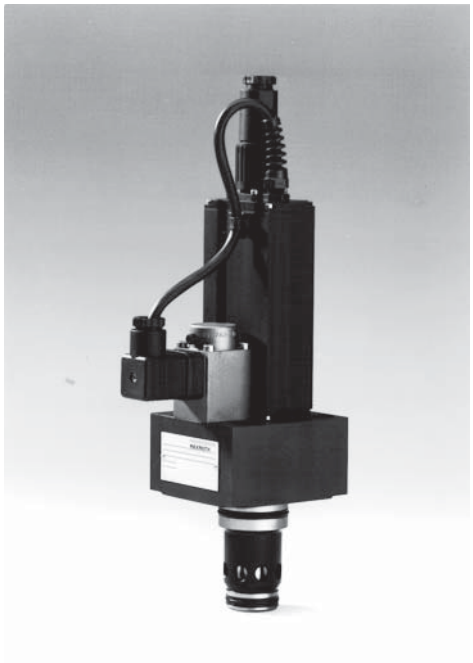
RE 29 209/11.02

Replaces: 03.00

2-way proportional throttle valve (cartridge valve) Type FES(E)

Nominal sizes 25, 32, 40, 50 and 63
Series 3X
Maximum operating pressure 315 bar
Maximum flow 1800 L/min



H/A 4541/94

Type FESE 25 CA-3X/…K0…
with plug-in connector (separate order)

Overview of contents

Features

- Pilot operated 2-way proportional throttle valve
- Installation dimensions to DIN ISO 7368
- Orifice spool is electrically closed loop position controlled
- Flow is possible in both directions
- If the power fails, there is a cable break or if the enable is withdrawn the orifice spool automatically moves into its seat position and isolates the flow in both directions
- Can be used in conjunction with a pressure compensator for pressure compensated flow control
- Type FES with external control electronics (separate order), see page 5
- Type FESE: Completely matched unit with integrated control electronics, can be optionally supplied with a voltage or current interface

Ordering details

FES			C	A – 3X /				*

For external control electronics **= No code**
With integrated control electronics **= E**

Nominal size 25 **= 25**
Nominal size 32 **= 32**
Nominal size 40 **= 40**
Nominal size 50 **= 50**
Nominal size 63 **= 63**

Cartridge **= C**

Direction of flow
A to B (X connected with A)
B to A (X connected with B) **= A**

Series 30 to 39 **= 3X**
(30 to 39: unchanged installation and connection dimensions)

Flow characteristics „linear" [1)]

NS 25 to 315 L/min **= 315L**
NS 32 to 450L/min **= 450L**
NS 40 to 670L/min **= 670L**
NS 50 to 1400 L/min **= 1400L**
NS 63 to 1800L/min **= 1800L**

[1)] Nominal flow in L/min at a Δp **10 bar** between ports A and B (also see hydraulic technical data on page 4)

Further details in clear text

M = NBR seals, suitable for mineral oil (HL, HLP) to DIN 51 524
V = FKM seals

Interface (see also page 7)
B1 = Command value input 0 to 10 V/ Actual value output 0 to – 10 V
G1 = Command value input 4 to 20 mA/ Actual value output 4 to 20 mA
No code = Version FES without integrated control electronics

Electrical connections for external control electronics
K4 = **Without** plug-in connectors, with component plug to DIN EN 175 301-803 for proportional solenoid and GSA20, manufacturer Hirschmann, for the position transducer
Plug-in connector – separate order, see page 6

With integrated control electronics
K0 = **Without** plug-in connector, with component plug to DIN 43 651
Plug-in connector – separate order, see page 7

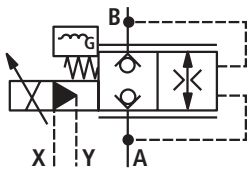
Preferred types (readily available)

Material No.	Type
R900973604	FESE 25 CA-3X/315LK0B1M
R900973605	FESE 32 CA-3X/450LK0B1M
R900973607	FESE 40 CA-3X/670LK0B1M
R900954504	FESE 50 CA-3X/1400LK0B1M
R900954505	FESE 63 CA-3X/1800LK0B1M

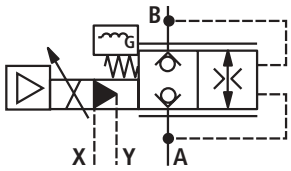
Symbols

Simplified

FES .. CA-3X/…



FESE .. CA-3X/…

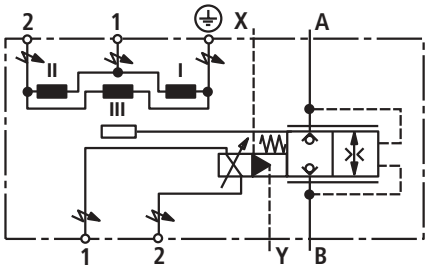


A = Actuator connection
B = Actuator connection
X = Pilot oil supply
Y = Pilot oil drain

Direction of flow: A to B (X connected with A)
B to A (X connected with B)

Detailed (example for FES)

FES . CA-3X/…



Function, section

The valve types FES(E) are pilot operated, 2-way proportional throttle valves (cartridge valves) for the stepless closed loop control of a flow.

Technical design:

The valve comprises of four main groups:

– Cover (1) with connection surface for the pilot oil connections.
– Main valve (2) with orifice spool (3).
– Pilot valve (4) with proportional solenoid (5).
– Integrated control electronics (6) (not with type FES) with position transducer (7).

Functional description:

General function

– Command value related closed loop position control of the orifice spool (3) and thereby a defined opening of the orifice (8).
– The flow is dependent on the Δp over the orifice (8) and the position of the orifice spool (3).
– Actual value acquisition of the position of the orifice spool (3) is via the position transducer (7); command/actual value comparison is within the electronics (6); deviations are processed and passed on as an adjustment variable to the proportional solenoid (5) and the pilot valve (4) for correcting the position of the orifice spool (3).
– The area relationship of the area (14) to area (15) = 2 : 1 for NS 25; 32; 40 and 1.6 : 1 for NS 50; 63.
– Direction of flow A → B (X connected with A);
Direction of flow B → A (X connected with B);
External pilot oil supply is possible via X.
– When the enable is withdrawn the orifice spool (3) moves onto the valve seat (9) and closes off leak-free, the direction of flow A ↔ B. The spool seal (11) seals the connection B to the control chamber (12) leak-free. With an internal pilot oil supply, take into account the leakage from X via the pilot control valve to Y!
– The orifice spool position is closed loop controlled with a command value of 0 V or 4 mA, the orifice (8) is however still in the positive overlap position.

Function, opening the orifice spool:

(Assuming that the flow is from A → B and A is connected to X)

- The proportional solenoid (5) pushes the pilot control spool (4.1) against the spring (13) and opens the connection from the control chamber (12) to Y; a reduction in pressure in the control chamber (12) and the movement of the orifice spool (3) in the opening direction due to the pressure in A on the area (15) plus the pressure in B on the annulus area (16).

Function, closing the orifice spool

(Assuming that the flow is from A → B and A is connected to X)

- A reduction in the current at the proportional solenoid (5); the spring (13) pushes the pilot control spool (4.1) against the proportional solenoid and opens the connection from X to the control chamber (12); an increase of pressure in control chamber (12); pressure on the area (14) plus the spring force (10) moves the orifice spool (3) in the closed direction.

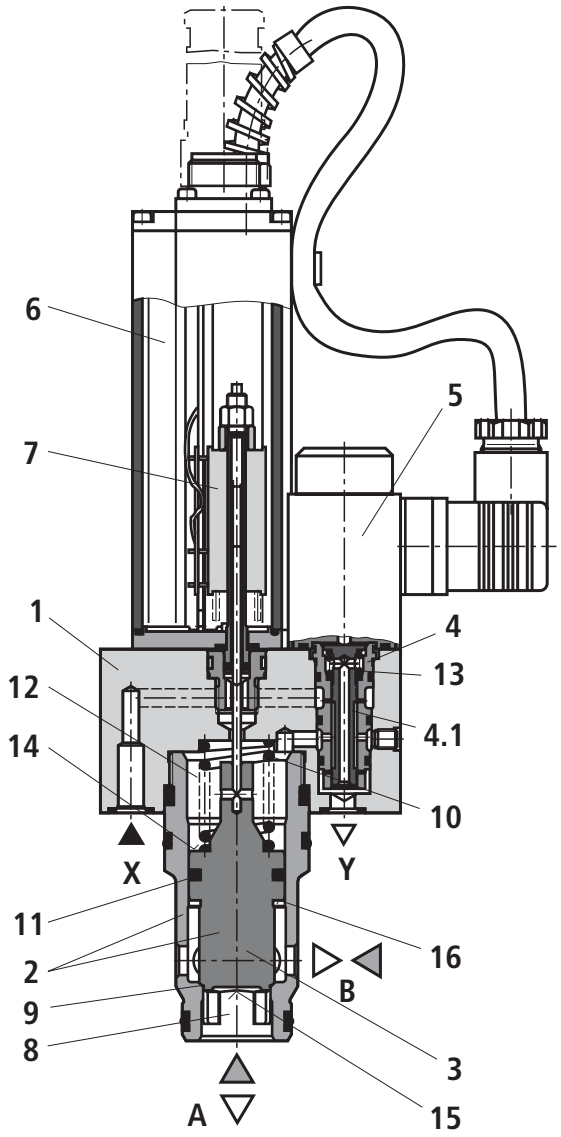
Flow control function:

- In conjunction with a pressure compensator the unit can be used for pressure compensated closed loop flow control.

