3-way Proportional pressure reducing valve, pilot operated

Type 3DRE(M) and 3DRE(M)E

Component series L6X
NG 10 and 16
Max pressure 315 bar
Max flow: 125L/min(size 10) 300L/min(size 16)

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Features

- Pilot operated valve for reducing a pressure (P to A) and limiting (A to T) a system pressure
- Actuation by proportional solenoid
- Maximum pressure relief function, optional
- Valve and control electronics from a single source
- Control electronics for type 3DRE(M):
  - Analogue amplifier type VT-VSPA1(K)-1 in Euro-card format
  - Digital amplifier type VT-VSPD-1 in Euro-card format
  - Analogue amplifier type VT 11131 of modular design
- Linear command value/pressure characteristic curve
- Integrated electronics (OBE) with type 3DRE(M)E:
  - Low manufacturing tolerance of the command value/pressure characteristic curve
  - Ramp times can be adjusted separately for pressure build-up
Valves of types 3DRE(M) and 3DRE(M)E are electrically pilot operated 3-way pressure reducing valves with pressure relief function for the actuator. They are used to reduce a system pressure.

Technical structure:
The valves consist of three main assemblies:
1) Pilot valve (1) optionally with maximum pressure relief function (16)
2) Proportional solenoid (2)
3) Main valve (3) with main spool (4)

Function:
General function:
Command value-related adjustment of the pressure to be reduced in channel A by proportional solenoid (2).
When no pressure is applied in port P, main spool (4) is held by springs (5) and (6) in the central position. Here, the connections from P to A and A to T are closed. Pilot oil flows from bore (7) via flow controller (8), pilot valve (1) to orifice (9), throttling gap (10), pipe (11) to port Y. This port must be connected at zero pressure to the tank.

Pressure reduction:
Build-up of pilot pressure in control chamber (12) as a function of the command value. Pressure is built up in spring chamber (14) via orifice (13) and the main spool is shifted to the right. Hydraulic fluid flows from P to A. The actuator pressure in port A is applied to spring chamber (15).
An increase in the pressure in port A to the pressure set on pilot valve (1) causes main spool (4) to be pushed to the left. The pressure in port A becomes virtually the same as the pressure set on pilot valve (1).

Pressure relief function:
When the pressure in port A exceeds the pressure set on pilot valve (1), main spool (4) is shifted further to the left. This causes the connection from A to T to open and limits the pressure applied in port A to the set command value.

Type 3DRE(M):
The valve is optionally available with an additional spring-loaded pilot valve (16) to provide a maximum pressure relief function.

Types 3DREE and 3DREME
– with integrated electronics (OBE):
In terms of function and structure, these valves correspond to types 3DRE and 3DREM, except for the integrated electronics.
The electronics receives the supply and command value voltage via cable socket.
The command value/pressure characteristic curve (zero point on spindle (17) and the gradient are adjusted in the factory with narrow tolerances on the \( I_{\text{max}} \) potentiometer in the electronics.
The ramp time for pressure build-up and pressure reduction can be adjusted independently of each other with the help of two potentiometers.
## Symbols

<table>
<thead>
<tr>
<th>3DRE...Y...</th>
<th>3DREM...Y...</th>
<th>3DRE...XY...</th>
<th>3DREM...XY...</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P</td>
<td>T</td>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3DREE...Y...</th>
<th>3DREME...Y...</th>
<th>3DREE...XY...</th>
<th>3DREME...XY...</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P</td>
<td>T</td>
<td>Y</td>
</tr>
</tbody>
</table>

## Ordering code

<table>
<thead>
<tr>
<th>3DRE</th>
<th>P</th>
<th>L6X</th>
<th>G24</th>
<th>V</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Without maximum pressure relief function = No code
- With maximum pressure relief function = M
- For external control electronics = No code
- With integrated electronics (OBE) = E
- Size 10 = 10
- Size 16 = 16
- Subplate mounting = P
- Component series 60 to 69 = L6X
  (60 to 69: unchanged installation and connection dimensions)

