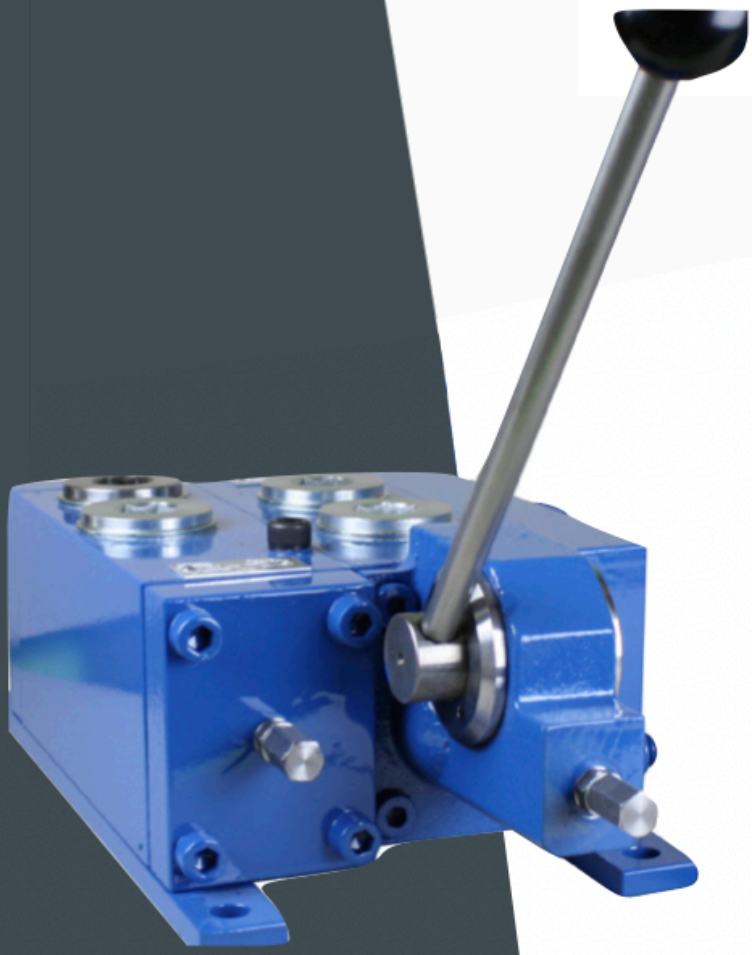
# MHV-K

HPV Hydraulic Proportional Valves



AMCA HYDRAULIC CONTROLS

## FEATURES

*The load independent output flow is proportional to the input signal (lever position).

* 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.

*Proportional directional control valves also available as:
Hydraulic proportional series MOV and
Electrical proportional series MEV.
Any combination of these control options is possible.

* The sandwich system allows a construction up to 8 control valves.

*Electrical pressure cut off at port A, B or A and B, available on request.

Publ. MHV...K-E-06/07

## TECHNICAL DATA

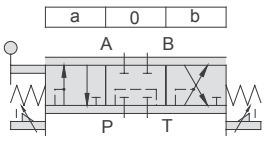
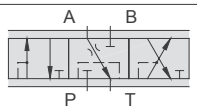
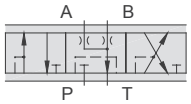
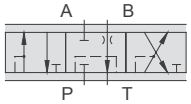
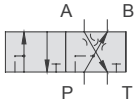
| | |
|---|---|
| Operating pressure (P,A,B) | ...350 bar (5000 psi) |
| Maximum return pressure (T): | |
| - aluminium endcaps | 15 bar (214 psi) |
| - cast iron endcaps | 30 bar (428 psi) |
| Δp compensator | 3; 6; 8 or 12 bar (43; 86; 114 or 172 psi) |
| Pressure setting range | 5...350 bar (72...5000 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 |
| Mounting position | optional |
| Lever, std. | Stainless steel |
| Size working ports: | MHV12 : 1/2" BSP (SAE optional) |
| | MHV16 : 3/4" BSP (SAE optional) |
| | MHV20 : 1" BSP (SAE optional) |
| | MHV25 : 1 1/4" BSP (SAE optional) |
| | MHV32 : 1 1/2" BSP (SAE optional) |

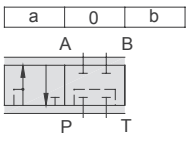
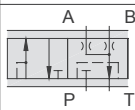
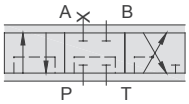
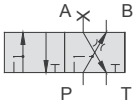
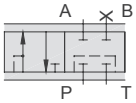
Max. flow in l/min. (USgpm) related to the Δp in bar (psi) over the compensator, per nominal bore:

| Size → | Δp compensator | | | | lever force | |
|---|---|---|---|---|---|---|
| | 3 (43) [1] | 6 (86) | 8 (114) | 12 (172) [2] | [N] | lbs |
| MHV12 | 50 (13) | 80 (21) | 90 (24) | 100 (26) | 2.2 | - 4.9 |
| MHV16 | 100 (26) | 140 (37) | 155 (41) | 180 (47) | 40 | - 8.9 |
| MHV20 | 160 (42) | 225 (59) | 250 (66) | 300 (79) | 33 | - 7.4 |
| MHV25 | 250 (66) | 350 (92) | 390 (103) | 500 (132) | 56 | - 12.6 |
| MHV32 | 400 (106) | 500 (132) | 550 (145) | 800 (211) | 80 | - 18.0 |

[1] Standard

[2] Due to loss of pressure c.q. energy conversion into heat, we recommend the next largest series.

| Spool types | Symbols | Operation Characteristic |
|---|---|---|
| A 4/3 way |   | In neutral position all ports blocked [3] |
| B 4/3 way |   | In neutral position, A - T, 20% of nominal bore [3] |
| C 4/3 way |   | In neutral position, A+B - T, 20% of nominal bore [3] |
| D 4/3 way |   | In neutral position, B - T, 20% of nominal bore [3] |
| E 4/2 way |   | P - B and A - T, 70% of nominal bore |

| Spool types | Symbols | Operation Characteristic |
|---|---|---|
| F 4/2 way |   | In neutral position all ports blocked [3] |
| G 4/2 way |   | In neutral position, A+B - T, 20% of nominal bore [3] |
| K 4/3 way (3/3) |   | Port A out of function position a additional [3] |
| M 3/2 way |   | Port A out of function P-B, 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

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)

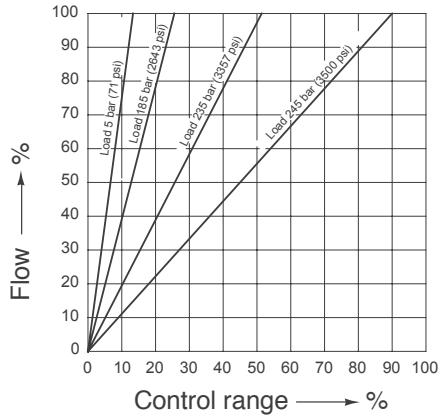



Fig. 1

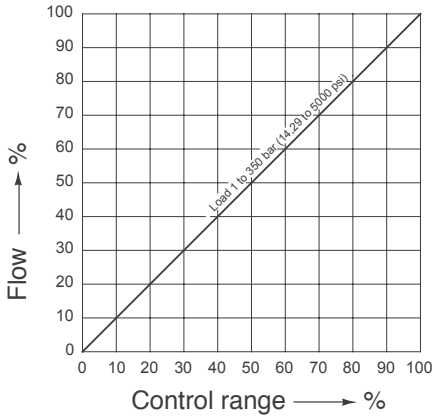



Fig. 2

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.

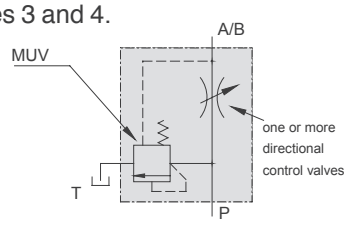



Fig. 3

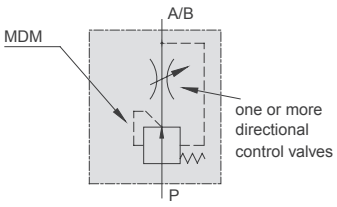



Fig. 4

**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).

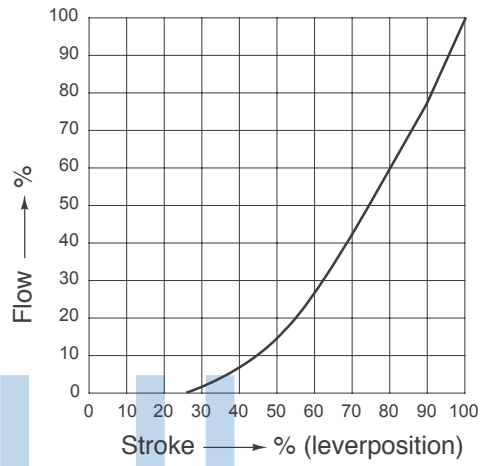



Fig. 5

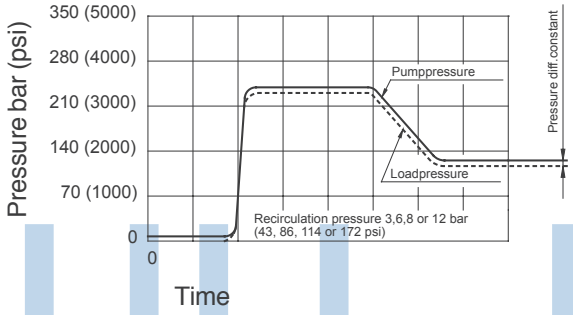



Fig. 6

**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 ($pxq_v$) turned into heat is very low.
The spring chamber is connected, via the "load-pressure check back system", to T (tank).
(example fig.26)

**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 $\Delta p$ over the directional control valve remains constant (3, 6, 8 or 12 bar (43, 86, 114 or 172 psi)).
As $q_v = k.\sqrt{\Delta p}$, 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.(example fig. 27)

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 $\Delta p$ at flow angle 2 remains constant (3, 6, 8 or 12 bar (42, 86, 114 or 172 psi)). As $q_v = k.\sqrt{\Delta p}$, 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. (Example fig. 24)

Note: (1) *If the systempump is of the load sensing type. no compensator is required (example fig. 28).*
(2) *For simultanious operation of te proportional directional control valve, independent of loadpressure, we advice a pressure compensator for each control valve.*
*For flows < 200 l/min. (53 USgpm) per control secton, the MFC stacked valves are a good alternative in this case. (see Publ. F12/F18K)*

