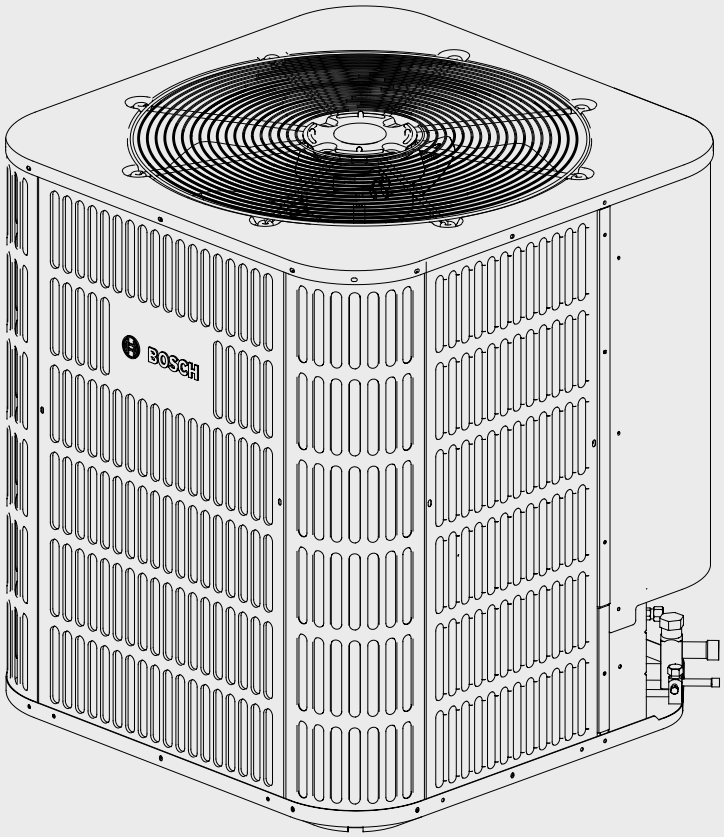
BOSCH

Installation and Operating Instructions

Bosch IDS Heat Pump
Light Series Condensing Unit

2-3-4-5 Ton Capacity | R454B



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1 Key to Symbols and Safety Instructions

1.1 Key to Symbols

Warnings

In warnings, signal words at the beginning of a warning are used to indicate the type and seriousness of the ensuing risk if measures for minimizing danger are not taken.

The following keywords are defined and can be used in this document:

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor to moderate injury.

NOTICE

NOTICE is used to address practices not related to personal injury.

Important information

The info symbol indicates important information where there is no risk to people or property.

1.2 Explanation of Symbols Displayed on the Unit

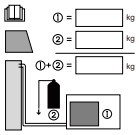
Symbol	
	WARNING This symbol shows that this appliance used a flammable refrigerant. If the refrigerant is leaked and exposed to an external ignition source, there is a risk of fire.
	WARNING This symbol shows that appliance shall be installed, operated and stored in a room with a floor area not less than the minimum room area.
	CAUTION This symbol shows that the operation manual should be read carefully.
	CAUTION This symbol shows that a service personnel should be handling this equipment with reference to the installation manual.
	CAUTION This symbol shows that information is available such as the operating manual or installation manual.
	CAUTION This symbol shows that when addition of charge is required by the manufacturer installation instructions for completing the REFRIGERATING SYSTEM. Recorded the resulting total REFRIGERANT CHARGE for each REFRIGERATING SYSTEM.

Table 1

1.3 Safety

Please read safety precautions before installation

WARNING

Electrical hazard 380 Volts DC!

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

WAIT FIVE (5) MINUTES after disconnecting power prior to touching electrical components as they may hold a dangerous charge of 380 VDC,then verify DC Voltage is less than 42VDC at inverter TEST POINTS P-N.

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.

The manufacturer recommends installing only approved matched indoor and outdoor systems. All of the manufacturer's split systems are AHRI 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.

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. installation.

WARNING

Personal injury, product damage!

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.

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 R454b refrigerant. Use only R454b approved service equipment. All R454b systems with variable speed compressors use a POE oil (VG75 or equivalent)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.

WARNING

Hot surface!

May cause minor to severe burning. Failure to follow this Caution could result in property damage or personal injury.

Do not touch high temperature components such as the compressor.

WARNING

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. Flammable refrigerant used.

WARNING

Contains lead!

This product can expose you to chemicals including Lead and Lead components, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www. P65Warnings.ca.gov.

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.

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.

If refrigerant gas leaks during installation, ventilate the area immediately.

Comply with national gas regulations.

WARNING

High current leakage!

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

WARNING

Risk of fire!

Mildly flammable refrigerant used.

Follow handling instructions carefully in compliance with national regulations.

DANGER

Fire, explosion!

Store in a well ventilated room without continuously operating flames or other potential ignition.

WARNING

Risk of electric shock!

Can cause injury or death. Disconnect all remote electric power supplies before servicing.

WARNING

Risk of fire!

Flammable refrigerant used. To be repaired only by trained service personnel. Do not puncture refrigerant tubing.

Dispose of properly in accordance with federal or local regulations. Flammable refrigerant used.

Flammable refrigerant used. Consult repair manual/owner's guide before attempting to service this product. All safety precautions must be followed.

Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.

WARNING

Personal injury!

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or persons who lack experience andknowledge, unless they are supervised or have been given instructions concerning the use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

Any person who is involved with working on or opening a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorizes their competence to handle refrigerants safely in accordance with an industry recognized assessment credential.

Servicing shall only be performed as recommended by the equipment manufacturer.

Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of a person competent in the use of flammable refrigerants.

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to minimize the risk of ignition.

WARNING

Flammable refrigerant!

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room that does not have continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).

Do not pierce or burn the unit.

Be aware that refrigerants may not contain an odor.

WARNING

Safe handling of flammable refrigerant!

Be sure the air conditioner is grounded.In order to avoid electric shock, make sure that the unit is grounded and that the earth wire is not connected to a gas or water pipe, lightning conductor or telephone earth wire.

Do not operate the air conditioner with a wet hands. An electric shock may happen.

Do not operate the air conditioner when using a room fumigation - type insecticide. Failure to observe this precaution could cause the chemicals to become deposited in the unit, which could endanger the health of those who are hypersensitive to chemicals.

To avoid oxygen deficiency, ventilate the room sufficiently if equipment with a burner is used together with the air conditioner.

Arrange the drain hose to ensure smooth drainage. Incomplete drainage may cause wetting of the building, furniture, etc.

Never touch the internal parts of the controller. Do not remove the front panel. Some parts inside are dangerous to touch, and machine troubles may occur.

Attention is drawn to the fact that additional transportation regulations may exist with respect to equipment containing flammable gas. The maximum number of pieces of equipment or the configuration of the equipment permitted to be transported together will be determined by the applicable transport regulations.

Signs for similar appliances used in a work area are generally addressed by local regulations and give the minimum requirements for the provision of safety and/or health signs for a work location.

Storage package protection should be constructed such a way that mechanical damage to the equipment inside the package will not cause a leak of the REFRIGERANT CHARGE.

The maximum number of pieces of equipment permitted to be stored together will be determined by local regulations.

Do not place appliances which produce open flame in places exposed to the air flow from the unit or under the indoor unit. It may cause incomplete combustion or deformation of the unit due to the heat.

Do not install the air conditioner in a location where flammable gas may leak out. If the gas leaks out and stays around the air conditioner, a fire may break out.

WARNING

Flammable refrigerant!

The appliance uses R454B refrigerant.

NOTICE

Indoor unit required!

The indoor units must be matched with R-454B TXV. The model of R-454B TXV can be changed according to the system capacity.

WARNING

Personal Injury, flammable refrigerant!

When repairing the refrigerating system, comply with the following precautions prior to conducting work on the system:

- Work shall be undertaken according to controlled procedures to minimize the risk of the presence of flammable gases or vapors while the work is being performed.
- All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.
- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable environment. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e., non-sparking, adequately sealed or intrinsically safe.
- If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available and easily accessible. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.
- When carrying out work in relation to a refrigerating system that involves exposing any pipe work, no sources of ignition shall be used in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repair, or removal and disposal of the unit, during which refrigerant can possibly be released into the surrounding space. Prior to beginning work, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be clearly displayed.

WARNING

Personal Injury, flammable refrigerant!

Ensure that the area is in the open or that it is adequately ventilated before opening the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the surroundings.

Where electrical components are being changed, they shall be fit according to their purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer’s technical department for assistance. The following checks shall be applied to installations using flammable refrigerants:

- The actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed.
- The ventilation machinery and outlets are operating adequately and are not obstructed.
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant.
- Equipment marking must remain visible and legible. Markings and signs that are illegible shall be corrected.

WARNING

Personal Injury, flammable refrigerant!

Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substances which may corrode refrigerant containing components, unless the components are constructed of materials that are inherently resistant to corrosion or are suitably protected against corrosion.

Repair and maintenance of electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until the fault has been dealt with.

- That capacitors are discharged: this shall be done in a safe manner to avoid the possibility of sparking.
- That no live electrical components and wiring are exposed while charging, recovering or purging the system.
- That there is continuity of grounding.

WARNING

Flammable refrigerant!

Sealed electrical components shall be replaced.

Intrinsically safe components must be replaced.

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

Under no circumstances shall potential sources of ignition be used while searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated for the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant which requires brazing is found, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

Examples of leak detection fluids are:

- bubble method,
- fluorescent method agents.

WARNING

Flammable refrigerant!

When breaking into the refrigerant circuit to make repairs or for any other purpose conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- safely remove refrigerant following local and national regulations.
- evacuate.
- purge the circuit with inert gas.
- evacuate.
- continuously flush or purge with inert gas when using flame to open circuit, and.
- open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant they contain.

Cylinders shall be kept upright. Ensure that the refrigeration system is grounded prior to charging the system with refrigerant.

Label the system when charging is complete (if it is not already labeled).

Take extreme care not to overfill the refrigeration system.

WARNING

Flammable refrigerant!

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of reclaimed refrigerant. It is essential that electrical power is available before the task is commenced.

a. Become familiar with the equipment and its operation.
b. Isolate system electrically.
c. Before attempting the procedure ensure that:
    - mechanical handling equipment is available, if required, for handling refrigerant cylinders.
    - all personal protective equipment is available and being used correctly.
    - the recovery process is supervised at all times by a competent person.
    - recovery equipment and cylinders conform to the appropriate standards.
d. Pump down refrigerant system, if possible.
e. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
f. Make sure that the cylinder is situated on the scales before recovery takes place.
g. Start the recovery machine and operate it in accordance with the manufacturer's instructions.
h. Do not overfill cylinders. (No more than 80% volume liquid charge).
i. Do not exceed the maximum working pressure of the cylinder, even temporarily.
j. When the cylinders have been filled correctly and the process has been completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
k. Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

Equipment shall be labeled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. Ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

WARNING

Flammable refrigerant!

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

Do not use the air conditioner for other purposes. In order to avoid any quality deterioration, do not use the unit for the cooling of precision instruments, food, plants, animals or works of art. Before cleaning, be sure to stop the operation, turn the breaker off or unplug the supply cord. Otherwise, electric shock and injury may occur.

To avoid electric shock or fire, make sure that a leak detector is installed. Never touch the air outlet or the horizontal blades while the swing flap is in operation. Fingers may be come caught or the unit may break down.

Never put any objects into the air inlet or outlet. Objects touching the fan at high speed can be dangerous. Never inspect or service the unit by yourself. Ask a qualified service person to perform this task.

Do not dispose of this product as unsorted municipal waste. This waste should be collected separately for special treatment. Do not dispose of electrical appliances as unsorted municipal waste. Use separate collection facilities. Contact your local government for information regarding the connection systems available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, hazardous to one's health and well-being.

To prevent refrigerant leak, contact your dealer.

When the system is installed and operates in a small room, it is required to maintain the concentration of the refrigerant below the limit, in case a leak occurs. Otherwise, oxygen in the room may be affected, resulting in a serious accident.

The refrigerant in the air conditioner is safe and normally does not leak.

If the refrigerant leaks into the room and encounters the fire of a burner, a heater or a cooker, a harmful gas could be released.

Turn off any combustible heating devices, ventilate the room, and contact the dealer where the unit was purchased.

Do not use the air conditioner until a service person confirms that the refrigerant leak is repaired.

Keep ventilation openings clear of obstruction.

WARNING

Product damage, personal injury!

This outdoor unit must combine the indoor unit with refrigerant leak detection device.

These instructions are exclusively intended for qualified contractors and authorized installers. Work on the refrigerant circuit with mild flammable refrigerant in safety group A2L may only be carried out by authorized heating contractors. These heating contractors must be trained in accordance with UL 60335-2-40, Section HH. The certificate of competence from an industry accredited body is required.

Work on electrical equipment may only be carried out by a qualified electrician.

Before initial commissioning, all safety – related points must be checked by the particular certified heating contractors. The system must be commissioned by the system installer or a qualified person authorized by the installer.

2 Unit Location Considerations

2.1 Unit Dimensions

Models	"H" in. [mm]	"W" in. [mm]	"L" in. [mm]
BOVA15-24	24-15/16 [634]	28 [712]	28 [712]
BOVA15-36	24-15/16 [634]	28 [712]	28 [712]
BOVA15-60	33-3/16 [843]	29-1/8 [740]	29-1/8 [740]

Table 2

The unit's weight values are 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.

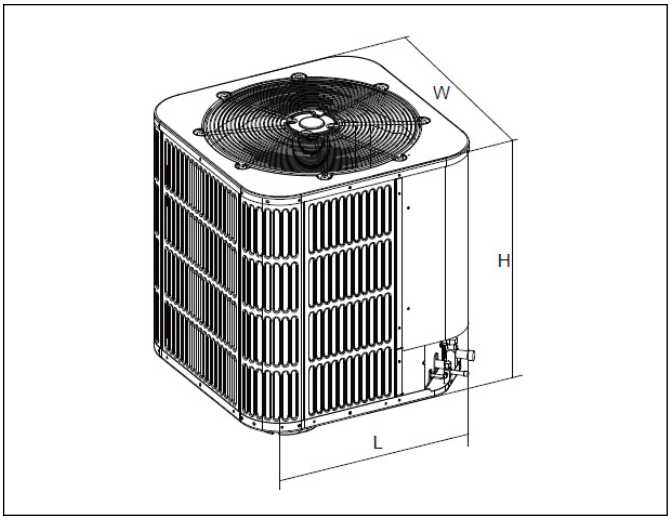


Figure 1

2.2 Refrigerant Piping Limits

System Capacity Model	Liquid Line	Suction Line	Total Equivalent Length - Feet			
			25	50	75	100
	Inch O.D.		Maximum Vertical Separation - Feet			
2 Ton	3/8 *	3/4 Std.	25	50	45	40
		5/8 Opt.	25	50	45	40
3 Ton	3/8 *	3/4 Std.	25	50	50	50
		5/8 Opt.	25	50	50	50
5 Ton	3/8 *	7/8 Std.	25	50	50	40
		3/4 Opt.	25	50	50	40
		1 1/8 Opt.	25	40	N/A	N/A

Table 3

** Standard line size is recommended;*
N/A: Application not recommended;
Refrigerant charge: refer to Sec. 16

- Use only the line diameters indicated in Table 3.
- If the suction linesets are greater than 50 feet, do not use a larger suction line than recommended.

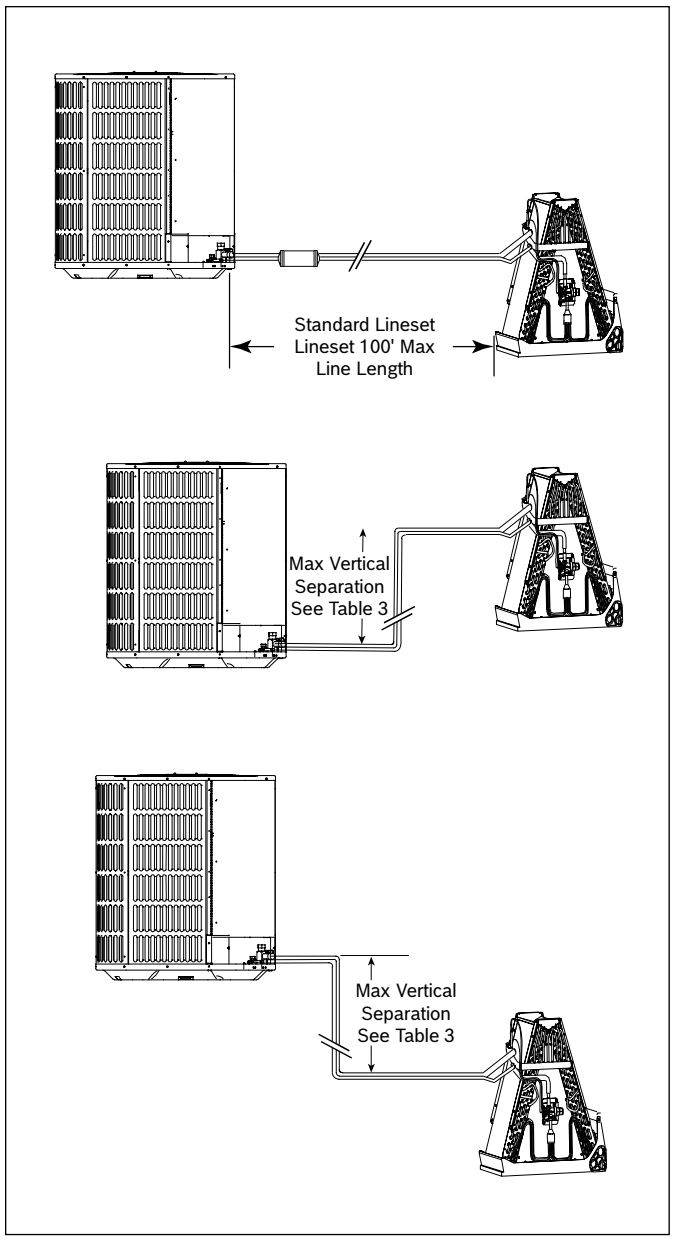


Figure 2

2.3 Location Restrictions

WARNING

Flammable refrigerant!

Appliance shall be installed, operated in a room that meets special requirements and has an area limit as shown in Section 2.4

WARNING

Flammable refrigerant!

The outdoor unit shall be located in a well-ventilated location other than the occupied space, such as in the open air.

For installation of the indoor unit, refer to the corresponding installation and operation manual. If an indoor unit is installed in an unventilated area, the area shall be so constructed that should any refrigerant leak, it will not stagnate so as to create a fire or explosion hazard.

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

Do not locate outdoor unit near bedrooms since normal operational sounds may be objectionable.

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 control board access panel to a wall and a minimum of 24 in. on the adjacent side of control board access panel.

Maintain a distance of 24 in. between units.

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

Only use this unit in well-ventilated spaces and ensure that there are no obstructions that could impede the airflow into and out of the unit. Do not use this unit in the following locations:

- Locations with mineral oil.
- Locations with saline atmospheres, such as seaside locations.
- Locations with sulphurous atmospheres, such as near natural hot springs.
- Where high voltage electricity is present, such as in certain industrial locations.
- On vehicles or vessels, such as trucks or ferry boats.
- Where exposure to oily or very humid air may occur, such as kitchens.
- In proximity to sources of electromagnetic radiation, such as high-frequency transmitters or other high strength radiation devices.

See Fig. 3 and Fig. 4.

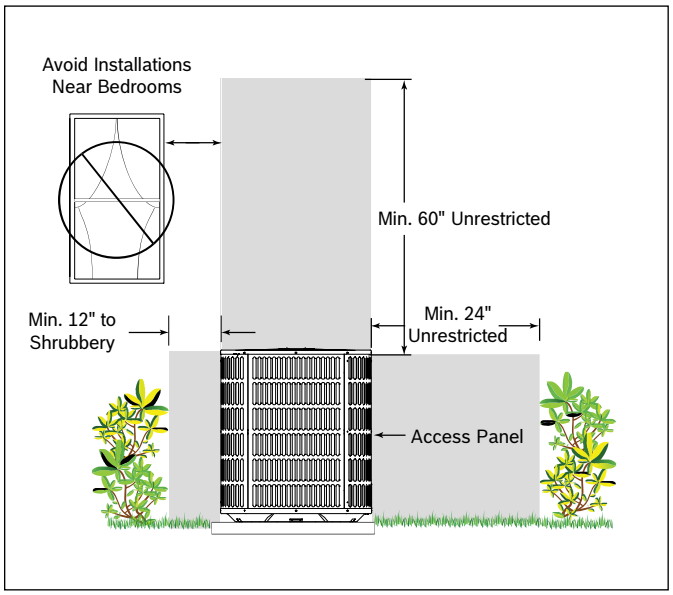


Figure 3

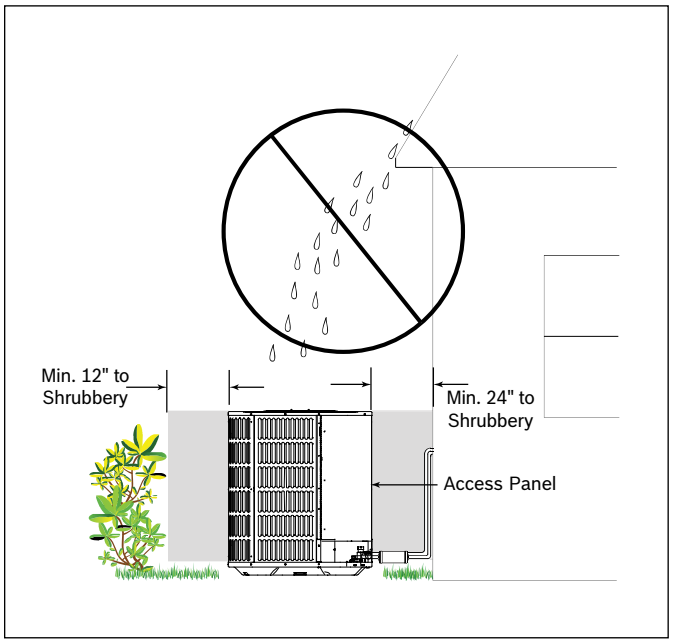


Figure 4

Cold climate considerations

Precautions must 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 during defrost cycle prior to its refreezing. Ensure that drain holes in unit base pan are not obstructed, which could prevent the drainage of defrost water (Fig. 5).
- If possible, avoid locations that are prone to 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.

Using a 5-point support system with snow legs is an effective way to distribute the weight of the outdoor unit, specifically supporting the compressor within it. This setup helps to prevent stress on individual points and ensures that the weight is evenly distributed, reducing the risk of damage or instability, especially in snowy conditions. By providing multiple points of contact, you're enhancing the unit's stability and longevity, which is crucial for its efficient operation over time.

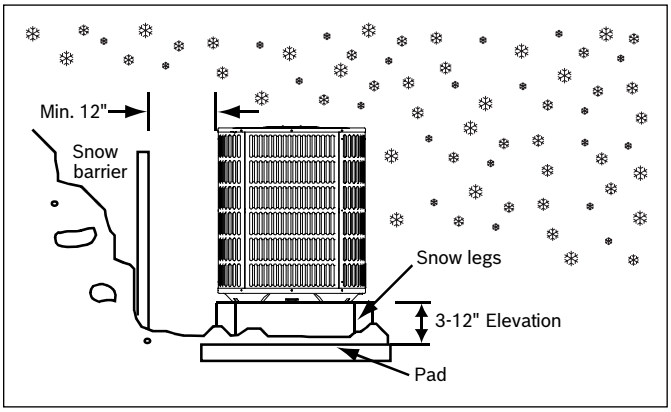


Figure 5

Corrosive Environment

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/hoses/waste water should not spray directly on the unit cabinet for prolonged periods of time.
- In coastal areas: locate the unit on the side of the building away from the waterfront.
- Fencing or shrubbery may provide some shielding protection to the unit, however minimum unit clearances must still be maintained.
- Approximately every three months, wash the outdoor coil and any exposed cabinet surfaces.

2.4 Refrigerant Charge and Room Area Limitations

In UL/CSA 60335-2-40, R454B refrigerant is classified as class A2L, which is mildly flammable. Therefore, R454B refrigerant is suitable for systems needing additional refrigerant charge and which will limit the area of the rooms being served by the system.

Similarly, the total amount of refrigerant in the system shall be less than or equal to the allowable maximum refrigerant charge. The allowable maximum refrigerant charge depends on the area of the rooms being served by the system.

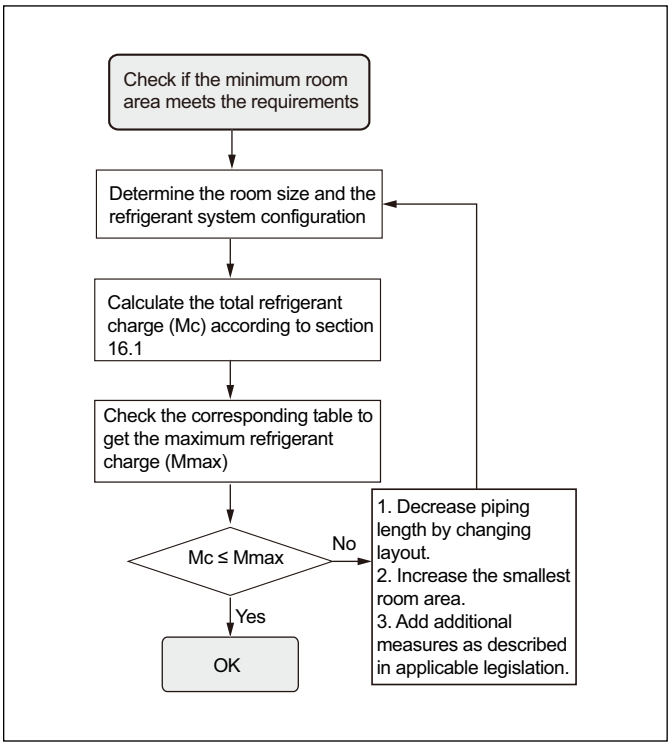


Figure 6

The terms in this section are explained as follows:

- Mc: The actual refrigerant charge in the system.
- A: the actual room area where the appliance is installed.
- Amin: The required minimum room area.
- Mmax:The allowable maximum refrigerant charge in a room.
- Qmin: The minimum circulation airflow.
- Anvmin:The minimum opening area for connected rooms.
- TAmin: The total area of the conditioned space (For appliances serving one or more rooms with an air dut system).
- TA: The total area of the conditioned space connected by air ducts.

2.4.1 The Room Area Calculation Requirements

CAUTION

Flammable refrigerant!

The space considered shall be any space which contains refrigerant-containing parts or into which refrigerant could be released.

The room area (A) of the smallest, enclosed,occupied space shall be used in the determination of the refrigerant quantity limits.

For determination of room area (A) when used to calculate the refrigerant charge limit, the following shall apply.

The room area (A) shall be defined as the room area enclosed by the projection to the base of the walls, partitions and doors of the space in which the appliance is installed.

Spaces connected by only drop ceilings, ductwork, or similar connections shall not be considered a single space.

Units mounted higher than 70-55/64 inches and spaces divided by partition walls that are no higher than 62-63/64 inches shall be considered a single space. Rooms on the same floor and connected by an open passageway between the spaces can be considered a single room when determining compliance to Amin, if the passageway complies with all of the following.

1. It is a permanent opening.
2. It extends to the floor.
3. It is intended for people to walk through.

The area of the connected rooms, on the same floor,connected by permanent opening in the walls and/or doors between occupied spaces, including gaps between the wall and the floor, can be considered a single room when determining compliance to Amin, provided all of the following conditions are met as shown in Figure 7.

