## Water Cooled Oil Cooler

**Series HOW □**

### Oil Cooler: Copper particle type (Floating pipe type)

<table>
<thead>
<tr>
<th>Series</th>
<th>Heat transfer area (Inside pipe) (m²)</th>
<th>Heat exchange volume (kW)</th>
<th>Flow rate (L/min)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron particle type: Series HOWF</td>
<td>0.077, 0.13, 0.21, 0.34, 0.56, 0.83, 1.28</td>
<td>5.2 to 73</td>
<td>20 to 800</td>
<td>40 to 125</td>
</tr>
<tr>
<td>Copper particle type: Series HOW</td>
<td>0.084, 0.13, 0.21, 0.32, 0.50, 0.75</td>
<td>6.0 to 52</td>
<td>20 to 400</td>
<td>25 to 100</td>
</tr>
</tbody>
</table>
**Fixed Pipe Type Oil Cooler**

**Series HOWF**

**Water Cooled: Iron Particle Type**

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**High heat transfer coefficient through the effects of turbulence**

The metal particles reliably generate turbulence by agitating the fluid, resulting in effective cooling without unevenness.

**Compact design requiring less installation space**

The compact design is only 1/2 to 1/5 the size of conventional oil coolers. Installation requires very little space.

**Large heat transfer area**

The metal particles firmly welded to the outer surface of the heat transfer pipes provide several times the heat transfer performance of fin tube configurations.

**Flexible installation orientation**

U-bolts are used to mount the oil cooler, providing plenty of flexibility with regard to the mounting orientation and method.

**Simple structure**

The baffle is also welded to a metal particle layer, a design that eliminates problems that previously tended to occur at the joints between the heat transfer pipes and baffles in conventional oil coolers.

**Minimal pressure drop**

The single-baffle structure increases the fluid path area, and the metal particles are 2 mm in diameter and pose no clogging danger.

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**Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating pressure</td>
<td>(Oil and Water sides) 1.0 MPa</td>
</tr>
<tr>
<td>Proof pressure</td>
<td>(Oil and Water sides) 1.5 MPa</td>
</tr>
<tr>
<td>Fluid temperature</td>
<td>Oil side: Max. 100°C/Water side: Max. 50°C</td>
</tr>
<tr>
<td>Cooling water</td>
<td>Industrial water, Tap water</td>
</tr>
<tr>
<td>Fluid cooled</td>
<td>General petroleum-based hydraulic fluid, Lubricating oil, Non-flammable oil (water-glycol)</td>
</tr>
<tr>
<td>Heat transfer medium</td>
<td>Copper tube and iron particles (iron particles surface treated with copper alloy)</td>
</tr>
<tr>
<td>Connection</td>
<td>Oil side: Threaded or Flange/Water side: Threaded</td>
</tr>
</tbody>
</table>

---

**Model**

<table>
<thead>
<tr>
<th>Model</th>
<th>Heat transfer area (inside pipe) (m²)</th>
<th>Heat exchange volume Note 1) (kW)</th>
<th>Oil side Note 3) Flow rate range (L/min)</th>
<th>Cooling water side Note 2) Flow rate (L/min)</th>
<th>Pressure drop (MPa)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOWF7-06</td>
<td>0.077</td>
<td>5.2</td>
<td>20 to 100</td>
<td>40</td>
<td>0.02</td>
<td>7</td>
</tr>
<tr>
<td>HOWF11-06</td>
<td>0.13</td>
<td>8.4</td>
<td>30 to 150</td>
<td>40</td>
<td>0.02</td>
<td>9</td>
</tr>
<tr>
<td>HOWF22-08</td>
<td>0.21</td>
<td>14</td>
<td>40 to 250</td>
<td>55</td>
<td>0.02</td>
<td>12</td>
</tr>
<tr>
<td>HOWF37-08</td>
<td>0.34</td>
<td>21</td>
<td>60 to 300</td>
<td>55</td>
<td>0.02</td>
<td>17</td>
</tr>
<tr>
<td>HOWF55-10</td>
<td>0.56</td>
<td>32</td>
<td>70 to 300</td>
<td>75</td>
<td>0.03</td>
<td>27</td>
</tr>
<tr>
<td>HOWF75-10</td>
<td>0.83</td>
<td>43</td>
<td>80 to 400</td>
<td>75</td>
<td>0.03</td>
<td>40</td>
</tr>
<tr>
<td>HOWF110-16</td>
<td>1.28</td>
<td>73</td>
<td>200 to 800</td>
<td>125</td>
<td>0.03</td>
<td>75</td>
</tr>
</tbody>
</table>

Note 1) Conditions: Turbine oil Class 1 (ISO VG32), oil outlet temperature 50°C, water inlet temperature 30°C

Note 2) Increasing the cooling water flow volume to greater than the rated flow volume will increase the heat transfer and provide better cooling, but should be avoided as the increased flow speed within the pipe can cause corrosion.

