
Air Oil Coolers

HLA2 Series - AC Motor Driven

HLD Series - DC Motor Driven

HLH2 Series - Hydraulic Motor Driven

HLO3 Series - Offline Circulation Pump Driven

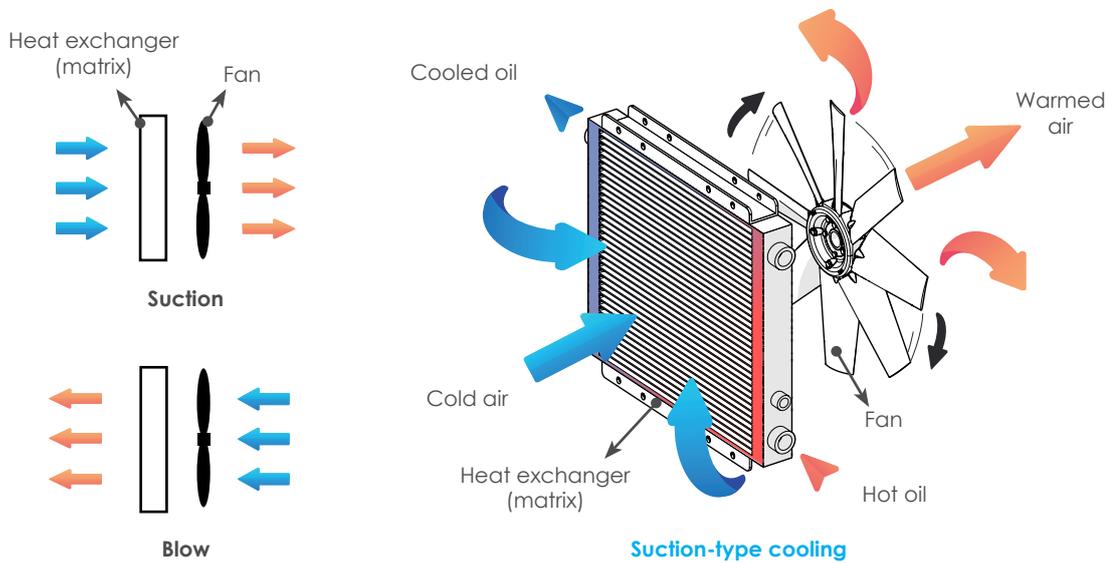
HLAX Series - Axial Motor Driven



What is an air oil cooler?

In a hydraulic system, managing the temperature of the working fluid is an important maintenance point that can affect system performance. If the temperature is too low, the viscosity increases, which can lead to damage to the hydraulic device due to increased friction. On the other hand, if the oil temperature rises above 60 °C, thermal degradation occurs, and viscosity changes as well. As a result, cylinder speed decreases, the life of the oil is shortened, and it can also affect the sealing, leading to leakage. In other words, if the temperature of the oil is not managed properly, the hydraulic system's performance can be degraded, and maintenance costs can increase.

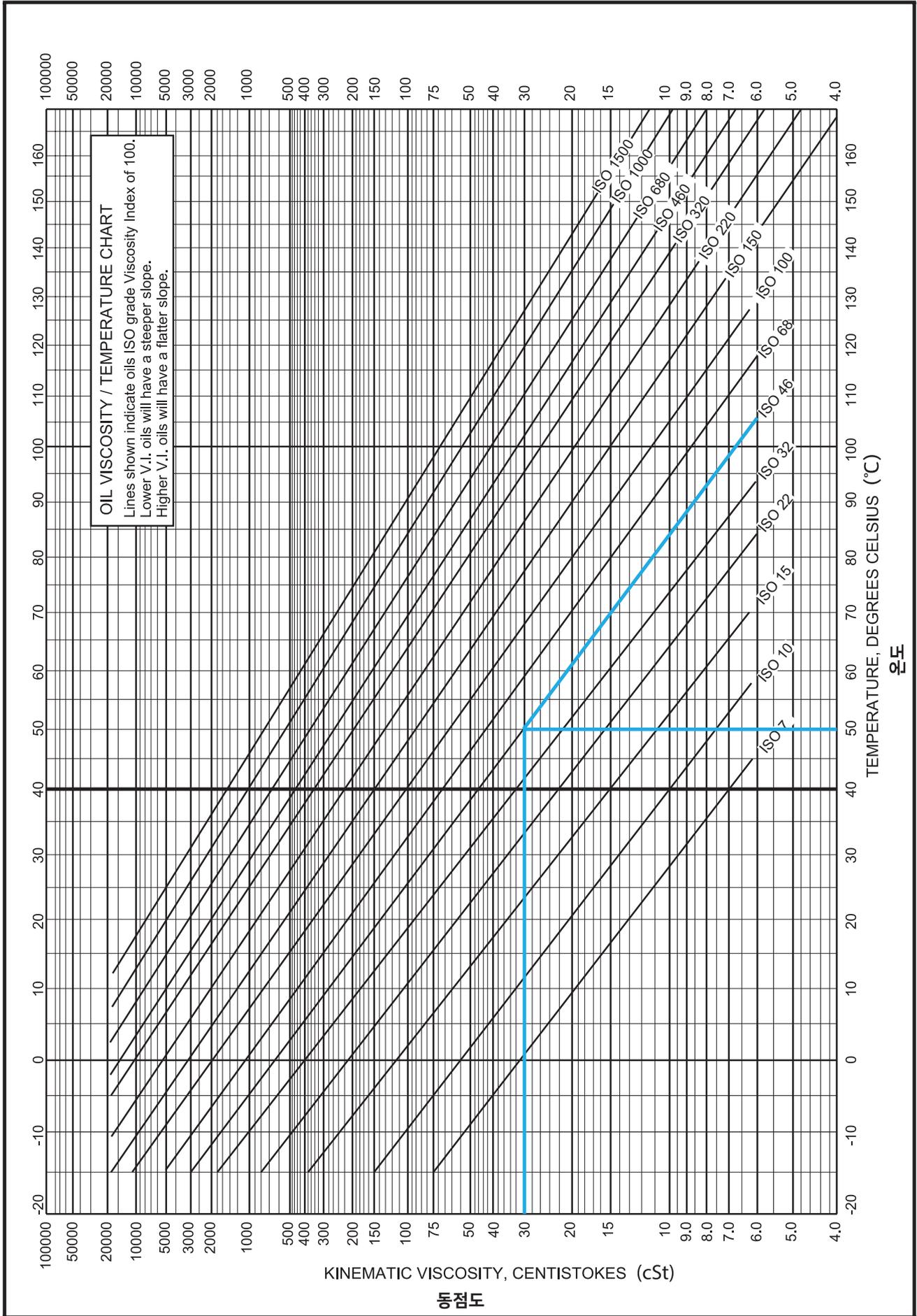
An air-cooled cooler is a device that cools high-temperature oil to maintain proper viscosity in a hydraulic system. An air oil cooler consists of heat exchanger plates (matrix) through which high-temperature oil passes, and a fan that blows air over the matrix to cool them. Depending on the direction of the airflow over the matrix, they can be classified as suction or blow types, with the suction type generally having better cooling efficiency.



