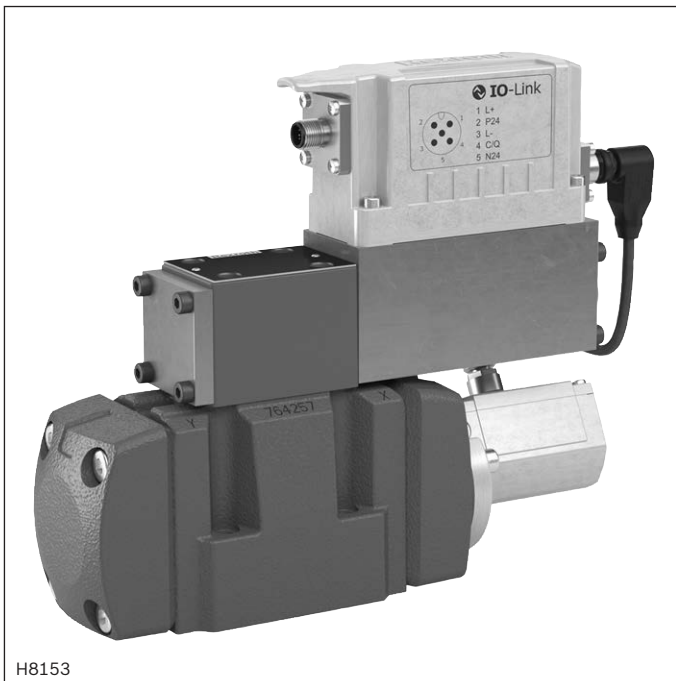


Directional control valves, pilot-operated, with electrical position feedback and integrated electronics (OBE)

Type 4WRLE



H8153

- ▶ Size 10 ... 35
- ▶ Component series 4X
- ▶ Maximum operating pressure 350 bar
- ▶ Rated flow 60 ... 1500 l/min
- ▶ Digital interface, IO link for I4.0



Features

- ▶ Reliable – proven and robust design
- ▶ Safe
 - The control spool of the pilot control valve is in the “fail safe” position when the unit is switched off
 - The control spool of the main valve is in the spring-centered central position and/or in the offset position
- ▶ High quality – control spool and sleeve of the pilot control valve in servo quality
- ▶ Flexible – suitable for position, velocity and pressure control
- ▶ Precise – high response sensitivity and little hysteresis
- ▶ IO-Link interface, optional

Contents

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Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
4	WRL	E					J	-	4X	/			/		24	*

01	4 main ports	4
02	Directional control valve, pilot-operated	WRL
03	With integrated electronics (OBE)	E
04	Size 10	10
	Size 16	16
	Size 25	25
	Size 27	27
	Size 35	35
05	Symbols e.g. E, E1-, W6- etc.; possible version see page 4	

Rated flow ($\Delta p = 5$ bar/control edge)

06	- Size 10	
	60 l/min (only symbol E, E1-, W6-, W8-, V, V1-)	60
	100 l/min	100
	- Size 16	
	200 l/min (only symbol W6- and W8-)	200
	250 l/min (only symbol E, E1-, V, V1- and Q3-)	250
	- Size 25	
	350 l/min (only symbol W6- and W8-)	350
	400 l/min (only symbol E, E1-, V, V1- and Q3-)	400
	- Size 27	
	430 l/min (only symbol W6- and W8-)	430
	600 l/min (only symbol E, E1-, V, V1- and Q3-)	600
	- Size 35	
	1000 l/min (only symbol E, E1-, V, V1-)	1000
	1200 l/min (only symbol W6- and W8-)	1200
	1500 l/min (only symbol E, E1-, V, V1- and Q3-)	1500

Flow characteristic

07	Linear	L
	Linear with fine control range (available for NG 10, other sizes on request)	P
	Progressive with linear fine control (only symbol Q3-)	M
08	Overlap jump (opening point 5% with covered valve; only symbols E, E1-, W6-, W8-)	J
09	Component series 40 ... 49 (40 ... 49: unchanged installation and mounting dimensions)	4X

Seal material (observe compatibility of seals with hydraulic fluid used, see page 10)

10	NBR seals	M
	FKM seals	V

Pilot oil flow

11	External pilot oil supply, external pilot oil return	XY
	Internal pilot oil supply, external pilot oil return	PY
	Internal pilot oil supply; internal pilot oil return	PT
	External pilot oil supply, internal pilot oil return	XT

Ordering code

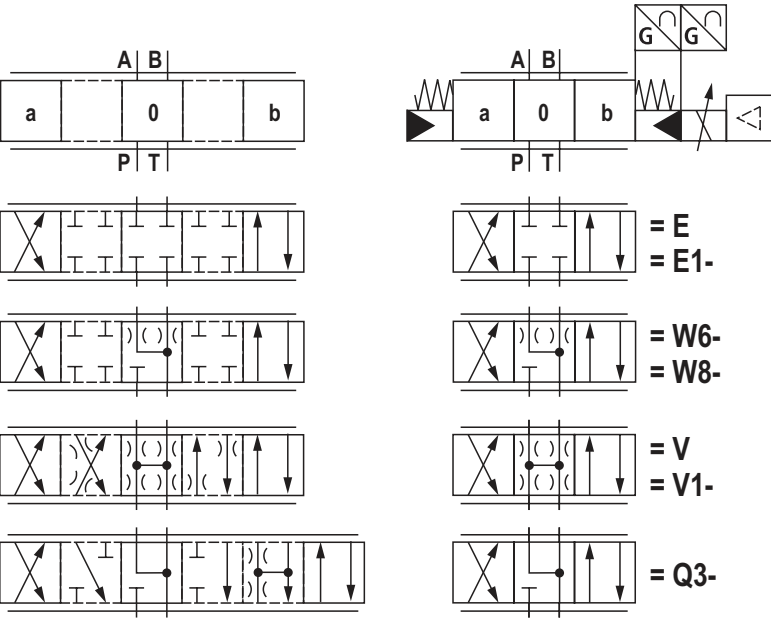
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
4	WRL	E					J	-	4X	/			/		24	*

12	Without damping plate	without designation
	With damping plate	D
13	Supply voltage 24 V	24

Interfaces of the control electronics

14	Command value input ± 10 V	A1
	Command value input 4 ... 20 mA	F1
	IO-Link interface	L1
	Command value ± 10 mA, actual value 4 ... 20 mA, release (connector 6+PE)	C6
15	Without electronics protection membrane	without designation
	With electronics protection membrane	-967
16	For further details, see the plain text	*

Symbols



With symbol E1-, V1- and W8-:

$P \rightarrow A: q_{V \max}$ $B \rightarrow T: q_V/2$
 $P \rightarrow B: q_V/2$ $A \rightarrow T: q_{V \max}$

Version	simple	detailed
"XY"		
"PY"		
"PT"		
"XT"		

- Notice:**
- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
 - For information on the "switch-off behavior", refer to the technical data on page 10.

Function, section: Symbol E. and W.

The valve type 4WRLE is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of 3 main assemblies:

- ▶ Pilot control valve (1) with control spool and sleeve, return spring, control solenoid and inductive position transducer (optionally with electronics protection membrane (5) and damping plate (4))
- ▶ Main valve (2) with centering spring and position feedback
- ▶ On-board electronics (OBE) (3) with analog (6) or IO-Link interface

Function

When the integrated electronics (OBE) are switched off or inactive, the control spool of the pilot control valve is spring-operated in the "fail-safe" position. The control spool of the main valve is in its spring-centered central position.

The integrated electronics (OBE) compare the specified command value to the position actual value of the main valve control spool. In case of control deviations, the control solenoid will be activated. Due to the changed magnetic force, the pilot control spool is adjusted against the spring.

The flow, which is activated via the control cross-sections, leads to an adjustment of the main control spool. The stroke/control cross-section of the main control spool is regulated proportionally to the command value.

The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.

Control solenoid shut-off

In case of the following errors, the control solenoids are

de-energized by the integrated electronics (OBE), the pilot control spool is set to its "fail-safe" position and unloads the pilot oil chambers of the main valve. Operated by the spring, the main valve control spool will move to the central position.

- ▶ Falling below the minimum supply voltage
- ▶ Only at interface "F1":
 - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)).
- ▶ Only at interface "L1":
 - Enable inactive, communication interruption (watchdog)
 - In case of internal IO-Link error
- ▶ Only at interface "C6":
 - Additionally, release inactive

Damping plate "D"

The damping plate (4) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).



Notice:

Using the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz.

Electronics protection membrane "-967"

To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (5) can be used.

Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



Notice:

Pilot-operated 4/3 directional control valves with positive overlap are functional in controlled or regulated axes. The overlap in the de-energized state is approx. 20% of the control spool stroke. While the electrical supply voltage is switching off, the drive may be accelerated for a short time in functional direction P to B.

For sectional drawing see page 6.

Function, section: Symbol V and V1-

The valve type 4WRLE is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of 3 main assemblies:

- Pilot control valve (1) with control spool and sleeve, return spring, control solenoid and inductive position transducer (optionally with electronics protection membrane (5) and damping plate (4))
- Main valve (2) with centering spring and position feedback
- On-board electronics (OBE) (3) with analog (6) or IO-Link interface

Function

When the integrated electronics (OBE) are switched off or inactive, the control spool of the pilot control valve is spring-operated in the "fail-safe" position. The control spool of the main valve is in its spring-centered offset position at approx. 6% of the stroke in direction P to B/A to T.

The integrated electronics (OBE) compare the specified command value to the position actual value of the main valve control spool. In case of control deviations, the control solenoid will be activated. Due to the changed

magnetic force, the pilot control spool is adjusted against the spring.

The flow, which is activated via the control cross-sections, leads to an adjustment of the main control spool. The stroke/control cross-section of the main control spool is regulated proportionally to the command value. In case of a command value presetting of 0 V, the electronics adjust the control spool of the main valve to central position.

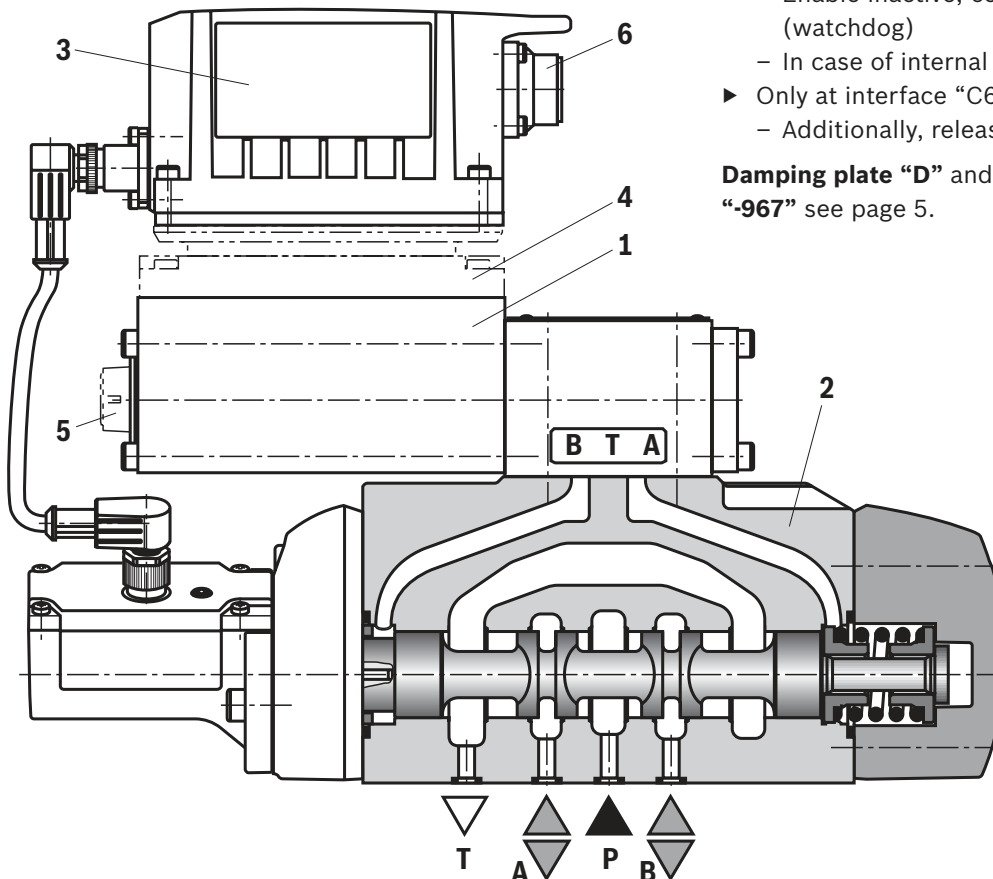
The pilot oil supply in the pilot control valve is either internal via port P or external via port X. The feedback can be internal via port T or external via port Y to the tank.

Control solenoid shut-off

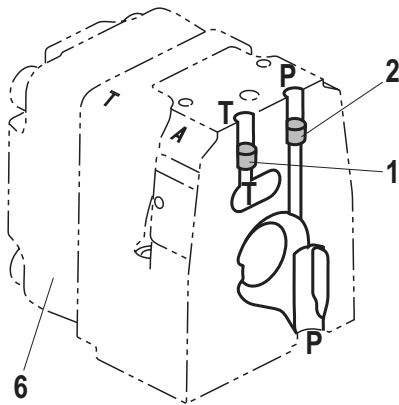
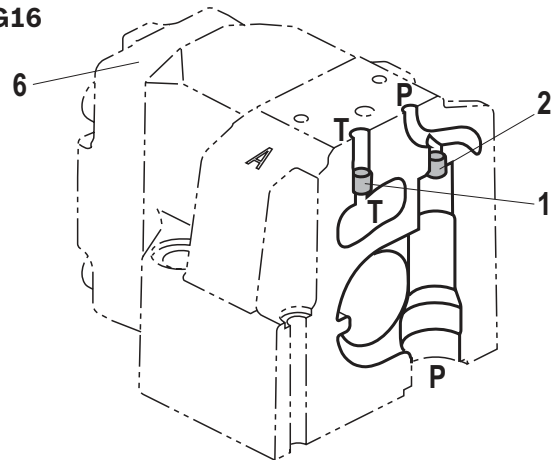
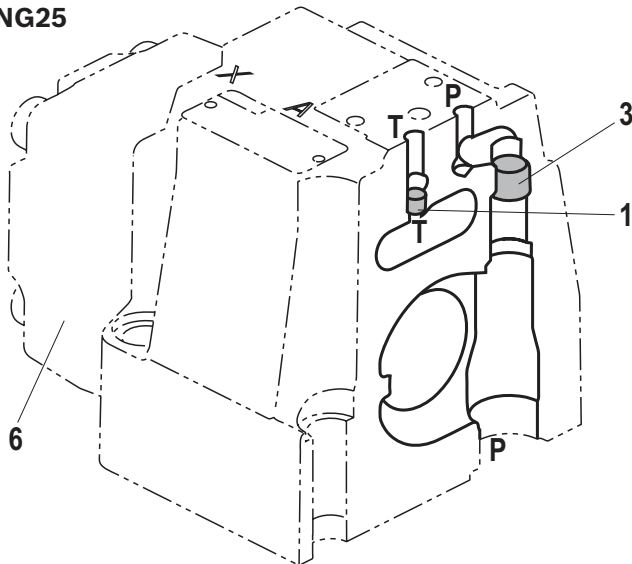
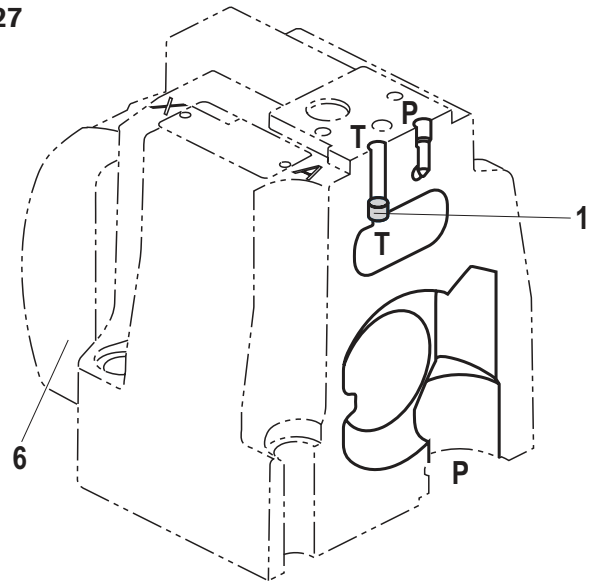
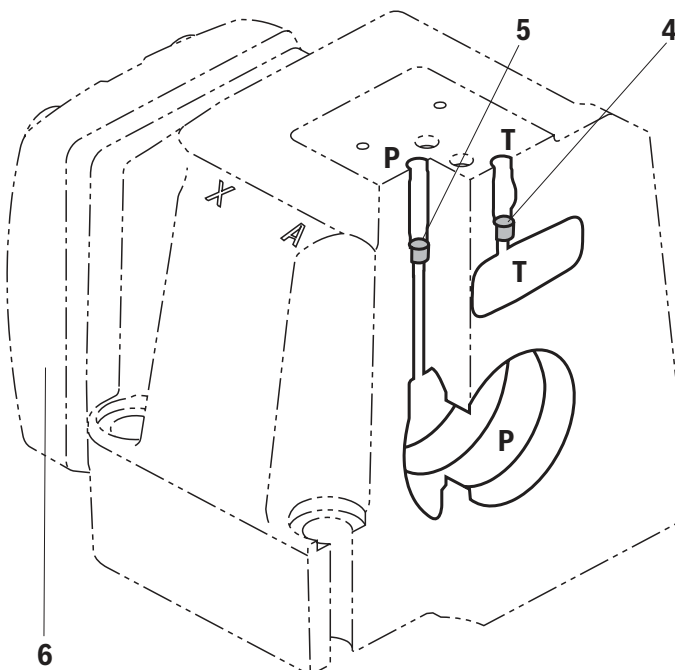
In case of the following errors, the control solenoids are de-energized by the integrated electronics (OBE), the pilot control spool is set to its "fail-safe" position and unloads the pilot oil chambers of the main valve. Operated by the spring, the main valve control spool will move to the offset position (approx. 6% P → B/A → T).

