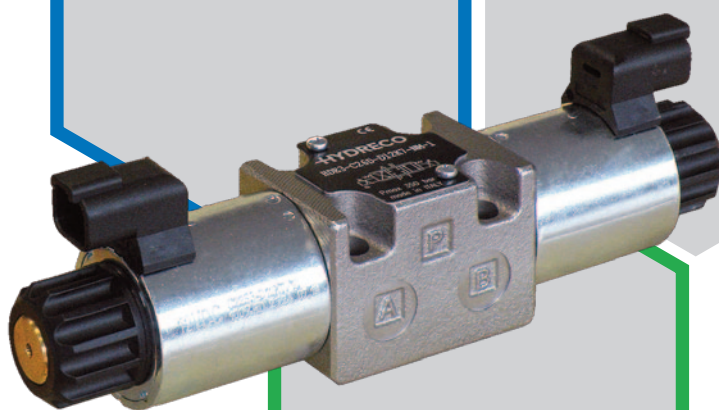




# HDS3

DIRECTIONAL  
SOLENOID VALVE

350 bar 80 l/min



## TECHNICAL CATALOGUE

## INTRODUCTION

The HDS3 valves are solenoid directional valves, direct operated, with porting pattern compliant to ISO 4401-03 standards.

These valves are supplied with a zinc-nickel plating making them the perfect choice for mobile and environmental applications that require better protection.

These valves are supplied with standard salt spray resistance up to 240 h. Salt spray resistance up to 600 h can be reached using WK\* coils (test according to UNI EN ISO 9227 and UNI EN ISO 10289 tests and standards).

The valve body is made with high strength iron castings with internal passages designed to minimize pressure drop.

## FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

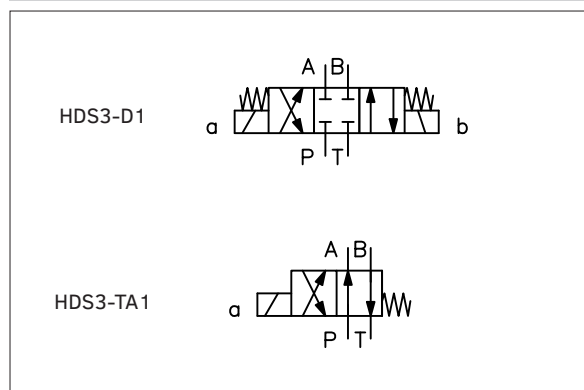
Using fluids at temperatures higher than 80 °C (180 °F) causes the accelerated degradation of seals as well as the fluid physical and chemical properties.

From a safety standpoint, temperatures above 55 °C (130 °F) are not recommended.

## OPERATING PARAMETERS

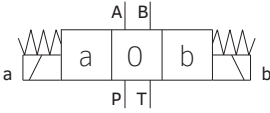
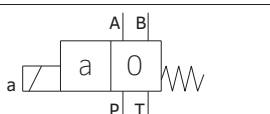
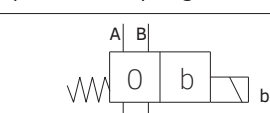
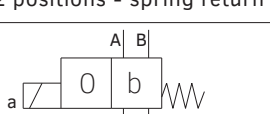
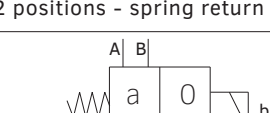
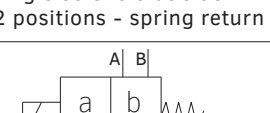
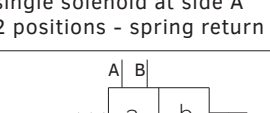
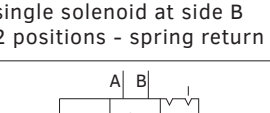
|                                   |                                 |               |               |
|-----------------------------------|---------------------------------|---------------|---------------|
| <b>MAXIMUM OPERATING PRESSURE</b> | P - A - B ports                 | 350 bar       | 5000 psi      |
|                                   | T port                          | 210 bar       | 3000 psi      |
| <b>FLOW RATE</b>                  |                                 | 80 l/min      | 21.1 gpm      |
| <b>MOUNTING SURFACE</b>           | ISO 4401-03-02-0-05<br>NFPA D03 |               |               |
| <b>STEP RESPONSE</b>              | 0 → 100%                        | 50 ms         |               |
|                                   | 100 → 0%                        | 40 ms         |               |
| <b>WEIGHT</b>                     | single solenoid                 | 1.5 kg        | 3.3 lbs       |
|                                   | double solenoid                 | 2 kg          | 4.4 lbs       |
| <b>RANGE TEMPERATURES</b>         | ambient                         | -20 to +54 °C | -4 to +130 °F |
|                                   | fluid                           | -20 to +82 °C | -4 to +180 °F |
| <b>FLUID VISCOSITY</b>            | range                           | 10-400 cSt    | 60-1900 SUS   |
|                                   | recommended                     | 25 cSt        | 120 SUS       |
| <b>FLUID CONTAMINATION</b>        | ISO 4406:1999<br>class 20/18/15 |               |               |

