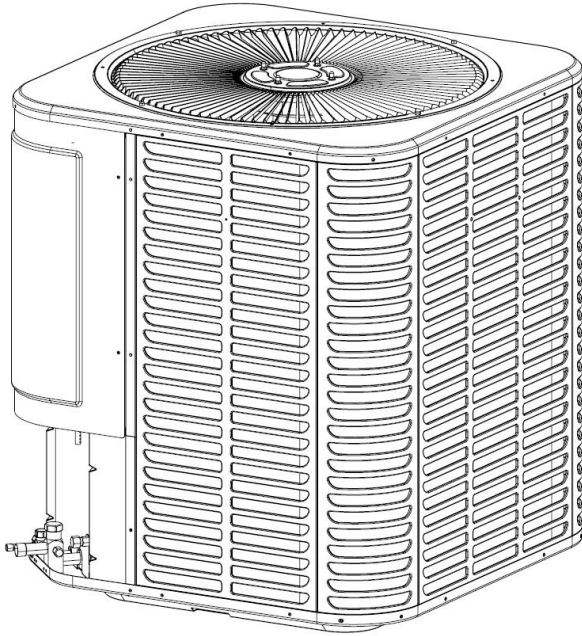




# Installation Manual

## Inverter Ducted Split

### 2-5 Ton R-410A Heat Pump



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**NOTE:** Appearance of unit may vary.  
 Installation must be performed in accordance with the requirements of NEC and CEC by authorized personnel only.




All phases of this installation must comply with National, State and Local Codes.

This document is customer’s property and is to remain with this unit. Please return it to customer with service information 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.

# 1. Safety

Read the following safety instructions before installing the unit or doing servicing work.

 **WARNING** may cause personal death or serious injury.

 **CAUTION** may lead to injury or structural damage under some conditions.



## WARNING

### HAZARDOUS VOLTAGE

Failure to follow this warning could result in property damage, severe personal injury, or death.

Disconnect all electric power, including remote disconnections before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized.

### REFRIGERANT OIL

Any attempt to repair central air conditioner and heat pump products may result in property damage, severe personal injury, or death.

These units use R-410A refrigerant which operates at 50~70% 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.

**PVE oil** is not just a lubricant but also a great solvent! It will quickly move any contaminants from the old line sets and plug up components like TXV, strainer and service valves. When replacing R-22 system with a new R-410A system, use flush (e.g. Rx11) to remove the old mineral oil, sludge, moisture, acid and other contaminants out of the system.

### 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 service valve. Turn valve stem counterclockwise only until the stem contacts the rolled edge. No torque is required.

### BRAZING REQUIRED

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

### HIGH CURRENT LEAKAGE

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



## CAUTION

### **AUTHORIZED PERSONNEL ONLY**

This information is intended for use by individuals possessing adequate backgrounds of electrical and mechanical experience. Any attempt to repair central air conditioner or heat pump products may result in personal injury and/or property damage.

### **INDOOR UNIT REQUIREMENT**

It is recommended to equip indoor units with adjustable non-bleed TXV for R-410A heat pump. The model of TXV should be suitable for the system capacity and should be with internal check valves for heat pump, which can be verified to work properly by checking superheat in cooling.

### **No micro channel coil shall be used for heat pump.**

Micro channel coils are suitable for cooling only system.

### **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.

### **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, it must be returned to their original position and properly fastened.

### **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 the system.

## 2. Unit Location Considerations

### 2.1 Inspect Units

Units are packaged for shipment to avoid damage during normal transit and handling. It is the receiving party’s responsibility to inspect the equipment upon arrival. Any obvious damage to the carton box should be reported on the bill of lading and a claim should be filed with the transportation company, and the factory should be noticed.

All units should be stored in the factory shipping carton with internal packaging in a dry place until installation. Carefully remove the packaging and inspect for hidden damage. Any hidden damage should be recorded and the factory should be notified. The gauge port can be used to check the refrigerant charge has been retained during shipment.

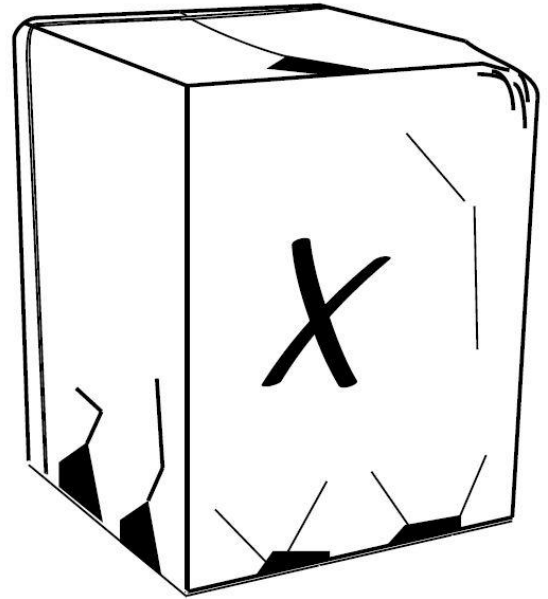


Fig 2-1 Check damage

### 2.2 Unit Dimensions

Two models sharing the same chassis are suit for most residential air conditioner and heat pump applications.

Table 2-1 Condensing unit dimensions

| Unit Dimensions |                            |
|-----------------|----------------------------|
| Model           | H x W x D (Inches)         |
| 2436            | 24-15/16 x 29-1/8 x 29-1/8 |
| 4860            | 33-3/16 x 29-1/8 x 29-1/8  |

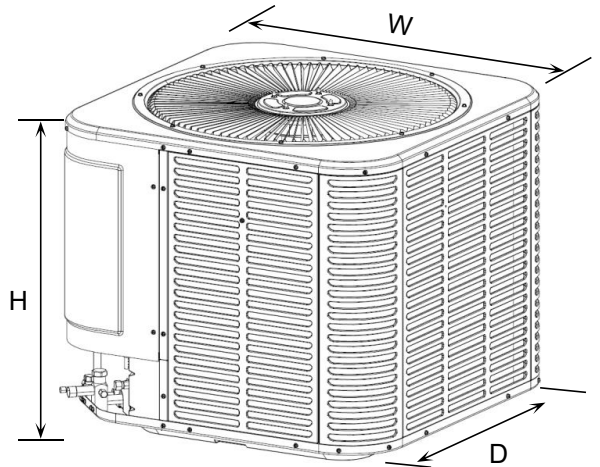


Fig 2-2 External dimensions

### 2.3 Location Restrictions

Exposure to a corrosive environment may shorten the life of the equipment, corrode metal parts, and/or negatively affect unit performance. Corrosive elements include, but are not limited to: sodium chloride, sodium hydroxide, sodium sulfate, and other compounds commonly found in ocean water, sulfur, chlorine, fluorine, fertilizers, and various chemical contaminants from industry/manufacturing plants. If installed in areas which may exposed to corrosive environments, special attention should be given to the equipment placement and maintenance.

- Lawn sprinklers/waste water should not spray directly on the unit cabinet for prolonged periods.
- In coastal areas: The outdoor unit should be installed at a location that is at least 1000 feet away from the coastal and on the side of the building that is farthest from the sea.

**Installation Clearance Requirement**

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

Do not locate condensing unit near bedrooms because normal operational sounds may be annoying. Position unit to allow adequate space for unobstructed airflow, wiring, refrigerant lines, and serviceability.

Allow a minimum of 12 in. clearance on one side of access panel to a wall and a minimum of 24 in. on the adjacent side of access panel. **Maintain a distance of 24 in. between units.**

Avoid to install near bedrooms

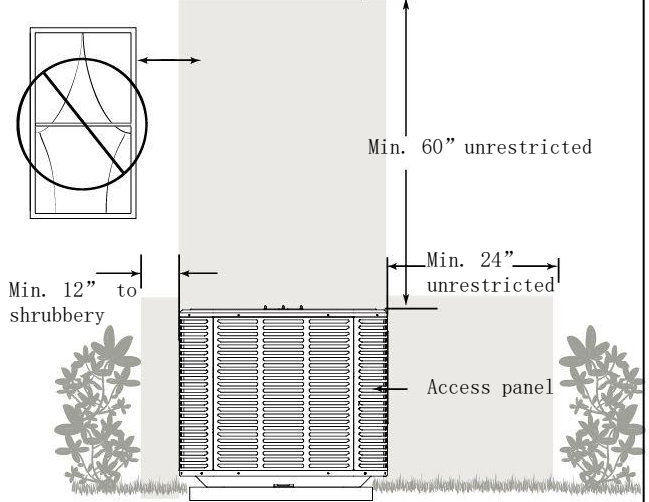


Fig 2-3 Clearance requirement

**Position unit so water, snow, or ice from roof overhang cannot fall directly on unit.**

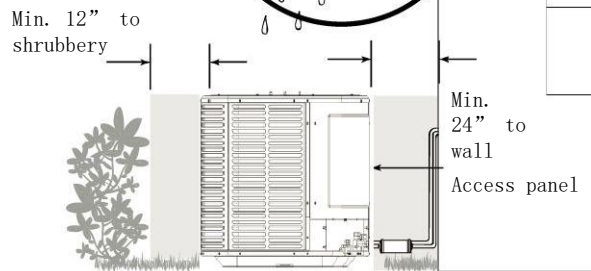


Fig 2-4 Unit location

## Cold Climate Considerations

Precautions must be taken for units being installed in areas where snow accumulation and prolonged below-freezing temperatures occur.

Elevate unit per local climate and code requirements.

- Where snowfall is anticipated, raise the unit above the base pad to prevent ice buildup and coil damage. Mount the unit high enough to be above the average accumulated area snowfall. See “Ground Snow Depth” chart below for representative snow depths.
- If unit must be elevated because of anticipated snowfall, secure unit and elevating stand such that unit and/or stand will not tip over or fall off.

A snow drift barrier should be installed around the unit to prevent a build-up of snow on the unit sides.

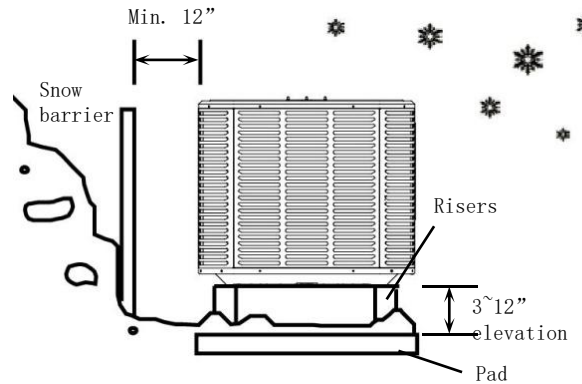


Fig 2-5 Consideration to prevent refreezing

## Snow Guard Kit Cautions

**No kit shall damage the top panel of condensing unit.**

- Main control board (MCB) will be damaged due to the rainwater flow into the control box.
- The condensing coil will be broken resulting in refrigerant leak.

In areas prone to blizzards and freezing rain, it is advisable to install a snow guard for added protection.

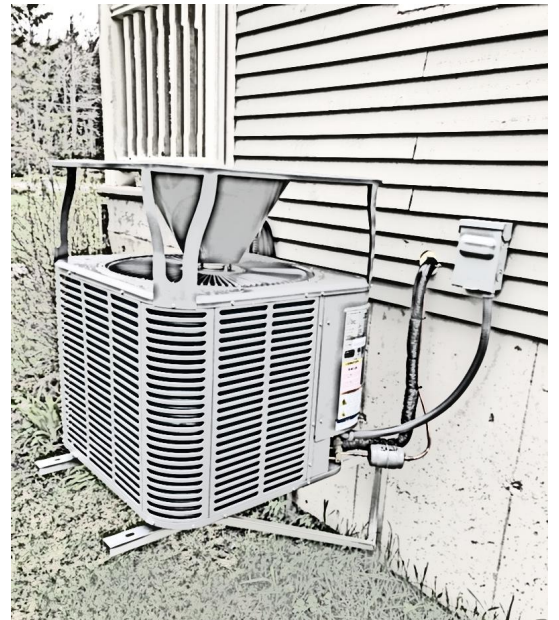


Fig 2-6 Snow Guard Kit

### 3. Position the Unit

When mounting the unit on a roof, be sure the roof will support the unit's weight obtained from nameplate.

Properly selected isolation is recommended to prevent sound or vibration transmission to the building structure. If elevating a unit on a flat roof, use 4" x 4" or equivalent stringers positioned to distribute unit weight evenly and prevent noise and vibration.

