# *Celebrity1™*
# *Modular Air Handlers*

## *Installation and Operation Manual*

October 2004

AAON®

Think Ahead.

**Since the inception of AAON®** in 1988, we have maintained our commitment to design, develop, manufacture, and deliver heating and cooling products to perform beyond all expectations and to demonstrate their daily value to our customers.

AAON utilizes extensive product knowledge and state of the art manufacturing to continuously provide practical HVAC products to the dynamic marketplace.

Our objective remains the same: ***Meet the customer specific requirement at a reasonable first cost.***

AAON's *Celebrity1™ Modular Air Handler* gives you near limitless capability for conquering complex projects. Its superior modular design can be as flexible as your application is demanding. Units can be ordered completely factory wired and assembled, ready for placement and start-up, or as separate modules, to be manipulated and connected on site. With multiple factory-installed conservation, air, and control options to choose from, AAON's modular systems fit jobs that would normally require a custom system design with intensive post-installation work. That makes the *Celebrity1™* very cost-effective, while creating happier customers for you.

**Construction**

- Double Wall Insulated Module
- G90 Galvanized Steel
- Maximum Access Doors/Panels
- Stainless Steel Hinges
- Cast Door Handles
- Double Sloped Drain Pan
- Field Ready Duct Flanges

**Process Based Design**

- Horizontal – Vertical Applications
- Panels/Doors Interchangeable
- All Sections Full Perimeter Gasket Sealed
- Multiple Wiring Combinations
- Single or Dual Path Configurable
- Multiple Energy Recovery Arrangements

**Standard Features**

- Multiple Coil Configurations
- External Coil Connection Stubs
- Lift-off Hinged Doors
- Factory Installed TXV on All DX Coils
- Control Circuit Transformer
- Fan Contactors
- Left or Right Side Access
- Adjustable Belt Drive and Motor Mount

**Other Factory Installed Options**

- Hot Gas Reheat
- Hot Gas Bypass
- Face and Bypass Applications
- AAONAIRE® Heat Wheel
- Left or Right Hand Connections
- Numerous Humidity Control Solutions
- Stainless Steel Drain Pan
- Oversized and High Efficiency Motors
- Custom Coil Designs
- Factory or Customer Supplied Controls
- Customizable "Blank" Modules
- Power Exhaust Selections
- Multiple Filtration Choices
- Various Safety Devices

**Celebrity1™ Modular Air Handler Installation and Operation Manual October 2004**

*Owner should pay particular attention to the words:* **NOTE**, **CAUTION**, *and* **WARNING**. **NOTES** *are intended to clarify or make the installation easier.* **CAUTIONS** *are given to prevent equipment damage.* **WARNINGS** *are given to alert owner that personal injury and/or equipment damage may result if installation procedure is not handled properly.*



**WARNING**

The information in this manual should be followed exactly to prevent property damage or personal injury.

**WARNING**

Installation and service must be performed by a qualified installer or service agency.



AAON®

# 1. Description

## Important Safety Information

ONLY QUALIFIED PERSONNEL SHOULD PERFORM INSTALLATION, OPERATION, AND MAINTENANCE OF EQUIPMENT DESCRIBED IN THIS MANUAL.

Celebrity1™ air handlers are designed for safe operation when installed, operated, and maintained within design specifications, and the instructions set forth in this manual. It is necessary to follow these instructions to avoid personal injury or damage to equipment or property during equipment installation, operation, and maintenance.

**NOTE**

IMPORTANT!

This equipment is protected by a standard limited warranty under the condition that initial installation, service, and maintenance is performed according to the instructions set forth in this manual. This manual should be read in its entirety prior to installation, and before performing any service or maintenance work.

Equipment described in this manual is available with many optional accessories. If you have questions after reading this manual in its entirety, consult other factory documentation, or contact your Sales Representative to obtain further information before manipulating this equipment, or its optional accessories.

**WARNING**

**RISK OF DAMAGE, INJURY, AND LOSS OF LIFE - Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, or loss of life. A qualified installer or service agency must perform installation and service.**

**WARNING**

RISK OF ELECTRICAL SHOCK -
Before attempting to perform any service or maintenance, turn the electrical power to the unit OFF at disconnect switch(es). Unit may have multiple power supplies.

**WARNING**

RISK OF INJURY FROM HOT PARTS – Disconnect all power before servicing electric resistance heating elements to prevent serious injury resulting from automatic starts. Unit may have multiple power supplies.

**WARNING**

RISK OF INJURY FROM HOT PARTS – Disconnect all power, close all isolation valves, and allow equipment to cool before servicing equipment with hot water and steam heating coils. Hot water will circulate even after power is off. Equipment may have multiple power supplies.

**WARNING**

RISK OF INJURY FROM MOVING PARTS - Disconnect all power before servicing motor or blower to prevent serious injury resulting from automatic starts. Motor and blower may have multiple power supplies.

**NOTE**

These units must not be used as a “construction heater” at any time during any phase of construction. Very low return air temperatures, harmful vapors, and misplacement of the filters will damage the unit and its efficiency.

## Unit Data

***Table 1.1, Unit Data***

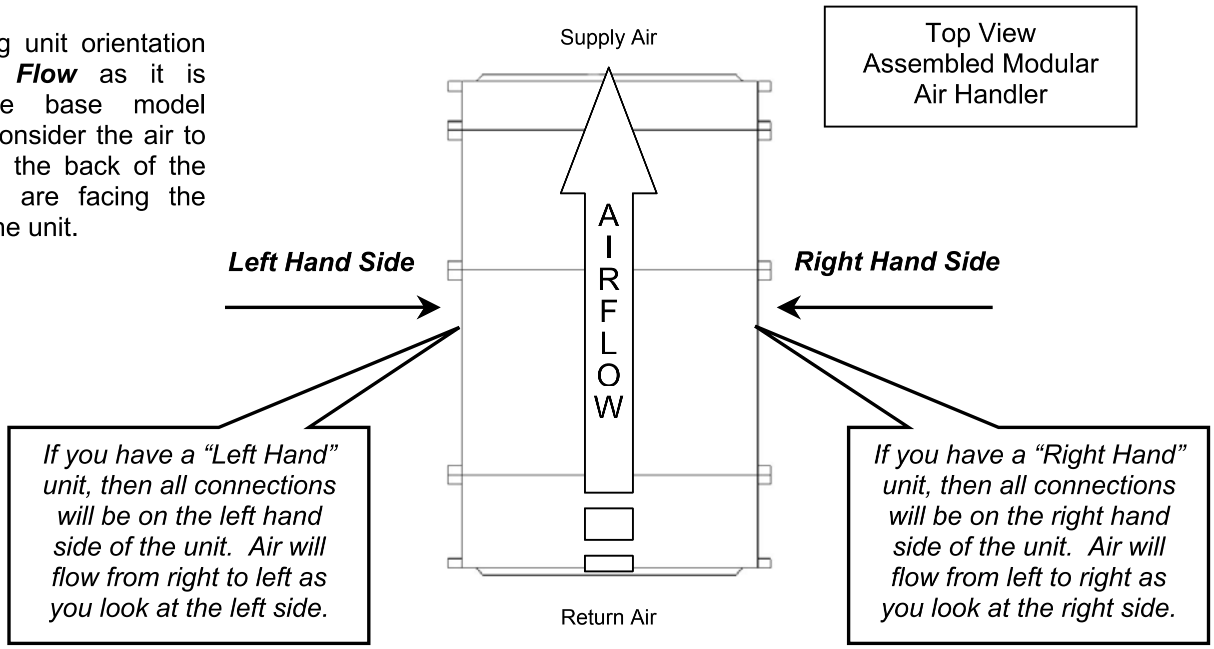
| Features | | Model Cabinet Size | | | | |
|---|---|---|---|---|---|---|
| | | 05 | 08 | 11 | 14 | 18 |
| CFM RANGE | | 1,000 to 2,700 | 2,000 to 4,400 | 3,100 to 6,000 | 5,000 to 7,700 | 6,000 to 10,300 |
| COOLING COIL SELECTION | | Face Area Sq. Ft. | | | | |
| DX Cooling | DX Single Circuit | | | | | |
| | 4 Row | 4.7 | 7.7 | 10.5 | 13.5 | 18.0 |
| | 6 Row | 4.7 | 7.7 | 10.5 | 13.5 | 18.0 |
| | 8 Row | 4.7 | 7.7 | 10.5 | 13.5 | 18.0 |
| | DX Double Circuit | | | | | |
| | 4 Row | 4.7 | 7.7 | 10.5 | 13.5 | 18.0 |
| | 6 Row | 4.7 | 7.7 | 10.5 | 13.5 | 18.0 |
| | 8 Row | 4.7 | 7.7 | 10.5 | 13.5 | 18.0 |
| Chilled Water Cooling | 4 Row | 4.7 | 8.0 | 10.2 | 13.6 | 18.1 |
| | 6 Row | 4.7 | 8.0 | 10.2 | 13.6 | 18.1 |
| | 8 Row | 4.7 | 8.0 | 10.2 | 13.6 | 18.1 |
| *Hot Water Heating | 1 Row | 4.7 | 8.0 | 10.2 | 13.6 | 18.1 |
| | 2 Row | 4.7 | 8.0 | 10.2 | 13.6 | 18.1 |
| Hot Gas Reheat | 2 Row | 4.7 | 7.7 | 10.5 | 13.5 | 18.0 |
| Min. / Max. Electric Heating kW | | 5.3 / 21.0 | 10.5 / 42.0 | 10.5 / 42.0 | 10.5 / 42.0 | 10.5 / 70.0 |
| Fan | Quantity | 1 | 1 | 1 | 1 | 1 |
| | Type | Back Incline | Back Incline | Back Incline | Back Incline | Back Incline |
| | Wheel O.D. (In.) | 15 | 15 / 18.5 | 18.5 / 22.5 | 18.5 / 22.5 | 22.5 / 27 |
| | Max. RPM | 2200 | 2200 / 2200 | 2200 / 2200 | 2200 / 2200 | 2200 / 1800 |
| | Motor HP | 1, 2, 3 | 1, 2, 3, 5, 7.5 | 3, 5, 7.5, 10 | 3, 5, 7.5, 10 | 3, 5, 7.5, 10 |
| Filters | Type | Size In. (Qty.) | | | | |
| | Pleated 2" Flat | 16 x 20 (2) | 16 x 20 (4) | 16 x 20 (6) | 20 x 20 (6) | 25 x 20 (6) |
| | Pleated 4" Flat | 16 x 20 (2) | 16 x 20 (4) | 16 x 20 (6) | 20 x 20 (6) | 25 x 20 (6) |
| | 12" Cartridge | 16 x 20 (2) | 16 x 20 (4) | 16 x 20 (6) | 20 x 20 (6) | 18 x 24 (6) |
| | 12" Bag | 16 x 20 (2) | 16 x 20 (4) | 16 x 20 (6) | 20 x 20 (6) | 20 x 24 (6) |
| Max. Total Static Pressure (In. w.g.) | | 3.2 | 4.5 | 4.5 | 4.0 | 3.5 |
| AAONAIRE® Heat Wheel O.D. | | 29" | 44" | 56" | 56" | 68" |

***Includes Hot Water Preheat & Reheat**

## Unit Orientation

When determining unit orientation (or ***Supply Air Flow*** as it is identified in the base model number below), consider the air to be "hitting you in the back of the head" when you are facing the return air end of the unit.

***Figure 1.1, Unit Orientation***

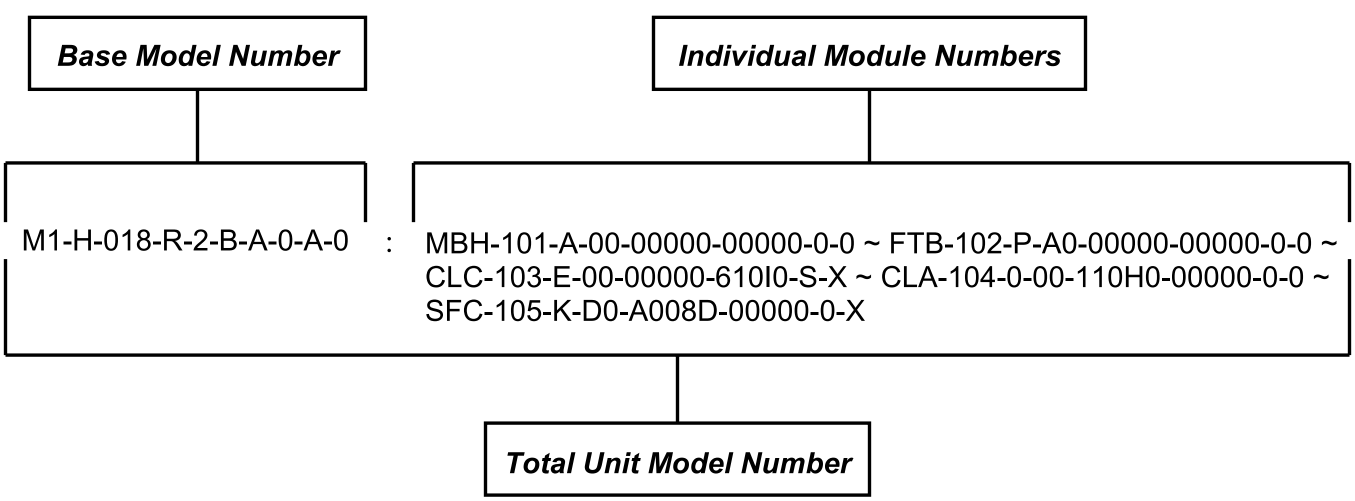



# 2. Model Number Nomenclature

### Number Structure

The total unit model number consists of a base model number followed by individual model numbers. The base model number identifies main unit features. Individual *module* numbers identify module configurations and optional features.

***Figure 2.1, Model Number Structure***



## Base Model Number

MAIN FEATURES

| M1 | TYPE | - | SIZE | - | SUPPLY AIR FLOW | - | VOLTAGE | - | ASSEMBLY | - | WIRING | - | PAINT | - | BASE RAIL | - | SPECIAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**TYPE**

| | |
|---|---|
| H = | Horizontal |
| V = | Vertical |

**SIZE**

| | |
|---|---|
| 005 = | 5 |
| 008 = | 8 |
| 011 = | 11 |
| 014 = | 14 |
| 018 = | 18 |

**SUPPLY AIR FLOW**

| | |
|---|---|
| L = | Left Hand |
| R = | Right Hand |

**VOLTAGE**

| | |
|---|---|
| 1 = | 230V/1Ø/60HZ |
| 2 = | 230V/3Ø/60HZ |
| 3 = | 460V/3Ø/60HZ |
| 4 = | 575V/3Ø/60HZ |
| 8 = | 208V/3Ø/60HZ |
| 9 = | 208V/1Ø/60HZ |

**ASSEMBLY**

| | |
|---|---|
| A = | Factory Assembled |
| B = | Loose Boxes |

**WIRING**

| | |
|---|---|
| 0 = | No Factory Wiring |
| A = | Control Panel in Fan Box |
| B = | Control Panel in Control Box |
| C = | Loose Control Panel |
| D = | Control Panel in Standard NEMA Box |
| E = | Control Panel in Large NEMA Box |

**PAINT**

| | |
|---|---|
| 0 = | No Paint |
| A = | Standard White Exterior |
| B = | Special Color Exterior |
| C = | Anti-Corrosion Paint |