Driving method

Depending on the method of driving the fan, the types of air oil coolers are determined, and typically include AC motors, DC motors, hydraulic motors, offline circulation pumps, and axial motor methods.





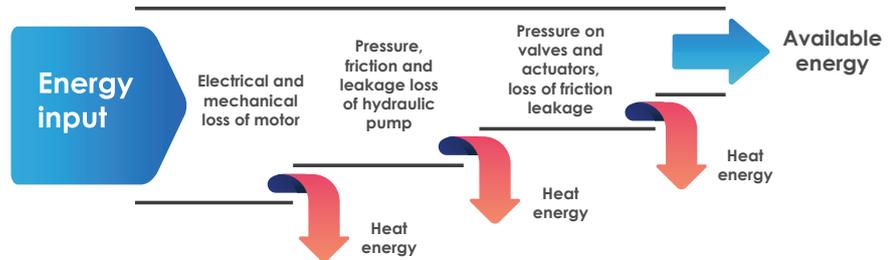
Management of oil viscosity

If the oil temperature is constant, the viscosity also remains constant, ensuring consistent valve response and cylinder speed. Please refer to the Kinematic Viscosity chart on the left page for the recommended kinematic viscosity and temperature control that should be maintained depending on the type of operating fluid used in the hydraulic system.

ISO Viscosity Grade (ISO VG)	Kinematic Viscosity @40 °C (cTs)		
	Minimum	Maximum	Mid-point
22	19.8	24.2	22.0
32	28.8	35.2	32.0
46	41.4	50.6	46.0
68	61.2	74.8	68.0
100	90.0	110	100
150	135	165	150
220	198	242	220
320	288	352	320
460	414	506	460
680	612	748	680

Purpose of use of cooler

In all hydraulic systems, there are various forms of energy loss, such as pressure, friction, and leakage to varying degrees. Energy is lost due to pressure drop in the lines caused by friction and flow bias, pressure drop in accessories such as valves, filters, and coolers, high throttling in pressure regulation systems, and leakage losses at sealing points. All of these losses are converted into heat that is absorbed by the oil and the housing.



The purpose of using a cooler is to maintain the heat generated by the energy loss at a constant level, thereby increasing the efficiency of the system and reducing maintenance costs. The heat generated by the loss of energy can damage the pump, hose, sealing, and bearings installed in the hydraulic system, shortening their lifespan. As mentioned earlier, the decrease in viscosity makes it difficult to control the valve and cylinder precisely, and the overall efficiency of the system decreases, resulting in a significant increase in maintenance costs.

