

# INSTALLATION AND MAINTENANCE INSTRUCTIONS

## SHP Series Split System Heat Pump - Outdoor Section

**⚠ WARNING**

The equipment covered in this manual is to be installed by trained and experienced service and installation technicians. Improper installation, modification, service or use can cause electrical shock, fire, explosion or other conditions which may cause personal injury, death or property damage. Use appropriate safety gear including safety glasses and gloves when installing this equipment.

**⚠ WARNING**

Risk of electrical shock. Disconnect all remote power supplies before installing or servicing any portion of the system.

**⚠ WARNING**

Installation and servicing of air conditioning equipment can be hazardous due to internal refrigerant pressure and live electrical components. Only trained and qualified service personnel should install, repair or service this equipment.

**⚠ WARNING**

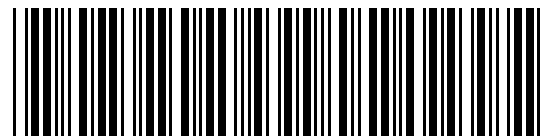
Before performing maintenance operations on system, turn off all main power switches to indoor and outdoor units. Turn off accessory heater power switch if applicable. Electrical shock could cause personal injury or death.

**TABLE OF CONTENTS**

|                       |    |
|-----------------------|----|
| INSTALLATION .....    | 2  |
| START-UP .....        | 5  |
| OPERATION .....       | 6  |
| MAINTENANCE .....     | 7  |
| WIRING DIAGRAMS ..... | 8  |
| WARRANTY .....        | 11 |

Manufactured By  
**A.A.C.**

**A *Lennox International Company***  
421 Monroe Street  
Bellevue, OH 44811



# INSTALLATION

## General

These instructions are intended to explain the recommended method of installation of the SHP series outdoor unit, interconnecting refrigerant tubing and associated electrical wiring.

This unit is designed and approved for use as a split system air-cooled outdoor section of an entire heat pump system.

The outdoor units are intended to be used in conjunction with matching indoor coils or blower coil units for comfort cooling/heating applications as shown in specification information.

These instructions, and any instructions packaged with mating components and/or accessories, should be carefully read prior to beginning installation. Note particularly any **CAUTIONS** or **WARNINGS** in these instructions and all labels on the units.

These instructions are intended as a general guide only for use by qualified personnel and do not supersede any national or local codes in any way. Compliance with all local, state, provincial or national codes pertaining to this type of equipment should be determined prior to installation.

## Inspection of Shipment

Upon receipt of equipment, carefully inspect it for possible shipping damage. If damage is found, it should be noted on the carrier's freight bill. Take special care to examine the unit inside the carton if the carton is damaged. Any concealed damage discovered should be reported to the last carrier immediately, preferably in writing, and should include a request for inspection by the carrier's agent.

If any damages are discovered and reported to the carrier **DO NOT INSTALL THE UNIT, as claim may be denied.**

**Check the unit rating plate to confirm specifications are as ordered.**

## Limitations

The unit should be installed in accordance with all national and local safety codes.

Limitations for the indoor unit, coil and appropriate accessories must also be observed.

The outdoor unit must not be installed with any ductwork in the airstream. The outdoor fan is not designed to operate against any additional static pressure.

| Application Limitations   |      |         |      |                          |      |      |      |
|---------------------------|------|---------|------|--------------------------|------|------|------|
| Outdoor Ambient Air Temp. |      |         |      | Indoor Ambient Air Temp. |      |      |      |
| Min. DB                   |      | Max. DB |      | Min.                     |      | Max. |      |
|                           |      |         |      | WB                       | DB   | WB   | DB   |
| Cool                      | Heat | Cool    | Heat | Cool                     | Heat | Cool | Heat |
| 65°F                      | 0°F  | 115°F   | 75°F | 57°F                     | 50°F | 72°F | 80°F |

**Table 1**

Minimum and maximum operating conditions must be observed to assure maximum system performance with minimum service required. Refer to Table 1 for the application limitations of the unit.

## Location

This outdoor unit is designed to be located outdoors with sufficient clearance for free entrance to the inlet and discharge air openings. The location must also allow for adequate service access. Figure 1 on page 3 shows a typical installation.

