

AIRCOOL CHILLER

MEDICOOL/CH.11P3R407C (50Hz)
&
MEDICOOL/CH.11P4R407C (60Hz)

User Manual (Revision 08)



AIRSYS

Product Information

GEHC P/N	Type	Description	Power Supply
5332778	MEDICOOL/CH.11P3R407C	11kw Water Chiller 50Hz	380/400/415V/50Hz
5346827	MEDICOOL/CH.11P4R407C	11kw Water Chiller 60Hz	460/480V/60Hz

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Revision History

Revision	Changing Description	Date
01	Initial release	2010/03/23
02	Re-write section 4	2010/04/19
03	1, Add note and diagnose description in AL13 in Alarm list in Section 8.1 for compressor internal thermo protection triggered; 2, Add requirements for item 15 in maintenance list in Section 10.4 3, Add new alarm codes, AL10, AL20, AL21, AL27, AL29, AL30 in Section 8.1; 4, Revised electric diagram in Section 10.2; 5, Change pictures in Fig 8, Section 2.5; 6, Replace piping diagram in section 10.2; 7, Add pump curve in Appendix;	2010/10/28
04	1, Change “Fig.- 13, Outdoor Piping/Hose Connection for Cooling Type B” to “Fig.- 13, Outdoor Piping/Hose Connection for Cooling Type C”; 2, Add task for “Fill tank of chiller with glycol” and add remark for leak reparation of customer made piping in Table-6, Installation responsibility; 3, Add “The distance may be extended to 60m by using 1” ID pipe” in warning page, item 5, and section 3.3.1.	2011/7/25
05	1, Table-2 change “Flexible hose kit (3/4 inch (20 mm) hose barbs , 3/4 inch quick disconnect fittings(male), 30.5 m (100 ft) lengths of 3/4 inch (20 mm) flexible rubber hose)” to “Kit (3/4 inch (20 mm) hose barbs , 3/4 inch ball valve)”, and change “1/2”—3/4” adapter) 2pcs” to “30.5 m (100 ft) lengths of 3/4 inch (20 mm) flexible rubber hose 1 pcs” 2, change “quick disconnect” to “ball valve” 3, Chapter 4.1 table change “Flexible hose kit (3/4 inch (20 mm) hose barbs , 3/4 inch quick disconnect fittings(male), 30.5 m (100 ft) lengths of 3/4 inch (20 mm) flexible rubber hose)” to “Kit (3/4 inch (20 mm) hose barbs , 3/4 inch ball valve)”, and change “1/2”—3/4” adapter) 2pcs” to “30.5 m (100 ft) lengths of 3/4 inch (20 mm) flexible rubber hose 1 pcs” 4, Change “Fig.- 1 Quick disconnection coupling “ to “Fig.- 2 Ball valve coupling” 5, Delete chapter 4.4 “Push center stud of coolant supply’s quick dis-connector (Fig.-24) until coolant comes out, then release the stud.” and “Fig.- 3 Pump air bleeding” 6, Replace Fig.- 4 label the coolant loop	2012/09/01
06	1, Change Circuit Diagram. 2, Update alarm list. 3, Add date sheet.	2013/01/09
07	1. Updated Technical Data Sheet	2015/06/05
08	1. Add AL31 in Alarm List	2017/05/04

Symbols used on the water chiller

Symbol	Meaning	Symbol	Meaning
	Danger This symbol is particularly relevant to safety.		Live components, risk of electric shock
	High Skilled Operation, Technician Only!		Caution
	THIS SIDE UP shows the orientation of the unit		NO HOOKS don't use hooks to lift the packed unit
	FRAGILE handle with care		KEEP AWAY FROM HEAT the unit must be kept away from heat sources
	PROTECT AGAINST MOISTURE The package unit must be stored in a dry place		DO NOT STACK

A **‘NOTE’** is used to call particular attention to a step of a procedure, which, if not strictly followed, could result in damage to, or destruction of equipment.

Warning labels



Equipment lives even with door open. To operate obey the safety rules.

Do not open. Skilled technicians only can enter the electric panel.

Do not start the compressor before pre-heating the oil (see instructions).



Handle gently, avoid vibration, shocking when installation.

Risk of electric shock. Disconnect power before servicing unit.

Hot surface. Do not touch.

Please read the manual before installation and operation!

ALWAYS GET HELP FROM QUALIFIED REFRIGERATION SERVICE ENGINEERS TO ACCESS THE CHILLER WHEN MALFUNCTION IS FOUND!

Important considerations before installation and operation:

1. This manual provides guidance for chiller type MEDICOOL/CH.11P3R407C (50Hz) and MEDICOOL/CH.11P4R407C (60Hz).



Before power cable connection, make sure local power supply meets the voltage/frequency requirements on the nameplate!

The power supply cable should be provided by customer.



It is recommended the main power fuse connected to the chiller should be equipped with 25A.

2. Pump can't work with voltage out of the scale for more than 30min, especially when the voltage exceeds the up limit (456V50Hz or 528V60Hz). Always keep the voltage within the range.
3. The machine can be operating at ambient temperature between **-30°C(-22°F)~43°C(109°F)**. If coolant outlet set point is 20°C~25°C, the upper limit of ambient temperature can be 48°C(118°F). And the altitude of the site for installation should not exceed 2,438 m (8,000 ft). Chiller may report high pressure alarm and stop working if condition is out of spec.



Note: Max. allowable temperatures may be reduced for high altitude operation by a factor of 6.4°C per 1000m.

4. The elevation of the chiller installed above the MRI should NOT greater than 30 m (100ft). The elevation the chiller installed below the MRI should NOT greater than 3 m (10ft).
5. Keep piping distance from chiller to operating room less than 30m to avoid additional pressure drop which may cause low flow rate. The distance may be extended to 60m by using 1" ID pipe. Order 100m cable in Option list (refer to Section 7) for remote controller if 30m cable is not enough.
6. Chiller installed near sea shore may cause corrosion on machine cover and pipe lines inside chiller because of salt fog. To minimize the corrosion, we recommend the chiller should be installed 10 km away from sea shore.
7. **Never power on the machine without coolant or use the pump to drain the unit, it will damage the pump immediately!** Follow the instruction in this manual or attached with unit to bleed air out of pump before the first start-up and for unit start-up which is stored without coolant for a long time.
8. **The rubber hose is supposed to be used for indoor connection only.** Pipe used for outdoor should be provided by customer. For unit installed outdoor, we recommend copper pipe and adequate temperature insulation for coolant pipe lines from unit into building.
9. Follow Section 3 of pre-installation instructions for appropriate installation. Chiller and/or any components on chiller damaged of inappropriate installation or misoperation described in this manual will be out of scope of warranty.

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1. Unpacking

1.1. Open the package

The unit is packed and transported in two special cases. The main package dimension of the unit is 1180 x 860 x 1490 mm³, gross weight is around 355kg (782pound). The package dimension of loose parts kit is 703x703x772 mm³, gross weight is around 178.5kg (394pound).

1. Visual checks the package for any damage during transportation. Contact forwarder, GEHC or AIRSYS as soon as possible if any damage is found. Use a pry bar to open top cover of the crate, remove and place it in an area clear of the uncrating area. (Fig.-1).

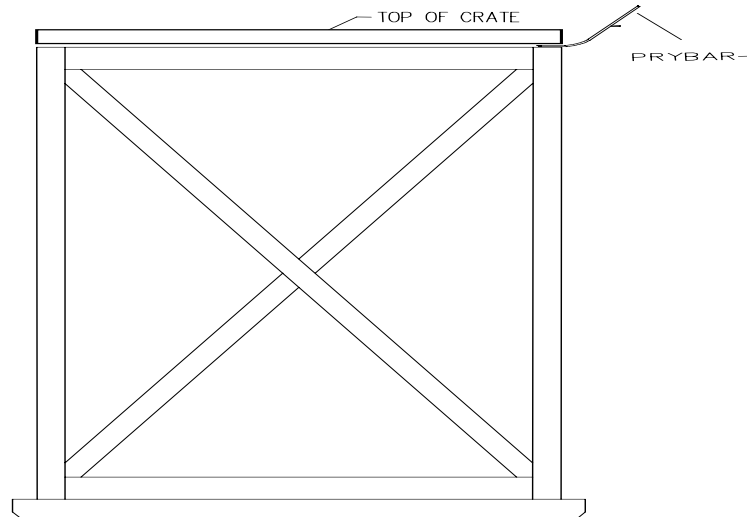


Fig.- 1 Remove top of the crate

2. Use a pry bar, carefully remove the plate of crate around the unit, and place in an area clear of the uncrating area. (Fig.- 2)

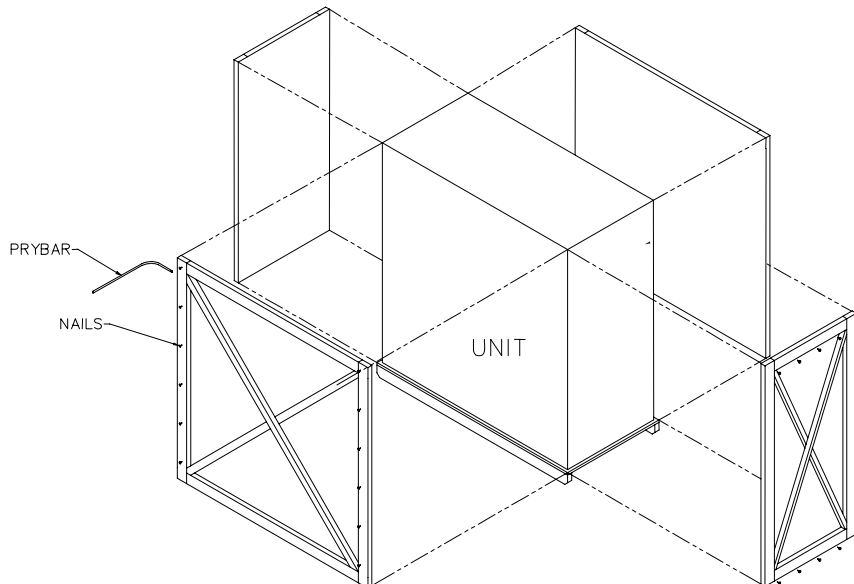


Fig.- 2 Remove other parts of the crate

3. CAREFULLY remove plastic protector.
4. Visual checks the equipment for any damage during transportation. Contact forwarder, GEHC or AIRSYS as soon as possible if any damage is found. AIRSYS can be reached by the information in second page in the manual.

5. **When the unit is for indoor purpose**, loose bolts between support bracket and chiller at bottom (remove the bracket) to use caster to move the chiller, refer to Fig.-3.

When the unit is for outdoor purpose, loose bolts between support brackets and bottom of crate and mount the unit on the concrete or rooftop, refers to Fig.-3.

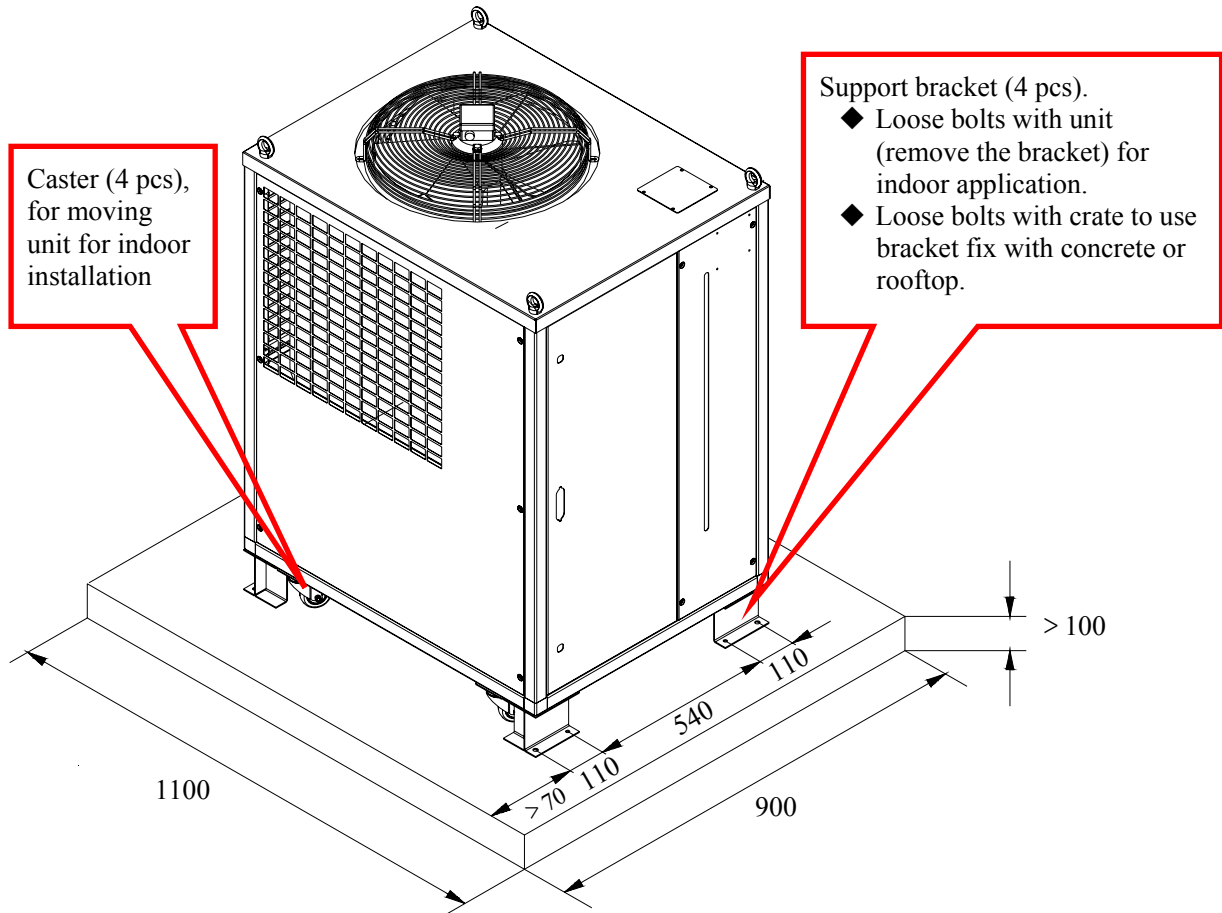


Fig.- 3 Mounting holes of unit and dimension of the concrete foundation for chiller installation (Unit: mm)

6. Use forklift truck to move unit to place where the chiller to be installed. Refer to Fig.-4.

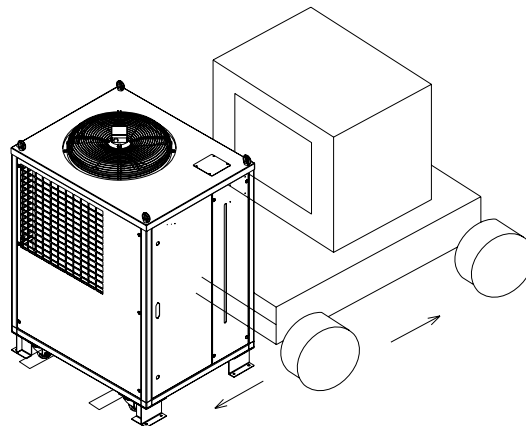


Fig.- 4 Unit lifting

7. If chiller is going to be installed on rooftop, prepare two lifting straps (Max. load >1000kg) with hooks at both of ends, approximately 2 m (79 inches) long to lift the unit. Let the hook pass through the lift-ring on top of unit, as the Fig.-5, and make sure unit is balance.

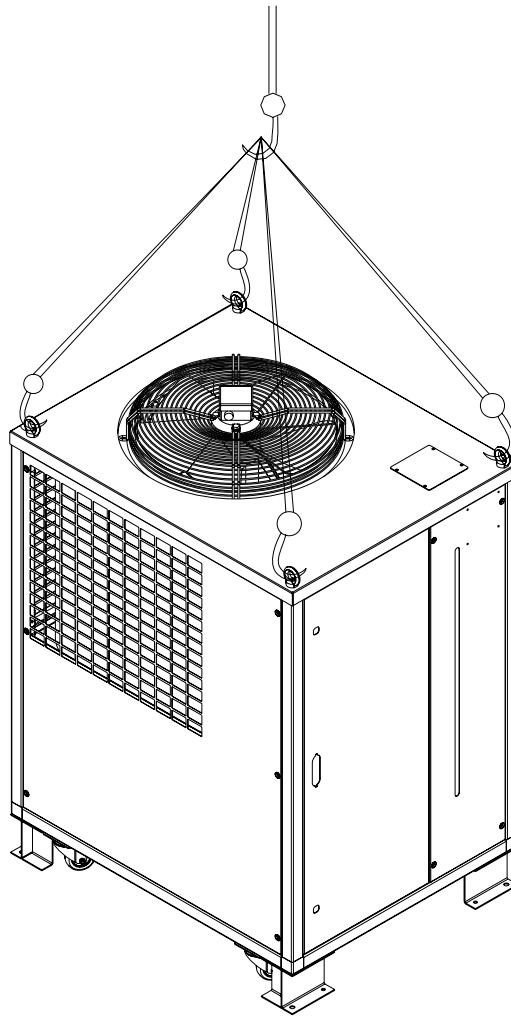


Fig.- 5 Move chiller on rooftop

8. Before move the unit to working place, try to lift the unit a little to see whether the two straps need to be adjusted to balance the unit from toppled over.

Keep the carton and all packing materials until the unit is completely assembled and working properly. Set up and run the unit immediately to confirm proper operation. If the unit is damaged or does not operate properly, contact the company who deliver the unit to your place, and file a damage claim. Inform GEHC or to whom your unit was purchased.

1.2. Package Contents of Main Box & Accessory Box

S/N	Item	Quantity	Check & Mark
1	11kW Water Chiller, <u>MEDICOOL/CH.11P3R407C</u> or <u>MEDICOOL/CH.11P4R407C</u>	1	<input type="checkbox"/>
2	Key for front door	2	<input type="checkbox"/>
3	User Manual	1	<input type="checkbox"/>
4	Certificate of conformity	1	<input type="checkbox"/>
5	Packing list of unit box	1	<input type="checkbox"/>

Table- 1 Packing list of unit box

S/N	Item	Quantity	Check & Mark
1	Hose clamps, 3/4inch (20 mm)	4	<input type="checkbox"/>
2	Kit (3/4 inch (20 mm) hose barbs , 3/4 inch ball valve)	2	<input type="checkbox"/>
3	Remote controller with bracket	1	<input type="checkbox"/>
4	Control cable from remote control panel to chiller, 30.5m.	1	<input type="checkbox"/>
5	20 liter 50/50 Mixture of propylene glycol and de-ionized water with additive of rust inhibitor and yellow dye	4	<input type="checkbox"/>
6	Plastic funnel(Max:φ175 Minφ35,height 22 volume 300ml)	1	<input type="checkbox"/>
7	Pipe-type terminals, 1.5mm ² (2.33X10 ⁻³ in ²)	6	<input type="checkbox"/>
8	Pipe-type terminals, 1.0mm ² (1.55X10 ⁻³ in ²),	6	<input type="checkbox"/>
9	Pipe-type terminals, 6.0mm ² (9.3X10 ⁻³ in ²)	6	<input type="checkbox"/>
10	Rubber hose, 12.7mm (1/2"), 5m	2	<input type="checkbox"/>
11	30.5 m (100 ft) lengths of 3/4 inch (20 mm) flexible rubber hose	1	<input type="checkbox"/>
12	Teflon tape 20m x 25mm x 0.1mm	1	<input type="checkbox"/>
13	Label	1 set	<input type="checkbox"/>
14	Packing list of loose parts	1	<input type="checkbox"/>
15	Self-tapping screw, SST	4	<input type="checkbox"/>

Table- 2 Packing list of loose parts

2. General Information

2.1. Brief of the Chiller

The manual is provided for water chiller, type MEDICOOL/CH.11P3R407C (50Hz) and MEDICOOL/CH.11P4R407C (60Hz), which is different in power supply, 380/400/415 VAC@ 50 Hz and 460/480 VAC@ 60 Hz, as shown in Table-1, Product information.