## HYDRAULIC SYMBOLS (TYPICAL)



HDS3 - ■ ■ - ■ ■ - ■ ■ - 1

design mark

| FUNCTION |   |
|----------|---|
| D        | <br>double solenoid<br>3 positions - spring centered           |
| A        | <br>single solenoid at side A<br>2 positions - spring return   |
| B        | <br>single solenoid at side B<br>2 positions - spring return   |
| RA       | <br>single solenoid at side A<br>2 positions - spring return |
| RB       | <br>single solenoid at side B<br>2 positions - spring return |
| TA       | <br>single solenoid at side A<br>2 positions - spring return |
| TB       | <br>single solenoid at side B<br>2 positions - spring return |
| K        | <br>double solenoid and detent<br>2 positions                |

| VOLTAGE |                   |
|---------|-------------------|
| D12     | 12 V DC solenoid  |
| D14     | 14 V DC solenoid  |
| D24     | 24 V DC solenoid  |
| D28     | 28 V DC solenoid  |
| D48     | 48 V DC solenoid  |
| D110    | 110 V DC solenoid |
| D00     | without coils     |

| COIL |   |
|------|---|
| K1   | DIN 43650   |
| K2   | AMP Junior  |
| K7   | DT04-2P 'deutsch'                                     |
| WK1  | DIN 43650<br>zinc-nickel plated                       |
| WK7  | DT04-2P 'deutsch'<br>zinc-nickel plated               |
| WK7D | DT04-2P 'deutsch'<br>zinc-nickel plated<br>with diode |

| MANUAL OVERRIDE |   |
|-----------------|---|
| M               | built-in with the tube,<br>pin ( <b>standard</b> ), not<br>available with WK* coils |
| B               | built-in with the tube,<br>boot protected<br>( <b>standard</b> with WK*<br>coils)   |
| L               | hand lever  |
| L1              | long hand lever   |
| K               | knob, turning   |
| K2              | knob, twist and lock  |

**NOTE:** Manual overrides of type L and L1 are not available for valves with spools type RA and RB.

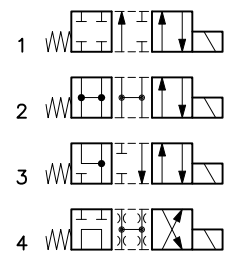
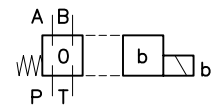
| SPOOL         |
|---------------|
| See next page |

| SEAL |                         |
|------|-------------------------|
| N    | NBR ( <b>standard</b> ) |
| V    | Viton                   |

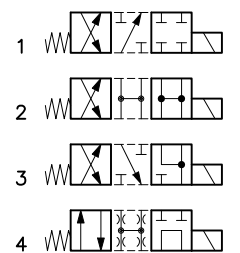
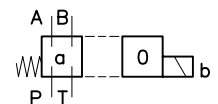
CODE EXAMPLES:

HDS3 - D1 - D12K7 - NM - 1  
HDS3 - D1 - D12WK7 - NB - 1

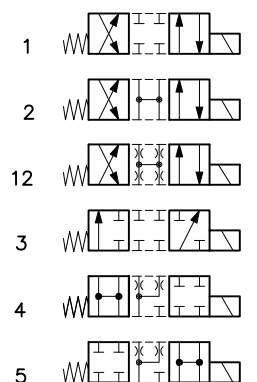
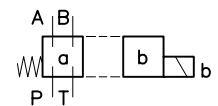
FUNCTION B