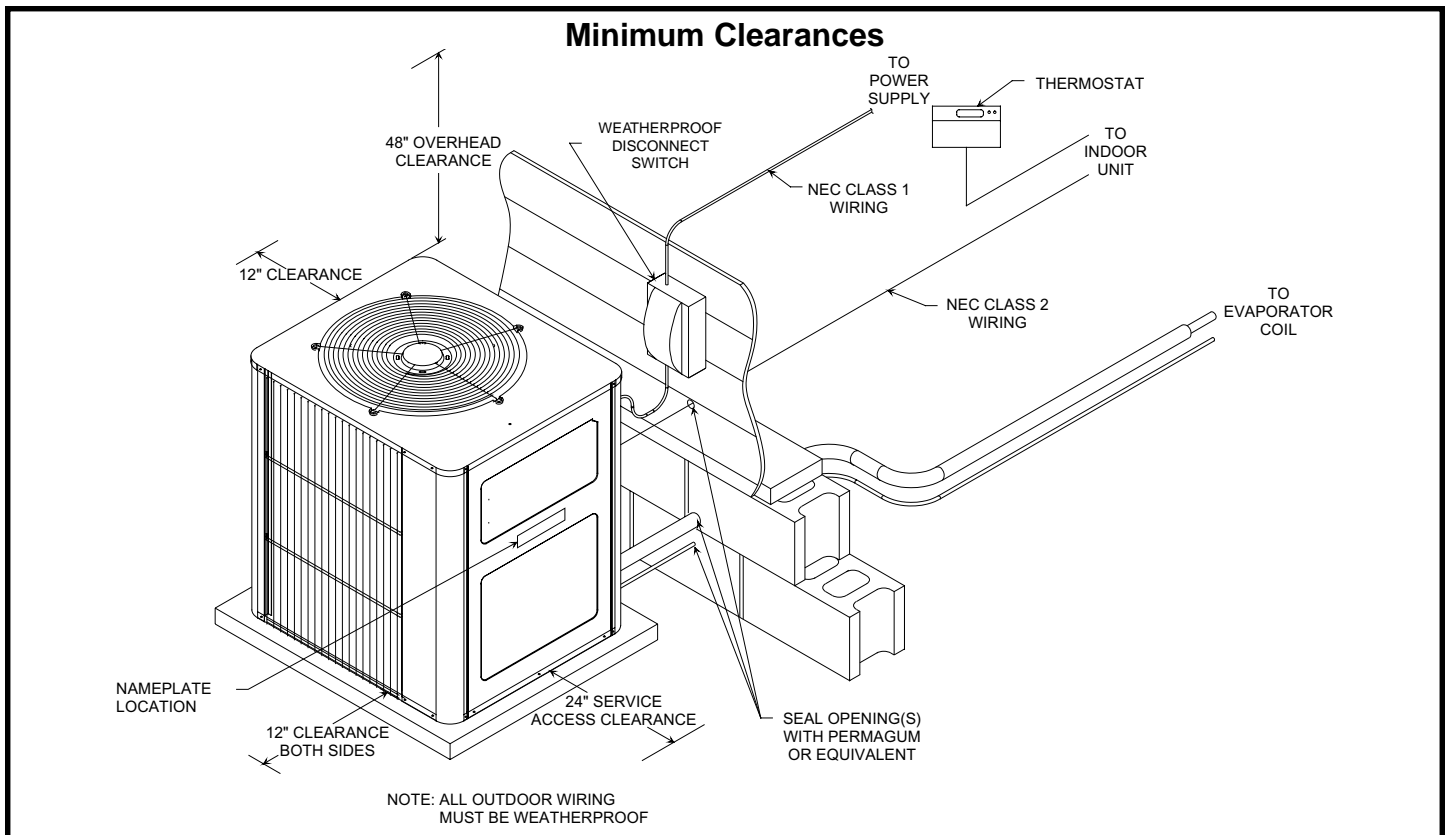
The unit must be installed on a solid foundation that will not settle or shift. Adequate structural support must be provided. Maintain minimum clearances as shown in Figure 1 and install the unit in a level position. Isolate the base from the building structure to avoid possible transmission of sound or vibration into the conditioned space.

The unit foundation should be raised to a minimum of 3" above finish grade. In areas which have prolonged periods of temperature below freezing and snowfall, the unit should be elevated above the average snow line. Also, extra precaution to allow free drainage of condensate from defrost cycles should be taken to prevent ice accumulation. The unit should be located away from walkways to prevent possible icing of surface from defrost condensate.

**Avoid placing the unit near quiet areas such as sleeping quarters or study rooms.** Normal operating sound levels may be objectionable if the unit is placed near certain rooms.

## Indoor Unit

**These outdoor units are designed to be matched with and must be used with indoor blower coil units and coils as per specifications.** Most indoor sections are manufactured with an interchangeable metering orifice to provide optimum refrigerant control and system performance. The correct metering orifice is standard with the matched indoor unit or may be shipped with the outdoor unit if an orifice change is required. Refer to the installation instructions provided with the indoor unit for indoor unit orifice change details. See the Charge/Orifice Table on the outdoor unit for the proper system orifice required.



**Figure 1**

Compare the refrigerant metering orifice marked on the indoor unit with those listed on the Charge/Orifice Table. The matching indoor unit components should be equipped with the proper orifice from the factory. If the indoor unit does not have a matching orifice, the proper parts should be ordered through Armstrong Service Parts. See the indoor unit installation instructions for further detail on orifice changes.

**For improved start-up performance, the indoor coil should be washed with suitable detergent to remove any residue from the manufacturing processes.**

### Refrigerant Tubing Connection

Connecting refrigerant tubing must be clean, dehydrated, refrigerant grade tubing. Units should be installed only with specified line sizes for approved system combinations with elevation differences up to 20 feet and total length of up to 50 feet (see Tables 2 & 3 on page 4).

Care must be taken to insure that the integrity of the tubing/system is maintained during the installation process. Do not remove the caps from the tubing or system connection points until connections are ready to be completed. Care should be taken to avoid sharp bends or possible kinking in the tube which may cause a restriction. Vapor lines must be insulated with a minimum 3/8" rubber insulation.

