FEATURES

The Kawasaki rotary actuator is suitable to be used for mechanical function involving limited rotation.
- Available of large torque without cumbersome linkages.
- Available of special type such as those with the outer stopper and buffer valve.

ORDERING CODE

<table>
<thead>
<tr>
<th>HR-08</th>
<th>S-04</th>
<th>1</th>
<th>1</th>
<th>C-402</th>
</tr>
</thead>
</table>

Rotary actuator
Diameter of vane
Number of vanes
- S: Single
- D: Double
Width of vane
Shaft type
- 1: Single-output-end shaft
- 2: Double-output-end shaft

Detailed model code (Determined as per detailed specifications) example: "402"…… without buffer
Design number
Shaft output end shape
- 1: Single-keyed (to JIS B1301-1965)
- 2: Splined (to JIS D2001-1959)
- 3: Double-keyed (to JIS B1301-1965)

CONSTRUCTION

Single-vane type

Double-vane type

Note: The number of keys of the wingshaft is one in the single-vane type, and two in the double-vane type.
1. Reciprocating rotary motion
The high-pressure oil supplied into Chamber A through Port B rotates the wingshaft counterclockwise displacing the low-pressure oil out of Port D through Ports E and F.
Conversely, if high-pressure oil is supplied into Chamber C through Port D, the wingshaft rotates clockwise with the low-pressure oil being displaced out of B. (Fig.1)

2. Buffer function
Models HR-17D and HR-20S are provided with the buffer mechanism as described below. (Models HR-08, HR-11, and HR-15 are not.)
(1) A check ball is assembled in Port F. So, when the low-pressure oil is displaced, it is let out through Port E with Port F closed by the check ball.
(2) When the wingshaft rotates until 10-20 deg. before the shaft travel end, the vane of the wingshaft passes Port E. And the confined oil is displaced through E via the narrow clearance between the vane and the end cover. (Fig.2)
(3) As a result, Chamber C is intermittently pressurized higher than the inlet high pressure in Chamber A. The reverse acceleration consequently generated decelerates the wingshaft, and the rotating speed becomes moderately slow.
Special types enable speed control of the wingshaft after the buffer effect.

PRECAUTION ON INSTALLATION

1. Be sure that neither radial nor thrust load is directly applied to the shaft output end. If such loads are unavoidable, install separate bearings to support them.
2. The rotary actuator must be operated within the stroke range of the specified total shaft travel.
3. When the rotary actuator is operated exceeding the maximum angular travel due to the moment of inertia of the attached equipment, provide an external stopper to prevent over-loading the abutment. (Excluding special types with the outer stopper.)
4. In case deceleration is achieved utilizing the hydraulic circuit, prevent the circuit pressure from exceeding the rated pressure due to the moment of inertia of the equipment in the circuit.
5. For disassembly and reassembly, use special tools designed for this unit, with particular care taken against any damage to the sealing part.
## SPECIFICATION

