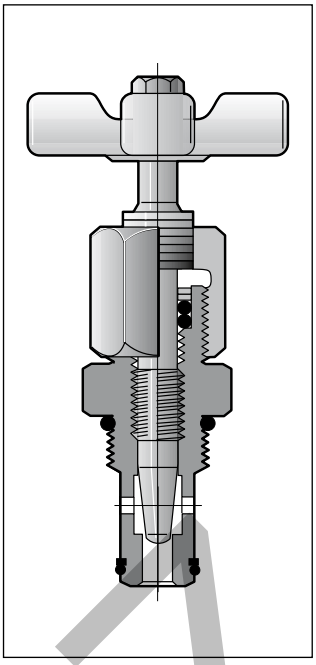
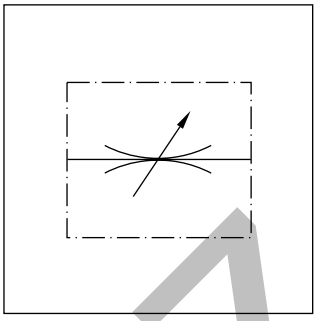
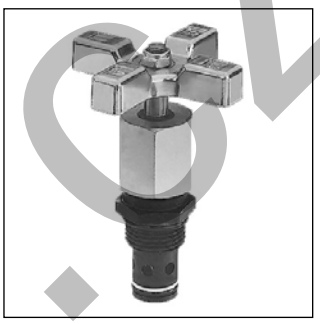
5

More flow valves are presented in the following chapters:
Chapter 7: Sandwich Valves
Chapter 8: Slip-In Cartridge Valves
Chapter 9: SAE Flange Valves
Chapter 10: Valves for Pipe Mounting

Manatrol needle valve with steel body as screw-in valve for block insertion, optionally with a 30° taper fine V-notch or micro-fine rectangular slot. The form of the metering opening influences the accuracy of the flow adjustment, which is pressure and viscosity dependent. The needle is made of stainless steel and fits into a ring gap in the valve cartridge. For details of cutting tools for reaming the block bore, see 'Accessories' at the end of this chapter.







Characteristic values

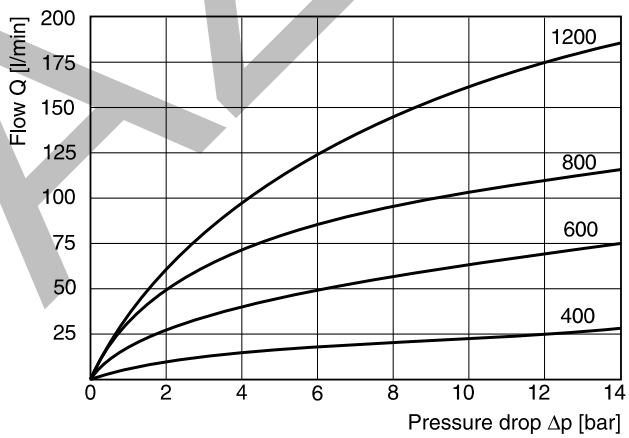
Size	Operating press. [bar]	Flow [l/min] Δp 10 bar	Max. orifice area [cm²]	Kv factor valve	Weight [kg]
400	350	25	0.14	6.3	0.18
600	350	65	0.37	18.5	0.32
800	350	105	0.55	27.5	0.59
1200	350	160	0.90	45.7	0.95
Needle size					
400-2		11	0.52		
400-3		2	0.012		

5

$$\text{Flow rate } Q \text{ [l/min]} = Kv \cdot \sqrt{\frac{\Delta p}{\gamma}}$$

Kv see table
Δp [bar]
γ [kg/dm³] = specific gravity of fluid
(γ for mineral oil = 0.85 – 0.9)

Δp/Q curves



All characteristic curves measured with HLP46 at 50 °C.

Ordering code

MVI	☐	S	☐	☐
Cartridge-type needle valve	Size and screw-in threads	Steel body	Needle	Seal

Code	Size	Threads
400	**1/4"**	**3/4 - 16 UNF-2B**
600	**3/8"**	**7/8 -14 UNF-2B**
800	**1/2"**	**1 1/16 - 12 UN-2B**
1200	**3/4"**	**1 5/16 - 12 UN-2B**

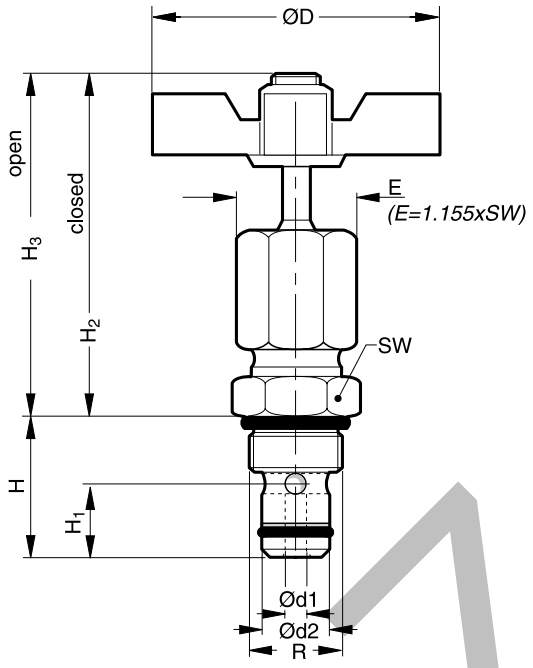
Code	Seal
omit	**NBR**
V	FPM

Code	Needle
omit	**Standard 30° taper**
2 [1]	Fine V-notch
3 [1]	Micro-fine slotted

Bold letters =
Short-term availability

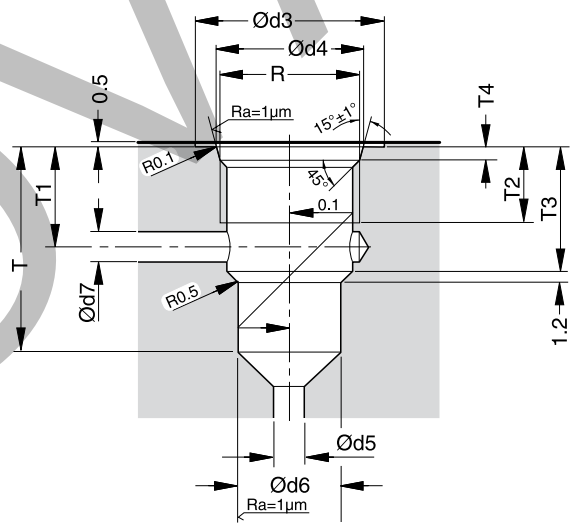
[1] Only for size 400.

Threaded cartridge valve



Size	H	H3	H2	H1	Ød1	Ød2	R (Threads)	ØD	SW
MVI 400	25.4	65	60	10.9	4.6	14.22	3/4 - 16 UNF-2	51	22.1
MVI 600	30	81	73	13.5	7.9	15.8	7/8 - 14 UNF-2	64	25.4
MVI 800	39.6	91	79	15.2	9.4	20.55	1 1/16 - 12 UN-2	83	31.8
MVI 1200	43.4	102	88	19.1	11.7	26.92	1 5/16 - 12 UN-2	98	38.1

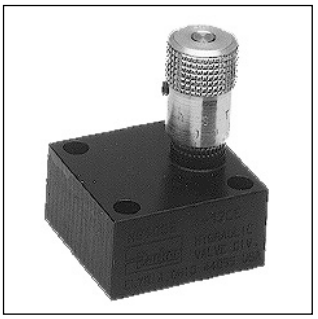
Mounting cavity

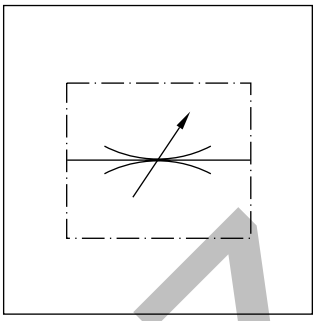


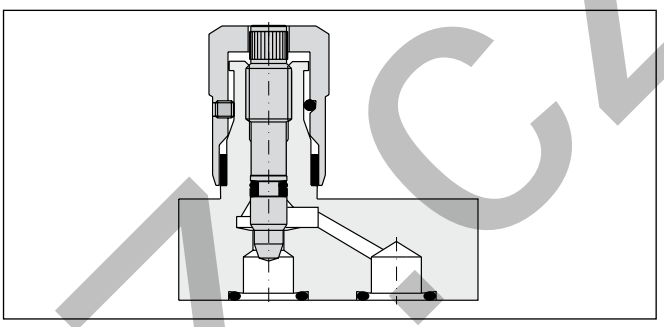
Size	Ød3	Ød4$^{+0.12}$	Ød5 (min)	Ød6$^{+0.05}$	Ød7	T4$^{+0.38}$	T2	T3	T	T1
MVI 400	26	20.6	5.3	14.275	5.3	2.54	15	17.8	27	14.2
MVI 600	30	23.93	8.1	15.85	8.1	2.54	17	21.6	32	16.5
MVI 800	37	29.16	10.2	20.6	10.2	3.3	19	30	42	24.1
MVI 1200	44	35.54	12.7	26.975	12.7	3.3	19	31.8	46	24.6

Manatrol shut-off and metering valves with 2 stage needle cone. Fine adjustment for the first stage can be achieved with 3 rotations of the adjustment knob. The second stage with normal throttle characteristics is achieved with 3 further rotations.

