

## INSTALLATION INSTRUCTIONS

**\*SH4ME5M - 1SP24K, 1SP30K, 1SP36K, 1SP42K, & 1SP48K**

**(2, 2.5, 3, 3.5, & 4 TON) SERIES - SINGLE PHASE MODELS WITH BRAZED CONNECTIONS**

### IMPORTANT

#### ATTENTION INSTALLERS:

It is your responsibility to know this product better than your customer. This includes being able to install the product according to strict safety guidelines and instructing the customer on how to operate and maintain the equipment for the life of the product. Safety should always be the deciding factor when installing this product and using common sense plays an important role as well. Pay attention to all safety warnings and any other special notes highlighted in the manual. Improper installation of the unit or failure to follow safety warnings could result in serious injury, death, or property damage.

These instructions are primarily intended to assist qualified individuals experienced in the proper installation of this appliance. Some local codes require licensed installation/service personnel for this type of equipment. Please read all instructions carefully before starting the installation. Return these instructions to the customer's package for future reference.

**DO NOT DESTROY. PLEASE READ CAREFULLY & KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.**

|                                                                            |           |
|----------------------------------------------------------------------------|-----------|
| <b>IMPORTANT SAFETY INFORMATION.....</b>                                   | <b>2</b>  |
| <b>GENERAL REQUIREMENTS .....</b>                                          | <b>3</b>  |
| Detecting Leaks of Flammable Refrigerants .....                            | 4         |
| Removing Refrigerant and Evacuation .....                                  | 4         |
| <b>HEAT PUMP INSTALLATION .....</b>                                        | <b>4</b>  |
| General Information .....                                                  | 4         |
| Before You Install this Unit.....                                          | 4         |
| Packaging Removal .....                                                    | 4         |
| Locating the Heat pump.....                                                | 4         |
| Clearance Requirements .....                                               | 5         |
| Ground Installations .....                                                 | 5         |
| Roof Installation .....                                                    | 5         |
| Accessory Mounting Kits.....                                               | 5         |
| Installation/Verification of the System's Expansion Device .....           | 5         |
| Connecting Refrigerant Tubing Between the Indoor & Outdoor Unit .....      | 5         |
| Outdoor Orifice Removal & Installation.....                                | 6         |
| <b>ELECTRICAL WIRING .....</b>                                             | <b>7</b>  |
| Pre-Electrical Checklist .....                                             | 7         |
| Line Voltage .....                                                         | 7         |
| Grounding .....                                                            | 7         |
| Thermostat Connections .....                                               | 7         |
| Low Voltage Connections .....                                              | 7         |
| <b>START UP &amp; ADJUSTMENTS .....</b>                                    | <b>7</b>  |
| Pre-Start Check List .....                                                 | 7         |
| Start-Up Procedures .....                                                  | 8         |
| Operating Temperatures .....                                               | 8         |
| Air Circulation - Indoor Blower .....                                      | 8         |
| Indoor Unit Leak Detection .....                                           | 8         |
| Short Cycle Protection .....                                               | 8         |
| System Cooling.....                                                        | 8         |
| System Heating .....                                                       | 9         |
| Defrost Control Board Test Pins .....                                      | 9         |
| <b>HEAT PUMP MAINTENANCE.....</b>                                          | <b>9</b>  |
| Panel Removal.....                                                         | 9         |
| Panel Installation.....                                                    | 9         |
| <b>REFRIGERANT CHARGING .....</b>                                          | <b>10</b> |
| Charging the Unit in AC mode .....                                         | 11        |
| If the outdoor temperature is 65 degrees F or higher: .....                | 11        |
| If the outdoor temperature is between 35 degrees F and 65 degrees F: ..... | 11        |
| If the outdoor temperature is below 35 degrees F: .....                    | 12        |
| <b>ELECTRICAL INFORMATION .....</b>                                        | <b>13</b> |
| Figure 8. Wiring Diagram for *SH4ME5M.....                                 | 13        |
| <b>REFRIGERANT RECOVERY .....</b>                                          | <b>14</b> |
| <b>DECOMMISSIONING.....</b>                                                | <b>14</b> |
| <b>INSTALLATION CHECKLIST.....</b>                                         | <b>16</b> |
| <b>REPLACEMENT PARTS .....</b>                                             | <b>16</b> |

## IMPORTANT SAFETY INFORMATION

**INSTALLER:** Please read all instructions before servicing this equipment. Pay attention to all safety warnings and any other special notes highlighted in the manual. Safety markings are used frequently throughout this manual to designate a degree or level of seriousness and should not be ignored.

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

**CAUTION** indicates a potentially hazardous situation that if not avoided, may result in minor or moderate injury or property damage.



Refrigerant  
Safety Group  
A2L

### **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:**

Shut off all electrical power to the unit before performing any maintenance or service on the system. Failure to comply may result in personal injury or death.

### **WARNING:**

Unless noted otherwise in these instructions, only factory authorized parts or accessory kits may be used with this product. Improper installation, service, adjustment, or maintenance may cause explosion, fire, electrical shock or other hazardous conditions which may result in personal injury or property damage

### **WARNING:**

**\*SH4ME5M split system heat pumps are shipped charged with R-454B refrigerant and ready for installation. If maintenance, service, or repairs make it necessary for evacuation and charging, opening of sealed components, or opening of ventilated enclosures, then it should only be attempted by qualified trained personnel thoroughly familiar with this equipment and have the appropriate training for working with A2L refrigerants. Under no circumstances should the owner attempt to install and/or service this equipment. Failure to comply with this warning could result in property damage, personal injury, or death.**

### **WARNING:**

The information listed in this manual must be followed during the installation, service, and operation of this unit. Unqualified individuals should not attempt to interpret these instructions or install this equipment. Failure to follow safety recommendations could result in possible damage to the equipment, serious personal injury or death.

### **CAUTION:**

This unit uses refrigerant R-454B. **DO NOT** use any other refrigerant in this unit. Use of another refrigerant will damage the unit. Ensure that any indoor section (coil or air handler) is suitable for use with R-454B. **DO NOT** mix refrigerants.