Low level opening:

1. The opening shall not be less than Anvmin in Table 4.
2. The area of any openings above 11-13/16 inches from the floor shall not be considered in determining compliance with Anvmin.
3. At least 50% of the opening area of Anvmin shall be below 7-7/8 inches from the floor.
4. The bottom of the opening is not more than 3-15/16 inches from the floor.
5. The opening is a permanent opening that cannot be closed.
6. For openings extending to the floor the height shall not be less than 25/32 inches above the surface of the floor covering.

High level opening:

1. The opening shall not be less than 50% of Anvmin in Table 4.
2. The opening is a permanent opening that cannot be closed.
3. The opening shall be at least 59 inches above the floor.
4. The height of the opening is not less than 25/32 inches.

Room size requirement:

1. The room into which refrigerant can leak, plus the connected adjacent room(s) shall have a total area not less than Amin. Amin is shown in Tables 6-8.
2. The room area in which the unit is installed shall be not less than 20% Amin. Amin is shown in Tables 6-8.

The requirement for the second opening can be met by drop ceilings, ventilation ducts, or similar arrangements that provide an airflow path between the connected rooms.

The minimum opening for natural ventilation (Anvmin) in connected rooms is related to the room area (A), the actual refrigerant charge of refrigerant in the system (Mc) , and the allowable MAXIMUM REFRIGERANT CHARGE in the system (Mmax), Anvmin can be determined according to Table 4.

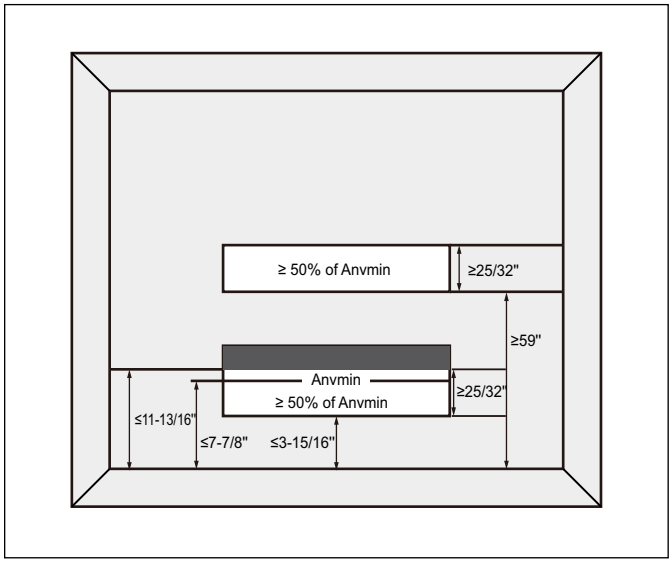


Figure 7

The minimum opening area for connected rooms:

A		m_c		m_{max}		Anv_{min}	
ft²	m²	lb-oz	kg	lb-oz	kg	ft²	m²
100	9.2	15-8	7	3-5	1.5	2.1	0.19
120	11.1	15-8	7	3-15	1.8	2.0	0.18
140	13.0	15-8	7	4-10	2.1	1.9	0.17
160	14.8	15-8	7	5-5	2.4	1.8	0.16
180	16.7	15-8	7	6-3	2.8	1.7	0.15
200	18.5	15-8	7	6-13	3.1	1.6	0.14
220	20.4	15-8	7	7-8	3.4	1.4	0.13
240	22.2	15-8	7	8-3	3.7	1.3	0.12
260	24.1	15-8	7	8-13	4.0	1.2	0.11
280	26.0	15-8	7	9-8	4.3	1.1	0.10
300	27.8	15-8	7	10-2	4.6	1.0	0.09
320	29.7	15-8	7	11-0	5.0	0.8	0.07
340	31.5	15-8	7	11-11	5.3	0.7	0.06
360	33.4	15-8	7	12-6	5.6	0.6	0.05
380	35.3	15-8	7	13-0	5.9	0.5	0.04
400	37.1	15-8	7	13-11	6.2	0.4	0.03
420	39.0	15-8	7	14-5	6.5	0.3	0.02
440	40.8	15-8	7	15-0	6.8	0.2	0.01
460	42.7	15-8	7	15-14	7.2	0.1	0.00

Table 4

Note: Take the Mc=15lb 8oz as an example.

For appliances serving one or more rooms with an air duct system, The room area calculation shall be determined based on the total area of the conditioned space (TA) connected by ducts taking into consideration that the circulating airflow distributed to all the rooms by the appliance integral indoor fan will mix and dilute the leaking refrigerant before entering any room.

2.4.2 The Allowed Maximum Refrigerant Charge and Required Minimum Room Area

If the fan incorporated to an appliance is continuously operated or operation is initiated by a REFRIGERANT DETECTION SYSTEM with a sufficient CIRCULATION AIRFLOW rate, the allowable maximum refrigerant charge (Mmax) and the required minimum room area (Amin/TAmin) is shown in Table 5 and Tables 6-8.

The allowable maximum refrigerant charges:

A/TA		m_{max}		A/TA		m_{max}	
ft²	m²	lb-oz	kg	ft²	m²	lb-oz	kg
30	2.7	0-14	0.4	250	23.2	8-10	3.9
40	3.7	1-5	0.6	260	24.1	8-13	4.0
50	4.6	1-9	0.7	270	25.0	9-4	4.2
60	5.5	2-0	0.9	280	26.0	9-8	4.3
70	6.5	2-3	1	290	26.9	9-15	4.5
80	7.4	2-10	1.2	300	27.8	10-2	4.6
90	8.3	3-1	1.4	310	28.7	10-9	4.8
100	9.2	3-5	1.5	320	29.7	11-0	5.0
110	10.2	3-12	1.7	330	30.6	11-4	5.1
120	11.1	3-15	1.8	340	31.5	11-11	5.3
130	12.0	4-7	2.0	350	32.5	11-14	5.4
140	13.0	4-10	2.1	360	33.4	12-6	5.6
150	13.9	5-1	2.3	370	34.3	12-9	5.7
160	14.8	5-5	2.4	380	35.3	13-0	5.9
170	15.7	5-12	2.6	390	36.2	13-7	6.1
180	16.7	6-3	2.8	400	37.1	13-11	6.2
190	17.6	6-6	2.9	410	38.0	14-2	6.4
200	18.5	6-13	3.1	420	39.0	14-5	6.5
210	19.5	7-1	3.2	430	39.9	14-12	6.7
220	20.4	7-8	3.4	440	40.8	15-0	6.8
230	21.3	7-11	3.5	450	41.8	15-7	7.0
240	22.2	8-3	3.7	460	42.7	15-14	7.2

Table 5

The required minimum room area:

m_c		A_{min}/TA_{min}		m_c		A_{min}/TA_{min}	
lb-oz	kg	ft²	m²	lb-oz	kg	ft²	m²
2-2	1.0	64.6	6.0	10-2	4.6	293.9	27.3
2-9	1.2	77.6	7.2	10-9	4.8	306.8	28.5
3-0	1.4	89.4	8.3	11-0	5.0	319.7	29.7
3-7	1.6	102.3	9.5	11-7	5.2	331.6	30.8
3-15	1.8	115.2	10.7	11-14	5.4	344.5	32.0
4-6	2.0	128.1	11.9	12 -5	5.6	357.4	33.2
4-13	2.2	141.1	13.1	12-12	5.8	370.3	34.4
5-4	2.4	154.0	14.3	13-3	6.0	383.2	35.6
5-11	2.6	165.8	15.4	13-10	6.2	396.2	36.8
6-2	2.8	178.7	16.6	14-1	6.4	409.1	38.0
6-9	3.0	191.6	17.8	14-8	6.6	420.9	39.1
7-0	3.2	204.6	19.0	14-15	6.8	433.8	40.3
7-7	3.4	217.5	20.2	15-6	7.0	446.8	41.5
7-15	3.6	230.4	21.4	15-14	7.2	459.7	42.7
8-6	3.8	243.3	22.6	16-5	7.4	472.6	43.9
8-13	4.0	255.2	23.7	16-12	7.6	485.5	45.1
9-4	4.2	268.1	24.9	17-3	7.8	497.3	46.2
9-11	4.4	281	26.1				

Table 6

The required minimum room area if installed at an altitude over 2000ft:

Altitude (m)		601-800		801-1000		1001-1200		1201-1400		1401-1600		1601-1800		1801-2000	
Altitude (ft)		1970-2625		2626-3280		3281-3938		3940-4593		4596-5250		5251-5905		5908-6562	
m_c		A_{min}/TA_{min}													
lb-oz	kg	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²
2	0.9	60	5.5	62	5.7	63	5.8	65	6.0	66	6.1	67	6.2	69	6.4
3	1.4	90	8.3	92	8.5	94	8.7	96	8.9	98	9.1	101	9.3	101	9.3
4	1.8	119	11.0	122	11.3	124	11.5	129	11.9	131	12.1	134	12.4	134	12.4
5	2.3	149	13.8	153	14.2	156	14.4	160	14.8	163	15.1	167	15.5	167	15.5
6	2.7	178	16.5	183	17.0	187	17.3	192	17.8	195	18.1	201	18.6	201	18.6
7	3.2	207	19.2	214	19.8	218	20.2	223	20.7	228	21.1	234	21.7	234	21.7
8	3.6	237	22.0	244	22.6	248	23.0	256	23.7	260	24.1	267	24.8	267	24.8
9	4.1	266	24.7	274	25.4	279	25.9	287	26.6	292	27.1	301	27.9	301	27.9
10	4.5	297	27.5	305	28.3	311	28.8	319	29.6	324	30.1	333	30.9	333	30.9
11	5.0	326	30.2	335	31.1	342	31.7	351	32.6	357	33.1	366	34.0	366	34.0
12	5.4	355	32.9	365	33.9	372	34.5	383	35.5	390	36.2	400	37.1	400	37.1
13	5.9	385	35.7	396	36.7	403	37.4	415	38.5	422	39.2	433	40.2	433	40.2
14	6.4	414	38.4	426	39.5	434	40.3	446	41.4	455	42.2	467	43.3	467	43.3
15	6.8	444	41.2	457	42.4	466	43.2	478	44.4	487	45.2	500	46.4	500	46.4
16	7.3	473	43.9	487	45.2	496	46.0	510	47.3	519	48.2	533	49.5	533	49.5
17	7.7	502	46.6	517	48.0	527	48.9	542	50.3	552	51.2	567	52.6	567	52.6
18	8.2	532	49.4	547	50.8	558	51.8	573	53.2	584	54.2	600	55.7	600	55.7
19	8.6	561	52.1	577	53.6	589	54.7	605	56.2	616	57.2	632	58.7	632	58.7
20	9.1	591	54.9	609	56.5	619	57.5	637	59.1	648	60.2	666	61.8	666	61.8

Table 7

Altitude (m)		2001-2200		2201-2400		2401-2600		2601-2800		2801-3000		3001-3200		above 3200	
Altitude (ft)		6565-7218		7221-7874		7877-8530		8533-9186		9190-9843		9846-10500		above 10500	
m_c		A_{min}/TA_{min}													
lb-oz	kg	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²	ft²	m²
2	0.9	72	6.6	60	5.5	62	5.7	63	5.8	65	6.0	66	6.1	67	6.2
3	1.4	101	9.3	90	8.3	92	8.5	94	8.7	96	8.9	98	9.1	101	9.3
4	1.8	134	12.4	119	11.0	122	11.3	124	11.5	129	11.9	131	12.1	134	12.4
5	2.3	167	15.5	149	13.8	153	14.2	156	14.4	160	14.8	163	15.1	167	15.5
6	2.7	201	18.6	178	16.5	183	17.0	187	17.3	192	17.8	195	18.1	201	18.6
7	3.2	234	21.7	207	19.2	214	19.8	218	20.2	223	20.7	228	21.1	234	21.7
8	3.6	267	24.8	237	22.0	244	22.6	248	23.0	256	23.7	260	24.1	267	24.8
9	4.1	301	27.9	266	24.7	274	25.4	279	25.9	287	26.6	292	27.1	301	27.9
10	4.5	333	30.9	297	27.5	305	28.3	311	28.8	319	29.6	324	30.1	333	30.9
11	5.0	366	34.0	326	30.2	335	31.1	342	31.7	351	32.6	357	33.1	366	34.0
12	5.4	400	37.1	355	32.9	365	33.9	372	34.5	383	35.5	390	36.2	400	37.1
13	5.9	433	40.2	385	35.7	396	36.7	403	37.4	415	38.5	422	39.2	433	40.2
14	6.4	467	43.3	414	38.4	426	39.5	434	40.3	446	41.4	455	42.2	467	43.3
15	6.8	500	46.4	444	41.2	457	42.4	466	43.2	478	44.4	487	45.2	500	46.4
16	7.3	533	49.5	473	43.9	487	45.2	496	46.0	510	47.3	519	48.2	533	49.5
17	7.7	567	52.6	502	46.6	517	48.0	527	48.9	542	50.3	552	51.2	567	52.6
18	8.2	600	55.7	532	49.4	547	50.8	558	51.8	573	53.2	584	54.2	600	55.7
19	8.6	632	58.7	561	52.1	577	53.6	589	54.7	605	56.2	616	57.2	632	58.7
20	9.1	666	61.8	591	54.9	609	56.5	619	57.5	637	59.1	648	60.2	666	61.8

Table 8

The minimum circulation airflow:

m_c		Q_{min}		m_c		Q_{min}	
lb-oz	kg	CFM	m³/h	lb-oz	kg	CFM	m³/h
2-2	1.0	116	196	10-2	4.6	530	900
2-9	1.2	139	235	10-9	4.8	553	939
3-0	1.4	162	274	11-0	5.0	576	978
3-7	1.6	185	313	11-7	5.2	599	1017
3-15	1.8	208	352	11-14	5.4	622	1056
4-6	2.0	231	391	12 -5	5.6	645	1095
4-13	2.2	253	430	12-12	5.8	668	1134
5-4	2.4	277	470	13-3	6.0	691	1173
5-11	2.6	300	509	13-10	6.2	713	1212
6-2	2.8	323	548	14-1	6.4	736	1251
6-9	3.0	346	587	14-8	6.6	759	1290
7-0	3.2	369	626	14-15	6.8	782	1329
7-7	3.4	392	665	15-6	7.0	806	1369
7-15	3.6	415	704	15-14	7.2	829	1408
8-6	3.8	438	743	16-5	7.4	852	1447
8-13	4.0	461	782	16-12	7.6	875	1486
9-4	4.2	483	821	17-3	7.8	898	1525
9-11	4.4	506	860				

Table 9

CAUTION

Min. room area and airflow required!

The allowable maximum refrigerant charge in Table 5 or the required minimum room area in Tables 6-8 is available only if the following conditions are met:

Minimum velocity of 3.28ft/s, which is calculated as the indoor unit airflow divided by the nominal face area of the outlet. And the grill area shall not be deducted.

Minimum airflow rate must meet the corresponding values in Table 9, which is related to the actual refrigerant charge of the system (Mc).

R454B refrigerant leakage sensor is configured.

The maximum refrigerant limit described above applies to unventilated areas. If adding additional measures, such as areas with mechanical ventilation or natural ventilation, The maximum refrigerant charge can be increased or the minimum room area can be reduced.

R454B refrigerant leakage sensor is configured for the indoor unit, meets the incorporated circulation airflow requirements the maximum refrigerant charge or minimum room area can be determined according to Table 5 or Tables 6-8.

CAUTION

Min. room area and airflow required!

If the actual room area, air outlet height, and refrigerant charge amount are not reflected in the above table, more severe cases need to be considered according to the data in the tables 4-9.

3 Unit Preparation

3.1 Prepare the Unit for Installation

- Check for damage and report promptly to the carrier any damage found to the unit (Fig. 8).
- The charge port can be used to ensure the refrigerant charge has been retained during shipment.

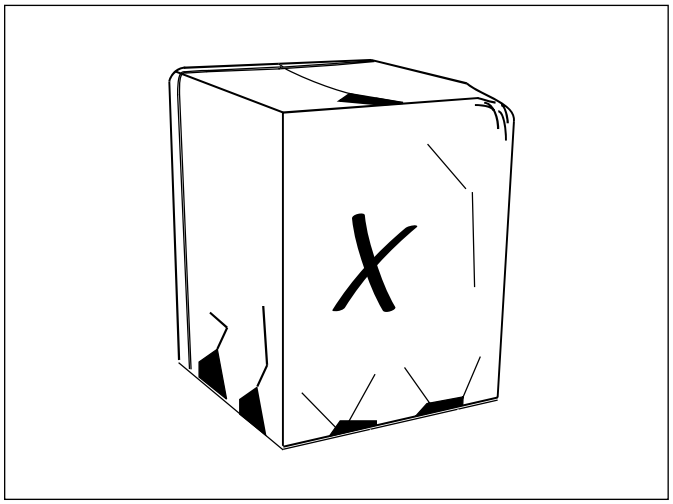


Figure 8

NOTICE

Product damage!

Appliances shall be transported, marked and stored in accordance with the applicable warnings from section 1.3 in mind. The appliance shall be stored so as to prevent mechanical damage from occurring.

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 must be at least 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.

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

NOTICE

Product damage!

The outdoor unit vapor service valve and liquid service valve need to be protected. do not grab them when moving the outdoor unit.

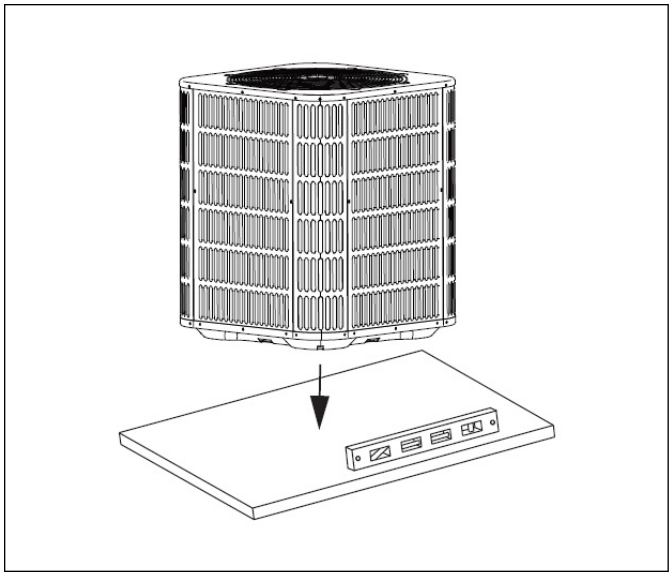


Figure 9

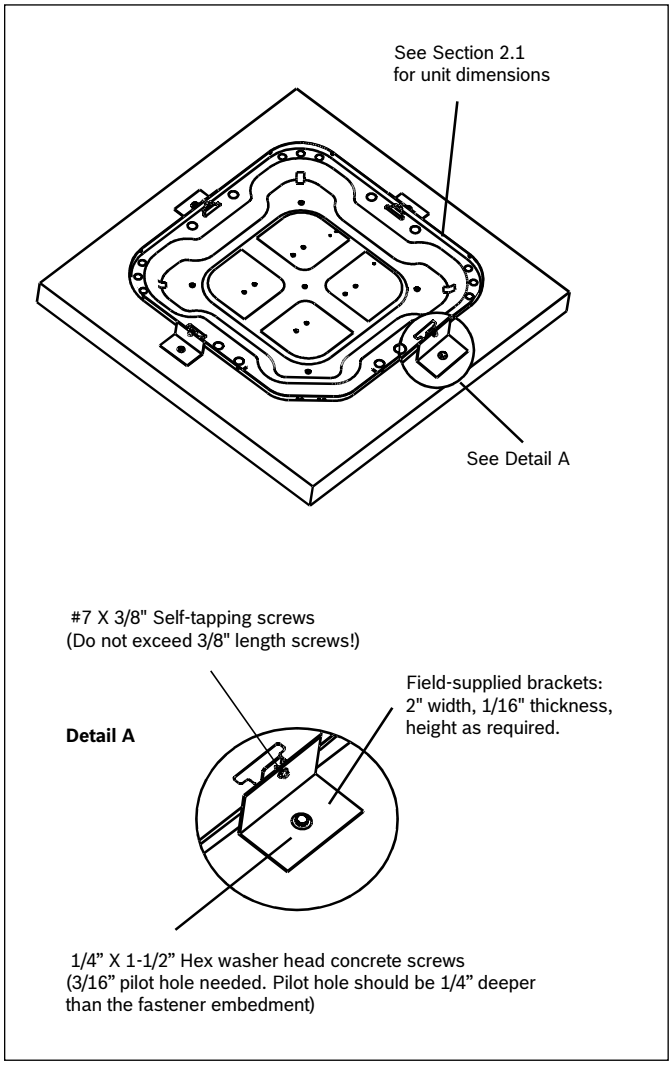


Figure 10

5 Refrigerant Line Considerations

5.1 Refrigerant Line and Service Valve Connection Sizes

Models	Suction Line	Liquid Line	Suction Line Connection	Liquid Line Connection
	Dimensions in inches			
BOVA15-24 BOVA15-36	3/4	3/8	3/4	3/8
BOVA15-60	7/8	3/8	7/8	3/8

Table 10

5.2 Required Refrigerant Line Length

Determine required line length (Fig. 11). Refer to Section 2.2.

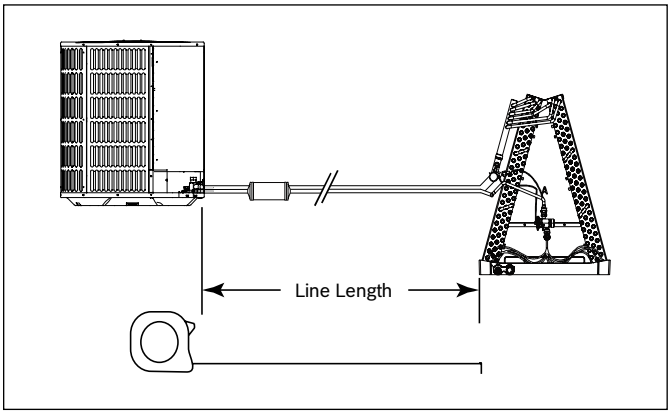


Figure 11

5.3 Refrigerant Line Insulation

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

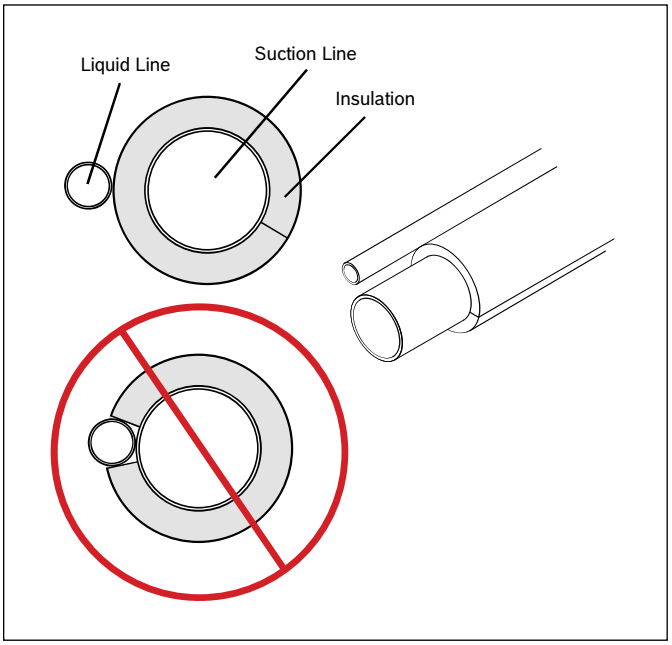


Figure 12

5.4 Reuse Existing Refrigerant Lines

CAUTION

MINOR TO MODERATE BURN!

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 and Table 3.
- Ensure that the refrigerant lines are free of leaks, acid, oil, and old refrigerant.

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

6 Refrigerant Line Routing

6.1 Precautions

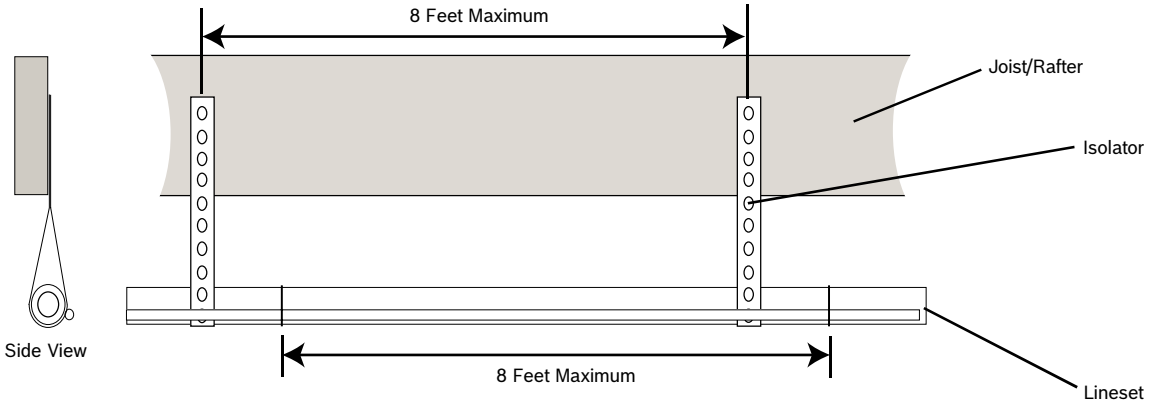
Take precautions to prevent noise within the building structure due to vibration transmission from the refrigerant lines. For example:

- 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.

NOTICE

Product damage!

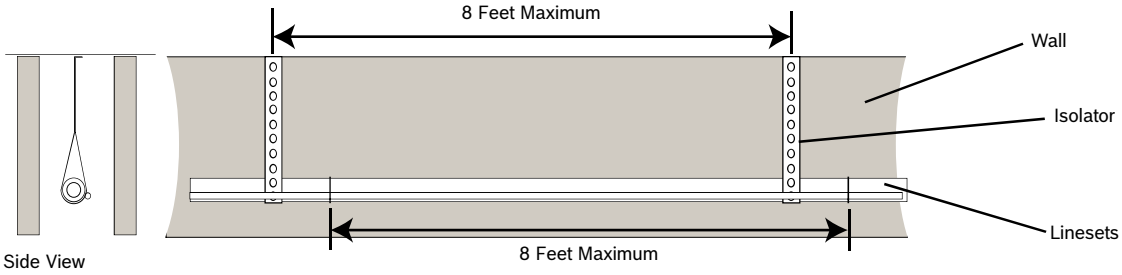
The pipe-work including piping material, pipe routing, and installation shall include protection from physical damage in operation and service, and be in compliance with national and local codes and standards, such as ASHRAE 15, ASHRAE 15.2, IAPMO Uniform Mechanical Code, ICC International Mechanical Code. Inspection prior to being covered or enclosed,or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.



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

Figure 13



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 On Walls

Figure 14

Comply with National, State, and local codes when isolating linesets from joists, rafters, walls, or other structural elements.

