



# AKZ

## OIL COOLING UNIT (CIRCULATION TYPE)

### SERIES A

#### DESCRIPTION

The AKZ oil cooling unit series achieves high energy-saving performance thanks to its built-in DAIKIN original IPM motor. The IPM motor allows highly accurate temperature control. The power consumption can be checked on the control panel.

The AKZ oil cooling units are available with or without tank, to meet any Customer's needs.

These oil cooling units can control the temperature in three different ways:

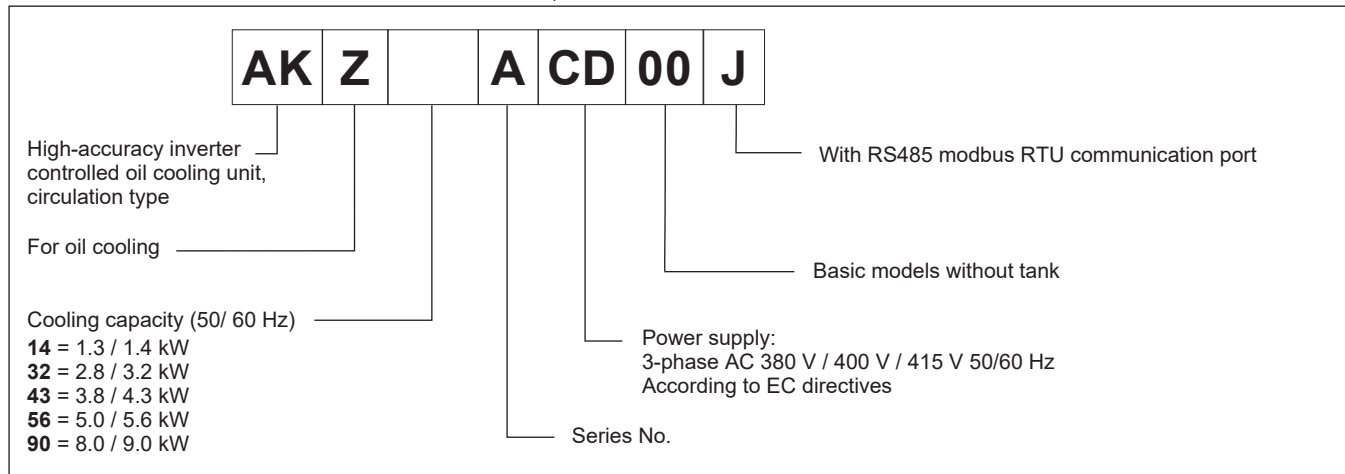
- by setting the fluid temperature according to the ambient temperature or to the main machine temperature
- by holding the fluid temperature constant
- by cooling the fluid at constant cooling capacity

An auto-tuning function that automatically sets the control gain according to the system installed (tank oil volume, piping, etc.) reduces adjustment time significantly at the trial run.

The AKZ oil cooling units are perfect in applications that demand a strict temperature control, such as machining centres, NC lathes, gearbox lubricants, grinding machines, electrical discharge machines, moulding machines, presses, etc.

#### MAIN CHARACTERISTICS

Cooling capacity 50/60 Hz	kW	1.3/1.4 ÷ 8.0/9.0 (see detailed specs. on page 2)
Accuracy of the temperature control	°C	±0.1 (load range from 0% to 100%)
Supply power voltage main circuit operating circuit		three-phase AC 380/400/415 V ±10% 50/60 Hz 12/24 V DC
Power consumption (400V 50/60Hz)	kW	1.02 ÷ 4.42 (see detailed specs. on page 2)
Current consumption (400V 50/60Hz)	A	2.2 ÷ 8.2 (see detailed specs. on page 2)
Applicable fluids		lubricating oils and hydraulic oils, mineral oil-based pollution level max ISO 4406:1999 class 21/19/16 corrosiveness to copper according to ISO 2160:1998 rating 1
Communication protocol		RS485 / Modbus RTU protocol
Ambient operating temperature	°C	+5 to +45
Fluid inlet temperature	°C	+5 to +50
Refrigerant gas		R410A contained in a full hermetical circuit
Relative humidity range	%RH	20 ÷ 85
Protection class Electric component housing		IP2X IP54 with proper cable glands and connectors

**1 - IDENTIFICATION CODE - BASIC MODELS, WITHOUT TANK**

**2 - SPECIFICATIONS - BASIC MODELS, WITHOUT TANK**

		<b>AKZ14</b>	<b>AKZ32</b>	<b>AKZ43</b>	<b>AKZ56</b>	<b>AKZ90</b>
Cooling capacity 50/60 Hz ( <b>NOTE 1</b> )	kW	1.3 / 1.4	2.8 / 3.2	3.8 / 4.3	5.0 / 5.6	8.0 / 9.0
Supply power		three-phase AC 380/400/415 V ±10% 50/60 Hz				
Supply voltage main circuit control circuit		three-phase AC 380/400/415 V ±10% 50/60 Hz 12/24 V DC				
Max power consumption (400V 50/60 Hz)	kW	1.02	1.6	1.99	2.54	4.42
Max current consumption (400V 50/60 Hz)	A	2.2	3.0	3.5	4.6	8.2
Compressor (hermetic DC swing type)	kW	0.4 max	0.75 max	1.1 max	1.5 max	2.2 max
Evaporator		brazed plate type				
Condenser		cross-fin coil type				
Motor of the propeller fan		Ø240, 54 W	Ø300, 54 W		Ø400, 100 W	Ø455, 100 W
Pump: motor discharge volume bypass opening pressure	l/min bar	0.4 kW x 4P 14.4 5	0.4 kW x 4P 28.8 6		0.7 kW x 4P 36 6	
Refrigerant control		compressor rotation speed control by inverter + electronic expansion valve opening				
Refrigerant gas R410A ( <b>NOTE 2</b> ) filling q.ty CO <sub>2</sub> equivalents	kg t	0.54 1.13	0.81 1.70	0.83 1.74	1.02 2.14	1.37 2.87
Noise level (front 1 m, height 1.55 m) ( <b>NOTE 3</b> )	dB(A)	62			65	67
Applicable fluids		lubricating oils and hydraulic oils, mineral oil-based pollution level max ISO 4406:1999 class 21/19/16 corrosiveness to copper according to ISO 2160:1998 rating 1				
Exterior colour		Ivory white				
Mass	kg	57	63	67	86	104
Permissible transport vibration		up and down vibration 14.7 m/s <sup>2</sup> × 2.5 hr. (7.5 to 100 Hz sweep/five min.)				
Altitude		2000 mt or less ( <b>NOTE 4</b> )				
ELCB (mandatory, in the customer's charge)	A	10			15	20

**NOTE 1:** Cooling capacity is the value at standard point (oil temperature: 35 °C, ambient temperature: 35 °C, fluid used: ISO VG32, 1 atm), 400V 50 Hz. The product tolerance is approx. ±5%.

**NOTE 2:** The R410A refrigerant is contained in a full hermetical circuit. The SDS (Safety Data Sheet) for R410A refrigerant is provided. GWP: 2090. 'Global Warming Potential' (GWP) means the measure of how much 1 kg of the refrigerant applied in the vapour compression cycle is estimated to contribute to global warming, expressed in kg CO<sub>2</sub> equivalents over a 100-year time horizon.

**NOTE 3:** The fan motor speed changes with room temperature to save energy. Therefore, it's normal for the noise level to vary.

**NOTE 4:** If installed over 1000 mt altitude, consider a 20-30% reduction in cooling capacity. Life expectancy of electrical components may be shorten.