GEHC P/N	Type	Description	Power Supply
5332778	MEDICOOL/CH.11P3R407C	11kw Water Chiller 50Hz	380/400/415V/50Hz
5346827	MEDICOOL/CH.11P4R407C	11kw Water Chiller 60Hz	460/480V/60Hz

Table- 3 Product information

The MEDICOOL/CH.11P3R407C/ MEDICOOL/CH.11P4R407C water chiller is a single-loop device, of which provides 7~23.1 Lpm (1.8~6.1 Gpm) of temperature constant coolant for medical equipment, or any process/machine requiring temperature control.

It contains a refrigeration unit, coolant reservoir and pump, integrated together with in a shelter that allows the unit to be operated indoors or outdoors. It has a microprocessor controller. The chiller also provides a remote control panel that allows the user to control the chiller wherever it is located, indoors or outdoors. The remote control panel allows the user to turn the chiller on/off, monitor coolant outlet/inlet temperature, set temperature, check alarm, etc. The refrigeration system is able to provide cooling as needed under precise temperature control, as well as greater temperature stability and long life of compressor. In general, this chiller has been designed for long life and easy to use.

Environmental conditions:

- Non-operating:

Ambient Temperature: -34°C (-29.2°F) ~ +55°C (131°F)

Altitude: 120m (400 ft) below to 3,352m (11,000 ft) above sea level

Magnetic Field: 30 Gauss

- Operating:

Ambient Temperature: -30°C (-22°F) ~ +43°C (109°F), coolant outlet setting point 15°C (59°F)~25°C(77°F);

-30°C (-22°F) ~ +48°C (118°F), coolant outlet setting point 20°C (68°F)~25°C(77°F);

Altitude: 30m (100 ft) below to 2,438m (8,000 ft) above sea level

(Max. allowable temperatures may be reduced for high altitude operation by a factor of 6.4°C per 1000m.);

Elevation above MRI: less than 30 m (100 ft);

Elevation below MRI: less than 3m (10 ft);

Magnetic Field: 30 Gauss

NOTE: If the unit is in place where ambient temperature is near limited temperature -34°C or 55°C, the unit will be started up only after it has been staying in normal temperature for 24 hours.

2.2. Specifications

ITEMS	UNITS	SPECIFICATIONS	
		MEDICOOL/CH.11P3R407C 50Hz	MEDICOOL/CH.11P4R407C 60Hz
Cooling Capacity*	kW	11.0	12.6
Set Point (default)	°C (°F)	20°C (68°F)	
Set Point Range	°C (°F)	15°C ~ 25°C (59°F ~ 77°F)	
Temperature Control Accuracy	°C (°F)	±1.0°C (1.8°F)	
Noise	dB(A)	68.0	70.5
Refrigerant		R407C	
Refrigerant Charge	kg	6.8±0.2	
Power Supply Voltage**	Rated	3~~380/400/415V	3~~460/480V
	Scale	±10%	±10%
Maximum Input Rating Power (Total)	kW	7.0	8.0
Starting Current	A	74	74
Total Current ***	A	13	13
Air Heat load at 7kw	kW(BTU/hr)	15.2(55600)	16.8(61440)
Air Heat load at 11kw	kW(BTU/hr)	13.8(50500)	15.4(56320)
Compressor	set	1	
Power Input	kW(HP)	3.64 (4.9)	4.30(5.8)
Current	A	6.7	7.9
Maximum Rating Current	A	7.4	8.7
Starting Current	A	70	70
Axial Fan	n	1	
Horse Power	kW(HP)	0.3(0.4)	(0.4)0.53
Current	A	1.25	1.7
Nominal Air Flow	M³/h	5000	6000
Refrigerant-water Heat Exchanger	set	1	
Water Flow	L/min(GPM)	7~40 adjustable	7~40 adjustable
Water Resistance	kPa	22.5@23.1	22.5@23.1
Refrigerant Circuits	set	1	
Capacity Control Methods		EEV	
Water Pump	set	1	
Head	m	65.0	68.0
Power Input	kW(HP)	2.45 (3.29)	2.99 (4.00)
Current	A	3.0	2.5
Coolant		50/50 mixture of propylene glycol and de-ionized water solution, with additive of rust inhibitor and yellow dye	
Water Tank Content	L(gal)	33(8.7)	
Dimension			
Length	mm(inch)	1075(43.32)	
Width	mm(inch)	805(31.70)	
Height	mm(inch)	1415(55.71)	
Net Weight	kg(pound)	315(695)	
Weight of Unit when Filled	kg(pound)	360(804)	
*- rated conditions: ambient temperature: 43°C (109.4°F); supply coolant temperature: 20°C (68°F); return coolant temperature: 25°C (77°F)			
**- Pump can't work with voltage out of the scale for a long time (more than 30min), especially when the voltage exceeds the up limit(456V50Hz or 528V60Hz). Always keep the voltage within the range.			
***-. We recommend the main power fuse connected to the chiller should be equipped with 25A.			

Table- 4 Specifications

2.3. Diagram of Unit and Dimensions

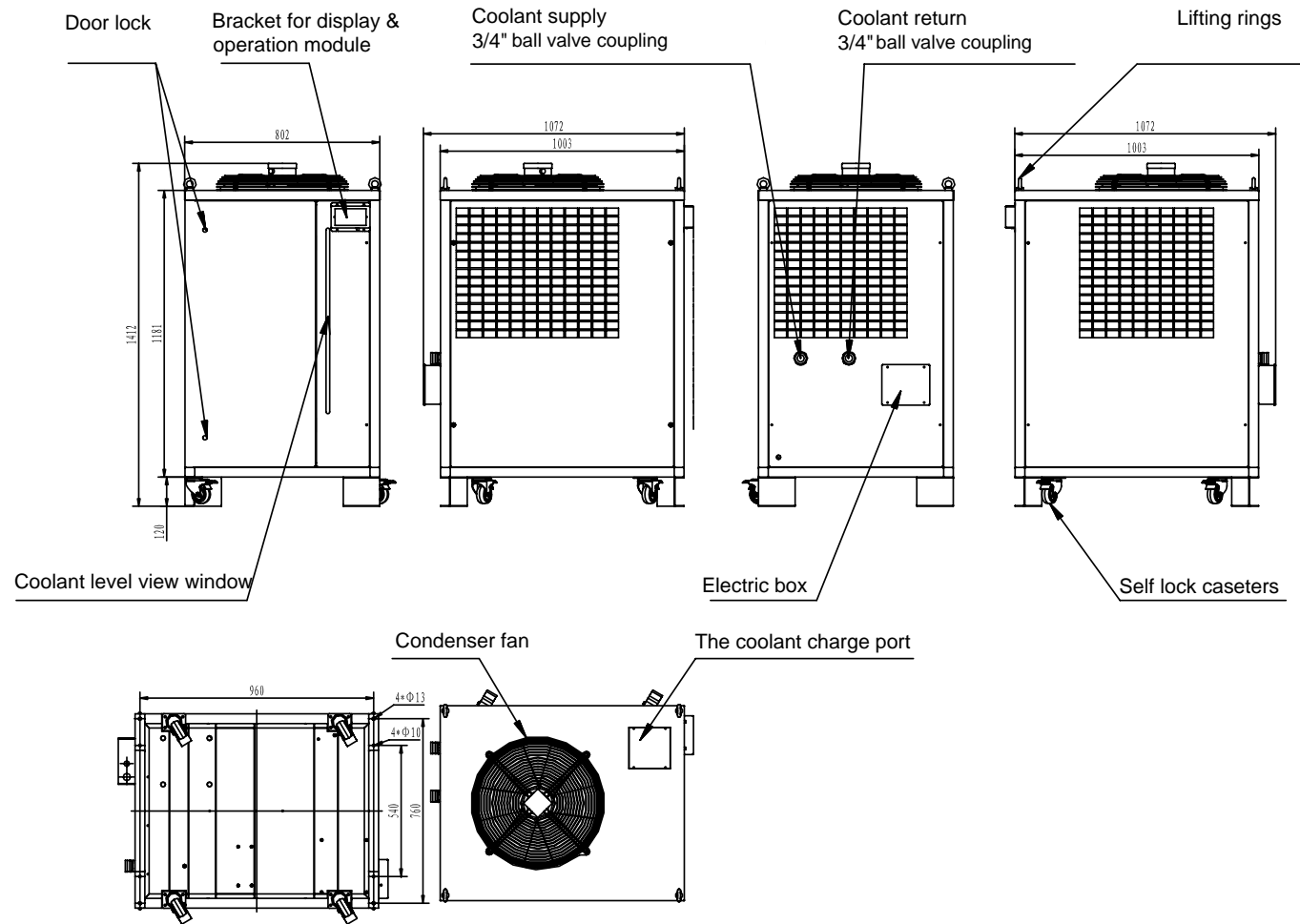


Fig.- 6 Overall dimension (Unit: mm)

2.4. Remote Control Panel

The chiller is operated via the remote control panel.

The control panel has a LCD display and six keys, as the below Fig.-7.

Key for recall alarms, silence buzzer, and reset current alarm.

Key for rolling page up, if the cursor is in the top left corner of the screen; or increase the value, if cursor is in the value of parameter.

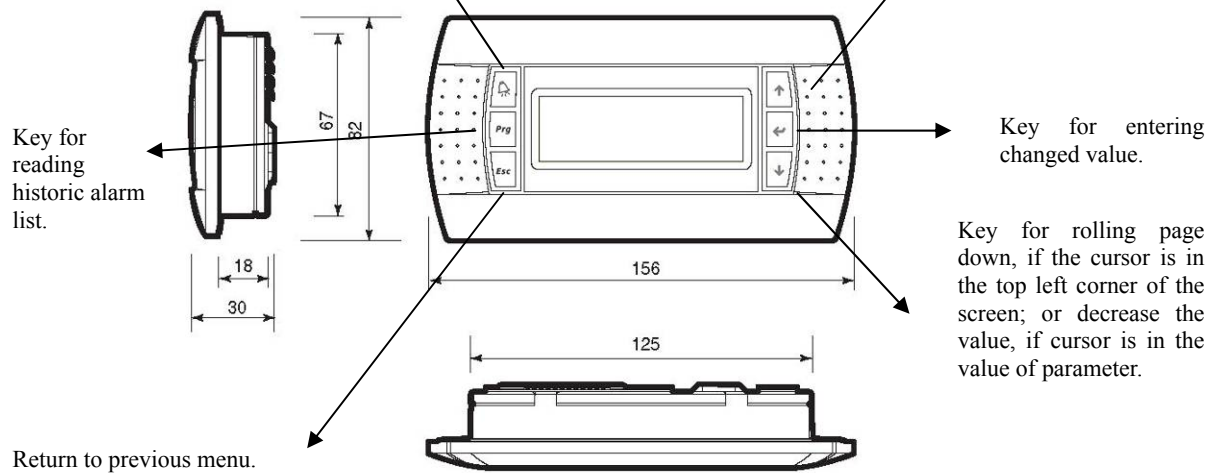









Fig.- 7 Remote controller description (unit: mm)

To start up or stop the unit, press "Esc"+"Enter" keys for 5 seconds.

The function of the keys is as following:

Button	Description
 ALARM	Key for recall alarms, silence buzzer, and reset current alarm
 UP	Key for rolling page up, if the cursor is in the top left corner of the screen, or increase the value, if cursor is in the value of parameter.
 DOWN	Key for rolling page down, if the cursor is in the top left corner of the screen, or increase the value, if cursor is in the value of parameter the value.
 ENTER	Key for entering changed value.
 PRG	Key for entering historic alarm list
 ESC	Return to previous menu.
 ESC+ENTER	Pressed at the same time for about 5 seconds to switch the unit On/Off.

2.5. Major Components

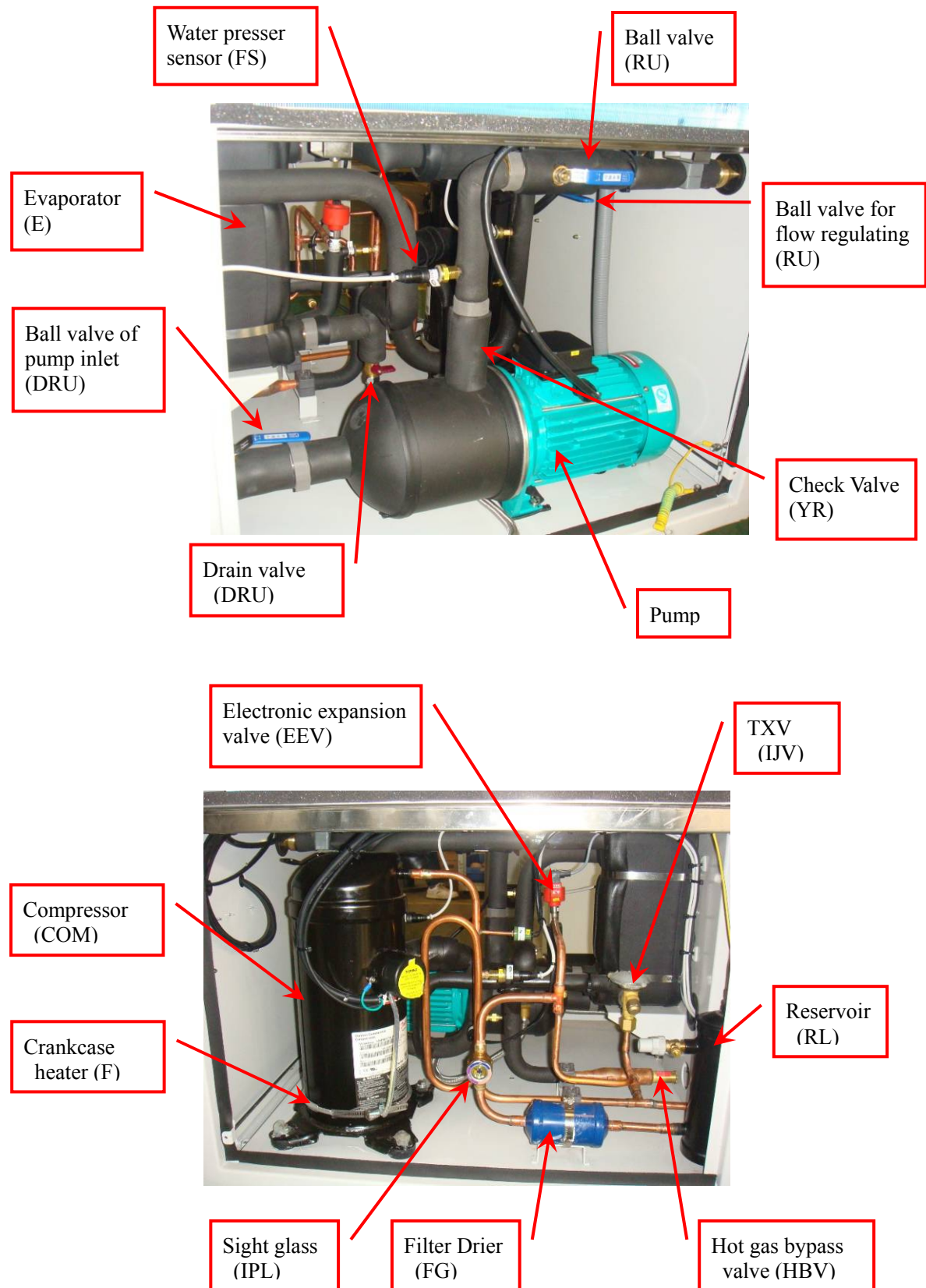


Fig.- 8 Major components

2.6. Service and Technical Support

Customer satisfaction is our highest priority. Please contact us immediately for technical assistance whenever you have questions or concerns. We can be reached by information listed in Table-5.

We could also be reached via email: 800@air-sys.com.

Please address information listed below before you call service or technical support,

- Model and Serial Number (getting from rating plate, e.g. CG02116001)
- Date of purchase and your purchase order number
- Suppliers' order number or invoice number
- A summary of your problem

Region	Address	Tel	Fax/Email
North America	GE Healthcare 3200N, Grandview Blvd, Waukesha, WI 53188	+1 800 437 1171	N/A
Europe & Mideast Countries	The Competitive Advantage Italy 27100 Pavia Via Sacco 7	+39 382 303 990	Roberto@caciolli.191.it
India	India Service Center	+91 33 2251 7220	+91 22 6645 9287 cc-india@air-sys.com
China & all other Countries	AIRSYS No.28, East LuGu St., Shijingshan Dist. Beijing P.R.China 100040	+86 10 400 820 5515 +86 10 6865 6161	+86 10 6865 2453 Callcenter@air-sys.com

Table- 5 Customer Service Information

3. Preparation for Installation

3.1. Installation Responsibility

Task	Customer	GE Service	Chiller Service
Unload Chiller from truck	✓		
Move chiller to equipment room or outdoor concrete pad and mount in accordance with local code	✓		
Connect customer-supplied power cable from field power supply or MDP to Chiller	✓		
Install water lines to chiller, and no leaks	✓		
Install remote controller and cable in Operation Room; and connect remote controller cable to chiller.	✓		
Fill tank of chiller with glycol	✓		
Start chiller, refill glycol into coolant loop			✓
Verify proper phase rotation and no leaks	✓ *		✓
Perform final Inspection of chiller and verify proper operation			✓
Attach labels			✓
Fulfill Start-up report			✓
Installation verification		✓	✓

*: perform leak repair when leak is found on piping between chiller and MRI.

Table- 6 Installation responsibility

NOTE: It is the customer's responsibility to choose the correct wire size according to line length, insulation type, wire routing and to comply with any local code requirements.

3.2. Material to be supplied by customer for installation

1. Power cable

2. Piping material (including pipe, joints, valve, etc.) for outdoor installation pipe connection.

Note: Copper pipe is recommended to be used for outdoor piping material. For other piping material, including pipe, joints and valves etc., for outdoor connection should meet requirements listed below:

- a) Working temperature: -30°C~90 °C ;
- b) Working pressure: ≥ 1.6 MPa;
- c) Material should be propylene glycol (50%) resistant.