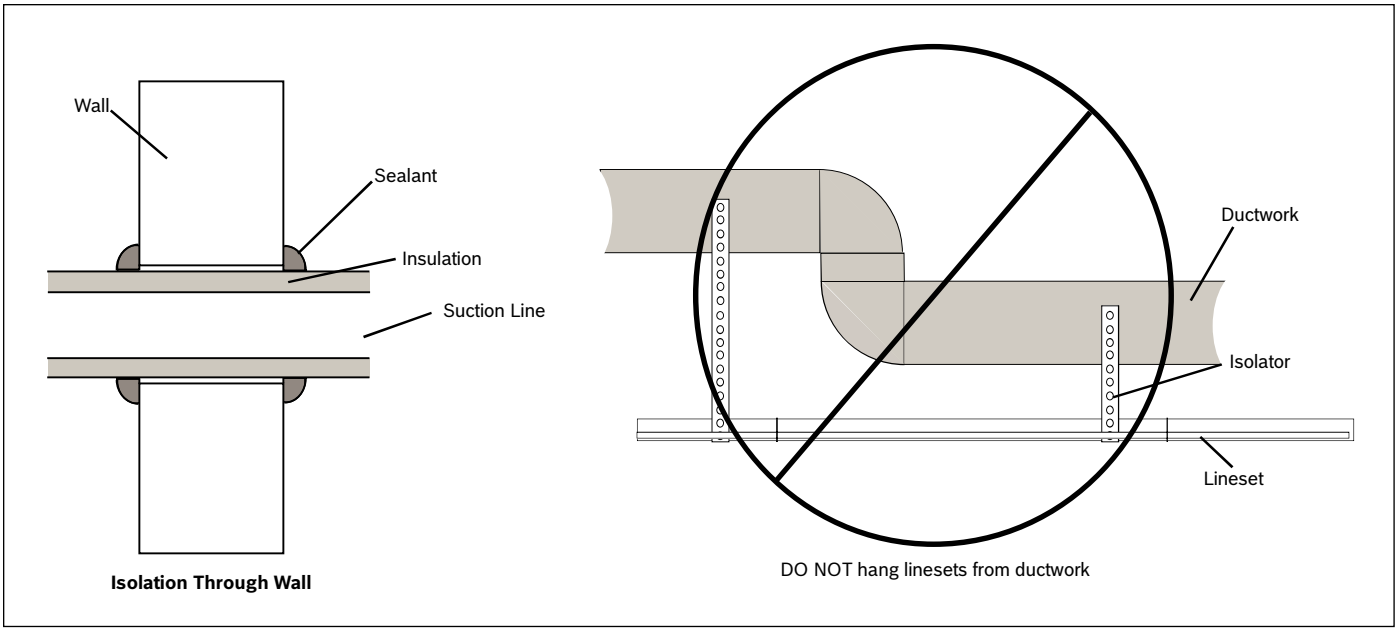


Figure 15

7 Refrigerant Line Connection

All joints made in the installation between parts of the REFRIGERATING SYSTEM, with at least one part charged, shall be made in accordance with the following:

- A brazed, welded, or mechanical connection shall be made before opening the valves to permit refrigerant to flow between the REFRIGERATING SYSTEM parts. A vacuum valve shall be provided to evacuate the interconnecting pipe or any uncharged REFRIGERATING SYSTEM part.
- Mechanical connectors used indoors shall comply with ISO 14903. When mechanical connectors are reused indoors, sealing parts shall be renewed.
- Refrigerant tubing shall be protected or enclosed to avoid damage.
- Flexible refrigerant connectors (such as connecting lines between the indoor and outdoor unit) that may be displaced during NORMAL OPERATION shall be protected against mechanical damage.

Compliance is checked according to the installation instructions and a trial installation, if necessary.

Field-made refrigerant joints indoors shall be tightness tested. The test method shall have a sensitivity of 5 grams per year of refrigerant age or better under a pressure of at least 0.25 times the maximum allowable pressure. No leak shall be detected.

For installations with field applied joints that are exposed in the occupied space these joints shall be at least one of the following:

- Mechanical joints in compliance with ISO 14903 or UL 207 (U.S. only).
- Welded or brazed joints.
- Joints in enclosures that vent to the unit or to the outside.

Compliance is checked by inspection and tests.

8 Refrigerant Line Brazing

Alll R454B products have a red tag on the refrigerant lines to indicate the product is charged with A2L refrigerant. It should not be removed.

8.1 Braze The Refrigerant Lines

1. Remove caps or plugs. Use a deburring tool to deburr the pipe ends. Clean both internal and external surfaces of the tubing using an emery cloth.

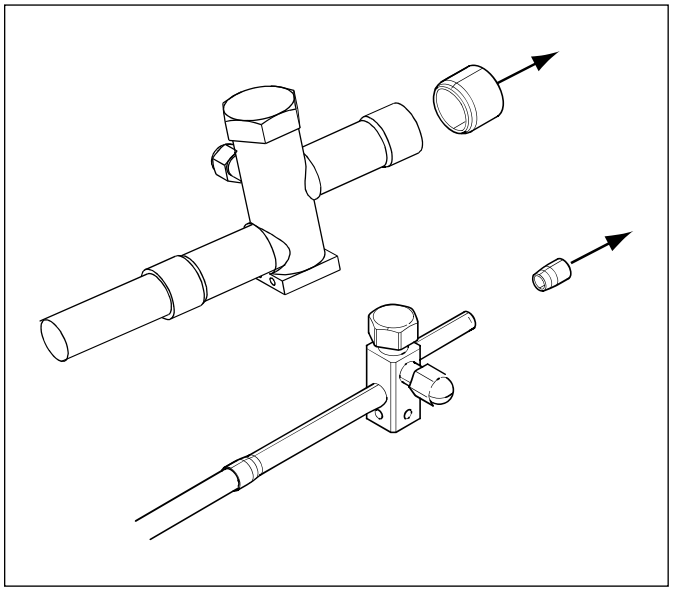


Figure 16

The locking cap might be required by your local code enforcement.

2. Remove the pressure tap cap from both service valves.

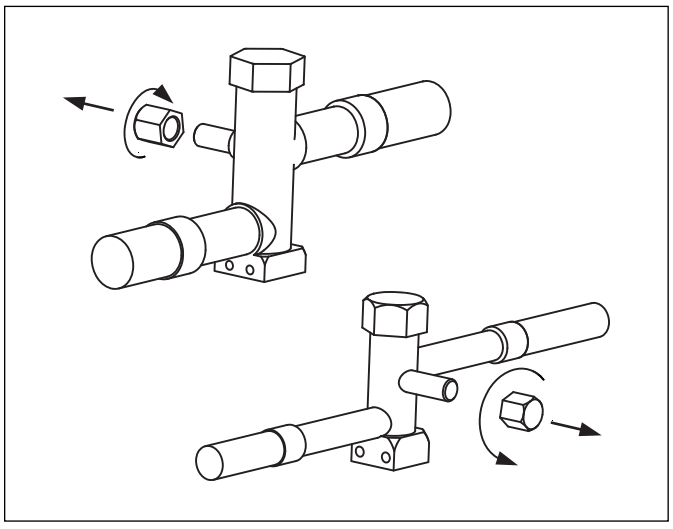


Figure 17

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

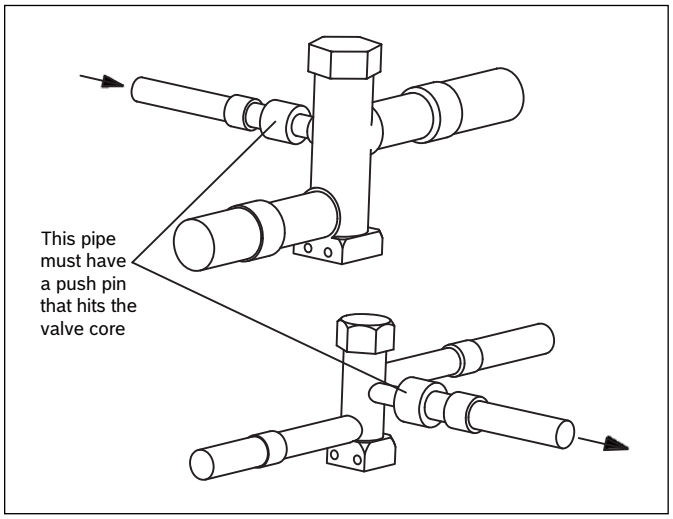


Figure 18

4. Wrap a wet rag around the valve body to avoid heat damage and continue the dry nitrogen purge (Fig. 19).

   Braze the refrigerant lines to the service valves.

   Braze the filter drier to the Liquid Line.

All units come standard with a bi-flow filter drier. Braze the filter drier to the liquid line, using caution not to push the refrigerant line too hard past the stop within the filter drier (this could damage the drier).

Remove the wet rag before stopping the dry nitrogen purge.

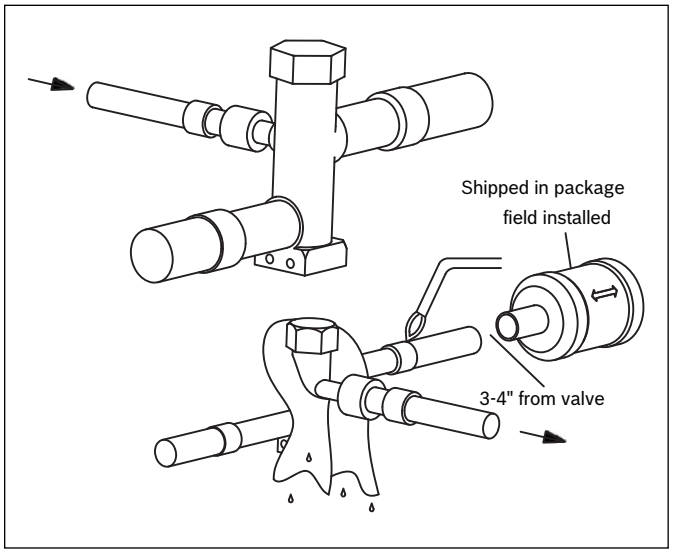


Figure 19

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

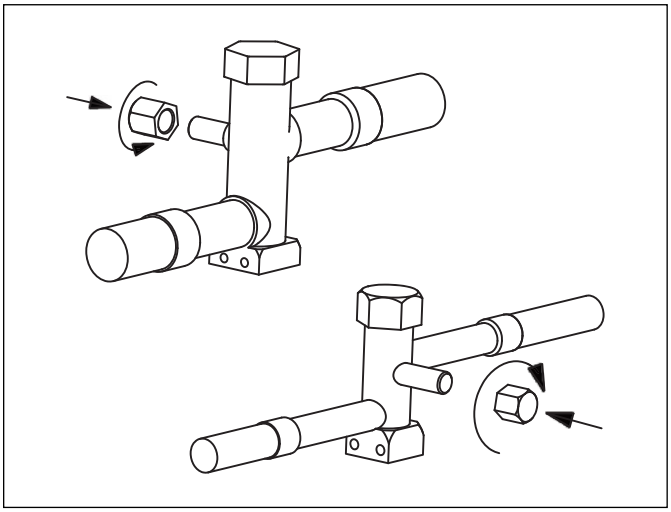


Figure 20

9 Refrigerant Line Leak Check

9.1 Check For Leaks

1. Pressurize the refrigerant lines and evaporator coil to 250 PSIG using dry nitrogen.

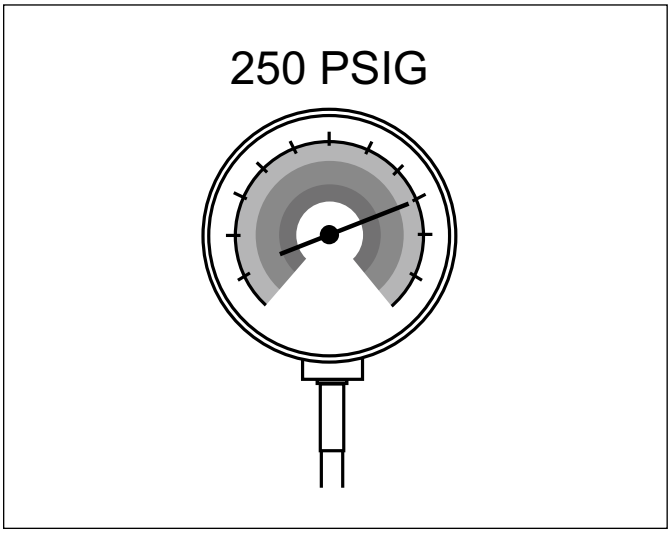


Figure 21

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

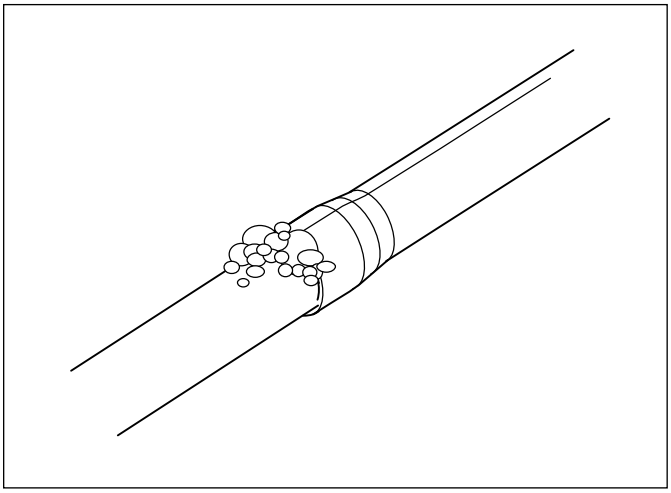


Figure 22

10 Evacuation

10.1 Evacuate the Refrigerant Lines and Indoor Coil

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

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

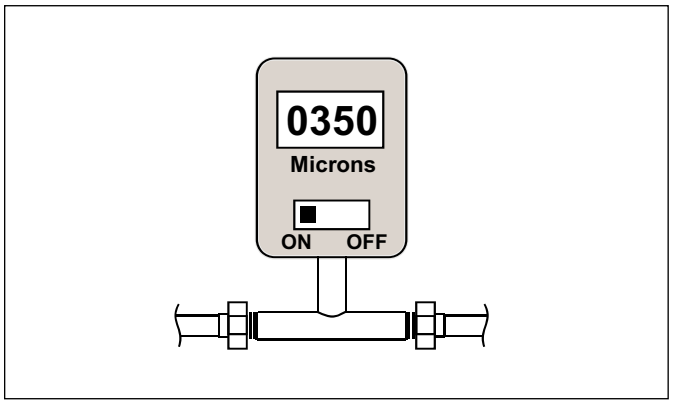


Figure 23

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, turn off the vacuum pump and micron gauge, and close the valves on the manifold gauge set.

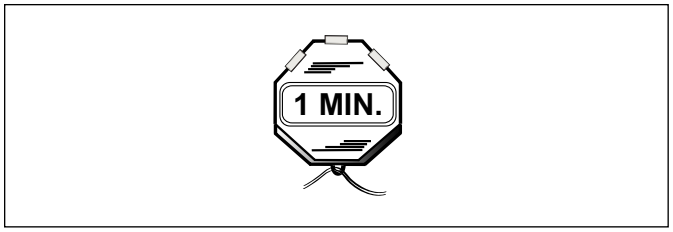


Figure 24

11 Service Valves

11.1 Open the Service Valves

WARNING

Moderate to severe burns!

Extreme caution should be exercised when opening the Liquid Line Service Valve. Turn counterclockwise 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.

Leak check and evacuation must be completed before opening the service valves. The brazed lineset valves should be used for leak checking and vacuuming. Using the separate suction port for this process will result in loss of charge.

The Suction Service Valve must be opened first BEFORE opening the Liquid Service Valve.

1. Remove Service Valve Cap (Fig. 25).
2. Fully insert hex wrench into the stem and back out counterclockwise until valve stem just touches the rolled edge (approximately five (5) turns.)
3. Replace the Valve Stem Cap to prevent leaks. Tighten finger tight plus an additional 1/6 turn.
4. Repeat STEPS 1 - 3 for Liquid Service Valve.

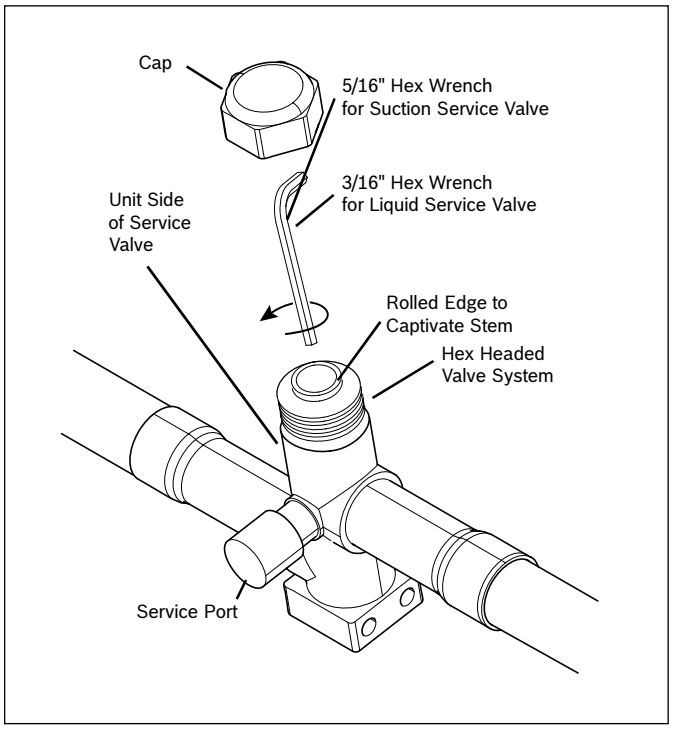


Figure 25

12 Electrical - Low Voltage

12.1 Low Voltage Maximum Wire Length

Table 11 & 12 define the maximum total length of low voltage wiring from the outdoor unit, to the indoor unit, and to the thermostat.

Conventional 24V Non-Communicating Control Wires	
Wire Size	Max Length
18 AWG	150 ft
16 AWG	225 ft

Table 11

Communicating (PQ) Wires	
Wire Size	Max Length
16/18 AWG	150 ft

Table 12

12.2 Low Voltage Hook-Up

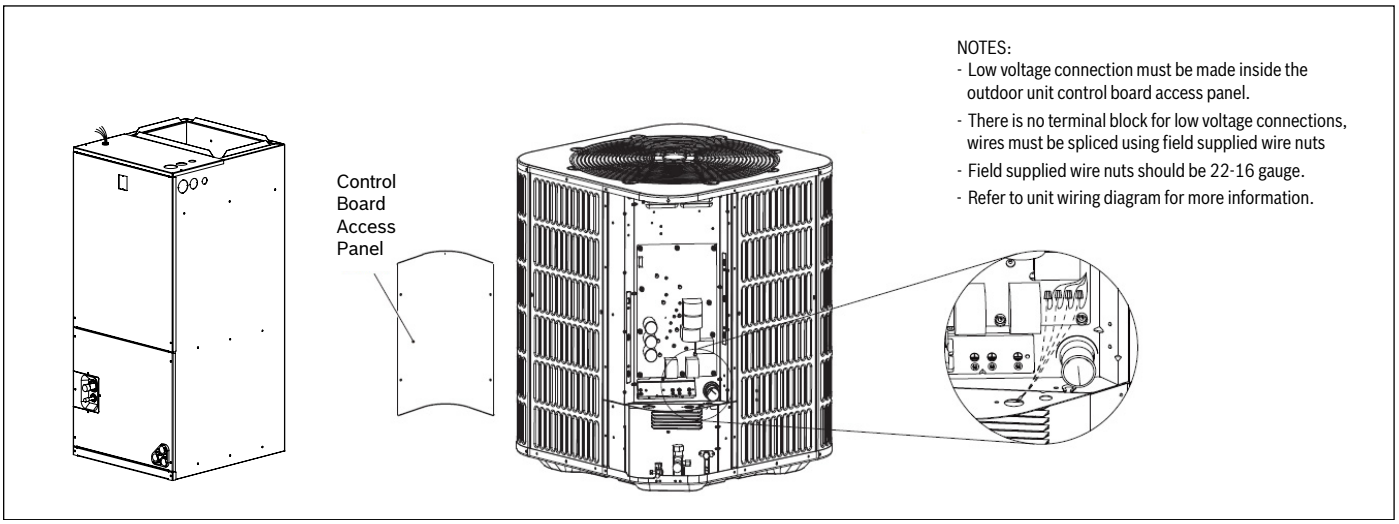


Figure 26 Low Voltage Unit Connections

12.3 Thermostat Wiring

- Be sure power supply agrees with equipment nameplate.
- Power wiring and grounding of equipment must comply with local codes.
- Low voltage wiring to be No. 18 AWG minimum conductor.
- "- - - - - - - -" Field installed electric auxiliary heat connection
- Single-stage auxiliary heating supported by 2H thermostat
- Twin-stage auxiliary heating supported by 3H thermostat
- W1: The first stage of field installed electric auxiliary heat.
- W2: The second stage of field installed electric auxiliary heat.
- The outdoor unit W signal is connected to the electric auxiliary heat or the first stage electric auxiliary heat.

Figures 29-34 and 40-45 refer to thermostat wiring diagrams when installed with a Bosch Air Handler Unit.

Dashed lines in the following thermostat wiring diagrams refer to optional wiring (wiring for Passive Dehumidification Function and/OR Electric Heat). For thermostat wiring please refer to the Owner's Manual of the thermostat.

B terminal to be connected with thermostat (O/B) wiring. Reversing valve energizes in heating.

12.3.1 Non-Communicating Set Up

Dip switch configurations for non-communicating mode

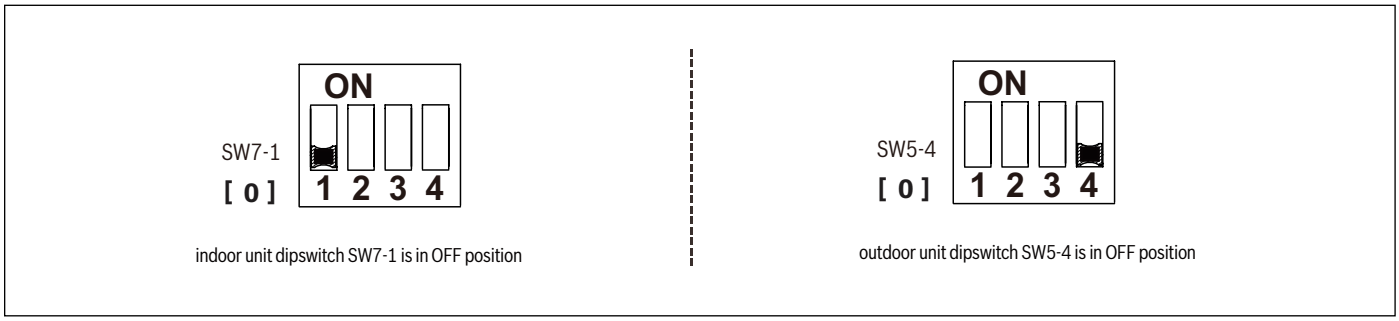


Figure 27

- The factory default mode is conventional 24VAC non-communicating mode.
- This device can be configured to communicating. Please refer to section 12.3.2 "Communicating Set Up" to review the setup steps, advanced features and benefits.

Low voltage wire connections with outdoor unit, non-communicating

1. Peel off the half-stripped wires of the pre-installed wires.
2. Connect the conventional 24VAC non-communicating thermostat control wires to the field supplied wires.

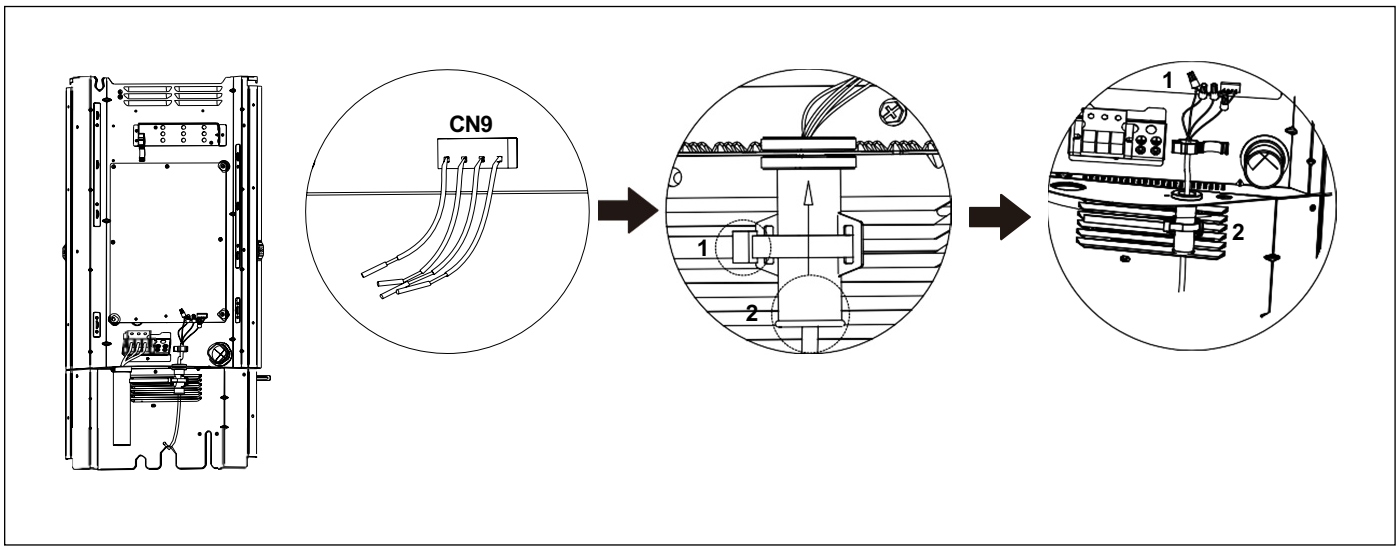
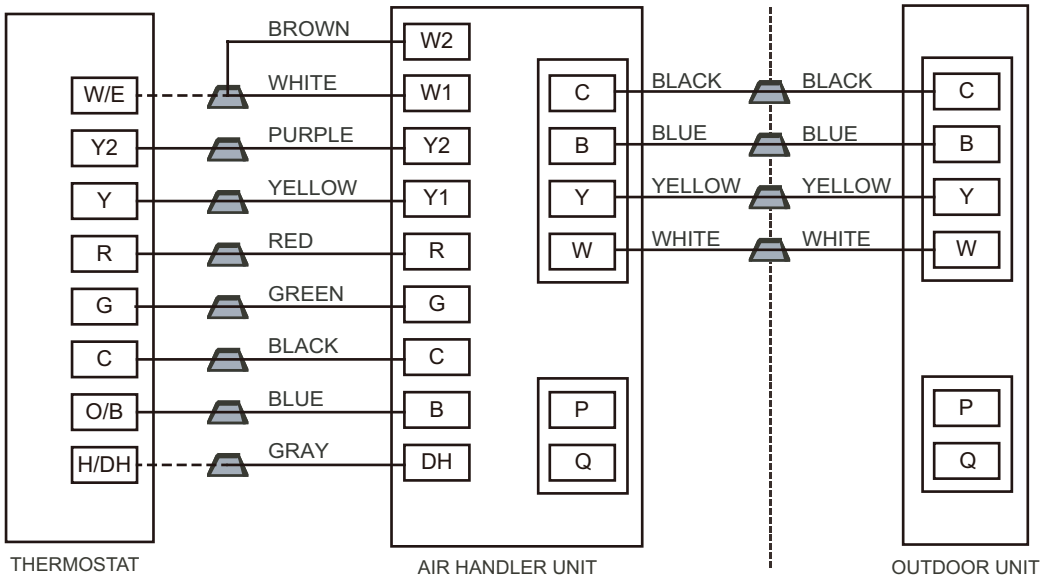


