



Flow valves

Contents

	Page
4.1 Throttle and throttle check valve, types MG/MK	0413-0416
4.2 Throttle and throttle check valve, types DV(P)/DRV(P)...10	0417-0424
4.3 Fine throttle valve, type F	0425-0430
4.4 Double throttle check valve, type Z2FS6...L4X	0431-0436
4.5 Double throttle check valve, type Z2FS6, 10, 16, 22	0437-0442
4.6 Flow control valve, type 2FRM6 and rectifier plate, type Z4S6	0443-0452
4.7 Flow control valve, type 2FRM5, 10, 16 and rectifier plate, type Z4S5, 10, 16	0453-0460
4.8 Flow control valve, types Z2FRM6 and 2FRM6K	0461-0468
4.9 Flow control valve, types Z2FRM10 and 2FRM10K	0469-0476
4.10 Check-Q-meter type FD...L2X	0477-0488



4.1

Throttle and throttle check valve

Type MG/MK

Sizes 6 to 30
Up to 315 bar
Up to 400 L/min



Contents

Function and configuration	02
Ordering code	02
Technical data	03
Characteristic curves	03
Unit dimensions	04

Features

- Suitable for direct in-line mounting
- Pressure and viscosity dependent

Function and configuration

Valve types MG and Mk are throttle and throttle check valves with viscosity and pressure dependent.

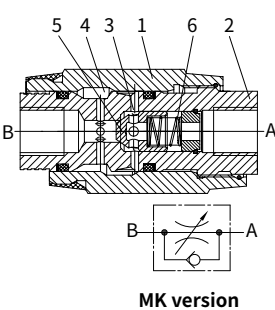
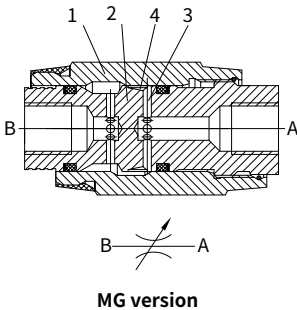
•Type MG (throttle valve)

This valve throttles in both flow directions. Fluid flows through side hole (3) to the throttling orifice (4) formed between the valve body (2) and the adjustable sleeve (1). The cross-section of throttling orifice (4) may be steplessly varied by rotating the sleeve (1).

•Type MK (throttle check valve)

In throttling direction, the spring (6) and the fluid presses the poppet (5) onto its seat, check valve is blocked. Fluid flows via the side hole (3) to the throttling orifice (4), formed between the valve body (2) and the adjustable sleeve (1).

In the opposite direction, fluid pressure acts on the face of the poppet (5), check valve is opened and fluid flows freely. At the same time, part of the fluid flowing through the annular groove gets self-clearance as the desired effect.



Ordering code

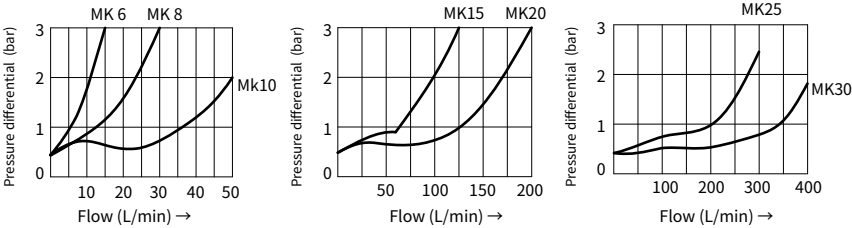
		G	1	2		*
						Further details in clear text
Throttle valve	=MG					No code = NBR seals
Throttle check valve	=MK					V = FKM seals
Nominal size 6	=6					Threaded connection
Nominal size 8	=8					G thread
Nominal size 10	=10					Metric thread
Nominal size 15	=15					
Nominal size 20	=20					
Nominal size 25	=25					
Nominal size 30	=30					
					1.2 =	1.2 series
					G =	Threaded connection

Technical data

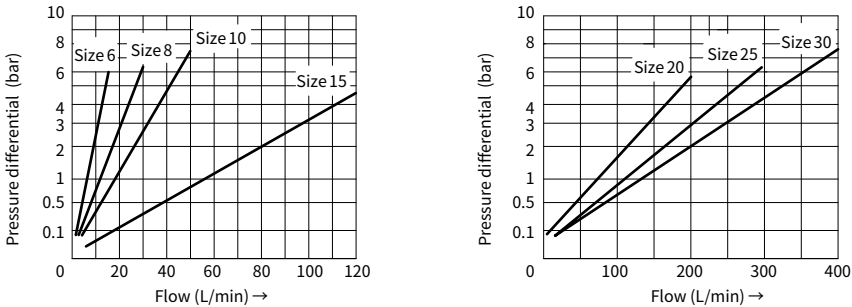
Size		6	8	10	15	20	25	30
Weight	kg	0.3	0.4	0.7	1.3	2.2	3.6	4.5
Max.operating pressure	bar	315bar, 210bar (NPTF1 1/4, NPTF1 1/2)						
Cracking pressure for type MK	bar	0.5						
Max.flow-rate	L/min	400						
Viscosity range	mm ² /s	10 to 800						
Fluid temperature range	°C	-30 °C to +80 °C						
Fluid		Mineral oil; Phosphate ester						
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406						

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

ΔP -Q curves via check valve, with closed throttle (type MK)



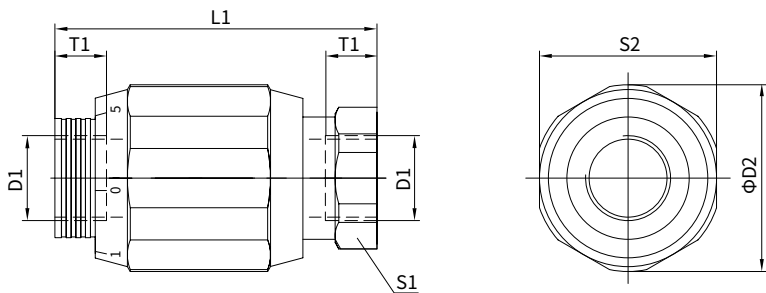
ΔP -Q curves via open throttle (type MG and MK)



Unit dimensions

(MK and MG are the same)

(Dimensions in mm)



Size	D1				D2	L1	S1	S2	T1
	G	Metric	NPTF	SAE					
6	G1/4	M14×1.5	NPTF 1/4	6SAE (9/16-18)	34	65 (SAE=75)	22	32	12 (SAE=14)
8	G3/8	M18×1.5	NPTF 3/8	8SAE (3/4-16)	38 (SAE=48)	65 (SAE=77)	24 (SAE=30)	36 (SAE=45)	12 (SAE=17)
10	G1/2	M22×1.5	NPTF 1/2	10SAE (7/8-14)	48	80 (SAE=93)	30	46	14 (SAE=20)
15	G3/4	M27×2	—	12SAE (1 1/16-12)	58	100 (SAE=113)	41	55	16 (SAE=22)
20	G1	M33×2	—	16SAE (1 5/16-12)	72	110 (SAE=120)	46	70	18 (SAE=22)
25	G1 1/4	M42×2	NPTF 1 1/4	20SAE (1 5/8-12)	87	130 (SAE=140)	55	85	20 (SAE=22)
30	G1 1/2	M48×2	NPTF 1 1/2	24SAE (1 7/8-12)	93	150 (SAE=160)	60	90	22 (SAE=24)



4.2

Throttle and throttle check valve

Type DV(P)/DRV(P)...10

Sizes 6 to 30
Up to 350 bar
Up to 375 L/min



Contents

Function and configuration	02
Symbols	02
Ordering code	03
Technical data	03
Characteristic curves	04
Unit dimensions	05-08

Features

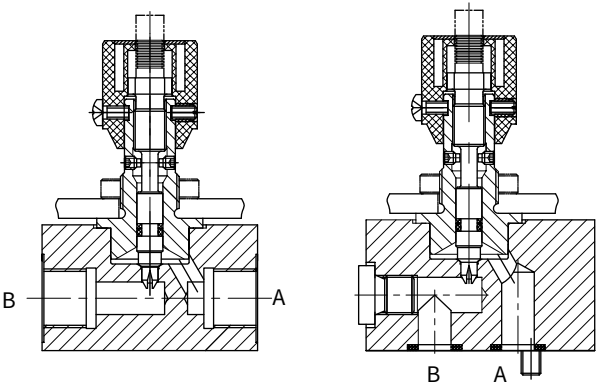
- For direct in-pipe mounting
- For control panel mounting
- Threaded connection
- Good repeatability of set values due to color scale
- Variant, optional:

Function and configuration

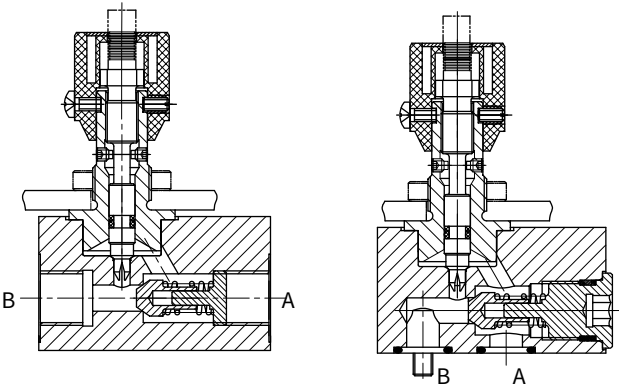
Throttle valve of type DV, DVP and check valve of type DRV, DRVP are flow control valves to adjust movement speed of actuators simply and exactly. These valve can also be used as shut-off valve when completely shut.

The scale of triangle shows how large the flow is (The larger the triangle is and the greater the flow is). At the same time, for resetting again, it can be restored to the preset position.

Type DV, DVP



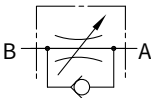
Type DRV, DRVP



Symbols



Type DV, DVP



Type DRV, DRVP

Ordering code

					1	—	10	✓		★	Further details in clear text
Throttle valve	=DV										No code = NBR seals
Throttle check valve	=DRV										V = FKM seals
Threaded connection	=No code										Threaded connection
Sub-plate mounting	=P										No code= Inch thread
Nominal size 6	=6										2 = Metric thread
Nominal size 8	=8										10= 10 Series
Nominal size 10	=10										1= Steel valve body
Nominal size 12	=12										- = For direct in-line mounting
Nominal size 16	=16										S = For Control panel mounting
Nominal size 20	=20										
Nominal size 25	=25										
Nominal size 30	=30										

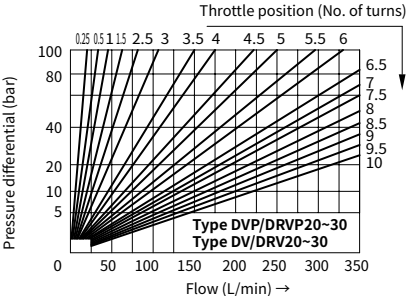
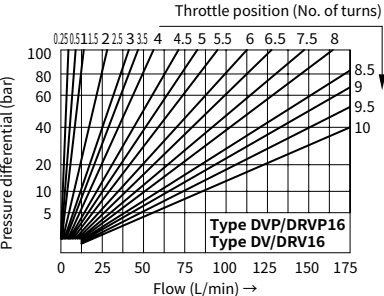
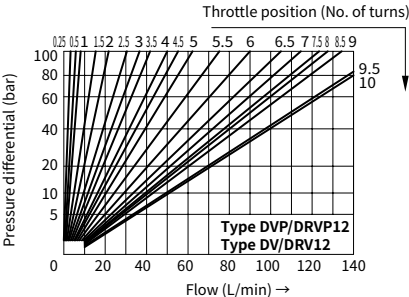
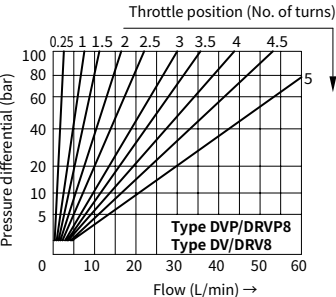
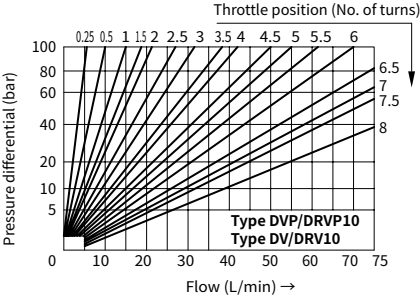
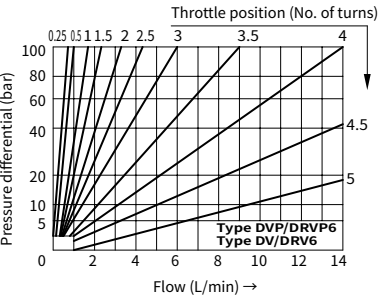
04

Technical data

Size		6	8	10	12	16	20	25	30	
Max. Operating pressure		bar 350								
Check valve cracking pressure		bar 0.5								
Weight	Type DV	kg	0.12	0.53	0.7	0.9	1.5	2.5	3.3	3.8
	Type DVP		0.25	0.7	1.0	1.3	2.6	4.3	8.3	11.2
	Type DRV		0.13	0.6	0.7	0.9	1.5	3.1	4.1	5.3
	Type DRVP		0.26	0.7	1.0	1.4	2.7	4.7	8.8	12.2
Fluid		Mineral oil; phosphate ester								
Fluid temperature range		°C -20 to +80								
Viscosity		mm²/s 2.8~500								
Installation position		Optional								
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406								

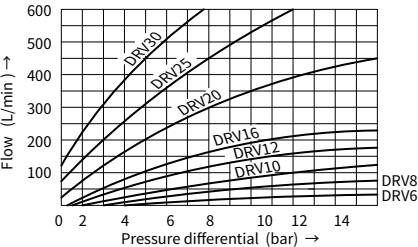
Characteristic curves (Measured at $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, using HLP46)

Flow direction: A to B relation of differential pressure ΔP to flow Q in constant throttle position



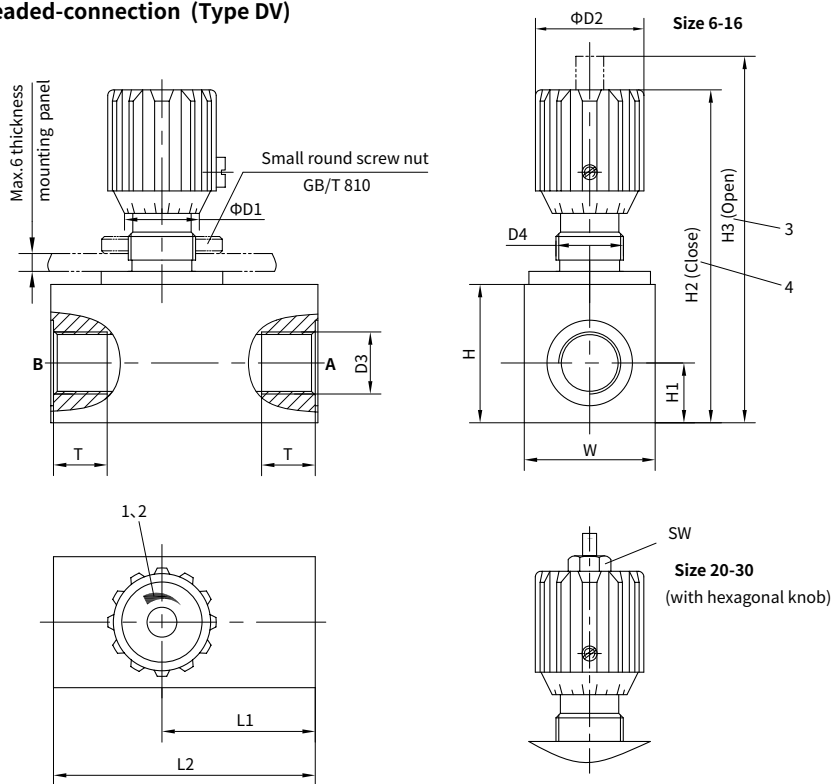
Type DRV

Flow direction : B to A P-Q curve of Free flow via open check valve



Unit dimensions

• Threaded-connection (Type DV)



1 Flow increases with anti-clockwise rotation

2 Flow reduces with clockwise rotation

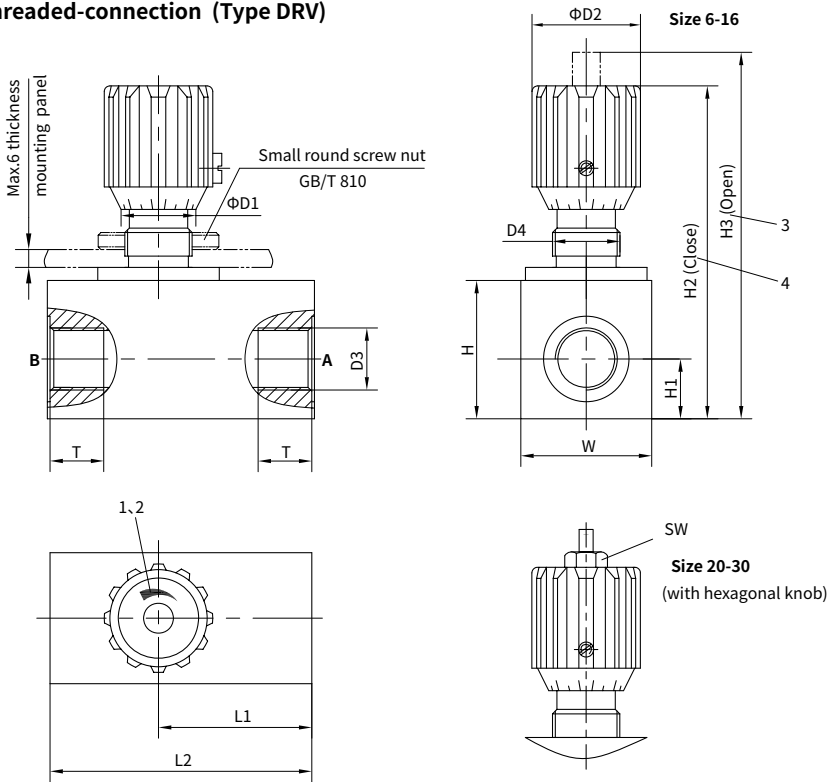
3 Throttle fully opens

4 Throttle closes

Size	W×H	$\Phi D1$	$\Phi D2$	D3		D4	H1	H2	H3	L1	L2	SW	T
6	20×20	15	24	G1/8	M10×1	M12×1.25	10	64	68	19.5	39		9
8	34×30.5	20	29	G1/4	M14×1.5	M18×1.5	12.5	83	90	32.5	63.5		12
10	36.5×38.5	20	29	G3/8	M18×1.5	M18×1.5	16	95	103	33	66		12
12	37×38	26	37.5	G1/2	M22×1.5	M22×1.5	17.5	101.5	109.5	44.5	80		14
16	45×52	26	37.5	G3/4	M27×2	M22×1.5	22.5	124	134.5	44.5			16
20	57×56.5	38	50	G1	M33×2	M36×1.5	26	162.5	178.5	49.5	99	19	18
25	63×66	38	50	G1 1/4	M42×2	M36×1.5	30	167	186	54.5	109	19	20
30	73×76	38	50	G1 1/2	M48×2	M36×1.5	35	177.5	196	54.5	109	19	22