- Falling below the minimum supply voltage
- Only at interface "F1":
 - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)).
- Only at interface "L1":
 - Enable inactive, communication interruption (watchdog)
 - In case of internal IO-Link error
- Only at interface "C6":
 - Additionally, release inactive

Damping plate "D" and electronics protection membrane "967" see page 5.

**Notice:**

Pilot-operated 4/3 directional control valves are only functional in the active control loop and do not have a locking basic position when deactivated. Consequently "external isolator valves" are required in many applications and must be taken into account regarding the switch-on/switch-off order. While the electrical supply voltage is switching off, the drive may be accelerated for a short time in functional direction P to B.

Pilot oil supply (schematic illustration)**NG10****NG16****NG25****NG27****NG35**

- 1** Plug screw M6 according to DIN 906, wrench size 3
– pilot oil return
- 2** Plug screw M6 according to DIN 906, wrench size 3
– pilot oil supply
- 3** Plug screw M12 x 1.5 according to DIN 906, wrench size 6
– pilot oil supply
- 4** Plug screw 1/16-27 NPTF, SW4
– pilot oil return
- 5** Plug screw 1/16-27 NPTF, SW4
– pilot oil supply
- 6** Housing cover main stage (position transducer side)

Pilot oil supplyExternal: **2, 3, 5** closedInternal: **2, 3, 5** open**Pilot oil return**External: **1, 4** closedInternal: **1, 4** open**Further explanations on page 8.**

Pilot oil supply

Version "XY"

External pilot oil supply

External pilot oil return

In this version, the pilot oil is supplied from a separate control circuit (external).

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

Version "PY"

Internal pilot oil supply

External pilot oil return

With this version, the pilot oil is supplied from channel P of the main valve (internal).

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

In the subplate, port X is to be closed.

Version "PT"

Internal pilot oil supply

Internal pilot oil return

With this version, the pilot oil is supplied from channel P of the main valve (internal).

The pilot oil is directly returned to channel T of the main valve (internal).

In the subplate, ports X and Y are to be closed.

Version "XT"

External pilot oil supply

Internal pilot oil return

In this version, the pilot oil is supplied from a separate control circuit (external).

The pilot oil is directly returned to channel T of the main valve (internal).

In the subplate, port Y is to be closed.



Notice:

The modification of the pilot oil supply may only be performed by authorized specialists or at the factory. The maximum admissible operating parameters must be observed, see page 9.

Technical data

(For applications outside these values, please consult us!)

General						
Size	NG	10	16	25	27	35
Installation position		Any				
Ambient temperature range	°C	-20 ... +60				
Maximum storage time	years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)				
Sine test according to DIN EN 60068-2-6	▶ Without damping plate	10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes				
	▶ With damping plate ¹⁾	10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes				
Noise test according to DIN EN 60068-2-64	▶ Without damping plate	20 ... 2000 Hz / 10 g _{RMS} / 30 g peak / 30 min. / 3 axes				
	▶ With damping plate ¹⁾	20 ... 2000 Hz / 10 g _{RMS} / 30 g peak / 24 h / 3 axes				
Transport shock according to DIN EN 60068-2-27	▶ Without damping plate	15 g / 11 ms / 3 shocks / 3 axes				
	▶ With damping plate ¹⁾	15 g / 11 ms / 3 shocks / 3 axes				
Shock according to DIN EN 60068-2-27	▶ With damping plate ¹⁾	35 g / 6 ms / 1000 shocks / 3 axes				
Weight	kg	9	12	19	21	80
Maximum relative humidity (no condensation)	%	95				
Maximum solenoid surface temperature	°C	120 (individual operation)				
MTTF _d value according to EN ISO 13849	years	75 (for further details see data sheet 08012)				
Conformity		▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2015/65/EU ▶ REACH ordinance (EC) no. 1907/2006				

¹⁾ Not recommended for applications with mainly low-frequency excitation < 300 Hz

Technical data

(For applications outside these values, please consult us!)

Hydraulic													
Size		NG	10		16		25		27		35		
Maximum operating pressure	► Ports A, B, P												
	– External pilot oil supply	bar	350						270		350		
	– Internal pilot oil supply	bar	280						270		280		
	► Port X	bar	280						270		280		
	► Ports T, Y	bar	250						210		250		
Minimum pilot pressure (pilot control valve)		bar	10										
Maximum flow		l/min	300		800		1250		1850		4700		
Rated flow (Δp = 5 bar/control edge) ²⁾		l/min	60/100		200/250		350/400		430/600		1000/1200/1500		
Pilot oil flow ³⁾	► Symbol E, W	l/min	2.4		3.5		7.5				23		
	► Symbol V, Q3-	l/min	4.5		11.5		22				29		
Maximum leakage flow (inlet pressure 100 bar)	► Symbol E, E1-												
	– Main valve	l/min	0.06		0.13		0.17				0.61		
	– Main valve + pilot control valve	l/min	0.14		0.28		0.42				1.01		
	► Symbol W6-, W8-												
	– Main valve	l/min	0.12		0.26		0.35				1.23		
	– Main valve + pilot control valve	l/min	0.2		0.41		0.6				1.63		
Maximum zero flow (inlet pressure 100 bar)	► Symbol V, V1-												
	– Main valve	l/min	1.7		2.3		2.8		3.3		7.2		
	– Main valve + pilot control valve	l/min	1.85		2.6		3.2		3.7		7.65		
	► Symbol Q3-												
	– Main valve	l/min	0.4		1.6		1.8		2.2		1.6		
	– Main valve + pilot control valve	l/min	0.55		1.9		2.2		2.6		2.05		
Flow unloading central position Δp = 5 bar/control edge			A→T	B→T	A→T	B→T	A→T	B→T	A→T	B→T	A→T	B→T	
		► Symbol W6-	l/min	2.8	2.8	4	4	6	6	6	6	25	25
		► Symbol W8-	l/min	2.8	1.4	4	2	6	3	6	3	25	12.5
Pilot oil volume	0 ... 100%	cm ³	1.3		2.9		6.8		6.8		33.2		
Hydraulic fluid			See table page 10										
Viscosity range	► Recommended	mm ² /s	20 ... 100										
	► Maximum	mm ² /s	10 ... 800										
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +70										
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 18/16/13 ⁴⁾										

²⁾ Flow for deviating Δp (control edge):

$$q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{5}}$$

³⁾ At port X and Y with stepped input signal from 0 ... 100% (pilot pressure 100 bar)

⁴⁾ The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Available filters can be found at www.boschrexroth.com/filter.

Explanation of the footnotes see page 10.

Technical data

(For applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	► Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	► Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	► Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	► Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

**Important notices on hydraulic fluids:**

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:**
If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.

► Flame-resistant – containing water:

- Due to the increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30 % as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20 % of the pressure differential at the component.
- Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic						
Size	NG	10	16	25	27	35
Hysteresis	%	< 0.1				
Response sensitivity	%	< 0.05				
Range of inversion	%	< 0.08				
Manufacturing tolerance q_{Vmax}	%	≤ 10				
Actuating time for 0 ... 100% at X=210 bar	ms	25	37	36	36	55
Switch-off behavior (after electric shut-off)	► Symbols E, E1-, W6-, W8-	Pilot control valve in fail-safe position, main valve moves to overlapped spring-centered central position				
	► Symbol V, V1-	Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (approx. 6%, P→B/A→T)				
	► Symbol Q3	Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (P blocked, A/B to port T open)				
Temperature drift (temperature range 20 °C ... 80 °C)	%/10 °C	Zero shift < 0.25				
Zero compensation		Ex plant ±1%				

Technical data

(For applications outside these values, please consult us!)

Electrical, integrated electronics (OBE) – Interface “A1” and “F1”			
Relative duty cycle	%	100 (continuous operation)	
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors	
Supply voltage	VDC	24	
▶ Terminal A	VDC	min. 19 / max. 36	
▶ Terminal B	VDC	0	
Maximum admissible residual ripple	V _{pp}	2.5	
Maximum power consumption	VA	40	
Fuse protection, external	A _T	2.5 (time-lag)	
Input, version "A1"		Differential amplifier, $R_i = 100\text{ k}\Omega$	
▶ Terminal D (U_E)	VDC	0 ... ± 10	
▶ Terminal E	VDC	0	
Input, version "F1"		Load, $R_{sh} = 200\text{ }\Omega$	
▶ Terminal D (I_{D-E})	mA	4 ... 20	
▶ Terminal E (I_{D-E})		Current loop I_{D-E} feedback	
Maximum voltage of the differential inputs against 0 V		D → B; E → B (max. 18 V)	
Test signal, version "A1"		LVDT	
▶ Terminal F (U_{Test})	V	0 ... ± 10	
▶ Terminal C		Reference 0 V	
Test signal, version "F1"		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum	
▶ Terminal F (I_{F-C})	mA	4 ... 20	
▶ Terminal C (I_{F-C})		Current loop I_{F-C} feedback	
Functional ground and screening		See page 13 (EMC-compliant installation)	
Adjustment		Calibrated in the plant, see valve characteristic curves page 15 ... 32	

Electrical, integrated electronics (OBE) – Interface “L1”			
Relative duty cycle	%	100 (continuous operation)	
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors	
Supply voltage		24	
▶ Valve amplifier	VDC	24	
– Pin 2	VDC	min. 18 / max. 30	
– Pin 5	VDC	0	
▶ IO-Link interface	VDC	24	
– Pin 1	VDC	min. 18 / max. 30	
– Pin 3	VDC	0	
Maximum current consumption		2	
▶ Valve amplifier	A	2	
▶ IO-Link interface	mA	50	
Maximum residual ripple	V _{pp}	1.3	
Maximum current consumption	mA	50	
Minimum process cycle time	ms	0.6	
Bit rate COM3	kBaud (kbit/s)	230.4	
Required master port class		Class B	
Resolution		12 (110% valve opening)	
▶ A/D transformer	bit	12 (110% valve opening)	
▶ D/A transformer	bit	12 (110% valve opening)	
Functional ground		Provide via valve block	
Adjustment		Calibrated in the plant	
Directive		IO-Link Interface and System Specification Version 1.1.2	

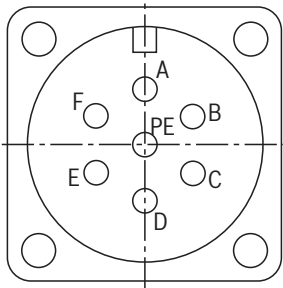
Technical data

(For applications outside these values, please consult us!)

Electrical, integrated control electronics (OBE) – Interface “C6”		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	V _{pp}	2.5
Maximum power consumption	VA	40
Fuse protection, external	A _T	2.5 (time-lag)
Input		Load, $R_{sh} = 200 \, \Omega$
▶ Terminal D (I_{D-E})	mA	0 ... ± 10
▶ Terminal E (I_{D-E})		Current loop I_{D-E} feedback
Test signal		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum
▶ Terminal F (I_{F-B})	mA	4 ... 20
▶ Terminal B (I_{F-B})		Current loop I_{F-B} feedback
Functional ground and screening		See page 13 (EMC-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 15 ... 32

Electrical connections and assignment

Contact	Interface assignment		
	"A1" (6 + PE)	"F1" (6 + PE)	"C6" (6 + PE)
A	24 VDC supply voltage		
B	GND		GND, reference potential actual value/enable
C	Reference potential actual value	Reference potential actual value	Enable input 24 VDC (high ≥ 11 V, low ≤ 5 V)
D	Command value ± 10 V ($R_e > 100$ k Ω)	Command value 4 ... 20 mA ($R_e = 200$ Ω)	Command value ± 10 mA ($R_e = 200$ Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ± 10 V ($R_i \approx 1$ k Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)
FE	Functional ground (directly connected to the valve housing)		



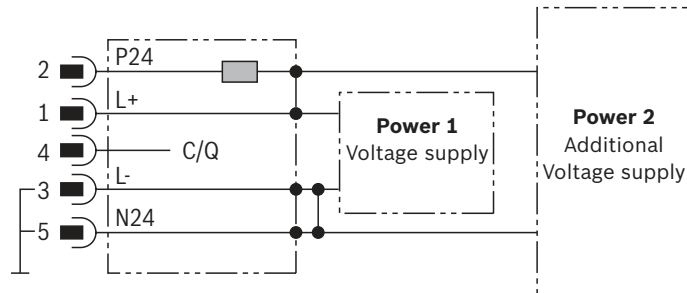
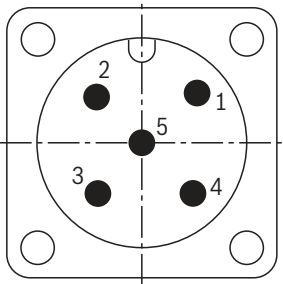
Command value:	► Positive command value (0 ... 10 V or 12 ... 20 mA) at D and reference potential at E cause flow from P → A and B → T.
	► Negative command value (0 ... -10 V or 12 ... 4 mA) at D and reference potential at E cause flow from P → B and A → T.
Connection cable:	► Up to 20 m cable length type LiYCY 7 x 0.75 mm ²
	► Up to 40 m cable length type LiYCY 7 x 1.0 mm ²
	► EMC-compliant installation:
	– Apply screening to both line ends – Use metal mating connector (see page 39)
	► Alternatively up to 30 m cable length admissible
	– Apply screening on supply side – Plastic mating connector (see page 39) can be used



Notice:

Mating connectors, separate order, see page 39 and data sheet 08006.

Connector pin assignment "L1" (M12-5, A-coded, class B)



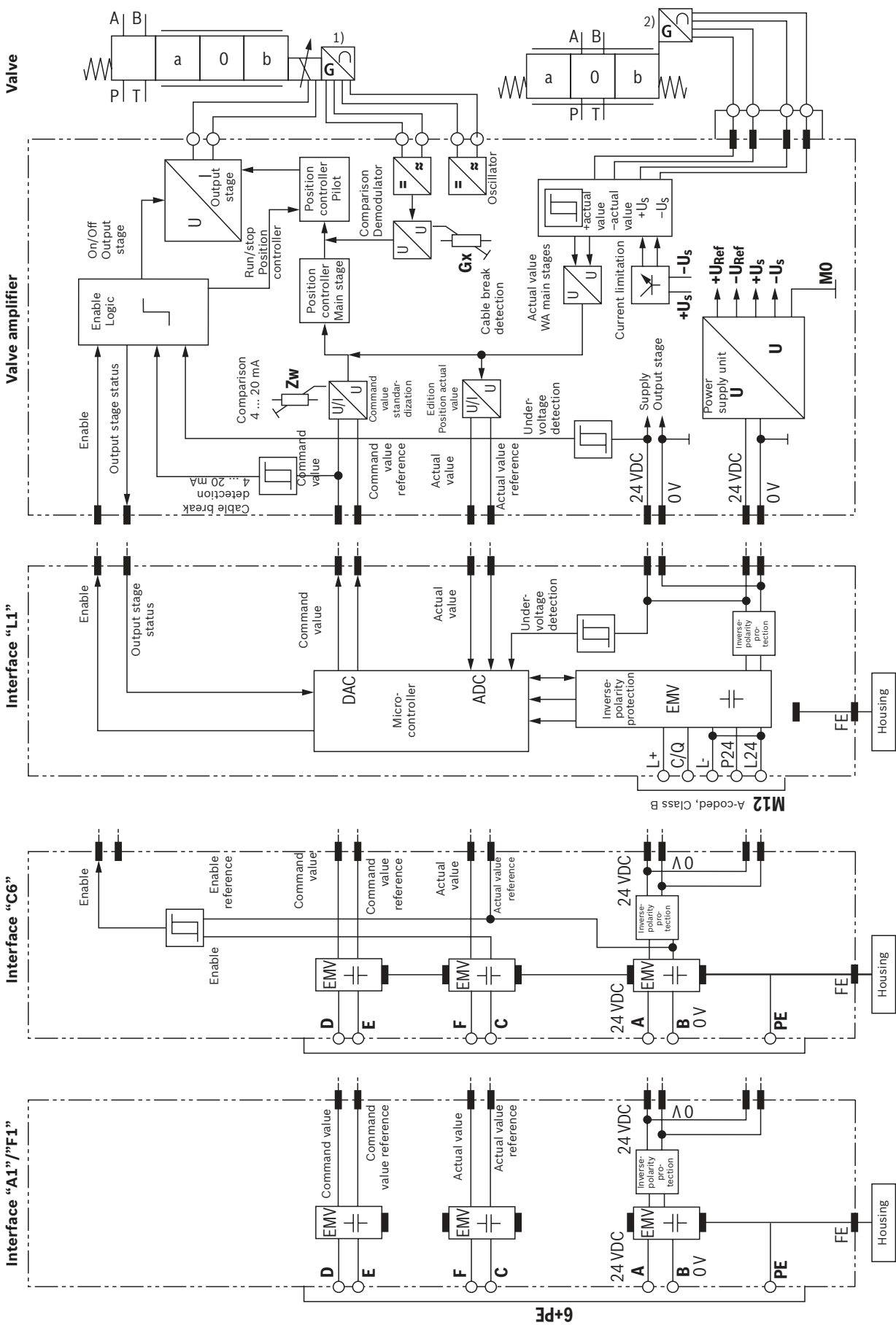
Notices:

- M12 sensor/actuator connection line, 5-pole; M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- Mating connectors, separate order, see page 39 and data sheet 08006.
- Communication and parameter description see data sheet 29400-PA

Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 2 A)
3	L-	Reference potential pin 1 ¹⁾
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 ¹⁾

¹⁾ Pin 3 and 5 are linked with each other in the valve electronics. The reference potentials L- and N24 of the two supply voltages must also be linked with each other on the power supply unit side.