3.3. Installation Requirements

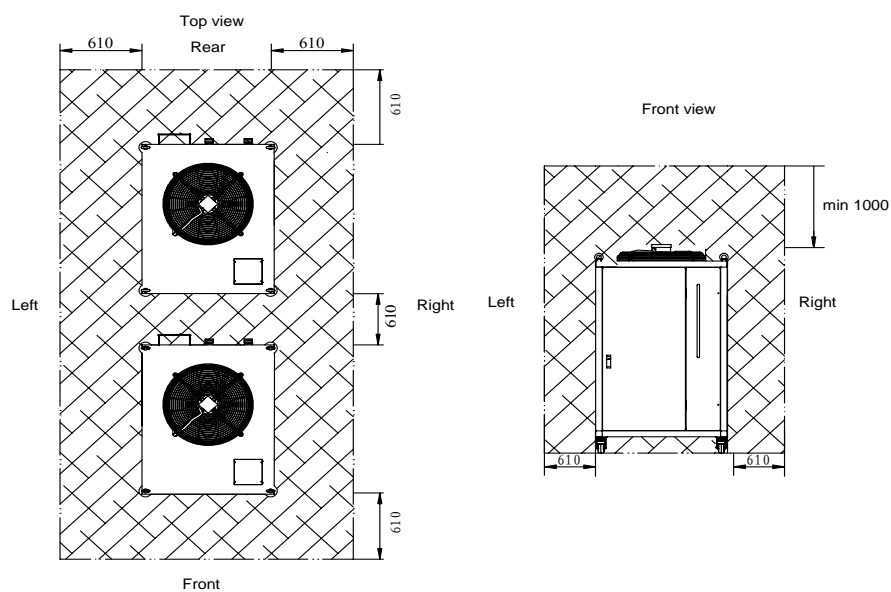
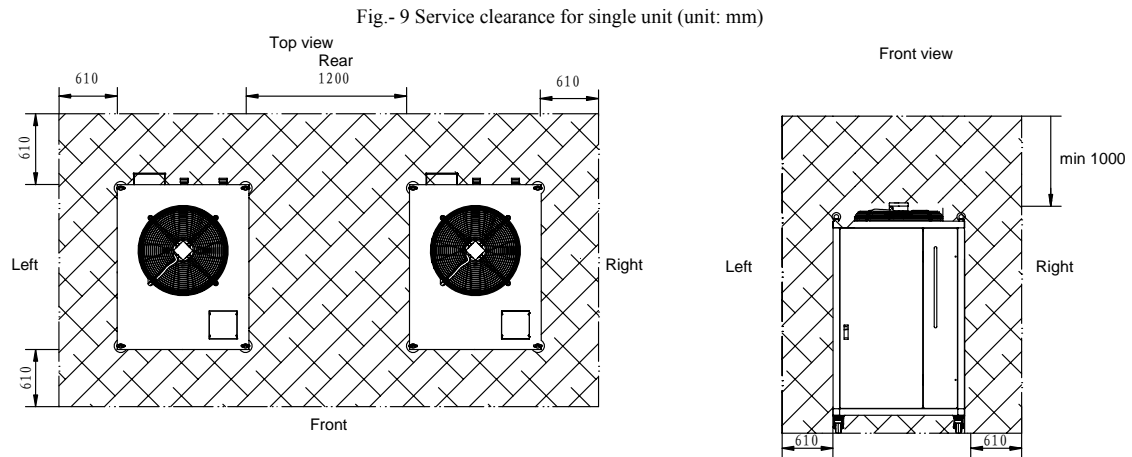
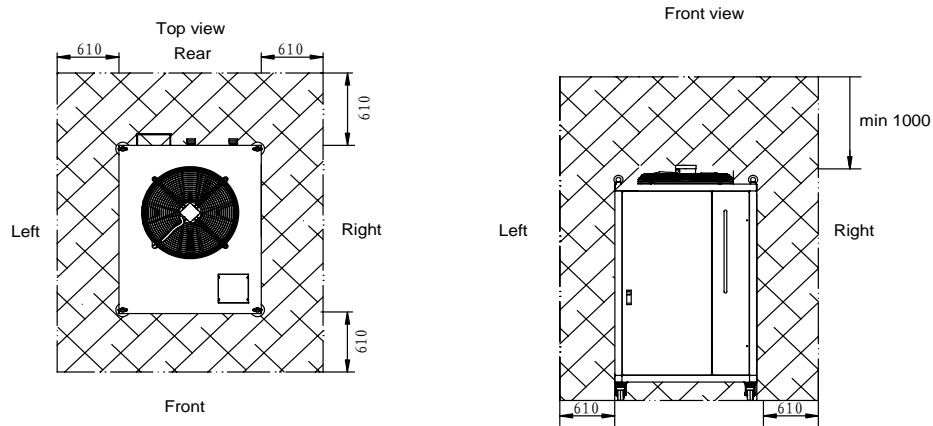
The chiller can be installed indoors, outdoors or on rooftop according to your field condition. You should mount the chiller following the manual. Any other mounting functions should be discussed with the AIRSYS or field engineers.

3.3.1. Distance & Height of the Location

NOTE: The piping distance from chiller to operating room should be less than 30m to avoid additional pressure drop which may cause low flow rate. The distance may be extended to 60m by using 1" ID pipe. The elevation of the chiller installed above the MRI should be not greater than 30 m (98ft). The elevation the chiller installed below the MRI should be not greater than 3 m (9.8ft).

3.3.2. Airflow Considerations

The air inlets are at the right, left and rear side of chiller. The air outlet is on the top of the chiller. Airflow flow in and out of the unit will affect cooling performance. The minimum clearance of machine is required when you plan the installation. The minimum service clearance is shown as in Fig.-9, Fig.-10 and Fig.-11.



3.3.3. Weather Considerations

The chiller can work through most of climates, snowing, raining, strong winding, etc. But in area where often encounter extreme heavy snowing, down pouring, season wind, etc, it is wise to install anti-climate shields by customer.

3.3.4. Power Requirements

The power distribution panel should be placed as closer as it could to the chiller. The customer can choose the power cables according to the below table.

ITEM	P/N	Description	REQUIREMENTS
Wire (customer supplied)	5332778	11kw Water Chiller 50Hz	The maximum wire size is 6 AWG (16 mm ²)
	5346827	11kw Water Chiller 60Hz	
Power Consumption	5332778	11kw Water Chiller 50Hz	8.8/5.0KVA (maximum/continuous)
	5346827	11kw Water Chiller 60Hz	10.9/6.2KVA (maximum/continuous)
Voltage Requirements	5332778	11kw Water Chiller 50Hz	380/400/415 VAC(+/-10%)@ 50 Hz(+/-3)
	5346827	11kw Water Chiller 60Hz	460/480 VAC(+/-10%)@ 60 Hz(+/-3)

Table- 7 Power requirement



NOTE: Check nameplate of the chiller and confirm the local power supply matches requirements on chiller.

3.3.5. Concrete ground requirement:

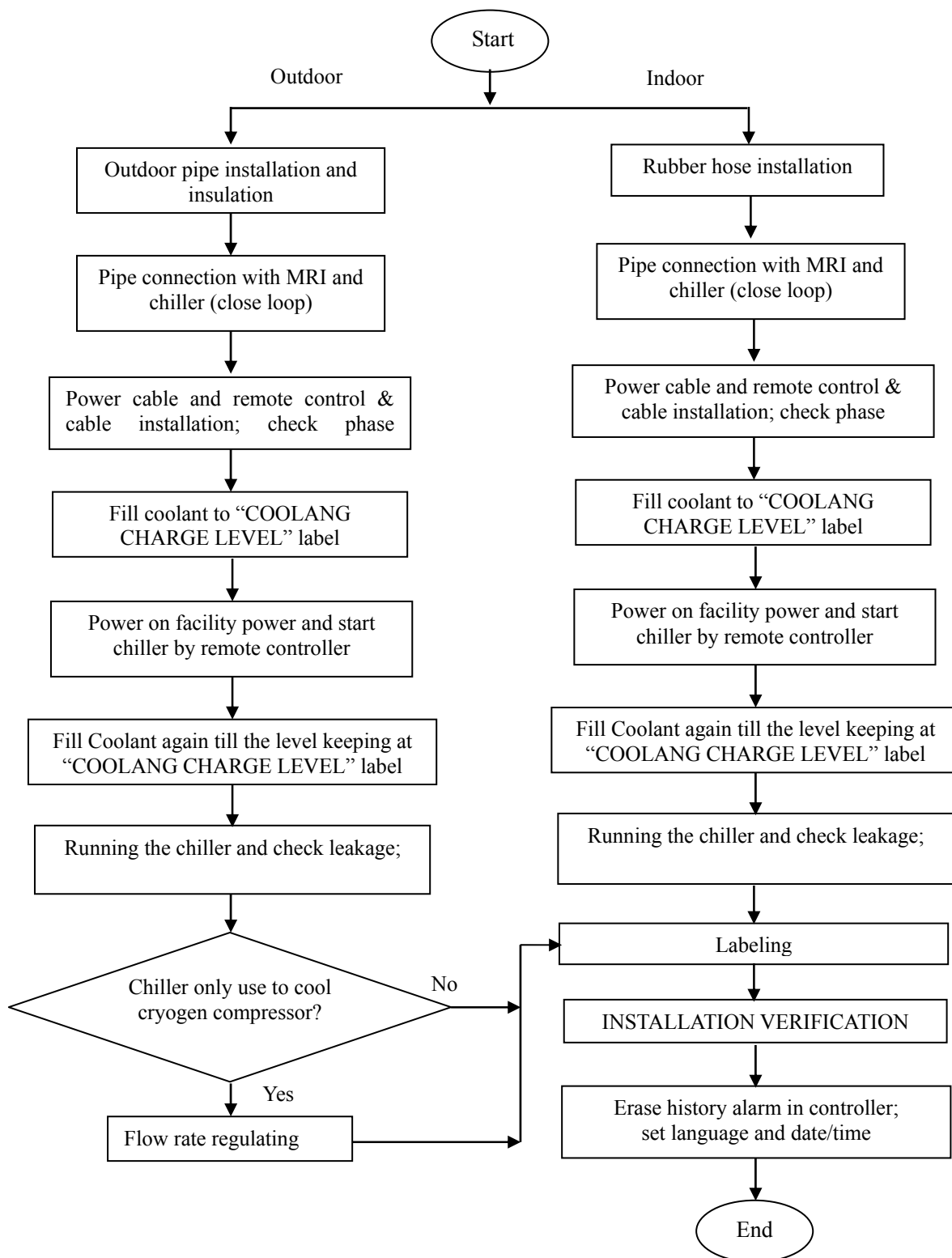
Concrete ground used for mounting the unit should be a level surface, which is 1/300 cm max allowed and be properly supported to prevent sedimentation. A concrete made area of 110.0cm (43 in) x90.0cm (35 in) at strength of minimum 17.23MPa (2500 psi), 4 inches thickness recommended, is needed to place the chiller. Refer to Fig.-3 for concrete dimension.

NOTE: The concrete footing should meet or exceed the local code requirements.

NOTE: 8 bolts (M12, provided by customer) are needed to fix the chiller, and local code should be followed.

4. Installation

Follow process diagram below and instruction and requirements in this section to finish installation and start-up the chiller.



4.1. Pipe Connections

Material that may be used during installation for coolant pipe like hose barbs, ball valve couplings, hose adapters and hose are supplied with the chiller. They can be found in the accessory box.

It is recommended that the coolant loop to be finished by chiller service provider or well trained people. Please following requirements list below when you plan the path of pipe line between chiller and MRI.

Material attached with unit for pipe connection:

S/N	Description	Qty	Remark
1	Hose clamps, 3/4inch (20 mm)	4 pcs	Attached with chiller in accessory box
2	Kit (3/4 inch (20 mm) hose barbs , 3/4 inch ball valve)	2 sets	Attached with chiller in accessory box
3	Rubber hose, 12.7mm (1/2"), 5m	2 pcs	Attached with chiller in accessory box
4	30.5 m (100 ft) lengths of 3/4 inch (20 mm) flexible hose	1 pcs	Attached with chiller in accessory box
5	Teflon tape 20m x 25mm x 0.1mm	1 pcs	Attached with chiller in accessory box
6	Label	1 set	Attached with chiller in accessory box
7	Copper pipe, ball valve, joints or other piping materials meet requirement for outdoor installation	Depends on site	Provider by customer

4.1.1. Coolant loop requirements

Note: Rubber hose attached with chiller only can be used indoor!

- Copper pipe and PP-R pipe is recommended to be used for outdoor piping material. For other piping material, including pipe, joints and valves etc., and outdoor connections should meet requirements listed below:
 - Working temperature: -30°C~90 °C ;
 - Working pressure: ≥ 1.6 MPa;
 - Material should be propylene glycol (50%) resistant.
- All pipe installed outdoor should be insulated.
- Outdoor piping material should be provided by customer.
- Choose shortest way and fewer elbows when you plan the path of pipe line between chiller and MRI to avoid additional pressure losses.
- Before use the hose pipe, check and clean the water hose thoroughly to make sure there is no metal residue or dirt inside.
- The hose connection with the unit should be adjusted smoothly to avoid additional strain that may result in a break or crack.
- Check leak after coolant piping is done before connecting with chiller if possible.
- Local codes should be followed when you plan the coolant loop.

4.1.2. Configuration for chiller connecting with MRI

There are two types of configuration for chiller(s) connect with MRI as shown in Fig.-12 and Fig.-13.

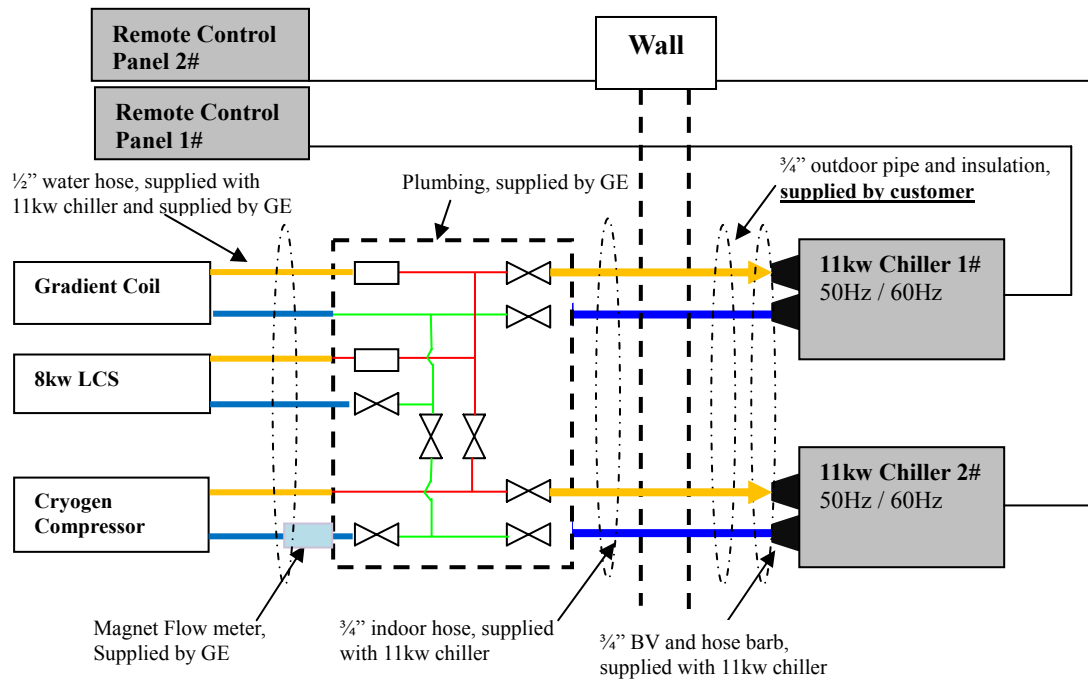


Fig.- 12 Outdoor Piping/Hose Connection for Cooling Type A

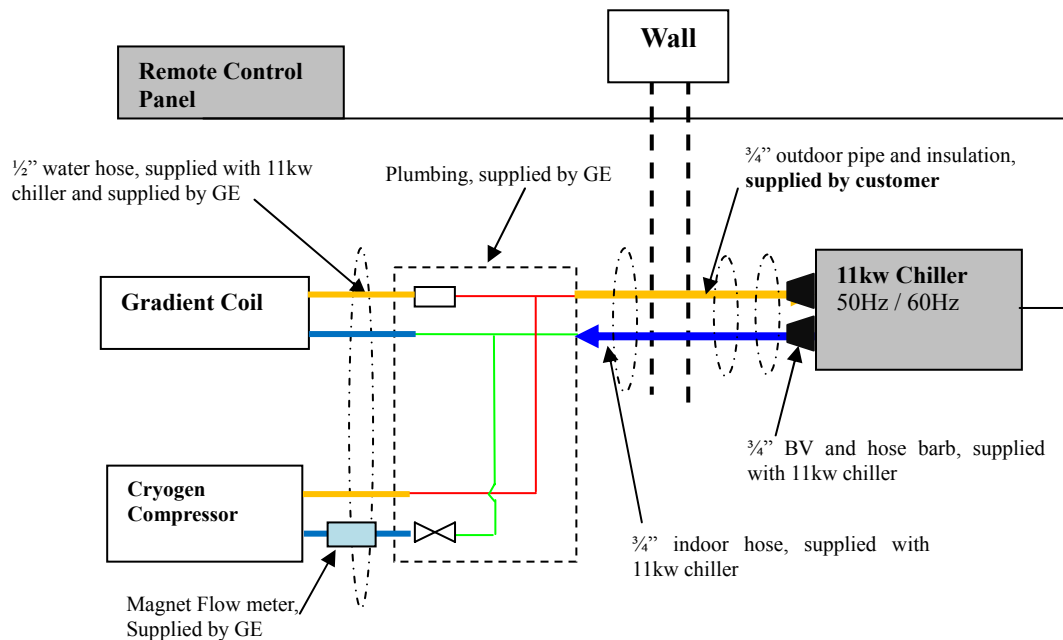


Fig.- 13 Outdoor Piping/Hose Connection for Cooling Type C

4.1.3. Coolant loop connection

(1) MRI pipe connection

Indoor connection:

- a) Connect hose with indoor chiller per configuration chart Fig-12 or Fig -13;
- b) Check coolant loop is connected correct; confirm all joints firmed.

Outdoor connection:

- a) Connect hose with devices per configuration chart Fig-12 or Fig -13 in equipment room;
- b) Plan and route pipe from chiller outdoor to equipment room. Choose shortest way and fewer elbows when you plan the path of pipe line between chiller and MRI to avoid additional pressure losses;
- c) Connect outdoor pipe with loop indoor;
- d) Check coolant loop is connected correct per configuration chart Fig-12 or Fig -13; confirm all connections firmed;
- e) Insulate outdoor pipe;

(2) Connect hose/piping with chiller

The coolant fluid inlet (COOLANT RETURN) and outlet (COOLANT SUPPLY) connections on chiller are located on the rear side. They are 19.1mm (3/4") ball valve coupling, together with 19.1 mm (3/4") hose barb and hose clamp. Please refer to Fig.-14 to operate the quick disconnection coupling.

Install the ball valve in the inlet and the outlet of the chiller



Fig.- 14 Ball valve coupling

4.2. Power Cable & Remote Cable Connections



Caution! Be sure that the power supply is same as power supply specification on the label. Local code should be followed when wiring the power cable!

Material preparation

S/N	Description	Qty	Remark
1	Power cable	Depends on site	Provided by customer
2	Remote cable, 30.5 m	1 pcs	Attached with chiller in accessory box
3	Pipe-type terminals, 6.0mm ² (9.3X10-3 in ²)	6 pcs	Attached with chiller in accessory box

For the electric connection, the installers need to connect and firm the power cables with terminators in electric box at rear side of the unit shown as the Fig.-6 Overall dimension.

The layout of inside of electric box is shown as fig.-12. The binding posts labeled L1, L2, L3 and PE are for power wiring. The binding posts labeled 45, 46 are used to connect the external alarm indicator (ring bell or flash lamp) supplied and powered by user.

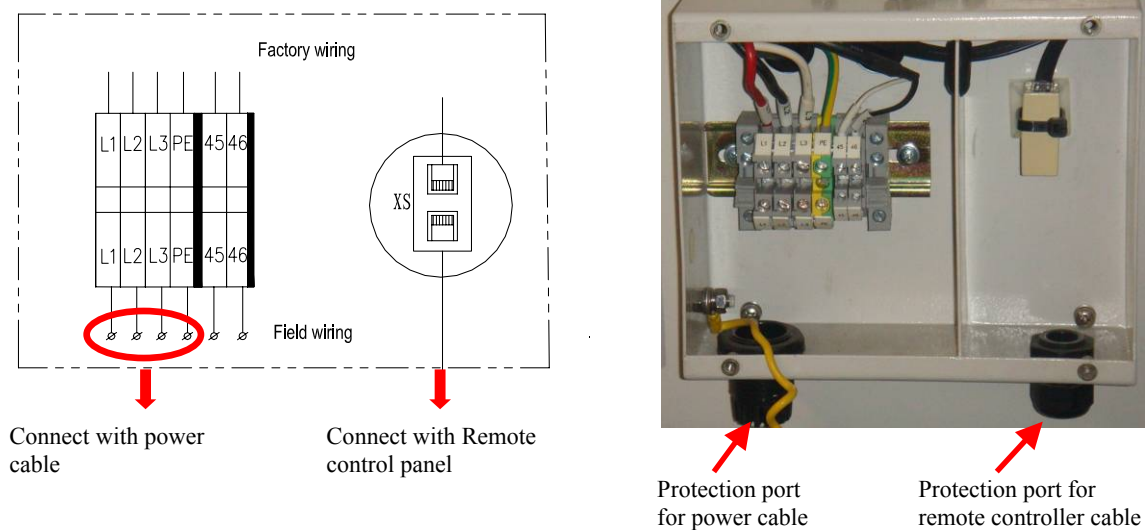


Fig.- 15 Electric box and Main power connection

Procedure:

1. Check and confirm the field power supply matches power supply description on nameplate of unit. **Make sure main power supply is cut off before wire connection!**
2. Connect power cable with field power; confirm all wires are firmed;
3. Wiring power cable to chiller;
4. Wiring remote controller cable from indoor to chiller;
5. Open cover of electric box and check factory connected wires/cable are firm (Refer to Fig.-6 and Fig.-13);
6. Loose right side of lock nut of protect port, let remote control cable (coming from operating room) pass through the port and insert plug into socket. Tighten the lock nut;
7. Peel insulation of power cable, 10mm; firm pipe-type terminal, 6.0mm² (9.3X10-3in²), on each wire (It can be found in accessory box);
8. Loose lock nut of protect port for power cable, let power cable pass through the port;

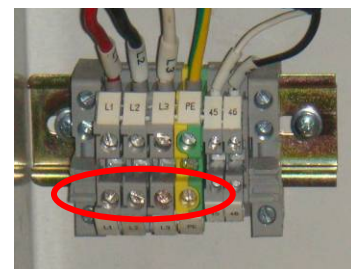


Fig.- 16 Power connection terminator

9. Loose screws of terminator, shown as Fig.-13. Insert each terminal into socket according to different phase, then tighten the screws. Confirm all wires are firmed;

10. Mounting back the electric box cover after check power phase sequences are correct.

Note: Skip step 3# and 6#, if the remote controller is going to be installed on chiller (refer to section 4.3.1).