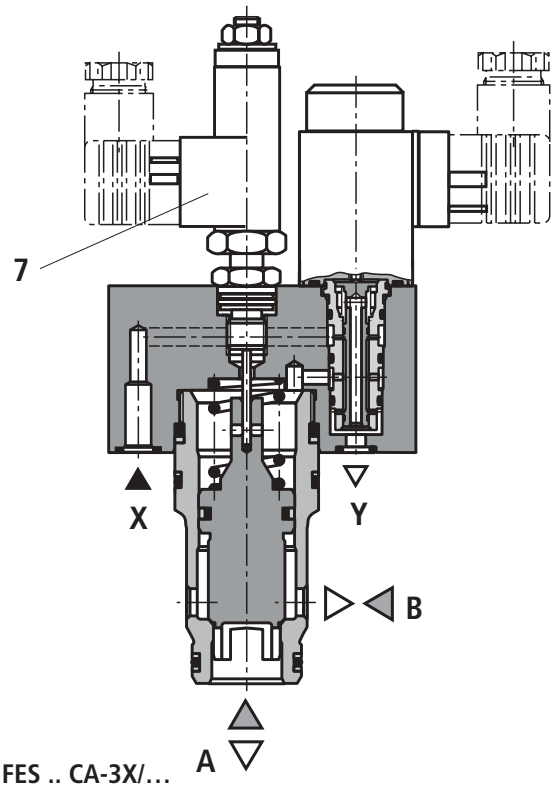
Loss of the power supply:

- The integrated control electronics de-energises the solenoid if the power supply fails or if there is a cable break in the position transducer (7).
- The spool is pushed onto the valve seat (9) by the pressure applied at the pilot connection X plus the spring force (10) and thereby stops the flow from A → B.

⚠ **Attention:** Loss of the power supply causes the axis to abruptly stop. The resulting accelerations could cause damage to the machine!



Type FESE .. CA-3X/…



Type FES .. CA-3X/…

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

General

Installation			Optional				
Storage temperature range		°C	– 20 to + 80				
Ambient temperature range	FES	°C	– 20 to + 70				
	FESE	°C	– 20 to + 50				
Weight		NS	25	32	40	50	63
	FES	kg	3.8	5.5	8.2	12.5	21
	FESE	kg	4	5.7	8.4	12.7	21.2

Hydraulic (measured with HLP 46 and ϑ_{oil} = 40 °C ± 5 °C)

Operating pressure	Ports A, B	bar	Up to 315				
Pilot pressure	Port X	bar	Up to 315				
Return pressure	Port Y		At zero pressure to tank				
Min. inlet pressure		NS	25	32	40	50	63
	– in A (direction of flow A → B)	bar	12	15	15	20	20
	– in B (direction of flow B → A)	bar	15	20	20	25	25
Max. flow q_{Vmax} of the main valve at Δp 10 bar							
	– Direction of flow A → B	L/min	360	480	680	1400	1800
	– Direction of flow B → A	L/min	330	460	585	1400	1800
Pilot oil volume for switching into the seated position → 100%		cm^3	3.9	7.6	12	23.4	52
Pilot oil flow at port Y:							
	– With a stepped form of input signal	L/min	Up to 5.0	Up to 6.5	Up to 10	Up to 12	Up to 17
Pilot oil volume	In the control position (0 to 100% com. value) from X via the pilot control valve Y	L/min	< 0.3 for all nominal sizes				
Direction of flow	Internal pilot oil supply A → B		A connected with X				
	B → A		B connected with X				
	External pilot oil supply A → B		Pressure at X > pressure in A				
	B → A		Pressure at X > pressure in B				
Leakage fluid	Condition: Command value 0 V or 4 mA, – From A → B / B → A in relation to the Δp		See characteristic curves on pages 9 to 14				
	– From A → X / B → X via the pilot control to Y at p = 315 bar		< 0.3 for all nominal sizes				
	Condition: Enable off		A → B / B → A isolated leak-free				
	– Solenoid de-energised ("fail-safe" position)		**⚠ Attention!** With internal pilot oil supply the leakage fluid from A or B to X via the pilot control valve to Y has to be taken into account. q_V < 0.2 L/min at Δp = 315 bar Via the external pilot oil supply at X the losses due to leakage from A or B can be prevented. The external pressure in X must be ^ than the pressure in A with the direction of flow A → B and ^ than the pressure in B with a direction of flow B → A.				
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524; Further pressure fluids on request!				
Pressure fluid temperature range		°C	– 20 to + 80				
Cleanliness class to ISO code			Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 class (C) class 18/16/13 [1)]				
Viscosity range		mm^2/s	15 to 380				
Hysteresis		%	< 0.2				
Response sensitivity		%	< 0.1				
Reversal span		%	< 0.15				

[1)] The cleanliness class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.
For the selection of filters see catalogue sheets RE 50 070, RE 50 076 and RE 50 081.

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

Type FES (external control electronics)

Electrical, solenoid (pilot control valve)

Voltage type			24 V DC
Nominal current		mA	1000
Coil resistance	– Cold value at 20 °C	Ω	12.7
	– Max. warm value	Ω	19.3
Duty		%	100
Electrical connections			With component plug to DIN EN 175 301-803
			Plug-in connector to DIN EN 175 301-803 [1)]
Protection to DIN 40 050			IP65 with mounted and fixed plug-in connector

Electrical, inductive position transducer (main stage; only for type FES)

Coil resistance	Total spool resistance between		1 and 2	2 and ⏚	⏚ and 1
at 20 °C (see symbols on page 2)		Ω	31.5	45.5	31.5
Inductivity		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical connections			With component plug GSA20, manufacturer Hirschmann		
			Plug-in connector GM209N (Pg9), manufacturer Hirschmann [1)]		
Protection to DIN 40 050			IP65 with mounted and fixed plug-in connector		
Electrical position measuring system			Differential throttle		

Control electronics (only for type FES; separate order)

Amplifier in Eurocard format		NS	25	32	40	50	63
	To RE 30 117	Analogue	VT-VRPA1-50	VT-VRPA1-51		VT-VRPA1-52	
	To RE 30 125	Digital	VT-VRPD-1				
Amplifier of modular design to RE 29 756		Analogue	VT 11037				

Type FESE (integrated control electronics)

Electrical

Duty		%	100
Current comsumption	I_{max}	A	1.3
	Impulse load	A	1.5
Electrical connections			With component plug to DIN 43 651
			Plug-in connector to DIN 43 651 11-pin + PE/Pg16 [2)]
Protection			IP65 with mounted and fixed plug-in connector
Control electronics			Integrated into the valve (see page 8)

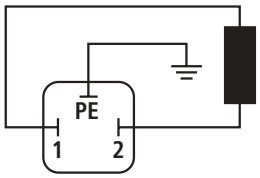
[1)] Separate order, see page 6

[2)] Separate order, see page 7

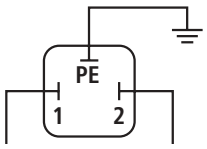
☞ **Note:** For details regarding the **environmental simulation test** covering EMC (electro-magnetic compatibility), climate and mechanical loading see RE 29 209-U (declaration regarding environmental compatibility).

For type FES (for external control electronics)

Connections at component plug

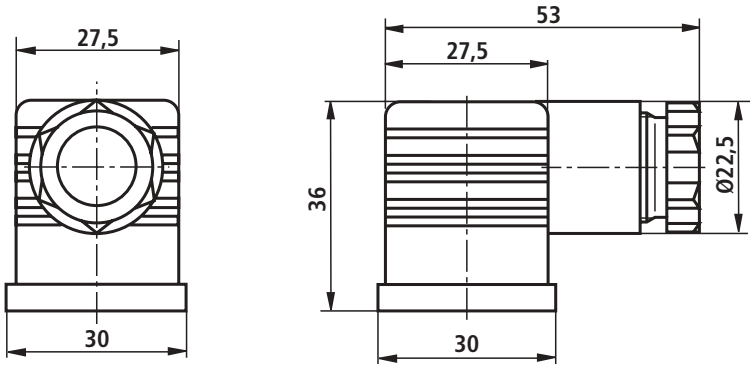


Connections at plug-in connector

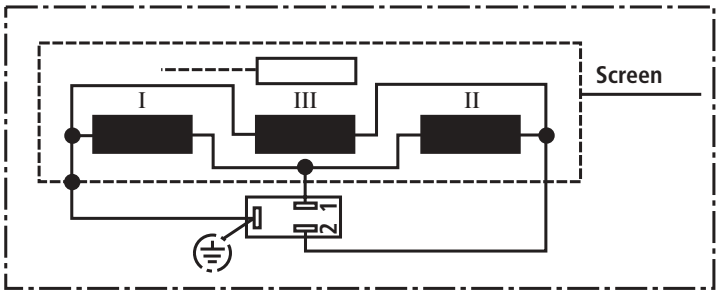


To amplifier

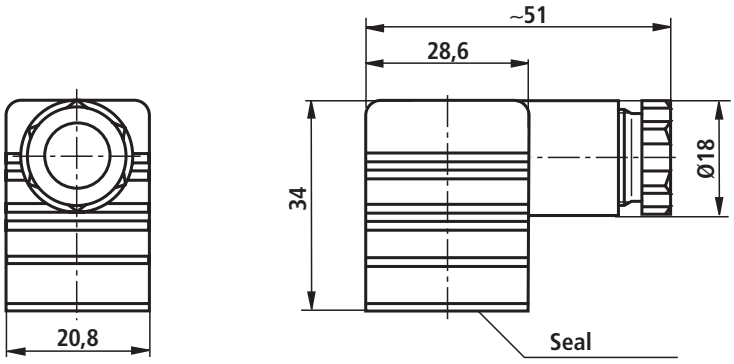
Plug-in connector to DIN EN 175 301-803
Separate order under Material No. **R900074684** (plastic version)



