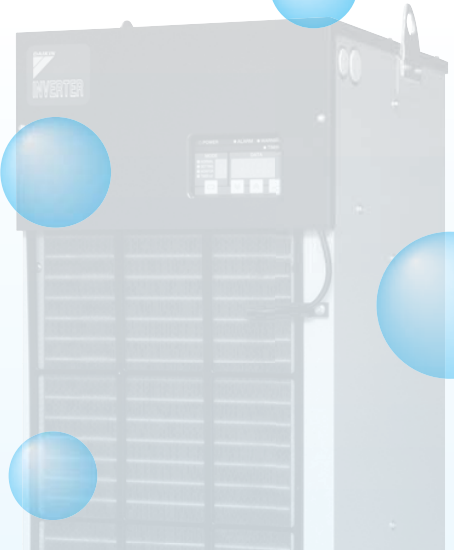


L

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	AKZ149	Operation at 50 Hz		Operation at 60 Hz												L-3
		AKZ329	Operation at 50 Hz		Operation at 60 Hz												
		AKZ439	Operation at 50 Hz		Operation at 60 Hz												
		AKZ569	Operation at 50 Hz		Operation at 60 Hz												
		AKZ909	Operation at 50 Hz		Operation at 60 Hz												
Immersion type oil cooling unit for coolant	AKZJ8 Series	AKZJ188	Operation at 50 Hz		Operation at 60 Hz												L-19
		AKJZ358	Operation at 50 Hz		Operation at 60 Hz												
		AKJZ458	Operation at 50 Hz		Operation at 60 Hz												
		AKJZ568	Operation at 50 Hz		Operation at 60 Hz												
		AKJZ908	Operation at 50 Hz		Operation at 60 Hz												
AKC9 Series Circulating type oil cooling unit for coolant	AKC359	Operation at 50 Hz		Operation at 60 Hz													L-26
	AKC569	Operation at 50 Hz		Operation at 60 Hz													
AKW9 Series Inverter controlled chiller	AKW149	Operation at 50 Hz		Operation at 60 Hz													L-38
	AKW329	Operation at 50 Hz		Operation at 60 Hz													
	AKW439	Operation at 50 Hz		Operation at 60 Hz													
	AKW189	Operation at 50 Hz		Operation at 60 Hz													
	AKW359	Operation at 50 Hz		Operation at 60 Hz													
	AKW459	Operation at 50 Hz		Operation at 60 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	Operation at 50 Hz			Operation at 60 Hz												L-44
	LT0504	Operation at 50 Hz			Operation at 60 Hz												
	LT0707	Operation at 50 Hz			Operation at 60 Hz												
	LT1010	Operation at 50 Hz			Operation at 60 Hz												
	LT1515	Operation at 50 Hz			Operation at 60 Hz												
	LT2020	Operation at 50 Hz			Operation at 60 Hz												
	LT3030	Operation at 50 Hz			Operation at 60 Hz												
	LT5060	Operation at 50 Hz			Operation at 60 Hz												

Oil Cooling Unit

Inline type cooling unit for spindle/lubrication oil



AKZ9 Series
For lubrication oil
For hydraulic oil

Immersion type cooling unit for coolant



AKZJ 8 Series
For cutting oil (fluid)
For grinding oil (fluid)