4.3. Remote Control Panel Installation

Remote control panel can be installed on chiller or in operating room. The cable for remote controller installed in operating room enclosed with chiller is 30.5 m (100ft) long.

4.3.1. Install the remote controller on chiller (for indoor installation)

Material preparation

S/N	Description	Qty	Remark
1	Remote controller and its bracket	1set	Attached with chiller in accessory box
2	Key for front door of chiller	2 pcs	Attached with chiller

Procedure:

1. Open front door of chiller with key attached with unit.
2. Switch the door lock to “off” position, shown as Fig.-17.



Fig.- 17 Door lock switch

3. Open the door of electric control box. Pull out the plug of cable shown as in Fig.18.
4. Plug in the cable for on-chiller remote installation, shown as in Fig.-18.



Fig.- 18 Remote controller cable connecting with controller

5. Close the door of electric control box, switch the door lock to “on” position, then close and lock the front door of chiller.
6. Remove cover at position of on-chiller remote installation, shown as in Fig.-19. The remote controller cable is behind the cover.

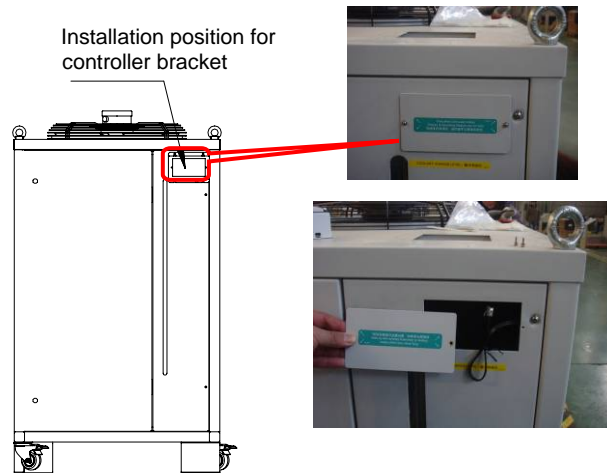


Fig.- 19 Install remote controller on chiller

7. Remove the remote controller from bracket, shown as Fig.-20.



Fig.- 20 Remove remote controller from bracket

8. Plug in cable to remote controller, shown as Fig.-21.



Fig.- 21 Cable connecting with remote controller

9. Then fix the remote controller onto place as shown in Fig.-22.

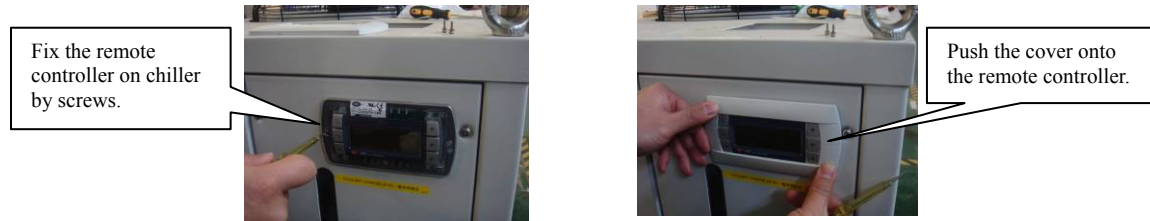


Fig.- 22 Fix remote controller on chiller

4.3.2. Install remote controller indoor (chiller outdoor installation)

It is customer's responsibility to install remote control panel and cable in operation room.

A 30m (100ft) long cable can be found in accessory box. If the distance from chiller to operating room greater than 30m (100ft), you can order 100m-long-cable from us.

Follow steps in section 4.2 to connect cable with chiller. Use bracket to install the remote controller indoor.

Leave adequate clearance around the bracket for cable connection and operating as shown in Fig.-23.

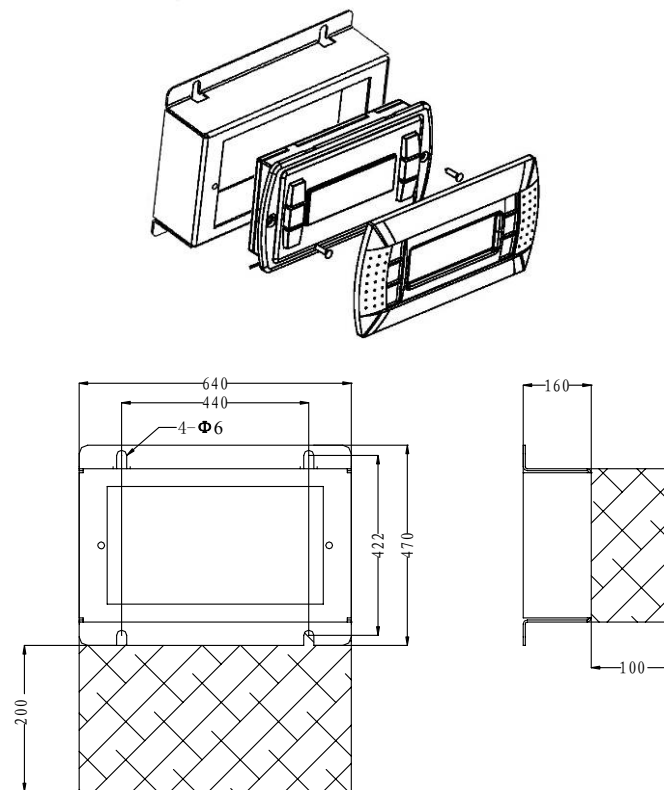


Fig.- 23 Dimension of remote control mounting bracket (unit: mm)

4.4. Coolant Fill, Chiller Power On and Leakage Check

There is 80L glycol shipped with unit in accessory box as well as funnel may use in following steps. The provided glycol is 50/50 mixture with additive of rust inhibitor and dye in yellow.

Material preparation

S/N	Description	Qty	Remark
1	50/50 Mixture of propylene glycol, 20L	4 pcs	Attached with chiller in accessory box
2	Plastic funnel	1 pcs	Attached with chiller in accessory box

Note: Main power supply should be available when you fill coolant.

Procedure of adding coolant:

1, Screw off cover of coolant charge port (refer to Fig.-8), put funnel in the coolant charge port. Fill the reservoir with coolant attached with unit. When coolant level reaches “COOLANT CHARGE LEVEL” label, remove the funnel and keep the charge port open.

2, Check hoses and fittings and be sure no bends or crimps on the hoses.

3, Switch on main power and follow steps below to start the chiller:

(1) Make sure the main power supply to chiller is available (switch on the main power supply);

(2) Wait a few seconds, the screen of the remote controller will display as Fig.-24 after the main power supply is available.

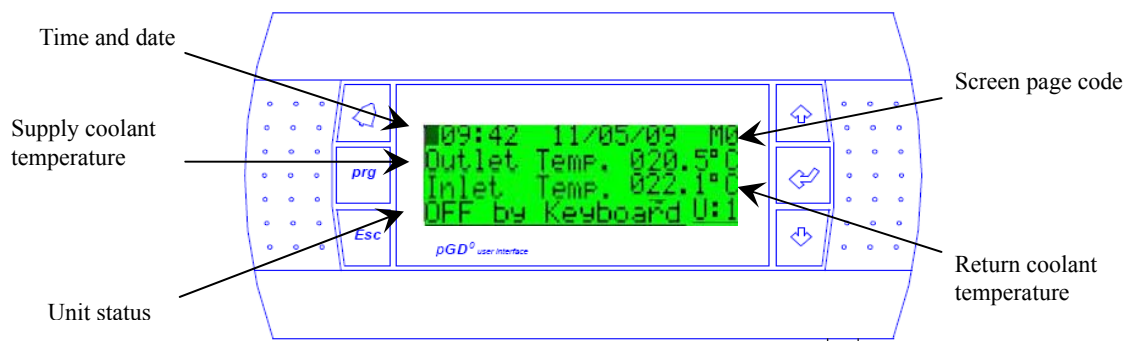


Fig.- 24 Start-up interface displayed on the controller screen when unit is powered(1)

(3) The default coolant outlet temperature setting is 20°C. Please contact GEHC field engineer to change outlet temperature setting point if your application is different.

(4) Press the “Esc” + “Enter” keys, shown as Fig.-25, on the remote keyboard at same time, hold for 5 seconds. The chiller will be turned on, and the screen of the controller will display as Fig.-25.

(5) The chiller will start pump first after turned on, then start compressor after 3 minutes if outlet temperature is greater than set point.

NOTE: For the first start up, if ambient temperature is below 0°C at which the unit placed more than 8 hours, to heat the lubricating oil of the compressor, you should wait for at least 2 hours before you use remote controller turn on chiller after main power supply is available.

NOTE: Wrong power phase setting will not start up the chiller without error code displayed. If the remote display did not show info like Fig.-25, please check (i) power supply is available; (ii) power supply phase sequence is correct. Contact service engineer if there is no issue found from power supply but the display shows nothing or any other info.

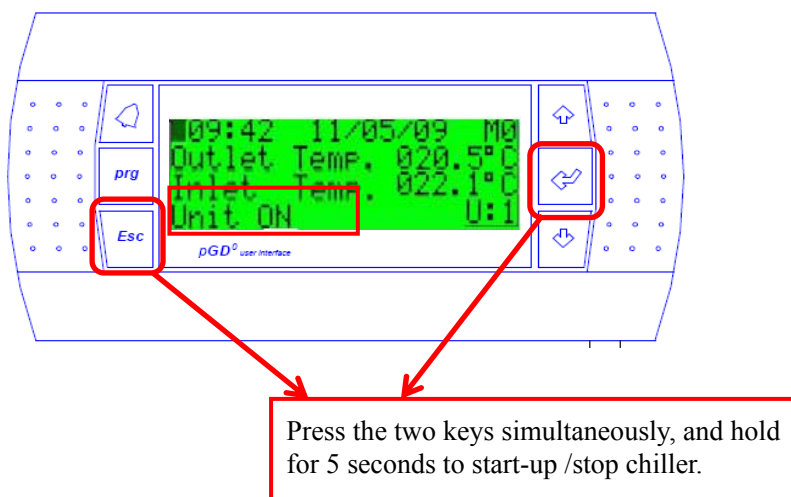


Fig.- 25 Unit-On interface displayed on the remote controller screen

4, The chiller will begin pumping coolant through the system after switched on. Meanwhile, the coolant in the reservoir will decrease as part of it fill into the system. Add coolant until the coolant level in the reservoir stops going down. (This means that your system is filled and the air has been purged out completely.)

5, Continue to fill the reservoir until coolant level reaches “**COOLANT CHARGE LEVEL**” line.

6, Running the chiller for 15 minutes, check if coolant level keeping upon “**COOLANT CHARGE LEVEL**” line, and check no leak at joints along with coolant piping system outside chiller.

7, The coolant observed from level gage should be clean. Otherwise the coolant loop need to be flushed and refilled.

NOTE: The chiller may report alarm for “Water low” during coolant filling. The alarm will be disappear when coolant reach the charge level.

Note: Important! Only use the coolant ship with the chiller. If additional coolant is needed, please order from GEHC, part number 2297672, one gallon of properly-mixed coolant.

Note: Follow instructions in MSDS to clean coolant on floor.

4.5. Flow Rate Regulating For Cooling Type A

When chiller only provide cooling for cryrogen compressor (refer to Fig.-12, chiller#2), the flow rate must regulated to be 7~10L/m. The unit is equipped with coolant by-pass system (refer to system diagram in Appendix, Fig.-8, and Fig.-15), customer can adjust coolant flow rate by regulating valve shown in the Fig.-8 according to their requirement. **The regulating valve is shut off as default factory setting.**

4.6. Label the unit

After finishing connects your closed coolant loop with chiller, and connects power cable and remote controller cable, it is service engineers' responsibility to apply labels on unit.

Material preparation

S/N	Description	Qty	Remark
1	Label	1 set	Attached with chiller in accessory box

◆ Label the coolant loop.

Label the coolant loop at ends of ball valve and other ends to MRI with labels of “COOLANT SUPPLY”, “COOLANT RETURN” and flow arrow labels on each hose connect to chiller, as shown in Fig.-26. The

“COOLANT RETURN” is drawing liquid into the chiller; the “COOLANT SUPPLY” is pumping cooled liquid out.

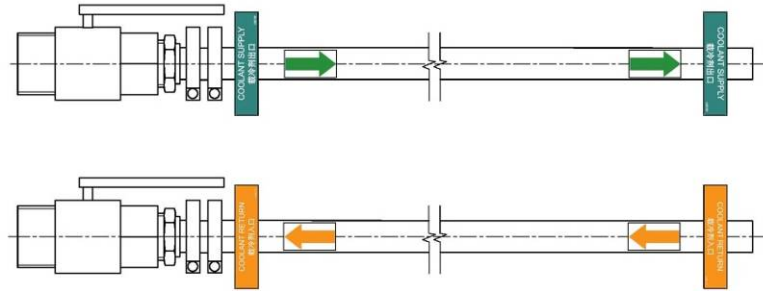


Fig.- 26 label the coolant loop

◆ Label the unit

Label the unit with “Cryo chiller” or “Gradient Chiller” on front door according to its application shown as Fig.-27.

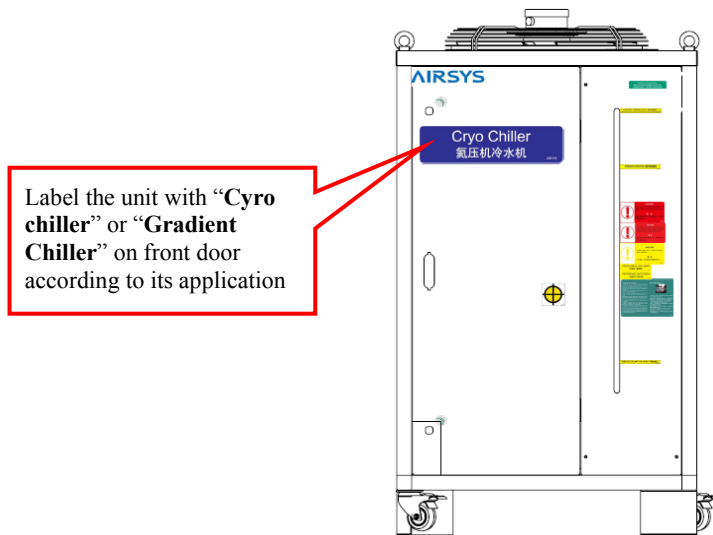


Fig.- 27 label the chiller at front door

◆ Label the remote controller

Label the remote controller with “Cryo chiller Control Panel” or “Gradient Chiller Control Panel” shown as Fig.-28.

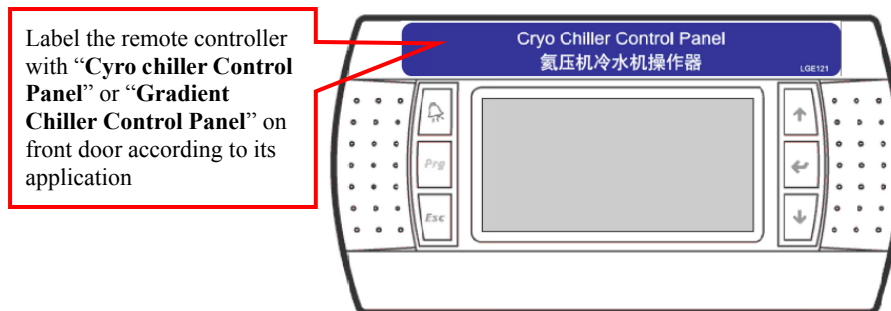


Fig.- 28 label the chiller at remote controller panel

4.7. Installation Verification














Before installation verification, it is recommended running the chiller for at least 1 hour, then check if it is working in specification, check leaks inside and outside chiller. Then finish installation report.

It is service engineers' responsibility to fulfill installation report (refer to Appendix 10.3). This report needs approval by GEHC field engineers and/or customer.









4.8. Date/time, language setting and erase history alarm(s)

After installation verification, erase history alarm(s) in controller, and if necessary, re-set date/time and language following steps below.



















4.8.1. Date/time setting

Press  to return page "M0" → Press  or  to access page "M3" → Press  to move cursor to "Hour" → Press  or  to set hour → Press  to move cursor to "Date" → Press  or  to set date → Press  to move cursor to "Day" → Press  or  to set day → Press  twice to return page "M0".

4.8.2. Language setting

Press  to return page "M0" → Press  or  to page "M2" → Press  and hold for 3 seconds to access page "A0" → Press  to move cursor to "Language" → Press  or  to set language in English or Chinese → Press  twice to return page "M0".

4.8.3. Erase history alarm(s)

Press  to return page "M0" → Press  or  to page "M2" → Press  and hold for 3 seconds to access page "A0" → Press  to access "Main Menu Screen" → Press  to move cursor to "Manufacturer" → Press  to access page "C0" → Press  to move cursor to "0000" → Press  or  to enter password → Press  to confirm password and access page "C1" → Press  or  to move cursor to page "C6", "Erase history alarm" → Press  to move cursor to "No" → Press  or  to change "No" to "Yes" → Press  to confirm → Press  twice to return page "M0".

5. Operating the Chiller

After going through the previous procedures (Section 4), the chiller will keep running if there is no interruption. The display of the chiller will show info as in Fig.-25. User can stop/start the chiller through remote controller following procedure in sections below.

5.1. Stop/Start the chiller

5.1.1. Stop the chiller

Press the “Esc” + “Enter” keys on the remote keyboard, hold for 5 seconds to stop the chiller, and the screen of the controller will display as Fig.-29.

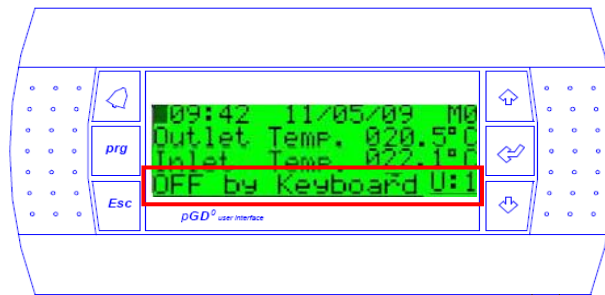


Fig.- 29 Unit-Off interface displayed on the remote controller screen

5.1.2. Start the chiller

Follow section 4.4, step 4 to start up chiller.

5.2. Parameter Setting

The controller is a fully parameter configurable device. All the parameters have been preset in the factory.

NOTE: Only service engineers who have been well trained allowed to change these settings.

5.3. Draining the Unit

NOTE: NEVER drain the unit by pump. It may damage the pump seal permanently!

When chiller is going to stop more than 1 week, it is necessary to drain coolant from unit to protect pump and coolant loop from rusting.

The unit provide drain valves to drain coolant from coolant tank and evaporator. Before this operation, turn off the unit, and follow all applicable Lock-out Tag-out procedures. Screw off the side panel, then open the drain valve (refer to Fig.-6) allowing unit to drain. A proper container is needed to keep liquid out and recycle.

