

4WREF

Direct-acting two-position four-way and three-position four-way proportional directional valves with electrical position feedback, with integrated amplifiers and fieldbus interfaces.

Nominal sizes: NS 6 and NS 10

Series: 2X

Max. operating pressure: 315bar

Max.flow: NS6 80L/min

NS10 180L/min

Document number: RD A1S101_2306a



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Features

- Direct - acting proportional directional valve, used for controlling the flow rate and direction switching.
- The proportional electromagnet is thread - mounted, and the electromagnet coil can be replaced.
- The valve spool is spring - centered.
- With electrical position feedback.
- The mounting surface complies with ISO 4401 - 03 - 02 - 0 - 05/ISO 4401 - 05 - 04 - 0 - 05.
- Equipped with an integrated amplifier.
- With a field - bus interface CANopen DS408.
- Can be interchanged with similar products from Europe and America.

Ordering details

4WRE	F	6	E	08	-	2X	/	M	-	24	C	A1	/	*
01	02	03	04	05		06		07		08	09	10		11

01	4WRE	4 Direct acting proportional directional control valve with position feedback
02	F	With integrated amplifier and fieldbus interface
03	6	NS 6
	10	NS 10

Symbols

04	E	E, E1-, V, W, W1-, EA, WA; See hydraulic symbol table for details
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Nominal flow rate ($\Delta p = 10 \text{ bar}$)

05	04	4 l/min	NS 6
	08	8 l/min	
	16	16 l/min	
	32	32 l/min	
	25	25 l/min	NS 10
	50	50 l/min	
	75	75 l/min	

06	2X	Series (20 to 29: unchanged installation and connection dimensions)
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Sealing material

07	M	NBR seals
	V	FKM seals
	DW	(H-NBR)seals

4WRE	F	6	E	08	-	2X	/	M	-	24	C	A1	/	*
01	02	03	04	05		06		07		08	09	10		11

08	24	Supply voltage : 24VDC
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Bus interface

09	C	CANopen DS408
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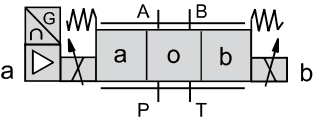
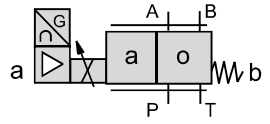
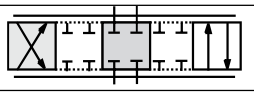
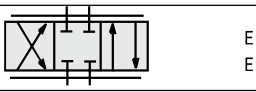
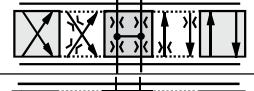
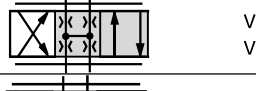
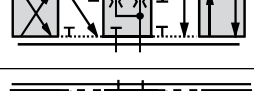
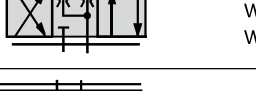
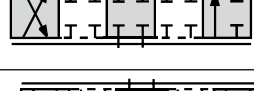
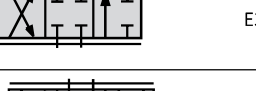
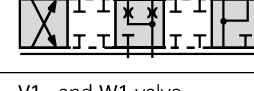
Command value of amplifier

10	A1	Command value input $\pm 10V$, actual value feedback $\pm 10V$
	F1	Command value input 4~(12)-20mA, actual value feedback 4~(12)-20mA
	A5	Command value input $\pm 10V$, with enable, actual value feedback $\pm 10V$
	F5	Command value input 4~(12)-20mA, with enable, actual value feedback 4~(12)-20mA

Other options

11	No code	None
	MH1	Vertical handle
	MH2	Horizontal handle
	BMH1	The vertical handle is installed on the side of port B.
	BMH2	The horizontal handle is installed on the side of port B

Symbols

 4WREF...		 4WREF...EA...;4WREF...WA...	
			
			
			
			
			
			

E1-, V1- and W1-valve

: P→A: $q_{V nom}$ B→T: $q_{V nom} / 2 A$

P→B: $q_{V nom} / 2$ →T: $q_{V nom}$

E3-valve: B→T: Not connected

P→A: $q_{V nom}$

P→B: $q_{V nom} / 2$ A→T: $q_{V nom}$

R and R3-valve:

P→A: $q_{V nom}$ B→P: $q_{V nom} / 2 A$

P→B: $q_{V nom} / 2$ →T: $q_{V nom}$

Note: When the spools W and WA are in the middle position, A is connected to T, and B is connected to T. The flow area is approximately 3% of the nominal flow area.

Functions, section

This valve is a direct-acting proportional directional valve with a plate connection. The proportional solenoid with a detachable coil is installed on the valve body via a centering thread. An integrated amplifier or an external amplifier is used to drive the solenoid.

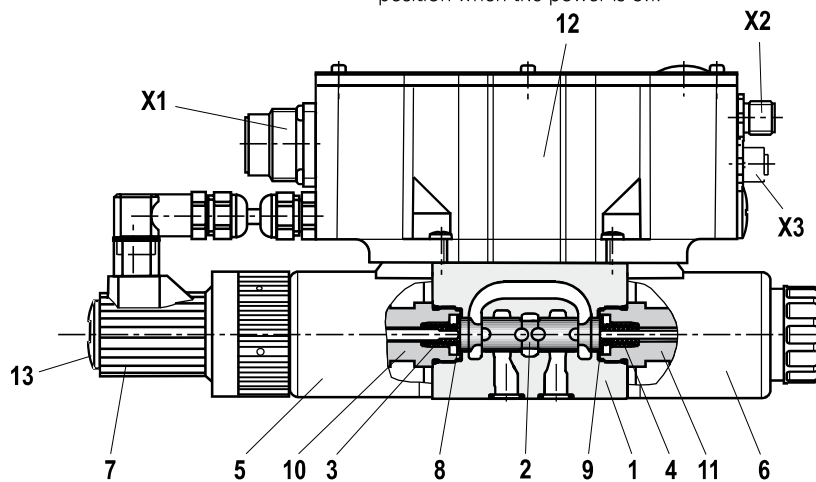
Design of the valve:

- Valve body (1) with a mounting surface
- Control spool (2), compression springs (3, 4), spring terminals (8, 9)
- Solenoids (5, 6)
- Position sensor (7)
- Magnetic conducting tubes (10, 11)
- Integrated amplifier (12)
- Protection cap for zero - position adjustment (13)

Function:

After the coils (5, 6) are de - energized, the control spool (2) is held in the center position by the compression springs (3, 4). When the solenoids are energized, the spool starts to move. For example, when the solenoid "b" (6) is energized, the control spool moves to the left in proportion to the input electrical signal. At this time, P is connected to A, and B is connected to T. When the solenoid "b" (6) is de - energized, the control spool (2) returns to the center position through the compression spring (3). In the de - energized state, the spool (2) is held in the mechanical center position by the coil return spring.

4WREF10...-2X/...



Two - position four - way valve

The functions of this type of valve are generally the same as those of the three - position valve. However, for the two - position four - way valve, only the coil on the a side is installed. For the valves with a 6 - mm nominal diameter and a 10 - mm nominal diameter, the coils on the b side are replaced with end caps.

