# INSTALLATION MANUAL

R-410A  
XA SERIES W/SMART EQUIPMENT™

6-1/2 - 12-1/2 Ton

60 Hertz

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General

TempMaster XA heat pumps are single package, reverse cycle air conditioners designed for outdoor installation on a rooftop or slab and for non-residential use. These units can be equipped with factory or field installed electric heaters for heating applications.

These units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power and duct connections. The electric heaters have nickel-chrome elements and utilize single-point power connection.

Safety Considerations

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 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 only property damage.

**WARNING**

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

**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**

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer or service agency.

**CAUTION**

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gage sets, hoses, refrigerant containers and recovery systems must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer. Failure to use R-410A compatible servicing equipment may result in property damage or injury.

Due to system pressure, moving parts, and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained service personnel should install, repair, or service this equipment. Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters.

Observe all precautions in the literature, labels, and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other applicable safety precautions and codes including National Electric Code, ANSI/NFPA No. 70 - latest edition U.S. A. and Canadian Electric Code, CSA C22.1 in Canada.

Wear safety glasses and work gloves. Use quenching cloth and have a fire extinguisher available during brazing operations.

**Inspection**

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier’s freight bill. A separate request for inspection by the carrier’s agent should be made in writing.
Reference

Additional information is available in the following reference forms:

- Technical Guide - XAT06 thru T12, 5123280
- General Installation - XAT06 thru T12, 5121837
- Smart Equipment™ Control Quick Start Guide 1136326
- Economizer Accessory -
  - Downflow Factory Installed
  - Downflow Field Installed
  - Horizontal Field Installed
- Motorized Outdoor Air Damper
- Manual Outdoor Air Damper (0-100%)
- Manual Outdoor Air Damper (0-35%)
- Electric Heater Accessory 50" cabinet

Renewal Parts

Contact your local TempMaster parts distribution center for authorized replacement parts.

Approvals

Design certified by CSA as follows:

1. For use as a cooling only unit, cooling unit with supplemental electric heat or a forced air furnace.
2. For outdoor installation only.
3. For installation on combustible material and may be installed directly on combustible flooring or, in the U.S., on wood flooring or Class A, Class B or Class C roof covering materials.

![CAUTION]

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

![WARNING]

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

![CAUTION]

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.
## Nomenclature

### 3-12.5 Ton Model Number Nomenclature

<table>
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<th>Configuration Options</th>
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<th>VFD Options</th>
<th>Control Options</th>
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<td>X = HP, Single Plg., R-410A</td>
<td>7 = Seventh Generation</td>
<td>T06 = 4.5 Ton, T07 = 7.5 Ton, T08 = 8.5 Ton, T10 = 10.0 Ton, T12 = 12.5 Ton</td>
<td>A = No Options</td>
<td>1 = Bottom Drain Composite-STD</td>
<td>1 = 2&quot; Throwaway Filters</td>
<td>A = None</td>
<td>A = No Options Installed</td>
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<td>N18</td>
<td>8 = Eighth Generation</td>
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<td></td>
<td>B = VFD/VAV</td>
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<td>A2</td>
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<td>T06 = 6.5 Ton</td>
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<td>2 = Reverse SS Drain Pan NonHGB</td>
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<td></td>
<td>C = VFD, w/Bypass, VAV</td>
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<td>D = Cost Sup VFD/VAV</td>
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<td>5 = Reverse SS Drain Pan WHGB</td>
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<td>F = VFD, w/Bypass, IntelliSpeed</td>
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### Electric Heat Options

- T06 = 6.5 Ton
- T07 = 7.5 Ton
- T08 = 8.5 Ton
- T10 = 10.0 Ton
- T12 = 12.5 Ton

### Nominal Heat Capacity (Unit Size Allowed)

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<td>B = Phase Monitor (PM)</td>
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<td>C = Coil Guard (CG)</td>
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### Additional Options

- A = No Options
- B = Relay Monitor (PM)
- C = Safety Seal (SS)
- D = Dirty Filter Switch (DFS)
- E = PM & CG
- F = PM & DFS
- G = CG & DFS
- H = PM, CG, & DFS

### Pre-Filter Options

- 1 = Bottom Drain Composite-STD
- 2 = Hot Gas Bypass
- 3 = SS Drain Pan NonHGB
- 4 = SS Drain Pan WHGB
- 5 = Reverse SS Drain Pan WHGB

### Control Options

- A = None
- B = VFD/VAV
- C = VFD, w/Bypass, VAV
- D = Cost Sup VFD/VAV
- E = VFD, IntelliSpeed
- F = VFD, w/Bypass, IntelliSpeed
- G = Cost Sup VFD, IntelliSpeed

### Additional Options

- A = No Options Installed
- B = Option 1
- C = Option 2
- D = Options 1 & 2
- E = Option 3
- F = Option 4
- G = Options 1 & 3
- H = Options 1 & 4
- J = Options 1, 2 & 3
- K = Options 1, 2, & 4
- L = Options 1, 3, & 4
- M = Options 1, 2, 3, & 4
- N = Options 2 & 3
- P = Options 2 & 4
- Q = Options 2, 3, & 4
- R = Options 3 & 4
- S = Options 3
- T = Options 1 & 5
- U = Options 1, 3, & 5
- V = Options 1, 4, & 5
- W = Options 1, 3, 4, & 5
- X = Options 3 & 5
- Y = Options 4 & 5
- Z = Options 3, 4 & 5

### Voltage Options

- 1 = Disconnect
- 2 = Non-Pwr'd Conv. Outlet
- 3 = Smoke Detector S.A.
- 4 = Smoke Detector R.A.
- 5 = Pwr'd Conv. Outlet
Installation

Installation Safety Information

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

This equipment is not to be used for temporary heating of buildings or structures under construction.

Preceding Installation

1. Remove the two screws holding the brackets in the front, rear and compressor side fork-lift slots.

2. Turn each bracket toward the ground and the protective plywood covering will drop to the ground.

3. Remove the condenser coil external protective covering prior to operation.

4. Remove the toolless doorknobs and instruction packet prior to installation.

5. If a factory option convenience outlet is installed, the weatherproof outlet cover must be field installed. The cover shall be located behind the filter access panel. To install the cover, remove the shipping label covering the convenience outlet, follow the instructions on the back of the weatherproof cover box, and attach the cover to the unit using the (4) screws provided.

208/230-3-60 and 380/415-3-50 units with factory installed Powered Convenience Outlet Option are wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

Limitations

These units must be installed in accordance with the following:

In U.S.A.:
2. Local building codes, and
3. Local electric utility requirements

In Canada:
1. Canadian Electrical Code, CSA C22.1
2. Installation Codes, CSA - B149.1.
3. Local plumbing and waste water codes, and
4. Other applicable local codes.

Refer to unit application data found in this document.

If components are to be added to a unit to meet local codes, they are to be installed at the dealer’s and/or customer’s expense.

Size of unit for proposed installation should be based on heat loss/heat gain calculation made according to the methods of Air Conditioning Contractors of America (ACCA).

This unit is not to be used for temporary heating of buildings or structures under construction.

It is permitted to use the unit for heating and cooling of buildings or structures under construction where the application and use must comply with all manufacturer’s installation instructions including:

- Unit must be operated under thermostatic control;
- Return and supply air ducts must be sealed to the unit;
- Air filters in place;
- Return air temperature maintained between 55°F (13°C) and 80°F (27°C);
- Upon completion of the construction phase and prior to formal start up and commissioning, the unit, duct work and components should be thoroughly cleaned and
inspected to assure that operation of the unit during construction has not contaminated the unit.

**NOTE:** Should the unit be used during the construction phase the standard limited warranty provisions go into effect once the unit is placed into operation.

The Smart Equipment™ control board used in this product will effectively operate the cooling system down to 0°F when this product is applied in a comfort cooling application for people. An economizer is typically included in this type of application. When applying this product for process cooling applications (computer rooms, switchgear, etc.), please call the applications department for Unitary Products @ 1-877-UPG-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30° F.

**Figure 4: XA Component Location**
Location

Use the following guidelines to select a suitable location for these units:

1. **Unit is designed for outdoor installation only.**

2. Condenser coils must have an unlimited supply of air. Where a choice of location is possible, position the unit on either north or east side of building.

3. Suitable for mounting on roof curb.

4. For ground level installation, use a level concrete slab with a minimum thickness of 4 inches. The length and width should be at least 6 inches greater than the unit base rails. Do not tie slab to the building foundation.

5. Roof structures must be able to support the weight of the unit and its options/accessories. Unit must be installed on a solid, level roof curb or appropriate angle iron frame.

6. Maintain level tolerance to 1/2" across the entire width and length of unit.

Clearances

All units require particular clearances for proper operation and service. Refer to Table 5 for clearances required for construction, servicing, and proper unit operation.

Rigging And Handling

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails. Spreader bars, whose length exceeds the largest dimension across the unit, MUST be used across the top of the unit.

If a unit is to be installed on a roof curb other than a TempMaster roof curb, gasketing must be applied to all surfaces that come in contact with the unit underside.

Before lifting, make sure the unit weight is distributed equally on the rigging cables so it will lift evenly.

Units may be moved or lifted with a forklift. Slotted openings in the base rails are provided for this purpose.

LENGTH OF FORKS MUST BE A MINIMUM OF 60 INCHES.

**WARNING**

Do not permit overhanging structures or shrubs to obstruct condenser air discharge outlet, combustion air inlet or vent outlets.

**CAUTION**

All panels must be secured in place when the unit is lifted. The condenser coils should be protected from rigging cable damage with plywood or other suitable material.

---

### Table 1: XAT06 thru T12 Unit Limitations

<table>
<thead>
<tr>
<th>Size (Tons)</th>
<th>Model</th>
<th>Unit Voltage</th>
<th>Unit Limitations</th>
<th>Outdoor DB Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>T06 (6.5)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>Min: 187</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>Max: 252</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>575-3-60</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>T07 (7.5)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>Min: 187</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>Max: 252</td>
<td>125</td>
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<tr>
<td></td>
<td></td>
<td>575-3-60</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>T08 (8.5)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>Min: 187</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>Max: 252</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>575-3-60</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>T10 (10)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>Min: 187</td>
<td>125</td>
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<td></td>
<td></td>
<td>460-3-60</td>
<td>Max: 252</td>
<td>125</td>
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<td></td>
<td></td>
<td>575-3-60</td>
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Table 2: Weights and Dimensions

<table>
<thead>
<tr>
<th>Size (Tons)</th>
<th>Model</th>
<th>Weight (lbs.)</th>
<th>Center of Gravity</th>
<th>4 Point Load Location (lbs.)</th>
<th>6 Point Load Location (lbs.)</th>
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<td></td>
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<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
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<td>XA</td>
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<td>XA</td>
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<td>XA</td>
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Table 3: XAT06 thru T12 Unit Accessory Weights

<table>
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<tr>
<th>Unit Accessory</th>
<th>Weight (lbs.)</th>
<th>Shipping</th>
<th>Operating</th>
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<td>85</td>
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<td>Power Exhaust</td>
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<tr>
<td>Electric Heat(^1)</td>
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1. Weight given is for the maximum heater size available (54KW).

Figure 8: XAT06 thru T10 Physical Dimensions

Figure 9: XAT12 Physical Dimensions
Table 4: XAT06 thru T12 Unit Physical Dimensions

<table>
<thead>
<tr>
<th>Unit Model Number</th>
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<th>D</th>
<th>E</th>
<th>F</th>
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<td>24 3/16</td>
<td>17 3/16</td>
<td>6 3/16</td>
</tr>
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<td>XAT08</td>
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<td>89</td>
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<td>24 3/16</td>
<td>17 3/16</td>
<td>6 3/16</td>
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<td>XAT10</td>
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<td>89</td>
<td>30 3/16</td>
<td>24 3/16</td>
<td>17 3/16</td>
<td>6 3/16</td>
</tr>
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<td>24 3/16</td>
<td>17 3/16</td>
<td>6 3/16</td>
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Table 5: XAT06 thru T12 Unit Clearances

<table>
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<th>Direction</th>
<th>Distance (in.)</th>
<th>Direction</th>
<th>Distance (in.)</th>
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<tr>
<td>Top¹</td>
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<td>Right</td>
<td>12</td>
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<td>Front</td>
<td>36</td>
<td>Left</td>
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<tr>
<td>Rear</td>
<td>36</td>
<td>Bottom²</td>
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</tbody>
</table>

1. Units must be installed outdoors. Overhanging structure or shrubs should not obscure condenser air discharge outlet.
2. Units may be installed on combustible floors made from wood or class A, B or C roof covering materials.

Figure 10: XAT06 thru T12 Unit Bottom Duct Openings
Figure 11: XAT06 thru T12 Unit Electrical Entry

Figure 12: XAT06 thru T10 Unit Side Duct Openings
Figure 13: XAT12 Unit Side Duct Openings

Table 6: Side Duct Dimensions

<table>
<thead>
<tr>
<th>Unit Model Number</th>
<th>Dimension (in.)</th>
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<td>XAT10</td>
<td>28 1/4</td>
</tr>
<tr>
<td>XAT12</td>
<td>28 1/4</td>
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</table>

Figure 14: XAT06 thru T12 Unit Left/End Duct Opening
Table 7:  Left/End Duct Dimensions

<table>
<thead>
<tr>
<th>Unit Model Number</th>
<th>Dimension (in.)</th>
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</thead>
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<td></td>
<td>A</td>
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<td>30.358</td>
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<tr>
<td>XAT07</td>
<td>30.358</td>
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<tr>
<td>XAT08</td>
<td>30.358</td>
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<tr>
<td>XAT10</td>
<td>30.358</td>
</tr>
<tr>
<td>XAT12</td>
<td>30.358</td>
</tr>
</tbody>
</table>

Figure 15: XAT06 thru T12 Roof Curb

Figure 16: XAT06 thru T12 Transition Roof Curb
Ductwork

Ductwork should be designed and sized according to the methods in Manual D of the Air Conditioning Contractors of America (ACCA) or as recommended by any other recognized authority such as ASHRAE or SMACNA.

A closed return duct system should be used. This will not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static pressure requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

Refer to Figure 10 for bottom air duct openings. Refer to Figures 12, 13 and Table 6 for side air duct openings.