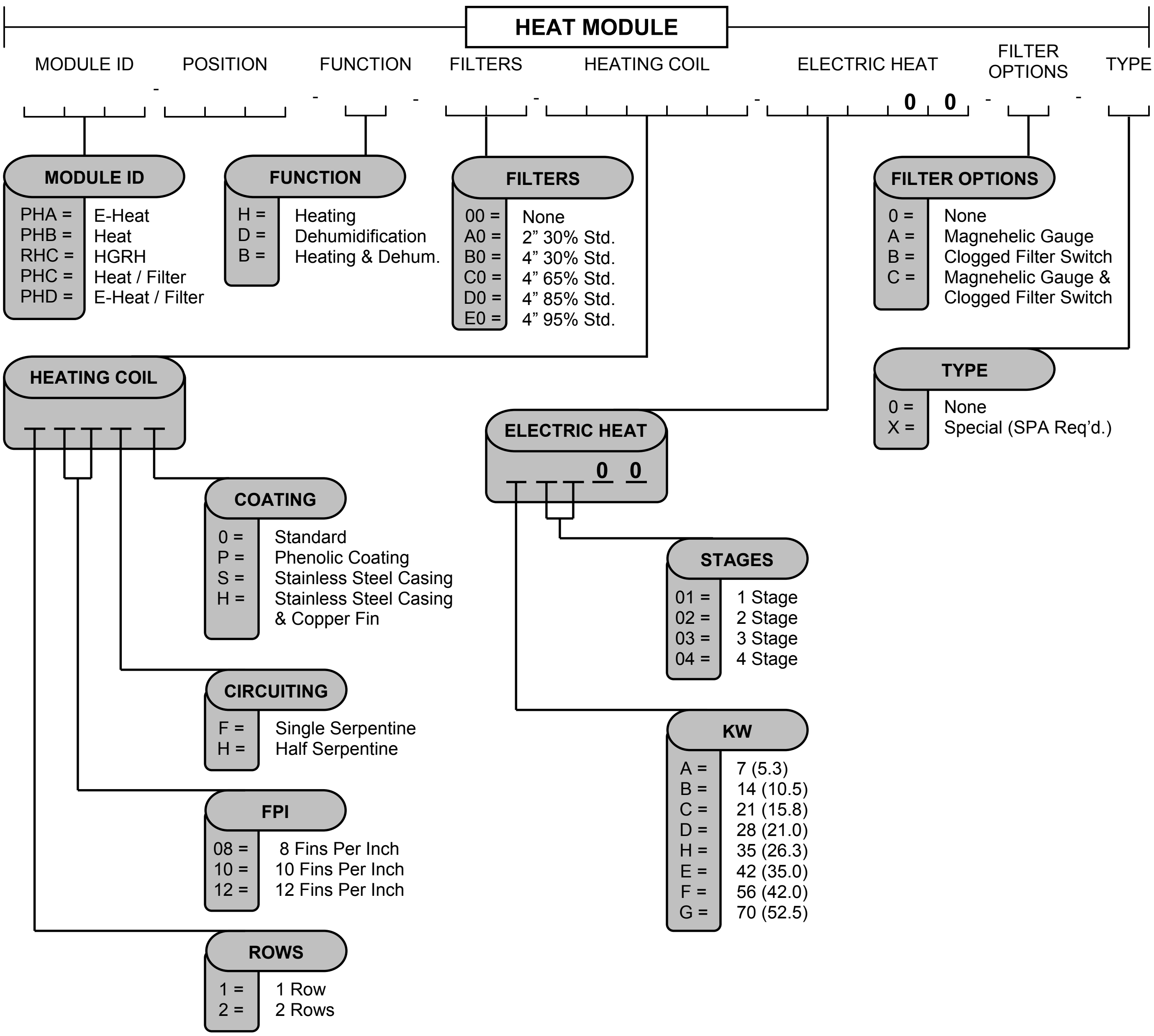
**BASE RAIL**

| | |
|---|---|
| A = | 4” High |
| B = | 8” High |
| C = | 6” High |

**SPECIAL**

| | |
|---|---|
| 0 = | None |
| A = | SPA Req’d. |

## Individual Module Numbers



## COIL MODULE

MODULE ID - POSITION - COOLING TYPE - ELECTRIC HEAT - HEATING COIL (_ _ _ 0 0) - COOLING COIL - DRAIN PAN - TYPE

### MODULE ID

| | |
|---|---|
| CLB = | CW / DX |
| CLC = | Cool / HGRH |
| CLD = | E-Heat / Heat |
| CLE = | E-Heat |
| CLF = | Heat & Cool |
| CLG = | E-Heat / Cool |
| CLH = | E-Heat / Cool / HGRH |
| CLI = | Cool or Heat w/Face Bypass |
| CLJ = | HW / DX / HGRH |
| CLK = | Vertical CW or DX |
| CLL = | Cool and Heat w/ Face Bypass |

### COOLING TYPE

| | |
|---|---|
| 0 = | No Cooling |
| C = | CW |
| D = | DX |
| E = | DX & Hot Gas Bypass |

### ELECTRIC HEAT

_ _ _ 0 0

#### STAGES

| | |
|---|---|
| 01 = | 1 Stage |
| 02 = | 2 Stage |
| 03 = | 3 Stage |
| 04 = | 4 Stage |

#### KW

| | |
|---|---|
| A = | 7 (5.3) |
| B = | 14 (10.5) |
| C = | 21 (15.8) |
| D = | 28 (21.0) |
| H = | 35 (26.3) |
| E = | 42 (35.0) |
| F = | 56 (42.0) |
| G = | 70 (52.5) |

### HEATING COIL

#### COATING

| | |
|---|---|
| 0 = | Standard |
| P = | Phenolic Coating |
| S = | Stainless Steel Casing |
| H = | Stainless Steel Casing & Copper Fin |

#### CIRCUITING

| | |
|---|---|
| F = | Single Serpentine |
| H = | Half Serpentine |

#### FPI

| | |
|---|---|
| 08 = | 8 Fins Per Inch |
| 10 = | 10 Fins Per Inch |
| 12 = | 12 Fins Per Inch |

#### ROWS

| | |
|---|---|
| 1 = | 1 Row |
| 2 = | 2 Rows |

### COOLING COIL

#### COATING

| | |
|---|---|
| 0 = | Standard |
| P = | Phenolic Coating |
| S = | Stainless Steel Casing |
| H = | Stainless Steel Casing & Copper Fin |

#### CIRCUITING

| | |
|---|---|
| F = | Single Serpentine |
| H = | Half Serpentine |
| S = | DX Single Circuit |
| I = | DX Interlaced (Dual) |

#### FPI

| | |
|---|---|
| 08 = | 8 Fins Per Inch |
| 10 = | 10 Fins Per Inch |
| 12 = | 12 Fins Per Inch |

#### ROWS

| | |
|---|---|
| 4 = | 4 Row |
| 6 = | 6 Row |
| 8 = | 8 Row |

### DRAIN PAN

| | |
|---|---|
| 0 = | None |
| S = | Stainless Steel Pan |
| G = | Galvanized Pan |
| U = | Stainless Steel Pan & UV Light |

### TYPE

| | |
|---|---|
| 0 = | None |
| X = | Special (SPA Req'd.) |

## FILTER MODULE

MODULE ID - POSITION - FILTER TYPE - FILTERS - SAFETY CONTROL - BLANK - FILTER OPTIONS - TYPE

_ _ _ - _ _ _ - _ - _ _ - 0 0 0 0 - 0 0 0 0 0 - _ - _

**MODULE ID**

| | |
|---|---|
| FTA = | Flat Filter, Small |
| FTF = | Flat Filter, Large |
| FTC = | Cartridge Filter |
| FTD = | Bag Filter |

**FILTER TYPE**

| | |
|---|---|
| P = | Pleated |
| C = | Cartridge |
| B = | Bag |

**FILTERS**

**PLEATED**

| | |
|---|---|
| A0 = | 2" 30% Eff. Std. |
| B0 = | 4" 30% Eff. Std. |
| C0 = | 4" 65% Eff. Std. |
| D0 = | 4" 85% Eff. Std. |
| E0 = | 4" 95% Eff. Std. |

**CARTRIDGE**

| | |
|---|---|
| C0 = | 65% Eff. |
| D0 = | 85% Eff. |
| E0 = | 95% Eff. |

**BAG**

| | |
|---|---|
| B0 = | 45% Eff. |
| C0 = | 65% Eff. |
| D0 = | 85% Eff. |
| E0 = | 95% Eff. |

**SAFETY CONTROL**

| | |
|---|---|
| 0 = | None |
| 1 = | Smoke Detector |
| 2 = | Firestat |
| 3 = | Smoke Detector & Firestat |

**FILTER OPTIONS**

| | |
|---|---|
| 0 = | None |
| A = | Magnehelic Gauge |
| B = | Clogged Filter Switch |
| C = | Magnehelic Gauge & Clogged Filter Switch |

**TYPE**

| | |
|---|---|
| 0 = | None |
| X = | Special (SPA Req'd.) |

## MIXING MODULE

MODULE ID - POSITION - ACTUATOR - FILTERS - SAFETY CONTROL - BYPASS OPEN - FILTER OPTIONS - TYPE

_ _ _ - _ _ _ - _ - _ _ - 0 0 0 0 - _ 0 0 0 0 - _ - _

**MODULE ID**

| | |
|---|---|
| MBA = | Vertical Damper |
| MBB = | Horizontal (Top) Damper |
| MBC = | Vertical / Horizontal (Bottom) Damper |
| MBF = | Horizontal (Bottom) Damper |
| MBH = | Vertical / Horizontal (Top) Damper |
| MBD = | Vertical Damper / Filter |
| MBE = | Horizontal (Top) Damper / Filter |
| MBI = | Horizontal (Bottom) Damper / Filter |
| MBJ = | Vertical / Horizontal (Top) Damper / Filter |

**ACTUATOR**

| | |
|---|---|
| 0 = | None |
| A = | Two Position |
| B = | DDC |

**FILTERS***

| | |
|---|---|
| 00 = | None |
| A0 = | 2" 30% Std. |
| B0 = | 4" 30% Std. |
| C0 = | 4" 65% Std. |
| D0 = | 4" 85% Std. |
| E0 = | 4" 95% Std. |

**SAFETY CONTROL**

| | |
|---|---|
| 0 = | None |
| 1 = | Smoke Detector |
| 2 = | Firestat |
| 3 = | Smoke Detector & Firestat |

**BYPASS OPEN**

| | |
|---|---|
| 0 = | None |
| A = | Top Open |
| B = | Bottom Open |

**FILTER OPTIONS**

| | |
|---|---|
| 0 = | None |
| A = | Magnehelic Gauge |
| B = | Clogged Filter Switch |
| C = | Magnehelic Gauge & Clogged Filter Switch |

**TYPE**

| | |
|---|---|
| 0 = | None |
| X = | Special (SPA Req'd.) |

***Filters compatible with modules MBD, MBE, MBI, & MBJ only.**

## FAN MODULE

MODULE ID - POSITION - MOTOR SIZE - BLOWER - MOTOR TYPE - SAFETY CONTROL - SPECIAL CONTROL - TYPE

_ _ _ - _ _ _ - _ - 0 - 0 0 X X - 0 0 0 0 - _ - _

**MODULE ID**

| | |
|---|---|
| PEA = | Power Exhaust |
| RFA = | Return Fan |
| SFA = | Supply Fan |
| SFB = | Supply Fan, Vertical |
| SFC = | Supply Fan, Top Discharge |
| PEC = | Exhaust Fan, Top Discharge |

**MOTOR SIZE**

| | |
|---|---|
| 0 = | None |
| E = | 1 HP |
| F = | 2 HP |
| G = | 3 HP |
| H = | 5 HP |
| J = | 7.5 HP |
| K = | 10 HP |

**BLOWER**

| | |
|---|---|
| 0 = | None |
| A = | 15” |
| B = | 18.5” |
| C = | 22.5” |
| D = | 27” |

**MOTOR TYPE**

_ 0 0 X X

**TYPE**

| | |
|---|---|
| A = | Standard |
| B = | Premium |
| C = | Premium w/ VFD |
| D = | Premium w/ VFD & Bypass |

**PULLEYS**

Pulley Combinations Assigned At Factory Acc. To Order Requirements

**SAFETY CONTROL**

| | |
|---|---|
| 0 = | None |
| A = | Phase & Brownout Protection |

**SPECIAL CONTROL**

| | |
|---|---|
| 0 = | None |
| A = | DDC Control & Terminal |
| B = | DDC Control |

**TYPE**

| | |
|---|---|
| 0 = | None |
| X = | Special (SPA Req’d.) |

## BLANK MODULE

MODULE ID - POSITION - BLANK - BLANK - SAFETY CONTROL - BYPASS OPEN - DRAIN PAN - TYPE

_ _ _ - _ _ _ - 0 - 0 0 - 0 0 0 0 - 0 0 0 0 - _ - _

**MODULE ID**

| | |
|---|---|
| BBA = | Small Blank |
| BBB = | Large Blank |
| BBC = | Small Blank, Top Discharge |
| BBD = | Large Blank, Top Discharge |

**SAFETY CONTROL**

| | |
|---|---|
| 0 = | None |
| 1 = | Smoke Detector |
| 2 = | Firestat |
| 3 = | Smoke Detector & Firestat |

**BYPASS OPEN**

| | |
|---|---|
| 0 = | None |
| A = | Top Open |
| B = | Bottom Open |

**DRAIN PAN**

| | |
|---|---|
| 0 = | None |
| S = | Stainless Steel Pan |
| G = | Galvanized Pan |
| U = | Stainless Steel Pan & UV Light |

**TYPE**

| | |
|---|---|
| 0 = | None |
| X = | Special (SPA Req’d.) |

## AAONAIRE® HEAT RECOVERY WHEEL MODULE

MODULE ID - POSITION - WHEEL SIZE - BLANK - BLANK - BLANK - BLANK - TYPE

_ _ _ - _ _ _ - _ - 0 0 - 0 0 0 0 0 - 0 0 0 0 0 - 0 - _

**MODULE ID**

HRA = AAONAIRE® Heat Wheel

**WHEEL SIZE***

A = Standard
B = Optional

**TYPE**

0 = None
X = Special (SPA Req'd.)

***Optional wheel size (selection 'B') available only in size 5, 8, and 11 units.**

## CONTROL PANEL MODULE

MODULE ID - POSITION - BLANK - BLANK - SAFETY OPTIONS - BLANK - BLANK - TYPE

_ _ _ - _ _ _ - 0 - 0 0 - _ 0 0 0 0 - 0 0 0 0 0 - 0 - _

**MODULE ID**

TRA = Control Panel

**SAFETY CONTROL**

0 = None
1 = Smoke Detector
2 = Firestat
3 = Smoke Detector & Firestat

**TYPE**

0 = None
X = Special (SPA Req'd.)

## 3. Delivery

ALL SHIPMENTS ARE F.O.B. THE FACTORY. IT IS THE RESPONSIBILITY OF THE RECEIVING PARTY TO INSPECT THE EQUIPMENT UPON ARRIVAL.

### Receipt & Inspection

The air handler should be inspected for damage that may have occurred in transit. Do the following upon receipt:

1. Inspect all items for internal, external, and concealed damage before accepting
2. Assure carrier is in compliance with Bill of Lading instructions

If damage is found:

1. Note all damage on Bill of Lading immediately
   - **Photograph damage if possible**
   - Do not move or discard damaged packaging materials
2. Call carrier immediately to file a freight claim, and to schedule a freight inspection
3. When damage is repairable, call ACP's Customer Care Hotline for parts: 1-903-247-9242
4. With permission of carrier, make the repairs
5. Stay in contact with carrier to ensure payment of your claim

If repairs must be made to damaged goods, the factory must be notified before any repair action is taken. Equipment alteration, repair, or unauthorized manipulation of damaged equipment without the manufacturer's consent will void all product warranties. Contact the ACP Warranty Department for assistance with handling damaged goods, repairs, and freight claims.

Verify the equipment against the order documents upon delivery. If what you received does not match your order exactly, then your sales representative must be notified at once.

**NOTE**

LOOSE SHIPMENT ITEMS – Upon receipt, check shipment for items that ship loose such as thermostats, and other controls. Consult order and shipment documentation to identify potential loose-shipped items.

**NOTE**

NOTICE OF PILFERING – Check packing list against delivered goods. Ensure that equipment, and loose-shipped items have not been stolen, or misplaced during staging or transit. The factory is not responsible for missing items after shipment.

### Storage

This equipment is not suitable for outdoor use, or storage. Never place this equipment where it may be subjected to outdoor conditions such as rain, snow, humidity, extreme temperatures, or corrosive chemicals.

If installation will not occur immediately following delivery, then store equipment in a dry, protected area, and in the proper orientation as marked on the packaging with all internal packaging in place. Secure all loose-shipped items.

# 4. Installation

## General

Celebrity1™ modular air handling units are designed as heating, cooling, or combination units for indoor installation only. The use of refrigerant, chilled water, electric resistance, steam, or hot water as operating mediums will be dictated by design of the heating and cooling coils installed in the unit. Flexible connectors are required on all duct connections and installed to minimize air leaks.

### Certification

Cooling Models

a) Certified for use with a commercial condensing or chilled water remote unit (with or without compressor(s))
b) Certified for indoor installation only.

Steam or Hot Water Heat Models

a) Certified for indoor installation only.

Electric Heat Models

a) Certified as an electric warm air furnace with or without cooling coil.
b) Certified for indoor installation only.

### Codes & Ordinances

System should be sized in accordance with National Warm Air Heating and Air Conditioning Association Literature, or the Guide of American Society of Heating, Refrigeration and Air Conditioning Engineers. The installation must conform with local building codes, or in the absence of local codes, with (United States) "ANSI / UL 1995", (Canada) current, C.S.A. Standard C22.2, No. 236, Canadian Electrical Code Part 1, and C.S.A. Standard B52 Mechanical Refrigeration Code, and Local Plumbing or Waste Water Codes.

**WARNING**

It is the responsibility of the installing contractor to comply with codes, ordinances, local and municipal building laws, and manufacturer's instructions. Personal injury and/or equipment damage may result if proper procedures are not followed.

### Handling

***Be aware of what is contained in the equipment!***

Dependent upon the optional accessories that were ordered, this equipment may contain fragile components and delicate electronics. Although the unit is constructed of sturdy materials, avoid impacts and handling methods that may damage internal apparatus and structure, or the exterior surfaces of the unit. Take care not to apply destructive force to coils, coil and drain stub-outs, or other parts protruding beyond the extents of the unit casing. Always handle the unit by its exterior casing, and never by any of the protruding parts.

Keep equipment free from debris and construction waste during installation. Foreign materials may adversely affect unit operation resulting in premature failures that will not be covered by the manufacturer's warranty. Attach all service panels, and cover all exposed equipment when work is not being performed. Leave unit protected from other construction activity until start-up is to occur.

**WARNING**

Always wear hand and eye protection when handling, installing, servicing, or maintaining equipment. Sharp or pointed edges, moving parts, and flying debris may cause personal injury.

