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# SPLIT SYSTEM HEAT PUMP & AIR ACONDITIONER - 18 SEER

## 2, 3, 4 and 5 Tons.

IDIC-8024KF-3 - IDIC-8024KC-3, / IDIC-8036KF-3 - IDIC-8036KC-3,
IDIC-8048KF-3 - IDIC-8048KC-3, / IDIC-8060KF-3 - IDIC-8060KC-3.

# INSTALLATION INSTRUCTIONS

intensity.mx

MAN-I-IDC-0615

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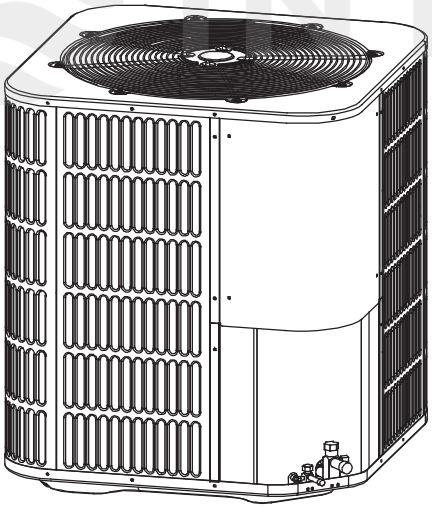

**NOTE**: Appearance of unit may vary.

## Air conditioning & Heating

ALL phases of this installation must comply with NATIONAL, STATE AND LOCAL CODES

IMPORTANT — This Document is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

These instructions do not cover all variations in systems or provide for every possible contingency to be met in connection with the installation. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to your installing dealer or local distributor.

***Note :*** *The manufacturer recommends installing only approved matched indoor and outdoor systems. All of the manufacturer's split systems are A.H.R.I. rated only with TXV indoor systems. Some of the benefits of installing approved matched indoor and outdoor split systems are maximum efficiency, optimum performance and the best overall system reliability.*

## Section 1. Safety

**Important** - This document contains a wiring diagram and service information. This is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

**CAUTION**

This information is intended for use by individuals possessing adequate backgrounds of electrical and mechanical experience. Any attempt to repair a central air conditioning product may result in personal injury and/or property damage. The manufacturer or seller cannot be responsible for the interpretation of this information, nor can it assume any liability in connection with its use.

**WARNING**

**HAZARDOUS VOLTAGE!**

Failure to follow this warning could result in property damage, severe personal injury, or death.
Disconnect all electric power, Including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized.

**WARNING**

**REFRIGERANT OIL!**

Any attempt to repair a central air conditioning product may result in property damage, severe personal injury, or death.
These units use R-410A refrigerant which operates at 50 to 7o% higher pressures than R-22. Use only R-410A approved service equipment. Refrigerant cylinders are painted a "Rose" color to indicate the type of refrigerant and may contain a "dip" tube to allow for charging of liquid refrigerant into the system. All R-410A systems with variable speed compressors use a PVE oil that readily absorbs moisture from the atmosphere To limit this 'hygroscopic" action. the system should remain sealed whenever possible. If a system has been open to the atmosphere for more than 4 hours, the compressor oil must be replaced. Never break a vacuum with air and always change the driers when opening the system for component replacement.

**CAUTION**

**HOT SURFACE!**

May cause minor to severe burning. Failure to follow this Caution could result in property damage or personal injury.
Do not touch top of compressor.

**CAUTION**

**CONTAINS REFRIGERANT!**

Failure to follow proper procedures can result in personal illness or injury or severe equipment damage.
System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening system.

**CAUTION**

**GROUNDING REQUIRED!**

Failure to inspect or use proper service tools may result in equipment damage or personal injury.
Reconnect all grounding devices. All parts of this product that are capable of conducting electrical current are grounded. if grounding wires, screws, straps, clips, nuts, or washers used to complete a path to ground are removed for service, they must be returned to their original position and properly fastened.

**WARNING**

**SERVICE VALVES!**

Failure to follow this warning will result in abrupt release of system charge and may result in personal injury and/or property damage. Extreme caution should be exercised when opening the Liquid Line Service valve. Turn valve stem counterclockwise only until the stem contacts the rolled edge. No torque is required.

**WARNING**

**BRAZING REQUIRED!**

Failure to inspect lines or use proper service tools may result in equipment damage or personal injury.
if using existing refrigerant lines make certain that all joints are brazed, not soldered.

**WARNING**

**HIGH LEAKAGE CURRENT!**

Failure to follow this warning could result in property damage, severe personal injury, or death.
Earth connection essential before connecting electrical supply.

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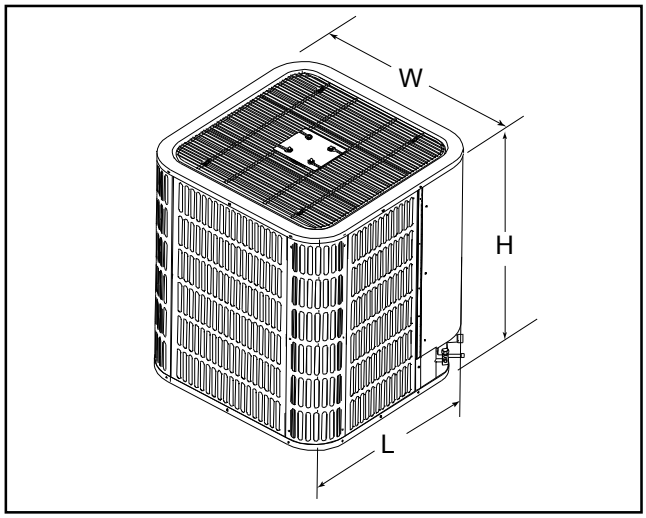
# Section 2. Unit Location Considerations

## 2.1 Unit Dimensions

| Unit Dimensions | |
|---|---|
| Models | H x W x L(Inches) |
| 24 | 24-15/16 x 29-1/8 x 29-1/8 |
| 36 | 24-15/16 x 29-1/8 x 29-1/8 |
| 48 | 33-3/16 x 29-1/8 x 29-1/8 |
| 60 | 33-3/16 x 29-1/8 x 29-1/8 |

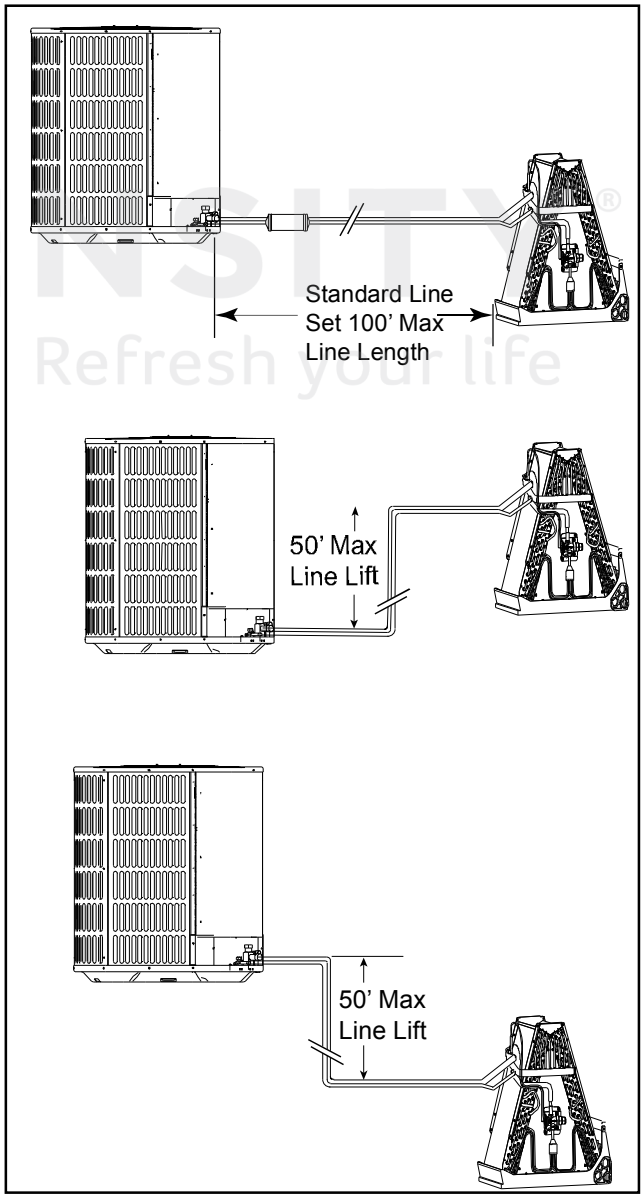
The unit's weight values is on the carton box.

When mounting the outdoor unit on a roof, be sure the roof will support the unit's weight. Properly selected isolation is recommended to prevent sound or vibration transmission to the building structure.




## 2.2 Refrigerant Piping Limits

- Maximum line length = 100 feet.
- Maximum vertical length = 50 feet.
- Compressor crankcase heat is required for line lengths over 50 feet.
- Use only the line diameters indicated in Table 5.1.
- Such as the connecting tube is more than 60 feet, does not use large Suction line than recommend.

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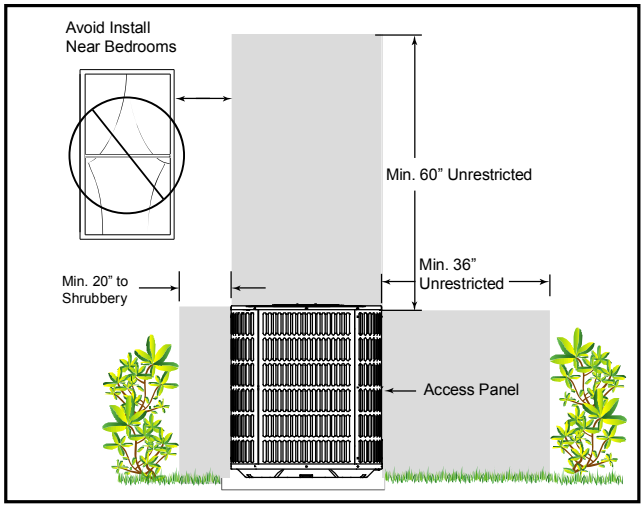
## 2.4 Location Restrictions

Ensure the top discharge area is unrestricted for at least 60 inches above the unit.

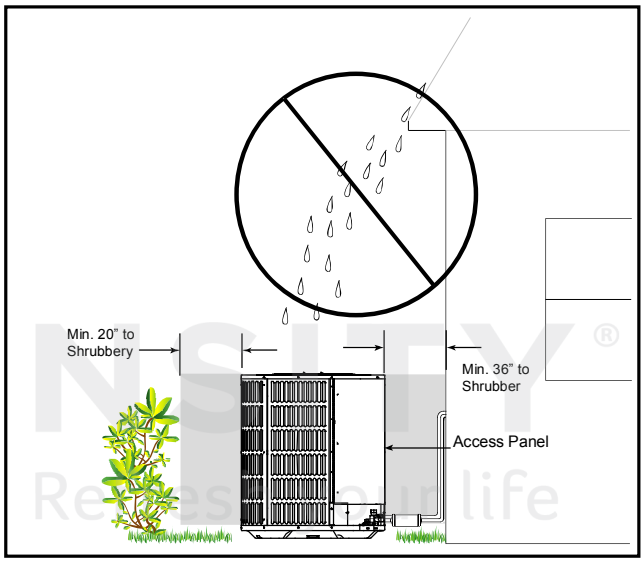
Clearance must be provided in front of the control box (access panels) and any other side requiring service.

Do not locate close to bedrooms, operational sounds may be objectionable.




Position the outdoor unit a minimum of 20 inches from any wall or surrounding shrubbery to ensure adequate airflow.

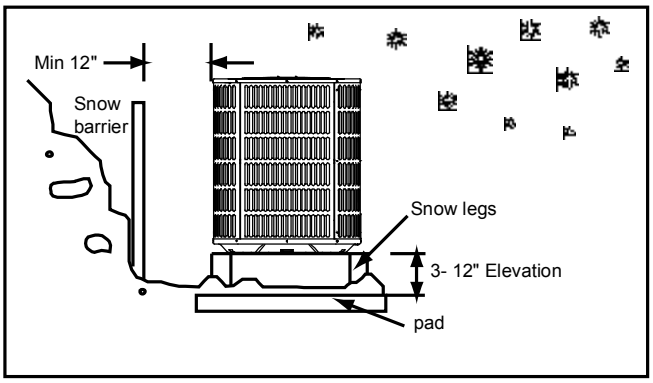
Outdoor unit location must be far enough away from any structure to prevent excess roof runoff water from pouring directly on the unit.




Cold Climate Considerations (Heat Pump Only)

Note: It is recommended that these precautions be taken for units being installed in areas where snow accumulation and prolonged below-freezing temperatures occur.

• Units should be elevated 3-12 inches above the pad or rooftop, depending on local weather. This additional height will allow drainage of snow and ice melted durlng defrost cycle prior to its refreezlng. Ensure that drain holes in unit base pan are not obstructed, preventing drainage of defrost water.
• If possible, avoid locations that are likely to accumulate snow drifts. if not possible, a snow drift barrier should be installed around the unit to prevent a build-up of snow on the sides of the unit.

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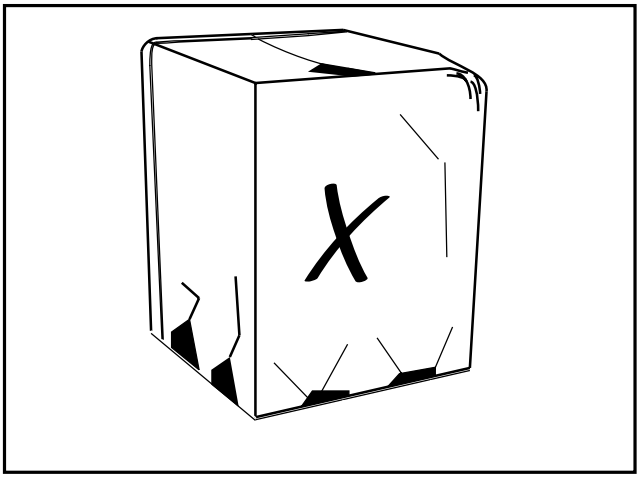
## Section 3. Unit Preparation

### 3.1 Prepare The Unit For Installation

**STEP 1 -** Check for damage and report promptly to the carrier any damage found to the unit.

The charge port can be used to check to be sure the refrigerant charge has been retained during shipment.

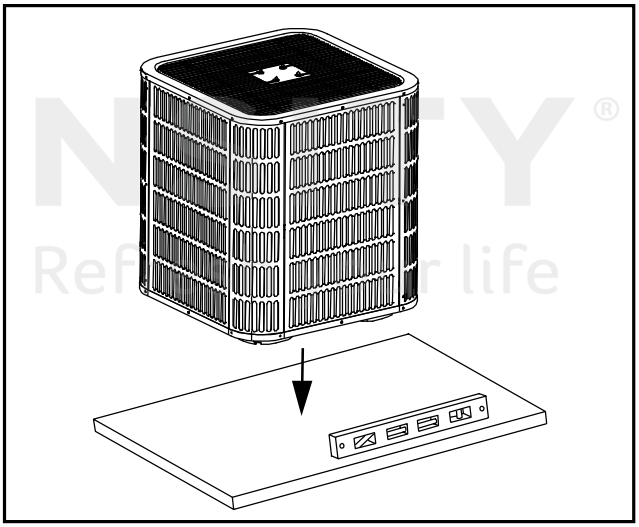


## Section 4. Setting the Unit

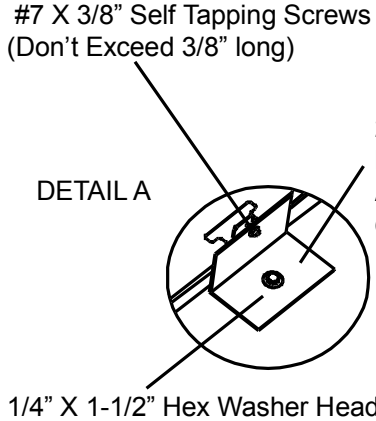
### 4.1 Pad Installation

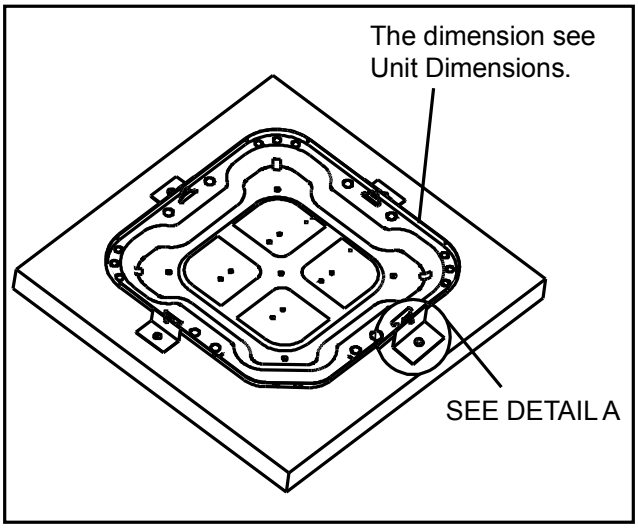
When installing the unit on a support pad, such as a concrete slab, consider the following:

- The pad should be at least 1-2” larger than the unit on all sides.
- The pad must be separate from any structure.
- The pad must be level.
- The pad should be high enough above grade to allow for drainage.
- The pad location must comply with National, State, and Local codes.