Duct Covers

Units are shipped with the side duct openings covered and a covering over the bottom of the unit. For bottom duct application, no duct cover changes are necessary. For side duct application, remove the side duct covers and install over the bottom duct openings. The panels removed from the side duct connections are designed to be reused by securing each panel to its respective down flow opening. But keep in mind that the supply panel is installed with the painted surface UP, facing the heat exchanger, while the return panel is installed with the painted surface DOWN, facing the down flow duct opening. The supply panel is secured with the bracket (already in place from the factory) and two screws. It’s a snug fit for the panel when sliding it between the heat exchanger and unit bottom, but there is room. The return panel is secured with four screws.

CAUTION

When fastening ductwork to side duct flanges on unit, insert screws through duct flanges only. DO NOT insert screws through casing. Outdoor ductwork must be insulated and water-proofed.
Side Panels

Units are shipped with side panels to cover the area where an economizer or motorized damper may be installed. These panels must be saved and used as tops for the Economizer rain hoods (See Figure 21).

Condensate Drain

The side condensate drain is reversible and may be re-oriented to the rear of the cabinet to facilitate condensate piping. A condensate drain connection is available through the base pan for piping inside the roof curb. Trap the connection per Figure 22. The trap and drain lines should be protected from freezing.

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install condensate drain line from the 3/4 inch NPT female connection on the unit to an open drain.

Compressors

The scroll compressor used in this product is specifically designed to operate with R-410A Refrigerant and cannot be interchanged.

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.
The compressor also uses a polyolester (POE oil), Mobil 3MA POE. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oil can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all necessary precautions to avoid exposure of the oil to the atmosphere.

---

**CAUTION**

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

POE (polyolester) compressor lubricants are known to cause long term damage to some synthetic roofing materials.

---

**CAUTION**

Exposure, even if immediately cleaned up, may cause embrittlement (leading to cracking) to occur in one year or more. When performing any service that may risk exposure of compressor oil to the roof, take precautions to protect roofing.

Procedures which risk oil leakage include, but are not limited to, compressor replacement, repairing refrigerant leaks, replacing refrigerant components such as filter drier, pressure switch, metering device or coil.

Units are shipped with compressor mountings which are factory-adjusted and ready for operation.

---

**CAUTION**

Do not loosen compressor mounting bolts.

**Filters**

Two-inch filters are supplied with each unit. One-inch filters may be used with no modification to the filter racks. Filters must always be installed ahead of evaporator coil and must be kept clean or replaced with same size and type. Dirty filters reduce the capacity of the unit and result in frosted coils or safety shutdown. Refer to physical data tables, for the number and size of filters needed for the unit. The unit should not be operated without filters properly installed.

---

**CAUTION**

Make sure that panel latches are properly positioned on the unit to maintain an airtight seal.

---

**Power And Control Wiring**

Field wiring to the unit, fuses, and disconnects must conform to provisions of National Electrical Code (NEC), ANSI/NFPA No. 70 – Latest Edition (in U.S.A.), current Canadian Electrical Code C221, and/or local ordinances. The unit must be electrically grounded in accordance with NEC and CEC as specified above and/or local codes.

Voltage tolerances which must be maintained at the compressor terminals during starting and running conditions are indicated on the unit Rating Plate and Table 1.

---

**CAUTION**

208/230-3-60 and 380/415-3-50 units control transformers are factory wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes should not be required. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

A disconnect must be utilized for these units. Factory installed disconnects are available. If installing a disconnect (field supplied or TempMaster supplied accessory), refer to Figure 4 for the recommended mounting location.

---

**CAUTION**

Avoid damage to internal components if drilling holes for disconnect mounting.

**NOTE:** Since not all local codes allow the mounting of a disconnect on the unit, please confirm compliance with local code before mounting a disconnect on the unit.

Electrical line must be sized properly to carry the load. USE COPPER CONDUCTORS ONLY. Each unit must be wired with a separate branch circuit fed directly from the meter panel and properly fused.

Refer to Figures 23 and 24 for typical field wiring and to the appropriate unit wiring diagram mounted inside control doors for control circuit and power wiring information.
Power Wiring Detail

Units are factory wired for the voltage shown on the unit nameplate. Refer to Electrical Data Table 9 to size power wiring, fuses, and disconnect switch.

Power wiring is brought into the unit through the side of the unit or the basepan inside the curb.

**CAUTION**

208/230-3-60 and 380/415-3-50 units control transformers are factory wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

---

**Figure 23: Field Wiring Disconnect - Cooling Unit With/Without Electric Heat**

**Thermostat Wiring**

The thermostat should be located on an inside wall approximately 56 inch above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow the manufacturer's instructions enclosed with thermostat for general installation procedure. Color-coded, insulated wires should be used to connect the thermostat to the unit. Refer to Table 8 for control wire sizing and maximum length.

**Table 8: Control Wire Sizes**

<table>
<thead>
<tr>
<th>Wire Size</th>
<th>Maximum Length†</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 AWG</td>
<td>150 Feet</td>
</tr>
</tbody>
</table>

†. From the unit to the thermostat and back to the unit.
Second stage heating not required on single stage heating units.
Jumper is required if there is no Smoke Detector circuit.
Jumper is required for any combination of R, RC, or RH.
OCC is an output from the thermostat to indicate the Occupied condition.
X is an input to the thermostat to display Error Status conditions.

Figure 24: Typical Electronic Thermostat Field Wiring
<table>
<thead>
<tr>
<th>Size (Tons)</th>
<th>Volt</th>
<th>Compressors (each)</th>
<th>OD Fan Motors (each)</th>
<th>Supply Blower Motor</th>
<th>Pwr Exh Motor</th>
<th>Pwr Conv Outlet</th>
<th>Electric Heat Option</th>
<th>MCA(^1) (Amps)</th>
<th>MCA(^1) w/Pwr Exh (Amps)</th>
<th>Max Fuse(^3) Size (\text{w/ Pwr Exh} ) (Amps)</th>
<th>Max Fuse(^3) Breaker Size (\text{w/ Pwr Exh} ) (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T06 (6.5)</td>
<td>208</td>
<td>13.5</td>
<td>88.0</td>
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<td>2.1</td>
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Table 9: Electrical Data

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1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.
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1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.
### XAT06 thru T12 Standard Motor - With Powered Convenience Outlet

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1. Minimum Circuit Ampacity.
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3. HACR type per NEC.
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3. HACR type per NEC.
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<td>13.5</td>
<td>13.5</td>
</tr>
<tr>
<td>Nominal CFM</td>
<td>2600</td>
<td>3000</td>
<td>3750</td>
<td>3750</td>
<td>4700</td>
</tr>
<tr>
<td>System power (KW)</td>
<td>6.78</td>
<td>8.18</td>
<td>9.27</td>
<td>10.45</td>
<td>13.59</td>
</tr>
<tr>
<td>Refrigerant type</td>
<td>R-410A</td>
<td>R-410A</td>
<td>R-410A</td>
<td>R-410A</td>
<td>R-410A</td>
</tr>
<tr>
<td>Refrigerant charge (lb-oz)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System 1</td>
<td>14-2</td>
<td>13-0</td>
<td>13-12</td>
<td>12-14</td>
<td>17-2</td>
</tr>
<tr>
<td>System 2</td>
<td>12-10</td>
<td>13-2</td>
<td>13-13</td>
<td>12-12</td>
<td>15-8</td>
</tr>
<tr>
<td><strong>AHRI HEATING PERFORMANCE</strong></td>
<td><strong>AHRI HEATING PERFORMANCE</strong></td>
<td><strong>AHRI HEATING PERFORMANCE</strong></td>
<td><strong>AHRI HEATING PERFORMANCE</strong></td>
<td><strong>AHRI HEATING PERFORMANCE</strong></td>
<td><strong>AHRI HEATING PERFORMANCE</strong></td>
</tr>
<tr>
<td>47°F capacity rating (Mbh)</td>
<td>75.0</td>
<td>88.0</td>
<td>94.0</td>
<td>106.0</td>
<td>135.0</td>
</tr>
<tr>
<td>System power (KW) / COP</td>
<td>6.2 / 3.40</td>
<td>7.7 / 3.40</td>
<td>7.9 / 3.40</td>
<td>8.6 / 3.40</td>
<td>13.2 / 3.2</td>
</tr>
<tr>
<td>17°F capacity rating (Mbh)</td>
<td>43.0</td>
<td>51.0</td>
<td>53.0</td>
<td>59.0</td>
<td>90.0</td>
</tr>
<tr>
<td>System power (KW) / COP</td>
<td>5.7 / 2.25</td>
<td>6.4 / 2.25</td>
<td>6.9 / 2.25</td>
<td>7.8 / 2.25</td>
<td>12.1 / 2.05</td>
</tr>
<tr>
<td><strong>DIMENSIONS (inches)</strong></td>
<td><strong>DIMENSIONS (inches)</strong></td>
<td><strong>DIMENSIONS (inches)</strong></td>
<td><strong>DIMENSIONS (inches)</strong></td>
<td><strong>DIMENSIONS (inches)</strong></td>
<td><strong>DIMENSIONS (inches)</strong></td>
</tr>
<tr>
<td>Length</td>
<td>89</td>
<td>89</td>
<td>89</td>
<td>89</td>
<td>119-7/16</td>
</tr>
<tr>
<td>Width</td>
<td>59</td>
<td>59</td>
<td>59</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td><strong>OPERATING WT. (lbs.)</strong></td>
<td><strong>OPERATING WT. (lbs.)</strong></td>
<td><strong>OPERATING WT. (lbs.)</strong></td>
<td><strong>OPERATING WT. (lbs.)</strong></td>
<td><strong>OPERATING WT. (lbs.)</strong></td>
<td><strong>OPERATING WT. (lbs.)</strong></td>
</tr>
<tr>
<td>1080</td>
<td>1090</td>
<td>1137</td>
<td>1135</td>
<td>1403</td>
<td></td>
</tr>
<tr>
<td><strong>COMPRESSORS</strong></td>
<td><strong>COMPRESSORS</strong></td>
<td><strong>COMPRESSORS</strong></td>
<td><strong>COMPRESSORS</strong></td>
<td><strong>COMPRESSORS</strong></td>
<td><strong>COMPRESSORS</strong></td>
</tr>
<tr>
<td>Type</td>
<td>Scroll</td>
<td>Scroll</td>
<td>Scroll</td>
<td>Scroll</td>
<td>Scroll</td>
</tr>
<tr>
<td>Quantity</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Unit Capacity Steps (%)</td>
<td>50 / 100</td>
<td>50 / 100</td>
<td>50 / 100</td>
<td>50 / 100</td>
<td>50 / 100</td>
</tr>
<tr>
<td><strong>CONDENSER COIL DATA</strong></td>
<td><strong>CONDENSER COIL DATA</strong></td>
<td><strong>CONDENSER COIL DATA</strong></td>
<td><strong>CONDENSER COIL DATA</strong></td>
<td><strong>CONDENSER COIL DATA</strong></td>
<td><strong>CONDENSER COIL DATA</strong></td>
</tr>
<tr>
<td>Face area (Sq. Ft.)</td>
<td>29.0</td>
<td>29.0</td>
<td>29.0</td>
<td>29.0</td>
<td>47.5</td>
</tr>
<tr>
<td>Rows</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Fins per inch</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Circuitry Type</td>
<td>Split-face</td>
<td>Split-face</td>
<td>Split-face</td>
<td>Split-face</td>
<td>Split-face</td>
</tr>
<tr>
<td>Refrigerant control</td>
<td>TXV</td>
<td>TXV</td>
<td>TXV</td>
<td>TXV</td>
<td>TXV</td>
</tr>
<tr>
<td><strong>EVAPORATOR COIL DATA</strong></td>
<td><strong>EVAPORATOR COIL DATA</strong></td>
<td><strong>EVAPORATOR COIL DATA</strong></td>
<td><strong>EVAPORATOR COIL DATA</strong></td>
<td><strong>EVAPORATOR COIL DATA</strong></td>
<td><strong>EVAPORATOR COIL DATA</strong></td>
</tr>
<tr>
<td>Face area (Sq. Ft.)</td>
<td>13.2</td>
<td>13.2</td>
<td>13.2</td>
<td>13.2</td>
<td>13.2</td>
</tr>
<tr>
<td>Rows</td>
<td>4</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Fins per inch</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Circuitry Type</td>
<td>Split-face</td>
<td>Split-face</td>
<td>Split-face</td>
<td>Split-face</td>
<td>Split-face</td>
</tr>
<tr>
<td>Refrigerant control</td>
<td>TXV</td>
<td>TXV</td>
<td>TXV</td>
<td>TXV</td>
<td>TXV</td>
</tr>
</tbody>
</table>
Optional Electric Heat

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending into the supply air chamber.

Fuses are supplied, where required, by the factory. Some kW sizes require fuses and others do not. Refer to Table 11 for minimum CFM limitations and to Table 9 for electrical data.

Table 10: XAT06 thru T12 Physical Data (Continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>XAT06</th>
<th>XAT07</th>
<th>XAT08</th>
<th>XAT10</th>
<th>XAT12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Tonnage</td>
<td>6.5</td>
<td>7.5</td>
<td>8.5</td>
<td>10</td>
<td>12.5</td>
</tr>
</tbody>
</table>

CONDENSER FAN DATA

| Quantity of Fans | 2 | 2 | 2 | 2 | 4 |
| Fan diameter (Inch) | 24 | 24 | 24 | 24 | 24 |
| Type | Prop | Prop | Prop | Prop | Prop |
| Drive Type | Direct | Direct | Direct | Direct | Direct |
| Quantity of motors | 2 | 2 | 2 | 2 | 4 |
| Motor HP each | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| No. speeds | 1 | 1 | 1 | 1 | 1 |
| RPM | 850 | 850 | 850 | 850 | 850 |
| Nominal total CFM | 6800 | 6800 | 6800 | 6800 | 14000 |

BELT DRIVE EVAP FAN DATA

| Quantity | 1 | 1 | 1 | 1 | 1 |
| Fan Size (Inch) | 15 x 15 | 15 x 15 | 15 x 15 | 15 x 15 | 15 x 15 |
| Type | Centrifugal | Centrifugal | Centrifugal | Centrifugal | Centrifugal |
| Motor Sheave | VL40 | VL44 | 1VL40 | 1VM50 | 1VP50 |
| Blower Sheave | AK84 | AK71 | AK69 | AK69 | AK74 |
| Belt | A54 | A52 | A52 | A54 | A56 |
| Motor HP each | 1-1/2 | 1-1/2 | 1-1/2 | 3 | 3 |
| RPM | 1725 | 1725 | 1725 | 1725 | 1725 |
| Frame size | 56 | 56 | 56 | 56 | 56 |

FILTERS

| Quantity - Size | 4 - (24 x 20 x 2)$^{2,3}$ | 4 - (24 x 20 x 2)$^{2,3}$ | 4 - (24 x 20 x 4)$^{4}$ | 4 - (24 x 20 x 4)$^{4}$ | 4 - (24 x 20 x 4)$^{4}$ |

1. XAT06, XAT07, XAT08, XAT10, XAT12 have crankcase heaters standard.
2. 2 In. Throwaway, Standard, MERV (Minimum Efficiency Reporting Value) 3.
3. 2 In. Pleated, Optional, MERV 8.