Note:

Internal leakage of hydraulic valves is inevitable. The leakage volume will increase as the hydraulic valve is used.

Note:

The return oil line of the proportional valve must not be emptied. To ensure proper operating conditions, a check valve with an opening pressure of approximately 2 bar can be installed on the return oil line of the valve if necessary.

Technical data (for applications outside these parameters, please consult us!)

General

NS		6	10
Installation		optional	
Storage temperature range	°C	-20 to +80	
Ambient temperature range	°C	-20 to +50	
Weight	Kg	2.4	6.5

Hydraulic (HLP46 at 40 °C ± 5 °C , Ps=100bar)

Max. operating pressure	Ports A, B, P	bar	315
	Port T	bar	210
Nominal flow $q_{V\ nom} \Delta p=10\text{bar}^{1)}$	L/min	4	25
		8	50
		16	75
		32	
Max. permissible flow	L/min	80	180
Oil temperature range	°C	-20 to +80 +40 (preferably +40 to +50)	
Viscosity range	mm ² /s	20 to 380 (preferably 30 to 46)	
Degree of contamination		ISO4406: 1999 20/18/15	
Hysteresis	%	≤ 0.1	
Return difference	%	≤ 0.05	
Response sensitivity	%	≤ 0.05	
Zero drift (the zero position will change according to changes in oil temperature and pressure)	%/10K	≤ 0.15	
	%/100bar	≤ 0.1	

Electrical

Supply voltage		DC
Command signal	Voltage signal input A1	V
For 4WREF	Voltage signal input F1	mA
Maximum current of a single solenoid	A	2.5
Coil resistance	Measured value at 20°C	Ω
	Measured value at the maximum operating temperature	Ω
Electrical connection	4WREF	Seven-pin socket complying with the standard of DIN EN 175201 - 804
Duty	%	100
Maximum temperature of the coil	°C	150
Protection level		IP65

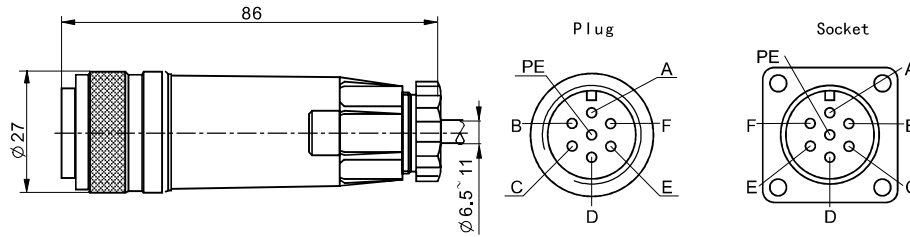
Integrated amplifier

4WREF6	Digital	RT-4WREF6-2X-40//A1(F1)
4WREF10	Digital	RT-4WREF10-2X-40//A1(F1)
Supply voltage	Rated voltage	VDC
	Lower limit value	V
	Upper limit value	V
Amplifier power consumption	Maximum current	A
	Pulse current	A

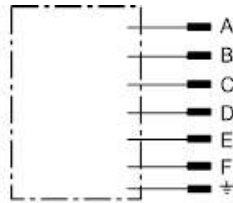
1) Other pressure differences $\Delta p \ q_x = q_{V\ nom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

Electrical connections

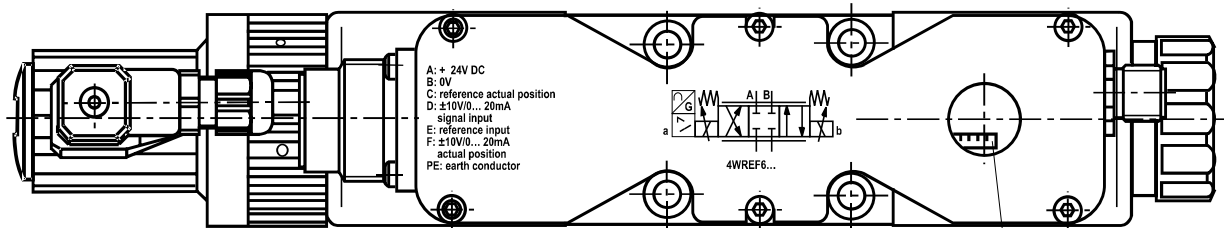
For type 4WREF (with integrated amplifier): Seven - pin plug conforming to DIN EN 175201 - 804 (to be ordered separately)



Pin assignment



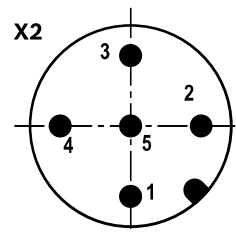
Metal nut structure (preferred model)
 Order separately, order number: R00050406
 Plastic nut structure
 Order separately, order number: R00050408
 All - metal structure
 Order separately, order number: R00050407



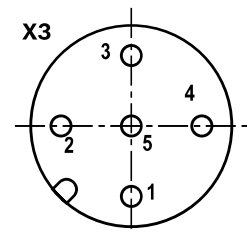
Function	Slot	Allocat interface A1	Allocat interface F1	Allocat interface A5	Allocat interface F5
Supply voltage	A	24VDC (19.4~35VDC), max. current 2A			
	B	GND			
Position feedback reference	C	Reference point for the feedback value			Enable input 24VDC enable $\geq 11VDC$, disable $\leq 5VDC$
	D	$\pm 10Vcom. value:$ $R_e > 50k\Omega$	$4 \sim 20mAcom. value:$ $R_e < 250\Omega$	$\pm 10Vcom. value:$ $R_e > 50k\Omega$	$4 \sim 20mAcom. value:$ $R_e < 250\Omega$
Amplifier input	E	ref. potential com. value			
Position feedback	F	$\pm 10 V act. value,$ (load max. 5 mA)	$4 \sim 20 mA act. value,$ load max. 300 Ω	$\pm 10 V act. value,$ (load max. 5 mA)	$4 \sim 20 mA act. value,$ load max. 300 Ω
	PE	Connected with cooling body and valve housing			

Pin assignment of connectors for CAN bus "X2" / "X3". Plug: M12, 5 - pin, A - coded.

Pin	Assignment/definition	Transmission rate kbit/s	Location
1	N.C	20-1000	1-127
2	N.C		
3	CAN_GND	Note: The baud rate and identifier can be set via the host computer.	
4	CAN_H		
5	CAN_L		



CANopen (plug)



CANopen (plug)

Control value Forward command: 0 to +10V (or 12 to 20mA) corresponds to P→A, B→T.
 -Input command between DE: Reverse command: 0 to -10V (or 12 to 4mA) corresponds to P→B, A→T.

-For valves with only one electromagnetic coil (functions EA and WA), 0 - 10V (or 4 - 20mA) corresponds to PB, AT.

Feedback value

-Feedback value between FC:

0 to +10 V (or 12 to 20 mA) corresponds to P A and B T.

0 to -10 V (or 4 to 12 mA) corresponds to P B and A T.

