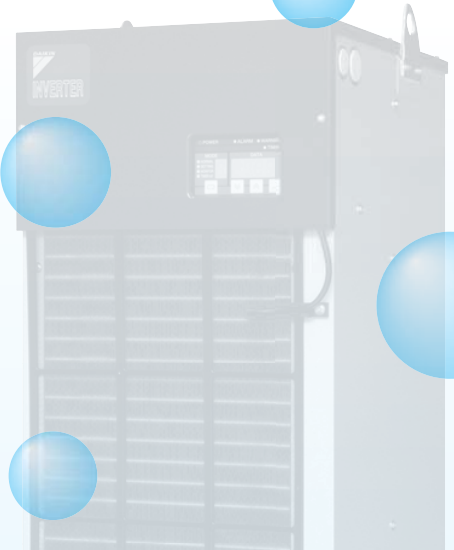


L

OIL COOLING EQUIPMENT



● Oil cooling unit, inverter controlled chiller (Air-cooled type)

Product name	Model name	Range of cooling capacity at standard point kW										Page		
		0	1	2	3	4	5	6	7	8	9		10	
Circulating type oil cooling unit for machine tool spindles	AKZ9 Series											L-3		
	AKZ149	Operation at 50 Hz												
	AKZ329	Operation at 50 Hz												
	AKZ439	Operation at 50 Hz												
	AKZ569	Operation at 50 Hz												
Immersion type oil cooling unit for coolant	AKZJ8 Series											L-19		
	AKZJ188	Operation at 50 Hz												
	AKZJ358	Operation at 50 Hz												
	AKZJ458	Operation at 50 Hz												
	AKZJ568	Operation at 50 Hz												
AKC9 Series Circulating type oil cooling unit for coolant	AKC359	Operation at 50 Hz												L-26
	AKC569	Operation at 50 Hz												
Inverter controlled chiller	AKW9 Series											L-38		
	AKW149	Operation at 50 Hz												
	AKW329	Operation at 50 Hz												
	AKW439	Operation at 50 Hz												
	AKW189	Operation at 50 Hz												
	AKW459	Operation at 50 Hz												

● LT cooler (Water-cooled type)

Product name	Model name	Range of cooling capacity kW										Page		
		1	2	3	4	5	10	100						
LT cooler	LT0403	1												L-44
	LT0504	1												
	LT0707	1												
	LT1010	1												
	LT1515	1												
	LT2020	1												
	LT3030	1												
	LT5060	1												

Inline type cooling unit for coolant

(Can be retrofitted to an existing tank)

