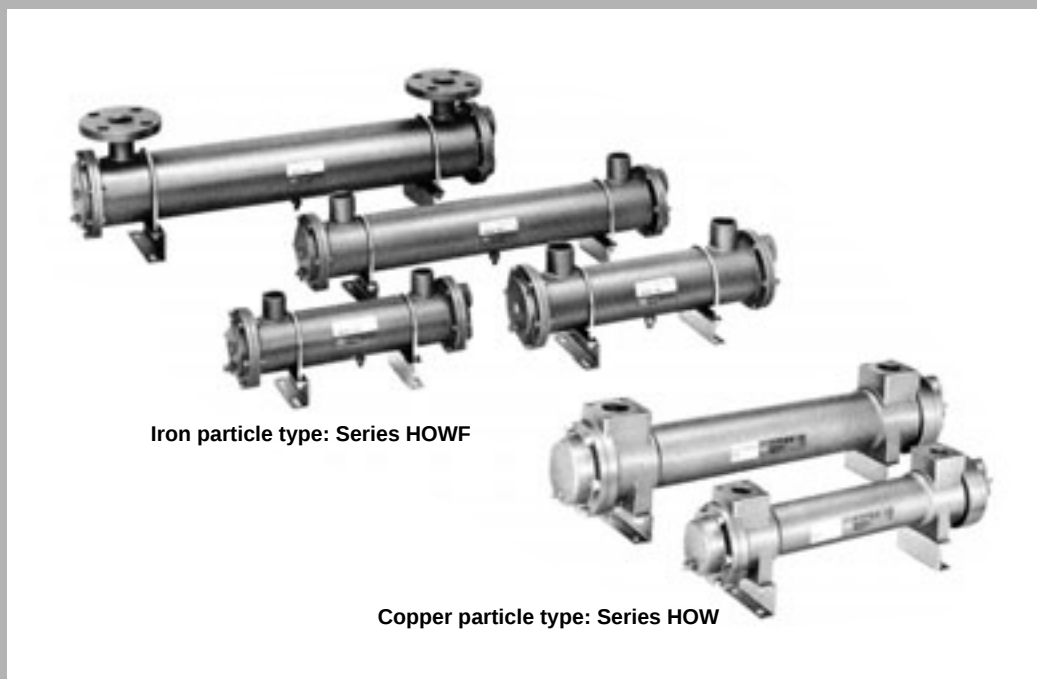


# Water Cooled Oil Cooler

## Series HOW ☐



FH ☐

HOW ☐

| Series                                                                    | Heat transfer area (Inside pipe)<br>(m <sup>2</sup> ) | Heat exchange<br>volume<br>(kW) | Flow rate (l/min) |                    | Page |
|---------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------|-------------------|--------------------|------|
|                                                                           |                                                       |                                 | Oil side          | Cooling water side |      |
| Oil Cooler:<br>Iron particle type<br>(Fixed pipe type)<br>Series HOWF     | 0.077, 0.13, 0.21, 0.34<br>0.56, 0.83, 1.28           | 5.2<br>to<br>73                 | 20<br>to<br>800   | 40<br>to<br>125    | 448  |
| Oil Cooler:<br>Copper particle type<br>(Floating pipe type)<br>Series HOW | 0.084, 0.13, 0.21, 0.32<br>0.50, 0.75                 | 6.0<br>to<br>52                 | 20<br>to<br>400   | 25<br>to<br>100    | 453  |

# Fixed Pipe Type Oil Cooler

## Series *HOWF*

### Water Cooled: Iron Particle Type

#### 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

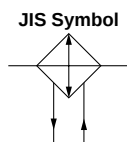
U-bolts are used to mount the oil cooler, providing plenty of flexibility with regard to the mounting orientation and method.

#### Simple structure

The baffle is also welded to a metal particle layer, a design that eliminates problems that previously tended to occur at the joins 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.



#### Specifications

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

Note) Refer to "Dimensions". 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).

#### Model

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

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.)

#### How to Order

## HOWF 7 - 06

##### Oil side port size

|    |               |
|----|---------------|
| 06 | Rc 3/4        |
| 08 | Rc 1          |
| 10 | 1 1/4" flange |
| 16 | 2" 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)

## Model Selection

To select the appropriate model for your application, use the data at right and follow the steps below.

| Item                 | Fluid cooled               | Cooling water |
|----------------------|----------------------------|---------------|
| Type (brand)         | Turbine oil Class 1 (VG56) | —             |
| Flow rate            | 130 ℓ/min                  | (40) ℓ/min    |
| Temperature          | Inlet<br>Outlet            | —<br>25°C     |
| Heat exchange volume | 15 kW                      |               |

### 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:  $Q = \frac{15}{0.97 \times 1.3} = 11.9 \text{ kW}$
- 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:  $\Delta P = 0.04 \text{ MPa}$
- 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:  $\Delta P = 0.4 \times 1.4 = 0.056 \text{ MPa}$

(Result) Model: HOWF22, Oil pressure drop:  $\Delta P = 0.056 \text{ MPa}$ ,  
Cooling water volume: 55 ℓ/min