For valves with only one solenoid coil (functions EA and WA), 0 to 10 V (or 4 to 20 mA) corresponds to P B and A T.

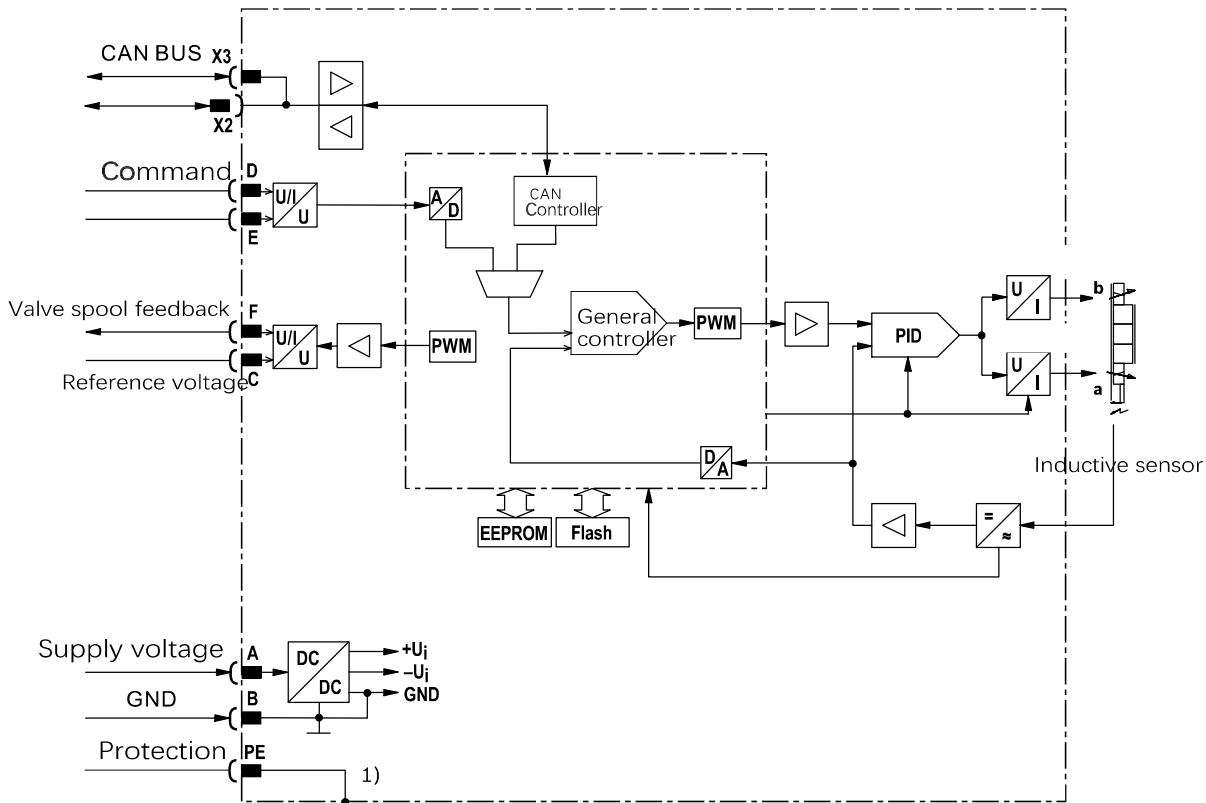
Connection cables:

-Select LiYCY 7x0.75mm² for cable lengths within 25m.

-Select LiYCY 7x1mm² for cable lengths within 50m.

Cable outer diameter: 6.5 - 11. The shielding wire of the cable is only allowed to be connected to PE at the power supply end.

Circuit diagram / Terminal block assignment (4WREF)



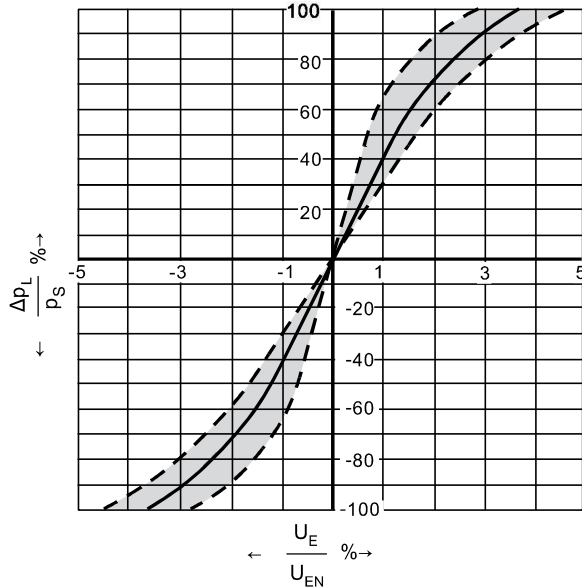
The protective earth (PE) is internally short - circuited to the heat sink and the valve body.

Characteristic curves (HLP46 at 40 °C ± 5 °C)

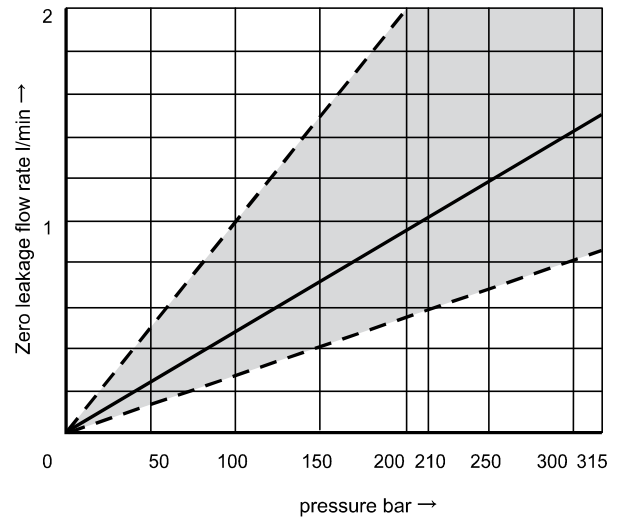
4WREF6

V-shaped valve spool) $P_s=100\text{bar}$

Pressure - input signal characteristic curve

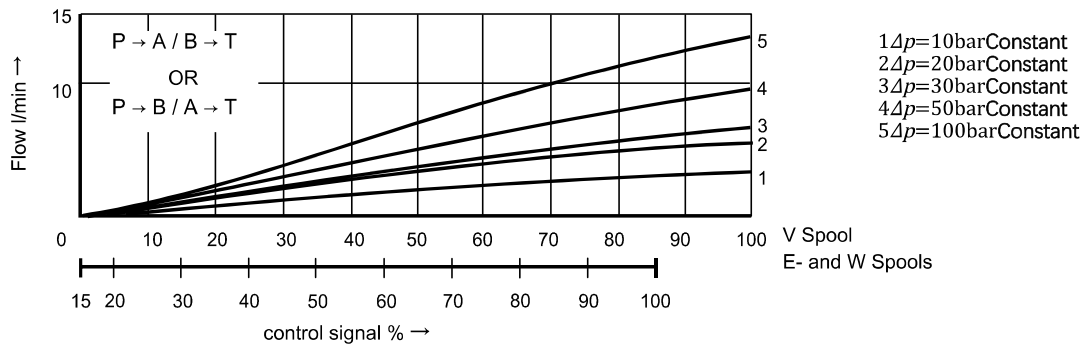


Spool middle position leakage - pressure characteristic curve (4WREF6V32)

