INSTALLATION AND MAINTENANCE INSTRUCTIONS

BELT-DRIVE HORIZONTAL, MODULAR, VERTICAL AND ROOFTOP UNITS

SIZES FROM 600 CFM TO 9,000 CFM

SIZES FROM 600 TO 4,000 CFM

SIZES FROM 600 CFM TO 9,000 CFM

⚠ WARNING

This air handler shall only be connected to an outdoor unit suitable for the same refrigerant.

This air handler (Model Series HP*X, EC*X, or BD*X) is a partial unit air conditioner, complying with partial unit requirements of Standard UL 60335-2-40 / CSA C22.2 No. 60335-2-40, and must only be connected to other units that have been confirmed as complying to corresponding partial unit requirements of Standard UL 60335-2-40 / CSA C22.2 No. 60335-2-40.

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INTRODUCTION

READ THE ENTIRE INSTALLATION, OPERATION AND MAINTENANCE MANUAL. OTHER IMPORTANT SAFETY PRECAUTIONS ARE PROVIDED THROUGHOUT THIS MANUAL.

The following information is to be used by the installer as a guide. Since each installation is unique, only general topics are covered. To order in which topics are presented may not be those required by the actual installation.

This guide does not supersede or circumvent any applicable national, state or local code.

The installer must read the entire contents of this guide and develop a thorough understanding before beginning installation.

Note: Due to continued product research and development, Commercial Aire Products, Inc. reserves the right to discontinue or change without notice, any or all specifications or designs without incurring obligations

INSPECTION

Receiving Unit

When received, the unit should be checked for damage that might have occurred in transit. If damage is found it should be noted on the carrier's freight bill. A request for inspection by carrier's agent should be made in writing at once. All sales are FOB from the warehouse in Fort Worth Texas and any in transit damage is carrier responsibility. The unit nameplate should be checked to ensure the correct model sizes and voltages have been received to match the job requirements.

If repairs must be made to damaged goods, then the factory should be notified before any repair action is taken in order to protect the warranty. Certain equipment alteration, repair, and manipulation of equipment without the manufacturer's consent may void the product warranty. Contact the Commercial Aire Products, Inc. Warranty Department for assistance with handling damaged goods, repairs, and freight claims: (817) 624-0820 ext. 227.

Note: Upon receipt, check shipment for items that ship loose such as filters and remote sensors. Consult order and shipment documentation to identify potential loose-shipped items. Loose-shipped items may have been placed inside unit cabinet for security.

Thoroughly inspect all packages upon receipt of product. Ensure pallet(s) have not been dropped, crushed or punctured. Inspect all contents for damage. If damage is found, immediately file a claim with the delivering freight carrier.

Storage

This equipment is not suitable for outdoor storage. If installation will not occur immediately following delivery, store equipment in a dry protected area away from construction traffic and in the proper orientation as marked on the packaging with all internal packaging in place. Secure all loose-shipped items.

SAFETY

⚠ IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFC's and HFC's) as of July 1, 1992. Approved methods of reclaiming must be followed. Fines and/or incarceration may be levied for non-compliance.

⚠ CAUTION

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

⚠ WARNING

Improper installation may create a condition where the operation of the product could cause personal injury and property damage.

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance; or for additional information consult a qualified contractor, installer, or service agency.

⚠ WARNING

FIRE OR ELECTRICAL HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death, or property damage.

A fire or electrical hazard may result causing property damage, personal injury or loss of life.

⚠ WARNING

Always shut off electricity at the disconnect switch or turn off the circuit breakers in the main electrical panel before performing any service to this air handler.

⚠ WARNING

Hot water from a boiler used to satisfy heating requirements can be heated to temperatures of 180°F. Parts containing water this hot can quickly scald. Use extreme caution when servicing or performing maintenance on any parts containing hot water.

⚠ WARNING

RISK OF FIRE

Air handlers equipped with a DX coil that utilize a flammable refrigerant are equipped with a refrigerant leak detector for safety and with electrically powered safety measures. To be effective, the unit must be electrically powered at all times after installation, other than when servicing.

⚠ WARNING

RISK OF FIRE

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

Air handlers containing a flammable refrigerant shall be stored in a room without continuously operating ignition sources (e.g.: open flames, an operating gas appliance or an operating electric heater).

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury. Understand and pay particular attention to the signal words **DANGER, WARNING, or CAUTION.**

DANGER: Indicates an imminently hazardous situation, which if not avoided, **will result in death or serious injury**.
WARNING: Indicates a potentially hazardous situation, which if not avoided, **could result in death or serious injury**.
CAUTION: Indicates a potentially hazardous situation, which if not avoided, **may result in minor or moderate injury**. It is also used to alert against unsafe practices and hazards involving property damage.

⚠ WARNING

RISK OF FIRE

Refer to Table 2 or 3 for the minimum floor area of the conditioned space served by this air handler due to the use of an A2L class flammable refrigerant.

Safety Requirements

1. This air handler should be installed in accordance with all national and local building/safety codes and requirements, local plumbing and waste water codes, and other applicable codes. In the absence of local codes, install in accordance with the following codes.
   - Standard for the Installation of Air Conditioning and Ventilating Systems (NFPA 90A)
   - Standard for the Installation of Warm Air Heating and Air Conditioning Systems (NFPA 90B)
   - All local codes (State, City, and Township)

   NOTE: All applicable codes take precedence recommendations made in these instructions. Commercial Aire Products, Inc. assumes no responsibility for air handlers that are installed in violation of any code or regulation.
2. Air handler must be installed according to the above listed codes or the instructions in this manual.
3. Failure to carefully read and follow all instructions in this manual can result in a malfunction that can lead to death, personal injury, and/or property damage.
4. Installing and servicing cooling or hot water coils can be hazardous due to high pressure, sub-zero refrigerant temperatures and/or hot water.
5. Only trained and qualified personnel should install repair or service heating/cooling air handlers. Untrained service personnel can perform basic maintenance functions such as cleaning of exterior surfaces and replacing the air filters. Observe all precautions in the manual and on the attached labels when servicing this air handler.
6. These instructions cover minimum requirements and conform to existing national standards and safety codes. In some cases, these instructions exceed certain local codes and ordinances, especially those who have not kept up with changing construction practices. These instructions are to be followed and are the minimum requirement for a safe installation.
7. 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.
8. Installation, servicing and maintenance must only be performed by qualified service personnel that are licensed by the state to install, service, and repair HVAC equipment and those who have successfully completed a course in handling, installing, commissioning, maintenance, servicing, repairing, decommissioning, and disposing of equipment using a flammable refrigerant offered by an accredited national training organization or the manufacturer of the equipment.
9. This air handler must not be operated with access panels removed.
10. This air handler is for use at elevations of 10,000 ft (3,048 m) or less.
11. This air handler is not to be used by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision and instruction concerning use of this air handler by a person responsible for their safety. Children must not be allowed to play with this air handler.

12. The use of dropped ceilings for return air is not permitted for this air handler.
13. Sealed electrical components must be replaced when they fail.
14. Intrinsically safe components must be replaced when they fail.
15. The installation and/or servicing of comfort conditioning equipment can be hazardous due to system pressures and electrical devices.
16. Observe all precautions and warnings in these installation instructions and labels affixed to the unit.
17. Wear eye protection and gloves. Have a fire extinguisher readily available.
18. Disconnect all power supplies before removing any panel from the unit.
19. Disconnecting more than one power supply may be required for some equipment.
20. **Safely Commissioning of the System**
    - Ensure that the floor area is sufficient for the refrigerant charge or that the ventilation duct is assembled in a correct manner.
    - Connect the pipes and carry out a leak test before charging with refrigerant.
    - Check safety equipment before putting into service.

Proper Safe Working Procedures for Equipment Using Flammable Refrigerants

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating system, the following steps must be completed prior to conducting work on the system.

1. 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.
2. 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.
3. 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.
4. If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available on hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.
5. No person performing work on 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.
6. 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.
7. 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.
8. 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;
   - Marking on 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.
9. **Detection 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.

   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.

   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.
   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 Step 10 below.
10. **Removal 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:

- safely remove refrigerant following local and national regulations;
- evacuate;
- purge the circuit with inert gas (optional for A2L);
- evacuate (optional for A2L);
- continuously flush or purge with inert gas when using flame to open circuit; and
- open the circuit.

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

For appliances containing flammable refrigerants, purging shall be achieved by breaking the vacuum in the system with oxygen- free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

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

11. **Charging Procedures**
In addition to conventional charging procedures, the following requirements shall be followed.
   - 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.

12. **Refrigerant Recovery Requirements**
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 labeled 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.

13. **Commissioning of the System**
   - Ensure that the floor area is sufficient for the refrigerant charge or that the ventilation duct is assembled in a correct manner.
   - Connect the pipes and perform a leak test before charging with refrigerant.
   - Check safety equipment before putting into service.

14. **Maintenance of the Air Handler**
   - Ensure sufficient ventilation at the repair place.
   - Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.
   - Discharge capacitors in a way that won't cause any spark. The standard procedure to short circuit the capacitor terminals usually creates sparks.
   - Reassemble sealed enclosures accurately. If seals are worn, replace them.
   - Check safety equipment before putting the system into service.

15. **Repair of the Air Handler**
   - Ensure sufficient ventilation at the repair place.
   - Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.
   - Discharge capacitors in a way that won't cause any spark.
   - When brazing is required, the following procedures shall be performed in the following order:
     - Safely remove the refrigerant following local and national regulations using a refrigerant reclaiming machine and cylinder and take the reclaimed refrigerant to a refrigerant recycler. Do not vent the refrigerant to the environment.
     - Purge the refrigerant circuit with oxygen free nitrogen;
     - Evacuate the refrigerant circuit;
     - Remove parts to be replaced by cutting or brazing.

- Purge the braze point with nitrogen during the brazing procedure required for repair.
- Perform a leak test before charging with refrigerant.

· Reassemble sealed enclosures accurately. If seals are worn, replace them.
· Check safety equipment before putting the system back into service.

16. **Decommissioning of the Air Handler (Refer to the last page of this manual for additional information)**
· If safety is affected when the equipment is put out of service, the refrigerant charge shall be removed before decommissioning.
· Ensure sufficient ventilation at the equipment location.
· Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.
· Remove the refrigerant using a refrigerant reclaiming machine and cylinder and take the reclaimed refrigerant to a refrigerant recycler. Do not vent the refrigerant to the environment.

17. **Disposal of the Air Handler (Refer to the last page of this manual for additional information)**
· Ensure sufficient ventilation at the working place.
· Remove the refrigerant using a refrigerant reclaiming machine and cylinder and take the reclaimed refrigerant to a refrigerant recycler. Do not vent the refrigerant to the environment.
· When flammable refrigerants are used,
- evacuate the refrigerant circuit.
- purge the refrigerant circuit with oxygen free nitrogen.

Minimum Conditioned Space for Flammable A2L Refrigerants. When flammable A2L class refrigerants are used, the minimum floor area of the conditioned space the air handler serves must comply with Table 2 or 3 to allow a refrigerant leak to disperse and be diluted with air to eliminate the risk of the refrigerant igniting and causing an explosion and/or fire. The minimum floor area must be corrected by an altitude adjustment factor based on the building site ground level altitude. See Table 1 for the altitude adjustment factor for various altitudes and refer to the example below for how to apply the altitude adjustment factor.

Example:
Total System Charge = 10.0 kg of R-454B
Altitude = 2400 m
Min. Conditioned Floor Area (MCFA) from Table 2 = 30.71 m^2
Altitude Adjustment Factor (AF) from Table 1 = 1.24
Adjusted MCFA = MCFA x AF
Adjusted MCFA (@ 2400 m. alt.) = 30.71 m^2 x 1.24 = 38.08 m^2

Altitude Correction Factors									
Altitude (m)	0	100	200	300	400	500	600	700	800
Altitude (ft)	0	328	656	984	1312	1640	1969	2297	2625
AF	1.00	1.01	1.02	1.02	1.03	1.04	1.05	1.06	1.07
Altitude (m)	900	1000	1100	1200	1300	1400	1500	1600	1700
Altitude (ft)	2953	3281	3609	3937	4265	4593	4921	5249	5577
AF	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16
Altitude (m)	1800	1900	2000	2100	2200	2300	2400	2500	2600
Altitude (ft)	5906	6234	6562	6890	7218	7546	7874	8202	8530
AF	1.17	1.18	1.19	1.20	1.21	1.22	1.24	1.25	1.26
Altitude (m)	2700	2800	2900	3000	3100	3200	3400	3600	3700
Altitude (ft)	8858	9186	9514	9842	10171	10499	11155	11811	12139
AF	1.27	1.29	1.30	1.31	1.33	1.34	1.37	1.40	1.42

Table1: Altitude Adjustment Factors

⚠ WARNING

FIRE HAZARD

For air handlers using A2L refrigerants connected via an air duct system to one or more rooms with a floor area less than shown in Table 2 or 3, those rooms shall be without continuously operating open flames (e.g.: an operating gas appliance) or other potential ignition sources (e.g.: an operating electric heater, hot surfaces). A flame producing device may be installed in the same space if the device is provided with an effective flame arrest.

⚠ WARNING

RISK OF FIRE – FLAMMABLE REFRIGERANT APPLICATIONS

If any refrigerating circuit contains more than 62.6 oz (1.776 kg) of R-454B refrigerant or more than 64.6 oz (1.836 kg) of R-32 refrigerant, an unventilated area where the air handler using a flammable refrigerant is installed shall be so constructed that should any refrigerant leak, it will not stagnate and create a fire or explosion hazard.

⚠ WARNING

FIRE HAZARD

For air handlers using A2L refrigerants connected via an air duct system to one or more rooms, auxiliary devices which may be a potential ignition source shall not be installed in the duct work. Examples of such potential ignition sources are hot surfaces with a temperature exceeding 1290°F (700°C) and electric switching devices.

For air handlers using A2L refrigerants connected via an air duct system to one or more rooms, only auxiliary devices approved by the air handler manufacturer or declared suitable with the refrigerant shall be installed in connecting ductwork.

UNIT INSTALLATION

Locating the Unit

Placement of the unit relative to ductwork, electrical and plumbing must be carefully considered. Return air plenum or duct can be mounted directly to the return air flanges.

Use flexible gasket material to seal the duct to the unit.

Verify floor, foundation or suspension support can support the total unit weight, including accessory weights.

Unit must be level in both horizontal axes to support the unit and reduce noise and vibration from the unit.

Allow adequate service clearances as shown on the unit nameplate and unit drawing. Consult your local building codes for additional service clearance requirements.

Allow adequate space for piping access and panel removal. Condenser water piping and condensate drain connections are located on either side of the unit.

Suspended Units

Horizontal air handling units are equipped for suspended installations. The unit should be lifted into position by supporting the unit with the skid used for shipping. The air handler must be installed level and care should be taken to prevent damage to the cabinet. Other installation provisions may be necessary according to job specifications.

LIFTING AND HANDLING THE UNIT

Horizontal, vertical, and modular units have channels underneath the base which provide lifting access to the underside of the unit and allow moving without physical damage.

Before lifting the unit, be sure that all the shipping materials has been removed.

Incorrect lifting can cause damage to the unit, injury or death. Lifting equipment capacity should exceed unit weight by an adequate safety factor.

Always test lift unit no more than 24 inches to verify the proper center of gravity lift point.

