Today's hydraulic systems demand high levels of automation, power efficiency, and energy efficiency, which is why the use of electro-hydraulic proportional valves is on the rise. Built-in electronic components deliver outstanding response and fluid pressure that allows high output, as well as superior operation, and control. The NACHI Electrohydraulic Proportional Valve Series includes the pressure control valves, flow control valves, and direction control valves that make it easy to meet these needs.

### Features

1. **Pressure Control Valve Series**
   - **EPR Series**: Small-volume direct driver type pilot relief valve
   - **ER Series**: Large-volume balanced piston type relief valve
   - **EGB Series**: Large-volume balanced piston type pressure reducing valve with relief function

   The pressure control section uses a poppet structure, which is virtually impervious to the effects of dirt in the operating fluid for outstanding pressure stability.

2. **Flow Control Valve Series**
   - **ES Series**: This 3-directional valve provides proportional flow control in accordance with input current.
   - **ESR Series**: With a built-in load sensing function, this 3-way valve is for use in low-energy circuits.

   A force feedback mechanism is used for main spool positioning, and amplification is performed by the pilot spool. The result is superior response with small hysteresis.

3. **Direction Flow Control Valve Series**
   - **ESD Series**: This electro-hydraulic proportional valve provides both direction control and flow control functions. Mounting methods are the same as those for standard directional valves, which allows simple structuring and maintenance.

4. **Modular Type Control Valve Series**
   - **EOG-G01**: This reduction valve with relief function can be used in ganged configurations.
   - **EOF-G01**: This flow control valve combines a restrictor valve with a pressure compensation valve. This dual configuration provides easy installation along with dramatically reduced space requirements.

### Series List

<table>
<thead>
<tr>
<th>Name</th>
<th>Maximum Working Pressure psi</th>
<th>.5</th>
<th>2.6</th>
<th>13.2</th>
<th>26.4</th>
<th>52.8</th>
<th>79.2</th>
<th>105</th>
<th>132</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electro-hydraulic Proportional Valve (EPR)</td>
<td>5000</td>
<td>01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electro-hydraulic Proportional Relief Valve (ER)</td>
<td>5000</td>
<td></td>
<td>03</td>
<td>06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electro-hydraulic Proportional Relief and Reducing Valve (EGB)</td>
<td>3600</td>
<td></td>
<td>03</td>
<td>06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electro-hydraulic Proportional Flow Control Valve (ES)</td>
<td>3000</td>
<td>02</td>
<td>03</td>
<td>06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Sensitive Electro-hydraulic Proportional Relief and Flow Control Valve (ESR)</td>
<td>3600</td>
<td></td>
<td>03</td>
<td>06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electro-hydraulic Proportional Flow Control Valve (ESD)</td>
<td>3600</td>
<td>01</td>
<td>03</td>
<td>04</td>
<td>06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modular Type Electro-hydraulic Proportional Reducing Valve (EOG)</td>
<td>3600</td>
<td>01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modular Type Electro-hydraulic Flow Control Valve (EOF)</td>
<td>3000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Amplifier (EMA)</td>
<td>5000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compact Power Amplifier (EBA)</td>
<td>5000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compact, Multi-function Power Amplifier (EDA)</td>
<td>5000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Catalog 1501
Handling

Air Bleeding
In order to ensure stable control, loosen the air vent and bleed air from the valve before starting operation. For details, see the user’s guide.

T Port Piping
When configuring piping, ensure that the T port (pilot valve T port for the G03, G04, and G06 sizes) is filled with operating fluid.

Manual Adjusting Screw
For the initial adjustment or when there is no input current to the valve due to an electrical problem or some other reason, the valve can be operated and valve pressure can be increased by rotating the manual adjustment screw clockwise (rightward). Normally, the manual adjusting screw should be rotated back fully to the left (counterclockwise).

Valve Mounting Orientation
Install the valve so the spool axis line is horizontal.

Combining with a Pressure Compensation Valve
Use of the optional pressure compensation kit is recommended when higher precision flow rate control is required or in high-pressure applications. For details, see page G-20.

If pilot pressure (ESD-G03, G04, G06) exceeds 1300 psi use a modular type P port reduction valve (OG-G01-P1-21) at a setting of 290 psi.

On a system that requires large brake pressure during deceleration or a system that uses a vertical cylinder, equip a counter balance valve. Use a single rod, if the rod exit is not slowed sufficiently, use a counter balance valve on the rod.

Maintain hydraulic operating fluid contamination so it is at least Class 9. Use of a G01 modular filter (Absolute: 8μm) is also helpful.