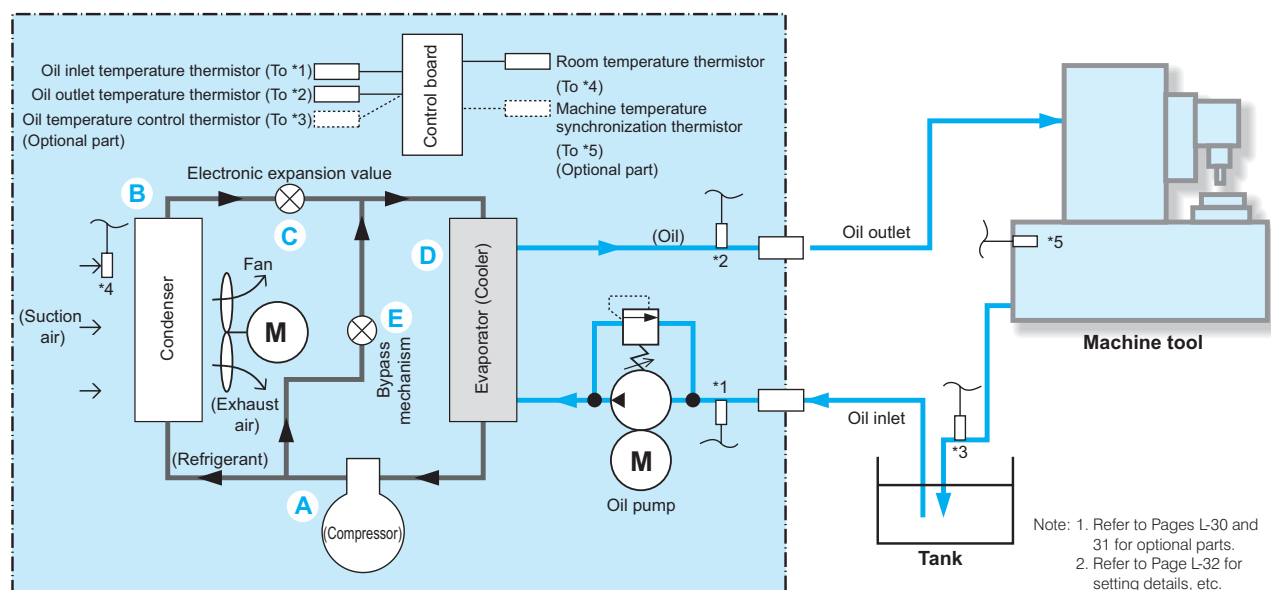
Inline type cooling unit for coolant



(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 AKJ※※8 (Immersion Type for Cooling Coolant)



Features

- **Immersion type oil cooling unit for coolant**
(to be mounted directly on the tank, not provided with the circulating pump)
- **High energy-saving performance achieved**
Achieves high energy-saving performance with the adoption of a Daikin original IPM motor and R410A refrigerant.
- **Achieving high-accuracy temperature control**
Inverter control maintains machine tools at the optimum operating conditions at all times and improves the machining accuracy of the machine tools.
- **Low-noise operation achieved**
AKZJ 1.2 HP class:
Noise level with conventional model at 68 dB (A) → **62 dB (A)** (value equivalent to measurement in an anechoic chamber)

Nomenclature

AKZJ	18	8	-	C	-	※※※※
1	2	3		4		5

1 Standard type (Basic type of oil cooling nit)

AKZJ: High-accuracy inverter controlled model, immersion open type
For cutting and grinding fluid (oil)

2 Cooling capacity (kW)

18: 1.8 kW
35: 3.5 kW
45: 4.5 kW
56: 5.6 kW
90: 9.0 kW

3 Symbol of series (Symbol to represent model change)

8: "8" series

4 Symbol of option type

Individual specifications for general purposes are set as a menu to avoid the need to design the individual specifications in each case and to enable shorter product delivery times.

* For the combination of menus, please consult us about detailed information.

5 Non-standard number (4 alphanumeric characters)

Non-standard type satisfying individual specifications not incorporated in the menu.

* Please consult us about special specifications, such as compliance with UL, or processing for tropical regions.

Specifications of standard, optional, and non-standard types

■ AKZJ8 (Immersion type)

	Standard specifications	Option	Non-standard	Remarks
Use of low-viscosity oil (fluid)	✓			Viscosity of oil used: 0.5 to 200 mm ² /s
With timer	✓			99-hour timer
With breaker		B		
Compliance with CE		C		European Safety Standard
Different voltages (With transformer)		E*		The type "E" marked with *** includes three voltage types (E1, E2, E3) as listed to the right. E1: AC 220, 230 V, 50/60 Hz E2: AC 380, 400, 415 V, 50/60 Hz E3: AC 440, 460, 480 V, 50/60 Hz
With heater		H		
Specified paint color			✓	
With additional PC board for serial communication			✓	Standard types (AKZJ188, AKZJ358 and AKZJ458), and -C, -E* types
With additional PC board for serial/parallel communication			✓	Standard types (AKZJ568 and AKZJ908), and -C, -E* types

Applications

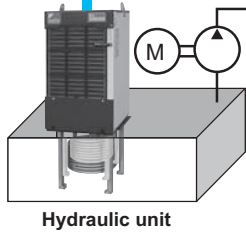
Examples of major applications

Machine tools: Machining centers, NC lathes, grinding machines, NC specialized machines, NC electric discharge machines, etc.
 Industrial machines: ... Molding machines, presses, etc.