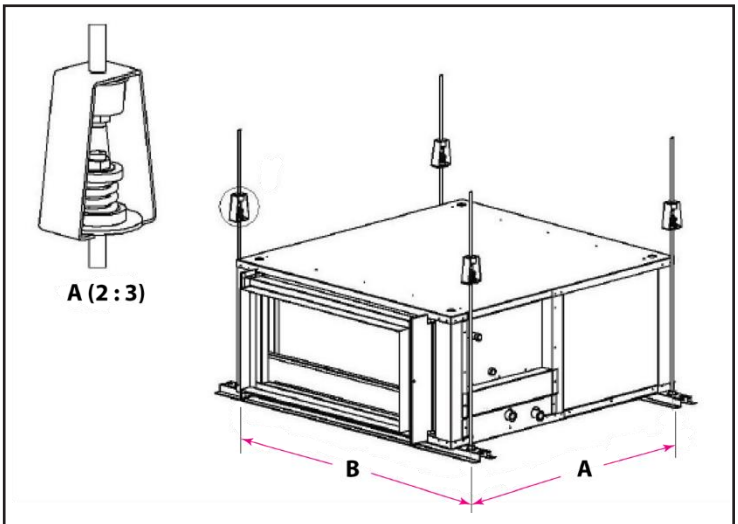


Figure 1: Suspended Unit

Minimum Clearances

The access doors on horizontal and modular units are removable for easy access and maintenance and the units are serviceable from both sides, the motors and moving parts can be located either on the right or left side. A minimum of 30" should be allowed on the service side of the unit, but additional clearance should be allowed to remove and replace the coil which should be equal to the total length of the coil on the service side only. The opposite side must have at least 30" of clearance to allow for access to that side of the coil for removing screws necessary for coil removal.

Vertical units are serviced from the front of the unit and the same restrictions apply in the front but need 0" clearance on the sides and the back if the local codes allow it.

Floor Mounted Units

Make sure the unit is level and mounted on a field supplied platform with a minimum height to allow for proper depth of the condensate line P-trap. Other installation provisions may be necessary according to job specifications. Vertical air handling units are designed for up flow applications only.

ELECTRICAL

Verify the unit nameplate agrees with the power supply. The wiring diagram is located inside the unit.

Route the power and control wiring separately, through the utility entry in the unit. **DO NOT RUN POWER AND CONTROL WIRES IN THE SAME CONDUIT.**

ELECTRIC SHOCK HAZARD Before attempting to perform any installation, service, or maintenance, disconnect all electrical power to the unit at the disconnect switches. Unit may have multiple power supplies. Failure to disconnect power could result in dangerous operation, serious injury, and death or property damage.

HEATING COILS

One or two-row hot water, hot gas, or steam preheating, heating, or reheating coils can be factory installed in the units. All valves and controls are field supplied and field installed. All precautions to prevent freezing should be taken by consulting engineers or contractors during the installation.

CHILLED WATER COILS

Water piping

All piping must be supported independently of the air handler to prevent vibration and stress on coil headers. Swing joints or flexible fittings must be provided to absorb expansion and contraction strains. Rigid piping reduces the effectiveness of vibration isolators.

Water piping should always be connected so that the entering water is on the leaving air side of the coil.

Coils must be adequately vented in order to prevent air binding. Units are provided with manual air vents mounted through manifold panel.

Units can have from 2 to 10 row chilled water coils or any combination with pre-heat and/or re-heat coils up to 10 rows factory mounted. All control valves flow measuring devices and freeze controls are field supply and field installed. All piping shall be in accordance with national and local codes. Pressure limiting devices, backflow preventers, flow meters, and all safety requirements are the sole responsibility of consulting engineers and installing contractors.

REFRIGERANT PIPING

Always use the condensing unit manufacturer's recommended line sizes. The suction line must be insulated for satisfactory operation. Observe all condensing unit manufacturer's installation requirements. Use refrigerant grade copper only. If unit is to be used when installed as the indoor coil of a heat pump, a bypass check valve must be used unless unit is equipped with a TXV which includes a bypass check valve.

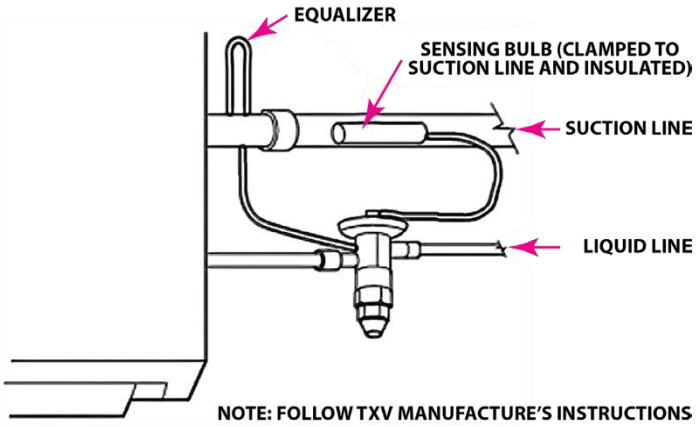


Figure 2: Correct TXV Sensing Bulb and Equalizer Locations

NOTE:

An oil trap must be installed in all vertical suction risers. An additional oil trap must be installed every 15' for risers over 15' high. If the condensing unit is located above the evaporator, an inverted oil trap must be installed at the top of the vertical riser.

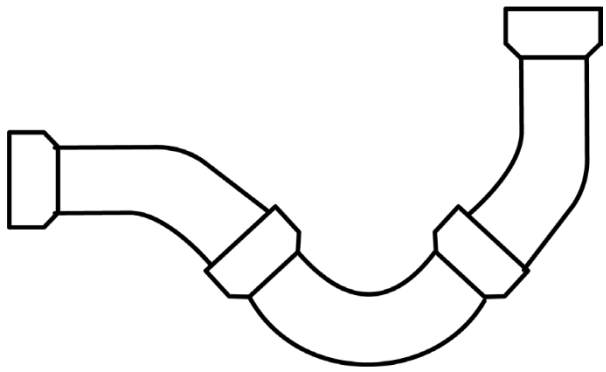


Figure 3: Typical Oil Trap

Piping from the condensing unit to the air handler is the responsibility of the installing contractor. The piping sizes must be selected to meet the codes and the actual installation conditions and not based on connection sizes of the evaporator and/or condensing unit. Improper installation, adjustment, alteration, service or maintenance, can cause property damage, personal injury or loss of life. Installation and service must be performed by a trained and qualified technician.

Only clean ACR tubing should be used. Piping should conform to all the generally accepted practices and codes. The coils in the air handler are shipped pressurized with nitrogen. The copper caps must be punctured to allow the gradual relief of the pressure prior to un-sweating the caps. Immediately couple the tubing to the indoor unit to avoid exposing the interior of the coils to moisture. When making solder connections, make sure to have dry nitrogen flowing through the lines to prevent copper oxidation inside the pipes.

Minimizing the refrigerant line size is favorable for reducing installation costs and reducing the potential for refrigerant leakage. However, as pipe diameters narrow, pressure-reducing frictional forces increase.

Excessive suction line pressure drop causes loss of compressor capacity and increased power usage resulting in reduced system efficiency. Excessive pressure drop in the liquid line can cause the liquid refrigerant to flash, resulting in TXV operational issues and poor system performance. In order to operate efficiently and to avoid malfunction, refrigeration systems must be designed to minimize pressure drop.

Equivalent Line Length

All line lengths discussed in this manual, unless specifically stated otherwise, are **Equivalent Line Lengths.** The frictional pressure drop through valves, fittings, and accessories is determined by establishing the equivalent length of straight pipe of the same diameter. **Always use equivalent line lengths when calculating pressure drop.** Special piping provisions must be taken when lines are run underground, up vertical risers, or in excessively long line runs.

Liquid Line Sizing

When sizing the liquid line, it is important to minimize the refrigerant charge to reduce installation costs and improve system reliability. This can be achieved by minimizing the liquid line diameter. However, reducing the pipe diameter will increase the velocity of the liquid refrigerant which increases the frictional pressure drop in the liquid line, and causes other undesirable effects such as noise.

Maintaining the pressure in the liquid line is critical to ensuring sufficient saturation temperature and sub-cooling, avoiding flashing upstream of the TXV, and maintaining system efficiency. Pressure losses through the liquid line due to frictional contact, installed accessories, and vertical risers are inevitable. Maintaining adequate sub-cooling at the condenser to overcome these losses is the only method to ensure that liquid refrigerant reaches the TXV.

Liquid refrigerant traveling upwards in a riser loses head pressure. If the evaporator is below the condenser, and the liquid line does not include risers, the gravitational force will increase the pressure of the liquid refrigerant. This will allow the refrigerant to withstand greater frictional losses without the occurrence of flashing prior to the TXV.

A moisture-indicating sight glass may be field installed in the liquid line to indicate the occurrence of premature flashing or moisture in the line. The sight glass should not be used to determine if the system is properly charged. Use temperature and pressure measurements to determine liquid sub-cooling, not the sight glass.

Liquid Line Routing
Care should be taken with vertical risers. When the system is shut down, gravity will pull liquid down the vertical column, and back to the condenser when it is below the evaporator. This may result in liquid flooding at the suction of the compressor. A check valve can be installed in the liquid line where the liquid column rises above the condenser to prevent this. The liquid line is typically pitched along with the suction line, or hot gas line, to minimize the complexity of the configuration.

Liquid Line Insulation
When the liquid line is routed through areas where temperature losses are expected, no insulation is required, as this may provide additional sub-cooling to the refrigerant. When routing the liquid line through high temperature areas, insulation of the line is appropriate to avoid loss of sub-cooling through heat gain.

Liquid Line Guidelines
In order to ensure 100% liquid at the TXV, frictional losses must not exceed available sub-cooling. A commonly used guideline to consider is a system design with pressure losses due to friction through the line not to exceed a corresponding 1-2°F change in saturation temperature.

If the velocity of refrigerant in the liquid line is too great, it could result in excessive noise or piping erosion. The recommended maximum velocities for liquid lines are 100 fpm from the condenser to a receiver tank to discourage fluid backup, and 300 fpm from receiver tank to the evaporator to minimize valve induced liquid hammer.

Liquid Line Accessories
Liquid line shut off valves and filter driers are field supplied. Filter driers must be field installed on all systems. The total length equivalent of pressure losses through valves, elbows, and fittings must be considered when adding additional components in the field. It is good practice to minimize the number of elbows to minimize pressure drop.

Suction Line Sizing
The suction line is more critical than the liquid line from a design and construction standpoint. More care must be taken to ensure that adequate velocity is achieved to return oil to the compressor at minimum loading conditions. However, reducing the piping diameter to increase the velocity at minimal load can result in excessive pressure losses, capacity reduction, and noise at full load.

Suction Line Routing
Pitch the suction line in the direction of flow (about 1 foot per 120 feet of length) to maintain oil flow towards the compressor and to keep it from flowing back into the evaporator. Crankcase heaters are provided to keep any condensed refrigerant that collects in the compressor from causing damage or wear. Make sure to provide support to maintain suction line positioning.

It is important to consider part-load operation when sizing suction lines. At minimum capacity, refrigerant velocity may not be adequate to return oil up a vertical riser. Decreasing the diameter of the vertical riser will increase the velocity, but will also increase the frictional loss.

A double suction riser can be applied to the situation of part load operation with a suction riser. A double suction riser is designed to return oil at minimum load while not incurring excessive frictional losses at full load. A double suction riser consists of a small diameter riser in parallel with a larger diameter riser, and a trap at the base of the large riser. At minimum capacity, refrigerant velocity is not sufficient to carry oil up both risers, and it collects in the trap, effectively closing off the larger diameter riser, and diverting refrigerant up the small riser where velocity of the refrigerant is sufficient to maintain oil flow.

At full load, the refrigerant flow clears the trap of oil, and refrigerant is carried through both risers. The smaller diameter pipe should be sized to return oil at minimum load, while the larger diameter pipe should be sized so that flow through both pipes provides acceptable pressure drop at full load.

Suction Line Insulation
The entire suction line should be insulated. This prevents condensation from forming on the line and reduces capacity loss associated with heat gain.

Suction Line Guidelines
For proper performance, suction line velocities should be limited to no more than 4,000 fpm. The minimum velocity required to return oil is dependent on the pipe diameter, however, a general guideline of 1,000 fpm minimum may be applied.

In a fashion similar to the liquid line, a common guideline to consider is a system design with pressure losses due to friction through the line not to exceed a corresponding 1-2°F change in saturation temperature.

At points where small pipe size can be used to provide sufficient velocity to return oil in vertical risers at part loads, greater pressure losses are incurred at full loads. This can be compensated for by over sizing the horizontal runs and vertical drop sections. However, this will require additional refrigerant charge. Circuits with variable capacity scroll compressors require suction riser traps every 15 feet.

Suction Line Accessories
If the job requirements specify suction accumulators, they must be separately purchased and field installed.

Hot Gas Bypass Line

Hot Gas Bypass is available for use with DX systems that may experience low suction pressure during the operating cycle. This may be due to varying load conditions associated with VAV applications or units supplying a large percentage of outside air. The system is designed to divert refrigerant from the compressor discharge to the low-pressure side of the system in order to prevent the evaporator from freezing and to maintain adequate refrigerant velocity for oil return at minimum load.

Hot discharge gas is redirected to the evaporator inlet via an auxiliary side connector (ASC) to false load the evaporator when reduced suction pressure is sensed. Field piping between the condensing unit and the evaporator is required.

Hot Gas Bypass Piping Considerations for Evaporator Above Condensing Unit

Pitch the hot gas bypass (HGB) line downward in the direction of refrigerant flow, toward the evaporator.

When installing hot gas bypass risers, a drain leg must be provided at the lowest point in the system. The drain leg must be vertical, its diameter should be the same as the diameter of the riser, and it should be 1 foot long. Install a sight glass in the drain leg for observation. Run an oil return line, using 1/8-inch capillary tube, 10 feet in length, from the drain leg to the suction line. Connect the oil return line below the sight glass and 1 inch above the bottom of the drain leg.

Hot gas bypass valves are adjustable. Factory hot gas bypass valve settings will be sufficient for most applications, but may require slight adjustments for some applications, including some make up air applications.

CONDENSATE DRAIN PIPING

Units are equipped with more than one drain connection. A P-trap and drain line must be installed in each drain connections of the unit with a P-trap not to exceed 6" from the drain connection. The lines should be the same size or larger than the drain connection including the P-trap, and pitched downward toward drain. An air brake should be used with long runs of condensate lines.

Units have draw-through coils and will have a negative static pressure in the drain pan area. This will cause an un trapped drain to back-up due to air being pulled up through the condensate drain piping.

Condensate drain trapping piping must conform to all applicable governing codes.

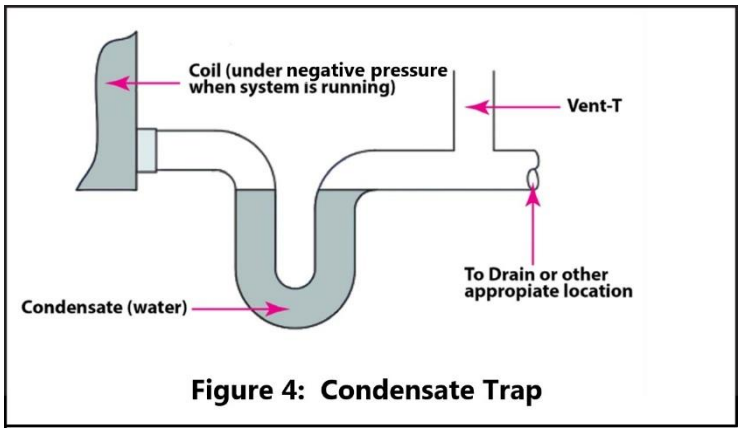


Figure 4: Condensate Trap

SPECIAL PIPING INSTRUCTIONS DUE TO USE OF A2L CLASS FLAMMABLE REFRIGERANT

⚠ WARNING

RISK OF FIRE

This following precautions must be taken for the refrigerant piping due to this air handler being used with an A2L class flammable refrigerant.