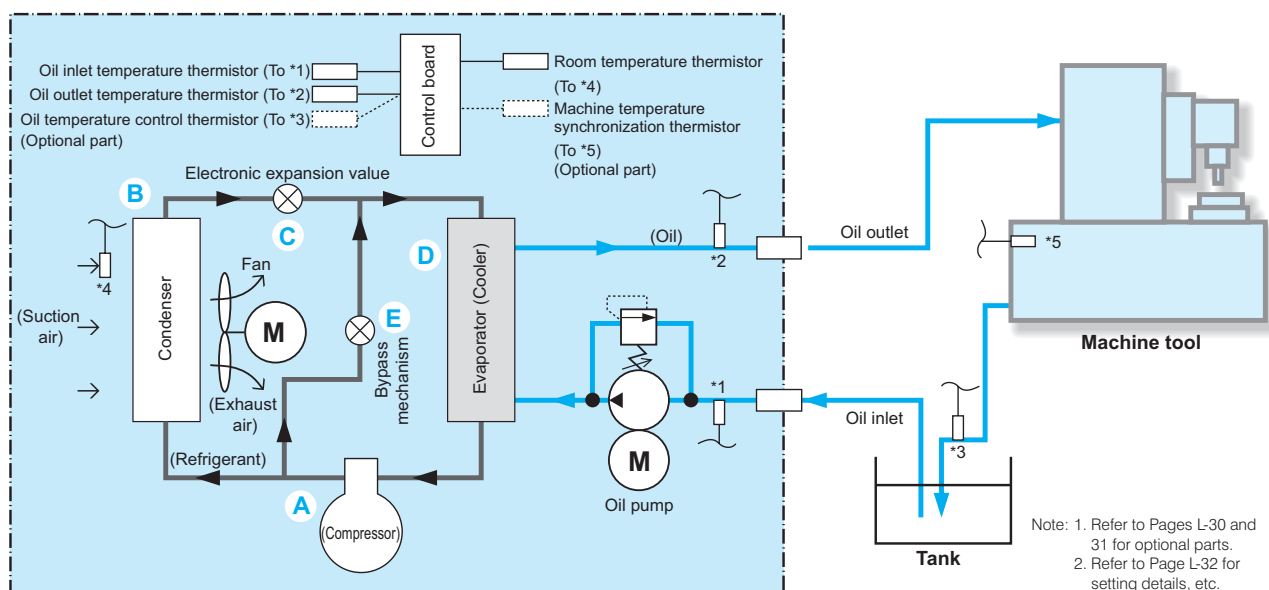


AKC9 Series

For cutting oil (fluid)

For grinding oil (fluid)

Principle of oil cooling unit and overall system diagram



[Refrigerating cycle]

- A:** Refrigerant gas is converted into compressed gas at high temperature and high pressure by a compressor so that the gas can be easily cooled and liquefied by a condenser.
- B:** In the condenser, the gas at high temperature and high pressure generated in the compressor is cooled with air and converted into liquid at high temperature and high pressure.
- C:** The electronic expansion valve reduces the pressure of the liquid at high temperature and high pressure and converts it into liquid at low temperature and low pressure by throttling it so that it can be easily vaporized in a cooler.
- D:** In the cooler, liquid at low temperature and low pressure generated by the electronic expansion valve absorbs heat from the oil, evaporates (cools the oil), and is converted into gas at low temperature and low pressure.
- E:** The bypass mechanism controls the cooling capacity by adjusting the volume of gas at high temperature and high pressure supplied to the cooler when heat load is low.

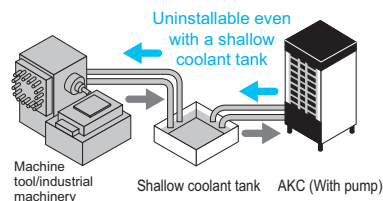
Oil Cooling Unit AKC**9 (Inline Type Cooling Unit for Coolant)



Features

● Inline type cooling unit for coolant

The inline type unit can be installed in the oil piping system no matter what the depth and other conditions of the coolant tank are. This unit also can be used for retrofitting in an existing system with an oil tank. An optional model with a built-in pump is also available.



● Highly accurate temperature control model by inverter control

The coolant temperature can be controlled within $\pm 0.1^{\circ}\text{C}$ over the entire cooling load range (from 0 to 100% load) and this helps to increase the accuracy of machine tools.

● Excellent energy savings

A Daikin original high efficiency IPM motor is adopted on a compressor, which leads to high energy savings with Inverter control technology and R410A refrigerant that has high COP characteristics. (Approx. 30% energy savings compared to the AKC 8 series)

● Complies with RoHS Directives such as Lead-Free (Environmentally friendly unit)

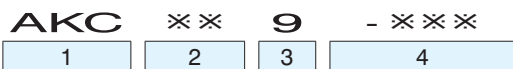
● Easy maintenance

The evaporator coil design has been improved to give more durability against clogging. It is also easy to disassemble and clean the evaporator coil.

● Greater durability against oil mist and dust

Ingress protection range for the control box is improved (equivalent to IP54).

Nomenclature



1 Oil cooling unit identification code

AKC: High-accuracy inverter controlled oil cooling unit [Coolant circulating type]

2 Cooling capacity (kW)

35: 3.5 kW
56: 5.6 kW

3 Symbol of series

(Symbol to represent model change)
9: "9" series

4 Symbol of option type (C/H/200)/Non-standard number

Options and their combinations

Symbol of option type	Compliance with CE	With heater	With pump
-C	✓	-	-
-H	-	✓	-
-200	-	-	✓
-CH	✓	✓	-
C200	✓	-	✓
H200	-	✓	✓
K200	✓	✓	✓

Special specifications (different voltages, with casters, etc.)