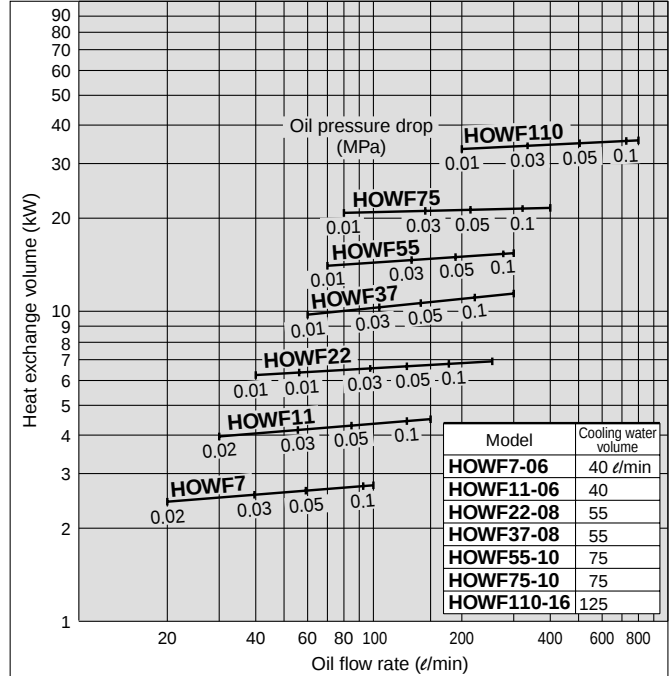
### Step (B): Cooling Water Flow Rate Specified

- 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.  
— Oil outlet temperature 50°C, provisional model selection 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:  $Q = \frac{15}{0.97 \times 1.3 \times 0.85} = 14 \text{ kW}$
- 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:  $\Delta P = 0.035 \text{ MPa}$
- 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:  $\Delta P = 0.35 \times 1.4 = 0.049 \text{ MPa}$

(Result) Model: HOWF37, Oil pressure drop:  $\Delta P = 0.049 \text{ MPa}$ ,  
Cooling water volume: 40 ℓ/min

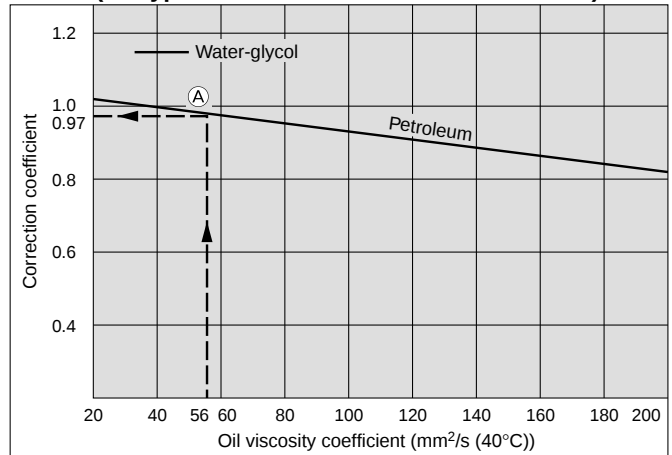
## Model Performance Graph ①: Oil Outlet Temperature 40°C

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

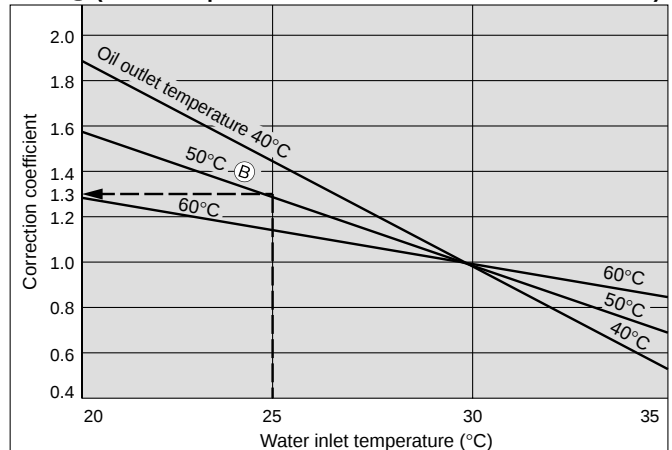


Model performance values include an allowance (approx. 25%) for water deposits.

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



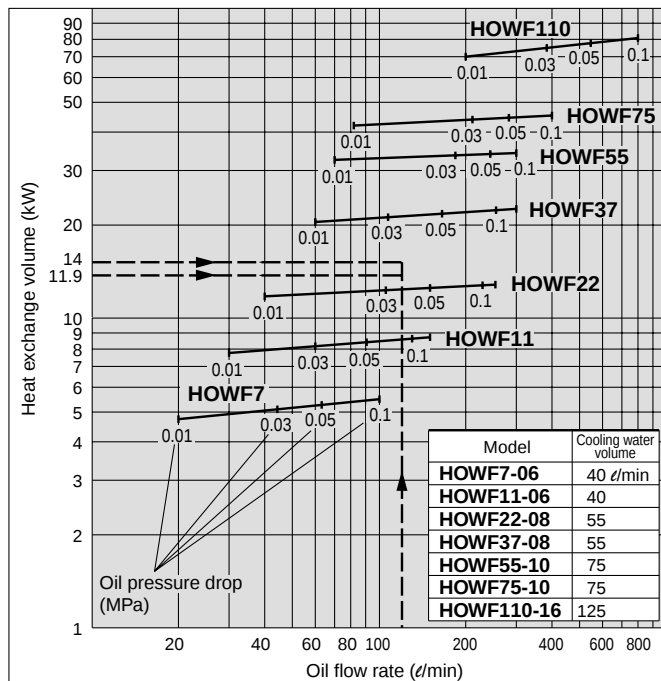
### Data (B) (Water temperature/Heat volume correction coefficient)