### Service & Installation Clearance

Before setting the air handler into place, caution must be taken to provide clearance for unit panels/doors that must be accessible for periodic service. These areas contain the controls, safety devices, refrigerant or water piping, shut-off valves and filter access.

Celebrity1™ air handler modules may be accessible from both sides of the unit. Service clearance equal to the width of the unit is recommended. That is, if the unit is 4 feet wide, then 4 feet of clearance is suggested on both sides.

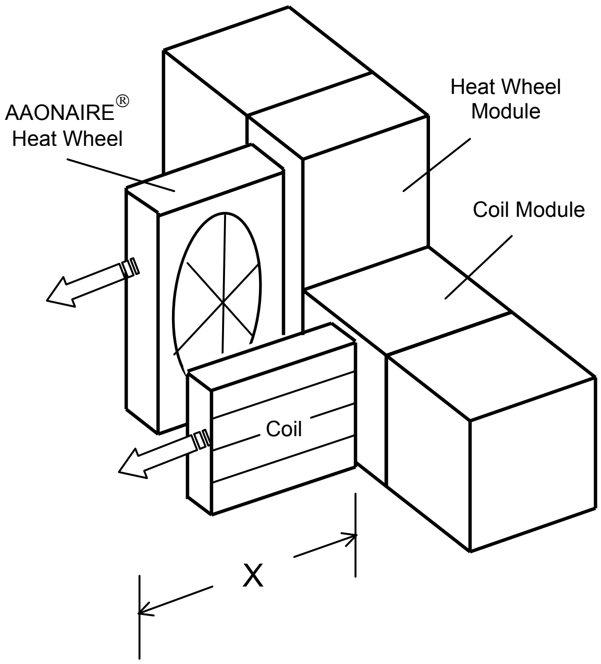
<u>Blower Module</u>

The blower module needs to be accessible with enough clearance to remove the motor or the plenum fan.

## Coil & AAONAIRE® Heat Wheel Modules

Coils and heat wheels slide out for easier servicing. There should be enough clearance left on one side of the unit (usually the piping connection side) to completely remove the coils and heat wheel for maintenance or replacement.

***Figure 4.1, Service Clearance for Heat Wheel and Coils***




*'X' is the minimum required service clearance for heat wheel and coil modules*

| Module Size | X = |
|---|---|
| 5 | 48 inches |
| 8 | 64 inches |
| 11 | 68 inches |
| 14 | 68 inches |
| 18 | 89 inches |

## Mounting & Suspension

Celebrity™ air handlers can be designed for horizontal or vertical airflow applications, and can be floor mounted or suspended. Units may be delivered in separate module components, or completely factory assembled with all modules connected. In the latter case, if the unit was received fully assembled on a skid, then the equipment should be lifted into place using the shipping skid to prevent damage to the modules.

**NOTE**

An auxiliary (emergency) drain pan is recommended for all applications where there is a risk of water damage to surrounding structure or furnishings. Refer to local codes.

### Floor Mounted

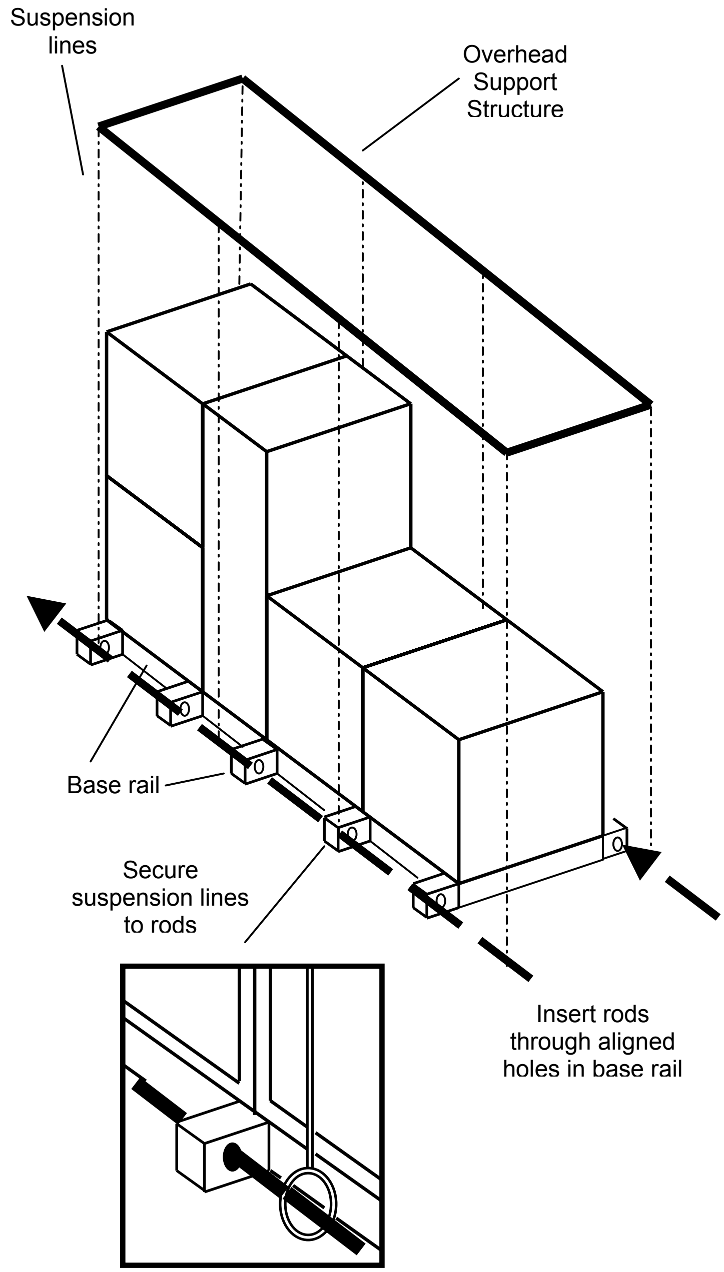
Make sure the unit is level, and installed with a minimum height of 6" to allow for proper drainage of the condensate line. Other installation provisions may be necessary according to job specifications.

### Suspended

Modular air handlers are equipped for suspended installations. All modules must be connected and the unit must be completely assembled before the unit is lifted into position. The base of the unit must be supported before hoisting. Do not lift the unit by any part other than the unit base.

Unit base rails are manufactured with suspension rod holes. To suspend an assembled unit, insert support rods through the aligned base rail holes on both sides of the unit. Secure suspension lines to the rods and to an overhead support structure. The air handler must be installed level as the internal drain pan is manufactured with a slope toward the drain. Be sure not to obstruct service access doors with the positioning of the suspension lines. Other installation provisions may be necessary according to job specifications and requirements.

*Figure 4.2, Suspended Modular Air Handler*




## Field Assembly

Although Celebrity1™ air handlers are shipped factory assembled as a standard, they may be ordered unassembled for certain applications such as for assembly in existing structures where modules must be manipulated separately. If the unit was ordered unassembled, then you will need to connect the modules in the field.

Modules present may include any or all of the following depending on the equipment ordered and the application:

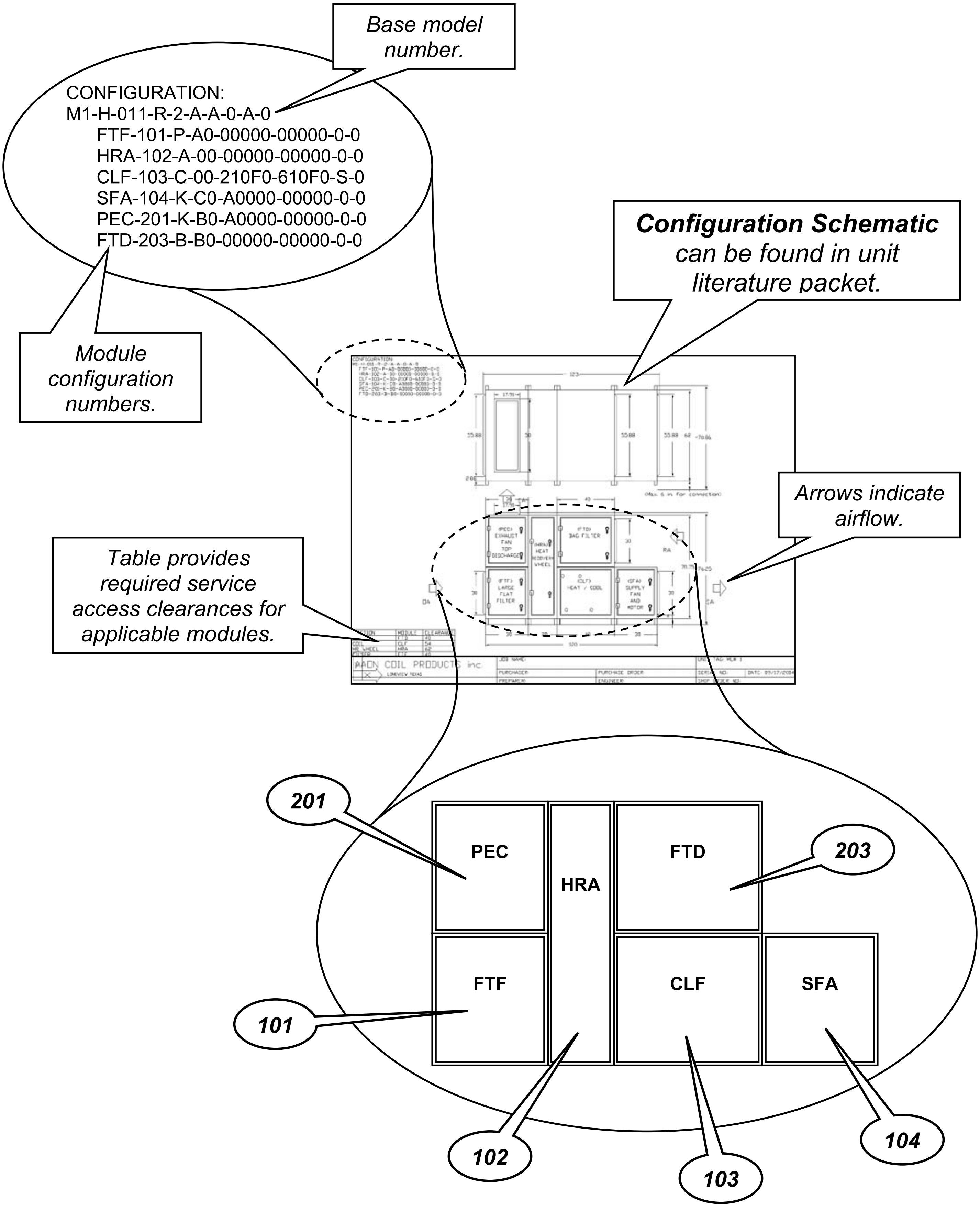
- Fan Module – includes the plenum fan and blower motor
- Coil Module – contains heating and/or cooling and/or re-heat coils. May contain electric heat.
- AAONAIRE® Heat Wheel Module – module has heat wheel installed.
- Air Mixing Module – module where outside air combines with return air.
- Filter Module – contains slide out filter racks and filters. May also contain special bag, or cartridge filters.
- Damper Module – contains motor actuated horizontal and/or vertical air dampers.
- Power Exhaust Module – includes power exhaust fan and motor.
- Blank Module – an empty module to be used for additional controls, parts, or can be used as a plenum.
- Control Panel Module – an additional module that contains a control panel when the panel is not ordered loose, or as part of the fan module.

Locate the configuration schematic in the equipment's literature packet. The schematic will have 'CONFIGURATION' written in the top left hand corner followed by the unit model number, and then each module's configuration number listed in order.

It is advisable to situate all required modules in the installation location, and preferably as near as possible to the order in which they will be connected. Identify each module by the configuration number on its label. For example, if a module has a configuration number of FTF-101-P-A0-00000-00000-0-0, then it is a large flat filter module (FTF), and should be placed in the first position (101) of the lower tier i.e. the bottom left.

Although you should have a schematic available, the configuration numbers have been devised to inform you of the module assembly without the need for a schematic. Modules are arranged in order, left to right with 100 series modules on the first tier, and 200 series modules on the second tier. Module 101 will always be located on the left end of the bottom tier, or the bottom left of a right hand assembly, and module 201 will always be located on the left end of the top tier, or the top left of a right hand assembly. So, it is possible to identify the exact module arrangement even without knowing the module type, or having a configuration schematic.

*Figure 4.3, Module Configuration Schematic*



Note that a heat wheel module will have a 100 series number identifying it, but will span both tiers also utilizing a 200 series space, and effectively “skipping” one of the top-tiered numbers.

If, for any reason, you are unable to identify any module, or its position in the final assembly, then consult the salesperson or project engineer.

***Table 4.1, Module Code Chart***

| Code | Description |
|---|---|
| BBA | Small Blank Box |
| BBB | Large Blank Box |
| CLB | Cooling Coil |
| CLC | Cooling Coil/Hot Gas Reheat Coil |
| CLD | Electric Heat/Hot Water Coil |
| CLE | Electric Heat |
| CLF | Hot Water/Cooling Coil |
| CLG | Electric Heat/Cooling Coil |
| CLH | Electric Heat/Cooling Coil/Hot Gas Reheat Coil |
| CLI | Cooling or Heating w/ Face Bypass |
| CLJ | Hot Water/Cooling Coil/Hot Gas Reheat Coil |
| CLK | Vertical Cooling Coil |
| CLL | Cooling and Heating w/ Face Bypass |
| FTA | Small Flat Filter |
| FTB | Angled Filter |
| FTC | Cartridge Filter |
| FTD | Bag Filter |
| FTF | Large Flat Filter |
| HRA | Energy Recovery Wheel |
| MBA | Vertical Damper Mixing Box |
| MBB | Horizontal Damper (top) Mixing Box |
| MBC | Horizontal (bottom)/Vertical Damper Mixing Box |
| MBD | Vertical Damper/Filter Mixing Box |
| MBE | Horizontal Damper (top)/Filter Mixing Box |
| MBF | Horizontal Damper (bottom) Mixing Box |
| MBG | Filter Mixing Box (no damper) |
| MBH | Vertical/Horizontal (top) Damper Mixing Box |
| MBI | Filter/Horizontal (bottom) Damper Mixing Box |
| MBJ | Vertical/Horizontal (top) Damper/Filter Mixing Box |
| MBK | Vertical/Horizontal (bottom) Damper/Filter Mixing Box |
| PEA | Power Exhaust |
| PHA | Electric Heat |
| PHB | Hot Water Coil |
| PHC | Filter/Hot Water Coil |
| PHD | Filter/Electric Heat |
| RFA | Return Fan |
| RHC | Hot Gas Reheat Coil |
| SFA | Supply Fan |
| SFB | Vertical Supply Fan |
| SFC | Supply Fan with Top Discharge |
| TRA | Control Box |

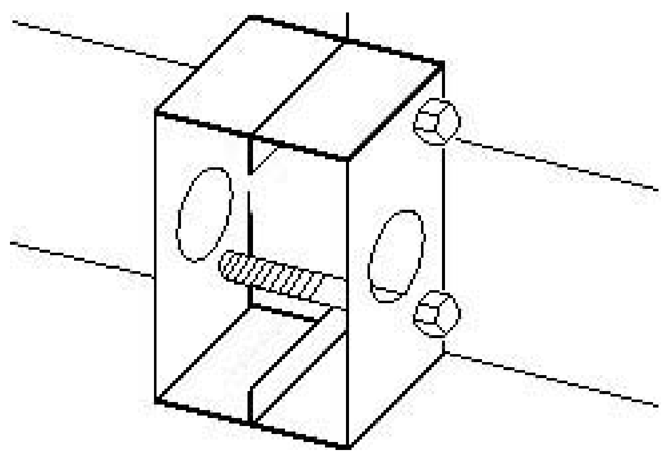
After identifying modules and determining module arrangement, you can begin connecting the modules.

Modules are to be connected with nuts and bolts that are shipped with the unit. Bolt holes are located inside the module frames near the corners, and in the base rail below the outside bottom corners of the module (due to various design criteria, some modules may have additional bolt holes along the inside of the module top, and should be used if present). Align modules, and insert bolts through the bolt holes of two adjacent modules, and secure with nuts to pull the two modules together tightly. Every bolt hole must be used to ensure a tight seal between modules, and a structurally stable assembly.

**NOTE**

All nuts, bolts, and gasketing required for assembly are packaged and shipped with unassembled unit orders.

***Figure 4.4, Bolted Base Rail***



## Sealing

It is very important to keep outside air from infiltrating the unit cabinet. Seal all piping penetrations with Armaflex, Permagum, or other suitable sealant. Also seal around drain connections, electrical connections, and all other inlets where air may enter the cabinet. This is especially important when the unit is installed in an unconditioned area.