A cylindrical needle with a rectangular slot is provided to reduce the viscosity effect for sizes 400 and 600. The flow is dependent on pressure and viscosity.







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Characteristic values
(only for standard 2 stage needle)

Size	Press. [bar] steel	brass	Flow [l/min] Δp 10 bar	Max. cross-section [cm²]	Kv factor valve open	Weight [kg]
400	210	140	25	0.13	6.3	0.4
600	210	140	40	0.22	11.2	0.6
800	210	140	50	0.28	13.9	1.0
1200	210	140	120	0.70	35.4	2.0
1600	210	35	250	1.48	75	4.0

$$\text{Flow rate } Q \text{ [l/min]} = Kv \cdot \sqrt{\frac{\Delta p}{\gamma}}$$

Kv — from the table
Δp [bar]
γ [kg/dm³] = specific weight of the medium
(γ for mineral oil = 0.85 – 0.9)

Ordering code

N	S		S				
Needle valve	Subplate mounting	Size	Steel body	Needle	Clamping screw	Seal

Code	Size
400	**400**
600	**600**
800	**800**
1200	**1200**
1600	1600

Code	Needle
omit	**Standard 2 stage needle**
4 [1]	Micro-fine hollow needle with slot

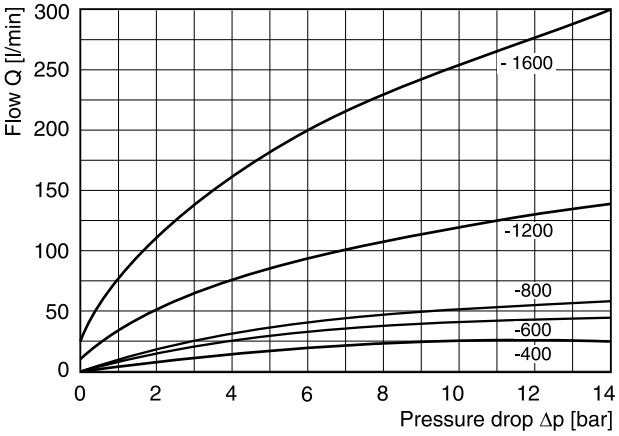
Code	Seal
omit	**NBR**
V	FPM

Code	Clamping screw
omit	**Hexagon socket**
F	With knurled knob

Bold letters =
Short-term availability

[1] Only for sizes 400 to 600.

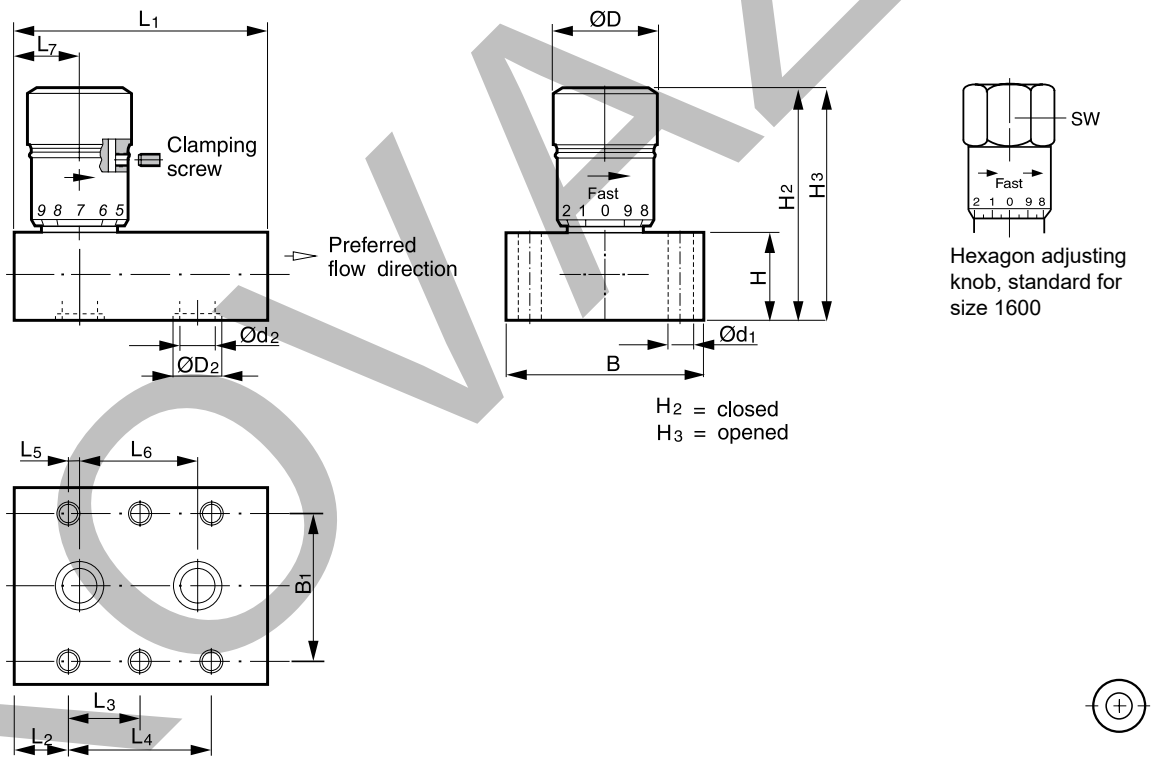
Δp/Q curves



All characteristic curves measured with HLP46 at 50 °C.

5

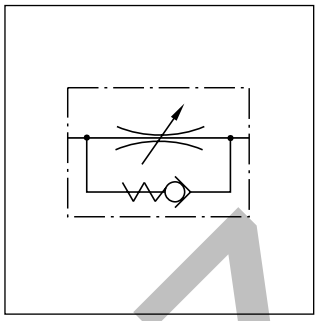
Dimensions

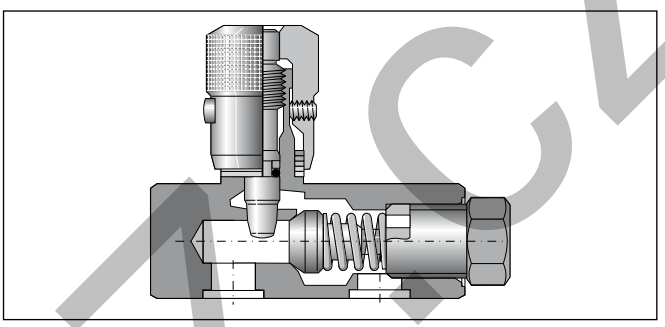


Size	L1	L2	L3	L4	L5	L6	L7	B	B1	H	H2	H3	Ød1	Ød2	ØD2	ØD	SW
NS400	47.8	6.4	–	34.7	4.8	25.4	11.2	44.5	33.3	22.4	49.5	54.6	6.8	7.1	13.3	20.6	–
NS600	50.8	8.6	–	33.6	4.1	25.4	12.7	50.8	38.1	25.4	61.0	67.3	7.0	8.6	16.0	25.4	–
NS800	75.4	18.5	–	38.1	4.1	30.2	22.6	57.2	44.4	25.4	70.0	77.2	7.0	11.9	19.1	30.0	–
NS1200	93.7	8.6	38.1	76.2	11.2	54.4	19.8	69.9	54.1	28.4	79.3	94.5	9.5	16.8	24	34.8	–
NS1600	111.3	7.9	47.8	95.3	19.0	57.2	26.9	76.2	60.4	44.5	123.2	140.0	9.5	22.4	32	–	47.5

Manatrol throttle check valves series FS allow the adjustment of the flow for a defined direction.

