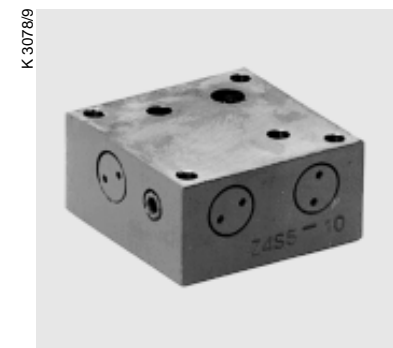


MANNESMANN REXROTH	2-Way Flow Control Valve, Pressure Compensated Model 2 FRM 5 (Series 3X)			RA 28 138/5.94 Replaces: 4.92
	Size 5	... 3050 PSI (210 bar)	... 3.96 GPM (15 L/min)	

- Pressure compensated flow control valve
- Optional anti-lunge adjustment on hydrostat, for smooth initial motion of the actuator
- Freewheeling, key lock handknob adjustment
- Sharp-edged orifice for temperature/viscosity immunity
- Scale for frequent adjustment reference
- Mounts on standard interface, for subplates see RA 45 066, models G44, G45



Model 2 FRM 5-3X/..



Model Z4 S 5-1X/..

Functional Description, Section

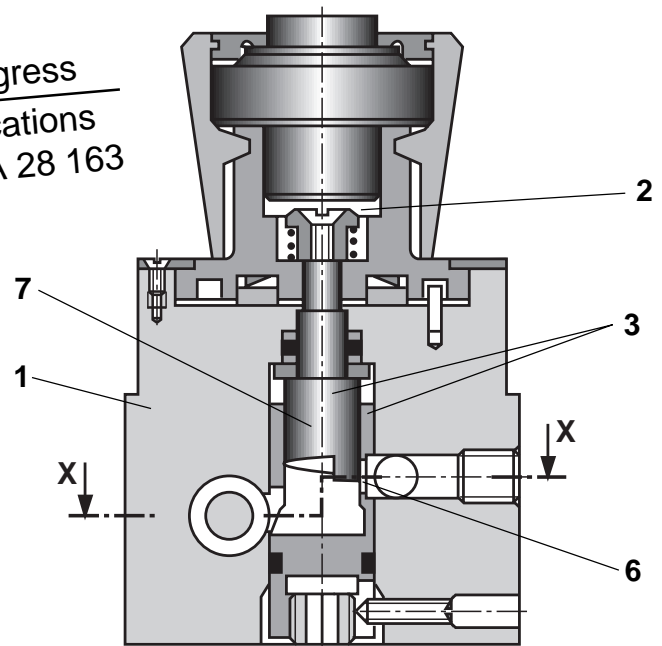
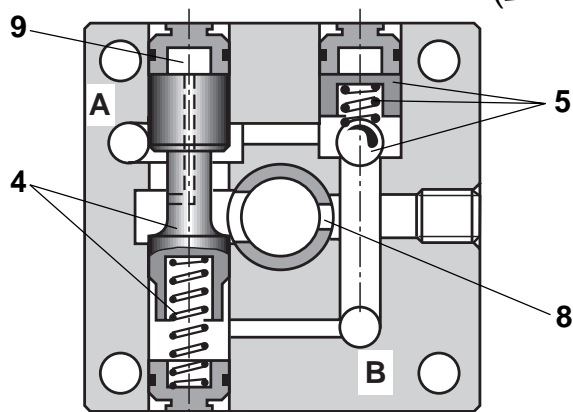
Pressure compensated flow control valves Model 2 FRM 5 are restrictive style flow regulators. They accurately control the rate of flow, independent of changes in fluid viscosity or pressure drop across the valve. This valve maintains a constant actuator speed, independent of changes in load induced pressure.