### Standard type

<table>
<thead>
<tr>
<th>Model</th>
<th>Rated pressure MPa (kgf/cm²)</th>
<th>Output torque N·m (kgf·m)</th>
<th>Total shaft travel rad. (deg.)</th>
<th>Displacement for total travel cm³</th>
<th>Displacement per radian cm³/rad.</th>
<th>Mass kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>at 6.9 MPa (70kgf/cm²)</td>
<td>at 10.8 MPa (110kgf/cm²)</td>
<td>at 13.7 MPa (140kgf/cm²)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR-08S-04-11C-402</td>
<td>13.7 (140)</td>
<td>108 (11)</td>
<td>226 (23)</td>
<td>4.9 (280)</td>
<td>102</td>
<td>20.8</td>
</tr>
<tr>
<td>HR-11S-06-11D-402</td>
<td></td>
<td>294 (30)</td>
<td>628 (64)</td>
<td>4.9 (280)</td>
<td>280</td>
<td>57.3</td>
</tr>
<tr>
<td>HR-15S-08-11D-402</td>
<td></td>
<td>794 (81)</td>
<td>1,716 (175)</td>
<td>4.9 (280)</td>
<td>753</td>
<td>154</td>
</tr>
<tr>
<td>HR-20S-10-12J</td>
<td></td>
<td>2,256 (230)</td>
<td>4,805 (490)</td>
<td>3.3 (190)</td>
<td>1,450</td>
<td>438</td>
</tr>
<tr>
<td>HR-20S-18-12E</td>
<td>6.9 (70)</td>
<td>3,972 (405)</td>
<td></td>
<td>3.3 (190)</td>
<td>2,500</td>
<td>755</td>
</tr>
<tr>
<td>HR-20S-18-13E</td>
<td></td>
<td>3,972 (405)</td>
<td></td>
<td>3.3 (190)</td>
<td>2,500</td>
<td>755</td>
</tr>
<tr>
<td>HR-20S-18-23E</td>
<td>10.8 (6.9) (110 (70))</td>
<td>3,972 (405)</td>
<td>6,374 (650)</td>
<td></td>
<td>3.3 (190)</td>
<td>2,500</td>
</tr>
<tr>
<td>HR-08D-04-13C-402</td>
<td>13.7 (140)</td>
<td>245 (25)</td>
<td>510 (52)</td>
<td>1.7 (100)</td>
<td>73</td>
<td>41.6</td>
</tr>
<tr>
<td>HR-11D-06-13D-402</td>
<td></td>
<td>677 (69)</td>
<td>1,422 (145)</td>
<td>1.7 (100)</td>
<td>200</td>
<td>115</td>
</tr>
<tr>
<td>HR-15D-08-13D-402</td>
<td></td>
<td>1,814 (185)</td>
<td>3,825 (39)</td>
<td>1.7 (100)</td>
<td>538</td>
<td>308</td>
</tr>
</tbody>
</table>

*If operated using only one of the double-output ends, the HR-20S-18-23 should be used at 6.9 MPa (70kgf/cm²) and below.

### Special type

<table>
<thead>
<tr>
<th>Model</th>
<th>Rated pressure MPa (kgf/cm²)</th>
<th>Output torque N·m (kgf·m)</th>
<th>Total shaft travel rad. (deg.)</th>
<th>Displacement for total travel cm³</th>
<th>Displacement per radian cm³/rad.</th>
<th>Mass kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>at 6.9 MPa (70kgf/cm²)</td>
<td>at 10.8 MPa (110kgf/cm²)</td>
<td>at 13.7 MPa (140kgf/cm²)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR-17D-06-12A-501B</td>
<td>13.7 (140)</td>
<td>1,471 (150)</td>
<td>3,109 (317)</td>
<td>1.57 (90)</td>
<td>395</td>
<td>252</td>
</tr>
<tr>
<td>HR-20S-10-12I-525F</td>
<td></td>
<td>2,256 (230)</td>
<td>4,805 (490)</td>
<td>1.59 (91)</td>
<td>695</td>
<td>438</td>
</tr>
</tbody>
</table>

*These two types are provided with the outer stopper and buffer valve.

## WORKING FLUID

- It is recommended that the anti-wear type hydraulic fluid be used as working fluid.
- Some kinds of fire-resistant fluid such as phosphate ester and water glycol require restriction of operating conditions as well as special materials of seal, paint and metal. Therefore, please consult us in advance for our advice indicating the kind of fluid used and specification.
## Performance

### Output Torque Curve

- **HR-08S-04**: 50 100
- **HR-11S-06**: 60 120
- **HR-15S-08**: 75 150
- **HR-20S-10**: 125 250
- **HR-20S-18**: 210 420
- **HR-08D-04**: 100 200
- **HR-11D-06**: 120 240
- **HR-15D-08**: 150 300
- **HR-17D-06**: 145 290

### Maximum Internal Leakage

<table>
<thead>
<tr>
<th>Model</th>
<th>6.9 MPa (70 kgf/cm²)</th>
<th>13.7 MPa (140 kgf/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR-08S-04</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>HR-11S-06</td>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>HR-15S-08</td>
<td>75</td>
<td>150</td>
</tr>
<tr>
<td>HR-20S-10</td>
<td>125</td>
<td>250</td>
</tr>
<tr>
<td>HR-20S-18</td>
<td>210</td>
<td>420</td>
</tr>
<tr>
<td>HR-08D-04</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>HR-11D-06</td>
<td>120</td>
<td>240</td>
</tr>
<tr>
<td>HR-15D-08</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>HR-17D-06</td>
<td>145</td>
<td>290</td>
</tr>
</tbody>
</table>

