Polar Comfort

DC INVERTER air- water heat pump

Developed by Polar Kulde AS

OUTDOOR UNIT: **8,6 kW**

TECHNICAL & SERVICE MANUAL

www.polarkulde.com

Important!

Please Read Before Starting

This air- water heatpump system meets strict safety and operating standards. As the installer or service person, it is an important part of your job to install or service the system so it operates safely and efficiently.

For safe installation and trouble-free operation, you must:

- Carefully read this instruction booklet before beginning.
- Follow each installation or repair step exactly as shown.
- Observe all local, state, and national electrical codes.
- Pay close attention to all warning and caution notices given in this manual.

WARNING **This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.**

CAUTION **This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.**

If Necessary, Get Help

These instructions are all you need for most installation sites and maintenance conditions. If you require help for a special problem, contact our sales/service outlet or your certified dealer for additional instructions.

In Case of Improper Installation

The manufacturer shall in no way be responsible for improper installation or maintenance service, including failure to follow the instructions in this document.

Special Precautions

WARNING When Wiring

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ONLY A QUALIFIED, EXPERIENCED ELECTRICIAN SHOULD ATTEMPT TO WIRE THIS SYSTEM.

- Do not supply power to the unit until all wiring and tubing are completed or reconnected and checked.
- Highly dangerous electrical voltages are used in this system. Carefully refer to the wiring diagram and these instructions when wiring. Improper connections and inadequate grounding can cause accidental injury or death.
- Ground the unit following local electrical codes.
- Connect all wiring tightly. Loose wiring may cause overheating at connection points and a possible fire hazard.

When Transporting

Be careful when picking up and moving watertank and outdoor units. Get a partner to help, and bend your knees when lifting to reduce strain on your back. Sharp edges or thin aluminum fins on the air conditioner can cut your fingers.

When Installing…

…In a Ceiling or Wall

Make sure the ceiling/wall is strong enough to hold the unit's weight. It may be necessary to construct a strong wood or metal frame to provide added support.

…In a Room

Properly insulate any tubing run inside a room to prevent "sweating" that can cause dripping and water damage to walls and floors.

…In Moist or Uneven Locations

Use a raised concrete pad or concrete blocks to provide a solid, level foundation for the outdoor unit. This prevents water damage and abnormal vibration.

…In an Area with High Winds

Securely anchor the outdoor unit down with bolts and a metal frame. Provide a suitable air baffle.

…In a Snowy Area (for Heat Pump-type Systems)

Install the outdoor unit on a raised platform that is higher than drifting snow. Provide snow vents.

When Connecting Refrigerant Tubing

- Use the flare method for connecting tubing.
- Apply refrigerant lubricant to the matching surfaces of the flare and union tubes before connecting them, then tighten the nut with a torque wrench for a leak-free connection.
- Check carefully for leaks before starting the test run.

When Servicing

- Turn the power off at the main power box (mains) before opening the unit to check or repair electrical parts and wiring.
- Keep your fingers and clothing away from any moving parts.
- Clean up the site after you finish, remembering to check that no metal scraps or bits of wiring have been left inside the unit being serviced.

Others

CAUTION

- Ventilate any enclosed areas when installing or testing the refrigeration system. Escaped refrigerant gas, on contact with fire or heat, can produce dangerously toxic gas.
- Confirm upon completing installation that no refrigerant gas is leaking. If escaped gas comes in contact with a stove, gas water heater, electric room heater or other heat source, it can produce dangerously toxic gas.

TABLE OF CONTENTS

1.

1-1 Unit specification

Outdoor Unit Polarcomfort 8,6

Power Source			220–240V ~ 50Hz		220V ~ 60Hz	
Voltage rating			230V		220V	
Performance				Heating		Heating
Capacity		kW		7.2 (1.7 - 8.6)		7.2 (1.7 - 8.6)
		BTU/h		29,300		29,300
Air circulation (High)		m^3/h	2,400		2,400	
Electrical Rating				Heating		Heating
Available voltage range		V	198 ~ 264		198 ~ 242	
Running amperes		A		10.7 (Max.15.5)		10.7 (Max.15.5)
Power input		W		2,500		2,500
Power factor		%		93		93
C.O.P.		W/W		3.8		3.8
Starting amperes		A	10.6		10.6	
Features						
Controls			Microprocessor			
Fan speeds			Auto (Hi, Lo)			
Compressor			Twin Rotary (DC inverter)			
Refrigerant / Amount charged at shipment		kg	R410A / 3,0			
Refrigerant control			Electric Expansion Valve			
Operation sound pressure level		Hi dB-A		49		49
Refrigerant tubing connections			Flare type			
Max. allowable tubing length		m	20			
Refrigerant tube diameter	Narrow tube	mm (in.)	6.35(1/4)			
	Wide tube	mm (in.)	9.52(3/8)			
Dimensions & Weight						
Outdoor Unit dimensions	Height	mm	730			
	Width	mm	940			
	Depth	mm	340			
Watertank dimensions	Height	mm	2060			
	Width	mm	590			
Weight	Heat pump	kg	69			
	Watertank	kg	75			

DATA SUBJECT TO CHANGE WITHOUT NOTICE.

Operating range outdoor unit -18°c / +30°c. Floorheating +25°c / 45°c. Tapwater +65°c / 95°c.

1. Rating conditions are:

Heating : Water temperature 35/30°C
Outdoor air temperature 7°C D.B. / 6°C W.B.

1-2 Major Component Specifications.

Outdoor Unit Polarcomfort 8,6

Control PCB / HIC PCB / Filter PCB		**Pow–CM5A1–C–T / CR-HIC30A2-C-T / POW- CM5B1-C-T**
Compressor		
Type		DC Twin Rotary (Hermetic)
Compressor model		C – 7RVN153H0W 80851080
Compressor oil … Amount	cc	FVC68S … 650
Coil resistance (Ambient temp. 25º C)	Ω	R – S: 0,788 S – T: 0,788 T – R: 0,788
Safety devices CT (Peak current cut-off control) Compressor discharge temp. control Operation cut-off control in abnomal ambient temp.		 YES YES -
Run capacitor	pF VAC	- -
Crankcase heater		18W 240V
Fan & Fan Motor		
Type		Propeller
Q`ty … Dia.	mm	1 … ø460
Fan motor model … Q`ty		KFC6S-61C4P-C …1
No. Of poles … rpm 220V, High)		6 … 670
Nominal output	W	60
Coil resistance (Ambient temp. 20º C)	Ω	WHT – BRN: 82,02 WHT – YEL: 41,94 YEL – PNK: 18,97
Safety devices Type Operating temp. Open Close	 ºC ºC	Thermal protector 130 ± 8 79 ± 15
Run capactitor	pF WAC	4 440
Heat Exchanger Coil		
Coil		Aluminum plate fin / Copper tube
Rows		2
Fin pitch	mm	1,4
Face area	m^2	0,630
External Finish		Acrylic baked-on enamel finish

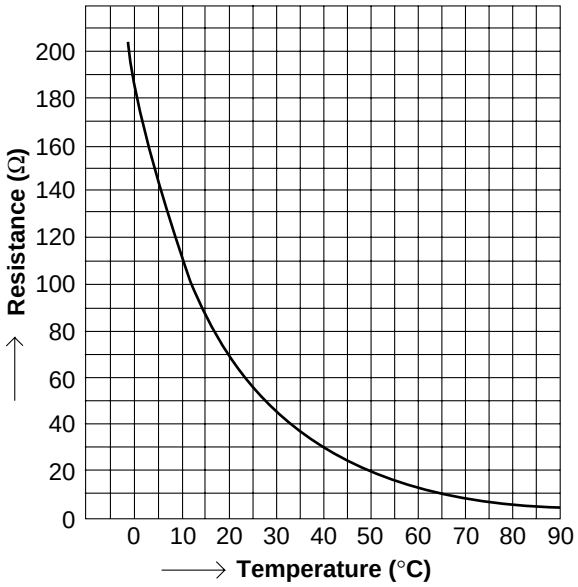
Control PCB

Part No.	POW-K5DHV5-A1
Controls	Microprocessor
Control circuit fuse	2,50V 3,15A

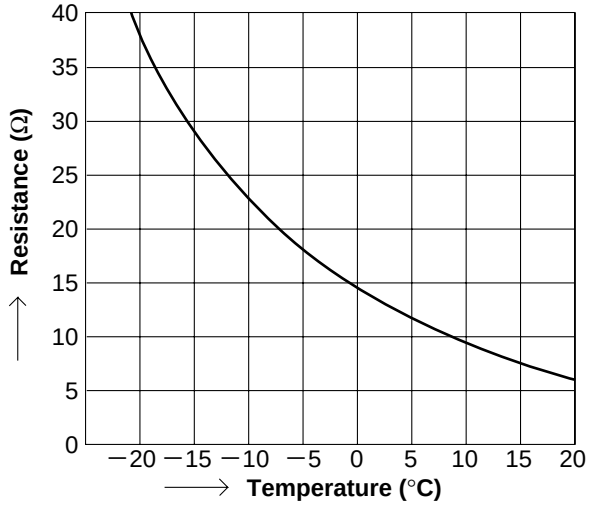
1-3. Other Component Specifications

Outdoor Unit

• Compressor temp sensor

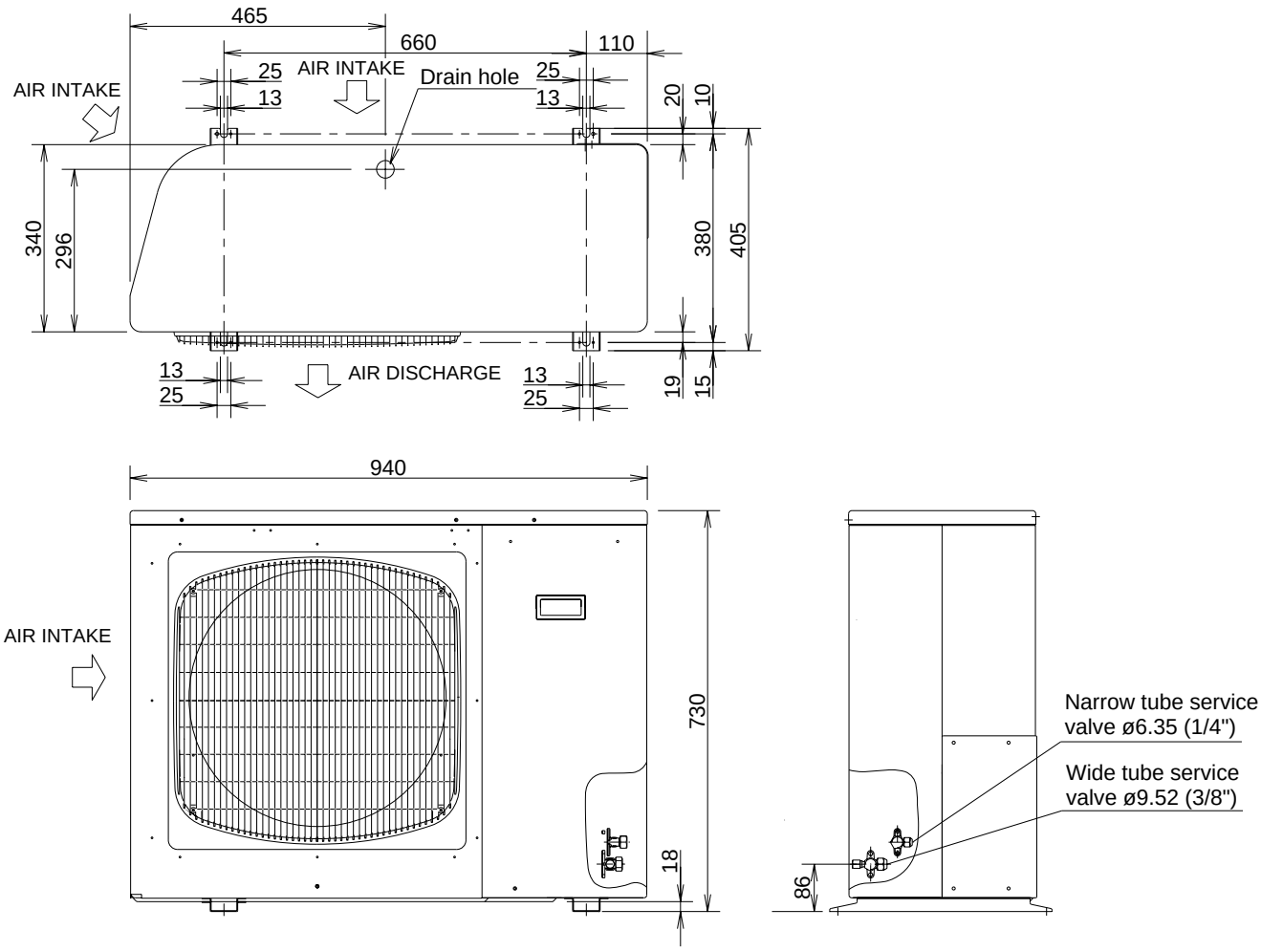


• Outdoor air temp sensor
• Outdoor heat exchanger sensor
• Narrow tube sensor
• Wide tube sensor



2. DIMENSIONAL DATA

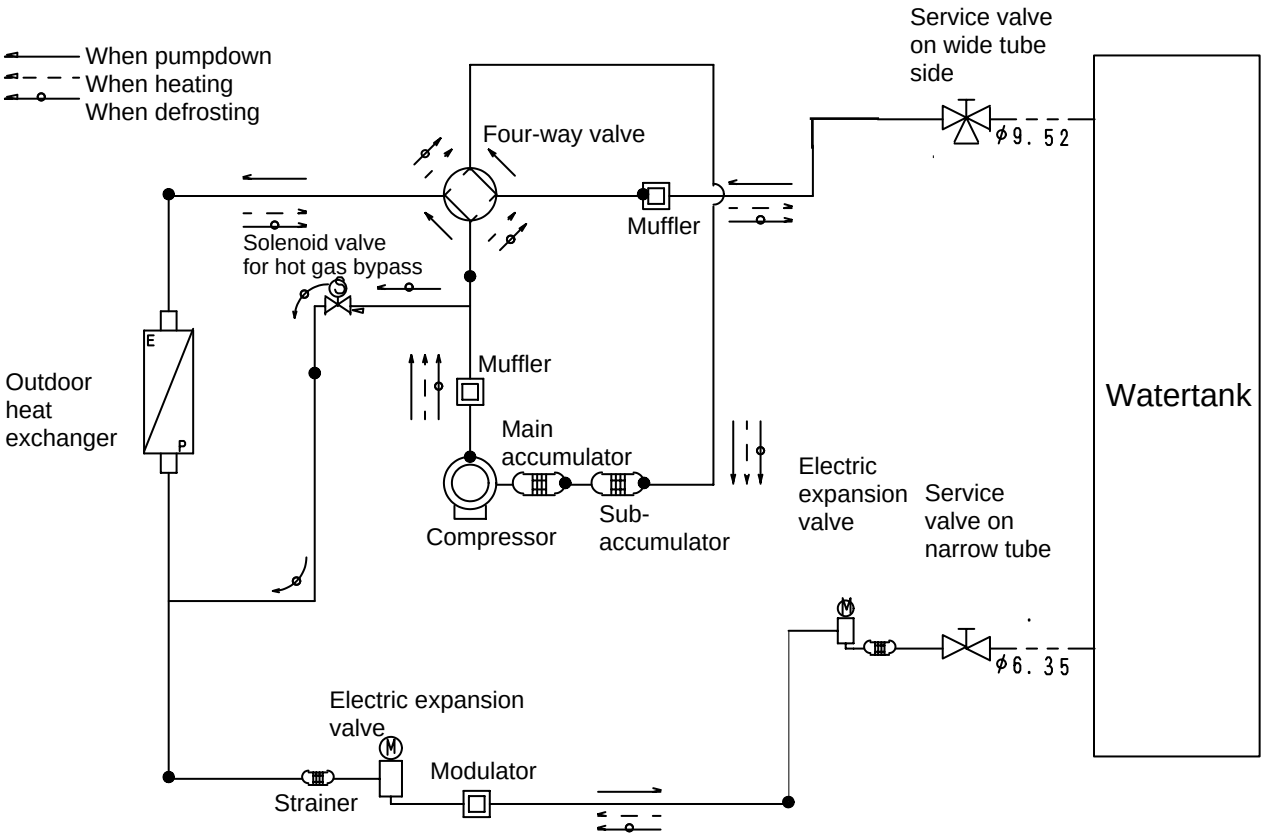
Outdoor Unit Polarcomfort 8,6



Unit: mm

3. REFRIGERANT FLOW DIAGRAM

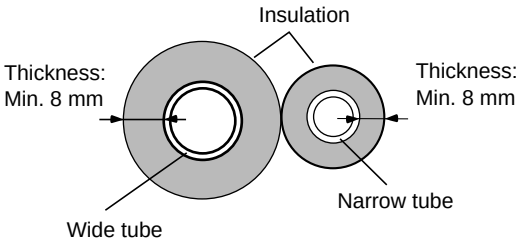
Outdoor Unit Polarcomfort 8,6



Insulation of Refrigerant Tubing

IMPORTANT

Because capillary tubing is used in the outdoor unit, both the wide and narrow tubes of this air conditioner become cold. To prevent heat loss and wet floors due to dripping of condensation, **both tubes must be well insulated** with a proper insulation material. The thickness of the insulation should be a min. 8 mm.