### 3 - TEMPERATURE CONTROL MODES

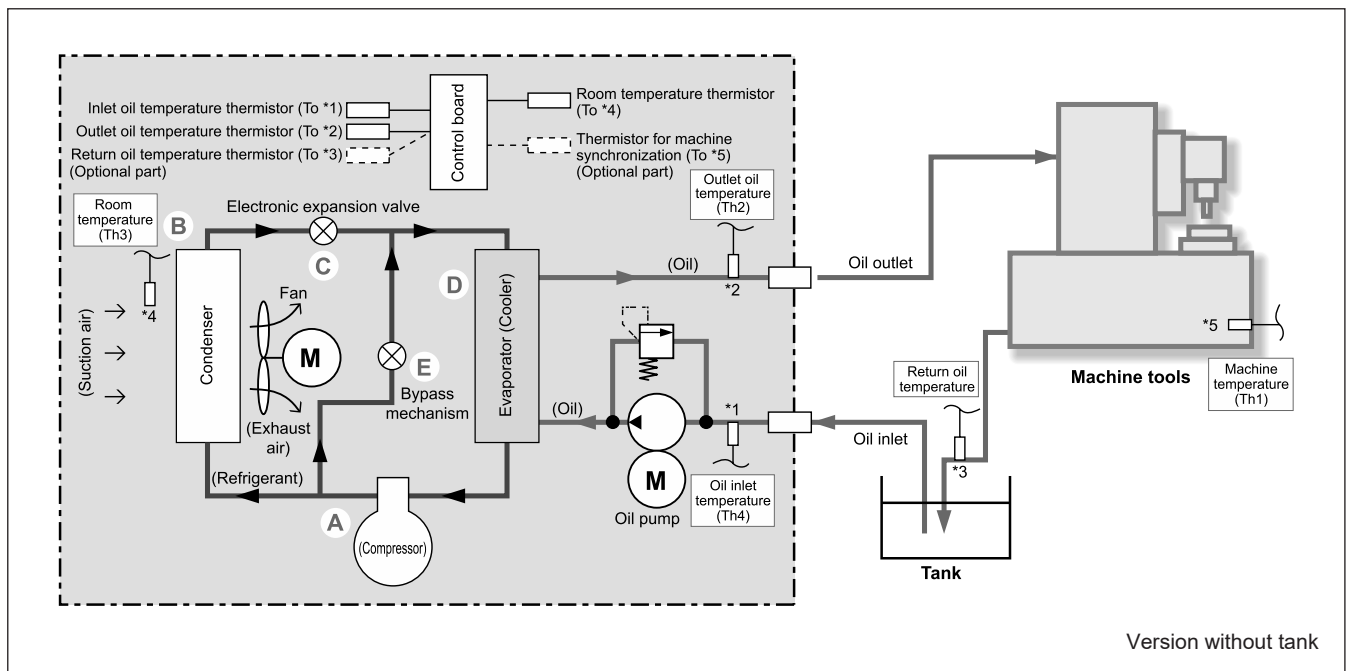
The AKZ oil cooling units can control the temperature of the fluid in three different ways, thanks to the thermistors located along the fluid circuit.

- **Set the oil temperature according to the ambient temperature** (standard mode).  
Control is done by keeping a constant temperature difference between inlet oil temperature and the ambient (room) temperature. By installing optional thermistors on the machine or on the outlet, other types of tuning are possible.  
The setting range is  $\pm 9.9$  °C against the reference temperature.
- **Hold the oil temperature constant**  
Control is done by keeping a control target at a constant temperature.  
The setting range is  $5 \div 45$  °C
- **Cool the oil at constant capacity**  
The temperature control is disabled. The cooling is according to the cooling capacity, set by command. Useful in trial run, etc..  
The setting range is  $0 \div 100\%$ .

Some operating modes require an additional thermistor, to be installed directly on the machine or along the fluid circuit. This kind of thermistor must be ordered separately and their installation is in the customer's charge. See point 17.

The operating mode is selectable from the control panel. Detailed instructions can be found in the instruction manual delivered with the oil cooling unit.

### 4 - SYSTEM OUTLINE



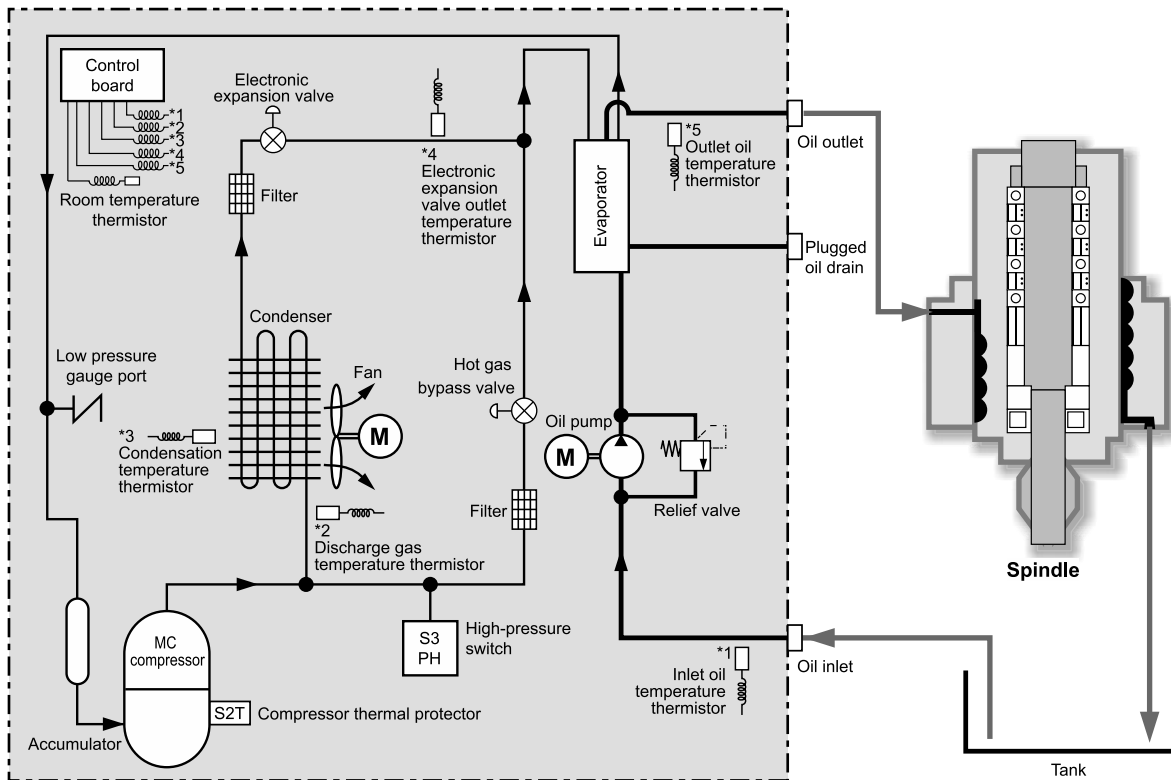
#### 4.1 - The refrigerating cycle

- The compressor produces compressed gas at high temperature and high pressure so that the refrigerant gas can be easily cooled and liquefied in the condenser.
- The condenser cools and condenses the high temperature/high pressure gas produced in the compressor, transforming it into a high temperature/high pressure liquid.
- The electronic expansion valve reduces the liquid/gas mixture pressure so that it can evaporate easily in the evaporator.
- The evaporator evaporates low pressure liquid/gas mixture by absorbing heat from the oil-based fluid (cooling the oil-based fluid) and transforms it into a low temperature/low pressure gas again.
- For very low load, the hot gas bypass valve automatically regulates the cooling capacity adding high temperature, high pressure gas to the mixture in order to achieve the correct proportion of gas/mixture at evaporator inlet.

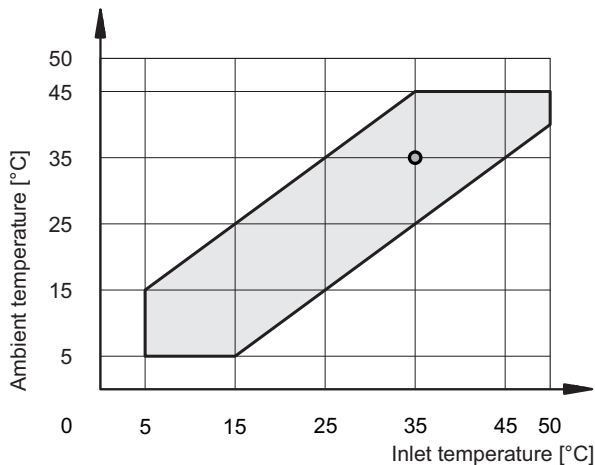
#### 4.2 - Fluid circuit

The fluid to be cooled comes from the machine into the external tank (the tank is in the Customer charge). The oil pump pumps the oil directly into the evaporator. The cooled fluid is delivered to the machining center .

## 5 - PIPING SYSTEM DIAGRAM



## 6 - OPERATING TEMPERATURE RANGE



- Admissible operating temperature range. Operation outside of this range may cause unit failure.
- Standard point (oil temperature at inlet and ambient temperature both 35 °C)

### 6.1 - Applicable fluids

This equipment is intended for:

- Lubricants and hydraulic oils (mineral oils) with an autoignition temperature over 100°C, flash point of 70°C or higher but below 250°C, and a discolouration rating of No.1 according to the "Petroleum Products - Corrosiveness to Copper - Copper Strip Test (ISO 2160)" as well as a pollution degree of ISO 4406:1998 class 21/19/16 (NAS Class 10).