### Calculation Formula

1. **Output Torque Calculation Formula**
   
   \[ \text{Output torque (N·m)} = \text{Operating pressure (MPa)} \times \text{Displacement (cm³/rad.)} \times \text{Mechanical efficiency} \]
   
   \( \text{Output torque (kgf·m)} = \text{Operating pressure (kgf/cm²)} \times \text{Displacement (cm³/rad.)} \times \text{Mechanical efficiency} \times 10^{-2} \)

2. **Required Oil Flow Calculation Formula**
   
   \[ \text{Oil flow (L/min.)} = \text{Displacement (cm³/rad.)} \times \text{Required angular velocity (rad./min.)} \times 10^{-3} + \text{Leaked oil (L/min.)} \]
   
   \( \text{Oil flow (L/min.)} = \pi /180 \times \text{Displacement (cm³/rad.)} \times \text{Required angular velocity (deg./min.)} \times 10^{-3} + \text{Leaked oil (L/min.)} \)

### Reference

Data are indicated in both the SI units and the engineering units. The relationship between these two units are shown below for reference.

<table>
<thead>
<tr>
<th>SI units</th>
<th>Engineering units</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.80665 MPa</td>
<td>100 kgf/cm²</td>
</tr>
<tr>
<td>9.80665 N·m</td>
<td>1 kgf·m</td>
</tr>
<tr>
<td>1 mm²/s</td>
<td>1 cSt</td>
</tr>
<tr>
<td>( \pi ) radian</td>
<td>180 deg.</td>
</tr>
</tbody>
</table>
When the V mark on the wingshaft matches that on the end cover, it is positioned at the stroke center. (The V mark on the wingshaft is put on the vane center line.)

### Standard type

HR-08S\(^D\)-04, HR-11S\(^D\)-06, HR-15S\(^D\)-08

When the V mark on the wingshaft matches that on the end cover, it is positioned at the stroke center. (The V mark on the wingshaft is put on the vane center line.)

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>K</th>
<th>M</th>
<th>N</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>W</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR-15S(^D)-04</td>
<td>130</td>
<td>180</td>
<td>102</td>
<td>78</td>
<td>52</td>
<td>32</td>
<td>6</td>
<td>65</td>
<td>7</td>
<td>M10</td>
<td>16</td>
<td>PF1/4</td>
<td>110</td>
<td>64</td>
<td>8</td>
<td>117</td>
<td>32</td>
</tr>
<tr>
<td>HR-11S(^D)-06</td>
<td>175</td>
<td>220</td>
<td>130</td>
<td>90</td>
<td>66</td>
<td>45</td>
<td>6</td>
<td>100</td>
<td>7</td>
<td>M12</td>
<td>19</td>
<td>PF1/4</td>
<td>150</td>
<td>90</td>
<td>14</td>
<td>140</td>
<td>44</td>
</tr>
<tr>
<td>HR-15S(^D)-08</td>
<td>220</td>
<td>275</td>
<td>162</td>
<td>113</td>
<td>83</td>
<td>70</td>
<td>6</td>
<td>130</td>
<td>7</td>
<td>M12</td>
<td>22</td>
<td>PF1/4</td>
<td>195</td>
<td>116</td>
<td>10</td>
<td>163</td>
<td>62</td>
</tr>
</tbody>
</table>

Note: The above diagrams show the construction of a single-vane type. The number of the keys of the wingshaft is one in the single-vane type, and two in the double-vane type.

### HR-20S-10

When the V mark on the wingshaft matches that on the end cover, it is positioned at the stroke center. (The V mark on the wingshaft is put on the vane center line.) Therefore, the wingshaft rotates ±95 deg. from this position to both ends.

### HR-20S-18

When the V mark on the wingshaft matches that on the end cover, it is positioned at the stroke center. (The V mark on the wingshaft is put on the vane center line.) Therefore, the wingshaft rotates ±95 deg. from this position to both ends.
When inquiring about the Kawasaki rotary actuator, please inform us of the following items.

1. Application
2. Model
3. Output Torque \( \text{N} \cdot \text{m (kgf} \cdot \text{m)} \)
4. Working Pressure \( \text{MPa (kgf/cm}^2 \) \)
5. Total Shaft Travel \( \text{rad. (deg.)} \)
6. Angular Velocity \( \text{rad./s (deg./s)} \)
7. Frequency
8. Kind of Working Fluid
9. Fluid temperature \( \circ \text{C} \)
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