Outdoor unit service valves must be cooled during the brazing process. The recommended method is to wrap the valve with a wet rag. The service valves can be extended outside the cabinet by loosening the 2 screws on the service valve bracket and pulling the valves outward. When the valves are in the extended position, tighten the screws. Indoor unit and connecting tubing should be purged with dry nitrogen through the service port on the valve during tubing connection. All copper connection points should be brazed with an alloy of silver or copper and phosphorus with a melting point above 1100 degrees F. **Do not use soft solder.** Leak test all braze joints.

Evacuate tubing and indoor unit through service ports to 150 micron level or less.

**The outdoor unit is factory charged with the proper charge amount for a matching evaporator and 20 feet of refrigerant tubing.** Adjustment of the refrigerant charge may be necessary based on the system combination and line length. See Charge/Orifice Table to determine proper system charge and compare this amount to the basic charge on the outdoor unit rating plate.

Remove caps from service valves and open the valves. Replace valve caps.

### **WARNING**

Extreme care should be taken not to open valve core past retaining clips.

Pack insulating material around refrigerant lines where they penetrate structure to protect tubing and minimize vibration transmission and seal with permagum or RTV.

Factory charge contains refrigerant for condenser, evaporator and 20 feet of 3/8" line set. For line set other than 20 feet, adjust charge at 0.60 oz. per foot of 3/8" o.d. liquid line and 1.2 oz. per foot of 1/2" line. To obtain optimum performance, system charge should be weighed in accordance to amount specified on unit rating plate and any adjustments for additional line length over 20 feet, as stated above.

**System performance may be verified by using the refrigerant charging labels provided with each unit.**

In air conditioning systems, horizontal suction lines should be slightly sloped toward the condensing unit. Piping must avoid dips or low spots can collect oil. To aid in the return of oil, a trap should be installed at the bottom of any suction riser. The top end of the riser must be pitched toward the compressor. For long vertical risers, additional traps are recommended for each additional 20 feet of pipe to insure proper oil movement.

**Electrical Wiring**

All field wiring must be done in accordance with National Electrical Code recommendations, Canadian Electrical

Code and CSA Standards, applicable requirements of UL, or local codes, where applicable. Power wiring, disconnect means and over-current protection are to be supplied by the installer. Refer to the unit rating plate for maximum over-current protection, minimum circuit ampacity, as well as operating voltage. The power supply must be sized and protected as according to specifications supplied.

**Use copper conductors only.**

Unit must be grounded with separate ground conductor. Refer to Figure 2 on page 5 for typical field wiring connection. Unit wiring diagrams are located inside the unit access panel. Low voltage control wiring are pigtail leads located below the main control box and are color coded to match the connection called out on the wiring schematic.

**Low Pressure Switch (if used)**

Some models come equipped with a low pressure switch to guard against the compressor overheating from loss of charge. The pressure control opens at 10 psi and resets at 30 psi. If the control trips during operation, a problem exists within the system. Check for the following as possible causes:

- Low system charge
- Leak
- Plugged air filter
- Fan/blower motor malfunction

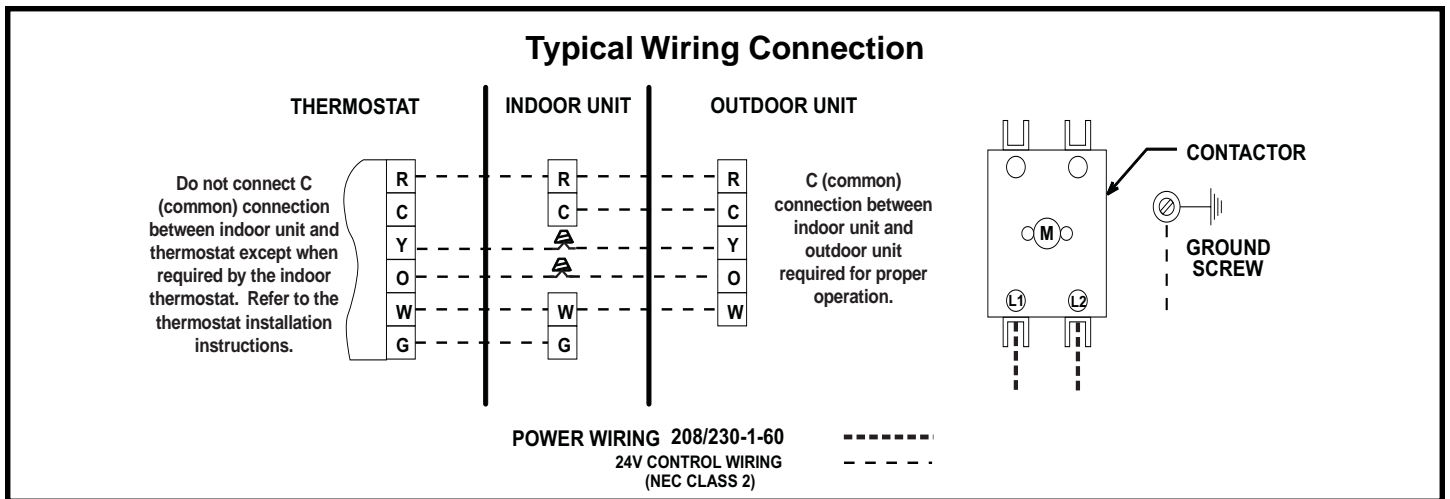
| Suction Line Sizes |                          |        |        |
|--------------------|--------------------------|--------|--------|
| BTU/HR             | LINE SET LENGTH AND SIZE |        |        |
|                    | 12 FT.                   | 25 FT. | 50 FT. |
| 12,000             | 3/4                      | 3/4    | 3/4    |
| 18,000             | 3/4                      | 3/4    | 3/4    |
| 24,000             | 3/4                      | 3/4    | 3/4    |
| 30,000             | 3/4                      | 3/4    | 3/4    |
| 36,000             | 7/8                      | 7/8    | 7/8    |
| 42,000             | 7/8                      | 7/8    | 7/8    |
| 48,000             | 7/8                      | 7/8    | 7/8    |
| 60,000             | 7/8                      | 7/8    | 7/8    |