### Pressure stage
- 50 bar = 50
- 100 bar = 100
- 200 bar = 200
- 250 bar (size 16 only) = 250
- 315 bar (size 10 only) = 315

### Supply voltage for control electronics
- G24 = 24V DC

### Pilot oil supply and pilot oil drain
- Y = Pilot oil supply internal, pilot oil drain external
- XY = Pilot oil supply external, pilot oil drain external

Further details in clear text:
- V = FKM seals, suitable for phosphate ester (HFD-R)
  - No code = NBR seals
- For type 3DRE(M):
  - \( A_1 \) = Command/actual value 0 to 10V
  - \( F_1 \) = Command/actual value 4 to 20mA
- For type 3DRE(M):
  - \( K_4 \) = Without plug-in connector
  - \( Z_4 \) = With plug-in connector
- For type 3DRE(M):
  - \( K_31 \) = Without plug-in connector
  - \( Z_31 \) = With plug-in connector
## Technical data

### General

<table>
<thead>
<tr>
<th></th>
<th>10</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>3DRE and 3DREM kg</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>3DREE and 3DREME kg</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>Installation orientation</strong></td>
<td>Optional, preferably horizontal</td>
<td></td>
</tr>
<tr>
<td><strong>Storage temperature range</strong></td>
<td>°C</td>
<td>-20 to +80</td>
</tr>
<tr>
<td><strong>Ambient temperature range</strong></td>
<td>3DRE and 3DREM °C</td>
<td>-20 to +70</td>
</tr>
<tr>
<td></td>
<td>3DREE and 3DREME °C</td>
<td>-20 to +50</td>
</tr>
</tbody>
</table>

### Hydraulic (measured with HLP46; $\theta_{oil}=40^\circ\text{C} \pm 5^\circ\text{C}$ and $p = 100\text{bar}$)

<table>
<thead>
<tr>
<th></th>
<th>10</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max. operating pressure</strong></td>
<td>Ports P, A and X bar</td>
<td>315</td>
</tr>
<tr>
<td></td>
<td>Port Y bar</td>
<td>separately and at zero pressure to tank</td>
</tr>
<tr>
<td><strong>Max. set pressure in channel A</strong></td>
<td>Pressure stage 50bar bar</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 100bar bar</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 200bar bar</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 250bar bar</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 315bar bar (size 10 only)</td>
<td>315</td>
</tr>
<tr>
<td><strong>Min. set pressure channel A at zero command value</strong></td>
<td>see characteristic curves</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum pressure relief function (infinitely adjustable)</strong></td>
<td>Pressure stage 50bar bar</td>
<td>30 to 70</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 100bar bar</td>
<td>50 to 130</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 200bar bar</td>
<td>90 to 230</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 250bar bar</td>
<td>100 to 250</td>
</tr>
<tr>
<td></td>
<td>Pressure stage 315bar bar</td>
<td>150 to 350</td>
</tr>
<tr>
<td><strong>Max. permissible flow</strong></td>
<td>L/min</td>
<td>125</td>
</tr>
<tr>
<td><strong>Pilot oil flow</strong></td>
<td>L/min</td>
<td>1</td>
</tr>
<tr>
<td><strong>Hydraulic fluid</strong></td>
<td>Mineral oil (HL, HLP) to DIN 51524; further hydraulic fluids on enquiry!</td>
<td></td>
</tr>
<tr>
<td><strong>Hydraulic fluid temperature range</strong></td>
<td>°C</td>
<td>-20 to +70</td>
</tr>
<tr>
<td><strong>Viscosity range</strong></td>
<td>mm$^2$/s</td>
<td>20 to 380</td>
</tr>
<tr>
<td><strong>Degree of contamination</strong></td>
<td>Maximum permissible degree of fluid contamination: Class 9.NAS 1638 or 20/18/15, ISO4406</td>
<td></td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td>%</td>
<td>±2 of max. set pressure</td>
</tr>
<tr>
<td><strong>Repeatability</strong></td>
<td>%</td>
<td>&lt; ±2 of max. set pressure</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>%</td>
<td>±3.5 of max. set pressure</td>
</tr>
<tr>
<td><strong>Manufacturing tolerance of command value/pressure char. curve, referred to hysteresis curve, increasing pressure</strong></td>
<td>3DRE and 3DREM %</td>
<td>±2.5 of max. set pressure</td>
</tr>
<tr>
<td></td>
<td>3DREE and 3DREME %</td>
<td>±1.5 of max. set pressure</td>
</tr>
<tr>
<td><strong>Switching time</strong></td>
<td>ms</td>
<td>100 to 200 (depending on system)</td>
</tr>
</tbody>
</table>
# Technical data

