LENNOX DOAS

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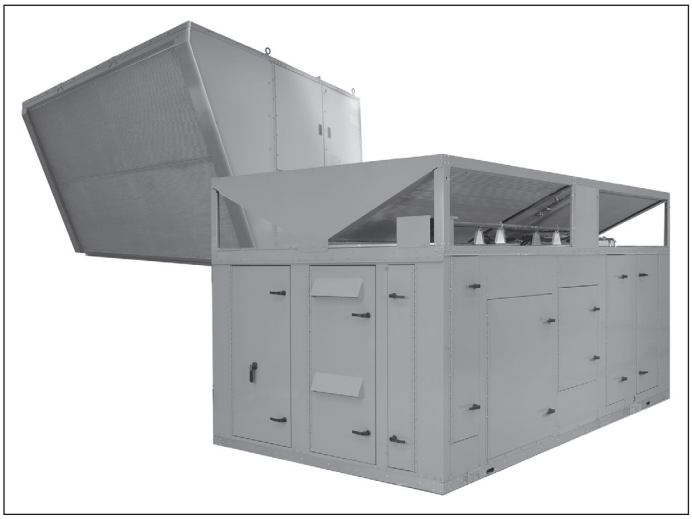
August, 2021

INSTALLATION AND SERVICE MANUAL
Packaged Ventilation/Dedicated Outside Air System (DOAS) model DLV



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⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death, and could cause exposure to substances which have been determined by various state agencies to cause cancer, birth defects or other reproductive harm. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

⚠ WARNING

This unit contains R-410A high pressure refrigerant. Hazards exist that could result in personal injury or death. Installation, maintenance, and service must only be performed by an HVAC technician qualified in R-410A refrigerant and using proper tools and equipment. Due to much higher pressure of R-410A refrigerant, DO NOT USE service equipment or tools designed for refrigerants other than R410A.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

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

Be sure to read and understand the installation, operation and service instructions in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause serious injury, death or property damage.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

- **Do not try to light any appliance.**
- **Do not touch any electrical switch, do not use any phone in your building.**
- **Leave the building immediately.**
- **Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Inspection on Arrival

1. Inspect unit upon arrival. In case of damage, report it immediately to transportation company and your local factory sales representative.
2. Check rating plate on unit to verify that power supply meets available electric power at the point of installation.
3. Inspect unit upon arrival for conformance with description of product ordered (including specifications where applicable).

THIS MANUAL IS THE PROPERTY OF THE OWNER.
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

SPECIAL PRECAUTIONS

SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH. THESE INSTRUCTIONS ARE SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

⚠ DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

⚠ WARNING

1. Failure to follow proper lifting instructions and applicable safety procedures could result in property damage, serious injury, or death. Lifting should only be done by a qualified rigging company. Use ALL lifting points. Test lift to ensure proper balance and rigging. Never lift in high winds.
2. Disconnect power supply before making wiring connections or working on this equipment. Follow all applicable safety procedures to prevent accidental power up. Failure to do so can result in injury or death from electrical shock or moving parts and may cause equipment damage.
3. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.
4. All appliances must be wired strictly in accordance with the wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
5. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
6. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than the rated voltage.
7. All field gas piping must be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
8. Gas pressure to appliance controls must never exceed 14" W.C. (1/2 psi).
9. To reduce the opportunity for condensation, the minimum sea level gas input to the appliance, as indicated on the serial plate, must not be less than 5% below the rated input, or 5% below the minimum rated input of dual rated units.

⚠ WARNING

10. When the dead front disconnect switch(es) (for main unit and/or powered convenience outlet option) is in the “OFF” position, supply power remains energized at the line (supply) side of the dead front disconnect switch(es). The switch body is located inside of another junction box to protect against contact with the live wiring. The junction box must not be disassembled unless the main power supply from the building to the unit is de-energized.
11. This unit contains R-410A high pressure refrigerant. Hazards exist that could result in personal injury or death. Installation, maintenance, and service must only be performed by an HVAC technician qualified in R-410A refrigerant and using proper tools and equipment. Due to the high pressure of R-410A refrigerant, DO NOT USE service equipment or tools designed for refrigerants other than R410A.
12. The power supply wiring for the Energy Recovery Section comes from a single point power connection on the unit. Disconnect power supply at model DLV before making wiring connections to prevent electrical shock and equipment damage.
13. When servicing or repairing this equipment, use only factory-approved service replacement parts. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

⚠ CAUTION

1. As with any mechanical equipment, personal injury can result from contact with sharp sheet metal edges. Be careful when you handle this equipment.
2. Appliances are designed for outdoor installation only. DO NOT LOCATE THIS APPLIANCE INDOORS.
3. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.
4. Purging of air from gas lines should be performed as described in ANSI Z223.1 - latest edition “National Fuel Gas Code”, or in Canada in CAN/CGA-B149 codes.
5. Units not approved for use in potable water systems.
6. Do not operate the unit with steam. The coil is not designed for steam condensate removal which can damage the unit.
7. Hot water supplied to the hot water heating option must not exceed 180°F temperature or 75 PSIG pressure.
8. When servicing the unit, some components may be hot enough to cause pain or injury. Allow time for cooling of hot components before servicing.
9. Do not overcharge the refrigeration system. This can lead to elevated compressor discharge pressure and may flood the compressor with liquid. This may result in compressor failure not covered under warranty.
10. Do not reuse any mechanical or electrical component which has been wet. Such components must be replaced.

IMPORTANT

1. To prevent premature heat exchanger failure, do not locate ANY gas-fired appliances in areas where corrosive vapors (i.e. chlorinated, halogenated or acid) are present in the atmosphere.
2. A properly designed drain with trap must be installed immediately after the unit evaporator coil condensate drain pan connection. Failure to do so will result in condensate that cannot properly drain from the unit, eventually causing the drain pan to fill. To prevent damage to the building or unit, a drain pan float switch is included as standard and will disable the unit if the maximum condensate level is reached.
3. To prevent premature heat exchanger failure, the input to the appliance, as indicated on the serial plate, must not exceed the rated input by more than 5%.
4. To prevent premature heat exchanger failure, check to be sure the blower has been set to deliver the proper airflow for the application. Refer to page 18 for Blower Adjustments.
5. Start-up and adjustment procedures must be performed by a qualified service agency.
6. All scroll compressors requires the correct supply power phase rotation. Phase reversal may result in compressor failure not covered under warranty.
7. All refrigeration checks must be made by a qualified R-410A refrigeration technician.
8. Do not release refrigerant to the atmosphere. When adding or removing refrigerant, all national, state/ province, and local laws must be followed.
9. On units with the electric preheat option, to prevent premature heat exchanger failure, check to be sure the blower has been set to deliver the proper airflow for the application. Refer to page 18 for Blower Adjustments.
10. The exhaust fan is not designed for high temperature or smoke control exhaust applications. Exhaust air temperature must not exceed 104°F. Operating the exhaust fan above 104°F will result in failure of the exhaust fan.

SI (METRIC) CONVERSION FACTORS

To Convert	Multiply By	To Obtain
CFH	1.699	m^3/min
Btu/ft^3	0.037	mJ/m^3
pound	0.453	kg
Btu/hr	0.000	kW/hr
gallons	3.785	liters
psig	27.7	"W.C.

To Convert	Multiply By	To Obtain
"W.C.	0.24	kPa
psig	6.893	kPa
°F	(°F-32) x 0.555	°C
inches	25.4	mm
feet	0.305	meters
CFM	0.028	m^3/min

Special Design Requests

Units are sometimes built units with special features as requested by the customer. This manual only covers standard features and does not include any changes made for special feature requests by the customer. Units built with special features are noted with a 5-digit SPO (Special Product Order) Number on the Serial Plate

Storage Prior to Installation

If the unit is stored outside prior to installation, the unit should be covered to protect the inlet and duct openings from the weather.

TABLE OF CONTENTS

UNIT LOCATION / COMBUSTIBLE MATERIAL & SERVICE CLEARANCES

UNIT LOCATION

⚠ DANGER

Appliances must not be installed where they may be exposed to potentially explosive or flammable atmosphere.

⚠ CAUTION

Appliances are designed for outdoor installation only. DO NOT LOCATE THIS APPLIANCE INDOORS.

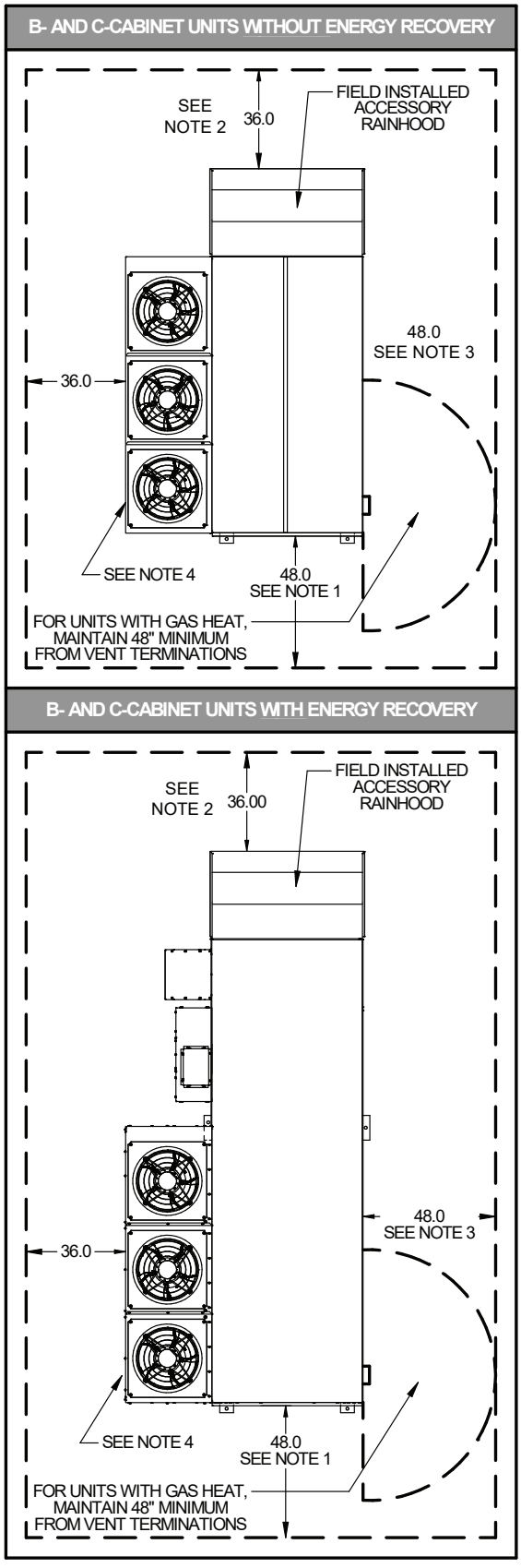
IMPORTANT

To prevent premature heat exchanger failure, do not locate ANY gas-fired appliances in areas where corrosive vapors (i.e. chlorinated, halogenated or acid) are present in the atmosphere.

Location Recommendations

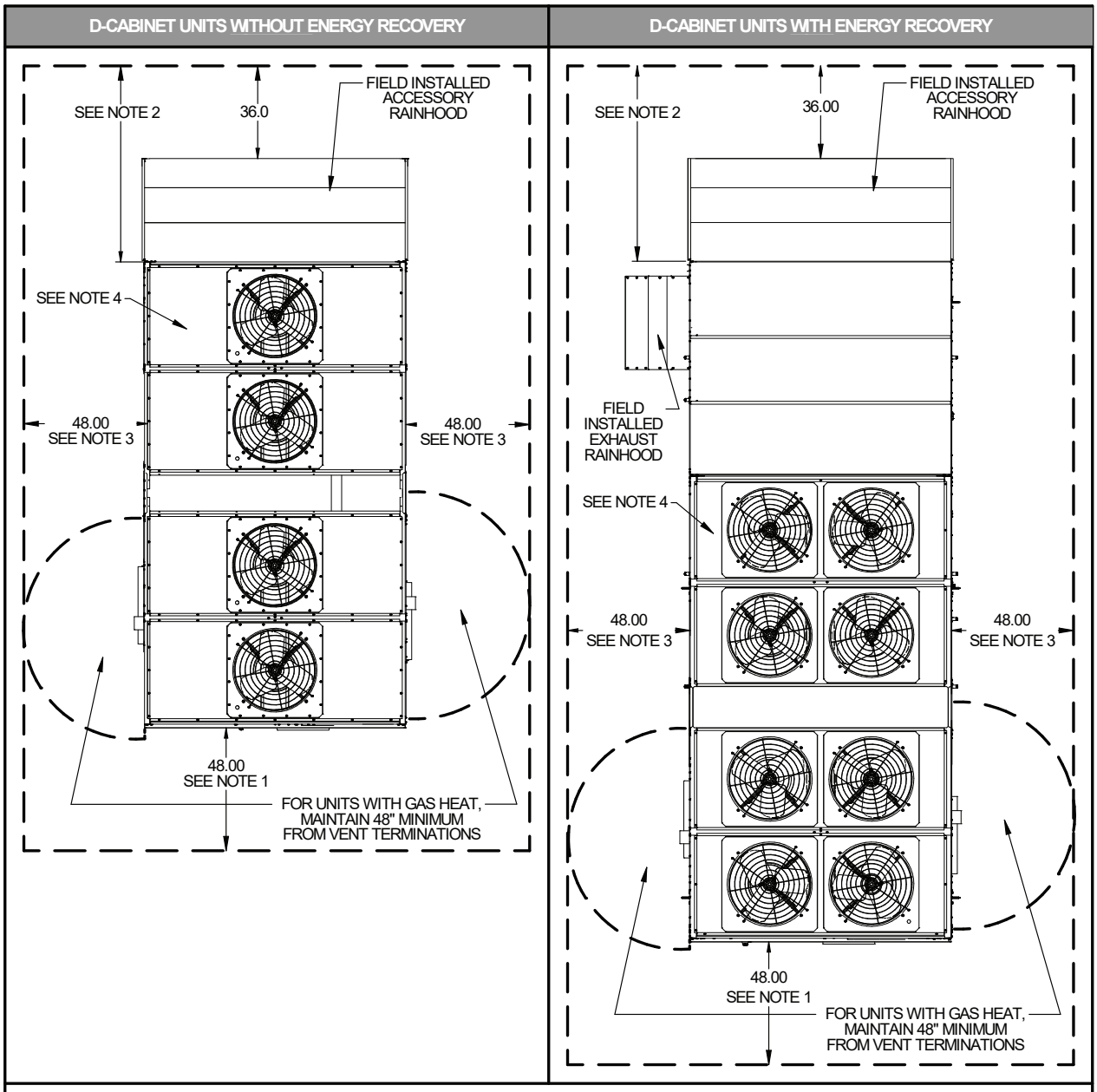
1. When locating the unit, consider general space and cooling/heating requirements and availability of gas and electrical supply.
2. Be sure the structural support at the unit location site is adequate to support the weight of the unit and any other required support structure. For proper operation the unit must be installed in a level horizontal position.
3. All mechanical equipment generates some sound and vibration that may require attenuation. Locating the equipment away from the critical area is desirable within ducting limitations. Frequently, units can be located above utility areas, corridors, restrooms, and other non-critical areas. Generally, a unit should be located within 15 feet of a primary support beam. Smaller deflections mean lesser vibration and noise transmission. For critical applications, please consult with an acoustical attenuation expert.
4. Do not install units in locations where the flue products (if equipped with a gas fired heating option) can be drawn into the adjacent building openings such as windows, fresh air intakes, etc.
5. Be sure that the minimum clearances to combustible materials and recommended service clearances are maintained. For units with the gas heating option, be sure clearances are maintained to the combustion air inlet louvers and power exhauster discharge cover. Units are designed for installation on non-combustible surfaces with the minimum clearances shown in Figures 4.1 and 5.1.
6. On units that have fresh air openings, a method must be provided to prevent water and debris from entering the unit such as a rainhood, which is available as an accessory from the factory. Where possible, install the unit so that the inlet is not facing into the prevailing wind to prevent water entrainment.
7. The exhaust fan is not designed for high temperature or smoke control exhaust applications. Exhaust air temperature must not exceed 104°F. Operating the exhaust fan above 104°F will result in failure of the exhaust fan.

Figure 4.1 - Combustible Material & Service Clearances (continued next page)



COMBUSTIBLE MATERIAL & SERVICE CLEARANCES

Figure 5.1 - Combustible Material & Service Clearances (continued from previous page)



① The minimum recommended clearance for service is 48". For service clearances less than shown, applicable local code requirements must be followed. If the ability for future condenser coil replacement is desired, the minimum clearance must be:

- 102" for B-Cabinet sized units
- 112" for C-Cabinet sized units
- 100” for D-Cabinet sized units

See Note ② for alternate coil replacement direction.

② The minimum recommended clearance for service is 36". For service clearances less than shown, applicable local code requirements must be followed. If the ability for future condenser coil replacement is desired, the minimum clearance must be (from the end panel of the condenser, not the end of the inlet hood):

- 102” for B-Cabinet sized units
- 112” for C-Cabinet sized units
- 100” for D-Cabinet sized units

See Note ① for alternate coil replacement direction.

③ The minimum recommended clearance for service is 48". For service clearances less than shown, applicable local code requirements must be followed. If the ability for future evaporator coil, hot gas reheat coil, and/or energy wheel replacement is desired, the minimum clearance must be:

- 55" for B-Cabinet sized units
- 64" for C-Cabinet sized units
- 100” for D-Cabinet sized units

④ Additional Required Clearances:
-Clearance above unit must be unobstructed.
-Clearance to combustibles below the unit is 6" minimum.

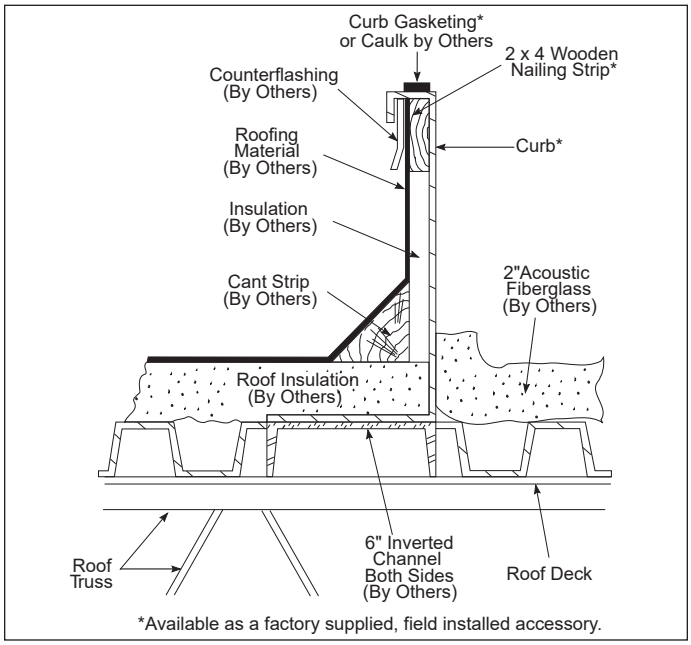
ROOF CURB INSTALLATION / GENERAL RIGGING INSTRUCTIONS

Roof Curb Installation

An optional roof curb is available to simplify site preparation and raise the unit above roof water and snow level for drainage. It can be installed in advance of the unit. The curb is shipped knocked down with separate instructions for its assembly, flashing, and sealing with the roof. The following are some general guidelines for roof curb installed units (refer to Figure 6.1):

1. The roof structure must be adequately designed to support the live weight load of the unit and any other required support structure. The roof curb should be supported at points no greater than five feet apart. Additional truss reinforcement should be provided, if necessary.
2. Factory supplied roof curbs are typically fabricated from 12 gauge galvanized steel and supplied knocked down for assembly on the job site. The curb consists of two side pieces, two end pieces, gasketing, four joiner angles, four 2x4 inch wood nailing strips, nuts, bolts, and washers.
3. Outside dimensions must be held when installing curb. Top surface must be level and straight to ensure weather-tightness. If roof is pitched it will be necessary to construct a sub-base on which to install the curb. All corners must be square.
4. All dimensions are +/- 1/8 inch.
5. When a roof curb is used in conjunction with factory supplied discharge and/or return air connectors, the ductwork can be fastened to the connectors prior to the unit installation. The connectors will accept 90° flanged ductwork (see Figure 7.2).
6. Final electric and gas connections must be made after unit is installed to allow for tolerance in setting of unit on curb. For electrical power supply allow approximately eight feet of wire, plus provisions for weathertight flexible conduit for connection to unit, as required by local codes.
7. Maintain a 12-inch minimum height from top of roof deck to top of curb.
8. Caulk butt joints after curb is assembled and installed on roof structural members and roof flashing is added.
9. For improved sound attentuation, line the roof deck within the curb area with 2" acoustic fiberglass.

Figure 6.1 - Typical Curb Details



*Available as a factory supplied, field installed accessory.

General Rigging Instructions

⚠ WARNING

Failure to follow proper lifting instructions and applicable safety procedures could result in property damage, serious injury, or death. Lifting should only be done by a qualified rigging company. Use ALL lifting points. Test lift to ensure proper balance and rigging. Never lift in high winds.

Lifting Lug Installation

Before attaching lifting equipment, verify location of lifting lugs or eyes. B- and C-Cabinet sized units have the lifting lugs or eyes factory installed as follows:

- B-Cabinet sized units without Energy Recovery include (4) eye bolts at each corner on the top of the unit.
- B-Cabinet sized units with Energy Recovery include (6) lifting lugs on the base, one at each corner and one on each length-wise side of the unit between the corners.
- C-Cabinet sized units include (4) eye bolts at each corner on the top of the unit. For units that include the shipped separate Energy Recovery Module (model EWM) option, refer to the Installation and Service Manual, #LNX15-520 that shipped with the EWM for separate rigging instructions.
- D-Cabinet sized units must have the lifting lugs field installed in the unit base assembly prior to rigging as follows:
  1. Locate the lifting lug kit box located in the supply fan compartment.
  2. Install the kit per the “Installation Instructions, Lifting Lugs D-Cabinet”, #LNX15-505, included with the kit.
  3. After installing the kit, verify that all required lugs are installed following the instructions in Step 2. Verify that each lug is secured using (4) Grade 5 bolts provided with the kit. Each bolt must be torqued to 75 ft-lb.

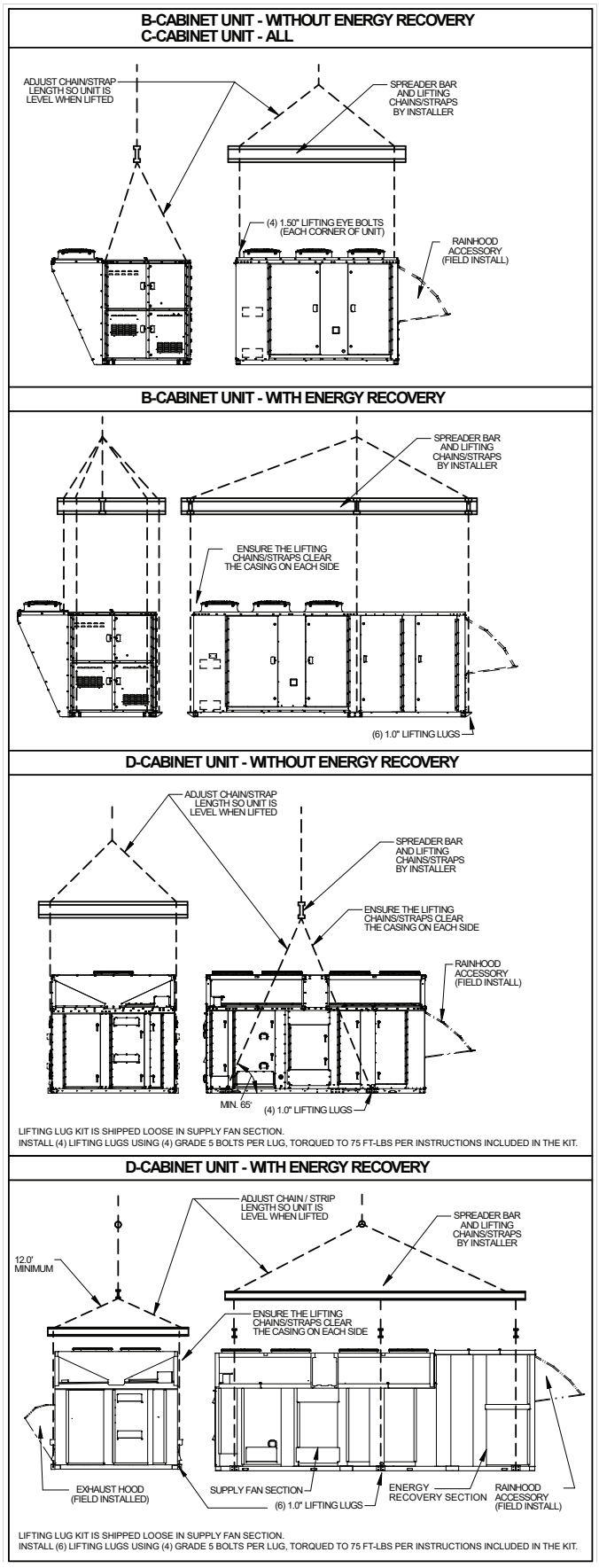
Unit Rigging and Lifting

Rigging and lifting of the units should only be done by a qualified rigging company and follow appropriate industry standards, including but not limited to the appropriate sections of ASME B30, OSHA 1910, and OSHA 1926.

With the lifting lugs or eyes identified and installed, the units can be lifted by crane or helicopter.

1. Follow site preparation instructions for the roof curb or equipment stand before installation.
2. Check the Serial Plate(s) of unit with plans to be sure unit is properly located. Although units may look outwardly similar, their function, capacities, options, and accessories will often vary.
3. Check unit dimensions of both the unit base and the curb or stand on which the unit will be installed.
4. If the unit will be installed on a roof curb:
   a. Thoroughly clean and dry the top of the curb surface.
   b. Lay a bead of weather resistant caulking on top perimeter of roof curb as illustrated in Figure 7.2. Note: If the roof curb is supplied with full perimeter gasket material, caulking is not necessary.
5. When lifting the equipment, connect sturdy steel cables, chains, or straps with eye loops as illustrated in Figure 7.1. For stability in lifting and lowering and to prevent damage

Figure 7.1 - Typical Rigging for Model DLV



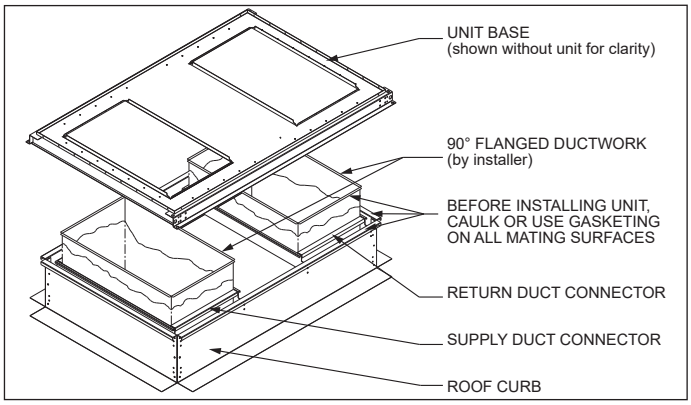
to the unit, include a spreader bar as illustrated in Figure 7.1. Avoid twisting or uneven lifting of the unit. The cable length from the lifting point on the unit to the spreader bar should always be longer than the distance between the outer lifting points.

6. Test lift the unit to check for proper rigging balance before hoisting to the desired installation location.
7. Once lifted to the installation location, orient the hoisted unit to match the ductwork locations and set evenly on the curb or stand.
8. Following the instructions in this manual, make final unit connections to the electric power supply and remote control circuits. Connect the gas lines to the unit heating compartment. Seal all utility line clearance holes on the unit after connections are completed so they are watertight.

Duct Installation

1. The unit is designed to accept 90° flanged ductwork on both the supply and return air openings. Refer to the roof curb or the unit base dimensional drawings to determine the location of the openings.
2. Acoustic duct liners are recommended on all internal supply and return air ducts.
3. When ductwork is installed prior to unit arrival, flexible connections should be included to make connections easier and to simplify possible future service.
4. When a roof curb is used in conjunction with factory supplied discharge and/or return air connectors, the ductwork can be fastened to the connectors prior to the unit installation. The connectors will accept 90° flanged ductwork (see Figure 7.2).