Selection of Cooler

The selection of a cooler is to achieve the goal by using a cooler with a cooling capacity equal to or greater than the heat energy converted from the input energy, as shown in the figure above. Therefore, to select a cooler, it is necessary to first accurately understand the heat load factors generated in the system. Machinery and hydraulic systems are used to generate and transmit power, but mechanical efficiency, friction, pressure, and other power losses generate heat. If this heat energy is defined as P_H the formula for calculating it can be expressed as follows:

When the specific heat unit is (kJ/kg°C)

$$P_H = (T_2 - T_1) \times SG \times SH \times Q / 60 \text{ [kW]}$$

When the specific heat unit is (Kcal/kg°C)

$$P_H = (T_2 - T_1) \times SG \times SH \times Q / 60 \text{ [Kcal/h]}$$

$$P_H = \frac{(T_2 - T_1) \times SG \times SH \times Q / 60}{860} \text{ [kW]}$$

P_H	System heat dissipation (kW)
T_1	Oil temperature before system operation (°C)
T_2	Oil temperature after system operation (°C)
Q	Flow rate of oil(l/min)
SG	Specific gravity of the oil (kg/l)
SH	Specific heat of oil

To maintain a certain temperature in the system, the cooling heat exchange amount P_C of the cooler must be equal to or greater than the heat generated by the system P_H under the maximum temperature conditions of the flow rate flowing into the cooler and the surrounding environment. The cooling heat exchange amount of the cooler is defined by the calculation formula of the inlet and outlet temperatures of the cooler, the ambient air temperature, the flow rate, and the fluid properties, as shown below.

When the specific heat unit is (kJ/kg°C)

$$P_C = (T_{in} - T_{out}) \times SG \times SH \times Q_C / 60 \text{ [kW]}$$

When the specific heat unit is (Kcal/kg°C)

$$P_C = (T_{in} - T_{out}) \times SG \times SH \times Q_C / 60 \text{ [Kcal/h]}$$

$$P_C = \frac{(T_{in} - T_{out}) \times SG \times SH \times Q_C / 60}{860} \text{ [kW]}$$

P_H	Cooler heat dissipation (kW)
T_{in}	Cooler inlet oil temperature (°C)
T_{out}	Cooler outlet oil temperature (°C)
Q	Flow rate of oil(l/min)
SG	Specific gravity of the oil (kg/l)
SH	Specific heat of oil

ETD(Entrance Temperature Difference) refers to the difference between the cooler's maximum ambient temperature and the oil temperature at the cooler inlet. In other words, it is expressed as follows:

$$ETD = T_{inmax} - T_{ambientmax}$$

T_{inmax}	Cooler inlet max. oil temperature (°C)
$T_{ambientmax}$	Cooler max. ambient temperature (°C)

For example, if the oil temperature at the cooler inlet is 60°C and the maximum ambient temperature is 20°C, the ETD is 40°C. By dividing the cooling heat exchange amount P_C defined above by the ETD, we define the cooling capacity (kW/°C). In this product selection guide, the cooling capacity is used as a unit to allow users to select the product.

$$\text{Cooling Capacity} = P_C / \text{ETD (kW/ °C)}$$

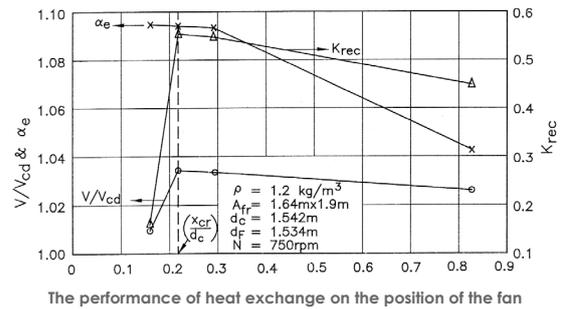
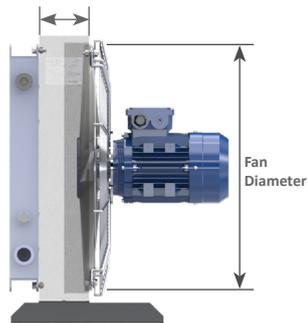
HydroLync
Design
Theory

HydroLync's product design is based on thoroughly proven scientific research and incorporates design concepts derived from that research. We strive to continuously create stable and optimized products by using CFD (Computational Fluid Dynamics) simulations to review both production efficiency and durability.

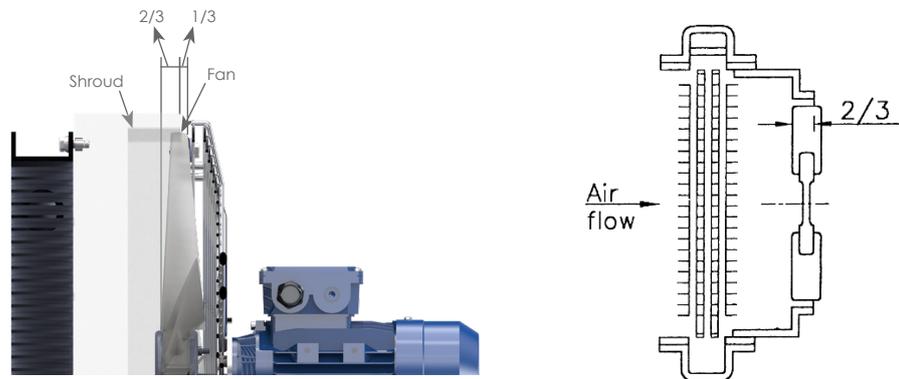
Fan Positioning

The main components of an air oil cooler are the heat exchanger, fan, and the driving mechanism that drives the fan. When designing the product, the shape and angle of the fan blade, as well as the distance between the heat exchanger and the fan, are important factors for maximizing the cooler's performance.

