HUSSMANN®

EVOLVE™ CO_2

OCU040

Outdoor Condensing Unit with CO_2 Refrigerant

Medium and Low Temperature

IMPORTANT

Keep for future reference!

Installation & Operation Manual

P/N 3202293_A
July 2024

BEFORE YOU BEGIN

Read the safety information completely and carefully.

The precautions and use of the procedures described herein are intended to use the product correctly and safely. Comply with the precautions described below to protect yourself and others from injuries. Relative to their potential danger, the relevant matters are divided into four parts as defined by ANSI Z535.5.

ANSI Z535.5 DEFINITIONS

⚠ DANGER	**DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	**WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	**CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	**NOTICE** is used to address practices not related to personal injury.
SAFETY INSTRUCTIONS	**SAFETY INSTRUCTIONS** (or equivalent) signs indicate specific safety-related instructions or procedures.

⚠ WARNING

- **Contractors must strictly adhere to specifications provided by the Engineer of Record (EOR), as well as US Environmental Protection Agency regulations, OSHA regulations, and all other federal, state and local codes. This work should only be done by qualified, licensed contractors.**
- **There are numerous hazards, not limited to, but including: burns due to high temperatures, high pressures, toxic substances, electrical arcs and shocks, very heavy equipment with specific lift points and structural constraints, food and product damage or contamination, public safety, noise, and possible environmental damage.**
- **Never leave operating compressors unattended during the manual soft-start process. Always power rocker switches off when unattended.**

⚠ WARNING

- **PERSONAL PROTECTION EQUIPMENT (PPE)**
- **Only qualified personnel should install and service this equipment. Personal Protection Equipment (PPE) is required whenever servicing this equipment. Wear safety glasses, gloves, protective boots or shoes, long pants, and a long-sleeve shirt as required when working with this equipment. Observe all precautions on tags, stickers, labels and literature attached to this equipment.**

⚠ WARNING

- **Proper Field Wiring and Grounding Required!**
- **Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.**

ENVIRONMENTAL CONCERNS

Hussmann recommends responsible handling of refrigerants. Only certified technicians may handle these refrigerants. All technicians must be aware of and follow the requirements set forth by the Federal Clean Air Act (Section 608) for any service procedure being performed on this equipment that involves refrigerant. Additionally, some states have other requirements that must be adhered to for responsible management of refrigerants.

⚠WARNING

— LOCK OUT / TAG OUT —

» **To avoid serious injury or death from electrical shock, always disconnect the electrical power at the main disconnect when servicing or replacing any electrical component. This includes, but is not limited to, such items as controllers, electrical panels, condensers, lights, fans, and heaters.**

⚠CAUTION

» **This manual was written in accordance with originally prescribed equipment that is subject to change. Hussmann reserves the right to change all or part of the equipment for future stores such as, but not limited to, controllers, valves and electrical specifications. It is the installers responsibility to reference the refrigeration drawings supplied for each installation, as directed by the Engineer of Record.**

This warning does not mean that Hussmann products will cause cancer or reproductive harm, or is in violation of any product-safety standards or requirements. As clarified by the California State government, Proposition 65 can be considered more of a 'right to know' law than a pure product safety law. When used as designed, Hussmann believes that our products are not harmful. We provide the Proposition 65 warning to stay in compliance with California State law. It is your responsibility to provide accurate Proposition 65 warning labels to your customers when necessary. For more information on Proposition 65, please visit the California State government website.

⚠WARNING

» **This equipment is prohibited from use in California with any refrigerants on the "List of Prohibited Substances" for that specific end-use, per California Code of Regulations, Title 17, Section 95374.**

» **Use in other locations is limited to refrigerants permitted by country, state, or local laws and is the responsibility of the installer/end-user to ensure only permitted refrigerants are used.**

» **This disclosure statement has been reviewed and approved by Hussmann and Hussmann attests, under penalty of perjury, that these statements are true and accurate.**

TABLE OF CONTENTS

UNIT INSPECTION

Upon delivery of the unit(s), verify that the correct unit and equipment is received by comparing the information on the unit serial plate with the ordering and submittal documents. All equipment should be thoroughly examined for shipping damage before and during unloading. This equipment has been carefully inspected at our factory. Any claim for loss or damage must be made to the carrier. The carrier will provide any necessary inspection reports and/or claim forms.

GENERAL SAFETY GUIDANCE FOR CO_2 SYSTEMS

CO_2 systems have similar safety concerns with all other refrigerants in that it displaces oxygen, and is heavier than air and will concentrate closer to the floor if there is a system leak. CO_2 should be monitored for leaks similar to other refrigerants. Confirm operation of leak detectors (e.g., by exhaling near the sensor), audible/visible alarms, and machine room ventilation.

Ventilate adjacent enclosed areas to prevent the formation of dangerous concentrations of carbon dioxide. Personnel, including rescue workers, should not enter areas in which the carbon dioxide content exceeds 3% (30,000ppm) by measurement unless wearing an SCBA or supplied air respirators. Avoid contact of the skin or eyes with solid carbon dioxide (dry ice) or objects cooled by solid carbon dioxide. Additional information on the safe use and handling of carbon dioxide can be found in Standards from the Compressed Gas Association Standard: https://www.cganet.com/.

ASPHYXIATION

R744 is odorless, heavier than air, and an asphyxiant. If the sensor reading is maxed out or non-responsive, assume an unsafe level of CO_2 and ventilate the room prior to entering.

- Practical limit of R744, 0.006 lb/ft3 (56,000 ppm);

NOTE:
The practical limit is defined in ASHRAE 34 but may vary depending on regional regulations. The table below summarizes the effect of CO_2 at various concentrations in the air.

A leak of R744 could result in a concentration exceeding the practical limit in an enclosed, occupied space such as a cold room. Precautions must be taken to prevent asphyxiation. These include the use of permanent leak detection, which activates an alarm in the event of a leak.

PPM of CO_2	Effects
370	Concentration in atmosphere
5,000	Long-term exposure limit (8 hours)
15,000	Short-term exposure limit (10 min)
30,000	Discomfort, breathing difficulties, headache, dizziness, etc.
100,000	Loss of consciousness, death
300,000	Quick death

CO_2 SYSTEM OVERVIEW

OUTDOOR CO_2 CONDENSING UNIT INTRODUCTION

This manual provides general information about installing, starting, maintaining, and servicing an outdoor condensing unit using carbon dioxide (CO_2). For detailed information about a specific component or application, use the QR codes in this manual or contact your Hussmann representative.

Additional specifications for job-specific site installation may include:

- **Legend of Equipment Load and Electrical Requirements**
- **Site-Specific Sequence of Operations**
- **Specifications of Components**
- **Piping Diagrams**
- **Site-Specific Dimension and Lifting Requirements**
- **Equipment Overview and List of Options**

CO_2 REFRIGERANT GRADE

Carbon dioxide purchased for use in refrigeration systems should be pure enough to prevent the accumulation of non-condensable gases and moisture. A build-up of these gases can block small orifices, such as expansion valves, or lead to high discharge pressure, reducing operation or causing the system to become inoperable.

CO_2 is commercially available at several different purity levels. The common names and percent purity are listed below. Hussmann recommends using Refrigeration Grade (99.99% purity) CO_2.

Grade	Purity
Industrial Grade	99.5%
Bone Dry (minimum acceptable)	99.8%
Anaerobic Grade	99.9%
Refrigeration Grade (Hussmann recommended)	**99.99%**
Coleman (Instrument) Grade	99.99%
Research Grade	99.999%
Ultra-Pure Grade	99.9999%

***Medical-grade CO_2 should not be used due to the outlet pressure regulators typically present on tanks.**

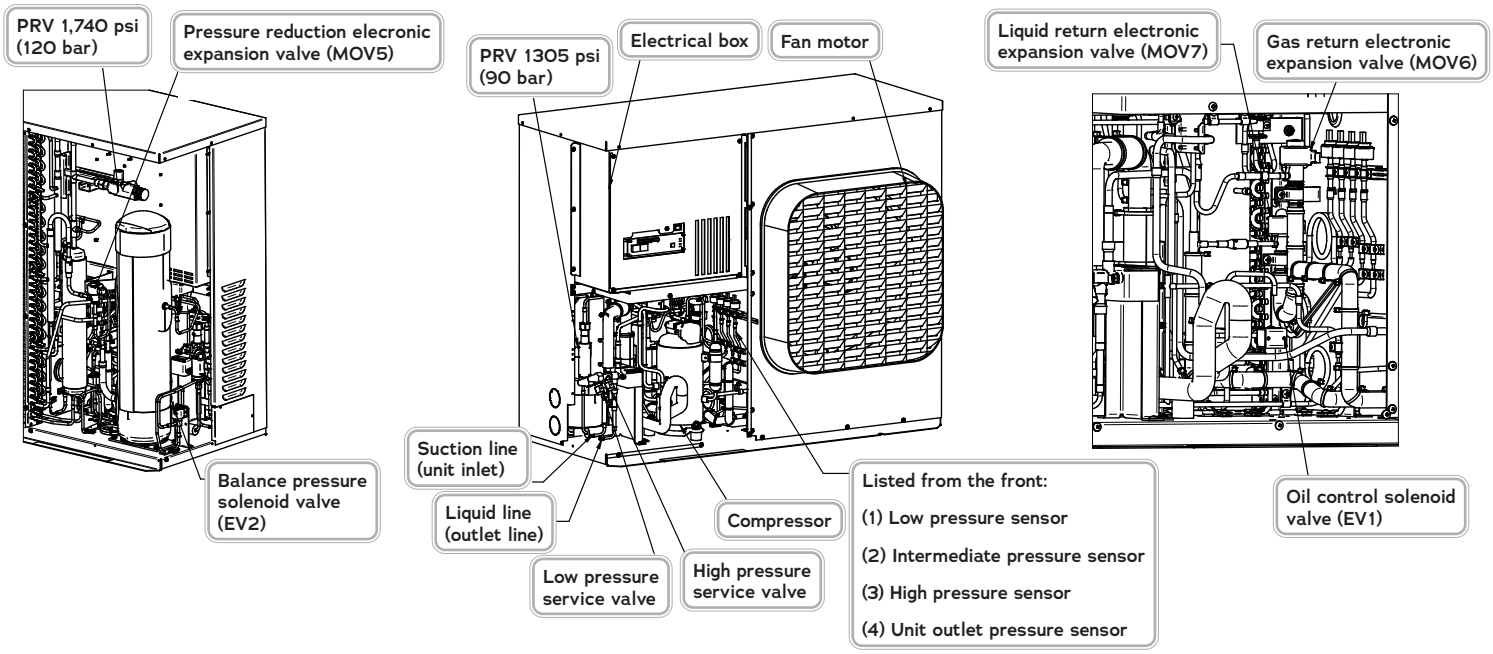
*The use of Bone-Dry Grade is the minimum acceptable purity to ensure proper operation of the equipment and is pure enough to prevent accumulation of non-condensable gases in the system.

Item	Specifications
Purity	> 99.9 % (volume)
Moisture	< 0.005 % (volume)
Total sulfur	< 0.03 ppm (weight)
Inert gas (H2, N2, 02, Ar)	< 0.01 % (volume)

Mixing higher-purity grades of CO_2 is acceptable. Lower grades of CO_2 contain higher levels of contaminants and water and may decrease system performance. Higher levels of moisture may react with the CO_2 and form carbonic acid, which can degrade component integrity. Hussmann recommends keeping enough refrigeration-grade CO_2 on-site to charge the system.

One of the benefits of CO_2 compared to synthetics is its high vapor density. CO_2 for low temperatures is approximately five times denser, which translates into smaller suction pipe sizes than other synthetic refrigerants.

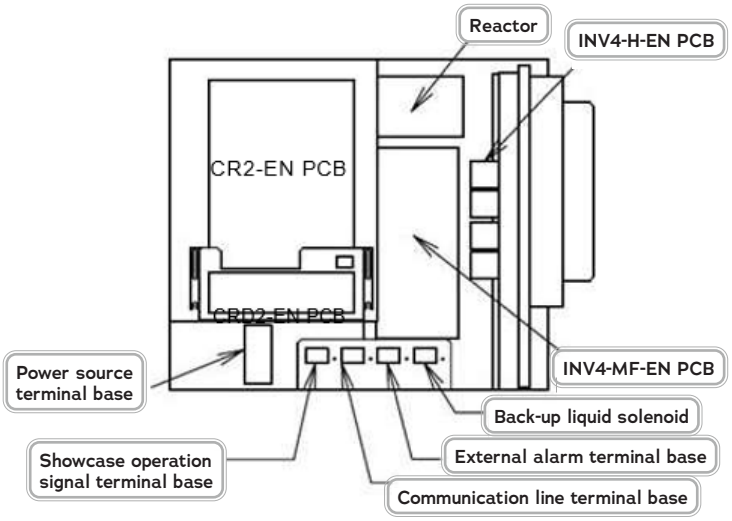
COMPONENT PARTS



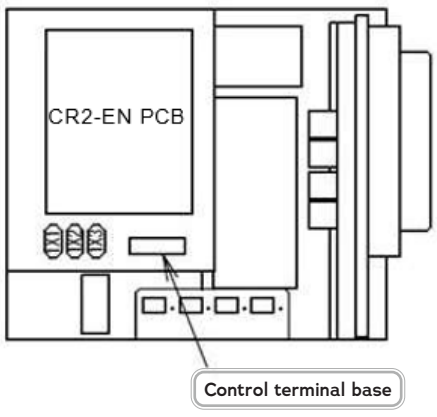
NOTE:
A PRV (Pressure Relief Valve) should be installed on the suction line for evaporator protection. The PRV pressure setting should be the same as rated pressure for the evaporator(s).

Electrical Box Internal Layout

Left side of refrigeration unit



Left side of refrigeration unit without MTG for CRD2-EN PCB



NOTE:
The suction line filter and the liquid line filter drier are shipped loose as standard accessories. The refrigeration unit contains standard pressure relief valves.

OPERATING RANGES

This refrigeration unit operates with a rotary compressor.

Use the refrigeration unit within the range shown below.

Item	Standard Value English (SI) and Imperial Units	Remarks
Refrigerant	R744	The charge supply amount must be adequate
Evaporating temperature	-49° F to 23° F -45° C to -5° C	Temperature conversion of inlet pressure
Suction pressure	105.9 psig to 427.9 psig 0.73MPa to 2.95MPa	Unit inlet pressure
Compressor rotational speed	40 s^{-1} to 80 s^{-1} 2,400 to 4,800 RPM	* RPM
Suction gas temperature	64.4° F or below 18° C or below	Unit inlet (suction gas) pipe temperature
Superheat at compressor suction	18° F (10° K) or above	Difference between evaporating temperature and compressor inlet temperature
Discharge pressure	1,319.8 psig or below 9.1MPa or below (except transient)	Compressor outlet pressure
Discharge gas temperature	239° F or below 115° C or below	Compressor outlet temperature
Oil temperature	212° F or below 100° C or below (Ambient temperature +10 K (18° F) or above)	
Ambient temperature	-4° F to 113° F -20°C to +45° C	Gas cooler intake air temperature
Power source	208V / 3 Φ / 60 Hz	Within ± 10 % of Rate Voltage
Installation inclination angle	1 degree or below	
ON/OFF cycle period	10 minutes or longer for ON/OFF cycle	Oil return must be ensured
Installation	Outdoor	The foundation must be rigid enough
Net Weight	329 lb (149 kg)	
Intermediate cooler	1.97 gallons (7.45 liters)	
Maximum refrigerant charge for the entire refrigeration system	17.6 lb (8.0 kg)	Adequate charge amount should be calculated by tool provided by Panasonic

NOTE:
The installer is solely responsible for the safety and compliance of the installation.

Relief Valve And Evaporator Component Requirement.

This equipment is for use with R744 (carbon dioxide) system components where the design high pressure is 1,740 psi (120 bar) and the design low / intermediate pressure is 1,305 psi (90 bar). The unit high side of the system is protected with a 1,740 psi (120 bar) rated pressure relief valve and the flash tank is protected with a 1,305 psi (90 bar) rated pressure relief valve. The field is required to provide pressure relief or pressure regulating relief valves of a sufficient number having capacity deemed adequate to provide protection of the evaporator components. The maximum rating for the field installed pressure relief shall be 1,305 psi (90 bar). For example, if the evaporator is rated 870 psig (60 bar), a 870 psi (60 bar) pressure relief valve should be installed on the suction line. The minimum rating for the liquid components shall be 1,305 psi (90 bar).

COLD WEATHER OPERATION COUNTERMEASURES

An enclosure may be required for the refrigeration unit in order to prevent excessive reduction of high pressure in a cold weather location.

RATED SPECIFICATIONS

Item	Rating		Unit
Power source	208 V / 3 Φ / 60 Hz		V
	Evaporating Temperature		
	-20° F	+23° F	
Cooling Capacity	13,826	20,756	BTU/HR
Power input	4.12	3.86	kW
Current	11.4	10.7	A

Conditions:

1. Evaporating temperature: -20° F (-29° C) , +23° F (-5° C)
2. Ambient temperature: 95° F (35° C)
3. Compressor rotational speed: 79 s-1
4. Compressor suction superheat: 18° F (10° K)

PERFORMANCES (208 V)

Ambient temperature	Item	Symbol	Evaporating temperature 14° F (-10° C)	Evaporating temperature -31° F (-35° C)	Unit
89.6° F (32° C)	Rated Cooling Capacity	Q	23427 (6.87)	12099 (3.55)	Btu/hr (KW)
	Rated Power Input	P	4.40	3.89	KW
	Rated COP	EER	5.32	3.11	(Btu/hr)/W
77° F (25° C)	Rated Cooling Capacity	Q	25498 (7.47)	12885 (3.78)	Btu/hr (KW)
	Rated Power Input	P	4.14	3.58	KW
	Rated COP	EER	6.16	3.60	(Btu/hr)/W
59° F (15° C)	Rated Cooling Capacity	Q	27141 (7.95)	13655 (4.00)	Btu/hr (KW)
	Rated Power Input	P	3.29	2.87	KW
	Rated COP	EER	8.25	4.76	(Btu/hr)/W
41° F (5° C)	Rated Cooling Capacity	Q	28430 (8.33)	14390 (4.22)	Btu/hr (KW)
	Rated Power Input	P	2.44	2.13	KW
	Rated COP	EER	11.65	6.76	(Btu/hr)/W
109.4° F (43° C)	Rated Cooling Capacity	Q	15607 (4.57)	9760 (2.86)	Btu/hr (KW)
	Rated Power Input	P	3.98	4.34	KW
	Rated COP	EER	3.92	2.25	(Btu/hr)/W

* Suction superheat: 18° F (10K)

SOUND PRESSURE LEVEL

The A-weighted sound pressure level is 70 dB.
(at a distance of 1 m from surface of product)

UNIT INSTALLATION

CAUTIONS FOR INSTALLATION WORK

This refrigeration unit has been designed exclusively for R744 (CO_2 refrigerant). Refrigeration oil and each component, including the compressor, have been exclusively designed for the refrigeration unit.

Please use sufficient caution to maintain the reliability of the product.

- Since CO_2 refrigerant becomes high pressure during the operation, the piping material and other components mainly designed for CO_2 refrigerant with sufficient strength are used. Wieland K65, Mueller XHP, or equivalent tubes are recommended for field installation and repair. Mueller XHP copper-iron fittings have a pressure rating of 1885 PSI at 250° F or 120° C.
- As the refrigeration oil absorbs moisture, the opening time should be as short as possible. The piping connection to the refrigeration unit should be made at the last stage of piping installation work. Avoid outdoor work on a rainy day.
- For piping work, use XHP, K65, or other CO_2 pressure-rated refrigeration-grade copper pipe, clean, dehydrated, and "phosphor-copper brazing solder." If "silver brazing solder" is to be used, do not use any chlorine flux. During pipe brazing, nitrogen overpressure is a must.
- Do not use pipe joints made for HFC refrigerant because they do not have the required strength. In addition, do not use flared joints.
- To protect the refrigeration unit and refrigeration cycle, install the included filter dryer at the refrigeration unit's liquid line. install the suction filter on the suction line as well. Hussmann will ship the liquid line filter/drier and suction filter for field installation.
- The gas leak detector for airtight tests should be foaming liquid or soap water. Do not use kitchen detergent. Kitchen detergent may corrode metals.

USING THE REFRIGERATION UNIT ECONOMICALLY

To use the refrigeration unit economically, consider the following:

Cooling capacity largely varies by the method of use. When the evaporating temperature falls by 1.8° F, the cooling capacity decreases by 3 to 4%, and an increase in discharge pressure decreases the cooling capacity and increases power consumption.

To fully extract the unit performance, compressor suction pressure should be increased as high as possible, and discharge pressure should be made as low as possible. For this reason, caution should be used in the following points.

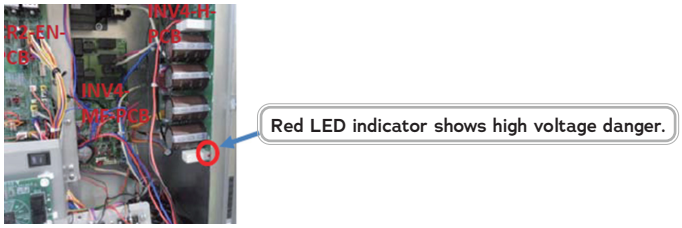
1. Make the piping resistance as small as possible.
   Ref: Capacity change rate per 1.8° F (1° C) pressure loss of suction line

Evaporating temperature	Capacity change rate per (1.8° F)1° C
-49° F to 23° F (-45° C to -5° C)	3% to 4%

2. Select an evaporator of sufficient capacity to raise the evaporating temperature as high as possible.
3. Do not block the cold air outlet in a refrigerator or showcase with food items.
4. Operate the refrigerator door opening as quickly as possible. (To avoid leak of cold air, reduce the time of door opening)
5. The gas cooler should be cleaned periodically to avoid clogging.

