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Oil Hydraulic Equipment

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DAIKIN

OILCOOLING UNIT

OILCON

AKZ(S)/AKZJ 7 SERIES

New refrigerant type

NEW MODEL

SERIES 7

DAIKIN INDUSTRIES, LTD.
Oil Hydraulics Division
Oil Hydraulics Equipment

Feel our enthusiasm for the OILCON with the advanced "hydraulic + refrigerating" fusion technology.

We have concentrated to supply highly trusted products for customers. New Oilcon improved accuracy and quality for keeping excellent conditions of every Machine Tools continuously .
You can feel our fiery mind through the OILCON supported by the excellent "hydraulic + refrigerating" fusion technology.

CONTENTS

OIL COOLING UNIT
OILCON
AKZ(S) / AKZJ7 SERIES

Contact Details
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Product map

Series		General description	Fluid applicable				HP					
Type	Series		Lubri-cating oil	Hydraulic oil	Water-insoluble cutting/ grinding oil	Water-soluble cutting/ grinding oil	0.5	1	1.2	1.5	2	3
AKZ	"7"	● High-accuracy and high-response type by compressor inverter control (electronic expansion valve control) ● Circulating oil cooling unit ● Built-in circulating pump ● Closed cooler	◎	◎	—	—	147	257	327	437	567	907
AKZS	"7"	● Compressor inverter control ● Circulating oil cooling unit ● Built-in circulating pump ● Closed cooler	◎	◎	—	—	147	257	327	437	567	907
AKZJ	"7"	● Compressor inverter control ● Immersion oil cooling unit (Directly mounted to the upper tank) ● Open cooler of stainless steel ● Without circulating pump (Local supply) ● Without tank (Local supply)	◎	◎	◎	◎	187	287	357	457	567	907

Note: The mark of ◎ means the fluid applicable.

Fusion Technology For Control

Circulating oil cooling unit

AKZ 7 series

Immersion oil cooling unit

AKZJ 7 series

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Nomenclature

AKZ	32	7	A	-	C	·····		-	
1	2	3	4		5				6

1 Standard model/type (Oil cooling unit of standard type)

For Spindle/lubricating oil
AKZS:Energy-saving inverter, Circulating type
A K Z :Highly accurate inverter, Circulating type

For cutting/grinding oil
AKZJ :Highly accurate inverter, Immersion open type

2 Nominal capacity (kw*10)

Adopted from JIS Z 8601 series (2 figures)
14, 18, 25, 28, 32, 35, 43, 45, 56, 90, etc.

3 Series number (Model change No.)

7,8,9·····

4 Series sub symbol (Minor change symbol)

A,B,C·····

5 Symbol of optional model (General specifications designated)

(For two standards or more, indicate in alphabetical order.)

	For Spindle and lubricating oil		For cutting and grinding oil
	AKZS	AKZ	AKZJ
C: Conforms to CE	○	○	○
E: Different voltage transformer (*1)	○	○	○
H :Heater timer (72hrs)	○	○	○
L :Low viscosity (VG2) pump	○	○	–
P :High pressure (*2) pump	○	○	–
T :Standard tank	○	○	○

※1 220/230V, 50/60Hz
380/400/415V, 50/60Hz
440/460/480V, 50/60Hz

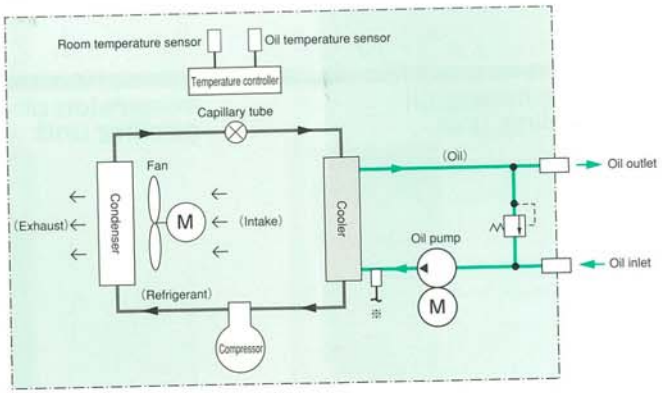
※2 Cracking Pressure 0.5MPa

6 Individual order symbol

Alphanumeric characters of 4 figures (Models changed or modified from the standard or optional models as follows:) Casing, nameplate, packing, electric parts and components, hydraulic system, foreign standards (UL, CSA), IP grade, tropical conditions, etc.
* Please contact us for further information.

(Remarks) The following optional accessories are available.
●Communication Interface (common to serial and parallel) ●Machine surface Temp. sensor (5, 10 m)
●Oil temperature sensor (2.5 m) ●Caster (for oil cooling unit for spindle and lubricating oil) ●Attachment (for AKJ, AKZJ)

Operating principle



[Cooling cycles]

●Refrigerant gas is compressed to high temperature and high pressure gas, so that it is cooled and liquefied easily by condenser.
●In condensing process, the high temperature and high pressure gas is cooled by air and condensed to make high temperature and high pressure fluid.
●In capillary tube, the high temperature and high pressure fluid is decompressed to make low temperature and low pressure fluid, so that it is evaporated easily by cooler.
●In cooling process, the low temperature and low pressure fluid is evaporated, while it takes heat from oil, to make low temperature and low pressure gas.

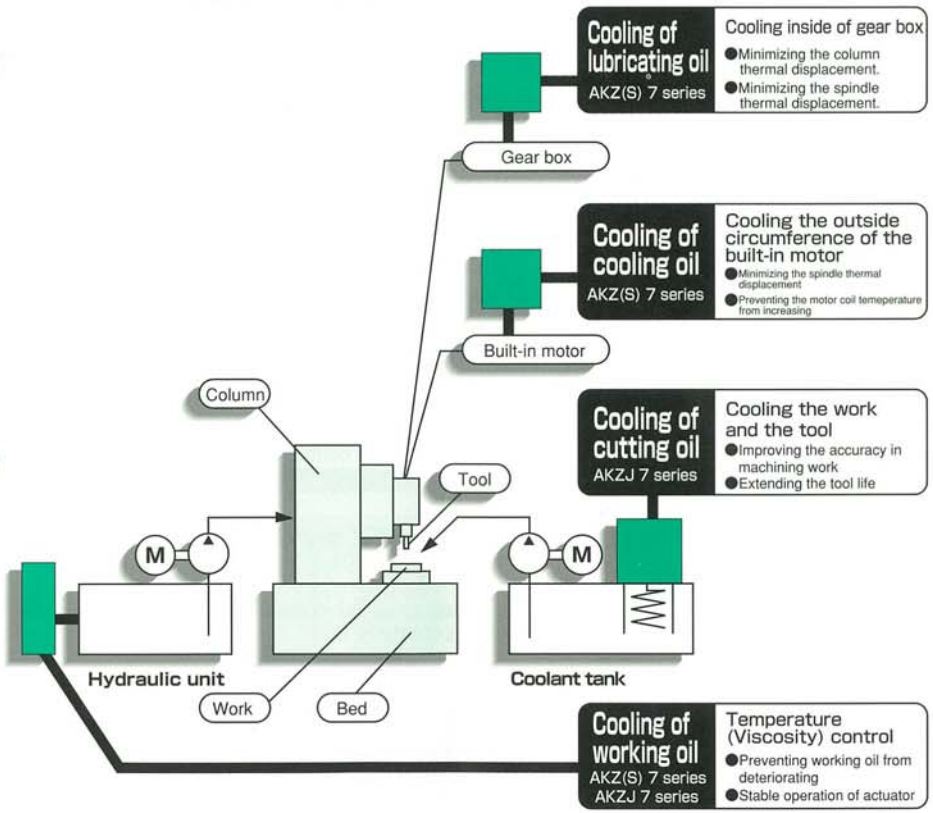
Application

Application examples

Machine tools : Machining center, NC lathe, Grinding machine, NC special machine, Electric spark machine, etc.
Industrial machines : Molding machine, Press, etc.