Figure 7.2 - Discharge and/or Return Air Connectors



5. To assure proper air flow from the unit, follow these duct design recommendations:
   a. Be sure ducts are properly sized and installed.
   b. As a general rule, all discharge ducts should have a straight run of at least three (3) hydraulic duct diameters before making turns in the ductwork.

      Hydraulic Duct Diameter for Rectangular Ducts = 4A/P
      Hydraulic Duct Diameter for Circular Ducts = D where:
      A = Cross Sectional Area of Rectangular Duct
      P = Perimeter of Rectangular Duct
      D = Diameter of Round Cut
   c. Wherever turns in the duct work are made, include turning vanes.
   d. Supply air ducts in a “T” configuration should be avoided to prevent air temperature stratification. If this configuration must be used, provide appropriate mixing devices and/or the necessary straight duct length before the “T” to provide uniformly mixed air temperature delivery to both supply air duct trunks.

Evap Condensate Drain Trap Installation

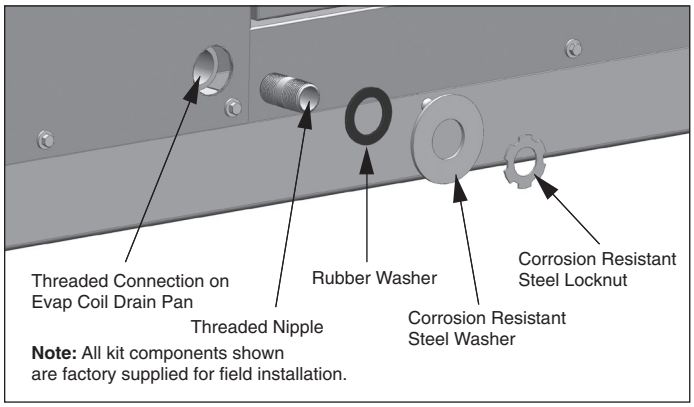
IMPORTANT

A properly designed drain with trap must be installed immediately after the unit evaporator coil condensate drain pan connection. Failure to do so will result in condensate that cannot properly drain from the unit, eventually causing the drain pan to fill. To prevent damage to the building or unit, a drain pan float switch is included as standard and will disable the unit if the maximum condensate level is reached.

All units require a drain system with a condensate trap to be connected to the condensate drain pan connection which is accessible from the exterior of the unit casing. Failure to install a condensate drain trap may result in condensate overflowing from the drain pan, causing damage to the unit and building. See Figure 34.1 or 35.1 for location. The drain system is to be installed as follows:

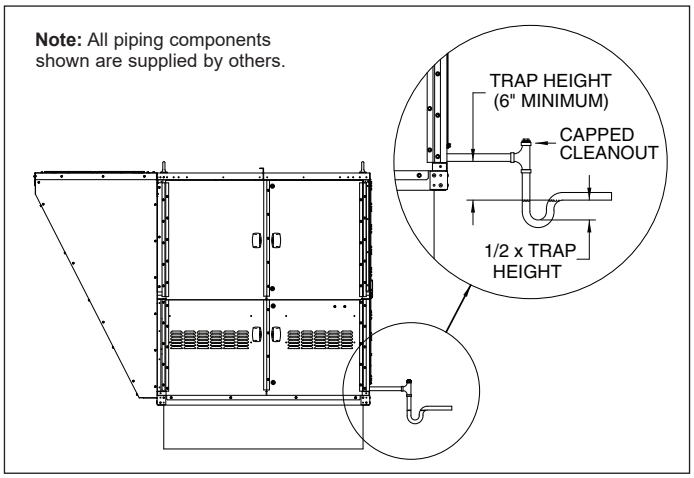
1. The condensate drain pan includes a 1-1/4" female NPT stainless steel connection accessible from the exterior of the unit casing. Do not reduce the drain diameter. A drain pan connection kit is shipped loose for field installation to allow connection exterior to the casing. Refer to Figure 8.1 for assembly details.

Figure 8.1 - Condensate Drain Pan Connection Kit



2. The drain line should include provisions for disconnectingthe line at or near the unit for maintenance/ servicing of the unit. The drain line must not interfere with access panels, which are removable for maintenance/ service.
3. The drain line must include a trap immediately after the unit, as shown in Figure 8.2. Failure to do so will result in condensate that cannot properly drain from the unit, eventually causing the drain pan to fill and overflow. If the drain pan overflows, significant damage can occur to the unit and/or building on which the unit is installed. A drain pan float switch is included as standard and will disable the unit if the maximum condensate level is reached.
4. The design of the trap is critical to ensure proper drainage. If the trap is not constructed properly with the dimensions as outlined in the following instructions, air could be drawn through the drain pipe and into the system or could back up into the drain pan.
   - The drain is located on the suction side of the main supply air fan, resulting in a negative pressure relative to outside the unit cabinet. The trap height must be at least 6” to account for maximum negative pressure, including allowance for dirty filters. Note that the trap height is the difference in height from the drain connection of the unit to the leaving side of the trap. Refer to Figure 8.2.
   - The trap depth must be ½ x the trap height. For example, if the trap height is the minimum 6”, the trap depth must be 3” (see Figure 8.2).
   - For maintenance, it is recommended to have a capped cleanout at the top of the trap as shown in Figure 8.2.
5. After the exit from the trap, the drain must be pitched down from the unit connection at least 1 inch for every 10 feet of horizontal run to promote proper drainage. If the local installation code allows, the drain can be run to a waste water system.
6. If the trap may experience below freezing temperatures during non-cooling periods, heating wraps must be used to avoid water in the trap from freezing and damaging the trap and drain system.
7. The trap must be primed before the unit is put into operation and properly maintained on a regular schedule. Refer to the Start-Up Procedure and Maintenance sections for additional guidance.

Figure 8.2 - Evap Condensate Drain Trap Installation



Utility Connections

Utility and control connections can be made to the unit from the bottom or through the fixed side panels. Holes can be field drilled in fixed side panels to accommodate utility connections as shown on the unit dimensional drawings and the utility entrance location area label located on the unit. All gas and electrical connections to the unit must be weatherized so they are watertight.

Electrical Connections

⚠ WARNING

1. Disconnect power supply before making wiring connections or working on this equipment. Follow all applicable safety procedures to prevent accidental power up. Failure to do so can result in injury or death from electrical shock or moving parts and may cause equipment damage.
2. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.
3. All appliances must be wired strictly in accordance with the wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
4. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
5. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than rated voltage.

⚠ CAUTION

1. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.
2. Do not reuse any mechanical or electrical component which has been wet. Such components must be replaced.

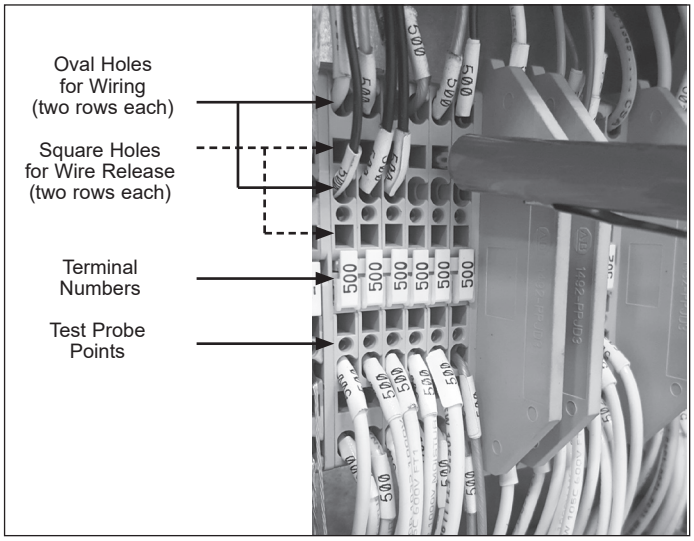
1. Installation of wiring must conform with local building codes, or in the absence of local codes, with the National Electric Code ANSI/NFPA 70 - Latest Edition. Unit must be electrically grounded in conformance to this code. In Canada, wiring must comply with CSA C22.1, Part 1, Electrical Code.
2. Two copies of the job specific wiring diagram are provided with each unit, one permanently affixed to the inside of the door of the controls compartment and the other as a loose copy with the literature packet that ships with the unit. Refer to this diagram for all wiring connections.
3. Control wiring consists of both 24V analog control wiring and low current digital control signal wiring. To avoid signal interference, the two types should be run in separate conduits. If run in the same conduit, the digital signal wiring should be shielded at one end of the wiring run. Wiring should be twisted, stranded, and shielded communication wire.
4. The wire gauge must be sized according to the National Electric Code or CSA code based on amp draw and length of run. Refer to Table 9.1 for maximum wire lengths and the number of wires that can be wired to each low voltage terminal block based on the wire gauge being used.

Table 9.1 - 24V and Digital Control Wire Lengths

Minimum Recommended Wire Gauge	Maximum Distance from Control Device to Unit	
	24V Control Wiring	Digital Control Wiring
22	n/a	120
20	n/a	200
18	75	300
16	125	500
14	175	n/a

5. For field wiring to the factory terminal strip, the terminal strip connections are designed to clamp down on the wires. To properly connect the wires to the terminal strip:
   - Push a small flat-head screwdriver into the square hole on the terminal. Press firmly until the screwdriver hits the back stop and opens the terminal (see Figure 9.1).
   - Remove approximately 3/8” of insulation from the end of the wire and push the stripped wire into the oval hole in the terminal.
   - Remove the screwdriver. Pull on the wire to make sure that it is securely clamped in the terminal.
   - Make sure that the terminal clamp is in contact with bare wire (insulation removed).

Figure 9.1 - Terminal Strip Wiring



6. Depending on the configuration of the unit controls, there may be sensors that are field installed. Review the unit ordered to verify that the sensors supplied match the configuration of the unit. The following are sensors that may be included for field installation:
   - **Supply Air Temperature Sensor**
     This sensor is required on all units and should be mounted in the supply air ductwork downstream of the unit. The sensor should be located at least 5 feet, but not more than 20 feet downstream from the unit discharge.
   - **Space Temperature/Humidity Sensor**
     This sensor is required on all units that have space temperature/humidity reset control. The sensor is to be wall-mounted in the space at a height of approximately 5 feet from the floor.
   - **Building Pressure Sensor**
     This sensor is required on all units that have space pressure control, either through modulating dampers or variable frequency drive control on the supply air blower. The sensor is to be mounted inside a control panel in the space and includes two pressure taps. One pressure tap is for outside atmospheric pressure reference, the other is for sampling the space pressure.
   - **Duct Pressure Sensor**
     This sensor is required on all units that have duct pressure control through variable frequency drive control on the supply air blower. The sensor is to be mounted with the sensing probe inserted into the supply duct. The atmospheric pressure sampling tap is left open.

- **Space CO_2 Sensor**
  This sensor is required on all units that have demand based ventilation control. The sensor is to be mounted in the space at a height of approximately 5 feet from the floor.
- **Duct Mounted Smoke Detector**
  When ordered as a field installed accessory, the detector should be mounted in the supply air or return air ductwork.

  For further instructions on the above sensor(s), refer to the installation instructions that shipped with the sensor(s).

7. If the unit is a C-Cabinet sized unit with an Energy Recovery Module, Model EWM, the wiring connection between the DLV unit and the EWM unit must be made by extending the loose end of the wire drop located in the DLV unit outside air damper section, through the transition duct between units, and connected to the EWM control panel. Refer to the Installation & Service Manual that shipped with the EWM unit for additional instructions. If the unit is a B-Cabinet sized unit with integral Energy Recovery, the unit is already factory wired to the Energy Recovery section.
8. The power supply to the unit must be protected with a fused or circuit breaker disconnect switch. Refer to the Figures on pages 35 through 39 for the location of the factory installed dead front disconnect option, if provided. Field installed disconnect switches should be mounted where required by the National Electric Code. Refer to the Model Serial plate for MCA and MOP values for the unit.
9. The power supply must be within +/-5% of the voltage rating and each phase must be balanced within 2% of each other. If not, advise the utility company.
10. External electrical service connections that must be installed include:
    a. Supply power (120, 208, 240, 480, or 600 volts).
    b. Thermostats, building pressure sensors, or any other accessory control devices that may be supplied (24 volts).
11. All outdoor electrical connections must be weatherized to prevent moisture from entering the electrical compartment.
12. Electrical connections are made in the controls cabinet and can be run through the bottom or side of the unit. Refer to the unit and base dimensional drawings for locations of wiring entrance. Refer to the wiring diagram for the terminal location of all low voltage wiring.

REVIEW BEFORE PROCEEDING

THIS SECTION APPLIES TO UNITS WITH OPTIONAL GAS HEAT (MODEL DIGIT 17=2, 3, 5, OR 6).

IF THE UNIT DOES NOT HAVE GAS HEAT, SKIP TO PAGE 16.

Gas Connections

⚠ WARNING

1. All field gas piping must be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
2. Gas pressure to appliance controls must never exceed 14" W.C. (1/2 psi).
3. To reduce the opportunity for condensation, the minimum sea level gas input to the appliance, as indicated on the serial plate, must not be less than 5% below the rated input, or 5% below the minimum rated input of dual rated units.

⚠ CAUTION

Purging of air from gas supply line should be performed as described in ANSI Z223.1 - latest edition “National Fuel Gas Code”, or in Canada in CAN/CGA-B149 codes.

IMPORTANT

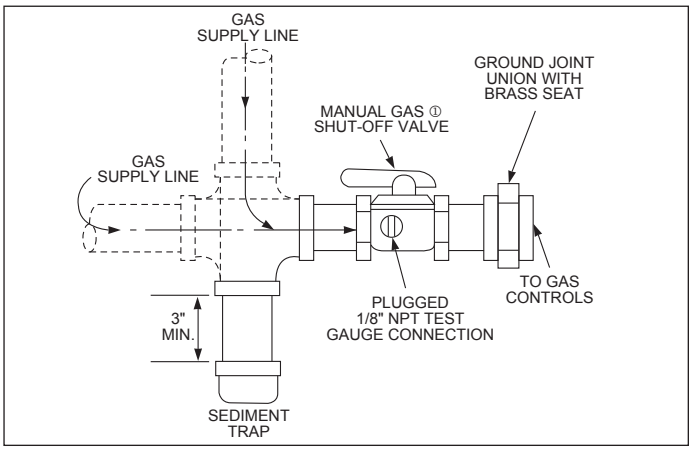
To prevent premature heat exchanger failure, the input to the appliance, as indicated on the serial plate, must not exceed the rated input by more than 5%.

1. Installation of piping must conform with local building codes, or in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) - Latest Edition. In Canada, installation must be in accordance with CAN/CGA-B149.1 for natural gas units and CAN/CGA-B149.2 for propane units.
2. Piping to units should conform with local and national requirements for type and volume of gas handled, and pressure drop allowed in the line. Refer to Table 11.1 to determine the gas piping connection size (inches) for the unit to be installed. Refer to Digit 18 of the Model Nomenclature on page 65 and the value on the unit serial plate to determine the gas heating capacity in Thousands of Btu/hr (MBH). For the length of pipe necessary, determine the pipe diameter from Tables 11.2 or 11.3 for the unit heating capacity. Refer to the example under Table 11.3. Where several units are served by the same main, the total capacity and length of main must be considered. While the gas connection(s) on the unit may be smaller than 1", do not use pipe sizes smaller than 1" leading up to the unit. At the unit, reduce the pipe size down to the appropriate size (refer to Table 11.1 for connection sizes). Table 11.2 allows for a 0.3" W.C. pressure drop in the supply pressure from the building main to the unit for Natural Gas, while Table 11.3 allows for a 0.5” W.C. pressure drop with Propane (LP) Gas. The inlet pressure to the unit must be 6-7" W.C. for natural gas or 11-14”

W.C. for propane gas and should not drop below 6.0" W.C. when the unit is operating. When sizing the inlet gas pipe diameter, make sure that the unit supply pressure can be met after the 0.3" or 0.5" W.C. has been subtracted. If the pressure drop is too high, refer to NFPA 54 National Fuel Gas Code for other pipe capacities.

3. The gas piping is to enter the unit from the side (refer to the unit dimensions). B- and C-Cabinet sized units include a hole and grommet in the side of the casing for side gas piping entry. D-Cabinet sized units include two holes with grommets for side pipe entry. Install a ground joint union with brass seat and a manual shut-off valve external of the unit casing, and adjacent to the unit for emergency shut-off and easy servicing of controls, including a 1/8" NPT plugged tapping accessible for test gauge connection (see Figure 11.1). Verify the manual shut-off valve is gas tight on an annual basis.
4. Provide a sediment trap before each unit in the line where low spots cannot be avoided (see Figure 11.1).
5. When Pressure/Leak testing pressures above 14" W.C. (1/2 psi), close the field installed shut-off valve, disconnect the appliance and its combination gas control from the gas supply line, and plug the supply line before testing. When testing pressures 14" W.C. (1/2 psi) or below, close the manual shut-off valve on the appliance before testing.

Figure 11.1 - Recommended Sediment Trap/Manual Shut-off Valve Installation



① Valve is in the "OFF" position when handle is perpendicular to pipe.

Table 11.1 - Gas Heating Piping Connection Sizes

Cabinet Size (Digit 6)	Gas Type (Digit 17) ①	Furnace Size (MBH)	Gas Connection Size
B	Natural Gas	Below 200	1/2"
		200 and Larger	3/4"
	Propane (LP) Gas	Below 300	1/2"
		300 and Larger	3/4"
C ②	Natural Gas	All	1"
	Propane (LP) Gas	All	3/4"
D ③	Natural Gas	Below 850	1" (Qty 2)
		850 and Larger	1-1/2" (Qty 2)
	Propane (LP) Gas	All	1" (Qty 2)

① Units with Natural Gas heating option have model nomenclature Digit 17 = 2 or 3. Units with Propane (LP) Gas heating option have model nomenclature Digit 17 = 5 or 6.

② C-Cabinet units consist of two furnaces that together total the value shown in Table 11.1.

③ D-Cabinet units consist of two furnaces that together total the value shown in Table 11.1 for sizes up to 800,000 Btu/hr. For sizes over 800,000 Btu/hr, the unit consists of four furnaces that together total the value shown in Table 11.1.

Table 11.2 - Natural Gas Pipe Capacities (MBH) ④

Pipe Length (ft)	Nominal Gas Pipe Diameter				
	1"	1-1/4"	1-1/2"	2"	2-1/2"
10	540	1,113	1,659	3,203	5,103
20	371	762	1,145	2,195	3,507
30	298	612	917	1,764	2,814
40	255	524	784	1,512	2,405
50	226	464	695	1,344	2,132
60	205	420	630	1,218	1,932
80	175	360	540	1,038	1,659
100	155	319	478	921	1,470
125	138	282	423	816	1,302
150	125	256	384	739	1,176
175	114	235	353	680	1,082
200	107	219	329	632	1,008

④ Capacities based on gas pressure up to 14" W.C. through Schedule 40 pipe with a pressure drop of 0.3" W.C. for Natural gas with a specific gravity of 0.60.

Table 11.3 - Propane Gas Pipe Capacities (MBH) ⑤

Pipe Length (ft)	Nominal Gas Pipe Diameter				
	1"	1-1/4"	1-1/2"	2"	2-1/2"
10	1,150	2,350	3,520	6,790	10,800
20	787	1,620	2,420	4,660	7,430
30	632	1,300	1,940	3,750	5,970
40	541	1,110	1,660	3,210	5,110
50	480	985	1,480	2,840	4,530
60	434	892	1,340	2,570	4,100
80	400	821	1,230	2,370	3,770
100	372	763	1,140	2,200	3,510
125	349	716	1,070	2,070	3,290
150	330	677	1,010	1,950	3,110
175	292	600	899	1,730	2,760
200	265	543	814	1,570	2,500

⑤ Capacities based on gas pressure up to 14" W.C. through Schedule 40 pipe with a pressure drop of 0.5" W.C. for Propane gas with a specific gravity of 1.50.

Example:

A D-Cabinet unit with Digit 17=2 (Natural Gas) and Digit 18=Q (800MBH) is installed in a location requiring 50 feet of gas supply pipe. What is the minimum pipe diameter required for the supply pipe?

From Table 11.2, 50 feet of 1-1/2" pipe has a capacity of 695MBH which may result in too significant of a pressure drop. The 2" pipe has a capacity of 1,344MBH which is sufficient for a unit with an 800MBH Natural Gas heat option.

GAS HEATING OPTION VENT TERMINALS AND COMBUSTION AIR HOODS

Vent Terminals and Combustion Air Hoods

1. Do not operate the units without the factory supplied and/or shipped loose power exhauster vent termination(s) and/or combustion air hoods if applicable. Refer to Table 12.1 to determine how many terminals and hoods are required based on the model nomenclature.

Table 12.1 - Vent Terminal & Combustion Air Hoods

Cabinet Size (Digit 6)	Digit 18	Nominal Heat Capacity (MBH)	Furnace Type & (Instruction Section)	Field Installed Qty	
				Vent Terminals	Combustion Air Hoods
B	F	150	Non-Condensing (Section A)	1	n/a
	G	200			
	H	250			
	J	300			
	K	400			
	R	175	Condensing (Section C)	1	
	S	225			
	T	310			
C	J	300	Non-Condensing (Section A)	2	
	K	400			
	L	500			
	M	600			
	U	350	Condensing (Section C)	2	
	V	450			
D	K	400	Non-Condensing (Section B)	2	2
	L	500			
	M	600			
	Q	800			
	1	900	Non-Condensing (Section B)	4	
	2	1,000			
	3	1,200			
	4	1,400			
	5	1,600			
	V	450	Condensing (Section D)	2	n/a (internal)
	P	620			
	6	850	Hybrid Condensing & Non-Condensing (Section E)	4	2
	7	950			
	8	1,220			
	9	1,420			

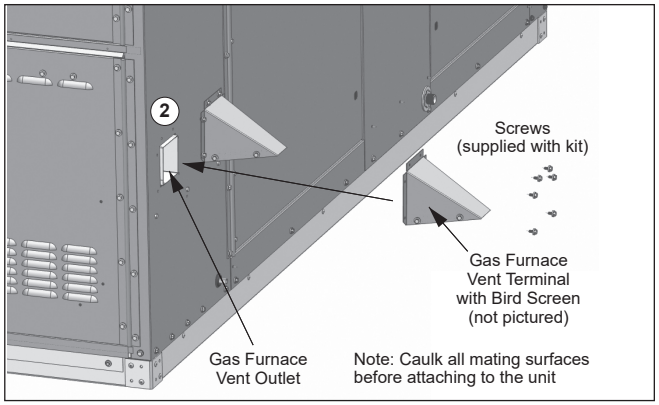
2. Do not modify or obstruct the combustion air inlet louvers or the power exhauster discharge cover terminations.
3. Do not add any vents other than those supplied by the manufacturer. For units that require vent extension kits, refer to Literature #LNX15-574, “Installation Instructions, Extended Vent Kit, Model DLV Gas Heat”.
4. For specific instructions on each configuration in Table 12.1, refer to the appropriate section indicated in the table.

   Example: For D-Cabinet, Digit 18=V, refer to Section D.

Section A: Non-Condensing B or C-Cabinet Furnaces

- Review Table 12.1 to verify this is the correct section for the unit and furnace type installed. If not, refer to the proper section as indicated for the unit as configured.
- For units that require vent extension kits, refer to Literature #LNX15-574, “Installation Instructions, Extended Vent Kit, Model DLV Gas Heat”, otherwise install the vent terminal(s) as shown in Figure 12.1.
- When the terminal(s) have been installed, proceed to the “Start-Up” section.

Figure 12.1 - Vent Terminal(s) for Non-Condensing Gas Furnace Option (B and C-Cabinet Units)

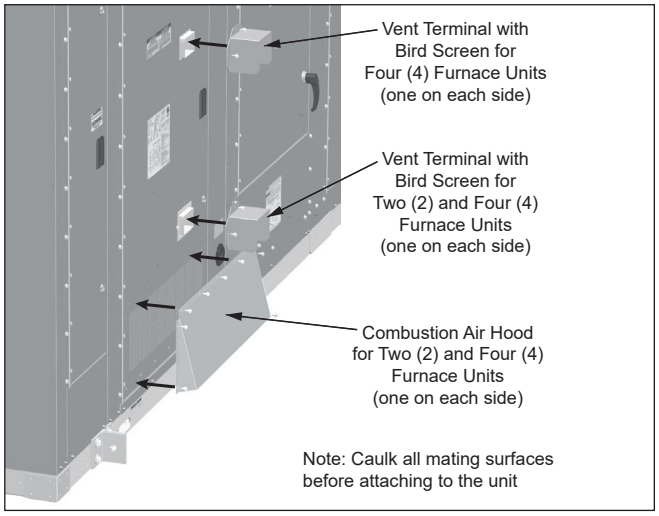


② C-Cabinet sized unit shown with two vent terminals.
B-Cabinet sized units have only one.

Section B: Non-Condensing D-Cabinet Furnaces

- Review Table 12.1 to verify this is the correct section for the unit and furnace type installed. If not, refer to the proper section as indicated for the unit as configured.
- For units that require vent extension kits, refer to Literature #LNX15-574, “Installation Instructions, Extended Vent Kit, Model DLV Gas Heat”, otherwise install the vent terminal(s) and combustion air hoods as shown in Figure 12.2.
- When the terminal(s) have been installed, proceed to the “Start-Up” section.

Figure 12.2 - Vent Terminal(s) and Combustion Air Hood for Non-Condensing Gas Furnace Option (D-Cabinet Units)



GAS HEATING OPTION VENT TERMINALS AND COMBUSTION AIR HOODS

Section C: Condensing B or C-Cabinet Furnaces

- Review Table 12.1 to verify this is the correct section for the unit and furnace type installed. If not, refer to the proper section as indicated for the unit as configured.
- For units that require vent extension kits, refer to Literature #LNX15-574, “Installation Instructions, Extended Vent Kit, Model DLV Gas Heat”, otherwise install the vent terminal(s) as shown in Figures 13.1 through 13.2. Note the following installation steps:

B-Cabinet Units Only (refer to Figure 13.1)

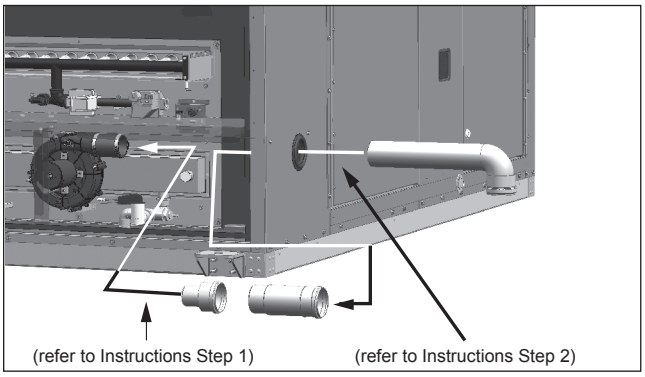
Step 1: Insert short vent pipe into the vent pipe reducer. Insert that assembly into the rubber coupling on the power exhauster outlet. Tighten the clamp on the flexible coupling to secure the vent pipe.

Step 2: Insert the outer vent pipe with termination elbow through the enclosure wall grommet and into the vent pipe section installed in Step 1.

Step 3: Verify that the bird screen is inserted in the termination elbow and that the vent terminal elbow is oriented to exhaust straight down.

C-Cabinet Units Only (refer to Figure 13.2)

Figure 13.1 - Vent Terminal for Condensing Gas Furnace Option (B-Cabinet Unit)



Step 1: Insert small diameter outside vent pipe termination through enclosure wall grommet and into the flexible rubber coupling on the right side power exhaust outlet. Tighten the clamp on the flexible coupling to secure the vent pipe.