FUNCTION RB

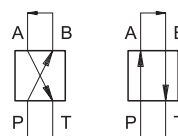


FUNCTION TB

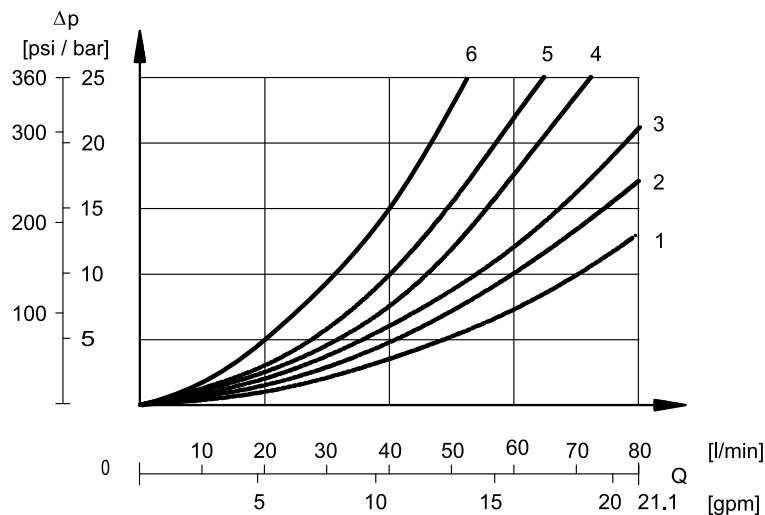


## 4

Flow characteristic curves obtained with mineral oil with viscosity of 36 cSt (170 sus) at 50 °C (122 °F) and 24V DC valve; the  $\Delta p$  values are measured between P and T (full loop) valve ports.



#### PRESSURE DROPS $\Delta p$ -Q



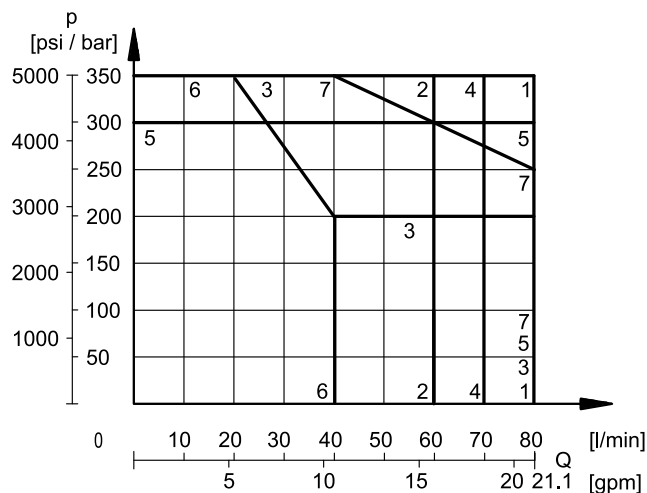
#### ENERGIZED POSITION

| TYPE                 | FLOW DIRECTION  |     |     |     |
|----------------------|-----------------|-----|-----|-----|
|                      | P→A             | P→B | A→T | B→T |
|                      | CURVES ON GRAPH |     |     |     |
| D1, A1, B1           | 2               | 2   | 3   | 3   |
| D2, A2, B2           | 1               | 1   | 3   | 3   |
| D3, A3, B3, RA3, RB3 | 3               | 3   | 1   | 1   |
| D4, A4, B4, RA4, RB4 | 5               | 5   | 5   | 5   |
| D5                   | 2               | 1   | 3   | 3   |
| D6                   | 2               | 2   | 3   | 1   |
| D7, D8               | 4               | 5   | 5   | 5   |
| D9                   | 2               | 2   | 3   | 3   |
| D10                  | 1               | 3   | 1   | 3   |
| D11                  | 2               | 2   | 1   | 3   |
| D12, D17, D19        | 2               | 2   | 3   | 3   |
| D18                  | 1               | 2   | 3   | 3   |
| D20, D22             | 1               | 5   | 2   |     |
| D21, D23             | 5               | 1   |     | 2   |
| TA1, TB1             | 3               | 3   | 3   | 3   |
| TA2, TB2             | 2               | 2   | 2   | 2   |
| TA3, TB3             | 3               | 3   |     |     |
| K1, K2, K3           | 2               | 2   | 2   | 2   |