**Table 2**

| Liquid Line Sizes |                          |        |        |
|-------------------|--------------------------|--------|--------|
| BTU/HR            | LINE SET LENGTH AND SIZE |        |        |
|                   | 12 FT.                   | 25 FT. | 50 FT. |
| 12,000            | 3/8                      | 3/8    | 3/8    |
| 18,000            | 3/8                      | 3/8    | 3/8    |
| 24,000            | 3/8                      | 3/8    | 3/8    |
| 30,000            | 3/8                      | 3/8    | 3/8    |
| 36,000            | 3/8                      | 3/8    | 3/8    |
| 42,000            | 3/8                      | 3/8    | 3/8    |
| 48,000            | 3/8                      | 3/8    | 3/8    |
| 60,000            | 3/8                      | 3/8    | 3/8    |

**Table 3**

**For installations exceeding 50 feet, contact Armstrong Air Conditioning Inc. Technical Services Department at (419) 483-4840.**



**Figure 2**

A thorough inspection of the system should be made to determine the cause.

#### Discharge Thermostat (if used)

Some models come equipped with a discharge thermostat (loss of charge control) to guard against the compressor overheating from loss of charge. The temperature cut out for this control is set at 250°F, as determined by compressor manufacturer's recommendation. **Discharge temperatures exceeding 250°F will cause compressor oil breakdown that will lead to premature compressor failure.** If the control trips during unit operation, a problem exists within the system. Check for the following as possible causes:

- Low system charge
- High discharge pressures

A thorough inspection of the system should be made to determine the cause. The discharge gas temperature may be verified by attaching an electronic type thermometer or thermocouple to the discharge line near the control.

#### Crankcase Heater (if used)

Some models are equipped with insertion crankcase heaters to prevent excessive migration of liquid refrigerant into the compressor. The following steps should be taken on initial start-up to prevent possible compressor damage. The procedure must be followed at initial start-up as well as any time power has been interrupted for 12 hours or longer.

1. Insure that the room thermostat is in OFF position to prevent the compressor from starting.
2. Apply the main power supply to the outdoor unit. This will energize the crankcase heater.

3. Maintain power to the unit for a minimum of 8 hours.
4. After reaching minimum elapsed time, the unit can be safely started.

Except as required for safety while servicing, **do not open the system disconnect switch.**

### START-UP

The procedure for start-up of the unit is as follows:

1. Operate the unit for a period of at least 15 minutes to allow for pressures and temperatures to stabilize.
2. Unless matched with an indoor section using an expansion valve, the superheat method can be used to check the system refrigerant charge. It should be noted that this method is not accurate at low load conditions or at outdoor ambients above 106° F.
3. Using accurate gauges and temperature measuring devices, determine the suction line pressure and temperature as well as the outdoor ambient temperature.
4. Refer to the refrigerant charging instruction label located on the inside of the outdoor unit access panel. Locate the intersection of the measured outdoor temperature and suction line pressure on the chart.
5. If the suction line temperature is higher than the intersection temperature, the system is undercharged. If the actual suction line temperature is lower than the chart temperature, the system is overcharged.

## OPERATION

### Sequence of Operation with Indoor Blower Coil Unit

#### Cooling

Upon cooling demand, the thermostat closes circuit R to O and Y. Closing R to O and Y energizes the reversing valve for cooling operation and closes the unit contactor, starting the compressor and outdoor fan. The thermostat automatically closes R to G circuit which also brings on the indoor fan at the same time. Upon satisfying cooling demand, the thermostat will open the above circuits and open the main contactor, stopping the compressor and outdoor fan. If the indoor unit is equipped with a delay timer, the blower will continue to operate for 60-90 seconds which improves system efficiency.

#### Heating

Upon heating demand, the thermostat closes circuit R to Y, which closes the unit contactor, starting the compressor and outdoor fan. The reversing valve is not energized in the heating mode. The thermostat again automatically brings on the indoor fan at the same time. Upon satisfying heating demand, the thermostat opens above circuits and stops unit operation.

