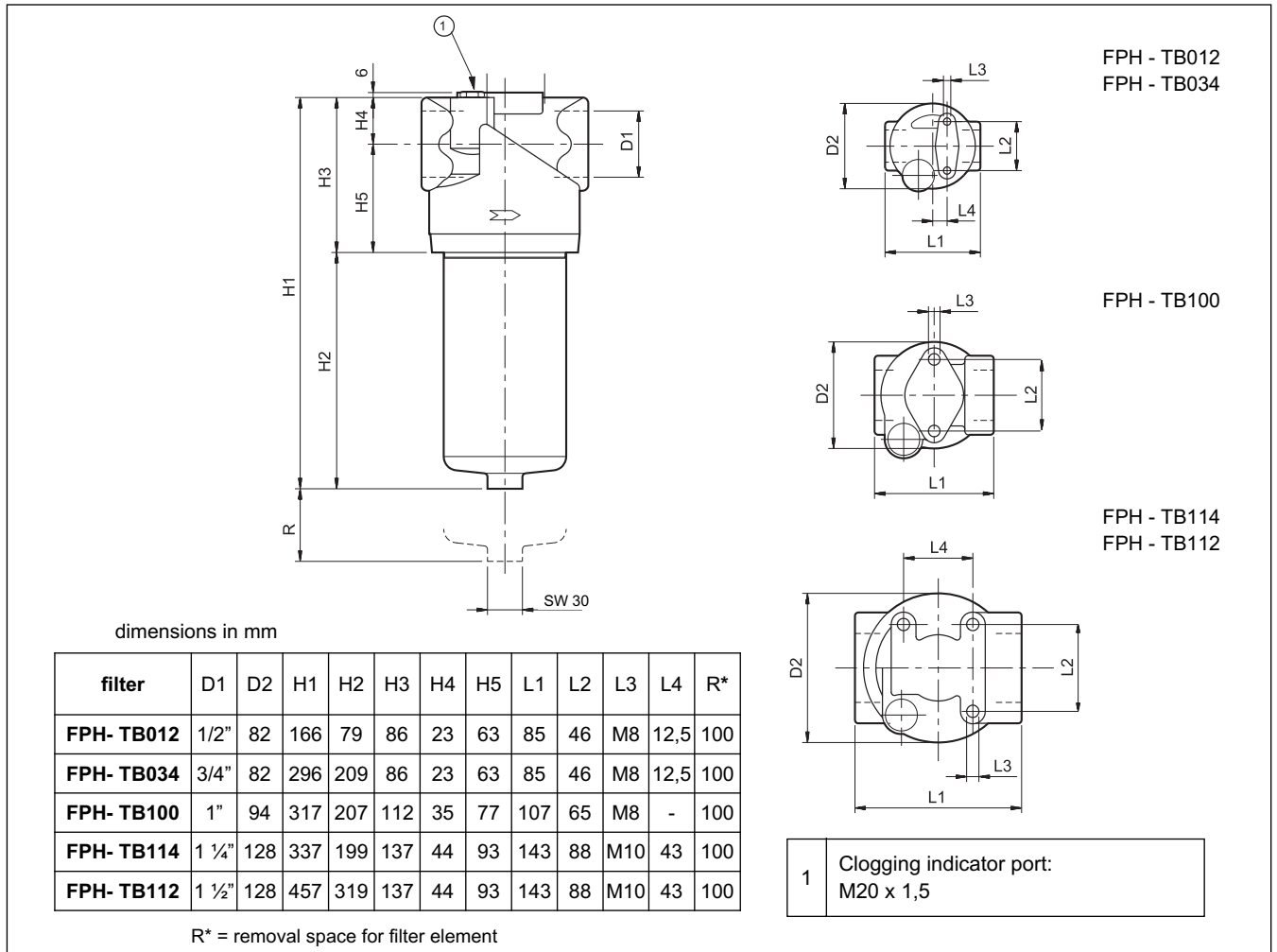


### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



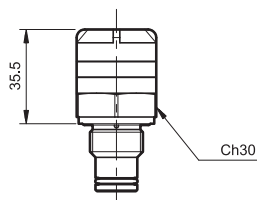


### 5 - CLOGGING INDICATORS

The filters are all designed to incorporate clogging indicators, which have to be ordered separately.

#### 5.1 - Visual indicator for delivery filters

Identification code: **VPM/10**



This indicator measures the differential pressure between the filter input and output.

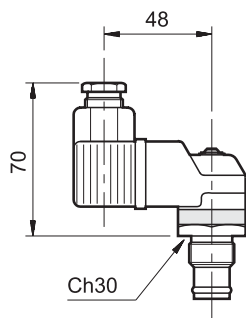
The indicator is supplied with coloured bands, which informs you about the clogging condition of the filter element:

WHITE: efficient filter element  $\Delta p < 5$  bar ( $\pm 10\%$ )

RED: the filter element has to be replaced  $\Delta p > 5$  bar ( $\pm 10\%$ )

#### 5.2 - Electric-visual indicator for delivery filters

Identification code: **EPM/10**



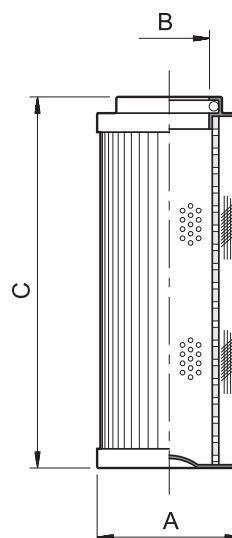
This indicator, apart from giving a visual indication, for example the VPM model, operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

### TECHNICAL SPECIFICATIONS

Differential operating pressure	bar	5
<b>AC power supply</b>		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive)	A	1
<b>DC power supply</b>		
Max. operating voltage	VDC	125
Max. load on the contacts (with V at 30-50-75-125 VDC) resistive inductive	A	2 - 0,5 - 0,25 - 0,2 2 - 0,5 - 0,25 - 0,03
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	

### 6 - FILTER ELEMENTS



filter element code	ØA	ØB	C	Average filtering surface [cm²]	
				H05	F12/F25
FPHE - 012	45	25	85	340	355
FPHE - 034	45	25	211	915	935
FPHE - 100	52	23,5	210	1785	1830
FPHE - 114	78	42,5	210	2695	3695
FPHE - 112	78	42,5	330	4325	5025

### FILTER ELEMENT IDENTIFICATION CODE

<b>F</b>	<b>P</b>	<b>H</b>	<b>E</b>	-			-			<b>S</b>	/	<b>10</b>
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Filter element for FPH filters

Nominal dimension:

**012** = 1/2"      **114** = 1 1/4"

**034** = 3/4"      **112** = 1 1/2"

**100** = 1"

Filtration degree: H05 = fibre 5 µm

F10 = fibre 10 µm

F25 = fibre 25 µm

Standard filter element

Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)

**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids (upon request)



# FPM

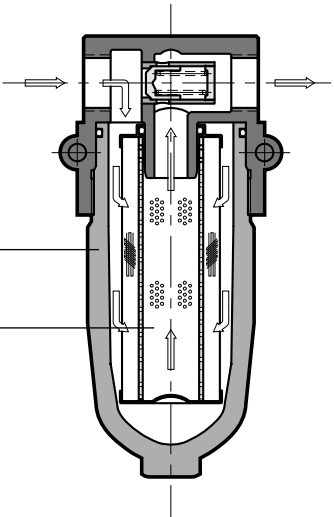
## MEDIUM PRESSURE FILTER FOR LINE MOUNTING

### SERIES 10

**p** max **210** bar

**Q** max (see table of performances)

#### OPERATING PRINCIPLE



Filter body

Filter element

- The FPM filters are designed to be line-mounted with BSP threaded ports for hydraulic connections. Threaded holes are machined on the head for possible filter bracket fixing .
- The replacement of the filter element can be easily carried out by using a normal hexagon spanner to unscrew the bowl of the filter, which has a suitably shaped end.
- FPM filters are designed to be installed on medium pressure lines up to 210 bar; the filter elements are made of high efficiency filtering materials and are available with three different filtration degrees:  
F05 = 5 µm absolute ( $\beta_5 > 100$  - ISO 4401:1999 class 17/15/12)  
F10 = 10 µm absolute ( $\beta_{10} > 100$  - ISO 4401:1999 class 18/16/13)  
F25 = 25 µm absolute ( $\beta_{25} > 100$  - ISO 4401:1999 class 19/17/14)
- The filters are always supplied with a by-pass valve.
- The filter elements are available in the standard version (S) or in the long-lasting version (L) is able to hold high quantities of contamination material. For all filter elements the collapsing differential pressure is 20 bar.
- All the FPM filters are designed to incorporate a visual-differential or a visual-electric clogging indicator to be ordered separately (see paragraph 5).

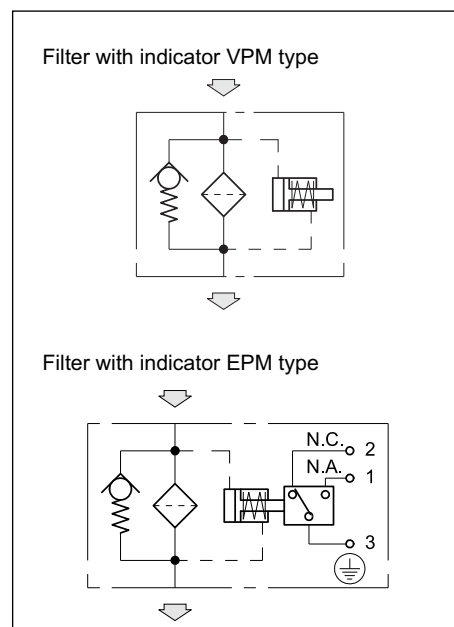
#### PERFORMANCES

Filter code	BSP port dimensions	Mass [Kg]		Rated flow (indicative) [l/min]					
		type S	type L	F05S	F05L	F10S	F10L	F25S	F25L
FPM-TB012	1/2"	1,5	2,0	25	40	35	50	45	60
FPM-TB034	3/4"			35	50	50	65	65	80
FPM-TB100	1"			40	60	60	85	85	100

**NOTE 1:** the flow rates stated in the table correspond to a 0.8 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.  
As for a different viscosity range, see NOTE 2 - par. 2.2.