Application examples by types

Example for machining center



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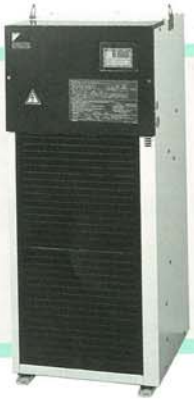
OILCOOLING UNIT OILCON

AKZ(S)7

SERIES



Features

Highly accurate inverter oil cooling unit (AKZ"7"series)

1.High accuracy oil Temperature control(±0.1℃)

2.Wider cooling control range

Compressor inverter control and coolant control achieve wider cooling control range (Load factor 10% or less to 100%)

Energy-saving inverter oil cooling unit (AKZS"7"series)

1.Energy-saving inverter instead of conventional ON/OFF selector type

Select operation mode automatically according heating load.

2.Equipped with inverter selecting function (for individual order)

Pump flow rate is controlled by two-stage control at low heating load to attain higher energy-saving effect. (Max. 40% compared to our ON/OFF model)

Features common to both AKZ series and AKZS series

1.New refrigerant

New refrigerant **R407C** is applied to all the models. It is promising alternative for HCFC-22. (Ozone depleting potentials "0")

2.Wide line-up (6 models)

In addition to the conventional 1.2, 2, 3HP; three models of 0.5, 1, 1.5HP are available.

3.Main unit equipped with communicating function (Option)

Use communication extension board to execute parallel and serial communication.

4.Conforming to CE (Option)

All the models conform to CE standard as option.

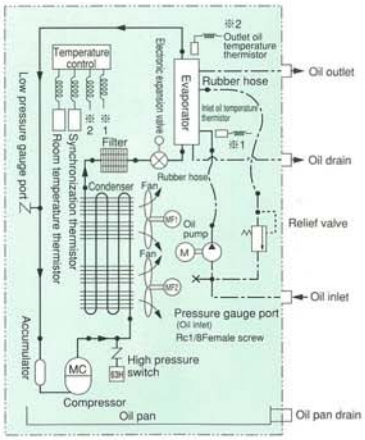
AKZ(S)7 SERIES

Specifications

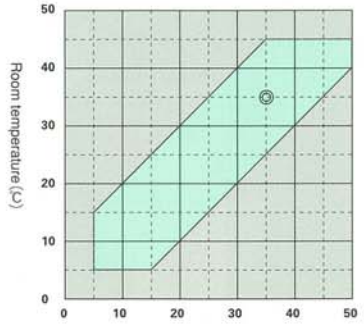
Horse power of OILCON (HP)			0.5	1	1.2	1.5	2	3
Model			AKZ(S)147	AKZ(S)257	AKZ(S)327	AKZ(S)437	AKZ(S)567	AKZ(S)907
Cooling capacity (50/60Hz) *Note 1		kW	1.3/1.4	2.3/2.5	2.8/3.2	3.8/4.3	5.0/5.6	8.0/9.0
Power source	Main circuit (50/60Hz)		3~ 200/200・220V 50/60Hz					
	Control circuit (50/60Hz)		DC24/12V					
	Capacity 200V 50Hz		1.4kVA/3.9A	2.1kVA/6.4A	2.5kVA/7.1A	2.6kVA/7.7A	3.8kVA/10.5A	6.0kVA/17.2A
	200V 60Hz		1.2kVA/3.5A	2.0kVA/6.3A	2.5kVA/7.2A	2.7kVA/7.8A	3.8kVA/11.0A	6.1kVA/17.6A
	220V 60Hz		1.3kVA/3.3A	2.1kVA/6.4A	2.5kVA/7.2A	2.6kVA/7.6A	4.0kVA/9.7A	6.1kVA/16.2A
Painted color			White gray (Munsell N.7.5)					
Dimensions (H×W×D)		mm	640×360×440	790×360×440	1,020×360×440	1,020×360×440	1,110×470×500	1,220×560×620
Compressor (Hermetic DC swing type)			0.6kW,2P	0.6kW,2P	0.75kW,2P	1.1kW,2P	1.5kW,2P	2.2kW,2P
Evaporator			Shell and coil type					
Condenser			Crossfin coil type					
Fan			Propeller fan					
Motor	Oil pump		0.4kW,4P				0.75kW,4P	
	Fan		In common with oil pump				90W,4P	150W,4P
Oil pump displacement (50/60Hz)		ℓ/min	12.1/14.4	24/29			30/36	
Temperature adjustment (Selectable)	Synchronized type:	Synchronization Control	Room temperature (Machine Surface temperature *Note 2) Inlet oil temperature (Outlet oil temperature *Note 3) Synchronization range :−9.9~+9.9℃(Range of 5-50℃)					
	Fixed type:	Control	Inlet oil temperature (Outlet oil temperature *Note 3) 5~50℃					
Refrigerant control			Compressor capacity control by inverter + Electronic expansion valve					
Protection devices			Overcurrent relay (Pump motor), High pressure switch *Note 4, Reverse phase protector, Restart preventive timer, Low room temperature thermostat, High oil temperature protective thermostat, Pump relief valve, Compressor head temperature thermostat, Inverter protector set					
Refrigerant	Name		R407C					
	Charged amount	g	490	500	810	810	1,390	1,620
Operating range	Room temperature	℃	5~45					
	Inlet oil temperature	℃	5~50					
	Oil viscosity	mm²/s	4~200				2~200	
	External pressure loss Discharge		0.29MPa or less				0.49MPa or less	0.59MPa or less
	Suction		−30.7~0kPa					
Oil applicable			Lubricating oil, Petroleum hydraulic working oil (Inapplicable to water glycol and phosphate hydraulic actuating oil, water, cutting oil, and grinding oil)					
Connection piping	Oil inlet		Rc3/4	Rc1			Rc1 1/4	
	Oil outlet		Rc3/4	Rc1			Rc1 1/4	
	Oil drain		UNF7/16-20 (Male screw)					
	Oil pan drain		Rc3/8					
Sound level	(Anechoic chamber)		64dB(A)	65dB(A)	68dB(A)	68dB(A)	68dB(A)	70dB(A)
Weight		kg	53	50	65	65	85	120
Transportation vibration			Vertical14.7m/s²×2.5Hr (10-100Hz sweep, 5min/cycle)					
Rated current of wiring breaker *Note 5 (Local supply)		A	10	10	10	10	15	20

Note 1. Cooling capacity at standard point (Room temperature 35℃, Inlet oil temperature 35℃ with ISO VG32. (Select an appropriate one according to cooling capacity and selecting method by models.)
Note 2. Optional Machine Surface temperature sensor (AKS5-OP21 or AKS5-OP22) is required.
Note 3. Optional outlet oil temperature sensor is required. (Only AKZ applicable)
Note 4. Mounted onto AKZ(S)907 and the model which conforms to CE.
Note 5. Wiring circuit breaker is not a standard accessory. Appropriate wiring circuit breaker for each model should be supplied in the field and mounted onto the machine.
Note 6. For special specifications, contact us.

Piping diagram



Operating range



Note 1. The mark ◎ means the standard point.
Note 2. Operate in the range of the above □.
(If failed, failures may be caused.)

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AKZ(S)7 SERIES

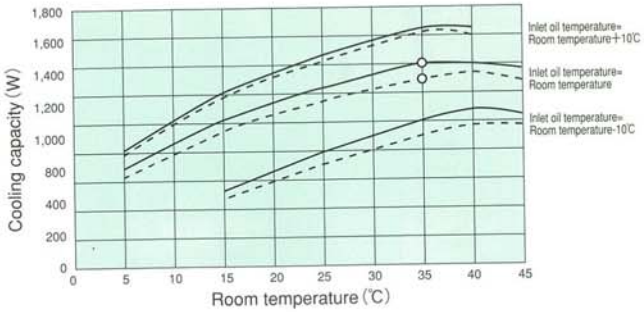
Performance curve

Unit conversion: 1kW = 860kcal/h

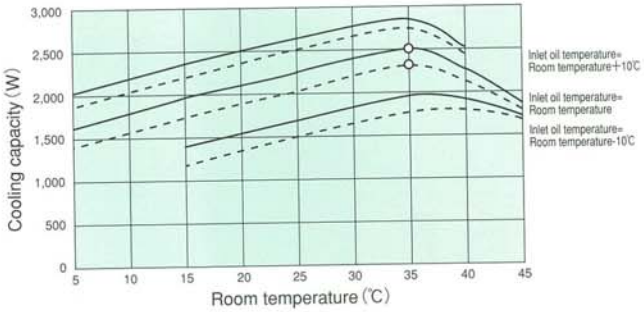
■Solid line ——: 60Hz ■Broken line - - - : 50Hz