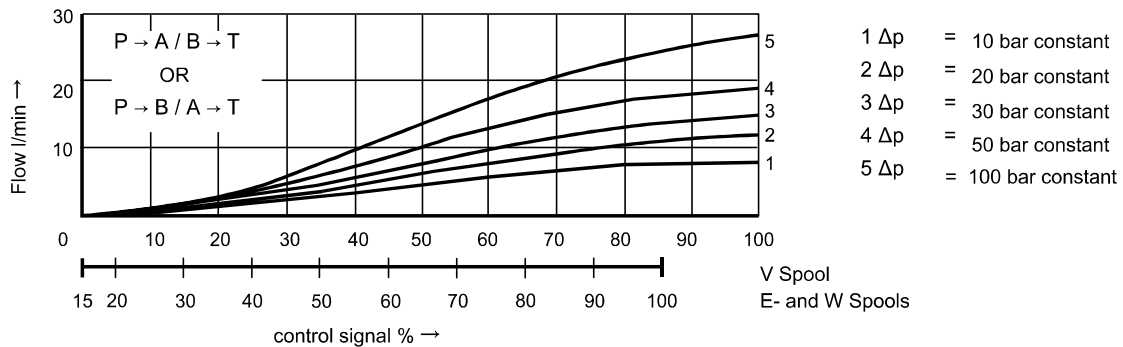


Flow characteristic curve

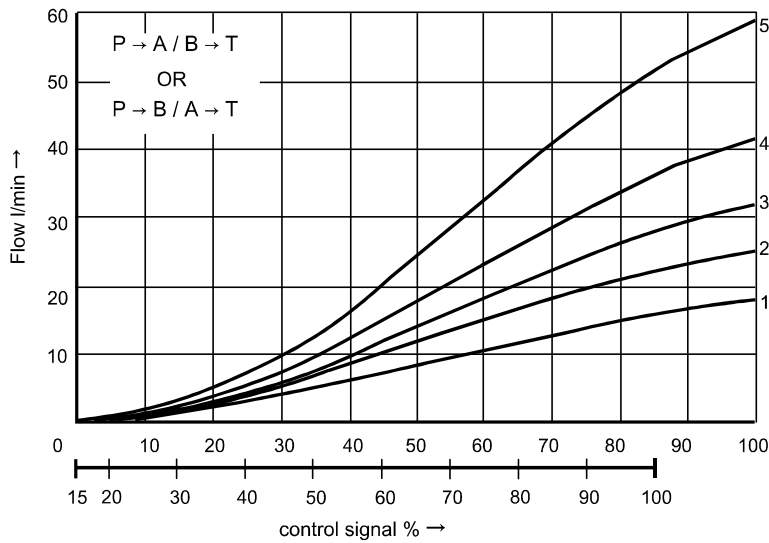
Rated flow rate=4 l/min, pressure difference=10 bar



Rated flow rate=8 l/min, pressure difference=10 bar

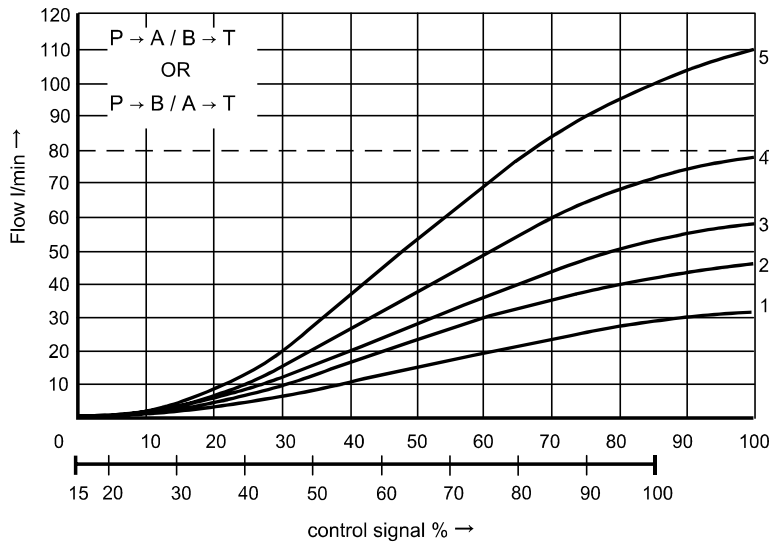


Rated flow rate=16 l/min, pressure difference=10 bar



- 1 Δp = 10 bar constant
- 2 Δp = 20 bar constant
- 3 Δp = 30 bar constant
- 4 Δp = 50 bar constant
- 5 Δp = 100 bar constant

Rated flow rate=32 l/min, pressure difference=10 bar



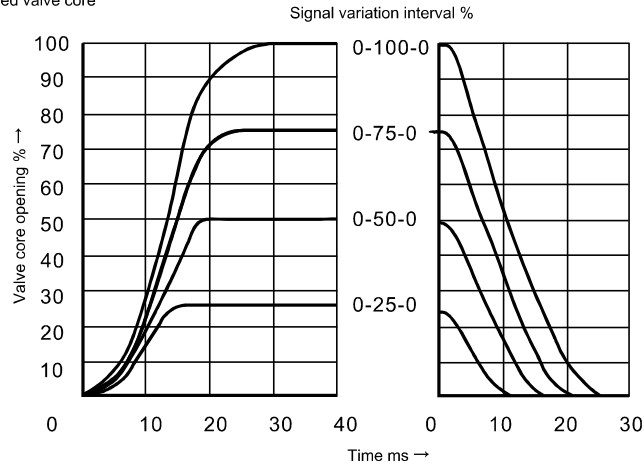
- 1 Δp = 10 bar constant
- 2 Δp = 20 bar constant
- 3 Δp = 30 bar constant
- 4 Δp = 50 bar constant
- 5 Δp = 100 bar constant

Maximum allowable flow rate
Please use in conjunction with the power limit curve

$\Delta P = P_P - P_L - P_T$
 ΔP : Valve pressure difference
 P_P : inlet pressure
 P_L : Load Pressure
 P_T : Return oil pressure