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

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

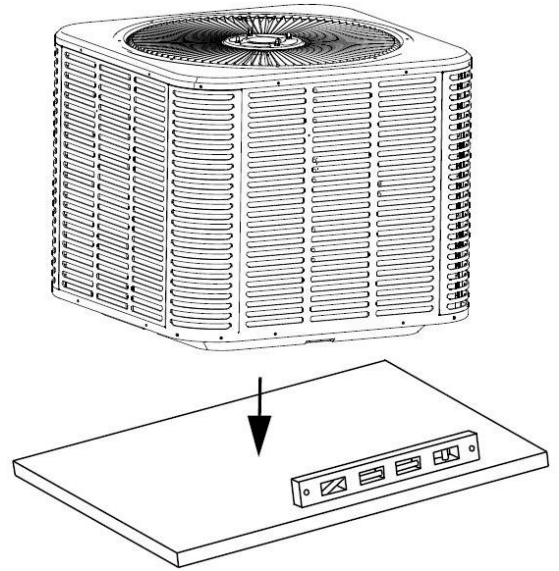


Fig 3-1 Position the unit on pad

**IMPORTANT NOTE:**

These instructions are intended to provide a method to tie-down unit to cement slab as a securing procedure for high wind areas. Check local codes for tie-down methods and protocols.

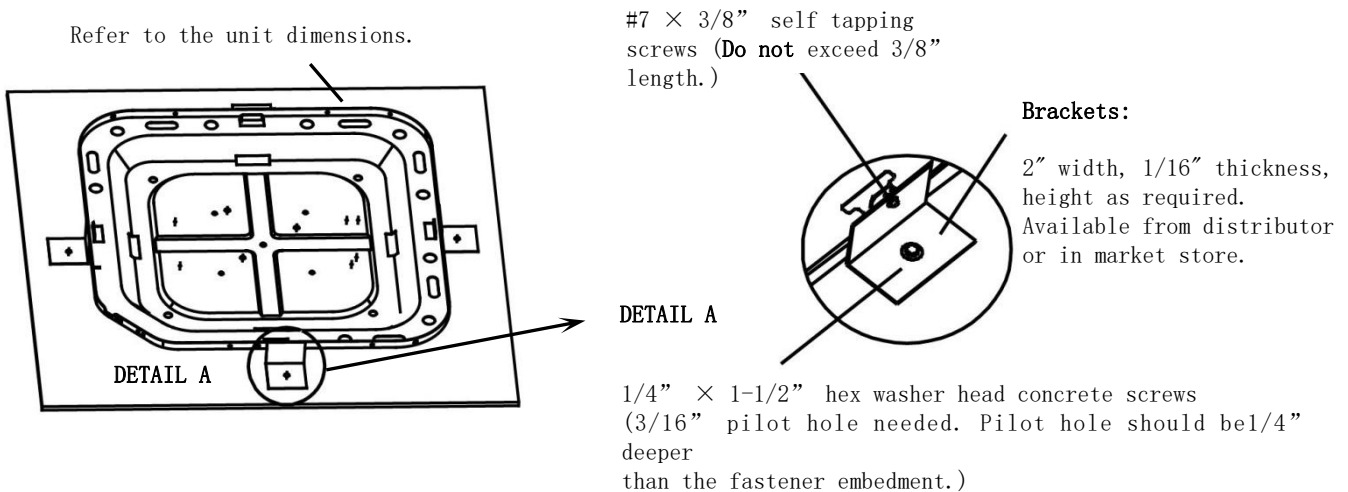


Fig 3-2 Fasten the condensing unit

# 4. Refrigerant Line Considerations

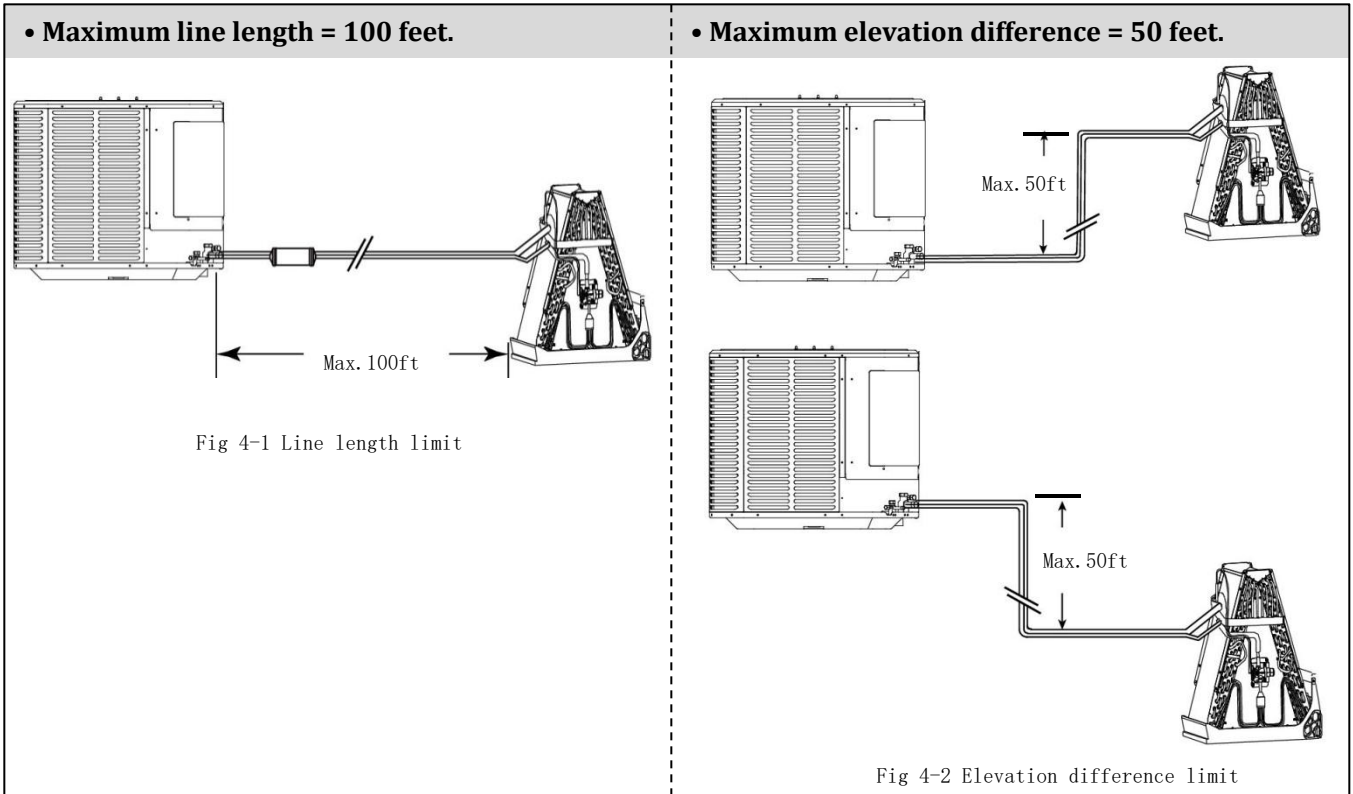
## 4.1 Refrigerant Line Limits

Use only the line sizes indicated in below table and determine required line length. If the suction line sets are greater than 50 feet, do not use a larger suction line than recommended.

Table 4-1 Line sizes and maximum length

| Model | Liquid Line          | Suction Line | Total Equivalent Length (FT)      |    |     |     |
|-------|----------------------|--------------|-----------------------------------|----|-----|-----|
|       |                      |              | 25                                | 50 | 75  | 100 |
|       | Dimensions in inches |              | Maximum Elevation Difference (FT) |    |     |     |
| 2Ton  | 3/8 Std.             | 3/4 Std.     | 25                                | 50 | 45  | 40  |
|       | 1/4 Opt.             | 5/8 Opt.     | 25                                | 50 | 40  | 30  |
| 3Ton  | 3/8 Std.             | 3/4 Std.     | 25                                | 50 | 50  | 50  |
|       | 1/4 Opt.             | 5/8 Opt.     | 25                                | 50 | 45  | 40  |
| 4Ton  | 3/8                  | 7/8 Std.     | 25                                | 50 | 50  | 40  |
|       |                      | 3/4 Opt.     | 25                                | 50 | 50  | 40  |
| 5Ton  | 3/8                  | 7/8 Std.     | 25                                | 50 | 50  | 40  |
|       |                      | 3/4 Opt.     | 25                                | 50 | 50  | 40  |
|       |                      | 1-1/8 Opt.   | 25                                | 30 | N/A | N/A |

**Std.:** Standard line size; **Opt.:** Optional line size; **N/A:** Application not recommended





## 4.2 Refrigerant Line Insulation

The suction line must always be insulated.

**DO NOT** allow the suction line and liquid line to come in direct (metal to metal) contact.

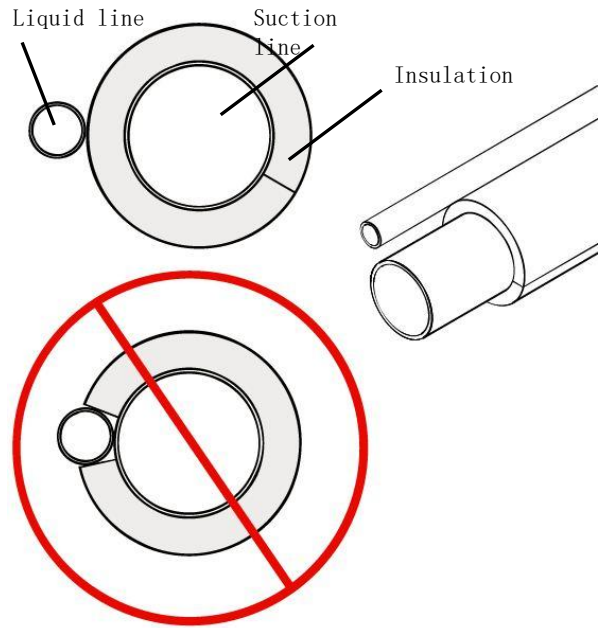


Fig 4-3 Line insulation

## 4.3 Reuse Existing Refrigerant Lines

### ⚠ CAUTION

If using existing refrigerant lines, make sure 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 according to Table 4-1. It's not recommended to use suction line bigger than standard size, in which will result poor oil return for inverter compressor.
- Ensure that the refrigerant lines are **free of leaks, acid and mineral oil**. When replacing R-22 system with a new R-410A system, be sure the existing lines can endure R-410A pressure which is 50~70% higher than R-22 system. Use flush (e.g. Rx11) to remove the old mineral oil, sludge, moisture, acid and other contaminants out of the line set.