Distance between matrix and fan



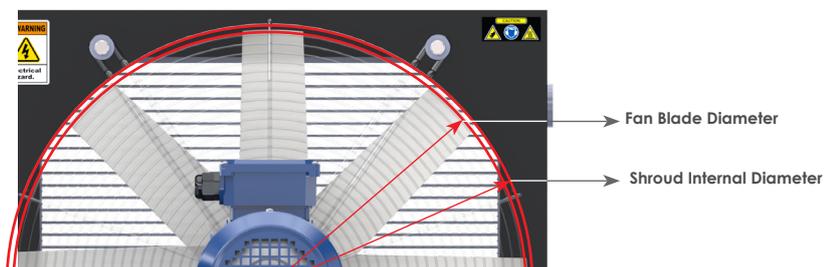
The performance graph shows how heat exchange performance varies depending on the position of the fan. HydroLync's air oil cooler is positioned according to these calculations to optimize performance.



Tip Clearance

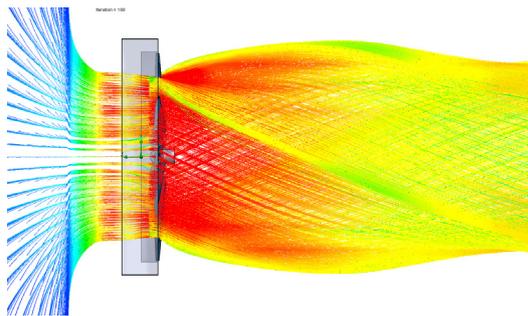
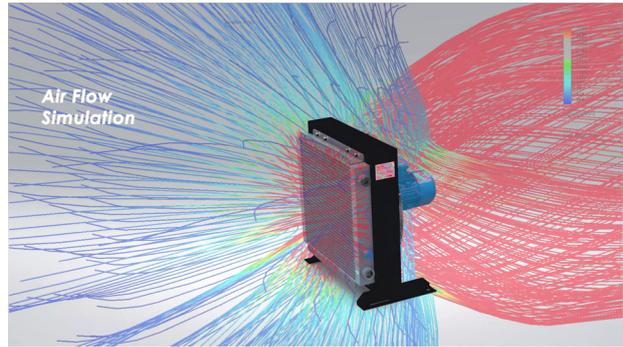
The distance between the surrounding surface and the blade tip of the fan called "tip clearance" around the fan called Shroud has a significant impact on the performance of the cooler. The design of the hydroLync applies the API (American Petroleum Institute) Standard 661, which states that the maximum airflow is achieved when the tip clearance is 0.5-1% of the fan blade diameter, and the theory that the fan blade should be located 1/3 outside of the shroud for optimal performance, as stated in the Military Vehicle Power Plant Cooling Handbook: AMCP 706-361 used by the US military.

Tip Clearance = Shroud Internal Diameter - Fan Blade Diameter

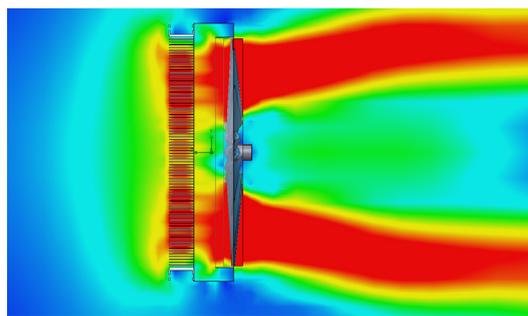
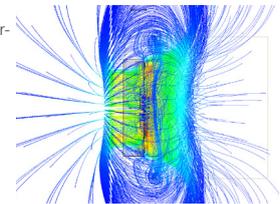


Simulation Analysis

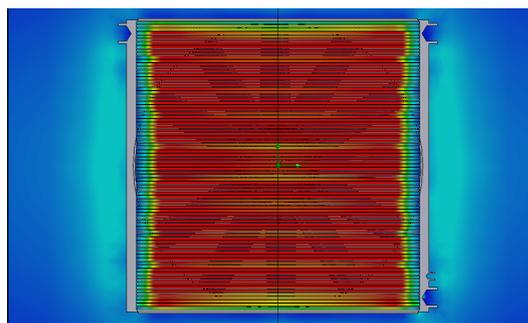
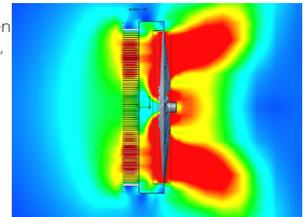
The use of CFD (Computation Fluid Dynamics) analysis has significantly reduced development costs by predicting the state of products under various conditions before applying them to mass production, and has greatly improved the productivity of developing new products. In an air oil cooler, the fan generates airflow, which passes through the oil flowing over the matrix, extracting heat and cooling it down. Therefore, the airflow is determined by the position of the fan, the shape of the blades, and their angles, which are directly linked to the performance of the cooler. During the product development phase, CFD simulation can be used to determine if the ideal performance is possible before creating a prototype. Any necessary improvements can be made immediately and reflected in the development process, allowing for a very rapid development process.



