Installation Manual: R-454B Outdoor Split-System Single-Phase Variable Speed Heat Pump - YH9 and XH9 Series

CAUTION

Risk of fire

This unit uses a mildly flammable (A2L) refrigerant. See A2L refrigerant safety considerations to ensure safe installation, operation, and servicing of this unit.

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Contents

About the unit....5
Certification....5
GoTemp Pro app (Formerly DS Solutions app)....5
Safety....6
Understanding safety symbols and instructions....6
Safety requirements....6
A2L refrigerant safety considerations....8
General....9
Room size requirements....10
Mechanical ventilation....11
Refrigerant equipment checks....11
Electrical devices checks....11
Detection of refrigerant....12
Wiring installation....12
Preparing for installation....15
Selecting a location for installation....15
Inspecting the unit....16
Understanding installation and operation limitations....17
Meeting requirements for A2L equipment....18
Installing the outdoor unit....19
Setting the outdoor unit on the ground or on a roof....19
Mounting the outdoor unit on a wall....21
Installing the outdoor unit as a replacement unit....21
Installing the refrigerant piping....23
Installing the vapor and liquid lines....23
Installing the liquid line filter-drier....25
Connecting the refrigerant lines....25
Brazing the refrigerant lines and service valves....25
Using braze free refrigerant line connections....27
Installing the thermostatic expansion valve (TXV)....28
Checking for refrigerant leaks....30
Evacuating the refrigerant lines and indoor coil....30
Releasing refrigerant into the system....31
Connecting the wiring....32
General information and grounding the unit....32
Completing the field power wiring connections....33

Completing the field control wiring connections..... 33
Control wiring diagrams..... 36
Charging the system..... 38
Adjusting the indoor airflow..... 39
Checking the indoor cubic feet per minute (CFM) settings..... 39
Determining the total system charge..... 39
Starting up the system..... 40
Energizing the stator heat (if applicable)..... 40
Adjusting system settings..... 41
Charging with gauges..... 41
Subcooling charging charts..... 43
Instructing the owner..... 45
Maintenance and repair..... 45
Required procedures for A2L systems..... 46
Decommissioning..... 47
Test input..... 48
System components and operation..... 49
Anti-short-cycle delay..... 49
Push button operation..... 49
Status display..... 49
Fault code display..... 51
Adaptive defrost operation..... 64
Defrost enable temperature..... 64
Defrost calibration mode..... 64
Defrost initiation..... 65
Time/temperature defrost mode..... 65
Demand defrost mode..... 66
Defrost mode..... 66
Frost detection..... 67
Defrost termination..... 67
Cooling and heating operation..... 68
Pressure switch fault detection and lockout..... 68
Wiring diagrams..... 70
Start-up sheet..... 71

About the unit

Read all sections of this manual. Keep this manual and the manual for the matching indoor unit for future reference.

The outdoor units are designed to connect to a matching indoor coil with sweat connect lines. Sweat connect units are factory charged with refrigerant for a nominal sized matching indoor coil and 15 ft of field-supplied lines.

Matching indoor coils can be used with a thermostatic expansion valve (TXV). Refer to the *Tabular Data Sheet* or to the *Technical Guide* for the correct TXV selection.

NOTICE

A nominal 2 ton and 4 ton outdoor unit model is not offered. If the 5 ton outdoor unit is used in a 4 ton application with a 4 ton indoor unit match, the outdoor unit must be converted to lower capacity mode. If the 3 ton outdoor unit is used in a 2 ton application with a 2 ton indoor match, the outdoor unit must be converted to lower capacity mode. See Adjusting system settings.

Certification

AHRI CERTIFIED™ www.ahridirectory.org

C SA US

Assembled at a facility with an ISO 9001:2015-certified Quality Management System

GoTemp Pro app (Formerly DS Solutions app)

BHC Group Heating & Cooling believes in empowering our customers with up-to-date, unit-specific information. Download GoTemp Pro app, a powerful, comprehensive app designed for contractors on the jobsite, available now in the App Store for iOS and Google Play for Android. Use the app to scan the unique QR code on the unit rating plate for easy access to product information and resources such as nomenclature, technical guide, installation manual, wiring diagrams, parts list, product registration, warranty, and much more. Simplify your tasks, save time, and stay ahead with the most comprehensive app built for professionals.

GoTemp Pro

iOS

Android

Safety

It is important to understand the safety symbols used in this manual. Read safety information carefully and follow all safety requirements to ensure correct installation.

Understanding safety symbols and instructions

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention to the signal words **DANGER**, **WARNING**, **CAUTION**, as well as the **NOTICE**, **Important**, and **Note** alerts.

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

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

CAUTION indicates a **potentially** hazardous situation, which, if not avoided **may result in minor or moderate injury**. It is also used to alert against unsafe practices and hazards involving only property damage.

NOTICE indicates information considered important, but not hazard-related, such as messages relating to property damage.

Important indicates information that is essential to complete a task or may result in damage to the device if not followed.

Note indicates something of special interest or importance. Notes can contain any type of information except safety information.

Safety requirements

WARNING

Incorrect installation may create a condition where the operation of the product could cause personal injury or property damage. Incorrect installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual for assistance. For additional information, consult a qualified contractor, installer, or service agency.

CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including but not limited to building, electrical, and mechanical codes.

CAUTION

R-454B systems operate at higher pressures than R-22 systems. Do not use R-22 or R-410A service equipment or components on R-454B equipment. Service equipment must be rated for R-454B.

⚠ WARNING

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning 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.

⚠ WARNING

Electrical Shock Hazard

Disconnect and lock out power before servicing. Wait 5 min to ensure that drive capacitors are discharged before servicing. Use compressor with grounded system only. Molded electrical plug must be used for connection to compressor.

⚠ WARNING

Burn Hazard

Failure to follow these warning could result in serious personal injury or property damage. Ensure that materials and wiring do not touch high temperature areas of the compressor. Personal safety equipment must be used.

⚠ CAUTION

Drive Handling

Caution must be used when lifting and installing the drive. Failure to use caution may result in bodily injury. Personal safety equipment must be used. Failure to follow these warnings could result in personal injury or property damage.

⚠ CAUTION

Safety Statements

Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission and maintain this equipment. Electrical connections must be made by qualified electrical personnel. All valid standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment must be observed.

A2L refrigerant safety considerations

⚠ CAUTION

You must read all of this section before installing this unit.

⚠ WARNING

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 without continuously operating ignition sources (for example, open flames, an operating gas appliance, or an operating electric heater).

Do not pierce or burn.

Be aware that refrigerants may not contain an odor.

⚠ WARNING

Auxiliary devices which may be a potential ignition source shall not be installed in the duct work, unless they have been approved by the appliance manufacturer or are suitable for use with the refrigerant being used.

Examples of such potential ignition sources are hot surfaces with a temperature exceeding 700 °C and electric switching devices.

⚠ WARNING

Any indoor field-made refrigerant joints shall be tightness tested with no leaks detected. The test method shall have a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 25% of the maximum allowable pressure.

⚠ WARNING

Any required ventilation openings must be kept clear of obstruction.

General

Table 1: Safety considerations

Item number	Safety consideration
1	Any room with an appliance containing more than 3.91 lb in a refrigerating circuit must be constructed such that any refrigerant leak cannot stagnate in a way that would create a fire or explosion hazard.
2	Before beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating system, item 3 to item 7 below must be adhered to before conducting work on the system.
3	Work must be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.
4	Instruct all maintenance staff and others working in the local area on the nature of work being carried out. Avoid work in confined spaces.
5	The area must be checked with an appropriate refrigerant detector before and during work to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants: non-sparking, adequately sealed, or intrinsically safe.
6	If conducting any hot work on the refrigerating equipment or any associated parts, you must have appropriate fire-extinguishing equipment on hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.
7	If conducting work in relation to the refrigerating system that involves exposing any pipework, do not use any sources of ignition in such a manner that may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, must be kept sufficiently far away from the site of installation, repair, removal, and disposal, during which refrigerant might possibly be released to the surrounding space. Before conducting any work, survey the area around the equipment ito ensure that there are no flammable hazards or ignition risks. Display “No Smoking” signs.
8	Ensure the area is in the open or that it is adequately ventilated before opening the system or while conducting any hot work. The ventilation must safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
9	Ensure that the sensor is not obstructed in any way.

Room size requirements

⚠ WARNING

If the unit must be installed in a residence with a minimum room area less than what is determined to be the minimum from Table 2, then that room must also not have any continuously operating open flames or other potential ignition sources. A device with a continuous pilot light may be present if that device is provided with an effective flame arrest.

ⓘ **Note:** Minimum installation height (X and W) is not applicable to this model series.

Table 2: Minimum room area

System charge (lb - oz)	Minimum room area (ft^2)	Minimum total conditioned room area (ft^2) (Z)	Minimum total conditioned room area (m^2) (Y)	Minimum airflow (CFM)
4-0	200	120	11.14	216
5-0	250	150	13.93	271
6-0	300	180	16.72	325
7-0	350	210	19.50	379
8-0	400	240	22.29	433
9-0	450	270	25.08	487
10-0	499	300	27.86	541
11-0	549	330	30.65	595
12-0	599	360	33.43	649
13-0	649	390	36.22	704
14-0	699	420	39.01	758
15-0	749	450	41.79	812
16-0	799	480	44.58	866
17-0	849	510	47.37	920
18-0	899	540	50.15	974
19-0	949	570	52.94	1028
20-0	999	600	55.72	1082
21-0	1049	630	58.51	1136

ⓘ **Note:**

The minimum total conditioned room area refers to the combined area of all air conditioned rooms in the residence.

If the system charge is not listed in the above table, use the formulas below to calculate the respective values:

- Minimum conditioned room area (ft^2) = system charge x 29.9903
- Minimum conditioned room area (m^2) = system charge x 2.786
- Minimum system airflow (CFM) = system charge x 54.117

Mechanical ventilation

Table 3: Mechanical ventilation

Item number	Safety consideration
1	If installing the unit in a residence below the determined total conditioned area from Room size requirements, then extra mechanical ventilation is required.

Refrigerant equipment checks

Table 4: Refrigerant equipment checks

Item number	Safety consideration
1	Where electrical components are being changed, they must be fit for the purpose and to the correct specification. At all times, the manufacturer's maintenance and service guidelines must be followed. If in doubt, consult the manufacturer's technical department for assistance.
2	Apply the following checks to installations using flammable refrigerants: • Ensure the actual refrigerant charge is in accordance with the room size within which the refrigerant-containing parts are installed. • Ensure the ventilation machinery and outlets are operating adequately and are not obstructed. • Ensure marking on the equipment continues to be visible and legible. Correct any markings and signs that are illegible. • Install refrigerating pipe or components in a position where they are unlikely to be exposed to any substance that may corrode refrigerant-containing components, unless the components are constructed of materials that are inherently resistant to being corroded or are suitably protected against being corroded.

Electrical devices checks

Table 5: Electrical devices checks

Item number	Safety consideration
1	Repair and maintenance to electrical components must include initial safety checks and component inspection procedures.
2	If a fault exists that could compromise safety, then do not connect any electrical supply to the circuit until the fault is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, use an adequate temporary solution. This must be reported to the owner of the equipment so all parties are advised.
3	Initial safety checks must include: • Ensure capacitors are discharged: take care to avoid the possibility of sparking. • Ensure no live electrical components and wiring are exposed while charging, recovering, or purging the system. • Ensure there is continuity of earth bonding.

Detection of refrigerant

Table 6: Detection of refrigerant

Item number	Safety consideration
1	Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. Do not use a halide torch or any other detector using a naked flame.
2	The following leak detection methods are deemed acceptable for all refrigerant systems. • 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. Calibrate the detection equipment in a refrigerant-free area. Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Set leak detection equipment at a percentage of the LFL of the refrigerant and calibrate to the refrigerant employed. Ensure the appropriate percentage of gas with a maximum of 25% is confirmed. • Leak detection fluids are also suitable for use with most refrigerants but avoid the use of detergents containing chlorine as the chlorine may react with the refrigerant and corrode the copper pipework. Examples of leak detection fluids are bubble method and fluorescent method agents.
3	If a leakage of refrigerant is found that requires brazing, recover all of the refrigerant from the system or isolate the leakage by means of shut-off valves in a part of the system remote from the leak. Remove refrigerant according to the *Removal and evacuations* section of the outdoor unit's *Installation Manual*.

Wiring installation

There are two different types of refrigerant detection systems (RDS or mitigation control) used with our split system indoor coils. One system has a control board, remote mounted sensor, and 10-pin connection cable. The other system is a sensor only, with a 6-pin connection cable. Control wiring for a communicating system is different based on the RDS system installed.

NOTICE

Cap unused wiring connections.

NOTICE

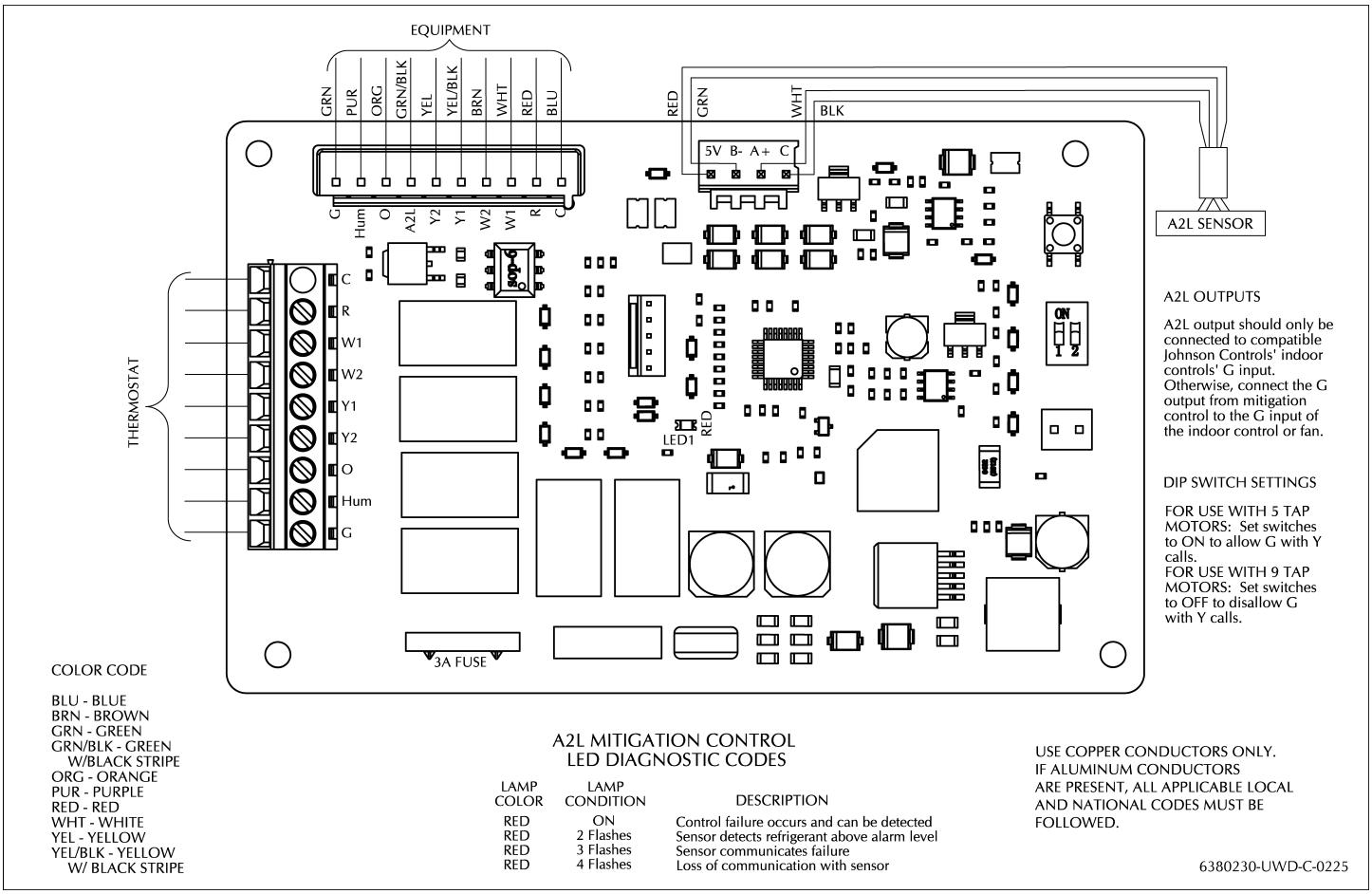
The mitigation control board has a bank of DIP switches. Both DIP switches must be in the 1 or on position.

Use the mitigation control A2L output instead of the G output for Y82V, Z8VT, Y92V, Z9VT, Y9VV, and Z9VV gas furnace models and JMC modular air handler models.

See Connecting the wiring for specific information on connecting the wiring for the coil and the chosen indoor and outdoor units.

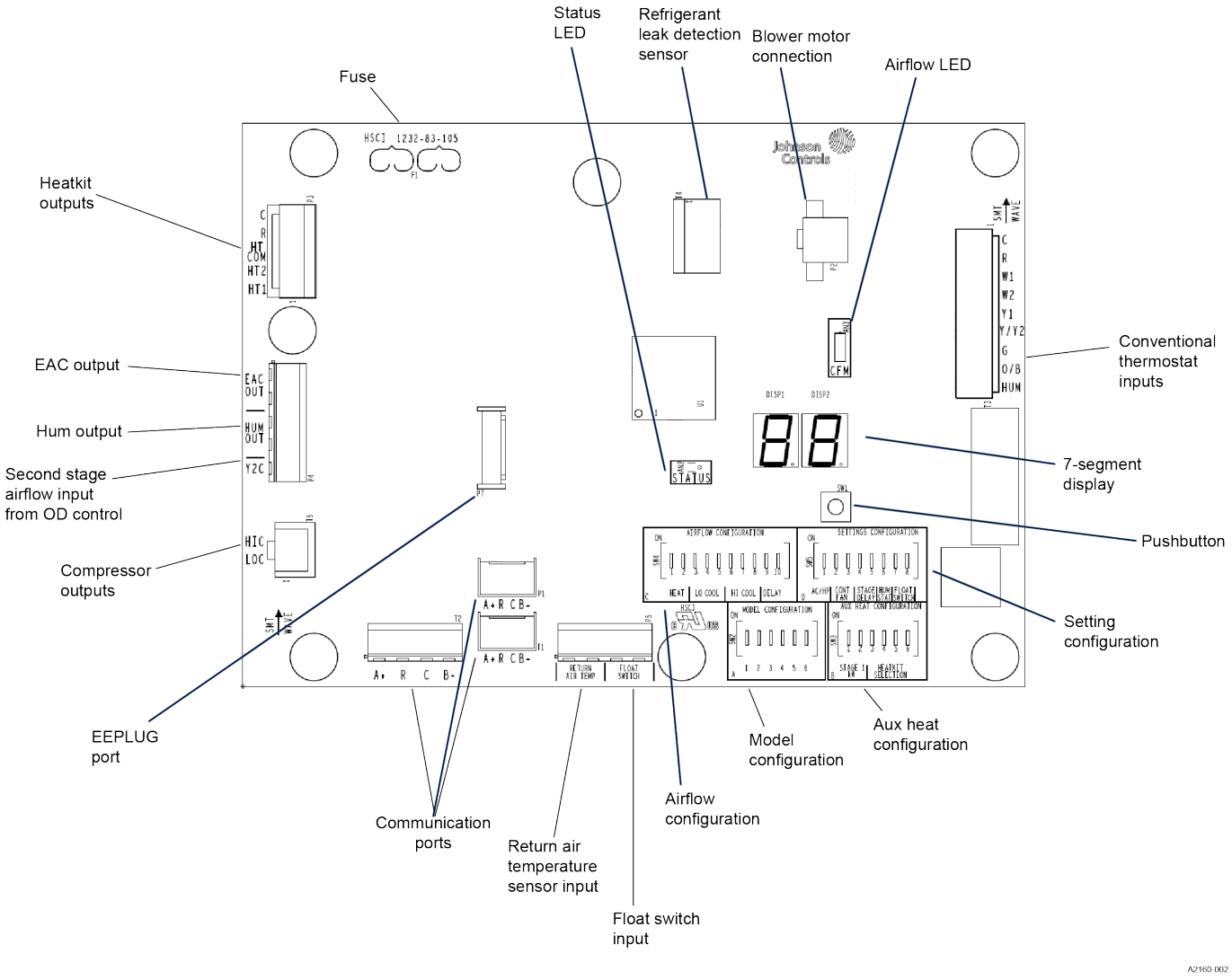
Note: The 10-pin mitigation harness is included in the loose parts kit.