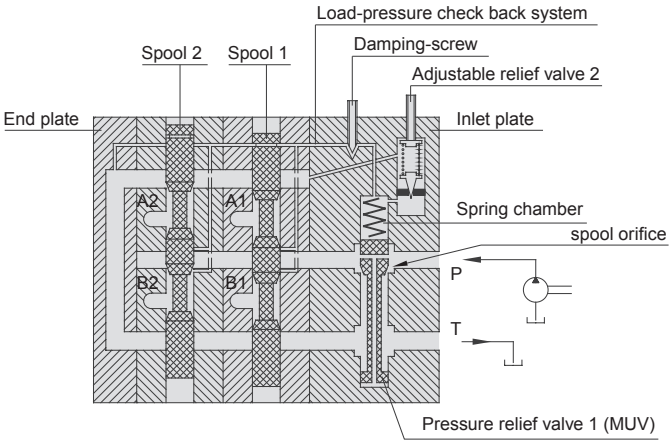



**Fig.7 By-pass flow control valve**

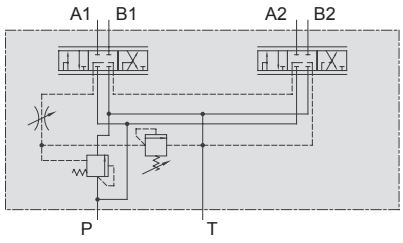



**Fig. 8 With MUV**

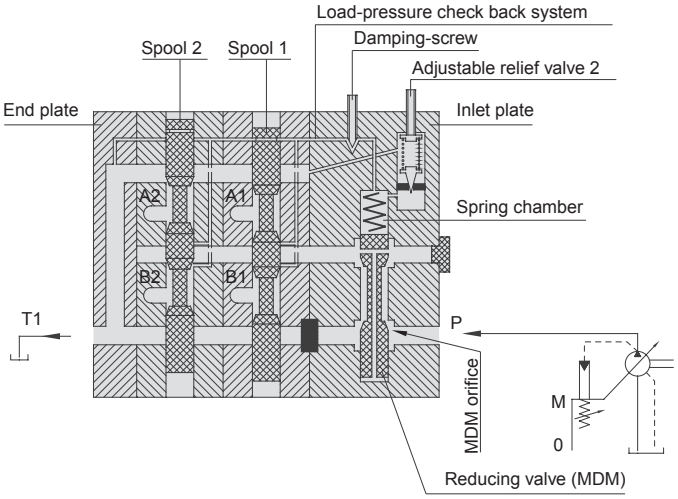



**Fig. 9 Series flow control valve**

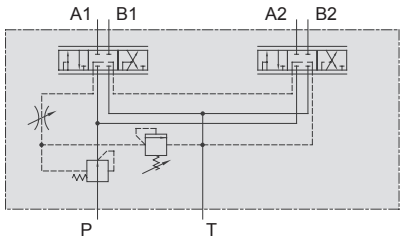



**Fig. 10 With MDM**

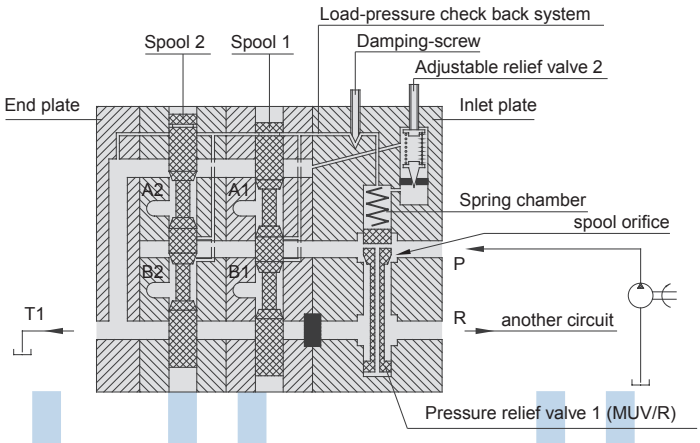



**Fig. 11 By-pass flow control valve**

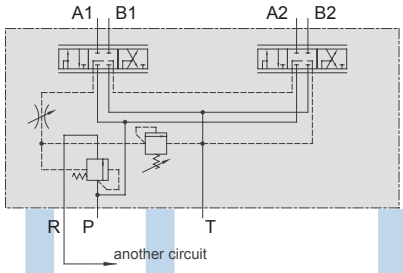



**Fig. 12 With MUV/R**

**Functioning of the proportional directional control valve with lever control** (see fig. 13 and 14)

- The handle mechanism and the return springchamber of the directional control spool are both provided with the used hydraulic fluid. This gives a perfect lubrication on the ball (fig.13) or rack and pinion (fig. 14) construction for fine control of the handle mechanism.

- The return pressure acts on both sides of the directional control spool. For every valve both chambers at both sides of the spool are connected to each other and connected to T by an orifice, this prevents spool movements caused by pressure peaks in the return line during operation.

- The directional control spool is fully balanced for perfect control. Shifting of the spool, if the pressure rises during reverse running, is therefore not necessary.

- If the directional control spool 2 (in fig. 15) moves out of the neutral position, the pressurised working port B2 is connected to the “load pressure check back” system before this port is connected to P.

The load pressure check back system remains connected to the spring chamber of the MUV, MDM, or to the L.S. port of the load sensing pump.

MHV 12 K

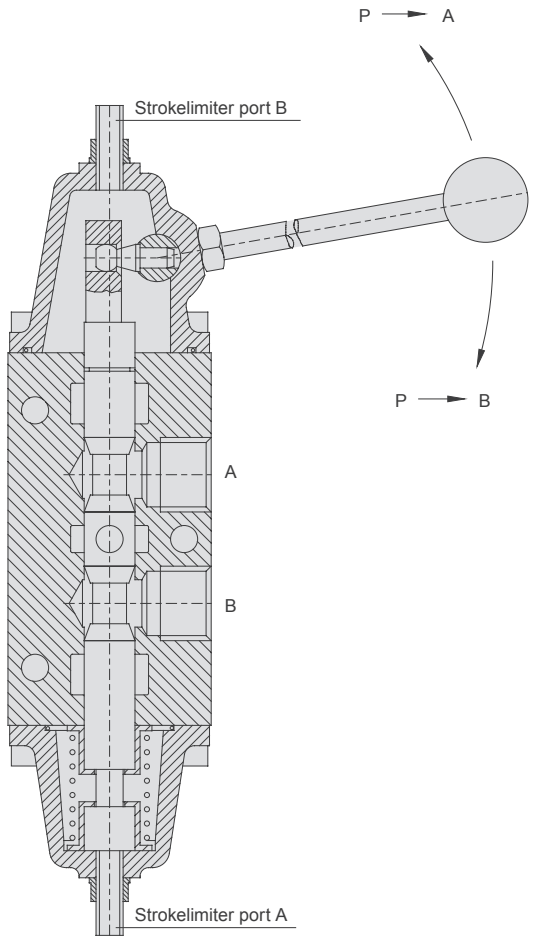



**Fig. 13**

MHV 16/32 K

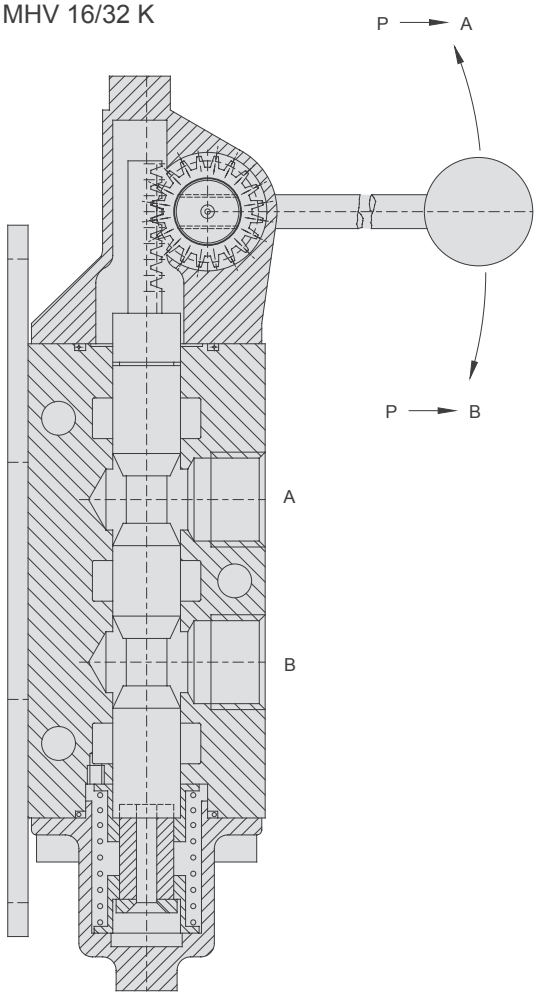
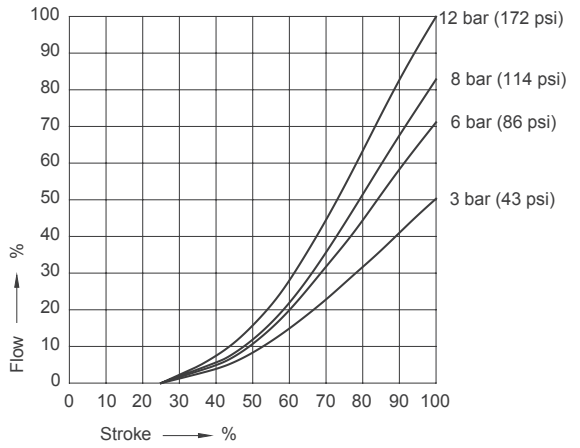


