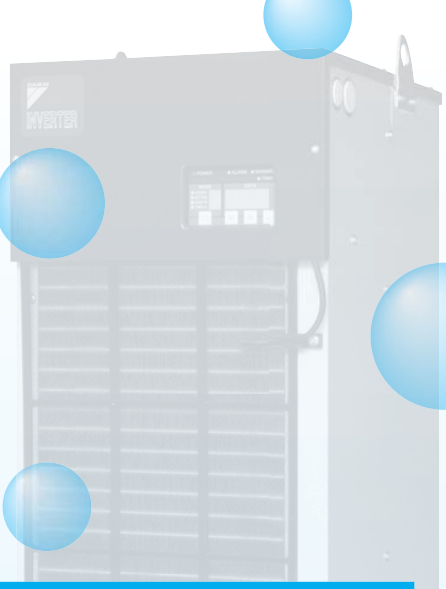
# L



# OIL COOLING EQUIPMENT

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

| Product name | Model name | Range of cooling capacity at standard point kW (0 1 2 3 4 5 6 7 8 9 10) | Page |
|---|---|---|---|
| AKZ9 Series<br>Circulating type oil cooling unit for machine tool spindles | AKZ149 | Operation at 50 Hz<br>Operation at 60 Hz | L-3 |
| | AKZ329 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKZ439 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKZ569 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKZ909 | Operation at 50 Hz<br>Operation at 60 Hz | |
| AKZJ8 Series<br>Immersion type oil cooling unit for coolant | AKZJ188 | Operation at 50 Hz<br>Operation at 60 Hz | L-19 |
| | AKJZ358 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKJZ458 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKJZ568 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKJZ908 | Operation at 50 Hz<br>Operation at 60 Hz | |
| AKC9 Series<br>Circulating type oil cooling unit for coolant | AKC359 | Operation at 50 Hz<br>Operation at 60 Hz | L-26 |
| | AKC569 | Operation at 50 Hz<br>Operation at 60 Hz | |
| AKW9 Series<br>Inverter controlled chiller | AKW149 | Operation at 50 Hz<br>Operation at 60 Hz | L-38 |
| | AKW329 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKW439 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKW189 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKW359 | Operation at 50 Hz<br>Operation at 60 Hz | |
| | AKW459 | Operation at 50 Hz<br>Operation at 60 Hz | |

## ● LT cooler (Water-cooled type)

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

**Inline type cooling unit for coolant**

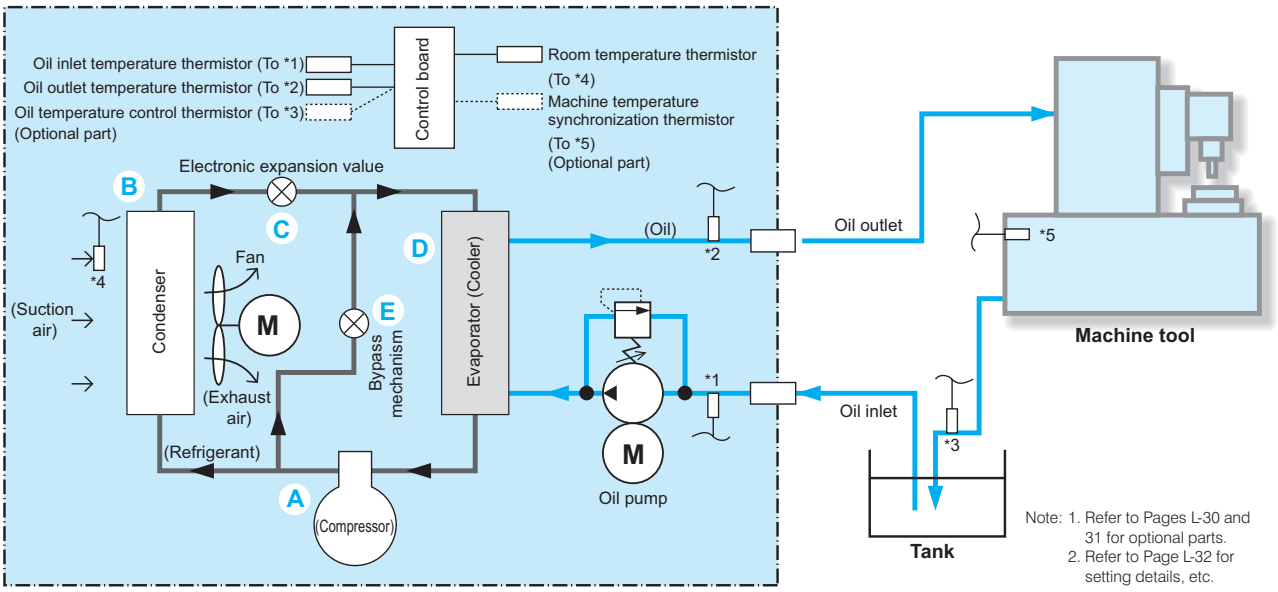
(Can be retrofitted to an existing tank)

