

AMCA
HYDRAULIC
CONTROLS

FEATURES

- * Load independent flow control corresponds to the spool-position proportional to the electrical input signal.
- * The pump pressure always corresponds to the user pressure, +3,6,8 or 12 bar (43, 86, 114 or 172 psi) Δp compensator.
- * The built-in pump-unloading valve results in:
 - very low power turned into heat;
 - minimum loading of the prime mover.
- * User speed is precisely controlled under all load conditions.
- * Progressive regulating curve; no pressure peaks when switching; sensitive control even for alternating pressures.
- * Constant working speed of differential cylinders at the different regulating flow to the valve by grinding angle.
- * Constant recirculation pressure independent of the number of units.
- * Any limiting of flow for every user port.
- * Load independent switching adjustment, constant acceleration and deceleration.
- * Proportional solenoids with longer life for the armature in the oil (explosion proof solenoids "II 2 EEx mII T4 or T5", available).
- * Proportional directional control valves also available as:
 - Manual proportional series MHV and
 - Hydraulic proportional series MOV.Any combination of these control options is possible.
- * The sub plate system allows a construction up to 8 control valves.

TECHNICAL DATA

Operating pressure (P,A,B)	...350 bar (5000 psi)
Maximum return pressure (T):	
- aluminium springcaps	15 bar (214 psi)
- cast iron springcaps	30 bar (428 psi)
Δp compensator	3; 6; 8 or 12 bar (43; 86; 114 or 172 psi)
Pressure setting range	5...350 bar (72...5000 psi)
Flow range	...800 l/min (...211 USgpm) - with 32 cSt at 40°C
Fluid	Mineral oil according to DIN 51524/51525
Fluid temperature range	-35...+80°C (-31°...+176°F)
Viscosity range	2,8...380 cSt, optimal 30 cSt
Contamination level max.	according to NAS 1638 Class 9 or ISO 18/15
Nominal voltage	12 V, 24 V
Nominal current	12 V DC = 1.400 mA ; 24 V DC = 700 mA
Hysteresis	3...8% (50...800 l/min (13...211 USgpm))
Continuous operating	100%
Type of protection	IP 65, optional IP67/II 2 EEx m II T4
Recommended dither frequency	100Hz
Mounting position	optional

Size working ports:	MEV12 : 1/2" BSP (SAE optional)
(in subplate)	MEV16 : 3/4" BSP (SAE optional)
	MEV20 : 1" BSP (SAE optional)
	MEV25 : 1 1/4" BSP (SAE optional)
	MEV32 : 1 1/2" BSP (SAE optional)

Max. flow in l/min. (USgpm) related to the Δp in bar (psi) over the compensator, per nominal bore:

Size	Δp compensator			
	3 (43) ¹⁾	6 (86)	8 (114)	12 (172) ²⁾
MEV12	50 (13)	80 (21)	90 (24)	100 (26)
MEV16	100 (26)	140 (37)	155 (41)	180 (47)
MEV20	160 (42)	225 (59)	250 (66)	300 (79)
MEV25	250 (66)	350 (92)	390 (103)	500 (132)
MEV32	400 (106)	500 (132)	550 (145)	800 (211)

- ¹⁾ For the MEV only valid with external pilot supply
²⁾ Due to loss of pressure c.q. energy conversion into heat, we recommend the next largest size related to a lower Δp compensator.

Spool types	Symbols	Operation Characteristic	Spool types	Symbols	Operation Characteristic
A 4/3 way		In neutral position all ports blocked ³⁾	F 4/2 way		In neutral position all ports blocked ³⁾
B 4/3 way		In neutral position A-T 20% of nominal bore ³⁾	G 4/2 way		In neutral position A+B-T 20% of nominal bore ³⁾
C 4/3 way		In neutral position A+B-T 20% of nominal bore ³⁾	K 3/3 way		Port A out of function position ³⁾
D 4/3 way		In neutral position B-T 20% of nominal bore ³⁾	M 3/2 way		Port A out of function, P-B 70% of nominal bore
E 4/2 way		P-B and A-T 70% of nominal bore	O 3/2 way		Port B out of function, port T leakage flow ³⁾

- ³⁾ recirculation at low pressure only with MUV

DESCRIPTION

Conventional directional control valves control start, stop and directions of movement from hydraulic motors and cylinders. However, the speed of these users depends on the load pressure. If this load pressure varies, the speed is hardly controllable (figure 1)

The AMCA proportional directional control valves are pressure compensated and achieve an ideal control of force, speed, acceleration and deceleration, independent of the load and increased demands (figure 2)

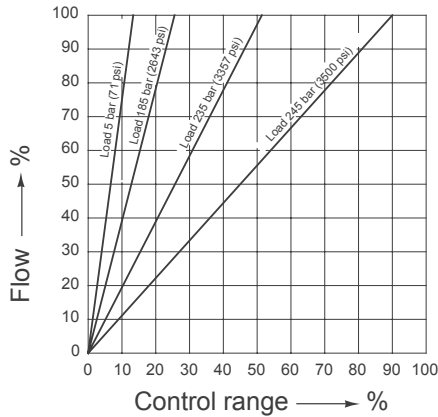


Fig. 1

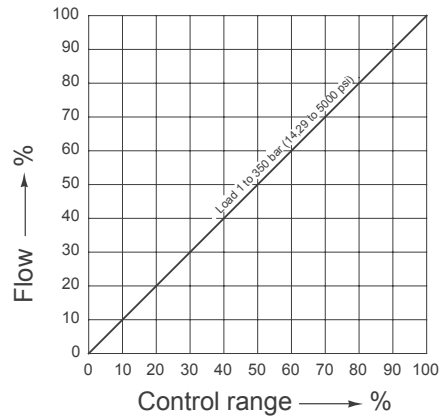


Fig. 2

The pressure compensator could be a pressure relief valve (MUV) or a pressure reducing valve (MDM), together with the throttling function of one or more directional control valve spools. This compensator acts as a **by-pass (3-way) flow control valve** (with MUV) or as **series (2-way) flow control valve** (with MDM). See figures 3 and 4.

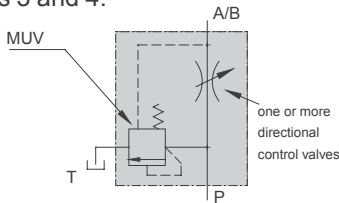


Fig. 3

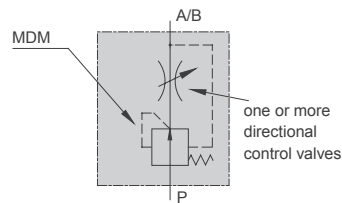


Fig. 4

Advantages of the AMCA Proportional Directional Control Valves:

The shape of the AMCA proportional directional control valve spool differs from the conventional one. The result is a progressive flow curve (figure 5). To make optimal use of the maximum stroke of the spool the flow angles of the A and/or B port can be defined for the different flows. For a constant flow, the pressuredrop over the orifice of the spool remains constant, independent of the load pressure (figure 6).

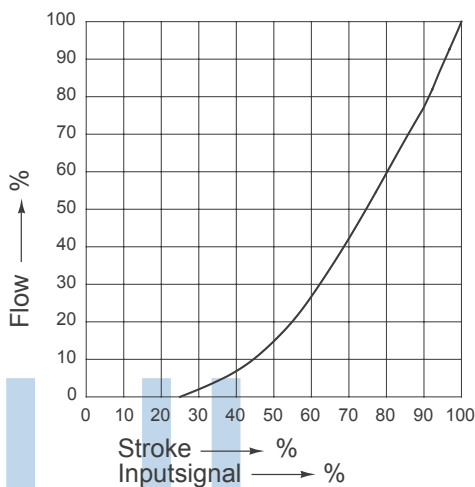


Fig. 5

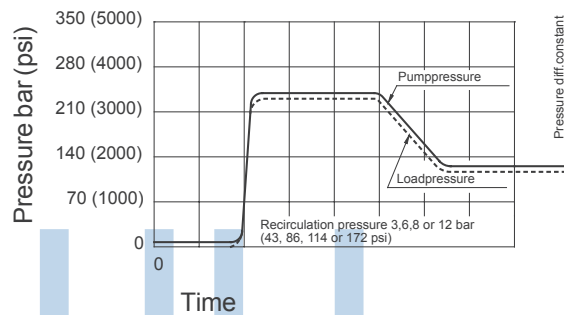


Fig. 6

Functioning of the by-pass (3-way) flow control valve (with MUV)

(this type is used in combination with fixed displacement pumps) (fig. 7 and 8)

The AMCA-MUV has three functions:

1. Energy saving

If the directional control spools are in neutral position (spool 1 in fig. 7), and the pump is running, the pressure relief valve 1 (MUV) opens at low pressure (depending on the spring 3, 6, 8 or 12 bar (43, 86, 114 or 172 psi)).

P and T are connected. The power ($p \times q_v$) turned into heat is very low.

The spring chamber is connected, via the "load-pressure check back system", to T (tank).

(example fig. 21)

2. Load independent flow control

(acting as a 3-way flow control valve)

If one directional control spool is actuated (spool 2 in fig. 7, where P is connected to B2), the load-pressure is connected to the spring chamber of the MUV. The left part of the "load pressure check back system" is closed by spool 2. The load-pressure added to the spring-equivalent pressure is in balance with the pressure at P. Therefore the Δp over the directional control valve remains constant (3, 6, 8 or 12 bar (43, 86, 114 or 172 psi)).

As $q_v = k \cdot \sqrt{\Delta p}$, the flow remains constant, at a given opening of port B2, independent of the load-pressure. The output (flow) is proportional to the input signal (displacement of spool).

The unnecessary pumpflow returns to tank.

3. Adjustable maximum load pressure

The maximum load-pressure can be restricted by the adjustable relief valve 2.

Functioning of the series (2-way) flow control valve (with MDM)

(this type is used in combination with variable displacement/pressure compensated pumps (example fig. 9 and 10) or accumulator circuits.

The AMCA-MDM has three functions:

1. Energy saving

If the directional control spools are in neutral position (spool 1 in fig. 9) and the pump is running, the pressure reducing valve MDM (normally open) tends

to close (is balancing).

The pressure controls the pump-capacity to a minimum. Again the power ($p \times q_v$) turned into heat is very low.

The spring chamber is connected, via the "load-pressure check back system" to T (tank).

2. Load independent flow control

(acting as a 2-way flow control valve)

If one directional control spool is actuated (spool 2 in fig. 9) MDM-orifice throttles the flow and reduces the pressure. This reduced pressure is connected to B2.

The left part of the "load pressure check back system" is closed by spool 2. The load pressure added to the spring-equivalent pressure (3, 6, 8 or 12 bar (43, 86, 114 or 172 psi)) is in balance with the reduced pressure.

Therefore the Δp at flow angle 2 remains constant (3, 6, 8 or 12 bar (42, 86, 114 or 172 psi)). As $q_v = k \cdot \sqrt{\Delta p}$, the flow remains constant at a given opening of port B2, independent of the load pressure.

The output (flow) is proportional to the input signal (displacement of spool).

There is no unnecessary pumpflow (pump capacity is controlled by pressure).

3. Adjustable maximum load pressure

The maximum load pressure can be restricted by the adjustable relief valve 2.

Functioning of the by-pass (3-way) flow control valve (with MUV/R)

(this type is used if there is a need to use the MUV as a sequence valve)

(fig. 11 and 12)

The function is the same as described in clause 1 (fig. 7). The return bore is blocked (as in fig. 9). There is an additional possibility of directing the pumpflow from P to R (fig. 12) to feed another circuit up to 350 bar, or to control the adjusting mechanism on a variable displacement pump (fig. 11).

(example fig. 24)

Note: (1) *If the system pump is of the load sensing type, no compensator is required. (example fig. 25)*

(2) *For simultaneous operation of the proportional directional control valve, independent of load pressure, we advise a pressure compensator for each control valve.*

For flows < 201 l/min. (53 USGpm) per control section, the MFC stacked valves are a good alternative in this case. (see Publ. F12/18K)

OPERATION

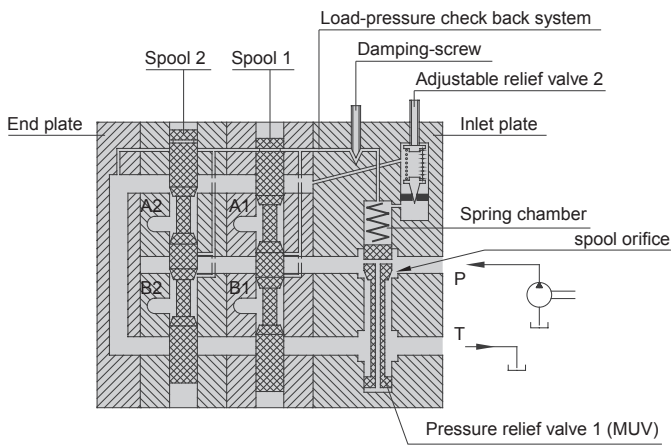


Fig.7 By-pass control valve

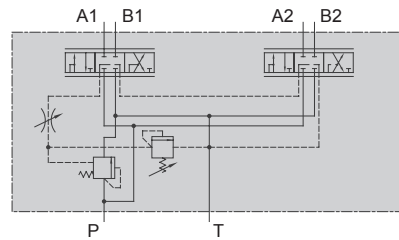


Fig. 8 With MUV

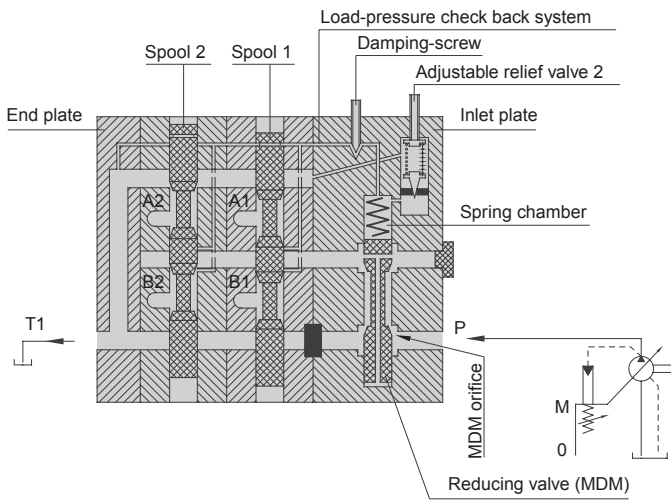


Fig. 9 Series flow control valve

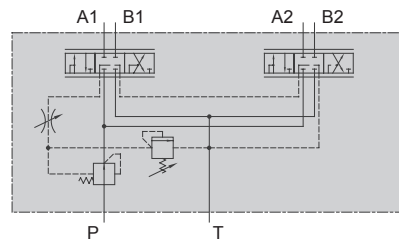


Fig. 10 With MDM

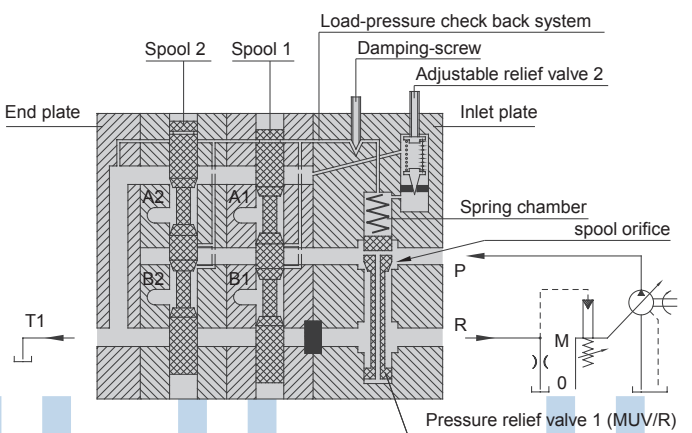


Fig. 11 By-pass flow control valve

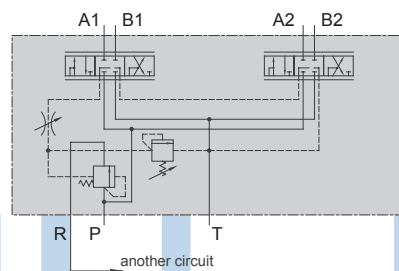


Fig. 12 With MUV/R

Functioning of the proportional directional control valve with electrically controlled pilot stage. (MEV)