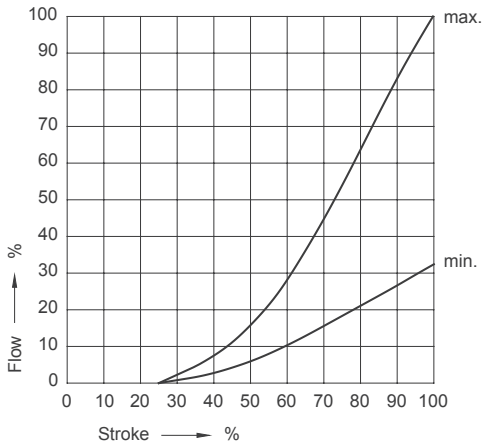

**Fig. 14**

## 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**



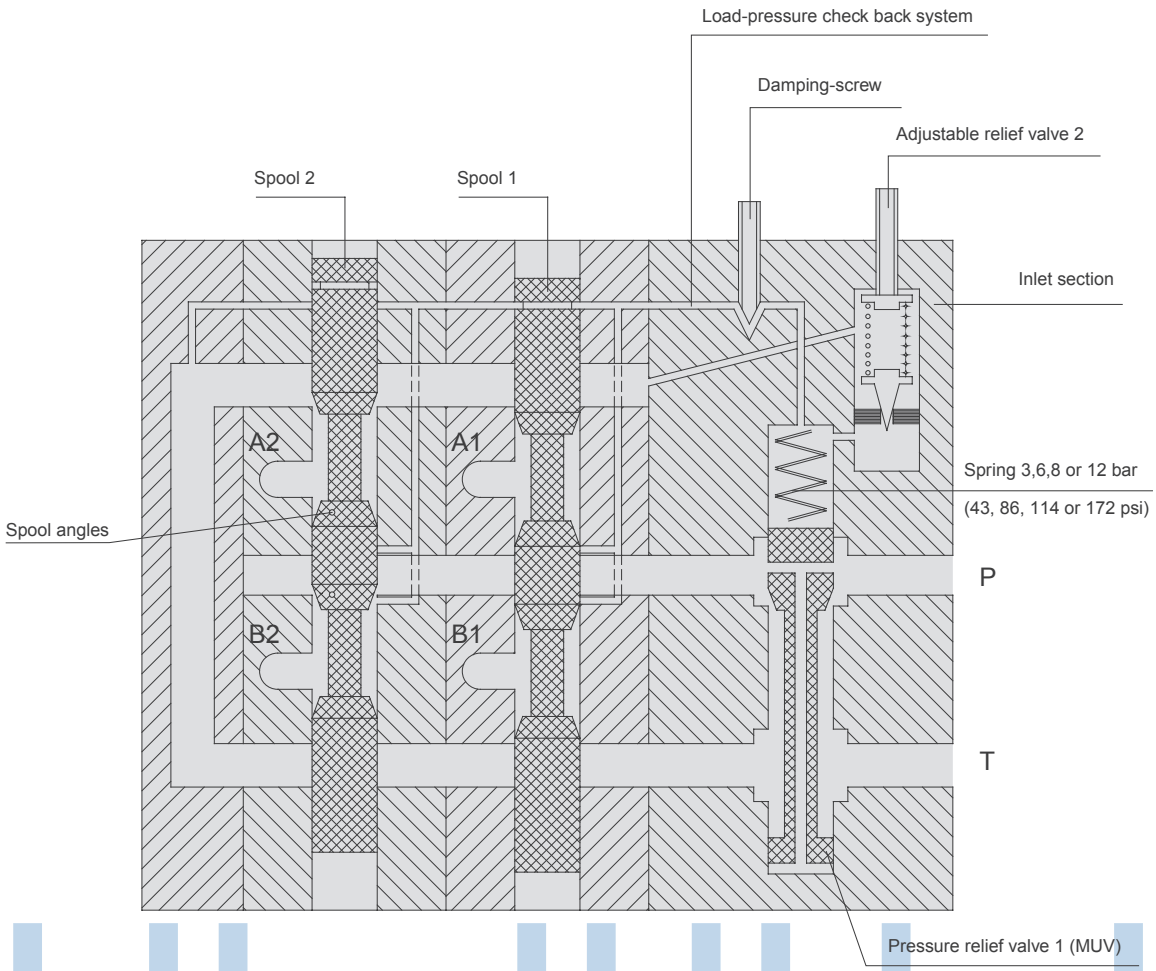
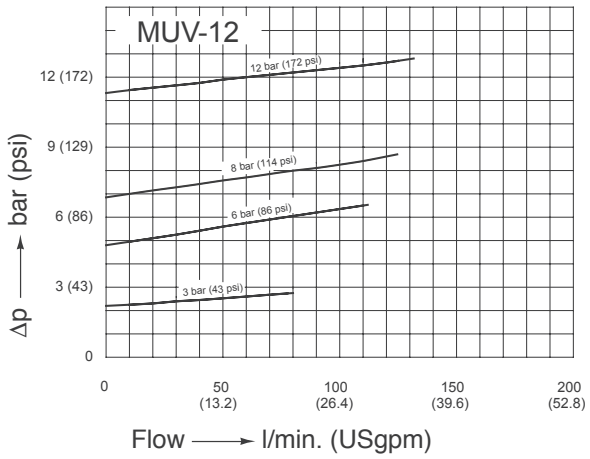
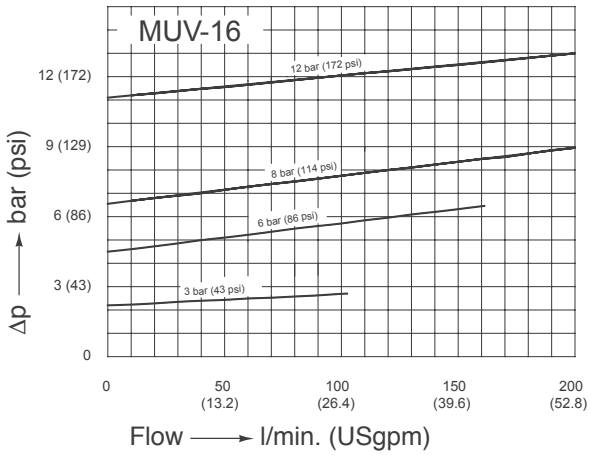



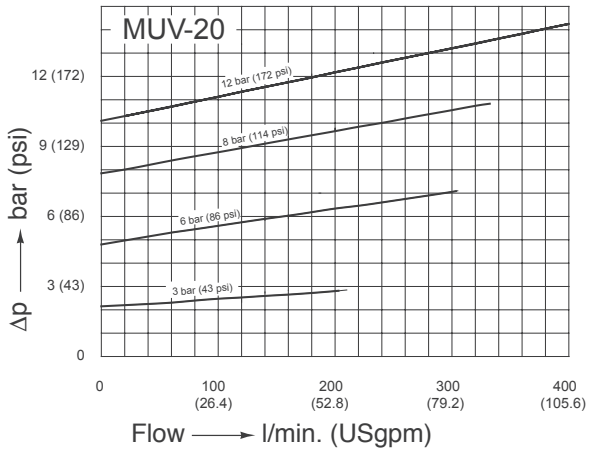

**Fig. 15**

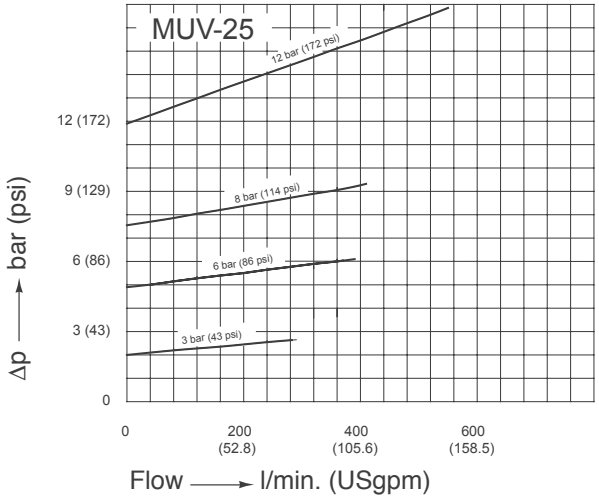
## DIAGRAMS

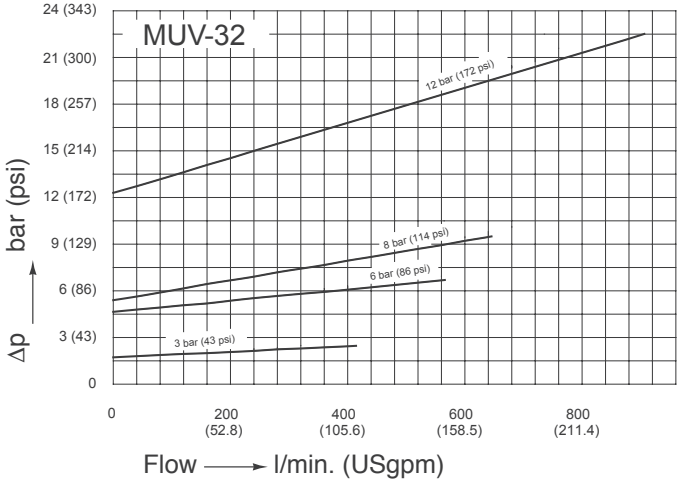
**Free recirculation pressure P⟶T**
**MUV with 3, 6, 8 or 12 bar spring (43, 86, 114 or 172 psi).**



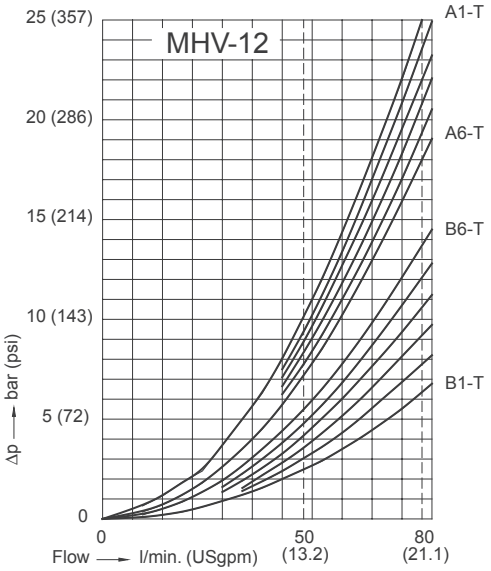



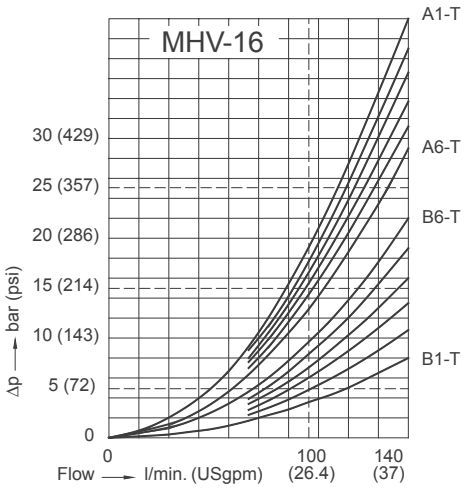



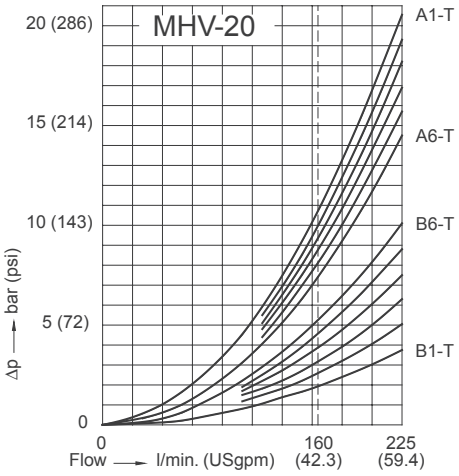



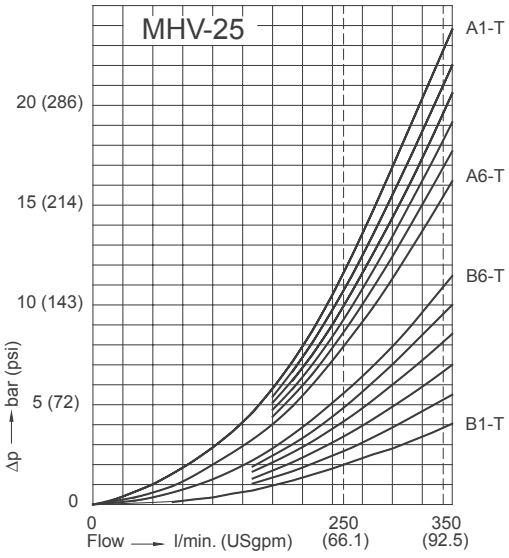



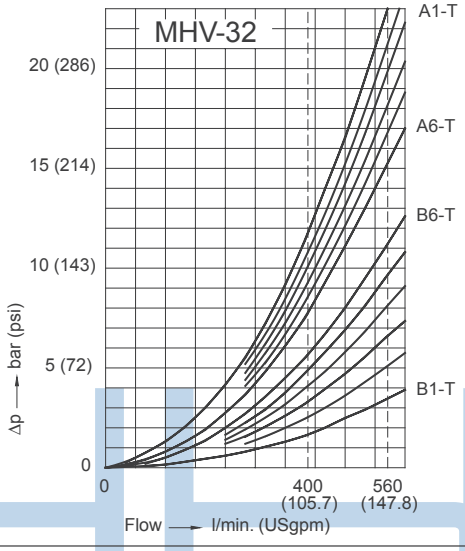
**Pressure drop A/B → T**
**With MUV or AN**