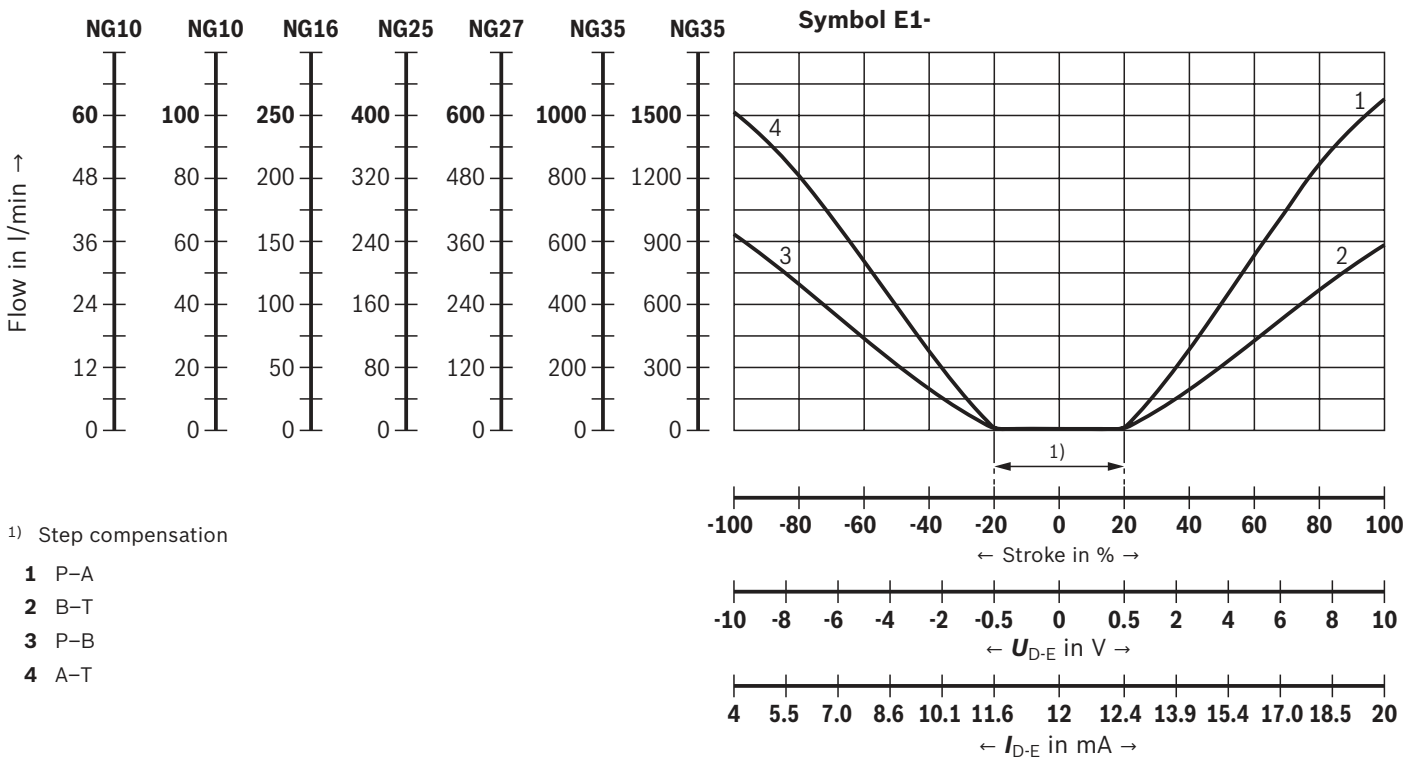
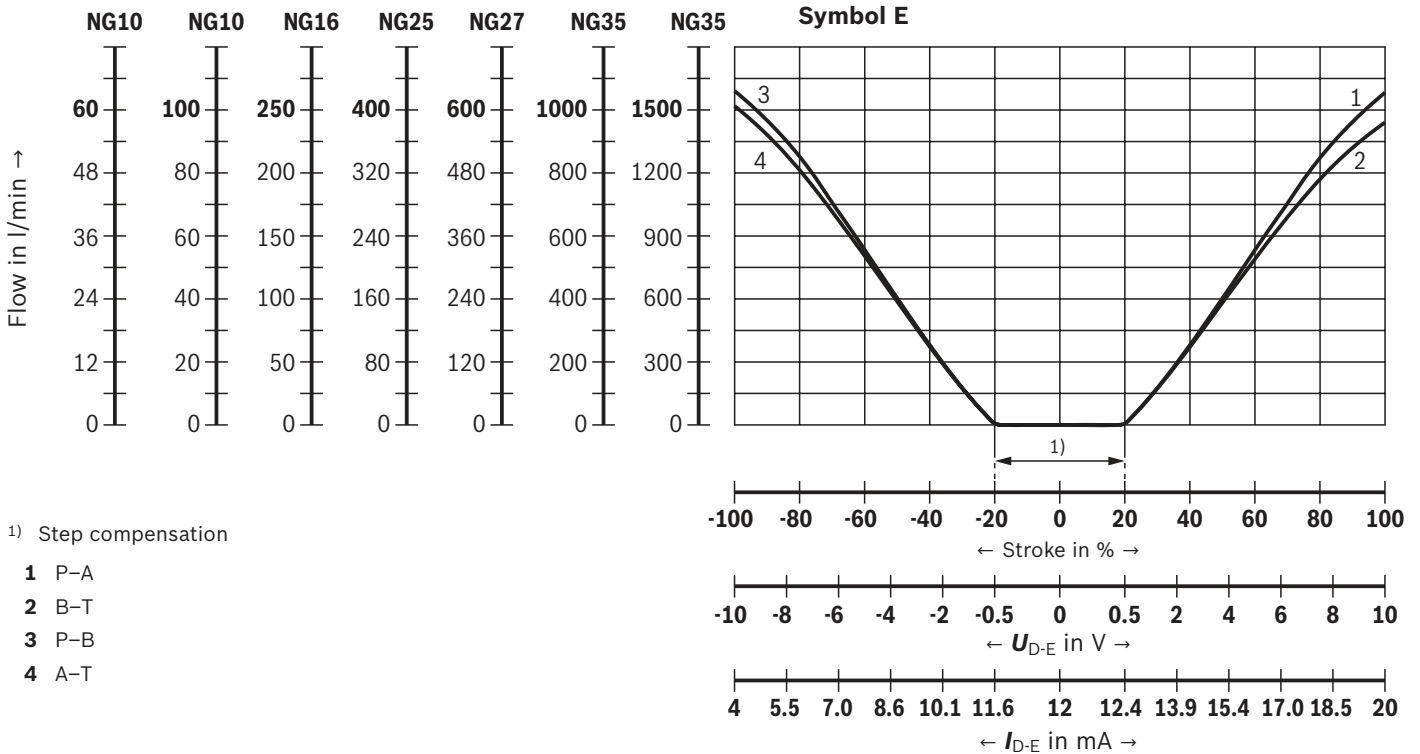
Block diagram/controller function block



- Notices:**
- ▶ Electrical signals provided via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions.
 - ▶ The setting of the potentiometer at the factory must not be changed.

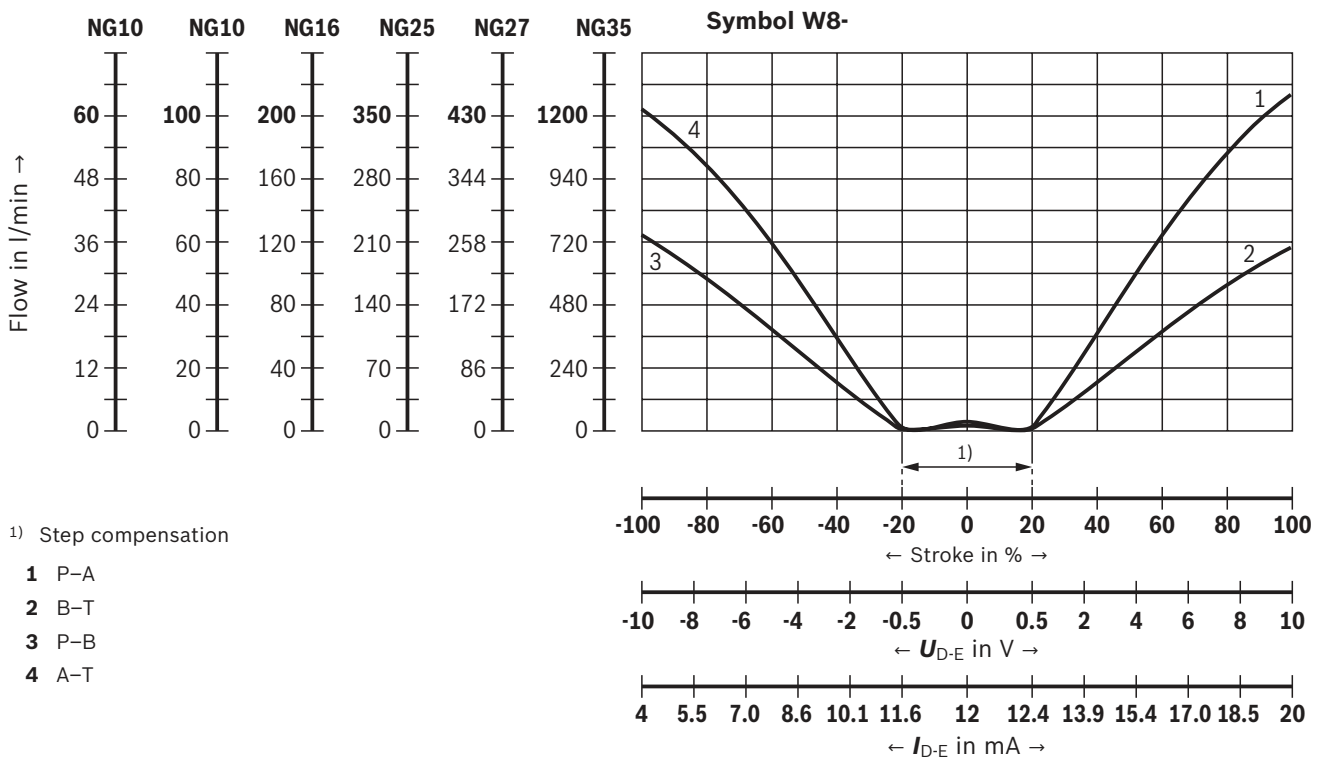
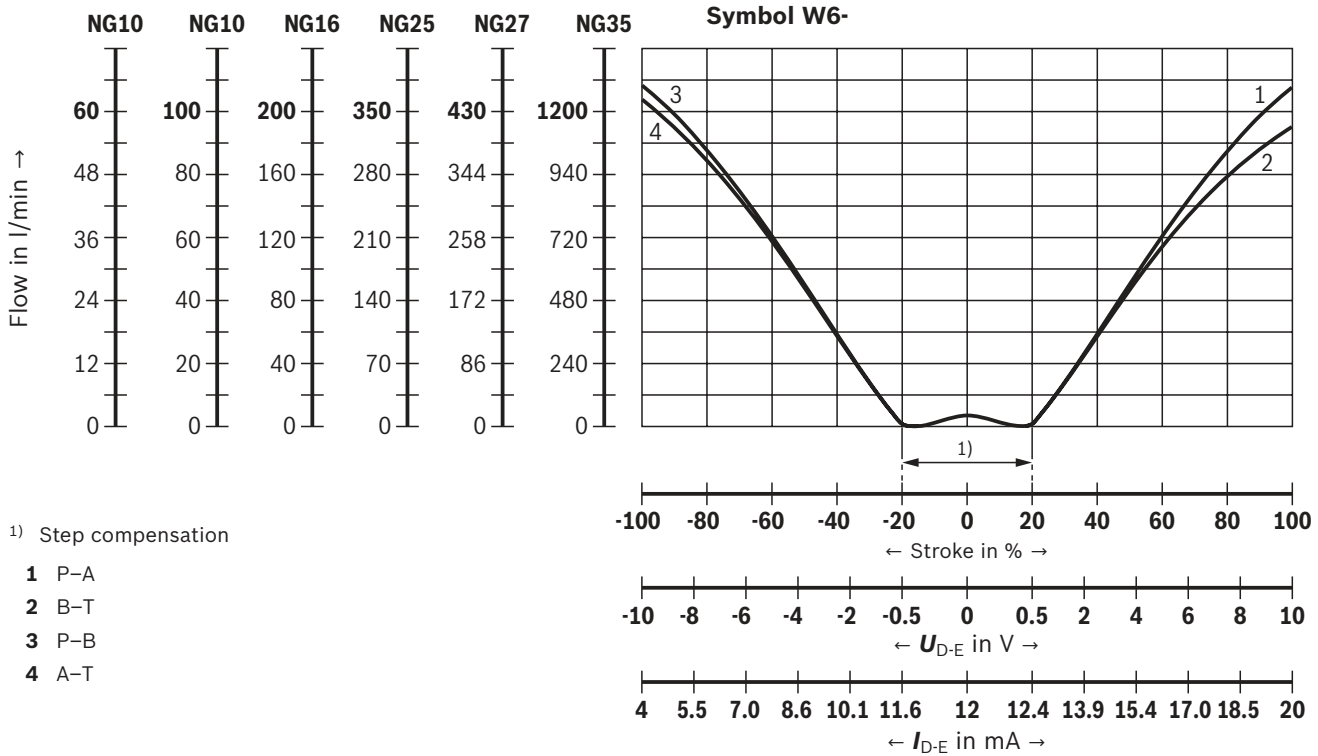
Characteristic curves: Flow characteristic "L"
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

Flow/signal function



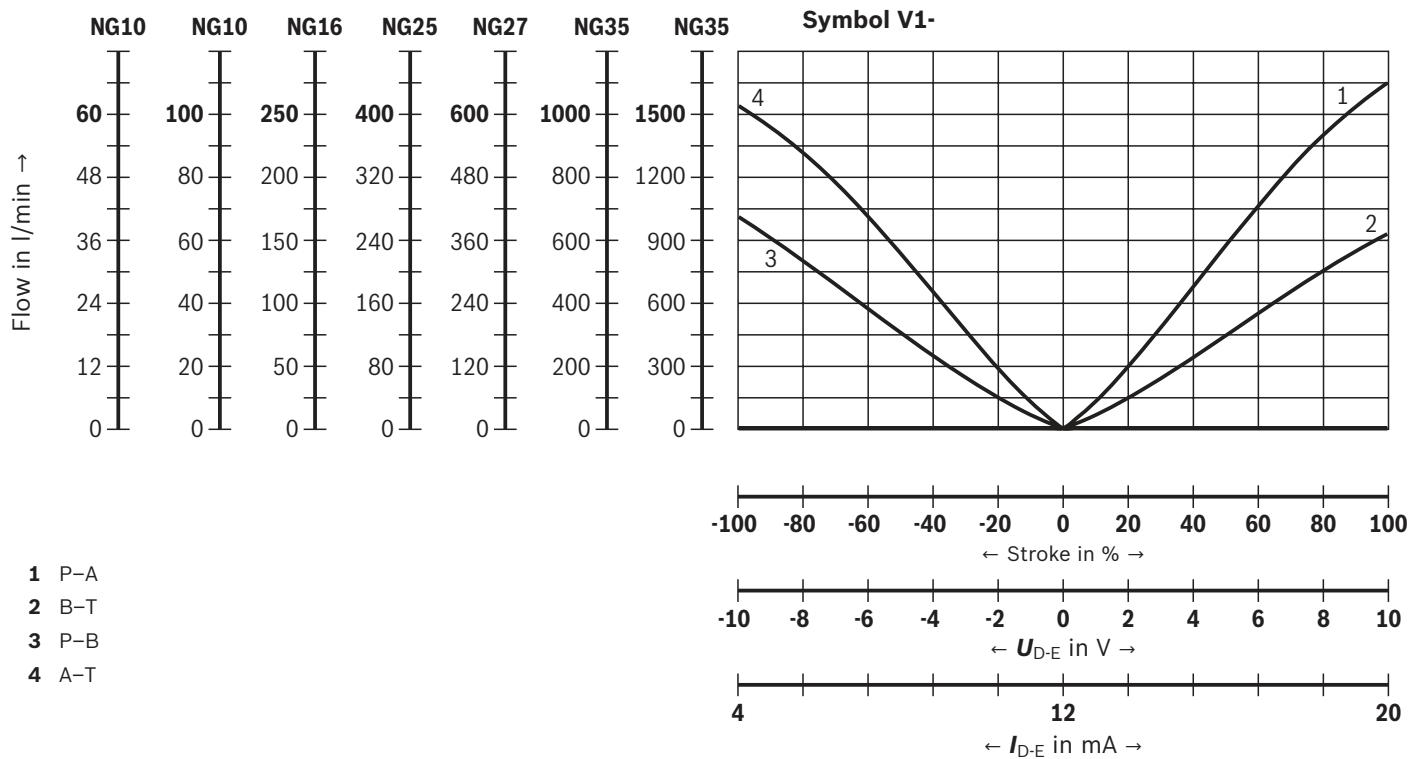
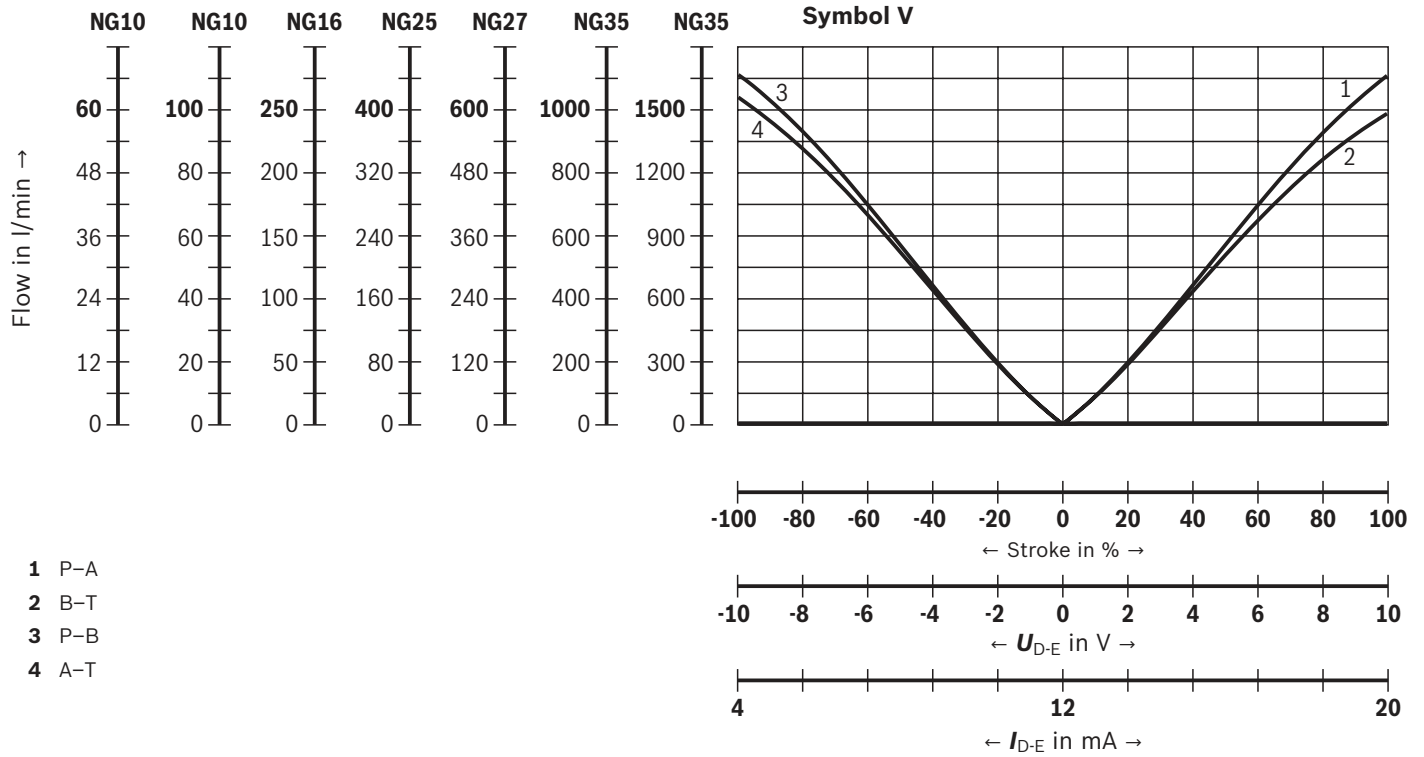
Characteristic curves: Flow characteristic “L”
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