Figure 28 Wires connections diagram

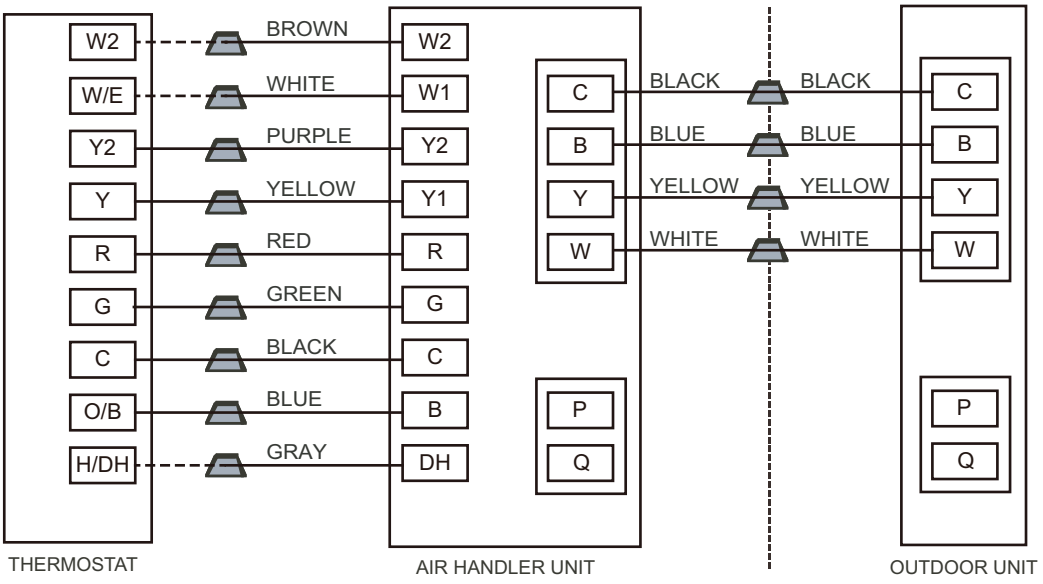
Non- communicating thermostat wiring diagrams



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 3H and 2C thermostat non-communicating setup

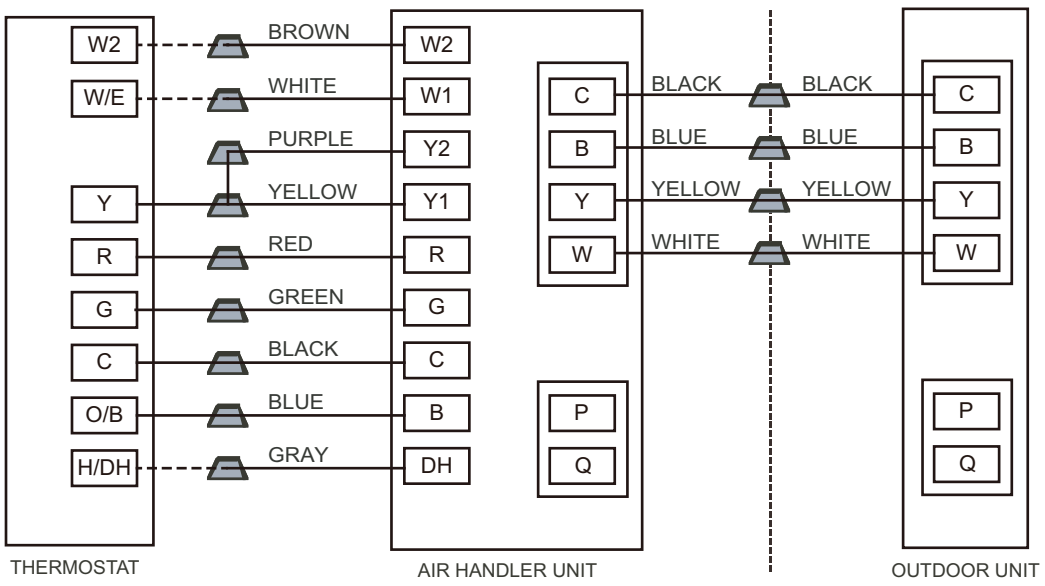
Figure 29 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 4H and 2C thermostat non-communicating setup

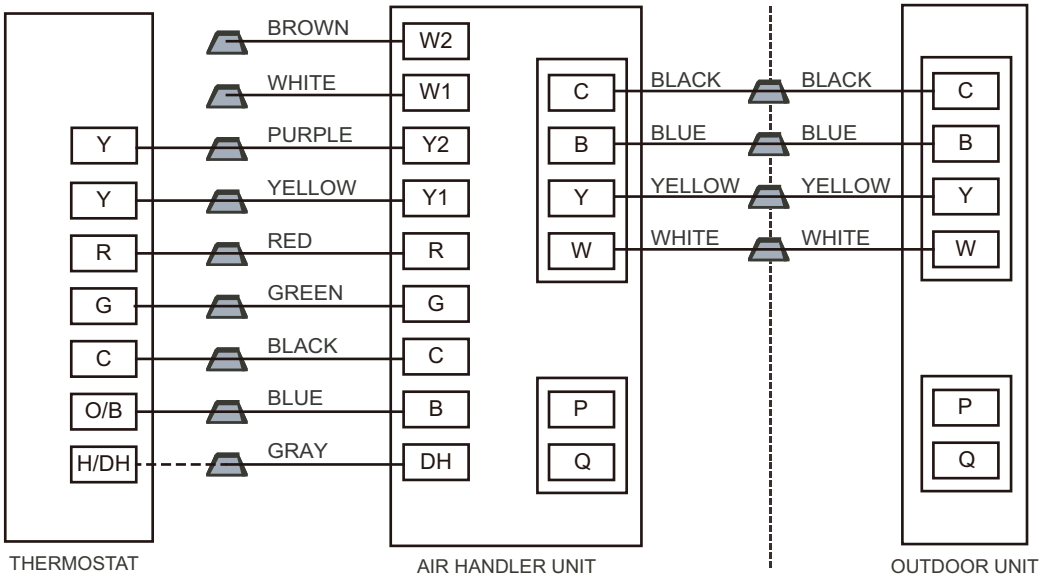
Figure 30 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 3H and 1C thermostat non-communicating setup

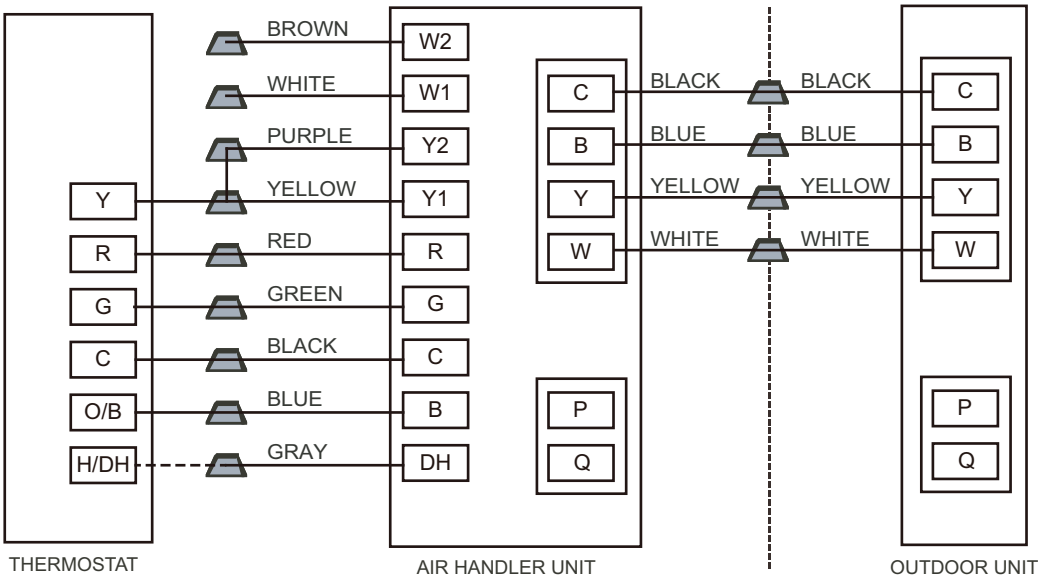
Figure 31 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 2H and 2C thermostat non-communicating setup

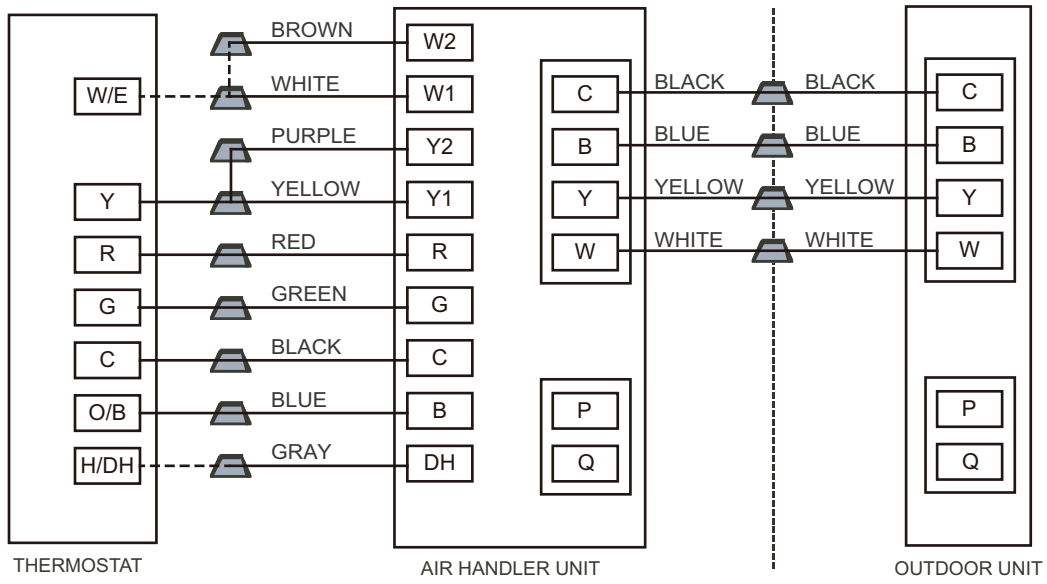
Figure 32 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 1H and 1C thermostat non-communicating setup

Figure 33 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 2H and 1C thermostat non-communicating setup

Figure 34 Control wiring for HP systems

12 .3.2 Communicating Set Up

Dip switch configurations for communicating mode

To setup the units as communication mode enable the indoor unit to transmit data effectively with a paired Bosch outdoor unit.

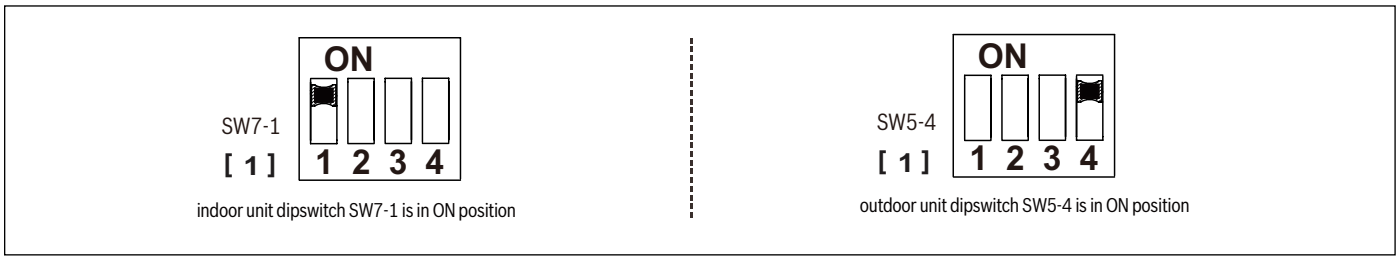


Figure 35

Advanced features and benefits for communicating mode:

1. **Enhanced dehumidification:**
   Once the system receives a DH call from the thermostat, it actively controls the compressor frequency and AHU blower speed to achieve enhanced dehumidification. Please note that the T-stat dehumidification configuration may vary depending on the thermostat used with the heat pump system.
2. **Advanced troubleshooting indication:**
   In communicating mode, the condensing unit can display error codes and check point values from the AHU, providing a more efficient troubleshooting solution for contractors.

- This is not the factory default configuration, and both dipswitches must be set to the position shown in Figure 35 to enable communication.
- The IDS Light ODU (BOVA15) can only be configured to communicate to the IDS Premium AHU (BIVA20)
- PQ communication supports non-polar communication.
- If there are 2 or more systems (communication) in the same area, make sure the low voltage wires are connected to the right unit that are connected to the same refrigerant line.

Low voltage wire connections with the indoor unit, communicating

1. Remove the conventional 24VAC non-communicating thermostat control wires plugged into CN9.

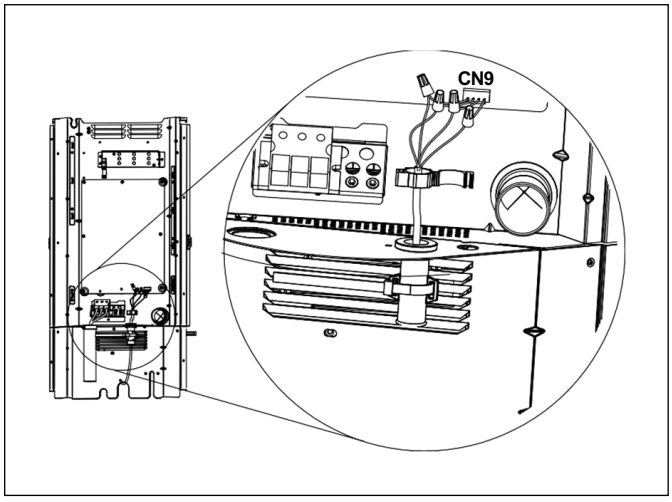


Figure 36

2. Take out the PQ communication wires from the accessory bag and plug it into CN12 on the control board.

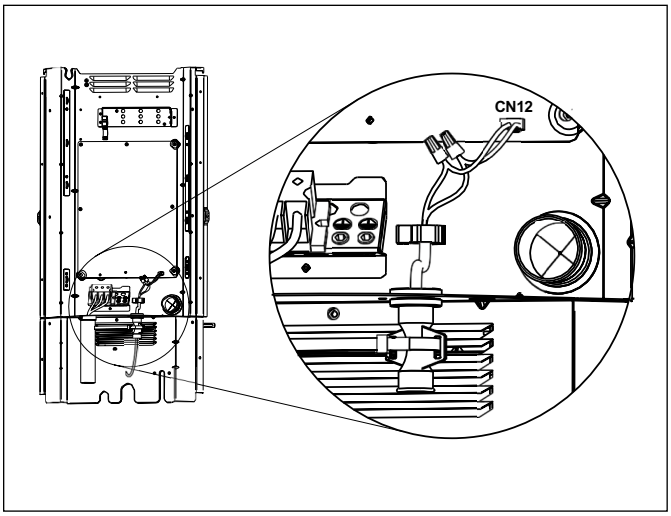


Figure 37

3. Loosen the zip tie and route the field supplied wires through the wiring grommet.

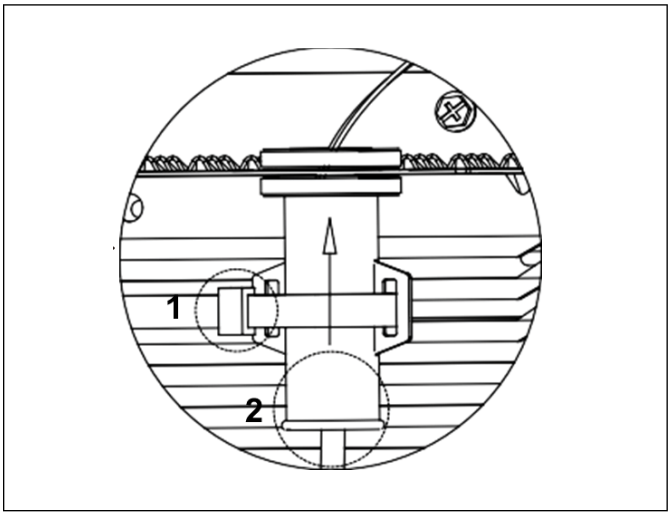


Figure 38

4. Connect the PQ communication wires to the two field supplied wires and tighten the zip tie on the wiring grommet.

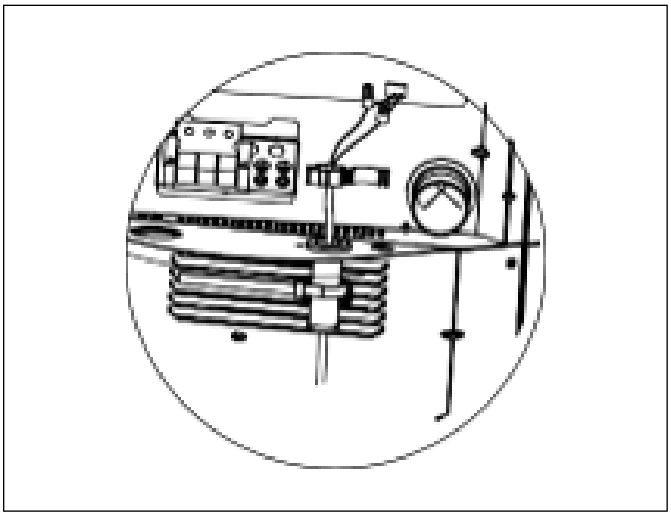
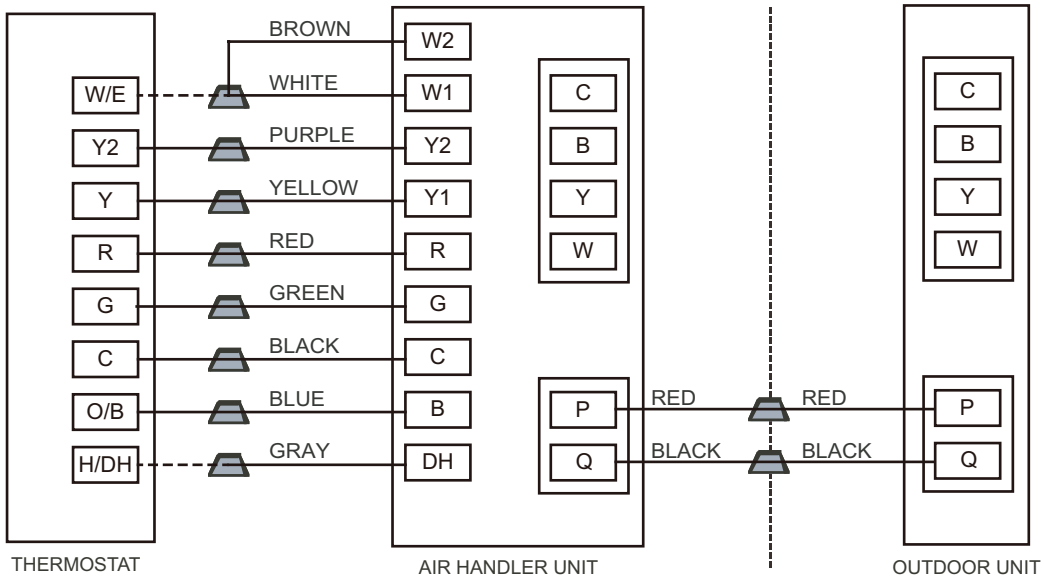


Figure 39

Ensure the dip switches are configured correctly for communicating mode (see Fig. 35).

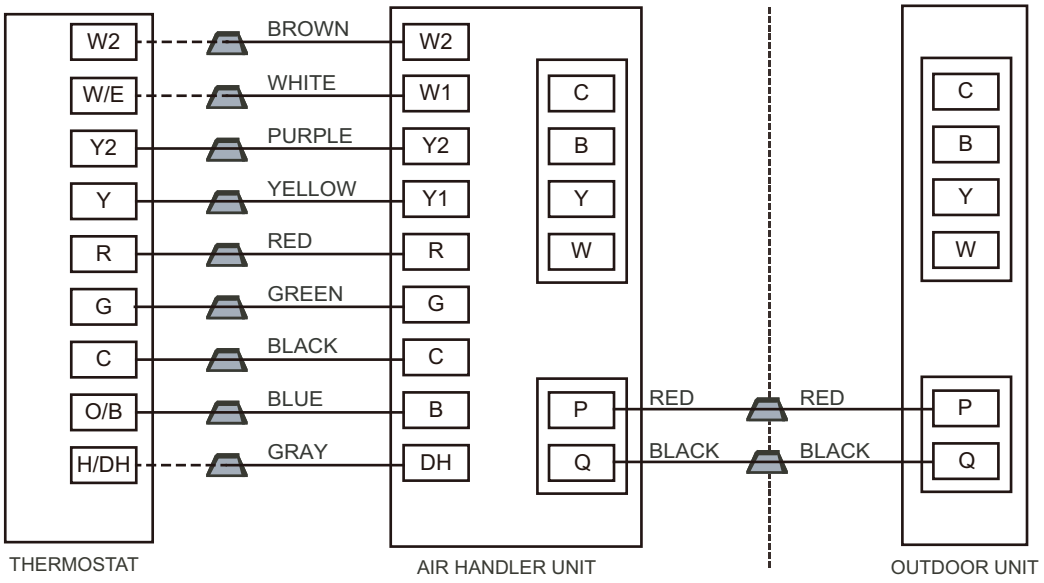
Communicating thermostat wiring diagrams



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 3H and 2C thermostat communication mode setup

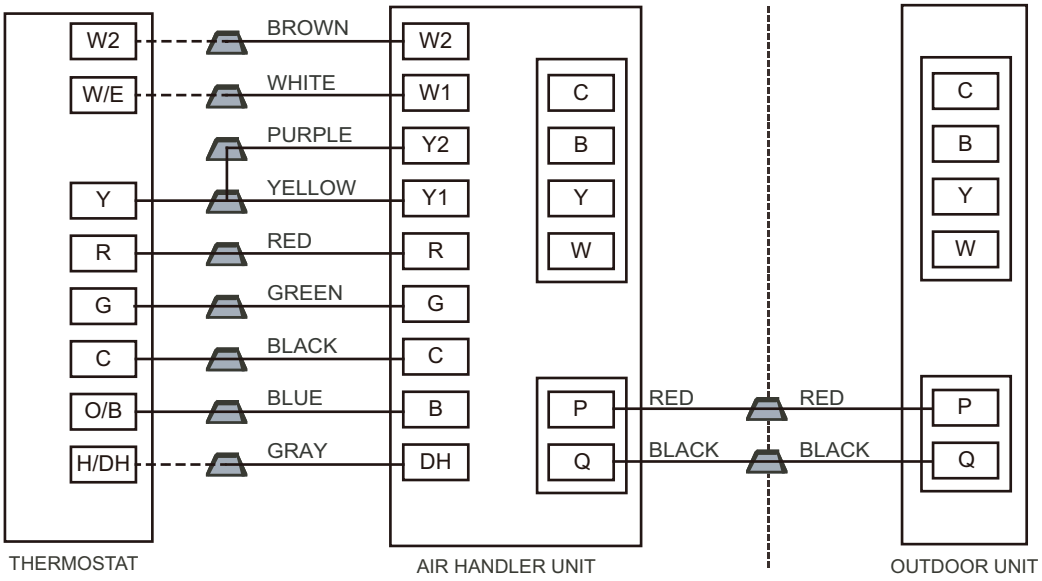
Figure 40 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 4H and 2C thermostat communication mode setup

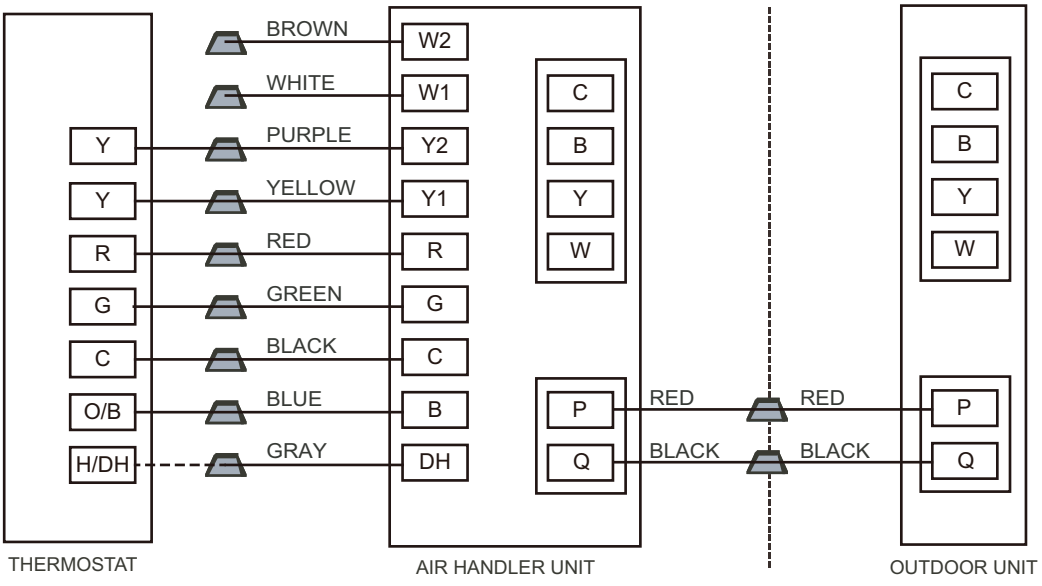
Figure 41 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 3H and 1C thermostat communication mode setup

Figure 42 Control wiring for HP systems

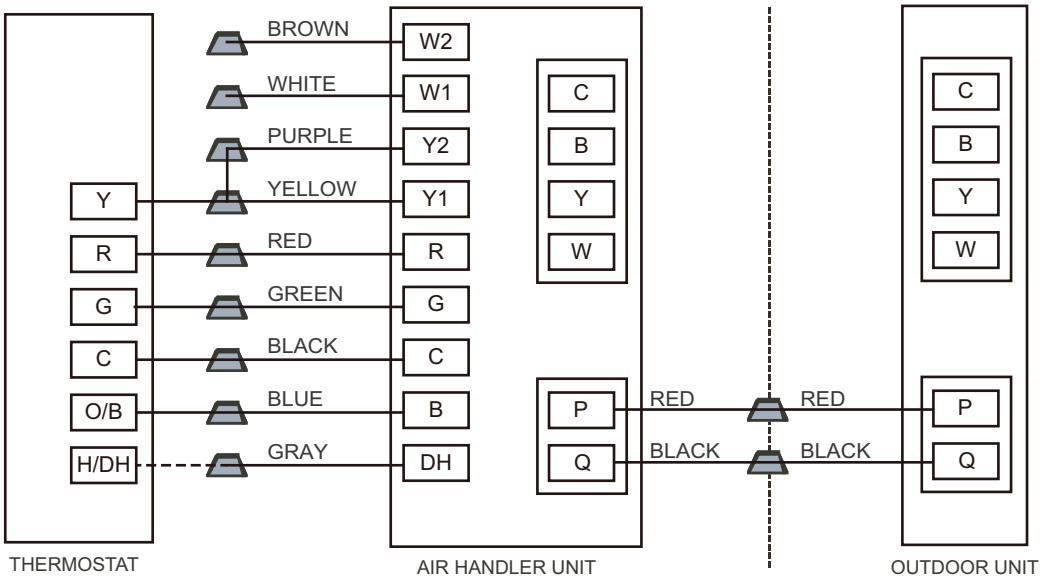


Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 2H and 2C thermostat communication mode setup

Figure 43 Control wiring for HP systems

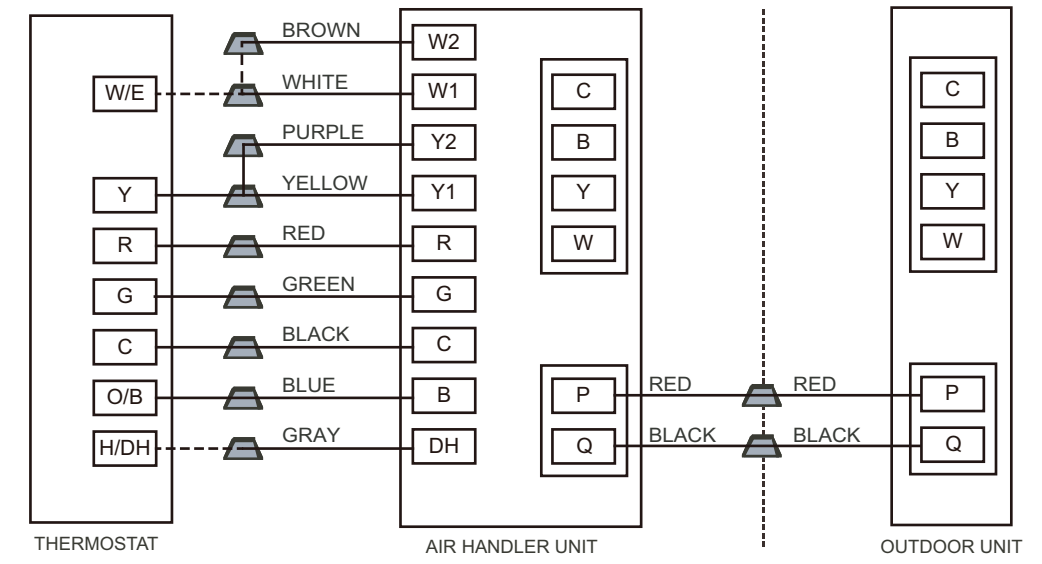
Figure 44



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 1H and 1C thermostat communication mode setup

Figure 45 Control wiring for HP systems



Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

Support 2H and 1C thermostat communication mode setup

Figure 46 Control wiring for HP systems

PQ communication mode and conventional 24VAC non-communicating thermostat control mode can not be used at the same time.