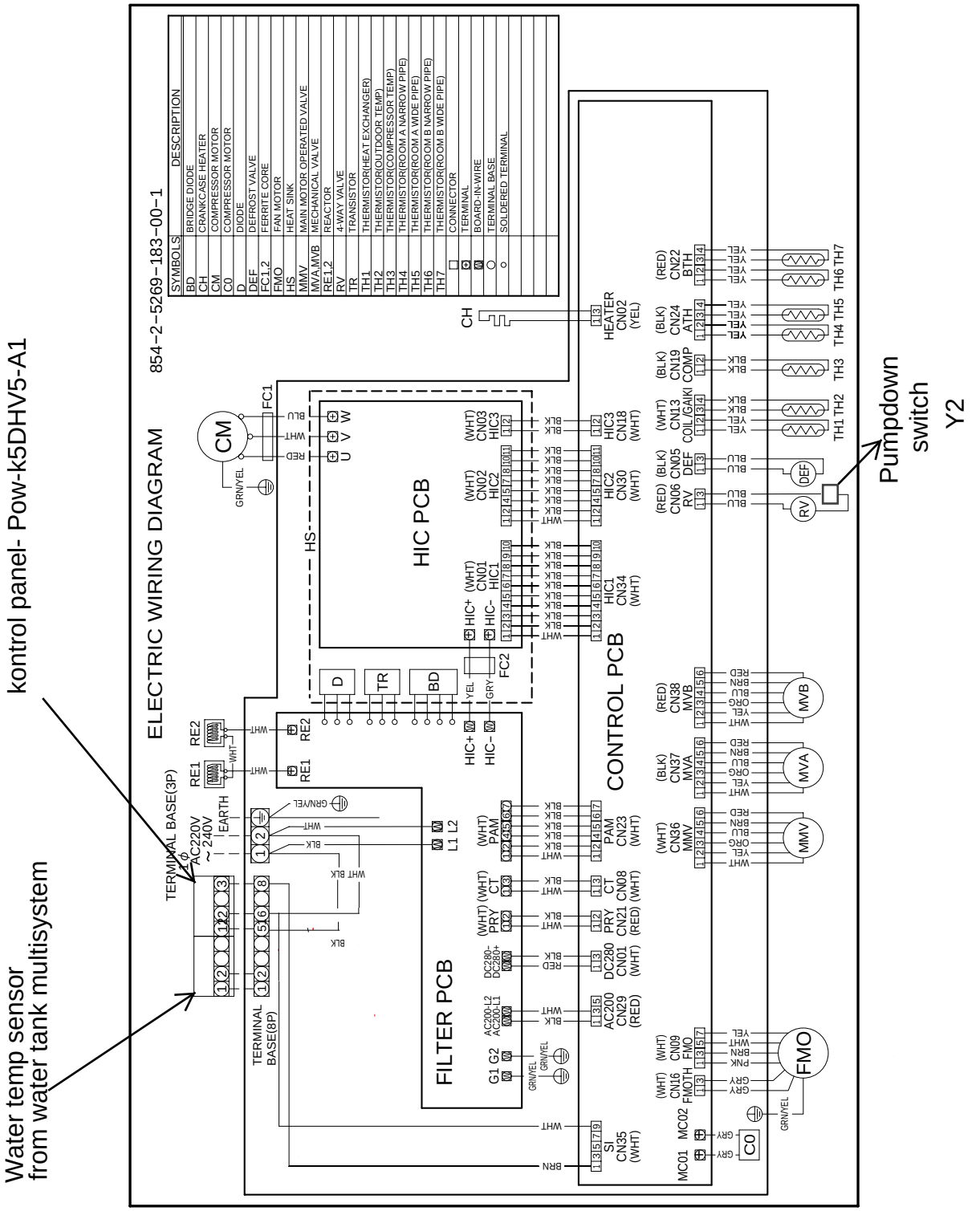
CAUTION

After a tube has been insulated, never try to bend it into a narrow curve because it can cause the tube to break or crack.

4. ELECTRICAL DATA

4-1. Electric Wiring Diagrams

Electric Wiring Diagram for outdoor unit Polarcomfort 8,6



CAUTION

Before replacing PCBs, turn off the power and check that all lamps on the PCB are off before starting work. Electric shock will occur if work is performed while the lamps are lit.

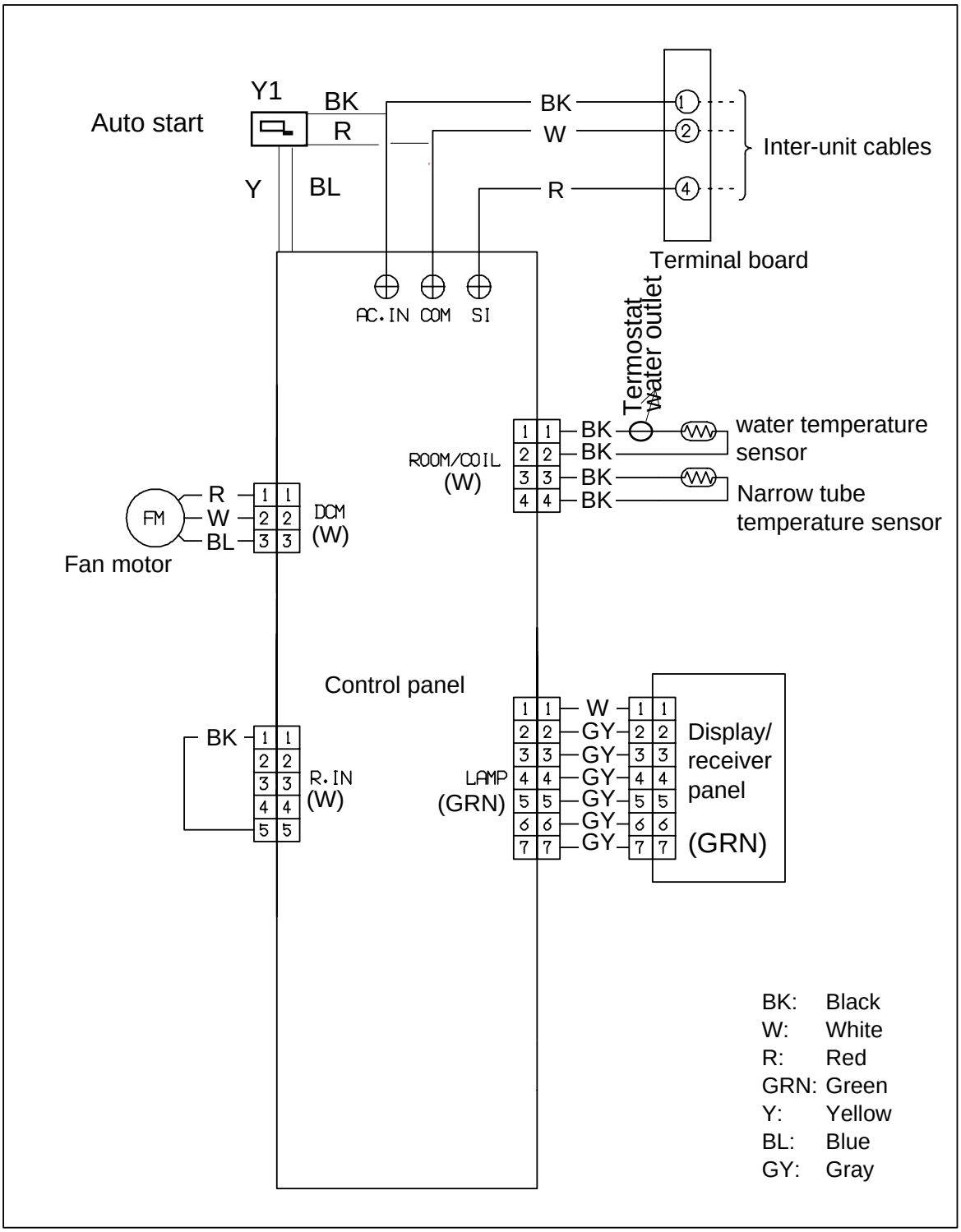
Electric Shock

4. ELECTRICAL DATA

4-2. Electrical Characteristics

Control panel **POW-K5DHV5-A1**

WARNING ***To avoid electrical shock hazard, be sure to disconnect power before checking, servicing and/or cleaning any electrical parts.***



5. INSTALLATION INSTRUCTIONS

Installation Site Selection

5-1. Indoor Unit

WARNING **To prevent abnormal heat generation and the possibility of fire, do not place obstacles, enclosures and grilles in front of or surrounding the heatpump in a way that may block air flow.**

Max allowable tubing length L1 20 m.

Limit of elevation difference H1 10 m.

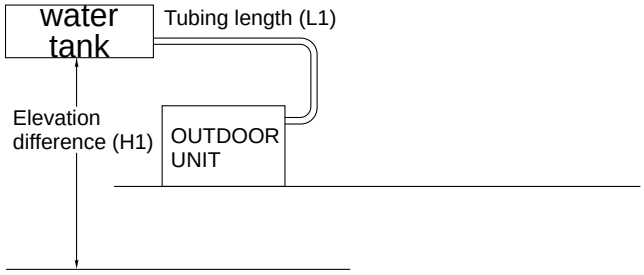


Fig. 1

5-2. Outdoor Unit

AVOID:

- heat sources, exhaust fans, etc. (Fig. 3)
- damp, humid or uneven locations.

DO:

- choose a place as cool as possible.
- choose a place that is well ventilated.
- allow enough room around the unit for air intake/ exhaust and possible maintenance. (Fig. 4a)
- provide a solid base (level concrete pad, concrete block, 15 × 40 cm beams or equal), a minimum of 15 cm above ground level to reduce humidity and protect the unit against possible water damage and decreased service life. (Fig. 4a)
- install cushion rubber under unit's feet to reduce vibration and noise. (Fig. 4b)
- use lug bolts or equal to bolt down unit, reducing vibration and noise.
- select a location where the operating noise and air blowing from the outdoor unit will not disturb neighbors.
- select a location where the clearance indicated by ⇔ in the installation diagram is ensured for the front, rear, left, and right of the main unit.
- install so that the unit is level.
- select a location that can fully support the weight of the outdoor unit, and that will not magnify operating noise or vibration.
  (Fasten in place with the anchor bolts (M10).)
- provide a base using concrete or similar material, and ensure proper drainage.
- select a location where there is no danger of flammable gas leakage.
- in snowy or rainy regions, be sure to construct a roof to keep off the snow and rain, and inhibit freezing and condensation.
- select a location that is at least 3 meters away from any antennas used for television, radio transceiver, or other equipment.
- for purposes of future service and repair, select a location where the inspection panel can be removed.
- select a location where the drain port will not be obstructed.

Install the inter-unit cable more than 1 meter away from any antenna or power lines or connecting wires used for television, radio, telephone, security system, or intercom. Electrical noise from any of these sources may affect operation.

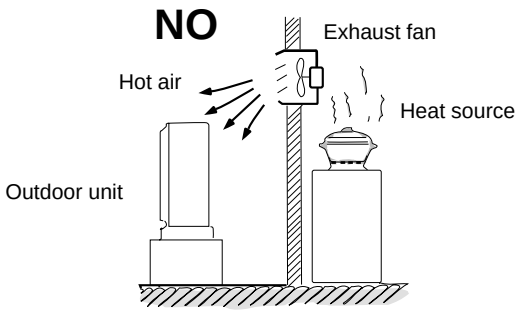
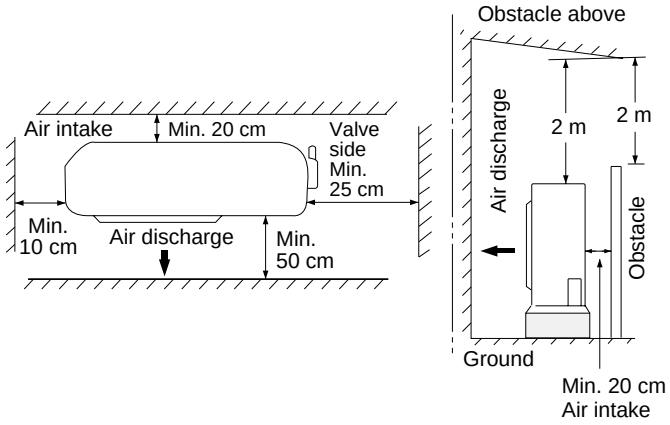


Fig. 3



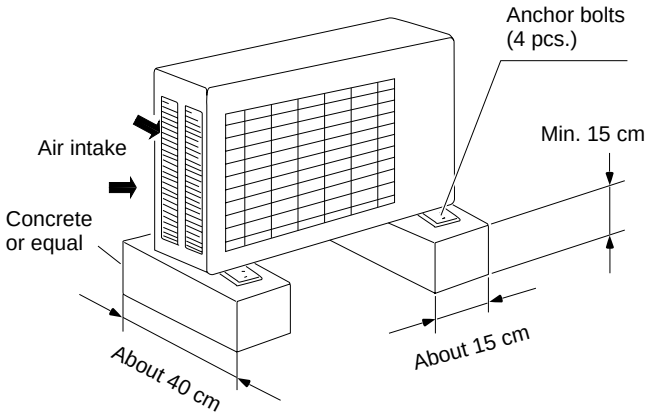


Fig. 4a

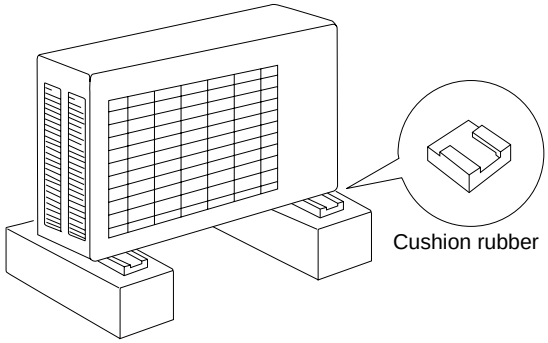


Fig. 4b

5-3. Diagram of Outdoor Unit Installation

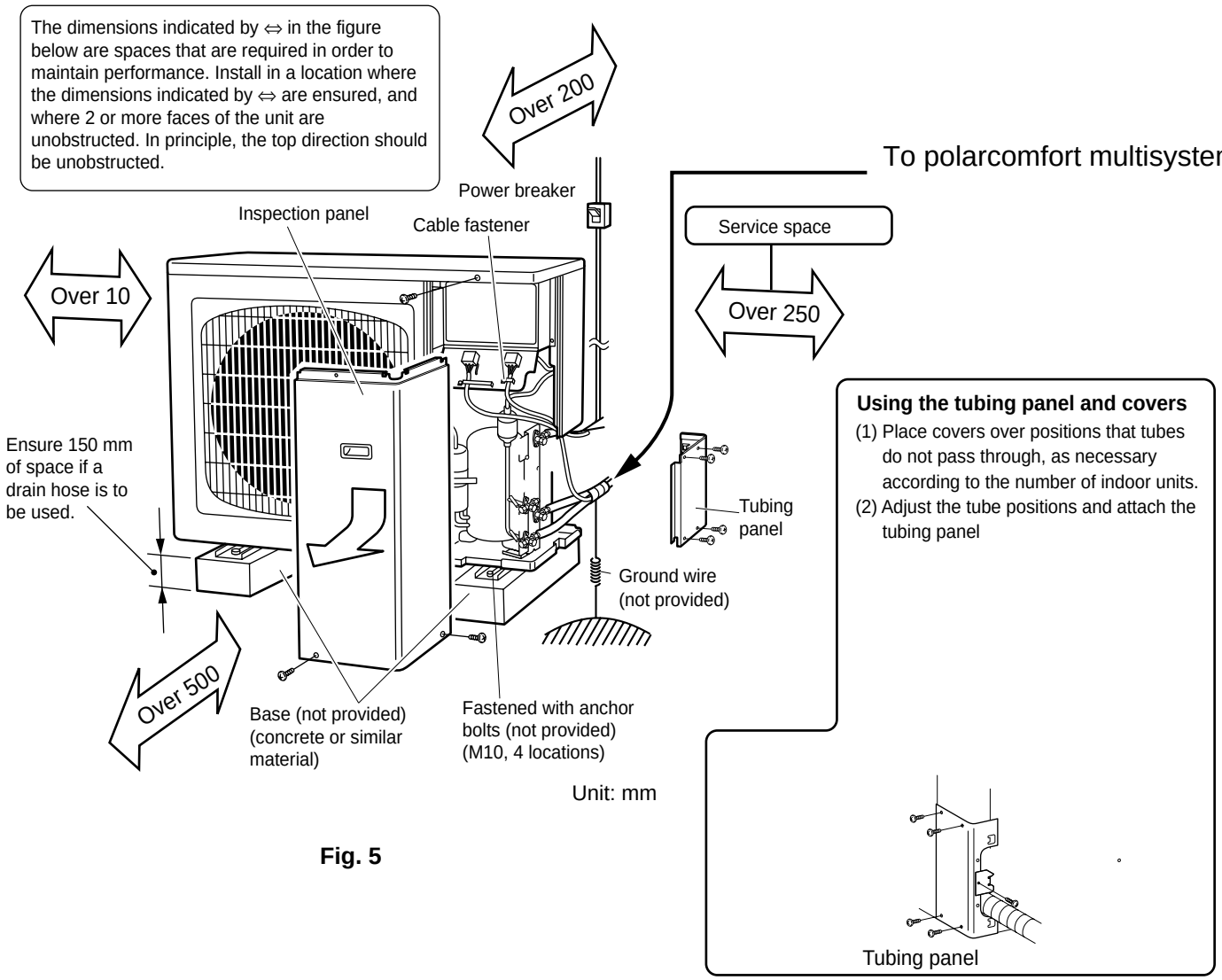


Fig. 5

5-4. Recommended Wire Length and Diameter

Regulations on wiring diameter differ from locality to locality. For field wiring requirements, please refer to your local electrical codes. Carefully observe these regulations when carrying out the installation.

NOTE

Max.Power line length.

2,0 M2 15 meter.
2,5- M2 20 meter.
3,5 M2 26 meter.

Fuse or circuit capacity 20A.

WARNING

WARNING **To avoid the risk of electric shock, heatpump unit must be grounded.**

- **Each wire must be firmly connected.**
- **No wire should be allowed to touch refrigerant tubing, the compressor, or any moving part.**
- **Be sure to connect power wires correctly matching up numbers on terminals of the outdoor unit.**

5-5. Wiring System Diagram

Polarcomfort 8,6 and watertank Polarcomfort multisystem.

