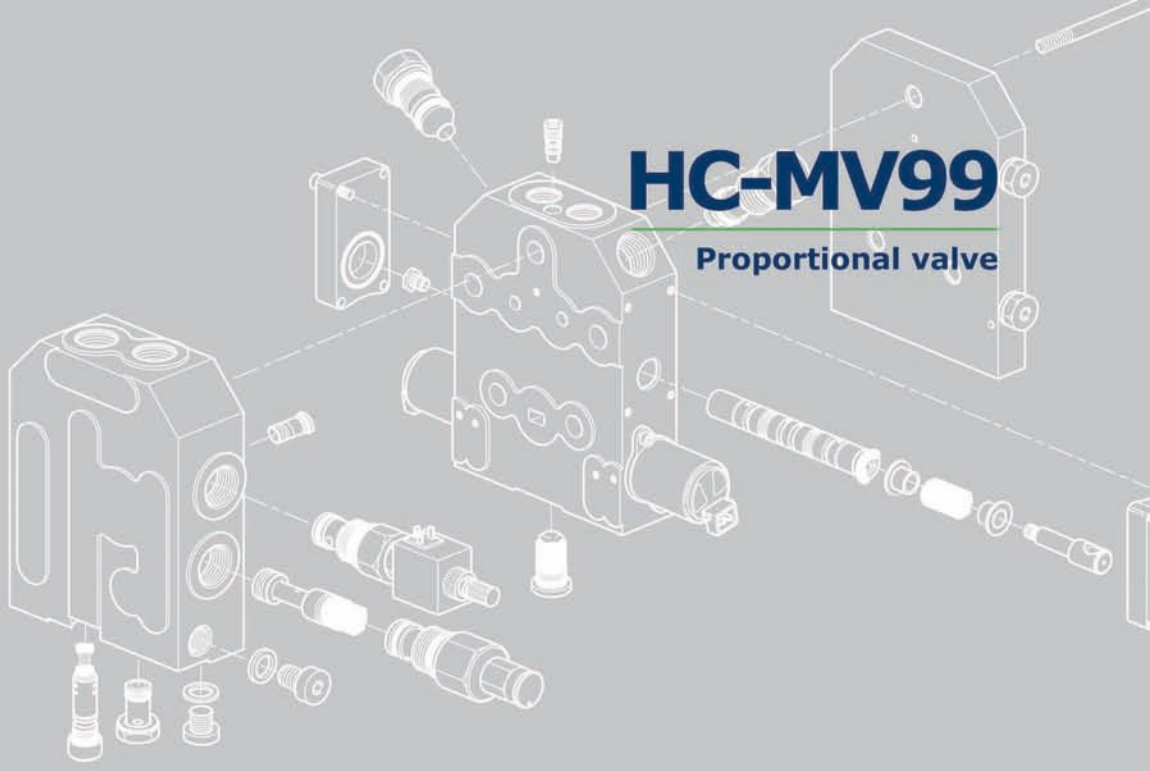
# HC-MV99

## Proportional valve



hydro control

A global partner for innovative solutions

**HC-MV99**

The proportional valve HC-MV99 has specifically been studied to equip lifting machinery; the Load Sensing system and the proportional electrohydraulic actuation allows for sensitive and accurate movement control.
Besides the inlet compensated version, now the fully compensated system is available: this resolves the difficulty of simultaneous movements, even with different loads on the ports.
Several different configurations give a solution to every application needs.

## QUICK REFERENCE GUIDE

| GENERAL SPECIFICATIONS | MV99 |
|---|---|
| working section number | 1 - 10 |
| **CIRCUIT** | |
| stroke (mm) | 7 + 7 |
| spool pitch | 43 |
| dead band (mm) | 1,5 + 1,5 |
| **RATED FLOW** | |
| Flow rate ports P and T | 130 l/min - 34 GPM |
| Flow rate ports A and B | 100 l/min - 26 GPM |
| **RATED PRESSURE** | |
| max recommended pressure port P | 420 bar - 6000 PSI |
| max recommended pressure ports A and B | 420 bar - 6000 PSI |
| max recommended pressure port T | 20 bar - 290 PSI |

| OPTION CHART | MV99 | |
|---|---|---|
| direct acting pressure relief valve on L.S. signal | • | |
| direct acting pressure relief valve on full flow | • | |
| electric operated dump valve (12 Vdc) | • | |
| electric operated dump valve (24 Vdc) | • | |
| **SPOOL ACTUATION** | | |
| lever actuation | • | |
| hydraulic actuation | • | |
| proportionlal electrohydraulic actuation | • | |
| **Manual actuation specifications - actuation force on the spool** | | |
| only lever actuation (daN) | 9,8 - 13,7 | |
| lever + hydraulic actuation (daN) | 12,5 - 37,4 | |
| lever + electrohydraulic actuation (daN) | 12,5 - 37,4 | |
| lever displacement | + 21° / - 21° | |
| **Hydraulic actuation specifications** | | |
| regulating pressure (bar) | 5 -15 | |
| max pressure on pilot line (bar) | 40 | |
| max pressure on pilot tank line (bar) | 3 | |
| **Proportional electrohydraulic actuation specifications** | | |
| Feeding reducing pressure (bar) | 30 | |
| Supply voltage (Vdc) | 12 | 24 |
| Coil resistance (Ω) | 5,3 | 21,2 |
| ON-OFF control current (mA) | 2200 | 1100 |
| Proportional control current (mA) | 500 - 1100 | 250 - 550 |
| PWM frequency suggested (Hz) | 70 - 90 | |
| Connector | AMP Junior Power Timer | |
| **SPOOL RETURN ACTION** | | |
| Return spring | • | |
| Hydraulic load limit | • | |
| Electrical load limit | • | |
| **AUXILIARY VALVE** | | |
| Antishock valve | • | |
| Anticavitation valve | • | |
| Pilot operated Antishock and anticavitation valve | • | |

## GENERAL INDEX

## GENERAL SPECIFICATION

### Standard working conditions

| | |
|---|---|
| Ambient operating temperature range | -40°C / +60°C |
| Kinematic viscosity range | 10 ÷ 300 cSt |
| Max contamination level | 9 (NAS 1638) - 20/18/15 (ISO 4406:1999) |
| Recommended filtration level | β10 > 75 (ISO 16889:2008) |
| Internal filter (on electroproportional valves pilot line) | 30 μm |

All information and diagrams in this catalogue refer to a mineral base oil VG46 at 50°C temperature (32 cSt kinematic viscosity)

### Fluid options

| Types of fluid (according to IS0 6743/4) Oil and Solutions | Temperature (°C) | | Compatible gasket |
|---|---|---|---|
| | min | max | |
| Mineral Oil HL, HM (or HLP acc. to DIN 51524) | -25 | +80 | NBR |
| Oil in water emulsions HFA | +5 | +55 | NBR |
| Water in oil emulsions HFB | +5 | +55 | NBR |
| Polyglycol-based aqueous solution HFC | -10 | +60 | NBR |

For special applications and different fluids, please call our Technical Department.

### Applications

HC-MV99 is Load Sensing control valve with electro-proportional actuation. The Load Sensing system maintains the ΔP constant through spool control notches by means of the pressure compensation principle: flow rate delivery and consequently control is entirely free from any variation in the handled load. In addition to the evident advantages of regulation, the system permits significant energy saving.

HC-MV99 can be adapted for fixed or variable pump systems.
The valve can be delivered with manual, hydraulic remote, electrohydraulic ON-OFF or proportional controls.
All components for electrohydraulic control (pressure reducing valve, filter, piloting system) are internal for a simple and reliable design.

Following options are available:
- intermediate inlet section for variable pump up to 200 l/min;
- special inlet section for variable pump with security system “P closed”;
- simplified version for manual actuation and cloche control.

## ORDER EXAMPLE

**HC-MV99/1: MR 005 150 KV G05 - W001C AACC H404 F001 RD1 G04 05 PA 05 PB - KZ3**

**TYPE:**
**MV99** product type
**/1** working section number

**1) INLET ARRANGEMENT:**

| | | |
|---|---|---|
| **1.1** | **MR 005** | inlet side and valve type |
| | **(150)** | setting (bar) |
| | **KV G05** | inlet position and available thread type |

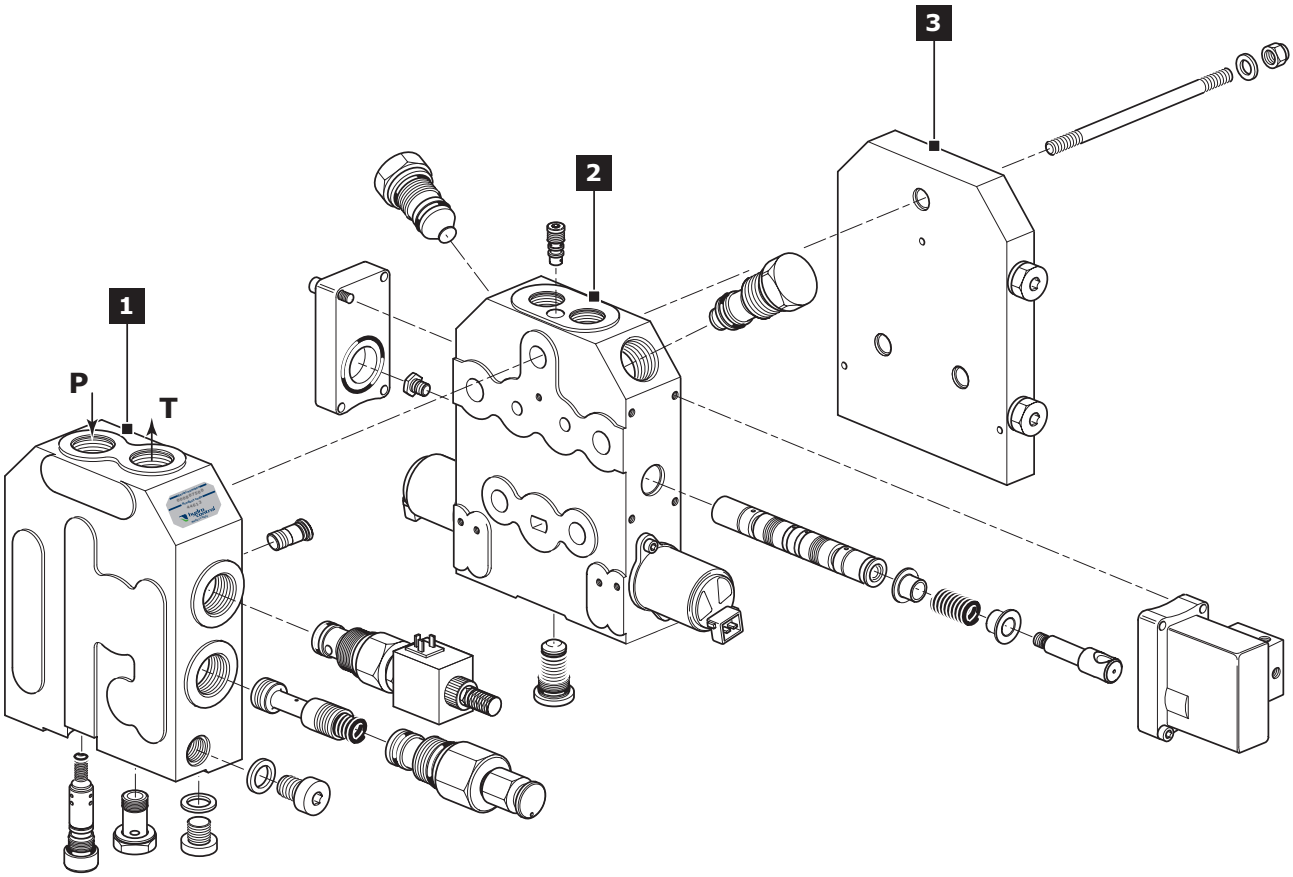
**2) WORK SECTION ARRANGEMENT:**

| | | |
|---|---|---|
| **2.1** | **W001C AACC** | type and spool delivery |
| **2.2** | **H404** | spool actuation type |
| **2.3** | **F001** | spool return action type |
| **2.4** | **RD1 G04** | section type and port threads |
| **2.5** | **05 PA** | auxiliary valve (port A) |
| **2.6** | **05 PB** | auxiliary valve (port B) |

**3) OUTLET ARRANGEMENT (END PLATE):**

| | | |
|---|---|---|
| **3.1** | **KZ3** | plate type |

Ordering row 2 must be repeated for every work section

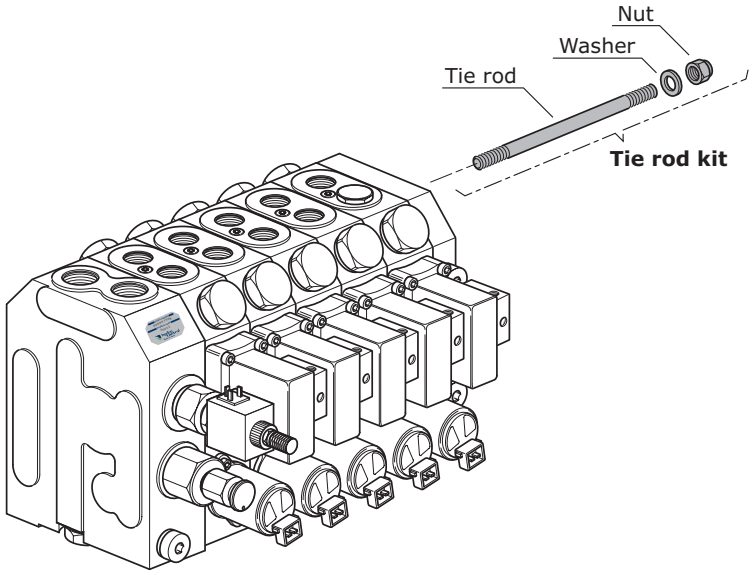



## Features

HC-MV99 valve is assembled through 3 tie rod kits; every kit includes bolt and washer (see Appendix "A" page 6).
Lever kits are not included in the valve controls: they must be ordered separately (see Appendix "B" page 6).
On request, HC-MV99 valve can be delivered painted (RAL 9005 black primer).

## Tie-rod kit classification (appendix "A")

Tie rod kit allows the correct assembly of sectional valves. Tie rod's length depends on the number of sections; each HC-MV99 valve is assembled with 3 tie rod kits including a tie rod, a nut and a washer.



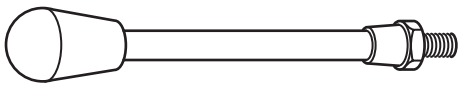

| tie rod lenght | /1 | /2 | /3 | /4 | /5 | /6 | /7 | /8 | /9 | /10 |
|---|---|---|---|---|---|---|---|---|---|---|
| (mm) | 86 | 129 | 172 | 215 | 258 | 301 | 344 | 387 | 430 | 473 |
| Tie rod clamping torque | **40 Nm** | | | | | | | | | |

## Lever kit identification (appendix "B")

Hydrocontrol can supply a lever kit to be assembled on the valve's manual controls; different lengths and threads are available. Lever kits must be ordered separately.