Unit dimensions

• Threaded-connection (Type DRV)

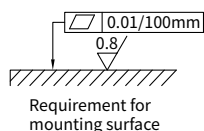
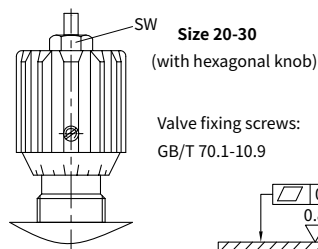
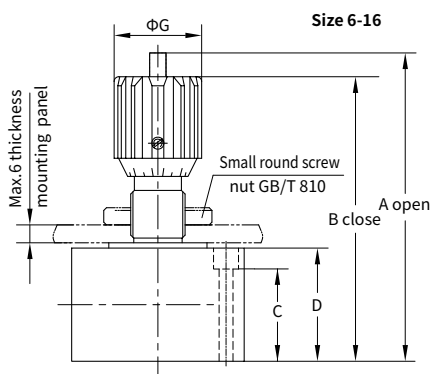
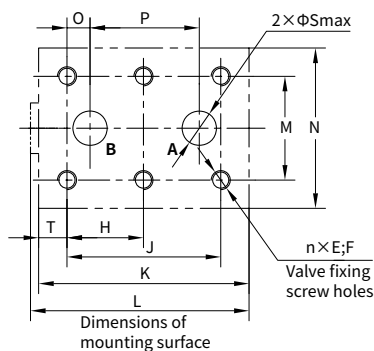
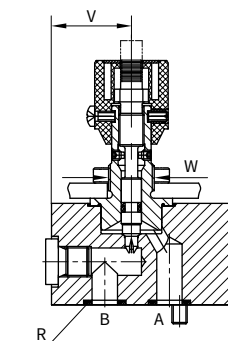


Size	W×H	$\Phi D1$	$\Phi D2$	D3		D4	H1	H2	H3	L1	L2	SW	T
6	20×21	15	24	G1/8	M10×1	M12×1.25	10	65	70	28	46		9
8	34×35	20	29	G1/4	M14×1.5	M18×1.5	15	87	94	38	64.5		12
10	36.5×41	20	29	G3/8	M18×1.5	M18×1.5	16	98	105	45.5	71		12
12	37×42	26	37.5	G1/2	M22×1.5	M22×1.5	17.5	105	113	48	81		14
16	45×54	26	37.5	G3/4	M27×2	M22×1.5	22.5	124	134.5	56.5	89		16
20	57×59	38	50	G1	M33×2	M36×1.5	26	162.5	178.5	80	128	19	18
25	63×70	38	50	G1 1/4	M42×2	M36×1.5	30	170	186.5	98	144	19	20
30	73×80	38	50	G1 1/2	M48×2	M36×1.5	35	180	195.5	105	145	19	22

- 1 Flow increases with anti-clockwise rotation
- 2 Flow reduces with clockwise rotation
- 3 Throttle fully opens
- 4 Throttle closes

Unit dimensions

• Sub-plate mounting (Type DVP)

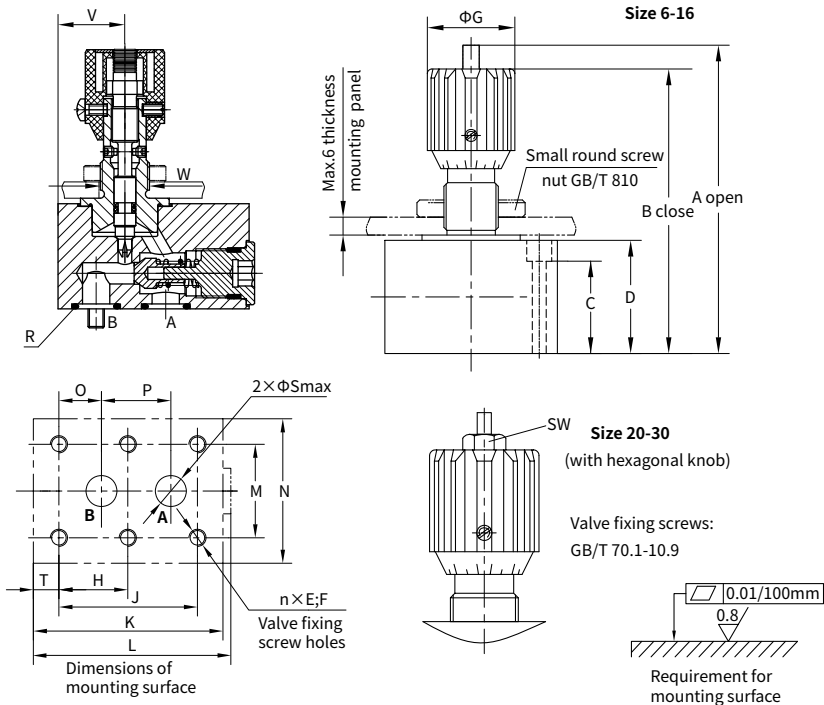


Size	A	B	C	D	n	E	F	G	H	J	K	L	M	N
6	66	61.5	10	18	4	M6	12	24	-	19	38	41	28.5	41.5
8	89.6	82.7	21	30.5	4	M6	12	29	-	35	63.5	67	33.5	46
10	104	96	29.5	40	4	M6	12	29	-	33.5	70	72.3	38	51
12	109	100.5	29	38	4	M6	12	37.5	-	38	80	82	44.5	57.5
16	133	122.3	41	52	6	M8	16	37.5	38	76	104	107	54	70
20	177	161	49	61	6	M8	16	50	47.5	95	127	129	60	76.5
25	185	170	55	68.5	6	M10	20	50	60	120	165	168	76	100
30	195	179	63	79	6	M12	24	50	71.5	143	186	186	92	115

Size	O	P	R	S	T	V	W	SW	Vale fixing screw
6	1.6	16	O-ring 7×1.5	5	9.5	18.5	M12×1.25	-	M6×20
8	4.5	25.5	O-ring 12.3×2.4	8	14.3	31	M18×1.5	-	M6×30
10	4	25.5	O-ring 12.3×2.4	10	17	31.5	M18×1.5	-	M6×40
12	4	30	O-ring 15×2.65	12	21	36.5	M22×1.5	-	M6×40
16	11.4	54	O-ring 19×3	15	14	49	M22×1.5	-	M8×55
20	19	57	O-ring 30×3	20	17	47	M36×1.5	19	M8×60
25	20.6	79.5	O-ring 32×3	25	15	77	M36×1.5	19	M10×70
30	23.8	95	O-ring 34.52×3.53	30	15	85	M36×1.5	19	M12×80

Unit dimensions

• Sub-plate mounting (Type DRVP)



Size	A	B	C	D	n	E	F	G	H	J	K	L	M	N
6	67	62.5	9	19	4	M6	12	24	-	19	41.5	43	28.5	41.5
8	90	83	19	31	4	M6	12	29	-	35	63	67	33.5	46
10	103	95	30	38.5	4	M6	12	29	-	33.5	70	72	38	51
12	112	103.5	29	41	4	M6	12	37.5	-	38	80	84	44.5	57.5
16	132	122	41	51	6	M8	16	37.5	38	76	104	107	54	70
20	176	161	48	60	6	M8	16	50	47.5	95	127	131	60	76.5
25	186	171	55	70	6	M10	20	50	60	120	165	169	76	100
30	195	180	63	79	6	M12	24	50	71.5	143	186	190	92	115

Size	O	P	R	S	T	V	W	SW	Vale fixing screw
6	1.6	16	O-ring7 $\times$ 1.5	5	6.4	10	M12 $\times$ 1.25	-	M6 $\times$ 20
8	4.5	25.5	O-ring12.3 $\times$ 2.4	8	9.3	25.8	M18 $\times$ 1.5	-	M6 $\times$ 30
10	4	25.5	O-ring13.2 $\times$ 2.4	10	10	24.5	M18 $\times$ 1.5	-	M6 $\times$ 40
12	4	30	O-ring15 $\times$ 2.65	12	21	31.5	M22 $\times$ 1.5	-	M6 $\times$ 40
16	11.4	54	O-ring19 $\times$ 3	15	14	41	M22 $\times$ 1.5	-	M8 $\times$ 55
20	19	57	O-ring30 $\times$ 3	20	17	44	M36 $\times$ 1.5	19	M8 $\times$ 60
25	20.6	79.5	O-ring32 $\times$ 3	25	15	62	M36 $\times$ 1.5	19	M10 $\times$ 70
30	23.8	95	O-ring34.52 $\times$ 3.53	30	15	72	M36 $\times$ 1.5	19	M12 $\times$ 80

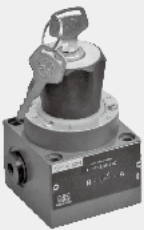


4.3

Fine throttle valve

Type F

Sizes 5 and 10
Up to 210 bar
Up to 80 L/min



Contents

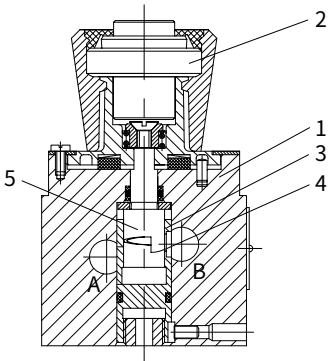
Function and configuration	02
Ordering code	02
Technical data	03
Characteristic curves	04-05
Unit dimensions	06

Features

- Sub-plate mounting
- Threaded connections
- Manifold mounting
- Lockable rotary knob

Function and configuration

Flow control valves, type F are fine throttle valves with orifice . They are basically comprised of housing (1), adjustment element (2) and thin-blade orifice (3). Throttling flow is almost independent of temperature variations. Throttling flow from A to B is carried out at orifice aperture (4). The throttle opening is adjusted by rotating cylindrical spool (5). The low dependence on temperature is due to an thin-blade orifice.



Ordering code

F

3

—

/

*

Fine throttle valve

Nominal size 5 = 5

Nominal size 10 = 10

For manifold mounting = K

For threaded connection = G

For sub-plate mounting = P

L20 to L29 Series (version K) =L2X

(L20 to L29: unchanged installation and connection dimensions)

L30 to L39 Series (versions G and P) =L3X

(L30 to L39: unchanged installation and connection dimensions)

Further details in clear text

No code = NBR seals

V = FKM seals

Threaded connection

No code= Inch

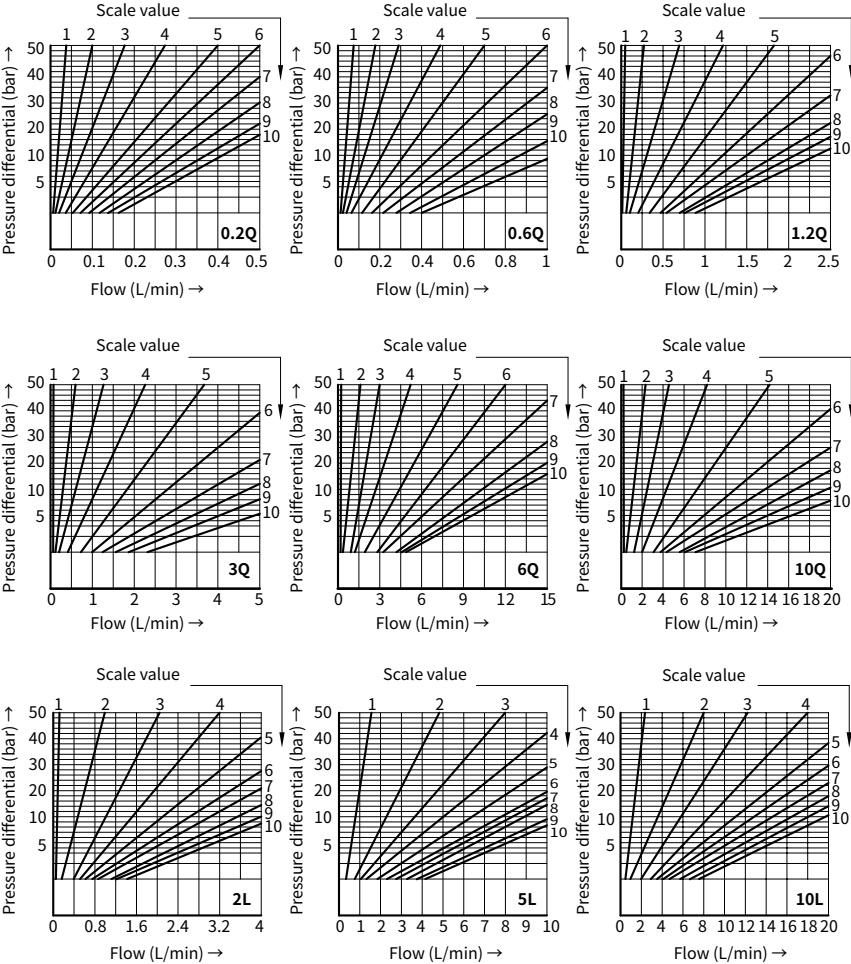
2 = Metric

Size 5	Size 10	
Non-linear	Non-linear	Linear
Orifice 0.2=0.2Q	Orifice 5=5Q	Orifice 2=2L
Orifice 0.6=0.6Q	Orifice 10=10Q	Orifice 5=5L
Orifice 1.2=1.2Q	Orifice 16=16Q	Orifice 10=10L
Orifice 3=3Q	Orifice 25=25Q	Orifice 16=16L
Orifice 6=6Q		Orifice 25=25L
Orifice 10=10Q		Orifice 50=50L

Technical data

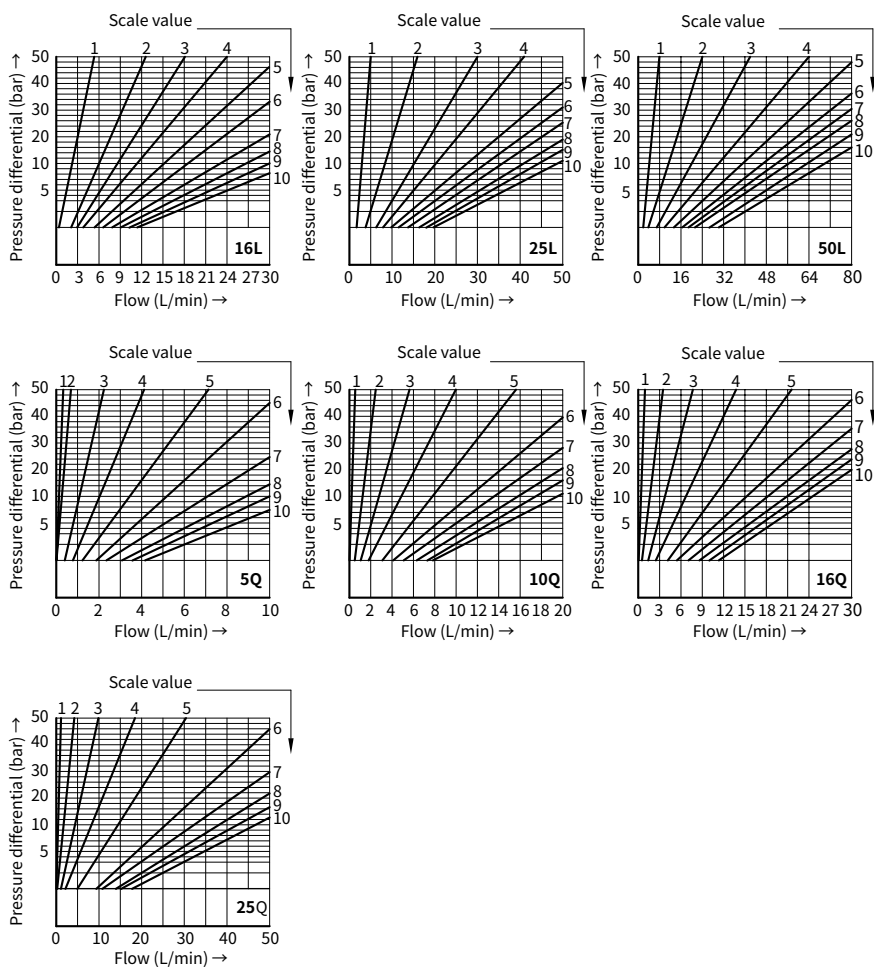
Installation position			Optional
Weight	- Manifold mounting	kg	1
	- Thaded connection	kg	1.6
	- Sub-plate mounting	kg	1.8
Fluid			Mineral oil suitable for NBR and FKM seal
			Phosphate ester for FKM seal
Degree of contamination			Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406
Fluid temperature range	°C		-30 to +80 (NBR seal)
			-20 to +80 (FKM seal)
Viscosity range	mm²/s		2.8 to 380
Max.operating pressure	bar		210
Max. flow-rate	L/min		80
Adjustment angle	°		300
Operating torque	- at 100 bar	Nm	1.1
	- at 200 bar	Nm	1.8

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



Characteristic curves

(Measured at $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, using HLP46)





4.4

Double throttle/ check valve

Type Z2FS6...L4X

Size 6
Up to 315 bar
Up to 80 L/min



Contents

Function and configurations	02
Ordering code	03
Symbols	03
Technical data	04
Characteristic curves	04
Unit dimensions	05

Features

- Sandwich plate valve
- Porting pattern to DIN 24 340 form A and ISO4401
- For limiting the main or pilot fluid flow of 2 actuator connections
- For meter-in or meter-out control

Function and configuration

Valve type Z2FS 6 is a double throttle/check valve with sandwich plate structure.