#### Defrost Cycle

If the outdoor ambient conditions are such that frost forms on the outdoor coil, the defrost control monitors the need for and initiates and terminates defrost cycles as necessary to maintain system performance. The defrost control is time/temperature initiated and temperature terminated with a maximum defrost time (time-out) of 10 minutes. Time between defrost cycles is preset at 60 minute intervals at the factory, but can be field adjusted between 30, 60, or 90 minutes. See Figure 3 for field adjustment of defrost timing.

Defrost control will initiate a defrost cycle if the time period has elapsed and the defrost sensor sees a temperature below freezing. At the start of a defrost cycle, the defrost control will energize the reversing valve solenoid, shifting the reversing valve and de-energizing the outdoor fan. The defrost relay will also close, energizing tempering heat for increased comfort during defrost (if the indoor unit is so equipped). The unit will remain in defrost until the defrost sensor has determined that the frost has been removed from the coil or a 10 minute time period has elapsed.

The defrost control is also equipped with a set of pins to aid in troubleshooting of the defrost system. The following is a brief outline of the testing of the defrost system.

1. Defrost sensor must be closed, 32°F or below. If temperatures are such that switch will not close, jumper between defrost sensor terminal on the defrost control.
2. Start system in heating operation.
3. Jumper test pins. A 1/4" quick connect terminal crimped onto a solid wire or brazing rod works well for test jumper. Closing test pins speeds up time interval by a factor of 256.

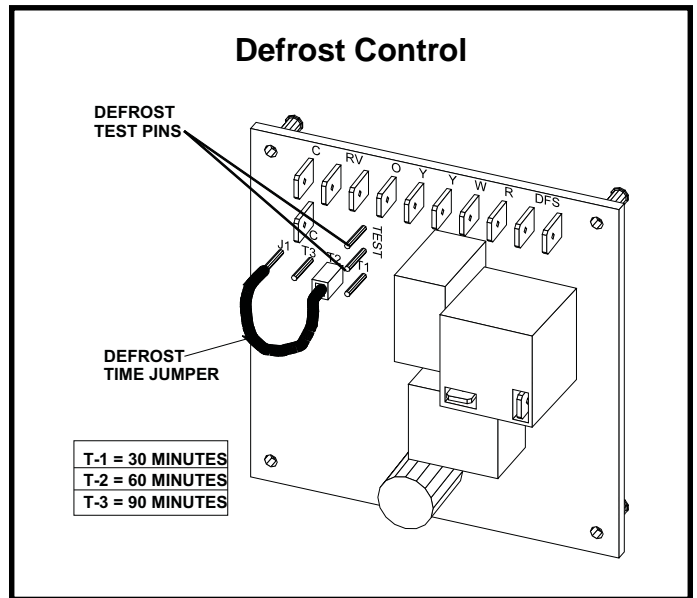


Figure 3

| Defrost Control Setting | Defrost Test Cycle Time |
|-------------------------|-------------------------|
| T1 - 30 minutes         | 7 seconds               |
| T2 - 60 minutes         | 14 seconds              |
| T3 - 90 minutes         | 21 seconds              |

After closing test pins and appropriate cycle time has elapsed, the reversing valve should shift to defrost mode and the outdoor fan should stop. After 2 seconds of defrost operation, the reversing valve should shift back to heating operation and the outdoor fan should start.

## System Performance

For maximum performance of this heat pump system, the operating temperatures and pressures should be checked and superheat determined at Standard ARI test conditions of 82°F outdoor - 80°F indoor dry bulb/67°F wet bulb. If superheat measured deviates from values found in the Charge/Orifice Table located on the outdoor unit, refrigerant charge should be adjusted accordingly for maximum performance.

## MAINTENANCE

### **WARNING**

Before performing maintenance operations on system, turn off all main power switches to indoor and outdoor units. Turn off accessory heater power switch(es), if applicable. Electrical shock could cause personal injury or death.

### Homeowner Maintenance

Leaves and other large obstructions should be carefully removed from the outdoor coil surfaces without damaging the fin surface of the coil.

Routinely clean or change the indoor air filter. Should the coil become dirty, thus restricting airflow, call a qualified service person to carefully clean the coil surface.

### Dealer Maintenance

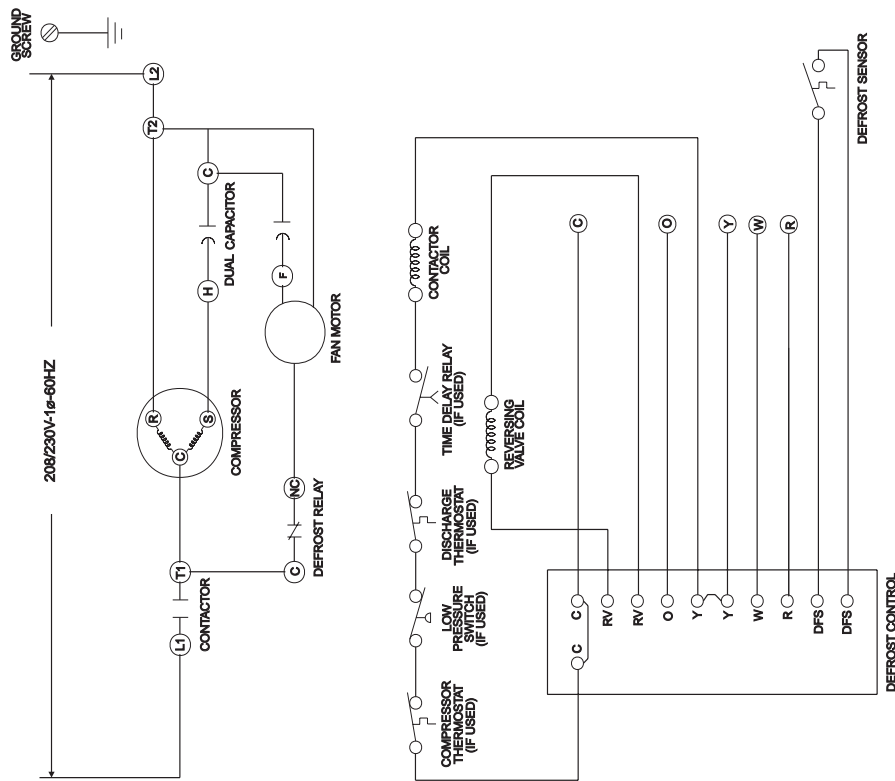
An annual inspection by a qualified service person should be performed to ensure continued quality performance.