(Fig. 13, 14 and 15)

When solenoid a is actuated it pushes the pilot spool towards solenoid b and opens throttle position 1. This allows pilot pressure to the springchamber 1 (speed controlled by the adjustable restriction 5) and also through bore 3 to the end of the pilot spool opposite to solenoid a.

The balance force on the pilot spool is the force of the solenoid which is proportional to the electric input.

The balance force equates the pilot pressure in solenoid b and also in springchamber 1.

This pressure pushes the main spool against the spring in springchamber 2 and thus takes up a position proportional to the electric input signal.

With the screws on the springchambers the maximum flow can be adjust by turning in the screw and block the main spool in his stroke.

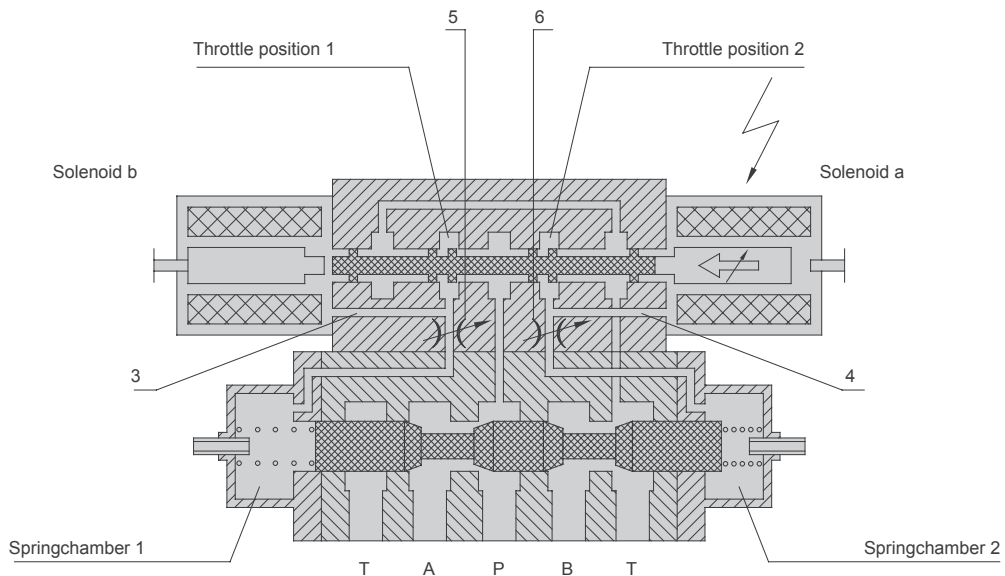


Fig. 13 MEV

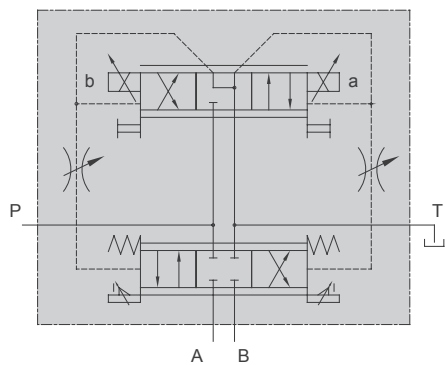


Fig. 14 (detailed)

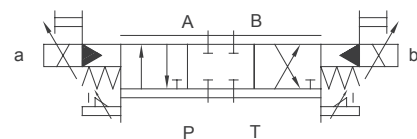
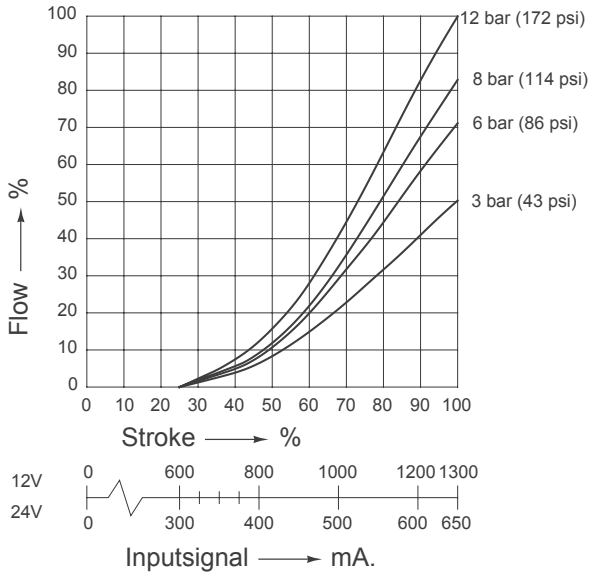


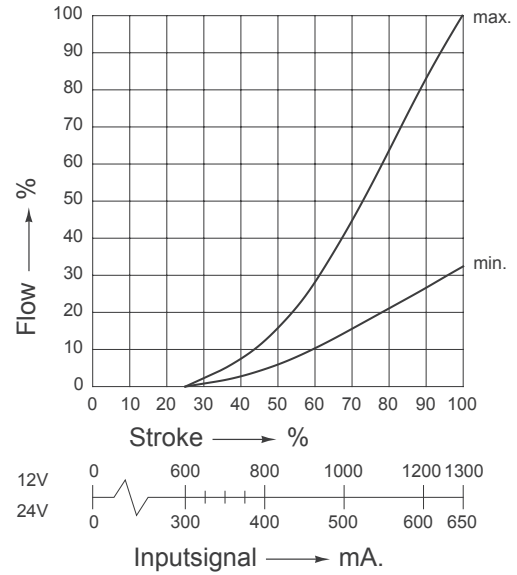
Fig. 15 (simplified)

DIAGRAMS

Flow P → A/B
with max. spoolangles
with 3, 6, 8 or 12 bar spring
(43, 86, 114 or 172 psi)

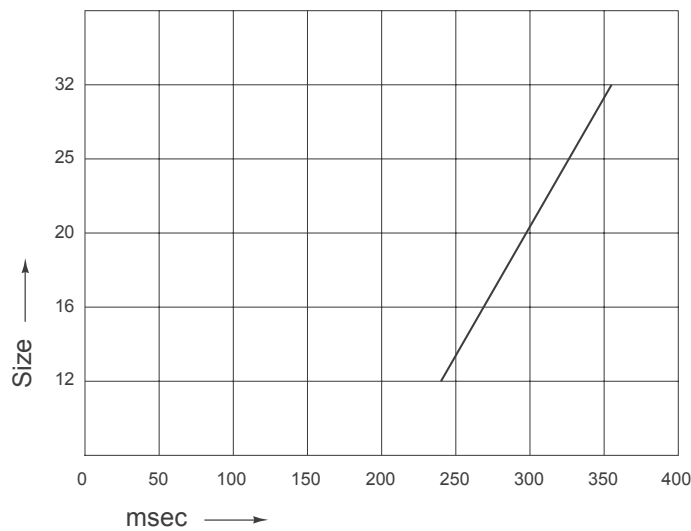


Flow P → A/B
with min. spoolangles
to max. spoolangles



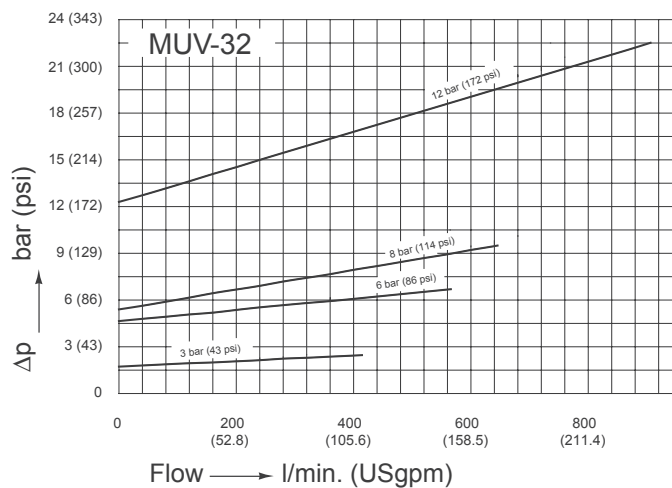
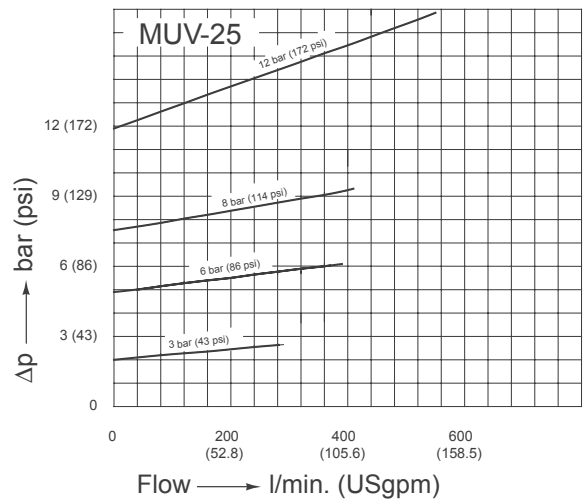
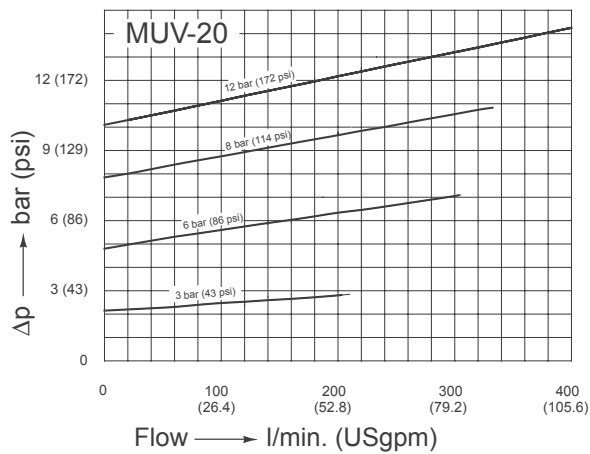
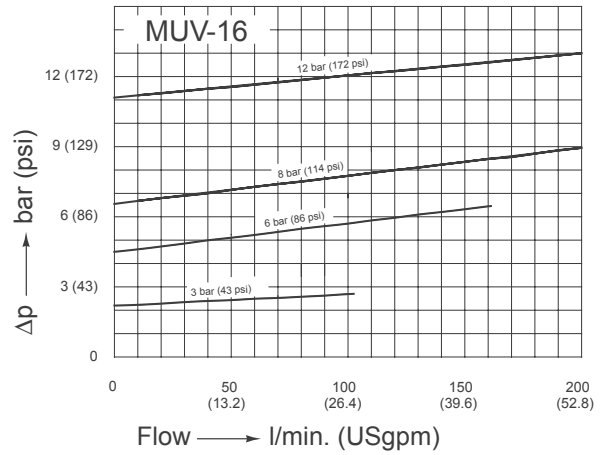
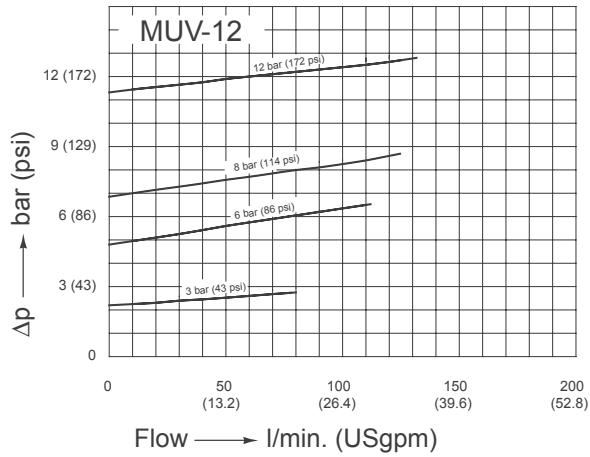
Response time from neutral position to maximum spool stroke.

Measured with external pilot supply
on the pilot stage = 100 bar (1430 psi)
at 32 cSt.