## Cooling Equipment

Air Handler Equipped with Refrigerant Coil (DX)

This section is not intended to provide all the information required by the designer or installer of the refrigerant piping between the condensing units and the air handler. The appropriate sections of the ASHRAE Guide and the ASME standards should be used for final information. Acceptable system design and installation will include consideration as follows:

- Piping from the condensing unit to the indoor air handler is the responsibility of the installing contractor.
- Only clean “ACR” tubing should be used.
- Piping should conform to generally accepted practices and codes.
- Care must be taken not to cross the circuits on multiple circuit systems.
- Once piped, the interconnecting piping and air handler **MUST BE** evacuated to 50 microns or less; leak checked and charged with refrigerant.
- Make sure air handler thermal expansion valve bulb is mounted with good thermal contact on the correct suction line on a horizontal section, close to the evaporator in the 4 or 8 o’clock position and well insulated. Care must be taken to ensure the bulb is mounted on the correct suction line on multiple circuit systems.
- The suction line (and hot gas bypass line if present) should be insulated for its entire length

Lines should be fastened and supported according to local codes.

Air Handler Equipped with Chilled Water Coil

Water supply lines must be insulated with closed cell type pipe insulation or insulation that includes a vapor barrier. Lines should be properly fastened, drained and supported according to local code requirements.

## Heating Equipment

When heat is called for, the cooling section is inoperable except for the indoor blower motor. Actual heating is accomplished by the air handling unit with hot water, steam or electric heating capabilities.

Air Handler Equipped with Hot Water Coil

Water supply lines must be insulated, properly fastened, drained and supported according to local code requirements.

Air Handler Equipped with Steam Coils

The air handling unit **MUST BE** installed high enough to allow for a minimum of one foot (1’) condensate drop leg off of the steam coil (or as recommended by the steam trap manufacturer). Lines should be insulated with approved insulation and be properly fastened, sloped and supported according to local code requirements.

Air Handler Equipped with Electric Heating

INSTALLATION IS TO BE ADJUSTED TO OBTAIN AN AIR TEMPERATURE RISE WITHIN THE RANGE SPECIFIED ON THE RATING PLATE.

Heating is accomplished by passing electrical current through a specified amount of resistance heaters which will produce the required heat. The indoor blower motor will energize at the same time as the heaters. Wiring to the air handler must be done in accordance with local electrical codes and/or standards. Check specified electrical rating and install with proper wire size.

## Condensate Piping

If the air handler is equipped with cooling, a drain trap must be connected to the drain pan at the unit. A condensate connection is provided on each side of the unit. Condensate piping should be installed according to local codes. The line should be the same pipe size as the drain nipple and should pitch downward toward the building drain.

All cooling coils must have drain pans equipped with “P” traps to avoid pulling air from outside the unit back through the drain line. The “P” trap is factory supplied, and is shipped loose in the control access compartment for field installation. A plug is provided for the unused condensate connection. The trap should be located in warm ambient spaces. An additional drain pan may be installed under the air handler, and should include a separate drain line for overflow from the primary drain. An air break should be used with long runs of condensate lines.

Drain pans in any air conditioning equipment, even when they have a built-in slope to the drain, will have moisture present and will require periodic cleaning to prevent any build-up of algae or bacteria. Cleaning of the drain pans will also prevent any possible plugging of the drain lines, and overflow of the pan itself. Some means to clean out the “P” trap should be provided. Only qualified personnel should clean drain pans, drain lines, or the insides of equipment.

## Electrical

Check the unit data plate to make sure it agrees with the power supply. Connect power to the unit according to the wiring diagram provided with the unit.

The power and control wiring may be brought in through the holes provided on the unit. Protect the branch circuit in accordance with code requirements.

If the control wires are to run inside the same conduit, use 600-volt wire or as required by applicable codes.

The units must be electrically grounded in accordance with the National Electric Code, ANSI / UL 1995 when installed if an external source is utilized; in Canada use current C.S.A. Standard C22.2, No. 236, Canadian Electric Code Part 1.

Power wiring is to the unit terminal block. The manufacturer has done all wiring beyond this point. Power can be applied to the unit after the control wiring is connected, and start up checks are complete.

### Thermostat

The low voltage room thermostat should be located on an inside wall 4 to 5 feet a above the floor where it will not be subjected to drafts, sun exposure or heat from electrical fixtures or appliances. Control wire size must be large enough to prevent excess voltage drop that may cause improper operation of the equipment. Follow manufacturer's instructions enclosed with thermostat for general installation procedure.

### Filters

Open filter access door and slide correct filter in with arrow pointing towards the blower in the direction of airflow.

## 5. Refrigerant Piping & Line Sizing Information

THIS SECTION IS FOR INFORMATION ONLY, AND IS NOT INTENDED TO PROVIDE ALL THE INFORMATION REQUIRED BY THE DESIGNER OR INSTALLER OF THE REFRIGERANT PIPING BETWEEN THE CONDENSING UNITS AND THE LOW SIDE COMPONENTS. AAON, INC. IS **NOT** RESPONSIBLE FOR INTERCONNECTING REFRIGERANT PIPING. THE APPROPRIATE SECTIONS OF THE **ASHRAE GUIDE** AND THE **ASME STANDARDS** SHOULD BE USED FOR FINAL INFORMATION.

The piping between the condenser and low side must assure:

1. Minimum pressure drop, and
2. Continuous oil return, and
3. Prevention of liquid refrigerant slugging, or carryover

Acceptable system design and installation will include consideration as follows.

### General

Use only clean type L copper tubing (type K for underground) that has been joined with high temperature brazing alloy.

**The pipe sizes must be selected to meet the actual installation conditions, and not simply based on the connection sizes at the evaporator and/or condensing unit.**

When sizing refrigerant lines, cost considerations favor keeping line sizes as small as possible. However, excessive suction or discharge line pressure drops cause loss of compressor capacity and increased power usage, resulting in reduced system efficiency. Furthermore, excessive liquid line pressure drops can cause the liquid refrigerant to flash resulting in faulty expansion valve operation.

Correct sizing must be based on minimizing cost and maximizing efficiency. Pressure drop calculations are referenced as normal pressure loss associated with a change in saturation temperature of the refrigerant. Typically, the refrigeration system will be sized for pressure losses of 2°F or less for each segment of the discharge, suction, and liquid lines.

### Liquid Line Piping

Systems are normally designed so that the pressure drop in the liquid line (due to friction) is not greater than that corresponding to an approximate 1 to 2°F change in saturation temperature. Liquid sub cooling is the only method of overcoming the liquid line pressure loss to guarantee presence of liquid at the expansion device in the evaporator.

If the sub cooling is insufficient, flashing will occur within the liquid line and the system efficiency will suffer. Accessories such as solenoid valves, filter driers, and hand valves, as well as the actual pipe, fittings between the receiver, or condenser outlet, and the metering device cause friction pressure drops in the liquid line. Liquid line risers are also a source of pressure loss, and add to the total loss of the liquid line. The loss due to risers is approximately 0.5 PSI per foot of liquid lift. The total loss is the sum of all friction losses plus the pressure loss from liquid risers.
If the refrigeration system has no liquid risers, and the evaporator is below the condenser/receiver, then it benefits from a gain in pressure due to liquid weight, and can tolerate larger friction losses without flashing. When flashing takes place, regardless of the routing of

the liquid lines, the overall efficiency is reduced, and the system may malfunction.

A pressure loss of 3 psi in the liquid line results in a 1°F loss of sub-cooling temperature with R-22.

***Table 5.1, R-22 Liquid Line Capacity w/ 3 PSI (1°F) Pressure Loss per 100 Feet at 100°F Liquid***

| Line Size (In.) | Max. Tons |
|---|---|
| 1/2 | 4.0 |
| 5/8 | 7.6 |
| 7/8 | 19.1 |

Note: The equivalent feet for a piping system must include the equivalent length of straight tubing for all the fittings, and any valves that are added to the system.

## Suction Line Piping

Suction lines are more critical than liquid lines and discharge lines from a design and construction standpoint. The proper return of oil to the compressor(s) is critical, and depends on maintaining sufficient velocity in the suction lines to carry the oil along with the refrigerant gas. Simultaneously, high refrigerant velocities in the suction line bring high-pressure losses that reduce capacity.

Suction lines should be sized to:

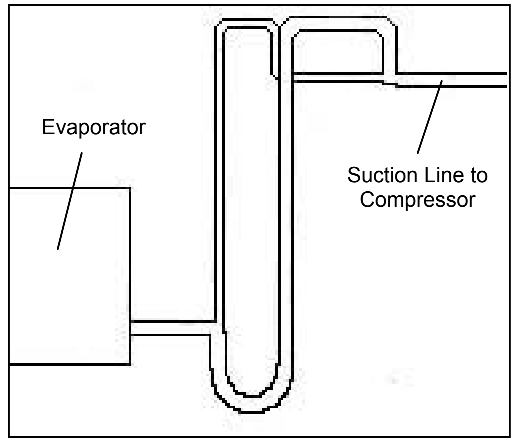
1. Provide minimum pressure drop at full load, and
2. return oil from the evaporator to the compressor under minimum load conditions, and
3. prevent oil from draining from an active evaporator into an idle one.

Over sizing of suction lines results in poor oil return to the compressor. Therefore, minimum suction gas velocity of 750 fpm in horizontal runs, and 1500 fpm in vertical runs is necessary.

A pressure drop in the suction line reduces a system's capacity because it forces the compressor to operate at a lower suction pressure to maintain a desired evaporating temperature in the coil. The suction line is normally sized to have a pressure drop from friction no greater than the equivalent of an approximate 2°F change in saturation temperature.

If oil is entrained up vertical risers at partial loads, and pipe size must be reduced to provide sufficient gas velocity, then greater pressure drops are imposed at full load. These pressure drops can usually be compensated for by over sizing the horizontal and down-run lines, and components. As shown in Figure 5.1, a double suction riser may be required in order to return oil at partial load.

***Figure 5.1, Double Suction Riser Example***




All vertical suction risers should be checked to confirm that oil will be returned to the compressor. Use the tables in this section for pipe sizing information.

***Table 5.2, Minimum Tons of Capacity to Carry Oil Up a Suction Riser at 40°F Saturated Suction***

| Line Size (In.) | Min. Tons |
|---|---|
| 5/8 | .3 |
| 7/8 | .8 |
| 1 1/8 | 1.6 |
| 1 3/8 | 2.8 |
| 1 5/8 | 4.4 |

All suction lines must be pitched in the direction of flow and supported to maintain their position. Full insulation must be used between the evaporator and condensing unit.

Suction accumulators are not included with AAON equipment (except with air source heat pumps), and must be field furnished and installed if required by job conditions.

***Table 5.3, R-22 Suction Line Capacity w/ 3 PSI (2°F) Pressure Loss per 100 Feet at 40°F Saturated Suction***

| Line Size (In.) | Max. Tons |
|---|---|
| 5/8 | 1.1 |
| 7/8 | 2.7 |
| 1 1/8 | 5.5 |
| 1 3/8 | 9.3 |
| 1 5/8 | 14.9 |

<u>Discharge Lines</u>

Discharge (hot-gas) lines should be designed to:

1. Avoid trapping oil at part-load operation, and
2. prevent condensed refrigerant and oil in the line from draining back to the head of the compressor, and
3. avoid developing excessive noise from either hot-gas pulsations, compressor vibrations, or both.

Pressure loss in hot-gas lines increases the required compressor power per unit of refrigeration, and decreases the compressor capacity. Pressure drop is minimized by over sizing the lines for low friction losses while maintaining refrigerant line velocities to entrain and carry oil at all loading conditions. Normally, pressure drop is designed not to exceed the equivalent of a 2°F change in saturation temperature, while recommended sizing is based on a 1°F change in saturation temperature.

## Other Piping

### Hot Gas Bypass Lines (Optional)

The hot gas bypass option is a system that maintains evaporator pressure at or above a minimum value in order to prevent the coil from freezing, and to keep refrigerant velocity high enough for proper oil return when operating at a light load.

Pressure drop in the hot gas line is normally designed not to exceed the equivalent of a 2°F change in saturation temperature with R-22. See Table 5.4 below that is based on a 1°F change in saturation temperature.

Hot gas bypass lines must be insulated to minimize heat loss and condensation of gas inside the piping and to prevent injury from high temperature surfaces.

See Section 8 of this manual for more information about hot gas bypass.

***Table 5.4, R-22 Hot Gas Bypass Line Capacity w/ 3 PSI (1°F) Pressure Loss per 100 Feet at 40°F Saturated Suction***

| Line Size (In.) | Tons |
|---|---|
| 1/2 | .9 |
| 5/8 | 1.6 |
| 7/8 | 4.1 |
| 1 1/8 | 8.4 |
| 1 3/8 | 14.2 |

### Minimum Gas Velocities for Oil Transport in Risers

On multiple compressor installations, the lowest possible system loading should be calculated with a riser size selected to give at least the minimum capacity for successful oil transport. Some installations will have excessive pressure drop at maximum load when multiple compressors exist with capacity control, a vertical hot-gas line, and that are sized to transport oil at minimum load. A double riser, or a single riser with an oil separator can be used to correct this problem.

### Double Hot-Gas Risers

A double hot-gas riser can be used the same way it is used in a suction line. Figure 5.1 shows the double riser principle.

### Single Riser and Oil Separator

Alternatively, an oil separator located in the discharge line, just before the riser, permits sizing the riser for a low-pressure drop. Any oil draining back down the riser accumulates in the oil separator. With large multiple compressors, the capacity of the separator may dictate the use of individual units for each compressor located between the discharge line, and the main discharge header. Horizontal lines should be level, or pitched downward in the direction of gas flow in order to facilitate travel of oil through the system, and back to the compressor.

### Piping to Prevent Liquid and Oil from Draining to Compressor Head

Whenever the condenser is located above the compressor, the hot-gas line should be trapped near the compressor before rising to the condenser, especially if the hot-gas riser is long. This minimizes the possibility that refrigerant, condensed in the line during off cycles, will drain back to the head of the compressor. Also, any oil traveling up the pipe wall will not drain back to the compressor head.

The loop in the hot-gas line serves as a reservoir and traps liquid resulting from condensation in the line during shutdown, thus preventing gravity drainage of liquid, and oil back to the compressor head. A small high-pressure float drainer should be installed at the bottom of the trap to drain significant amounts of refrigerant condensate to a low side component such as a suction accumulator, or low-pressure receiver.

This float prevents excessive liquid buildup in the trap, and reduces the potential for “liquid hammer” when the compressor is restarted.

In order to prevent gas from active compressors from condensing on the heads of idle compressors in multiple compressor arrangements, each discharge line should have a check valve. For single-compressor applications, a tightly closing check valve should be installed in the hot-gas line of the compressor whenever the condenser, and the receiver ambient temperature are higher than that of the compressor. The check valve prevents refrigerant from boiling off in the condenser, or receiver, and condensing on the compressor heads during off cycles. The check valve should be a piston type that closes by gravity when the compressor stops running.

## ECat32 Refrigerant Piping Calculator

This program contained in the *AAON Engineering Tools* section of AAON’s ECat32 equipment rating and selection software can be used to size liquid, discharge, and suction lines.

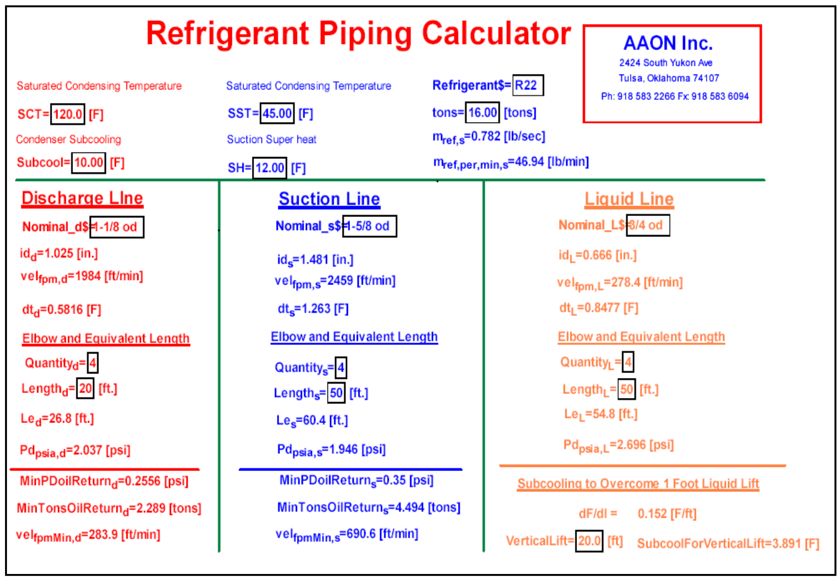
The program calculates the equivalent length as the sum of the actual length plus the number of elbows times the equivalent length per elbow. Pressure drop of other components should be incorporated using the *ASHRAE Refrigeration Handbook* to determine fitting, and valve losses in equivalent lengths of pipe. Additional losses should be added to the total length before calculation.

***Table 5.5, Fitting Losses in Equivalent Feet of Straight Copper Tubing***

| Tubing Size (In.) | 90° Std. | 90° Long Rad. | 90° Street | 45° Std. | 45° Street | 180° Std. |
|---|---|---|---|---|---|---|
| 1/2 | 1.4 | .9 | 2.3 | .7 | 1.1 | 2.3 |
| 5/8 | 1.6 | 1.0 | 2.5 | .8 | 1.3 | 2.5 |
| 7/8 | 2.0 | 1.4 | 3.2 | .9 | 1.6 | 3.2 |
| 1 1/8 | 2.6 | 1.7 | 4.1 | 1.3 | 2.1 | 4.1 |
| 1 3/8 | 3.3 | 2.3 | 5.6 | 1.7 | 3.0 | 5.6 |
| 1 5/8 | 4.0 | 2.6 | 6.3 | 2.1 | 3.4 | 6.3 |

Note: The equivalent feet for a piping system must include the equivalent length of straight tubing for all the fittings, and any valves that are added to the system.