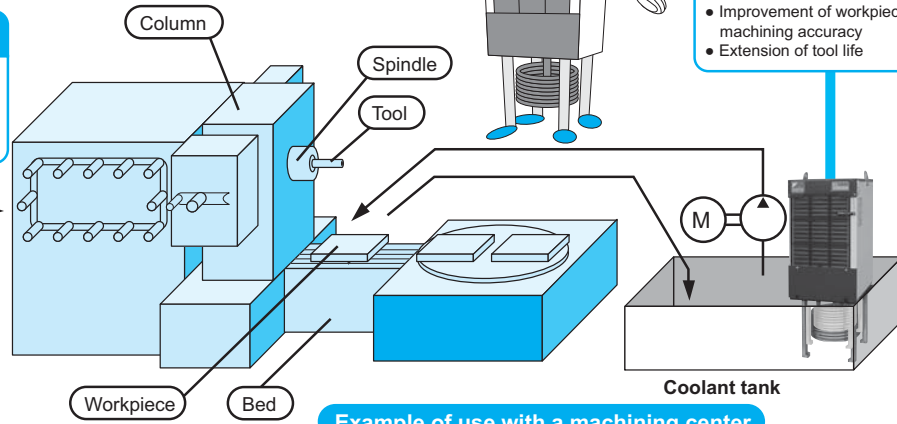
Cooling of hydraulic oil

Temperature (viscosity) control

- Prevention of deterioration of hydraulic oil (Longer life)
- Stabilized operation of actuators



Hydraulic unit



Example of use with a machining center

Cooling of cutting oil

Cooling of workpiece and tool

- Improvement of workpiece machining accuracy
- Extension of tool life

Specifications (AKZJ188/358/458)

Oil cooling unit horsepower	HP	0.5					1.2					1.5							
		AKZJ188					AKZJ358					AKZJ458							
Model name		Standard	-B	-C	-H	-E *3	Standard	-B	-C	-H	-E *3	Standard	-B	-C	-H	-E *3			
Cooling capacity (50/60 Hz) *1	kW	1.6/1.8					3.2/3.5					4.2/4.5							
Heater	kW	-					1					-							
Power supply *2		Three-phase AC 200/200·220 V 50/60 Hz					*3					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	When cooling	200 V 50 Hz	1.07 kVA/3.1 A				*9	1.76 kVA/5.2 A				*9	1.94 kVA/5.7 A						
		200 V 60 Hz	1.09 kVA/3.2 A					1.78 kVA/5.2 A					1.96 kVA/5.7 A						
		220 V 60 Hz	1.07 kVA/2.8 A					1.79 kVA/4.9 A					1.98 kVA/5.3 A						
	When heating *8	200 V 50 Hz	-	1.1 kVA/5.7 A			-	1.2 kVA/5.9 A			-	1.2 kVA/5.9 A			-				
		200 V 60 Hz	-	1.1 kVA/5.6 A			-	1.2 kVA/5.8 A			-	1.2 kVA/5.8 A			-				
		220 V 60 Hz	-	1.3 kVA/6.1 A			-	1.4 kVA/6.3 A			-	1.4 kVA/6.3 A			-				
Transformer capacity		-				2.2 kVA		-			2.2 kVA		-			2.2 kVA			
External paint color		White																	
External dimensions (H × W × D)	mm	980 × 360 × 440				980 × 450 × 630		1,120 × 360 × 440				1,120 × 450 × 630		1,320 × 360 × 440				1,320 × 450 × 630	
Compressor (Hermetic DC swing type)		Equivalent to 0.4 kW					Equivalent to 0.75 kW					Equivalent to 1.1 kW							
Evaporator		Open coil type																	
Condenser		Cross-fin-coil type																	
Propeller fan	Motor	φ300, 75 W																	
Agitator	Motor	1-phase, 50 W, 4-pole motor																	
Temperature control (Selectable)	Synchronization type	Standard	Room temperature or machine temperature ** (Set to room temperature by default)																
		Controlled object	Tank fluid temperature																
	Fixed type	Synchronization range K	-9.9 to +9.9 against the reference temperature (Set at 0.0 by default)																
		Controlled object	Tank fluid temperature																
Refrigerant control		Rotation speed control of compressor by inverter + Opening rate control of electric expansion valve																	
Refrigerant (R410A) *5 Filling volume	kg	0.58					0.81					0.99							
Protection devices		A set of internal thermistor (for agitator), reverse-phase protection device, restart prevention timer, low room temperature protection thermistor, high fluid temperature protection thermistor, low fluid temperature protection thermistor, discharge pipe temperature thermistor, condenser temperature thermistor, refrigerant leakage detector, inverter protection device, non-fuse breaker (-B type only), High-pressure switch (-C type only), compressor thermal protector (-C type only), overheat prevention temperature thermistor (-H type only), fuse (-H type only)																	
Operation range	Room temperature	°C																	
	Tank fluid temperature	°C																	
	Oil viscosity	mm ² /s																	
Acceptable oils		Water-soluble cutting/grinding fluid, cutting/grinding oil, lubrication oil, hydraulic oil, industrial water (Cannot be used for chemicals, food products or fuel)																	
Noise level (Value equivalent to measurement in an anechoic chamber) (Front 1 m, height 1 m)	dB (A)	62																	
Permissible transport vibration		Up and down vibration 14.7 m/S ² (1.5 G) × 2.5 hr (10 to 100 Hz sweep/5 min.)																	
Mass	kg	38	41	103	44	47	109	53	56	118									
Molded-case circuit breaker (Rated current)	A	-	10	-	-	10	-	10	-	-	10	-	-	-	-				
Items prepared by the customer	Molded-case circuit breaker (Rated current)	A																	
	Device other than molded-case circuit breaker	10 (Required for types other than -B type) Tank (400 mm or more in depth), supply pump, float switch, return filter																	