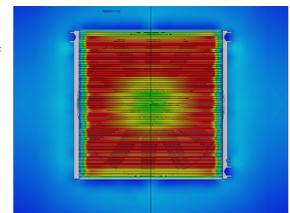
The ideal airflow shape formed by the rotation of the fan blades should be streamlined, as shown on the left side of the image. The shape shown below is the result of incorrect positioning of the fan and blade settings, resulting in significant turbulence in the airflow, which leads to increased power consumption and decreased cooling performance.



A fast airflow helps to quickly dissipate heat from the matrix, resulting in improved cooling performance. By setting the fan in an ideal position, the airflow can be formed as quickly as possible over the entire surface of the matrix. On the other hand, incorrect settings result in uneven airflow over the matrix, leading to decreased cooling performance.



When the fan is not ideally positioned, a dead zone can occur where little or no airflow is formed over some areas of the matrix. The ideal state is to minimize the dead zone over the entire surface, as shown on the left side of the image. However, if the fan position is incorrectly set, a dead zone can occur as shown below, leading to decreased cooling performance of the cooler.



HLAX Series

Axial Motor Driven



Air Oil Coolers

Features



- Compact and cost-effective
- Optimum efficiency levels and noise development with aerodynamic design of the fan blades

Quick Overview

Hydraulic oil cooler, HLAX Series from HydroLync, provides a wide range of specifications. You can quickly check the cooling performance, heat dissipation, and maximum flow rate of each model in ISO VG 46 oil based on ETD 40°C.

No.	Model-Poles_Cooling Performance(KW/°C) (Heat Dissipation KW, Kcal/h) / Max. Flow rate(LPM)
1	HLAX 07-2(220/380V, 50/60Hz) _ 0.19KW/°C (7.6KW, 6,536Kcal/h) / Max.125LPM
2	HLAX 11-2(220/380V, 50/60Hz) _ 0.38KW/°C (15.2KW, 13,072Kcal/h) / Max.150LPM
3	HLAX 16-4(220/380V, 50/60Hz)_ 0.495KW/°C (19.8KW, 17,028Kcal/h) / Max.200LPM
4	HLAX 23-4(220/380V, 50/60Hz) _ 0.70KW/°C (28KW, 24,080Kcal/h) / Max.200LPM
5	HLAX 33-4(220/380V, 50/60Hz) _ 0.90KW/°C (36KW, 30,960Kcal/h) / Max.300LPM
6	HLAX 35-4(220/380V, 50/60Hz) _ 1.20KW/°C (48KW, 41,280Kcal/h) / Max.350LPM
7	HLAX 56-6(380V, 50/60Hz)_ 1.35KW/ °C (54KW, 46,440Kcal/h) / Max.300LPM
8	HLAX 58-6(380V, 50/60Hz) _ 1.6KW/°C (64KW, 55,040Kcal/h) / Max.400LPM
9	HLAX 76-6(380V, 50/60Hz) _ 1.75KW/°C (70KW, 60,200Kcal/h) / Max.400LPM
10	HLAX 78-6(380V, 50/60Hz) _ 2.05KW/°C (82KW, 70,520Kcal/h) / Max.500LPM

[Remark] Ns=120•f/p
Ns: RPM for AC motor
f: Frequency
p: Pole

* Based On ETD 40°C / ISO VG 46 *

Ordering code

Example: HLAX 07 - 2 - 220/380V 60Hz - W50 - D -

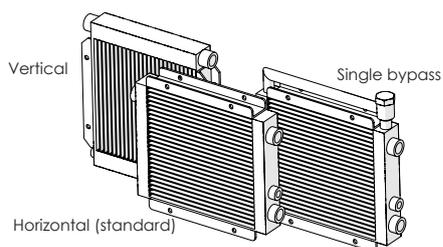
1 2 3 4 5 6 7

1 Matrix types

Horizontal (Standard)

V Vertical

SB Single Bypass



2 Matrix size

Code	Size	Port
07	335x322x63	G1
11	405x390x63	G1
16	464x458x63	G1
23	545x540x63	G1
33	640x648x63	G1
35	640x648x83	G1 1/2
56	802x826x63	G1 1/4
58	802x826x83	G2
76	940x1019x63	G1 1/2
78	940x1019x83	G2

3 Motor specifications

Poles	Model	Hertz	Max. Speed (RPM)
2	HLAX 07	50Hz	2,400
		60Hz	2,820
4	HLAX 11	50Hz	2,340
		60Hz	2,760
4	HLAX 16	50Hz	1,420
		60Hz	1,670
4	HLAX 23	50Hz	1,380
		60Hz	1,620
4	HLAX 33, 35	50Hz	1,370
		60Hz	1,610
6	HLAX 56, 58	50Hz	900
		60Hz	1,060
6	HLAX 76, 78	50Hz	920
		60Hz	1,080

4 Power Supply

Phase	Power supply	Applicable models
Single	220V 50/60Hz	HLAX 07~11
Three	220/380V 50/60Hz	HLAX 07~35
Three	380V 50/60Hz	HLAX 56~78

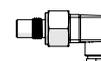
5 Thermal switch

Code	Temperature	Working range
None		
W/D	30	ON 35±5°C / OFF 25±5°C
W/D	40	ON 45±5°C / OFF 35±5°C
W/D	50	ON 55±5°C / OFF 45±5°C
W/D	60	ON 65±5°C / OFF 55±5°C
W/D	70	ON 75±5°C / OFF 65±5°C