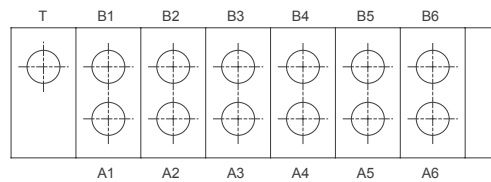
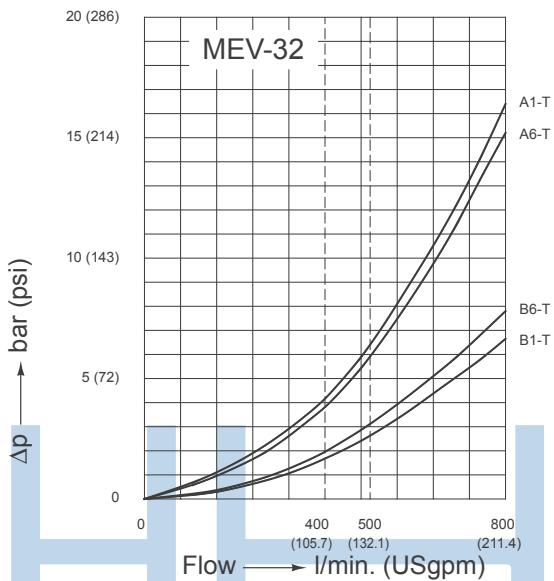
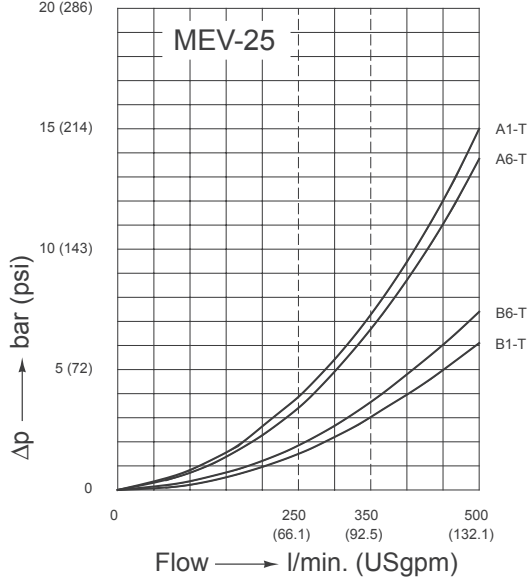
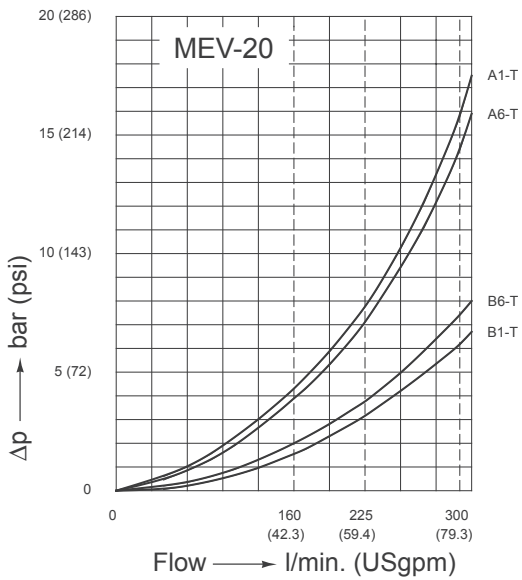
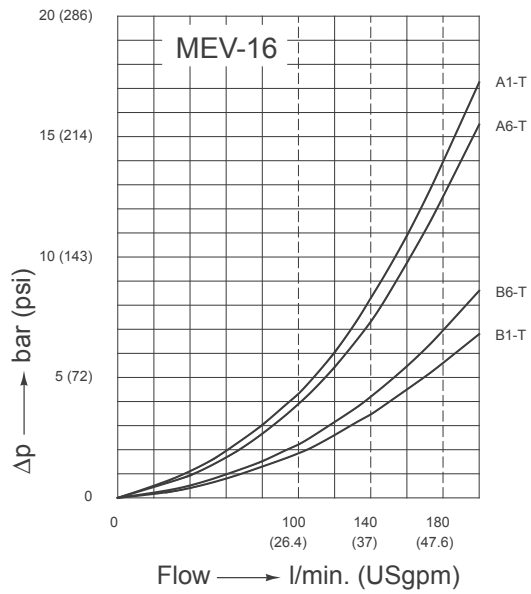
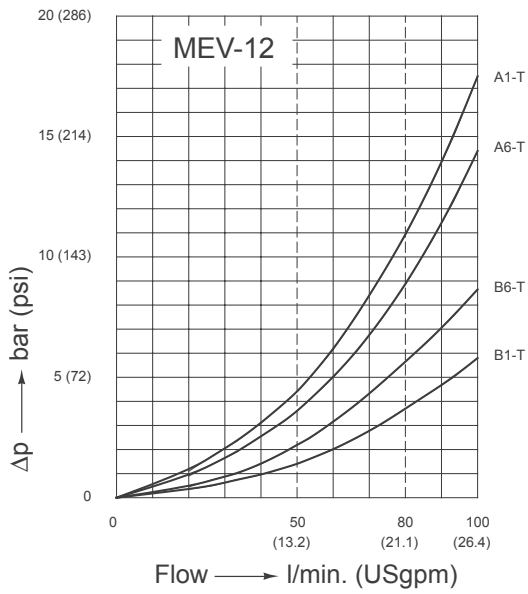
DIAGRAMS

Free recirculation pressure P → T
 MUV with 3, 6, 8 or 12 bar spring (43, 86, 114 or 172 psi).



DIAGRAMS

Pressure drop A/B → T



measured with C-spool and max. spoolopening A/B → T
 Viscosity 32 cSt.
 Including subplates and couplings.

TYPE OF VALVE MOUNTING

The AMCA proportional directional control valves series MEV...A are sub-plate-, multiple sub-plate- and ganged sub-plate valves. A complete AMCA-MEV..A system consists for example of three main parts (fig 16)

- 1. MUV or MDM : pressure relief (fig 17) or pressure reducing valve (fig 18)).
- 2. MEV : 4/3 directional control valve with electrically controlled pilot stage.
- 3. Ganged sub-plates : including inlet- and endplate

1 : MUV..A or MDM..A
 2 : MEV..A (including pilot stage)
 3 : A..UV or A..DM + A..EV + AP

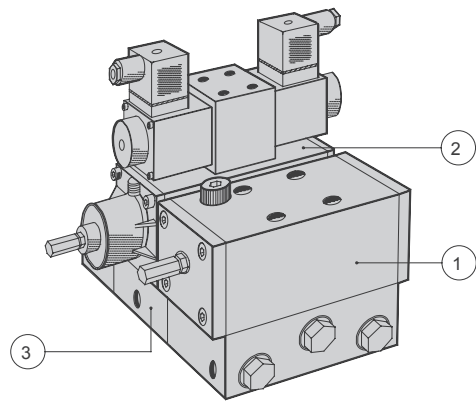


Fig. 16

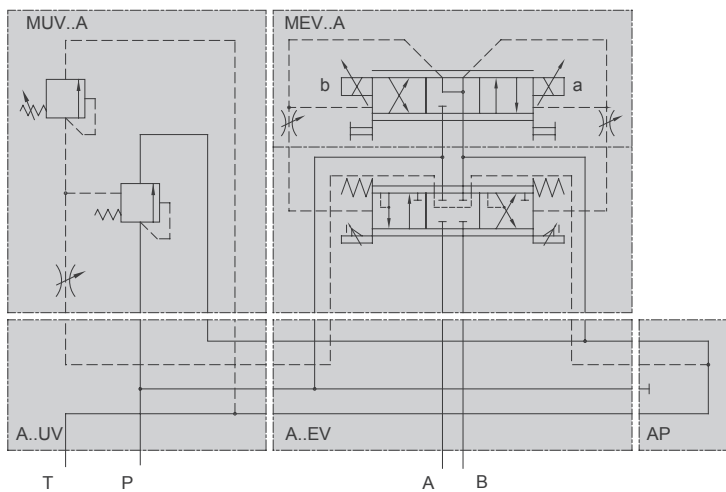


Fig. 17 (detailed)

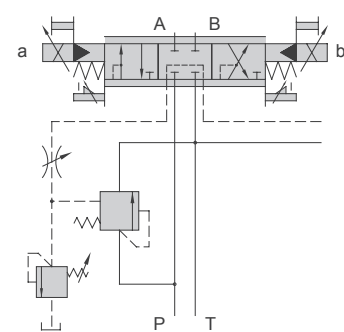


Fig. 17a (simplified)

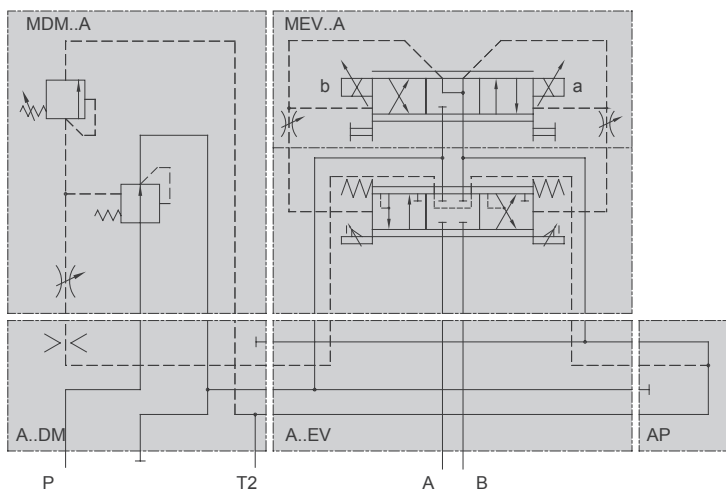


Fig. 18 (detailed)

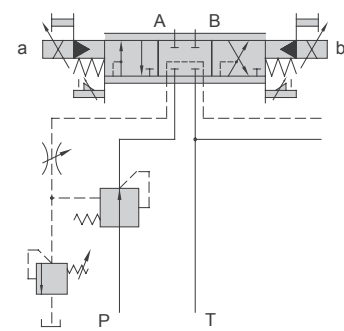


Fig. 18a (simplified)

OPTIONS

The following options are possible (see fig 19, application (example) and ordering code).

Port connections:

T2 : Low back pressure.

- if a MUV-valve is mounted, T2 is normally plugged in the subplate, or
- if there are cylinders in the circuit with a large returnflow, T2 shall be connected to tank for a lower return pressure in the valve, or
- if a MDM-valve is mounted on the subplate, T2 is the mainport to tank.

T3 : External pilot drain (on the pilot stage).

- is necessary if the backpressure in the returnline rises continually above 6 bar, for example a spring loaded check valve in the returnline between T connection of the valve and the tank connection,
- T3 is a pilotdrain and has to be drained to tank separately.

X : Auxiliary port (on inlet subplate).

- the maximum pressure-level in the entire system can be remotely controlled by the use of a small relief valve (size 4 mm (0.16 inch)) connected to the auxiliary port X, or
- the pressure in the entire system can be unloaded by the use of an electrically operated 2/2 valve connected to aux. port X (e.g. for load security systems on mobile cranes), or
- in case of a load sensing system, the load pressure check back signal on the X port can be connected to the load sense port of the variable displacement pump.

X2 : External pilot supply (on the pilot stage).

- if, due to very light loads, the pump pressure does not rise up to 12 bar (172 psi) during a part of the cycle, the pilot stage shall be fed by an external pilot supply source.

Y : Auxiliary port (on the directional control subplate).

- if it is necessary that one or more users in a circuit operate at reduced pressure, a small relief valve (size 4 mm (0.16 inch)) may be connected to port Y.

Z : Auxiliary port (on the directional control subplate).

- if valves are combined (with the same or different size), port Z is used, or
- for sensing the load pressure check back signal, this port shall be connected to port X of the next valve, which requires only a simple inlet plate AN (see ordering code).

Options are standard with BSP thread, SAE thread is optional

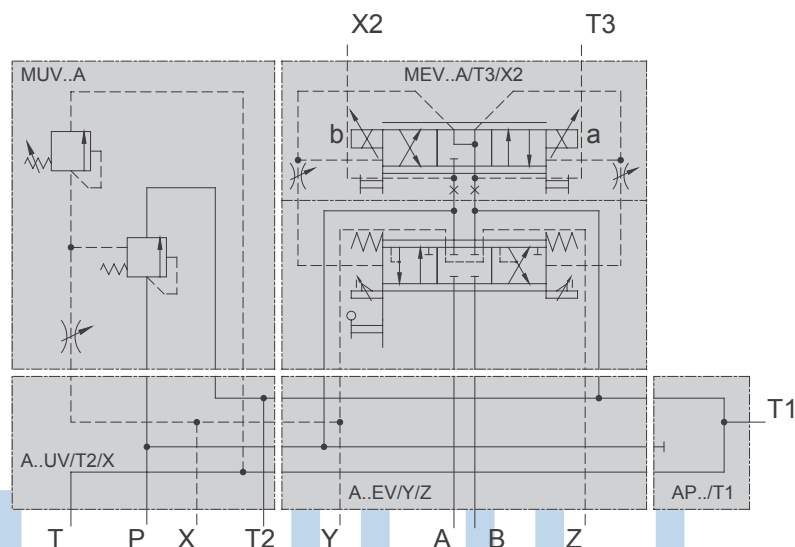


Fig. 19 (detailed) with options

VARIANTS/OPTIONS

The following variants/options are possible (see ordering code, page 26 and 28).

Compensator (MUV/MDM) variants:

Recirculation pressure:

- V : Adjustment 6...12 bar (86...172 psi). The spring in the spring chamber is adjustable between 6 and 12 bar (86 and 172 psi) for exact control of the max. flow on users A and B of the proportional directional control valve. (see page 26)

Max. pressure adjustments variants:

- H : With handwheel (Ø 30mm, Ø 1.18inch) for manual adjustment without using tools
E2 : Electrical remote control up to 350 bar (5000 psi)
W : Without pressure adjustment, no relief valve.

Options:

- Q : Normally, MUV spools have no connection between the P bore and the spring chamber. In certain cases, a small orifice (0,6 mm) to provide a "positive feed in" is desirable. As an example: for multi-section blocks.
P : Normally, MDM spools are mounted with a small orifice, to connect the reduced pressure to the spring chamber for quick response. If one or more MDM valves are connected to a load sensing pump, option P (plugged MDM-spool) is recommended.

Control valve (MEV) variants:

Electrical control system:

- N : No proportional control, on/off
F : Proportional control

Spool types:

A,B,C,D,E,F,G,K,M,O : See page 2

Flow:

.../... : Flow port A/port B in litres/minute, the choice has to be made in combination with the Δp of the compensator (MUV or MDM). For the maximum flow per Δp compensator see page 2.