NOTICE

Product damage!

Do not interconnect different communication wires or conventional 24VAC non-communicating thermostat control wires (PQ, CBYW, etc.), otherwise it will damage the control board. The following example shows incorrect wiring.

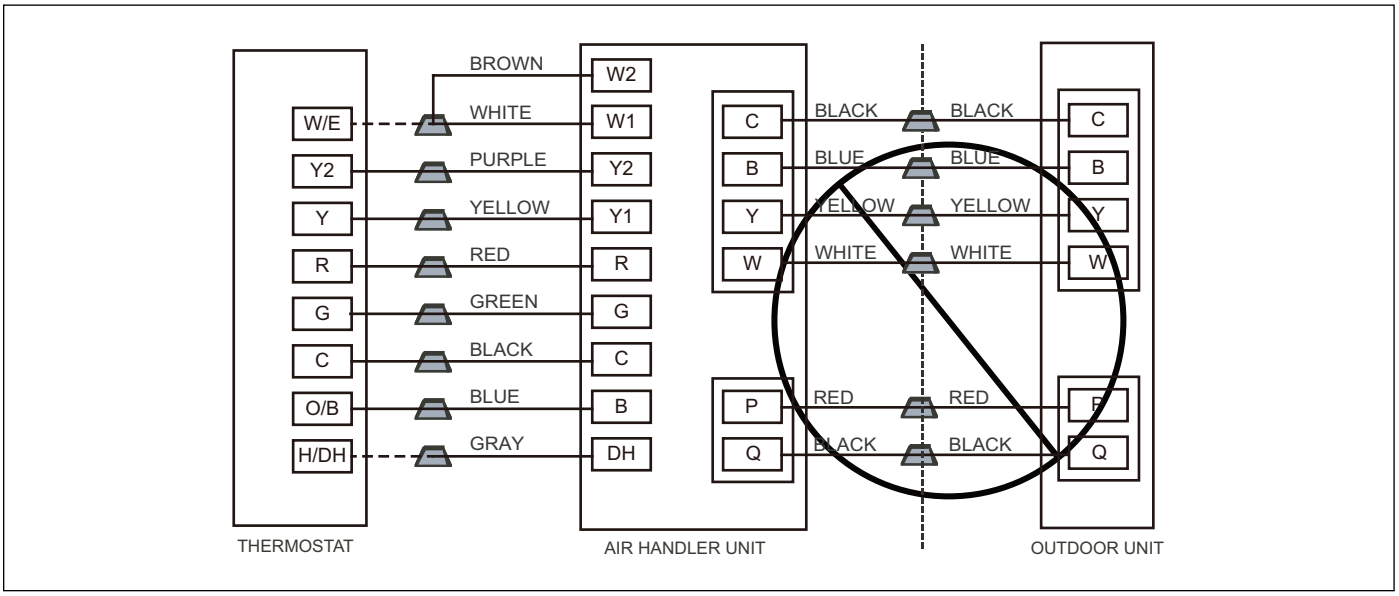


Figure 47 Incorrect wiring example

Electric wiring gauge for H/P systems

Model(Btu/h)			24	36	48	60
Power		Phase	Single			
		Voltage/frequency	208/230VAC, 60Hz			
Line Gauge	Input Current Fuse	Indoor unit (A)	15A	15A	15A	15A
	Indoor Unit Power Line	Line Quantity	3	3	3	3
		Line Diameter (AWG)	14	14	14	14
	Outdoor Unit Power Line	Line Quantity	3	3	3	3
		Line Diameter (AWG)	14	12	10	10
	Outdoor -Indoor Signal Line	Line Quantity	4	4	4	4
		Line Diameter (AWG)	18	18	18	18
	Thermostat Signal Line	Line Quantity	5	5	5	5
		Line Diameter (AWG)	18	18	18	18

Table 13

13 Electrical - High Voltage

13.1 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 match the equipment nameplate (208/230V, 1PH, 60Hz).

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

Follow instructions on unit wiring diagram located on the inside of the control box access panel and refer to wiring diagram in this IOM.

13.2 High Voltage Disconnect Switch

Install a separate disconnect switch at the outdoor unit.

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

13.3 High Voltage Ground

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

14 Unit Capacity Selection

Select the appropriate tonnage to allow the unit to operate in the range of compressor and fan speeds that is optimized for best unit performance and efficiency.

Depending on the model, if the intended capacity for the application is 5 Ton or 3 Ton, then no change is required. If the intended capacity for the application is 4 Ton or 2 Ton, the “J2” DIP switch must be configured to “OFF” .

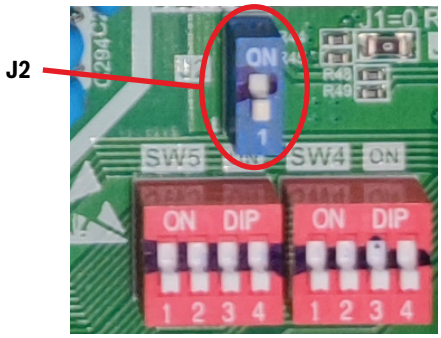


Figure 48

J2 Dip Switch	Capacity
ON	5 Ton / 3 Ton
OFF	4 Ton / 2 Ton

Table 14

Unit must be power cycled after a DIP switch change for it to take effect.

15 Start Up

15.1 System Start Up

1. Ensure Sections 7-14 have been completed.
2. Set System Thermostat to OFF.

Figure 49

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

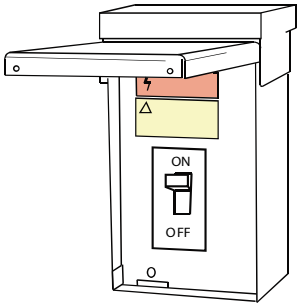


Figure 50

4. Upon initial unit installation, wait one (1) hour before starting the unit if compressor crankcase heater is used and the outdoor ambient temperature is below 70 ºF.

Figure 51

5. Set system thermostat to ON.

Figure 52

16 System Charge Adjustment

16.1 Charging: Weigh-In Method

Use weigh-in method 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.

Model	Factory Charge	Charge multiplier for interconnecting refrigerant tube length
BOVA15-24	4 lb 13 oz	0.59 oz/ft
BOVA15-36	5 lb 11 oz	0.59 oz/ft
BOVA15-60	8 lb 2 oz	0.59 oz/ft

Table 15

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

New Installations—Calculating additional charge for lineset greater than 15 ft.

1. Total Line Length (ft) = _____(a)
2. Standard Lineset (ft) = __15__(b)
3. (a) minus (b) = _____(c)
4. Refrigerant Multiplier = 0.59 oz/ft (d)
5. Refrigerant Adder (c*d) = _____(e)*

*If lineset is less than 15 ft, (e) = 0

Sealed-System Repairs—Calculating total system charge.

1. Total Line Length (ft) = _____(a)
2. Standard Lineset (ft) = __15__(b)
3. (a) minus (b) = _____(c)
4. Refrigerant Multiplier = 0.59 oz/ft (d)
5. Refrigerant Adder (c*d) = _____(e)*
6. Factory Charge (namplate) = _____(f)
7. Total System Charge (e+f) = _____

** If lineset is less than 15 ft, (e) = 0*

The only mode approved for validating system charge is while in Cooling "Force Mode". Outdoor temperature must be between 55°F and 120°F with indoor temperature kept between 70°F and 80°F.

16.2 Subcooling Charging And Refrigerant Adjustment In Cooling (Above 55°F Outdoor Temp.)

1. Check the outdoor ambient temperatures.

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

   For outdoor ambient temperatures below 55ºF use weigh-in charge method.

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.

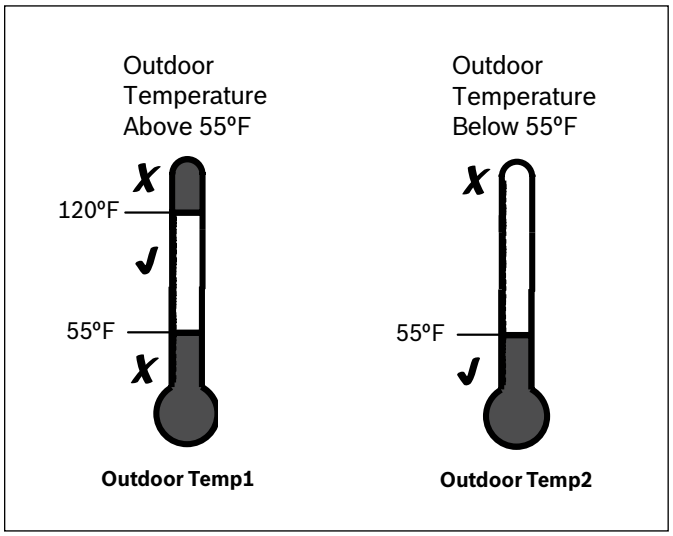


Figure 53

For best results, the indoor temperature should be kept between 70ºF and 80ºF during the install.

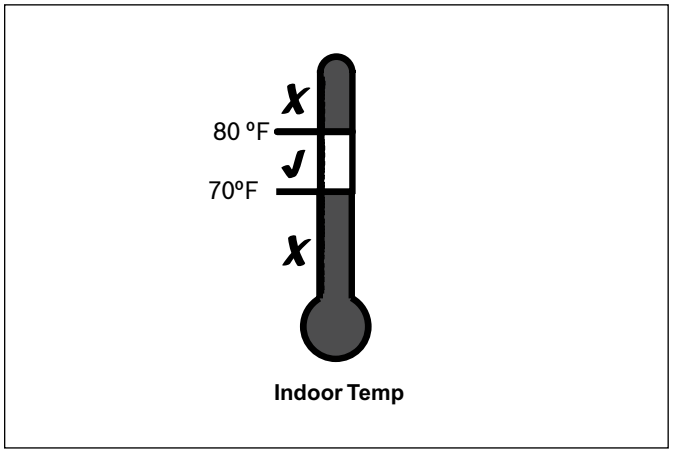


Figure 54

2. Ensure Sections 7-15 have been completed.

3. Stabilize the system.

   After **starting the system in cooling mode**, short press "FORCE" button, and "⊢" symbol should appear. System may take 10 minutes to ramp up. Operate the system for a minimum of twenty (20) minutes.

After a twenty (20) minute stabilization period operating at 100% capacity (i.e. once the compressor reaches the frequency shown in Table 16), maintain continuous operation while adjusting refrigerant charge. After adjusting, operate system for a minimum of five (5) minutes for system to stabilize, otherwise repeat step 3.

Compressor Frequency in Force Mode in Cooling				
ODU Capacity	2TON	3TON	4TON	5TON
Frequency (HZ)	46	66	54	60

Table 16

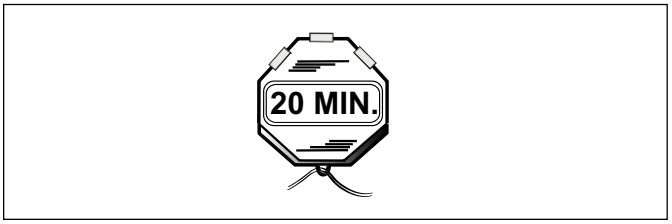


Figure 55

4. Calculate superheat value (According to Table 17)
   - Measured Suction Line Temp = _____ºF
   - Measured Suction Line Pressure = _____ PSIG
   - Calculate superheat value = _____ºF

Check the superheat and select correct subcooling according to superheat, refer to Table 18. It is recommended to keep the superheat at 10-18ºF if a third party indoor unit is used.

5. Calculate subcooling value (According to Table 18)
   - Measured Liquid Line Temp. = _____ºF
   - Measured Liquid Line Pressure = _____ PSIG
   - Calculate subcooling value = _____ºF

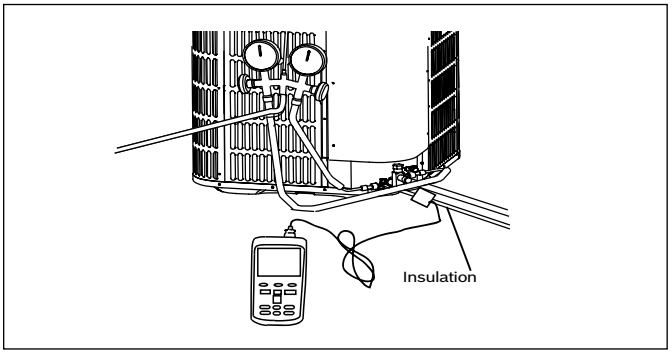


Figure 56

If the superheat is out of range, refer to Troubleshooting section of this IOM.

Suction Temp (ºF)	Final Superheat (ºF)								
	6	8	10	12	14	16	18	20	22
	Suction Gauge Pressure (PSIG)								
40	95	91	87	84	80	77	74	70	67
42	99	95	91	87	84	80	77	74	70
44	103	99	95	91	87	84	80	77	74
46	107	103	99	95	91	87	84	80	77
48	111	107	103	99	95	91	87	84	80
50	116	111	107	103	99	95	91	87	84
52	120	116	111	107	103	99	95	91	87
54	125	120	116	111	107	103	99	95	91
56	129	125	120	116	111	107	103	99	95
58	134	129	125	120	116	111	107	103	99
60	139	134	129	125	120	116	111	107	103
62	144	139	134	129	125	120	116	111	107
64	149	144	139	134	129	125	120	116	111
66	155	149	144	139	134	129	125	120	116
68	160	155	149	144	139	134	129	125	120
70	166	160	155	149	144	139	134	129	125
72	171	166	160	155	149	144	139	134	129

Table 17 R-454B Refrigerant chart - Final Superheat

Liquid Temp (ºF)	Final Subcooling (ºF)							
	6	7	8	9	10	11	12	13
	Liquid Gauge Pressure (PSIG)							
55	164	167	170	172	175	178	181	184
60	178	181	184	187	191	194	197	200
65	194	197	200	203	206	210	213	217
70	210	213	217	220	223	227	230	234
75	227	230	234	238	241	245	249	252
80	245	249	252	256	260	264	268	272
85	264	268	272	276	280	284	288	292
90	284	288	292	297	301	305	309	314
95	305	309	314	318	323	327	332	336
100	327	332	336	341	346	351	355	360
105	351	355	360	365	370	375	380	385
110	375	380	385	390	396	401	406	412
115	401	406	412	417	422	428	433	439
120	428	433	439	445	450	456	462	468
125	456	462	468	474	480	486	492	498

Table 18 R-454B Refrigerant chart - Final Subcooling

Design Subcooling		
Model	Subcooling/°F	Superheat/°F
24K/36K	6-10*	6-8*
	8-12	8-18
48K/60K	6-10*	8-10*
	10-12	8-18

Table 19
** Optimized range for superheat/subcool*

6. Adjust refrigerant level to attain proper gauge pressure.

Add refrigerant if the subcooling reading from Table 18 is lower than the designed value (Table 19).

- Connect gauges to refrigerant bottle and unit as illustrated (Fig. 56).
- Purge all hoses.
- Open tank.
- Stop adding refrigerant when subcooling matches the design value (Table 19).

Recover refrigerant if the subcooling reading from Table 18 is higher than the design value (Table 19).

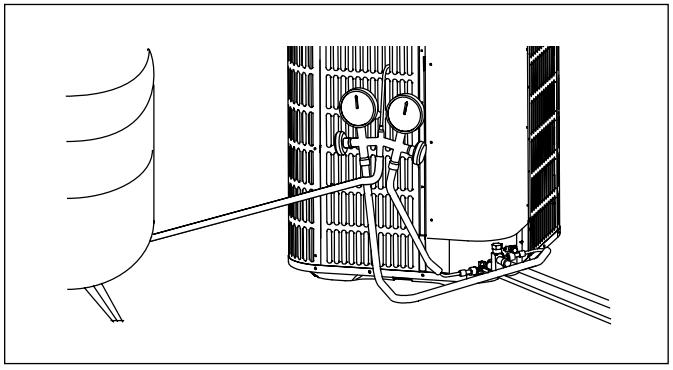


Figure 57

7. Stabilize the system.
   - Wait 5 minutes for the system condition to stabilize between adjustments.

When the subcooling matches the design value (Table 19), the system is properly charged.

- Remove gauges.
- Replace service port caps to prevent leaks. Tighten finger tight plus an additional 1/6 turn.

8. Record System Information for reference (Table 20).
   Record system pressures and temperatures after charging is complete.

Description	Value
Outdoor model number	
Measured Outdoor Ambient	°F
Measured Indoor Ambient	°F
Measured Liquid Line Temp	°F
Measured Suction Line Temp	°F
Liquid Gauge Pressure	PSIG
Suction Gauge Pressure	PSIG

Table 20

16.3 Record the Refrigerant Charge Amount

After refrigerant is charged, record the amount of refrigerant to be charged on the label of the outdoor unit. **1** indicates the amount of refrigerant to be charged by the factory, **2** indicates the additional refrigerant, and **1** + **2** indicates the total refrigerant to be charged.

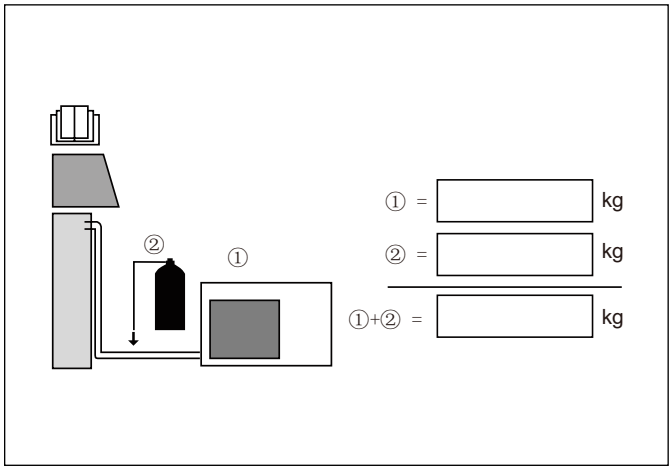


Figure 58

17 System Operation and Troubleshooting

17.1 Control Logic Description

- The variable speed system adopts the same 24VAC control as any conventional heat pump.
- The compressor's speed is controlled based on coil pressures monitored by the unit's pressure transducer. To ensure stable and adequate capacity, the compressor speed will modulate relative to evaporator pressure during cooling operation and relative to condensing pressure during heating operation. The target pressure can automatically adjust based on compressor operation so optimal capacity can be achieved. Target pressure can be manually adjusted (SW4) to achieve improved dehumidification and capacity demands.

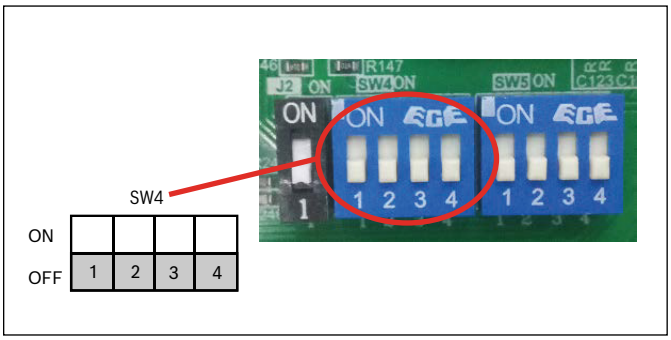


Figure 59

DIP Switch		Description
SW4-1	ON	Unused
	OFF	Must be set at "OFF" position
SW4-2	ON	Unused
	OFF	Must be set at "OFF" position
SW4-3	ON	Adaptive Capacity Output Disable
	OFF	Adaptive Capacity Output Enable*
SW4-4	ON	Accelerated Cooling/Heating
	OFF	Normal Cooling/Heating*

Table 21

*Factory Default

- Adaptive capacity function is a "self-learning function" which allows a range of target coil temperatures to adapt for better unit operation and reduced short cycling.
- Accelerated cooling/heating function changes the initial target coil temperature to provide "enhanced comfort" by increasing unit capacity.

17.2 Sensors (Thermistors/Pressure Transducer)

- T3 = Outdoor Coil Temperature (Table 26)
  - High/Low temperature protection
  - Outdoor fan control (cooling mode)
  - Defrost control (heating mode)
- T4 = Ambient Temperature (Table 26)
  - Operating condition permission
  - Defrosting condition permission
  - Outdoor fan control (heating mode)
- T5 = Compressor Discharge Temperature (Table 27)
  - High/Low temperature protection
  - Electronic Expansion Valve (EEV) (ODU/heating mode only)
- T3L = Liquid Line Temperature (Table 26)
- TF = Control Board Temperature
  - Control board overheat protection
- Pressure transducer
  - Compressor frequency control
  - Electronic Expansion Valve (EEV) control (heating mode only)
  - High pressure protection (heating mode)
  - Low pressure protection (cooling mode)

17.3 Pressure Equalizer Valve (PEV)

Used to balance the pressure in the system before compressor start up.

17.4 Defrost Description

- The Demand Defrost Control (DDC) monitors the ODU coil temperature using thermistor (T3). A second thermistor (T4) monitors outdoor ambient temperature. Based on these parameters, as well as accumulative run time and high pressure, the DDC calculates proper initiation of defrost.
- Any one of the below three conditions is required to enter defrost:
  1. The calculated temperature difference between the outdoor temperature (T4) and the coil temperature (T3) is called Delta T. After Delta T is achieved and continues for 3 minutes.
     - T4 ≥ 39°F, Delta T = 18°F
     - T4 ≥ 30°F, Delta T = 16°F
     - T4 ≥ 19°F, Delta T = 14°F
     - When T4 < 19°F, T3 < 9°F, accumulative compressor run time ≥ 80 minutes.
  2. After "Minimum Run Time" (MRT) is achieved. MRT is based on outdoor ambient temperature (T4), for example:
     - MRT is 4 hours when: T4 < 23°F
     - MRT is 2 hours when: 23°F ≤ T4 < 40°F
     - MRT is 50 minutes when: Last defrost cycle was at least 8 minutes.
  3. After the high pressure saturation temperature drops below 82°F for 20 minutes when 14F <= T4 < 29F.
- Defrost will terminate once outdoor coil temperature (T3) reaches 64°F for a period of 1 minute or defrost time has exceeded 8 minutes.

- Defrost Termination Settings (SW5) offers different defrost termination options for enhanced defrost for different geographical and outdoor conditions.

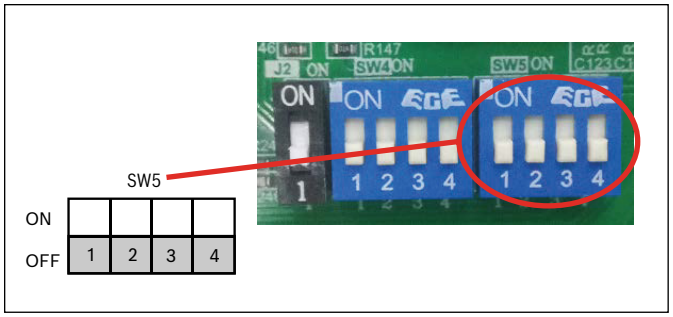


Figure 60

DIP Switch		Description
SW5-1	ON	Heating time reduced 10%
	OFF	Normal*
SW5-2	ON	Defrosting extended for 120 seconds
	OFF	Normal*
SW5-3	ON	Reserved
	OFF	Normal*
SW5-4	ON	Reserved
	OFF	Must be set at "OFF" Position

Table 22

- Manual Defrost:
  1. System must have a call for heat and have been operating for a minimum of 8 minutes.
  2. Press “Force” button on control board for 6 seconds to begin forced defrost.
  3. Wait approximately 40 seconds for defrost to initiate.
  4. Once defrost initiates, the display will indicate “dF”.
  5. Defrost test will terminate automatically, after which the display will indicate running speed.
  6. If a second defrost test is required, repeat steps 2-5 after 5 minutes.

17.5 Compressor Crankcase Heater Description

Refrigerant migration during the OFF cycle can result in noisy start-ups, therefore a CrankCase Heater (CCH) is used to minimize refrigerant migration thereby minimizing start-up noise and/or bearing “wash out”. All CCHs must be installed on the lower half of the compressor shell. Its purpose is to warm the compressor during the OFF cycle, driving refrigerant from compressor. After extended shutdown periods in cold weather, it is recommended to allow CCH to be energized for at least 12 hours prior to compressor operation by applying line voltage to heat pump with thermostat OFF.

- CCH operation energizes:
  1. First time line voltage is applied and compressor discharge temperature T5 < 53.6°F.
  2. Compressor stops running for 3 hours (outdoor ambient temperature T4 < 41°F OR compressor discharge temperature T5 < 53.6°F).
- CCH operation de-energizes:
  1. Compressor discharge temperature T5 ≥ 60.8°F.
  2. Compressor start running.

17.6 Reversing Valve Operation

- Reversing valve energizes during heat mode and de-energizes in cool mode. The input voltage of reversing valve is 220V.

During a heat call on first time operation the unit will run about 1 minute in cooling to build up pressure for the reversing valve to change.

17.7 Protection Functions

- Outdoor coil temperature protection (T3)
  - i. If T3 ≥ 147.2°F, compressor is de-energized.
  - ii. If T3 < 133°F, compressor is energized.
- Ambient temperature protection (T4)
  - i. If 40°F ≤ T4 < 120°F, unit can operate in cooling.
  - ii. If 3°F ≤ T4 < 86°F, unit can operate in heating.
  - iii. If T4 < 1.4°F, heat pump will provide 24V control to indoor unit energizing electric heat (if installed).

See BOVA15 Product Specification for extended performance data.