Piping material, pipe routing, and installation shall include protection from physical damage in operation and service, and shall be in compliance with national and local codes and standards, such as ASHRAE 15, 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.

The installation of pipe-work shall be kept to a minimum.

Due to this air handler being used with an A2L class flammable refrigerant, the refrigerant pipe-work shall not be installed in an unventilated space if that space is smaller than the minimum floor area shown in Table 2 or 3 unless there are no joints in the pipe-work in that space (e.g.: pipework that is run in walls or between floors).

Since refrigerant line length affects the final refrigerant charge, the final refrigerant charge after field charging of the system must be noted and used when determining the minimum floor area of the conditioned space from Table 2 or 3.

Mechanical connections shall be accessible for maintenance purposes.

For appliances using flammable refrigerants, all joints made in the installation between parts of the refrigerating system, with at least one part charged, shall be made in accordance with the following:

- A brazed, welded, or mechanical connection shall be made before opening the valves to permit refrigerant to flow between the refrigerating system parts. A vacuum valve shall be provided to evacuate the interconnecting pipe or any uncharged refrigerating part.
- Mechanical connectors used indoors shall comply with ISO 14903 or UL 207 Annex A (USA only). When mechanical connectors are reused indoors, sealing parts shall be renewed. When flared joints are reused indoors, the flare part shall be refabricated.
- Refrigerant tubing shall be protected or enclosed to avoid damage.
- Flexible refrigerant connectors (such as connecting lines between the indoor and outdoor unit) that may be displaced during normal operation shall be protected against mechanical damage.

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

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

Provision shall be made for expansion and contraction of long runs of piping.

Protection devices, piping, and fittings shall be protected as far as possible against adverse environmental effects, for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris.

Piping in refrigeration systems shall be so designed and installed to minimize the likelihood of hydraulic shock damaging the system. After completion of field piping for split systems, the field pipework shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, according to the following requirements:

- The minimum test pressure for the low side of the system shall be the low side design pressure as stated on the air handler rating plate and the minimum test pressure for the high side of the system shall be the high side design pressure as stated on the air handler rating plate, unless the high side of the system cannot be isolated from the low side of the system in which case the entire system shall be pressure tested to the low side design pressure.
- The test pressure after removal of pressure source shall be maintained for at least 1 hour with no decrease of pressure indicated by the test gauge, with test gauge resolution not exceeding 5% of the test pressure.
- During the evacuation test, after achieving a vacuum level specified in the manual or less, the refrigeration system shall be isolated from the vacuum pump and the pressure shall not rise above 1500 microns within 10 min. The vacuum pressure level shall be the lesser of 500 microns or the value required for compliance with national and local codes and standards, which may vary between residential, commercial, and industrial buildings.

Field-made refrigerant joints indoors 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 0.25 times the maximum allowable pressure. No leak shall be detected.

⚠ WARNING

RISK OF FIRE – FLAMMABLE REFRIGERANT APPLICATIONS

The ductwork connected to this air handler shall not contain an ignition source.

Auxiliary devices which may be a potential ignition source shall not be installed in the duct work. Examples of such potential ignition sources are hot surfaces with a temperature exceeding 1292°F (700°C) and electric switching devices.

Only auxiliary devices approved by the air handler manufacturer or declared suitable with the refrigerant shall be installed within connecting ductwork.

⚠ WARNING

RISK OF FIRE – FLAMMABLE REFRIGERANT APPLICATIONS

If any refrigerating circuit contains more than 62.6 oz (1.776 kg) of R-454B refrigerant or more than 64.6 oz (1.836 kg) of R-32 refrigerant, an unventilated area where there is an air handler using a flammable refrigerant is installed shall be so constructed that should any refrigerant leak, it will not stagnate and create a fire or explosion hazard.

If the air duct system connected to one or more rooms with an area less than the minimum conditioned space floor area shown in Table 2 or 3 based on the total system refrigerant charge, that room shall be without continuously operating open flames (e.g.: an operating gas appliance) or other potential ignition sources (e.g.: an operating electric heater, hot surfaces). A flame-producing device may be installed in the same space if the device is provided with an effective flame arrest.

⚠ WARNING

RISK OF FIRE

Refer to Table 2 or 3 for the minimum floor area of the conditioned space served by this air handler due to the use of an A2L class flammable refrigerant.

⚠ WARNING

RISK OF FIRE – FLAMMABLE REFRIGERANT APPLICATIONS

The following requirements are necessary to allow the flammable refrigerant mitigation system to properly dilute the refrigerant with air in the event of a refrigerant leak.

The supply and return air shall be directly ducted to the space. Open areas such as false ceilings shall not be used as a return air duct.

REFRIGERANT LEAK DETECTION SYSTEM

This air handler is equipped with a factory installed refrigerant leak detection system consisting of a refrigerant sensor with integral relays to perform the necessary leak mitigation if a refrigerant leak if detected by the sensor. Should a refrigerant leak occur in the indoor coil, the refrigerant leak detection system will energize the indoor blower and will open the 24VAC circuit to the outdoor unit compressor contactor. The circulation of air will disperse the leaked flammable refrigerant into the conditioned space where it will be diluted to point where it can no longer be ignited by an ignition source. The indoor blower will continue to operate until 5 minutes after the concentration of the refrigerant at the sensor drops below the sensor's setpoint. Should the concentration of the refrigerant rise above the setpoint of the sensor, the mitigation cycle will repeat until the refrigerant concentration stays below the setpoint of the

sensor. The ORANGE sensor pigtail marked "ALARM" will normally be energized with 24VAC when no leak is detected and will be de-energized when a leak is detected for the purpose of notifying a building management system to issue a refrigerant leak alarm if a field supplied normally closed relay is installed (See Figure 6).

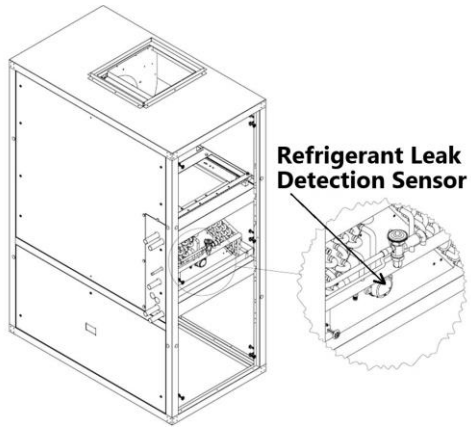
Should the sensor fail or if the sensor wiring is damaged or disconnected, the sensor will automatically enter the mitigation mode until the sensor is replaced or the wiring is reconnected or repaired.

⚠ IMPORTANT

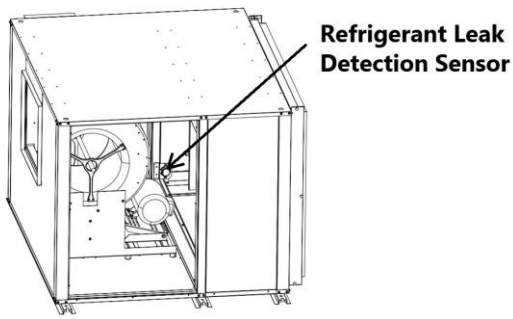
The outdoor unit control wiring must be connected to the WHITE refrigerant sensor pigtail labelled "Y-CC" and the "COM" on the air handler low voltage terminal strip for the refrigerant detection system to de-energize the compressor during the leak mitigation mode of operation.

⚠ IMPORTANT

Only refrigerant detection system sensors specified by Commercial Aire Products, Inc. may be used as a replacement for a failed sensor.



Vertical Air Handler



Horizontal Air Handler

Figure 5: Refrigerant Leak Detection Sensor Location

⚠ WARNING

Air handlers designed for use with a flammable refrigerant are equipped with a refrigerant leak mitigation system that energizes the furnace blower motor to deliver at least the required minimum airflow (See Table 2 or 3) when the refrigerant leak detection system detects a leak. This will dilute the flammable A2L class refrigerant to a point that it no longer poses a risk of an explosion or fire. Follow the procedure "Verifying Proper Functioning of Refrigerant Leak Mitigation System" later in this section to confirm the refrigerant mitigation system is functioning as it should).

Refrigerant Leak Alarm Output

The air handler's refrigerant leak sensor has an alarm output signal that can be used as an input to a building management system or smart thermostat to alert the homeowner or user that the refrigerant detection system has detected a refrigerant leak and is in the leak mitigation mode. There is an ORANGE low voltage pigtail wire in the sensor harness labeled "ALARM". When the sensor is powered and no refrigerant leak is detected, the ORANGE "ALARM" pigtail wire is energized with 24 VAC indicating normal operation. When the refrigerant leak detection system detects a refrigerant leak and enters the leak mitigation mode (indoor blower energized and outdoor unit disabled), the ORANGE "ALARM" pigtail wire will be de-energized (0 VAC). The ORANGE "ALARM" pigtail wire is capped with a wire nut from the factory. Remove this wire nut and connect it to the building management system or smart thermostat as required if a refrigerant leak alert is desired. The building management system or smart thermostat shall be programmed to accept the reverse logic alarm signal (24 VAC – Normal; 0 VAC – Refrigerant Leak).

If a 24 VAC output when a refrigerant leak is detected is required to activate a warning light or audible alarm, the ORANGE "ALARM" pigtail wire shall be connected to the coil of a field supplied relay with normally closed contacts and a 24 VAC coil. An 18 AWG minimum wire from the furnace 24 VAC common circuit shall be connected to the other side of the relay coil. An 18 AWG minimum wire from the furnace 24 VAC "R" transformer circuit shall be connected to the terminal for one side of the normally closed relay contacts and an 18 AWG minimum wire to the warning light or audible alarm shall be connected to terminal for the other side of the normally closed relay contacts. All field supplied wiring shall be protected from damage. When no refrigerant leak is detected, the relay will be energized and the relay contacts will open, disconnecting the 24 VAC signal to the warning light or audible alarm. When a refrigerant leak is detected, the relay will be de-energized and the contacts will close, sending a 24 VAC signal to the warning light or audible alarm. See Figure 6 for suggested field wiring connections.

Minimum Circulating Airflow for Refrigerant Leak Mitigation

There is a minimum circulating air flow required when the refrigerant leak detection system is operating in the leak mitigation mode. This minimum depends on the total system refrigerant charge and can be found listed in Tables 2 and 3. The refrigerant mitigation system energizes the continuous fan function on the furnace or air handler. The continuous fan CFM (l/s) may need to be increased to achieve the minimum leak mitigation circulating airflow level

by changing the blower speed to deliver the minimum mitigation airflow level. Refer to the furnace or air handler blower performance tables and wiring diagrams in the manufacturer's installation manual to determine if this adjustment is necessary and if it is determined to be necessary to increase the continuous fan airflow level. Refer to the Operation and Maintenance Section for the blower speed adjustment procedure.

Refrigerant Detection System Sequence of Operation

Should a refrigerant leak occur in the indoor coil, the refrigerant leak detection system will energize the indoor blower and will open the 24VAC circuit to the outdoor unit compressor contactor. The circulation of air will disperse the leaked flammable refrigerant into the conditioned space where it will be diluted to point where it can no longer be ignited by an ignition source. The indoor blower will continue to operate until 5 minutes after the concentration of the refrigerant at the sensor drops below the sensor's setpoint. Should the concentration of the refrigerant rise above the setpoint of the sensor, the cycle will repeat until the refrigerant concentration stays below the setpoint of the sensor. The sensor pigtail marked "ALARM" will normally be energized with 24VAC when no leak is detected and will be de-energized when a leak is detected for the purpose of notifying a building management system to issue a refrigerant leak alarm or to energize a leak warning light or audible alarm if a field supplied normally closed relay is installed (See Figure 6).

Should the sensor fail or if the sensor wiring is damaged or disconnected, the sensor will automatically enter the mitigation mode until the sensor is replaced or the wiring is reconnected or repaired.

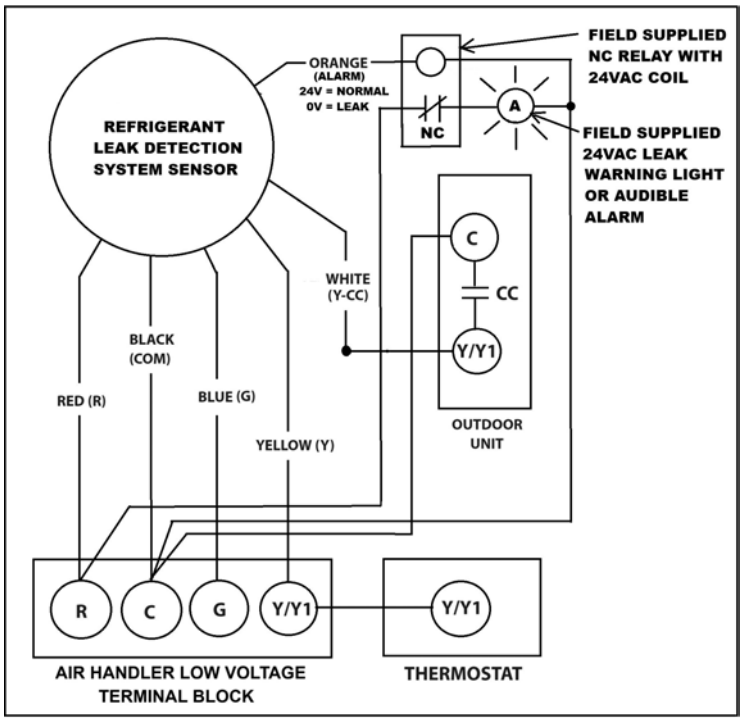


Figure 6: Refrigerant Leak Detection System Wiring Connections

Verifying Proper Functioning of Refrigerant Leak Mitigation System

Follow the steps below to verify the proper functioning of the **Refrigerant Leak Mitigation System.**

1. Remove the coil access panel from the front of the coil or air handler.
2. Locate the black refrigerant sensor located near the bottom front of the coil assembly (see Figure 5).

Leak Detected During Cooling Cycle

3. Set the thermostat to "COOL" and the fan switch to "AUTO" and lower the temperature setpoint below the indoor temperature so the system enters the cooling mode.
4. Confirm the outdoor unit compressor is operating.
5. Within 30 seconds of the compressor starting, release a small amount of refrigerant on the refrigerant sensor to activate the leak mitigation mode.
7. Confirm the outdoor unit compressor and fan motor shut down and the indoor blower continues to operate.
8. Confirm the outdoor unit compressor and fan motor are reenergized approximately 5 minutes after the flow of refrigerant near the sensor has ended and that the indoor blower continues to operate.

Leak Detected During the OFF Cycle

9. Set the thermostat to the "OFF" position and wait until the outdoor unit compressor and fan motor stop and indoor blower stops.
10. Release a small amount of refrigerant on the refrigerant sensor to activate the leak mitigation mode.
11. Confirm the indoor blower is energized and 24V is not present at the coil pigtail marked "ALARM".
12. Confirm the indoor blower shuts down after approximately 5 minutes after the flow of refrigerant on the refrigerant sensor has ended.
13. If the Refrigerant Leak Mitigation System does not operate as stated above, check for loose wiring connections or replace the refrigerant sensor.
14. Reinstall the coil access panel on the coil or air handler.
15. Set the thermostat to the desired operating mode and temperature.

If the leak detection system does not function properly when subjected to the above procedure, check for miswiring of the system. If the wiring connections are found to be correct per the coil or air handler wiring diagram, replace the sensor with an approved replacement from the manufacturer.