**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.

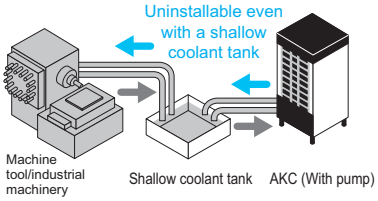
D: In the cooler, liquid at low temperature and low pressure generated by the electronic expansion valve absorbs heat from the oil, evaporates (cools the oil), and is converted into gas at low temperature and low pressure.

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 ±0.1°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

| AKC | ※※ | 9 | - ※※※ |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

**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

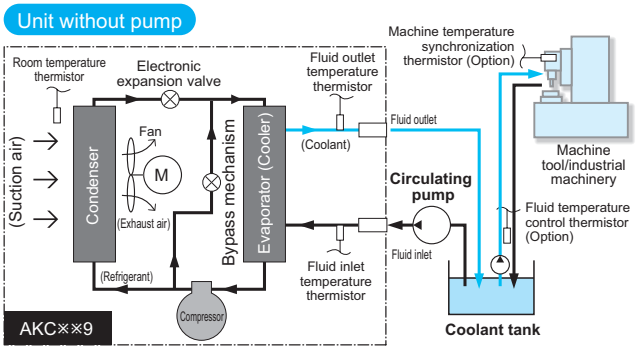
| Symbol of option type | Compliance with CE | With heater | With pump |
|---|---|---|---|
| -C | ✓ | – | – |
| -H | – | ✓ | – |
| -200 | – | – | ✓ |
| -CH | ✓ | ✓ | – |
| C200 | ✓ | – | ✓ |
| H200 | – | ✓ | ✓ |
| K200 | ✓ | ✓ | ✓ |

Special specifications (different voltages, with casters, etc.)
-※※※ (3-digit number), C※※※ (3-digit number), etc.
Please consult us about detailed information.

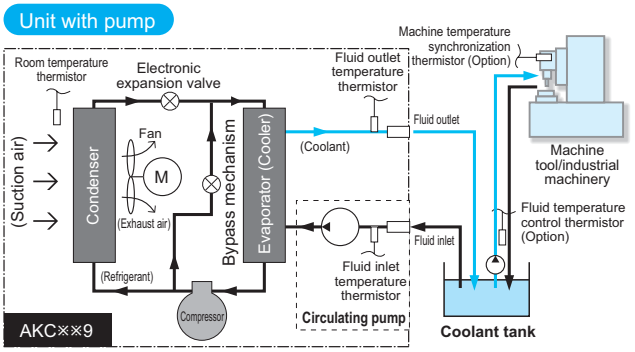
## System configuration

- Easy retrofit into the existing system
- Newly designed evaporator improved for greater durability against clogging

