

4WRKE

4/3 proportional directional valves, pilot operated, with electrical position feedback

Nominal sizes: 10, 16, 25, 32

Series: 3X

Maximum operating pressure: 350bar

Maximum flow: 1600L/min



Overview of contents

Contents
 Features
 Ordering code
 Symbols
 Function, section
 Technical data
 Electrical connections
 Characteristic curves
 Unit dimensions
 Pilot oil supply

Features

- 1 - Pilot operated 2-stage proportional directional valve
- 1 - Main spools with electrical position feedback
- 1 - Valve for the control of the size and direction of a flow
- 2 - Actuation via proportional solenoids
- 3 - Proportional solenoid operation, with central thread and removable coil
- 4 - Spring centred main spool
- 7 - Integrated control electronics
- 12 - Single stage proportional directional valve pilot control, main stage with closed loop position control
- 17 - For subplate mounting: porting pattern to ISO4401 NS10 to 32

Ordering code

4WRKE	16	E	125	L	-	3X	/	6E	G24	ET	K31	/	A1	D3	V	*
01	02	03	04	05		06		07	08	09	10		11	12	13	14

01	4WRKE	Electrically operated 2-stage proportional directional valve of 4-way design with integrated electronics
02	10	NS 10
	16	NS 16
	25	NS 25
	27	NS 27
	32	NS 32

Symbols

03	E	E, E1-, E3-, W6-, W8-, R, R3-, EA, W6A, EB, W6B See hydraulic symbol table for details
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Nominal flow in L/min at 5 bar valve pressure differential

04	50	50 L/min	NS 10
	100	100 L/min	
	125	125 L/min	NS 16
	200	200 L/min	
	220	220 L/min	NS 25
	350	350 L/min	
	500	500 L/min	NS 27
	400	400 L/min	
	600	600 L/min	NS 32

05	L	Linear
	P	Linear with fine control range
06	3X	Series 30 to 39 (30 to 39: unchanged installation and mounting dimensions)

4WRKE	16	E	125	L	-	3X	/	6E	G24	ET	K31	/	A1	D3	V	*
01	02	03	04	05	06	07	08	09	10	11	12	13	14			

07	6E	Proportional solenoid with removable coil
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08	G24	24V DC
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Pilot oil supply and drain

09	No code	Pilot oil supply external, Pilot oil drain external
	E	Pilot oil supply internal, Pilot oil drain external
	ET	Pilot oil supply internal, Pilot oil drain internal
	T	Pilot oil supply external, Pilot oil drain internal

Electrical connections

10	K31	7 pin sockets conforming to DIN EN 175201-804 (plugs need to be ordered separately), see page 5
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Interfaces

11	A1	Command value input ± 10 V (the electrical interface is to be defined with A5 (enable signal at Pin C))
	F1	Command value input 4 to 20 mA
12	D3	With pressure reducing valve ZDR 6 DP0-4X/40YM-W80 (fixed setting)

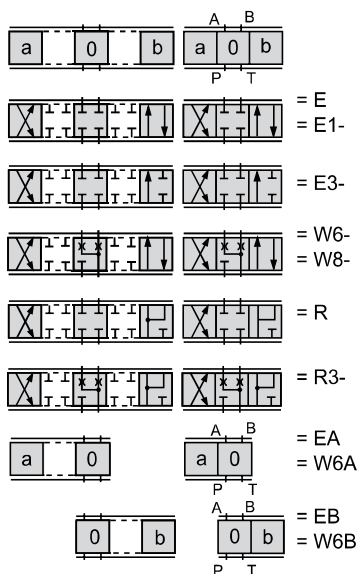
Sealing material

13	M	NBR seals
	V	FKM seals

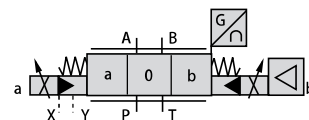
14	A	The amplifier assembly is installed on the side of the port A
	KS	External control of mold locking, application of injection molding machine, please contact us for details
	KE	With enable of external mold locking control, application of injection molding machine, please contact us for details

Symbols

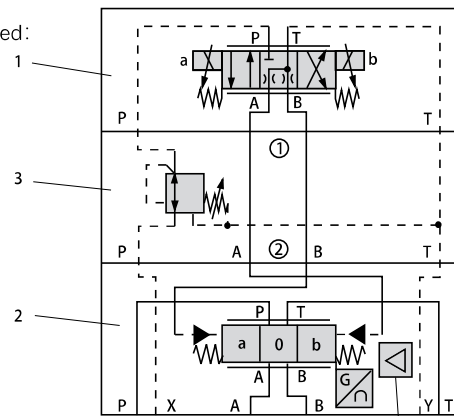
symbols:



Symbols detailed:



Symbols simplified:



Pilot oil supply external
Pilot oil drain external

1. Pilot control valve type 4WRAP 6...
2. Main valve
3. Pressure reducing valve type ZDR6DP0-4X/40YM-W80
4. integrated electronics

Note:

E1- and W8- spools:

$$\begin{aligned} P \rightarrow A: & q_{V \text{ nom}} & B \rightarrow T: & q_{V \text{ nom}} / 2 \\ P \rightarrow B: & q_{V \text{ nom}} / 2 & A \rightarrow T: & q_{V \text{ nom}} \end{aligned}$$

R and R3- spools:

$$\begin{aligned} P \rightarrow A: & q_{V \text{ nom}} & B \rightarrow P: & q_{V \text{ nom}} / 2 \\ P \rightarrow B: & q_{V \text{ nom}} / 2 & A \rightarrow T: & q_{V \text{ nom}} \end{aligned}$$

With the spools W6, W8 there is a connection from A to T and B to T in the zero position with approx. 2 % of the applicable nominal cross-section.

Function, section

Pilot control valve type 4WRAP6 W7.3X/G24... (1st stage)

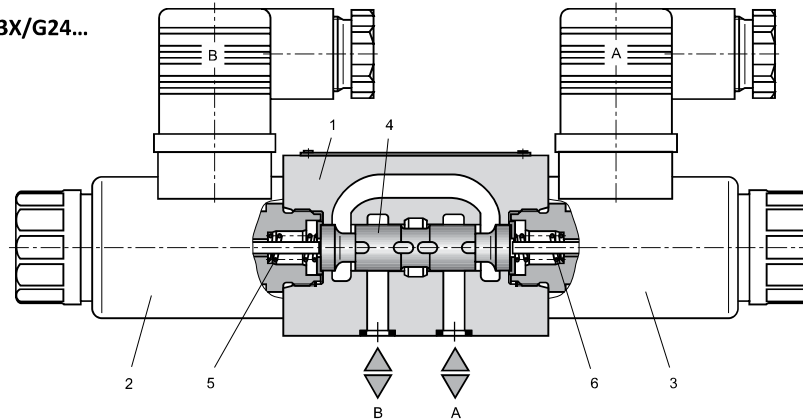
The pilot control valve is a direct operated proportional valve. The control edge geometries were designed and optimised for the use as a pilot control valve for the proportional directional valves type 4WRKE.

The proportional solenoids are pressure tight, oil-immersed DC solenoids with removable coil. They convert an electrical current proportionally into a mechanical force. An increase in the current strength causes an appropriately higher solenoid force. The set solenoid force remains constant over the entire control stroke.

The pilot control valve basically consists of the housing (1), proportional solenoids (2 and 3), valve spool (4) and springs (5 and 6). In the de-energised condition both actuator ports are connected to tank. If one of the two solenoids (2 or 3) is energised, then the solenoid force moves the valve spool (4) against the spring (6 or 5).

Once the overlap area is overcome, the connection to tank of one of the two actuator ports is blocked and the connection to the pressure chamber is established. There is flow from P to the control chamber of the main stage.

4WRAP6W7.3X/G24...



The type 4WRKE valves are 2-stage proportional directional control valves. They control the size and direction of a flow.

The main stage is closed loop position controlled so that the spool position is also independent of flow forces at larger flows.

The valves basically consist of the pilot control valve (1), housing (8), main spool (7), covers (5 and 6), centering spring (4), inductive position transducer (9) and the pressure reducing valve (3).

If no input signal is being applied then the main spool (10) is held in the centre position by the centering spring (4). The two control chambers in the covers (5 and 6) are connected via the valve spool (2) to tank.

The main spool (7) is connected to suitable control electronics via the inductive position transducer (9). The positional change of the main spool (7) as well as the alteration of the command value at the summation point of the amplifier produces a differential voltage.