Table 11: Electric Heat Minimum Supply Air

<table>
<thead>
<tr>
<th>Size (Tons)</th>
<th>Model</th>
<th>Voltage</th>
<th>Minimum Supply Air (CFM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T06 (6.5)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>1950</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600-3-60</td>
<td>1950</td>
</tr>
<tr>
<td>T07 (7.5)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>2250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>2250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600-3-60</td>
<td>2250</td>
</tr>
<tr>
<td>T08 (8.5)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>2550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>2550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600-3-60</td>
<td>2550</td>
</tr>
<tr>
<td>T10 (10)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600-3-60</td>
<td>-</td>
</tr>
<tr>
<td>T12 (12.5)</td>
<td>XA</td>
<td>208/230-3-60</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460-3-60</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600-3-60</td>
<td>-</td>
</tr>
</tbody>
</table>
Options/Accessories

Electric Heat

Electric heaters are available as factory-installed options or field-installed accessories. Refer to electric heat instructions for installation. These heaters mount in the heat compartment with the heating elements extending into the supply air chamber. All electric heaters are fused and intended for use with single point power supply.

Motorized Outdoor Damper

The Motorized Outdoor Damper can be a factory installed option or a field installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete the assembly. Field installed Motorized Outdoor Damper accessories include complete instructions for installation.

Economizer

The Economizer can be a factory installed option or a field installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete the assembly. Field installed Economizer accessories include complete instructions for installation.

There are two Economizer options:
1. Down Flow, End Return Horizontal applications which include Fresh Air Hood, Exhaust Hood with Barometric Relief.
2. Horizontal Flow application (Field Installed Kit Only) that requires the purchase of a barometric relief hood.

NOTE: With the Down Flow, End Return Horizontal application it is required to save the two Side Panels for the economizer hood tops (See Figure 21).

Power Exhaust

The Power Exhaust can be a factory installed option or a field installed accessory. If factory installed, refer to the instructions included with the outdoor air hood to complete the assembly. Field installed Power Exhaust accessories include complete instructions for installation.

The Power Exhaust factory installed option is for Down Flow application only.

There are two field installed Power Exhaust accessories:
1. Down Flow application.
2. Horizontal Flow application that requires the purchase of a barometric relief hood.

Rain Hood

All of the hood components, including the filters, the gasketing and the hardware for assembling, are packaged and located between the condenser coil section and the main unit cabinet, if the unit has factory installed options. If field installed accessories are being installed all parts necessary for the installation comes in the accessory.

Economizer Sequences

Several functions can drive the economizer, including: minimum position, free cooling, economizer loading, and minimum outdoor air supply.

Economizer Minimum Position

The economizer minimum position is set during occupied mode when outside air is not suitable for free cooling. The position of the damper is set proportionally between the “Economizer Minimum Position and the Economizer Minimum Position Low Speed Fan” set points, in relationship to the VFD output percentage. On a constant volume single speed supply fan system both set-points should be set to the same value.

Free Cooling

Four types of free cooling options are available: dry bulb changeover, single enthalpy, dual enthalpy changeover, and Auto.

Dry Bulb Changeover

For dry bulb economizer operation, the outside air is suitable for free cooling if the outside air temperature is 1°F below the Economizer OAT Enable Setpoint and 1°F below the Return Air Temperature.

Free cooling is no longer available if the outside air temperature rises above either the Economizer OAT Enable setpoint or the return air temperature.

Single Enthalpy Changeover

For single enthalpy economizer operation, the outside air is suitable for free cooling if the outside air enthalpy is at least 1 BTU/lb below the Economizer Outside Air Enthalpy Setpoint and the outside air temperature is no greater than the RAT plus 9°F.

If the outside air temperature rises above the RAT plus 10°F, free cooling is no longer available. The outside air temperature must drop to no greater than RAT plus 9°F to enter free cooling again.

Free cooling is no longer available if the outside air enthalpy rises above the Economizer Outside Air Enthalpy Setpoint.

Dual Enthalpy Changeover

For dual enthalpy economizer operation, the outside air enthalpy must be lower than the return air enthalpy by 1 btu/lb AND the outside air temperature is no greater than the RAT plus 9°F.

Auto

The control determines the type of free cooling changeover based on which sensors are present and reliable. Conditions include:

- Return and outside air dry bulb = dry bulb changeover
• Return and outside air dry bulb and outside air humidity = single enthalpy
• Return and outside air dry bulb and return and outside air humidity = dual enthalpy
• If either the return or outside air dry bulb sensors are unreliable, free cooling is not available

Free Cooling Operation

When the control determines that the outside air is suitable, the first stage of cooling will always be free cooling.

*Thermostat*

In free cooling, with a thermostat input to Y1, the dampers modulate to control the supply air temperature to the Economizer Setpoint +/- 1°F (default 55°F).

If the thermostat provides an input to Y2 and the parameter Compressors Off in Free Cooling is turned OFF a compressor output energizes. The economizer dampers continue to modulate to control the supply air temperature to the Economizer Setpoint.

If the supply air temperature cannot be maintained within 5°F of the economizer setpoint, the first stage compressor (C1) will be turned on. Second stage compressor (C2) will be added as needed to keep the supply air temperature within the 5°F of the economizer setpoint.

*Sensor*

In free cooling, with a demand from the zone/return sensor for the first stage of cooling, the dampers modulate to control the supply air temperature to the Economizer Setpoint +/- 1°F.

If the economizer output is at 100% and the SAT is greater than the Economizer setpoint + 1°F, the control starts a 12-minute timer to energize a compressor output.

If at any time the economizer output drops below 100% the timer stops and resets when the economizer output returns to 100%.

Once a compressor output is turned ON, the economizer dampers continue to modulate to control the supply air temperature to the Economizer Setpoint.

At no time will a compressor output be turned ON if the economizer output is less than 100%, even if the differential between zone (or return) temperature and the current cooling setpoint is great enough to demand more than one stage of cooling.

If the economizer output goes to minimum position and the SAT is less than Economizer Setpoint -1°F, the control starts a 12-minute timer to de-energize a compressor output.

If at any time the economizer output goes above the minimum position the timer stops and resets when the economizer output returns to minimum position.

If the demand for cooling from the space/return is satisfied, the economizer output will modulate to minimum position and the compressor outputs will be de-energized as long as their minimum run timers have expired.

*Power Exhaust*

**Setpoints**

- Economizer Enable: ON
- Power Exhaust Enable: ON
- Modulating Power Exhaust: OFF
- Exhaust VFD Installed: OFF
- Building Pressure Sensor Enabled: OFF
- Econo Damper Position For Exh Fan: ON Percent
- Econo Damper Position For Exh Fan: OFF Percent

*Inputs*

No inputs are present for non-modulating power exhaust.

*Outputs*

- 2-10 VDC from ECON on Economizer Expansion module
- 24 VAC from EX-FAN to energize exhaust fan on Economizer Expansion module

*Operation*

Operation details include:

- Compares economizer output to the Economizer Damper Position For Exhaust Fan On and OFF.
- Energizes exhaust fan when economizer output is above Economizer Damper Position For Exhaust Fan On.
- De-energizes exhaust fan when economizer output is below the Economizer Damper Position for Exhaust Fan OFF
Table 12: Smart Equipment™ Economizer Board Details

<table>
<thead>
<tr>
<th>Board Label</th>
<th>Cover Label</th>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directional orientation: viewed with the center text of the cover label upright</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANALOG INPUTS Terminal at left on upper edge of economizer board</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>COM</td>
<td>24 VAC common/0-10 VDC negative for economizer actuator position feedback</td>
<td>Connects through circuit trace to 24V~ IN pin COM</td>
</tr>
<tr>
<td>IN2</td>
<td>ECOFB</td>
<td>0-10 VDC positive input from Economizer actuator position Feedback</td>
<td>EconDampPos parameter reports input status (0-100%). Used to meet Cali. Title 24 requirements for economizer actuator position feedback</td>
</tr>
<tr>
<td>R</td>
<td>24V~</td>
<td>24 VAC hot supplied for economizer actuator position feedback</td>
<td>Connects through circuit trace to 24V~ IN pin HOT</td>
</tr>
<tr>
<td>C</td>
<td>COM</td>
<td>Mixed Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
<td>MAT parameter reports input status (°F/°C), 3.65 VDC reading MAT (+) to COM (−) with open circuit. Read-only use in current control revision.</td>
</tr>
<tr>
<td>IN1</td>
<td>MAT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEDs at left on upper edge of economizer board</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POWER</td>
<td>POWER</td>
<td>Green UCB power indicator</td>
<td>Lit indicates 24 VAC is present at 24V~ IN COM and HOT pins</td>
</tr>
<tr>
<td>FAULT</td>
<td>FAULT</td>
<td>Red networking error and firmware error indicator</td>
<td>1/10th second on/off flashing indicates a networking error (polarity, addressing, etc.) or a firmware error (likely correctable with re-loading from USB flash drive)</td>
</tr>
<tr>
<td>SA BUS</td>
<td>SA BUS</td>
<td>Green UCB SA bus communication transmission indicator</td>
<td>Lit/flickering indicates UCB-to-economizer board SA bus communication is currently active, off indicates the economizer board is awaiting SA bus communication</td>
</tr>
</tbody>
</table>
Table 12: Smart Equipment™ Economizer Board Details (Continued)

<table>
<thead>
<tr>
<th>Board Label</th>
<th>Cover Label</th>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>COM</td>
<td>Common for SA BUS power and communication circuits</td>
<td>EconCtrl parameter reports UCB-to-economizer board SA bus communication status. Negative of the SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection &amp; diagnostics board</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>Communication for SA BUS devices</td>
<td>EconCtrl parameter reports UCB-to-economizer board SA BUS communication status. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts lower than +) SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection &amp; diagnostics board</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>Communication for SA BUS devices</td>
<td>EconCtrl parameter reports UCB-to-economizer board SA BUS communication status. Positive of the VDC (typically, a fluctuating 1.5 to 3.5 volts reading to C; at least 0.25 volts higher than –) SA BUS communication circuit to the UCB. Through the unit wiring harness, may continue on to the 4-stage board and/or fault detection &amp; diagnostics board</td>
</tr>
</tbody>
</table>

**ANALOG OUTPUTS Pin at center on upper edge of economizer board**

| J4          | EX VFD      | 2-10 VDC positive output for the modulating power Exhaust fan Variable Frequency Drive/ discharge damper modulating power exhaust actuator | ExFanVFD parameter reports output status (0-100%) when ExFType selection is Variable Frequency Fan; EAD-O parameter reports output status (0-100%) when ExFType selection is Modulating Damper. Used to ramp the power exhaust fan VFD/ position the discharge damper actuator. |
| COM         | COM         | 24 VAC common/0-10 VDC negative for the power exhaust variable frequency drive/ discharge damper modulating power exhaust actuator | Connects through circuit trace to 24V~ IN pin COM |
| 24V~        | 24V~        | 24 VAC hot supplied for the discharge damper modulating power exhaust actuator and economizer actuator | Connects through circuit trace to 24V~ IN pin HOT |
| ECON        | ECON        | 2-10 VDC output for the Economizer actuator | Econ parameter reports output status (0-100%). Used to position the economizer actuator for minimum position, free cooling, demand ventilation, cooling economizer loading and purge functions |
| COM         | COM         | 24 VAC common/0-10 VDC negative for economizer actuator | Connects through circuit trace to 24V~ IN pin COM |

**BINARY OUTPUTS Pin at right on upper edge of economizer board**

| J3          | 24V~        | 24 VAC hot supplied for an incremental (floating control) economizer actuator | Connects through circuit trace to 24V~ IN pin HOT |
| ACT-A       | 24V~        | 24 VAC hot outputs to position an incremental (floating control) economizer actuator | Unused in current control revision |
| ACT-B       | 24V~        | 24 VAC return | Unused in current control revision |
| COM         | 24V~        | 24 VAC common for an incremental (floating control) economizer actuator | Connects through circuit trace to 24V~ IN pin COM |
| EX-FAN      | 24V~        | 24 VAC hot output to energize power exhaust fan contactor coil/VFD enable relay coil | ExFan parameter reports output status (Off-On) when ExFType selection is Non-Modulating, Modulating Damper or Variable Frequency Fan. Used to turn on/enable the power exhaust fan motor. |
| COM         | 24V~        | 24 VAC common/0-10 VDC negative for economizer actuator | Connects through circuit trace to 24V~ IN pin COM |
### 24V~ IN Pin connections at right on upper edge of economizer board

<table>
<thead>
<tr>
<th>Board Label</th>
<th>Cover Label</th>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>COM</td>
<td>24 V AC transformer Common referenced to cabinet ground</td>
<td>24 V AC common connection to power the economizer board. Connects through circuit traces to C/COM terminals and pins distributed on the economizer board.</td>
</tr>
<tr>
<td>R</td>
<td>HOT</td>
<td>24 V AC transformer HOT</td>
<td>24 V AC hot connection to power the economizer board. Connects through circuit traces to R/24V~ terminals and pins distributed on the economizer board.</td>
</tr>
</tbody>
</table>