- Discharge Temperature (DT) protection (T5)
  - i. If DT > 230°F during cooling or heating mode, the compressor will stop.
  - ii. If DT < 185°F during cooling or heating mode, the compressor will restart.
- High Pressure (HP) protection (mechanical open/close pressure switch)
  - i. High Pressure Switch opens at P > 580 PSIG, the compressor and outdoor fan stop.
  - ii. High Pressure Switch closes at P < 435 PSIG, the compressor and outdoor fan restart.
- Low Pressure (LP) protection
  - i. If Low Pressure < 22 psig for 3 seconds during cooling mode, the compressor and outdoor fan will stop.The system will attempt to run again after 6 minutes.
- Low discharge superheat protection
  - i. Head discharge superheat HDSH < 9 °F last 40 minutes.

17.8 Fault Code Table

Code	Fault Description (Sensor)
AtL	Ambient Temperature Limited (T4)
b2	Temperature sensor fault in indoor unit (T2)
b3	R454B refrigerant sensor hardware fault in indoor unit
b4	R454B refrigerant sensor communication (wiring) fault in indoor unit
b5	Communication fault between indoor unit and outdoor unit
b7	R454B refrigerant leakage protection in indoor unit
b8	R454B refrigerant sensor over service life in indoor unit
C3	The coil sensor is seated fault in cooling (T3)
E41	Temperature sensor fault (T3)
E42	Temperature sensor fault (T3L)
E43	Temperature sensor fault (T4)
E44	Temperature sensor fault (T5)
E51	Outdoor unit high/low input voltage protection
E52	Outdoor unit high/low DC bus voltage protection
E7	Compressor discharge sensor is seated fault (T5)
E81	EEVA coil fault
EA	Control program does not match drive program in outdoor unit
F1	High pressure switch protection (HPS)
F2*	5 times (P21) protection in 100 minutes, system lockout
F4	Pressure transducer fault (PT)
H01	Drive chip Communication fault in outdoor unit
J00-JCF	Compressor driver fault
n00-nCF	Outdoor fan motor driver fault
P0	Compressor IPM temperature protection(TF)
P1	High pressure protection
P11	High pressure protection in heating (PT)
P21	Low pressure protection in cooling (PT)
P31	Outdoor unit input over current protection
P32	Compressor over current protection
P4	High compressor discharge temperature protection (T5)
P5	Condensor coil temperature protection in cooling (T3)
PH	Low discharge superheat protection

Table 23

** Fault requires hard restart*

17.9 System Protection Status Codes

Code	Description
	Running indication under T3 limited condition
	Forced operation mode
	Running indication under high pressure
	Running indication under low pressure
	Running indication under return oil mode
	Running indication under current limited condition
	Running indication under T5 limited condition
	Running indication under COMP. IPM Temp. limited condition
	Running indication under compressor ratio limited condition
	Running indication under low voltage limited condition
	Running indication under defrost mode

Table 24

** If the first digit shown on the control board LED is one of the following protection codes (followed by two numerical digits which show the current compressor frequency in Hz), the unit will continue to run but in a limited condition.*

17.10 Parameter Point Check Table

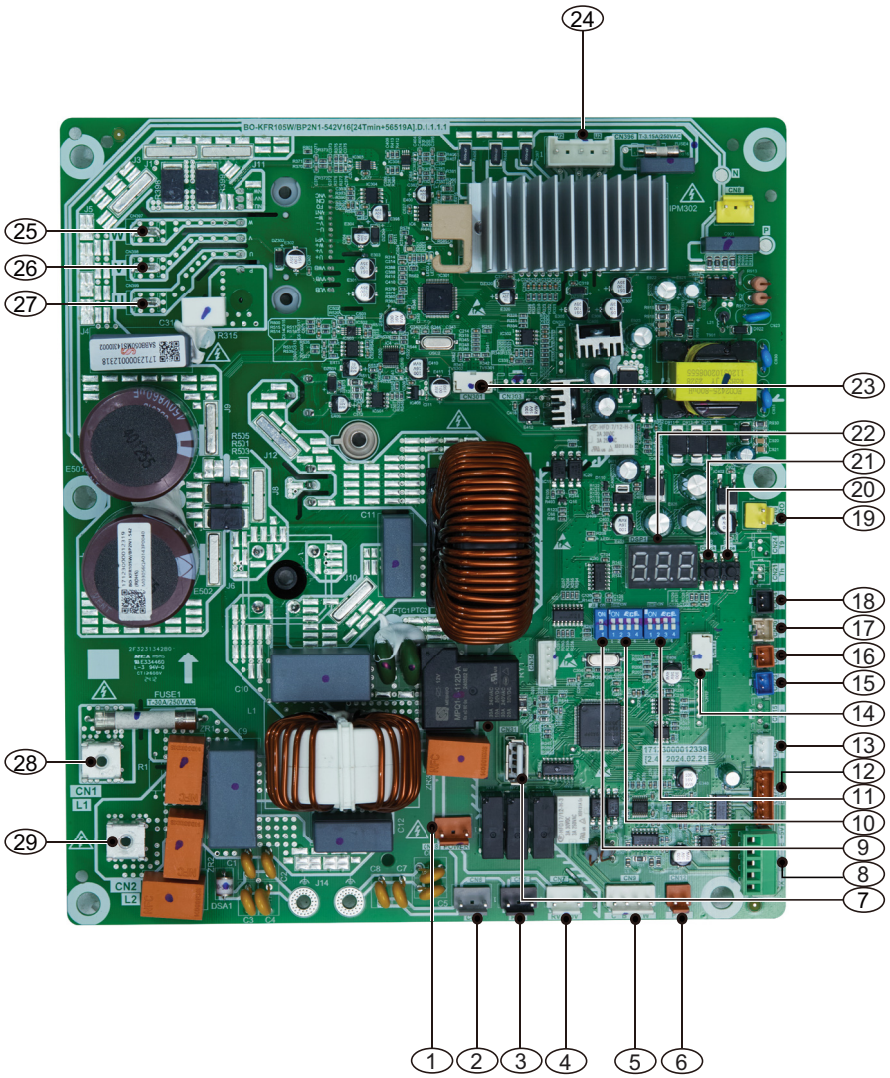
- To display system parameters, press the “Check” button to index through the series of parameters available. The first time you press the “Check” button, it will display the sequence, and after 1 second it will display the value of the parameter. If you press the “Check” button again, it will display the next sequence. Refer to Figure 60 and 61 for check button location on the control board.
- Normal Status, last two digits will display under the following conditions
  i. Unit not operating (Standby Mode); “outdoor ambient temperature”.
  ii. Unit operating; displays “compressor operating frequency”.
- After 20 seconds on same parameter, the display will revert back to normal status.
- If a system protection is active, first digit will display “status code”.

No.	Point check content	Example	Remark
0	Outdoor unit capacity	H5	H5=Heat Pump 5 ton
1	Outdoor unit mode	2	0 standby,2 cooling,3 heating
2	Outdoor unit set compressor speed	56	Hz
3	System last fault code	E4	System
4	T3: outdoor coil temp.(℉)	108	℉
5	T3L: outdoor coil outlet temp.(℉)	102	℉
6	T4: outdoor ambient temp.(℉)	95	℉
7	T5: compressor discharge temp.(℉)	140	℉
8	Tf: control board temp.(℉)	120	℉
9	Pe: evaporating pressure(psig) (only for cooling mode)	130	psig
10	Pc: condensing pressure(psig) (only for heating mode)	320	psig
11	Tes: target evaporating temp.(℉) (only for cooling mode)	43	℉
12	Te: evaporating temp.(℉)	43	℉
13	Tcs: target condensing temp.(℉) (only for heating mode)	106	℉
14	Tc: condensing temp.(℉)	106	℉
15	Target value of the compressor discharge superheat(℉) (only for heating mode)	36	℉
16	Compressor discharge superheat (℉)	36	℉
17	Openings of EEVA(P)	200	0-480P
18	Fan speed stage	8	(0-10)
19	Outdoor unit fan current(A)	1	A
20	Compressor current(A)	10	A
21	Outdoor unit input current(A)	10	A
22	Outdoor unit input voltage(V)	230	V
23	Outdoor unit DC bus voltage(V)	380	V
24	Outdoor unit power(*0.1kW)	200	Outdoor unit * 0.1kW
25	Continuous running time of the compressor(min)	35	minutes/0-999/Maintain at maximum
26	Outdoor unit main control software version	11	11
27	Indoor unit Heat Kit Staging (only for communication mode)	1	0~3
28	T2: indoor unit coil temp.(℉) (only for communication mode)	55	℉
29	Indoor unit software version (only for communication mode)	11	
30	Reserved	--	
31	Remark“--”	--	

Table 25

17.11 Control Board Overviews

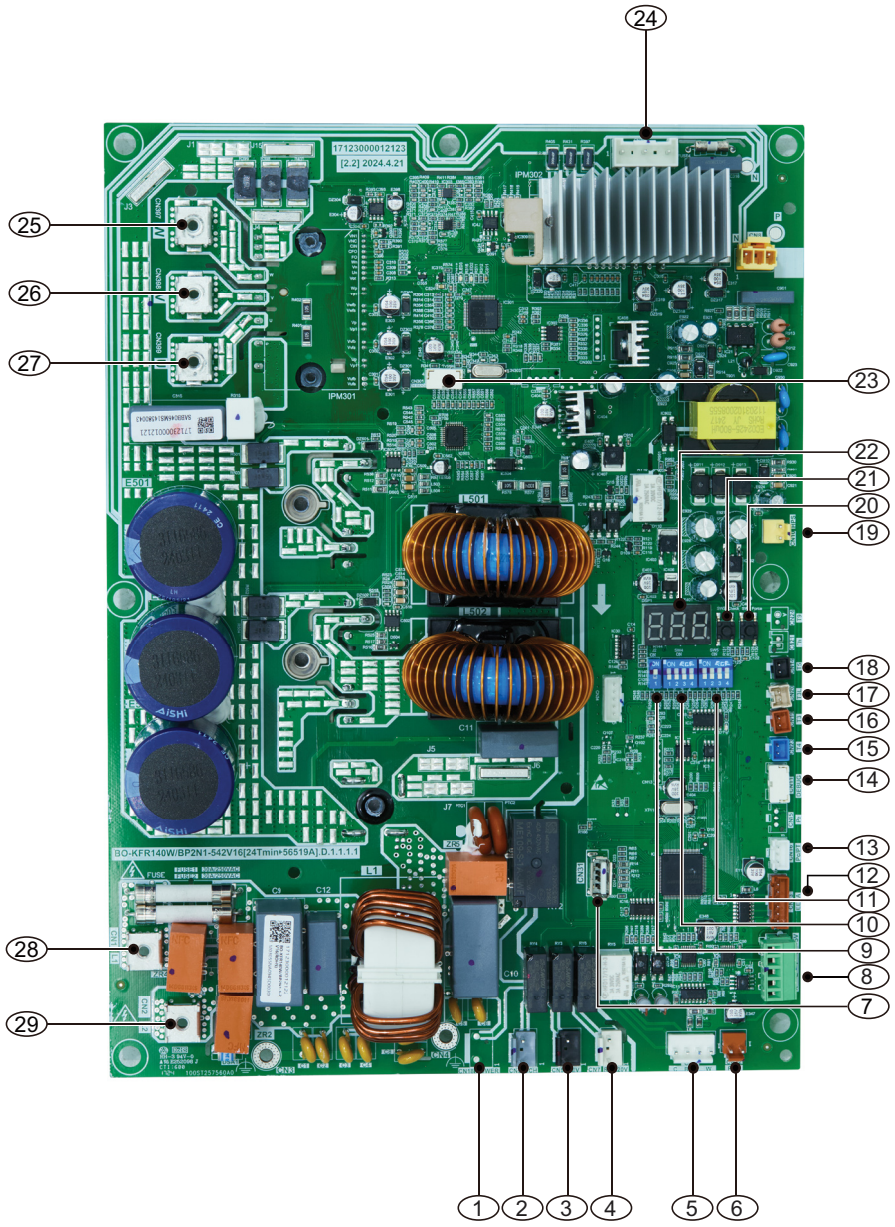
Main Control Board for 24/36 ODU Model



No.	Function Description
1	Power output（Reserve）
2	Compressor crankcase heater port
3	Solenoid valve port PEV
4	Reversing valve port
5	Thermostat wire connections
6	Indoor unit comm. bus port
7	USB port
8	Gateway wire connections
9	J2 Dip SWITCH:Control logic settings
10	SW4 Dip SWITCH:Control logic settings
11	SW5 Dip SWITCH:Control logic settings
12	EEVA port
13	Pressure transducer port
14	Debug
15	T4 sensor port
16	T3 sensor port
17	T3L sensor port
18	T5 sensor port
19	High pressure switch port
20	SW1 FORCE BUTTON
21	SW2 CHECK BUTTON
22	Digital tube
23	Debug
24	Fan motor port
25	Compressor: W port
26	Compressor: V port
27	Compressor: U port
28	Power input
29	Power input

Figure 61

Main Control Board for 48/60 ODU Model



No.	Function Description
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4	Reversing valve port
5	Thermostat wire connections
6	Indoor unit comm. bus port
7	USB port
8	Gateway wire connections
9	J2 Dip SWITCH:Control logic settings
10	SW4 Dip SWITCH:Control logic settings
11	SW5 Dip SWITCH:Control logic settings
12	EEVA port
13	Pressure transducer port
14	Debug
15	T4 sensor port
16	T3 sensor port
17	T3L sensor port
18	T5 sensor port
19	High pressure switch port
20	SW1 FORCE BUTTON
21	SW2 CHECK BUTTON
22	Digital tube
23	Debug
24	Fan motor port
25	Compressor: W port
26	Compressor: V port
27	Compressor: U port
28	Power input
29	Power input

Figure 62

17.12 Error Code Troubleshooting

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
AtL	Ambient Temperature Limited Condition

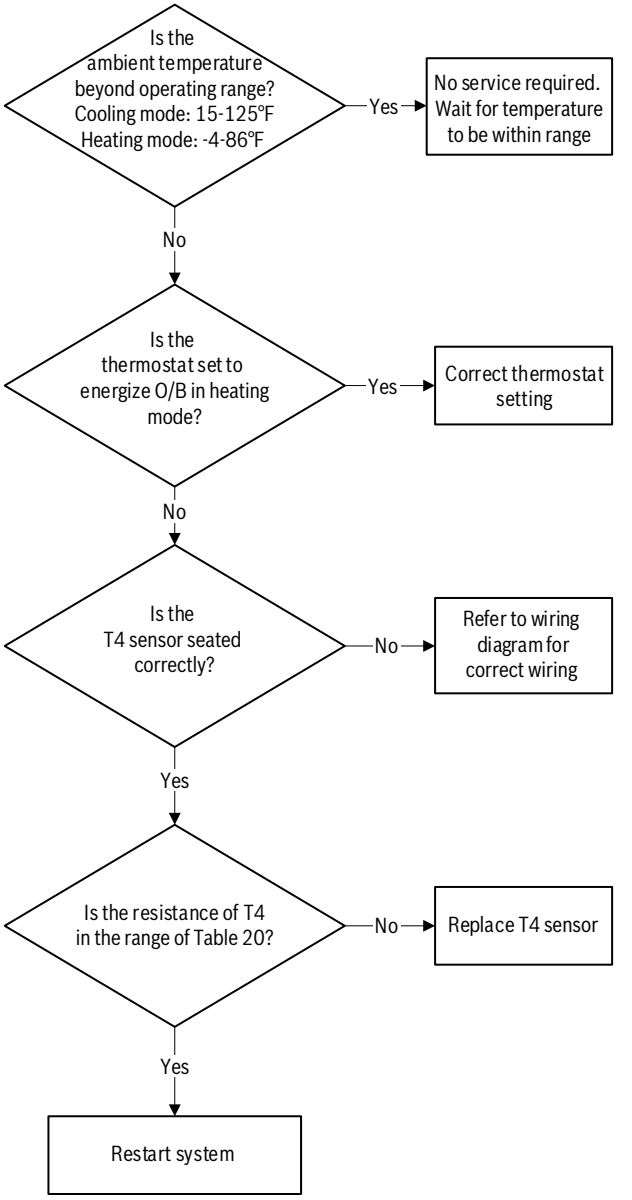


Figure 63

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
b2	Indoor unit T2 sensor fault

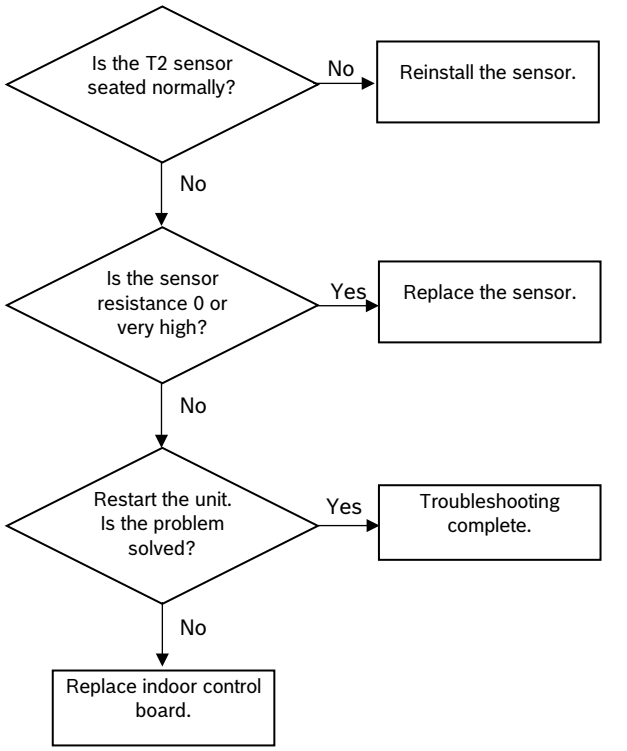


Figure 64

Fault code	Description (Sensor)
b3	Indoor unit A2L refrigerant sensor fault

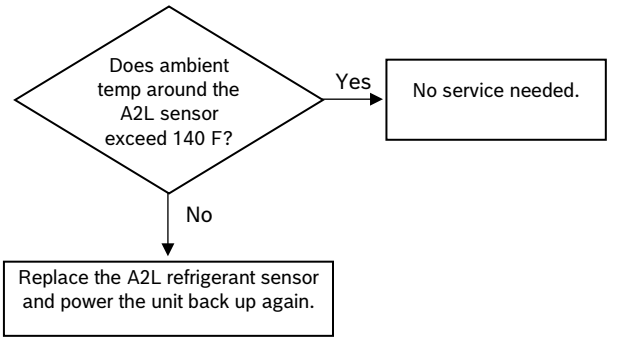


Figure 65

Fault code	Description (Sensor)
b4	Indoor unit A2L refrigerant sensor communication fault

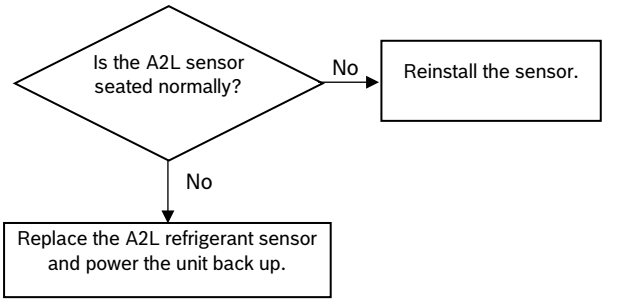


Figure 66

Fault code	Description (Sensor)
b5	Communication Fault between IDU and ODU

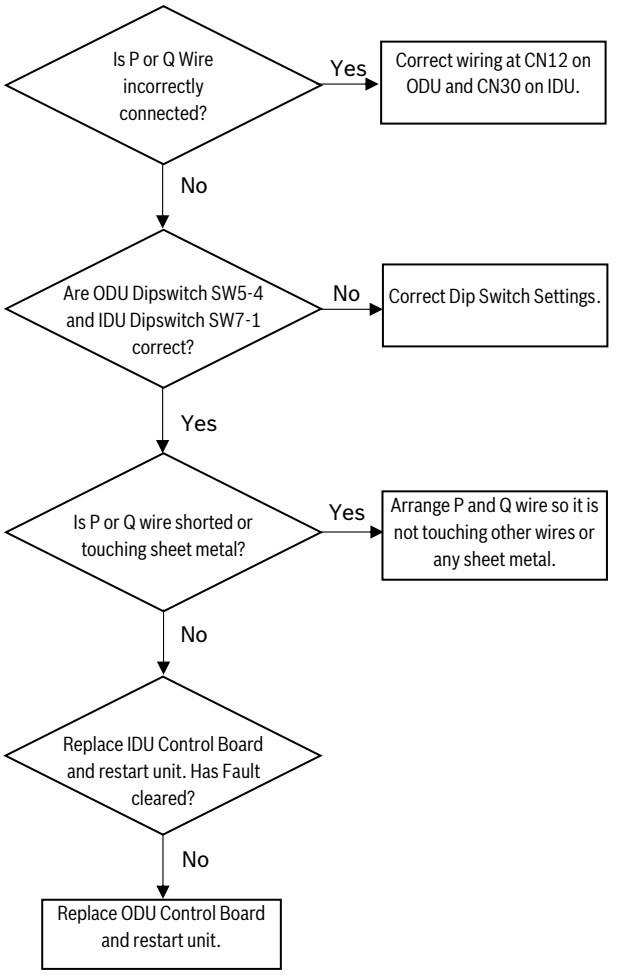


Figure 67

Fault code	Description (Sensor)
b7	R454B refrigerant Leakage fault in indoor unit

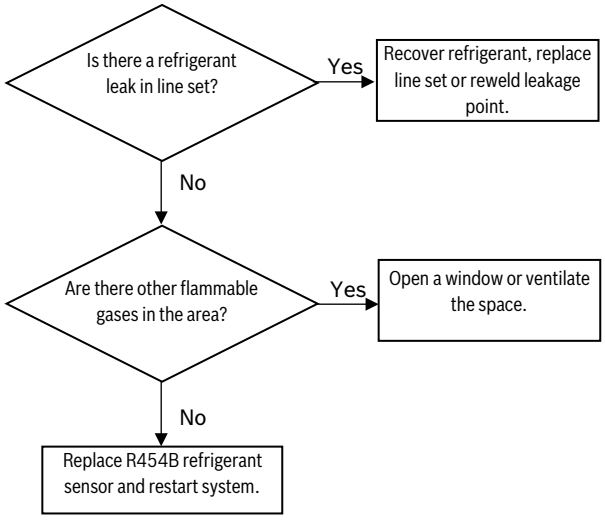


Figure 68

Fault code	Description (Sensor)
b8	Indoor unit A2L refrigerant sensor past service life

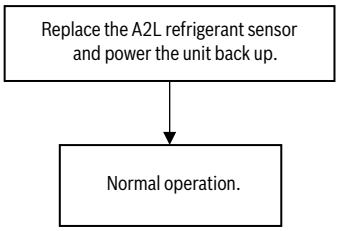


Figure 69

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
C3	T3 sensor is not reading correctly in cooling

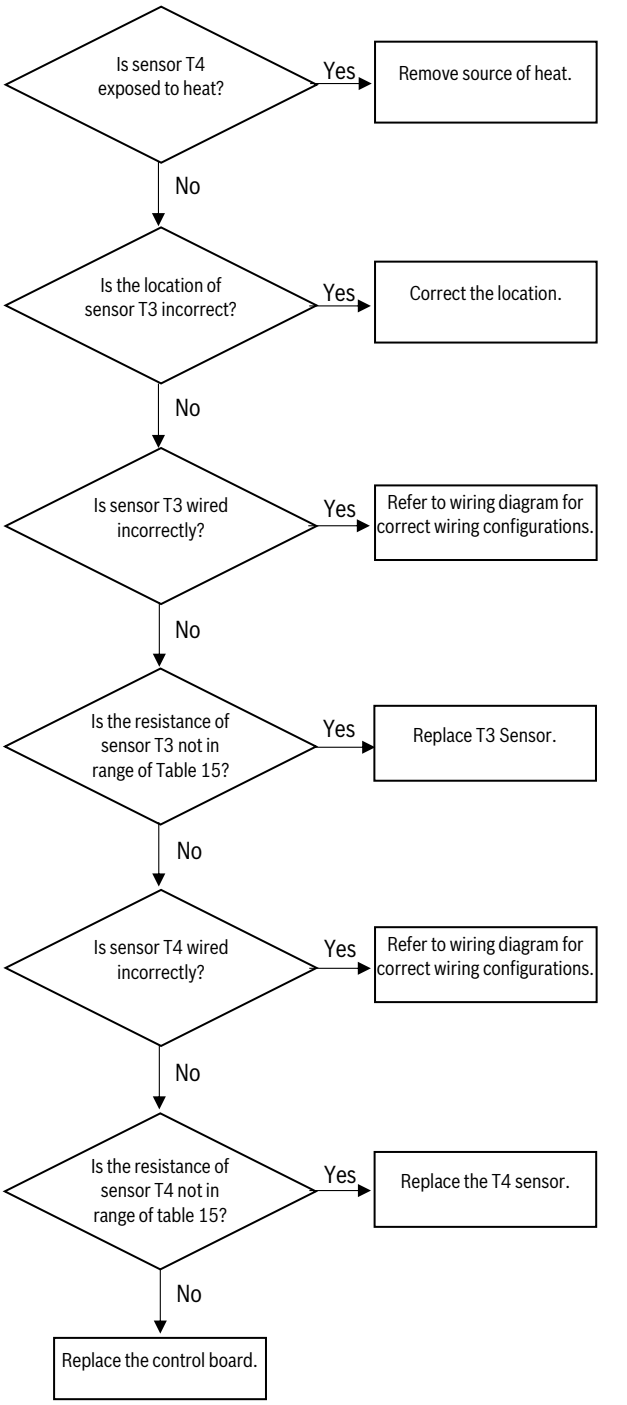


Figure 70

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
E41	T3 temperature sensor fault

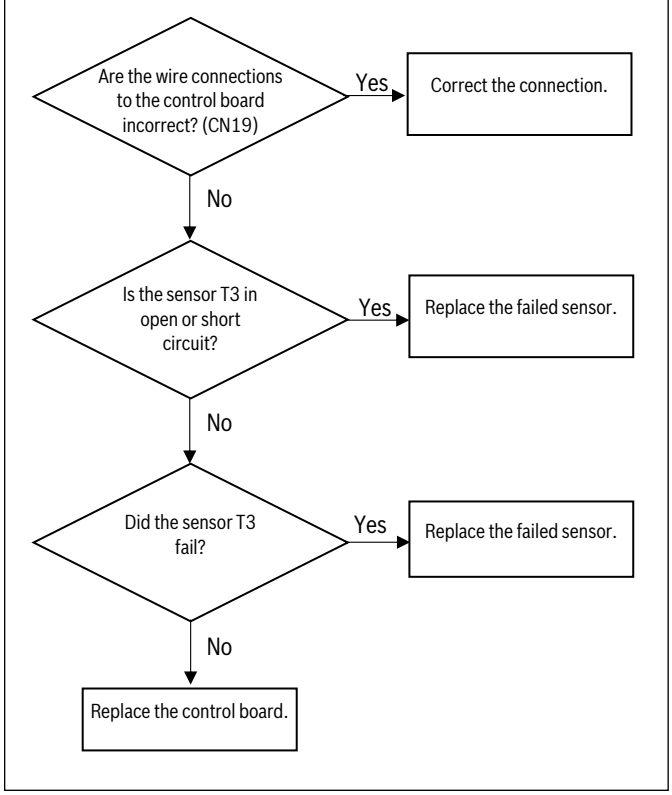


Figure 71

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
E42	T3L temperature sensor fault