**ZA** = Lever with knob

| type | description | code |
|---|---|---|
| **ZA - M8 - 135** | Lever with knob (135 mm) | 430503001 |
| **ZA - M8 - 210** | Lever with knob (210 mm) | 430503002 |

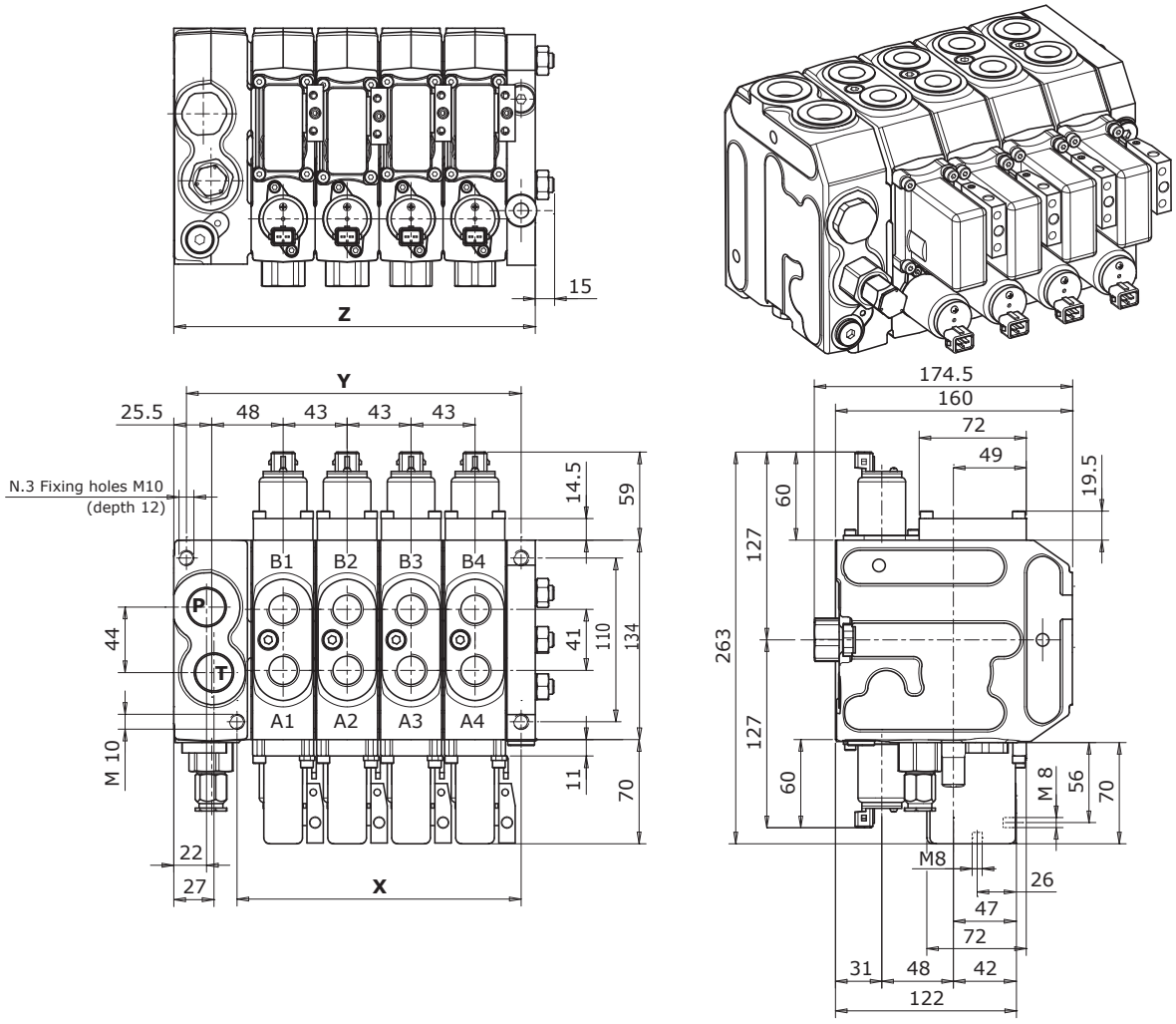


## Order example

**ZA - M8 - 210**

- Lever lenght (mm)
- Lever thread
- Lever type

## DIMENSIONS




| type | /1 | /2 | /3 | /4 | /5 | /6 | /7 | /8 | /9 | /10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **X (mm)** | 62 | 105 | 148 | 191 | 234 | 277 | 320 | 363 | 406 | 449 |
| **Y (mm)** | 96 | 139 | 182 | 225 | 268 | 311 | 354 | 397 | 440 | 483 |
| **Z (mm)** | 114 | 157 | 200 | 243 | 286 | 329 | 372 | 415 | 458 | 501 |
| **Weights (kg)** | 16.5 | 23 | 29.5 | 36 | 42.5 | 49 | 55.5 | 62 | 68.5 | 75 |

## Standard thread

| ports | BSP (ISO - 228) | UN-UNF (ISO - 725) |
|---|---|---|
| **Inlet Port (P)** | G 3/4 | 1”1/16 - 12 UNF |
| **Ports (A - B)** | G 1/2 | 7/8” - 14 UNF |
| **Outlet (T) - Carry over (HPCO)** | G 3/4 | 1”1/16 - 12 UNF |

## Thread codes

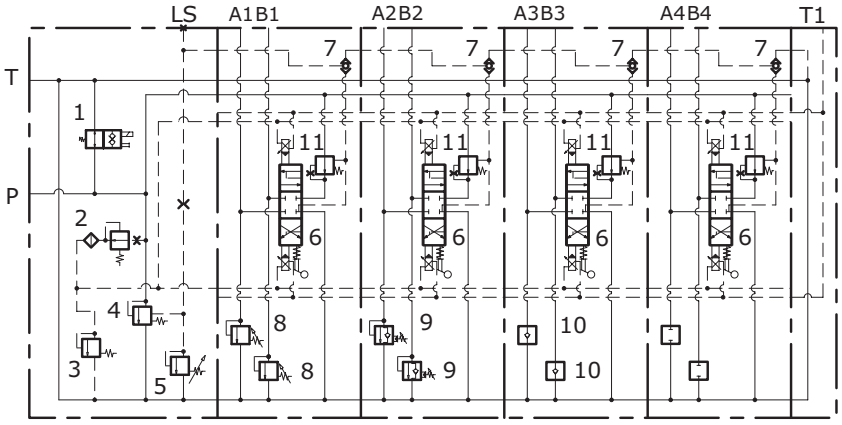
The connection ports size is indicated by an ordering code common for all Hydrocontrol products. Following table shows all available connections.

| BSP thread (ISO 228-1 / ISO 1179-1) | | |
|---|---|---|
| **Type** | G 1/2 | G 3/4 |
| **Code** | **G04** | **G05** |

| UN / UNF thread (ISO 725 / ISO 11926-1) | | |
|---|---|---|
| **Type** | 7/8” - 12 UNF | 1”5/16 - 12 UNF |
| **Code** | **U04** | **U05** |

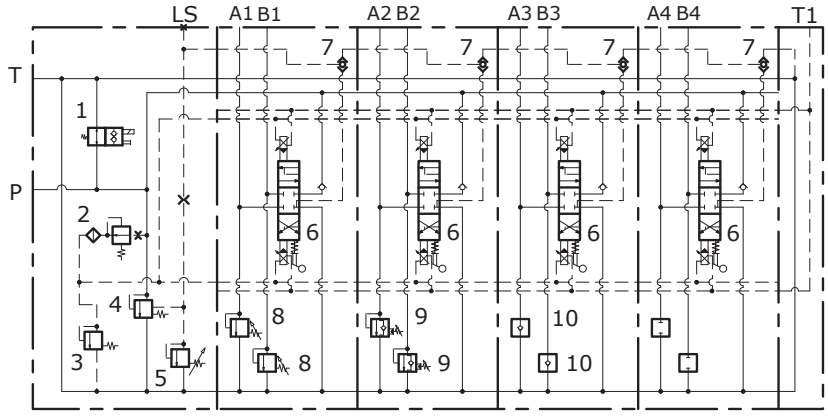
## HYDRAULIC SCHEMA

### Compensated on work section valve




1. Electric operated dump valve
2. Pressure reducing valve with internal filter for electrohydraulic actuation
3. Relief valve for electrohydraulic actuation
4. Inlet pressure compensator
5. Main relief valve
6. Manual and electrohydraulic operated spool
7. L.S. selection valve
8. Antichock auxiliary valve
9. Pilot combined auxiliary valve
10. Anticavitation auxiliary valve
11. Work section pressure compensator

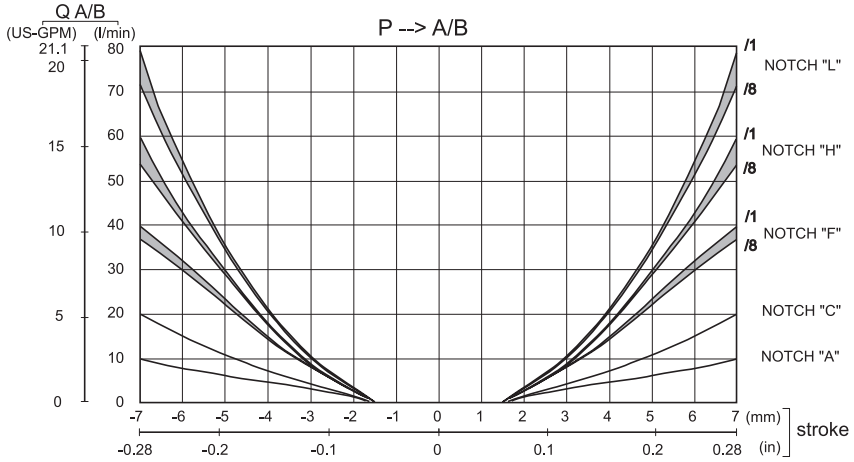
### Compensated on inlet section valve



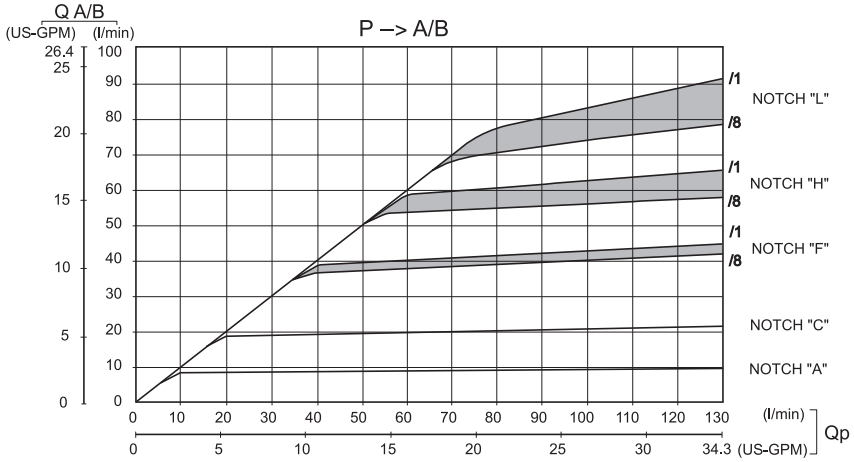

1. Electric operated dump valve
2. Pressure reducing valve with internal filter for electrohydraulic actuation
3. Relief valve for electrohydraulic actuation
4. Inlet pressure compensator
5. Main relief valve
6. Manual and electrohydraulic operated spool
7. L.S. selection valve
8. Antichock auxiliary valve
9. Pilot combined auxiliary valve
10. Anticavitation auxiliary valve

## TYPICAL CURVES

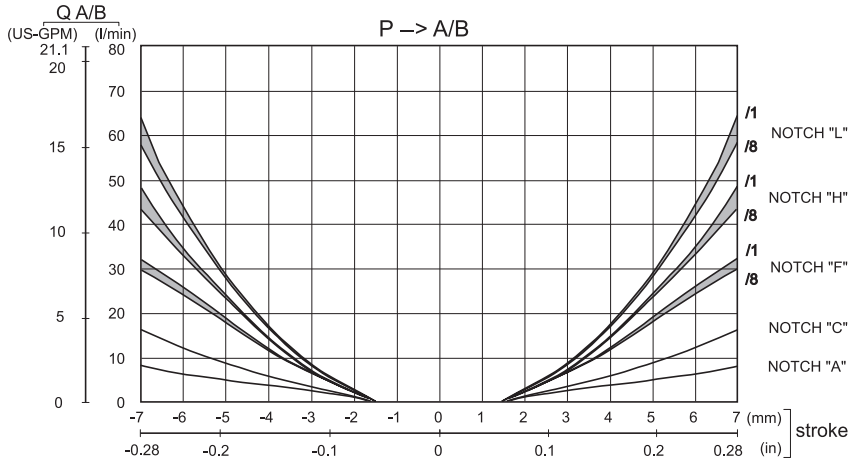
**Compensated on inlet section valve**
Flow on ports A and B (Q A/B) as function of spool stroke - Inlet flow Qp = 100 l/min




**Compensated on inlet section valve**
Flow on ports A and B (Q A/B) as function of inlet flow (Qp)



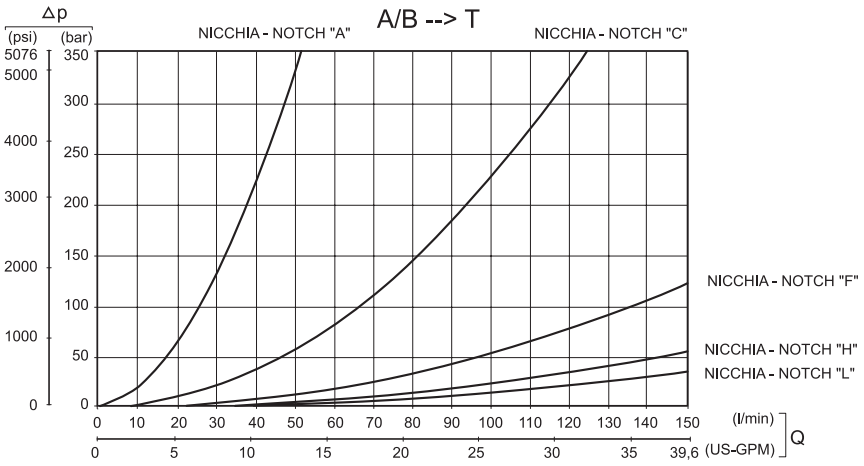

**Compensated on work section valve**
Flow on ports A and B (Q A/B) as function of spool stroke - Inlet flow Qp = 100 l/min



## TYPICAL CURVES

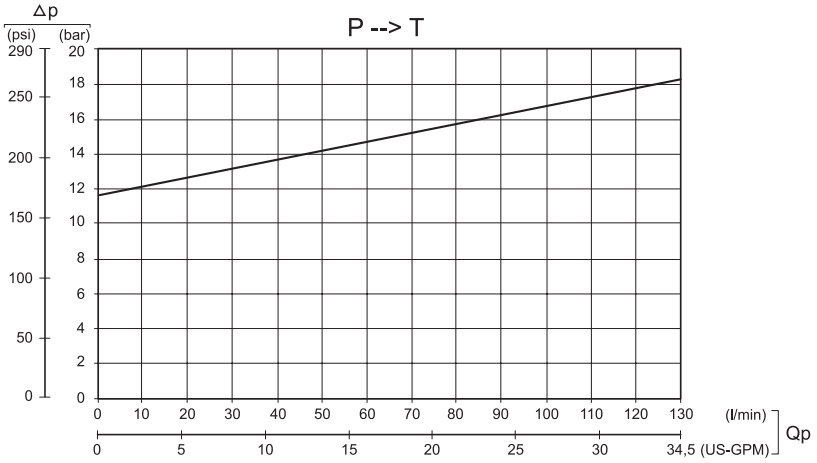
**Pressure drop**

Pressure drop (A/B in T) as function of spool. Spool at end of stroke



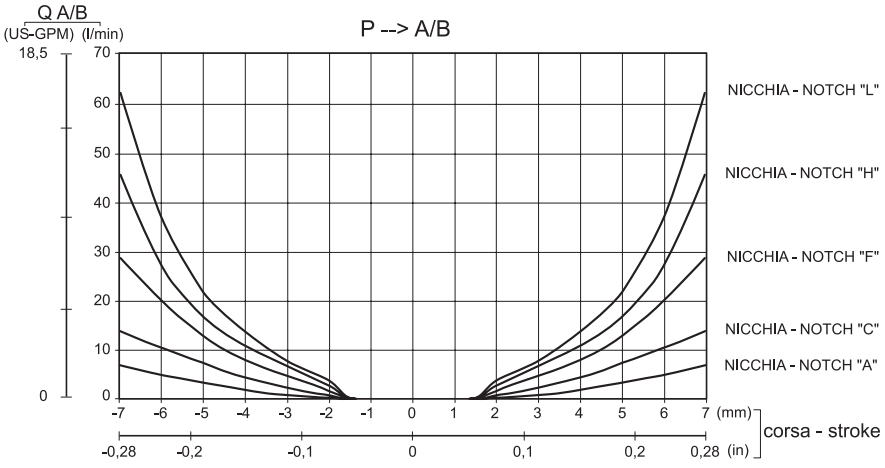

**Inlet section pressure compensator**

Pressure drop as function of inlet flow for open centre circuit



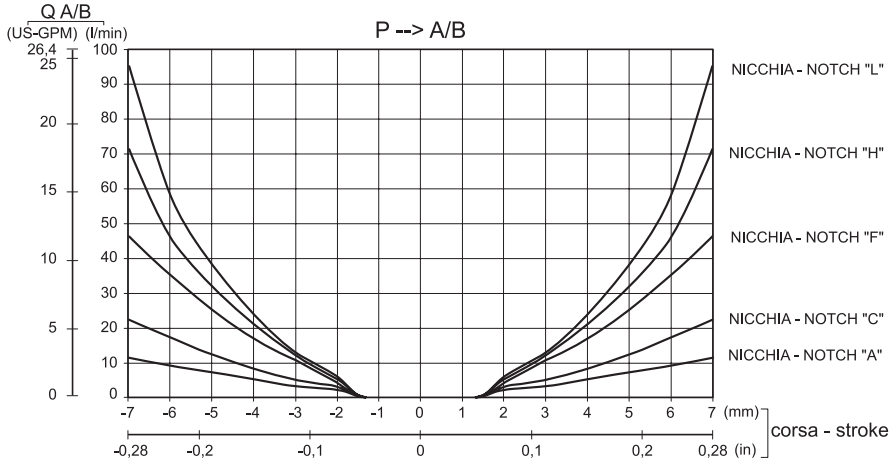

**Compensated on inlet section valve**

Flow on ports A and B (Q A/B) as function of spool stroke. Closed centre circuit with 10 bar set on variable pump.