PRECAUTIONS FOR A TRANSCRITICAL CO_2 CONDENSING UNIT

1. Even after turning the power off, voltage remains in the charged part. Approximately 5 minutes are required until the LED (red) of the INV4-H EN PCB turns off (until the capacitor discharges the potential). Do not touch any components until voltage is fully discharged.



2. To prevent inverter noise, keep as much distance as possible from the wiring of a radio receiver or wired broadcast source. Inverter noise may cause an undesired sound.
3. The two-stage compression mechanism prevents the temperature rise of the second-stage discharge gas of the compressor.
4. During operation with a small quantity of refrigerant in the refrigeration circuit, a protection device (the CR2- EN PCB) stops the compressor. Avoid operating with a refrigerant shortage.
5. Rotary compressors consist of high-precision components. Use caution during piping work to avoid contamination from dust, metal powder, oxide scale, etc.

NOTE: It is critical that inverter based units have the right amount of oil.

Initial oil charge of the unit from the factory is shown in the table below.

Model No.	Compressor	Oil Separator
OCU040xxx	20.3 US fl. oz (600 ml)	18.6 US fl. oz (550 ml)

Oil type	PZ-68S

⚠CAUTION

» **When adding or changing oil, be sure to use specified oil (PZ-68S) detailed in the Optional Accessories Section of this manual.**

The compressor has 0.634 qt (600 ml) of oil. Another 0.581 qt (550 ml) oil is added to the oil separator from the factory. The oil is added to the oil separator at the top before final brazing of the pipes. Additional oil may be needed for a piping line run larger than 164 ft (50 meters).

Below is an example to calculate the additional amount of oil that needs to be added for initial charge:
7cc / m for the excess length over the max piping = 0.00225 qt/ft (2.13 ml / ft).

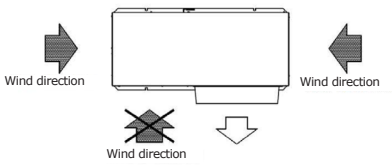
Example for 4 hp units:
If the length is 200 ft, (200 – 164) ft x 0.00255 qt (2.13 ml) / ft = 0.081 qt (77 ml) needs to be added.

If excessive length (>200 ft) is required for the installation, please consult your Hussmann representative first to help prevent any pressure drop issues. There is also an online calculator tool for those that know their system specifications already and simply need to do the calculation.

SELECTION OF INSTALLATION LOCATION

Each unit of the equipment should be placed by selecting the most convenient location that is easy to install, operate, and maintain.

1. Each unit should be placed to make the piping and wiring length as short as possible and easy to install.
2. The controller should be located within the reach of the user's hand for convenient routine operations (RUN, STOP, reset warning, etc.). Do not locate the controller in a place easily accessed by people other than the user.
3. Install the refrigeration unit at a location accessible to be serviced for daily maintenance and inspection. Routine maintenance and inspection involve checking the operation pressure and compressor operation condition for abnormal sound or vibration.
    - Location not disturbing others: Avoid air flow from the gas cooler causing a disturbance
    - Location with a sturdy and level surface
    - Install the refrigeration unit on a firm foundation to avoid increased noise and vibration, particularly at the boundary of a neighbor's lot. Always comply with the regional laws and regulations.
    - Location away from a heat source
    - Installation should not be affected by reflection from the floor.
    - Location with good ventilation
    - To ensure good ventilation, the installed location should provide the intake air by the gas cooler at 113° F (45° C) or below with good airflow.
    - Location is not affected by a wet floor.
    - The refrigeration unit is often affected by rainwater and drain water from defrosting. Apply drain water work as required.
    - Location not affected by snow accumulation.
    - In a cold weather location, a roof should be furnished to avoid snow accumulation and frosting or freezing.
    - Direction for avoiding strong wind
    - Install the refrigeration unit with its blow-out side facing perpendicular to the direction of the wind.



REFRIGERATION UNIT PLACEMENT

Carrying the Unit:

1. Carry the refrigeration unit gently, keeping its position vertical.
2. When moving the refrigeration unit with a forklift, use the square holes at the corners of the unit base to secure it and keeps its position vertical.

Suspending the Unit:

1. When suspending the refrigeration unit, follow the "Precautions for Hanging the Product" attached to the refrigeration unit.
2. When suspending and moving the refrigeration unit, keep it level and avoid impact that may damage the unit.
3. Rope, straps, etc., must be strong enough to easily withstand the weight of the refrigeration unit.

FOUNDATION/PLATFORM WORK

- As a reference, the foundation should be made from concrete, which has a mass about three times that of the refrigeration unit (absorbing vibration by mass).
- Vibration should be reduced by a platform or anti-vibration pad to avoid vibration transmission to the floor and wall.
- To avoid falling, secure the refrigeration unit by using anchor bolts (use all securing positions).
- The refrigeration unit must be installed at 1° or less inclination angle.
- The refrigeration unit must be installed below 6,562 ft (2,000 m) altitude.

If a foundation meeting the requirement above cannot be secured, ensure that no abnormal vibration is generated by resonating the refrigeration unit and piping system.

1. Basic foundation work when the pipe is extended horizontally.

On a concrete foundation 5.9 inches (150 mm) or higher from the floor surface, place anti-vibration pads approximately 0.31 to 0.59 inches (8 to 15 mm) thick, and secure the unit on the entire unit base with anchor bolts.

2. Basic foundation work when the pipe is extended downward.

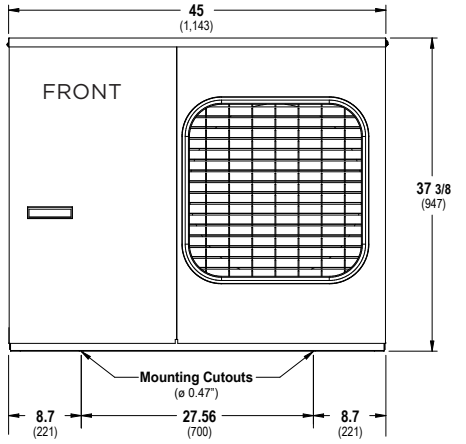
Form an elevated foundation with vertical columns. Place an anti-vibration pad (thickness of 0.31 to 0.59 inches (8 to 15 mm) on the entire surface of the foundation and secure it with anchor bolts.

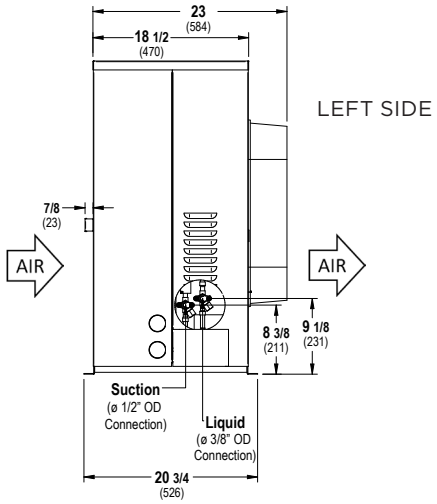
3. Anchor bolts

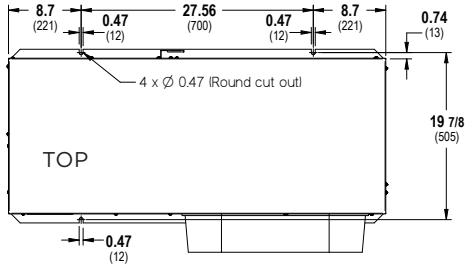
Use 7/16 (5 mm) anchor bolts and bury at least 3.94 inches (100 mm) on the concrete foundation. Fix the unit with double nuts and plain washers 1.1 inches (28 mm) O.D. minimum.

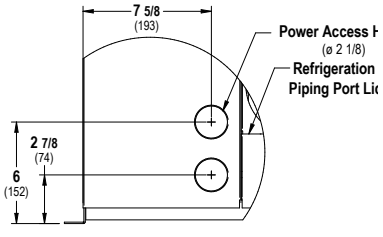
EXTERNAL DIMENSIONS

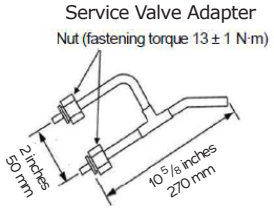
(Unit external dimensions are shown in inches)



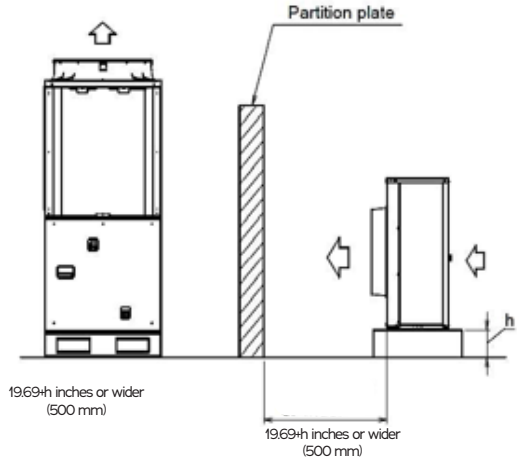






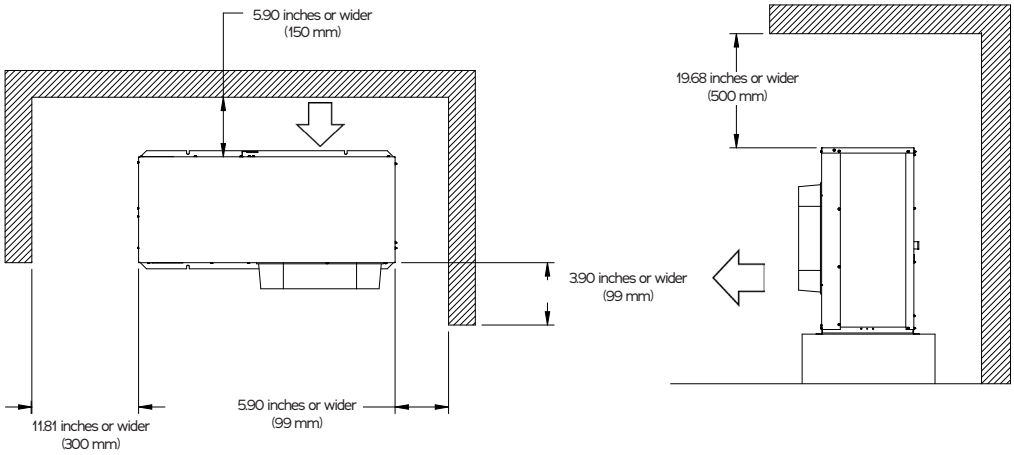


INSTALLATION EXAMPLES



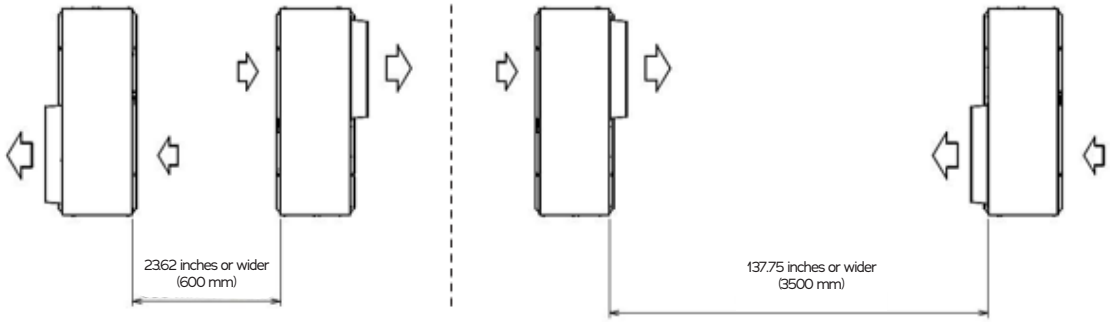
When no obstruction exists in the blow-out side

(Unit external dimensions are shown in inches)



When installing next to a top-blow refrigeration unit

In the case of face-to-face installation



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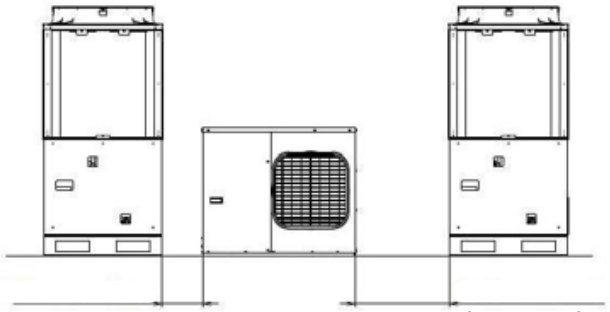
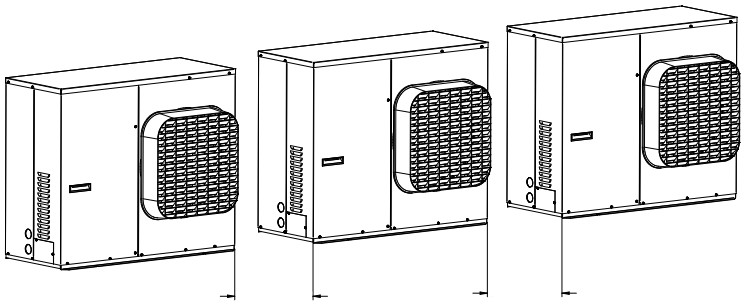


12 in. (305 mm) or wider

40 in. (1,016 mm) or wider

Side-by-side installation



12 in. (305 mm) or wider

Avoid direct entry of the blow-out heat into the heat exchanger of the top-blow refrigeration unit.

REFRIGERANT PIPING WORK

The design and installation of the refrigerant piping work directly affect the performance of the refrigeration unit, as well as the product life and occurrence of problems.

Selection of Refrigerant Piping Size

The connection piping size for refrigeration unit is, in principle, as shown below, but each should be determined by calculating pressure loss of the piping and refrigerant flow speed and making sure no problem occurs in the cooling capacity and oil return.

As refrigeration unit using CO_2 refrigerant incurs pressure higher than when using HFC refrigerant, it is necessary to choose adequate materials.

Model No.	Suction Line OD (unit inlet)	Liquid line OD (unit outlet)
OCU040xxx	Ø 1/2" (Ø 12.7 mm)	Ø 3/8" (Ø 9.52 mm)

NOTE: Welding is outer diameter welding. The max length is 164 ft or 50 m.

- Piping material should be XHP, K65, or other CO_2 pressure-rated refrigeration grade copper pipe.
- When cutting pipe, use a pipe cutter and always remove burrs.
- When bending pipe, secure a bending radius four times or greater than the outer diameter. During bending, pay attention to distortion and scars.
- When the connection length of the suction line is 49 ft (15 m) or shorter, increase the piping size by one rank to improve the starting performance of the refrigeration unit. (Piping size of the suction line: Ø0.50 inches (Ø12.7 mm) to Ø0.625 inches (Ø15.88 mm).

⚠CAUTION

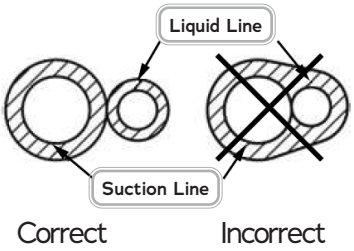
» **Open the high-pressure service port and then the low-pressure service port to prevent oil loss. The rapid release of refrigerant could cause refrigeration oil to be released together with refrigerant.**

⚠CAUTION

» **Use sufficient caution for handling piping by sealing the pipe end with tape or any other cover to avoid entry of contaminants and moisture into the pipe.**

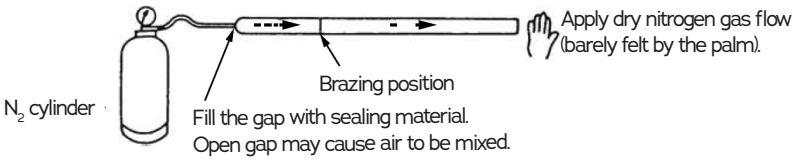
CAUTIONS FOR HEAT INSULATION WORK

- Apply heat insulation on the suction line and liquid line to avoid thermal effects from outside.
- Do not wrap the suction line and liquid line together with heat insulation material. (Refer to the illustration)
- Apply heat insulation only after executing airtight and pressure testing.



Prevent contamination of foreign objects such as dust, metal powder, oxide scale, etc. Since the compressor consists of high-precision components, contaminants generate scratches on the sliding surfaces, increasing gas leaks, deteriorating performance, and causing excessive wear and seizure.

- Flow nitrogen gas during welding.
- Piping inside and outside must be clean.
- Avoid mixing debris during cutting



Airtight Test

Pressure testing should only be performed by trained service personnel according to regulations.

Liquid side (High pressure side)	Suction side (Low pressure side)
1,015 psig (7 MPa)	1,015 psig (7 MPa)

NOTE:
Use N2 for airtight test

Caution for Gas Leak

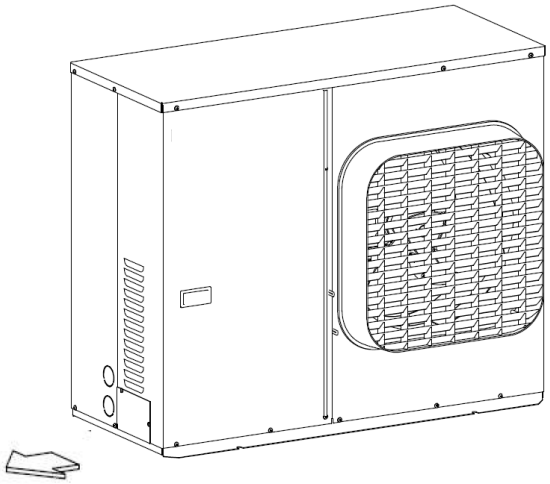
Gas leaks may lead to excessive heat operation of the compressor and air-mixed operation, thus causing compressor failure.

- Securely execute the airtight test.
- See Service Section for airtight test procedures.

Piping Direction

The pipe can be connected from one direction (the left side of the refrigeration unit).

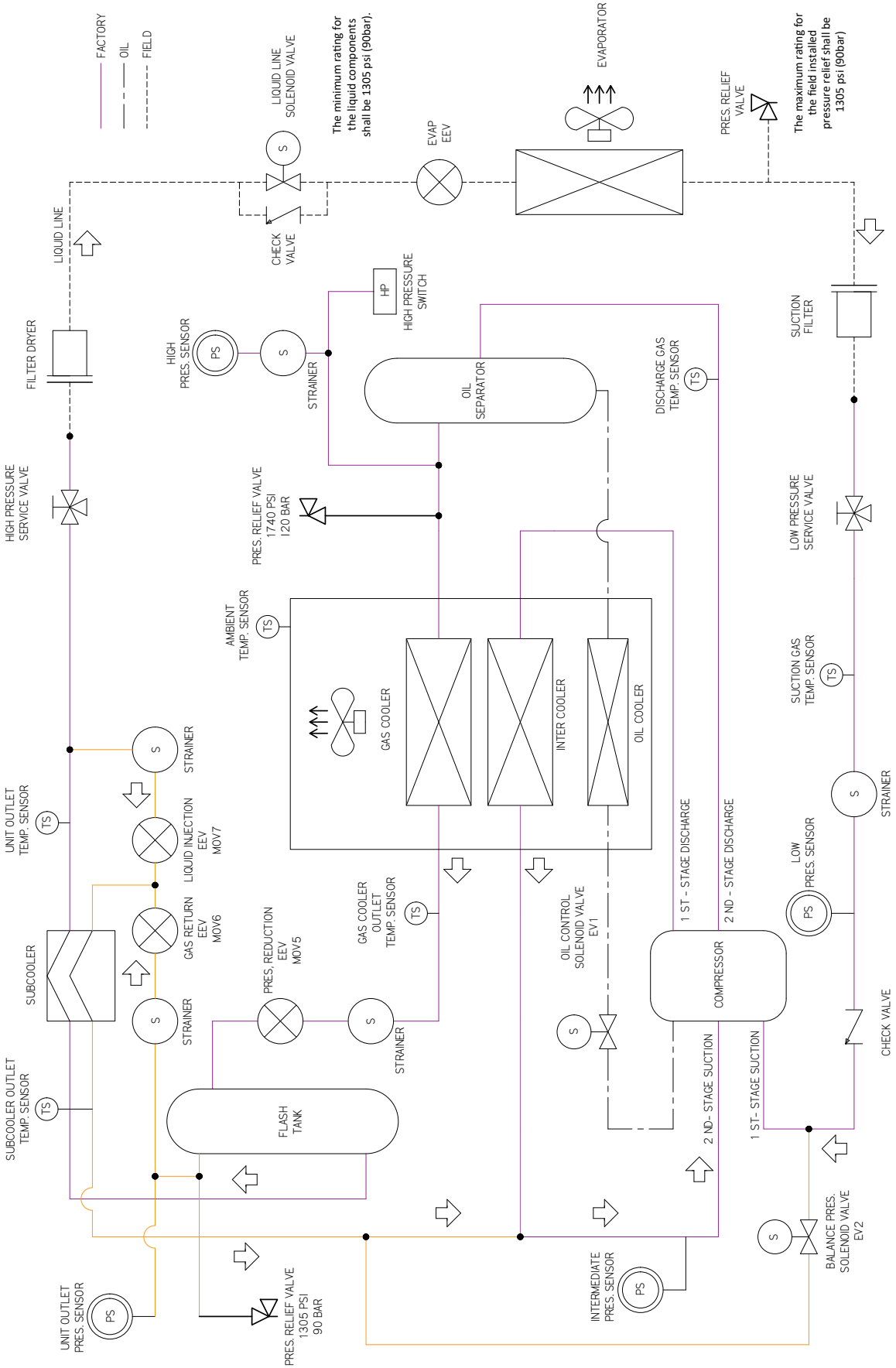
When connecting the refrigerant pipe, remove the left side panel.



Liquid Line Filter/Drier and Suction Line Filter

The liquid line filter/drier and the suction filter are shipped from the factory as loose parts for field installation.