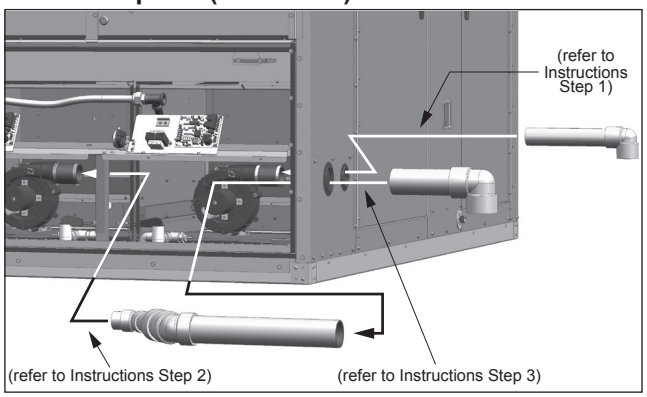
Step 2: Insert large diameter inner vent pipe assembly into the flexible rubber coupling on the left side power exhaust outlet. Tighten the clamp on the flexible coupling to secure the vent pipe.

Step 3: Insert large diameter outside vent pipe termination through enclosure wall grommet and into the interlocking joint of the inner vent pipe assembly from Step 2.

Step 4: Verify that the bird screens are inserted in the termination elbows and that the vent terminal elbow is oriented to exhaust straight down.

- Once complete, proceed to the “Condensate Drain and Trap Installation” Section.

Figure 13.2 - Vent Terminal for Condensing Gas Furnace Option (C-Cabinet)



Section D: Condensing D-Cabinet Furnaces

- Review Table 12.1 to verify this is the correct section for the unit and furnace type installed. If not, refer to the proper section as indicated for the unit as configured.
- For units that require vent extension kits, refer to Literature #LNX15-574, “Installation Instructions, Extended Vent Kit, Model DLV Gas Heat”, otherwise install the vent terminal(s) as shown in Figure 13.3. Note the following installation steps:

D-Cabinet Units Only (refer to Figure 13.3)

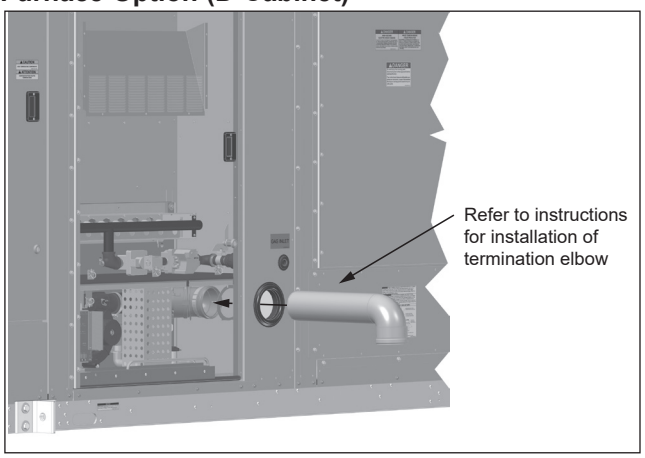
Step 1: Insert the outer vent pipe with termination elbow through the enclosure wall grommet on one side of the unit and into the rubber coupling on the power exhauster outlet. Tighten the clamp on the flexible coupling to secure the vent pipe.

Step 2: Verify that the bird screen is inserted in the termination elbow and that the vent terminal elbow is oriented to exhaust straight down.

Step 3: Repeat Steps 1 and 2 for the heating section on the opposite side of the unit.

- This is the only D-Cabinet gas heat configuration that does NOT have combustion air hoods to be field installed.
- Once complete, proceed to the “Condensate Drain and Trap Installation” Section.

Figure 13.3 - Vent Terminals for Condensing Gas Furnace Option (D-Cabinet)



GAS HEATING OPTION VENT TERMINALS AND COMBUSTION AIR HOODS

Section E: Hybrid Condensing & Non-Condensing D-Cabinet Furnaces

- Review Table 12.1 to verify this is the correct section for the unit and furnace type installed. If not, refer to the proper section as indicated for the unit as configured.
- For units that require vent extension kits, refer to Literature #LNX15-574, “Installation Instructions, Extended Vent Kit, Model DLV Gas Heat”, otherwise install the vent terminal(s) as shown in Figure 14.1. Note the following installation steps:

D-Cabinet Units Only (refer to Figure 14.1)

Step 1: Insert the outer vent pipe with termination elbow for the condensing furnace through the enclosure wall grommet on one side of the unit and into the rubber coupling on the power exhauster outlet. Tighten the clamp on the flexible coupling to secure the vent pipe.

Step 2: Verify that the bird screen is inserted in the termination elbow and that the vent terminal elbow is oriented to exhaust straight down.

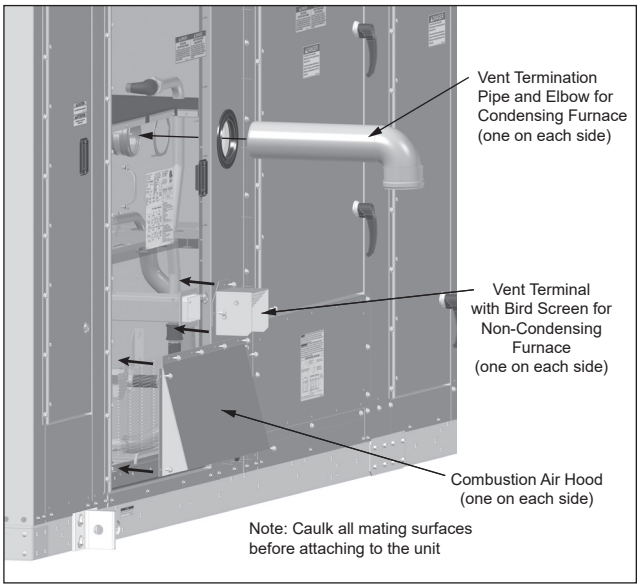
Step 3: Install the vent terminal with bird screen for the non-condensing furnace on one side of the unit and secure with screws provided. Caulk the mating surface before attaching.

Step 4: Install the combustion air hood on one side of the unit using the screws provided. Caulk the mating surface before attaching.

Step 5: Repeat Steps 1 and 4 for the heating sections on the opposite side of the unit.

- Once complete, proceed to the “Condensate Drain and Trap Installation” Section.

Figure 14.1 - Vent Terminals for Hybrid Gas Furnace Option (D-Cabinet)



GAS HEATING OPTION CONDENSATE DRAIN AND TRAP INSTALLATION

Furnace Condensate Drain/Trap Installation

REVIEW BEFORE PROCEEDING

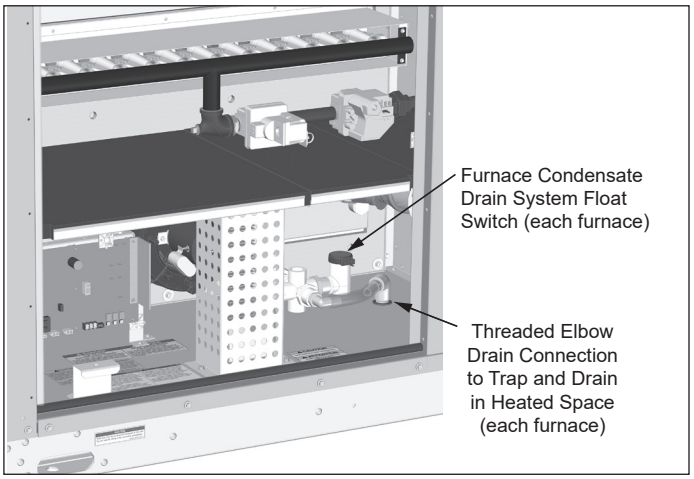
THIS SECTION APPLIES TO UNITS WITH OPTIONAL CONDENSING OR HYBRID GAS HEAT (MODEL DIGIT 17=2 OR 3) PER TABLE 12.1.

IF THE UNIT DOES NOT HAVE CONDENSING GAS HEAT, SKIP TO PAGE 16.

For Condensing furnace types, as determined from Table 12.1 on page 12, during heating operation, condensate is produced in the furnace sections. The installation requires condensate drain systems from each furnace section, as shown in Figures 15.1 and 15.2 and described below. Condensate trap kits are provided with the unit.

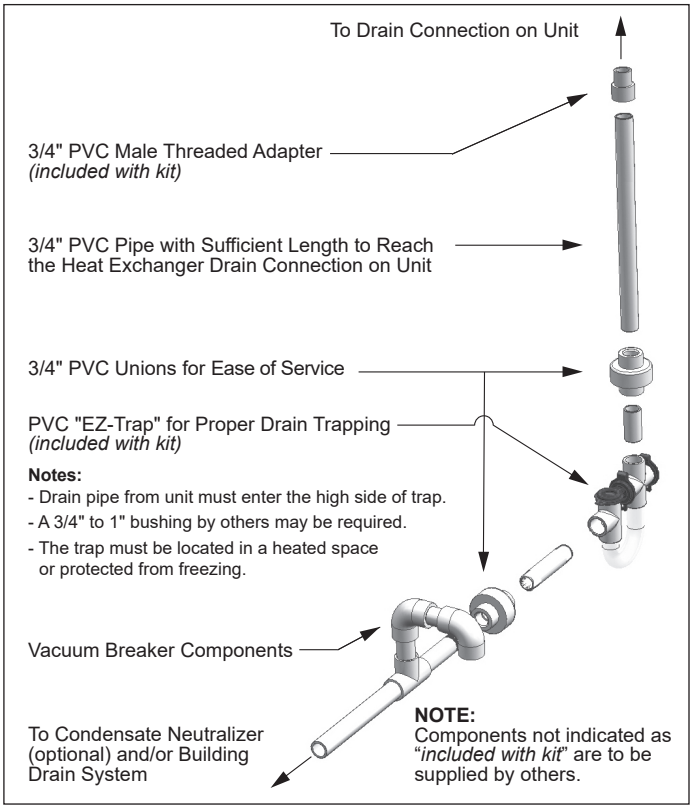
1. For proper heating system performance, the condensate drain system must include a trap for each furnace. B-Cabinet units have one furnace while C and D-Cabinet units have two furnaces.
2. All joints must be watertight to prevent condensate leakage. The drains must be extended down through the base of the unit and into the heated space below.
3. Each heat exchanger drain assembly includes a threaded elbow that is oriented down as shown in Figure 15.1. Once the male threaded PVC adapters, included with the kit, are glued to the PVC drain pipe (by others) that extends into the space, they are to be routed up through the holes in the unit base pan and screwed into the elbow connections. The threads must be sealed to prevent leaks.
4. Unions are recommended to permit maintenance of the drains and to facilitate service of the heater. A union is shown on both sides of each trap.
5. A vacuum breaker is required after each trap. The vacuum breaker should be constructed so that dirt and debris do not enter and clog the drain system.
6. Local code permitting, multiple condensate drain systems may be joined after the traps and connected to a sanitary drain within the building. Because the condensate produced is acidic, some municipalities may require that the condensate be neutralized before being discharged into the sanitary sewer. A condensate neutralizer tube kit is available to reduce the pH. A single tube can be used for drains that are joined after the traps providing the tube is installed after the junction. Refer to the kit instructions for additional information.
7. For proper operation, the traps must be primed with water. The traps must be installed with the higher side connected to the heater and the lower side connected to the drain.
8. If there is an opportunity that the temperature in the space will fall below freezing during non-operating periods, the condensate drain systems and secondary heat exchanger must be completely drained to prevent damage. Alternately, heat tape can be applied to the drain pipe system in accordance with the heat tape manufacturers instructions.
9. When the furnace condensate drain system has been installed, proceed to the “Start-Up” section.

Figure 15.1 - Furnace Condensate Drain and Float Switch Location ①



① D-Cabinet unit shown for example purposes. B and C-Cabinet condensing furnace options will also have a condensate drain system float switch with a drain connection through the base of the unit.

Figure 15.2 - Condensate Drain System with Trap and Vacuum Breaker ②



② B-Cabinet units require a single drain system while C and D-Cabinet units require two condensate drain systems, one for each furnace.

HOT WATER PIPING CONNECTIONS

REVIEW BEFORE PROCEEDING

THIS SECTION APPLIES TO UNITS WITH OPTIONAL HOT WATER HEAT (MODEL DIGIT 17=4).

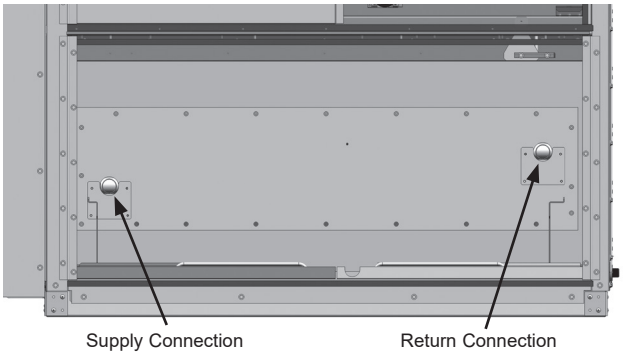
IF THE UNIT DOES NOT HAVE HOT WATER HEAT, SKIP TO PAGE 17.

⚠ CAUTION

1. Units not approved for use in potable water systems.
2. Do not operate the unit with steam. The coil is not designed for steam condensate removal which can damage the unit.
3. Hot water supplied to the hot water heating option must not exceed 180°F temperature or 75 PSIG pressure.

1. Models with a factory installed hot water heating coil (for use with water or glycol fluids) are supplied with 1-1/2" sweat connections (1.625").

Figure 16.1 - Hot Water Coil Connections



2. The entering water temperature (EWT) supplied to the heating coil must not exceed 180°F.
3. The fluid flow rate must not exceed 50 GPM and fluid pressure must not exceed 75 psi.
4. It is recommended to use an inhibited glycol solution that is designed for HVAC applications for corrosion protection and freeze protection for the lowest possible outside air temperatures for the installed location. Failure to protect against freezing can result in damage to the coil and property.
5. Provide adequate pipe hangers, supports, or anchors to secure the piping system independently of the coil to prevent excess vibration and stress that can damage the piping and joints.
6. All field brazing and welding should be performed using high quality materials and an inert gas purge (such as nitrogen) to reduce oxidation of the internal surface of the coil.
7. System piping should be flexible enough to allow for thermal expansion and contraction of the coil and piping components.
8. Refer to Figures 16.2 and 16.3 for typical piping system design and the following recommended items:
   - Install shut-off valves in lines to and from the unit to allow for maintenance or replacement of the coil without shutting down and draining the entire system.
   - Install unions for ease of piping component/coil removal.
   - Include a circuit setter in the return line to regulate flow.
   - On 3-way valve control configurations, include a balancing valve between the supply line and control valve to balance the system.
   - Include a hose bib drain valve on the bottom of the supply manifold to allow for periodic flushing of the system to remove sediments from the coil.
   - Include a pipe line strainer on the supply line to prevent sediment from reaching the coil.
   - Include an air vent at the top of the return manifold to bleed off accumulated air in the system. Air in the system will generate noise and may cause water hammer that can damage the joints of the piping and coil.
   - Include either a 2-way or 3-way modulating control valve designed for a 0-10VDC control signal. The valves will be automatically modulated by the unit's Carel controller to maintain the supply air temperature setpoint. Note that the control valve must be a normally open, spring return type valve. This is to allow hot water to flow through the coil for freeze protection when the unit is shut down. Refer to the Freeze Stat Option section below for additional detail.
   - Hot water pipes should be insulated to reduce heat loss and to prevent overheating of the end compartment.
9. Leak test the coil and connections as outlined in the Start-Up section.

Figure 16.2 - Typical 2-Way Piping Installation (piping and components by others)

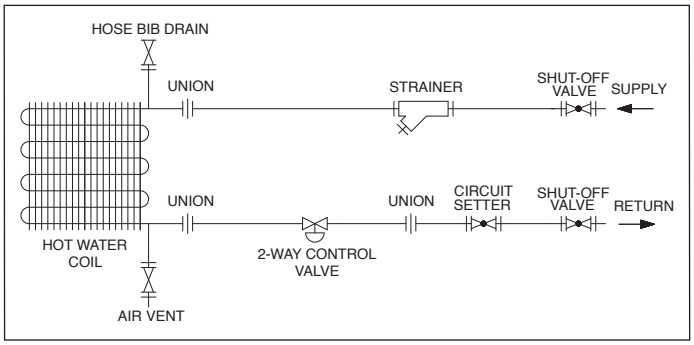
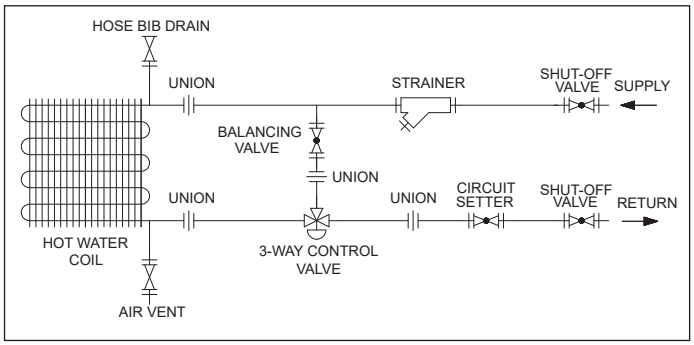


Figure 16.3 - Typical 3-Way Piping Installation (piping and components by others)



Optional Factory Installed Freeze Stat

When equipped with the optional Coil Freeze Stat, an auto-resetting capillary type freeze stat (see Figure 56.1) is factory installed immediately below and across the face of the hot water coil. The stat is set to trip at 40°F (adjustable) and will automatically reset when the coil temperature rises 5°F above the setpoint. If the stat has tripped, the unit controls would respond by closing the outdoor air damper, opening the return air damper (if applicable), de-energize the supply air fan, open the hot water coil valve 100%, and log the alarm on the controller. The freeze stat can be removed from the unit for servicing as discussed in the Maintenance section.

START-UP PROCEDURE

General

⚠WARNING

1. When the dead front disconnect switch(es) (for main unit and/or powered convenience outlet option) is in the "OFF" position, supply power remains energized at the line (supply) side of the dead front disconnect switch(es). The switch body is located inside of another junction box to protect against contact with the live wiring. The junction box must not be disassembled unless the main power supply from the building to the unit is de-energized.
2. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.

⚠CAUTION

When servicing the unit, some components may be hot enough to cause pain or injury. Allow time for cooling of hot components before servicing.

IMPORTANT

1. To prevent premature heat exchanger failure, check to be sure the blower has been set to deliver the proper airflow for the application. Refer to page 18 for Blower Adjustments.
2. Start-up and adjustment procedures must be performed by a qualified service agency.
3. All scroll compressors requires the correct supply power phase rotation. Phase reversal may result in compressor failure not covered under warranty.
4. The exhaust fan is not designed for high temperature or smoke control exhaust applications. Exhaust air temperature must not exceed 104°F. Operating the exhaust fan above 104°F will result in failure of the exhaust fan.

1. Turn off power to the unit at the disconnect switch. If equipped with gas heating option, turn all hand gas valves to the "OFF" position.

   Note: The dead front disconnect switch, if included, is factory installed in the controls/compressor compartment section (refer to the figures on pages 36 through 39). The disconnect switch is designed so that it must be turned "OFF" before entry to the compartment can be obtained. When in the "OFF" position, power is disconnected to all unit wiring electrically following the switch (see WARNING).
2. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.
3. Open the power compartment, controls compartment, and blower access doors.
4. Check that the supply voltage matches the unit supply voltage listed on the Unit Serial Plate. For units equipped for dual power supply sources, the voltage on both the main feed and the auxiliary feed must match the unit supply voltage listed on the Unit Serial Plate.
5. Check that fuses or circuit breakers are in place and sized correctly.
6. Verify that all wiring is secure and properly protected. Trace circuits to ensure that the unit has been wired according to the wiring diagram.
7. Check that all electrical and gas connections are weatherized.
8. For C-Cabinet sized units, if the unit is installed with an Energy Recovery Module, Model EWM, verify the wiring connection between the DLV unit and the EWM unit has been properly installed. If the unit is a B or D-Cabinet sized unit with integral Energy Recovery, the unit is already factory wired to the Energy Recovery section.
9. For units with gas heating, check to ensure that the combustion air inlet louvers and the power exhauster discharge cover (Non-Condensing as determined from Table 12.1 on page 12) or the vent elbow terminations (Condensing as determined from Table 12.1 on page 12) are free from obstructions.
10. For units with condensing gas heating, check that the condensate drain system is properly installed and the trap has been primed with water.
11. For units with Hot Water Heat (Digit 17=4), check the following:
    - Open air vents so that air is eliminated from within the coil circuitry and headers. Verify that vents and drains are not obstructed and do discharge a stream of water.
    - Open all required valves to fill the coil. Once the coil is full, close all air vents.
    - Perform an initial hydrostatic leak test of all brazed, threaded or flanged joints, valves and interconnecting piping, and the hot water coil. Recheck the coil level and correct if necessary.
    - When the setup is found to be leak free, flush the coil through the drain valve to eliminate grease, oil, flux and sealing compounds present from the installation.
    - Recheck the coil and all connections for water leaks.
    - Check water flow rates and pressure drops and compare to design.
    - Check that the hot water supplied to the coil does not exceed 180°F temperature or 75 PSIG pressure. Verify that the appropriate glycol mixture is used for freeze protection.
12. Check to see that there are no obstructions to the intake and discharge of the unit.
13. Verify that the belts are aligned in the sheave grooves properly and are not angled from sheave to sheave.
14. On belt driven blowers, blower bearings are permanently lubricated unless they are pillow block bearings or if they have grease fittings. For motors or blower bearings that are not permanently lubricated, lubricate according to the manufacturer's instructions. Refer to the Maintenance section on page 54.
15. Check to make sure that all filters are in place and that they are installed properly according to direction of air flow. Pleat direction must be vertical to ensure optimum performance.
16. Perform a visual inspection of the unit to make sure no damage has occurred during installation.

17. Check that the evaporator drain pan drain trap has been primed with water.
18. Turn on power to the unit at the disconnect switch. **Note:** Units include one blower door switch per access door (one on B- and C-Cabinet, two on D-Cabinet) that are factory installed inside the blower access section door(s). When a blower section door (supply and/or exhaust) is opened, the switch is opened and interrupts power to the low voltage circuit and de-energizes the blower motor controller. D-Cabinet units also have the same switches on the evaporator/hot gas reheat coil access sections.
19. Check the Carel microprocessor controller and supply fan blower motor for electrical operation. If the unit is equipped with the optional building power exhauster module (with or without energy recovery), check the blower motor for electrical operation. If these do not function, recheck the wiring diagram. Check to ensure that none of the Control Options (for example, smoke detector, etc.) have tripped.
20. Check to make sure that the outside air inlet dampers (and return air dampers if equipped) operate properly without binding.
21. If the unit is equipped with power exhaust (model Digit 7=B, C, E, or F) or barometric relief dampers (Digit 7=R), check to ensure the dampers move freely and do not bind when manually opened and closed. Refer to Figure 57.1.
22. Check that the supply power wiring is wired with the correct phase rotation. For units equipped for dual power supply sources, correct phase rotation must be verified on both the main feed and the auxiliary feed. Incorrect phase rotation can damage the equipment.

    The supply fan variable frequency drive will correct the phase rotation for the supply fan, but will not correct the phase rotation for the rest of the unit, therefore observing the supply blower wheel rotation direction is not an accurate indicator of correct phase rotation. Scroll compressors will only compress in one rotational direction. Verification of proper rotation direction is made by observing that suction pressure drops and discharge pressure rises when the compressor is energized. Reverse rotation will result in no pressure differential as compared to normal values. There is no negative impact on durability caused by operating the compressors in the reversed direction for a short period of time (under one hour) but should not be allowed to operate longer than the time it takes to verify rotation. If the compressor is rotating in the opposite direction, the phase reversal must be corrected by changing the incoming power feed legs at the supply to the unit, NOT at the compressor. Recheck for proper rotation.
23. Check the blower speed (rpm). Refer to Blower Adjustments for modification.
24. Check the motor speed (rpm).
25. Check the motor voltage. On three phase systems, check to make sure all legs are in balance.
26. Check the motor amp draw to make sure it does not exceed the motor nameplate rating. Check all legs to ensure system is balanced.
27. For units equipped for dual power supply sources, the unit should be started separately on the main power feed and again on the auxiliary power feed to verify proper unit and control operation.

    Note: Units equipped for dual power supply sources have the unit power wiring separated into two circuits as follows:

    Circuit #1
    - Compressors
    - Condenser fans
    - Electric heating section (if applicable).
    - Energy recovery wheel (if applicable)

    Circuit #2
    - Main unit controller
    - Supply fan
    - Dampers
    - Gas heating section (if applicable)
    - Exhaust fan (if applicable)
    - Energy recovery wheel bypass damper (if applicable)

    When operating in a full power state with the main power feed, both Circuit #1 and Circuit #2 should be powered. When operating in a low power state with the auxiliary power feed, only Circuit #2 should be powered.

Blower Adjustments

The units are designed for ease of airflow adjustments, within a range, for field balancing against actual external static pressure conditions. If the static pressure external to the unit is above or below the original design point for the unit, the blower will deliver an airflow volume that is lower or higher than required. When equipped with the building exhaust option (with or without energy recovery), the air balancing must be performed for both the main unit supply fan, as well as the exhaust fan.

The blower speed (supply and/or exhaust blowers) may be adjusted to achieve the desired air volume, provided:

- The allowable temperature rise range and the maximum supply air temperature for heating is not exceeded as shown in Table 19.1, and
- The airflow is within the allowable limits shown on the serial plate for both heating and cooling, and
- The total static pressure does not exceed the limit shown on the unit serial plate, and
- It is within the range of adjustability for the unit, and
- The motor amp draw must not exceed the motor nameplate rating.

The blower speed adjustment method is dependent on the following configurations:

- **Direct Drive** where the blower is driven directly by the motor as seen in Figure 19.1. This is the current standard supply fan configuration for all units.
- **Belt Drive** where the blower is driven by the motor with a belt and sheaves as seen in Figure 19.2. This is the current standard exhaust fan configuration (if equipped) for all B- and C-Cabinet sized units. D-Cabinet sized units with exhaust are direct drive (see previous bullet point).

Once the blower/motor configuration of the unit is determined, follow the appropriate instructions in the sections on the following pages.