A 2 stage needle allows for very exact setting of smaller flow rates with the first 3 rotations of the adjustment knob. After 3 more rotations, the valve is completely open. The valve setting can be locked by a locking screw.





Flow rate Q [l/min] = Kv · $\sqrt{\frac{\Delta p}{\gamma}}$

Kv	from the table
Δp [bar]	
γ [kg/dm³]	= specific gravity of fluid
(γ for mineral oil	= 0.85 – 0.9)

5

Characteristic values

		Δ					
400 [1]	210	25	0.37	18.6	0.13	6.3	0.23
600 [1]	210	40	0.62	30.4	0.22	11.2	0.31
800 [1]	210	50	0.86	43.4	0.28	14	0.67
1200 [1]	210	120	1.18	60	0.70	35.4	1.17
1600 [1]	210	250	2.23	111	1.48	75	2.31

[1] $MTTF_D$ value 150 years

Ordering code

F	S		S			
Throttle and check valve	Subplate mounting	Size	Steel body	Needle	Clamping screw	Seal

Code	Size
400	**400**
600	**600**
800	**800**
1200	**1200**
1600	1600

Code	Seal
omit	**NBR**
V	FPM

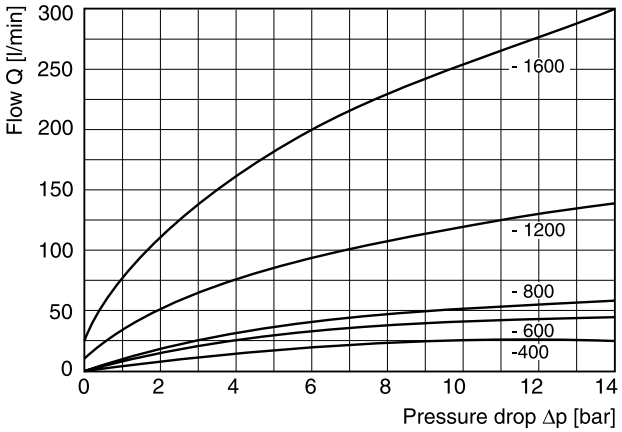
Code	Clamping screw
omit	**Hexagon socket**
F	With knurled knob

Code	Needle
omit	**Standard 2 stage needle**
4 [1]	Micro-fine hollow needle with slot

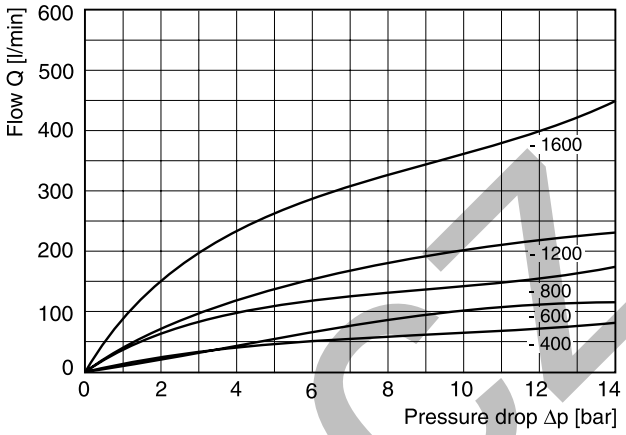
[1] Only for sizes 400 to 600.

Bold letters =
Short-term availability

Δp/Q performance curves



Δp/Q performance curves free flow



All characteristic curves measured with HLP46 at 50 °C.

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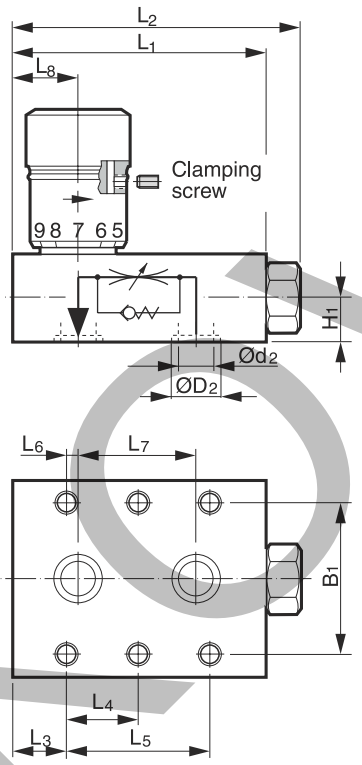
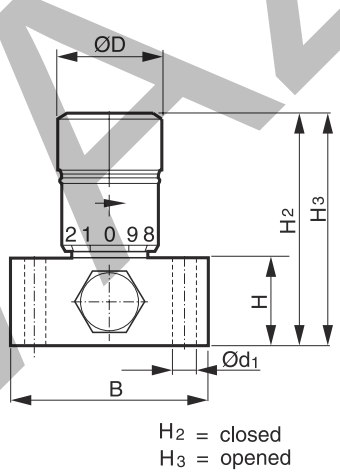
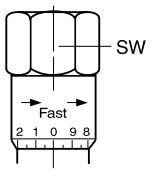
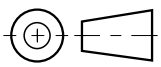
Dimensions





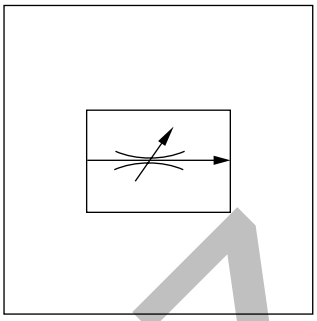


Hex head adjusting knob Standard for Size 1600



Size	L1	L2	L3	L4	L5	L6	L7	L8	B	B1	H	H1	H2	H3	Ød1	Ød2	ØD2	ØD	SW
FS400	63.5	71.4	14.2	–	35.1	4.9	25.4	21.3	44.5	33.3	22.1	10.9	51.1	56.1	6.8	7.1	13.3	20.6	–
FS600	69.9	78.0	18.3	–	33.3	4.1	25.4	25.4	50.8	38.1	25.4	12.7	61.0	67.3	7.0	10.4	16	25.4	–
FS800	81.0	89.2	21.3	–	38.1	4.1	30.2	30.7	57.2	44.5	31.8	15.7	76.2	83.6	7.0	11.9	19.1	30.0	–
FS1200	103.9	114.6	14.0	38.1	76.2	11.2	54.1	38.6	69.9	54.1	44.5	22.1	95.5	110.5	9.0	16.8	24	34.8	–
FS1600	127.0	137.7	15.7	47.8	95.5	19.3	56.9	45.2	76.2	60.5	50.8	25.4	129.5	146.3	9.0	22.4	32	–	47.5

Manatrol 2-way flow control valves for pressure compensated regulation of the flow. As a consequence of pressure changes, the set value can vary by ± 5 % within the tolerance range. Changes in viscosity and in temperature have the same effect and are to be observed.



Characteristic values

Size	Max. press. [bar]	Flow control		Weight [kg]
		Q[1] [l/min]	Δp [bar]	
400	210	1 - 10	7	0.77
600	210	2 - 25	7	1.23
800	210	6 - 60	11	2.50
1200	210	10 - 100	11	3.18
1600	210	19 - 190	11	7.41

Ordering code

PC	M	S	☐	S	☐	☐	⌜⌝
Pressure compens. flow control valve	Manual adjustment	Subplate mounting	Size	Steel body	Clamping screw	Seal	Design series (not required for ordering)

Code	Nominal size
400	400
600	**600**
800	**800**
1200	1200
1600	1600

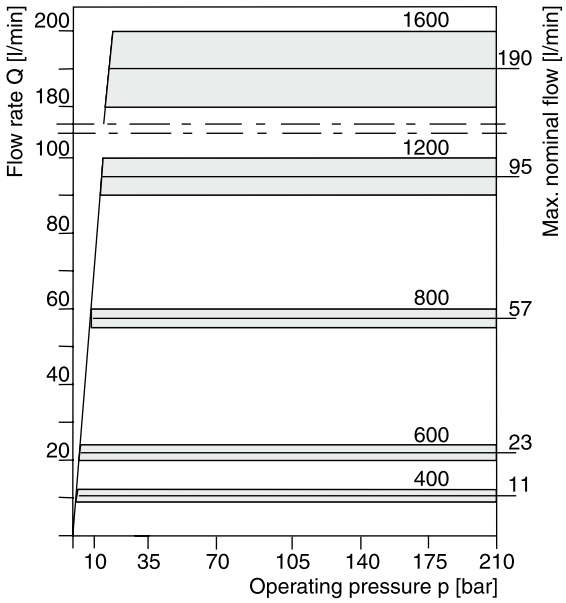
Code	Seal
omit	**NBR**
V	FPM

Code	Clamping screw
omit	**Hexagon socket**
F	With knurled knob

Bold letters =
Short-term availability

[1] Min. and max. flow rate.