Figure 1: 10-pin mitigation control wiring for modular air handlers, furnaces, and loose coils



For communicating systems YH9 / XH9 with Y82V, Z8VT, Y92V, Z9VT, Y9VV or Z9VV, connect only "C" (blue wire), "R" (red wire), and "A2L" (green with black stripe wire) to the equipment. Cap the remaining unused wire. There will be no wires between the thermostat and the mitigation board with this setup.

Figure 2: Single-piece air handler with integral mitigation board



For communicating single piece air handlers with integral mitigation boards, the A2L sensor connects directly to the board.

Preparing for installation

⚠ WARNING

These units are partial unit air conditioners, complying with the partial unit requirements of this standard, and must only be connected to other units that have been confirmed as complying to corresponding partial unit requirements of this standard, UL 60335-2-40/CSA C22.2 No. 60335-2-40.

Complete the necessary preparation before you begin the installation:

1. Visit the installation site to select a suitable location for the outdoor unit and plan the refrigerant piping system.
2. Inspect the outdoor unit.
3. Make sure that you are aware of the installation and operation limitations.
4. Familiarise yourself with the requirements for installing or servicing R-454B equipment and make sure you have all necessary equipment.

Selecting a location for installation

Before starting the installation, you must select a suitable location for the outdoor unit. Observe all limitations and clearance requirements. You can install the outdoor unit on the ground, on a roof, or on a wall.

ⓘ **Note:** For more information about selecting a suitable location for the indoor unit, refer to the *Installation Manual* for the indoor unit.

⚠ WARNING

The outdoor unit must not be installed in an area where mud or ice could cause personal injury. Condensate will drip from the unit coil during heat and defrost cycles and this condensate will freeze when the temperature of the outdoor air is below 32°F.

NOTICE

For multiple unit installations, units must be spaced a minimum of 24 in. (61 cm) apart, coil face to coil face.

➤ **Important:** To prevent damage to the unit, do not install the unit in the following locations:
- Where there is machine oil
- Coastal regions where the equipment is prone to atmospheric corrosion
- Near hot springs where the equipment is prone to sulfide gas corrosion
- In proximity to high-frequency or wireless equipment

- Select a location for the outdoor unit that meets the following general requirements for installation:
  - Is away from bedroom windows or other room windows where the sound of the unit operation might be objectionable.
  - Provides adequate structural support for the unit.
  - Allows sufficient clearance for air entrance to the outdoor coil, air discharge, and service access.

- Isolate the unit from rain gutters to avoid any possible wash out of the foundation.
- Allows you to elevate the unit sufficiently to prevent any blockage of the air entrances by snow in areas where snow may accumulate. Check the local weather bureau for the expected snow accumulation in your area.
- If the unit is installed on a hot sun-exposed roof or a paved ground area that is seasonally hot, the unit must be raised sufficiently above the roof or ground to avoid taking the accumulated layer of hot air into the outdoor unit.
- If the system is being installed during seasonally cold weather of 55°F or below, the preferred method is to weigh in the charge. For charging or checking the system charge at 55°F or below, see the *Heating charging charts*. An optional cold weather charging accessory kit is available to prevent the outdoor unit from taking in cold air below 55°F. The kit part number can be found in the list of accessory kits at www.simplygettingthejobdone.com.

• Select a location for the outdoor unit that meets any requirements that are specific to the type of installation as outlined in Table 7.

Table 7: Additional location requirements for each type of installation

Type of installation	Additional location requirements
Ground installation	• The location of the outdoor unit allows installation at ground level on a solid base that does not shift or settle, causing strain on the refrigerant lines and possible leaks. • The location of the outdoor unit allows for the condensate to drain directly on the ground in a safe area where public walkways will not be impacted.
Roof installation	• The structure is capable of supporting the total weight of the unit, including a base, lintels, and rails. You must use a base, lintels, and rails to minimize the transmission of sound or vibration to the structure. • The location of the outdoor unit allows sufficient space for the base. The base must not come in contact with the foundation or side of the structure because sound may transmit to the residence.
Wall-mounted installation	• Mounting the outdoor unit does not cause a loss of structural integrity. • The location of the outdoor unit ensures that there is minimal transmission of sound and vibration into the living space. • The outdoor unit can be accessed safely when mounted, for example, for servicing. • The location of the outdoor unit allows you provide adequate support for the base pan.

Inspecting the unit

1. Remove the shipping carton and inspect the unit immediately after receiving it for possible damage during transit.
2. If damage is evident, do the following:
   a. Note the extent of any damage on the carrier's receipt.
   b. Make a separate written request for the carrier's agent to inspect the unit.
   c. Contact the local distributor for more information.

Understanding installation and operation limitations

Install the unit in accordance with all national, state, and local safety codes, and the following requirements:

- Observe the limitations for the indoor unit, coil, and appropriate accessories.
- Do not install the outdoor unit with any ductwork in the air stream. The outdoor fan is a propeller fan and is not designed to operate against any additional external static pressure.
- Rotary compressor - If you are selecting a unit with a rotary compressor, the maximum equivalent interconnecting line length is 100 ft.
- Observe the maximum and minimum conditions for operation to ensure that the system gives maximum performance and requires minimum service. See Table 8.

Table 8: Maximum and minimum operating limit conditions

Air temperature	Outdoor coil °F (°C)		Indoor coil °F (°C)	
	DB cool	DB heat	WB cool	DB heat
Minimum	55 (13)	-10 (-23)	57 (14)	50 (10)
Maximum	115 (46)	75 (24)	72 (22)	80 (27)

Note: Operation below the minimum indoor temperature is permissible for a short period of time, during morning warm-up.

Important: Do not operate the unit in cooling mode at outdoor temperatures below 55°F.

Important: The maximum allowable line length for this product is 80 ft. Consult the *Piping Application Guide (P/N 247077)* for installations over the maximum allowable line length. Installation of an accessory crankcase heater is required if not factory-installed for installations over the maximum allowable line length.

NOTICE

Inverter Temperature Protection

If excessive inverter temperatures are sensed, the compressor speed/capacity is reduced until an acceptable condition is reached. When the inverter temperature returns to an acceptable level, the system returns to normal operation.

Over/Under Current Protection

If a low or high Current Condition is sensed, the compressor speed/capacity is reduced until an acceptable current level is reached. When the system reaches an acceptable current level, the compressor and fan return to normal operating conditions.

Over/Under Voltage Protection

If a low or high supply Voltage Condition is experienced (below 187 VAC or above 253 VAC), the compressor speed/capacity is automatically reduced until an acceptable voltage level is sensed. When an acceptable voltage level is sensed, the system automatically returns to a normal state of operation.

High Altitude Protection

If the unit is installed in Altitudes of 6,500 ft / 2,000 m above sea level or higher, the compressor and outdoor fan reduce speeds to protect the system. It is not recommended that these units be installed at altitudes greater than 6,500 ft / 2,000 m above sea level.

Low Ambient Protection

Cooling Mode: The unit automatically adjusts to maintain cooling operation in outdoor ambient conditions down to 55°F (13°C). The unit reduces capacity and Low Ambient Protection (cooling mode) or cycles off if asked to provide cooling when the outdoor temperature is at or below these conditions.

Heating Model: The unit provides compressor heat down to an outdoor ambient temperature of -10°F (-23°C). As the outdoor ambient temperature reduces, available heat reduces for all air source heat pumps. Make sure the balance point and auxilliary heat are appropriately set and sized for the application of the heat pump.

Meeting requirements for A2L equipment

Make sure that you have all necessary equipment before you begin the installation. You must adhere to the following requirements when installing or servicing R-454B equipment:

- Gauge sets, hoses, refrigerant containers, and the recovery system must be designed to handle the POE type oils and the higher pressures of R-454B.
- Manifold sets should be high side and low side with low side retard.
- All hoses must have a 700 psig service pressure rating.
- Electronic leak detectors can be used for detecting refrigerant leaks. For flammable refrigerants, check the sensitivity and potentially recalibrate the detector.
- Leak detection fluids are also suitable for use with most refrigerants. Avoid using detergents containing chlorine, as they can react with refrigerants and corrode copper pipework. Examples of leak detection methods include the bubble method and fluorescent agents.
- Recovery equipment (including refrigerant recovery containers) must be specifically designed to handle R-454B.
- Only use a TXV that is specifically designed for R-454B refrigerant.
- If an indirect refrigerating circuit is used, inspect the secondary circuit for refrigerant presence.
- Maintain visible and legible markings on the equipment. Illegible markings or signs should be corrected.
- Install refrigerant pipes and components in locations where they are unlikely to be exposed to corrosive substances, unless the components are made from corrosion-resistant materials or adequately protected against corrosion.

Installing the outdoor unit

There are three installation options for the outdoor unit: ground installation, roof installation, and wall-mounted installation. You must follow all requirements for the specific type of installation. See Selecting a location for installation for location requirements for ground, roof, and wall-mounted installation.

If you are installing the outdoor unit as a replacement for an existing unit, follow the procedure outlined in Installing the outdoor unit as a replacement unit.

Setting the outdoor unit on the ground or on a roof

Before you begin:
Make sure that the location you have selected for the outdoor unit is suitable. See Selecting a location for installation.

For ground installation, you must use a strong, solid base, made of concrete or a similar material. For roof installation, you must use a base, lintels, and rails to minimize the transmission of sound or vibration to the structure. If site conditions require, elevate the unit above the base, for example, using riser legs, a stand, or snow legs.

NOTICE

Heat pumps defrost periodically resulting in water drainage. Do not locate the unit where water drainage may freeze and create a hazardous condition, such as sidewalks and steps.

1. Position the base in the pre-determined location, see Selecting a location for installation.
2. Ensure that compressor tie-down bolts remain tightened.
3. Install the unit in as level a position as possible while maintaining the clearances shown in Figure 3 and Figure 4.
4. Fasten the outdoor unit tightly to prevent noise.

Figure 3: Typical installation clearances

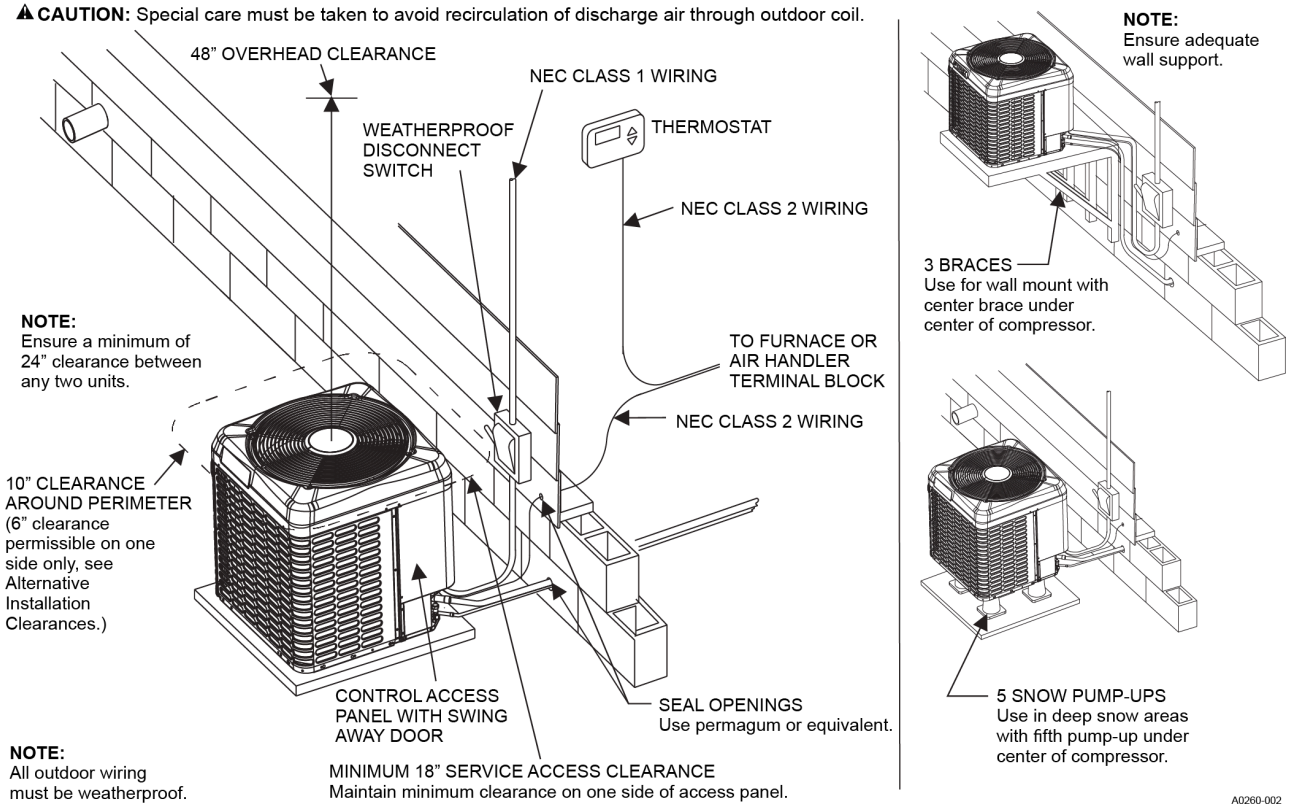
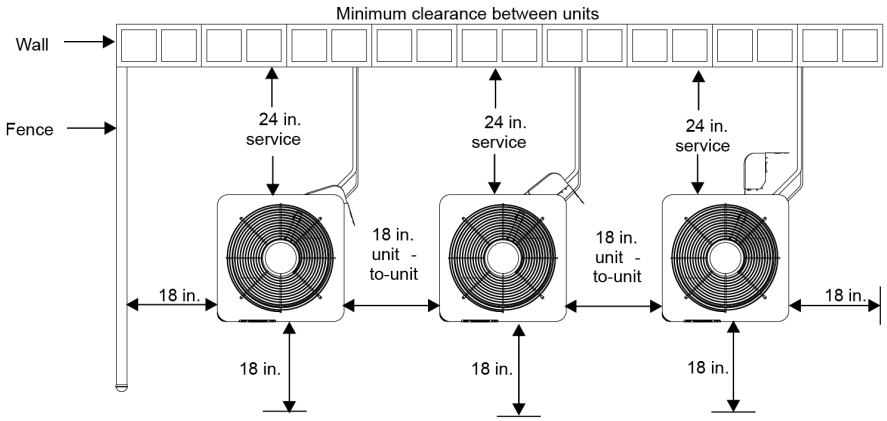
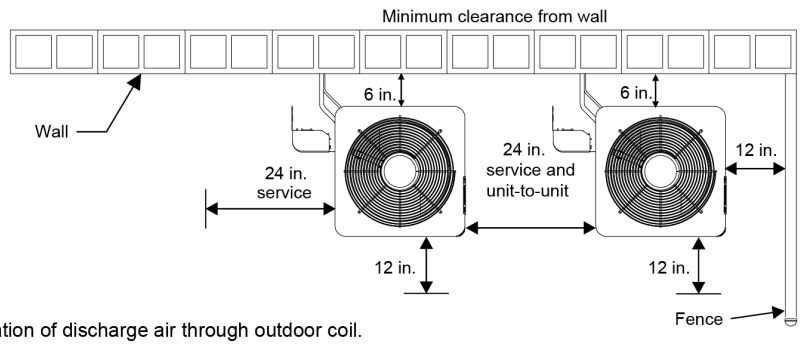


Figure 4: Alternative installation clearances



Note:
Clearance between two units may be reduced to 18 in. minimum provided the service access clearance is increased to 24 in. minimum, and the clearance on each remaining side is maintained at 18 in. minimum.

Note:
Clearance to one side of the unit may be reduced to 6 in. provided the clearance to each remaining side is increased to 12 in. minimum, the service access is increased to 24 in. minimum, and the clearances between any two units is maintained at 24 in. minimum.



CAUTION:
Special care must be taken to avoid recirculation of discharge air through outdoor coil.

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Mounting the outdoor unit on a wall

Before you begin:
On occasion, site conditions may require direct wall mounted brackets to be used to locate and support the outdoor unit. In these applications, address unit base pan support, structural integrity, safe access, and serviceability, as well as the possible sound and vibration transmission into the structure.

When site conditions require you to mount the outdoor unit on a wall, you must use two direct wall mount brackets to support the outdoor unit. The wall mount brackets are field supplied. It is important to be aware that wall mounting is best served by a correctly engineered solution.

1. Make sure that the location you have selected for the outdoor unit is suitable. See Selecting a location for installation.
2. Use two wall mount brackets to mount the outdoor unit on the wall.

Installing the outdoor unit as a replacement unit

When installing this unit as a replacement for an existing R-410A unit, you must replace the outdoor unit, indoor coil, and metering device. Complete all of the steps outlined to ensure correct system operation and performance. Replace the refrigeration piping where possible.

⚠ WARNING

Never install a suction-line filter drier in the liquid line of an R-454B system. Failure to follow this warning can cause a fire, injury, or death.

NOTICE

Never leave a suction-line drier in the system for longer than 50 h of run time.

1. Remove the existing outdoor unit.
2. Make sure that the location of the outdoor unit you are replacing is suitable for installing the new outdoor unit. See Selecting a location for installation.
3. Replace the indoor coil with an approved R-454B coil or outdoor unit combination with the appropriate metering device.
4. Install the outdoor unit. See Setting the outdoor unit on the ground or on a roof or Mounting the outdoor unit on a wall.
5. Replace the refrigeration piping when replacing an R-22, R-410A, or other refrigerant unit with an R454B unit to reduce cross-contamination of oils and refrigerants. See Table 9.

Table 9: Replacing refrigerant piping

Installation condition	Approach
You are replacing an outdoor unit that uses R-22, R-410A, or other refrigerant with an outdoor unit that uses R-454B refrigerant	Replace the refrigerant piping to reduce cross-contamination of oils and refrigerants. See Installing the refrigerant piping. If replacing the refrigerant piping is not practical, take the following precautions: 1. Inspect the refrigeration piping for kinks, sharp bends or other restrictions, and for corrosion. 2. Determine if there are any low spots which might be serving as oil traps. 3. Flush the refrigeration piping with a commercially available flush kit to remove as much of the existing oil and contaminants as possible. 4. Install a suction line filter-drier to trap any remaining contaminants, and remove after 50 h of operation.
You are replacing the outdoor unit because of a compressor burnout	Replace the refrigerant piping or, at a minimum, thoroughly flush the refrigerant piping with a commercially available flush kit.