### **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.

## GENERAL REQUIREMENTS

- The installer must comply with all local codes and regulations which govern the installation of this type of equipment. Local codes and regulations take precedence over any recommendations contained in these instructions. Consult local building codes and the National Electrical Code (ANSI) for special installation requirements.
  - This unit is a PARTIAL UNIT HEAT PUMP, complying with PARTIAL UNIT requirements of UL 60335-2-40, and must only be connected to other units that have been confirmed as complying to corresponding PARTIAL UNIT requirements of UL 60335-2-40, CSA 22.2 No 60335-2 40, or UL 1995.CSA 22.2 No 236
  - This system contains R-454B, a mildly-flammable refrigerant. Because of this, there are requirements, including a minimum size, for the room in which the indoor portion of this system shall be installed within. Consult the indoor unit's installation instructions and labels for more information.
  - Prior to beginning work on this system, take steps to minimize the risk of refrigerant being ignited. These steps should include the following:
    - o Work shall 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.
    - o All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.
    - o The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.
    - o If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.
    - o No person carrying out work in relation to a refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.
    - o Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
    - o Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance.
  - o The following checks shall be applied to installations using FLAMMABLE REFRIGERANTS:
    - the actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed
    - the ventilation machinery and outlets are operating adequately and are not obstructed
    - marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected
    - refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.
  - Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.
    - o Initial safety checks shall include:
      - that capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
      - that no live electrical components and wiring are exposed while charging, recovering or purging the system;
      - that there is continuity of earth bonding
  - Sealed components and intrinsically safe components shall be replaced instead of trying to repair them.
- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.
- All electrical wiring must be completed in accordance with local, state and national codes and regulations and with the National Electric Code (ANSI/NFPA 70) or in Canada the Canadian Electric Code Part 1 CSA C.22.1.
  - This equipment contains liquid and gaseous refrigerant under high pressure. **DO NOT USE ANY PORTION OF THE CHARGE FOR PURGING OR LEAK TESTING.** Installation or servicing should only be performed by qualified trained personnel thoroughly familiar with this type equipment.
  - Fully annealed, refrigerant grade copper tubing should be used when installing the system. Refrigerant suction line tubing should be fully insulated.
  - Pipe-work including piping material, pipe routing, and installation shall include protection from physical damage in operation and service, and be in compliance with national and local codes and standards, such as ASHRAE 15, ASHRAE 15.2, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.
  - Installation of equipment may require brazing operations. Installer must comply with safety codes and wear appropriate safety equipment (safety glasses, work gloves, fire extinguisher, etc.) when performing brazing operations.

- Follow all precautions in the literature, on tags, and on labels provided with the equipment. Read and thoroughly understand the instructions provided with the equipment prior to performing the installation and operational checkout of the equipment.
- When refrigerant tubing and electrical wiring penetrates a structure's envelope, the openings should be made to be suitably water-tight after their installation.
- This unit is designed for outdoor installations only and should be positioned as shown on [page 5](#).

### Detecting Leaks of Flammable Refrigerants

- Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.
- The following leak detection methods are deemed acceptable for all refrigerant systems
  - o Electronic leak detectors may be used to detect refrigerant leaks but, in the case of FLAMMABLE REFRIGERANTS, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.
  - o Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.
  - o NOTE Examples of leak detection fluids are:
    - bubble method,
    - fluorescent method agents.
- If a leak is suspected, all naked flames shall be removed/ extinguished.
- If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to the "Removing Refrigerant and Evacuation" section of this document.

### Removing Refrigerant and Evacuation

- When breaking into the refrigerant circuit to make repairs – or for any other purpose --conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:
  - o Safely remove refrigerant following local and national regulations
  - o Evacuate the system
  - o Purge the circuit with inert gas
  - o Evacuate the system
  - o Continuously flush or purge with inert gas when using flame to open circuit
  - o Open the circuit

## HEAT PUMP INSTALLATION

### General Information

The \*SH4ME5M series heat pump is designed only for outdoor rooftop or ground level installations. This unit has been tested for capacity and efficiency in accordance with AHRI Standards and will provide many years of safe and dependable comfort, providing it is properly installed and maintained. Abuse, improper use, and/or improper maintenance can shorten the life of the appliance and create unsafe hazards.

To achieve optimum performance and minimize equipment failure, it is recommended that periodic maintenance be performed on this unit. The ability to properly perform maintenance on this equipment requires certain mechanical skills and tools.

### Before You Install this Unit

- ✓ The cooling load of the area to be conditioned must be calculated and a system of the proper capacity selected. It is recommended that the area to be conditioned be completely insulated and vapor sealed.
- ✓ Check the electrical supply and verify the power supply is adequate for unit operation. The system must be wired and provided with circuit protection in accordance with local building codes. If there is any question concerning the power supply, contact the local power company.
- ✓ Check that the marked maximum operating pressure on the indoor coil or air handler and the maximum operating pressure on the outdoor unit are suitable for each other.
- ✓ Check that the indoor coil or air handler and the outdoor unit are both suitable for the same refrigerant.
- ✓ The indoor section (air handler, furnace, etc) should be installed before routing the refrigerant tubing. Refer to the indoor unit's installation instructions for installation details.
- ✓ All units are securely packed at the time of shipment and upon arrival should be carefully inspected for damage prior to installing the equipment at the job site. Claims for damage (apparent or concealed) should be filed immediately with the carrier.
- ✓ Please consult your dealer for maintenance information and availability of maintenance contracts. Please read all instructions before installing the unit.

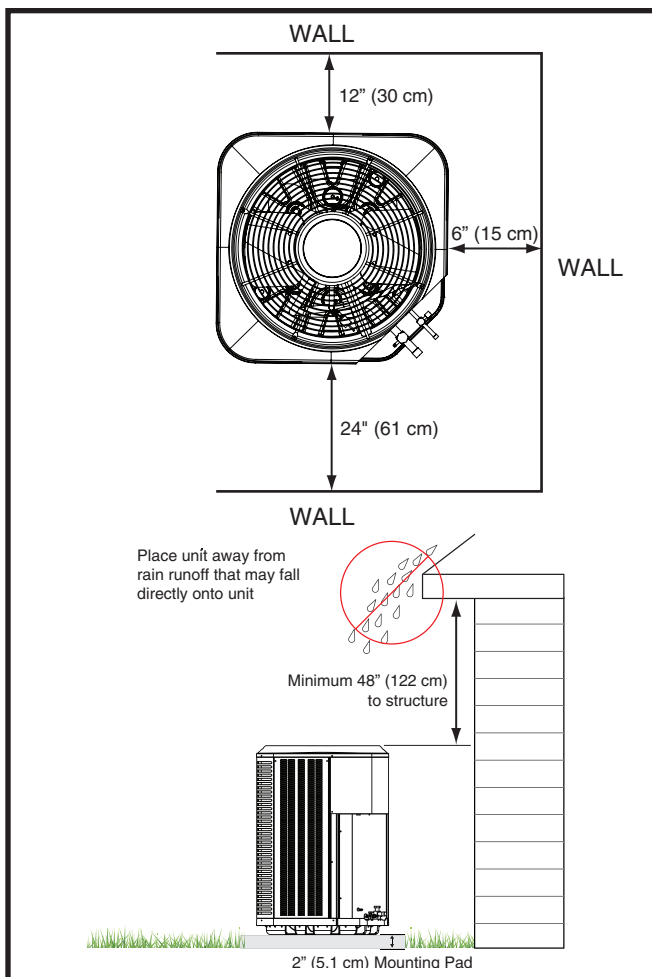
### Packaging Removal

**NOTE:** To prevent damage to the tubing connections, carefully remove the carton and user's manual from the equipment. Discard the shipping carton.

### Locating the Heat Pump

- Survey the job site to determine the best location for mounting the outdoor unit.
- Sufficient clearance for unobstructed airflow through the outdoor coil must be maintained in order to achieve rated performance. See [Figure 1](#) for minimum clearances to obstructions.
- Overhead obstructions ([Figure 1](#)), poorly ventilated areas, and areas subject to accumulation of debris should be avoided.
- The unit should not be placed under roofing or other overhangs which are not guttered; that would allow water or ice to fall into the unit's discharge opening.
- Consideration should be given to availability of electric power, service access, noise, and shade.





