



# AKW\*

## CHILLING UNITS FOR WATER-BASED FLUIDS SERIES 10

### DESCRIPTION

The AKW\* chiller 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 AKW\* chillers are available with or without pump and tank.

These chillers can control the temperature in three different ways:

- Set the fluid temperature according to the ambient temperature or to the main machine temperature
- Hold the fluid temperature constant
- Cool the fluid at constant cooling capacity

The AKW chillers are perfect in applications that demand a strict control of the temperature, such as machining centers, NC lathes, semiconductor production equipment, laser cutting machines/laser oscillators, electrical discharge machines, beam welding machines and medical equipment.

### MAIN CHARACTERISTICS

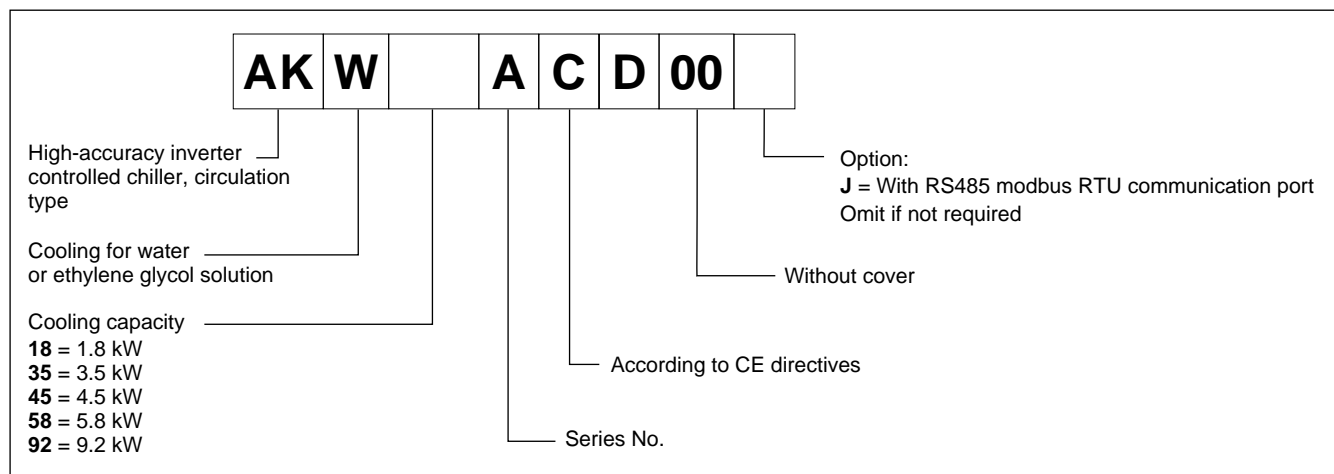
Cooling capacity ( <b>NOTE</b> )	kW	1.8 ÷ 9.2 (see detailed specifications at pp. 2 and 6)
Accuracy of the temperature control		±0.1 °C (load range from 0% to 100%)
Supply power voltage main circuit operating circuit		three-phase 400 V AC 50/60Hz (±10%) 12/24 V DC
Power consumption (400V 50/60Hz)	kW	0.81 ÷ 3.84 (see detailed specifications at pp. 2 and 6)
Current consumption (400V 50/60Hz)	A	1.6 ÷ 7.5 (see detailed specifications at pp. 2 and 6)
Admitted fluids		Industrial purpose purified water, ethylene glycol solution (50 vol% or less)
Ambient operating temperature	°C	+5 to +45
Evaporator outlet liquid temperature	°C	+5 to +45
Refrigerant gas		R410A contained in a full hermetical circuit
Relative humidity range	%RH	20 ÷ 85
Protection class Electric component housing		IP2X IP54 with proper cableglands and connectors

**NOTE 1:** The cooling capacity is the value at standard point (outlet liquid temperature: 25 °C, ambient temperature: 25 °C, liquid used: water, rated circulation rate, 1 atm). The product tolerance is approx. ±5%.



**1 - IDENTIFICATION CODE OF AKW\* MODELS WITHOUT PUMP AND TANK**

**NOTE:** Models with pump and tank are illustrated starting on page 11.



**2 - SPECIFICATIONS FOR MODELS WITHOUT PUMP AND TANK**

		<b>AKW18</b>	<b>AKW35</b>	<b>AKW45</b>	<b>AKW58</b>	<b>AKW92</b>
Cooling capacity (NOTE 1)	kW	1.8	3.5	4.5	5.8	9.2
Supply power		3-phase AC 380/400/415 V 50/60 Hz				
Supply voltage main circuit control circuit		3-phase AC 380/400/415 V 50/60 Hz 12/24 V DC				
Max power consumption (400V 50/60 Hz)	kW	0.81	1.36	1.60	2.40	3.84
Max current consumption (400V 50/60 Hz)	A	1.6	2.6	3.0	4.3	7.5
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
Refrigerant control		Rotation speed control of compressor by inverter + electronic expansion valve opening				
Refrigerant gas R410A (NOTE 2) filling q.ty CO <sub>2</sub> equivalents	kg	0.56 1.18	0.79 1.66	0.84 1.76	1.02 2.14	1.42 2.97
Cooling fluid whitstand pressure	bar	5			10	
Circulating volume rated range	l/min	10 6 ÷ 15	15 10 ÷ 20	15 10 ÷ 30	25 13 ÷ 30	40 25 ÷ 45
Noise level (front 1 m, height 1.55 m)	dB(A)	60	61	62	65	67
Applicable liquid		Industrial purpose purified water Ethylene glycol aqueous solution (50 vol% or less)				
Exterior color		Ivory white				
Mass	kg	38	43	44	70	88
ELCB (mandatory, in the customer's charge)	A	10			15	20

**NOTE 1:** Cooling capacity is the value at standard point (outlet liquid temperature: 25 °C, ambient temperature: 25 °C, liquid used: water, rated circulation rate, 1 atm). 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.

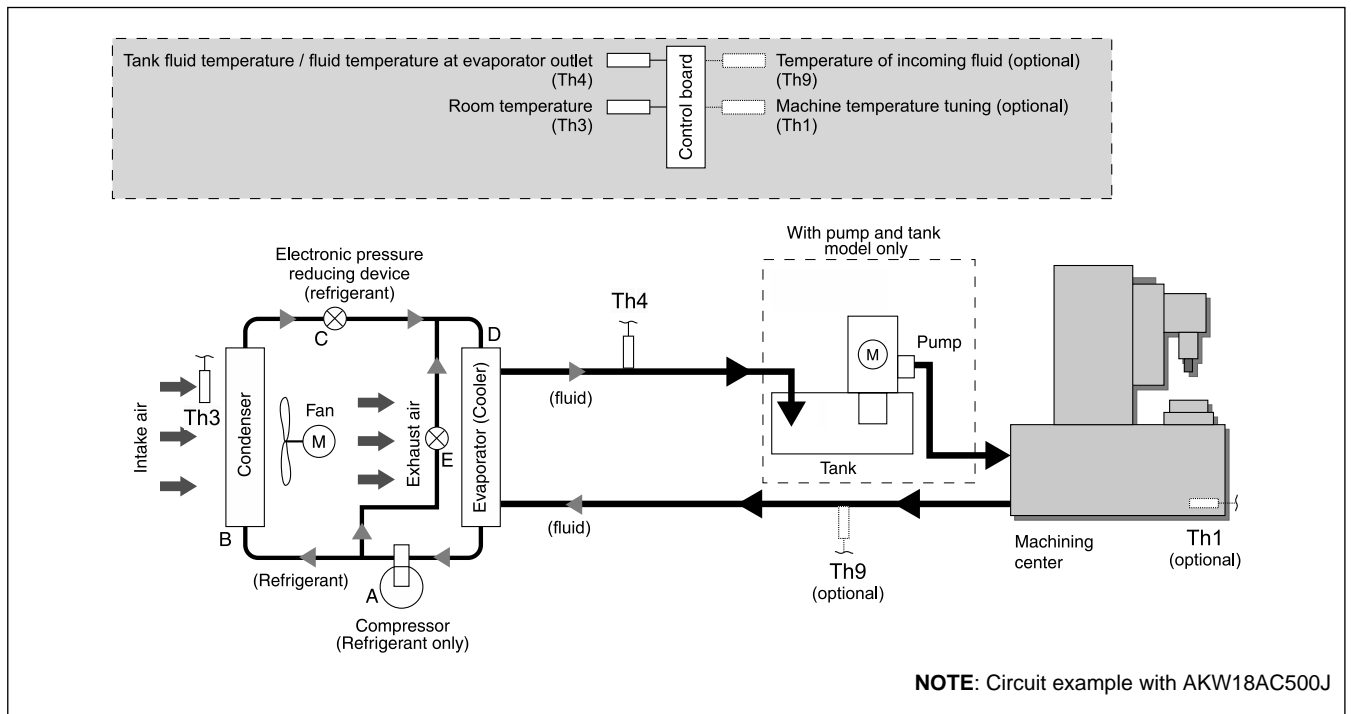
### 3 - TEMPERATURE CONTROL MODES

The AKW\* chillers are able to control the temperature of the fluid in three different ways, thanks to the thermistors (some of which are optional and are to be installed separately) located along the fluid (water) circuit.

- Set the fluid (water) temperature according to the ambient temperature (standard mode).  
Control is done by keeping a constant temperature difference between the evaporator outlet liquid temperature and the reference temperature. AKW58 and AKW92 are factory setting with the evaporator inlet liquid temperature as target. This setting can be modified. By installing an optional thermistor (Th1), it is possible to measure the temperature directly on the main machine. The setting range is  $\pm 9.9$  °C against the reference temperature.
- Hold the fluid (water) temperature constant:  
Control is done by keeping a control target at a constant temperature. The setting range is 5 ÷ 45 °C
- Cool the fluid at constant capacity  
The temperature control is disabled. The cooling is according to the cooling capacity, set by command. The setting range is 0 ÷ 100%.