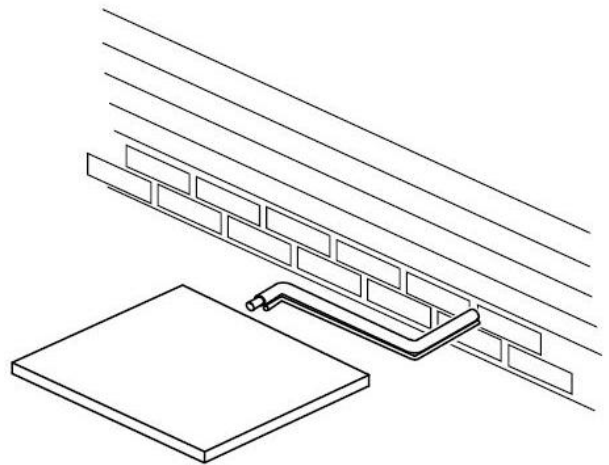


Fig 4-4 Use existing refrigerant lines

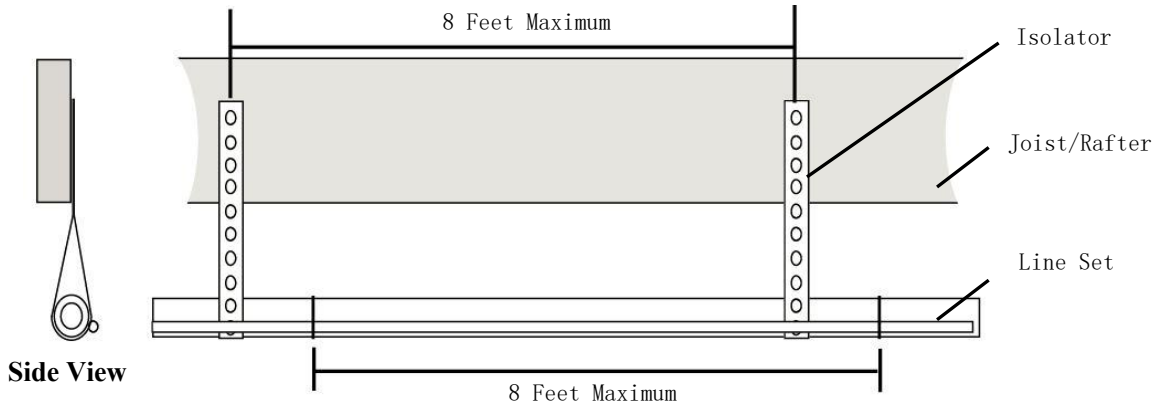
### IMPORTANT:

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

# 5. Refrigerant Line Routing

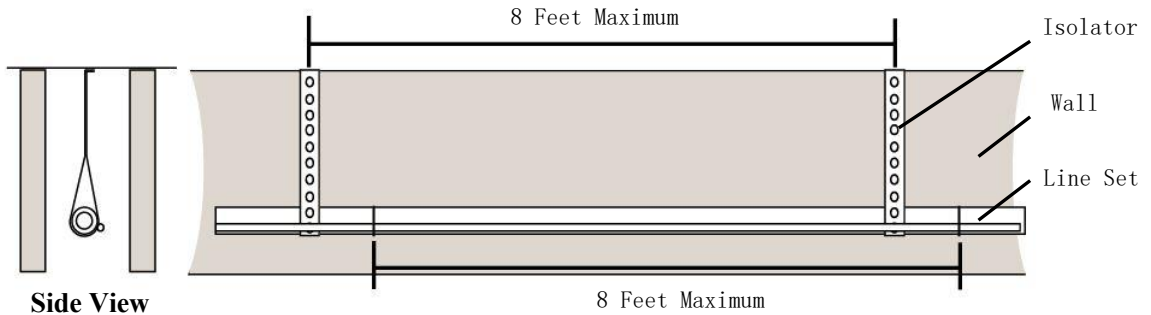
**Comply with National, State, and Local Codes when isolating line sets from joists, rafters, walls, or other structural elements.** Take precautions to prevent noise within the building structure due to vibration transmission from the refrigerant lines. For Example:

- Use isolation type hangers when the refrigerant lines have to be fastened to floor joists or other framing.
- Isolation hangers should also be used when refrigerant lines traverse stud spaces or enclosed ceilings.
- Where the refrigerant lines pass through a wall or sill, it should be insulated and isolated.
- Isolate the lines from all ductwork.
- Minimize the number of 90° turns.



Secure suction line from joists using isolators every 8 ft. Secure liquid line directly to insulated suction line using tape, wire, or other appropriate method every 8 ft.

Fig 5-1 Isolation from Joist/Rafter



Secure suction line using isolators every 8 ft. Secure liquid line directly to insulated suction line using tape, wire, or other appropriate method every 8 ft.

Fig 5-2 Isolation in wall spaces

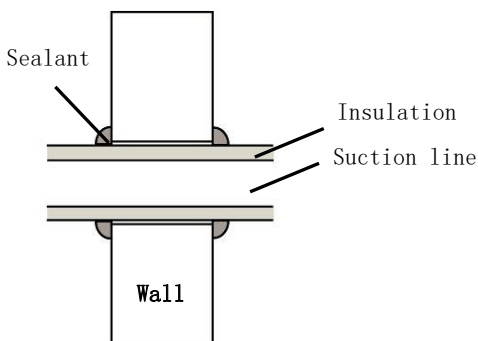


Fig 5-3 Isolation through wall

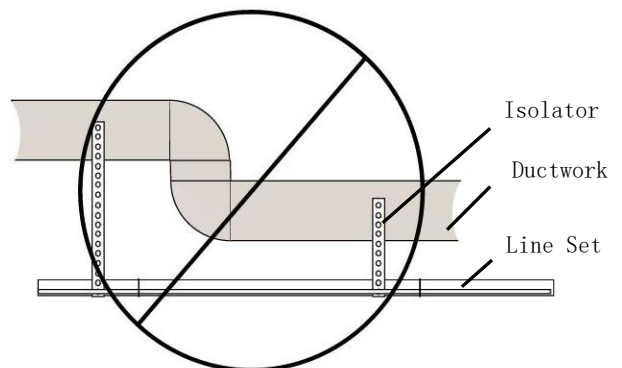


Fig 5-4 DO NOT hang line sets from ductwork

# 6. Refrigerant Line Brazing

Refer to below figures marked with digital number for line brazing procedures. Every figure is corresponding to the following illustrations.

1. Remove caps or plugs. Use a tool to deburr the line ends. Clean both internal and external surfaces of the tubing using an emery cloth.
2. Remove the pressure tap cap from both service valves.
3. Purge the refrigerant lines and indoor coil with **dry nitrogen** from gas service valve.
4. Wrap a wet rag around the service valve body to avoid heat damage and continue the dry nitrogen purge. Braze the refrigerant lines to the service valves. Install a **bidirectional filter drier (NO active alumina allowed)** in liquid line to protect the heat pump. Do not remove the wet rag until all brazing is completed.
5. Put the pressure tap caps back after the service valves cooled down.

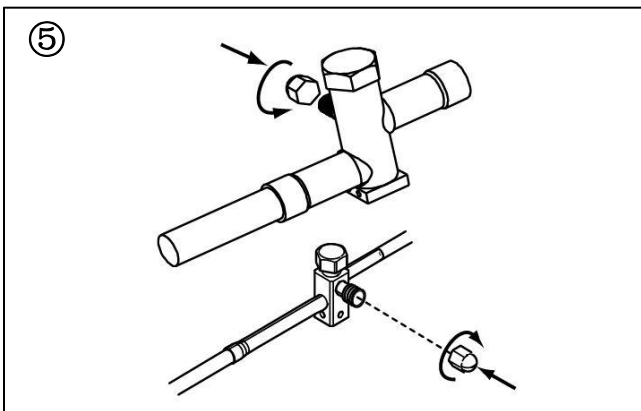
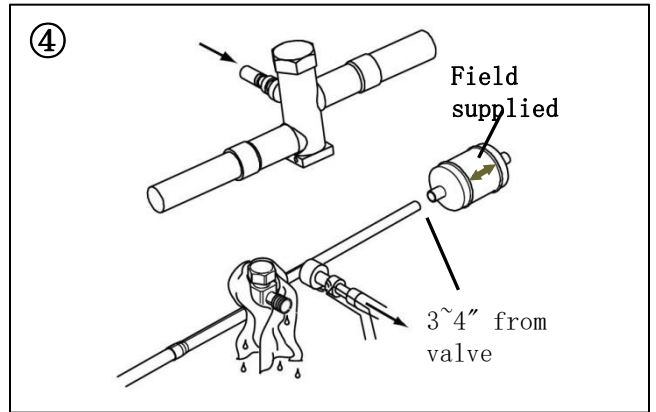
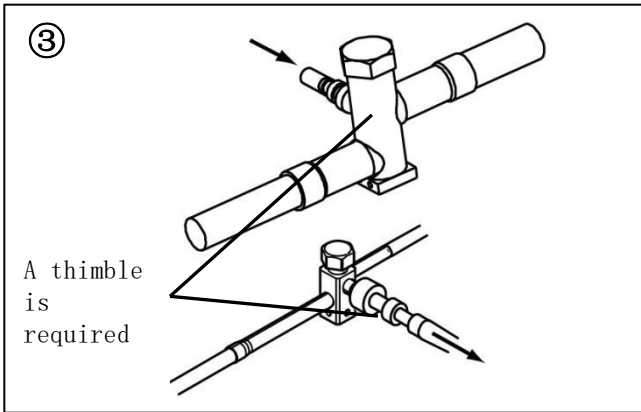
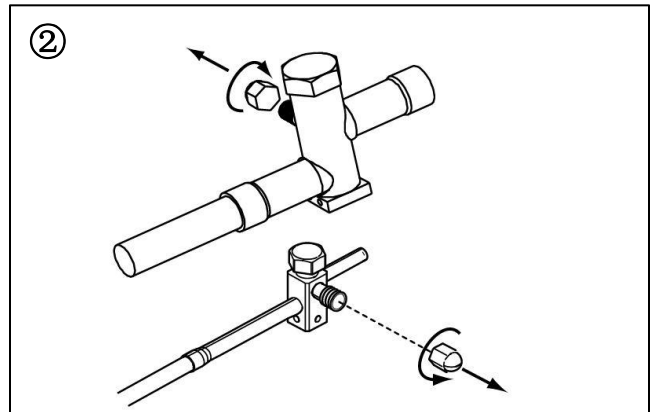
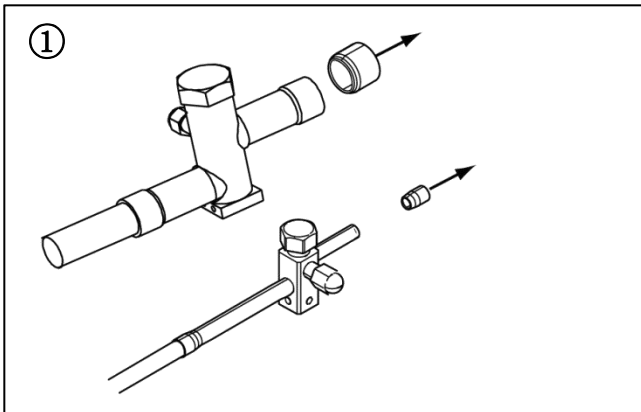


Fig 6-1 Refrigerant line brazing work

# 7. System Leak Check

**Leak check is required for the brazed line connections.**

1. Pressurize the brazed refrigerant lines and indoor coil to at least 450 PSIG using dry nitrogen.
2. Wait for 10 minutes without a drop in pressure.
3. Check for leaks by using a soapy solution or bubbles at each brazed location.

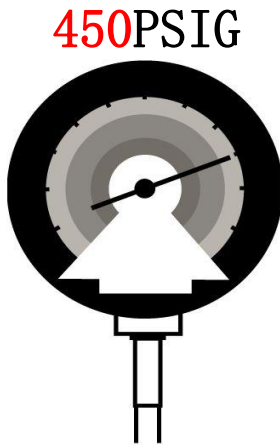


Fig 7-1 Charge dry nitrogen to the system

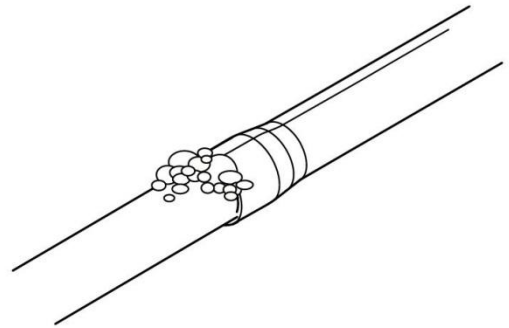


Fig 7-2 Leak check

# 8. Evacuation

**Do not open the service valves until the leak check and evacuation are complete.**

1. The vacuum should be pulled for at least 45 minutes.
2. Evacuate until the micron gauge reads less than 350 microns, then close the valve to the vacuum pump.
3. Evacuation is complete if the micron gauge does not rise above 500 microns in 10 minutes.

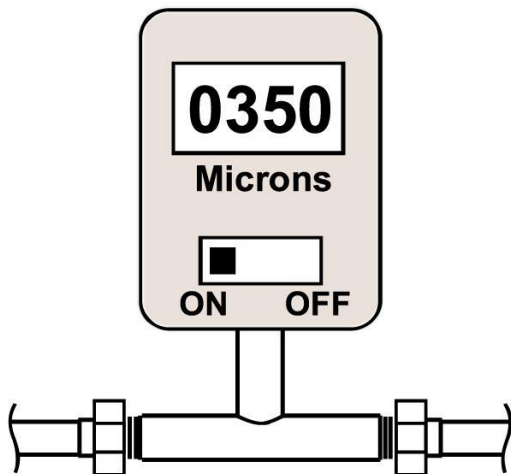


Fig 8-1 Evacuation the refrigerant system

# 9. Service Valves

Leak check and evacuation must be completed before opening the service valves.