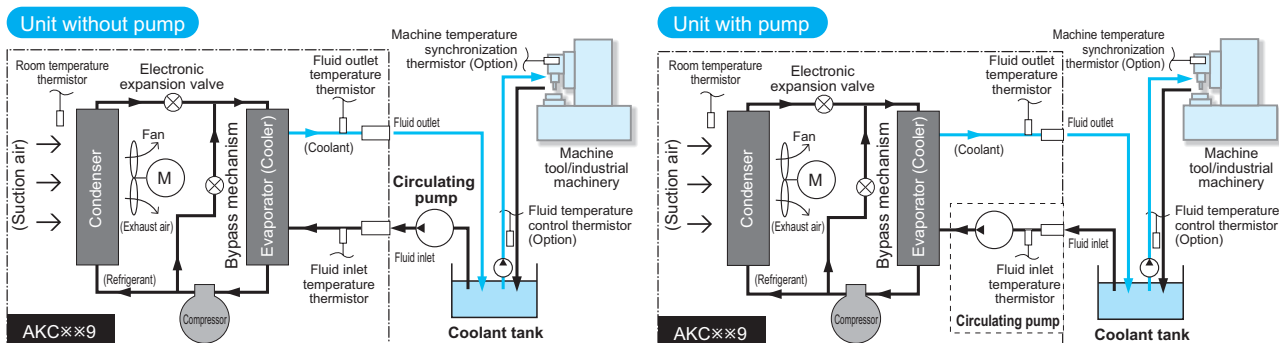
-*** (3-digit number), C*** (3-digit number), etc.

Please consult us about detailed information.

System configuration

■ Easy retrofit into the existing system

■ Newly designed evaporator improved for greater durability against clogging



Specifications

Oil cooling unit horsepower	HP	1.2			2.0							
		AKC359			AKC569							
Model name	Standard	-C (CE compliant type)	-H (With heater)	-200 (With pump)	Standard	-C (CE compliant type)	-H (With heater)	-200 (With pump)				
Cooling capacity (50/60 Hz) *1	kW	3.5/3.5			5.6/5.6			5.3/5.3				
Heater	kW	-			-			2				
Power supply *2		Three-phase AC 200/200 · 220 V 50/60 Hz										
Power voltage	Main circuit	Three-phase AC 200/200 · 220 V 50/60 Hz										
	Operation circuit	DC 12/24 V										
Max. power consumption	200 V 50 Hz	1.17 kW/4.2 A			1.44 kW/5.3 A			1.78 kW/6.2 A	2.34 kW/7.0 A *3	2.10 kW/7.4 A		
Max. current consumption	200 V 60 Hz	1.22 kW/4.3 A			1.60 kW/5.5 A			1.87 kW/6.3 A			2.34 kW/7.0 A *3	2.30 kW/7.6 A
	220 V 60 Hz	1.21 kW/4.1 A			1.60 kW/5.2 A			1.86 kW/6.1 A			2.81 kW/7.6 A *3	2.30 kW/7.3 A
External paint color		Ivory white										
External dimensions (H × W × D)	mm	995 × 450 × 560			1,200 × 470 × 670							
Compressor (Hermetic DC swing type)		Equivalent to 0.75 kW			Equivalent to 1.5 kW							
Evaporator		Shell-end coil type										
Condenser		Cross-fin-coil type										
Propeller fan	Motor	φ300, 54 W			φ400, 100 W							
Pump	Motor	-			0.4 kW-2-pole motor			-		0.4 kW-2-pole motor		
	Total head (standard point, 50/60 Hz)	-			10/15 m			-		10/15 m		
	Suction lift	-			0.5 m *4			-		0.5 m *4		
Temperature control (Selectable)	Synchronization type	Standard	Room temperature or machine temperature *5 (Set to room temperature by default)									
		Controlled object	Fluid inlet temperature or fluid outlet temperature (Set to fluid inlet temperature by default)									
	Fixed type	Synchronization range K	-9.9 to 9.9 against the reference temperature (Set at 0.0 by default)									
		Controlled object	Fluid inlet temperature or fluid outlet temperature									
Refrigerant control		Rotation speed control of compressor by inverter + Opening rate control of electric expansion valve										
Refrigerant (R410A) *6 Filling volume	kg	0.80			1.25							
Protection devices		A set of overcurrent relay (for a pump motor), discharge pipe temperature thermistor, condenser temperature thermistor, reverse-phase protection device, restart prevention timer, low room temperature protection thermistor, high fluid temperature protection thermistor, low fluid temperature protection thermistor, refrigerant leakage detector, evaporator clogging detection (intake pipe temperature thermistor), inverter protection device, circuit breaker, temperature fuse (-H type only), overheat prevention temperature switch (-H type only), high pressure switch (-C type only), and compressor thermal protector (-C type only)										
Operation range	Room temperature °C	5 to 45			5 to 45							
	Fluid inlet temperature °C	5 to 50			5 to 50							
	Fluid viscosity mm ² /s	200 maximum (water soluble to ISO VG32)										
	Withstanding pressure MPa	0.2										
	Rated circulating volume L/min	35										
	Circulating volume L/min	15 minimum										
Acceptable fluid		Lubrication oil, hydraulic oil, cutting oil, (water based) coolant, (grinding oil *) (Use clean fluid that can pass through filter equipment with a screen mesh of 40 or greater.)										
Connecting pipe	Fluid inlet	Rc3/4			Rc3/4							
	Fluid outlet	Rc3/4			Rc3/4							
	Fluid drain port	Rc1			Rc1							
	Pump priming port *8	Rc1/2			Rc1/2							
	Oil pan drain	-			Rc3/4			-		Rc3/4		
Noise level *9 (Value equivalent to measurement in an anechoic chamber) (Front 1 m, height 1 m) dB (A)		62			65							
Permissible transport vibration		Up and down vibration 14.7 m/S ² × 2.5 hr (7.5 to 100 Hz sweep/5 min.)										
Ingress protection		IP2X *10										
Mass	kg	83			86			105	100	106	122	
Molded-case circuit breaker (Rated current) A		10			15							
Items prepared by the customer		Circulating pump			-			Circulating pump		-		