**Figure 1. Clearance Requirements**

### Clearance Requirements

- The general recommendation is for the units to be installed with 18 inches of clearance on 3 sides and with 24 inches of clearance for the service access side to the unit's service panel.
- For installations that are space constrained, one side of the unit, adjacent to the service panel, may have its air side clearance reduced to a minimum of 6 inches. The other side adjacent to the service panel requires 24 inches for service access. The remaining two sides, at a minimum shall require 12 inches of clearance. However, for those two remaining sides that require at least 12 inches of clearance, only one of them may be adjacent to a solid wall.
- A minimum of 18 inches between two units must be maintained for proper performance.

### Ground Installations

The unit should be installed on a solid base, that is level and located at least 2 inches above grade\*.

**Note:** It is recommended that poured concrete mounting bases are not attached or adjacent to the building structure or foundation.

### Roof Installation

The unit may only be installed on a structure that is capable of supporting the total weight of the unit and its anchorage. The support for the base of the unit may not slope more than 1/8 inch per foot. The minimum clearance for the base of the unit to the roof-line is 2 inches\* for residential applications.

**Note on ground and roof clearances:** Heat Pump and other applications should account for the accumulation of snow and raise the base of the unit accordingly. (At a minimum, a 6 inch clearance is required.)

### Accessory Mounting Kits

Kits for other mounting methods and accessories can be found in the technical sales literature for the unit. Or the literature library on NortekHVAC.com.

### Installation/Verification of the System's Expansion Device

After outdoor and indoor unit placement has been determined, refer to the Quick Reference Data sheet for information on the appropriate expansion device to use for the equipment. Verify that the installed expansion device matches those requirements or install the correct expansion device. Note: Some outdoor units may include the correct indoor orifice expansion device for the installation application but is dependent upon the actual unit match. The correct expansion device or kit is available for all approved Nordyne listed applications from the parts department.

### Connecting Refrigerant Tubing Between the Indoor & Outdoor Unit

## ⚠ CAUTION:

When connecting refrigerant line-sets together, it is highly recommended that dry nitrogen be flowing through the joints during brazing to prevent internal oxidation and scaling. Copper oxides, internal to the system can damage the compressors bearings and seals, block small orifices and microchannels or otherwise damage components.

## ⚠ CAUTION:

When performing brazing operations always protect the system components and seals from the possibility of heat damage. Remove all caps, plugs and Schrader valve cores on piping system components just prior to assembly and brazing. Use good brazing practices to protect components from the heat and flame of the brazing torch.

After outdoor and indoor unit placement has been determined, route refrigerant tubing between the equipment in accordance with sound installation practices.

- Refrigerant tubing should be routed in a manner that minimizes the length of tubing and the number of bends in the tubing. If precise forming of refrigerant lines is required, a copper tubing bender is recommended. Avoid sharp bends and contact of the refrigerant lines with metal surfaces.
- Refrigerant tubing should be supported in a manner that the tubing will not vibrate or abrade during system operation.
- Tubing should be kept clean of foreign debris during installation.
- Every effort should be made by the installer to ensure that the field installed refrigerant containing components of the system have been installed in accordance with these instructions and sound installation practices to insure reliable system operation and longevity.
- The maximum recommended interconnecting refrigerant line lengths is 75 ft. and the vertical elevation difference between the indoor and outdoor sections should not exceed 20 ft.
- A filter dryer is provided with the unit and must be installed in the liquid line of the system. If the installation replaces a system with a filter dryer already present in the liquid line, the filter dryer must be replaced with the one supplied with the unit. The filter dryer must be installed in strict accordance with the manufacturer's installation instructions.
- Optional equipment such as liquid line solenoid valves, low ambient, etc., should be installed in strict accordance with the manufacturer's installation instructions.
- After the completion of all brazing operations and when the components have been properly cooled, replace all the seals, Schrader cores and caps which had been previously removed. It is recommended that all seals be lubricated with a light coat of refrigerant oil. Always verify that oil applied matches the oil type listed on the compressor nameplate. A thread sealant which is compatible with the system refrigerant and oil can be sparingly applied if desired. applied per the manufacturer's instructions.

### Outdoor Orifice Removal & Installation

The orifice installed in the outdoor unit has been sized for use with the most popularly matched indoor units. Depending on the indoor coil that the unit is being matched with, the outdoor restrictor may need to be changed. Please refer to the Quick Reference Data sheet that is supplied with the outdoor unit for more information.

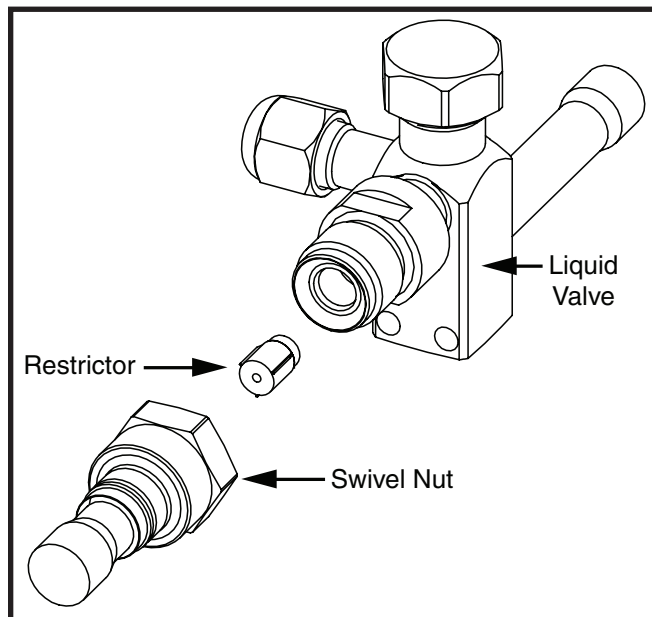
If the outdoor unit has the liquid valve shown in [Figure 2](#), then the restrictor is located inside the swivel nut connection of the liquid valve and not inside the outdoor unit's distributor. Perform steps 1 - 5 if the outdoor restrictor needs to be changed.

### CAUTION:

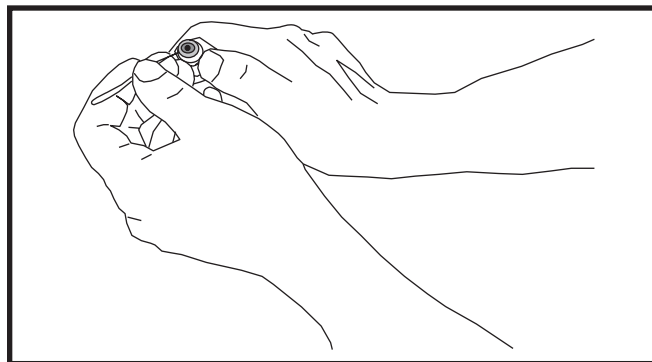
**To prevent damage to the unit or internal components, it is recommended that two wrenches be used when loosening or tightening nuts. Do not over tighten!**

1. Using two wrenches loosen the nut and liquid valve. Turn the assembly nut counter-clockwise until the orifice body halves are separated.