*W: Wire type



*D: DIN plug type



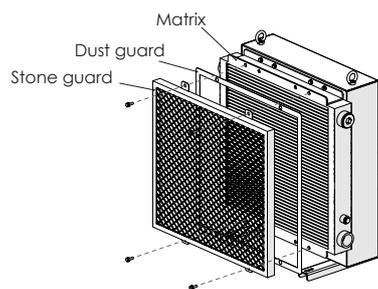
6 Matrix protection accessories

None (standard)

D Dust Guard

S Stone Guard

A Dust Guard + Stone Guard

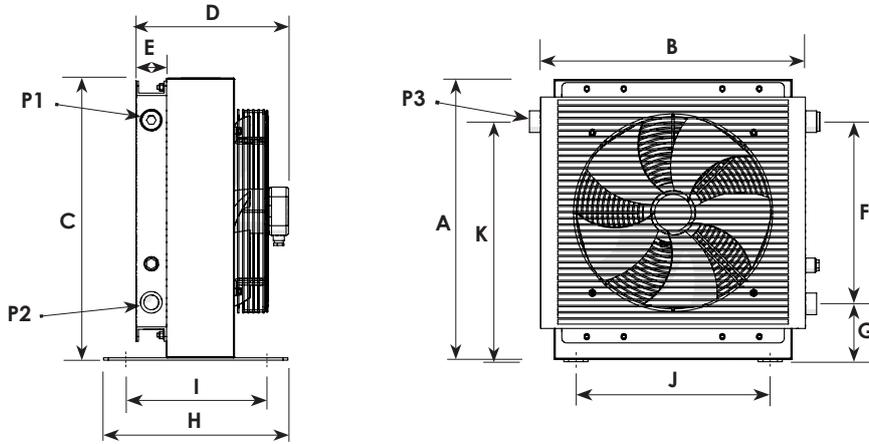


7 Production type

Standard

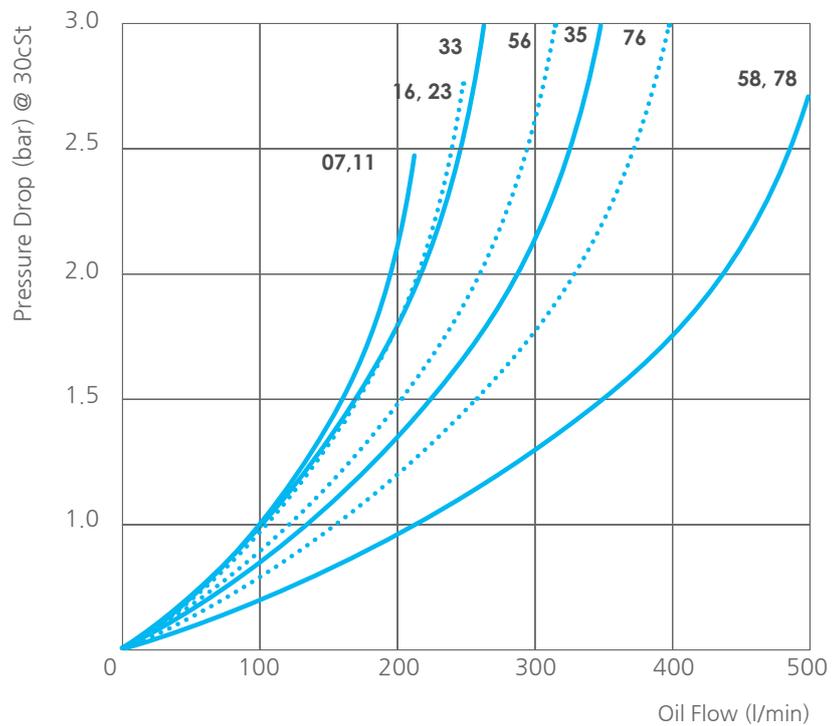
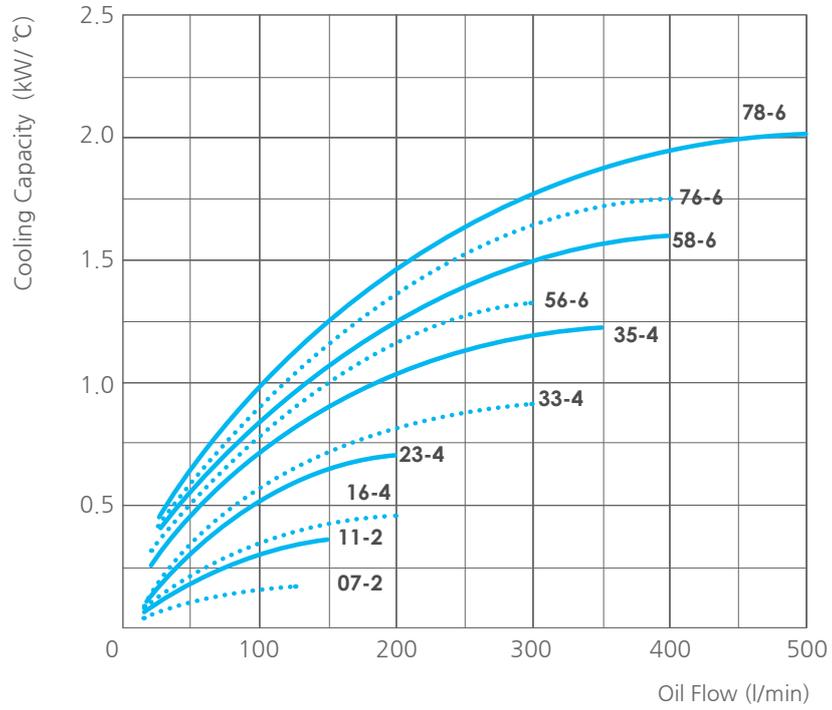
C Customization