**IMPORTANT NOTE:**
These instructions are intended to provide a method to tie-down system to cement slab as a securing procedure for high wind areas. It is recommended to check Local Codes for tie-down methods and protocols.



# Section 5. Refrigerant Line Considerations

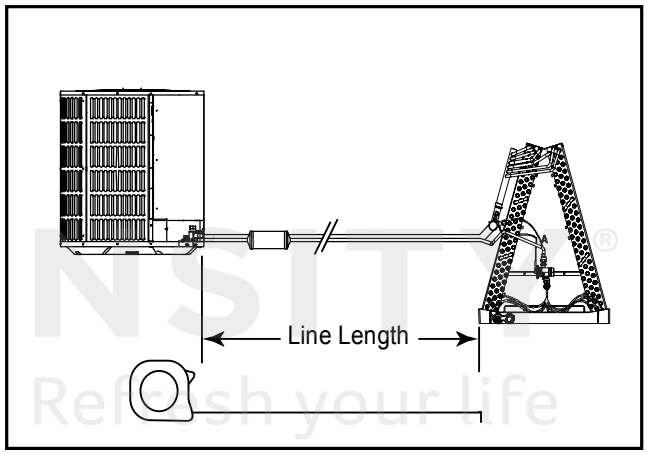
## 5.1 Refrigerant Line and Service Valve Connection Sizes

**Table 5.1**

| Model | Line Sizes | | Service Valve Connection Sizes | |
|---|---|---|---|---|
| | Suction Line | Liquid Line | Suction Line Connection | Liquid Line Connection |
| 24 | 3/4 | 3/8 | 3/4 | 3/8 |
| 36 | 3/4 | 3/8 | 3/4 | 3/8 |
| 48 | 7/8 | 3/8 | 7/8 | 3/8 |
| 60 | 7/8 | 3/8 | 7/8 | 3/8 |

## 5.2 Required Refrigerant Line Length

Determine required line length.

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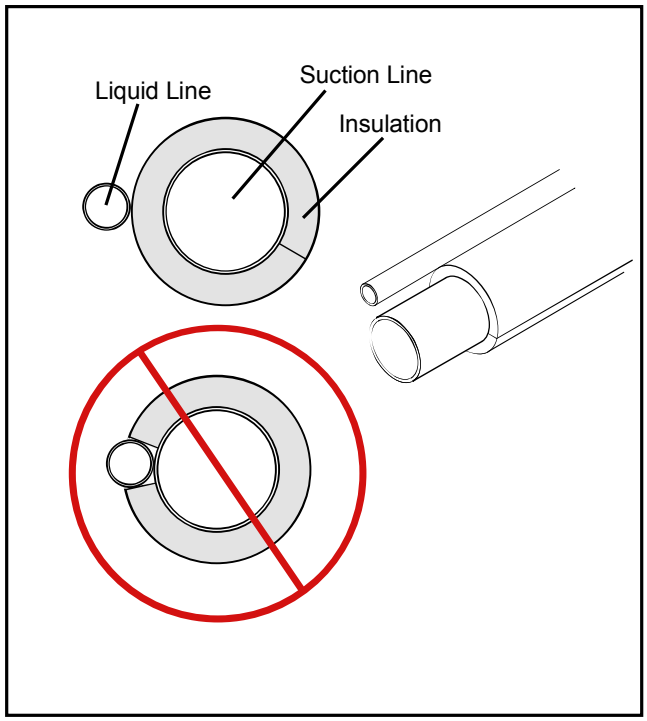
## 5.3 Refrigerant Line Insulation

***Important:*** The Suction Line must always be insulated. DO NOT allow the Liquid Line and Suction Line to come in direct (metal to metal) contact.



### 5.4 Reuse Existing Refrigerant Lines

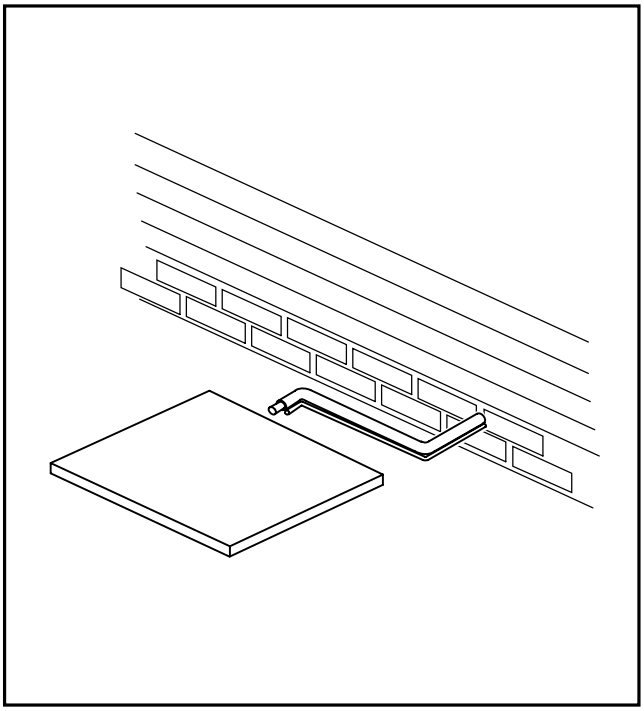
**⚠ CAUTION**

If using existing refrigerant lines make certain that all joints are brazed, not soldered.

For retrofit applications, where the existing refrigerant lines will be used, the following precautions should be taken:

- Ensure that the refrigerant lines are the correct size. Refer to Section 2.2 listed and Table 5.1.
- Ensure that the refrigerant lines are free of leaks, acid, and oil.

***Note:*** The manufacturer recommends installing only approved matched indoor and outdoor systems. All of the manufacturer's split systems are A.H.R.I. rated only with TXV indoor systems. Some of the benefits of installing approved matched indoor and outdoor split systems are maximum efficiency, optimum performance and the best overall system reliability.



## Section 6. Refrigerant Line Routing

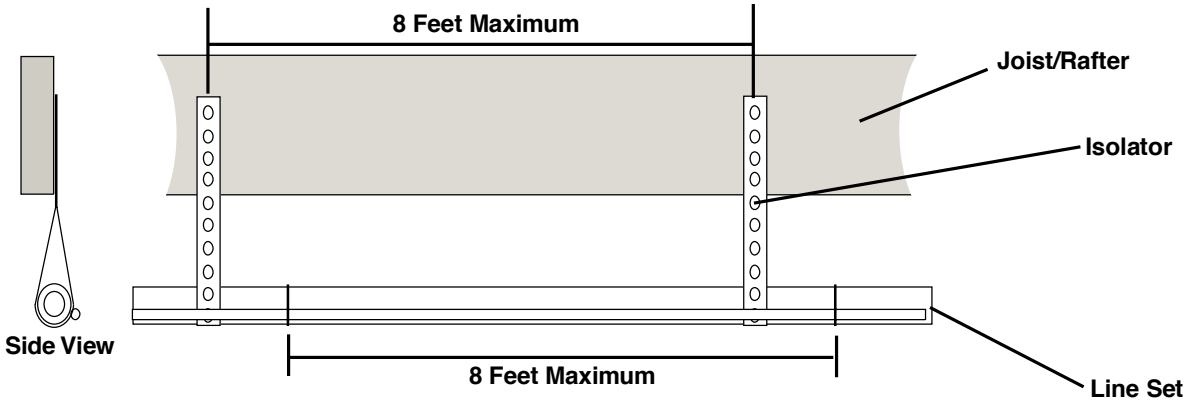
### 6.1 Precautions

***Important:*** Take precautions to prevent noise within the building structure due to vibration transmission from the refrigerant lines.

Comply with National, State, and Local Codes when isolating line sets from joists, rafters, walls, or other structural elements.

For Example:

- When the refrigerant lines have to be fastened to floor joists or other framing in a structure, use isolation type hangers.
- Isolation hangers should also be used when refrigerant lines are run in stud spaces or enclosed ceilings.
- Where the refrigerant lines run through a wall or sill, they should be insulated and isolated.
- Isolate the lines from all ductwork.
- Minimize the number of 90º turns.




**Secure Suction line from joists using isolators every 8 ft. Secure Liquid Line directly to Suction line using tape, wire, or other appropriate method every 8 ft.**

**Isolation From Joist/Rafter**

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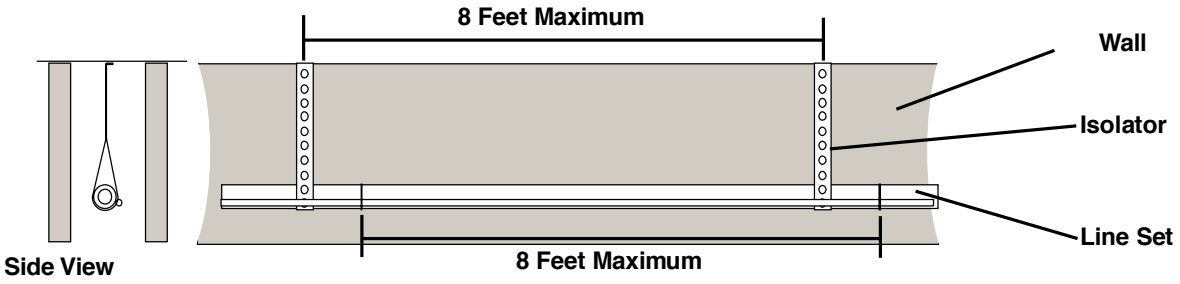
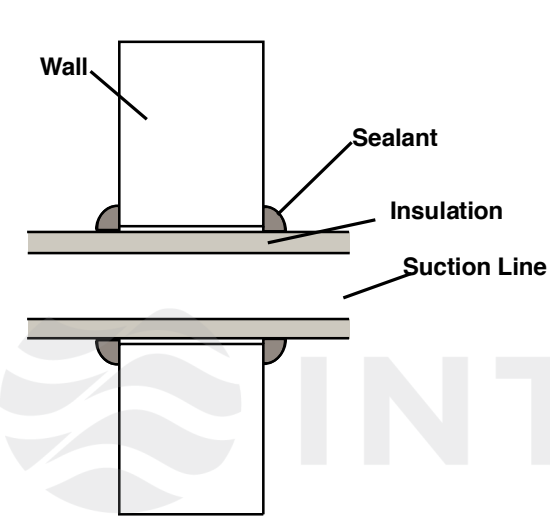
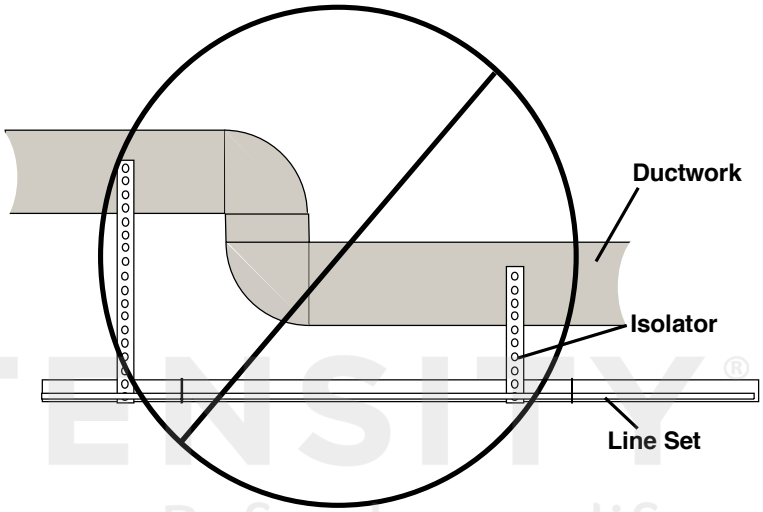



**Secure Suction Line using isolators every 8 ft. Secure Liquid Line directly to Suction Line using tape, wire, or other appropriate method every 8 ft.**

**Isolation In Wall Spaces**




**Isolation Through Wall**

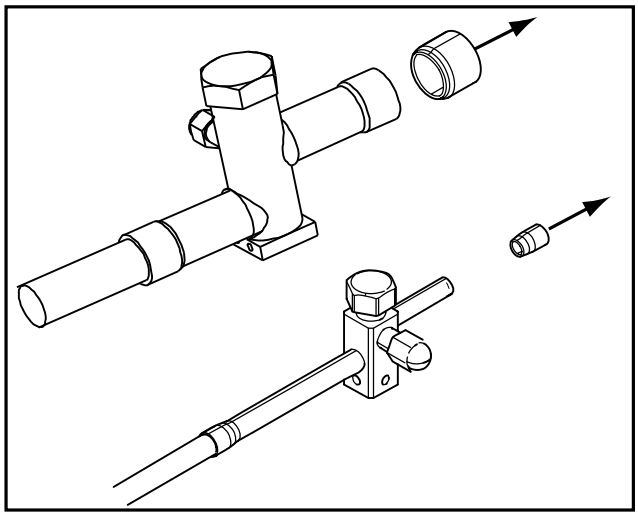



**DO NOT hang line sets from ductwork**

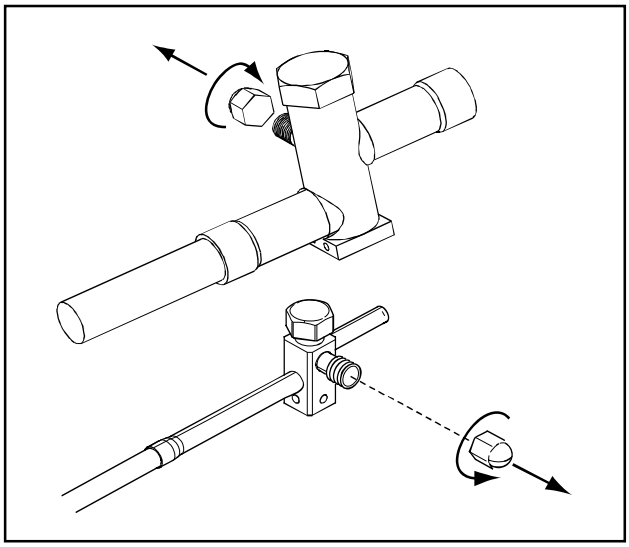
## Section 7. Refrigerant Line Brazing

### 7.1 Braze The Refrigerant Lines

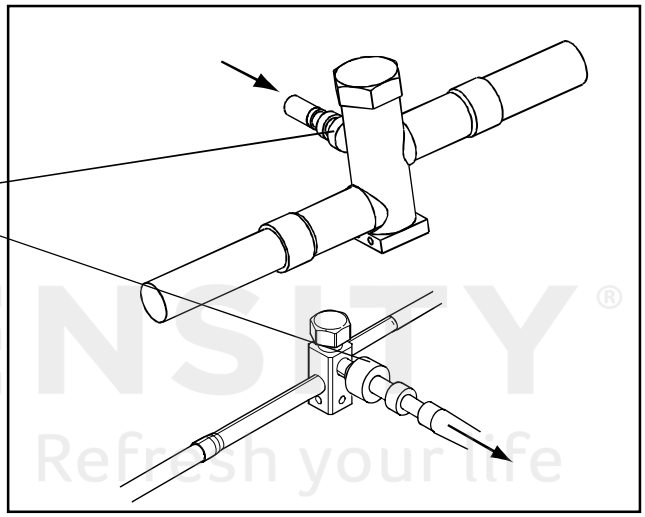
**STEP 1** - Remove caps or plugs. Use a deburing tool to debur the pipe ends. Clean both internal and external surfaces of the tubing using an emery cloth.



**STEP 2** - Remove the pressure tap cap from both service valves.



**STEP 3** - Purge the refrigerant lines and indoor coil with dry nitrogen.

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**STEP 4** – Wrap a wet rag around the valve body to avoid heat damage and continue the dry nitrogen purge.

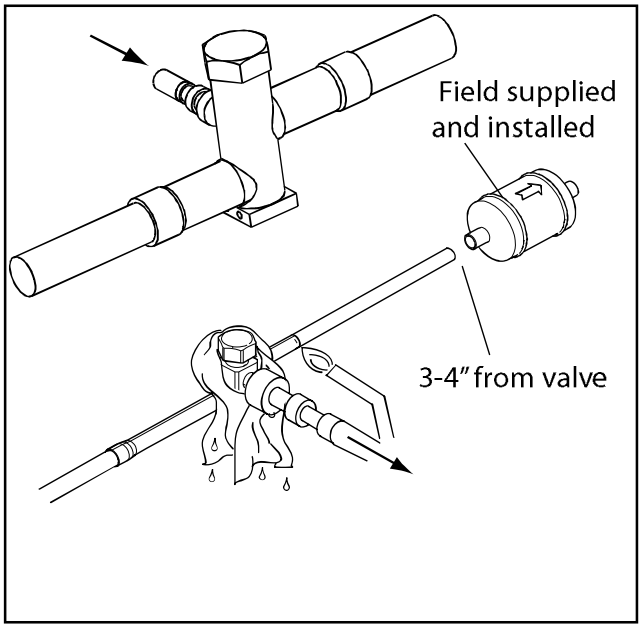
Braze the refrigerant lines to the service valves.