2. Insert a light-gauge wire hook between the valve body and the restrictor orifice while being careful not to scratch either part. Carefully remove the restrictor orifice from the valve body. See [Figure 3](#).
3. Check the actual size of the new orifice. NOTE: The size is stamped on its side. Do not use pin gauges to measure the orifice diameter.
4. Insert the new orifice into the valve body, with the rounded end facing into the valve. See [Figure 2](#).
5. Realign the assembly nut on the valve body and hand tighten both components. Mark a line on both bodies and then tighten an additional  $\frac{1}{4}$  turn using two wrenches. The movement of the two lines will show how much the nut is tightened.



**Figure 2. Liquid Valve, Restrictor, & Swivel Nut Adapter**



**Figure 3. Removal of Orifice**

### CAUTION:

**If repairs are necessary to the refrigerant line-set or indoor setup after the initial installation, then when servicing, cover or seal openings to minimize the exposure of the refrigerant system to air to prevent accumulation of moisture and other contaminants.**

## ELECTRICAL WIRING



### WARNING:

#### Electrical Shock Or Fire Hazard

**To avoid risk of electrical shock, personal injury, or death, disconnect all electrical power to the unit before performing any maintenance or service. The unit may have more than one electrical supply.**

**Label all wires prior to disconnection when servicing the unit. Wiring errors can cause improper and dangerous operation.**

- All electrical connections must be in compliance with all applicable local codes and ordinances, and with the current revision of the National Electric Code (ANSI/NFPA 70).
- For Canadian installations the electrical connections and grounding shall comply with the current Canadian Electrical Code (CSA C22.1 and/or local codes).

#### Pre-Electrical Checklist

- ✓ Verify that the voltage, frequency, and phase of the supply source match the specifications on the unit rating plate.
- ✓ Verify that the service provided by the utility is sufficient to handle the additional load imposed by this equipment. Refer to the unit wiring label for proper voltage wiring.
- ✓ If replacing an existing unit, verify that the: current wiring, unit disconnect and circuit breaker is properly sized and rated for the new units requirements. Verify that information with the MCA and MOP values on the unit nameplate.
- ✓ Verify factory wiring is in accordance with the unit wiring diagram. See [Figure 8, \(page 13\)](#). Inspect for loose connections.

#### Line Voltage

- A wiring diagram is located on the inside cover of the electrical box of the outdoor unit. The installer should become familiar with the wiring diagram before making any electrical connections to the outdoor unit.
- **An electrical disconnect must be located within sight of and readily accessible to the unit.** This switch shall be capable of electrically de-energizing the outdoor unit.
- Line voltage to the unit should be supplied from a dedicated branch circuit containing the correct fuse or circuit breaker for the unit. Incoming field wiring and minimum size of electrical conductors and circuit protection must be in compliance with information listed on the outdoor unit data label. Any other wiring methods must be acceptable to authority having jurisdiction.
- The outdoor unit requires electrical connections for its incoming line voltage wiring, its safety ground wiring, and the low voltage control circuit wiring. Refer to the wiring diagram / schematic for identification and location of outdoor unit field wiring interfaces. See [Figure 8, \(page 13\)](#). Make all electrical connections in accordance with all applicable codes and ordinances.
- Overcurrent protection must be provided at the branch circuit distribution panel and sized as shown on the unit rating label and according to applicable local codes. See the unit rating plate for minimum circuit ampacity (MCA) and maximum overcurrent protection (MOP) limits.
- Provide power supply for the unit in accordance with the

unit wiring diagram, and the unit rating plate. Connect the line-voltage leads to the terminals on the contactor inside the control compartment.

- Use only copper wire for the line voltage power supply to this unit in strict accordance of the NEC (ANSI/NFPA 70), applicable local codes, and the instructions provided with the equipment. Use proper code agency listed conduit and a conduit connector for connecting the supply wires to the unit. Use of rain tight conduit is recommended.
- Optional equipment requiring connection to the power or control circuits must be wired in strict accordance of the NEC (ANSI/NFPA 70), applicable local codes, and the instructions provided with the equipment.
- A whip/conduit spacer has been provided that must be installed as a reinforcement where the whip/conduit enters the unit. Break this spacer in half to use the appropriate size.

#### Grounding



### WARNING:

**The unit cabinet must have an uninterrupted or unbroken electrical ground to minimize personal injury if an electrical fault should occur. Do not use gas piping as an electrical ground!**

This unit must be electrically grounded in accordance with local codes or, in the absence of local codes, with the National Electrical Code (ANSI/NFPA 70) or the CSA C22.1 Electrical Code. Use the grounding lug provided in the control box for grounding the unit.

#### Thermostat Connections

- Thermostat connections should be made in accordance with the instructions supplied with the thermostat and the indoor equipment.
- The outdoor unit is designed to operate from a 24 VAC Class II control circuit. The control circuit wiring must comply with the current provisions of the NEC (ANSI/NFPA 70) and with applicable local codes having jurisdiction.

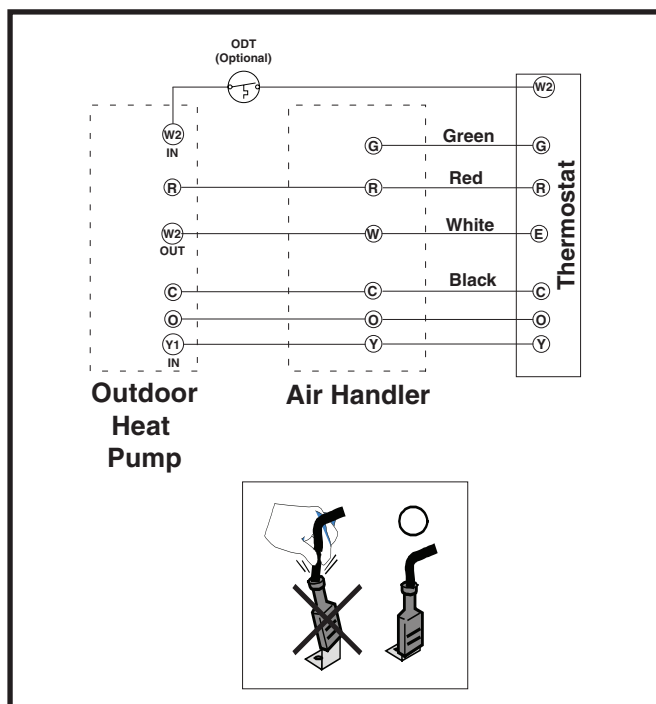
#### Low Voltage Connections

- The outdoor unit is designed to operate from a 24 VAC Class II control circuit which is provided by the indoor unit. The control circuit wiring must comply with the current provisions of the NEC (ANSI/NFPA 70) and with applicable local codes having jurisdiction.
- The low voltage wires must be properly connected to the outdoor unit's low voltage terminal block and as indicated on the units wiring diagram.