Inductive position transducer



Plug-in connector GM209N (Pg 9), manufacturer Hirschmann
Separate order under Material No. **R900013674** (plastic version)

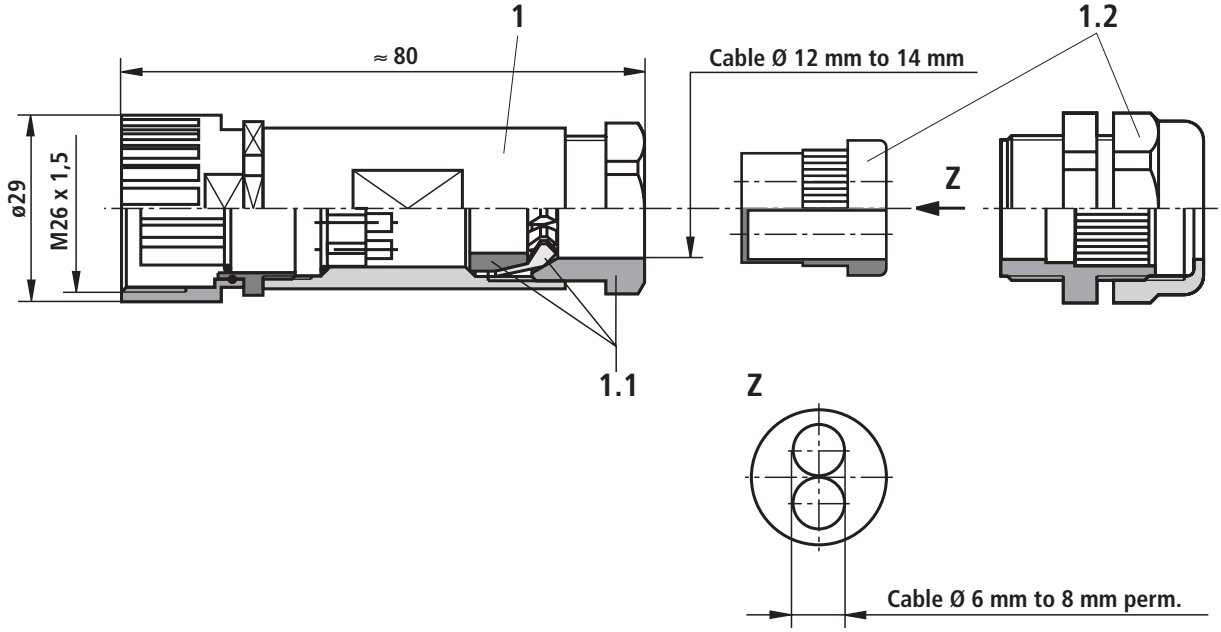


Electrical connections, plug-in connectors

For type FESE (with integrated control electronics)

Plug-in connector to DIN 43 651/11-pin + PE/Pg16
Separate order under Material No. **R900855978**
(plastic version)
Assembly comprises of Pos. 1 and 1.1 or Pos. 1 and 1.2,
Protection IP65

Note:
- When using **one** cable, combine Pos. 1 with Pos. 1.1
- When using **two** cables, combine Pos. 1 with Pos. 1.2



Pin	Function	Conditions	
1	Operating voltage +UL	U_B = 24 VDC; $u_B(t)_{max}$ = 36 V; $u_B(t)_{min}$ = 21.6 V	
2	Weight L0		
3	Enable input / reference for Pin 2	log 1 = 10 V to 36 V; log 0 = U < 8 V	
		Type **FESE…/…B1…**	Type **FESE…/…G1…**
		Voltage interface	Current interface
4	Command value input	0 V to + 10 V (R_e > 50 kΩ)	+ 4 mA to + 20 mA / load = 100 Ω
5	Command value input, reference		
6	Acutal value output	0 V to – 10 V (I_{max} = 5 mA)	+ 4 mA to + 20 mA / load ≤ 500 Ω
7	Actual value output, reference		
8	Free		
9	Free		
10	Free		
11	Operational (output)	Valve not operational:	U_{Pin11} < 8 V;
		Valve operational:	$U_{Pin11} = U_B$ – 3 V
		Reference – Pin 2:	(I_{max} against 0 V; 50 mA);
PE	Earth ⏚		

Recommended connection cable:
- Up to 25 m → min. 0.75 mm² per core
- Up to 50 m → min. 1.5 mm² per core
- Connect the screen only to PE on the supply side

Functional description of the integrated control electronics

1. Switching sequence/fault characteristics:

After the 24 V power supply has been applied the electronics are operational when the following conditions are fulfilled.

– The operating voltage U_B > 18 VDC
– The internal supply voltage ± 7.5 V is symmetrical
– The connection to the position transducer is not interrupted.
– The command value line is not interrupted (only for the 4 mA to 20 mA interface)

If one of these conditions is not met then the controller and output stage are locked and operational signal is set to < 8 V.

2. Normal operation

With an inactive enable (< 8V) and an applied command value (0 to 10V or 4 to 20mA), the orifice spool is located in its seated position and therefore isolates the flow from A to B.

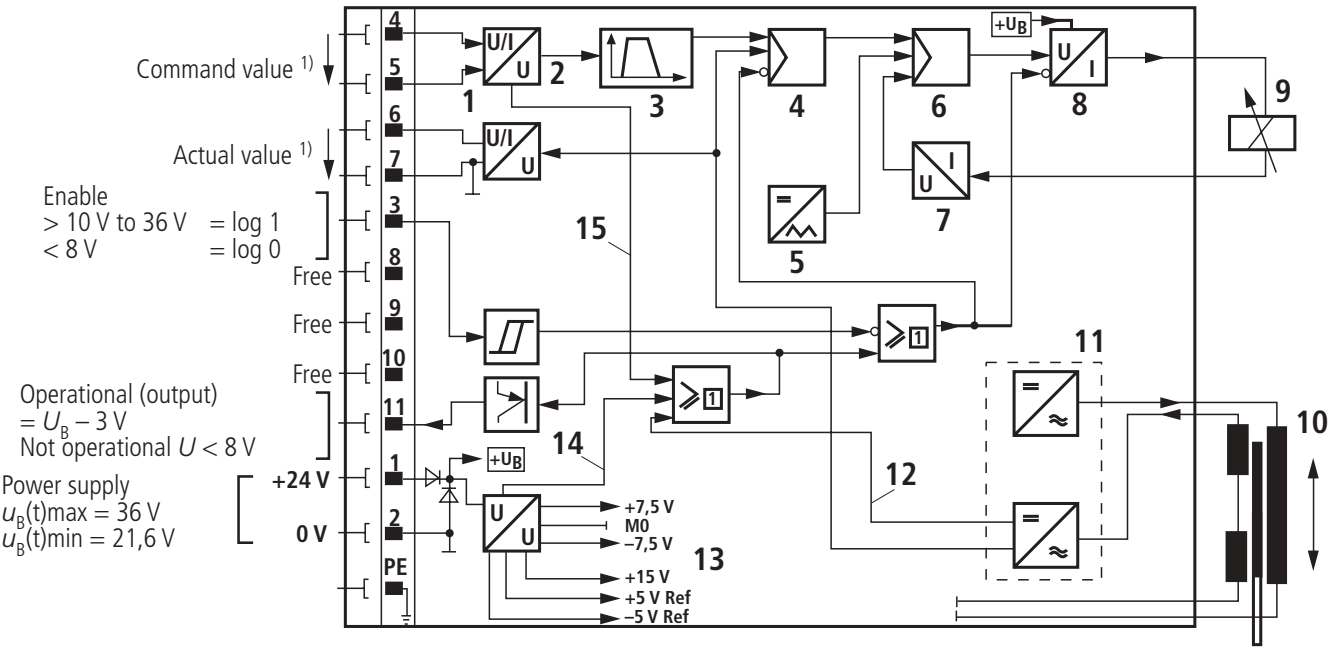
By applying a voltage > 10 V at the enable, the orifice spool position controller and the output stage of the pilot control valve are activated. At the same time the actual value from the orifice spool position and the applied command value are compared in the position controller (PID) and an adjustment variable is passed to the output stage. The solenoid current is changed until the orifice spool position matches the command value.