Note 3) Use an oil-side flow rate within the range indicated above. (The product cannot be used with flow rates exceeding this range.)

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**How to Order**

**HOWF 7-06**

- **Oil side port size**
  - 06 Rp (PS) 3/4
  - 08 Rp (PS) 1
  - 10 1 1/4th flange
  - 16 2th flange

- **Basic size (Equivalent hydraulic motor kW)**
  - 7 7.5
  - 11 11
  - 22 22
  - 37 37
  - 55 55
  - 75 75
  - 110 110

Conditions: In case of 55% heat loss of hydraulic motor kW

- Oil outlet temperature 50°C
- Water inlet temperature 30°C
- Turbine oil Class 1 (ISO VG32)
To select the appropriate model for your application, use the data at right and follow the steps below.

### Model Selection

#### Step A: No Cooling Water Flow Rate Specified

1. From Data (a), calculate the oil type–heat volume correction coefficient.
   - Example: A = 0.97
2. From Data (b), calculate the water temperature–heat volume correction coefficient.
   - Example: B = 1.3
3. Using the correction coefficients obtained in 1 and 2, calculate the converted heat exchange volume.
   - Example: Q = \frac{15}{0.97 \times 1.3} = 11.9 kW
4. Select the appropriate model from the model performance graph.
   - Example: Oil outlet temperature 50°C, selected model HOWF22
   - In this case, the oil pressure drop can be calculated as follows.
5. From the model performance graph, determine the oil pressure drop.
   - Example: \( \Delta P = 0.04 \) MPa
6. From Data (f), calculate the oil type–pressure drop correction coefficient.
   - Example: D = 1.4
7. Using 5 and 6, calculate the corrected oil pressure drop.
   - Example: \( \Delta P = 0.4 \times 1.4 = 0.56 \) MPa

(Result) Model: HOWF22, Oil pressure drop: \( \Delta P = 0.056 \) MPa,
Cooling water volume: 55 L/min

#### Step B: Cooling Water Flow Rate Specified

1. From Data (a), calculate the oil type–heat volume correction coefficient.
   - Example: A = 0.97
2. From Data (b), calculate the water temperature–heat volume correction coefficient.
   - Example: B = 1.3
3. From the model performance graph, locate the intersection of the oil flow rate and heat exchange volume lines to make a provisional model selection. Note that the rated water volume for the selected model can be determined from the specifications.
   - Example: Oil outlet temperature 50°C, selected model HOWF37
   - Rated water volume 55 L/min
4. Divide the actual water volume by the rated water volume from 3. If the calculated water volume is 1 or greater, treat it as 1.
   - Example: \( \frac{40}{55} = 0.72 \)
5. From Data (c), calculate the water volume–heat volume correction coefficient.
   - Example: C = 0.85
6. Using the correction coefficients obtained in 1, 2, and 5, calculate the converted heat exchange volume.
   - Example: Q = \frac{15}{0.97 \times 1.3 \times 0.85} = 14 kW
7. Select the appropriate model from the model performance graph.
   - Example: Oil outlet temperature 50°C, selected model HOWF37
   - In this case, the oil pressure drop can be calculated as follows.
8. From the model performance graph, calculate the oil pressure drop.
   - Example: \( \Delta P = 0.035 \) MPa
9. From Data (f), calculate the oil type–pressure drop correction coefficient.
   - Example: D = 1.4
10. Using 9 and 8, calculate the corrected oil pressure drop.
    - Example: \( \Delta P = 0.35 \times 1.4 = 0.49 \) MPa

(Result) Model: HOWF37, Oil pressure drop: \( \Delta P = 0.049 \) MPa,
Cooling water volume: 40 L/min

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### Model Performance Graph 1: Oil Outlet Temperature 40°C

Conditions
- Oil outlet temperature: 40°C
- Water inlet temperature: 30°C

Fluid: Turbine oil Class 1 (ISO VG32)

Oil side pressure drop: 0.01, 0.03, 0.05, 0.1 MPa indicated

Model performance values include an allowance (approx. 25%) for water deposits.