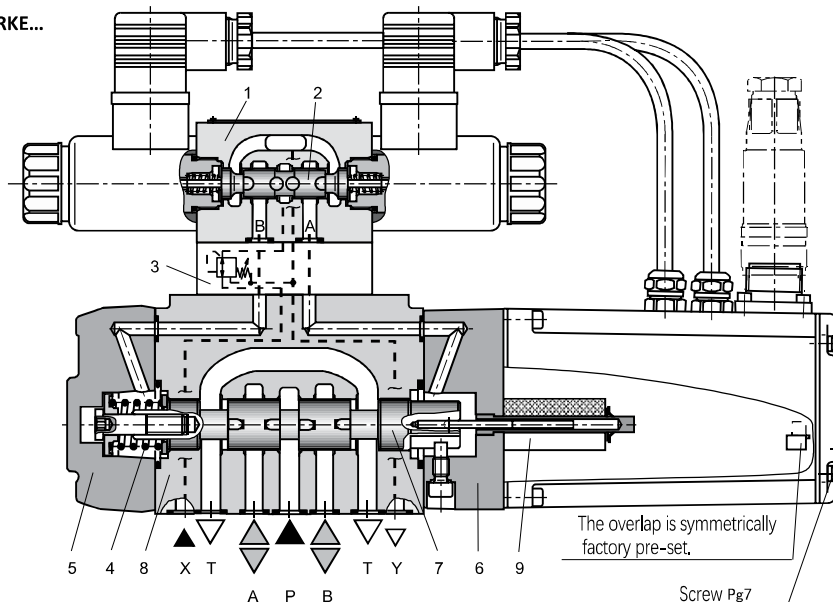
With the command value/actual value comparison a possible control deviation is recognized via the electronics and an electrical current is applied to the proportional solenoid of the pilot valve (1).

The current induces, within the solenoid, a force which is passed on to the solenoid pin which in turn actuates the control spool. The flow which is provided via the control cross sections causes the main spool to move.

The main spool (7) with the attached core of the inductive position transducer (9) is moved until the actual value is equal to the command value. In the controlled condition the main spool (7) is force balanced and is held in this controlled position. Spool stroke and control opening change in proportion to the command value.

The control electronics are integrated into the valve. By matching the valve and the electronics the model variation of the units is kept low. Prevent the tank lines from emptying; with appropriate installation conditions, a back pressure valve is to be installed (back pressure approx. 2 bar).

4WRKE...



If the pilot valve or control element has been replaced, the valve needs to be reset to zero. Zeroing operation needs to be operated by trained professionals.

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

General

Nominal size		10	16	25	27	32
Installation and commissioning guidelines		Optional, preferably horizontal				
Storage temperature range	°C	-20 to +80				
Ambient temperature range	°C	-20 to +50				
Weight	Kg	8.7	11.2	16.8	17	31.5

Hydraulic (measured at p = 100 bar, with HLP46 at 40 °C ± 5 °C)

Max. operating pressure	Pilot oil supply	bar	25~315					
	Main valve, ports A, B, P	bar	315	350	350	210	350	
	Port T	Pilot oil drain, internal	bar	Static < 10 (pilot valve)				
		Pilot oil drain, external	bar	315	250	250	210	250
	Port Y		bar	Static < 10 (pilot valve)				
Nominal flow $q_{Vnom} \pm 10\%$ at $\Delta p = 10\text{ bar}^{1)}$		L/min	50	125	220	500	400	
			100	200	350		600	
Max. flow of main valve		L/min	170	460	870	1000	1600	
Pilot oil flow at port X/Y with an input signal from 0 to 100 % (315 bar)		L/min	4.1	8.5	11.7	11.7	13	
Pressure fluid temperature range		°C	-20 to +80 (preferably+40 to +50)					
Viscosity range		mm²/s	20 to 380 (preferably 30 to 45)					
Degree of contamination	Pilot control valve		ISO4406: 1999 18/16/13					
	Main valve		ISO4406: 1999 20/18/15					
Hysteresis		%	≤1					
Response sensitivity		%	≤0.5					

parameters

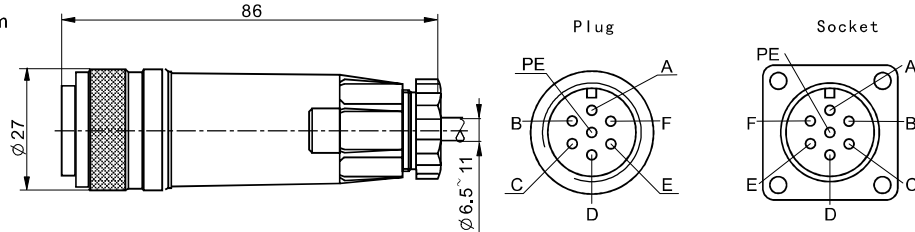
Voltage type		DC
Signal type		Analogue
Power, max.	W	72 (average = 24 W)
Max. current of a solenoid	A	< 2
Electrical connection		7 pin socket conforming to DIN EN 175201-804
Duty	%	100
Max. temperature of the solenoid	°C	150
Valve protection to EN 60529		IP65

1) Flow under other Δp_x : $q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{5}}$

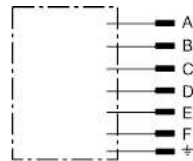
Electrical connections

Seven - pin plug compliant with DIN EN 175201 - 804 (ordered separately)

Dimensions in mm



Plug pin assignment



Metal nut structure (preferred model)

To be ordered separately. Order number: R00050406

Plastic nut structure

To be ordered separately. Order number: R00050408

All - metal structureT

o be ordered separately. Order number: R00050407

Electrical connection with a 7 - pin plug

Design	Slot	Allocation interface A1	Allocation interface F1	Allocation interface C2	Allocation interface A5	Allocation interface F5	Allocation interface C6
Supply power+	A	24VDC (21~40VDC)				GND,enable the reference potential	
Supply power-	B	GND					
	C	Feedback value reference point				(Enable input 24VDC enable $\geq$ 11VDC, disable $\leq$ 5VDC)	
Command input+	D	$\pm 10V$ com. value: $R_e > 50k\Omega$	4~20mA com. value $R_e < 250\Omega$	4~20mA com. value $R_e < 250\Omega$	$\pm 10V$ com. value: $R_e > 50k\Omega$	4~20mA com. value $R_e < 250\Omega$	$\pm 10V$ com. value: $R_e < 250\Omega$
Command input-	E	Input command				Reference potential	
Position feedback	F	Actual value: $\pm 10 V$ Maximum load: 5 mA	Actual value;4~20mA Maximum load;300 Ω	Actual value;4~20mA Maximum load;300 Ω	Actual value: $\pm 10 V$ Maximum load: 5 mA	Actual value;4~20mA Maximum load;300 Ω	Actual value;4~ 20mA Maximum load;300 Ω
	PE	Connected with cooling body and valve housing					

Command value:

A positive command value 0-10v(or 12 to 20 mA) at D and the reference potential at E results in a flow from P to A and B to T.

A negative command value 0--10vor 4 to 12 mA) at D and the reference potential at E results in a flow from p to B and A to T

For a valve with 1 solenoid on side a (e.g. spool variants EA and WA) a positive command value (or 4 to 20 mA) at D and the reference potential at E results in a flow from P to B and A to T.

Connection cable:

Recommendation: – Up to 25 m cable length type LiYCY 7 x 0.75 mm²

– Up to 50 m cable length type LiYCY 7 x 1.0 mm²

External diameter: – 6.5 to 11 mm (plastic plug-in connection)

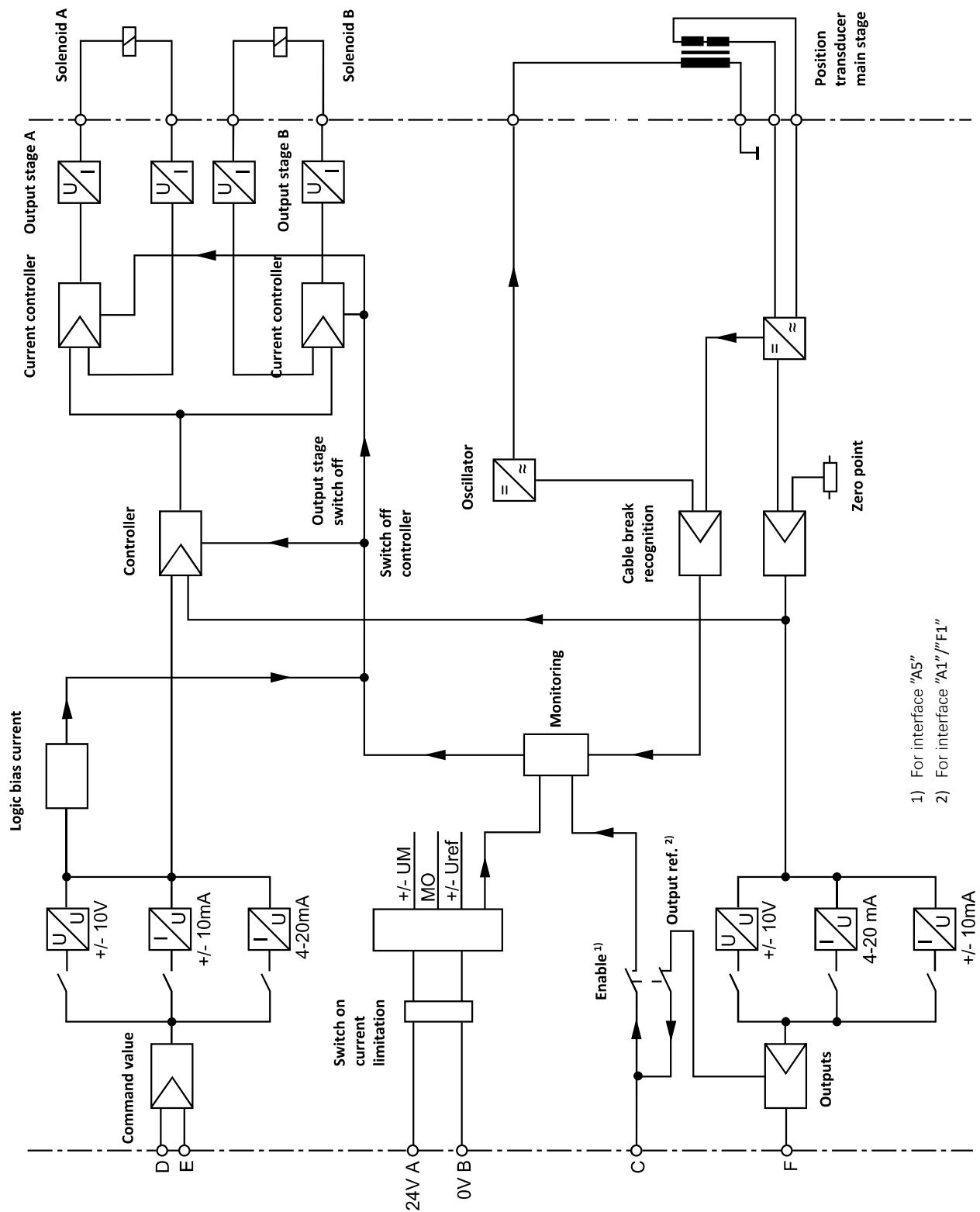
– 8 to 12 mm (metal plug-in connector)