1.Mark ○ is the standard point. (Room temperature:35℃/Inlet oil temperature:35℃/Oil used:ISO VG32)
2.Cooling capacity varies depending on conditions such as room temperature, inlet oil temperature, and kinematic viscosity of oil

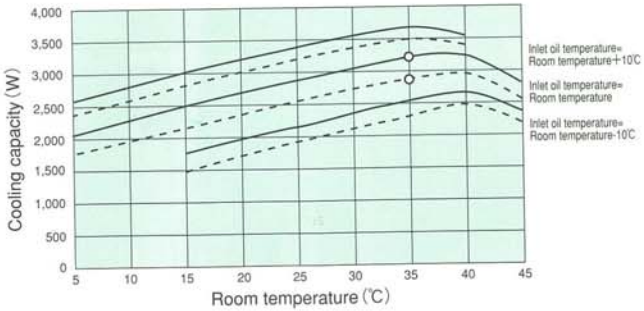
AKZ(S)147



AKZ(S)257



AKZ(S)327



AKZ(S)7 SERIES

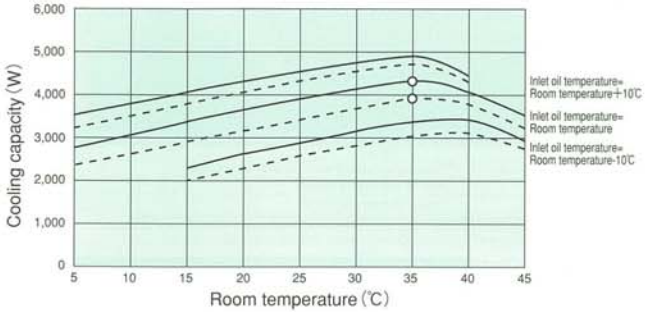
Performance curve

Unit conversion: 1kW = 860kcal/h

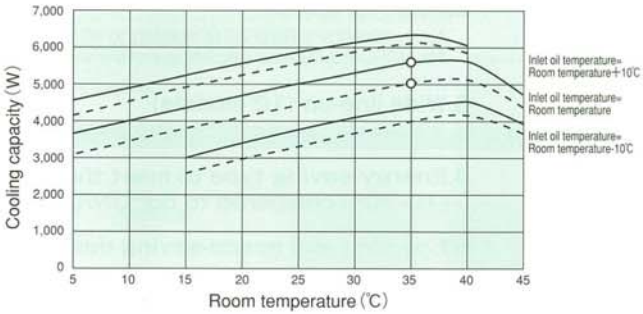
■Solid line ——: 60Hz ■Broken line - - - : 50Hz

1.Mark ○ is the standard point. (Room temperature:35℃/Inlet oil temperature:35℃/Oil used:ISO VG32)
2.Cooling capacity varies depending on conditions such as room temperature, inlet oil temperature, and kinematic viscosity of oil

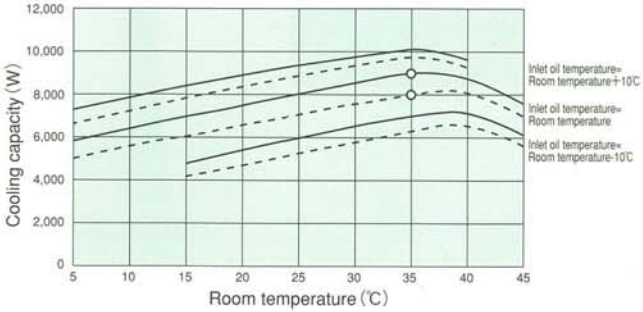
AKZ(S)437



AKZ(S)567



AKZ(S)907



OILCOOLING UNIT OILCON

AKZJ7 SERIES

Features

Highly accurate inverter oil cooling unit (AKZJ "7"series)

1.Conventional AKJ type improved with inverter functions

2.New refrigerant
New refrigerant **R407C** is applied to all the models. It is promising alternative for HCFC-22. (Ozone depleting potentials "0")

3.Wide line-up (12 models)
In addition to the conventioanl 1/2, 1, 2, 3HP; four models of 1.2, 1.5HP are available.

4.Energy-saving type to meet the market needs (10-20% compared to our ON/OFF model)

5.Compact and space-saving design as First in its class

6.Main unit equipped with communicating function (Option)
Use communication extension board to execute parallel and serial communications.

7.Conforming to CE (Option)
All the models conform to CE standard as semi-standard.

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AKZJ7 SERIES

Specifications

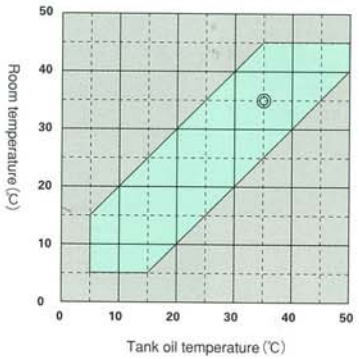
Horse power equivalent to OILCON (HP)		0.5		1		1.2		1.5		2		3	
Model		AKZJ 187	AKZJ 187-H	AKZJ 287	AKZJ 287-H	AKZJ 357	AKZJ 357-H	AKZJ 457	AKZJ 457-H	AKZJ 567	AKZJ 567-H	AKZJ 907	AKZJ 907-H
Cooling capacity (50/60Hz) (Note 1)	kW	1.4/1.8		2.5/2.8		3.2/3.5		3.8/4.5		5.0/5.6		8.0/9.0	
Heater heating capacity	kW	—	1	—	1	—	1	—	2	—	2	—	4
Power source	Main circuit (50/60Hz)	3~ 200/200•220V 50/60Hz											
	Control circuit (50/60Hz)	DC24/12V											
	Capacity kVA	1.2/1.3		2.0/2.1		2.5/2.6		2.6/2.7		3.8/4.0		6.0/6.1	
Painted color		White gray (Munsell N.7.5)											
Dimensions (H×W×D)	mm	610(960)×360×390		760(1,110)×360×390		910(1,260)×360×390		910(1,260)×470×500		950(1,370)×470×500		950(1,370)×560×620	
Compressor (Hermetic DC swing type)		0.4kW.2P		0.6kW.2P		0.75kW.2P		1.1kW.2P		1.5kW.2P		2.2kW.2P	
Cooler		Open coil type											
Condenser		Cross fin coil type											
Fan		Propeller fan											
Fan motor		40/40W.4P		56/66W.4P				90W.4P				150W.4P	
Agitator motor		100W.4P											
Temperature adjustment	Synchronized type	Room temperature (Machine Surface temperature (Note 2)) −9.9~+9.9℃											
	Fixed type	Tank oil temperature 5~50℃											
Refrigerant control		Electronic expansion valve											
Protection devices		Agitator inner thermostat, Fan motor inner thermostat, Over current protector (Compressor), Compressor protective thermostat, Reverse phase protector, Restart preventive timer, Low room temperature protective thermostat, High oil temperature protective thermostat, Low oil temperature protective thermostat, Overheat preventive thermostat (Model equipped with heater only)											
Refrigerant		R407C											
Operating range	Room temperature ℃	5~45											
	Tank oil temperature ℃	5~50											
	Oil viscosity mm²/s	0.5~200											
Oil applicable		Cutting oil, Grinding oil, Water-soluble cutting/grinding oil, Lubricating oil, Hydraulic working oil											
Weight	kg	35	47	43	45	45	47	80	85	85	90	110	120
Transportation vibration		Vertical4.7m/s²×2.5Hr(10-100Hz sweep, 5min/cycle)											
Rated current of wiring circuit breaker (Local supply)	A	10								15		20	
Tank (Local supply)		Depth 400mm or more								Depth 470mm or more			
Release schedule		October 2001		February 2002		October 2001		December 2001		December 2001		January 2002	

Note 1. Cooling capacity at standard point (Room temperature 35℃, Inlet oil temperature 35℃) with ISO VG32.
(Select an appropriate one according to cooling capacity and selecting method by models)
Note 2. Optional body temperature sensor (AKS5-OP21 or AKS5-OP22) is required.
Note 3. Wiring circuit breaker is not a standard accessory. Appropriate wiring circuit breaker for each model should be supplied in the field and mounted onto the machine.
Note 4. For special specifications, contact us.