Leak Detection Sensor Replacement

When the refrigerant leak detection system sensor fails or reaches the end of its life, the leak detection system will enter and remain in the leak mitigation mode even though there is no refrigerant leak present. If the leak detection system continues to operate in the mitigation mode even when a refrigerant leak isn't indicated by a portable refrigerant leak detector, replace the sensor with an approved replacement from the coil manufacturer. Disconnect the wiring harness connector from the failed sensor and remove the sensor mounting screws. Discard the failed sensor. Mount the replacement sensor in the same location as the failed sensor that was removed and connect the sensor wiring harness connector to the sensor. Verify the proper function of the refrigerant leak mitigation system using the "**Verifying Proper Functioning of Refrigerant Leak Mitigation System**" procedure above.

Only the following replacement refrigerant sensors may be used for Commercial Aire Products, Inc. air handlers.

R-32/R-454B Refrigerant (Dual Refrigerant Sensor): R68ALL003

IMPORTANT: The sensor wiring harness plug must be pointing down or horizontal. If the plug is pointing up, water could collect in the plug and result in operational issues. This does not apply to Cubic brand sensors which have a water tight plug and will be pointing up in horizontal applications.

⚠ IMPORTANT

Commercial Aire Products, Inc. may source sensors from various manufacturers that have a different wiring harness connection. A wiring may be necessary to allow the replacement sensor to connect the sensor wiring harness. The wiring adapter will be provided with the replacement sensor. Alternate mounting holes are provided in the coil delta plate to accommodate the various approved sensors. Only use a replacement sensor approved by and provided by Commercial Aire Products, Inc. to assure proper operation and compatibility.

ELECTRICAL WIRING

All units require field supply electrical over-current and short circuit protection. The over-current and short circuit protection device must be sized no larger than the **Maximum Over-Current Protection (MOP)** listed on the unit rating plate.

Size the electrical supply conductors according to the **Minimum Circuit Ampacity (MCA)** rating listed on the unit rating plate. Supply conductors must be rated a minimum of 75ºC. Protect each branch circuit according with the codes and requirements. All the units must be electrically grounded in accordance with local codes or, in absence of local codes, as per the current National Electric Code.

Supply voltage must be within the minimum/ maximum range shown on the unit nameplate, available short circuit current should not exceed the **Short Circuit Current Rating (SCCR)** listed on the unit rating plate.

The installing contractor must check for proper motor rotation and verify the bower motor amps are not exceeding the name plate.

Control wiring must be wired in separate conduit from the power to avoid inductance problems and must follow the local codes for low voltage wiring. The following table is a guide for control wiring size and allowable distance:

20 AWG	200 FT	18 AWG	350 FT
16 AWG	500 FT	14 AWG	750 FT
12 AWG	1250 FT		

Codes may require a disconnect switch to be within sight of the unit. It is recommended that over-current protection and disconnect switch not be installed in the unit.

Locations for field cut electrical entries are marked on the unit. Field openings must be at least 6” away from any component to prevent damage during the cutting procedure.

To pass wires through the wall or roof of the unit, a hole should be cut and a conduit should be passed through it using the following procedure.

CUTTING ELECTRICAL OPENINGS

1. Locate the placement of the hole. Be sure that the hole will not interfere with any component operation or prevent access to any part of the unit.
2. Drill a pilot hole all the way through the panel, insulation and interior panel.
3. Using a hole saw, cut the hole through the outside metal, insulation, and inside metal
4. Install the conduit through the panel and caulk the entire perimeter of the conduit in both sides with and industrial grade caulking or duct seal compound.

DUCT HEATER INSTALLATION

Approved Commercial Aire Products duct heaters may be used with heat pumps, cooling units or force air systems. They are suitable for zero clearance installations in vertical or horizontal duct systems.

Duct Heaters Installation Guidelines:

1. Install the electric duct heater on the air handler discharge opening per the instructions supplied with the duct heater.
2. Allow at least 2 ft. of duct between the duct heater and an elbow.
3. Transitions from the duct heater to the supply duct should be limited to 20% of the duct area per linear foot.
4. All duct materials must be suitable for 250ºF operation.
5. The air duct should be installed in accordance with the standards of the NFPA for installation of air conditioning and ventilating systems pamphlet No. 90A and 90B.
6. Locate the heater so that it is completely accessible and normal ventilation is assured.
7. The amount of air curtain between the heater elements and limit switches must not be reduced by internal duct liner within 1 ft before or after the heater. In fiberglass duct systems, a metal sleeve inside the duct to support the heater must be used. If the base of the heater is not flush with the air stream, nuisance cycling may result.
8. Field connected wires entering the heater controls compartment must be copper suitable for 75 ° C (167 ° F) Field wire the supply and control circuits in accord with the National and Local Codes and use the wiring diagram supply with each heater as a guide. The heater must not operate unless the fan is on. Never use a fan delay with these heaters.

START UP LIST FOR DUCT HEATERS

1. Only qualified individuals experienced in proper installation of heating and cooling should perform any start-up operations of HVAC systems.
2. Electric duct heater must be installed according to manufacturer’s installation instruction manual and must be in compliance with all NEC, local and state codes. Failure to observe all of the installation guide lines will void the warranty and listing of the product.
3. Review heater data information label found on outside of heater panel cover.
4. Voltage, phase and frequency of heater must match heater data label. If field voltage and/or phase does not match heater data label, do not operate heater.
5. The proper field wire size to heater must be used, copper conductors only. See wire size data label adjacent to heater terminal block or disconnect switch in heater. Heater must be properly ground to accommodate NEC guide lines. Failure to do so may result in shock or death.
6. Ensure all electrical connections are tight before energizing

heater circuit. Electrical lugs for #10-14 AWG wiring must be torqued to 35 inch-pounds and electrical lugs for 8 AWG wiring must be torqued to 40 inch-pounds.

7. Review the proper size disconnect means and /or fusing has been applied to heater power supply circuit.
8. Turn disconnect switch (s) to the ON position. Energize heater circuit with thermostat to 100% rating of heater KW rating. First start-up of the heating element will burn off any element manufacturing oil that may cause some smoke in the air system.
9. Using proper measuring devices to measure voltage to heater, line voltage should be plus or minus 5% of heater rated voltage. Never operate 208V rated heater on 240V line voltage. Measure line 1 to line 2 on single phase heaters and line 1 to neutral on 120V and 277V heaters.
10. On 3-phase heaters, measure line 1 to line 3, line 2 to line 3 and line 1 to line 2 for proper line voltage. Measure amp draw on supply conductors to heater disconnect switch or terminal block, for proper amp draw with proper instruments. Amp draw must match heater data label with 100% heater is energized; reading should be plus or minus 3%.
11. Airflow over heating elements must be even across the face of the heater. Duct system must have 0.08" minimum static pressure duct system.
12. Automatic reset limits will de-energize heater if heater is not installed to manufacturers duct installation manual or low air flow/uneven air across face of element.
13. Correction must be made to operate heater. Manual reset limits will also de-energized heater if there is low or uneven air flow over the heating elements. Airflow volume and/or reinstallation of heater must be done before energizing heater.
14. If heater has a control transformer, it may have a circuit breaker in the circuit. If the transformer is shorted, the circuit breaker will open the circuit. The cause of the short must be identified and corrected and then the circuit breaker may be reset. If the transformer has no circuit breaker, it could have an inline fuse. A short circuit will open the fuse. The fuse must be replaced with the same style fuse with the same amp rating.
15. The airflow proving switch only proves that some air flow exists, not that the minimum proper air flow exists. The airflow proving switch is configured from the factory for a positive air pressure system. If the heater is installed in a negative pressure system, the pressure tube connected to the switch pressure port must be relocated to the open port of the switch.
16. After heater installation and operation has met standards and heater data label, close the heater panel door and energized heater circuit.

Minimum Air Flow Requirements Across the Heaters

Each kW of electric heat produces 3,413 BTUH. Divide the total BTUH required by 3,413 to determine the kW of electric heat required. The chart in Figure 7 is used to find the minimum air flow required. The maximum inlet temperature of the heater must be identified. The outlet air from a heat pump (typically 110ºF) would be the inlet air to an auxiliary heater. The kW per sq. ft. of the Minimum Duct Area (kW/sq. ft. MDA) for the heater must be determined. An example for determining this shown below:

EXAMPLE:

12 kW heater designed for a minimum duct size of 8" x 16". The maximum inlet air to the heater is assumed to be 77ºF for this example.

8" x 16" divided by 144 sq. in. = 0.89 sq. ft.

12kW divided by 0.89 sq. ft. = 13.48 kW/sq. ft. MDA

Locate the 13.48 along the top side of the chart and from there draw a vertical line downward until the 77ºF inlet air line is intersected. From the point of intersection, draw a horizontal line to the left side of the chart to obtain approximately 800 FPM of minimum air velocity required over the heater.

To convert to CFM, multiply the air velocity in FPM by the minimum cross-sectional area in sq. ft. of the duct that encloses the heater. In the example, 800 FPM is multiplied by 0.89 sq. ft. which gives 712 CFM.

These minimum air flow requirements should be met at any point over the face of the heater. If heaters are used in ducts larger than the heater minimum duct design, reliable means should be used to assure the proper air flow through the heater.

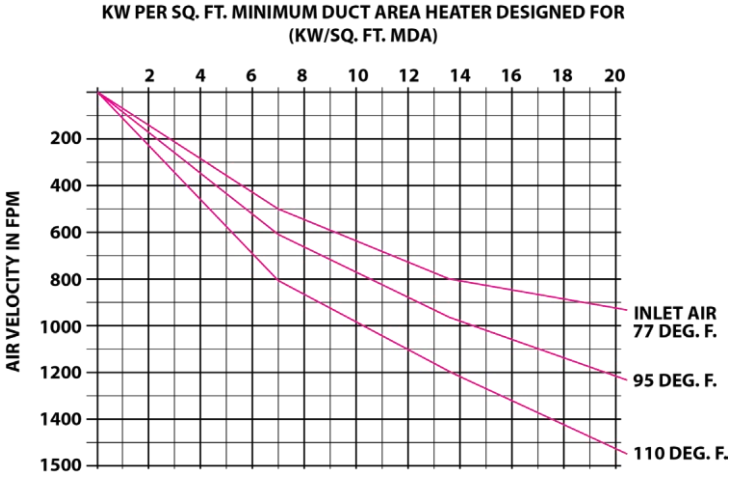


Figure 7: Min. Air Velocity for Electric Heaters

ELECTRIC DUCT HEATER MAINTENANCE GUIDE LINES

In most cases electric duct heaters require very little maintenance or service during the life of the product. The duct heater must be installed according to our installation instruction manual and NEC / SMACNA guide lines.

1) Disconnect ALL power circuit(s) to heater before any service is to be performed, there may be more than one disconnects switch that needs to be in the off position.
2) All electrical connections to the heater power & control circuits should be tight. Inspect all electrical connections in heater, as they may become loose during operation. All wiring must be installed in accordance with the National Electrical Code and any applicable state & local codes.
3) All air filters in duct or unit system should be checked to ensure clean air is present with no restriction of air flow to heating elements. Always replace the filter with the same type as originally furnished.
4) Check the field electrical voltage and phase rating is the same as the heater information data. Check full line amp draw of heater against rated heater data plate/label. Correct field wire size and grade must be used to heater power circuit(s). Heater must be properly grounded.
5) Heater should be free and clean of dust /dirt and moisture in heater control panel.
6) Heater construction or wiring must not be modified or any

alterations made to change the heater construction which would void the ETL listing and heater warranty.

7) Replacement components must be approved by the factory first, if they are not of the same part number and style. Safety automatic and manual reset limits must be of the same temperature, part number and vendor for proper heater operation. Using higher rated temperature limits for replacements in the heater circuit will void the ETL listing and warranty and could cause damage or result in a fire.
8) The heater panel cover should not be removed or open during heater operation. Optimal operation of heater requires cleanliness.
9) Check the operation of heater circuits with thermostat/ controller to ensure proper cycling of heater relays(s) and to the controller or thermostat set point.
10) If dust or other material is found to be collecting on the heating elements, check for dirty air filter(s) and replace if necessary. The heater may have to be removed from duct section for cleaning. Use low pressure air to remove dust from heating element surfaces. Always wear eye protection and breathing protection during this operation.
11) Do not try to repair any of the heater components, as they need to be replaced with original part number from the manufacturer for safe operation of the heater. Do not file down any relay contacts to stop relay chatter or to extend the life of the relay. Element male/female chassis insulators that are cracked or broken should be replaced with the same style and size. Insulators in the element support frame that are missing or broken must be replaced or replacement frame assembly should be ordered. Broken heating elements must be replaced with the same element gauge, ohms and outside diameter (O.D.) size.
12) Inspect all internal wiring in heater control panel for burned or broken wires. Replacement wiring must be rated for 105°C and must be the same gauge for proper operation of heater.
13) Preventative maintenance to achieve maximum performance and service life of heater is highly recommended, so a formal schedule of regular maintenance should be established and maintained.

DUCT CONNECTIONS

Check existing duct insulation and vapor barriers. Previously installed heating supply ductwork may or may not have adequate insulation to prevent excessive heat gain/loss. Additional insulation may be required depending on the application.

External insulated duct systems must have adequate vapor seal for summer operation, particularly where the ducts are exposed to high humidity conditions such as in an attic, vented crawl space, unconditioned basement, or utility room.

Remove any shipping material from the unit before installing the duct. Be sure that there is no material inside the unit that can damage the blower wheel while it is rotating. Attach the duct to the flanges provided on the unit. The installer is responsible for sealing the ducts to the duct flanges to prevent leaks or contamination. Ductwork should be sized according and installed according to all the local and national codes. When attaching the ductwork to the unit, 3-inch flexible connectors are recommended to avoid vibration from being transferred to the ductwork.

PRIOR TO START-UP

Ensure all shipping bolts, screws, and brackets are removed. Inspect all mounting bolts/screws on blowers, motor, coils and mounting brackets.

Check the sheaves to ensure alignment. Check belt tension and tighten all set screws.

Check for proper rotation of the blower. Exchanging two of the three leads at the motor will reverse three- phase motor rotation. Note that not all installations will use motor starters.

Exchanging leads inside the motor junction box can reverse single phase motor rotation. (Refer to motor data plate).
Ensure all filters are properly installed and free from construction debris.

Replace all doors and panels.

Check amperage draw of the motor. The amperage draw should not exceed the full load amperage shown on the motor data plate.

OPERATION AND MAINTENANCE

⚠ WARNING

Disconnect electrical power to all circuits before servicing unit. Failure to do so may result in personal injury or death from electrical shock or moving parts.

RETURN AIR FILTERS – Filter access is from either side of unit. Inspect filters on a regular basis (at least monthly) and clean or replace if necessary.

⚠ CAUTION

Never operate unit without a filter or with filter access door removed as this will result in the coil being clogged and damage to the blower motor may result.

BELT AND SHEAVES

Proper sheave alignment and belt tension must be maintained at all times. Check the sheave set-screws and bolts for tightness.

All Commercial Aire Products air handlers are factory set to operate at a specified CFM at a specified external static pressure. Adjustments will likely be required once the air handler is installed and operational to meet the requirements of the application. The contractor is responsible for verification of the airflow balance at the installed conditions. Failure to verify the correct airflow and balance after installation can cause excess airflow which can result in water blow-off from the coils and equipment damage. Insufficient airflow can cause inadequate capacity and coil freezing.