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

### 4 - SYSTEM OUTLINE



#### 4.1 - The refrigerating cycle

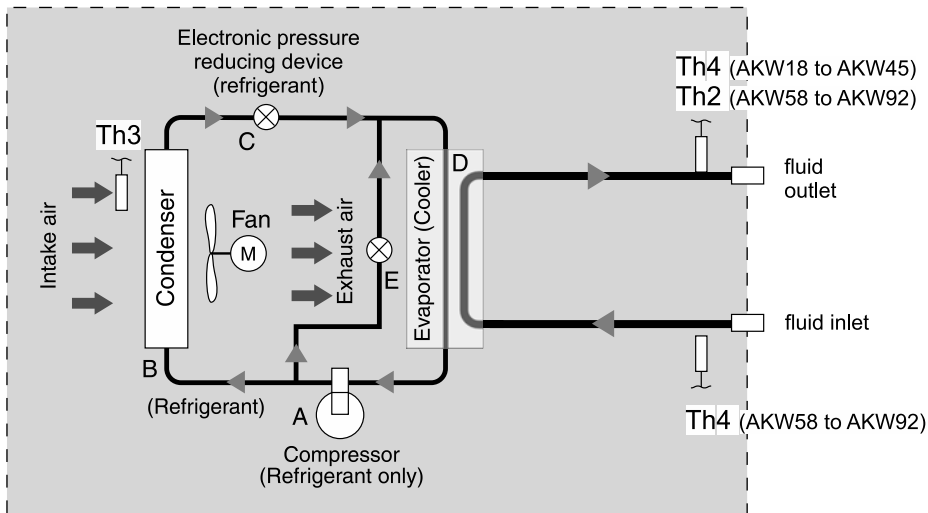
- The compressor produces compressed gas at high temperature and high pressure so that the refrigerant gas can be easily cooled and liquefied in the condenser.
- The condenser cools and condenses the high temperature/high pressure gas produced in the compressor, transforming it into a high temperature/high 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 water-based fluid (cooling the water 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

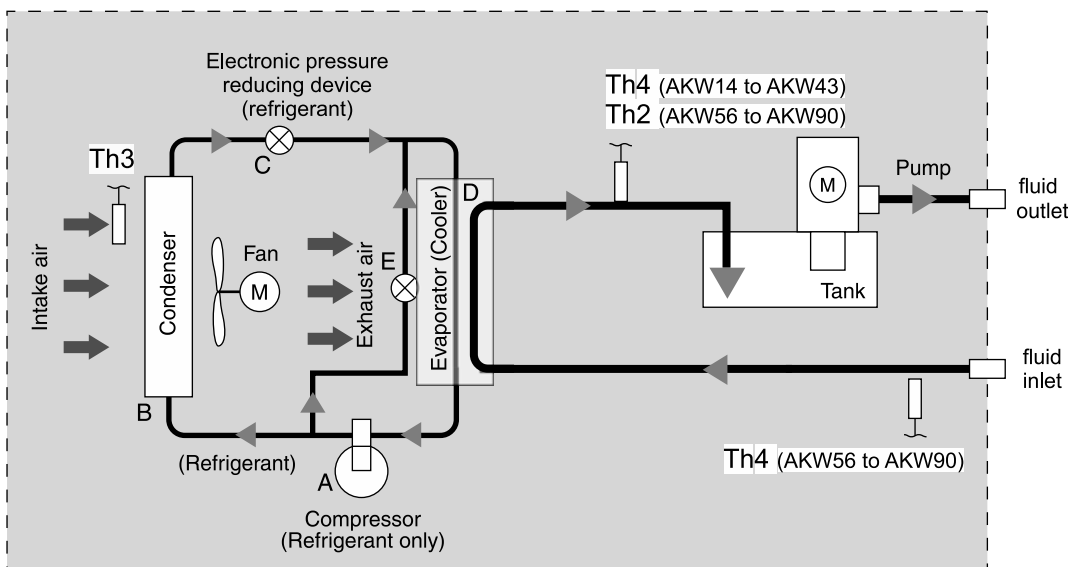
The fluid to be cooled comes from the machine directly into the evaporator. The cooled fluid is delivered to the machining center (pump and tank are supplied or they are in the customer's charge, according to the purchased model).

## 5 - CIRCUIT SCHEMES

### 5.1 - Models without pump and tank



### 5.2 - Models with pump and tank

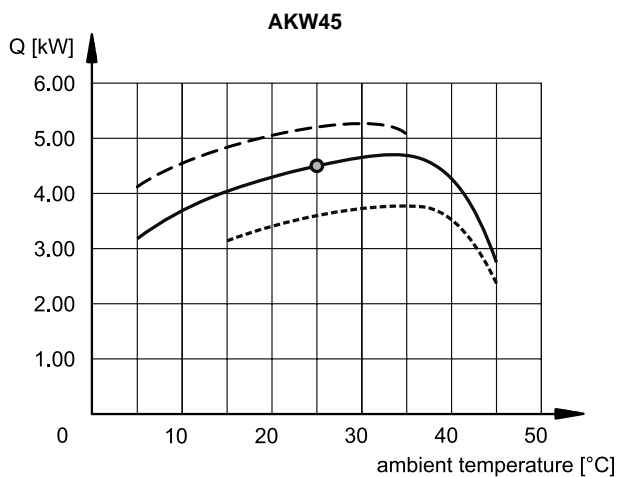
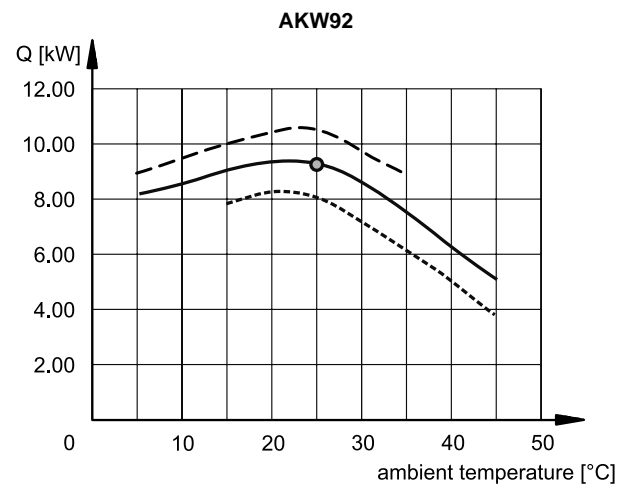
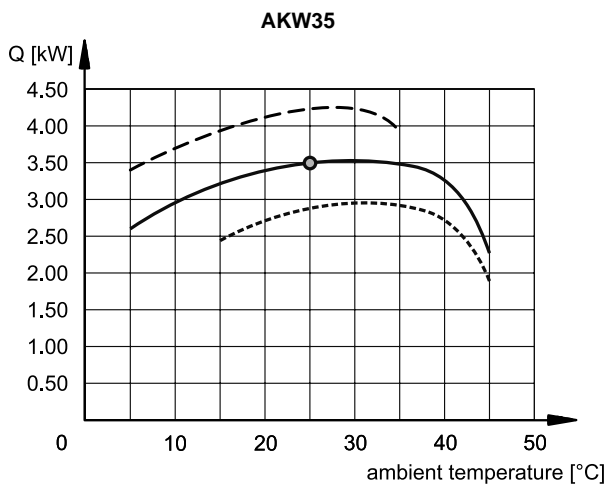
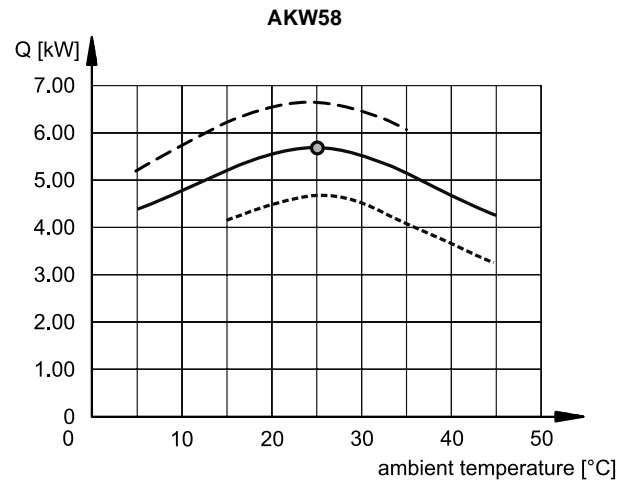
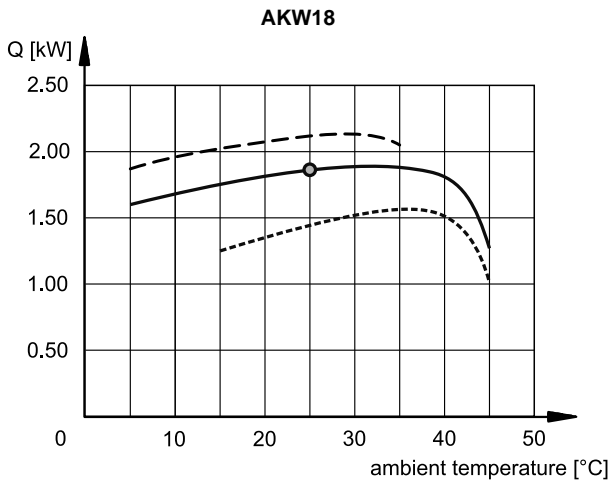


## 6 - CHARACTERISTICS AKW\* MODELS WITHOUT PUMP AND TANK

Values obtained and rated for standard point with ambient temperature: 25 °C and fluid temperature: 25 °C. Fluid used: H<sub>2</sub>O.

### 6.1 -Temperature control

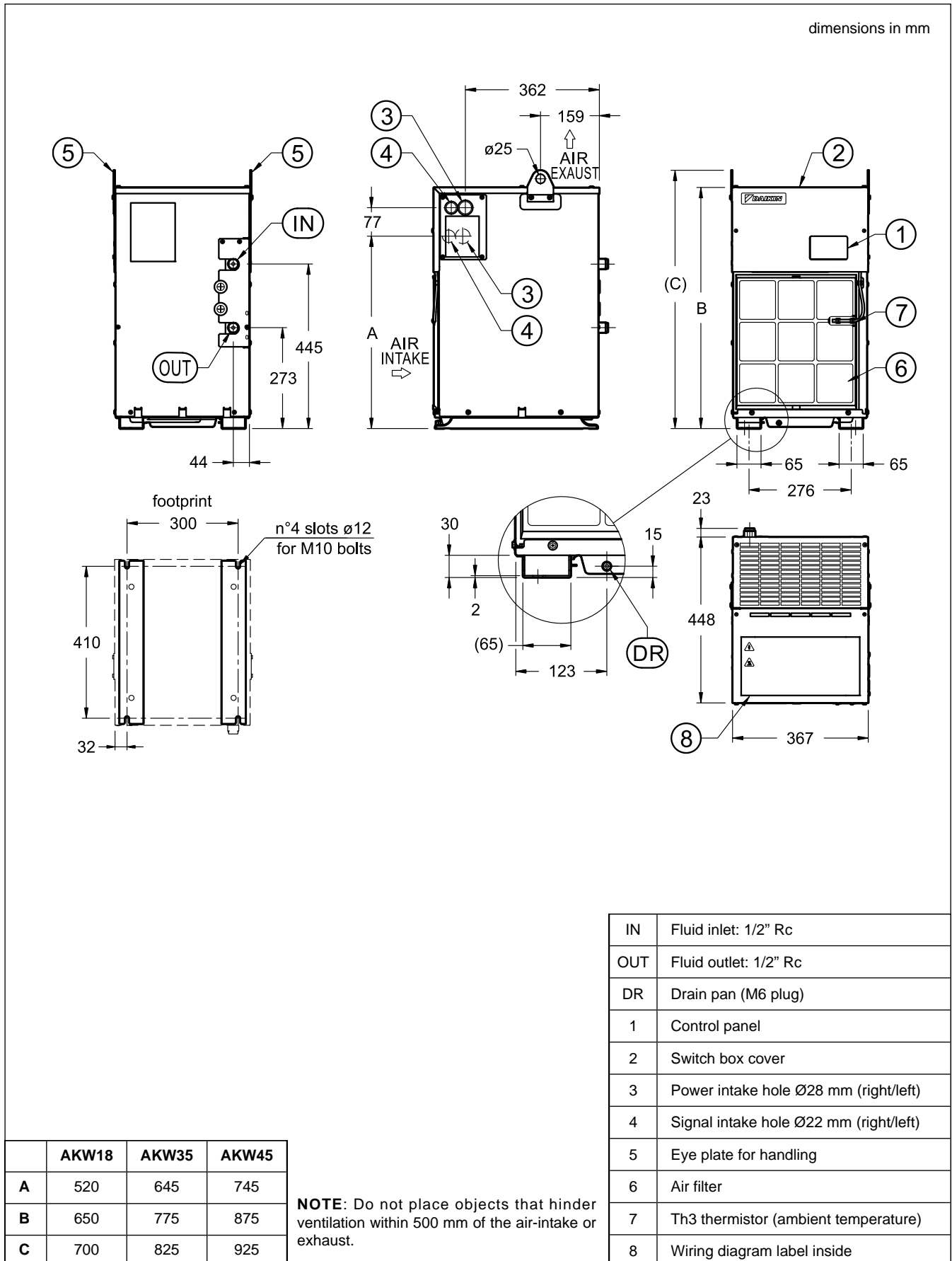
Cooling capacity (kW) according to the ambient temperature.