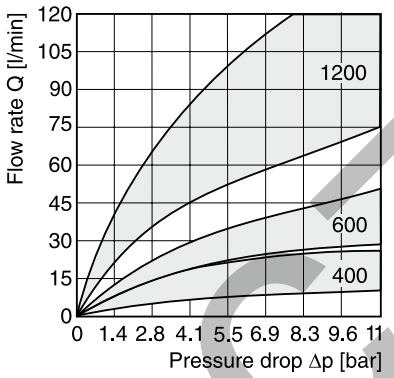
Controlled flow vs. pressure drop



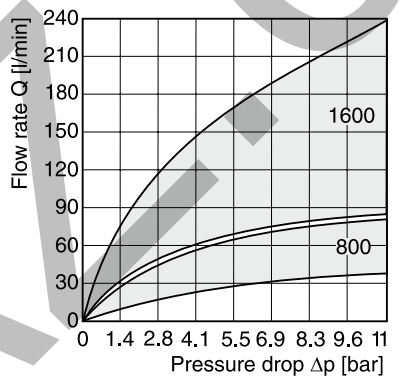
All characteristic curves measured with HLP46 at 50 °C.

Reverse flow vs. pressure drop at minimum and maximum settings

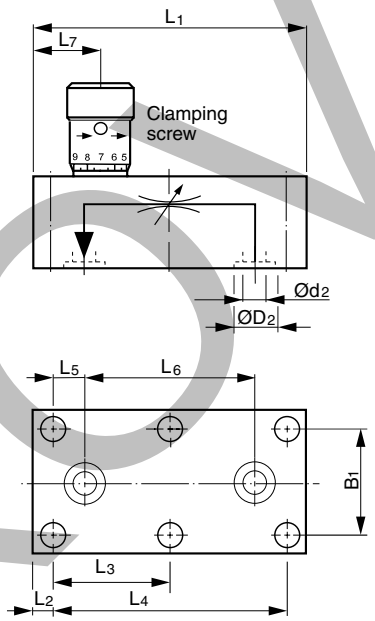
Sizes 400, 600 and 1200

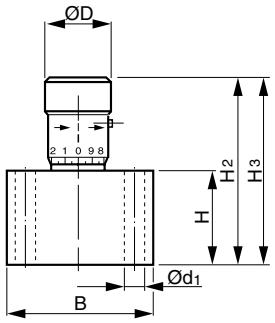


Sizes 800 and 1600

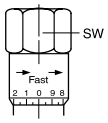


Dimensions





H_2 = closed
H_3 = opened

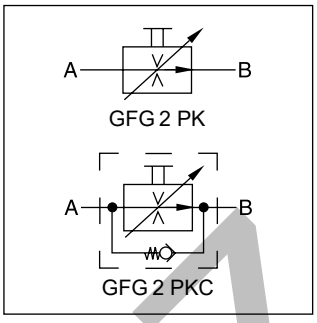


Hexagon adjusting knob, standard for size 1600

Size	L1	L2	L3	L4	L5	L6	L7	B	B1	H	H2	H3	Ød1	Ød2	ØD2	ØD	SW
400	85.9	6.4	–	72.8	9.3	54.2	21.3	44.5	33.3	28.4	57.7	62.7	6.8	7.1	13.3	20.6	–
600	101.6	6.4	–	88.9	10.4	68.0	25.4	50.8	38.1	31.8	67.8	73.4	7.0	8.6	16.0	25.4	–
800	117.3	6.4	–	104.9	12.7	79.5	44.5	57.2	44.4	44.5	95.0	102.6	7.0	11.9	19.1	30.0	–
1200	142.7	9.7	61.7	123.7	15.7	91.9	40.4	69.9	54.1	57.2	115.8	128.5	9.5	16.8	24.0	34.8	–
1600	171.5	12.7	73.2	146.1	19.1	107.9	49.3	76.2	60.4	69.9	158.2	175.3	9.5	22.4	32.0	–	47.5

2-way flow control valves series GFG2 are used to provide pressure compensated flow. The valve design compensates temperature variations to a certain extent.

The GFG is optionally equipped with a built-in check valve for the return flow.



Design

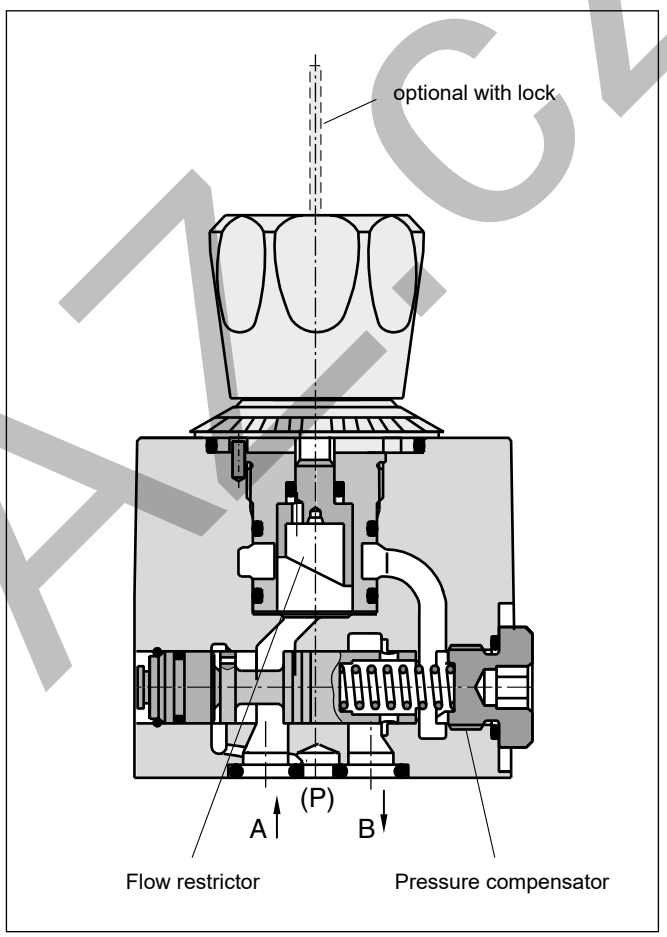
The 2-way flow control valves are used with a triangular flow restrictor and a subsequent pressure compensator. The setting of the flow rate can be locked by a cylinder lock in the adjusting knob against unauthorized adjustment (option S).

Function

The fluid enters through port A through the flow restrictor. Downstream of the flow restrictor the pressure compensator is located. The control edges are provided by four radial bores in the poppet, which are fully open to port B in the neutral position.

Optionally the flow from A to B can be blocked by external pilot pressure applied to port P (option X). This can be used to avoid unintended initial movements of actuators.

The flow adjustment is done via the hand knob with an adjusting angle knob of 270°.



Features

- Flow rate independent of pressure and temperature
- Available for 7 different flow rates
- Good fine adjustment
- External port (P) to block flow from A to B
- Optional reverse flow check valve
- Turn knob with cylinder lock (option S)

Note

Rectifier plate and subplates see 'Accessories' at the end of this chapter.

Ordering code

GFG	2	PK					– 10		–	
2-way flow control valve	Nominal Size NG06	Pressure compensated	Check valve	Locking option	Flow	Seal		Pilot port		Design series (not required for ordering)

Code	Check valve
omit	**Without check valve**
C	**With check valve**

Code	Locking option
omit	**Standard without lock**
S	**With cylinder lock**

Code	Flow [l/min]
0.6	**0.015 to 0.6**
1.0	**0.015 to 1.0**
1.6	**0.015 to 1.6**
3.2	**0.025 to 3.2**
6.3	**0.025 to 6.3**
12	**0.080 to 12.0**
18	**0.080 to 18.0**

Code	Control of the pressure compensator
omit	**Standard internal**
X [1)]	External

Code	Seal
omit	**NBR**
V	FPM

Bold letters =
Short-term availability

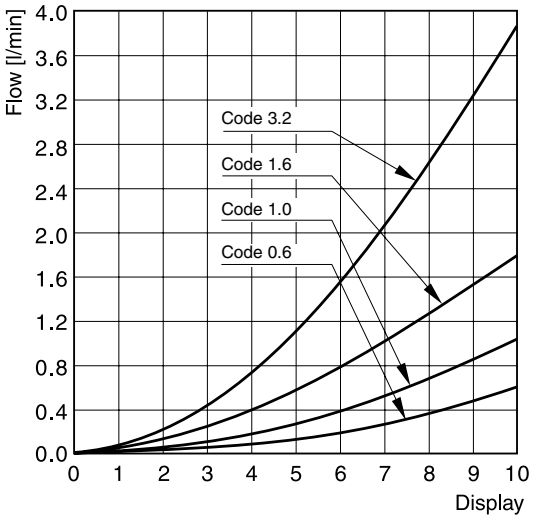
[1)] Only in combination with integrated check valve.