Outdoor coil surfaces should be cleaned taking care not to damage the fin surface of the coil.

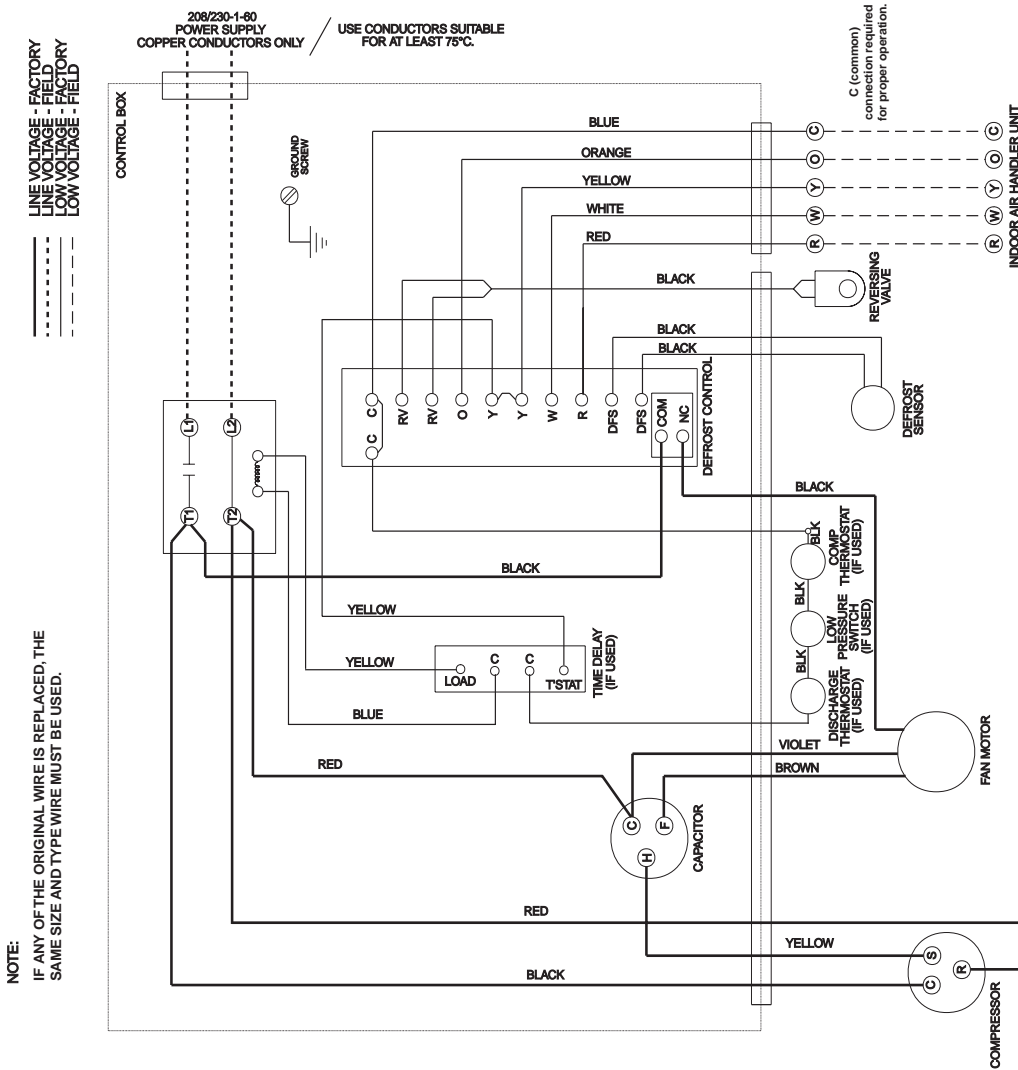
Several weep holes located in the unit base should be inspected and cleaned if necessary to ensure that proper drainage can occur.

All electrical wiring and connections should be inspected as well as physical connections of individual components within units.