Figure 19.1 - Direct Drive Blower Example

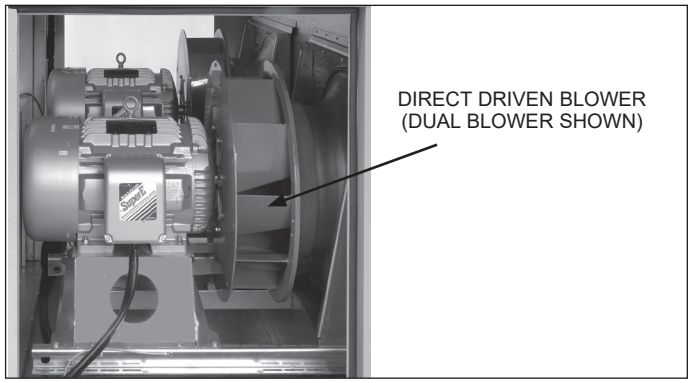


Figure 19.2 - Belt Drive Blower Example

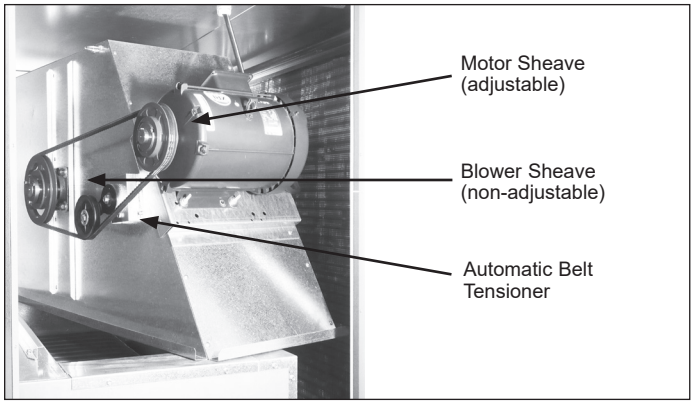


Table 19.1 - Allowable Temperature Rise Range and Maximum Supply Air Temperature

Cabinet Size (Digit 6)	Heat Type (Digit 17)	Heat Capacity (Digit 18)	Temp Rise (Digit 19)	Allowable Temp Rise Range	Max Supply Air Temp	Efficiency (for formula)
B	1	A, B, C, D, 1, 3, 5, 7	N	1-100°F	100°F	1.00
	2 or 3	F, G, H, J, K	L	30-70°F	130°F	0.81
			H	70-100°F		
		R, S, T	N	30-100°F	100°F	0.94
	5 or 6	F, G, H	L	30-70°F	130°F	0.81
		F, G, H, J, K	H	70-100°F		
C	1	A, B, C, D, E	N	1-100°F	100°F	1.00
	2 or 3	J	N	30-75°F	130°F	0.81
		K, L, M	L	30-70°F		
			H	70-100°F		
		U, V	L	30-70°F	100°F	0.90
			H	70-100°F		
	5 or 6	J	N	30-75°F	130°F	0.81
		K, L	L	30-70°F		
			H	70-100°F		
D	1	A, B, C, D, E, 1, 3, 5, 7	N	1-100°F	100°F	1.00
	2 or 3	K	L	30-75°F	130°F	0.81
		L, M, Q	L	30-70°F		
		L, M, Q	H	70-100°F		
		1, 4	H	70-120°F		
		2, 3, 5	H	60-120°F		
		6, 7, 8, 9	H	70-120°F	130°F	0.87
		P, V	N	30-100°F	100°F	0.94
	5 or 6	1	H	70-120°F	130°F	0.81
		2	H	60-120°F		
		K	L	30-75°F		
		L	L	30-70°F		
			H	70-100°F		

Blower Adjustments – Direct Drive Fans

All direct drive supply fan speed adjustments can be performed with the main unit Carel programmable microprocessor controller. There are two ways to access the menus:

1. Using the user interface on the main unit controller.
2. Using the handheld pGD1 Digital Display/Interface Module.

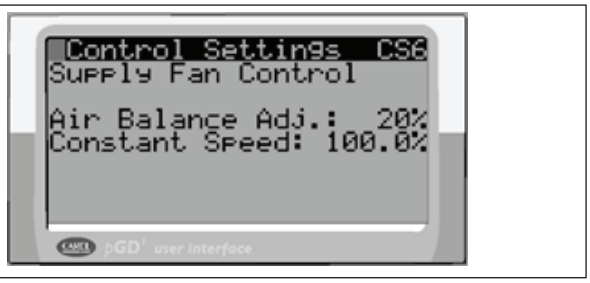
For guidance on either method above, refer to the latest revision of the following documents for additional warnings, cautions, controller location, instructions, and menu navigation:

- Controls Manual that shipped with the unit.
- Installation Instructions that shipped with the handheld pGD1 Digital Display/Interface Module.

The blower adjustments are made as follows:

1. Ensure unit is running at the maximum airflow setting for the control type selected. For example, if the unit has Multi-Speed or Variable Speed fan control, ensure the unit is operating at the highest speed setting.
2. On the keypad navigate to menu “G. Service -> f. SERVICE SETTINGS”. At this menu, you will be prompted to enter the Service password of 1500.
3. Navigate to “c. Control Settings” and scroll to the “Supply Fan Control (CS6)” screen. See Figure 19.3.

Figure 19.3 - Control Settings Screen CS6



4. Adjust the Air Balance Adj. parameter up or down to obtain the design airflow given the actual static pressure.
5. In the event you are unable to increase or decrease the motor speed to the desired air balance please consult your factory representative.
6. Check the motor amps to ensure the maximum motor amp rating is not exceeded. For units equipped with a VFD, measure the amps at the incoming lines to the motor. If the unit has dual supply fans, measure each motor individually. Verify airflow volume and repeat steps above for further adjustment.
7. If equipped with gas heat, turn on the gas and initiate burner operation. For guidance, refer to the Controls Manual that shipped with the unit.
8. Verify the temperature rise and supply air temperature of the heating section do not fall outside the range or exceed the maximums shown in Table 19.1. Airflow (CFM) and Temp Rise (ATR) can be approximated with the following formulas in Figure 19.4:

Figure 19.4 - Airflow and Temp Rise Formulas

CFM = (Input MBH x 1000 x Eff) / (1.08 x ATR)

or

ATR = (Input MBH x 1000 x Eff) / (1.08 x CFM)

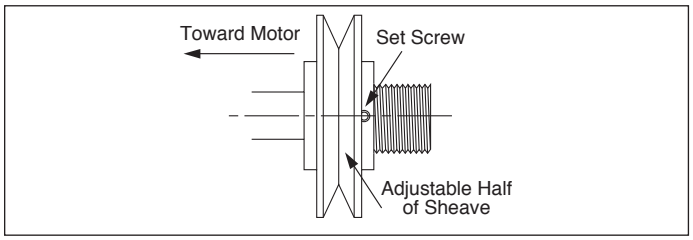
where Eff (Efficiency) is determined from Table 19.1

Blower Adjustments – Belt Drive Fans

All belt drive supply fan and, if applicable, exhaust fan speed adjustments can be made with the adjustable sheave on the blower motor as follows:

1. Turn off power to the unit at the disconnect switch. If equipped with gas heat option, turn all hand gas valves to the “OFF” position.
2. Loosen the belt tension and remove the belt.
3. On the motor sheave, loosen the set screw on the side away from the motor (see Figure 20.1).

Figure 20.1 - Motor Sheave Adjustment



4. To increase the blower speed, turn the adjustable half of the sheave inward. To decrease the blower speed, turn the adjustable half of the sheave outward. The sheave half is adjustable in ½ turn (180°) increments. Each ½ turn represents approximately a 2-5% change in blower speed and airflow volume.
5. Tighten the set screw on the flat portion of the sheave shaft.
6. Replace the belt and verify that the belts are aligned in the sheave grooves properly and are not angled from sheave to sheave.
7. Turn on power to the unit and initiate blower motor operation. For guidance, refer to the Controls Manual that shipped with the unit.
8. Check the motor amps to ensure the maximum motor amp rating is not exceeded. Verify airflow volume and repeat steps above for further adjustment.
9. If equipped with gas heat, turn on the gas and initiate burner operation. For guidance, refer to the Controls Manual that shipped with the unit.
10. Verify the temperature rise and supply air temperature of the heating section do not fall outside the range or exceed the maximums shown in Table 19.1. Airflow (CFM) can be approximated with the formula from Figure 19.4.
11. After 24 hours of operation, retighten the setscrews to the torque listed in the owners manual on the bearing, sheave, and blower wheel to avoid damage to the unit.

Air Flow Proving Switch / Optional Dirty Filter Switch

The air flow proving switch is factory installed in the blower compartment and acts to cut power to the controls if a positive pressure is not measured by the switch, which would be caused by a lack of air movement through the unit.

The optional dirty filter pressure switch is factory installed in the filter section and monitors the pressure across the filters. When the filters become dirty, the pressure increases and trips the switch, initiating an alarm from the Carel controller. The switch must be field set because setting the switch requires the blower to be in operation and the ductwork to be installed.

Setting the Air Flow Proving or Dirty Filter Switch

1. Ensure that the unit filters are clean. Replace if necessary.
2. Using the Carel controller interface, start blower operation.
3. Turn the pressure switch set screw clockwise until it stops.
4. With the wires removed from the common and normally open terminals of the switch, measure continuity and turn the adjustment screw counter-clockwise until the switch makes. Then turn the adjustment screw one additional turn counter-clockwise to account for dirty filters or other system static changes.

Variable Air Movement Applications

Units may be supplied with variable frequency drives for variable air volume applications. The lowest airflow attainable is called the Minimum Turndown Airflow (MTA) and can vary based on the unit design airflow and nominal cooling/heating size. The MTA can also vary between heating and cooling modes. The following are basic guidelines for determining the MTA capability, which can be expressed as a % by dividing the MTA by the design airflow.

Cooling Mode

The $MTA_{COOLING}$ is the GREATER of 30% of design airflow and the minimums shown in Table 20.1.

Table 20.1 - Minimum Turndown Airflow - Cooling

Cabinet Size (Digit 6)	Nominal Tons (Digits 4-5)	Minimum Turndown Airflow (CFM) ①
B	**7-10**	800
	13-20	1000
C	**15-30**	1550
D	**30-40**	1750
	52-60	2450

① The Minimum Turndown Airflow must not drop below 30% of design airflow.

Example: What is the $MTA_{COOLING}$ capability of a 10 nominal ton B-Cabinet unit in cooling mode with a design airflow of 2000 CFM?

- 30% of 2000 CFM is 600 CFM, which is below the 800 CFM minimum shown in Table 20.1, so 30% is not acceptable.
- The 800 CFM minimum shown would be the $MTA_{COOLING}$ capability, which corresponds to a turndown to 40% for the unit as configured (800 / 2000 = 40%).

Heating Mode

The $MTA_{HEATING}$ is the GREATER of 30% of design airflow and an airflow that results in the maximum allowable temperature rise (ATR) shown in Table 19.1 for the heat option selected. Note that the minimum airflow is listed on the heat option serial plate.

Example: What is the $MTA_{HEATING}$ capability of a B-Cabinet unit in heating mode with a design airflow of 2000 CFM and a 200,000 Btu/hr gas heat option (Digit 18=G)?

- 30% of 2000 CFM is 600 CFM, which would result in an ATR of 250°F, which is above the 100°F maximum shown in Table 19.1, so 30% is not acceptable.
- The maximum ATR for the selected heat option would occur at an airflow of 1500 CFM, which would be the $MTA_{HEATING}$ capability, which corresponds to a turndown to 75% for the unit as configured (1500 / 2000 = 75%).

Refer refer to the Controls Manual that shipped with the unit for additional information.

Checking Refrigerant Charge

⚠ WARNING

This unit contains R-410A high pressure refrigerant. Hazards exist that could result in personal injury or death. Installation, maintenance, and service must only be performed by an HVAC technician qualified in R-410A refrigerant and using proper tools and equipment. Due to the high pressure of R-410A refrigerant, DO NOT USE service equipment or tools designed for refrigerants other than R410A.

⚠ CAUTION

Do not overcharge the refrigeration system. This can lead to elevated compressor discharge pressure and may flood the compressor with liquid. This may result in compressor failure not covered under warranty.

IMPORTANT

1. All refrigeration checks must be made by a qualified R-410A refrigeration technician.
2. Do not release refrigerant to the atmosphere. When adding or removing refrigerant, all National, State/ Province, and local laws must be followed.

Units are charged with refrigerant at the factory with the charge amount shown in Table 21.1. Refrigerant charge can be verified by checking both superheat and subcooling. B and C-Cabinet units have one circuit and D-Cabinet units have two circuits. The following procedure is to be done for each refrigeration circuit.

1. Check the evaporator coil to be sure there are no obstructions to airflow.
2. From the Carel controller interface, create a call for cooling. If the unit has the hot gas reheat option, the hot gas reheat valves must be closed.
3. The unit must be operated at near to full load operation before checking the refrigerant charge. The unit operation should be stabilized, typically after 10-15 minutes of operation.
4. Measure subcooling as follows:
   a. Read the gauge pressure at the liquid line test port (refer to the figures on pages 34 through 35). Note the saturation temperature on the gauge.
   b. Measure the temperature of the liquid line at a point near where the pressure reading was taken.
   c. Subtract the measured liquid line temperature from the saturation temperature to determine the liquid subcooling. For units without the hot gas reheat option, the subcooling should be 10-15°F. For units with the hot gas reheat option, the subcooling should be 5-15°F.
5. Measure the superheat as follows:
   a. Read the gauge pressure at the suction line close to the compressor. Note the saturation temperature on the gauge.
   b. Measure the temperature of the suction line at a point near where the pressure reading was taken.
   c. Subtract the saturated temperature from the measured suction line temperature to determine the evaporator superheat. The superheat should be 8-12°F.
6. Determine if the system is undercharged or overcharged and correct as follows:
   a. Undercharged: Typically, superheat is too high and subcooling is too low. Refrigerant should be added.
   b. Overcharged: Typically, superheat is too low and subcooling is too high. Refrigerant should be removed.
7. After adding or removing refrigerant, allow the system to stabilize for 10-15 minutes before making any other adjustments.
8. Repeat the steps above until the subcooling and superheat are within the range specified.
9. Repeat the above procedure for the 2nd circuit on D-Cabinet units.
10. Once the correct charge has been established, operate the unit reheat mode to verify correct operation.

Table 21.1 - Refrigerant Charge

Casing Size (Digit 6)	Unit Tons (Digits 4-5)	Hot Gas Reheat (Digit 10)	Refrigerant Charge per Circuit (lbs.)	Circuit Qty
B	07	0	17.0	1
		1 or 2	20.0	
	10	0	17.0	
		1 or 2	20.5	
	13	0	23.0	
		1 or 2	28.5	
	15	0	24.0	
		1 or 2	28.5	
	20	0	28.5	
		1 or 2	35.5	
C	15	0	35.0	1
		1 or 2	39.0	
	20	0	37.0	
		1 or 2	42.0	
	26	0	38.0	
		1 or 2	44.0	
	30	0	39.0	
		1 or 2	46.0	
D	30	0	34.5	2
		1 or 2	45.0	
	40	0	36.0	
		1 or 2	46.5	
	52	0	40.0	
		1 or 2	55.0	
	60	0	41.0	
		1 or 2	56.0	

REVIEW BEFORE PROCEEDING

THIS SECTION APPLIES ONLY CERTAIN UNITS WITH OPTIONAL GAS HEAT (DLV MODEL DIGIT 17=2, 3, 5 OR 6).
REVIEW THE SECTION BELOW TO DETERMINE IF THESE INSTRUCTIONS ARE APPLICABLE.

IF THE UNIT DOES NOT HAVE GAS HEAT, SKIP TO PAGE 32.

Gas Heating Option Identification

The instructions in this section are only for units that meet the following conditions:

- Digit 17 of the DLV unit model number (not the gas heat option model number) is 2, 3, 5, or 6 indicating the gas heat option. Example:

  *DLV20CD1A1A8S16D**2**KHDNNNN (Digit 17=2)*

- Digit 11 of the gas heat option furnace model number (not the model DLV unit model number) is 4, 6 (with VB1200 controller), or 8. Example:

  *FMP0600SSN**4**H0A (Digit 11=4)*

Refer to Pages 62 through 66 for Serial Plate and Model Nomenclature information. Note that the furnace serial plate is separate from the unit (model DLV) serial plate.

Identify the Gas Control Type

Before you begin, review the furnace serial plate to determine the model installed. The serial plate is located on the right hand access door for the furnace section. Samples are shown on page 62. Note that the furnace serial plate is separate from the unit (model DLV) serial plate. Digit 11 of the furnace model number denotes the type of gas control used. These instructions are for the Digit 11 values defined below:

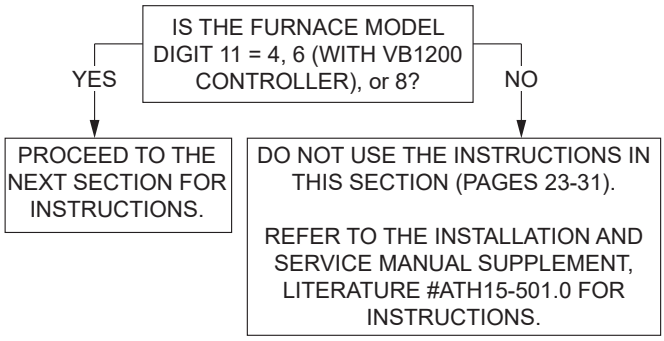
4 - Indicates two heat exchangers using basic modulating controls with United Technologies ignition. Manifold pressure of both heat exchangers is varied simultaneously based on demand. Power exhausters operate at a constant speed.

6① - Indicates a single heat exchanger with Beckett advanced modulation control which varies the manifold pressure and power exhauster speed based on demand. High turn down and more consistent efficiency are possible with this control.

① Applies to units with VB1200 furnace controller only (see Figure 25.1). For Digit 11=6 with a VB1285 furnace controller, see the next column for guidance.

8 - Indicates two or more heat exchangers; one equipped with advanced Beckett modulation primary control and the other(s) equipped with non-modulating single input secondary control. The secondary control heat exchanger(s) is controlled and monitored by the primary control and will turn on or off depending on demand.

The instructions on pages 23 through 31 are only for gas heating options on furnaces with Digit 11=4, 6 (with a VB1200 furnace controller as shown in Figure 25.1) or 8. If the Digit 11 is not one of those numbers, or Digit 11=6 with a VB1285 furnace controller, refer to the following flowchart to determine next steps:



Gas Heating Option Adjustments

The Gas Heating Option requires gas pressure be measured and adjusted as required at several points on the unit. The following steps must be completed for units as identified as applicable on page 22.

Check/Adjust Pressure Upstream of Unit

With the field installed manual gas shut-off valve in the “OFF” position, recheck the gas supply pressure at the field installed manual shut-off valve. The inlet pressure should be 6"-7" W.C. on natural gas or 11”-14” W.C. on propane (LP) gas, while all burners are operating, but never more than 14" W.C. when the burners are off. If inlet pressure is too high, install an additional pressure regulator upstream of the combination gas control.

Check/Adjust Pressure at Combination Gas Valve

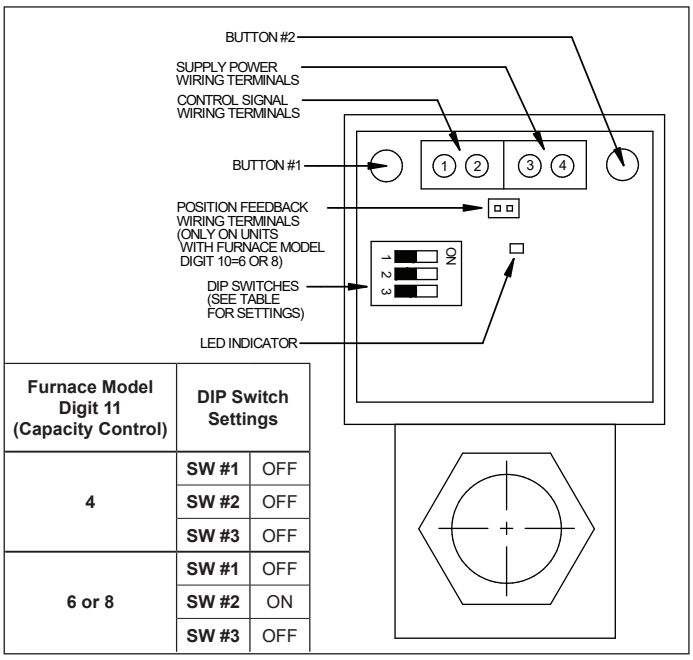
1. Open the field installed manual gas shut-off valve and set the combination gas control valve to the “ON” position. Note for C- and D-Cabinet sized units, the Gas Heating Option consists of two or more heating sections. For this step, only one combination gas valve is to be set to the “ON” position.
2. Enable the unit controls. For furnace models with furnace model Digit 11=6, the LED display on the furnace control board (Figure 25.1) will briefly display the furnace size. Verify that the model readout is correct for the unit being started.
3. Ensure that the supply fan blower is operating at the proper airflow and adjust the Carel controller control setpoint to create a call for heat. Refer to the Controls Manual for instructions on changing the setpoint.
4. Check the ignition control and gas valve for electrical operation.
5. Check to make sure that the main gas valve opens while the supply fan blower is operating.
6. Check the gas pressure at the INLET to the combination gas control valve (refer to figures on pages 26 through 31) and adjust as needed to maintain 6-7" W.C. for Natural Gas (11-14" W.C. for Propane) while the burners are operating at high fire. This pressure is required for proper ignition and to attain the rated input of the unit. If this pressure cannot be obtained, the gas supply is undersized and needs to be corrected or the gas supplier must be contacted.
7. Check gas pressure on the OUTLET of the combination gas control valve (refer to figures on pages 26 through 31) when the burners are functioning. This should be set to 4.0" W.C. for Natural Gas (10.5" W.C. for Propane) for all furnaces with furnace model Digit 11=4, or 6. For C-Cabinet furnaces with furnace model Digit 11=8, only the right hand modulated heat exchanger (Primary) is set to 4.0”W.C. for Natural Gas (10.5" W.C. for Propane). The left hand fixed input heat exchanger (Secondary) is set to 3.5”W.C. for Natural Gas (10.0" W.C. for Propane). Adjust the gas control valve regulator as needed (see gas valve instruction sheet for location.)
8. Check to ensure that gas controls sequence properly (see Controls Manual for additional information).
9. For units with multiple heat exchangers, repeat steps 3 through 8 for each heat exchanger before proceeding to the next step.

Check/Adjust Pressure at Manifold

The following steps are required to check/adjust the manifold pressure on modulated heat exchangers. For units with furnace model Digit 11=4, this process applies to both heat exchangers and is conducted on one heat exchanger at a time. For all other units, this process applies to only one heat exchanger, normally the lower right heat exchanger on multiple heat exchanger units.

1. Move the field installed manual shut-off valve to the “OFF” position.
2. Remove the 1/8" pipe plug in the pipe tee of the furnace.
3. Attach a digital or “U” tube type water manometer which is at least 12" high and capable of reading to 0.1" W.C.
4. The Maxitrol EXA modulating valve series (refer to figures on pages 26 through 31) has a cover secured with two screws that must be removed. Once removed, there are a bank of (3) DIP switches and two buttons and a communication LED for the user interface as shown in Figure 23.1.
5. Verify that the DIP switches are properly set to the settings shown in Figure 23.1.

Figure 23.1 - Maxitrol EXA Modulating Valve



Furnace Model Digit 11 (Capacity Control)	DIP Switch Settings	
4	SW #1	OFF
	SW #2	OFF
	SW #3	OFF
6 or 8	SW #1	OFF
	SW #2	ON
	SW #3	OFF

6. Move the field installed manual gas shut-off valve to the “ON” position.
7. Adjust the High Fire Setting as follows:
   a. Enable the unit controls.
   b. For units with furnace model Digit 11=6 or 8, place the furnace control into the “Checkout Test Mode” as described on the next page and set the Fire Rate Input to 10.0.
   c. Press and hold Button #1 on the modulating valve until the LED lights solid red, then release.
   d. With the valve now in the high fire setting mode, confirm or adjust the high fire manifold pressure to be 3.5" W.C. for Natural Gas (10.0" W.C. for Propane). If the pressure needs to be adjusted, press or hold Button #1 to increase gas flow and press or hold Button #2 to decrease gas flow.
   e. If 3.5" W.C. for Natural Gas (10.0" W.C. for Propane) cannot be attained, recheck the inlet gas pressure as

described previously. After addressing any issues, if the pressure still cannot be attained, step the valve closed using button #2 to the point where manifold pressure begins to be impacted. If the pressure at that point is less than 3.3" W.C. for Natural Gas (9.5 to 10.0" W.C. for Propane), corrective action is required.

f. Save the setting by simultaneously holding Buttons #1 and #2 until the LED turns OFF. If this is not performed within 5 minutes, the control will default to the previously saved settings and return to normal operating mode.

8. Adjust the Low Fire Setting as follows:
   a. For units with furnace model Digit 11=6 or 8, place the furnace control into the “Checkout Test Mode” as instructed in the next section and set the Fire Rate Input to 2.0.
   b. Press and hold Button #2 on the modulating valve until the LED light blinks red, then release.
   c. With the valve now in the low fire setting mode, confirm or adjust the low fire manifold pressure to be no less than the minimum shown on the furnace serial plate in the box called “Min. Manifold Pressure”. If the pressure needs to be adjusted:

      Press or hold Button #1 to increase gas flow and press Button #2 to decrease gas flow. It is best to push and release button #2 to single step the valve to the minimum manifold pressure. Pressing and holding the button is likely to cause the valve to close too far and lose flame.

   d. Save the setting by simultaneously holding Buttons #1 and #2 until the LED turns OFF. If this is not performed within 5 minutes, the control will default to the previously saved settings and return to normal operating mode.
9. For furnace models with Digit 11=6 or 8, if no errors or alerts were recorded by the board (these will be on the 3 LED displays as an “A” or “E” followed by a number), proceed to the next step. If any alerts or errors were logged by the board, refer to the “Clearing Furnace Control Board Error Codes” section on the next page to clear the errors.
10. For furnace models with Digit 11=6 or 8, verify the furnace control board and modulating valve is communicating properly by adjusting the Fire Rate Input on the control board from 10.0 to 2.0 with the up and down buttons.
    - The high fire manifold pressure may be in the range of 3.3" W.C. to 3.5" W.C. for Natural Gas (9.5 to 10.0" W.C. for Propane) at the 10.0 Fire Rate Input setting.
    - The low fire manifold pressure must not go below the minimum manifold pressure specified on the serial plate at the 2.0 Fire Rate Input setting. If the manifold pressure drops below the minimum specified or flame is lost, repeat the "Check/Adjust Pressure at Combination Gas Valve" section on the previous page and then repeat the “Low Fire Setting” sequence described above.
11. Once the setting of the modulating valve has been completed, replace the valve cover that was removed earlier.
12. Move the field installed manual shut-off valve to the “OFF” position, remove the manometer, and replace the 1/8" pipe plug.
13. After the plug is in place, move the field installed manual shut-off valve to the “ON” position and recheck the pipe plug for gas leaks with soap solution.
14. For units with furnace model Digit 11=4, repeat the entire process for the 2nd furnace.

Place Primary Furnace Control Into “Checkout Test Mode”
(Applies to furnace models with Digit 11=6 with VB1200 controller or 8)

The primary furnace control board (Figure 25.1) has functionality to be put it in a manual operation “Checkout Test Mode” for testing purposes as noted in the previous sections for checking and setting gas pressure. To enter that mode, perform the following steps:

1. The Checkout Test mode is only available when the furnace control board detects an “E09” error condition (No Firing Rate Input). To accomplish this, temporarily disconnect wire #804 from the furnace control board and create a call for heat from the main Carel controller. Be sure to insulate the end of the signal wire so it cannot cause a short.
2. Press the MODE button for at least 4 seconds until the LED display changes to display “Lo9”.
3. Press the DOWN button briefly to change the display to “tSt”, and then briefly press the MODE button to enter the Checkout Test mode.
4. When the Checkout Test mode is entered, the control board will initiate a normal ignition sequence with the Firing Rate Input set to a simulated 10.0 VDC. The simulated Firing Rate Input can be set to different 1.0 VDC step values from 10V to 2V. A 10V signal will give maximum fire rate while a 2V signal will give the minimum fire rate. Once burner ignition has been achieved and the control enters the RUN mode, the normal runtime data parameters, including the Firing Rate, will be continuously displayed on the furnace control board LED indicators.
5. If a lockout error condition occurs, or the MODE button is depressed for more than 4 seconds, or there is no push button activity for 30 minutes, then the Checkout Test mode will be exited.

Clearing Furnace Control Board Error Codes

1. Fault codes can be reviewed by pressing the MODE button for at least 4 seconds until the LED display changes to display “Lo9”. Refer to Figure 25.1 for location of buttons and LED display.
2. Briefly press the MODE button again to review the fault codes. Up to 15 fault codes are stored and can be reviewed by pressing the UP or DOWN buttons. Codes will be displayed followed by the number of days since the fault was detected.
3. To clear the fault codes from memory, press the DOWN button until “CLr” is displayed. Press and hold the MODE button to clear the memory. The board will then revert to normal operation.