HLAX 07 ~ 78



HLAX Model	A	B	C	D	E	F	G	H	I	J	K	P1,2,3	Slot Hole	Weight Kg	Noise Level (dB) 1m
07-2	355	335	360	(199)	63	160	114	250	(190)	255	274	G1"	ø10x30	11.7	60
11-2	424	405	429	(278)	63	228	116	290	(230)	255	344	G1"	ø10x30	17.5	60
16-4	496	464	501	(299)	63	296	118	370	(310)	286	414	G1"	ø10x30	28.2	65
23-4	580	545	585	(314)	63	378	120	380	(320)	400	498	G1"	ø10x40	34.7	68
33-4	710	640	740	(334)	63	482	167	400	(340)	440	649	G1 1/4"	ø10x40	49.2	73
35-4	740	640	740	(354)	83	482	167	400	(340)	440	649	G1 1/2"	ø10x40	56.0	73
56-6	900	802	935	(427)	63	664	181	500	(440)	570	845	G1 1/4"	ø13x43	97.4	73
58-6	900	802	935	(447)	83	664	181	500	(440)	570	845	G2"	ø13x43	108.4	73
76-6	1100	940	1135	(442)	63	821	213	540	(480)	750	1034	G1 1/2"	ø13x43	101.1	75
78-6	1100	940	1135	(462)	83	821	213	540	(480)	750	1034	G2"	ø13x43	137.3	75

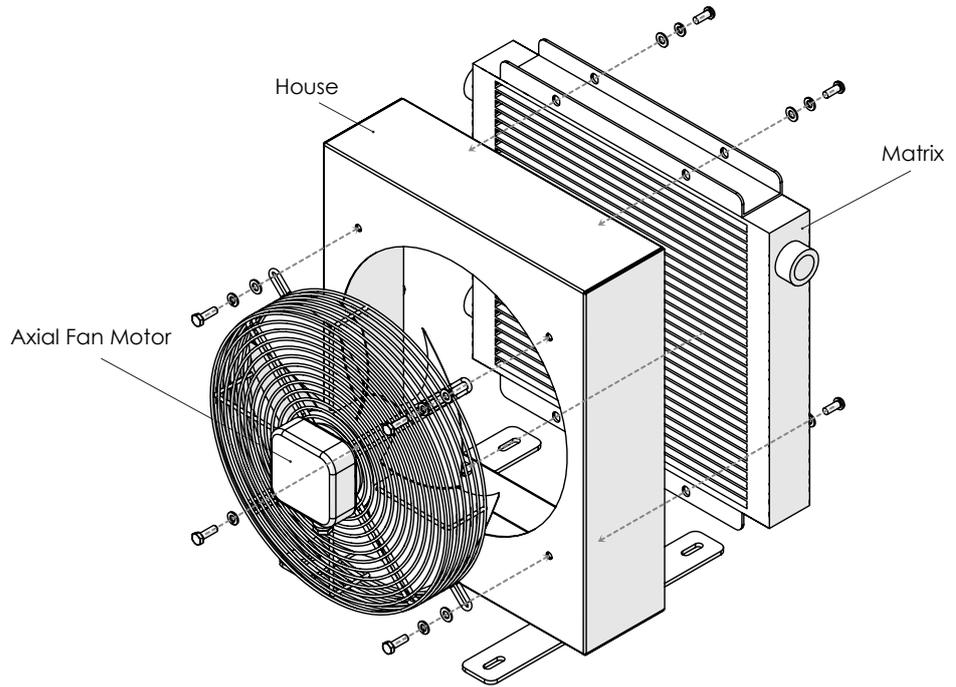




The cooling capacity curve is based on the oil temperature and the ambient air temperature entering the cooler. An oil temperature of +60°C (T_{inlet}) and an ambient air temperature of +20°C ($T_{ambientmax}$) provide a temperature difference (ETD) of +40°C. To obtain the total cooling capacity, multiply the cooling performance (kW/°C) by ETD (°C) as follows:

$$ETD = T_{inlet} - T_{ambientmax} \text{ Cooling performance (kW/°C)} \times ETD (\text{°C}) = \text{Cooling capacity (kW)}$$

Specifications



Aluminum matrix

Hydrolync provides various aluminum matrices, and customers can choose between horizontal and vertical types to meet their requirements.