Procedure to drain the unit:

- 1) Remove right side panel of the unit (refer to Fig.-6), the drain water pipes will be seen at the bottom of the unit, as shown in Fig.- 8.
- 2) Loose water drain pipe connection with evaporator (refer to Fig.-8), put the end into container, open drain valve of coolant tank, drain coolant from the tank. After coolant tank drained, shut off the drain valve.
- 3) Loose water drain pipe connection with tank, put the end into container, connect the other end with evaporator drain valve (refer to Fig.-8), open the valve and drain coolant from evaporator. After coolant tank drained, shut off

the drain valve, and connect the other end with tank drain valve.

4) Remount the side panel of the unit.

NOTE: Make sure the two drain valves had been shut off after coolant drained!

6. Maintenance

It is recommended to have 2 times PM each year. Considering the site condition where chiller is installed, please contact with your service engineer to determine the times of PM for each year.

Following items listed in table in Appendix 10.4 to fulfill PM. It is service engineer's responsibility to fill the Preventive Maintenance Check List (refer to Appendix 10.4). The list should be signed by GE Healthcare field engineer and/or end-user as approval.

It is recommended to do job in list below periodically to keep the unit always in best condition.

S/N	Content of Replacement/maintenance	Recommended Frequency
1	Periodical maintenance	2 times/year
2	Condenser cleaning	2 times/year
3	Mash of Y filter cleaning	1 time/year depends on cleaning of coolant
4	Glycol replacement	1 time/2 years depends on cleaning of coolant

7. Option List

S/N	P/N	Description	Purpose
1	2041000100ROHS	Long distance cables kit for controller (default length 30m), including: 100 m cable and T card.	Used for distance between chiller and remote controller over 30m

Table- 8 Option part order information

8. Troubleshooting

The controller can perform full system self-diagnose and displays alarms in serial code accordingly. In the event of a system failure, the alarm code and its meaning will be shown on the display.

NOTE: ALWAYS GET HELP FROM QUALIFIED REFRIGERATION SERVICE ENGINEERS TO ACCESS THE CHILLER WHEN MALFUNCTION IS FOUND!

Alarm codes are sorted into prompt alarm and critical alarm. If prompt alarm occurs, the light of the alarm key will be turned on and alarm info will be displayed. And if critical alarm occurs, the "Alarm" key will be twinkling and buzzer will be triggered. Press the alarm key once to silence buzzer.

NOTE: It is wise that review all history alarm record in controller sorted by date/time before calling for service engineer come to site and resolve problem.

The alarm message consists of a code with the format "ALxx" (where "xx" is a 2-digit number, indicating the type of failure detected, such as: AL00, AL10, AL15....) and following its meaning, as shown in Fig-30.



Fig.- 30 Screen status when alarm reported

To check the description of alarm, follow the steps below.

- 1) If the alarm occurs like Fig.-30, press "alarm" key, and the screen of the controller will display as Fig.-31.



Fig.- 31 "Err" page

- 2) If there are other alarms, press "Down" or "Up" to inquire other alarm information.

Please refer to alarm list to understand alarm reported

- 3) If user want to know all alarm informations, press "Prg" key to inquire "Alarm history" menu, where the alarm type, time and date were recorded as Fig.-32

	History Alarm	Numbers of history alarm
	H006	
	AL05	Code of alarm
	Pump Overload	Note of alarm
	11: 47 22/06/09	Time of alarm, 2009.6.22

Fig.- 32 History alarm page

Press 'ENTER' to enter in the history of the alarm interface the specific analog parameters when the UP / DOWN to view alarm as Fig.-33. Press 'ESC' to return to the historical alarm interface.

AL05			
Outlet Temp.	020.5°C	Water P :	4.1 bar
Inlet Temp.	022.1°C	SuperHeat :	3.1°C
Ext. Temp.	022.1°C	EEV position:	450

Fig - 33 History alarm parameters page

Contact Airsys and provide site info via email, 800@airsys.com, to request service manual when necessary.

NOTE: When the power restored after power failure, the controller will be back to the status before the failure.

Follow instructions in MSDS to clean floor if coolant leak occurs.



NOTE: When chiller is found lack of refrigerant, the system should be vacuumed to 53pa and the vacuum should less than 133pa after keeping for 30min before reload. The quantity of refrigerant to be reloaded is 6.8+0.2kg.

8.1. Alarm list

Note: If compressor's internal thermo protection triggered, the chiller will not report alarm and temperature of coolant outlet will keep rising. It is may caused by high ambient temperature, and/or low refrigerant volume in system.

Alarm Code	Loads Shut Down	Signal	Meaning & Description	Possible Cause	Check Points	Recommend Actions
AL01	Compressor	compressor thermal switch protection	Compressor will be shut down. water pump continues to run Manual reset if triggered	Loose wire in high pressure protector	High/low pressure protector wiring	Tighten up the loose wire or reconnect the line of these terminal
				High/low pressure protector failed	Simulate the pressure to activate the protector.	Replace it with a new one
				Condenser fan failed	Measure the power input the fan, if input power is ok, the capacitance or the fan motor maybe fail.	Replace it with a new one
				Fan blocked by something.	check the fan leaves if it could rotate freely by hand	remove the things that stalled the fan leaves
AL02	Compressor	Low pressure protection	Compressors and condenser fan will be shut down Active if low pressure (suction pressure) below 0.6Bar when the chiller is operating Manual reset if triggered	Refrigerant leak in refrigeration loop, compressor suction pressure is lower than the setting point 0.5bar(7.3psi)	check all the refrigeration loop	properly seal the leak point
	Condenser Fan			EEV block or failed and cause the suction pressure too low	check suction pressure when the chiller still running	replace TEV
				Blockage in refrigeration system and suction pressure too low	check suction pressure when unit still running, check if the coolant temperature is correct	replaced TEV and clean the refrigerant system
				False alarm due to the failure of high/low pressure protector switch	Simulate the pressure to activate the protector.	replace the protector if the protector fails to respond
				Loose wiring triggers the alarm	check all the line connection about this alarm according to the electrical diagram	tighten up the connection or reconnect the terminals
				Low ambient temperature	does the environment temperature drop below -30C degree(-22F)	the operating condition is outside of specified range, pls contact the Field engineer or tech support

Alarm Code	Loads Shut Down	Signal	Meaning & Description	Possible Cause	Check Points	Recommend Actions
AL03	Compressor Condenser Fan	Compressor high pressure switch alarm or condenser fan overload alarm	Compressor and fan will be shut down. water pump continues to run Manual reset if trigged	The high pressure of the refrigeration loop exceeds setting point(29bar/420.5psi)	fan speed regulator wire loose or malfunction. If so, the condenser may not be cooled properly.	fasten the loose wire and/or connections of these terminals. Replace fan speed control board if it is in malfunction
					condenser with dirt or something	clean the condenser
					The ambient temperature is higher than 43C degree(109.4F)	Contact FE, and/or order option parts for high ambient temp kit.
					Debris in sealed system clogging TEV or refrigerant filter	Clean the refrigeration sub-system and recharge the refrigerant or replace the filter if necessary
				The fan thermal protector activation	Dirty condenser	Clean the condenser
					The ambient temperature is higher than 43C degree(109.4F)	Contact FE, and/or order option parts for high ambient temp kit.
					Fan blocked by something.	Clean the fan
				Wrong fan speed/parameter setting	check the parameter in the controller	correct the wrong parameters
AL3b		pressure sensor high alarm	Compressor and fan will be shut down.	The high pressure of the refrigeration loop exceeds setting point(26~28bar)	fan speed regulator wire loose or malfunction. If so, the condenser may not be cooled properly.	fasten the loose wire and/or connections of these terminals. Replace fan speed control board if it is in malfunction
					condenser with dirt or something	clean the condenser
					The ambient temperature is higher than 43C degree(109.4F)	Contact FE, and/or order option parts for high ambient temp kit.
					Debris in sealed system clogging TEV or refrigerant filter	Clean the refrigeration sub-system and recharge the refrigerant or replace the filter if necessary
AL04		water low level switch	Water level in tank below the low water level switch. Automatic reset; promote only;	Coolant leak in pipe system	every pipe joint and components in coolant loop	properly seal the leak spots
				Coolant lost for evaporation	Coolant level	Add coolant to recharge level
				loose wire between the level switch and terminal block	check wire connection of water level switch and terminal block	Tighten up the line connection
				Coolant level switch failed	coolant level switch	replaced the switch

Alarm Code	Loads Shut Down	Signal	Meaning & Description	Possible Cause	Check Points	Recommend Actions
AL05	Compressor	Pump thermal switch protection	All loads will be shut down; Active if the current of pump exceed 4.5A.; and events per hour reaches the value of 3 ; need manually reset; Manual reset if triggered	Loose wire in the pump thermal protector(FR2)	Line connection in the pump thermal protector failed	tighten up the line connection
	Capacity control			Water pump running current exceeds the setting point of the current protector	Check pump motor windings	Replace pump with a new one
	Condenser Fan				Something stuck in the pump impeller. Check the current or the noisy of the motor when it is running	If so, remove the blockage, or replace with new
	Pump				Pump rusty	Replace the pump and clean the water loop
AL06	Compressor	Serious Low water level	All loads will be shut down; need to be manually reset; Automatic reset	Coolant leak in pipe system	every pipe joint and components in coolant loop	properly seal the leak spots
	Capacity control			loose wire between the level switch and terminal block	check line connecting of water level switch and terminal block	Tighten up the line connection
	Condenser Fan			Coolant level switch failed	coolant level switch	replaced the switch
AL07		Probe SP3 fault (coolant outlet pressure sensor)	Triggered if pressure valve exceed -1~9.3 bar Automatic reset; promote only;	Pressure sensor SP3 failed	check pressure sensor	replace the sensor
				loose wire at the terminal block	check terminal block in electrical box	tighten up the line or reconnect the terminal block
AL08		Probe ST2 fault (coolant return temp sensor)	Triggered if the water return temperature sensor shorts or is cut off or probe limits are exceeded (-50°C.. 100°C).	loose wire at the terminal block	terminal block in electrical box	tighten up the line or reconnect the terminal block
				the temperature sensor ST2 failed	check the resistance of the sensor	replace the sensor
AL09		Probe SP2 fault (condensing pressure sensor)	Triggered if pressure valve exceed 0~34.5 bar; fan running in full speed; Automatic reset; promote only;	Pressure sensor SP2 failed	check pressure sensor	replace the sensor
				loose wire at the terminal block	check terminal block in electrical box	tighten up the line or reconnect the terminal block
AL10	Compressor Capacity control Pump Condenser Fan	Serious high coolant outlet temp	Triggered if coolant outlet temp exceeds 53C; Automatic reset	Refrigeration system problem	Check all other error codes recorded	Resolve problems according to error codes recorded, restart chiller.
				Low coolant flow rate	Check if coolant flow rate is blocked for contamination or large pressure drop of loop.	Clean loop or decrease pressure drop of loop.

Alarm Code	Loads Shut Down	Signal	Meaning & Description	Possible Cause	Check Points	Recommend Actions
				the temperature sensor ST1 failed	check the resistance of the sensor	replace the sensor
				loose wire at the terminal block	Check connection at terminal block in electrical box	tighten up the line or reconnect the terminal block
AL11		Time card	Time card malfunction; promote only;	Time card connection or battery	Connection of time card or battery	Re-connect time card or replace battery
AL12	Compressor Capacity control Pump Condenser Fan	Low coolant outlet temp	Triggered if coolant outlet temp is below -40C; Automatic reset	Low temp of coolant add to chiller	Check if temp of coolant added to chiller is below -40C	Warm up coolant
				loose wire at the terminal block	check terminal block in electrical box	tighten up the line or reconnect the terminal block
				the temperature sensor ST1 failed	check the resistance of the sensor	replace the sensor
AL13	Compressor	Coolant supply temperature is above 28C (77F).	Stops compressor; (3 times in an hour, locks and shuts down the system; needs to be reset manually) Each time when judgment, If the temperature has the drop tendency, only prompts. Otherwise, stops the compressor.	all the other possible failure causing compressor shut off and water temperature goes up	check the alarm history to find out other alarm codes registered earlier	deal with issues corresponding to the relevant alarm code in history list and start-up again.
	Capacity control			Unit did not cool or less of capacity to cool water.	check if low pressure alarm code is recorded; if yes, then the unit didn't cool the coolant	first solve the problem according to the alarm of low pressure
					Dirty evaporator if there is no malfunction found in refrigeration system.	Flush evaporator with clean water and observe temp control, or replace evaporator if outlet temp keep raising after flushing.
	Condenser Fan			low coolant flow rate	check if there is blockage in the coolant loop and adjust flow rate if necessary	adjust or clean the coolant loop or replace the coolant filter if necessary
	Pump			EEV in malfunction	check if this is the case	replace the bad one
				ambient temperature of the chiller exceed the design range of the unit	measure the ambient the temperature of the chiller	Contact FE, and/or order option parts for high ambient temp kit.
				parameters in controller is set incorrect	check the parameter right or not	refer to the controller operating manual and set the parameters

Alarm Code	Loads Shut Down	Signal	Meaning & Description	Possible Cause	Check Points	Recommend Actions
				Compressor internal thermo protection triggered	check if compressor stopped without alarm code, and discharge temp over 120C	Discharge the whole system and recharge refrigerant to 6.8~7.0kg
AL14	Compressor	Probe SP 1 fault (compressor suction pressure sensor)	Compressor will be shut down Pressure valve exceed 0~17.3 bar Automatic reset	Pressure sensor SP failed	check pressure sensor	replace the sensor
	Condenser Fan			loose wire at the terminal block	check terminal block in electrical box	tighten up the line or reconnect the terminal block
AL15	Compressor	EEV driver memory failure	Compressor will be shut down Eeprom fail or disconnected Press alarm key to reset	Eeprom failed	check Eeprom	replace the Eeprom
	Condenser Fan			loose connection	check connection of Eeprom	re-connect the Eeprom
AL16	Compressor	EEV driver motor failure	Compressor will be shut down Press alarm key to reset	driver motor failed	check movement of drive motor manually	replace the Eeprom
	Condenser Fan			loose connection	check connection of driver	re-connect the driver
AL17	Compressor Condenser Fan	EEV configuration incomplete	Compressor will be shut down EEV configuration incomplete Press alarm key to reset	EEV configuration incomplete	Check configuration of EEV	Re-configuration EEV
AL18	Compressor Condenser Fan	High evaporation pressure (SP1)	Compressor will be shut down High evaporation pressure Automatically reset	EEV malfunction	Check function of EEV	replace EEV
AL19	Compressor Condenser Fan	Low evaporation pressure (SP1)	Compressor will be shut down Low evaporation pressure Automatically reset	Low evaporation pressure	check if low pressure alarm code is recorded; if yes, then the unit didn't cool the coolant	solve the problem according to the alarm of low pressure
AL20	Compressor Condenser Fan	Low superheat	Compressor will be shut down Promote only; automatic reset	EEV and/or EEV control malfunction	Check EEV and/or EEV control	Replace EEV and/or EEV control
AL21	Compressor Condenser Fan	High superheat	Compressor will be shut down Promote only; automatic reset	EEV and/or EEV control malfunction	Check EEV and/or EEV control	Replace EEV and/or EEV control

Alarm Code	Loads Shut Down	Signal	Meaning & Description	Possible Cause	Check Points	Recommend Actions
AL22	Compressor Condenser Fan	EEV driver reset fault after power off	Compressor will be shut down EEV did not shut off during EEV driver power off Automatically reset	EEV did not shut off during EEV driver power off	Restore power of EEV driver	Replace EEV if alarm again
AL23	Compressor	EEV driver communication failure	Compressor will be shut down	loose connection of controller	check connections of EEV driver	re-connect all terminators
	Condenser Fan		loose connection of controller Press alarm key to reset			replace cable
AL24	Compressor Capacity control Pump Condenser Fan	Temperature sensor at coolant from outlet of evaporator (ST1)	Chiller will be shut down; Triggered if temperature sensor shorts or is cut off or probe limits are exceeded (-50°C.. 100°C). Press alarm key to reset.	loose wire at the terminal block	check terminal block in electrical box	tighten up the line or reconnect the terminal block
				the temperature sensor ST1 failed	check temperature sensor	replace the sensor
AL25	Compressor	Temperature sensor (ST5) at compressor suction failure	Compressor will be shut down Triggered if temperature sensor shorts or is cut off or probe limits are exceeded (-50°C.. 100°C). Press alarm key to reset.	loose wire at the terminal block	check terminal block in electrical box	tighten up the line or reconnect the terminal block
	Condenser Fan			the temperature sensor ST5 failed	check temperature sensor	replace the sensor
AL26		Temperature sensor (ST6) of ambient temperature	Triggered if temperature sensor shorts or is cut off or probe limits are exceeded (-50°C.. 100°C). Press alarm key to reset. AL28 can't happen	loose wire at the terminal block	check terminal block in electrical box	tighten up the line or reconnect the terminal block
				the temperature sensor ST6 failed	check temperature sensor	replace the sensor
AL27	Compressor Capacity control Pump Condenser Fan	Compressor pressure differential (suction and discharge) fault	Compressor will be shut down Triggered if pressure differential less than 2 bar for 60s; manual reset;	Compressor internal thermo protection triggered	Check if compressor stopped	Recharge R407C to the system to 7kg
AL28	Compressor Capacity control Pump	ambient temperature below -31°C	Chiller will be shut down; Active if ambient	ambient temperature of the chiller exceeds the operation range	measure the ambient the temperature at the chiller	chiller can't work if ambient temp out of spec

Alarm Code	Loads Shut Down	Signal	Meaning & Description	Possible Cause	Check Points	Recommend Actions
	Condenser Fan		temperature sensor detects a value below -31°C; Automatically reset	the ambient temperature sensor failed	check temperature sensor	replace the sensor
AL29	Compressor Capacity control Pump Condenser Fan	Coolant outlet pressure high	Triggered if pressure great than 6.9 bar ; Manual reset	Coolant loop to long or blocked.	Check coolant loop	Clean coolant loop/shorten coolant loop
AL30		Coolant outlet pressure low	Triggered if pressure less than 2.0 bar ; promote only; Automatically reset	Coolant loop leak	Check coolant loop	Repair leak point
AL31		Coolant outlet pressure high	Triggered if pressure less than 6.4 bar ; promote only; Automatically reset	Coolant loop to long or blocked	Check coolant loop	Clean coolant loop/shorten coolant loop

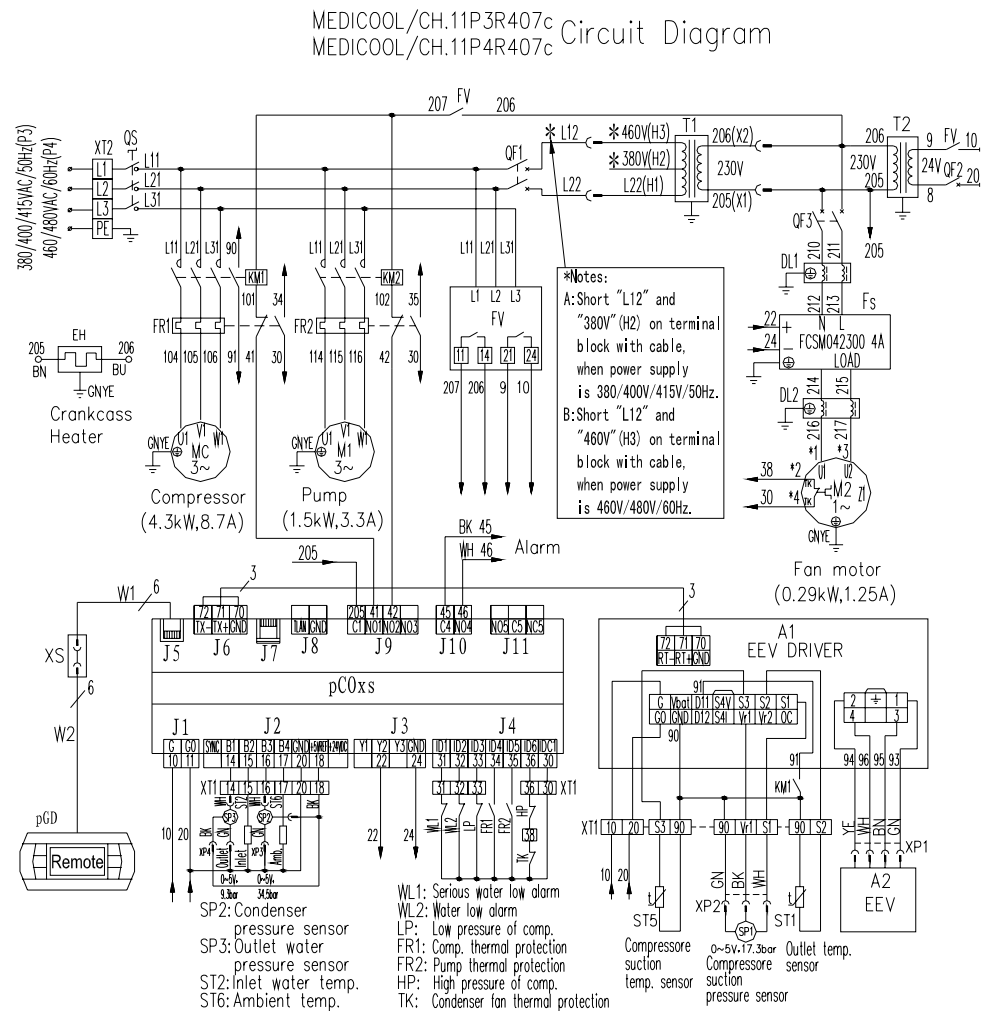
9. Limited Warranty

AIRSYS warrants each new product manufactured and sold to be free from defects in material, workmanship and construction, except for maintenance items which may be contained therein, and that when used in accordance with this owner's manual will perform to applicable specifications for one year and a half from date of shipment. AIRSYS' obligation is limited to repair or replacement, at its option, at its factory, of the defective unit or its components. AIRSYS is not responsible for products which have been subject to misuse, alteration, accident or for repairs not performed or approved by AIRSYS. Instruments must be returned properly packed with transportation charges prepaid to AIRSYS; return transportation charges will be F.O.B. factory. No parts shall be returned unless a return authorization number is received, which will be furnished by request. The foregoing warranty constitutes AIRSYS sole liability, and is in lieu of any other warranty, of merchantability or fitness. AIRSYS' OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND AIRSYS DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION. AIRSYS ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE. AIRSYS' liability does not include any labor charges for replacement of parts, adjustments, repairs, or any other work done outside its factories and its liability does not include any resulting damage to persons, property, equipment, goods or merchandise arising out of any defect in or failure of its apparatus. AIRSYS' obligation to repair or replace shall not apply to any apparatus which shall have been repaired or altered outside of its factory in any way, or which has been subject to negligence, to misuse, or to pressures in excess of stated limits. On parts not of AIRSYS' manufacture, such as motors, controls, etc., AIRSYS extends only those warranties given to AIRSYS to the extent AIRSYS can do so. AIRSYS' agreement hereunder runs only to the immediate purchaser from AIRSYS and does not extend, expressly or by implication, to any other person.