Check liquid line filter drier's directional flow arrow to confirm correct direction of refrigeration flow (away from outdoor unit and toward evaporator coil) as il–lustrated. Braze the filter drier to the Liquid Line.

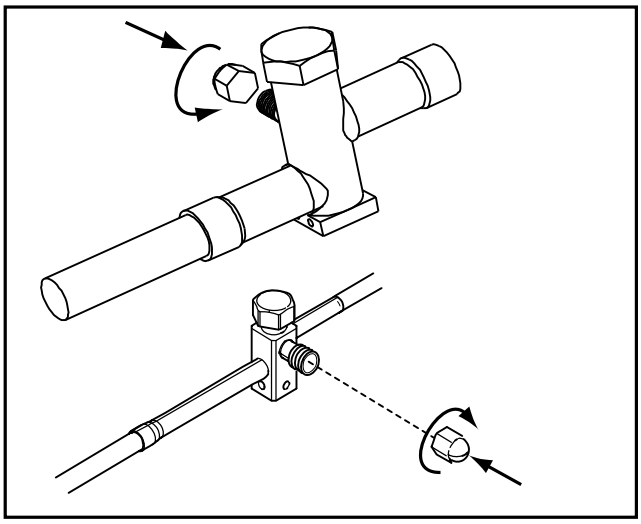
Continue the dry nitrogen purge. Do not remove the wet rag until all brazing is completed.

Important: Remove the wet rag before stopping the dry nitrogen purge.

***Note:*** Install drier in Liquid Line.



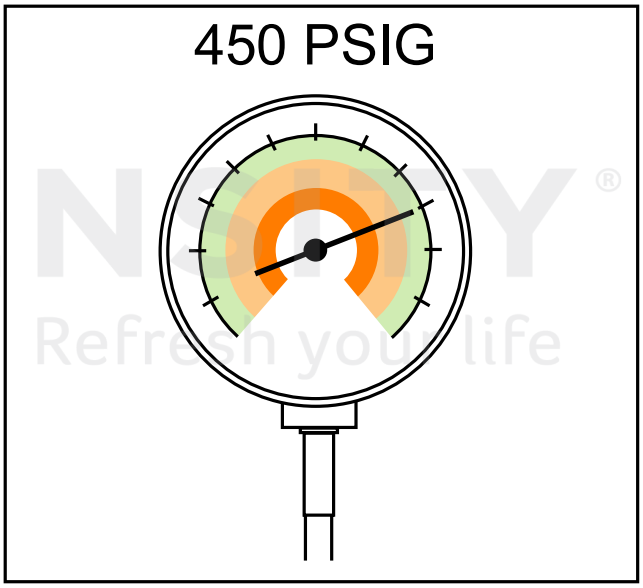
**STEP 5** - Replace the pressure tap caps after the service valves have cooled.



## Section 8. Refrigerant Line Leak Check

### 8.1 Check For Leaks

**STEP 1** –Pressurize the refrigerant lines and evaporator coil to 450 PSIG using dry nitrogen.

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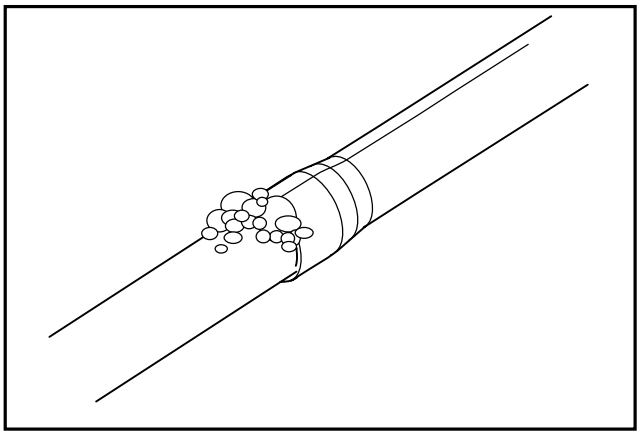
**STEP 2** –Check for leaks by using a soapy solution or bubbles at each brazed location.

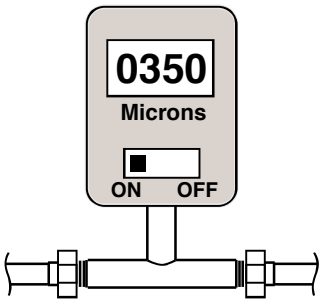


## Section 9. Evacuation

### 9.1 Evacuate the Refrigerant Lines and Indoor Coil

***Important:*** Do not open the service valves until the refrigerant lines and indoor coil leak check and evacuation are complete.

**STEP 1** – Evacuate until the micron gauge reads no higher than 350 microns, then close the valve to the vacuum pump.




**STEP 2** – Observe the micron gauge. Evacuation is complete if the micron gauge does not rise above 500 microns in one (1) minute.

Once evacuation is complete blank off the vacuum pump and micron gauge, and close the valves on the manifold gauge set.

## Section 10. Service Valves

### 10.1 Open the Service Valves

**⚠ WARNING**

Extreme caution should be exercised when opening the Liquid Line Service Valve. Turn counterclock–wise until the valve stem just touches the rolled edge. No torque is required. Failure to follow this warning will result in abrupt release of system charge and may result in personal injury and /or property damage.

***Important:*** Leak check and evacuation must be com–pleted before opening the service valves.

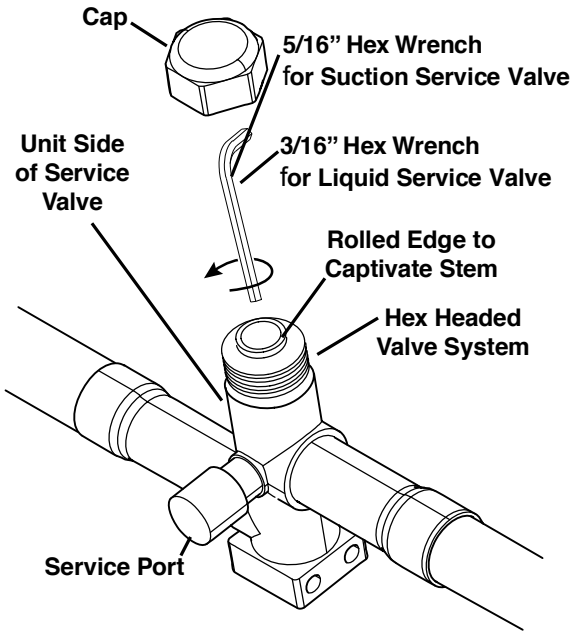
***Important:*** The Suction Service Valve must be opened first BEFORE opening the Liquid Service Valve!

**STEP 1** - Remove service valve cap.

**STEP 2** - Fully insert hex wrench into the stem and back out counterclockwise until valve stem just touches the rolled edge (approximately five (5) turns.)

**STEP 3** - Replace the valve stem cap to prevent leaks. Tighten finger tight plus an additional 1/6 turn.

**STEP 4** - Repeat STEPS 1 - 3 for Liquid Service Valve.

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# Section 11. Electrical - Low Voltage

### 11.1 Low Voltage Maximum Wire Length

Table 11.1 defines the maximum total length of low voltage wiring from the outdoor unit, to the indoor unit, and to the thermostat.

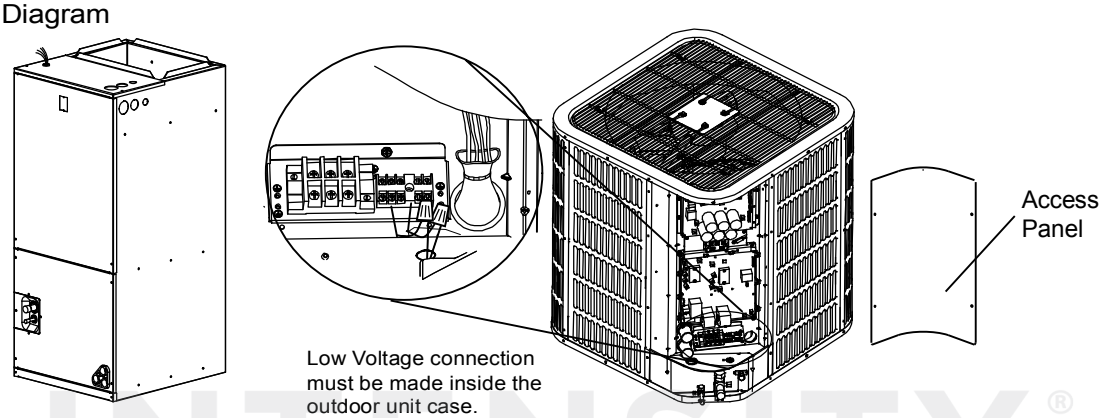
Field provided bushing or strain relief is required at the low voltage wire entry point.

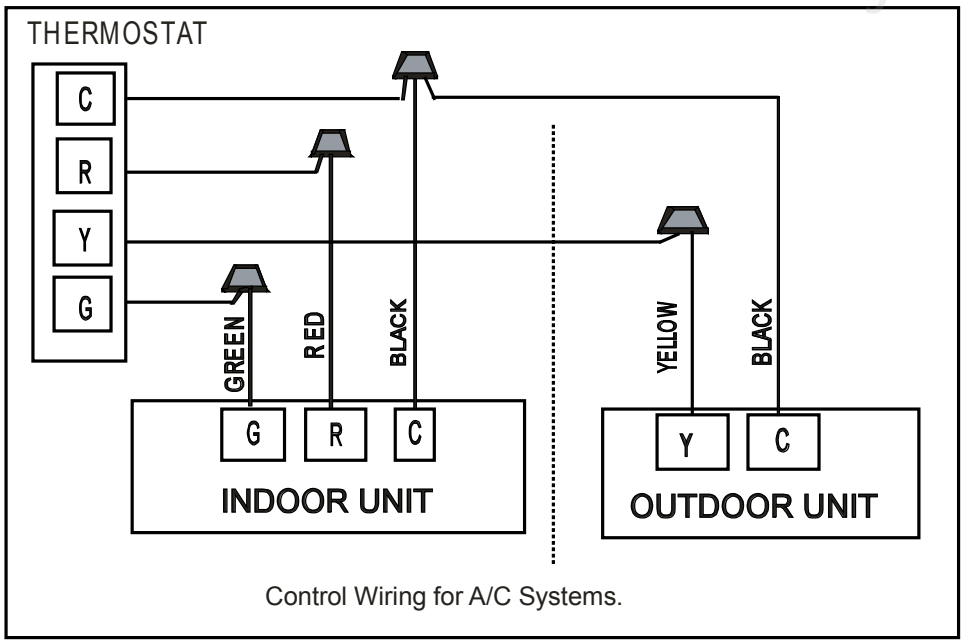
**Table 11.1**

| 24 VOLTS | |
|---|---|
| WIRE SIZE | MAX. WIRE LENGTH |
| 18 AWG | 150 Ft. |
| 16 AWG | 225 Ft. |
| 14 AWG | 300 Ft. |

### 11.2 Low Voltage Hook-up Diagrams

Air Handler Hook-up Diagram




Control Wiring for A/C Systems.

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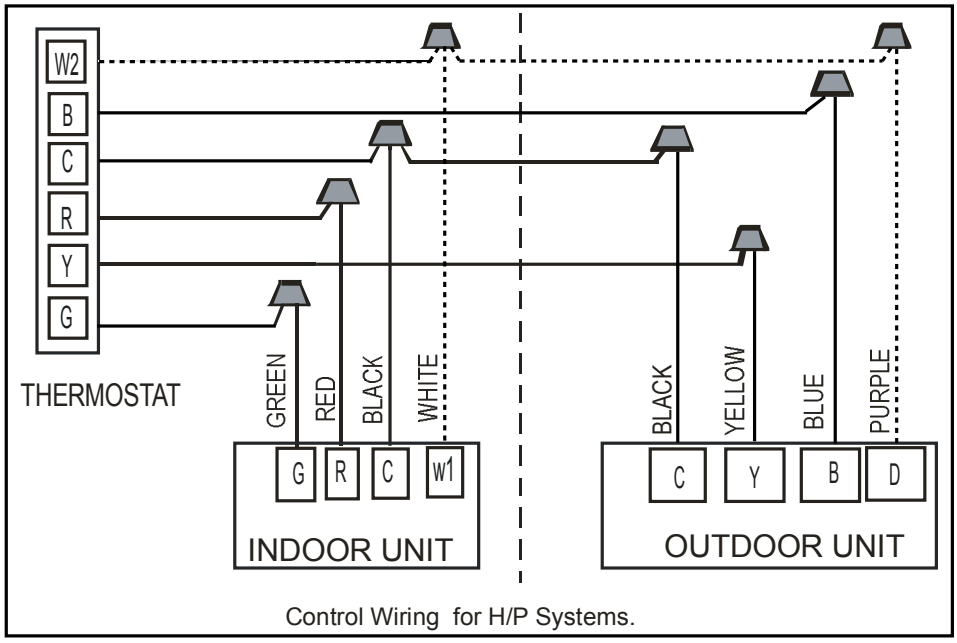


Control Wiring for H/P Systems.

*Notes:*

1. *Be sure power supply agrees with equipment nameplate.*
2. *Power wiring and grounding of equipment must comply with local codes.*
3. *Low voltage wiring to be No. 18 AWG minimum conductor.*
4. *"-----"The electric auxiliary heat connection.*

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# Section 12. Electrical - High Voltage

### 12.1 High Voltage Power Supply

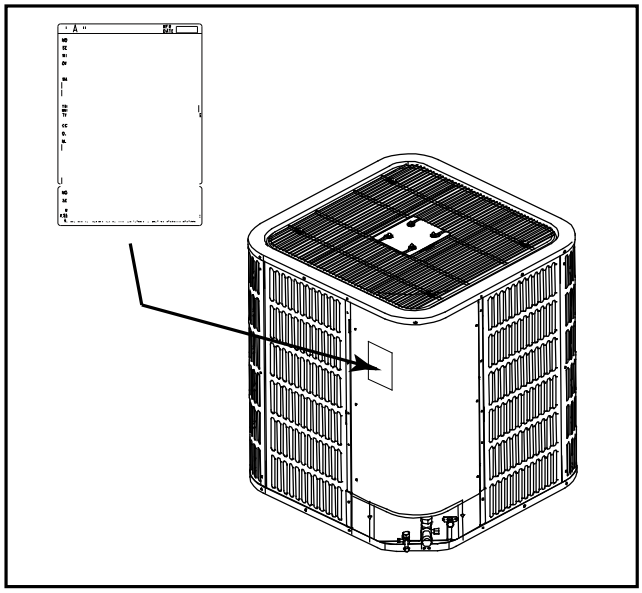
**⚠ WARNING**

LIVE ELECTRICAL COMPONENTS!
During installation, testing, servicing, and trouble-shooting of this product, it may be necessary to work with live electrical components. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

The high voltage power supply must agree with the equipment nameplate.

Power wiring must comply with national, state, and local codes.

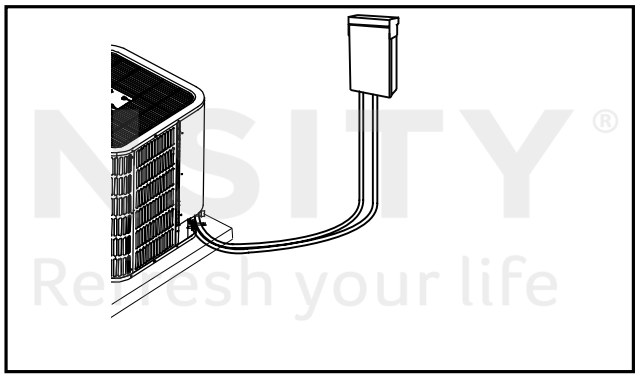
Follow instructions on unit wiring diagram located on the inside of the control box cover and in the Service Facts document included with the unit.



### 12.2 High Voltage Disconnect Switch

Install a separate disconnect switch at the outdoor unit.

Field provided flexible electrical conduit must be used for high voltage wiring.



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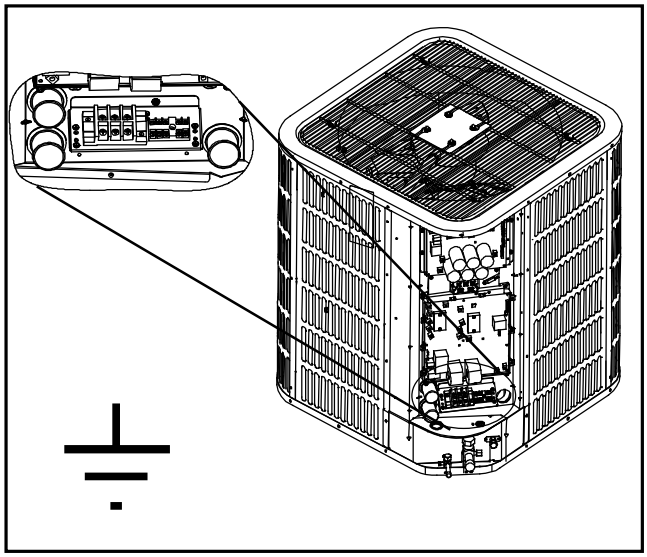
### 12.3 High Voltage Ground

Ground the outdoor unit per national, state, and local code requirements.