CHANGING BLOWER SPEED WITH ADJUSTABLE MOTOR SHEAVE

Adjustable motor sheaves are commonly used to change the blower speed in light commercial air handlers.

How Adjustable Sheaves Work

As the two halves of an adjustable motor sheave are turned closer to each other, the belt is forced to the outside of the sheave. This causes the effective sheave diameter to increase which increases the speed of the blower.

As the two halves of an adjustable sheave are turned further apart, this causes the effective sheave diameter to decrease which reduces the speed of the blower the speed of the blower.

In order to measure the effective sheave pitch diameter where the belt rides on a sheave, use calipers to measure the outside diameter of the belt while it is wrapped around the sheave. The diameter of the sheave will likely be smaller than the outside diameter of the sheave.

Screw the two halves of the sheave in or out to increase or decrease the pitch diameter to the required value. Then install the belt around the sheave again and measure the diameter to verify that the pitch is correct.

After the sheave pitch diameter has been adjusted to the required value, re-install the sheave onto the shaft if it has been removed. An air flow hood may be used to verify that the desired airflow is being delivered.

MOTOR – Tighten motor mount bracket and base bolts as required.

BLOWER – Check bearings for wear and replace as required. Check blower wheel for accumulation of dirt and clean as required.

Figure 7: Two Halves of Adjustable Sheave

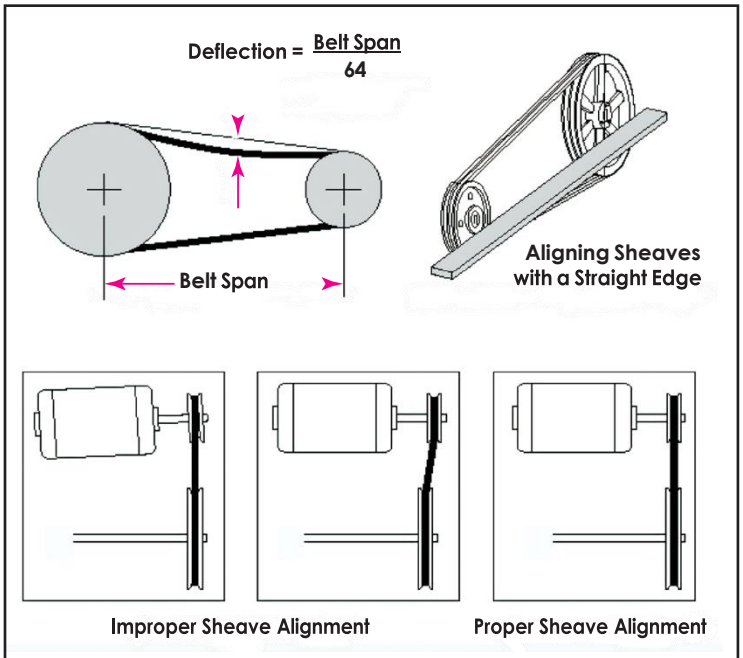


Figure 8: Blower Sheave Alignment and Tension

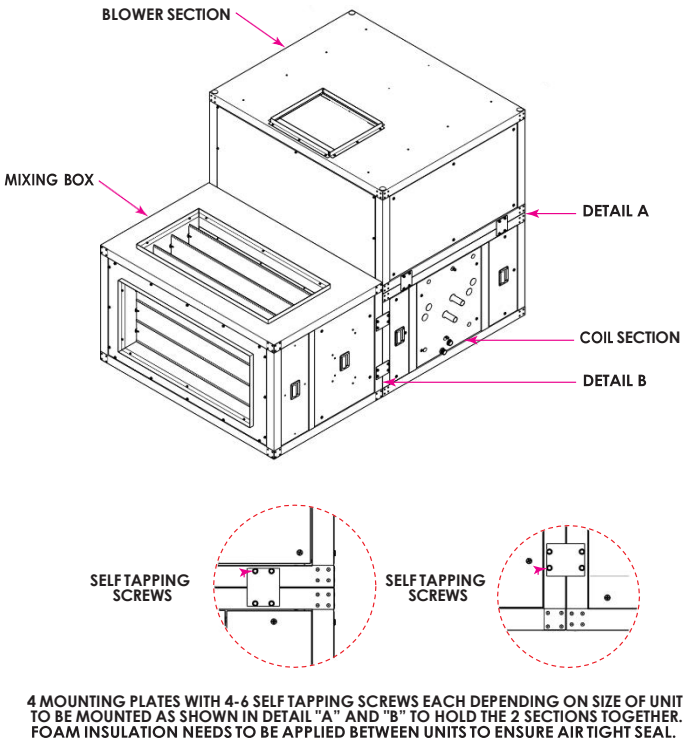


Figure 9: Modular Mixing Box Section Assembly Instructions

INSTALLATION CHECK LIST

Job Name: _____ Date: _____
Address: _____
Serial: _____ Tag: _____
Contractor: _____

INITIAL CHECKLIST

INSTALLING CONTRACTOR MUST VERIFY THE FOLLOWING ITEMS

1- Did you check the unit for any visible shipping damage?	YES? ___	NO? ___
2- Is the unit installed properly level?	YES? ___	NO? ___
3- Are the clearances adequate for operation and service?	YES? ___	NO? ___
4- Can you open the access doors and removable panels?	YES? ___	NO? ___
5- Have all the shipping braces and protections been removed?	YES? ___	NO? ___
6- Did you check the incoming voltage against the name plate?	YES? ___	NO? ___
7- Have all electrical connections been tested?	YES? ___	NO? ___
8- Has over current protection been installed matching the requirements?	YES? ___	NO? ___
9- Do the fan rotate freely?	YES? ___	NO? ___
10- Is copper tubing isolated from any metal parts?	YES? ___	NO? ___
11- Are the filters clean and installed with the proper orientation?	YES? ___	NO? ___
12- Have the drain and p-trap checked and properly connected?	YES? ___	NO? ___

Ambient Dry Bulb Temperature_____ Ambient Wet Bulb Temperature_____

Supply Fan Details

Alignment Checked?	YES? ___	NO? ___
Rotation Checked?	YES? ___	NO? ___

Band Size_____
Motor RPM_____ Blower RPM_____

Design CFM_____ Actual CFM_____

Design ESP_____ Actual ESP_____

MAINTENANCE LOG

This log must be kept with the unit. It is the responsibility of the owner and/or maintenance/service contractor to document any service, repair or adjustments. Commercial Aire Products, Inc. Warranty Department is available to advise and provide phone help for proper operation and replacement parts. The responsibility for proper start-up, maintenance and servicing of the equipment falls to the owner and qualified licensed technician.

ACTION DATE	ACTION TAKEN	NAME/TELEPHONE

Total System Refrigerant Charge (kg)	Total System Refrigerant Charge (oz)	Total System Refrigerant Charge (lb)	Min. Area of Conditioned Space (m^2)	Min. Area of Conditioned Space (ft^2)	Min. Air-Flow ($meter^3/hr$)	Min. Air-Flow (liter/s)	Min. Air-Flow (CFM)
1.776 kg or less	62.6 oz or less	3.91 lb or less	No Minimum	No Minimum	No Minimum	No Minimum	No Minimum
1.78	63	3.92	5.47	59	180	50	106
2.03	72	4.48	6.23	67	206	57	121
2.28	80	5.03	7.00	75	231	64	136
2.53	89	5.58	7.77	84	256	71	151
2.78	98	6.13	8.54	92	282	78	166
3.03	107	6.68	9.31	100	307	85	181
3.28	116	7.23	10.07	108	332	92	196
3.53	125	7.78	10.84	117	358	99	211
3.78	133	8.33	11.61	125	383	106	225
4.03	142	8.88	12.38	133	408	113	240
4.28	151	9.44	13.14	141	434	120	255
4.53	160	9.99	13.91	150	459	128	270
4.78	169	10.54	14.68	158	484	135	285
5.03	177	11.09	15.45	166	510	142	300
5.28	186	11.64	16.22	175	535	149	315
5.53	195	12.19	16.98	183	560	156	330
5.78	204	12.74	17.75	191	586	163	345
6.03	213	13.29	18.52	199	611	170	360
6.28	222	13.85	19.29	208	636	177	375
6.53	230	14.40	20.06	216	662	184	389
6.78	239	14.95	20.82	224	687	191	404
7.03	248	15.50	21.59	232	713	198	419
7.50	265	16.53	23.03	248	760	211	447
8.00	282	17.64	24.57	264	811	225	477
8.50	300	18.74	26.11	281	861	239	507
9.00	317	19.84	27.64	298	912	253	537
9.50	335	20.94	29.18	314	963	267	567
10.00	353	22.05	30.71	331	1014	282	596
10.50	370	23.15	32.25	347	1064	296	626
11.00	388	24.25	33.78	364	1115	310	656
11.50	406	25.35	35.32	380	1166	324	686
12.00	423	26.46	36.86	397	1216	338	716
12.50	441	27.56	38.39	413	1267	352	746
13.00	459	28.66	39.93	430	1318	366	775
13.50	476	29.76	41.46	446	1368	380	805
14.00	494	30.86	43.00	463	1419	394	835
14.50	511	31.97	44.53	479	1470	408	865
15.00	529	33.07	46.07	496	1520	422	895
15.50	547	34.17	47.60	512	1571	436	925
16.00	564	35.27	49.14	529	1622	450	954
16.50	582	36.38	50.68	545	1672	465	984
17.00	600	37.48	52.21	562	1723	479	1014
17.50	617	38.58	53.75	579	1774	493	1044
18.00	635	39.68	55.28	595	1824	507	1074
18.50	653	40.79	56.82	612	1875	521	1103
19.00	670	41.89	58.35	628	1926	535	1133
19.50	688	42.99	59.89	645	1976	549	1163
20.00	705	44.09	61.43	661	2027	563	1193
20.50	723	45.19	62.96	678	2078	577	1223
21.00	741	46.30	64.50	694	2128	591	1253
21.50	758	47.40	66.03	711	2179	605	1282
22.00	776	48.50	67.57	727	2230	619	1312
22.50	794	49.60	69.10	744	2280	633	1342
23.00	811	50.71	70.64	760	2331	648	1372
23.50	829	51.81	72.17	777	2382	662	1402
24.00	847	52.91	73.71	793	2432	676	1432
24.50	864	54.01	75.25	810	2483	690	1461
25.00	882	55.12	76.78	826	2534	704	1491
25.50	899	56.22	78.32	843	2584	718	1521
26.00	917	57.32	79.85	860	2635	732	1551
26.50	935	58.42	81.39	876	2686	746	1581
27.00	952	59.52	82.92	893	2736	760	1610
27.50	970	60.63	84.46	909	2787	774	1640
28.00	988	61.73	86.00	926	2838	788	1670
28.50	1005	62.83	87.53	942	2889	802	1700
29.00	1023	63.93	89.07	959	2939	816	1730
29.50	1041	65.04	90.60	975	2990	831	1760
30.00	1058	66.14	92.14	992	3041	845	1789
30.50	1076	67.24	93.67	1008	3091	859	1819
31.00	1093	68.34	95.21	1025	3142	873	1849
31.50	1111	69.45	96.74	1041	3193	887	1879
32.00	1129	70.55	98.28	1058	3243	901	1909
32.50	1146	71.65	99.82	1074	3294	915	1939
33.00	1164	72.75	101.35	1091	3345	929	1968
33.50	1182	73.85	102.89	1107	3395	943	1998
34.00	1199	74.96	104.42	1124	3446	957	2028
34.50	1217	76.06	105.96	1141	3497	971	2058
35.00	1235	77.16	107.49	1157	3547	985	2088
35.50	1252	78.26	109.03	1174	3598	999	2117
36.00	1270	79.37	110.57	1190	3649	1014	2147
36.50	1288	80.47	112.10	1207	3699	1028	2177

TABLE 2: MINIMUM CONDITIONED SPACE AREA & AIR-FLOW FOR R-454B REFRIGERANT INSTALLATIONS

NOTES: 1. Applies to fixed ducted systems with continuous air-flow or refrigerant detection systems only.
2. Based on an LFL of 0.296 kg/m3

Total System Refrigerant Charge (kg)	Total System Refrigerant Charge (oz)	Total System Refrigerant Charge (lb)	Min. Area of Conditioned Space (m^2)	Min. Area of Conditioned Space (ft^2)	Min. Air-Flow ($meter^3/hr$)	Min. Air-Flow (liter/s)	Min. Air-Flow (CFM)
1.836 kg or less	64.6 oz or less	4.04 lb or less	No Minimum	No Minimum	No Minimum	No Minimum	No Minimum
1.84	65	4.06	5.47	59	180	50	106
2.09	74	4.61	6.21	67	205	57	121
2.34	83	5.16	6.95	75	229	64	135
2.59	91	5.71	7.69	83	254	71	149
2.84	100	6.26	8.44	91	278	77	164
3.09	109	6.81	9.18	99	303	84	178
3.34	118	7.36	9.92	107	327	91	193
3.59	127	7.91	10.67	115	352	98	207
3.84	135	8.47	11.41	123	376	105	222
4.09	144	9.02	12.15	131	401	111	236
4.34	153	9.57	12.89	139	425	118	250
4.59	162	10.12	13.64	147	450	125	265
4.84	171	10.67	14.38	155	475	132	279
5.09	180	11.22	15.12	163	499	139	294
5.34	188	11.77	15.86	171	524	145	308
5.59	197	12.32	16.61	179	548	152	323
5.84	206	12.88	17.35	187	573	159	337
6.09	215	13.43	18.09	195	597	166	351
6.34	224	13.98	18.84	203	622	173	366
6.59	232	14.53	19.58	211	646	179	380
6.84	241	15.08	20.32	219	671	186	395
7.09	250	15.63	21.06	227	695	193	409
7.50	265	16.53	22.28	240	735	204	433
8.00	282	17.64	23.77	256	784	218	462
8.50	300	18.74	25.25	272	833	231	490
9.00	317	19.84	26.74	288	882	245	519
9.50	335	20.94	28.22	304	931	259	548
10.00	353	22.05	29.71	320	980	272	577
10.50	370	23.15	31.19	336	1029	286	606
11.00	388	24.25	32.68	352	1078	300	635
11.50	406	25.35	34.17	368	1127	313	664
12.00	423	26.46	35.65	384	1176	327	692
12.50	441	27.56	37.14	400	1225	340	721
13.00	459	28.66	38.62	416	1275	354	750
13.50	476	29.76	40.11	432	1324	368	779
14.00	494	30.86	41.59	448	1373	381	808
14.50	511	31.97	43.08	464	1422	395	837
15.00	529	33.07	44.56	480	1471	408	865
15.50	547	34.17	46.05	496	1520	422	894
16.00	564	35.27	47.53	512	1569	436	923
16.50	582	36.38	49.02	528	1618	449	952
17.00	600	37.48	50.51	544	1667	463	981
17.50	617	38.58	51.99	560	1716	477	1010
18.00	635	39.68	53.48	576	1765	490	1039
18.50	653	40.79	54.96	592	1814	504	1067
19.00	670	41.89	56.45	608	1863	517	1096
19.50	688	42.99	57.93	624	1912	531	1125
20.00	705	44.09	59.42	640	1961	545	1154
20.50	723	45.19	60.90	656	2010	558	1183
21.00	741	46.30	62.39	672	2059	572	1212
21.50	758	47.40	63.87	688	2108	586	1240
22.00	776	48.50	65.36	704	2157	599	1269
22.50	794	49.60	66.84	720	2206	613	1298
23.00	811	50.71	68.33	736	2255	626	1327
23.50	829	51.81	69.82	751	2304	640	1356
24.00	847	52.91	71.30	767	2353	654	1385
24.50	864	54.01	72.79	783	2402	667	1414
25.00	882	55.12	74.27	799	2451	681	1442
25.50	899	56.22	75.76	815	2500	694	1471
26.00	917	57.32	77.24	831	2549	708	1500
26.50	935	58.42	78.73	847	2598	722	1529
27.00	952	59.52	80.21	863	2647	735	1558
27.50	970	60.63	81.70	879	2696	749	1587
28.00	988	61.73	83.18	895	2745	763	1616
28.50	1005	62.83	84.67	911	2794	776	1644
29.00	1023	63.93	86.16	927	2843	790	1673
29.50	1041	65.04	87.64	943	2892	803	1702
30.00	1058	66.14	89.13	959	2941	817	1731
30.50	1076	67.24	90.61	975	2990	831	1760
31.00	1093	68.34	92.10	991	3039	844	1789
31.50	1111	69.45	93.58	1007	3088	858	1817
32.00	1129	70.55	95.07	1023	3137	871	1846
32.50	1146	71.65	96.55	1039	3186	885	1875
33.00	1164	72.75	98.04	1055	3235	899	1904
33.50	1182	73.85	99.52	1071	3284	912	1933
34.00	1199	74.96	101.01	1087	3333	926	1962
34.50	1217	76.06	102.50	1103	3382	940	1991
35.00	1235	77.16	103.98	1119	3431	953	2019
35.50	1252	78.26	105.47	1135	3480	967	2048
36.00	1270	79.37	106.95	1151	3529	980	2077
36.50	1288	80.47	108.44	1167	3578	994	2106