Connect screen to $\perp$ only on supply side.

Note:

Electrical signals (e.g. actual value or feedback signals) taken via valve electronics must not be used to switch off the machine safety functions!

Blockcircuit diagram



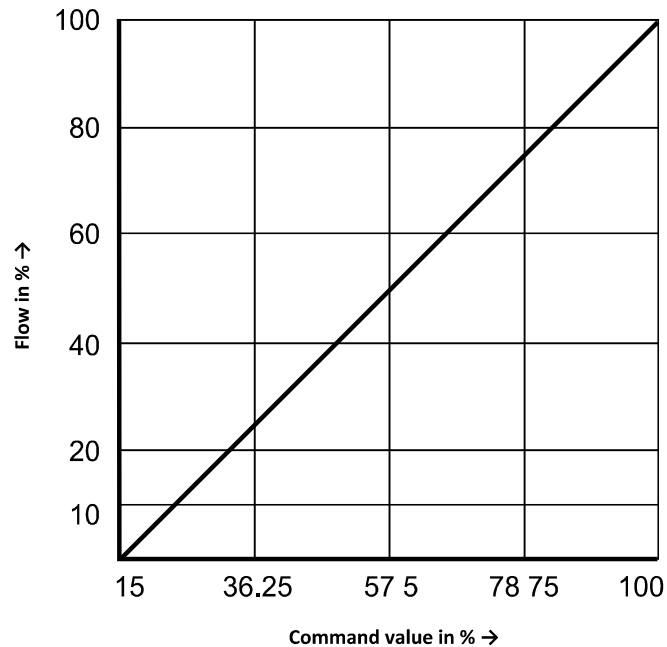
- 1) For interface "A5"
 2) For interface "A1"/"F1"

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

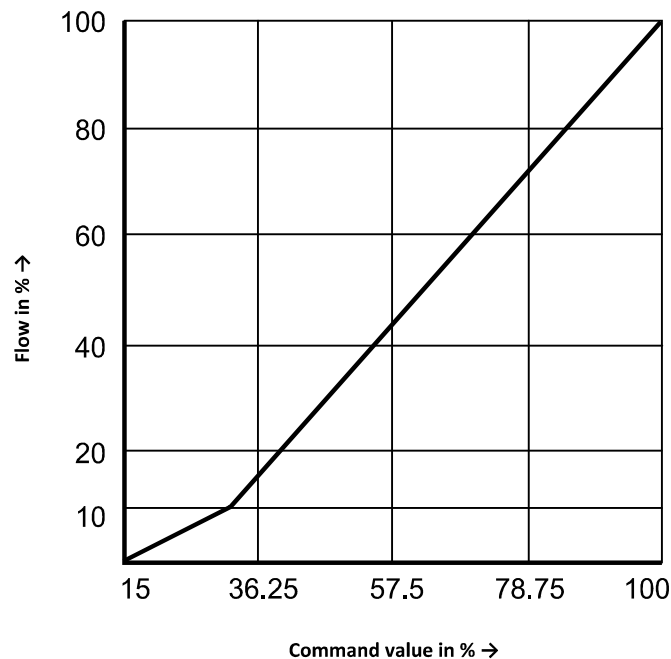
Flow characteristic curve, $P_p = 100$ bar, spools E/W/R

10 bar valve pressure differential or 5 bar per control land

Spool with characteristic curve L

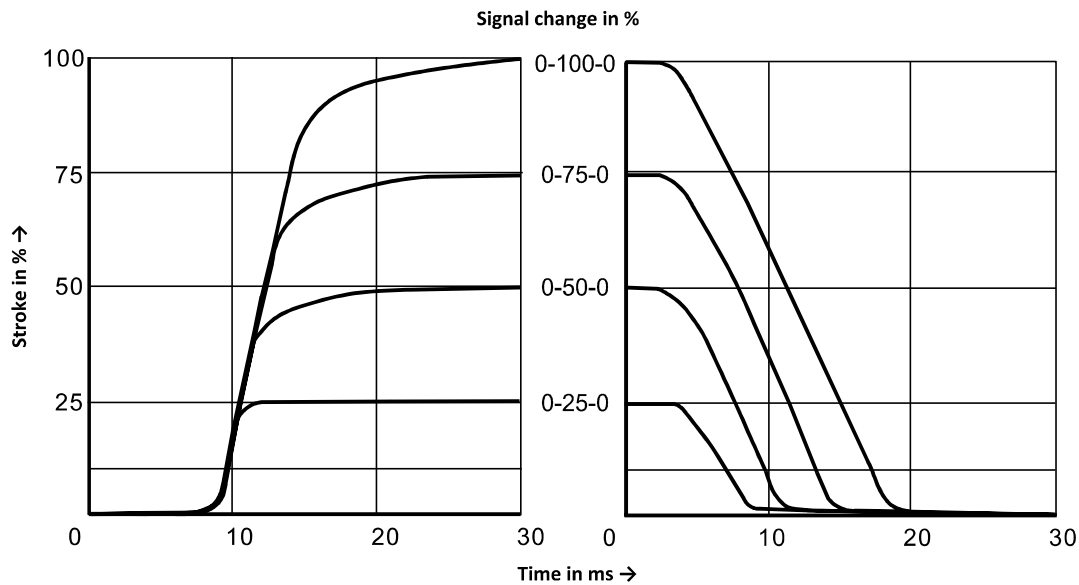


Spool with characteristic curve P

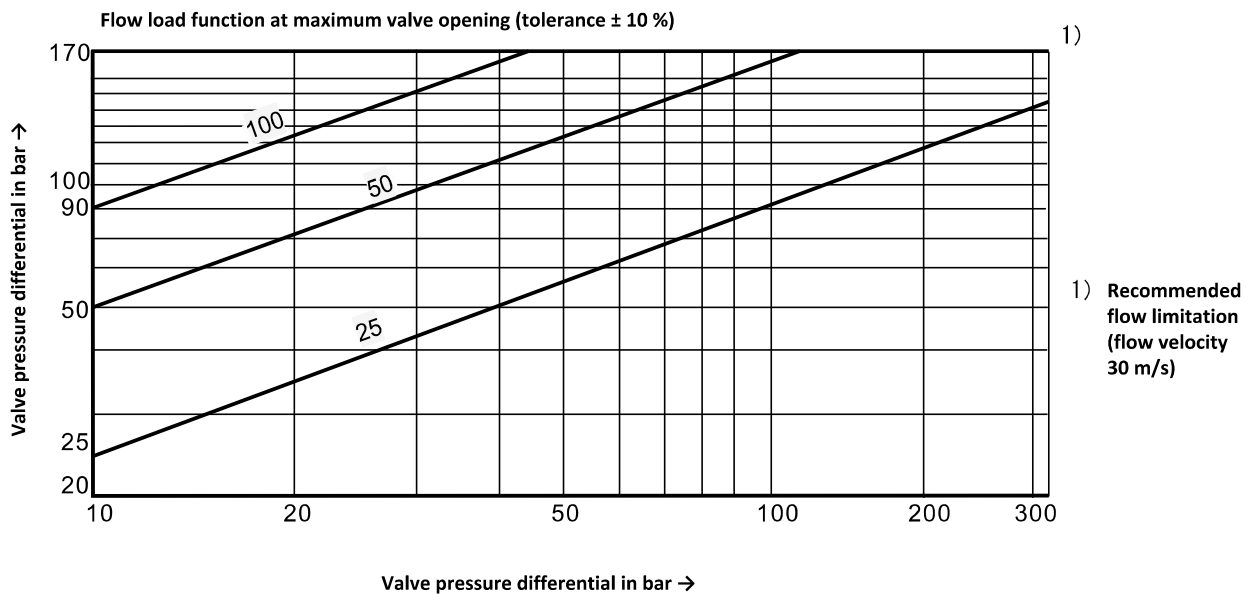


Characteristic curves NS10 (HLP46 at 40 °C ± 5 °C)