(Continued on next page)
Installation Dimension Drawings

ESD-G01

ESD-G03

ESD-G04

Bundled Accessories (Valve Mounting Bolts)

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Bolt Size</th>
<th>Qty</th>
<th>Tightening Torque ft lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD-G01</td>
<td>10-24 x 1 3/4</td>
<td>4</td>
<td>3.6 to 5 ft lbs</td>
</tr>
<tr>
<td>ESD-G03</td>
<td>1/4-20 x 1 3/8</td>
<td>4</td>
<td>7 to 9.5 ft lbs</td>
</tr>
<tr>
<td>ESD-G04</td>
<td>1/4-20 x 1 3/4</td>
<td>2</td>
<td>7 to 9.5 ft lbs</td>
</tr>
<tr>
<td></td>
<td>3/8-16 x 2</td>
<td>4</td>
<td>33 to 40 ft lbs</td>
</tr>
<tr>
<td>ESD-G06</td>
<td>1/2-13 x 2 3/8</td>
<td>6</td>
<td>44 to 51 ft lbs</td>
</tr>
</tbody>
</table>

For information about sub plates, see MSA-01Y-E10 on page G-3.

Gasket Surface Dimensions (ISO 4401-03-02-0-94)

Use an operating fluid that conforms to both of the following:
Oil temperature: –4 to 158º F
Viscosity: 12 to 400 centistokes. The recommended viscosity range is 15 to 60 centistokes.

ESD-G03 Mounting Gasket Surface Dimensions

Gasket Surface Mounting Dimensions (ISO4401-05-0-94)

Note: The coil cover has an M4 set screw. To change the air vent orientation, loosen the M4 screw and then rotate the cover. After bleeding air, tighten the cover and then secure it with the M4 screw.

Auxiliary symbol G: Equipping a modular type pilot reduction valve increases the height by 1.57".

The gasket surface dimensions comply with the ISO standards shown below.

ESD-G04 - ISO 4401-07-06-0-94
ESD-G06 - ISO 4401-08-07-0-94
ESD-G10 - ISO 4401-10-08-0-94

Model No. |
-----------|
ESD-G01   |
ESD-G03   |
ESD-G04   |
ESD-G06   |
ESD-G10   |

Tightening Torque

3.6 to 5 ft lbs
7 to 9.5 ft lbs
7 to 9.5 ft lbs
33 to 40 ft lbs
44 to 51 ft lbs

Note: The coil cover has an M4 set screw. To change the air vent orientation, loosen the M4 screw and then rotate the cover. After bleeding air, tighten the cover and then secure it with the M4 screw.
**Performance Curves**

*Input Current* – Flow Rate Characteristics

- For Pressure – Flow Rate Characteristics, the horizontal shaft valve differential pressure indicates the pressure drop volume of the entire control valve (between P, A, B, T), and flow rate is measured at the oil motor.

- **Hydraulic Operating Fluid Viscosity**: 32 centistokes

**Input Current** – Flow Rate Characteristics

<table>
<thead>
<tr>
<th>ESD-G01</th>
<th>ESD-G03</th>
<th>ESD-G04</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="ESD-G01.png" alt="Graph" /></td>
<td><img src="ESD-G03.png" alt="Graph" /></td>
<td><img src="ESD-G04.png" alt="Graph" /></td>
</tr>
</tbody>
</table>

- **ESD-G01**: Viscosity 32 centistokes
- **ESD-G03**: Viscosity 32 centistokes
- **ESD-G04**: Viscosity 32 centistokes
Cross-sectional Drawing

ESD-G01-****-12

Seal Part List (Kit Model Number JDS-G01-1A)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Part Name</th>
<th>Part Number</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>O-ring</td>
<td>AS 568-012(Hs90)</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>O-ring</td>
<td>AS 568-019(Hs90)</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>O-ring</td>
<td>1B-P22</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>O-ring</td>
<td>AS 568-016(Hs90)</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>O-ring</td>
<td>1B-P7</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>O-ring</td>
<td>S-25</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>O-ring</td>
<td>1A-P20</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Seal</td>
<td>CW1000F0</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: O-ring 1A/B** refers to JIS B2401-1A/B**.
G Proportional Valves

Manual adjustment section
(ESD-G03, G04, G06, G10)

Note: The coil cover has an M4 set screw. When changing the orientation of the air vent, loosen the M4 screw and rotate the cover. Retighten after bleeding the air.

Methods for Changing the Pilot/Drain System

After Change | Hexagon Socket Head Plug
--- | ---
Pilot  | Internal | Change to PP port from C.
External | Change from PP port to C.
Drain  | Internal | Change from D to DR port.
External | Change from DR port to D.