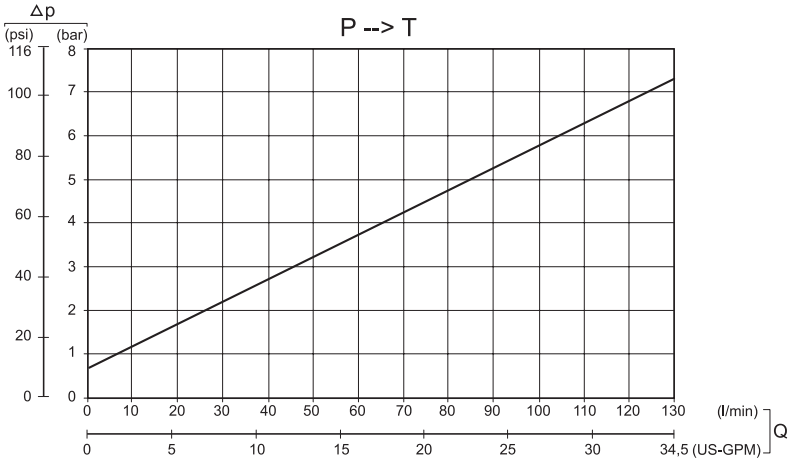


## TYPICAL CURVES

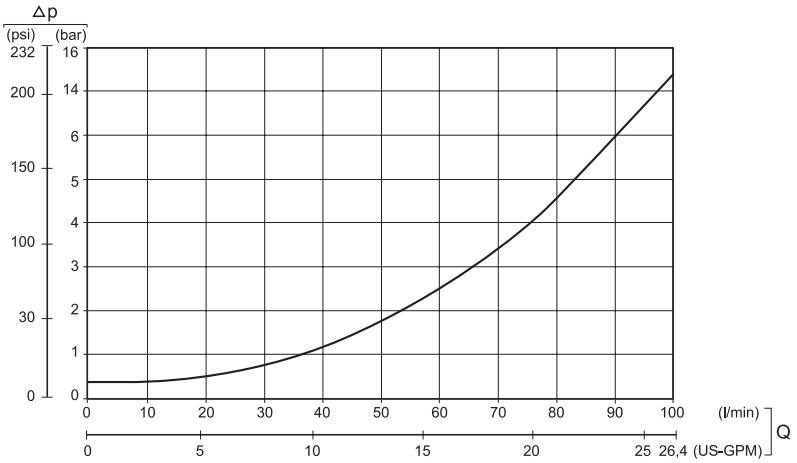
**Compensated on inlet section valve**
Flow on ports A and B (Q A/B) as function of spool stroke. Closed centre circuit with 20 bar set on variable pump.




**Electric dump valve**
Pressure drop through open electric dump valve.



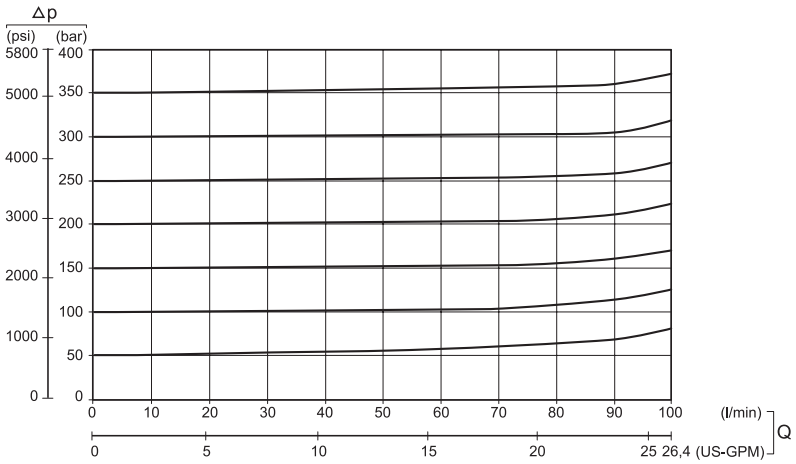

**Anticavitation valve**
Opening and pressure drop characteristic.



## TYPICAL CURVES

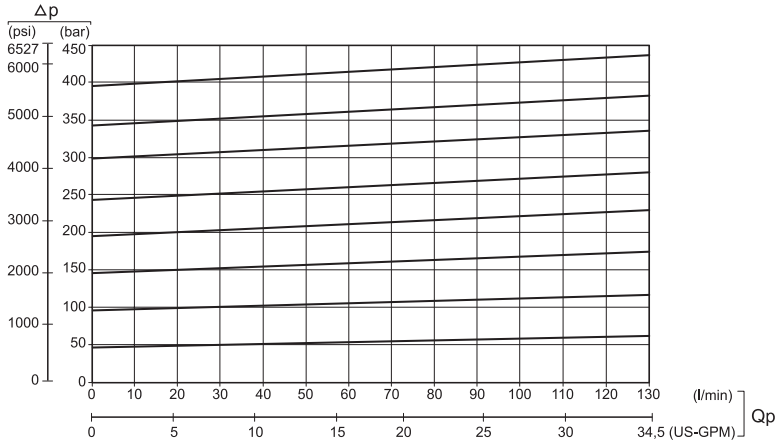
**Antishock valve**

Antishock auxiliary valve characteristic: setting at 15 l/min




**Main relief valve on LS signal**

Main relief valve on LS signal characteristic: setting at 15 l/min



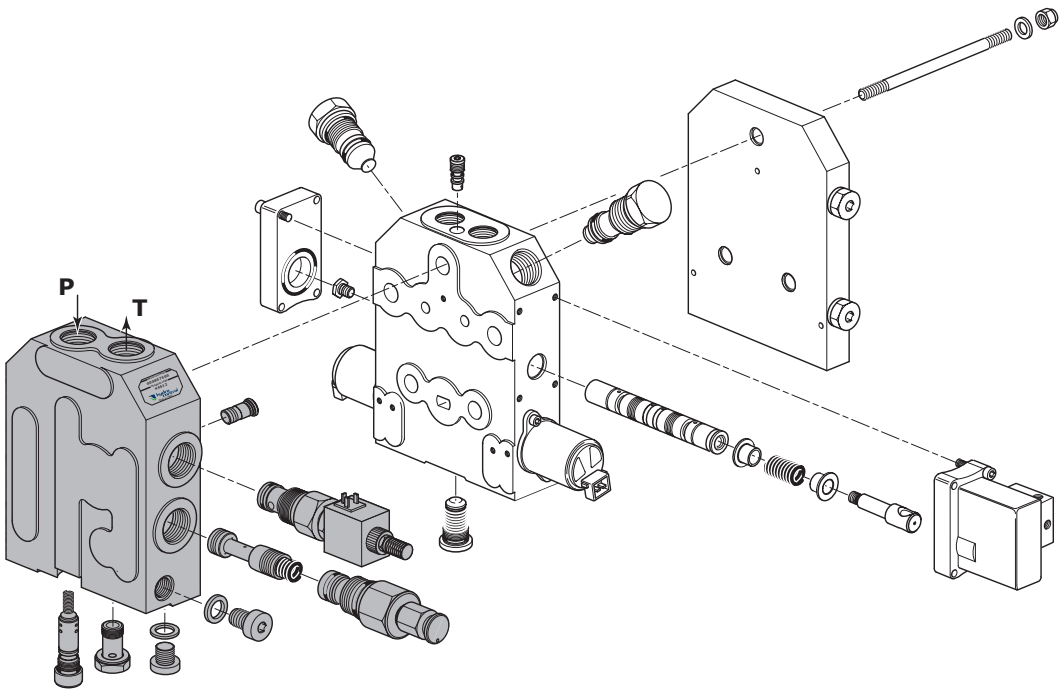
## INLET SECTION

The inlet module includes the valve feed port Pand tank port T in addition to an outlet for LS signal. It can be variously equipped with a 12 or 24 VDC electric operated dump valve, a main pressure relief valve, a pressure reducing valve to feed the proportional electro-hydraulic control (equipped with a 30 μm filter) and a pressure relief valve. The open center version for combination with fixed displacement pumps or the closed center version for variable displacement pumps are both available. In the first circumstance, the spool functions as a general pressure compensator for the Load Sensing system, whereas in the closed center version, it acts as a main stage for the main pressure relief valve.

### Order example

**MR 005 150 KV G05**

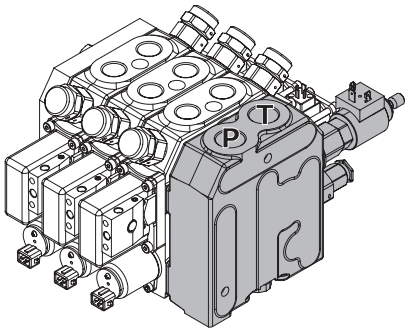
| | | |
|---|---|---|
| **1.** | **MR** | inlet side |
| **2.** | **005** | valve arrangement |
| | **150** | setting (bar); when ordering a main relief valve it is necessary to specify setting |
| **3.** | **KV G05** | inlet position and available thread type |

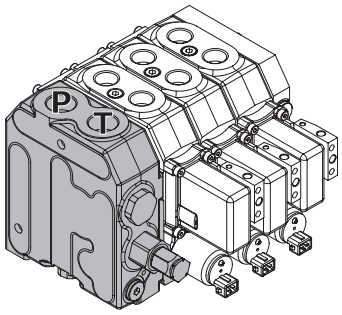



| | | |
|---|---|---|
| **1.** | **INLET SIDE CLASSIFICATION:** | **pg. 14** |
| **MR** | Proportional valve with right inlet section | |
| **ML** | Proportional valve with left inlet section | |
| **2.** | **VALVE ARRANGEMENT: (standard combinations)** | **pg. 15** |
| **001** | Inlet section with Direct acting pressure relief valve on LS signal | |
| **004** | Inlet section with Direct acting pressure relief valve on LS signal and Solenoid dump valve 12 Vdc | |
| **005** | Inlet section with Direct acting pressure relief valve on LS signal and Solenoid dump valve 24 Vdc | |
| **019** | Inlet section without valves | |
| **3.** | **INLET CLASSIFICATION:** | **pg. 16** |
| **KV G05** | Open centre inlet section for fixed displacement pumps (thread G 3/4) | |
| **KV U05** | Open centre inlet section for fixed displacement pumps (thread 1”1/16-12 UN) | |
| **JV G05** | Closed centre inlet section for variable displacement pumps (thread G 3/4) | |
| **JV U05** | Closed centre inlet section for variable displacement pumps (thread 1”1/16-12 UN) | |
| **HV G05** | Open centre inlet section for fixed displacement pumps with carry-over HPCO (thread G 3/4) | |
| **HV U05** | Open centre inlet section for fixed displacement pumps with carry-over HPCO (thread 1”1/16-12 UN) | |

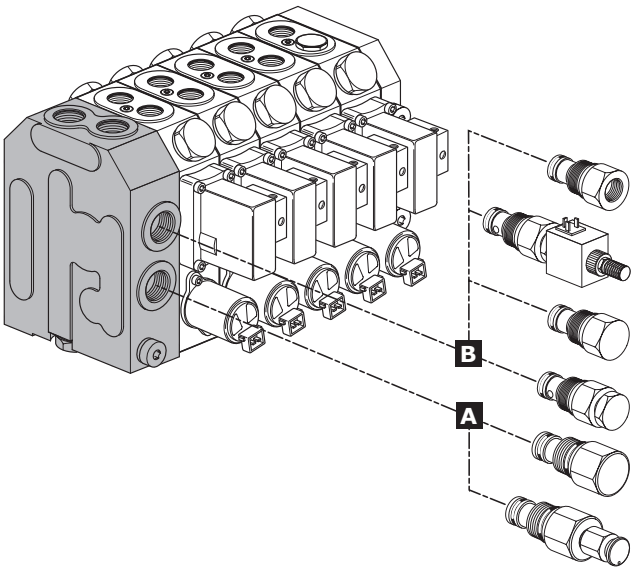
## Inlet side classifications

| MR | Proportional valve with right inlet section | ML | Proportional valve with left inlet section |
|---|---|---|---|




## Valve identification




**11** Plug with pressure-gauge connection

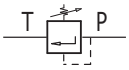
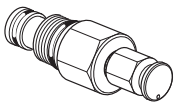
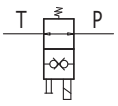
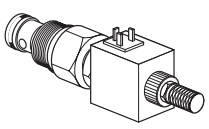
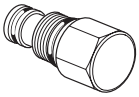
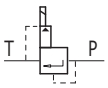
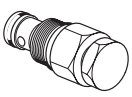
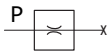
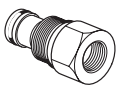
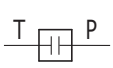
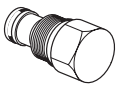
**8** Electric operated dump valve (24 vdc)
**7** Electric operated dump valve (12 vdc)

**4** Relief valve plugged on full flow

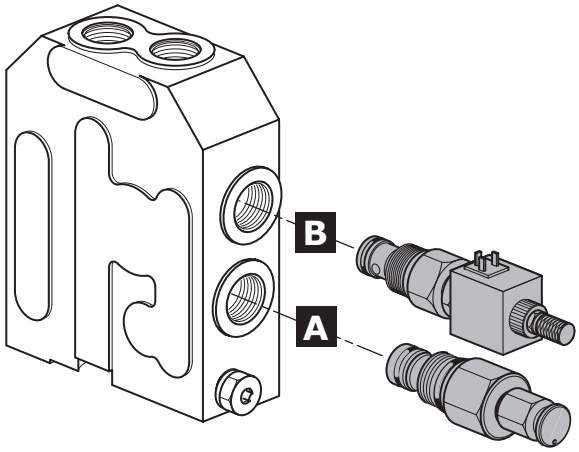
**3** Pilot operated pressure relief valve on full flow

**2** Relief valve plugged on LS signal

**1** Direct acting pressure relief valve on LS signal

| type | schema | layout | description | type | schema | layout | description |
|---|---|---|---|---|---|---|---|
| 1 |  |  | Direct acting pressure relief valve on LS signal | 7 |  |  | Electric operated dump valve (12 vdc) |
| 2 |  |  | Relief valve plugged on LS signal | 8 | | | Electric operated dump valve (24 vdc) |
| 3 |  |  | Pilot operated pressure relief valve on full flow | 11 |  |  | Plug with pressure-gauge connection |
| 4 |  |  | Relief valve plugged on full flow | | | | |

## Valve arrangement



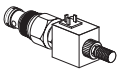
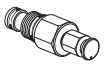

**Combination valve example: 005 = 1A - 8B**

**005** Combination valve
**1A** Relief valve in port A
**8B** Solenoid dump valve in port B

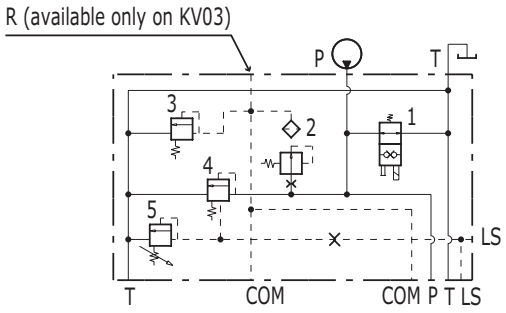
**The code identifies:**
with a number, the type of valve; with a letter its position on the inlet section.