Maximum operating pressure	bar	210
Collapsing differential pressure of the filter element	bar	20
Differential pressure for the opening of the by-pass valve ( $\pm 10$ %)	bar	6
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

#### HYDRAULIC SYMBOL



### 1 - IDENTIFICATION CODE

<b>F</b>	<b>P</b>	<b>M</b>	<b>-</b>	<b>T</b>	<b>B</b>			<b>-</b>			<b>/ 10</b>		<b>-</b>	
----------	----------	----------	----------	----------	----------	--	--	----------	--	--	-------------	--	----------	--

Medium pressure delivery filter

BSP threaded ports

Nominal dimension:  
**012** = 1/2"    **034** = 3/4"    **100** = 1"

Filtration degree:  
**F05** = fibre 5 µm ( $\beta_5 > 100$ ) - ISO 4401:1999 class 17/15/12  
**F10** = fibre 10 µm ( $\beta_{10} > 100$ ) - ISO 4401:1999 class 18/16/13  
**F25** = fibre 25 µm ( $\beta_{25} > 100$ ) - ISO 4401:1999 class 19/17/14

Type of filter element:  
**S** = standard    **L** = long-lasting element

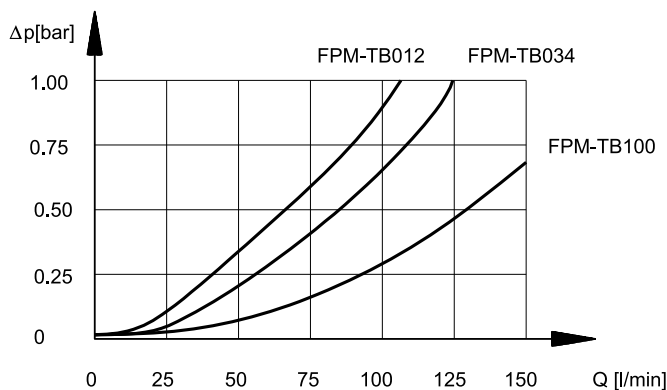
**B** = with by-pass valve  
Opening pressure 6 bar  
**0** = without by-pass valve  
(upon request only)

Seals:  
**N** = NBR standard seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids

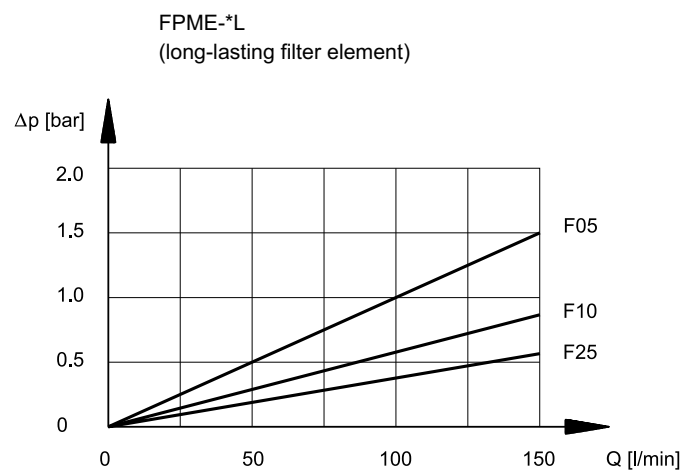
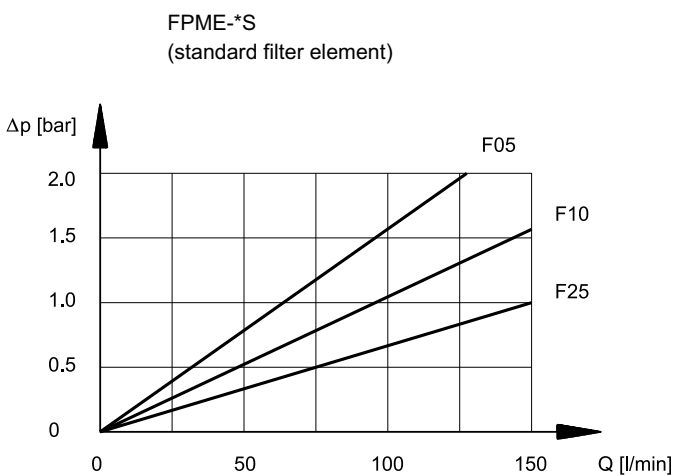
Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

### 2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

#### 2.1 - Pressure drops through the filter body



#### 2.2 - Pressure drops through FPME filter element



**NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.8 bar.**

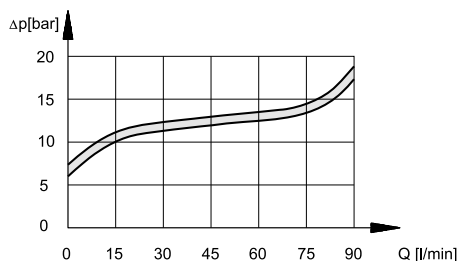
The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

$$\text{total } \Delta p_l \text{ value} = \text{body } \Delta p \text{ value} + (\text{real } \Delta p \text{ value of the filter element} \times \text{real viscosity value (cSt)} / 36)$$

$$\text{real } \Delta p \text{ value of the filter element} = \text{value obtainable through the diagrams in paragraph 2.2}$$

Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

### 2.3 - Pressure drops through by-pass valve



### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

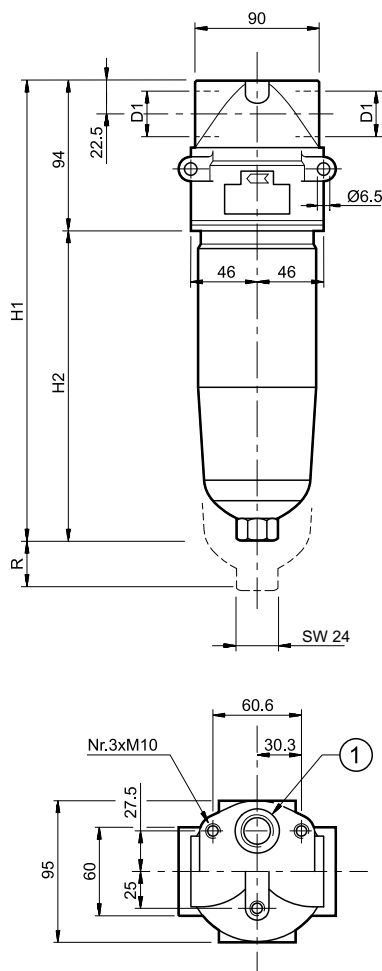
### 4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

Filter code	D1	H1	H2	R*
FPM-TB012-*S	1/2"	205	111	100
FPM-TB034-*S	3/4"	205	111	100
FPM-TB100-*S	1"	205	111	100
FPM-TB012-*L	1/2"	298	197	100
FPM-TB034-*L	3/4"	298	197	100
FPM-TB100-*L	1"	298	197	100

R\* = Filter element removal space

1	Clogging indicator port: M20 x 1,5
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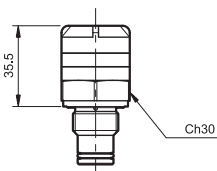


### 5 - CLOGGING INDICATORS

The filters are all designed to incorporate clogging indicators, which have to be ordered separately

#### 5.1 - Visual indicator for medium pressure delivery filters

Identification code: **VPM/10**



This indicator measures the differential pressure between the filter input and output.

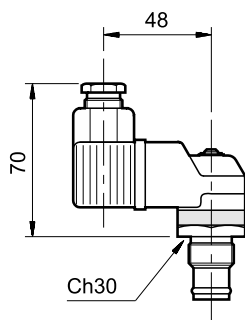
The indicator is supplied with coloured bands, which informs you about the clogging condition of the filter element:

WHITE: efficient filter element  $\Delta p < 5$  bar ( $\pm 10\%$ )

RED: the filter element has to be replaced  $p > 5$  bar ( $\pm 10\%$ )

#### 5.2 - Electric-visual indicator for delivery filters

Identification code: **EPM/10**



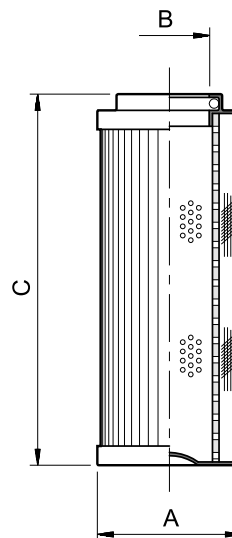
This indicator, apart from giving a visual indication, for example the VPM model, operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

### TECHNICAL SPECIFICATIONS

Differential operating pressure	bar	5
<b>AC power supply</b>		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive)	A	5
<b>DC power supply</b>		
Max. operating voltage	VDC	125
Max. load on the contacts (with V at 30-50-75-125 VDC) resistive inductive	A	2 - 0,5 - 0,25 - 0,2 2 - 0,5 - 0,25 - 0,03
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	

### 6 - FILTER ELEMENTS



filter element code	ØA	ØB	C	Average filtering surface [cm²]
FPME - *S	52	23,5	115	975
FPME - *L	52	23,5	210	1830

### FILTER ELEMENT IDENTIFICATION CODE

**F P M E - / 10**

Filter element for FPM filters

Filtration degree:

**F05** = fibre 5 µm

**F10** = fibre 10 µm

**F25** = fibre 25 µm

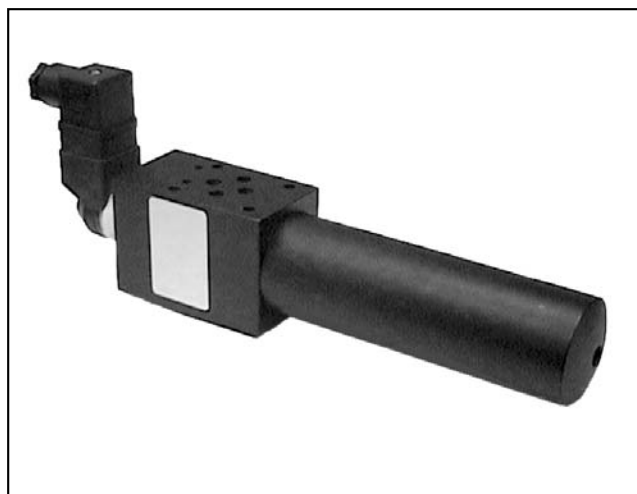
Filter element type:

**S** = standard

**L** = long-lasting

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

**N** = NBR seals for mineral oils (**standard**)  
**V** = FPM seals for special fluids (upon request)



# FPHM

## PRESSURE FILTER

### SERIES 10

#### MODULAR VERSION

**p** max **320** bar

**Q** max (see table of performances)

#### OPERATING PRINCIPLE

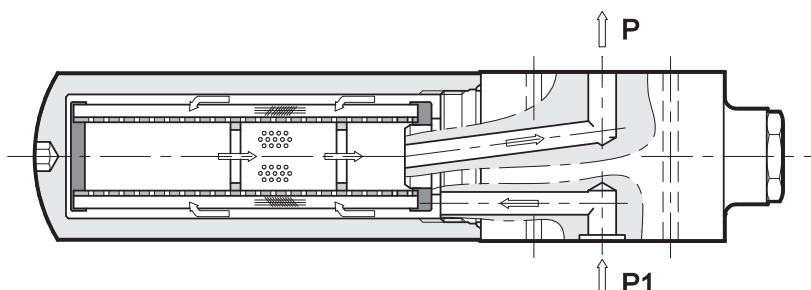
- The FPHM filters are designed for the modular mounting directly under proportional valves or servovalves with ISO 4401 (CETOP RP 121H) interfaces.
- They are available in two nominal dimensions with ISO 4401-03 (CETOP 03) e ISO 4401-05 (CETOP 05) mounting surface.
- FPHM filters are designed for working pressures up to 320 bar. The filter elements are made of high efficiency filtering materials and are available with three different filtration degrees and with a collapsing differential pressure = 210 bar:

F05 = 5  $\mu$ m absolute  
( $\beta_{10}>100$  - ISO 4406:1999 class 17/15/12)

F10 = 10  $\mu$ m absolute  
( $\beta_{10}>100$  - ISO 4406:1999 class 18/16/13)

F25 = 25  $\mu$ m absolute  
( $\beta_{25}>100$  - ISO 4406:1999 class 19/17/14)

- All the FPHM filters are supplied without by-pass valve and are designed to incorporate a visual-differential or a visual-electric clogging indicator to be ordered separately (see paragraph 5).



#### PERFORMANCES

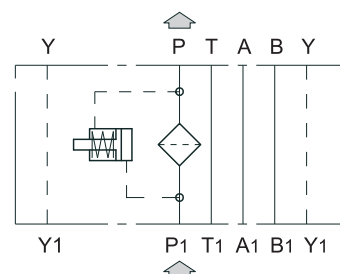
Filter	Dimensions	Mass [Kg]	Rated flow (indicative) [l/min]		
			F05	F10	F25
<b>FPHM3</b>	ISO 4401-03	2,5	12	13,5	16
<b>FPHM5</b>	ISO 4401-05	4,2	22	25	28

**NOTE 1:** The flow rates stated in the table correspond to a 3 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.  
As for a different viscosity range, see NOTE 2 - par. 2.2.