**SCHEMATIC**



**CONNECTION DIAGRAM**



LINE VOLTAGE - FACTORY  
 LINE VOLTAGE - FIELD  
 LOW VOLTAGE - FACTORY  
 LOW VOLTAGE - FIELD

NOTE:  
 IF ANY OF THE ORIGINAL WIRE IS REPLACED, THE  
 SAME SIZE AND TYPE WIRE MUST BE USED.

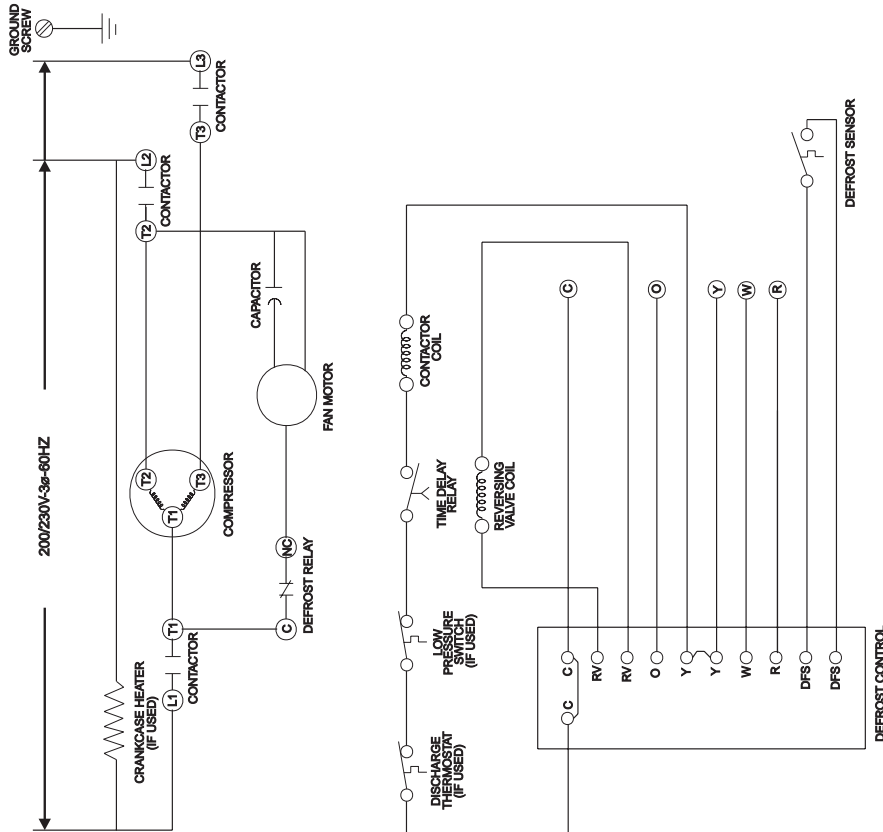
208/230-1-ϕ0  
 POWER SUPPLY  
 COPPER CONDUCTORS ONLY

USE CONDUCTORS SUITABLE  
 FOR AT LEAST 75°C.

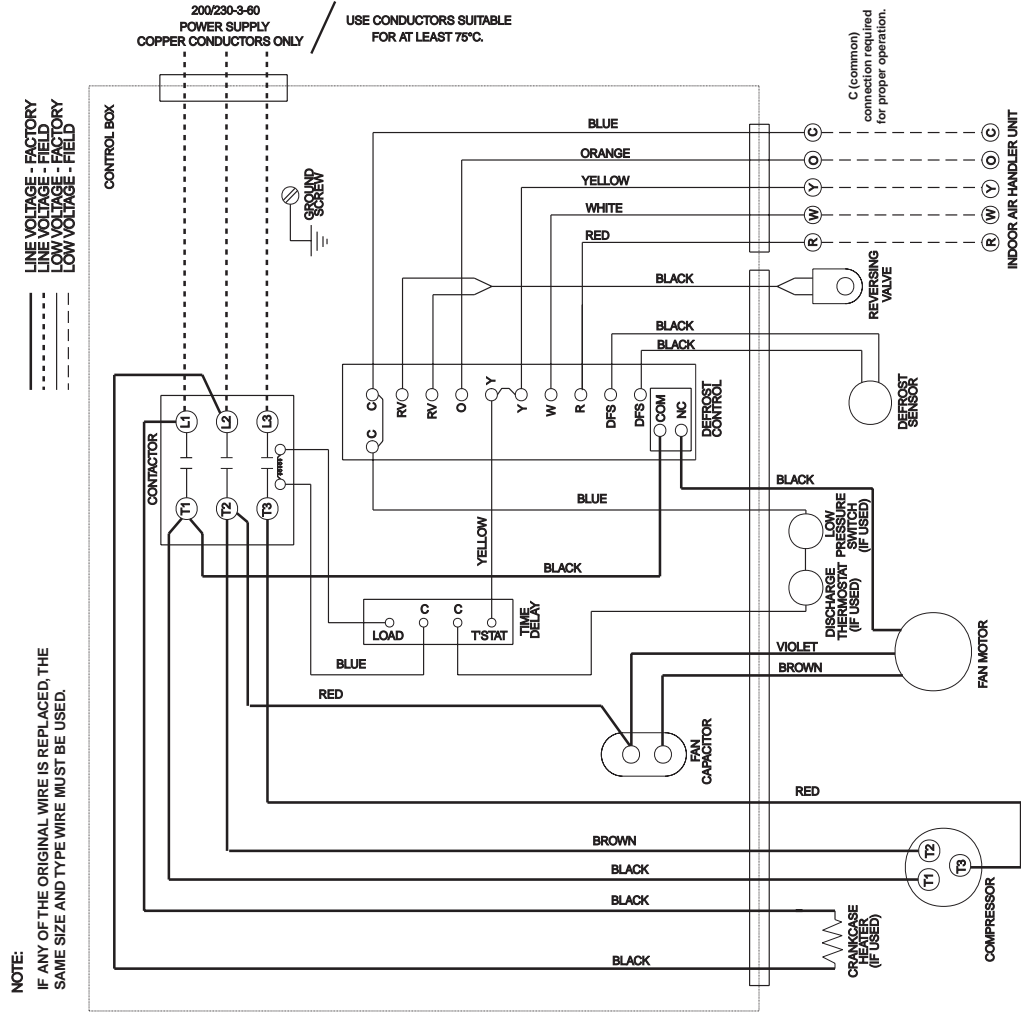
C (common)  
 connection required  
 for proper operation.