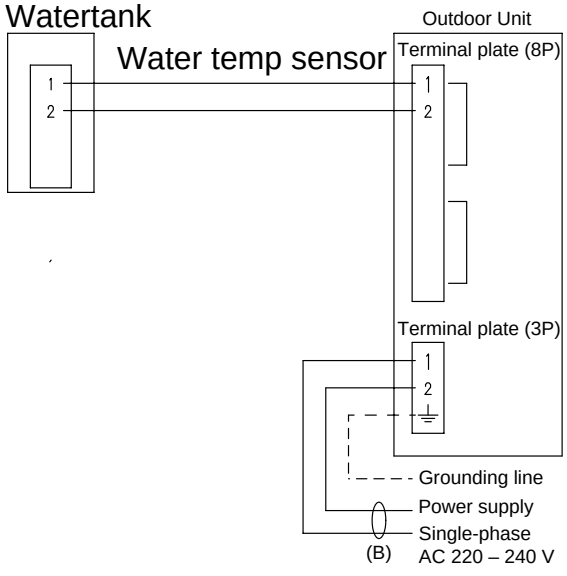
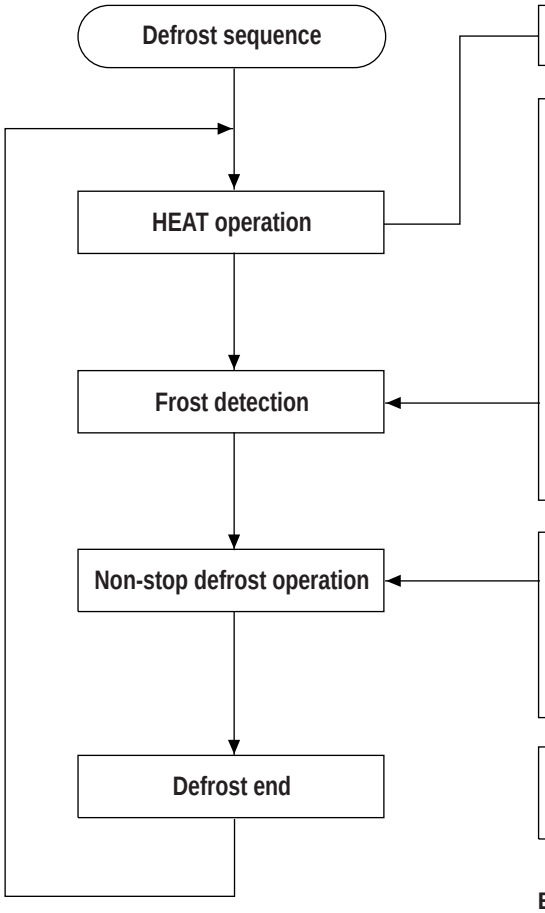


Fig. 6a

6. FUNCTIONS

6-1. Defrost Detection and End

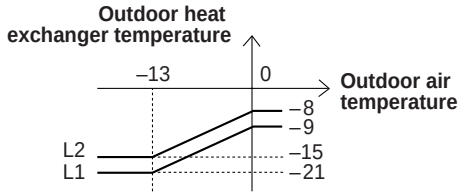
Non-stop defrosting



4-way valve ON

Defrost detection occurs in either of the following cases:

- The temperature of the heat exchanger remains at or below the L1 line for 35 minutes after the start of HEAT operation.
- The temperature of the heat exchanger remains at or below the L2 line for 120 minutes after the start of HEAT operation.



- Compressor → 100 Hz operation (4-way valve ON)
- Outdoor fan → OFF
- Solenoid valve (for hot gas bypass) → ON
- Indoor fan → OFF

- Temperature of the outdoor heat exchanger is at or above the temperature shown in the table below.
- Defrost operation has continued for 12 minutes (max. length).

End temperature

Defrost operation time	Less than 2 minutes	2 minutes or more
Coil temperature for ending defrost	Not ended	*1 10°C or higher

*1 The temperature for ending defrost is 7°C or higher when the outdoor air temperature is less than 0°C.

6-2. Current Control

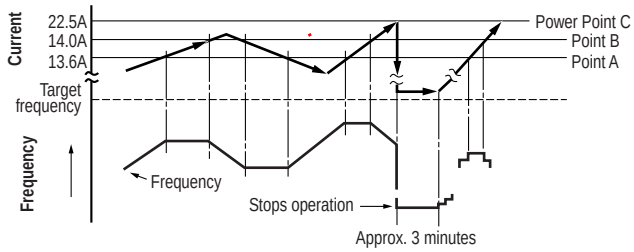
● The operating current may rise as a result of causes including increasing heating or cooling loads or decreases in power voltage. In these cases, the operating frequency is automatically reduced, or operation is stopped, in order to control the operating current so that it is 20 A or less.

As a result:

- Power breakers and fuses will not be tripped.
- Operation can continue during this period with somewhat reduced heating or cooling capacity.
- Operation at normal capacity is restored when the cause of the current rise is eliminated.

Description of function

Example of operation for heating



- Operates at the target frequency at Point A and below.
- Stops increases to the frequency between Points A and B.
- Reduces the frequency by 1 Hz per 0.5 seconds when Point B is exceeded.
- Stops operation, and restarts it approximately 3 minutes later, if Point C is exceeded.
  (May operate when sudden voltage fluctuations occur. → Indicates trouble.)

6-5. Automatic frequency control

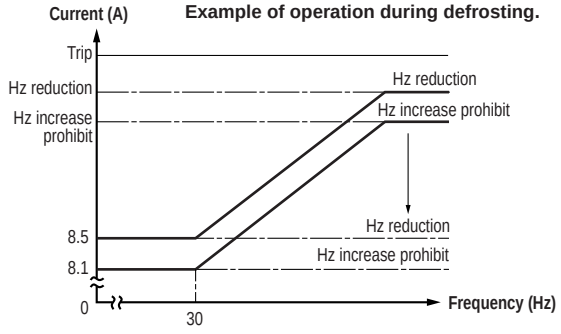
The operating frequency is reduced automatically, or operation is stopped, in order to control the operating current so that it is at or below the values shown in the table below.

	20A	
	HEAT	Defrost
Point C (peak cut trip)	22.5	22.5
Point B (Hz reduction)	14.0	13.0
Point A (Hz increase prohibit)	13.6	12.6

6-6. Current control

The operating frequency upper limits shown in the figure below are established for frequency reduction and increase-prohibit.

Example of operation during defrosting.

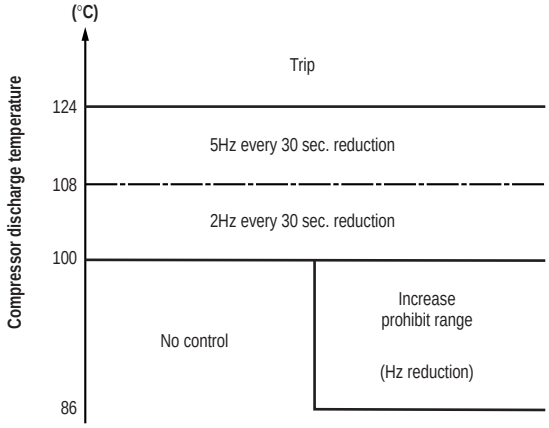


6-3. Low Start Current

Operation starts at 10 Hz, and the start current is less than the normal operating current. This prevents the flickering of fluorescent lights or television screens that occurs when ordinary A/C units start.

6-4. Compressor Temperature Control

To protect the compressor coil from overheating, the operating frequency is controlled based on the compressor discharge temperature.



* Within the increase-prohibit range, the range changes to the Hz reduction range (2 Hz every 30 seconds) if the compressor temperature rises by 2°C.

7. TROUBLESHOOTING

7-1

■ Precautions before performing inspection or repair

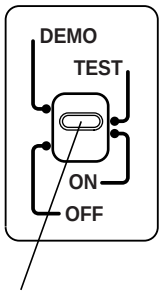
- After checking the self-diagnostics monitor, turn the power OFF before starting inspection or repair.
- High-capacity electrolytic capacitors are used inside the outdoor unit controller (inverter). They retain an electrical charge (charging voltage DC 280 V) even after the power is turned OFF, and some time is required for the charge to dissipate. Be careful not to touch any electrified parts before the controller LED (red) turns OFF.

  If the outdoor controller is normal, approximately 30 seconds will be required for the charge to dissipate. However, allow at least 5 minutes for the charge to dissipate if there is thought to be any trouble with the outdoor controller.

  After inspection or repair is completed, be sure to move the operation switch to the DEMO position, turn the power ON, and erase the diagnostics contents.

■ **Method of self-diagnostics** on control card K5DVH-A1

If the unit operation lamp is flashing every 0.5 seconds, follow the procedure below to perform detailed trouble diagnostics.



Operation selector

Ordinarily, this switch should be in the OFF position.

The OFF, TEST, and DEMO positions are used for inspection.

NOTE

1: If the operation lamp flashes every 0.5 seconds immediately when the power is turned ON, there is an external ROM (OTP data) failure on the control panel circuit board or ROM socket insertion problem, or the ROM has not been installed.

2: The failure mode is stored in memory even when the power is not ON. Follow the procedure below to perform diagnostics.

PROCEDURE

① Remow the auto start rele y1.Turn the power switch ON.

② Move the operation selector on the main unit to OFF (self-diagnostics).

③ If there is a sensor failure or a protective function has activated, self-diagnostics lamps 1, 2, and 3 will illuminate in the following pattern: 5 seconds flashing (illuminated) + 2 seconds OFF. (Buzzer sounds once while lamps are OFF.)

Note: If there is no trouble, then self-diagnostics lamps 1, 2, and 3 do not illuminate, and the buzzer does not sound.

④ Diagnostics is completed when the buzzer sounds 3 beeps.

⑤ After inspection or repair is completed, be sure to move the operation selector to the DEMO position, turn the power ON, and erase the diagnostics contents. Then move the selector to the OFF position and check that the diagnostics contents have been erased before using the unit. Replays the auto start rele y1.

Details of Self-Diagnostics

When the operation selector on the indoor unit is moved from the ON or TEST position to the OFF (Self-diagnostics) position, the indicator lamps on the indoor unit will flash (or remain ON) for 5 seconds and then turn OFF for 2 seconds (buzzer sounds once) to indicate the presence of a sensor failure or the activation of a protective function.

Self-diagnostics is completed when the buzzer sounds 3 beeps.

If there is no trouble, the lamps do not flash (illuminate). Also note that the corresponding parts listed below may not be present in some models.

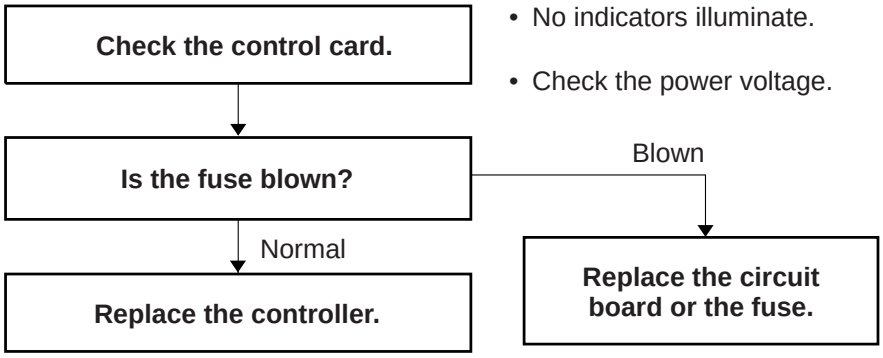
Indication on indicator lamps				···· OFF ···· Flashing ···· ON	
●●●	Timer ●●	Operation ●	Code	Diagnostics item	Diagnostics contents
×	×	◑	S01	Water temperature sensor failure	① Sensor open circuit or short circuit ② Contact failure at connector or open circuit at terminal crimping location (short-circuit detection only for the humidity sensor) ③ K5DHV-A1 card/outdoor circuit board failure
×	◑	×	S02	Narrow tube heat sensor failure	
×	◑	◑	S03		
◑	×	×	S04	• Compressor temperature sensor failure • SH sensor failure	① Sensor open circuit or short circuit ② Contact failure at connector or open circuit at terminal crimping location ③ Outdoor circuit board failure
◑	×	◑	S05	• Outdoor heat exchanger sensor failure • Outdoor narrow tubing sensor failure	
◑	◑	×	S06	• Outdoor air temperature sensor failure • Outdoor wide tubing sensor failure	
◑	◑	◑	S07	Outdoor electrical current sensor failure	Outdoor circuit board failure
×	×	☼	E01	K5DHV-A1/outdoor communications failure (serial communications)	① Miswiring ② AC power failure ③ Blown fuse ④ Power relay failure ⑤ K5DHV-A1 or outdoor circuit board failure
×	☼	×	E02	• HIC circuit failure • Power Tr circuit failure	① HIC or power Tr failure ② Outdoor fan does not turn. ③ Instantaneous power outage ④ Service valve not opened. ⑤ Outdoor fan blocked. ⑥ Continuous overload operation ⑦ Compressor failure ⑧ Outdoor circuit board failure
×	☼	☼	E03	Outdoor unit external ROM failure	① External ROM data failure ② Outdoor circuit board failure
☼	×	×	E04	Peak current cut-off	① Instantaneous power outage ② HIC or power Tr failure ③ Outdoor circuit board failure
☼	×	☼	E05	• PAM circuit failure • Active circuit failure	① Outdoor circuit board failure ② Outdoor power supply voltage failure
☼	☼	×	E06	Compressor discharge overheat prevention	① Electric expansion valve failure ② Capillaries blocked. ③ No gas ④ Continuous overload operation ⑤ Outdoor fan does not turn. ⑥ Outdoor circuit board failure
☼	☼	☼	E07	Indoor fan operating failure	① Fan motor failure ② Contact failure at connector ③ K5DHV-A1 circuit board failure
◑	◑	☼	E08	• 4-way valve switching failure • Indoor zero-cross failure	① 4-way valve failure ② Outdoor circuit board failure
◑	☼	◑	E09	No-refrigerant protection	① Service valve not opened. ② No refrigerant
◑	☼	☼	E10	DC compressor drive circuit failure	① Open phase ② Outdoor circuit board failure
☼	◑	◑	E11	Outdoor AC fan operating failure	① Fan motor failure ② Contact failure at connector ③ Outdoor circuit board failure
☼	◑	☼	E12	• Outdoor system communications failure • Outdoor high-voltage SW, OLR operation • Outdoor power supply open phase, outdoor coil freezing	① Miswiring ② Blown fuse ③ Power relay failure ④ Open phase ⑤ Outdoor circuit board failure ⑥ Compressor failure
☼	☼	◑	E13	Freeze-prevention operation	① Water pump system failure ② No refrigerant ③ Low-temperature operation

Other : Timer lamp flashes (3-second intervals).

NOTE : If the operation lamp continues to flash (orange) even when the K5DHV-A1 card operation selector has been moved to the OFF position, an indoor unit external ROM failure has occurred. (E14)

After inspection or repair is completed, be sure to move the operation selector to the DEMO position, turn the power ON, and erase the diagnostics contents.

7-3 ■ If the self-diagnostics function fails to operate



● If there are no problems with the above, then check the outdoor unit.

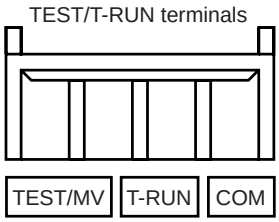
■ Checking the outdoor unit

No.	Control	Check items (unit operation)
1	Apply the rated voltage between outdoor unit terminals 1 and 2.	• The control panel LED (red) must illuminate.
2	Short-circuit the outdoor unit COM terminal to the T-RUN terminal.	• The compressor and fan motor must turn ON.

● If there are no problems with the above, then check the indoor unit.

● Using the TEST/T-RUN terminals

T-RUN : Test run (compressor and fan motor turn ON.)
TEST/MV : Compresses time to 1/60th (accelerates operation by 60 times faster than normal). Fully opens the electric expansion valve.



■ Checking the serial communications

	→ Control 1	→ Control 2	
Initial self-diagnostics	**Short-circuit terminals 2 and 3 on the indoor unit 3P terminal block.**	**Short-circuit terminals 2 and 3 on the indoor unit 3P terminal block.**	**Probable location of malfunction**
(1) illuminate	No change	——	control card circuit board failure
	Change: (1) and (3) illuminate, and (2) flashes.	Change: (1) and (3) illuminate, and (2) flashes.	Outdoor unit circuit board failure
	Change: (1) and (3) illuminate, and (3) flashes.	Change: (1) illuminates	Failure (open circuit, contact failure, etc.) in the inter-unit cable
(1) and (3) illuminate, and (2) flashes.	——	——	Control card circuit board failure

● Turn the power OFF before performing short circuiting work.

● During the self-diagnostics check, the check results are the first indication when the operation switch is moved to OFF while the indicators are flashing after power ON → DEMO (5 seconds) → ON.

● So that the check can be made quickly, indicators flash at first communication after power ON.

● Before performing the above checks, perform DEMO operation, and check that AC 220 V is output to terminals 1 and 2. If it is not output, there is a failure related to the control card unit power.

7-4. Outdoor Unit Trouble Diagnostics

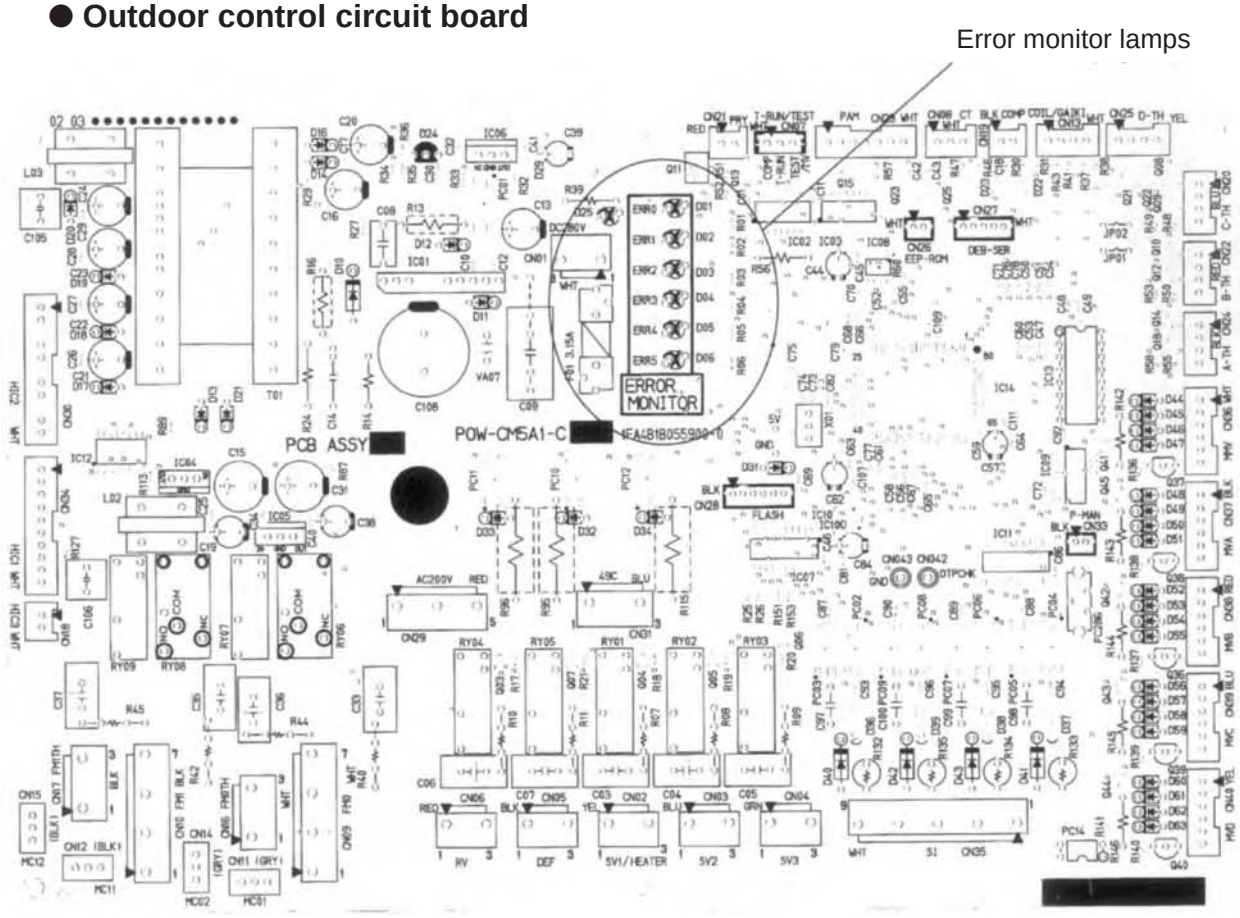
If a protective device has activated or there is a sensor failure in the outdoor unit, the 6 error monitor lamps on the outdoor control circuit board will indicate the nature of the trouble.