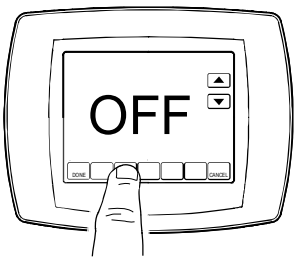


# Section 13. Start Up

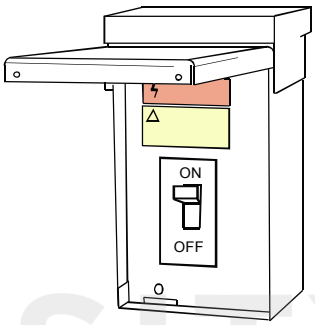
## 13.1 System Start Up

**STEP 1** - Ensure Sections 7, 8, 9, 10, 11, 12, and 13 have been completed.

**STEP 2** - Set System Thermostat to OFF.



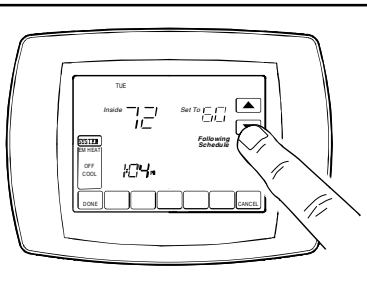

**STEP 3** - Turn on disconnect to apply power to the indoor and outdoor units.




**STEP 4** - Wait five (5) minutes before moving to Step 5 if no crankcase heater accessory is used,

Wait one (1) hour before starting the unit if compressor crankcase heater accessory is used and the Outdoor Ambient Temperature is below 70 ºF.

**STEP 5** - Set system thermostat to ON.

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# Section 14. System Charge Adjustment

## 14.1 charging: weigh-In Method

weigh-In Method can be used for the Initial installation, or anytime a system charge is being replaced. weigh-In Method can also be used when power is not available to the equipment site or operating conditions (indoor/Outdoor temperatures) are not In range to verify with the subcooling charging method.

| A | B | C |
|---|---|---|
| Model | Factory Charge | charge multiplier for interconnecting refrigerant tube length |
| All models | (The data on nameplate) | 0.6 oz/ft |

Note: The factory charge in the outdoor unit is sufficient for 15 feet of standard size interconnecting liquid line.

Table 19. New Installations — calculating charge using the weigh-In method

| | |
|---|---|
| 1. Measure in feet the distance between the outdoor unit and the indoor unit and record on (Line 1). Include the entire length of the line from the servIce valve to the IDU.<br>2. Enter the charge multiplier from column C.<br>3. Muitply the total length of refrigerant tubing (Line 1) tImes the value on step 2. Record the resulting value.<br>4. This Is the amount of refrigerant to weigh-in prior to opening the service valves. | New Installation weigh-In Method worksheet<br>1. Line Length (ft) _____<br>2. value from Column C x _____<br>3. Refrigerant((Step1-15) x Step2) = _____<br>Note: If line length is Less than 15 feet , Refrigerant=0,don't charge. |

Table 20. Sealed-System Repairs — calculating charge using the weigh-In method.

| | |
|---|---|
| 1. Measure in feet the distance between the outdoor unit and the indoor unit and record on (Line 1). Include the entire length of the line from the service valve to the IDU.<br>2. Enter the charge multiplIer from cotumn C.<br>3. MultIply the total length of refrigerant tubing (Line 1) times the value on (Line 2). Record the result on (Line 3) of the worksheet.<br>4. Record the value in column B to Line 4 of the worksheet.<br>5. Add the values from step 3, step 4,and record the resulting value on Line 5. ThIs is the amount of refrigerant to weigh-in. | New Installation weigh-In Method worksheet<br>1. Line Length (ft) _____<br>2. value from Column C x _____<br>3. (Step1-15) x step 2 = _____<br>4. Factory charge (column B) + _____<br>5. RefrIgerant (steps 3+4) = _____<br>Note: If line length is Less than 15 feet , Refrigerant=factory charge |

Note: The only mode aperoved for setting validating system charge Is using Charging Mode-cooling. Outdoor Temperature must be between 55$^{O}$F and 120$^{O}$F with Indoor Temperature kept between 70$^{O}$F and 80$^{O}$F.

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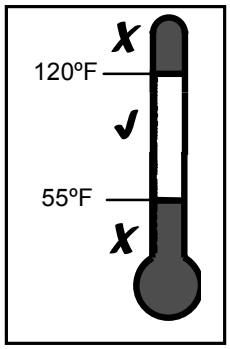
## 14.2 Subcooling charging and refrigerant adjustment in cooling (above 55 F outdoor temp.)

**STEP 1** - Check the outdoor ambient temperatures.

Subcooling (in cooling mode) is the only recommended method of charging above 55ºF outdoor ambient temperatures.

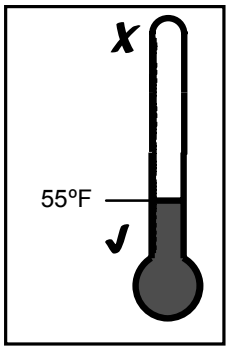
Outdoor Temperature Above 55ºF




**Outdoor Temp1**

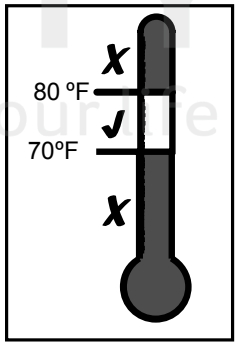
For outdoor ambient temperatures below 55ºF , use weigh-in charge method.
Note:It is important to return in the spring or summer to accurately charge the system in the cooling mode when outdoor ambient temperature is above 55ºF.

Outdoor Temperature Below 55ºF




**Outdoor Temp2**

For best results the indoor temperature should be kept between 70ºF to 80ºF.




**Indoor Temp**

**STEP 2** - Ensure Sections 7, 8, 9, 10, and 13 have been completed.

**STEP 3** - Stabilize the system.

After starting the system in cooling mode, short press "FORCE"button, and " ⊢" symbol appears in 10 minutes, operate the system for a minimum of twenty (20) minutes.

***Important:Whenever charge adjustment or expansion valve adjustment, if unit is running continuously, the system must be operated for a minimum of five (5) minutes, otherwise repeat step 3.***

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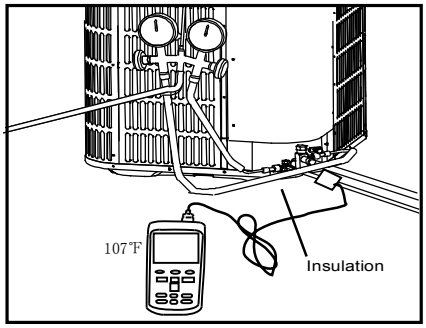
**STEP 4** - Calculate superheat value on suction valves(According to form )

Measured Suction Line Temp. = _____ºF
Measured Suction Line Pressure = _____ PSIG
Calculate superheat value = _____ºF

Note:Make sure the superheat value of suction valve should be above 12ºF, if the value is lower than this, indoor TXV should be adjusted.If the temperature is higher than 18ºF, we suggest to adjust indoor TXV. Repeat the steps above.

(If to adjust TXV ,steps of adjustment are shown on separate sheet , and repeat this step.)

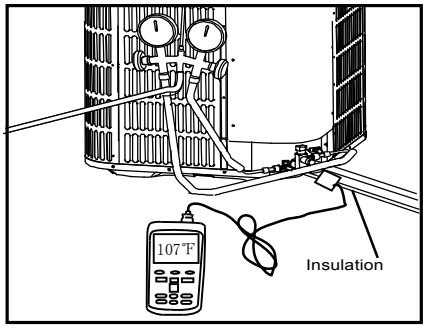



| R-410A REFRIGERAN CHART | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SUCTION TEMP (℉) | FINAL SUPERHEAT(℉) | | | | | | | |
| | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 |
| | SUCTION GAGE PRESSURE (PSI) | | | | | | | |
| 40 | 101 | 97 | 93 | 89 | 86 | 82 | 78 | 75 |
| 42 | 105 | 101 | 97 | 93 | 89 | 86 | 82 | 78 |
| 44 | 110 | 105 | 101 | 97 | 93 | 89 | 86 | 82 |
| 46 | 114 | 110 | 105 | 101 | 97 | 93 | 89 | 86 |
| 48 | 118 | 114 | 110 | 105 | 101 | 97 | 93 | 89 |
| 50 | 123 | 118 | 114 | 110 | 105 | 101 | 97 | 93 |
| 52 | 128 | 123 | 118 | 114 | 110 | 105 | 101 | 97 |
| 54 | 133 | 128 | 123 | 118 | 114 | 110 | 105 | 101 |
| 56 | 138 | 133 | 128 | 123 | 118 | 114 | 110 | 105 |
| 58 | 143 | 138 | 133 | 128 | 123 | 118 | 114 | 110 |
| 60 | 148 | 143 | 138 | 133 | 128 | 123 | 118 | 114 |
| 62 | 153 | 148 | 143 | 138 | 133 | 128 | 123 | 118 |
| 64 | 159 | 153 | 148 | 143 | 138 | 133 | 128 | 123 |
| 66 | 164 | 159 | 153 | 148 | 143 | 138 | 133 | 128 |
| 68 | 170 | 164 | 159 | 153 | 148 | 143 | 138 | 133 |
| 70 | 176 | 170 | 164 | 159 | 153 | 148 | 143 | 138 |
| 72 | 182 | 176 | 170 | 164 | 159 | 153 | 148 | 143 |

**STEP 5** - Calculate subcooling value on liquid valves(According to form )

Measured liquid Line Temp = _____ºF
Measured liquid Line Pressure = _____ PSIG
Calculate subcooling value = _____ºF

Note: If calculated subcooling value is lower than the design subcooling value, please add refrigerant. Repeat the steps above.




| R-410A REFRIGERAN CHART | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SUCTION TEMP (℉) | FINALSUBCOOLING (℉) | | | | | | | |
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | LIQUID GAGE PRESSURE (PSI) | | | | | | | |
| 55 | 173 | 176 | 179 | 182 | 185 | 188 | 191 | 195 |
| 60 | 188 | 191 | 195 | 198 | 201 | 204 | 208 | 211 |
| 65 | 204 | 208 | 211 | 215 | 218 | 221 | 225 | 229 |
| 70 | 221 | 225 | 229 | 232 | 236 | 239 | 243 | 247 |
| 75 | 239 | 243 | 247 | 251 | 255 | 259 | 262 | 266 |
| 80 | 259 | 262 | 266 | 270 | 275 | 279 | 283 | 287 |
| 85 | 279 | 283 | 287 | 291 | 295 | 300 | 304 | 309 |
| 90 | 300 | 304 | 309 | 313 | 318 | 322 | 327 | 331 |
| 95 | 322 | 327 | 331 | 336 | 341 | 346 | 351 | 355 |
| 100 | 346 | 351 | 355 | 360 | 365 | 370 | 376 | 381 |
| 105 | 370 | 376 | 381 | 386 | 391 | 397 | 402 | 407 |
| 110 | 397 | 402 | 407 | 413 | 418 | 424 | 430 | 435 |
| 115 | 424 | 430 | 435 | 441 | 447 | 453 | 459 | 465 |
| 120 | 453 | 459 | 465 | 471 | 477 | 483 | 489 | 496 |
| 125 | 483 | 489 | 496 | 502 | 508 | 515 | 521 | 528 |

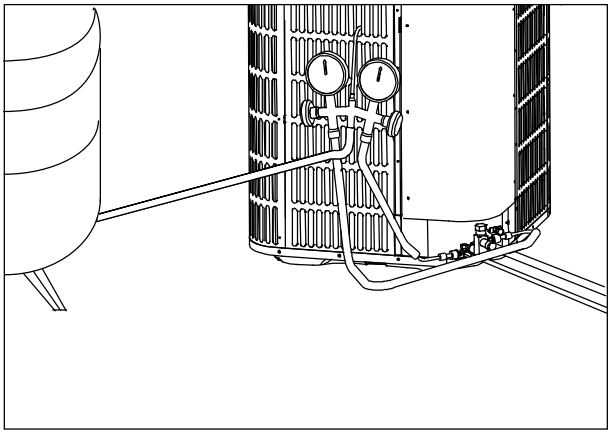
| Model | 24 | 36 | 48 | 60 |
|---|---|---|---|---|
| Design subcooling | 10ºF | 10ºF | 8ºF | 8ºF |

**STEP 6** - Adjust refrigerant level to attain proper gage pressure.

**Add refrigerant** if the design subcooling is lower than the chart value.

1. Connect gages to refrigerant bottle and unit as illustrated.
2. Purge all hoses.
3. Open bottle.
4. Stop adding refrigerant when subcooling. matches the charging chart Final Subcooling value.

**Recover refrigerant** if the subcooling is higher than the chart value.



**STEP 7** - Stabilize the system.

1. Wait 5 minutes for the system condition to stabilize between adjustments.

**Note:** When the subcooling match the chart, the system is properly charged.

2. Remove gages.
3. Replace service port caps to prevent leaks. Tighten finger tight plus an additional 1/6 turn.

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**STEP 8** - Record System Information for reference.

Record system pressures and temperatures after charging is complete.

Outdoor model number = _____

Measured Outdoor Ambient = _____ ℉

Measured Indoor Ambient = _____ ℉

Measured Liquid Line Temp = _____ ℉

Measured Suction Line Temp = _____ ℉

Liquid Gage Pressure = _____ PSIG

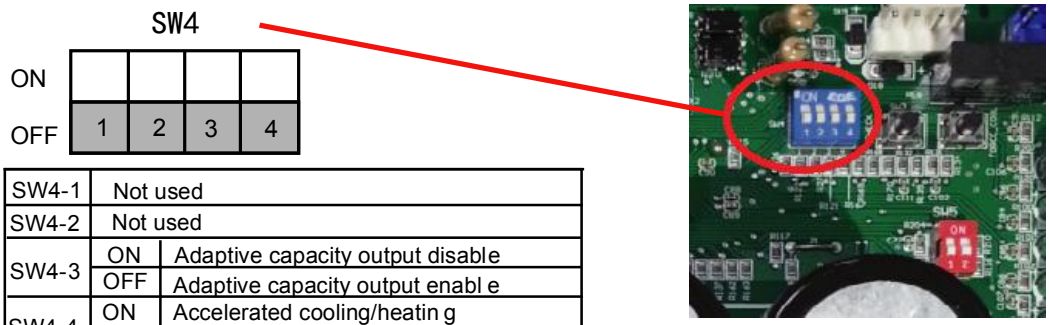
Suction Gage Pressure = _____ PSIG

# Section 15 System operation and Troubleshooting

## 1. Control logic description

● The variable speed system adopts the same control communication command as that of common heat pump and air condition unit , it is the 24V control command .

● The speed of compressor is controlled by outdoor unit itself according to the pressure transducer. Usually , to ensure stable and adequate capacity, the speed will change according to the evaporating pressure in cooling and according to the condensing pressure in heating , another, the pressure target may adjust automatically based on the compressor operating so that the capacity can better meet the needs. It can choose the target setting according to dehumidification and high capacity demands by manually adjusting the code.




| | | |
|---|---|---|
| SW4-1 | Not used | |
| SW4-2 | Not used | |
| SW4-3 | ON | Adaptive capacity output disable |
| | OFF | Adaptive capacity output enabl e |
| SW4-4 | ON | Accelerated cooling/heatin g |
| | OFF | Normally cooling/heatin g |

## 2. Sensor

● T3(Outdoor coil temperature) and T4(ambient temperature, heat pump only) see TABLE A
● T5(compressor discharge temperature) and Tf(IPM radiator temperature) see TABLE B.
● Pressure Transducer see TABLE C.

## 3. Sensor description

A working T3 Sensor is required for:
● Operating protection (high temp./low temp.)
● Outdoor fan control(cooling)
● Defrost（heat pump only）
● Ambient temp forecast（Cooling only）

A working T4 Sensor is required for（Heat pump only）:
● Operating condition permission
● Defrosting condition determination
● Outdoor fan control(heating mode, Heat pump only)

A working T5 Sensor is required for:
● Protection(high temp./low temp.)
● Outside Electronic Expansion Valve control（Heat pump only）

A working Tf Sensor is required for:
● Module temp. protection(high temp.)

A working Pressure Transducer (PT) is required for:
● Operating speed control
● Outside Electronic Expansion Valve control（Heat pump only）
● High pressure protection(heating mode, Heat pump only)
● Low pressure protection(cooling mode)

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## 4、Defrost description (Heat Pump only)

● The demand defrost control measures the coil temperature with a sensor locatde on the heat pump coil.A second sensor located outside the outdoor coil is used to measure outdoor ambient temperature.
The demand of defrost is computed by the coil temperature and outdoor ambient temperature ,also , by the running time and outdoor ambient temperature, by the running time and high pressure when hing pressure is lower than a certain value.