Note: *1 The cooling capacity indicates the value at the standard point (fluid inlet temperature: 35°C, room temperature: 35°C, fluid used use: ISO VG32, flow rate: rated circulating volume).

*2 This unit has about ±5% of product tolerance.

*3 Use a commercial power supply for the power source. The use of an inverter power supply may cause burn damage to the machine. The voltage fluctuation range should be within ±10%. If it is more than ±10%, please consult us.

*4 The maximum power consumption/maximum current consumption indicates the value when heating fluid with the heater. The values when cooling fluid with the cooler are the same as with the standard models.

*5 Indicates the maximum value with clean fresh water.

*6 The optional thermistor for machine temperature synchronization is required.

*7 The MSDS (Material Safety Data Sheet) of refrigerant R410A is attached to the -C type.

*8 If the unit is used for a grinding machine or similar equipment, the evaporator tends to become clogged with foreign material, necessitating frequent maintenance of the evaporator or a considerably shorter pump service life due to wear of the pump parts (mainly the mechanical seals).


*9 Not applicable to models without a pump

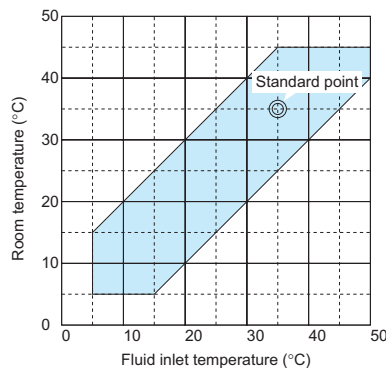
*10 The rotational speed of the fan varies depending on the room temperature to conserve energy. Therefore, it is normal for the noise level to vary accordingly.

*11 Ingress protection for switch box: equivalent to IP54 (When wired with IP54 or higher conduit tube or other protection on the wiring port.)

Operation range

Note: 1. The mark Ⓞ shows the standard point.