○: ON ×: OFF

ERR						Error contents
0	1	2	3	4	5	
○	×	×	×	×	×	Compressor discharge temperature sensor
×	×	○	×	×	×	Heat exchanger temperature sensor
○	×	○	×	×	×	Branch tubing A sensor (narrow tubing)
×	○	○	×	×	×	Branch tubing B sensor (narrow tubing)
○	○	○	×	×	×	Branch tubing C sensor (narrow tubing)
×	×	×	○	×	×	Branch tubing D sensor (narrow tubing)
○	○	×	○	×	×	Outdoor air temperature sensor
×	×	○	○	×	×	Branch tubing A sensor (wide tubing)
○	×	○	○	×	×	Branch tubing B sensor (wide tubing)
×	○	○	○	×	×	Branch tubing C sensor (wide tubing)
○	○	○	○	×	×	Branch tubing D sensor (wide tubing)
×	○	×	×	○	×	CT (current) sensor
×	○	○	×	○	×	HIC protective device (current, temperature)

ERR						Error contents
0	1	2	3	4	5	
○	×	○	○	○	×	OTP data failure
×	×	×	○	○	×	Current peak exceeded
○	×	×	○	○	×	Current control failure
○	×	○	×	×	○	Active failure
×	○	×	○	○	×	Compressor discharge temperature high
×	×	○	×	×	○	Zero-cross failure
○	×	×	×	×	○	DC compressor rotation failure
○	○	×	×	○	×	3ϕ 200 V open phase
×	○	○	×	×	○	Compressor internal thermostat activated
×	×	○	×	○	×	High-pressure switch activated
○	×	○	×	○	×	Miswiring, incorrect tubing connections
○	○	×	×	×	○	Freeze-prevention activated
×	×	○	○	○	×	Reset count exceeded

● Outdoor control circuit board



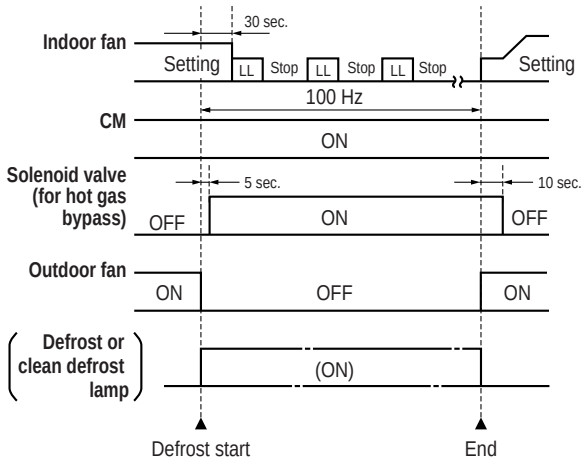
7-5. Checking the Outdoor System

7-5-1. Checking the outdoor unit

No.	Control	Check items (unit operation)
1	• Apply 220 V AC between terminals 1 and 2 on the outdoor unit 3P terminal block.	• The LED (red) on the control circuit board must illuminate.
2	• Of the connector T-RUN/TEST terminals, short-circuit the T-RUN terminal to the COM terminal.	• The compressor, fan motor, 4-way valve, and solenoid valve (for the hot gas bypass) must turn ON. (They turn ON a few seconds after the power is turned ON.)

NOTE: If the above check items are okay, but the outdoor unit does not operate, there may be a faulty connection between the indoor unit and the outdoor unit.

7-5-2. Using forced defrost procedure

No.	Control	Check items (unit operation)
1	• Connect a dummy resistor of 39 kΩ to the outdoor coil temperature sensor connector.	■ **Non-stop defrost**  **NOTE:** The dashed line for the defrost or clean defrost lamp indicates lamp illumination at clean defrost only. • The maximum length of defrost operation is 12 minutes. Defrost can also be ended based on the below conditions for the outdoor heat exchanger sensor. Less than 2 minutes → Not ended 2 minutes or more → 10°C or higher (However, the condition is 7°C or higher when the outdoor air temperature is below 0°C.)

7-6. Unit Problems and Inspection Points

Problems / Inspection points		K5DHV-A1-card				Outdoor unit									Others		Note
			Operation lamp flashes.	Operation lamp does not illuminate.		Outdoor unit does not operate.	Outdoor fan does not turn.	4-way valve does not operate.	The compressor (only) does not operate.	The compressor stops on occasion.	The compressor speed does not increase.	The outdoor air temperature is high, however defrost operation occurs.	Defrost operation does not occur.	The electric expansion valve does not operate.		Does not heat or heating performance is inadequate.	
Self-Diagnostics check			○			○			○			○	○				
Control card	① Indoor controller (control unit)		○	○		○											
	③ water temperature sensor		○														
	④ Narrow tube temperature sensor		○														
	⑤ Inter-unit cable		○			○	○	○	○	○	○						
	⑥ Switch circuit board			○													
Outdoor unit	⑦ Outdoor control circuit board		○			○	○	○	○	○	○	○					
	⑧ Diode module		○			○											
	⑨ HIC		○			○											
	⑩ Electrolytic capacitor		○			○											
	⑪ Fuse		○			○											
	⑫ Compressor		○			○	○	○	○	○	○						
	⑬ Compressor protective thermistor		○			○			○	○							
	⑭ Outdoor fan motor						○			○		○					
	⑮ 4-way valve							○									
	⑯ Coil thermistor		○									○	○				
	⑰ Electric expansion valve													○		○	
	⑱ Branch tubing temperature sensor		○														
Others	⑲ Breaker					○											
	⑳ Refrigerant gas pressure									○						○	Measure during a test run.

• For details about the inspection points, refer to Inspection points for each part.

7-6-1. Outdoor control circuit board

Refer to 9-3-1. Checking the outdoor unit.

NOTE: Do not remove or insert the outdoor control circuit board connector when power is being supplied to it. (The controller will be damaged.)

7-6-2. HIC

		HIC measurement points			
Tester polarity	⊕ (Black)	+	+	–	–
			U		U
			V		V
			W		W
	⊖ (Red)	–	–	+	+
		U		U	
		V		V	
		W		W	
Continuity		∞	∞	Below 1kΩ	Below 1kΩ

Perform the continuity tests shown in the table above. Locations which are not as shown in the table have suffered HIC failures.

NOTE: Ordinarily, the red lead of the tester has negative polarity. However, the reverse may be true, particularly with digital testers. Use caution.

7-6-3. Fuse

Check the continuity visually or with a tester.

7-6-4. Compressor

Check for an open circuit in the compressor coil winding.

7-6-5. Compressor protective sensor (compressor discharge temperature thermistor)

Check that the sensor is securely contained in the thermostat holder.

7-6-6. Outdoor fan motor

Turn the fan slowly by hand.

- If the fan rotates easily:
  - ⓐ Replace the running capacitor on the outdoor control circuit board.
  - ⓑ Check for an open circuit in the fan motor coil winding.
  - ⓒ Use the tester AC range to check whether voltage is reaching the connector on the outdoor fan motor circuit board. If the needle moves, the result is normal.
- If the fan does not rotate easily:
  - ⓐ Check whether something is obstructing the fan, or if the fan itself is coming into contact with the outer case, preventing it from rotating. Correct if necessary.
  - ⓑ Otherwise, the fan motor bearings have seized. Replace the bearings.

7-6-7. 4-way valve

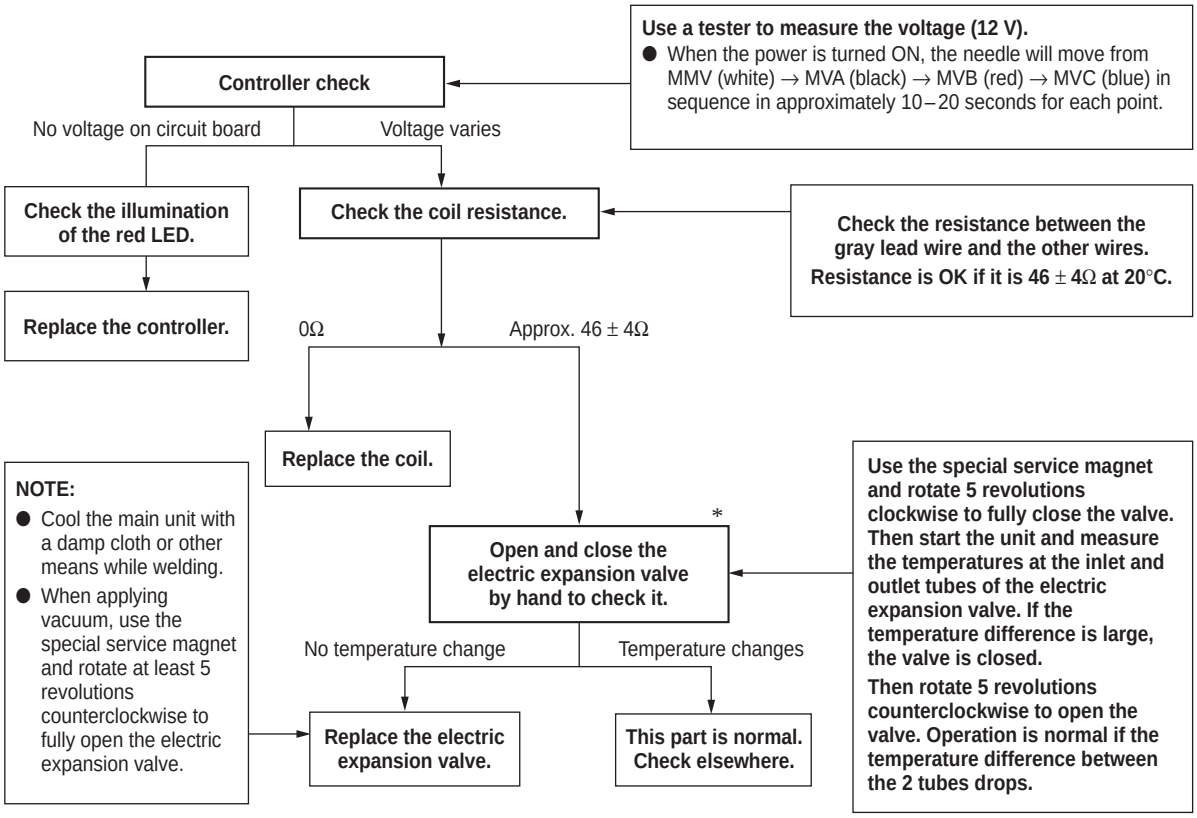
Of the outdoor control circuit board connector T-RUN/TEST terminals, short-circuit the T-RUN terminal to the COM terminal. Perform a test run of the unit alone, and check whether the 4-way valve inside the outdoor unit produces a click sound.

7-6-8. Coil thermistor

Check that the sensor is securely contained in the thermostat holder.

7-6-9. Electric expansion valve

- When replacing the electric expansion valve and coil, be sure to attach the connectors in the correct positions. Labels are applied to the valve body and coil, corresponding to the connector colors, to identify them.



* If you have manually checked the electric expansion valve, be sure to reapply the outdoor 220 V after you have replaced the wiring. (The position of the electric expansion valve will be changed.)

7-6-10. Branch tubing temperature sensor

Check that the sensor is securely contained in the thermostat holder.

7-6-11. Breaker

Check whether or not the breaker has been tripped.

- Check that the breakers and fuses used are of the specified capacity.
- Check that the breaker and its line are exclusive for A/C use.

7-6-12. Refrigerant gas pressure

Start a COOL test run, and measure the temperatures of the A/C intake air and discharge air. Compare the values with the performance charts.

- If the values are higher than the performance charts:
  Check for refrigerant shortage or blockage of the refrigerant circuit.

  Assessment of refrigerant shortage:

  ⓐ The low-pressure pressure value is 5 MPa or more below the value in the performance charts.

  ⓑ There is little condensation on the indoor heat exchanger, which overall appears dry.

  Distinguishing between refrigerant shortage and refrigerant circuit blockage:

  If the low-pressure pressure does not change when the circuit is charged 2–3 times with refrigerant gas (200 g each time), or if the change is small, then the problem may not be refrigerant shortage. The problem may be a blockage of the refrigerant circuit.

  ⓐ Check that there is no internal leakage inside the 4-way valve:

  At the low-pressure side tubing, check that there is no temperature difference between the intake and discharge of the 4-way valve.

  ⓑ Check that the electric expansion valve is not blocked. Check as described on the preceding page.

7-7. Explanation of Functions

	Control/conditions	Unit operation	Explanation
INITIAL	Breaker is ON.		
		Heat begins depending on the water temperature and outdoor temperature at the time operation starts.	
		⇩ Heating	
HEAT	Breaker on	● Operation lamp illuminates. ● Outdoor unit begins operating.	● The unit is forced to stop for 10 minutes after the power is turned ON, or 3 minutes after the compressor stops, in order to protect the compressor. The frequency is increased at the rate of 1 Hz every 0.5 seconds.
		– the compressor starts, – the outdoor fan starts,	
		When the frequency reaches α Hz, frequency increases are stopped for a period of β seconds. (Refer to Table 2 on page 35.)	This is in order to stabilize the return of oil to the compressor.
		The frequency then increases.	If the water and outdoor temperatures are high, the current peak cut-off activates, stopping any increases in frequency.
	The water temperature has reached the desired temperature.	● The water temperature and the termostat controller temperature setting are approximately equal.	Operating frequency is stabilized in order to maintain water temperature

Control/conditions		Unit operation	Explanation
HEAT	When defrost operation begins, frost has formed on the outdoor unit (when the ambient air temperature is low).	**Non-stop defrost** ● Outdoor fan: Stopped ● Compressor: 120 Hz ● Solenoid valve (for hot gas bypass): ON ● 4-way valve: Remains ON. ● Defrost lamp: Remains OFF. (Lamp is ON for clean defrost.)	Defrost operation begins based on outdoor temperature conditions. **Non-stop defrost** (Refer to Fig. 1 below.) ① After HEAT operation begins, the temperature of the outdoor heat exchanger is at or below the L1 line for 35 minutes. ② After HEAT operation begins, the temperature of the outdoor heat exchanger is at or below the L2 line for 120 minutes. The 4-way valve remains ON during defrost. ● The outdoor fan stops and the solenoid valve turns ON, allowing the refrigerant to bypass the indoor unit. ● The operating frequency during defrost is 120 Hz. (Frequency is lowered if the current peak cut-off function is activated.) ● The maximum length of a single defrost operation is 12 minutes. ● For the outdoor heat exchanger temperature conditions for ending defrost, refer to Table 1 below.

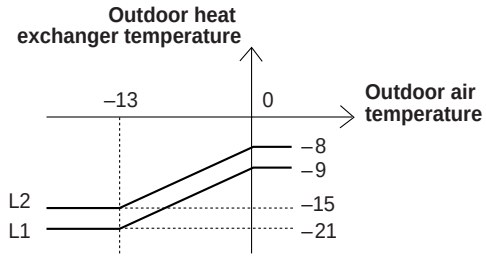


Fig. 1

End temperature

Defrost operation time	Less than 2 minutes	2 minutes or more
Coil temperature for ending defrost	Not ended	***1** 10°C or higher

***1** The temperature for ending defrost is 7°C or higher when the outdoor air temperature is less than 0°C.

Table 1

8. REFRIGERANT R410A: SPECIAL PRECAUTIONS WHEN SERVICING UNIT

8-1. Characteristics of New Refrigerant R410A

What is New Refrigerant R410A?

R410A is a new refrigerant that contains two types of pseudo-non-azeotropic refrigerant mixture which do not adversely affect the earth's ozone layer. Its refrigeration capacity and energy efficiency are about the same level as the conventional refrigerant, R22.

Components (mixing proportions)

HFC32 (50%) / HFC125 (50%)

Characteristics

- Less toxic, more chemically stable refrigerant
- The composition of refrigerant R410A changes whether it is in a gaseous phase or liquid phase. Thus, when there is a refrigerant leak the basic performance of the air conditioner may be degraded because of a change in composition of the remaining refrigerant. ***Therefore, do not add new refrigerant.*** Instead, recover the remaining refrigerant with the refrigerant recovery unit. Then, after evacuation, totally recharge the specified amount of refrigerant with the new refrigerant at its normal mixed composition state (in liquid phase).
- When refrigerant R410A is used, the composition will differ depending on whether it is in gaseous or liquid phase, and the basic performance of the air conditioner will be degraded if it is charged while the refrigerant is in gaseous state. ***Thus, always charge the refrigerant while it is in liquid phase.***

CAUTION

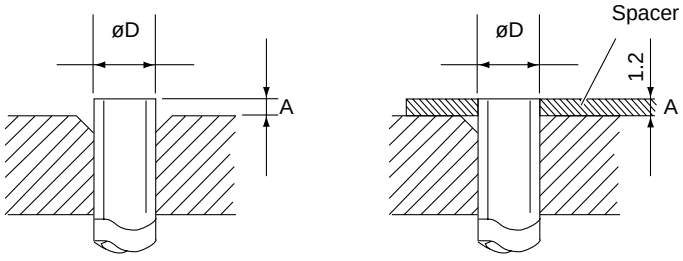
Ether-type oil is used for compressor oil for R410A-type units, which is different from the mineral oil used for R22. Thus more attention to moisture prevention and faster replacement work compared with conventional models are required.

8-2. Checklist Before Servicing

Use a clutch-type flare tool for R410A or the conventional flare tool. Note that sizes of the resultant flares differ between these two tools. Where a conventional flare tool is used, make sure to observe A Specification (amount of extrusion) by using the flare spacer.

Diameter of tube (ø) D	A Specification	
	Flare tool for R410A	Conventional flare tool (for R22)
ø6.35 (1/4")	0 – 0.5 mm	1.0 – 1.5 mm
ø9.52 (3/8")	0 – 0.5 mm	1.0 – 1.5 mm

- **Size of flare**



Flare tool for R410A　　Conventional flare tool (R22)

- **Tubing precautions**

  Refrigerant R410A is more easily affected by dust or moisture compared with R22, thus be sure to temporarily cover the ends of the tubing with caps or tape prior to installation.