### ANALOG INPUTS Terminal on lower edge of economizer board

<table>
<thead>
<tr>
<th>Board Label</th>
<th>Cover Label</th>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>24V~</td>
<td>24 V AC hot supplied for the outdoor air humidity sensor</td>
<td>Connects through circuit trace to 24V~ IN pin HOT</td>
</tr>
<tr>
<td>IN3</td>
<td>OAH</td>
<td>0-10 VDC positive input from the Outdoor Air Humidity sensor</td>
<td>OAH parameter reports input status (0-100%). Used in outdoor air enthalpy calculation for dual enthalpy economizer free cooling changeover.</td>
</tr>
<tr>
<td>C</td>
<td>COM</td>
<td>24 V AC common/0-10 VDC negative for the outdoor air humidity sensor</td>
<td>Connects through circuit trace to 24V~ IN pin COM</td>
</tr>
<tr>
<td>R</td>
<td>24V~</td>
<td>24 V AC hot supplied for the supply air humidity sensor</td>
<td>Connects through circuit trace to 24V~ IN pin HOT</td>
</tr>
<tr>
<td>IN4</td>
<td>SAH</td>
<td>0-10 VDC positive input from the Supply Air Humidity sensor</td>
<td>SAH parameter reports input status (0-100%). Unused in current control revision.</td>
</tr>
<tr>
<td>C</td>
<td>COM</td>
<td>24 V AC common/0-10 VDC negative for the supply air humidity sensor</td>
<td>Connects through circuit trace to 24V~ IN pin COM</td>
</tr>
<tr>
<td>R</td>
<td>24V~</td>
<td>24 V AC hot supplied for the indoor air quality sensor</td>
<td>Connects through circuit trace to 24V~ IN pin HOT</td>
</tr>
<tr>
<td>IN5</td>
<td>IAQ</td>
<td>0-10 VDC positive input from the Indoor Air Quality sensor</td>
<td>IAQRange parameter sets the CO2 parts per million measured by the indoor air quality sensor when it outputs 10 VDC; IAQ parameter reports input status (0-5000ppm). Used for demand ventilation functions if the NetIAQ parameter indicates ?Unrel.</td>
</tr>
<tr>
<td>C</td>
<td>COM</td>
<td>24 V AC common/0-10 VDC negative for the indoor air quality sensor</td>
<td>Connects through circuit trace to 24V~ IN pin COM</td>
</tr>
<tr>
<td>R</td>
<td>24V~</td>
<td>24 V AC hot supplied for the outdoor air quality sensor</td>
<td>Connects through circuit trace to 24V~ IN pin HOT</td>
</tr>
<tr>
<td>IN6</td>
<td>OAQ</td>
<td>0-10 VDC positive input from the Outdoor Air Quality sensor</td>
<td>OAQRange parameter sets the CO2 parts per million measured by the outdoor air quality sensor when it outputs 10 VDC; OAQ parameter reports input status (0-5000ppm). Used for demand ventilation function when DVent-Mode selection is Diff between IAQ and OAQ and the NetOAQ parameter indicates ?Unrel.</td>
</tr>
<tr>
<td>C</td>
<td>COM</td>
<td>24 V AC common/0-10 VDC negative for the outdoor air quality sensor</td>
<td>Connects through circuit trace to 24V~ IN pin COM</td>
</tr>
<tr>
<td>R</td>
<td>24V~</td>
<td>24 V AC hot supplied for the air monitoring station sensor</td>
<td>Connects through circuit trace to 24V~ IN pin HOT</td>
</tr>
<tr>
<td>IN7</td>
<td>FR AIR</td>
<td>0-10 VDC positive input from the air monitoring station sensor</td>
<td>MOA-Range parameter sets the cubic feet per minute/liters per second measured by the air monitoring station sensor when it outputs 10 VDC; Fr Air parameter reports input status (0-5000CFM/23595lps). Used for economizer minimum position reset in speed-controlled indoor blower applications.</td>
</tr>
<tr>
<td>C</td>
<td>COM</td>
<td>24 V AC common/0-10 VDC negative for the air monitoring station sensor</td>
<td>Connects through circuit trace to 24V~ IN pin COM</td>
</tr>
<tr>
<td>R</td>
<td>24V~</td>
<td>24 V AC hot supplied for the building pressure sensor</td>
<td>Connects through circuit trace to 24V~ IN pin HOT</td>
</tr>
</tbody>
</table>
Indoor Air Quality - IAQ

Indoor Air Quality (indoor sensor input): The Indoor Air Quality sensor is connected to the economizer board through the IAQ analog input terminal and the associated COM and 24V~ inputs on the economizer board. Terminal IAQ accepts a 0 to +10 Vdc signal with respect to the (IAQ) terminal. When the signal is below its set point, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the IAQ signal exceeds its set point setting, and there is no call for free cooling, the actuator is proportionately modulated from the 0 to 10 Vdc signal, with 0 Vdc corresponding to full closed and 10 Vdc corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ Max damper position setting. When the signal exceeds its set point (Demand Control Ventilation Set Point) setting and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the IAQ voltage input.

- Optional CO2 Space Sensor Kit Part #2AQ04700524
- Optional CO2 Sensor Kit Part #2AQ04700624

Phasing

XA units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the phasing of the Field Line.

<table>
<thead>
<tr>
<th>Unit Size (Ton)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>T06 (6.5)</td>
<td>1950</td>
<td>3250</td>
</tr>
<tr>
<td>T07 (7.5)</td>
<td>2250</td>
<td>3750</td>
</tr>
<tr>
<td>T08 (8.5)</td>
<td>2550</td>
<td>4250</td>
</tr>
<tr>
<td>T10 (10)</td>
<td>3000</td>
<td>5000</td>
</tr>
<tr>
<td>T12 (12.5)</td>
<td>3750</td>
<td>6250</td>
</tr>
</tbody>
</table>

Connection at the factory or field supplied disconnect to obtain proper rotation. (Scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased.)

Scroll compressors require proper rotation to operate correctly. Units are properly phased at the factory. Do not change the internal wiring to make the blower condenser fans, or compressor rotate correctly.

Blower Rotation

Check for proper supply air blower rotation. If the blower is rotating backwards, the line voltage at the unit point of power connection is misphased (See 'PHASING').
Belt Tension

The tension on the belt should be adjusted as shown in Figure 26.

Procedure for adjusting belt tension:
1. Loosen six nuts (top and bottom) A.
2. Adjust by turning (B).
3. Never loosen nuts (C).
4. Use belt tension checker to apply a perpendicular force to one belt at the midpoint of the span as shown. Deflection distance of 4mm (5/32") is obtained.
5. After adjusting re-tighten nuts (A).

To determine the deflection distance from normal position, use a straight edge from sheave to sheave as reference line. The recommended deflection force is as follows:
- Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any retensioning should fall between the min. and max. deflection force values.

CFM Static Pressure and Power-Altitude and Temperature Corrections

The information below should be used to assist in application of product when being applied at altitudes at or exceeding 1000 feet above sea level.

The air flow rates listed in the standard blower performance tables are based on standard air at sea level. As the altitude or temperature increases, the density of air decreases. In order to use the indoor blower tables for high altitude applications, certain corrections are necessary.

A centrifugal fan is a "constant volume" device. This means that, if the rpm remains constant, the CFM delivered is the same regardless of the density of the air. However, since the air at high altitude is less dense, less static pressure will be generated and less power will be required than a similar application at sea level. Air density correction factors are shown in Table 14 and Figure 27.
Figure 27: Altitude/Temperature Correction Factors

The examples below will assist in determining the airflow performance of the product at altitude.

**Example 1:** What are the corrected CFM, static pressure, and BHP at an elevation of 5,000 ft. if the blower performance data is 6,000 CFM, 1.5 IWC and 4.0 BHP?

**Solution:** At an elevation of 5,000 ft. the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, Table 14 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table 15 shows the correction factor to be 0.832.

Corrected static pressure = 1.5 x 0.832 = 1.248 IWC

Corrected BHP = 4.0 x 0.832 = 3.328

**Example 2:** A system, located at 5,000 feet of elevation, is to deliver 6,000 CFM at a static pressure of 1.5". Use the unit blower tables to select the blower speed and the BHP requirement.

**Solution:** As in the example above, no temperature information is given so 70°F is assumed.

The 1.5" static pressure given is at an elevation of 5,000 ft. The first step is to convert this static pressure to equivalent sea level conditions.

Sea level static pressure = 1.5 / .832 = 1.80"

Enter the blower table at 6000 sCFM and static pressure of 1.8". The rpm listed will be the same rpm needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 3.2. This value must be corrected for elevation.

BHP at 5,000 ft. = 3.2 x .832 = 2.66
Drive Selection

1. Determine side or bottom supply duct Application.
2. Determine desired airflow.
3. Calculate or measure the amount of external static pressure.
4. Using the operating point determined from steps 1, 2 & 3, locate this point on the appropriate supply air blower performance table. (Linear interpolation may be necessary.)
5. Noting the RPM and BHP from step 4, locate the appropriate motor and, or drive on the RPM selection table.
6. Review the BHP compared to the motor options available. Select the appropriate motor and, or drive.
7. Review the RPM range for the motor options available. Select the appropriate drive if multiple drives are available for the chosen motor.
8. Determine turns open to obtain the desired operation point.

Example

1. 2600 CFM
2. 1.6 iwg
3. Using the supply air blower performance table below, the following data point was located: 1268 RPM & 1.95 BHP.
4. Using the RPM selection table below, Size X and Model Y is found.
5. 1.95 BHP exceeds the maximum continuous BHP rating of the 1.5 HP motor. The 2 HP motor is required.
6. 1268 RPM is within the range of the 2 HP drives.
7. Using the 2 HP motor and drive, .5 turns open will achieve 1268 RPM.

Example Supply Air Blower Performance

<table>
<thead>
<tr>
<th>Air Flow (CFM)</th>
<th>0.2 RPM</th>
<th>0.4 RPM</th>
<th>0.6 RPM</th>
<th>0.8 RPM</th>
<th>1.0 RPM</th>
<th>1.2 RPM</th>
<th>1.4 RPM</th>
<th>1.6 RPM</th>
<th>1.8 RPM</th>
<th>2.0 RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
<td>BHP</td>
</tr>
<tr>
<td>2200</td>
<td>804</td>
<td>0.50</td>
<td>866</td>
<td>0.71</td>
<td>925</td>
<td>0.90</td>
<td>982</td>
<td>1.06</td>
<td>1038</td>
<td>1.21</td>
</tr>
<tr>
<td>2400</td>
<td>835</td>
<td>0.66</td>
<td>897</td>
<td>0.87</td>
<td>956</td>
<td>1.06</td>
<td>1013</td>
<td>1.22</td>
<td>1069</td>
<td>1.37</td>
</tr>
<tr>
<td>2600</td>
<td>869</td>
<td>0.84</td>
<td>931</td>
<td>1.05</td>
<td>990</td>
<td>1.24</td>
<td>1047</td>
<td>1.40</td>
<td>1103</td>
<td>1.55</td>
</tr>
<tr>
<td>2800</td>
<td>906</td>
<td>1.03</td>
<td>968</td>
<td>1.25</td>
<td>1027</td>
<td>1.43</td>
<td>1084</td>
<td>1.60</td>
<td>1139</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Table X: RPM Selection

<table>
<thead>
<tr>
<th>Size (Tons)</th>
<th>Model</th>
<th>HP</th>
<th>Max BHP</th>
<th>Motor Sheave</th>
<th>Blower Sheave</th>
<th>6 Turns Open</th>
<th>5 Turns Open</th>
<th>4 Turns Open</th>
<th>3 Turns Open</th>
<th>2 Turns Open</th>
<th>1 Turn Open</th>
<th>Fully Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Y</td>
<td>1.5</td>
<td>1.73</td>
<td>1VM50</td>
<td>AK74</td>
<td>N/A</td>
<td>697</td>
<td>945</td>
<td>991</td>
<td>1035</td>
<td>1079</td>
<td>1126</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>2.30</td>
<td>1VM50</td>
<td>AK64</td>
<td>N/A</td>
<td>1039</td>
<td>1094</td>
<td>1150</td>
<td>1207</td>
<td>1256</td>
<td>1308</td>
</tr>
</tbody>
</table>
Table 15: Airflow Performance - Side Duct Application

### XAT06 (6.5 Ton) Side Duct

<table>
<thead>
<tr>
<th>Air Flow (CFM)</th>
<th>0.2 RPM</th>
<th>0.4 RPM</th>
<th>0.6 RPM</th>
<th>0.8 RPM</th>
<th>1.0 RPM</th>
<th>1.2 RPM</th>
<th>1.4 RPM</th>
<th>1.6 RPM</th>
<th>1.8 RPM</th>
<th>2.0 RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>1.6</td>
<td>2.1</td>
<td>3.4</td>
<td>4.5</td>
<td>5.9</td>
<td>7.6</td>
<td>9.0</td>
<td>11.0</td>
<td>13.0</td>
<td>14.5</td>
</tr>
<tr>
<td>2000</td>
<td>2.0</td>
<td>2.6</td>
<td>3.9</td>
<td>4.9</td>
<td>6.4</td>
<td>8.0</td>
<td>9.3</td>
<td>11.3</td>
<td>13.3</td>
<td>14.8</td>
</tr>
<tr>
<td>2200</td>
<td>2.3</td>
<td>2.9</td>
<td>4.2</td>
<td>5.1</td>
<td>6.6</td>
<td>8.1</td>
<td>9.5</td>
<td>11.5</td>
<td>13.5</td>
<td>15.0</td>
</tr>
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<td>2400</td>
<td>2.5</td>
<td>3.1</td>
<td>4.5</td>
<td>5.3</td>
<td>6.8</td>
<td>8.3</td>
<td>9.7</td>
<td>11.7</td>
<td>13.7</td>
<td>15.2</td>
</tr>
<tr>
<td>2600</td>
<td>2.7</td>
<td>3.3</td>
<td>4.7</td>
<td>5.5</td>
<td>7.0</td>
<td>8.5</td>
<td>10.0</td>
<td>12.0</td>
<td>14.0</td>
<td>15.5</td>
</tr>
<tr>
<td>2800</td>
<td>2.8</td>
<td>3.4</td>
<td>4.9</td>
<td>5.7</td>
<td>7.2</td>
<td>8.7</td>
<td>10.2</td>
<td>12.2</td>
<td>14.2</td>
<td>15.7</td>
</tr>
<tr>
<td>3000</td>
<td>2.9</td>
<td>3.5</td>
<td>5.1</td>
<td>5.9</td>
<td>7.4</td>
<td>8.9</td>
<td>10.4</td>
<td>12.4</td>
<td>14.4</td>
<td>15.9</td>
</tr>
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<td>3200</td>
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<td>3.7</td>
<td>5.4</td>
<td>6.1</td>
<td>7.7</td>
<td>9.2</td>
<td>10.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.2</td>
</tr>
<tr>
<td>3400</td>
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<td>3.8</td>
<td>5.5</td>
<td>6.3</td>
<td>7.9</td>
<td>9.4</td>
<td>10.9</td>
<td>12.9</td>
<td>14.9</td>
<td>16.4</td>
</tr>
</tbody>
</table>

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor shear setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