5. If the outdoor unit is being replaced due to a compressor burnout, then the installation of a 100% activated alumina suction-line filter-drier in the suction-line is required, in addition to the field-installed biflow liquid-line drier. See Table 9. Take the following steps:
   a. Operate the system for 10 h. Monitor the suction drier pressure drop.
   b. If the pressure drop exceeds 3 psig, replace both the suction-line and liquid-line driers.
   c. After a total of 10 h runtime where the suction-line pressure drop has not exceeded 3 psig, replace the liquid-line drier, and remove the suction-line drier.

Installing the refrigerant piping

To install the refrigerant piping correctly, you must do the following:

1. Install the vapor line and liquid line.
2. Install a liquid-line filter drier on the liquid line.
3. Braze the refrigerant lines and service valves.
4. Install the thermostatic expansion valve (TXV).
5. Check the refrigerant system for leaks.
6. Evacuate the system.
7. Release refrigerant into the system.

Installing the vapor and liquid lines

Connect the outdoor unit to the indoor coil using field-supplied refrigerant grade (ACR) copper tubing that is internally clean and dry. Only install the unit with the tubing sizes for approved system combinations as specified in the *Tabular data sheet*. The charge given is applicable for total tubing lengths up to 15 ft (4.6 m). Refer to the *Piping Application Guide (P/N 247077)* for installing tubing of longer lengths and elevation differences.

Rotary compressor - If you are selecting a unit with a rotary compressor, the maximum equivalent interconnecting line length is 100 ft.

NOTICE

Using a larger than specified line size could result in oil return problems. Using too small a line results in loss of capacity and other problems caused by insufficient refrigerant flow. Slope horizontal vapor lines at least 1 in. (2.5 cm) every 20 ft (6.1 m) toward the outdoor unit to facilitate sufficient oil return. If more than the 80 ft line length is necessary, facilitate sufficient refrigerant velocity with adjusted line diameter in accordance with the *Piping Application Guide (P/N 247077)*.

⚠ CAUTION

This system uses R-454B refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gauge sets, hoses, refrigerant containers, and the recovery system must be designed to handle R-454B. If you are unsure, consult the equipment manufacturer.

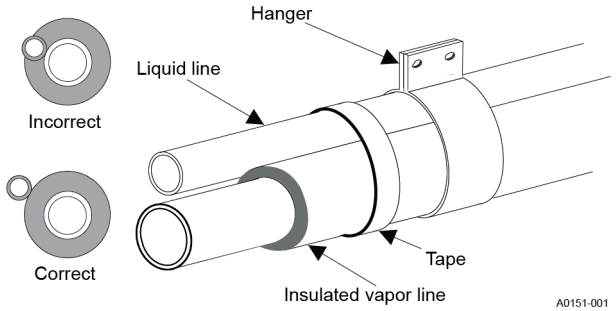
⚠ WARNING

Never install a suction-line filter-drier in the liquid line of an R-454B system. Failure to follow this warning can cause a fire, injury or death.

- Install the lines with as few bends as possible. Take care not to damage the couplings or kink the tubing. Use clean hard drawn copper tubing where no appreciable amount of bending around obstruction is necessary. If soft copper must be used, take care to avoid sharp bends which may cause a restriction.
- Install the lines so that they do not obstruct service access to the coil, air handling system, or filter.
- Take care to isolate the refrigerant lines to minimize noise transmission from the equipment to the structure.

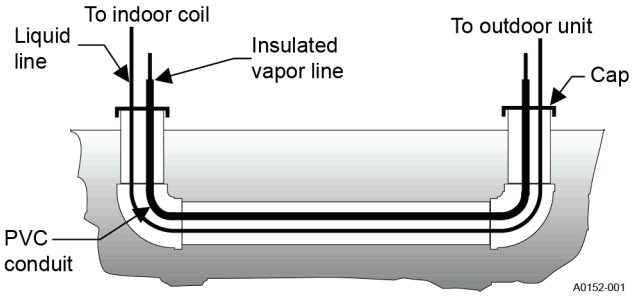
- Insulate the vapor line with a minimum of 1/2 in. foam rubber insulation such as Armaflex or an equivalent. Liquid lines exposed to direct sunlight, high temperatures, or excessive humidity must also be insulated.
- Tape and suspend the refrigerant lines as shown. Do not allow tube metal-to-metal contact. See Figure 5.
- Use PVC piping as a conduit for all underground installations as shown in Figure 6. Keep buried lines as short as possible to minimize the build up of liquid refrigerant in the vapor line during long periods of shutdown.

Figure 5: Installation of vapor line



- Pack fiberglass insulation and a sealing material such as permagum around refrigerant lines where they penetrate a wall to reduce vibration and to retain some flexibility.
- For systems with total line length exceeding 80 ft (22.86 m), refer to *Piping Application Guide* (P/N 247077) for the following specifications:
  - Vapor and liquid line sizing
  - Calibration of liquid line pressure loss or gain
  - Determination of vapor line velocity
  - Elevation limitations
  - TXV connections
  - System charging
  - Traps
  - Crankcase heater

Figure 6: Underground installation



Installing the liquid line filter-drier

The liquid line filter-drier is packaged and shipped along with the outdoor unit.

⚠ CAUTION

Filter-drier is required to be installed in liquid line. The recommended location is at the indoor coil before the refrigerant metering device. It can be installed at the outdoor unit if required.

⚠ CAUTION

Using a granular type drier may result in damage to the equipment.

⚠ CAUTION

The liquid line filter-drier must be wrapped in a wet rag while brazing.

NOTICE

All replacements for the liquid line filter-drier must be bi-flow and be an approved replacement from Source 1.

1. Find a suitable location on the liquid line to install the filter-drier. The preferred location is inside at the indoor coil before the metering device. If this is not possible, outside next to the liquid service valve is acceptable.
2. Install the liquid-line filter drier in accordance with the installation instructions for the liquid-line filter drier.

Connecting the refrigerant lines

Depending on the indoor coil model and application, there are two methods of connecting the refrigerant lines:

1. Brazing the connections
2. Using non-braze connections

Some coil models have straight piping connections ready for use with braze-free connectors. You can also use straight piping connections for brazing, but you need to expand the pipe in the field using a swage tool. Alternatively, use a sweat coupling.

Brazing the refrigerant lines and service valves

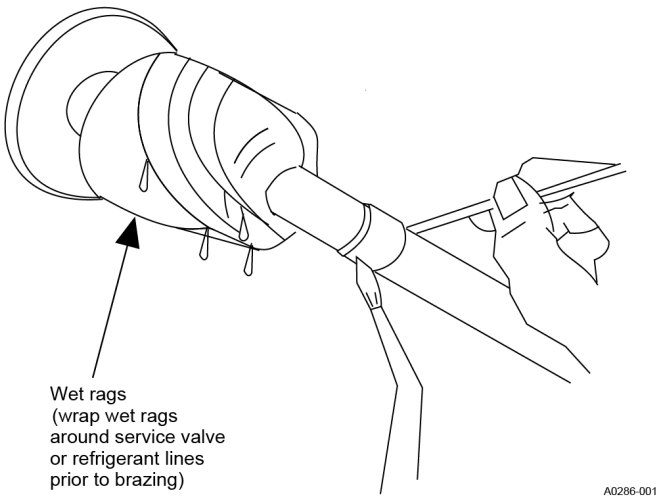
It is important to take the necessary precautions for brazing the refrigerant lines and service valves. All outdoor unit and indoor coil connections are copper-to-copper and you must braze them with a phosphorous-copper alloy material such as Silfos-5 or equivalent. **Do not use soft solder.** The outdoor units have reusable service valves on both the liquid and vapor connections. The total system refrigerant charge is retained within the outdoor unit during shipping and installation. The reusable service valves are provided to evacuate and charge as outlined in

this manual. You can avoid serious service problems by taking adequate precautions to ensure an internally clean and dry system.

⚠ CAUTION

Dry nitrogen must always be supplied through the tubing while it is being brazed because the temperature required is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen must continue until the joint cools. Always use a pressure regulator and safety valve to ensure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation.

Figure 7: Heat protection



⚠ CAUTION

Do not install any coil in a furnace which is to be operated during the heating season without attaching the refrigerant lines to the coil. The coil is under pressure which must be released to prevent excessive pressure build-up and possible coil damage.

⚠ CAUTION

Do not connect manifold gauges unless trouble is suspected. Approximately 3/4 oz of refrigerant is lost each time a standard manifold gauge is connected.

⚠ WARNING

Never attempt to repair any brazed connections while the system is under pressure. Personal injury could result.

Take the following precautions when brazing the service valve:

- Wrap a wet rag around the service valve to prevent heat damage as shown in Figure 7.
- Protect items such as all painted surfaces, insulation, and the plastic base during brazing.
- After brazing, cool the joint with a wet rag.

⚠ WARNING

This is not a backseating valve. The service access port has a valve core. The opening or closing valve does not close service access port. If the valve stem is backed out past the chamfered retaining wall, the O-ring can be damaged causing leakage or system pressure could force the valve stem out of the valve body possibly causing personal injury.

After you have considered the precautions, proceed with brazing the refrigerant lines and service valves:

1. Remove the cap and Schrader core from both the liquid and vapor service valve service ports at the outdoor unit.
2. Connect low pressure nitrogen to the liquid line service port.
3. Braze the liquid line to the liquid valve at the outdoor unit. Be sure to wrap the valve body with a wet rag. Allow the nitrogen to continue flowing.
4. Carefully remove the plugs from the indoor liquid and vapor connections at the indoor coil.
5. Braze the liquid line to the indoor coil liquid connection. Nitrogen should be flowing through the indoor coil.
6. Slide the grommet away from the vapor connection at the indoor coil. Braze the vapor line to the indoor coil vapor connection. After the connection has cooled, slide the grommet back into original position.
7. Protect the vapor valve with a wet rag and braze the vapor line connection to the outdoor unit. The nitrogen flow should be exiting the system from the vapor service port connection. After this connection has cooled, remove the nitrogen source from the liquid fitting service port.
8. Replace the Schrader core in the liquid and vapor valves.

Using braze free refrigerant line connections

Use the following steps to fit braze-free refrigerant line connections. For brazed connections, see Brazing the refrigerant lines and service valves.

➤ **Important:** Prepare the valve and line connections per the braze-free connection part's *Installation Instructions*.

1. Fit a braze-free connection onto the liquid valve on the outdoor unit.
2. Connect the liquid line to the outdoor unit liquid valve braze-free connection.
3. Fit a braze-free connection to the outdoor unit vapor valve. Connect the vapor valve line to the outdoor vapor valve braze-free connection.
4. Prepare and connect indoor coil liquid and vapor line connections following the indoor coil installation instructions. If any brazing will take place, dry nitrogen must be flowing to prevent oxidation.
5. Carefully remove the plugs from the liquid and vapor connections at the indoor coil.
6. Connect the liquid line to the liquid braze-free connection on the indoor coil.
7. Connect the vapor line to the indoor coil's vapor valve braze-free connection.
8. Install the liquid line and vapor line grommets on the indoor coil.

Installing the thermostatic expansion valve (TXV)

This is a basic overview of the procedure, for detailed instructions, refer to the *Installation Manual* accompanying the TXV kit and the indoor coil. Install the TXV kit as follows:

Important: Refer to the *Technical Guide* for the unit to determine the correct TXV kit to use on this product.

1. Relieve the holding charge by depressing the Schrader core on the suction manifold stub out.
2. After the holding charge is completely discharged, loosen and remove the Schrader core.
3. Place a backup wrench on the distributor, then loosen and remove the brass distributor nut. Retain the brass nut for use on the liquid line. Keep the PTFE washer in place and discard the clear disk.
4. Install the TXV to the distributor assembly with the supplied fittings. Ensure that the PTFE washer is seated in the distributor. Hand tighten and turn an additional quarter turn to seal. Do not over-tighten fittings. See Figure 8.

CAUTION

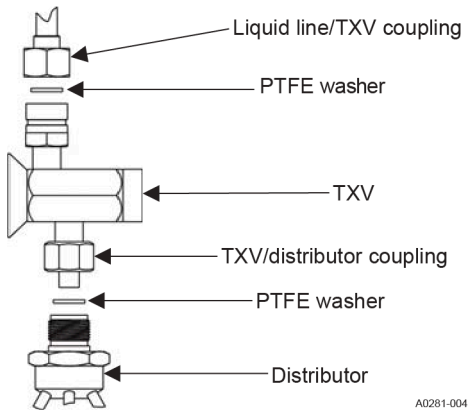
Do not over-torque. Do not use slip joint pliers. This distorts the aluminum distributor and the brass fitting, potentially causing leaks.

5. Slide the nut removed in Step 3 over the supplied liquid line. Place the supplied PTFE washer from the TXV kit on the TXV, and install liquid line to the top of the TXV. Adjust assembly so liquid line aligns with hole in access panel. Hand tighten the liquid line, and apply an additional quarter turn to seal.

WARNING

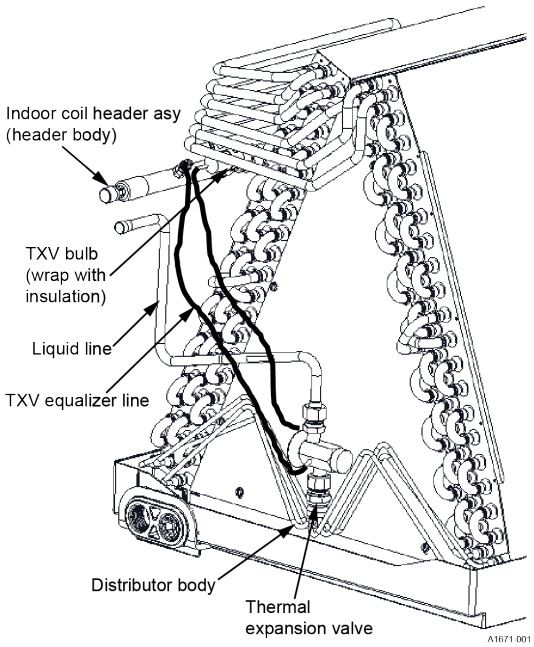
Schrader valve core must not be installed with TXV installation. Poor system performance or system failure could result.

Figure 8: TXV installation



6. Install the TXV equalizer line onto the vapor line by hand tightening the 1/4 in. SAE coupling nut to the equalizer fitting, and applying an additional third turn to seal. See Figure 9.

Figure 9: TXV bulb and equalizer line installations

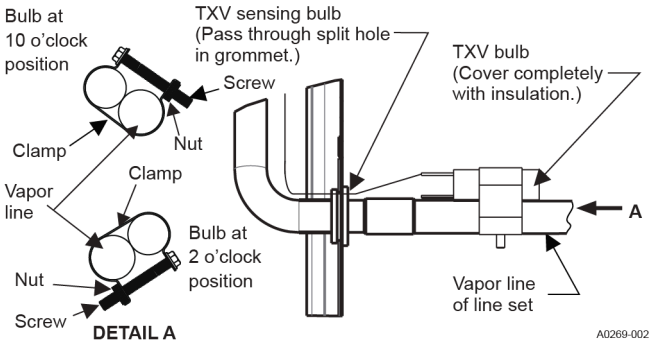


⚠ CAUTION

In all cases, mount the TXV bulb after vapor line is brazed and has had sufficient time to cool. Failure to use suction line grommet may result in premature TXV failure.

7. If the indoor coil is an **A** coil, skip to Step 8. If not, pass the TXV temperature sensing bulb through the suction line split grommet in the access panel.
8. Install the TXV bulb to the vapor line using the bulb clamps furnished with the TXV assembly. Ensure the bulb is making maximum contact. See Figure 9 and Figure 10.
   a. If possible, install the temperature bulb on a horizontal run of the vapor line. Ensure that the bulb is installed at a 10 o'clock or 2 o'clock position. See Figure 10.
   b. If bulb installation is made on a vertical run, ensure that the bulb is a minimum of 8 in. (20.3 cm) away from the elbow coming out of the coil. Position the bulb with the tail of the bulb at the top, so that the bulb acts as a reservoir.
   c. Insulate the bulb using thermal insulation provided to protect it from the effect of the surrounding ambient temperature. Cover completely to insulate.

Figure 10: Correct bulb location



After the refrigerant piping is installed, leak test the system.

Checking for refrigerant leaks

NOTICE

Pressurize the refrigerant piping and the indoor coil to 250 psig with dry nitrogen and leak test with a bubble type leak detector. Then release the nitrogen charge.

Do not use the system refrigerant in the outdoor unit to purge or leak test.

1. Pressurize the refrigerant piping and the indoor coil to 250 psig with dry nitrogen.
2. Leak test all refrigerant piping connections including the service port flare caps to be sure they are leak tight. Do not over-tighten the refrigerant piping connections: tighten between 40 in-lb and 60 in-lb maximum.
3. Release the nitrogen charge.
4. If refrigerant leaks are present, repair the leaks and repeat Step 1 to Step 4 as needed until the testing indicates that no refrigerant leaks are present.

Evacuating the refrigerant lines and indoor coil

Evacuate the system to 500 microns or less. If a leak is suspected, leak test with dry nitrogen to locate the leak. Repair the leak and test again.

To verify that the system has no leaks, do the following steps:

1. Close the valve to the vacuum pump suction to isolate the pump and hold the system under vacuum.
2. Watch the micron gauge for a few minutes.
   a. If the micron gauge indicates a steady and continuous rise, it is an indication of a leak.
   b. If the gauge shows a rise, then levels off after a few minutes and remains fairly constant, it is an indication the system is leak free but still contains moisture and may require further evacuation if the reading is above 500 microns.

Releasing refrigerant into the system

Before you begin:
Make sure that you have checked the refrigerant system for leaks and evacuated the refrigerant lines and indoor coil before releasing the refrigerant charge into the system. See Checking for refrigerant leaks and Evacuating the refrigerant lines and indoor coil.

To release the refrigerant charge into the system, follow these steps:

1. Open the liquid line service valve first.
2. When the system pressures have equalized, open the vapor line service valve by removing the valve caps and turning the valve counterclockwise using a hex-head wrench.
3. If the service valve is a ball valve, use an adjustable end wrench to turn the valve stem one-quarter turn counterclockwise to open. Do not overturn or the valve stem may break or become damaged. See Brazing the refrigerant lines and service valves.
4. Replace the service valve cap finger tight, then tighten an additional 1/12 turn (1/2 hex flat). Replace the cap to prevent leaks.
5. See Charging the system for checking and recording system charge.

Connecting the wiring

To connect the wiring correctly, you must do the following:

1. Observe the general information and grounding information.
2. Install the field connections power wiring.
3. Install the field connections control wiring.
4. Control the dehumidification of the unit.
5. Configure the typcial indoor cubic feet per minute (CFM) settings.

See for the outdoor unit wiring diagrams.

General information and grounding the unit

Before you begin:
Before you connect the wiring for the outdoor unit, note the information below.