This equipment is not intended for use with:

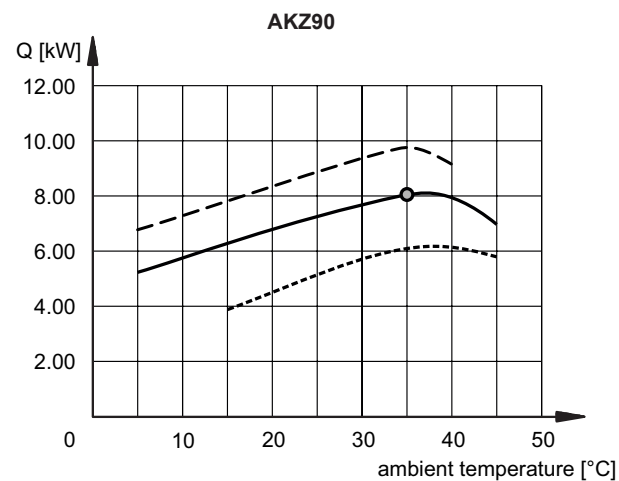
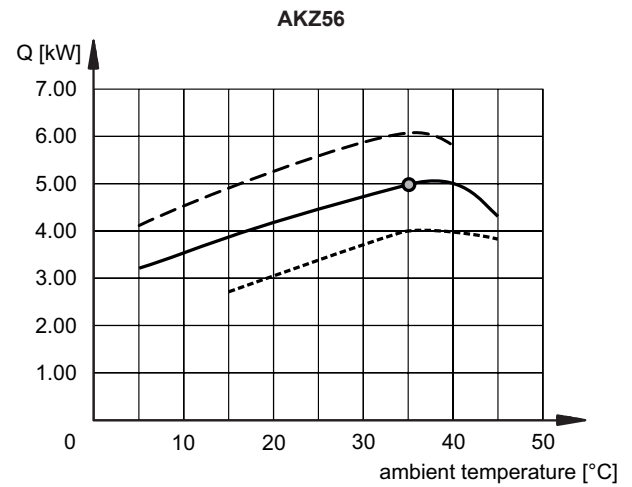
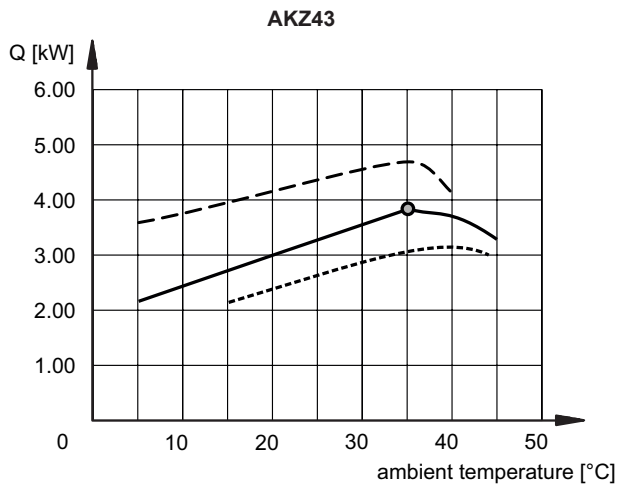
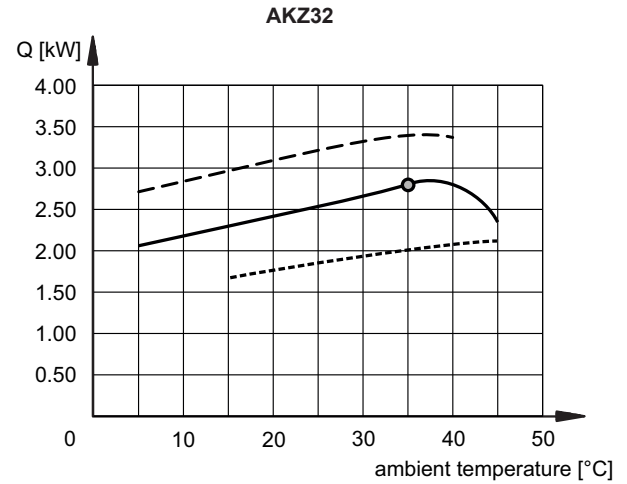
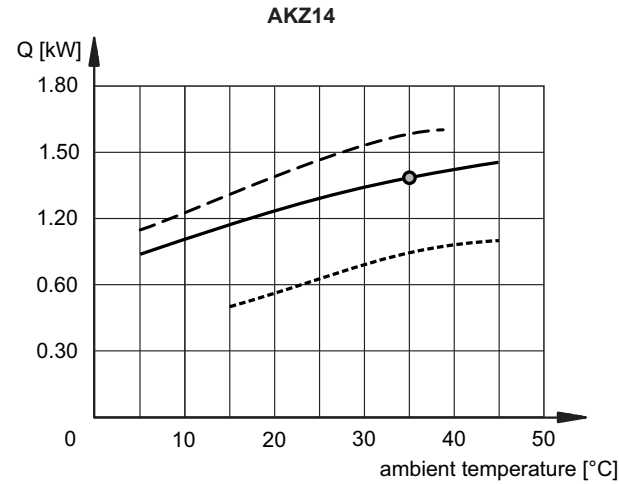
- Flame-resistant hydraulic oil (Phosphoric ester / chlorinated hydrocarbon / water + glycol / W/O, O/W emulsion type oils)
- Water and water-soluble liquids,
- Chemical and food liquids
- Cutting oil (fluid) and grinding oil (fluid)
- Fuels

### 7 - CHARACTERISTICS

Values obtained and rated for standard point with ambient temperature: 35 °C and fluid temperature: 35 °C, 50 Hz. Fluid used: ISO VG32 mineral oil.

#### 7.1 -Temperature control

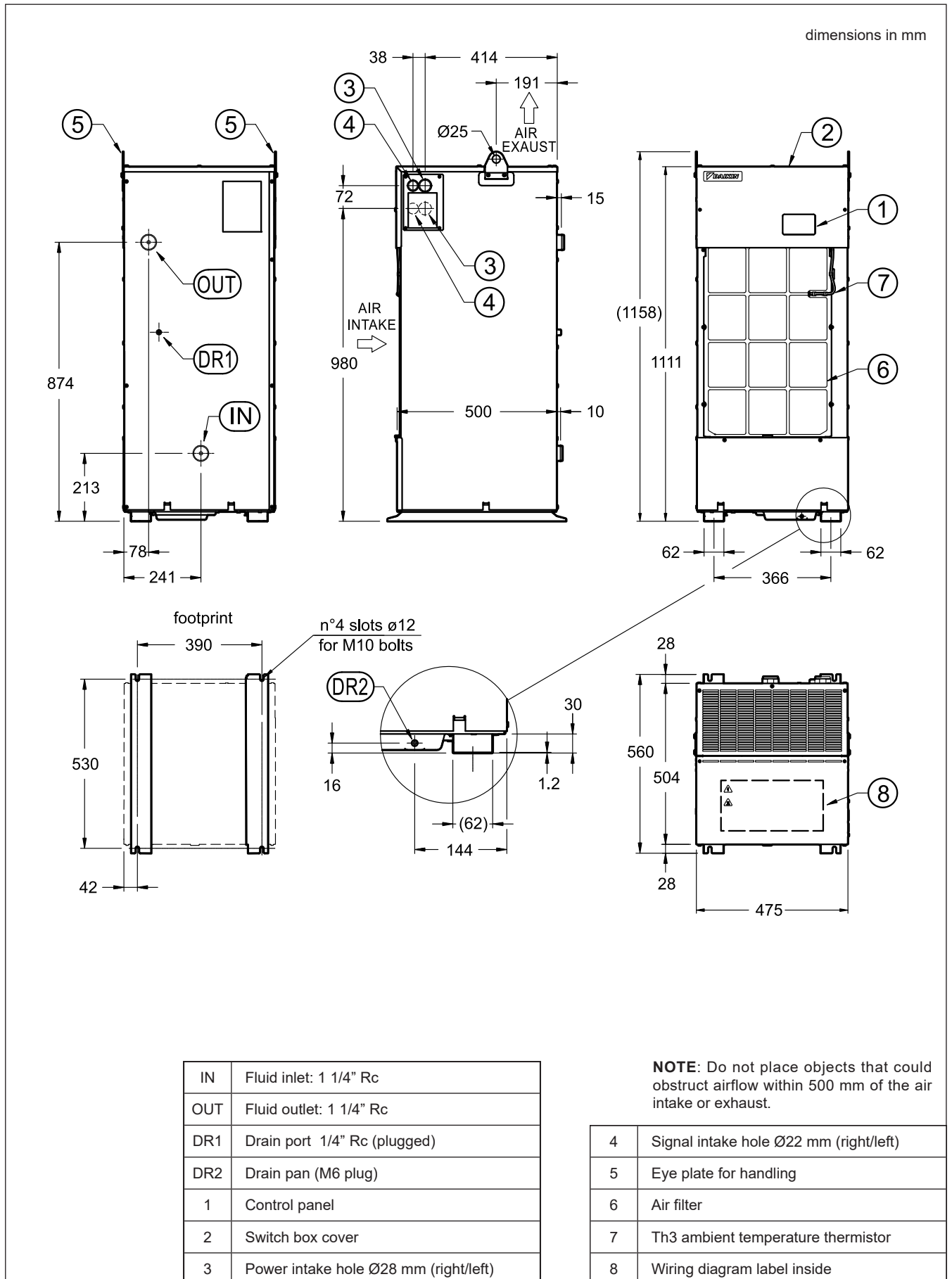
Cooling capacity (kW) according to the ambient temperature.