**The gas service valve must be opened BEFORE opening the Liquid Service Valve!**

1. Remove service valve cap.
2. Fully insert hex wrench into the stem and counterclockwise until valve stem just touches the rolled edge (approximately five turns.)
3. Replace and tighten the valve stem cap to prevent leaks. Additional 1/6 turn may be required.

Repeat 1 to 3 for Liquid Service Valve.

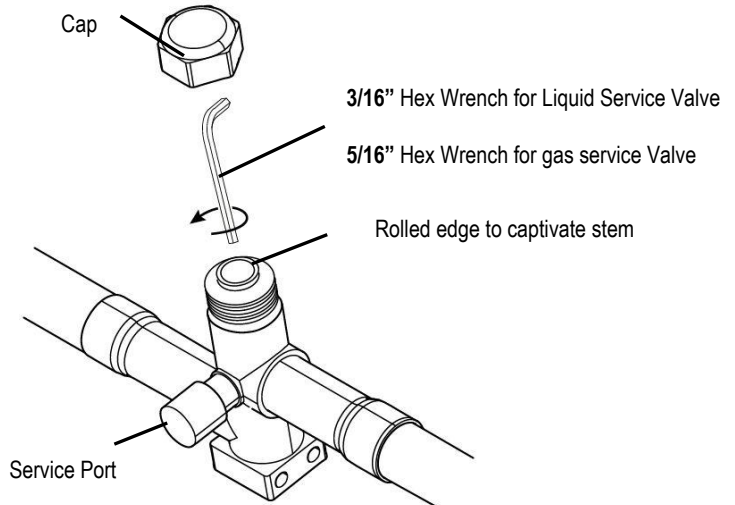


Fig 9-1 Open the service valves



## WARNING

Extreme caution should be exercised when opening the Liquid Service Valve. Turn counterclockwise until the valve stem just touches the rolled edge. No torque is required.

Failure to follow this will result in abrupt release of system charge and may lead to personal injury and /or property damage.

# 10. Electrical – Low Voltage

## 10.1 Low voltage wire requirement

Define the maximum length of low voltage wiring from condensing unit to indoor unit and thermostat.

**Field installed electrical conduit is required at the low voltage wire entry point.** Animals like frogs, snakes, spiders and others may climb into the control box resulting in the MCB damage. **Manufacturer reserves the rights to reject warranty claim on MCB if not comply.**

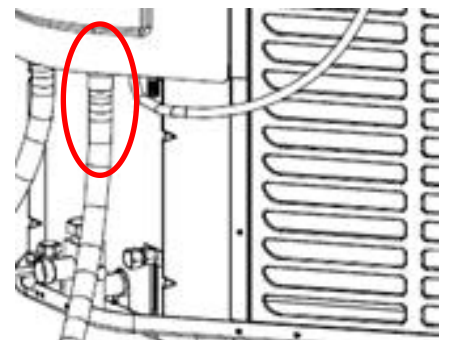
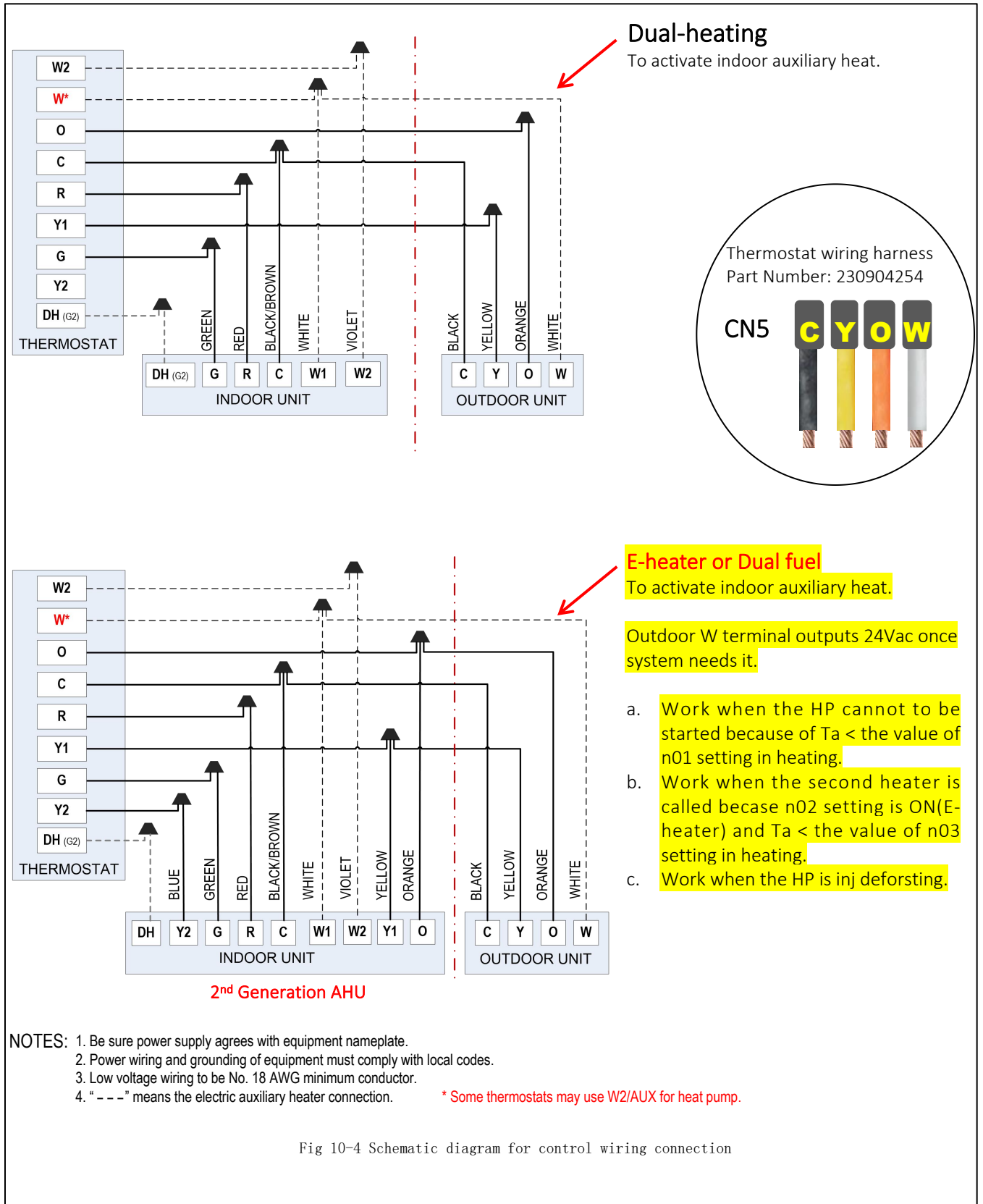


Fig 10-1 Sealing requirement

Table 10-1 Low voltage control wiring requirement


| CONTROL WIRING |                  |
|----------------|------------------|
| Wire Size      | Max. Wire Length |
| 18 AWG         | 150Ft            |
| 16 AWG         | 225Ft            |

# 10.2 Low voltage hook-up diagrams



# 11. Electrical – High Voltage

## 11.1 High voltage power supply


**WARNING**

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.

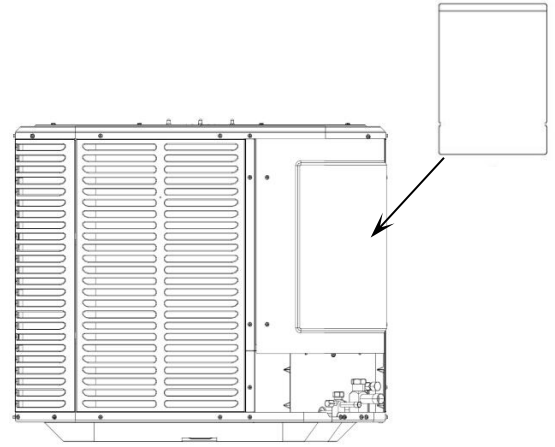


Fig 11-1 Read the Warning Label

| Power Supply |                   |       |           |
|--------------|-------------------|-------|-----------|
| Model        | Voltage           | MCA * | Breaker * |
| 2436         | 208/230V-1Ph-60Hz | 24.4A | 40A       |
| 4860         | 208/230V-1Ph-60Hz | 32.5A | 50A       |

\*The data on nameplate shall prevail if there is a difference between IM and nameplate.

## 11.2 High voltage disconnect switch

Install a separated disconnect switch at the condensing unit. Field provided **flexible electrical conduit** must be used for high voltage wiring.

In order to get full warranty coverage on the compressor, it's mandatory to install a **surge protector** to prevent the unit from damaging caused by abnormal electrical spikes.

**We recommend the Installation of a GFIC (install the GFIC as per your local codes).**

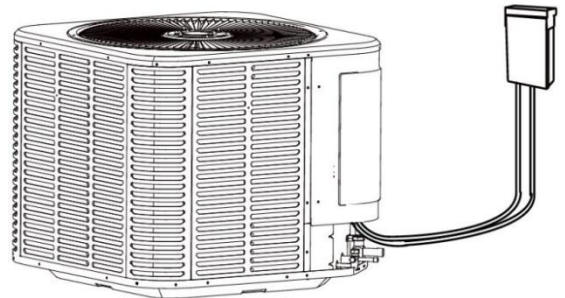


Fig 11-2 Install an independent switch

## 11.3 High voltage ground

Ground the condensing unit according to National, State, and Local code requirements.

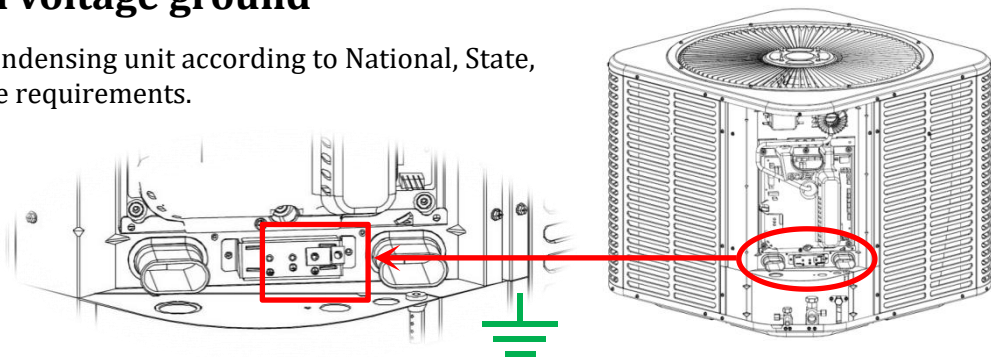


Fig 11-3 Unit grounding

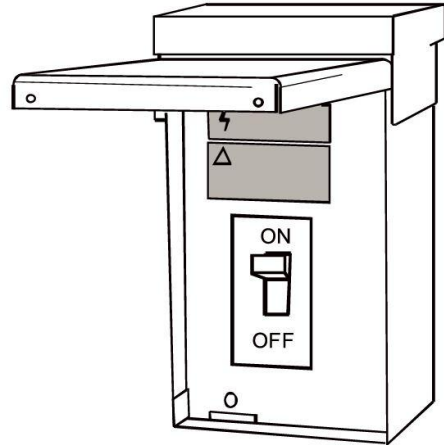
# 12. Start-up

Prior to start-up the unit, connect IoT device if equipped with. Refer to IoT IM and Registration Guide via ESS Pro App. At the same time, ensure chapters 5 to 11 have been completed.

## 1. Set the thermostat to OFF.



## 2. Turn on disconnect switch to apply power to the indoor and outdoor units.



## 3. Wait an hour before starting the unit if the outdoor ambient temperature < 59 °F.



## 4. Set the thermostat to ON.



**NOTE:**  
It may take up to **45 minutes** in the first time for heating operation to exit start-up control. This is normal function to preheat lubricants in the bottom of compressor.




# 13. System Charge Adjustment

## 13.1 Weigh-in method

Weigh-in method can be used for the initial installation, or anytime a system charge needs to be replaced. Weigh-in method can also be used when power is not available on the job site or the ambient temperature is improper to use refrigerant coefficient and sub-cooling charge method.

**When use weigh-in method in heating mode, be sure the compressor discharge superheat (DSH) meets the target value. Basically, the liquid line sub-cooling (SC) shall not exceed 30°F.**

Use **gauge port** to charge the system in heating mode, query live data by BS3 button to calculate DSH or check SC/DSH via ESS Pro App.