#### DE-ENERGIZED POSITION

| TYPE                 | FLOW DIRECTION  |     |     |     |     |
|----------------------|-----------------|-----|-----|-----|-----|
|                      | P→A             | P→B | A→T | B→T | P→T |
|                      | CURVES ON GRAPH |     |     |     |     |
| D2, A2, B2           |                 |     |     |     | 2   |
| D3, A3, B3, RA3, RB3 |                 |     | 3   | 3   |     |
| D4, A4, B4, RA4, RB4 |                 |     |     |     | 3   |
| D5                   |                 | 4   |     |     |     |
| D6                   |                 |     |     | 3   |     |
| D7, D8               |                 |     | 6   | 6   | 3   |
| D10                  | 3               | 3   |     |     |     |
| D11                  |                 |     | 3   |     |     |
| D18                  | 4               |     |     |     |     |
| D22, D23             |                 |     |     | 6   |     |

PERFORMANCE CURVES - STANDARD OPERATION

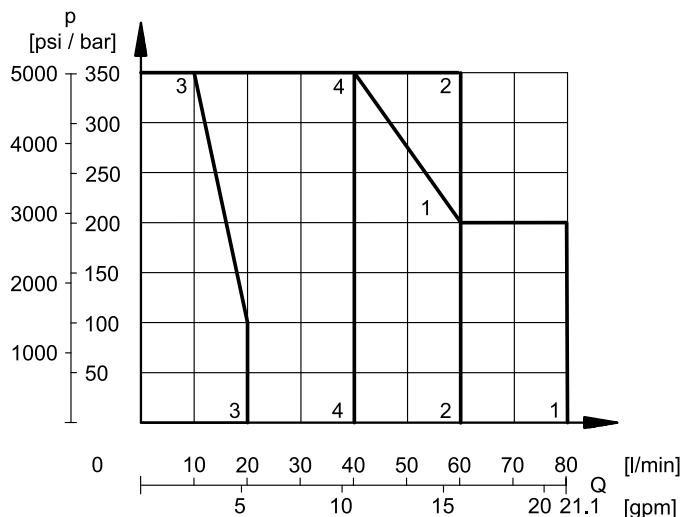


\* Performance obtained for a valve with A and B lines connected the one to the piston-side chamber and the other to the rod-side chamber of a double-acting cylinder with area ratio 2:1.

| TYPE       | CURVE |     |
|------------|-------|-----|
|            | P→A   | P→B |
| D1, A1, B1 | 1     | 1   |
| D2, A2, B2 | 2     | 2   |
| D3, A3, B3 | 3     | 3   |
| D4, A4, B4 | 4     | 4   |
| D5         | 5     | 5   |
| D6         | 4     | 6   |
| D7         | 4     | 4   |
| D8         | 4     | 4   |
| D9         | 1     | 1   |
| D10        | 1     | 1   |
| D11        | 4     | 6   |
| D12        | 1     | 1   |
| D17        | 4     | 4   |

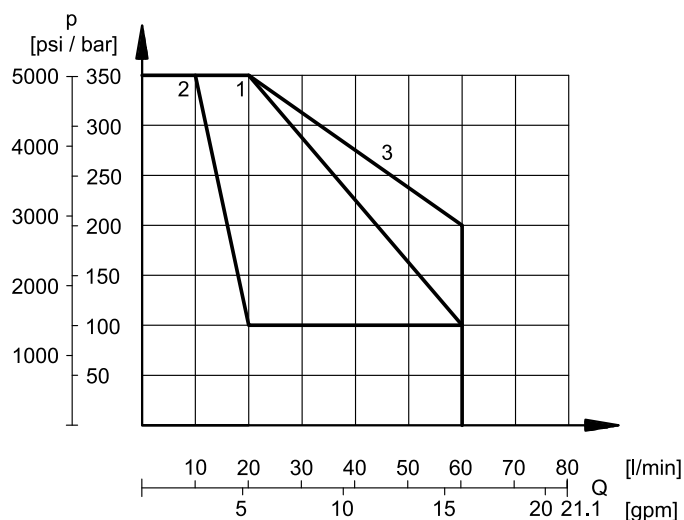
| TYPE     | CURVE |     |
|----------|-------|-----|
|          | P→A   | P→B |
| D18      | 5     | 5   |
| D19      | 4     | 4   |
| D20      | 6*    | 6   |
| D21      | 6     | 6*  |
| D22, D23 | 6     | 6   |
| TA1, TB1 | 1     | 1   |
| TA2, TB2 | 7     | 7   |
| TA3, TB3 | 2     | 2   |
| TA4      | 1     | -   |
| K1       | 1     | 1   |
| K2       | 7     | 7   |
| K3       | 1     | 1   |