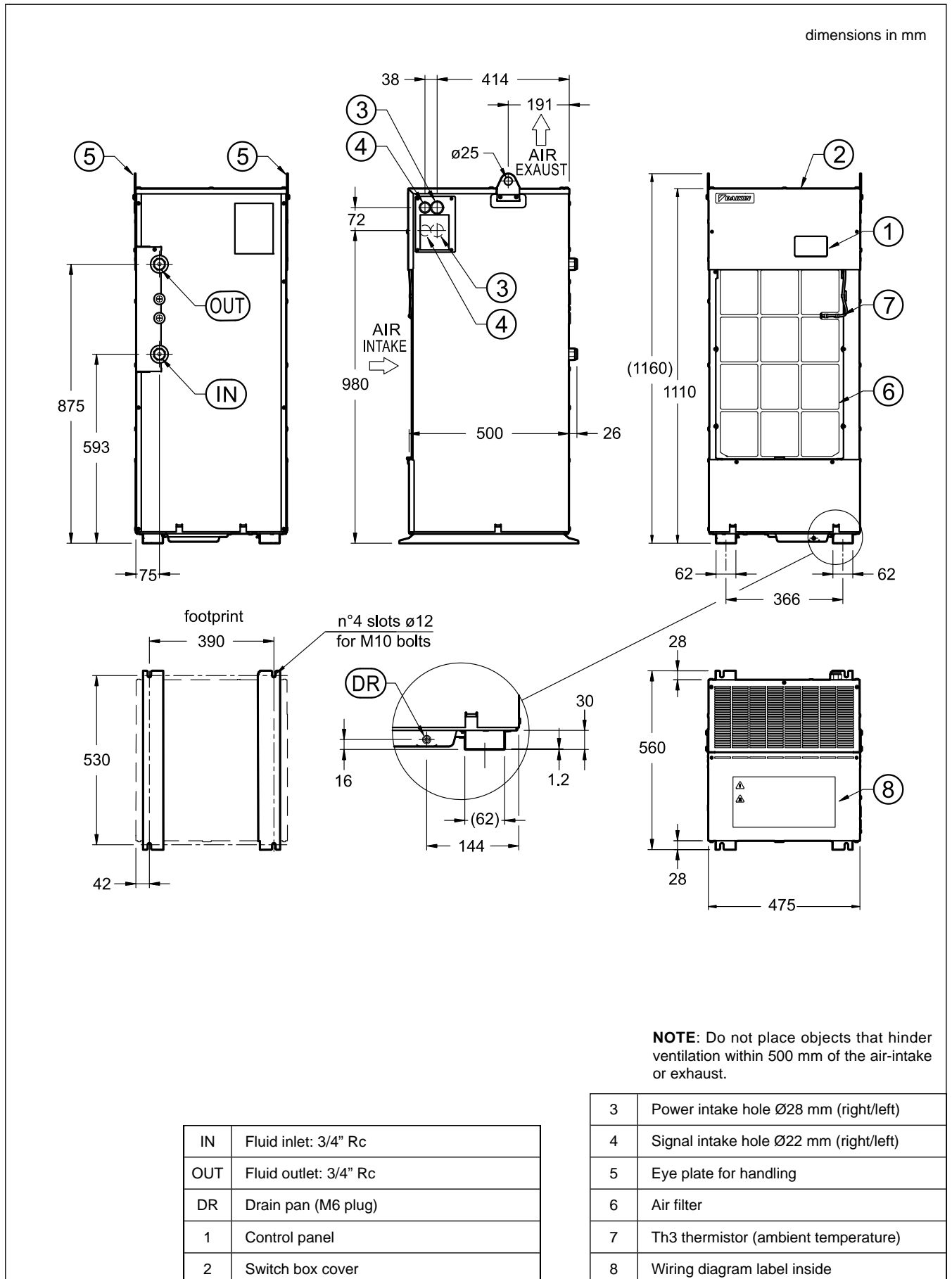
- H<sub>2</sub>O temperature = ambient temperature
- - - H<sub>2</sub>O temperature = ambient temperature + 10 °C
- · · H<sub>2</sub>O temperature = ambient temperature - 10 °C
- standard point (H<sub>2</sub>O temperature and ambient temperature 25 °C)