# Series HOWF

## Model Performance Graph ②: Oil Outlet Temperature 50°C

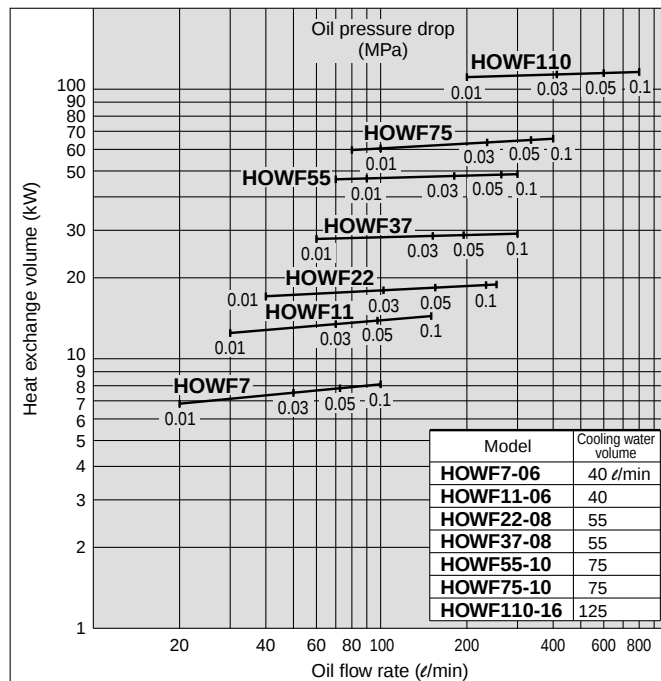
Conditions Oil outlet temperature: 50°C  
 Water inlet temperature: 30°C  
 Fluid: Turbine oil Class 1 (ISO VG32)  
 Oil side pressure drop: 0.01, 0.03, 0.05, 0.1 MPa indicated



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

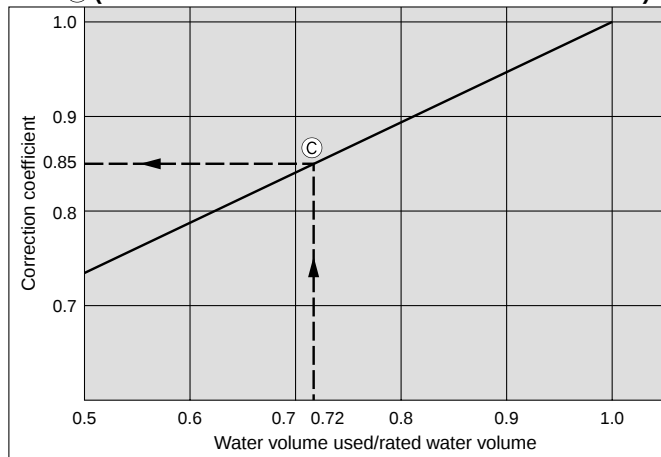
## Model Performance Graph ③: Oil Outlet Temperature 60°C

Conditions Oil outlet temperature: 60°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

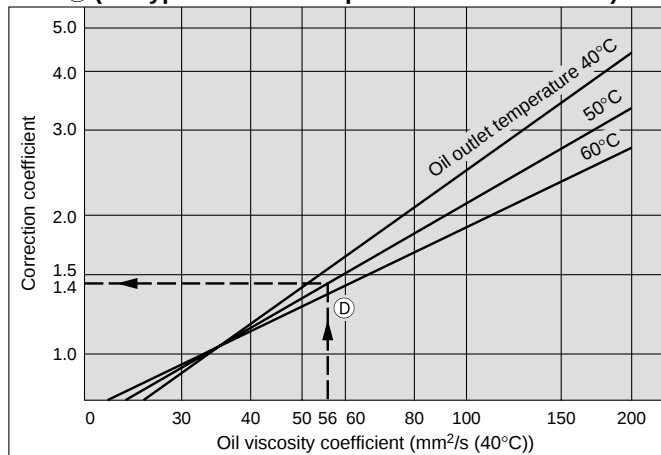


Model performance values include an allowance (approx. 25%) for water deposits.

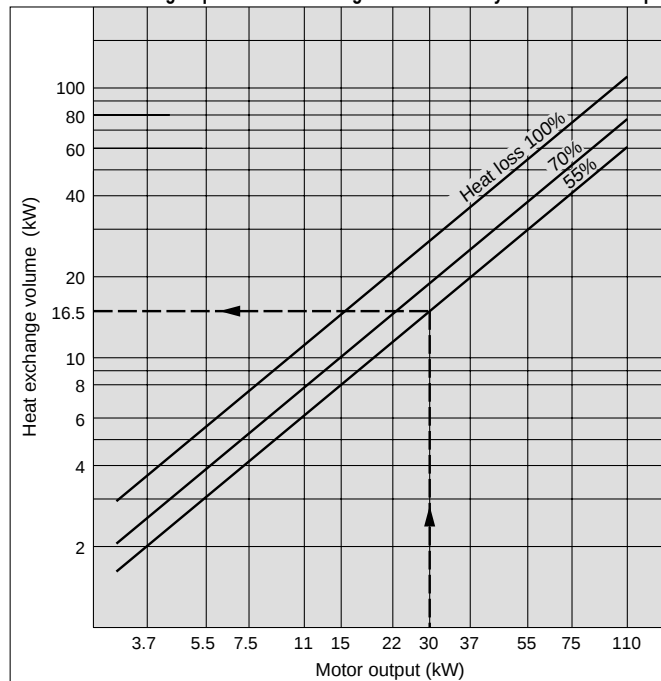
## Data ㉔ (Water volume/Heat volume correction coefficient)