In-line type: AKZG is separately supported.

Operating range

Note 1. The mark ◎ means the standard point.
Note 2. Operate in the range of the above ▭.
(If failed, failures may be caused.)



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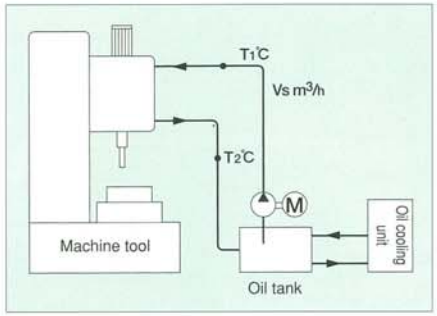
Unit conversion formula ● 1kW=860kcal/h

1.Select the model of 20-30% larger cooling capacity than the calorific value of the machine tool.
2.The cooling capacity of the oil cooling unit varies depending on the fluid temperature (inlet) and the room temperature. It is necessary to know the fluid and room temperatures before selecting the appropriate model.
3.The following three methods are the guideline of the calorific value calculation. Finally, however, it is recommended to conduct tests to determine the calorific value.

●Calorific value calculation of machine tools for the unit selection (Guideline)

(1) Cooling of machining center main shaft head

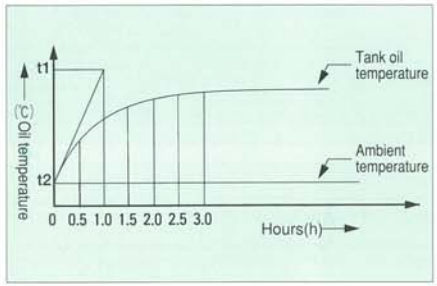
●Method 1: Calorific value is estimated from temperature difference between supply oil and return oil.



$$Q=Cp\cdot\gamma\cdot Vs\cdot\triangle T$$

Q : Calorific value(kW)
Cp : Specific heat under constant pressure(J/kg℃)…1967.4J/kg℃
γ : Specific gravity(kg/㎥)…876kg/㎥
Vs : Oil flow rate(㎥/h)
△T : Temperature difference(℃)…T_2-T_1
Example: At △T=5℃, Vs=1.8㎥/h (30ℓ/min)
Q=1967.4×876×18.5/3600/1000
=4.3kW

●Method 2: Calorific value is estimated from tank oil temperature increase.



Determine the maximum inclination in the oil temperature rise.
(To determine the maximum inclination, measure △t every minute for the first ten minutes.)

$$Q=Cp\cdot\gamma\cdot V\cdot\triangle t/H$$

Q : Calorific value(kW)
Cp : Specific heat under constant pressure(J/kg℃)…1967.4J/kg℃
γ : Specific gravity(kg/㎥)…876kg/㎥
V : Oil flow rate(㎥/h)
△t : Temperature difference(℃)…t_1-t_2
H : Hours
Example: At △t=10℃, Total oil=300ℓ (0.3㎥)
Q=1967.4×876×0.3×10/3600/1000
=1.4kW

●Method 3: Motor output loss is regarded as heating

$$Q=H\cdot\frac{\eta}{100}$$

Q : Calorific value(kW)
H : Motor output… For driving spindle
n : Motor output loss (%)
Example: 7.5kW motor output loss is 30%. ➡Generally around 30% (Cooling main shaft head)
Q=7.5×0.3=2.3kW

(2) Cooling of cutting oil and grinding oil

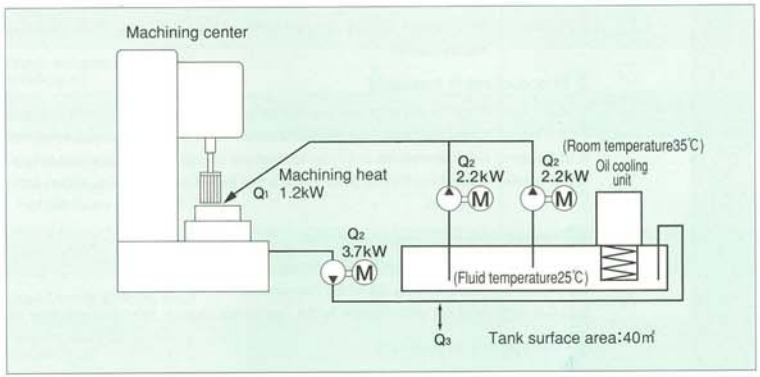
1.Calorific value of the cutting oil/grinding oil system is roughly calculated from the following expression as the tank capacity and the pump flow rate are generally high. Next, the calorific value is determined by testing actually to select an appropriate oil cooling unit.
2.Calculation (Rough)

$$Q=Q_1+Q_2+Q_3$$

Q : Heat load of the entire machining system
Q_1 : Machining heat
Q_2 : Calorific value of coolant pump motor (Heat moved to coolant)
Q_2=Pump motor output(kW)×$\frac{\eta}{100}$
Q_3 : Heat balance between coolant and room temperature through coolant tank
$Q_3=K\cdot A\cdot\triangle T$ K : Overall heat transfer coeffieient (W/㎡·℃), generally K=11.6-23.2
A : Surface area of tank contacting with fluid (㎡)
△T : Room temperature - Tank internal fluid temperature controlled (℃)

3.Determine calorific value according to Method 1 and Method 2 on Page 17 to test.

●Estimated calorific value



Example: In the above figure,
Q_1=1.2kW
Q_2= (2.2+2.2+3.7)×$\frac{\eta}{100}$ ≒4.1kW(η =50% generally for coolant pump)
Q_3=20×4×(35−25)/1000=0.9kW

∴Q=$Q_1+Q_2+Q_3$
=1.2+4.1+0.9
=6.2kW

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Safety precautions

※Before handling and operating this unit, you should first thoroughly read the instruction manual to understand.

① General precautions

1. [⚠Warning] Observe these precautions and the following laws and regulations relating to safety to operate the unit safely.
   ① Industrial Safety and Health Act
   ② Fire Services Act
   ③ JIS B 8361 Haydraulic System Rule
2. [⚠Caution] Wear appropriate protectors in handling, as needed, to prevent from being injured.
3. [⚠Caution] Take every possible care in working to prevent hands from being caught and to prevent a crick in the back due to heavy weight and hard working posture.
4. [⚠Caution] Completely wipe off the liquid from the unit and the floor, if spilled.
5. [⚠Caution] Carrying, installing, piping, and wiring should be carried out only by qualified persons or specialists.

② Precautions in carrying

1. [⚠Caution] Do not incline the unit at 30℃ or more in carrying (including storing). If inclined at 30℃ or more, compressor failures may be caused.
2. [⚠Caution] Use all the included eyeplates or eyebolts to lift the unit.
   If failed (If only one eyeplate is used to lift), the unit may drop.
3. [⚠Caution] Do not get on, hit, drop, nor apply external force to the unit. Malfunction, breakage, or other problems may be caused.

③ Precautions in installing

1. [⚠Caution] Place the unit on a level and rigid place without vibration. Securely fix the unit with bolts.
2. [⚠Warning] Do not pour water and liquid onto the unit directly. Electric shocks or failures may be caused.
3. [⚠Danger] Never operate the unit in the atmosphere with dangers of explosions or fires.
4. [⚠Caution] Install the unit in the place where is free from dust, dirt, powder, steam, and oil mist (especially metal-corrosive).

④ Precautions in piping and wiring

1. [⚠Caution] Install the oil pan drain in the field.
2. [⚠Warning] Before working, cut off the main power.
3. [⚠Caution] nstall the wiring breaker for the main power capacity (refer to specification field for each model).

⑤ Precautions in test run

1. [⚠Caution] Before operating, make sure that oil piping and electric wiring are correctly carried out and that no connections are loose.

⑥ Precautions in operating

1. [⚠Danger] Never remove the cover (outside plate) during operating. Injuries may be caused due to electric shocks or sliding parts including fan.
2. [⚠Warning] When any abnormality is detected, immediately stop operating and take necessary actions.
3. [⚠Caution] Operate the unit only under the conditions defined in the catalog, drawings, specifications, and others.
4. [⚠Caution] Exhaust air temperature rises during operating. Do not touch the exhaust opening. Do not place anything near the exhaust opening.