## 7 - OVERALL DIMENSIONS AND MOUNTING - MODELS WITHOUT PUMP AND TANK

### 7.1 - AKW18ACD00, AKW35ACD00 and AKW45ACD00

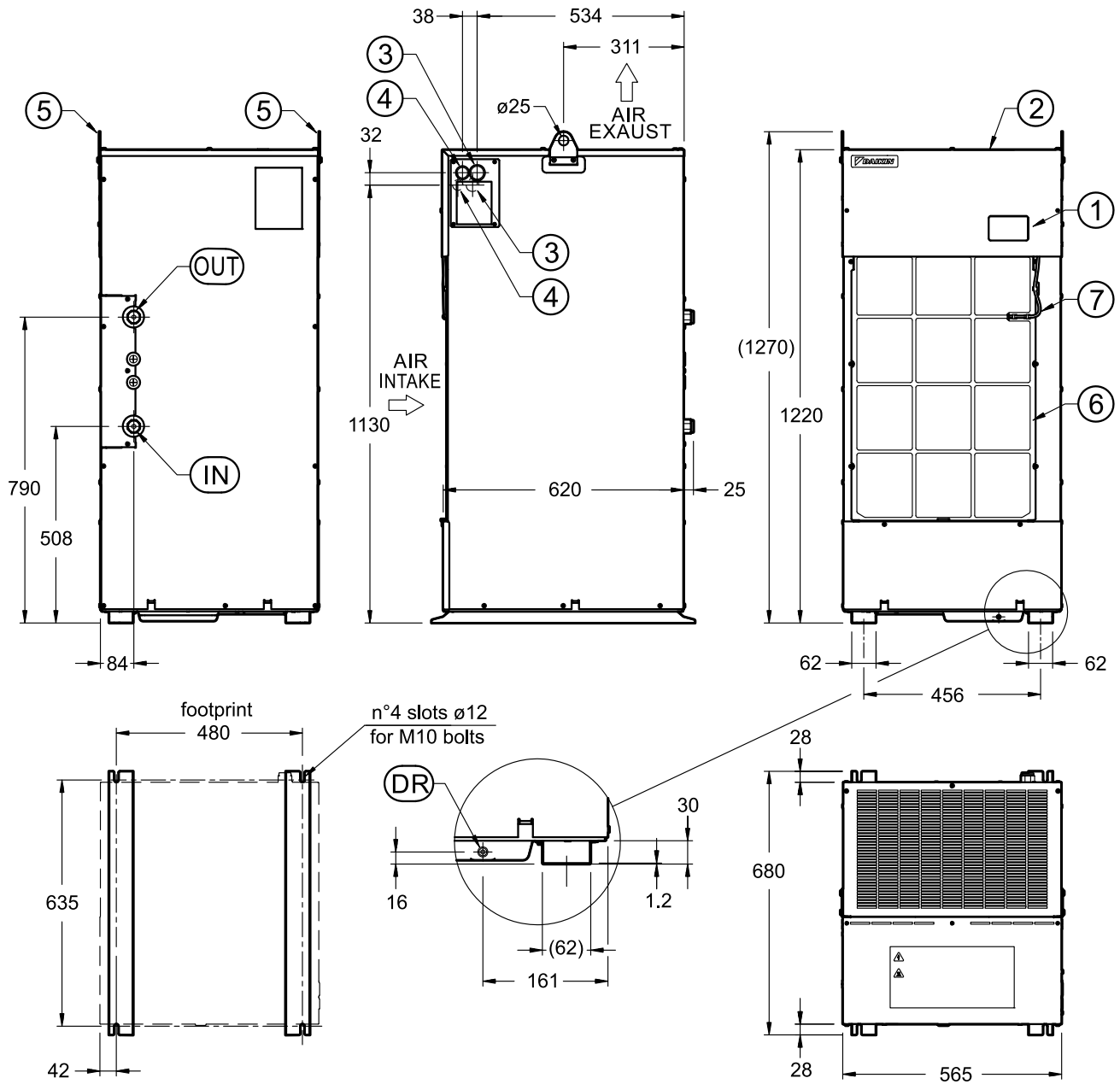


7.2 - AKW58ACD00



7.3 - AKW92ACD00

dimensions in mm



**NOTE:** Do not place objects that hinder ventilation within 500 mm of the air-intake or exhaust.

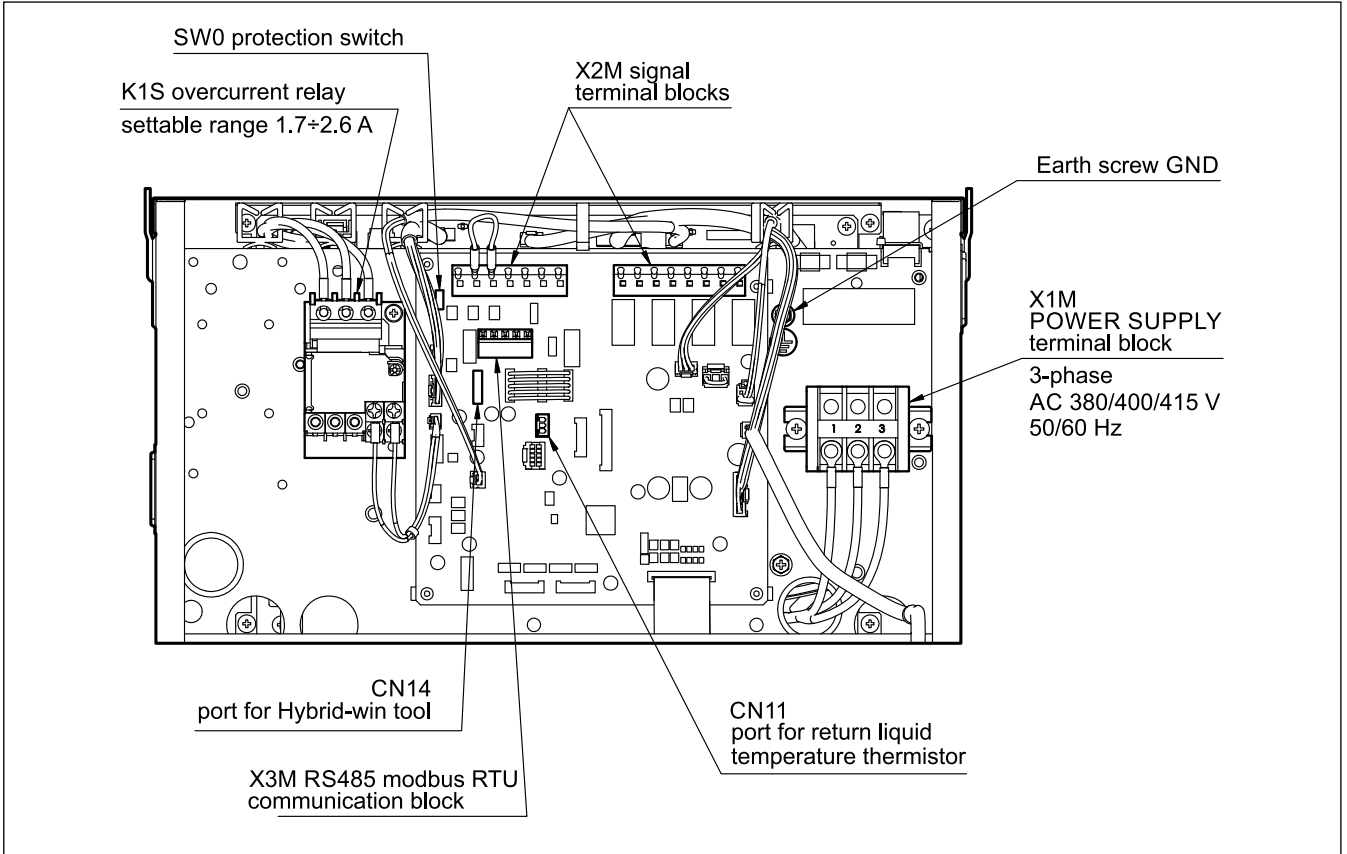
IN	Fluid inlet: 3/4" Rc
OUT	Fluid outlet: 3/4" Rc
DR	Drain pan (M6 plug)
1	Control panel
2	Switch box cover

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 thermistor (ambient temperature)
8	Wiring diagram label inside



## 8 - 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.



### 8.1 - EMC 2014/30/EU compliance

The AKW\* chillers 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 molded 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 the no surplus wire will come in contact with control circuit board, etc.

When conducting remote operation, remove the short-circuit wire between [10]-[11] and install an operation switch (to be prepared by the customer).

As the machine 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 operation manual.

The AKW\* chillers are equipped with an erroneous operation prevention switch (SW0) to make settings from control panel ineffective. Please refer to the operation manual for details.

### 8.2 - Cables

Main power connection (X1M, L1, L2 and L3)

AKW90, AKW92: 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  $\geq 2.5 \text{ mm}^2$ .

Over current relay (K1S, for pump motor)

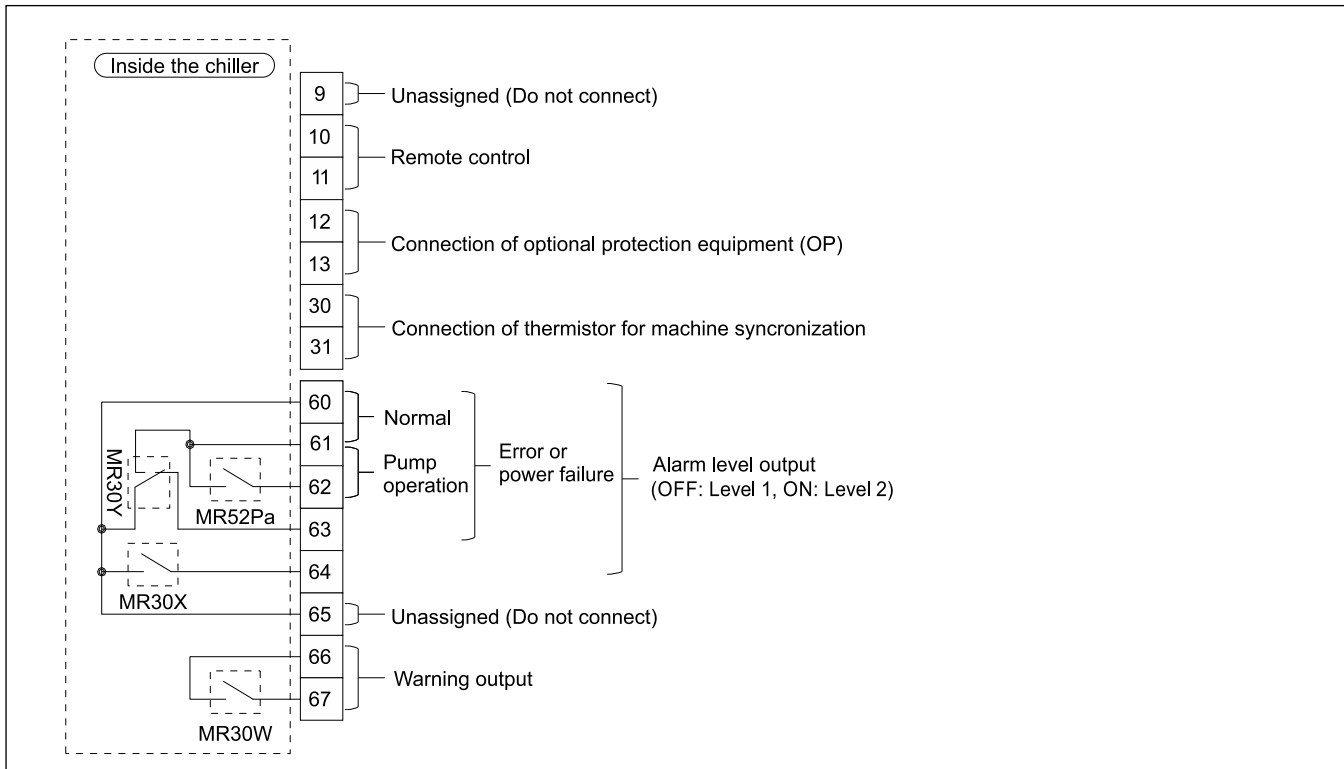
screw terminal M3.5. Use ring solderless terminal connection, cables with section  $\geq 1.5 \text{ mm}^2$ .

For signals (X2M) (X3M)

Use bar solderless terminal connection, use the stranded wire. 2-core cable, wires with section 0.5 to 1.5  $\text{mm}^2$ .

Shielded cables are recommended for thermistors with leads longer than 10 m and in areas with electrical noise.

### 8.3 - Connection to signal terminal block (X2M)



### X2M - terminal blocks

		description		function / notes
X2M	9		NC	Unused
	10	remote control	min load: 5 V DC, 1 mA max load: 24V 1A	To perform remote control, remove the short-circuit wire between [10] and [11] and install an operation switch (customer's charge)
	11			
	12	connection for optional protective device		The chiller can activate an alarm by receiving an output signal from external protection devices (e.g. flow switch, level switch). Parameter [n002]
	13			
	30	connection for machine synchronizing thermistor		Connection for optional thermistor Th1
	31			
	60	alarm / (pump) run output logic states		The output settings for the alarm output depend on the value set for parameter number [n001], for NORMAL status (run), alarm 1st level alarm (LOCK), 2nd level alarm, POWER FAILURE
	61			
	62			
	63			
	64			
65		NC		Unused
66	warning output	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	
67				



## 9 - IDENTIFICATION CODE OF MODELS WITH PUMP AND TANK

<b>AK</b>	<b>W</b>		<b>A</b>	<b>C</b>	<b>D</b>		<b>J</b>	<b>-</b>	<b>K***</b>
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High-accuracy inverter controlled chiller, circulation type

Cooling for water or ethylene glycol solution

Cooling capacity

**14** = 1.4 kW      **56** = 5.6 kW  
**32** = 3.2 kW      **90** = 9.0 kW  
**43** = 4.3 kW

Series No.

According to CE directives

Cover option:

**00** = without cover  
**50** = with cover (not available for AKW 56 and 90)

Pump and switch options, see table

CODE	switch + connector	pump type
<b>001</b>	-	15 l/min @ 2.0 bar <b>(standard)</b>
<b>002</b>	■	
<b>003</b>	-	25 l/min @ 4.0 bar
<b>004</b>	■	
<b>005</b>	-	40 l/min @ 4.0 bar <b>(NOTE)</b>
<b>006</b>	■	

**NOTE** : codes K005 and K006 are not available for chillers AKW\*\*ACD**50**

With RS485 modbus RTU communication port

## 10 - SPECIFICATIONS FOR MODELS WITH PUMP AND TANK

		AKW14	AKW32	AKW43	AKW56	AKW90
Cooling capacity ( <b>NOTE 1</b> , page 2)	kW	1.4	3.2	4.3	5.6	9.0
Supply power		3-phase AC 380/400/415 V 50/60 Hz				
Supply voltage main circuit control circuit		3-phase AC 380/400/415 V 50/60 Hz 12/24 V DC				
Max power consumption (400V 50/60 Hz)	kW	1.56	2.11	2.36	3.16	4.60
Max current consumption (400V 50/60 Hz)	A	3.0	3.9	4.3	5.6	8.8
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		0.55 kW x 2P				
Pump liquid head (50/60 Hz) *standard pump	m	26.5 / 38.5 ±7% at 10 l/min, 25.5 / 37.5 ±7% at 15 l/min, 24.0 / 35.0 ±7% at 25 l/min, 19.5 / 30.5 ±7% at 40 l/min				
Refrigerant control		Rotation speed control of compressor by inverter + electronic expansion valve opening				
Refrigerant gas R410A ( <b>NOTE 2</b> , page 2) filling q.ty CO <sub>2</sub> equivalents	kg	0.56 1.18	0.79 1.66	0.84 1.76	1.02 2.14	1.42 2.97
Cooling fluid whitstand pressure	bar	-				
Circulating volume rated range	l/min	10 6 ÷ 15	15 10 ÷ 20	15 10 ÷ 30	25 13 ÷ 30	40 25 ÷ 45
Noise level (front 1 m, height 1.55 m)	dB(A)	60	61	62	65	67
Applicable liquid		Industrial purpose purified water Ethylene glycol aqueous solution (50 vol% or less)				
Exterior color		Ivory white				
Mass	kg	63	68	69	109	137
Tank volume	l	10			20	
ELCB (mandatory, in the customer's charge)	A	10			15	20