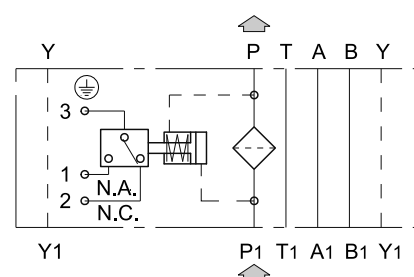
Maximum operating pressure	bar	320
Collapsing differential pressure of the filter element	bar	210
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

#### HYDRAULIC SYMBOL

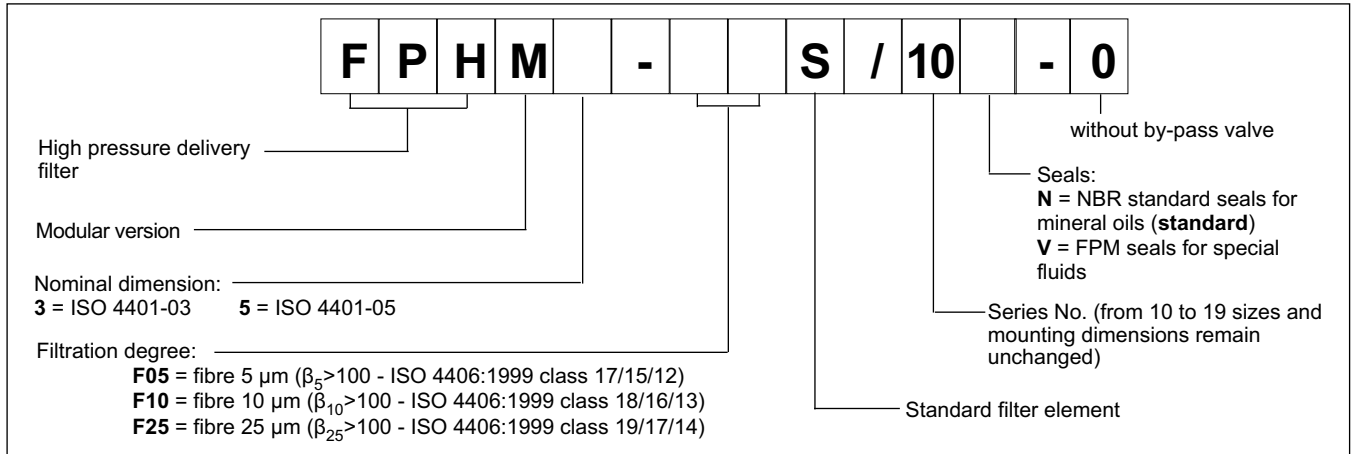
Modular filter with indicator VM type



Modular filter with indicator EM type

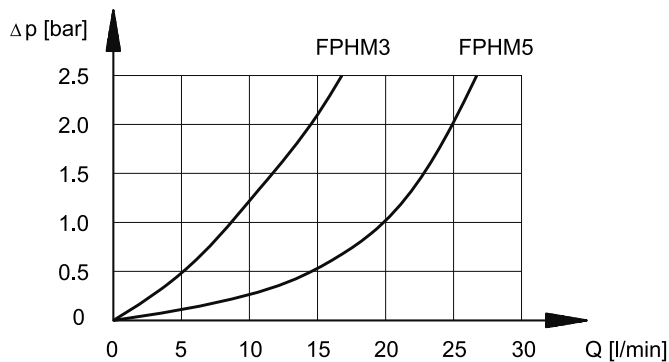


## 1 - IDENTIFICATION CODE

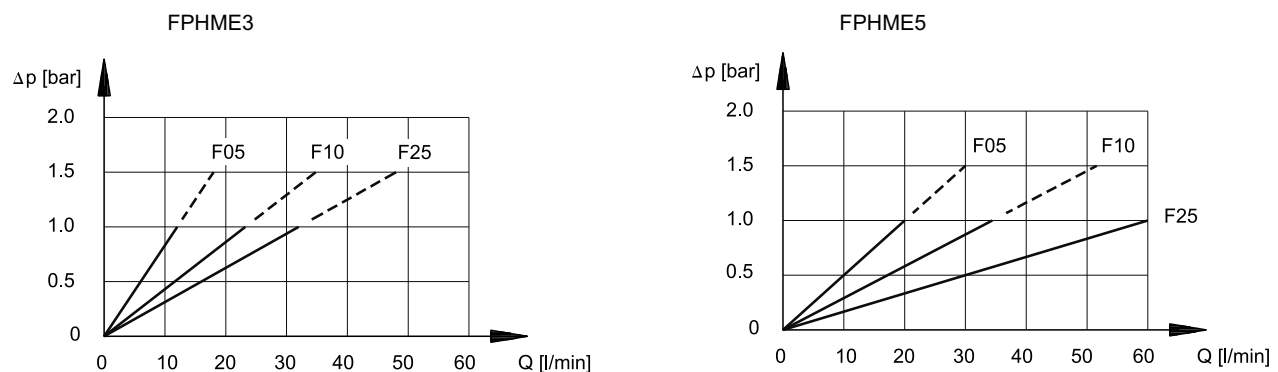


## 2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

### 2.1 - Pressure drops through the filter body



### 2.2 - Pressure drops through FPHME filter element



**NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.8 bar.**

The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

$$\text{total } \Delta p \text{ value} = \text{body } \Delta p \text{ value} + (\text{real } \Delta p \text{ value of the filter element} \times \text{real viscosity value (cSt)} / 36)$$

$$\text{real } \Delta p \text{ value of the filter element} = \text{value obtainable through the diagrams in par. 2.2}$$

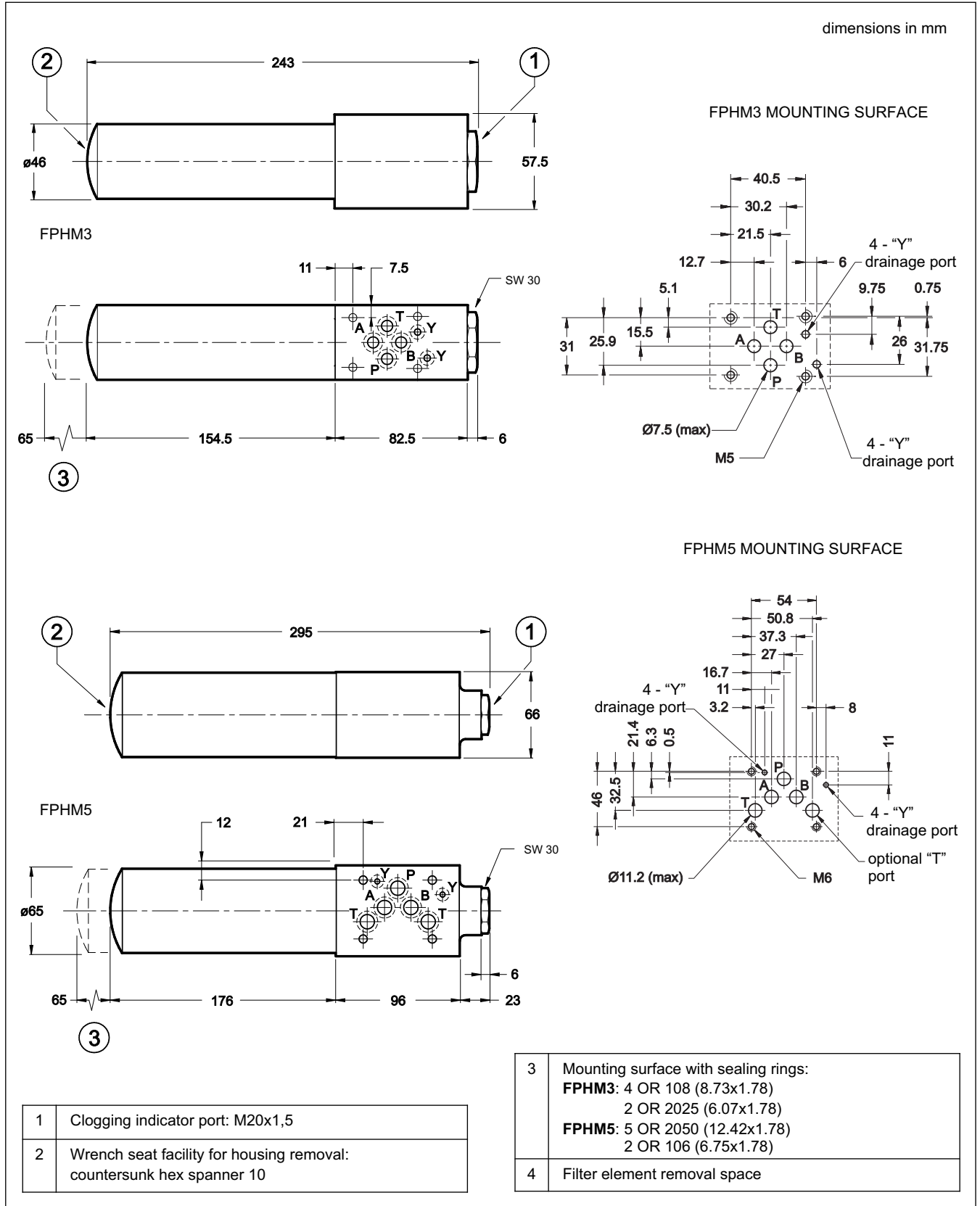
Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

### 3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

### 4 - OVERALL AND MOUNTING DIMENSIONS



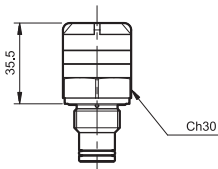


## 5 - CLOGGING INDICATORS

The filters are all designed to incorporate clogging indicators, which have to be ordered separately.

### 5.1 - Visual indicator for modular filters

Identification code: VM/10



This indicator measures the differential pressure between the filter input and output.

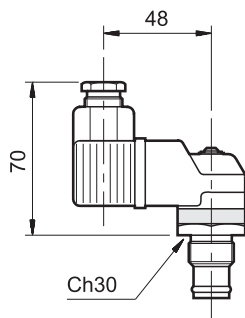
The indicator is supplied with coloured bands, which informs you about the clogging condition of the filter element:

WHITE: efficient filter element  $\Delta p < 8 \text{ bar}$  ( $\pm 10\%$ )

RED: the filter element has to be replaced  $\Delta p > 8 \text{ bar}$  ( $\pm 10\%$ )

### 5.2 - Electric-visual indicator for modular filters

Identification code: EM/10



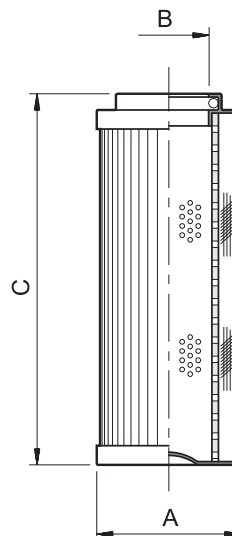
This indicator, apart from giving a visual indication, for example the VPM model, operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

## TECHNICAL SPECIFICATIONS

Differential operating pressure	bar	8
<b>AC power supply</b>		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive)	A	5
<b>DC power supply</b>		
Max. operating voltage	VDC	125
Max. load on the contacts (with V at 30-50-75-125 VDC)	A	
resistive		2 - 0,5 - 0,25 - 0,2
inductive		2 - 0,5 - 0,25 - 0,03
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	

## 6 - FILTER ELEMENTS



filter element code	ØA	ØB	C	Average filtering surface [cm²]
<b>FPHME3</b>	33	16	100	270
<b>FPHME5</b>	45	25	115	475

## FILTER ELEMENTS IDENTIFICATION CODE

<b>F</b>	<b>P</b>	<b>H</b>	<b>M</b>	<b>E</b>	-		<b>S</b>	/	<b>10</b>
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Filter element for FPHM modular filter

Nominal dimension:

**3** = ISO 4401-03

**5** = ISO 4401-05

Filtration degree : **F05** = fibre 5 µm

**F10** = fibre 10 µm

**F25** = fibre 25 µm

Standard filter element

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

**N** = NBR seals for mineral oils (**standard**)

**V** = FPM seals for special fluids (upon request)



# CTR\*

## HYDRAULIC POWER UNITS

### TANK CAPACITY

from 8 lt to 150 lt

### PUMP FLOW RATE

from 1,6 lt to 41lt

### DESCRIPTION

The CTR\* power units, are realised with a soaked gear pump and a vertically mounted electric motor.