REFRIGERANT PIPING DIAGRAM



Relief Valve And Evaporator Component Requirement

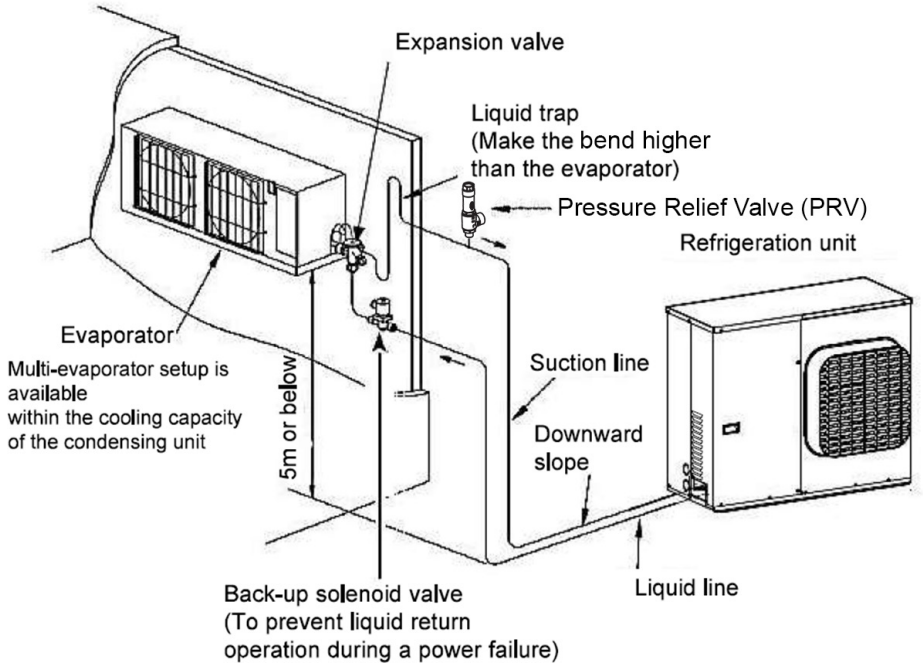
This equipment is for use with R744 (carbon dioxide) system components where the design high pressure is 1,740 psi (120 bar) and the design low / intermediate pressure is 1,305 psi (90 bar). The unit high side of the system is protected with a 1,740 psi (120 bar) rated pressure relief valve and the flash tank is protected with a 1,305 psi (90 bar) rated pressure relief valve. The field is required to provide pressure relief or pressure regulating relief valves of a sufficient number having capacity deemed adequate to provide protection of the evaporator components. The maximum rating for the field installed pressure relief shall be 1,305 psi (90 bar). For example, if the evaporator is rated 870 psig (60 bar), a 870 psi (60 bar) pressure relief valve should be installed on the suction line. The minimum rating for the liquid components shall be 1,305 psi (90 bar).

When the evaporator is located higher:

Total piping length should be limited to 164 ft (50 m) one way. If longer that 164 ft, please consult factory to prevent pressure drop and additional oil issues.

Height difference 16.4 ft (5 m) or less

- The suction line should ideally slope gently towards the unit. The recommendation slope is 1/200–1/250.
- Refrigerant pipe should be covered with heat insulation material on both the suction and liquid lines.



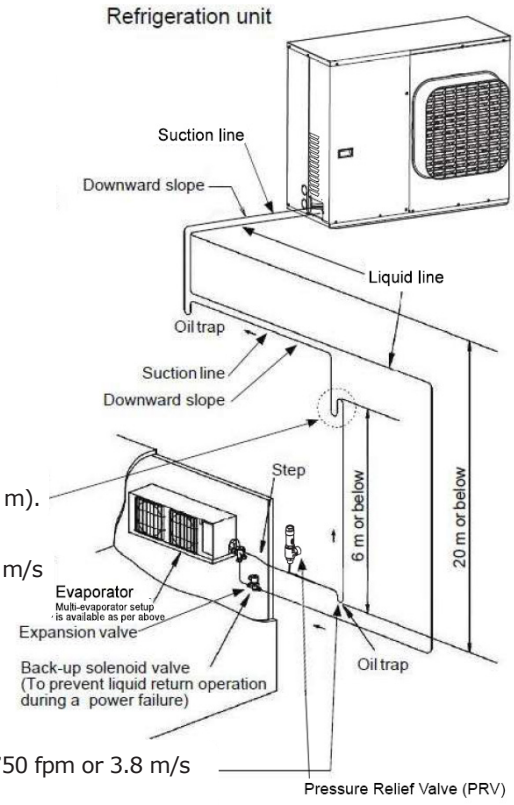
When the evaporator is located lower:

Height difference 65½ ft (20 m) or less

To promote good oil return in the suction line, piping size, and trap need to be considered.

- The suction line should ideally slope gently towards the unit. Recommendation slope is 1/200–1/250.
- Refrigerant pipe should be covered with heat insulation material on both suction and liquid lines.

The suction line and liquid line need to be insulated to the evaporator. Install clamps to mitigate vibration.



NOTE: Oil traps should be installed every 20 ft (6 m).

NOTE: Adjust refrigerant flow rate to 1,500 fpm or 7.6 m/s or more in the vertical suction pipe.

NOTE: Adjust refrigerant flow rate to 750 fpm or 3.8 m/s or more in the vertical suction pipe.

REFRIGERANT CHARGING

Evacuation (Perform after completing electrical wiring.)
Unit is shipped precharged with approximately 10 psig of CO_2 to prevent air and moisture from entering the system.

Vacuum-dry the entire circuit using a vacuum pump before charging the refrigerant to avoid including air or moisture in the refrigeration system. Following the procedure, execute evacuation after securely carrying out the airtight test.

1. Connect electrical wiring. Ensure all wiring connections are secure.
2. In Vacuum Mode, all electronic expansion and solenoid valves are open.

   Enter Vacuum Mode by following this sequence:

   - Check that the Electrical Circuit Breaker is OFF (No electric power supplied to the unit)
   - Turn the No. 1 and 2 of 8P Dip Switch (SW13) ON. No. 3 through 8 must be OFF.
   - Set the Slide Switch (SW15) to [CHECK].

   Then,

   - Turn the Electrical Circuit Breaker ON.
   - Turn the Operation Switch (S1) to ON.
   - Set the Rotary Switch (SW11) to [OPERATION]
   - Check that [uAcU] is indicated in the display.

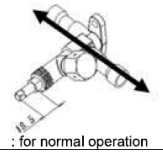
   Display will indicate

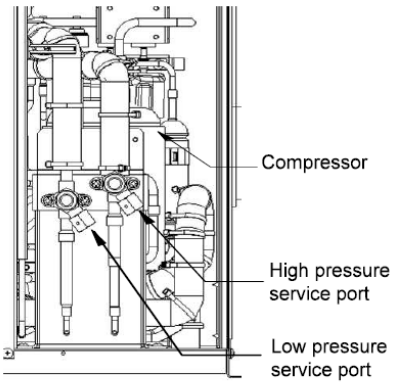
   "Low Pressure » High Pressure » Unit outlet Pressure » [uAcU] » Low Pressure »"

   - Check Operation Switch (S1) is ON. (even though the display is showing [uAcU], the unit is not in Vacuum Mode if (S1) is OFF)

3. Evacuation
   - Connect the vacuum pressure gauge and vacuum pump to the low-pressure and high-pressure service ports, and set both to the "mid-position".
   - Apply evacuation from the two ports.
   - Evacuate down to 500 microns (66 Pa) target level for evacuation, and continue for 1 to 3 hours.
   - Execute the refrigerant charging immediately after evacuation, according to the charging procedure described in the next page.

Explanation of each Seat Position

A: Back seated position (Turn the stem fullycounter-clockwise)	**B:** Mid-position (Stem height approx. 13.25mm)	**C:** Front seated position (Turn the stem fully clockwise)
	• High pressure side Approx. 3 and a half turns • Low pressure side Approx. 3 turns 	
: for normal operation	: for refrigerant charge and service	: for airtight test



Left side of refrigeration unit

METHOD OF CHARGING

Execute the refrigerant charging immediately after evacuation. R744 (CO_2) must be used; do not mix it with any other refrigerant. The refrigerant must be charged according to the following procedure.

1. Preparation (Unit must be in Vacuum Mode)
   - Close the vacuum valve of the manifold gauge set exclusively for CO_2 refrigerant and separate the vacuum pump.
   - Place the refrigerant cylinder on the platform scale and remove air in the tube. The platform scale must be on a flat surface, and zero-point adjustment must be performed.
2. Initial charge (Unit must be in Vacuum Mode)
   - Check that low-pressure and high-pressure service ports are open to charge refrigerant.
   - Slightly open the charge valve of manifold to charge the refrigerant over 100 psi (0.7 MPa).

⚠CAUTION

» **Never charge liquid CO_2 until the pressure reaches 100 psi (0.7 MPa) to prevent formation of dry ice.**

3. Additional charge (Unit must be in Normal Mode)
   - Close the high-pressure service port. The low-pressure service port remains open.
   - Set the Slide Switch (SW15) to [CONTROL]
   - Turn No.1 of 8P Dip Switch (SW13) OFF. No.2 should remain ON.
   - Turn the Operation Switch (S1) ON and let the compressor start.

   Slightly open the valve of the cylinder to let the unit suck in the refrigerant from the low-pressure service port. Continue charging until the target refrigerant amount is charged (charge amount can be checked by scale). Close the low-pressure service port to complete the charge.
4. Charge amount:
   - To calculate, contact your Hussmann Application Engineer or use the online calculator tool if all system specifications are already known and simply need the calculation to be completed. You will need to provide the following information: line size and length (liquid and suction), evaporator model (for associated volume), evaporating temperature, and expected maximum ambient temperature.

   NOTE:
   a. Do not charge liquid refrigerant from the low-pressure side (low-pressure service port).
   b. To avoid overcharging, the charging rate should be around 0.7055 oz / 5 sec (20 g per 5 sec.)
   c. If it is difficult to adjust refrigerant charging rate by operating the joint valve and manifold gauge set charging valve, attach a capillary tube between the refrigerant cylinder and manifold gauge set.
   d. Do not attach a capillary tube between the manifold gauge set and service valve adapter.

Refrigerant quantity adjustment should conform to the "Refrigerant Quantity Adjustment of Refrigeration Unit" in the Section "Adjustment during Operation."

5. After completing the refrigerant quantity adjustment, close the refrigerant cylinder valve and check that the low-pressure and high-pressure service ports have been closed.
6. Slowly open the vacuum valve or purge port of the manifold gauge set to emit the remaining refrigerant in the service valve adapter and manifold gauge set.
   Note: Since refrigerant becomes cold when released, use caution when opening the valve for frostbite.
7. After completing the operation, check gland nut loosening of the low-pressure and high-pressure service valves and fasten them if any looseness exists. The fastening torque is 88 ± 17 in-lb (10 ± 2 N-m).

ELECTRICAL WIRING WORK

Condensing unit components are wired as completely as possible at the factory with all work completed in accordance with the UL file. All deviations required by governing electrical codes will be the responsibility of the installer. The main lugs in the compressor control panel are sized for copper wire only, with 75° C insulation. All wiring must be in compliance with governing electrical codes.

Refer to the serial plate to determine wire size (MCA) and overcurrent protection (MOPD). Field provided ground fault protection is required; 30A rated, 30mA detected.

Use shielded cable grounded at the external source for the back-up liquid solenoid valve, external alarm, remote communication, and case run signal. The shield should only be connected to the unit in the absence of the source ground.

Unit has a factory-installed jumper (TB 1&2) that is required to be removed when the case run signal is used.

Connect external alarm (no voltage contact) at TB 5&6. External power source is maximum 3A @ 250VAC.

WIRING

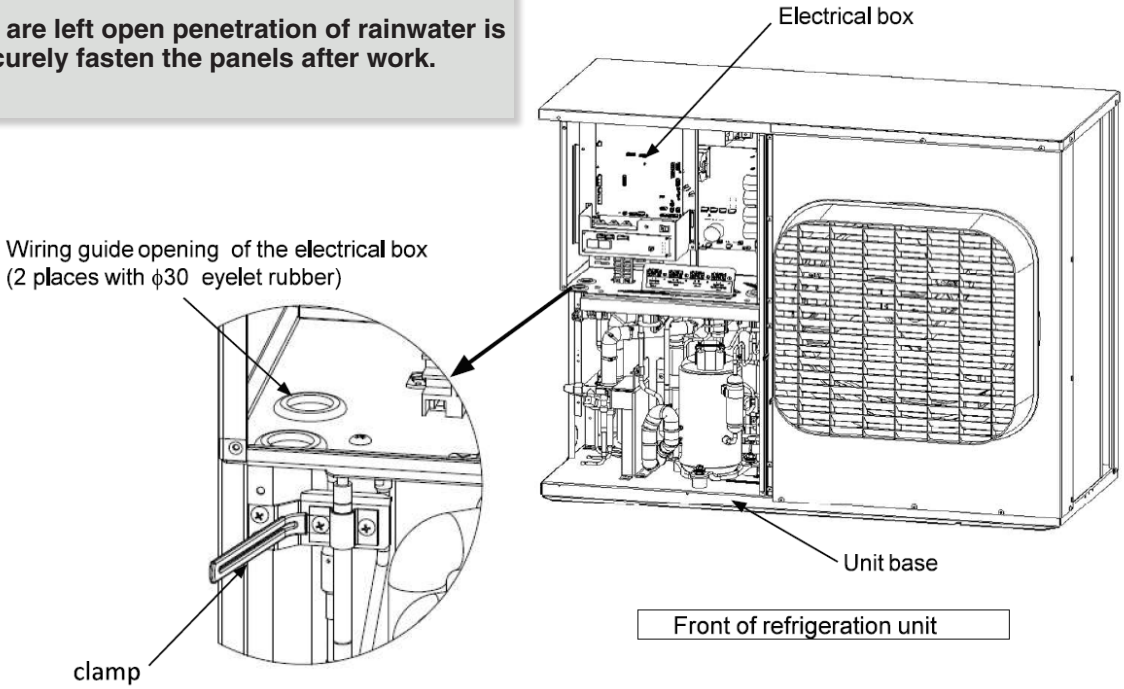
The wiring guide opening is on the refrigeration unit's left side.

1. Connect the Power and Grounding cables through the eyelet rubber on the backside.
2. Connect the shielded cables through the eyelet rubber on the front.
3. Use the clamp on the bottom of the electrical box to bundle the above cables together so they will not bend.

⚠CAUTION

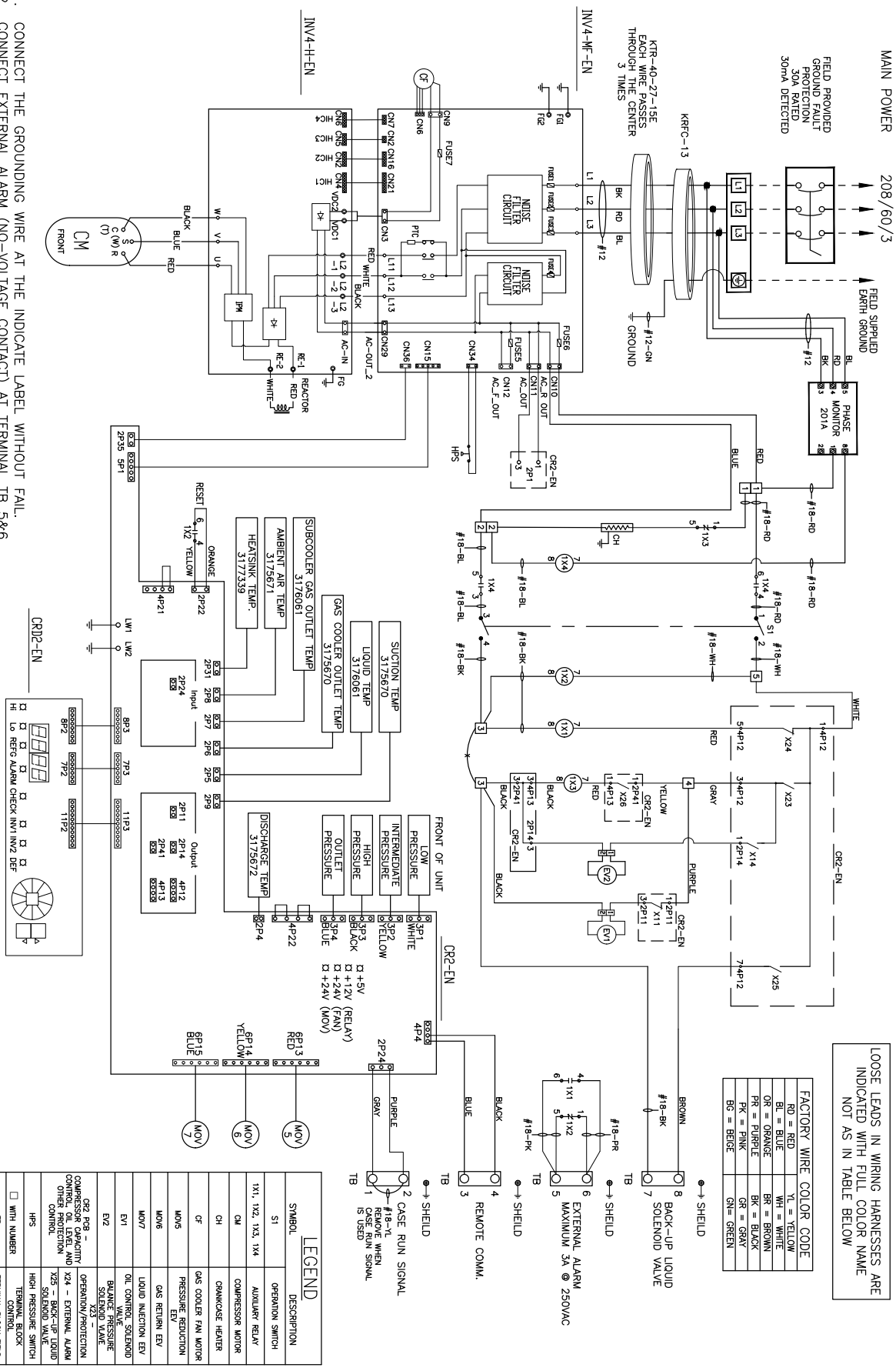
» **Power line and communication line must connect to refrigeration unit and run through separate conduit.**

» **If unit panels are left open penetration of rainwater is possible. Securely fasten the panels after work.**



ELECTRICAL CIRCUIT DIAGRAM

Electrical circuit diagram (standard electrical wiring diagram)



1. CONNECT THE GROUNDING WIRE AT THE INDICATE LABEL WITHOUT FAIL.
2. CONNECT EXTERNAL ALARM (NO-VOLTAGE CONTACT) AT TERMINAL TB 5&6.
3. WHEN AN ALARM IS GENERATED, CHECK THE ABNORMALITY. ELIMINATE THE CAUSE OF THE PROBLEM AND THEN CYCLE THE POWER.
4. FIELD WIRING TO TB TERMINAL SHOULD BE SHIELDED CABLE GROUNDED AT THE EXTERNAL SOURCE. ONLY GROUND THE SHIELD AT THIS UNIT IN THE ABSENCE OF THE SOURCE GROUND.

FINAL CHECKS BEFORE OPERATION

Confirm before Operation:

1. Please recheck if any incorrect wiring or loose wiring exists.
2. Check that all connections are tight; no leaks.
3. Fully open all service valves.
4. Check that the power supply voltage is within ±10% of the rated voltage.

Power Supply to the Crankcase Heater

During initial start-up or a long period of compressor off-time—especially at low ambient temperature—the crankcase heater should be energized before the compressor is turned on. This will prevent the refrigerant from being condensed in the crankcase and avoid an oil foaming issue.

⚠CAUTION

» **Turning the ground fault protector ON causes power to be applied to the crankcase heater. Do not touch with hand.**

Protection of High Pressure

The set value of high-pressure abnormality is 1,639 psi (11.3 MPa).

START-UP AND SEQUENCE OF OPERATION

Overview

The OCU TCO_2 controller monitors suction pressure (low pressure / LP), intermediate pressure (IP), discharge pressure (high pressure / HP), liquid pressure (outlet pressure / OP), discharge temperature, ambient temperature, gas cooler outlet temperature, liquid temperature (unit outlet temperature), sub-cooler suction return temperature (split outlet), suction temperature, and heatsink temperature to controller and alarm operation of the unit.

Compressor control is managed by the controller.

Gas cooler operation is based on high pressure and ambient temperature. The OCU controller modulates the fan speed of the gas cooler fan via a temperature difference (TD) between gas cooler outlet temperature and ambient temperature.

Compressor

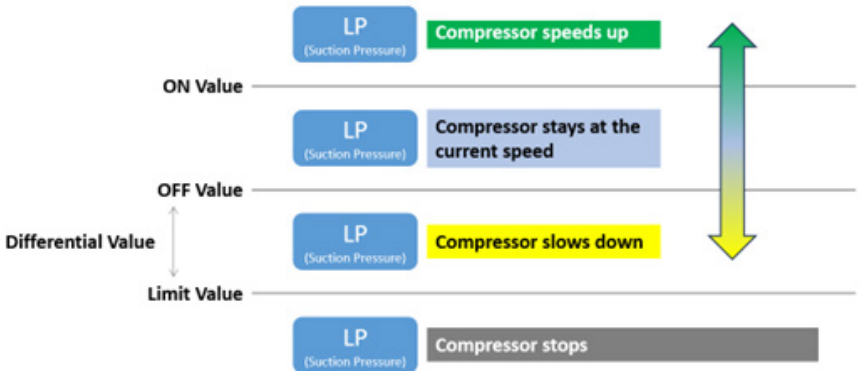
Starting

After all the conditions below are met, the compressor will run at 40 rps (minimum speed).

- Operation switch is ON
- No abnormal / error / alarm occurred
- Forced stop time has elapsed
- Suction pressure ≥ ON value
- OCU receives run request signal
- OCU is in normal operation mode
- Back-solenoid valve output (X25) is ON

Speed

The control point for compressor speed is suction pressure (LP). There are three parameters (ON / OFF / DIFF) for the suction pressure settings. The target is between the ON value and OFF value. The compressor will accelerate when suction pressure is higher than ON value and decelerate when suction pressure is below the OFF value. When suction pressure is below (OFF – DIFF) value, the compressor will stop (zero speed).