**Wiring Diagram - Single Phase  
 208/230 Volt  
 Part #41470-004**

**SCHEMATIC**



**CONNECTION DIAGRAM**



NOTE:  
IF ANY OF THE ORIGINAL WIRE IS REPLACED, THE SAME SIZE AND TYPE WIRE MUST BE USED.

**Wiring Diagram - Three Phase  
200/230 Volt  
Part #41465-005**



## Limited Warranty

August 1, 1997

*This warranty gives you specific legal rights and you may have other rights which vary from state/province to state/province.*

**Warrantor: Armstrong Air Conditioning Inc., 421 Monroe St., Bellevue, OH 44811**

Armstrong Air Conditioning Inc. products are available under the following names: AirEase, Armstrong Air, American Aire, Concord

Subject to the limitations stated in this warranty, we warrant to the first buyer for use the residential heating, cooling or heat pump unit, when installed, operated and maintained as required by this warranty, to be free of defects in workmanship or material for a period of five years (two years for commercial equipment) from the time of installation. We will replace any defective component without cost or expense to you except for the costs of delivery and labor for removal and replacement of the defective component.

**The SHP12 series and E series products carry a 10 year compressor warranty. All other SHP series heat pumps carry a 5 year compressor warranty.**

### Warranty Begins

The warranty period begins when the installation is complete and the product is ready to operate. You must be able to verify this date whenever a warranty claim is made. Original bill of sale, installer's invoice or other similar document will suffice. If the beginning date cannot be verified, we will consider warranty coverage to begin six months after the date the product was shipped from our factory.

### Limitations on Implied Warranties

Implied warranties of merchantability or, to the extent applicable, fitness for a particular purpose are limited to five years, the same duration as the basic limited written warranty provided herein. Some states/provinces do not allow limitations on how long an implied warranty of merchantability or fitness lasts, so the above limitations or exclusions may not apply to you.

### Only Warranty

This written Limited Warranty is the only warranty made by the warrantor; this warranty is in lieu of and excludes all other warranties, express or implied. The warrantor does not authorize any person to provide any other warranty or to assume for it any further obligation in connection with the warranted product.

### What is NOT Covered

1. Cabinets or cabinet pieces.
2. Normal maintenance items such as filters, fan belts, fuses or other consumable items.
3. Damage caused by misuse, failure to maintain properly, accidents or acts of God.
4. External wiring, piping, venting or attachment of accessory products not integral to our product, including without limitation, humidifier, air cleaner, vent damper, thermostat or other mechanical devices not manufactured by the warrantor.
5. Products that have been operated in a corrosive atmosphere where a concentration of acids, halogenated hydrocarbons or other corrosive elements causes deterioration to metal surfaces or integral components. NOTE: Operation in a corrosive atmosphere is considered abuse and voids this warranty.
6. Products that have NOT been installed in accordance with our published installation instructions, applicable local, state/provincial or national codes, ACCA published standards.
7. Products that have NOT been installed by competent, qualified installers.
8. Products that have been moved from their original place of installation.

### Warranty on Replacement Components

Any replacement component furnished by us will assume the remaining (unused) portion of the Limited Warranty.

### Consequential Damages

The warrantor shall not be responsible for any consequential damages caused by any defect in the product. Some state/provinces do not allow the exclusion or limitations of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

NOTE: After the first year, in the event that a gas or oil heat exchanger is no longer being manufactured by the warrantor, the warrantor will allow a credit equal to the then current wholesale price of an equivalent heat exchanger towards the purchase of a new Armstrong gas or oil furnace.

This product must be installed, used and cared for in accordance with the instruction manual. You are responsible for required periodic maintenance or service, such as changing or cleaning of air filters and lubrication or cleaning of components. Failure to properly install, operate or maintain your unit voids this warranty.

### Owner Record

Model # \_\_\_\_\_ Serial # \_\_\_\_\_ Installation Date \_\_\_\_\_

#### INSTALLED BY:

Dealer \_\_\_\_\_

Address \_\_\_\_\_

Telephone # \_\_\_\_\_ License # \_\_\_\_\_