These valves consist of housing (1), freewheeling, lockable handknob adjustment mechanism (2), and a hydrostat (4), to maintain a constant pressure drop across sharp-edged orifice (3). Optionally available is an anti-lunge adjustment. Reverse free-flow check valve (5), is standard. During operation, flow from port "A" to "B" is

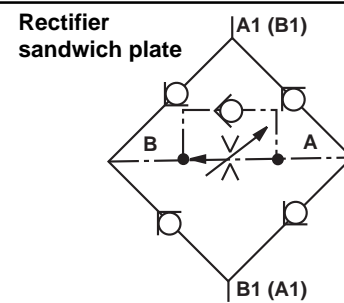
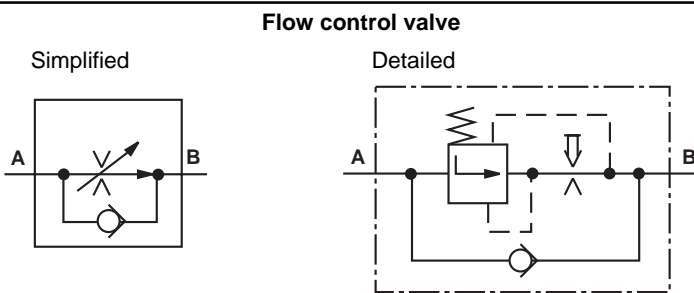
throttled by orifice (6). The throttle opening is adjusted by rotating spindle (7), with manual adjustment mechanism (2).

The hydrostat (4) senses supply pressure at area (9) and outlet pressure on the spring chamber side. Hydrostat (4) restricts flow from port "A" to maintain a fixed pressure drop across orifice (3) by spring (4). To control equal velocity in both directions of actuator motion, a rectifier sandwich plate is available, which permits controlled flow in both directions A → B and B → A.

*Phase Out in Progress
Not for New Applications
Please Consider RA 28 163
(2FRM6)*



Symbols



Ordering Code

2	FR	M	5	3X	*
2-way	= 2				
Flow control valve, pressure compensated	= FR				
Manual lockable handknob adjustment	= M				
Size 5	= 5				
Series 3X (30 ... 39 externally interchangeable)	= 3X				
Further details to be written in clear text					
no desig. = Buna-N seals, suitable for petroleum oils (HM, HL, HLP)					
V = Viton seals, suitable for phosphate ester fluids (HFD-R)					
no desig. = without anti-lunge adjustment					
B = with anti-lunge adjustment					
<i>Non-linear flow range</i>					
... 12.2 in ³ /min (0.05 GPM) (0.2 L/min)					= 0.2 Q
... 36.6 in ³ /min (0.16 GPM) (0.6 L/min)					= 0.6 Q
... 73.2 in ³ /min (0.32 GPM) (1.2 L/min)					= 1.2 Q
... 183.1 in ³ /min (0.79 GPM) (3.0 L/min)					= 3.0 Q
... 366.1 in ³ /min (1.59 GPM) (6.0 L/min)					= 6.0 Q
... 610.2 in ³ /min (2.64 GPM) (10.0 L/min)					= 10.0 Q
... 915.4 in ³ /min (3.96 GPM) (15.0 L/min)					= 15.0 Q

