

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.

TYPE	STRUCTURE	COOLING TUBE	MAX WORKING PRESSURE [MPa]	MODEL	HEAT TRANSFER AREA [m ²]	HEAT EXCHANGE AMOUNT [kW]	SHELL SIDE (OIL) FLOW RATE [l/min]	SPEC. EQUIPMENT, OPTION	PAGE
	Shell tube sheet type 2 pass	Shell Low Fin tube Phosphor-bronze	1.0	FCF	0.01~0.2	0.1~10	10~100		
				TCC	0.01~1	0.1~10	10~100		
				ZCC	0.01~0.5	0.1~10	10~100		

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.

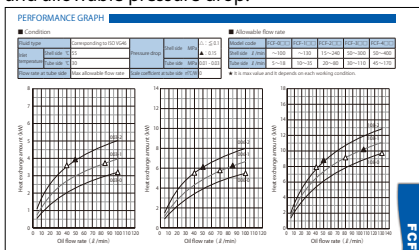


Fig.3 How to check heat transfer area of heat exchanger

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		Corresponding to ISO VG46		Pressure drop	Shell side MPa	△ : 0.1
Inlet temperature	Shell side °C	55			Tube side MPa	▲ : 0.15
	Tube side °C	30				0.01 - 0.03
Flow rate at tube side		Max allowable flow rate	Scale coefficient at tube side	m ² C/W 0		

Allowable flow rate

Model code	FCX-1□□	FCX-2□□
Shell side ℓ/min	~130	15~240
Tube side ℓ/min	10~35	20~80

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