## Data ㉕ (Oil type/Pressure drop correction coefficient)

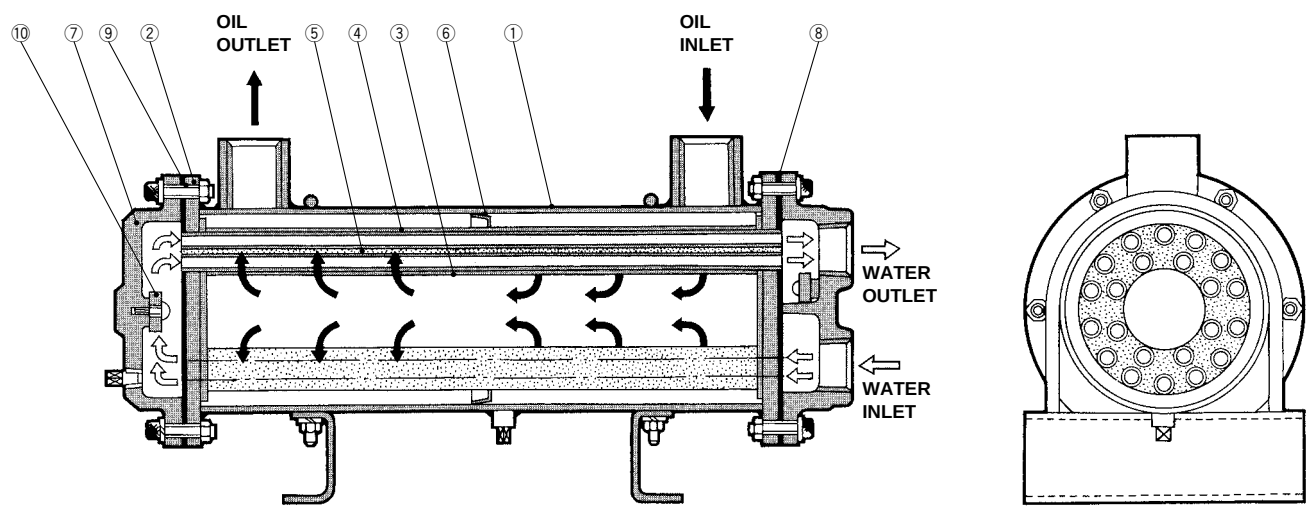


## Table for calculating required heat exchange volume from hydraulic motor output



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.)

Construction/Component Parts



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.

Component Part Materials

| No. | Description          | Material            | Note          |
|-----|----------------------|---------------------|---------------|
| ①   | Body                 | STK                 |               |
| ②   | Pipe plate A         | SS400               |               |
| ③   | Metal particle cover | Stainless steel 304 |               |
| ④   | Heat transfer pipe   | C1220T              |               |
| ⑤   | Metal particles      | SS                  | Copper-plated |
| ⑥   | Baffle               | Stainless steel 304 |               |
| ⑦   | Water chamber cover  | FC200               |               |

Component Parts

| No.         | ⑧        | ⑨        | ⑩                        |
|-------------|----------|----------|--------------------------|
| Description | Gasket A | Gasket B | Corrosion-resistant zinc |
| Material    | NBR      | NBR      | Zn                       |
| Quantity    | 1        | 1        | 3                        |
| Model       |          |          |                          |
| HOWF7-06    |          |          |                          |
| HOWF11-06   | P1751411 | P1751412 |                          |
| HOWF22-08   |          |          |                          |
| HOWF37-08   | P1751611 | P1751612 | P1751427                 |
| HOWF55-10   |          |          |                          |
| HOWF75-10   | P1751810 | P1751811 |                          |
| HOWF110-16  | P175126  | P175127  | P175067                  |