Rev. C Effective Jan 5th, 2009

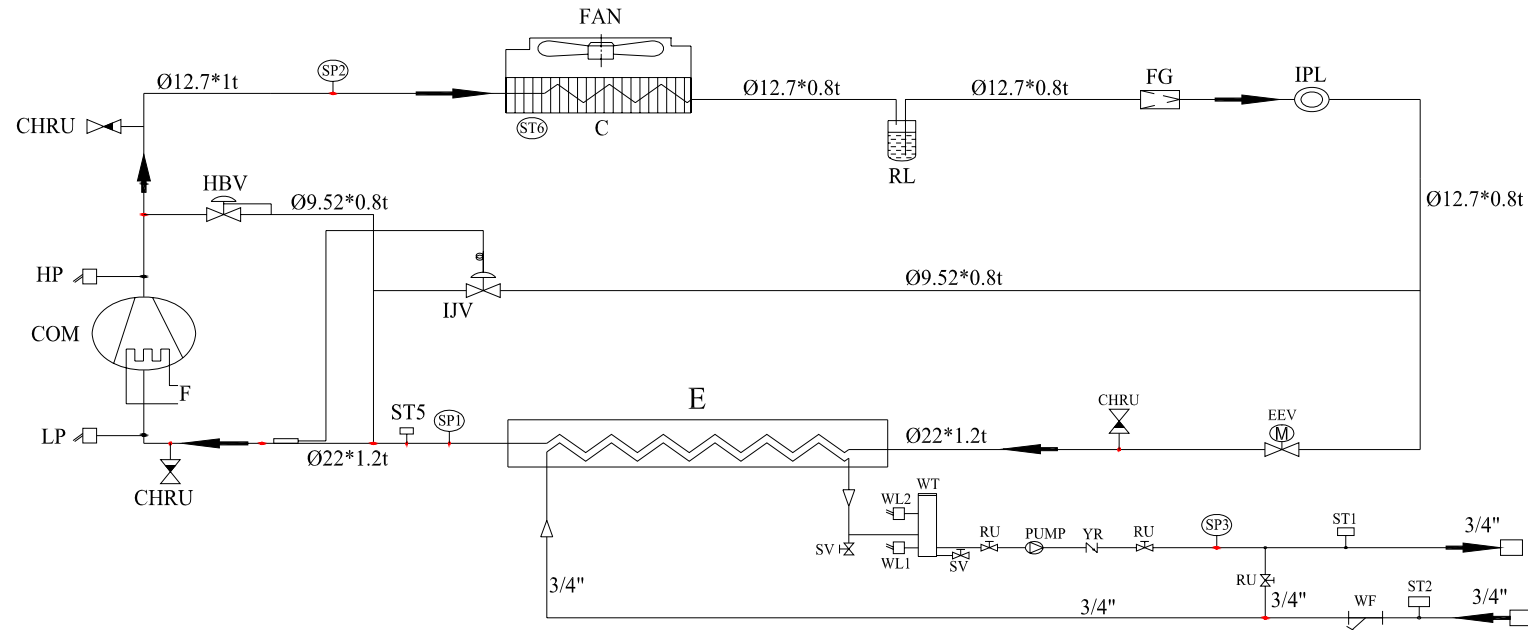
10. APPENDIX

10.1. Circuit Diagram



NO.	Code	Name
1	QS	SwitchLine
2	KM1.KM2	AC Contactor
3	FR1.FR2	Thermal overload relay
4	QF1~QF3	Miniature circuit breaker
5	FV	Phase sequence monitor
6	LP	Low pressure switch
7	HP	High pressure switch
8	T1	Transformer 650VA 380~460V/230V
9	T2	Transformer 40W 240V/24V
10	pCOxs	Controller
11	Fs	Fan Controller
12	pGD	PGD terminals
13	ST1.ST2.ST5.ST6	Temperature sensor
14	A1	Electronic expansion valve Driver
15	A2	Electronic expansion valve
16	XP1	Electronic expansion valve Cable
17	XP2~XP4	Pressure sensor Cable
18	SP1~SP3	Pressure sensor
19	W1.W2	Connect Cable
20	XS	Socket
21	MC	Compressor
22	M1	Pump
23	M2	Condenser fan
24	DL1.DL2	Filter

10.2. Piping Diagram



C	Condenser	HBV	Hot gas by-pass valve	ST1	Temp sensor (water supply)	WL1	Water level switch(low)
CHRU	Re-charge valve	HP	High pressure switch	ST2	Temp sensor (water return)	WL2	Water level switch(high)
COM	Compressor	IJV	TXV	ST5	Temp sensor (suction)	WT	Water tank
E	Evaporator	IPL	Sight glass	ST6	Temp sensor (ambient)	YR	Check valve
EEV	Electronic expansion valve	LP	Low pressure switch	SP1	Pressure sensor(suction)	SV	Drain valve
FAN	Condenser fan	PUMP	Water pump	SP2	Pressure sensor(discharge)		
F	Crankcase heater	RL	Reservoir	SP3	Pressure sensor(coolant)		
FG	Dry filter	RU	Service valve	WF	Water filter		

10.3. Start-up list

Start up Checklist of Medicoool 11kW Chiller

Model: Medicoool/CH.11P3R407C & Medicoool/CH.11P4R407C

Airsys Refrigeration Engineering Technology Co. Ltd.

Customer:

Document NO. GEService003

Revision: 1.0

Location:

Unit Serial NO.:

Service company:

Service Engineer signature:

Date:

Ch	Check list	Initial status	Correct action	Status after	Remarks	Requirement
1	Check the location of the unit, it should be on a strong, and level surface. The casters should be locked for an indoor installation, tied down for an outdoor installation. Chiller can be located 30 m above or 3 m below the gradient coil or cryogen compressor. See Section 2 in the user manual.					-3m<H<30m, lean < 1/300
2	Check coolant piping for loose connections and leaks.					No leak
3	Leak test refrigerant system.					No leak
4	Check the coolant in the reservoir, add coolant if it is below the charge level.					Fill to "Coolant Charge Level "
5	Check electrical wiring, including control panel and all junction boxes, for loose connections or misplaced wiring Check time setting according to local time.					
6	Check the voltage, and phase rotation. Verify voltage setting of chiller to match power supply in site.					Voltage variable range should be within +/-10%
7	Verify the pump outlet valve is adjusted to the correct outlet pressure after start up. Adjust pressure to obtain correct flow of 6.1 GPM. Do not allow the pressure to exceed 66 Psig.					0.45MPa+0.5MPa/6.1 GPM
8	Verify the clearances around the chiller meet the requirements in Sections 4 in the installation manual.					Front>500mm, Rear>600mm
9	Verify the proper operation of the pump system, record the following running data;					
9.1	Flow rate					rated 6.1GPM/23.1 LPM
9.2	Outlet pressure					<0.455MPa
9.3	Running current of each phase	L1:		L1:		11.0<A<17.0
		L2:		L2:		11.0<A<17.0
		L3:		L3:		11.0<A<17.0
9.4	Running voltage of each phase	L1&L2:		L1&L2:		(380/460)+/- 10%
		L1&L3:		L1&L3:		(380/460)+/- 10%
		L2&L3:		L2&L3:		(380/460)+/- 10%
10	Verifying proper operation of refrigerant system, record the following operating data.					
10.1	Compressor discharge pressure					<2400kpa
10.2	Temp of compressor inlet					>0° C
10.3	Coil temperature (read from PLC)					<55 °C/ 131 °F
10.4	Condenser air inlet temperature					<43° C
10.5	Supply coolant temperature (read from PLC)					18.0° C<T<20.0° C, +/- 1° C
10.6	Return coolant temperature (Read from PLC)					24.5° C<T<28.5° C
10.7	Compressor suction pressure					>436kpa
10.8	Compressor input voltage of each phase	L1&L2:		L1&L2:		(380/460)+/- 10%
		L1&L3:		L1&L3:		(380/460)+/- 10%
		L2&L3:		L2&L3:		(380/460)+/- 10%
10.9	Coil temperature (read from PLC)					<55 °C/ 131 °F
10.10	Compressor discharge pipe temperature at 4 to 8 inches from the discharge port.					<90 °C/194 °F
10.11	Compressor running current of each phase	L1:		L1:		5.0<A<10.0
		L2:		L2:		5.0<A<10.0
		L3:		L3:		5.0<A<10.0
10.12	Chiller total running current of each phase	L1:		L1:		11.0<A<17.0
		L2:		L2:		11.0<A<17.0
		L3:		L3:		11.0<A<17.0
10.13	Check refrigerant sight glass status (add refrigerant and do leak-test if it indicates a low refrigerant charge)					Refrigerant should be dry and no or only few bubble
11	Do a detailed visual inspection of the equipment and a general cleaning. Record any damages.					
12	Check PLC parameters setting by comparing with the table of parameters in manual, and correct the wrong settings.					
13	Verify that the cooling capacity meets the requirement of the GE equipment. Record the supply water temperature every 5 minutes for 30 minutes.			T1: T2: T3: T4: T5: T6:		20 °C +/- 1° C
14	Check/correct time setting. Clear all history alarm record					

10.4. Maintenances check list

Preventative Maintenance Verification Checklist of Medicoool 11kW Chiller

Model: Medicoool/CH.11P3R407C & :Medicoool/CH.11P4R407C

Airsys Refrigeration Engineering Technology Co. Ltd.

Customer: _____		Document NO. GEService003		Revision: 1.0	
Location: _____		Unit Serial NO.: _____			
Service company: _____					
Service Engineer signature: _____		Date _____			

Ch	check list	Initial status	Maintenance action	Status after action	Other comments	Requirement
1	Check the controller for any error codes and investigate as appropriate. Clear history alarms in controller.					
2	Check the coolant water filter if the flow rate is under the normal value(6.1 GPM / 23.1 LPM) (A pump outlet pressure that exceeds 500Kpa may indicate that the flow rate is under the normal value)					-3m<H<30m, lean < 1/300
3	Leak test for refrigerant system and check for damage in piping.					
4	Check coolant piping inside the unit cabinet for obvious leaks and for worn areas. Report any leaks or worn areas on piping outside the unit cabinet to GE.					
5	Fill the reservoir if the coolant level is below the label "COOLANT CHARGE LEVEL", which is located on the back upper panel.					
6	Check electrical control system including control panel and all junction boxes inside or outside the chiller for burned or frayed wiring and loose connections, and do the insulation test of the field installing power input line with meg-ohm meter. Record the insulation data. Check time setting and battery of clock board. Replace battery if necessary.					
7	Check for weak or defective contactors, burned or pitted contacts. Fix or replace contactor if it makes any unusual noise or is the source of high current draw.					
8	Verify the proper operation of the pump system, record the following running data;					
8-1	Flow rate (if available)					rated 6.1GPM/23.1 LPM
8-2	Outlet pressure					0.455MPa
8-3	Running current of each phase	L1:		L1:		11.0<A<17.0
		L2:		L2:		11.0<A<17.0
		L3:		L3:		11.0<A<17.0
8-4	Running voltage of each phase	L1&L2:		L1&L2:		Nominal +/- 10%
		L1&L3:		L1&L3:		Nominal +/- 10%
		L2&L3:		L2&L3:		Nominal +/- 10%
9	Verifying proper operation of refrigerant system, record the following operating data.					
9-1	Compressor discharge pressure					<2400kpa
9-2	Condenser air inlet temperature					<43° C
9-3	Supply coolant temperature (read from PLC)					18.0° C<T<20.0° C, +/- 1° C
9-4	Return coolant temperature (Read from PLC)					24.5° C<T<28.5° C
9-5	Compressor suction pressure					>436kpa
9-6	Compressor Input voltage of each phase	L1&L2:		L1&L2:		Nominal +/- 10%
		L1&L3:		L1&L3:		Nominal +/- 10%
		L2&L3:		L2&L3:		Nominal +/- 10%
9-7	Coil temperature (read from PLC)					<55 °C/ 131 °F
9-8	Compressor discharge pipe temperature at 4 to 8 inches from the discharge port.					<90 °C/194 °F
9-9	Compressor running current of each phase	L1:		L1:		5.0<A<10.0
		L2:		L2:		5.0<A<10.0
		L3:		L3:		5.0<A<10.0
9-10	Chiller total running current of each phase	L1:		L1:		11.0<A<17.0
		L2:		L2:		11.0<A<17.0
		L3:		L3:		11.0<A<17.0
9-11	Check refrigerant sight glass status (add refrigerant and do leak-test if it indicates a low refrigerant charge)					Refrigerant should be dry and no or only few bubble
10	Visual check and clean for the equipment.					record damages
11	Check PLC parameters setting by comparing with the table of parameters in user manual, and correct the wrong settings.					refer to parameter in manual
12	Verify that the cooling capacity meets the requirement of the GE equipment. Record the supply water temperature every 5 minutes for 30 minutes.			T1: T2: T3: T4: T5: T6:		20 °C +/- 1° C
13	Record the ambient temperature and temperature at inlet of condenser.					< 43 °C
14	Confirm the condenser fan is operating normally. Check the fan speed can be changed through observation.					
15	Check condenser coils for dirt or damage, clean the coil if necessary					Condenser wind inlet speed > 1.8m/s(average)
16	Confirm coolant supply temperature setting is 19 deg C.					
17	Record compressor inlet temperature.					>0° C
18	Check/correct time setting. Clear all history alarm record					

10.5. Data sheet

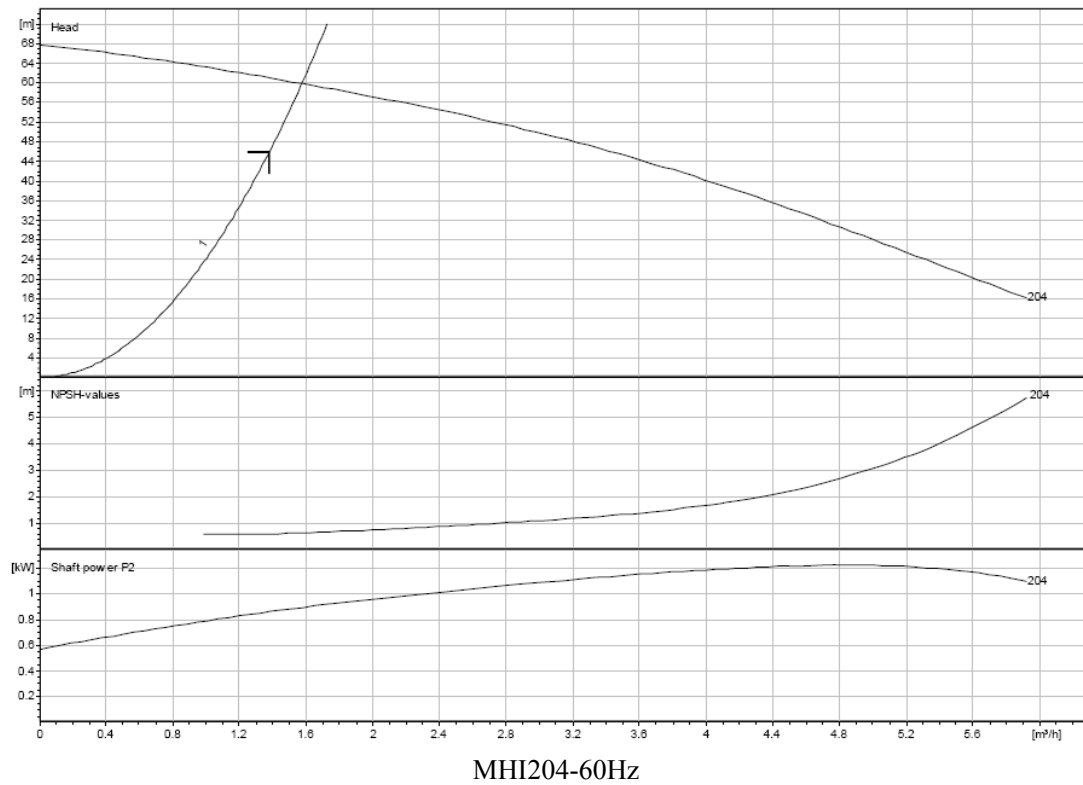
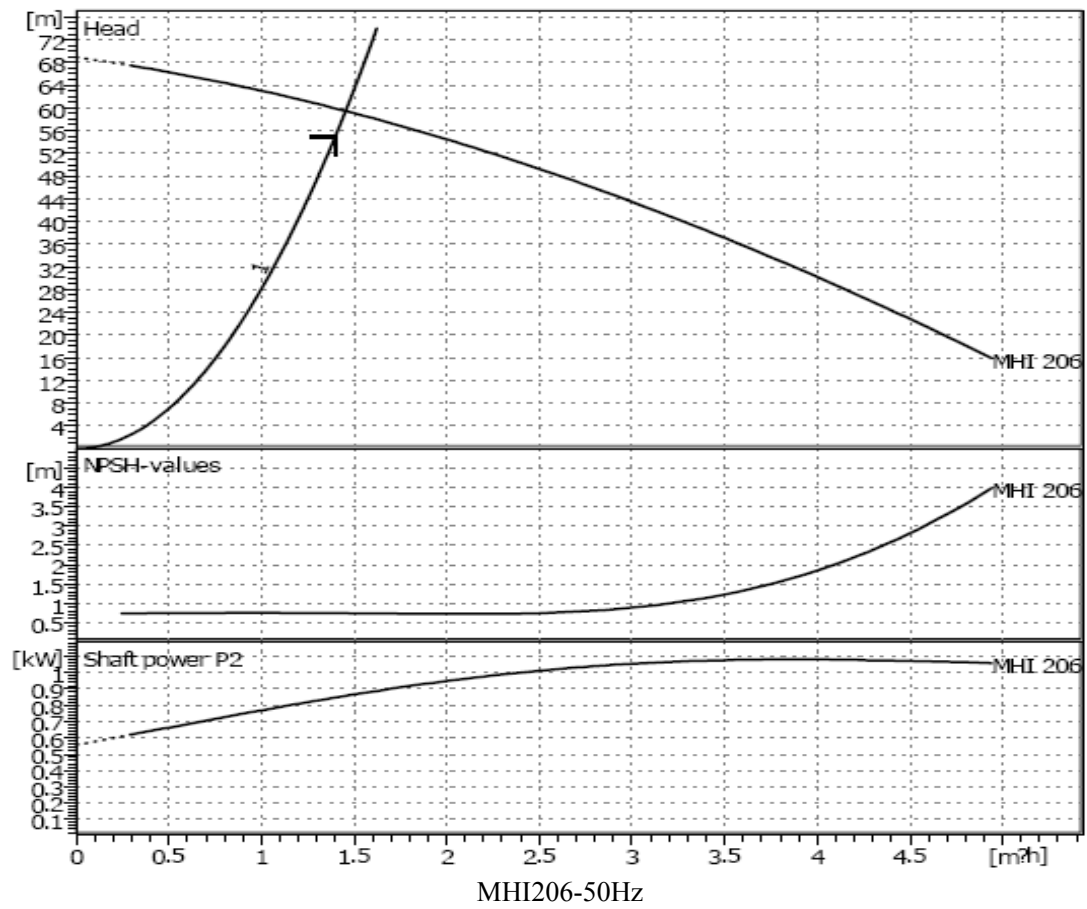
Data sheet of Medicoool 11kW Chiller

Model: Medicoool/CH.11P3R407C & Medicoool/CH.11P4R407C

Airsys Refrigeration Engineering Technology Co. Ltd.