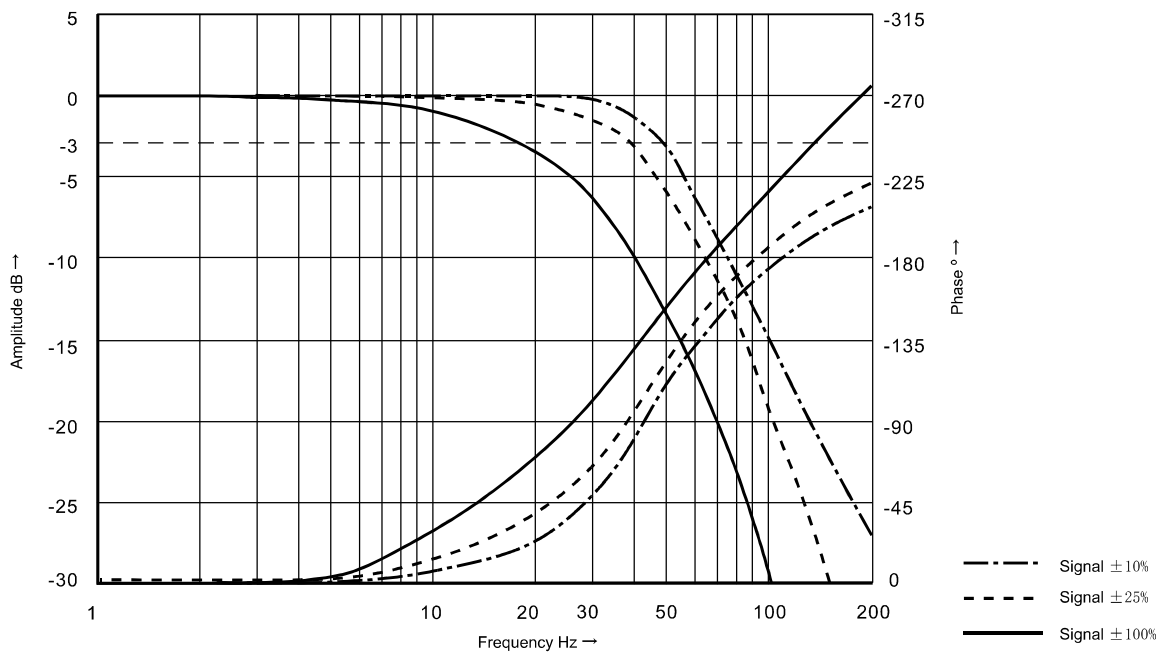
Step response curve (three - position four - way E - type valve spool)

Three position four-way E-shaped valve core

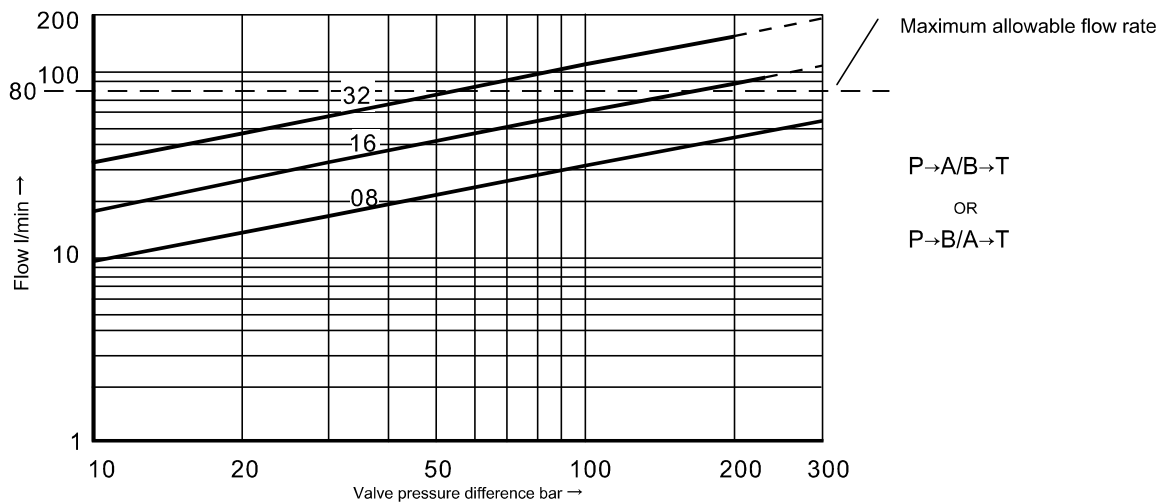


Frequency response curve (three - position four - way V - type valve spool)

Three position four-way V-shaped valve core



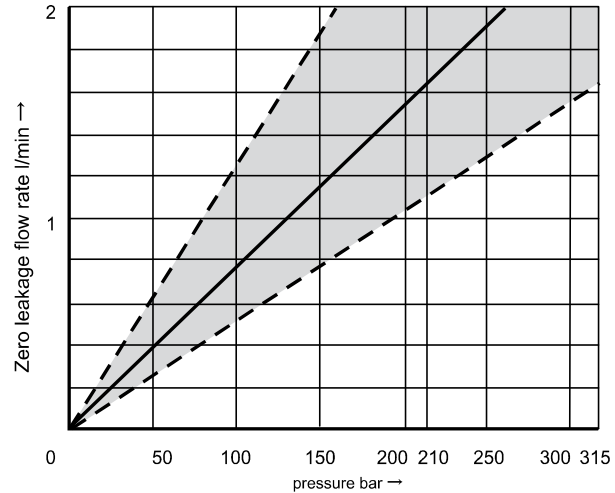
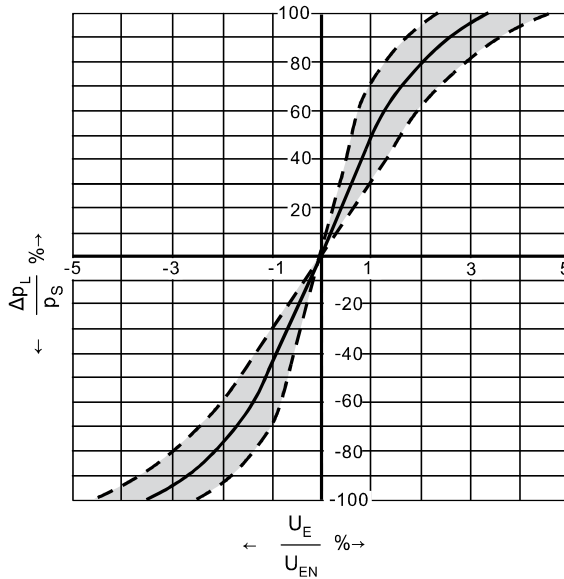
Power limit flow for 8/16/32 V-shaped valve spools



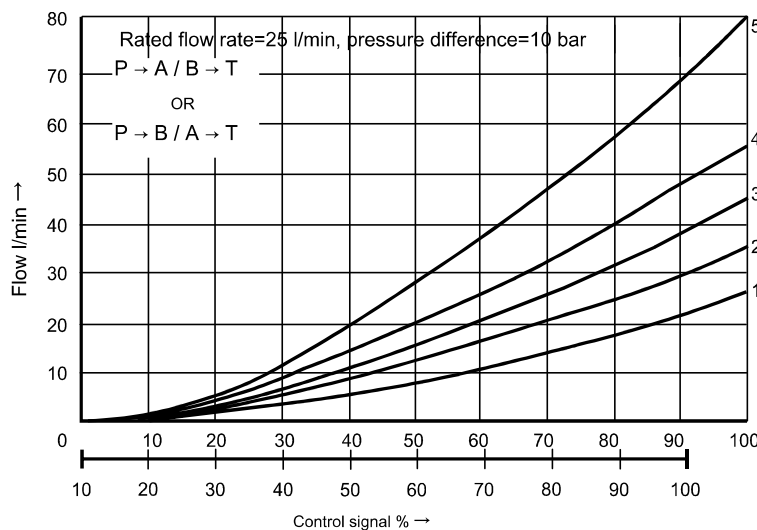
Characteristic curves (HLP46 at 40 °C ± 5 °C)