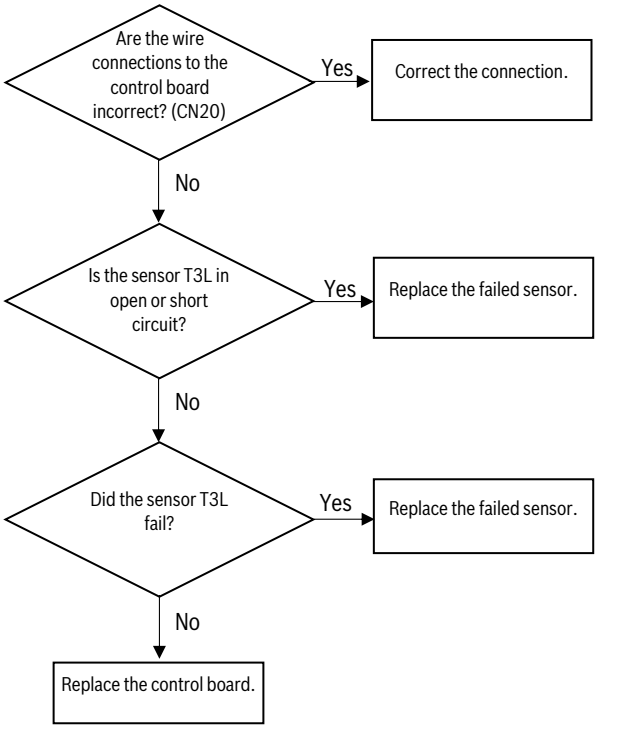


Figure 72

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
E43	T4 temperature sensor fault

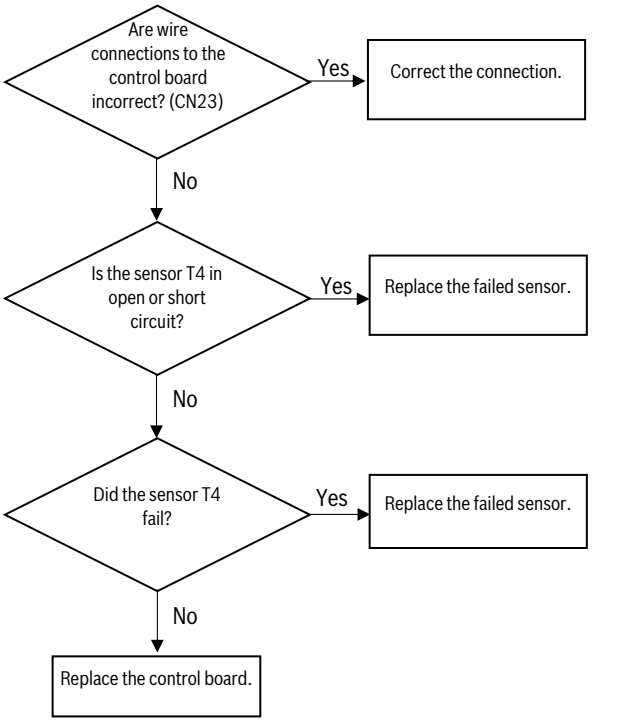


Figure 73

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
E44	T5 temperature sensor fault

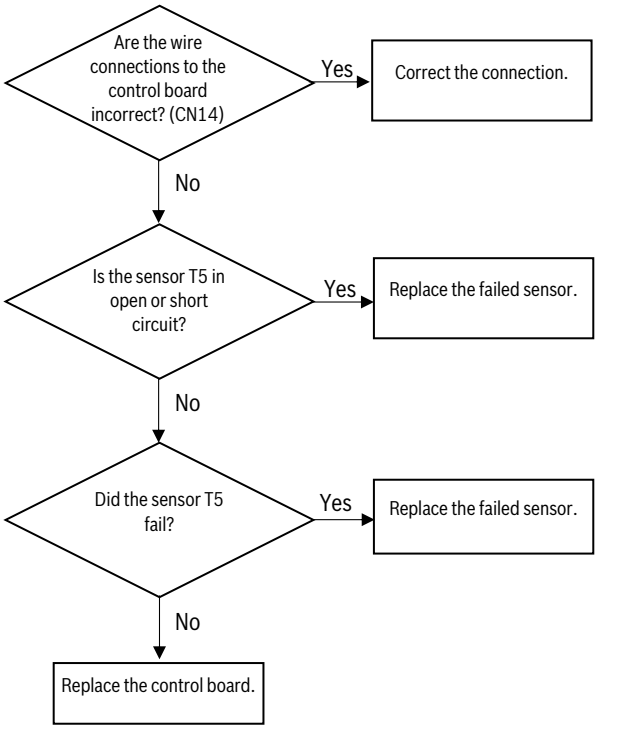


Figure 74

Fault code	Description (Sensor)
E51	Outdoor unit high/low input voltage protection

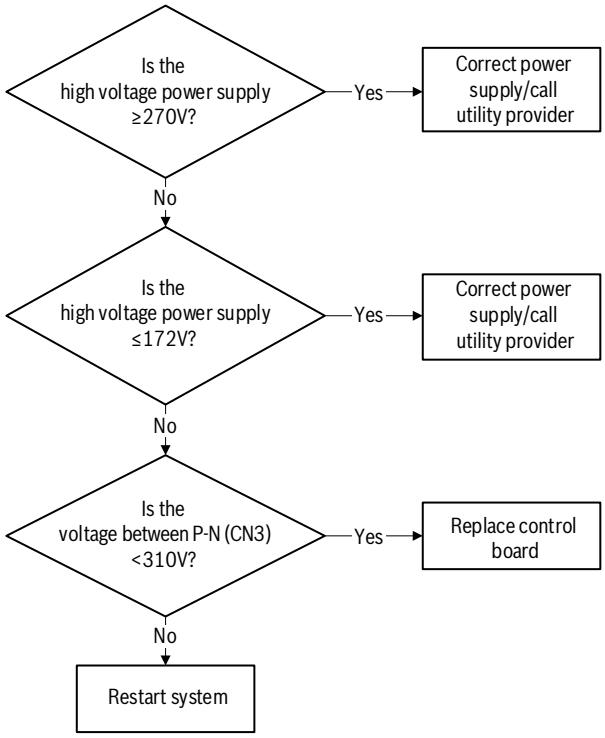


Figure 75

Fault code	Description (Sensor)
E52	Outdoor unit high/low DC bus voltage protection

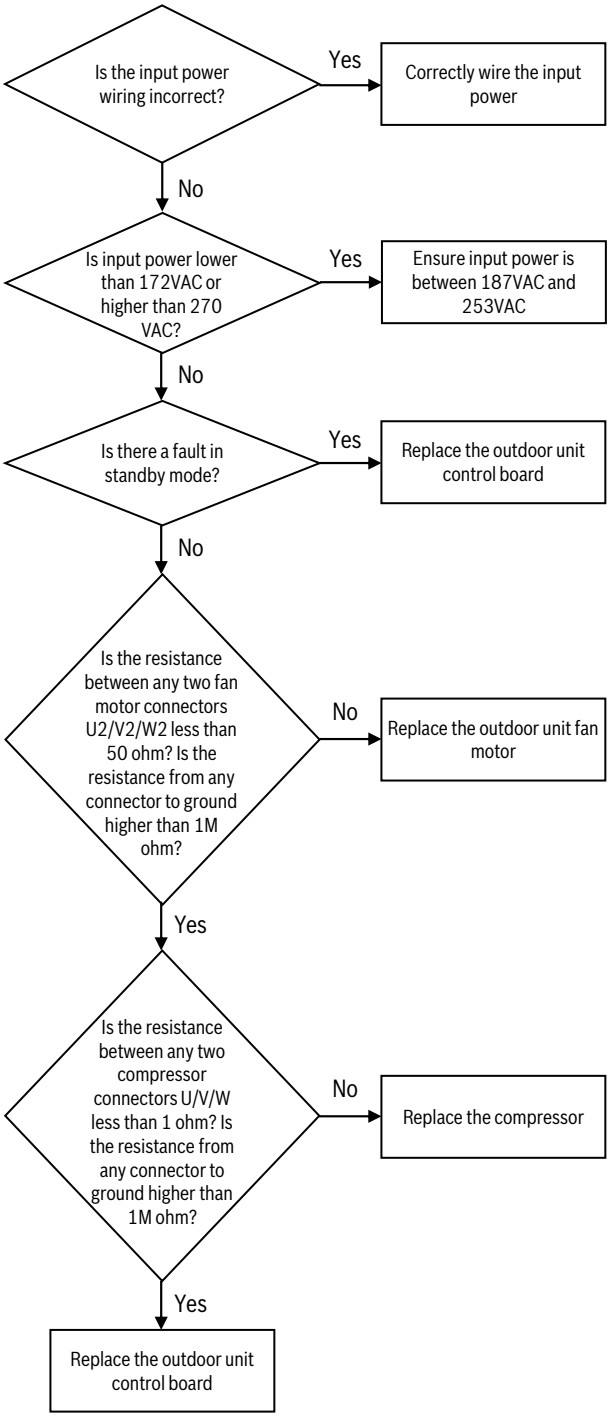


Figure 76

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
E7	T5 sensor not reading correctly

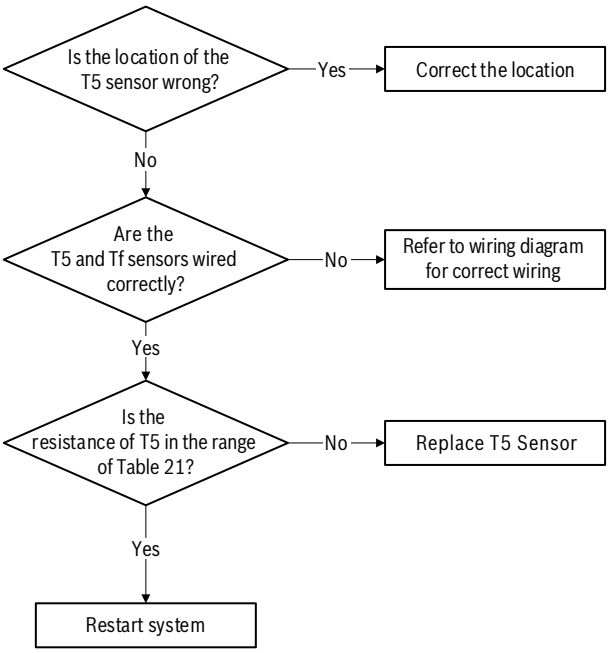


Figure 77

Fault code	Description (Sensor)
E81	EEVA coil fault

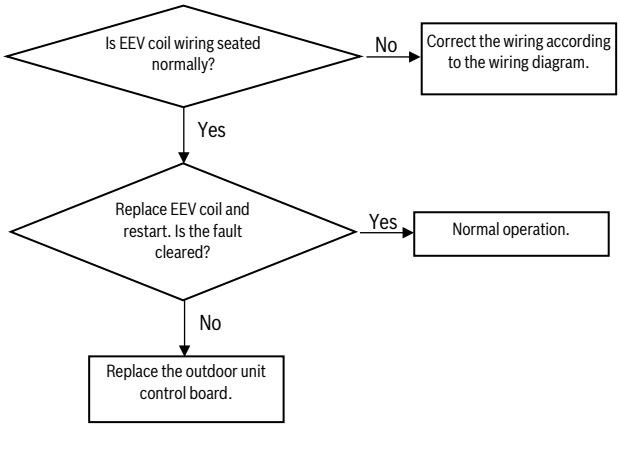


Figure 78

Fault code	Description (Sensor)
EA	Control program does not match drive program in outdoor unit

Replace the control board in the outdoor unit and restart.

Figure 79

Fault code	Description (Sensor)
F1	High pressure switch protection (HPS)

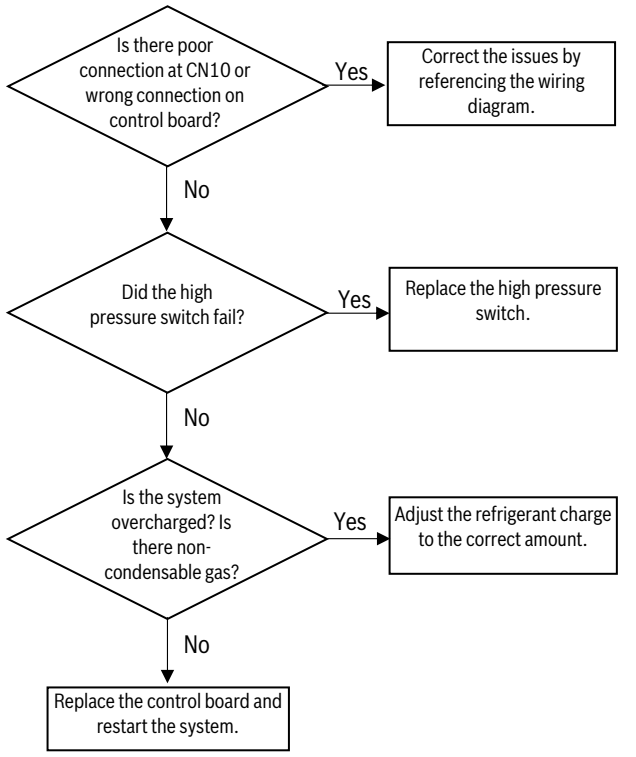


Figure 80

Fault code	Description (Sensor)
F4	Pressure Transducer Fault (PT)

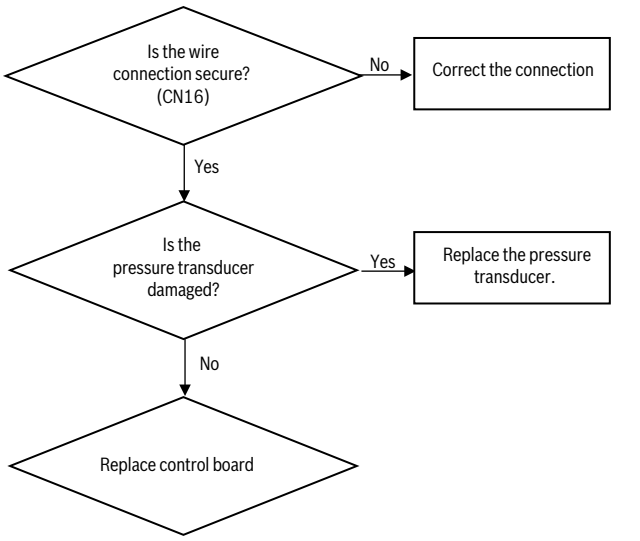


Figure 81

Fault code	Description (Sensor)
F41	High pressure sensor fault

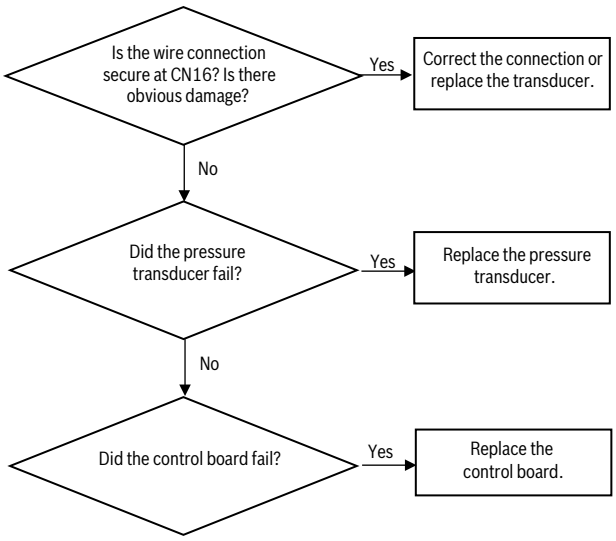


Figure 82

Fault code	Description (Sensor)
F42	Low pressure sensor fault

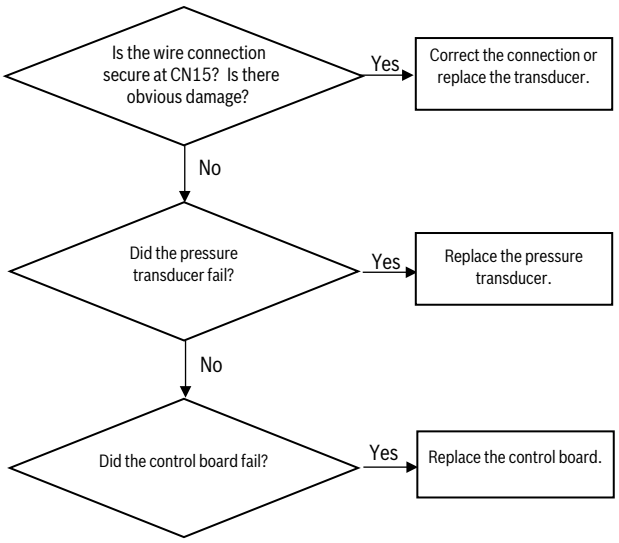


Figure 83

Fault code	Description (Sensor)
H01	Drive chip communication fault in outdoor unit

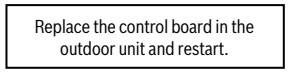


Figure 84

Fault code	Description (Sensor)
o37	Lack of Refrigerant in Heating Mode

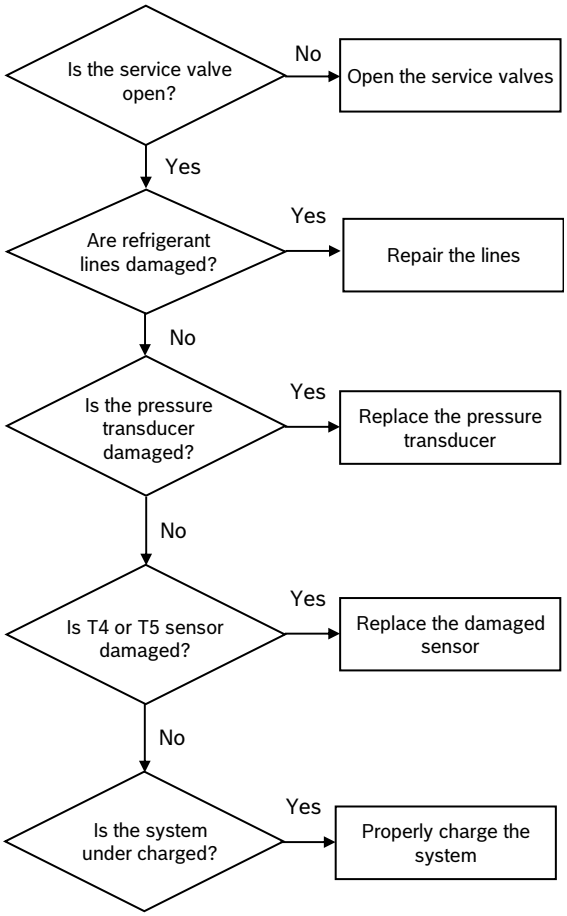


Figure 85

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description
P0	Compressor IPM temperature protection

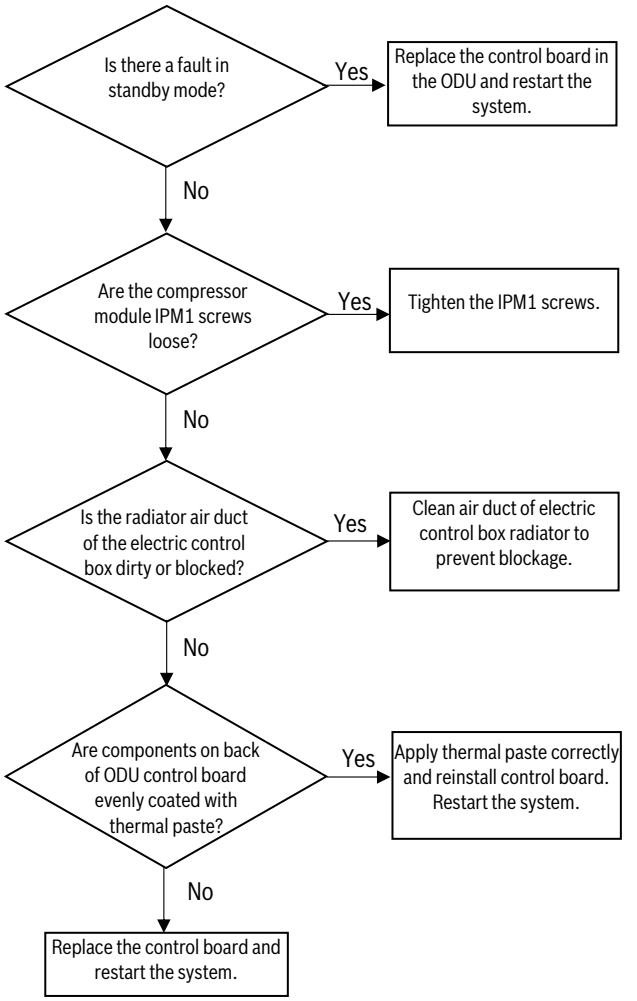


Figure 86

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
P1	High pressure protection

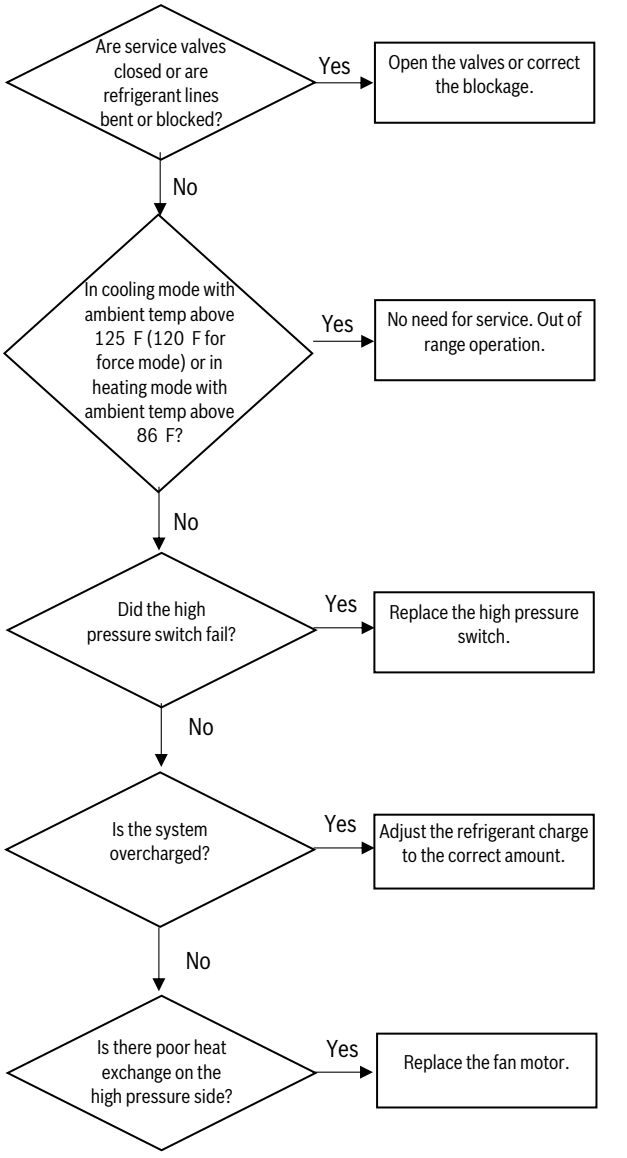


Figure 87

Fault code	Description (Sensor)
P11	High pressure protection in cooling/heating (Pc)

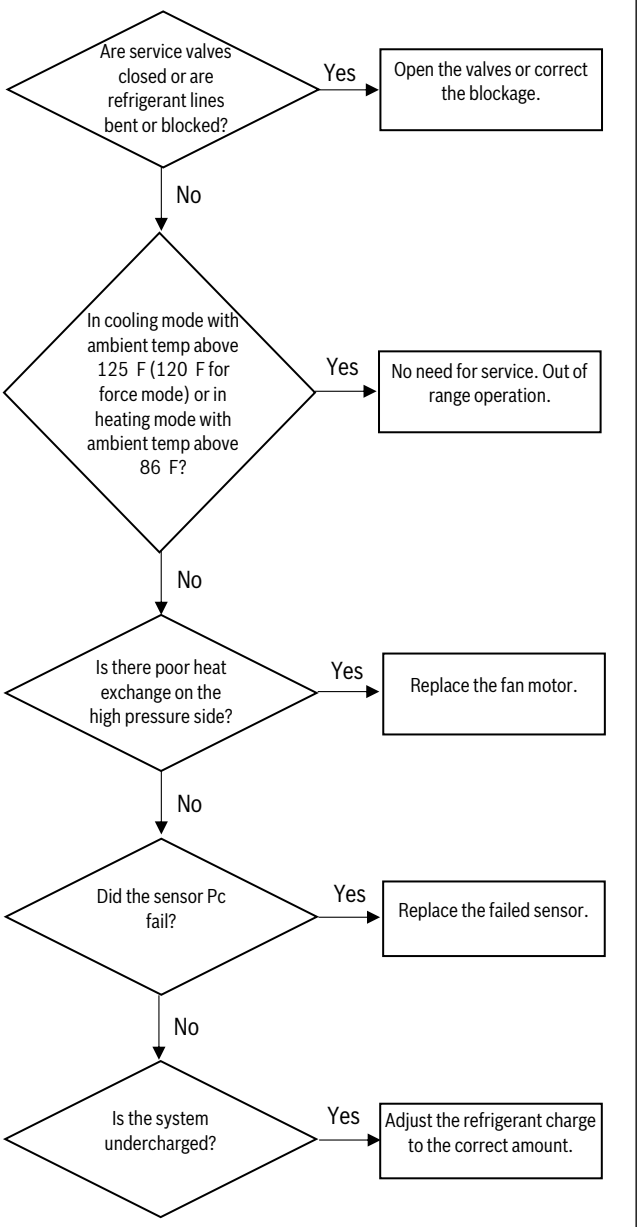


Figure 88

Fault code	Description (Sensor)
P21	Low pressure protection
F2	System lockout, P2 occurs 5 times in 100 minutes

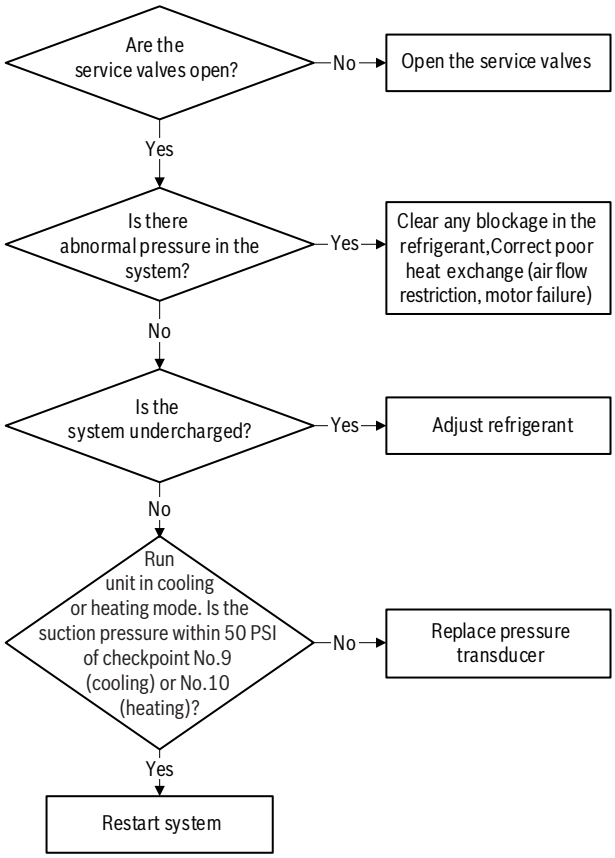


Figure 89

WARNING

Hazardous voltage!