<i>Customer:</i> _____		<i>Unit Serial NO.:</i> _____						
<i>Location:</i> _____		<i>Service company:</i> _____						
<i>Service Engineer signature:</i> _____		<i>Date:</i> _____						
Number	Parameter list							Record Date
	Outlet Temp	Inlet Temp	Ambient Temp	High Pressure of Comp.	Low Pressure of Comp.	Suction Temp	Water Pressure	
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10.6. Pump Curve Diagram



10.7. Safety Data sheet of Propylene Glycol (English/Chinese)

10.8. Safety Data Sheet of R407C MSDS

PROPYLENE GLYCOL INDUSTRIAL

SECTION 1: IDENTIFICATION

Product Name: PROPYLENE GLYCOL INDUSTRIAL

Product Number: 000000000000499202

Chemical Family: Glycols

CAS Number: 57-55-6

Synonyms: Propylene Glycol, 1,2-Propanediol, 1,2-Dihydroxypropane, Monopropylene Glycol

Company

Lyondell Asia Pacific, Ltd.
12/F Caroline Centre, Lee Gardens Two
28 Yun Ping Road
Causeway Bay, Hong Kong
24 Hour Emergency Contact
(886) 933 635 556 Taiwan

Business Contact

+85 2 2882 2668
+852-2840 1690 (FAX)
product.safety@lyondellbasell.com

SECTION 2: HAZARD IDENTIFICATION

Emergency Overview

Hazards

Slightly combustible liquid. Do not handle near heat, sparks, or open flame. May cause minor eye irritation. High aerosol concentrations may cause mild irritation of the nose and throat as well as central nervous system depression. Not expected to cause skin irritation. Not expected to be a sensitizer.

Physical State

liquid

Color

Clear, colorless.

Odor

Little or no odor.

Odor Threshold

No value available.

Potential Health Effects

Routes of Exposure

Eye. Inhalation. Skin.

Signs and Symptoms of Acute Exposure

See component summary.

- *Propylene Glycol 57-55-6*

May cause minor eye irritation. High aerosol concentrations may cause mild irritation of the nose and throat as well as central nervous system depression.

Skin

Not a skin irritant. Not expected to be a sensitizer.

Inhalation

High aerosol concentrations may cause mild reversible irritation of the nose and throat as well as CNS depression (primarily fatigue, dizziness and possibly loss of concentration, with collapse, coma and death possible in cases of severe over

PROPYLENE GLYCOL INDUSTRIAL

Inhalation
exposure).**Eye**

May cause minor eye irritation. Effects of eye irritation are reversible.

Ingestion

Ingestion of high doses may cause discomfort and irritation of the gastrointestinal tract and CNS depression (fatigue, dizziness and possibly loss of concentration, with collapse, coma and death in cases of severe over-exposure).

Chronic Health Effects

See component summary.

- *Propylene Glycol 57-55-6*

Repeated or prolonged exposure of the skin to this material may cause defatting and drying of the skin. Prolonged or repeated breathing of high concentrations may cause symptoms of central nervous system depression.

Conditions Aggravated by Exposure

This material or its emissions may aggravate pre-existing eye disease.

SECTION 3 : COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component Name</u>	<u>CAS #</u>	<u>EU Inventory</u>	<u>Concentration Wt. %</u>
Propylene Glycol	57-55-6	200-338-0	> 99.0

Compositions given are typical values not specifications.

SECTION 4: FIRST AID MEASURES

General

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid. For specific information refer to the Emergency Overview in Section 2 of this MSDS.

Skin

Not expected to present a significant skin hazard under anticipated conditions of normal use. If skin contact occurs, remove contaminated clothing and wash skin thoroughly.

Inhalation

Not expected to present a significant inhalation hazard under anticipated conditions of normal use. If overcome by exposure, remove victim to fresh air immediately. Give oxygen or artificial respiration as needed. Obtain medical attention if breathing difficulty persists.

Eye

Thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persists, seek medical attention.

Ingestion

Ingestion unlikely. If large quantity swallowed, give lukewarm water (pint/ 1/2 litre) if victim completely conscious/alert. Obtain medical attention.

PROPYLENE GLYCOL INDUSTRIAL

Note to Physician

Treat symptomatically. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

SECTION 5: FIRE FIGHTING MEASURES

Flammable Properties

Classification

Slightly combustible.

Flash Point

~ 109 °C (228.2 °F) (PMCC) (Aqueous solution).

Auto-Ignition Temperature

~ 371 °C (699.8 °F)

Lower Flammable Limit

~ 2.4 vol%

Upper Flammable Limit

~ 17.4 vol%

Extinguishing Media

Suitable:

SMALL FIRE: Use dry chemicals, CO₂, water spray or alcohol-resistant foam. LARGE FIRE: Use water spray, water fog or alcohol-resistant foam.

Unsuitable:

Do not use solid water stream.

Protection of Firefighters

Protective Equipment/Clothing:

Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters protective clothing will only provide limited protection.

Fire Fighting Guidance:

Heat from fire can generate flammable vapor. Fine sprays/mists may be combustible at temperatures below normal flash point. When mixed with air and exposed to ignition source, vapors can burn in open or explode if confined. Vapors may be heavier than air. May travel long distances along the ground before igniting and flashing back to vapor source. Aqueous solutions containing less than 95% propylene glycol by weight have no flash point as obtained by standard test methods. However aqueous solutions of propylene glycol greater than 22% by weight, if heated sufficiently, will produce flammable vapors. Only aqueous solutions of propylene glycol less than 22% should be used in sprinkler systems or other fire-fighting equipment. Always drain and flush systems containing propylene glycol with water before welding or other maintenance.

Hazardous Combustion Products:

Incomplete combustion may produce carbon monoxide and other toxic gases.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Release Response

In case of accidental spill, may contaminate water supplies/pollute public waters. Evacuate/limit access. Equip responders with proper protection. Extinguish ignition sources; stop release; prevent flow to sewers or public waters. Notify fire and environmental authorities. Water soluble liquid. Restrict water use for cleanup. Slippery walking/spread granular cover or soak up. Impound/recover large land spill; soak up small spill with inert solids. Use suitable disposal containers. Report per

PROPYLENE GLYCOL INDUSTRIAL

Release Response
regulatory requirements.

SECTION 7: HANDLING AND STORAGE

Handling

Hygroscopic. Handle with care. After handling, always wash hands thoroughly with soap and water. Always drain and flush systems containing propylene glycol with water before welding or other maintenance. Wear recommended personal protective equipment. Observe precautions pertaining to confined space entry.

Storage

Hygroscopic. Keep drums tightly closed to prevent contamination. Store away from heat, sparks, open flames, strong oxidizing agents and direct sunlight. Store at 65-90°F (18-32°C). Stainless steel containers. Lined steel. Mild steel. Reinforced plastic. Use dry nitrogen or low dew point air for tank padding.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

No special ventilation is recommended under anticipated conditions of normal use beyond that needed for normal comfort control.

Personal Protection

Inhalation

No special respiratory protection is recommended under anticipated conditions of normal use with adequate ventilation.

Skin

Wear chemical resistant gloves such as: Neoprene. Where use can result in skin contact, practice good personal hygiene. The equipment must be cleaned thoroughly after each use.

Eye

Use splash goggles when eye contact due to splashing or spraying liquid is possible.

Additional Remarks

Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Promptly remove soiled clothing/wash thoroughly before reuse.

Occupational Exposure Limits

Consult local authorities for acceptable exposure limits.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

PROPYLENE GLYCOL INDUSTRIAL

Appearance: liquid Clear, colorless.

Odor: Little or no odor.

Odor Threshold: No value available.

pH: ~ 7

Boiling Point/Boiling Range: ~ 188 °C (370.4 °F) @ 760 mm Hg

Freezing Point/Melting Point: ~ -60 °C (-76 °F)

Flash Point: ~ 109 °C (228.2 °F) (PMCC) (Aqueous solution).

Auto-ignition: ~ 371 °C (699.8 °F)

Flammability: Slightly combustible.

Lower Flammable Limit: ~ 2.4 vol%

Upper Flammable Limit: ~ 17.4 vol%

Explosive Properties: No Data Available.

Oxidizing Properties: No Data Available.

Vapor Pressure: < 0.1 mm Hg @ 25 °C (77 °F)

Evaporation Rate: 0.01 (butyl acetate = 1)

Relative Density: ~ 1.04 @ 25 °C (77 °F)

Relative Vapor Density: ~ 2.6 @ ~ 15 - 32 °C (59 - 89.6 °F)(Air = 1.0)

Viscosity: ~ 46 mPa.s @ 25 °C (77 °F) (Brookfield).

Solubility (Water): Complete (In All Proportions).

Partition Coefficient (Kow): ~ -0.92

Additional Physical and Chemical Properties: Volatile Characteristics: Slight: 0.1 to 1.0% Hygroscopic. Additional properties may be listed in Sections 2 and 5.

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability

Stable.

Conditions to Avoid

High temperatures, oxidizing conditions. May degrade when exposed to light or other radiation sources.

Substances to Avoid

Reacts with strong oxidizing agents. Strong acids. Isocyanates.

Decomposition Products

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Decomposition Products

Carbon Monoxide and other toxic vapors.

Hazardous Polymerization

Not expected to occur.

Reactions with Air and Water

Not expected to occur.

SECTION 11: TOXICOLOGICAL INFORMATION

PRODUCT INFORMATION

Product Summary

No additional toxicology information is available for this product itself. (See Component Toxicity Information).

COMPONENT INFORMATION

- *Propylene Glycol* 57-55-6

Acute Toxicity - Lethal Doses

LD50 (Oral) rat 22,000 MG/KG BWT

LD50 (Skin) Rabbit. 20,800 MG/KG BWT

IrritationSkin

Not a skin irritant. Repeated or prolonged contact with skin may cause dermatitis.

Eye

May cause minor eye irritation. Effects of eye irritation are reversible.

Sensitization

Not expected to cause sensitization by skin contact, however skin reactions of unknown etiology have been described in some hypersensitive individuals following topical application.

Target Organ Effects

Skin. Repeated or prolonged contact with skin may cause defatting and drying of the skin which may result in dermatitis.

Repeated Dose Toxicity

No adverse systemic changes were reported in rats or dogs following repeated dietary exposure to high concentrations of propylene glycol. Cats responded with species-specific hematological changes (Heinz body formation) yet all other tissues were unaffected. No systemic effects, but mild eye and nasal irritation were noted in rats following sub-chronic exposure to high concentrations of propylene glycol aerosol. Overall propylene glycol is of low inherent toxicity following repeated oral or inhalation exposure.

Reproductive Effects

No adverse effect on reproductive performance was seen in male and female mice exposed continuously to high doses of propylene glycol in drinking water for up to 3 months.

Developmental Effects

Results from studies in pregnant rats, mice, hamsters and rabbits demonstrate that propylene glycol is not teratogenic or fetotoxic.

Genetic Toxicity

Negative for genotoxicity both in vitro and in vivo tests.

Carcinogenicity

PROPYLENE GLYCOL INDUSTRIAL

Carcinogenicity

No increase in tumors was noted in rats and dogs exposed to high concentrations of propylene glycol via the diet for up to 2 years. The incidence of skin tumors was unaltered in mice following dermal application over a lifetime. Not listed by IARC, NTP, OSHA or EPA.

SECTION 12: ECOLOGICAL INFORMATION

PRODUCT INFORMATION

Ecotoxicity

This material is expected to be non-hazardous to aquatic species.

Environmental Fate and Pathway

See components summary.

COMPONENT INFORMATION

- *Propylene Glycol* 57-55-6

Ecotoxicity

This material is expected to be non-hazardous to aquatic species.

Acute toxicity to fish

LC50 / 96 HOUR fathead minnow 51,400 mg/l

LC50 / 96 HOUR salmon 51,600 mg/l

Acute toxicity to aquatic invertebrates

EC50 / 48 HOUR Daphnia magna. 43,500 mg/l

EC50 / 48 HOUR saltwater mysid. 27,300 mg/l

Toxicity to aquatic plants

EC50 / 72 HOUR Freshwater Algae. 24,200 mg/l

EC50 / 72 HOUR Marine algae 19,300 mg/l

Toxicity to microorganisms

Summary: No Data Available.

Chronic toxicity to fish

Summary: No Data Available.

Chronic toxicity to aquatic invertebrates

IC25 / waterflea. 13,470 mg/l

Summary: A three generation reproductive study.

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Environmental Fate and Pathway

Mobility

Transport between environmental compartments: Environmental releases of propylene glycol will tend to partition to water and soil, with little potential for evaporation.

Persistence and Degradability

Biodegradation: Readily biodegradable in aerobic conditions. There is evidence that it is degraded under anaerobic conditions.

Bioaccumulation: < 1.5 This material is not expected to bioaccumulate. BCF < 1.5

Other Adverse Effects

No additional information available.

SECTION 13: DISPOSAL CONSIDERATIONS

Comply with applicable local, state or international regulations concerning solid or hazardous waste disposal and/or container disposal. Landfill solids at permitted sites. Burn concentrated liquids, diluting with clean, low viscosity fuel. Dilute aqueous waste may biodegrade. Assure effluent complies with applicable regulations.

SECTION 14: TRANSPORT INFORMATION

Special Requirements

If you reformulate or further process this material, you should consider re-evaluation of the regulatory status of the components listed in the composition section of this sheet, based on final composition of your product.

Proper Shipping Name PROPYLENE GLYCOL,

SECTION 15: REGULATORY INFORMATION

Regulatory Status

This product and its components are listed, or exempt from listing, on the following:

Country	Inventory
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Japan	ENCS
Korea	ECL
Philippines	PICCS
United States	TSCA
New Zealand	NZIoC

Contact product.safety@lyondellbasell.com for additional global inventory information.

SECTION 16: OTHER INFORMATION

Latest Revision(s)

Revised Section(s): 1 April 29 2009

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DISCLAIMER OF RESPONSIBILITY

This document is generated for the purpose of distributing health, safety, and environmental data.

It is not a specification sheet nor should any displayed data be construed as a specification.

The information on this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Numerical Data Presentation

The presentation of numerical data, such as that used for physical and chemical properties and toxicological values, is expressed using a comma (,) to separate digits into groups of three and a period (.) as the decimal marker. For example, 1,234.56 mg/kg = 1 234,56 mg/kg.

Language Translations

This document may be available in languages other than English.

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PROPYLENE GLYCOL INDUSTRIAL

第一部分: 物品與廠商資料

物品名: 丙二醇

物品號碼: 000000000000499202

化學分類: 醇類

化學文摘號碼: 57-55-6

化學名: 1,2-Propanediol

同義名: Propylene Glycol, 1,2-Propanediol, 1,2-Dihydroxypropane, Monopropylene Glycol

公司名稱

Lyondell Asia Pacific, Ltd.

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(886) 933 635 556 台灣

第二部分: 危害辨識資料

GHS 分類

根據 Globally Harmonized System 分類, 此物質非有害物或危險物。

第三部份 成份辨識資料

成份名稱	化學文摘號 碼CAS #	歐盟化學清單	含量 Wt.%*
Propylene Glycol	57-55-6	200-338-0	> 99.0

*所列成份是 typical values 非規格。

第四部分: 急救措施

一般性

提供急救行為前必須做好個人防範措施。

如果覺得不舒服時, 立即尋求醫療諮詢。

皮膚接觸

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立即去除污染衣物並用水及肥皂清洗接觸部位。

如起紅疹立即送醫治療。

吸 入

將患者移至空氣新鮮處，並提供舒適休息環境以利呼吸順暢。

眼睛接觸

立即用水沖洗數分鐘以上，如佩帶隱形眼鏡則盡可能去除並持續讓水沖洗眼睛。

食 入

不可進行催吐。立即送醫治療。

醫療提示

採症狀治療。對於過度曝露者應該對患者直接控制其症狀。

第五部分 滅火措施

火災特性

火災分類

輕微可燃。

閃火點

~ 109 °C (228.2 °F) (PMCC) (水溶液)。

自燃溫度

~ 371 °C (699.8 °F)

燃燒下限

~ 2 vol%

燃燒上限

~ 17 vol%

滅火方法和滅火劑

適用:

適用: 小火: 使用化學乾粉、二氧化碳、灑水、酒精泡沫進行滅火。

大火: 使用灑水、水霧、酒精泡沫進行滅火。

不適用:

不可使用水柱避免火源擴散。

消防人員防護

防護設備/衣服:

消防人員應著合格自給式空氣呼吸器。一般性消防衣只能提供有限防護。

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消防指導:

火場熱氣會產生易燃氣體，當與空氣混合時，蒸氣在開放空間可燃燒。如在密閉空間可能引起爆炸。飄散氣體可能比空氣重。飄散氣體可能沿地面擴散，一遇火源可能產生回火現象。水溶液中含丙二醇低於95%時，在標準檢測方法下無法測得閃火點。但水溶液中丙二醇含量高於22%，則在足夠熱度下會產生可燃性氣體。在灑水系統或消防系統內，丙二醇水溶液須低於22%。在做系統或設備維修焊接時，如果含丙二醇則事先應用大量水沖洗。

燃燒分解危害物:

一氧化碳和其他有毒氣體。

第六部分 洩漏處理方法

應急處理

可能污染水源/供水系統。限制人員出入。處理人員應穿著適當防護具。防止洩漏液流入下水道/污水道。進行止漏。立即依相關規定通報主管機關。嚴禁用水清洗。地板濕滑/以吸附材覆蓋及吸附。大量洩漏時以回收處理。少量洩漏時以吸附材吸附處理並裝入廢棄桶。可以生物分解。洩漏液應儘速清除避免擴散。依法規定進行通報。

第七部分 安全處置與儲存方法

操作注意事項

吸水性強。操作小心。操作後應用水和肥皂徹底清洗雙手。穿著適當個人防護具，進入侷限空間作業時，應有人戒備。

儲存注意事項

使用碳鋼或不銹鋼。容器保持緊閉以避免污染，儲存於 65~90°F (18~32°C)，使用氮氣或惰性氣體進行補壓。

第八部分 暴露預防措施

工程控制

在正常使用情況下不須特別排氣通風系統。如超過正常使用情況則須使用局部排氣通風設備。

個人防護

呼吸防護

在正常預期的工作環境下並有適當的通風，不須特殊的呼吸防護。

皮膚防護

使用化學防護手套如：橡膠手套。保持個人良好衛生習慣。防護具於每次使用後應徹底清洗乾淨。

眼睛防護

如化學品可能接觸眼睛則使用安全眼鏡及防濺面罩以防止化學品噴濺。

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其他防護

依照工作性質條件、時間，及工作期間可能產生的危害來選擇適當的個人防護器具。在可能接觸地點須設置緊急沖身洗眼器，保持個人良好衛生習慣。吃東西、喝東西、抽煙，或使用廁所前須洗淨雙手。污染衣物立即脫下，徹底清洗後才可再穿。

工作場所曝露限制

組成名稱	資料來源	類型	曝露限值	註記
Propylene Glycol	OEL (臺灣)	TWA	無規定	

第九部分 物理及化學性質

外觀: 液體. 透明、無色.