**NOTE:** when ordering a main relief valve it is necessary to specify setting.

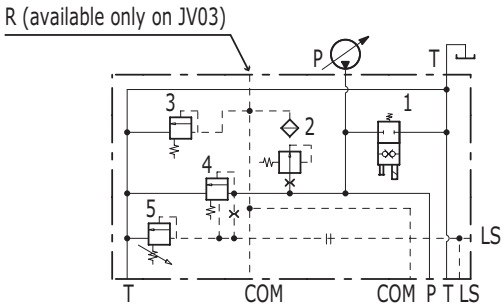
**SETTING RANGE DIRECT ACTING RELIEF VALVE:**
A - 50/200 bar
B - 205/420 bar

| Available combinations on inlet section | | | Valve type on port B | | | | |
|---|---|---|---|---|---|---|---|
| | | |  |  |  |  | |
| | | | 3 | 4 | 7 | 8 | 11 |
| Valve type on port A |  | 1 | | 001 | 004 | 005 | 008 |
| |  | 2 | 018 | 019 | 023 | 024 | 027 |

## Inlet classification

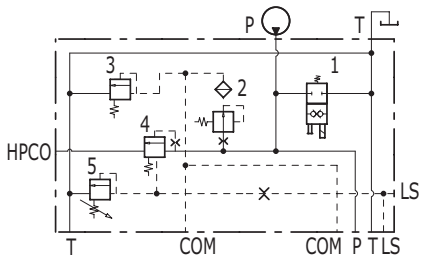
| Inlet combination and thread available | | |
|---|---|---|
| **KV G05**<br>**KV U05**<br>**KV03 G05** |  | **Open centre inlet section**<br>for fixed displacement pumps |

The inlet section with KV configuration enables control valveusage with fixed displacement pumps. When fully equipped, a 12 or 24 VDC electric operated dump valve (1) is used to act on full inlet flow rate and serves as a safety device. Load Sensing flow rate control is achieved by the pressure compensator (4), which keeps a pressure drop constant through the spool control notches by comparing the LS signal and feed pressure. In its standard version, the main relief valve (5) acts on the LS signal. The pressure reducing valve (2), equipped with a 30 µm filter and a relief valve (3), feeds the proportional electro-hydraulic section controls.

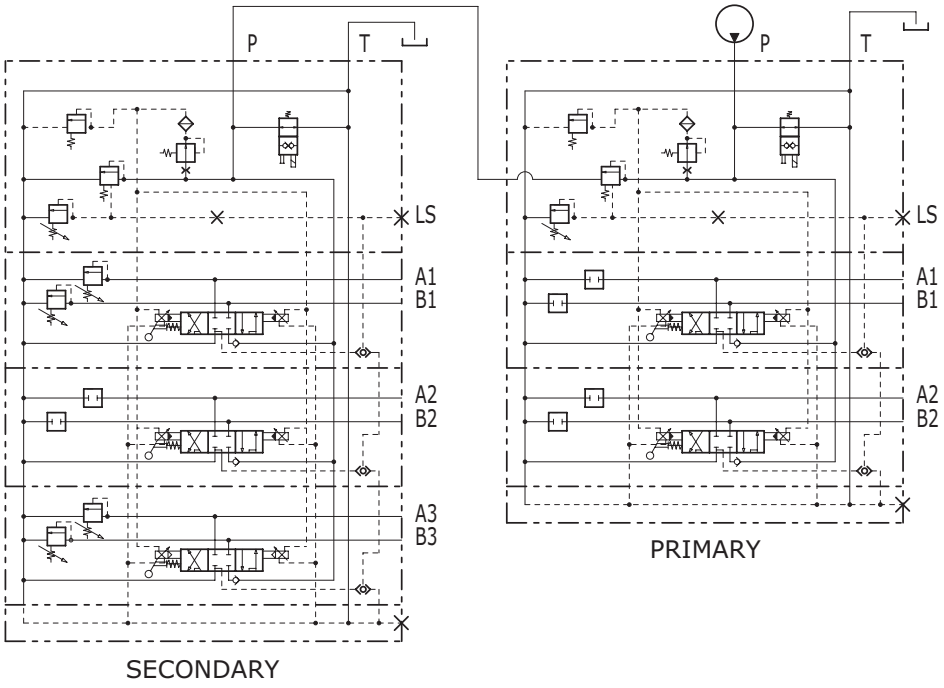
| | | |
|---|---|---|
| **JV G05**<br>**JV U05**<br>**JV03 G05** |  | **Closed centre inlet section**<br>for variable displacement pumps |

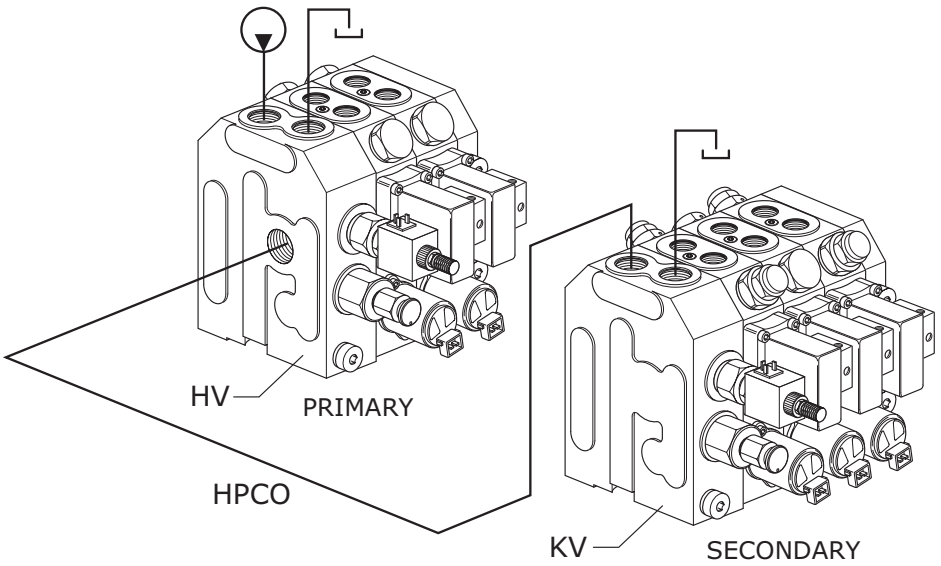
The inlet section with JV configuration enables control valve usage with variable displacement pumps. The piloting signal of the pump displacement controller can be drawn from the LS outlet. The 12 or 24 VDC electric operated dump valve (1) acts on full flow rate and serves as a safety device. In this case, the main relief valve (5) acts on a piloting line and serves as a pilot stage for the main stage (4), disposing of the entire flow rate. The pressure reducing valve (2) ensures thatthe relative 30 µm filter and the relief valve feed the sections proportional electro-hydraulic controls.

**NOTE: transformation of the inlet section from closed center to open center and vice versa is possible by ordering the appropriate kit 320055005 or 320055021 (see page 32)**

| Sample of carry-over special circuit (HV type) | | |
|---|---|---|
| **HV G05**<br>**HV U05** |  | **Open centre inlet section with carry over HPCO**<br>for fixed displacement pumps |

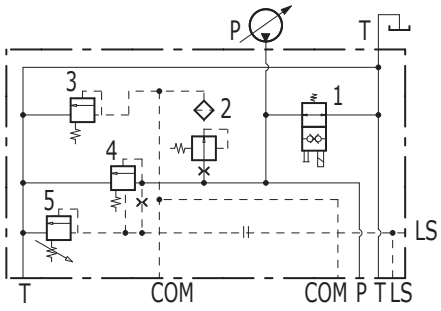
The special HV inlet module section achieving a special carry-over connection between two MV99 control valves which is extremely useful as only two connection tubes are used between the two control valves. This application is only suitable for systems with fixed displacement pumps. Flow rate goes through the first control valve, with HV inlet configurations, then proceeds from HPCO outlet to the second control valve with KV inlet configuration; the second control valve is fed by the unused flow rate of the first one. Available also for this version are: the 12 or 24 VDC electric operated dump valve (1), the main relief valve (5) and the pressure reducing valve (2) with 30 µm filter and relief valve (3).



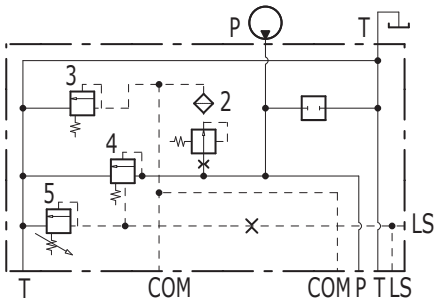



## Complete configuration samples for inlet section

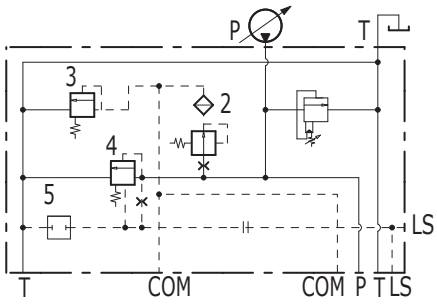
ordering code: **MR 004 (180) JV G05**

| hydraulic diagram | description |
|---|---|
|  | Right inlet section<br>Arranged with electric operated dump valve (12 VDC) and direct acting relief valve on LS signal (setting 180 BAR)<br>"JV" type for variable pump<br>3/4" BSP thread |

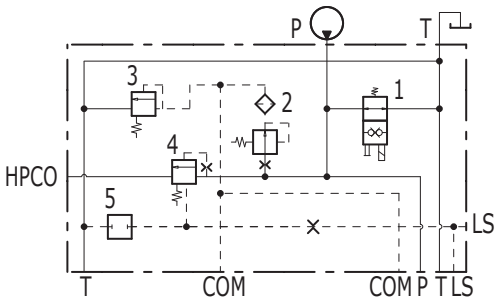
ordering code: **ML 001 (130) KV G05**

| hydraulic diagram | description |
|---|---|
|  | Left inlet section<br>Arranged with plug and direct acting relief valve LSsignal(setting 130 bar)<br>"KV" type for fixed pump<br>3/4 " BSP thread |

ordering code: **MR 018 (210) JV U05**

| hydraulic diagram | description |
|---|---|
|  | Right inlet section<br>Arranged with plug and pilot operated relief valve on full flow (setting 210 BAR)<br>"JV" type for variable pump<br>1"1/16-12 UN thread |

ordering code: **ML 023 HV G05**

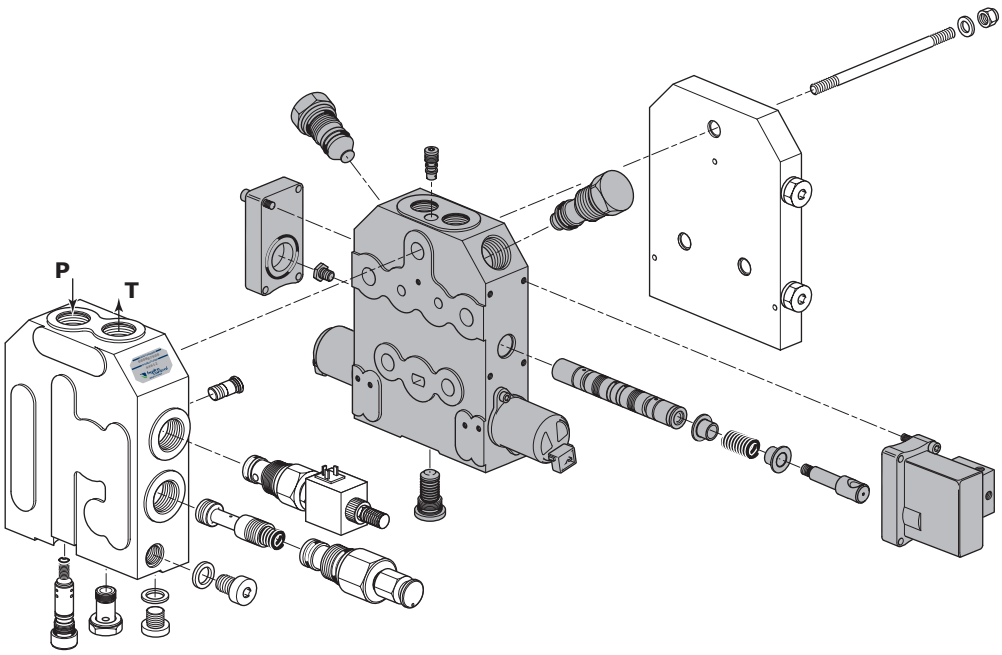
| hydraulic diagram | description |
|---|---|
|  | Left inlet section<br>Arranged with plug and electric operated dump valve 12 VDC<br>"HV" type for fixed pump and special carry-over<br>3/4" BSP thread |

## WORKING SECTION

### Order example:

**W001C AACC H404 F001 RD1 G04 05 PA 05 PB**

| | | |
|---|---|---|
| **1.** | **W001C** | spool type |
| | **AACC** | spool flow |
| **2.** | **H404** | spool actuation type |
| **3.** | **F001** | spool return action type |
| **4.** | **RD1** | section type |
| | **G04** | thread type |
| **5.** | **05 PA** | auxiliary valve (port A - handle side) |
| **6.** | **05 PB** | auxiliary valve (port B - cap side) |




**1. SPOOL IDENTIFICATION: pg. 20**

| | |
|---|---|
| **W001C** | 3 positions double-acting |
| **W002C** | 3 positions double-acting A and B to tank |
| **W005C** | 3 positions single-acting on A |
| **W006C** | 3 positions single-acting on B |
| **AACC** | Spool flow (sea page 21) |

**2. SPOOL ACTUATION CLASSIFICATION: pg. 22**

| | |
|---|---|
| **H401** | lever actuation |
| **H403** | lever + hydraulic actuation |
| **H404** | lever + electrohydraulic actuation 12 vdc |
| **H405** | lever + electrohydraulic actuation 24 vdc |

**3. SPOOL RETURN ACTION CLASSIFICATION: pg. 23**

| | |
|---|---|
| **F001** | 3 positions spring-centred spool |
| **F024** | Load limit in A and B |
| **F026** | Load limit in A |
| **F028** | Load limit in |
| **F0360** | Directional load limit kit |
| **F0470** | Hall effect linear position sensor |