It is used to control the flow by changing the throttling. In the opposite direction, fluid flows freely through the check valve.

For meter-in control fluid passes from port A1 to port A2 via the throttling point (1), which is made up of the valve seat (2) and the throttling spool (3). The throttling spool (3) is axially adjustable through the adjustment screw (4).

Fluid flows from A2 to A1, valve seat (2) is opened against spring (5) and valve acts as check valve. Depending on the installation position, the throttling effect may be arranged as a meter-in or a meter-out control.

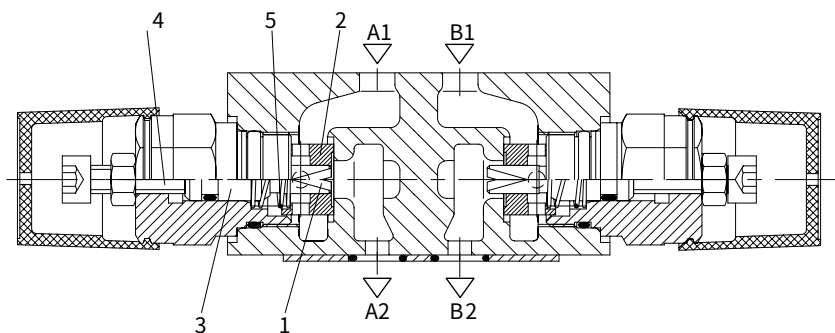
Standard version used for controlling main flow (Z2FS6.../2Q)

In order to change the velocity of an actuator (limiting of main flow), the double throttle/check valve is installed between the directional valve and the sub-plate.

Fine control version used for controlling pilot flow(Z2FS6.../1Q)

In order to limit the pilot flow, the double throttle/check valve is installed between the main valve and the pilot valve.

Type: Z2FS6-2-L4X/2Q



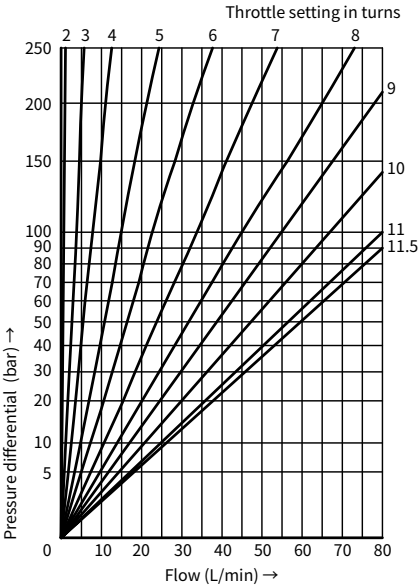
This installed position is for meter-in control

Technical data

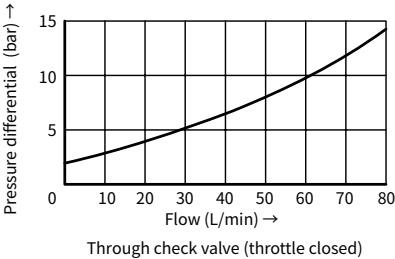
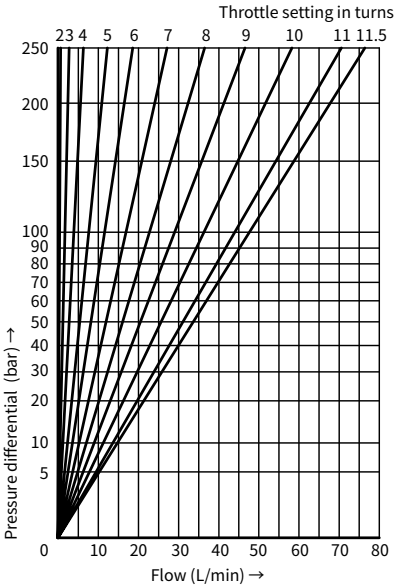
Fluid		Mineral oil suitable for NBR and FKM seal
		Phosphate ester for FKM seal
Fluid temperature range	°C	-30 to +80 (NBR seal)
		-20 to +80 (FKM seal)
Viscosity range	mm²/s	10 to 800
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406
Max. working pressure	bar	315
Max. flow-rate	L/min	80
Weight	kg	Approx. 1.0

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

ΔP - Q_v curve-Z2FS6-...-L4X/2QV



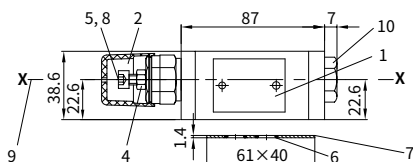
ΔP - Q_v curve-Z2FS6-...-L4X/1QV



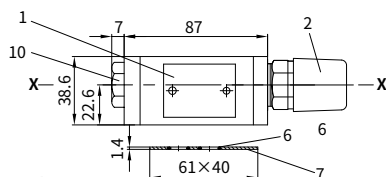
Unit dimensions

(Dimensions in mm)

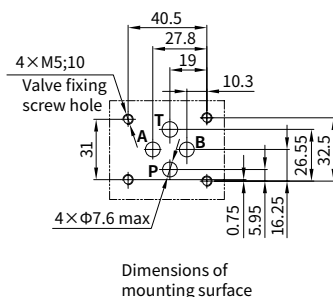
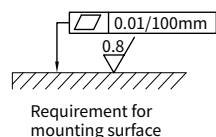
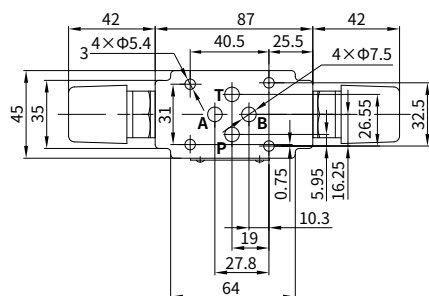
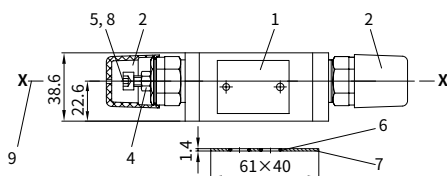
Type:Z2FS6A-...-L4X/ ...



Type:Z2FS6B-...-L4X/...



Type:Z2FS6-...-L4X/ ...



Valve fixing screws:

M5 according to GB/T 70.1-10.9, the length according to sandwich, Tightening torque $M_A = 8.9\text{Nm}$, must be ordered separately.

- 1 Nameplate
- 2 Adjustment element "2"
- 3 Valve fixing holes
- 4 Lockable nut S=10
- 5 Internal hexagon screw S=5
- 6 O-rings 9.25×1.78 (Port A, B, P, T)
- 7 O-ring plate

- 8 For adjustment elements:
turn anti-clockwise=increases flow
turn clockwise=decreases flow
- 9 To change from meter-in to meter-out,
rotate the unit around the 'X-X' axis
- 10 End cap S=22

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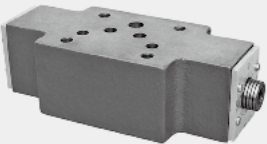


4.5

Double Throttle/ Check Valve

Type Z2FS6, 10, 16, 22...30

Sizes 6, 10, 16, 22
Up to 350bar
Up to 360 L/min



Contents

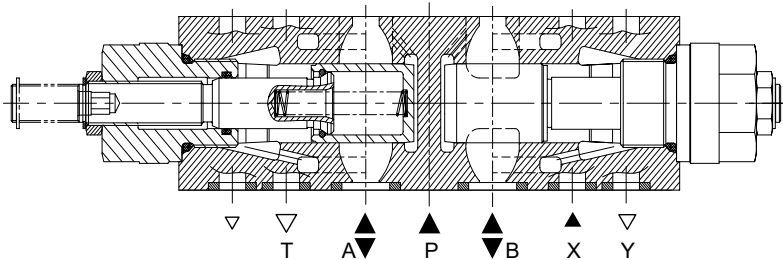
Function and configurations	02
Symbols	02
Ordering code	03
Technical data	03
Characteristic curves	04
Unit dimensions	05-06

Features

- Sandwich plate valve
- Porting pattern to DIN 24 340 form A and ISO4401
- For limiting the main or control fluid flow of 2 actuator connections

Function and configuration

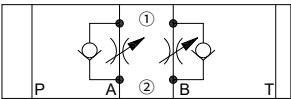
Valve type Z2FS is a double throttle/check valve with sandwich plate structure. It is used to control the flow by changing the throttling. In the opposite direction, fluid flows freely through the check valve. For Z2FS10, depending on the installation position, the throttling effect may be arranged as a meter-in or a meter-out control. While for Z2FS16 and 22, depending on the model (S or S2) throttling may take place in either meter-in or meter-out, and at the same time the two operating oil chambers are connected.



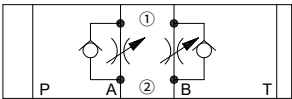
Structure chart of double throttle/Check Valve

Symbols

Size 6:

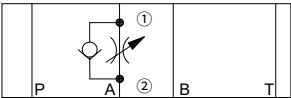


Type:Z2FS6-30/ (meter-in control)

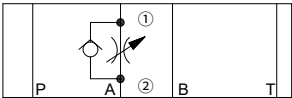


Type:Z2FS6-30/ (meter-out control)

Size 10:

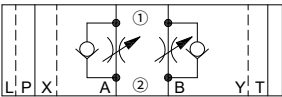


Type:Z2FS10-30/ (meter-in control)

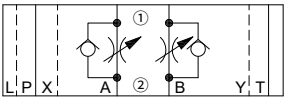


Type:Z2FS10-30/ (meter-out control)

Size 16, 22:



Type:Z2FS...-30/ (meter-in control)



Type:Z2FS...-30/ (meter-out control)

① =valve side
② = sub-plate side

Ordering code

Z2FS



30

*

Double throttle/
check valve

Nominal size 6 =6

Nominal size 10 =10

Nominal size 16 =16

Nominal size 22 =22

L30 Series =30

Further details in clear text

No code = NBR seals
V = FKM seals

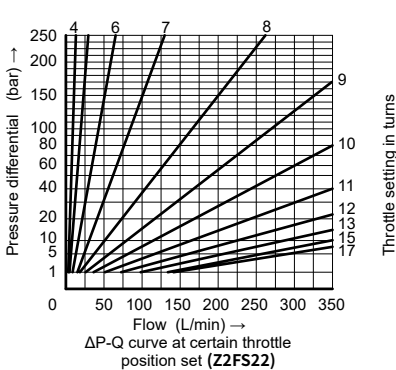
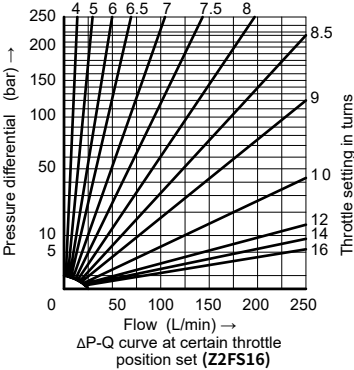
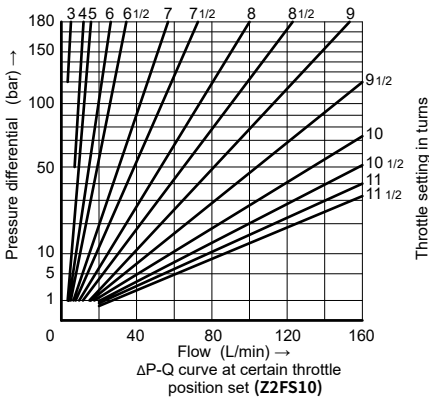
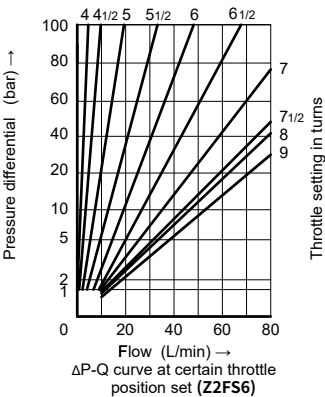
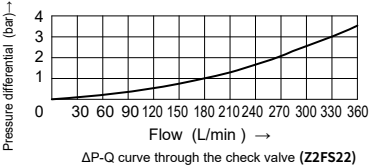
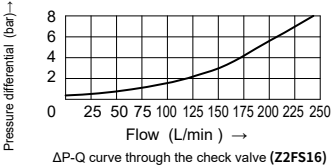
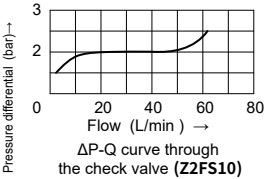
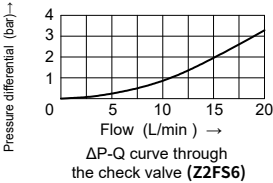
No code= Meter-in /meter-out control
S = Meter-in contro
S2 = Meter-out control

Note: overturning the Z2FS10 by 180° the
throttling effect can be arranged as a meter-in
or meter-out control.

Technical data

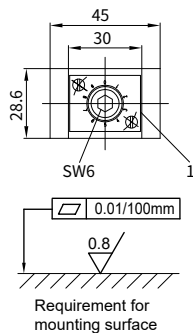
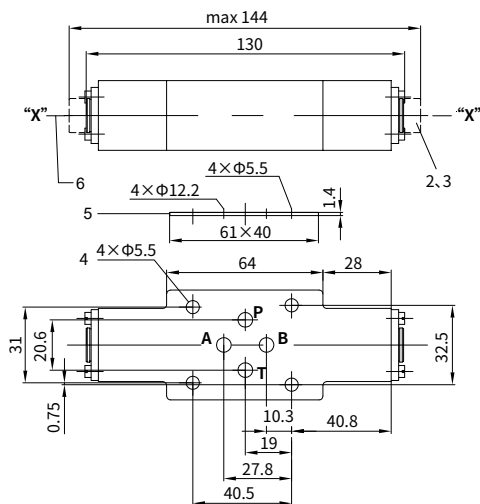
Installation position		Optional			
Flow direction		One direction throttle, return through the check valve by another direction			
Fluid		Mineral oil suitable for NBR and FKM seal, Phosphate ester for FKM seal			
Fluid temperature range °C		-20 to +80			
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406			
Viscosity range mm²/s		10 to 800			
Max.operating pressure bar		to 350			
Nominal size		6	10	16	22
Weight kg		0.9	3.1	4.7	8

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



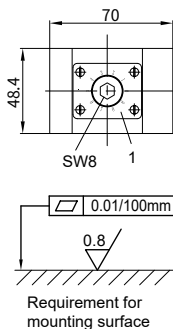
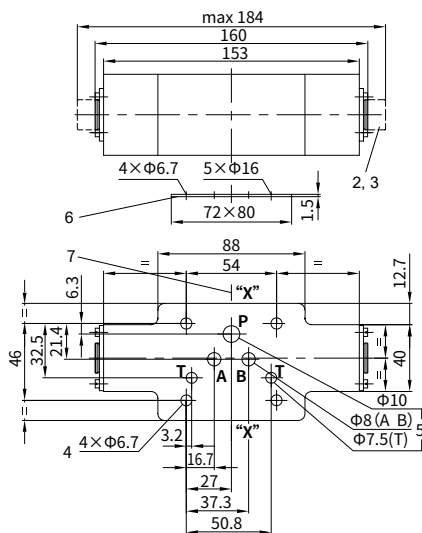
Unit dimensions:

(Dimensions in mm)

• Outline dimension of double throttle/Check Valve Type Z2FS6

- 1 Nameplate
- 2 Adjustable bolt
- 3 Turn anti-clockwise=increases flow,
turn clockwise=decreases flow
- 4 Valve fixing holes
- 5 O-ring plate
- 6 To change from meter-in to meter-out,
rotate the unit around the "X - X" axis

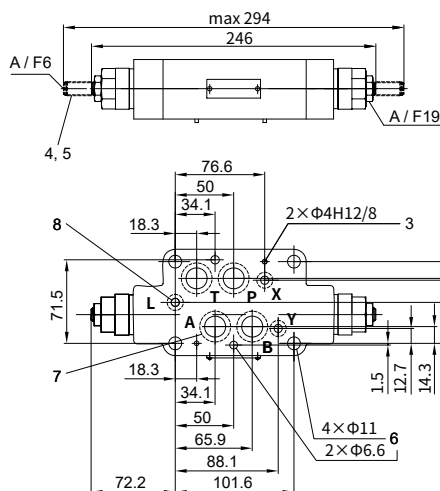
04

• Outline dimension of double throttle/Check Valve Type Z2FS10

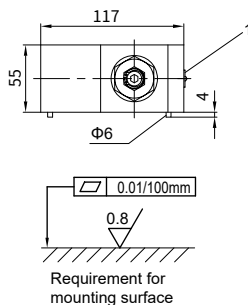
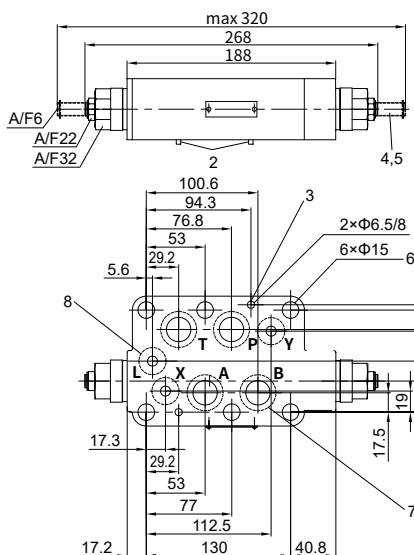
- 1 Nameplate
- 2 Adjustable bolt
- 3 Turn anti-clockwise = increases flow,
turn clockwise = decreases flow
- 4 Valve fixing holes
- 5 Port (A, B, P, T)
- 6 O-ring plate
- 7 To change from meter-in to meter-out,
rotate the unit around the "X - X" axis

Unit dimensions:

(Dimensions in mm)

• Outline dimension of double throttle/Check Valve Type Z2FS16

- 1 Nameplate
- 2 Locating pins
- 3 Two locating pin holes
- 4 Adjustable bolt used for adjusting throttle area
- 5 Turn anti-clockwise = increases flow, turn clockwise = decreases flow
- 6 6 through holes for valve connection
- 7 O- ring 22×2.5 for ports A, B, P, T
- 8 O- ring 10×2 for ports X, Y, L

• Outline dimension of double throttle/Check Valve Type Z2FS22

- 1 Nameplate
- 2 Locating pins
- 3 2 locating pin holes
- 4 Adjustable bolt used for adjusting throttle area
- 5 Turn anti-clockwise = increases flow, turn clockwise = decreases flow
- 6 6 holes for valve connection
- 7 O- ring 27×3 for ports A, B, P, T
- 8 O- ring 19×3 for ports X, Y, L



4.6

Flow Control Valve

Type 2FRM6

Rectifier Plate

Type Z4S6

Size 6
Up to 315 bar
Up to 32 L/min



Contents

Function and configurations	02
Symbols	02
Ordering code	03
Technical data	04
Characteristic curves	05
Unit dimensions	06-09

Features

- For subplates see catalogue
- External closing of the pressure compensator, optional
- Check valve, optional
- Rotary knob with scale, optional lockable

Function and configurations

Flow control valve of type 2FRM is a two-way flow control valve, used for maintaining a constant flow and is independent of pressure and temperature. It consists of housing(1), knob rotary(2), orifice(3), pressure compensator(4), optional check valve(9).