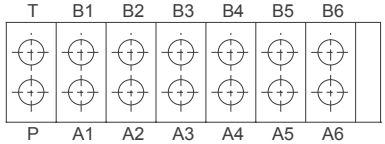


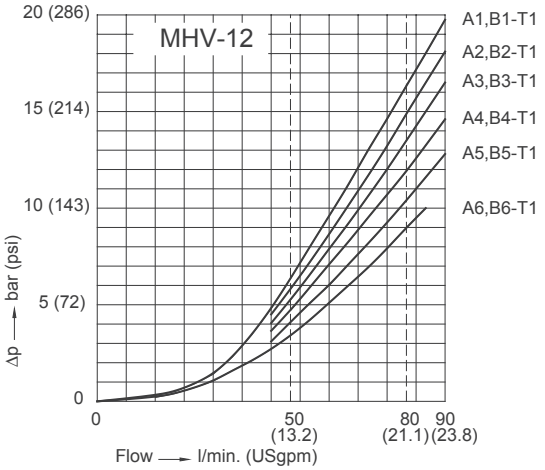



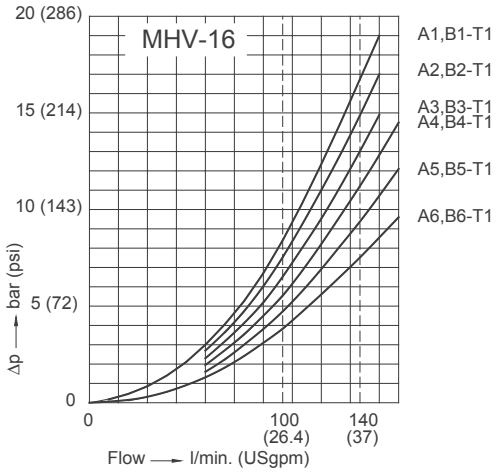



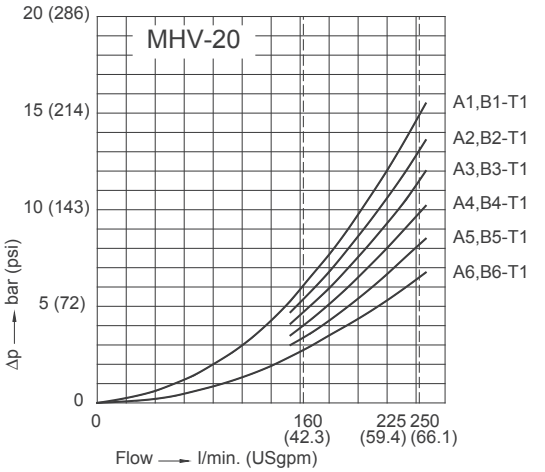



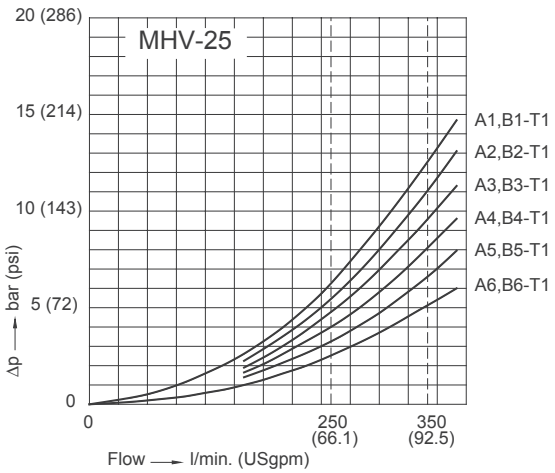

Measured with C-spool and
max. spoolopening A/B → T
Viscosity 32cSt.
Including couplings.

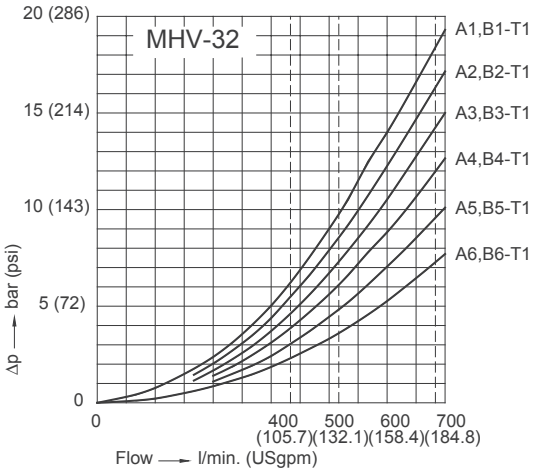
## Pressure drop A/B → T
## With MDM or MUV/R

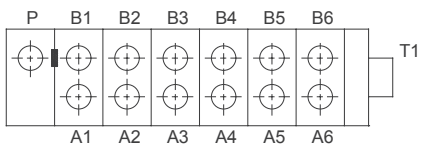


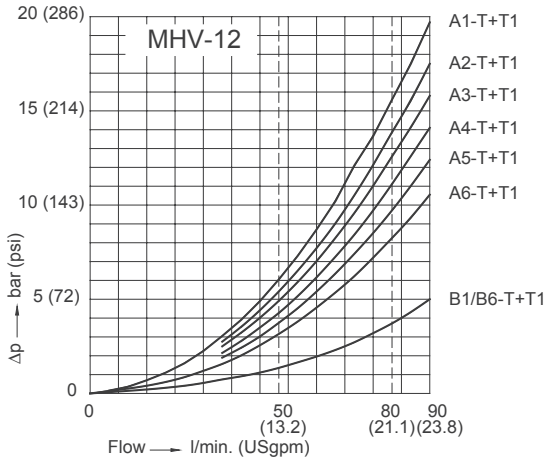



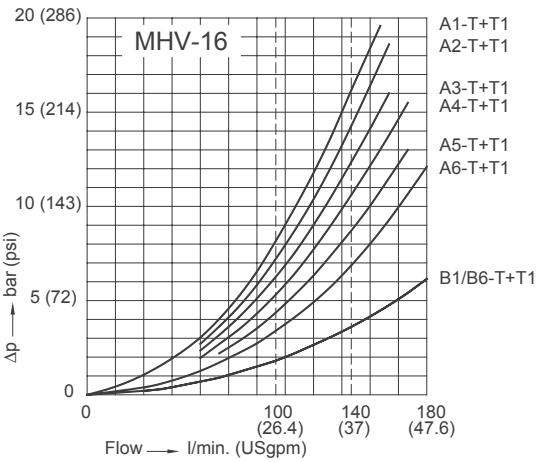



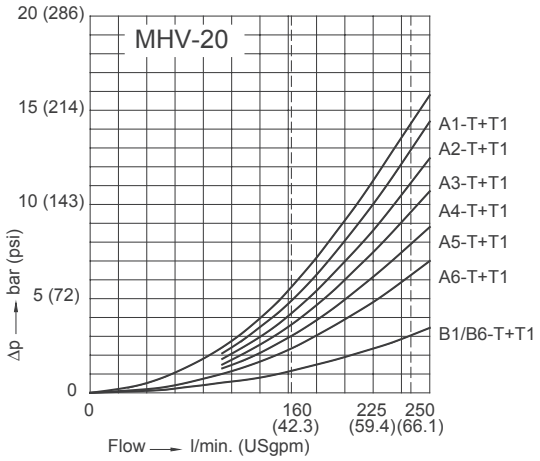



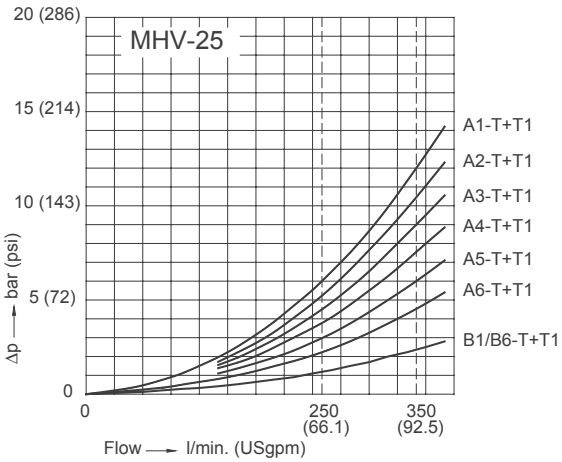

Measured with C-spool and
max. spoolopening A/B → T1
Viscosity 32cSt.
Including couplings.

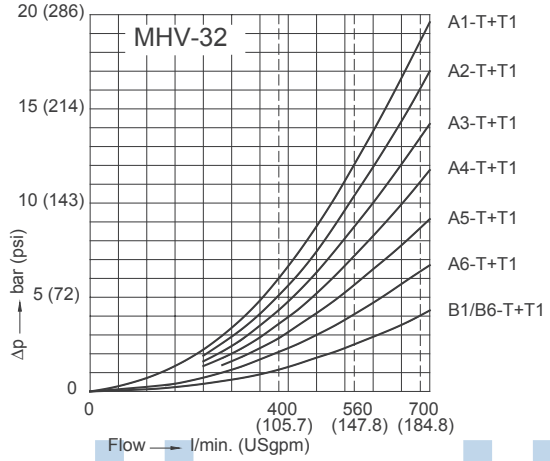
## Pressure drop A/B → T+T1
## With MUV or AN

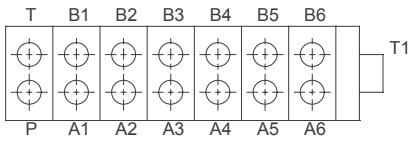



Measured with C-spool and
max. spoolopening A/B → T+T1
Viscosity 32cSt.
Including couplings.

## TYPE OF VALVE MOUNTING

The AMCA proportional directional control valves series MHV...K are ganged valves.
A complete AMCA-MHV..K system consist for example of three main parts (fig 16).

1. MUV or MDM : pressure relief (MUV, fig 17) or pressure reducing (MDM, fig 18) valve
2. MHV .. : 4/3 directional control valve with lever control.
3. AP : endplate.

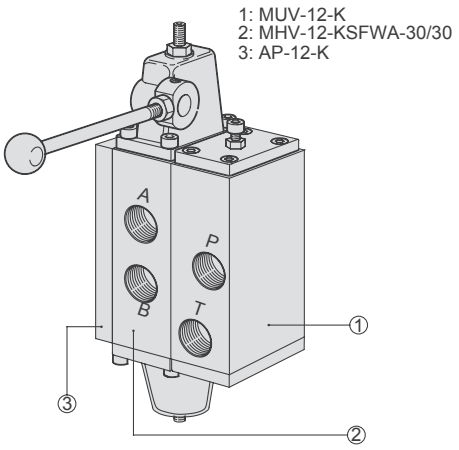



**Fig. 16**

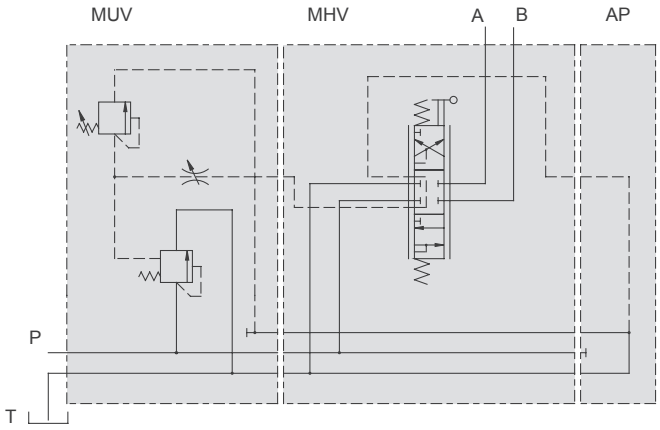



**Fig. 17**

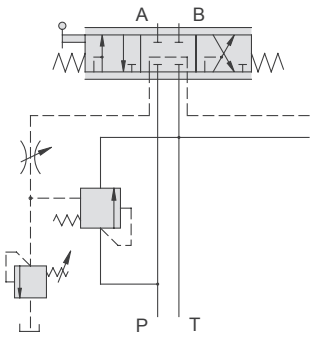



**Fig. 17A**

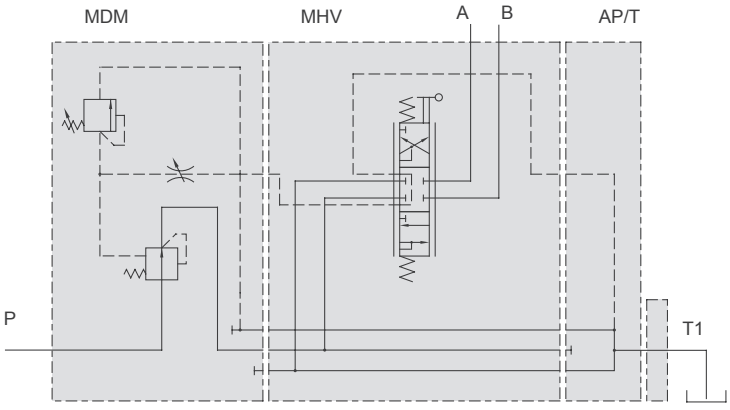



**Fig. 18**

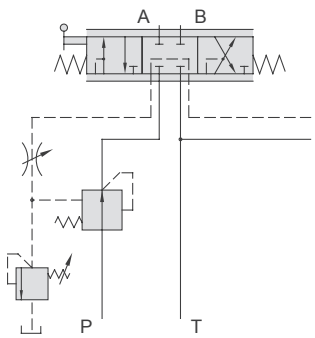



**Fig. 18A**

## OPTIONS

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

**Port connections**:

T1 : Low back pressure.
- if there are cylinders in the circuit with a large returnflow, T1 shall be connected to tank for a lower return pressure in the valve;
- if a MDM-valve is mounted, T1 is the mainport to tank std. mounted on the endplate;
- if a MUV-valve is mounted, the T1 on the endplate is an option.