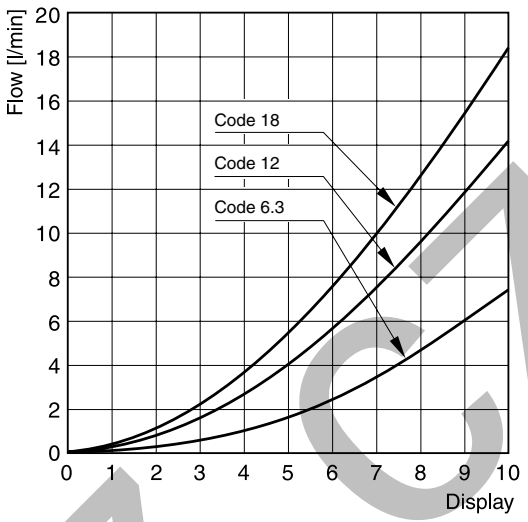
5

Technical data

Design		Orifice, infinitely variable, pressure-compensated
Actuator		Manual flow rate adjustment
Mounting type		ISO 6263 code: ISO 6263-AB-03-4-B
Mounting position		unrestricted
$MTTF_D$ value	[years]	150
Weight	[kg]	1.1 (without subplate)
Ambient temperature	[°C]	-20...+60
Fluid		Hydraulic oil according to DIN 51524
Fluid temperature	[°C]	-20...+70 (NBR: -25...+70)
Viscosity, permitted recommended	[cSt] / [mm²/s] [cSt] / [mm²/s]	20 ... 400 30 ... 80
Filtering		ISO 4406 (1999); 18/16/13
Min. pressure difference	[bar]	5 (GFG*1.6/3.2), 8.5 (GFG*6.3/12/18)
Operating pressure	[bar]	A; B = 315 , P = 5 (GFG*, GFG*C), A, B, P = 160 (GFG*X)
Effect of pressure on Q_{max} at p = 160 bar	[%]	± 2 (GFG*1.6/3.2/6.3/12), ± 2.5 (GFG*18)
Flow direction A → B B → A		 Flow control function Throttle function or free flow through check valve

Performance curves





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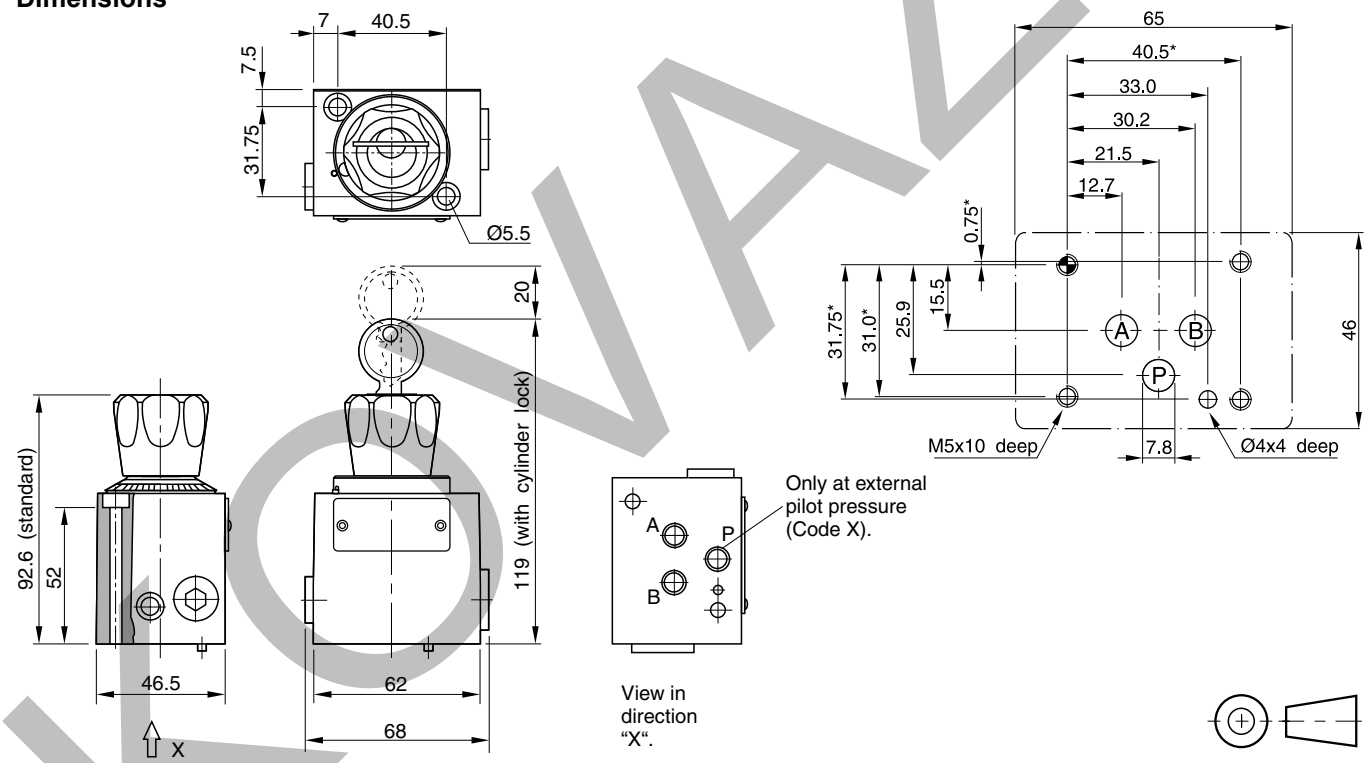
All characteristic curves measured with HLP46 at 50 °C.

Changes in pressure cause a change of pre-set flow rate. Flow rate deviations at Q_{max}: ± 2 %

Dimensions



Bolt kits (Cylinder head ISO 4762-12.9 not included)

Nominal size Valve	Valve model	Quantity	Tightening torque [Nm]	Valve without rectifier plate		Valve with rectifier plate	
				Dimensions	Order No.	Dimensions	Order No.
NG06	GFG2	2	7.6 Nm	2x M5x60	BK380	2x M5x100	BK466

O-rings for sealing the connecting surface

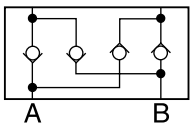
Nominal size Valve	Valve model	Ports	Dimensions Ø-inner x cord thickness	Quantity	Seal kits	
					NBR	FPM
NG06	GFG2	A and B	9.25 x 1.78	3	SK-GFG2	SK-GFG2 FPM

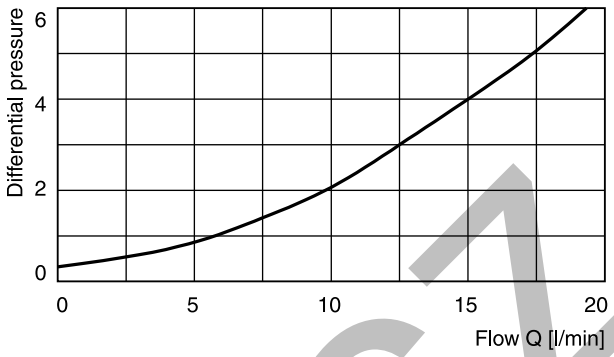
Sandwich rectifier plate

If a 2-way flow control valve is used in combination with a rectifier plate the valve can be used for meter-in and meter-out flow control of an actuator.

Design

The intermediate rectifier plate is designed with 4 identical, symmetrically arranged check valves. Thus the differential pressure is the same in both flow directions.





Measured with HLP46 at 50 °C.