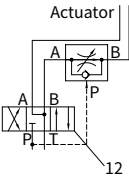
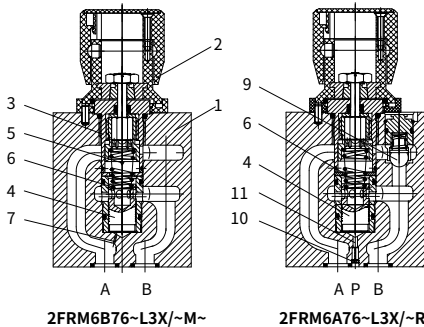
Flow control valve 2FRM6B~L3X/~M

Flow from A to B is throttled at throttle channel (5). Throttle cross-section is varied by turning the knob rotary(2). To avoid effects of pressure at port B on constant flow, a compensator (4) is fitted. Spring (6) separately compress the compensator (4) and orifice (3) tightly. Spring (6) compresses the compensator (4) tightly to maintain it open when no fluid flows through the valve. Once the fluid flows across the valve, the pressure in port A applies a force to pressure compensator (4) through the orifice (7). The pressure compensator (4) moves into the compensating position until the force is balanced. If the pressure in

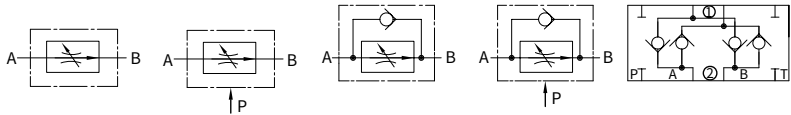
port A rises, the compensator (4) moves to its closing direction until force is balanced again. Due to the compensator (4) continuous action, a constant flow is obtained.

2FRM6A~L3X/~R

The function of this valve is basically the same as that of valve type 2FRM6B~L3X/~R. However, pressure compensator (4) of this type of valve is connected with port P (11) so that pressure compensator (4) can be closed by external pressure. Any pressure in port P through the orifice (10) can make the compensator (4) closed against the force of compression spring (6). When the directional valve (12) acts, fluid flows from P to B, control is achieved as type 2FRM6B. This flow controls the valve with the external pressure compensator which can be closed. It only works by controlling the inlet flow.



Symbols



Type 2FRM6B ..L3X/~.M Type 2FRM6A ..L3X/~.M Type 2FRM6B ..L3X/~.R Type 2FRM6A ..L3X/~.R Rectifier type Z4S6-L1X
① = Valve side
② = sub-plate side

Ordering code

• For flow control valve

	2FRM	6			6	-	L3X	/			*	
Flow control valve												Further details in clear text
Nominal size 6		=6										No code= NBR seals V = FKM seals
With pressure compensator external close (Restraining starting impact, can not work with Z4S6)			=A									R= With check valve
Without pressure compensator external close (Standard type)			=B									M= Without check valve
Without pressure compensator external close (for meter plate mounting)			=SB									
Regulating element:												Flow (A → B)
Lockable rotary knob with scale			= 3									0.2Q= up to 0.2L/min
Rotary knob with scale			= 7									0.6Q= up to 0.6L/min
Zero position of the markings at port P												1.5Q= up to 1.5L/min
												3Q= up to 3.0L/min
												6Q= up to 6.0L/min
												10Q= up to 10.0L/min
												16Q= up to 16.0L/min
												25Q= up to 25.0L/min
												32Q= up to 32.0L/min
L30 to L39 Series (L30 to L39: unchanged installation and connection dimensions)							=L3X					

• For rectifier plate

	Z4S	6	-	L1X	/		*	
Rectifier								Further details in clear text
Nominal size 6		=6						No code = NBR seals V = FKM seals
L10 to L19 Series (L10 to L19: unchanged installation and connection dimensions)			=L1X					

Technical data

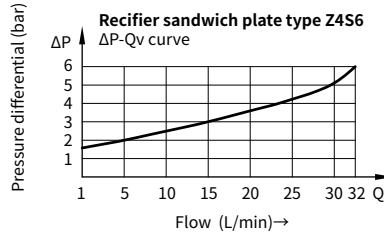
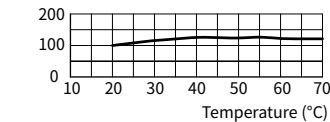
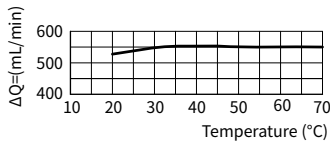
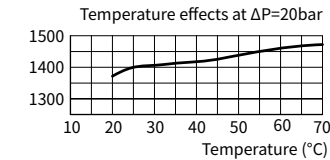
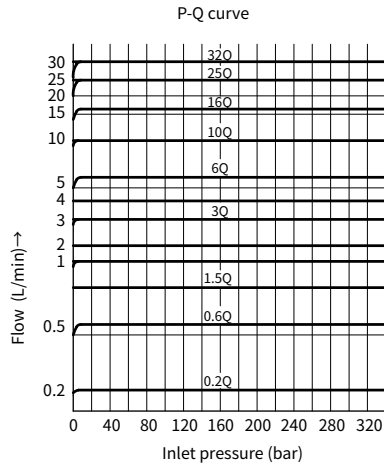
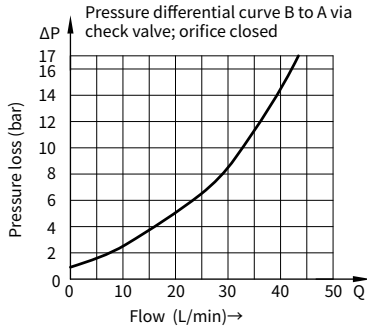
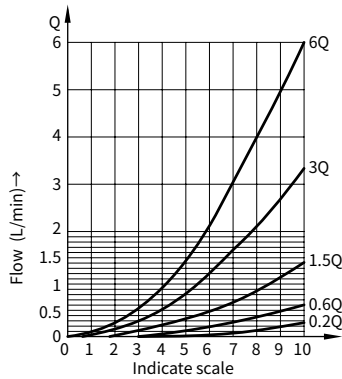
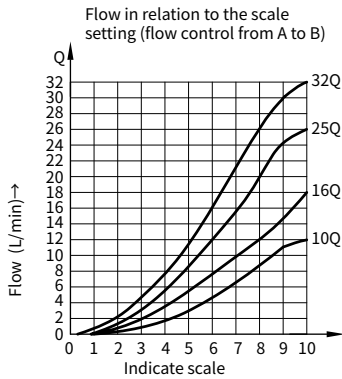
• Flow control valve

Max. operating pressure at port A		bar	315									
Pressure differential ΔP for free return flow B to A			See characteristic curves									
Minimum pressure differential		bar	6 to 14									
Pressure stability up to P= 315 bar		%	$\pm 2(Q_{max})$									
Flow -rate	Qmax	L/min	0.2	0.6	1.5	3	6	10	16	25	32	
	Qmin to 100bar	mL/min	15	15	15	15	25	50	70	100	250	
	Qmin to 315bar	mL/min	25	25	25	25	25	50	70	100	250	
Fluid			Mineral oil suit, Phosphoric acid ester									
Fluid temperature range		°C	- 20 to + 80									
Viscosity range		mm ² /s	10 to 800									
Degree of contamination			Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406									
Installation position			Optional									
Circumstances temperature range		°C	-20 to +50									
Weight	2FRM6A...2FRM6B...	kg	Approx.1.3									
	2FRM6SB...	kg	Approx.1.5									

• Rectifier

Nominal flow	bar	320
Maximum operating pressure	bar	To 210
Cracking pressure	bar	0.7
Weight	kg	Approx.0.9

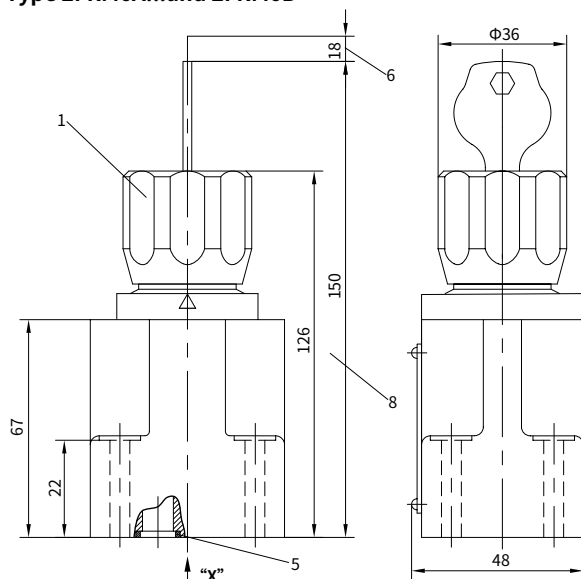
Characteristic curves (Measured at $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, using HLP46)



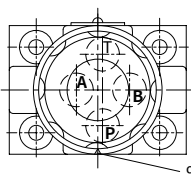
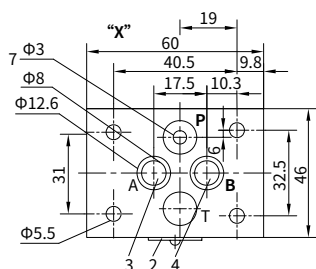
Unit dimensions

(Dimensions in mm)

Type 2FRM6A...and 2FRM6B



- 1 Lockable rotary knob with scale (adjustment element "3")
- 2 Name plate
- 3 Inlet "A"
- 4 Outlet "B"
- 5 O-rings 9.25×1.78 for ports A, B, P and T
- 6 Space required to remove key
- 7 Hole $\varnothing 3$ for version 2FRM6B is not drilled. (without external connection)
- 8 Rotary knob with scale (adjustment element "7")
- 9 Position of marking at port P, A, T or B

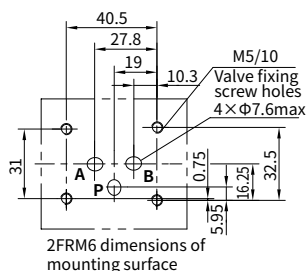


Valve fixing screws:

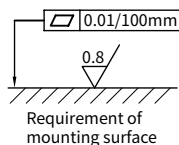
Without rectifier GB/T 70.1-M5 $\times$ 30-10.9, internal hexagon screw, tightening torque $M_A = 8.9$ Nm.
With rectifier GB/T 70.1-M5 $\times$ 70-10.9, internal hexagon screw, tightening torque $M_A = 8.9$ Nm must be ordered separately.

Sub-plates:

Type G 341/01 (G 1/4)
Type G 342/01 (G 3/8)
Type G 502/01 (G 1/2)



2FRM6 dimensions of mounting surface

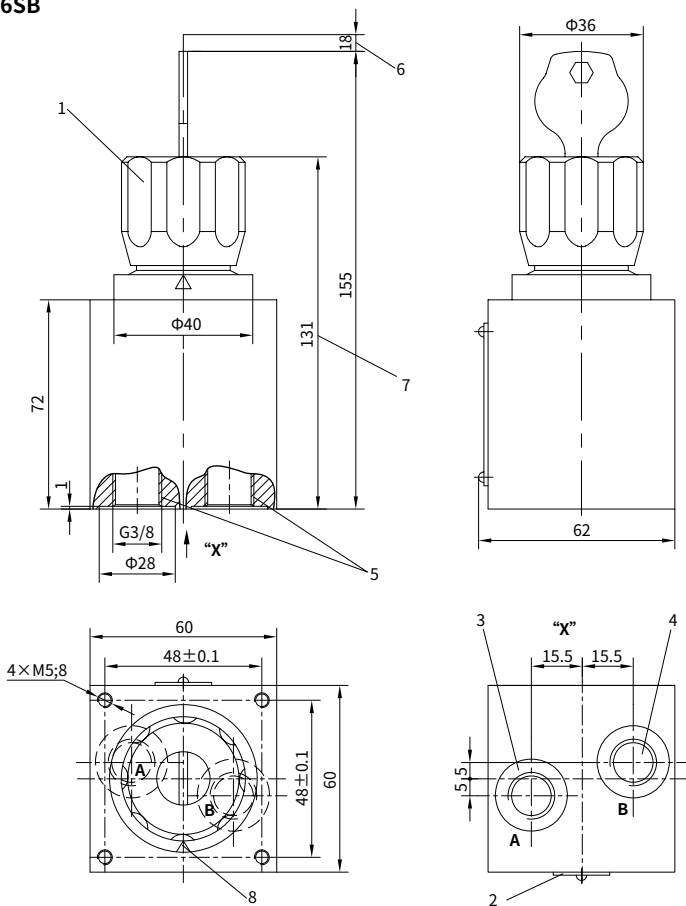


Requirement of mounting surface

Unit dimensions

(Dimensions in mm)

Type 2FRM6SB



1 Lockable rotary knob with scale
(adjustment element "3")

2 Name plate

3 Inlet a

4 Outlet "B"

5 Connection thread G 3/8 to ISO 228/1

6 Space required to remove key

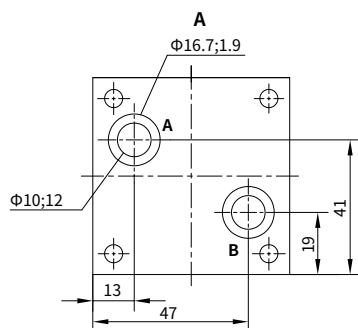
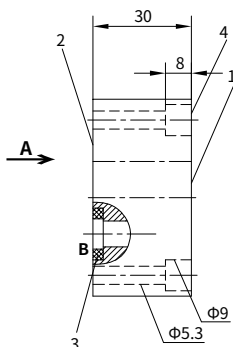
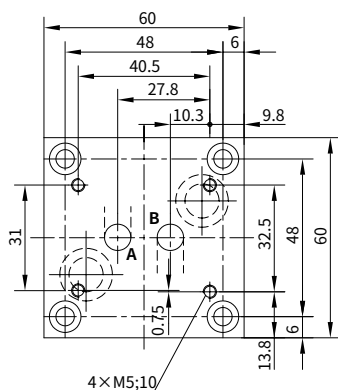
7 Rotary knob with scale (adjustment element "7")

8 Position of marking opposite to the nameplate

Unit dimensions

(Dimensions in mm)

Transition plate AG5075



- 1 Mounting surface matching flow control valve Type 2FRM6
- 2 Mounting surface matching flow control valve Type 2FRM5
- 3 O-rings 12×2.5
- 4 **Valve fixing screws:**
M5×30 GB/T 70.1-10.9
internal hexagon screw
(Tightening torque $M_A = 6.1 \text{ Nm}$)

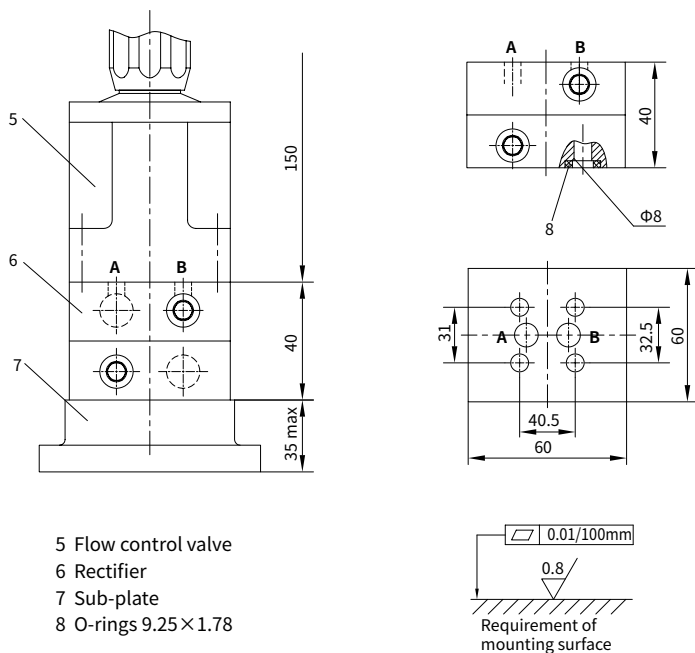
Note:

The transition plate type AG5075 is specially designed for mounting flow control valve type 2FRM6B...-L3X/.. onto an existing porting pattern of flow control valve type 2FRM5-30/...

Unit dimensions

(Dimensions in mm)

Rectifier type Z4S6-L1X



Caution:

Rectifier sandwich plate type Z4S6-L1X can not be used in conjunction with flow control valve type 2FRM6A...-L3X/.. with built-in external connection of the pressure compensator.