  Never use 0.7mm-thick copper tubing or tubing which is less than 0.8mm in thickness, since air conditioners with R410A are subject to higher pressure than those using R22 and R407C.

- **No addition of compressor oil for R410A**

  No additional charge of compressor oil is permitted.

- **No use of refrigerant other than R410A**

  Never use a refrigerant other than R410A.

- **If refrigerant R410A is exposed to fire**

  Through welding, etc., toxic gas may be released when R410A refrigerant is exposed to fire. Therefore, be sure to provide ample ventilation during installation work.

- **Caution in case of R410A leak**

  Check for possible leak points with the special leak detector for R410A. If a leak occurs inside the room, immediately provide thorough ventilation.

8-3. Tools Specifically for R410A

- **For servicing, use the following tools for R410A**

Tool Distinction	Tool Name
Tools specifically for R410A	● Gauge manifold ● Charging hose ● Gas leak detector ● Refrigerant cylinder ● Charging cylinder ● Refrigerant recovery unit ● Vacuum pump with anti-reverse flow (***1**) (Solenoid valve-installed type, which prevents oil from flowing back into the unit when the power is off, is recommended.) ● Vacuum pump (***2**) … can be used if the following adapter is attached. ● Vacuum pump adapter (reverse-flow prevention adapter) (***3**). (Solenoid valve-installed adapter attached to a conventional vacuum pump.) ● Electronic scale for charging refrigerant ● Flare tool
Tools which can be commonly used for R22, R407C, and R410A	● Bender ● Torque wrench ● Cutter, reamer ● Welding machine, nitrogen gas cylinder

CAUTION

- **The above tools specifically for R410A must not be used for R22 and R407C. Doing so will cause malfunction of the unit.**
- **For the above vacuum pump (*1, *2) and vacuum pump adapter (*3), those for R22-type units can be used for R407C-type. However, they must be used exclusively for R410A and never alternately with R22 and R407C.**

- To prevent other refrigerants (R22, R407C) from being mistakenly charged to this unit, sizes of the service ports and flare nuts of the narrow tube service valve and wide tube service valve have been altered.

8-4. Tubing Installation Procedures

When the tubes are connected, ***always apply HAB oil on the flare portions to improve the sealing of tubing.***

The following is the **HAB oil** generally used:

Esso: ZERICE S32

NOTE For details on tubing installation procedures, refer to the installation manuals attached to the indoor unit and outdoor unit.

8-5. In Case of Compressor Malfunction

CAUTION

- **Should the compressor malfunction, be sure to make the switch to a replacement compressor as quickly as possible.**
- **Use only the tools indicated exclusively for R410A. → See "10-3. Tools Specifically for R410A."**

Procedure for replacing compressor

(1) Recovering refrigerant

- Any remaining refrigerant inside the unit should not be released to the atmosphere, but recovered using the refrigerant recovery unit for R410A.
- Do not reuse the recovered refrigerant, since it will contain impurities.

(2) Replacing Compressor

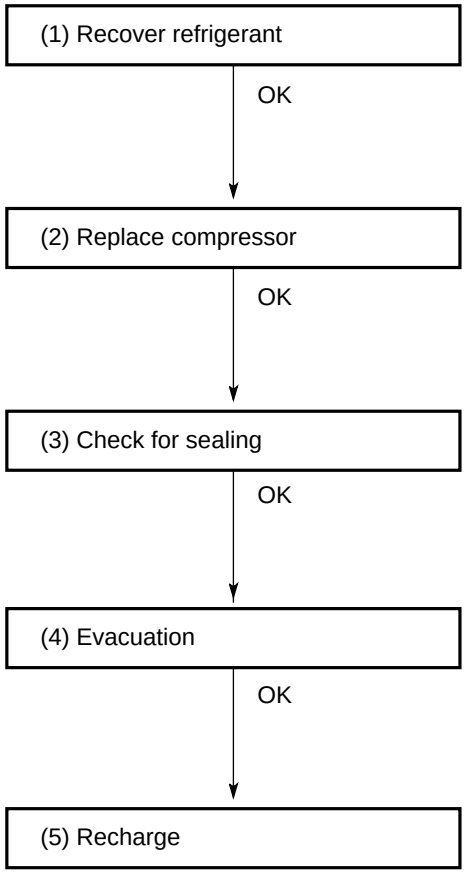
- Soon after removing seals of both discharge and suction tubes of the new compressor, replace it quickly.

(3) Checking for sealing

- Use nitrogen gas for the pressurized gas, and never use a refrigerant other than R410A. Also do not use oxygen or any flammable gas.

(4) Evacuation

- ***Use a solenoid valve-installed vacuum pump*** so that even if power is cut off in the middle of evacuation of air due to a power interruption, the valve will prevent the pump oil from flowing back.
- The equipment may be damaged if moisture remains in the tubing, thus carry out the evacuation thoroughly.
- When using a vacuum pump with exhaust air volume more than 25L/min. and ultimate vacuum pressure rate of 0.05Torr:



Standard time for evacuation

Length of tubing	Less than 10 meters	More than 10 meters
Time	More than 120 minutes	More than 140 minutes

(5) Recharging

- ***Be sure to charge the specified amount of refrigerant in liquid state*** using the service port of the wide tube service valve. The proper amount is listed on the unit's nameplate.

  When the entire amount cannot be charged all at once, charge gradually while operating the unit in Cooling Operation.

CAUTION

Never charge a large amount of liquid refrigerant at once to the unit. This may cause damage to the compressor.

- When charging with a refrigerant cylinder, use an electronic scale for charging refrigerant. In this case, if the volume of refrigerant in the cylinder becomes less than 20% of the fully-charged amount, the composition of the refrigerant starts to change. Thus, ***do not use the refrigerant if the amount in the charging cylinder is less than 20%.***

  Also, charge the minimum necessary amount to the charging cylinder before using it to charge the air conditioning unit.

Example:

In case of charging refrigerant to a unit requiring 0.76Kg using a capacity of a 10Kg cylinder, the minimum necessary amount for the cylinder is:

$$0.76 + 10 \times 0.20 = 2.76\text{Kg}$$

For the remaining refrigerant, refer to the instructions of the refrigerant manufacturer.

- If using a charging cylinder, transfer the specified amount of liquid refrigerant from the refrigerant cylinder to the charging cylinder.

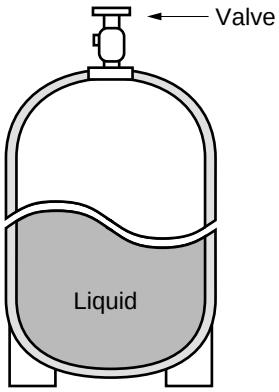
  Prepare an evacuated charging cylinder beforehand.

CAUTION

- **To prevent the composition of R410A from changing, never bleed the refrigerant gas into the atmosphere while transferring the refrigerant. (Fig. 3)**

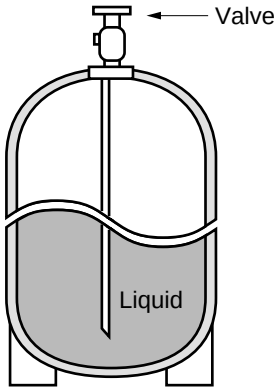
Do not use the refrigerant if the amount in the charging cylinder is less than 20%.

Configuration and characteristics of cylinders



Single valve
Charge liquid refrigerant with cylinder in up-side-down position.

Fig. 1



Single valve (with siphon tube)
Charge with cylinder in normal position.

Fig. 2

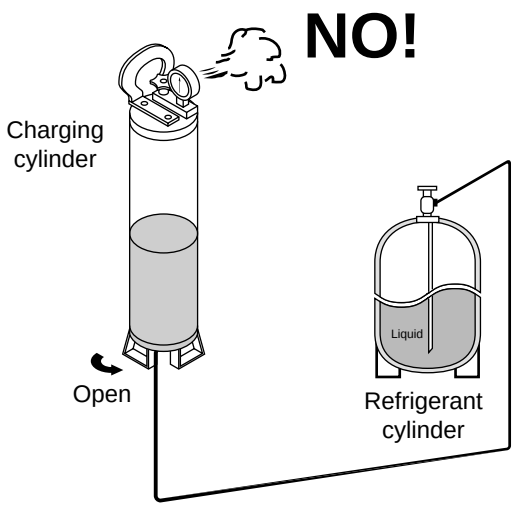


Fig. 3

8-6. Charging Additional Refrigerant

When Tubes are Extended

- Observe the proper amount of refrigerant as stated in this service manual or the installation manual that came with the indoor unit. ***Charge additional refrigerant in liquid state only.***

CAUTION

Never charge additional refrigerant if refrigerant is leaking from the unit. Follow instructions given in "10-6. In Case Refrigerant is Leaking" and completely carry out repairs. Only then should you recharge the refrigerant.

8-7. Retro-Fitting Existing Systems

Use of Existing Units

- ***Never use new refrigerant R410A for existing units which use R22.*** This will cause the air conditioner to operate improperly and may result in a hazardous condition.

Use of Existing Tubing

- If replacing an older unit that used refrigerant R22 with a R410A unit, ***do not use its existing tubing.*** Instead, completely new tubing must be used.

NOTE

When reaming, hold the tube end downward and be sure that no copper scraps fall into the tube. (Fig. 9)

(1) Remove the flare nut from the unit and be sure to mount it on the copper tube.

(2) Make a flare at the end of copper tube with a flare tool.* (Figs. 10 and 11)

(*Use “RIGID” or equivalent.)

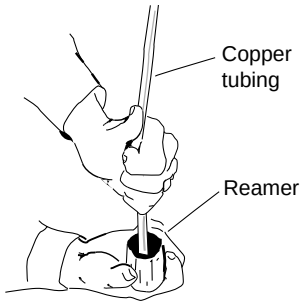


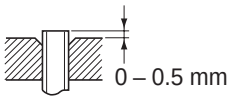
Fig. 9

NOTE

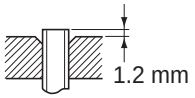
A good flare should have the following characteristics:

- inside surface is glossy and smooth.
- edge is smooth.
- tapered sides are of uniform length.

If the special R410A flare tool is used:



If the previous flare tool (clutch-type) is used:



Adjust so that the amount of tube protrusion is as shown in the figure.

Fig. 10

Caution Before Connecting Tubes Tightly

a) Be sure to apply a sealing cap or water-proof tape to prevent dust or water from getting into the tubes before they are used.

b) Be sure to apply refrigerant lubricant to the matching surfaces of the flare and union before connecting them together. This is effective for reducing gas leaks. (Fig. 12)

c) For proper connection, align the union tube and flare tube straight with each other, then screw in the flare nut lightly at first to obtain a smooth match. (Fig. 13)

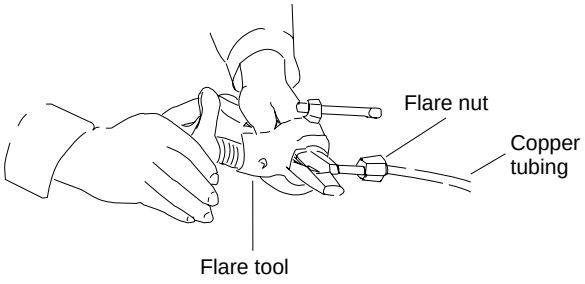


Fig. 11

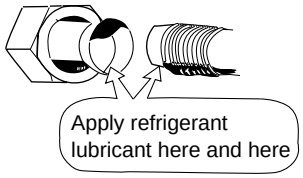


Fig. 12

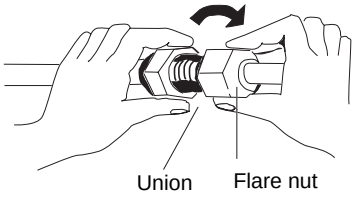


Fig. 13

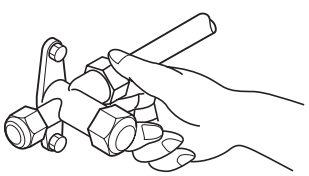
Tubing Connections

a) Temporary connection:
Screw in 3 – 5 rotations by hand. (Fig.14)

b) To fasten the flare nuts, apply specified torque as:

Table 4

Tube Dia.	Tightening Torque
6.35 mm	14 – 18 N·m (140 – 180 kgf · cm)
9.52 mm	34 – 42 N·m (340 – 420 kgf · cm)



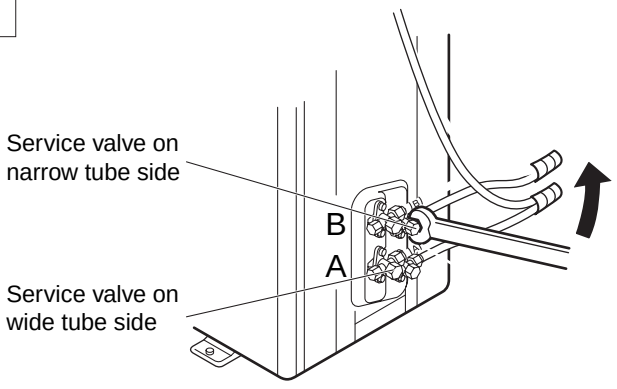


Fig. 14

CAUTION

Be sure to match refrigerant tubing and electric wiring between indoor and outdoor units. For more details, refer to "Tubing Check Control" in the Technical & Service Manual.

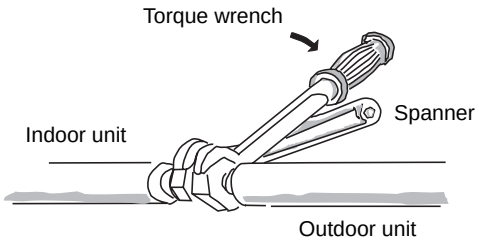


Fig. 15

Insulation of Refrigerant Tubing

IMPORTANT

To prevent heat loss and wet floors due to dripping of condensation, **both tubes must be well insulated with a proper insulation material.**
The thickness of the insulation should be a minimum 8 mm. (Fig. 17)

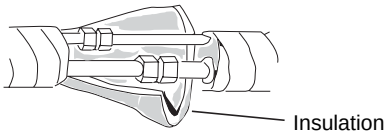


Fig. 16

Taping the Tubes

CAUTION

After a tube has been insulated, never try to bend it into a narrow curve, as this may cause the tube to break or crack.

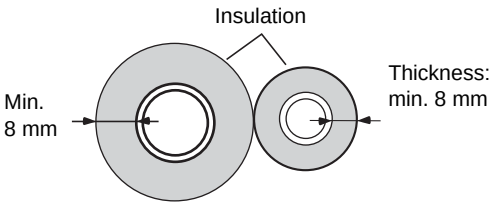


Fig. 17

(1) At this time, the 2 refrigerant tubes (and electrical wire if local codes permit) should be taped together with armoring tape. The drain hose may also be included and taped together as 1 bundle with the tubing.

(2) Wrap the armoring tape from the bottom of the outdoor unit to the top of the tubing where it enters the wall. As you wrap the tubing, overlap half of each previous tape turn. (Fig. 18)

(3) Clamp the tubing bundle to wall, using 1 clamp approx. every 120 cm.

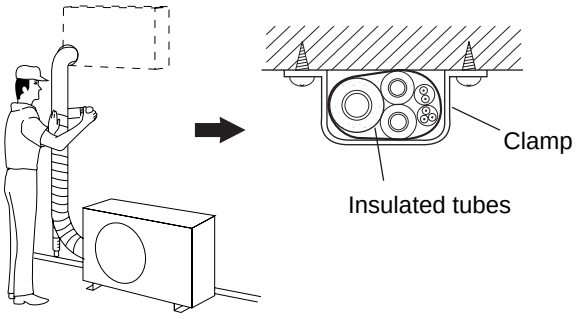


Fig. 18

NOTE

Do not wind the armoring tape too tightly, since this will decrease the heat insulation effect. Also, be sure the condensation drain hose splits away from the bundle and drips clear of the unit and the tubing.

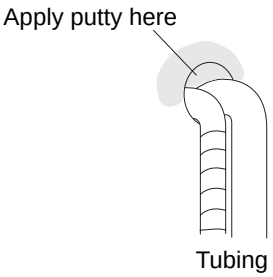


Fig. 19

Finishing the Installation

After finishing insulating and taping over the tubing, use sealing putty to seal off the hole in the wall to prevent rain and draft from entering. (Fig. 19)

4. Air Purging

Air and moisture remaining in the refrigerant system have undesirable effects as indicated below. Therefore, they must be purged completely.

- pressure in the system rises
- operating current rises
- cooling efficiency drops
- moisture in the air may freeze and block capillary tubing
- water may lead to corrosion of parts in the refrigerant system

■ Air Purging with a Vacuum Pump (for Test Run)

- In order to protect the earth's environment, be sure to use a vacuum pump to perform the air purge. (Never perform an air purge by using the refrigerant gas cylinder or other external gas, or by using the gas inside the outdoor unit.) Perform the air purge for tubes A .

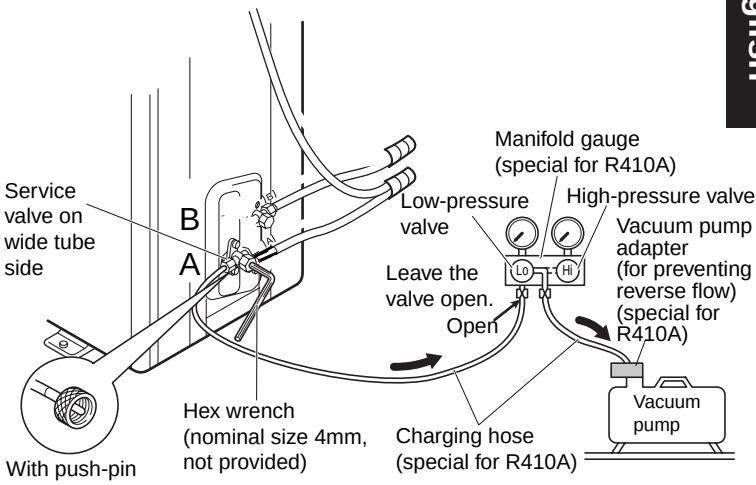


Fig. 20

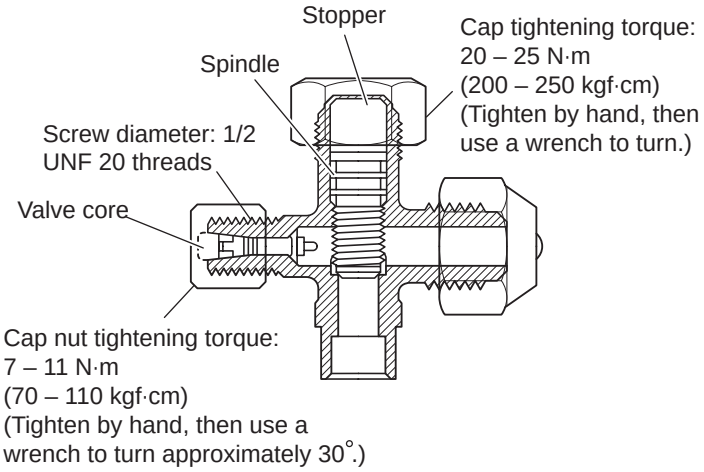
CAUTION

In order to prevent charging errors with A/C that uses R410A, the screw diameter at the service valve charging port has been changed. When recharging or performing other servicing, use the special charging hose and manifold gauge.