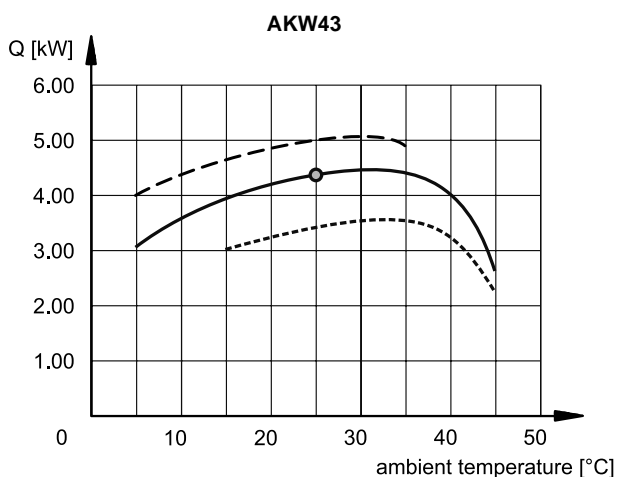
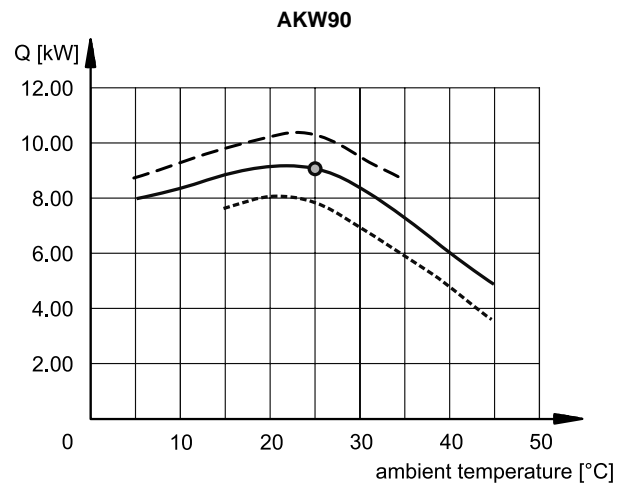
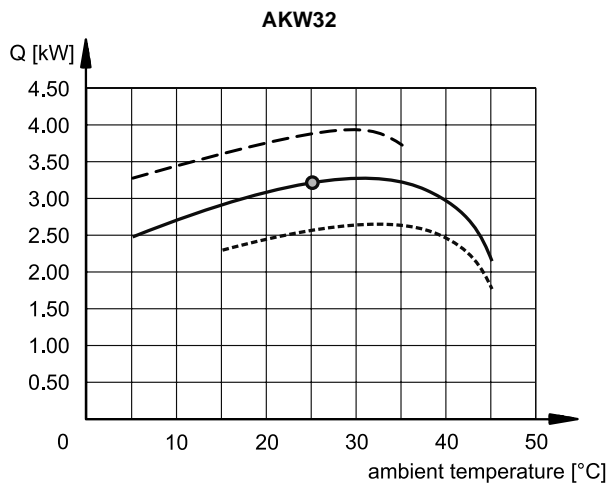
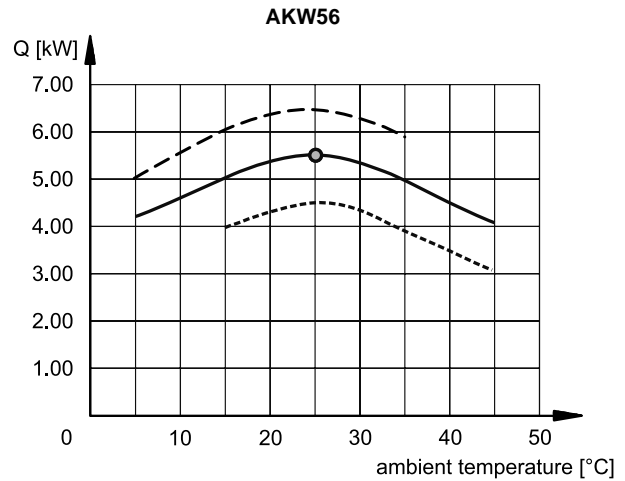
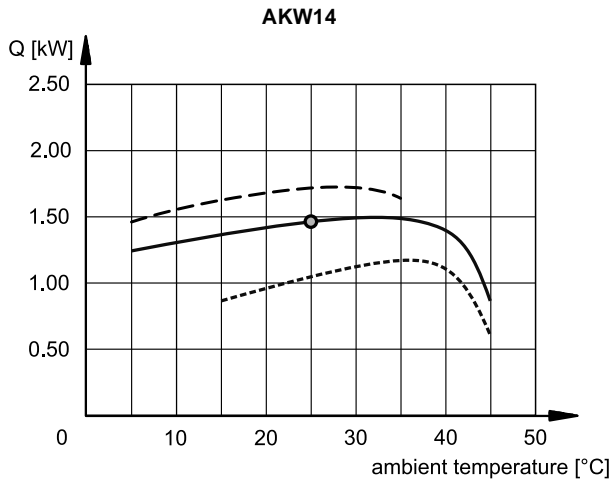


## 11 - CHARACTERISTICS AKW\* MODELS WITH PUMP AND TANK

Values obtained and rated for standard point with standard pump model, ambient temperature: 25 °C and fluid temperature: 25 °C. Fluid used: H<sub>2</sub>O.

### 11.1 - Temperature control

Cooling capacity (kW) according to the ambient temperature.



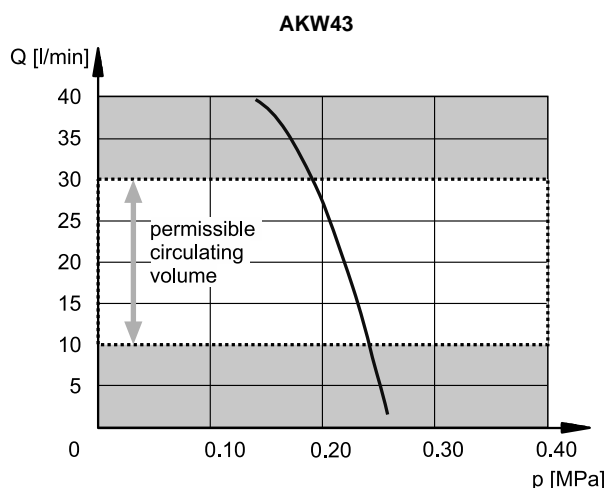
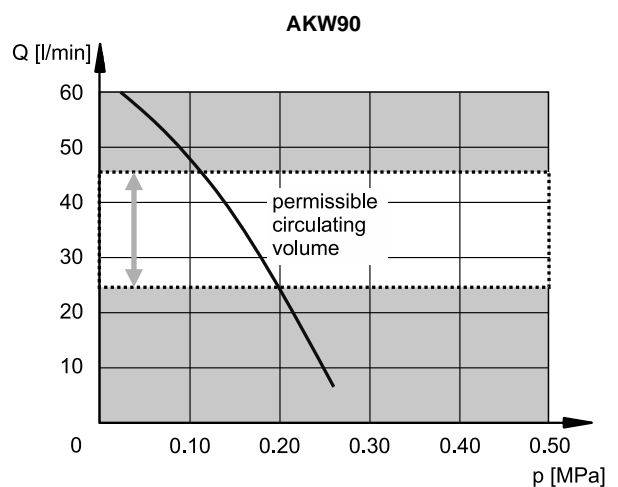
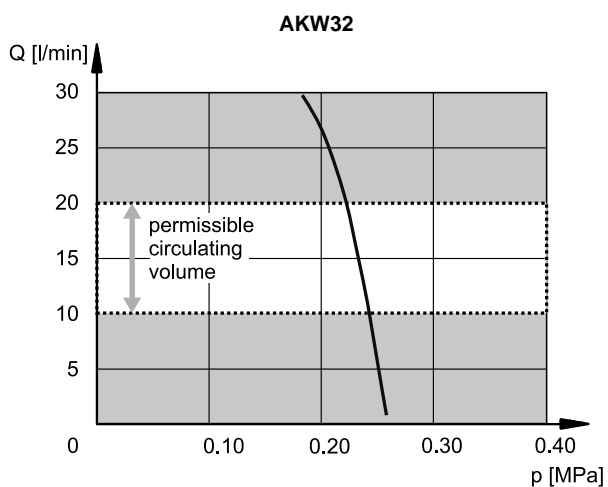
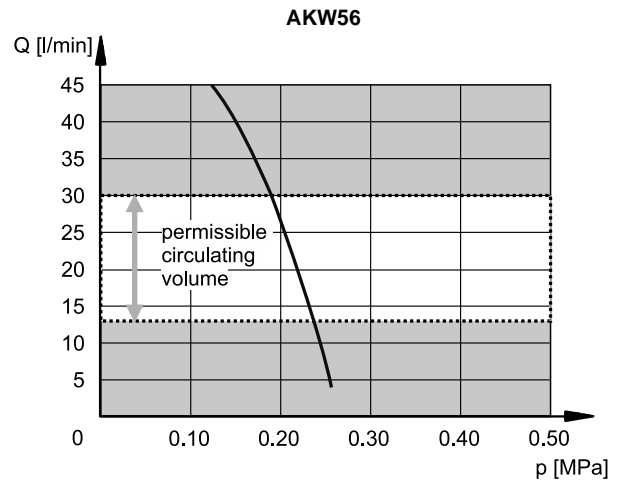
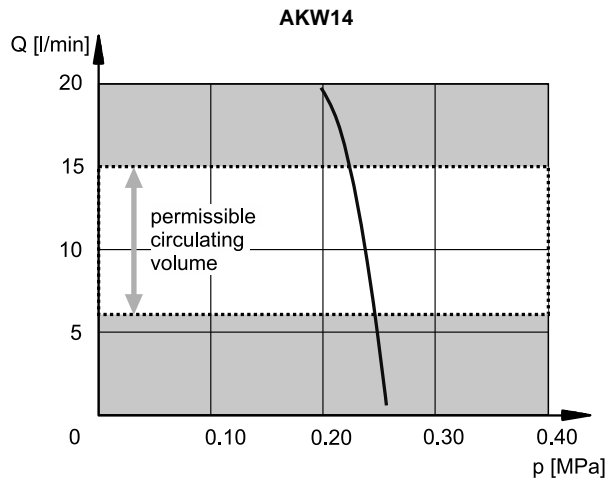
- H<sub>2</sub>O temperature = ambient temperature
- - - H<sub>2</sub>O temperature = ambient temperature + 10 °C
- ⋯ H<sub>2</sub>O temperature = ambient temperature - 10 °C
- standard point (H<sub>2</sub>O temperature and ambient temperature 25 °C)

### 11.2 - Pump flow rate characteristics

The following diagrams show the flow characteristics of the standard pumps with the internal pressure loss for the standard specifications taken into account (50 Hz).