X : Auxiliary port (on the MUV or MDM valve)
- 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.

Y : Auxiliary port (on the directional control valve).
- 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 endplate).
- if valves are combined (with the same or different size), port Z is used;
- 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).

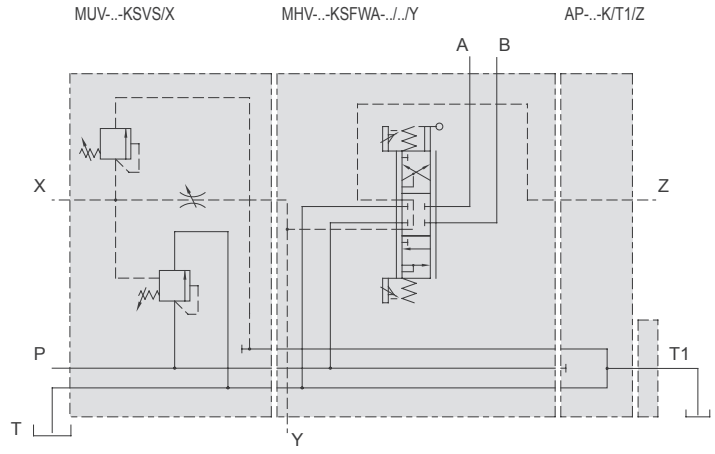



**Fig. 19**

## VARIANTS / OPTIONS

The following variants/options are possible (see ordering code).

**Compensator (MUV/MDM) variants:**

Adjustment 3 up to 12 bar (43...172 psi).Fig 20.

V : The spring in the spring chamber is adjustable between 3 and 12 bar (43 and 172 psi) for decreasing or increasing the max. flow at user A and B of the proportional control valve. This variant is recommended at a constant pressure circuit in combination with a very low load-pressure.

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)

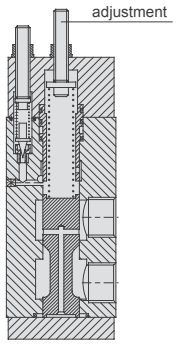
W : Without pressure adjustment, no relief valve.

Options:

P : The MDM-spool is plugged. (standard)

Q : The MDM-spool has a small orifice to the spring chamber for quick response.
This variant is recommended at a constant pressure circuit.

**Fig. 20 Adjustable recirculation pressure**




Position lock:

F : Standard, spring return to center position.

B : Friction brake with center detent, fig 21, the spool can be set in any position.

O : No spring return to center position

R : Detent, fig 21, the spool can be set in any position, the center position and both end positions are perceptible.

V : Stronger spring to center position.

Neutral lever position:

H, S, R and W :
Factory setting of the handle position, see page 19.

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.
Standard is Δp 3 bar (43 psi)

Options:

A : Metal housed microswitch, if there is a need for electrical indicators (10A, 125-250 VAC ), the microswitch has 2 electrically-isolated single-poles, changeover for either independent or double-pole use, fig. 22.

G : Cast iron spring and handlemechnism caps for max. return pressure is 30 bar (428 psi).

H : Stroke limitation, for adjustment of the maximum flow by blocking the stroke of the spool, fig. 21 and 22.

SW : Cast iron spring and handlemechnism caps, whereby the movable parts are suitable for special environment conditions, like seawater.

U : Without lever.

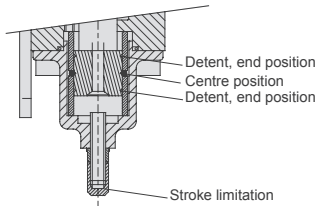



**Fig. 21 Friction brake / detent**

**Fig. 22 Microswitch**

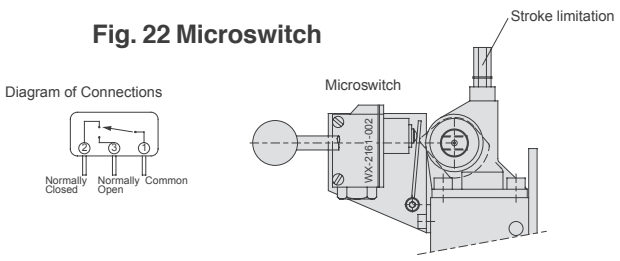


**Fig. 23 Hydraulic foundation rig**

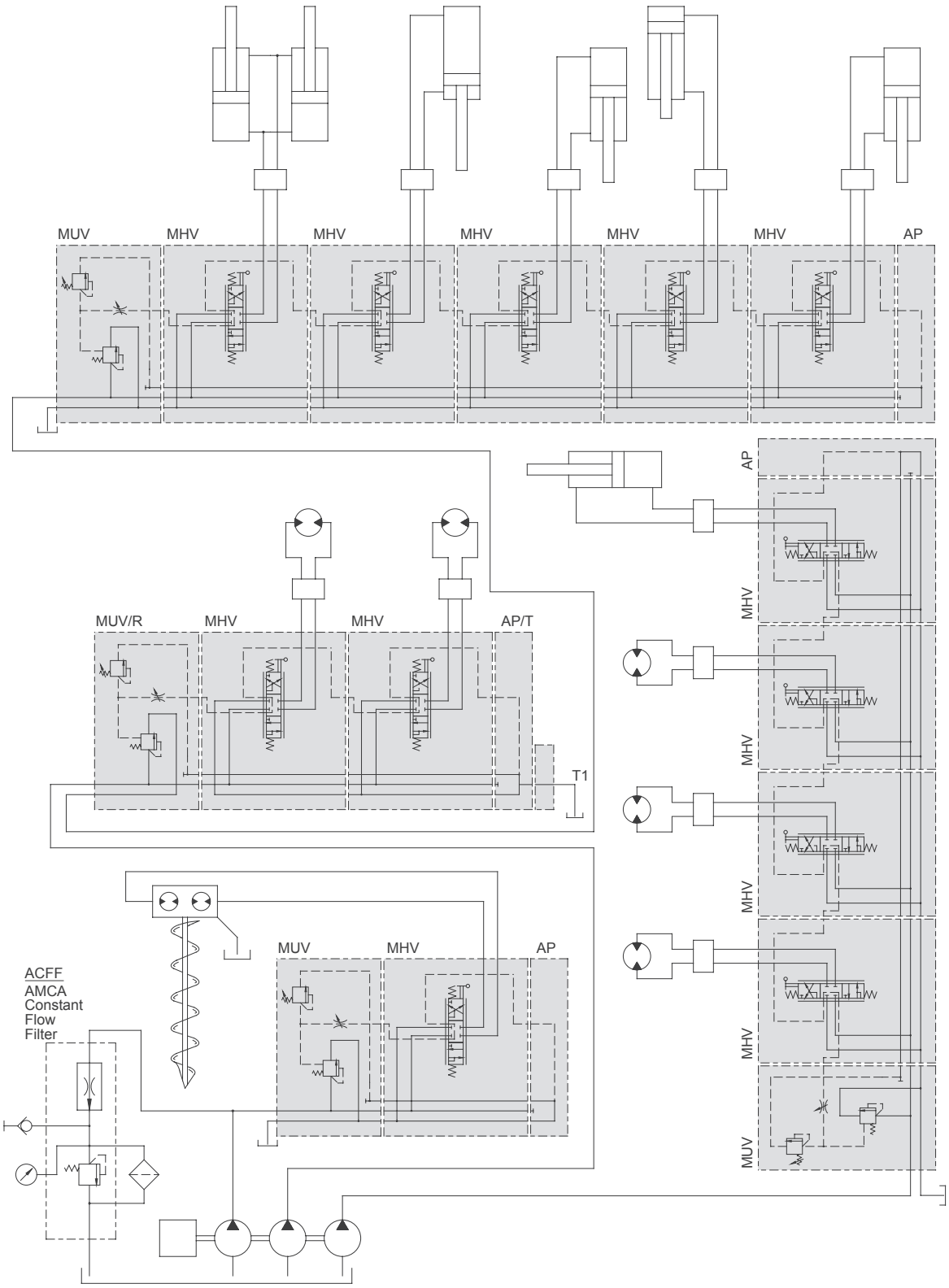



**Fig. 24 Hydraulic foundation rig**

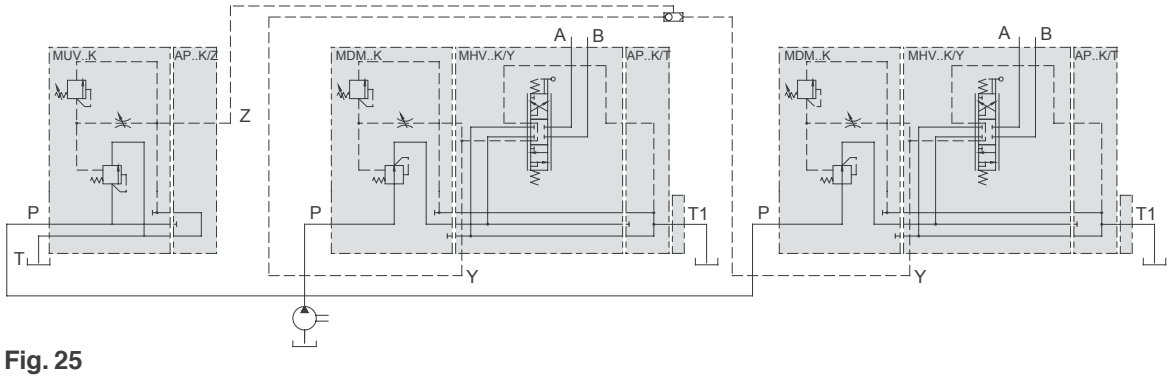



**Fig. 25**

**A System with a fixed displacement pump**.
The use of a pump with a constant output requires the additional use of a pressure relief valve (MUV) for recirculation with 3,6,8 or 12 bar. Simultaneous use of the two consumers is possible.

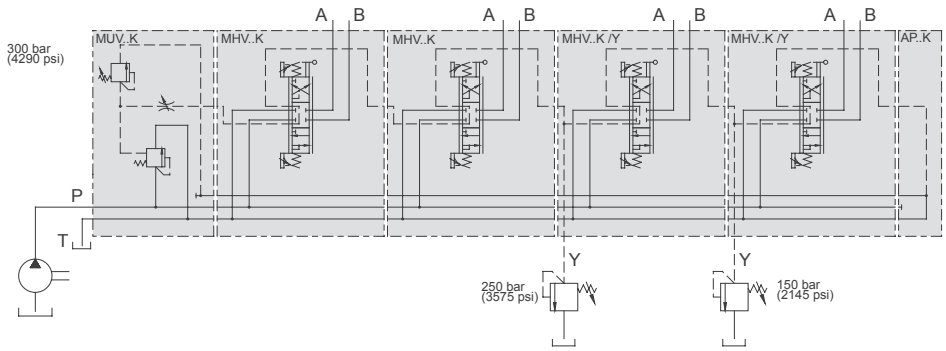



**Fig. 26**

**Varied pressures during use**.
When several directional control valves are built into one control block and one or more control circuits must have a different maximum pressure during use, to the present conditions, a pressure relief valve (nominal bore 4) must be fastened to the Y connection. The directional control valve with the highest pressure during use must be positioned immediately after the pressure relief valve (MUV), followed by the others in (pressure) decreasing order. The adjustable relief valve of the MUV-valve is positioned at the highest pressure point, while the following control circuit is connected to the pressure relief valves at the Y connection.