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Germany +49 172 3683463	Japan +81 03 6809 1696



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4.7

Flow control valve

Type 2FRM5, 10, 16

Rectifier plate

Type Z4S5, 10, 16

Sizes 5, 10 and 16
Up to 315 bar
Up to 160 L/min



Contents

Function and configuration	02
Ordering code	03
Technical data	04
Characteristic curves	05
Unit dimensions	06-08

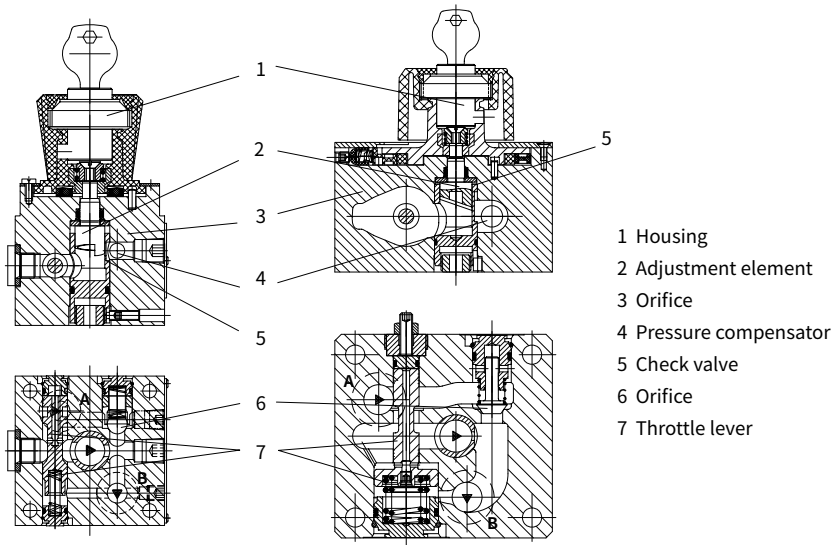
Features

- For subplates see catalogue
- External closing of the pressure compensator, optional
- Rotary knob with scale, optional lockable

Function and configurations

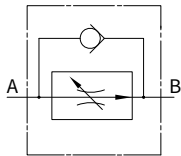
Flow control valve type 2FRM is two-way flow control valve, consisting of pressure compensator and throttle valve in series. When fluid flows into the valve, it is reduced of pressure by the pressure compensator first and then throttled by the throttle valve. The flow in the flow control valve is able to maintain stable independent of any impact from the changing load because of pressure compensation function. Meanwhile the orifice is designed into the shape of a blade, making flow little influenced by variance of temperature. When the flow control valve is connected with a check valve in parallel, fluid can flow back in the opposite direction.

The rectifier plate of type Z4S is installed under the flow control valve to stabilize the flow in both directions of the valve.

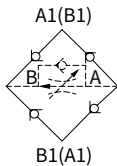


Flow control valve section,
type 2FRM5-30

Flow control valve section,
type 2FRM10-20 and 2FRM16-20



Symbol of flow control valve,
type 2FRM



Symbol of rectifier,
type Z4S

Ordering code

- For flow control valve

2FRM	—	/			*
Flow control valve			Further details in clear text		
Nominal size 5	= 5	No code = NBR seals			
Nominal size 10	=10	V = FKM seals			
Nominal size 16	=16				
30 Series(Nominal size 5)		=30	No code = Pressure compensator, without stroke regulator		
20 Series(Nominal size 10 and 16)		=20	B = Pressure compensator, with stroke regulator		
Flow adjustment range (A → B)					
Size=5	Size=10	Size=16			
0.2L/min=0.2L	10L/min=10L	60L/min=60L			
0.6L/min=0.6L	16L/min=16L	100L/min=100L			
1.2L/min=1.2L	25L/min=25L	160L/min=160L			
3L/min=3L	50L/min=50L				
6L/min=6L					
10L/min=10L					
15L/min=15L					

- For rectifier plate

	Z4S	10	*	
Rectifier				Further details in clear text
Size 5	= 5			
Size 10	=10			
Size 16	=16			
10 Series	=10			
			No code =	NBR seals
			V =	FKM seals

Technical data

• For flow control valve

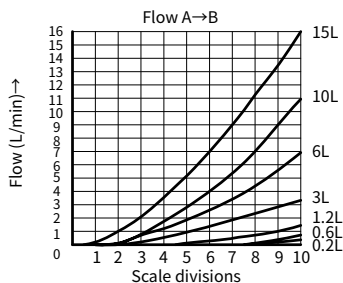
Fluid		Mineral oil ;Phosphate ester														
Fluid temperature range	°C	-20~+80														
Viscosity range	mm²/s	10~800														
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406														
Item	Size	5							10				16			
Max. flow-rate	L/min	0.2	0.6	1.2	3	6	10	15	10	16	25	50	60	100	160	
Pressure differential when backward flow B to A	bar	0.5	0.5	0.6	0.9	1.8	3.6	6.7	2	2.5	3.5	6	2.8	4.3	7.3	
Flow stability range (-20°C ~+80 °C)%Qmax		±5	±3	±2				±2								
		±2(P= 210bar)							±2(P= 315bar)							
Working pressure	bar	210							315							
Min. pressure differential	bar	3~5				6~8			3~7				5~12			
Weight	kg	1.6							3.4				7.4			

• For rectifier plate

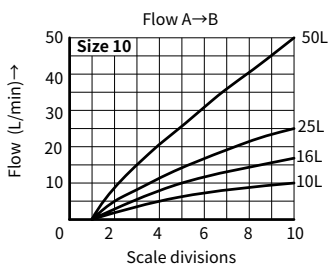
Fluid	Mineral oil; Phosphate ester			
Fluid temperature range	°C	-20~+80		
Viscosity range	mm ² /s	10~800		
Degree of contamination	Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406			
Size	mm	5	10	16
Max. flow-rate	L/min	15	50	160
Working pressure	bar	210	315	315
Cracking pressure	bar	1	1.5	1.5
Weight	kg	0.6	3.2	9.3

Characteristic curves

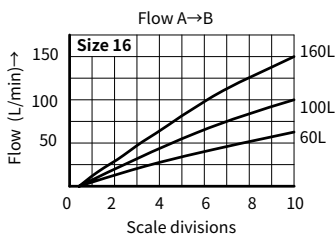
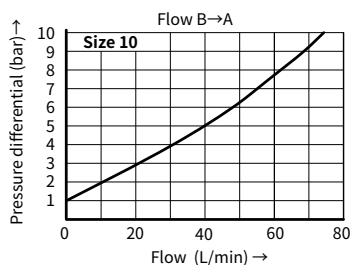
(Measured at $\vartheta_{oil} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, using HLP46)



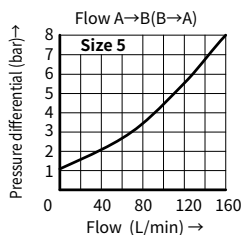
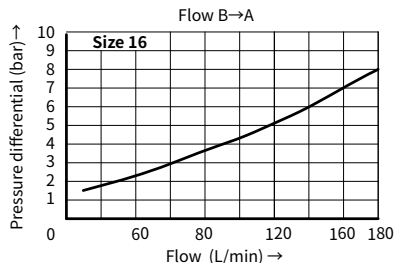
◀ Characteristic curve of flow control valve type 2FRM5



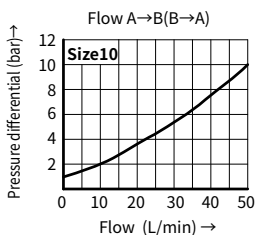
▲ Curve of flow control valve type 2FRM10



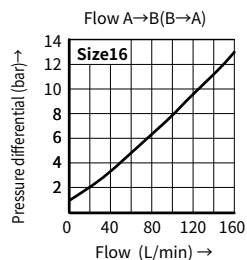
▲ Curve of flow control valve type 2FRM16



▲ Curve of rectifier plate type Z4S5



▲ Curve of rectifier plate type Z4S10

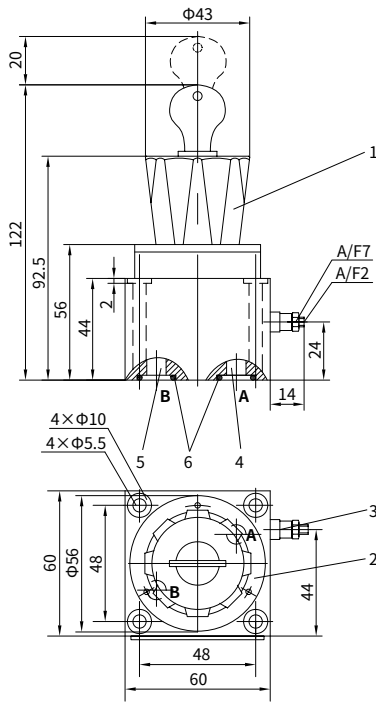


▲ Curve of rectifier plate type Z4S16

Unit dimensions:

(Dimensions in mm)

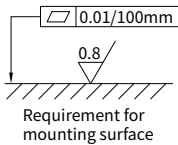
• Outline dimension of flow control valve type 2FRM5



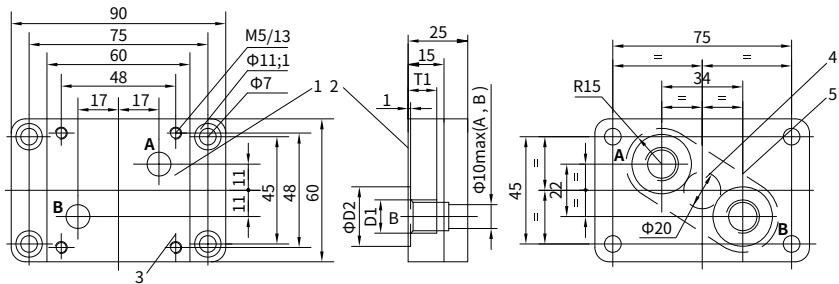
- 1 Lockable rotary knob
- 2 Scale tray
- 3 Stroke regulator of pressure relief valve
- 4 Inlet 'A'
- 5 Outlet 'B'
- 6 O-ring (12×2.5)

Valve fixing screws:
4-M5 $\times$ 50
GB/T 70.1-10.9,
Tightening torque $M_A=75$ Nm

It must be ordered separately, if connection plate is needed:
Type:
G44/01(02), G45/01(02)



• Connection plate dimension of flow control valve type 2FRM5



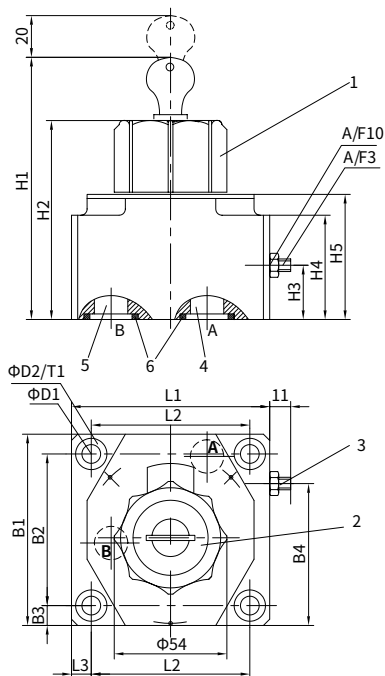
- 1 Mounting surface
- 2 Underside surface
- 3 Fixing holes
- 4 No any holes within the area of $\Phi 20$
- 5 Panel cut-out for connecting valve

Type of sub-plate	D1	D2	T1
G44/01(02)	G1/4(M14 $\times$ 1.5)	25	12
G45/01(02)	G1/2(M22 $\times$ 1.5)	32	15

Unit dimensions:

(Dimensions in mm)

- **Outline dimension of flow control valve type 2FRM10 and 2FRM16**



- 1 Lockable rotary knob
 - 2 Name plate
 - 3 Stroke regulator of pressure compensator
 - 4 Inlet 'A'
 - 5 Outlet 'B'
 - 6 O-ring
- (Size 10: 18.66×3.53, Size 16: 26.58×3.53)

Valve mounting screws:

Size 10: 4pcs M8×50 GB/T 70.1-10.9

Tighten torque $M_A=37\text{Nm}$

Size 16: 4pcs M10×80 GB/T 70.1-10.9

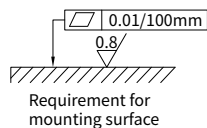
Tighten torque $M_A = 75 \text{ Nm}$

**It must be ordered separately,
if connection plate is needed**

Type:

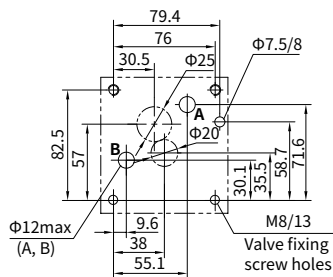
Size 10: G279/01(02), G280/01(02)

Size 16: G281/01(02), G282/01(02)



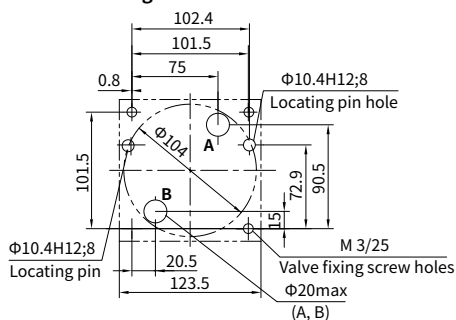
Szie	B1	B2	B3	B4	D1	D2	H1	H2	H3	H4	H5	L1	L2	L3	T1
10	101.5	82.5	9.5	68	9	15	125	95	26	51	60	95	76	9.5	13
16	123.5	101.5	11	81.5	11	18	147	117	34	72	82	123.5	101.5	11	12

•Type 2FRM10 dimensions of mounting surface



Note: No any holes within the area of Ø20 and Ø25.

• Type 2FRM16 dimensions of mounting surface

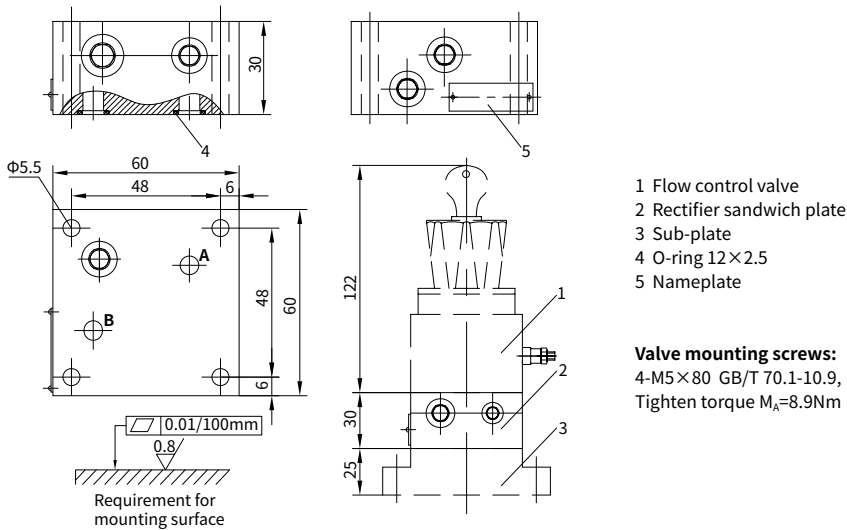


Note: No any holes within the area of Ø104.

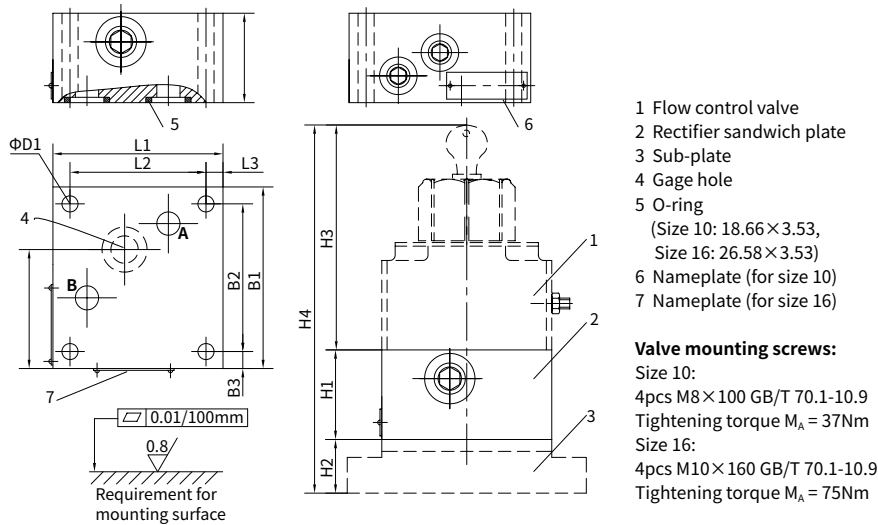
Unit dimensions:

(Dimensions in mm)

• Outline dimension of rectifier type Z4S5



• Outline dimension of rectifier Z4S10 and Z4S16



Size	B1	B2	B3	D1	H1	H2	H3	H4	L1	L2	L3
10	101.5	82.5	9.5	9	50	30	125	205	95	76	9.5
16	123.5	101.5	11	11	85	40	147	272	123.5	101.5	11



4.8

Sandwich flow control valve

Type Z2FRM6

Flow control valve

Type 2FRM6K

Size 6
Up to 315 bar
Up to 32 L/min



Contents

Function and configuration	02
Symbols	03
Ordering code	03
Technical data	04
Characteristic curves	04
Unit dimensions	05-07

Features

- Sandwich plate valve
- Porting pattern to DIN 24 340 Form A, without locating pin hole (standard)
- Porting pattern to ISO 4401 and CETOP-RP 121 H
- With 1 or 2 flow control cartridges
- Adjustment element with internal hexagon

Function and configuration

The valve type Z2FRM is a 2-way flow control valve of sandwich plate design and type 2FRM6K is a 2-way flow control cartridge valve. The former is used for maintaining a constant flow and is independent of the pressure and temperature.

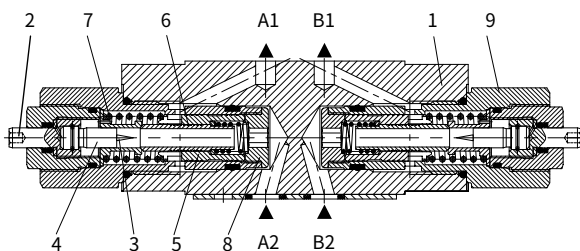
The valve basically consists of a housing (1) and one or two flow control cartridges type 2FRM6K (9).

The throttling of the flow from port A2/B2 (A) to port A1/B1 (B) occurs at the throttle area (3). The throttle bolt (4) is driven by the adjustment element (2). To maintain a constant flow in port A1/B1(B) which is independent of pressure, a pressure compensator (5) is fitted downstream of the throttle area (3).