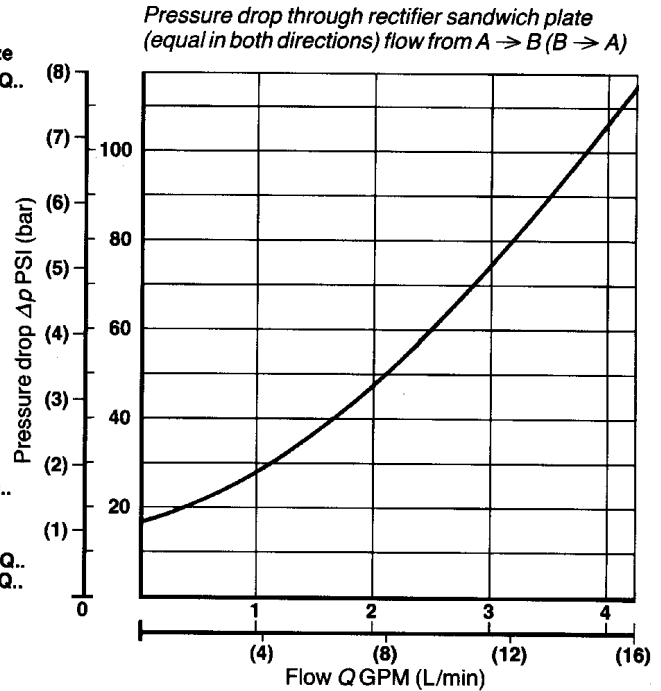
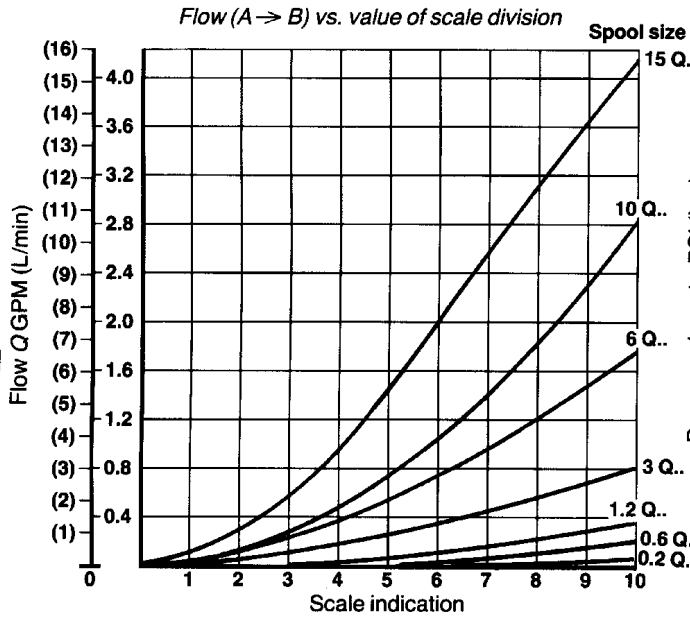
Ordering Code: Rectifier Sandwich Plate

Z4S	5	1X	*
Rectifier sandwich plate	= Z4S		
Size 5	= 5		
Series 1X (10 ... 19 externally interchangeable)	= 1X		
Further details to be written in clear text			
no desig. = Buna-N seals, suitable for petroleum oils (HM, HL, HLP)			
V = Viton seals, suitable for phosphate ester fluids (HFD-R)			

Technical Data (For applications outside these parameters, please consult us!)