Refer to Page L-21 for explanatory notes.

Specifications (AKZJ568/908)

Oil cooling unit horsepower		HP	2.0					3.0					
Model name			AKZJ568					AKZJ908					
			Standard	-B	-C	-H	-E *3	Standard	-B	-C	-H	-E *3	
Cooling capacity (50/60 Hz) *1	kW					5.0/5.6					8.0/9.0		
Heater	kW		-			2		-			4		
Power supply *2			Three-phase AC 200/200·220 V 50/60 Hz					Three-phase AC 200/200·220 V 50/60 Hz					
Power voltage	Main circuit		Three-phase AC 200/200·220 V 50/60 Hz					Three-phase AC 200/200·220 V 50/60 Hz					
	Operation circuit		DC 12/24 V					DC 12/24 V					
Max. power consumption Max. current consumption	When cooling	200 V 50 Hz				3.3 kVA/9.4 A	*9				3.9 kVA/11.2 A	*9	
		200 V 60 Hz				3.3 kVA/9.4 A					4.1 kVA/11.7 A		
		220 V 60 Hz				3.4 kVA/9.0 A					4.3 kVA/11.2 A		
	When heating *8	200 V 50 Hz		-			2.3 kVA/11.4 A		-			4.3 kVA/21.6 A	
		200 V 60 Hz		-			2.3 kVA/11.4 A		-			4.3 kVA/21.6 A	
		220 V 60 Hz		-			2.7 kVA/12.5 A		-			5.2 kVA/23.7 A	
Transformer capacity						5 kVA					6 kVA		
External paint color						White							
External dimensions (H × W × D)	mm				1,450 × 470 × 500	1,450 × 560 × 710				1,630 × 560 × 620	1,630 × 655 × 830		
Compressor (Hermetic DC swing type)					Equivalent to 1.5 kW					Equivalent to 2.2 kW			
Evaporator							Open coil type						
Condenser							Cross-fin-coil type						
Propeller fan	Motor				φ400, 90 W, 4-pole motor					φ450, 150 W, 4-pole motor			
Agitator	Motor						1-phase, 50 W, 4-pole motor						
Temperature control (Selectable)	Synchronization type	Standard	Room temperature or machine temperature *4 (Set to room temperature by default)										
		Controlled object	Tank fluid temperature										
		Synchronization range K	-9.9 to +9.9 against the reference temperature (Set at 0.0 by default)										
	Fixed type	Controlled object	Tank fluid temperature										
Range °C		5 to 50											
Refrigerant control							Rotation speed control of compressor by inverter + Opening rate control of electric expansion valve						
Refrigerant (R410A) *5 Filling volume	kg					1.25					1.65		
Protection devices							A set of internal thermistor (for fan motor), internal thermistor (for agitator), reverse-phase protection device, restart prevention timer, low room temperature protection thermistor, high fluid temperature protection thermistor, low fluid temperature protection thermistor, discharge pipe temperature thermistor, condenser temperature thermistor, refrigerant leakage detector, inverter protection device, non-fuse breaker (-B type only) High-pressure switch (-C type only), compressor thermal protector (-C type only), overheat prevention temperature thermistor (-H type only), fuse (-H type only)						
Operation range	Room temperature	°C					5 to 45						
	Tank fluid temperature	°C					5 to 50						
	Oil viscosity	mm ² /s					0.5 to 200						
Acceptable oils						Water-soluble cutting/grinding fluid, cutting/grinding oil, lubrication oil, hydraulic oil, industrial water (Cannot be used for chemicals, food products or fuel)							
Noise level (Value equivalent to measurement in an anechoic chamber) (Front 1 m, height 1 m)	dB (A)					65					68		
Permissible transport vibration						Up and down vibration 14.7 m/S ² (1.5 G) × 2.5 hr (10 to 100 Hz sweep/5 min.)							
Mass	kg		83		86	160		132		140	220		
Molded-case circuit breaker (Rated current)	A		-	15		-		-	20		-		
Items prepared by the customer	Molded-case circuit breaker (Rated current)	A	15 (Required for types other than the -B type)					20 (Required for types other than the -B type)					
	Device other than molded-case circuit breaker		Tank (400 mm or more in depth), supply pump, float switch, return filter										