The tank cover can be rotated of 180° without disassembling the installed components.

The standard components are intake filter, gear pump, motor - pump connection group, arrangement for the electric motor, pressure relief valve, a position for one electro-valve (not included in the supplying), manometer with the shut-off cock, oil charge cover and oil visual indicator.

The electric motor supplied is a eurotension 4-poles three-phase asynchronous motor with shape B5 according to UNEL-MEC standards.

The available paintings are dull black RAL 9005 (**standard**), Grey RAL 7037 and Green RAL 6011.

The power units works with mineral oil (not included in the supplying).

To work with other hydraulic fluids, please consult our Technical Department.

### OPTIONALS

The standard power unit can be equipped with the following components:

#### CTR 0 - 1 - 2

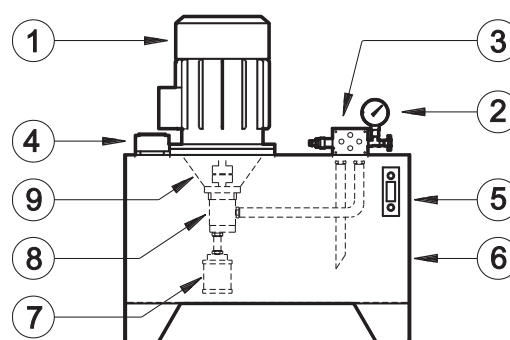
- other settings for electro-valves ISO 4401-03 (CETOP 03) with P2D modular subplates
- thermostat
- level gauge
- return filter for line mounting
- other colour paintings under request

#### CTR 3 - 4

- high pressure pumps H version
- other settings for electrovalves ISO 4401-03 (CETOP 03) with P2D modular subplates.
- thermostat
- level gauge
- a return filter for line mounting
- an heat exchanger air/oil or water/oil
- other colour paintings under request

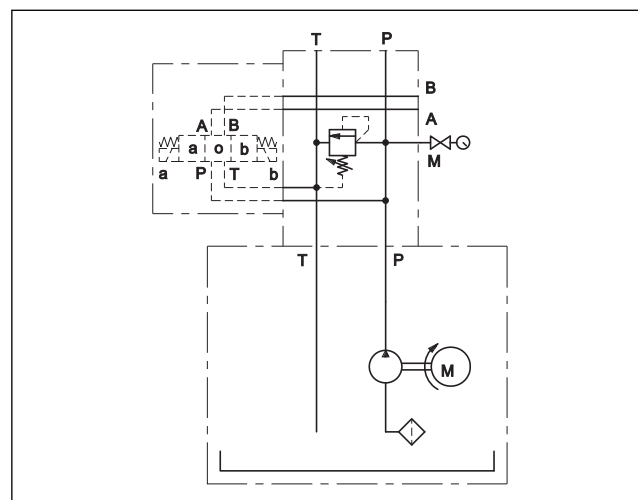
The standard power unit is delivered without the functional diagram.

### STANDARD COMPONENTS



- 1) Electric motor
- 2) Manometer with shut-off selector
- 3) Pressure relief valve
- 4) Charge cover
- 5) Level gauge
- 6) Oil reservoir
- 7) intake filter
- 8) Gear pumps
- 9) Motor - pump connection group

### HYDRAULIC SYMBOL





## 1 - CTR0 power unit

### 1.1 - Identification code

<b>C</b>	<b>T</b>	<b>R</b>	<b>0</b>	<b>-</b>	<b>008</b>	<b>/</b>				<b>/</b>	<b>1P</b>	<b>-</b>	<b>/</b>				<b>/</b>	<b>40</b>
----------	----------	----------	----------	----------	------------	----------	--	--	--	----------	-----------	----------	----------	--	--	--	----------	-----------

power unit with soaked pump

Cover size \_\_\_\_\_

Tank capacity 8 dm<sup>3</sup> \_\_\_\_\_

Electric motor shape B5  
**P** = arrangement for motor mounting  
**M** = electric motor already mounted

4-poles electric motor power:  
**0.25** = 0.25 kW  
**0.37** = 0.37 kW

Electric motor voltage  
(omit for P version)  
**A** = 230-400V / 50-60 Hz

Pump type **1P** \_\_\_\_\_  
(see cat. 11 110 for the pump technical characteristics)

Pump flow rate(l/min) at 1500 rpm  
(see flow rate / pressure table)

Series No. (from 40 to 49 sizes and mounting dimensions remain unchanged)

**N** = Dull black RAL 9005 (**standard**)  
**G** = Grey RAL 7037  
**V** = Green RAL 6011

**0** = without thermostat  
**1** = with thermostat

**0** = without level gauge  
**1** = with level gauge

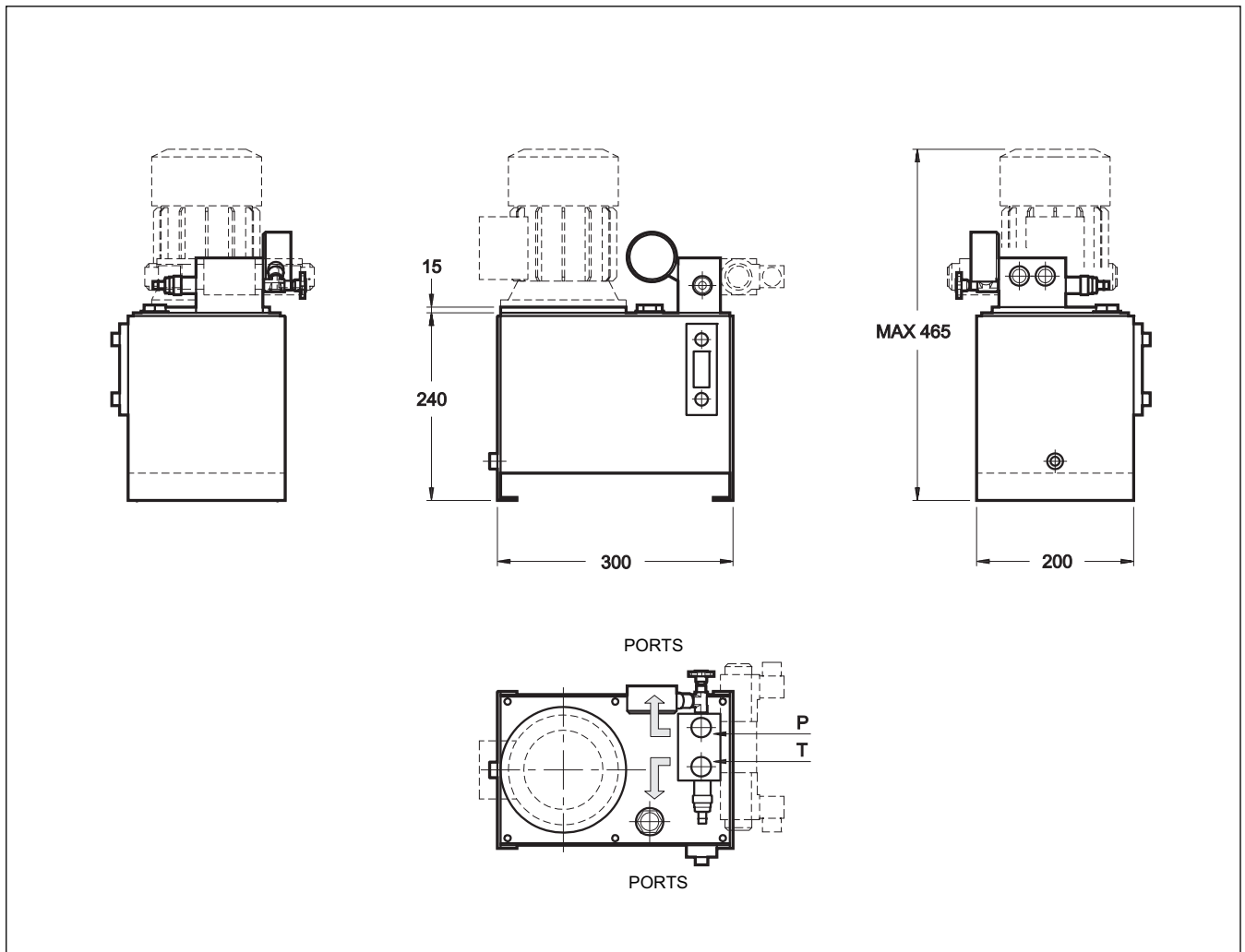
Standard panel with 3/8" rear ports  
**A** = P2D-M\* with 1 pos. ISO 4401-03 (CETOP 03)  
**B** = P2T -M\* with 2 pos. ISO 4401-03 (CETOP 03)

### 1.2 - Flowrate / pressure table

Electric motor flange size			Ø = 160	
CTR0	Pump type	Flow rate at 1500 rpm [lt/min]	Electric motor power [kW]	
			<b>0,25</b>	<b>0,37</b>
			Max pressure [bar]	
008	1P 1,6 R	<b>1,6</b> *	80	115
	2 R	<b>2,0</b>	65	95
	2,5 R	<b>2,4</b> *	55	80
	3,3 R	<b>3,2</b>	40	60
	4,2 R	<b>3,9</b> *	30	50
	5 R	<b>4,8</b>	25	40
	5,8 R	<b>5,5</b> *	20	35
	6,7 R	<b>6,3</b>	15	30
	7,5 R	<b>7,1</b>	10	25

\* pumps for preferential choice

## 1.3 - Overall and mounting dimensions for CTR0





## 2 - POWER UNITS CTR1

### 2.1 - Identification code

<b>C</b>	<b>T</b>	<b>R</b>	<b>1</b>	-		/				/	<b>1P</b>	-		/					/	<b>40</b>
----------	----------	----------	----------	---	--	---	--	--	--	---	-----------	---	--	---	--	--	--	--	---	-----------

power unit with soaked pump

Cover size \_\_\_\_\_

Tank capacity \_\_\_\_\_  
**013** = 13 dm<sup>3</sup>  
**020** = 20 dm<sup>3</sup>

Electric motor B5 shape \_\_\_\_\_  
**P** = Predisposition for motor assembly  
**M** = Mounted electric motor

4-poles power electric motor: \_\_\_\_\_  
**0.55** = 0.55 kW  
**0.75** = 0.75 kW  
**1.1** = 1.1 kW  
**1.5** = 1.5 kW

Electric motor voltage \_\_\_\_\_  
(omit for P version)  
**A** = 230-400V / 50-60 Hz

Pump type **1P** \_\_\_\_\_  
(see cat. 11 110 for the pump technical characteristics)

Flowrate pump (l/min) at 1500 rpm \_\_\_\_\_  
(see flowrate / pressure table)

Series No. (from 40 to 49 sizes and mounting dimensions remain unchanged)

**N** = Dull black RAL 9005 (**standard**)  
**G** = Grey RAL 7037  
**V** = Green RAL 6011

Return filter:  
**0** = without filter  
**1** = filter with visual indicator  
**2** = filter with electric indicator

**0** = without thermostat  
**1** = with thermostat

**0** = without level gauge  
**1** = with level gauge

Standard panel with rear ports G 3/8"