PERFORMANCE CURVES - REVERSED SPOOLS



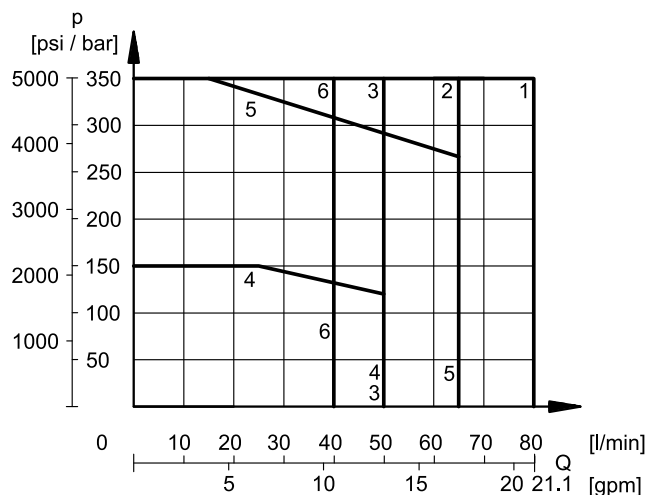
| TYPE | CURVE |
|------|-------|
| RA1  | 1     |
| RA2  | 2     |
| R3   | 3     |
| RA4  | 4     |

PERFORMANCE CURVES - 3-PORTS OPERATION



| TYPE   | CURVE |
|--|-------|
| TA1 backpressure in A<br>TB1 backpressure in B | 1     |
| TA2 backpressure in A<br>TB2 backpressure in B | 1     |
| TA1 backpressure in B<br>TB1 backpressure in A | 2     |
| TA2 backpressure in B<br>TB2 backpressure in A | 3     |

PERFORMANCE CURVES - AC RECTIFIER CONNECTORS



| TYPE       | CURVE |     |
|------------|-------|-----|
|            | P→A   | P→B |
| D1, A1, B1 | 2     | 2   |
| D2, A2, B2 | 3     | 3   |
| D3, A3, B3 | 4     | 4   |
| D4, A4, B4 | 2     | 2   |
| D9         | 5     | 5   |
| TA1, TB1   | 6     | 6   |
| K1         | 1     | 1   |

ELECTRICAL DATA

Solenoids are made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a retainer, and can be indexed 360°, to suit the clearance space.

It is possible to feed D48 and D110 coils with alternating current (50 or 60 Hz) using connectors with built-in Graetz bridge rectifier. Consider a reduction of the operating limits. (see diagram in page 6)

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

Use coil codes in the table below to order spare parts.

|  |                              |
|--|------------------------------|
| <b>DUTY CYCLE</b>                          | 100%                         |
| <b>MAXIMUM SWITCH ON FREQUENCY</b>         | 10,000 cycles/hr             |
| <b>SUPPLY VOLTAGE FLUCTUATION</b>          | ± 10% Vnom                   |
| <b>ELECTROMAGNETIC COMPATIBILITY (EMC)</b> | 2014/30/EU                   |
| <b>LOW VOLTAGE</b>                         | 2014/35/EU                   |
| <b>PROTECTION CLASS FOR INSULATION</b>     | copper wire class H (180 °C) |
|  | coil class F (155 °C)        |

(values ± 10%)

|             | Nominal voltage [V] | Resistance at 20°C [Ω] | Current consumpt. [A] | Power consumpt [W] | Coil code |         |         |            |            |            |
|-------------|---------------------|------------------------|-----------------------|--------------------|-----------|---------|---------|------------|------------|------------|
|             |                     |                        |                       |                    | K1        | K2      | K7      | WK1        | WK7        | WK7D       |
| <b>D12</b>  | 12                  | 4,4                    | 2,72                  | 32,7               | 1903080   | 1903100 | 1902940 | 3984000001 | 3984000101 | 3984000111 |
| <b>D14</b>  | 14                  | 7,2                    | 1.93                  | 27                 | 1903086   |         |         |            |            |            |
| <b>D24</b>  | 24                  | 18,6                   | 1,29                  | 31                 | 1903081   | 1903101 | 1902941 | 3984000002 | 3984000102 | 3984000112 |
| <b>D26</b>  | 26,4                | 21,8                   | 1,21                  | 32                 |           |         |         | 3984000003 | 3984000103 |            |
| <b>D28</b>  | 28                  | 26                     | 1,11                  | 31                 | 1903082   |         |         |            |            |            |
| <b>D48</b>  | 48                  | 78,6                   | 0,61                  | 29,5               | 1903083   |         |         |            |            |            |
| <b>D110</b> | 110                 | 423                    | 0,26                  | 28,2               | 1903464   |         |         |            |            |            |