4WREF10

Pressure signal characteristic curve of V-shaped valve spool Spool middle position pressure - leakage curve (4WREF10V75)
 $P_s = 100$ bar

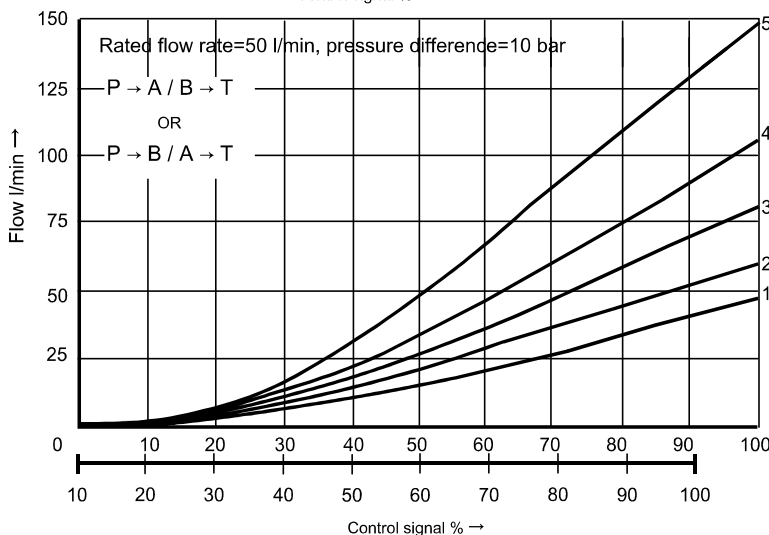


Flow characteristic curve



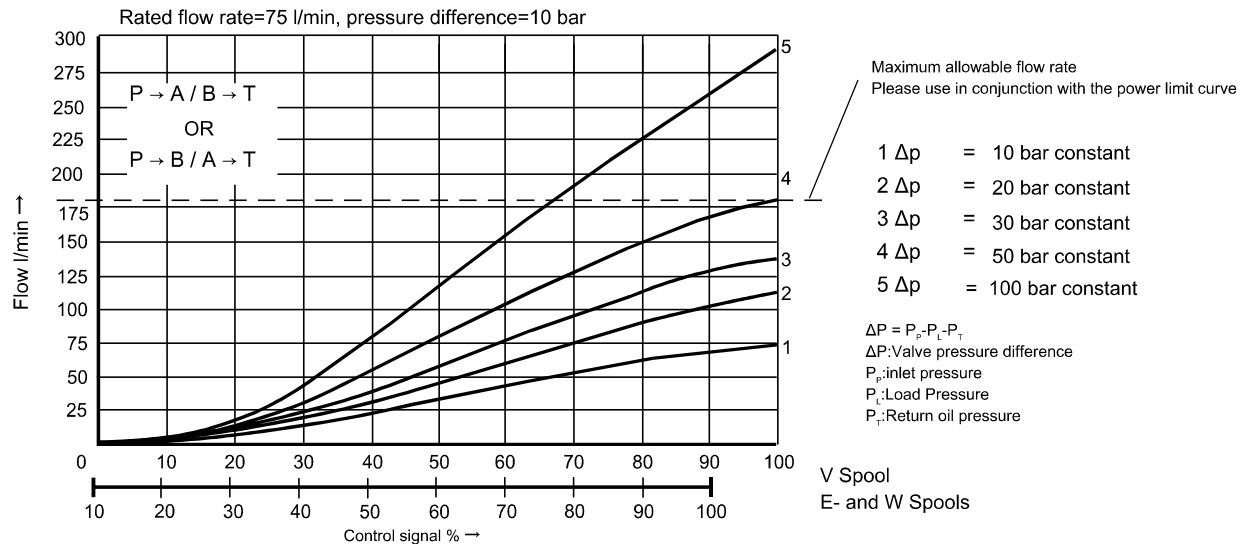
- 1 Δp = 10 bar constant
- 2 Δp = 20 bar constant
- 3 Δp = 30 bar constant
- 4 Δp = 50 bar constant
- 5 Δp = 100 bar constant

V Spool
 E- and W Spools

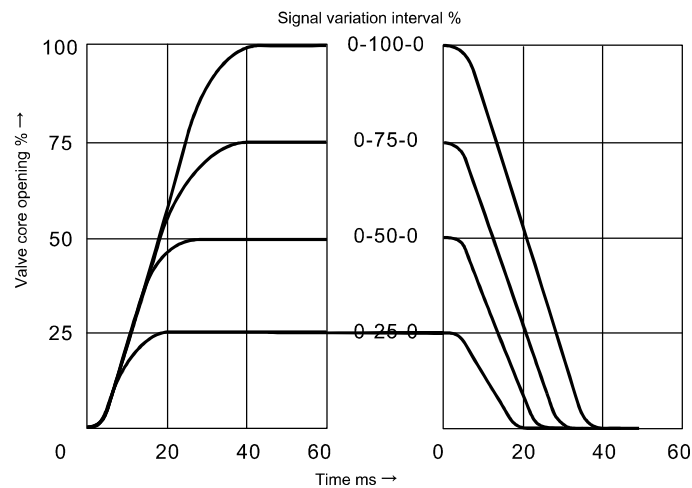


- 1 Δp = 10 bar constant
- 2 Δp = 20 bar constant
- 3 Δp = 30 bar constant
- 4 Δp = 50 bar constant
- 5 Δp = 100 bar constant