High Pressure Control

Abnormal high pressure is controlled by limiting compressor speed changes under the conditions below.

High Pressure	Output
1,639 psi ≤ HP	0 rps (compressor stop)
1,610 psi ≤ HP < 1,639 psi	compressor decelerates but not below 40 rps
1,581 psi ≤ HP < 1,610 psi	speed increase prohibited

Liquid Pressure Control

When abnormal high unit outlet pressure occurs, the pressure is reduced by increasing high pressure setpoint, running fan at maximum speed, and preventing compressor speed reduction.

Liquid Pressure	High Pressure Setpoint	Fan Speed	Compressor
1144 psi < OP	increased (1,522 psi max.)	maximum 800 rpm	prohibit speed reduction
OP < 986 psi	reduced until normal setting	Back to Normal Operation Mode	

Pump Down Mode

When this mode is activated, the unit is able to operate regardless of the status of the operation signal. The compressor will turn on to protect the evaporators, even without the operation signal being on. The operation switch must be on for the unit to run in this mode. When this mode is activated and the operation signal from the evaporator is off, the ON/OFF/DIFF values are replaced by the Pump-Down ON/OFF/DIFF values. The Pump-Down DIFF is locked to zero. The Pump-Down ON/OFF values should be set according to the design pressure of the evaporators.

NOTE: The operation switch must be on for the unit to run.

Pump Down Mode	Operation Signal	ON Value	OFF Value	DIFF Value
Activated	On	As Usual	As Usual	As Usual
Activated	Off	PD ON Value	PD OFF Value	0
Not Activated	On or Off	As Usual	As Usual	As Usual

Example:

Normal values for +23° F evaporator temp	481 psi (33 bar)	447 psi (31 bar)	35 psi (2.4 bar)
PD values for 870 psi (60 bar) evaporator design pressure (EDP)	798 psi (55 bar)	653 psi (45 bar)	0 psi (0 bar) uneditable

Recommended Maximum PD Values

EDP − 72 psi (5 bar)	PD ON − 145 psi (10 bar)	uneditable

High Pressure Safety Switch

The high pressure switch will stop the compressor in an overpressure event and automatically reset to allow the compressor to restart when the pressure has dropped below the resume value.

Stop

Any condition below will force the compressor to zero speed (0 rps).

- Operation switch is OFF
- Abnormal condition / error / alarm occurred
- OCU receives off request operation signal
- Suction pressure below (OFF − DIFF) value
- Discharge pressure ≥ 1639 psi
- Intermediate pressure ≥ 1160 psi
- Liquid pressure ≥ 1146 psi

Balance Pressure Solenoid Valve (EV2)

For smoother compressor start-up, the high pressure (HP) / intermediate pressure (IP) / low pressure (LP) are balanced. EV2 is open when the unit is initial turned on and after any unit shut down. After the end of the start-up period, the valve will close when IP – LP ≤ 36 psi or after 3 minutes.

Oil System

Components
Separator, solenoid valve, and pressure reducing capillary tube. Oil is constantly returned to the compressor by opening the oil solenoid valve (EV1) while the compressor is rotating.

Oil Boost Mode
During this mode, the unit keeps running even when the operation signal is off. This mode stops when Low Pressure reaches the limit value or any error occurs such as HP alert. Auto recovery alerts are neither recorded nor communicated during this mode, while manual recovery alerts are recorded and communicated usual. The compressor speed is accelerated once every 2 hours to stimulate oil return.

The oil return performance has a strong correlation with the compressor speed as follows:

- Oil recovery from the evaporator side (mainly related to refrigerant velocity)
- Oil return from the Oil Separator which is regulated by the HP-IP differential (this mode raises both simultaneously)

The ON/OFF/DIFF values are changed to the values in Table 1 for [C] minutes when either of the following conditions are satisfied:

- Low RPS Condition — Compressor speed does not exceed [A] x [Max. RPS] for 2 hours
- Short Cycle Condition — Compressor stopped from more than [B] times in 2 hours

Table 1: Oil Booost ON/OFF/DIFF Value

Item	Set Point	psi	(Mpa)
ON Value		110	0.76
OFF Value		99	0.68
DIFF Value		15	0.1

Table 2: Oil Booost Parameter (editable)

Item		Default	Range
[A]	Percentage of Max. speed	0.75	0.00 - 1.00
[B]	Comp. Stop Count	10	0 - 30
[C]	Oil Boost Duration (minutes)	10	0 - 30

Gas Cooler

Normal Operation
The gas cooler fan speed is modulated to maintain 2 to 8 degrees TD between gas cooler outlet temperature and ambient temperature.
Compressor Stop
When the compressor is stopped and the high pressure rises ≥ 725 psi, the gas cooler fan will turn on.
Abnormal High Pressure
If a high pressure error or alarm occurs to stop the compressor, the gas cooler fan will turn on.
PCB Heatsink Temperature
If the inverter PCB heatsink temperature rises above 176° F, the gas cooler fan speed increases to maximum 800 rpm. The full speed control is canceled when the heatsink temperature is below 158° F.

Electrically Controlled Expansion Valve (MOV)

After each microprocessor reset, the MOV will initialize to full open to full close before the compressor start-up process begins. Every 10 hours the MOV initializing will repeat.

- Pressure Reduction Valve (MOV5) — Modulates to adjust high pressure in response to changing ambient temperature and evaporating temperature.
- Gas Injection Valve (MOV6) — Modulates to adjust unit liquid outlet pressure.
- Liquid Injection Valve (MOV7) — Modulates to adjust discharge temperature.

Alarms

Abnormal Temperature And Pressure Sensors

When abnormal conditions are detected, operation of the unit (compressor, fan motor, etc.) will stop and an error code will be displayed. If the error is cleared, the unit will automatically restart after 1 minute. If the same sensor anomaly is detected 3 times in 30 minutes, the unit will require a manual reset.

Condition	Display	
	Abnormal (Automatic Recovery)	Alarm (Manual Recovery)
low pressure sensor anomaly	E05	E05
high pressure sensor anomaly	E06	E06
intermediate pressure sensor anomaly	E81	E81
unit outlet pressure sensor anomaly	E88	E88
suction gas (refrigeration inlet) temperature sensor anomaly	E07	E07
ambient temperature sensor anomaly	E23	E23
unit outlet temperature sensor anomaly	E57	E57
gas cooler outlet temperature sensor anomaly	E59	E59
split (intercooler) outlet temperature sensor anomaly	E80	E80
discharge temperature sensor anomaly	E041	E041
heatsink temperature sensor anomaly	E221	E221

High Pressure

When abnormal conditions are detected, operation of the unit (compressor, fan motor, etc.) will stop and an error code will be displayed. If the error is cleared, the unit will automatically restart after 5 minutes. If the same sensor anomaly is detected 7 times in 60 minutes, the unit will require a manual reset.

Condition	Display	
	Abnormal (Automatic Recovery)	Alarm (Manual Recovery)
intermediate pressure ≥ 1,160 psi	E36	E46
unit outlet pressure ≥ 1,160 psi	E37	E47
high pressure ≥ 1,639 psi	E311	E011

High Temperature

When abnormal conditions are detected, operation of the unit (compressor, fan motor, etc.) will stop and an error code will be displayed. After the error is cleared, the unit when automatically restart.

Condition	Display	
	Abnormal (Automatic Recovery)	Alarm (Manual Recovery)
discharge gas temperature ≥ 244° F (reset when temperature drops below 167° F)	E101 / E10	E031 / E03
heatsink temperature ≥ 212° F (reset when temperature drops below 212° F)	E201	E201

Alarms (continued)

External Communication

If communication from the external controller is interrupted for 10 minutes or more, the operation of the unit (compressor, fan motor, etc.) will stop and an error code will be displayed. When the correct data is received from the external controller, the error is cleared the unit when automatically restart.

Condition	Display	
	Abnormal (Automatic Recovery)	Alarm (Manual Recovery)
master controller communication anomaly	E19	N/A

Fan Motor

When abnormal conditions are detected, the operation of the unit (compressor, fan motor, etc.) will stop and an error code will be displayed. If the error is cleared, the unit will automatically restart after 1 minute. If error is detected 3 times in 60 minutes, the unit will require a manual reset.

Condition	Display	
	Abnormal (Automatic Recovery)	Alarm (Manual Recovery)
fan motor anomaly	E271	E281

Inverter

When abnormal conditions are detected, the operation of the unit (compressor, fan motor, etc.) will stop and an error code will be displayed. After 1 minute if the error is cleared the unit will automatically restart. If error is detected 3 times in 60 minutes, the unit will require a manual reset.

Condition	Display	
	Abnormal (Automatic Recovery)	Alarm (Manual Recovery)
inverter communication anomaly	E181	E181
inverter anomaly	E601	E701
inverter short circuit	E611	E711
inverter overcurrent	E621	E721
inverter heat sink overheat	E631	E731
inverter overload	E641	E741
inverter voltage anomaly	E651	E751
inverter out of tune anomaly	E661	E761
inverter low voltage	E671	E771
inverter inrush prevention circuit anomaly	E681	E781
inverter output voltage detection anomaly	E691	E791

Miscellaneous

When the compressor suction superheat is 2° F or less for 2 minutes, error code E32 will be displayed. The error code will automatically clear when the compressor stops, or the superheat increases to 9° F.

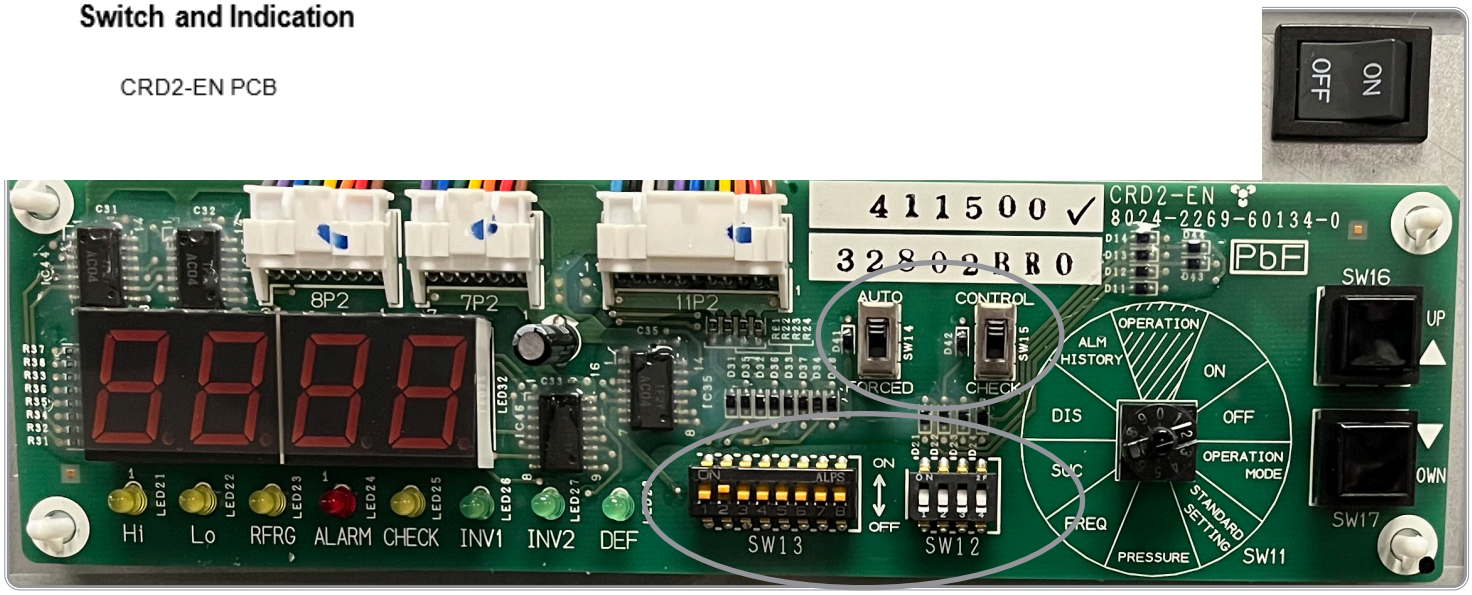
Condition	Display	
	Abnormal (Automatic Recovery)	Alarm (Manual Recovery)
refrigerant flood back alarm	E32	N/A

SETTING AND INDICATION

This refrigeration unit is equipped with the function of setting a variety of compressor operation modes by the switch on the CRD2-EN PCB. Operating condition of the compressor can be checked by the display. In particular, when any abnormality occurs in the refrigeration unit, an alarm LED (Red) lights up or blinks, and the cause of abnormality is displayed digitally by an error code.

Switch and Indication

CRD2-EN PCB



Switch Setting

(1) AUTO/FORCED switch (Slide switch, SW14)

SW14	Function	Remarks
AUTO	Auto	
FORCED	Forced	Not yet used

(2) CONTROL/CHECK switch (Slide switch, SW15)

SW15		Function	Remarks
CONTROL	CONTROL	Normal Mode	
CHECK	CHECK	Special Mode	Evacuation Mode (DIP switch SW13 setting is also required)

(3) 8P DIP switch (SW13)

The following functions can be selected. Change setting as required.
Switch setting at factory shipment is No.2: ON, other (No.1, No.3~No.8) : OFF.

SW13	No.	Function with ON	Remarks
ON 1 2 3 4 5 6 7 8	1	Evacuation	No.3, 4, 5, 6, 7, 8: OFF, SW15: CHECK
	2	Always ON	
	3	Always OFF	
	4		
	5		
	6		
	7	Back mode 2	No.1, 3, 4, 5, 6, 8: OFF
	8	Back mode 1	No.1, 3, 4, 5, 6, 7: OFF

(4) 4P DIP switch (SW12)

The following functions can be selected. Change setting as required.
Switch setting at factory shipment is No.1, No.2, No.3, No.4: OFF.

SW12	No.	Function	Remarks
ON 1 2 3 4	1		
	2	Mod Bus baud rate	ON: 19200bps OFF: 9600 bps
	3		
	4		

LOW PRESSURE SETTING

1. Turn OFF the operation switch S1.
2. Ensure power is ON.
3. Adjusting the Low Pressure setting (ON value, OFF value, Diff. value)

   The default Low Pressure setting is as shown in No.3 of the "Standard Pressure Setup Table" below. Since the Target Low Pressure Setting can be changed, use the following procedure as required.

- Turn OFF No.1 and No.3–No.8 on the 8P DIP switch (SW13), meaning all OFF except No.2.
- Set the rotary switch (SW11) to "Standard Pressure Setting". The display will show a single number.
- Press ▲ or ▼ button to select the desired number. Each set value for the number is shown in the table below.
- Set the rotary switch (SW11) to [OPERATION]

No.	Use	Evaporating temperature (° F)	ON value (psig)	OFF value (psig)	Low-press. Diff. value (psig)	Lim value (psig)
1	Dairy / Deli	23	481.4	446.6	34.8	411.8
2	Veg, fruits, etc.	19	432.1	414.7	34.8	379.9
3	Meat, fish	10	377.0	359.6	34.8	324.8
4	Freezer, ice	-31	197.2	179.8	17.4	162.4

Lim value: Lowest low pressure to cause the compressor to stop. Lim value = OFF value - Diff. value

4. Target Low Pressure confirm and adjustment

   These are default settings. Settings can be customized.

- Turn ON No.8 on the 8P DIP switch (SW13).
- Turn OFF No.1 and No.3–No.7 on the 8P DIP switch (SW13).
- Set the rotary switch (SW11) to [ON]
  To change the ON value, press ▲ or ▼ button.
  "ON value" range is from 110 psig to 725 psig and it must be higher than "OFF value" by 12 psig or more.
- Set the rotary switch (SW11) to [OFF].
  To change the OFF value, press ▲ or ▼ button.
  "OFF value" range is from 99 psig to 714 psig and it must be lower than "ON value" by 11 psig or more.
- Set the rotary switch (SW11) to [OPERATION MODE].
  To change the Diff. value, press ▲ or ▼ button.
  "Diff. value" range is from 12 psig to 267 psig, and "Lim value" must be 84 psig or more.
- Set the rotary switch (SW11) to [OPERATION].
  Then the ON value and OFF value are stored in memory.

INDICATION

1. Individual LED of CRD2-EN PCB

Name	Color	Condition when the LED lights up
Hi	Yellow	The low pressure is equal to the Control "ON valve" or higher.
Lo	Yellow	The low pressure is equal to the Control "OFF value" or lower.
Alarm	Red	Lights up/blinks in the event of an anomaly or when an alarm condition is generated. For details, refer to the "Description of Abnormality Alarm" in "AboutAlarms."
Check	Yellow	ON: In the PCB check mode, or evacuation mode Blink: Slide switch SW 15 ("control/ check") is set to "check."
INV1	Green	Lights up during compressor operation.
INV2	Green	Not applicable
DEF	Green	Blink: In the Vacuum Mode, electronic expansion valve in manual control

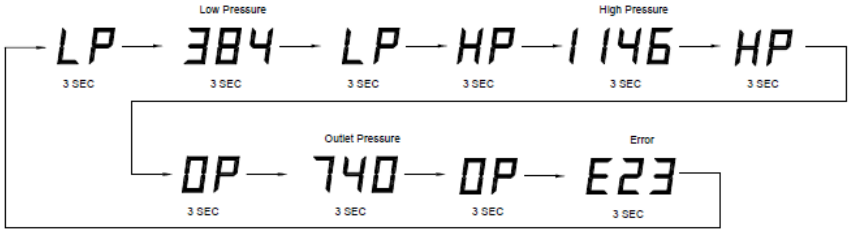
2. Display - When the rotary switch (SW11) is at [OPERATION], the display indicates "a." to "d." below:

   a. Normal operation

   During normal operation, the display alternates between low pressure (psig) » high pressure (psig) » unit outlet pressure (psig). Indicates "Lo" when low pressure is below 0.00. For identification purposes, "H" is added to the end of high pressure, and "o" to the end of unit outlet pressure.

   b. When an alarm condition is generated.

   The display alternates between low pressure (psig) » High pressure (psig) » Unit outlet pressure (psig) » Error content.



   c. Method of fixing indication of low pressure

   Pressing ▼ button during normal operation fixes the low pressure display for 10 minutes. Pressing ▼ button again cancels the fixed display. However, during alarm is generated, low pressure indication cannot be fixed.

   d. The point at the lowest digit of the digital display (bottom right)

Blinks: during manual operation or forced stop of the compressor.

SETTING DISPLAY LISTING

Digital display and operation list

Mode	DIPSW 13-8	DIPSW 13-7	DIPSW 13-6	Rotary switch (Knob) position	Display/Setup		Remarks
Standard mode	OFF	OFF	OFF	OPERATION	Low pressure and high pressure is displayed alternately.	Low pressure: Lo.0.00 to 9.98 (MPa) High pressure: Lo-H, 0.00H to *** H (MPa)	▲ pressing: Red LED blinking cancelled During pressing ▼: evaporating temperature Pressing ▼ and release: low pressure (Only when no error is indicated)
				ON	"ON value"	0,76 to 5,00 (MPa)	Setting cannot be changed.
				OFF	"OFF value"	0.68 to 4.92 (MPa)	▲ pressing: "Lim value" ▼ pressing: "Diff value"
				OPERATION MODE	Operation mode	[FrE] display	Setting cannot be changed.
				STANDARD SETTING	Standard pressure selection	[F] display	▲ pressing: Up the set value ▼ pressing: Down the set value
				PRESSURE	Hi / Med / Unit outlet / Lo pressure	High pres: *** H (MPa) Med pres: *** c (MPa) Unit outlet pres: *** o (MPa) Low pres: *** (MPa)	▲ pressing: displayed data change ▼ pressing: displayed data change
				FREQUENCY	Compressor Rotational Speed	** . ** (s^{-1})	[Ex] In the case of 10 (s^{-1}) → xx,0 In the case of less than 10 (s^{-1}) → x,00
				SUCTION	Suction gas temperature	**** (°C)	▲ pressing: Suction heating rate(K) ▼ pressing: Unit outlet temperature (°C)
				DISCHARGE	Discharge gas temperature	**** (°C)	
				ALM HISTORY	Alarm history error code display	E *** (Error code) Latest 50 items (Older data erased)	▲ pressing: Older data ▼ pressing: Newer data
Back mode 1	ON	OFF	OFF	ON	"ON value" setting	0,76 to 5,00 (MPa)	▲ pressing: Up the set value ▼ pressing: Down the set value
				OFF	"OFF value" setting	0,68 to 4,92 (MPa)	
				OPERATION MODE	"Diff, value" setting	0,08 to 1,84 (MPa)	
				STANDARD SETTING	Forced stopping time setting	30 sec to 180 sec (1 sec increment)	
				PRESSURE	Protocol type selection	1,PAn 2,oth 3,Mod	
				FREQUENCY	Address setting	0: No communication (Setting at shipment) 1 to 49: Pan/oth 1 to 50: Mod	▲ pressing: Up the set value ▼ pressing: Down the set value
				SUCTION	Operation mode	Fixed to "High resolution mode (FrE)"	Setting cannot be changed.
				DISCHARGE	Fan operation mode	—	—
				ALM HISTORY	Switch the Liquid tube electromagnetic valve signal terminal to the function that outputs voltage according to the outside air temperature	On: The Liquid tube electromagnetic valve signal terminal operation Off: Outputs voltage according to the outside air temperature	▲ pressing: On ▼ pressing: Off
Back mode 2	OFF	ON	OFF	ON	High pressure/ Intermediate pressure/ Unit outlet pressure/ Low pressure display	High pressure: *** H (MPa) Intermediate pressure: *** c (MPa) Unit outlet pressure: *** o (MPa) Low pressure: *** (MPa)	▲ pressing: Increase the displayed value ▼ pressing: Reduce the displayed value
				OFF	Other temperature display (Suction, Unit outlet, Gas cooler)	**** (°C)	
				PRESSURE	Electronic expansion valve opening display (Pressure reduction, Gas return, Liquid injection)	MOV5: 5, *** (step) MOV6: 6, *** (step) MOV7: 7, *** (step)	—
				FREQUENCY	Compressor current	**** (A)	—
				SUCTION	Gas cooler fan speed	**** (rpm)	—
				DISCHARGE	—	—	▲ pressing: Software Version ▼ pressing: Erase Alarm history
				ALM HISTORY	Ambient temperature	**** (°C)	—
Back mode 4	OFF	OFF	ON	OPERATION MODE	Compressor start delay	0 sec to 30sec (1 sec increment)	▲ pressing: Up the set value ▼ pressing: Down the set value
				ON	Voltage output ON/OFF setting when switch the Liquid tube electromagnetic valve signal terminal to the function that outputs voltage according to the outside air temperature	"ON temperature" setting Settable range 20 to 40 (℃)	▲ pressing: Up the set value ▼ pressing: Down the set value
				OFF		"Differential" setting Settable range 1 to 20 (℃) "OFF temperature" is given by the "Differential" from the "ON temperature" value	▲ pressing: Up the set value ▼ pressing: Down the set value

CONTROL AND SYSTEM FUNCTIONS

Low Pressure Control Method

Compressor capacity is controlled by changing the inverter frequency based on the difference between the low pressure and set value by adjusting the low pressure to the set value (ON value to OFF value). However, compressor operation continues even if the low pressure becomes below "OFF value" and finally stops when the low pressure reaches below the "Lim value".