When measuring resistance , make sure the unit is powered off and wait 3 min before taking measurement.

Fault code	Description (Sensor)
P31	Outdoor unit input over current protection

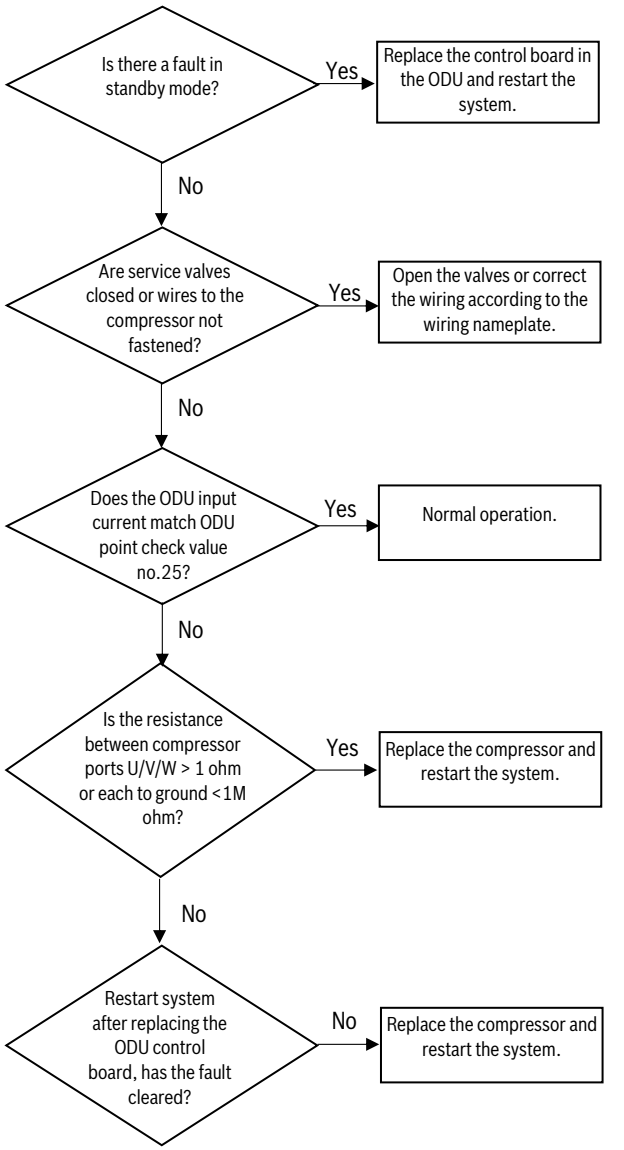


Figure 90

Fault code	Description (Sensor)
P32	Compressor over current protection

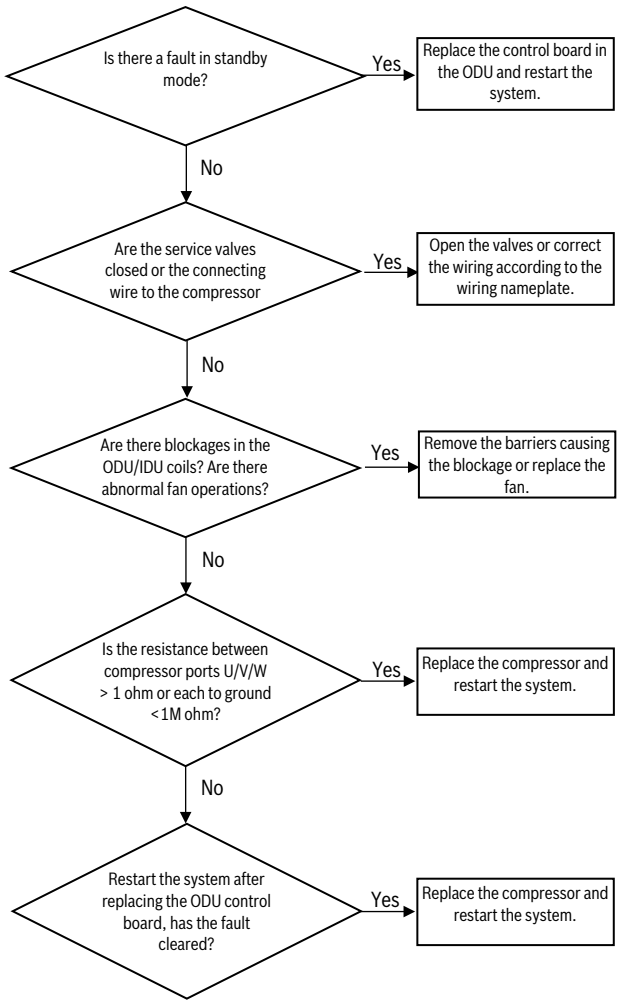


Figure 91

Fault code	Description (Sensor)
P4	High compressor discharge temperature protection (T5)

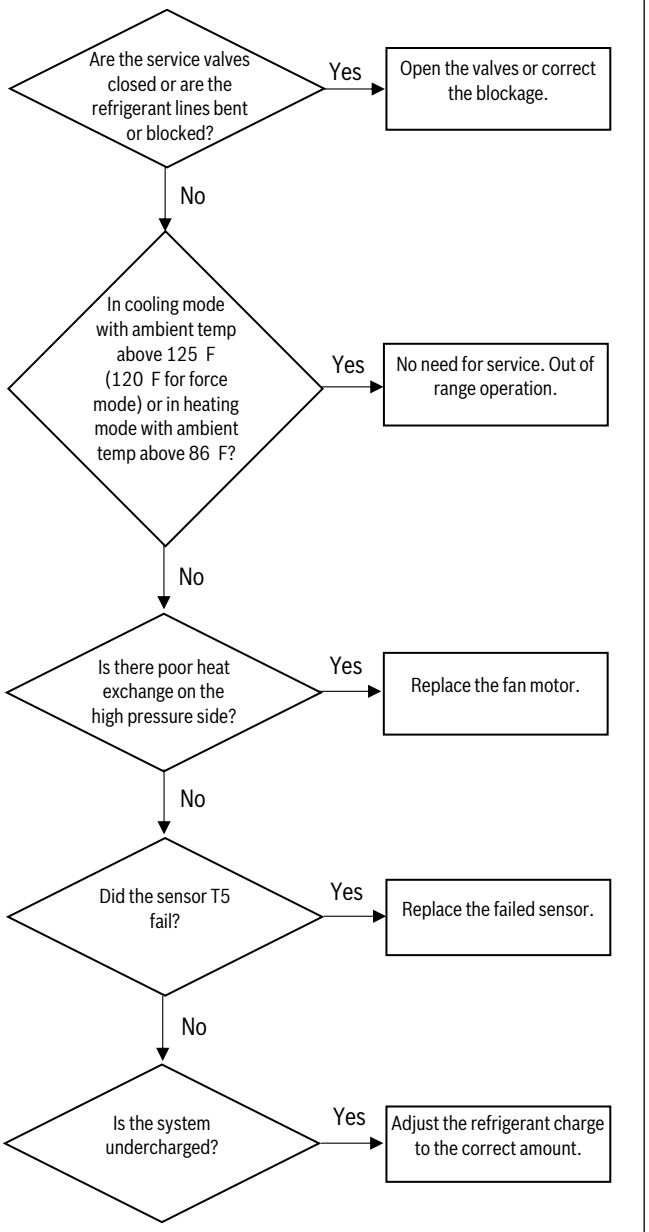


Figure 92

Fault code	Description (Sensor)
P5	Condenser coil temperature (T3) protection in cooling

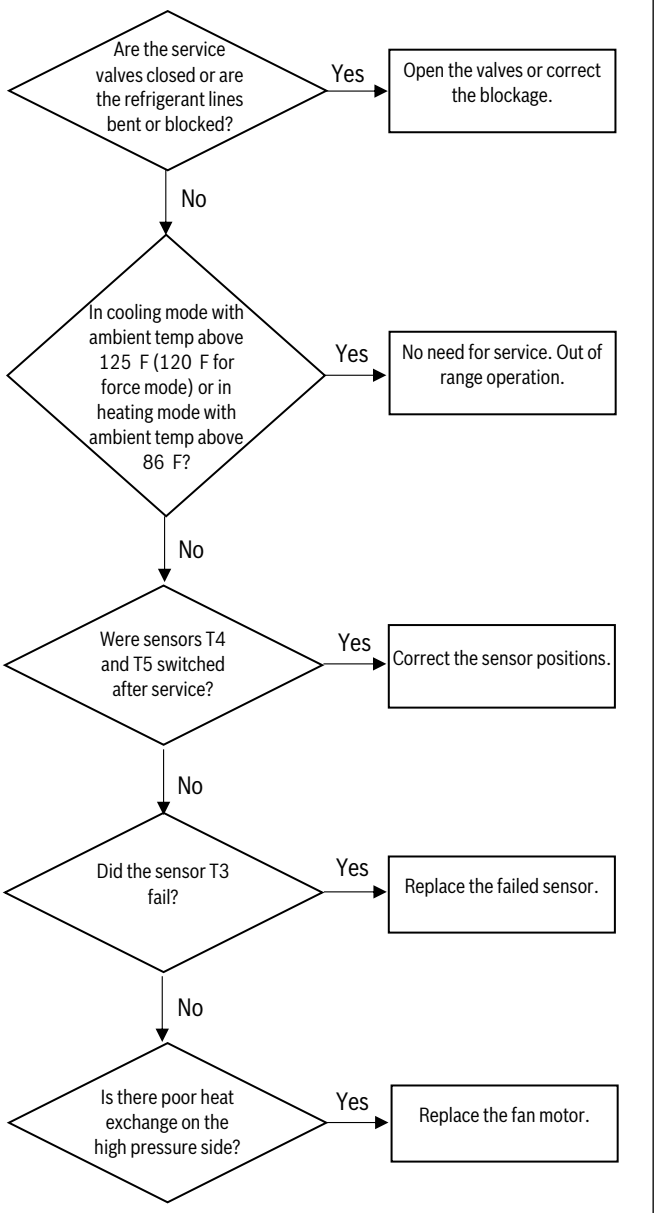


Figure 93

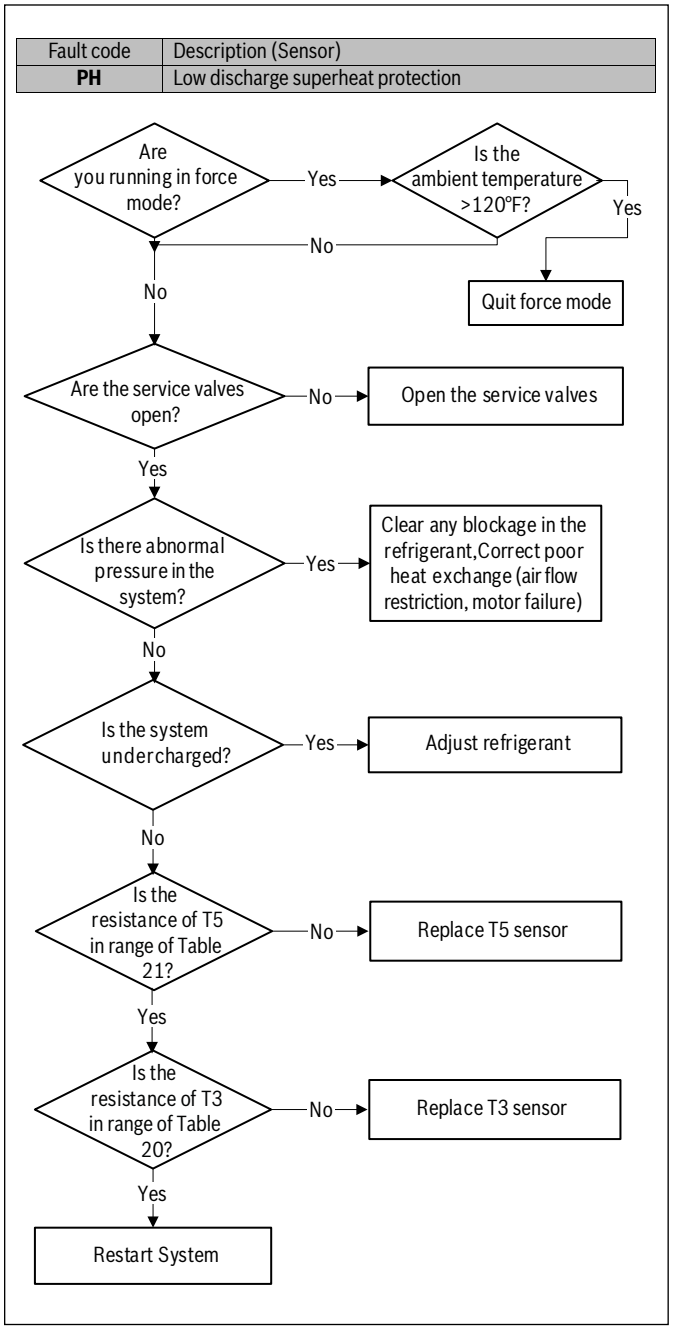


Figure 94

Online Help Resources

Alternatively, please visit our Service & Support webpage to find FAQs, videos, service bulletins, and more; www.boschheatingcooling.com/service or use your cellphone to scan the code below.

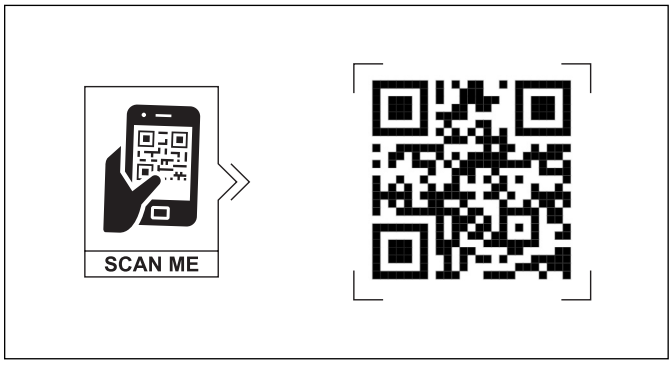


Figure 95

17.13 Temperature and Resistance Relationship Tables (for Sensors)

Temp (°F)	Temp (°C)	Resistance (kΩ)
-20	-28.89	218.11
-15	-26.11	154.74
-10	-23.33	129.74
-5	-20.56	107.73
0	-17.78	99.54
10	-12.22	71.80
20	-6.67	49.65
30	-1.11	36.71
40	4.44	27.39
50	10.00	20.61
60	15.56	15.65
70	21.11	11.99
80	26.67	9.27
90	32.22	7.23
100	37.78	5.68
110	43.33	4.51
120	48.89	3.61
130	54.44	2.90
140	60.00	2.35
150	65.67	1.91
160	71.11	1.57
170	76.67	1.28
180	82.22	1.00
190	87.78	0.91
200	93.33	0.76
210	98.89	0.65
220	104.44	0.56

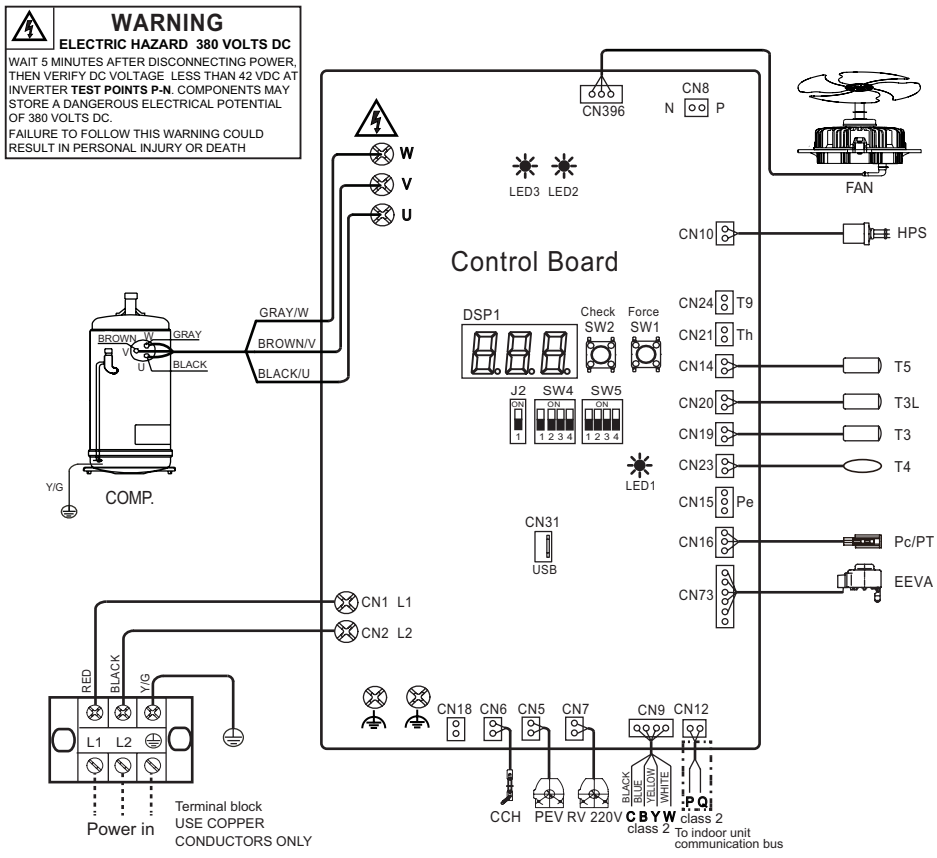
Table 26 for T3, T4, T3L

17.14 Temperature and Resistance Relationship Tables (for T5 Sensor)

Temp (°F)	Temp (°C)	Resistance (kΩ)
-20	-28.89	862.00
-15	-26.11	725.82
-10	-23.33	612.41
-5	-20.56	600.13
0	-17.78	505.55
10	-12.22	362.74
20	-6.67	265.40
30	-1.11	195.60
40	4.44	146.70
50	10.00	110.71
60	15.56	84.47
70	21.11	65.41
80	26.67	50.90
90	32.22	40.15
100	37.78	31.81
110	43.33	25.51
120	48.89	20.53
130	54.44	16.71
140	60.00	13.64
150	65.67	11.21
160	71.11	9.31
170	76.67	7.75
180	82.22	6.50
190	87.78	5.47
200	93.33	4.65
210	98.89	3.95
220	104.44	3.38

Table 27 for T5

18 Wiring Diagram

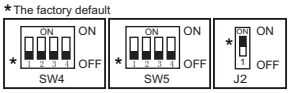


LED1 GREEN	Solid ON	Main board powered on
	OFF	Power off
LED2 RED	Solid ON	Compressor running
	2s ON 2s OFF	Standby
	0.2s ON 0.2s OFF	Communication fault with main control chip
	Blink	Driver fault
	OFF	Power off
LED3 RED	Solid ON	Fan running
	2s ON 2s OFF	Standby
	0.2s ON 0.2s OFF	Communication fault with main control chip
	Blink	Driver fault
	OFF	Power off

CODE	Fault description
AtL	Ambient Temperature Limited(T4)
b2	Temperature sensor fault in indoor unit (T2)
b3	R454B refrigerant sensor fault in indoor unit
b4	R454B refrigerant sensor communication fault in indoor unit
b5	Communication fault between indoor unit and outdoor unit
b7	R454B refrigerant leakage protection in indoor unit
b8	R454B refrigerant sensor over service life in indoor unit
C3	The coil sensor is seated fault in cooling (T3)
E41	Temperature sensor fault（T3）
E42	Temperature sensor fault（T3L）
E43	Temperature sensor fault（T4）
E44	Temperature sensor fault（T5）
E51	Outdoor unit high/low input voltage protection
E52	Outdoor unit high/low DC bus voltage protection
E7	Compressor discharge sensor is seated fault (T5)
E81	EEVA coil fault
EA	Control program does not match drive program in outdoor unit
F1	High pressure switch protection (HPS)
F2	5 times (P21/o37) protection in 100 minutes, system lockout
F4	Pressure transducer fault (PT)
H01	Drive chip Communication fault in outdoor unit
J00-JCF	Compressor drive fault
n00-nCF	Fan drive fault
o37	Lack of refrigerant in heating mode
P0	Compressor IPM temperature protection
P1	High pressure switch protection (HPS)
P11	High pressure protection in heating (PT)
P21	Low pressure protection in cooling (PT)
P31	Outdoor unit input over current protection
P32	Compressor over current protection
P4	High compressor discharge temperature protection (T5)
P5	Condensor coil temperature protection in cooling (T3)
PH	Low discharge superheat protection

CODE	Description
⊢	Forced operation mode
¯(top)	Running indication under high pressure
‑(bottom)	Running indication under low pressure
A	Running indication under return oil mode
C	Running indication under current limited condition
d	Running indication under T5 limited condition
F	Running indication under COMP. IPM Temp. limited condition
L	Running indication under T3 limited condition
r	Running indication under compressor ratio limited condition
U	Running indication under low voltage limited condition
dF	Running indication under defrost mode

*The factory default



J2 Set capacity	ON / OFF	For 36/60K model *
	ON / OFF	For 24/48K model

SW4-1	ON	Unused
	OFF	Must be set at OFF position *
SW4-2	ON	Unused
	OFF	Must be set at OFF position *
SW4-3	ON	Adaptive capacity output disable
	OFF	Adaptive capacity output enable *
SW4-4	ON	Accelerated cooling/heating
	OFF	Normally cooling/heating *
SW5-1	ON	Heating time reduced 10%
	OFF	Normal *
SW5-2	ON	Defrosting extended for 120 seconds
	OFF	Normal *
SW5-3	ON	Reserved
	OFF	Normal *
SW5-4	ON	Communication mode
	OFF	Non-communication mode

Note:
1. C,B,Y and W are connected to indoor unit in non-communication mode.
2. B terminal is connected in heat pump heating operation,energized for heating.
3. B and W signals are for heat pump system.
4. Dash-dotted line means optional.
5. Dotted line means field installed.
6. P and Q are connected to indoor unit in communication mode.

HPS	High pressure switch
Pc/PT	Pressure transducer
T4	Ambient temp. sensor
T3	Outdoor coil temp. sensor
T3L	Outdoor coil outlet temp. sensor
EEVA	A electronic expansion valve
T5	Comp. discharge temp. sensor
RV	Reversing valve
CCH	Compressor crankcase heating
PEV	Pressure equalizer valve
COMP.	Compressor
Temp.	Temperature

Detailed reference manual instructions

FORCE SW1	PRESS 1s	Forced cooling/heating (Charge mode)
	PRESS 6s	Forced defrosting
CHECK SW2	PRESS 1s	Check the system parameters
	PRESS 6s	Test mode (Not used)

Number	Point check content
0	Outdoor unit capacity: H5=Heat pump 5 ton
1	Outdoor unit mode:0-standby,2-cooling,3-heating
2	Outdoor unit set compressor speed
3	System last fault code
4	T3: outdoor coil temp.(°F)
5	T3L: outdoor coil outlet temp.(°F)
6	T4: outdoor ambient temp.(°F)
7	T5: compressor discharge temp.(°F)
8	Compressor IPM temp.(°F)
9	Pe: evaporating pressure(psig) (only for cooling mode)
10	Pc: condensing pressure(psig) (only for heating mode)
11	Tes: target evaporating temp.(°F) (only for cooling mode)
12	Te: evaporating temp.(°F)
13	Tcs: target condensing temp.(°F) (only for heating mode)
14	Tc: condensing temp.(°F)
15	Target value of the compressor discharge superheat(°F) (only for heating mode)
16	Compressor discharge superheat (°F)
17	Openings of EEVA(P)
18	Fan speed stage
19	Outdoor unit fan current(A)
20	Compressor current(A)
21	Outdoor unit input current(A)
22	Outdoor unit input voltage(V)
23	Outdoor unit DC bus voltage(V)
24	Outdoor unit power(*0.1kW)
25	Continuous running time of the compressor(min)
26	Outdoor unit main control software version
27	Indoor unit Heat Kit Staging (only for communication mode)
28	T2: indoor unit coil temp.(°F) (only for communication mode)
29	Indoor unit software version (only for communication mode)
30	Reserved
31	Remark"--"

Figure 96

19 Care and Maintenance

19.1 Cleaning Precautions

WARNING

Maintenance and repair!

Any maintenance and cleaning of outdoor unit must be performed by qualified service personnel only.
Any unit repairs must be performed by qualified service personnel only.

CAUTION

Electric shock!

Always turn off your heat pump and disconnect the power supply before cleaning or maintenance.lified service personnel only.

NOTICE

Cleaning!

Do not use chemicals or chemically treated cloths to clean the unit .
Do not use benzene, paint thinner, polishing powder or other solvents to clean the unit.

CAUTION

Personal injury!

When removing filter, do not touch metal parts in the unit. The sharp metal edges can cut you.

19.2 Maintenance – Pre-Season Inspection

At the beginning of each heating or cooling season, the following is required:

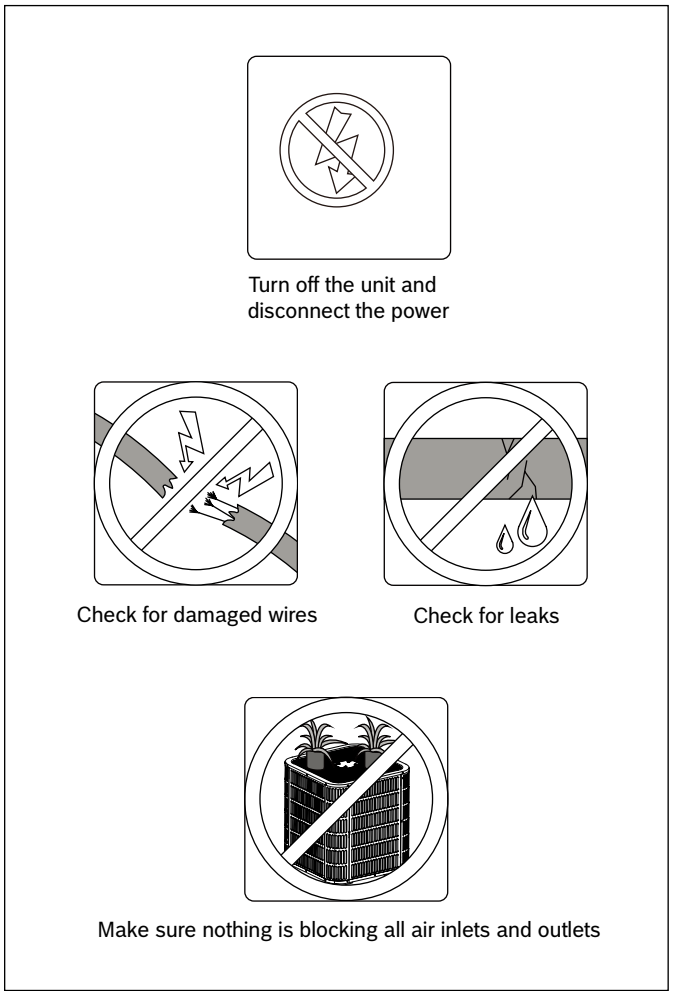


Figure 97

20 Disposal

WARNING

Disposal!

Disposal of unit or components must be performed by qualified service personnel only .
Components and units must be properly disposed in accordance with federal or local regulations.

Components and accessories from the units are not part of ordinary domestic waste.

Complete units , compressors, motors etc. are only to be disposed of via qualified disposal specialists.

This unit uses hydrogen fluorocarbons. Please contact the dealer when you want to dispose of this unit. Law requires that the collection, transportation and disposal of refrigerants must conform with the regulations governing the collection and destruction of hydrofluorocarbons.

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