Note: *1 The cooling capacity indicates the value at the standard point (inlet oil temperature: 35°C, room temperature: 35°C, oil used: ISO VG32).

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 There are three types of different voltage specifications depending on the power source: the -E1, -E2 and -E3 units. (Refer to Page L-19 for details.)

*4 The machine temperature synchronization thermistor available as an option is required for this function.

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

*6 The molded-case circuit breaker is not supplied with this product. Please prepare it yourself.

*7 Conventional models of the 1 HP class such as AKJ106 and AKZJ287 were unified with AKZJ358 in the 1.2 HP class.

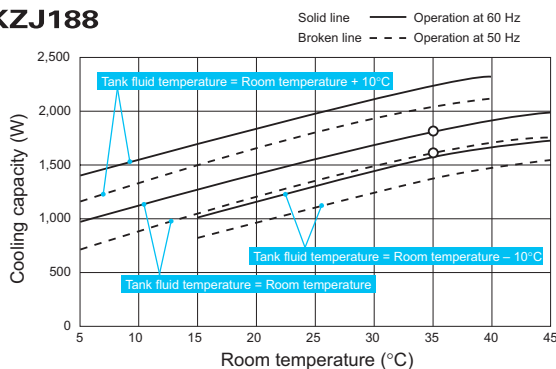
*8 A 1-phase power supply is used for the heater.

*9 The maximum power consumption/maximum current consumption of different voltage specifications are shown in the tables below.

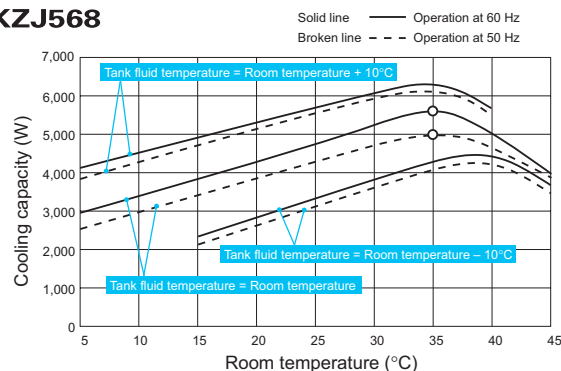
■ AKZJ188			■ AKZJ358			■ AKZJ458			■ AKZJ568			■ AKZJ908		
Supply power	Power/current		Supply power	Power/current		Supply power	Power/current		Supply power	Power/current		Supply power	Power/current	
380 V		1.9 A	380 V		3.0 A	380 V		3.3 A	380 V		5.4 A	380 V		6.8 A
400 V		1.8 A	400 V		2.9 A	400 V		3.1 A	400 V		5.2 A	400 V		6.4 A
415 V		1.7 A	415 V		2.8 A	415 V		3.0 A	415 V		5.0 A	415 V		6.2 A
440 V	50/60 Hz	1.6 A	440 V	50/60 Hz	2.6 A	440 V	50/60 Hz	2.9 A	440 V	50/60 Hz	4.7 A	440 V	50/60 Hz	5.9 A
460 V		1.5 A	460 V		2.5 A	460 V		2.7 A	460 V		4.5 A	460 V		5.6 A
480 V		1.5 A	480 V		2.4 A	480 V		2.6 A	480 V		4.3 A	480 V		5.4 A