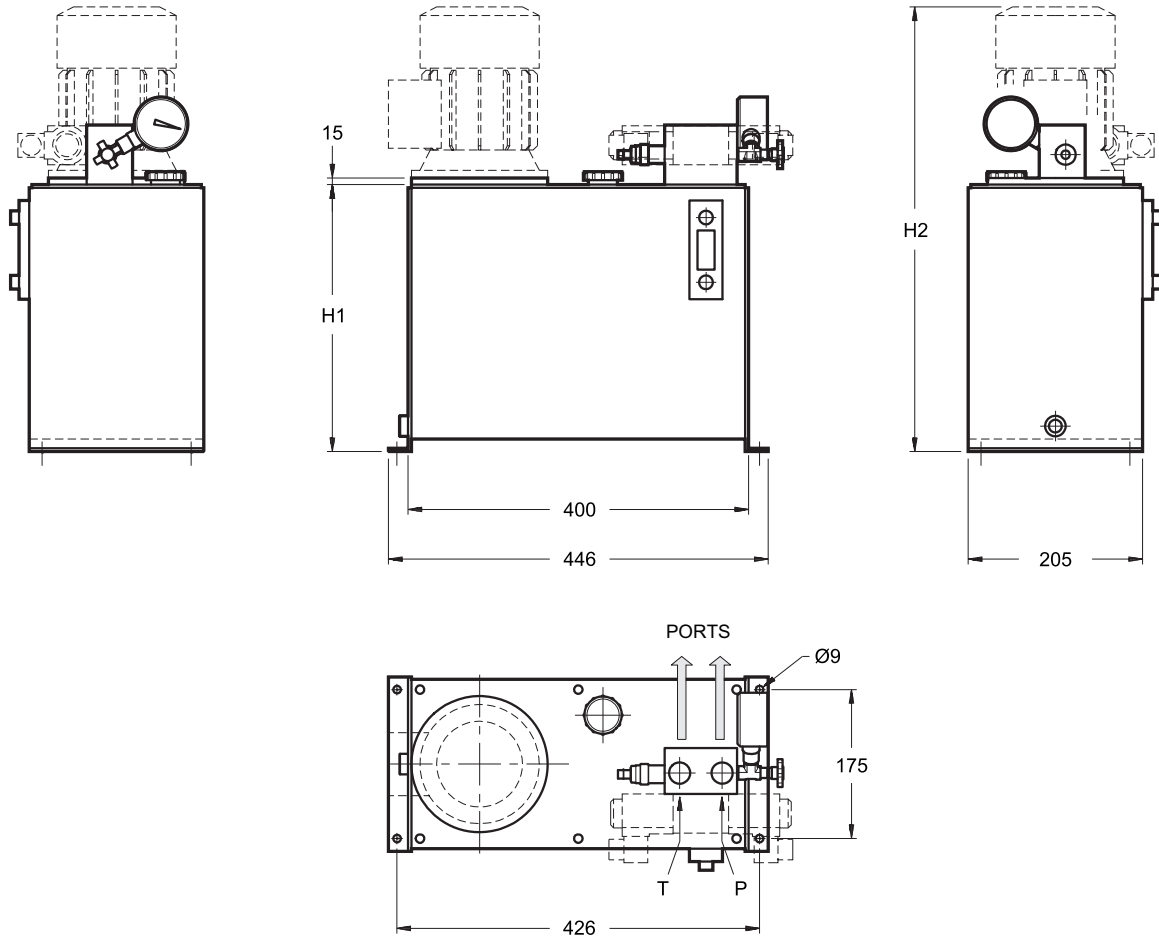
**A** = P2D-M\* with 1 pos. ISO 4401-03 (CETOP 03)  
**B** = P2T-M\* with 2 pos. ISO 4401-03 (CETOP 03)

### 2.2 - Flowrate / pressure table

Electric motor flange size				Ø = 200			
CTR1		Pump type	Flow at 1500 rpm [lt/min]	Electric motor power [kW]			
				0,55	0,75	1	1,5
				max pressure [bar]			
020	013	1P 1,6 R	1,6 *	180	-	-	-
		2 R	2,0	145	195	-	-
		2,5 R	2,4 *	120	160	-	-
		3,3 R	3,2	90	120	160	-
		4,2 R	3,9 *	75	100	130	200
		5 R	4,8	60	80	110	160
		5,8 R	5,5 *	50	70	95	140
		6,7 R	6,3	45	60	80	120
		7,5 R	7,1	40	55	70	110
		9,2 R	8,7 *	35	45	60	90
		11,5 R	11,9	25	30	45	65

\* pumps for preferential choice

## 2.3 - Overall and mounting dimensions for CTR1



	013	020
H1	235	315
H2 (max)	535	615



## 3 - POWER UNITS CTR2

### 3.1- Identification code

<b>C</b>	<b>T</b>	<b>R</b>	<b>2</b>	<b>-</b>	<b>025</b>	<b>/</b>		<b>/</b>	<b>1P</b>	<b>-</b>	<b>/</b>				<b>/</b>	<b>40</b>
----------	----------	----------	----------	----------	------------	----------	--	----------	-----------	----------	----------	--	--	--	----------	-----------

power unit with soaked pump

Cover size \_\_\_\_\_

Tank capacity \_\_\_\_\_  
**025** = 25 dm<sup>3</sup>

Electric motor B5 shape \_\_\_\_\_  
**P** = Predisposition for motor assembly  
**M** = Mounted electric motor

4-poles power electric motor: \_\_\_\_\_  
**0.55** = 0.55 kW  
**0.75** = 0.75 kW  
**1.1** = 1.1 kW  
**1.5** = 1.5 kW

Electric motor voltage \_\_\_\_\_  
(omit for P version)  
**A** = 230-400V / 50-60 Hz

Pump type **1P** \_\_\_\_\_  
(see cat. 11 110 for the pump technical characteristics)

Flowrate pump (l/min) at 1500 rpm \_\_\_\_\_  
(see flowrate / pressure table)

Series No. (from 40 to 49 sizes and mounting dimensions remain unchanged)

**N** = Dull black RAL 9005 (**standard**)  
**G** = Grey RAL 7037  
**V** = Green RAL 6011

Return filter:  
**0** = without filter  
**1** = filter with visual indicator  
**2** = filter with electric indicator

**0** = without thermostat  
**1** = with thermostat

**0** = without level gauge  
**1** = with level gauge

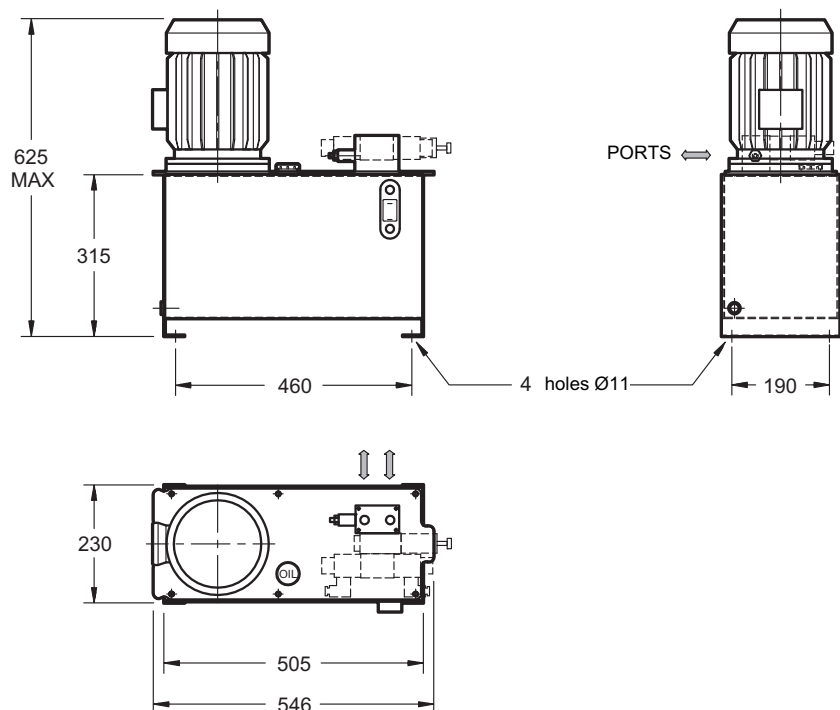
Standard panel with rear ports G 3/8"  
**A** = P2D-M\* with 1 pos. ISO 4401-03 (CETOP 03)  
**B** = P2T-M\* with 2 pos. ISO 4401-03 (CETOP 03)

### 3.2 - Flowrate / pressure table

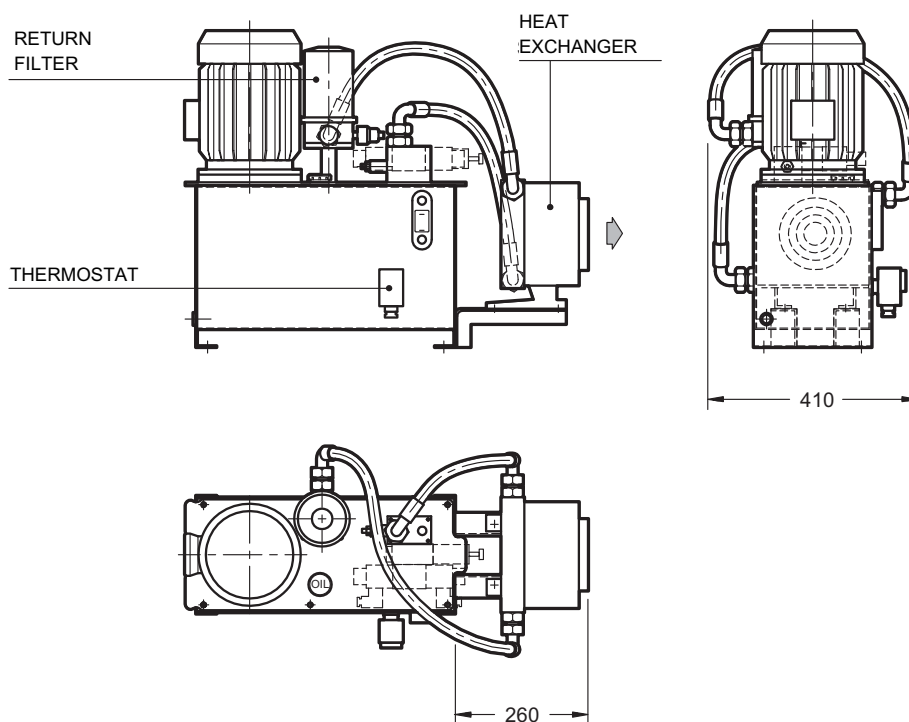
Electric motor flange size			Ø = 200			
CTR2	Pump type	Flowrate at 1500 rpm [lt/min]	Electric motor power [kW]			
			0,55	0,75	1	1,5
			max pressure [bar]			
025	1P 1,6 R	1,6 *	180	-	-	-
	2 R	2,0	145	195	-	-
	2,5 R	2,4 *	120	160	-	-
	3,3 R	3,2	90	120	160	-
	4,2 R	3,9 *	75	100	130	200
	5 R	4,8	60	80	110	160
	5,8 R	5,5 *	50	70	95	140
	6,7 R	6,3	45	60	80	120
	7,5 R	7,1	40	55	70	110
	9,2 R	8,7 *	35	45	60	90
	11,5 R	11,9	25	30	45	65
	GP1-0013	2,0 *	140	190	250	-
	0020	3,0 *	95	130	170	250