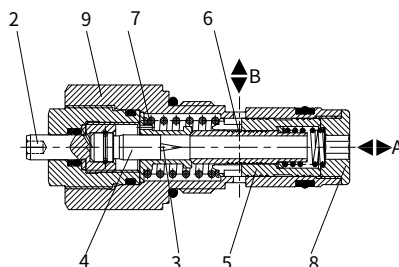
The pressure compensator (5) is pressed against the plug (8), via a compression spring (7). When there is no oil flow, pressure compensator (5) keeps in open position. If there is flow through the valve then the pressure in port A2/B2(A) acts on the pressure compensator (5). Then the pressure compensator (5) moves until the forces are balanced. If the pressure in port A2/B2 (A) increases, then the pressure compensator (5) moves in the closing direction until the forces are balanced again. Due to the continuous compensation by the pressure compensator, a constant flow is achieved.

Free flow from port A1/B1 (B) to port A2/B2 (A) is via check valve (6).

Type Z2FRM 6 C...
(meter-out flow control)



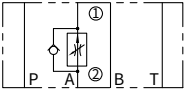
Flow control valve
Type 2FRM 6 K...



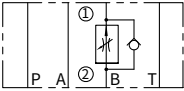
Symbols (① =valve side ② = sub-plate side)

• Sandwich flow control valve Type Z2FRM6

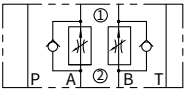
Type Z2FRM 6 A...
(meter-out flow control)



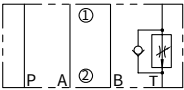
Type Z2FRM 6 B...
(meter-out flow control)



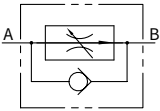
Type Z2FRM 6 C...
(meter-out flow control)



Type Z2FRM 6 T...
(port T flow control)



• Flow control valve Type 2FRM6K...



Note: Meter-in flow control refer to page 06/08.

Ordering code

• Sandwich flow control valve Type Z2FRM6

Z2FRM	6		B	2	L2X	/		R		★
Sandwich plate 2-way Flow control valve									Further details in clear text	
Size 6		= 6							No code = NBR seals V = FKM seals	
Flow control function (meter-out control) in								R =	With check valve	
Port A		= A							Flow A to B	
Port B		= B							up to 6.0 L/min	
Ports A and B		= C						6Q =	up to 32.0 L/min	
Port T ¹⁾		= T						32Q =		
Without closing external of the pressure compensator		= B						L2X=	Series L20 to L29	
Adjustment element with internal hexagon		= 2							(L20 to L29: unchanged installation and connection dimensions)	

• Flow control valve Type 2FRM6K

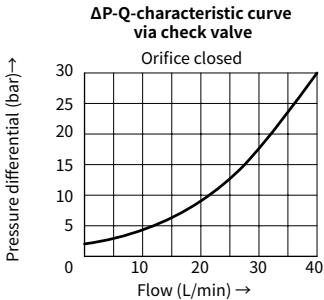
2FRM		6	K	2 – L1X /		R		*	
Flow control valve								Further details in clear text	
Size 6		= 6						No code =	NBR seals
Insert cartridge		=K						V =	FKM seals
Internal hexagon adjustment unit		=2					R =		With check valve
Series L10 to L19									Flow A to B
(L10 to L19: unchanged installation and connection dimensions)							6Q =		up to 6.0 L/min
							32Q =		up to 32.0 L/min

Technical data

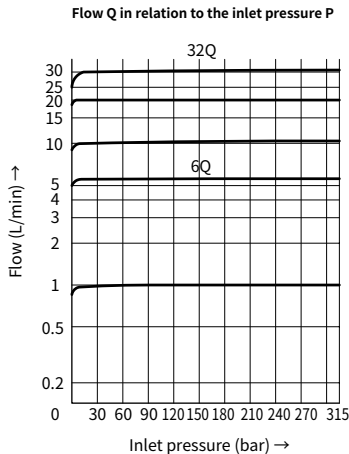
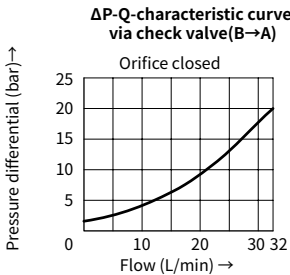
		Sandwich flow control valve type Z2FRM 6	Flow control valve type 2FRM6K
Mounting type		Flat mounting interface	Install position:optional
Connection type		Indirect connection via a subplate or block, porting pattern to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H	
Weight	kg	1.3 (flow control function in ports A, B or T) 1.5 (flow control function in ports A and B)	0.2
Nominal pressure	bar	315	
Fluid		Mineral oil,Phosphoric acid ester	
Fluid temperature range	°C	-20 to +80	
Viscosity range	mm ² /s	10 to 800	
Flow range	L/min	0.05~6; 0.25~32	
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406	
Min.pressure drawdown	bar	18 (Flow control valve type 2FRM6K)	
Pressure stability to $\Delta P=315$ bar	%	± 3 (Qmax)	

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

• Sandwich flow control valve Type Z2FRM6



• Flow control valve Type 2FRM6K

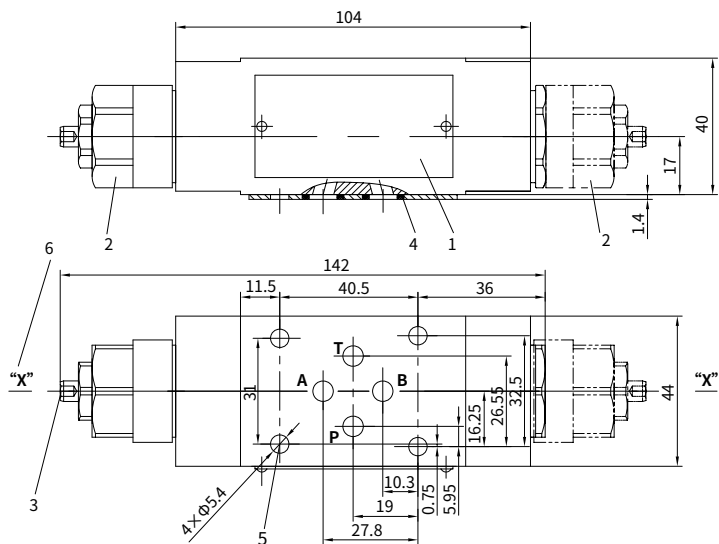


Unit dimensions:

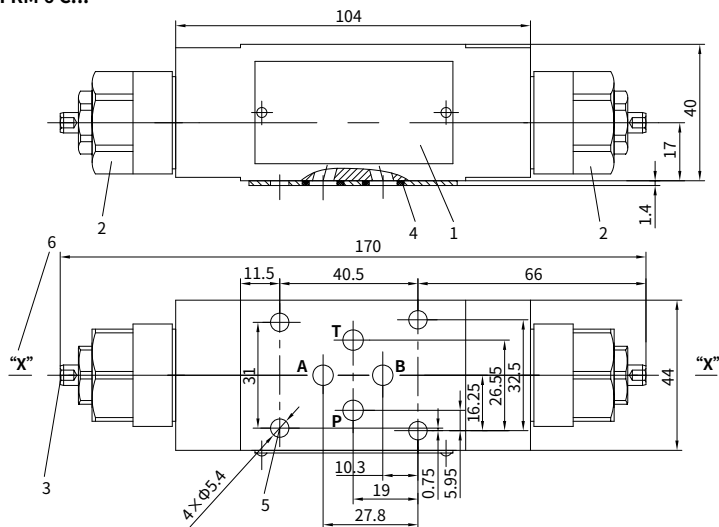
(Dimensions in mm)

- Sandwich flow control valve Type Z2FRM6

Type Z2FRM6A... and Z2FRM 6 B...



Type Z2FRM 6 C...

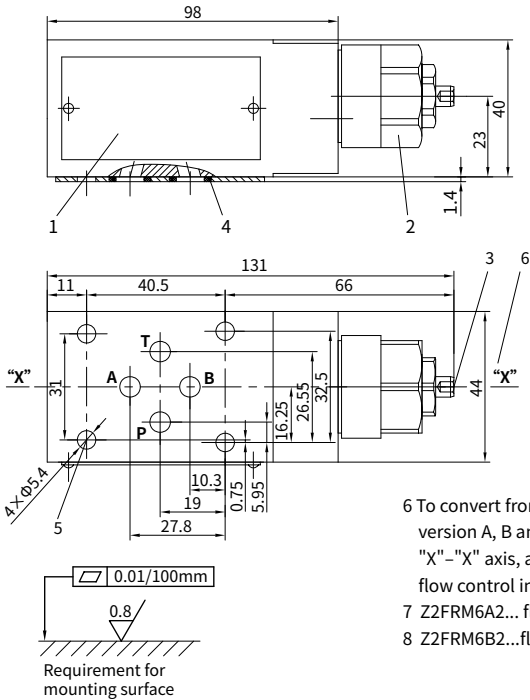


Unit dimensions:

(Dimensions in mm)

• Sandwich flow control valve Type Z2FRM6

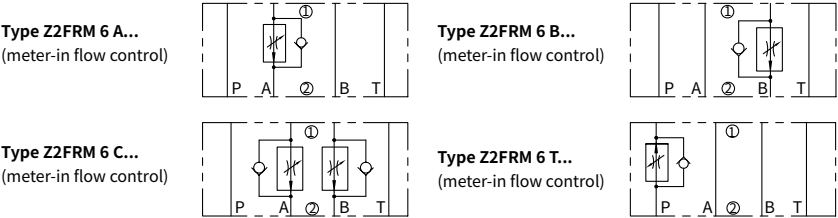
Type Z2FRM6 T



- 1 Name plate
- 2 Flow control cartridge type 2FRM6K hexagon 27A/F, $M_A = 50 \text{ Nm}$
- 3 Adjustment element with internal hexagon 3A/F
- 4 O-rings 9.25 x 1.78 (Ports A2, B2, P2, T2)
- 5 Valve fixing holes
- Valve fixing screws $M5 \times \text{**}$ GB/T70.1-10.9 tightening torque $M_A = 50 \text{ Nm}$, the screws length accords to the sandwich valves

- 6 To convert from meter-out into meter-in control for version A, B and C, rotate the component about the "X" - "X" axis, and for version T, convert from Port T flow control into Port P flow control.
- 7 Z2FRM6A2... flow control in port A
- 8 Z2FRM6B2...flow control in port B

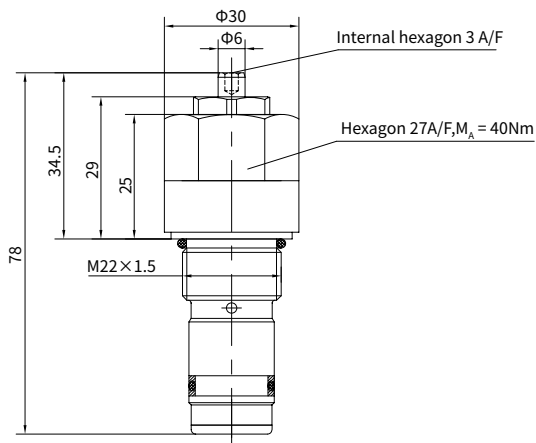
Symbols of rotation the component about the "X" - "X" axis
(① =valve side ② =sub-plate side)



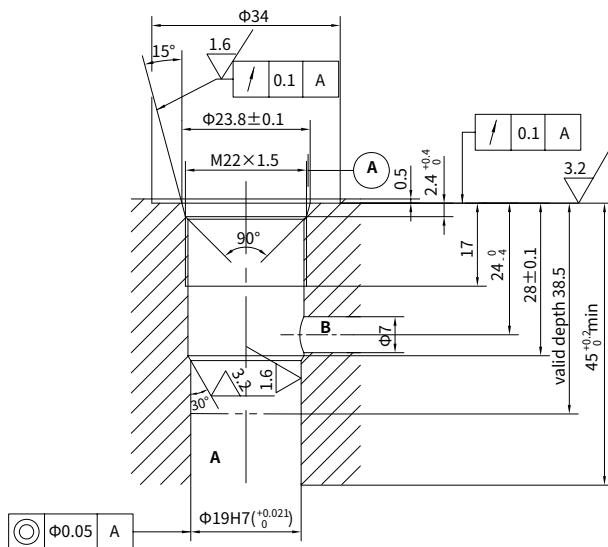
Unit dimensions:

(Dimensions in mm)

- **Flow control valve Type 2FRM6K**



Insert hole DIN ISO 7789



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4.9

Sandwich flow control valve

Type Z2FRM10

Flow control valve

Type 2FRM10K

Size 10
Up to 210 bar
Up to 60 L/min



Contents

Function and configuration	02
Symbols	03
Ordering code	03
Technical data	04
Characteristic curves	04
Unit dimensions	05-07

Features

- Sandwich plate valve
- Porting pattern to DIN 24 340 Form A, without locating pin hole (standard)
- Porting pattern to ISO 4401 and CETOP-RP 121 H
- With 1 or 2 flow control cartridges
- Adjustment element with internal hexagon

Function and configuration

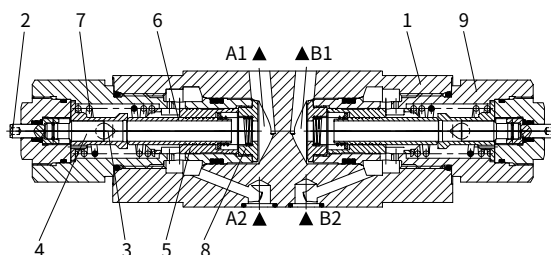
The valve type Z2FRM10 is a 2-way flow control valve of sandwich plate design and type 2FRM10K is a 2-way flow control cartridge valve. The former is used for maintaining a constant flow and is independent of the pressure and temperature.

The valve basically consists of a housing (1) and one or two flow control cartridges type 2FRM10K (9).

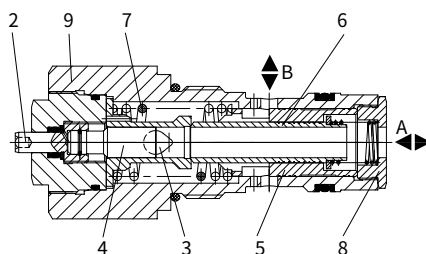
The throttling of the flow from port A1/B1 (A) to port A2/B2 (B) occurs at the throttle area (3). The throttle bolt (4) is driven by the adjustment element (2). To maintain a constant flow in port A2/B2(B) which is independent of pressure, a pressure compensator (5) is fitted downstream of the throttle area (3). The pressure compensator (5) is pressed against the plug (8), via a compression spring (7). When there is no oil flow, pressure compensator (5) keeps in open position. If there is flow through the valve then the pressure in port A1/B1 (A) acts on the pressure compensator (5). Then the pressure compensator (5) moves until the forces are balanced. If the pressure in port A1/B1 (A) increases, then the pressure compensator (5) moves in the closing direction until the forces are balanced again. Due to the continuous compensation by the pressure compensator, a constant flow is achieved.

Free flow from port A2/B2 (B) to port A1/B1 (A) is via check valve (6).

Type Z2FRM 10 C...

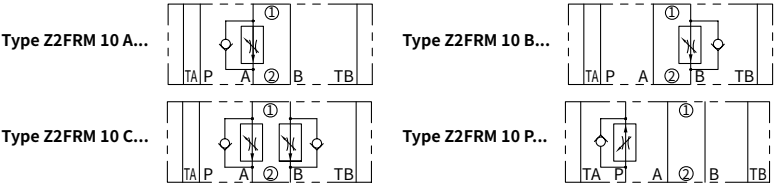


Flow control valve
Type 2FRM 10 K...

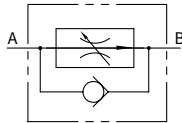


Symbols (① =valve side ② = sub-plate side)

• **Sandwich flow control valve Type Z2FRM10**

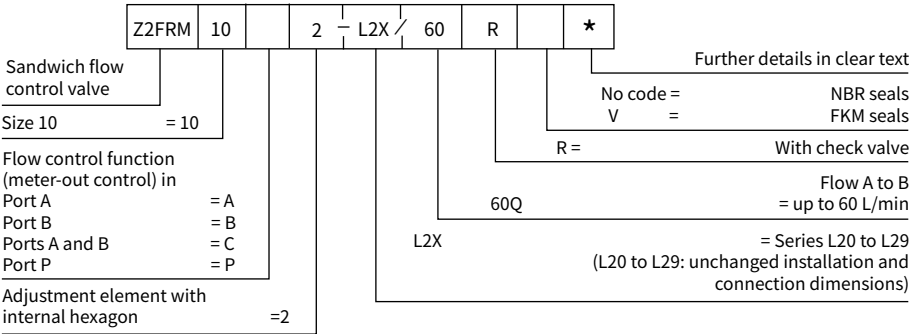


• **Flow control valve Type 2FRM10K...**

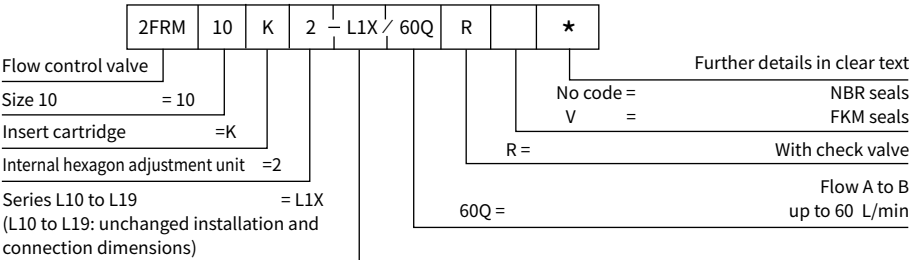


Ordering code

• **Sandwich flow control valve Type Z2FRM10**



• **Flow control valve Type 2FRM10K**

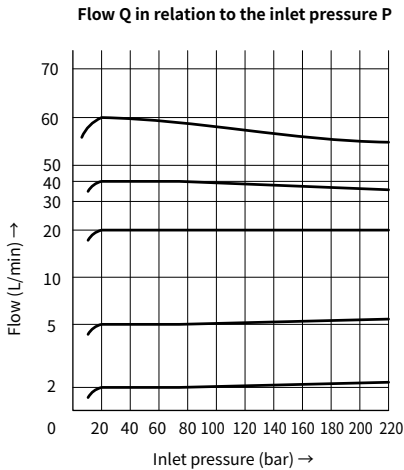
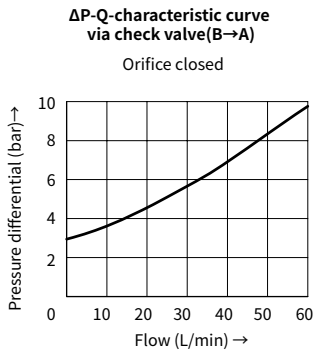


