**MD1D**

**SOLENOID OPERATED**

**DIRECTIONAL CONTROL VALVES**

**DIRECT CURRENT - SERIES 50**

**ALTERNATING CURRENT - SERIES 55**

**CETOP 03**

\[ p_{\text{max}} = 350 \text{ bar} \]

\[ Q_{\text{max}} = 75 \text{ l/min} \]

**MOUNTING INTERFACE**

CETOP 4.2-4-03-350
ISO/CD 4401-03

1) Cast iron body with wide moulded passages.
2) Wet armature solenoids, with movable parts immersed in oil, in direct current or alternating current.
3) Interchangeable spools for various centre types and hydraulic configurations.

A wide range of versions, with different spool positions at rest, are available:

- **Type S**: 4-way, 3-position directional valve, with two solenoids; positioning of spool at rest is obtained with centering springs.
- **Type TA/TC**: 4-way, 2-position directional valve, with one solenoid; spool position at rest is obtained with a return spring.
- **Type RK**: 4-way, 2-position directional valve, with two solenoids; with mechanical detent of the extreme spool positions when solenoids are de-energized.
- **Version 23**: 3-way, 2-position directional valve, with one solenoid; positioning of spool at rest is obtained with a return spring.

**OPERATING PRINCIPLE**

1) Cast iron body with wide moulded passages.
2) Wet armature solenoids, with movable parts immersed in oil, in direct current or alternating current.
3) Interchangeable spools for various centre types and hydraulic configurations.

**PERFORMANCE RATINGS** (working with mineral oil of viscosity of 36 cSt at 50°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
</table>
| Max. working pressure:             | \[
| – ports P A B                      | 350 bar                                    |
| – port T                           | 140 bar                                    |
| Maximum flow rate:                 | \[
| – from port P to A or B            | 75 l/min                                    |
| – from port A or B to T            | 85 l/min                                    |
| Ambient temperature range          | °C –20 +50                                  |
| Fluid temperature range            | °C –20 +80                                  |
| Fluid viscosity range              | cSt 10 + 400                               |
| Recommended viscosity              | cSt 25                                      |
| Degree of fluid contamination      | According to NAS 1638 class 10             |
| Mass: MD1D-S, RK                   | kg 2                                        |
| MD1D-TA/TC                         | kg 1.5                                      |

41 200/103 ED 1/8
1 - IDENTIFICATION CODE

MD1D - / - / / 

Solenoid operated directional control valve

CETOP 03 size

Model

Number of ways: omit for 4-way
23 for 3-way

Configuration: S - TA - TC - RK
type of centre and connection diagram (see table 2)

Seals: omit for mineral oils
V = viton for special fluids

CM = manual override, boot protected (omit if not required)

Electrical supply features:
24 V-CC for direct current
110V-50Hz for alternating current
(for selection of other available voltages, see par. 6.2)

Series No.: 50 for DC solenoid valves
55 for AC solenoid valves
(the overall and mounting dimensions remain unchanged from 50 to 59)

2 - CONFIGURATIONS

Type S:
3 positions with spring centering

Type TA:
2 positions with return spring

Type TC:
2 positions with return spring

Type *TA:
2 positions with return spring

Type *TC:
2 positions with return spring

Type RK:
2 positions with mechanical detent

Model 23:
3-way with return spring
types TA and TC

23TA
23TC

Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids, with the addition of suitable anti-frothing and anti-oxidising agents.

For the use of other fluid types (water glycol, phosphate esters and others), please consult our technical department.

Using fluids at temperatures higher than 70°C causes a faster degrading of the fluid’s characteristics and of the seals. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS Δp-Q (obtained with viscosity of 36 cSt at 50 °C)
5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the solenoid valve pressure with DC and AC solenoids. The values have been obtained with viscosity 36 cSt, temperature 50 °C, filtration 25 µm and with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

<table>
<thead>
<tr>
<th>Curve</th>
<th>Type</th>
<th>Curve</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S4, S7, S8</td>
<td>4</td>
<td>S5, S10, S18</td>
</tr>
<tr>
<td>2</td>
<td>S2</td>
<td>5</td>
<td>S3, S6, S9, S11</td>
</tr>
<tr>
<td>3</td>
<td>S1, RK, TA</td>
<td>6</td>
<td>23</td>
</tr>
</tbody>
</table>

The values indicated in the two graphs can be considerably reduced if a 4-way valve is used with port A or B plugged.