Note: the control valve is standard equipped with stroke limitation screws in the spring caps, if the flow of a port is adjusted with this screw, the electrical input signal has a shorter bandwidth.

Solenoid types:

- A : 12 VDC IP65 with emergency control by pin
B : 24 VDC IP65 with emergency control by pin (standard)
E : 12 VDC IP65 with emergency control by button
F : 24 VDC IP65 with emergency control by button
H : 24 VDC IP67 with explosion proof, II 2 G EEx m II T4, IP 57, including connector and 5 metres (16.4 ft) cable
J : 24 VDC Military, IP 67, without female connector

Options:

- ACS : Adjustable Centering Springs on the main spool, if the users A and B should have exactly the same flow in combination with the same current on solenoids a and b.
G : Cast iron spring caps. If the standard aluminium caps are not suitable for the environment conditions. (for instance seawater resistance)
JS : Additional connection for hydraulic control, with shuttle valves and restriction for external pilot control e.g., through pilot pressure devices.
M : Additional manual control, a second control possibility in addition to the electrical control. (manual override)
MSW : As option M, suitable for special environment conditions like seawater. (the springcap is also in cast iron)
N : Neutral spool position signal, through inductive switch.

APPLICATIONS

Many applications have been realized.
Some examples are described below.

1. Concrete pump	Australia	21. Salt Spreader	Switzerland
2. Swing Bridge	Britain	22. Salt Spreader	The Netherlands
3. Grader	China	23. Skyworker	The Netherlands
4. Fire Ladder	France	24. Rubber Press	The Netherlands
5. Arc Furnace	France	25. Fire Brigade Skyworker	The Netherlands
6. Road Bridge	France	26. Steering Gear (for ships)	The Netherlands
7. Container Handling	France	27. Cargo Cranes	The Netherlands
8. Road Roller	France	28. Grain Elevator	The Netherlands
9. Canal Lock	France	29. Manipulator (Robot)	The Netherlands
10. Injection Moulding Machine	France	30. Cargo Doors	The Netherlands
11. Telescope Cranes	Germany	31. Ship cleaning Installations	The Netherlands
12. Rocker Truck	Germany	32. Probing Machines	The Netherlands
13. Winches for Mobile Cranes	Germany	33. Winches for Fishing Vessels	The Netherlands
14. Injection Moulding Machine	India	34. Diamond-, Exploration- and Rotary drilling equipment	USA
15. Ladle Carriage	Italy		
16. Injection Moulding Machine	Italy		
17. Grinding Machine	Italy		
18. Deck Cranes	Norway		
19. Winches	Norway		
20. Waste Collection	Switzerland		



Fig. 20 Cone Penetration Testing Unit, The Netherlands

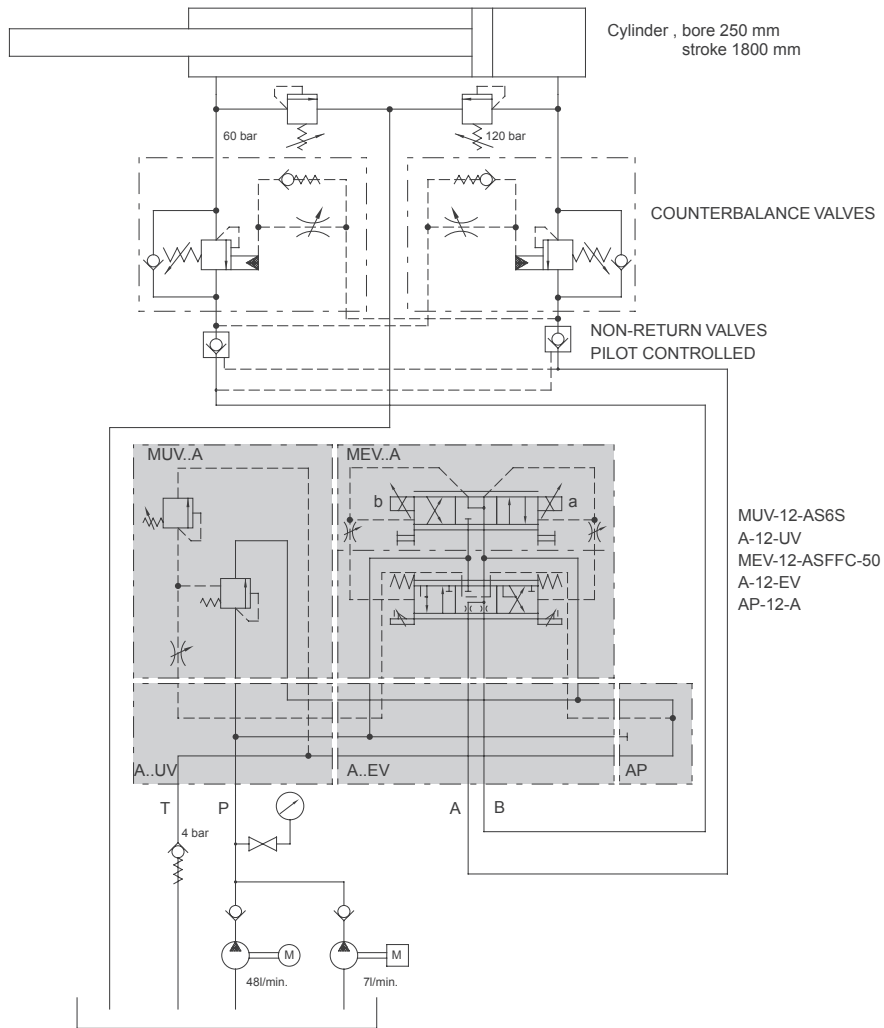


Fig. 21 Circuit diagram example

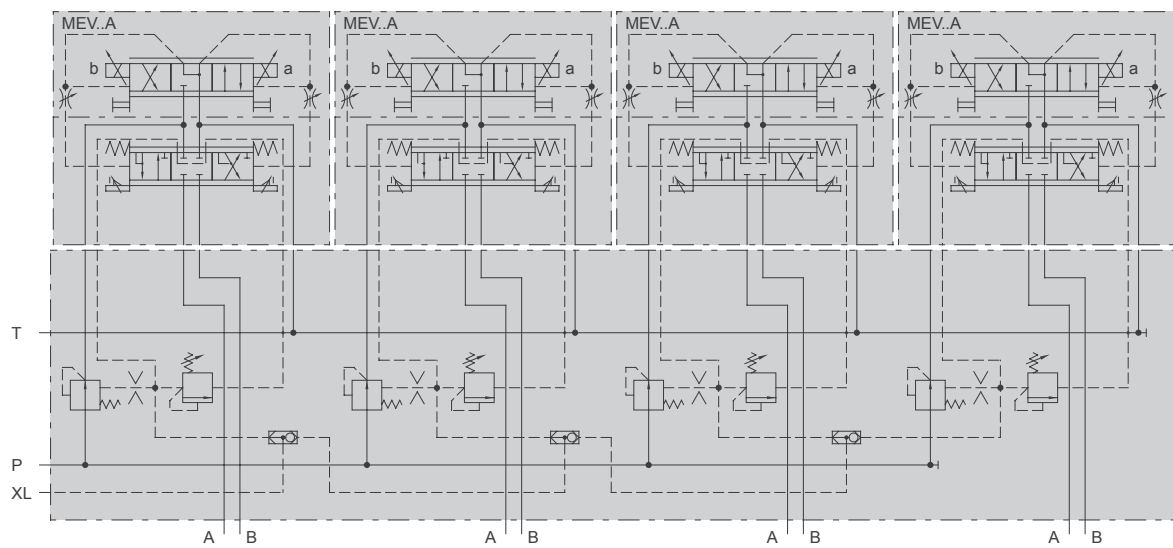


Fig. 22 Example for simultaneous operation (independant of load pressure)

See note on page 4.

APPLICATIONS (EXAMPLE)

First control block

Second control block

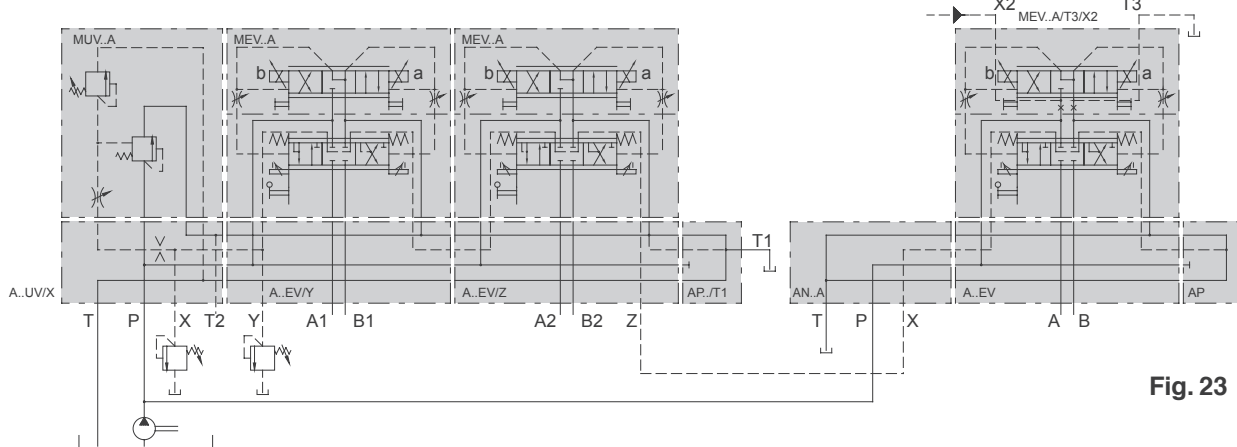


Fig. 23

Parallel circuit with fixed displacement pump

Two valve blocks using only one pressure compensator (MUV).

By connecting port X (the load pressure signal) of the second control block (AN..A) to port Z of the first control block (A..EV/Z), the MUV creates a load independent flow control for both valve-blocks (not for simultaneous operation).

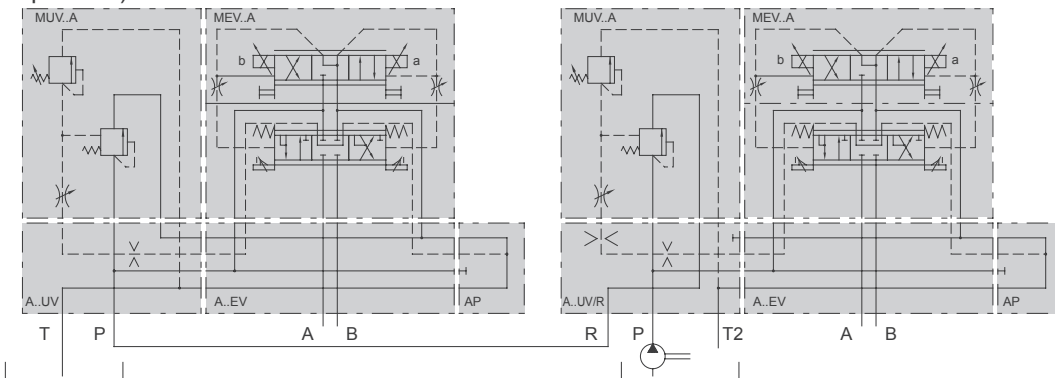


Fig. 24

Series circuit with fixed displacement pump

With the subplate A..UV/R there is an additional possibility of directing the pumpflow from P to R in order to feed another circuit.

Note: - Connecting T2 of the subplate A..UV/R must always be connected to tank.
- Not for simultaneous operation.

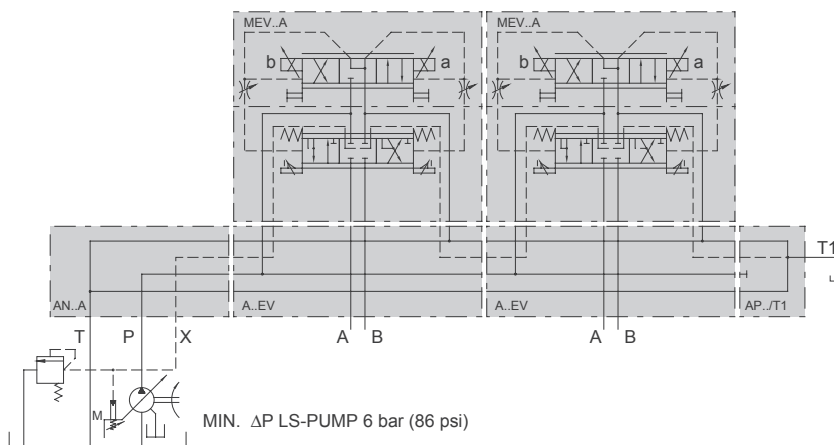


Fig. 25

Load independent flow control by using load sensing pump. (No AMCA compensator: AN)

If the hydraulic system is equipped with a load sensing pump, the X port of the inlet plate AN..A has to be connected with the load sensing signal-port of the LS-pump. A pressure compensator MUV or MDM is not necessary in that case.

Note: If ordering the control valves (MEV) the Δp of the pump has to be specified, so the spools can be grinded for the ordered flow.