Technical data

		Sandwich flow control valve type Z2FRM10	Flow control valve type 2FRM10K
Mounting style		Flat mounting interface	Install position: optional
Connection type		Indirect connection via a subplate or block, porting pattern to DIN 24 340 form A, ISO 4401 and CETOP-RP 121 H	
Weight	kg	4.7 (flow control function in ports A, B or P) 5.3 (flow control function in ports A and B)	0.6
Nominal pressure	bar	210	
Fluid		Mineral oil, Phosphoric acid ester	
Fluid temperature range	°C	-20 to +80	
Viscosity range	mm ² /s	10 to 800	
Flow range	L/min	0.5~60	
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406	
Min. pressure drawdown	bar	18 (Flow control valve type 2FRM6K)	
Pressure stable up to $\Delta P=210$ bar	%	± 3 (Qmax)	

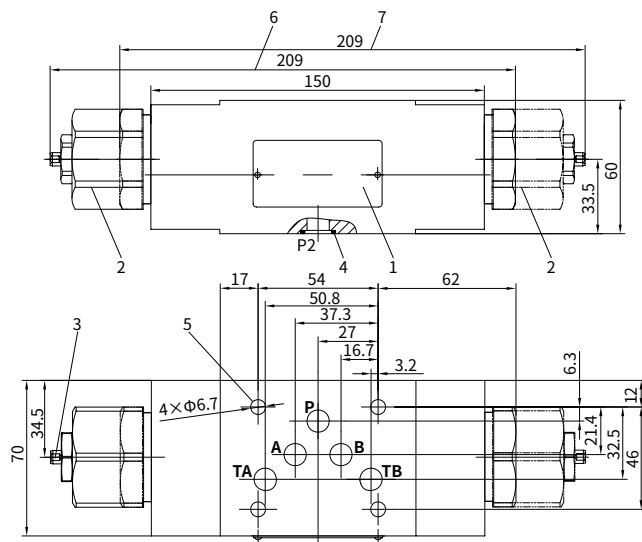
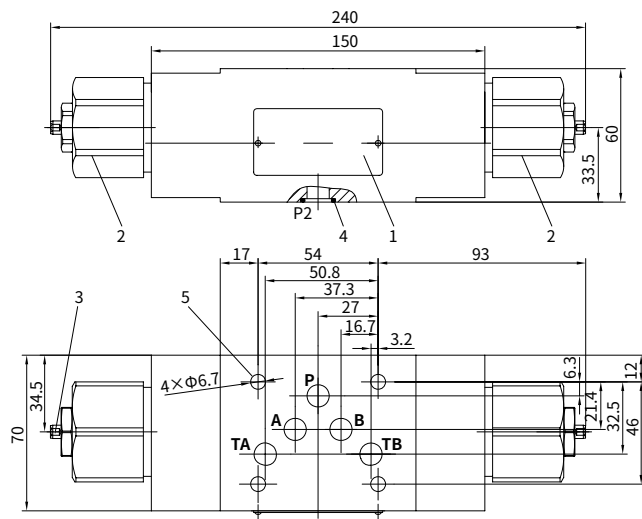
Characteristic curves (Measured at $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, using HLP46)

• Flow control valve Type Z2FRM10K



Unit dimensions:

(Dimensions in mm)

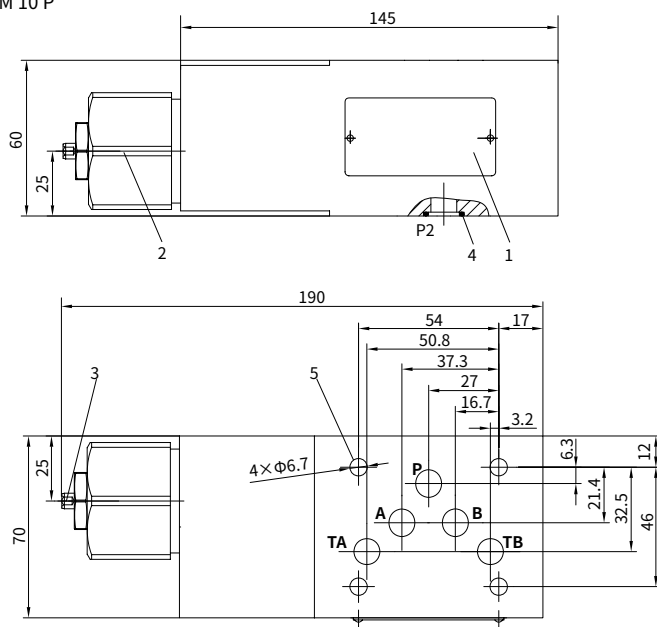
• Sandwich flow control valve Type Z2FRM10**Type Z2FRM 10 A... and Z2FRM 10 B...****Type Z2FRM 10 C...**

Unit dimensions:

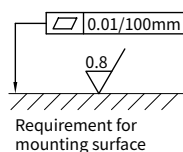
(Dimensions in mm)

• **Sandwich flow control valve Type Z2FRM10**

Type Z2FRM 10 P



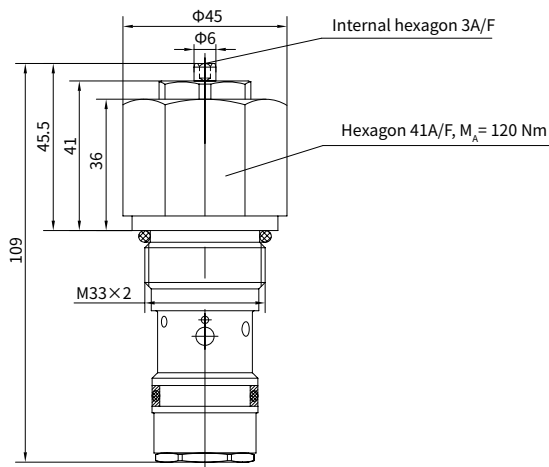
- 1 Name plate
- 2 Flow control cartridge type 2FRM10K
hexagon 41A/F, $M_A = 120 \text{ Nm}$
- 3 Adjustment element with internal hexagon 3A/F
- 4 O-rings 12×2 (Ports A2, B2, P2, TA2, TB2)
- 5 Valve fixing screws, M6 x ** GB/T70.1-10.9
tightening torque $M_A = 15.5 \text{ Nm}$,
the screws length accords to the sandwich valves
- 6 Z2FRM10A2...flow control in port A
- 7 Z2FRM10B2...flow control in port B



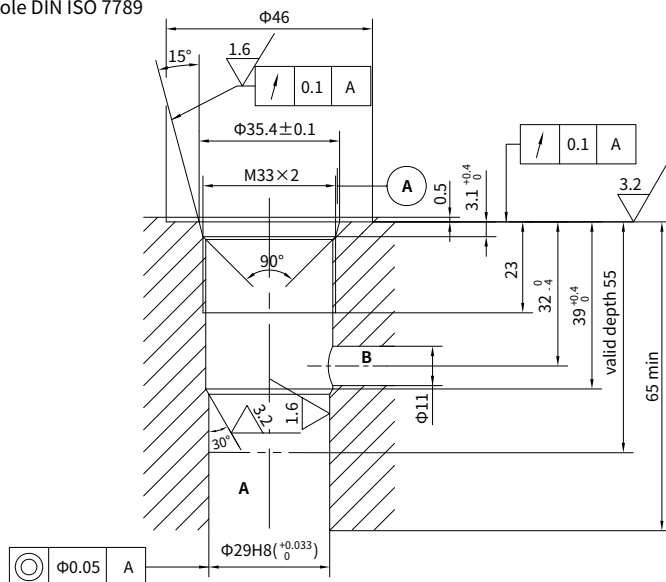
Unit dimensions:

(Dimensions in mm)

- **Flow control valve Type 2FRM10K**



Insert hole DIN ISO 7789



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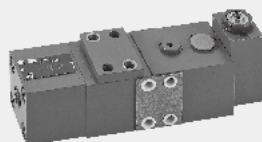


4.10

Check-Q-meter

Type FD...L2X

Sizes 12 to 32
Up to 350 bar
Up to 560 L/min



Contents

Function and configuration	02
Curcuit examples	03
Symbols	04
Ordering code	04
Technical data	05
Characteristic curves	05
Unit dimensions	06-11

Features

- Installation in manifolds (cartridge valve)
- With SAE flange ports
- Sub-plate connection or block, porting pattern to DIN 24340 form D, ISO 5781 and CETOP-RP121 H
- Check valve pilot operated (leakage-free)
- The check-Q-meter controls the returning flow Q_{v2} in relation to the flow Q_{v1} in the inlet port of actuator. For the application in cylinders system, the area ratio ($Q_{v2} = Q_{v1} \Phi$) has to be taken into account
- Bypass valve, free flow in opposite direction
- Safety valve, optional
(Only for valve with flange port and special plate valve type FD12 and FD16)

Function and configuration

Check-Q-meters are used to prevent runaway of hydraulic cylinder and motor in hydraulic system. They can also prevent pipe bursting.

Check-Q-meter basically consists of the housing (1), main poppet (2), pilot part (3), steel ball (11), pilot spool (4), spring seat (5) and damping (6). When load is lifted, fluid flows from A to B, the main spool (2) is opened. If pipe is cracked caused by the system, main spool (2) closes immediately because chamber (8) is connected with load pressure.

Lowering the load (circuit examples)

The direction of flow is from B to A. Port A is connected to tank via the directional valve. The piston rod side of the cylinder has a flow applied which corresponds to the working conditions. The relationship between the control pressure at port X and the load pressure at port B = 1:20.

When the control pressure is reached, the main spool opens. Via the control spool (4) the pilot stage (3) and steel ball (11) are lifted off its seat and chamber (8) is de-compressed via its internal hole and port A to tank. At the same time the load pressure in port B is no longer applied to chamber (8), this is due to the longitudinal movement of the pilot stage (3) within the main spool. The main poppet (2) is thereby unloaded. The reverse side of the control spool (4) at the main poppet (2), lies against the collar edge of the damping spool (5).

In order to open the main poppet, the pressure in the port X is decided by the spring in the chamber (9). When the valve open, the pressure is 20bar, and fully

open it is 60bar.

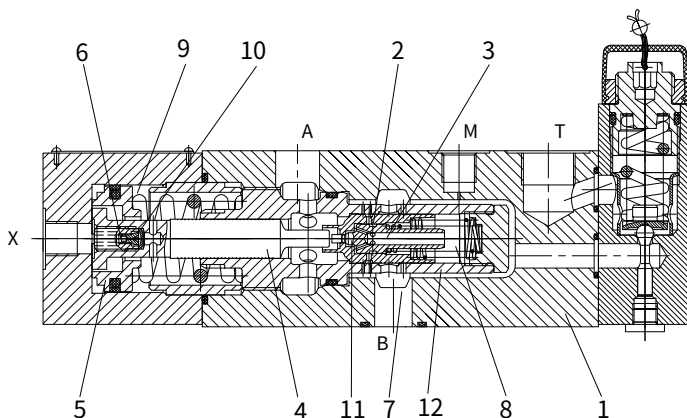
The opening cross-section for flow control increases progressively. It is created by the successive opening of radial hole in the sleeve (12) and the main poppet (2) land.

The relationship between the control pressure, cracking pressure and differential pressure determines the flow to the actuator via the connection of B to A. Thus uncontrolled running away of the actuator is prevented.

The controlled lowering procedure is not affected even if there is a pipe burst between the directional valve and port A.

Guidelines for influencing the opening and closing times of the check-Q-meter.

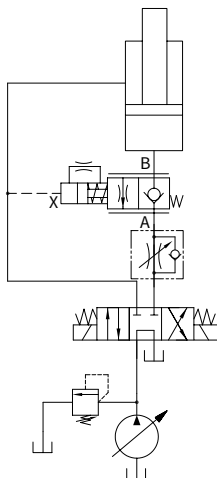
- Throttling of the opening sequence is via orifice (6) in the control spool (4) and both sides of the damping spool (5). The orifice (6) is protected by sieves (10).
- The closing movement of the check-Q-meter is virtually unthrottled.
- When being used in conjunction with cylinders the control line to port X can be fitted with a throttle check valve (meter-out control) to influence the closing sequence.
- When being used in conjunction with motors a throttle check valve should not be fitted in the control line to port X. In this case it is recommended that the control time of the directional valve are influenced.



Curcuit examples

• Cylinder with single rod

On safety grounds, a closed in-between position directional valve should always be used!



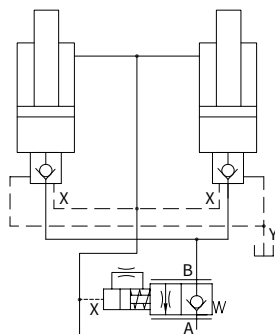
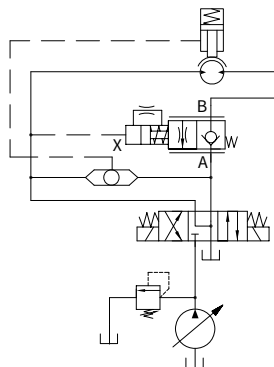
Notes:

It is not allowed to use two check-Q-meters to control two synchronized cylinders, as same synchronisation pressure cannot be guaranteed in each cylinder. Therefore, two pilot operated check valves, type SL should be equipped in cylinders. The check-Q-meter is fitted in a common line.

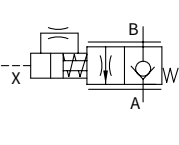
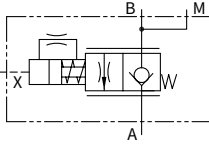
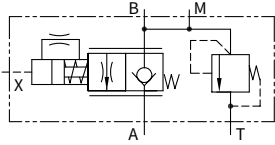
In this case, the load pressure must not exceed 200bar! To avoid the vibration because of too quick descent causing pressure lost at port X, a check throttle valve is commended to externally connect to Port A to limit the descent speed.

• Hydraulic motor

To make sure that brake can be operated, both of the directional valve ports have to be connected to the tank in the in-between position. If the brake is externally unloaded then it is possible to use a closed in-between position directional valve.



Symbols

Without safety valve		With safety valve
		
Type of valve: FD12KA-L2X/B03... FD16KA-L2X/B03... FD25KA-L2X/B04... FD32KA-L2X/B06...		Type of valve: FD12FA-L2X/B03... FD16FA-L2X/B03... FD25FA-L2X/B04... FD32FA-L2X/B06... FD12PB-L2X/B03... FD16PB-L2X/B03... FD25FB-L2X/B04... FD32FB-L2X/B06...

Ordering code

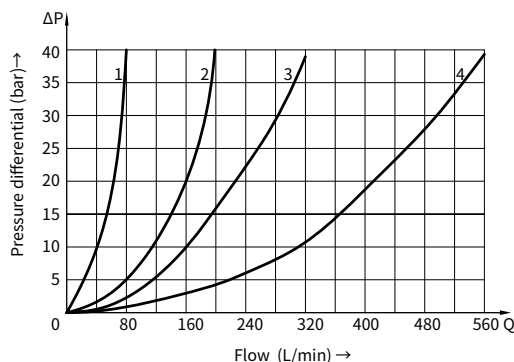
FD		L2X		/		/		*	
Check-Q-meter								Further details in clear text	
Nominal size 12	= 12							No code =	NBR seals
Nominal size 16	= 16							V =	FKM seals
Nominal size 25	= 25							External connection	
Nominal size 32	= 32							threaded connection (X, M, T)	
Cartridge valve	= KA							No code =	Inch thread
Sub-plate mounting	= PA							2 =	Metric thread
Flange connections without safety valve	= FA							B00 =	
Flange connections with safety valve	= FB							B03 =	
Sub-plate with safety valve								B04 =	
(only nominal size 12 and 16)	=PB							B06 =	
Series L20 to L29	=L2X							(other orifice diameters on request)	
(L20 to L29: unchanged installation and connection dimensions)									
Pressure setting range of safety valve								Relief setting:	
(Only for valve with flange port and special valve type FD12 and FD16)								At least 1.3 times the highest expected load !	
Pressure setting up to 200 bar	=20								
Pressure setting up to 300 bar	=30								
Pressure setting up to 400 bar	=40								

Technical data

Operating pressure, ports A, X	bar	to 350
Operating pressure, port B	bar	to 420
Pilot pressure, port X (flow control range)	bar	min.20~60, max.350
Cracking pressure, A to B	bar	2
Setting pressure for secondary pressure relief valve	bar	to 400
Flow -rate	L/min	80(size 12),200(size 16),320(size 25),560(size 32)
Area ratio of the pre-opening	$\frac{\text{poppet seat area}}{\text{area of pilot spool}} = \frac{1}{20}$	
Fluid	Mineral oil, phosphate ester	
Fluid temperature range	°C	-20 to +80
Viscosity range	mm ² /s	10 to 800
Degree of contamination	Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406	

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

04

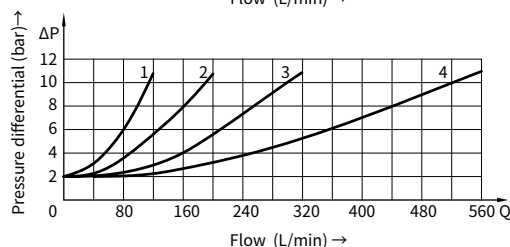


Pressure differential
Pin relation to flow Q,
measured at throttle position:

Throttle fully open ($P_x=60\text{bar}$)

B to A

1 = size 12
2 = size 16
3 = size 25
4 = size 32



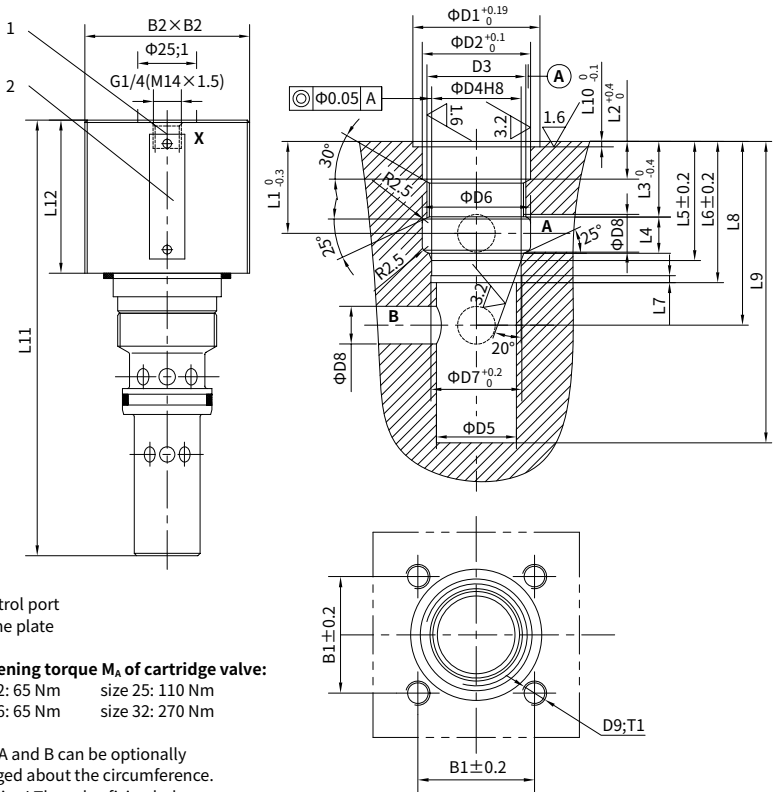
Pressure differential
Pin in relation to flow Q,
measured over the
check valve.