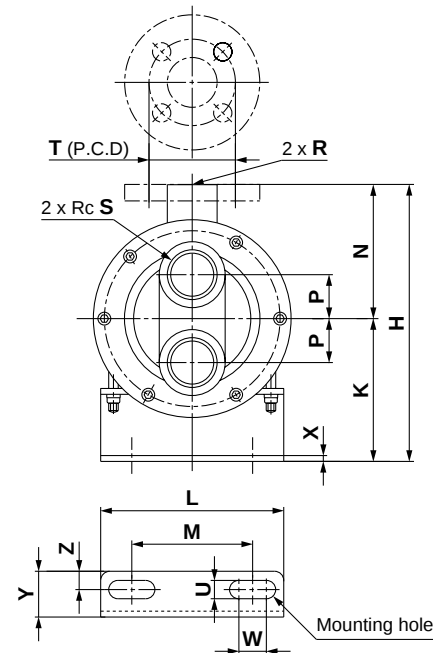
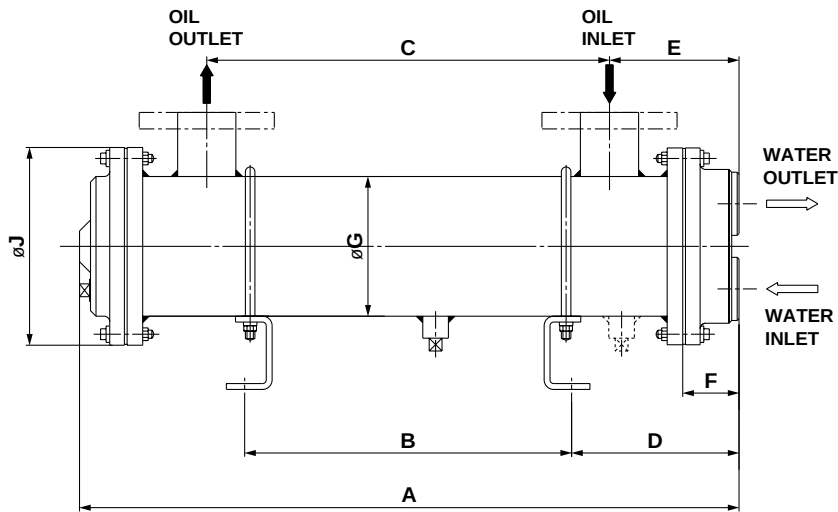
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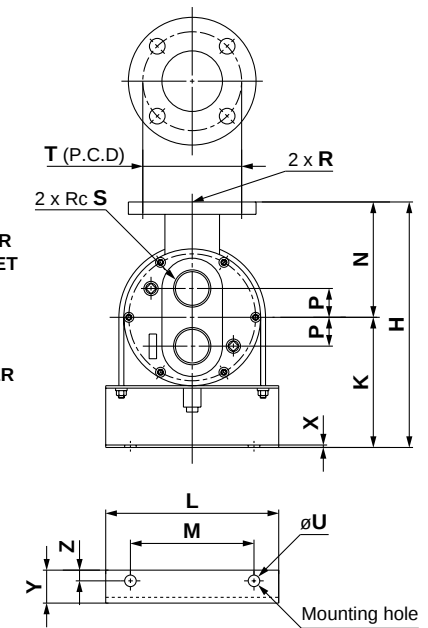
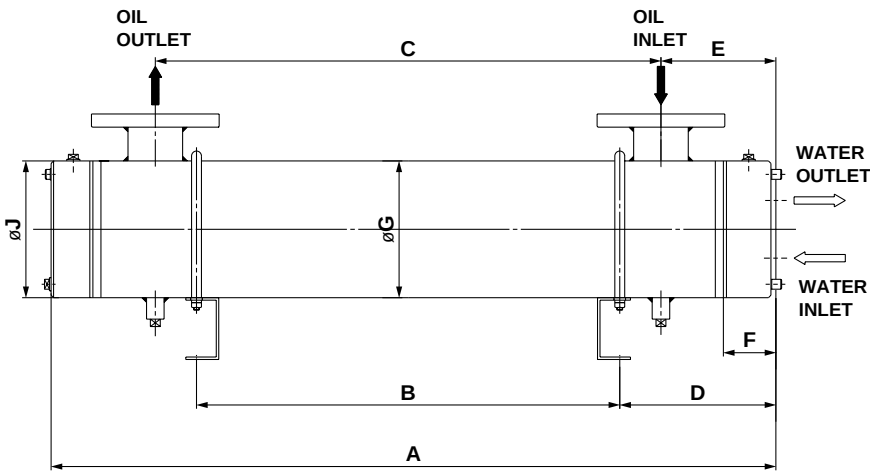
# Series HOWF

## Dimensions

### HOWF7-06 to HOWF75-10



### HOWF110-16



| Model      | A    | B   | C    | D   | E   | F  | øG  | H   | øJ  | K   | L   | M   | N   | P  | R                         | S     |
|------------|------|-----|------|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|----|---------------------------|-------|
| HOWF7-06   | 246  | 60  | 105  | 93  | 72  | 30 | 76  | 151 | 108 | 78  | 100 | 66  | 73  | 24 | Rc3/4                     | 3/4   |
| HOWF11-06  | 361  | 175 | 220  | 95  | 72  | 30 | 76  | 151 | 108 | 78  | 100 | 66  | 73  | 24 | Rc3/4                     | 3/4   |
| HOWF22-08  | 429  | 210 | 270  | 113 | 83  | 33 | 89  | 169 | 121 | 84  | 113 | 79  | 85  | 28 | Rc1                       | 1     |
| HOWF37-08  | 639  | 420 | 480  | 113 | 83  | 33 | 89  | 169 | 121 | 84  | 113 | 79  | 85  | 28 | Rc1                       | 1     |
| HOWF55-10  | 742  | 500 | 570  | 125 | 90  | 35 | 114 | 229 | 146 | 107 | 143 | 103 | 122 | 34 | 1 1/4 <sup>B</sup> flange | 1 1/4 |
| HOWF75-10  | 1057 | 815 | 885  | 125 | 90  | 35 | 114 | 229 | 146 | 107 | 143 | 103 | 122 | 34 | 1 1/4 <sup>B</sup> flange | 1 1/4 |
| HOWF110-16 | 1313 | 950 | 1050 | 189 | 139 | 64 | 165 | 298 | 166 | 158 | 210 | 150 | 140 | 35 | 2 <sup>B</sup> flange     | 1 1/2 |

| Model      | T   | U   | W  | X   | Y  | Z  |
|------------|-----|-----|----|-----|----|----|
| HOWF7-06   | —   | 10  | 15 | 3.2 | 25 | 10 |
| HOWF11-06  | —   | 10  | 15 | 3.2 | 25 | 10 |
| HOWF22-08  | —   | 10  | 15 | 3.2 | 25 | 10 |
| HOWF37-08  | —   | 10  | 15 | 3.2 | 25 | 10 |
| HOWF55-10  | 100 | 12  | 13 | 3.2 | 30 | 12 |
| HOWF75-10  | 100 | 12  | 13 | 3.2 | 30 | 12 |
| HOWF110-16 | 120 | ø14 | —  | 7   | 40 | 13 |

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

|                         |                                                                             |
|-------------------------|-----------------------------------------------------------------------------|
| Max. operating pressure | (Oil and Water sides) 1.0 MPa                                               |
| Proof pressure          | (Oil and Water sides) 1.5 MPa                                               |
| Fluid temperature       | Oil side: Max. 100°C/Water side: Max. 50°C                                  |
| Cooling water           | Industrial water, Tap water                                                 |
| Fluid cooled            | General petroleum-based hydraulic fluid, Lubricating oil <sup>Note 1)</sup> |
| Heat transfer medium    | Copper tube and copper particles                                            |
| Connection              | Threaded <sup>Note 2)</sup>                                                 |

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.