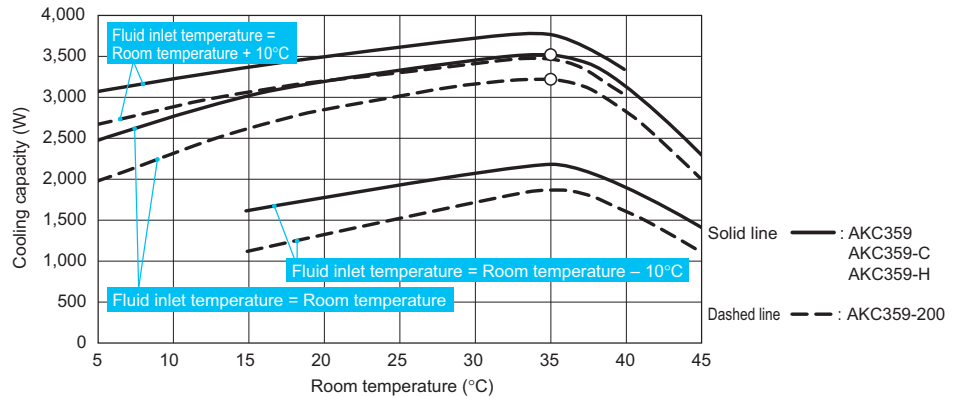
2. Be sure to use the unit within the range of use specified in  (Use outside this range may cause unit failure.)



Cooling capacity characteristic chart

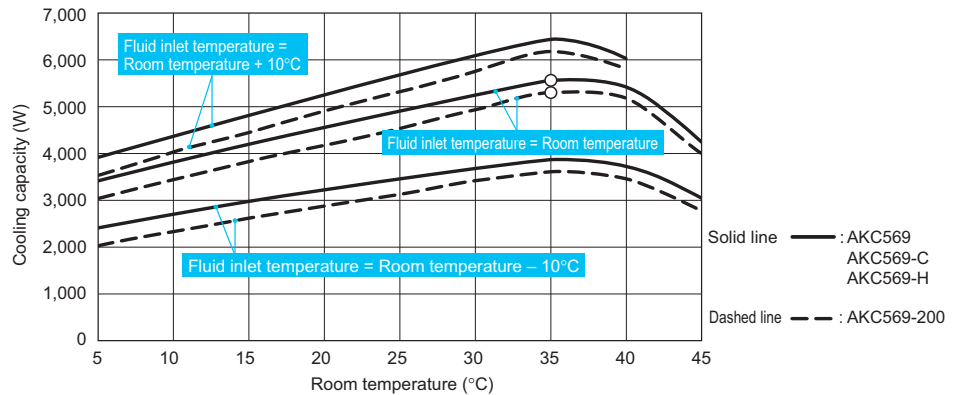
AKC359

Fluid used: VG32
Flow rate: 35 L/min



AKC569

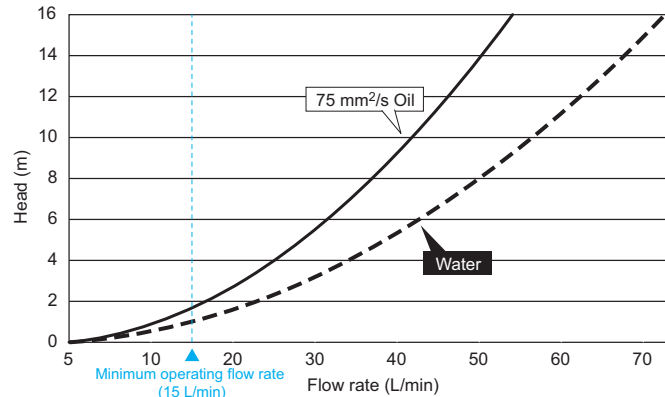
Fluid used: VG32
Flow rate: Flow rate variation depending on fluid temperature variation (With the piping pressure loss at standard point maintained)



- The mark "O" shows the standard point.
(Room temperature: 35°C, Fluid inlet temperature: 35°C, Flow rate: 35 L/min, Fluid used: ISO VG32)
- The cooling capacity varies depending on conditions such as room temperature, fluid temperature, oil dynamic viscosity and other factors.

Internal pressure loss

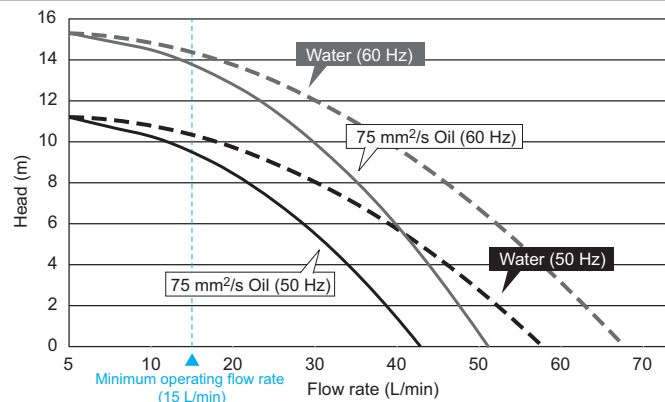
For the selection of the oil pump size and piping system, such as diameter and length of pipes, refer to the chart to the right. Pay attention to making the oil flow rate 15 L/min or greater.