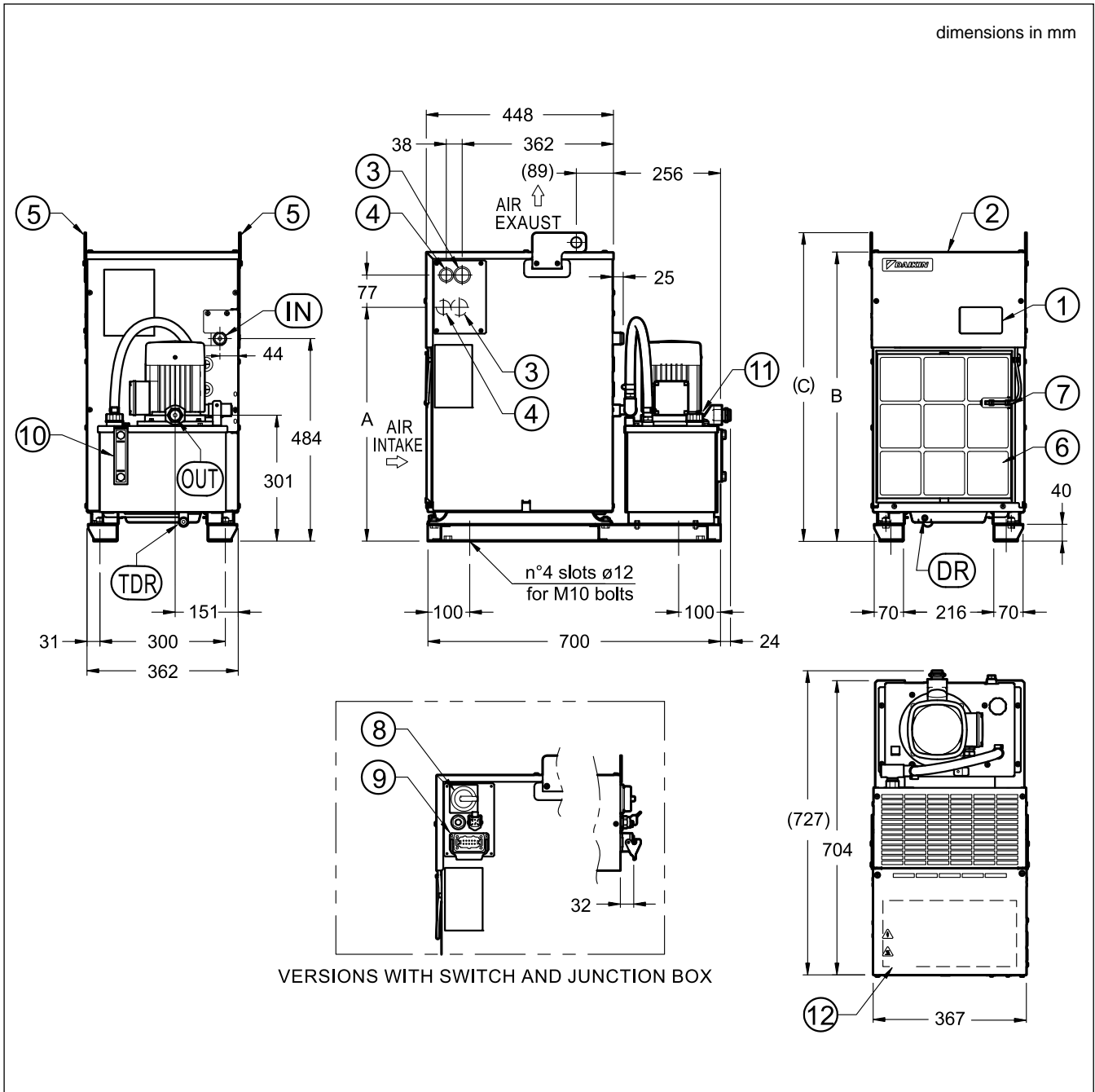
**NOTE:** The flow rate characteristics are for water. The flow rate characteristics are lower when cooling with ethylene-glycol solution.

Select diameters and lengths of pipe so as to keep the circulating volume within the permissible range. Pump flow characteristics outside the standard specifications can also be supported.



## 12 - OVERALL DIMENSIONS AND MOUNTING - MODELS WITH STANDARD PUMP AND TANK

### 12.1 - AKW14ACD00-K\*\*, AKW32ACD00-K\*\* and AKW43ACD00-K\*\*



IN	Fluid inlet: 1/2" Rc
OUT	Fluid outlet: 1/2" Rc
DR	Drain pan (M6 plug)
TDR	Tank drain: 3/8" Rc
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

**NOTE 1:** Do not place objects that hinder ventilation within 500 mm of the air-intake or exhaust.

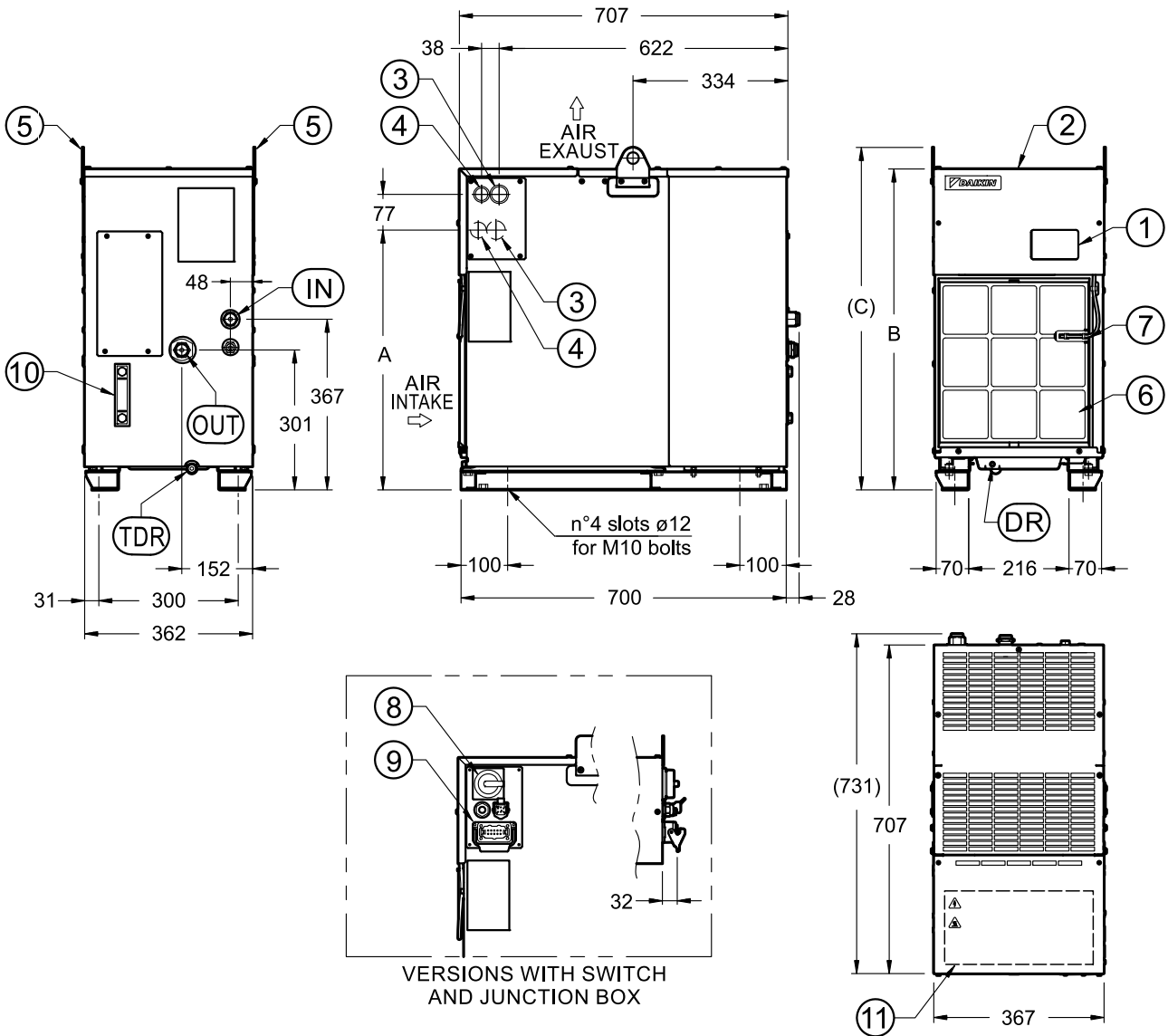
**NOTE 2:** Handle the chiller using both the 2 eye plates on the top.

7	Th3 thermistor (ambient temperature)
8	Power switch
9	Connection box
10	Fluid level indicator: Upper 10 L; lower 6 L
11	Charge and air breather
12	Wiring diagram label inside

	AKW14	AKW32	AKW43
A	560	685	785
B	690	815	915
C	740	865	965

12.2 - AKW14ACD50-K\*\*\*, AKW32ACD50-K\*\*\* and AKW43ACD50-K\*\*\*

dimensions in mm



VERSIONS WITH SWITCH AND JUNCTION BOX

IN	Fluid inlet: 1/2" Rc
OUT	Fluid outlet: 1/2" Rc
DR	Drain pan (M6 plug)
TDR	Tank drain: 3/8" Rc
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

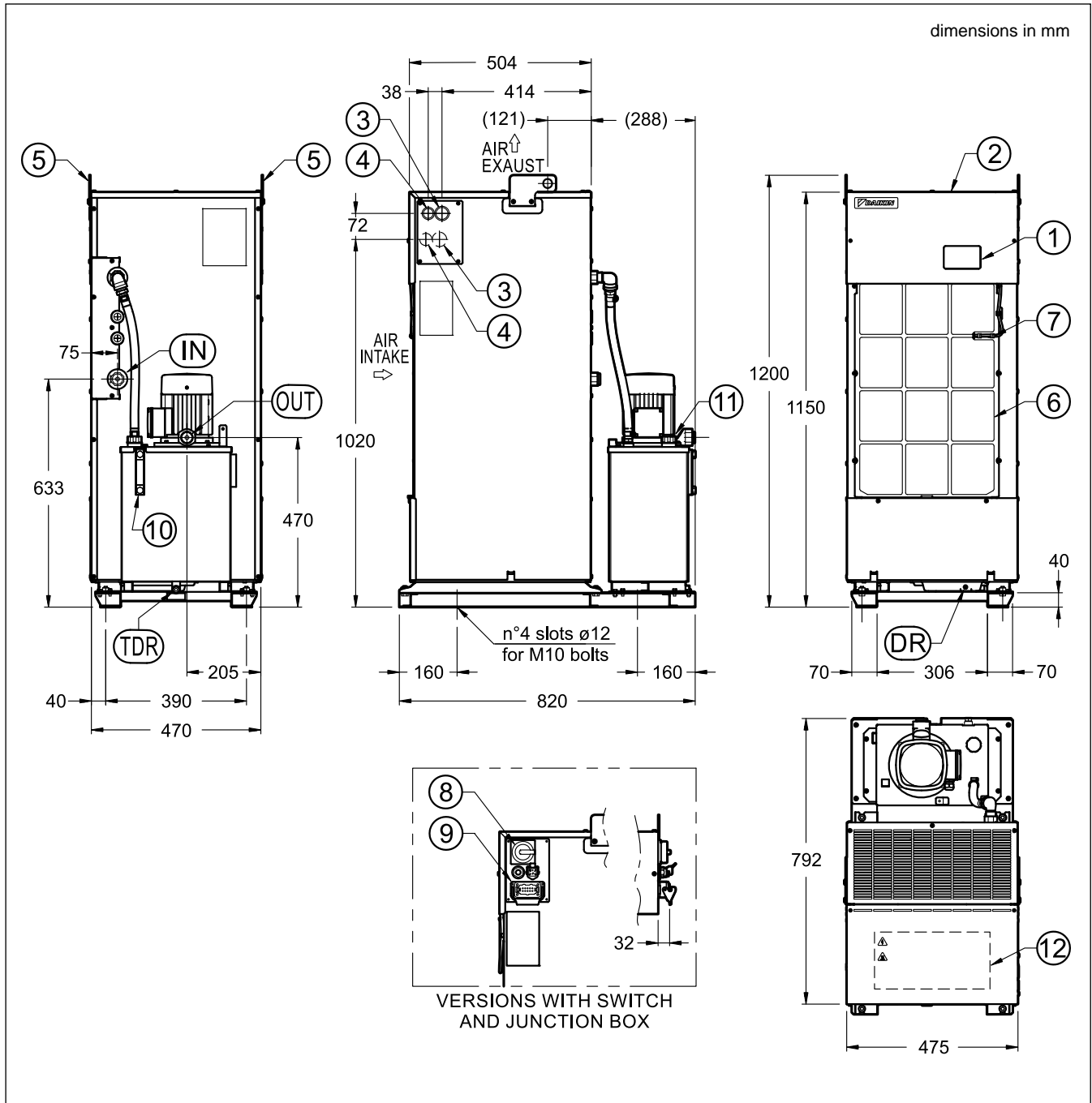
**NOTE 1:** Do not place objects that hinder ventilation within 500 mm of the air-intake or exhaust.