***Figure 5.2, AAON Ecat32 Screenshot: Refrigerant Piping Calculator***



# 6. Start-Up

## General

**CAUTION**

Equipment power should be on at least 24 hours before start-up to allow the crankcase heater to boil off refrigerant that may have accumulated in the compressor oil.

ONLY QUALIFIED, AUTHORIZED PERSONNEL SHOULD POWER ON, OR START-UP THIS EQUIPMENT.

The use of common sense, and good practice in the installation, and start-up of equipment will prevent many potential problems with the system in the future.

Before starting up the equipment, building construction should be complete, and start-up personnel should:

- Have a working knowledge of general HVAC and mechanical commissioning procedures and practices;
- Be familiar with unit functions, features, optional unit accessories, and all control sequences;
- Have appropriate literature on hand for consultation.

**CAUTION**

Equipment operation during construction is not recommended. Construction site pollution can affect unit operation, and seriously degrade performance. Operation during construction will void all manufacturer's warranties.

Before the structure is occupied, the installation, and/or start-up personnel must take three essential steps:

1. Check Out
2. Start-Up
3. Commissioning

Check Out

Equipment should be thoroughly checked for loose wiring, a free spinning blower wheel, and well fitting access panels. Air handlers should not be operated without proper ductwork and access panels installed, except as required during start-up and air balancing.

1. Check all electrical connections to be sure they are tight.
2. Open all access panels, and remove all shipping screws, or restraints.
3. Clean out any debris that may have been left.
4. Check belt alignment, and tightness of fan drives.
5. Check bearing locking collars, and fan wheel set screws for tightness.
6. Turn fan wheels to assure free rotation.
7. Ensure electrical supply matches the unit nameplate.
8. Ensure condensate lines are connected, and glued.
9. Check local codes for any special provisions.
10. Replace, and/or close all access panels.
11. Ensure that return, and/or supply dampers in ductwork are open.

Start-Up

**NOTE**

Failure to adhere to the following start-up procedures will void all manufacturer's warranties.

Install gauges, voltmeter, and ammeter before start-up. Observe refrigerant pressures during initial operation. Note, and determine the cause of any excessive sound, or vibration. Follow start-up procedures outlined below to start each piece of equipment.

## Procedures

**NOTE**

Completed factory test sheets are in the equipment literature packet shipped inside the unit. Factory run-test readings recorded on the test sheets for may be helpful to reference during start-up.

Electric Heating Section:

1. Perform final visual inspection. Check all equipment, ductwork, and piping to verify that all work is complete, and equipment is

properly installed and mounted. Improperly installed equipment, or ductwork can affect readings.
2. Ensure there is no construction debris in the unit.
3. Check the unit for external damage.
4. Note all accessories installed.
5. Install a filter of the proper size and type.
6. Check all terminal blocks, fuses, fuse blocks, and contactors for correctness.
7. Check all high and low voltage wiring connections for correctness, and tightness.
8. Check unit for correct incoming voltage per the data plate.
9. Check the security of the locking system on all blower bearings
10. Turn the unit power on.
11. Turn the unit blower on, and check for correct rotation.
12. If correct, take blower amp readings, and compare to see if the amp draw is within the safety factor area of the motor. Once correct, turn blower off.
13. Turn on the first stage of heating
    - Check amp draw of each element of each stage
    - Ensure blower started w/ electric heat
    - Check for temperature rise across heating section while all stages are on
    - If temperature rise is within range, turn all heating calls off
    - Check to see that blower stops
14. If equipped with an economizer, when testing of cooling circuits is complete, turn cooling circuits off, and leave blower running.
15. Call for the economizer circuit to operate.
16. Check for economizer blades to open fully with no binding.
17. If equipped with power exhaust, check that it will operate with the economizer circuit.
18. Take power exhaust motor amp readings.

Refrigerant (DX) Cooling Section:

1. Perform final visual inspection. Check all equipment, ductwork, and piping to verify that all work is complete, and equipment is properly installed and mounted. Improperly installed equipment, or ductwork can affect readings.
2. Perform condenser start-up checks in addition to these air handler checks according to the condenser manufacturer's instructions.
3. Ensure there is no construction debris in the unit.
4. Check the unit for external damage.
5. Note all accessories installed.
6. Install filter of the proper size and type.
7. Ensure that drain P-trap is installed.
8. Check all terminal blocks, fuses, fuse blocks, and contactors for correctness.
9. Check all high, and low voltage wiring connections for tightness. Check unit for correct incoming voltage per the data plate.
10. Check the security of the locking system on all blower bearings
11. Turn the unit power on.
12. Turn the unit blower on, and check for correct rotation.
13. If correct, take blower amp readings, and compare to see if the amp draw is within the safety factor area of the motor.
14. Check, and record ambient temperature.
15. Check for Guaranteed Off Timers (GOT), and/or Time Delay Relays (TDR).
16. Start the first stage cooling circuit, and blower circuit.
17. After all stages of cooling have been on for at least five minutes, record the return air temperature, and supply air temperature.
18. Check the temperature difference across the evaporator coil.
19. If equipped with an economizer, after testing of cooling circuits is complete, turn cooling circuits off, and leave blower running.
20. Call for the economizer circuit to operate.
21. Check for economizer blades to open fully with no binding.
22. If equipped with power exhaust, check that it will operate with the economizer circuit.
23. Take power exhaust motor amp readings.

Optional Equipment

Operation of each of the following, if equipped in the unit, must be checked according to that item's manufacturer's specifications:

- Clogged filter switch
- Magnehelic gauge
- Supply air smoke detector
- Return air smoke detector
- Return air fire stat
- Supply air fire stat
- Phase and brownout monitor
- Ground fault circuit interrupter outlet
- Low limit control
- Duct stats
- Hot gas reheat
- Hot gas bypass
- Compressor lockout/ Low ambient
- Heat wheel drive motor
- Null pressure switch

Commissioning

The commissioning of an air conditioning system is the process of achieving, verifying, and **documenting** the performance of that system to meet the operational needs of the building. This may not be a formal process in smaller structures, such as a normal residence, but some form of owner acceptance will occur. Adjustments made during the commissioning phase may include air, or water balancing, or configuration of controls, and operational sequences.

### Air Balancing

High performance systems commonly have complex air distribution and fan systems. Unqualified personnel should not attempt to adjust fan operation, or air circulation, as all systems have unique operating characteristics. Professional air balance specialists should be employed to establish actual operating conditions, and to configure the air delivery system for optimal performance.

### Water Balancing

A hydronic specialist with a complete working knowledge of water systems, controls, and operation must be employed to properly balance the entire system. Unqualified personnel should not attempt to manipulate temperatures, pressures, or flow rates, as all systems have unique operating characteristics, and improper balancing can result in undesirable noises and operation.

### Controls

A variety of controls and electrical accessories may be provided with the equipment.

Identify the controls on each unit by consulting appropriate submittal, or order documents, and operate according to the control manufacturer's instructions. If you cannot locate installation, operation, or maintenance information for the specific controls, then contact your sales representative, or the control manufacturer for assistance.

**WARNING**

Do not alter factory wiring. Deviation from the supplied wiring diagram will void all warranties, and may result in equipment damage or personal injury. Contact the factory with wiring discrepancies.

## 7. Operation & Maintenance

### General

Immediately following building occupancy, the air conditioning system requires a maintenance schedule to assure continued successful operation. A maintenance program similar to the example given below should be scheduled for routine maintenance of this equipment in order to provide continued efficient, and reliable operation for the owner.

### Maintenance Schedule

One week after start-up:

- Check refrigerant charge. Evacuate and repair coil if leaking.
- Adjust belt tension on all fan drives.
- Check filters for cleanliness. Measure pressure loss if applicable. Replace if necessary.
- Check cycling of compressors, fans, and valves. Correct unusual cycling.

Monthly:

- Lubricate bearings if operating continuously at 1500 rpm, or higher, or in other extreme conditions.
- Check cleanliness of filters, and replace if necessary.
- Check cooling coil drain pan to assure proper drainage.
- Inspect evaporator, and condenser coils. Clean if dirty, or obstructed in any way.

Quarterly:

- Lubricate bearings if operating at 1000 rpm, or less, and in temperatures less than 150°F, or other extreme conditions.
- Check damper operation for freedom of movement. Correct any binding that may occur.
- Check belts, and pulleys on all fan drives for tension, and unusual wear.
- Check operation of heating, and cooling section if seasonal.
- Check inlet, and outlet air temperatures. Determine cause for abnormal changes.

Annually:

- Clean the condenser, and evaporator coils with steam, or a non-corrosive coil cleaner.

- Clean the drain line, "P" trap, and condensate pan.
- Check refrigerant pressures, and temperatures every Spring, and correct unusual operation.
- Check heating section every Fall. Check all electrical connections for tightness, and check heater elements for indications of overheating. Determine cause and replace elements if necessary.

## Blower Assembly

AAON air handlers use backward inclined airfoil blower wheels that are non-overloading, very efficient, and very easy to clean. Clean blower wheels are necessary to reduce electrical use, maintain capacity and reduce stress on the unit. The blower wheel, and blower section need to be inspected periodically, and cleaned of dust, or debris.

To inspect and clean the blower; set thermostat to the "OFF" position; turn the electrical power to the unit to the "OFF" position at the disconnect switch. Clean the assembly, check the bearings for looseness, inspect the belt condition and tightness, check screws for tightness, rotate blower wheel while listening close to each bearing to check for noise or roughness in the bearing, which indicates a failing bearing.

### Bearings

AAON uses pre-lubricated bearings, and bearings that have been sized for an average failure rate of 50% after 200,000 hours, or 22.8 years, of operation (see heading "Lubrication" in this section for more information). The bearing sizing tables below are based on rotational speeds, and radial loading. However, the alignment of the bearing to the shaft, and the security of the bearing inner race to the shaft will greatly affect bearing life. Even though the manufacturer is responsible for bearing tolerances, and mounting design, **the installer is advised to check the security of the bearing locking system before start-up**.

***Table 7.1, Bearing Setscrew Torque Recommendations***

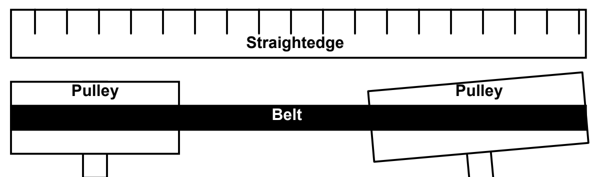
| Shaft Size (In.) | Setscrew Locking | | Skewzloc Locking | |
|---|---|---|---|---|
| | Thread | Torque (In-Lbs) | Thread | Torque (In-Lbs) |
| 1 | 1/4 - 28 | 66 - 85 | 8 - 32 | 63 - 70 |
| 1 3/16 | 1/4 - 28 | 66 - 85 | 8 - 32 | 63 - 70 |
| 1 7/16 | 5/16 - 24 | 126 - 164 | 10 - 24 | 81 - 90 |
| 1 7/8 | 3/8 - 24 | 228 - 296 | 1/4 - 20 | 162 - 180 |

### Belts

Belt drive misalignment is one of the most common causes of premature belt failure. A belt can be destroyed in a matter of days if the drives have been aligned incorrectly.

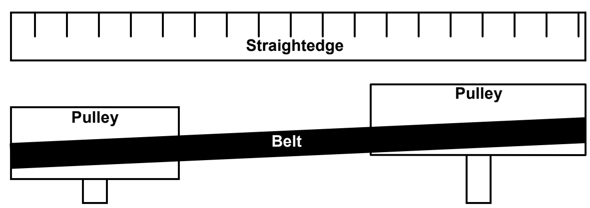
The most common tool for measuring misalignment is a straightedge. Hold the straightedge flush across one pulley to gauge the degree of misalignment of the two sheaves. The maximum allowed misalignment is one half degree of angular misalignment, and 1/10$^{th}$ of an inch per foot between sheave centers for parallel misalignment.

***Figure 7.1, Angular Misalignment***




*Corrected by moving the position of the motor.*

***Figure 7.2, Parallel Misalignment***

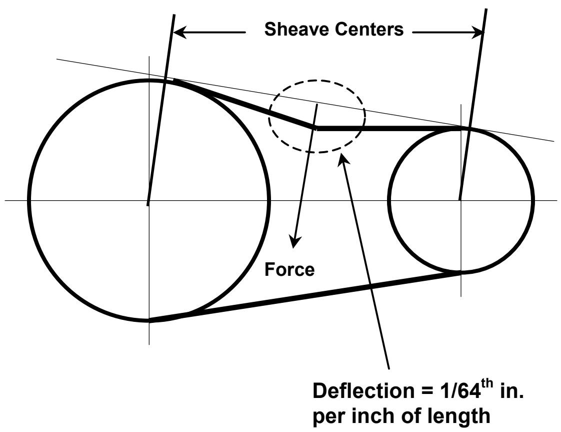



*Corrected by adjusting sheaves on one, or both shafts.*

Frequent belt tensioning is highly recommended. Most belt manufacturers would suggest a retensioning after as little as 8 hours of operation. A simplified method of adjusting tension is to gauge the amount of force required to deflect the belt by 1/64$^{th}$ of an inch per inch of distance between sheave centers. For example, if the sheaves are 20 inches apart, then the amount of deflection with the forces listed below is 20/64$^{th}$ (5/16$^{th}$) of an inch.

Deflections required for:
"A" belts: 4 to 6 lbs.
"B" belts: 6 to 10 lbs.
"C" belts: 10 to 18 lbs.

*Figure 7.3, Belt Deflection*




## Coils

Coils should be inspected and cleaned annually to ensure there is no obstruction to airflow.

### Evaporator (Indoor/Cooling Coil)

Dirty evaporator coils will eventually freeze up, and often result in a time consuming, and expensive service call. Clean filters will help to prevent dirt from accumulating on the evaporator, however the evaporator should be cleaned annually with a soft bristled brush, and/or a non-corrosive coil cleaning solution.

### Condenser (Outdoor Coil)

One of the most overlooked maintenance requirements is the need to keep air moving freely across air-cooled condensing coils. Dirty condensers, like evaporators, can significantly increase cooling costs during the year. As a minimum, clean the condenser coil at the beginning of each cooling season. It is preferable to use a medium pressure water spray from the inside of the condenser cabinet with a non-corrosive coil cleaning solution. TURN OFF all power to the unit before cleaning.

Comb out any visible exterior fin damage to help maintain unit efficiency. Clean the fan blades if they are dirty. Always check condenser fan blades to ensure unobstructed, free rotation after manipulating the unit cabinet in any way, and before turning power back on to the condenser.

## Refrigeration Cycle

Satisfactory performance of the refrigeration cycle can be determined by measuring suction line superheat. In order to determine if refrigerant flowing from the evaporator is dry, ensure that the system has enough refrigerant to produce liquid line subcooling, but not so much to cause abnormally high condensing temperatures (and pressures). Refrigerant cycle analysis is best performed in conditions that approach the conditions where the air conditioner will be expected to operate.

### Superheat

Superheat is the extra heat in vapor when at a temperature higher than the saturation temperature corresponding to its pressure. To determine the superheat, measure the temperature of the suction line (insulate the temperature probe from surrounding air), and read the suction line pressure. The difference between the suction line temperature, and the temperature indicated on a refrigerant pressure-temperature chart (see inside back cover) at the suction line pressure is the degree of superheat.

### Subcooling

Subcooling enhances unit capacity, and assures that only liquid appears at the threshold of the expansion valve, also prolonging expansion valve life, and providing better expansion valve control. Subcooling is determined by measuring the difference between the temperature of liquid refrigerant as it leaves the condenser coil, and the temperature indicated on a pressure-temperature chart at the pressure measured in the liquid line.

### Determining Charge

Table 7.2 shows expected discharge superheat levels in R-22 systems when properly charged. To determine proper charge using this table, do the following:

1. Connect manifold gauges to the unit, and allow the unit to operate for at least 5 minutes in order to allow system pressures to stabilize.
2. Attach thermocouples to discharge line, and take temperature measurement.
3. Measure suction, and discharge pressures, and convert to saturated temperatures using the temperature-pressure chart.
4. Subtract saturated condensing temperature from measured discharge line temperature to get discharge line superheat.

5. If the discharge superheat measured does not agree with the values in Table 7.2, then adjust the charge (see heading “Charging” in this section).

If the superheat is 5°F higher than shown, then the system is ***undercharged***.

If the superheat is 5°F lower than shown, then the system is ***overcharged***.