25~50°F  
DSH

Table 13-1 Charge amount table

| A     | B                     | C       |                                     | D   |
|-------|-----------------------|---------|-------------------------------------|---|
| Model | Factory charge        | Indoor  | Charge amount for Ecoer air handler | Charge multiplier for liquid line length *2 |
| 2436  | The data on nameplate | 24K     | 0                                   | 0.6 oz/ft                                   |
|       |                       | 36K     | 14oz *1                             |   |
| 36K   |                       | 0       |                                     |   |
| 48K   |                       | 11oz*1  |                                     |   |
| 60K   |                       | 25oz *1 |                                     |   |

- Every condensing unit is factory charged for the smallest rated indoor coil combinations. An additional amount of refrigerant adjustment is required for a large indoor coil. It's invalid for system with electric heat or other third-party heat source whose capacity is 1.2 times of heat pump nominal capacity.
- The charging guideline is calculated in 25ft of standard size line set.** A refrigerant adjustment may be necessary if the line set length is over the pre-charged 25 ft (adding 0.6 oz/ft on 3/8 liquid line respectively).

**Charging example:**

If the air handler is 3T with the 2436 unit, and the liquid line length is 40ft, the charging is below,

- The air handler charging = 14 oz(A)
- The liquid line length = 40 ft(B) \* If less than 25ft, it is defined as 25ft.
- Standard line length = 25 ft(C)
- Charge multiplier for 3/8 line = 0.6 oz/ft(D)
- The charging for line ((B-C) × D)= (40-25) × 0.6=9 oz(E)
- The total charging(A+E)= 14 + 9 =23 oz(F)

## 13.2 Auto charge mode

Turn on the power supply for the system, select **cooling mode** at thermostat. Make sure the setting temperature is lower than indoor temperature for at least 5° F to finish this charge mode **\*NOTE1**.

**Press and hold BS4 button for five (5) seconds** until SEG1 displays blinking 7. After one minute, the system will go into AUTO charge mode **\*NOTE2**.



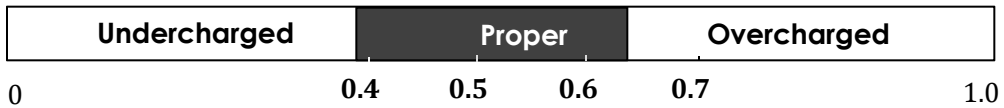
Fig 13-1 LED display in AUTO charge mode

Run the system for 15~20 minutes and check **refrigerant coefficient** number (here short for “X”,  $0 < X < 1$ ) from the LED display. If  $X > 0.6$ , remove refrigerant; or  $X < 0.4$ , add more refrigerant. Then wait for 5 minutes to allow system pressure balanced. Check the new coefficient number to make sure you get 0.5. Basically, 0.4 to 0.6 is acceptable if  $7^\circ\text{F} \leq \text{SSH} \leq 20^\circ\text{F}$ .

**When the LED displays “--” for more than 20 minutes, stop charging and adjust the TXV opening to ensure required compressor suction superheat** (Refer to the following page).

### Refrigerant coefficient

The refrigerant coefficient is used to evaluate the refrigerant level in the ecoer system.



### Use either way below to end AUTO charge mode

Press **BS4 once**/ After 2 hours running (Automatically EXIT)/ Turn off the system at thermostat

### NOTES:

- This AUTO charge mode is suitable for ambient temperature between 50°F and 115°F. But for the best results, indoor temperature should be kept between 70°F and 80°F. For outdoor ambient temperature is below 50° F, use weigh-in charge method only.



Fig 13-2 Temperature limit for AUTO charge mode

- Start-up control is enforced to complete prior to activate the AUTO charge mode. It may take 4 to 10 minutes to exit start-up control procedure and fix the compressor speed (RPS).

## TIPS: How to adjust indoor TXV opening

To keep the best performance and reliability of Ecoer Smart Inverter (ESI) system, be sure liquid line sub-cooling (SC) and compressor suction superheat (SSH) meet the requirements.

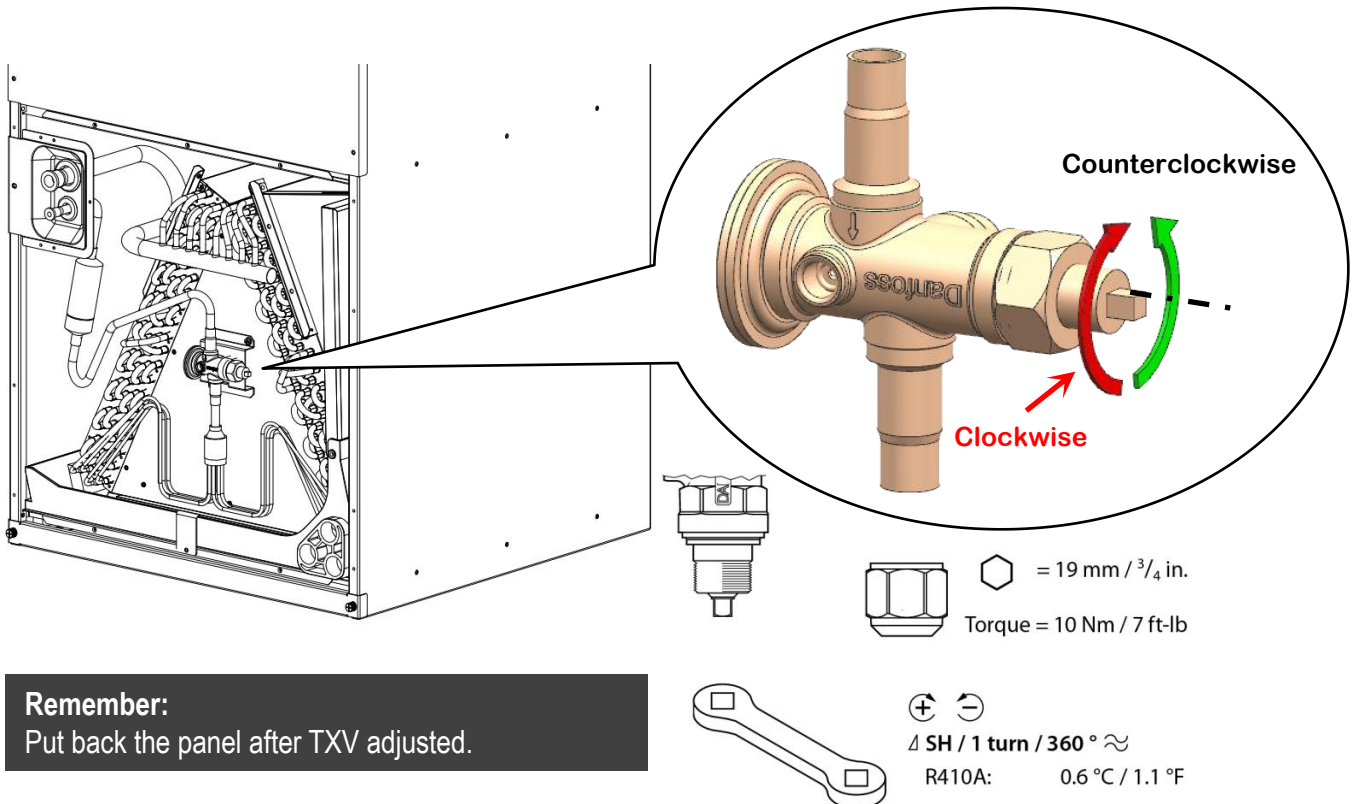


**Target SC and SSH  
in cooling**



- If the LED displays "--" in AUTO charge mode for more than 20 minutes, stop charging and use a wrench to **clockwise** the TXV to ensure SH is no less than 7° F.
- In case that the cooling performance is abnormal due to improper superheat (i.e. SSH >20° F). Proceed as followings to complete the field adjustment.
  1. Activate AUTO charge mode from outdoor condensing unit to fix compressor speed (RPS) by press BS4 for 5 seconds on MCB. Run the system for 15~20 minutes to check refrigerant coefficient number from LED display or ESS Pro App, **add refrigerant until you get 0.6**.
  2. Open the front panel of the indoor unit, then use a wrench to **counterclockwise** the TXV until SH ≤ 20° F. This will make more refrigerant flow into indoor coil for better cooling performance.

**NOTE: Maintain a minimum of 15 minutes operation** after every refrigerant amount or TXV opening adjustment (**the TXV adjustment should be done at ¼ turn each time**), then check live SC and SSH on ESS Pro App.



**Remember:**  
Put back the panel after TXV adjusted.

Fig 13-3 Adjust indoor TXV opening according to SC and SH

# 13.3 Sub-cooling charge

Refer to the following steps to charge refrigerant by sub-cooling degree in cooling mode.

## STEP1 CALCULATE SUPERHEAT ON SUCTION VALVE

Measured suction line temperature = \_\_\_\_\_°F

Measured suction line pressure = \_\_\_\_\_PSIG

Calculated superheat value = \_\_\_\_\_°F

Table 13-2 Superheat calculation on gas service valve

| Suction line<br>TEMP (°F) | Final Superheat (°F)          |     |     |     |     |     |     |     |
|---------------------------|-------------------------------|-----|-----|-----|-----|-----|-----|-----|
|                           | 8                             | 10  | 12  | 14  | 16  | 18  | 20  | 22  |
|                           | Suction Gauge Pressure (PSIG) |     |     |     |     |     |     |     |
| 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 |

## STEP2 CALCULATE SUB-COOLING ON LIQUID VALVE

Measured liquid line temperature = \_\_\_\_\_°F

Measured liquid line pressure = \_\_\_\_\_PSIG

Calculated sub-cooling value = \_\_\_\_\_°F

Add refrigerant if calculated sub-cooling value is lower than the designed one. Repeat the steps above.

Table 13-3 Sub-cooling calculation on liquid service valve

| Liquid line<br>TEMP (°F) | Final Sub-cooling (°F)       |     |     |     |     |     |     |     |
|--------------------------|------------------------------|-----|-----|-----|-----|-----|-----|-----|
|                          | 6                            | 7   | 8   | 9   | 10  | 11  | 12  | 13  |
|                          | Liquid Gauge Pressure (PSIG) |     |     |     |     |     |     |     |
| 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 |

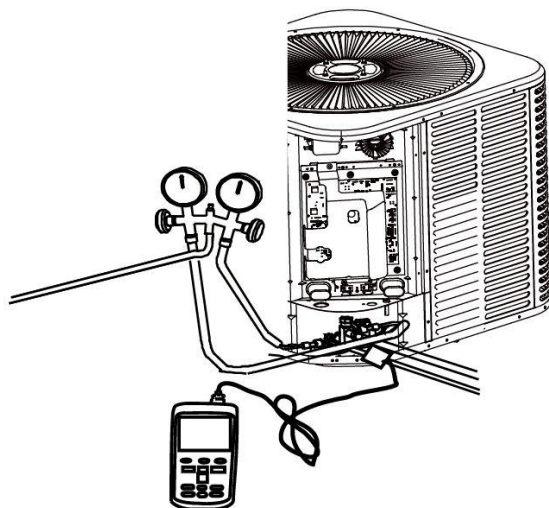


Fig 13-4 Measure the superheat or sub-cooling

Table 13-4 Designed sub-cooling degree

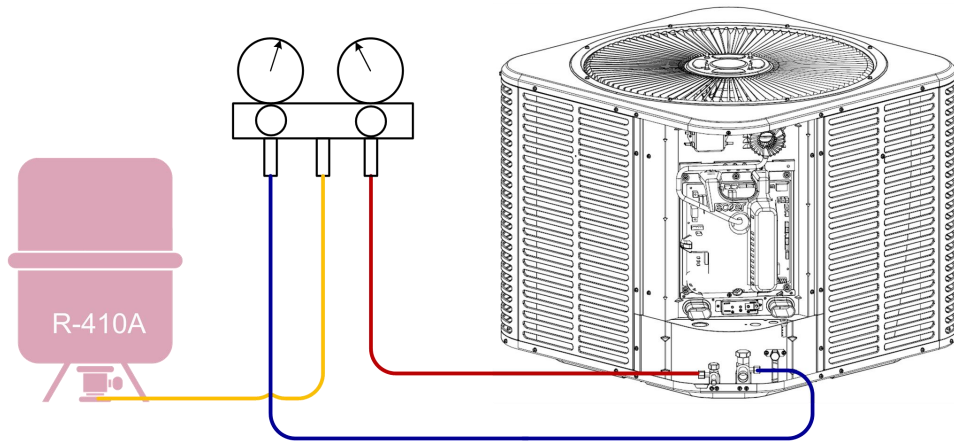
| Model | Designed sub-cooling degree (SC) |
|-------|----------------------------------|
| 24    | 8°F (±2°F)                       |
| 36    | 10°F (±2°F)                      |
| 4860  | 8°F (±2°F)                       |

**STEP3 ADJUST REFRIGERANT LEVEL TO ATTAIN PROPER GAUGE PRESSURE**

**Add refrigerant** if the sub-cooling is lower than the chart value.

1. Connect gauge hoses to refrigerant tank and liquid/gas service valves (Use gauge port instead of gas service valve for charge in heating).
2. Purge all hoses.
3. Stand the refrigerant tank upside-down and charge.
4. Stop adding refrigerant when sub-cooling matches the charging chart.