TABLE 3: MINIMUM CONDITIONED SPACE AREA & AIR-FLOW FOR R-32 REFRIGERANT INSTALLATIONS

NOTES: 1. Applies to fixed ducted systems with continuous air-flow or refrigerant detection systems only.
2. Based on an LFL of 0.306 kg/m3

DECOMMISSIONING AND DISPOSAL OF THE AIR HANDLER

When the air handler is at the end of its life and is being removed for replacement, proper procedures must be followed to assure the safety of the technician and building occupants due to the flammable refrigerant contained in the refrigeration system. Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

Decommissioning Procedure

a. Become familiar with the equipment and its operation.
b. Before attempting the procedure, ensure that:
   - Mechanical handling equipment is available, if required, for handling refrigerant cylinders;
   - All personal protective equipment is available and being used correctly;
   - The recovery process is supervised at all times by a competent person;
   - Recovery equipment and cylinders conform to the appropriate standards.
c. Pump down the refrigerant into the outdoor unit, if possible, by closing the outdoor unit liquid service valve and energizing the compressor until the suction pressure is near atmospheric pressure. If pumping the system down is not possible due to an inoperable compressor, the refrigerant must be recovered following local and national regulations.
d. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
e. Make sure that the recovery cylinder is situated on the scales before recovery takes place.
f. Start the recovery machine and operate in accordance with instructions. (Also refer to Refrigerant Recovery Requirements in the next column.)
g. Do not overfill cylinders (no more than 80 % volume liquid charge).
h. Do not exceed the maximum working pressure of the cylinder, even temporarily.
i. 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.
j. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.
k. Once all of the refrigerant has been pumped into the outdoor unit or has been recovered, disconnect the refrigerant lines from the air handler. Continuously flush or purge with inert gas when using a flame to open the circuit at the field refrigerant line connections.
l. Turn the circuit breaker(s) serving the furnace or air handler in the main electrical panel to the OFF position or if a disconnect switch has been installed near the furnace or air handler, switch it to the OFF position.
m. Disconnect all electrical wiring from the air handler.
n. Once the refrigerant lines and electrical wiring have been disconnected from the air handler, remove the air handler from the property and dispose of it. Taking the air handler to a recycling center is encouraged.
o. Equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

Refrigerant Recovery Requirements

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 labeled 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.

Disposal of the Air Handler

- Ensure sufficient ventilation at the working place.
- Remove the refrigerant. If the recovery is not required by national regulations, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should guard the outlet. Take special care that drained refrigerant will not float back into the building.
- When flammable refrigerants are used,
  - evacuate the refrigerant circuit.
  - purge the refrigerant circuit with oxygen free nitrogen.