The actual value for the orifice spool position is obtained via an inductive position transducer. This signal is rectified by a demodulator and is then fed back to the PID controller.

As output signals the following are available at the plug:

– Position actual value FESE.../...B1 (Pin 6)
  • 0 V to – 10 V relates to a 0 % to 100 % valve opening
  • Orifice spool in the seated position → actual value > 0.8 V
– Position actual value FESE.../...G1 (Pin 6)
  • 4 mA to 20 mA relates to a 0 % to 100 % valve opening
  • Orifice spool in the seated position → actual value < 2.7 mA
– Operational signal (Pin 11)
  • All of the above conditions have been fulfilled → > 10 V
  • One of the conditions has not been fulfilled → < 8V

Block circuit diagram for the integrated control electronics

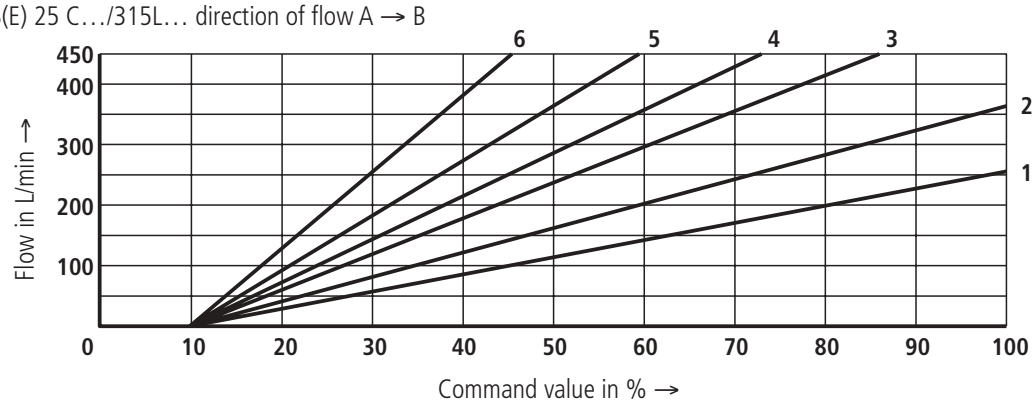


1) For the current version (4 mA to 20 mA) take the following into account:
Between connections 5 and 4 the load = 100 Ω
Between connections 6 and 7 the load ≤ 500 Ω

1 Input
2 Output
3 Fixed ramp
4 Position controller
5 Clock
6 Current controller
7 I/U converter
8 Output stage
9 Proportional solenoid
10 Position transducer
11 Oscillator / demodulator
12 Fault signal, position transducer
13 Power supply
14 Fault signal at +U_B under voltage and asymmetry in the power supply
15 Cable break signal with a current command value

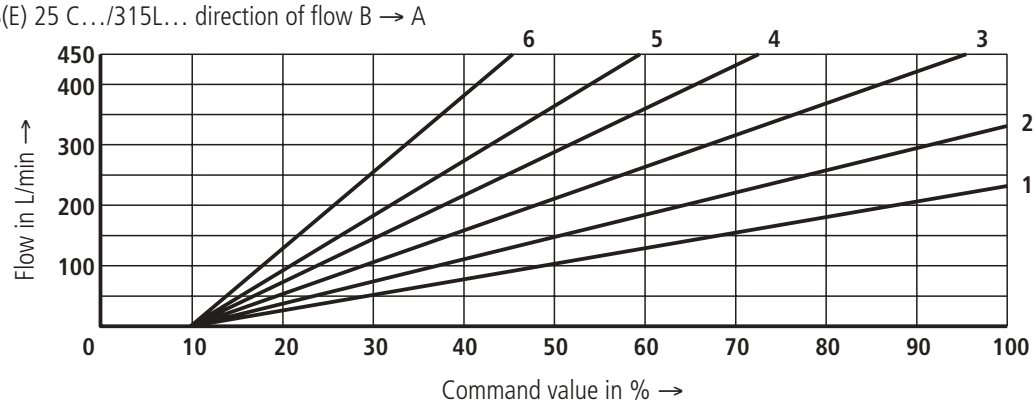
Linear flow characteristics

FES(E) 25 C…/315L… direction of flow A → B



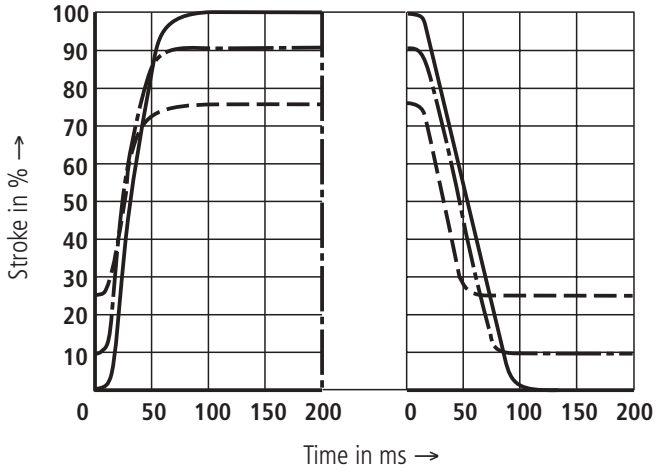
1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

FES(E) 25 C…/315L… direction of flow B → A



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

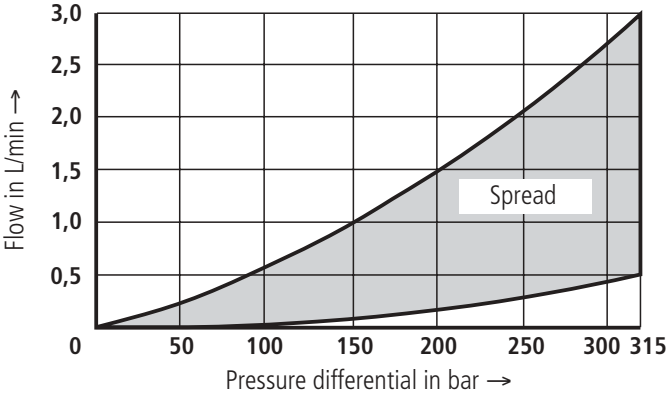
Transient function with a stepped form of command value change[1)]



Step response 0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

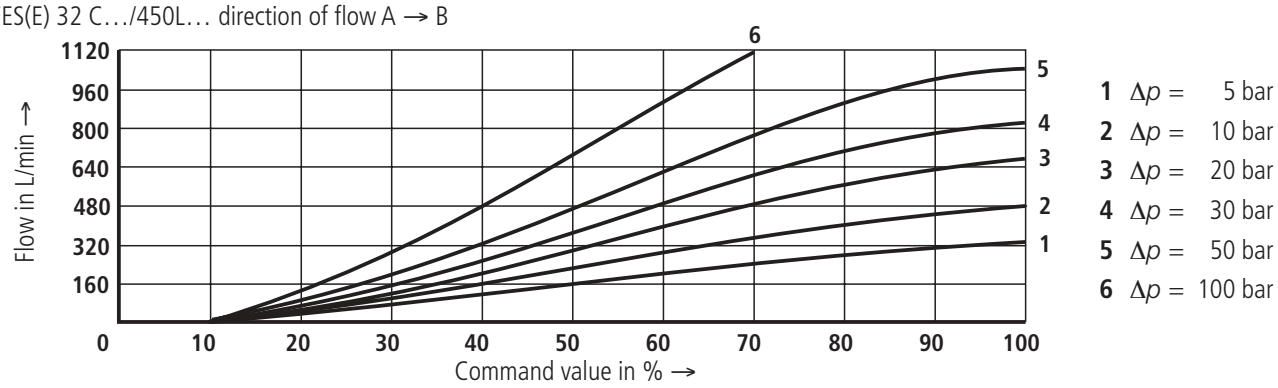
[1)] Measurement conditions
Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B$ = 50 bar)
Pressure in A < 50 bar → adjustment time increases
Pressure in A > 50 bar → adjustment time decreases
The changes to the adjustment times due to the orifice spool area relationship are influenced as follows:
→ Com. value 0 → 100%: The adjustment time decreases, the higher the inlet pressure and the lower the Δp is over the valve.
→ Com. value 100% → 0: The adjustment time decreases, the higher the inlet pressure and the higher the Δp is over the valve.