**Remove refrigerant** if the sub-cooling is higher than the chart value.



**STEP4 STABILIZE THE SYSTEM**

1. Wait five (5) minutes for the unit to stabilize between adjustments. When the sub-cooling matches the chart, the system is properly charged.
2. Remove gauge hoses.
3. Replace and tighten service port caps to prevent leaks. Plus an additional 1/6 turn may be required.

**STEP5 RECORD SYSTEM INFORMATION FOR FURTHER REFERENCE**

|                                      |      |
|--------------------------------------|------|
| Condensing unit model                |      |
| Indoor unit model                    |      |
| Measured outdoor ambient temperature | °F   |
| Measured indoor ambient temperature  | °F   |
| Liquid gauge pressure                | PSIG |
| Suction gauge pressure               | PSIG |
| Measured suction line temperature    | °F   |
| Measured liquid line temperature     | °F   |

# 14. System Operation

## 14.1 Default display

LED on main control board can display the operating status of outdoor unit (ODU).



**SEG1:** Normally blank, but it displays codes “0 to 9” accordingly if there is damaged sensor and command response.

| SEG1 Code | Description   |
|-----------|---|
| 0         | Software is updating through IoT device                           |
| 1         | High pressure sensor (HP) fault backup running                    |
| 2         | Low pressure sensor (LP) fault backup running                     |
| 3         | Compressor discharge temperature sensor (TD) fault backup running |
| 4         | IPM module temperature sensor (TF) fault backup running           |
| 5         | Ambient temperature sensor (TA) fault backup running              |
| 6         | Defrost sensor (TH) fault backup running                          |
| 7         | Compressor suction temperature sensor (TS) fault backup running   |
| 8         | Liquid line temperature sensor (TL) fault backup running          |
| 9         | IoT command response  |

**SEG2:** Normally blank, but it will display code accordingly as below if outdoor unit is running under limited condition.

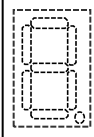
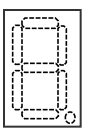
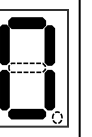
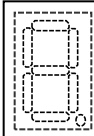
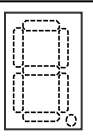
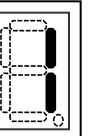
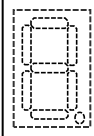
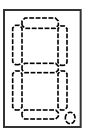
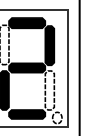
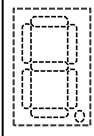
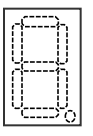

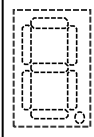
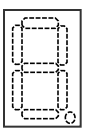

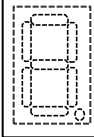
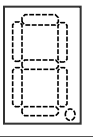
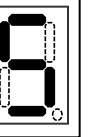
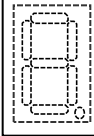
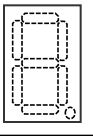
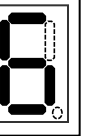
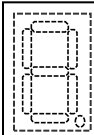
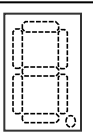
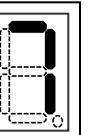
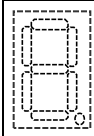
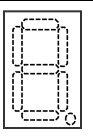

| SEG2 Code | Description                                |
|-----------|--|
| 0         | Running under high pressure limit          |
| 1         | Running under low pressure limit           |
| 2         | Running under discharge temperature limit  |
| 3         | Running under IPM module temperature limit |
| 4         | Running under compressor current limit     |

**SEG3:** It displays outdoor unit’s operation mode.

| SEG3 Code | Description                    |
|-----------|--------------------------------|
| 0         | Stop (Y signal de-energized)   |
| 1         | Ready to start-up <b>*NOTE</b> |
| 2         | Cooling                        |
| 3         | Heating                        |
| 4         | Oil return                     |
| 5         | Defrost                        |
| 6         | Manual defrost                 |
| 7         | AUTO charge mode in cooling    |
| 8         | Pump down                      |

**NOTE:** Compressor waits three to eight (8) minutes to restart.

# Mode list (SEG3 Display)

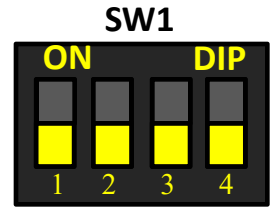
|                                    |  |
|------------------------------------|--|
| <b>Stop or standby</b>             | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div>       |
| <b>Ready to start-up</b>           | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div>       |
| <b>Cooling</b>                     | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div>       |
| <b>Heating</b>                     | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div>       |
| <b>Oil return</b>                  | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div>    |
| <b>Defrost</b>                     | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div> |
| <b>Manual defrost</b>              | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div> |
| <b>AUTO charge mode in cooling</b> | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div> |
| <b>Pump down</b>                   | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">SEG1<br/></div> <div style="text-align: center;">SEG2<br/></div> <div style="text-align: center;">SEG3<br/></div> </div> |

## 14.2 Field setting

Outdoor condensing units' functions can be applied by dipping switch and pressing buttons.

### 14.2.1 Setting by dip switches

| SW1 Dip switch |                             | Description   |            |
|----------------|-----------------------------|---------------|------------|
| NO.            | Setting item                | Status        | Content    |
| 1              | Snow Sensor Control *a      | ON            | Disable    |
|                |                             | OFF (factory) | Enable     |
| 2              | Capacity selection          | ON            | 2 or 4 Ton |
|                |                             | OFF (factory) | 3 or 5 Ton |
| 3              | AC only / Heat pump         | ON            | AC only    |
|                |                             | OFF (factory) | Heat pump  |
| 4              | Command *b response for IoT | ON            | Disable    |
|                |                             | OFF (factory) | Enable     |

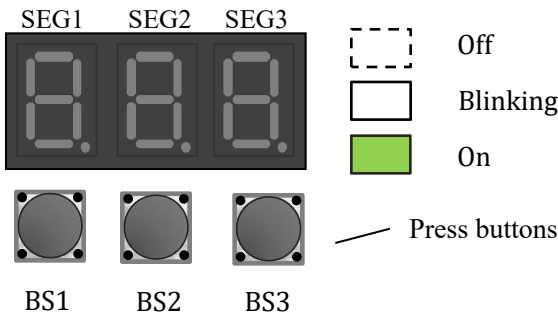


Use minor straight screwdriver to dip switch. Must power off the unit for at least two minutes to activate the change.

a. ver203 or above support this function    b. Remote field setting, troubleshooting, software programming etc.

### 14.2.2 Setting by pressing buttons

Query and setting operation can be done by pressing buttons on main control board.



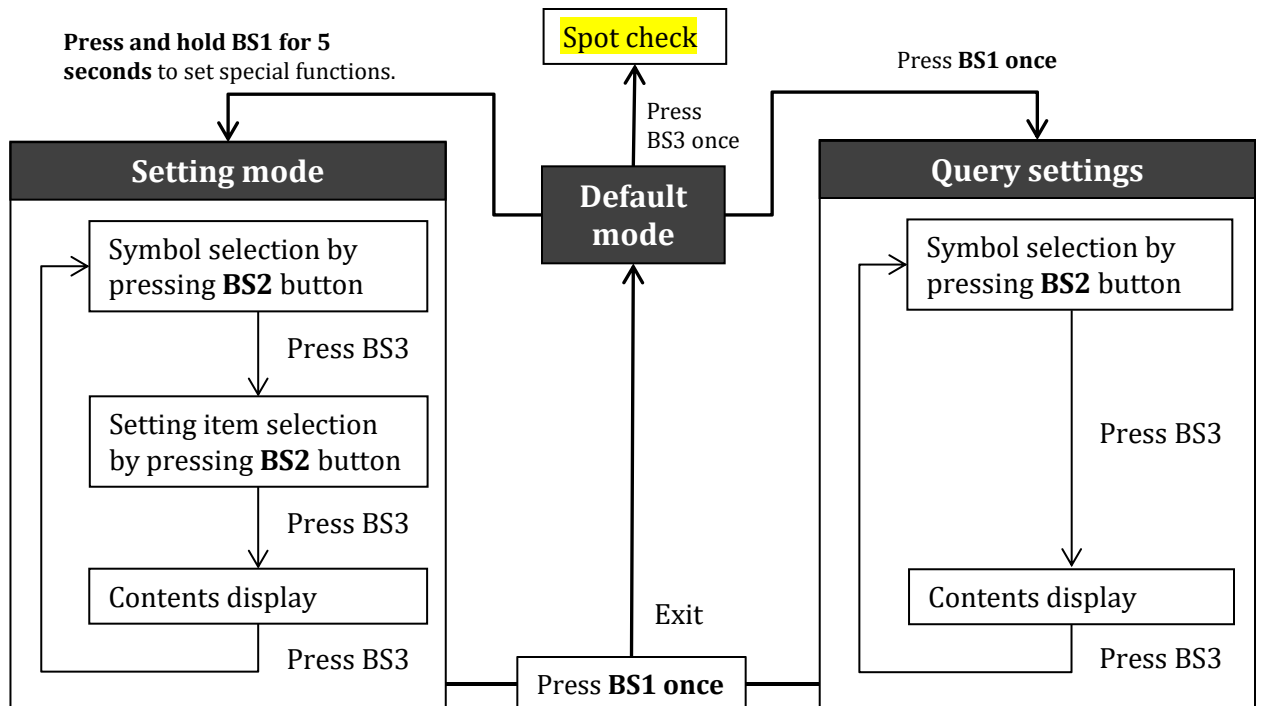
**BS1:** Menu or back button

**BS2:** UP button

**BS3:** Spot check and confirm button

**Remarks:**

Press or tip any directions are valid.

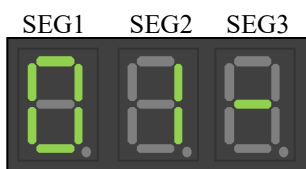




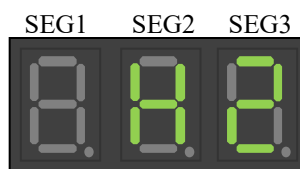
**Default mode (Spot check)**

System states can be showed on the 7 segments display (LED) of outdoor unit. Press **BS3** button to get the code number and corresponding information with an interval of one second.

Example: Code number



Detailed information



| No.     | Number content                        | Example | Description   |
|---------|---------------------------------------|---------|---|
| Default | Refer to default display instructions | 902     | 9: Command/Troubleshooting<br>0: Running under high pressure limit<br>2: Cooling mode |
| 01-     | Outdoor unit type and capacity        | H3      | H: Heat pump C: AC only<br>3: 3Ton  |
| 02-     | Liquid line sub-cooling               | 10      | 10° F   |
| 03-     | Compressor suction superheat          | 18      | 18° F   |
| 04-     | Compressor speed                      | 56      | 56RPS   |
| 05-     | Electronic expansion valve opening    | 360     | 360pls  |
| 06-     | Step of fan                           | 8       | The 8th step  |
| 07-     | Low pressure (LP sensor)              | 145     | 145psig   |
| 08-     | High pressure (HP sensor)             | 350     | 350psig   |
| 09-     | Outdoor ambient temp. (TA)            | 95      | 95° F   |
| 10-     | Compressor suction temp. (TS)         | 70      | 70° F   |
| 11-     | Compressor discharge temp. (TD)       | 170     | 170° F  |
| 12-     | Defrost sensor temp. (TH)             | 80      | 80° F   |
| 13-     | Liquid line temp. (TL)                | 70      | 70° F   |
| 14-     | Inverter module temp. (TF)            | 150     | 150° F  |
| 15-     | Target evaporating temp. (Tes)        | 43      | 43° F   |
| 16-     | Current evaporating temp. (Te)        | 45      | 45° F   |
| 17-     | Target condensing temp. (Tcs)         | 104     | 104° F  |
| 18-     | Current condensing temp. (Tc)         | 112     | 112° F  |
| 19-     | Compressor DC current                 | 10.1    | 10.1A   |
| 20-     | Undercharged refrigerant signal       | 1       | 0: None 1: Level 1 2: Level 2   |
| 21-     | Main software version                 | 200     | Ver 200   |
| 22-     | Inverter software version             | 16      | Ver 16  |
| 23-     | Current fault                         | E1      | Display up to 5 * codes   |
| 24-     | The last fault                        | F1      | --: none  |
| 25-     | Fault before the last fault           | F2      | --: none  |

**Remarks:** When multi-error codes exist at the same time, each code will be displayed one by one with an interval of one (1) second.