Cooling capacity characteristic chart

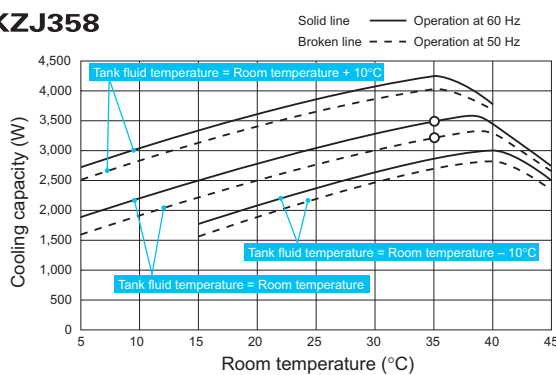
AKZJ188



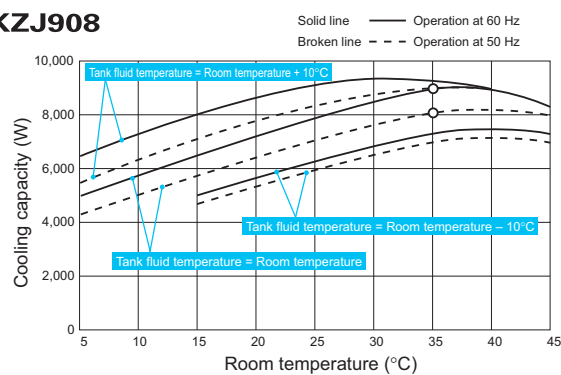
AKZJ568



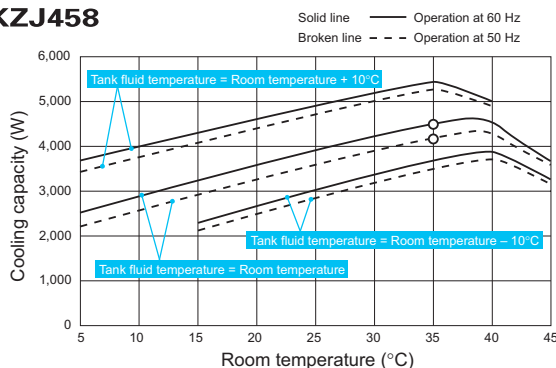
AKZJ358



AKZJ908




AKZJ458

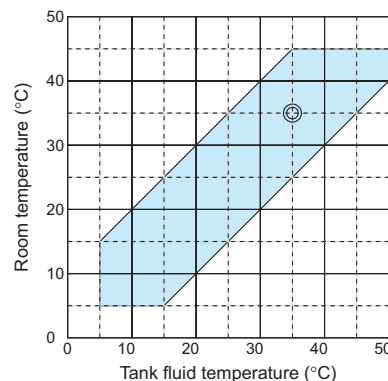


1. The mark "O" shows the standard point.
(Room temperature: 35°C/Oil inlet temperature: 35°C/Oil used: ISO VG32)
2. The cooling capacity varies depending on conditions such as the room temperature, tank fluid, oil dynamic viscosity and other factors.

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.)



Notes to be observed at the main machine side (AKZ9/AKZJ8 series)

• Important notes to be observed regarding the main machine side (machine tools and industrial machinery)

- When rough transport conditions are expected while transporting the machine overseas or elsewhere, special precautions should be taken in the packaging and transportation method so as to avoid the application of excessive force on the oil cooling unit (this unit).
- The oil cooling unit (this unit) does not have a flow switch for checking the oil supply or a temperature switch for abnormal temperature of supplied oil (high temperature or low temperature). So, please provide a protective device such as a flow switch and a temperature switch at the main machine side.