5.1 Switching times

The values indicated refer to an S1 solenoid valve for Q=50 l/min, p=150 bar working with mineral oil at a temperature of 50°C, a viscosity of 36 cSt and with PA and BT connections. The energizing times are obtained at the time the spool switches over. The de-energizing times are measured at the time pressure variation occurs on the line.

<table>
<thead>
<tr>
<th>TIMES (±10%)</th>
<th>ENERGIZING</th>
<th>DE-ENERGIZING</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC solenoid</td>
<td>30 ms</td>
<td>40 ms</td>
</tr>
<tr>
<td>DC solenoid</td>
<td>50 ms</td>
<td>40 ms</td>
</tr>
</tbody>
</table>
6 - ELECTRICAL FEATURES

6.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded onto 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 tubes for alternating current supply are different than those for direct current and are recognizable by the letter “A” stamped on the rear, on the manual override side.

The coil is fastened to the tube by a threaded nut, and can be rotated 360°, compatible with the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current; alternating or direct (AC or DC / CCR).

6.2 Available voltages

Besides the standard voltages shown in the table, other special configurations are available upon request.

The CCR coils must be used when rectified current is used to supply a valve equipped with a DC tube.

Rectified current supply takes place by fitting a rectifier, externally or incorporated in the “D” type connectors, between the alternating current source (24 V or 110 V, /50 or /60 Hz) and the coil.

Direct current coils *VCC (values ± 5%)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>4,6</td>
<td>2,6</td>
<td>31,2</td>
<td>1901671</td>
</tr>
<tr>
<td>24</td>
<td>17,8</td>
<td>1,35</td>
<td>32,1</td>
<td>1901672</td>
</tr>
<tr>
<td>48</td>
<td>71,5</td>
<td>0,67</td>
<td>32,1</td>
<td>1901673</td>
</tr>
<tr>
<td>110</td>
<td>390</td>
<td>0,28</td>
<td>30,8</td>
<td>1901674</td>
</tr>
<tr>
<td>220</td>
<td>1510</td>
<td>0,15</td>
<td>32</td>
<td>1901675</td>
</tr>
</tbody>
</table>

Rectified current coils *V-CCR (values ± 5%)

<table>
<thead>
<tr>
<th>Nominal voltage [V]</th>
<th>Resistance at 20°C [ohm]</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>14,3</td>
<td>1901677</td>
</tr>
<tr>
<td>48</td>
<td>57,2</td>
<td>1901680</td>
</tr>
<tr>
<td>110</td>
<td>335</td>
<td>1901678</td>
</tr>
<tr>
<td>220</td>
<td>1284</td>
<td>1901679</td>
</tr>
</tbody>
</table>