### XAT07 (7.5 Ton) Side Duct

<table>
<thead>
<tr>
<th>Air Flow (CFM)</th>
<th>0.2 RPM</th>
<th>0.4 RPM</th>
<th>0.6 RPM</th>
<th>0.8 RPM</th>
<th>1.0 RPM</th>
<th>1.2 RPM</th>
<th>1.4 RPM</th>
<th>1.6 RPM</th>
<th>1.8 RPM</th>
<th>2.0 RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1.5</td>
<td>1.9</td>
<td>2.9</td>
<td>3.7</td>
<td>4.7</td>
<td>5.7</td>
<td>6.9</td>
<td>8.1</td>
<td>9.8</td>
<td>11.5</td>
</tr>
<tr>
<td>2200</td>
<td>1.8</td>
<td>2.3</td>
<td>3.3</td>
<td>4.1</td>
<td>5.2</td>
<td>6.3</td>
<td>7.4</td>
<td>8.7</td>
<td>10.4</td>
<td>12.0</td>
</tr>
<tr>
<td>2400</td>
<td>2.0</td>
<td>2.5</td>
<td>3.5</td>
<td>4.3</td>
<td>5.4</td>
<td>6.5</td>
<td>7.8</td>
<td>9.1</td>
<td>10.7</td>
<td>12.3</td>
</tr>
<tr>
<td>2600</td>
<td>2.2</td>
<td>2.7</td>
<td>3.7</td>
<td>4.6</td>
<td>5.6</td>
<td>6.7</td>
<td>8.0</td>
<td>9.4</td>
<td>11.0</td>
<td>12.5</td>
</tr>
<tr>
<td>2800</td>
<td>2.3</td>
<td>2.8</td>
<td>3.9</td>
<td>4.7</td>
<td>5.8</td>
<td>7.0</td>
<td>8.3</td>
<td>9.7</td>
<td>11.3</td>
<td>12.8</td>
</tr>
<tr>
<td>3000</td>
<td>2.5</td>
<td>3.0</td>
<td>4.1</td>
<td>4.9</td>
<td>6.0</td>
<td>7.2</td>
<td>8.6</td>
<td>10.0</td>
<td>11.5</td>
<td>13.1</td>
</tr>
<tr>
<td>3200</td>
<td>2.6</td>
<td>3.1</td>
<td>4.3</td>
<td>5.1</td>
<td>6.3</td>
<td>7.5</td>
<td>8.9</td>
<td>10.4</td>
<td>11.9</td>
<td>13.4</td>
</tr>
<tr>
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<td>3.3</td>
<td>4.6</td>
<td>5.4</td>
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<td>8.0</td>
<td>9.4</td>
<td>10.8</td>
<td>12.3</td>
<td>13.8</td>
</tr>
</tbody>
</table>

1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor shear setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

### XAT08 (8.5 Ton) Side Duct

<table>
<thead>
<tr>
<th>Air Flow (CFM)</th>
<th>0.2 RPM</th>
<th>0.4 RPM</th>
<th>0.6 RPM</th>
<th>0.8 RPM</th>
<th>1.0 RPM</th>
<th>1.2 RPM</th>
<th>1.4 RPM</th>
<th>1.6 RPM</th>
<th>1.8 RPM</th>
<th>2.0 RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1.4</td>
<td>1.7</td>
<td>2.2</td>
<td>2.7</td>
<td>3.2</td>
<td>3.7</td>
<td>4.2</td>
<td>4.7</td>
<td>5.2</td>
<td>5.7</td>
</tr>
<tr>
<td>2200</td>
<td>1.5</td>
<td>1.8</td>
<td>2.3</td>
<td>2.8</td>
<td>3.3</td>
<td>3.8</td>
<td>4.4</td>
<td>4.9</td>
<td>5.4</td>
<td>5.9</td>
</tr>
<tr>
<td>2400</td>
<td>1.6</td>
<td>1.9</td>
<td>2.4</td>
<td>2.9</td>
<td>3.4</td>
<td>3.9</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>2600</td>
<td>1.7</td>
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1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor shear setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.
XAT10 (10 Ton) Side Duct

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Available External Static Pressure - IWG^1

1. Blower performance includes 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

XAT12 (12.5 Ton) Side Duct

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<th>1.4</th>
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Available External Static Pressure - IWG^1

1. Blower performance includes 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
Table 16: Airflow Performance - Bottom Duct Application

**XAT06 (6.5 Ton) Bottom Duct**

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1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

**XAT07 (7.5 Ton) Bottom Duct**

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1. Blower performance includes gas heat exchangers and 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.

**XAT08 (8.5 Ton) Bottom Duct**

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<td>RPM</td>
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<td>RPM</td>
<td>BHP</td>
</tr>
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<td>3000</td>
<td>1124</td>
<td>1.30</td>
<td>1144</td>
<td>1.33</td>
<td>1164</td>
<td>1.36</td>
<td>1184</td>
<td>1.39</td>
<td>1204</td>
<td>1.42</td>
</tr>
<tr>
<td>3200</td>
<td>1144</td>
<td>1.33</td>
<td>1164</td>
<td>1.36</td>
<td>1184</td>
<td>1.39</td>
<td>1204</td>
<td>1.42</td>
<td>1224</td>
<td>1.45</td>
</tr>
</tbody>
</table>

1. Blower performance includes 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
4. Field Supplied Drive.
### Table 17: RPM Selection

<table>
<thead>
<tr>
<th>Air Flow (CFM)</th>
<th>RPM</th>
<th>BHP</th>
<th>Standard 2 HP &amp; Drive</th>
<th>Hi Static 3 HP &amp; Drive</th>
<th>Available External Static Pressure - IWG&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td>3 HP &amp; Field Supplied Drive</td>
</tr>
<tr>
<td>2600</td>
<td>2 HP &amp; Field Supplied Drive</td>
<td>757</td>
<td>1.20</td>
<td>811</td>
<td>1.36</td>
</tr>
<tr>
<td>2800</td>
<td>2 HP &amp; Field Supplied Drive</td>
<td>782</td>
<td>1.40</td>
<td>865</td>
<td>1.76</td>
</tr>
<tr>
<td>3000</td>
<td>2 HP &amp; Field Supplied Drive</td>
<td>841</td>
<td>1.85</td>
<td>896</td>
<td>2.00</td>
</tr>
<tr>
<td>3200</td>
<td>2 HP &amp; Field Supplied Drive</td>
<td>909</td>
<td>2.38</td>
<td>963</td>
<td>2.53</td>
</tr>
<tr>
<td>3400</td>
<td>2 HP &amp; Field Supplied Drive</td>
<td>946</td>
<td>2.68</td>
<td>1000</td>
<td>2.83</td>
</tr>
<tr>
<td>3600</td>
<td>2 HP &amp; Field Supplied Drive</td>
<td>985</td>
<td>3.00</td>
<td>1040</td>
<td>3.15</td>
</tr>
<tr>
<td>3800</td>
<td>2 HP &amp; Field Supplied Drive</td>
<td>1026</td>
<td>3.33</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

1. Blower performance includes 2" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.
Air Balance

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

Checking Air Quantity

Method One

1. Remove the dot plugs from the duct panel (for location of the dot plugs see Figures 12 and 13).
2. Insert eight-inches of 1/4 inch metal tubing into the airflow on both sides of the indoor coil.

**NOTE:** The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.
3. Use an Inclined Manometer or Magnehelic to determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil can vary greatly, measuring the pressure drop across a wet coil under field conditions could be inaccurate. To assure a dry coil, the compressors should be de-activated while the test is being run.

**NOTE:** De-energize the compressors before taking any test measurements to assure a dry evaporator coil.

4. The CFM through the unit can be determined from the pressure drop indicated by the manometer by referring to Figure 28. In order to obtain an accurate measurement, be certain that the air filters are clean.
5. To adjust Measured CFM to Required CFM, see SUPPLY AIR DRIVE ADJUSTMENT.
6. After readings have been obtained, remove the tubes and replace the dot plugs.
7. Tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

Method Two

1. Drill two 5/16 inch holes, one in the return air duct as close to the inlet of the unit as possible, and another in the supply air duct as close to the outlet of the unit as possible.
2. Using the whole drilled in step 1, insert eight inches of 1/4 inch metal tubing into the airflow of the return and supply air ducts of the unit.

**CAUTION**

Belt drive blower systems MUST be adjusted to the specific static and CFM requirements for the application. The Belt drive blowers are NOT set at the factory for any specific static or CFM. Adjustments of the blower speed and belt tension are REQUIRED. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

**WARNING**

Failure to properly adjust the total system air quantity can result in extensive blower damage.
NOTE: The tubes must be inserted and held in position perpendicular to the airflow so that velocity pressure will not affect the static pressure readings.

3. Use an Inclined Manometer or Magnehelic to determine the pressure drop across the unit. This is the External Static Pressure (ESP). In order to obtain an accurate measurement, be certain that the air filters are clean.

4. Determine the number of turns the variable motor sheave is open.

5. Select the correct blower performance table for the unit from Tables 15 and 16. Tables are presented for side and downflow configuration.

6. Determine the unit Measured CFM from the Blower Performance Table, External Static Pressure and the number of turns the variable motor sheave is open.

7. To adjust Measured CFM to Required CFM, see SUPPLY AIR DRIVE ADJUSTMENT.

8. After reading has been obtained, remove the tubes and seal holes.

9. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

NOTE: With the addition of field installed accessories repeat this procedure.

---

**WARNING**

Failure to properly adjust the total system air quantity can result in extensive blower damage.

---

Figure 28: Dry Coil Delta P
Supply Air Drive Adjustment

CAUTION

Before making any blower speed changes review the installation for any installation errors, leaks or undesirable systems effects that can result in loss of airflow.

Even small changes in blower speed can result in substantial changes in static pressure and BHP. BHP and AMP draw of the blower motor will increase by the cube of the blower speed. Only qualified personnel should make blower speed changes, strictly adhering to the fan laws.

At unit start-up, the measured CFM may be higher or lower than the required CFM. To achieve the required CFM, the speed of the drive may have adjusted by changing the datum diameter (DD) of the variable pitch motor sheave as described below:

\[
\frac{4,000 \text{ CFM}}{3,800 \text{ CFM}} \cdot 4.0 \text{ in.} = 4.21 \text{ in.}
\]

Use the following tables and the DD calculated per the above equation to adjust the motor variable pitch sheave.

CAUTION

Belt drive blower systems MUST be adjusted to the specific static and CFM requirements for the application. The Belt drive blowers are NOT set at the factory for any specific static or CFM. Adjustments of the blower speed and belt tension are REQUIRED. Verify proper sheave alignment; tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

EXAMPLE

A 12.5 ton unit was selected to deliver 4,000 CFM with a 3 HP motor, but the unit is delivering 3,800 CFM. The variable pitch motor sheave is set at 2 turns open.

Use the equation to determine the required DD for the new motor sheave,

\[
\left( \frac{\text{Required CFM}}{\text{Measured CFM}} \right) \cdot \text{Existing DD} = \text{New DD}
\]

Use Table 20 to locate the DD nearest to 4.21 in. Close the sheave to 1 turn open.

New BHP

\[
= (\text{Speed increase})^3 \cdot \text{BHP at 3,800 CFM}
\]

New motor Amps

\[
= (\text{Speed increase})^3 \cdot \text{Amps at 3,800 CFM}
\]

Table 20: Motor Sheave Datum Diameters

<table>
<thead>
<tr>
<th>1VM50x7/8 (1-1/2, 2 &amp; 3 HP Motor)</th>
<th>1VP56x1-1/8 (5 HP Motor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turns Open</td>
<td>Datum Diameter</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
</tr>
<tr>
<td>0</td>
<td>4.4</td>
</tr>
<tr>
<td>1/2</td>
<td>4.3</td>
</tr>
<tr>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>1-1/2</td>
<td>4.1</td>
</tr>
<tr>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>2-1/2</td>
<td>3.9</td>
</tr>
<tr>
<td>3</td>
<td>3.8</td>
</tr>
<tr>
<td>3-1/2</td>
<td>3.7</td>
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<tr>
<td>4</td>
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<td>4-1/2</td>
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</tr>
<tr>
<td>5</td>
<td>3.4</td>
</tr>
</tbody>
</table>
Table 21: Additional Static Resistance

<table>
<thead>
<tr>
<th>Size (Tons)</th>
<th>Model</th>
<th>CFM</th>
<th>Economizer¹²</th>
<th>4&quot; Filter²</th>
<th>Electric Heat kW¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>T06 (6.5)</td>
<td></td>
<td>1900</td>
<td>0.02</td>
<td>0.12</td>
<td>0.05</td>
</tr>
<tr>
<td>T07 (7.5)</td>
<td></td>
<td>2100</td>
<td>0.02</td>
<td>0.13</td>
<td>0.06</td>
</tr>
<tr>
<td>T08 (8.5)</td>
<td></td>
<td>2300</td>
<td>0.04</td>
<td>0.14</td>
<td>0.07</td>
</tr>
<tr>
<td>T10 (10)</td>
<td></td>
<td>2500</td>
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<td>0.16</td>
<td>0.08</td>
</tr>
<tr>
<td>T12 (12.5)</td>
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<td>0.19</td>
<td>0.09</td>
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<tr>
<td>XA</td>
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<tr>
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<td>0.31</td>
<td>0.22</td>
<td>0.13</td>
</tr>
<tr>
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<td>0.37</td>
<td>0.26</td>
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<td>0.43</td>
<td>0.29</td>
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<td>0.32</td>
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<td>0.75</td>
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<td></td>
<td>6100</td>
<td>1.02</td>
<td>0.79</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6300</td>
<td>1.06</td>
<td>0.83</td>
<td>0.56</td>
</tr>
</tbody>
</table>

1. Deduct these values from the available external static pressure shown in the respective Blower Performance Tables.
2. The pressure drop through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct is less than 0.25 IWG, the unit will deliver less CFM during full economizer operation.
Operation

Cooling Sequence Of Operation

NOTE: For more in-depth sequence of operation of the Smart Equipment™ control please refer to LIT-12011950 on www.upgnet.com under Product Center \ Equipment Catalog \ Commercial Products \ Zoning Systems and Controls.

For the XP series of units, the thermostat makes a circuit between "R" and "Y1" for the first stage of cooling. The call is passed to the Unit Control Board (UCB), which then determines whether the requested operation is available and, if so, energizes ID fan contactor M3, compressor #1 contactor M1, condenser fans contactor M4 and reversing valves relay RW1. If the (UCB) receives call for second stage cooling from the thermostat, "R" and "Y2", then the UCB energizes compressor #2 contactor M2 for full cooling operation.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

Continuous Blower

By setting the room thermostat fan switch to "ON," the supply air blower will operate continuously.