Flow rate characteristics for models with a pump

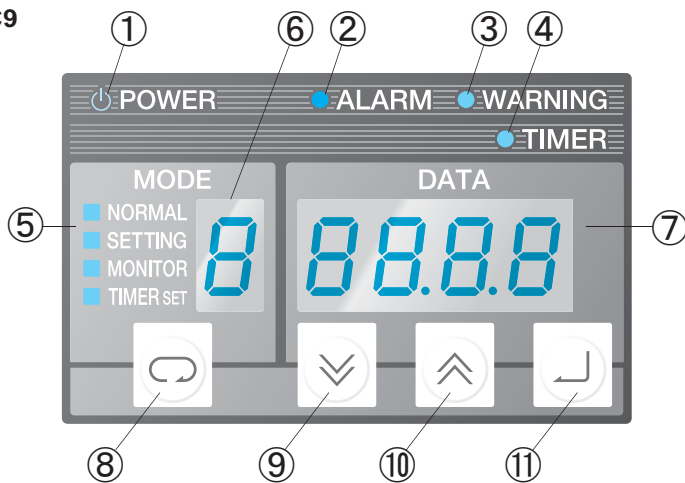
(Internal pressure loss included)

The diagram to the right shows the flow rate characteristics for oil cooling unit models with a pump, with the internal pressure loss included. Select the diameters and lengths of pipes by referring to the diagrams to the right such that a circulating volume of 15 L/min or greater can be maintained.

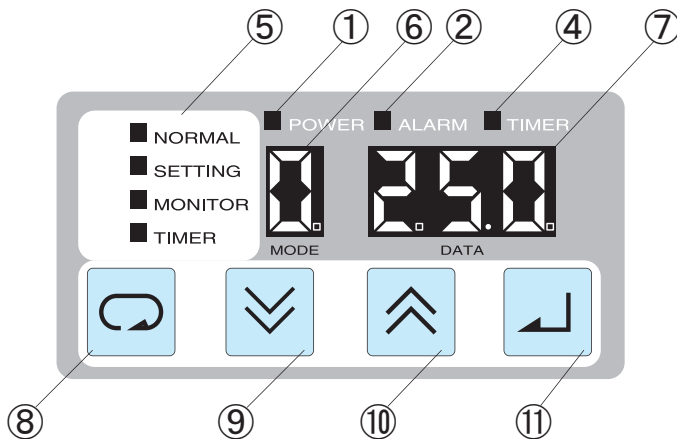


Names and functions of the components on the control panel

AKZ9, AKC9



AKZJ8



No.	Item	Description
①	Power lamp (Green)	The lamp is continuously on while power is supplied.
②	Error warning lamp (Red)	When an error occurs Level 1 alarm: The lamp keeps blinking. Level 2 alarm: The lamp is continuously on.
③	Warning lamp (Green)	When a warning occurs Level 1 warning: The lamp keeps blinking. Level 2 warning: The lamp is continuously on. (Only with "9" series)
④	Timer mode lamp (Red)	The lamp keeps blinking while the machine is at a stop in the timer mode.
⑤	Operation mode display	Displays the mode of the control panel. NORMAL: Normal mode SETTING: Operation setting mode MONITOR: Monitor mode TIMER SET: Timer setting mode
⑥	Operation mode/ Data No. display	Displays the current operation mode (Normal mode, Operation setting mode) or data number of the data currently displayed on the data display.
⑦	Data display	Displays various data. The data displayed differs depending on the operation mode and data number.
⑧	[SELECT] (Select) key	Selects the operation mode.
⑨	[DOWN] key	Decrements the value of the operation mode, data number or data by 1. When held for two seconds or longer, decrements the values by 10.
⑩	[UP] key	Increments the value of the operation mode, data number or data by 1. When held for two seconds or longer, increments the values by 10.
⑪	[ENT] (Confirm) key	Confirms the edited operation mode/data number/data.