**4. WORK SECTION IDENTIFICATION: pg. 25**

| | |
|---|---|
| **RD1 G04** | Not compensated section arranged for auxiliary valves (G 1/2) |
| **RD2 G04** | Not compensated section without auxiliary valve (G 1/2) |
| **RC1 G04** | Compensated section arranged for auxiliary valve (G 1/2) |
| **RC2 G04** | Compensated section without auxiliary valve (G 1/2) |
| **RD1 U04** | Not compensated section arranged for auxiliary valve (1"1/16-12 UN) |
| **RD2 U04** | Not compensated section without auxiliary valve (1"1/16-12 UN) |
| **RC1 U04** | Compensated section arranged for auxiliary valve (1"1/16-12 UN) |
| **RC2 U04** | Compensated section without auxiliary valve (1"1/16-12 UN) |

**5. AUXILIARY VALVE TYPE (PORT A): pg. 26**

| | |
|---|---|
| **01 PA** | Antishock valve on porta A |
| **02 PA** | Anticavitation valve on port A |
| **04 PA** | Pilot combined valve on port A |
| **05 PA** | Prearrangement for auxiliary valve on port A |

**6. AUXILIARY VALVE TYPE (PORT B): pg. 26**

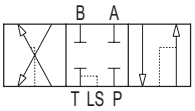
| | |
|---|---|
| **01 PB** | Antishock valve on porta B |
| **02 PB** | Anticavitation valve on port B |
| **04 PB** | Pilot combined valve on port B |
| **05 PB** | Prearrangement for auxiliary valve on port B |

**Nota:** sections designed to house auxiliary valve option require double choice on work ports A and B.
Always indicate setting value when using antishock valve and pilot combined valve: **01PA (120) - 04PA (120)**

## Spool identification

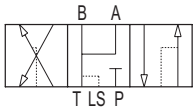
**W001C**

3 positions double-acting



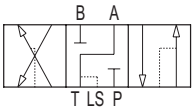

**W002C**

3 positions double-acting
A and B to tank



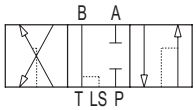

**W003C**

3 positions double-acting
A to tank B blocked



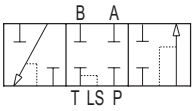

**W004C**

3 positions double-acting
A blocked B to tank



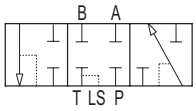

**W005C**

3 positions
single-acting on A



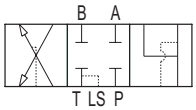

**W006C**

3 positions
single-acting on B

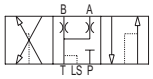
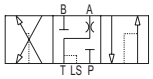
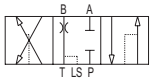



**W013C**

3 positions double-acting
regenerative




**NOTE:**
W013 spools need a special machining on the valve body.
Float spools are also available under specific application conditions: please ask for further informations.
Float spools need special detent kit (F008) and special machining on the valve body.

| spools with restricted service ports | | | | |
|---|---|---|---|---|
| **code** | **circuit** | **restriction on diameter (mm)** | **section (mm²)** | **hydraulic schema** |
| **J10** | A-B IN T | 0,10 | 2,82 |  |
| **K10** | A IN T | 0,10 | 2,82 |  |
| **Y10** | B IN T | 0,10 | 2,82 |  |

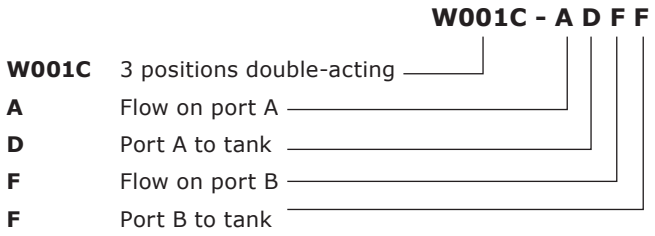
## Order example

**W001C J20**

**W001C** 3 positions double-acting
**J20** restriction on diameter (0,20 mm in A and B)

## Spool flow

Flow rates delivered to the A, B ports and the return control characteristics of the spools are identified by a four letter abbreviation as explained below:




Spools are defined as standard when delivery and return flow rates are the same for each single port (ex. AADD, AAFF, AAII).
The correct definition of delivered flow rates can be established via the following table where different notch types are indicated. Following table shows possible flows for ports A and B: flows are different depending on the type of section (compensated or not compensated): data are valid considering 100 l/min inlet flow and fixed pump configuration.

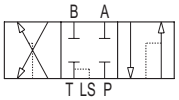
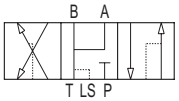
| NOTCH TYPE (l/min) | Z | A | D | F | I | N |
|---|---|---|---|---|---|---|
| **not-compensated section (RD)** | 6 | 10 | 25 | 40 | 70 | 95 |
| **compensated section (RC)** | 4 | 8 | 16 | 26 | 50 | 70 |

For complete simmetric spools (ex. AAAA, BBBB, CCCC), following flow rates are also available:

| NOTCH TYPE (l/min) | B | C | E | G | H | L | M |
|---|---|---|---|---|---|---|---|
| **not-compensated section (RD)** | 15 | 20 | 30 | 50 | 60 | 80 | 90 |
| **compensated section (RC)** | 11 | 14 | 20 | 34 | 45 | 60 | 68 |

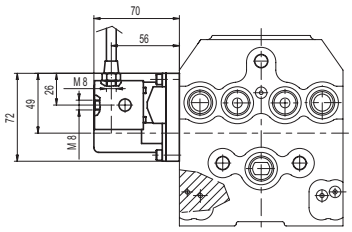
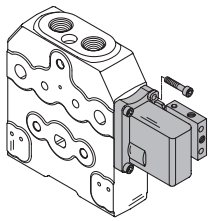
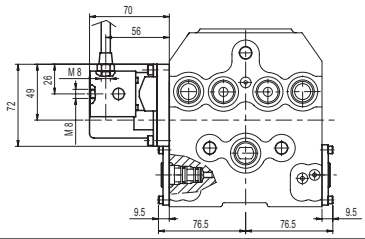
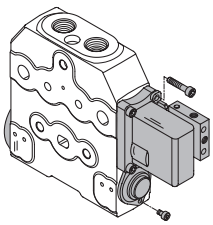
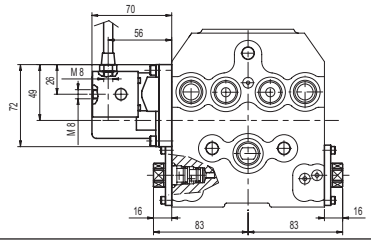
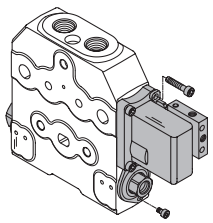
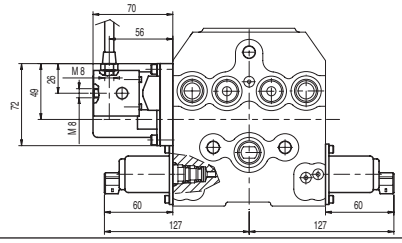
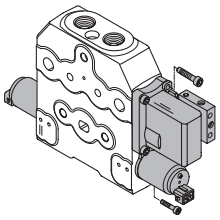
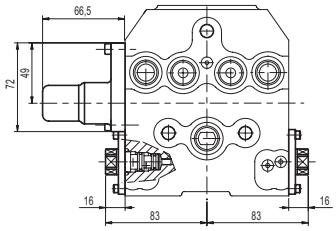
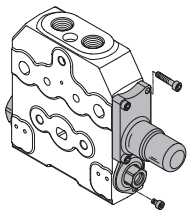
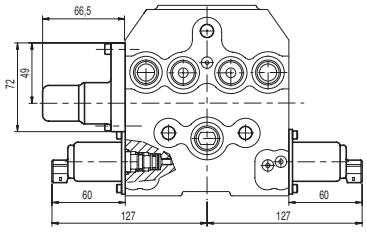
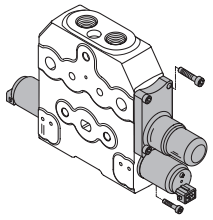
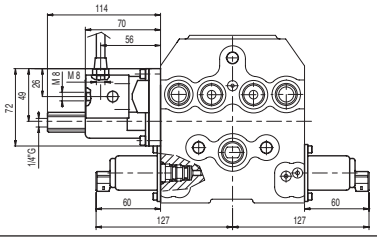
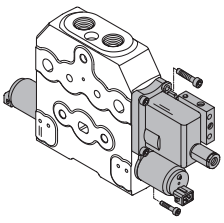
## Special spool flow

Special spools for high flow rate are also available:

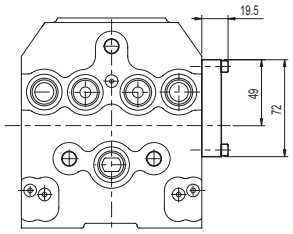
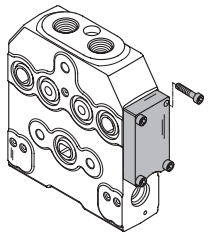
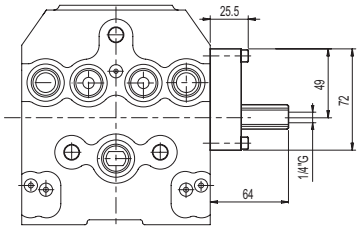
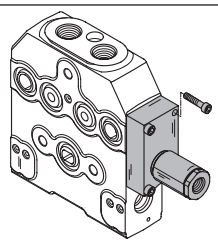
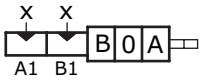
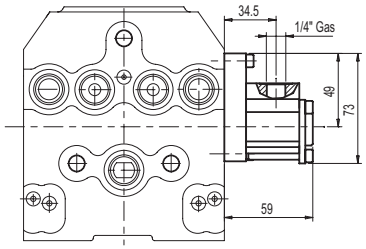
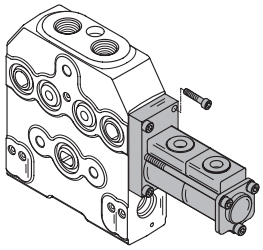
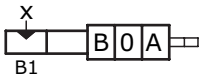
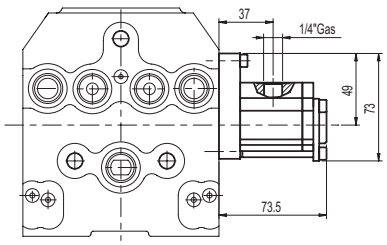
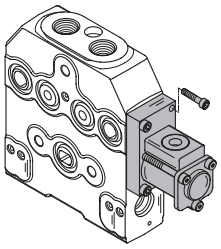
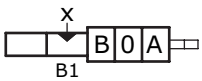
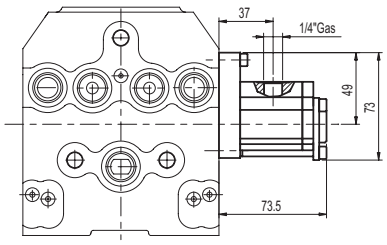
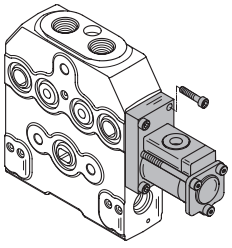
| Special spool code | Hydraulic schema | Description | RD (l/min) | RC (l/min) |
|---|---|---|---|---|
| **WSP006** |   | High flow<br>3 positions double-acting | 110 | 90 |
| **WSP013** |   | High flow<br>3 positions double-acting<br>A and B to tank | | |

On compensated sections flow rates can be additionally increased about 15% by means of special compensator kit **RC4-RC5 (see page xx).**

## Spool actuation classification

| code | description | dimensions | configuration |
|---|---|---|---|
| **H401** | Lever actuation |  |  |
| **H402** | Lever actuation arranged for electrohydraulic proportional actuation |  |  |
| **H403** | Lever actuation + hydraulic actuation |  |  |
| **H404** | Lever actuation + electrohydraulic actuation (12 vdc) |  |  |
| **H405** | Lever actuation + electrohydraulic actuation (24 vdc) | | |
| **H406** | Without lever + hydraulic actuation |  |  |
| **H407** | Without lever + electrohydraulic actuation (12 vdc) |  |  |
| **H408** | Without lever + electrohydraulic actuation (24 vdc) | | |
| **H424** | lever + hydraulic actuation electrohydraulic actuation (12 vdc) |  |  |
| **H425** | lever + hydraulic actuation electrohydraulic actuation (24 vdc) | | |

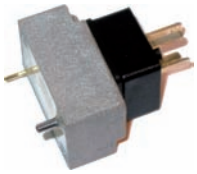
## Spool return action classification

| code | description | dimensions | configuration |
|---|---|---|---|
| **F001** | 3 position spring centered spool |  |  |
| **F0710** | 3 position spring centered spool<br>(only for H424=H425) |  |  |
| **F024** | Load limit in A and B<br>X in A1: it inhibits flow on port A<br>X in B1: it inhibits flow on port B<br>P max = 350 bar<br>  |  |  |
| **F026** | Load limit in A<br>X in A1: it inhibits flow on port A<br>P max = 350 bar<br>  |  |  |
| **F028** | Load limit in B<br>X in B1: it inhibits flow on port B<br>P max = 350 bar<br>  |  |  |

**NOTE:**
Detent kit (F008) for Float spools are also available under specific application conditions: please ask for further informations.

## Special spools return action with hall effect Linear Position Sensor HLPS2

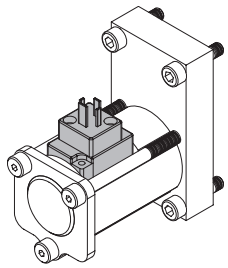
### HC-HLPS



HLPS is a Hall effect sensor based device used in conjunction with spool position transducer kits available for HC-MV99. HC-HLPS is based on a state of the art programmable Hall effect sensor device; after the final assembly of the valve a computer assisted calibration procedure is performed that compensates for mechanical inaccuracies and uncertainties allowing to attain high accuracy and linearity in spool position detection. Spool position is output as an analog voltage signal in the 0.5 - 4.5V range. The unit works in 12V and 24V environments and is protected against load-dump and other major electrical faults. Fault signalling is carried out through the output signal. HLPS with the companion mechanical kit is therefore applicable in spool loopback control applications and whenever determining spool position reliably is, as in safety functions, a major concern.

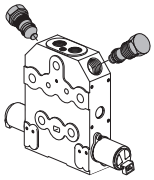
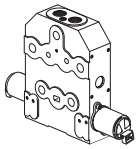
### Technical specifications

| | |
|---|---|
| **Electrical** | |
| Operating voltage | 6 - 30 Vdc |
| Max current consumption | 20.5 mA |
| **Output** | |
| Output voltage spanning | 0.5 - 4.5 Vdc |
| Quiescent voltage | 2.5 Vdc |
| Output current | -1 - +1 mA |
| Minimum output load resistance | 4.5 kOhm |
| Overall accuracy | ± 2.5% |
| Resolution | 12 bit |
| Fault signalling levels | 4.8V < Vout < 0.2 Vdc |
| Protections | short circuit protection, reverse,battery protection, thermal shutdown, overvoltage, undervoltage, load-dump |
| EM Immunity | > 60 Vdc/m |
| **Mechanical, Environmental** | |
| Operating temperature | -40 / +85 °C |
| Ingress Protection Rating | IP 65 |
| Dimensions | 28 x 18 x 23 mm (L x W x H) |
| **Connections** | |
| I/O | DIN 43650-C male |
| **Applied Standards** | |
| Immunity for industrial environments | EN 61000-6-2 |
| Emission standard for residential commercial and light-industrial environments | EN 61000-6-3 |
| EMC - Agricultural and forestry machines | EN 14982 |
| EMC - Earth-moving machinery | ISO 13766 |

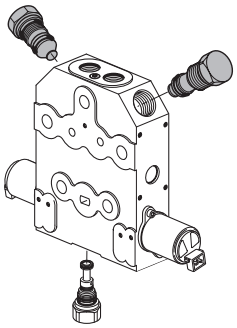
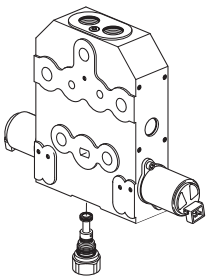
| code | description | configuration |
|---|---|---|
| **F0470** | Return action with hall effect Linear Position Sensor |  |

## Work section identification

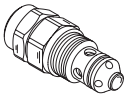
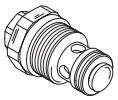
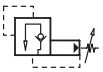
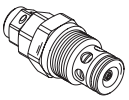
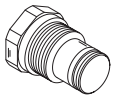
**Non compensated section**
A spool with ample flow ranges, differentiated on ports A and B if required, is used for each work section. Spool actuation can be manual, hydraulic or proportional electro-hydraulic. The selector valve, which appears on all sections, selects the highest LS signal and transmits it to the inlet module in the event of simultaneous section operation. The A and B ports can also both be equipped with an auxiliary valve which can be of antishock, anticavitation or combined type, according to requirements. When using not compensated sections, the Load Sensing principle (flow rate control is entirely free from load variations) is guaranteed for each work section only when operated individually. If two or more sections are operated simultaneously, only the one with the highest load will keep its flow rate constant against load changes.