## START UP & ADJUSTMENTS

#### Pre-Start Check List

- ✓ Verify that the outdoor unit is installed according to all instructions in this document.
- ✓ Verify that the indoor unit is appropriate for use with the refrigerant listed on the outdoor unit and that it has the proper design pressure for the outdoor unit.
- ✓ Verify that the indoor unit is appropriate for use with the refrigerant listed on the outdoor unit. And that it has the proper design pressure for the outdoor unit equipment type.
- ✓ Verify the indoor unit and thermostat have been installed in accordance with that equipment's instructions.
- ✓ Verify line voltage power leads are securely connected and



**Figure 4. Typical Thermostat Connections**

- that both indoor and outdoor units are properly grounded.
- ✓ Verify that the power supplied by branch circuits for both the indoor and outdoor equipment is:
  - the proper voltage for the equipment, and
  - that the overcurrent protection device is properly sized, and
  - that the supply wiring is the correct gauge.
- ✓ Verify that the low voltage and thermostat wiring are securely connected to the proper terminals for all equipment.
- ✓ Verify that the low voltage transformer has been properly connected with that unit's instructions.
- ✓ Verify that the refrigerant line-set has been properly routed between the units, connected appropriately, is properly secured and protected from damage, and that it has the correct piping insulation installed.
- ✓ Verify that the refrigerant system and lines are leak free by inspection with a leak detector or the soap-bubble method.
- ✓ Verify that any attached indoor ducting has been properly installed and sealed.
- ✓ Verify that the indoor condensate drain line and trap are properly installed and functioning.
- ✓ Verify that all removable panels have been re-installed, and all cabinet enclosures and fan guards are secure.
- ✓ Verify that the air filters are clean and properly installed.
- ✓ Verify that the thermostat is set to the stand-by, or off setting. And the fan switch is set to automatic or off.

## Start-Up Procedures

### **WARNING:**

This unit is equipped with a crankcase heater. Allow 24 hours prior to continuing the start up procedures to allow for heating of the refrigerant compressor crankcase. Failure to comply may result in damage and could cause premature failure of the system. This warning should be followed at initial start up and any time the power has been removed for 12 hours or longer.

### Operating Temperatures

This equipment has been designed to operate within the temperatures specified in [Table 1](#). Running the equipment in heating at higher than 70°F may require the use of a Heat Pump Mild Weather Control Kit or changing over to emergency or auxiliary heating.

| COOLING  |          | HEATING  |          |
|----------|----------|----------|----------|
| MIN (°F) | MAX (°F) | MIN (°F) | MAX (°F) |
| 60       | 115      | -10      | 70       |

**Table 1. Heat Pump Operating Temperatures**

The thermostat's function mode should be set to OFF and the fan mode should be set to AUTO. Close all electrical disconnects to energize the system.

### Air Circulation - Indoor Blower

1. Set the thermostat system mode on OFF and the fan mode to ON.
2. Verify the blower runs continuously. Check the air delivery at the supply registers and adjust register openings for balanced air distribution. If insufficient air is detected, examine ductwork for leaks or obstructions.
3. Set the thermostat fan mode to AUTO and verify the blower stops running.

### Indoor Unit Leak Detection

1. Ensure that the indoor unit's leak detection and mitigation components are working properly. Refer to the indoor unit's installation instructions for more information.

### Short Cycle Protection

1. Set the thermostat system mode to COOL. Observe the temperature setting of the thermostat and gradually raise the set-point temperature until the unit de-energizes.
2. Immediately lower the set point temperature of the thermostat to its original setting and verify that the indoor blower is energized and outdoor unit remains de-energized.
3. After approximately 5 minutes, verify the outdoor unit energizes and the temperature of the discharge air is cooler than the room temperature.

### System Cooling

1. Set the thermostat's system mode to COOL and the fan mode to AUTO. Gradually lower the thermostat temperature setpoint below room temperature and verify the outdoor unit and indoor blower energize.
2. Verify blower wheel is spinning in direction indicated by arrow. Feel the air being circulated by the indoor blower and verify that it is cooler than ambient temperature. Listen for any unusual noises. If unusual sounds occur, determine the source of the noise and correct as necessary.



3. Verify HI and LO refrigerant pressures.
4. Allow the system to operate for several minutes and then set the temperature selector above room temperature. Verify the fan and compressor cycle off with the thermostat.  
**NOTE:** The blower should also stop unless fan mode is set to the ON position.

### System Heating

1. Set the thermostat's system mode to HEAT and the temperature mode to below room temperature.
2. Verify the outdoor unit and indoor fan stop running. After 5 minutes, increase the temperature on the thermostat to it's maximum setting.
3. Verify the outdoor unit and indoor blower energize. Feel the air being circulated by the indoor blower and verify that it is warmer than ambient temperature. Listen for any unusual noises. If unusual sounds occur, determine the source of the noise and correct as necessary.

### Defrost Control Board Test Pins

- Verify the Status Indicator (on the control board) against the codes listed in [Table 2](#) to determine proper diagnostic description.
- Terminals 'R' and 'C' must have 18-30 VAC present between them for proper board operation.
- Board anti-short cycle timer can be bypassed by shorting the test terminals for less than 1 second while there is a call for heating or cooling.
- Forced defrost enabled when shorting the test terminals for more than three seconds while there is a call for heating or cooling. After short removed, defrost mode will be terminated when conditions are met.
- Forced defrost can be maintained for up to 11 minutes by continuously maintaining the short across the test terminals. If held for over 11 minutes, the unit will stop and a flashing 'dF' will be indicated on the board.
- A continuous display of a fault code will indicate that the fault is still active.
- A flashing fault code indicates that the fault has been corrected but remains in memory for troubleshooting purposes.
- Multiple fault codes are listed in order from the most recent to the oldest. Only ten codes will be stored in memory.
- Faults will remain in the board memory for seven days after the last fault is corrected.
- Faults can be cleared from memory by shorting the test terminal momentarily while there is not a call for heating or cooling.

## HEAT PUMP MAINTENANCE

### WARNING:

**To prevent electrical shock, personal injury, or death, disconnect all electrical power to the unit before performing any maintenance or service. The unit may have more than one electrical supply.**

Proper maintenance is important to achieve optimum performance from the heat pump. The ability to properly perform maintenance on this equipment requires certain mechanical skills and tools. If you do not possess these skills, contact your dealer for maintenance. Consult your local dealer about the availability of maintenance contracts. Routine maintenance should include the following:

| STATUS INDICATOR | STATUS TYPE      | DIAGNOSTIC DESCRIPTION                                     |
|------------------|------------------|------------------------------------------------------------|
| C1               | Operating Status | Cooling, 1st Stage                                         |
| C2               | Operating Status | Cooling, 2nd Stage                                         |
| H1               | Operating Status | Heating, 1st Stage                                         |
| H2               | Operating Status | Heating, 2nd Stage                                         |
| SC               | Operating Status | Anti Short Cycle Timer                                     |
| DF               | Operating Status | Defrost                                                    |
| —                | Operating Status | Power on, no call for operation                            |
| 01               | Fault            | Pressure switch, low                                       |
| 02               | Fault            | Pressure switch, high                                      |
| 03               | Fault            | Temperature Sensor, Ambient                                |
| 04               | Fault            | Temperature Sensor, Coil                                   |
| 05               | Fault            | Board                                                      |
| 0F (FLASHING)    | Input Error      | Forced defrost - test short applied longer than 11 minutes |

**Table 2. Defrost Control Board Status Indicators**

- Inspect and clean or replace air filters at the beginning of each heating and cooling season, or more frequently if required.
- Inspect the condensate drains in the unit's basepan and the outdoor coil at the beginning of each cooling season. Remove any debris. Clean the outdoor coil and louvers as necessary using a mild detergent and water. Rinse thoroughly with water.
- To access the outdoor coil on units equipped with louvered panels, refer to [Figure 5, \(page 10\)](#) for panel removal and [Figure 6, \(page 10\)](#) for panel installation.
- Inspect the electrical connections for tightness at the beginning of each heating and cooling season. Service as necessary.
- Do not attempt to add additional oil or grease to motors unequipped with oil tubes or grease fittings. Most outdoor unit motors are manufactured with sealed, permanently lubricated bearings that are designed for the life of the equipment without maintenance.
- The compressor is hermetically sealed and shipped from the factory with the proper oil charge for most installations. Lubricating oil should only be added by trained personnel and is typically only required for long line-sets or tall riser applications.