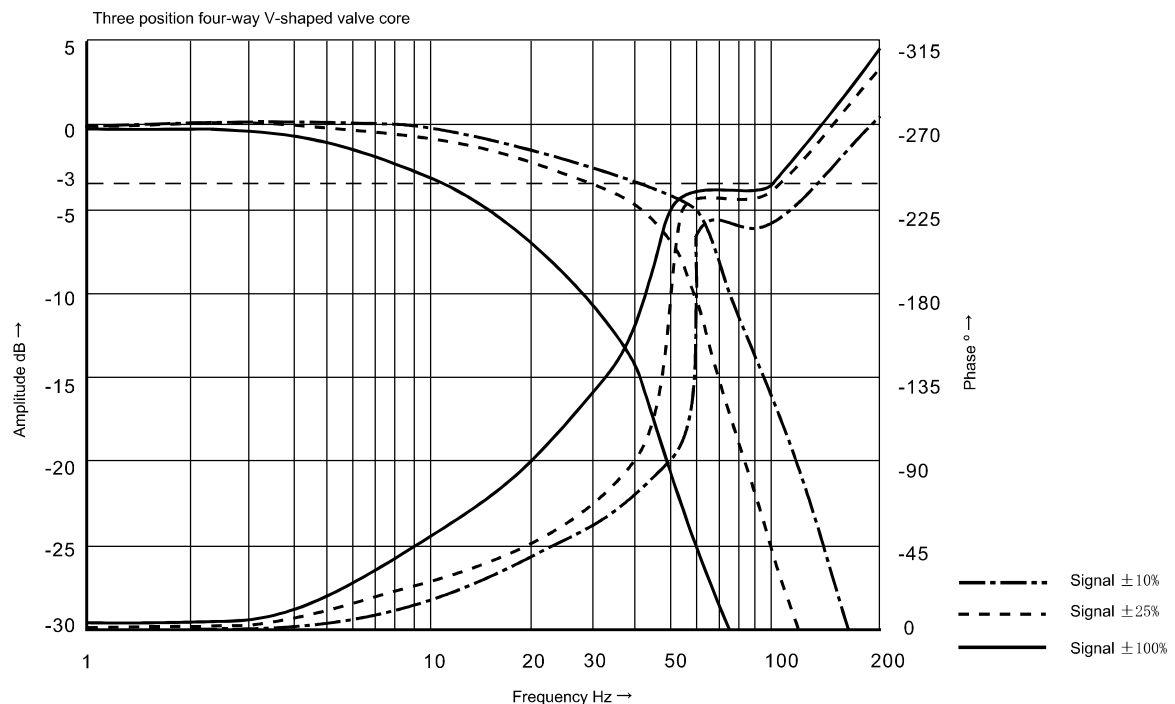
V Spool
 E- and W Spools



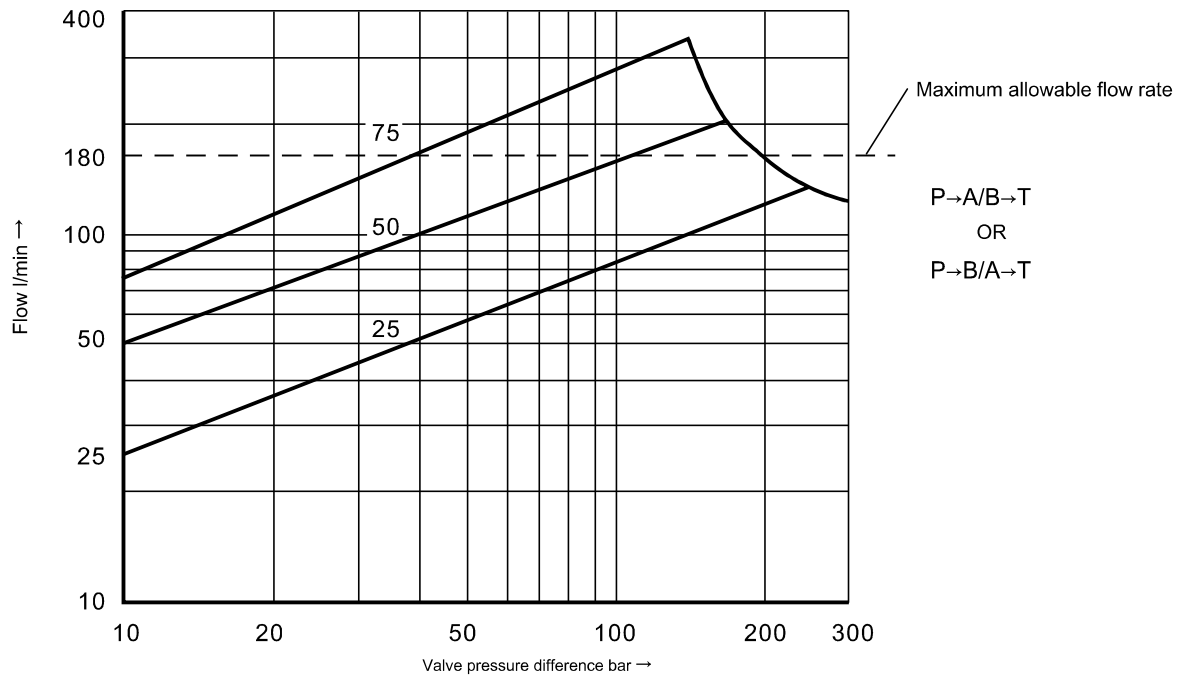
Step response curve (three - position four - way E - type valve spool)



Frequency response curve of three - position four - way V - shaped valve spool

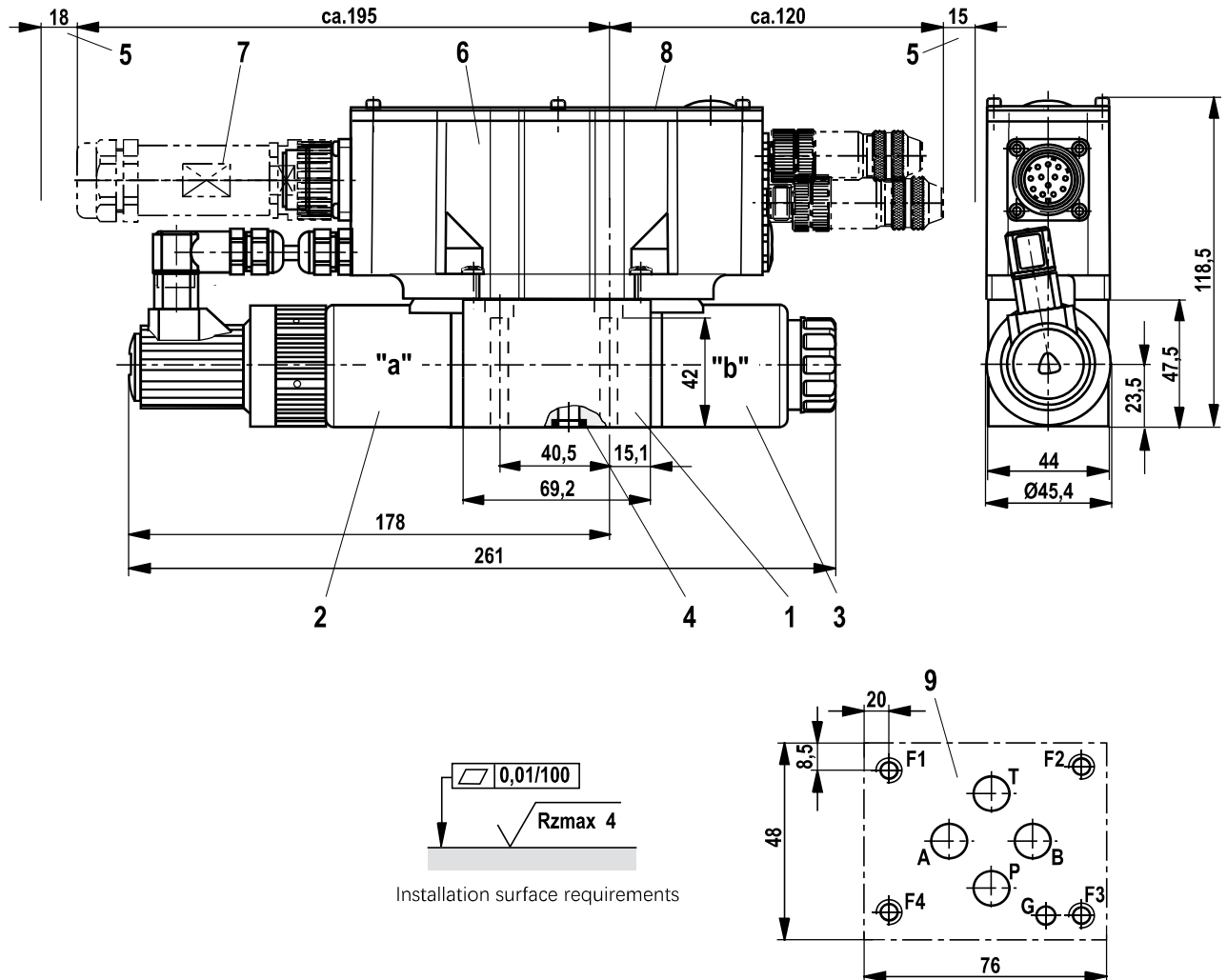


Power limit flow for 25/50/75 V-shaped valve spools



Dimensions (dimensions in mm)