Transient function with a stepped form of electrical input signal for type 4WRKE10

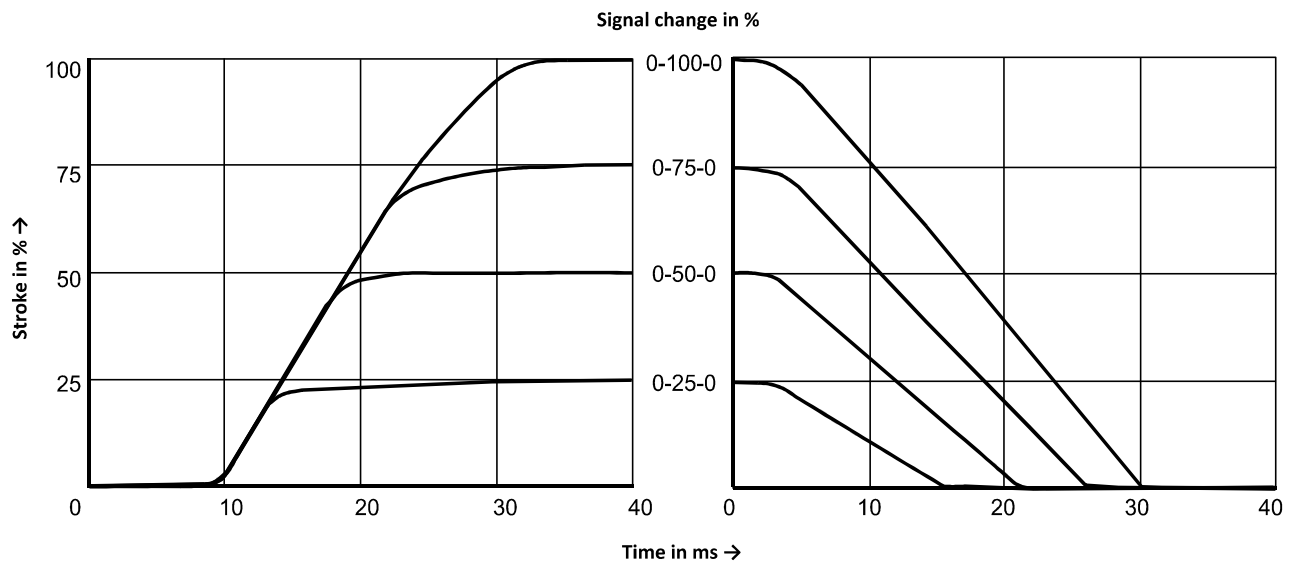


Power limit

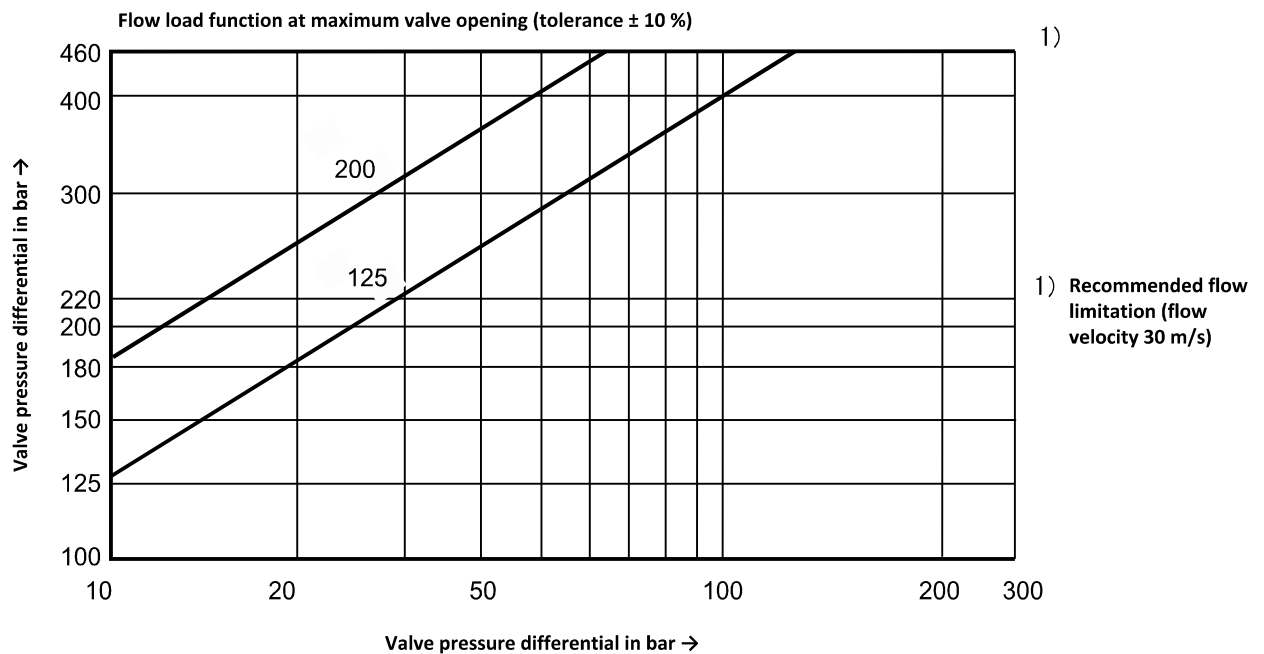


Characteristic curves NS16 (HLP46 at 40 °C ± 5 °C)

Transient function with a stepped form of electrical input signal for type 4WRKE16