(1) Check that each tube (both narrow and wide tubes) between the watertank and outdoor units have been properly connected.
Note that narrow
and wide tube service valve on the outdoor unit are kept closed at this stage.

(2) Using an adjustable wrench or box wrench, remove the valve caps from the service valve on narrow and wide tube.

(3) Connect a vacuum pump and a manifold valve (with pressure gauges) to the service port on the wide tube service valve. (Fig. 20).



<Structure of service valve on wide tube side>

Fig. 21

CAUTION

Before using the vacuum pump adapter, read the vacuum pump adapter manual, and use the adapter correctly.

CAUTION

Be sure to use a manifold valve for air purging. If it is not available, use a stop valve for this purpose. The "Hi" knob of the manifold valve must always be kept closed.

- When using a hex wrench to open the spindle, an extremely small amount of refrigerant may leak. This does not indicate a problem.
- Use a hex wrench of a type to which force can be easily applied.

(4) With the “Lo” knob of the manifold valve open and high-pressure valve (“Hi”) closed completely, run the vacuum pump. Run the pump until the pressure is –101 kPa (–76 cmHg). The operation time for the vacuum pump varies with tubing length and the capacity of the pump. The following table shows the amount of time required for evacuation:

Table 5

Required time for evacuation when capacity of 100 liter/h vacuum pump is used
120 min. or more

NOTE

The required time in the above table is calculated based on the assumption that the ideal (or target) vacuum condition is around 10 mmHg abs.

(5) With the vacuum pump still running, close the “Lo” knob of the manifold valve. Then stop the vacuum pump. Fully close the low-pressure valve and stop the vacuum pump. (Wait 1 – 2 minutes and check that the manifold gauge pointer does not return. If it does return, find and repair the leak, then apply the vacuum again.)

(6) With a hex wrench, turn the valve stem on the narrow tube service valve counter-clockwise by 90 degrees (1/4 turn) for 10 seconds, and then turn the stem clockwise to close it again.

CAUTION **Be sure to completely insert the hex wrench before attempting to turn the valve.**

(7) With a standard screwdriver, turn the wide tube service valve stem counterclockwise to fully open the valve.

(8) Turn the narrow tube service valve stem counterclockwise to fully open the valve.

(9) Loosen the vacuum hose connected to the wide tube service port slightly to release the pressure. Then, remove the hose.

(10) Leak test all joints at the tubing (watertank and outdoors) with liquid soap. Bubbles indicate a leak. Be sure to wipe off the soap with a clean cloth.

CAUTION **If a CFC gas detector is used, use a special detector for HFC refrigerant (such as R410A and R134a).**

(11) Replace the flare nut on the wide tube service port and fasten the flare nut securely with an adjustable wrench or box wrench. Next, mount the valve cap and tighten it with a torque wrench (the cap needs to be tightened with the torque of 20 N·m (200 kgf · cm)). This process is very important to prevent gas from leaking from the system.

(12) While the heatpump is running, apply liquid soap to check for any gas leaks around the service valves or caps.

(13) If there is no leakage, stop the heatpump

(14) Wipe off the soap on the tubing.

This completes air purging with a vacuum pump and the heatpump is ready for actual operation.

10. ■ Pump Down

In order to protect the earth's environment, be sure to perform pump-down to recover refrigerant gas without releasing it into the atmosphere.

- When relocating or disposing of the heat pump, request this service from the dealer where the unit was purchased, or from an appropriate agent. Perform pump-down as described below.

What is pump-down?

- Pump-down refers to recovering the refrigerant gas from the refrigerant cycle at the outdoor unit. This work must be performed during heating operation.

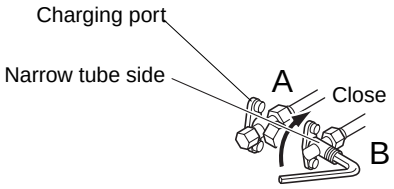


Fig. 22

Pump-down procedure

(1) Stop heatpump. Fully close the spindle at the valves on the narrow tube side of tubes B. (Refer to Fig. 22.)

(2) Connect the manifold gauge to the charging port at the valve on the wide tube side of tube A. Purge the air from the charging hose. (Refer to Fig. 23.)

(3) Perform heating operation and turn on pumpdown switch Y2 terminal base(8p). When the pressure at the low-pressure side is 0.15 – 0.2 MPa (0.5 – 1 kg/cm^{2}G), fully close the spindle at the valve on the wide tube side A, and immediately stop operation. (Refer to Fig. 23.)

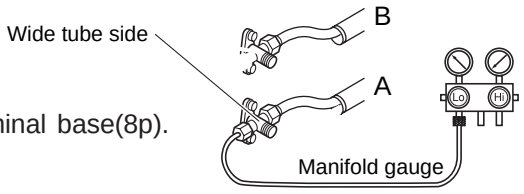


Fig. 23

(4) Disconnect the manifold gauge and the inter-unit tubes, and attach the caps and flare nuts. At this point, pump-down is completed. (If the caps and flare nuts are not reattached, there is the danger of gas leakage.) (Refer to Fig. 24.)

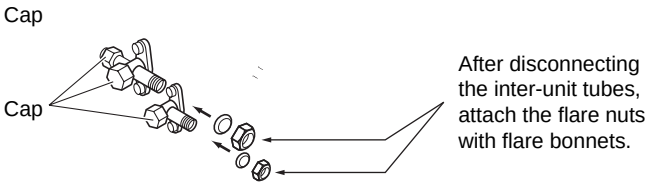


Fig. 24

If pump-down is not possible

If the heatpump cannot be operated because of a malfunction or other cause, use a refrigerant recovery device to recover the refrigerant.

11. Wiring Instructions

General Precautions on Wiring

(1) Before wiring, confirm the rated voltage of the unit as shown on its nameplate, then carry out the wiring closely following the wiring diagram.

(2) Provide a power outlet to be used exclusively for each unit, with a power supply disconnect and circuit breaker for overcurrent protection provided in the exclusive line.

(3) To prevent possible hazard due to insulation failure, the unit must be grounded.

(4) Each wiring connection must be done tightly and in accordance with the wiring system diagram. Wrong wiring may cause the unit to misoperate or become damaged.

(5) Do not allow wiring to touch the refrigerant tubing, compressor, or any moving parts of the fan.

(6) Unauthorized changes in the internal wiring can be very dangerous. The manufacturer will accept no responsibility for any damage or misoperation that occurs as a result of such unauthorized changes.

Recommended Wire Length and Diameter

Regulations on wiring diameter differ from locality to locality. For field wiring requirements, please refer to your local electrical codes. Carefully observe these regulations when carrying out the installation.
Table 5-4 page 11 shows maximum wire lengths for control line and power line and fuse or circuit capacity.

English

How to Connect Wiring to the Terminal

WARNING **Loose wiring may cause the terminal to overheat or result in unit malfunction. A fire hazard may also exist. Therefore, be sure all wiring is tightly connected.**

When connecting each power wire to the corresponding terminal, follow the instructions “How to connect wiring to the terminal” and fasten the wire securely tight with the fixing screw of the terminal plate.

How to connect wiring to the terminal

a) For termostat Watertank

(1) Cut the wire end with a cutting pliers, then strip the insulation to expose the wire about 5 mm. See the label (Fig. 26) near the terminal plate.

(2) Using a screwdriver, loosen the terminal screw on the terminal plate.

(3) Insert the wire and tighten the terminal screw completely using a screwdriver.

b) For Outdoor Unit

■ For solid core wiring (or F-cable)

(1) Cut the wire end with a cutting pliers, then strip the insulation to expose the solid wire about 25 mm. (Fig. 27)

(2) Using a screwdriver, remove the terminal screw(s) on the terminal plate.

(3) Using the pliers, bend the solid wire to form a loop suitable for the terminal screw.

(4) Shape the loop wire properly, place it on the terminal plate and fix it securely with the removed terminal screw using a screwdriver.

■ For stranded wiring

(1) Cut the wire end with a cutting pliers, then strip the insulation to expose the stranded wiring about 10 mm and tightly twist the wire ends. (Figs. 28 and 29)

(2) Using a screwdriver, remove the terminal screw(s) on the terminal plate.

(3) Using a ring connector fastener or pliers, securely clamp each stripped wire end with a ring connector. (Fig. 28)

(4) Place the ring connector wire, and replace and tighten the removed terminal screw using a screwdriver. (Fig. 30)

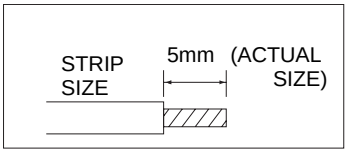


Fig. 26

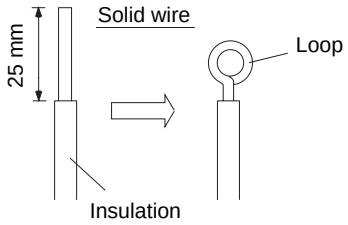


Fig. 27

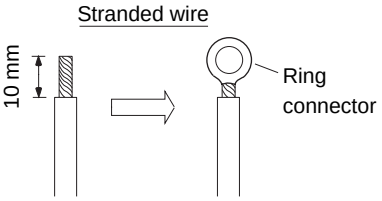


Fig. 28

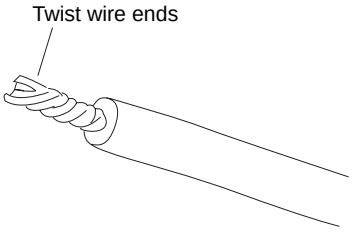


Fig. 29

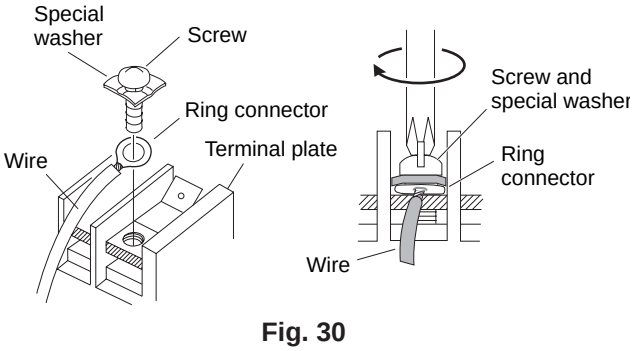
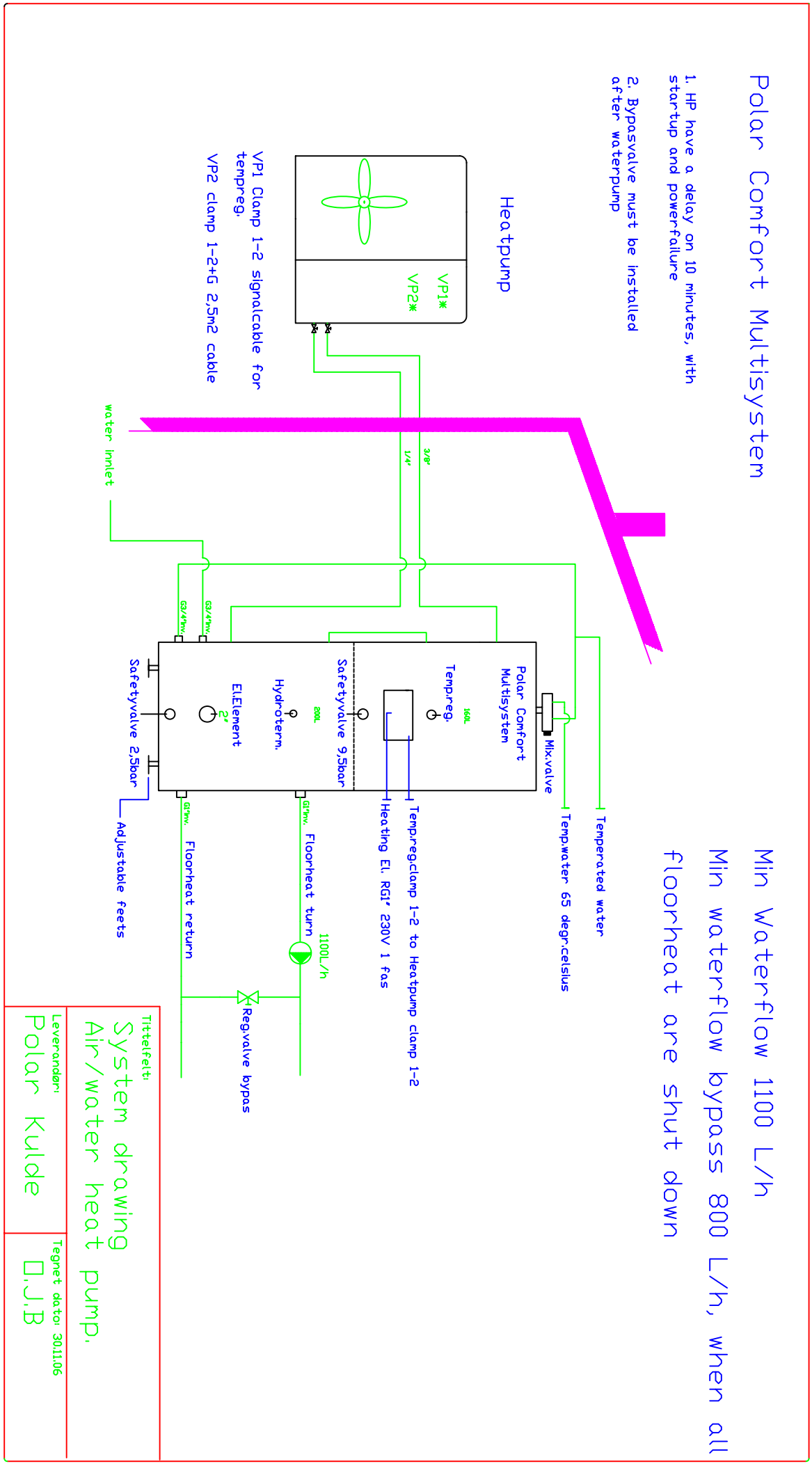


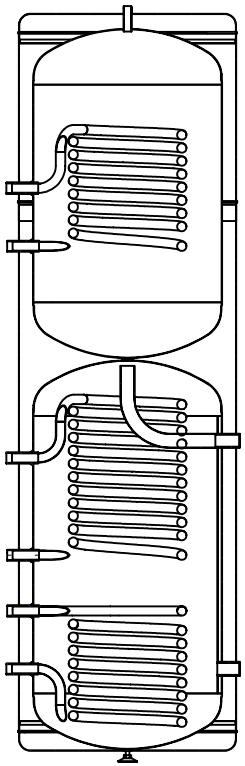
Fig. 30

12. Installation Check Sheet

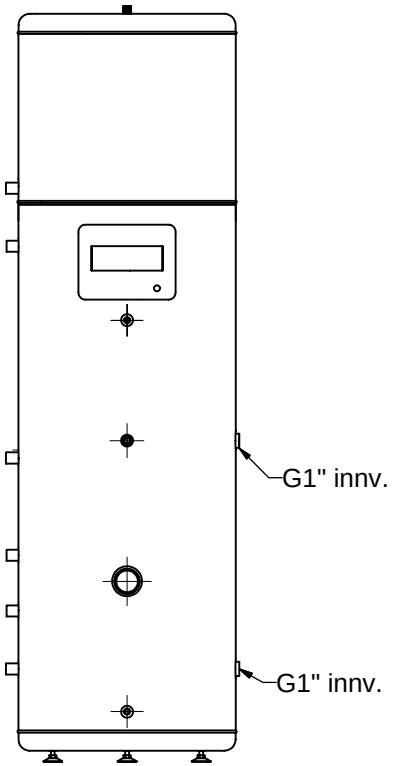
- ☐ The strength of the installation location is sufficient to support the heatpump weight.
- ☐ The watertank and outdoor units are installed level.
- ☐ The power and voltage are as specified.
- ☐ Inter-unit cables are securely fastened to the terminal board.
- ☐ Inter-unit cables are securely fixed.
- ☐ The power cord and inter-unit cables are not connected anywhere along their paths.
- ☐ The ground wire is securely connected.
- ☐ An air purge of the refrigerant circuit has been conducted.
- ☐ A leak test of the tubing connections has been performed.
- ☐ Thermal insulation has been applied to the tubing connections.
- ☐ Putty has been used to close the hole in the wall.
- ☐ service valves A/B are fully open.

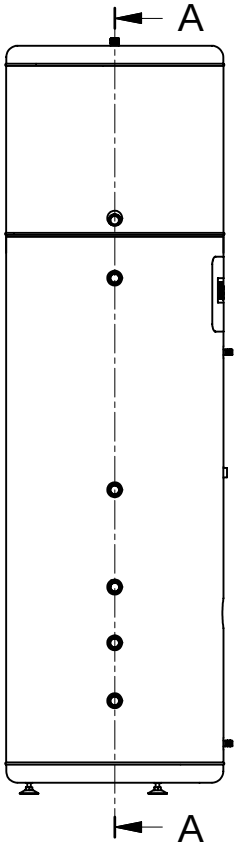

Polar Comfort Multisystem
1. HP have a delay on 10 minutes, with startup and powerfailure
2. Bypasvalve must be installed after waterpump
Heatpump
VP1*
VP2*
VP1 Clamp 1-2 signalcable for tempreg.
VP2 clamp 1-2+G 2,5m2 cable
water inlet
3/8"
1/4"
G3/4"fmv.
Safetyvalve 2,5bar
El.Element
2"
Hydroterm.
200L
Safetyvalve 9,5bar
Tempreg.
160L
Polar Comfort Multisystem
Mix.valve
Min Waterflow 1100 L/h
Min waterflow bypass 800 L/h, when all floorheat are shut down
Temperated water
Tempwater 65 degr.celsius
Temp.reg.clamp 1-2 to Heatpump clamp 1-2
Heating El. RGI, 230V 1 fas
G1"mv.
Floorheat turn
1100L/h
Floorheat return
Reg.valve bypas
Adjustable feets
Tittelfelt:
System drawing
Air/water heat pump.
Leverandør:
Polar Kulde
Tegnet dato: 30.11.06
D.J.B

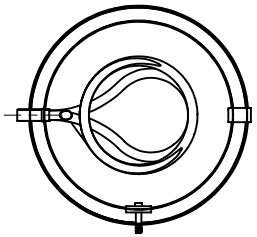
14.