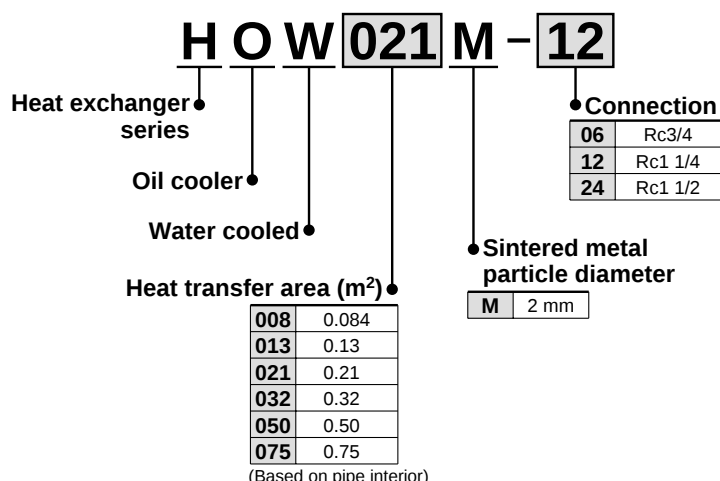
#### Model

| Model      | Heat transfer area (inside pipe) (m <sup>2</sup> ) | Heat exchange volume (kW) | Oil side                | Cooling water side |                     | Mass (kg) |
|------------|----------------------------------------------------|---------------------------|-------------------------|--------------------|---------------------|-----------|
|            |                                                    |                           | Flow rate range (l/min) | Flow rate (l/min)  | Pressure drop (MPa) |           |
| HOW008M-06 | 0.084                                              | 6                         | 20 to 130               | 25                 | 0.02                | 7         |
| HOW013M-06 | 0.13                                               | 8.5                       | 30 to 160               | 25                 | 0.02                | 8         |
| HOW021M-12 | 0.21                                               | 14                        | 35 to 200               | 65                 | 0.03                | 14        |
| HOW032M-12 | 0.32                                               | 21                        | 40 to 250               | 65                 | 0.03                | 18        |
| HOW050M-12 | 0.50                                               | 30                        | 50 to 300               | 65                 | 0.03                | 24        |
| HOW075M-14 | 0.75                                               | 52                        | 60 to 400               | 100                | 0.05                | 42        |

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



FH□

HOW□

## 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 (D) are listed in the series HOWF section.)

| Item                 | Fluid cooled               | Cooling water |
|----------------------|----------------------------|---------------|
| Type (brand)         | Turbine oil Class 1 (VG56) | —             |
| Flow rate            | 130 ℓ/min                  | (47) ℓ/min    |
| Temperature          | Inlet<br>Outlet            | —<br>25°C     |
| Heat exchange volume | 15 kW                      |               |

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

- From Data (A), calculate the oil type–heat volume correction coefficient.  
— Example:  $A = 0.97$
- From Data (B), calculate the water temperature–heat volume correction coefficient.  
— Example:  $B = 1.3$
- Using the correction coefficients obtained in (1) and (2), calculate the converted heat exchange volume.  
— Example:  $Q = \frac{15}{0.97 \times 1.3} = 11.9 \text{ kW}$
- Select the appropriate model from the model performance graph.  
— Example: Oil outlet temperature 50°C, selected model **HOW021M**  
In this case, the oil pressure drop can be calculated as follows.
- From the model performance graph, determine the oil pressure drop.  
— Example:  $\Delta P = 0.06 \text{ MPa}$
- From Data (D), calculate the oil type–pressure drop correction coefficient.  
— Example:  $D = 1.4$
- Using (5) and (6), calculate the corrected oil pressure drop.  
— Example:  $\Delta P = 0.6 \times 1.4 = 0.084 \text{ MPa}$

(Result) Model: HOW021M, Oil pressure drop:  $\Delta P = 0.084 \text{ MPa}$ ,  
Rated water volume: 65 ℓ/min

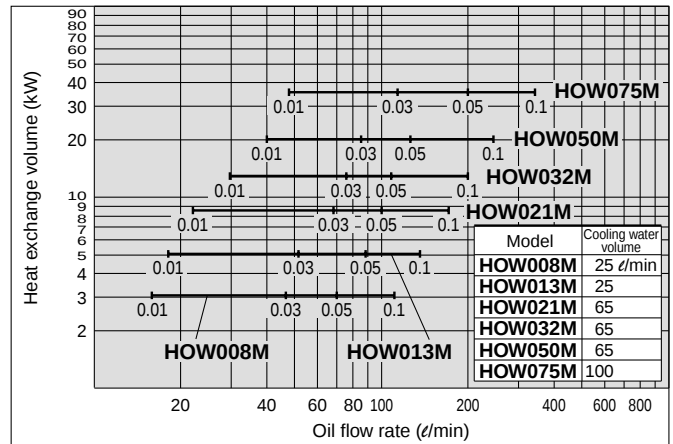
### Step (B) : Cooling Water Flow Rate Specified

- From Data (A), calculate the oil type–heat volume correction coefficient.  
— Example:  $A = 0.97$
- From Data (B), calculate the water temperature–heat volume correction coefficient.  
— Example:  $B = 1.3$
- 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.  
— Oil outlet temperature 50°C, provisional model selection HOW021M, rated water volume 65 ℓ/min.
- 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:  $\frac{47}{65} = 0.72$
- From Data (C), calculate the water volume–heat volume correction coefficient.  
— Example:  $C = 0.85$
- Using the correction coefficients obtained in (1), (2), and (5), calculate the converted heat exchange volume.  
— Example:  $Q = \frac{15}{0.97 \times 1.3 \times 0.85} = 14 \text{ kW}$
- Select the appropriate model from the model performance graph.  
— Example: Oil outlet temperature 50°C, selected model **HOW021M**  
In this case, the oil pressure drop can be calculated as follows.
- From the model performance graph, determine the oil pressure drop.  
— Example:  $\Delta P = 0.06 \text{ MPa}$
- From Data (D), calculate the oil type–pressure drop correction coefficient.  
— Example:  $D = 1.4$
- Using (8) and (9), calculate the corrected oil pressure drop.  
— Example:  $\Delta P = 0.6 \times 1.4 = 0.084 \text{ MPa}$