### Data A (Oil type/Heat volume correction coefficient)

- Water-glycol
- Petroleum

### Data B (Water temperature/Heat volume correction coefficient)

- 50°C
- 60°C
- 70°C
- 80°C
- 90°C

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Model Performance Graph ②: Oil Outlet Temperature 50°C

Conditions
- Oil outlet temperature: 50°C
- Water inlet temperature: 30°C
- Fluid: Turbine oil Class 1 (ISO VG32)
- Oil side pressure drop: 0.01, 0.03, 0.05, 0.1 MPa indicated

Model performance values include an allowance (approx. 25%) for water deposits.

Data ⑥ (Oil type/Pressure drop correction coefficient)

Data ⑤ (Water volume/Heat volume correction coefficient)

Table for calculating required heat exchange volume from hydraulic motor output

Note) If the hydraulic pump motor output is 30 kW and the heat loss is 55%, the required conversion volume is 16.5 kW. (Select the heat loss percentage based on the hydraulic circuit.)
The series HOWF employs a multi-pipe design with the heat transfer pipes arranged in a circular pattern. The area between the pipes is filled with porous metal particles. Cooling water flows through the heat transfer pipes. Fluid flows in through the inlet on the side of the cooler and passes among the metal particles outside the heat transfer pipes, finally reaching the open cavity in the center. It then flows axially through the center cavity, once again passes among the metal particles, and flows out through the outlet. The cooling water inlet and outlet may be reversed, and the oil inlet and outlet may be reversed as well. It is not possible to switch the cooling water and oil flow paths, however.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>STK</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pipe plate A</td>
<td>SS400</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Metal particle cover</td>
<td>Stainless steel 304</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Heat transfer pipe</td>
<td>C1220T</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Metal particles</td>
<td>SS</td>
<td>Copper-plated</td>
</tr>
<tr>
<td>6</td>
<td>Baffle</td>
<td>Stainless steel 304</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Water chamber cover</td>
<td>FC200</td>
<td></td>
</tr>
</tbody>
</table>

### Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Gasket A</td>
<td>NBR</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Gasket B</td>
<td>NBR</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Corrosion-resistant zinc</td>
<td>Zn</td>
<td></td>
</tr>
</tbody>
</table>

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**Material No. Description**

- P1751411: HOWF7-06
- P1751412: HOWF11-06
- P1751611: HOWF22-08
- P1751612: HOWF37-08
- P1751810: HOWF55-10
- P1751811: HOWF75-10
- P175126:HOWF110-16
- P175127: P175067
- P175126: P175127
- P175067