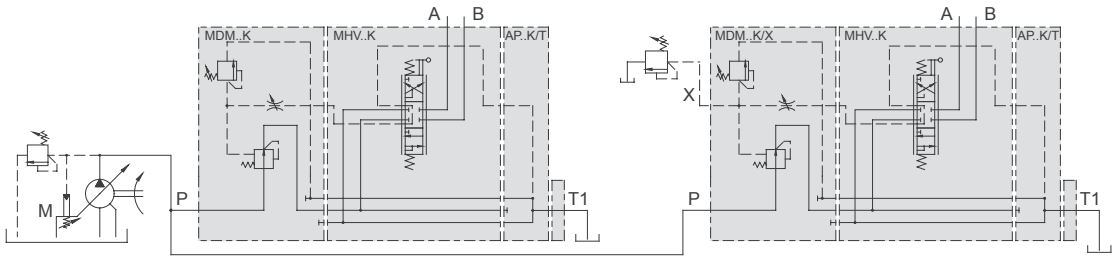



**Fig. 27**

**A System with variable displacement pump or constant pressure line systems**.
With only one pressure compensated variable displacement pump it is possible to have a load-independent simultaneous use of several consumers by the use of pressure reducing (MDM) valves.

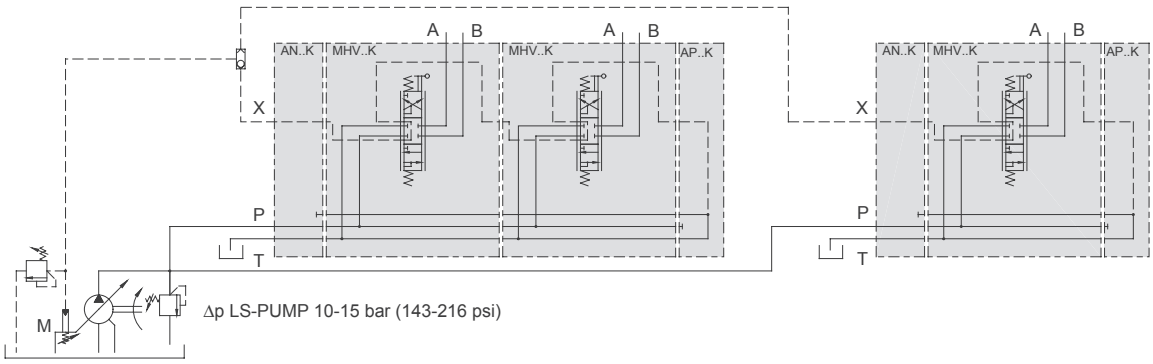
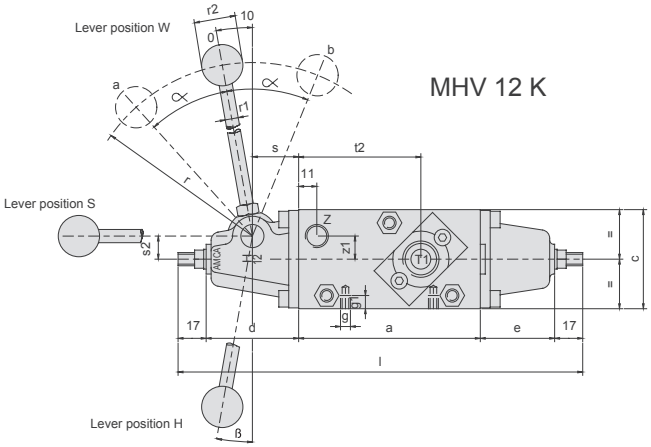
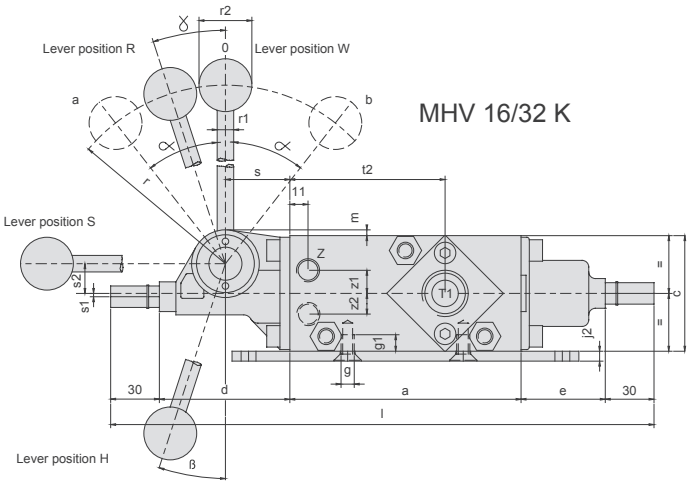


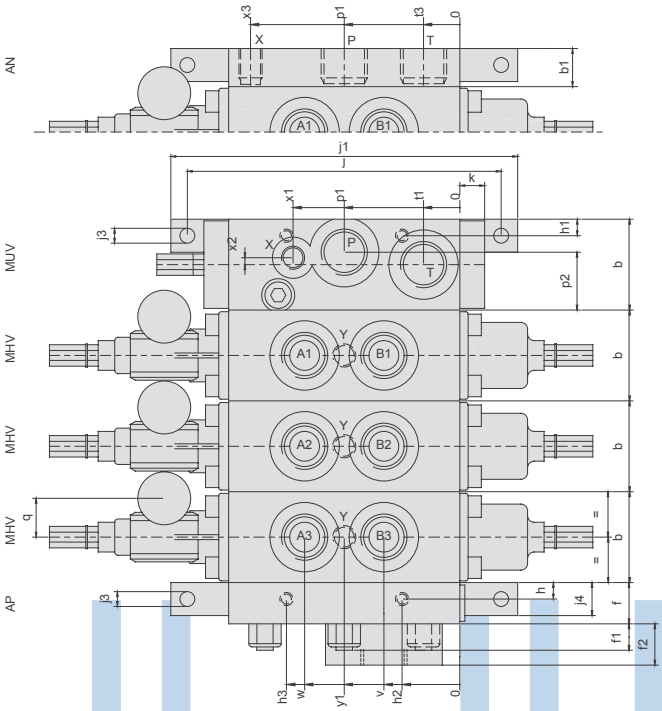

**Fig. 28**

**A sytem with a LS-pump**
Load independent flow control by using load sensing pump.
If the hydraulic system is equiped with a load sensing pump, the X port of the inlet plate AN..K has to be connected with the load sensing signal. A pressure compensator MUV or MDM is not necessary in that case.
Note: If ordering the control valves (MHV) the Δp of the pump has to be specified, so the spools can be grinded for the exact flow.

## DIMENSIONS




| Nominal bore | 12 | 16 | 20 | 25 | 32 |
|---|---|---|---|---|---|
| Connecting threads in BSP (SAE thraight thread 'O'ring BOSS) (other thread on request) | | | | | |
| P,T,A,B,T1 | G1/2" (8) | G3/4" (12) | G1" (16) | G1 1/4" (20) | G1 1/2" (24) |
| X,Y,Z | G1/4" (6) | G1/4" (6) | G1/4" (6) | G1/4" (6) | G1/4" (6) |
| Control spool stroke | 2 x 8 | 2 x 10 | 2 x 12 | 2 x 14 | 2 x 16 |
| in mm. (inch) | (2 x 0.32) | (2 x 0.39) | (2 x 0.47) | (2 x 0.55) | (2 x 0.63) |

Dimensions in mm. (inch)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ∝ | 32 | | 38 | | 46 | | 35,5 | | 41 | |
| ß | 10 | | 18 | | 18 | | 12 | | 12 | |
| ϑ | - | | 18 | | 18 | | 12 | | 12 | |
| a | 110 | (4.33) | 140 | (5.52) | 170 | (6.70) | 200 | (7.88) | 235 | (9.26) |
| b | 46 | (1.81) | 55 | (2.17) | 68 | (2.68) | 76 | (2.99) | 90 | (3.55) |
| b1 | 30 | (1.18) | 30 | (1.18) | 30 | (1.18) | 40 | (1.57) | 45 | (1.77) |
| c | 60 | (2.36) | 70 | (2.76) | 86 | (3.39) | 100 | (3.94) | 120 | (4.73) |
| d | 56 | (2.21) | 79 | (3.11) | 89 | (3.51) | 108 | (4.26) | 128 | (5.04) |
| e | 45 | (1.77) | 51 | (2.01) | 65 | (2.56) | 68 | (2.68) | 71 | (2.80) |
| f | 20 | (0.79) | 25 | (0.99) | 30 | (1.18) | 40 | (1.58) | 45 | (1.77) |
| f1 | 11 | (0.43) | 16 | (0.63) | 18 | (0.71) | 20 | (0.79) | 23 | (0.91) |
| f2 | 30 | (1.18) | 30 | (1.18) | 30 | (1.18) | 40 | (1.58) | 40 | (1.58) |
| g | M6 | | M8 | | M10 | | M12 | | M14 | |
| g1 | 9 | (0.35) | 10 | (0.39) | 13 | (0.51) | 15 | (0.59) | 18 | (0.71) |
| h | 8,5 | (0.33) | 10 | (0.39) | 12,5 | (0.49) | 15 | (0.59) | 17,5 | (0.69) |
| h1 | 7,5 | (0.30) | 10 | (0.39) | 12,5 | (0.49) | 15 | (0.59) | 17,5 | (0.69) |
| h2 | 28,4 | (1.12) | 35 | (1.38) | 40 | (1.58) | 50 | (1.97) | 57,5 | (2.27) |
| h3 | 81,65 | (3.22) | 105 | (4.14) | 130 | (5.12) | 150 | (5.91) | 177,5 | (6.99) |
| j | - | | 190 | (7.49) | 235 | (9.26) | 292 | (11.50) | 355 | (13.99) |
| j1 | - | | 210 | (8.27) | 260 | (10.24) | 322 | (12.69) | 390 | (15.37) |
| j2 | - | | 6 | (0.24) | 8 | (0.32) | 10 | (0.39) | 10 | (0.39) |
| j3 | - | | 9 | (0.35) | 11 | (0.43) | 13 | (0.51) | 15 | (0.59) |
| j4 | - | | 20 | (0.79) | 25 | (0.99) | 30 | (1.18) | 35 | (1.38) |
| k | 12 | (0.47) | 15 | (0.59) | 20 | (0.79) | 25 | (0.99) | 30 | (1.18) |
| l | 271 | (10.68) | 330 | (13) | 384 | (15.13) | 436 | (17.18) | 494 | (19.46) |
| m | - | | 3,5 | (0.14) | - | | 10 | (0.39) | - | |
| p1 | 55 | (2.17) | 70 | (2.76) | 85 | (3.35) | 100 | (3.94) | 117,5 | (4.63) |
| p2 | 29 | (1.14) | 35 | (1.38) | 42 | (1.65) | 46 | (1.81) | 50 | (1.79) |
| q | 20,5 | (0.81) | 23,5 | (0.93) | 25 | (0.99) | 33 | (1.30) | 33 | (1.30) |
| r | 200 | (7.88) | 230 | (9.06) | 230 | (9.06) | 270 | (10.64) | 270 | (10.64) |
| r1 | 8 | (0.32) | 10 | (0.39) | 10 | (0.39) | 12 | (0.47) | 12 | (0.47) |
| r2 | 25 | (0.99) | 32 | (1.26) | 32 | (1.26) | 40 | (1.58) | 40 | (1.58) |
| s | 28 | (1.10) | 39 | (1.54) | 43 | (1.69) | 55 | (2.17) | 59 | (2.32) |
| s1 | - | | 2 | (0.08) | 1,5 | (0.06) | 1,5 | (0.06) | 1,5 | (0.06) |
| s2 | 14 | (0.55) | 18 | (0.71) | 19,5 | (0.77) | 30 | (1.18) | 30 | (1.18) |
| t1 | 19 | (0.75) | 22 | (0.87) | 25 | (0.99) | 35 | (1.38) | 38,5 | (1.52) |
| t2 | 74 | (2.92) | 94 | (3.70) | 115 | (4.53) | 135 | (5.32) | 159,5 | (6.28) |
| t3 | 17 | (0.67) | 20 | (0.79) | 25 | (0.99) | 30 | (1.18) | 33,5 | (1.32) |
| v | 36 | (1.42) | 46 | (1.81) | 55 | (2.17) | 65 | (2.56) | 75,5 | (2.97) |
| w | 74 | (2.92) | 94 | (3.70) | 115 | (4.53) | 135 | (5.32) | 159,5 | (6.28) |
| x1 | 85 | (3.35) | 101 | (3.98) | 122 | (4.81) | 150 | (5.91) | 183 | (7.21) |
| x2 | 5 | (0.20) | - | | - | | - | | - | |
| x3 | 99 | (3.90) | 129 | (5.08) | 159 | (6.26) | 189 | (7.44) | 224 | (8.82) |
| y1 | 64 | (2.52) | 78 | (3.07) | 95 | (3.74) | 112,5 | (4.43) | 133,5 | (5.26) |
| z1 | 14 | (0.55) | 14 | (0.55) | 20 | (0.79) | - | | - | |
| z2 | - | | - | | - | | 19 | (0.75) | 23 | (0.91) |