***Table 7.2, R-22 Discharge Superheat Temperatures, °F***

| Saturated Suction Temp. | Saturated Condensing Temperature | | | | | | |
|---|---|---|---|---|---|---|---|
| | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 34 | 64.2 | 67.6 | 70.9 | 74.0 | 77.0 | 79.7 | 82.1 |
| 36 | 62.4 | 65.7 | 68.9 | 72.0 | 75.0 | 77.7 | 80.1 |
| 38 | 60.7 | 63.8 | 67.0 | 70.1 | 73.0 | 75.7 | 78.2 |
| 40 | 59.0 | 62.0 | 65.1 | 68.1 | 71.0 | 73.8 | 76.3 |
| 42 | 57.3 | 60.3 | 63.3 | 66.3 | 69.1 | 71.9 | 74.4 |
| 44 | 55.7 | 58.6 | 61.5 | 64.4 | 67.3 | 70.0 | 72.6 |
| 46 | 54.0 | 56.8 | 59.7 | 62.6 | 65.5 | 68.2 | 70.8 |
| 48 | 52.4 | 55.2 | 58.0 | 60.8 | 63.7 | 66.4 | 69.1 |
| 50 | 50.9 | 53.5 | 56.3 | 59.1 | 61.9 | 64.7 | 67.3 |
| 52 | 49.3 | 51.8 | 54.5 | 57.3 | 60.1 | 62.9 | 65.6 |
| 54 | 47.7 | 50.2 | 52.8 | 55.6 | 58.4 | 61.2 | 63.9 |

## Charging

The following charging methods apply to TXV systems only as manufactured and sold by AAON.

The system should be charged during warm weather, however there are times when systems must be charged during colder weather. Charging in cold weather, while not as simple as it would otherwise be, is possible to accomplish contrary to popular belief.

### Warm Weather Charging

If you are charging in warm, or hot weather, above outdoor ambient temperatures of 65°F, then use the standard superheat charging method by first determining the superheat as described in the previous section, “Refrigerant Cycle”. If the system is undercharged, add refrigerant according to Table 7.2. If the system is overcharged, then recover refrigerant according to Table 7.2.

### Cold Weather Charging

If you are charging in cool, or cold weather, below outdoor ambient temperatures of 65°F, then you should “weigh in” the refrigerant charge. Therefore, you must have a refrigerant scale in order to charge during cold weather, and if you are complying with all of the U.S. Environmental Protection Agency’s laws governing the use of refrigerants, then you will have a refrigerant scale available to use.

First, recover all refrigerant from the system, and evacuate to .05 microns. Next, create a false load on the system by running the building heat long enough to hold an indoor temperature between 70°F and 80°F for the charging period. Using a scale, weigh in the refrigerant nameplate charge. In AAON condensing units, the nameplate charge is enough refrigerant for the condenser, and 15 feet of line set. If you are not using an AAON condensing unit, then you must check that manufacturer’s literature for refrigerant charge specifications.

Additional line length, beyond 15 feet with AAON condensers, will require more refrigerant. Use Table 7.3 to determine how much refrigerant should be weighed into the system based on line set diameters, and lengths.

In extremely cold outdoor temperatures, it is helpful to warm up the refrigerant drum. Electric heating pads, an electric blanket, or simply a bucket of hot water can be used.

***Table 7.3, Weight of R-22 in Type L Copper Tubing (Pounds per 100 Feet)***

| Line Size (In.) | Liquid at 100°F | Suction at 40°F |
|---|---|---|
| 3/8 | 3.8 | .08 |
| 1/2 | 7.4 | .16 |
| 5/8 | 11.9 | .26 |
| 7/8 | 23.9 | .51 |
| 1 1/8 | 40.7 | .87 |
| 1 3/8 | 60.1 | 1.29 |
| 1 5/8 | - | 1.82 |

Remember that as you add, or take away refrigerant, system pressures must stabilize to obtain accurate readings. The time required for proper stabilization increases with the length, and overall size of the line set, and can vary by the amount of refrigerant in the system. Patience is required to properly charge any system.

If you are charging the system for the first time after installation, and start-up, then you are advised to return after a full week of cooling operation, as outlined in “Maintenance Schedule” of this section, in order to check that refrigerant is cycling properly throughout the system.

## Heating

Electric

Set thermostat in the heat mode; call for heat to engage all electric heat strips. Check blower for proper rotation and voltage. Measure the amperage and voltage. Compare them to the nameplate data.

If applicable, check remote heat pump condenser as per the manufacturer's recommendations.

Steam or Hot Water

Set thermostat in the heat mode. Observe supply blower for proper rotation and voltage. Check boiler or hot water operation according to the manufacturer's instructions. Check control flow valves for correct operation and settings per the manufacturer's instructions.

## Cleaning

Inspect and clean unit interior at the beginning of each heating and cooling season and as operating conditions require.

## Chilled Water

Check remote chiller operations as per the manufacturer's instructions. Check coolant flow valves for correct operation and settings.

## Lubrication

Most motors and bearings are permanently lubricated. Some applications, however, will require that bearings be re-lubricated periodically. The schedule will depend on the operating duty, temperature variations or other atmospheric conditions.

For bearings equipped with lubrication fittings the lubrication schedule is dependent on operating temperatures, and rotational speeds as shown in table 5 below. Lithium based grease conforming to an NLGI grade No. 2 consistency is recommended. This medium viscosity, low torque grease is rust inhibiting, and water-resistant. It is satisfactory for operating temperatures in the range of –10°F to 250°F.

Bearings should only be re-lubricated when at normal operating temperatures, and not running. Rotate the fan shaft by hand, adding only enough grease to purge the seals. A one-inch bearing has a total grease capacity of only .25 ounces. Added grease should be limited to .09 ounces.

**DO NOT OVER LUBRICATE!**

Recommended greases are:

- SHELL OIL – DOLIUM R
- CHEVRON OIL – SRI No. 2
- TEXACO INC. – PREMIUM RB

***Table 7.4, Fan Bearing Lubrication Schedule***

| Fan Speed | Temperature | Environment | Greasing Interval |
|---|---|---|---|
| 500 rpm | Up to 150 °F | Clean | 2 to 6 months |
| 1000 rpm | Up to 210 °F | Clean | 2 weeks to 2 months |
| 1500 rpm | Up to 210 °F | Clean | Monthly |
| Any Speed | Up to 150 °F | Dirty | 1 week to 1 month |
| Any Speed | 210 - 250 °F | Dirty | Weekly |

## Service

In the event the unit is not functioning correctly and a service company is required, only a company with service technicians qualified and experienced in both heating and air conditioning should be permitted to service the systems in order to keep warranties in effect. The service tech may call the factory if assistance is required.

BEFORE CALLING, THE MODEL AND SERIAL NUMBER OF THE UNIT WILL BE NEEDED FOR THE WARRANTY SERVICE DEPARTMENT TO HELP ANSWER QUESTIONS REGARDING THE UNIT.

AAON Coil Products
Phone: 1-903-247-9242
Fax: 903-236-4463

Warranty Department

## Filters

Open filter access door. Slide filters towards you and inspect. Replace old filters with the size indicated on each filter or as shown in Table 1.1. Be sure arrow points toward the blower. Filters should be checked every 30 days and replaced or cleaned as necessary.

IT IS IMPORTANT TO KEEP COILS, BLOWERS, AND FILTERS CLEAN!

# 8. Hot Gas Bypass

The purpose of (external) hot gas bypass (HGBP) is to prevent coil freeze-up and compressor damage from liquid slugging during periods of low airflow operation, or with low entering air temperatures.

HGBP is useful when the air conditioning system is subject to variations in load caused by varying air volume or large proportions of outside air. The HGBP valve meters discharge refrigerant gas to the distributor downstream of the expansion valve, and at the entrance to the evaporator distributor tubes. The quantity of gas varies to control a constant suction pressure, allowing more gas to flow as suction pressure decreases.

HGBP is available, factory installed, on AAON condensing units, and for use with modular air handlers, and all AAON split systems, in order to meet various design conditions. A modular air handler selected with DX cooling can be connected to a condensing unit that has also been prepared for HGBP to the evaporator coil. The option requires a third piping connection from the matching condensing unit. This connection must observe the same length and height restrictions as used for the liquid and suction piping. It is advisable to insulate the hot gas line, especially on long piping runs.

***Figure 8.1, Components of Hot Gas Bypass***

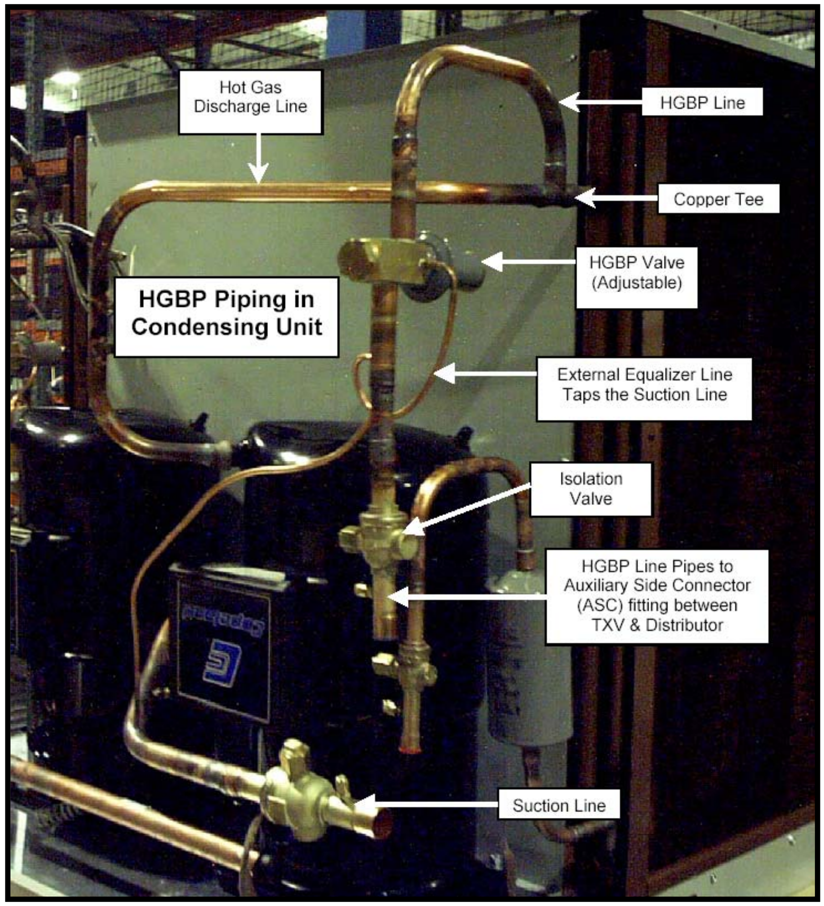



***Figure 8.2, External HGBP Piping***

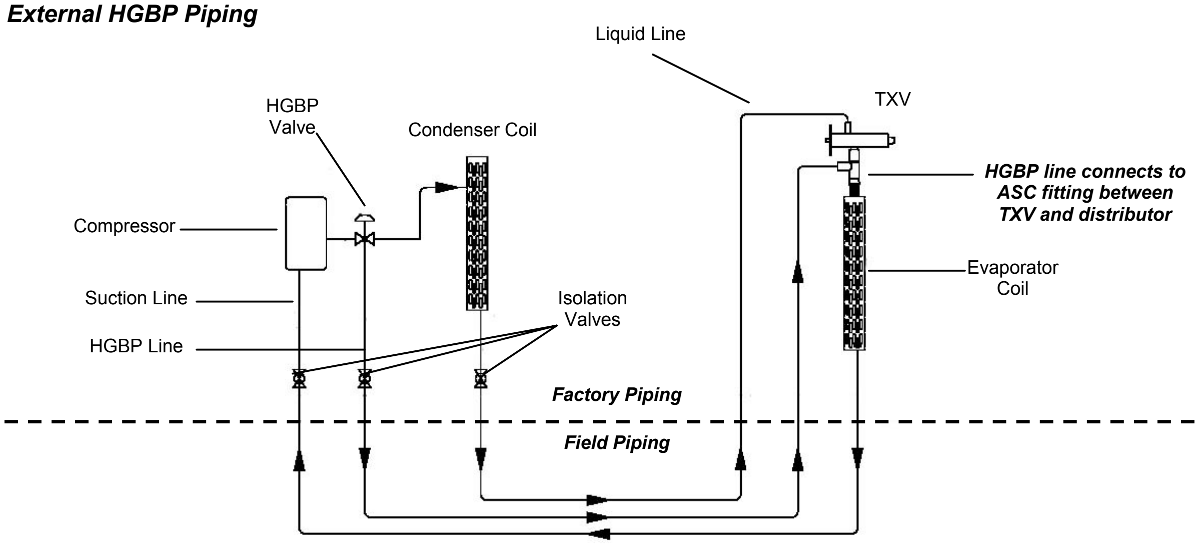


***Figure 8.3, HGBP Connection to Evaporator & ASC Fitting***

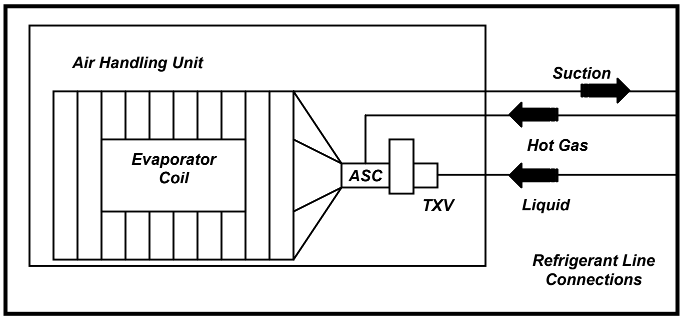
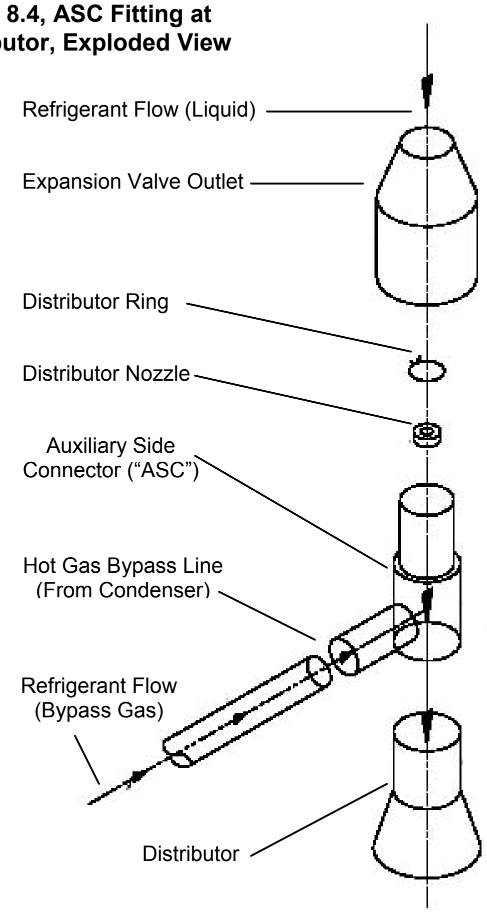



**Figure 8.4, ASC Fitting at Distributor, Exploded View**




The ASC fitting will come installed by the factory. Should you need to re-install the ASC fitting in the field, then do so according to the following procedure:

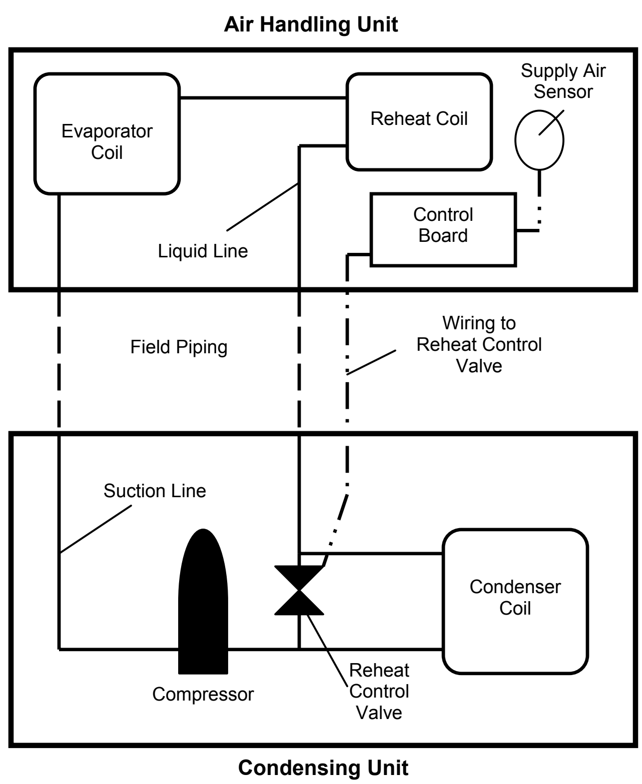
1. Install nozzle and ring in ASC (orientation as shown) – remove from distributor if necessary.
2. Install ASC on distributor inlet.
3. Install expansion valve on ASC inlet.
4. Install liquid line.
5. Install hot gas bypass line.

# 9. Hot Gas Reheat

Although the evaporator reduces moisture content from warm, moist air being conditioned, the space thermostat is a dry bulb device and will not call for refrigeration if outdoor and space temperatures are mild but very humid and the space temperature is satisfied. However, the humidity level may cause the space to be uncomfortable. A reheat system is used to correct this condition. To prompt operation of the air conditioning system, a humidistat is required and to avoid cooling the space excessively while removing moisture, a coil which accepts discharge gas from the compressor is located downstream of the evaporator. The function of this coil is to heat the air that has been cooled by the evaporator to approximate room temperature. A reheat valve is installed in the compressor discharge line to divert discharge gas to the reheat coil when the humidistat calls for dehumidification but returns all discharge gas to the condenser when cooling is required.