(Result) Model: HOW021M, Oil pressure drop:  $\Delta P = 0.084 \text{ MPa}$ ,  
Cooling water volume: 47 ℓ/min

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

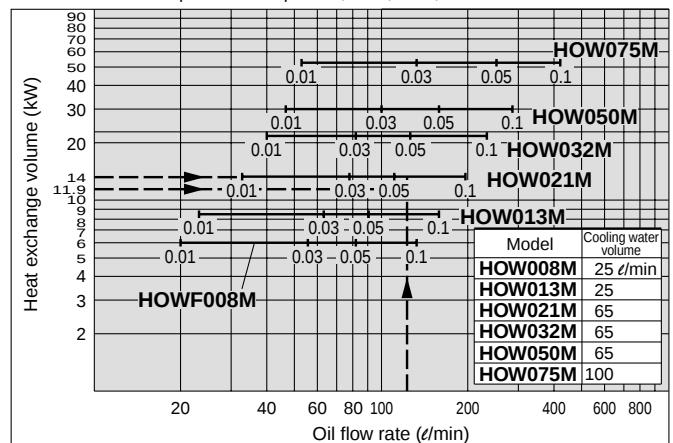
Conditions Oil outlet temperature: 40°C  
Water inlet temperature: 30°C  
Fluid: Turbine oil Class 1 (ISO VG32)  
Oil side pressure drop: 0.01, 0.03, 0.05, 0.1 MPa indicated



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

## Model Performance Graph ②: Oil Outlet Temperature 50°C

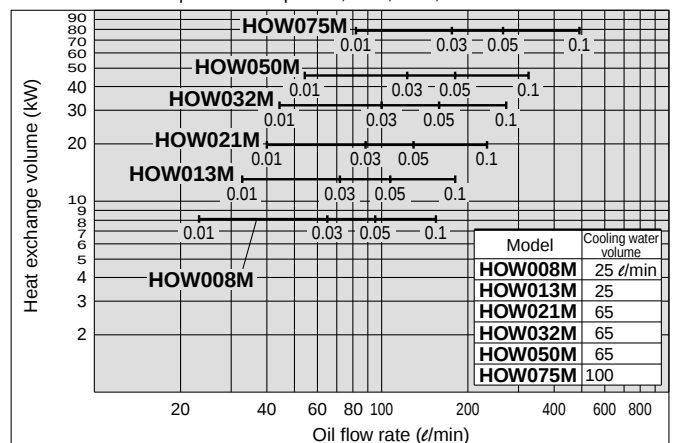
Conditions Oil outlet temperature: 50°C  
Water inlet temperature: 30°C  
Fluid: Turbine oil Class 1 (ISO VG32)  
Oil side pressure drop: 0.01, 0.03, 0.05, 0.1 MPa indicated



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

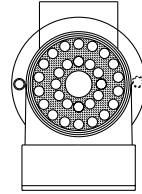
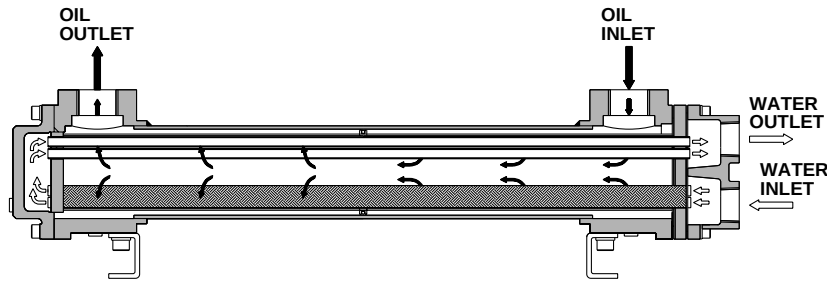
## Model Performance Graph ③: Oil Outlet Temperature 60°C

Conditions Oil outlet temperature: 60°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.

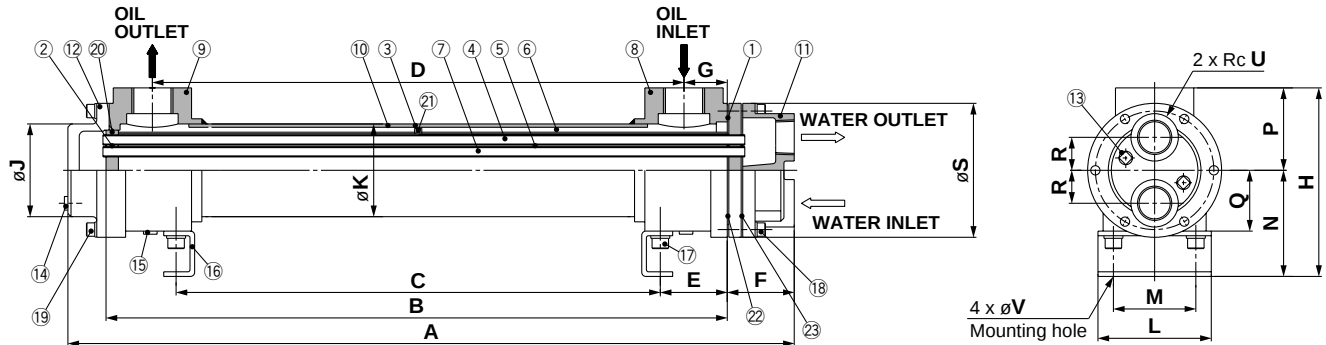
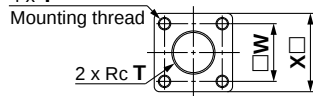
## Construction



### 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 outside the heat transfer pipes, 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.