⑦ Precautions in maintenance and inspection

1. [⚠Caution] Do not disassemble/assemble the unit without permission. The specified performance cannot be exerted, and failures and accidents may be caused. If needed to disassemble/assemble, consult the manufacturer.
2. [⚠Danger] Avoid working under the closed condition. The refrigerant may cause suffocation.
3. [⚠Warning] Before disassembling/assembling, cut off the main power and make sure each motor stops.
4. [⚠Danger] If any flame working is needed, take necessary actions in due consideration of atmospheric conditions and coolant types before working.
5. [⚠Caution] Never change or modify the unit for yourself.

Important precautions on the machine tool side

1. For bad transportation conditions including overseas transportation, refer to separate packing specifications.
2. When it is required to check that oil is supplied from this oil cooling unit to the machine tool, the machine tool should be equipped with a flow switch. (This unit is not equipped with a built-in flow switch for checking for oil supply.)
3. When the machine tool requires a protector against the temperature error (high or low) of the oil supplied from the oil cooling unit, the machine tool should be equipped with a temperature switch or other protectors.
   (This unit is not equipped with a built-in temperature switch for protecting the machine tool.)

Precautions regarding oil/fluid applicable and cooling capacity

1.Oil/fluid applicable to the oil cooling unit (○: Applicable,×: Inapplicable)
※ Oil/fluid inapplicable marked with (in the list below must be absolutely avoided.

	AKZ(S)7 series	AKZJ7 series
Lubricating oil, Hydraulic actuating oil	○	○
Water-soluble cutting oil/ grinding oil	×	○
Water	×	× Consult us. Note 7.
Fuel (Kerosene oil, Gasoline) [Class 4 Dangerous articles, First petroleum, Second petroleum]	×	×
Chemicals	×	×
Liquid foods (Drinks, etc.)	×	×
Noncombustible hydraulic actuating oil ● Phosphate ● Hydrogen chloride/carbide ● Water-glycol	×	×

Notes:1.Fluid which may corrode cooling coil (SUS304) cannot be applied to AKZJ7 series.

2. Do not supply oil higher than 55℃ to the unit. Start the oil cooling unit simultaneously with the main machine or before the oil temperature rises to 40℃.
3. The clogged air filter may deteriorate the cooling capacity. To prevent the air filter from being clogged, periodic cleaning (hot water, air blow) should be carried out every half month.
4. Do not place anything which obstructs ventilation in the area within 500mm from suction port and exhaust port.
5. For bad transportation conditions including overseas transportation, refer to separate packing specifications.
6. Cutting dust and chips accumulated on the cooling coil or the evaporator of AKZJ7 series may deteriorate the cooling capacity which may result in failures. Attach efficient return filter to the return side of the tank (oil inlet).
7. When the unit is applied to water, the material of the unit legs should be changed to stainless steel to prevent against rust. (Special order)

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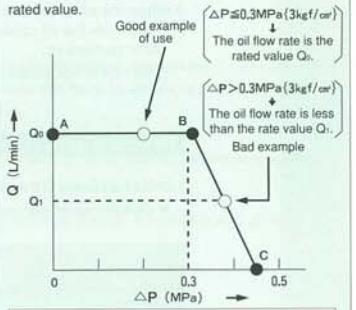
Precautions in external-piping

Over external pressure loss (local piping resistance) may cause abnormal pump noise (relief noise, cavitation noise), deterioration of cooling capacity, oil temperature control failure, and problems. The external pressure loss must be within the normal operation range.

1. Suction piping
   Suction vacuum pressure should be within the range of-29.7 to 0kPa (-230 to 0mmHg). Suction filter of 100-150mesh is recommended.
2. Discharge piping
   Discharge piping pressure loss should be 0.3 MPa {3.0kgf/㎠} and less.
3. Do not install stop valve onto either suction or discharge piping. If needed, use relief valve of 0.3Mpa{3.0kgf/㎠} together with the stop valve without fail.
4. Calculation of piping resistance
   After calculating the oil piping resistance with the following equation to determine the oil piping size.
   Piping resistance
   (for general hydraulic oil, lubricating oil)
   △P: Piping resistance(MPa)
   ν: Coefficient of kinematic viscosity (㎟/s), Refer to viscosity/temperature graph.
   Q: Flow rate (ℓ /s)
   ℓ : Pipe length (m)
   D: Pipe inside diameter (mm)

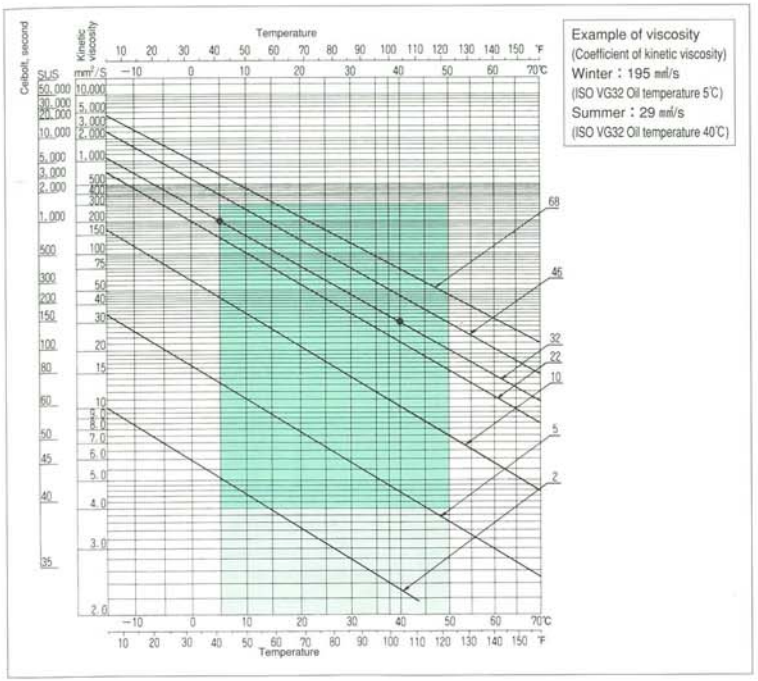
●Relation between oil cooling unit oil flow rate and external pressure loss

AKZ and AKS type pump built-in circulating oil cooling unit has the following characteristics. When the external pressure loss (△P) is 0.3MPa{3kgf/㎠} and less, the oil flow rate is the rated value (Q0). When the external pressure loss (△P) is over 0.3MPa{3kgf/㎠}, the oil flow rate is less than the rated value.



Q (L/min) : Oil flow rate (Q_0: Rated flow rate)
(P (MPa) : External pressure loss
Point A : External pressure loss is 0.
Point B : External pressure loss is 0.3MPa. (Relief valve cracking pressure)
Point C : External pressure loss is high and oil flow rate is 0.

■ Viscosity/Temperature graph.



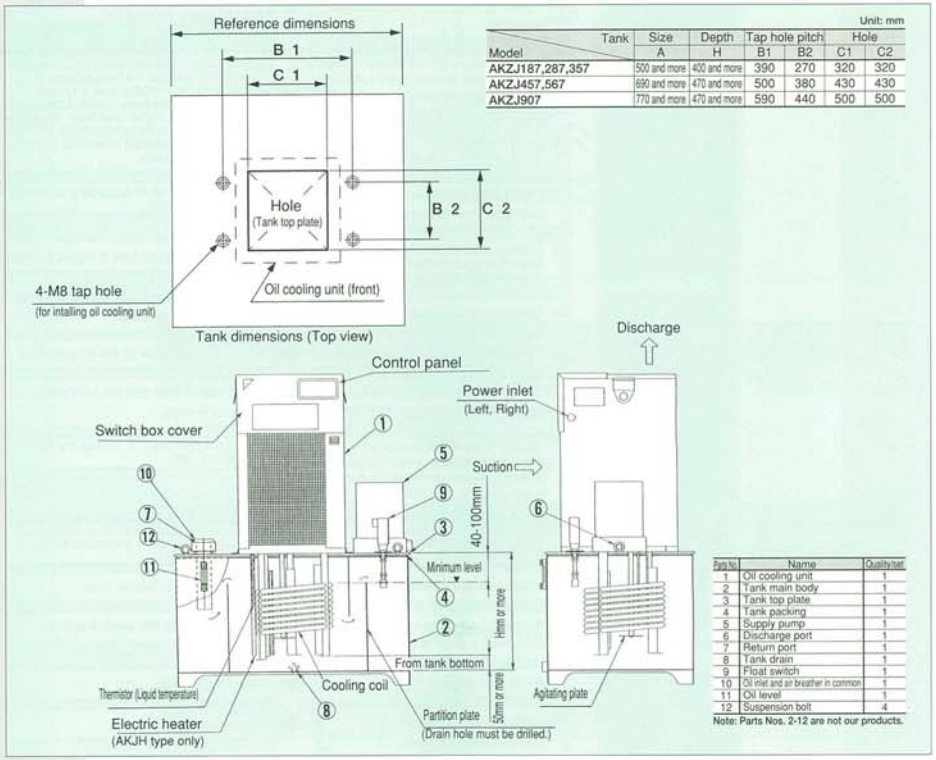
Example of viscosity
(Coefficient of kinetic viscosity)
Winter : 195 ㎟/s
(ISO VG32 Oil temperature 5℃)
Summer : 29 ㎟/s
(ISO VG32 Oil temperature 40℃)