DIMENSIONS

Nominal bore	12	16	20	25	32
--------------	----	----	----	----	----

Connecting threads in BSP (SAE thraight thread 'O'ring BOSS) (Other thread on request)

A,B,P,T,T2	1/2" (8)	3/4" (12)	1" (16)	1 1/4" (20)	1 1/2" (24)
X	1/8" (4)	1/8" (4)	1/4" (6)	1/4" (6)	1/4" (6)
Y,Z	1/8" (4)	1/4" (6)	1/4" (6)	1/4" (6)	1/4" (6)
X2,T3	1/8" (4)	1/8" (4)	1/8" (4)	1/8" (4)	1/8" (4)
T1	3/8" (6)	3/8" (6)	1/2" (8)	3/4" (12)	1" (16)

Control spool stroke in mm. (inch)	2 x 8 (2 x 0.32)	2 x 10 (2 x 0.39)	2 x 12 (2 x 0.47)	2 x 14 (2 x 3.15)	2 x 16 (2 x 0.63)
---------------------------------------	---------------------	----------------------	----------------------	----------------------	----------------------

Dimensions in mm. (inch)

a	60 (2.36)	60 (2.36)	70 (2.76)	86 (3.39)	100 (3.94)
b	46 (1.81)	46 (1.81)	55 (2.17)	68 (2.68)	76 (2.99)
c	60 (2.36)	55 (2.17)	68 (2.68)	76 (2.99)	90 (3.55)
d	46 (1.81)	70 (2.76)	86 (3.39)	100 (3.94)	120 (4.73)
e	50 (1.97)	60 (2.36)	70 (2.76)	86 (3.38)	100 (3.94)
f	40 (1.58)	46 (1.81)	55 (2.17)	68 (2.68)	76 (2.99)
g	40 (1.58)	40 (1.58)	46 (1.81)	55 (2.17)	68 (2.68)
h	50 (1.97)	50 (1.97)	60 (2.36)	70 (2.76)	86 (2.39)
j	46 (1.81)	55 (2.17)	68 (2.68)	76 (2.99)	90 (3.55)
k	60 (2.36)	70 (2.76)	86 (3.39)	100 (3.94)	120 (4.73)
l	246 (9.69)	296 (11.66)	338 (13.32)	376 (14.81)	425 (16.75)
m	38 (1.50)	48 (1.89)	54 (2.13)	58 (2.29)	66 (2.60)
n	110 (4.33)	140 (5.52)	170 (6.70)	200 (7.88)	235 (9.26)
p1	55 (2.17)	70 (2.76)	85 (3.35)	100 (3.94)	117,5 (4.63)
r	36 (1.42)	46 (1.81)	55 (2.17)	65 (2.56)	75,5 (2.97)
s	74 (2.92)	94 (3.70)	115 (4.53)	135 (5.32)	159,5 (6.28)
t1	93 (3.66)	118 (4.65)	145 (5.71)	170 (6.70)	201,5 (7.94)
t2	17 (0.67)	22 (0.87)	25 (0.99)	30 (1.18)	33,5 (1.32)
u	10 (0.39)	12 (0.47)	14 (0.55)	16 (0.63)	17 (0.67)
v	M6x8	M6x8	M8x10	M8x10	M8x10
w	188 (7.41)	204 (8.04)	229 (9.02)	256 (10.09)	284 (11.19)
x1	20 (0.79)	19 (0.75)	25 (0.99)	27 (1.06)	31 (1.22)
x2	33 (1.30)	46 (1.81)	55 (2.17)	65 (2.56)	75,5 (2.97)
y1	11 (0.43)	11 (0.43)	15 (0.59)	18,5 (0.73)	21 (0.83)
y2	8 (0.32)	11 (0.43)	11 (0.43)	11 (0.43)	11 (0.43)
z	70 (2.76)	81 (3.19)	98 (3.86)	118 (4.65)	136 (5.36)

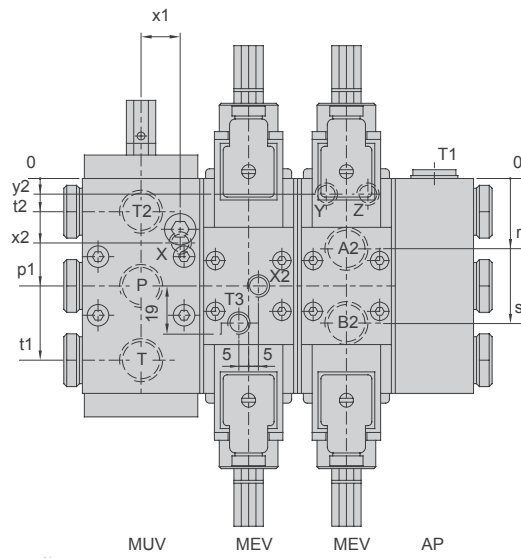
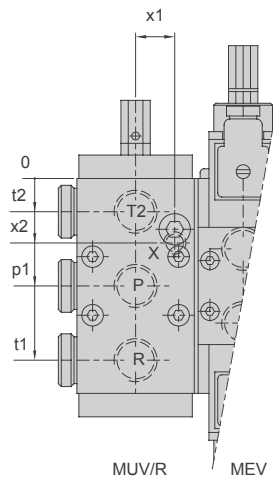
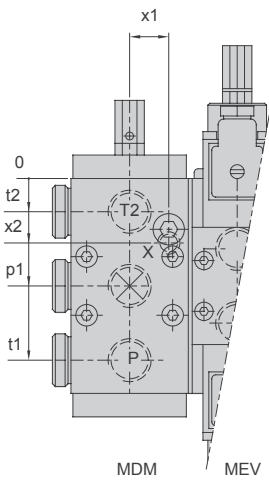
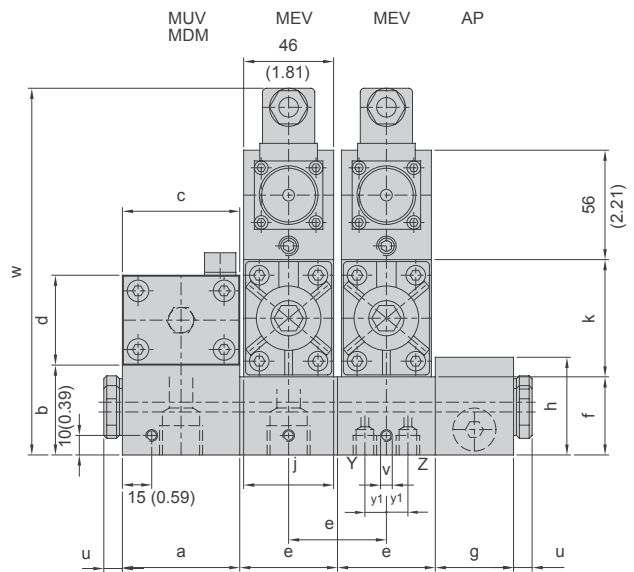
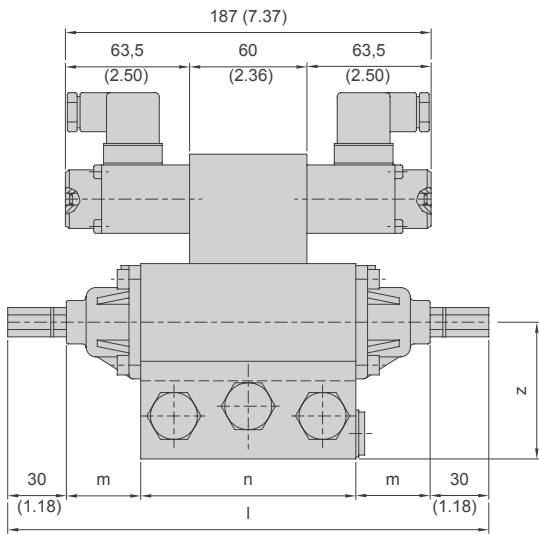
Dimensions option M in mm. (inch)

n	110 (4.33)	140 (5.52)	170 (6.70)	200 (7.88)	235 (9.26)
m1	45 (1.77)	58 (2.29)	70 (2.76)	80 (3.15)	88 (3.47)
m2	75 (2.96)	79 (3.11)	90 (3.55)	164 (6.46)	171 (6.74)
m3	30 (1.18)	30 (1.18)	30 (1.18)	30 (1.18)	30 (1.18)
m4	30 (1.18)	30 (1.18)	30 (1.18)	25 (0.99)	23 (0.91)
m5	Ø25 (Ø0.99)	Ø32 (Ø1.26)	Ø32 (Ø1.26)	Ø40 (Ø1.58)	Ø40 (Ø1.58)
m6	Ø8 (Ø0.32)	Ø10 (Ø0.39)	Ø10 (Ø0.39)	Ø12 (Ø0.47)	Ø12 (Ø0.47)
mr	182,5 (7.19)	234 (9.22)	234 (9.22)	270 (10.64)	270 (10.64)
mα	18°	18°	18°	12°	12°
mβ	51°	58°	66°	71°	82°
mγ	10°	5°	-	-	-

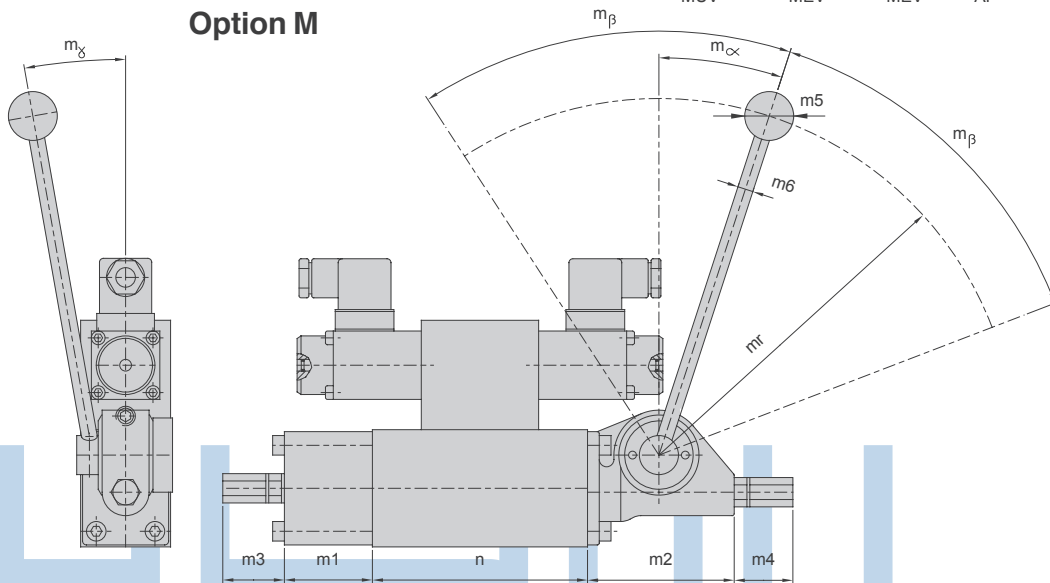
Weight in N (lbs)

MUV	26,48 (5.95)	41,19 (9.26)	78,45 (17.64)	125,53 (28.22)	205,94 (46.30)
MDM	26,48 (5.95)	41,19 (9.26)	78,45 (17.64)	125,53 (28.22)	205,94 (46.30)
A-UV	17,65 (3.97)	23,54 (5.29)	34,32 (7.72)	78,45 (17.64)	93,16 (20.94)
MEV	44,13 (9.92)	58,84 (13.23)	93,16 (20.94)	132,39 (29.76)	181,42 (40.78)
A-EV	17,65 (3.97)	23,54 (5.29)	34,32 (7.72)	78,45 (17.64)	88,26 (19.84)
AP	13,73 (3.09)	16,67 (3.75)	29,42 (6.61)	58,84 (13.23)	93,16 (20.94)

DIMENSIONS



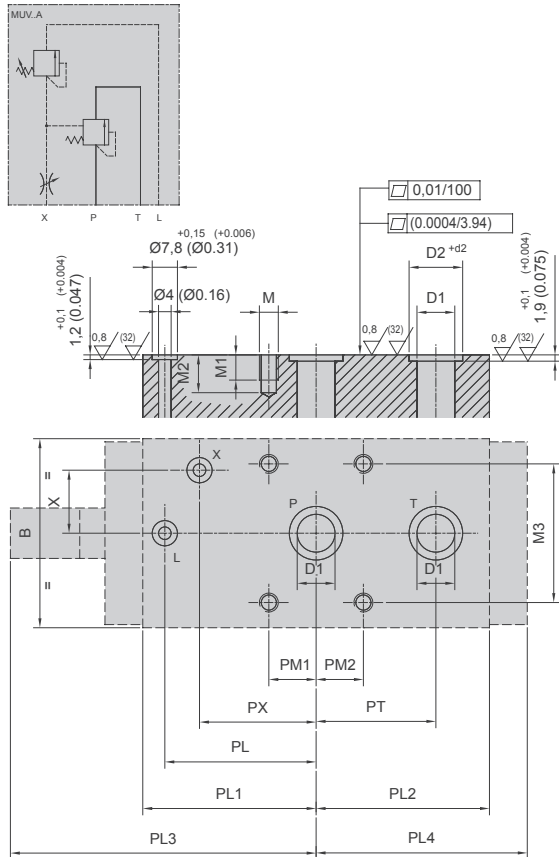
Option M



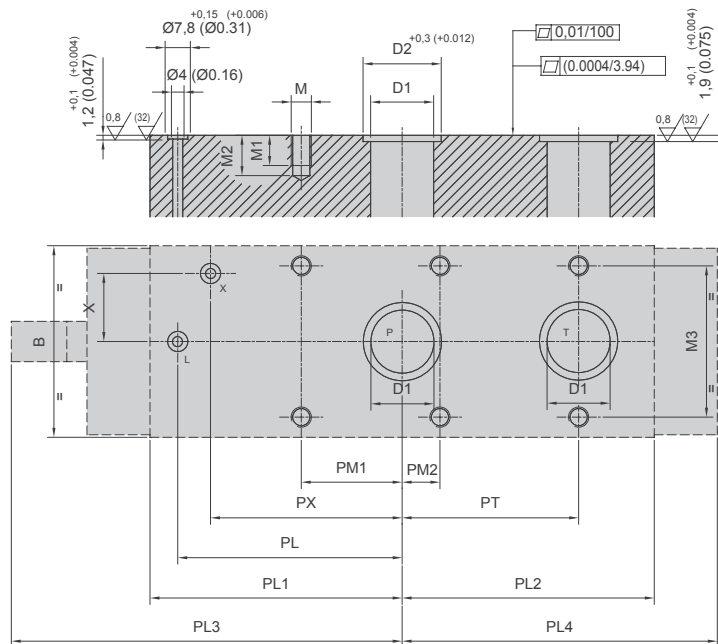
DIMENSIONS

Dimensions in millimeters (inches)