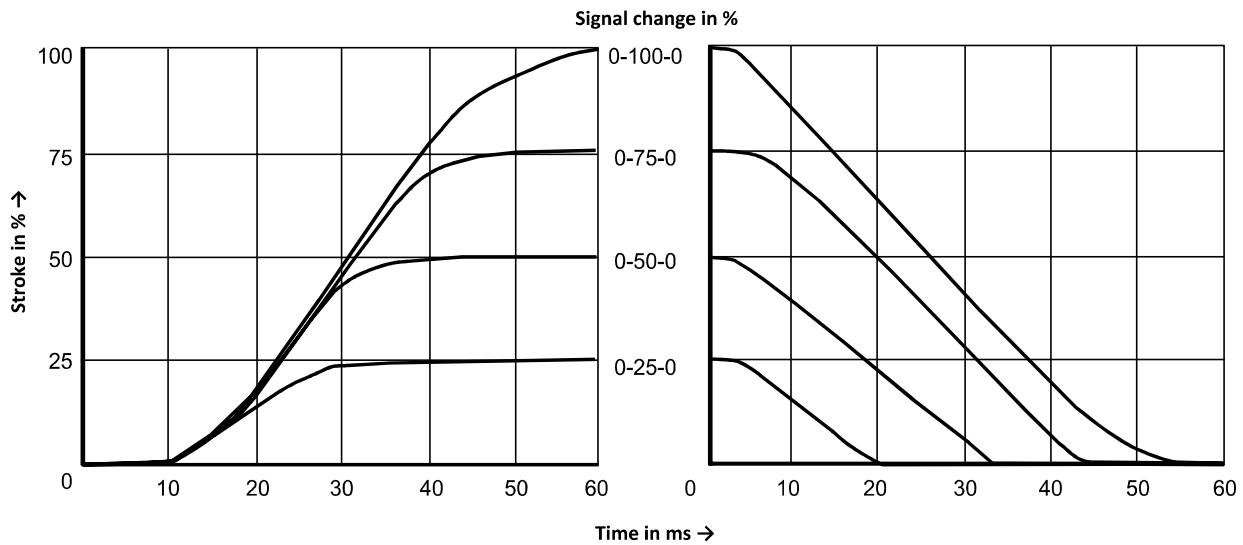


Power limit

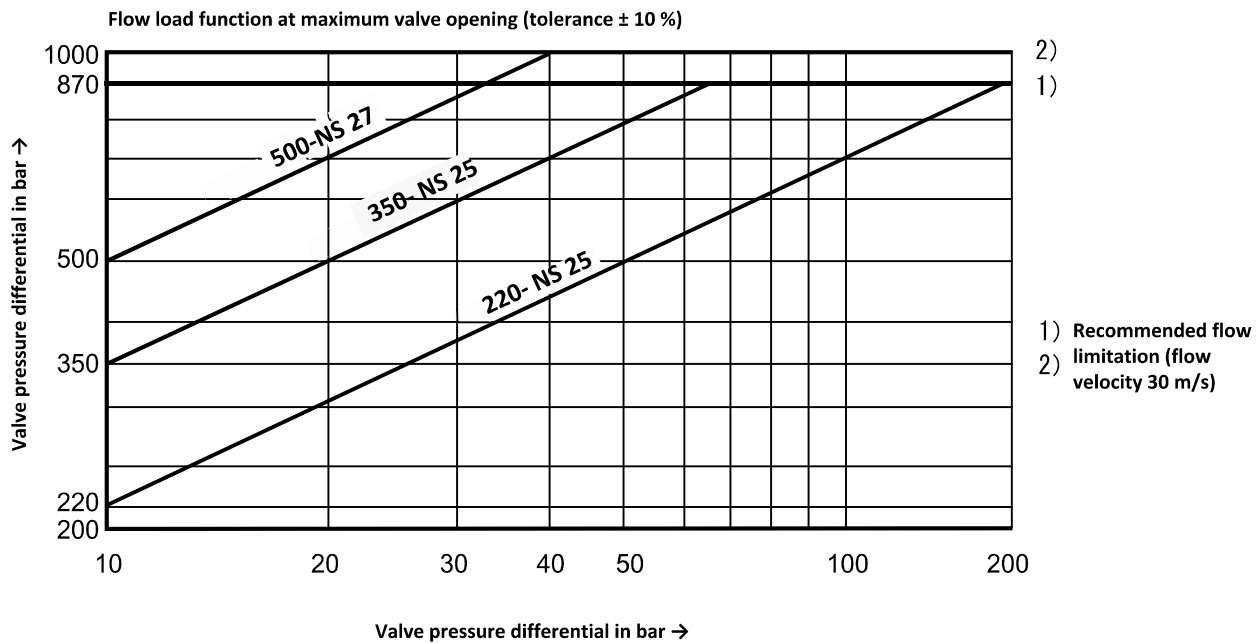


Characteristic curves NS25 and 27 (HLP46 at 40 °C ± 5 °C)

Transient function with a stepped form of electrical input signal for type 4WRKE25/27

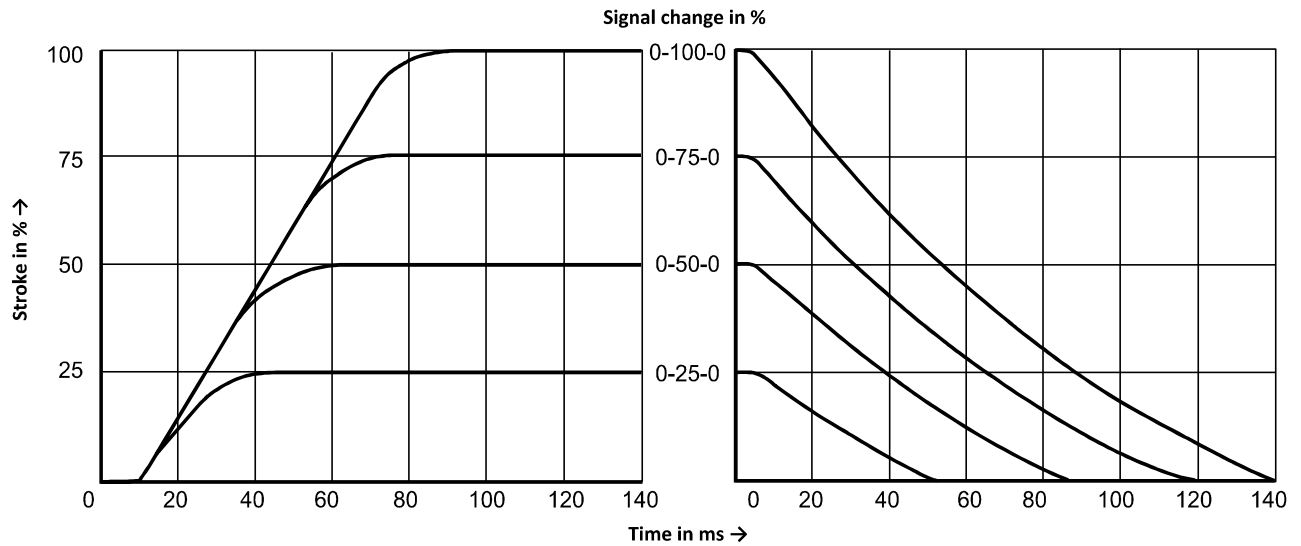


Power limit

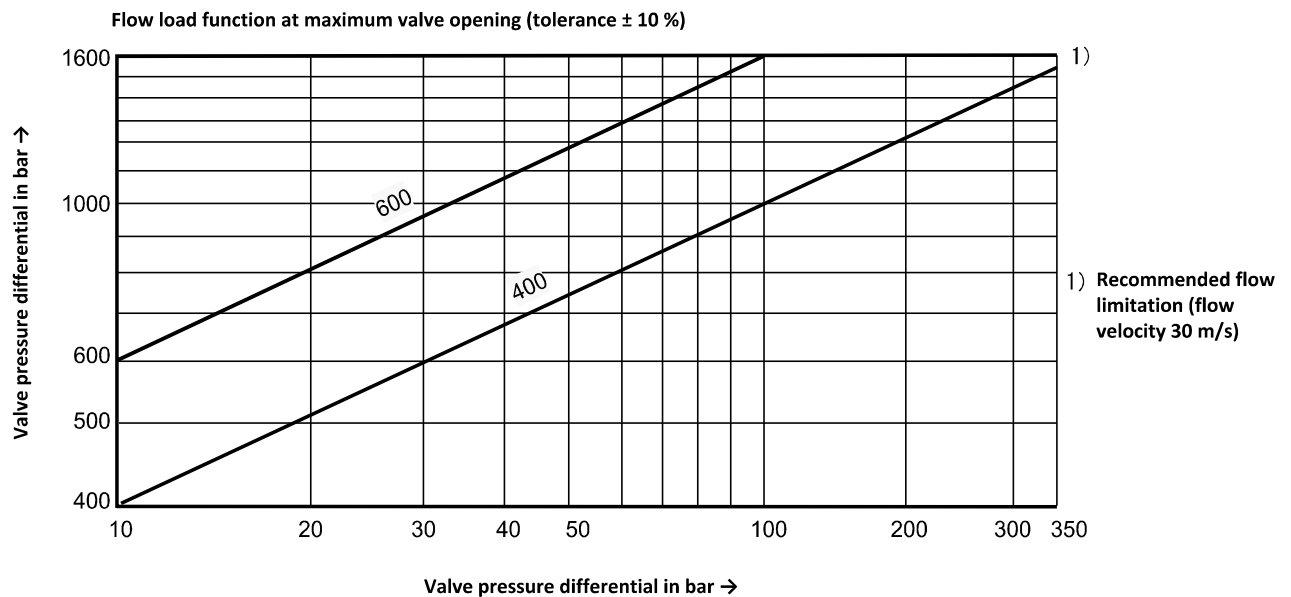


Characteristic curves NS32 (HLP46 at 40 °C ± 5 °C)

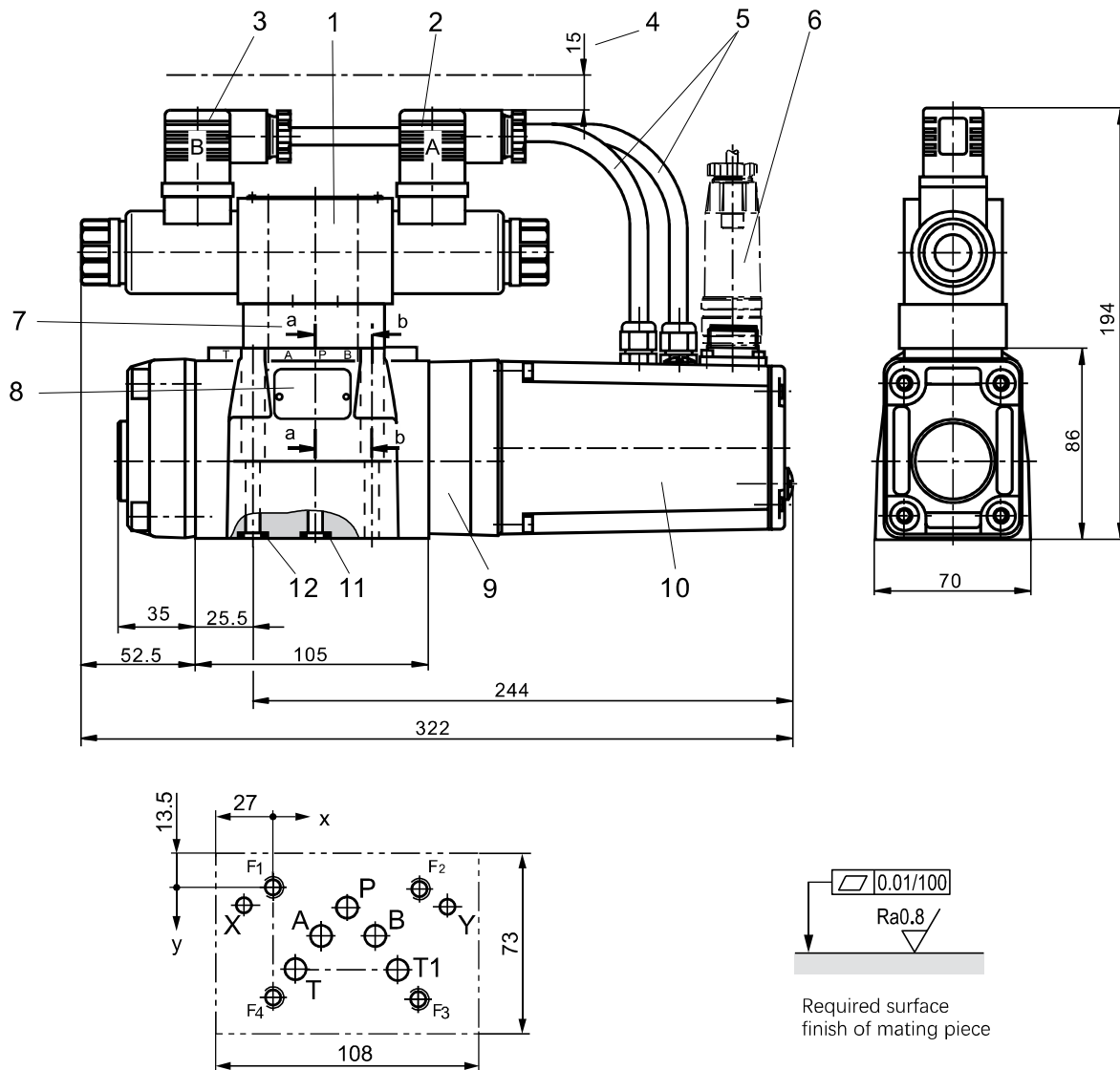
Transient function with a stepped form of electrical input signal for type 4WRKE32