Flow/signal function



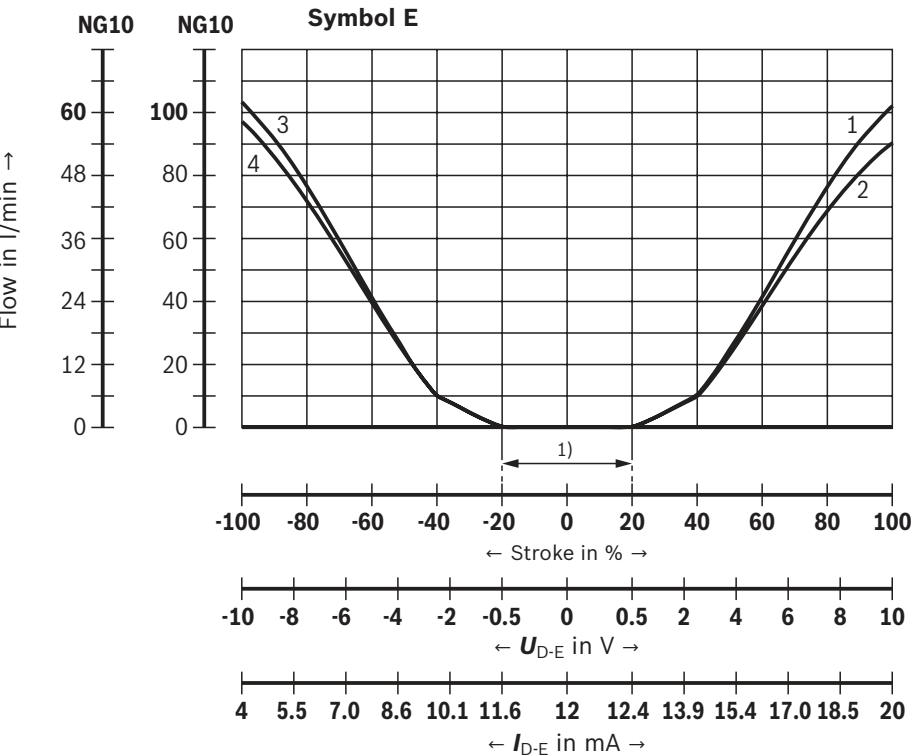
Characteristic curves: Flow characteristic “L”
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

Flow/signal function

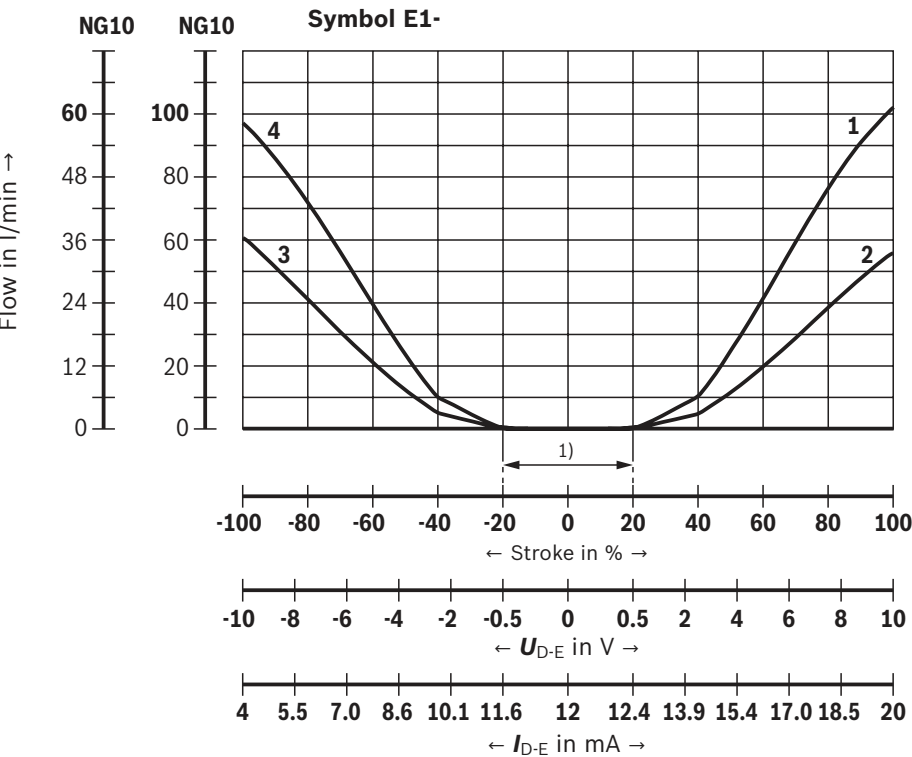


Characteristic curves: Flow characteristic “P”
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

Flow/signal function



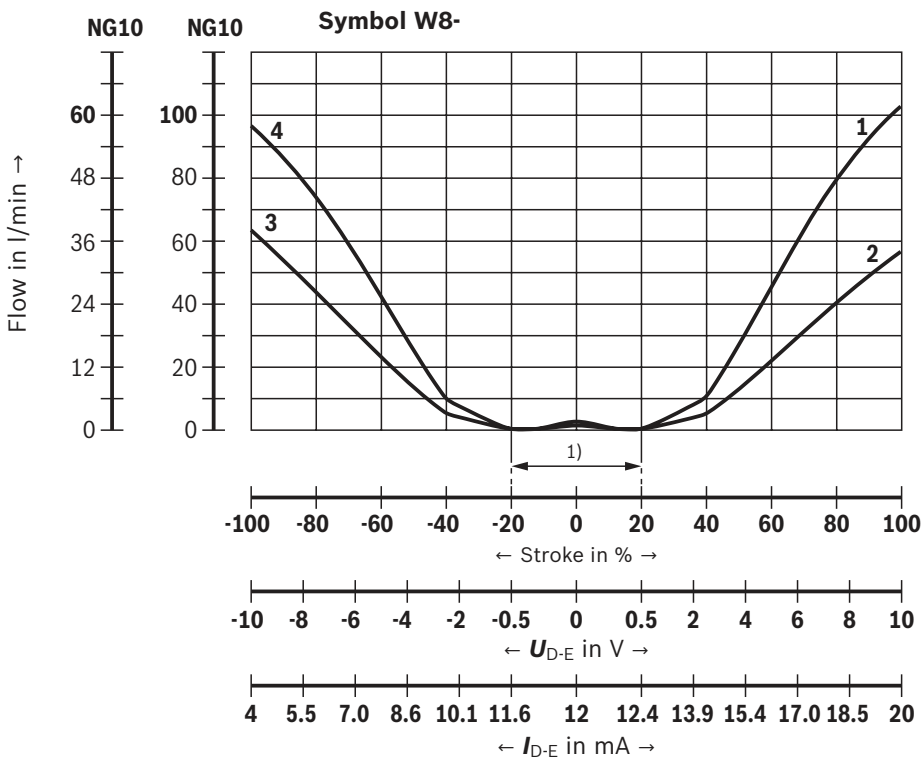
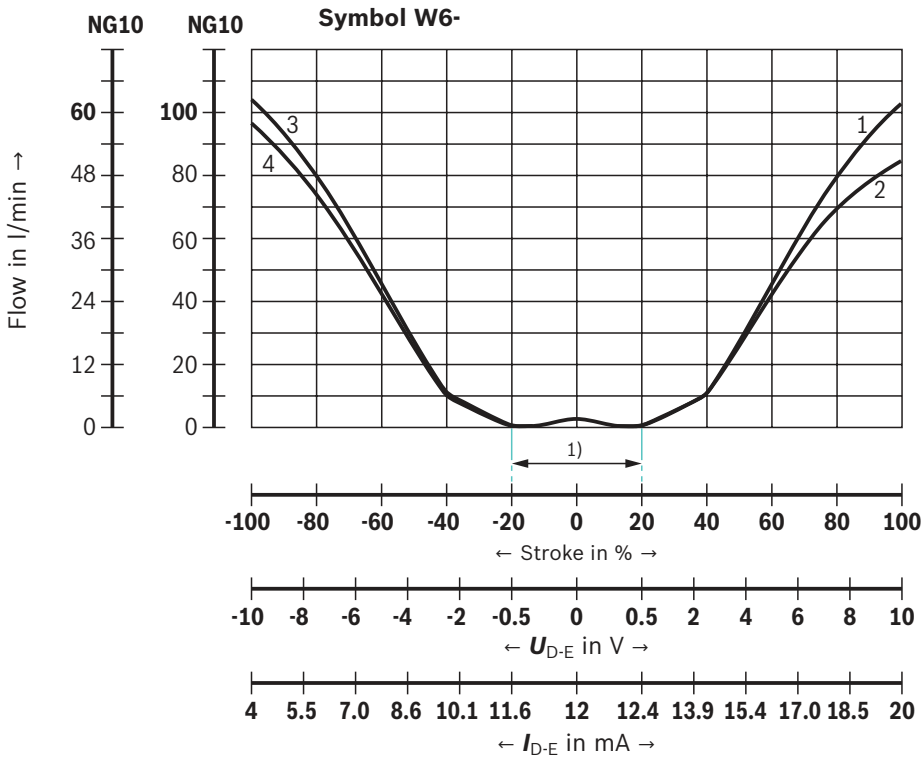
- 1) Step compensation
- 1 P-A
 - 2 B-T
 - 3 P-B
 - 4 A-T



- 1) Step compensation
- 1 P-A
 - 2 B-T
 - 3 P-B
 - 4 A-T

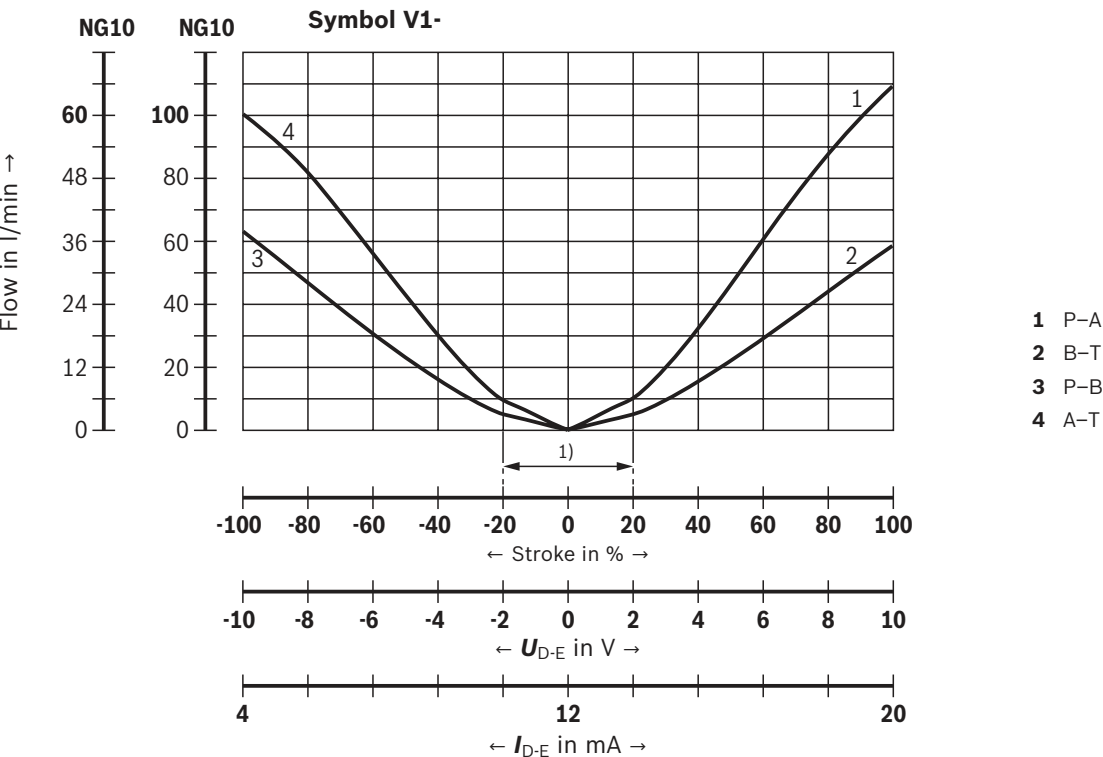
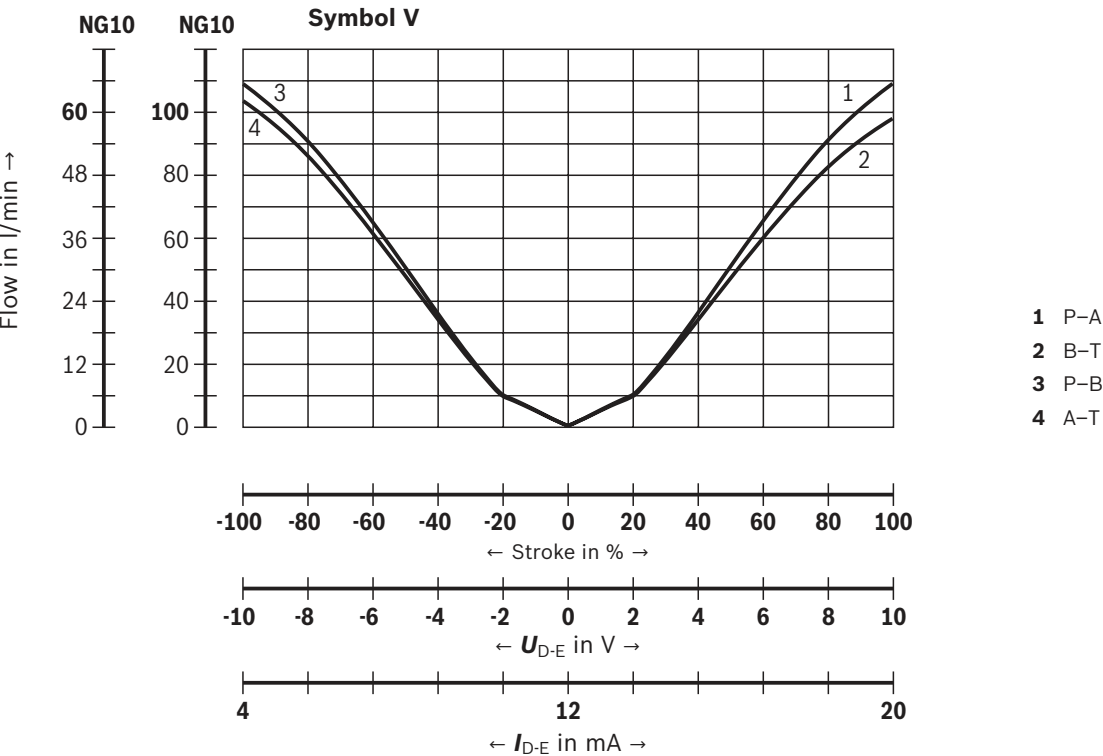
Characteristic curves: Flow characteristic “P”
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