DIMENSIONS + LAY-OUT FOR SUBPLATES MUV; TO PRODUCE BY CUSTOMERS



MUV	12	16	20
B	60 (2.36)	55 (2.17)	68 (2.68)
D1	Ø12 (Ø0.47)	Ø16 (Ø0.63)	Ø20 (Ø0.79)
D2	Ø17,25 (Ø0.68)	Ø21,9 (Ø0.86)	Ø26,6 (Ø1.05)
d2	0,15 (0.006)	0,2 (0.008)	0,2 (0.008)
D3	Ø17,25 (Ø0.68)	Ø21,9 (Ø0.86)	Ø26,6 (Ø1.05)
M	M6	M8	M10
M1	8 (0.32)	12 (0.47)	12 (0.47)
M2	12 (0.47)	17 (0.67)	17 (0.67)
M3	44 (1.73)	38 (1.50)	50 (1.97)
PM1	15 (0.59)	24 (0.95)	31 (1.22)
PM2	15 (0.59)	24 (0.95)	31 (1.22)
PX	37 (1.46)	51 (2.01)	63 (2.48)
PT	38 (1.50)	48 (1.89)	60 (2.36)
PL	48 (1.89)	59 (2.32)	75 (2.96)
PL1	55 (2.17)	70 (2.76)	70 (2.76)
PL2	55 (2.17)	70 (2.76)	70 (2.76)
PL3	97 (3.82)	115 (4.53)	135 (5.32)
PL4	67 (2.64)	85 (3.35)	105 (4.14)
X	20 (0.79)	19 (0.75)	25 (0.99)



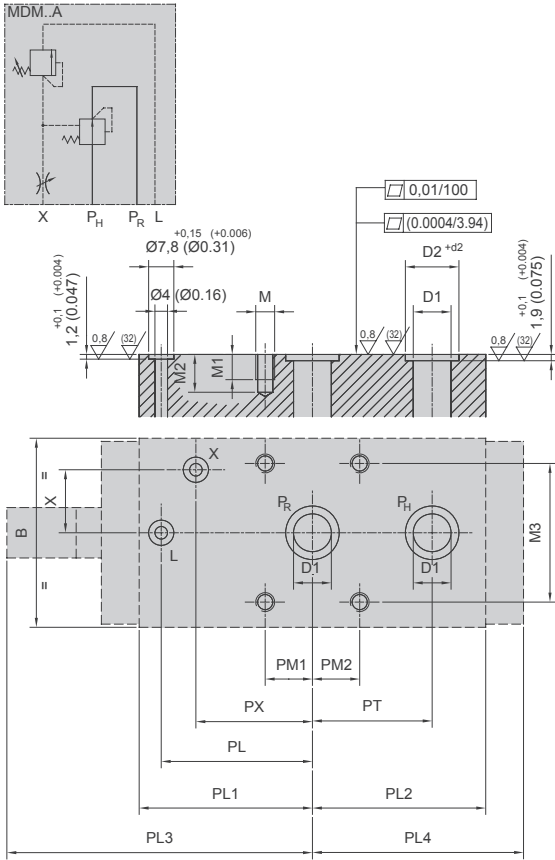
MUV	25	32
B	76 (2.99)	90 (3.55)
D1	Ø25 (Ø0.99)	Ø32 (Ø1.26)
D2	Ø31,25 (Ø1.23)	Ø37,5 (Ø1.48)
M	M8	M10
M1	10 (0.39)	12 (0.47)
M2	14 (0.55)	15 (0.59)
M3	60 (2.36)	70 (2.76)
PM1	40 (1.58)	46 (1.81)
PM2	15 (0.59)	19 (0.75)
PX	76 (2.99)	84,5 (3.33)
PT	70 (2.76)	84 (3.31)
PL	89 (3.51)	105,5 (4.16)
PL1	100 (3.94)	117,5 (4.63)
PL2	100 (3.94)	117,5 (4.63)
PL3	155 (6.11)	177,5 (6.99)
PL4	125 (4.93)	147,5 (5.81)
X	27 (1.06)	31 (1.22)

ALL COORDINATES $\pm 0,25 (0.001)$

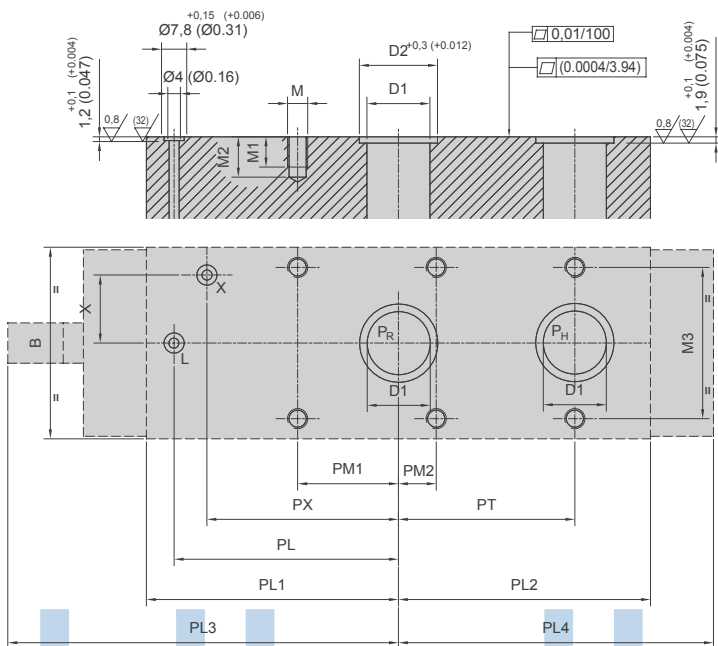
DIMENSIONS

Dimensions in millimeters (inches)

DIMENSIONS + LAY-OUT FOR SUBPLATES MDM; TO PRODUCE BY CUSTOMERS



MDM	12	16	20
B	60 (2.36)	55 (2.17)	68 (2.68)
D1	Ø12 (Ø0.47)	Ø16 (Ø0.63)	Ø20 (Ø0.79)
D2	Ø17,25 (Ø0.68)	Ø21,9 (Ø0.86)	Ø26,6 (Ø1.05)
d2	0,15 (0.006)	0,2 (0.008)	0,2 (0.008)
D3	Ø17,25 (Ø0.68)	Ø21,9 (Ø0.86)	Ø26,6 (Ø1.05)
M	M6	M8	M10
M1	8 (0.32)	12 (0.47)	12 (0.47)
M2	12 (0.47)	17 (0.67)	17 (0.67)
M3	44 (1.73)	38 (1.50)	50 (1.97)
PM1	15 (0.59)	24 (0.95)	31 (1.22)
PM2	15 (0.59)	24 (0.95)	31 (1.22)
PX	37 (1.46)	51 (2.01)	63 (2.48)
PT	38 (1.50)	48 (1.89)	60 (2.36)
PL	48 (1.89)	59 (2.32)	75 (2.96)
PL1	55 (2.17)	70 (2.76)	70 (2.76)
PL2	55 (2.17)	70 (2.76)	70 (2.76)
PL3	97 (3.82)	115 (4.53)	135 (5.32)
PL4	67 (2.64)	85 (3.35)	105 (4.14)
X	20 (0.79)	19 (0.75)	25 (0.99)



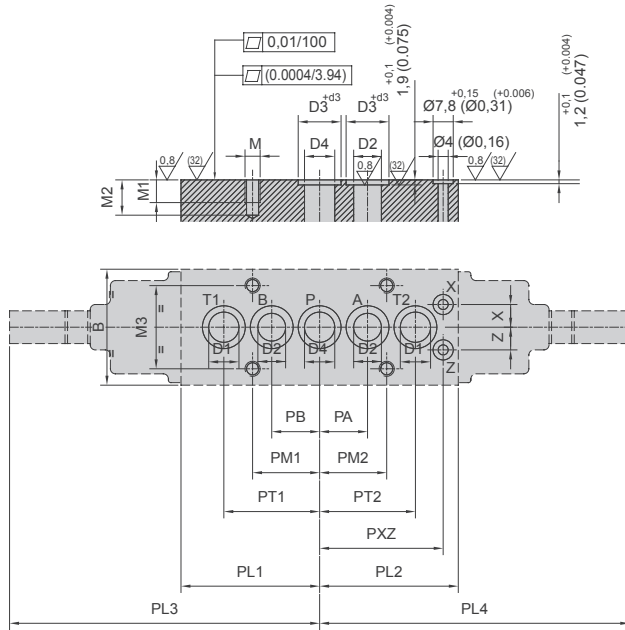
MDM	25	32
B	76 (2.99)	90 (3.55)
D1	Ø25 (Ø0.99)	Ø32 (Ø1.26)
D2	Ø31,25 (Ø1.23)	Ø37,5 (Ø1.48)
M	M8	M10
M1	10 (0.39)	12 (0.47)
M2	14 (0.55)	15 (0.59)
M3	60 (2.36)	70 (2.76)
PM1	40 (1.58)	46 (1.81)
PM2	15 (0.59)	19 (0.75)
PX	76 (2.99)	84,5 (3.33)
PT	70 (2.76)	84 (3.31)
PL	89 (3.51)	105,5 (4.16)
PL1	100 (3.94)	117,5 (4.63)
PL2	100 (3.94)	117,5 (4.63)
PL3	155 (6.11)	177,5 (6.99)
PL4	125 (4.93)	147,5 (5.81)
X	27 (1.06)	31 (1.22)

ALL COORDINATES Φ 0,25 (0.001)

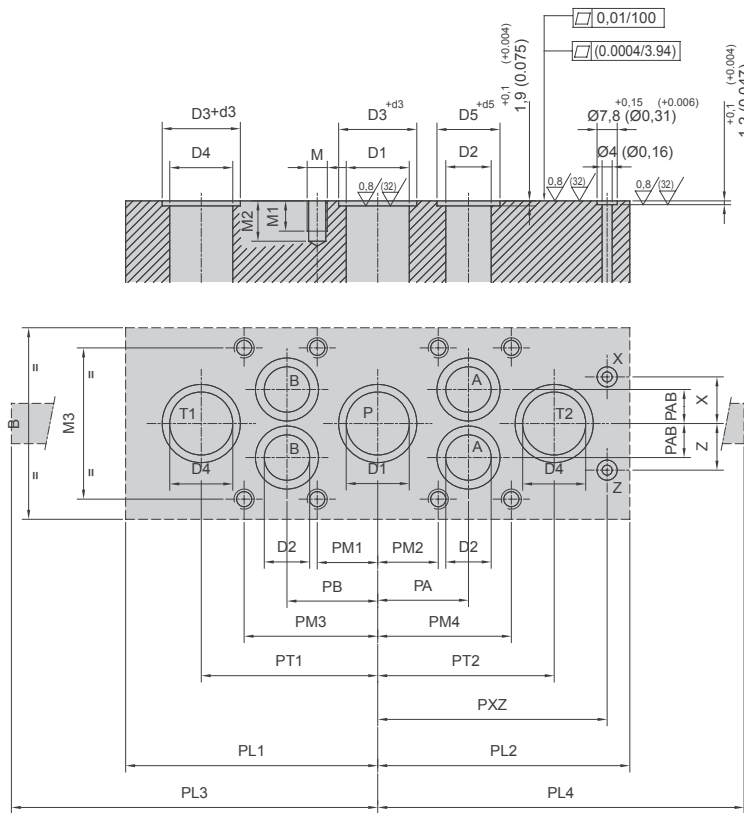
DIMENSIONS

Dimensions in millimeters (inches)

DIMENSIONS + LAY-OUT FOR SUBPLATES MEV; TO PRODUCE BY CUSTOMERS



MEV	12	16	20
B	46 (1.81)	55 (2.17)	68 (2.68)
D1	Ø12 (Ø0.47)	Ø16 (Ø0.63)	Ø20 (Ø0.79)
D2	Ø11 (Ø0.43)	Ø14 (Ø0.55)	Ø17 (Ø0.67)
D3	Ø17,25 (Ø0.68)	Ø21,9 (Ø0.86)	Ø26,6 (Ø1.05)
d3	0,15 (0.006)	0,2 (0.008)	0,2 (0.008)
D4	Ø12 (Ø0.47)	Ø14 (Ø0.55)	Ø18 (Ø0.008)
M	M6	M8	M10
M1	9 (0.35)	12 (0.47)	12 (0.47)
M2	14 (0.55)	15 (0.59)	17 (0.67)
M3	33 (1.30)	40 (1.58)	50 (1.97)
PA	19 (0.75)	24 (0.95)	30 (1.18)
PB	19 (0.75)	24 (0.95)	30 (1.18)
PM1	26,6 (1.05)	30 (1.18)	43 (1.69)
PM2	26,6 (1.05)	30 (1.18)	43 (1.69)
PT1	38 (1.50)	48 (1.89)	60 (2.36)
PT2	38 (1.05)	48 (1.89)	60 (2.36)
PL1	55 (2.17)	70 (2.76)	85 (3.35)
PL2	55 (2.17)	70 (2.76)	85 (3.35)
PL3	123 (4.85)	148 (5.83)	169 (6.66)
PL4	123 (4.85)	148 (5.83)	169 (6.66)
PXZ	49 (1.93)	64 (2.52)	77 (3.03)
X	9 (0.35)	10 (0.39)	15 (0.59)
Z	9 (0.35)	10 (0.39)	15 (0.59)



MEV	25	32
B	76 (2.99)	90 (3.55)
D1	Ø25 (Ø0.99)	Ø30 (Ø1.18)
D2	Ø18 (Ø0.71)	Ø23 (Ø0.91)
D3	Ø31,25 (Ø1.23)	Ø37,5 (Ø1.48)
d3	0,3 (0.01)	0,3 (0.01)
D4	Ø25 (Ø0.99)	Ø32 (Ø1.26)
D5	Ø25 (Ø0.99)	Ø29,7 (Ø1.17)
d5	0,2 (0.008)	0,3 (0.01)
M	M8	M10
M1	12 (0.47)	12 (0.47)
M2	16 (0.63)	17 (0.67)
M3	60 (2.36)	70 (2.76)
PA	36 (1.42)	43 (1.69)
PB	36 (1.42)	43 (1.69)
PM1	24 (0.95)	28,5 (1.12)
PM2	24 (0.95)	28,5 (1.12)
PM3	53 (2.09)	63 (2.48)
PM4	53 (2.09)	63 (2.48)
PT1	70 (2.76)	84 (3.31)
PT2	70 (2.76)	84 (3.31)
PL1	100 (3.94)	117,5 (4.63)
PL2	100 (3.94)	117,5 (4.63)
PL3	188 (7.41)	212,5 (8.37)
PL4	188 (7.41)	212,5 (8.37)
PXZ	91 (3.59)	108,5 (4.27)
PAB	13,5 (0.53)	16 (0.63)
X	18,5 (0.73)	21 (0.83)
Z	18,5 (0.73)	21 (0.830)

ALL COORDINATES $\pm 0,25 (0.001)$

Mounting procedure

- AMCA-valves shall not be mounted by overtightening of mounting bolts, causing mechanical distortion and thus spool lock. (see tightening torques).
- Mounting on flat surface, flatness $\square 0,01/100$ mm (0.0004/3.9 inch).
- Don't use conical thread for port-fittings.
- For sealing purposes, use O-rings.
- At the port-connections at the sub-plates, the B-port shall be connected to the line with the largest return-flow (e.g. piston-side of differential cylinder), because in the valve the distance B-T is shorter than A-T.
- Check the voltage and current of the solenoids, before operation.
- Avoid ingress of contaminants during mounting.