* Lim value = OFF value - Diff value

For the setting of Diff value, refer to "Low Pressure Setting" of "Setting and Indication".

Short Cycle Prevention Control

After the compressor has been stopped, and even as the pressure becomes higher than the "ON value", stopping continues for the forced stopping time (30 to 180 sec).

Protective Functions

1. Power reverse/missing phase, high pressure abnormality, intermediate pressure abnormality, unit outlet pressure abnormality - Stops the compressor.
2. Discharge gas temperature abnormality

   a. Normal operation

   Compressor operation stops when the discharge gas temperature exceeds 244° F (118° C) and resumes when the discharge gas temperature becomes 167° F (75° C).

   When abnormal discharge gas temperature occurs 3 times in 2 hours, the compressor will stop operating even if the discharge gas temperature becomes 167° F (75° C). For the method of resuming (resetting) compressor operation, refer to the "Description of Abnormality Alarm" in "About Alarms."

3. Refrigerant flood back abnormality

   When the difference (suction gas superheat) between the suction gas temperature sensor value and evaporating temperature converted from the low pressure becomes 2° F or below for continuously 2 minutes, an error signal is indicated. During such condition, compressor operation continues. Error indication is canceled when the suction gas superheat exceeds 9° F.

4. Sensor abnormality

   a. Open condition of low pressure, intermediate pressure sensor, unit outlet pressure sensor, high pressure sensor - Compressor stops with an error indication. For the method of resuming (resetting) compressor operation, refer to the "Description of Abnormality Alarm" in "About Alarms."

   b. Open condition of discharge gas temperature sensor, gas cooler outlet temperature sensor, unit outlet temperature sensor, and ambient temperature sensor - Compressor stops with an error indication. For the method of resuming (resetting) compressor operation, refer to the "Description of Abnormality Alarm" in "About Alarms."

   c. Open condition of suction gas temperature sensor Compressor stops with an error indication. For the method of resuming (resetting) compressor operation, refer to the "Description of Abnormality Alarm" in "About Alarms."

5. Communication abnormality (Modbus RS-485)

   While communication continues with the controller (external communication refrigerator No. is other than 0), if the controller data is not received for 10 minutes, then an error is indicated. During such conditions, compressor operation continues. The error is canceled when data reception from the controller is resumed.

⚠CAUTION

» **When the external communication refrigerator No. is set to other than 0 without connecting the controller, an error(E19) is displayed.**

6. Inverter abnormality

   Compressor is stopped when abnormal operations which are indicated as section "About alarms" occurred. Refer to Inverter anomaly of section "About alarm" for detail.

7. Inverter communication abnormality

   When the INV4-MF-EN PCB cannot receive data from the CR2-EN PCB, compressor operation stops with error display.

   For the method of resuming (resetting) compressor operation, refer to the "Description of Abnormality Alarm" in "About Alarms."

ADJUSTMENT DURING OPERATION

Avoiding Short Cycle Operations

Short cycle operation (frequent start/stop operation) causes excessive oil carry-over during starting and causes insufficient lubrication.

Adjust operation cycle to avoid short cycle operation. (Adjust ON-OFF cycle to be 10 minutes or longer.) The main cause of short cycle operation is inappropriate pressure setting on CRD2-EN PCB, suction filter clogging, and unbalance of cooling capacity and load.

When a cooling coil is used, incorrect attachment position of the compartment temperature sensor (cold air-blow directly hit the sensor) would become a problem in addition to the above. Review the sensor position.

Checking the Operating Condition of the Refrigeration Unit

1. Check abnormal vibration of the refrigeration unit and piping.
2. Check insufficient or excessive charging of refrigerant (check gas cooler outlet temperature and high pressure).
3. Check if the set value of the expansion valve (electronic expansion valve) and thermostat is appropriate.
4. Check whether or not liquid return operation is permitted (check superheat of suction gas temperature).

Adjusting Refrigerant Quantity of the Refrigeration Unit

When determining refrigerant quantity, the temperature setting of all Unit coolers/Display cases must be set to the lowest temperature without activation of the thermostat to allow the refrigeration unit to operate continuously.

1. Method of determining refrigerant quantity

   Check the refrigeration unit's operation condition using the following method, and adjust the refrigerant quantity to the appropriate value according to Table 3 (Determination criteria of refrigerant quantity).

   a. Check that the suction gas temperature is 64.4° F or below.

   b. Check that the superheat of the suction gas temperature is 18° F or greater.

   c. Check if the high pressure has been set to the standard high pressure (Table 2).

   d. Check if the gas cooler outlet temperature is +3.6° F to +9° F from the ambient temperature.

The method of checking each temperature and pressure should comply with Table 1 and the value should be confirmed with the digital display.

Table 1 Method of checking each temperature and pressure

Item	DIP switch SW13 settings	Rotary switch SW11 position
Suction gas temperature	SW13-2 ON (all other OFF)	Suction
High pressure	SW13-2 ON (all other OFF)	Pressure
Gas cooler outlet temperature	SW13-2 and 7 ON (others OFF)	OFF (Press ▲ 3 times)
Ambient temperature	SW13-2 and 7 ON (others OFF)	ALM history

Table 2 Standard high pressure

Ambient Temperature	Evaporating Temperature ≤ -4°F (-20°C)	Evaporating Temperature > -4°F (-20°C)
	High Pressure	High Pressure
32°F or below (0°C or below)	493 psig (3.4 MPa)	493 psig (3.4 MPa)
41°F (5°C)	566 psig (3.9 MPa)	566 psig (3.9 MPa)
50°F (10°C)	638 psig (4.4 MPa)	638 psig (4.4 MPa)
59°F (15°C)	725 psig (5.0 MPa)	725 psig (5.0 MPa)
68°F (20°C)	812 psig (5.6 MPa)	841 psig (5.8 MPa)
77°F (25°C)	1044 psig (7.2 MPa)	1160 psig (8.0 Mpa)
86°F (30°C)	1146 psig (7.9 MPa)	1276 psig (8.8 MPa)
95°F (35°C)	1233 psig (8.5 MPa)	1363 psig (9.4 MPa)

Table 3 Determination criteria of refrigerant quantity

Gas Cooler Outlet temp. / High Pressure	Less than "Ambient temp. + 3.6 F (2 K)"	"Ambient temp. + 3.6 F (2 K)" to "Ambient temp. + 9 F (5 K)"	Greater than "Ambient temp. + 9 F (5 K)"
High	▲	▲	O
Standard	O	◎	▽
Low	▽	▽	▽

▲: Refrigerant overcharge, ◎: Appropiate, ▽ : Refrigerant shortage

O: Perform continous operation and monitor the condition

2. Refrigerant quantity adjustment

a. Shortage of refrigerant (when charging additional refrigerant)

- Perform cooling operation and charge additional refrigerant via the access port of the low pressure service valve.
- Adjust valve opening during slow charging operation to avoid frosting beyond the refrigerant service valve.
- Guideline of charging rate of refrigerant is 0.71 oz. (20 g) per 5 seconds.

NOTE: Rapid refrigerant charging may lead to a compressor failure.

b. Overcharging of refrigerant (when releasing the refrigerant)

- Release the refrigerant via the access port of the low pressure service valve.
- Open the valve very slowly. Use caution, oil may leak out.
- As CO_2 refrigerant is heavier to air, use caution for gas stagnation.

c. After completing refrigerant adjustment, close the access port of the low pressure service valve.

⚠CAUTION

» **Shortage of refrigerant tends to cause lower level of high pressure and higher level of intermediate pressure.**

ADDITIONAL ALARM INFORMATION

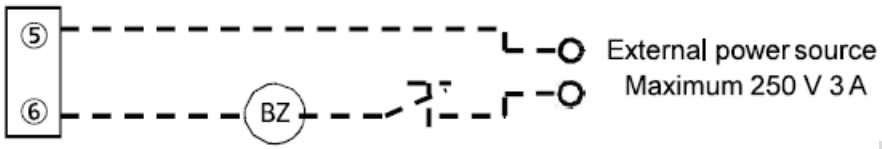
Installation of an Alarm System

This refrigeration unit has a variety of protection devices for securing safety. When the ground fault protector or other protection device is activated, and the alarm system or temperature control system is insufficient, cooling operation is stopped for many hours thereby damaging the food items.
To enable prompt actions at such time, an alarm system or temperature control system should be considered at the time of plan development.

External Alarms

This refrigeration unit is capable of delivering alarm output during abnormality (no voltage contact: contact capacity Maximum 250 V 3 A).

During unit abnormality, the alarm output between the external alarm terminal base 5 and base 6 is turned ON (continuity between the contacts). Connection of an external alarm circuit (local wiring) is recommended. External alarm power should be furnished separately from the refrigeration unit power. Detail of abnormality alarm content is shown in the table below.



Buzzer Buzzer stopping switch

⚠CAUTION

» **Use shielded cable suitable for the voltage of the external power supply used.**

DESCRIPTION OF ABNORMALITY ALARM

When the ground fault protector is activated, check insulation of the equipment and circuit, eliminate the cause, and supply power again.

	Anomaly Item									
		When restarting				When stopped				
		Alarm indication				Alarm indication				
	Number of times to automatically restart	ALARM (Red) LED	Error code	External alarm signal	Communication signal	ALARM (Red) LED	Error code	External alarm signal	Communication signal	Note
Reverse phase, Loss of phase	None					lighting	E00	output	output	
High-pressure anomaly	6	blinking	E311	none	none	lighting	E011	output	output	1)
Discharge gas temperature anomaly	2	blinking	E101	none	none	lighting	E031	output	output	2)
Discharge gas temperature sensor anomaly	None					lighting	E041	output	output	
Low-pressure sensor anomaly	None					lighting	E05	output	output	
High-pressure sensor anomaly	None					lighting	E06	output	output	
Suction gas temperature sensor anomaly	None					OFF	E07	none	none	
Inverter communication anomaly	None					lighting	E181	output	output	
Controller communication anomaly	None					OFF	E19	none	none	
Heat sink temperature anomaly	None					lighting	E201	output	output	
Heat sink temperature anomaly	None					lighting	E221	output	output	
Ambient temperature sensor anomaly	None					lighting	E23	output	output	
Gas cooler fan motor anomaly	None	blinking	E271	none	none	OFF	E281	output	output	
Refrigerant floodback alarm	None					OFF	E32	none	none	3)
Intermediate pressure anomaly	6	blinking	E36	none	none	lighting	E46	output	output	
Unit outlet pressure anomaly	6	blinking	E37	none	none	lighting	E47	output	output	
Intermediate pressure sensor anomaly	None					lighting	E81	output	output	
Unit outlet temperature sensor anomaly	None					lighting	E57	output	output	
Gas cooler outlet temperature sensor anomaly	None					lighting	E59	output	output	
Unit outlet pressure sensor anomaly	None					lighting	E88	output	output	
Refrigerant overcharge		blinking	E84	none	none					

Reset Method When Stopped

※ Operate either ground fault interrupter, operation switch, or controller.

1. After stopping for 5 min, then "auto recovery".
2. Restart when the discharge gas temperature becomes (167° F) 75° C or below.
3. Auto recovery occurs when the difference between the evaporating temperature and suction gas temperature is 9° F (5° C) or greater.

	Inverter anomaly item							
	When 1st and 2nd incident are automatically restore				When 3rd incident is stop			
	Error code	ALARM (Red) LED	External alarm signal	Communication signal	Error code	ALARM (Red) LED	External alarm signal	Communication signal
Inverter anomaly	E601	blinking	none	none	E701	lighting	Output	Output
Inverter current anomaly	E621	blinking	none	none	E721	lighting	Output	output
Inverter voltage anomaly	E651	blinking	none	none	E751	lighting	output	output
Inverter out-of-tune anomaly	E661	blinking	none	none	E761	lighting	output	output
Inverter inrush prevention circuit anomaly	E681	blinking	none	none	E781	lighting	output	output

MAINTENANCE AND INSPECTION

Maintenance and inspection work is the responsibility of the installation contractor. All work must be performed by authorized and licensed technicians.

Request for Maintenance and Inspection:
Refrigeration unit components require inspection periodically before service life. The installation company needs to contract with the equipment user for performing scheduled inspection of the equipment including the cooling system.

Service Parts and Replacement Guidelines
Major components requiring inspection and replacement in a refrigeration unit along with their frequency of inspection and replacement are shown below. When any abnormality is detected by inspection, replace it early. See Optional Accessories and Replacement Parts on Pages 58-58.

Inspection and replacement timing vary by operation rate and condition, ambient environment, and individual component condition and cannot uniformly be determined. We request full inspection particularly at (1) Commissioning, (2) Scheduled inspection, (3) System maintenance, etc.

Inspection items/Replacement parts		Inspection content/Replacement guideline
System overall (Each part temperature)		(1) Pressure condition should match the cooling temperature (2) Temperature of each part must be normal (3) No abnormality exists in the installed condition.
Compressor	Abnormal sound, abnormal vibration	No abnormal sound or abnormal vibration should be generated.
Gas cooler	Fin clogging	Is the fin clogged with dust? ... Scheduled cleaning
	Fan rotation	Is there any abnormality in the fan rotation ?
Piping component	Filter dryer	Replace the filter dryer for clogging, deformation, or large temperature and/or large pressure differences between the dryer inlet and outlet.
	Suction filter	Replace the suction filter for clogging, deformation, or large temperature and/or large pressure differences (abnormally low pressure) between the filter inlet and outlet.
	Other piping positions	Refrigerant leak, oil leak, deformation, abnormal vibration, deterioration of heat insulation material
Electrical components	Fan motor	Replace when generating abnormal sound, heavy in rotation, oil smearing, etc.
	Activation of protection device and control component	Replace when control failure by motion defect, chattering etc.
	Terminal, wiring, etc.	Any change of color, deterioration of insulation
	Electrical box air filter	Clean the filter periodically (every 3 to 6 months) according to the contamination.

SERVICE DIAGNOSIS

ACTIONS AT THE TIME OF FAILURE

When the refrigeration unit or any refrigerant circuit component fails to operate, turn off the power before making a systems diagnosis or any repairs. For questions about your equipment please contact our Technical Support Team 866-785-8499. For General Support or Service Calls contact our Customer Support Call Center 800-922-1919.

To avoid failure recurrence, follow the cautions below:

1. To avoid the recurrence of the same failure, execute a reliable failure diagnosis and identify the actual cause before starting a repair.

   When the ground fault protector is activated, check the insulation of the equipment and circuit, eliminate the cause, and then supply power gain.
2. When a piping repair, be sure to release refrigerant from the brazed point and perform brazing while flowing nitrogen gas.
3. Always replace the filter dryer when replacing a major component such as a compressor, gas cooler, refrigerant, or oil.

   When the refrigerant circuit is contaminated by a burnt compressor motor, etc., apply nitrogen blow to eliminate refrigeration oil remaining in the refrigerant circuit. (At such time, also remove the expansion valve (electronic expansion valve)).
4. When replacing the compressor, do not apply power to the crankcase heater when removed from the compressor. Be sure to shut off the power (It may lead to fire).
5. To avoid current leak accidents, install the components (cover, electric parts, etc.) removed during inspection and service and attach them as they were initially.
6. Replace the filter circuit board (INV4-MF-EN PCB) as a whole when the fuse is broken.

⚠WARNING

— LOCK OUT / TAG OUT —

» **To avoid serious injury or death from electrical shock, always disconnect the electrical power at the main disconnect when servicing or replacing any electrical component. This includes, but is not limited to, such items as controllers, electrical components, condensers, lights, fans, and heaters.**

CLEARING ALARM HISTORY

Operate the rotary switch (knob) and DIP switch.

1. Align the rotary switch (knob) with [DIS]. (Discharge gas temperature is displayed)
2. Turn ON the DIP switch SW13-7.
3. Press ▼ button. (Entire content of [Alarm History] is cleared.)
4. Turn OFF the DIP switch SW13-7.
5. Align the rotary switch (knob) with [Alarm History] and confirm that (E***) is displayed, indicating that the content has been cleared.
6. Set the rotary switch (knob) back to [OPERATION] position.

Error Codes

1. When the rotary switch (knob) is at [OPERATION] position, the digital display on the CRD2-EN PCB alternately displays low pressure, high pressure and error code (E ***).

Error code	Meaning	Cause	Correction method
E00	Reverse phase, Loss of phase	Reversed phase or loss of phase detected.	(1) Check if the power supply is normal. (2) Check the connection of power source terminal base "L1, L2, L3," and the connection of INV4-MF-EN PCB "L1, L2, L3,".
E011	High-pressure anomaly (7th incident)	Increased high pressure caused a high-pressure anomaly.	(1) Investigate the cause of high-pressure anomaly. (2) Check for the presence of any anomalies of the high-pressure sensor.
E031	Discharge gas temperature anomaly (3rd incident)	Abnormal stop caused by increased discharge temperature to 118°C or higher occurred three times in two hours.	Follow the procedure shown in "Failure Diagnosis at the time of Abnormal Discharge Gas Temperature." (1) Search for the cause of increasing discharge gas temperature. (2) Check the connection of CR2-EN PCB "2P4 discharge 1 connector." (3) Check the resistance value of the discharge gas temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E041	Discharge gas temperature sensor anomaly	Discharge gas temperature sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "2P4 discharge 1 connector." (2) Check the resistance value of the discharge gas temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E05	Low-pressure sensor anomaly	Low pressure sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "3P1 low pressure connector." (2) Check the output voltage of the low-pressure sensor (Refer to "Method of Checking Sensor Characteristics").
E06	High-pressure sensor anomaly	High-pressure sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "3P3 high-pressure connector." (2) Check the output voltage of the high-pressure sensor (Refer to "Method of Checking Sensor Characteristics").
E07	Suction gas temperature sensor anomaly	Suction gas temperature sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "2P9 U inlet connector." (2) Check the resistance value of the suction gas temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E101	Discharge gas temperature anomaly (1st to 2nd incident)	Discharge gas temperature increased to 118°C or higher and generated an abnormal stop. Or discharge gas temperature sensor shorted.	Comply with the "Failure Diagnosis at the time of Abnormal Discharge Gas Temperature." (1) Search for the cause of increasing discharge gas temperature. (2) Check the connection of CR2-EN PCB "2P4 discharge 1 connector." (3) Check the resistance value of the discharge gas temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E181	Inverter communication anomaly	No serial communication signal between "CR2-EN PCB" and "INV4-MF-EN PCB"	Check the communication line between CR2-EN PCB "5P1, 5P2 connector" and INV4-MF-EN PCB "CN14, CN15 connector."
E19	Controller communication anomaly	No controller signal exists in communication.	(1) Check the communication line (CR2-EN PCB "5P4, 5P5 connector"). (2) Set the communicating refrigeration unit No. to a value other than "0."
E201	Heat sink temperature anomaly	Inverter heat sink temperature increased to 100°C or higher and stopped abnormally.	(1) Investigate the cause of the increasing heat sink temperature. (2) Check the connection of CR2-EN PCB "2P31 Cooler 1 connector." (3) Check the resistance value of the heat sink temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E221	Heat sink temperature sensor anomaly	Heat sink temperature sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "2P31 Cooler 1 connector." (2) Check the resistance value of the heat sink temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E23	Ambient temperature sensor anomaly	Ambient temperature sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "2P8 ambient air connector." (2) Check the resistance value of the ambient temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E271	Gas cooler fan motor anomaly (1st to 2nd incident)	Gas cooler fan motor became abnormal. (The fan rotation speed significantly deviated from the set rotation speed.)	(1) Check for the presence of a fan lock, fan dislocation, etc. (2) Check the connection of INV4-MF-EN PCB "CN6, CN9 or C30 connectors." (3) Check the connection of CR2-EN PCB "6P1 FAN 1 connector."
E281	Gas cooler fan motor anomaly (3rd incident)		
E311	High-pressure anomaly (1st to 6th incident)	Increased high pressure caused a high-pressure anomaly.	(1) Investigate the cause of high-pressure anomaly. (2) Check for the presence of any anomalies in the high-pressure sensor.
E32	Refrigerant floodback alarm	Suction gas superheat (difference between "suction gas temperature" and "evaporating temperature calculated from low pressure") became 1 K or below continuously for 2 min.	Check the cause of refrigerant floodback operation.
E36	Intermediate pressure anomaly (1st to 6th incident)	Increased intermediate pressure caused an abnormal intermediate pressure.	(1) Investigate the cause of intermediate pressure anomaly. (2) Check for the presence of any anomalies of the intermediate pressure sensor.