Flow/signal function



Characteristic curves: Flow characteristic “P”
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

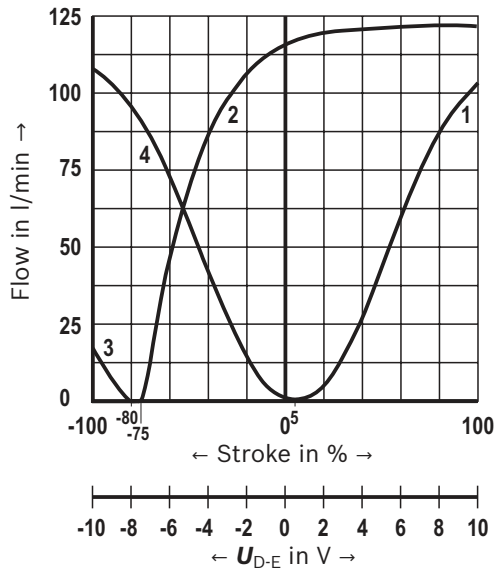
Flow/signal function



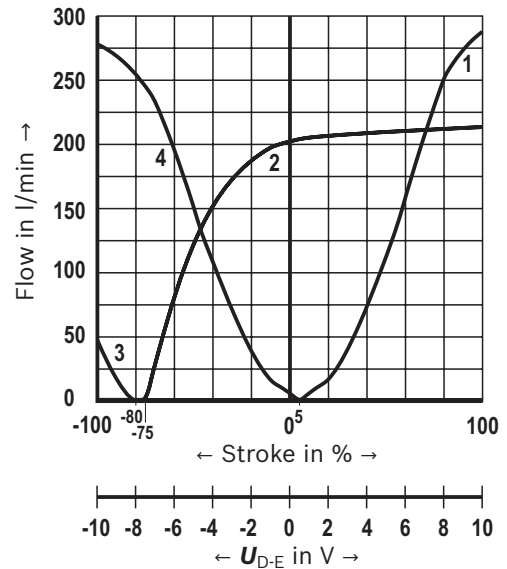
Characteristic curves: Flow characteristic "M"
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ } ^\circ\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

Flow/signal function

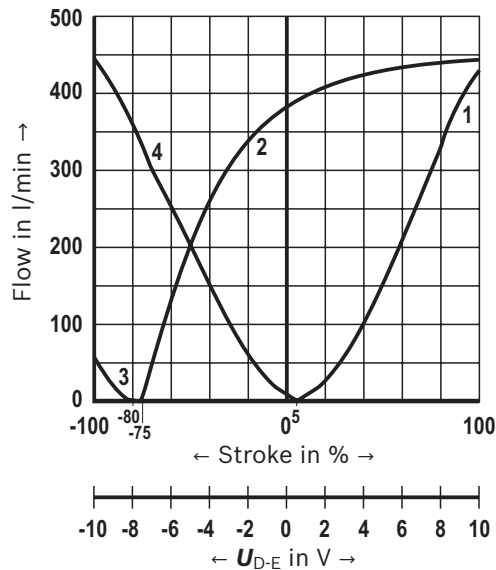
Symbol Q3, version "100"



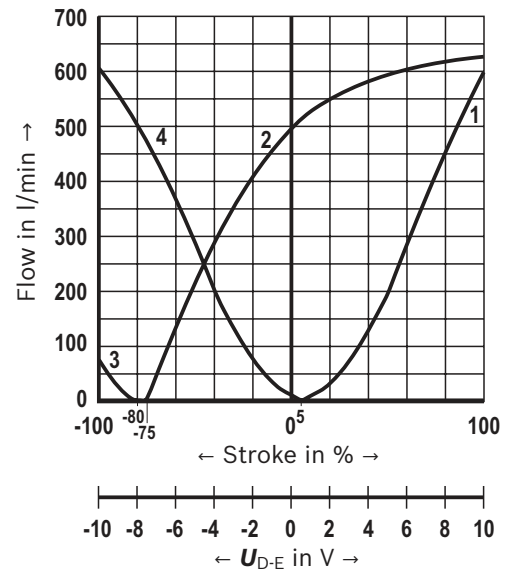
Symbol Q3, version "250"



Symbol Q3, version "400"



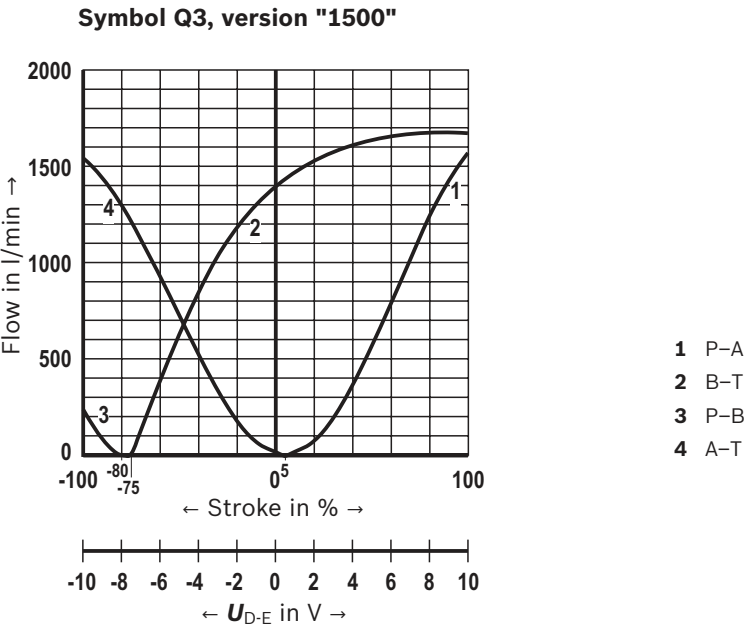
Symbol Q3, version "600"



- 1 P-A
- 2 B-T
- 3 P-B
- 4 A-T

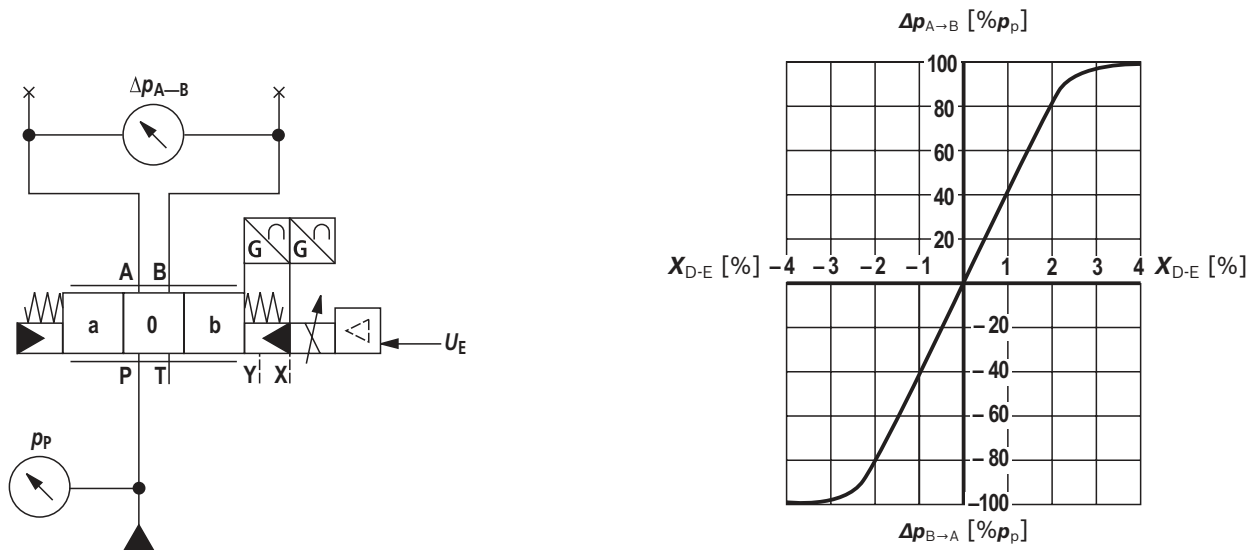
Characteristic curves: Flow characteristic "M"
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$; $\Delta p = 5 \text{ bar/control edge}$)

Flow/signal function



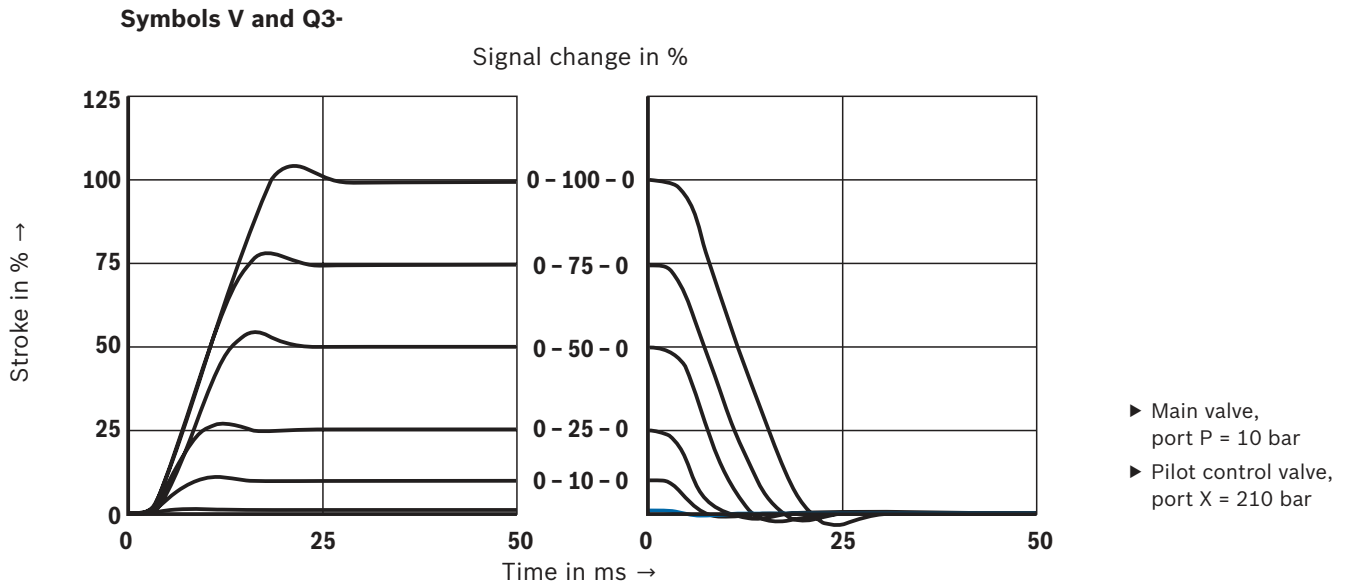
Characteristic curves
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Pressure/signal characteristic curve

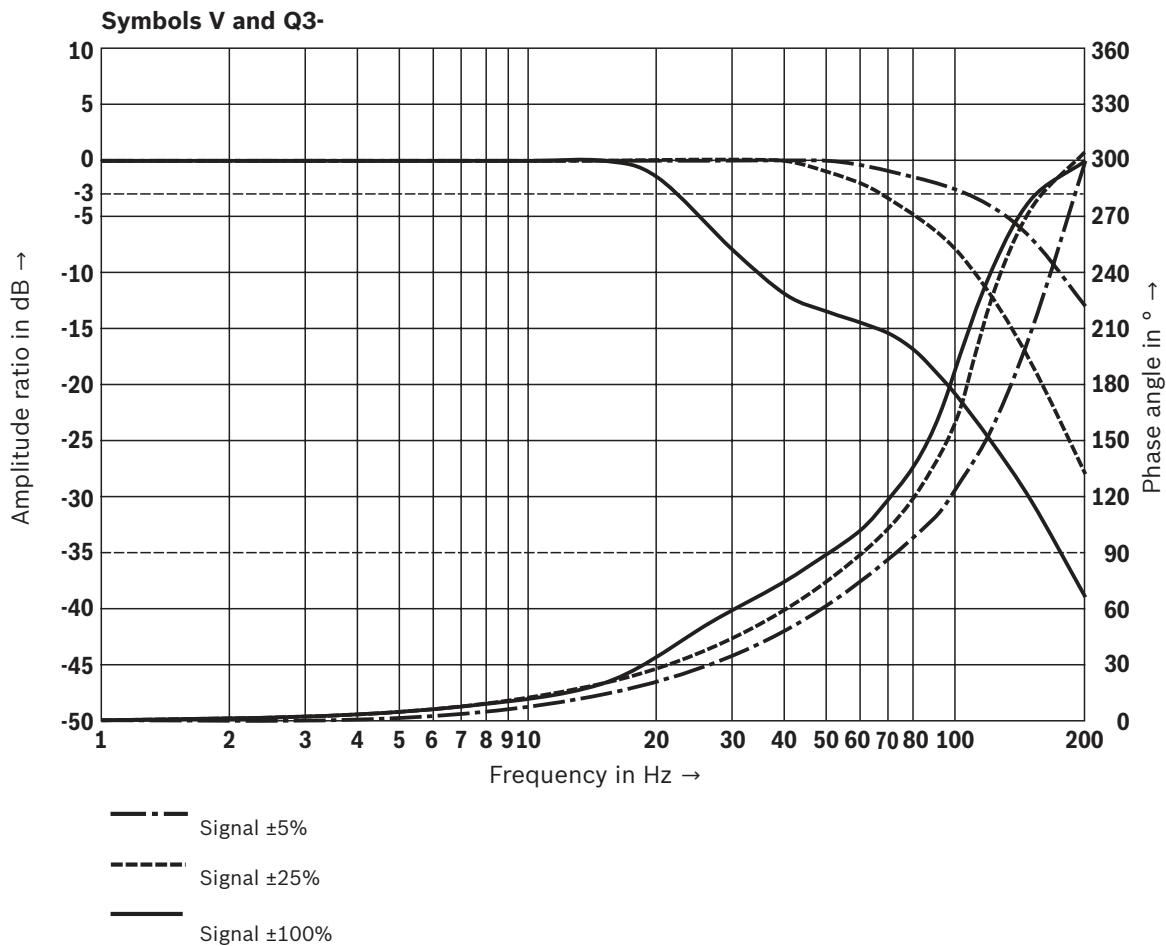


Characteristic curves: Size 10
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Transition function with stepped electric input signals

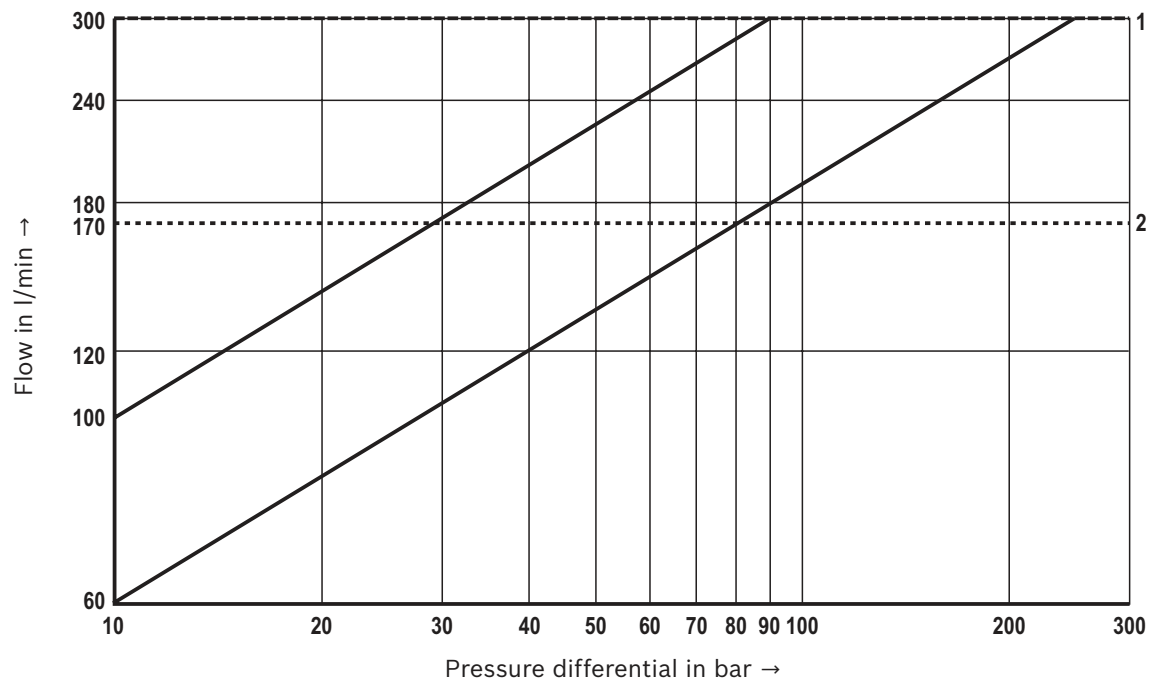


Frequency response characteristic curves



Characteristic curves: Size 10
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