## Setting mode

Press and hold **BS1** button for five (5) seconds to enter the parameter setting interface. The latest setting will be taken as the final one.

| Symbol | Function   | Item        | Description                       |
|--------|--|-------------|-----------------------------------|
| n00    | Mode choice  | 0 (factory) | Normal (Energy Saving) mode       |
|        |  | 1           | Dry mode *1                       |
|        |  | 2           | High capacity mode *2             |
| n01    | Forced heat pump stop when ambient temperature is lower than specified value. Switching to heat by gas furnace or boiler in cold winter.         | 0           | Stop heat pump when TA<-22°F      |
|        |  | 1 (factory) | Stop heat pump when TA<-3°F       |
|        |  | 2           | Stop heat pump when TA<15 °F      |
|        |  | 3           | Stop heat pump when TA<30 °F      |
|        |  | 4           | Stop heat pump when TA<40°F       |
| n02    | Indoor second heater for outdoor unit outputs 24VAC at W terminal (CN5).   | 0 (factory) | ON (Electric auxiliary heater)    |
|        |  | 1           | OFF (Furnace or Boiler)           |
| n03    | Outdoor unit outputs 24VAC at W terminal (CN5) when ambient temperature is lower than specified value to start indoor electric auxiliary heater. | 0 (factory) | TA<15°F (24VAC output)            |
|        |  | 1           | TA<30°F (24VAC output)            |
|        |  | 2           | TA<40°F (24VAC output)            |
|        |  | 3           | TA<-3°F (24VAC output)            |
|        |  | 4           | OFF                               |
| n04    | Defrost mode setting *3  | 0           | Defrost in heavy snow area        |
|        |  | 1 (factory) | Standard mode                     |
|        |  | 2           | Defrost in light snow area        |
| n05    | Silent mode setting  | 0 (factory) | None silent mode                  |
|        |  | 1           | Silent mode (level 1)             |
|        |  | 2           | Super silent mode (level 2)       |
|        |  | 3           | Night silent mode (level 1)       |
|        |  | 4           | Night super silent mode (level 2) |
| n06    | Night silent setting- start time   | 0           | 17:00                             |
|        |  | 1 (factory) | 18:00                             |
|        |  | 2           | 19:00                             |
|        |  | 3           | 20:00                             |
|        |  | 4           | 21:00                             |
| n07    | Night silent setting- end time   | 0           | 5:00                              |
|        |  | 1 (factory) | 6:00                              |
|        |  | 2           | 7:00                              |
|        |  | 3           | 8:00                              |
|        |  | 4           | 9:00                              |
| n08    | Forced defrost   | 0 (factory) | OFF                               |
|        |  | 1           | ON *4                             |

### Remarks:

1. The evaporating temperature of indoor coil can drop down to 28°F.
2. The evaporating temperature of indoor coil can drop down to 28°F in cooling mode, and the condensing temperature can go up to 122°F in heating mode.
3. Reduce about 10% heating time for heavy snow area, increase about 10% heating time for light snow area.
4. System enters defrost after the heating start-up and an extra five minutes.

### 14.3 Major components function

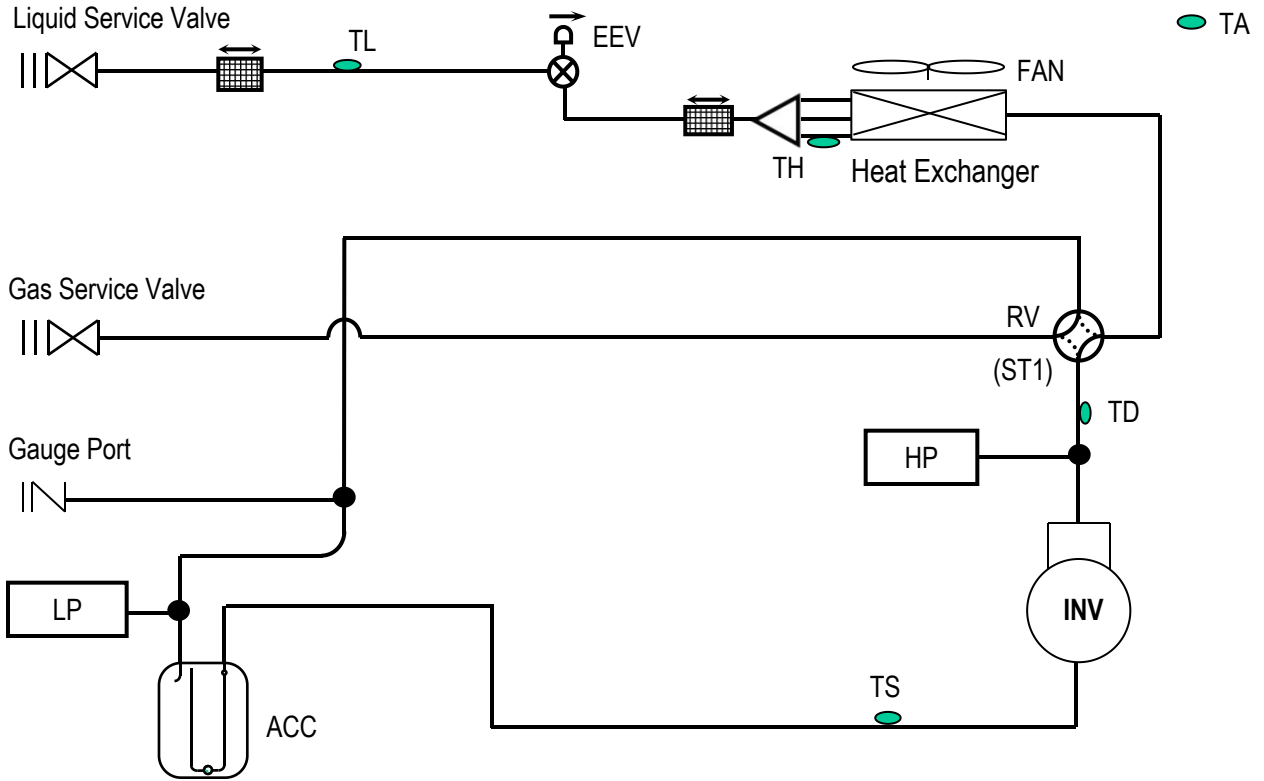


Fig 14-1 Refrigerant Circuit

| Name                       | Symbol   | Function   |
|----------------------------|----------|--|
| Inverter compressor        | INV      | Adjusts refrigerant flow rate by changing the speed (RPS) based on objective pressure.                             |
| Outdoor fan                | FAN      | Outputs heat exchanger capacity by adjusting the motor rotation speed based on operating pressure.                 |
| Electronic expansion valve | EEV      | 1) Fully open in cooling mode and defrost operation.<br>2) Control compressor discharge superheat in heating mode. |
| Reversing valve            | RV (ST1) | Switches the operation mode between heating and cooling (including defrost control).                               |
| Temperature sensor         | TH       | Uses to control defrost during heating operation.  |
|                            | TA       | Uses to detect outdoor air temperature and control fan speed.  |
|                            | TS       | Uses to detect compressor suction temperature and calculate compressor suction superheat (SH).                     |
|                            | TL       | Uses to detect liquid line temperature and calculate sub-cooling (SC).   |
|                            | TD       | Uses to detect compressor discharge temperature and calculate discharge superheat (DSH).                           |
|                            | TF       | Uses to detect heat sink temperature of inverter module.   |
| High pressure sensor       | HP       | Uses to detect high pressure.  |
| Low pressure sensor        | LP       | Uses to detect low pressure.   |
| Accumulator                | ACC      | Uses to store excess refrigerant.  |

# 14.4 Control logic description

## 14.4.1 Operation mode

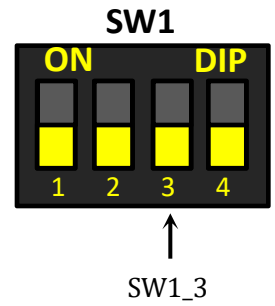
SW1\_3=OFF (factory), ESI system uses Y/O/C signal to operate heat pump function.

SW1\_3=ON has been set, ESI system uses Y/C signal to run cooling only.

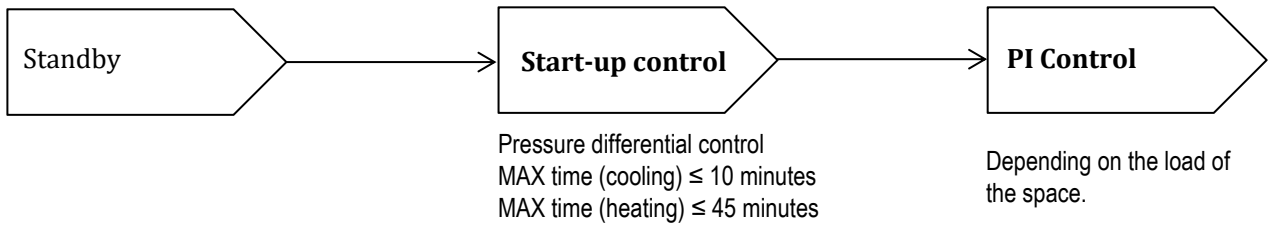
### Normal operation:

Compressor control / EEV control / Fan motor control / Protection control

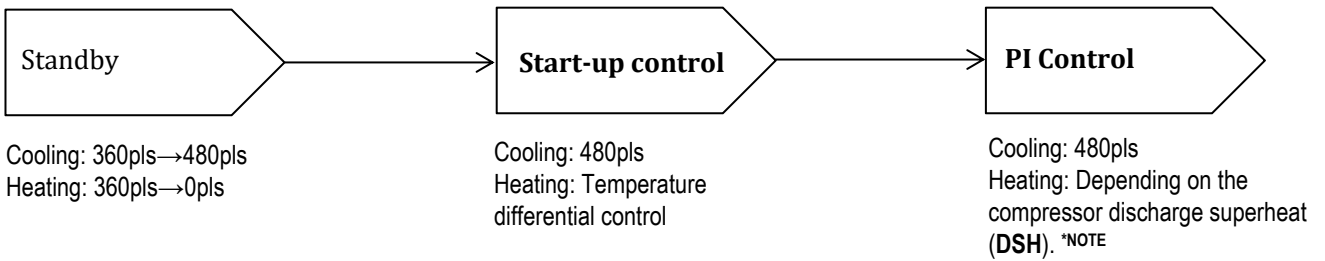
More detailed information can be found on ESI (Ultra) service manual.