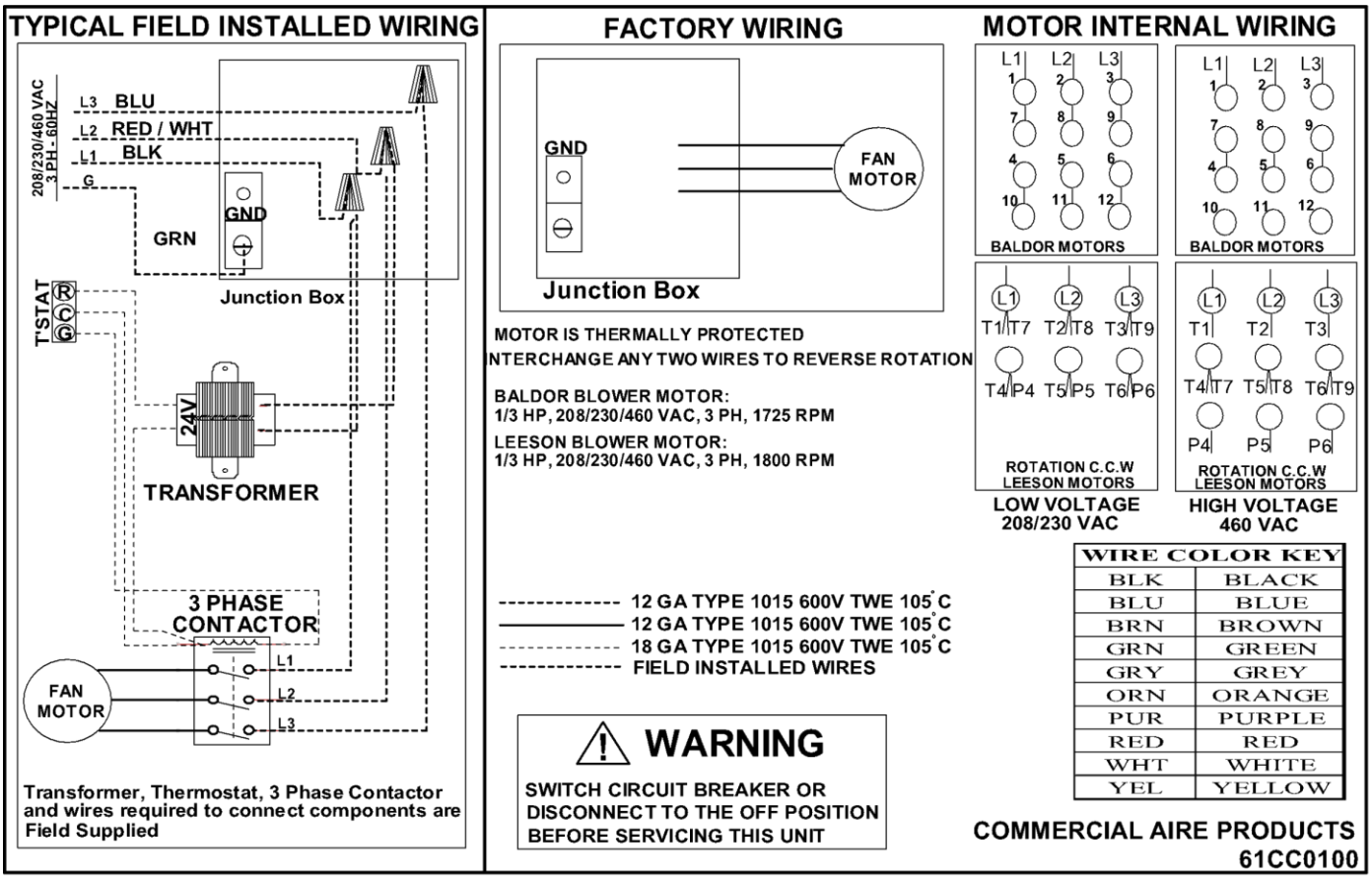


Figure 10: Wiring Diagram

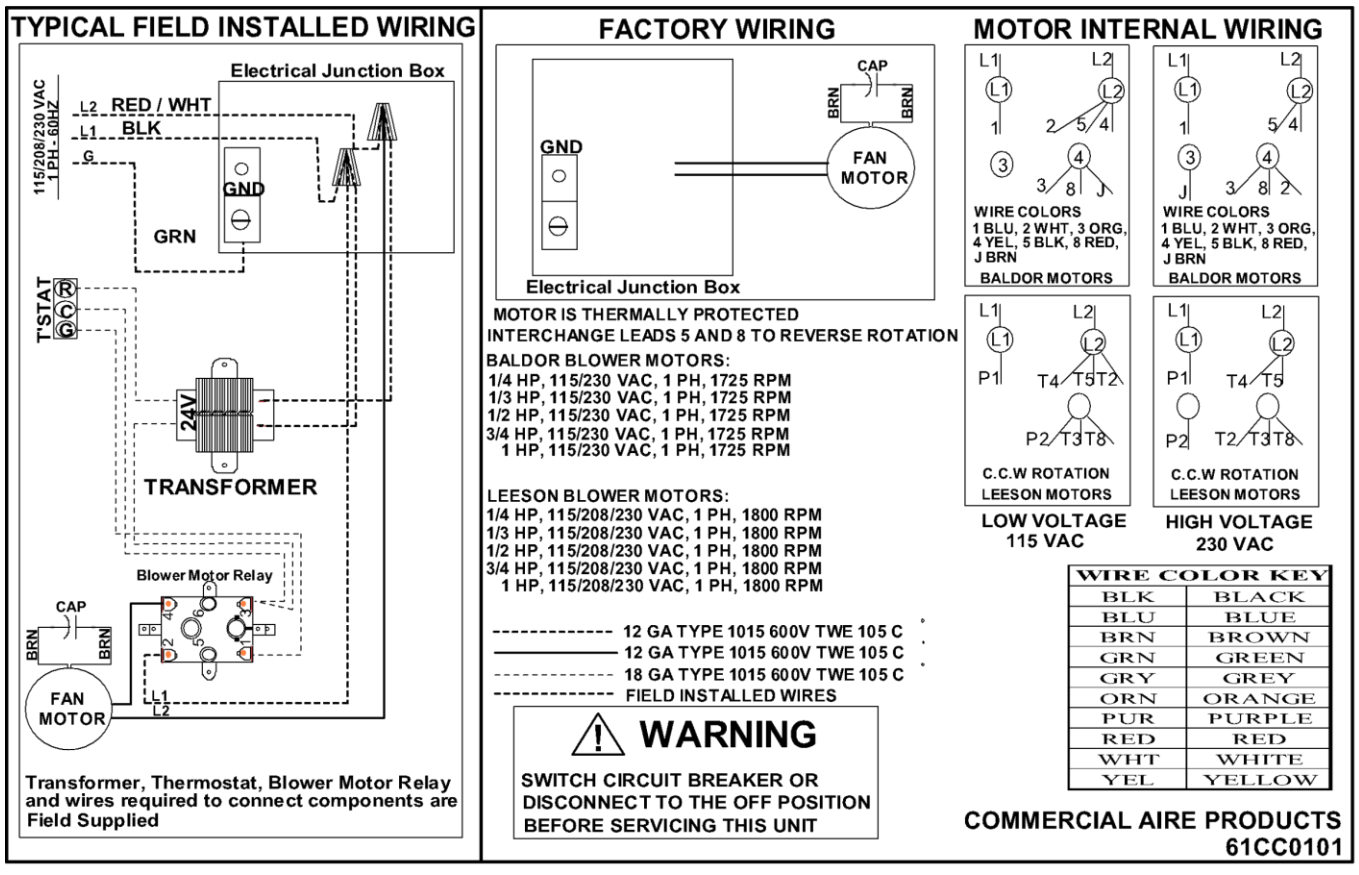


Figure 11: Wiring Diagram

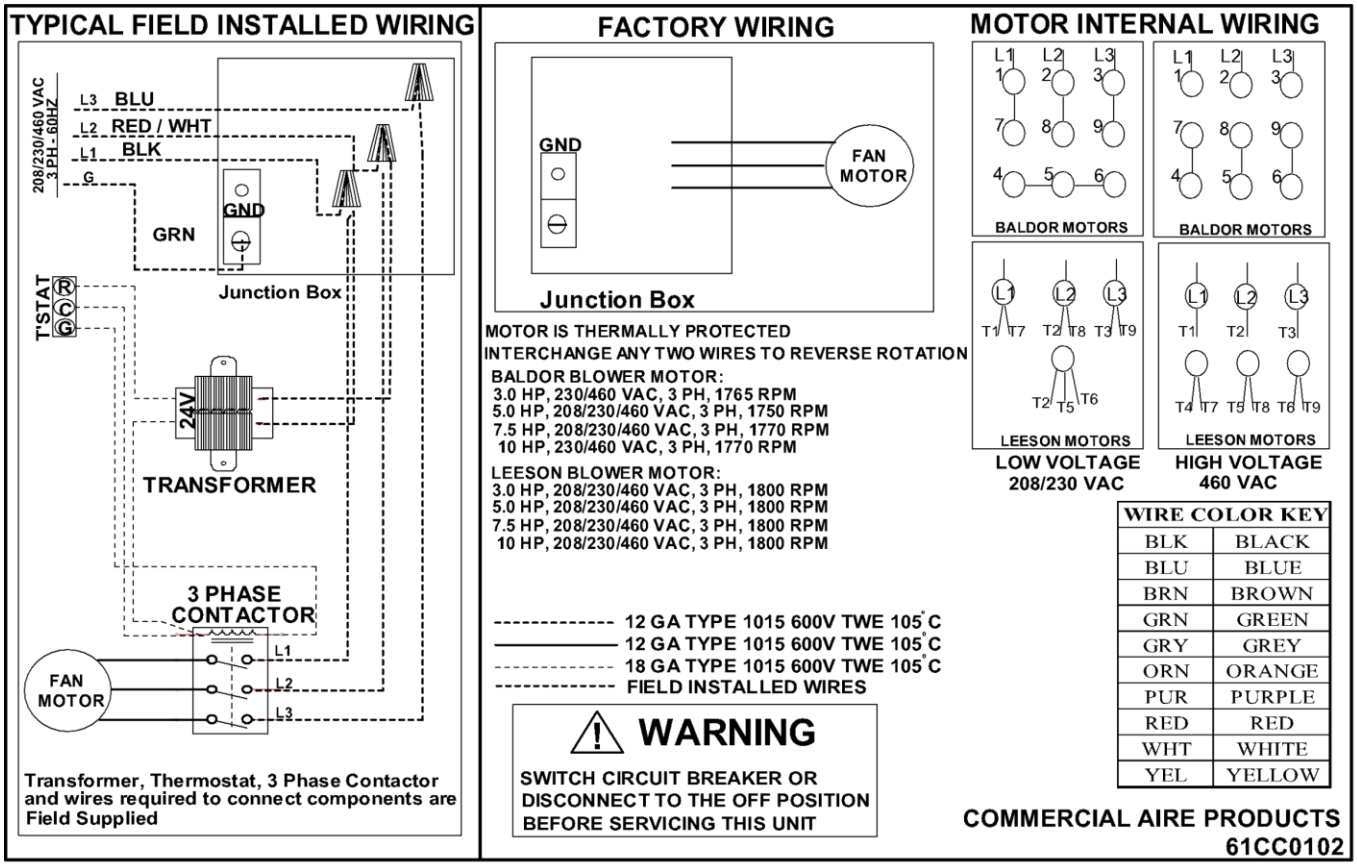


Figure 12: Wiring Diagram

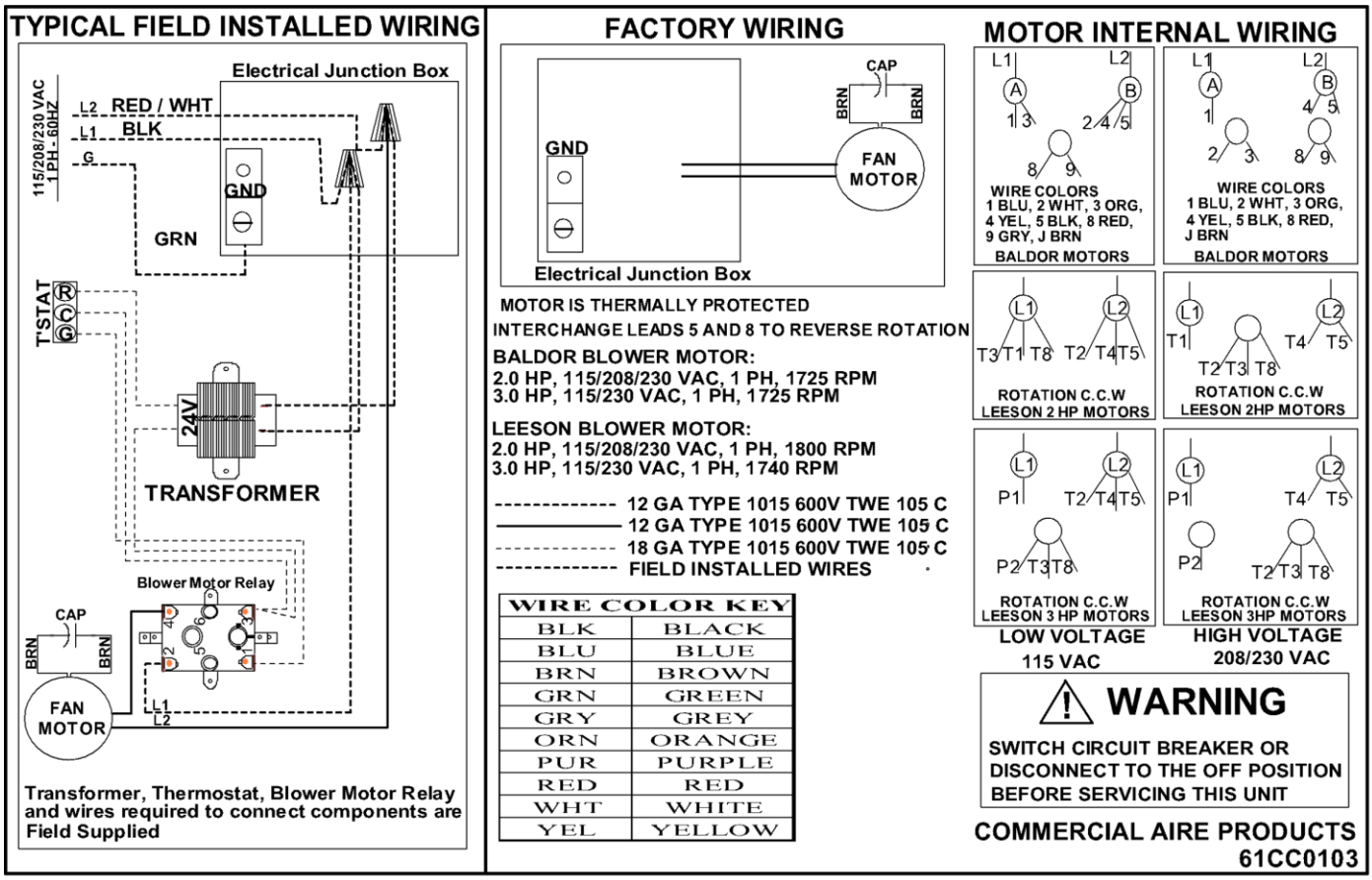


Figure 13: Wiring Diagram

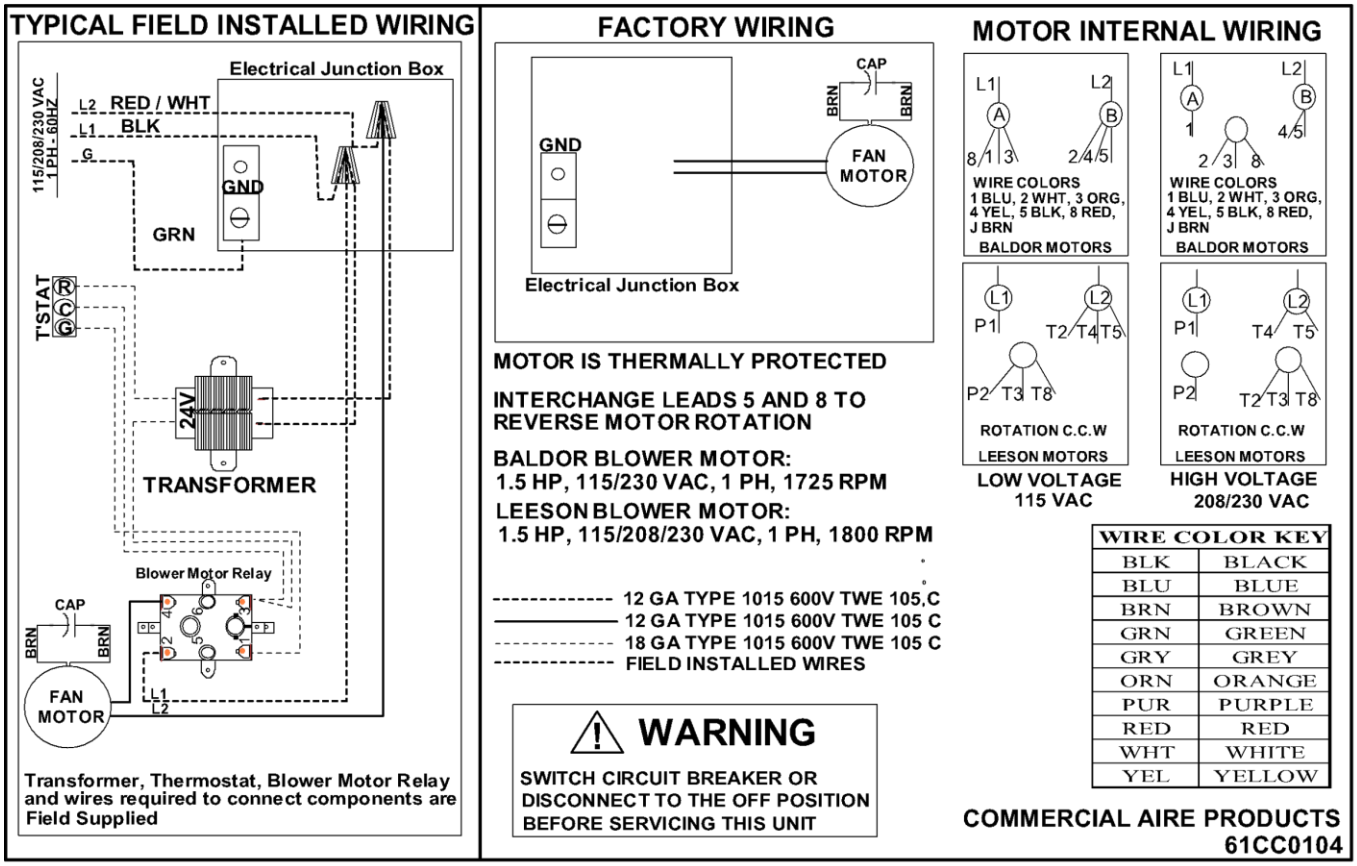


Figure 14: Wiring Diagram

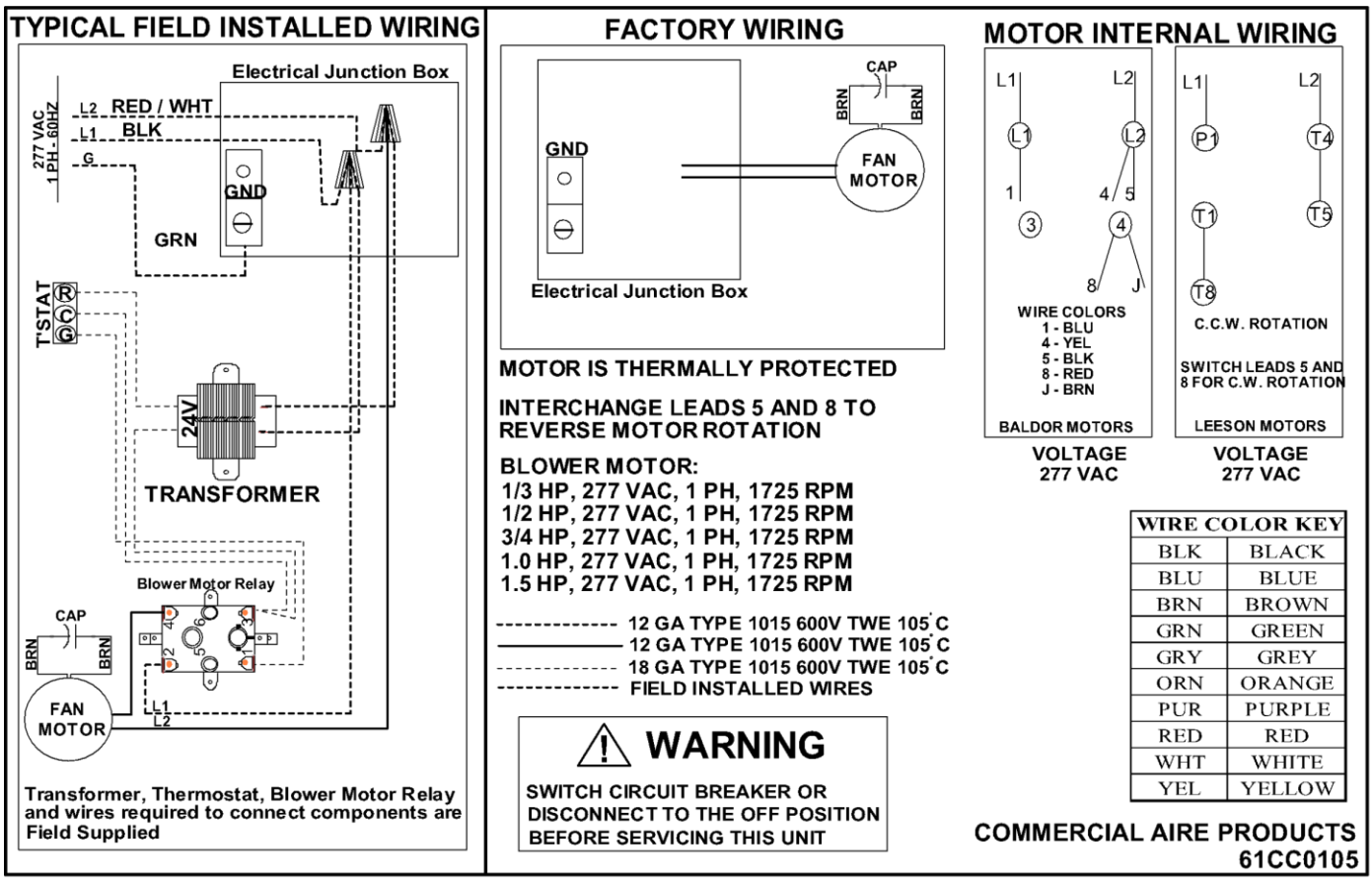


Figure 15: Wiring Diagram

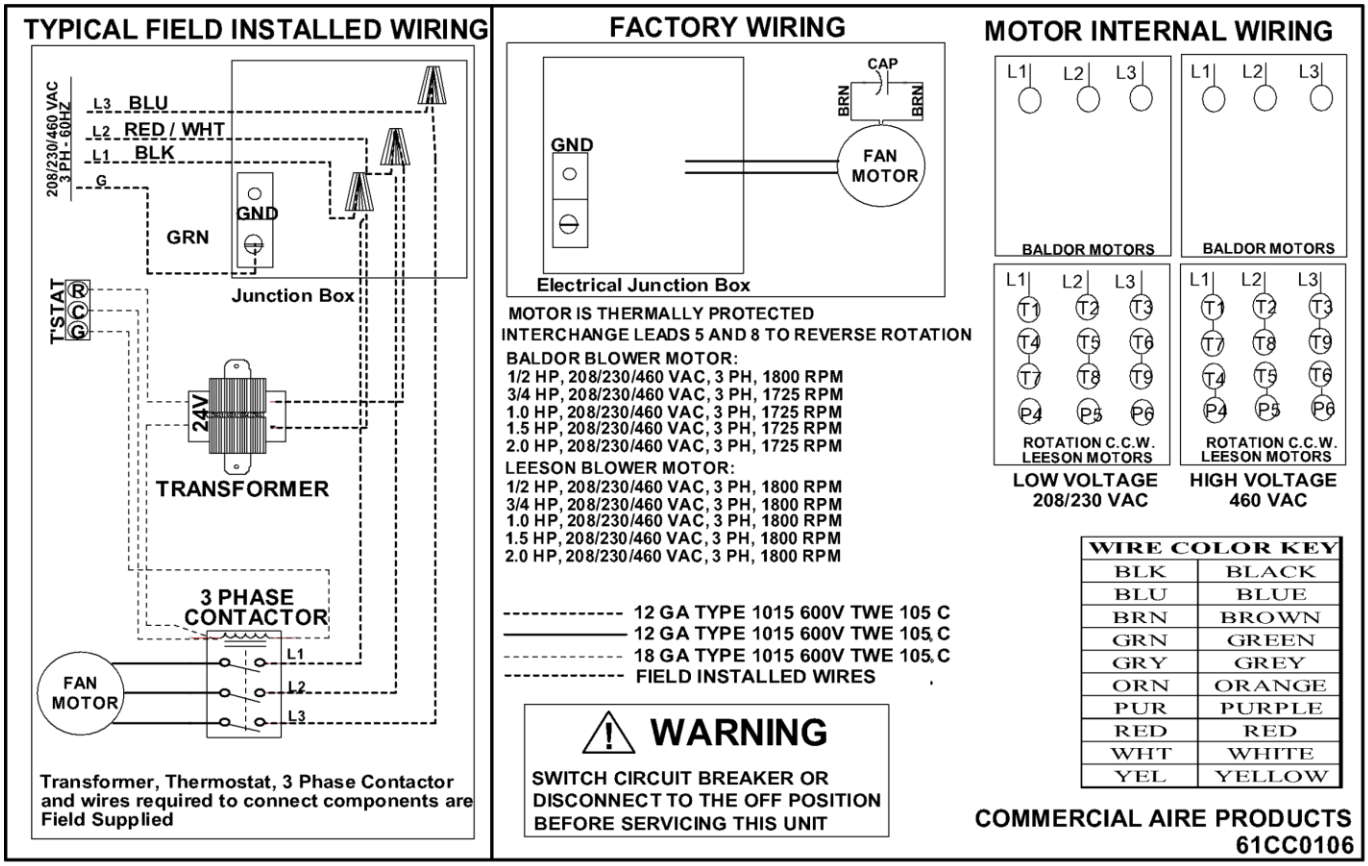


Figure 16: Wiring Diagram

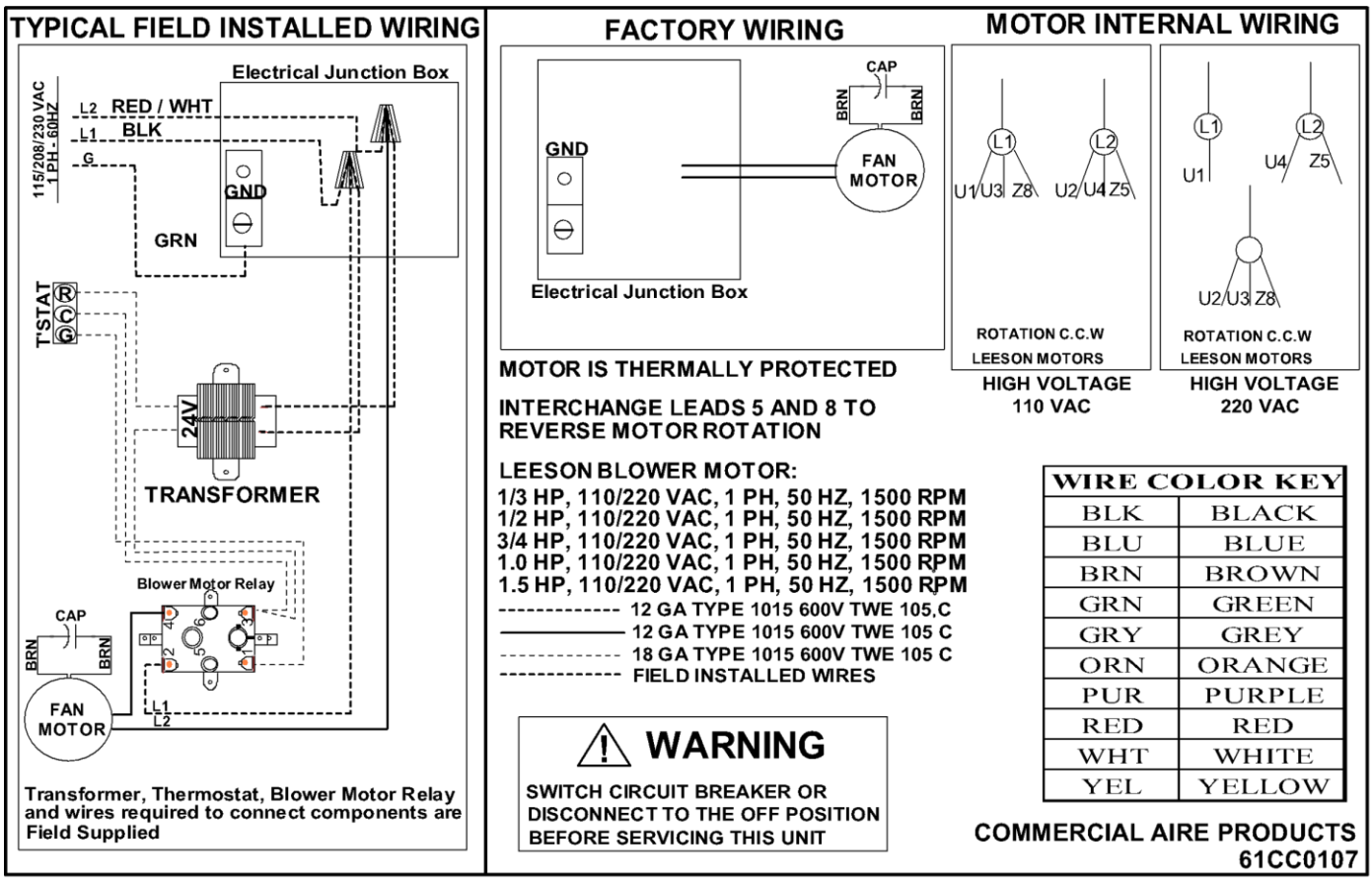


Figure 17: Wiring Diagram

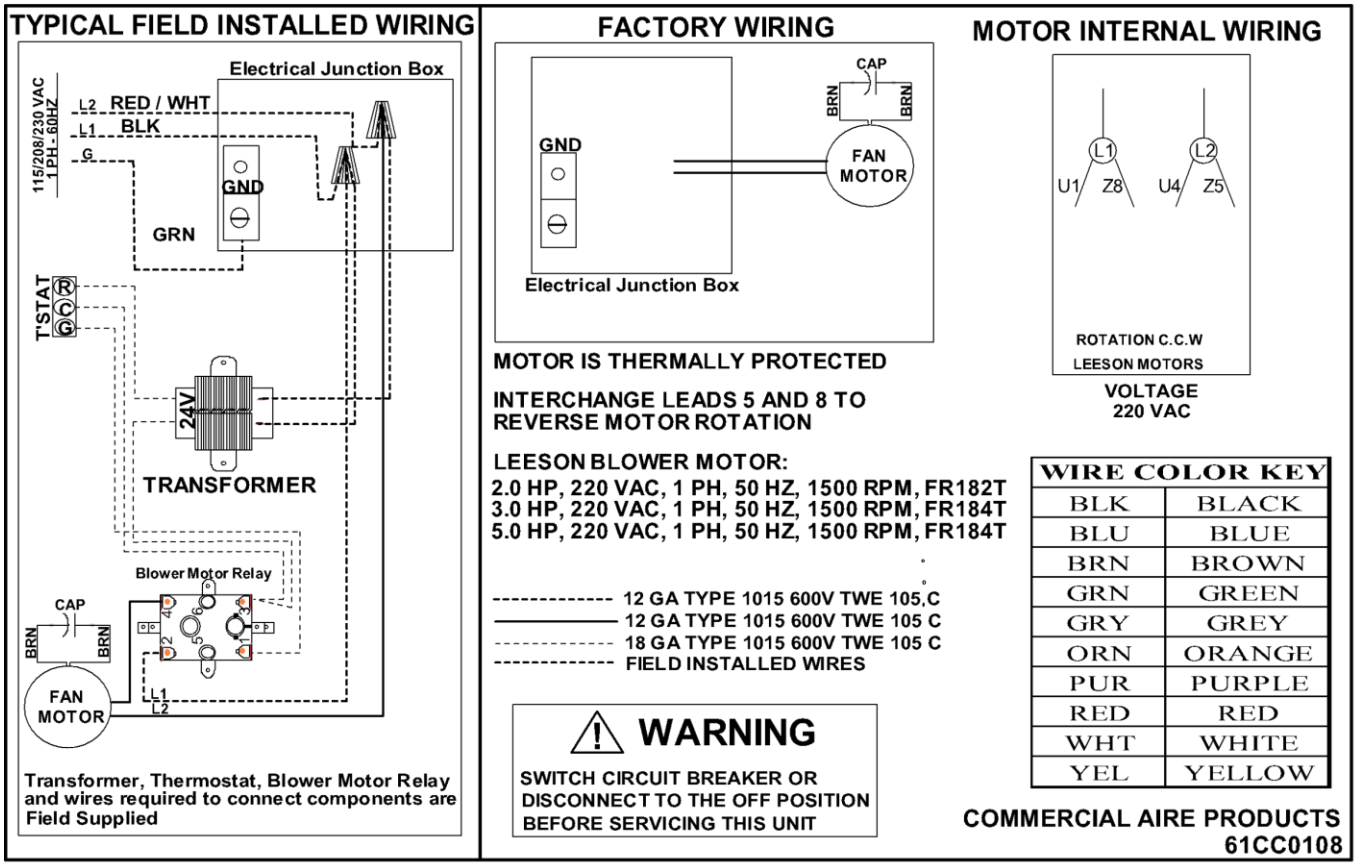


Figure 18: Wiring Diagram

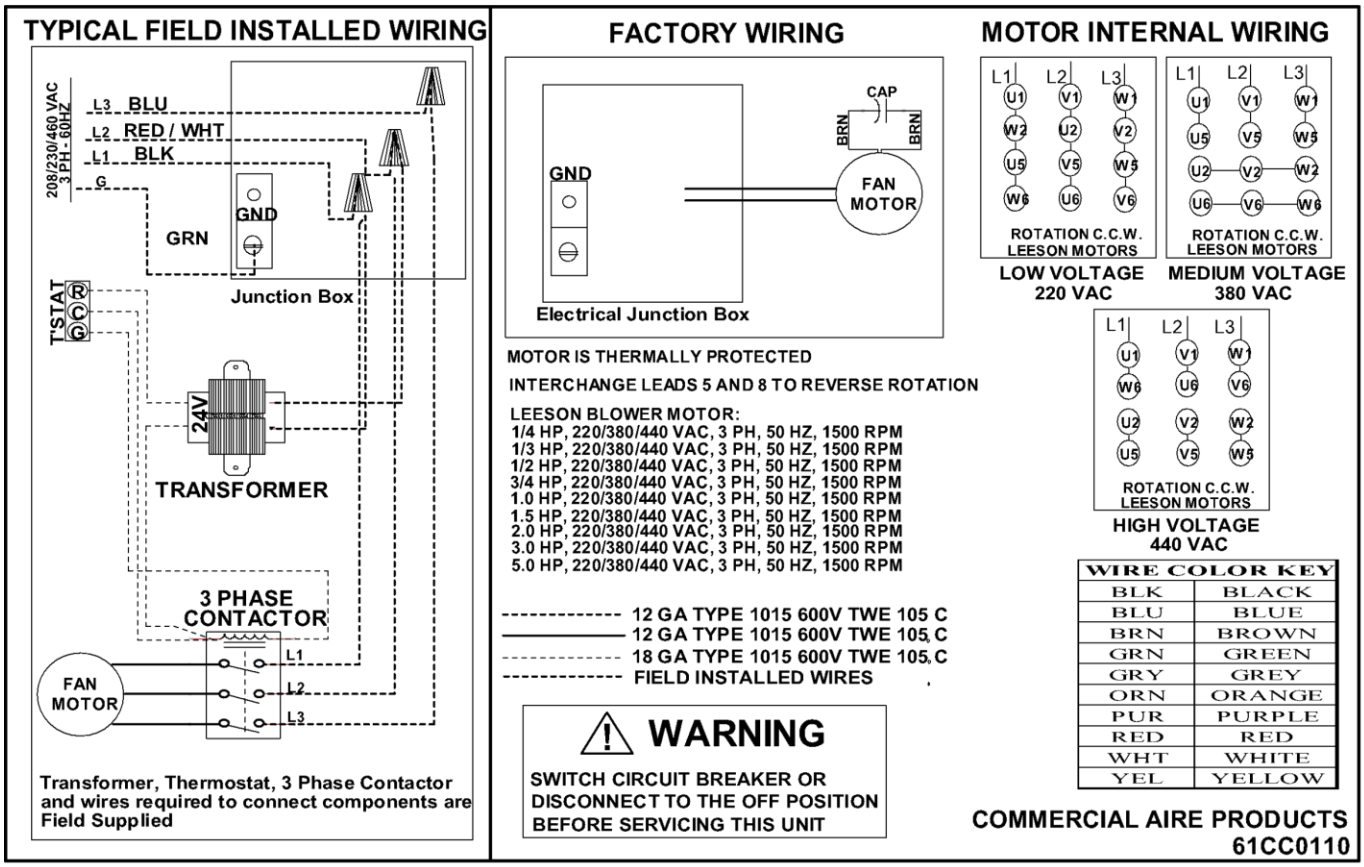


Figure 19: Wiring Diagram

LIMITED WARRANTY

Commercial Aire products, Inc. (CAP) warrants this product to be free from defects in factory workmanship and material for a term of ONE YEAR under normal use and service. CAP will, at its option, repair or replace any parts that prove to have such defects according to the terms outlined below. This warranty covers only the equipment described by the product Model and Serial Number listed below.

For your benefit and protection, fax this completed sheet to CAP at (817) 624-8581 promptly after installation. This will initiate the warranty period. In the absence of recorded warranty coverage, the warranty period will begin upon date of manufacture based upon the serial number provided. The warranty period for repair or replacement parts shall not exceed 2 years from date of manufacture.

This warranty extends only to the original consumer purchaser and is non-transferable. For this warranty to apply the product must be installed according to CAP recommendations and specifications, and in accordance with all local, state, and national codes; and the product must not be removed from its place of original installation.

CAP strongly recommends regular periodic preventative maintenance on this equipment. A licensed contractor can ensure your maintenance program meets the conditions of the warranty, maximize the efficiency of the equipment, and service your unit within the mandated guidelines with regard to unlawful discharge of refrigerants into the atmosphere.

This warranty applies only to products installed in the United States and Canada.

For Owner's Information:

PRODUCT MODEL NO._____ INSTALLATION DATE_____

UNIT SERIAL NO_____ INSTALLED BY: _____

CONTRACTOR PHONE #_____ CONTRACTOR LICENSE #_____

EXCLUSIONS

This warranty does not cover any:

1. Shipping, labor, or material charges (including Refrigerant).
2. Damages resulting from transportation, installation, or servicing.
3. Damages resulting from: use of the product in a corrosive atmosphere; accident; abuse; fire; flood; alteration; or acts of God. Tampering, altering, defacing or removing the product serial number will void this warranty.
4. Damages resulting from inadequacy or interruption of electrical service or fuel supply, improper voltage conditions, Blown fuses, or other like damages.
5. Cleaning or replacement of filters.
6. Damages resulting from failure to properly and regularly clean air and/or water side of condenser and evaporator.