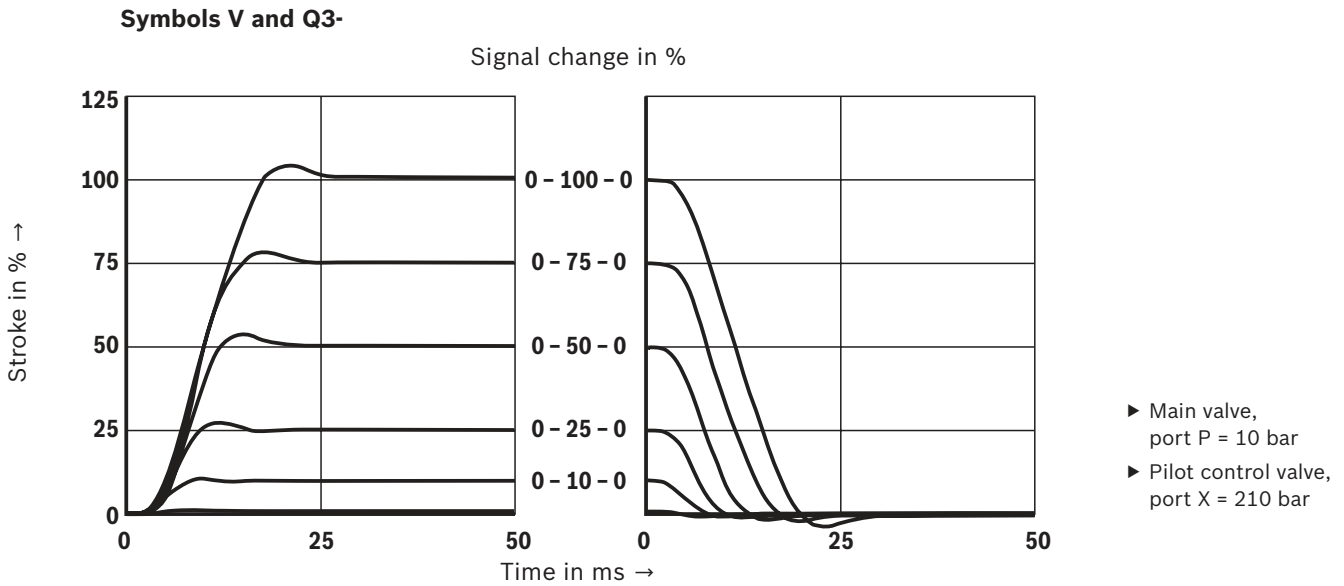
Flow/load function (with maximum valve opening; tolerance $\pm 10\%$)



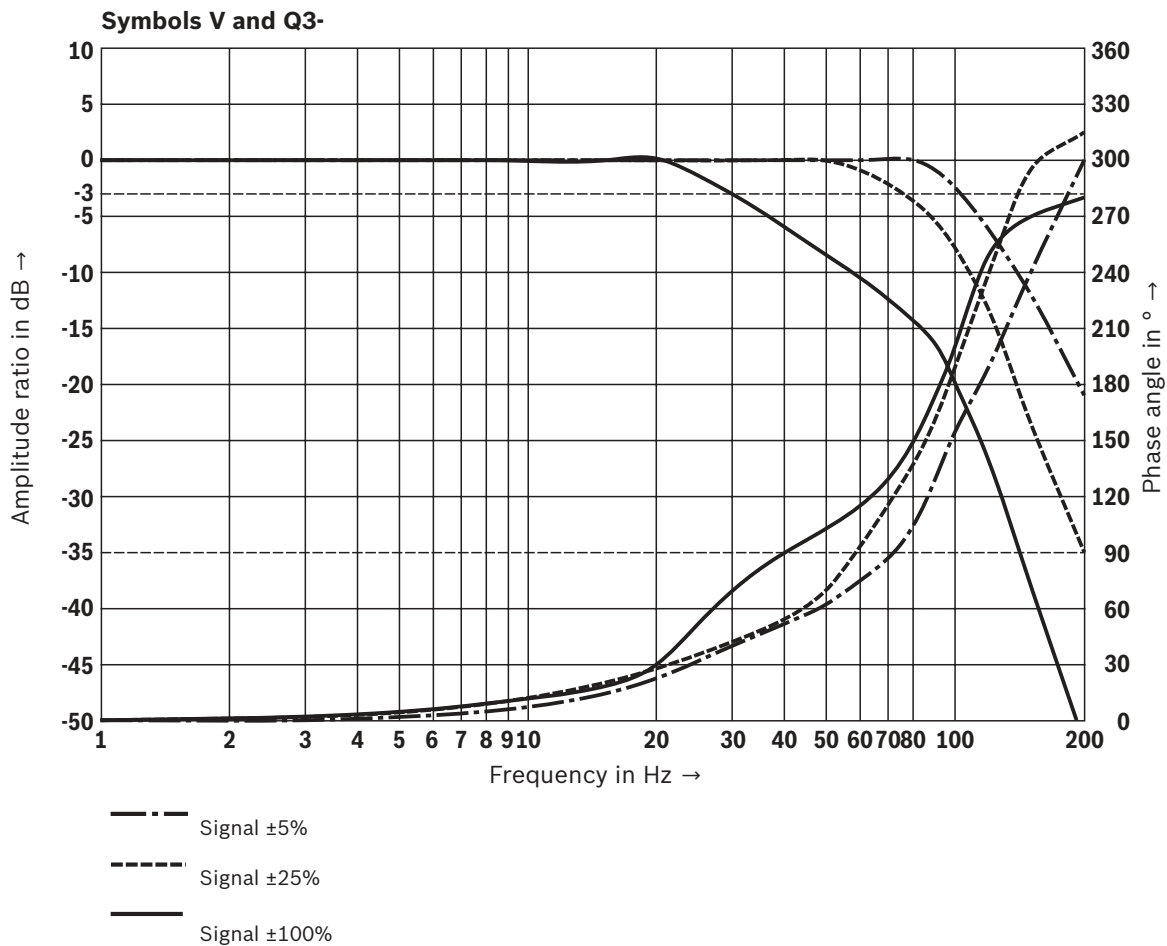
- 1 Maximum admissible flow
- 2 Recommended flow
(flow velocity 30 m/s)

Characteristic curves: Size 16
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Transition function with stepped electric input signals

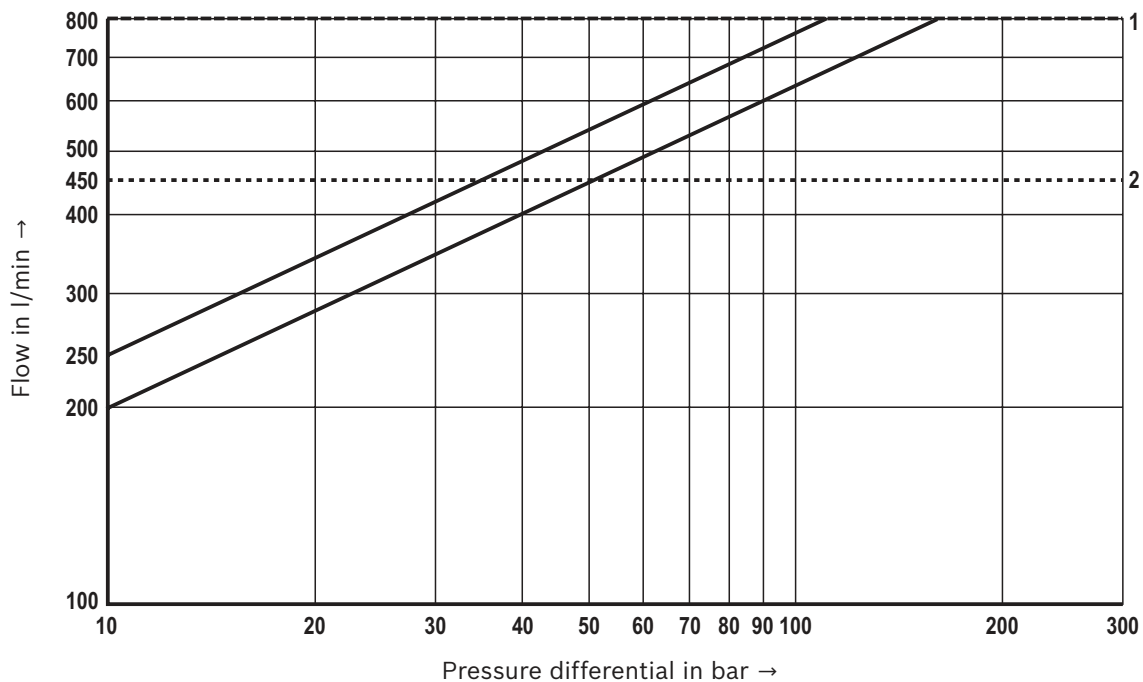


Frequency response characteristic curves



Characteristic curves: Size 16
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

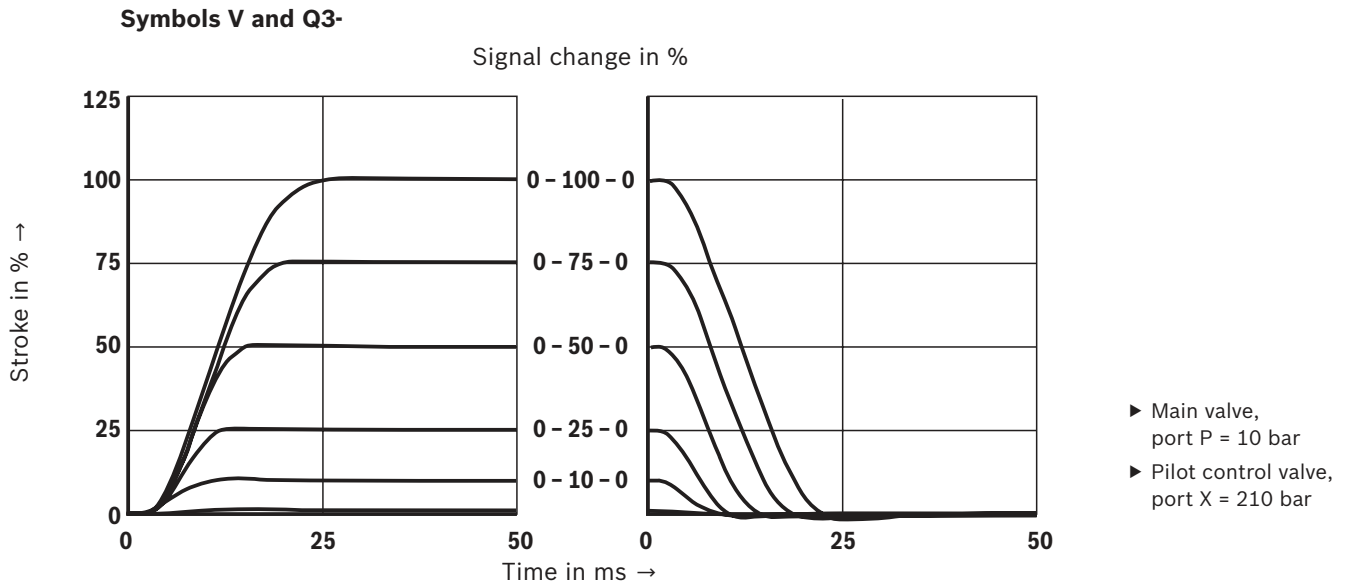
Flow/load function (with maximum valve opening; tolerance $\pm 10\%$)



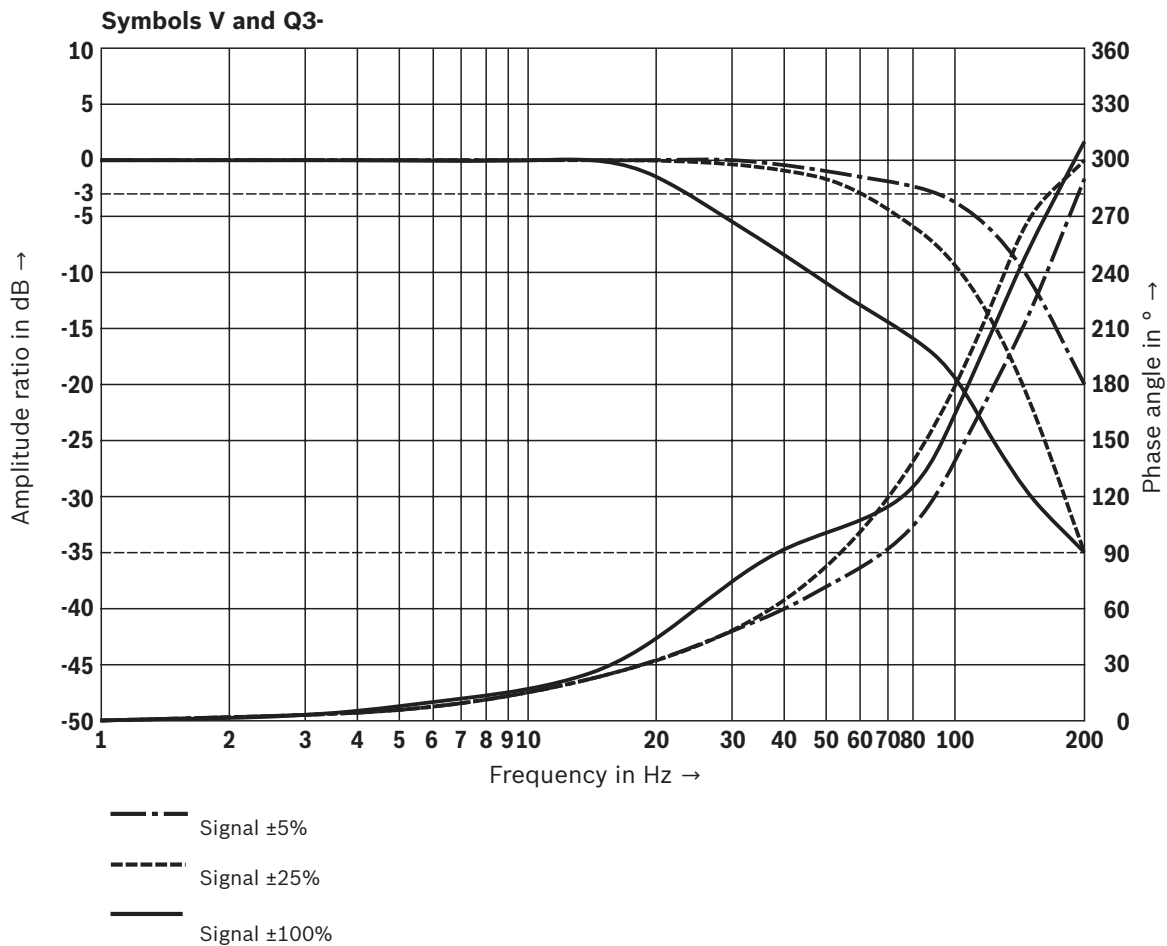
- 1 Maximum admissible flow
- 2 Recommended flow
(flow velocity 30 m/s)

Characteristic curves: Size 25
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Transition function with stepped electric input signals

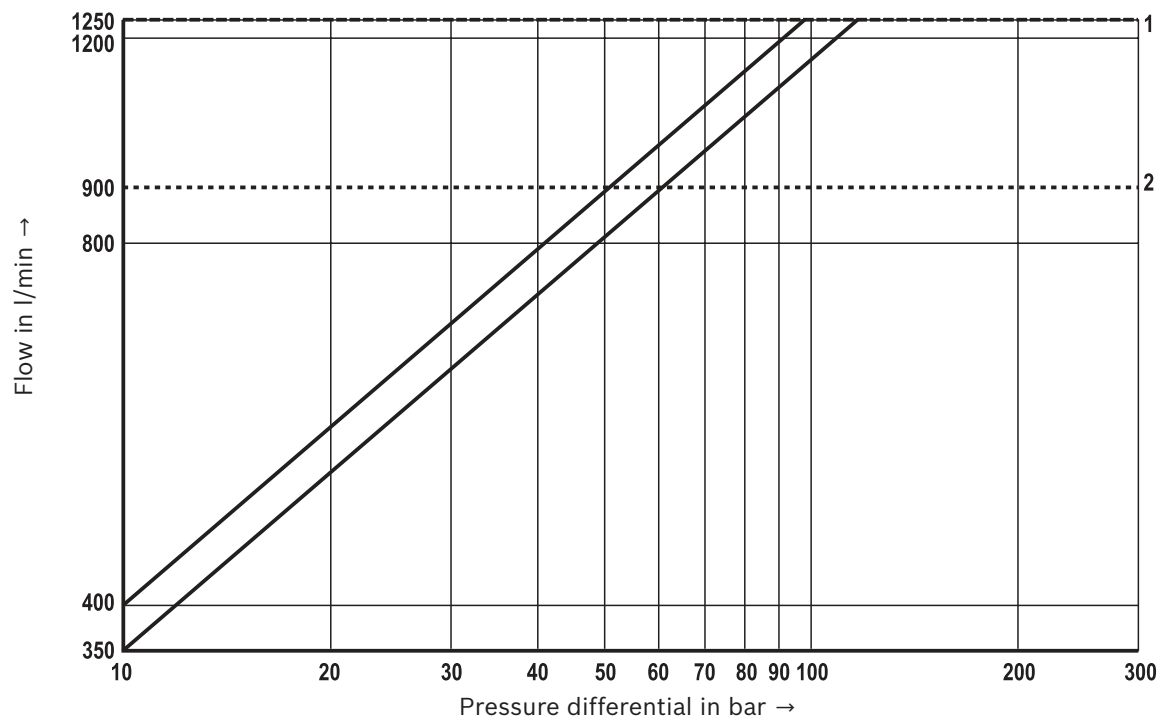


Frequency response characteristic curves



Characteristic curves: Size 25
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

Flow/load function (with maximum valve opening; tolerance $\pm 10\%$)