## 14.4.2 Compressor control



## 14.4.3 Outdoor electronic expansion valve (EEV) control



**NOTE: Heating DSH should be between 25 ° F and 50 ° F with proper refrigerant level.**

- **Overcharged:** DSH is less than 18 ° F with EEV opening < 72pls.
- **Undercharged:** DSH is higher than 50 ° F with EEV opening ≥ 460pls


# 15. Troubleshooting

If the system does not operate properly besides any malfunctions. Check the system based on the following procedures.

| Symptoms   | Possible causes   | Solutions  |
|--|---|--|
| System does not start-up but the digital tube shows normally | <ul style="list-style-type: none"> <li>No 24 VAC for Y signal from thermostat.</li> <li>Incompatible thermostat</li> </ul>  | <ul style="list-style-type: none"> <li>Be sure Y/O/C wirings are connected correctly and the cooling/heating setting temperature at thermostat is proper</li> <li>Use other traditional 24VAC thermostats</li> </ul>   |
| System operates mode reversely                               | <ul style="list-style-type: none"> <li>Incorrect O/B signal selection</li> </ul>  | <ul style="list-style-type: none"> <li>Choose <b>O for cooling</b> at thermostat</li> </ul>  |
| System cannot cool well                                      | <ul style="list-style-type: none"> <li>Outside temperature is too high</li> <li>Outside temperature is too low</li> <li>Dirty air filter or blocked duct</li> <li>Lack of refrigerant</li> <li>Refrigerant has been blocked in the condenser coil</li> </ul>  | <ul style="list-style-type: none"> <li>Normal protection control to limit RPS</li> <li>Ensure the cooling loads</li> <li>Replace the air filter and eliminate any obstacles.</li> <li>Check refrigerant amount or any leaks.</li> <li>Counterclockwise the TXV (Make sure the refrigerant coefficient is 0.6)</li> </ul> |
| System cannot heat well                                      | <ul style="list-style-type: none"> <li>Outside temperature is too low but no third-party heat inside</li> <li>The outdoor coil is dirty or has been covered by heavy snow</li> <li>Dirty air filter</li> <li>Micro channel coil has been used for heat pump</li> <li>Lack of refrigerant</li> </ul> | <ul style="list-style-type: none"> <li>Install auxiliary heat for backup *<b>Dual-heating</b> is recommended</li> <li>Clean the outdoor coil</li> <li>Replace the air filter</li> <li>No micro channel coils shall be used for heat pump</li> <li>Check refrigerant amount or any leaks</li> </ul>                       |

**Remarks:**

ESI(Ultra) systems are compatible with most traditional 24VAC thermostats.

|  |
|--|
|  <b>CAUTION</b> |
| Reversing valve is energized(208/230VAC) in heating mode.  |

## Error codes List for Condensing Unit

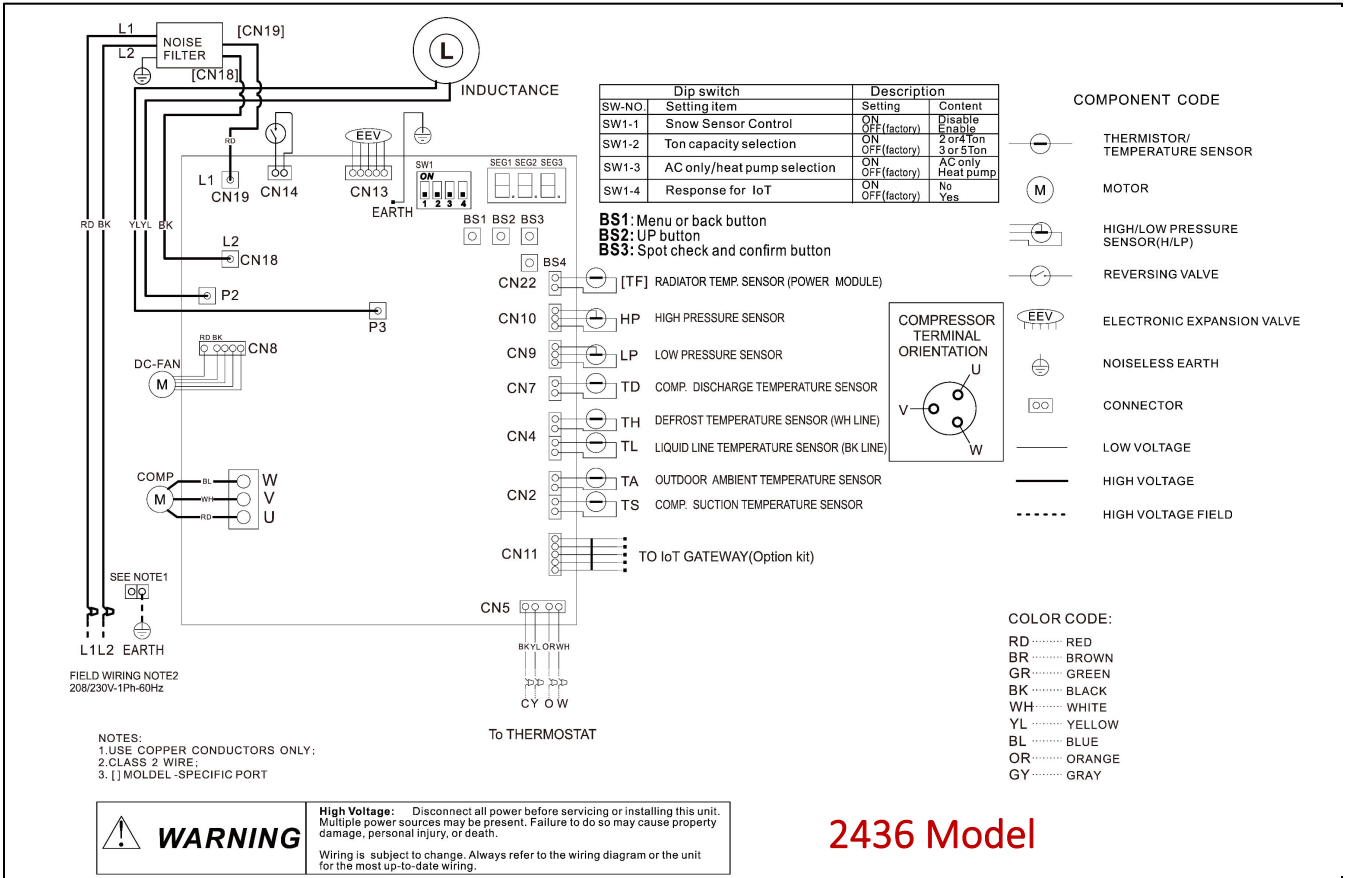
Error codes can be inquired by BS3 button, and seen on Ecoer Smart Service Pro App. **Sign in App >Files >Service, refer to ESI (Ultra) service manual for troubleshooting details.**

| Code  | Description   | Legend            |
|-------|---|-------------------|
| P1    | High pressure protection  |                   |
| E1    | System locks up when P1 has occurred six times in 3 hours.          | Cannot restart *1 |
| P2    | Low pressure protection in cooling mode                             |                   |
| E2    | System locks up when P2 has occurred six times within 3 hours.      | Cannot restart *1 |
| P3    | Compressor discharge temperature (TD) protection                    |                   |
| E3    | System locks up when P3 has occurred six times within 3 hours.      | Cannot restart *1 |
| P4    | Compressor discharge temperature (TD) sensor error                  |                   |
| P5    | Inverter module temperature (TF) protection                         |                   |
| E5    | System locks up when P5 has occurred six times within 3 hours.      | Cannot restart *1 |
| P6    | Compressor over-current protection                                  |                   |
| E6    | System locks up when P6 has occurred six times within 3 hours.      | Cannot restart *1 |
| P7    | Liquid slugging protection  |                   |
| E7    | System locks up when P7 has occurred three times within 5 hours.    | Cannot restart *1 |
| P8    | Low compressor voltage protection                                   |                   |
| E8    | System locks up when P8 has occurred three times within an hour.    | Cannot restart *1 |
| P9    | Incorrect compressor line sequence                                  | Cannot restart *1 |
| PA    | DC fan motor over-load protection                                   | Cannot restart *1 |
| F1    | Ambient temperature (TA) sensor fault                               | Backup running*2  |
| F2    | Compressor suction temperature (TS) sensor fault                    | Backup running*2  |
| F3    | Liquid line temperature (TL) sensor fault                           | Backup running*2  |
| F4    | Defrost temperature (TH) sensor fault                               | Backup running*2  |
| F5    | Compressor discharge temperature (TD) sensor fault                  | Backup running*2  |
| F6    | Inverter module temperature (TF) sensor fault                       | Backup running*2  |
| F7    | High pressure (HP) sensor fault                                     | Backup running*2  |
| F8    | Low pressure (LP) sensor fault                                      | Backup running*2  |
| E4    | Communication fault between main chip and INV drive chip            | Cannot restart *1 |
| H1    | Ambient temperature limit operation in cooling                      |                   |
| H2    | Ambient temperature limit operation in heating                      |                   |
| H3    | Abnormal switch alarm for reversing valve                           | Alarm             |
| H4    | Defrost temperature (TH) sensor error                               |                   |
| H5    | EEPROM fault  |                   |
| H6    | Low voltage alarm   |                   |
| HF    | Abnormal function control   | Alarm             |
| C0-CC | Compressor INV module protection                                    |                   |
| E0    | System locks up when C0~CA has occurred three times within an hour. | Cannot restart *1 |

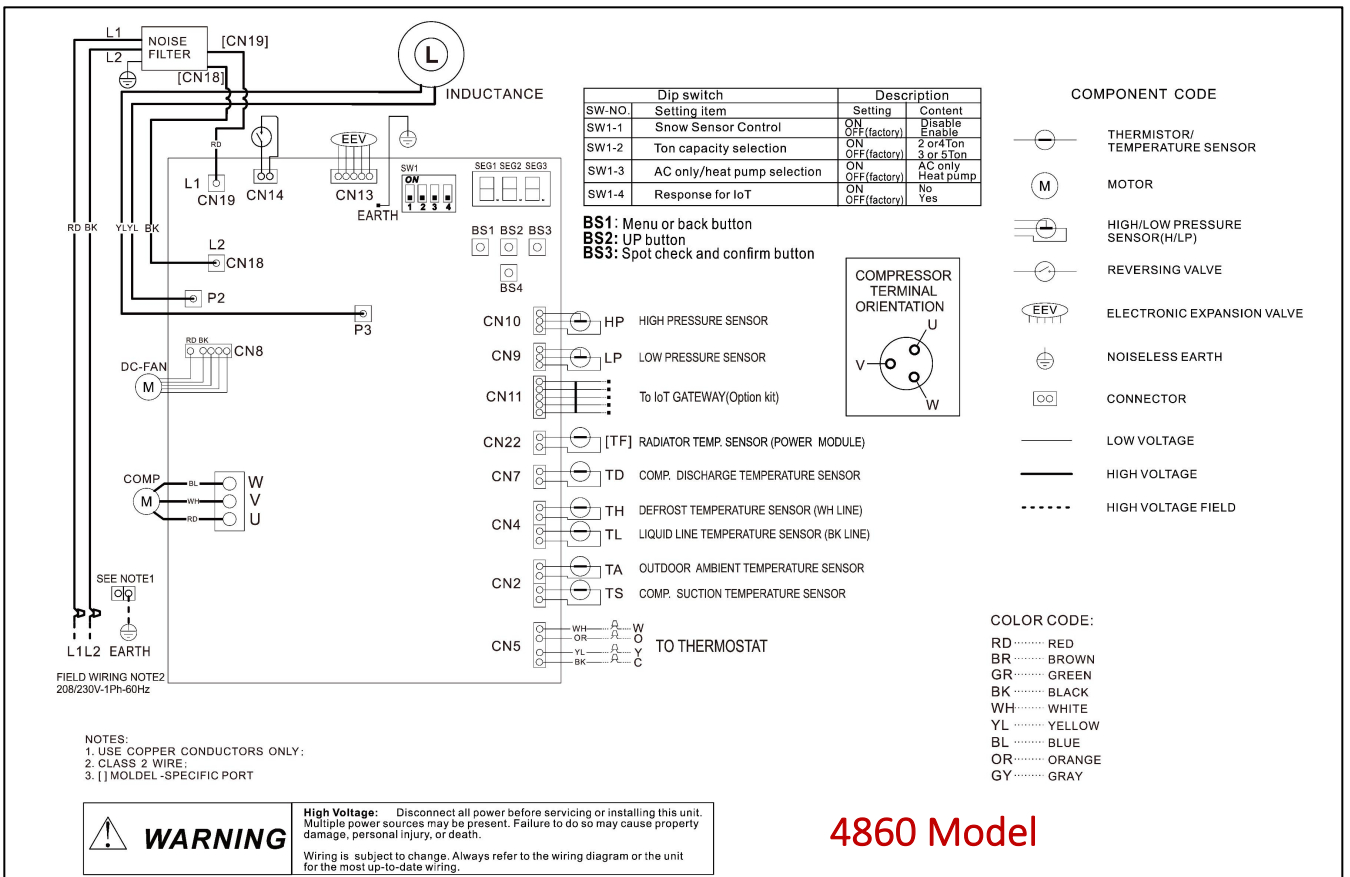
### Remarks:

1. Disconnect power supply switch for 5 minutes to reset, then turn on power supply for the unit.
2. Unit goes to backup running under sensors fault varies from 7 to 120 days. Allow up to two (2) sensors backup running at the same time.

# 16. Wiring Diagram



2436 Model



4860 Model

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