

How to select Heat Exchanger

You can select heat exchanger simply by the catalog. Please refer to the following instruction.

STEP.1 Working condition check

| Check item | Remarks |
|------------------------|---|
| Type | Water-Cooled Shell and Tube type, Air-Cooled type |
| Heat exchange amount | If not specified, temperature of inlet and outlet at shell side should be set. |
| Working temperature | Shell side: inlet and outlet temperature Tube side: inlet temperature |
| Max working pressure | 1 MPa for both Shell and Tube type and Air-Cooled type |
| Flow rate (normal/max) | Shell side: Should be specified Tube side: If not specified, set the same value as a shell side. |

Heat exchanger selection is NOT possible if check item in **large character** is not specified.

| Check item | Remarks |
|-------------------------|--|
| Fluid type | Shell side: Fluid type, density, and kinematic viscosity Tube side: Type of cooling water |
| Allowable pressure drop | If not specified, Shell side: $\leq 0.1\text{MPa}$ Tube side: $\leq 0.05\text{MPa}$ |
| Scale coefficient | If not specified, set $0\text{ m}^2\text{C/W}$ for both shell side and tube side. |
| Pipe connection | Size and connection type (flange/thread) should be specified. |

(Standard working condition in the catalog)

Fluid: Corresponding to ISO VG46 / Inlet temperature at shell side: 55°C / Inlet temperature at tube side: 30°C

STEP.2 Calculation of required condition

- A) If working condition checked at **STEP 1** is almost same with standard condition in the catalog Go to **STEP.2-①**
- B) If working condition checked at **STEP 1** is NOT same with standard condition in the catalog Go to **STEP.6**

① Calculation of heat transfer area

i) Calculation of heat exchange amount [kW]
(ρ : specific gravity, C: specific heat)
Calculate working temperature by the following equation
if heat exchange amount and oil flow rate is determined.

$$Q = W_o \times 60 \times \rho_o \times C_o \times (T_1 - T_2)$$

$$= W_w \times 60 \times \rho_w \times C_w \times (t_2 - t_1)$$

ii) Calculation of logarithmic mean temperature difference θ [°C]

$$\theta = \frac{(T_1 - t_2) - (T_2 - t_1)}{2.3 \log \frac{(T_1 - t_2)}{(T_2 - t_1)}}$$

iii) Calculation of required heat transfer area A [m²]
(K-value: Overall heat transfer coefficient [W/m²C])

$$A = \frac{Q \times 1000}{\theta \cdot K}$$

Fig.1 Although K-value depends on working condition, structure of heat exchanger, and so on, please select mean value of catalog products.

| Type of cooling tube | K - Value |
|--------------------------------------|-----------|
| Products of $\phi 9$ low fin tube | 350~450 |
| Products of $\phi 12.7$ low fin tube | 200~250 |

[W: Flow rate (l/min), T1/T2: Inlet and outlet temperature at shell side (°C), t1/t2: Inlet and outlet temperature at tube side (°C)]

STEP.3 Base model selection

- ① Select a base model from P.8 - 9 "INDEX" that meets the requirements in **STEP 2**.
- ② Refer to the production line-up page of the selected base model.

STEP.4 Size selection

Refer to "PERFORMANCE GRAPH" of the selected model in **STEP 3**, and select the minimum size within the determined condition of heat exchange amount and allowable pressure drop.

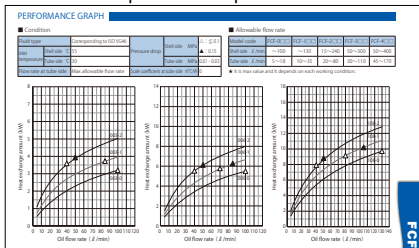


Fig.2 Oil quantity variation

| Oil flow rate | Large | Small |
|---------------|-------|-------|
| CODE | 0 | 1 2 |

Fig.3 How to check heat transfer area of heat exchanger

| Type | How to check |
|------------------------------|--|
| FCF*1, FCD(B), FCX, FCW, FCU | Divide the last two numbers of MODEL CODE by 20 |
| FCF*2, FPD | Divide the last two numbers of MODEL CODE by 2 |
| FTC(B), FTS(B), TEMA | The number right after MODEL CODE (It is directly heat transfer area.) |

(Ex.) In case of FCF-114-2 $\Rightarrow 14 \div 20 = 0.7\text{m}^2$

* 1 FCF-003~FCF-390 * 2 FCF-311~FCF-420

STEP.5 Spec confirmation

○ Estimate K-value by back calculating in **STEP 2 - ①**, and confirm if the heat transfer area of selected model in **STEP 4** satisfies required specification.

- a) Estimated K-value equals to the one in **fig.1** \Rightarrow ○ Selected model is OK.
- b) Estimated K-value does not equal to the one in **fig.1** \Rightarrow × Back to **STEP 4** and select again.

STEP.6 Model selection for other conditions

○ If standard working condition on the catalog does not meet your requirement or if you request air-cooled type heat exchanger, please fill out necessary items from "Request (Filter/Heat Exchanger)" on our WEB site.

Download of drawing, CAD data (outline drawing), and operation manual is available on our WEB site*.

* User account registration is required (for free). https://www.taiseikogyo.co.jp/en/request_cooler/

PERFORMANCE GRAPH

Condition

| | | | | | | |
|------------------------|-------------------------------|-------------------------|--|---|----------------|----------------------------|
| Fluid type | | Fresh water | | Pressure drop | Shell side MPa | \triangle : ≤ 0.002 |
| Inlet temperature | Shell side $^{\circ}\text{C}$ | 80 | | | Tube side MPa | \blacktriangle : 0.005 |
| | Tube side $^{\circ}\text{C}$ | 30 | | Scale coefficient at tube side $\text{m}^3\text{C/W}$ 0 | | |
| Flow rate at tube side | | Max allowable flow rate | | | | |

Allowable flow rate

| | | | |
|------------------------------|--------------|--------------|---------------|
| Model code | TCW-1□□ | TCW-2□□ | TCW-3□□ |
| Shell side ℓ/min | ~ 100 | ~ 180 | 50 \sim 300 |
| Tube side ℓ/min | 20 \sim 35 | 30 \sim 80 | 30 \sim 110 |

★ It is max value and it depends on each working condition.