4WREF6

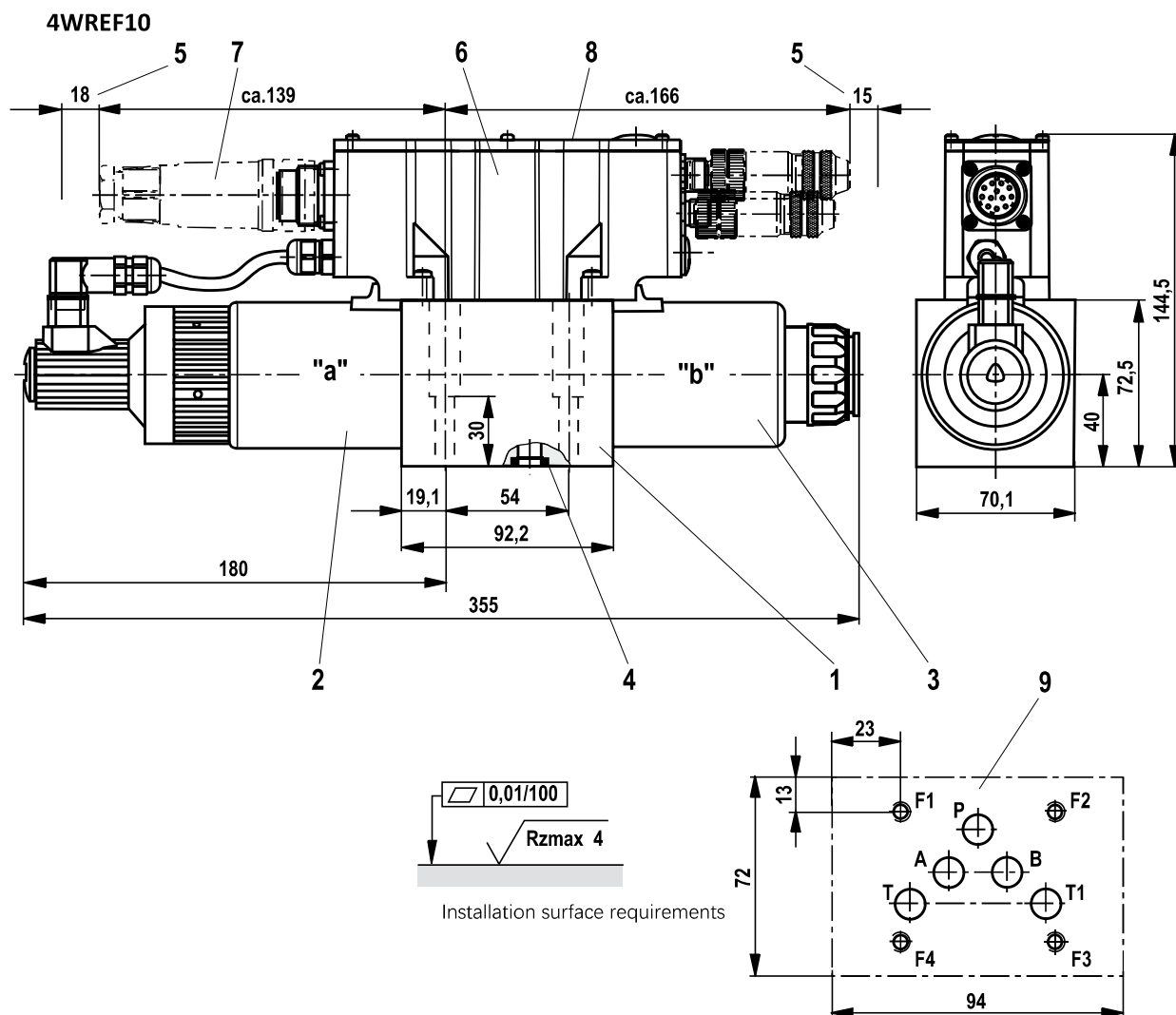


Dimensions in mm	P	A	T	B	F1	F2	F3	F4	G
Diameters/threads	7.5 max	7.5 max	7.5 max	7.5 max	M5	M5	M5	M5	4
x	21.5	12.7	21.5	30.2	0	40.5	40.5	0	33
y	25.9	15.5	5.1	15.5	0	-0.75	31.75	31	31.75

- 1 Valve body
- 2 Proportional coil a
- 3 Proportional coil b
- 4 O-rings (9.25x1.78, NBR90) for ports P, T, A and B.
- 5 Space required for plug removal
- 6 Integrated amplifier
- 7 Seven - pin socket conforming to DIN EN 175201 - 804 (plug to be ordered separately)
- 8 Nameplate
- 9 Mounting surface of the hydraulic valve, conforming to ISO 4401 - 03 - 02 - 0 - 05. Deviation from the standard for port connection positions and standard tolerances: Ports P, A, B and port T have a diameter of 7.5mm

Fixing screws: : 4 GB/T 70.1-M5x50-10
 Torque: 8.9Nm±10%

Dimensions (dimensions in mm)



Dimensions in mm	P	A	T	(T1)	B	F1	F2	F3	F4
Diameters/threads	11.2 max	11.2 max	11.2 max	11.2 max	11.2 max	M6	M6	M6	M6
x	27	16.7	3.2	50.8	37.3	0	54	54	0
y	6.3	21.4	32.5	32.5	21.4	0	0	46	46

1Valve body

2Proportional coil a

3Proportional coil b

4O-rings of size 9.25x1.78 made of NBR 90 for four ports P, T, A and B.

5Space required for removing the plug

6Integrated amplifier

7Seven - pin socket complying with DIN EN 175201 - 804 (the plug needs to be ordered separately)

8Nameplate

9Mounting surface of the hydraulic valve, complying with the port connection positions and standard tolerances of ISO 440 1 - 03 - 02 - 0 - 05.

Deviation from the standard for port connection positions and standard tolerances: Ports P, A, B and port T have a diameter of $\varnothing 7.5\text{mm}$

Fixing screws : 4 GB/T 70.1-M6x40-10.9

Torque: 15.5Nm $\pm$ 10%