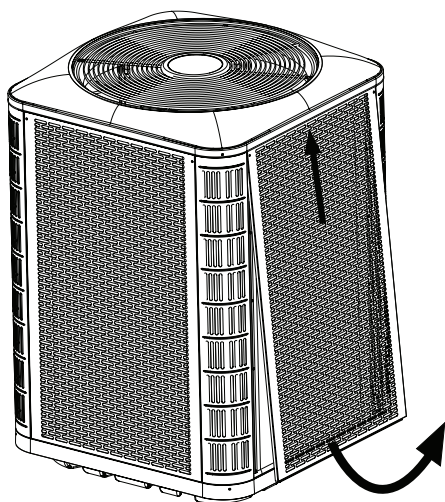
### Panel Removal

1. Remove screws securing the panel.
2. Slide the panel up towards the top pan in order to clear the bottom flange from the base pan. See [Figure 5](#).
3. Swing the bottom of the panel out and pull the panel down to remove it from the unit.

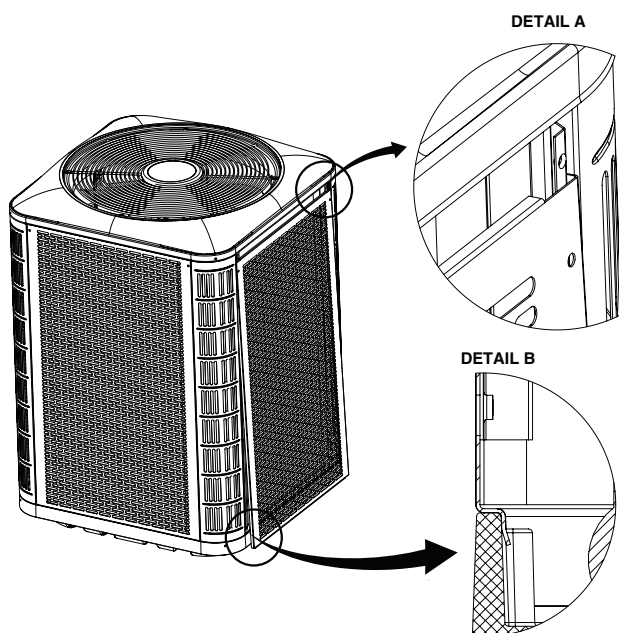
### Panel Installation

1. Insert the top corners of side panel flanges into the corner post channels as shown in Detail A in [Figure 6](#).
2. Slide the panel up into the top pan. (You may need to push on the center of the panel at the top in order to clear the top pan edge).
3. Swing the panel in and push down until the panel is resting on the top edge of the base pan wall as shown in Detail B.
4. Insert screws into the panel to secure it to the unit.

## REFRIGERANT CHARGING



**Figure 5. Panel Removal**



**Figure 6. Panel Installation**

## **⚠ WARNING:**

**\*SH4ME5M Split System Heat Pumps are shipped charged with R-454B refrigerant and ready for installation. If repairs make it necessary for evacuation and charging, it should only be attempted by qualified trained personnel thoroughly familiar with this equipment. Under no circumstances should the owner attempt to install and/or service this equipment. Failure to comply with this warning could result in property damage, personal injury, or death.**

- After refrigerant line connections are completed, but **BEFORE** the unit's base valves are opened, it is required that you pressure test with an inert gas, leak check, and evacuate the indoor section and all line connections (using proper methods) before finalizing the full system refrigerant charge.

## **⚠ CAUTION:**

**The outdoor unit shall be isolated during pressure testing. If at any time the outdoor unit does need to be pressure tested then the pressure must never exceed 450 psig or the compressor may be damaged and the warranty voided.**

- When pressure testing the indoor unit and lineset the minimum pressure to be used shall be the maximum allowable pressure on the indoor unit's rating label.
- The refrigerant joints between the lineset and indoor unit, and any other field-made refrigerant joints inside the home or building shall be tightness tested. The test method shall have a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 200 psig. No leak shall be detected.
- Along with typical charging best practices, the following additional requirements shall be followed due to the mildly flammable refrigerant used in this system
  - Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
  - Cylinders shall be kept in an appropriate position according to the instructions.
  - Ensure that the refrigerating system is earthed prior to charging the system with refrigerant
  - Label the system when charging is complete (if not already).
  - Extreme care shall be taken not to overfill the refrigerating system.
- Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.
- Refer to the Quick Reference Data sheet for additional charging information for this unit with the approved Nordyne indoor units. For reference, these units are listed in the AHRI Directory with all approved combinations of indoor

coils and units. Installing these outdoor units on systems that combine it with an indoor coil or unit not listed there, is not recommended. When approved combinations of indoor and outdoor units are installed, they should be set up to operate within the airflow and other operational parameters prescribed in all of the units provided instructions and technical specifications.

- Installation of this outdoor unit with other, non-listed indoor unit combinations may require different airflows, expansion devices, charge values and system setup from the instructions provided here and with this unit. Nordyne does not recommend the use of this product in unlisted combinations, and the system performance and efficiency values of unlisted unit combinations may be different than the listed product combinations.
- The refrigerant charge can be checked and adjusted through the service ports provided external to the outdoor unit. Use only gauge sets with hoses which have a "Schrader" depression device present to actuate the valve. A common suction port for heating mode charging is included and located on the compressor access panel above the outdoor unit service valves.
- An automatic high-pressure switch is factory-installed installed in these units and is located on the discharge line after the unit's compressor. This switch is designed to protect the system when very high pressures occur during abnormal conditions. Under normal conditions, the switch is closed. If the system pressure rises to 650 psig, then the switch will open and de-energize the contactor coil in the outdoor unit. The switch will close again once the liquid pressure decreases to 460 psig and allow the unit to restart after a 5 minute short cycle delay.
- A low-pressure switch is factory installed (certain models) and located internally on the suction line of the outdoor unit. The switch is designed to protect the compressor from a loss of charge by interrupting the thermostat inputs to the unit. If the suction pressure falls below 20 psig, the switch will open and de-energize the outdoor unit. The switch will close again when the suction pressure increases above 35 psig. When the switch opens and then closes, there is a 3 minute short cycling delay before the outdoor unit will energize. Under normal conditions the switch is closed.
- **NOTE:** After completing the charging of the system the final system charge shall be recorded in the appropriate location on the outdoor unit's rating plate.