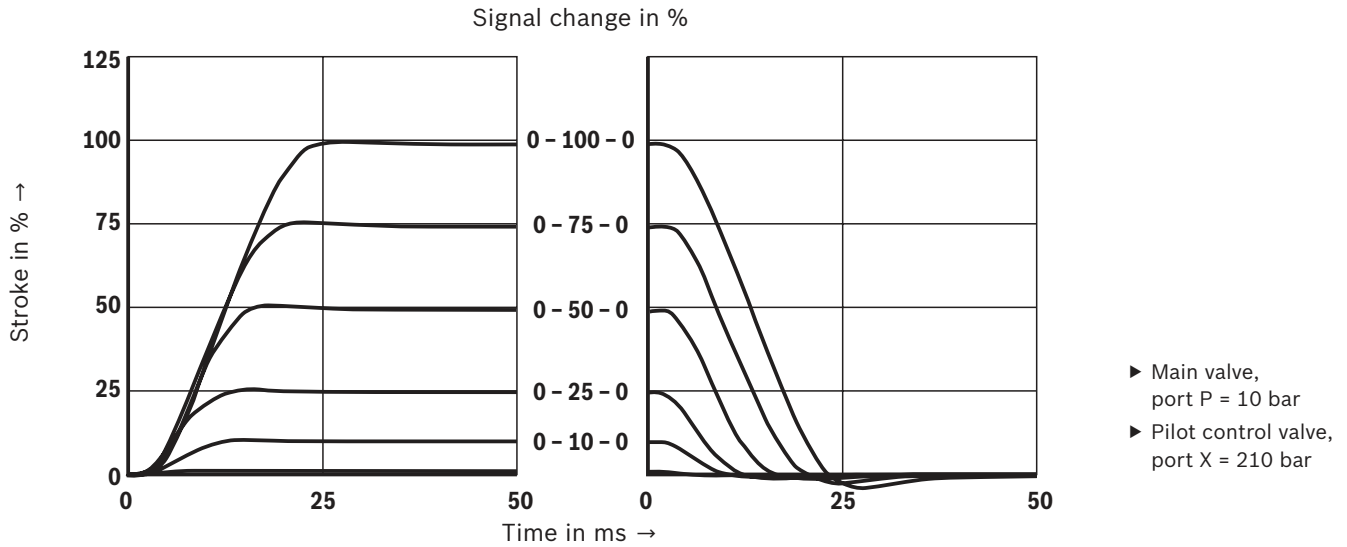


- 1 Maximum admissible flow
- 2 Recommended flow
(flow velocity 30 m/s)

Characteristic curves: Size 27
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ } ^\circ\text{C}$)

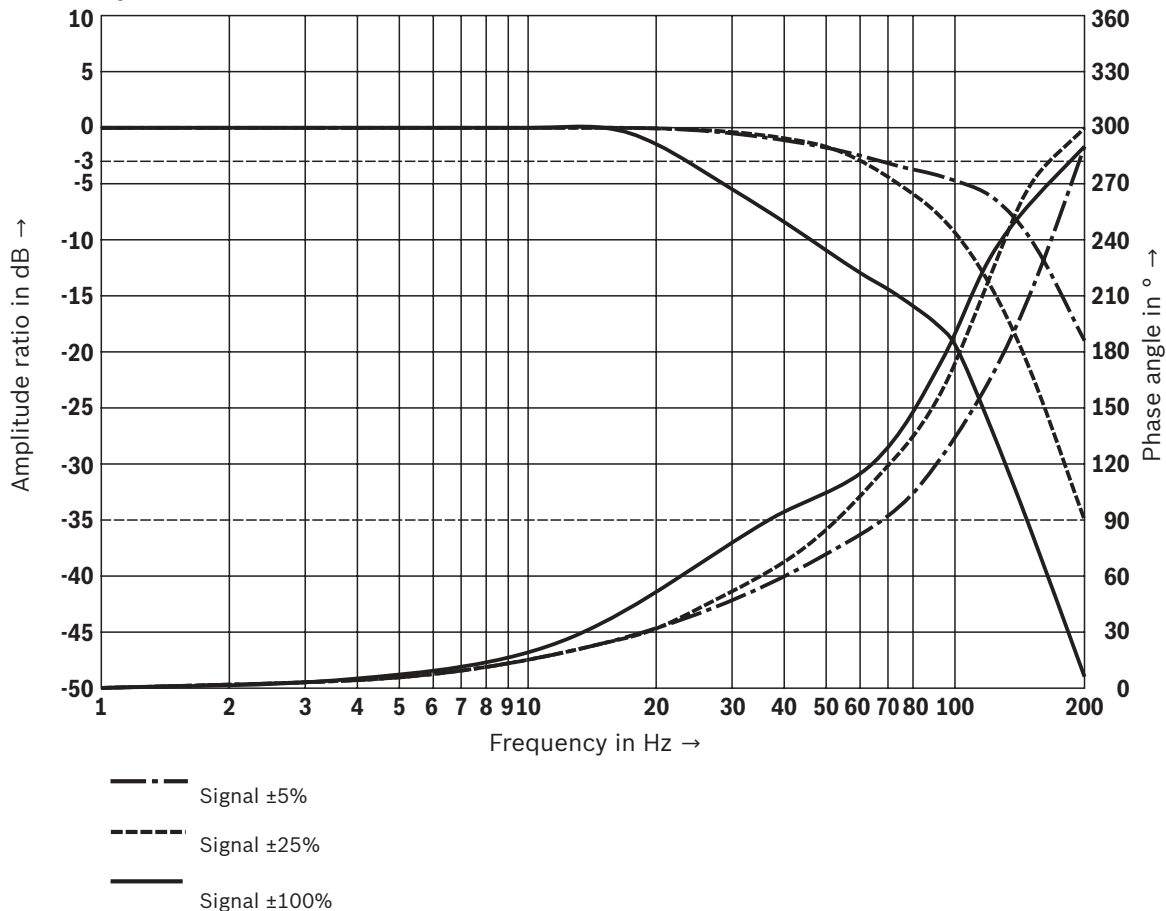
Transition function with stepped electric input signals

Symbols V and Q3-



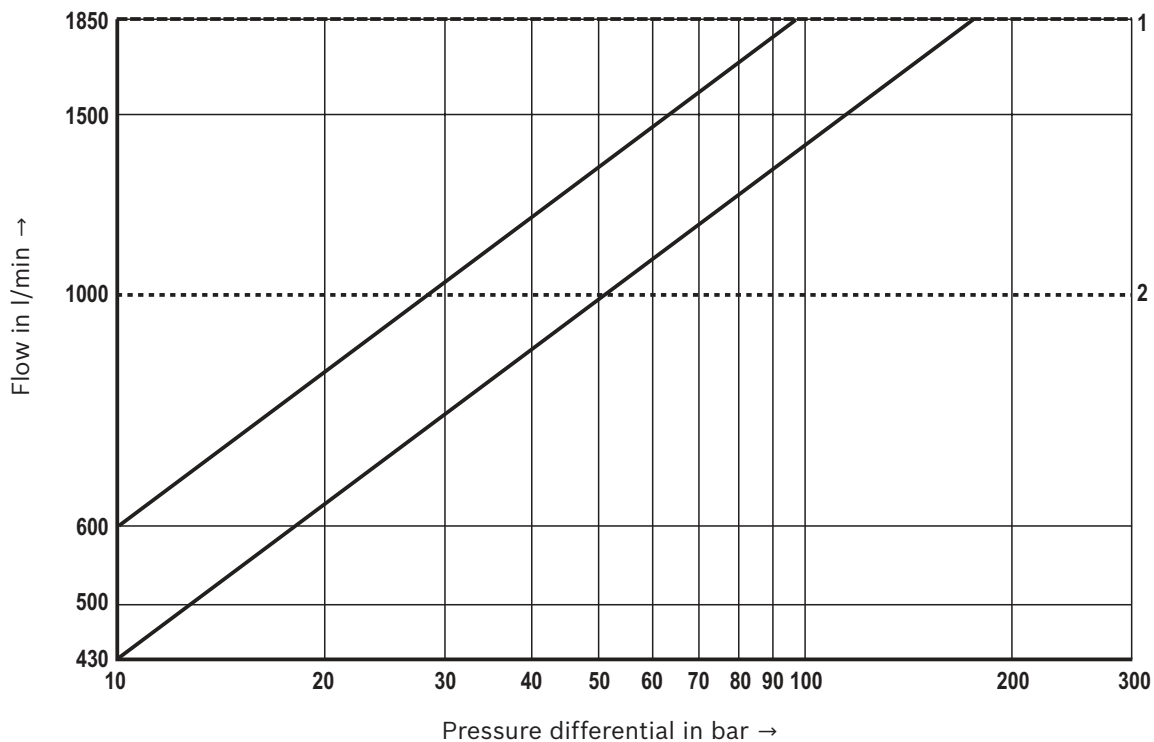
Frequency response characteristic curves

Symbols V and Q3-



Characteristic curves: Size 27
(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

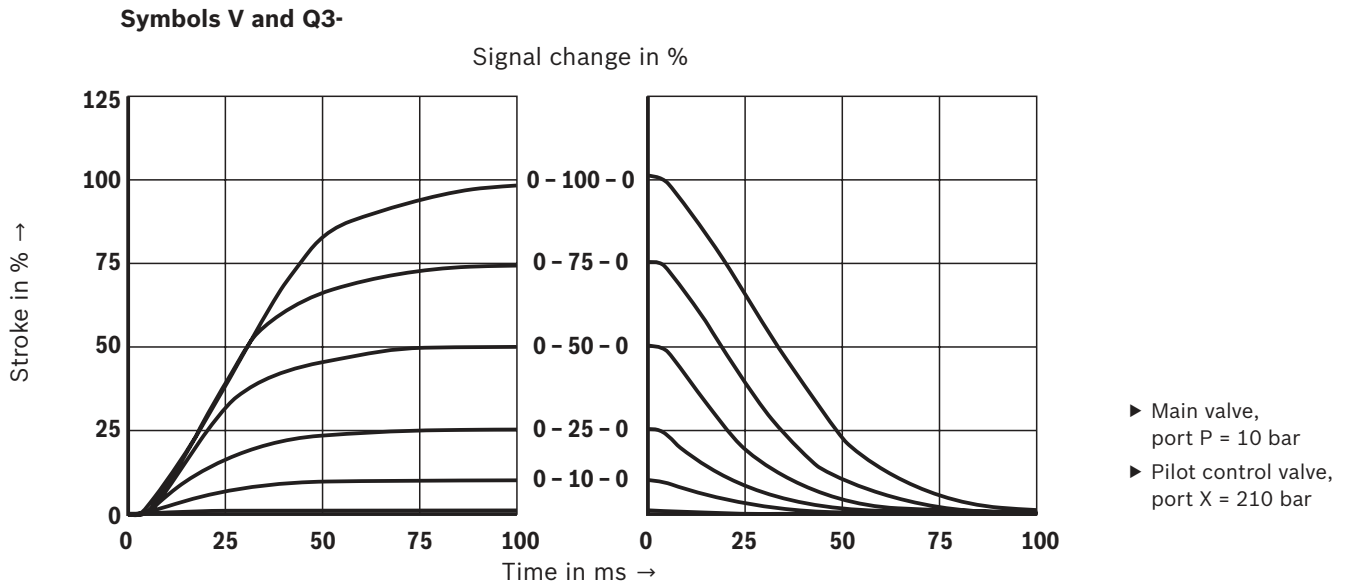
Flow/load function (with maximum valve opening; tolerance $\pm 10\%$)



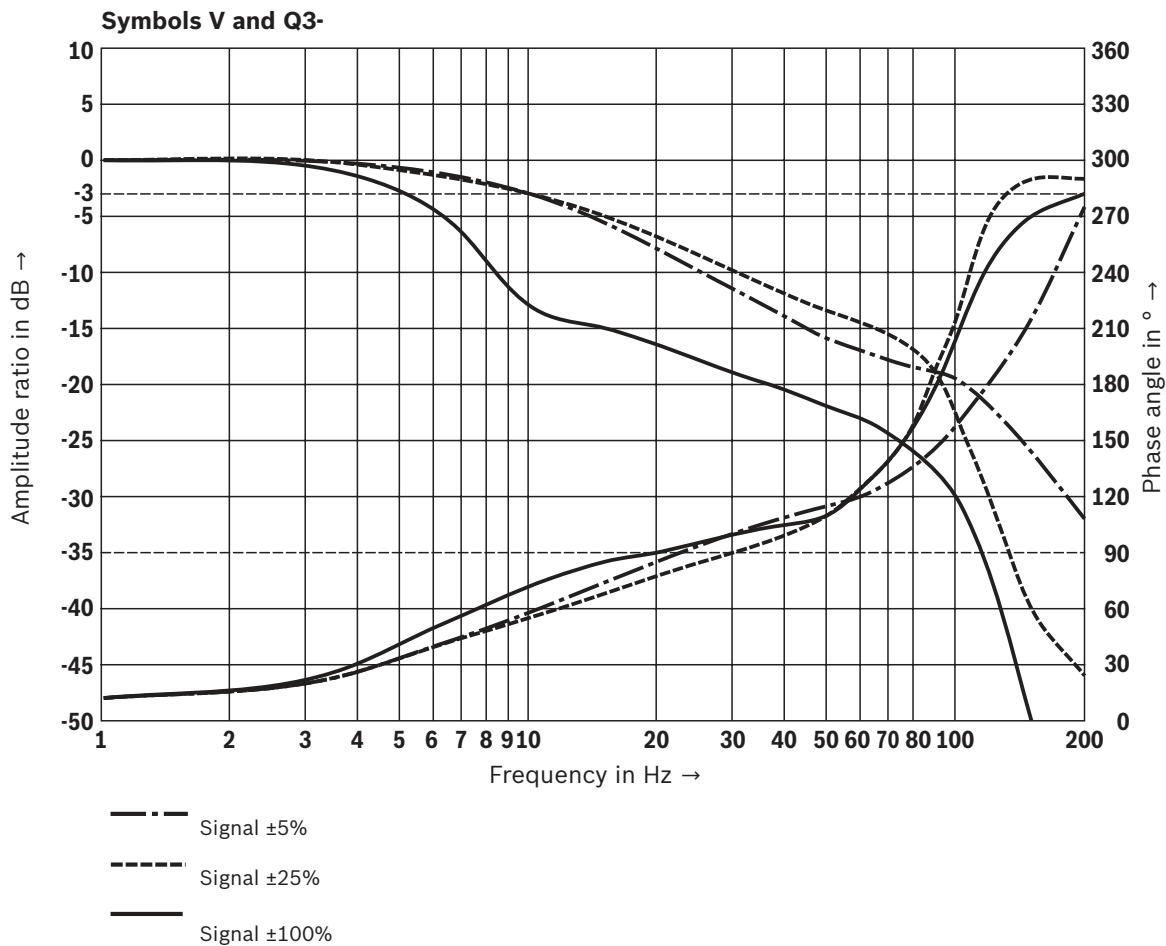
- 1 Maximum admissible flow
- 2 Recommended flow
(flow velocity 30 m/s)

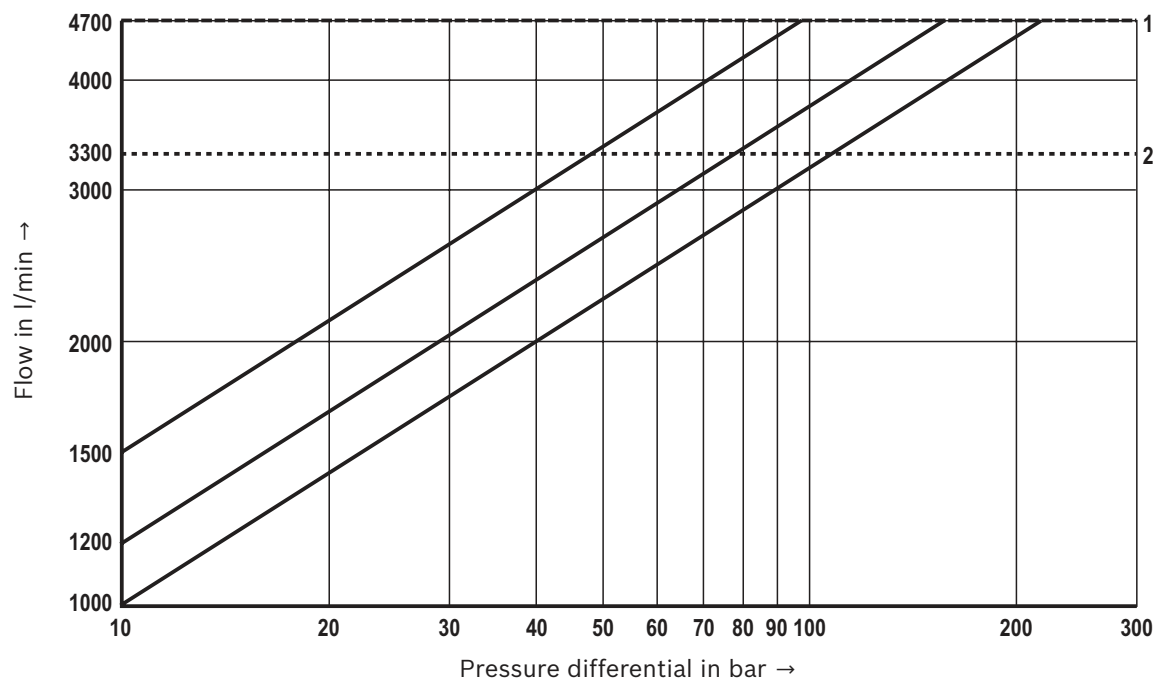
Characteristic curves: Size 35
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ } ^\circ\text{C}$)