- Oil temperature = ambient temperature
- - - Oil temperature = ambient temperature +10 °C
- · · Oil temperature = ambient temperature -10 °C
- standard point (oil inlet temperature and ambient temperature both 35 °C; ISO VG32 oil)

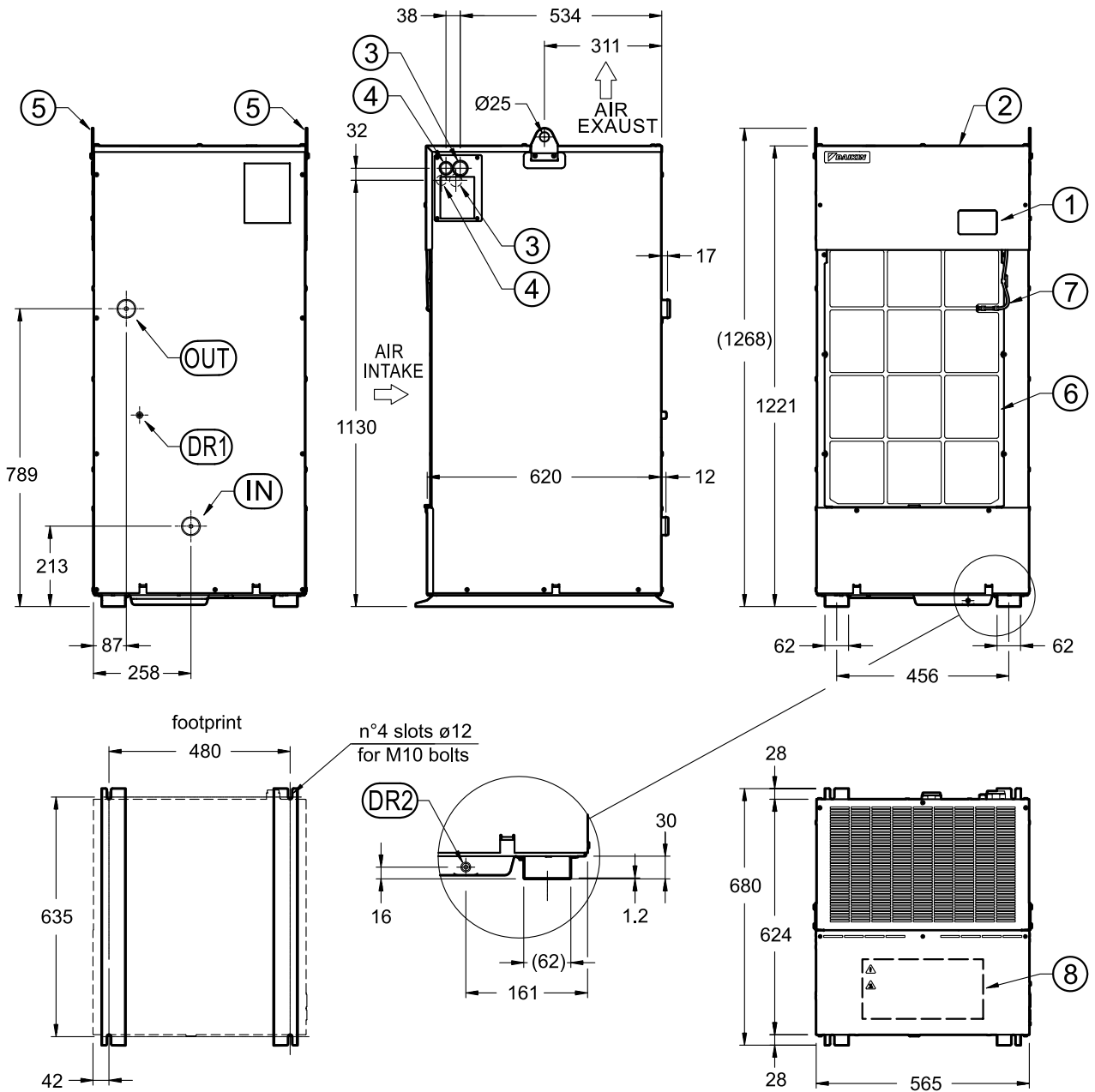


8.2 - AKZ56ACD00J



8.3 - AKZ90ACD00J

dimensions in mm



**NOTE:** Do not place objects that could obstruct airflow within 500 mm of the air intake or exhaust.

IN	Fluid inlet: 1 1/4" Rc
OUT	Fluid outlet: 1 1/4" Rc
DR1	Drain port 1/4" Rc (plugged)
DR2	Drain pan (M6 plug)
1	Control panel
2	Switch box cover

3	Power intake hole Ø28 mm (right/left)
4	Signal intake hole Ø22 mm (right/left)
5	Eye plate for handling
6	Air filter
7	Th3 ambient temperature thermistor
8	Wiring diagram label inside

## 9 - EMC 2014/30/EU COMPLIANCE

The AKZ oil cooling units are classified as auxiliary machines of over-voltage category II, main machine. Install a main power switch as required by EN60204-1 on the control panel of the main machine. Carry out power supply through a transformer provided with basic insulation (IEC Code 60335-1)



Be sure to connect the earth leakage circuit breaker (ELCB) of specified capacity (to be prepared by the customer) to the main power. (Other measures against earth leakage must be taken when using the moulded case circuit breaker (MCCB)).



Be sure to install an Earth conductor. Due to a noise filter being mounted, there is a danger of electrical shock unless earth connection is provided.



Be sure to disconnect power supply before opening the cover of the electrical panel. **Leave it out for 5 minutes**, waiting for the discharge of the internal high voltage to be completed. Do not connect power supply while the electrical equipment box is open.

To avoid the effect of electrical noise, cut off the power cable to a proper length when connecting, so that no surplus wire will come in contact with control circuit board, etc.

## 10 - WIRING

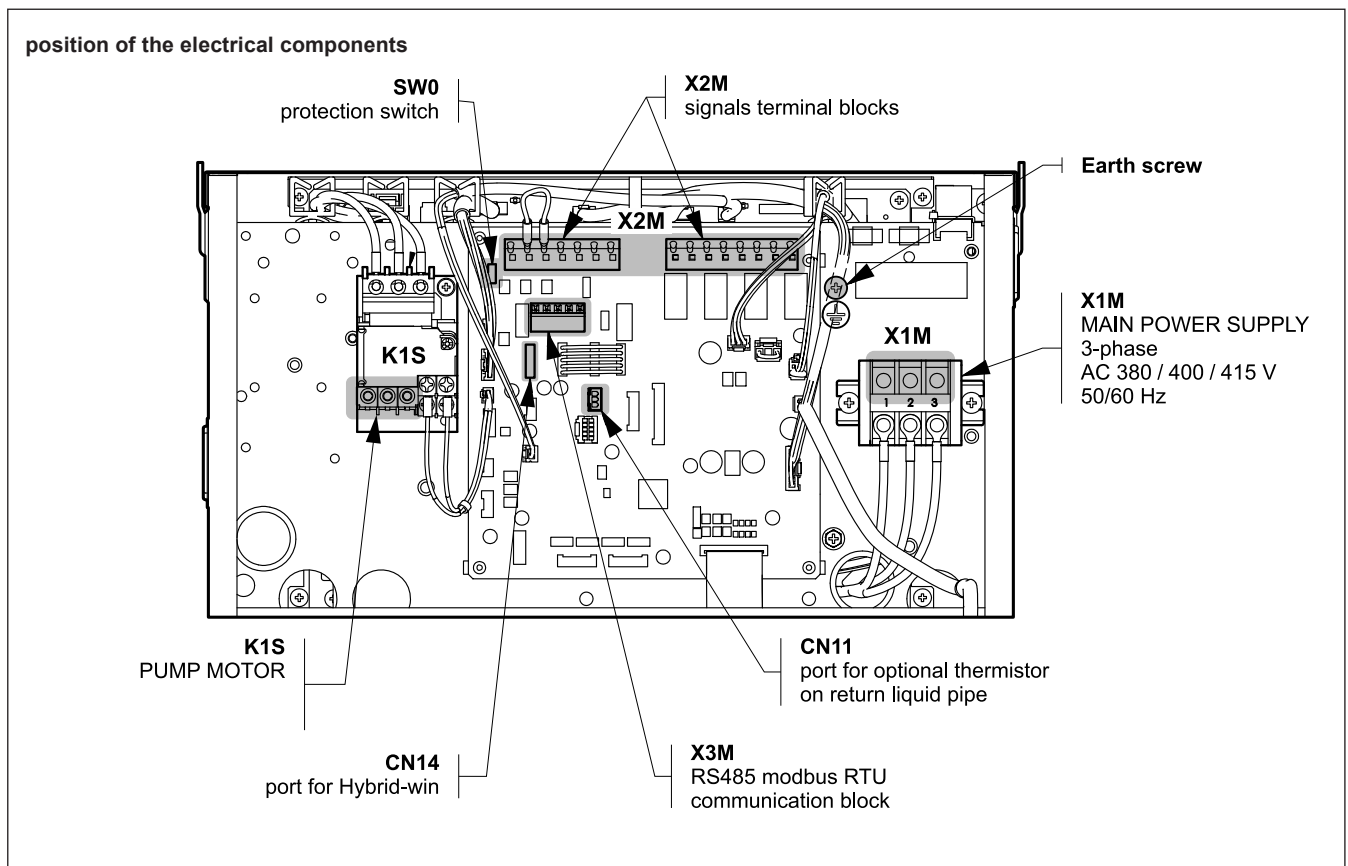
To proceed with the wiring of the electrical parts, open the cover, taking care to keep the special screws that seal it and not to damage the gasket located on the edge of the cover. The screws will be reused to close it at the end of the wiring.