● Enter defrosting

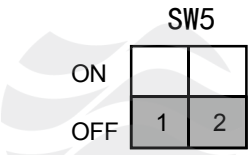
The following 3 situations were determined to enter defrosting:
①Outdoor coil temp. T3<34°F, and satisfy a certain correspondence of T4 ambient temp.
②When operating time accumulates to a certain value. For different Ambient Temp. T4, time settings are different, when T4<-23°F, cumulative time is 4h, when T4≥-23°F and T4＜42°F the cumulative time is 2h .
③ When high pressure lasts low, the situation that the saturation temperature of high pressure lower than 82°F lasts for 20 min determines to enter defrosting.

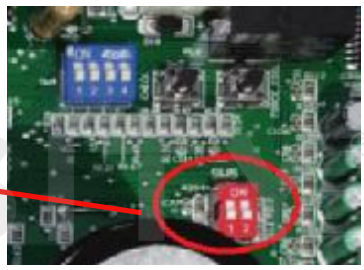
● Dial code SW5：

Defrosting quit
According to outdoor coil temp.T3 is up to 64°F and lasts for 1 min. Or defrosting time is up to 8 min.

● Defrosting control choice

Dial code SW5 can adjust and set the time that enters and quits defrosting
In general, adjust dial code to ON can enhance the ability of defrosting.



| Defrosting choice | SW5-1 | SW5-2 | Remarks |
|---|---|---|---|
| ON | Operating time is reduced by 10% | Defrosting extended for 60 seconds | |
| OFF | Normal | Normal | Default |
| Remarks | Enter defrost | Quit defrost | |

● Manual defrosting (Heat Pump only)

1.System must be running with demand from the thermostat.
2.Forced Defrost Test can be initiated when the running time must be longer than 8 minutes in heat mode only.
3.Press “FORCE” key for 6 secends to begin forced defrost.
4.Execute Forced Defrost.(Please wait 40 secends before defrost)
5.When test begins,the displays will display “dF”.(the display procedure:the running speed of 40S-- “dF”-- the running speed )
6.Forced Defrost Test is complete automatically ,and the displys is the running speed.
7.If Forced Defrost is needed again , you can repeat step 3 after 5 minutes.

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## 5. Compressor Crankcase heater description

Refrigerant migration during the off cycle can result in a noisy start up. Add a crankcase heater to minimize refrigeration migration, and to help eliminate any start up noise or bearing “wash out”.

All heaters must be located on the lower half of the compressor shell. Its purpose is to drive refrigerant from the compressor shell during long off cycles, thus preventing damage to the compressor during start-up.

At initial start-up or after extended shutdown periods, make sure the heater is energized for at least 12 hours before the compressor is started. (Disconnect switch on and wall thermostat off.)

● The crankcase heating start condition:

Start if crankcase heating zone can satisfy one of the three conditions,

1. First time to power on and T5>104℉
2. In process of defrosting
3. Compressor stops running for 4h and the outdoor ambient temp. T4 once lower than 50℉ or T5< 104℉ .

● The crankcase heating stop must meet condition:

Air discharge temp. T5≥113℉

## 6. Reversing valve introduction (heat pump only)

● Reversing valve energizes at the heating conditions,and cut off at the cooling condition.

## 7. Protection function introduction

● Outdoor coil temperature protection(T3)

T3>143.6°F, compressor stop working; T3< 129.2°F, compressor start working.

● Ambient temperature protection(T4) (Cooling only system T4=T3)

When 50°F≤ T4 < 140 °F, the units can work at the cooling condition.

When -4°F≤ T4 < 86 °F, the units can work at the heating condition.

When T4 < 6.8 °F,If the electrical heater kit is installed in the indoor unit, the outdoor unit would provide a signal to drive up the heater.

● Discharge temperature protection(T5)

When discharge temp. > 239 °F, the compressor will stop at the cooling condition.

When discharge temp. < 194 °F, the compressor will restart at the cooling condition.

When discharge temp. > 221 °F, the compressor will stop at the heating condition.

When discharge temp. < 167 °F, the compressor will restart at the heating condition.

● High pressure protection (HPS)

When high pressure > 580 PSIG, the compressor and outdoor fan will stop.

When high pressure < 435 PSIG, the compressor and outdoor fan will restart.

● Low pressure protection(PT)

Low pressure < 43.5 PSIG lasting for 5 min in cooling model, the compressor and outdoor fan will stop. System will run again after 6 minutes.

● Module temperature protection (TF)

When TF>176 °F, the compressor and outdoor fan will stop.

When TF<145 °F, the compressor and outdoor fan will restart.

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## 8. Fault code table

| CODE | FAULT DESCRIPTION |
|---|---|
| E4 | Temperature sensor fault(T3 /T4/T5/TF) |
| E5 | High/low voltage protection |
| E6 | DC fan motor fault |
| Eb | System lockup, 2 times(E6),protection in 10 minutes |
| E7 | Compressor discharge sensor(T5) is seated fault |
| E9 | EEPROM fault |
| H0 | Communication fault in main contrrol chip |
| H3 | 3 times (P3) protection in 120 minutes,system lockup |
| H4 | 3 times (P6) protection in 60 minutes,system lockup |
| H5 | 5 times (P2) protection in 100 minutes,system lockup |
| H6 | 3 times (P4) protection in 100 minutes,system lockup |
| H8 | Pressure transducer(PT) short or open fault |
| Hb | High pressure(PT) protection in Heating |
| HH | 2 times(PH) protection in 200 minutes,system lockup |
| P0 | The module radiator temperature (TF)protection |
| P1 | High pressure switch(HPS) protection |
| P2 | Low pressure (PT) Protection |
| P3 | Compressor over current protection |
| P4 | High compressor discharge temperature(T5) protection |
| P5 | High condensor coil temp. (T3) protection |
| P6 | IPM module protection |
| P8 | Hurricane protection of the DC fan motor |
| PH | Low discharge superheat protection |
| PC | Reversing valve fault protection |
| F1 | High pressure switch(HPS) fault |
| F3 | 5 times (P5) protection in180 minutes,system lockup |
| F4 | 3 times(P0) protection in 120 minutes,system lockup |
| F5 | 5 times(Hb) protection in 180 minutes,system lockup |
| C3 | Condensor coil sensor(T3) is seated fault in cooling |
| C4 | 3 times(C3) protection in 120 minutes,system lockup |
| C5 | 2 times(E7) protection in 180 minutes,system lockup |
| C6 | 2 times(PC) protection in 180 minutes,system lockup |
| CE | 5 times (P1) protection in 150 minutes,system lockup |
| L0-L9 | IPM module protection or frequent power on/off |
| ⊢ | Indication under charge model |
| L | Running indication under T3 limited condition |
| D | Running indication under T5 limited condition |
| P | Running indication under compressor ratio limited condition |
| F | Running indication under Tf limited condition |
| C | Running indication under current limited condition |
| U | Running indication under low voltage limited condition |
| H | Running indication under high pressure(PT) limited condition in heatin |
| A | Running indication under return oil model |
| dF | Running indication under defrost model |

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## 9. Parameter point check table

1、Shift to display content of data code pipe when pressing point check key shortly(check key). Display the next set of data when press the key once. The display content is accordance with the sequence.
2、There're 3 digits for LED. The first digit is sequence(only display units digit, recycling display), the second and third digits are values. For example, the 8th item is operating low pressure saturation temperature. The 11th item is operating low pressure. For detailed meanings, please refer to the point check table.3. After staying for 20s, it will recover to the normal status display
4、For normal status display, the last 2 digits of nixie tube will display ambient temp when the unit is in standby status(the first nixie tube has no display). During operating, last 2 digits of nixie tube will display operating frequency.(If there's system protection, the first digit of nixie tube will display status code, details for code meaning, please refer to the Fault code table )

| No. | Point check content | Example | Remark |
|---|---|---|---|
| 0 | Outdoor unit capacity | C3 | Model+RT |
| 1 | Outdoor unit mode | 2 | 0 standby,<br>2 cooling,<br>3 heating |
| 2 | Outdoor unit set compressor speed | | |
| 3 | opening of EXV | | Actual value |
| 4 | T3(outdoor coil temp.) | | |
| 5 | T4 (outdoor ambient temp.) | | |
| 6 | T5(compressor discharge temp.) | | |
| 7 | Reserved | | |
| 8 | Te (evaporating temp.) | | |
| 9 | Tc (condensing temp.) | | |
| 10 | Tf (module temp.) | | |
| 11 | Pe (evaporating pressure) | | Actual value<br>MPa x10 |
| 12 | Pc (evaporating pressure) | | Actual value<br>MPa x10 |
| 13 | Compressor discharge superheat | | |
| 14 | Reserved | | |
| 15 | Reserved | | |
| 16 | compressor current | | |
| 17 | Reserved | | |
| 18 | Fan speed | | |
| 19 | Reserved | | |
| 20 | Reserved | | |
| 21 | Reserved | | |
| 22 | Reserved | | |
| 23 | The last time Fault code | | |
| 24 | Software version | | |
| 25 | Remark"--" | | |

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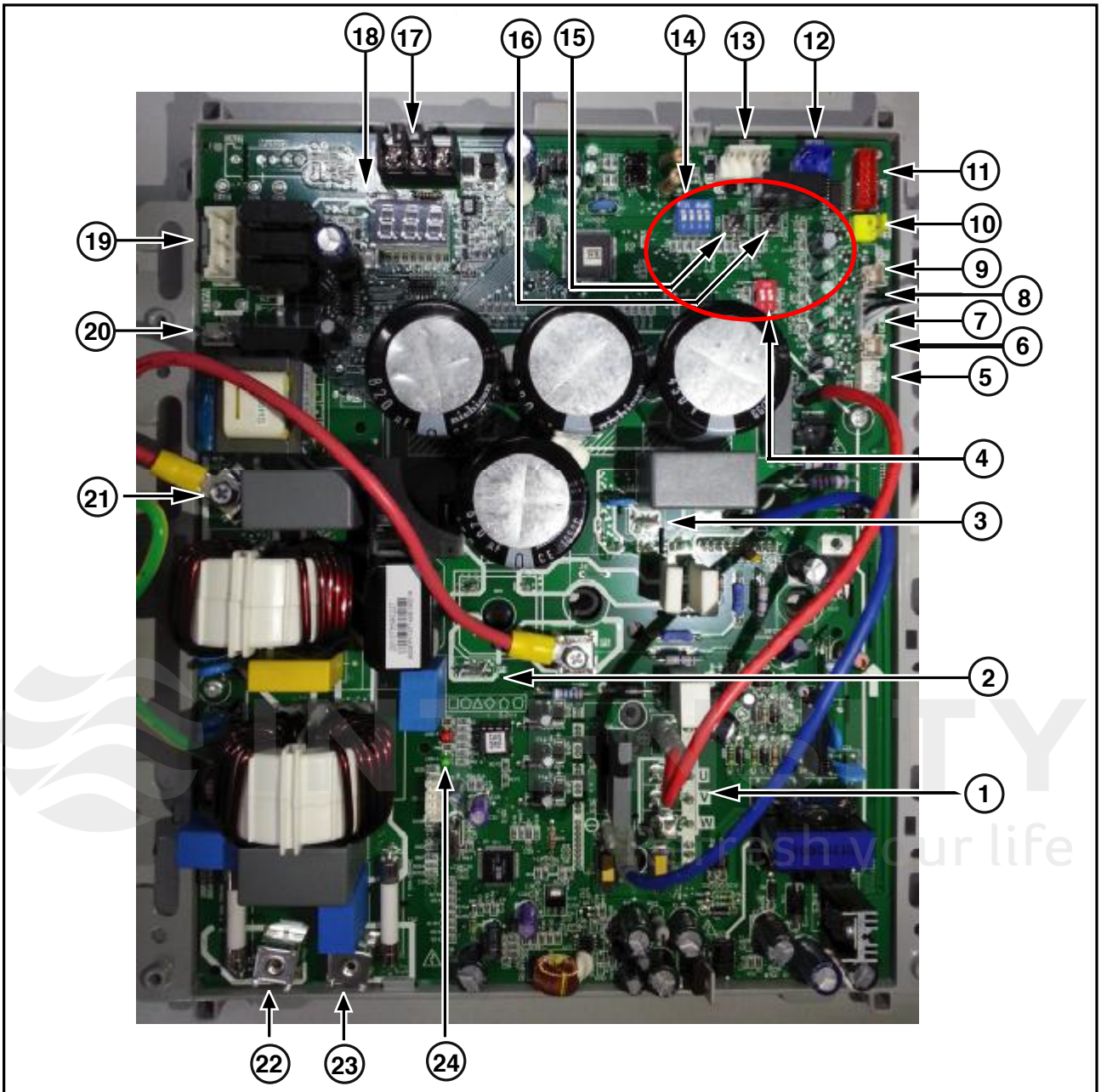
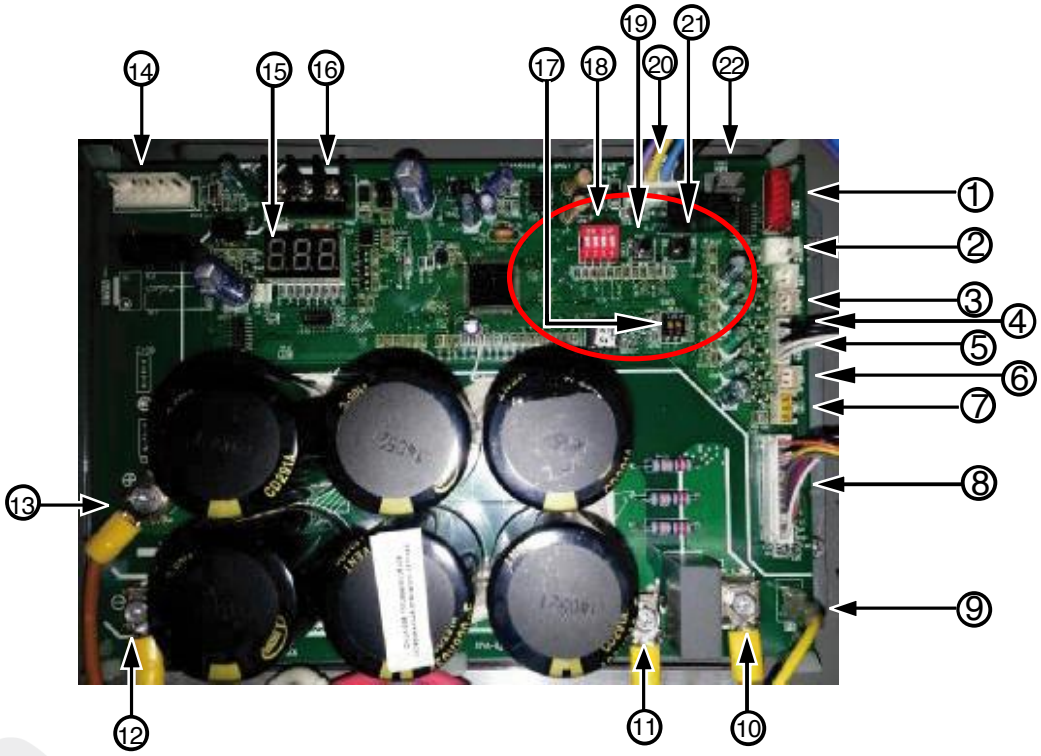
## For 24/36k model