Leakage from A → B und B → A in relation to the pressure differential Δp (command value 0 V or 4 mA)



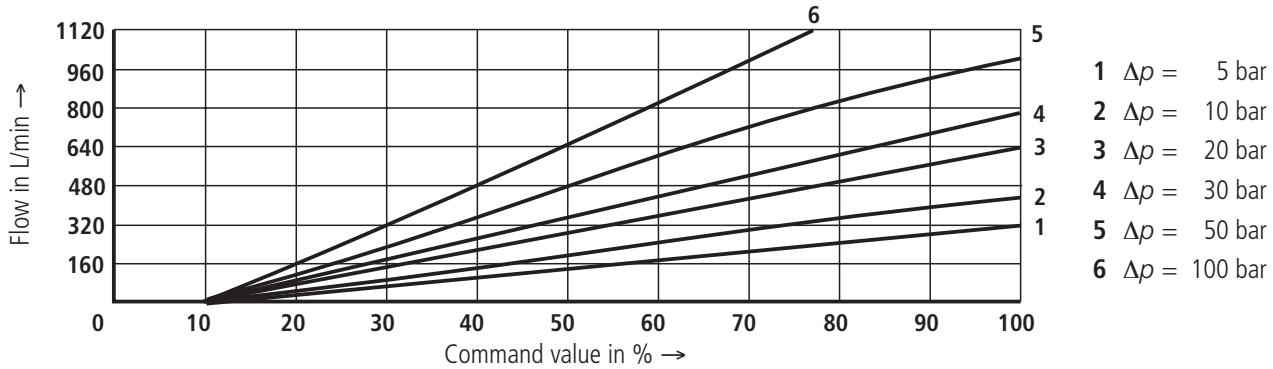
Linear flow characteristics

FES(E) 32 C…/450L… direction of flow A → B



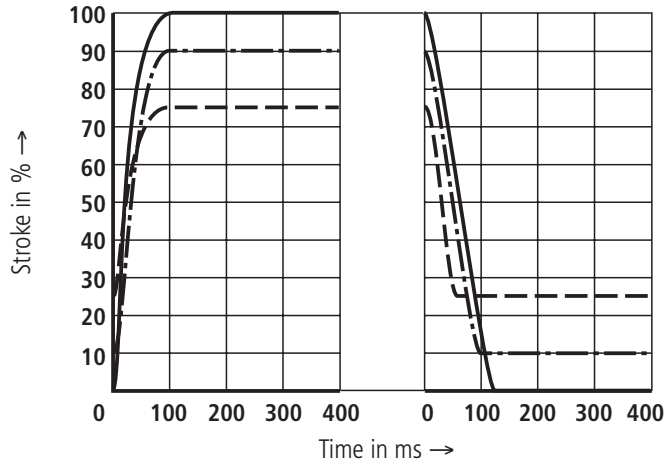
1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

FES(E) 32 C…/450L… direction of flow B → A



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

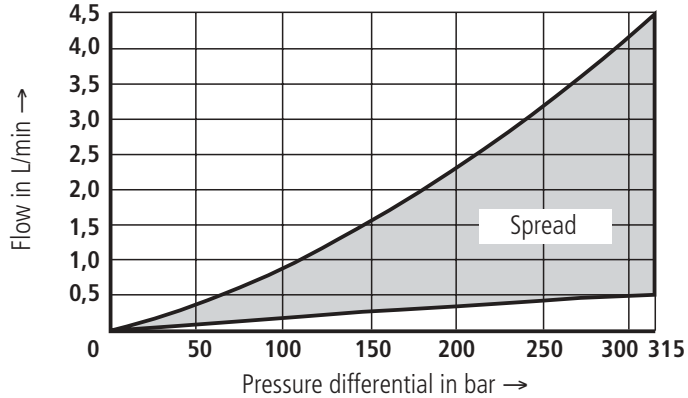
Transient function with a stepped form of command value change[1)]



Step response
0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

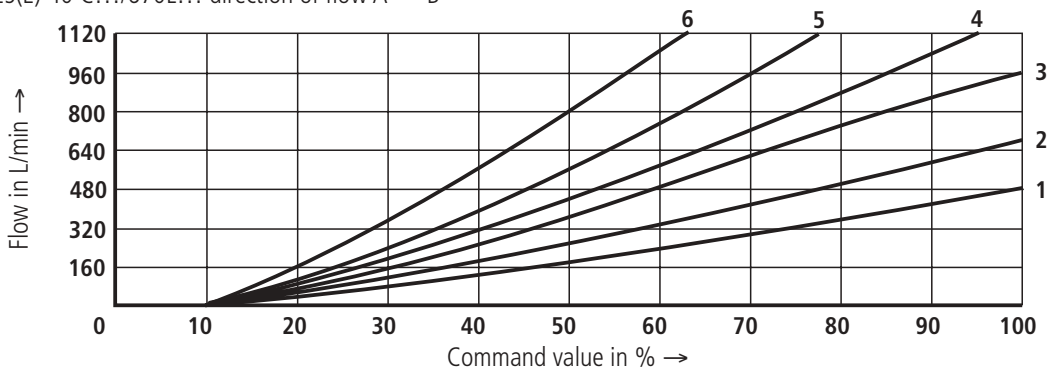
[1)] Measurement conditions
Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B$ = 50 bar)
Pressure in A < 50 bar → adjustment time increases
Pressure in A > 50 bar → adjustment time decreases
The changes to the adjustment times due to the orifice spool area relationship are influenced as follows:
→ Com. value 0 → 100%: The adjustment time decreases, the higher the inlet pressure and the lower the Δp is over the valve.
→ Com. value 100% → 0: The adjustment time decreases, the higher the inlet pressure and the higher the Δp is over the valve.

Leakage from A → B and B → A in relation to the pressure differential Δp (command value 0 V or 4 mA)



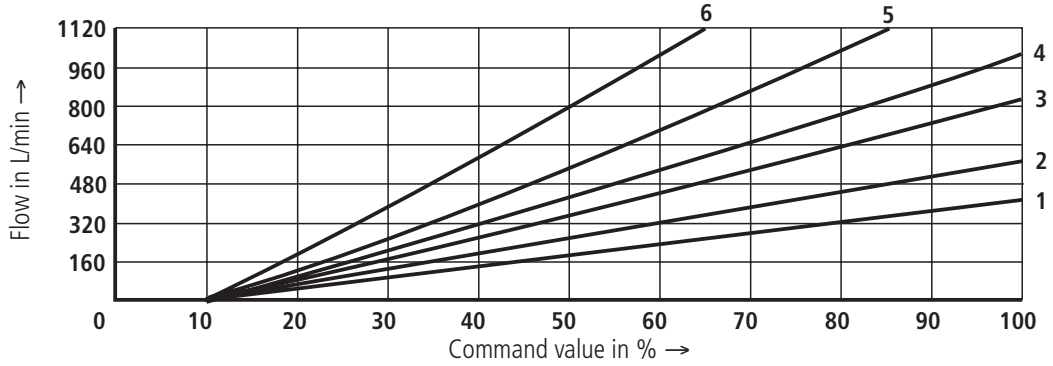
Linear flow characteristic

FES(E) 40 C…/670L… direction of flow A → B



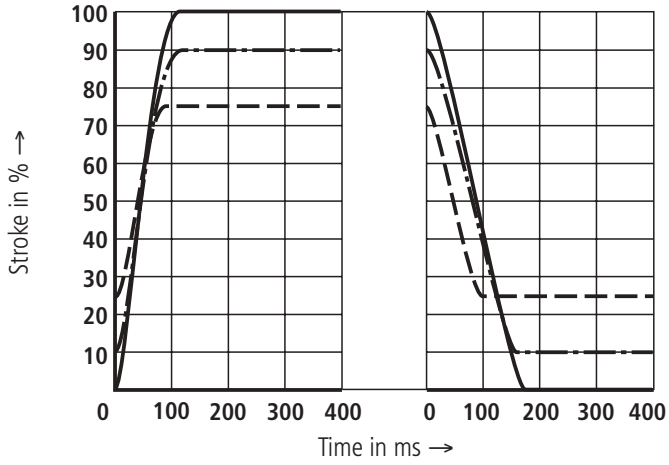
1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

FES(E) 40 C…/670L… direction of flow B → A



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

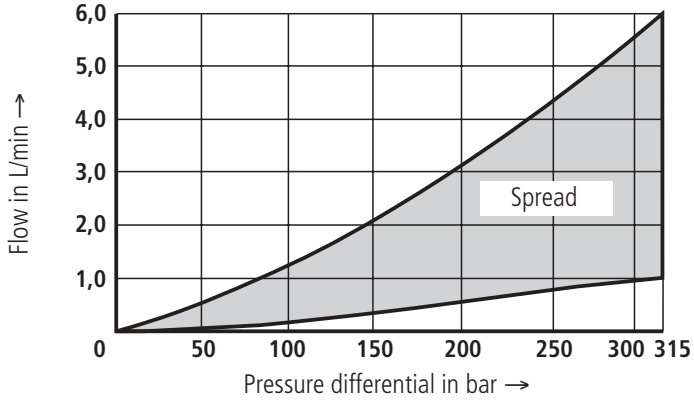
Transient function with a stepped form of command value change[1)]