A to B

Unit dimensions

(Dimensions in mm)

• Installation in manifolds (cartridge valve)



1 Control port
2 Name plate

Tightening torque M_A of cartridge valve:
size 12: 65 Nm size 25: 110 Nm
size 16: 65 Nm size 32: 270 Nm

Ports A and B can be optionally arranged about the circumference.
Attention! The valve fixing holes must not be damaged.

Note: the cartridge valve is incompact structure but not integral, so when fixing, it can refer to Page 2/12.
First fix the sleeve with threaded, then fix other components, and the cover is last.

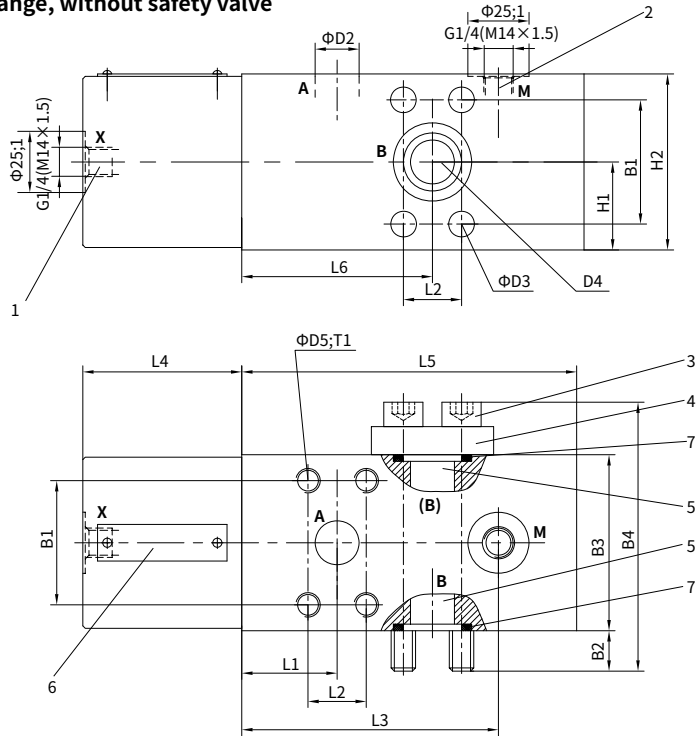
Type	B1	B2	D1	D2	D3	D4	D5	D6	D7	D8	D9	T1	L1	L2	L3	L4	L5
FD12KA	48	70	54	46	M42×2	38	34	46	38.6	16	M10	16	39	16	32	15.5	50.5
FD16KA	48	70	54	46	M42×2	38	34	46	38.6	16	M10	16	39	16	32	15.5	50.6
FD25KA	56	80	60	54	M52×2	48	40	60	48.6	25	M12	19	50	19	39	22	65
FD32KA	66	95	72	65	M64×2	58	52	74	58.6	30	M16	23	52	19	40	25	71

Type	L6	L7	L8	L9	L10	L11	L12	valve fixing screws/Tighting torque	M_A (Nm)	Weight
FD12KA	60	3	78	128	2.3	191	65	4 pcs M10×70 GB/T70.1-10.9	69	3.5kg
FD16KA	60	3	78	128	2.3	191	65	4 pcs M10×70 GB/T70.1-10.9	69	3.5kg
FD25KA	80	4	105	182	2.3	253	75	4 pcs M12×80 GB/T70.1-10.9	120	5.6kg
FD32KA	85	4	115	198	2.3	289	94	4 pcs M16×100 GB/T70.1-10.9	295	8.0kg

Unit dimensions

(Dimensions in mm)

• SAE flange, without safety valve



SAE flange connection:

Operating pressure 420bar

Flange mounting screws and blanking flange are included within the scope of supply.

- 1 Control port 3 Flange fixing screws 5 Optional port B 7 O-ring
2 Measuring port 4 Cover 6 Name plate

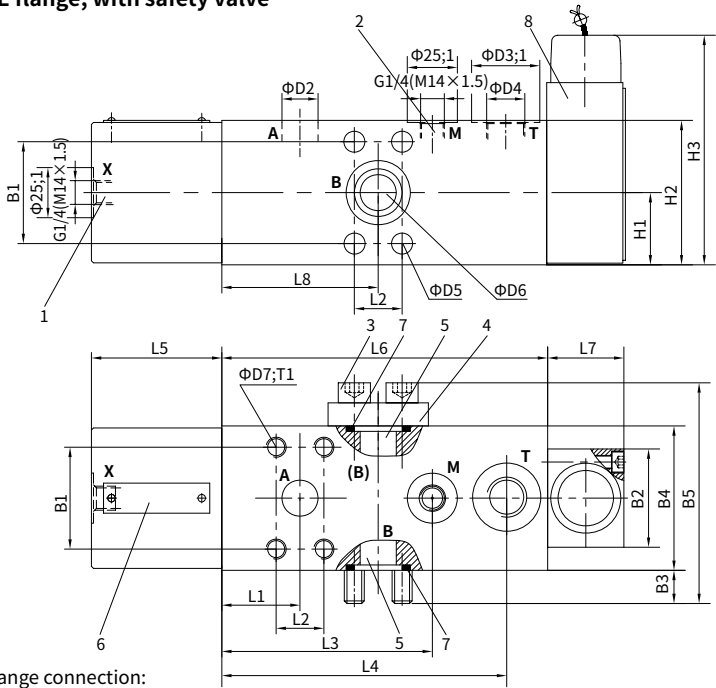
Type	B1	B2	B3	B4	D1	D2	D3	D4	D5	H1	H2	L1	L2	L3	L4
FD12FA	50.8	16.5	72	110	43	18	10.5	18	M10	36	72	39	23.8	105	65
FD16FA	50.8	16.5	72	110	43	18	10.5	18	M10	36	72	39	23.8	105	65
FD25FA	57.2	14.5	90	132	50	25	13.5	25	M12	45	90	50	27.8	148	75
FD32FA	66.7	20	105	154	56	30	15	30	M14	50	105	52	31.8	155	94

Type	L5	L6	T1	Weight	O-ring(7)	Valve fixing screws
FD12FA	140	78	15	7.2kg	25×3.5	4 pcs M10×100 GB/T70.1-10.9
FD16FA	140	78	15	7.2kg	25×3.5	4 pcs M10×100 GB/T70.1-10.9
FD25FA	200	105	18	16kg	32.92×3.53	4 pcs M12×120 GB/T70.1-10.9
FD32FA	215	115	21	23kg	37.7×3.53	4 pcs M14×140 GB/T70.1-10.9

Unit dimensions

(Dimensions in mm)

• SAE flange, with safety valve



SAE flange connection:

Operating pressure 420bar

Flange mounting screws and blanking flange are included within the scope of supply.

- 1 Control port 2 Measuring port 3 Flange fixing screws 4 Cover
5 Optional port B 6 Name plate 7 O-ring 8 Safety valve

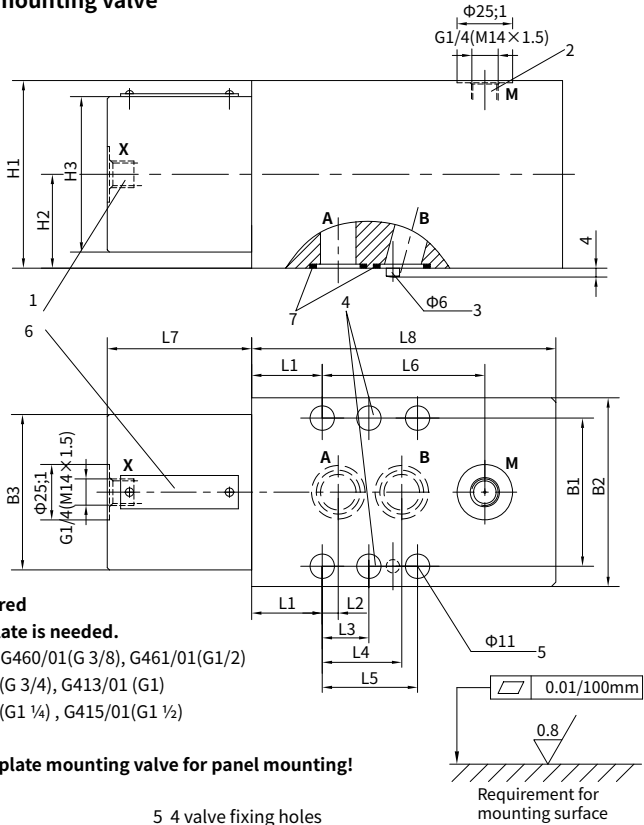
Type	B1	B2	B3	B4	B5	D1	D2	D3	D4		D5	D6	D7	H1	H2	H3	L1
									Inch	Metric							
FD12FB	50.8	49	16.5	72	110	43	18	34	G1/2	M22×1.5	10.5	18	M10	36	72	118	39
FD16FB	50.8	49	16.5	72	110	43	18	34	G1/2	M22×1.5	10.5	18	M10	36	72	118	39
FD25FB	57.2	78	14.5	90	132	50	25	42	G3/4	M27×2	13.5	25	M12	45	90	145	50
FD32FB	66.7	78	20	105	154	56	30	42	G3/4	M27×2	15	30	M14	50	105	145	52

Type	L2	L3	L4	L5	L6	L7	L8	T1	Weight	O-ring(7)	valve fixing screws
FD12FB	23.8	105	141.5	65	162	38	78	15	9kg	25×3.5	4 pcs M10×100
FD16FB	23.8	105	141.5	65	162	38	78	15	9kg	25×3.5	4 pcs M10×100
FD25FB	27.8	148	198	75	225	50	105	18	20kg	32.92×3.53	4 pcs M12×120
FD32FB	31.8	155	215	94	240	50	115	21	28kg	37.7×3.53	4 pcs M14×140

Unit dimensions

(Dimensions in mm)

• Sub-plate mounting valve



It must be ordered

if connection plate is needed.

Sizes 12 and 16: G460/01(G 3/8), G461/01(G1/2)

size 25: G412/01(G 3/4), G413/01 (G1)

size 32: G414/01(G1 1/4) , G415/01(G1 1/2)

Notes:

Only use a sub-plate mounting valve for panel mounting!

- 1 Control port
- 2 Measuring port
- 3 Locating pin
- 4 Not for sizes 12, 16 and 25
- 5 4 valve fixing holes for sizes 12, 16 and 25
- 6 valve fixing holes for size 32
- 7 Name plate

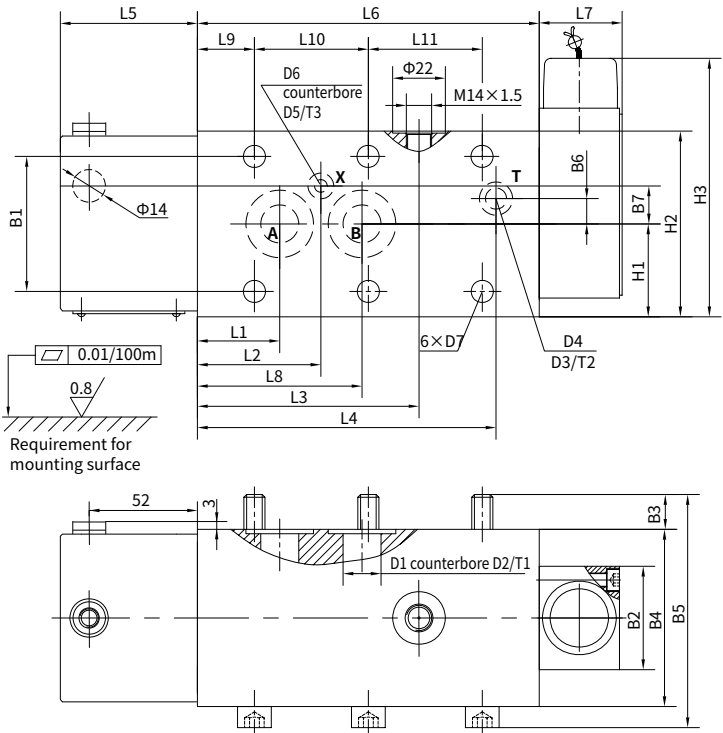
Type	B1	B2	B3	H1	H2	H3	L1	L2	L3	L4	L5	L6
FD12PA	66.7	85	70	85	42.5	70	31.8	7.2	-	35.8	42.9	73.2
FD16PA	66.7	85	70	85	42.5	70	31.8	7.2	-	35.8	42.9	73.2
FD25PA	79.4	100	80	100	50	80	38.9	11.1	-	49.2	60.3	109.1
FD32PA	96.8	120	95	120	60	95	35.3	16.7	42.1	67.5	84.2	119.7

Type	L7	L8	Valve fixing screws/tighting torque	M _A (Nm)	Weight	O-ring(7)
FD12PA	65	140	4 pcs M10×100 GB/T70.1-10.9	75	9.3kg	21.3×2.4
FD16PA	65	140	4 pcs M10×100 GB/T70.1-10.9	75	9.3kg	21.3×2.4
FD25PA	75	200	4 pcs M10×120 GB/T70.1-10.9	75	18kg	29.82×2.62
FD32PA	94	215	6 pcs M10×140 GB/T70.1-10.9	75	28kg	38×3

Unit dimensions

(Dimensions in mm)

• Special sub-plate amounting check-q-meter, with safety valve



Dimension of Check-Q-meter type FD12PB
Dimension of Check-Q-meter type FD16PB

Type	B1	B2	B3	B4	B5	B6	B7	D1	D2	D3	D4	D5	D6	D7
FD12PB	64	49	16	84	11	12.5	18	18	32	15.7	10	12.2	6	10.5
FD16PB	64	49	16	84	11	12.5	18	18	32	15.7	10	12.2	6	10.5

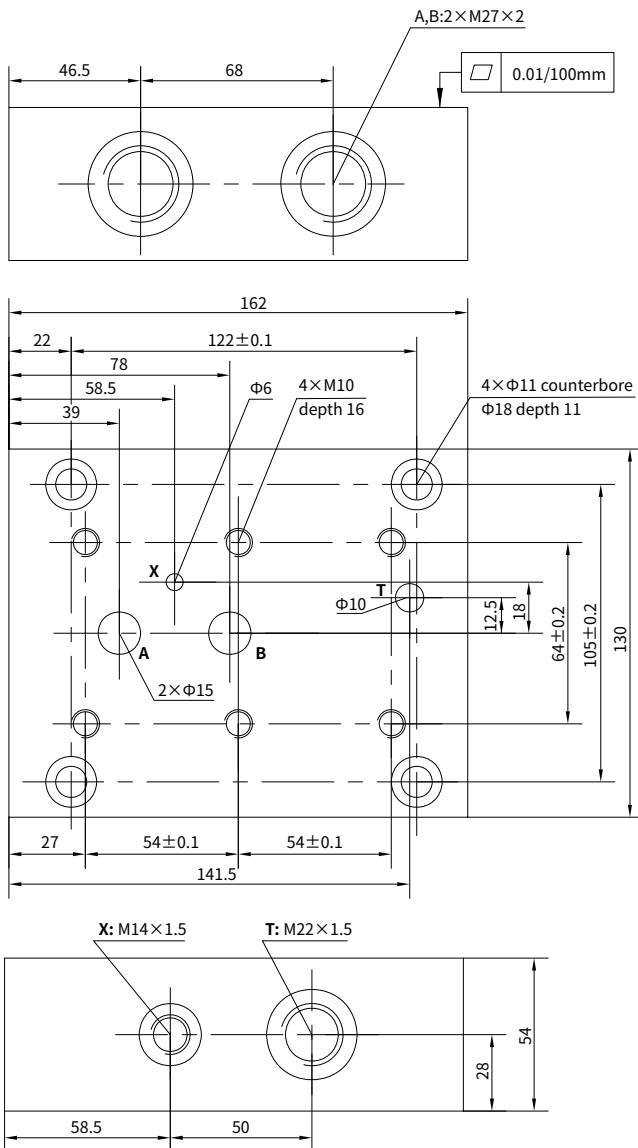
Type	H1	H2	H3	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
FD12PB	44	88	126	39	58.5	105	141.5	65	162	38	78	27	54	54
FD16PB	44	88	126	39	58.5	105	141.5	65	162	38	78	27	54	54

Type	T1	T2	T3	Weight	Fixing screws	O-ring(7)		
FD12PB	2.7	1.9	1.4	10kg	4pcs M10×100	25×3.53	12×2	9.25×1.78
FD16PB	2.7	1.9	1.4	10kg	GB/T70.1-10.9	25×3.53	12×2	9.25×1.78

Unit dimensions

(Dimensions in mm)

- **Sub-plate for special check-Q-meter with safety valve**



Sub-plate dimension of Check-Q-meter type FD12PB

Sub-plate dimension of Check-Q-meter type FD16PB

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