氣味: 輕微 或 無味.

氣味嗅限值: 無資料.

pH: ~ 7

沸點: ~ 188 °C (370.4 °F) @ 760 mm Hg

凝固點/溶點: ~ -60 °C (-76 °F)

閃火點: ~ 109 °C (228.2 °F) (PMCC) (Aqueous solution).

自燃溫度: ~ 371 °C (699.8 °F)

可燃性: 輕微可燃.

燃燒下限: ~ 2 vol%

燃燒上限: ~ 17 vol%

爆炸特性: 無資料 .

氧化特性: 無資料 .

蒸汽壓: ~ 0.08 mm Hg @ 20 °C (68 °F)

揮發速率: 無資料 .

相對密度: ~ 1.04 @ 25 °C (77 °F)

相對蒸氣比重: ~ 2 (Air = 1.0 at 15 - 20°C/59 - 68°F)

黏度: ~ 46 mPa.s @ 25 °C (77 °F) (Brookfield).

水中溶解度: 全溶 (所有部份).

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分離系數 (Kow): Log Kow = -0.78

其他物理及化學性質: 揮發特性: 輕微: 0.1至1.0%, 吸水性。其他特性可能列於第二、五部份。

第十部分 安定性和反應性

化學穩定性
穩定。

避免接觸的條件
高溫, 氧化條件。曝露在光線或其他輻射線下可能會產生分解。

避免接觸的物質
與強氧化劑反應。強酸、異氰酸酯。

分解產物
一氧化碳及其他有毒氣體。

危害聚合
不預期會發生。

與水 / 空氣之反應
不預期會發生。

第十一部分 毒性資料

產品訊息

產品摘要

丙二醇在注射或皮膚接觸下是低急毒性的。雖然重覆接觸未稀釋的丙二醇會造成皮膚脆裂, 但它並不會刺激皮膚。它也不具皮膚致敏性, 但不明病因的皮膚反應已經在一些個別應用上被提及。乾淨的丙二醇亦會造成輕微的眼睛刺激。在對老鼠及狗的重覆口服曝露實驗中顯示, 丙二醇是低遺傳性。但對特殊種類的貓確顯示紅血球(其他組織並不顯著)會改變。老鼠重覆曝露在高濃度霧滴中會對眼睛、鼻子黏膜造成刺激。但並無證據顯示會造成系統毒性。在對懷孕的大鼠、小鼠、天竺鼠及兔子的研究中顯示, 丙二醇並非致畸胎的, 對公鼠、母鼠持續3個月給予高劑量的丙二醇在飲水中, 亦未發現有生殖毒性現象。丙二醇並未有基因素性, 大鼠及狗曝露在高劑量的丙二醇2年下, 並未發現有腫瘤增生而死亡。而小鼠終生曝露在皮膚接觸下, 皮膚腫瘤罹患率並未改變。

組成訊息

- Propylene Glycol 57-55-6

急毒性 – 致死劑量

LD50 (口服) 大鼠 22,000 MG/KG BWT

LD50 (皮膚) 兔子 20,800 MG/KG BWT

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刺激性

皮膚

不會造成皮膚刺激。長期或重複接觸可能造成皮膚炎。

眼睛

可能造成輕微的眼睛刺激。眼睛刺激影響是可恢復的。

致敏性

皮膚接觸不預期會造成致敏性，但不明原因的皮膚反應在一些個別的應用上已經被提出。

主要影響器官

皮膚。重複或長期皮膚接觸可能造成缺少油脂而導致皮膚乾燥產生皮膚炎。

重複曝露毒性

在老鼠及狗的高劑量丙二醇飲食重複曝露研究中，並未有報告提及全身有任何改變。特殊種類的貓會有血液改變的反應，而其他組織則無影響。在老鼠曝露在高濃度霧滴研究中發現，丙二醇慢性毒性非全身影響，但輕微眼睛及鼻子刺激。整體而言，丙二醇在口服及吸入曝露下是低毒性的。

生殖系統影響

對公鼠、母鼠持續3個月給予高劑量的丙二醇在飲水中，亦未發現有生殖毒性現象。

發育影響

在對懷孕的大鼠、小鼠、天竺鼠及兔子的研究中顯示，丙二醇並非致畸胎的。

基因毒性

在實驗中並無證據顯示有基因毒性。

致癌性

大鼠及狗曝露在高劑量的丙二醇2年下，並未發現有腫瘤增生而死亡。而小鼠終生曝露在皮膚接觸下，皮膚腫瘤罹患率並未改變。未列入 IARC, NTP, OSHA 或 EPA

第十二部分 生態資料

產品訊息

生態毒性

此物質不預期會對水生物種造成危害。參考組成訊息。

環境影響及管道

此物質對水中生物不預期會造成危害。參考組成訊息。

組成訊息

- Propylene Glycol 57-55-6

生態毒性

PROPYLENE GLYCOL INDUSTRIAL

此物質對水中生物不預期會造成危害。

急性毒性 - 魚

LC50 / 96 HOUR fathead minnow 51,400 mg/l

LC50 / 96 HOUR salmon 51,600 mg/l

急性毒性 - 水中無脊椎動物

EC50 / 48 HOUR Daphnia magna. 43,500 mg/l

EC50 / 48 HOUR saltwater mysid. 27,300 mg/l

毒性 - 水中植物

EC50 / 72 HOUR Freshwater Algae. 24,200 mg/l

EC50 / 72 HOUR Marine algae 19,300 mg/l

毒性 - 水中有機生物

結論: 無資料。

慢性毒性 - 魚

結論: 無資料。

慢性毒性 - 水中無脊椎動物

IC25 / waterflea. 13,470 mg/l

結論: 從研究三代中得到。

環境影響及管道

流動性

環境中移動: 丙二醇洩漏至環境中會流至水及土壤中。僅有極少部份會揮發至空氣中。

蓄積及分解力

生物分解性: 在喜氧狀態下, 迅速被生物分解。有證據顯示在厭氧狀態下亦可被分解。

生物蓄積性: 不預期會有生物蓄積。BCF < 1.5

其他影響

無其他資料。

第十三部分 廢棄處置方法

依當地法規進行處置。在合格掩埋場掩埋。高濃度廢液以焚化處理。稀釋廢液可用生物分解, 避免濃度過高危害微生物。廢水排放須符合法規。

第十四部分 運送資料

PROPYLENE GLYCOL INDUSTRIAL

特殊要求

如果你從新配方或製造此物質，你應該根據最終產品成份組成考慮從新評估成份的法規適用性。

適當運輸名稱

PROPYLENE GLYCOL, NOT REGULATED

第十五部分 法規資料

法規現況

國家	Inventory
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Japan	ENCS
Korea	ECL
Philippines	PICCS
United States	TSCA
New Zealand	NZIoC

如需全球其他inventory資料，請連絡 Product.Safety@Lyondell.com。

台灣 - 有害物名單

未列入。

台灣 - 毒性化學物質名單

未列入。

台灣 - 毒性化學物清單

未列入。

第十六部分 其他資料

參考文獻：

填表時間：2009年4月21日

填表部門：Health Safety and Environmental

填表者：龔峰生

修改說明：

最新版本

經修訂的第（補）：1 修訂日期：2009年4月21日

承諾責任

此文件的目的是來傳達此物質安全、衛生、環境資料，並非產品規格，亦非用來建立產品規格。我們相信此物質安全資料表內資料來源是可靠的，但我們並不對其正確性做保證。有一些資料的表述並非直接從測試結果所得，此物質最終的操作、儲存、使用、廢棄處理已超出我方所能掌控，而且可能也已超出我方的了解。因此，我方不認為應對操作、儲存、使用、廢棄處理負有責任。如果此物質是用來做另一物質的成份配方，則此份物質安全資料表上資料可能不適用。

PROPYLENE GLYCOL INDUSTRIAL

承諾責任

數字資料表達

數字資料如物理／化學性質，毒理數據，是用逗點(，)來分隔每三個阿拉伯數字，用句點(．)來表示小數點。例如：
1,234.56 mg/kg = 1 234,56 mg/kg.

語言翻譯

此文件除了英文外，亦有其他語言版本。

<結束>

SAFETY DATA SHEET

Product:

FORANE 407C

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Version : 4

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Cancel and replace: 18/06/1998

01 - IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

PRODUCT NAME	FORANE 407C
SDS No.	01965
SUPPLIER	ELF ATOCHEM D. FLUORES ET OXYGENES Cours Michelet - La Défense 10 92091 PARIS LA DEFENSE CEDEX FRANCE
	Téléphone : 01 49 00 80 80
	Télécopie : 01 49 00 83 96
Emergency telephone number	33 1 49 00 80 80

02 - COMPOSITION / INFORMATION ON INGREDIENTS

CHEMICAL NATURE OF THE PREPARATION	MIXTURE BASED ON :
	FORANE 32 (DIFLUOROMETHANE)
	CAS : 75-10-5 EINECS : 200-839-4 (*)
	FORANE 125 (PENTAFLUOROETHANE)
	CAS : 354-33-6 EINECS : 206-557-8 (*)
	FORANE 134a (1,1,1,2-TETRAFLUOROETHANE)
	CAS : 811-97-2 EINECS : 212-377-8 (*)

03 - HAZARDS IDENTIFICATION

MOST IMPORTANT HAZARDS	-
PHYSICAL AND CHEMICAL HAZARDS	Thermal decomposition giving toxic and corrosive products.

04 - FIRST AID MEASURES

GENERAL ADVICE	-
INHALATION (*)	Move to fresh air. Oxygen or artificial respiration if needed. In case of persistent problems : (*) Consult a doctor. (*)
SKIN CONTACT	Frostbite : treat as thermal burns.
EYE CONTACT	Wash immediately, abundantly and thoroughly with water. If irritation persists, consult an ophthalmologist.
PROTECTION OF FIRST-AIDERS (*)	In case of insufficient ventilation, wear suitable respiratory equipment. (*)
INFORMATION FOR DOCTORS	Do not administer catecholamines (because of the cardiac effect caused by the product)

05 - FIRE-FIGHTING MEASURES

SPECIFIC HAZARDS	Thermal decomposition giving toxic and corrosive products. Hydrogen fluoride
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SPECIFIC METHODS	Carbon oxides
	One of the components of this preparation gives flammable mixtures with air.
SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS	Cool containers / tanks with water spray.
	Prohibit all sources of sparks and ignition - Do not smoke.
	Wear a self-contained breathing apparatus and protective suit.

06 - ACCIDENTAL RELEASE MEASURES

PERSONAL PROTECTION	Avoid contact with skin and eyes and inhalation of vapours. Wear personal protective equipment. In enclosed areas : ventilate or wear a self-contained breathing apparatus (risk of anoxia). Do not smoke.
ENVIRONMENTAL PROTECTION	Minimize as much as possible discharge into the environment

07 - HANDLING AND STORAGE

Technical measures/Precautions	Storage and handling precautions applicable to products : GAS UNDER PRESSURE Ensure appropriate exhaust and ventilation at machinery.
Safe handling advice	Prohibit ignition sources and contact with hot surfaces - DO NOT SMOKE.
Technical measures/Storage conditions	Store at ambient temperature in the original container. Keep away from naked flames, hot surfaces and sources of ignition. Keep in a cool, well-ventilated place. Protect full containers from sources of heat to avoid overpressurization.
Recommended	Ordinary steel
To be avoided	Alloys containing more than 2% of magnesium. Plastic materials

08 - EXPOSURE CONTROLS / PERSONAL PROTECTION

PROTECTIVE PROVISIONS	Ensure sufficient air exchange and/or exhaust in work areas.
CONTROL PARAMETERS	-
Exposure limits	No limit value F-USA FORANE 134a Value recommended by the "Comité Valeur limite d'exposition" of ELF ATOCHEM: VME = 1000 ppm - FORANE 32 Value proposed by the "Comité Valeur limite d'exposition" of ELF ATOCHEM : VME = 1000 ppm. Forane 125 Value proposed by the "Comité Valeur limite d'exposition" of ELF ATOCHEM : VME = 1000 ppm. - PERSONAL PROTECTION EQUIPMENT
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Hand protection	Gloves
Eye protection	Safety glasses.

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09 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE (20°C)	liquefied gas
COLOUR	colourless
ODOUR	Slightly ether-like
pH	Not applicable
BOILING POINT/RANGE	-42.4 °C
FLASH POINT	No flash point (in the test conditions)
VAPOUR PRESSURE	(25°C) : 1.13 MPa (11.3 bar) (50°C) : 2.11 MPa (21.1 bar) (70°C) : 3.26 MPa (32.6 bar)
VAPOUR DENSITY	At the boiling point : 4.54 kg/m3
DENSITY	(25°C) : 1133 kg/m3 (50°C) : 1004 kg/m3 (70°C) : 861 kg/m3
PARTITION COEFFICIENT (n-octanol/water)	log Pow = 0.21 (Forane 32) - log Pow = 1.48 (Forane 125) - log Pow = 1.06 (Forane 134a)
OTHER DATA	Forane 134a : Does not dissociate in water Henry's constant : 3.09E5 Pa m3/mole (Forane 125) - : 1.55E5Pa m3/mole Critical temperature: Tc=89°C Critical pressure: Pc=4.64 MPa (46.4 bar)

10 - STABILITY AND REACTIVITY

CONDITIONS TO AVOID	Avoid contact with flames and red hot metallic surfaces.
HAZARDOUS DECOMPOSITION PRODUCTS	Thermal decomposition into toxic products containing fluorine
	Hydrogen fluoride (hydrofluoric acid) Carbon oxides
FURTHER INFORMATION	The product is stable under normal handling and storage conditions.

11 - TOXICOLOGICAL INFORMATION

ACUTE TOXICITY	-
Inhalation	Experimental effects on animals : FORANE 134a, FORANE 32, FORANE 125 Practically not harmful by inhalation. No mortality in rat at 500 000 ppm / 4h. As with other volatile aliphatic halogenated compounds, through vapour accumulation and/or inhalation of large quantities, the product can cause : Loss of consciousness and cardiac disorders aggravated by stress and lack of oxygen: risk of mortality.
LOCAL EFFECTS	-
Skin-contact	Ejection of liquefied gas : frostbite possible.
CHRONIC TOXICITY	FORANE 134a, FORANE 32, FORANE 125 Studies of prolonged inhalation in animals have not shown sub-chronic toxic effects. (rat /3 month(s)/Inhalation : 50 000 ppm)
SPECIFIC EFFECTS	GENOTOXICITY : According to available experimental data :

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FORANE 134a, FORANE 32, FORANE 125

Not genotoxic

CARCINOGENICITY :

FORANE 134a

Experimentation on animals has not shown clear evidence of carcinogenic effect.

(rat/Inhalation - oral route)

REPRODUCTIVE TOXICITY :

Foetal development :

FORANE 134a, FORANE 32, FORANE 125

According to available experimental data :

Absence of toxic effects for foetal development

(Inhalation/rat - rabbit)

Fertility :

According to limited available data in animals :

FORANE 134a

Absence of toxic effects on fertility

(mouse/Inhalation)

12 - ECOLOGICAL INFORMATION

- SUBSTANCE CONCERNED

PERSISTENCE/DEGRADABILITY

In water

BIOACCUMULATION

FORANE 32

-

Not readily biodegradable : 5% after 28d

Practically not bioaccumulable : log Pow = 0.21
(measured)

- SUBSTANCE CONCERNED

MOBILITY

PERSISTENCE/DEGRADABILITY

In water

In air

FORANE 125

Rapid evaporation : t_{1/2} life = 3.2h (estimated)

-

Not readily biodegradable 5% after 28d

Degradation in the troposphere : t_{1/2} life = 28.3y (estimated)

Ozone depletion potential : ODP (R-11 = 1) = 0

Global warming potential (GWP) : (HGWP) = 0.58

Slight adsorption :

log Koc = 1.3 - 1.7

In soils and sediments

BIOACCUMULATION

Practically not bioaccumulable

log Pow = 1.48

- SUBSTANCE CONCERNED

MOBILITY

PERSISTENCE/DEGRADABILITY

In water

In air

FORANE 134a

Rapid evaporation : t_{1/2} life = 3h (estimated)

-

Not readily biodegradable : 3% after 28d

Degradation in the atmosphere : 3 % after 28d

Ozone depletion potential : ODP (R-11 = 1) = 0

Global warming potential (GWP) = 0.26

BIOACCUMULATION

Practically not bioaccumulable : log Pow = 1.06

13 - DISPOSAL CONSIDERATIONS

DISPOSAL OF PRODUCT

Recycle or incinerate at an approved waste disposal site only.

14 - TRANSPORT INFORMATION (*)

UN Number (*)

3340 (*)

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ADR/RID

Class : 2

Prescriptions (*)

Item (letter) : 2°A

Labels : 2

IMDG (*)

H.I. Nr/ID Nr : 20/3340 (*)

Class : 2.2

Prescriptions

UN Nr (IMDG) : 3340 (*)

IATA (*)

Labels : 2.2 (*)

Class : 2.2

Prescriptions

UN Nr (IATA) or ID Nr : 3340 (*)

Labels : 2.2

Consult ELF ATOCHEM's safety department for any further information

15 - REGULATORY INFORMATION

EEC DIRECTIVE

-

SAFETY DATA SHEETS

D. 91/155/EEC amended by D.93/112/EEC : Dangerous substances and preparations

EC CLASSIFICATION / LABELLING

-

DANGEROUS PREPARATIONS

D. 88/379/EEC amended by D. 93/18/EEC (3rd ATP)

SUBSTANCES DAMAGING TO THE
OZONE LAYER (*)

Not classified as dangerous

EC Regulation N° 3093/94 of 15.12.94. (*)

INVENTORIES (*)

EINECS (EU) : conforms (*)

TSCA (USA) : conforms

16 - OTHER INFORMATION

RECOMMENDED USES

Refrigerant

BIBLIOGRAPHY REFERENCES

Encyclopédie des gaz (Air Liquide - Ed.1976 – ELSEVIER AMSTERDAM)

-

This information applies to the PRODUCT AS SUCH and conforming to specifications of ELF ATOCHEM.

In case of formulations or mixtures, it is necessary to ascertain that a new danger will not appear.

The information contained is based on our knowledge of the product, at the date of publishing and it is given quite sincerely. However the revision of some data is in progress.

Users are advised of possible additional hazards when the product is used in applications for which it was not intended. This sheet shall only be used and reproduced for prevention and security purposes.

The references to legislative, regulatory and codes of practice documents cannot be considered as exhaustive.

It is the responsibility of the person receiving the product to refer to the totality of the official documents concerning the use, the possession and the handling of the product.

It is also the responsibility of the handlers of the product to pass on to any subsequent persons who will come into contact with the product (usage, storage, cleaning of containers, other processes)

the totality of the information contained within this safety data sheet and necessary for safety at work, the protection of health and the protection of environment.

The (*) indicate the changes made with respect to the previous version.

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End of document.

Number of page(s): 6

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