NOTICE

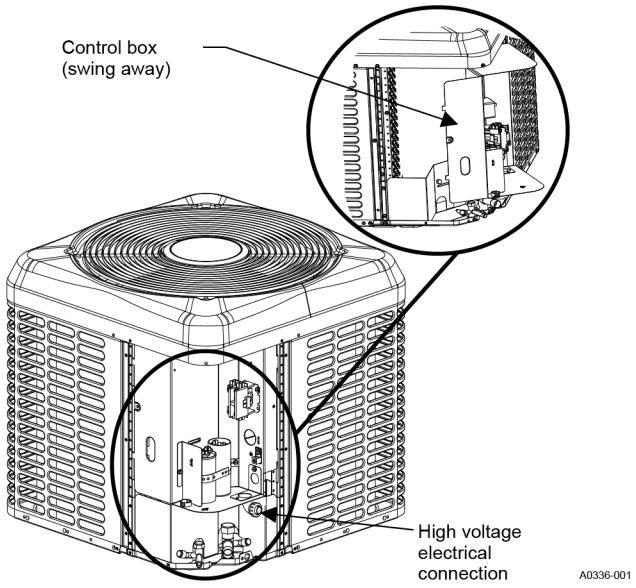
Install flexible electrical wiring to use the swing away function of the control box. Rigid type electrical connections require the wiring to be disconnected to swing the control box open.

⚠ CAUTION

All field wiring must use copper conductors only and be in accordance with local, national, fire, safety and electrical codes. This unit must be grounded with a separate ground wire in accordance with the above codes.

- The control box cover is held in place with three screws, one screw in each lower corner and one screw at the top center post. The control box can swing open by removing the screw from the center of each side of the control box and allowing the control box to lower an inch into a pivotal position.
- The control box can then swing open from the left by rotating on the right side pivots for easy service of refrigeration components. If no wiring is in or routed through the control box, it can be removed from the unit by lifting slightly, tilting the top hinge out, and lifting the bottom hinge out. During the installation, route the low voltage wiring for the thermostat along the unit high voltage wiring to help facilitate the swing away feature of the control box. See Figure 11.
- Check the electrical supply to be sure that it meets the values specified on the unit nameplate and wiring label.
- Power wiring, control (low voltage) wiring, disconnect switches and over current protection must be supplied by the installer. Wire size must be sized per NEC requirements.
- The complete connection diagram and schematic wiring label is located on the inside surface of the unit service access panel.

Figure 11: Outdoor unit swing away control box



Completing the field power wiring connections

1. Install the correct size weatherproof disconnect switch outdoors and within sight of the unit.
2. Remove the screws at the top and sides of the corner cover.
3. Slide the control box cover down and remove from unit.
4. Run power wiring from the disconnect switch to the unit.
5. Route wires from disconnect through power wiring exit provided and into the unit control box correct location as shown in Figure 12.
6. Install the correct size time-delay fuses or circuit breaker, and make the power supply connections.

Completing the field control wiring connections

Important:

With communicating systems, you must use the Smart Home Control (S1-TSHC510).

If you are using a fully communicating system with an outdoor unit containing A2L refrigerants, a refrigerant detection system (RDS) is required.

The communicating system consists of several intelligent communicating components, including the following:

- Smart Home Control (S1-TSHC510), a communicating wall thermostat
- Variable speed air handler or furnace
- Communicating capable outdoor units that continually communicate with each other using a four-wire connection called the A-R-C-B bus

Commands, operating conditions, and other data pass continually between components over the A-R-C-B bus. See the *Control wiring diagrams*. The result is a new level of comfort, versatility, and simplicity. To use the heat pump in full communications (COMM) mode, it is essential to install it with the matching Smart Home Control (S1-TSHC510) and an indoor air handler or furnace with a fully communicating control.

1. Route low voltage wiring into bottom of control box correct location as shown in Figure 12. Connect low voltage wiring to the appropriate connections.

2. The complete connection diagram and schematic wiring label is located on the inside surface of the unit service access panel.
3. Replace the control box cover removed in Step 2 of Completing the field power wiring connections.
4. All field wiring to be in accordance with national electrical codes (NEC) and local-city codes.
5. Mount the thermostat about 5 ft above the floor, where it is exposed to normal room air circulation. Do not place it on an outside wall or where it is exposed to the radiant effect from exposed glass or appliances, drafts from outside doors or supply air grilles.
6. Route the 24 V control wiring (NEC Class 2) from the outdoor unit to the indoor unit and thermostat.

NOTICE

Shield communication cable is not required fo the 24 V control wiring but is strongly recommended in applications where interference from other wiring, electronics, or machinery could create communication issues. Common examples of these applications include: Multi-family Housing, Medical Buildings, Offices, Data Centers, and Industrial Buildings. The shielded communication cable drain wire should be connected to the chassis ground at the indoor unit. The drain wire should NOT be connected to any terminal at the wall thermostat and/or outdoor unit.

If the installation contains excess conductors greater than 3-4 wires (communication equipment dependent), the excess wires should be grounded to reduce electrical noise. Use a wire nut to bundle the excess wires at each end. A single wire should then be connected to "chassis ground" (near the transformer or ground lug).

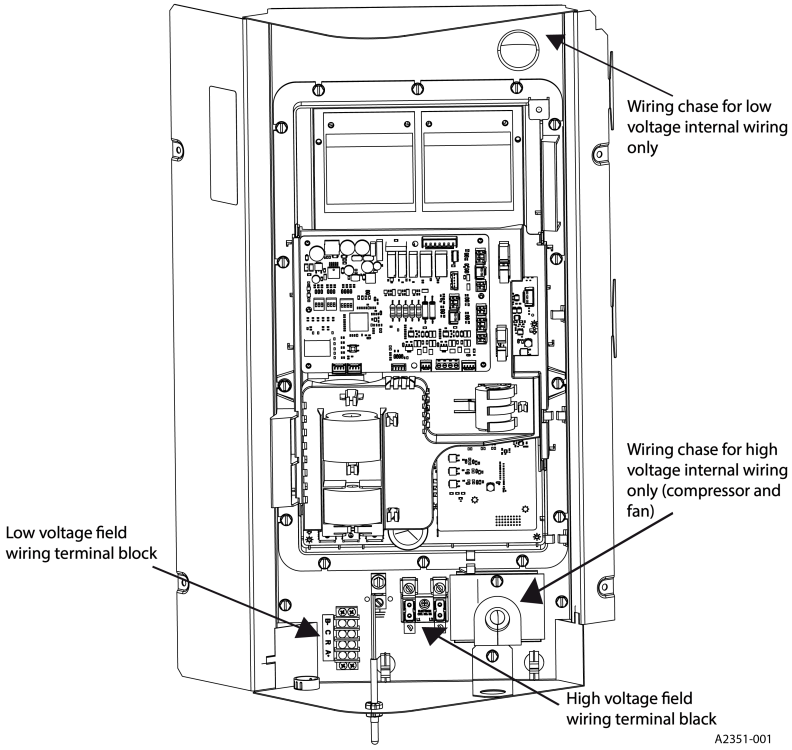
NOTICE

To eliminate erratic operation, seal the hole in the wall at the thermostat with permagum or equivalent to prevent air drafts affecting the operation of in the thermostat.

NOTICE

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

Figure 12: Outdoor unit control box - YH9



Control wiring diagrams

NOTICE

Gas furnace heat pump jumper must be set to YES.

For full field low-voltage wiring, refer to the mitigation control kit and the indoor unit *Installation Manual.*

To use communicating controls, do the following:

- Connect the air handler control, touch screen communicating control (Smart Home Control (S1-TSHC510)), and communicatingoutdoor units as shown in the *Control wiring diagrams*. Ensure all of the A+ terminals are connected together, all of the B- terminals are connected together, all of the C terminals are connected together, and all of the R terminals are connected together.

Figure 13: Control wiring - variable ECM air handler with built-in refrigerant dectection sensor and variable speed heat pump

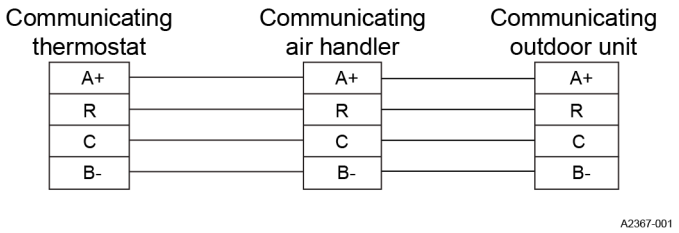
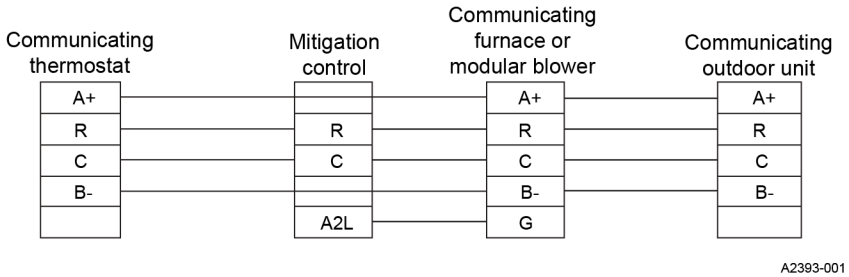


Figure 14: Control wiring - 10-pin mitigation control - variable ECM gas furnace models Y82V, Z8VT, Y92V, Z9VT, Y9VV, and Z9VV or modular blower JMC and variable speed heat pump

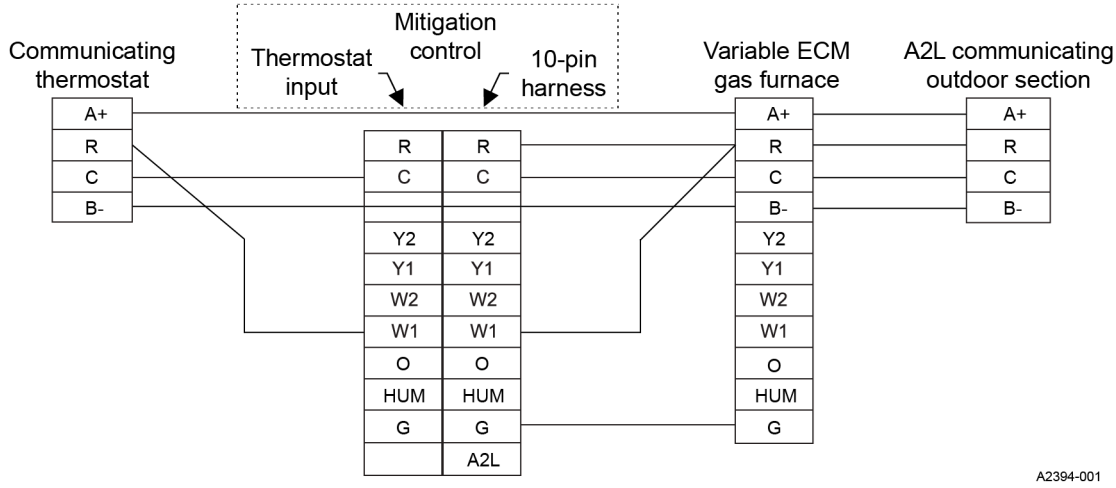


NOTICE

The mitigation control board has a bank of DIP switches. Both DIP switches must be in the 1 or on position.

Use the mitigation control A2L output instead of the G output for Y82V, Z8VT, Y92V, Z9VT, Y9VV, and Z9VV gas furnace models and JMC modular air handler models.

Figure 15: Control wiring - 10-pin mitigation control - variable ECM gas furnace models YP9C, TP9C, LP9C, CP9C, YPLC, TPLC, TM9V, TM8V and variable speed heat pump



NOTICE

A+ and B- do not connect to the mitigation control.

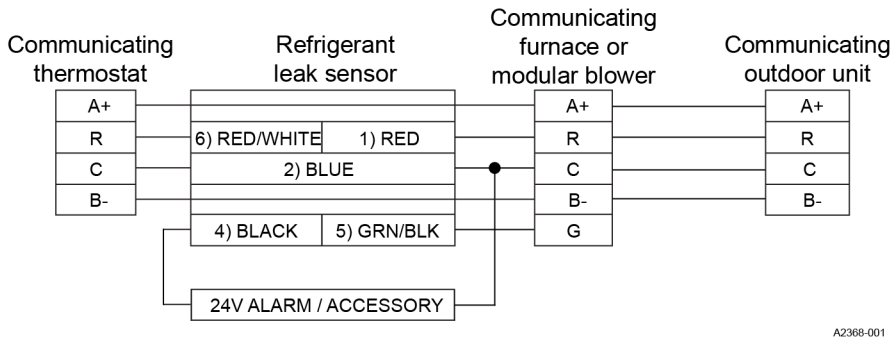
Connect the mitigation control harness W1 wire (WHITE) to the gas furnace R terminal.

Do not connect the room thermostat R terminal to the gas furnace R terminal.

Connect the mitigation control harness G wire (GREEN) to the gas furnace G terminal.

When the mitigation control is in alarm state, power to the room thermostat will be interrupted and the mitigation control will send power to the gas furnace G input to operate the indoor blower.

Figure 16: Control wiring - 6-pin mitigation control - variable ECM gas furnace or modular blower and variable speed heat pump



Charging the system

⚠ CAUTION

If a field-installed device is placed in the inner-connecting refrigerant lines that can store a significant refrigerant charge, for example, a refrigerant mass flow meter or a liquid receiver, the unit may not perform as designed. If such a performance-affecting device is installed and it is possible to check the unit in heating mode, the unit pressures should be confirmed in heating mode. See *Heating charging charts*.

⚠ CAUTION

Refrigerant charging must be carried out by a licensed qualified air conditioning contractor.

⚠ CAUTION

Always charge in liquid form. Take care not to slug the compressor.

⚠ CAUTION

Compressor damage occurs if the system is inadequately charged. On new system installations, charge the system according to the *Tabular Data Sheet* for the matched coil and follow guidelines in this instruction.

Refer to the *Tabular Data Sheet* provided in the customer booklet for the unit for charge requirements. Permanently mark the total system charge on the unit data plate.

⚠ CAUTION

Do not leave the system open to the atmosphere. Unit damage could occur due to moisture being absorbed by the POE oil in the system. This type of oil is highly susceptible to moisture absorption.

The factory charge in the outdoor unit includes enough charge for the unit, 15 ft (4.6 m) of refrigerant piping, and the smallest indoor coil or air handler match-up. Some indoor coil or air handler matches may require additional charge.

➤ **Important:** Ensure that different refrigerants are not mixed when using charging equipment, and keep hoses or lines as short as possible to minimize refrigerant collecting in them.

Ensure that the refrigerating system is properly grounded before charging it with refrigerant.

To ensure that the unit performs at the published levels, it is important to determine the indoor airflow and add refrigerant charge accordingly. To charge the system, follow these steps:

1. Measure the indoor airflow.
2. Determine the total system charge.

3. Use the indoor airflow and total system charge results to charge the unit.
4. Label the system when the charging process is complete, if not already labeled.
5. Perform a leak test on the system after charging but before commissioning. Conduct a follow-up leak test before leaving the site. See Checking for refrigerant leaks.

Adjusting the indoor airflow

Variable speed air handlers are designed to deliver constant airflow (CFM) regardless of the external static pressure (ESP) in the ductwork.

The constant CFM indoor blower motor communicates with the control board using the ClimateTalk communications protocol.

The Smart Home Control (S1-TSHC510) can be used to adjust CFM up to +/- 10% if needed. Adjustments can be made in the service menu of the Smart Home Control (S1-TSHC510). See the Smart Home Control (S1-TSHC510) manual for further details.

Checking the indoor cubic feet per minute (CFM) settings

Refer to the indoor unit *Installation Manual* instructions for the air handler or furnace interface with the outdoor heat pump. Refer to the outdoor *Technical Guide* for the indoor airflow settings you should set for each specific heat pump. For the system to operate correctly, ensure that the indoor CFM selection is correct.

Determining the total system charge

1. Determine the outdoor unit factory charge using the *Tabular Data Sheet* (item 1).
2. Determine the indoor coil adjustment (if any) using the *Tabular Data Sheet* (item 2).
3. Calculate the additional charge for the refrigerant piping using the *Tabular Data Sheet* if the line length is greater than 15 ft (4.6 m) (item 3).
4. Note that the total system charge = item 1 + item 2 + item 3.
5. Check the unit against the pressure value listed on the cooling chart on the unit or the appropriate heat charging chart in this manual. Make any adjustment necessary.
6. Add or subtract refrigerant to obtain the pressure listed on the charging chart. Adjust the total system charge by the amount added or removed to obtain the charging chart pressures. Permanently mark the unit data plate with the total amount of refrigerant in the system.

⚠ WARNING

Do not attempt to pump total system charge into outdoor unit for maintenance or service. This may cause damage to the compressor or other components. Recover and weigh system charge into an appropriate recovery cylinder for any instances requiring evacuation.

⚠ CAUTION

It is unlawful to knowingly vent, release, or discharge refrigerant into the open air during repair, service, maintenance or the final disposal of this unit.

Starting up the system

Before you begin:
When the outdoor unit is in place and the refrigerant piping and wiring are complete, you must start up the system and make sure that the system is operating correctly.

⚠ CAUTION

Do not operate the system until all the checks outlined in this procedure have been performed.

⚠ WARNING

Do not touch any of the parts at the discharge gas side by hand. The compressor chamber and the pipes at the discharge side are heated to temperatures higher than 194°F (90°C).

To start up the system, do the following:

1. Check to ensure that the service base valves of the outdoor unit are fully open.
2. Check to ensure that the electric wires are fully connected.
3. Energize the line voltage to the outdoor section first, and then to the indoor section.
4. The equipment must be set up at the indoor thermostat. The thermostat will display **SETUP** upon power up if communication is present with the indoor section. Once setup of the indoor section is complete, the thermostat will search for the outdoor section. Once it is found, complete the system setup.

   ➤ **Important:** Outdoor unit tonnage must be selected. The 3 ton model can be configured as a 2 ton or 3 ton, and the 5 ton model can be configured as a 4 ton or 5 ton.
5. Once setup is complete, enter the service menu and scroll down to **SERVICE MODE**. Change **SERVICE** mode from **OFF** to **ON** so that unit charge can be adjusted or validated. Once **SERVICE MODE** is in the **ON** position, call for heating or cooling and unit operation will start.
6. Once the correct unit refrigerant charge is confirmed or adjusted, end the thermostat call for heating or cooling, enter the service menu, scroll down to **SERVICE MODE**, and change **SERVICE** from the **ON** to the **OFF** position.

   ⓘ **Note:** See System components and operation for more information about the system if needed.

Energizing the stator heat (if applicable)

This system uses stator heat in lieu of a crankcase heater. To energize the stator heat, set the indoor thermostat to the **OFF** position. Close the line power disconnect to the unit. Stator heat activates when the outdoor ambient temperature is below 55°F for 30 seconds continually, and it has been >10 minutes since compressor operation. The stator heat will deactivate when the outdoor ambient temperature is above 55°F for 30 seconds continually or there is a call for compressor operation.

NOTICE

An attempt to start the compressor at low ambient conditions without at least 8 h of stator heat may damage the compressor.

Adjusting system settings

All unit settings can be changed at the room thermostat. We recommend to leave **all** unit control board dipswitches in their factory positions, and make changes at the room thermostat. See Starting up the system regarding unit commissioning and setup.

The control is equiped with a service mode which operates the system at a fixed speed and settings for charging and troubleshooting. To charge the system the controls must be in service mode. The charging charts are only accurate with the system in this mode. Service mode can be entered using the communicating thermostat or through the 4-position dipswitch ("Test Mode") on the control board.

To change from normal mode to test mode, de-energize the 24 V power to the controls and change the dip switch to that shown in Table 10 and then reapply power. To change the system back to normal mode, remove power again and set dip switches to that shown in Table 10 and reapply power. The system will also revert back to normal mode after 24 hours in service mode.