***Note: No additional piping is required for modulating hot gas reheat!***

***Figure 9.1, AAON's Modulating Reheat System***



After the room temperature thermostat is satisfied and the humidistat continues to call for moisture removal, the modulating valve will allow a controlled amount of hot gas to enter the reheat coil. A discharge air temperature sensor mounted within the air handling unit provides input to an electronic control board. The valve position is controlled to provide a specific supply air temperature set point that is set on the control board, or sent to the control board by a remote 0 to 10 VDC signal.

Since the controlled amount of hot gas is inserted into the liquid line at the condensing unit, no additional piping is necessary from the condensing unit. Only the normal liquid and suction piping is required. The modulating hot gas valve is factory mounted and wired. The control board is shipped with a default setting for a neutral discharge air temperature of 75°F.

The only additional work required is to run the valve control wires to the outdoor unit. The factory setting can be overridden by connection to a 0 to 10 VDC signal from another control system.

Unlike some other manufacturers' cycling "on-off" reheat control solenoid valve that are poorly regulated, and produce unacceptable supply temperatures, AAON's modulating hot gas reheat system provides a controlled supply air temperature, and will meet most outside air requirements for handling enhanced latent capacity. The system can be designed with the outdoor air quantity to meet the design occupancy. When used in a make-up air application, even up to 100%, the unit controller can maintain the neutral supply air temperature under most conditions.

## 10. HGBP & HGRH Together

See appendices A and B for individual information about HGBP and HGRH.

If you still have questions about the installation or operation of either HGBP or HGRH after reading these sections, then please contact your AAON Sales Representative.

**NOTE**

**IMPORTANT!**

***HGRH*** **will always be on the 1st stage circuit only, and never on the second stage circuit, when ordered on an AAON condensing unit.**

***HGBP*** **will always be on both 1st and 2nd stage circuits, and never only on one circuit, when ordered on an AAON condensing unit.**

**These rules apply even when HGRH and HGBP exist together on the same system.**

*Figure 10.1, Components of Hot Gas Bypass & Hot Gas Reheat*

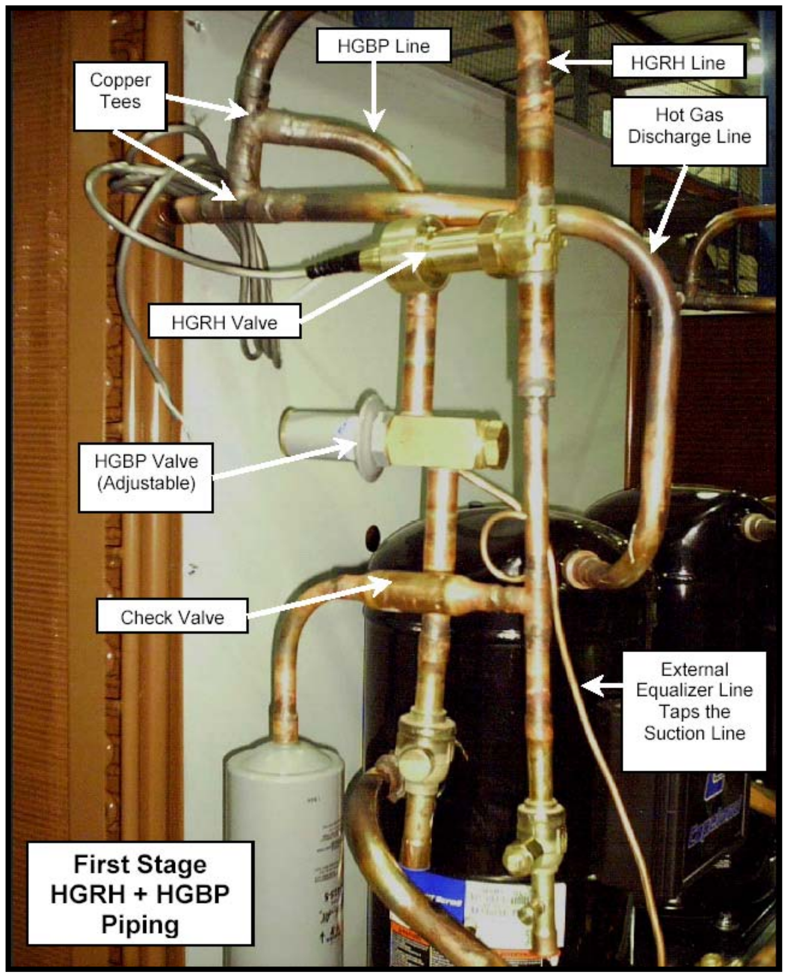
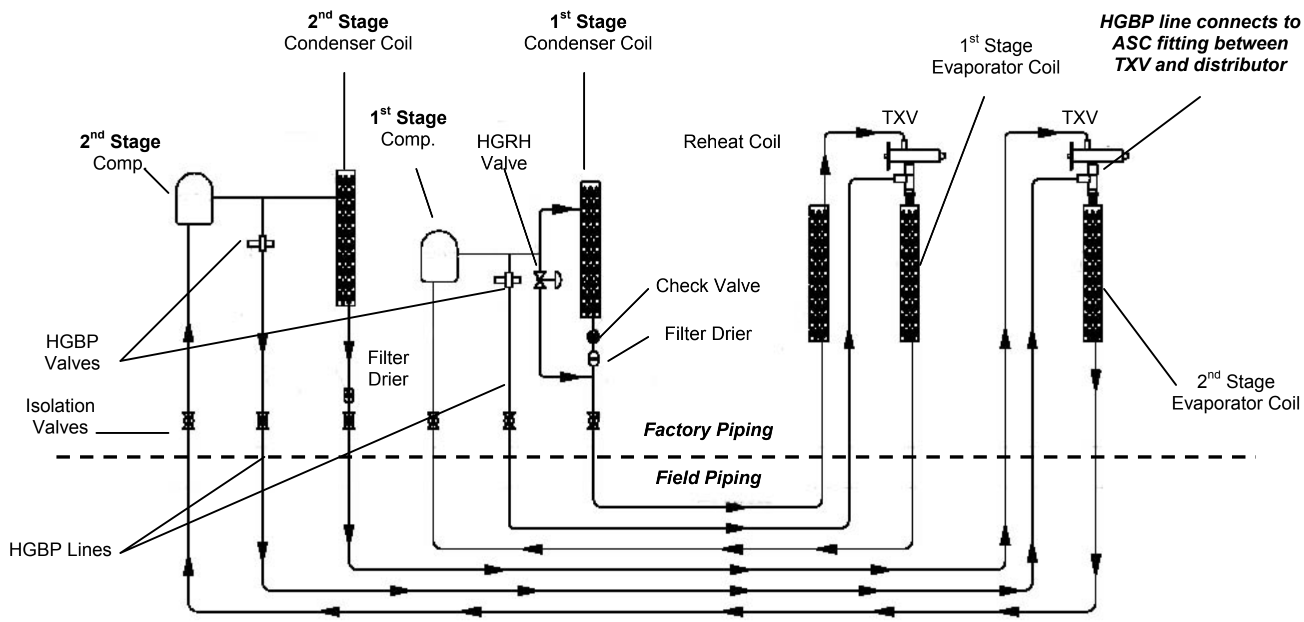


*Figure 10.2, HGRH with External HGBP Piping*




## 11. AAONAIRE® Heat Wheel

The AAONAIRE® Heat Wheel is a "total energy" recovery wheel, which means that it can transfer both sensible and latent energy, that is, heat and moisture, from one air stream to another. The heat wheel is a disc composed of spirally wound desiccant matrix material. The wheel is divided across the center when installed, and rotated by an electric motor at up to 60 RPM so that one half of the matrix material is exposed at one moment to the exhaust air stream, and at the next moment to the ventilation supply air stream. With a heat wheel, efficiencies of 70 to 85% are achievable for both sensible and latent energy transfer.

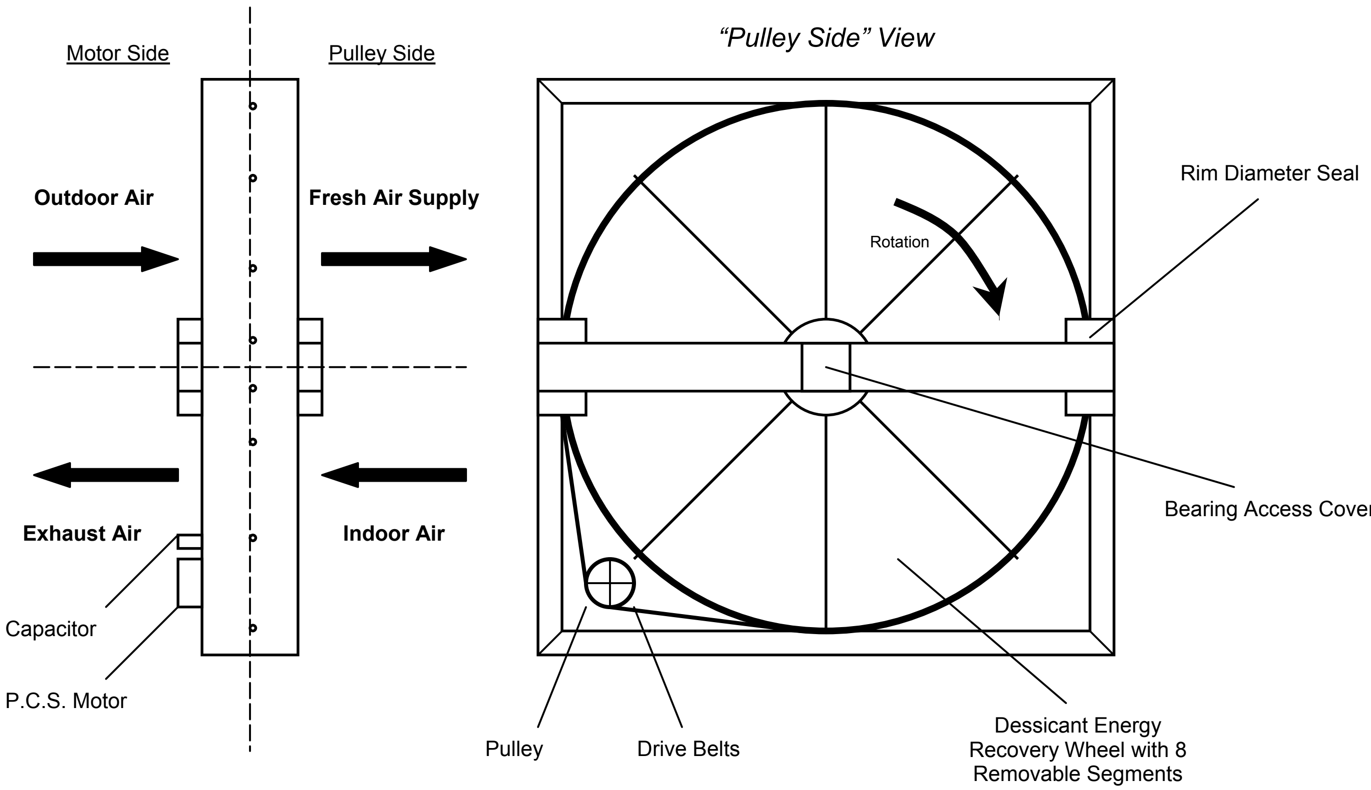
Figure 11 below shows the basics of a heat wheel. For installation, maintenance, performance, or other information, consult the *AAONAIRE® Setup Information* booklet that came with your AAONAIRE® heat wheel.

### Cleaning

The need for cleaning of the heat wheel will be determined by the operating schedule, climate, and regular contaminants of the conditioned space. The AAONAIRE® Heat Wheel is "self-cleaning" in that the smallest particles will pass through, and larger particles will land on the wheel surface, and will then be blown clear as the wheel rotates into the opposite direction of laminar flow. The primary cleaning need will be to remove oil based aerosols that have condensed on energy transfer surfaces. These oily films can clog micron sized pores in the desiccant material reducing the wheel's efficiency. It can take several years in a reasonably clean environment such as a school, or an office building, for measurable efficiency loss to occur. Dirtier air, such as that from a kitchen, industrial or machine shop, or a smoke filled room in a bar, will reduce efficiency in a much shorter period of time.

To clean the wheel, remove the segments from the wheel frame, and brush foreign material from the face. Soak the segments in a non-acid based coil cleaner, or another alkaline detergent, and warm water. Massaging the matrix with your hands will increase the cleaning action. Rinse well, and shake excess water away before reinstalling. For applications where frequent cleaning is required, it is advisable to keep a second set of wheel segments on hand. While a set is soaking, or being cleaned, the spare set can be replaced in the wheel.

