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.

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**OPERATING PARAMETERS**

<table>
<thead>
<tr>
<th>MAXIMUM OPERATING PRESSURE</th>
<th>P - A - B ports</th>
<th>350 bar</th>
<th>5000 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>T port</td>
<td>210 bar</td>
<td>3000 psi</td>
<td></td>
</tr>
</tbody>
</table>

**FLOW RATE**

| Flow Rate | 80 l/min | 21.1 gpm |

**MOUNTING SURFACE**

| ISO 4401-03-02-0-05 NFPA D03 |

**STEP RESPONSE**

| 0 → 100% | 50 ms |
| 100 → 0% | 40 ms |

**WEIGHT**

| Single solenoid | 1.5 kg | 3.3 lbs |
| Double solenoid | 2 kg   | 4.4 lbs |

**RANGE TEMPERATURES**

| Ambient   | -20 to +54 °C | -4 to +130 °F |
| Fluid     | -20 to +82 °C | -4 to +180 °F |

**FLUID VISCOSITY**

| Range       | 10 - 400 cSt | 60 - 1900 SUS |
| Recommended | 25 cSt       | 120 SUS       |

**FLUID CONTAMINATION**

ISO 4406:1999 class 20/18/15
### FUNCTION

<table>
<thead>
<tr>
<th>Model</th>
<th>Side</th>
<th>Solenoid</th>
<th>Positions</th>
<th>Spring Return</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D</strong></td>
<td>A/B</td>
<td>A/B</td>
<td>3</td>
<td>centered</td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>a/b</td>
<td>a/b</td>
<td>2</td>
<td>return</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>a/b</td>
<td>a/b</td>
<td>2</td>
<td>return</td>
</tr>
<tr>
<td><strong>RA</strong></td>
<td>a/b</td>
<td>a/b</td>
<td>2</td>
<td>return</td>
</tr>
<tr>
<td><strong>RB</strong></td>
<td>a/b</td>
<td>a/b</td>
<td>2</td>
<td>return</td>
</tr>
<tr>
<td><strong>TA</strong></td>
<td>a/b</td>
<td>a/b</td>
<td>2</td>
<td>return</td>
</tr>
<tr>
<td><strong>TB</strong></td>
<td>a/b</td>
<td>a/b</td>
<td>2</td>
<td>return</td>
</tr>
<tr>
<td><strong>K</strong></td>
<td>a/b</td>
<td>a/b</td>
<td>2</td>
<td>return</td>
</tr>
</tbody>
</table>

**D** - Double solenoid, 3 positions - spring centered

**A** - Single solenoid at Side A, 2 positions - spring return

**B** - Single solenoid at Side B, 2 positions - spring return

**RA** - Single solenoid at Side A, 2 positions - spring return

**RB** - Single solenoid at Side B, 2 positions - spring return

**TA** - Single solenoid at Side A, 2 positions - spring return

**TB** - Single solenoid at Side B, 2 positions - spring return

**K** - Double solenoid and detent

### VOLTAGE

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>D12</td>
<td>12 V DC solenoid</td>
</tr>
<tr>
<td>D14</td>
<td>14 V DC solenoid</td>
</tr>
<tr>
<td>D24</td>
<td>24 V DC solenoid</td>
</tr>
<tr>
<td>D28</td>
<td>28 V DC solenoid</td>
</tr>
<tr>
<td>D48</td>
<td>48 V DC solenoid</td>
</tr>
<tr>
<td>D110</td>
<td>110 V DC solenoid</td>
</tr>
<tr>
<td>D00</td>
<td>Without coils</td>
</tr>
</tbody>
</table>

### COIL

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>DIN 43650</td>
</tr>
<tr>
<td>K2</td>
<td>AMP Junior</td>
</tr>
<tr>
<td>K7</td>
<td>DT04-2P 'deutsch'</td>
</tr>
<tr>
<td>WK1</td>
<td>DIN 43650 zinc-nickel plated</td>
</tr>
<tr>
<td>WK7</td>
<td>DT04-2P 'deutsch' zinc-nickel plated</td>
</tr>
<tr>
<td>WK7D</td>
<td>DT04-2P 'deutsch' zinc-nickel plated with diode</td>
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### SEAL

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<tr>
<td>N</td>
<td>NBR (standard)</td>
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<tr>
<td>V</td>
<td>Viton</td>
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### CODE EXAMPLES:

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

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

**HDS3 - Spools**

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Function D</strong></td>
<td><img src="image1" alt="Diagram" /></td>
</tr>
<tr>
<td><strong>Function A</strong></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td><strong>Function B</strong></td>
<td><img src="image3" alt="Diagram" /></td>
</tr>
<tr>
<td><strong>Function RA</strong></td>
<td><img src="image4" alt="Diagram" /></td>
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<tr>
<td><strong>Function RB</strong></td>
<td><img src="image5" alt="Diagram" /></td>
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<tr>
<td><strong>Function TA</strong></td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
<tr>
<td><strong>Function TB</strong></td>
<td><img src="image7" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**Diagram Details:**
- Spool configurations are shown for each function.
- The diagrams illustrate the flow paths for different spool positions.
Flow characteristic curves obtained with mineral oil with viscosity of 36 cSt (170 sus) at 50 °C (122 °F) and 24V DC valve; the Δp values are measured between P and T (full loop) valve ports.