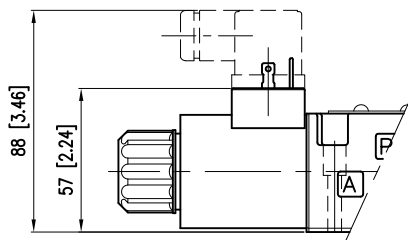
## HDS3 - Electrical Connection and IP Degree

Declared IP degrees are intended according to EMC 2014/30/EU, only for both valve and connectors of an equivalent IP degree, installed properly.

WK1, WK7 and WK7D coils reach a better IP degree than standard coils thanks to the zinc-nickel plating and to some constructive measures. The valves with these coils have a salt spray resistance up to 600 hours (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

Mating connectors are not included in solenoid valves delivery. Connectors for K1 and WK1 coils can be ordered separately.

## K1

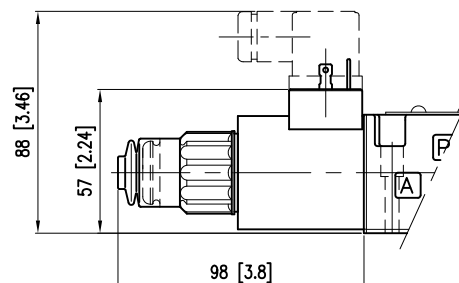
**DIN 43650 (EN 175301-803)**

Mating connectors type ISO 4400 / DIN 43650 (EN 175301-803).

IP degree of electrical connection: IP65

IP degree of whole valve: IP65

## WK1

**DIN 43650 (EN 175301-803)**

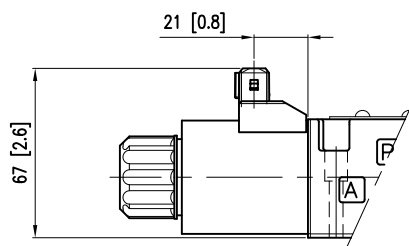
Zinc-nickel plated coil.

IP degree of electrical connection: IP66

IP degree of whole valve: IP66

The pin for manual override is boot-protected (code B).

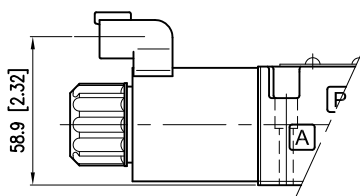
## K2

**AMP Junior**

IP degree of electrical connection: IP65/IP67

IP degree of whole valve: IP65

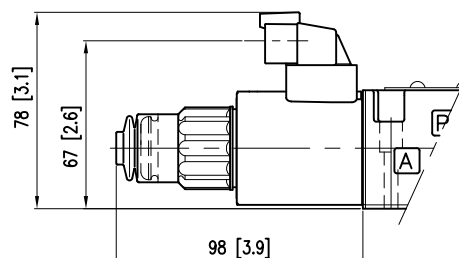
## K7

**DEUTSCH DT04 MALE**

IP degree of electrical connection: IP65/IP67

IP degree of whole valve: IP65

## WK7 / WK7D

**DEUTSCH DT04 MALE**

Zinc-nickel plated coil.