\* pumps for preferential choice

### 3.3 - Overall and mounting dimensions for basic CTR2



### 3.4 - CTR2 with optionals





## 4 - POWER UNITS CTR3

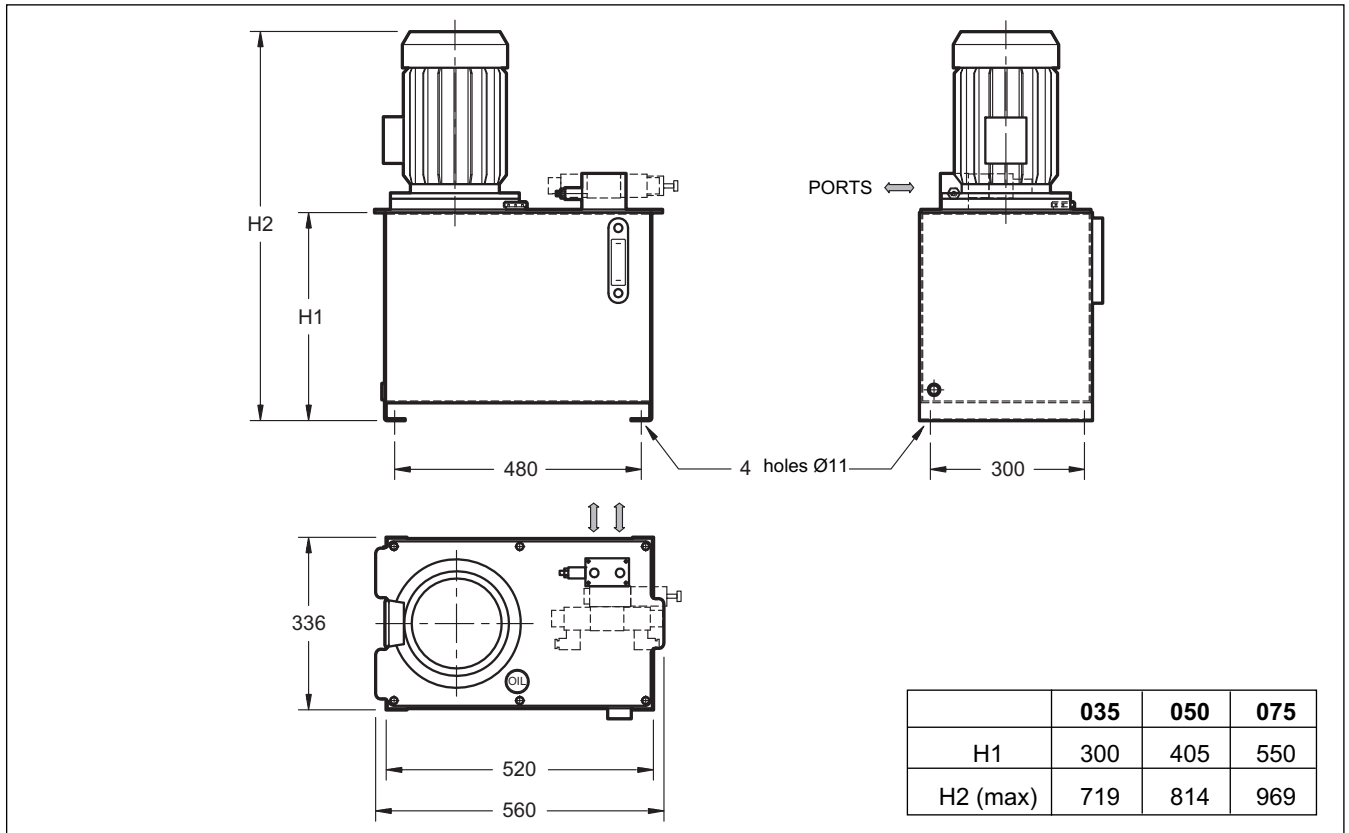
### 4.1 - Identification code

<b>C</b>	<b>T</b>	<b>R</b>	<b>3</b>	<b>-</b>		<b>/</b>				<b>/</b>		<b>-</b>	<b>/</b>					<b>/</b>	<b>40</b>
power unit with soaked pump																		Series No. (from 40 to 49 sizes and mounting dimensions does not change)	
Cover size																		N = Dull black RAL 9005 <b>standard</b> G = Grey RAL 7037 V = Green RAL 6011	
Tank capacity																		Heat exchanger: 0 = without exchanger 1 = oil/water exchanger 2010K 2 = oil/water exchanger 2020K	
035 = 35 dm <sup>3</sup> 050 = 50 dm <sup>3</sup> 075 = 75 dm <sup>3</sup>																		Return filter: 0 = without filter 1 = filter with visual indicator 2 = filter with electric indicator	
Electric motor B5 shape P = Predisposition for motor assembly M = Mounted electric motor																		0 = without thermostat 1 = with thermostat	
4-poles power electric motor:																		0 = without level gauge 1 = with level gauge	
0.55 = 0.55 kW      2.2 = 2.2 kW 0.75 = 0.75 kW      3 = 3 kW 1.1 = 1.1 kW      4 = 4 kW 1.5 = 1.5 kW																			
Electric motor voltage (omit for P version) A = 380-420V / 50Hz-440-480V/60Hz for motors from 2.2 kW to 7.5 kW B = 230-400V/50-60 Hz for motors from 0.55 kW to 1.5 kW																			
Pump type : GP1      GP2 (see cat. 11 100 for the pumps technical characteristics)																			
Flowrate pump (l/min) at 1500 rpm (see flowrate / pressure table)																		Standard panel with rear ports G 3/8"	
																		A = P2D-M* with 1 pos. ISO 4401-03 (CETOP 03) B = P2T-M* with 2 pos. ISO 4401-03 (CETOP 03)	

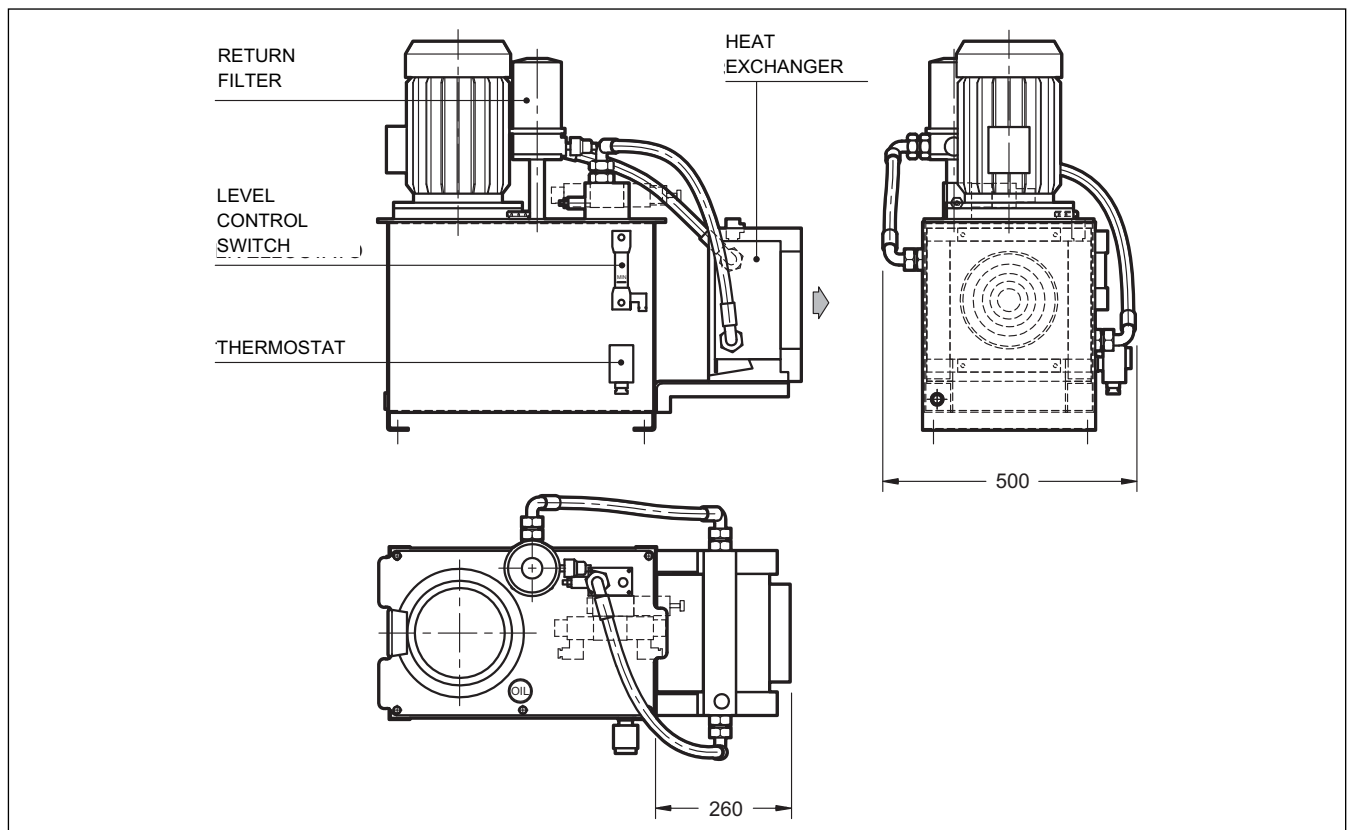
### 4.2 - Flowrate / pressure table

Electric motor flange size					Ø = 200				Ø = 250			
CTR3			Pump type	Flow rate at 1500 rpm [lt/min]	Electric motor power [kW]							
					0,55	0,75	1,1	1,5	2,2	3	4	
					max pressure [bar]							
075	050	035	GP1-0013	2,0	145	195	-	-	-	-	-	
			0020	3,0	90	120	160	-	-	-	-	
			0027	4,0	75	100	130	200	-	-	-	
			0034	5,1	60	80	110	160	-	-	-	
			0041	6,1 *	45	60	80	120	185	-	-	
			0051	7,6 *	35	50	65	105	150	200	-	
			0061	9,1	30	40	55	85	125	170	-	
			0074	11,1 *	25	30	45	65	100	140	180	
			0091	13,6	20	25	40	55	85	115	150	
			0108	15,7	15	20	35	50	70	95	130	
			GP2-0113	16,9 *	10	15	30	45	65	90	120	
			0140	21,0 *	-	10	25	35	55	75	100	
			0158	23,7	-	-	20	30	45	65	85	
			0178	26,7 *	-	-	15	25	40	55	75	
			0208	31,2	-	-	10	20	35	50	65	
			0234	35,1 *	-	-	-	15	30	45	60	
			0279	41,8	-	-	-	10	25	35	50	

#### 4.3 - Overall and mounting dimensions for basic CTR3



#### 4.4 - CTR3 with optionals



## 5 - POWER UNITS CTR4

### 5.1 - Identification code

The diagram illustrates the configuration code for a pump assembly, structured as follows:

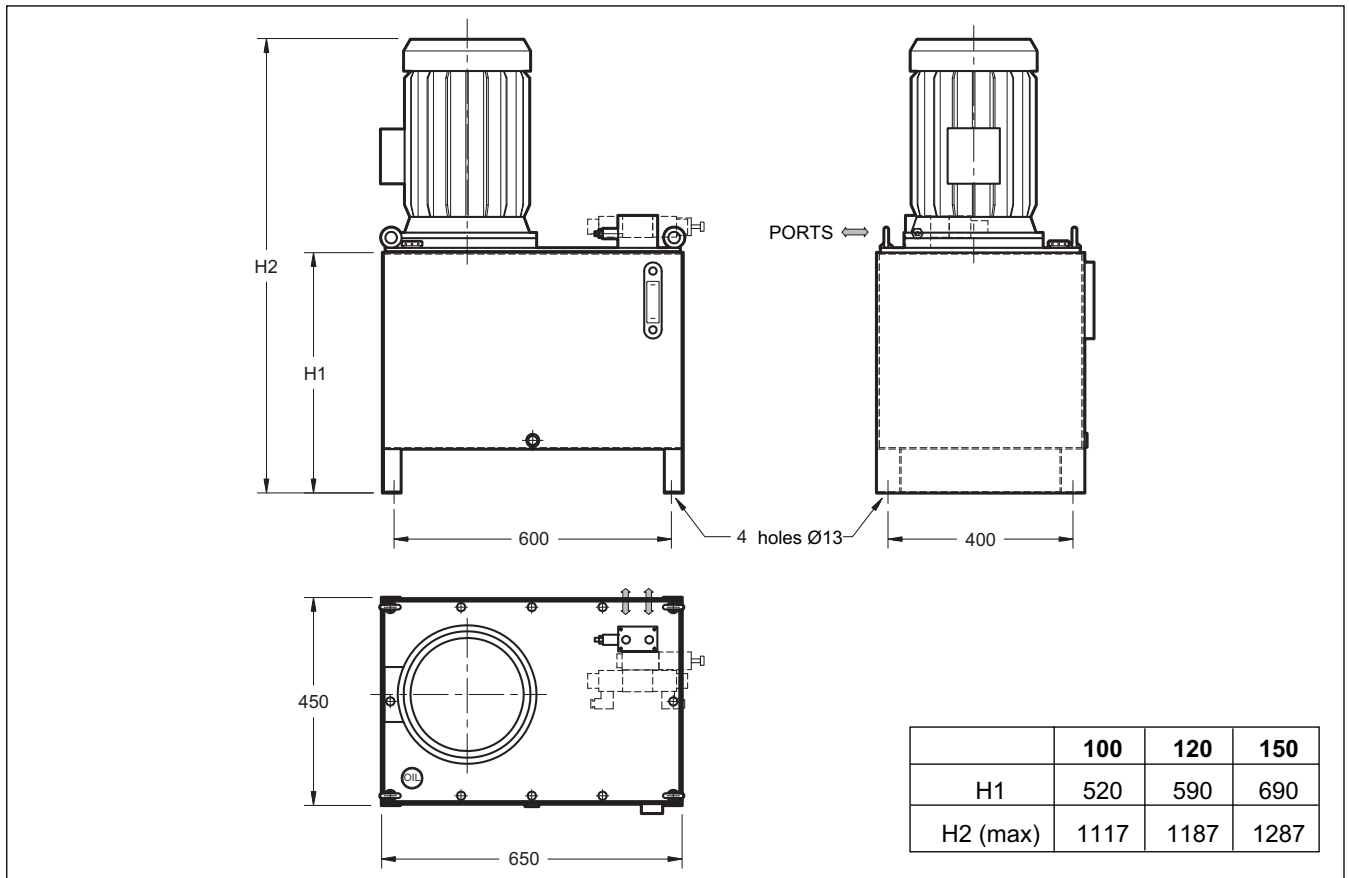
- C T R 4 -**: Power unit with soaked pump.
- /**: Cover size.
- /**: Tank capacity (100 = 100 dm<sup>3</sup>, 120 = 120 dm<sup>3</sup>, 150 = 150 dm<sup>3</sup>).
- /**: Electric motor B5 shape (P = Predisposition for motor assembly, M = Mounted electric motor).
- : 4-poles power electric motor (2.2 = 2.2 kW, 3 = 3 kW, 4 = 4 kW; 5.5 = 5.5 kW, 7.5 = 7.5 kW, 9 = 9 kW).
- /**: Electric motor voltage (omit for P version) (A = 230/400V / 50/60 Hz).
- /**: Pump type (GP1, GP2) (see cat. 11 100 for the pumps technical characteristics).
- /**: Flowrate pump (l/min) at 1500 rpm (see flowrate / pressure table).
- /**: Series No. (from 40 to 49 sizes and mounting dimensions does not change).
  - N = Dull black RAL 9005 (**standard**)
  - G = Grey RAL 7037
  - V = Green RAL 6011
- /**: Heat exchanger (0 = without exchanger, 1 = oil/water exchanger 2010K, 2 = oil/water exchanger 2020K).
- /**: Return filter (0 = without filter, 1 = filter with visual indicator, 2 = filter with electric indicator).
- /**: Thermostat (0 = without thermostat, 1 = with thermostat).
- /**: Level gauge (0 = without level gauge, 1 = with level gauge).
- /**: Standard panel with rear ports G 3/8" (A = P2D-M\* with 1 pos. ISO 4401-03 (CETOP 03), B = P2T-M\* with 2 pos. ISO 4401-03 (CETOP 03)).
- /**: P2X\*M multi-station manifold ISO 4401-03 (CETOP 03) to use with GP2 pumps (rear ports G 1/2").
- /**: Positions (C2 = 2 positions, C4 = 4 positions, C6 = 6 positions).
- / 40**: Final digit of the code.

## 5.2 - Flowrate / pressure table

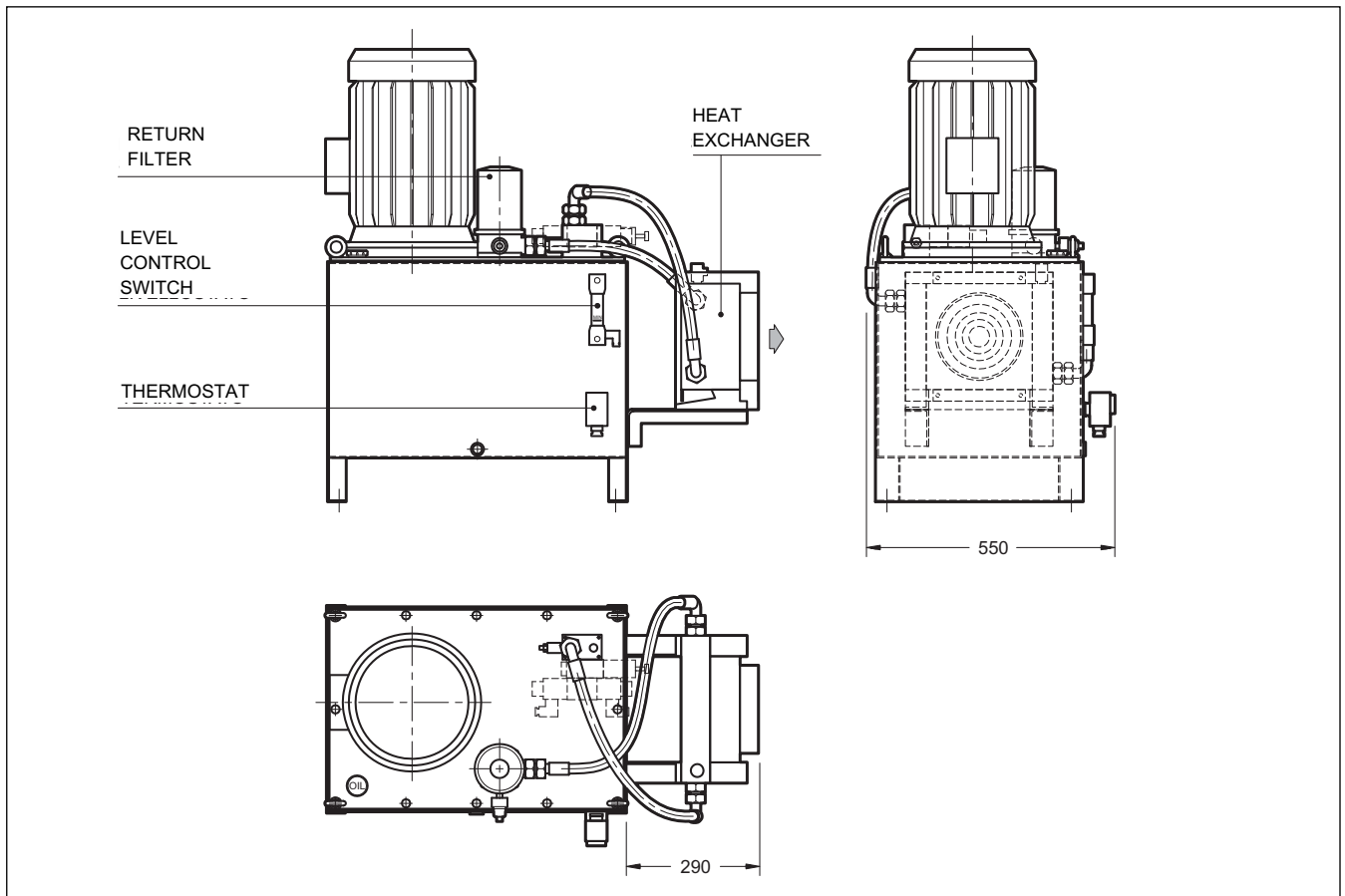
Electric motor flange size					Ø = 250			Ø = 300		
CTR4			Pump type	Flow rate at 1500 rpm [lt/min]	Electric motor power [kW]					
					2,2	3	4	5,5	7,5	9
					max pressure [bar]					
150	120	100	GP1-0041	6,1	185	-	-	-	-	-
			0051	7,6	150	200	-	-	-	-
			0061	9,1	125	170	-	-	-	-
			0074	11,1	100	140	180	-	-	-
			0091	13,6	85	115	150	-	-	-
			GP2-095	14,2 *	80	110	145	200	-	-
			0113	16,9 *	65	90	120	170	-	-
			0140	21 *	55	75	100	135	185	-
			0158	23,7 *	45	65	85	120	165	-
			0178	26,7 *	40	55	75	105	145	-
			0208	31,2 *	35	50	65	90	125	150
			0234	35,1 *	30	45	60	80	110	130
			0279	41,8	25	35	50	70	95	110

\* pumps for preferential choice

**5.3 - Overall and mounting dimensions for CTR4-P2**



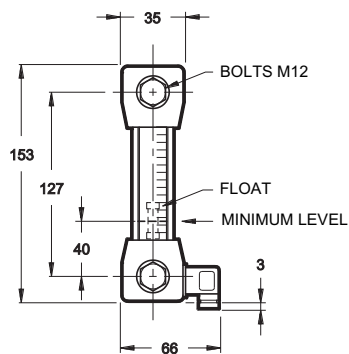
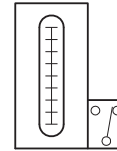
**5.4 - Overall and mounting dimensions for CTR4-P2X\*M**



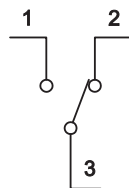
## 6 - ACCESSORIES

### 6.1 - Level gauge LV/E1-127-M12-SC cod. 0770764

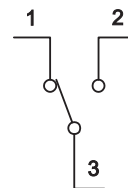
Maximum pressure	bar	1
Working temperature	°C	-20 / +70
Transparent tube material	/	Nylon + glass 35%
Seals material	/	NBR
Reed in exchange	/	1A, 20W, 20VA, 200V



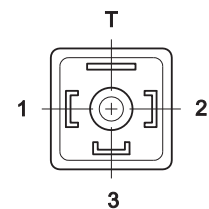
ELECTRIC DIAGRAM  
(WITH FLUID)



ELECTRIC DIAGRAM  
(WITHOUT FLUID)

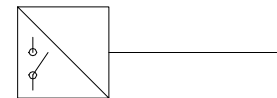


CONNECTOR CE DIN 40050  
IP65 PG7

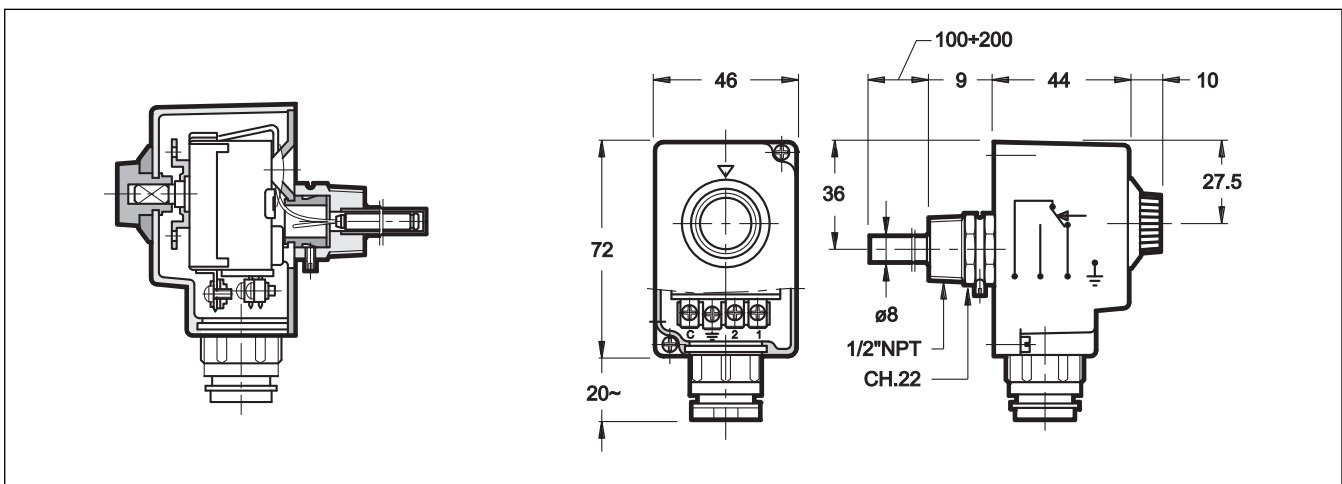


### 6.2 - Thermostat TC2 cod. 0630285

External sensor temperature range	°C	0/90
Degree of protection	/	IP40
Contacts	A	10
Max. voltage	V AC	250
Max. working temperature	°C	50
Cable guide	/	PG9
Housing material	/	Plastic
Contacts material	/	Silver
Capillary material	/	Copper
Pocket material	/	Brass
Mass	Kg	0.3



#### 6.2.1 - Overall dimensions



### 6.3 - FRC return line filter for tank top or line mounting cod. 3951600004

#### 6.3.1 - Technical data

Filter code	BSP port dimensions	Mass [kg]	Rated flow (indicative) [l/min] P25L
FRC-TB034	3/4"	1,6	75

**NOTE 1:** The flow rate stated in the table correspond to a 0.5 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.  
As for a different viscosity range, see the catalogue 95160.