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

7	Th3 thermistor (ambient temperature)
8	Power switch
9	Connection box
10	Fluid level indicator: Upper 10 L; lower 6 L
11	Wiring diagram label inside

	AKW14	AKW32	AKW43
A	560	685	785
B	690	815	915
C	740	865	965

### 12.3 - AKW56ACD00-K\*\*\*



IN	Fluid inlet: 3/4" Rc
OUT	Fluid outlet: 3/4" Rp
DR	Drain pan (M6 plug)
TDR	Tank drain: 3/8" Rc
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

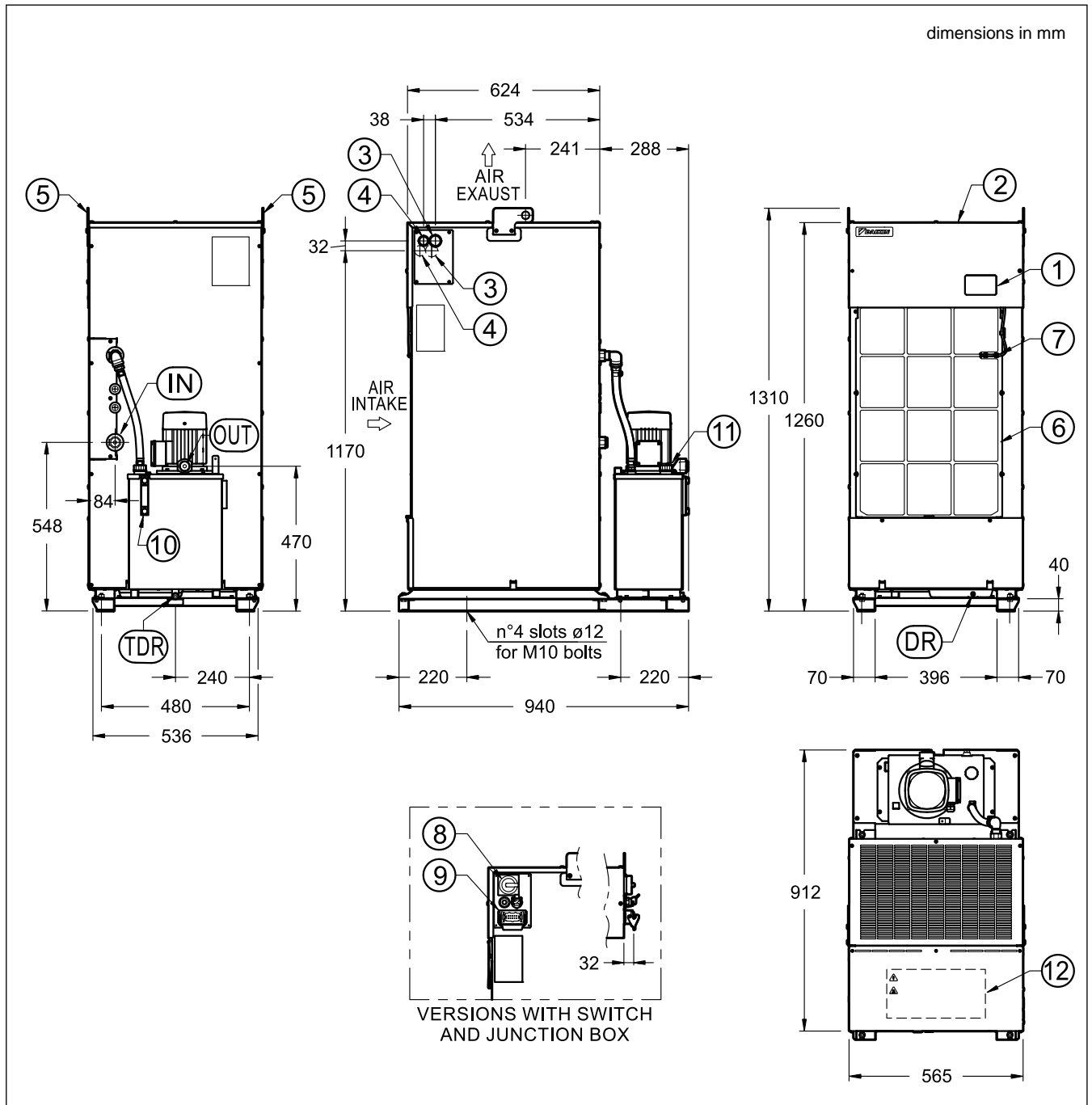
**NOTE 1:** Do not place objects that hinder ventilation within 500 mm of the air-intake or exhaust.

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

7	Th3 thermistor (ambient temperature)
8	Power switch
9	Connection box
10	Fluid level indicator: Upper 20 L; lower 16 L
11	Charge and air breather
12	Wiring diagram label inside



12.4 - AKW90ACD00-K\*\*\*



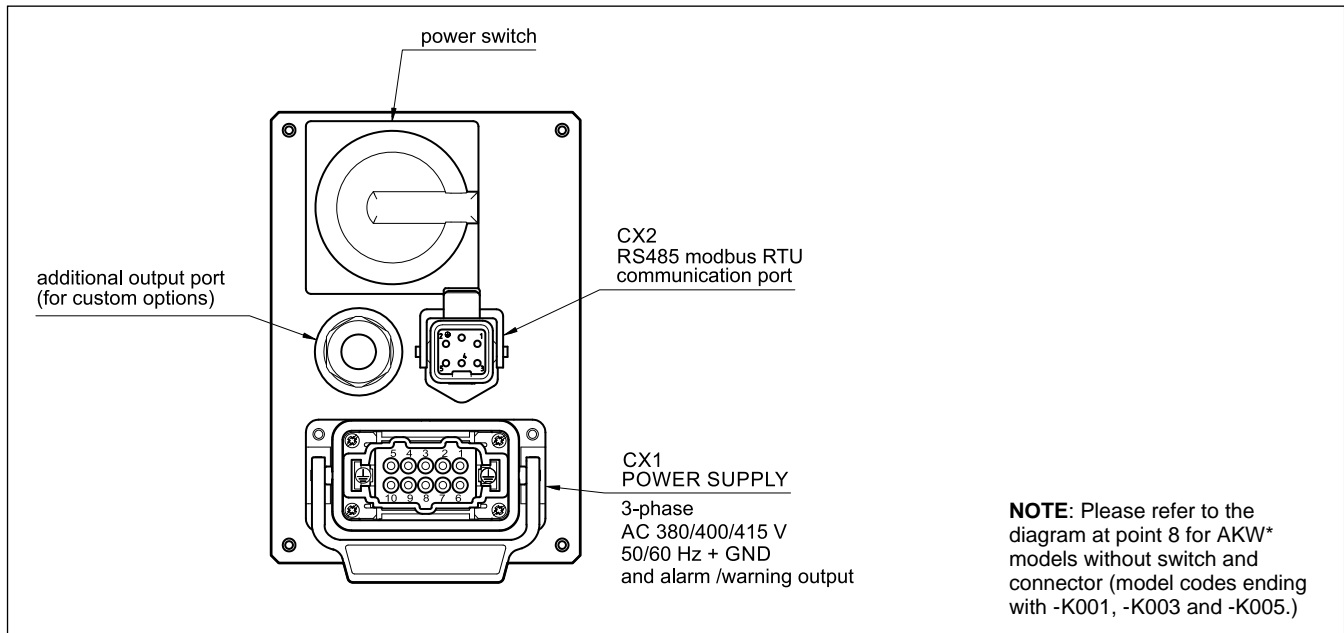
IN	Fluid inlet: 3/4" Rc
OUT	Fluid outlet: 3/4" Rp
DR	Drain pan (M6 plug)
TDR	Tank drain: 3/8" Rc
1	Control panel
2	Switch box cover
3	Power intake hole $\varnothing 28$ mm (right/left)
4	Signal intake hole $\varnothing 22$ mm (right/left)
5	Eye plate for handling
6	Air filter