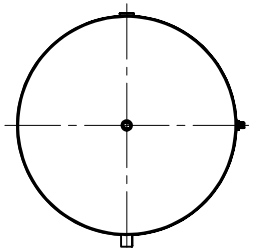
A-A

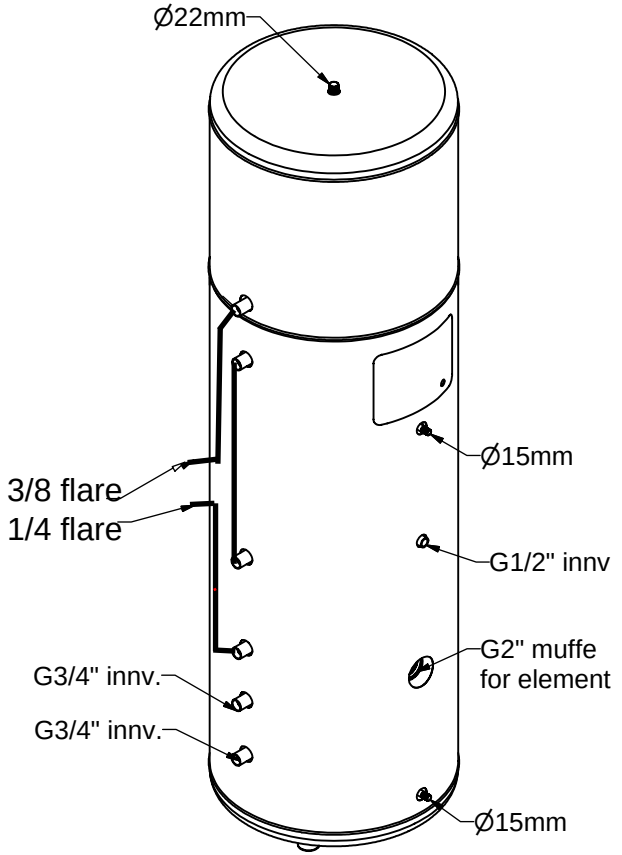






B-B





Dato 21.04.2005	Konstr./ Tegnet Lars Hansen	Gen tol: NS-ISO 1432 (Grad A) NS-ISO 2768 (Middels)	Målestokk:	Polar Kulde AS Opstadveien 7 4332 Ålgård
Kontroll	Kontrollert	Godkjent ok		
Polarcomfort multitank 160L / 200L			Erstatning for:	Erstatt av:
			Tegn, nr: 1114.03	Rev. k
Henvisning	Filenavn: Polarcomfort multisystem		Arkiv nr:	Plot dato:

ART.NR	BENEVNING TYPE/MATR/DIM	STK
2240	MEMBRANPAKNING EPDM 80 IRHD. Per.vulc.	1
29220	MEMBRANSKIVE PA 6.6 30% GF	1
2253	O-RING 14x1.78 EPDM PER.	1
2315	SOLE KLEMMUTTER 15mm Cz-121 CuZn39Pb3	1
23171	VENTILHUS SOLE SV DRAIN Cz-132 CuZn36Pb2As	1
2457	FJÆR for SV X 12 Cr Ni 177 DIN 17224 1.4310 1.9mm	1
2715	FJÆRHUS PA 6.6 30% GF	1
2716	AVLASTNINGSRATT 9 BAR 5kW PA 6.6 30% GF	1
2717	KONPLUGG f/TØMMING Cz-132 CuZn36Pb2As	1
23141	SOLE KLEMRING 15mm Cz-132 CuZn36Pb2As	1
2752	SPINDEL for SV2 – SV95 Cz-121 CuZn39Pb3	1
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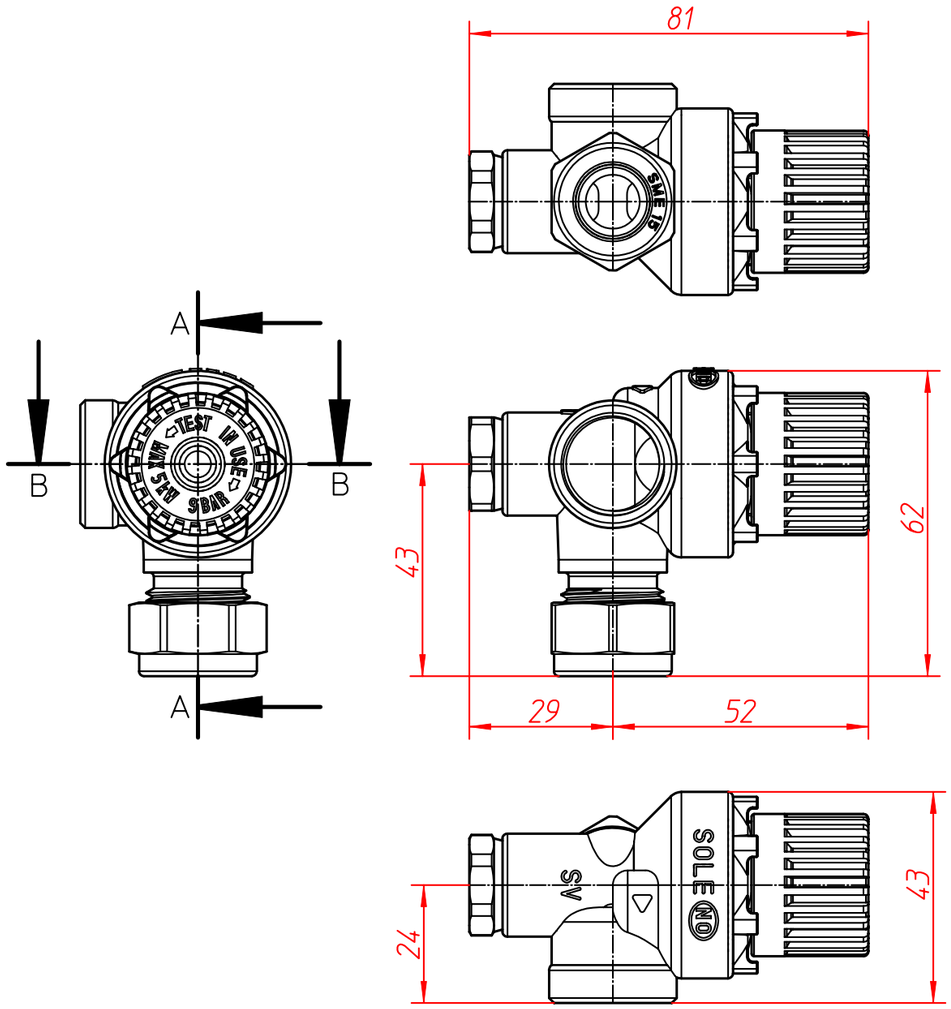
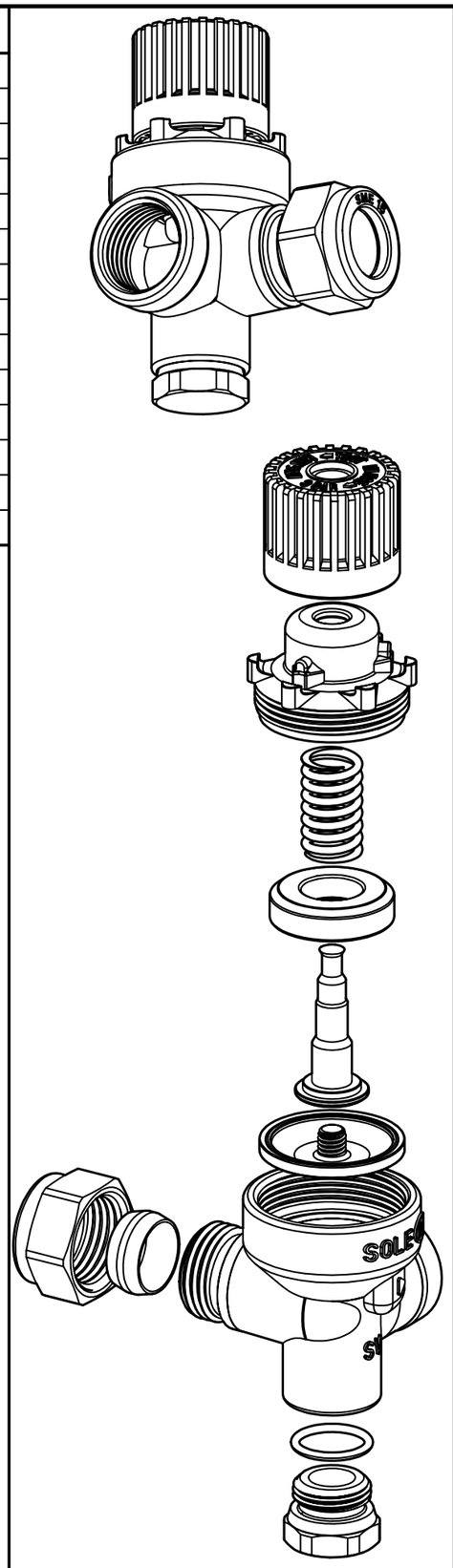
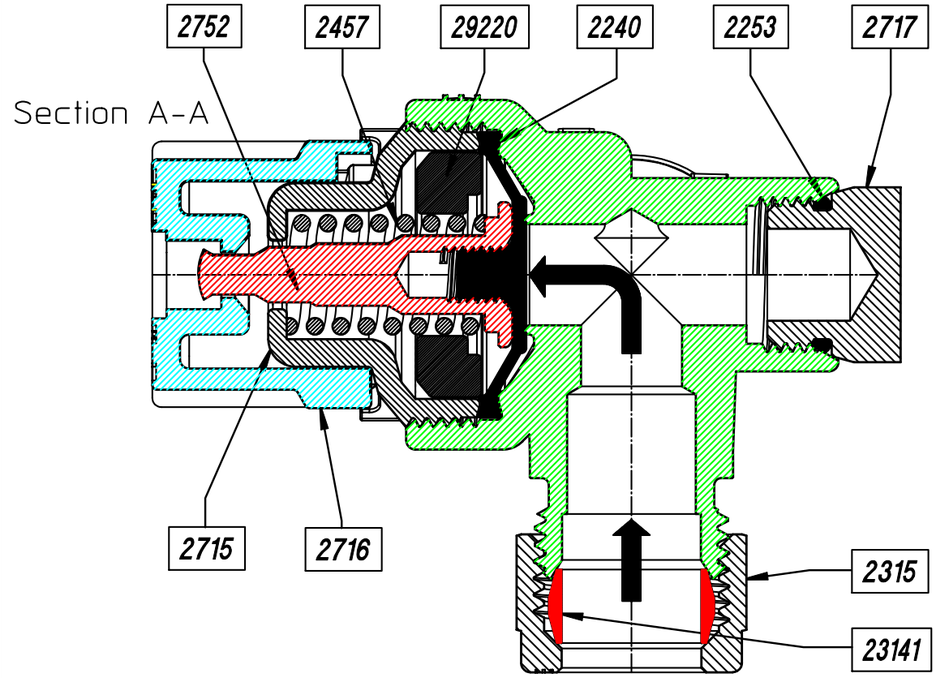
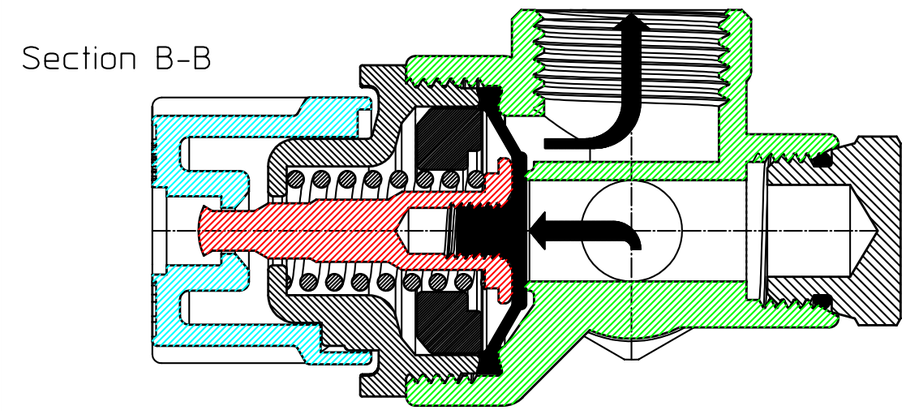






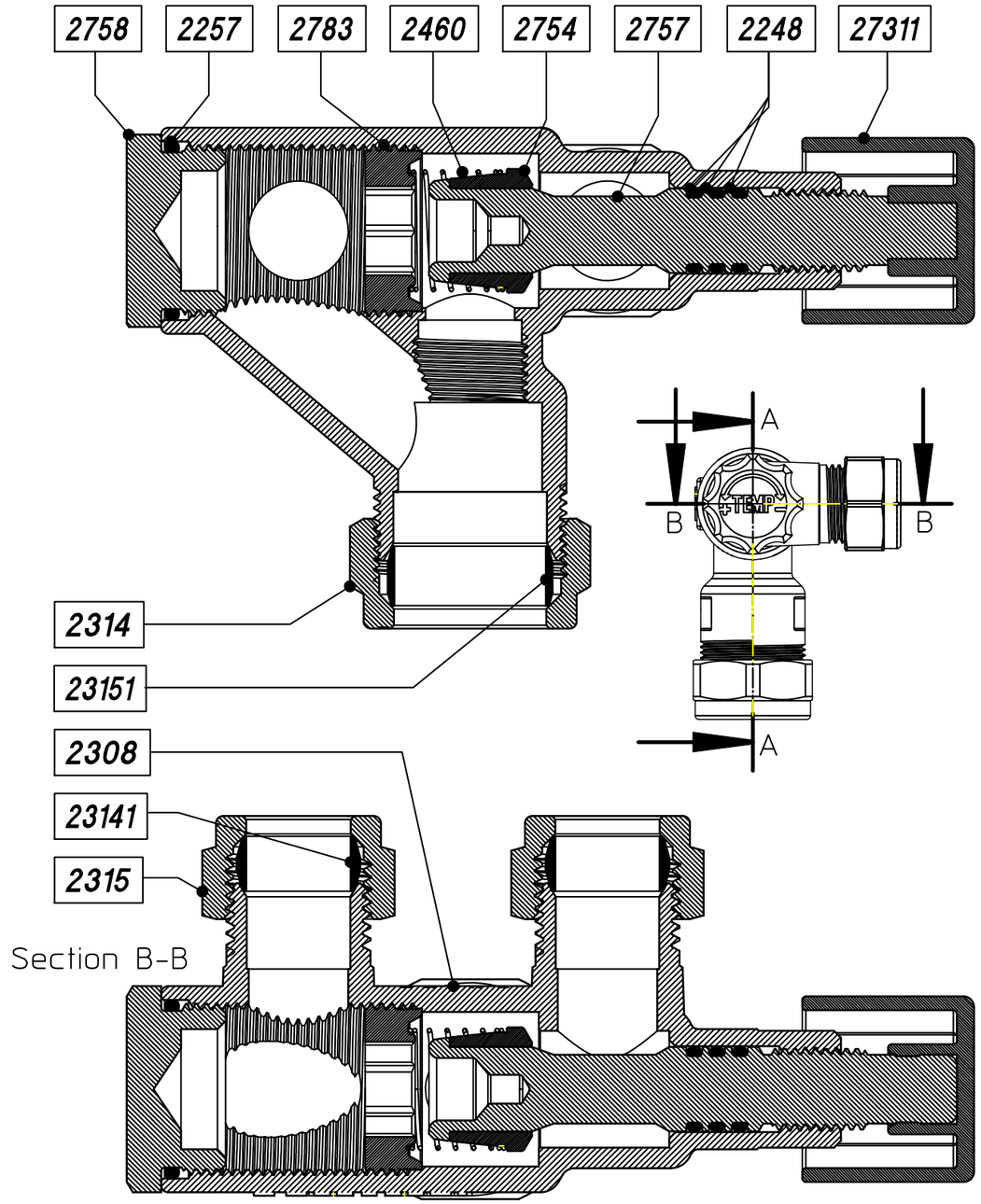


VENTIL TYPE

SVA

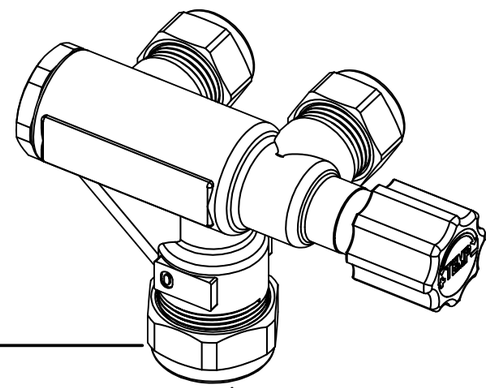
SIKKERHETSVENTIL
m/AVTAPPING

ART.NR: 3388	
TEGN.NR:	SME-20001158
UTGAVENR:	B
DATO:	7.OKT-2005
GODKJ:	SOLE

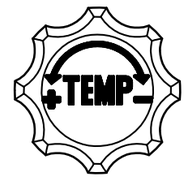


ART.NR	BENEVNING	STK
2315	KLEMMUTTER 15MM Cz–121 CuZn39Pb3	2
2257	O–RING 22x2 f/UP EPDM 70 SHORE	1
2783	SETE FOR UX–MANUELL PES 30% GF	1
27311	RATT HØIAX MANUELL, Rødt Tekst: +TEMP–	1
23151	KLEMRING 22mm Cz–132 CuZn36Pb2As	1
2758	PLUGG f/UP Cz–132 CuZn36Pb2As	1
23141	KLEMRING 15mm	2
2308	HUS f/UP–15 med HØIAX–logo	1
2248	O–RING 9.25x1.78 EPDM 70	3
2757	SPINDEL f/UP PES 30% GF	1
2754	STEMPEL f/UP	1
2460	FJÆR UP15	1
2314	KLEMMUTTER 22mm 6 KT	1

UM–15 MANUELL



27311



MANUELL BLANDING

UM–15

TEGN.NR:	SOLE–20051777
UTGAVENR:	A
DATO:	31.JAN–2005
GODKJ:	SOLE

ART.NR:

33801

Varmekolber for bereder tank R 1" rørgjenger

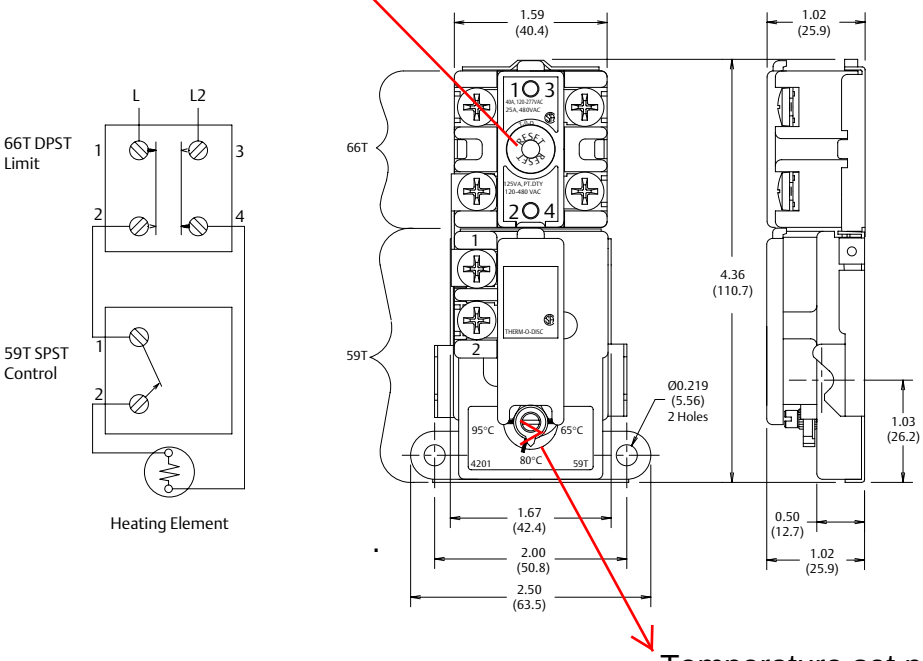
Utførelse:
Syrefaste rørelementer (AISI 316 L)
R 1" messinghode
Flatstifttilkobling
2 ulike elementer for trinnregulering
Flatebelastning ca.9W pr.cm^2
Spenning 230V 1~50 hz

Type	Effekt kW	L mm	Art.nr.
IU 23	**2,0** (0,75+1,25)	450	2520398003

Termostat and safety devices for tapwater heating tank

The thermostat and wireing for single element water heaters are shown below *see figures 2* .
The combination 59T SPST and 66T DPST is used in residential 240VAC applications, as well as in commercial electric water heater applications where each element may be independently controlled.