Error code	Meaning	Cause	Correction method
E37	Unit outlet pressure anomaly (1st to 6th incident)	Increased unit outlet pressure caused a unit outlet pressure anomaly.	(1) Investigate the cause of unit outlet pressure anomaly. (2) Check for the presence of any anomalies of the unit outlet pressure sensor.
E46	Intermediate pressure anomaly (7th incident)	Increased intermediate pressure caused an intermediate pressure anomaly.	(1) Investigate the cause of intermediate pressure anomaly. (2) Check for the presence of any anomalies of the intermediate pressure sensor.
E47	Unit outlet pressure anomaly (7th incident)	Increased unit outlet pressure caused a unit outlet pressure anomaly.	(1) Investigate the cause of unit outlet pressure anomaly. (2) Check for the presence of any anomalies of the unit outlet pressure sensor.
E57	Unit outlet sensor anomaly	Unit outlet temperature sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "2P5 U outlet connector." (2) Check the resistance value of the unit outlet temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E59	Gas cooler outlet temperature sensor anomaly	Gas cooler outlet temperature sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "2P6 GC outlet connector." (2) Check the resistance value of the gas cooler outlet temperature sensor (Refer to "Method of Checking Sensor Characteristics").
E6X1 ~E7X1	Inverter anomaly	The inverter operation became abnormal.	Comply with the "Failure Diagnosis of Inverter Unit." (1) Check if Power source is connected to power source terminal base. (2) Confirm whether an overload operation is taking place. (3) Check for the presence of a power source voltage drop or power missing phase. (4) Check if the compressor is locked. (5) Check if INV4-H-EN PCB "U,V,W terminal" are connected to compressor. (6) Check if INV4-MF-EN PCB CN9 and CN6 or CN30 are connected to fan motor.
E81	Intermediate pressure sensor anomaly	Intermediate pressure sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "3P2 intermediate pressure connector." (2) Check the output voltage of the intermediate pressure sensor (Refer to "Method of Checking the Resistance of Electronic Expansion Valve Coil").
E88	Unit outlet pressure sensor anomaly	Unit outlet pressure sensor became abnormal (open circuit condition).	(1) Check the connection of CR2-EN PCB "3P4 U outlet connector." (2) Check the output voltage of the unit outlet pressure sensor (Refer to "Method of Checking Sensor Characteristics").

Indication	Meaning	Correction method	Remarks
Alarm (red) LED blinks	Anomaly that occurred in the past. Up to 50 past error codes are saved in the "Alarm History."	Check the error code in the table above and eliminate the cause. Then, align the rotary switch (knob) to "Operation," and press • or turn the operation switch "OFF." Then, LED stops blinking.	
Digital display "-CH-"	CR2-EN PCB is in the check mode.	Set CR2-EN PCB slide switch SW15 to "Control."	Set CR2-EN PCB slide switch SW15 to "Check," and DIP switch SW13-1 and SW13-6 to "ON" and supply power to enter the check mode.

FAILURE DIAGNOSIS AT THE TIME OF ABNORMAL DISCHARGE GAS TEMPERATURE

When the discharge gas temperature goes up abnormally, the compressor is stopped to protect the compression components of the compressor, and a discharge gas temperature abnormality alarm is generated at the same time. In such a case, check the problem position and apply appropriate actions in the sequence shown below.

Checking the refrigeration cycle operation condition
- ☐ (1) Is the refrigerant quantity insufficient?
  Refer to the "Adjusting Refrigerant Quantity of the Refrigeration Unit" in the "Adjustment during Operation",
- ☐ (2) Is the suction gas temperature exceeding the limit?
- ☐ (3) Is the low pressure at 0.00 MPa or below?

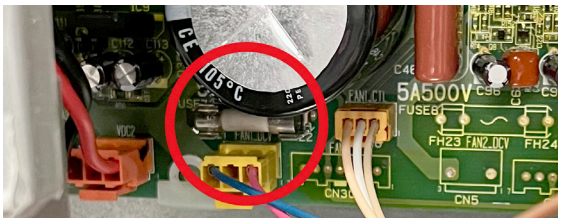
↓

Compressor Operation Status Check
- ☐ (1) Is the operation sound normal?
  (Metallic sound is higher when abnormal)
- ☐ (2) Is the operation current value normal?
- ☐ (3) Is the temperature of cooled load no problem?
- ☐ (4) Is any other abnormal point detected?

↓

Control Component Check
- ☐ (1) Mounted condition of the discharge gas temperature sensor body, connector on CR2-EN PCB

FAILURE DIAGNOSIS OF FAN MOTOR



1. Check "FUSE" of INV4-MF-EN PCB.
   a. When fuse is broken, replace INV4-MF-EN PCB and Fan motor.
   b. If fuse is not broken, replace Fan motor.
2. When the ground fault protector shuts OFF.
   a. Check the insulation resistance between fan motor circuit INV4-MF-EN PCB "CN9-1p" and the ground (G terminal).
      ... When the insulation resistance is 1 Ω or below, insulation failure exists in the INV4-MF-EN PCB or fan motor.
   b. Disconnect INV4-MF-EN PCB"CN9" and check the insulation resistance between power terminal of fan motor and ground.
      ... When the insulation resistance is 1 Ω or below, insulation failure exists in the fan motor.
3. When the fan motor does not rotate normally.
   a. While the fan motor is powered, it does not rotate smoothly (stopping or uneven rotation) or generates roaring noise.
      ... Fan motor bearing failure is the cause.

CHECKING SENSOR CHARACTERISTICS

1. Pressure (low, intermediate, unit outlet, high pressure) sensor

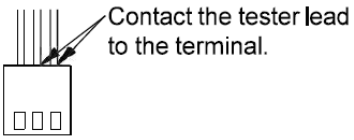
   While the connector is inserted to the CR2-EN PCB, measure the voltage and check if the pressure is normal by using the table below.

   < Relationship between sensor output voltage and pressure>

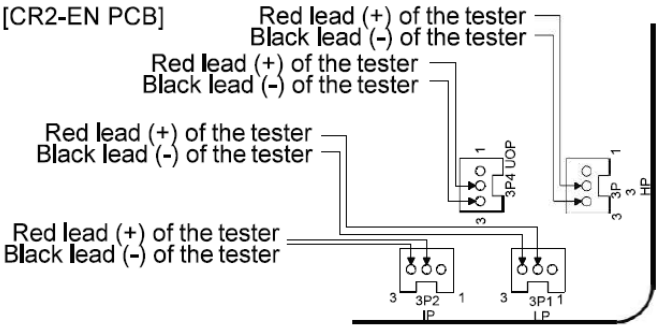
Pressure (MPa)	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00
Voltage (DCV)	0.50	0.77	1.03	1.30	1.57	1.83	2.10	2.37	2.63	2.90	3.17	3.43	3.70

* In the table above, when the pressure value is an intermediate value such as 4.5MPa, use a proportional calculation.

[Voltage measurement method]



[CR2-EN PCB]



⚠CAUTION

» **When checking the voltage of a pressure sensor, always use DCV range of the tester. Use caution, measurement by using resistance range may cause a sensor failure.**

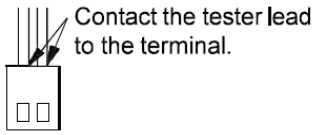
2. Suction gas temperature sensor, gas cooler outlet temperature sensor

   Measure the resistance while the connector is disconnected from the CR2-EN PCB, and check if the temperature is normal by using the following table.

   < Relationship between sensor temperature and resistance value>

Temperature (°C)	-50	-40	-30	-20	-10	0	10	20	30
Resistance value (kΩ)	77.58	43.34	25.17	15.13	9.39	6.00	3.94	2.64	1.82

[Resistance measurement method]



* In the table above, when the temperature is an intermediate value such as -5° C, use a proportional calculation.

3. Discharge gas temperature sensor

   Measure the resistance while the connector is disconnected from the CR2-EN PCB, and check if the temperature is normal by using the following table.

   < Relationship between sensor temperature and resistance value >

Temperature (°C)	20	30	40	50	60	70	80	90	100	110	120
Resistance value (kΩ)	70.13	45.05	29.67	20.00	13.79	9.71	6.97	5.09	3.77	2.84	2.16

* In the table above, when the temperature is an intermediate value such as 65° C, use a proportional calculation.

4. Other temperature (unit outlet, ambient temperature.) sensors

Measure the resistance while the connector is disconnected from the CR2-EN PCB, and check if the temperature is normal by using the following table.

< Relationship between sensor temperature and resistance value >

*In the table above, when the temperature is an intermediate value such as 35° C, use a proportional calculation.

Temperature (°C)	-10	0	10	20	30	40	50	60	70
Resistance value (kΩ)	26.22	15.76	9.76	6.21	4.05	2.70	1.84	1.28	0.90

CHECKING THE RESISTANCE OF ELECTRONIC EXPANSION VALVE COIL

Electronic expansion valve coil:

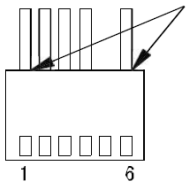
Used in Electronic expansion valve for pressure reduction (MOV5),
Electronic expansion valve for gas return (MOV6),
and Electronic expansion valve for liquid return (MOV7)

Measure the resistance with the connector disconnected from the CR2-EN PCB, and check if the resistance value is normal level by using the table below.

Measurement Position	Resistance Value
Between connector 1-6	185 Ω ± 18 Ω
Between connector 2-6	185 Ω ± 18 Ω
Between connector 3-6	185 Ω ± 18 Ω
Between connector 4-6	185 Ω ± 18 Ω

[Resistance measurement method]

Contact the tester lead to the terminal.



NOTE: Ambient temperature 20°C

<Electronic expansion valve connector>
6P13: Electronic expansion valve for pressure reduction (MOV5)
6P14: Electronic expansion valve for gas return (MOV6)
6P15: Electronic expansion valve for liquid return (MOV7)

⚠CAUTION

» **The CR2-EN PCB will fail when the refrigerator power is supplied while the coil resistance is 0 Ohms (shorted).**

» **When a motion failure of an electronic expansion valve is questioned, always check the resistance value of the electronic expansion valve before replacing the CR2-EN PCB.**

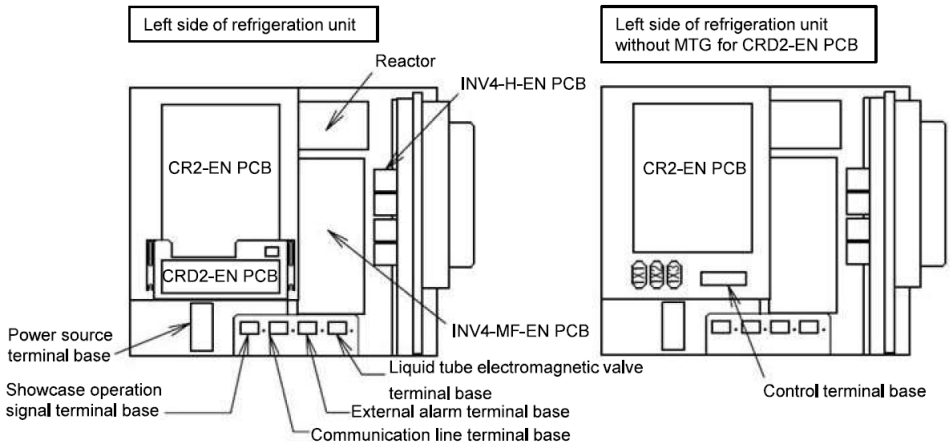
FAILURE DIAGNOSIS OF INVERTER CIRCUIT

⚠CAUTION

» **When performing an inspection or replacement, make sure to start working after the high voltage danger indication red light on the INV4- H-EN PCB has been turned off.**

» **(Approximately 5 minutes are required for the capacitor to discharge)**

Electrical box internal layout



When the refrigeration unit is stopped by activation of the ground fault protector, the possible cause is as follows. Check all of the following causes as shown in the table below.

Cause	Method of Checking	Method of Action
Compressor failure	Check insulation resistance between each phase of the compressor and case. Less than 1 MΩ indicates motor failure.	Replace the compressor
	Check the winding resistance of the compressor. 0.27 to 0.37 Ω (at 77° F (25° C)) indicates no problem.	
Failure of an electric component other than the compressor.	Check the insulation resistance between each output terminal of the INV4-MF-EN PCB, INV4-H-EN, and ground (G terminal). Less than 1 M Ω indicates insulation failure of the INV4-MF-EN PCB, INV4-H-EN PCB.	Replace the INV4-MF-EN PCB or INV4-H-EN PCB.

⚠CAUTION

» **Be sure to eliminate the cause of the failure before supplying the power (turning the ground fault protector ON).**

FAILURE DIAGNOSIS OF INVERTER CIRCUIT (INV4-MF-EN PCB, INV4-H-EN PCB)

When inverter abnormality (E6XX to E7XX) is generated, possible cause is as follows. Check all the following causes.

Cause	Method of Checking	Method of Action
Overload condition	(1) Check if the compressor motor current or fan motor, or both are high. (2) Check if any overload condition occurred even in a short duration of time.	Eliminate the cause of overload.
Abnormality of power voltage	Check if the supplied power voltage to the refrigeration unit is in the range of 208 V ± 20 V / 230 V ± 23 V / 460 V ± 46 V.	Execute maintenance of the power supply facility.
Failure of the INV4-MF-US PCB or INV4-H-EN PCB.	When the supplied voltage to the refrigeration unit is in the range of 208 V ± 20 V / 230 V ± 23 V / 460 V ± 46 V, check if any abnormality exists in the appearance of the INV4-MF-EN PCB or INV4-H-EN PCB.	Replace the INV4-MF-US PCB or INV4-H-US PCB, or both.
Failure of the FUSE of INV4-MF-US PCB	Check FUSE1,FUSE2,FUSE3 of INV4-MF-US PCB. 1) If any is broken 2) If not broken Check FUSE7 of INV4-MF-EN PCB. 1) If any is broken 2) If not broken	1) Replace the INV4-MF-US PCB, INV4-H-US PCB and compressor 2) Replace the Compressor 1) Replace the INV4-MF-EN PCB and Fan motor 2) Replace the Fan motor

⚠CAUTION

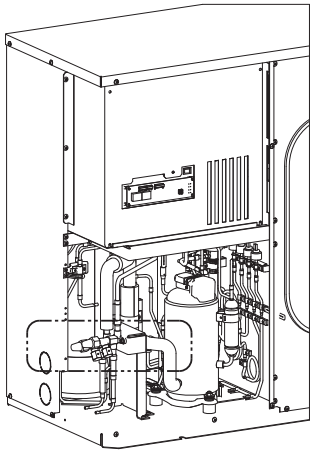
» **When an external cause such as momentary power failure or lightening, or short duration of overload occurs, an error is generated by momentary over-current even without any component failure.**

SERVICE PROCEDURES

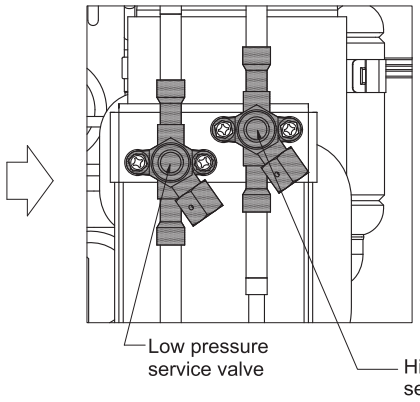
SERVICE VALVE OPERATION METHOD

1. Location of service valves and access ports

Front of refrigeration unit



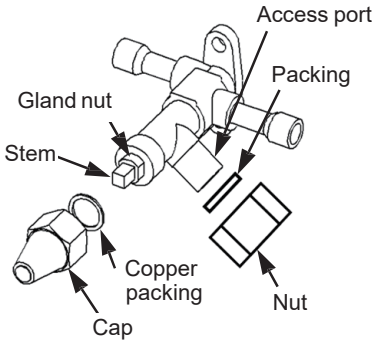
Detail of access ports location

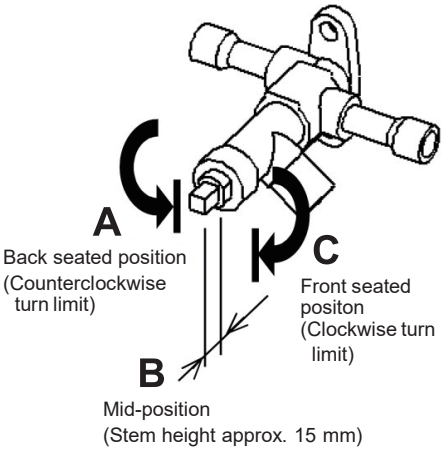


2. Method of operating service valves

The service valves fall into two categories types as follows.

High pressure and low pressure service valve

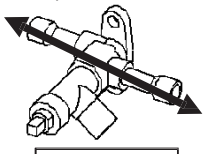
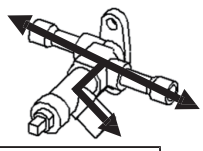
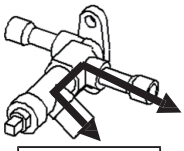




Notes: 1. Copper packing, cap and nut must be installed after the work. (gas leak prevention)
2. Check Gland nut loosening of the service valves, and fasten them if any looseness exists.
3. Fastening torques are as follows.

Cap: 265 +/- 44 in-lbs (30 +/- 5 N-m). Nut: 115 +/- 9 in-lbs (13 +/- 1 N-m), Gland Nut: 88 +/- 9 in lbs (10 +/- 1 N-m)

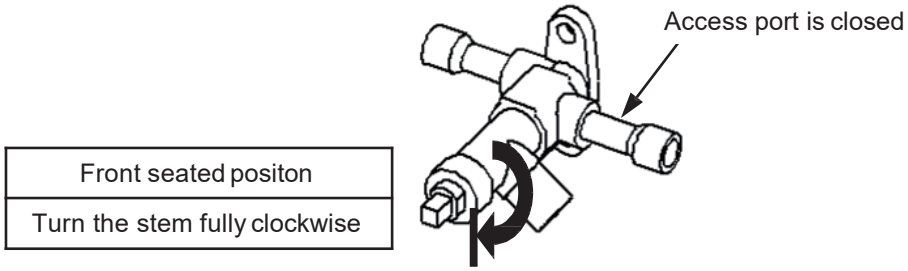
3. Relationship between each seat position and refrigerant flow direction

A: Back seated position (Turn the stem fully counter-clockwise)	**B**: Mid-position (Stem height approx. 15mm)	**C**: Front seated position (Turn the stem fully clockwise)
	▪High pressure side Approx. 3 and a half turns ▪Low pressure side Approx. 3 turns 	
Access port is **Closed**.	All three service valve openings are accessible.	Access port is **Open**.

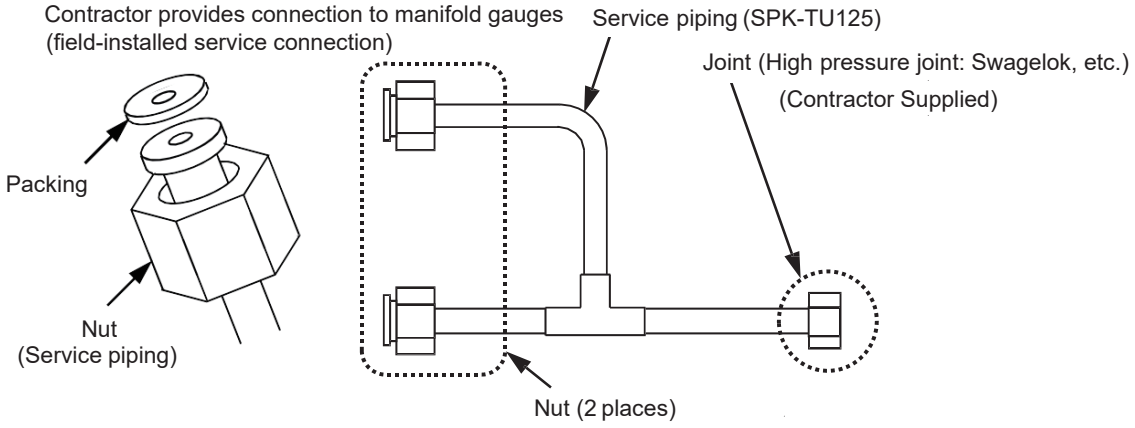
SERVICE PIPE CONNECTION/DISCONNECTION METHOD

1. Preparation for attachment of the service piping

1) To front seat service valves, turn the stem of the high pressure and low pressure service valves clockwise as far as possible.



2) Attach a packing to the service piping (2 places).



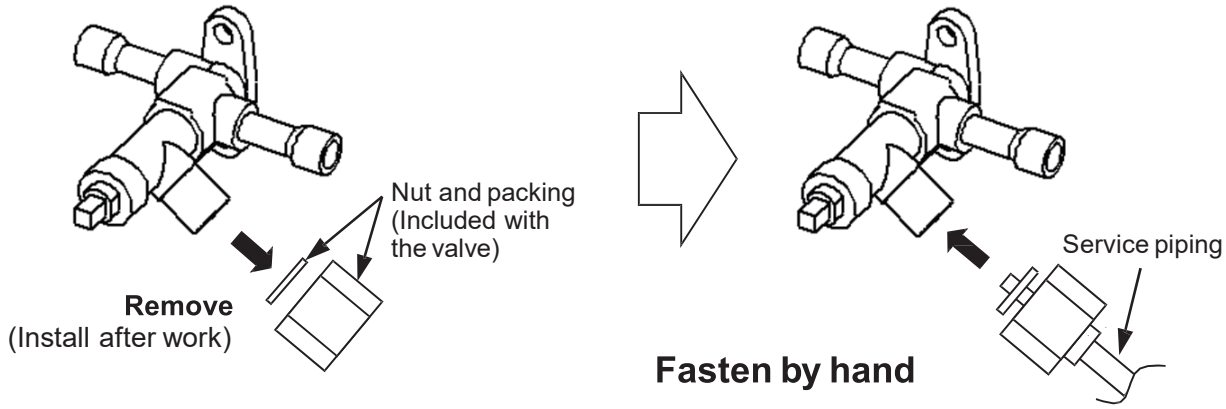
Notes: 1. Use a new packing.
2. Check that there is no adhering foreign objects.