Step response 0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

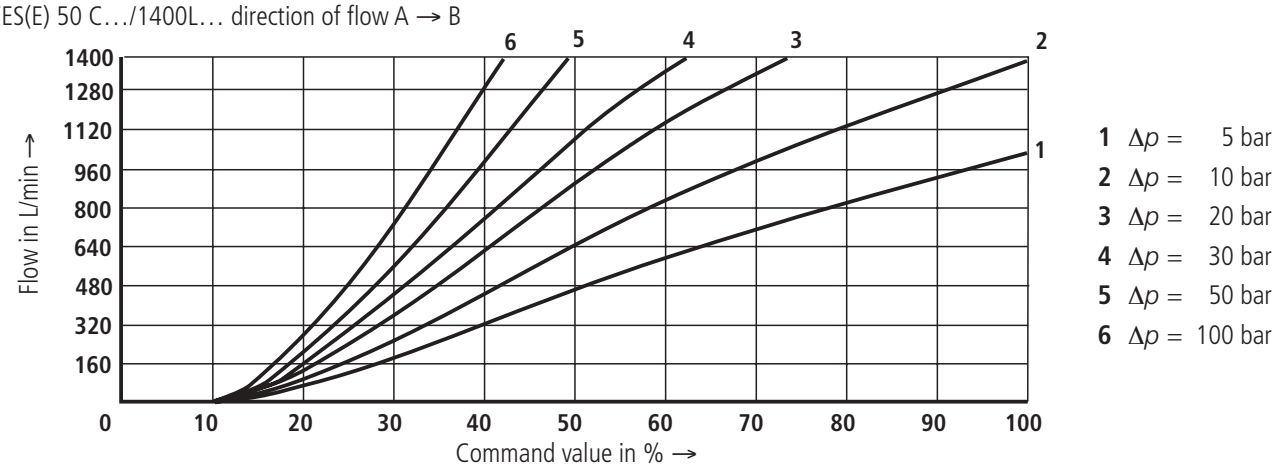
[1)] Measurement conditions
Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B$ = 50 bar)
Pressure in A < 50 bar → adjustment times increases
Pressure in A > 50 bar → adustment times decreases
The changes to the adjustment times due to the orifice spool area relationship are influenced as follows:
→ Com. value 0 → 100%: The adjustment time decreases, the higher the inlet pressure and the lower the Δp is over the valve.
→ Com. value 100% → 0: The adjustment time decreases, the higher the inlet pressure and the higher the Δp is over the valve.

Leakage from A → B and B → A in relation to the pressure differential Δp (command value 0 V or 4 mA)



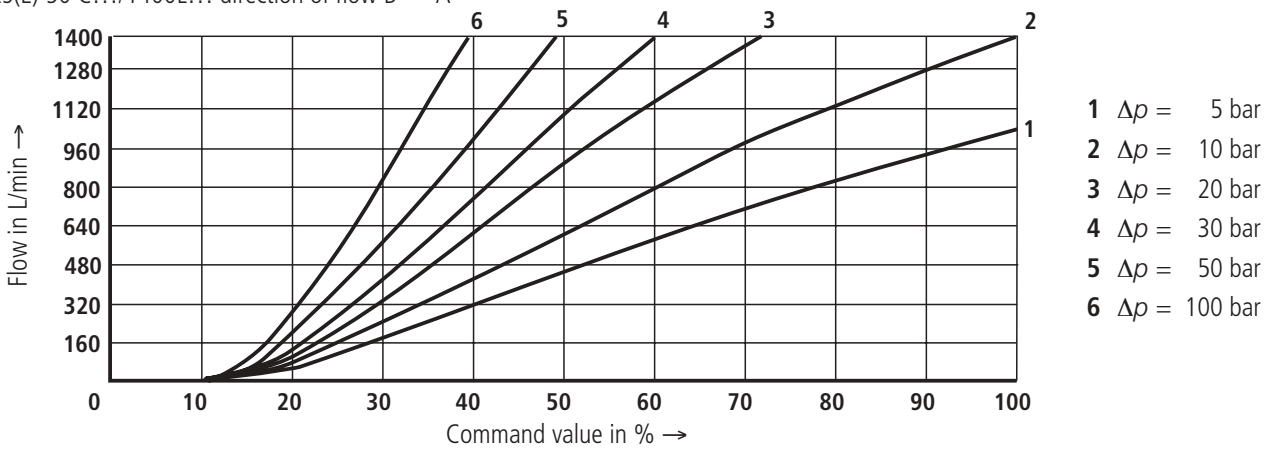
Linear flow characteristics [1)]

FES(E) 50 C…/1400L… direction of flow A → B



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

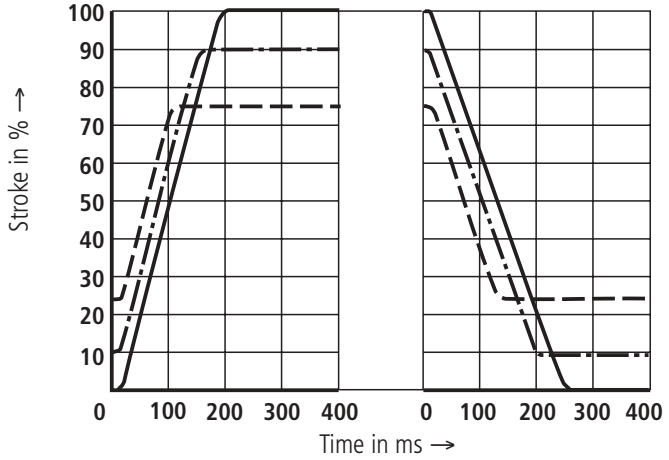
FES(E) 50 C…/1400L… direction of flow B → A



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

Transient function with a stepped form of command value change

[2)]



Step response 0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

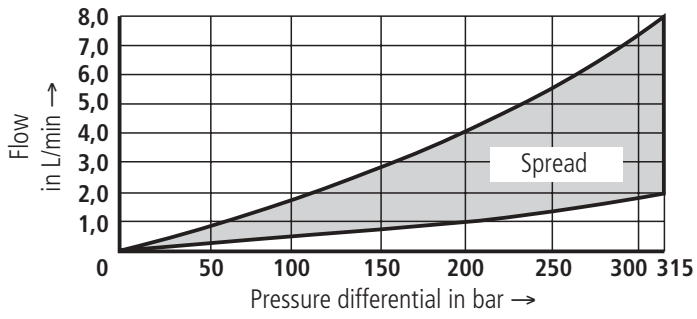
[1)] Flow details over 1200 L/min are not measured values!

[2)] Measurement conditions
Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B$ = 50 bar)
Pressure in A < 50 bar → adjustment times increases
Pressure in A > 50 bar → adjustment times decreases
The changes to the adjustment times due to the orifice spool area relationship are influenced as follows:

→ Com. value 0 → 100%: The adjustment time decreases, the higher the inlet pressure and the lower the Δp is over the valve.

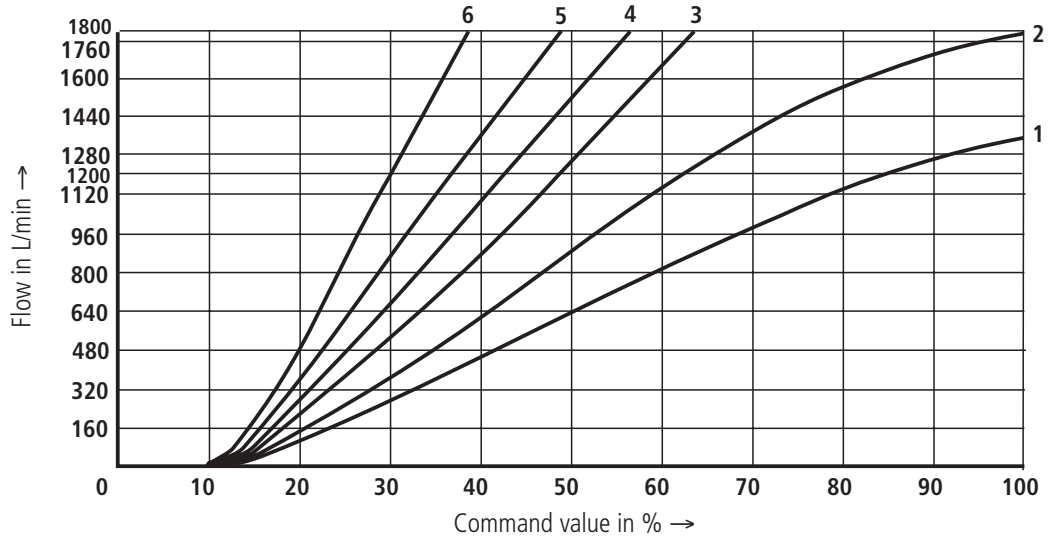
→ Com. value 100% → 0: The adjustment time decreases, the higher the inlet pressure and the higher the Δp is over the valve.