Intermittent Blower

With the thermostat switch set to "AUTO" and the system switch set to either the "AUTO" or "HEAT" settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds minimum off.

No Outdoor Air Options

When the thermostat calls for the first stage of cooling, the low-voltage control circuit from "R" to "Y1" and "G" is completed. The UCB energizes the economizer (if installed and free cooling is available) or the first available compressor and the condenser fans. For first stage cooling, compressor #1 is energized. If compressor #1 is unavailable, compressor #2 is energized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

When the thermostat calls for the second stage of cooling, the low-voltage control circuit from "R" to "Y2" is completed. The control board energizes the first available compressor. If free cooling is used for the first stage of cooling, compressor #1 is energized. If compressor #1 is active for first stage cooling or the first compressor is locked-out, compressor #2 is energized. In free-cooling mode, if the call for the second stage of cooling continues for 20 minutes, compressor #2 is energized, provided it has not been locked-out.

If there is an initial call for both stages of cooling, the UCB will delay energizing compressor #2 by 30 seconds in order to avoid a power rush.

Once the thermostat has been satisfied, it will de-energize Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling.

* To be available, a compressor must not be lock-out due to a high or low-pressure switch or the Evaporator Low Limit Sensor (EC1, 2) detects a temperature below 26 Deg. F and the Anti-Short Cycle Delay (ASCD) must have elapsed.

Economizer With Single Enthalpy Sensor

When the room thermostat calls for "first-stage" cooling, the low voltage control circuit from "R" to "G" and "Y1" is completed. The UCB energizes the blower motor (if the fan switch on the room thermostat is set in the "AUTO" position) and drives the economizer dampers from the fully closed to their minimum position. If the enthalpy of the outdoor air is below the set point of the enthalpy controller (previously determined), "Y1" energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the set point, "Y1" energizes compressor #1.

When the thermostat calls for "second-stage" cooling, the low voltage control circuit from "R" to "Y2" is completed. The UCB energizes the first available compressor. If the enthalpy of the outdoor air is below the set point of the enthalpy controller (i.e. first stage has energized the economizer), "Y2" will energize compressor #1. If the outdoor air is above the set point, "Y2" will energize compressor #2.

Once the thermostat has been satisfied, it will de-energize "Y1" and "Y2". If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continuous fan operation, the economizer damper goes to the minimum position.

Economizer With Dual Enthalpy Sensors

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer damper goes to the closed position. If the unit is in continuous fan operation, the economizer damper goes to the minimum position.

Economizer With Power Exhaust

A unit equipped with an economizer (single or dual enthalpy) and a power exhaust operates as specified above with one
addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan set point on the economizer control. As always, the "R" to "G" connection provides minimum position but does not provide power exhaust operation.

**Motorized Outdoor Air Dampers**

This system operation is the same as the units with no outdoor air options with one exception. When the "R" to "G" circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the "R" to "G" circuit is opened, the damper spring returns fully closed.

**Cooling Operation Errors**

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

**NOTE:** The following components are needed to access the control points in the Smart Equipment™ control. Installation and operation guides are located on www.upgnet.com under Product Center \ Equipment Catalog \ Commercial Products \ Zoning Systems and Controls.

1. Local LCD on Unit Control Board.
   OR
   • Source 1 P/N S1-JC-MAP1810-OP
   • MAP Gateway Quick Start Guide P/N 24-10737-16
   • MAP Gateway Instruction P/N 24-10737-8

**High-Pressure Limit Switch**

During cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor, initiate the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor. Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor. If the other compressor is inactive, the condenser fans will be de-energized.

**Low-Pressure Limit Switch**

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor. Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the associated compressor. If the other compressor is inactive, the condenser fans will be de-energized.

**Evaporator Low Limit**

During cooling operation, if the **Evaporator Low Limit Sensor** (EC1, 2) detects a temperature below 26 Deg. F (default), the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor. Should the UCB detect the evaporator low limit sensor (EC1, 2) falling below 26 Deg. F (default) three times within two hours of operation, the UCB will lock-out the associated compressor. If the other compressor is inactive, the condenser fans will be de-energized.

**Low Ambient Cooling**

To determine when to operate in low ambient mode, the UCB has an **Outdoor Air Temperature Sensor (OAT)** with a low ambient setpoint at 45ºF (default). When the OAT Sensor senses a temperature below the low ambient setpoint and the thermostat is calling for cooling, the UCB will operate in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The off cycle will begin immediately following the elapse of the minimum run time.

When operating in low ambient mode, an evaporator low limit sensor (EC1, 2) temperature below 26ºF will de-energize the associated compressor. If the call for cooling is still present at the end of the ASCD and the and the evaporator temperature sensor (EC1, 2) temperature is above 26ºF, the unit will resume operation.

**Safety Controls**

The unit control board monitors the following inputs for each cooling system:

1. An evaporator low limit sensor (EC1, 2) (Located on the Suction Line at the Evaporator Coil.) to protect against low evaporator temperatures due to a low airflow or a low return air temperature, set at 26ºF.
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig).

3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 22 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action. The other refrigerant system will continue in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of units with electric heat.

**Compressor Protection**

In addition to the external pressure switches, the compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An Anti-Short Cycle Delay (ASCD) is utilized to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

**Reset**

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature.

**Heating Sequence of Operation**

**With Electric Heat**

When the thermostat calls for heating, the low voltage control circuit is completed between "R" and "W1" for heating. The call is passed to the UCB, which then determines whether the requested operation is available and if so, energizes ID fan contactor M3, compressor #1 contactor M1. After a two second delay, it then energizes compressor #2 contactor M2. Therefore, on a call for heat from W1, both sets of compressors are always energized, unless one or the other is locked out by the UCB. Also on the call for heat, the UCB energizes the M4 contactor which brings on the condenser fans.

In the event of a needed defrost, the defrost control will signal the UCB, which will de-energize the condenser fans contactor M4 and energize the reversing valves relay RW1, putting the unit into defrost.

**Without Electric Heat**

When the thermostat calls for heating, the low voltage control circuit is completed between "R" and "W1" for heating. The call is passed to the UCB, which then determines whether the requested operation is available and if so, energizes ID fan contactor M3, compressor #1 contactor M1. After a two second delay, it then energizes compressor #2 contactor M2. Therefore, on a call for heat from W1, both sets of compressors are always energized, unless one or the other is locked out by the UCB. Also on the call for heat, the UCB energizes the M4 contactor which brings on the condenser fans.

In the event of a needed defrost, the defrost control will signal the UCB, which will de-energize the condenser fans contactor M4 and energize the reversing valves relay RW1, putting the unit into defrost.

**Defrost Initiation**

Defrost control implements a temperature differential, demand defrost algorithm. The heat pump is allowed to operate in the heating mode until the combination of outdoor ambient temperature and outdoor coil temperature indicate that defrosting is necessary. When the coil temperature is maintained below the initiate point for a given ambient temperature, continuously for 4-1/2 minutes, the heat pump is put into a defrost cycle. This 4-1/2 minute timer eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle.

For defrost, the UCB will signal the energizing of the reversing valve and de-energizing the systems condenser fan motor(s). The unit's optional electric first-stage heater is also energized via a 24-volt VAC output terminal labeled "H2".

**Defrost Termination**

The UCB terminates the defrost mode when either of the following two conditions are met;

1. The outdoor coil temperature sensor reaches 50°F, or
2. The maximum allowable defrost run time of 8 minutes.

**Interval between Defrosts**

A timed inhibit feature prevents the system from responding to a call for defrost less than 40 minutes after the initiation of the previous defrost. After this inhibit time has expired, temperature conditions must call for defrost continuously for 4-1/2 minutes before another defrost cycle is initiated. A temperature inhibit feature prohibits defrost if the coil temperature is above 40°F. All defrost timing occurs only while the compressor is on.

**Forced Defrost**

A forced-defrost feature puts the system into a defrost cycle every 6 hours and 4 minutes to recirculate lubricants, unless the coil temperature is above 40°F. All defrost timing occurs only while the compressor is on.
For trouble shooting purposes, the defrost cycle can be manually initiated by selecting "Test Defrost" in the UCB menu.

**Electric Heat Operation Errors**

**Temperature Limit**

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor.

**Safety Controls**

The UCB monitors the temperature limit switch of electric heat units.

The control circuit includes the following safety controls:

**Limit Switch (LS)**

This control is located inside the heater compartment and is set to open at the temperature indicated in the Electric Heat Limit Setting Table 22. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

**Reset**

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature.

**Electric Heat Anticipator Setpoints**

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter "ON" cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 23 for the required electric heat anticipator setting.

**Start-Up (Cooling)**

**Prestart Check List**

After installation has been completed:

1. Check the electrical supply voltage being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn unit electrical power on.
4. Set the room thermostat fan switch to on.
5. Check indoor blower rotation.
   • If blower rotation is in the wrong direction. Refer to Phasing Section in general information section.
   Check blower drive belt tension.
6. Check the unit supply air (CFM).
7. Measure evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn unit electrical power off.

**Operating Instructions**

1. Turn unit electrical power on.

**NOTE:** Prior to each cooling season, the crankcase heaters must be energized at least 10 hours before the system is put into operation.
2. Set the room thermostat setting to lower than the room temperature.
3. First stage compressors will energize after the built-in time delay (five minutes).
4. The second stage of the thermostat will energize second stage compressor if needed.

**Post Start Check List**

1. Verify proper system pressures for both circuits.

---

**Table 22: Electric Heat Limit Setting 50° Cabinet**

<table>
<thead>
<tr>
<th>UNIT (TONS)</th>
<th>VOLTAGE</th>
<th>HEATER kW</th>
<th>LIMIT SWITCH OPENS °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>XAT06, T07, T08 (6.5, 7.5, 8.5)</td>
<td>208/230</td>
<td>9</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54</td>
<td>130</td>
</tr>
<tr>
<td>XAT10, T12 (10, 12.5)</td>
<td>480</td>
<td>9</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54</td>
<td>130</td>
</tr>
<tr>
<td>XAT06, T07, T08 (6.5, 7.5, 8.5)</td>
<td>600</td>
<td>9</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54</td>
<td>130</td>
</tr>
<tr>
<td>XAT10, T12 (10, 12.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 23: Electric Heat Anticipator Setpoints**

<table>
<thead>
<tr>
<th>SETTING, AMPS</th>
<th>W1</th>
<th>W2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.13</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>
2. Measure the temperature drop across the evaporator coil.

**Charging The Unit**

All XA units use Thermal Expansion Devices. Charge the unit to nameplate charge.

**Control Board Navigation Components**

The following components are needed to access the control points in the Smart Equipment™ control. Installation and operation guides are located on www.upgnet.com under Product Center \ Equipment Catalog \ Commercial Products \ Zoning Systems and Controls.

1. Local LCD on Unit Control Board.
   OR
   - Source 1 P/N S1-JC-MAP1810-OP
   - MAP Gateway Quick Start Guide P/N 24-10737-16
   - MAP Gateway Instruction P/N 24-10737-8

**NOTE:** For more in-depth sequence of operation of the Smart Equipment™ control please refer to LIT-12011950 on www.upgnet.com under Product Center \ Equipment Catalog \ Commercial Products \ Zoning Systems and Controls.
Smart Equipment™ Firmware Version 3.2 Basic Unit Control Board Navigation Examples:

The following document details the navigation and viewing of the LCD display screen equipped as a standard item on the Smart Equipment™ control installed within various commercial UPG packaged and split system equipment. The following information provides a step-by-step demonstration on how to navigate the basic status menu and how to change basic configuration settings. The basic navigation steps outlined in this short demonstration applies to most menus within the Smart Equipment™ control.

Understanding the Local LCD
After you apply power to your Rooftop Unit (RTU), a start-up countdown begins on the Unit Control Board (UCB) LCD. When the controller is ready, the screen is blank because no faults are present. Use the joystick and the two push buttons below the LCD, to navigate through the menus.

Step 1 - After the start-up countdown is complete the first screen displayed is the “Status & Alarms” screen. When the cursor is on the top “Status” line hit the “ENTER” button. This action steps the LCD display into the status mode. Hit “ENTER” to view the status menu.

Step 2 - Scroll down to “DVent-Mode”. This is the demand ventilation mode.

Step 3 - When the cursor is on the “DVent-Mode” hit “ENTER” to view the status of this mode. In this case a CO2 sensor is not installed, thus Demand Ventilation or DVent is disabled.

Step 4 - To exit out of the “DVent-Mode status screen push “Cancel”. The screen returns to that shown below.

Step 5 - By pushing the joystick down, the cursor toggles to OprST (Operating Space Temp).

Step 6 - By pushing “ENTER” the actual OprST (Operating Space Temp) appears. Pushing the joystick down scrolls through SAT, RAT, OAT and other available sensor readings.

Press the “Cancel” button to exit each menu level. Repeatedly pressing “Cancel” returns the menu to the first “Status, Alarms” screen.
When the “Cancel” button is pressed multiple times to exit each menu level and the screen returns to the first “Status, Alarms” display the next demonstration can begin. In this demonstration the information below steps through the “Commissioning” menu.

**Step 1:** Beginning at the status/alarm screen toggle the joystick down three times. This accesses the “Commissioning” screen. In this menu section various settings can be changed. Please see the Unit Control Board menu for a list of parameters that can be modified.

**Step 2:** Once commission appears next to the cursor, press “ENTER” to begin viewing parameters.

**Step 3:** After “ENTER” is pressed the various parameter sections appear, such as: HVAC zone, Indoor Fan, Clg, Htg, Econ and others.

**Step 4:** After toggling the joystick down two times “Clg” appears. This allows items, such as lead-lag and OCC/UNOCC cooling set points, to be changed.

**Step 5:** At the “Clg” screen once “ENTER” is pushed the status indicates if cooling is engaged/disengaged and lead-lag is engaged/disengaged.

**Step 6:** By toggling down twice the screen reaches the “ClgOcc-SP” screen or “Cooling Occupied Set Point”.

**Step 7:** After pressing “ENTER” at the “ClgOcc-SP” screen the space temperature set point appears. NOTE: Only applies to units controlled by a space sensor.