2. Service piping attachment

1) Remove the nut and packing included with the service valve (2 places).

2) Assemble the service piping.

- Turn the nut by hand until the packing needs to be fastened with a tool.
- If it is difficult to fasten, slightly loosen the nut and gradually try to align it in parallel with the male thread of the service valve.



Note: Fastening the nut with a tool while the threads are not fully aligned would break the thread and lead to a gas leak.

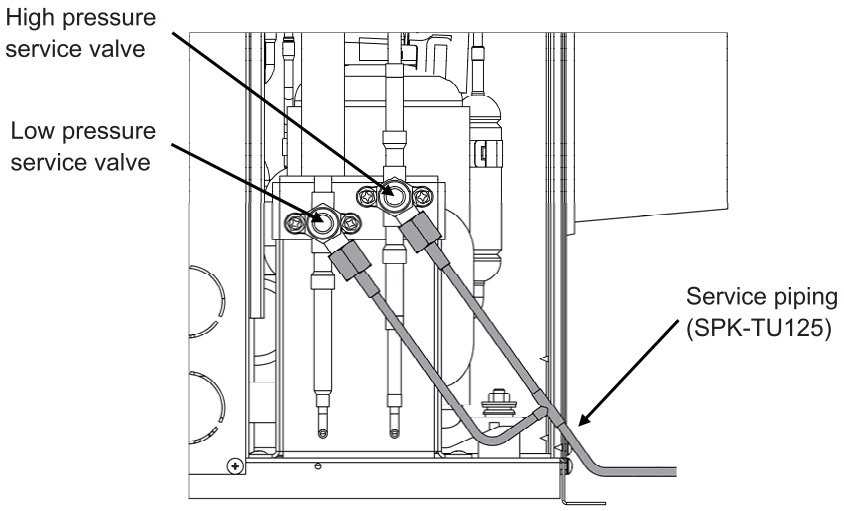
SERVICE PIPE CONNECTION/DISCONNECTION METHOD

(Continued)

3. Fastening the service piping

Fasten the nuts by hand up to the condition shown below, and then fasten them with a tool. Fastening torque of 115 ± 9 in-lbs (13 ± 1 N-m) is recommended for the nuts.

Note: Fastening the nut too tight may damage the service connection.

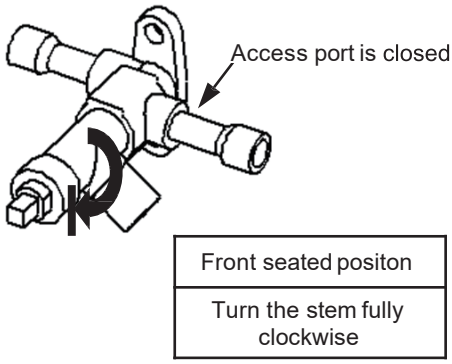


4. After completing service operation

1) After completing service operations such as evacuation and refrigerant charging, turn the stem of the high pressure and low pressure service valves clockwise as far as possible. (The access port is closed.)

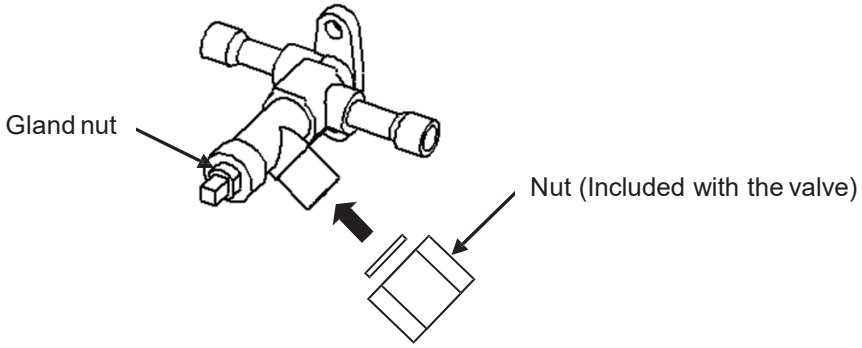
2) Any remaining nitrogen or refrigerant in the service piping should be purged.

3) Detach the service piping.
After detaching the service piping, Install the nut originally used on the service valve by hand.
(Refer to "2. Service piping attachment".)



4) Fasten the nut. Fastening torque of 115 ± 9 in-lbs (13 ± 1 N-m) is recommended. (Refer to "3. Fastening the service piping".)

5) Check the gland nut loosening of the low pressure and high pressure service valves and fasten them if any looseness exists. Fastening torque is 89 ± 7 in-lbs(10 ± 2 N-m).



EVACUATION MODE

1. Evacuation mode

In the evacuation mode, fully open the electronic expansion valve and solenoid valve in the refrigeration unit.

Note: If the refrigeration unit is not set to the evacuation mode, the electronic expansion valve and solenoid valve in the unit do not open, thus leading to incomplete the evacuation.

2. Evacuation mode procedure

1) Turn OFF the ground fault interrupter.

Note: The evacuation mode cannot be started with power supplied to the refrigeration unit.

2) Turn ON the operation switch (Seesaw switch S1).

3) Turn ON the DIP switch SW13-1 on the CRD2-EN PCB.

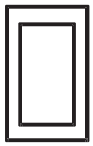
4) Set the Slide switch SW15 (“Control/Check”) on the CRD2-EN PCB to “Check.”

5) Turn ON the ground fault interrupter. (Supply power to the refrigeration unit.)

6) The 7-segment LED indicates

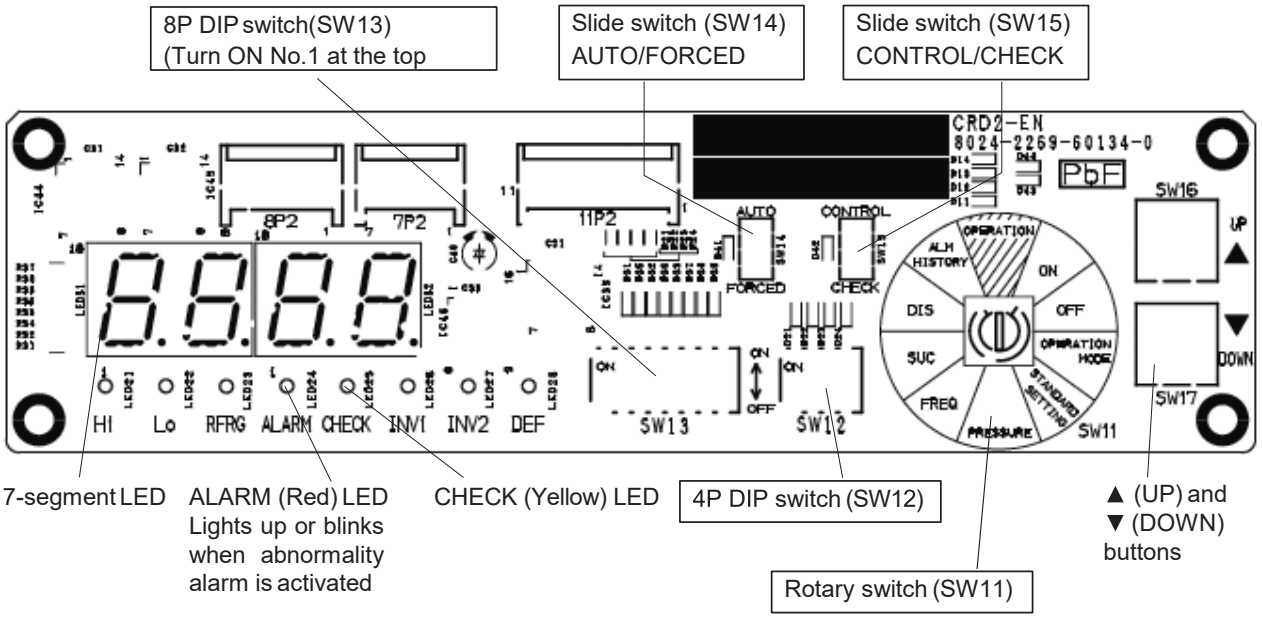
↱ Low pressure → High pressure → Unit outlet pressure → Vacuum（uAcU）┐

Operation switch S1 (ON) (Attached to Electrical box)



(ON)

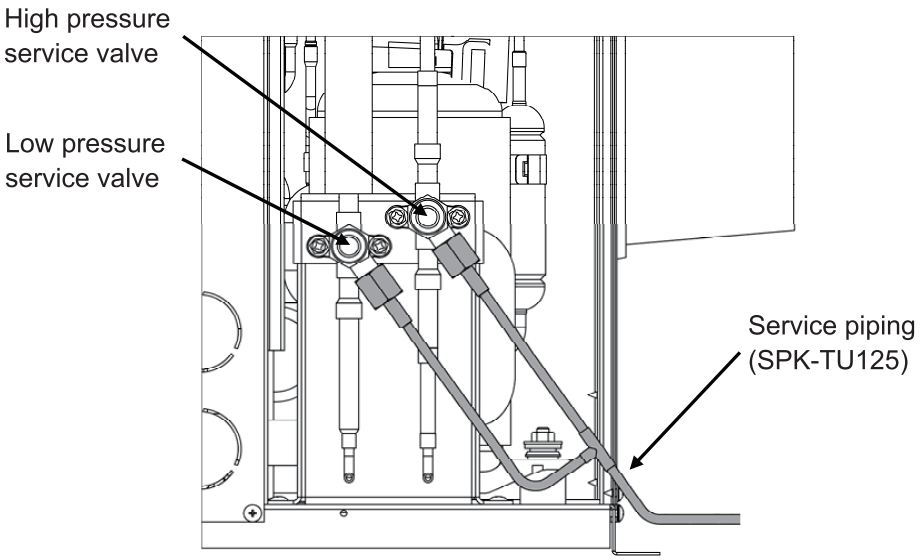
CRD2-EN PCB (Attached to Electrical box)



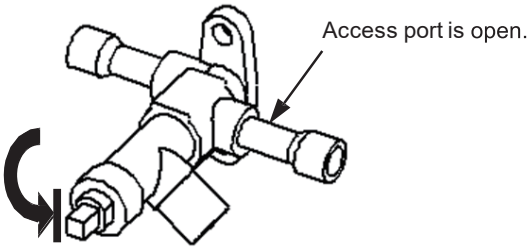
REFRIGERANT RELEASING PROCEDURE

1. Preparation for refrigerant releasing
   1) Check that the access ports of the high pressure and low pressure service valve have been closed. (The front seated position)
   2) Attach the service piping with the joint valve in "Closed" condition.
   3) Fasten the nuts by hand up to the condition shown below, and then fasten them with a tool. Fastening torque 115 ± 9 in-lbs (13 ± 1 N-m) is recommended for the nuts.

      Note: Fastening the nut too tight may deform the packing.



2. Refrigerant releasing
   1) Set the evacuation mode.
   2) Set the low pressure and high pressure service valves to the back seated position. (The access ports are open.)
   3) Slowly open the joint valve to release refrigerant.



Back seated positon
Turn the stem fully counterclockwise

⚠CAUTION

» **The rapid release of refrigerant could cause oil to be released together with refrigerant.**

AIRTIGHT TEST PROCEDURE

(Execute this test after completing piping work and airtight but before starting heat insulation work)

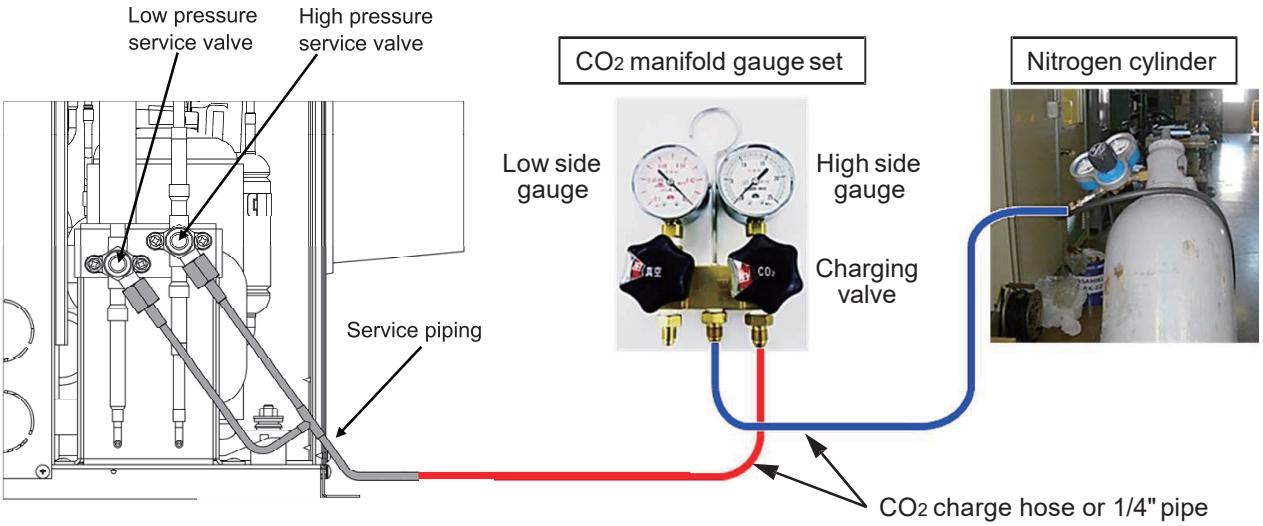
⚠CAUTION

» **Make sure to close the vacuum valve of the CO_2 manifold gauge set.**

1. Preparation for airtight test

1) Connect the joint valve of the service piping (SPK-TU125) and the manifold gauge set exclusively for CO_2 refrigerant by using a CO_2 charge hose or 1/4" pipe.

2) Connect a nitrogen cylinder and the manifold gauge set by using a CO_2 charge hose or 1/4" pipe.

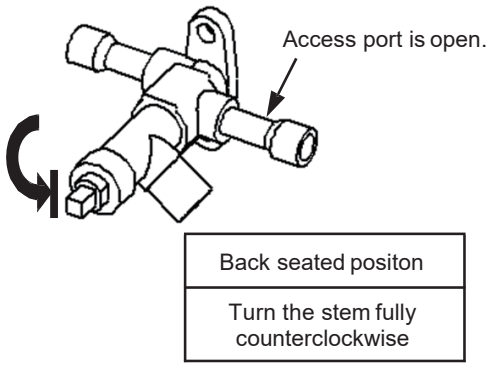


2. Airtight test

1) Set the evacuation mode in accordance with " Evacuation Mode".

2) Perform the airtight test of interconnecting pipes (the liquid line and suction line).

When performing the airtight test of interconnecting pipes, set the low pressure and high pressure service valves to the back seated position. (The access ports are open.)



Note: Airtight test of the refrigeration unit was completed at the time of factory shipment. Pressure testing should only be carried out by personal / companies who have necessary certification. Consider carefully local regulations and EN378.

Design pressure in Factory

Liquid side (High pressure side)	Suction side (Low pressure side)
1,015 psig (7MPa)	1,015 psig (7MPa)

VACUUM PUMP ATTACHMENT AND EVACUATION PROCEDURE

⚠CAUTION

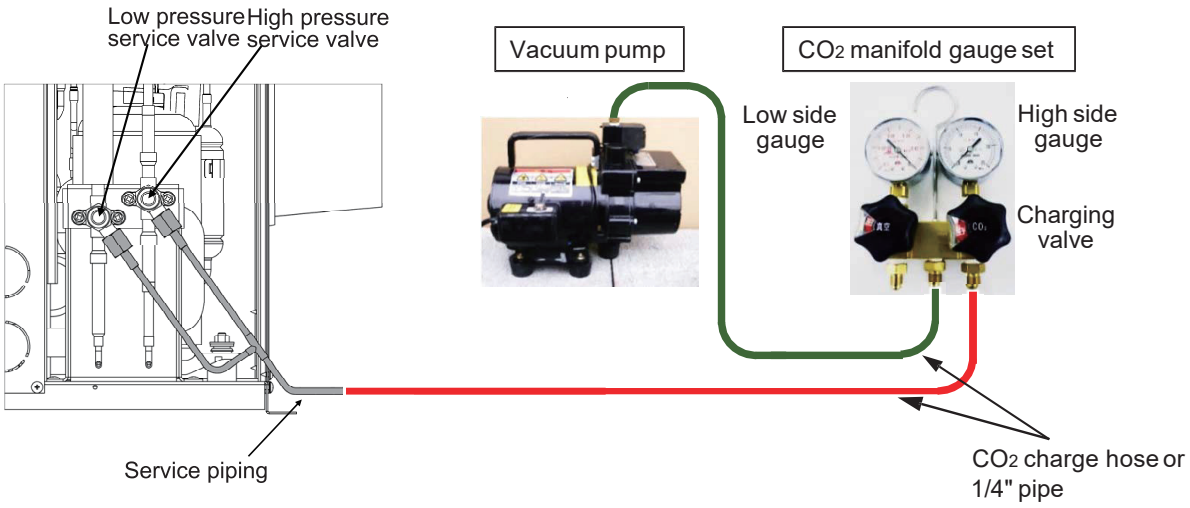
» **Evacuation should be performed after completing the airtight test following local codes and regulations.**

1. Vacuum pump attachment and piping connection

1) Connect the joint valve of the service piping (SPK-TU125) and the manifold gauge set exclusively for CO_2 refrigerant by using a CO_2 charge hose or 1/4" pipe.

2) Connect a vacuum pump, CO_2 refrigerant cylinder, and the manifold gauge set by using a charge hose or 1/4" pipe.

Note: The low side gauge for this operation should be able to indicate the vacuum level to be reached (-0.1MPa).

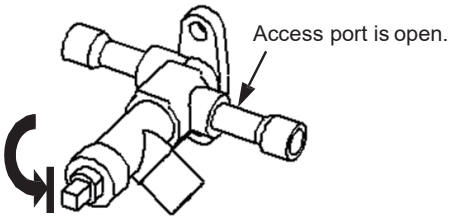


2. Evacuation

1) Set the evacuation mode in accordance with “Evacuation Mode".

2) Set the low pressure and high pressure service valves to the back seated position (the access ports are open), and operate the vacuum pump.

3) Continue the evacuation until the low side gauge indication reaches -0.1MPa and continue evacuation for an additional 1 to 3 hours.



Back seated positon
Turn the stem fully counterclockwise

Note: When the intended vacuum level (-0.1MPa) cannot be reached after 2 hours, check the setup for any leaks.

REFRIGERANT CHARGING PROCEDURE

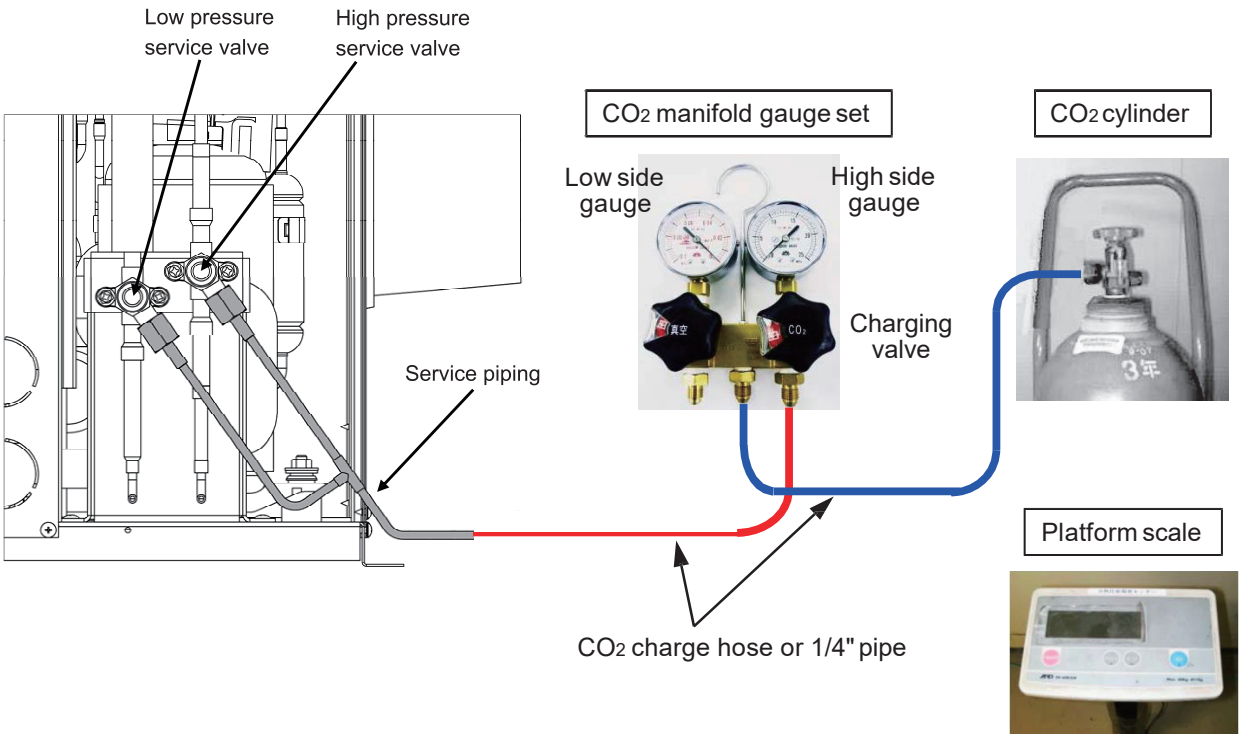
⚠CAUTION

» **Make sure to close the vacuum valve of the CO_2 manifold gauge set.**

1. Preparation for refrigerant charging

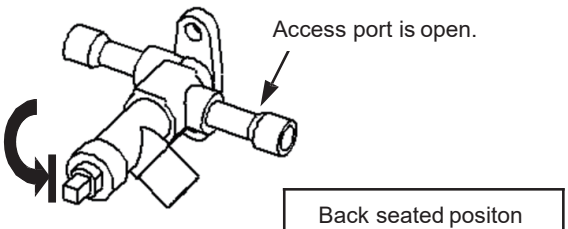
1) Connect the joint valve of the service piping (SPK-TU125) and the manifold gauge set exclusively for CO_2 refrigerant by using a CO_2 charge hose or 1/4" pipe.