Unit without pump




Unit with pump



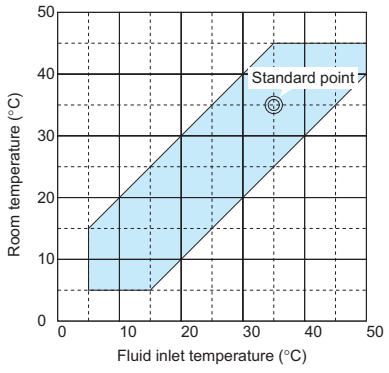
# Specifications

| Oil cooling unit horsepower HP | | | 1.2 | | | | 2.0 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model name | | | AKC359 | | | | AKC569 | | | |
| | | | 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 | | | 3.2/3.2 | 5.6/5.6 | | | 5.3/5.3 |
| Heater kW | | | – | | 1 | – | – | | 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 Max. current 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 |
| | 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) | | | | | | | |
| | | Synchronization range K | –9.9 to 9.9 against the reference temperature (Set at 0.0 by default) | | | | | | | |
| | Fixed type | Controlled object | Fluid inlet temperature or fluid outlet temperature | | | | | | | |
| | | Range °C | 5 to 50 | | | | | | | |
| 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 | | | | | | | |
| | Fluid inlet temperature °C | | 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 *7)<br>(Use clean fluid that can pass through filter equipment with a screen mesh of 40 or greater.) | | | | | | | |
| Connecting pipe | Fluid inlet | | Rc¾ | | | | | | | |
| | Fluid outlet | | Rc¾ | | | | | | | |
| | Fluid drain port | | Rc1 | | | | | | | |
| | Pump priming port *8 | | Rc½ | | | | | | | |
| | Oil pan drain | | – | | | Rc⅜ | – | | | Rc½ |
| 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/S² × 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). This unit has about ±5% of product tolerance.
*2 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.
*3 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.
*4 Indicates the maximum value with clean fresh water.
*5 The optional thermistor for machine temperature synchronization is required.
*6 The MSDS (Material Safety Data Sheet) of refrigerant R410A is attached to the -C type.
*7 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).
*8 Not applicable to models without a pump
*9 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.
*10 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.)