START-UP PROCEDURE - CONTINUED

Figure 25.1 - Primary Furnace Control Board (Furnace models with Digit 11=6 or 8 only)

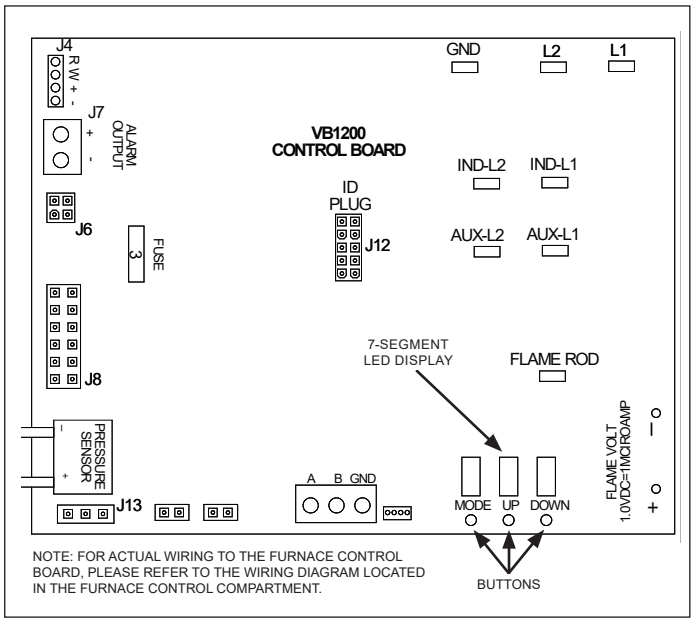
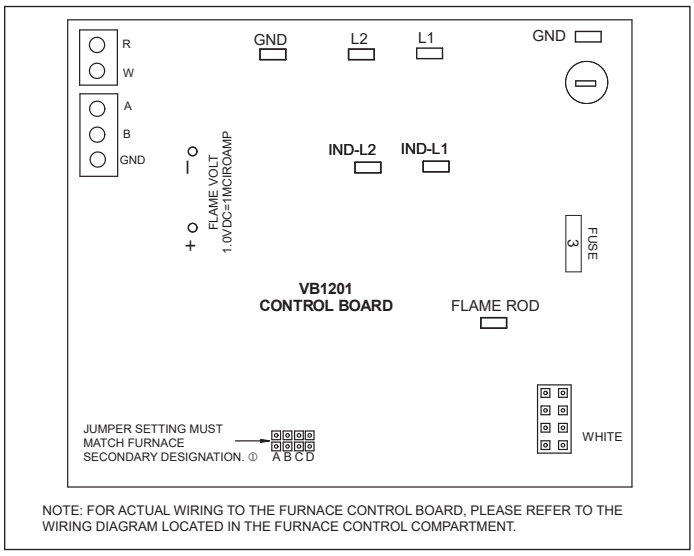
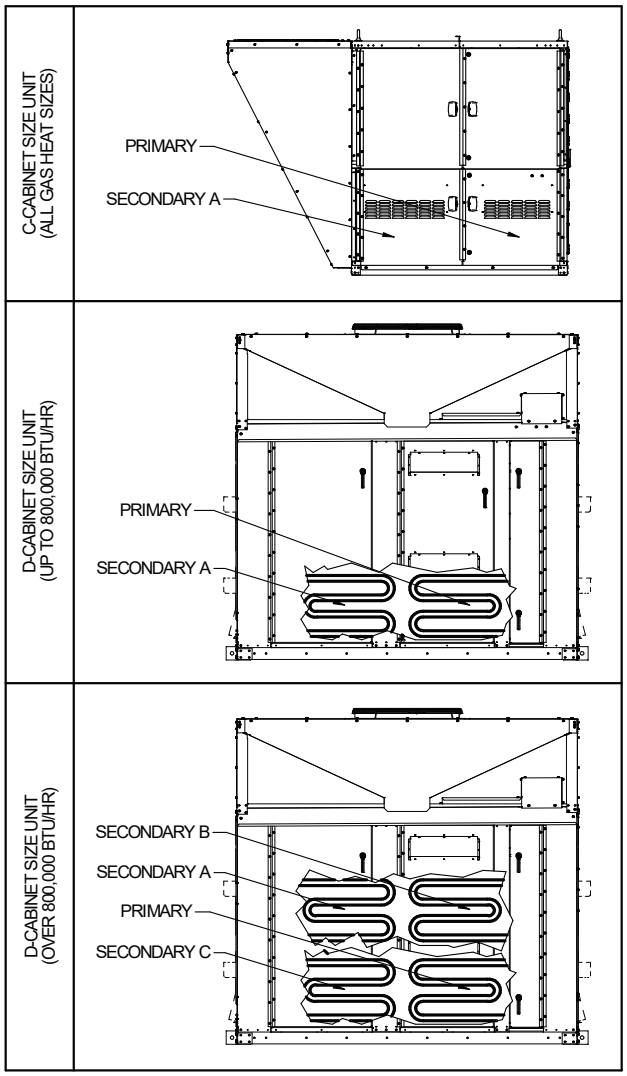


Figure 25.2 - Secondary Furnace Control Board (Furnace models with Digit 11=8) ①



① This applies to C- and D-Cabinet sized units with furnace model Digit 11=8. Refer to Figure 25.3 for identifying which furnace is the Primary and which furnace(s) are the Secondary furnace(s).

Figure 25.3 - Furnace Primary/Secondary Locations



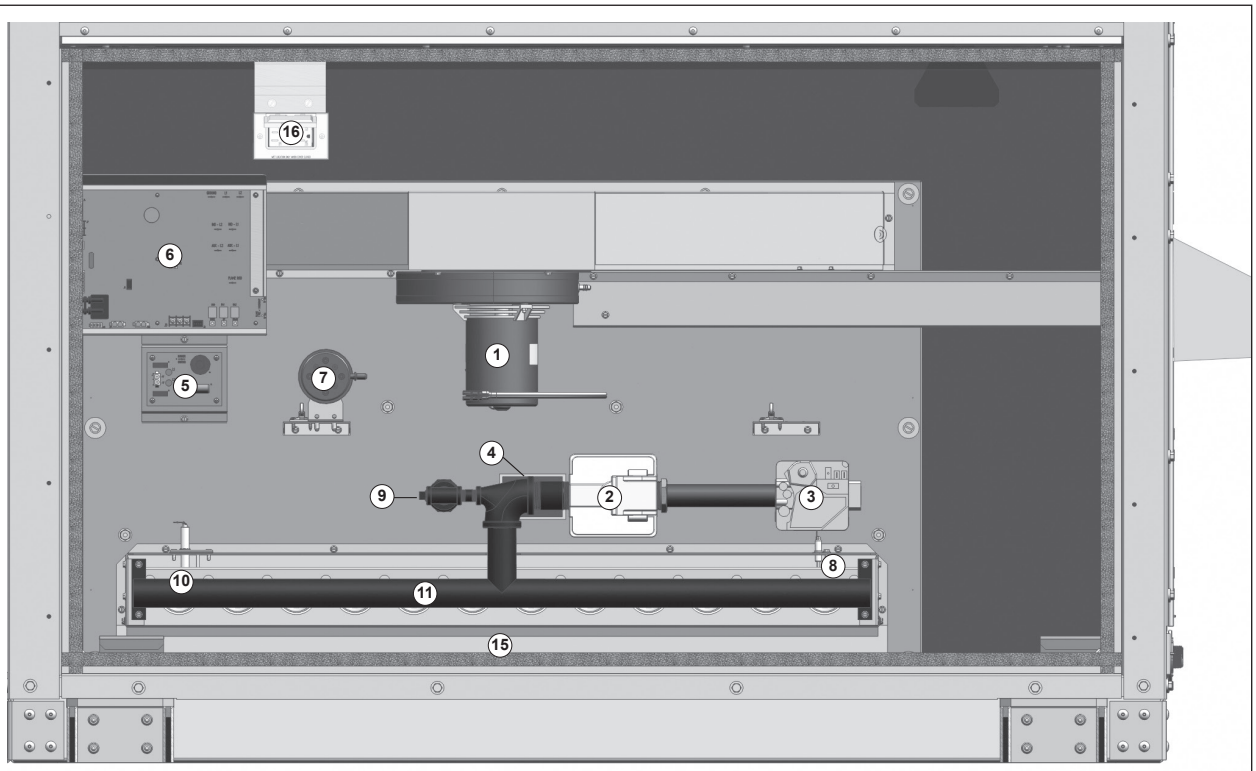
② Furnace locations are shown for reference, not the location of the furnace controls. Refer to the figures on pages 26 through 31 for controls location.

Final Check

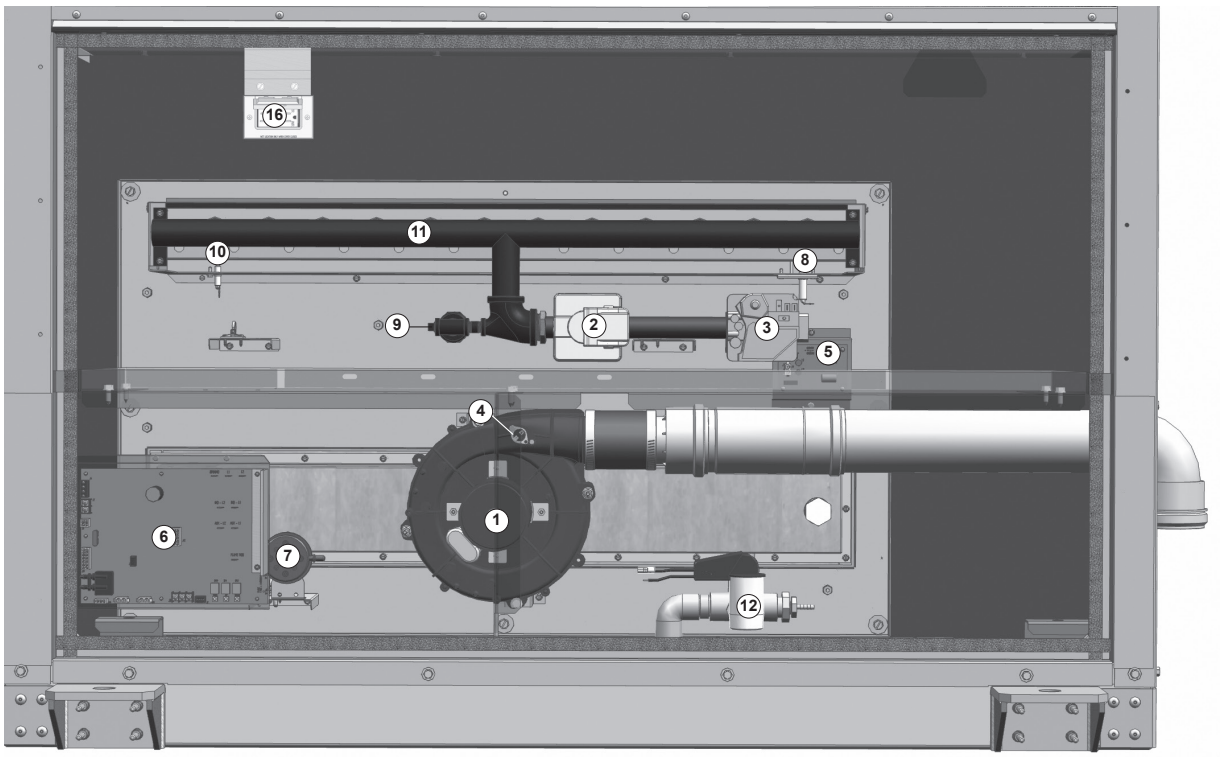
1. Operate furnace (all furnaces for units with multiple heat exchangers) at high fire and verify that gas pressure to the INLET of the combination gas control valve is maintained at 6”-7” W.C. for Natural Gas (11-14" W.C. for Propane). If the pressure cannot be maintained in this range while operating at high fire, the gas supply system is undersized and must be corrected and the entire check and adjustment of gas pressures section must be repeated.
2. Once all gas pressures have been checked and are at the proper settings, shut the unit down and move the field installed manual shut-off value to the “OFF” position.
3. Remove all testing equipment and replace any hardware (plugs, covers, etc.). For furnace models with Digit 11=6, replace wire #804 that was temporarily removed when the control was placed in the “Checkout Test Mode”.
4. Close the unit access doors.

Figure 26.1 - Gas Heat Option Gas Controls - B-Cabinet Sized Units

81% Efficiency Gas Heat Option (Digit 18 = F,G,H, J or K)



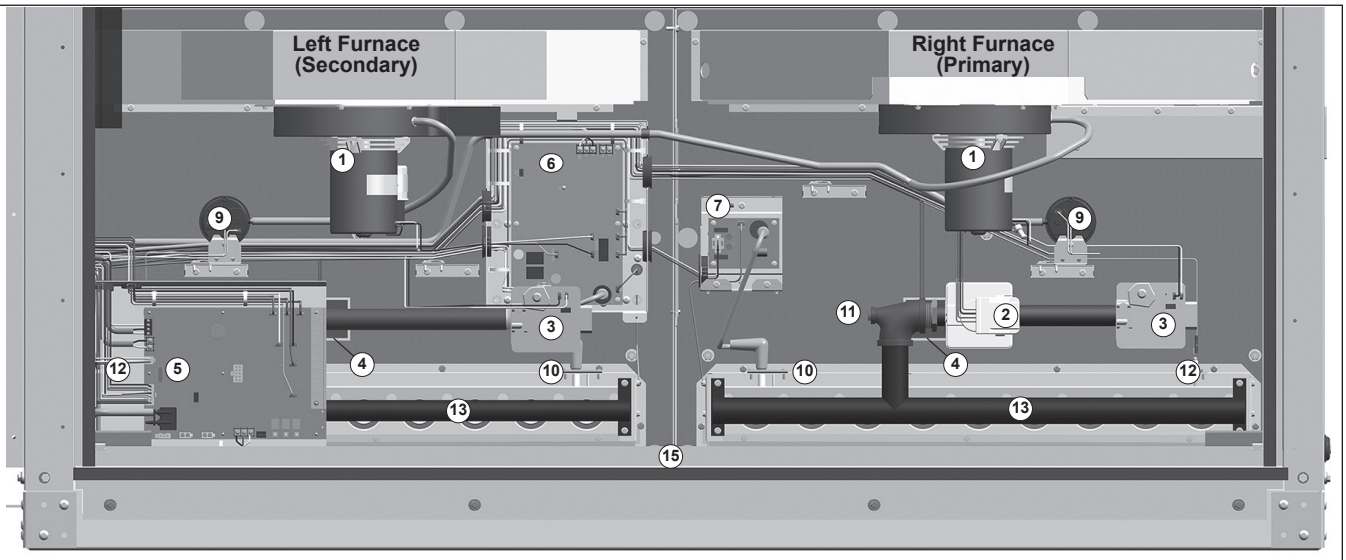
94% Efficiency Gas Heat Option (Digit 18 = R, S or T)



1. Power exhauster
2. Maxitrol EXA STAR modulating gas valve
3. Main combination gas valve
4. High limit control (hidden behind Item #2 on 80% efficiency furnace)
5. Solid state ignition control board (cover removed)
6. Furnace control board (cover removed)
7. Vent differential pressure proving switch
8. Direct spark ignitor
9. Manifold pressure tap on manifold tee
10. Flame sensor
11. Manifold piping with gas orifices
12. Condensate drain float switch (94% efficiency furnace only)
13. Compartment strip heater/thermostat (94% efficiency furnace only - not pictured)
14. Not applicable
15. Heat exchanger tube drain tray with drain line (80% efficiency furnace only - not pictured)
16. Convenience outlet (optional feature)

Figure 27.1 - Gas Heat Option Gas Controls - C-Cabinet Sized Units

81% Efficiency Option (Digit 18 = J, K, L or M)



1. Power exhauster
2. Maxitrol EXA STAR modulating gas valve (right-hand furnace only)
3. Main combination gas valve
4. High limit control
5. VB1200 primary furnace control board (for right-side furnace, but located on left side of cabinet)
6. VB1201 secondary furnace control board (for left-side furnace)
7. Direct spark ignition control board (cover removed)
8. Not Applicable
9. Vent differential pressure proving switch
10. Direct spark ignitor
11. Manifold tee pressure tap (primary furnace only)
12. Flame sensor
13. Manifold piping with gas orifices
14. Not applicable
15. Heat exchanger tube drain tray with drain line

90% Efficiency Option (Digit 18 = U or V)

NOTE: For this option, only the left-side furnace is shown. The right-side furnace will be nearly identical.

1. Power exhauster
2. Maxitrol EXA STAR modulating gas valve
3. Main combination gas valve (hidden behind Item #5)
4. High limit control
5. Solid state ignition control board (cover removed)
6. Valve state relay to Carel controller
7. Not applicable
8. Not Applicable
9. Vent differential pressure proving switch
10. Direct spark ignitor
11. Manifold tee pressure tap
12. Flame sensor
13. Manifold piping with gas orifices
14. Condensate drain float switch

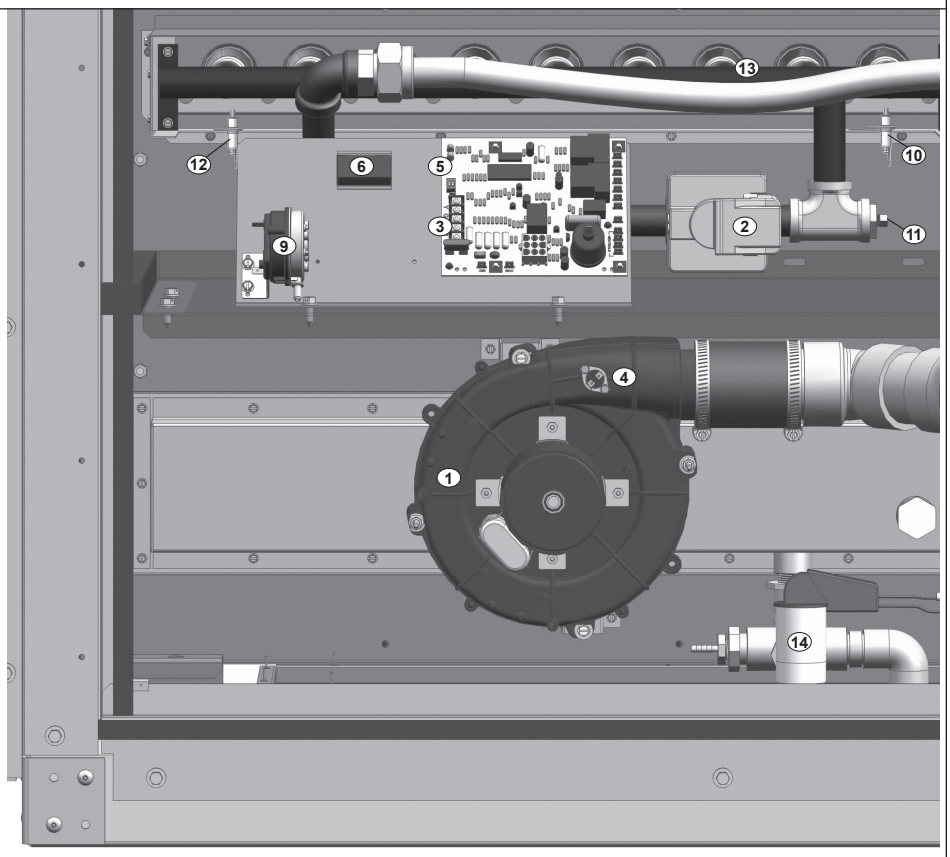
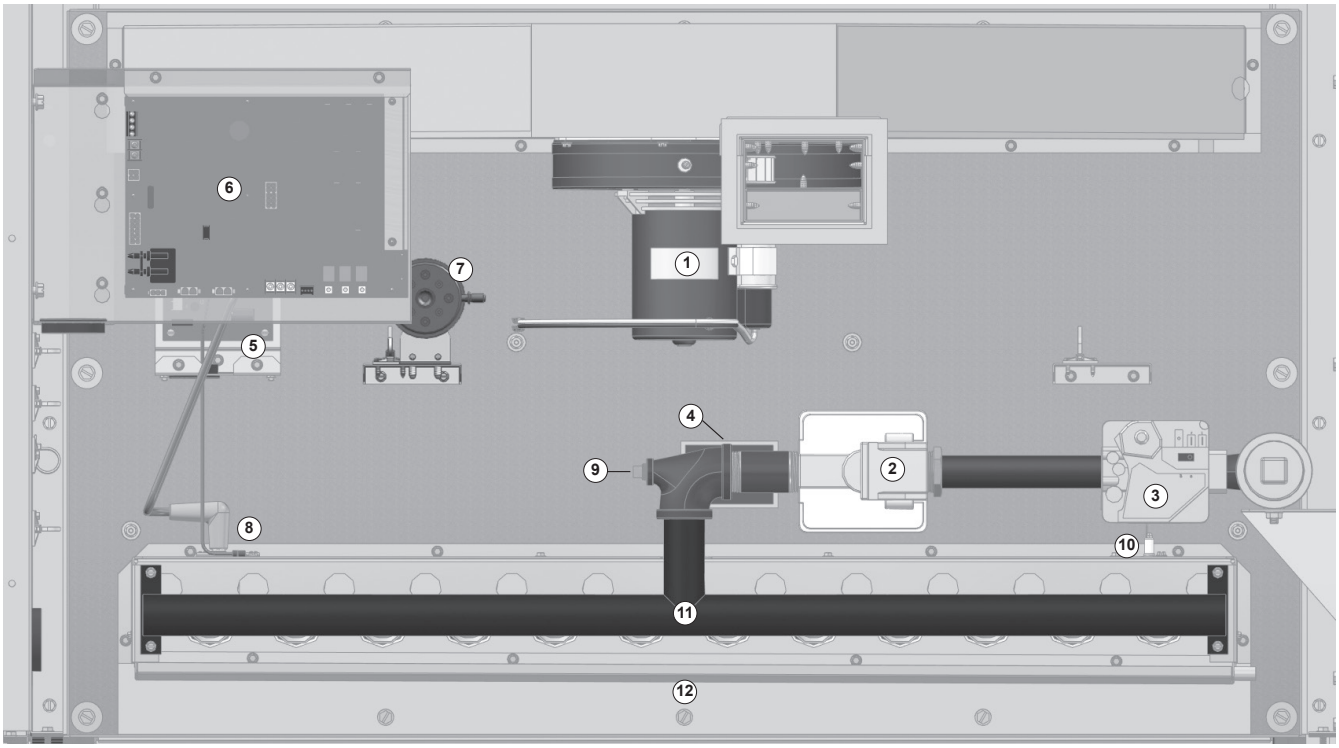
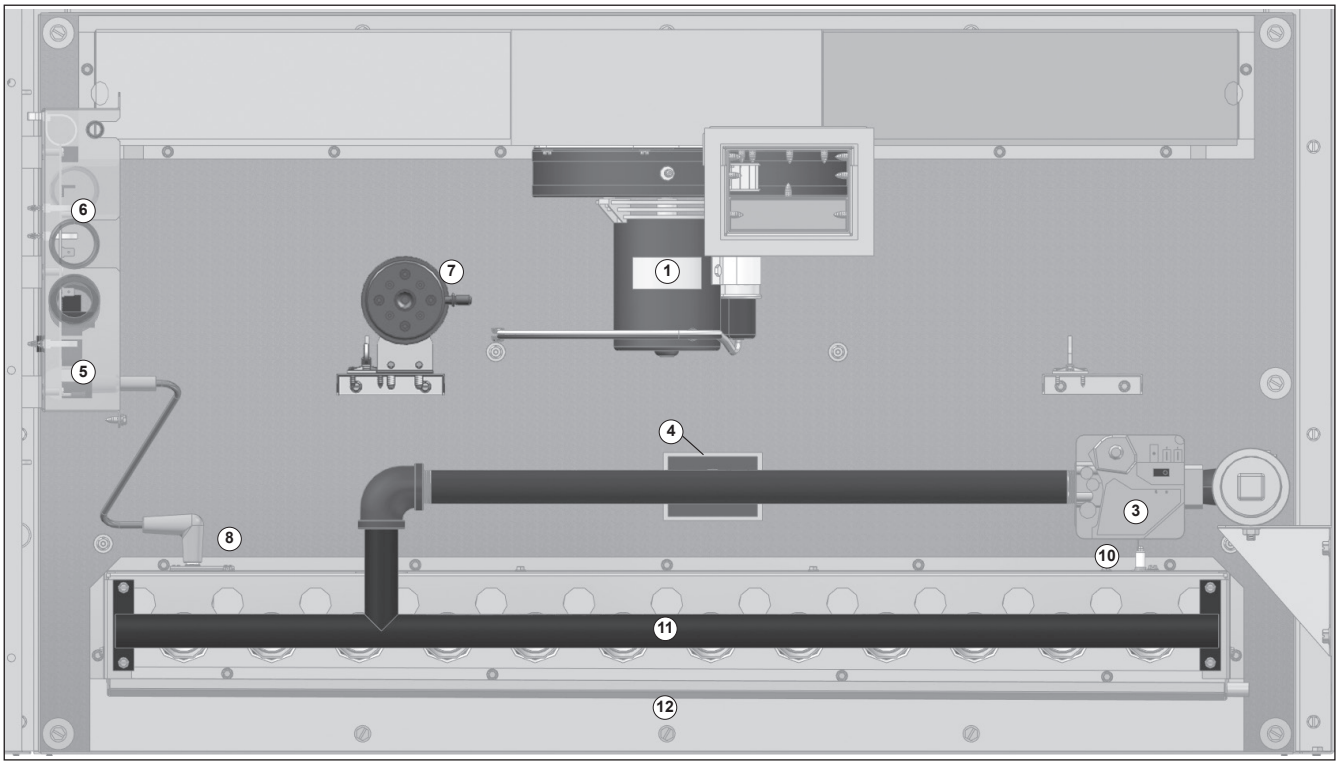


Figure 28.1 - Gas Heat Option Gas Controls - D-Cabinet Sized Units - 800,000 Btu/hr and Smaller (81% Eff)

Primary Furnace (Right Side of Cabinet)



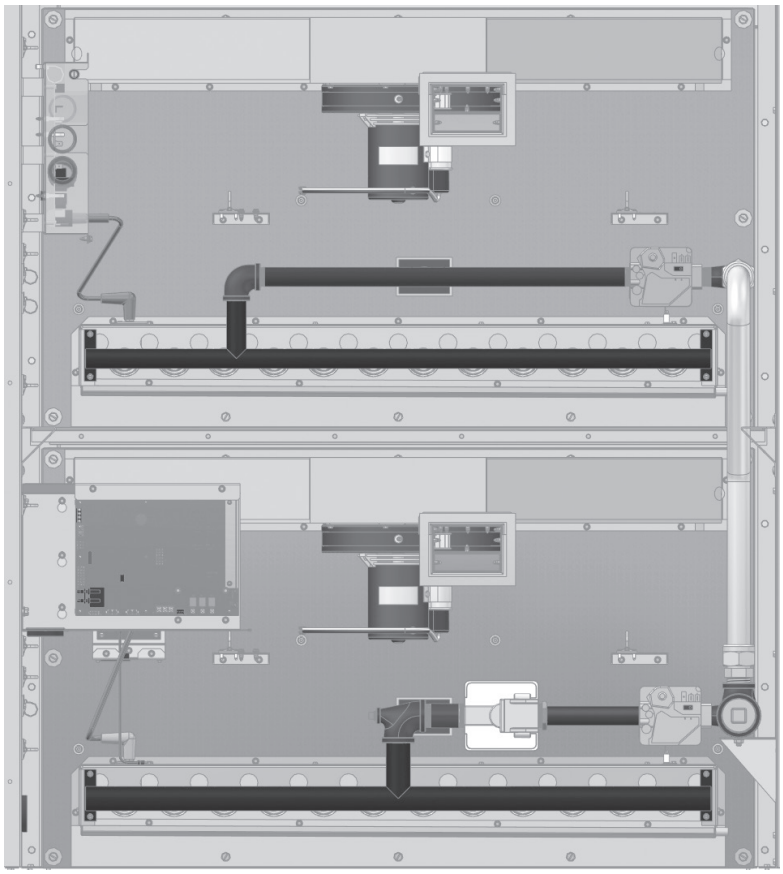
Secondary Furnace (Left Side of Cabinet)



1. Power exhauster
2. Maxitrol EXA STAR modulating gas valve (primary furnace only)
3. Main combination gas valve
4. High limit control (hidden behind piping as shown)
5. Solid state ignition control board (cover removed)
6. Furnace control board (cover removed)
7. Vent differential pressure proving switch
8. Direct spark ignitor
9. Manifold pressure tap on manifold tee (primary furnace only)
10. Flame sensor
11. Manifold piping with gas orifices
12. Heat exchanger tube drain tray with drain line

Figure 29.1 - Gas Heat Option Gas Controls - D-Cabinet Sized Units - 900,000 Btu/hr and Larger (81% Eff)

Stacked Primary/Secondary Furnaces ①

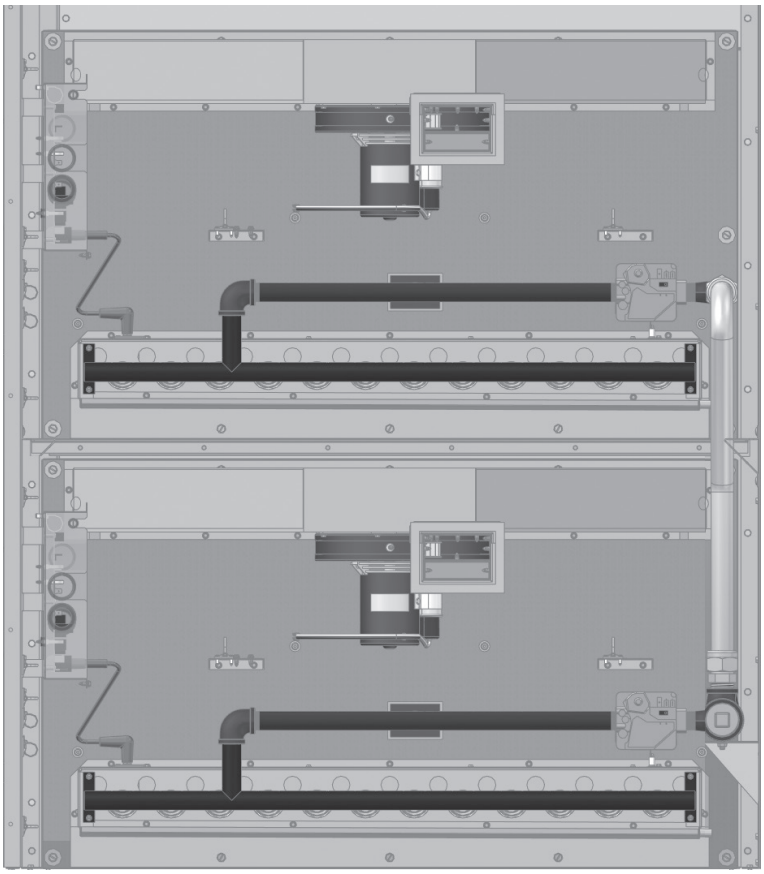


Secondary Furnace “B” ②

Primary Furnace ②

① Refer to Figure 25.3 for location of furnace positions.
② Refer to Figure 28.1 for idenfication of furnace components.