## Electrical

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Min. control current mA</td>
<td>100</td>
</tr>
<tr>
<td>Max. control current mA</td>
<td>1600</td>
</tr>
<tr>
<td>Max. control current mA</td>
<td>1440 to 1760</td>
</tr>
<tr>
<td>Solenoid coil resistance Ω</td>
<td>5.4</td>
</tr>
<tr>
<td>Max. hot value Ω</td>
<td>7.8</td>
</tr>
<tr>
<td>Duty cycle %</td>
<td>100</td>
</tr>
<tr>
<td>Electrical connection</td>
<td></td>
</tr>
<tr>
<td>3DRE and 3DREM</td>
<td>With component plug to DIN EN 175301-803</td>
</tr>
<tr>
<td></td>
<td>Cable socket to DIN EN 175301-803</td>
</tr>
<tr>
<td>3DREE and 3DREME</td>
<td>With component plug to DIN EN 175201-804</td>
</tr>
<tr>
<td></td>
<td>Cable socket to DIN EN 175201-804</td>
</tr>
</tbody>
</table>

## Control electronics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated electronics (OBE)</td>
<td>Integrated in the valve</td>
</tr>
<tr>
<td>External control electronics</td>
<td></td>
</tr>
<tr>
<td>3DRE and 3DREM</td>
<td>VT-VSPA1(K)-1</td>
</tr>
<tr>
<td>3DREE and 3DREME</td>
<td>VT-VSPD-1</td>
</tr>
<tr>
<td>Amplifier in Euro-card format</td>
<td>VT 11131</td>
</tr>
<tr>
<td>Amplifier of modular design</td>
<td></td>
</tr>
</tbody>
</table>
Electrical connections, plug-in connectors

- For type 3DRE(M) (without integrated electronics))

Connections on the component plug:
Cable socket to DIN EN 175301-803 or ISO4400

Connections on the plug-in connector:

- For type 3DRE(M)E (with integrated electronics (OBE))

For pin allocation also see block circuit diagram.
Plug-in connector to DIN EN 175201-804
**Integrated electronics (OBE) of Types DREE and DREM E**

**Function:**
The integrated electronics is controlled via the two differential amplifier connections D and E. The ramp generator generates from a command value step change (0 to 10 V or 10 to 0 V) a delayed increase or drop of the solenoid current. Potentiometer R14 can be used to adjust the rise time, potentiometer R13 to adjust the drop time of the solenoid current. The maximum ramp time of 5 s is only possible over the full command value range. In the case of minor changes in the command value, the ramp time shortens accordingly. The command value/solenoid current characteristic curve is adjusted to the valve by means of the characteristic curve generator so that non-linearities in the hydraulic system are compensated for and a linear command value/pressure characteristic curve is obtained.

The current regulator regulates the solenoid current independently of the solenoid coil resistance. Potentiometer R30 can be used to change the gradient of the command value/current characteristic curve and hence the gradient of the command value/pressure characteristic curve of the proportional pressure control valve.