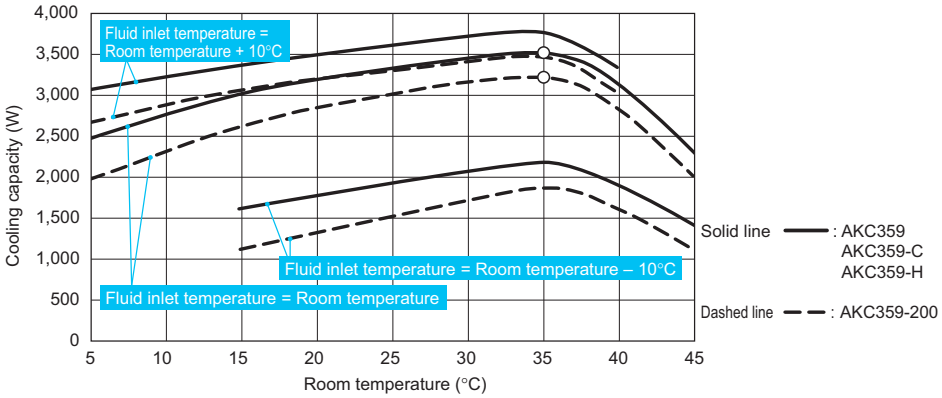


# Cooling capacity characteristic chart

## AKC359

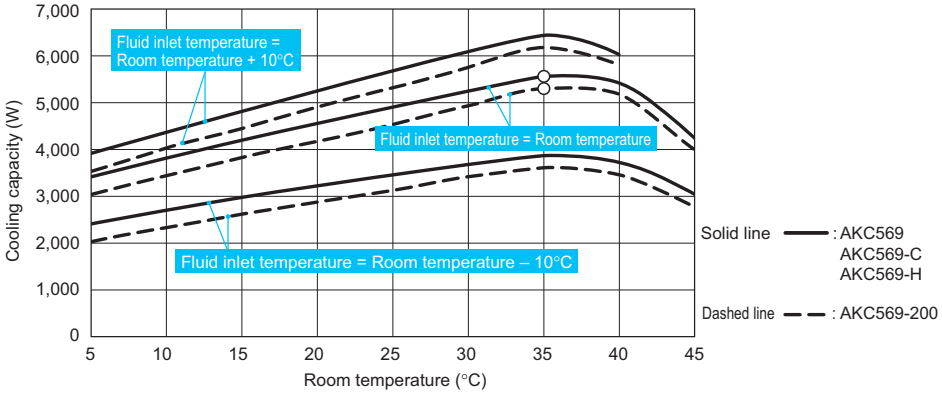
Fluid used: VG32

Flow rate: 35 L/min




## AKC569

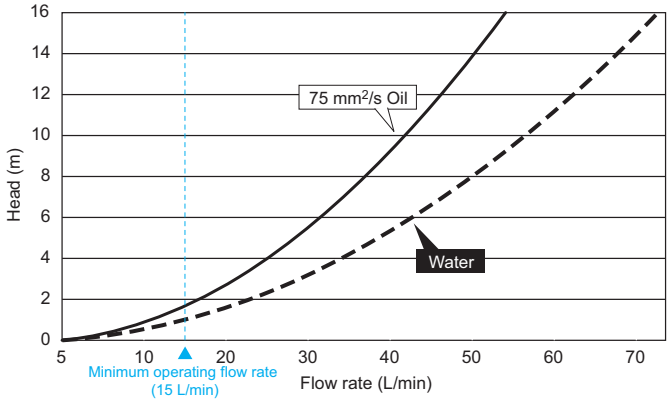
Fluid used: VG32
Flow rate: Flow rate variation depending on fluid temperature variation
(With the piping pressure loss at standard point maintained)




1. 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)
2. The cooling capacity varies depending on conditions such as room temperature, fluid temperature, oil dynamic viscosity and other factors.

# Internal pressure loss

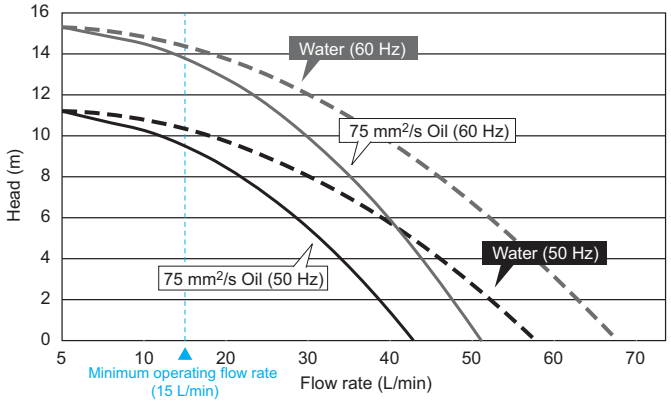
For the selection of the oil pump size and piping system, such as diameter and length of pipes, refer to the chart to the right. Pay attention to making the oil flow rate 15 L/min or greater.




# Flow rate characteristics for models with a pump

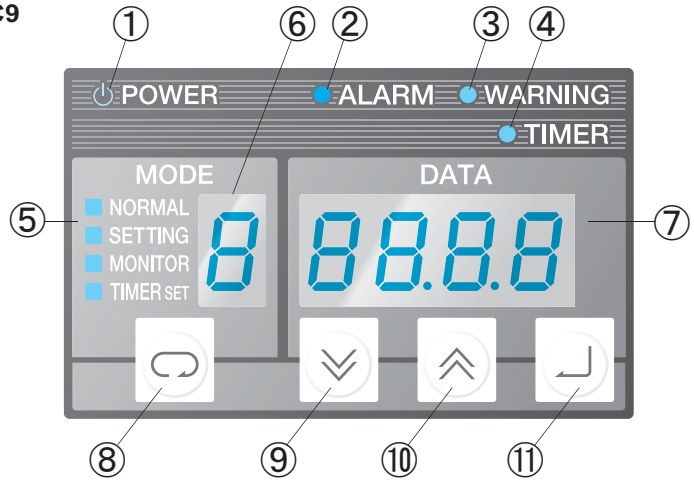
(Internal pressure loss included)

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.