Power limit



Unit dimensions: NS 10 (Dimensions in mm)



Dimensions in mm	P	A	T	T1	B	F1	F2	F3	F4	X	Y
Diameter/thread	Max. ø11.2	Max. ø11.2	Max. ø11.2	Max. ø11.2	Max. ø11.2	M6	M6	M6	M6	Max. ø6.3	Max. ø6.3
x	27	16.7	3.2	50.8	37.3	0	54	54	0	-8	62
y	6.3	21.4	32.5	32.5	21.4	0	0	46	46	11	11

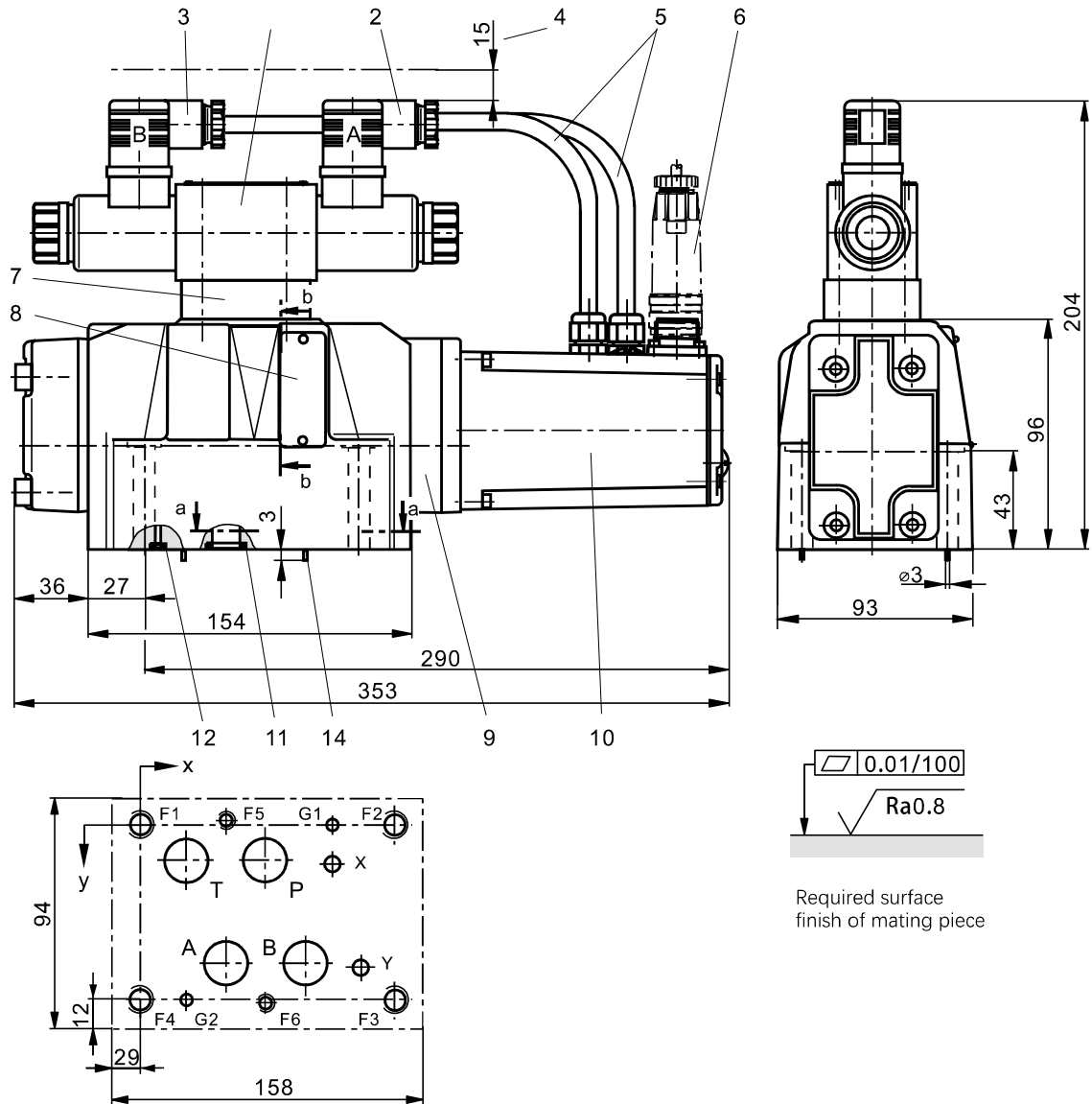
1. Pilot control valve
2. Plug-in connector "A", color grey
3. Plug-in connector "B", color black
4. Space required to remove the plug-in connector
5. Cable
6. Plug-in connector, separate order
7. Pressure reducing valve
8. Name plate
9. Main valve

10. Integrated control electronics
11. R-ring 13 x 1.6 x 2, ports A, B, P, T (O-ring 12 x 2)
12. R-ring 11.18 x 1.6 x 1.78, ports X and Y (O-ring 10.82 x 1.78)
13. Machined valve mounting surface, position of the ports to ISO4401-05-05-0-05

Fixing screws: 4 GB/T 70.1 - M6 x 45 10.9

Torque: 15.5 Nm ± 10 %

Unit dimensions: NS 16 (Dimensions in mm)



Dimensions in mm	P	A	T	B	X	Y	G1	G2	F1	F2	F3	F4	F5	F6
Diameter/thread	ø17.5 MAX.	ø17.5 MAX.	ø17.5 MAX.	ø17.5 MAX.	ø6.3 MAX.	ø6.3 MAX.	ø4	ø4	M10	M10	M10	M10	M6	M6
x	50	34.1	18.3	65.9	76.6	88.1	76.6	18.3	0	101.6	101.6	0	34.1	50
y	14.3	55.6	14.3	55.6	15.9	57.2	0	69.9	0	0	69.9	69.9	-1.6	71.5

1. Pilot control valve
2. Plug-in connector "A", color grey
3. Plug-in connector "B", color black
4. Space required to remove the plug-in connector
5. Cable
6. Plug-in connector, separate order
7. Pressure reducing valve
8. Name plate
9. Main valve

10. Integrated control electronics
11. R-ring 22.53 x 2.3 x 2.62, ports A, B, P and T (O-ring 22 x 2.5)
12. R-ring 10 x 2 x 2, ports X and Y (O-ring 10 x 2)
13. Machined valve mounting surface, position of the ports to ISO4401-07-07-0-05
14. Locating pin