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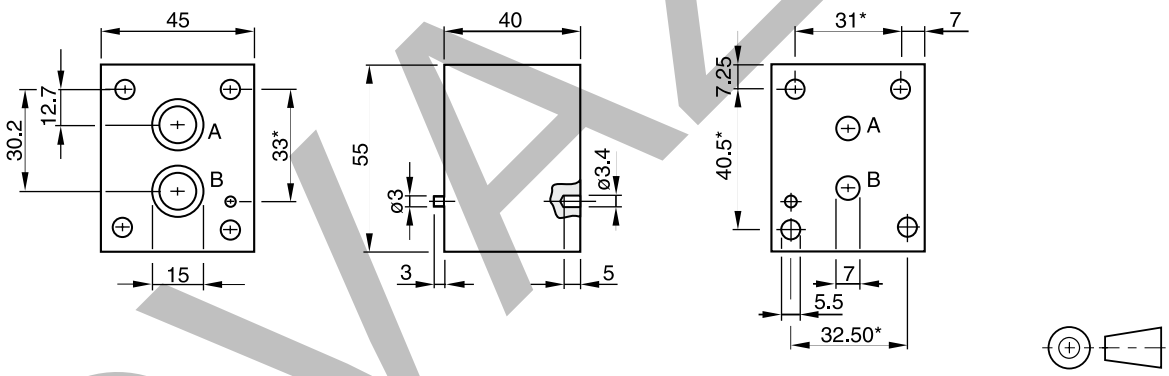
Dimensions



Dimension tolerances
* : ± 0.1mm
others : ± 0.2 mm
holes and silhouette of valve body : untoleranced dimension

Ordering code: HR OA 06 C

O-ring for sealing the connecting surface

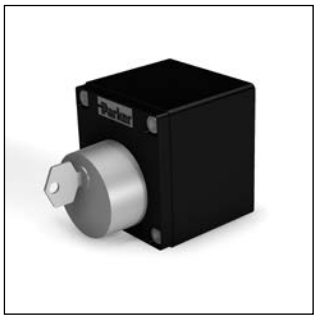
Connections	Dimensions	required units
A, B	12 x 1.5	2

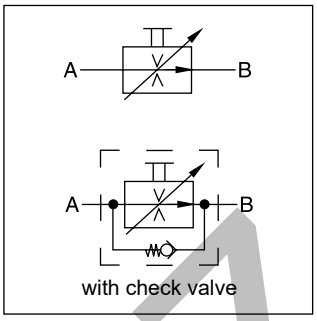
Subplates [1)]

Ordering code	
SPD 22 B 910	P, A, B and T = G1/4
SPD 23 B 910	P, A, B and T = G1/8

[1)] Details see chapter 12, series SPD.

2-way flow control valves series 2F1C provide pressure and viscosity compensated flow from port A to port B. The counter direction is blocked (standard) or can be open via an integral reverse flow check valve (optional).





Function

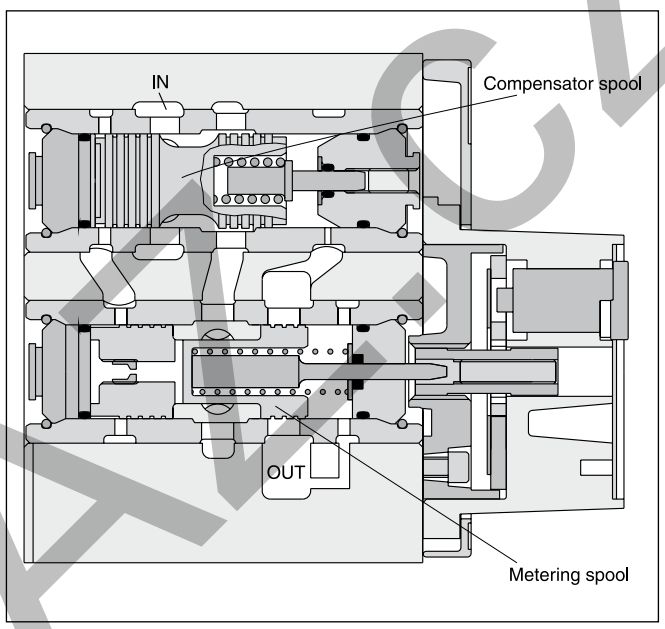
The compensator spool is located in front of the metering spool. The metering spool is closed in the neutral position to avoid undesired initial actuator motion. The oil flow to open the metering spool has to pass a needle valve (not shown in the sectional drawing). The needle valve can be adjusted from the front panel to set the response time of the 2F1C.

The metering spool is adjusted by the main control knob. The key lock has three positions:

Lock: Adjustment is locked.

Adjust: Full adjustment is permitted.

Trim: Fine adjustment of ±5 % is possible.



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Features

- 2-way flow control valve
- Subplate mounting according to ISO 6263
- Excellent fine adjustment
- Adjustable response time
- Closed in neutral position
- Optional reverse flow check valve
- 2 sizes, NG10 (3/8“), NG16 (3/4“)

Ordering code

2F1C	☐	–	01	B	5	☐	☐
2-way flow control valve	Size		Adjustment knob with lock	Design series	Seal FPM	Reverse flow check	Options

Code	Size
02	NG10 (3/8”)
03	NG16 (3/4”)

Code	Check valve
0	without check
C	with check

General				
Design			Orifice, infinitely variable, pressure-compensated	
Actuator			Manual flow rate adjustment	
Mounting type			ISO 6263	
Mounting position			unrestricted	
$MTTF_D$ value		[years]	150	
Weight		[kg]	6.0 (2F1C02), 9.0 (2F1C03)	
Ambient temperature		[°C]	-20...+60	
Fluid			Hydraulic oil according to DIN 51524	
Fluid temperature		[°C]	-20...+70	
Viscosity,	permitted	[cSt] / [mm²/s]	20 ... 400	
	recommended	[cSt] / [mm²/s]	30 ... 80	
Filtering			ISO 4406 (1999); 18/16/13	
Min. pressure difference		[bar]	see diagram	
Max. operating pressure			**2F1C02**	**2F1C03**
	Port A	[bar]	14...280	14...350
	Port B	[bar]	0...270	0...340
Flow direction				
	A → B		Flow control function	
	B → A		blocked or free flow through check valve	

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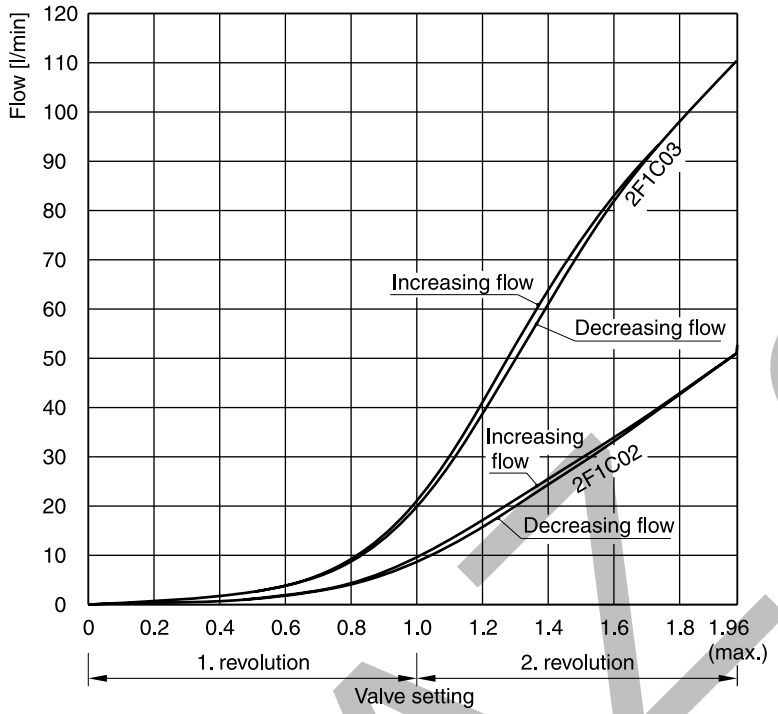
Performance curves