Basic example to install to tank

Basic example to install to tank • AKZJ7 SERIES

●Points in manufacturing tank

1. Divide the oil tank at least into three and adopt the overflow system. Prevent cut powder, cut dust, and other foreign matters from directly entering the suction line.
2. Correctly position the partition plate and piping so that the high temperature return oil from the machine and the low temperature oil cooled by the oil cooling unit may be mixed uniformly.
3. The tank should have the structure easy to be cleaned (for example, tank top plate' s removable).
4. Tank material: SUS is recommended. Select appropriate material in consideration of suitability to the oil/fluid. (There are some examples of using SS material for cutting oil tanks with coated (epoxy resin) internally.)



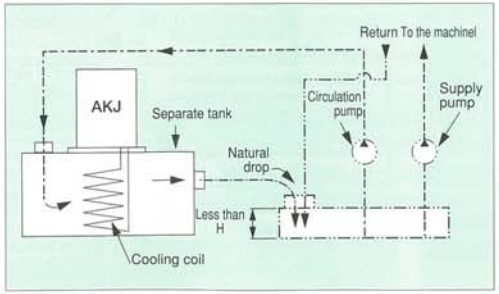
Unit: mm

Model \ Tank	Size A	Depth H	Tap hole pitch B1	Tap hole pitch B2	Hole C1	Hole C2
AKZJ187,287,357	500 and more	400 and more	390	270	320	320
AKZJ457,567	690 and more	470 and more	500	380	430	430
AKZJ907	770 and more	470 and more	590	440	500	500

Parts No.	Name	Quantity/set
1	Oil cooling unit	1
2	Tank main body	1
3	Tank top plate	1
4	Tank packing	1
5	Supply pump	1
6	Discharge port	1
7	Return port	1
8	Tank drain	1
9	Float switch	1
10	Oil inlet and air breather in common	1
11	Oil level	1
12	Suspension bolt	4

Note: Parts Nos. 2-12 are not our products.

●**Separate type:** Tank depth is less than H in the above table.



Notes:
1. To prevent foreign matters including cutting dust and chips from entering, efficient filter should be installed onto the supply and return lines.
2. Cutting dust and chips accumulated on the cooling coil may deteriorate the cooling capacity which may result in failures.

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Trouble shooting

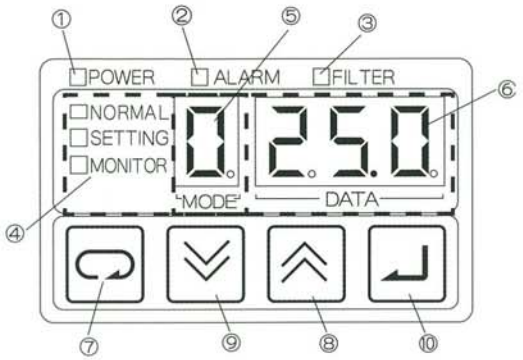
- Before operating the oil cooling unit, thoroughly read the instruction manual.
- Correctly solve the problems according to the table "countermeasures" below

Problem	Cause	Countermeasures
Not start operating. (No alarm)	1. Power is not supplied.	Check if the power is ON.
	2. Power lamp is not lit.	Check if the power lamp and the fuse are burnt out. Check if the operation circuit is short circuited or broken. If necessary, repair them.
	3. The oil cooling unit is not ready for start ON.	Refer to the instruction manual to mak e the unit ready for start ON.
No cooling.	1. The selected model is not suitable for the heat load of the entire system.	Completely calculate the heat balance of machining heat + internal heat + system heat + room temperature. Select appropriate model of 20-30% higher heat load. When the unit is operated under the conditions different from the initially selected conditions, recheck the heating conditions.
	2. High piping pressure loss, Low oil flow rate, Low cooling capacity.	Conduct piping work according to the instruction manual.
	3. Cutting dust accumulated on tank, Low cooling capacity due to cooling coil contaminated/buried.	Clean the coil and the tank at regular intervals.
	4. Cooling coil exposed.	Check the tank oil level.
	5. Oil temperature control is incorrectly set.	Check the set value of the temperature.
	6. Condenser capacity is lowered.	Clean the air filter and the condenser at regular intervals.
	7. Capacity is lowered due to short refrigerant gas. (Simple method to assure: temperature difference between suction and discharge pumping is 10 to 15℃ (normal).	Check for gas leak. If necessary, fill the refrigerant gas.
Abnormal noise.	1. High pressure loss on the oil discharge side, Noise at relief valve.	Conduct piping work according to the instruction manual.
	2. Airation on the oil suction side.	Make sure not to breath in air.
	3. Incorrect service space (500mm) at suction and exhaust ports.	Correctly secure the service space.
	4. Air filter is clogged.	Clean the air filter.
	5. Compressor cushion for transportation remains.	Remove the cushion.
Oil undischarged. Only a little oil discharged.	1. Low viscosity oil is used.	Select a pump for low viscosity oil.
	2. Air mixed on the oil cooling unit suction side.	Purge air. Check oil quantity and oil level.
	3. External piping pressure loss is high and the relief valve is open.	Conduct piping work according to the instruction manual.
Water drained.	1. Water may be drained depending on operation conditions.	Drain piping should be installed.
Alarm is output.	1. Protectors function.	Refer to the section of Fault Finding in each instruction manual.

Supplementary

Description, function, operation of each item on control panel

●General description of control panel



No.	Items	Details
①	Power lamp	The lamp is lit continually during the power is ON.
②	Alarm lamp	When error is detected Level 1 Alarm is flashing and Level 2 Alarm is lit.
③	Filter cleaning sign lamp	When the compressor total operation time reaches the set value, the lamp is lit. The lit lamp can be cancelled by pressing the [ENT] key in normal mode.
④	Operation mode lamp Start mode	Control panel mode is indicated. NORMAL : Normal mode SETTING : Operation setting mode MONITOR : Monitor mode
⑤	Select No. display	Current operation mode (Normal mode, Operation Setting mode) is displayed or Data No. on the data display is displayed.
⑥	Data display	Various data is displayed. Data displayed varies depending on operation mode and data number.
⑦	Select [SEL] key	Selects operation mode.
⑧	[UP] key	Goes up Operation Mode/Data No./Data Value by +1. Keep pressing to start key repeat.
⑨	[DOWN] key	Goes down Operation Mode/Data No./Data Value by -1. Keep pressing to start key repeat.
⑩	Enter [ENT] key	Enters the changed Operation Mode/Data No./Data Value. When the filter cleaning sign lamp is lit, press [ENT] key in normal mode to cancel the sign lamp.