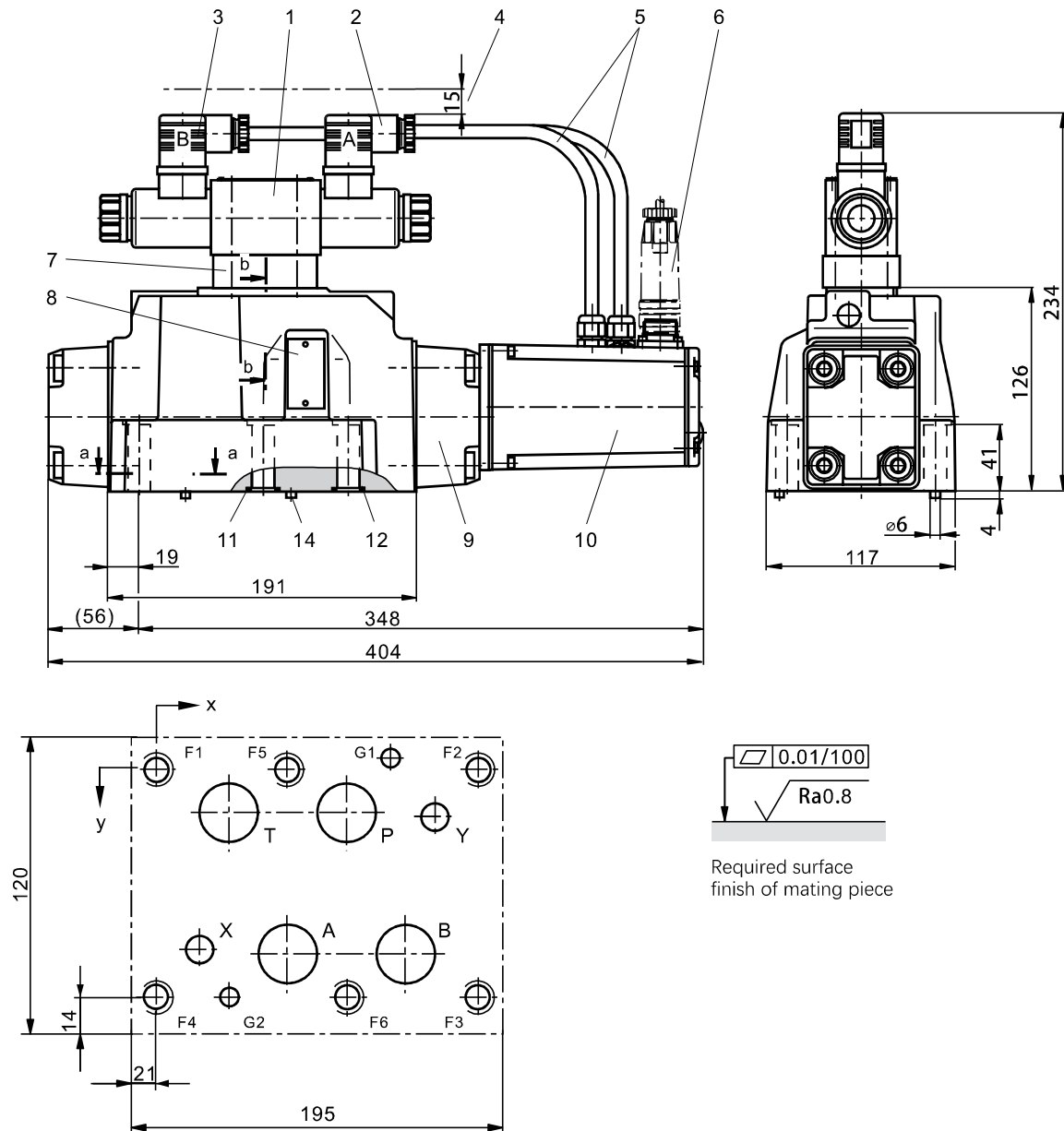
Fixing screws: 4 GB/T 70.1 - M10 x 60 10.9

Torque: 75 Nm ± 20 %

Fixing screws: 2 GB/T 70.1 - M6 x 60 10.9

Torque: 15.5 Nm ± 20 %

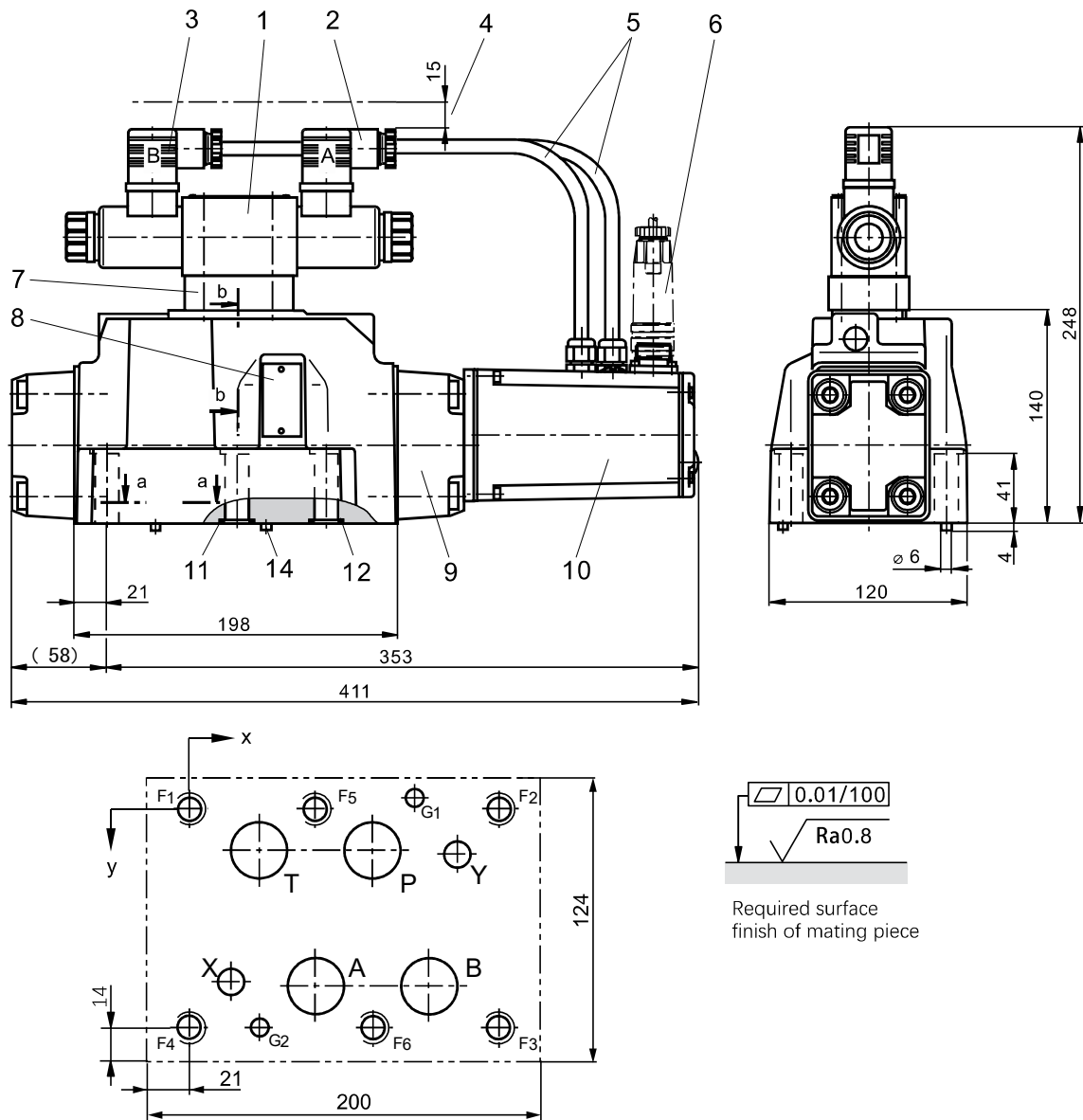
Unit dimensions: NS 25 (Dimensions in mm)



Dimensions in mm	P	A	T	B	X	Y	G1	G2	F1	F2	F3	F4	F5	F6
Diameter/thread	ø25 MAX.	ø25 MAX.	ø25 MAX.	ø25 MAX.	ø11.2 MAX.	ø11.2 MAX.	ø7.5	ø7.5	M12	M12	M12	M12	M12	M12
x	77	53.2	29.4	100.8	17.5	112.7	94.5	29.4	0	130.2	130.2	0	53.2	77
y	17.5	74.6	17.5	74.6	73	19	-4.8	92.1	0	0	92.1	92.1	0	92.1

- Pilot control valve
 - Plug-in connector "A", color grey
 - Plug-in connector "B", color black
 - Space required to remove the plug-in connector
 - Cable
 - Plug-in connector, separate order
 - Pressure reducing valve
 - Name plate
 - Main valve
 - Integrated control electronics
 - R-ring 27.8 x 2.6 x 3, ports A, B, P and T (O-ring 27 x 3)
 - R-ring 19 x 3 x 3, ports X, Y (O-ring 19 x 3)
 - Machined valve mounting surface, position of the ports to ISO4401-08-08-0-05
 - Locating pin
- Fixing screws: 6 GB/T 70.1 - M12 x 60 10.9
 Torque: 130 Nm ± 20 %