**NOTE 1:** Do not place objects that hinder ventilation within 500 mm of the air-intake or exhaust.

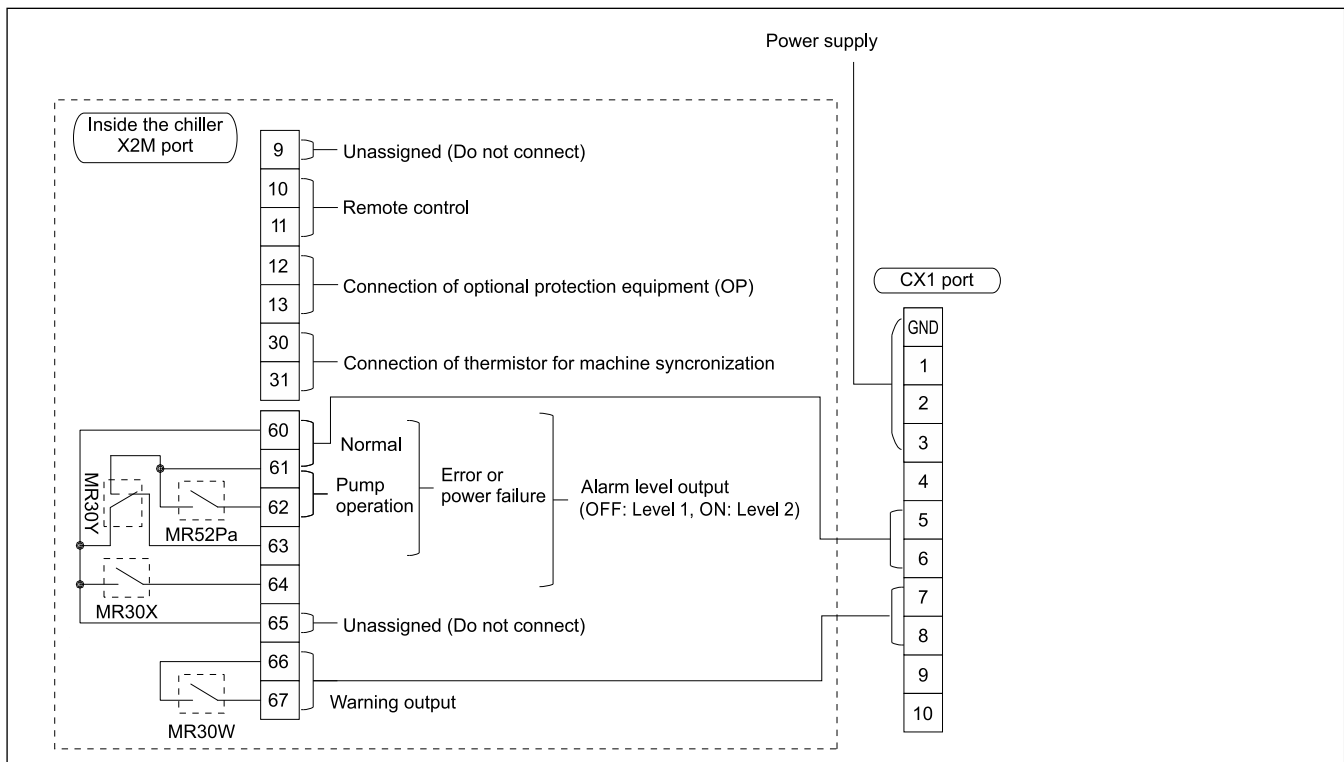
**NOTE 2:** Handle the chiller using both the 2 eye plates on the top.

7	Th3 thermistor (ambient temperature)
8	Power switch
9	Connection box
10	Fluid level indicator: Upper 20 L; lower 16 L
11	Charge and air breather
12	Wiring diagram label inside

## 13 - ELECTRICAL CONNECTIONS



### 13.1 - Connection to the internal board



		description		function / notes
CX1	1	power supply 3-phase AC 380/400/415 V 50/60 Hz		Main power supply
	2			
	3			
		GND		GND of the main power supply
	5	Alarm output	min load: 5V DC, 1 mA max load: 24V 1A	The output settings for the alarm / warning output depend on the value set for parameter number [n001], for NORMAL status (run), alarm 1st level alarm / warning (LOCK), 2nd level alarm / warning, POWER FAILURE
6	Warning output			
7				
	8			

### 13.2 - Cables

For signals in (CX1) use cable type: 4x0,5 mm<sup>2</sup> 300/500V

For the power connection (CX1) use cable type: 4G 2,5 mm<sup>2</sup> 600/1000V. For AKW90, AKW92 use cables with 4-wires, with section  $\geq 4$  mm<sup>2</sup>.

For RS485 Modbus RTU port (CX2) use cable 5G 0,5 mm<sup>2</sup> 300/500V shielded

Shielded cables are recommended for thermistors with leads longer than 10 m and in areas with noise.

### 13.3 - EMC 2014/30/EU compliance

The AKW\* chillers with pump and tank 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 molded 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 the discharge of the internal high voltage has been completed. Do not connect power supply while the electrical equipment box is left unclosed.

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

When conducting remote operation, remove the short-circuit wire between [10]-[11] in the X2M port (inner board) and install an operation switch (to be prepared by the customer).

As the machine 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 operation manual.

The AKW\* chillers are equipped with an erroneous operation prevention switch (SW0) to make settings from control panel ineffective. Please refer to the Instruction Manual for details.

## 14 - DEVICE SETUP



The AKW\* chillers are configurable through the display, from which it is always possible to set and monitor parameters and alarms. Only the AKW\* chiller units with communication option (J option in the identification code) allow remote control from the main machine control board.

### 14.1 - Communication function (J option)

This option features the communication function through the RS485 interface to enable data transmission/reception with a host computer, PLC (programmable logic controller), touchscreen, etc. The maximum permissible length for communication wiring is 200 m (total extension). The communication data format is defined according to the Modbus protocol. The chiller operates as a slave station.

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

### 14.2 - 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. The connection to the machine is done by an harness to be connected on the the main board, inside the unit control panel to a device with the Hybrid-win software installed.

The software is compliant with Microsoft Windows OS.

The connection between the chillers and the PC requires a cable connection kit, that can be ordered separately. See point 15.

The Hybrid-win software and the additional literature for the AKW units without pump and tanks can be easily downloaded from the Customer's page inside the product section at [www.hyd.daikin.com](http://www.hyd.daikin.com)

### 14.3 - Parameters table

Please refer to the *Instruction Manual* delivered with the product for a complete list of parameters and their settings.

## 15 - ACCESSORIES

Optional thermistors for machine temperature synchronization control are available. They are sold separately and their assembly on the power unit is in the Customer's charge. The cable kit for Hybrid-win connections is also available. Please contact our Sales Dept.

## 16 - INSTALLATION NOTES

### 16.1 - Handling, machine side

- When rough transport conditions are expected, special precautions should be taken in the packaging and transportation method so as to avoid the application of excessive force on the chiller.
- The chiller does not incorporate a flow switch for checking the fluid supply or a temperature switch for abnormal temperature (high temperature or low temperature) of the fluid supplied. So, please provide protection devices such as a flow switch and temperature switch at the machine side.

### 16.2 - Operation and cooling capacity

- Before operating this unit, be sure to read the operation manual and properly understand it.
- Do not use the chiller to cool a fluid from 45°C or higher. Start running the chiller at the same time as the machine or before the fluid temperature rises to 40°C.
- **Do not place objects** that hinder ventilation **within 500 mm of the air-intake or exhaust.**
- If the air filter is clogged, the cooling capacity will be reduced. Clean the air filter (wash with warm water or clean with air) periodically once every two weeks to prevent clogging.

### 16.3 - Coolant Water quality standard

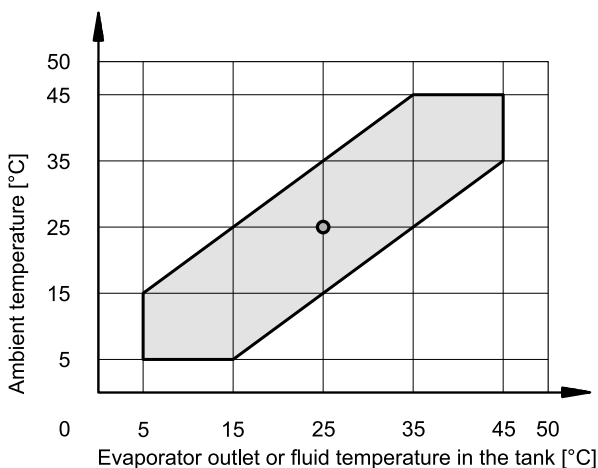
Use clean, fresh water that satisfies the water quality standards (including for that for dilution of ethylene-glycol solution) as indicated in the table below. Even if the standards are satisfied, there is no guarantee that corrosion will be completely prevented.

(source: Guideline of Water Quality for Refrigeration and Air Conditioning Equipment (JRA-GL-02-1994).)

	Item		Unit	Standard Value	Tendency	
					Corrosion	Scale Generation
Standard items	pH (25°C)		-	6.0 to 8.0	■	■
	Electrical conductivity (25 °C)		mS/m	max 30	■	■
	Chloride ion	Cl <sup>-</sup>	mg/l	max 50	■	
	Sulfate ion	SO <sub>4</sub> <sup>2-</sup>		max 50	■	
	Acid consumption (pH 4.8)	CaCO <sub>3</sub>		max 50		■
	Total hardness	CaCO <sub>3</sub>		max 70		■
	Calcium hardness	CaCO <sub>3</sub>		max 50		■
	Ionic silica	SiO <sub>2</sub>		max 30		■
Iron	Fe	mg/l		max 0.3	■	■
Copper	Cu			max 0.1	■	
Sulfate ion	S <sup>2-</sup>		not to be detected	■		
Ammonium ion	NH <sub>4</sub> <sup>+</sup>		max 0.1	■		
Residual chlorine	Cl		max 0.3	■		
Free carbon dioxide	CO <sub>2</sub>		max 4.0	■		

**NOTE:** Bullet in a row indicates that the relevant factor is associated with the tendency for corrosion or scale formation.

### 16.4 - Operating temperature range



- Admissible operating temperature range. Operation outside of this range may cause unit failure.
- Standard point (H<sub>2</sub>O temperature and ambient temperature 25 °C)

## 17 - INSTRUCTION FOR SAFE OPERATION

### General instructions

- 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 Defense Law).
- Caution 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 2,000 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 30 degrees.

### Instructions for installation

- Install the equipment on a rigid, level foundation and secure it appropriately.
- Do not place an object near the suction port or discharge port of the equipment.

### Instructions for wiring and piping installation

- Wiring and piping installation should be performed by a person with specialized knowledge and skills.
- Always use a commercial power supply for the power source: the use of an inverter power supply may cause burn damage.
- Connect the wiring for power supply in accordance with the electric wiring instruction diagram of the specification sheet and operation manual.
- Ground the equipment properly.
- Install the wiring in accordance with the standard by checking the electric wiring diagram.

- Always install a dedicated all-pole (3-pole) earth leakage breaker appropriate for the capacity of the chiller on the main power supply on site.
- Check to see that the fluid piping has a pressure resistance of 1 MPa or more and install the piping appropriately.

### Instructions for trial run

- Check that the machine is in a safe status (not activated) before starting the trial run.
- Check that the oil piping and electric wiring are correctly connected to the machine and that there is no leakages in connections and joints.
- Disable the operation lock of the chiller before starting the main machine.
- Check that the fluid piping system contains the required amount of fluid, and that the piping is not blocked part way through.

### Instructions during operation

- Do not splash water or liquid on the chiller.
- Do not push your finger or an object into gaps of the chiller.
- Do not touch the heated exhaust port of the chiller.

### Instructions for maintenance and inspection

- Perform maintenance and inspection of the chiller in a properly ventilated environment. Working in a closed environment may result in suffocation due to the leak of refrigerant.
- 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 chiller with its cover opened.
- Wear protective gear such as gloves and an eye protector when performing maintenance, inspection and cleaning.
- Clean the air filter periodically (once every two weeks in general).
- Ensure that the water quality and concentration of the fluid meet the standards at all times.
- Check the fluid level in the tank and ensure that it is between the yellow line and the red line.
- Inspect the underneath (drain pan) of the chiller once every six months, and if fluid has accumulated, discharge it through the drainage port.

### Selection Method for Chillers

- Select a chiller with a cooling capacity 20 to 30% larger than the amount of heat generated by the machine tool.
- Since the cooling capacity of chillers 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 chiller.



**AKW\***  
SERIES 10

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