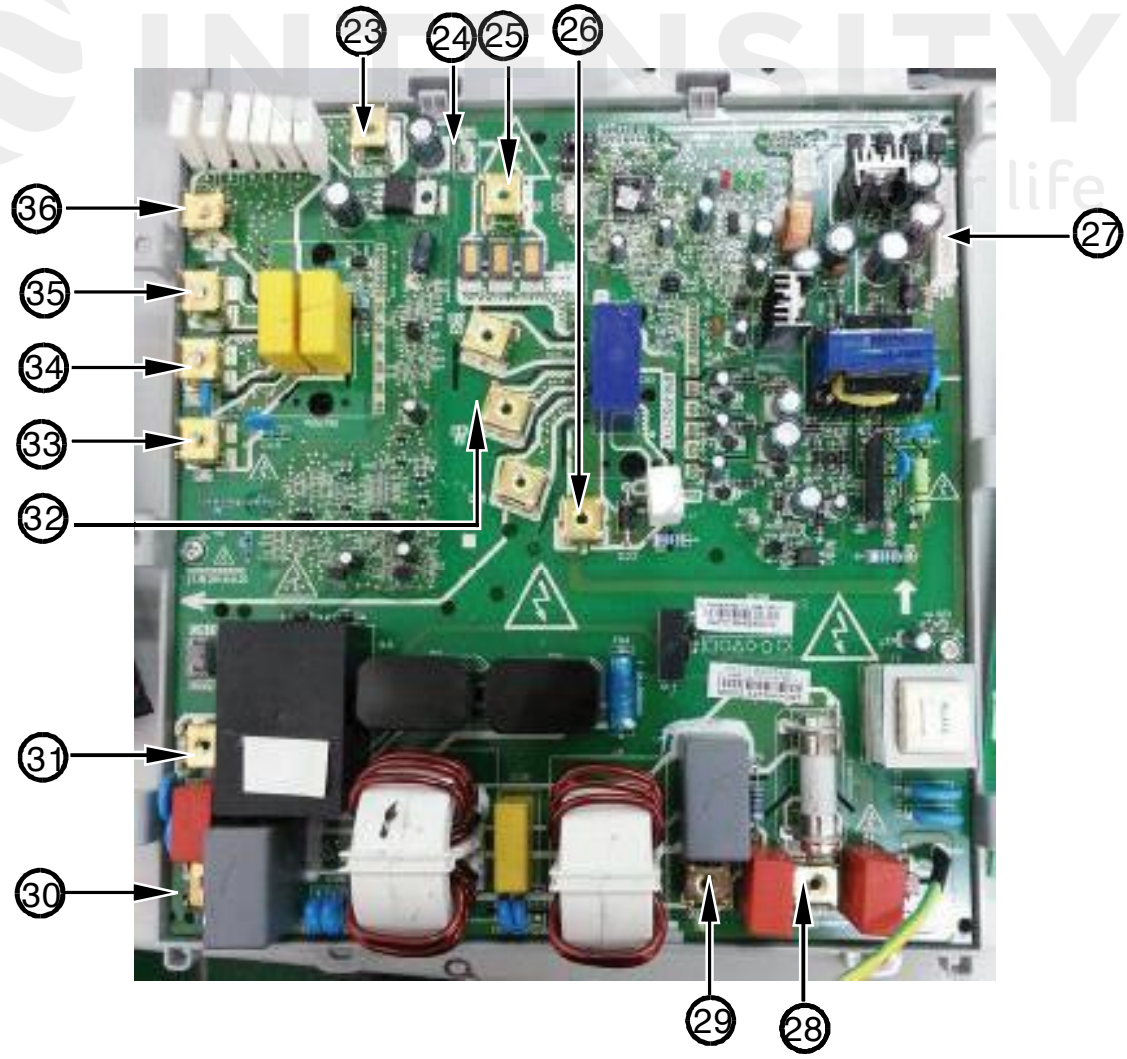



**Function description for the corresponding position**

| No. | Content | No. | Content |
|---|---|---|---|
| 1 | Compressor iring terminal | 13 | Temp. controller connecting port |
| 2 | Reactor w iring terminal(connect a reactor betw een 2 and 3 ) | 14 | Function dial code SW4 |
| 3 | Reactor w iring terminal(connect a reactor betw een 2 and 3 ) | 15 | Spot check button |
| 4 | Defrosting function dial codeSW5 | 16 | Forced operation button |
| 5 | Pressure transducer port | 17 | Reserved |
| 6 | Air discharge temp.sensor port | 18 | Nixie tube display |
| 7 | Outdoor temp.sensor port(HP only) | 19 | Fan control port |
| 8 | Condenser temp.sensor port | 20 | Crankcase heating zone control terminal |
| 9 | Radiator temp.sensor port | 21 | Short w ire |
| 10 | High pressure sw itch port | 22 | Pow er supply connecting terminal |
| 11 | EXV drive port(HP only) | 23 | Pow er supply connecting terminal |
| 12 | Reversing valve port | 24 | Indicator lamp |

## For 48/60k model

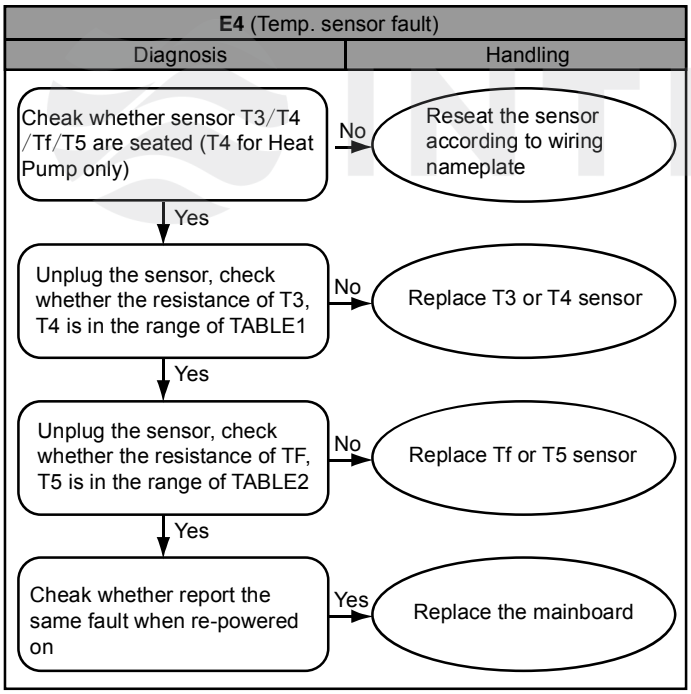


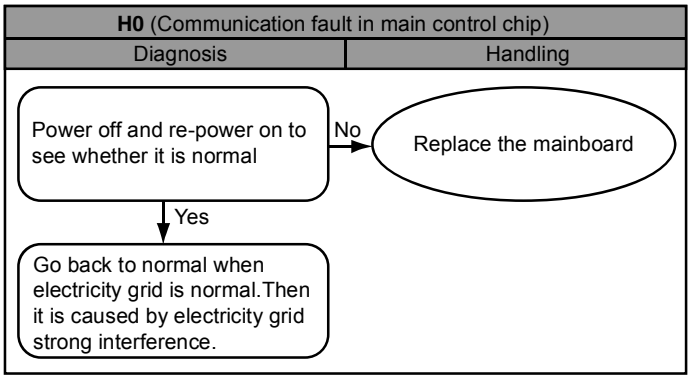



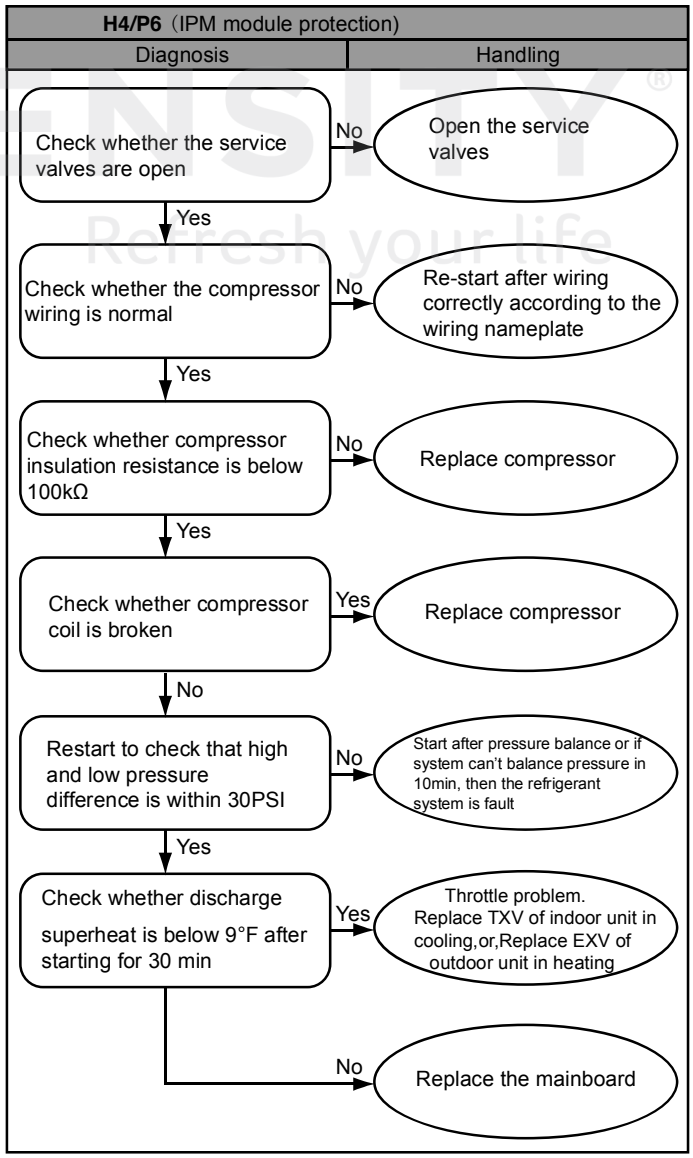
### Function description for the corresponding position (For 48/60k model)

| No. | Content | No. | Content |
|---|---|---|---|
| 1 | EXV driving port (HP only) | 19 | Point check button |
| 2 | High pressure switch port | 20 | Temp. controller connection port |
| 3 | Radiator temp. sensor port | 21 | Forced operation button |
| 4 | Condenser temp. sensor port | 22 | 4-way valve port (HP only) |
| 5 | Outdoor temp. sensor port (HP only) | 23 | Connect the cathode of the rectifier bridge |
| 6 | Air discharge temp. sensor port | 24 | DC motor driving source(15V-P2) |
| 7 | Pressure transducer | 25 | The voltage between 25 and 26 is 380Vdc (Compressor is running ) |
| 8 | Connection wire port between main boards | 26 | The voltage between 25 and 26 is 380Vdc (Compressor is running) |
| 9 | DC motor driving source(15V-P2) | 27 | Connection wire port between main boards |
| 10 | The voltage between 10 and 11 is 380Vdc (Compressor is running) | 28 | AC power supply input port |
| 11 | The voltage between 10 and 11 is 380Vdc (Compressor is running) | 29 | AC power supply input port |
| 12 | The voltage between 12 and 13 is 380Vdc (Compressor is running) | 30 | AC power supply output port |
| 13 | The voltage between 12 and 13 is 380Vdc (Compressor is running) | 31 | AC power supply output port |
| 14 | DC motor control port | 32 | Compressor connection terminal |
| 15 | Nixie tube display | 33 | The voltage between 33 and 36 is 380Vdc (Compressor is running ) |
| 16 | Reserved | 34 | Reactor L1 wiring terminal |
| 17 | Defrosting function dial code SW5 | 35 | Reactor L2 wiring terminal |
| 18 | Function dial code SW4 | 36 | The voltage between 33 and 36 is 380Vdc (Compressor is running) |

## Troubleshooting

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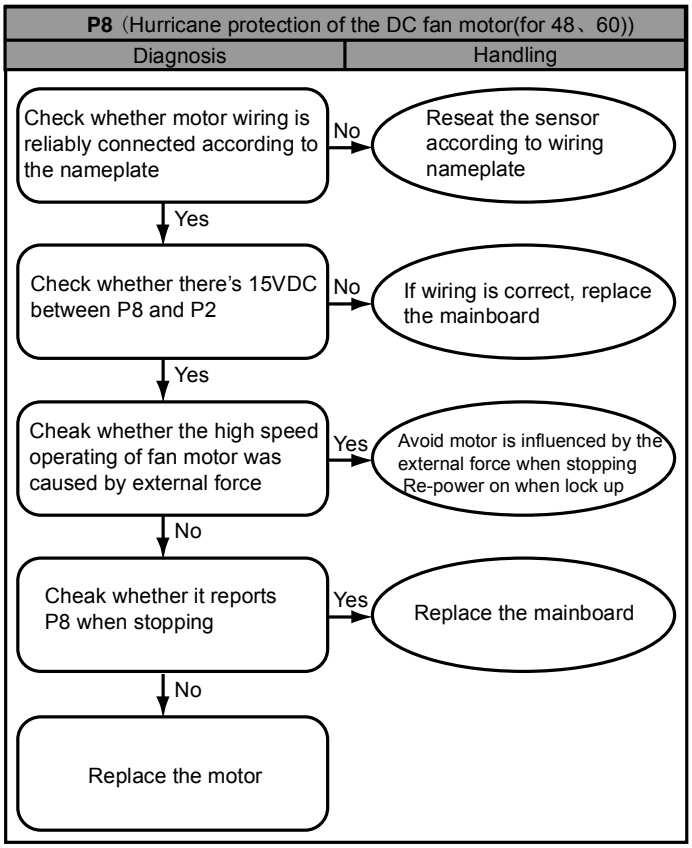
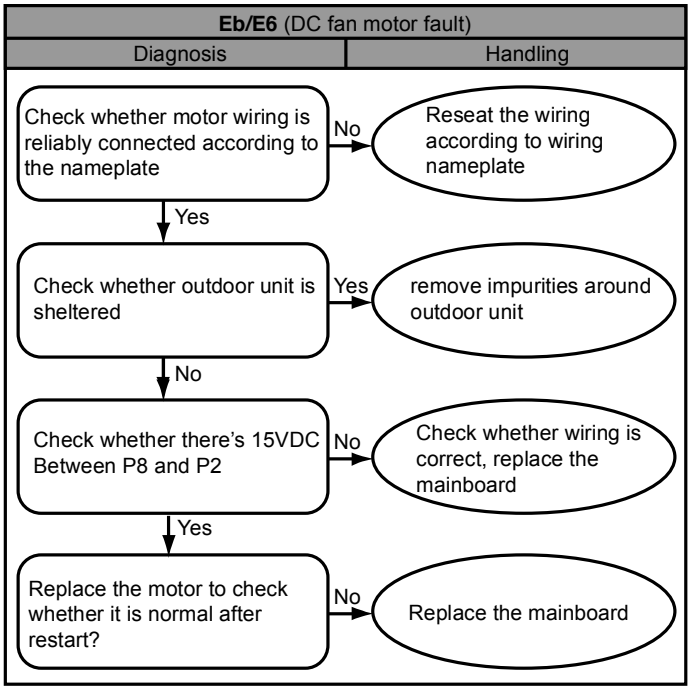
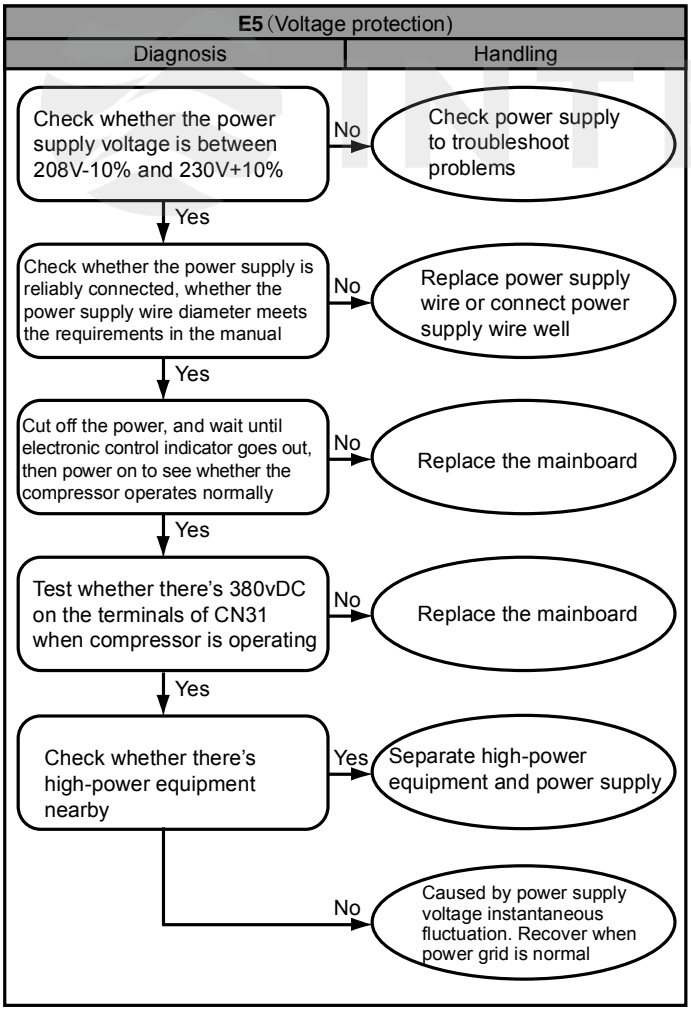
**P8** (Hurricane protection of the DC fan motor(for 48、60))