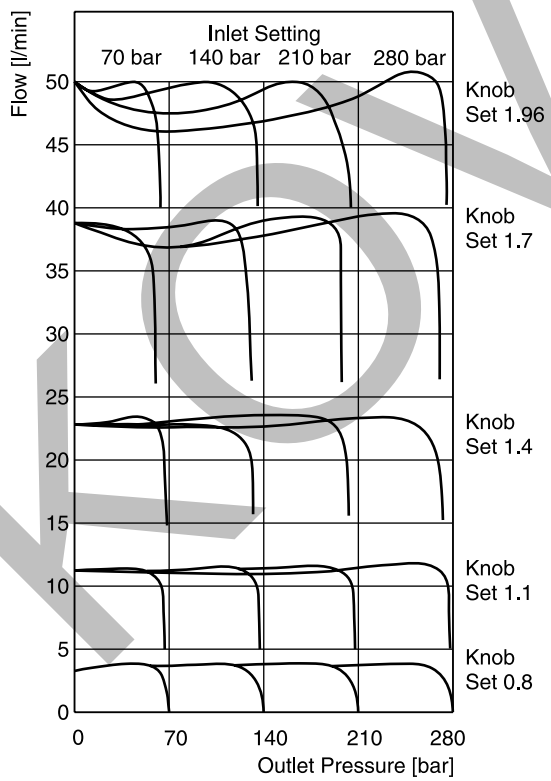
Flow / knob adjustment characteristics at 210 bar



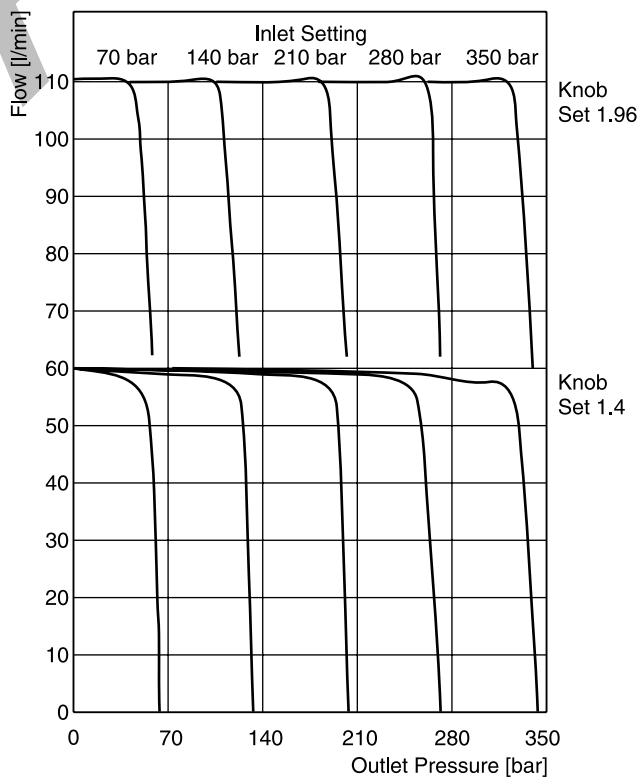
Flow / pressure drop curves

Constant inlet pressure – variable outlet pressure

2F1C02



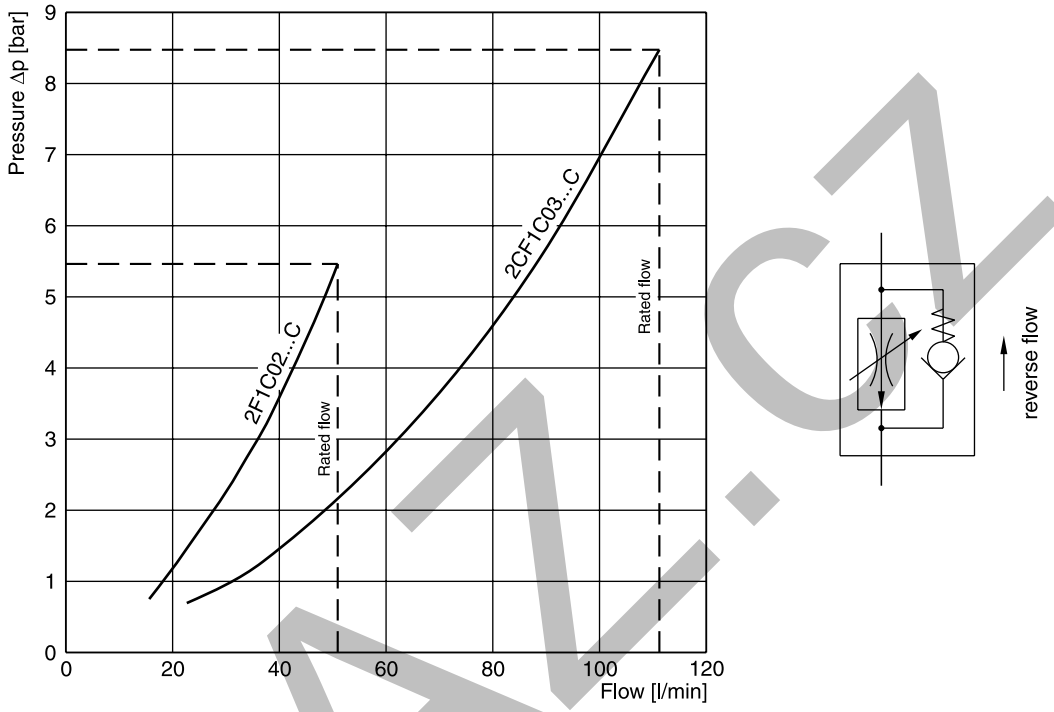
2F1C03



All characteristic curves measured with HLP46 at 50 °C.

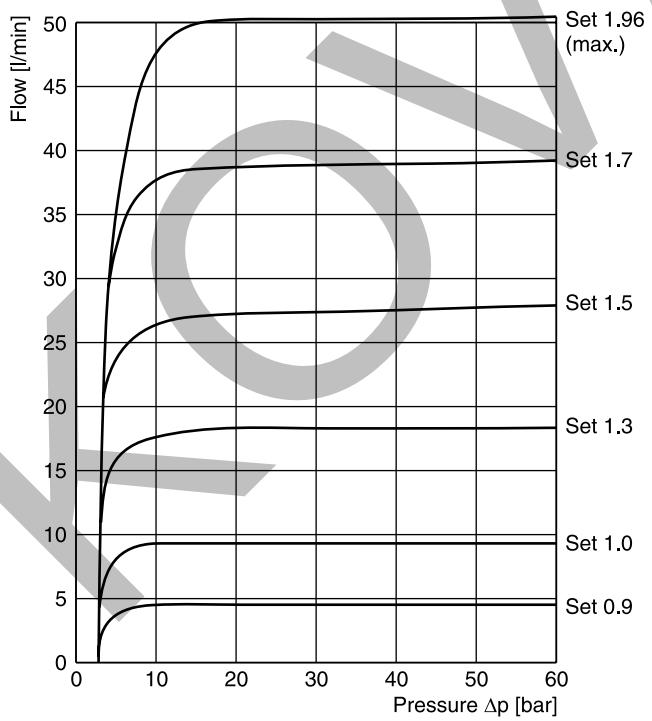
Δp/Q performance curves

for reverse flow direction
2F1C02 at 280 bar
2F1C03 at 350 bar

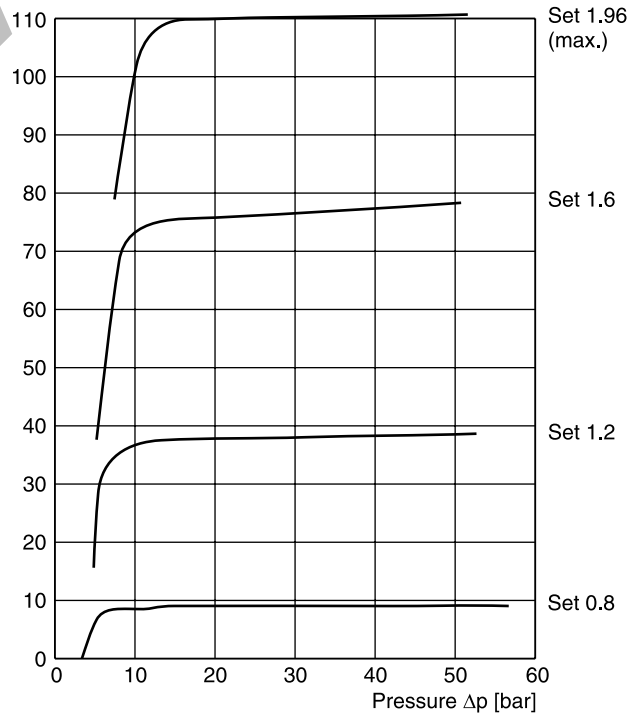


Minimum pressure difference curves

2F1C02



2F1C03



All characteristic curves measured with HLP46 at 50 °C.