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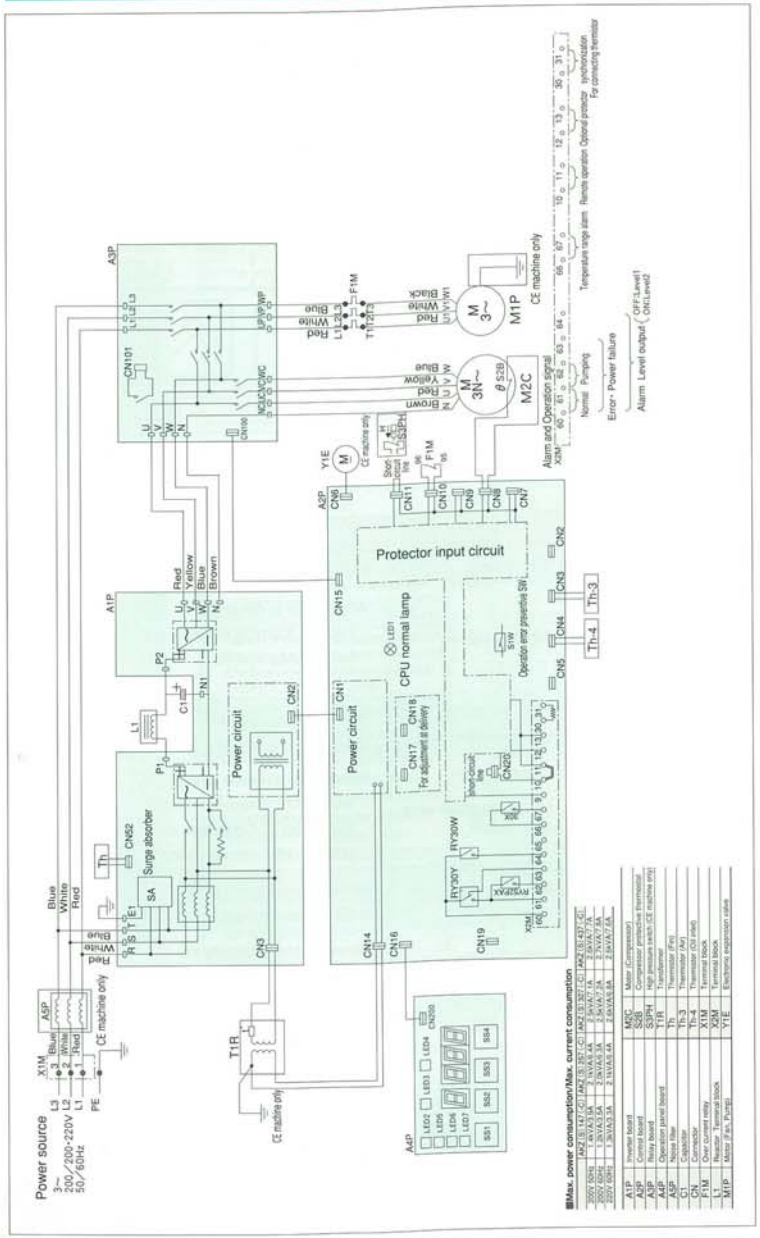
Electric Diagram 〈AKZ(S) series〉



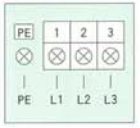
Wiring and connecting 〈AKZ(S) series〉

●Power capacity

■Max. power consumption/Max. current consumption

Model	AKZ(S)147(-C)	AKZ(S)257(-C)	AKZ(S)327(-C)	AKZ(S)437(-C)	AKZ(S)567(-C)	AKZ(S)907(-C)
200V 50Hz	1.4kVA/3.9A	2.1kVA/6.4A	2.5kVA/7.1A	2.6kVA/7.7A	3.8kVA/10.5A	6.0kVA/17.2A
200V 60Hz	1.2kVA/3.5A	2.0kVA/6.3A	2.5kVA/7.2A	2.7kVA/7.8A	3.5kVA/11.0A	6.1kVA/17.6A
220V 60Hz	1.3kVA/3.3A	2.1kVA/6.4A	2.6kVA/6.8A	2.6kVA/7.6A	4.0kVA/9.7A	6.1kVA/16.2A
Wiring breaker capacity	10A	10A	10A	10A	15A	20A

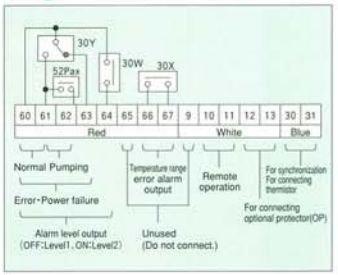
●Power terminal block (X1M)



1.Screw terminal and wire diameter

	Screw terminal	Wire diameter JIS wire	IEC wire	UL wire
Other than AKZ(S)907(-C)	M4	2.0mm² and more	2.5mm² and more	AWG#14 and more
AKZ(S)907(-C)	M5	3.5mm² and more	4.0mm² and more	AWG#12 and more

●Signal terminal block (X2M)

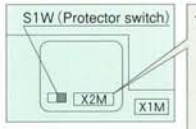


⚠ Danger:

1. The main power supply must be equipped with wiring circuit breaker (local supply) of specified capacity.
2. Connect the ground without fail. The unit is equipped with noise filter. If the unit is not grounded, electric shock may be caused.
3. Before opening the electric component box, power off and leave it as it is for 5 minutes. After the internal high voltage is discharged completely, open the box.
4. Do not energize the unit with the electric component box opened.

⚠ Caution:

1. To avoid the effect of noise, cut the wire to appropriate length before connecting so that the excess wire may not contact the control board.
2. For remote control, remove the bridge between [10] and [11] and mount the start switch (local supply).
3. The unit is set to LOCK mode when it leaves the factory. Cancel the LOCK mode on the control panel. To see how to cancel the LOCK mode, refer to the operation nameplate and the instruction manual.
4. This unit is equipped with a protector switch (S1W) to reject the setting command from the operation panel. If needed, refer to the instruction manual to set.
5. Use cable tube to put the power cable and securely fix it to the cable anchor on the bottom of the control box with insulation lock.
6. CE model (-C) is classified as auxiliary machine to the main machine in the over voltage category. Observe the following in installing.
   ①The main control panel must be equipped with the main power breaker required by EN60204-1.
   ②Power must be supplied through the transformer with the basic insulation.



1.Screwless terminal block of plug type. The following wires are applicable.Screwless terminal block of plug type. The following wires are applicable.
Single wire : φ0.4～φ1.2 (AWG#26～#16)
Stranded wire : 0.3mm²～1.25mm² (AWG#22～16)

2. [60-64], [66-67]: Load applicable is as follows:
   Max. load applicable : DC30V 2A (Resistance load)
   Min. load applicable : DC10mV 10μAor more
3. [10]-[13]: Prepare contact to satisfy min. load applicable DC12V 5mA.
4. [30]-[31]: When connected thermistor length is over 10m or when wiring is made in an area where noise environment is poor, shielded wire should be used.

■Alarm/State signal output time chart

Signal output	Operation state		Remote control [10]-[11] ON: Normal	ON: Level 1 Error or Lock	ON: Level 2 Error	ON: Power failure (Power OFF)	OFF: Normal	OFF: Level 1 Error or Lock	OFF: Level 2 Error	OFF: Power failure (Power OFF)
Normal (Contact a)	60—61	ON								
		OFF								
Error, Lock (Power OFF) (Contact b)	60—63	ON								
		OFF								
Error level (Contact a)	60—64	ON								
		OFF								
Pumping (Contact a)	61—62	ON								
		OFF								

■Temperature range alarm output time chart

Signal output	Operation state		Temperature range check: Within set range: Normal operation	Within set range: Level 1 Error or Lock	Within set range: Level 2 Error	Within set range: Power failure (Power OFF)	Beyond set range: Normal operation	Beyond set range: Level 1 Error or Lock	Beyond set range: Level 2 Error	Beyond set range: Power failure (Power OFF)
Temperature range normal (Contact a)	66—67	ON								
		OFF								