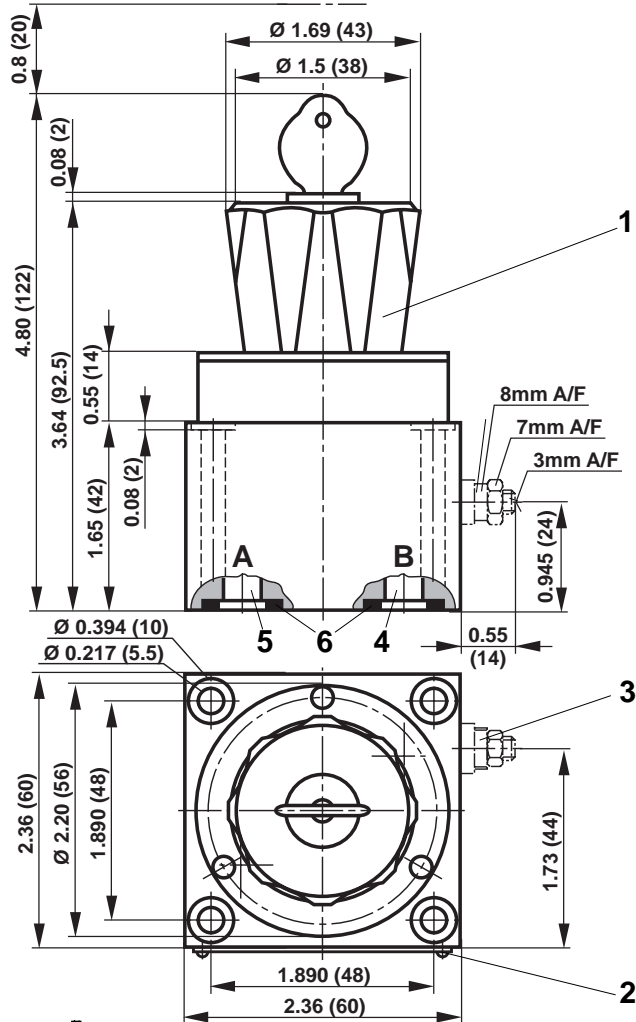
Hydraulic fluid	Petroleum oils (HM, HL, HLP); Phosphate ester fluids (HFD-R)							
Fluid temperature range	°F (°C)	Buna-N seals; - 22 ... 176 (- 30 ... 80) Viton seals; - 4 ... 176 (- 20 ... 80)						
Viscosity range	SUS (mm ² /s)	60 ... 3710 (10 ... 800)						
Maximum degree of fluid contamination	Class 18/15 according to ISO 4406. Therefore, we recommend a filter with a retention rate of $\beta_{10} \geq 75$.							
2-way flow control valve								
Maximum flow	GPM (L/min)	0.05(0.2)	0.16(0.6)	0.32(1.2)	0.79(3.0)	1.59(6.0)	2.64(10.0)	3.96(15.0)
Δp with reverse free-flow B → A across check valve, Q-related	PSI (bar)	7.3(0.5)	7.3(0.5)	8.7(0.6)	13(0.9)	26(1.8)	52(3.6)	97(6.7)
Flow temperature stability	- 4 ... 158 °F (- 20 ... 70 °C)	± 5 %	± 3 %	± 2 %				
pressure stability	$\Delta p = \dots 3050$ PSI (210 bar)	± 2 %					± 4 %	
Operating pressure, Port A	PSI (bar)	... 3050 (210)						
Minimum pressure drop	PSI (bar)	44 ... 73 (3 ... 5)					87 ... 116 (6 ... 8)	
Weight (approx.)	lbs (kg)	3.5 (1.6)						
Rectifier sandwich plate								
Maximum flow	GPM (L/min)	3.96 (15)						
Operating pressure	PSI (bar)	... 3050 (210)						
Cracking pressure	PSI (bar)	14.5 (1)						
Weight (approx.)	lbs (kg)	1.3 (0.6)						

Performance Curves, measured at $\nu = 190 \text{ SUS}$ ($41 \text{ mm}^2/\text{s}$) and $t = 122^\circ\text{F}$ (50°C)



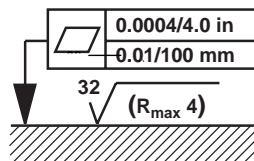
Unit Dimensions: 2 FRM 5 Flow Control Valve

(Dimensions in inches and millimeters)