**Step 8:** In order to change set points push the toggle switch left or right. Note: The screen flashes. Left decreases the value, right increases. In this demonstration the ClgOcc setpoint is changed from 72°F to 95°F.

**Step 9:** The joystick was toggled right to increase the set point temperature. The screen flashes when in the change mode. Once the desired set point/value is reached press the “ENTER” button to save the value.

These few pages provide a simple demonstration how to navigate the menu’s of the Smart Equipment™ control containing Version 3 firmware. Please utilize this document along with the additional information in the Users Guide and detailed navigation menu to adjust the control to customer preferences or job specifications.

**NOTE:** IF OPERATING THE EQUIPMENT WITH A THERMOSTAT, THE UCB SETPOINTS AND PARAMETERS SHOULD NOT REQUIRE ALTERATION; HOWEVER, THERE MAY BE THE CASE WHERE MINIMUM OUTSIDE AIR, LEAD-LAG OR OTHER CUSTOM SETTINGS ARE REQUIRED. PLEASE READ THIS DOCUMENT IN DETAIL TO UNDERSTAND THE IMPLICATIONS OF MAKING CHANGES BEFORE PROCEEDING. IT IS STRONGLY RECOMMENDED THAT A BACKUP OF PARAMETER SETTINGS BE SAVED ON A USB DRIVE BEFORE MAKING ANY MAJOR CHANGES TO THE CONTROL!
Table 24: Smart Equipment™ UCB Details

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Terminal Directional orientation: viewed with silkscreen labels upright</strong></td>
<td></td>
</tr>
<tr>
<td>Limit, 24 VAC power and shutdown connections from unit wiring harness at left on upper edge of UCB</td>
<td></td>
</tr>
<tr>
<td>LIMIT</td>
<td>Monitored 24 VAC input through heat section limit switch(es)</td>
</tr>
<tr>
<td>C</td>
<td>24 VAC, 75 VA transformer Common referenced to cabinet ground</td>
</tr>
<tr>
<td>24V</td>
<td>24 VAC, 75 VA transformer hot</td>
</tr>
<tr>
<td>SD 24</td>
<td>24 VAC hot out for factory accessory smoke detector, condensate overflow and/or user shutdown relay switching in series</td>
</tr>
<tr>
<td>SD R</td>
<td>24 VAC hot return from factory accessory smoke detector, condensate overflow and user shutdown relay switching in series</td>
</tr>
<tr>
<td>R</td>
<td>24 VAC hot for switched inputs to the UCB</td>
</tr>
</tbody>
</table>
### Table 24: Smart Equipment™ UCB Details (Continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Terminal Thermostat connection strip on left edge of UCB</strong></td>
<td></td>
</tr>
<tr>
<td>W1</td>
<td>1st stage heating request, 24 VAC input switched from R</td>
</tr>
<tr>
<td></td>
<td>Not effective for cooling-only units</td>
</tr>
<tr>
<td>W2</td>
<td>2nd stage heating request, 24 VAC input switched from R</td>
</tr>
<tr>
<td></td>
<td>Not effective for cooling-only units or units with single-stage heat sections</td>
</tr>
<tr>
<td>Y1</td>
<td>1st stage cooling request, 24 VAC input switched from R</td>
</tr>
<tr>
<td></td>
<td>Visible in the display menu when the #ClgStgs parameter is set for 2 or more, also effective for economizer free cooling supply air temperature reset when the #ClgStgs parameter is set for 1 or more</td>
</tr>
<tr>
<td>Y2</td>
<td>2nd stage cooling request, 24 VAC input switched from R</td>
</tr>
<tr>
<td>G</td>
<td>Continuous indoor blower request, 24 VAC input switched from R</td>
</tr>
<tr>
<td>OCC</td>
<td>Occupancy request, 24 VAC input switched from R</td>
</tr>
<tr>
<td></td>
<td>Must have the OccMode parameter set for External to be effective</td>
</tr>
<tr>
<td>X</td>
<td>Hard lockout indicator, 24 volt output to a light thermostat LED</td>
</tr>
<tr>
<td>R</td>
<td>24 VAC hot for thermostat switching and power</td>
</tr>
<tr>
<td></td>
<td>If field-added external accessories for unit shutdown are used, 24 VAC hot return from smoke detector, condensate overflow and/or user shutdown relay switching in series</td>
</tr>
<tr>
<td>SD-24</td>
<td>If field-added external accessories for unit shutdown are used, 24 VAC hot out for smoke detector, condensate over-flow and/or user shutdown relay switching in series</td>
</tr>
<tr>
<td></td>
<td>Unit wiring harness jumper plug for factory shutdown accessories must be removed if the switching of field-added external accessories for unit shutdown are wired between thermo-stat connection strip SD-24 and R</td>
</tr>
<tr>
<td>C</td>
<td>24 VAC common for thermostat power</td>
</tr>
<tr>
<td><strong>LEDs on left edge of UCB</strong></td>
<td></td>
</tr>
<tr>
<td>POWER</td>
<td>Green UCB power indicator</td>
</tr>
<tr>
<td></td>
<td>Lit indicates 24 VAC is present at C and 24V terminals</td>
</tr>
<tr>
<td>FAULT</td>
<td>Red hard lockout, networking error and firmware error indicator</td>
</tr>
<tr>
<td></td>
<td>1/2 second on/off flashing indicates one or more alarm is currently active, 1/10th second on/off flashing indicates a networking error (polarity, addressing, etc.) or a firmware error (likely correctable with re-loading from USB flash drive)</td>
</tr>
<tr>
<td>SA BUS</td>
<td>Green UCB SA bus communication transmission indicator</td>
</tr>
<tr>
<td></td>
<td>Lit/flickering indicates UCB SA bus communication is currently active, off indicates the UCB is awaiting SA bus communication</td>
</tr>
<tr>
<td><strong>Terminal Space temperature sensor connections at center on upper edge of UCB</strong></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>Space Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
<tr>
<td></td>
<td>Positive of VDC circuit (3.625 VDC reading to COM with open circuit), effective if &quot;Thermo- stat-only Control&quot; parameter is set OFF, space sensor override momentary shorts ST to COM to initiate/terminate temporary occupancy</td>
</tr>
<tr>
<td>COM</td>
<td>Common for ST and SSO inputs</td>
</tr>
<tr>
<td></td>
<td>Negative of VDC circuit for ST and SSO inputs</td>
</tr>
<tr>
<td>SSO</td>
<td>Space Sensor Offset input from 0 to 20KΩ potentiometer</td>
</tr>
<tr>
<td></td>
<td>Positive of VDC circuit (3.625 VDC reading to COM with open circuit), 10KΩ/2.5 VDC is 0°F offset, 0Ω/0 VDC is maximum above offset and 20KΩ/3.4 VDC is maximum below offset from active space temperature setpoint</td>
</tr>
<tr>
<td><strong>Pin Temperature sensor connections at right on upper edge of UCB</strong></td>
<td></td>
</tr>
<tr>
<td>SAT+</td>
<td>Supply Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
<tr>
<td></td>
<td>Input required for operation: 3.625 VDC reading SAT+ to SAT- with open circuit. Used in heat/cool staging cutouts, free cooling operation, demand ventilation operation, comfort ventilation operation, economizer loading operation, VAV cooling operation, hydronic heat operation.</td>
</tr>
</tbody>
</table>
### Table 24: Smart Equipment™ UCB Details (Continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAT+</strong></td>
<td>Return Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
<tr>
<td><strong>OAT+</strong></td>
<td>Outside Air Temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
<tr>
<td><strong>CC1+</strong></td>
<td>#1 refrigerant circuit Condenser Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
<tr>
<td><strong>EC1+</strong></td>
<td>#1 refrigerant circuit Evaporator Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
<tr>
<td><strong>CC2+</strong></td>
<td>#2 refrigerant circuit Condenser Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
<tr>
<td><strong>EC2+</strong></td>
<td>#2 refrigerant circuit Evaporator Coil temperature sensor input from 10KΩ @ 77°F, Type III negative temperature coefficient thermistor</td>
</tr>
</tbody>
</table>

**Pinned connections on right edge of UCB**

| RAH+                             | Return Air Humidity input from 0-10 VDC @ 0-100% RH sensor | Input required for reheat units, optional in all other units, may be a communicated value. Used in return air enthalpy calculation, temperature/humidity setpoint reset, reheat operation. |
| DCT PRS+                         | Supply Duct Pressure input from 0-5 VDC @ 0-5" w.c. sensor | Input required for variable air volume units. Used in VAV indoor blower operation. |
| DFS (upper pin)                  | 24 VAC hot return from Dirty Filter Switch                | Optional input; switch closure for greater than 15 seconds during indoor blower operation initiates a notification alarm |
| DFS (lower pin)                  | 24 VAC hot out for Dirty Filter Switch                    | Connects through circuit trace to the R terminal |
| APS (upper pin)                  | 24 VAC hot return from Air Proving Switch                 | When this optional input is enabled: the air proving switch must close within 30 seconds of initiation of indoor blower operation and not open for greater than 10 seconds during indoor blower operation to allow heat/cool operation and prevent an “APS open” alarm; the air proving switch must open within 30 seconds of termination of indoor blower operation to prevent an “APS stuck closed” notification alarm |
| APS (lower pin)                  | 24 VAC hot out for Air Proving Switch                     | Connects through circuit trace to the R terminal |
| **C**                            | Common for the VFD output                                 | Negative of the VDC circuit for the VFD output |
| **VFD**                          | 2-10 VDC (0-100%) output for the indoor blower Variable Frequency Drive | Output is active with indoor blower operation. For CV units: this output provides stepped IntelliSpeed control of the indoor blower VFD based on fan-only, cooling stage and heating stage outputs. For VAV units: this output provides control of the indoor blower VFD based on supply duct static pressure input and setpoint. |
### Table 24: Smart Equipment™ UCB Details (Continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VFDFLT</strong></td>
<td>24 VAC hot input from the normally open VFD alarm contact. The VFD alarm contact switches from R within the unit wiring harness. 24 VAC input results in unit shutdown and a “VFD fault” alarm.</td>
</tr>
<tr>
<td><strong>Terminal at lower right corner of UCB</strong></td>
<td></td>
</tr>
<tr>
<td><strong>24V FOR OUTPUTS</strong></td>
<td>24 VAC hot for H1, H2, CN-FAN, AUX HGR, FAN C1 and C2 output relay contact switching. Output relay circuitry is isolated from other UCB components and the 24 VAC hot source may be from a second transformer in the unit.</td>
</tr>
<tr>
<td><strong>Pin Heat section connections at right on lower edge of UCB</strong></td>
<td></td>
</tr>
<tr>
<td><strong>H1</strong></td>
<td>24 VAC hot output for heat section stage 1. Not effective for cooling-only units. Output if demand is present and permissions allow one stage or two stages of heat section operation.</td>
</tr>
<tr>
<td><strong>H2</strong></td>
<td>24 VAC hot output for heat section stage 2. Not effective for cooling-only units or units with single-stage heat sections. Output if demand is present and permissions allow two stages of heat section operation.</td>
</tr>
<tr>
<td><strong>MV</strong></td>
<td>24 VAC hot input confirming heat section operation. Sourced from gas valve in gas heat units or first stage heat contactor in electric heat units. Input within 5 minutes from initiation of H1 output initiates the “Heat On Fan Delay” timer, loss of input following the termination of H1 output initiates the “Heat On Fan Delay” timer, no input within 5 minutes from initiation of H1 output initiates an “Ignition Failure” alarm, input for longer than 5 minutes without H1 output initiates a “Gas Valve Mis-wire” alarm.</td>
</tr>
<tr>
<td><strong>Pin Cooling and fan output connections at right on lower edge of UCB</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CN-FAN</strong></td>
<td>24 VAC hot output for the condenser fan contactor coil. Output with either C1 or C2 output; interrupted during defrost cycle for heat pump units.</td>
</tr>
<tr>
<td><strong>AUX HGR</strong></td>
<td>24 VAC hot output for hot gas reheat components. Effective only for reheat units, output with reheat operation.</td>
</tr>
<tr>
<td><strong>FAN</strong></td>
<td>24 VAC hot output for indoor blower contactor coil/indoor blower VFD enable relay coil. Output with heat/cool operation, G input or schedule demand.</td>
</tr>
<tr>
<td><strong>C1</strong></td>
<td>24 VAC hot output for compressor 1. If demand is present and permissions allow compressor 1 operation; output with compressor cooling, comfort ventilation cooling, reheate or heat pump heating demands.</td>
</tr>
<tr>
<td><strong>C2</strong></td>
<td>24 VAC hot output for compressor 2. Not effective for one stage compressor UCBs. If demand is present and permissions allow compressor 2 operation; output with compressor cooling, comfort ventilation cooling or heat pump heating demands.</td>
</tr>
<tr>
<td><strong>Pin Refrigerant circuit safety switch and indoor blower overload connections at center on lower edge of UCB</strong></td>
<td></td>
</tr>
<tr>
<td><strong>HPS1 (right pin)</strong></td>
<td>24 VAC hot out for refrigerant circuit 1 High Pressure Switch. Connects through circuit trace to the R terminal.</td>
</tr>
<tr>
<td><strong>HPS1 (left pin)</strong></td>
<td>24 VAC hot return from refrigerant circuit 1 High Pressure Switch. Input is only considered if C1 output is needed; input must be present to allow C1 output. Three HPS1 trips in a two hour period cause a “High Pressure Switch 1 Lockout” and C1 output is then prevented until alarm reset. Connects through circuit trace to the right LPS1 pin.</td>
</tr>
<tr>
<td><strong>LPS1 (right pin)</strong></td>
<td>24 VAC hot out for refrigerant circuit 1 Low Pressure Switch. Connects through circuit trace to the left HPS1 pin.</td>
</tr>
<tr>
<td><strong>LPS1 (left pin)</strong></td>
<td>24 VAC hot return from refrigerant circuit 1 Low Pressure Switch. Input is only considered after 30 seconds of C1 output; afterwards, input must be present to allow C1 output. Three LPS1 trips in a one hour period cause a “Low Pressure Switch 1 Lockout” and C1 output is then prevented until alarm reset.</td>
</tr>
<tr>
<td><strong>HPS2 (right pin)</strong></td>
<td>24 VAC hot out for refrigerant circuit 2 High Pressure Switch. Not effective for one stage compressor UCBs. Connects through circuit trace to the R terminal.</td>
</tr>
<tr>
<td>Description</td>
<td>Function &amp; Comments</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>HPS2 (left pin)</td>
<td>24 VAC hot return from refrigerant circuit 2 High Pressure Switch</td>
</tr>
<tr>
<td>LPS2 (right pin)</td>
<td>24 VAC hot out for refrigerant circuit 2 Low Pressure Switch</td>
</tr>
<tr>
<td>LPS2 (left pin)</td>
<td>24 VAC hot return from refrigerant circuit 2 Low Pressure Switch</td>
</tr>
<tr>
<td>FAN OVR (right pin)</td>
<td>24 VAC hot out for indoor blower FAN Overload relay contact/motor protector switch</td>
</tr>
<tr>
<td>FAN OVR (left pin)</td>
<td>24 VAC hot return from indoor blower FAN Overload relay contact/motor protector switch</td>
</tr>
</tbody>
</table>