Stacked Secondary Furnaces (Opposite Side of Cabinet) ①



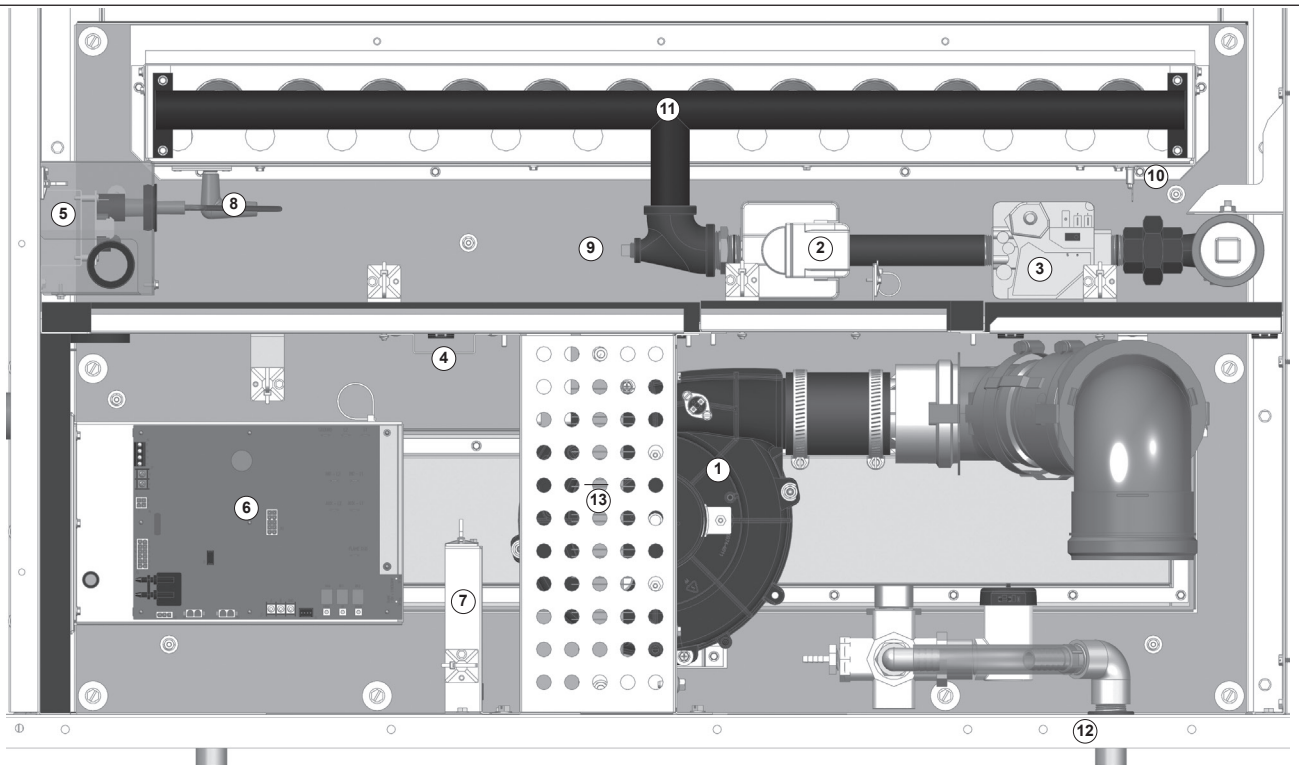
Secondary Furnace “A” ②

Secondary Furnace “C” ②

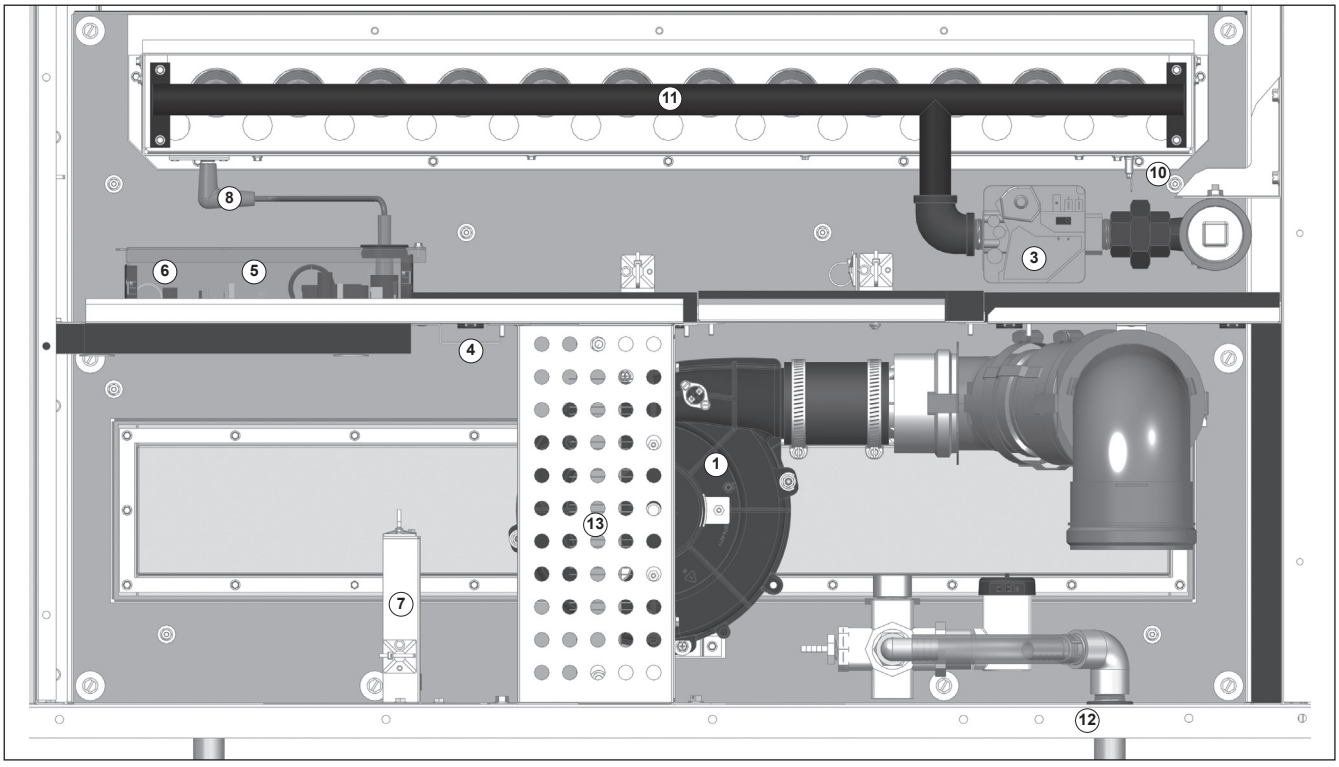
① Refer to Figure 25.3 for location of furnace positions.
② Refer to Figure 28.1 for idenfication of furnace components.

Figure 30.1 - Gas Heat Option Gas Controls - D-Cabinet Units - 620,000 Btu/hr and Smaller (94% Eff)

Primary Furnace (Right Side of Cabinet)



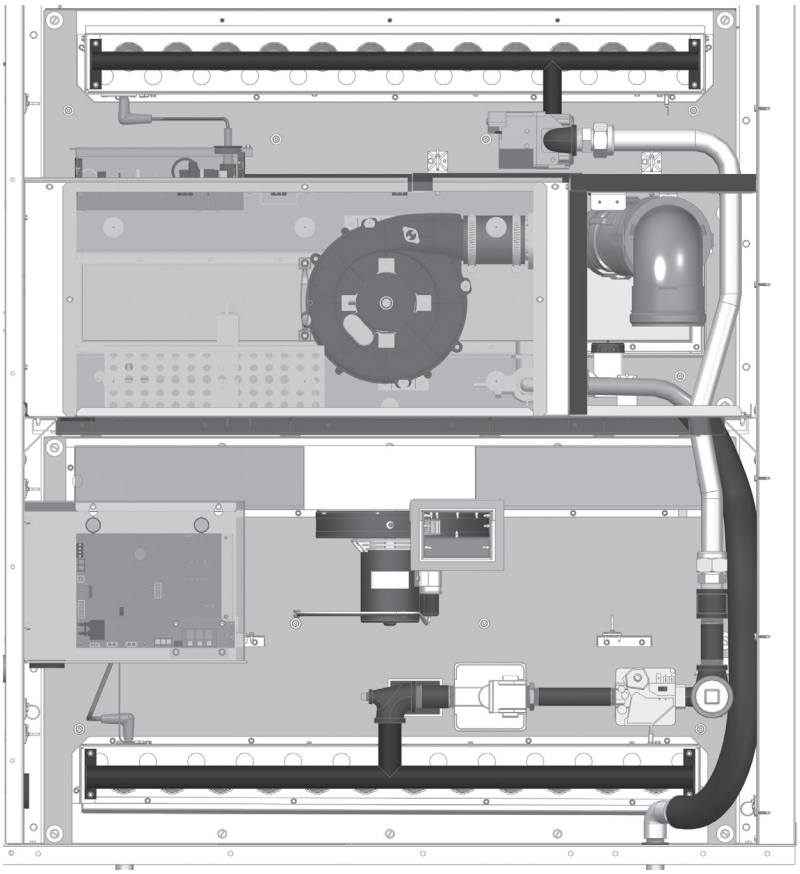
Secondary Furnace (Left Side of Cabinet)



1. Power exhauster
2. Maxitrol EXA STAR modulating gas valve (primary furnace only)
3. Main combination gas valve
4. High limit control (hidden behind piping as shown)
5. Solid state ignition control board
6. Furnace control board (cover removed)
7. Vent differential pressure proving switch
8. Direct spark ignitor
9. Manifold pressure tap on manifold tee (primary furnace only)
10. Flame sensor
11. Manifold piping with gas orifices
12. Heat exchanger tube drain tray with drain line
13. Cabinet strip heater

Figure 31.1 - Gas Heat Option Gas Controls - D-Cabinet Units - 850,000 Btu/hr and Larger (Hybrid 87% Eff)

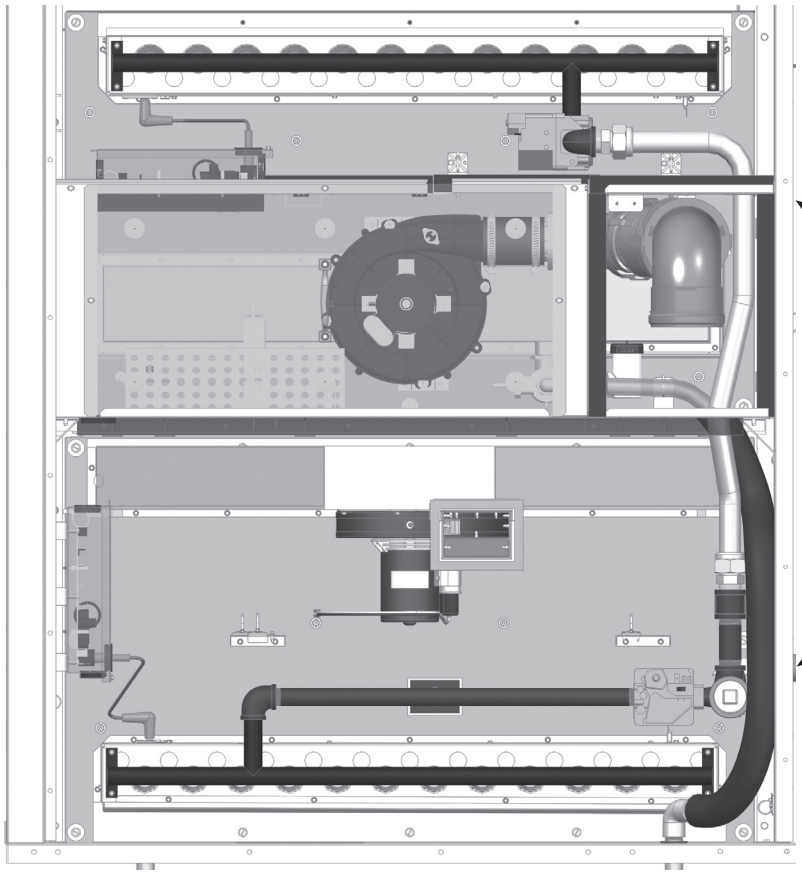
Stacked Primary/Secondary Furnaces ①



① Refer to Figure 25.3 for location of furnace positions.

② For identification of furnace components, refer to Figure 28.1 for the 81% efficient modules on the bottom and Figure 30.1 for the condensing modules on the top.

Stacked Secondary Furnaces (Opposite Side of Cabinet) ①



① Refer to Figure 25.3 for location of furnace positions.

② For identification of furnace components, refer to Figure 28.1 for the 81% efficient modules on the bottom and Figure 30.1 for the condensing modules on the top.

REVIEW BEFORE PROCEEDING	THE FOLLOWING SECTION APPLIES ONLY TO B- AND D-CABINET SIZED UNITS WITH OPTIONAL ENERGY RECOVERY EXHAUST (MODEL NOMENCLATURE DIGIT 6=B OR D, DIGIT 7=B OR E). ① IF THE UNIT DOES NOT HAVE THIS OPTION, SKIP TO PAGE 34.

① If the unit is a C-cabinet size with energy recovery module, refer to the Installation & Service Manual that shipped with the module for the Start-Up Procedure.

Energy Recovery Exhaust Option

⚠WARNING

1. The power supply wiring for the Energy Recovery Section comes from a single point power connection on the unit. Disconnect power supply at model DLV before making wiring connections to prevent electrical shock and equipment damage.
2. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.

IMPORTANT

1. On units with the electric preheat option, to prevent premature heat exchanger failure, check to be sure the blower has been set to deliver the proper airflow for the application. Refer to page 18 for Blower Adjustments.
2. The exhaust fan is not designed for high temperature or smoke control exhaust applications. Exhaust air temperature must not exceed 104°F. Operating the exhaust fan above 104°F will result in failure of the exhaust fan.

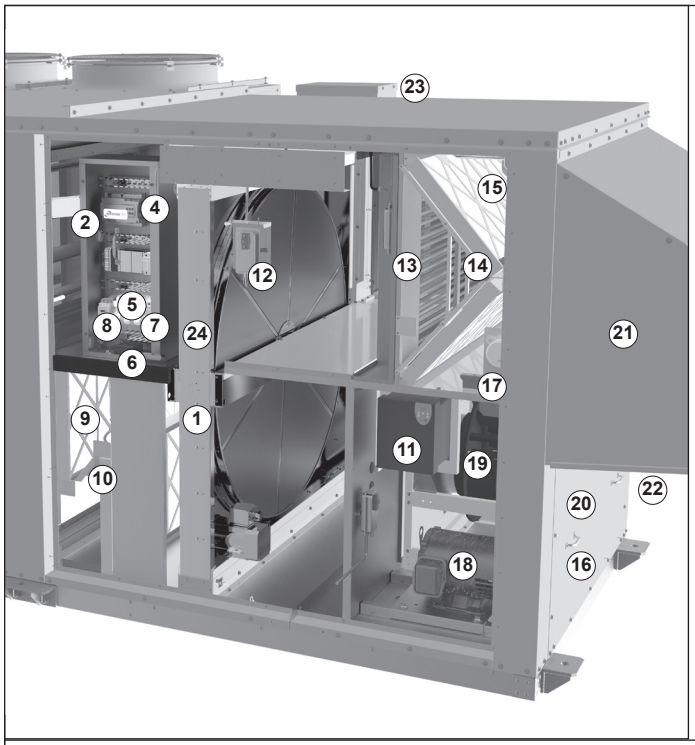
1. Turn off power to the unit at the disconnect switch. If equipped with gas heating option, turn all hand gas valves to the “OFF” position.

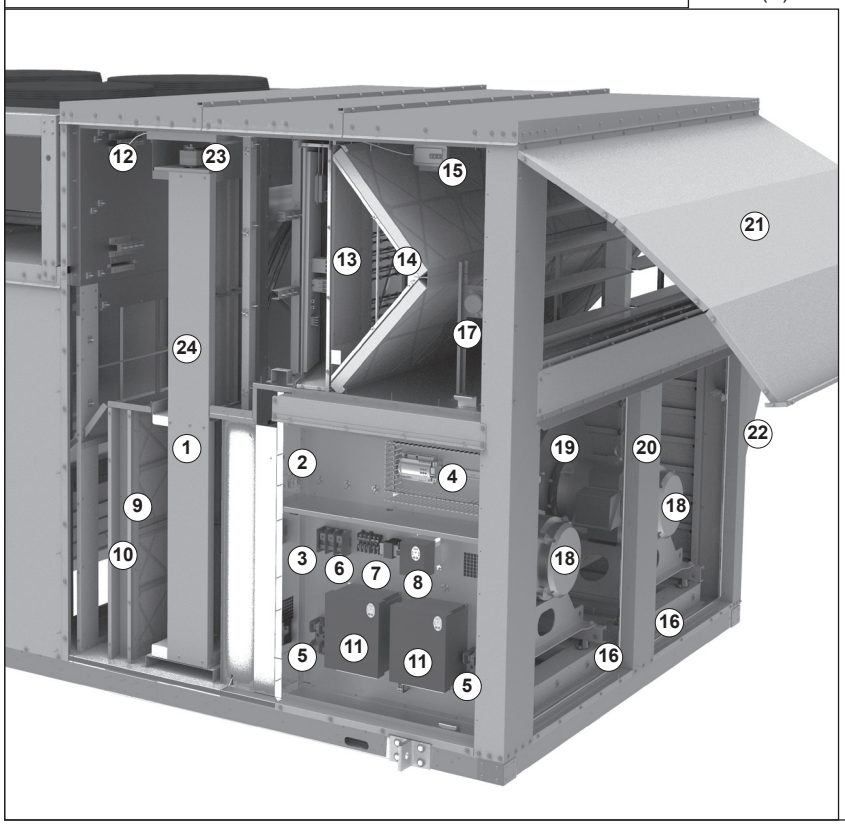
   Note: The dead front disconnect switch, if included, is factory installed in the controls/compressor compartment section (refer to the figures on pages 36 through 39). The disconnect switch is designed so that it must be turned “OFF” before entry to the compartment can be obtained. When in the “OFF” position, power is disconnected to all unit wiring electrically following the switch (see WARNING).
2. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.
3. Open the power compartment, controls compartment, and blower access doors. Refer to Figure 33.1 for location of doors and internal components.
4. Check that the supply voltage matches the unit supply voltage listed on the Unit Serial Plate. Verify that all wiring is secure and properly protected. Trace circuits to insure that the unit has been wired according to the wiring diagram.
5. Check that fuses or circuit breakers are in place and sized correctly.
6. Check to see that there are no obstructions to the intake and discharge of the unit.
7. Check the belt tension and sheave alignment for the exhaust blower.
8. Most motors are permanently lubricated for long life and are identified as such on the motor nameplate. Most blower bearings are permanently lubricated as well, except for pillow block bearings or those identified with grease fittings. For motors or blower bearings that are not permanently lubricated, lubricate according to the manufacturer’s instructions.
9. Check to make sure that all filters are in place and that they are installed properly according to direction of air flow.
10. Perform a visual inspection of the unit to make sure no damage has occurred during installation.
11. Turn on power to the unit at the disconnect switch.

    Note: The unit includes a door switch installed inside the exhaust blower section access door. When the door is opened, the switch interrupts power to a microprocessor controller input and the exhaust blower motor is de-energized.
12. Check the Carel controller and exhaust fan blower motor for electrical operation. If this does not function, recheck the wiring diagram. Check to insure that none of the Control Options have tripped.
13. Check to make sure that the economizer wheel bypass damper (if equipped) opens properly without binding.
14. Check the blower wheel for proper direction of rotation when compared to the air flow direction arrow on the blower housing. Blower wheel rotation, not air movement, must be checked as insufficient air will be delivered with the blower wheel running backwards.
15. Check the blower speed (RPM). Refer to Blower Adjustments for modification.
16. Check the motor speed (RPM).
17. Check the motor voltage. Check to make sure all phases are in balance.
18. Check the motor amp draw to make sure it does not exceed the motor nameplate rating. Check all phases to insure system is balanced.
19. Check that the energy recovery wheel rotates in the direction of the arrow without interference noise (scraping, brushing, banging etc.). The wheel is factory set to rotate at approximately 40 RPM to maximize latent heat transfer.
20. Check that the belt tracks near the middle of the wheel rim, not against the rim support, and that the belt is not flipped.
21. Check the energy recovery wheel voltage and amp draw to make sure it does not exceed the motor nameplate rating.

COMPONENT IDENTIFICATION / LOCATION

Figure 33.1 - Controls Cabinet - Energy Recovery Section (B and D-Cabinet only, if equipped) ①





1. (S) Energy recovery wheel
2. (S) Controls/power compartment with terminal strips (B-Cabinet)
   (S) Controls compartment with terminal strips (see #3) (D-Cabinet)
3. (S) Power compartment with terminal strips (see #2) (D-Cabinet)
4. (S) Carel pCOxs microprocessor controller
5. (S) Exhaust fan motor circuit fuses ②
6. (S) Power distribution block
7. (S) Energy recovery wheel drive motor circuit breaker
8. (S) Energy recovery wheel drive motor motor starter
   (O) Energy recovery wheel drive motor VFD (D-Cabinet)
9. (O) Exhaust air filters
10. (O) Exhaust air filters dirty filter switch (not shown)
11. (S) Exhaust fan VFD ②
12. (O) Energy recovery wheel pressure drop switch
13. (O) Electric preheat assembly with controls/power compartment
14. (S) Outside air filters
15. (O) Outside air filters dirty filter switch
16. (S) Blower door switch
17. (S) Outside air enthalpy sensor
18. (S) Exhaust fan motor ②
19. (S) Exhaust plenum fan ②
20. (S) Exhaust fan/motor access
21. (O) Inlet hood
22. (S) Exhaust hood (not shown on B-Cabinet)
23. (S) Economizer bypass damper actuator access
    (Economizer bypass not available on D-Cabinet with 81" wheel, Digit 21=L)
24. (O) Energy recovery wheel rotation detection sensor (not shown)

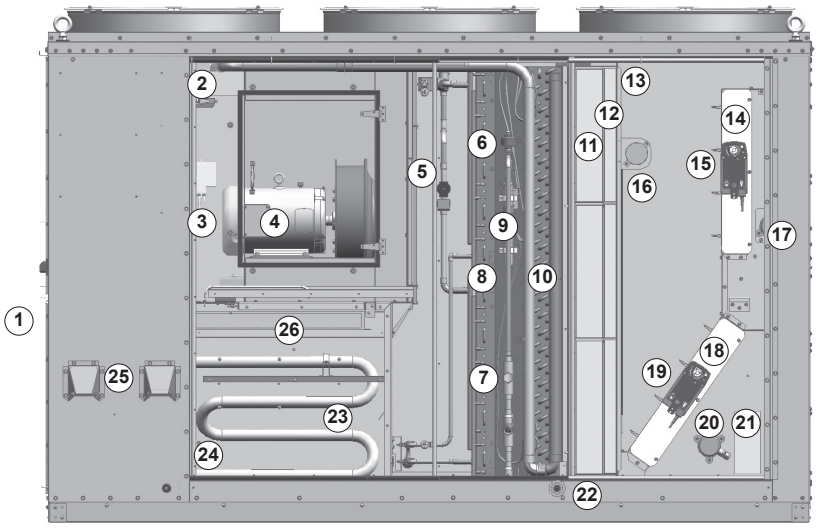
(S) = standard (O) = optional

① Location of components is typical, but may change depending on the unit configuration.
② D-Cabinet units with Digit 22=J have dual fans. For fans with 15 or 20HP motors (Digit 23=X or Y), the fan motors are controlled by two individually protected VFD's.

COMPONENT IDENTIFICATION / LOCATION

ALL FIGURES ON THIS PAGE ARE FOR B- AND C-CABINET SIZED UNITS

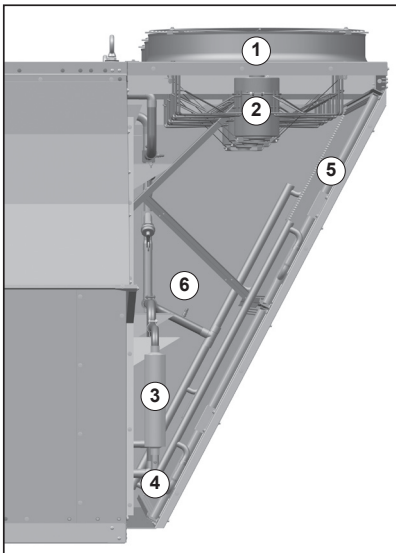
Figure 34.1 - Blower/Evaporator/Filter/Damper Sections ①



1 (O) GFCI convenience outlet (not shown here, refer to Figure 26.1)
2 (S) Blower door switch
3 (S) Airflow proving switch
4 (S) Supply fan motor with direct drive fan
5 (O) Hot gas reheat circuit shut-off valves (one located in controls compartment for C-Cabinet sized units)
6 (S) Electronic expansion valve
7 (S) Refrigeration circuit sight glass
8 (O) Hot gas reheat coil
9 (S) Distributor and distributor piping (not all distributor tubes shown)
10 (S) High capacity evaporator coil
11 (O) 4" secondary filters, MERV 13 or 16
12 (S) 2" primary filters, MERV 10 (standard), 13, or 15
13 (O) Dirty filter pressure switch (not shown)
14 (S/O) Outside air damper (standard on units with outside air)
15 (S/O) Modulating damper actuator (standard on units with outside air)
16 (S) Mixed air temperature sensor (standard on all units with outside and return air dampers)
17 (S) Outside air enthalpy sensor
18 (O) Return air damper
19 (O) Modulating damper actuator
20 (O) Return air enthalpy sensor
21 (O) Return air smoke detector
22 (S) Evaporator drain pan drain connection
23 (O) Gas or electric heat module (gas shown)
24 (O) Gas heating high limit control (standard if gas heat)
25 (O) Gas heating power exhauster outlet (standard if gas heat)
26 (O) Gas heat auxiliary electric heat (not pictured)

(S) = standard (O) = optional

Figure 34.2 - Condenser Section ①

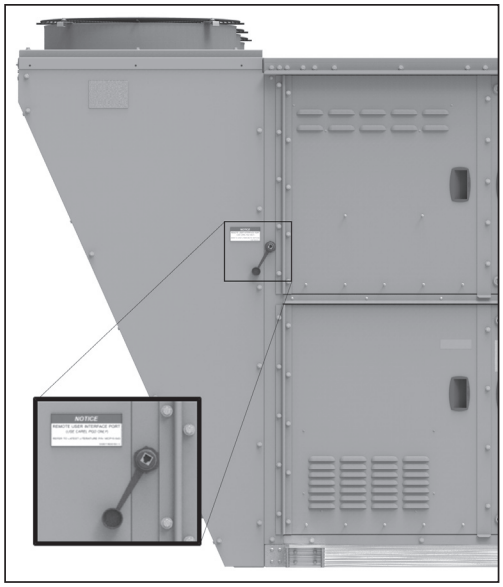


1 (S) Condenser fan housing
2 (S) Condenser fan motors
3 (S) Refrigerant filter/dryer assembly
4 (S) Liquid line pressure transducer
5 (S) PF™ aluminum microchannel condenser coils
6 (S) Schraeder valve pressure test port

(S) = standard (O) = optional

① Pictured is the C-Cabinet sized unit. Component locations are similarly placed on the B-Cabinet sized unit. Location of components is typical, but may change depending on the configuration of the unit.