Safety device termostate. For reseting the termostate press in the safety bottom.



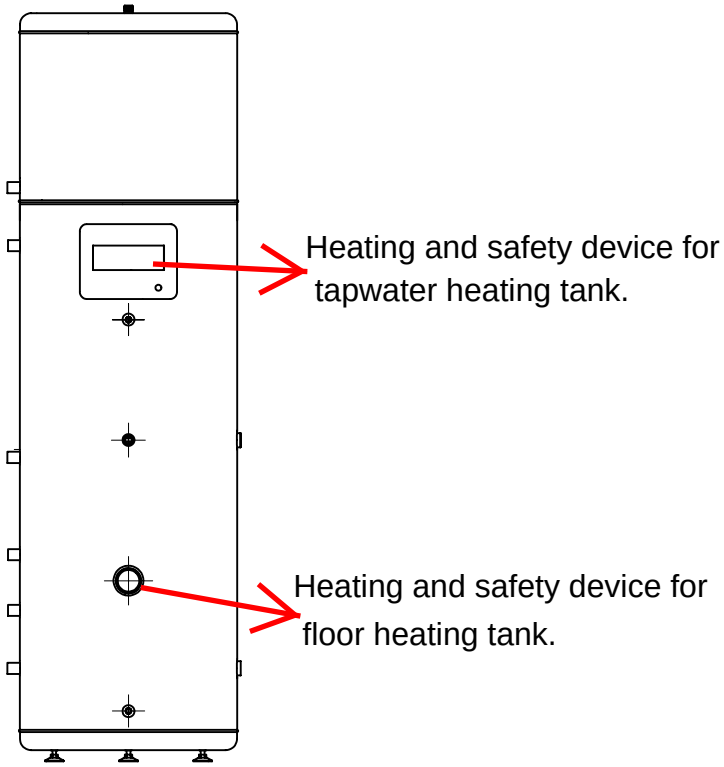
Temperature set point termostat

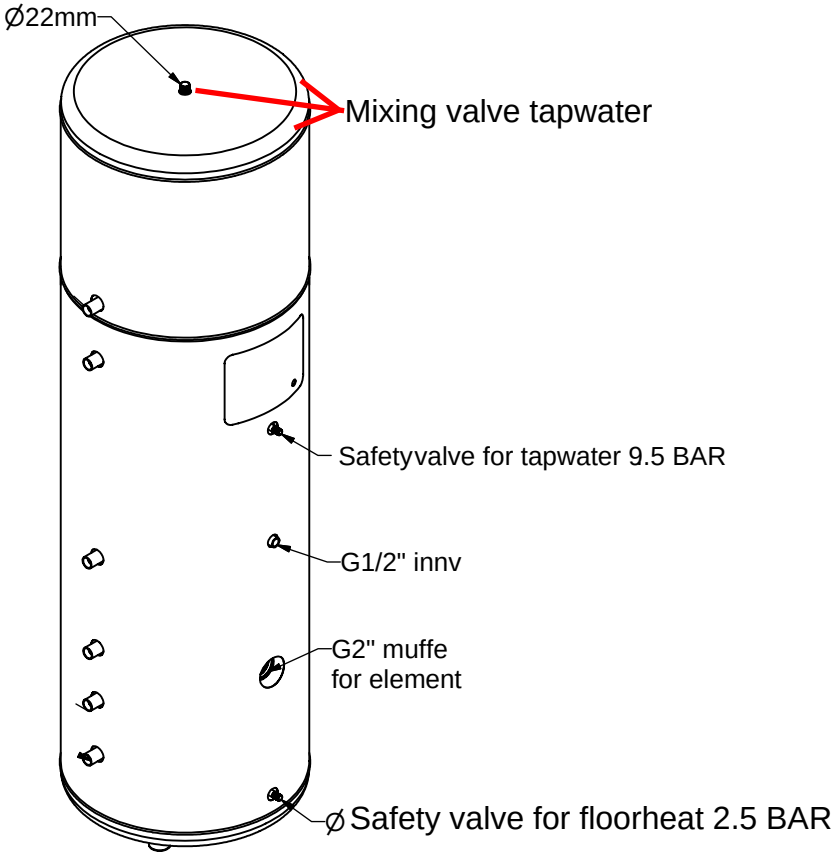
The termostate safety device is set to 92 c. Reset the safet devicey when no heating occurs.

Termostat temperature are set to +65 c.

Location off additional heating device se page 44.

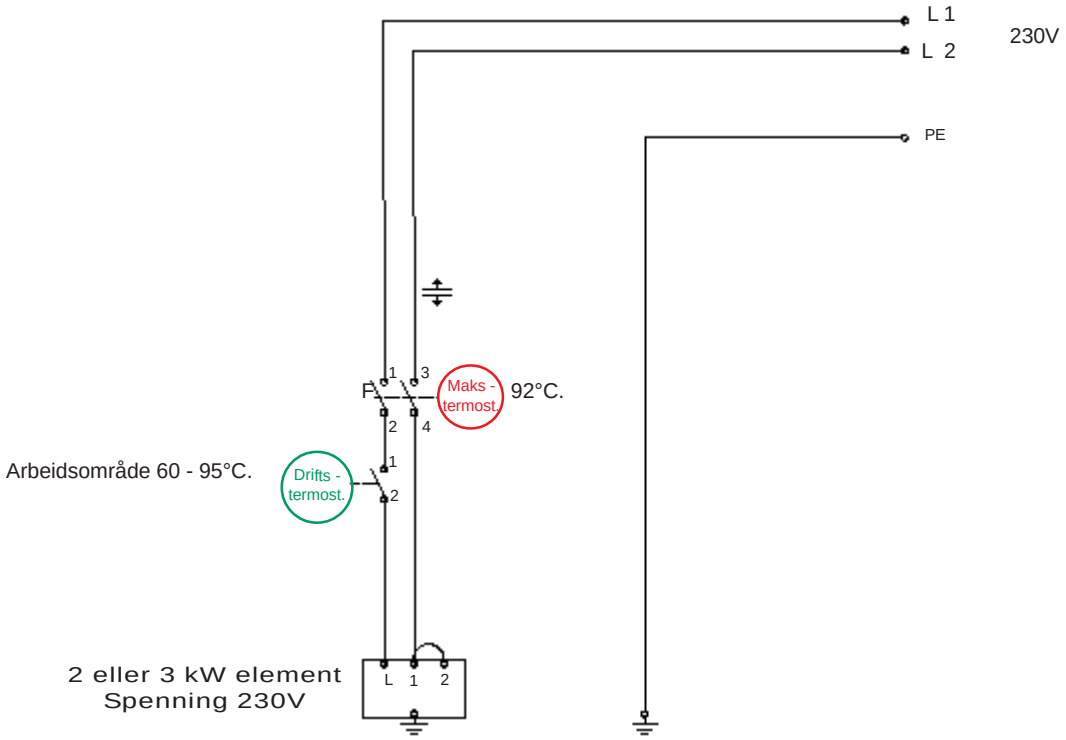
LOCATION OF ADDITIONAL HEATING DEVICE





Elektroskjema Polarcomfort tapwatertank

230 V

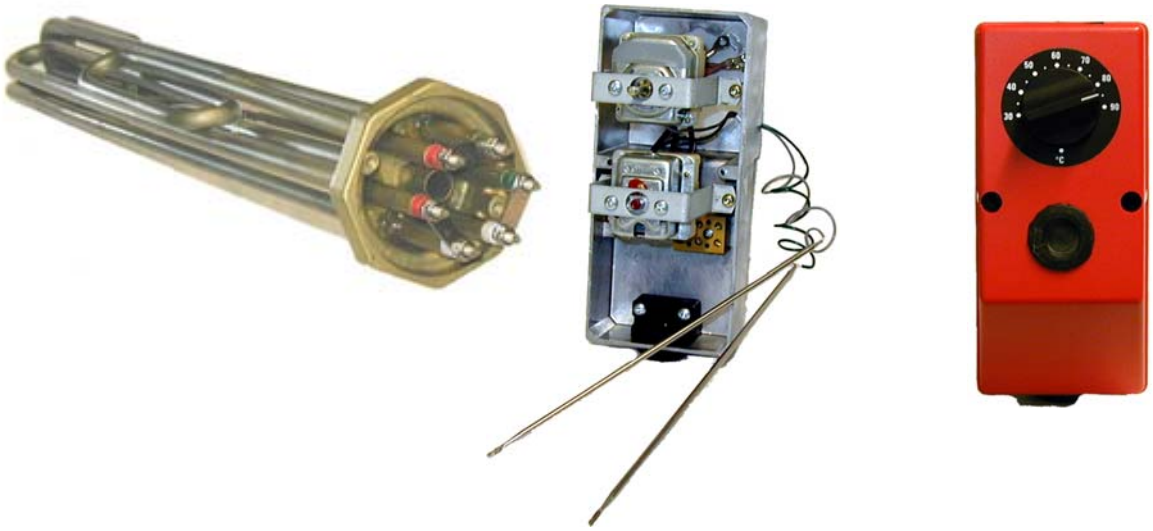


Kombi KEK

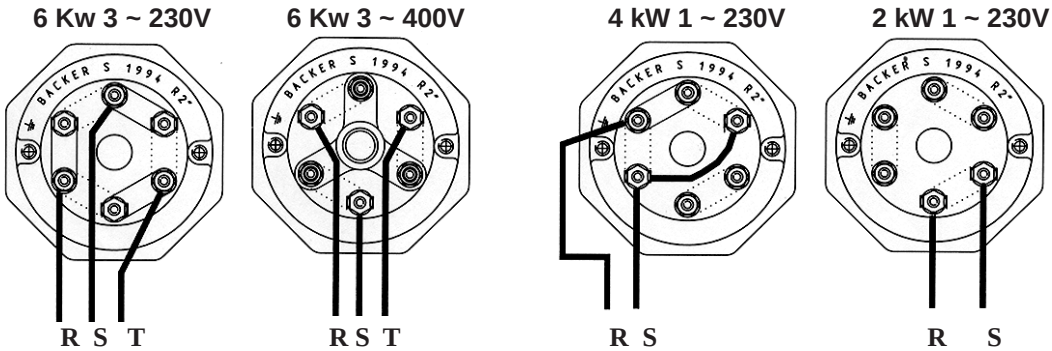
Innstikkslengde kolbe inkl. gjenger	mm	465
Termostathus : Bredde	mm	94
Høyde	mm	200
Dybde inkl. ratt for arbeidstermostat og messing mutter	mm	165

Termostathuset er av aluminum med lokk i karbonplast. Huset er vridbart, slik at riktig stilling på kabelinntaket lett kan innjusteres.

Termostathuset leveres med 2 - polig arbeidstermostat 30 - 90°C
og 3 - polig sikkerhetstermostat 102°C



Koblings alternativer IU 39R



UGINE & ALZ
Groupe Arcelor

Ugine & ALZ France
Site de Gueugnon
71130 Gueugnon
FRANCE

MILL CERTIFICATE BS EN 10204/3.1

CERTIFICAT DE RECEPTION NF EN 10204/3.1
ABNAHMEPRUEFZEUGNIS B DIN EN 10204/3.1

N-Nr-N 06-G-85406-01-01

ISO TS 16949V2002 - ISO 14001 V1996

Manufacturer's works order number N° de la commande usine productrice Werksauftragsnummer 6UA607320/02-55633/1	**Purchaser and/or consignee** Client et/ou destinataire Besteller und/oder Empfaenger HOIAX A/S TRIPPEVN.5 LISLEBY 1618 FREDRIKSTAD NORVEGE
Purchaser's order number N° de commande client Kundenbestellnummer 4414	**Customer article number** N° d'article client Artikelnummer des Kunden
Product - Produit - Erzeugnis COLD-ROLLED COIL BOBINE LAMINEE A FROID KALTGEWALZTES BAND	
Steel designation Désignation de l'acier Stahlbezeichnung EN 10088-2 / 05 - 1. 4521	**Finish** Présentation Ausfuehrung 2B
Steelmaking process Mode d'élaboration de l'acier Stahlherstellungsverfahren Prod.proces:Electric arc furnace-VOD/AOD-Continuous casting Proc.fabric.: Four à arc-VOD/AOD-Coulée continue Fertigungsablauf:Elektro-Ofen-VOD/AOD-Stranggussanlage	**Product delivery condition** Etat de livraison du produit Lieferzustand Annealed 820-880 C Recuit Geglueht Forced Air Air forcé Geblaese Luft
Any supplementary requirements Prescriptions supplémentaires Zusätzliche Anforderungen	

PRESSURE VESSEL - APPAREIL A PRESSION - RP0.2% MINI : 340 MPA AT 20 C & 300 MPA AT 100 C - RM MINI 480 MPA.

Identification of the product Identification du produit-Identifizierung des Erzeugnisses		Dimensions Dimensions - Abmessungen			Number of pieces Nombre de pièces - Stueckzahl	1
Coil n. N° de bobine Band Nr	**Heat n.** N° de coulée Schmelz Nr	**Thickness** Epaisseur - Dicke	**Width** Largeur - Breite	**Length** Longueur - Laenge	**Net weight** Poids net - Netto Gewicht	6303 KGS
902942	117460	1,350 mm	760,00 mm			

CHEMICAL ANALYSIS - ANALYSE CHIMIQUE - CHEMISCHE ZUSAMMENSETZUNG

	C	Si	Mn	Ni	Cr	Mo	Ti	N	S	P	Nb					
Required-Exigé % mini					17,00	1,80										
Anforderung % maxi	0,025	1,00	1,00		20,00	2,50	0,800	0,030	0,0150	0,040						
Cast Analysis Analyse coulée Analyse Schmelze	0,016	0,39	0,30		17,62	1,85	0,200	0,017	0,0015	0,028	0,339					
	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84	C85	C86

Tests to verify batch and quality have been carried out : OK
Tests de vérification de la conformité de la nuance fournie : OK
Verwechslungspruefung wurde durchgefuehrt : OK C04

C93

Bend test results are satisfactory D32
Les essais de pliage sont satisfaisants
Ergebnisse des Biegeversuchs entsprechen den Vorschriften

MECHANICAL PROPERTIES - PROPRIETES MECANIQUES - MECHANICAL WERTE

Location (1) — Room temperature - Température ambiante - Raumtemperatur — Test temperature : C03

Direction (2)		Yield strength Limite d'élasticité Streckgrenze Mpa		Tensile strength Résistance à la traction Zugfestigkeit Mpa	Elongation after fracture Allongement après rupture Bruchdehnung %		Hardness Dureté Haerte	Yield strength Limite d'élasticité Streckgrenze Mpa		Tensile str. Résist. Mpa Zugfestigkeit	Elongation % Allongement Bruchdehnung
	Required Exigé Anforderung	Rp 0.2 %	Rp 1 %	Rm	80mm		C30	Rp 0.2 %	Rp 1 %	Rm	
	mini	320		420	20						
	maxi			640							
3 T	Obtained Obtenu Ergebnisse	344		510	30						
		C11	C14	C12	C13	C15	C31	C16	C17	C18	C19

Impact strength test Essai de résilience Kerbschlagzaehigkeitstest C40		Corrosion test Test de corrosion Korrosionstest								
temperature C44										
		C42		C50	C51	C52	C53	C54	C55	C56

D51 Internal cleanliness : A: B: C: D: C57

Location of the sample (1) Emplacement de l'échantillon Lage des Probenabschnittes 1.Front - Début - Anfang 2.Back - Fin - Ende 3.Middle - Milieu - Mitte C01	The delivery is in accordance with the order La fourniture est conforme aux exigences de la commande Die Lieferung entspricht den Bestellbedingungen Z01	Organisation inspection Organisme et/ou service contrôle Ueberwachungsabteilung A05 Service Métallurgique Le : 02/10/2006 J.C. EVON The inspector Le responsable Der Werssachverstaendige Z02
Direction of the test pieces (2) Orientation des éprouvettes Probenrichtung T.Transverse - Travers - Quer L.Longitudinal - Long - Laengs C02	Marking, inspection and measurement : without objection Contrôle de marquage, d'aspect et de dimensions : satisfaisants Pruefung der Stempelung, des Oberflaechenaspekts und der Abmessungen : ohne Beanstandung D01	