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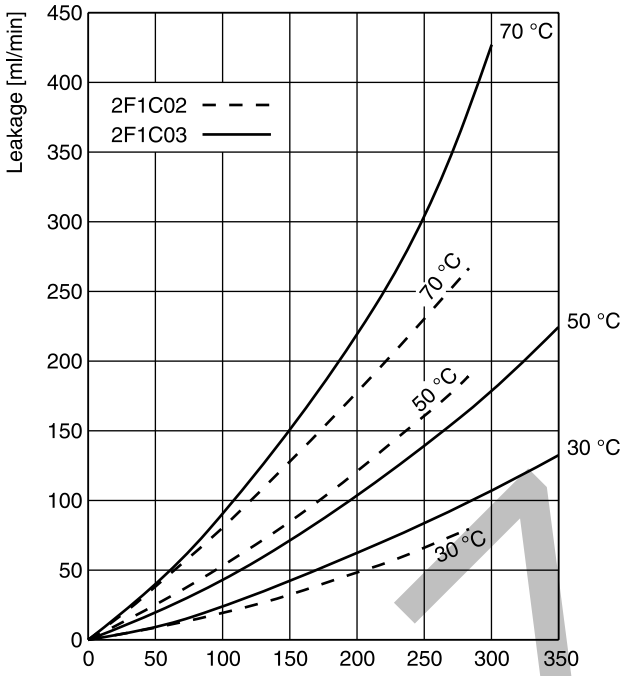
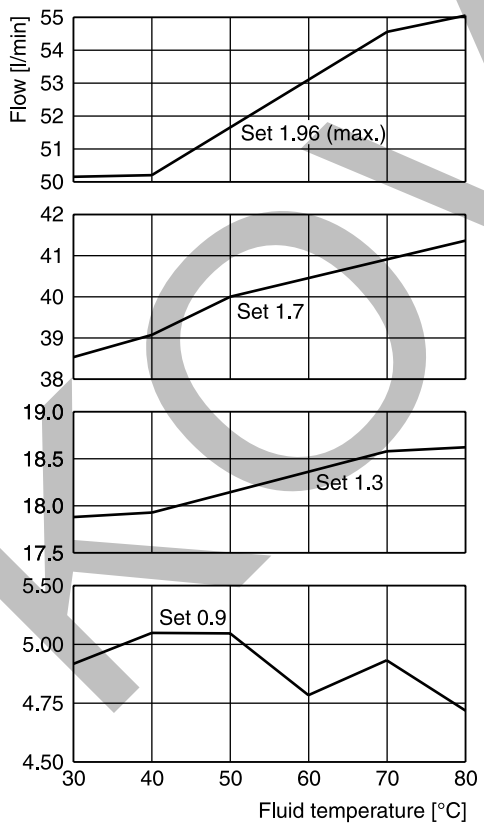
Leakage / pressure curves

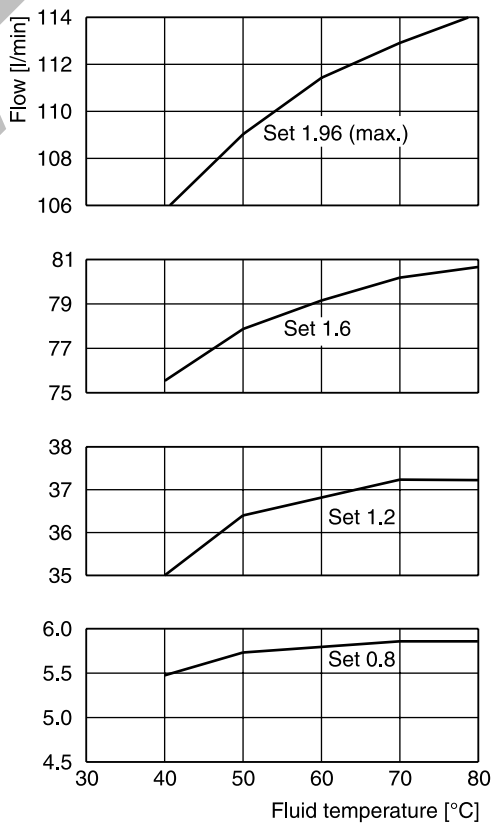


Flow / temperature curves at 210 bar

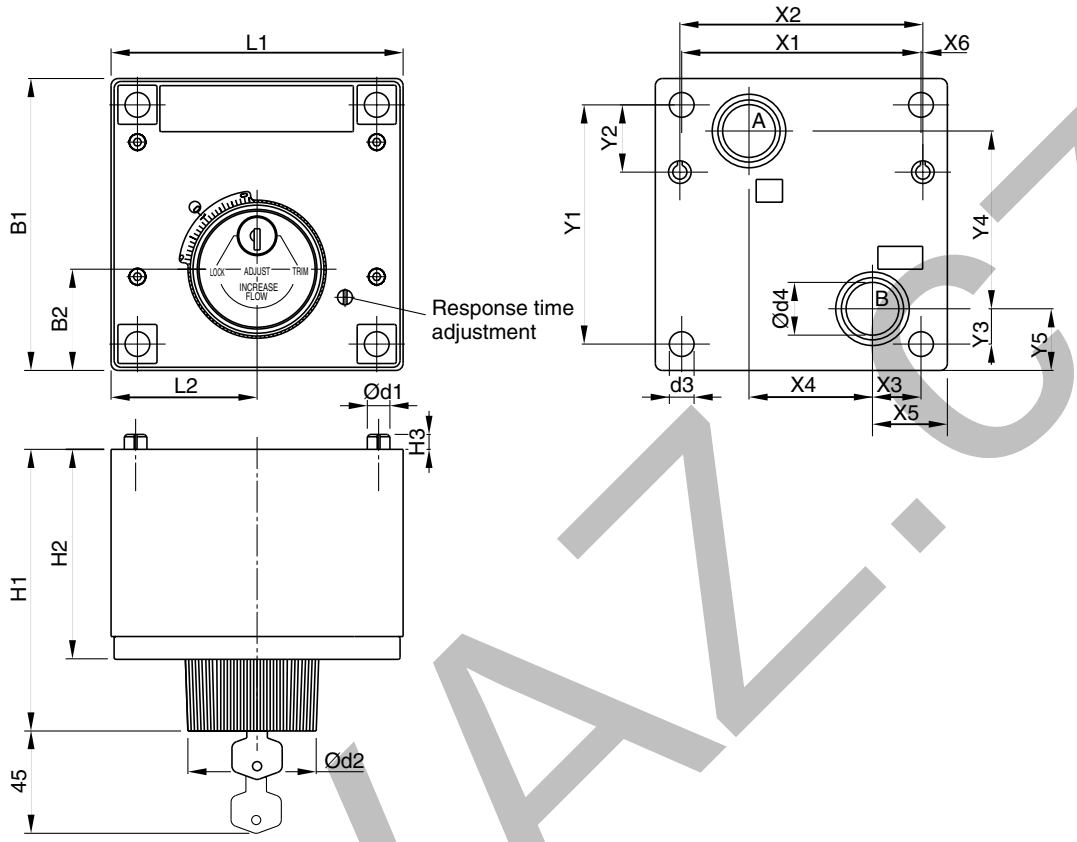
2F1C02



2F1C03



All characteristic curves measured with HLP46 at 50 °C.



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Size	ISO-code	x1	x2	x3	x4	x5	x6	y1	y2	y3	y4	y5
02	6263-AM-07-2-A	76.2	79.4	9.5	44.5	19	–	82.5	23.8	30.2	41.3	39.7
03	6263-AK-06-2-A	101.6	103.2	20.6	52.4	31.8	0.8	101.6	28.6	15.1	75.4	26.2

Size	ISO-code	B1	B2	H1	H2	H3	L1	L2	d1	d2	d3	d4
02	6263-AM-07-2-A	101.6	38.1	119.6	87.4	6.4	95.2	47.6	6.4	57.2	8.7	14.2
03	6263-AK-06-2-A	124	42.9	121.4	89.2	6.4	124	62	9.5	57.2	10.5	22.4

NG	ISO-code	Bolt kit - ISO 4762-12.9		Kit	Surface finish
02	6263-AM-07-2-A	BK538 4x M8x95	31.8 Nm ±15 %	on request	R_{max}6.3 ▱ 0.01/100
03	6263-AK-06-2-A	BK539 4x M10x95	63 Nm ±15 %		