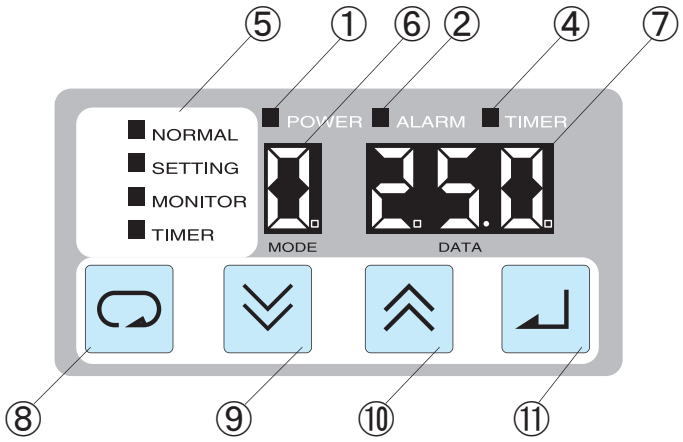


## Names and functions of the components on the control panel

**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

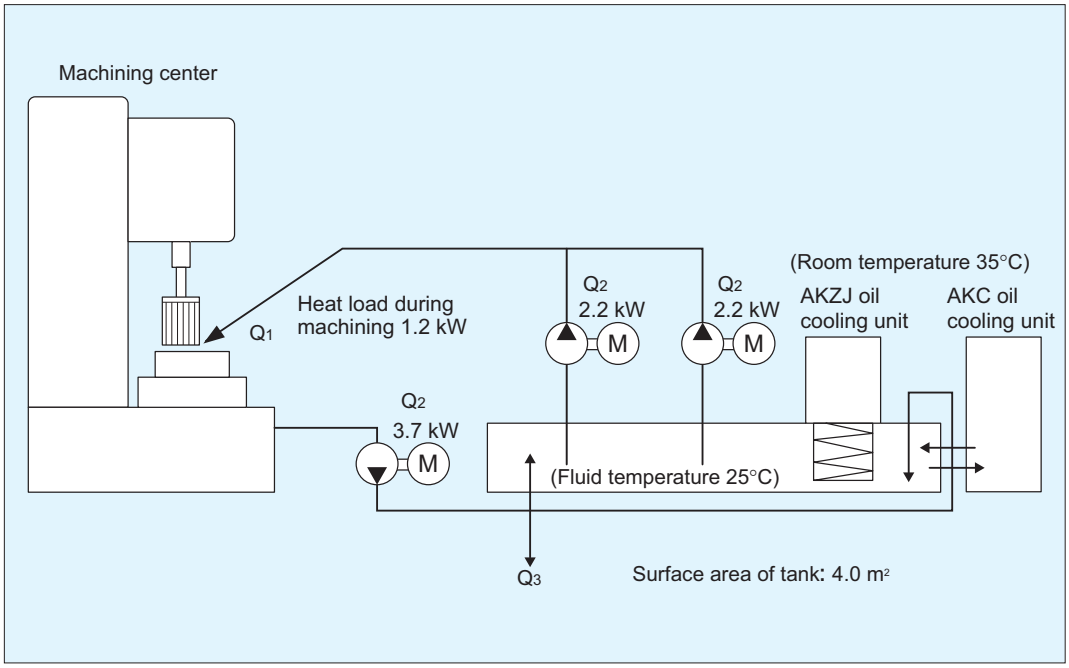
1. Since the tank capacity and pump flow rate are generally large the heat load from the cutting and grinding fluid system should be roughly estimated according to the following formula. After rough estimation, the heat load should be determined by conducting tests on the actual machine to select the 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
$Q_1$: Heat load during machining on a machine tool
$Q_2$: Heat load of the pump motor for coolant pump (Amount of heat transferred to coolant)
: $Q2 = \text{Pump motor output (kW)} \times \frac{\eta}{100}$
$Q_3$: Heat balance between coolant and room temperature via coolant tank
$Q3 = K \cdot A \cdot \Delta T$ K: Heat transfer coefficient ($W/m^2 \cdot °C$), K = 11.6 to 23.2 in general
A: Surface area of tank in contact with fluid ($m^2$)
$\Delta T$: 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 $Q_1 = 1.2$ kW
$Q_2 = (2.2 + 2.2 + 3.7) \times \frac{50}{100} \approx 4.1$ kW (For a coolant pump, "η" is generally 50%.)
$Q_3 = 20 \times 4 \times (35 - 25) / 1000 = 0.8$ kW
$\therefore Q = Q_1 + Q_2 + Q_3$
$= 1.2 + 4.1 + 0.8$
$= 6.1$ kW

# *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**