Table 10: S1 dipswitch bank

Operation description	Switch position 1	Switch position 2	Switch position 3	Switch position 4
Normal mode	OFF	OFF	OFF	OFF
Service mode	OFF	OFF	OFF	ON

The control has a feature to operate the system at a lower capacity where the application requires it. A nominal 3 ton model can be set up to run as a 2 ton with a 2 ton indoor match and a nominal 5 ton model can be set up to run as a 4 ton with a 4 ton indoor match.

To change the capacity, de-energize the 24V power to the controls and set the dip switch settings per Table 11. This setting can also be changed using the communicating thermostat. The system must be set to the correct tonnage when charging the system.

Table 11: S3 dipswitch bank

Operation description	Switch position 1	Switch position 2	Switch position 3
2 ton	OFF	ON	OFF
3 ton	OFF	OFF	OFF
4 ton	OFF	ON	OFF
5 ton	OFF	OFF	OFF

Charging with gauges

⚠ CAUTION

Refrigerant charging must only be carried out by a qualified air conditioning contractor.

ⓘ **Note:** All pressures and subcool valves shown are with the compressor on high stage. The system must be charged with the compressor at full capacity.

All units include a cooling charging chart for the most common indoor application in upflow orientation. For all other cooling charging charts, see Table 13 to Table 16. You can also access these charts and heating mode service tables in the Service Application Data section at www.simplygettingthejobdone.com.

⚠ CAUTION

Compressor damage occurs if system is insufficiently charged. On new system installations, charge the system according to the *Tabular Data Sheet* for the matched coil and follow the guidelines in this manual.

To charge with gauges, follow these steps:

1. Before using the gauges, confirm that the gauges are accurate by comparing the gauges against a calibrated pressure gauge that has been calibrated against a national standard. If a calibrated pressure gauge is not available, place an R-454B virgin refrigerant container in a conditioned space long enough to come to temperature equilibrium with the surroundings. Then measure the temperature of the air and the pressure of the refrigerant and compare it to the following table:

   Table 12: R-454B saturation properties

Pressure (psig)	Tsat liquid (bubble) (°F)	Tsat vapor (dew)
100	34	37
110	39	41
125	46	48
135	50	52
150	56	58
160	60	62
175	65	67
190	70	72
205	75	77
225	80	83
240	85	87
260	90	92
280	95	97
300	100	102
325	106	108
345	110	112
370	115	117
395	120	122
420	125	127
450	130	132
480	135	137
510	140	142

2. Locate the applicable cooling chart in Table 13 to Table 16 for the indoor coil. Use the method outlined in to calculate the airflow, then consult the correct table and match the liquid pressure to that airflow.

Subcooling charging charts

ⓘ **Note:** An asterisk (*) on indoor match names is used in place of the cabinet width, refrigerant type, and metering device characters. Refer to the indoor unit manuals for the details on indoor unit nomenclature.

Table 13: Nominal 2 ton cooling charging chart for YH936/XH936 and JHC24*C or CT(F,M,U)30*C

Outdoor ambient DB (°F)	Indoor wet bulb (°F) at 80°F dry bulb			
	57	62	67	72
	Pressure (psig) and subcooling (°F) at liquid base valve			
55	187 (8)	189 (9)	191 (10)	194 (10)
60	203 (8)	207 (9)	209 (9)	212 (10)
65	219 (8)	224 (9)	227 (9)	229 (9)
70	235 (8)	242 (9)	244 (9)	247 (9)
75	251 (8)	259 (8)	262 (9)	265 (9)
80	273 (8)	278 (8)	282 (9)	285 (8)
85	294 (8)	298 (8)	301 (8)	304 (8)
90	316 (8)	317 (8)	321 (8)	323 (8)
95	338 (8)	336 (8)	340 (8)	343 (8)
100	364 (8)	363 (8)	367 (8)	369 (8)
105	391 (8)	390 (8)	394 (8)	396 (8)
110	414 (8)	414 (8)	418 (8)	422 (8)
115	438 (8)	439 (8)	443 (8)	449 (8)
120	467 (8)	468 (8)	471 (8)	476 (7)
125	496 (8)	497 (8)	500 (8)	503 (7)

Table 14: Nominal 3 ton cooling charging chart for YH936/XH936 and JHC(30,36)*D or CT(F,M,U)(30,36)*D

Outdoor ambient DB (°F)	Indoor wet bulb (°F) at 80°F dry bulb			
	57	62	67	72
	Pressure (psig) and subcooling (°F) at liquid base valve			
55	194 (11)	195 (11)	198 (12)	202 (12)
60	212 (11)	213 (11)	216 (12)	221 (12)
65	230 (11)	231 (11)	234 (12)	239 (12)
70	247 (11)	248 (11)	252 (11)	257 (12)
75	265 (11)	266 (12)	271 (11)	275 (12)
80	288 (11)	288 (12)	293 (12)	298 (12)
85	311 (11)	311 (12)	315 (12)	320 (12)
90	333 (12)	333 (12)	337 (12)	342 (12)
95	356 (12)	356 (12)	359 (12)	364 (12)
100	385 (12)	385 (12)	388 (12)	393 (12)
105	414 (12)	414 (12)	417 (12)	422 (12)
110	439 (13)	440 (13)	443 (13)	447 (12)
115	465 (13)	466 (13)	469 (13)	473 (12)
120	497 (13)	498 (13)	501 (13)	505 (12)
125	529 (13)	531 (13)	533 (13)	536 (13)

Table 15: Nominal 4 ton cooling charging chart for YH960/XH960 and JHC48*G or CT(F,M,U)60*G

Outdoor ambient DB (°F)	Indoor wet bulb (°F) at 80°F dry bulb			
	57	62	67	72
	Pressure (psig) and subcooling (°F) at liquid base valve			
55	193 (8)	195 (8)	196 (9)	202 (9)
60	208 (7)	210 (8)	211 (8)	216 (9)
65	222 (7)	226 (8)	226 (8)	231 (8)
70	237 (7)	241 (8)	241 (7)	245 (7)
75	252 (6)	257 (8)	256 (7)	260 (7)
80	275 (7)	279 (8)	279 (7)	283 (7)
85	299 (7)	301 (8)	303 (8)	307 (8)
90	322 (8)	323 (8)	326 (8)	330 (8)
95	346 (8)	345 (9)	350 (8)	354 (9)
100	374 (8)	372 (9)	377 (9)	381 (9)
105	402 (8)	400 (9)	404 (9)	408 (9)
110	433 (9)	424 (9)	429 (9)	435 (9)
115	464 (10)	448 (9)	455 (9)	461 (9)
120	489 (9)	479 (9)	484 (9)	489 (9)
125	514 (9)	510 (9)	513 (9)	518 (9)

Table 16: Nominal 5 ton cooling charging chart for YH960/XH960 and JHC60*H, JHC60*J, CT(F,M,U)60*H or CT(F,M,U)60*J

Outdoor ambient DB (°F)	Indoor wet bulb (°F) at 80°F dry bulb			
	57	62	67	72
	Pressure (psig) and subcooling (°F) at liquid base valve			
55	197 (11)	202 (12)	205 (13)	210 (14)
60	216 (11)	218 (12)	223 (13)	229 (14)
65	235 (11)	235 (11)	240 (12)	247 (14)
70	253 (11)	251 (11)	257 (12)	266 (13)
75	272 (11)	268 (11)	274 (12)	285 (13)
80	296 (12)	291 (11)	297 (12)	306 (13)
85	319 (12)	313 (11)	319 (12)	327 (13)
90	343 (12)	336 (11)	341 (12)	348 (13)
95	367 (12)	359 (11)	364 (12)	369 (12)
100	395 (12)	388 (11)	393 (12)	397 (12)
105	424 (12)	418 (12)	423 (12)	425 (12)
110	446 (12)	444 (12)	451 (13)	450 (12)
115	468 (12)	471 (12)	478 (13)	475 (12)
120	503 (12)	504 (12)	510 (13)	506 (12)
125	538 (13)	538 (13)	541 (13)	537 (12)

Instructing the owner

When installation and start-up is complete, instruct the owner on the following:

- Processing warranties or online registration
- Reviewing the *User's Information Manual*
- Operating and maintaining the unit correctly, how to start, stop, and adjust the temperature setting
- When applicable, instruct the owner that the compressor is equipped with stator heat to prevent the migration of refrigerant to the compressor during the OFF cycle. The heater is energized only when the unit is not operating. If the main switch is disconnected for long periods of shut down, do not attempt to start the unit until 8 h after the switch has been connected. This allows sufficient time for all liquid refrigerant to be driven out of the compressor.
- The installer must also instruct the owner on correct operation and maintenance of all other system components.

Maintenance and repair

Before you begin:

- The area must be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. **No Smoking** signs must be displayed.
- Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, and be non-sparking, adequately sealed, and intrinsically safe.
- Be aware that equipment malfunction may be due to refrigerant loss and potential leaks.
- If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment must be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.
- Initial safety check must include:

  * Ensure that capacitors are discharged to avoid the possibility of sparking.

  * Ensure that no live electrical components and wiring are exposed while charging, recovering or purging the system.

  * Ensure that there is continuity of earth bonding.
- Repair and maintenance to electrical components must include initial safety checks and component inspection procedures.
- During repairs to sealed components, all electrical supplies must be disconnected from the equipment being worked upon prior to any removal of sealed covers. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
- For sealed electrical components such as capacitors, only replace components with parts specified by the manufacturer. Using other parts may lead to the ignition of refrigerant in the atmosphere in the case of a leak.
- For compressor evacuation, ensure compressors and compressor oils are properly evacuated to remove any flammable refrigerants. The compressor body must not be heated by an open flame or other ignition sources to accelerate this process.
- Ensure that the recovery equipment is in good working order and suitable for recovering flammable refrigerants.
- Always recover the refrigerant charge into the correct recovery cylinders if venting is not allowed by local and national codes.
- Ensure that cylinders are labelled for the recovered refrigerant, and that they have pressure-relief valves and working shut-off valves.

⚠ CAUTION

Risk of fire

Ensure that the outlet for the vacuum pump is not near potential ignition sources and has ventilation available

It is important to maintain the unit correctly, adhere to the following:

- Do not allow dirt to accumulate on the outdoor coils or other parts in the air circuit. Clean the unit as often as necessary. Use a brush, vacuum cleaner attachment, or other suitable means.
- The outdoor fan motor bearings are permanently lubricated and do not require periodic oiling.
- If the coil needs to be cleaned, it must be washed with water or with Nu-Calgon Cal-Green (or equivalent). If using coil cleaner, follow the directions included with it. Rinse thoroughly with clean water after use. Do not use a high pressure power washer on the coil or fin damage may occur.
- The indoor coil and drain pan must be inspected and cleaned regularly to prevent odors and ensure adequate drainage. Refer to the furnace or air handler *Installation Manual* for filter and blower motor maintenance.

ⓘ **Note:** Refer to the furnace or air handler *Installation Manual* for filter and blower motor maintenance.

⚠ CAUTION

It is unlawful to knowingly vent, release or discharge refrigerant into the open air during repair, service, maintenance, or the final disposal of this unit.

Required procedures for A2L systems

The following procedures are required for A2L systems:

Table 17: A2L required procedures

Procedure	A2L
Safely remove refrigerant, following local and national codes.	Required
Purge circuit with inert gas (oxygen-free nitrogen).	Required
Evacuate the refrigerant.	Required
Repair the system and purge with nitrogen during brazing.	Required
Leak test and pressure test the unit.	Required
Evacuate the system.	Required
Charge the system.	Required

Decommissioning

Before you begin:
Before attempting the procedure, complete the following:

- Ensure that the technician is completely familiar with the equipment and all its detail.
- Ensure to safely recover all refrigerants.
- Take an oil and refrigerant sample, in case analysis is required before reusing the recovered refrigerant.
- Ensure that electrical power is available.
- Ensure that mechanical handling equipment is available, if required, for handling refrigerant cylinders.
- Ensure that all personal protective equipment is available and being used correctly.
- Ensure that the recovery process is supervised at all times by a competent person.
- Ensure that recovery equipment and cylinders conform to the appropriate standards.

Follow the steps below to ensure the unit is correctly and safely decommissioned:

1. Isolate the system electrically.
2. Connect a recovery machine to remove refrigerant from the system.
3. Ensure that the cylinder is situated on the scales before recovery takes place.
4. Start the recovery machine and operate in accordance with instructions provided with the machine.

   ⓘ **Note:**
   - Do not overfill cylinders to more than 80% volume liquid charge.
   - Do not exceed the maximum working pressure of the cylinder, even temporarily.

5. When the cylinders have been filled correctly and the process completed, ensure that the cylinders and the equipment are removed from the site promptly and that all isolation valves on the equipment are closed off.

   ⓘ **Note:** Do not charge recovered refrigerant into another refrigerating system unless it has been cleaned and checked.

Label the equipment stating that it has been decommissioned and emptied of refrigerant. Date and sign the label. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating that the equipment contains a flammable refrigerant.

Test input

Figure 17: Heat pump flow diagram

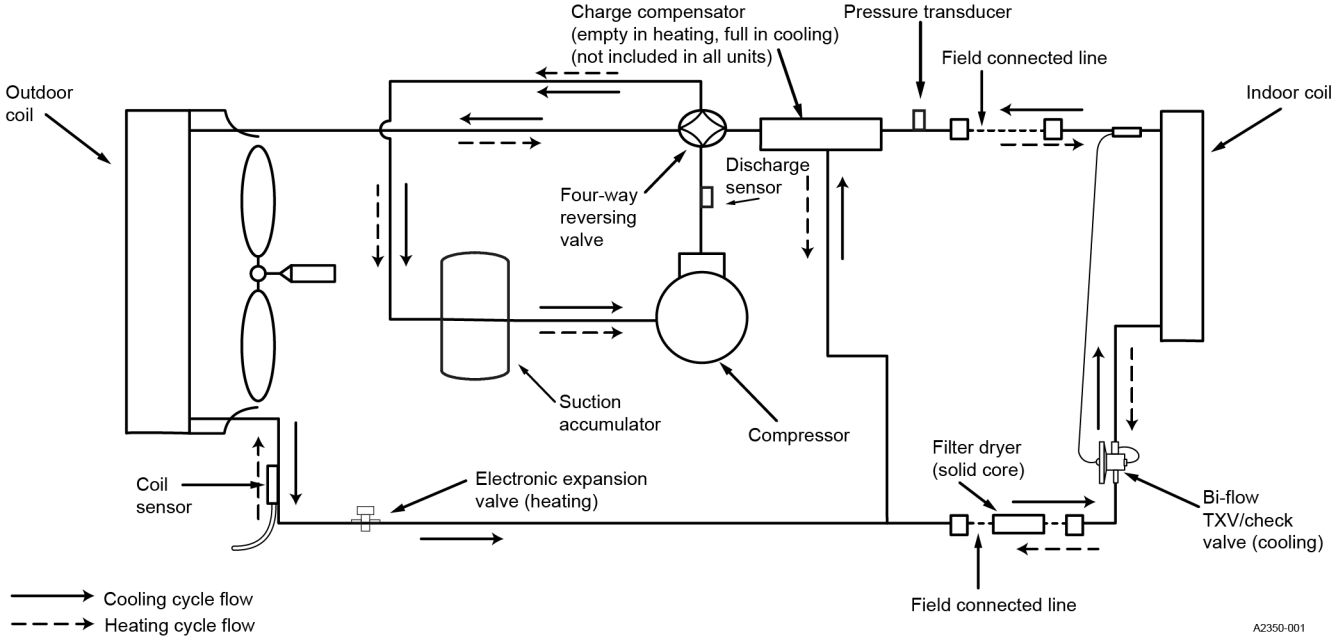
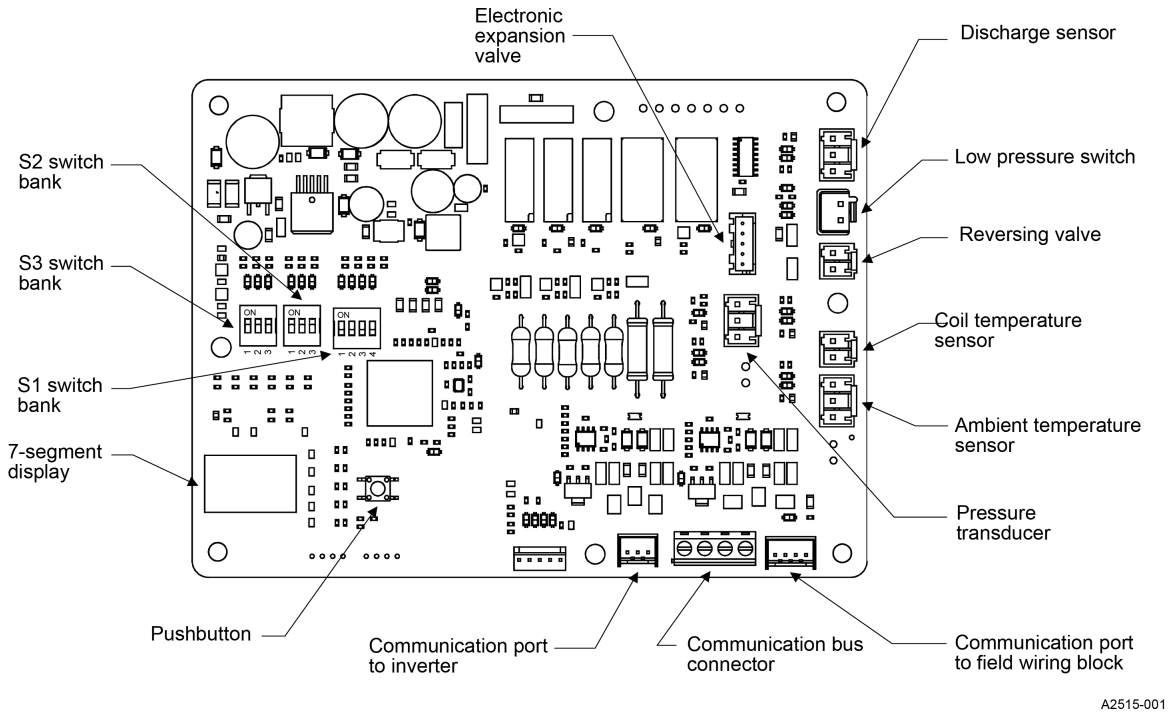


Figure 18: Defrost control module



System components and operation

Anti-short-cycle delay

The control includes a 5 min anti-short-cycle delay (ASCD) timer to prevent the compressor from short-cycling after a power or thermostat signal interruption. The ASCD timer is applied when the control is first powered from the indoor unit thermostat and immediately following the completion of a compressor run cycle. The compressor and the outdoor fan do not operate during the 5 min that the timer is active.

The ASCD timer can be bypassed by pressing the push button on the main control board for 0.5-3 seconds or more than 12 seconds.

Push button operation

The controller is equipped with a push button that facilitates both input and output operations. See Table 18 for detailed actions when the push button is pressed. While the push button is pressed the control will flash a dash on the middle 7-segment display once every second.

Table 18: Push button operation

Push duration (s)	No active call	Active call
0 - 0.5	No response	
0.5 - 3	• Display current/stored fault code(s) if present ⓘ **Note:** If a fault condition is active, the control will continue to display the active fault. It will not display stored faults until the active fault is cleared.	• Bypass anti-short cycling delay (ASCD) timer, or • Display compressor speed (Hz) for 5 seconds then outdoor fan speed in (RPM) for 5 seconds
3 - 7	Display current defrost mode	
7 - 12	• Clear fault codes and lockouts • Reset the 6 hour defrost timer	• Clear fault codes and lockouts • If no faults or lockouts are present, ignore the low-pressure switch (LPS) for 10 minutes • Reset the 6 hour defrost timer
>12	No response	• Bypass ASCD timer • Force defrost and energize Aux Heat if in heating mode and 4 minutes after start-up ⓘ **Note:** Forced defrost will continue for as long as the push button is pressed. Once released, defrost will end normally.