7. Damages resulting from: (a) freezing of condenser water or condensate; (b) inadequate or interrupted water supply; (c) Use of corrosive water; (d) fouling or restriction of the water circuit by foreign material or like causes.
8. Damages resulting from operation with inadequate supply of air or water.
9. Damages resulting from use of components or accessories not manufactured or approved by Commercial Aire Products, Inc.
10. Increase in fuel or electric cost.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. Some states do not allow the disclaimer of implied warranty, so the preceding disclaimer may not apply. In states allowing only a partial limitation on implied warranties, the duration of implied warranties is expressly limited to the duration of the express warranty on the face hereof. In no event, whether as a result of breach of warranty or contract, tort (including negligence) strict liability or otherwise, shall CAP be liable of special, incidental, or consequential damages, including (but not limited to) loss of use of equipment or associated equipment, lost revenues, lost profits, cost of substitute equipment or cost of fuel or electricity.

The above limitations shall inure to the benefit of CAP suppliers and sub-contractors. The above limitation on consequential damage shall not apply to injuries to persons in the case of consumer goods. Some states do not allow the exclusion or limitation of liability for consequential, or incidental damages, or for strict liability in tort, so the above exclusions and limitations may not apply.

CAP does not assume or authorize any person to assume for CAP any other liability for the sale of CAP product. This warranty gives you specific legal rights. You may also have other rights, which vary from state to state.

The above warranty applies with respect to parts only and not labor. Accordingly, subject to the conditions and limitations set forth herein, the above warrant entitles the Customer only to receive a repaired or replacement part and not to the installation thereof. However, for the first one (1) year only of the above warranty period, CAP will provide labor services to repair a Product or install repaired or replacement parts at its designated repair facilities, or at its option, compensate its authorized dealers and authorized contractors at CAP's standard fixed rates then in effect (irrespective of charges actually imposed and time actually expended) to provide such services.

The above warranty is for repair or replacement only. Except to that limited extent, CAP will not under any circumstances be liable for any loss, cost, damage, or expense of any kind arising out of a breach of this warranty or otherwise. Without intending to limit the foregoing sentence, it is specifically provided as follows: CAP shall not be liable for any incidental, consequential, exemplary, special, or punitive damages, or for any loss of revenue, profit or use, arising out of a breach of this warranty (including but not limited to damage resulting from condensate leakage) or in connection of the sale, maintenance, use, operation or repair of any CAP product. In no event will CAP be liable for any amount greater than the purchase price of a defective product.

Warranty 07/21/11 61BU0020 12.10.25