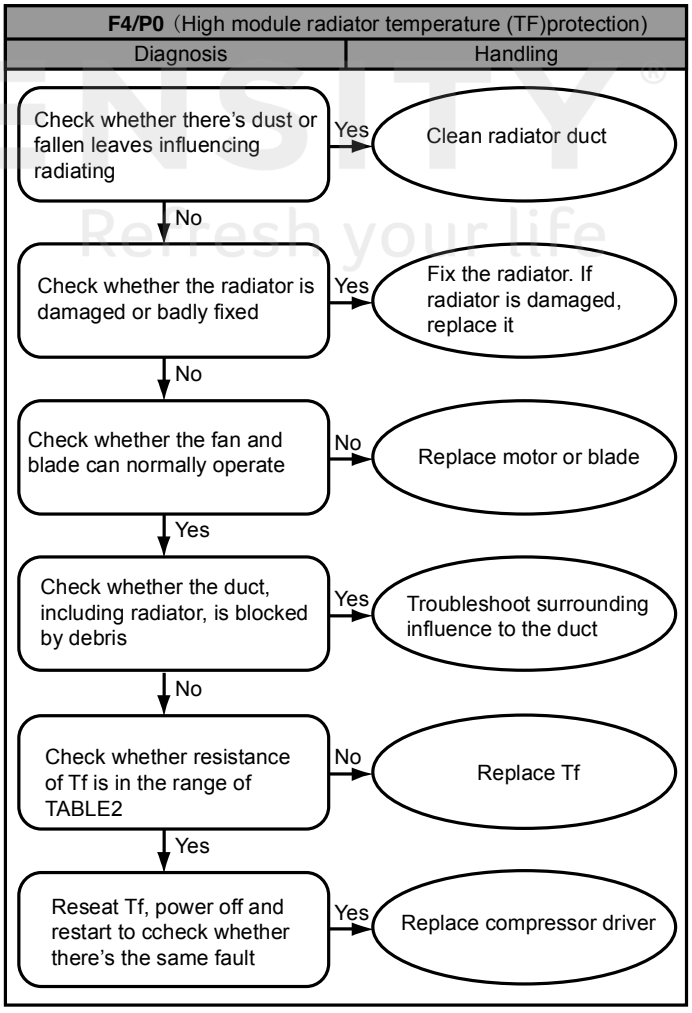

**Eb/E6** (DC fan motor fault)




**E5**(Voltage protection)




**F4/P0** (High module radiator temperature (TF)protection)

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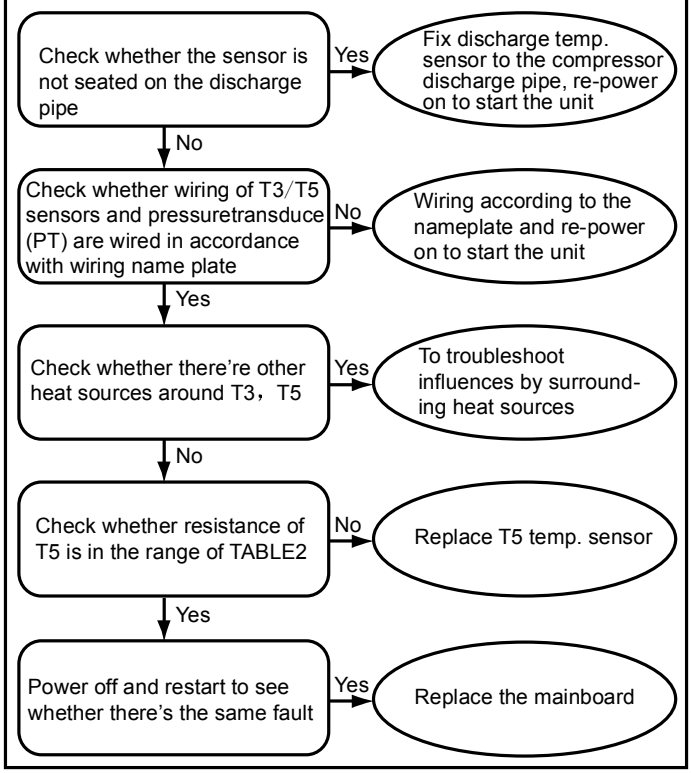
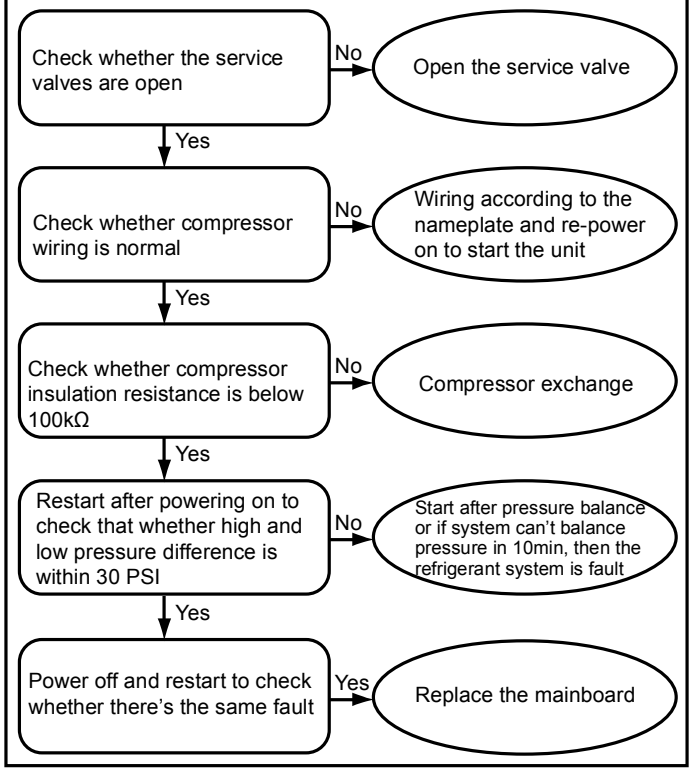
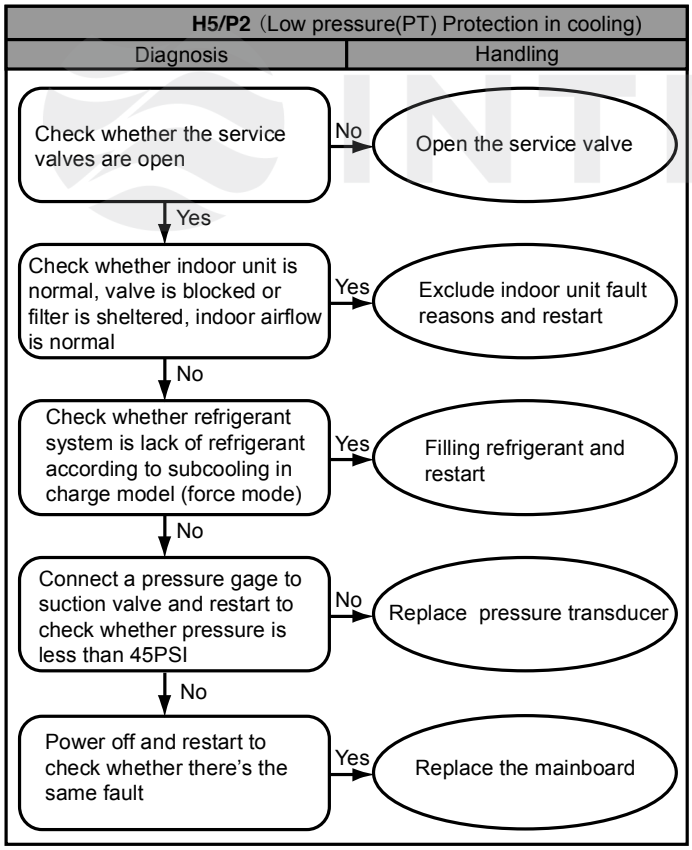
**C5/E7**（Compressor discharge sensor(T5) is seated fault)



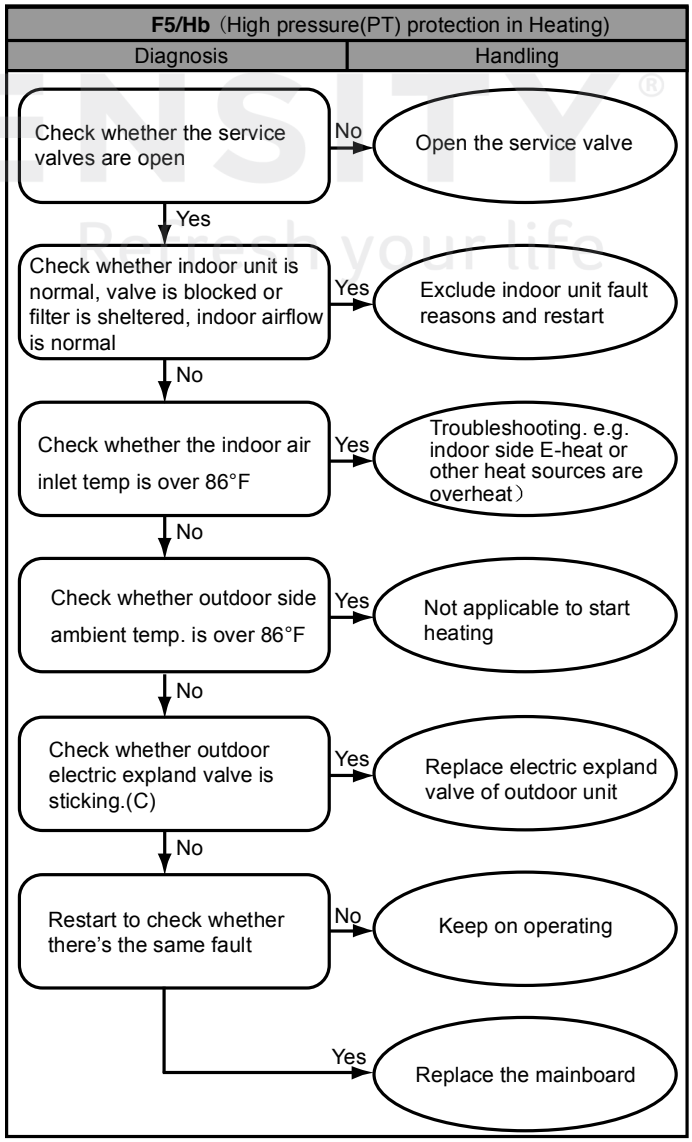

**H3/P3**（Compressor over current protection)




**H5/P2**（Low pressure(PT) Protection in cooling)




**F5/Hb**（High pressure(PT) protection in Heating)

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**F1** (High pressure switch(HPS) fault)

| Diagnosis | Handling |
|---|---|
| Check whether the service valves are open | No → Open the service valve |
| Yes → Whether high pressure switch resistance is normal (CLOSE is normal) | No → Replace high pressure switch |
| Yes → Stop the unit for an hour to check whether it reports the same fault | Yes → Replace the mainboard |
| No → Keep operating | |

**H8** (Pressure transducer(PT) fault)

| Diagnosis | Handling |
|---|---|
| Check whether pressure transducer(PT) wiring is normal | No → Wiring according to the nameplate correctly and power on to restart |
| Yes → Check whether the voltage between gauging pressure thansducer(PT) white line and black line is between 0.5-4.5V when the system is on power | No → Replace pressure sensor |
| Yes → Restart to check whether there's the same fault | No → Keep on operating |
| Yes → Replace the mainboard | |

**F3/P5** (condensor coil temperature(T3) protection in cooling)

| Diagnosis | Handling |
|---|---|
| Check whether the service valves are open | No → Open the service valve |
| Yes → Check whether T3/T5 are abnormal according to resistance | Yes → Replace sensors |
| No → Check whether outdoor unit fan is abnormal and whether the outdoor condenser coil is blocked by debris | Yes → Replace the fan and exclude the surrounding debris of heat exchanger |
| No → Check whether there's short circuit in air outlet and inlet side when the ambient temp. is high | Yes → Replace installation position or rectify the surrounding goods to avoid air return short circuit |
| No → Check refrigerant filling amount according to refrigerant filling mode | Yes → Refill enough amount of refrigerant |
| No → Restart to check whether there's the same fault | No → Keep operating |
| Yes → Replace the mainboard | |

**C4/C3** (T3 sensor is seated fault in cooling)

| Diagnosis | Handling |
|---|---|
| Check whether the T3 sensor is seated to the condenser coil | Yes → reseat the sensor to the condenser coil and power on to restart |
| No → Check whether T3/T4 sensors and high pressure switch are wired according to wiring nameplate | No → Wiring according to the nameplate correctly and power on to restart |
| Yes → Check whether there're other heat sources around T3/T4 | Yes → Exclude influence by the nearby heat sources |
| No → Check whether high pressure switch HPS is in fault(CLOSE is normal), whether the fan doesn't operate | Yes → Replace the fan and high pressure switch |
| No → Power off and restart to check whether there's the same fault | Yes → Replace the mainboard |

**E9** (EEPROM fault)

| Diagnosis | Handling |
|---|---|
| Power off and re-power on to see whether it is normal | No → Re-insert the EEPROM Replace the mainboard |
| Yes → Caused by electricity grid strong interference. Go back to normal when electricity grid is normal | |

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**H6/P4**（High compressor discharge temperature(T5) protection)

| Diagnosis | Handling |
|---|---|
| Check whether the service valves are open | No → Open the service valve |
| Check whether discharge temp sensor T5 resistance is normal, refer to TABLE2 | No → Replace air discharge temp. sensor |
| Check whether position of discharge temp. sensor is normal. whether there're other heat sources around | Yes → Troubleshooting problems and restart |
| Check whether refrigerant system is lack of refrigerant according to subcooling in charge model (force mode) | Yes → Filling refrigerant and restart |
| Whether compressor is normal（abnormal noise，abnormal vibration） | Yes → Replace compressor |
| In heating mode,check whether compressor gas return pressure is too low so that there's vacuum phenomenon | Yes → Replace EXV (valve sticking) |
| | No → Replace the mainboard |

**CE/P1**（High pressure switch(HPS)protection)

| Diagnosis | Handling |
|---|---|
| Check whether the service valves are open | No → Open the service valve |
| Check whether outdoor unit is sheltered | Yes / No → remove impurities around outdoor unit |
| Check whether high pressure switch resistance is normal (COSL is normal) | No → Replace high pressure switch |
| Cooling mode refers to F3/P5 Heating mode refers to F5/Hb | |

**HH/PH**（low discharge superheat protection)

| Diagnosis | Handling |
|---|---|
| Check whether T3，T5 are abnormal (refer to sensor fault testing) | Yes → Replace sensors |
| Check whether indoor unit is normal, valve is blocked or filter is sheltered, indoor airflow is normal | Yes → Exclude indoor unit fault reasons and restart |
| In cooling mode,whether there's TXV or EV adjusting for indoor unit and the suction superheat is normal | No → 1.Not applicable for piston 2.Adjust the TXV for full evaporation and superheat 3.To further adjust TXV swich to SW4-4"ON" |
| In heating mode, reporting fault To check whether outdoor fan is normal,outdoor unit is sheltered | No → Troubleshoot outdoor fan (replace the fan motor or fan blade) |
| Restart and heating, after 45min, check whether the external EV action is normal (If air discharge superheat) | No → Replace the mainboard |
| | Yes → Replace outdoor EV |

**C6/Pc**（Reversing valve fault protection)

| Diagnosis | Handling |
|---|---|
| Check whether the running model is normal (heating mode for Heat Pump) | No → Adjust control for system |
| Check whether reversing valve is normal for admand | Yes → Replace the reversing valve electric coil |
| Check whether reversing valve is normal for actor | No → Replace the reversing valve |
| Restart to Check whether there's the same fault | No → Kee operating |
| | Yes → kee operating |

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TABLE A

| TEMP F | TEMP C | RESISTANCE kΩ | VOLTS DC | TEMP F | TEMP C | RESISTANCE kΩ | VOLTS DC |
|---|---|---|---|---|---|---|---|
| -5 | -20.6 | 107.732 | 4.65 | 90 | 32.2 | 7.225 | 2.36 |
| 0 | -17.8 | 93.535 | 4.6 | 95 | 35 | 6.401 | 2.21 |
| 5 | -15 | 79.521 | 4.54 | 100 | 37.8 | 5.683 | 2.07 |
| 10 | -12.2 | 67.795 | 4.47 | 105 | 40.6 | 5.057 | 1.93 |
| 15 | -9.4 | 57.948 | 4.39 | 110 | 43.3 | 4.509 | 1.79 |
| 20 | -6.7 | 49.652 | 4.3 | 115 | 46.1 | 4.028 | 1.67 |
| 25 | -3.9 | 42.645 | 4.21 | 120 | 48.9 | 3.606 | 1.55 |
| 30 | -1.1 | 36.710 | 4.1 | 125 | 51.7 | 3.233 | 1.43 |
| 40 | 4.4 | 27.386 | 3.86 | 130 | 54.4 | 2.902 | 1.32 |
| 45 | 7.2 | 23.732 | 3.73 | 135 | 57.2 | 2.610 | 1.22 |
| 50 | 10 | 20.610 | 3.59 | 140 | 60 | 2.350 | 1.13 |
| 55 | 12.8 | 17.939 | 3.45 | 145 | 62.8 | 2.119 | 1.04 |
| 60 | 15.6 | 15.648 | 3.3 | 150 | 65.6 | 1.914 | 0.96 |
| 65 | 18.3 | 13.681 | 3.15 | 155 | 68.3 | 1.731 | 0.88 |
| 70 | 21.1 | 11.987 | 2.99 | 160 | 71.1 | 1.574 | 0.82 |
| 75 | 23.9 | 10.527 | 2.83 | 165 | 73.9 | 1.416 | 0.75 |
| 80 | 26.7 | 9.265 | 2.67 | 170 | 76.7 | 1.276 | 0.68 |
| 85 | 29.4 | 8.172 | 2.52 | | | | |