**PRESSURE DROPS Δp-Q**

**ENERGIZED POSITION**

<table>
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<th>TYPE</th>
<th>FLOW DIRECTION</th>
<th>CURVES ON GRAPH</th>
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<tbody>
<tr>
<td></td>
<td>P→A</td>
<td>P→B</td>
</tr>
<tr>
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<td>2</td>
</tr>
<tr>
<td>D2, A2, B2</td>
<td>1</td>
<td>1</td>
</tr>
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<td>D3, A3, B3, RA3, RB3</td>
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<td>3</td>
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<td>5</td>
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<tr>
<td>D5</td>
<td>2</td>
<td>1</td>
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<tr>
<td>D6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>D7, D8</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D9</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>D10</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>D11</td>
<td>2</td>
<td>2</td>
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<tr>
<td>D12, D17, D19</td>
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<td>2</td>
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<tr>
<td>D18</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D20, D22</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>D21, D23</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>TA1, TB1</td>
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<td>K1, K2, K3</td>
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**DE-ENERGIZED POSITION**

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</thead>
<tbody>
<tr>
<td></td>
<td>P→A</td>
<td>P→B</td>
</tr>
<tr>
<td>D2, A2, B2</td>
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</tr>
<tr>
<td>D3, A3, B3, RA3, RB3</td>
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</tr>
<tr>
<td>D4, A4, B4, RA4, RB4</td>
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<td>3</td>
</tr>
<tr>
<td>D5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>D6</td>
<td>3</td>
<td></td>
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<tr>
<td>D7, D8</td>
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<td>6</td>
</tr>
<tr>
<td>D9</td>
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<td>3</td>
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<td>D10</td>
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<tr>
<td>D11</td>
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<td></td>
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<tr>
<td>D18</td>
<td>4</td>
<td></td>
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<tr>
<td>D22, D23</td>
<td></td>
<td>6</td>
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</table>
* 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.
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.

(values ± 10%)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>D12</td>
<td>12</td>
<td>4,4</td>
<td>2,72</td>
<td>32,7</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>K1 1903080</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>K2 1903100</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>K7 1902940</td>
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<td>WK1 1903590</td>
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<td></td>
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<td>WK7 1903580</td>
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<td></td>
<td>WK7D 1903600</td>
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<td>27</td>
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<td></td>
<td></td>
<td></td>
<td>K1 1903086</td>
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<tr>
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<td>24</td>
<td>18,6</td>
<td>1,29</td>
<td>31</td>
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<td></td>
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<td>K1 1903081</td>
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<td></td>
<td>K2 1903101</td>
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<td></td>
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<td></td>
<td>K7 1902941</td>
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<td>WK1 1903591</td>
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<td>WK7 1903581</td>
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<td></td>
<td></td>
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<td>WK7D 1903601</td>
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<td>D26</td>
<td>26,4</td>
<td>21,8</td>
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<td>32</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>K1 1903599</td>
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<tr>
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<td></td>
<td></td>
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<td>K2 1903589</td>
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<tr>
<td>D28</td>
<td>28</td>
<td>26</td>
<td>1,11</td>
<td>31</td>
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<td>K1 1903082</td>
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<td>48</td>
<td>78,6</td>
<td>0,61</td>
<td>29,5</td>
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<td>K1 1903083</td>
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<td>D110</td>
<td>110</td>
<td>423</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>K1 1903464</td>
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</tbody>
</table>
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]
- Mounting surface with sealing rings: 4 OR 2037 90 shore A
- Coil removal space
- Ring retainer tightening torque: 5 ± 0.5 Nm

HDS3 SINGLE SOLENOID SIDE A (K7 COIL)

- Fastening bolts: 4 SHCS M5x30 - ISO 4762 - torque 5 Nm (A 8.8)
- Threads of mounting holes: M5x10

HDS3 SINGLE SOLENOID SIDE B (K7 COIL)

- Manual override integrated in the solenoid tube (code M)
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.

**OVERRIDE 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.

**KNOB, TURNING**

Code K

**KNOB, 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**

<table>
<thead>
<tr>
<th>Region</th>
<th>Company Name</th>
<th>Phone Numbers</th>
<th>Email Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EMEA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Germany</td>
<td>Hydreco Hydraulics GmbH, Straelen (NRW)</td>
<td>+49 283494303-41</td>
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<td><a href="mailto:sales-it@hydreco.com">sales-it@hydreco.com</a></td>
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<td>Hydreco Hydraulics Italia Srl, Parma (PR)</td>
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<td><a href="mailto:post-no@hydreco.com">post-no@hydreco.com</a></td>
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<td>UK</td>
<td>Hydreco Hydraulics Ltd, Poole, Dorset</td>
<td>+44 (0) 1202 627500</td>
<td><a href="mailto:info-uk@hydreco.com">info-uk@hydreco.com</a></td>
</tr>
<tr>
<td><strong>AMERICAS</strong></td>
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</tr>
<tr>
<td>North/Latin</td>
<td>Hydreco Inc / Continental Hydraulics Inc, Shakopee (MN)</td>
<td>+1 952 895 6400</td>
<td><a href="mailto:sales@conthyd.com">sales@conthyd.com</a></td>
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<tr>
<td><strong>APAC</strong></td>
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<tr>
<td>Australia</td>
<td>Hydreco Hydraulics Pty Ltd, Seven Hills (NSW)</td>
<td>+61 2 9838 6800</td>
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<td>Australia</td>
<td>Hydreco Hydraulics Pty Ltd, Welshpool (WA)</td>
<td>+61 8 9377 2211</td>
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<tr>
<td>India</td>
<td>Hydreco Hydraulics India Private Ltd, Bangalore</td>
<td>+91 80 67656300</td>
<td><a href="mailto:sales-in@hydreco.com">sales-in@hydreco.com</a></td>
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**world@hydreco.com**