**Use cables with an IP54 protection rating or higher for the incoming wiring, so that the electrical panel maintains a protection rating equivalent to IP54.**

Customer have to wire for: power source (X1M), for signals (X2M), and for communication with the main machine (X3M).



**Please refer to the instruction manual for detailed instructions for wiring and to the PIM00605B\_Modbus communication function instruction manual\_EN.pdf .**



### 10.1 - Earth screw

Connect the ground cable to the (ground) terminal. Use green/yellow ground cable.

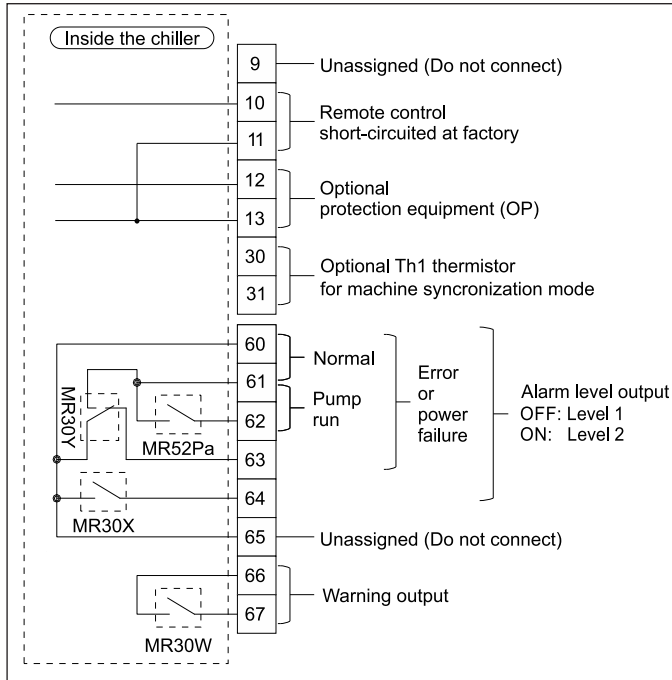
### 10.2 - Power source (X1M terminal block)

AKZ90: screw terminal M5. Use cables with 4-wires, with section  $\geq 4 \text{ mm}^2$ .

other models: screw terminal M4, M5. Use cables with 4-wires, with section  $\geq 2.5 \text{ mm}^2$ .

### 10.3 - Signals (X2M terminal block)

Use bar solderless terminal connection; use the stranded wire. 2-core cable, wires with section 0.5 to 1.5 mm<sup>2</sup>. If using stripped wires, make the stripped length 9 to 10 mm. Shielded cables are recommended for thermistors with leads longer than 10 m and in areas with electrical noise.



### 10.4 - Optional Thermistor Connection on Return Pipe (CN11)

Connect the optional thermistor cable to the CN11 port.

load	function / notes
NC	Unused
min load: 12 V DC 5 mA	To perform remote control, remove the short-circuit wire between [10] and [11] and install an operation switch (customer's charge)  The AKZ unit can activate an alarm by receiving an output signal from external protection devices (e.g. flow switch, level switch). Parameter [n002]
	If thermistor cable length exceeds 15 mt or in noisy environments, use a shielded cable.
min load: 5 V DC 1 mA max load: 24V 1A	The output settings for the alarm output depends on the value set for parameter number [n001]. Contact capacity 30 V DC, 2A Please refer to the <i>Instruction manual</i> for setting options.
NC	Unused
min load: 5V DC 1 mA max load: 24V 1A	The output settings for the warning output depend on the value set for parameter number [n001], for NORMAL status (run), 1st level warning (LOCK), 2nd level warning, POWER FAILURE

### 10.5 - Communication function (X3M terminal block)

This connection with RS485 interface and termination resistor allows data transmission/reception with a host computer, PLC (programmable logic controller), touch screen, etc.

The maximum allowed length for communication wiring is 200 m (total extension). The communication data format is defined according to the Modbus protocol. The cooling unit operates as a slave station.

Please refer to the *Modbus Communication Function Instruction Manual* for detailed information.

### 10.6 - Error Prevention Switch (SW0)

The AKZ cooling units are equipped with an error prevention/protection switch (SW0) to disable settings from the control panel. The default setting for this switch is OFF, but some non-standard units may be set to ON.

### 11 - IDENTIFICATION CODE - CONFIGURABLE MODELS WITH INTEGRATED TANK

	<b>AK</b>	<b>Z</b>		<b>A</b>	<b>CD</b>	<b>00</b>	<b>J</b>	/	<b>P</b>	<b>M</b>	<b>B</b>	-		-	<b>0</b>	-	<b>K****</b>
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High-accuracy inverter controlled cooling unit  
For oil cooling

Cooling capacity (50/ 60 Hz)  
**14** = 1.3 / 1.4 kW  
**32** = 2.8 / 3.2 kW  
**43** = 3.8 / 4.3 kW  
**56** = 5.0 / 5.6 kW  
**90** = 8.0 / 9.0 kW

Series 10

Power supply:  
3-phase AC 380 V / 400 V / 415 V 50/60 Hz  
According to EC directives

Frame model with pump, with or without tank

With RS485 Modbus RTU communication protocol

Project code for customisation (assigned by Diplomatic) (NOTE 1)

Other options

Electrical connections  
**0** = to be wired to terminal block  
**S** = with plug-in sockets and external isolator switch

Painted steel tank

Medium pressure 5 bar pump head

Horizontal pump

**NOTE 1: Customised Options**

The cooling unit can be customised according to the customer's requirements by liaising with the pre-sales service.

Customisations include the installation of optional protection devices (flow switch, level switch, pressure gauge on pump outlet), castors, Rc / BSP adapter fittings, wiring of optional thermistors supplied by us, and programming different from the factory standard.

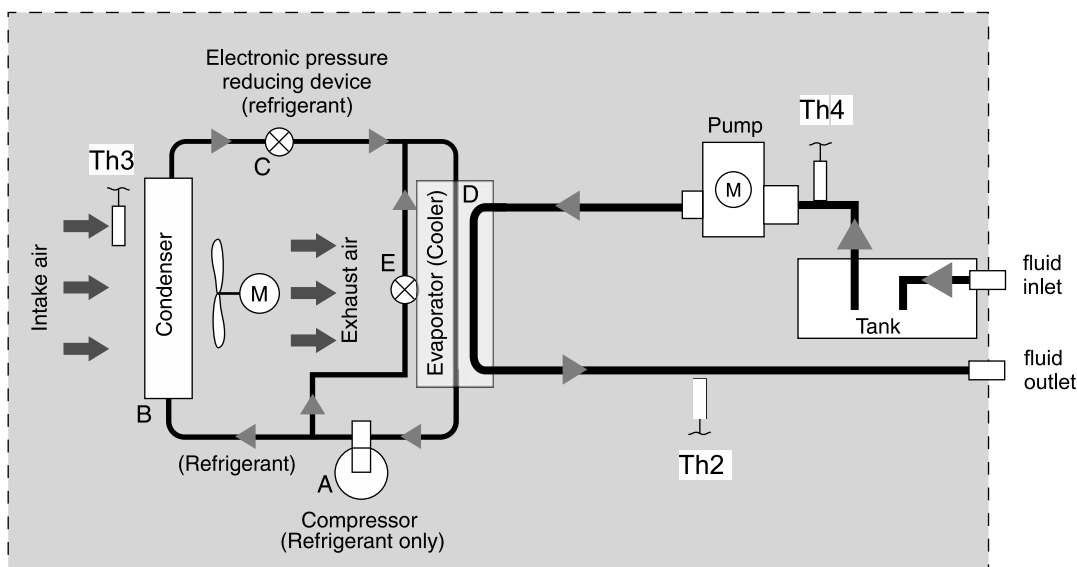
Separately available for purchase are: the plug for the Modbus communication socket, adapter fittings, long-life filters, and the cable kit for connection with Hybrid Win software. See catalogue 90 661 - AK\* ACCESSORIES.