### Charging the Unit in AC mode

If the outdoor temperature is 65 degrees F or higher:

After completing the refrigerant line connections, leak checking the system, and evacuating the indoor section and all line connections (using proper methods), perform the following steps:

1. Determine the recommended charge addition (if applicable) for the system being installed. This information is in the unit's QRD (Quick Reference Data sheet).
2. Calculate the amount of additional refrigerant needed for the line set length of the actual installation. This information is on the first page of the unit's QRD (Quick Reference Data sheet).
3. Weigh in the additional charge amounts determined by step 1 and 2 above.
4. Adjust the charge to match the superheat (for fixed orifice systems) or subcooling (for TXV systems). The charging tables are on the inside of the outdoor unit's electrical

box cover panel. These tables provide superheat targets for fixed orifice systems and subcooling targets for TXV systems. The system should be charged so that the measured superheat/ subcooling are within 1 degree F of the target listed in the table.

#### For fixed orifice systems:

- If your measured superheat at the suction valve is **LESS THAN** the recommended superheat value in the table then **REMOVE** refrigerant.
- If your measured superheat at the suction valve is **GREATER THAN** the recommended superheat value in the table then **ADD** refrigerant.

#### For TXV systems:

- If your measured subcooling at the liquid valve is **LESS THAN** the recommended subcooling value in the table then **ADD** refrigerant.
- If your measured subcooling at the liquid valve is **GREATER THAN** the recommended subcooling value in the table then **REMOVE** refrigerant.

If the outdoor temperature is between 35 degrees F and 65 degrees F:

After completing the refrigerant line connections, leak checking the system, and evacuating the indoor section and all line connections (using proper methods), perform the following steps:

1. Determine the recommended charge addition (if applicable) for the system being installed. This information is in the unit's QRD (Quick Reference Data sheet).
2. Calculate the amount of additional refrigerant needed for the line set length of the actual installation. This information is on the first page of the unit's QRD (Quick Reference Data sheet).
3. Weigh in the additional charge amounts determined by step 1 and 2 above.
4. Block off the discharge of the outdoor fan. **NOTE:** One half of the unit should be covered corner to corner as shown in [Figure 7, \(page 12\)](#).
5. With the unit in cooling mode, Adjust the charge to match the superheat (for fixed orifice systems) or subcooling (for TXV systems). There are two different resources for doing this:
  - a.) The [chargecalculator.com](http://chargecalculator.com) website. This will walk you through the charging process step by step.
  - b.) The low ambient charging tables on the inside of the outdoor unit's electrical box cover panel. These tables provide superheat targets for fixed orifice systems and subcooling targets for TXV systems. The system should be charged so that the measured superheat/subcooling are within 1 degree F of the target listed in the table.

#### For fixed orifice systems:

- If your measured superheat at the suction valve is **LESS THAN** the recommended superheat value in the table then **REMOVE** refrigerant.
- If your measured superheat at the suction valve is **GREATER THAN** the recommended superheat value in the table then **ADD** refrigerant.

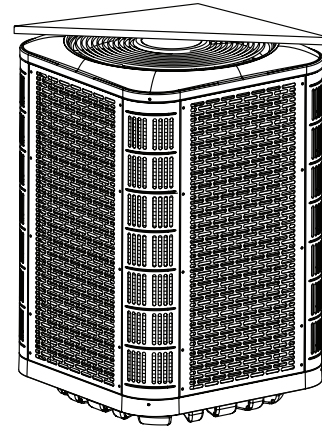
**For TXV systems:**

- If your measured subcooling at the liquid valve is **LESS THAN** the recommended subcooling value in the table then **ADD** refrigerant.
- If your measured subcooling at the liquid valve is **GREATER THAN** the recommended subcooling value in the table then **REMOVE** refrigerant

If the outdoor temperature is below 35 degrees F:

After completing the refrigerant line connections, leak checking the system, and evacuating the indoor section and all line connections (using proper methods), perform the following steps:

1. Determine the recommended charge addition (if applicable) for the system being installed. This information is in the unit's QRD (Quick Reference Data sheet).
2. Calculate the amount of additional refrigerant needed for the line set length of the actual installation. This information is on the first page of the unit's QRD (Quick Reference Data sheet).
3. Weigh in the additional charge amounts determined by steps 1 and 2 above.
4. Return to the system when the outdoor temperature is 35 degrees F or higher and follow the steps defined in step 4 of the "If the outdoor temperature is between 35 degrees and 65 degrees F" or "If the outdoor temperature is 65 degree F or higher" sections above as applicable.



**NOTE:** One half of the unit should be covered corner to corner.

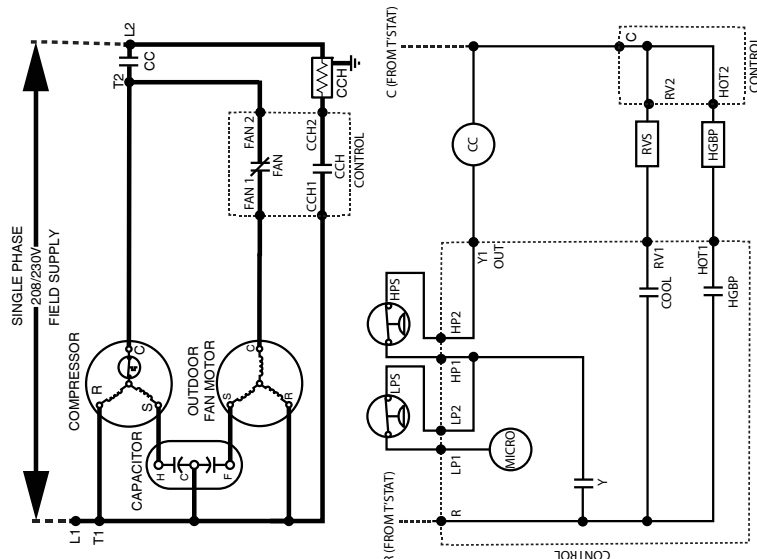
**Figure 7. Blocked Off Outdoor Fan Discharge**



