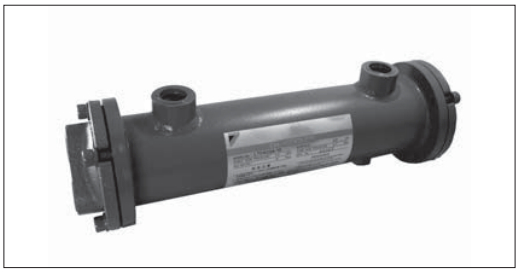
Oil Cooler (LT Cooler - Water Cooled Type)



● LT type oil cooler having a bigger cooling capacity with less water.

Nomenclature

LT	※※※※	A	-	10
1	2	3		4

1 Model No.
LT: oil cooler

2 Capacity code

0403	1515
0504	2020
0707	3030
1010	5060

3 Acceptable water
A: for fresh water, industrial water
(Sea water is unusable.)

4 Design No.
(The design No. is subject to change)

Model code	A	B	C	D	E	F	G	H	K	J × L	M	N	P	S	U	V	W	Heat transfer area m^2	Max. oil flow rate L/min/min	Mass kg
LT0403	364	200	87	140	115	60	57	75	14.5	20 × 10	¾	½	108	76.3	30	2.3	105	0.3	40	7
LT0504	504	340	87	280	115	60	57	75	14.5	20 × 10	¾	½	108	76.3	30	2.3	105	0.4	50	9
LT0707	614	440	92	340	140	85	66	80	17.5	25 × 10	1	½	124	89.1	30	2.3	114	0.7	75	13
LT1010	814	640	92	540	140	85	66	80	17.5	25 × 10	1	½	124	89.1	30	2.3	114	1.0	100	16
LT1515	614	430	97	330	145	100	82	100	21	25 × 12	1¼	¾	144	114.3	35	2.3	144	1.4	150	20
LT2020	814	630	97	530	145	100	82	100	21	25 × 12	1¼	¾	144	114.3	35	2.3	144	2.0	200	24
LT3030	829	590	127	490	175	130	95	110	25	32 × 12	1½	1	168	139.8	40	3.2	174	3.4	300	33
LT5060	1099	830	142	710	200	150	111	125	29	32 × 12	2	1	200	165.2	40	3.2	200	6.3	500	56

Handling

- Fluids or water that will corrode the cooling piping (Cu) or seawater must not be used.

- **Use cooling water that satisfies the water quality standard.**

  The quality and flow rate of the cooling water must be maintained at a standard level to prolong the life of the oil cooler.
  The oil cooler is made of copper pipes for better heat exchanger effectiveness and better resistance to corrosion. However, using water of poor quality may cause corrosion that shortens the service life, or generate scales that deteriorate the cooling capacity.
  To secure a prolonged oil cooler service life, observe the water quality standards given in the table below.

Table-1 Water quality standards for cooling water

Item			Standard value	Effect on oil cooler	
				Corrosion	Scale generation
PH		(25°C)	6.0 to 8.0	✓	✓
Electrical conductivity at 25°C		(μS/cm)	500 maximum	✓	
M alkalinity	$CaCO_3$	(PPM)	100 maximum		✓
Total hardness	$CaCO_3$	(PPM)	200 maximum		✓
Chlorine ion	Cl^-	(PPM)	200 maximum	✓	
Sulfate ion	SO_4^{2-}	(PPM)	200 maximum	✓	
Total iron	Fe	(PPM)	1.0 maximum	✓	✓
Sulfur ion	S^{2-}	(PPM)	Not detectable	✓	
Ammonium ion	NH_4^+	(PPM)	Not detectable	✓	
Silica	SiO_2	(PPM)	50 maximum		✓

Table-2 Water quality standards for makeup water

Item			Standard value
PH		(25°C)	6.0 to 8.0
Electrical conductivity at 25°C		(μS/cm)	200 maximum
M alkalinity	$CaCO_3$	(PPM)	50 maximum
Total hardness	$CaCO_3$	(PPM)	50 maximum
Chlorine ion	Cl^-	(PPM)	50 maximum
Sulfate ion	SO_4^{2-}	(PPM)	50 maximum
Total iron	Fe	(PPM)	0.3 maximum
Sulfur ion	S^{2-}	(PPM)	Not detectable
Ammonium ion	NH_4^+	(PPM)	Not detectable
Silica	SiO_2	(PPM)	30 maximum

Note: 1. Either in a circulating type or one-way type system, "cooling water" refers to the water that passes through the oil cooler.
2. These standards conform to the water quality standard for cooling towers stipulated by The Japan Refrigeration and Air Conditioning Industry Association.