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**Diagram**

- OIL INLET
- WATER INLET
- OIL OUTLET
- WATER OUTLET
### Dimensions

**HOWF7-06 to HOWF75-10**

<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>øG</th>
<th>øJ</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>P</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOWF7-06</td>
<td>246</td>
<td>60</td>
<td>105</td>
<td>93</td>
<td>72</td>
<td>30</td>
<td>76</td>
<td>151</td>
<td>108</td>
<td>78</td>
<td>100</td>
<td>66</td>
<td>73</td>
<td>24</td>
<td>3/4</td>
</tr>
<tr>
<td>HOWF11-06</td>
<td>361</td>
<td>175</td>
<td>220</td>
<td>95</td>
<td>72</td>
<td>30</td>
<td>76</td>
<td>151</td>
<td>108</td>
<td>78</td>
<td>100</td>
<td>66</td>
<td>73</td>
<td>24</td>
<td>3/4</td>
</tr>
<tr>
<td>HOWF22-08</td>
<td>429</td>
<td>210</td>
<td>270</td>
<td>113</td>
<td>83</td>
<td>33</td>
<td>89</td>
<td>169</td>
<td>121</td>
<td>84</td>
<td>113</td>
<td>79</td>
<td>85</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>HOWF37-08</td>
<td>639</td>
<td>420</td>
<td>480</td>
<td>113</td>
<td>83</td>
<td>33</td>
<td>89</td>
<td>169</td>
<td>121</td>
<td>84</td>
<td>113</td>
<td>79</td>
<td>85</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>HOWF55-10</td>
<td>742</td>
<td>500</td>
<td>570</td>
<td>125</td>
<td>90</td>
<td>35</td>
<td>114</td>
<td>229</td>
<td>146</td>
<td>107</td>
<td>143</td>
<td>122</td>
<td>34</td>
<td>1 1/4</td>
<td>1/2</td>
</tr>
<tr>
<td>HOWF75-10</td>
<td>1057</td>
<td>815</td>
<td>885</td>
<td>125</td>
<td>90</td>
<td>35</td>
<td>114</td>
<td>229</td>
<td>146</td>
<td>107</td>
<td>143</td>
<td>122</td>
<td>34</td>
<td>1 1/4</td>
<td>1/4</td>
</tr>
<tr>
<td>HOWF110-16</td>
<td>1313</td>
<td>950</td>
<td>1050</td>
<td>189</td>
<td>139</td>
<td>64</td>
<td>165</td>
<td>298</td>
<td>166</td>
<td>158</td>
<td>210</td>
<td>150</td>
<td>140</td>
<td>35</td>
<td>2 1/2</td>
</tr>
</tbody>
</table>

Note) Threads conform to JIS B 0203 parallel female thread (oil side) and tapered female thread (water side). Flanges conform to JIS B 2220 (JIS 10K FF). B dimensions are maximum values.

The HOWF7-06 only is equipped with a fluid drain plug directly below the OIL INLET. Since foot and U-bolts are not pre-mounted, they should be mounted during installation.
Floating Pipe Type Oil Cooler
Series HOW
Water Cooled: Copper Particle Type

Large heat transfer area
The porous nature of the metal particles welded to the outer surface of the heat transfer pipes provide several times the heat transfer area of fin tube configurations.

High heat conductivity
The highly heat-conductive metal particles are firmly welded, so they provide effective cooling even when attached to a surface separated from the heat transfer pipes.

Compact design requiring less installation space
The compact design is only 1/2 to 1/5 the size of conventional oil coolers. Installation requires very little space.

High heat exchange effectiveness due to turbulence
The layer of metal particles reliably generates turbulence by agitating the fluid, resulting in effective cooling without unevenness.

Minimal pressure loss
The single-baffle structure increases the fluid path area. The metal particles are 2 mm in diameter, so they produce little pressure loss and will not create clogging that degrades performance.

Simple structure
The single baffle is welded to the metal particle layer for increased rigidity, a design that eliminates problems that previously tended to occur at the joins between the heat transfer pipes and baffles in conventional oil coolers.

Easy maintenance
The floating pipe type makes interior cleaning and inspection easy. The compact pipe bundle makes for easy handling.

Specifications

<table>
<thead>
<tr>
<th></th>
<th>HOW008M-06</th>
<th>HOW013M-06</th>
<th>HOW021M-12</th>
<th>HOW032M-12</th>
<th>HOW050M-12</th>
<th>HOW075M-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Oil side</td>
<td>Cooling water side</td>
<td>Flow rate range (L/min)</td>
<td>Flow rate (L/min)</td>
<td>Pressure drop (MPa)</td>
<td>Weight (kg)</td>
</tr>
<tr>
<td>Heat transfer area (inside pipe) (m²)</td>
<td>0.084</td>
<td>0.13</td>
<td>0.21</td>
<td>0.32</td>
<td>0.50</td>
<td>0.75</td>
</tr>
<tr>
<td>Heat exchange volume (KW)</td>
<td>6</td>
<td>8.5</td>
<td>14</td>
<td>21</td>
<td>30</td>
<td>52</td>
</tr>
<tr>
<td>Oil side</td>
<td>20 to 130</td>
<td>30 to 160</td>
<td>35 to 200</td>
<td>40 to 250</td>
<td>50 to 300</td>
<td>60 to 400</td>
</tr>
<tr>
<td>Cooling water side</td>
<td>25</td>
<td>25</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Pressure drop (MPa)</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>7</td>
<td>8</td>
<td>14</td>
<td>18</td>
<td>24</td>
<td>42</td>
</tr>
</tbody>
</table>

Note 1) Conditions: Turbine oil Class 1 (ISO VG32), oil outlet temperature 50°C, water inlet temperature 30°C
Note 2) Increasing the cooling water flow volume to greater than the rated flow volume will increase the heat transfer and provide better cooling, but should be avoided as the increased flow speed within the pipe can cause corrosion.