Weight in N (lbs)

| | | | | | |
|---|---|---|---|---|---|
| MUV | 23,54 (5.29) | 42,17 (9.48) | 78,45 (17.63) | 122,58 (27.54) | 205,94 (46.27) |
| MDM | 23,54 (5.29) | 42,17 (9.48) | 78,45 (17.63) | 122,58 (27.54) | 205,94 (46.27) |
| AN | 8,83 (1.98) | 15,69 (3.53) | 29,42 (6.61) | 51,98 (11.68) | 68,65 (15.43) |
| MHV | 27,46 (6.17) | 38,25 (8.59) | 68,65 (15.43) | 127,49 (28.65) | 161,81 (36.36) |
| AP | 9,81 (2.20) | 16,67 (3.75) | 29,42 (6.61) | 52,96 (11.90) | 68,65 (15.43) |

**Mounting procedure**

- AMCA-valves shall not be mounted by overtightening of mounting bolts, causing mechanical distortion and thus spool lock. (see tightening torques on page 23).

- Don't use conical thread for port-fittings.
- For sealing purposes, use o-rings.
- At the port-connections, 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.
- Avoid ingression of contaminants during mounting.

**Start-up procedure**

- Start the system-flushing procedure with the adjustment-screw of relief valve 2 (see page 5) fully released to achieve the minimum pressure.
- Turning the adjustment-screw clockwise (360° turn = ca. 100 bar (1430 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. 7 and 9) is factory-setted. Adjustment on location is possible as follows:
- Remove the cover-screw (width 8 mm (0.32 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.

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. 30, 5)
- Remove cover-screw of stroke limiter
- Loosen the lock-nut (width 13 mm (0.51 inch))
- Turn the stroke limiting screw with (width 4 mm (0.16 inch)) clockwise to reduce flow and anti-clockwise to enlarge flow.

2. $\Delta$p-adjustment (see fig. 28, 1)
- Loosen the lock-nut (width 13 mm (0.51 inch)
- Turn the adjustment screw with (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 $\Delta$p-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.

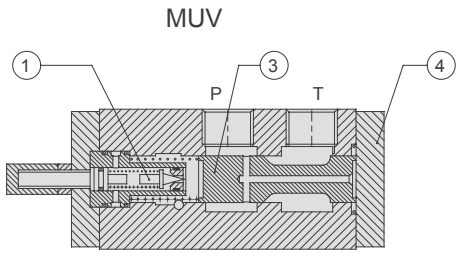



Fig. 29

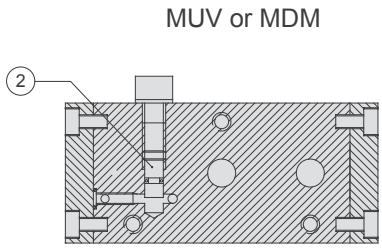



Fig. 30

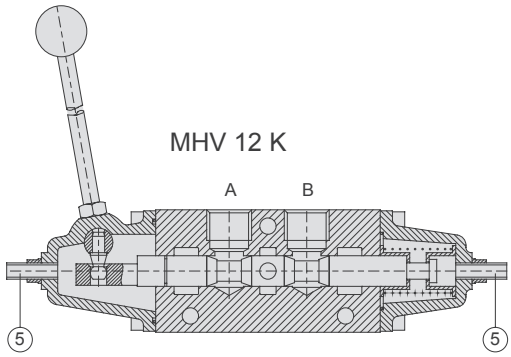



Fig. 31

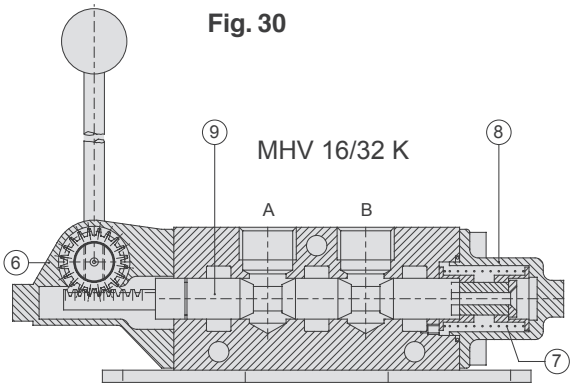



Fig. 32

**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 spool). If damaged, replace cone and seat (if necessary).
   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) jammed open*
   When removing the 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).

2. *Excessive friction of directional spool*
   Remove spring-cap (8) and examine spool (9) and bore from dirt or damage. Deburr with care. Examine system filter.
   Also spool lock, by overtightening mounting screws or bolts.

3. *Excessive damping*
   See A2.

4. *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*
   Handle mechanism deficiency (6)

4. *MUV-spool jammed open*
   See A3/or broken spring (unlikely) (7)

5. *There is insufficient user load.*

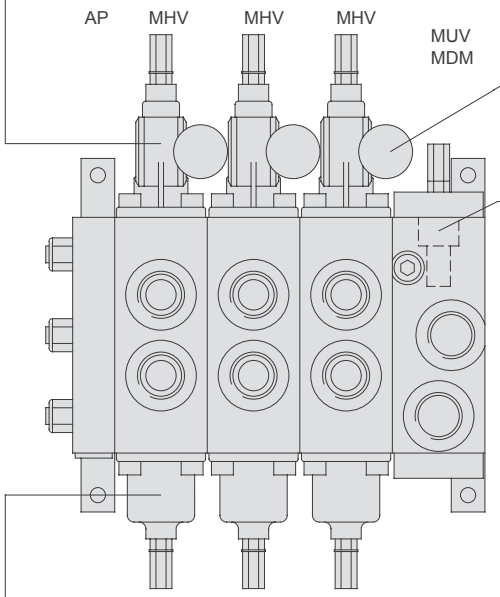
**D. Pump does not unload**

1. *MUV-spool jammed (see A3)*

2. *Directional spool not centring*
   Excessive friction (see B2).

# RECOMMENDED SPARE PARTS

| Handle mechanism:* | alloy: | cast iron: | Seawater Resistant: | alloy + code H: | cast iron + code H: | Seawater Resistant: + code H: |
|---|---|---|---|---|---|---|
| MHV-12: | HR-0131K304 | HR-0131K424 | HB-0503-531 | HR-0131K304 | HR-0131K424 | HB-0503-531 |
| MHV-16: | HR-0112K304 | HR-0112K404 | HB-0503-416 | HR-0112K324 | HR-0112K424 | HB-0503-516 |
| MHV-20: | HR-0113K304 | HR-0113K404 | HB-0503-420 | HR-0113K324 | HR-0113K424 | HB-0503-520 |
| MHV-25: | HR-0114K304 | HR-0114K404 | HB-0503-425 | HR-0114K324 | HR-0114K424 | HB-0503-525 |
| MHV-32: | HR-0115K304 | HR-0115K404 | HB-0503-432 | HR-0115K324 | HR-0115K424 | HB-0503-532 |




Lever with knob:

| | |
|---|---|
| MHV-12: | HR-0131K309 |
| MHV-16: | HR-0112-309 |
| MHV-20: | HR-0112-309 |
| MHV-25: | HR-0114-309 |
| MHV-32: | HR-0114-309 |

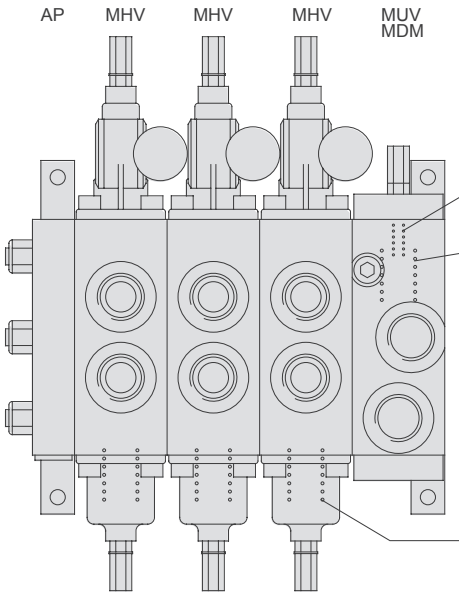
Relief valve insert:

| | |
|---|---|
| MHV-12: | HR-0111K335 |
| MHV-16: | HR-0111K335 |
| MHV-20: | HR-0113K335 |
| MHV-25: | HR-0114K335 |
| MHV-32: | HR-0115K335 |

* Standard with BUNA-N seals, if Viton seals are requested, add 'V' at the end of the code.

| Spring cap:* | alloy: | cast iron: | alloy + code H: | cast iron + code H: |
|---|---|---|---|---|
| MHV-12: | HR-0131K303 | HR-0131K423 | HR-0131K303 | HR-0131K423 |
| MHV-16: | HR-0112K303 | HR-0112K403 | HR-0112K323 | HR-0112K423 |
| MHV-20: | HR-0113K303 | HR-0113K403 | HR-0113K323 | HR-0113K423 |
| MHV-25: | HR-0114K303 | HR-0114K403 | HR-0114K323 | HR-0114K423 |
| MHV-32: | HR-0115K303 | HR-0115K403 | HR-0115K323 | HR-0115K423 |

SPRINGS MHV




Pressure adjustment spring: HR-0111-039

Recirculation pressure spring:

| Size: | Recirculation pressure: 3 bar (43 psi) | 6 bar (86 psi) | 8 bar (114 psi) | 12 bar (172 psi) |
|---|---|---|---|---|
| MDM/MUV 12: | HR-0111-040 | HR-2121-032 | HB-0014-001 | HR-2121-040 |
| MDM/MUV 16: | HR-0111-040 | HR-2121-032 | HB-0014-001 | HR-2121-040 |
| MDM/MUV 20: | HR-0113-040 | HR-2123-032 | HB-0014-003 | HR-2123-040 |
| MDM/MUV 25: | HR-0114-040 | HR-2124-032 | HB-0014-002 | HR-2124-040 |
| MDM/MUV 32: | HR-0115-040 | HR-2125-032 | HB-0112-014 | HR-2125-040 |