*Figure 11.1, AAONAIRE® "Total Energy" Heat Wheel*



# 12. Troubleshooting

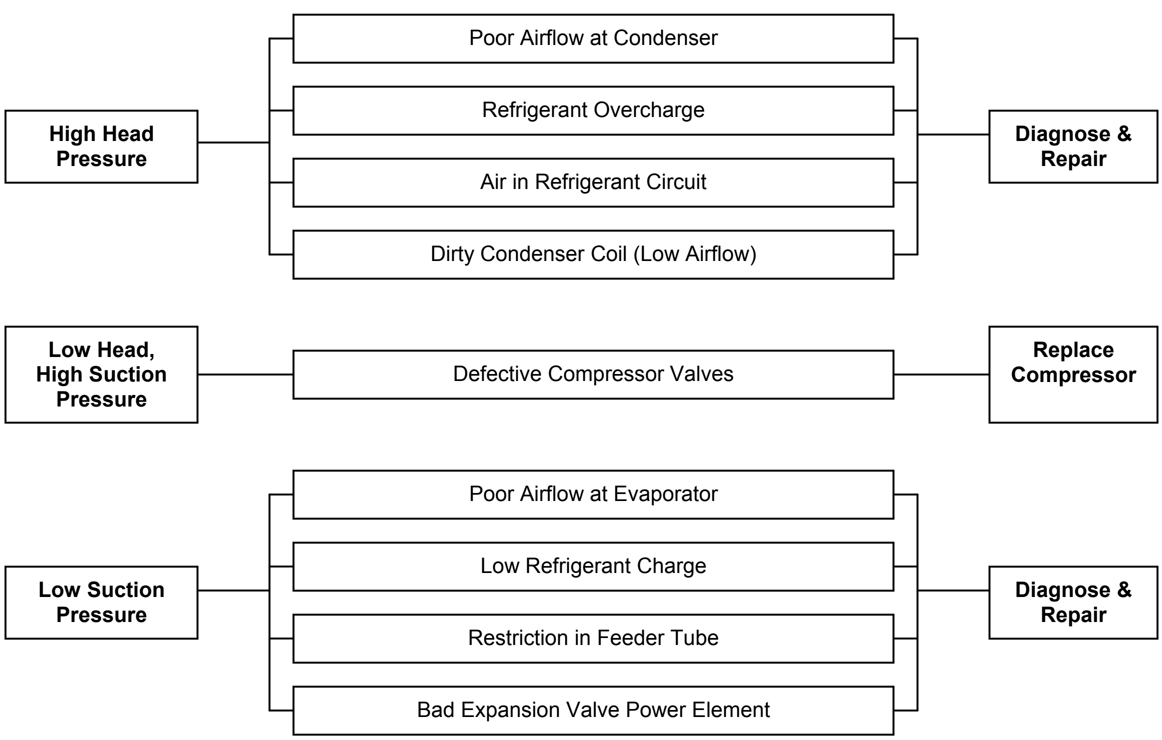
## Common Problems

***Table 12.1, Problems, Causes, & Solutions***

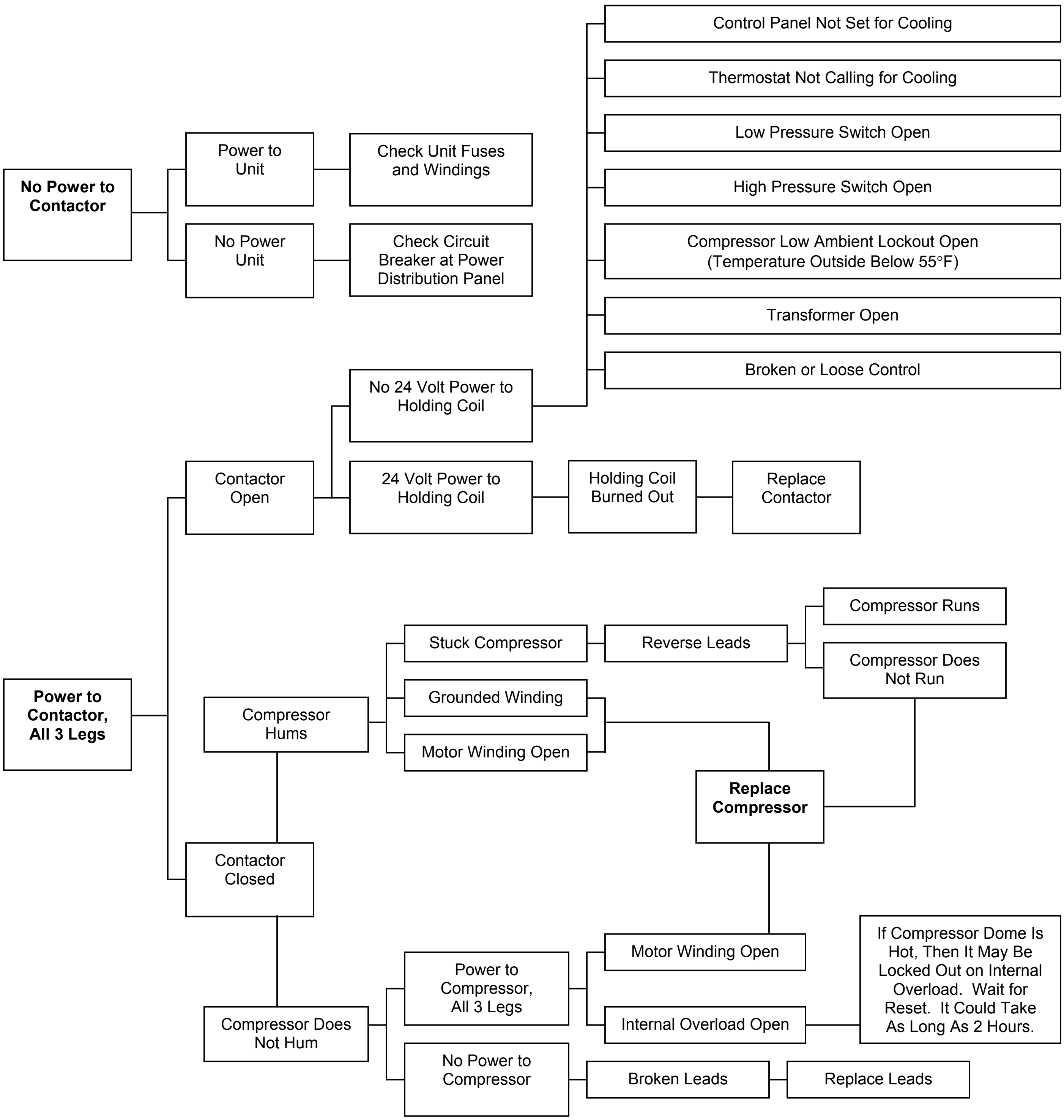
| Problem | Possible Cause | Solutions |
|---|---|---|
| Frosted evaporator coil, low suction pressure | Restricted air flow<br>Low fan speed<br>Reversed blower rotation<br>Low refrigerant charge | Clean, or replace filters<br>Check fan drives<br>Correct wiring<br>Add refrigerant |
| Unit runs, but supplies warm air | Loss of refrigerant<br>Dead expansion valve element<br>Plugged filter-drier | Check leaks, add refrigerant<br>Replace valve element<br>Replace filter-drier |
| Compressor starts, but opens high pressure control | Refrigerant over-charged<br>Air in condenser coil<br>Condenser fan dead<br>Condenser coil dirty | Remove some refrigerant<br>Evacuate and recharge refrigerant<br>Replace fan motor<br>Clean condenser coil |
| High suction pressure, but low superheat | Oversized expansion valve<br>Poor sensing bulb location<br>Low superheat adjustment | Replace with correct expansion valve<br>Relocate sensing bulb, secure to suction line<br>Adjust expansion valve |
| Unit operates continuously | Low refrigerant charge<br>Unit undersized | Check and recharge to nameplate<br>Decrease load or resize unit<br>Thermostat set too low, increase temperature setting |

## Compressor Checkout

Poor Cooling - Compressor Runs or Cycles



No Cooling – Compressor Will Not Run



## 13. Factory Start-Up Form

The factory start-up form is provided for the convenience of the installing contractor, and is not required for return to the factory for any reason. However, it is advisable to complete a start-up form to file with the unit records. The form on the back of this page may be completed and sent to the factory for archiving. It may be used by the factory to assist with solutions to potential future malfunctions and solutions, or for the evaluation and/or verification of warranty claims.

We appreciate your completing and returning it to:

AAON Coil Products, Inc.
Warranty Department
203 Gum Springs Road
Longview, Texas 75602

*Additional Start-Up Notes:*

# AAON Coil Products, Inc. FACTORY START-UP FORM

**For Warranty Purposes, Please Complete This Form At Start-Up and Return To:**

**AAON Coil Products, Inc.**
**Warranty Department**
**203 Gum Springs Road**
**Longview, Texas 75602**

**For Assistance Contact Parts & Warranty:**

**903-247-9242**
**903-247-9243**
**ACPWarranty1@aaon.com**

| | |
|---|---|
| JOB NAME: ______ | DATE: ______ |
| ADDRESS: ______ | MODEL #: ______ |
| CITY, STATE: ______ | SERIAL #: ______ |
| START-UP CONTRACTOR: ______ | TAG #: ______ |

**PRE-START-UP CHECK LIST - GENERAL CHECKS**

| | | | |
|---|---|---|---|
| Inspect Unit for Damage: | ☐ | Verify All Air Filters Are Installed: | ☐ |
| Check All Fans for Free Movement: | ☐ | Inspect Damper Assemblies: | ☐ |
| Verify All Copper Tubing Is Isolated So It Does Not Rub: | ☐ | Verify Voltage: | ☐ |
| Check and Tighten All Electrical Terminals: | ☐ | Verify Transformer Voltage: | ☐ |
| Tighten All Set Screws on Pulleys, Bearings, and Fans: | ☐ | System Evacuated to 500 Microns: | ☐ |

Additional Checks and Notes: ______

**EVAPORATOR BLOWER ASSEMBLY**

| | | | |
|---|---|---|---|
| Check Fan(s) Alignment: | ☐ | Check Belt(s) Tension: | ☐ |
| Check Fan(s) Rotation: | ☐ | Check VFD Controls: | ☐ |

Nameplate Amps: ______

| MOTOR MAKE / AMPS | 3 Phase / 1 Phase | | |
|---|---|---|---|
| 1) | | | |
| 2) | | | |

**Inside Supply Air Temp at Inlet to Unit: _______°F**

**POWER EXHAUST ASSEMBLY**

| | | | |
|---|---|---|---|
| Check Fan(s) Alignment: | ☐ | Check Belt(s) Tension: | ☐ |
| Check Fan(s) Rotation: | ☐ | Check Auto Air Balance: | ☐ |

Nameplate Amps: ______

| MOTOR MAKE / AMPS | 3 Phase / 1 Phase | | |
|---|---|---|---|
| 1) | | | |
| 2) | | | |

**Outside Air Supply: _______ %**

**COOLING TEST - AMBIENT TEMP.: __________ °F**

| COMPRESSOR # & AMPS (3 Phase / 1 Phase) L1 | L2 | L3 | Crankcase Heater Amps | Discharge PSIG | Discharge Temp | Suction PSIG | Suction Temp |
|---|---|---|---|---|---|---|---|
| 1) | | | | | | | |
| 2) | | | | | | | |
| 3) | | | | | | | |
| 4) | | | | | | | |

**Superheat Setting: _______**
**Total Refrigerant Charge: _______**

**CONDENSER ASSEMBLY**

**NAMEPLATE AMPS: ______**

| MOTOR MAKE / AMPS | 3 Phase / 1 Phase | | |
|---|---|---|---|
| 1) | | | |
| 2) | | | |
| 3) | | | |
| 4) | | | |

**Condenser Outlet Liquid: PSIG _______ Temp _______°F**
**Hot Gas Bypass Pressure Setting: PSIG _______**

**HEATING TEST - ELECTRIC**

**HEATER # & AMPS**

| | | | | | |
|---|---|---|---|---|---|
| 1) | | | 7) | | |
| 2) | | | 8) | | |
| 3) | | | 9) | | |
| 4) | | | 10) | | |
| 5) | | | 11) | | |
| 6) | | | 12) | | |

**DAMPER**

Type: ______ Motor Type: ______
Wiring: ______ Gears: ______
Operation: ______

**MISCELLANEOUS CONTROLS**

**OTHER**

**Supply Air Temperature Leaving Unit with Reheat: _______°F**
**Supply Air Temperature Leaving Unit without Reheat: _______°F**
**System Control Voltage When System is Fully Loaded: _______**
**Reheat Temperature Control Board Set Point: _______**
**Leak Test: Pressure _______, Hold Time _______** ***(Note: Unit should be pressure tested before installation)***

**COMMENTS**

**START-UP TECHNICIAN: ______**

Control No. 13-003-001
Last Revision: 09/27/04

*Table Index:*



*Figure Index:*

# Pressure – Temperature Chart, R-410A & R-22

| | PSIG | | | PSIG | | | PSIG | | | PSIG | | | PSIG | | | PSIG | | | PSIG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *(°F)* | *R-410A* | *R-22* | *(°F)* | *R-410A* | *R-22* | *(°F)* | *R-410A* | *R-22* | *(°F)* | *R-410A* | *R-22* | *(°F)* | *R-410A* | *R-22* | *(°F)* | *R-410A* | *R-22* | *(°F)* | *R-410A* | *R-22* |
| **-40** | 10.8 | 0.6 | **-10** | 36.4 | 16.5 | **20** | 78.3 | 43.1 | **50** | 142.2 | 84.1 | **80** | 234.9 | 143.6 | **110** | 364.1 | 226.4 | **140** | 540.1 | 337.4 |
| **-39** | 11.5 | 1.0 | **-9** | 37.5 | 17.2 | **21** | 80.0 | 44.2 | **51** | 144.8 | 85.7 | **81** | 238.6 | 146.0 | **111** | 369.1 | 229.6 | **141** | 547.0 | 341.6 |
| **-38** | 12.1 | 1.4 | **-8** | 38.6 | 17.9 | **22** | 81.8 | 45.3 | **52** | 147.4 | 87.4 | **82** | 242.3 | 148.4 | **112** | 374.2 | 232.8 | **142** | 553.9 | 345.9 |
| **-37** | 12.8 | 1.8 | **-7** | 39.8 | 18.7 | **23** | 83.6 | 46.5 | **53** | 150.1 | 89.1 | **83** | 246.0 | 150.8 | **113** | 379.4 | 236.1 | **143** | 560.9 | 350.3 |
| **-36** | 13.5 | 2.2 | **-6** | 40.9 | 19.4 | **24** | 85.4 | 47.6 | **54** | 152.8 | 90.8 | **84** | 249.8 | 153.2 | **114** | 384.6 | 239.4 | **144** | 567.9 | 354.6 |
| **-35** | 14.2 | 2.6 | **-5** | 42.1 | 20.1 | **25** | 87.2 | 48.8 | **55** | 155.5 | 92.6 | **85** | 253.7 | 155.7 | **115** | 389.9 | 242.8 | **145** | 575.1 | 359.0 |
| **-34** | 14.9 | 3.1 | **-4** | 43.3 | 20.9 | **26** | 89.1 | 50.0 | **56** | 158.2 | 94.4 | **86** | 257.5 | 158.2 | **116** | 395.2 | 246.1 | **146** | 582.3 | 363.5 |
| **-33** | 15.6 | 3.5 | **-3** | 44.5 | 21.7 | **27** | 91.0 | 51.2 | **57** | 161.0 | 96.1 | **87** | 261.4 | 160.7 | **117** | 400.5 | 249.5 | **147** | 589.6 | 368.0 |
| **-32** | 16.3 | 4.0 | **-2** | 45.7 | 22.4 | **28** | 92.9 | 52.4 | **58** | 163.8 | 98.0 | **88** | 265.4 | 163.2 | **118** | 405.9 | 253.0 | **148** | 596.9 | 372.5 |
| **-31** | 17.1 | 4.5 | **-1** | 47.0 | 23.2 | **29** | 94.9 | 53.7 | **59** | 166.7 | 99.8 | **89** | 269.4 | 165.8 | **119** | 411.4 | 256.5 | **149** | 604.4 | 377.1 |
| **-30** | 17.8 | 4.9 | **0** | 48.3 | 24.0 | **30** | 96.8 | 55.0 | **60** | 169.6 | 101.6 | **90** | 273.5 | 168.4 | **120** | 416.9 | 260.0 | **150** | 611.9 | 381.7 |
| **-29** | 18.6 | 5.4 | **1** | 49.6 | 24.9 | **31** | 98.8 | 56.2 | **61** | 172.5 | 103.5 | **91** | 277.6 | 171.0 | **121** | 422.5 | 263.5 | | | |
| **-28** | 19.4 | 5.9 | **2** | 50.9 | 25.7 | **32** | 100.9 | 57.5 | **62** | 175.4 | 105.4 | **92** | 281.7 | 173.7 | **122** | 428.2 | 267.1 | | | |
| **-27** | 20.2 | 6.4 | **3** | 52.2 | 26.5 | **33** | 102.9 | 58.8 | **63** | 178.4 | 107.3 | **93** | 285.9 | 176.4 | **123** | 433.9 | 270.7 | | | |
| **-26** | 21.1 | 6.9 | **4** | 53.6 | 27.4 | **34** | 105.0 | 60.2 | **64** | 181.5 | 109.3 | **94** | 290.1 | 179.1 | **124** | 439.6 | 274.3 | | | |
| **-25** | 21.9 | 7.4 | **5** | 55.0 | 28.3 | **35** | 107.1 | 61.5 | **65** | 184.5 | 111.2 | **95** | 294.4 | 181.8 | **125** | 445.4 | 278.0 | | | |
| **-24** | 22.7 | 8.0 | **6** | 56.3 | 29.2 | **36** | 109.2 | 62.9 | **66** | 187.6 | 113.2 | **96** | 298.7 | 184.6 | **126** | 451.3 | 281.7 | | | |
| **-23** | 23.6 | 8.5 | **7** | 57.8 | 30.1 | **37** | 111.4 | 64.3 | **67** | 190.7 | 115.3 | **97** | 303.0 | 187.4 | **127** | 457.3 | 285.4 | | | |
| **-22** | 24.5 | 9.1 | **8** | 59.2 | 31.0 | **38** | 113.6 | 65.7 | **68** | 193.9 | 117.3 | **98** | 307.5 | 190.2 | **128** | 463.2 | 289.2 | | | |
| **-21** | 25.4 | 9.6 | **9** | 60.7 | 31.9 | **39** | 115.8 | 67.1 | **69** | 197.1 | 119.4 | **99** | 311.9 | 193.0 | **129** | 469.3 | 293.0 | | | |
| **-20** | 26.3 | 10.2 | **10** | 62.2 | 32.8 | **40** | 118.1 | 68.6 | **70** | 200.4 | 121.4 | **100** | 316.4 | 195.9 | **130** | 475.4 | 296.9 | | | |
| **-19** | 27.2 | 10.8 | **11** | 63.7 | 33.8 | **41** | 120.3 | 70.0 | **71** | 203.6 | 123.5 | **101** | 321.0 | 198.8 | **131** | 481.6 | 300.8 | | | |
| **-18** | 28.2 | 11.4 | **12** | 65.2 | 34.8 | **42** | 122.7 | 71.5 | **72** | 207.0 | 125.7 | **102** | 325.6 | 201.8 | **132** | 487.8 | 304.7 | | | |
| **-17** | 29.2 | 12.0 | **13** | 66.8 | 35.8 | **43** | 125.0 | 73.0 | **73** | 210.3 | 127.8 | **103** | 330.2 | 204.7 | **133** | 494.1 | 308.7 | | | |
| **-16** | 30.1 | 12.6 | **14** | 68.3 | 36.8 | **44** | 127.4 | 74.5 | **74** | 213.7 | 130.0 | **104** | 334.9 | 207.7 | **134** | 500.5 | 312.6 | | | |
| **-15** | 31.1 | 13.2 | **15** | 69.9 | 37.8 | **45** | 129.8 | 76.1 | **75** | 217.1 | 132.2 | **105** | 339.6 | 210.8 | **135** | 506.9 | 316.7 | | | |
| **-14** | 32.2 | 13.9 | **16** | 71.5 | 38.8 | **46** | 132.2 | 77.6 | **76** | 220.6 | 134.5 | **106** | 344.4 | 213.8 | **136** | 513.4 | 320.7 | | | |
| **-13** | 33.2 | 14.5 | **17** | 73.2 | 39.9 | **47** | 134.7 | 79.2 | **77** | 224.1 | 136.7 | **107** | 349.3 | 216.9 | **137** | 520.0 | 324.8 | | | |
| **-12** | 34.2 | 15.2 | **18** | 74.9 | 40.9 | **48** | 137.2 | 80.8 | **78** | 227.7 | 139.0 | **108** | 354.2 | 220.0 | **138** | 526.6 | 329.0 | | | |
| **-11** | 35.3 | 15.9 | **19** | 76.6 | 42.0 | **49** | 139.7 | 82.4 | **79** | 231.3 | 141.3 | **109** | 359.1 | 223.2 | **139** | 533.3 | 333.2 | | | |

***AAON offers the Celebrity 1™ modular air handler to accommodate new and remodeled applications. Whether the need be heating, cooling, dehumidification, filtering, or ventilation, the Celebrity 1™ product line assures the flexibility to meet your customer's requirements.***

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