- The unit cannot be used for cooling chemicals or food products.
- The unit cannot be used when the temperature difference at the oil inlet and water inlet is 80°C or greater.
- The maximum operating pressure is 1 MPa {10 kgf/cm^2} in the oil piping and 0.7 MPa {7 kgf/cm^2} in the water piping.

- **Be sure to keep the water flow rate within the permissible ranges given in the table below.**

  An excessive water flow rate inside the copper tubes may cause them to corrode, and an insufficient water flow rate results in deterioration of thermal efficiency and cooling performance with a tendency for scale generation.
  The appropriate range for the flow velocity is from 0.5 to 2.0 m/s and the minimum and maximum water flow rates at an appropriate velocity for an LT oil cooler are given in the table below.

Table-3 Water flow rate standards for oil coolers

Water flow rate \ Model	LT0403	LT0504	LT0707	LT1010	LT1515	LT2020	LT3030	LT5060
Minimum water flow rate L/min (velocity 0.5 m/s)	8	10	12	15	20	25	35	60
Maximum water flow rate L/min (velocity 2.0 m/s)	30	30	43	43	87	87	150	200

- Clean the water pipes (inner face of heat exchanger pipes) once every six months to prevent corrosion of the heat exchanger pipes and deterioration of cooling capacity.
- There is no restriction on selection of the inlet and outlet side oil ports. However, for water inlet/outlet ports it is the common practice to lead water in at the lower port to avoid residual air inside the unit.
- The cooler can be used in a vertical orientation, but in that case, take care about piping design and install an air bleeder to avoid residual air inside the unit.

Example of selection

■Amount of exchanged heat at the maximum water flow rate

At the maximum water flow rate

Model No.	LT0403	LT0504	LT0707	LT1010	LT1515	LT2020	LT3030	LT5060
Water flow rate L/min	30	30	43	43	87	87	150	200

●Conditions

Oil inlet temperature	Water inlet temperature	Oil usable
55 °C	28 °C	Equivalent to ISO VG32

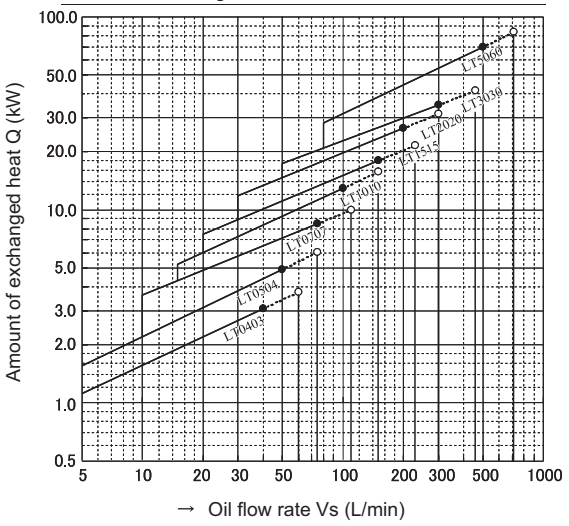
The selection graph to the right shows the criteria for selecting oil coolers when using oil of standard viscosity (equivalent to ISO VG32) with the maximum water flow rate.

●Example of selection
Assuming the case where 27 kW of heat is to be removed from oil equivalent to ISO VG32 at an oil flow rate of 200 L/min under the conditions described above, LT2020 is selected from the graph to the right at the maximum water flow rate (87 L/min for LT2020).

●Oil chilled temperature
= 36.9 [*1] × Amount of exchanged heat Q [kW] ÷ Oil flow rate Vs [L/min]
If 27 kW of heat is removed from oil flowing at 200 L/min in the example of selection above, the oil cooling temperature = 36.9 × 27 kW ÷ 200 L/min ≈ 5.0°C, i.e. oil at 55°C will be cooled to 50°C and flow out from the cooler.