Potentiometer R43 serves for adjusting the biasing current. This setting should not be changed. If required, adjust the zero point of the command value/pressure characteristic curve on the valve seat.

A chopper amplifier forms the power stage of the electronics for controlling the proportional valve. It is pulsewidth-modulated with a clock frequency of 300 Hz.

The solenoid current can be measured at both measuring sockets MP1 and MP2. A voltage drop of 0.352 V at the measuring resistor corresponds to a solenoid current of 1.6 A.

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**Block circuit diagram / pin assignment of integrated electronics**
**Integrated electronics (OBE) of Types DREE and DREM**

*Supply voltage*

Power supply unit with rectifier.
- Single-phase rectification or three-phase current bridge: $U_{\text{eff}} = 22$ to 33V
- Residual ripple content on the power supply unit: $\leq 5\%$
- Output current: $I_{\text{eff}} = \text{max. } 1.4\text{A}$
- **Supply cable:**
  - Recommended: 5-wire, 0.75 or 1 mm$^2$
  - with protective conductor and shield
  - Outer diameter 6.5 to 11 mm
  - Shield to 0 V supply voltage
  - Max. permissible length 100 m

The minimum supply voltage of the power supply unit depends on the length of the supply cable (see diagram). In the case of lengths >50 m, a capacitor of 2200μ must be provided in the supply cable in the vicinity of valve.
Characteristic curves (measured with HLP46, $\theta_{av}=40^\circ C \pm 5^\circ C$ and $p=100$bar)

- Pressure in channel A - command value (measured at flow 0 L/min)

- Pressure in channel A – flow

- Min. set pressure – flow
Unit dimensions

Size 10

1. Main valve
2. Pilot valve
3. Proportional solenoid
4. Maximum pressure relief function (Type 3DREM...)
5. Identical seal rings for ports A, B, P, T (R-ring 13×1.6×2),
6. Identical seal rings for ports X and Y (11.18×1.6×1.78),
7. Machined mounting face, position of ports to DIN24340 A, ISO 4401 and CETOP-RP 121 H
8. In the case of "internal" pilot oil supply (version Y), port X on the subplate must be plugged.
9. Port B on the subplate must be plugged

Valve fixing screws:
4 socket head cap screws
M6×45 GB/T 70.1-10.9;
tightening torque Mₐ=15.5Nm

Required surface quality of mounting face
Unit dimensions (nominal dimensions in mm)

Size 16

1. Main valve
2. Pilot valve
3. Proportional solenoid
4. Maximum pressure relief function (Type 3DREM...)
5. Identical seal rings for ports A, B, P, T (22.53 × 2.3 × 2.62),
6. Identical seal rings for ports X and Y (10 × 2 × 2),
7. Machined mounting face, position of ports to DIN24 340 A, ISO 4401 and CETOP-RP 121 H
8. In the case of “internal” pilot oil supply (version Y), port X on the subplate must be plugged.
9. Ports B and L on the subplate must be plugged

Valve fixing screws:
4 socket head cap screws
M10 × 60 GB/T 70.1-10.9;
tightening torque Mₙ = 73 Nm
2 socket head cap screws
M6 × 55 GB/T 70.1-10.9;
tightening torque Mₙ = 15.5 Nm

Required surface quality of mounting face

0.01/100mm

0.8
**Pilot oil supply**

- **Type 3DRE...-...XY**
  - Pilot oil supply external
  - Pilot oil drain external

  With this version, the pilot oil is supplied from a separate control circuit (external). The pilot oil drain is not directed to the T-channel of the main valve, but fed separately to the tank via port Y (external).

- **Type 3DRE.../...Y...**
  - Pilot oil supply internal
  - Pilot oil drain external

  With this version, the pilot oil is supplied from the P-channel of the main valve (internal). The pilot oil drain is not directed to the T-channel of the main valve, but fed separately to the tank via port Y (external). Port X on the subplate must be plugged.