**Terminal SA BUS connections on at left on lower edge and center of UCB**

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>Power for SA (“Sensor-Actuator”) BUS devices</td>
</tr>
<tr>
<td>C</td>
<td>Common for SA BUS power and communication circuits</td>
</tr>
<tr>
<td>–</td>
<td>Communication for SA BUS devices</td>
</tr>
<tr>
<td>+</td>
<td>Communication for SA BUS devices</td>
</tr>
<tr>
<td>J8</td>
<td>6-pin phone jack connector</td>
</tr>
</tbody>
</table>

**Item Integrated user interface at lower left corner of UCB**

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>On-board, 2-line x 8-character back-lit display</td>
</tr>
<tr>
<td>ENTER</td>
<td>Button for display menu acknowledgment and navigation</td>
</tr>
<tr>
<td>CANCEL</td>
<td>Button for display menu navigation and zeroing of active compressor ASCD timer</td>
</tr>
<tr>
<td>JOY</td>
<td>4-way Joystick for display menu navigation</td>
</tr>
</tbody>
</table>

**Item USB connector at right of UCB**

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>J10</td>
<td>Type A female Universal Serial Bus connector</td>
</tr>
</tbody>
</table>
### Optional communication sub-board at center of UCB

<table>
<thead>
<tr>
<th>Description</th>
<th>Function &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>J15</td>
<td>Factory wired SA Bus connector</td>
</tr>
</tbody>
</table>

### Terminal FC BUS connections on left edge of the communication board

<table>
<thead>
<tr>
<th>Table 25: Cable for FC Buses and SA Buses in Order of Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bus and Cable Type</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>FC Bus:</strong> 22 AWG Stranded, 3-Wire Twisted Shielded Cable</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>SA Bus (Terminal Block):</strong> 22 AWG Stranded, 4-Wire, 2 Twisted-Pair Shielded Cable</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>SA Bus (Modular Jack): 26 AWG Solid 6-Wire, 3 Twisted-Pair Cable</strong></td>
</tr>
<tr>
<td><strong>FC Bus:</strong> 22 AWG Stranded, 3-Wire Twisted Non-Shielded Cable</td>
</tr>
<tr>
<td><strong>SA Bus (Terminal Block):</strong> 22 AWG Stranded, 4-Wire, 2 Twisted-Pair Non-Shielded Cable</td>
</tr>
</tbody>
</table>

1. We strongly recommend 3-wire (for FC bus) and 4-wire, 2 twisted-pair (for SA bus), 22 AWG stranded, shielded cable. A 22 gauge cable offers the best performance for various baud rates, cable distances, and number of trunk devices primarily due to lower conductor-to-conductor capacitance. Shielded cable offers better overall electrical noise immunity than non-shielded cable. Observe the shield grounding requirements.
2. We recommend 26 AWG solid, 6-wire (3 twisted pairs) cable as the best fit for fabricating modular cables with the modular jack housing assembly. Be sure the cable you use fits the modular jack housing. The preassembled cables that are available from Anixter (Part No. CBL-NETWORKxxx) use 24 gauge wire.
START-UP & SERVICE DATA INSTRUCTION

COMMERCIAL PACKAGE UNITS

3.0 To 40.0 TONS

START-UP CHECKLIST

Date: _______________________________________________________________________________________________________

Job Name: __________________________________________________________________________________________________

Customer Name: _____________________________________________________________________________________________

Address: ____________________________________________________________________________________________________

City: ______________________________   State: ______________________________   Zip: ________________________________

Model Number: _________________________________________ Serial Number: __________________________________________

Qualified Start-up Technician: _________________________________ Signature: _________________________________________

HVAC Contractor: _________________________________________________________ Phone: _____________________________

Address: ____________________________________________________________________________________________________

Contractor’s E-mail Address: ____________________________________________________________________________________

Electrical Contractor: _____________________________________________________   Phone: _____________________________

Distributor Name: ________________________________________________________   Phone: _____________________________

WARRANTY STATEMENT

Johnson Controls/UPG is confident that this equipment will operate to the owner’s satisfaction if the proper procedures are followed and checks are made at initial start-up. This confidence is supported by the 30 day dealer protection coverage portion of our standard warranty policy which states that Johnson Controls/UPG will cover parts and labor on new equipment start-up failures that are caused by a defect in factory workmanship or material, for a period of 30 days from installation. Refer to current standard warranty policy and warranty manual found on UPGnet for details.

In the event that communication with Johnson Controls/UPG is required regarding technical and/or warranty concerns, all parties to the discussion should have a copy of the equipment start-up sheet for reference. A copy of the original start-up sheet should be filed with the Technical Services Department.

The packaged unit is available in constant or variable air volume versions with a large variety of custom options and accessories available. Therefore, some variation in the startup procedure will exist depending upon the products capacity, control system, options and accessories installed.

This start-up sheet covers all startup check points common to all package equipment. In addition it covers essential startup check points for a number of common installation options. Depending upon the particular unit being started not all sections of this startup sheet will apply. Complete those sections applicable and use the notes section to record any additional information pertinent to your particular installation.

Warranty claims are to be made through the distributor from whom the equipment was purchased.

EQUIPMENT STARTUP

Use the local LCD or Mobile Access Portal (MAP) Gateway to complete the start-up.

A copy of the completed start-up sheet should be kept on file by the distributor providing the equipment and a copy sent to:

Johnson Controls/UPG
Technical Services Department
5005 York Drive
Norman, OK 73069
SAFETY WARNINGS

The inspections and recording of data outlined in this procedure are required for start-up of Johnson Controls/UPG's packaged products. Industry recognized safety standards and practices must be observed at all times. General industry knowledge and experience are required to assure technician safety. It is the responsibility of the technician to assess all potential dangers and take all steps warranted to perform the work in a safe manner. By addressing those potential dangers, prior to beginning any work, the technician can perform the work in a safe manner with minimal risk of injury.

NOTE: Read and review this entire document before beginning any of the startup procedures.

DESIGN APPLICATION INFORMATION

This information will be available from the specifying engineer who selected the equipment. If the system is a VAV system the CFM will be the airflow when the remote VAV boxes are in the full open position and the frequency drive is operating at 60 HZ. Do not proceed with the equipment start-up without the design CFM information.

Design Supply Air CFM: __________________________ Design Return Air CFM: __________________________
Design Outdoor Air CFM At Minimum Position: ________________________________________________
Total External Static Pressure: ________________________________________________________________
Supply Static Pressure: ______________________________________________________________________
Return Static Pressure: ______________________________________________________________________
Design Building Static Pressure: __________________________________________________________________
Outside Air Dilution: Economizer Position Percentage: __________________________________________ CFM: ______________
Supply Gas Pressure After Regulator W/o Heat Active ___________________________ Inches________

ADDITIONAL APPLICATION NOTES FROM SPECIFYING ENGINEER:
## REFERENCE

### General Inspection

<table>
<thead>
<tr>
<th>Task</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit inspected for shipping, storage, or rigging damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit installed with proper clearances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit installed within slope limitations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigeration system checked for gross leaks (presence of oil)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal screws and wiring connections checked for tightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filters installed correctly and clean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economizer hoods installed in operating position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condensate drain trapped properly, refer to Installation Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economizer damper linkage tight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Heat vent hood installed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All field wiring (power and control) complete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Air Moving Inspection

<table>
<thead>
<tr>
<th>Task</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment of drive components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt tension adjusted properly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blower pulleys tight on shaft, bearing set screws tight, wheel tight to shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure switch or transducer tubing installed properly</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Exhaust Inspection

<table>
<thead>
<tr>
<th>Task</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check hub for tightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check fan blade for clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for proper rotation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for proper mounting (screen faces towards unit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prove operation by increasing minimum setting on economizer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Economizer Inspection

<table>
<thead>
<tr>
<th>Task</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ sensor installed</td>
<td>Yes No</td>
<td></td>
</tr>
<tr>
<td>Check economizer setting (Reference Smart Equipment™ Control Board LCD menu location)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prove economizer open/close through Smart Equipment™ Board Setting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Reheat Mode

- Normal ☐
- Alternate ☐
- Not Applicable ☐

Humidity Sensor (2SH0401) ______________________________
### Operating Measurements - Air Flow

Fan operates with proper rotation (All VFD equipped units with the optional Manual Bypass must be phased for correct blower rotation with the Bypass switch set in the LINE position)

<table>
<thead>
<tr>
<th>Pressure drop across dry evaporator coil (At maximum design CFM)</th>
<th>ID Fans</th>
<th>Exh. Fans</th>
<th>Cond. Fans</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 - T2 ____________________________________________________</td>
<td>IWC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Static Pressure</td>
<td></td>
<td>IWC</td>
<td></td>
</tr>
<tr>
<td>Return Static Pressure</td>
<td></td>
<td>IWC</td>
<td></td>
</tr>
<tr>
<td>Supply Static Pressure</td>
<td></td>
<td>IWC</td>
<td></td>
</tr>
<tr>
<td>Supply Air CFM Using Dry Coil Chart</td>
<td>CFM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Adjusted Supply Air CFM</td>
<td>CFM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Consult the proper airflow to pressure drop table to obtain the actual airflow at the measured pressure differential.
2. Was a motor pulley adjustment or change required to obtain the correct airflow?
   - Was it necessary to increase or decrease the airflow to meet the design conditions?
   - If the motor pulley size was changed, measure the outside diameters of the motor and blower pulleys and record those diameters here;

### ELECTRICAL DATA

- Supply Fan Motor
- Exhaust Motor (Dampers 100%)
- Condenser Fan #1
- Condenser Fan #2 (if equipped)
- Condenser Fan #3 (if equipped)
- Condenser Fan #4 (if equipped)
- Compressor #1
- Compressor #2 (if equipped)
- Compressor #3 (if equipped)
- Compressor #4 (if equipped)

<table>
<thead>
<tr>
<th>Device</th>
<th>Nameplate</th>
<th>Measured List All Three Amperages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Fan Motor</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Exhaust Motor (Dampers 100%)</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Condenser Fan #1</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Condenser Fan #2 (if equipped)</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Condenser Fan #3 (if equipped)</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Condenser Fan #4 (if equipped)</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Compressor #1</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Compressor #2 (if equipped)</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Compressor #3 (if equipped)</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td>Compressor #4 (if equipped)</td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
</tbody>
</table>

1. VAV units with heat section - simulate heat call to drive VAV boxes and VFD/IGV to maximum design airflow position.
2. VAV units without heat section - VAV boxes must be set to maximum design airflow position.
# OPERATING MEASUREMENTS - COOLING

<table>
<thead>
<tr>
<th>Stage</th>
<th>Discharge Pressure</th>
<th>Discharge Temp.</th>
<th>Liquid Line Temp.</th>
<th>Subcooling</th>
<th>Suction Pressure</th>
<th>Suction Temp.</th>
<th>Superheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Second (if equipped)</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Third (if equipped)</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Fourth (if equipped)</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>Reheat 1st Stage</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
</tbody>
</table>

1. Liquid temperature should be taken before filter/drier.
2. Subtract 10 psi from discharge pressure for estimated liquid line pressure

### REFRIGERANT SAFETIES

<table>
<thead>
<tr>
<th>Action</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prove Compressor Rotation (3 phase only) by gauge pressure</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Prove High Pressure Safety, All Systems</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Prove Low Pressure Safety, All Systems</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

### OPERATING MEASUREMENTS - GAS HEATING

**Fuel Type:**
- ☐ Natural Gas
- ☐ LP Gas

<table>
<thead>
<tr>
<th>Action</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for gas leaks</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Prove Ventor Motor Operation</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Prove Primary Safety Operation</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Prove Auxiliary Safety Operation</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Prove Rollout Switch Operation</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Prove Smoke Detector Operation</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manifold Pressure</th>
<th>Action</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>IWC</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Stage 2 (If Equipped)</td>
<td>IWC</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Stage 3 (If Equipped)</td>
<td>IWC</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply gas pressure at full fire</th>
<th>Action</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IWC</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check temperature rise</th>
<th>Action</th>
<th>Completed</th>
<th>See Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ measured at full fire</td>
<td>°F</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

1. **Input X Eff. (BTU output)**
2. 1.08 X Temp. Rise

---

Unitary Products Group

Johnson Controls Unitary Products
**OPERATIONAL MEASUREMENTS - STAGING CONTROLS**

<table>
<thead>
<tr>
<th>Verify Proper Operation of Heating/Cooling Staging Controls</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a cooling demand at the Thermostat, BAS System or Smart Equipment™</td>
<td></td>
</tr>
<tr>
<td>Verify that cooling/economizer stages are energized.</td>
<td></td>
</tr>
<tr>
<td>Create a heating demand at the Thermostat, BAS System or Smart Equipment™</td>
<td></td>
</tr>
<tr>
<td>Verify that heating stages are energized.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verify Proper Operation of the Variable Frequency Drive (If Required)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify that motor speed modulates with duct pressure change.</td>
<td></td>
</tr>
</tbody>
</table>

**FINAL - INSPECTION**

<table>
<thead>
<tr>
<th>Verify that all operational control set points have been set to desired value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scroll through all setpoints and change as may be necessary to suit the occupant requirements.</td>
<td></td>
</tr>
<tr>
<td>Verify that all option parameters are correct</td>
<td></td>
</tr>
<tr>
<td>Scroll through all option parameters and ensure that all installed options are enabled in the software and all others are disabled in the software. (Factory software settings should match the installed options)</td>
<td></td>
</tr>
<tr>
<td>Verify that all access panels have been closed and secured</td>
<td></td>
</tr>
<tr>
<td>Save a backup file from the unit control board onto a USB flash drive.</td>
<td></td>
</tr>
</tbody>
</table>

**OBSERVED PRODUCT DEFICIENCIES & CONCERNS:**

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________