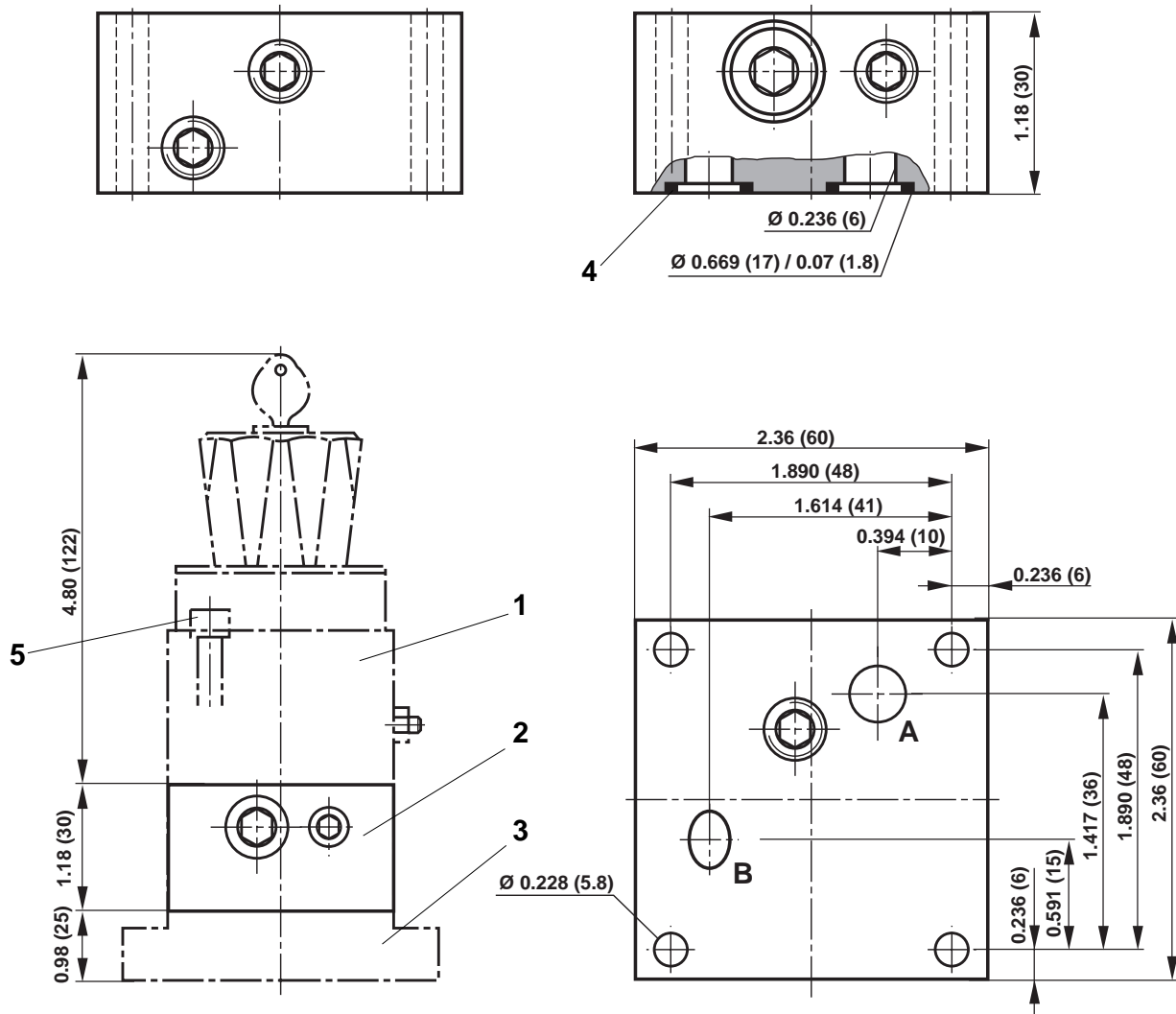


- 1 Lockable handknob (locks in any position) rotates through 300° which equals 10 scale divisions
 - 2 Nameplate
 - 3 Optional anti-lunge adjustment
 - 4 Inlet port "A"
 - 5 Outlet port "B"
 - 6 O-ring 12 mm x 2.5 mm
 - 7 **Subplates**, see RA 45 066
 G 44/05 (1/4" NPT)
 G 44/12 (SAE-4; 7/16-20)
 G 45/05 (1/2" NPT)
 G 45/12 (SAE-8; 3/4-16)
- Valve mounting bolts**
- 4) 10-24 UNC x 2" (M5 x 50)
 Socket head cap screws, SAE grade 8 or better
 Tightening torque 53 lb-in (6 Nm)
 Subplates and valve mounting bolts, must be ordered separately

Required surface finish of interface when mounting the valve without our subplate



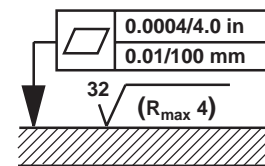
Unit dimensions, Model Z 4 S 5 rectifier sandwich plate: dimensions in inches (millimeters)



- 1 2 FRM 5 flow control valve
- 2 Rectifier sandwich plate
- 3 Subplate, see RA 45 066
- 4 R-rings 12.81 mm x 2.4 mm x 2.62 mm

- 5 Valve mounting bolts, for use with rectifier sandwich plate are longer
- 4) 10 x 24 UNC x 3-1/4 (M5 x 80) Socked head cap screws, SAE grade 8 or better. These bolts including the subplate (page 3) must be ordered separately

Required surface finish of interface when mounting the valve without our subplate



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