Position lock spring:

| Size: | Spring return (code: F) | Stronger spring return (code: V) |
|---|---|---|
| MHV-12 | HR-0111-010 | HB-0032-001 |
| MHV-16 | HR-0112-010 | HB-0032-002 |
| MHV-20 | HR-0113-010 | HB-0032-003 |
| MHV-25 | HR-0114-010 | HR-0114-010 |
| MHV-32 | HR-0115-010 | HR-0115-010 |

## Seals and assembly kits

R – .. – ... – ..

| R | SPARE KIT |
|---|---|

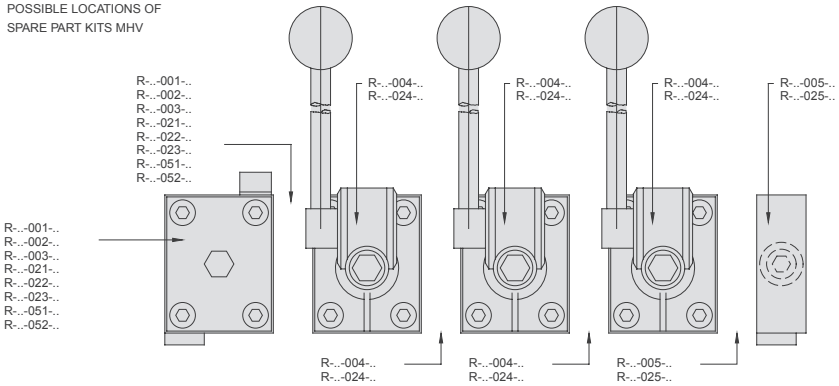
| | |
|---|---|
| 01 | Seals (BUNA-N 70° Shore) |
| 02 | Seals (BUNA-N 70° Shore) and springs * |
| 06 | Assembly kit:Seals (BUNA-N 70° Shore), shims and bushes |
| 11 | Seals (VITON 70° Shore) |
| 12 | Seals (VITON 70° Shore) and springs * |
| 16 | Assembly kit:Seals (VITON 70° Shore), shims and bushes |
| 21 | Seals (VITON 90° Shore) |
| 22 | Seals (VITON 90° Shore) and springs * |
| 26 | Assembly kit:Seals (VITON 90° Shore), shims and bushes |

| | |
|---|---|
| 001 | for MUV-16/32-K |
| 002 | for MDM/MUV/R-16/32-K |
| 004 | for MHV-16-32-K |
| 005 | for AP-16/32-K |
| 021 | for MUV-12-K |
| 022 | for MDM-12-K |
| 024 | for MHV-12-K |
| 025 | for AP-12-K |
| 051 | for MUV + ΔP |
| 052 | for MDM + ΔP |

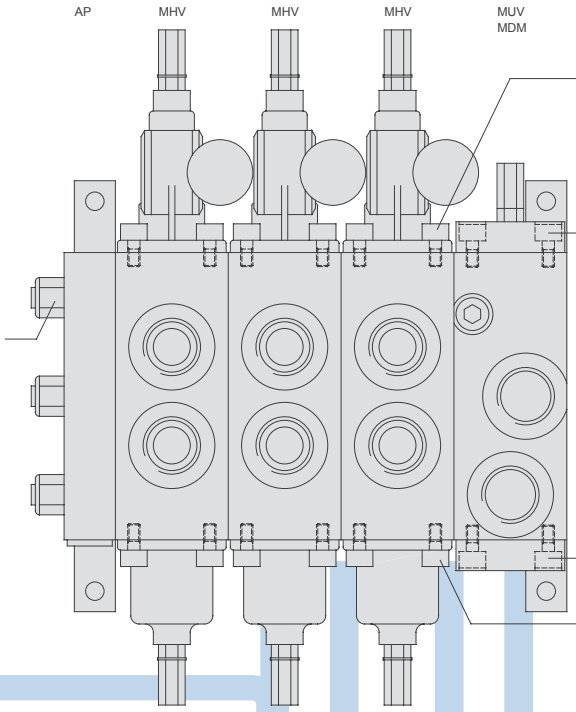
| | |
|---|---|
| 12 | MHV-12 |
| 16 | MHV-16 |
| 20 | MHV-20 |
| 25 | MHV-25 |
| 32 | MHV-32 |

* FOR MUV/MDM SPRINGS GIVE R

POSSIBLE LOCATIONS OF SPARE PART KITS MHV




## MAXIMUM TIGHTENING TORQUES MHV




MHV-12: 4 Nm (2.96 lb.ft)
MHV-16: 8 Nm (5.92 lb.ft)
MHV-20: 8 Nm (5.92 lb.ft)
MHV-25: 15 Nm (11.1 lb.ft)
MHV-32: 20 Nm (14.8 lb.ft)

MHV-12: 9,5 Nm (7.03 lb.ft)
MHV-16: 15 Nm (11.1 lb.ft)
MHV-20: 20 Nm (14.8 lb.ft)
MHV-25: 35 Nm (25.9 lb.ft)
MHV-32: 50 Nm (37 lb.ft)

MHV-12: 15 Nm (11.1 lb.ft)
MHV-16: 30 Nm (22.2 lb.ft)
MHV-20: 50 Nm (37 lb.ft)
MHV-25: 80 Nm (59.2 lb.ft)
MHV-32: 130 Nm (96.2 lb.ft)

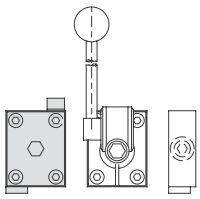
MHV-12: 9,5 Nm (7.03 lb.ft)
MHV-16: 15 Nm (11.1 lb.ft)
MHV-20: 20 Nm (14.8 lb.tf)
MHV-25: 35 Nm (25.9 lb.ft)
MHV-32: 50 Nm (37 lb.ft)

MHV-12: 4 Nm (2.96 lb.ft)
MHV-16: 8 Nm (5.92 lb.ft)
MHV-20: 8 Nm (5.92 lb.ft)
MHV-25: 15 Nm (11.1 lb.ft)
MHV-32: 20 Nm (14.8 lb.ft)

## ORDERING CODE

(For composing a valve block use a copy of the order form, page 31)

### Inlet plate: MUV OR MDM



Model Number: MUV 16 K S 3 S / X

**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**
K = Sandwich

**Series**
S = max. operating pressure 350 bar

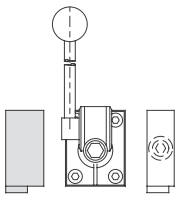
**Δp Compensator**
3 = 3 bar version (43 psi)
6 = 6 bar version (86 psi)
8 = 8 bar version (114 psi)
12 = 12 bar version (172 psi) *
V = 3-12 bar (43-172 psi) adjustable, page 14, fig. 20.

**Options**
P = Plugged MDM-spool
Q = Orifice in MDM-spool
R = Allows serial connection with 2nd MUV (only for MUV)
Viton = With Viton seals 70 Shore
X = Remote control connection
SAE = S.A.E. straight thread 'O'RING BOSS
... = Factory setting of operating pressure: 350 bar (5000 psi) Indicate here other desired operating pressure in bar.

**Maximum pressure adjustment**
S = With screw (standard)
H = With handwheel (Ø30 mm, Ø1.18 inch) for manual adjustment
E2 = Electrical remote control up to 350 bar (5000 psi)
W = Without pressure adjustment

* Due to loss of pressure, c.q. energy conversion into heat, we recommend the next largest series.

### Inlet plate: AN (instead MUV or MDM)



Model Number: AN 16 K / - / Δp = 3 bar

**Compensator type**
AN = Inlet Plate, no compensator (standard an X port for LS signal)

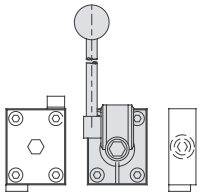
**Size**
12 = for size 12
16 = for size 16
20 = for size 20
25 = for size 25
32 = for size 32

**Mounting type**
K = Sandwich

**Options**
- = no option
SAE = S.A.E. straight thread 'O'RING BOSS

**Pressure drop for max. flow**
Δp = Give Δp, in bars, of the main compensator or standby pressure of the LS-pump

## CONTROL VALVE (MHV)



Model Number **MHV 16 K S F W A 50/100 / H**

**Series**
MHV = Directional control valve, Lever-controlled

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

**Mounting type**
K = Sandwich

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

**Position lock, see also page 14**
F = Spring return (standard)
B = Friction brake with center position
O = No spring return to center position
R = Detent
V = Stronger spring to center position.

**Neutral lever position**
H =
S =
R = See page 19
W =

**Spool type**
A, B, C, D, E, F, G, K, M, 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)

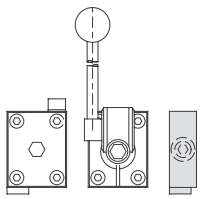
In case of different flow ranges for ports A + B, the range for port A is given first, followed by the range for B, eg. 50/100.

**Options , see also page 13 and 14**
A = With switch contact IP65
G = With cast iron handle mech.and spring cap.
H = With stroke limitation
SW = Resistant to sea water
U = Without lever
Viton = With Viton Seals 70 Shore
Y = Remote control connection
SAE = S.A.E. straight thread 'O'RING BOSS

## ORDERING CODE

### END PLATE

Model Number **AP 16 K / 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**
K = Sandwich

**Options**
T1 = With additional tank port (in combination with MDM standard)
Viton = With Viton seals 70° Shore
Z = Remote control
SAE = S.A.E. straight thread 'O'RING BOSS

## ORDERING EXAMPLE

Example for ordering:
- Manual control valve block with inlet plate nominal bore 12, max. operating pressure 350 bar.

1. AN : Inletplate, Δp compensator 3 bar.
2. MHV : 4/3 -way valve for manual operation, spooltype "A", volume flow range 30 l/min. at connections A + B, 3 switched positions, with spring return into the neutral position, lever pos. W., with stroke limitation.
3. MHV : like 2.
4. MHV : 4/3-way valve for manual operation spooltype "C", volume flow range at connection A = 20 l/min, connection B = 40 l/min, with 3 positions detent lever pos. W.
5. AP : Endplate AP standard

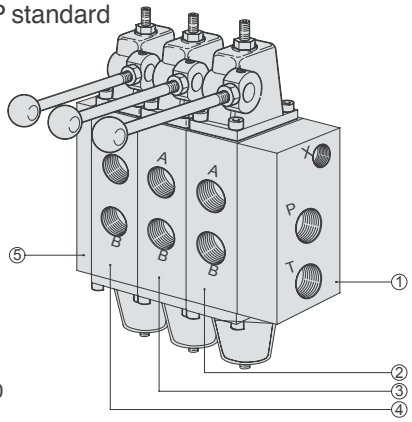



**Fig. 32**

1 = AN-12-K / Δp= 3 bar
2 = MHV-12-KSFWA-30/30
3 = MHV-12-KSFWA-30/30
4 = MHV-12-KSRWC-20/40
5 = AP-12-K

Example for ordering:
- By-pass (3-way) pressure relief valve (MUV) with 6 bar (86 psi) Δp compensator, max. operating pressure 250 bar (5000 psi).
- End plate with auxiliary 'Z' port 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).

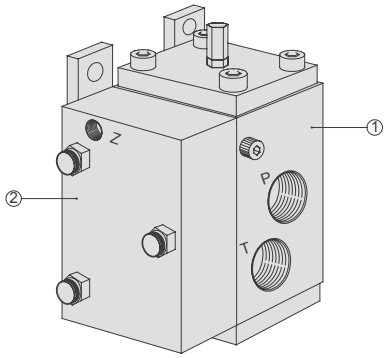



**Fig. 33**

1 = MUV-25KS6S >
2 = AP-25K/Z >

HPV Hydraulic Proportional Valves

# HPV b.v.

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The Netherlands

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**E:** sales@hpv-nl.com