4 x Y



| Model      | A    | B   | C   | D   | E  | F  | G  | H   | øJ  | øK  | L   | M   | N   | P   | Q  | R  | øS  | T     | U     | øV | W  | X  | Y (Mounting thread)    |
|------------|------|-----|-----|-----|----|----|----|-----|-----|-----|-----|-----|-----|-----|----|----|-----|-------|-------|----|----|----|------------------------|
| HOW008M-06 | 493  | 400 | 300 | 336 | 50 | 58 | 32 | 149 | 64  | 73  | 90  | 60  | 87  | 62  | 47 | 25 | 100 | 3/4   | 1/2   | 10 | 40 | 56 | M8 x P1.25 x depth 14  |
| HOW013M-06 | 693  | 600 | 500 | 536 | 50 | 58 | 32 | 149 | 64  | 73  | 90  | 60  | 87  | 62  | 47 | 25 | 100 | 3/4   | 1/2   | 10 | 40 | 56 | M8 x P1.25 x depth 14  |
| HOW021M-12 | 505  | 400 | 270 | 316 | 65 | 65 | 42 | 184 | 90  | 90  | 110 | 80  | 104 | 80  | 59 | 32 | 130 | 1 1/4 | 1     | 12 | 56 | 76 | M12 x P1.75 x depth 20 |
| HOW032M-12 | 705  | 600 | 470 | 516 | 65 | 65 | 42 | 184 | 90  | 90  | 110 | 80  | 104 | 80  | 59 | 32 | 130 | 1 1/4 | 1     | 12 | 56 | 76 | M12 x P1.75 x depth 20 |
| HOW050M-12 | 1055 | 950 | 820 | 866 | 65 | 65 | 42 | 184 | 90  | 90  | 110 | 80  | 104 | 80  | 59 | 32 | 130 | 1 1/4 | 1     | 12 | 56 | 76 | M12 x P1.75 x depth 20 |
| HOW075M-14 | 1077 | 950 | 780 | 842 | 85 | 77 | 54 | 230 | 118 | 120 | 150 | 100 | 130 | 100 | 75 | 40 | 168 | 1 1/2 | 1 1/4 | 14 | 65 | 92 | M16 x P2 x depth 25    |

### Component Parts

| No. | Description            | Material            | Quantity |
|-----|------------------------|---------------------|----------|
| ①   | Tube sheet A           | SS400               | 1        |
| ②   | Tube sheet B           | SS400               | 1        |
| ③   | Baffle                 | SS400               | 1        |
| ④   | Heat transfer pipes    | C1220T              | —        |
| ⑤   | Metal particle layer   | Cu                  | —        |
| ⑥   | Metal particle cover A | Stainless steel 304 | 2        |
| ⑦   | Metal particle cover B | Stainless steel 304 | 1        |
| ⑧   | Shell flange A         | AC4C                | 1        |
| ⑨   | Shell flange B         | AC4C                | 1        |
| ⑩   | Shell pipe             | A6063T              | 1        |
| ⑪   | Water chamber cover A  | FC200               | 1        |
| ⑫   | Water chamber cover B  | FC200               | 1        |

| No. | Description              | Material            | Quantity |
|-----|--------------------------|---------------------|----------|
| ⑬   | Corrosion-resistant plug | Zn, FCMB            | 2        |
| ⑭   | Water drain plug         | FCMB                | 1        |
| ⑮   | Oil drain plug           | FCMB                | 2        |
| ⑯   | Foot                     | SS400               | 2        |
| ⑰   | Foot bolt                | S20C                | 4        |
| ⑱   | Cap bolt                 | SCM3                | 6        |
| ⑲   | Cap bolt                 | SCM3                | 6        |
| ⑳   | O-ring A                 | NBR                 | 1        |
| ㉑   | O-ring B                 | NBR                 | 1        |
| ㉒   | Seal A                   | V <sup>®</sup> 6500 | 1        |
| ㉓   | Seal B                   | V <sup>®</sup> 6500 | 1        |

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

| Application                                |                     |                    |               |
|--------------------------------------------|---------------------|--------------------|---------------|
| Heat exchange volume                       |                     | kW                 |               |
| Item                                       |                     | Fluid to be cooled | Cooling water |
| Type (brand)                               |                     |                    |               |
| Flow rate                                  |                     | ℓ/min              | ℓ/min         |
| Temperature                                | Inlet               | °C                 | °C            |
|                                            | Outlet              | °C                 | —             |
| Allowable pressure drop                    |                     | MPa                | MPa           |
| Max. operating pressure                    |                     | MPa                | MPa           |
| Property values                            | Weight volume ratio | kgf/cm³            | —             |
|                                            | Specific heat       | kW/kg°C            | —             |
|                                            | Viscosity           | mm²/s              | —             |
| If hydraulic fluid, hydraulic motor output |                     | kW                 | —             |



## Series *HOW/HOWF* Specific Product Precautions

Be sure to read before handling.

Refer to front matters 30 and 31 for Safety Instructions.

### 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.

### 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.

### 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.

### 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 gets 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  $\mu$ m 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.**

### 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.