Status display

The controller provides status codes using the LED and 7-segment display. Status codes indicate a state of operation but do not indicate a fault. Status codes will not be displayed when a fault code is present.

Table 19: Status code display

Description	LED	Color	7-segment display 1	7-segment display 2	7-segment display 3
No power to control	OFF	OFF	OFF	OFF	OFF
Control normal operation – no call for compressor (Standby Mode)	2s ON / 2s OFF (“Heartbeat”)	Green	OFF	OFF	OFF
Control normal operation – in ASCD period (COOLING)	0.1 sec ON / 0.1 sec OFF	Green	OFF	OFF	OFF

Table 19: Status code display

Description	LED	Color	7-segment display 1	7-segment display 2	7-segment display 3
Control normal operation – in ASCD period (HEATING)	0.1 sec ON / 0.1 sec OFF	Amber	OFF	OFF	OFF
Control in Factory run test mode	OFF	OFF	OFF		
Push button actively pressed	OFF	OFF	OFF		OFF
Any fault code that would prevent the equipment from running	See Fault Code Table for list of fault codes				
No fault codes in memory	2 Flashes	Green	OFF	OFF	OFF
Fault code memory cleared	3 Flashes	Green	OFF	OFF	OFF
Cooling	ON	Green	OFF	OFF	
Quick cool	ON	Green	OFF		
Heating	ON	Amber	OFF	OFF	
Quick heat	ON	Amber	OFF		
Auxiliary Heat	ON	Amber	OFF		
Auxiliary Lockout	ON	Amber	OFF		
Emergency Heat	ON	Amber	OFF		
Defrost	ON	Amber	OFF		
Time Temp Defrost	ON	Amber	OFF		
Demand Defrost	ON	Amber	OFF		

Table 19: Status code display

Description	LED	Color	7-segment display 1	7-segment display 2	7-segment display 3
Sacrificial Defrost	ON	Amber	OFF		
Forced Defrost	ON	Amber	OFF		

Fault code display

The control provides fault codes via a display on the control board. Table 20 below describes the LED and 7-Segment displays during fault codes. The control will only display a single fault code on the LED and 7-Segment Displays. The control will display the fault code on the 7-Segment Displays repeatedly with a 2 second off period between repetitions of the fault code. If multiple fault codes are present at the same time, the 7-Segment Displays will display only the highest priority fault. The other active error(s) may be accessed via the pushbutton.

Status codes will not be displayed when a fault code is present.

Table 20: Fault codes

Description	LED*	7-segment display 1	7-segment display 2	7-segment display 3	Control response
CONTROL FAILURE	RED (solid)	-	0	0	Immediate shutdown
HPS OPEN		-	0	1	
HPS-NORMAL	2 RED flashes / 3 RED flashes	-	0	2	
HPS-DEFROST		-	0	3	
LOW SUCTION PRESSURE		-	0	4	
LOW VOLTAGE (<19VAC)	RED (solid)	-	0	5	Reduced performance
LOW VOLTAGE (<16VAC)		-	0	6	Lockout until voltage >19.5 VAC
COM ERROR INVERTER		-	0	7	Shutdown after >60 sec
COM ERROR TSTAT		-	0	8	
AMBIENT SENSOR SHORTED	2 RED flashes	-	0	9	Immediate shutdown
AMBIENT SENSOR OPEN		-	1	0	
COIL SENSOR SHORTED		-	1	1	
COIL SENSOR OPEN		-	1	2	
DISCHARGE LINE SENSOR SHORTED		-	1	3	
DISCHARGE LINE SENSOR OPEN		-	1	4	
PRESSURE TRANSDUCER LOW VOLTAGE		-	1	5	
PRESSURE TRANSDUCER HIGH VOLTAGE		-	1	6	
REVERSING VALVE NOT DETECTED		-	1	7	
HIGH DISCHARGE TEMP	2 RED flashes / 3 RED flashes	-	1	8	
LOW DISCHARGE TEMP		-	1	9	

Table 20: Fault codes

Description	LED*	7-segment display 1	7-segment display 2	7-segment display 3	Control response
OD AMBIENT < 55°F (Cooling Mode)	RED (solid)	-	2	1	Shutdown until OD ambient >55°F
HIGH SUPERHEAT	OFF	-	2	2	Record fault
LOW SUPERHEAT		-	2	3	
NORMAL OPERATION RESUMED (Walk away mode active)		-	2	4	Resume with normal operation
CHECK TEST MODE DIPSWITCH		-	2	5	Immediate shutdown
INV: COMP OVER CURRENT	RED (solid) 2 RED flashes / 3 RED flashes**	-	2	6	
INV: COMP MISALIGNMENT	RED (solid) / 2 RED flashes	-	2	7	
INV: COMP PHASE LOST		-	2	8	
INV: DC BUS UNDER VOLTAGE		-	2	9	Controlled shutdown ramp down to 0 Hz
INV: DC BUS OVER VOLTAGE		-	3	0	

Table 20: Fault codes

Description	LED*	7-segment display 1	7-segment display 2	7-segment display 3	Control response
INV: COMM FAULT	RED (solid)	-	3	1	Immediate shutdown
INV: AC INPUT OVER CURRENT	RED (solid) / 2 RED flashes	-	3	2	
INV: AC INPUT UNDER VOLTAGE		-	3	3	
INV: HIGH PRESSURE SWITCH PROTECT	RED (solid)	-	3	4	
INV: COMP IPM OVER TEMP	RED (solid) / 2 RED flashes	-	3	5	
INV: COMP SW OVER CURRENT		-	3	6	
INV: PFC OVER TEMP		-	3	7	
INV: FAN HW OVER CURRENT		-	3	8	
INV: FAN MISALIGNMENT		-	3	9	
INV: FAN PHASE LOST		-	4	0	
INV: FAN SW OVER CURRENT		-	4	1	
INV: EEPROM FAULT		-	4	2	
INV: CHIP SELF DIAGNOSE		-	4	3	
INV: ADC ABNORMAL		-	4	4	
INV: CRYSTAL FAULT		-	4	5	
INV: FAN START FAILURE		-	4	6	
INV: COMP START FAILURE		-	4	7	
INV: COMP AD BIAS		-	4	8	
INV: PFC HW PROTECT		-	4	9	
INV: COMP IPM SENSOR FAULT		-	5	0	
INV: PFC SENSOR FAULT		-	5	1	
INV: FAN IPM OVER TEMP		-	5	2	
INV: FAN IPM SENSOR FAULT		-	5	3	
INV: FAN AD BIAS FAULT		-	5	4	
INV: 4051/15V BIAS FAULT		-	5	5	

Table 20: Fault codes

Description	LED*	7-segment display 1	7-segment display 2	7-segment display 3	Control response
INV: SPEED LIMIT - COMP IPM OVER TEMP	Current Operation Status	-	5	6	Limit compressor speed
INV: SPEED REDUCE - COMP IPM OVER TEMP		-	5	7	
INV: SPEED LIMIT - FAN IPM OVER TEMP		-	5	8	
INV: SPEED REDUCE – FAN IPM OVER TEMP		-	5	9	
INV: SPEED LIMIT - PFC OVER TEMP		-	6	0	
INV: SPEED REDUCE - PFC OVER TEMP		-	6	1	
INV: SPEED LIMIT - COMP OVER CURRENT		-	6	2	
INV: SPEED REDUCE - COMP OVER CURRENT		-	6	3	
INV: SPEED LIMIT - AC OVER CURRENT		-	6	4	
INV: SPEED REDUCE - AC OVER CURRENT		-	6	5	
INV: SPD LIMIT & REDUCE – FAN OVER CURRENT		-	6	6	
INV: SPD LIMIT & REDUCE – DC VOLTAGE SAT		-	6	7	
DISCHARGE TEMP > 227°F	Current Operation Status	-	6	8	
ADR LIMIT EXCEEDED - SHUTDOWN	RED (solid)	-	6	9	Shut OD Unit Down
ID: A2L REFRIGERANT LEAK DETECTED AT ID UNIT	RED (solid)	-	7	2	Immediate Shutdown

Note:

*A solid RED LED indicates a fault; two RED flashes indicate a soft lockout; three RED flashes indicate a hard lockout.

**Overcurrent occuring 1-9 times will trigger a shutdown. After the 10th time it will trigger a hard lockout.

Note: If the system shuts down due to a fault, it will automatically attempt to restart after 5 minutes, provided the fault condition is no longer present.

If the system enters a soft lockout, it will attempt to restart after 1 hour. However, the soft lockout can be cleared earlier by using one of the following methods:

- Press the manual reset push button
- Cycle the 24V power to the control board

If the system enters a hard lockout, it will not restart automatically. It must be manually reset using one of the following methods:

- Press the manual reset push button
- Cycle the 24V power to the control board

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
00	CONTROL FAILURE	Program frozen or failure	Cycle 24 power to control board
		Under voltage	Check input power supply wires.
			Check input power supply and 24 VAC circuit before and during operation to verify voltage is within range given in manual (197 VAC to 252 VAC and >19).
			Check 24 VAC transformer tap for correct input power supply voltage selection.
		If fault remains.	Contact Technical Services.
01	HPS OPEN	Cooling Mode - Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.
		Cooling Mode - Reduced or no OD airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Cooling Mode - OD air temp out of range	Verify the outdoor ambient temperature is within the range listed in the IOM.
		Heating Mode - Reduced or no ID airflow	Check for dirty filter - clean or replace.
			Check blower motor operation and for airflow restrictions.
			Dirty ID coil.
			If attached to zoning system, ensure smallest zone can handle minimum cubic feet per minute (CFM) requirements.
			External static is too high - correct duct work.
		Heating Mode - Reduced or no ID airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Heating Mode - ID air temp out of range	Verify the ID ambient temperature is with the range listed in the IOM/ design parameters.
		Defrost - Reversing valve didn't switch	Verify proper valve wiring and actuation.
		Defrost - Coil sensor faulty	Verify coil sensor is plugged in and wires are in good condition.
			Check that the sensor is in correct location.
			Check sensor is securely fastened to the tube. Check that the sensor is well insulated and the insulation is intact
			Check temperature vs. resistance curve per Table 10.
		Pressure switch is disconnected from OD unit control board	Check high pressure switch connection on the outdoor board. Verify leads are not loose. Verify wires are are in good shape
		Pressure switch faulty	Ohm out the switch to confirm continuity when the system pressure is below 650 PSIG.
		Faulty EEV or restriction	Check EEV operation as superheat and/or subcooling will be high.
		System overcharged	Verify the system has the correct amount of refrigerant charge. Refer to the tables in the product Technical Guide.
		Loose or damaged wiring leads	Check wiring lead from switch to board.
		Loose connection	Check that the switch is plugged into board and the wire terminations are secure
		Faulty OD control board	If leads and sensor show no defects, board may be faulty and need replacement.
		Fault Remains	Contact Technical Services
02	HPS-NORMAL	See causes from error 01 "HPS OPEN"	
03	HPS-DEFROST	See causes from error 01 "HPS OPEN"	

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
04	LOW SUCTION PRESSURE	Heating Mode - Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.
		Heating Mode - Reduced or no OD airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Heating Mode - OD air temp out of range	Verify the outdoor ambient temperature is within the range listed in the IOM.
		Cooling Mode - Reduced or no ID airflow	Check for dirty filter - clean or replace.
			Check blower motor operation and for airflow restrictions.
			Dirty ID coil.
			If attached to zoning system, ensure smallest zone can handle minimum cubic feet per minute (CFM) requirements.
			External static is too high - correct duct work.
		Cooling Mode - Reduced or no ID airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Cooling Mode - ID air temp out of range	Verify the ID ambient temperature is with the range listed in the IOM/ design parameters.
		Pressure switch is disconnected from OD unit control board	Check high pressure switch connection on the outdoor board. Verify leads are not loose. Verify wires are are in good shape
		Incorrect installation	Check that switch is properly seated and torqued down and schrader valve is depressed
		Pressure switch faulty	Ohm out the switch to confirm continuity when the system pressure is below 650 PSIG.
		Faulty EEV or restriction	Check EEV operation as superheat and/or subcooling will be high.
		System undercharged	Verify the system has the correct amount of refrigerant charge. Refer to the tables in the product Technical Guide.
		Loose or damaged wiring leads	Check wiring lead from switch to board.
		Loose connection	Check that the switch is plugged into board and the wire terminations are secure
		Faulty OD control board	If leads and sensor show no defects, board may be faulty and need replacement.
		Fault Remains	Contact Technical Services
05	LOW VOLTAGE (<19VAC)	Supplied control power is under voltage	Check input 24 VAC circuit before and during operation to verify voltage is within range.
			Check 24 VAC transformer tap for correct input power supply voltage selection.
		Faulty OD control board	If proper voltage is being applied, board may be faulty and need replacement.
		Fault Remains	Contact Technical Services
06	LOW VOLTAGE (<16VAC)	See causes from error 05 "LOW VOLTAGE (<19VAC)"	
07	COM ERROR INVERTER	Loose or damaged wiring	Check wiring from OD control to Inverter.
		Low voltage	Check that COM wires are secure and 24V power is applied to the board
		Loose or faulty power wiring	Check that inverter has power applied and the voltage is within tolerance
		Damaged OD control board	Remove 24V power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Damaged inverter board	Remove high voltage power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Fault Remains	Contact Technical Services

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
08	COM ERROR TSTAT	Refrigeration mitigation control alarm	Check if the mitigation system is in alarm. Certain wiring configurations will cut thermostat communication in the event of A2L detection. Refer to the indoor unit *Installation Manual* for further instructions.
		Loose or damaged wiring	Check all wiring between OD control, low voltage terminal strip, indoor system and thermostat.
		Low voltage	Check that COM wires are secure and 24V power is applied to the board
		Loose or faulty power wiring	Check that inverter has power applied and the voltage is within tolerance
		Damaged OD control board	Remove 24V power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Damaged inverter board	Remove high voltage power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Fault Remains	Contact Technical Services
09	AMBIENT SENSOR SHORTED	Failed thermistor	Check temperature vs. resistance curve per Table 10.
		Loose or damaged wiring leads	Check wiring lead from sensor to board.
		Loose connection	Check that the sensor is plugged into board and the wire terminations are secure
		Faulty OD control board	If leads and sensor show no defects, board may be faulty and need replacement.
		Fault Remains	Contact Technical Services
10	AMBIENT SENSOR OPEN	See causes from error 09 "AMBIENT SENSOR SHORTED"	
11	COIL SENSOR SHORTED	See causes from error 09 "AMBIENT SENSOR SHORTED"	
12	COIL SENSOR OPEN	See causes from error 09 "AMBIENT SENSOR SHORTED"	
13	DISCHARGE LINE SENSOR SHORTED	See causes from error 09 "AMBIENT SENSOR SHORTED"	
14	DISCHARGE LINE SENSOR OPEN	See causes from error 09 "AMBIENT SENSOR SHORTED"	
15	PRESSURE TRANSDUCER LOW VOLTAGE	Loose or damaged wiring harness	Check harness for continuity.
		Loose connection	Verify harness is plugged into the control board and pressure transducer and wire terminations are secure. Verify that the rubber seals are properly seated.
		Faulty OD control board	If supply voltage across BLK and RED/WHT does not read 4.5 VDC to 5.5 VDC replace OD control board.
		Failed transducer	If voltage across BLK and RED/WHT is within a tolerance of 4.5 VDC to 5.5 VDC and the voltage across WHT and BLK does not read between 0.5 VDC to 4.5 VDC replace sensor.
		Failed transducer	Verify voltage output is correct according to the voltage to pressure chart
		Faulty OD control board	If voltage across WHT and BLK reads between 0.5 VDC to 4.5 VDC but fault still exists, replace OD control board.
		Fault Remains	Contact Technical Services
16	PRESSURE TRANSDUCER HIGH VOLTAGE	See causes from error 15 "PRESSURE TRANSDUCER LOW VOLTAGE"	
17	REVERSING VALVE NOT DETECTED	Loose or damaged wiring harness	Check harness for continuity.
		Loose connection	Verify harness is plugged into the control board and RV and wire terminations are secure.
		Failed reversing valve	Check RV solenoid for continuity
		Faulty OD control board	If leads and solenoid show no defects, board may be faulty and need replacement.
		Fault Remains	Contact Technical Services

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
18	HIGH DISCHARGE TEMP	Outside Envelope	Verify system is operating within indoor/outdoor temperature envelop
		Incorrect system charge	Verify the system has the correct amount of refrigerant charge. Refer to the tables in the product Technical Guide.
		Heating Mode - Reduced or no ID airflow	Check for dirty filter - clean or replace.
			Check blower motor operation and for airflow restrictions.
			Dirty ID coil.
			If attached to zoning system, ensure smallest zone can handle minimum cubic feet per minute (CFM) requirements.
			External static is too high - correct duct work.
		Cooling Mode - Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.
		Cooling Mode - Reduced or no OD airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Cooling Mode - OD air temp out of range	Verify the outdoor ambient temperature is within the range listed in the IOM.
		Failed thermistor	Check temperature vs. resistance curve per Table 10.
		Loose or damaged wiring leads	Check wiring lead from sensor to board.
19	LOW DISCHARGE TEMP	Incorrect installation	Check sensor is securely fastened to the discharge tube. Check that the sensor is well insulated and the insulation is intact
		Outside Envelope	Verify system is operating within indoor/outdoor temperature envelop
		Incorrect system charge	Verify the system has the correct amount of refrigerant charge. Refer to the tables in the product Technical Guide.
		Cooling Mode - Reduced or no ID airflow	Check for dirty filter - clean or replace.
			Check blower motor operation and for airflow restrictions.
			Dirty ID coil.
			If attached to zoning system, ensure smallest zone can handle minimum cubic feet per minute (CFM) requirements.
			External static is too high - correct duct work.
		Heating Mode - Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.
		Heating Mode - Reduced or no OD airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Heating Mode - OD air temp out of range	Verify the outdoor ambient temperature is within the range listed in the IOM.
		Failed thermistor	Check temperature vs. resistance curve per Table 10.
		Loose or damaged wiring leads	Check wiring lead from sensor to board.
21	OD AMBIENT < 55°F (Cooling Mode)	Outside Envelope	Verify system is operating within outdoor temperature envelop
		If ambient temperature is >55°F (+/-2°F), check for failed sensor	Check temperature vs. resistance curve per Table 10.