Maximum pressure	bar	7
Collapsing differential pressure of the filter element	bar	3.0
Differential pressure for the opening of the by-pass valve ( $\pm 10\%$ )	bar	1,7
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

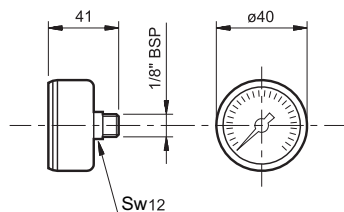
For further detailed informations and overall dimensions please consult the catalogue 95160.

#### 6.3.2 - Clogging indicators

The filters are all designed to incorporate clogging indicators, which have to be ordered separately.

##### 1 - VR/10 Visual indicator for return filters

Identification code: 3959000003



This indicator is a pressure gauge sensitive to the filter input pressure.

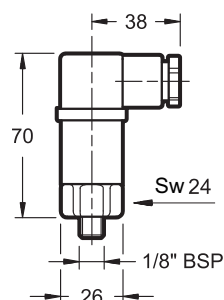
The indicator is supplied with a 0 ÷ 6 bar graduated scale and with a two-colour reading scale, which informs you about the clogging condition of the filter element:

GREEN: efficient filter element (0 ÷ 1.7 bar)

RED: the filter element has to be replaced (> 1.7 bar)

##### 2 - ER/11 Electric indicator for return filters

Identification code: 3959000016



This indicator is a pressure switch sensitive to the filter input pressure, which switches an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

#### TECHNICAL SPECIFICATIONS

Operating pressure	bar	1,5
<b>AC power supply</b>		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	3 0,5
<b>DC power supply</b>		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

## 6.4 - Heat Exchanger oil/water with fixed blowing air flow .

### 6.4.1 - Technical data

		2010K	2020K
Code		0713268	0712078
Operating pressure	bar	20	
Test pressure	bar	35	
Maximum operating pressure	°C	120	
Air Flow	m³/h	190	645
Capacity	litre	0,3	0,7
Three-phase supply voltage	V	230 - 400	
Frequency	Hz	50 / 60	
Rpm	kW	0,045	0,068
Thermostat regulation field	°C	40 - 28	50 - 38
Oil threaded inlet / outlet connections	-	1/2" BSP	1" BSP
Mass	kg	6	8
IP protection degree		IP54	IP44

### CLEANING AND MAINTENANCE

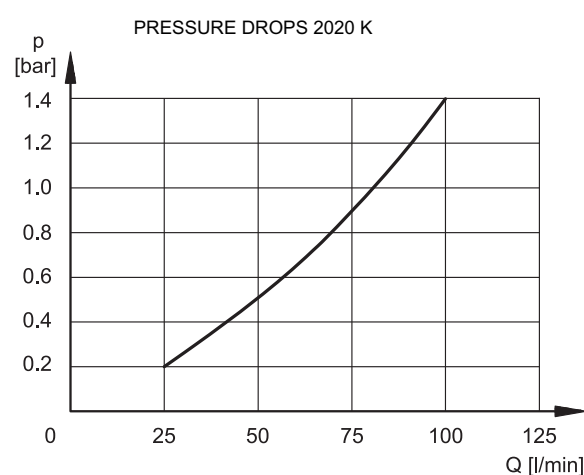
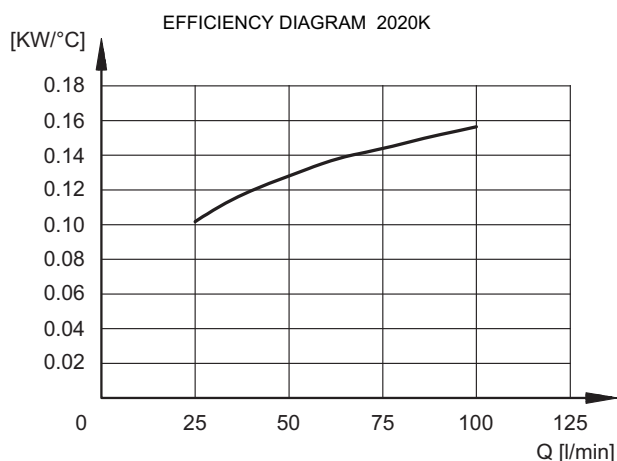
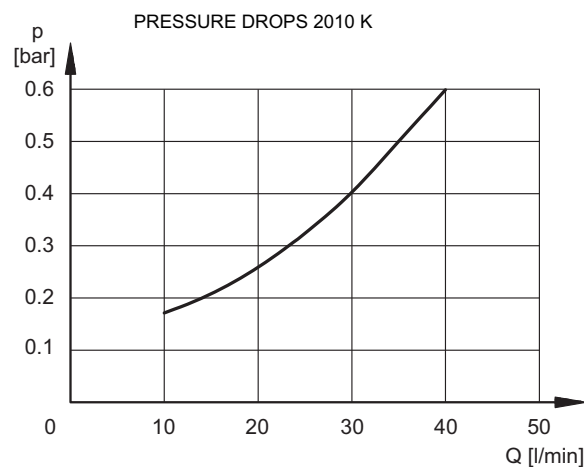
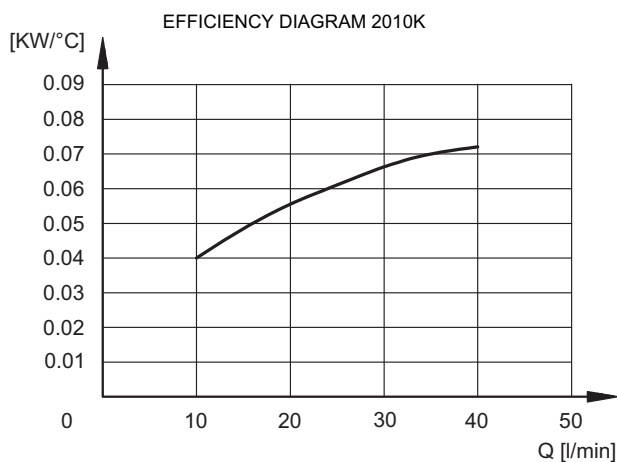
As a general rule verify that the voltage supply correspond to those shown on the plate.

Cleaning oil side: The exchanger must be dismantled. Dirt can be removed by a detergent product as perchloride, in the opposite direction to normal. At the end it must be washed out with hot water.

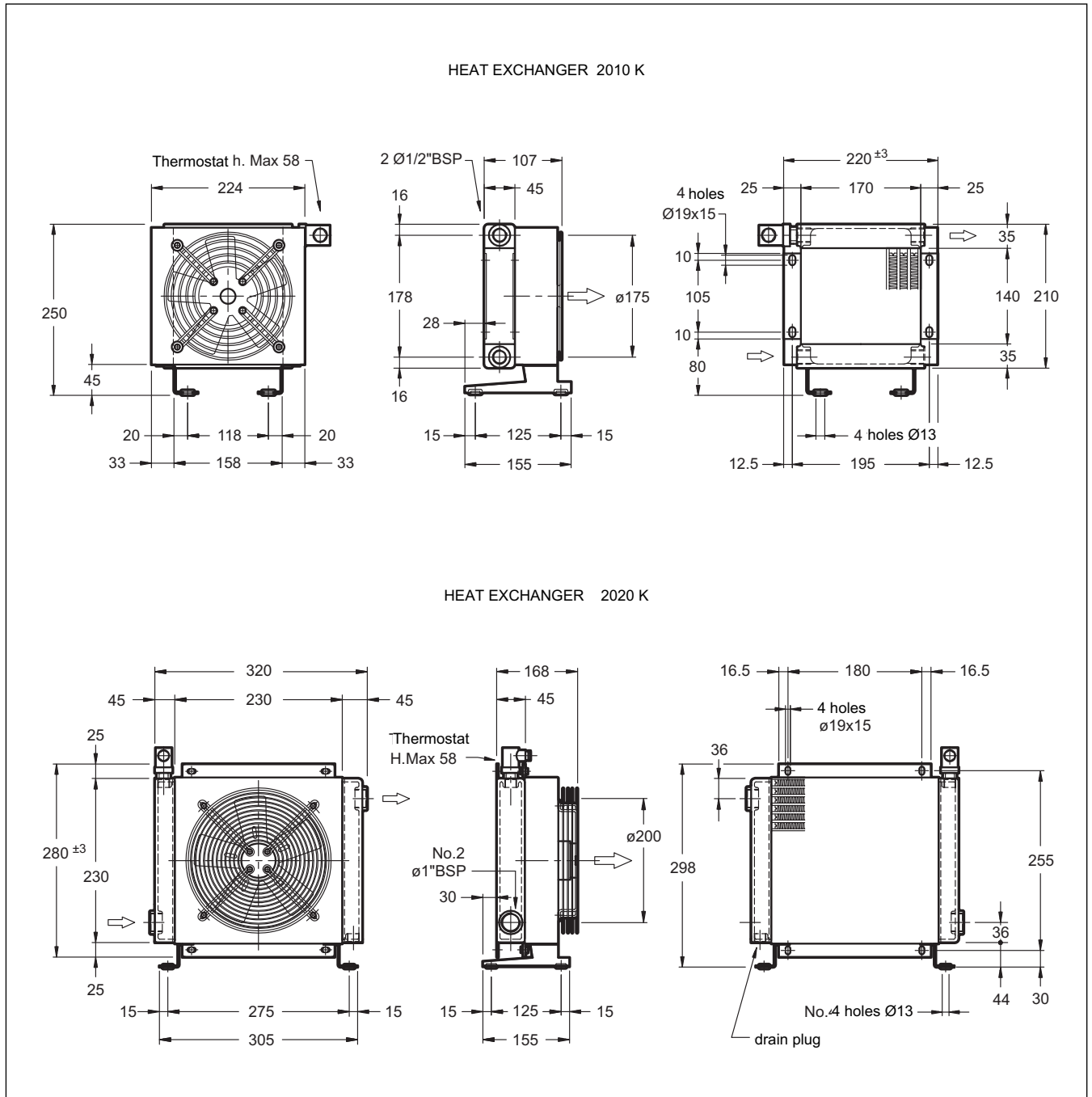
Cleaning air side: This can be done means of compressed air or water. The direction of the jet must be parallel to the fins, to avoid damaging them. If the dirt is oil or greasy it must be cleaned by a jet of steam or hot water.

**The electric motor must be protected during the cleaning operation.**

### 6.4.2 - Characteristics



### 6.4.3 - Overall dimensions







CTR\*



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