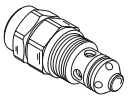
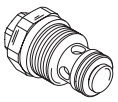
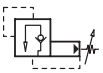
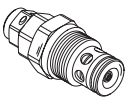
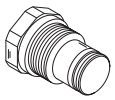
| not compensated section | | |
|---|---|---|
| RD1 G04<br>RD1 U04 |  | **Not compensated section**<br>arranged for auxiliary valves |
| RD2 G04<br>RD2 U04 |  | **Not compensated section**<br>without auxiliary valves |

**Compensated section**
The technical specifications of each non compensated section can be directly transferred to compensated ones. A local pressure compensator spool is also provided. In addition to guaranteeing constant flow rate against load changes as in the previous case, compensated sections also ensure this function during contemporary operation of two or more spools. This solution exploits this highly developed Load Sensing system and frees each function from external disturbances.

| compensated section | | |
|---|---|---|
| RC1 G04<br>RC1 U04 |  | **Compensated section**<br>arranged for auxiliary valves |
| RC5 G04<br>RC5 U04 | | **Compensated section**<br>**for high flow rate**<br>arranged for auxiliary valves<br><br>(include special compensator kit<br>code: 320255008<br>to increase 15% spool flow) |
| RC2 G04<br>RC2 U04 |  | **Compensated section**<br>without auxiliary valves |
| RC4 G04<br>RC4 U04 | | **Compensated section**<br>**for high flow rate**<br>without auxiliary valves<br><br>(include special compensator kit<br>code: 320255008<br>to increase 15% spool flow) |

## Auxiliary valve identification

| code | description | schema | configuration | setting range (bar) | |
|---|---|---|---|---|---|
| **01PA** | Antishock valve (port A) |  |  | **A** | 50 / 200 |
| | | | | **B** | 205 / 420 |
| **02PA** | Anticavitation valve (port A) |  |  | | |
| **04PA** | Pilot operated combined valve (port A) |  |  | **A** | 50 / 420 |
| **05PA** | Prearrangement for auxiliary valve (port A) |  |  | | |

| code | description | schema | configuration | setting range (bar) | |
|---|---|---|---|---|---|
| **01PB** | Antishock valve (port B) |  |  | **A** | 50 / 200 |
| | | | | **B** | 205 / 420 |
| **02PB** | Anticavitation valve (port B) |  |  | | |
| **04PB** | Pilot operated combined valve (port B) |  |  | **A** | 50 / 420 |
| **05PB** | Prearrangement for auxiliary valve (port B) |  |  | | |

## Auxiliary valve - Setting range

Sections designed to house auxiliary valve option require double choise on work ports A and B.
Always indicate setting value when using antishock valve:
**01PA (120) = setting at full flow**
**01PA (120-A) = setting at min. flow**

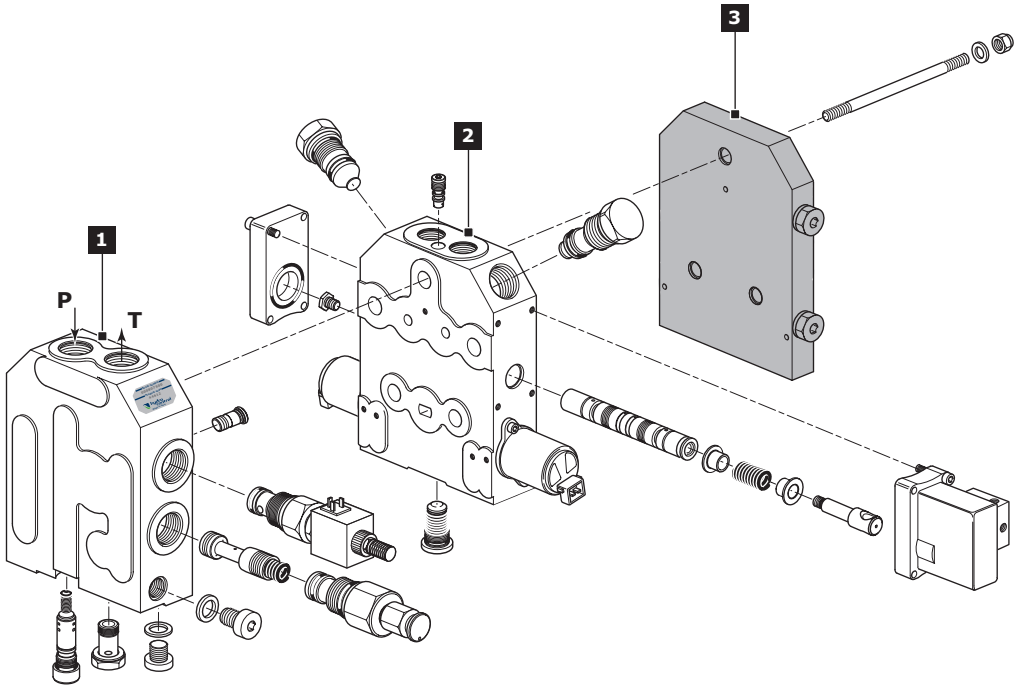
## OUTLET SECTION (END PLATE)

The standard end plate version includes the drainage for LS signal. If proportional electrovalves are used, their drainageis taken from port T1. Special plates are also available for HPCO connection between two MV99 control valves.

### Order example

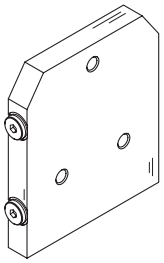
**KZ3**

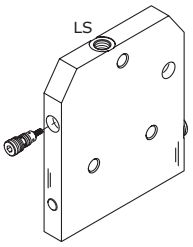
**1.** **KZ3** Plate type



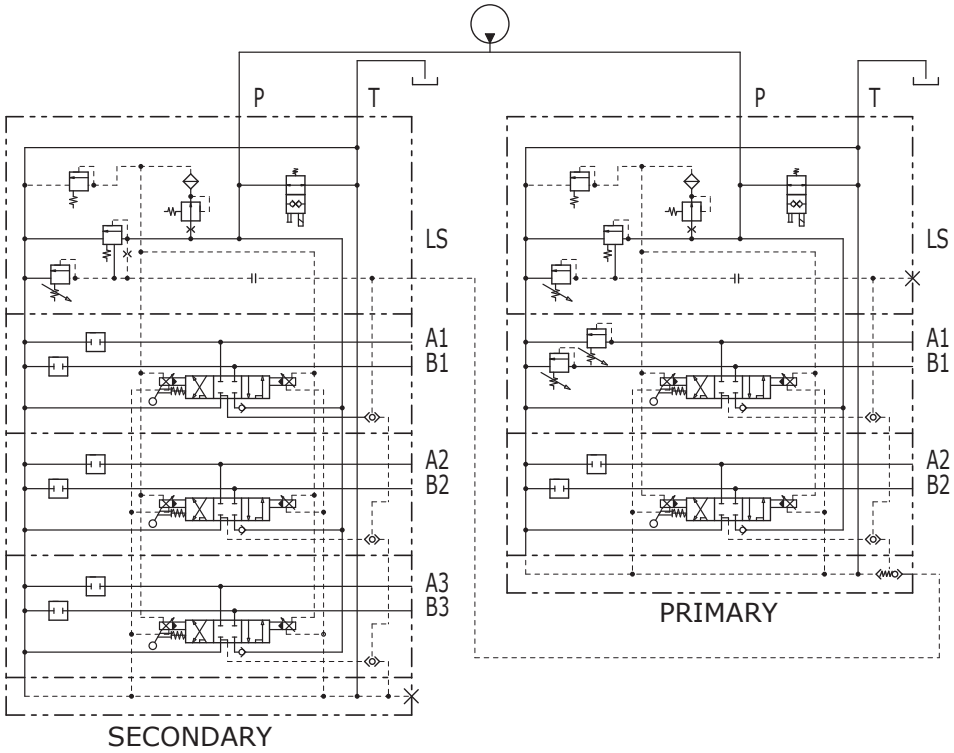

**1.** **OUTLET SECTION (END PLATE):**

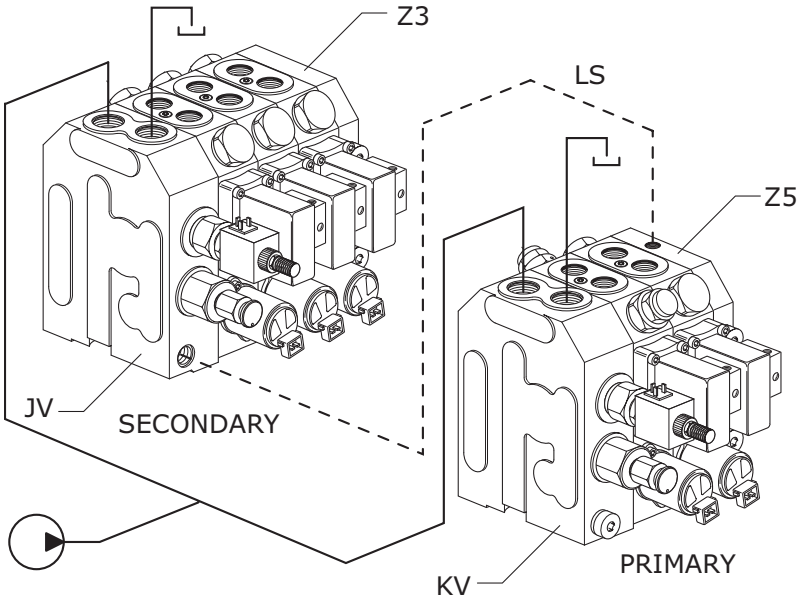
**KZ3** End plate with T1 port plugged
**KZ4** End plate with separated proportional electrovalves tank line (port T1)
**KZ5** End plate with T1 port plugged (HPCO version)
**KZ6** End plate with separated proportional electrovalves tank line (port T1) (HPCO version)

| standard version | | |
|---|---|---|
| **Z3** |  | **End plate with T1 port plugged**<br>to be used with:<br>H401-H403-H406 |
| **Z4** | | **End plate with separated proportional electrovalves tank line (port T1)**<br>to be used with:<br>H402-H404-H405-H407-H408-H424-H425 |

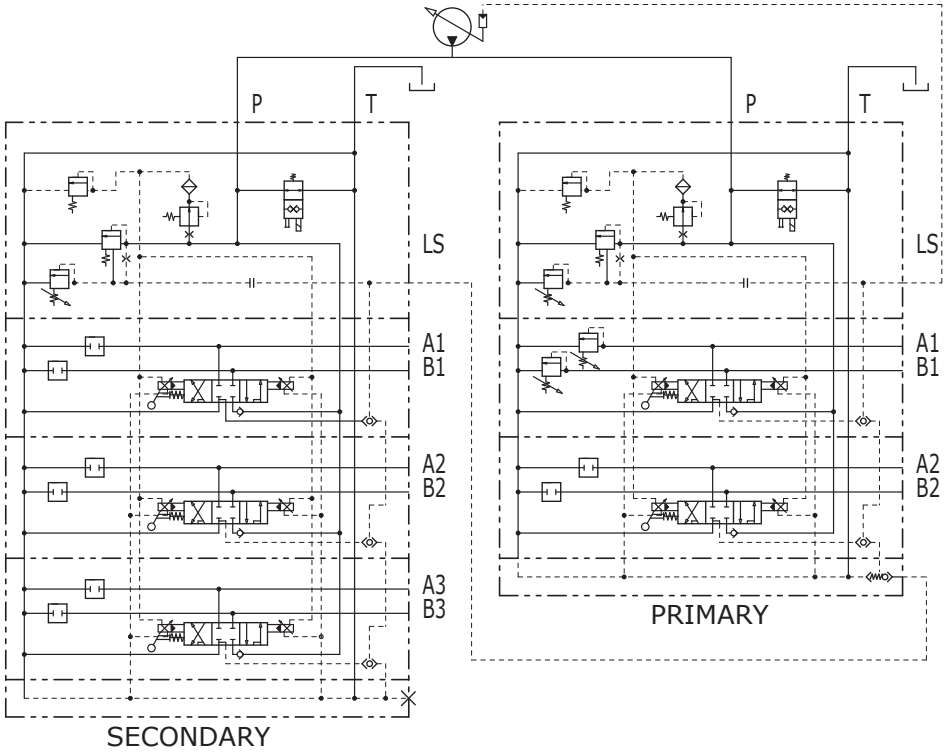
| special version (HPCO) | | |
|---|---|---|
| **Z5** |  | **End plate with T1 port plugged (HPCO version)**<br>to be used with:<br>H401-H403-H406 |
| **Z6** | | **End plate with separated proportional electrovalves tank line (port T1) HPCO version**<br>to be used with:<br>H402-H404-H405-H407-H408-H424-H425 |

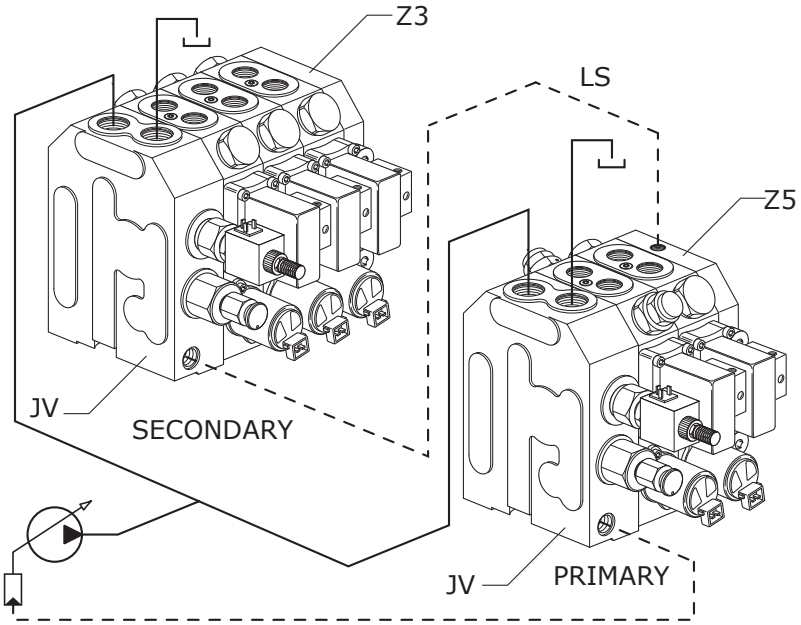
## Sample of end plate (with fixed displacement pump)