Leakage from A → B and B → A in relation to the pressure differential Δp (command value 0 V or 4 mA)



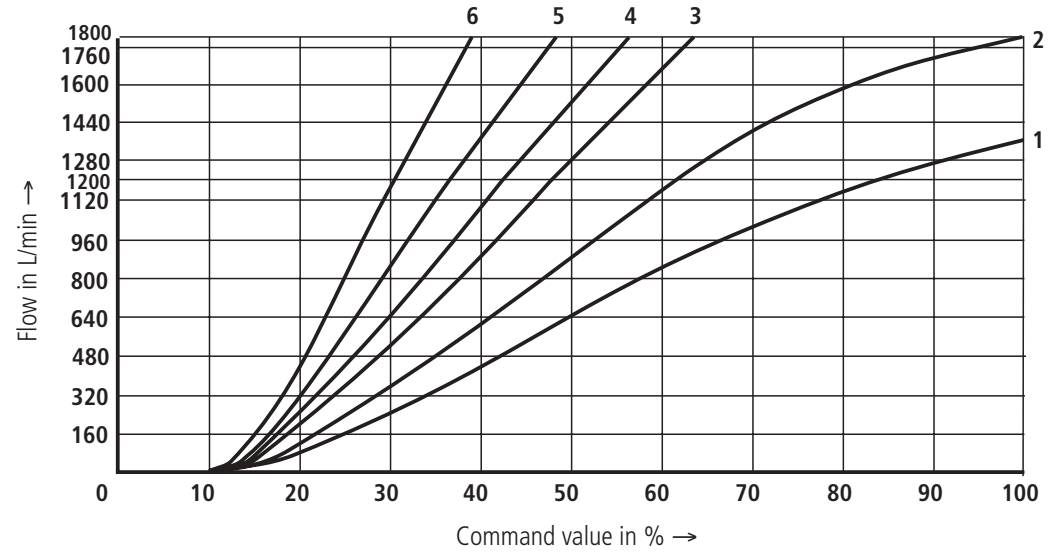
Linear flow characteristics [1)]

FES(E) 63 C…/1800L… direction of flow A → B



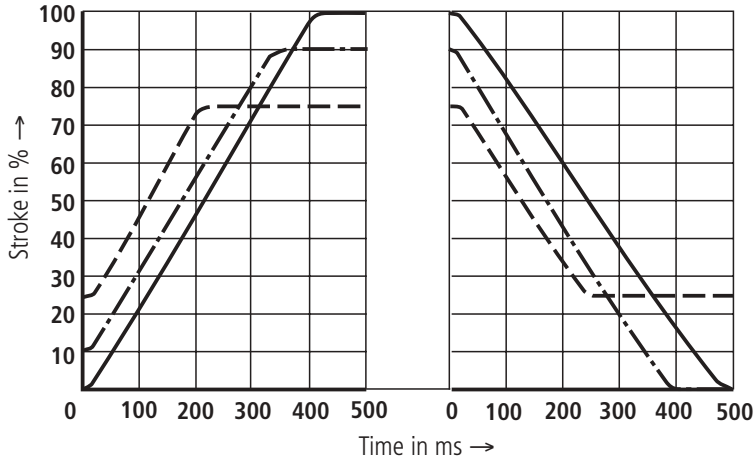
1 Δp = 5 bar
2 Δp = 10 bar
3 Δp = 20 bar
4 Δp = 30 bar
5 Δp = 50 bar
6 Δp = 100 bar

FES(E) 63C…/1800L… direction of flow B → A



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

Transient function with a stepped form of command value change[2)]



Step response
0 – 100 – 0 %
10 – 90 – 10 %
25 – 75 – 25 %

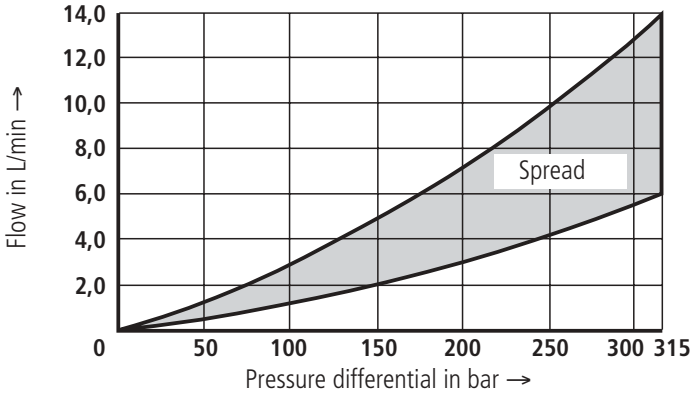
[1)] Flow details over 1200 L/min are not measured values!

[2)] Measurement conditions
Pressure in A = 50 bar
Actuator in B closed ($p_A = p_B$ = 50 bar)
Pressure in A < 50 bar → adjustment time increases
Pressure in A > 50 bar → adjustment time decreases
The changes to the adjustment times due to the orifice spool area relationship are influenced as follows:

→ Com. value 0 → 100%: The adjustment time decreases, the higher the inlet pressure and the lower the Δp is over the valve.

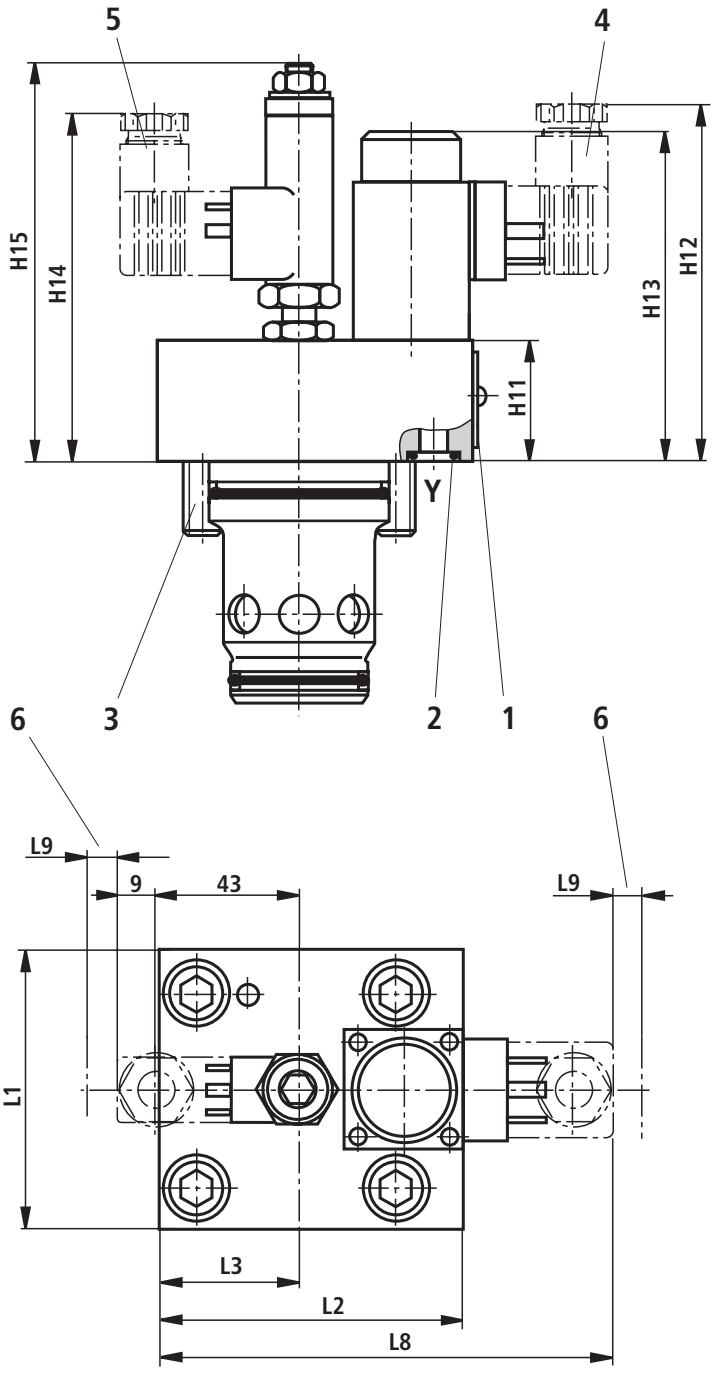
→ Com. value 100% → 0: The adjustment time decreases, the higher the inlet pressure and the higher the Δp is over the valve

Leakage from A → B and B → A in relation to the pressure differential Δp (command value 0 V or 4 mA)



Unit dimensions: type FES (dimensions in mm)

NS	25	32	40	50	63
H11	51	63	62	73	90
H12	116	128	127	138	155
H13	110	122	121	132	149
H14	118	130	129	140	157
H15	137.5	149.5	148.5	159.5	176.5
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51.25	63	70	90
L8	139	150	169	184	219
L9	15	15	15	15	15



1 Name plate

2 Identical seal rings for ports X and Y

3 4 off valve fixing screws
to DIN 912-10.9 (are included within the scope of supply):
NS 25: M12 x 60,
Tightening torque M_A = 75 Nm
NS 32: M16 x 75,
Tightening torque M_A = 170 Nm
NS 40: M20 x 80,
Tightening torque M_A = 350 Nm
NS 50: M20 x 90,
Tightening torque M_A = 380 Nm
NS 63: M30 x 100,
Tightening torque M_A = 1200 Nm