Start-up procedure

- Start the system-flushing procedure with the adjustment-screw of relief valve (see fig. 29-31, (1) on page 22) fully released to achieve the minimum pressure.
- Turning the adjustment-screw clockwise (360 turn = ca. 100 bar (143 psi)), the maximum load-pressure rises up to the desired level. (max. 350 bar (5000 psi)). During this adjustment the end-users (cylinder and/or motor) should be blocked.
- Check the valve-function and the tightness of fittings etc.
- Use the stroke limiting screws to bleed the end-caps, during system bleeding.

Adjustment procedure

MDM/MUV

To avoid instability of the MDM- or MUV-spool, the damping-screw (see fig. 32, (2) on page 22) is factory-setted. Adjustment on location is possible as follows:

- Remove the cover-screw (width 5 mm (0.2 inch))
- Adjust the damping with the damping-screw (width 5 mm (0.2 inch)), turning clockwise or anti-clockwise for more or less throttling.

Note: Don't throttle too much especially in the case of MDM otherwise the load signal can be disturbed.

Valve response time

The valve response time is adjustable from 0,24 - 10 seconds. Adjustment screws are on the pilot stage below the solenoids.

- Turn the adjustment screws clockwise to enlarge valve response time.
- Turn the adjustment screws anti-clockwise to shorten valve response time.

Flow-adjustment

Factory-setting of flows, as ordered in ordering code. If, after long life-cycle, re-adjustment should be necessary, two possibilities are available, depending on the configuration:

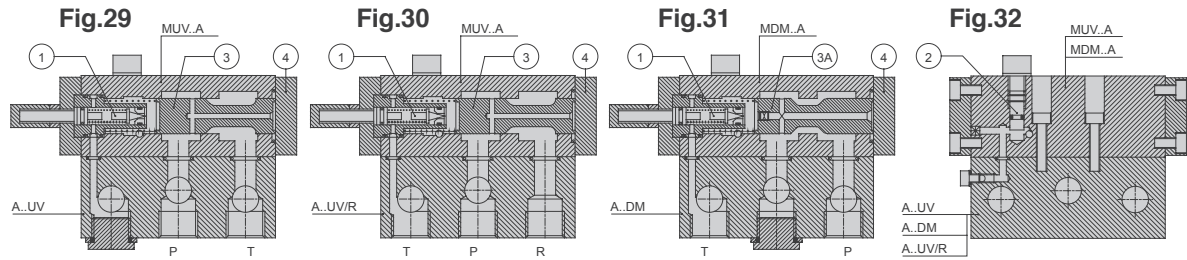
1. Stroke limiter (see fig. 33, (5) on page 22)
 - Remove cover-screw of stroke limiter
 - Loosen the lock-nut (width 13 mm (0.51 inch))
 - Turn the stroke limiting screw (width 4 mm (0.16 inch)) clockwise to reduce flow and anti-clockwise to enlarge flow.
2. Δp adjustment (see page 26)
 - Loosen the lock-nut (width 13 mm (0.51 inch))
 - Turn the adjustment screw (width 4 mm (0.16 inch)) clockwise to enlarge the preset spring-force, to achieve more flow. (anti-clockwise to reduce flow)
 - Tighten lock-nut.

Note: If the flow through A-port is sufficient and the flow through B-port should be enlarged, adjust first the B-flow by Δp -adjustment and reduce after that the A-flow by stroke limitation.

Fluid maintenance

Due to the construction, these AMCA-valves, are not highly susceptible to particulate (silt type) lock, nor to contaminant wear. Therefore the contaminant sensitivity is very low.

- Use mineral oil (recommended ISO/VG-32). Other fluids on request.
- Keep the contamination level better or equal NAS 1638 class 9 or ISO 18/15.



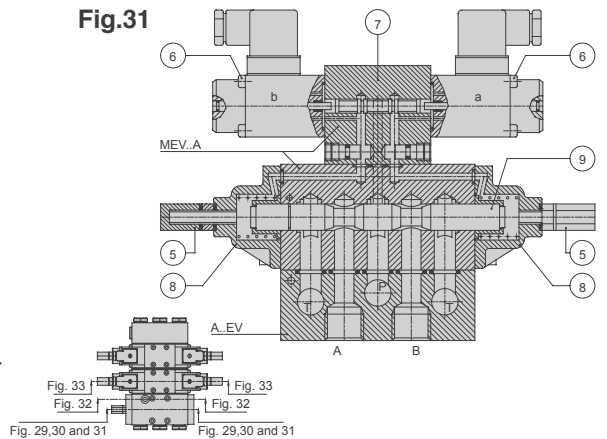
A. System pressure too low or set pressure cannot be reached

1. *Relief valve cartridge fouled*
Dirt particles jammed between cone and seat of relief valve (1) and prevent pressure being built up.
Turn adjustment anti-clock wise, switch a directional valve several times. If necessary, dismantle (a M4 bolt assists in removing the springcup). If damaged, replace cone and seat. Examine the system filter.
2. *Damping throttle (2) blocked (dirt or maladjustment).*
If necessary, remove, clean and replace. Adjust to 1 1/2 - 2 1/2 turns from fully closed position. Find the right damping position. Turn the throttle only by unloaded pump.
3. *MUV-spool (3) or MDM-spool (3A) jammed open*
When removing lower end-cover (4) the spring should push out of the spool. Remove and examine the spool and bore for damage. Deburr with care. Flush the spool to remove dirt.
4. *Faults in other components of the system*
Damaged pump, motor, seals etc.

Note: The set pressure can only be reached if a cylinder is at the end of its stroke or a motor is stalled.

B. User moves erratically

1. *Air in system*
Bleed both end-caps with stroke limiting screws (5).
Slacken bolts (6) fixing the solenoids to body and retighten after repeated operation.
2. *Pilot valve faulty*
Fit a pressure gauge in place of the stroke limiting screws to observe pilot pressure.
If persistent, swap pilot stage (7) to another section to detect faulty unit.
3. *Excessive friction of directional spool*
Remove both end-caps (8) and examine spool (9) and bore from dirt or damage. Deburr with care. Examine system filter.



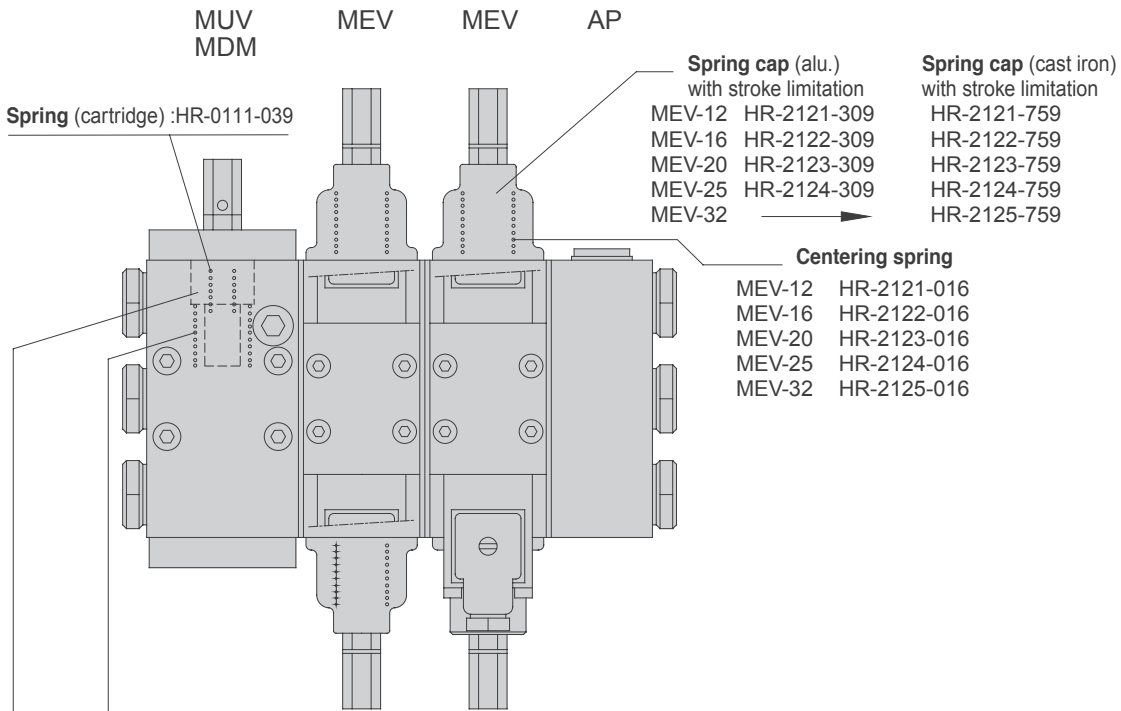
Also spool lock, when mounting faces are not flat.

4. *Excessive damping*
See B2.
 5. *Excessive friction in other components of the system*
- C. User does not move or moves at slow speed**
1. *Damping throttle blocked or dirty*
See A2.
 2. *Relief valve setting too low*
See A1.
 3. *Directional spool does not shift*
See B3.
 4. *MUV or MDM-spool jammed open*
See A3.
 5. *There is insufficient user load.*
 6. *Filter in returnline is contaminated.*

D. Pump does not unload

1. *MUV-spool jammed (see A3)*
2. *Directional spool not centring*
Excessive friction (see B3).
Electrical fault. Check the electrical circuit.

RECOMMENDED SPARE PARTS



Spring (MUV/MDM):

Δ P compensator

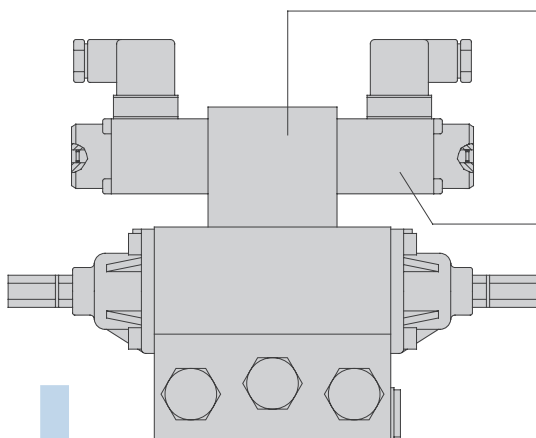
Size	3 bar(with X2)	6 bar	8 bar	12 bar
12	HR-0111-040	HR-2121-032	HB-0014-001	HR-2121-040
16	HR-0111-040	HR-2121-032	HB-0014-001	HR-2121-040
20	HR-0113-040	HR-2123-032	HB-0014-003	HR-2123-040
25	HR-0114-040	HR-2124-032	HB-0014-002	HR-2124-040
32	HR-0115-040	HR-2125-032	HB-0112-014	HR-2125-040

Relief valve insert

Size	With standard seals	With Viton seals
12	HR-0111-335	HR-0111-635
16	HR-0111-335	HR-0111-635
20	HR-0113-335	HR-0113-635
25	HR-0114-335	HR-0114-635
32	HR-0115-335	HR-0115-635

Pilot stage

HR-2121-264 : Pilot stage without solenoid
 HR-2121-264V : Ditto with Viton seals

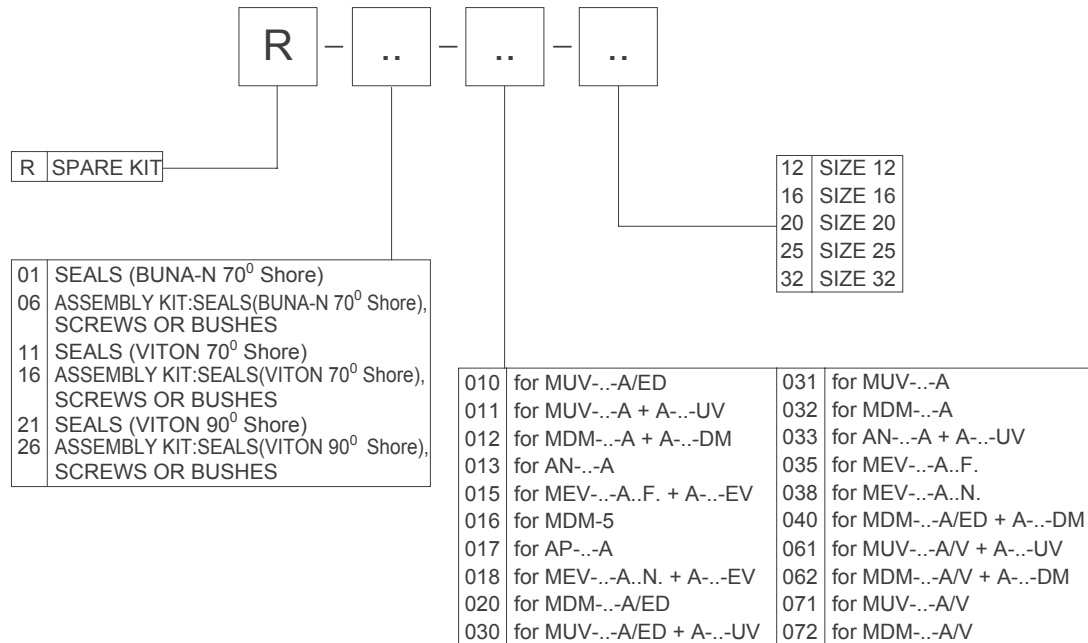


Solenoid (including BUNA-N seal)