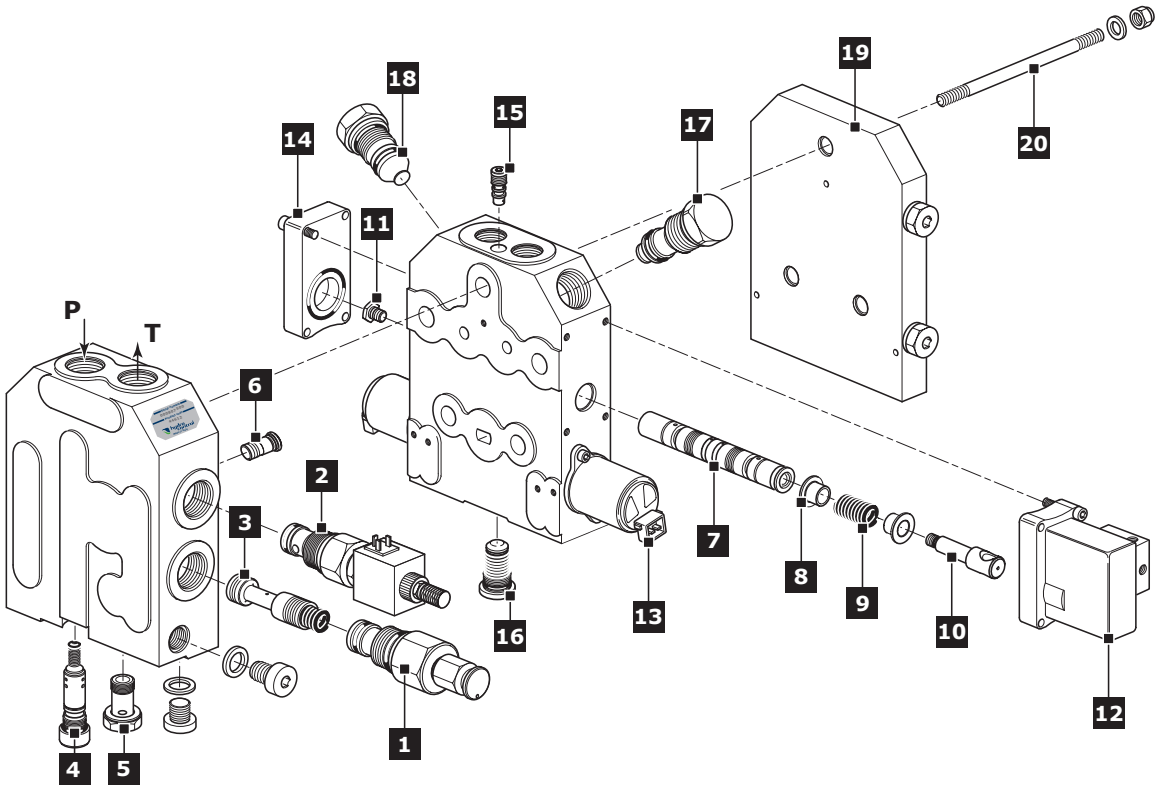
## Sample of end plate (with fixed displacement pump)




**NOTES:** the secondary control valve necessarily adopts a JV type inlet module; the LS signal of the secondary one is drawn from the inlet module and driven to the end plate Z5 (o Z6) of the primary control valve. The primary control valve is equipped with a KV or JV type inlet module depending on whether the system is fed by a variable or fixed displacement pump.

## MV99 SPARE PARTS LIST



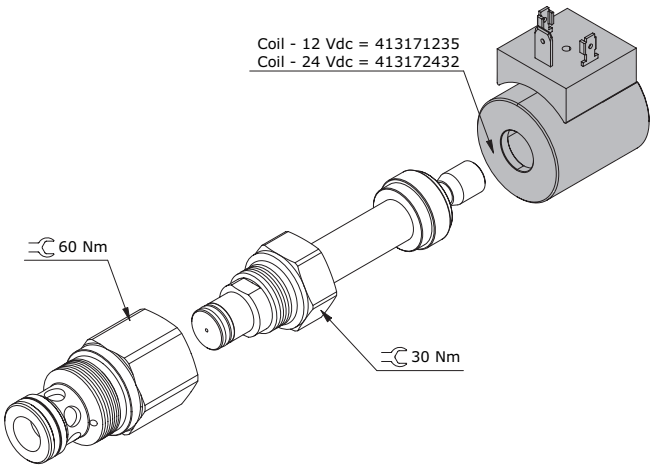

| Rif. | Description | Order code | Type | Note |
|---|---|---|---|---|
| 1 | Direct acting pressure relief valve on LS signal (*) | **33208** | | Setting: 100 bar |
| | | **49967** | | Setting: 200 bar |
| | | **26002** | | Setting: 300 bar |
| | Relief valve plugged on LS signal | **430155001** | | |
| 2 | Relief valve plugged | **430455001** | | |
| | Pilot operated pressure relief valve on full flow (*) | **35824** | | Setting: 100 bar |
| | | **26698** | | Setting: 250 bar |
| | | **80208** | | Setting: 400 bar |
| | Complete electric operated dump valve (12 vdc) (**) | **915045501** | | |
| | Complete electric operated dump valve (24 vdc) (**) | **915045502** | | |
| | Plug with pressure-gauge connection | **430455002** | | |
| 3 | Compensator Spool | **421255001** | | only for KV and HV |
| | | **421255094** | | only for JV |
| 4 | Pressure reducing valve kit (RDP) | **320255001** | | |
| 5 | Control signal valve | **320255002** | | only for KV and HV |
| | | **430055002** | | only for JV |
| 6 | Flow limiter valve | **320055001** | | |
| 7 | 3 positions double-acting spool | **421255003** | **W001C-AAAA** | |
| | | **421255029** | **W001C-DDDD** | |
| | | **421255012** | **W001C-FFFF** | |
| | | **421255018** | **W001C-IIII** | |
| | | **421255057** | **W001C-NNNN** | |
| | | **421255028** | **W001C-ZZZZ** | |
| | 3 positions double-acting Aand B to tank spool | **421255008** | **W002C-AAAA** | |
| | | **421255035** | **W002C-DDDD** | |
| | | **421255035** | **W002C-FFFF** | |
| | | **421255025** | **W002C-IIII** | |
| | | **421255112** | **W002C-NNNN** | |
| | | **421255181** | **W002C-ZZZZ** | |
| 8 | Spacer | **421901117** | | |
| 9 | Spring | **421801128** | | for lever kit |
| | | **421801127** | | for proportional kit |
| 10 | Anterior spool end kit | **430055016** | | |

| Rif. | Description | Order code | Type | Note |
|---|---|---|---|---|
| **11** | Posterior spool end kit | **430055019** | | |
| **12** | Lever actuation kit | **320355001** | | |
| | Without lever actuation kit | **320355002** | | |
| | Lever + Hydraulic + electrohydraulic actuation kit | **320355005** | | |
| | Hydraulic atuation | **430855001** | | |
| **13** | Electrohydraulic actuation 12 Vdc | **430055004** | | |
| | Electrohydraulic actuation 24 Vdc | **430055003** | | |
| | Prearrangemet for Electrohydraulic actuation | **430055001** | | |
| **14** | 3 positions spring centered spool | **320755001** | **F001** | |
| | 3 positions spring centered spool | **320755002** | **F0710** | only for H424-H425 |
| | Load limit in A and B | **320055007** | **F024** | |
| | Load limit in A | **320055009** | **F026** | |
| | Load limit in B | **320055008** | **F028** | |
| | Proportional directional load limit | **320055024** | **F0470** | |
| **15** | Signal selection valve | **320255004** | | |
| **16** | Check valve | **320255005** | | for not compensated section |
| | Compensated valve on section | **320255003** | | for compensated section |
| **17** | Antishock valve on port A (*) | **20705** | **01 PA** | Setting: 100 bar |
| | | **35838** | **01 PA** | Setting: 200 bar |
| | | **20783** | **01 PA** | Setting: 300 bar |
| | Anticavitation valve on port A | **915085501** | **02 PA** | |
| | Pilot operated combined valve on port A (*) | **35824** | **04 PA** | Setting: 100 bar |
| | | **26698** | **04 PA** | Setting: 250 bar |
| | | **80208** | **04 PA** | Setting: 400 bar |
| | Prearrangement for auxiliary valve on port A | **430455001** | **05 PA** | |
| **18** | Antishock valve on port B (*) | **20705** | **01 PB** | Setting: 100 bar |
| | | **35838** | **01 PB** | Setting: 200 bar |
| | | **20783** | **01 PB** | Setting: 300 bar |
| | Anticavitation valve on port B | **915085501** | **02 PB** | |
| | Pilot operated combined valve on port B (*) | **35824** | **04 PB** | Setting: 100 bar |
| | | **26698** | **04 PB** | Setting: 250 bar |
| | | **80208** | **04 PB** | Setting: 400 bar |
| | Prearrangement for auxiliary valve on port B | **430455001** | **05 PB** | |
| **19** | End plate with T1 port plugged | **20615** | **KZ3** | |
| | | **20565** | **KZ4** | |
| | End plate with HPCO version | **20955** | **KZ5** | |
| | | **20669** | **KZ6** | |
| **20** | Tie rod kit MV99/1 | **300155001** | | |
| | Tie rod kit MV99/2 | **300155002** | | |
| | Tie rod kit MV99/3 | **300155003** | | |
| | Tie rod kit MV99/4 | **300155004** | | |
| | Tie rod kit MV99/5 | **300155005** | | |
| | Tie rod kit MV99/6 | **300155006** | | |
| | Tie rod kit MV99/7 | **300155007** | | |
| | Tie rod kit MV99/8 | **300155008** | | |
| | Tie rod kit MV99/9 | **300155009** | | |
| | Tie rod kit MV99/10 | **300155010** | | |

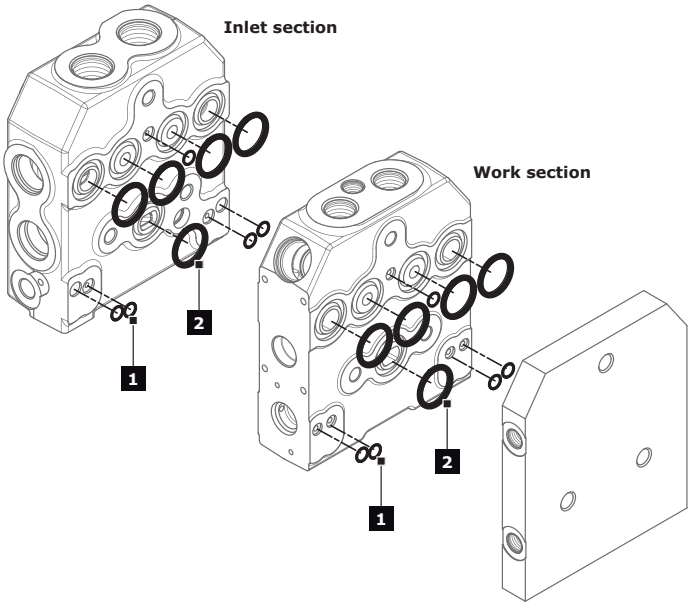
**Note**

(*) = for different settings please contact our Sales Dpt.

(**) = electric dump valve coil can be ordered separately as spare part: (see drawing)
Ordering code Coil 12 vdc: 413171235
Ordering code Coil 24 vdc: 413172432



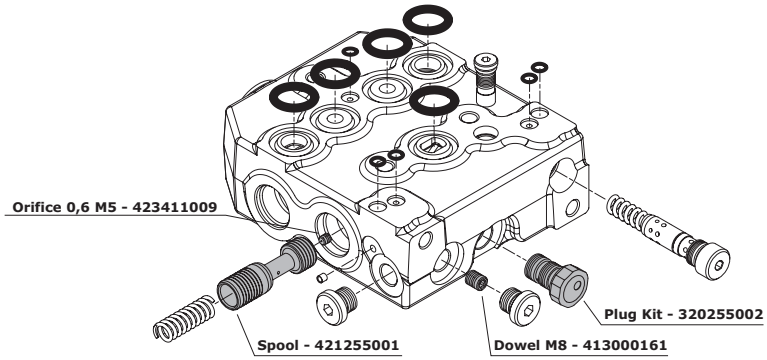
## GASKET KITS




| INLET AND WORK SECTION | | | |
|---|---|---|---|
| **Rif.** | **order code** | **Description** | **Q.ty** |
| **1** | 412010122 | O.R.70SH (2-10) | 5 |
| **2** | 412020610 | O.R.90SH (2-1118) | 5 |
| **Complete Gasket kit: order code - 350955001** | | | |

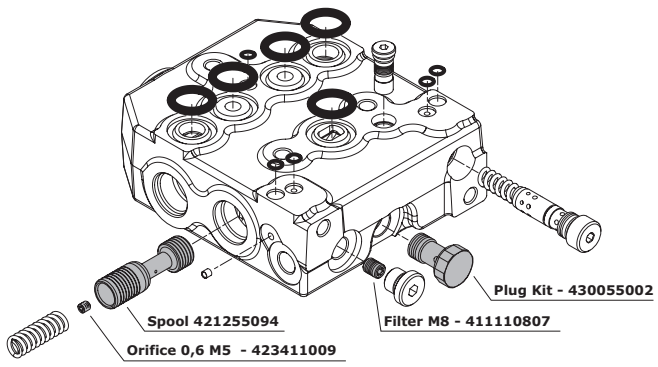
## TRANSFORMATION KITS

Transformation on the inlet section from open center to closed center is possible by ordering the complete kit code:
**320055005 (transformation kit from KV/HV to JV)**




| OPEN CENTER CONFIGURATION (KV-HV) FIXED PUMP | | |
|---|---|---|
| **order code** | **Description** | **Q.ty** |
| 421255001 | Spool | 1 |
| 423411009 | Orifice 0,6 M5 | 1 |
| 413000161 | Dowel M8 | 1 |
| 320255002 | Plug kit | 1 |
| **Complete transformation kit: order code - 320055005** | | |

Transformation on the inlet section from closed center to open center is possible by ordering the complete kit code:
**320055021 (transformation kit from JV to KV/HV)**

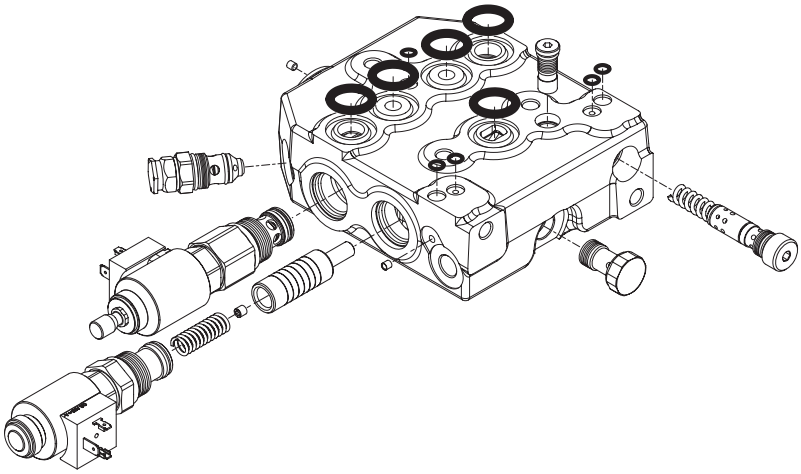


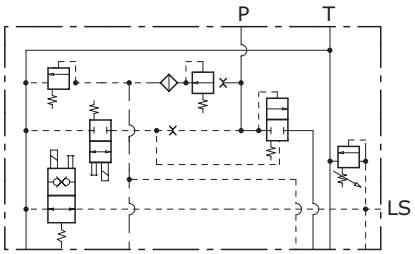

| OPEN CENTER CONFIGURATION (JV) VARIABLE PUMP | | |
|---|---|---|
| **order code** | **Description** | **Q.ty** |
| 421255094 | Spool | 1 |
| 423411009 | Orifice 0,6 M5 | 1 |
| 411110807 | M8 Filter | 1 |
| 430055002 | Plug kit | 1 |
| **Complete transformation kit: order code - 320055021** | | |

## SPECIAL OPTIONS

### Inlet section with P-Closed

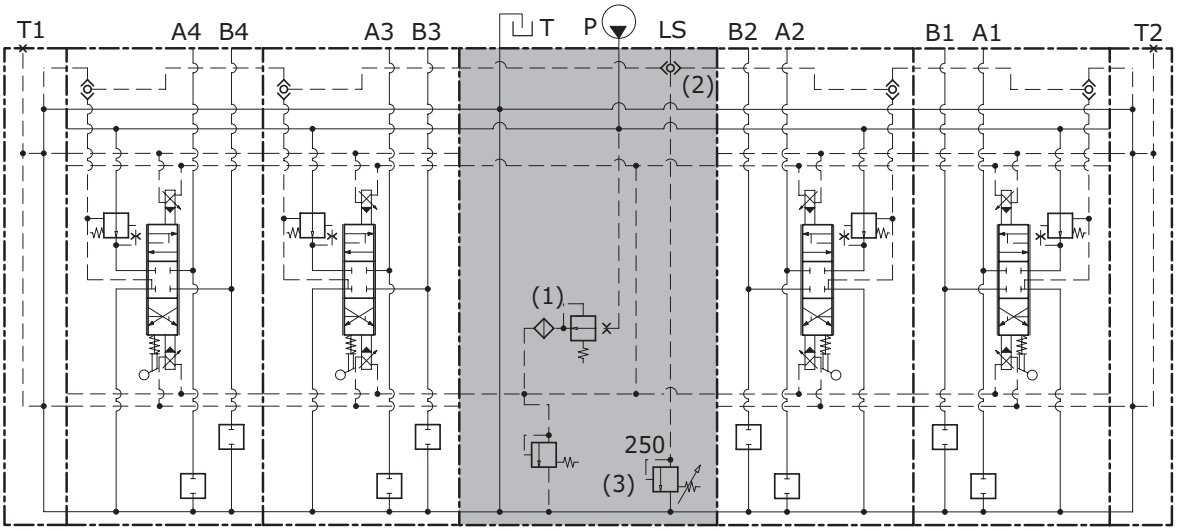
P closed inlet section is a special execution for variable pump systems that completely inhibits the oil flow to the valve. Active operations are inhibited even in presence of pump stand by pressure.
The valve can be activated by means of en electric operated cartridge.
LS signal dump valve is also available on request.