Note: [*1] The value of 36.9 indicated above can be obtained from the following equation.
36.9 = 60 / ([Weight volume ratio of oil 0.865 kg/L] × [Specific heat of oil 1.88 kJ/(kg°C)])

<Amount of exchanged heat at the maximum water flow rate>



Note: Solid line: Pressure loss at oil side ⊿Ps ≤ 0.1 MPa {1 kgf/cm²}
Dashed line: 0.1 MPa {1 kgf/cm²} < Pressure loss at oil side ⊿Ps ≤ 0.2 MPa {2 kgf/cm²}
"●" mark: Point with the pressure loss at oil side of 0.1 MPa {1 kgf/cm²}
"○" mark: Point with the pressure loss at the oil side of 0.2 MPa {2 kgf/cm²}

■Amount of exchanged heat at the minimum water flow rate when using high viscosity oil

At the minimum water flow rate

Model No.	LT0403	LT0504	LT0707	LT1010	LT1515	LT2020	LT3030	LT5060
Water flow rate L/min	8	10	12	15	20	25	35	60

●Conditions

Oil inlet temperature	Water inlet temperature	Oil usable
55 °C	28 °C	Oil equivalent to ISO VG56

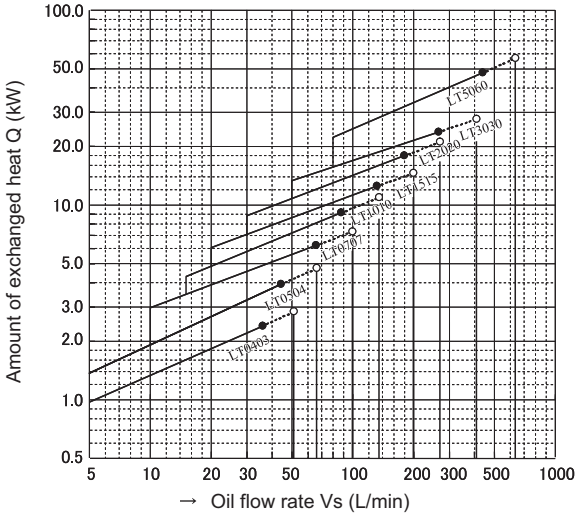
The selection graph to the right shows the criteria for selecting oil coolers when using oil with high viscosity (equivalent to ISO VG56) with the minimum water flow rate.

●Example of selection
If oil equivalent to ISO VG56 is used in the example above, where 27 kW of heat is to be removed from oil at an oil flow rate of 200 L/min, LT5060 is selected from the graph to the right at the minimum water flow rate (60 L/min for LT5060).

●Oil chilled temperature
In this example of selection, LT5060 which has a relatively large cooling capacity is selected, 34 kW of heat can be removed from the oil, and the oil cooling temperature = 36.9 × 34 kW ÷ 200 L/min ≈ 6.3°C, i.e. oil at 55°C will be cooled to 48.7°C and flow out from the cooler.

The oil cooler is designed to cool petroleum-based hydraulic oil. For applications other than petroleum-based hydraulic oil, please consult us.

<Amount of exchanged heat at the minimum water flow rate when using high viscosity oil>



Note: Solid line: Pressure loss at oil side ⊿Ps ≤ 0.1 MPa {1 kgf/cm²}
Dashed line: 0.1 MPa {1 kgf/cm²} < Pressure loss at oil side ⊿Ps ≤ 0.2 MPa {2 kgf/cm²}
"●" mark: Point with the pressure loss at oil side of 0.1 MPa {1 kgf/cm²}
"○" mark: Point with a pressure loss at the oil side of 0.2 MPa {2 kgf/cm²}

DAIKIN INDUSTRIES, LTD.

Oil Hydraulic Equipment

Osaka Office
YODOGAWA PLANT
1-1, Nishi-Hitotsuya, Settsu, Osaka 566-8585, Japan

Indian Representative
Technocrats Alliance Engineering Pvt. Ltd.
Works/Correspondence Office : 11/23, TIL Compound, Site-IV,
Sahibabad Industrial. Area, Ghaziabad - 201010 (UP) INDIA

Registered Office : C - 12 / 333, Yamuna Vihar, Delhi - 110053 INDIA
Tel: +91-11- 42448311, 22448312 Fax: +91-11-4248312
E-mail : **info@tca.co.in** website : **www.tca.co.in**