Refer to the individual product catalog and instruction manual for details of the operation modes and setting procedures.

Refer to "Cautions on Using Oil Controllers and Inverter Chillers" at the beginning of this catalog for the notes to be observed.

Selection method for oil cooling units (AKZJ8/AKC9 series)

(2) In the case of cooling of cutting and grinding fluid

1. Since the tank capacity and pump flow rate are generally large the heat load from the cutting and grinding fluid system should be roughly estimated according to the following formula. After rough estimation, the heat load should be determined by conducting tests on the actual machine to select the oil cooling unit.
2. Formula for rough calculation of heat load.

$$Q = Q_1 + Q_2 + Q_3$$

Q: Heat load of the entire machine tool system

Q₁: Heat load during machining on a machine tool

Q₂: Heat load of the pump motor for coolant pump (Amount of heat transferred to coolant)

$$Q_2 = \text{Pump motor output (kW)} \times \frac{\eta}{100}$$

Q₃: Heat balance between coolant and room temperature via coolant tank

$$Q_3 = K \cdot A \cdot \Delta T$$

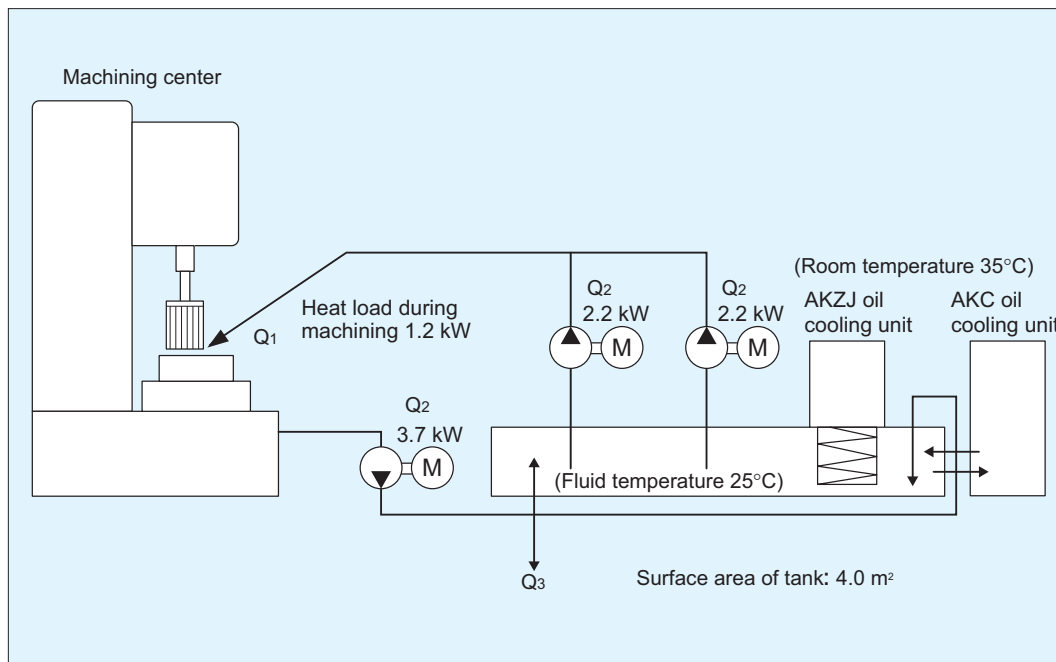
K: Heat transfer coefficient (W/m² · °C), K = 11.6 to 23.2 in general

A: Surface area of tank in contact with fluid (m²)

ΔT: Room temperature - Controlled fluid temperature in tank (°C)

3. Refer to Page L-34 and determine the heat load according to Method 1 or Method 2.

General guide for heat load



E.g.) In the diagram above,

When Q₁ = 1.2 kW

$$Q_2 = (2.2 + 2.2 + 3.7) \times \frac{50}{100} \approx 4.1 \text{ kW (For a coolant pump, "}\eta\text{" is generally 50\%.)}$$

$$Q_3 = 20 \times 4 \times (35 - 25) / 1000 = 0.8 \text{ kW}$$

$$\begin{aligned} \therefore Q &= Q_1 + Q_2 + Q_3 \\ &= 1.2 + 4.1 + 0.8 \\ &= 6.1 \text{ kW} \end{aligned}$$

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