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
22	HIGH SUPERHEAT	See causes from error 15 "PRESSURE TRANSDUCER LOW VOLTAGE"	
		See causes from error 18 "HIGH DISCHARGE TEMP"	
		Improperly functioning OD EEV	Check coil windings. White/Red, Orange/Red, Yellow/Red, and Blue/Red should each read between 42 ohms and 50 ohms.
			Check 12 VDC output signal from OD control board.
		Run time	Verify system has been running for at least 30 minutes and superheat has leveled out
		Restriction in system	Check for response by manually adjusting superheat with EEV service tool
		Faulty EEV or solenoid	Check for response by manually adjusting superheat with EEV service tool. If superheat does not change, new EEV may be required or there may be a restriction somewhere in the system.
		Reduced or no ID airflow	Check for dirty filter - clean or replace.
			Check blower motor operation and for airflow restrictions.
			Dirty ID coil.
			If attached to zoning system, ensure smallest zone can handle minimum cubic feet per minute (CFM) requirements.
			External static is too high - correct duct work.
		Reduced or no ID airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		ID air temp out of range	Verify the ID ambient temperature is with the range listed in the IOM/ design parameters.
23	LOW SUPERHEAT	See causes from error 15 "PRESSURE TRANSDUCER LOW VOLTAGE"	
		See causes from error 19 "LOW DISCHARGE TEMP"	
		Improperly functioning OD EEV	Check coil windings. White/Red, Orange/Red, Yellow/Red, and Blue/Red should each read between 42 ohms and 50 ohms.
		Run time	Verify system has been running for at least 30 minutes and superheat has leveled out
		Faulty EEV or solenoid	Check for response by manually adjusting superheat with EEV service tool. If superheat does not change, new EEV may be required or there may be a restriction somewhere in the system.
		Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.
		Reduced or no OD airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		OD air temp out of range	Verify the outdoor ambient temperature is within the range listed in the IOM.
24	NORMAL OPERATION RESUMED (Walk away mode active)	System left in service mode	System will revert back to normal operation after 24 hours in service mode. Service mode can be exited by changing dip switch on the control board or through the communicating thermostat
25	CHECK TEST MODE DIPSWITCH	System left in test mode	System will revert back to normal operation after 24 hours in test mode. Test mode can be exited by changing dip switch on the control board or through the communicating thermostat

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
26	INV: COMP OVER CURRENT	Incorrect refrigerant charge.	Verify the system has the correct amount of refrigerant charge. Refer to the tables in the product Technical Guide.
		Compressor is operating outside the allowed operational envelope.	Inverter reduces speed to a lower compressor speed. (High ambient conditions.) (If compressor speed is reduced in moderate ambient conditions, check the deflector shield for a blockage or debris against the inverter heat sink.)
		Incoming power supply voltage.	Check voltage versus unit rating plate for allowable range.
		Loose or incorrect wire connections.	Check incoming power leads and leads to the compressor plug and at inverter drive.
		Phase imbalance.	Check compressor winding resistance at the compressor terminals. 3 ton - 0.417Ω 5 ton - 0.405Ω
		Cooling Mode - Reduced or no OD airflow	Verify outdoor coil is clean. Verify fan is functioning. Verify there is airflow through the coil.
		Cooling Mode - Reduced or no OD airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Cooling Mode - OD air temp out of range	Verify the outdoor ambient temperature is within the range listed in the IOM.
		Heating Mode - Reduced or no ID airflow	Check for dirty filter - clean or replace.
			Check blower motor operation and for airflow restrictions.
			Dirty ID coil.
			If attached to zoning system, ensure smallest zone can handle minimum cubic feet per minute (CFM) requirements.
			External static is too high - correct duct work.
		Heating Mode - Reduced or no ID airflow due to motor limits	Check motor current against limits.
			Check input voltage to ensure within range.
		Heating Mode - ID air temp out of range	Verify the ID ambient temperature is with the range listed in the IOM/ design parameters.
		Defrost - Reversing valve didn't switch	Verify proper valve wiring and actuation.
		Defrost - Coil sensor faulty	Verify coil sensor is plugged in and wires are in good condition.
			Check that the sensor is in correct location.
			Check sensor is securely fastened to the tube. Check that the sensor is well insulated and the insulation is intact
			Check temperature vs. resistance curve per Table 10.
		Inverter internal damage.	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		Compressor internal damage.	Replace compressor. (Validate the fix. If the issue is persistent, reinstall the original compressor, and go to the last step.)
		If fault remains.	Contact Technical Services.
27	INV: COMP MISALIGNMENT	Loose or incorrect wire connections.	Check incoming power leads and leads to the compressor plug.
		Phase imbalance.	Check compressor winding resistance at the compressor terminals. 3 ton - 0.417Ω 5 ton - 0.405Ω
		Interal Drive Error	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Inverter internal damage.	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		Compressor internal damage.	Replace compressor. (Validate the fix. If the issue is persistent, reinstall the original compressor.)
		If fault remains	Contact Technical Services.
28	INV: COMP PHASE LOST	See causes from error 27 "INV: COMP MISALIGNMENT"	
29	INV: DC BUS UNDER VOLTAGE	Low supply line voltage (less than 187 VAC).	Check supply voltage to the outdoor unit. (If low, contact utility provider.)
		Loose wire in control box area. (Breaker terminal not secure.)	Loose wire: Check for loose wire in outdoor unit. Verify bench circuit is sized right.
		Validate voltage (230 VAC).	Check supply voltage to the Outdoor Unit. (If low, contact utility provider.)
		Inverter internal damage.	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
30	INV: DC BUS OVER VOLTAGE	High supply line voltage (greater than 253 VAC).	Check supply voltage to the outdoor unit. (If high, contact utility provider.)
		Interal Drive Error	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Inverter internal damage.	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
31	INV: COMM FAULT	Broken or damaged communication harness.	Check harness for continuity.
		Loose or disconnected communication harness.	Validate harness connections at board. Verify wire termination are secure.
		Radio or electrical noise.	Verify wire routing matches original factory routing
		Inverter internal damage.	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
32	INV: AC INPUT OVER CURRENT	See causes from error 26 "INV: COMP OVER CURRENT"	
		Reduced input voltage	Check the line voltage if it is < 187 VAC.
		Distorted input voltage	Check the line voltage for noise. Call an electrician or the power company if noise is found.
		High compressor load	Check the compressor is operating with in specified limits.
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
33	INV: AC INPUT UNDER VOLTAGE	Low input voltage	Check the line voltage if it is < 187 VAC (if low, contact utility provider).
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
35	INV: COMP IPM OVER TEMP	Outdoor airflow is too low or off	Verify proper airflow over the drive heat sink. Verify air duct behind control box is intact and free from debris.
		Outdoor airflow is too low or off in “Cooling Mode.”	Check outdoor coil for clogging (ice or debris), and clean or de-ice if necessary. Troubleshoot outdoor fan motor and make sure it is working.
		Fan motor internal damage.	Replace outdoor fan motor. (Validate the fix. If the issue is persistent, reinstall the original OD fan motor)
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
36	INV: COMP SW OVER CURRENT	See causes from error 26 "INV: COMP OVER CURRENT"	
37	INV: PFC OVER TEMP	See causes from error 35 "INV: COMP IPM OVER TEMP"	
38	INV: FAN HW OVER CURRENT	Sudden supply voltage change.	Check supply power voltage to the outdoor unit inverter.
		Sudden load change on the fan motor.	Inspect outdoor fan motor and blade for damage. (Ensure they are in good working order.)
		Loose or incorrect fan motor wiring.	Check outdoor fan motor connectors and harness.
		Phase imbalance.	Check outdoor fan winding resistance or miswire of the OD fan plug at the OD fan terminals.
		Interal Drive Error	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Fan motor internal damage.	Replace outdoor fan motor. (Validate the fix. If the issue is persistent, reinstall the original OD fan motor)
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
39	INV: FAN MISALIGNMENT	Loose or incorrect fan motor wiring.	Check outdoor fan motor connectors and harness.
		Outdoor fan blade restricted.	Check outdoor fan blade. Check for ice build up.
		Outdoor fan blade bent or out of balance.	Check outdoor fan blade is intact and spins freely
		Interal Drive Error	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Fan motor internal damage.	Replace outdoor fan motor. (Validate the fix. If the issue is persistent, reinstall the original OD fan motor)
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
40	INV: FAN PHASE LOST	Loose or incorrect fan motor wiring.	Check outdoor fan motor connectors and harness.
		Phase imbalance.	Check outdoor fan winding resistance or miswire of the OD fan plug at the OD fan terminals.
		Interal Drive Error	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Fan motor internal damage.	Replace outdoor fan motor. (Validate the fix. If the issue is persistent, reinstall the original OD fan motor)
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
41	INV: FAN SW OVER CURRENT	See causes from error 38 "INV: FAN HW OVER CURRENT"	
42	INV: EEPROM FAULT	Digital Signal Processor self-check	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Incorrect input voltage	Check power supplied to the inverter is between 187 and 253 VAC
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
43	INV: CHIP SELF DIAGNOSE	Digital Signal Processor self-check	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Incorrect input voltage	Check power supplied to the inverter is between 187 and 253 VAC
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
44	INV: ADC ABNORMAL	See causes from error 27 "INV: COMP MISALIGNMENT"	
45	INV: CRYSTAL FAULT	Digital Signal Processor self-check	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Incorrect input voltage	Check power supplied to the inverter is between 187 and 253 VAC
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
46	INV: FAN START FAILURE	See causes from error 39 "INV: FAN MISALIGNMENT"	
47	INV: COMP START FAILURE	See causes from error 27 "INV: COMP MISALIGNMENT"	
48	INV: COMP AD BIAS	See causes from error 27 "INV: COMP MISALIGNMENT"	
49	INV: PFC HW PROTECT	See causes from error 26 "INV: COMP OVER CURRENT"	
		See causes from error 38 "INV: FAN HW OVER CURRENT"	
50	INV: COMP IPM SENSOR FAULT	Temperature sensor on the drive is potentially faulty	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Incorrect input voltage	Check power supplied to the inverter is between 187 and 253 VAC
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
51	INV: PFC SENSOR FAULT	Temperature sensor on the drive is potentially faulty	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Incorrect input voltage	Check power supplied to the inverter is between 187 and 253 VAC
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
52	INV: FAN IPM OVER TEMP	See causes from error 38 "INV: FAN HW OVER CURRENT"	
		Outdoor airflow is too low or off	Verify proper airflow over the drive heat sink. Verify air duct behind control box is intact and free from debris.
		System is operating outside the allowed operational envelope.	Inverter reduces speed to a lower fan speed.
53	INV: FAN IPM SENSOR FAULT	Temperature sensor on the drive is potentially faulty	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Incorrect input voltage	Check power supplied to the inverter is between 187 and 253 VAC
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
54	INV: FAN AD BIAS FAULT	See causes from error 39 "INV: FAN MISALIGNMENT"	

Table 21: Troubleshooting

Error code	Error description	Possible cause	Solution
55	INV: 4051/15V BIAS FAULT	Internal system error	Remove power to drive for 2 min or until LEDs on drive are off. Reapply power.
		Incorrect input voltage	Check power supplied to the inverter is between 187 and 253 VAC
		Faulty inverter drive	Change out the inverter drive. (Validate the fix. If the issue is persistent, reinstall the original inverter drive.)
		If fault remains.	Contact Technical Services.
56	INV: SPEED LIMIT - COMP IPM OVER TEMP	See causes from error 26 "INV: COMP OVER CURRENT"	
57	INV: SPEED REDUCE - COMP IPM OVER TEMP	See causes from error 26 "INV: COMP OVER CURRENT"	
58	INV: SPEED LIMIT - FAN IPM OVER TEMP	See causes from error 38 "INV: FAN HW OVER CURRENT"	
59	INV: SPEED REDUCE – FAN IPM OVER TEMP	See causes from error 38 "INV: FAN HW OVER CURRENT"	
60	INV: SPEED LIMIT - PFC OVER TEMP	See causes from error 26 "INV: COMP OVER CURRENT"	
		See causes from error 38 "INV: FAN HW OVER CURRENT"	
61	INV: SPEED REDUCE - PFC OVER TEMP	See causes from error 26 "INV: COMP OVER CURRENT"	
		See causes from error 38 "INV: FAN HW OVER CURRENT"	
62	INV: SPEED LIMIT - COMP OVER CURRENT	See causes from error 26 "INV: COMP OVER CURRENT"	
63	INV: SPEED REDUCE - COMP OVER CURRENT	See causes from error 26 "INV: COMP OVER CURRENT"	
64	INV: SPEED LIMIT - AC OVER CURRENT	See causes from error 32 "INV: AC INPUT OVER CURRENT"	
65	INV: SPEED REDUCE - AC OVER CURRENT	See causes from error 32 "INV: AC INPUT OVER CURRENT"	
66	INV: SPD LIMIT & REDUCE – FAN OVER CURRENT	See causes from error 38 "INV: FAN HW OVER CURRENT"	
67	INV: SPD LIMIT & REDUCE – DC VOLTAGE SAT	See causes from error 32 "INV: AC INPUT OVER CURRENT"	
68	DISCHARGE TEMP > 227°F	See causes from error 18 "HIGH DISCHARGE TEMP"	
69	ADR LIMIT EXCEEDED - SHUTDOWN	The power demand is outside the specified limits set by the utility provider.	System will remain shut down until demand response is removed or when the system setpoint threshold is exceeded. Contact utility provider for details on demand response application.
72	ID: A2L REFRIGERANT LEAK DETECTED AT ID UNIT	Refrigerant leak has been detected	Refer to indoor IOM for further instructions

Table 22: Thermistor resistance vs. temperature

Temp °C	Temp °F	Resistance		Temp °C	Temp °F	Resistance		Temp °C	Temp °F	Resistance
-40	-40.0	336000		22	71.6	11418		84	183.2	1104
-39	-38.2	314490		23	73.4	10921		85	185.0	1070
-38	-36.4	294520		24	75.2	10449		86	186.8	1037
-37	-34.6	275970		25	77.0	10000		87	188.6	1005
-36	-32.8	258730		26	78.8	9571		88	190.4	974
-35	-31.0	242700		27	80.6	9164		89	192.2	944
-34	-29.2	227610		28	82.4	8776		90	194.0	915
-33	-27.4	213570		29	84.2	8407		91	195.8	889
-32	-25.6	200510		30	86.0	8056		92	197.6	861
-31	-23.8	188340		31	87.8	7720		93	199.4	836
-30	-22.0	177000		32	89.6	7401		94	201.2	811
-29	-20.2	166342		33	91.4	7096		95	203.0	787
-28	-18.4	156404		34	93.2	6806		96	204.8	764
-27	-16.6	147134		35	95.0	6530		97	206.6	742
-26	-14.8	138482		36	96.8	6266		98	208.4	721
-25	-13.0	130402		37	98.6	6014		99	210.2	700
-24	-11.2	122807		38	100.4	5774		100	212.0	680
-23	-9.4	115710		39	102.2	5546		101	213.8	661
-22	-7.6	109075		40	104.0	5327		102	215.6	643
-21	-5.8	102868		41	105.8	5117		103	217.4	626
-20	-4.0	97060		42	107.6	4918		104	219.2	609
-19	-2.2	91588		43	109.4	4727		105	221.0	592
-18	-0.4	86463		44	111.2	4544		106	222.8	576
-17	1.4	81662		45	113.0	4370		107	224.6	561
-16	3.2	77162		46	114.8	4203		108	226.4	546
-15	5.0	72940		47	116.6	4042		109	228.2	531
-14	6.8	68957		48	118.4	3889		110	230.0	517
-13	8.6	65219		49	120.2	3743		111	231.8	503
-12	10.4	61711		50	122.0	3603		112	233.6	489
-11	12.2	58415		51	123.8	3469		113	235.4	476
-10	14.0	55319		52	125.6	3340		114	237.2	463
-9	15.8	52392		53	127.4	3217		115	239.0	450
-8	17.6	49640		54	129.2	3099		116	240.8	437
-7	19.4	47052		55	131.0	2986		117	242.6	425

Table 22: Thermistor resistance vs. temperature

Temp °C	Temp °F	Resistance		Temp °C	Temp °F	Resistance		Temp °C	Temp °F	Resistance
-6	21.2	44617		56	132.8	2878		118	244.4	413
-5	23.0	42324		57	134.6	2774		119	246.2	401
-4	24.8	40153		58	136.4	2675		120	248.0	390
-3	26.6	38109		59	138.2	2579		121	249.8	379
-2	28.4	36182		60	140.0	2488		122	251.6	369
-1	30.2	34367		61	141.8	2400		123	253.4	359
0	32.0	32654		62	143.6	2315		124	255.2	349
1	33.8	31030		63	145.4	2235		125	257.0	340
2	35.6	29498		64	147.2	2157		126	258.8	332
3	37.4	28052		65	149.0	2083		127	260.6	323
4	39.2	26686		66	150.8	2011		128	262.4	315
5	41.0	25396		67	152.6	1943		129	264.2	308
6	42.8	24171		68	154.4	1876		130	266.0	300
7	44.6	23013		69	156.2	1813		131	267.8	293
8	46.4	21918		70	158.0	1752		132	269.6	285
9	48.2	20883		71	159.8	1693		133	271.4	278
10	50.0	19903		72	161.6	1637		134	273.2	272
11	51.8	18972		73	163.4	1582		135	275.0	265
12	53.6	18090		74	165.2	1530		136	276.8	259
13	55.4	17255		75	167.0	1480		137	278.6	253
14	57.2	16464		76	168.8	1431		138	280.4	247
15	59.0	15714		77	170.6	1385		139	282.2	241
16	60.8	15000		78	172.4	1340		140	284.0	235
17	62.6	14323		79	174.2	1297		141	285.8	230
18	64.4	13681		80	176.0	1255		142	287.6	224
19	66.2	13071		81	177.8	1215		143	289.4	219
20	68.0	12493		82	179.6	1177		144	291.2	214
21	69.8	11942		83	181.4	1140		145	293.0	209

Adaptive defrost operation

The system uses an adaptive defrost algorithm. The system stores four unique settings that allow the system to defrost differently depending on the selected setting, Terminate Temperatures. This is done by changing the terminate temperature at which the defrost is terminated. This selection is made through the service menu on the Smart Home Control (S1-TSHC510), see the thermostat manual for details. The default temperature is 50°F.

If 6 h of Compressor Run Time (accumulated compressor runtime during a heating call) elapse without a defrost cycle, a defrost cycle is initiated, unless the coil temperature is above the inhibit temperature of 32°F. The system will end the defrost at the terminate temperature, the same as a normal defrost. The system will reset the 6 hour oil return timer if a defrost is initiated.

Defrost enable temperature

The defrost enable temperature is 32°F. If the coil temperature is above 32°F and the compressor is active, the system does not accumulate defrost run time, but it does accumulate Compressor Run Time for the purpose of running the 6 h defrost. If the coil temperature is below 32°F and the compressor is active, the system accumulates Defrost Run Time and Compressor Run Time (for the purpose of running the 6 h defrost).

NOTICE

The defrost run time and compressor run time are two separate timers and will work independently of one another.

Defrost calibration mode

The system is considered un-calibrated when power is applied to the system and/or if a successful calibration has not been completed. All defrost calibration modes are cleared when power is applied to the system. Calibration

of the system occurs after a defrost cycle to ensure that there is not ice on the coil. During calibration, the temperature of both the coil and ambient sensors are measured to establish a Frost Free DeltaT (FFD), which is (AmbT-CoilT). The Frost Free DeltaT will be a different value depending on what speed the compressor is operating at, what indoor conditions exist, and what outdoor conditions exist.

When the system is in an un-calibrated state, the system initiates a sacrificial defrost after 31 min of accumulated compressor runtime in heating mode with coil temperature below 32°F (Defrost Run Time). The defrost cycle terminates if the coil sensor reaches the selected termination temperature or after a 12 min defrost (Defrost Cycle Time). Once the sacrificial defrost has terminated, the system commands the compressor to return to the speed that the compressor was running immediately before initiating the defrost. This speed is called the Calibrated Compressor Speed. The system runs this speed during calibration mode. Upon completion of the calibration mode, the system re-enters normal operation in the same location it was before the defrost. A clear coil (non-iced condition) is established by averaging coil temperature readings and the outdoor ambient temperature readings once a minute for 4 min, starting on the 5th minute (stabilized coil condition, allowing system pressures and temperatures to stabilize) following termination of the last defrost. At that point, the Frost Free DeltaT and the Outdoor Calibrated Ambient Temperatures are stored. From this, a linear curve Frost Free Curve is developed based on the Calibrated Ambient Temperature, Current Ambient Temperature, Frost Free DeltaT, and Defrost DeltaT Change. This FFC curve is the curve the system will use for the next defrost cycle. The current ambient temperature will still be a variable and change the FFC value as the ambient temperature changes until the next defrost occurs.