### 12 - SPECIFICATIONS FOR CONFIGURABLE MODELS WITH INTEGRATED TANK

		AKZ14	AKZ32	AKZ43	AKZ56	AKZ90
Tank volume	l	25			50	70
Transportation weight	kg	67	73	77	96	114

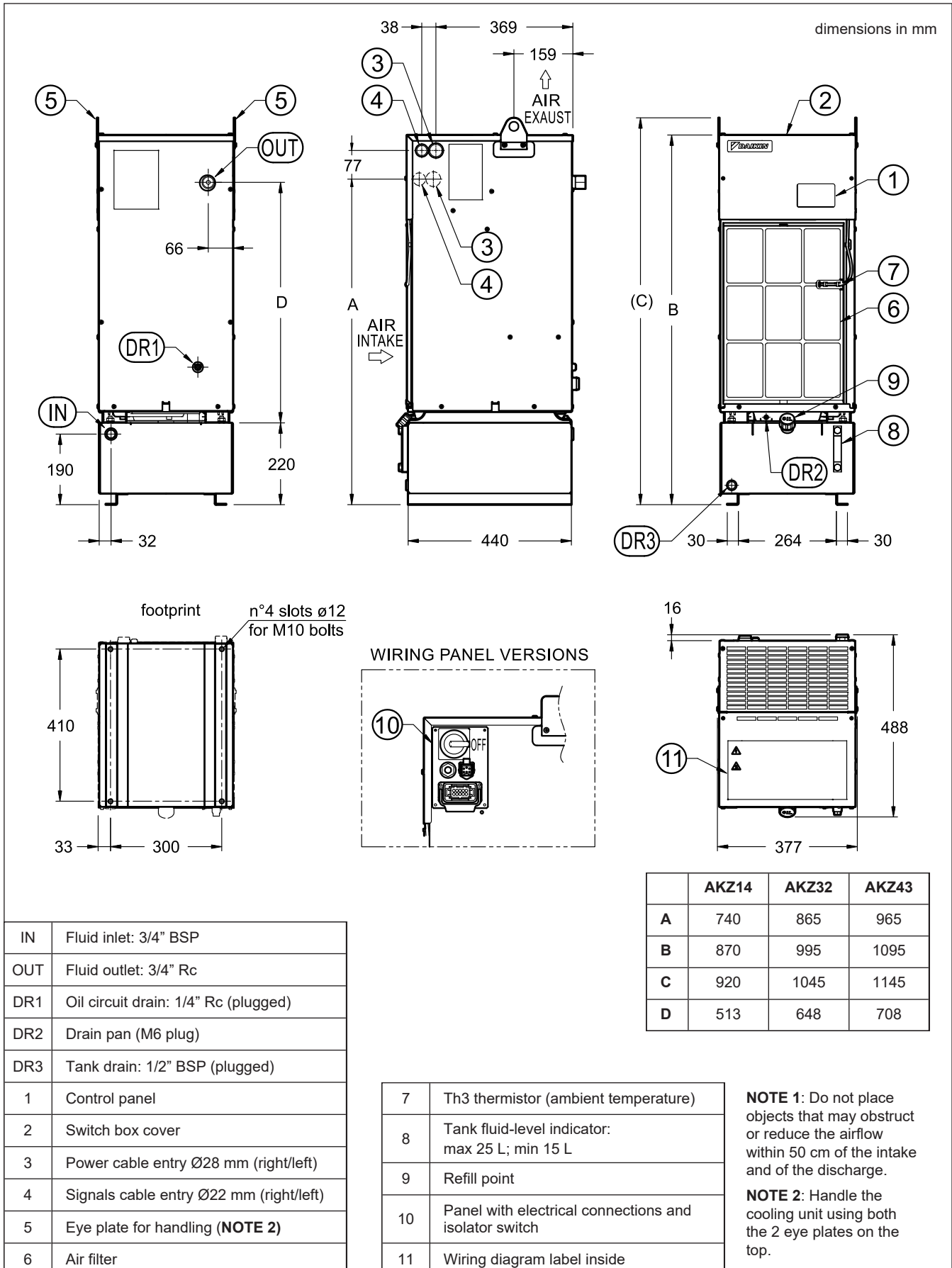
### 13 - CIRCUIT DIAGRAM OF CONFIGURABLE MODELS WITH INTEGRATED TANK

The heat transfer fluid circulates co-current with the refrigerant circuit, and a thermistor is also present on the inlet piping.



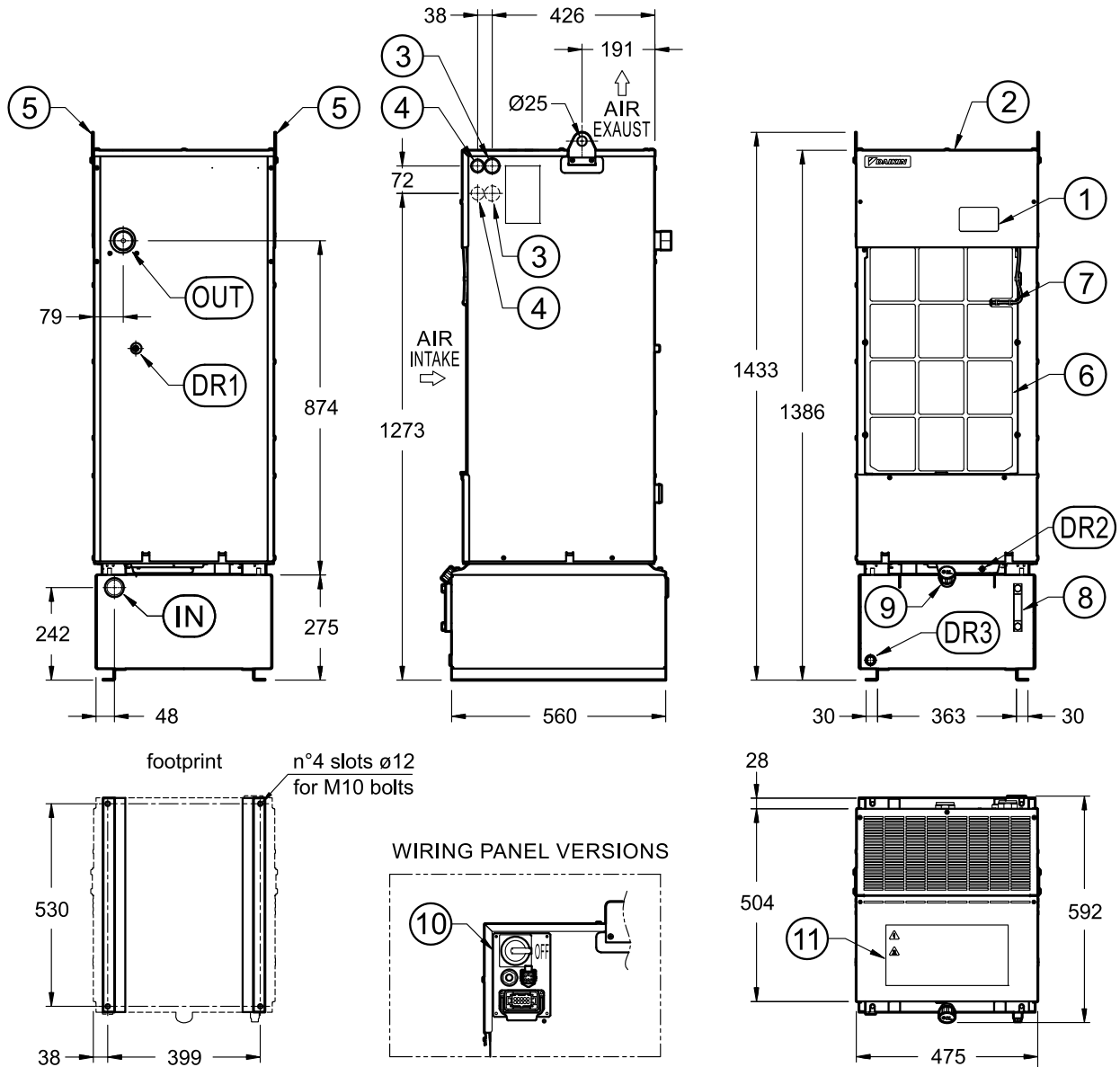
## 14 - OVERALL DIMENSIONS AND MOUNTING - CONFIGURABLE MODELS WITH INTEGRATED TANK