Note: A single hex head plug (NPTF 1/16) is required when changing to external pilot. Hex Head Plug: TPUA-1/16

Seal Part List (Kit Model Number JHS-***)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Part Name</th>
<th>ESD-G03</th>
<th>ESD-G04</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>O-ring</td>
<td>1B-P12</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>O-ring</td>
<td>1B-P9</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>O-ring</td>
<td>1B-P28</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>O-ring</td>
<td>1B-P9</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>O-ring</td>
<td>——</td>
<td>—</td>
</tr>
</tbody>
</table>

Kit Model No.  | JHS-G03 | JHS-G04

Note: O-ring 1B-** refers to JIS B 2401-1B-**.

Part No.  | Part Name
--- | ---
1 | Body
2 | Spool
3 | Cover
4 | Retainer
5 | Ball
6 | Spring
7 | Pilot spool
8 | Stopper
9 | Screw
10 | O-ring
11 | O-ring
12 | O-ring
13 | O-ring
14 | O-ring
15 | Proportional solenoid

Note: Coil model number JD64-D2
Seal Part List (Kit Model Number JHS-G06)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Part Name</th>
<th>Part Number</th>
<th>Q’ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>O-ring</td>
<td>1B-P28</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>O-ring</td>
<td>1B-P20</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>O-ring</td>
<td>1B-G45</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>O-ring</td>
<td>1B-P10</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>O-ring</td>
<td>1B-P8</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: O-ring 1B-** refers to JIS B 2401-1B-**.

Changing the Pilot and Drain Connections

<table>
<thead>
<tr>
<th>After Change</th>
<th>Hexagon Socket Head Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot</td>
<td></td>
</tr>
<tr>
<td>Internal</td>
<td>Switch from A to x .</td>
</tr>
<tr>
<td>External</td>
<td>Switch from x to A .</td>
</tr>
<tr>
<td>Drain</td>
<td></td>
</tr>
<tr>
<td>Internal</td>
<td>Switch from B to C .</td>
</tr>
<tr>
<td>External</td>
<td>Switch from C to B .</td>
</tr>
</tbody>
</table>

Part No. | Part Name                      |
---------|--------------------------------|
1        | Body                           |
2        | Spool                          |
3        | Cover                          |
4        | Retainer                       |
5        | Ball                           |
6        | Spring                         |
7        | Spring                         |
8        | Screw                          |
9        | Pin                            |
10       | Pilot spool                    |
11       | Stopper                        |
12       | O-ring                         |
13       | O-ring                         |
14       | O-ring                         |
15       | O-ring                         |
16       | O-ring                         |
17       | Proportional solenoid          |
When using the pressure compensation kit, use an external pilot type for the ESD valve (G03, 06).

An internal pilot type pressure compensation valve kit is used when the pilot flow rate is supplied from the P port, without an eternal pilot port (Pp port) on the manifold. An external pilot type pressure compensation valve kit is used when there is an external pilot port (Pp port) on the manifold.

### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>JHF-01027</th>
<th>JHF-03040(E)</th>
<th>JHF-03080(E)</th>
<th>JHF-06170(E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Operating Pressure psi</td>
<td>3045</td>
<td>3625</td>
<td>3625</td>
<td>3045</td>
</tr>
<tr>
<td>Pressure Compensation Differential Pressure psi</td>
<td>145</td>
<td>87</td>
<td>203</td>
<td>116</td>
</tr>
<tr>
<td>Maximum Flow Rate l/min (gpm)</td>
<td>27 (7.1)</td>
<td>40 (10.5)</td>
<td>80 (21.1)</td>
<td>170 (44.9)</td>
</tr>
<tr>
<td>Weight lbs</td>
<td>3.3</td>
<td>10.3</td>
<td>11.0</td>
<td>26.4</td>
</tr>
</tbody>
</table>

### Understanding Model Numbers

- **JHF**
- **03**
- **040**
- **(E)**

Auxiliary symbol (See "Handling.")

- None: Internal pilot
- E: External pilot

Maximum flow rate

Nominal diameter 01, 03, 06

Pressure compensation valve kit

- Handling
  - When using the pressure compensation kit, use an external pilot type for the ESD valve (G03, 06).

### Installation Dimension Drawings

Pressure compensation valve kit

JHF-01027
Proportional Valves

JHF-03040(E)  JHF-03080(E)

Note: Mounting bolts are not included with the pressure compensation kit. Use the valve mounting bolt lists on pages F-87 through F-89 to select mounting bolts.

Internal pilot  External pilot