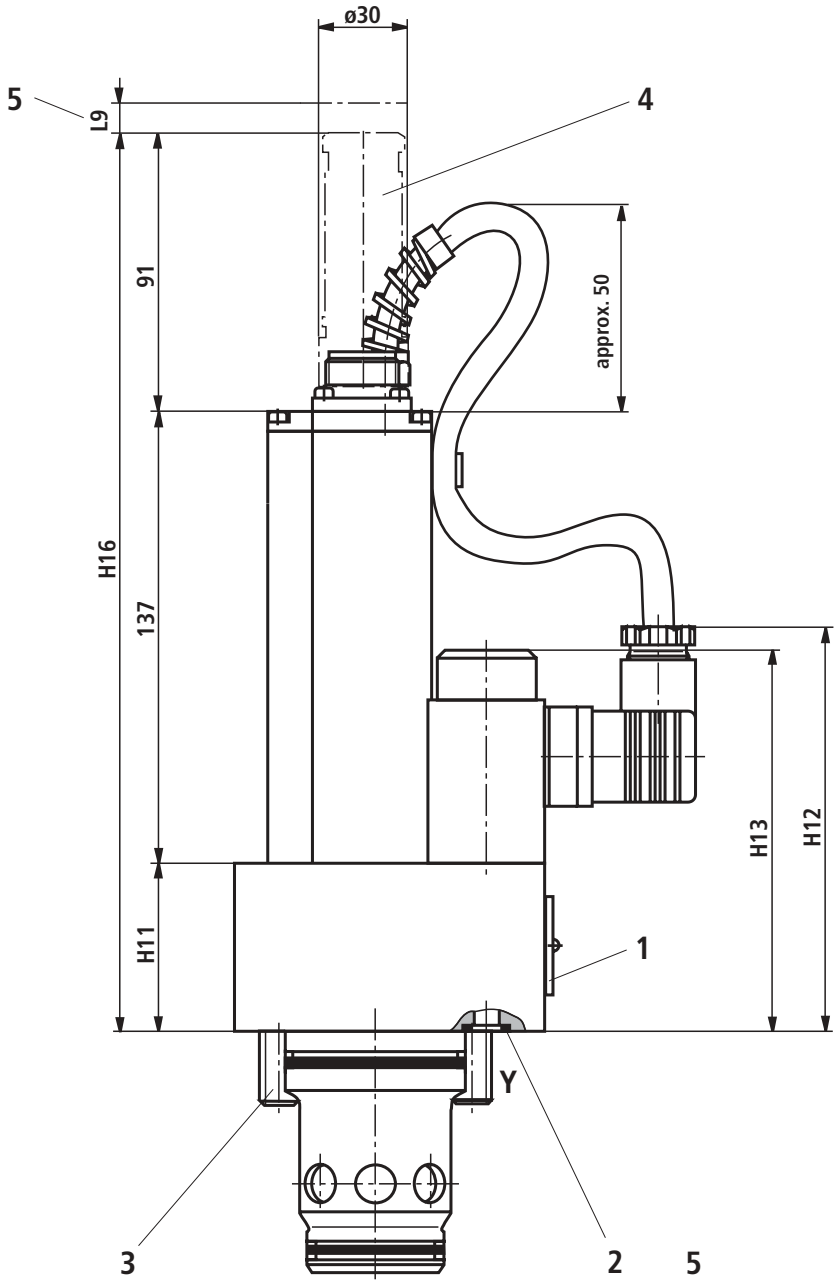
4 Plug-in connector for the proportional solenoid, separate order, see page 6

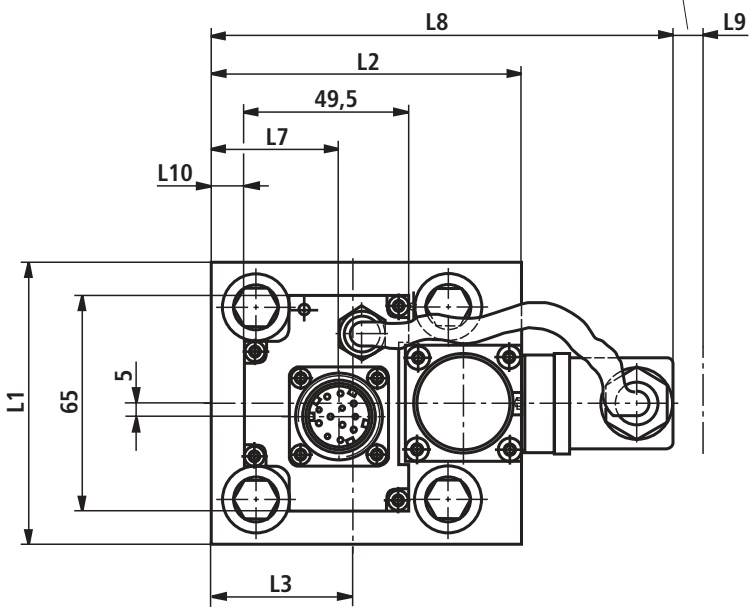
5 Plug-in connector for the inductive position transducer, separate order, see page 6

6 Space required to remove the plug-in connector

Unit dimensions: type FESE (dimensions in mm)

NS	25	32	40	50	63
H11	51	63	62	73	90
H12	116	128	127	138	155
H13	110	122	121	132	149
H16	279	291	290	301	318
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51.25	63	70	90
L7	38.5	51.25	63	66	86
L8	139	150	169	184	219
L9	15	15	15	15	15
L10	10	18.75	30.5	37.5	57.5





1 Name plate

2 Identical seal rings for ports X and Y

3 4 off valve fixing screws DIN 912-10.9 (are included within the scope of supply):
- NS 25: M12 x 60, Tightening torque M_A = 75 Nm
- NS 32: M16 x 75, Tightening torque M_A = 170 Nm
- NS 40: M20 x 80, Tightening torque M_A = 350 Nm
- NS 50: M20 x 90, Tightening torque M_A = 380 Nm
- NS 63: M30 x 100, Tightening torque M_A = 1200 N

4 Plug-in connector, separate order, see page 7

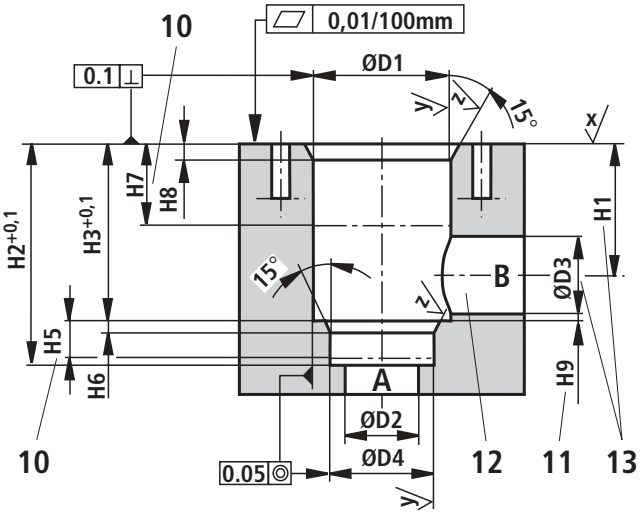
5 Space required to remove the plug-in connector

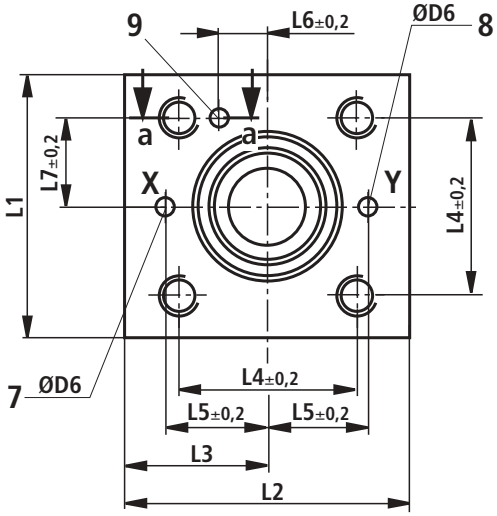
Cavities (dimensions in mm)

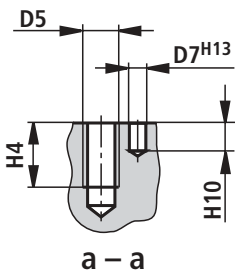
Cavity dimensions to DIN ISO 7368					
NS	**25**	**32**	**40**	**50**	**63**
Ø D1 H8	45	60	75	90	120
Ø D2	25	32	40	50	63
Ø D3	25	32	40	50	63
max. Ø D3	32	40	50	63	80
Ø D4 H8	34	45	55	68	90
D5	M12	M16	M20	M20	M30
max. Ø D6	6	8	10	10	12
Ø D7 H13	6	6	6	8	8
H1	44	52	64	72	95
H1 1)	40.5	48	59	65.5	86.5
H2	72	85	105	122	155
H3	58	70	87	100	130
H4	25	35	45	45	65
H5	12	13	15	17	20
H6	2.5	2.5	3	3	4
H7	30	30	30	35	40
H8	2.5	2.5	3	4	4
min. H9, (control dim.)	1	1.5	2.5	2.5	3
min. H10	8	8	8	8	8
L1	85	102.5	126	140	180
L2	93.5	102.5	126	140	180
L3	42.5	51.25	63	70	90
L4	58	70	85	100	125
L5	33	41	50	58	75
L6	16	17	23	30	38
L7	29	35	42.5	50	62.5

1) Centre of hole at a max. ØD3

NS	Cavities to DIN ISO 7368
25	ISO 7368-BB-08-2-A
32	ISO 7368-BC-09-2-A
40	ISO 7368-BD-10-2-A
50	ISO 7368-BE-12-2-A
63	ISO 7368-BF-12-2-A







$\sqrt{x} = \sqrt{R_{max}\,4}$

$\sqrt{y} = \sqrt{R_{max}\,8}$

$\sqrt{z} = \sqrt{R_z\,10}$

7 Port X
8 Port Y
9 Locating pin hole
10 Depth of fit
11 Control dimension
12 Port B can be arranged at random about the middle axis of port A. Care has, however to be taken to ensure that the fixing holes and control bores are not damaged.
13 If the diameter for port B is different from that stated, then the distance from the control cover mounting surface to the hole centre line has to be calculated.

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