Alternating current coils *V-Hz (values ± 5%)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>24</td>
<td>0,88</td>
<td>8,7</td>
<td>2,35</td>
<td>209</td>
<td>56,5</td>
<td>1902660</td>
</tr>
<tr>
<td>48</td>
<td>3,2</td>
<td>4,5</td>
<td>1,25</td>
<td>216</td>
<td>60</td>
<td>1902661</td>
<td></td>
</tr>
<tr>
<td>230</td>
<td>80</td>
<td>0,85</td>
<td>0,21</td>
<td>196</td>
<td>49</td>
<td>1902679</td>
<td></td>
</tr>
<tr>
<td>50/60</td>
<td>110V-50Hz</td>
<td>17,5</td>
<td>1,9</td>
<td>0,48</td>
<td>209</td>
<td>52,8</td>
<td>1902677</td>
</tr>
<tr>
<td></td>
<td>120V-60Hz</td>
<td>17,5</td>
<td>1,8</td>
<td>0,45</td>
<td>216</td>
<td>54</td>
<td>1902678</td>
</tr>
<tr>
<td></td>
<td>220V-50Hz</td>
<td>70</td>
<td>0,95</td>
<td>0,23</td>
<td>209</td>
<td>50,6</td>
<td>1902679</td>
</tr>
<tr>
<td></td>
<td>240V-60Hz</td>
<td>70</td>
<td>0,87</td>
<td>0,21</td>
<td>209</td>
<td>50,4</td>
<td>1902675</td>
</tr>
<tr>
<td>50</td>
<td>24</td>
<td>0,78</td>
<td>10</td>
<td>2,6</td>
<td>240</td>
<td>62,4</td>
<td>1902675</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>2,3</td>
<td>5,6</td>
<td>1,5</td>
<td>269</td>
<td>72</td>
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<tr>
<td></td>
<td>110</td>
<td>15</td>
<td>2</td>
<td>0,5</td>
<td>220</td>
<td>55</td>
<td>1902680</td>
</tr>
<tr>
<td></td>
<td>220</td>
<td>60</td>
<td>1</td>
<td>0,26</td>
<td>220</td>
<td>57,2</td>
<td>1902681</td>
</tr>
</tbody>
</table>
MD1D - S
MD1D - RK

dimensions in mm

1. Coil removal space
2. Mounting surface with sealing rings
3. Manual override
4. Electric connector to be ordered separately (see cat. 49 000)
5. Connector removal space
6. CM manual override, boot protected

See par. 11 for fastening bolts and sealing rings
8 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type RK valves - without spring and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fitting takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur. For use in tropical climates, it is necessary to include the CM option.

9 - ELECTRIC CONNECTORS

The solenoid valves are never supplied with connector. Connectors must be ordered separately. For the identification of the connector type to be ordered, please see catalogue 49 000.

10 - SPECIAL CONFIGURATIONS

10.1 MD1D solenoid valve with soft shift device (option G)

When the valve switching connection from one configuration to another is required to have a smooth change-over, the valves can be fitted with a soft shift device of the spool movement. These valves are particularly useful to smoothen the start, the stop and the changeover of motion of an actuator, reducing pressure shocks. The resulting average times are 120 ÷ 180 ms (with viscosity of 36 cSt at 50°C). Note: the valve response times are influenced not only by the working hydraulic conditions (flow rate and pressure), but also by the hydraulic fluid temperature and viscosity. This solution is possible only with direct current solenoids. In order to improve the valve soft shift effect, use of spools with choked openings is recommended: type S12 (hydraulic diagram like S1) and type S42 (hydraulic diagram like S4) Valve code example: MD1D- S12/G/50-24VCC. For their use, consult our technical department.

10.2 MD1D solenoid valve with special spools

Besides the standard spool configurations (see table 2), Duplomatic can develop, on request, connection diagrams with special spools for a wide range of applications: consult our technical department for their identification, feasibility and operating limits.

Examples:

```
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>P</td>
<td>T</td>
</tr>
</tbody>
</table>
```

S1-10

```
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>P</td>
<td>T</td>
</tr>
</tbody>
</table>
```

10S1

Surface finishing

0,01/100

0,8
10.3 MDD44 Solenoid valve (see catalogue 41 250)
Switch-over solenoid valve in modular construction with passage holes through the entire body, a feature which makes its assembly with all modular valves equipped with CETOP 03 interface possible.

Application examples

- **MD1D-S1**
- **RPC1-*M/A**
- **MDD44-1TA**

This circuit is used to drive working units: fast approach, adjustable working speed and fast return.

- **MD1D-S1**
- **RPC1-*M/D**
- **MDD44-S1**

This circuit is used to drive working units in both directions: fast approach - adjustable working speed.

11 - FASTENING BOLTS AND SEALING RINGS

- Single valve fastening: 4 bolts M5x50
- Tightening torque: 5 Nm
- Threads of mounting holes: M5x10
- Sealing rings: 4 OR type 2037

12 - SUBPLATES (See catalogue 51 000)

- Type PMMD-AI3G with rear ports
- Type PMMD-AL3G with side ports
- P, T, A, B port dimensions: 3/8" BSP