Figure 34.3 - Optional Data Port ②

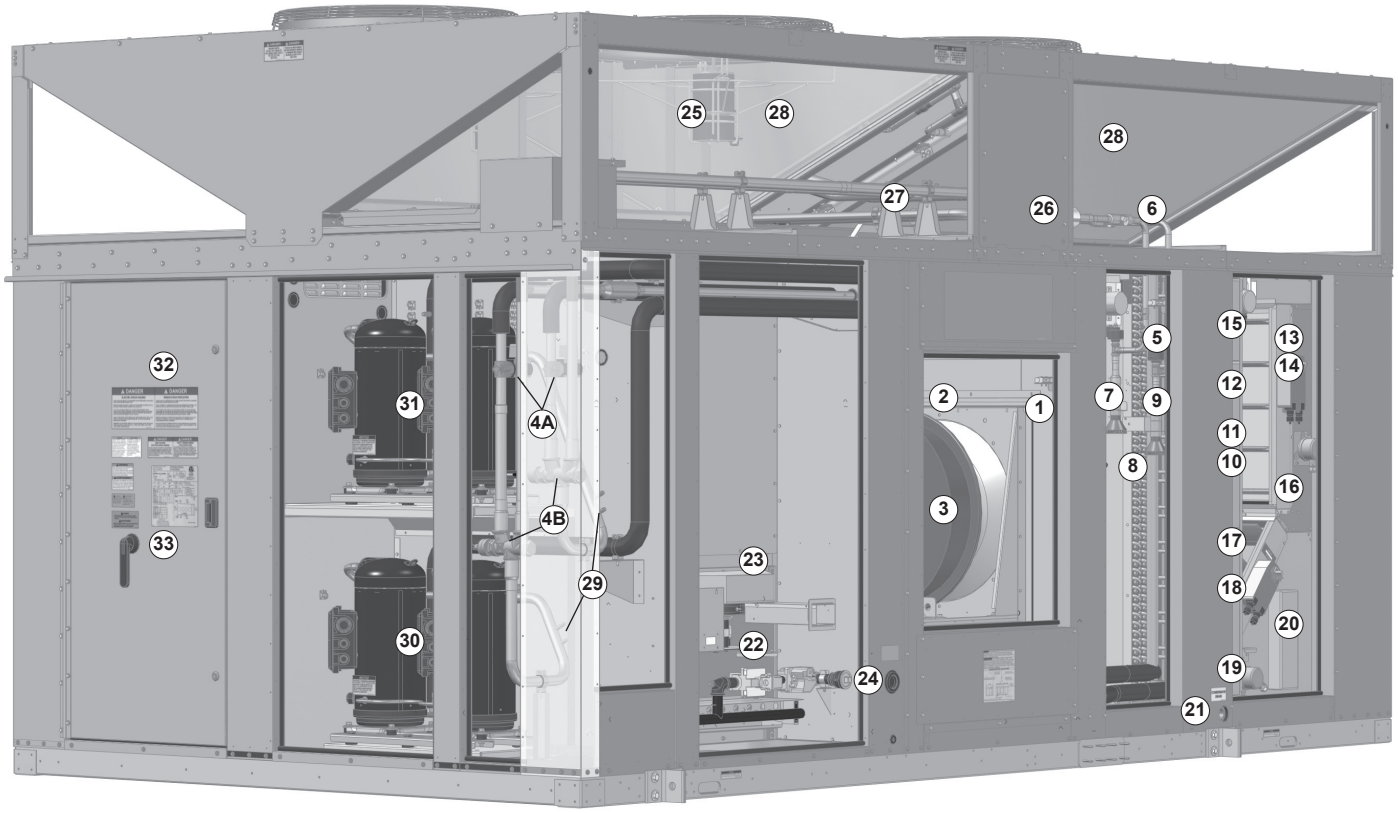


② Pictured is the OPTIONAL weatherproof RJ-11 jack for connection of the Carel pGD1 Remote User Interface Module (optional accessory) to the unit to allow real-time diagnostics without opening the cabinet or shutting the unit off. Refer to the pGD1 Installation Instructions for additional information.

COMPONENT IDENTIFICATION / LOCATION

ALL FIGURES ON THIS PAGE ARE FOR D-CABINET SIZED UNITS

Figure 35.1 - Compressor/Condenser/Blower/Evaporator/Filter/Damper Sections ①



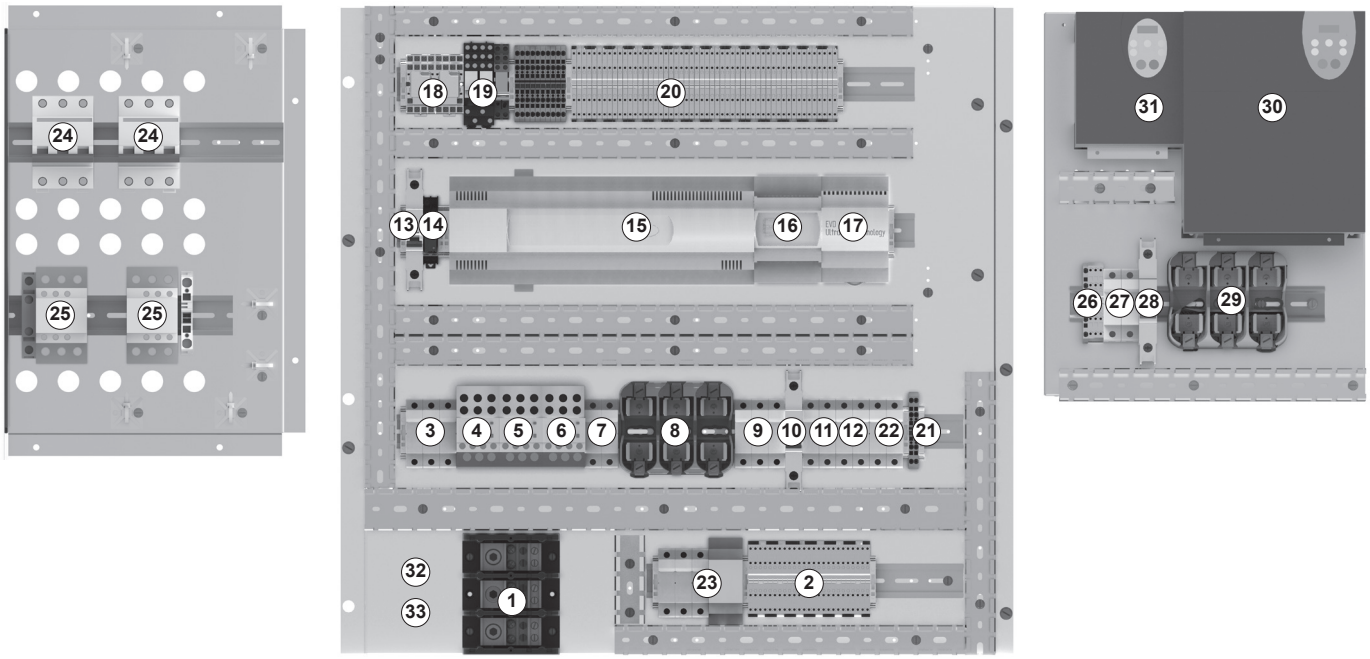
1. (S) Blower door switch
2. (S) Airflow proving switch (not shown, located on opposite side)
3. (S) Direct drive supply fan(s)/motor(s)
4. (O) Hot gas reheat valves
   - 4A. Circuit #1 and #2 shut-off valves
   - 4B. Circuit #1 and #2 3-way modulating valves
5. (S) Electronic expansion valves
6. (S) Refrigeration circuit sight glasses
7. (O) Hot gas reheat coil
8. (S) Distributor and distributor piping (not all distributor tubes shown)
9. (S) High capacity evaporator coil
10. (O) 4" secondary filters, MERV 13 (not shown)
11. (S) 2" primary filters, MERV 10 (standard), 13, or 15
12. (O) Dirty filter pressure switch (not shown)
13. (S/O) Outside air damper (standard on units with outside air)
14. (S/O) Damper actuator (standard on units with outside air)
15. (S/O) Mixed air temperature sensor (standard on units with outside and return air dampers)
16. (S) Outside air enthalpy sensor
17. (O) Return air damper
18. (O) Modulating damper actuator
19. (O) Return air enthalpy sensor
20. (O) Return air smoke detector
21. (S) Evaporator drain pan drain connection
22. (O) Gas or electric heat module (gas shown)
23. (O) Gas heat auxiliary electric heat (not pictured)
24. (O) Gas supply connection point
25. (S) Condenser fans/motors
26. (S) Refrigerant filter/dryer assembly (located behind panel)
27. (S) Liquid line pressure transducer
28. (S) PF™ aluminum microchannel condenser coils (one displayed clear for purposes of providing condenser fan/motor detail)
29. (S) Schraeder valve pressure test ports
30. (S) Tandem Compressor Set #1 (Digital Modulating-On/Off)
31. (S) Tandem Compressor Set #2 (On/Off-On/Off)
32. (S) Power Cabinet (refer to page 39)
33. (O) Deadfront Disconnect Switch Handle

(S) = Standard (O) = Optional

① Location of components is typical, but may change depending on the configuration of the unit.

COMPONENT IDENTIFICATION / LOCATION

Figure 36.1 - Typical Controls Cabinet - B-Cabinet Sized Units ①



MAIN PANEL

1. (S) Power distribution block
2. (S) High voltage wiring terminal strip with ground terminals
3. (S) Condenser fan variable frequency drive fuse holder
4. (S) Condenser fan motor overload #1
5. (S) Condenser fan motor overload #2
6. (O) Condenser fan motor overload #3
7. (S) Compressor crankcase heater fuse holder
8. (O) Auxiliary / Supplementary electric heat fuse holder
9. (O) Power exhaust motor fuse holder
10. (O) Gas heating circuit transformer secondary circuit breaker
11. (O) Gas heating circuit transformer primary fuse holder
12. (S) Main controls transformer primary fuse holder
13. (S) Main controls transformer secondary circuit breaker
14. (S) Solid state relay for Carel solution
15. (S) Carel pCO5+ microprocessor controller (main)
16. (S) Carel EVD electronic expansion valve controller
17. (S) Carel Ultracap for EVD controller
18. (O) Four pole relay(s) for Smoke detector
19. (O) Two pole relay(s) for remote shutdown, exhaust initiation, and compressor
20. (S) Low voltage wiring terminal strip with ground terminals
21. (S) Condenser fan ground terminals.
22. (O) Condensing gas heat option strip heater fuses
23. (O) Phase failure relay and fuses

COMPRESSOR CONTROL PANEL (LEFT SIDE)

24. (S) Compressor circuit breakers
25. (S) Compressor contactors with auxiliary contact blocks

AUXILIARY CONTROL PANEL (RIGHT SIDE)

26. (S) High voltage wiring terminal strip with ground terminals
27. (O) Convenience outlet step-down transformer primary fuse holder (if factory powered)
28. (O) Convenience outlet step-down transformer secondary circuit breaker (if factory powered)
29. (S) Supply fan variable frequency drive fuse holder
30. (S) Supply fan variable frequency drive
31. (S) Condenser fan variable frequency drive

OTHER ITEMS NOT SHOWN

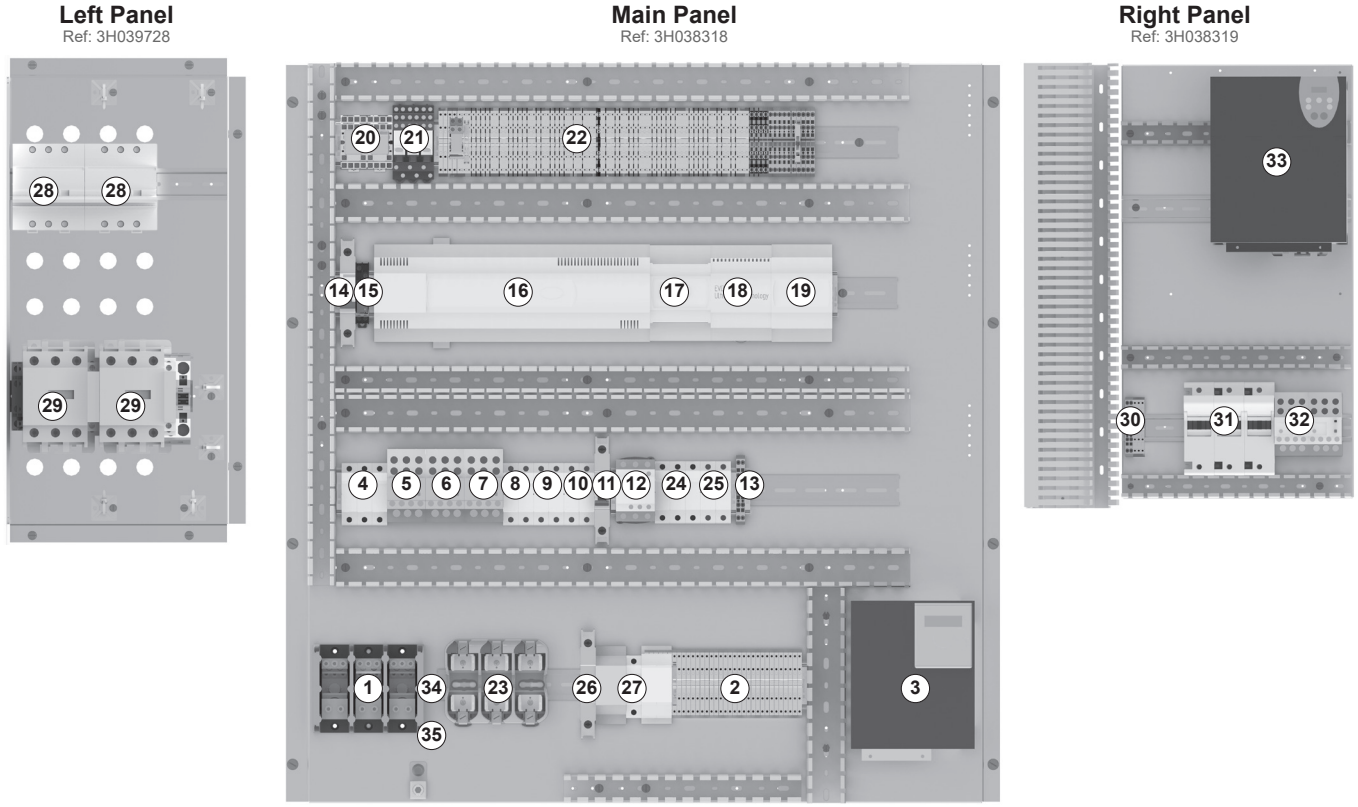
32. (O) Factory powered convenience outlet disconnect switch
33. (O) Main unit deadfront disconnect

(S) = standard (O) = optional

① Components and their location is typical and may change depending on the configuration of the unit.

COMPONENT IDENTIFICATION / LOCATION

Figure 37.1 - Typical Controls Cabinet - C-Cabinet Sized Units ①



MAIN PANEL

1. (S) Power distribution block
2. (S) High voltage wiring terminal strip with ground terminals
3. (S) Condenser fan variable frequency drive
4. (S) Condenser fan variable frequency drive fuse holder
5. (S) Condenser fan motor overload #1
6. (S) Condenser fan motor overload #2
7. (O) Condenser fan motor overload #3
8. (S) Compressor crankcase heater fuse holder
9. (S) Main controls transformer primary fuse holder
10. (O) Gas heating circuit transformer primary fuse holder
11. (O) Gas heating circuit transformer secondary circuit breaker
12. (O) Gas heating 90+ strip heater contactor
13. (S) Condenser fan ground terminals
14. (S) Main controls transformer secondary circuit breaker
15. (S) Solid state relay for Carel controller
16. (S) Carel pCO5+ microprocessor controller (main)
17. (S) Carel EVD electronic expansion valve controller
18. (S) Carel Ultracap for EVD controller
19. (O) Carel pCOe microprocessor expansion module
20. (O) Four pole relay(s) for smoke detector
21. (O) Two pole relay(s) for remote shutdown, exhaust initiation, and compressor
22. (S) Low voltage wiring terminal strip with ground terminals
23. (O) Auxiliary / Supplementary electric heat fuse holder
24. (O) Power exhaust motor fuse holder
25. (O) Convenience outlet transformer primary fuse holder (if factory powered)
26. (O) Convenience outlet transformer secondary cicuit breaker (if factory powered)
27. (O) Phase failure relay and fuses

COMPRESSOR CONTROL PANEL (LEFT SIDE)

28. (S) Compressor circuit breakers
29. (S) Compressor contactors with auxiliary contact blocks

AUXILIARY CONTROL PANEL (RIGHT SIDE)

30. (S) High voltage wiring terminal strip with ground terminals
31. (S) Supply fan variable frequency drive fuse holder
32. (S) Supply fan variable frequency drive overload relay
33. (S) Supply fan variable frequency drive

OTHER ITEMS NOT SHOWN

34. (O) Factory powered convenience outlet disconnect switch
35. (O) Main unit deadfront disconnect

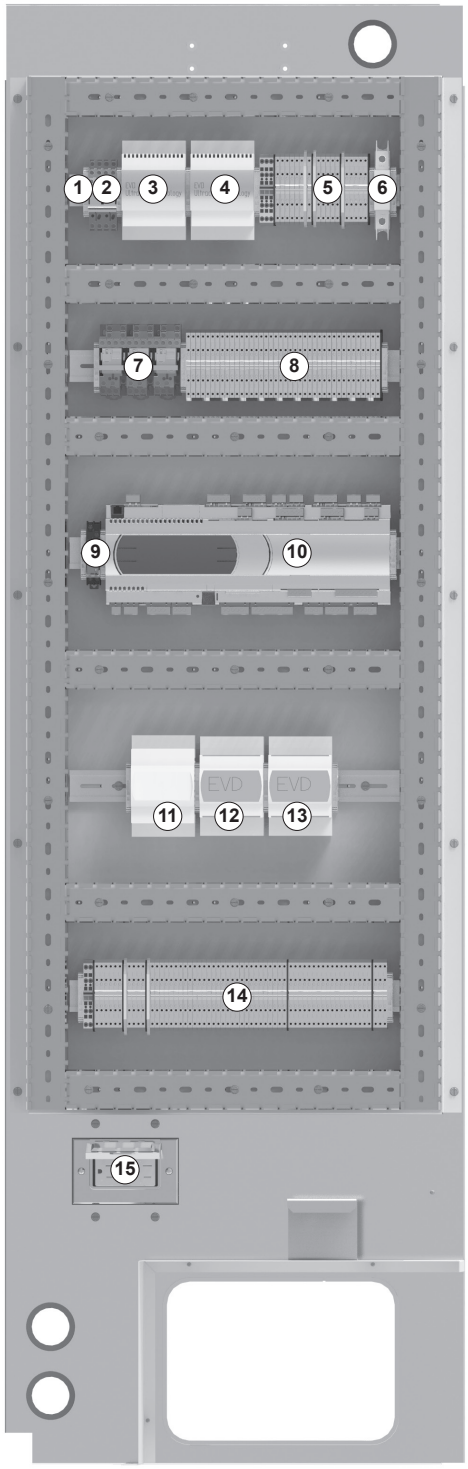
(S) = standard (O) = optional

① Location of components is typical, but may change depending on the configuration of the unit.

COMPONENT IDENTIFICATION / LOCATION

Figure 38.1 - Typical Controls Cabinet - D-Cabinet Sized Units ①

Main Panel
Ref: 3H039503



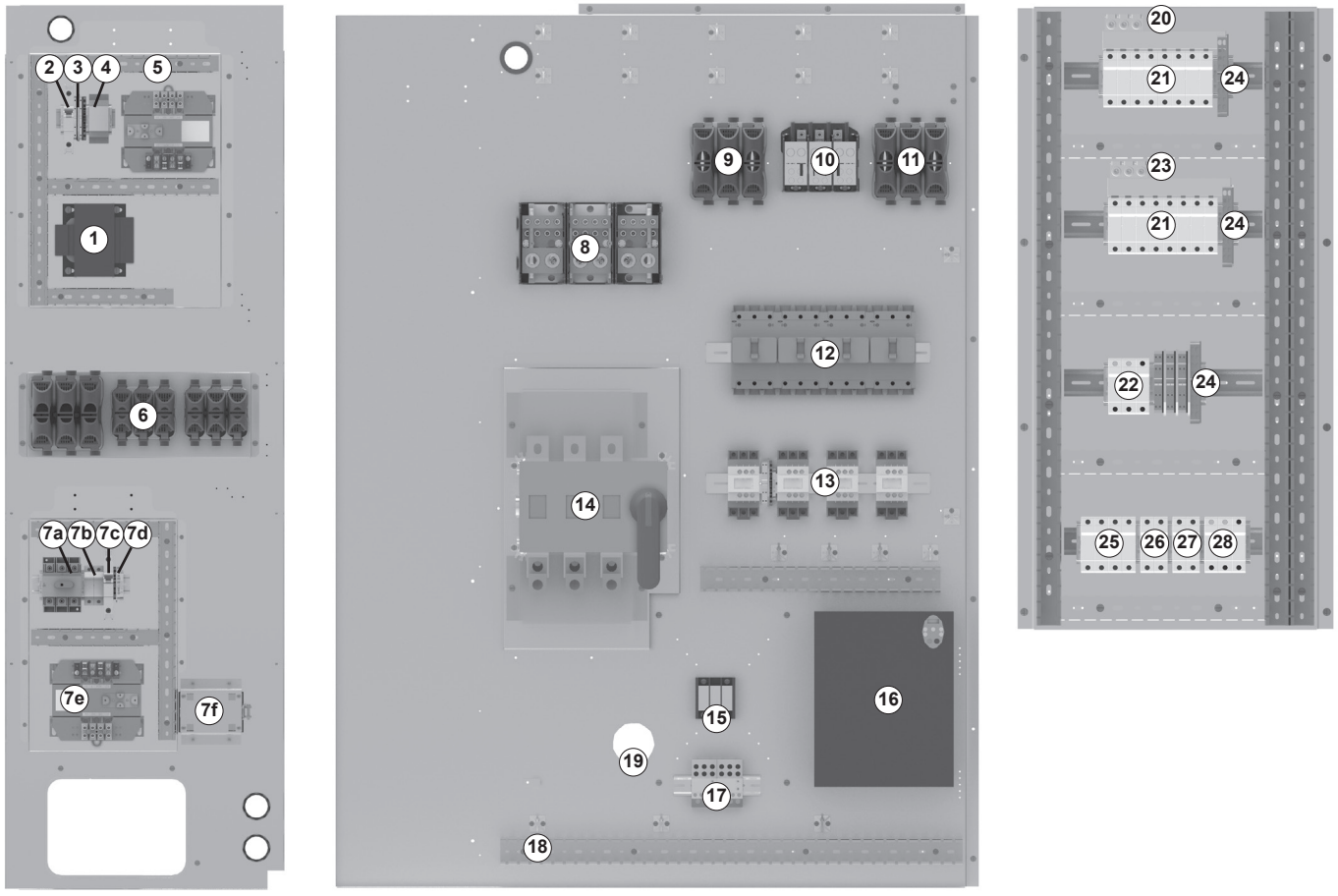
1. (O) Remote shutdown relay
2. (O) Supply fan enable relay (for units with two supply fan VFD's)
3. (S) Carel EVD Ultracap - Circuit #1
4. (S) Carel EVD Ultracap - Circuit #2
5. (S) Low voltage terminal strip
6. (S) Controls secondary circuit breaker
7. (O) Four-pole relays for smoke detector(s) and exhaust fan initiation
8. (S) Low voltage terminal strip
9. (S) Solid state relay unloader
10. (S) Carel PCO5+ microprocessor controller
11. (S) Carel PCOe microprocessor expansion module
12. (S) Carel EVD electronic expansion valve controller - Circuit #1
13. (S) Carel EVD electronic expansion valve controller - Circuit #2
14. (S) Low voltage terminal strip
15. (O) GFCI convenience outlet

(S) = standard (O) = optional

① Location of components is typical, but may change depending on the configuration of the unit.