IP degree of electrical connection: IP66/IP68/IP69 -

IP degree of whole valve: IP66/IP68/IP69

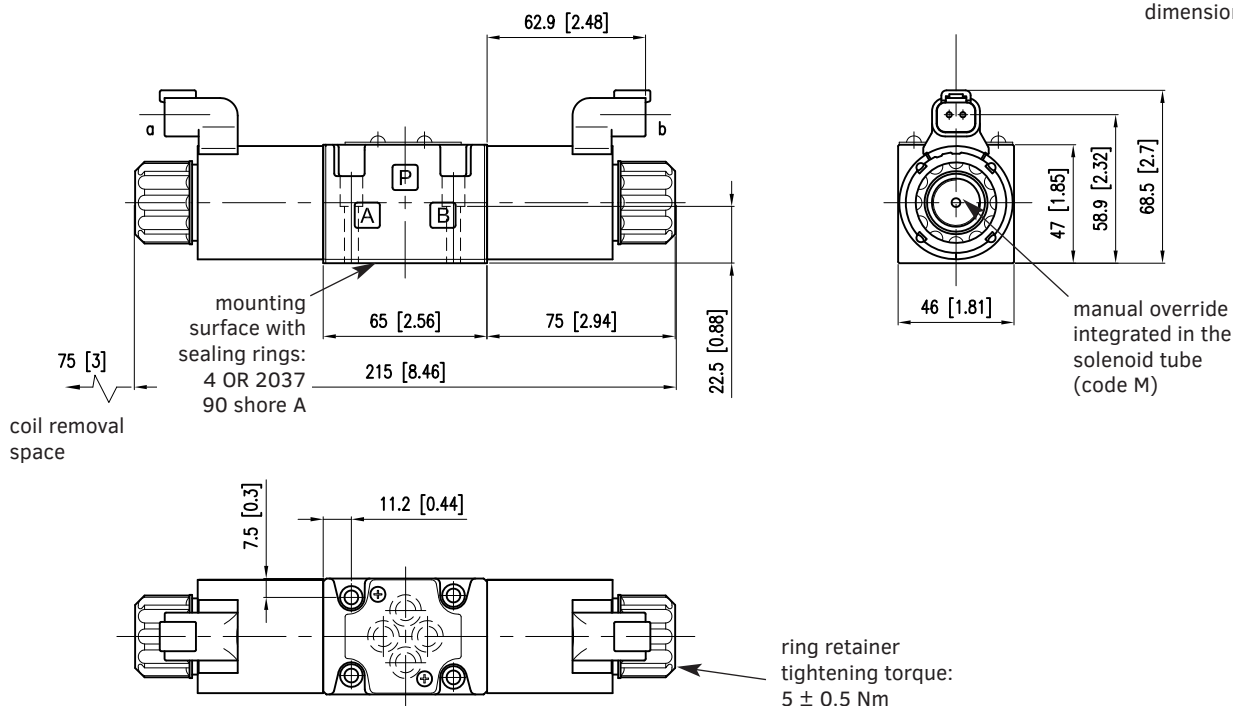
IP degree according to ISO 20653: IP69K

The pin for manual override is boot-protected (code B).

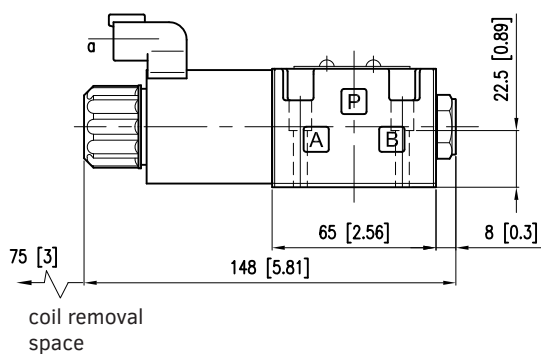


### HDS3 DOUBLE SOLENOID (K7 COIL)

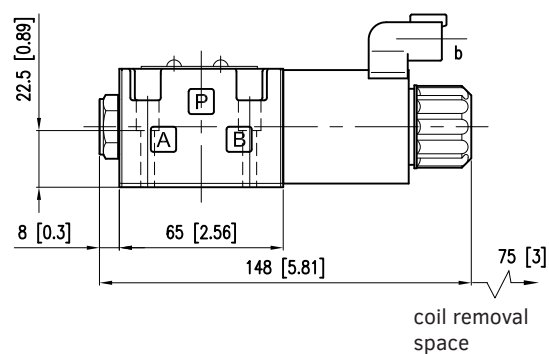
dimensions in mm [in]



### HDS3 SINGLE SOLENOID SIDE A (K7 COIL)



### HDS3 SINGLE SOLENOID SIDE B (K7 COIL)



#### Fastening bolts:

4 SHCS M5x30 - ISO 4762 - torque 5 Nm (A 8.8)

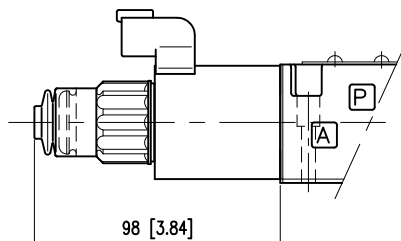
Threads of mounting holes: M5x10

The standard valve has override pins integrated in the tube.  
The operation of this control must be executed with a suitable tool, carefully not to damage the sliding surface.