### 14.1 - AKZ14ACD00J/P, AKZ32ACD00J/P and AKZ43ACD00J/P



### 14.2 - AKZ56ACD00J/P

dimensions in mm



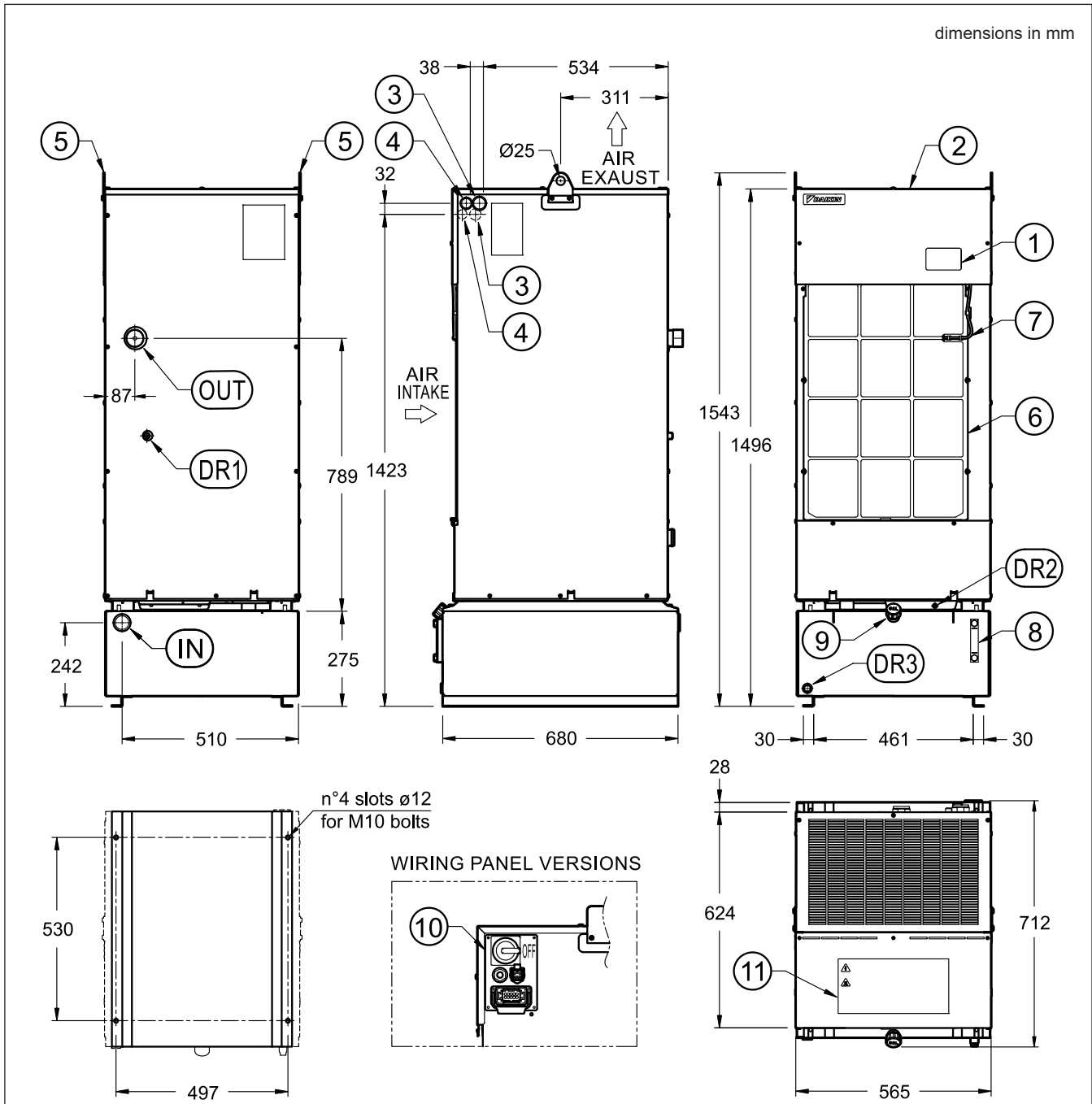
IN	Fluid inlet: 3/4" BSP
OUT	Fluid outlet: 1 1/4" BSP
DR1	Oil circuit drain: 1/4" Rc (plugged)
DR2	Drain pan (M6 plug)
DR3	Tank drain: 1/2" BSP (plugged)
1	Control panel
2	Switch box cover
3	Power cable entry Ø28 mm (right/left)
4	Signals cable entry Ø22 mm (right/left)
5	Eye plate for handling ( <b>NOTE 2</b> )

6	Air filter
7	Th3 thermistor (ambient temperature)
8	Tank fluid-level indicator: max 50 L; min 32 L
9	Refill point
10	Panel with electrical connections and isolator switch
11	Wiring diagram label inside

**NOTE 1:** Do not place objects that may obstruct or reduce the airflow within 50 cm of the intake and of the discharge.

**NOTE 2:** Handle the cooling unit using both the 2 eye plates on the top.

### 14.3 - AKZ90ACD00J/P



IN	Fluid inlet: 3/4" BSP
OUT	Fluid outlet: 1 1/4" BSP
DR1	Oil circuit drain: 1/4" Rc (plugged)
DR2	Drain pan (M6 plug)
DR3	Tank drain: 1/2" BSP (plugged)
1	Control panel
2	Switch box cover
3	Power cable entry $\varnothing 28$ mm (right/left)
4	Signals cable entry $\varnothing 22$ mm (right/left)
5	Eye plate for handling ( <b>NOTE 2</b> )

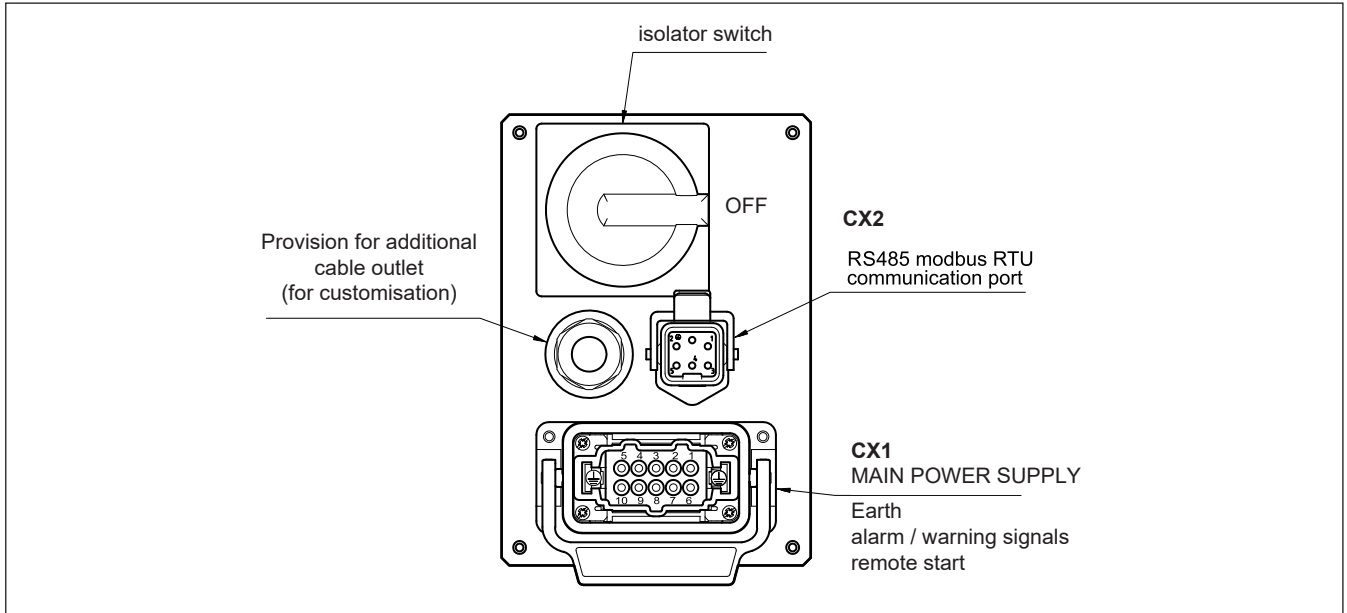
6	Air filter
7	Th3 thermistor (ambient temperature)
8	Tank fluid-level indicator: max 70 L; min 54 L
9	Refill point
10	Panel with electrical connections and isolator switch
11	Wiring diagram label inside

**NOTE 1:** Do not place objects that may obstruct or reduce the airflow within 50 cm of the intake and of the discharge.

**NOTE 2:** Handle the cooling unit using both the 2 eye plates on the top.

**15 - ELECTRICAL CONNECTIONS**

Below are the instructions for the models with the panel featuring a switch and plug-in sockets (code S). For models with a direct connection to the internal terminal block of the cooling unit's electrical panel (code 0), refer to the wiring diagram on page 9.


**15.1 - Pinout of CX1 socket**

The plug is supplied.

internal AKZ pin		CX1	cable	description
M5 screw		<b>PE</b>	6 mm <sup>2</sup>	Earth
L1 (X1M)		<b>1</b>	6 mm <sup>2</sup>	Main Power Supply Three-phase AC 380/400/415 V 50/60 Hz ±10%
L2 (X1M)		<b>2</b>		
L3 (X1M)		<b>3</b>		
-		<b>4</b>	NC	-
60 (X2M)		<b>5</b>	0.75 mm <sup>2</sup>	Normal Operation (RUN) Min load: 5V DC, 1 mA - Max load: 24V 1A
61 (X2M)		<b>6</b>		
66 (X2M)		<b>7</b>	0.75 mm <sup>2</sup>	Warning Signal Output (LOCK) Min load: 5V DC, 1 mA - Max load: 24V 1A
67 (X2M)		<b>8</b>		
10 (X2M)		<b>9</b>	1 mm <sup>2</sup>	Remote Start (Optional upon request)
11 (X2M)		<b>10</b>		

**15.2 - Pinout of CX2 socket**

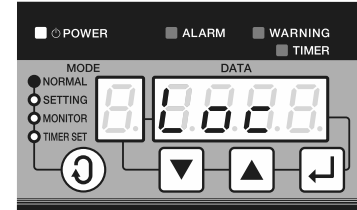
The plug can be ordered separately; see point 17.

internal AKZ pin		CX2	cable	description
		<b>PE</b>	NC	-
1 (X3M)		<b>1</b>	1 mm <sup>2</sup>	Communication with main machine using Modbus RTU protocol RS485 serial interface
2 (X3M)		<b>2</b>		
3 (X3M)		<b>3</b>		
4 (X3M)		<b>4</b>		
5 (X3M)		<b>5</b>		

## 16 - DEVICE SETUP

The AKZ oil cooling units are configurable via the display, from which it is always possible to set and monitor parameters and alarms. AKZ oil cooling units allow also the remote control from the main machine control board.