As the ambient temperature changes, a slope of 1 F Defrost DeltaT Change for every 8 F ambient change is used to adjust the detection of frost accumulation.

If a heating call ends during the process re-evaluating the clear coil temperature, it utilizes the previously stored averaged values from the previous cycle. Do not clear the utilized value until the four values are averaged and that value is ready to populate the utilized value. If no previously stored averaged values exist, the system remains un-calibrated and attempts calibration at the next defrost, depending on the terminating condition.

After initial calibration has been completed, the system prevents a defrost occurrence for 31 min of accumulated runtime to avoid unnecessary defrost operation due to system transient conditions. During a Defrost Cycle the system indicates the current mode of the defrost operation on the outdoor display. While in calibration mode the outdoor display indicates DEFROST CAL (ACTIVE).

Defrost initiation

To activate a defrost sequence, the O communication input must not be active and the coil temperature must be below 32°F. When these conditions are met, the defrost run time timer tracks the compressor runtime, and accumulates Defrost Run Time in the heating mode.

If the coil temperature is above 32°F, the Defrost Run Time timer is not cleared, and does not accumulate run time. If the coil temperature is above the selected Defrost Temp (termination temperature), the Defrost Run Time timer is cleared. If the O communication input is active, the Defrost Run Time timer is cleared.

Time/temperature defrost mode

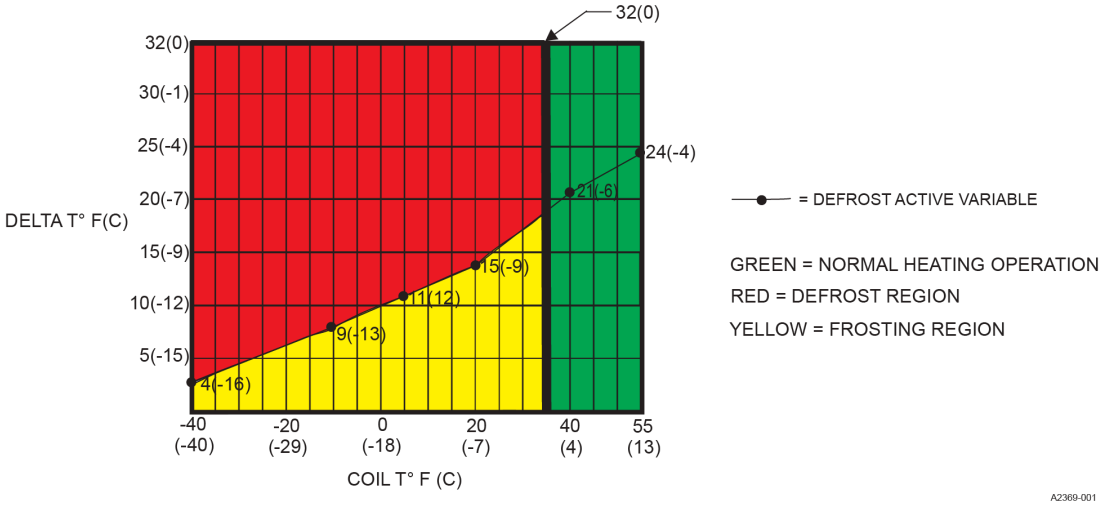
The system enters Time/Temperature Defrost Mode if the last defrost was terminated based on Defrost Cycle Time and the CoilT is < 32°F for > 4 min. When the Defrost Run Time timer reaches 31 min, the defrost operation is initiated immediately. At that time, the system records the compressor speed as the Calibrated Compressor Speed: this is used during the calibration mode of the defrost algorithm. Depending on how the system exits the new defrost determines which defrost mode the system will remain or enter.

During a Defrost Cycle the system indicates the current mode of the defrost operation on the outdoor display. While in a Time Temperature Defrost the outdoor display indicates DEFROST TT (ACTIVE).

Demand defrost mode

The system enters Demand Defrost Mode if the last defrost was terminated based on Defrost Temp (Termination Temperature) or the last defrost was terminated based on Defrost Cycle Time and the CoilT > 32°F for > 4 min. When the Defrost Run Time timer reaches 31 min, the defrost operation is initiated by Frost Detection. At the time of initiation, the system records the compressor speed as the Calibrated Compressor Speed: this is used during the calibration mode of the defrost algorithm.

Figure 19: Defrost operation curves (variables - defrost active variable)



Defrost mode

The defrost mode is equivalent to the cooling mode except that the outdoor fan motor is de-energized.

If the call for heating is removed from the control during the defrost cycle, the system terminates the defrost cycle. The system also stops the Defrost Cycle Timer but does not reset it. When the system receives another call for compressor heating, it restarts the defrost cycle and the Defrost Cycle Timer at the point at which the call for heating was removed, if the conditions requiring a defrost still remain (coil temperature is below 32°F).

The system remembers what compressor speed and where in the operational algorithm the system is being operated before initiating a defrost. The system runs the Defrost Compressor Speed for the given tonnage. The system runs the Calibrated Compressor Speed during calibration.

The system does the following to initiate a defrost cycle:

- Records the Outdoor EEV Setpoint
- Records the Calibrated Compressor Speed and where in the operational algorithm the system is
- The Suction Pressure Fault is ignored during defrost
- Communicates proper speed of compressor “Defrost Compressor Speed”
- Communicates proper speed of ID CFM for the “Defrost ID Airflow”
- Communicates the Outdoor Fan speed to 0
- Energizes the reversing valve
- Fully opens the Outdoor EEV
- Begins the “Defrost Cycle Timer”
- Communicates for auxiliary heat

Frost detection

The system is capable of detecting frost accumulation on the outdoor coil and initiating a defrost cycle when the current deltaT (AmbT-CoilT) >= “Defrost Active Variable” for the current outdoor ambient temperature for 5 s.

Defrost termination

The system terminates the defrost cycle immediately after the coil temperature goes above the selected termination temperature 50°F, 60°F, 70°F, or 80°F for 2 s. This selection is available on the thermostat. If the terminate temperature selection is not selected, the default termination temperature is 50°F.

Defrost termination temperature can also be set at the outdoor unit dipswitch bank S2.

Table 23: S2 dipswitch bank

Defrost termination temperature	Switch position 1	Switch position 2	Switch position 3
50°F	OFF	OFF	OFF
60°F	OFF	ON	OFF
70°F	ON	OFF	OFF
80°F	ON	ON	OFF

Once a defrost mode has been initiated, an internal timer (Defrost Cycle Timer) counts the time that the defrost mode is engaged and the compressor is energized. After 12 min of operation in the defrost mode, the defrost sequence terminates immediately and resets the internal timings regardless of the state of the coil sensor temperature.

The system operation is based on accumulated run time. Once a defrost mode has been initiated, an internal timer (CoilT > 32°F Timer) counts the time that the coil temperature CoilT is above 32°F. The system is able to indicate at the end of a defrost if the CoilT has or has not been > 32°F for 4 min. If the system determines that it was above 32°F for greater than 4 min and the system terminates the defrost based on the Defrost Cycle Timer, the system will accept that the coil is frost free and remain/enter Demand Defrost Mode and calibrate for the next defrost. If the system determines that it was not above 32°F for greater than 4 min and the system terminates the defrost based on the Defrost Cycle Timer, the system will accept that the coil is not frost free and will remain and/or enter Time/Temperature Defrost Mode.

The Suction Pressure Fault is ignored during defrost and for 300 s following the termination of a Defrost.

The system establishes a new Dry Coil Delta T following termination of this defrost cycle. The compressor run time is reset when the defrost cycle is complete.

The system returns to the previous compressor speed for the calibration process. Upon completing the calibration process, the system returns to the same place in the control algorithm. The system communicates the ID airflow for the proper compressor speed being operated during the calibration process.

The system does the following to terminate a defrost cycle:

- De-energizes the reversing valve
- Communicates proper Outdoor EEV Setpoint “OD EEV Setpoint”
- The Suction Pressure Fault is ignored for 300 s following the termination of a defrost.
- Waits 5 s
- Clears the maximum “Defrost Cycle Timer”
- Communicates to de-energize the auxiliary heat outputs (unless required by present heating call)
- Communicates the Outdoor Fan speed
- Changes the Compressor Speed to the previously recorded Calibrated Compressor Speed
- Communicates the proper speed of ID CFM

- Waits 4 min (only relative if the next defrost operation is demand defrost, not time temp)
- Takes readings starting at the 4th minute for the next 30 minutes to determine optimum dry coil delta T
- Returns the system to the same spot in the normal algorithm, the place the system was in before initiating a defrost
- Resets and restarts the defrost inhibit time

Cooling and heating operation

This system communicates with the Smart Home Control (S1-TSHC510), the mode, setpoint, and room temperature. The control board will use this information to initiate cooling, heating or emergency heat. The system will adjust the compressor speed based on the difference between the set point and room temperature.

Pressure switch fault detection and lockout

The heat pump is equipped with a high pressure switch and low pressure switch that connect to the control at the pressure switch terminals. If the high pressure switch input opens for more than 40 ms, the control de-energizes the compressor. If the switch is closed and a thermostat call for compressor operation is present, the control applies the 5 min anti-short-cycle delay timer and starts the compressor when the timer expires.

If the low pressure switch opens for 5 s under conditions when the control is not ignoring the low pressure switch input, the control enters a low pressure switch fault. The control ignores the low pressure switch input during the following conditions:

- Defrost operation
- After system start up
- 300 s following the completion of a defrost cycle
- When the outdoor ambient temperature is below 20°

When the compressor starts after a switch fault, the control starts a 6 h timer based on accumulated compressor runtime. If the control senses another opening of the switch before the timer expires, it causes a soft lockout condition. The second opening of the switch must be greater than 160 ms for the lockout to occur. If the second opening is between 40 ms and 160 ms, the control de-energizes the compressor but does not cause a soft lockout condition. If the control does not sense a second switch opening before the 6 h timer expires, the timer and counter reset.

During the soft lockout mode, the control de-energizes the compressor and energizes the LED output with the appropriate flash code.

The control resets the soft lockout condition when any of the following occur after removal of the fault condition:

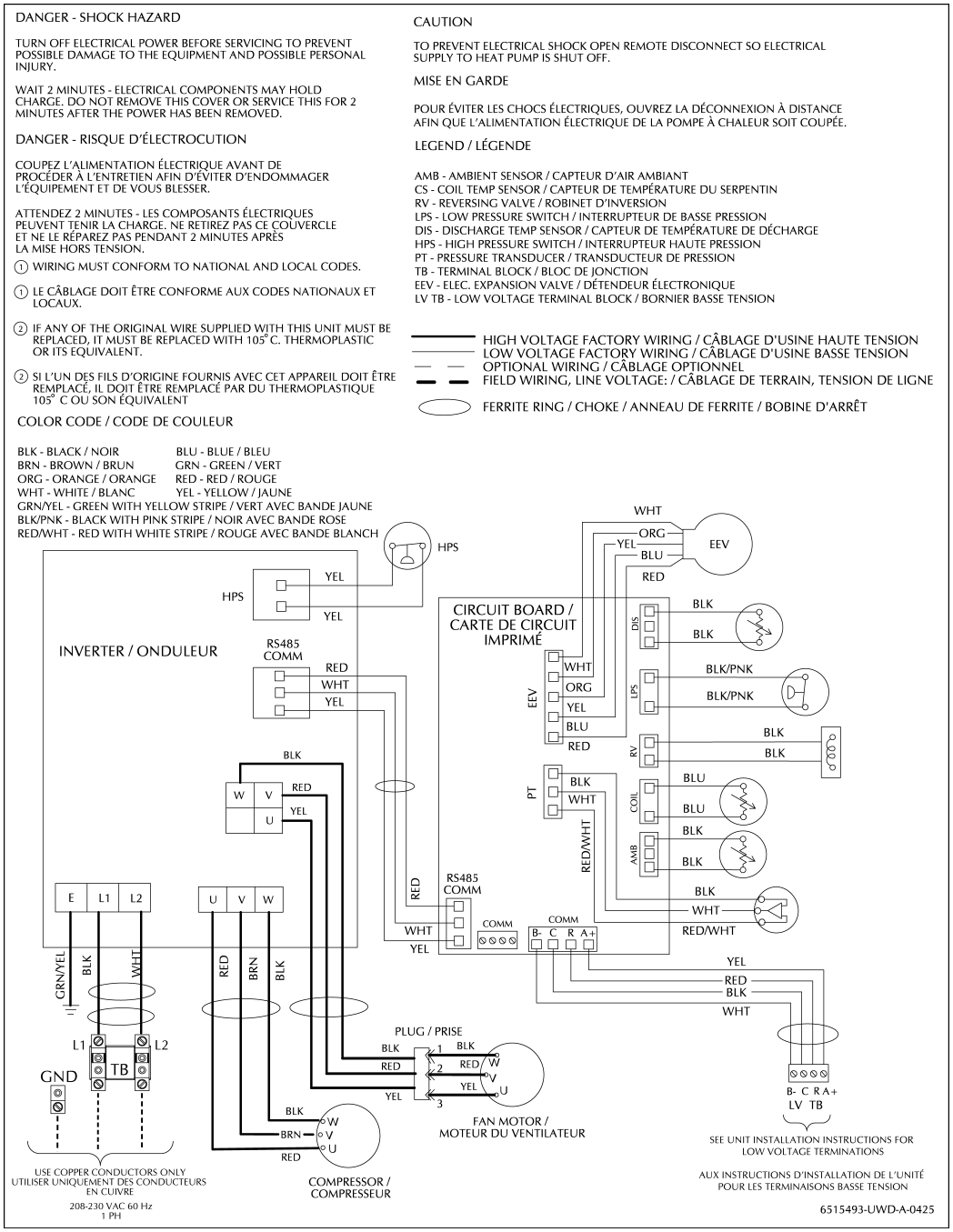
- Power is cycled to the R inputs of the control. This causes the soft lockout condition to be reset when the thermostat is satisfied or when the thermostat is set to SYSTEM OFF and back to HEAT or COOL mode.
- When the soft lockout condition is reset, the control stops displaying the fault code and responds to thermostat inputs normally.

Third-party trademarks notice

Third-Party Trademarks Notice: For information about third-party trademarks, refer to the relevant company websites.

Wiring diagrams

Figure 20: Wiring diagram



Start-up sheet

Heat Pump and Supplementary Heat Start-up Sheet

Correct start-up is critical to customer comfort and equipment longevity

Start-up date

Technician performing start-up | Installing contractor name

Owner information

Name | Address

City | State or province | Zip or postal code

Equipment data

○ Upflow ○ Downflow ○ Horizontal left ○ Horizontal right

Indoor unit model no. | Indoor unit serial no.

Indoor coil model no. | Indoor coil serial no.

Outdoor unit model no. | Outdoor unit serial no.

Filter, thermostat, and accessories

Filter type | Filter size | Filter locations

Thermostat type | Other system equipment and accessories

Connections in accordance with installation instructions and local codes

☐ Unit is level ☐ Supply plenum and return ducts are connected and sealed ☐ Refrigerant piping complete and leak-tested

☐ Gas piping is connected (if applicable) ☐ Vent system is connected (if applicable)

☐ Condensate drain for indoor coil correctly connected ☐ Condensate drain for furnace (if applicable)

Electrical: line voltage

Indoor unit (VAC) | Outdoor unit (VAC) | Overcurrent protection breaker/fuses (A)

☐ Ground wire is connected ☐ Polarity is correct (120 VAC indoor units), black is L1 (hot), white is N (neutral)

Electrical: low voltage

☐ Thermostat wiring complete ☐ Heat anticipator is set to the recommended value listed in the installation instructions

Low voltage values: R and C at indoor unit control board (VAC)

R and C at outdoor unit control board (VAC) | Heat anticipator recommended value

Supplementary heating set-up

Heating type: ○ Electric air handler ○ Natural gas ○ LP gas (requires LP conversion kit)

Inlet gas pressure (in. W.C.) | Manifold gas pressure (in. W.C.) | LP gas conversion kit part no. used

Calculated input in Btu/h - clock the gas meter (natural gas only) | LP kit installed by

Electric heat kit part no. (if applicable) | kW installed | Rated Btu/h (furnaces)

Venting (if applicable)

☐ Venting system correctly sized within the limitations of the charts in the installation instructions

Intake size | No. of 90° elbows | No. 0f 45° elbows | Length

Exhaust size | No. of 90° elbows | No. 0f 45° elbows | Length

Page 1 of 2 (9/24/21)

Air side: system total external static pressure

Supply static before indoor coil (in. W.C.)		Supply static after indoor coil (in. W.C.)	
Return static (in. W.C.) before filter		Return static (in. W.C.) after filter (furnace side)	
Total external static pressure (ESP)		Maximum rated ESP (in. W.C.)	

Airflow setup

Blower type and set-up	Variable speed ECM (circle 0 or 1)	Heat	0 / 1	0 / 1						
		Low cool	0 / 1	0 / 1	0 / 1					
		High cool	0 / 1	0 / 1	0 / 1					
		Delay	0 / 1	0 / 1						
		Stage 1 kW	0 / 1	0 / 1						
		Heat kit selection	0 / 1	0 / 1	0 / 1	0 / 1				
	Standard ECM	Compressor high	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	◯ 7	◯ 8	◯ 9
		Compressor low	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	◯ 7	◯ 8	◯ 9
		Continuous fan	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	◯ 7	◯ 8	◯ 9
		Electric heat	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	◯ 7	◯ 8	◯ 9

Supply static (in. W.C.)		Supply air dry bulb temperature		Outside air dry bulb temperature	
Return static (in. W.C.)		Return air dry bulb temperature		Return air wet bulb temperature	
Total external static pressure		Temperature drop		Supply air wet bulb temperature	

Defrost control board

Fill in ON, OFF, or the appropriate value for the fields that apply to the installed defrost control board.

◯ Two stage ◯ Demand defrost ◯ Variable capacity ◯ Time and temperature

Low temperature cut out | Balance point | Defrost curve | Y2 lock | FFUEL | Switch point

Hot heat pump | Bonnet sensor present | Runtime (time and temperature board): only 30 min, 60 min, or 90 min

Refrigerant charge and metering device

◯ R-410A ◯ TXV ◯ Fixed orifice

Additional refrigeration piping length | Adder per lb·ft | oz

No. of elbows | No. of 45s | Total added: lb | oz

Orifice size | Suction line temperature (°F) | High side pressure | Low side pressure

TXV No. | Liquid line temperature (°F) | Subcooling | Superheat

Cycle test

- ☐ Operate the unit through several heating cycles from the thermostat, noting and correcting any problems.
- ☐ Operate the unit through continuous fan cycles from the thermostat, noting and correcting any problems.
- ☐ Operate the unit through a cooling cycle, noting and correcting any problems.
- ☐ Operate the unit through an emergency heating cycle, noting and correcting any problems.

Clean up

- ☐ Installation debris disposed of, and indoor and outdoor areas cleaned up

Owner education

- ☐ Provide the owner with the owner's manual.
- ☐ Explain operation of the system to the owner.
- ☐ Explain thermostat use and programming (if applicable) to the owner.
- ☐ Explain the importance of regular filter replacement and equipment maintenance.

Comments section