Further manual overrides are available, entering the proper code in the model number.

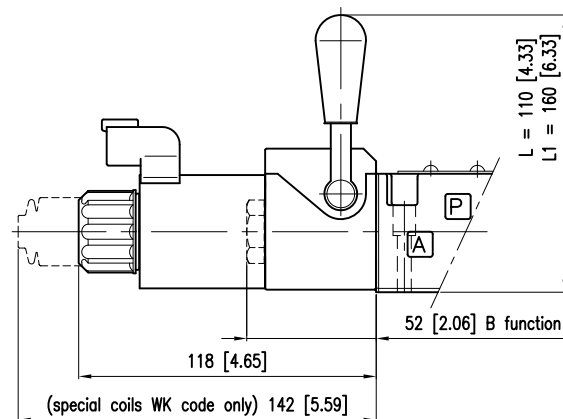
#### VERRIDE PINS INTEGRATED THE TUBE, BOOT PROTECTED

Code B



#### HAND LEVER

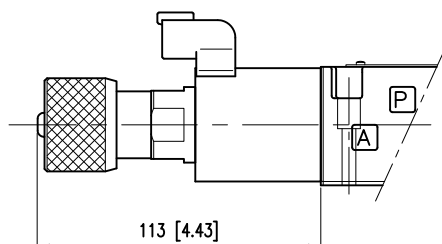
Codes L, L1



The lever device is always placed on side A, with the exception of the valves type HDS3-TB.  
Valves with WK coils are equipped with the boot for solenoid tube protection.

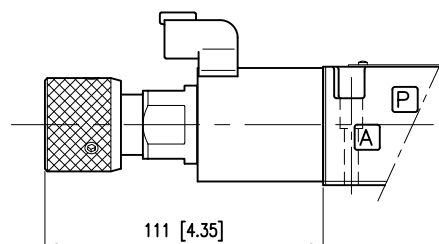
#### NOB, TURNING

Code K



#### NOB, TWIST AND LOCK

Code K2



### IP DEGREE TIPS

The technical reference standard for IP degree is IEC 60529, which classifies and rates the degree of protection provided by equipments and electrical enclosures against intrusions.

The first digit (6) concerns the protection from solid particles (body parts to dust).

The second digit of the IP rating concerns the liquid ingress protection. It indicates three different types of atmospheric agents from which protection is provided:

Values from 1 to 6 → water jets.

Values 7 and 8 → immersion.

Value 9 → high pressure and high temperature water jets.

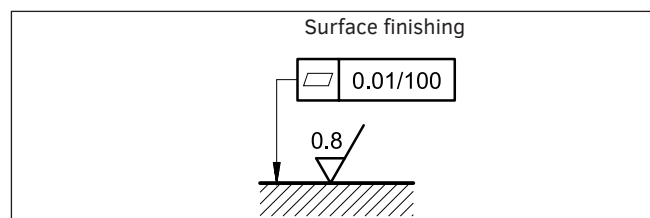
This means that IP66 covers all the lower steps, rating IP68 covers IP67 but not IP66 and lower. Instead, IP69 does not cover any of them. Whether a device meets two types of protection requirements it must be indicated by listing both separated by a slash. (E.g. a marking of an equipment covered both by temporary immersion and water jets is IP66/IP68).

### INSTALLATION

These valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



Supported by a worldwide network



## CONTACT INFORMATION

### EMEA

|                |   |                       |                         |
|----------------|---|-----------------------|-------------------------|
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| <b>ITALY</b>   | Hydreco Hydraulics Italia Srl, Vignola (MO) | ☎ +39 059 7700411     | ✉ sales-it@hydreco.com  |
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| <b>NORWAY</b>  | Hydreco Hydraulics Norway AS, Nittedal      | ☎ +47 22909410        | ✉ post-no@hydreco.com   |
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### AMERICAS

|                    |   |                   |                     |
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### APAC

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|------------------|---|-------------------|----------------------------|
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| <b>INDIA</b>     | Hydreco Hydraulics India Private Ltd, Bangalore | ☎ +91 80 67656300 | ✉ sales-in@hydreco.com     |