# WIRING DIAGRAM

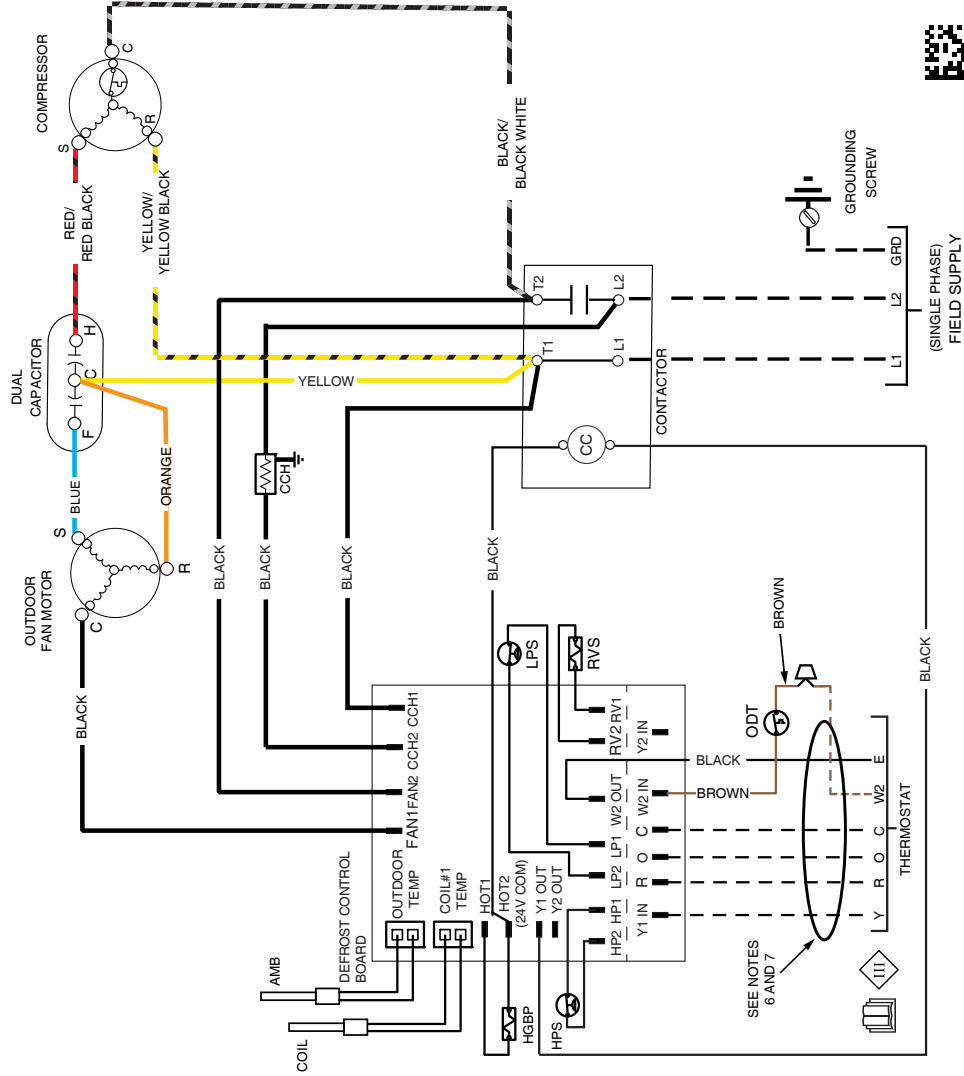
## Split System Heat Pump (Outdoor Section)

- NOTES:**
1. Disconnect all power before servicing.
  2. For supply connections use copper conductors only.
  3. Not suitable on systems that exceed 150 volts to ground
  4. For replacement wires use conductors suitable for 105° C.
  5. For ampacities and overcurrent protection, see unit rating plate.
  6. Connect to 24 vac/40va/class 2 circuit. See furnace/air handler installation instructions for control circuit and optional relay/transformer kits.
  7. Caution: The Low Voltage wiring shall NOT be grounded to this unit.



## Single Phase

1. Couper le courant avant de faire le retien.
2. Employez uniquement des conducteurs en cuivre.
3. Ne convient pas aux installations de plus de 150 volt a la terre.



10468920  
12/23

Figure 8. Wiring Diagram for \*SH4ME5M

## REFRIGERANT RECOVERY

---

### **WARNING:**

**Recovering refrigerant involves breaking into the refrigerant circuit. It should only be attempted by qualified trained personnel thoroughly familiar with this equipment. Under no circumstances should the owner attempt to do this work. Failure to comply with this warning could result in property damage, personal injury, or death.**

---

- When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.
  - When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
  - The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.
  - The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.
  - If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.
- It is recommended good practice that all refrigerants are recovered when possible.
  - Before decommissioning the system:
    - Become familiar with the equipment and its operation.
    - Take a sample of oil and refrigerant in case analysis is required prior to re-use of recovered refrigerant.
    - Ensure that electrical power is available for use in the decommissioning operations
    - Ensure that mechanical handling equipment is available, if required, for handling refrigerant cylinders
    - Ensure that all personal protective equipment (PPE) is available and being used correctly.
    - Ensure that the recovery process is supervised at all times by a competent person.
    - Ensure that the recovery equipment to be used and refrigerant cylinders conform to the appropriate standards.
    - Position the recovery cylinder on the scales before recovery of refrigerant begins.
  - Procedure For Decommissioning System
    1. Isolate the system electrically.
    2. Pump down the refrigerant system, if possible.
    3. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
    4. Start the recovery machine and operate it in accordance with its instructions. Refer to the Refrigerant Recovery section of this document for additional information.
    5. Do NOT overfill cylinders (no more than 80% volume liquid charge).
    6. Do NOT exceed the maximum working pressure of the cylinder, even temporarily.
    7. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
    8. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.
    9. Label the system stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. Ensure that there are still labels on the equipment stating that the system contains flammable refrigerant to properly identify it.

## DECOMMISSIONING

---

### **WARNING:**

**Decommissioning the system involves breaking into the refrigerant circuit. It should only be attempted by qualified trained personnel thoroughly familiar with this equipment. Under no circumstances should the owner attempt to do this work. Failure to comply with this warning could result in property damage, personal injury, or death.**

---



## INSTALLATION CHECKLIST

|                                                                     |        |    |
|---------------------------------------------------------------------|--------|----|
| <b>INSTALLATION ADDRESS:</b>                                        |        |    |
| CITY:                                                               | STATE: |    |
| UNIT MODEL #                                                        |        |    |
| UNIT SERIAL #                                                       |        |    |
| <b>INSTALLER NAME:</b>                                              |        |    |
| CITY                                                                | STATE  |    |
| Unit Installed Minimum clearances shown on <a href="#">page 5</a> ? | YES    | NO |
| Has the owner's information been reviewed with the customer?        | YES    | NO |
| Has the Literature Package been left with the unit?                 | YES    | NO |

| REFRIGERATION SYSTEM                                       |     |    |
|------------------------------------------------------------|-----|----|
| Was unit given 24 hr warm up period for crankcase heaters? | YES | NO |
| Stage-1 Liquid Pressure (high side):                       |     |    |
| Stage-1 Suction Pressure (low side):                       |     |    |

| ELECTRICAL SYSTEM                                        |     |    |
|----------------------------------------------------------|-----|----|
| Electrical connections tight?                            | YES | NO |
| Line voltage polarity correct?                           | YES | NO |
| Rated Voltage:                                           |     |    |
| Maximum deviation of voltage from average volts:         |     |    |
| Has the thermostat been calibrated?                      | YES | NO |
| Is the thermostat level?                                 | YES | NO |
| Is the heat anticipator setting correct? (If Applicable) | YES | NO |

### REPLACEMENT PARTS

Replacement parts are available through your distributor. Please have the complete model and serial number of the unit when ordering replacement parts.

#### ELECTRICAL:

- Capacitors
- Compressors
- Contactors
- Pressure Switches
- Relays
- Temperature Limit Switches
- Thermostats
- Time Delay Relays
- Transformers

#### MOTORS:

- Blower Motor
- Fan Motor

#### COMPONENTS:

- Blower Assembly
- Cabinet Panels
- Expansion Valves
- Fan Grille
- Filter/Driers