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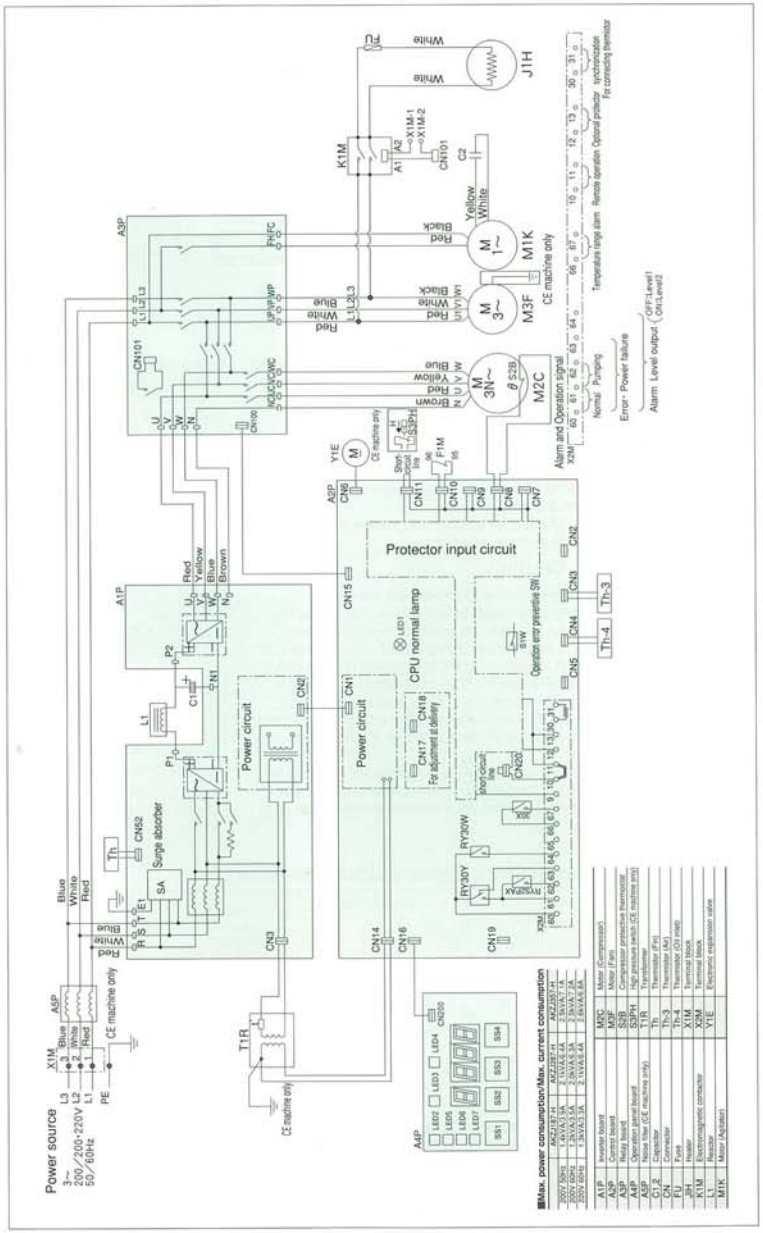
Electric Diagram 〈AKZJ(-H) series〉



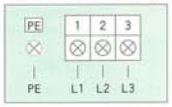
Wiring and connecting 〈AKZJ(-H) series〉

●Power capacity

■Max. power consumption/Max. current consumption

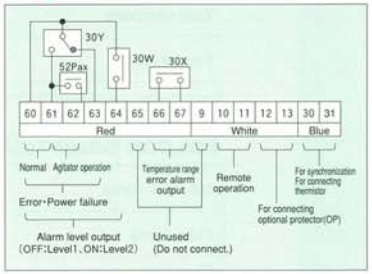
Model	AKZJ187(-H)	AKZJ287(-H)	AKZJ357(-H)
200V 50Hz	1.4kVA/3.9A	2.1kVA/6.4A	2.5kVA/7.1A
200V 60Hz	1.2kVA/3.5A	2.0kVA/6.3A	2.5kVA/7.2A
220V 60Hz	1.3kVA/3.3A	2.1kVA/6.4A	2.6kVA/6.8A
Wiring breaker capacity	10A	10A	10A

●Power terminal block (X1M)



1. Use round crimp style terminal to connect.
2. The terminal block has 3 poles. The ground is screwed onto the cabinet.

●Signal terminal block (X2M)

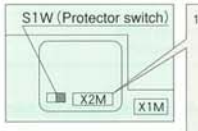


⚠ Danger:

1. The main power supply must be equipped with wiring circuit breaker (local supply) of specified capacity.
2. Connect the ground without fail. The unit is equipped with noise filter. If the unit is not grounded, electric shock may be caused.
3. Before opening the electric component box, power off and leave it as it is for 5 minutes. After the internal high voltage is discharged completely, open the box.
4. Do not energize the unit with the electric component box opened.

⚠ Caution:

1. To avoid the effect of noise, cut the wire to appropriate length before connecting so that the excess wire may not contact the control board.
2. For remote control, remove the bridge between [10] and [11] and mount the start switch (local supply).
3. The unit is set to LOCK mode when it leaves the factory. Cancel the LOCK mode on the control panel. To see how to cancel the LOCK mode, refer to the operation nameplate and the instruction manual.
4. This unit is equipped with a protector switch (S1W) to reject the setting command from the operation panel. If needed, refer to the instruction manual to set.
5. Use cable tube to put the power cable and securely fix it to the cable anchor on the bottom of the control box with insulation lock.
6. CE model (-C) is classified as auxiliary machine to the main machine in the over voltage category. Observe the following in installing.
   ①The main control panel must be equipped with the main power breaker required by EN60204-1.
   ②Power must be supplied through the transformer with the basic insulation.



1. Screwless terminal block of plug type. The following wires are applicable. Screwless terminal block of plug type. The following wires are applicable.
   Single wire : φ0.4～φ1.2 (AWG#26～#16)
   Stranded wire : 0.3mm²～1.25mm² (AWG#22～16)
2. [60-64], [66-67]: Load applicable is as follows:
   Max. load applicable : DC30V 2A (Resistance load)
   Min. load applicable : DC10mV 10μAor more
3. [10]-[13]: Prepare contact to satisfy min. load applicable DC12V 5mA.
4. [30]-[31]: When connected thermistor length is over 10m or when wiring is made in an area where noise environment is poor, shielded wire should be used.

■Alarm/State signal output time chart

Signal output			Operation state: Remote control [10]-[11] ON: Normal	ON: Level 1 Error or Lock	ON: Level 2 Error	ON: Power failure (Power OFF)	OFF: Normal	OFF: Level 1 Error or Lock	OFF: Level 2 Error	OFF: Power failure (Power OFF)
Normal (Contact a)	60—61	ON								
		OFF								
Error, Lock (Power OFF) (Contact b)	60—63	ON								
		OFF								
Error level (Contact a)	60—64	ON								
		OFF								
Pumping (Contact a)	61—62	ON								
		OFF								

■Temperature range alarm output time charth

Signal output			Operation state: Temperature range check; Within set range: Normal operation	Within set range: Level 1 Error or Lock	Within set range: Level 2 Error	Within set range: Power failure (Power OFF)	Beyond set range: Normal operation	Beyond set range: Level 1 Error or Lock	Beyond set range: Level 2 Error	Beyond set range: Power failure (Power OFF)
Temperature range normal (Contact a)	66—67	ON								
		OFF								

Supplementary

Inquiry Requirements

Your company	TEL
Your contact	FAX

For estimate, enter the OILCON Select Table and return it to us.

◆OILCON Select Table

Machine name	Fluid physical property value
Fluid name	15／4℃
Fluid type (Actuating oil, Cutting oil, Lubricating oil, etc.)	Viscosity { 100°F cSt
Fluid total volume (or Tank capacity) m^3	200°F cSt }

Pump type	Motor output	Discharge pressure	Discharge rate	Spindle rotating power
		Mpa	m/min	

※For cutting oil, grinding oil, and lubricating oil, spindle rotating power must be entered.

●Values to determine required cooling capacity

Desired fluid temperature ℃	Annual maximum room temperature n the machine installation area ℃

◆Measurement of temperature rise

Time (min)	Fluid temperature (in tank)	Room temperature	Precautions in measuring
0			①Start operating at the fluid temperature almost equal to the room temperature. Measure the average fluid temperature in the tank. The time means the time elapsed from starting. ②Operate under the highest heating condition. ③Continue measuring until the difference between the fluid temperature and the room temperature becomes constant. ④When it is difficult to continue measuring until the difference between the fluid temperature and the room temperature becomes constant due to too much heating (or very poor heat emission), measure up to the temperature as high as possible. ⑤When water tube is placed in the tank to cool due to too much heating (water-cooling type cooler is used), measure up to the temperature measurable without flowing water and then flow water to make the fluid temperature constant. At that time, measure the fluid temperature, water flow rate, and water inlet/outlet temperature.
10			
20			
30			
40			
50			
60			
120			
180			
240			
300			
360			
420			
480			

Water flow rate ℓ/min	Fluid temperature ℃
Inlet temperature ℃	Outlet temperature ℃

Contact Details
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