TABLE B

| TEMP F | TEMP C | RESISTANCE kΩ | VOLTS DC | TEMP F | TEMP C | RESISTANCE kΩ | VOLTS DC |
|---|---|---|---|---|---|---|---|
| -5 | -20.6 | 600.134 | 4.93 | 140 | 60 | 13.643 | 3.14 |
| 0 | -17.8 | 505.551 | 4.92 | 145 | 62.8 | 12.359 | 3.03 |
| 5 | -15 | 427.463 | 4.91 | 150 | 65.6 | 11.214 | 2.91 |
| 10 | -12.2 | 362.739 | 4.89 | 155 | 68.3 | 10.227 | 2.8 |
| 15 | -9.4 | 308.891 | 4.87 | 160 | 71.1 | 9.308 | 2.68 |
| 20 | -6.7 | 265.398 | 4.85 | 165 | 73.9 | 8.485 | 2.56 |
| 25 | -3.9 | 227.481 | 4.83 | 170 | 76.7 | 7.746 | 2.45 |
| 30 | -1.1 | 195.601 | 4.8 | 175 | 79.4 | 7.105 | 2.34 |
| 35 | 1.7 | 168.707 | 4.77 | 180 | 82.2 | 6.504 | 2.23 |
| 40 | 4.4 | 146.695 | 4.74 | 185 | 85 | 5.963 | 2.13 |
| 45 | 7.2 | 127.258 | 4.7 | 190 | 87.8 | 5.474 | 2.02 |
| 50 | 10 | 110.707 | 4.66 | 195 | 90.6 | 5.032 | 1.92 |
| 55 | 12.8 | 96.572 | 4.61 | 200 | 93.3 | 4.645 | 1.83 |
| 60 | 15.6 | 84.465 | 4.56 | 205 | 96.1 | 4.28 | 1.73 |
| 65 | 18.3 | 74.411 | 4.51 | 210 | 98.9 | 3.949 | 1.64 |
| 70 | 21.1 | 65.408 | 4.45 | 215 | 101.7 | 3.648 | 1.56 |
| 75 | 23.9 | 57.634 | 4.39 | 220 | 104.4 | 3.383 | 1.48 |
| 80 | 26.7 | 50.904 | 4.32 | 225 | 107.2 | 3.133 | 1.4 |
| 85 | 29.4 | 45.258 | 4.24 | 230 | 110 | 2.904 | 1.32 |
| 90 | 32.2 | 40.152 | 4.16 | 235 | 112.8 | 2.694 | 1.25 |
| 95 | 35 | 35.699 | 4.08 | 240 | 115.6 | 2.503 | 1.18 |
| 100 | 37.8 | 31.807 | 3.99 | 245 | 118.3 | 2.334 | 1.12 |
| 105 | 40.6 | 28.398 | 3.89 | 250 | 121.1 | 2.172 | 1.06 |
| 110 | 43.3 | 25.506 | 3.8 | 255 | 123.9 | 2.024 | 1 |
| 115 | 46.1 | 22.861 | 3.7 | 260 | 126.7 | 1.888 | 0.95 |
| 120 | 48.9 | 20.529 | 3.59 | 265 | 129.4 | 1.767 | 0.9 |
| 125 | 51.7 | 18.47 | 3.48 | 270 | 132.2 | 1.651 | 0.85 |
| 130 | 54.4 | 16.708 | 3.37 | 275 | 135 | 1.544 | 0.8 |
| 135 | 57.2 | 15.085 | 3.26 | 280 | 137.8 | 1.446 | 0.76 |

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TABLE C1 (For AC model)

| NSK-BD020I | | V=2*MPa+0.5 | | | |
|---|---|---|---|---|---|
| No. | V | Te | Pe | No. | V |
| | | ℃ | MPa | | |
| 1 | 1.04 | -22 | 0.27 | 47 | 2 |
| 2 | 1.07 | -21 | 0.28 | 48 | 2.02 |
| 3 | 1.1 | -20 | 0.3 | 49 | 2.05 |
| 4 | 1.11 | -19.5 | 0.31 | 50 | 2.08 |
| 5 | 1.13 | -19 | 0.31 | 51 | 2.11 |
| 6 | 1.14 | -18.5 | 0.32 | 52 | 2.14 |
| 7 | 1.16 | -18 | 0.33 | 53 | 2.16 |
| 8 | 1.17 | -17.5 | 0.34 | 54 | 2.19 |
| 9 | 1.19 | -17 | 0.35 | 55 | 2.22 |
| 10 | 1.21 | -16.5 | 0.35 | 56 | 2.25 |
| 11 | 1.22 | -16 | 0.36 | 57 | 2.28 |
| 12 | 1.24 | -15.5 | 0.37 | 58 | 2.31 |
| 13 | 1.26 | -15 | 0.38 | 59 | 2.34 |
| 14 | 1.27 | -14.5 | 0.39 | 60 | 2.37 |
| 15 | 1.29 | -14 | 0.4 | 61 | 2.4 |
| 16 | 1.31 | -13.5 | 0.41 | 62 | 2.44 |
| 17 | 1.33 | -13 | 0.41 | 63 | 2.47 |
| 18 | 1.35 | -12.5 | 0.42 | 64 | 2.5 |
| 19 | 1.37 | -12 | 0.43 | 65 | 2.53 |
| 20 | 1.38 | -11.5 | 0.44 | 66 | 2.56 |
| 21 | 1.4 | -11 | 0.45 | 67 | 2.6 |
| 22 | 1.42 | -10.5 | 0.46 | 68 | 2.63 |
| 23 | 1.44 | -10 | 0.47 | 69 | 2.67 |
| 24 | 1.46 | -9.5 | 0.48 | 70 | 2.7 |
| 25 | 1.48 | -9 | 0.49 | 71 | 2.74 |
| 26 | 1.5 | -8.5 | 0.5 | 72 | 2.77 |
| 27 | 1.52 | -8 | 0.51 | 73 | 2.81 |
| 28 | 1.54 | -7.5 | 0.52 | 74 | 2.84 |
| 29 | 1.57 | -7 | 0.53 | 75 | 2.88 |
| 30 | 1.59 | -6.5 | 0.54 | 76 | 2.92 |
| 31 | 1.61 | -6 | 0.55 | 77 | 2.95 |
| 32 | 1.63 | -5.5 | 0.57 | 78 | 2.99 |
| 33 | 1.65 | -5 | 0.58 | 79 | 3.03 |
| 34 | 1.68 | -4.5 | 0.59 | 80 | 3.07 |
| 35 | 1.7 | -4 | 0.6 | 81 | 3.1 |
| 36 | 1.72 | -3.5 | 0.61 | 82 | 3.14 |
| 37 | 1.75 | -3 | 0.62 | 83 | 3.18 |
| 38 | 1.77 | -2.5 | 0.64 | 84 | 3.22 |
| 39 | 1.79 | -2 | 0.65 | 85 | 3.26 |
| 40 | 1.82 | -1.5 | 0.66 | 86 | 3.3 |
| 41 | 1.84 | -1 | 0.67 | 87 | 3.35 |
| 42 | 1.87 | -0.5 | 0.68 | 88 | 3.39 |
| 43 | 1.89 | 0 | 0.7 | 89 | 3.43 |
| 44 | 1.92 | 0.5 | 0.71 | 90 | 3.47 |
| 45 | 1.94 | 1 | 0.72 | 91 | 3.51 |
| 46 | 1.97 | 1.5 | 0.74 | 92 | 3.56 |
| 17 | 80.2376 | 74 | 8.4881 | 132 | 1.4937 |
| 18 | 76.6616 | 75 | 8.166 | 133 | 1.4551 |
| 19 | 73.2636 | 76 | 7.8945 | 134 | 1.4177 |
| 20 | 70.0337 | 77 | 7.6334 | 135 | 1.3813 |
| 21 | 66.9628 | 78 | 7.382 | 136 | 1.3461 |
| 22 | 64.0424 | 79 | 7.1401 | 137 | 1.3118 |
| 23 | 61.2643 | 80 | 6.9072 | 138 | 1.2786 |
| 24 | 58.6208 | 81 | 6.683 | 139 | 1.2463 |
| 25 | 56.1048 | 82 | 6.467 | 140 | 1.215 |
| 26 | 53.7095 | 83 | 6.259 | | |

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TABLE C2 (For HP model)

| NSK-BD035I | | | | V=(8/7)*MPa+0.5 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | V | Te/Tc | Pe/Pc | No. | V | Te/Tc | Pe/Pc | No. | V | Te/Tc | Pe/Pc |
| | | ℃ | MPa | | | ℃ | MPa | | | ℃ | MPa |
| 1 | 0.69 | -30 | 0.17 | 56 | 1.37 | 2.5 | 0.76 | 111 | 2.54 | 30 | 1.78 |
| 2 | 0.7 | -29 | 0.18 | 57 | 1.39 | 3 | 0.78 | 112 | 2.56 | 30.5 | 1.81 |
| 3 | 0.72 | -28 | 0.19 | 58 | 1.4 | 3.5 | 0.79 | 113 | 2.59 | 31 | 1.83 |
| 4 | 0.73 | -27 | 0.2 | 59 | 1.42 | 4 | 0.8 | 114 | 2.62 | 31.5 | 1.86 |
| 5 | 0.75 | -26 | 0.22 | 60 | 1.43 | 4.5 | 0.82 | 115 | 2.65 | 32 | 1.88 |
| 6 | 0.76 | -25 | 0.23 | 61 | 1.45 | 5 | 0.83 | 116 | 2.68 | 32.5 | 1.91 |
| 7 | 0.78 | -24 | 0.24 | 62 | 1.47 | 5.5 | 0.85 | 117 | 2.71 | 33 | 1.93 |
| 8 | 0.79 | -23 | 0.25 | 63 | 1.48 | 6 | 0.86 | 118 | 2.74 | 33.5 | 1.96 |
| 9 | 0.81 | -22 | 0.27 | 64 | 1.5 | 6.5 | 0.88 | 119 | 2.77 | 34 | 1.98 |
| 10 | 0.82 | -21 | 0.28 | 65 | 1.52 | 7 | 0.89 | 120 | 2.8 | 34.5 | 2.01 |
| 11 | 0.84 | -20 | 0.3 | 66 | 1.53 | 7.5 | 0.91 | 121 | 2.83 | 35 | 2.04 |
| 12 | 0.85 | -19.5 | 0.31 | 67 | 1.55 | 8 | 0.92 | 122 | 2.86 | 35.5 | 2.06 |
| 13 | 0.86 | -19 | 0.31 | 68 | 1.57 | 8.5 | 0.94 | 123 | 2.89 | 36 | 2.09 |
| 14 | 0.87 | -18.5 | 0.32 | 69 | 1.59 | 9 | 0.95 | 124 | 2.92 | 36.5 | 2.12 |
| 15 | 0.88 | -18 | 0.33 | 70 | 1.61 | 9.5 | 0.97 | 125 | 2.95 | 37 | 2.15 |
| 16 | 0.89 | -17.5 | 0.34 | 71 | 1.62 | 10 | 0.98 | 126 | 2.98 | 37.5 | 2.17 |
| 17 | 0.89 | -17 | 0.35 | 72 | 1.64 | 10.5 | 1 | 127 | 3.02 | 38 | 2.2 |
| 18 | 0.9 | -16.5 | 0.35 | 73 | 1.66 | 11 | 1.02 | 128 | 3.05 | 38.5 | 2.23 |
| 19 | 0.91 | -16 | 0.36 | 74 | 1.68 | 11.5 | 1.03 | 129 | 3.08 | 39 | 2.26 |
| 20 | 0.92 | -15.5 | 0.37 | 75 | 1.7 | 12 | 1.05 | 130 | 3.12 | 39.5 | 2.29 |
| 21 | 0.93 | -15 | 0.38 | 76 | 1.72 | 12.5 | 1.07 | 131 | 3.15 | 40 | 2.32 |
| 22 | 0.94 | -14.5 | 0.39 | 77 | 1.74 | 13 | 1.08 | 132 | 3.18 | 40.5 | 2.35 |
| 23 | 0.95 | -14 | 0.4 | 78 | 1.76 | 13.5 | 1.1 | 133 | 3.22 | 41 | 2.38 |
| 24 | 0.96 | -13.5 | 0.41 | 79 | 1.78 | 14 | 1.12 | 134 | 3.25 | 41.5 | 2.41 |
| 25 | 0.97 | -13 | 0.41 | 80 | 1.8 | 14.5 | 1.14 | 135 | 3.29 | 42 | 2.44 |
| 26 | 0.98 | -12.5 | 0.42 | 81 | 1.82 | 15 | 1.15 | 136 | 3.32 | 42.5 | 2.47 |
| 27 | 0.99 | -12 | 0.43 | 82 | 1.84 | 15.5 | 1.17 | 137 | 3.36 | 43 | 2.5 |
| 28 | 1.01 | -11.5 | 0.44 | 83 | 1.86 | 16 | 1.19 | 138 | 3.39 | 43.5 | 2.53 |
| 29 | 1.02 | -11 | 0.45 | 84 | 1.88 | 16.5 | 1.21 | 139 | 3.43 | 44 | 2.56 |
| 30 | 1.03 | -10.5 | 0.46 | 85 | 1.9 | 17 | 1.23 | 140 | 3.46 | 44.5 | 2.59 |
| 31 | 1.04 | -10 | 0.47 | 86 | 1.92 | 17.5 | 1.24 | 141 | 3.5 | 45 | 2.62 |
| 32 | 1.05 | -9.5 | 0.48 | 87 | 1.94 | 18 | 1.26 | 142 | 3.54 | 45.5 | 2.66 |
| 33 | 1.06 | -9 | 0.49 | 88 | 1.97 | 18.5 | 1.28 | 143 | 3.57 | 46 | 2.69 |
| 34 | 1.07 | -8.5 | 0.5 | 89 | 1.99 | 19 | 1.3 | 144 | 3.61 | 46.5 | 2.72 |
| 35 | 1.09 | -8 | 0.51 | 90 | 2.01 | 19.5 | 1.32 | 145 | 3.65 | 47 | 2.76 |
| 36 | 1.1 | -7.5 | 0.52 | 91 | 2.03 | 20 | 1.34 | 146 | 3.69 | 47.5 | 2.79 |
| 37 | 1.11 | -7 | 0.53 | 92 | 2.06 | 20.5 | 1.36 | 147 | 3.73 | 48 | 2.82 |
| 38 | 1.12 | -6.5 | 0.54 | 93 | 2.08 | 21 | 1.38 | 148 | 3.77 | 48.5 | 2.86 |
| 39 | 1.13 | -6 | 0.55 | 94 | 2.1 | 21.5 | 1.4 | 149 | 3.8 | 49 | 2.89 |
| 40 | 1.15 | -5.5 | 0.57 | 95 | 2.13 | 22 | 1.42 | 150 | 3.84 | 49.5 | 2.93 |
| 41 | 1.16 | -5 | 0.58 | 96 | 2.15 | 22.5 | 1.44 | 151 | 3.88 | 50 | 2.96 |
| 42 | 1.17 | -4.5 | 0.59 | 97 | 2.17 | 23 | 1.46 | 152 | 3.93 | 50.5 | 3 |
| 43 | 1.19 | -4 | 0.6 | 98 | 2.2 | 23.5 | 1.49 | 153 | 3.97 | 51 | 3.03 |
| 44 | 1.2 | -3.5 | 0.61 | 99 | 2.22 | 24 | 1.51 | 154 | 4.01 | 51.5 | 3.07 |
| 45 | 1.21 | -3 | 0.62 | 100 | 2.25 | 24.5 | 1.53 | 155 | 4.05 | 52 | 3.1 |
| 46 | 1.23 | -2.5 | 0.64 | 101 | 2.27 | 25 | 1.55 | 156 | 4.09 | 52.5 | 3.14 |
| 47 | 1.24 | -2 | 0.65 | 102 | 2.3 | 25.5 | 1.57 | 157 | 4.13 | 53 | 3.18 |
| 48 | 1.25 | -1.5 | 0.66 | 103 | 2.32 | 26 | 1.6 | 158 | 4.18 | 53.5 | 3.22 |
| 49 | 1.27 | -1 | 0.67 | 104 | 2.35 | 26.5 | 1.62 | 159 | 4.22 | 54 | 3.25 |
| 50 | 1.28 | -0.5 | 0.68 | 105 | 2.38 | 27 | 1.64 | 160 | 4.26 | 54.5 | 3.29 |
| 51 | 1.3 | 0 | 0.7 | 106 | 2.4 | 27.5 | 1.66 | 161 | 4.31 | 55 | 3.33 |
| 52 | 1.31 | 0.5 | 0.71 | 107 | 2.43 | 28 | 1.69 | 162 | 4.35 | 55.5 | 3.37 |
| 53 | 1.33 | 1 | 0.72 | 108 | 2.45 | 28.5 | 1.71 | 163 | 4.39 | 56 | 3.41 |
| 54 | 1.34 | 1.5 | 0.74 | 109 | 2.48 | 29 | 1.73 | 164 | 4.44 | 56.5 | 3.45 |
| 55 | 1.36 | 2 | 0.75 | 110 | 2.51 | 29.5 | 1.76 | 165 | 4.48 | 57 | 3.49 |

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