Notes on operation and cooling capacity

- Do not use the oil cooling unit to chill a fluid from 50°C or higher. Start to operate the oil cooling unit at the same time as the main machine or before the fluid temperature rises to 40°C.
- Do not place an object that hinders ventilation within 500 mm of the air-intake or exhaust.
- If the air filter is clogged, the cooling capacity should be diminished. Clean the air filter (wash with warm water or clean with air) periodically once every two weeks to prevent clogging.
- If cutting chips and powder-like chips deposit on and adhere to the cooling coil (evaporator) in the AKZJ8 series, the cooling capacity should be diminished and it could cause failure. To avoid the adherence of deposits on the cooling coil, install an efficient return filter on the return side (fluid inlet) of the tank and periodically clean the tank inside.

Notes on usable fluids with oil cooling units

- The fluid usable with the oil cooling unit is listed in the table below for each series.
- Do not use fluid listed below as “unusable”

	Description	AKZ9 Series	AKZJ8 series
Lubrication oil Mineral hydraulic oil	<ul style="list-style-type: none"> Oil that is classified as third class petroleum or fourth class petroleum of the fourth group hazardous materials stipulated in the Fire Defense Law and that corresponds to discoloration No. 1 in the copper corrosion test method (JIS K 2513) of petroleum products Oil that satisfies pollution level NAS 10 	✓	✓
Nonflammable hydraulic oil <ul style="list-style-type: none"> Ester phosphate series Chlorinated hydrocarbon series Water - Glycol series W/O • O/W emulsion series (High-aqueous hydraulic oil) 	—	Unusable	Unusable
Coolant fluid <ul style="list-style-type: none"> Water-soluble cutting and grinding fluid Non water-soluble cutting and grinding oil 	—	Unusable	✓
Ethylene glycol (Antifreeze liquid)	Fluid not including any ingredient that corrodes the SUS304 material used for the evaporator coil	Unusable	✓
Water (Industrial water)		Unusable	✓
Inflammable liquids like fuel	Liquids that are classified as special flammables, alcohol, third class petroleum or fourth class petroleum of the fourth group hazardous materials stipulated in the Fire Defense Law	Unusable	Unusable
Chemicals	—	Unusable	Unusable
Liquids for food products	Drinking water, water for cooling food products, etc.	Unusable	Unusable

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

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

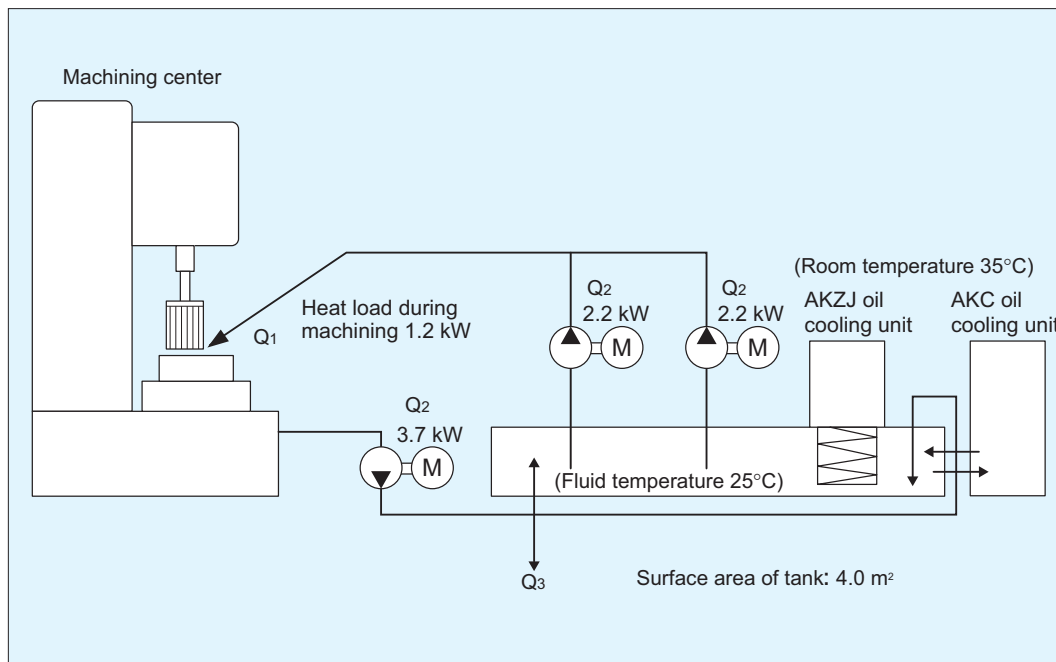
K: Heat transfer coefficient (W/m² · °C), K = 11.6 to 23.2 in general

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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