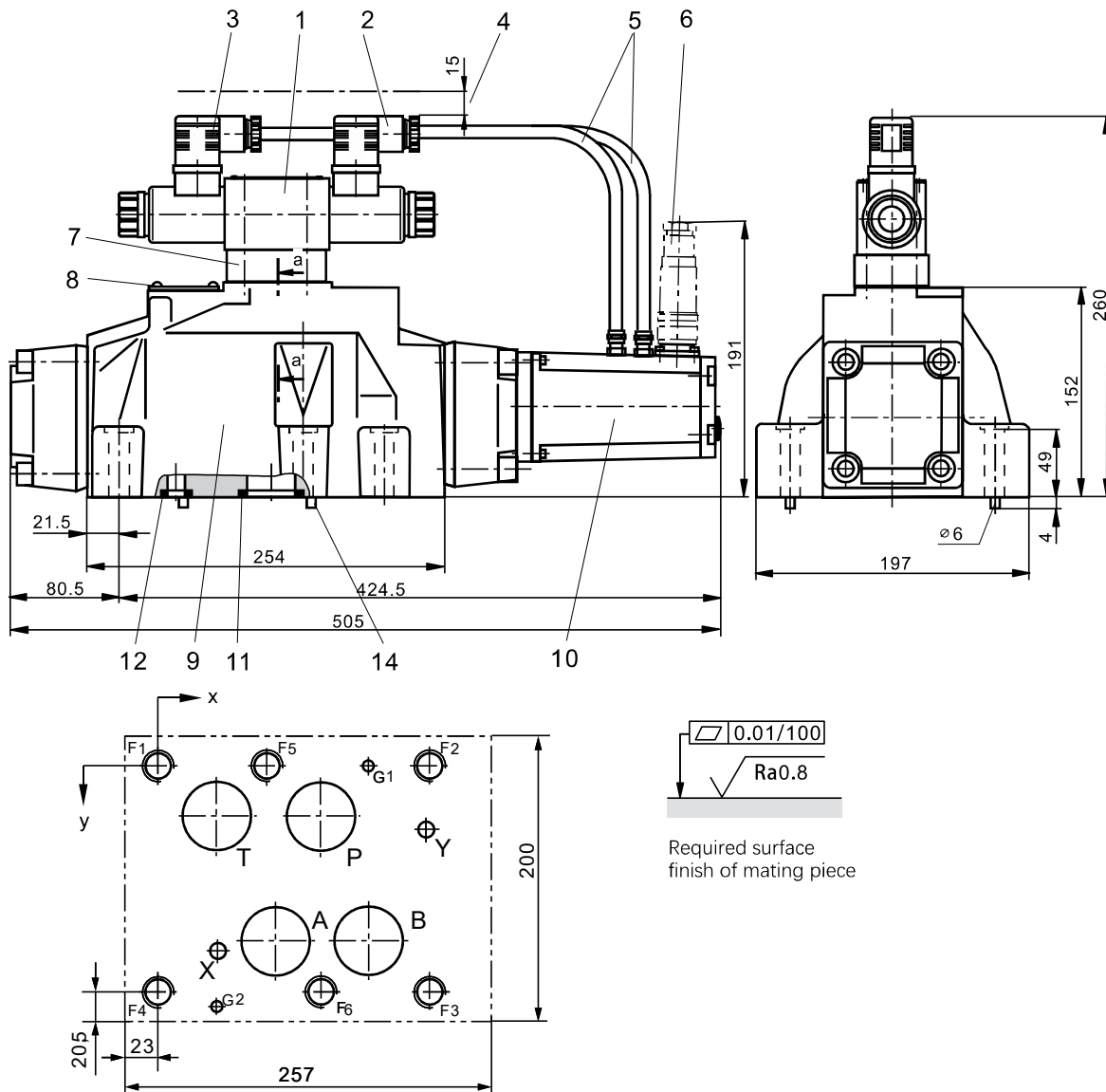
Unit dimensions: NS 27 (Dimensions in mm)



Dimensions in mm	P	A	T	B	X	Y	G1	G2	F1	F2	F3	F4	F5	F6
Diameter/thread	ø35 MAX.	ø35 MAX.	ø35 MAX.	ø35 MAX.	ø11.2 MAX.	ø11.2 MAX.	ø7.5	ø7.5	M12	M12	M12	M12	M12	M12
x	77	53.2	29.4	100.8	17.5	112.7	94.5	29.4	0	130.2	130.2	0	53.2	77
y	17.5	74.6	17.5	74.6	73	19	-4.8	92.1	0	0	92.1	92.1	0	92.1

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Pilot control valve 2. Plug-in connector "A", color grey 3. Plug-in connector "B", color black 4. Space required to remove the plug-in connector 5. Cable 6. Plug-in connector, separate order 7. Pressure reducing valve 8. Name plate 9. Main valve | <ol style="list-style-type: none"> 10. Integrated control electronics 11. R-ring , ports A, B, P and T 12. R-ring , ports X, Y 13. Machined valve mounting surface, position of the ports to ISO4401-08-08-0-05 14. Locating pin <p>Fixing screws: 6 GB/T 70.1 - M12 x 60 10.9
Torque: 130 Nm ± 20 %</p> |
|--|---|

Unit dimensions: NS 32 (Dimensions in mm)



Dimensions in mm	P	A	T	B	X	Y	G1	G2	F1	F2	F3	F4	F5	F6
Diameter/thread	ø34 MAX.	ø38 MAX.	ø38 MAX.	ø38 MAX.	ø13 MAX.	ø13 MAX.	ø6.5	ø6.5	M20	M20	M20	M20	M20	M20
x	114.5	82.5	41.5	147.5	41.5	168.5	147.5	41.5	0	190.5	190.5	0	76	114.5
y	35	124	35	124	130.5	44.5	0	159	0	0	159	159	0	159

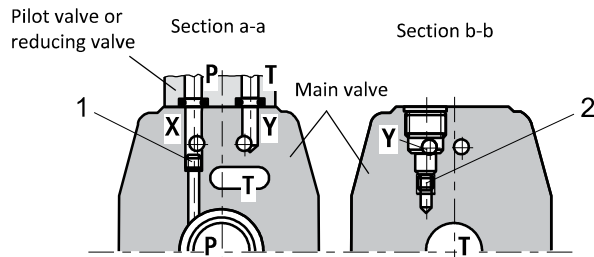
1. Pilot control valve
2. Plug-in connector "A", color grey
3. Plug-in connector "B", color black
4. Space required to remove the plug-in connector
5. Cable
6. Plug-in connector, separate order
7. Pressure reducing valve
8. Name plate
9. Main valve

10. Integrated control electronics
11. R-ring 42.5 x 3 x 3; ports A, B, P, T
12. R-ring 19 x 3 x 3; ports X, Y
13. Machined valve mounting surface, position of the ports to ISO4401-10-09-0-05
14. Locating pin

Fixing screws: 6 GB/T 70.1 - M20 x 80 10.9
 Torque: 430 Nm ± 20 %

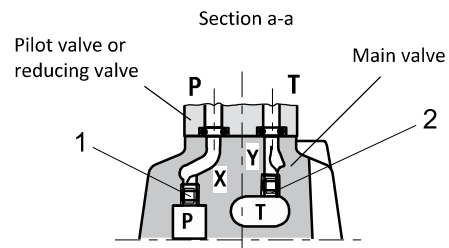
Pilot oil supply and drain

NS 10 Section diagram, see page 13



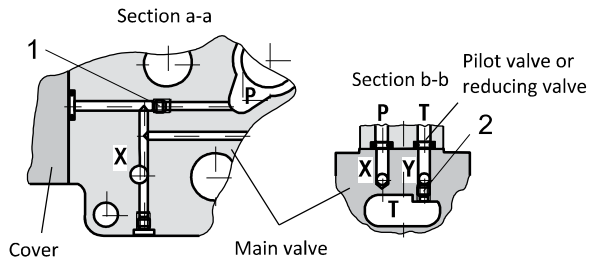
Pilot oil supply	external:	1	closed
	internal:	1	open
Pilot oil drain	external:	2	closed
	internal:	2	open

NS 16 Section diagram, see page 14



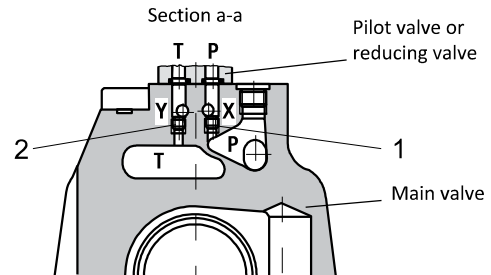
Pilot oil supply	external:	1	closed
	internal:	1	open
Pilot oil drain	external:	2	closed
	internal:	2	open

NS 25 and 27 Section diagram, see page 15 and 16



Pilot oil supply	external:	1	closed
	internal:	1	open
Pilot oil drain	external:	2	closed
	internal:	2	open

NS 32 Section diagram, see page 17



Pilot oil supply	external:	1	closed
	internal:	1	open
Pilot oil drain	external:	2	closed
	internal:	2	open

Pilot oil supply and drain

"No code" = Pilot oil supply external, Pilot oil drain external

In this type the pilot oil supply is from a separate pilot pressure circuit(external).

The pilot oil drain is not into the T port of the main valve but separately into tank via port Y (external).

Type "E" = Pilot oil supply internal, Pilot oil drain external

In this type the pilot oil supply is from the P port of the main valve (internal).

The pilot oil drain is not into the T port of the main valve but separately into tank via port Y (external).

Port X must be plugged in the subplate.

Type "ET" = Pilot oil supply internal, Pilot oil drain internal

In this type the pilot oil supply is from the P port of the main valve (internal).

The pilot oil drain is directly into the T port of the main valve (internal).

Port Y must be plugged in the subplate.

Type "T" = Pilot oil supply external, Pilot oil drain internal

In this type the pilot oil supply is from a separate pilot pressure circuit (external).

The pilot oil drain is directly into the T port of the main valve (internal).

Port Y must be plugged in the subplate.