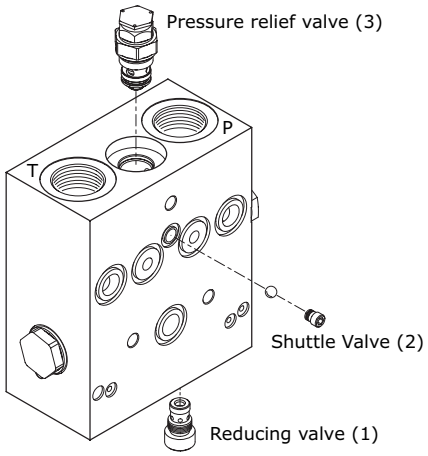




## Intermediate inlet section

The intermediate inlet section for the HC-MV99 control valve allows inlet flow rate up to 200 l/min from a Load Sensing variable displacement pump. This intermediate section has been designed to assemble two independent flow control units, fed from a single, high flow rate pump. The symmetrical pressure drop control allows the regulated flow-rates to be accurately distributed. Among the possible applications are travel systems for drills, excavators and medium- to large-sized agricultural machinery.



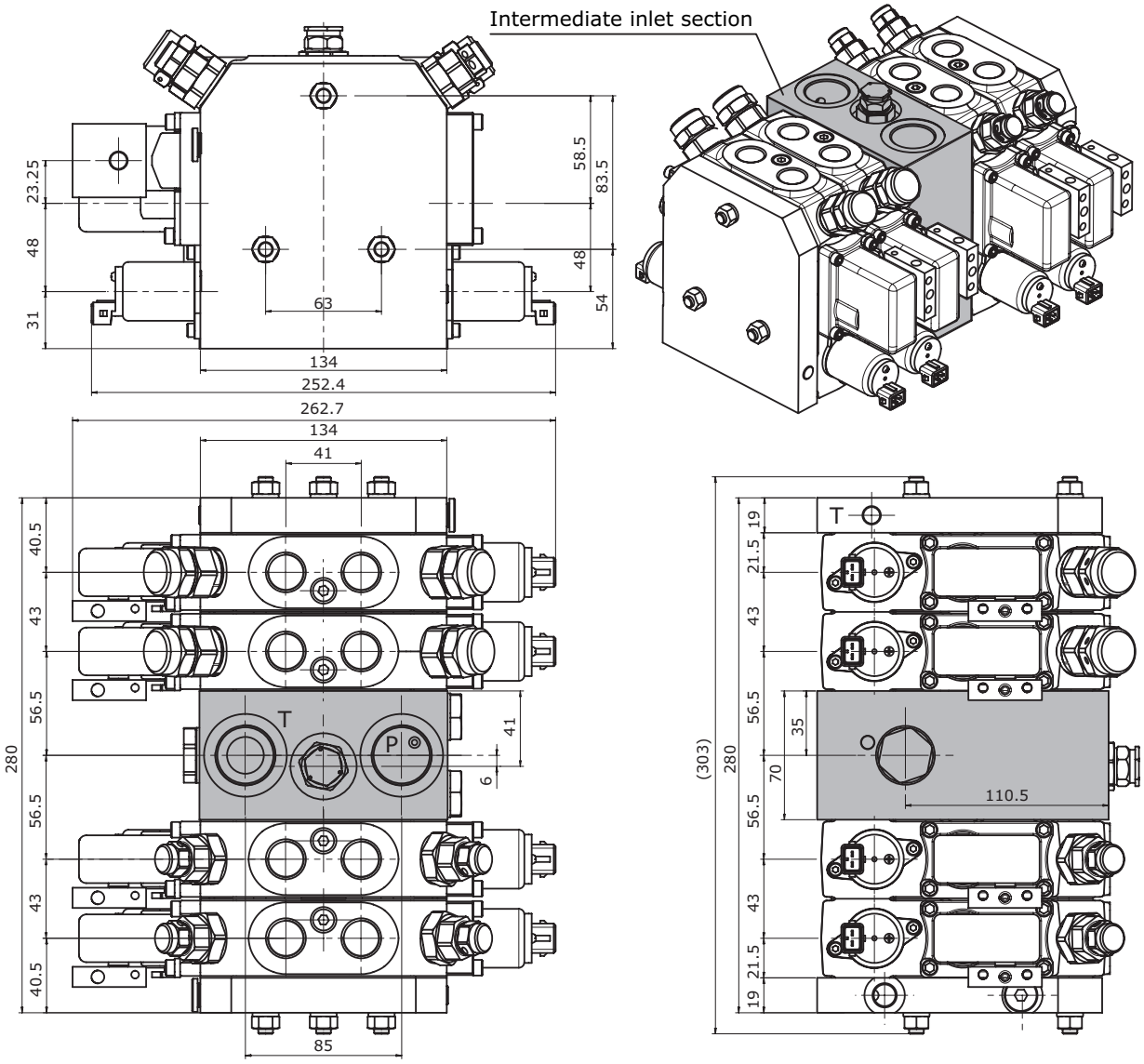

### Assembly kit

The HC-MV99 intermediate inlet section is equipped with a pressure reducer valve (1) feeding the proportional electro-hydraulic controls, equipped with a filter and pressure limiting device. It also has an integral "Shuttle Valve" (2) to select LS signals coming from the two flow control units, controlled in turn by the pressure relief valve (3).

### Ordering code

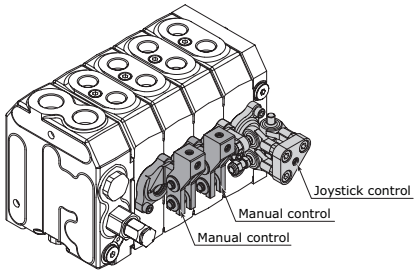
The intermediate section assembly ordering code is **61071**. The proportional control valve assembly (equipped with an intermediate inlet section) should be used with two closure plates on both ends and without an inlet module.

## Dimensional drawing

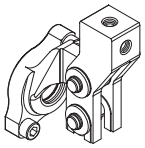


## Manual and Joystick control

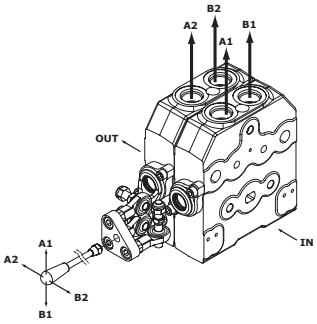
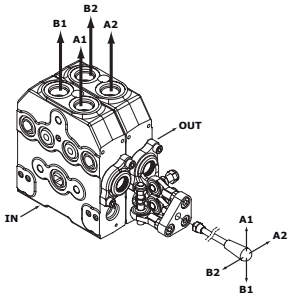
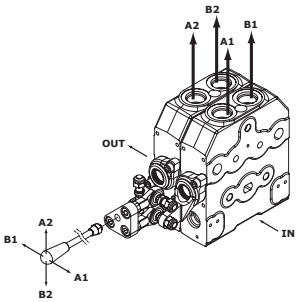
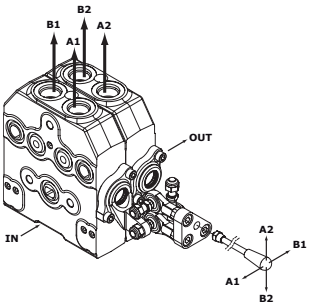
A special version of MV99 has been specifically developed for manual control.
This version requires dedicated section bodies, special spool return action and allows the use of simple and robust manual control kit such as lever and cloche control.
This solution is particularly indicated for heavy duty application.
Following some ordering codes for special manual version:




## Manual spool actuation

| code | description | configuration |
|---|---|---|
| **H101** | Unprotected lever |  |
| **H102** | Unprotected lever rotated 180° | |

## Joystick control spool actuation

| code | description | configuration | code | description | configuration |
|---|---|---|---|---|---|
| **H009** | Right side inlet fulcrum on 1st section (compulsory code for second section: H120) |  | **H011** | Left side inlet fulcrum on 1st section (compulsory code for second section: H120) |  |
| **H010** | Right side inlet fulcrum on 2nd section (compulsory code for first section: H120) |  | **H012** | Left side inlet fulcrum on 2nd section (compulsory code for first section: H120) |  |

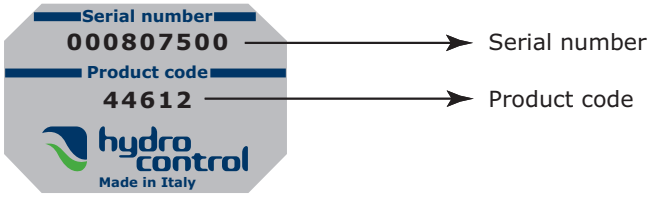
## Manual spool return action

| code | description | configuration |
|---|---|---|
| **F001A** | 3 positions spring-centred spool (Spring type A) |  |
| **F001B** | 3 positions spring-centred spool (Spring type B) | |

## GENERAL CONDITIONS AND PATENTS

### Product identification

All Hydrocontrol products have an identifying plate placed in specific position.




### Serial number:

It univocally identifies the physical valve: this provides an easy way to find all sales and production details.

### Product code:

It is a number univocally identifying the configuration and pressure settings of a valve.

### General

These general conditions are applicable to all the supplies which Hydrocontrol s.p.a. will carry out, on the base of purchasing orders forwarded from the Customer. Terms like EXW, DDP and so on are referred to the so called Incotems published by the International Chamber of Commerce, current at the date of conclusion of these General Conditions.

### Purchasing orders management

Purchasing orders are binding for Hydrocontrol s.p.a. only if confirmed in writing with order confirmations. Hydrocontrol s.p.a. engages itself to supply goods up to the order confirmations. Any complaints regarding the content of the order confirmation must be notified in writing to Hydrocontrol s.p.a. by 5 days and no later the forwarding of the order confirmation. The Customer undertakes to pay the goods supplied by Hydrocontrol s.p.a., according to the prices listed on the order confirmation.

### Payment conditions

The Parties agree upon the payment conditions at the beginning of the supply. In case of delay of payment, Hydrocontrol s.p.a. will have the right to request of moratory interests equal to the Euribor, increased by 2 points. In case of delay of payment, Hydrocontrol s.p.a. will have the right to not execute the eventual purchasing orders in progress, even if confirmed.

### Delivery and shipment

The supply of the goods will always be Ex-Works, even in the case that Hydrocontrol s.p.a. had agreed with the Customer that Hydrocontrol s.p.a. takes care of the shipment, or part of it. In any case, the risks about perishment or damage of the goods will pass to the Customer, at latest, when the goods are delivered to the first carrier.

### Characteristics of products

Hydrocontrol s.p.a. engages itself to supply good quality products, up to the technical specifications contained in technical schedules or in the catalogue. Hydrocontrol s.p.a. reserves the exclusive right to make any change to the products, which, without altering their essential features, appear to be necessary or suitable.

### Complaints

The complaints regarding the apparent defects of the Products (such as, for instance, the packing, quantity, number or exterior features of the Products) must be notified in writing to Hydrocontrol s.p.a. by 7 days and no later upon the receipt of the goods. Failing such notification, the Customer's right to claim the above defects will be forfeited. The hidden defects (defects which cannot be discovered by the Customer on the basis of a careful inspection upon the receipt) shall be notified in writing to Hydrocontrol s.p.a. by 7 days and no later from the discovery of the defects, and in any case no later than 18 months from the delivery of the Goods. Failing such notification, the Customer's right to claim the above defects will be forfeited. It's agreed that, even in case of any complaint or objection, the Customer will not have the right to suspend or delay the payments due to Hydrocontrol s.p.a., as well as payment of any other supplies.

## GENERAL CONDITIONS AND PATENTS

### Warranty

In case of any defects, lack of quality or non-conformity of the supplied Products, Hydrocontrol s.p.a., at its exclusive choice, engages itself to replace or repair the defective Products provided such defects or non-conformity have been timely notified in writing to Hydrocontrol s.p.a., in accordance to point nr. 6, by 18 months from the delivery of the Goods and no later. Products repaired or replaces under warranty as above described are submitted to the same guarantee, for a period of 18 months from the date of repair or replacement. Except in case of fraud or gross negligence, in case of defects, lack of quality or non-conformity, Hydrocontrol S.p.a. undertakes only to repair or replace the defective Products, in accordance to what above described. This guarantee ( i.e. the obligation of repairing or replacing the Products) is in lieu of any other legal guarantee or liability of the Supplier, with the exclusion of any other guarantee or liability – whether contractual or non-contractual – in connection with the Products supplied (i.e. compensation for damages, loss of profit, recall campaigns, ...). Hydrocontrol s.p.a. is covered by appropriate policy of Product Legal Liability.

### Retention of title

The Goods supplied by Hydrocontrol s.p.a. remain property of Hydrocontrol s.p.a. until the complete payment of the supply is received.

### Secrecy bond

Hydrocontrol s.p.a. engages itself to treat as highly confidential all the technical or commercial information should learnt from the Customer, which are not already of public divulgence.

### Patents

Except preventive written authorization of Hydrocontrol s.p.a., the Customer cannot use the supplied Products, or part of them, or the descriptions or the drawings of them – whether registered patented or not – to project or make similar goods. Even in case of preventive written authorization of Hydrocontrol s.p.a., all the patents, labels and registered design, royalties and intellectual property rights related or in connection with Products supplied by Hydrocontrol s.p.a., are and remain property of Hydrocontrol s.p.a. The Customer undertakes to treat all of them as highly confidential.

### Applicable law and jurisdiction

The supplies carried out by Hydrocontrol S.p.a. are governed by these present General Conditions and, for what here not expressly provided, by the Italian Law. The competent Law Courts of Bologna have the exclusive jurisdiction in any controversies regarding the supplies of Products by Hydrocontrol s.p.a., or from the supplies arising out or to the supplies connected, in which Hydrocontrol s.p.a. is part.

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