As the oil cooling unit is preset to LOCK mode (STOP mode) at the time of factory shipment, carry out the unlocking operation via the control panel. Unlocking method is given in the *Instruction Manual*.



## 17 - ACCESSORIES

### 17.1 - Hybrid-win software

The Hybrid-win software is a service tool that allows to monitor the operating data in real time through a graphical interface. It has to be installed on devices with Microsoft Windows OS, allowing real-time monitoring of operating data via a graphical interface.

Connection is by harness, directly to the main board inside the chiller. The cable connection kit AKPC (made of USB converter + special cable + harness) is to be ordered separately. Refer to catalogue 90 661 for details.

The Hybrid-win software can be downloaded easily from the product section at Duplomatic Motion Solution website: [accessories for AK\\* cooling units](#).

### 17.2 - Other accessories

Accessories are sold separately and their assembly on the oil cooling unit / machine is in the Customer's charge. Please refer to the catalogue 90 661 - ACCESSORIES FOR COOLING UNITS for details about thermistors, long life filters, adapters, and cable kit for Hybrid-Win tool.

## 18 - INSTRUCTION FOR SAFE OPERATION

- Use the equipment only in accordance with the intended specifications (specified in brochure, specification sheet, operation manual, and caution plates).
- Never operate the equipment in an explosive atmosphere.
- Do not disassemble, repair or modify the equipment by yourself.
- Always comply with the laws and regulations for safety (Industrial Safety and Health Law and Fire Defence Law).
- Measures in the event of refrigerant leak:
  - Ventilate the room adequately (to avoid the risk of suffocation)
  - Avoid direct contact of the refrigerant with skin (to avoid the risk of cryogenic burns).
  - In the event of inhalation of a great deal of refrigerant, contact with skin, or refrigerant in the eye, seek medical attention immediately.
- In the event of an abnormal condition, stop operation promptly, investigate the cause of the problem and take appropriate remedial measures.
- Do not use the unit outdoor or in atypical environments (locations subject to high temperatures, high humidity, or a lot of dust, contamination, steam, oil mist or corrosive gases: H<sub>2</sub>S, SO<sub>2</sub>, NO<sub>2</sub> or Cl<sub>2</sub>).
- Install a flow switch and a temperature switch on the machine to protect the spindle and other components.
- Do not get on the equipment or place an object on the equipment.
- Use the unit at an altitude of up to 2000 m. At altitudes over 1000 m the cooling capacity decreases by around 20 to 30%, so please select a model with adequate leeway in terms of cooling capacity.

### Instructions for transportation

- When hoisting the equipment, check its weight and use the eye plates and hangers on it properly.
- When hoisting the equipment, do not do so while it is fitted with a tank or anything else that you have provided.
- Do not approach the equipment while it is being hoisted and moved.

- When moving the equipment, take appropriate measures for fall prevention.
- Do not tilt the equipment over 30 degrees.

### Instructions for installation

- Install the equipment on a rigid, level foundation and secure it firmly.
- Keep the suction vacuum pressure within the range of -0.3 to 0 bar.
- Use a suction filter with a mesh size of 100 to 150.
- Keep the pressure loss in the discharge-side piping at 5 bar or less.
- Do not install a stop valve on the suction or discharge side. If a stop valve must be installed on the discharge side, use a relief valve rated for 5 bar together with the stop valve
- Verify that the site piping is rated for a pressure of at least 10 bar.
- Ensure the fluid piping is rated for at least 10 bar and install it according to the instructions.

### Instructions for wiring

- Wiring installation must be performed by qualified personnel.
- Always use a commercial power supply; the use of an inverter power supply may cause damage.
- Connect the power supply wiring in accordance with the wiring diagram provided in the specification sheet and operation manual.
- Install the wiring in compliance with applicable standards and the wiring diagram.
- Ground the equipment properly.
- Always install a dedicated all-pole (3-pole) earth leakage breaker appropriate for the capacity of the oil cooling unit on the main power supply.

### Instructions for trial run

- Before starting the trial run, ensure the main machine is in a safe condition (not running).

- Verify that the oil piping and electrical wiring are properly connected and that all connections and joints are free of leaks.
- Disable the operation lock of the oil cooling unit before starting the main machine.
- Verify that the fluid piping system is filled with the required amount of fluid and is free from obstructions.

### Instructions during operation

- Do not spray water or other liquids directly onto the oil cooling unit.
- Do not insert fingers or objects into any openings or gaps of the oil cooling unit.
- Do not touch the hot exhaust port of the oil cooling unit.

### Instructions for maintenance and inspection

- Wear protective gear such as gloves and an eye protector when performing maintenance, inspection and cleaning.
- Perform maintenance and inspection of the oil cooling unit in a well-ventilated area. In the event of a refrigerant leak, working in an enclosed space may pose a risk of asphyxiation.
- Always turn off the main power supply before starting maintenance and inspection.

- Wait for **five minutes** after turning off the main power supply before starting maintenance and inspection operation.
- Do not operate the oil cooling unit with its cover opened.
- Clean the air filter periodically (once every two weeks in general).
- Ensure that the oil cleanliness meets the standards at all times.
- Check the fluid level in the tank and make sure it is between the yellow and red indicators.
- Inspect the drain pan beneath the oil cooling unit every six months. If fluid has accumulated, drain it through the drainage port.

### Selection method for oil cooling units

- Select a oil cooling unit with a cooling capacity 20 to 30% larger than the amount of heat generated by the machine tool.
- Since the cooling capacity of oil cooling units varies with changes in the fluid temperature and ambient temperature, the fluid temperature and ambient temperature conditions have to be clarified to select the appropriate oil cooling unit.

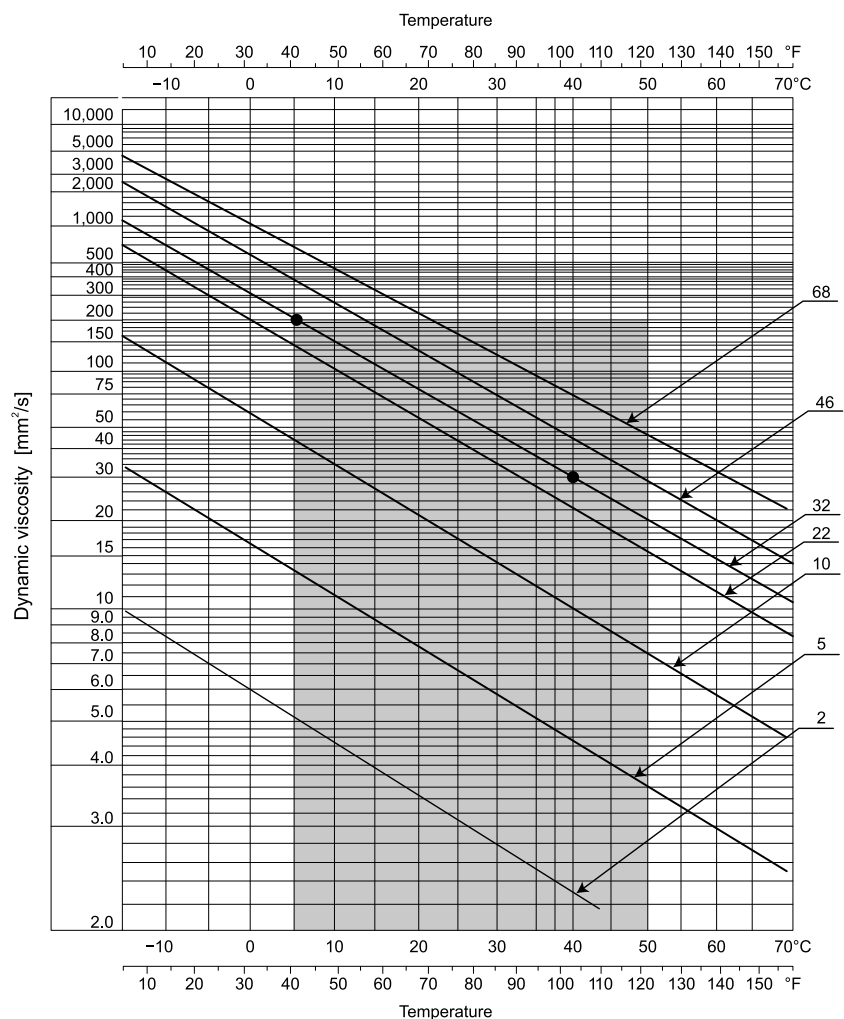
## 19 - VISCOSITY CHART

The viscosity of ISO VG oil changes significantly with temperature.

For example: ISO VG32, at 5 °C (winter conditions) it is about 195 mm<sup>2</sup>/s, while at 40 °C (summer conditions) it drops to around 29 mm<sup>2</sup>/s.

This variation is critical because higher viscosity at low temperatures increases flow resistance and pump load, whereas lower viscosity at high temperatures can reduce lubrication and heat transfer efficiency.

See the viscosity vs. temperature chart at side for a visual representation of this behavior.





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