2) Place a CO_2 refrigerant cylinder on a platform scale, and connect the manifold gauge set by using a CO_2 charge hose or 1/4" pipe.

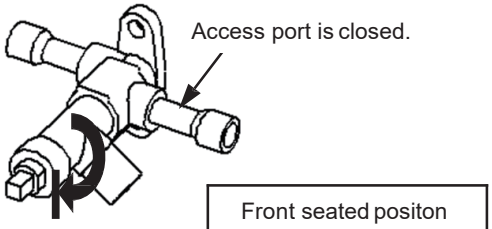


3) Check that the joint valve is closed and set the high pressure service valve to the back seated position (the access port is open), and the low pressure service valve to the front seated position.

Note: Do not charge the refrigeration unit with liquid refrigerant from the low pressure side under any circumstances. Refer to Initial Refrigerant Charging and Method of Charging procedures as shown on pages 20 and 21.



Back seated positon
Turn the stem fully counterclockwise



Front seated positon
Turn the stem fully clockwise

4) Adjust the zero point of the platform scale.

5. CO_2 refrigerant grade

Charge CO_2 refrigerant (R744) that is compatible with the following specifications.

Item	Specifications
Purity	> 99.9% (volume)
Moisture	< 0.005% (volume)
Total sulfur	< 0.03ppm (weight)
Inert gas (H_2, N_2, O_2, Ar)	< 0.01% (volume)

6. Refrigerant Charging

1) With the refrigeration unit being stopped, open the joint valve and gradually charge the refrigeration unit with refrigerant in the liquid state.

   When it is difficult to adjust the charging speed by using the joint valve or the charging valve of manifold gauge set, install a capillary tube between the CO_2 refrigerant cylinder and manifold gauge set.

   Note: Do not install a capillary tube between the service piping and manifold gauge set.

2) When the liquid refrigerant no longer goes into the refrigeration unit, close the access port of the high pressure service valve (the front seated position) and make the refrigeration unit in cooling operation condition to adjust refrigerant quantity using the access port of the low pressure service valve (the back seated position).

   Note: In order to avoid overcharging, maintain the charging rate at approx. 20 g in 5 seconds.

3) After completing charging operation, close the refrigerant cylinder valve and check that the access ports of the low pressure and high pressure service valves have been closed.

4) Gradually open the purge valve of the manifold gauge set, and release the refrigerant remaining in the service piping, manifold gauge set, and charge hose (or 1/4" pipe).

   When detaching the service piping, refer to “Service Pipe Connection/Disconnection Method”.

GAS LEAK REPAIR PROCEDURE

1. Gas leak position identification

   1) When using a liquid type leak detector
      Identify the position where oil is leaking.
      Find gas leaks by applying the liquid type leak detector and checking for foaming.

   2) When using a leak detector
      Identify the position where oil is leaking.
      Detect gas leaks by bringing the leak detector probe near the identified position.

      Note: Use caution not to blow air during the detection process. Detector reacts to blown air.

2. Releasing refrigerant

   Release refrigerant in accordance with “Refrigerant Releasing Procedure".

3. Brazing repair operation

   1) Prepare for brazing operation.

      You will need the following tools during brazing operation:

      - Brazing burner
      - Phosphor copper solder
        If silver brazing solder is to be used, do not use any flux containing chlorine.
      - Shield plate, heat insulation plate, wet waste cloth
      - Blow and replacement nitrogen

   2) Carry out brazing operation.

      Since the copper pipes used with the CO_2 refrigeration unit have a thicker wall than the HFC refrigeration unit, make sure that the melted brazing material is fully wetting the target position.

      Notes: 1. Maintain a flow of oxygen-free nitrogen through the brazing position at a very low pressure during brazing. Nitrogen displaces the air and prevents the formation of copper oxides in the brazing position.

      2. During brazing, make sure that there is no refrigeration oil residue on the surface.

4. Airtight test

   Carry out the airtight test in accordance with "Airtight Test Procedure ".

5. Evacuation

   Carry out the evacuation in accordance with "Vacuum Pump Attachment and Evacuation Procedure".

6. Refrigerant Charging

   Charge the refrigeration unit with refrigerant in accordance with "Refrigerant Charging Procedure".

COMPRESSOR REPLACEMENT PROCEDURE

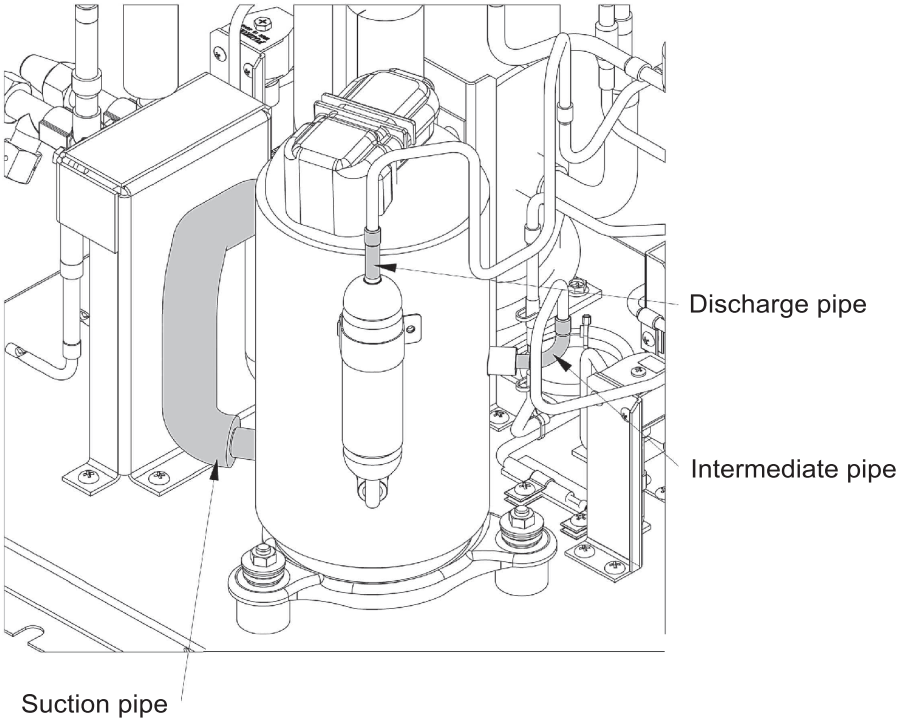
1. Preparation for compressor replacement

1) Release refrigerant in accordance with “Refrigerant Releasing Procedure”.

2) Remove the heat insulation material of the 1st stage suction pipe (cut out ties).

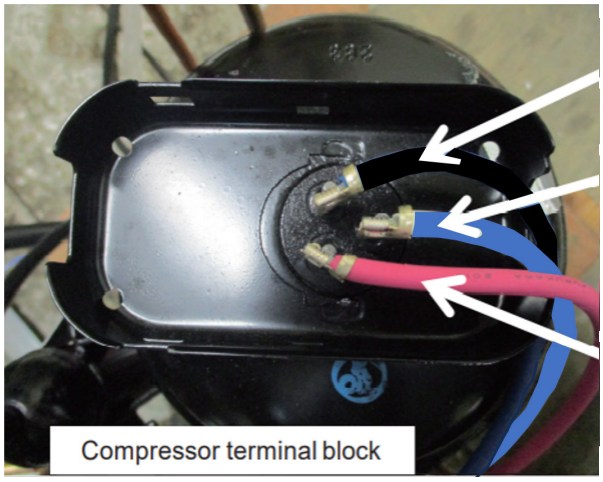
3) Remove the temperature sensor of the 2nd stage discharge pipe.

4) Loosen the three bolts securing the compressor.



5) Turn OFF the ground fault interrupter when the pressure indication on CR2-EN PCB reaches zero and the refrigerant release sound is no longer heard.

6) Remove the terminal cover of the compressor, and disconnect all lead wires of U,V, and W phase from the compressor terminal block S(W) ,R and C(T).



C(T) phase lead wire (white)
Notation of circuit diagram W.

S(W) phase lead wire (Blue).
Notation of circuit diagram V.

R phase lead wire (Red)
Notation of circuit diagram U.

7) Remove the crank case heater under the compressor.

⚠CAUTION

» **Always wear protective gear when servicing equipment.**

2. Compressor removal

1) After completing the preparation for compressor replacement, cut the compressor piping at five places (1st stage suction, 1st stage discharge, 2nd stage suction, 2nd stage discharge, and oil return) using a pipe cutter or cable cutter.

Notes: 1. The cutting position should be on the compressor side of the welded part as follows. Cutting the refrigeration unit side would disable recovery.

2. Use sufficient caution not to deform the welded part of the pipe while cutting.

2) Remove the securing bolt, spring washer, flat washer, and protective rubber washer, etc. in three places (two places in the front and one in the back) of the compressor to be replaced.

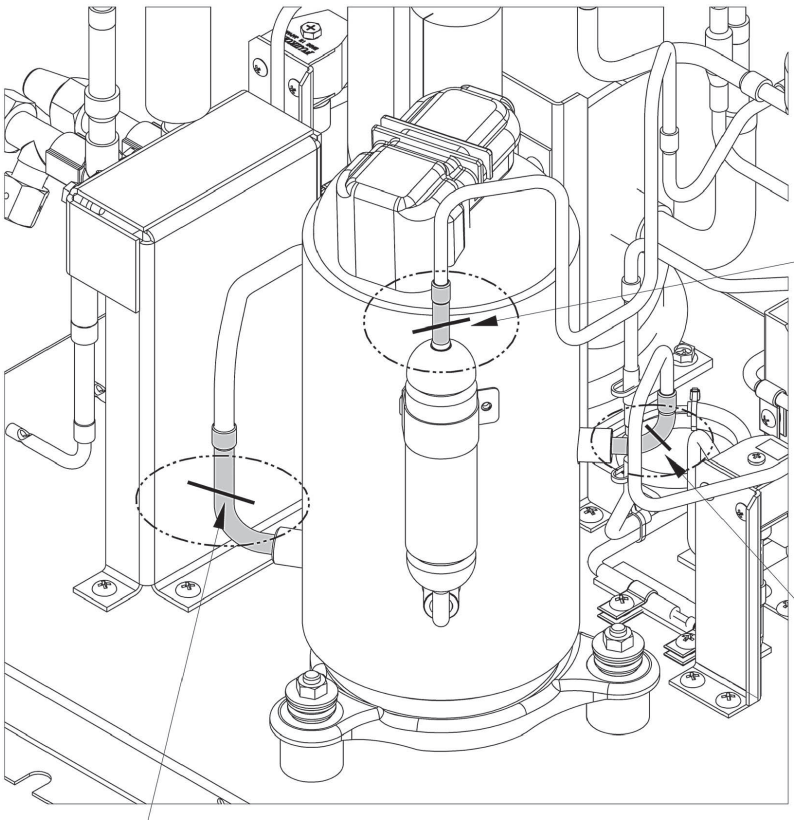
3) Remove the compressor from the refrigeration unit.

4) Remove the compressor pipe left on the refrigeration unit side by heating the cut end.

Notes: 1. In order to avoid heating flame radiation, make sure to cover the wiring and heat insulation material with a wet waste cloth.

2. During heating, supply nitrogen gas by using the service piping (SPK-TU125). Nitrogen displaces the air and prevents the formation of copper oxides in the heating position.

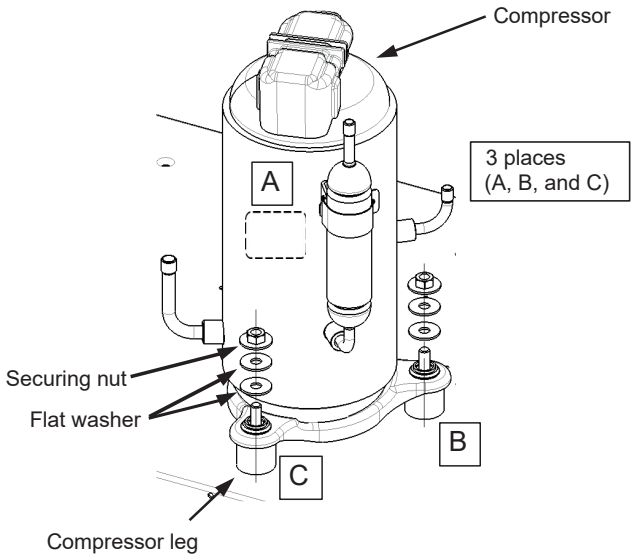
5) Remove the secured part of the piping. (Make sure to prevent bending/deformation.)



3. Service compressor installation
   1) Place the service compressor in its original position, and install the securing bolt, spring washer, flat washer, and protective rubber washer, etc. (three places)

Note: 1. Incorrect attachment may cause excessive vibration and lead to a piping breakage failure. Carefully check with the illustration shown below.
2. The securing nut on each compressor leg must be tightened once and then re-tightened for confirmation purposes. (two times in total)

Tightening order A⇒B⇒C⇒A⇒B⇒C, tightening torque is 115 ± 9 in-lb (13 ± 1 N-m)



2) Insert each pipe into the compressor and connect it by brazing.

Note: During brazing, supply nitrogen gas by using the service piping (SPK-TU125). Nitrogen displaces the air and prevents the formation of copper oxides in the brazing position.

3) After completing brazing, perform an airtight test of the brazed part.

4) Reconnect the removed wires in their original configuration.
   - Compressor wiring, terminal cover

5) Turn on the power and confirm that it is in the evacuation mode (indication of “uAcU” on CR2-EN PCB). (Refer to “Evacuation Mode”.)

6) Release the nitrogen used for the airtight test and apply evacuation.

7) During evacuation, install the remaining heat insulation materials, anti-vibration materials, etc.
   - Discharge gas temperature sensor
   - Heat insulation material
   - Crank case heater

8) After completing evacuation, charge the specified quantity of refrigerant.

OIL REFILLING PROCEDURE

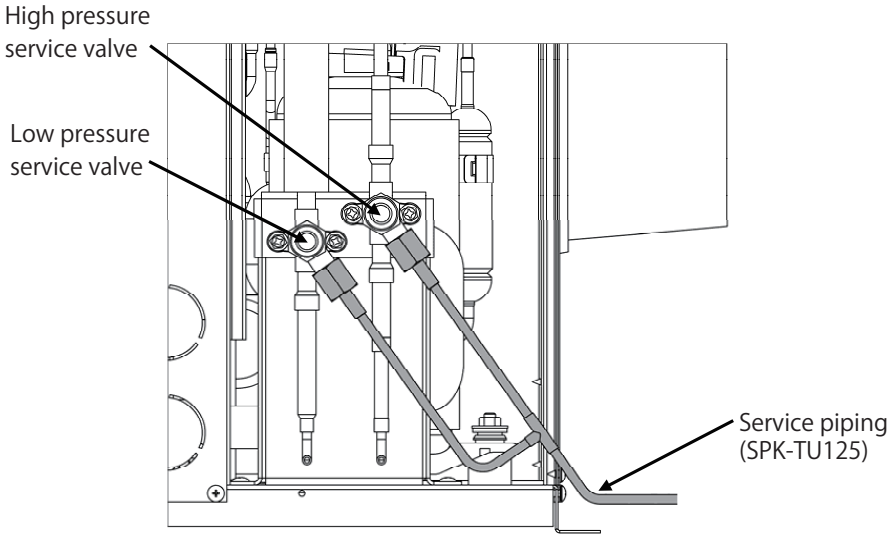
⚠CAUTION

» **In principal, there is no need for adding oil to the refrigeration unit. However, if such an operation is required when moving the refrigeration unit or for other reasons, then comply with the following procedure:**

» **(Any failure of a refrigeration unit resulting from moving is not covered by the warranty.)**

1. Release of refrigerant and evacuation
   1) Carry out the release of refrigeration and the evacuation of the refrigerant circuit in accordance with the "Refrigerant Releasing Procedure" and "Vacuum Pump Attachment and Evacuation Procedure".
   2) After completing the evacuation, set the high pressure and low pressure service valves to the back seated position. (The access ports of the high pressure and low pressure service valves have been closed.)
   3) Remove the service piping (SPK-TU125).

2. Addition of oil
   1) Attach the service piping for oil (SPK-TU125) to the low pressure service valve. (Joint valve of the service piping is "CLOSED")
   2) Assemble the extension pipe to the joint valve. Make sure that the tip of the pipe reaches the bottom of the oil container.
   3) Set the low pressure service valve to the mid-position (the access ports are open), and open the joint valve (oil is sucked up). Have the high pressure service valve seated in the back position.
   4) After completing oil suction, close the joint valve and remove the extension pipe from the joint valve.
   5) Connect a nitrogen cylinder to the joint valve. Pump the oil remaining in the service piping into the circuit using nitrogen.
   6) After completing this process, set the low pressure service valve to the back seated position, and remove the service piping and nitrogen cylinder.



⚠CAUTION

» **When setting each service valve to the front seat, recheck in advance that there is no slack in the nut of each service valve, or in the joint of the service valve adapter. A loose nut or pipe joint may cause the refrigerant to leak out.**

OPTIONAL ACCESSORIES

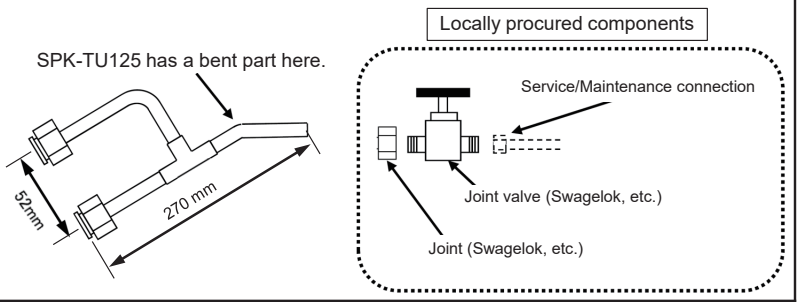
Name	Details	Applicable refrigeration unit
Suction Line Filter Part number: 3201567	KGQ-S45070-001 (Sanhua) ½" Connection, 5.8" Length	OCU040xxx
Liquid Line Filter Drier Part number: 3175674	CASTEL or Sanhua ½" Connection, 5.8" Length	
Service Valve Adapter Part number: 3202781	SPK-TU125	
Idemitsu Oil Part number: 3204671	1 Quart	

Service Valve Adapter

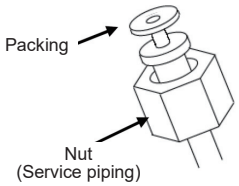
Service Valve Adapter is required when connecting the refrigeration unit and vacuum pump, cylinders, etc., during installation.

Use these components to connect to locally sourced components.

Service Valve Adapter (SPK-TU125)



Service Valve Adapter (packing attachment)



Notes: 1. Install the packing by avoiding the adherence of dust.
2. Fasten the nut with fastening torque of 13 ± 1 N•m.

REPLACEMENT PARTS

	Part Number	Description
1.	3174959	COMPRESSOR 8LV080ZA0F0B
2.	3204671	OIL-PZ68S (1 qt)
3.	3175862	COIL-GAS COOLER CR400VF8A
4.	3175567	SUBCOOLER CR400VF8A
5.	3175597	GUARD-FAN CR400VF8A
6.	3175602	VALVE-HPV-102D, SOLENOID VALVE EV1
7.	3175855	COIL-EV1 HPV MOAJ503A1
8.	3175624	FAN-BLADE CR400VF8A
9.	3176060	TRANSDUCER-HSK-BC150D-014
10.	3175670	SENSOR-TEMP GASCOOLER OUTLET
11.	3175671	SENSOR-TEMP AMBIENT
12.	3175672	SENSOR-TEMP DISCHARGE GAS
13.	3176061	SENSOR-TEMP SPLIT HEAT EXCHANGER/UNIT OUTLET
14.	3177339	SENSOR-TEMP ELECTRICAL BOX
15.	3175674	FILTER DRIER-DTG-C05030-901, 3/8"
16.	3201567	STRAINER-KGQ-S45070-01, 1/2" SUCTION FILTER
17.	3175707	VALVE-DPF R05 2.4D-04, MOV5/6 BODY
18.	3175709	VALVE-COIL PQ-M08024-13001, MOV5/6 COIL
19.	3175710	VALVE-DPF R04 1.5D-07, MOV7 BODY
20.	3175712	VALVE-COIL PQ-M15024-001003, MOV7 COIL
21.	3175856	VALVE-EV2 HPV-402DQ3
22.	3175857	COIL-EV2 HPV-MOAQ2680C1
23.	3175858	MOTOR-SIC-71FW-D8120-10A
24.	3175861	RELAY-AUX MC200-240A2-F
25.	3176059	CRANKCASE HEATER-SP4518P-X
26.	3176299	SWITCH-HIGH PRESSURE DC 12V
27.	3176369	REACTOR-25A 60HZ
28.	3181681	VALVE-HIGH PRES 0.500 120 BAR
29.	3201559	VALVE-HIGH PRES 0.500 90 BAR
30.	3181680	VALVE-INTER PRES 0.500 80 BAR
31.	3197644	VALVE-HIGH PRES 0.500 60 BAR
32.	3181761	ADAPTER-PRV VALVE 0.500
33.	3182229	FILTER-CONTROL CR400VF8A
34.	3197463	PCBA-INV4-MF-EN
35.	3197464	PCBA-INV4-H-EN
36.	3197465	PCBA-CR2-EN
37.	3197466	PCBA-CRD2-EN
38.	0397726000	RELAY-3PH VOLTAGE MONITOR 201A

WARRANTY INFORMATION

HUSSMANN®

To obtain warranty information or other support, contact your Hussmann representative or visit: https://www.hussmann.com/services/warranty.

Please include the model and serial number of the product.

For questions about your equipment please contact our Technical Support Team 866-785-8499

For General Support or Service Calls contact our Customer Support Call Center 800-922-1919

For ordering Aftermarket Warranty Parts 1-855-Huss-Prt (1-855-487-7778)
Hussmann_part_warranty@hussmann.com

REVISIONS

Rev. A - July 2024 - Initial release