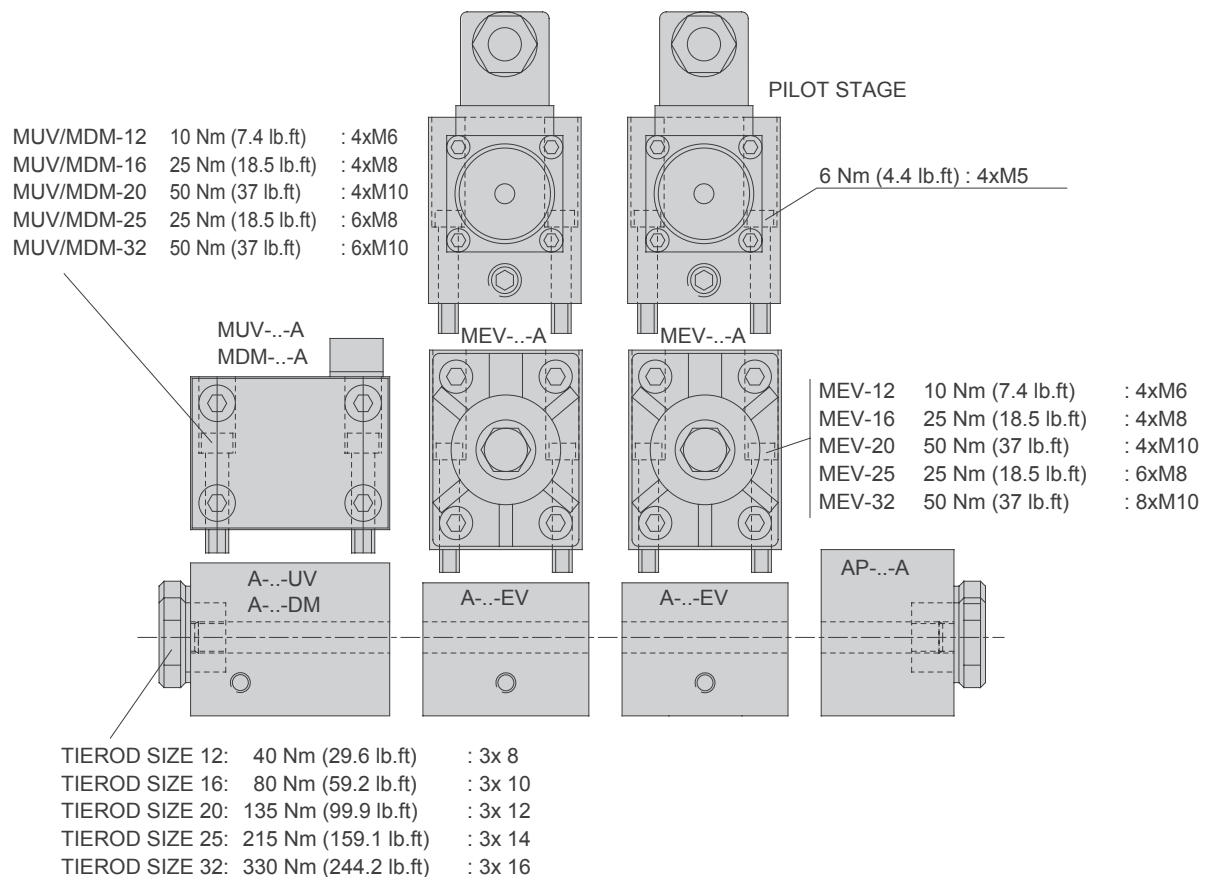
WX-2170K001 : SOLENOID 24 V + MANUAL PIN
 WX-2170K002 : SOLENOID 12 V + MANUAL PIN
 WX-2170K011 : SOLENOID 24 V + MANUAL BUTTON
 WX-2170K012 : SOLENOID 12 V + MANUAL BUTTON
 WX-2270K051 : SOLENOID 24 V + EEx m II T4 (Explosion Proof)
 WX-2270K041 : SOLENOID 24 V + IP67 and MIL.
 WX-2170K101 : Female connector for MIL. solenoid

RECOMMENDED SPARE PARTS

Seals and assembly kits



Maximum tightening torques MEV

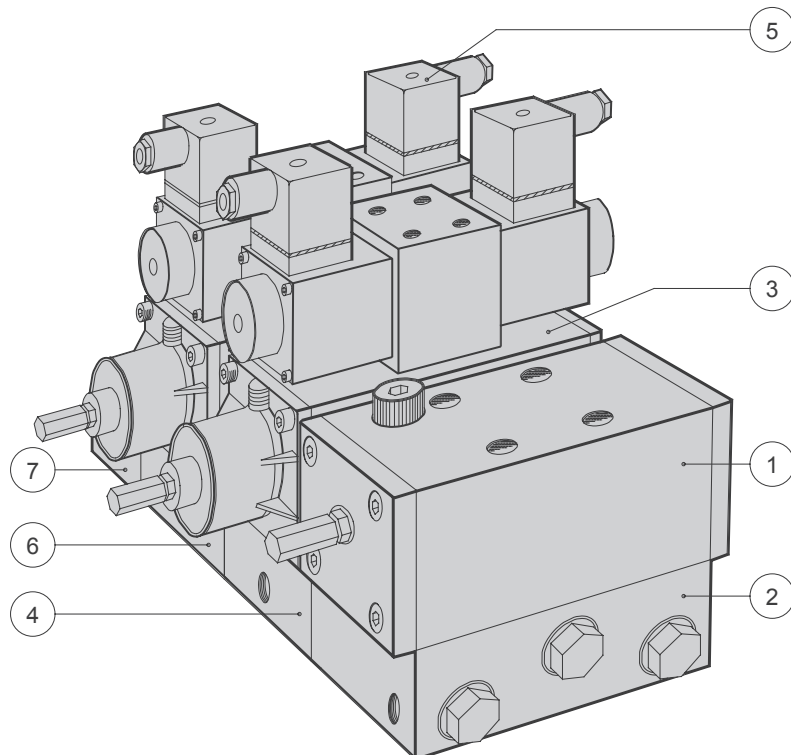


Example for Ordering

One electrically controlled directional control valve assembly, nominal bore 16, mounting type; sub-plate, consists of:

1. MUV Pressure relief valve, Δp compensator 6 bar (86 psi)
2. A..UV/X Inlet plate for ganged sub-plate and pressure relief valve with X connection for remote control
3. MEV 4/3 way controlvalve, spool type A, flow range 100 l/min (26 USgpm) (at ports A + B , with spring return to neutral position and adjustable flow limiter
4. A..EV Sub-plate for 4/3 way valve, standard
5. MEV 4/3 way controlvalve, spool type A, flow range at port A = 50 l/min (13 USgpm) port B = 100 l/min (26 USgpm) with spring return to neutral position and adjustable flow limiter
6. A..EV Sub-plate for 4/3 way control valve, standard
7. AP..A AP endplate, standard

(Ordering codes see page 26, 27, 28 and 29)



- 1: MUV 16 AS6S
- 2: A 16 UV/X
- 3: MEV 16 ASFFA 100/100
- 4: A 16 EV
- 5: MEV 16 ASFFA 50/100
- 6: A 16 EV
- 7: AP 16 A

ORDERING CODE

(For composing a valve block use a copy of the order form, page 30)

MUV OR MDM

Model Number **M U V 1 6 A S 6 S / Viton**

Compensator type

MUV = pressure relief valve
MDM = pressure reducing valve

Size

12 = for size 12
16 = for size 16
20 = for size 20
25 = for size 25
32 = for size 32

Mounting type

A = Sub-plate

Series

S = max. operating pressure
350 bar (5000 psi)

Δp Compensator

3 = 3 bar version (43 psi) *
6 = 6 bar version (86 psi)
8 = 8 bar version (114 psi)
12 = 12 bar version (172 psi) **
V = 6-12 bar (86-172 psi) adjustable, see picture below.
(to increase or decrease the flows of the control valves)

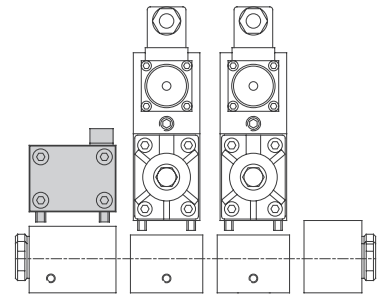
Maximum pressure adjustment

S = With screw (standard)
H = With handwheel for manual adjustment
E2 = Electrical remote control up to 350 bar (5000 psi)
W = Without pressure adjustment

Options

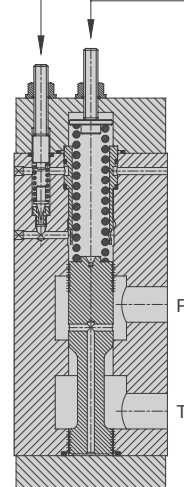
P = Plugged MDM-spool (standard)
Q = Orifice in MDM-spool
Viton = With Viton seals 70 Shore
... = Factory setting of operating pressure: 350 bar (5000 psi)
Indicate here other desired operating pressure in bar.

* Only with external pilot pressure (X2) on MEV-section.
** Due to loss of pressure, c.q. energy conversion into heat,
we recommend the next largest series.



Option V
(ΔP Adjustment 6-12 bar)

MAX. PRESSURE SETTING
 ΔP ADJUSTMENT



ORDERING CODE

(For composing a valve block use a copy of the order form, page 30)

INLETPLATE FOR GANGED SUB-PLATES

Model Number **A 16 UV / T2**

Series

A = Sub-plate

Size

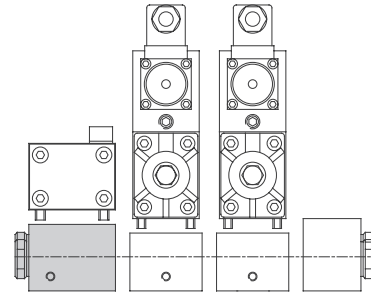
12 = for size 12
16 = for size 16
20 = for size 20
25 = for size 25
32 = for size 32

Sub-plate

UV = for MUV
DM = for MDM

Options

R = allows serial connection with 2nd MUV (only for sub-plate UV)
SAE = S.A.E. straight thread O RING BOSS
T2 = 2nd tankport (only for sub-plate UV)
Viton = With Viton seals
X = Remote Control Connection



INLETPLATE FOR GANGED SUB-PLATES (WITHOUT MOUNTED MUV OR MDM)

Model Number **AN 16 A / T2**

Series

AN = Inlet plate*

Size

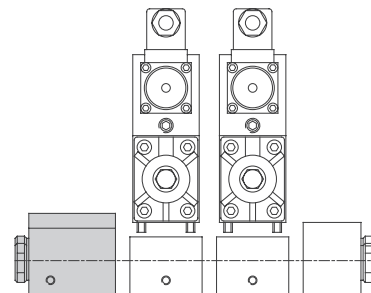
12 = for size 12
16 = for size 16
20 = for size 20
25 = for size 25
32 = for size 32

Mounting type

A = Sub-plate

Options

SAE = S.A.E. straight thread 'O'RING BOSS
T2 = 2nd tankport
Viton = With Viton seals



* AN = Inlet plate for use with variable displacement pump (L.S. pump) or two valve systems in parallel use, with one MUV.
Standard with X-port in sub-plate

ORDERING CODE

(For composing a valve block use a copy of the order form, page 30)

CONTROL VALVE (MEV)

Model Number

MEV 16 A S F F A 50/50 / T3 / X2 / A

Series

MEV = Directional control valve, electrically controlled

Size

12 = for size 12
 16 = for size 16
 20 = for size 20
 25 = for size 25
 32 = for size 32

Mounting type

A = Sub-plate

Series

S = Max. operating pressure 350 bar (5000 psi)

Position lock

F = Spring return (spring ctr)

Control system

N = on/off
 F = proportional

Spool type

A, B, C, D, E, F, G, K, M or O. See page 2

Maximum Flow (l/min)

.../... = choose the flow for port A and port B
 (see for max. flows page 2, choose the flow in combination with the Δp compensator)

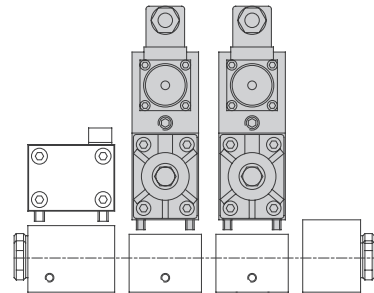
In case of differing flow ranges for ports A + B, the range for port A is given first, followed by the range for B, eg. 50/100.

Options

ACS = Adjustable Centering Springs
 G = Cast iron spring caps
 JS = Additional connection for hydraulic control
 M = Additional manual control
 MSW = Additional manual control Seawater Resistant
 N = Neutral spool position signal, through inductive switch
 SAE = S.A.E. straight thread 'O'RING BOSS (Option T3 and/or X2)
 T3 = External pilot drain
 Viton = With Viton seals
 X2 = External pilot pressure

Solenoid types

A = 12V DC IP65 with emergency control by pin
 B = 24V DC IP65 with emergency control by pin (standard)
 E = 12V DC IP65 with emergency control by button
 F = 24V DC IP65 with emergency control by button
 H = 24V DC IP57 EEx m II T4 (Explosion Proof)
 J = 24V DC IP67 Military, without female connector



ORDERING CODE

(For composing a valve block use a copy of the order form, page 30)

GANGED SUB-PLATE

Model Number **A 16 EV / Y**

Series

A = Sub-plate

Size

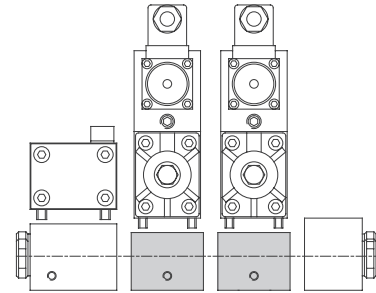
12 = for size 12
16 = for size 16
20 = for size 20
25 = for size 25
32 = for size 32

Sub-plate

EV = for MEV

Options

SAE = S.A.E. straight thread 'O'RING BOSS
Viton = With Viton seals
Y = Remote Control Connection
Z = Remote Control Connection



END PLATE (AP)

Model Number **AP 16 A / T1**

Series

AP = End-plate

Size

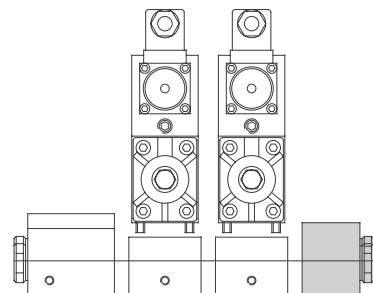
12 = for size 12
16 = for size 16
20 = for size 20
25 = for size 25
32 = for size 32

Mounting type

A = Sub-plate

Options

SAE = S.A.E. straight thread 'O'RING BOSS
T1 = With additional tank port.
Viton = With Viton seals





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