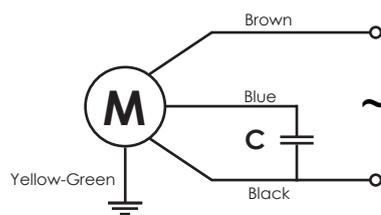
- Material: 3003/4004/5052
- Test pressure: 21 bar
- Test standard: ISO/DIS 10771-1
- Max. Working pressure: 14 bar
- Max. Working temperature: 120 °C
- Paint: Epoxy / Polyester powder coatings - coating thickness 60 µm
- Paint color: AL 9006 / silver

Fan

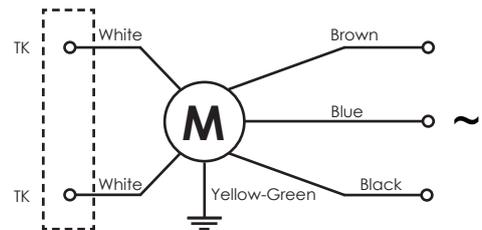
- Working mode: S1 (Suction)
- Insulation grade: B, F
- Ingress protection rating: IP54
- Working temperature range: -30~60 °C
- Certifications : CCC, CE, UL
- Energy Efficiency Labelling: ErP2015
- Power supply: 220/380V, 50/60Hz

House

- Material: steel
- Paint: powder coating
- Color: black, white (option)



Single phase



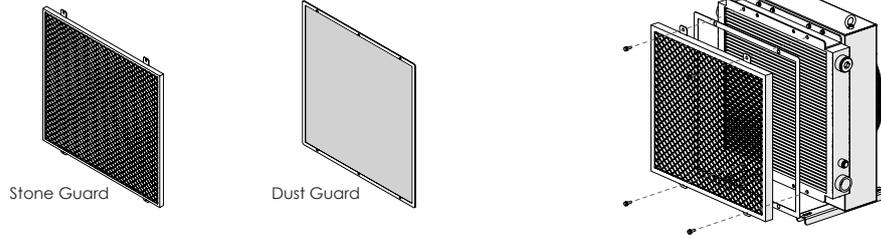
Three phase

Motor wiring

Accessories

Protection of the matrix

Coolers installed in harsh environments with dust, oil, and other contaminants may cause damage to the surface of the matrix or decrease heat exchange performance due to oil and dust sticking to the fins. In this case, if the surface is damaged or oil and dust cannot be cleaned from the fins, the matrix must be replaced. To reduce such losses, Stone Guard or Dust Guard can be installed on the matrix to protect it and reduce maintenance costs. It is important to note that when installing a Dust Guard, regular cleaning is necessary to maintain performance, as failure to do so may reduce the airflow and cause the motor to overload.



Attention

- To maintain the cooler's optimal cooling performance, the Dust Guard should be cleaned twice a week.
- The cleaning cycle for Stone Guard is approximately once every three months.
- If the environmental pollution conditions are severe, reduce the cleaning cycle.

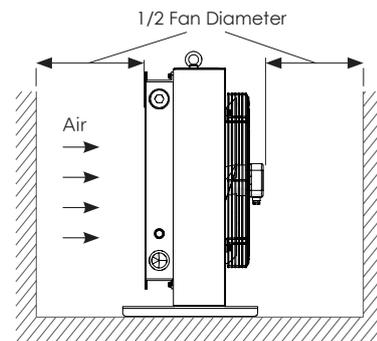
Installation and Maintenance

*Please refer to the product manual for more detailed information.

Installation

The cooler has a very sturdy structure and can be mounted on both the face and foot. When installing it on the front of a duct or ventilation shaft, use the 4 to 8 mounting holes in the U-channel of the matrix. Place the cooler so that the airflow is not restricted. The distance to the nearest wall should be at least half the diameter of the fan.

HLAX Model	1/2 Fan Diameter
07	125
11	150
16	175
23	200
33, 35	250
56,58	352
76,78	392

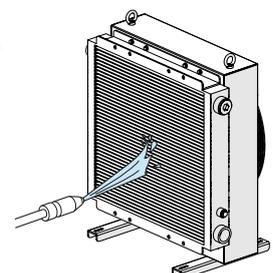


Cleaning the inside of the matrix

To clean the inside of the matrix, connect the cooler to a closed circuit and circulate perchloroethylene. After cleaning, flush the matrix with oil before reconnecting it to the hydraulic system.

Cleaning the outside of the matrix

The easiest way to clean the fins is to use compressed air or wash them with water. Grease removers and high-pressure cleaning systems can also be used to remove foreign matter. When using a high-pressure cleaning system, make sure that the water stream is parallel to the fins and at least 3cm away from them. Be careful not to damage the fins with a strong water stream.





“Engineering Excellence! We are always prepared to promptly address our customers’ needs.”

Contact us

Republic of Korea Tel +82 (31) 499 6682 Fax +82 (31) 499 6683 ✉ info@hydrolync.com
Headquarter 4, Emtibeui 25-ro 58beon-gil, Siheung-si, Gyeonggi-do, Republic of Korea zip: 15117
경기도 시흥시 엠티브이25로 58번길 4 우편번호: 15117

China Mobile(Wechat): 138 6170 0580 ✉ info@hydrolync.com
240-3, Xidalu, Xinwu District, Wuxi, Jiangsu, China
中国江苏省无锡市新吴区锡达路240-3





YouTube



HydroLync

Engineering Excellence