Transition function with stepped electric input signals



Frequency response characteristic curves

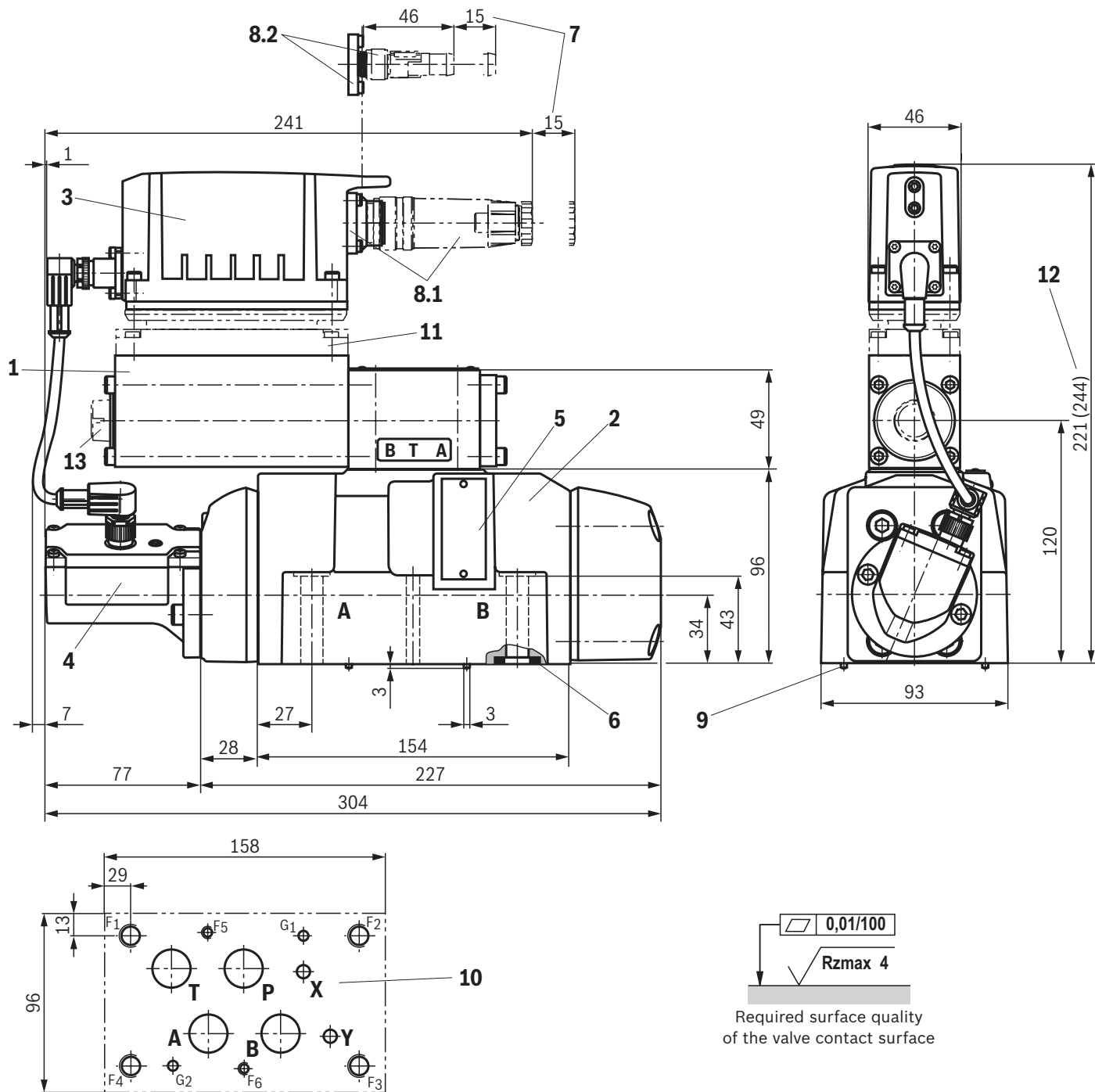


Characteristic curves: Size 35(valid for HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)**Flow/load function** (with maximum valve opening; tolerance $\pm 10\%$)

- 1 Maximum admissible flow
- 2 Recommended flow
(flow velocity 30 m/s)

Dimensions: Size 16

(dimensions in mm)



Item explanations can be found on page 37.

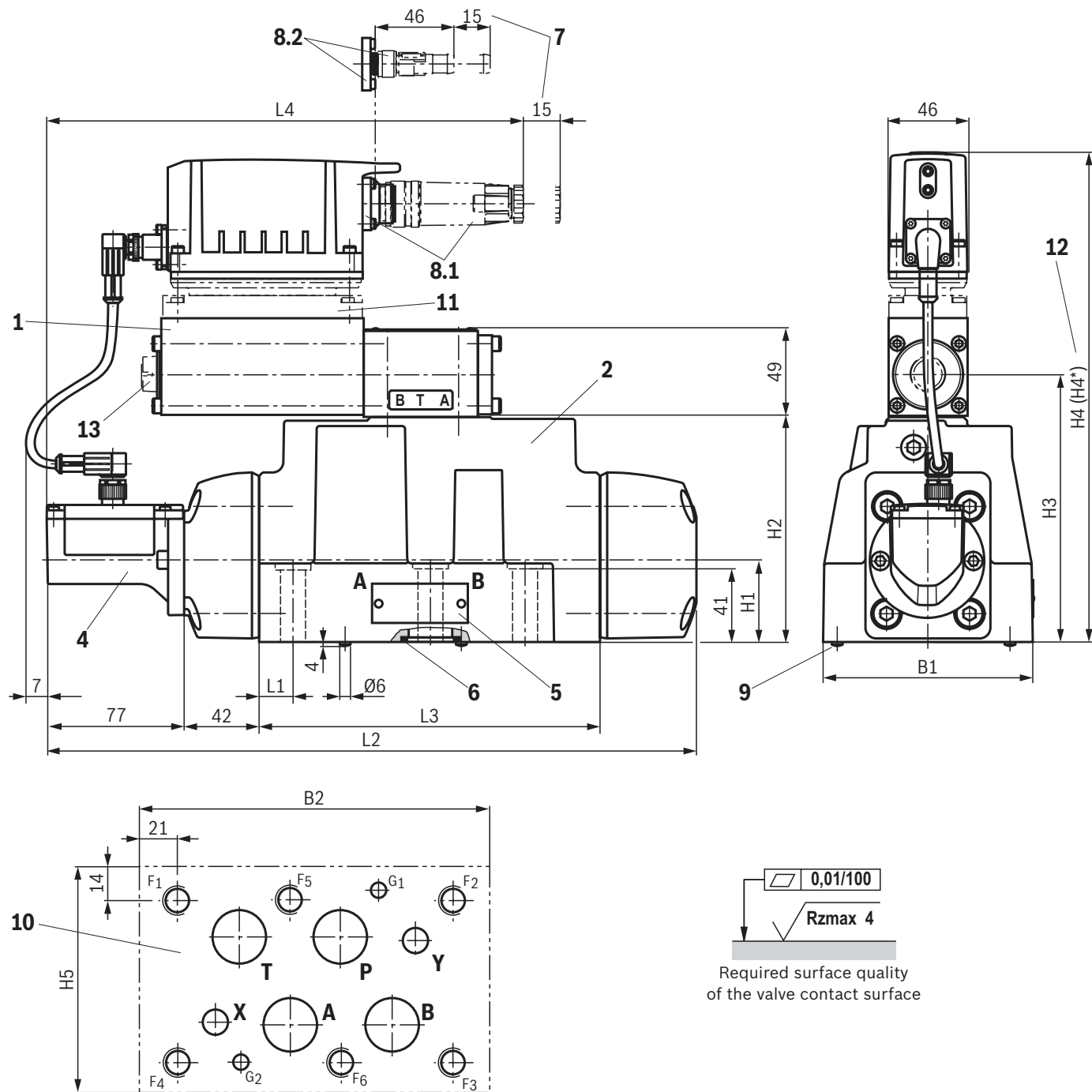
Valve mounting screws and **subplates**, see page 12.



Notices:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Sizes 25 and 27
(dimensions in mm)



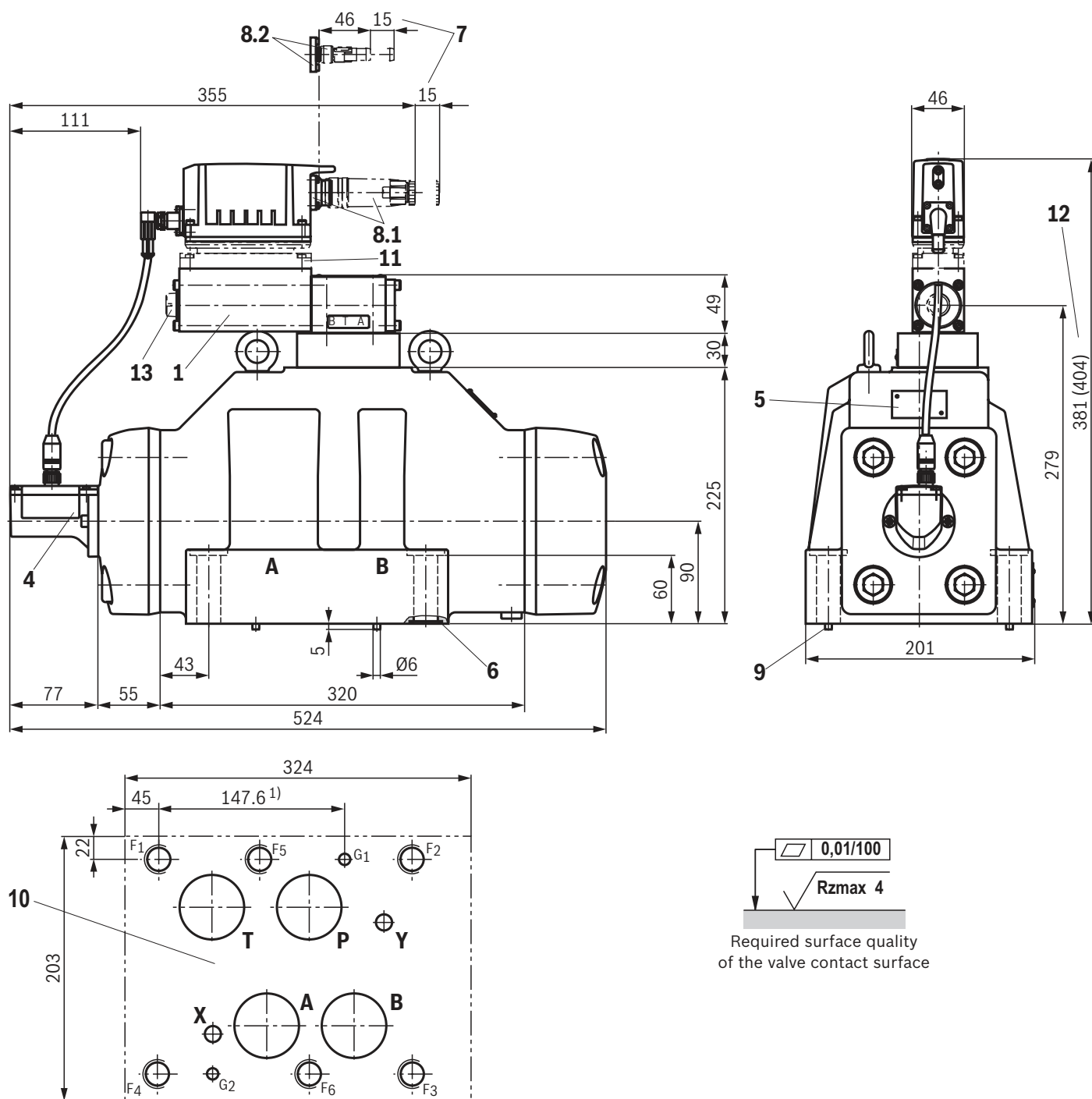
NG	L1	L2	L3	L4	H1	H2	H3	H4	H4*	H5	B1	B2
25	19	364	191	274	46	126	150	251	274	120	118	195
27	20.5	371	198	277	50	140	164	265	288	124	120	200

Item explanations can be found on page 37.
Valve mounting screws and subplates, see page 12.

Notices:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Size 35

(dimensions in mm)



Item explanations can be found on page 37. **Valve mounting screws** and **subplates**, see page 12.

 Notices:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

- 1** Pilot control valve
- 2** Main valve
- 3** Integrated electronics (OBE)
- 4** Inductive position transducer (main valve)
- 5** Name plate
- 6** Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y
- 7** Space required for removing the mating connector
- 8.1** Mating connectors for version "A1", "F1" and "C6",
separate order, see page 39 and data sheet 08006.
- 8.2** Mating connectors for version "L1", separate order,
see page 39 and data sheet 08006.
- 9** Locking pin
- 10** Machined valve contact surface
 - Size 10:
Porting pattern according to ISO 4401-05-05-0-05
 - Size 16:
Porting pattern according to ISO 4401-07-07-0-05
Deviating from the standard:
Ports P, A, B, T – Ø20 mm
 - Size 25 and 27:
Porting pattern according to ISO 4401-08-08-0-05
Deviating from the standard:
NG27: Ports P, A, B, T – Ø32 mm
 - Size 35:
Porting pattern according to ISO 4401-10-09-0-05
Deviating from the standard:
Ports P, A, B, T – Ø50 mm
¹⁾Position G1 according to DIN 24340 Form A
- 11** Damping plate "D"
- 12** Dimension in () for version with damping plate "D"
- 13** Electronics protection membrane "-967"

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Tightening torque $M_A = 13.5 \text{ Nm} \pm 10\%$	R913043777
	or		
	4	ISO 4762 - M6 x 45 - 10.9 Tightening torque $M_A = 15.5 \text{ Nm} \pm 10\%$	Not included in the Rexroth delivery range
	or		
16	4	ASME B18.3 - 1/4-20 UNC x 1 3/4" - ASTM-A574 Tightening torque $M_A = 15 \text{ Nm}$ [11 ft-lbs] $\pm 10\%$	Not included in the Rexroth delivery range
	2	ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Tightening torque $M_A = 12.2 \text{ Nm} \pm 10\%$	R913043410
	4	ISO 4762 - M10 x 60 - 10.9-flZn/nc/480h/C Tightening torque $M_A = 58 \text{ Nm} \pm 20\%$	R913014770
	or		
	2	ISO 4762 - M6 x 60 - 10.9 Tightening torque $M_A = 15.5 \text{ Nm} \pm 10\%$	Not included in the Rexroth delivery range
	4	ISO 4762 - M10 x 60 - 10.9 Tightening torque $M_A = 75 \text{ Nm} \pm 20\%$	
	or		
	2	ASME B18.3 - 1/4-20 UNC x 2 1/4" - ASTM-A574 Tightening torque $M_A = 15 \text{ Nm}$ [11 ft-lbs] $\pm 10\%$	Not included in the Rexroth delivery range
25, 27	4	ASME B18.3 - 3/8-16 UNC x 2 1/4" - ASTM-A574 Tightening torque $M_A = 60 \text{ Nm}$ [44 ft-lbs] $\pm 10\%$	
	6	ISO 4762 - M12 x 60 - 10.9-flZn/nc/480h/C Tightening torque $M_A = 100 \text{ Nm} \pm 20\%$	R913015613
	or		
	6	ISO 4762 - M12 x 60 Tightening torque $M_A = 130 \text{ Nm} \pm 20\%$	Not included in the Rexroth delivery range
35	or		
	6	ASME B18.3 - 1/2-13 UNC x 2 1/4" - ASTM-A574 Tightening torque $M_A = 110 \text{ Nm}$ [81 ft-lbs] $\pm 10\%$	Not included in the Rexroth delivery range
	6	ISO 4762 - M20 x 90 - 10.9-flZn/nc/480h/C Tightening torque $M_A = 465 \text{ Nm} \pm 20\%$	R913009160
	or		
35	6	ISO 4762 - M20 x 90 - 10.9 Tightening torque $M_A = 610 \text{ Nm} \pm 20\%$	Not included in the Rexroth delivery range
	or		
	6	ASME B18.3 - 3/4-10 UNC x 3 1/2" - ASTM-A574 tightening torque $M_A = 395 \text{ Nm}$ [291 ft-lbs] $\pm 10\%$	Not included in the Rexroth delivery range



Notice:

- The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.
- When replacing component series 3X with 4X, only the valve mounting screws listed here may be used (for size 16, a minimum screw length of 55 mm is admissible, as well). Prior to assembly, check the existing mounting bore on the block for sufficient screw-in depth.

Subplates (separate order) with porting pattern according to ISO 4401, see data sheet 45100.

Accessories (separate order)**Valves with integrated electronics**

Interface	Mating connectors 6-pole + PE	Design	Version	Material number	Data sheet
„A1“, „F1“, „C6“	For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm ²	Straight	Metal	R900223890	08006
		Straight	Plastic	R900021267	08006
		Angled	Plastic	R900217845	–

Interface	Cable sets 6-pole + PE	Length in m	Material number	Data sheet
„A1“, „F1“, „C6“	For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm ²	3.0	R901420483	08006
		5.0	R901420491	08006
		10.0	R901420496	08006
		20.0	R901448068	–

Test and service devices

	Material number	Data sheet
Service case with test device for proportional servo valves with integrated electronics (OBE)	R901049737	29685

IO-Link gateways

Designation	Description	Material number
S67E-PN-IOL8-DI4-M12-6P	IndraControl S67E PROFINET device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	R911174436
S67E-S3-IOL8-DI4-M12-6P	IndraControl S67E Sercos device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	R911174437

Further information

▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Subplates	Data sheet 45100
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
▶ Reliability characteristics according to EN ISO 13849	Data sheet 08012
▶ Hexagon socket head cap screw, metric/UNC	Data sheet 08936
▶ General product information on hydraulic products	Data sheet 07008
▶ Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ Directional control valves, direct operated, with electrical position feedback and IO-Link interface	Data sheet 29400-PA
▶ Selection of filters	www.boschrexroth.com/filter
▶ Information on available spare parts	www.boschrexroth.com/spc
▶ Link hydraulics via IO-Link	www.boschrexroth.com/io-link

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