How to Order

Heat exchanger series
Oil cooler
Water cooled
Sintered metal particle diameter
Heat transfer area (m²)

<table>
<thead>
<tr>
<th>Model</th>
<th>Heat transfer area (m²)</th>
<th>Width (mm)</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>008</td>
<td>0.084</td>
<td>2</td>
<td>Rc34</td>
</tr>
<tr>
<td>013</td>
<td>0.13</td>
<td>2</td>
<td>Rc1 1/4</td>
</tr>
<tr>
<td>021</td>
<td>0.21</td>
<td>2</td>
<td>Rc1 1/2</td>
</tr>
<tr>
<td>032</td>
<td>0.32</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>050</td>
<td>0.50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>075</td>
<td>0.75</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Note 1) Not suitable for use with non-flammable fluid (water-glycol) or phosphoric ester hydraulic fluid.
Note 2) Thread connection is standard for the oil side, but flange connection is possible using a (custom) companion flange.
Model Selection

To select the appropriate model for your application, use the data at right and follow the steps below. (Note that Data A through Data E are listed in the series HOWF section.)

<table>
<thead>
<tr>
<th>Type (brand)</th>
<th>Fluid cooled</th>
<th>Cooling water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine oil Class 1 (VG56)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Flow rate</td>
<td>Inlet: 130 L/min, Outlet: 25° C</td>
<td></td>
</tr>
<tr>
<td>Heat exchange volume</td>
<td>15 kW</td>
<td></td>
</tr>
</tbody>
</table>

**Step A: No Cooling Water Flow Rate Specified**

1. From Data A, calculate the oil type–heat volume correction coefficient.
   - Example: A = 0.97
2. From Data B, calculate the water temperature–heat volume correction coefficient.
   - Example: B = 1.3
3. Using the correction coefficients obtained in 1 and 2, calculate the converted heat exchange volume.
   - Example: Q = 0.97 x 1.3 x 14 kW
4. Select the appropriate model from the model performance graph.
   - Example: Oil outlet temperature 50° C, selected model HOW021M
5. From the model performance graph, determine the oil pressure drop.
   - Example: ΔP = 0.06 MPa
6. From Data D, calculate the oil type–pressure drop correction coefficient.
   - Example: D = 1.4
7. Using 5 and 6, calculate the corrected oil pressure drop.
   - Example: ΔP = 0.6 x 1.4 = 0.084 MPa

(Result) Model: HOW021M, Oil pressure drop: ΔP = 0.084 MPa, Rated water volume: 65 L/min

**Step B: Cooling Water Flow Rate Specified**

1. From Data A, calculate the oil type–heat volume correction coefficient.
   - Example: A = 0.97
2. From Data B, calculate the water temperature–heat volume correction coefficient.
   - Example: B = 1.3
3. From the model performance graph, locate the intersection of the oil flow rate and heat exchange volume lines to make a provisional model selection. Note that the rated water volume for the selected model can be determined from the specifications.
   - Example: Oil outlet temperature 50° C, provisional model selection HOW021M
4. Divide the actual water volume by the rated water volume from 3. If the calculated water volume is 1 or greater, treat it as 1.
   - Example: 47 = 0.72
5. From Data E, calculate the water volume–heat volume correction coefficient.
   - Example: C = 0.85
6. Using the correction coefficients obtained in 1, 2, and 5, calculate the converted heat exchange volume.
   - Example: Q = 0.97 x 1.3 x 0.85
7. Select the appropriate model from the model performance graph.
   - Example: Oil outlet temperature 50° C, selected model HOW021M
8. From the model performance graph, determine the oil pressure drop.
   - Example: ΔP = 0.06 MPa
9. From Data D, calculate the oil type–pressure drop correction coefficient.
   - Example: D = 1.4
10. Using 8 and 9, calculate the corrected oil pressure drop.
    - Example: ΔP = 0.6 x 1.4 = 0.084 MPa

(Result) Model: HOW021M, Oil pressure drop: ΔP = 0.084 MPa, Cooling water volume: 47 L/min
Construction description

The series HOW employs a multi-pipe design with the heat transfer pipes arranged in a circular pattern. The area between the pipes is filled with porous metal particles. Cooling water flows through the heat transfer pipes. Fluid flows in through the inlet on the side of the shell and passes into the metal particle layer, finally reaching the open cavity in the center. It then flows axially through the center cavity, once again passes through the metal particle layer, and flows out through the outlet. The cooling water inlet and outlet may be reversed, and the oil inlet and outlet may be reversed as well. It is not possible to switch the cooling water and oil flow paths, however.

### Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Part Description</th>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tube sheet A</td>
<td>SS400</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Tube sheet B</td>
<td>SS400</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Baffle</td>
<td>SS400</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Heat transfer pipes</td>
<td>C1220T</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Metal particle layer</td>
<td>Cu</td>
<td>—</td>
</tr>
<tr>
<td>6</td>
<td>Metal particle cover A</td>
<td>Stainless steel 304</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Metal particle cover B</td>
<td>Stainless steel 304</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Shell flange A</td>
<td>AC4C</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Shell flange B</td>
<td>AC4C</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Shell pipe</td>
<td>A6060T</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Water chamber cover A</td>
<td>FC200</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Water chamber cover B</td>
<td>FC200</td>
<td>1</td>
</tr>
</tbody>
</table>

*If you are unsure which model is suitable, please refer to the items at right and contact SMC.*

### Application

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid to be cooled</td>
<td>Cooling water</td>
</tr>
<tr>
<td>Heat exchange volume</td>
<td>kW</td>
</tr>
</tbody>
</table>

### Mechanical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow rate L/min</td>
<td></td>
</tr>
<tr>
<td>Temperature Inlet °C</td>
<td></td>
</tr>
<tr>
<td>Temperature Outlet °C</td>
<td></td>
</tr>
<tr>
<td>Allowable pressure drop MPa</td>
<td></td>
</tr>
<tr>
<td>Max. operating pressure MPa</td>
<td></td>
</tr>
</tbody>
</table>

### Fluid Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight volume ratio kgf/cm²</td>
<td></td>
</tr>
<tr>
<td>Specific heat kW/kg°C</td>
<td></td>
</tr>
<tr>
<td>Viscosity mm²/s</td>
<td></td>
</tr>
<tr>
<td>If hydraulic fluid, hydraulic motor output kW</td>
<td></td>
</tr>
</tbody>
</table>
### Design

#### Caution
1. Do not use at a pressure that exceeds the operating pressure range.
2. Do not use at a temperature that exceeds the operating temperature range.
3. Fluid
   - Do not use the product with gases.
4. Fatigue damage
   - Under the following conditions, special measures are required:
     1) If the product will be subjected to pressure surges.
     2) If the product is not mounted securely and will be subject to friction or vibrations.
5. Corrosion
   - The product may corrode depending on usage conditions and environment.

### Piping

#### Caution
1. Make sure to allow sufficient space for maintenance when installing and piping.
2. Connections
   - Make sure no cutting chips from pipe threads or sealing material get inside the piping. If sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the male thread.
3. Filter installation
   - Install #100 µm filters into the inlet pipes of the oil cooler on both the oil and cooling water sides.
4. The cooling water inlet and outlet may be reversed, and the oil inlet and outlet may be reversed as well. It is not possible to switch the cooling water and oil flow paths, however.

### Selection

#### Warning
1. When selecting products, carefully consider the usage purpose, the required specifications, and the usage conditions (fluid, pressure, flow rate, temperature, environment), and ensure that the specification range is not exceeded.
2. The fluid used must not be heated to the boiling point.
3. Do not use the product with air or other gases under any circumstances.
4. Do not use the product in circumstances where it will be exposed to pressure that exceeds 1 MPa, such as with a water hammer or surge pressure.

### Operating Environment

#### Caution
1. If the product is used in an environment or location conducive to corrosion, discoloration or deterioration due to corrosion may occur.
2. Fatigue damage may occur if the product is used in a location subject to vibrations or impacts.

### Maintenance

#### Caution
1. Wash out the cooling water side once a year.

### Fluid

#### Warning
1. Use tap water or industrial water as cooling water.
   - Do not use seawater.
2. Do not use for cooling chemicals or food products.