COMPONENT IDENTIFICATION / LOCATION

Figure 39.1 - Typical Power Cabinet - D-Cabinet Sized Units ①



LEFT SIDE POWER PANEL

1. (S) 24V Control Transformer
2. (O) Gas Heat Control Transformer Secondary Circuit Breaker
3. (O) Wiring Terminals for Item #5
4. (O) Phase Failure Relay
5. (O) Gas Heat Control Transformer
6. (O) Energy Recovery Main Power and Electric Preheat Fuses
7. (O) Powered GFCI Convenience Outlet Option Consisting of:
- **a.** Disconnect Switch
- **b.** Transformer Primary Fuses
- **c.** Secondary Circuit Breaker
- **d.** Terminal Strip
- **e.** Transformer
- **f.** Convenience Outlet Junction Box *(Outlet Accessible from Low Voltage Control Cabinet)*

MAIN POWER PANEL

8. (S) Main Power Distribution Block
9. (O) Supply Fan VFD #2 Fuses (Dual Blower 15 or 20HP Only)
10. (S) Compressor Power Distribution Block
11. (S) Supply Fan VFD #1 Fuses
12. (S) Compressor Circuit Breakers
13. (S) Compressor Contactors
14. (O) Main Factory Mounted Disconnect Switch
15. (S) Supply Fan Power Distribution Block (Dual Blower 1-10HP)
16. (S) Supply Fan VFD #1
(Supply Fan VFD #2 for Dual Blower 15 or 20HP not shown)
17. (S) Supply Fan Overloads (Dual Blower 1-10HP)
18. (S) Ground Lug
19. (S) Cabinet Cooling Device *(not shown)*

RIGHT SIDE POWER PANEL

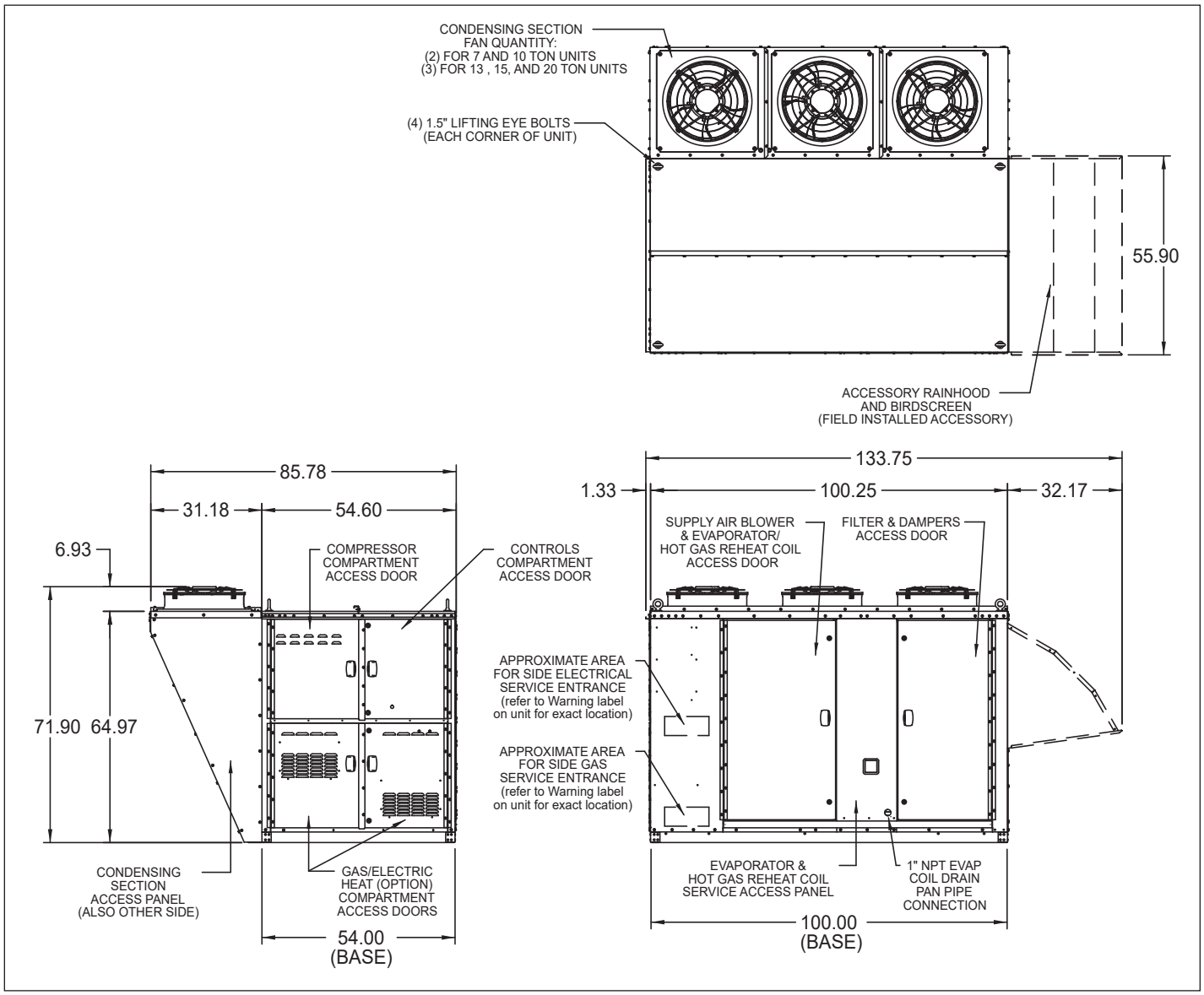
20. (S) Bus Bar Terminals
21. (S) Condenser Fan Fuses
22. (S) Auxiliary Fuses
23. (S) Bus Bar Terminals (52/60 Ton only)
24. (S) High Voltage Wiring Terminal Strip with Ground Terminals
25. (S) Compressor Crankcase Heater Fuses
26. (S) Control Transformer Primary Fuses
27. (O) Gas Heat Control Transformer Primary Fuses
28. (O) Phase Relay Fuses

(S) = standard (O) = optional

① Location of components is typical, but may change depending on the configuration of the unit.

DIMENSIONS - B-CABINET SIZE UNIT (NO ENERGY RECOVERY)

Figure 40.1 - Unit Dimensions (inches)



DIMENSIONS - B-CABINET UNIT BASE/ROOF CURB (NO ENERGY RECOVERY)

Figure 41.1 - Unit Base Dimensions (inches)

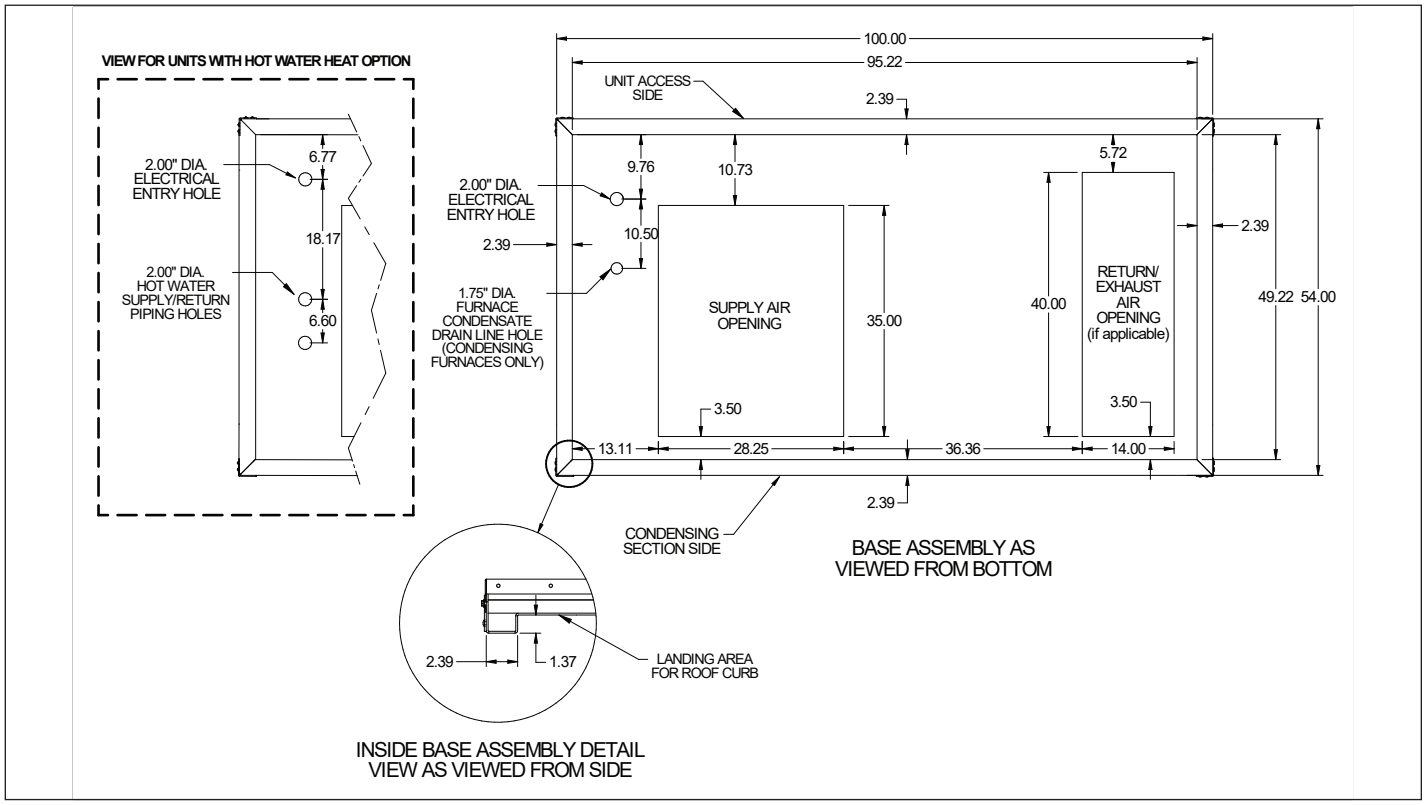


Figure 41.2 - Roof Curb Dimensions (inches)

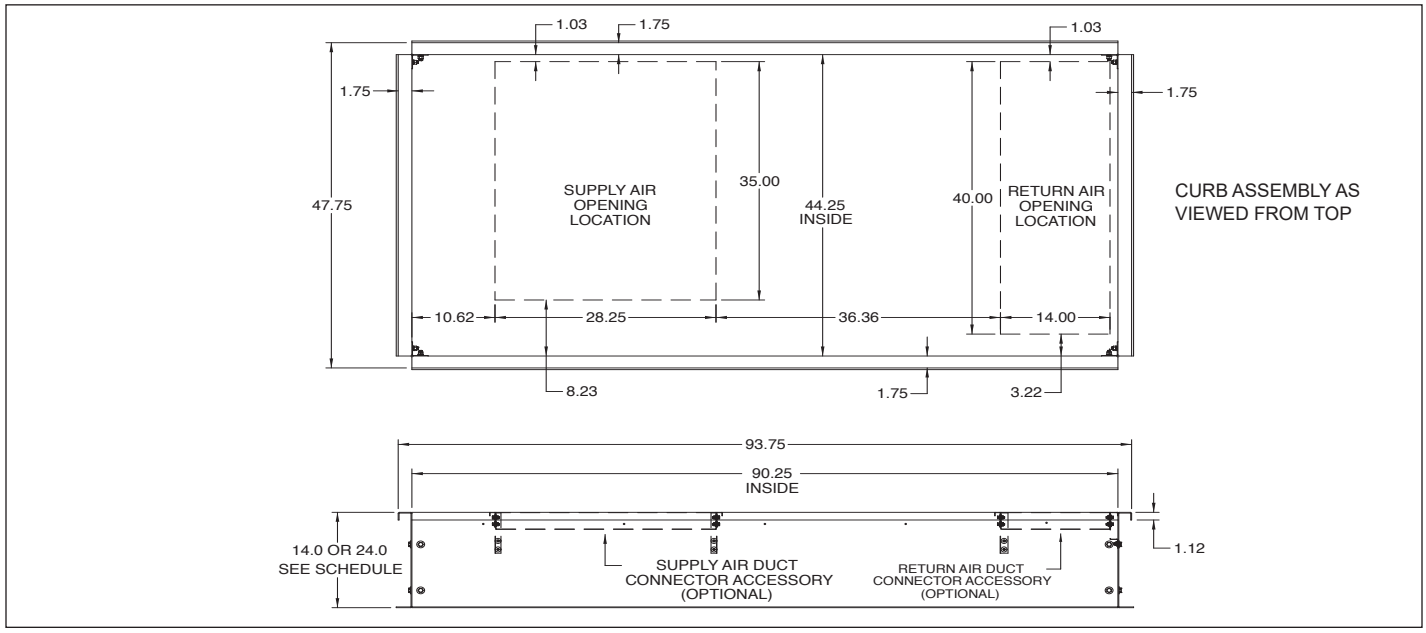
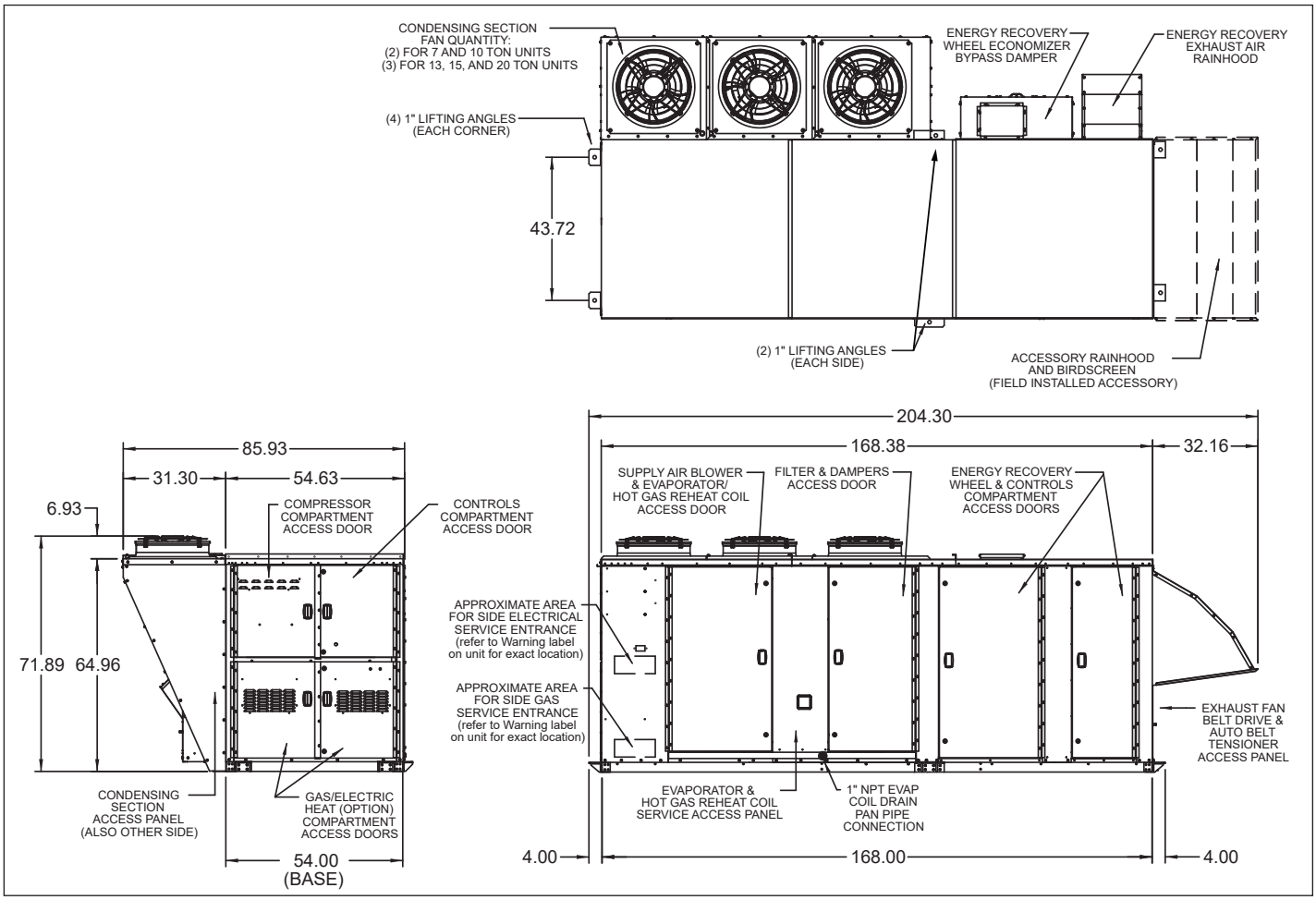


Table 41.3 - Roof Curb Weight (approx) - lbs.

Section	Description	Weight
Roof Curb	14” - Insulated	179
	24” - Insulated	273

DIMENSIONS - B-CABINET SIZE UNIT (WITH ENERGY RECOVERY)

Figure 42.1 - Unit Dimensions (inches)



DIMENSIONS - B-CABINET UNIT BASE/ROOF CURB (W/ ENERGY RECOVERY)

Figure 43.1 - Unit Base Dimensions (inches)

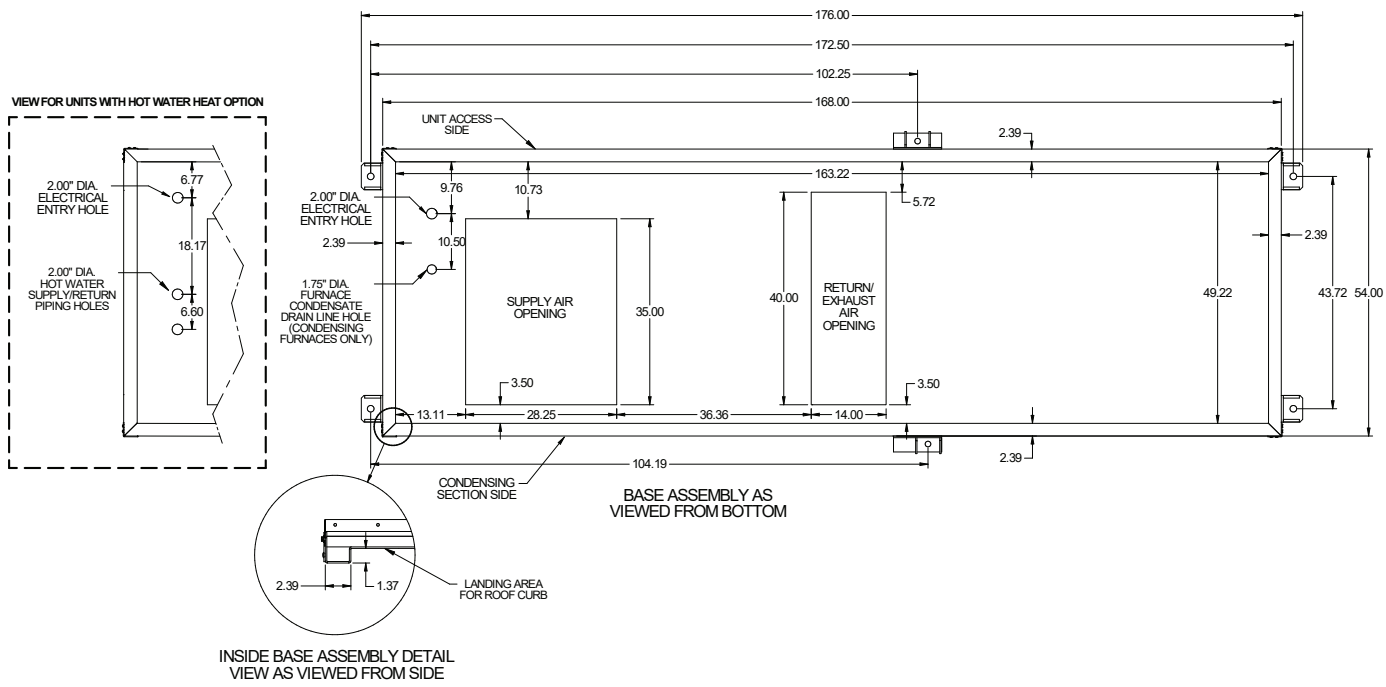


Figure 43.2 - Unit Roof Curb Dimensions (inches)

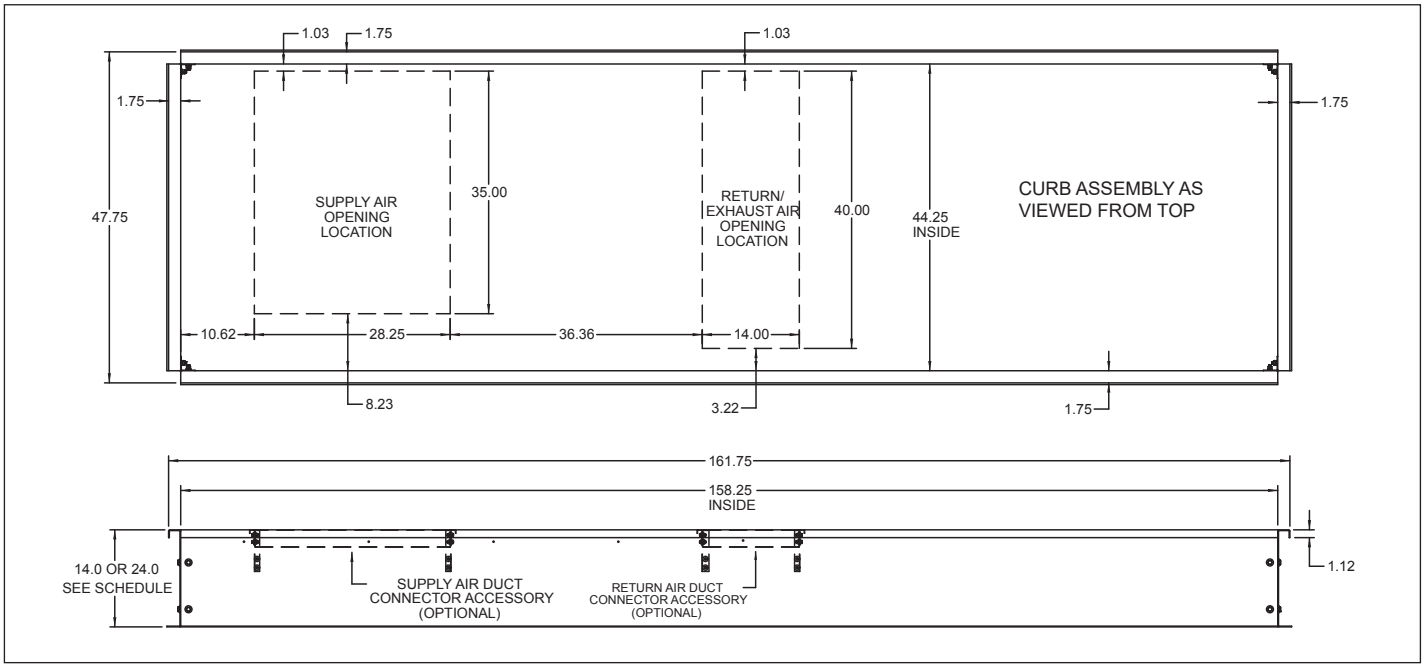
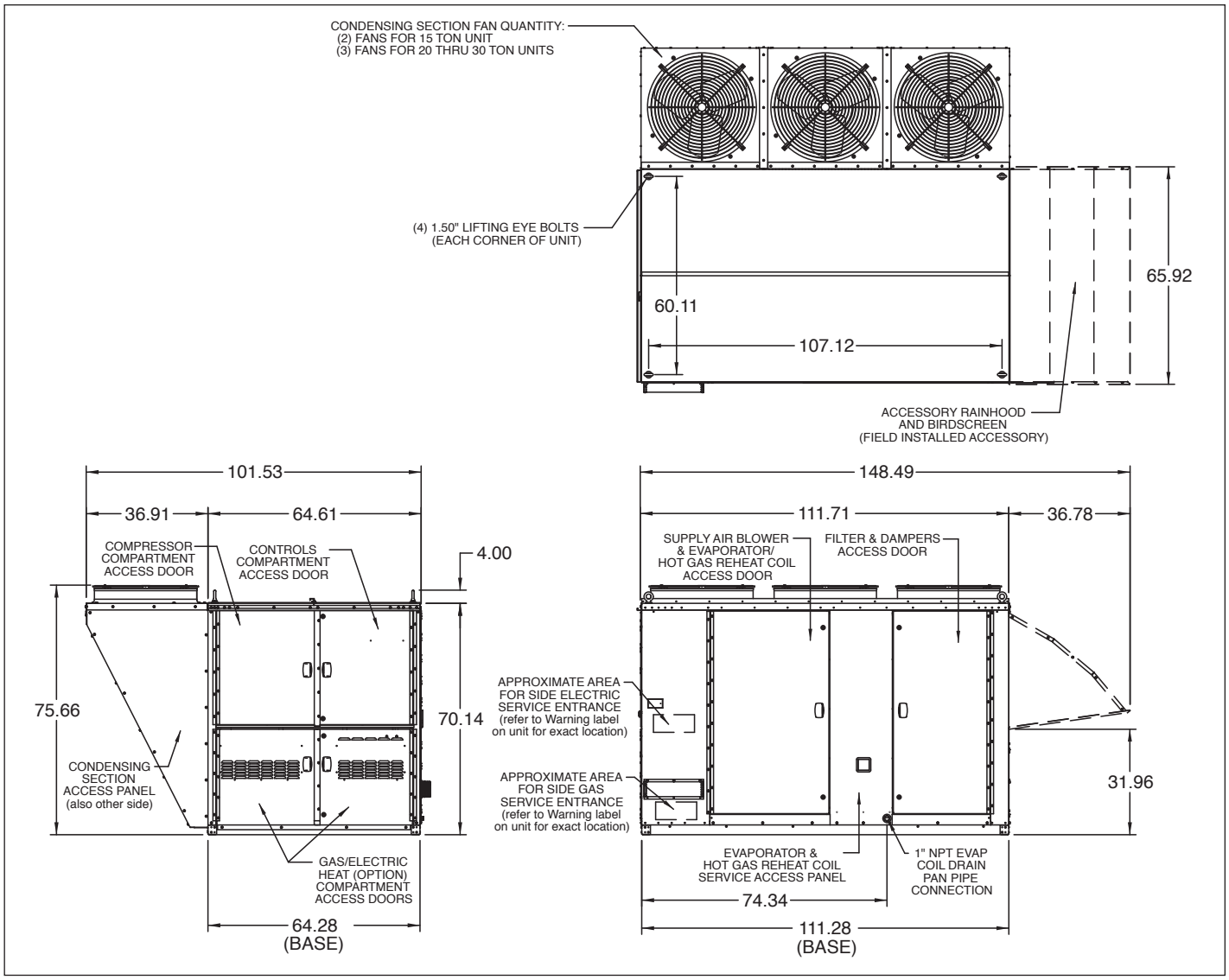


Table 43.3 - Roof Curb Weight (approx) - lbs.

Section	Description	Weight
Roof Curb	14” - Insulated	266
	24” - Insulated	401

DIMENSIONS - C-CABINET SIZE UNIT

Figure 44.1 - Unit Dimensions (inches)



DIMENSIONS - C-CABINET SIZE UNIT BASE / ROOF CURB

Figure 45.1 - Unit Base Dimensions (inches)

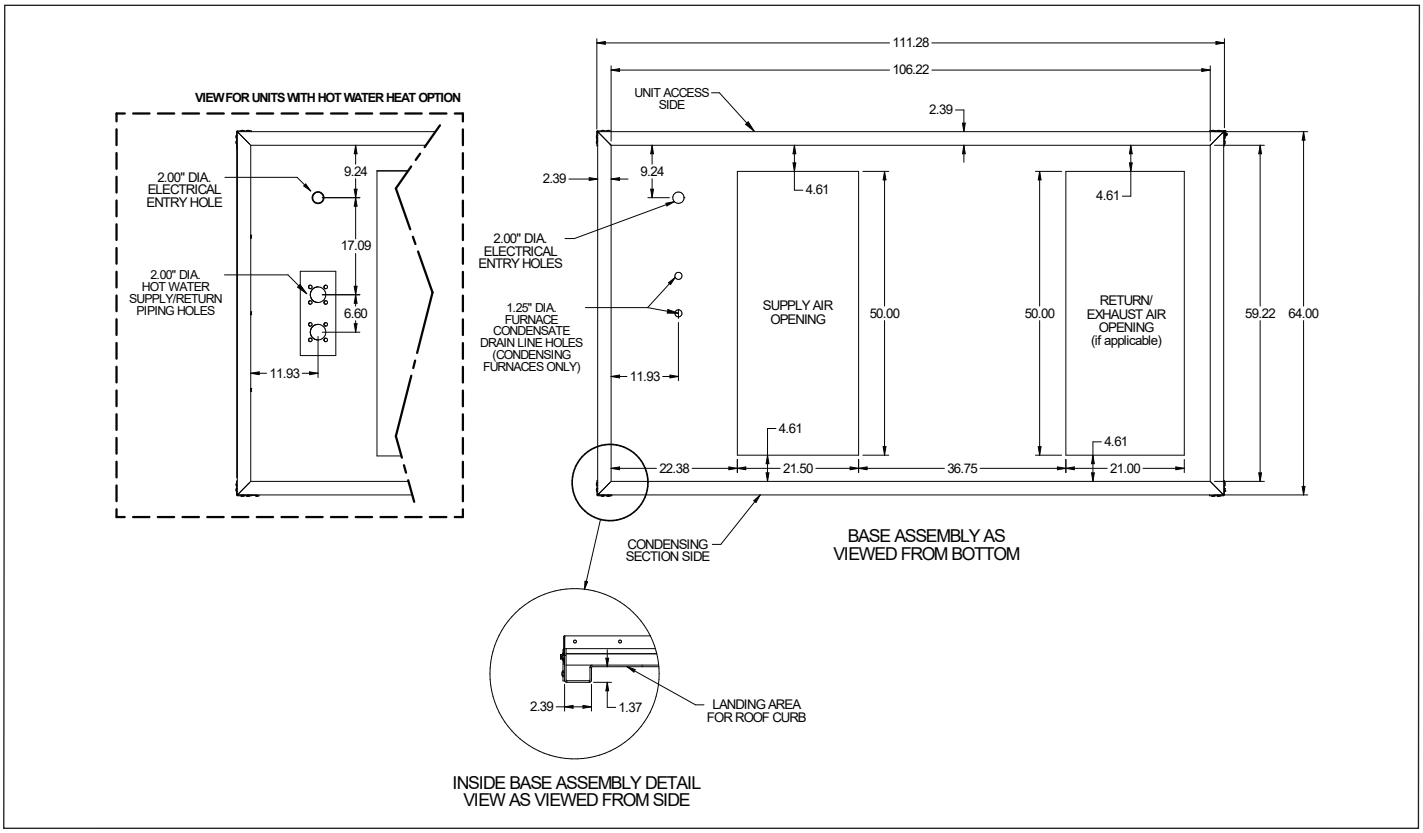


Figure 45.2 - Roof Curb Dimensions (inches)

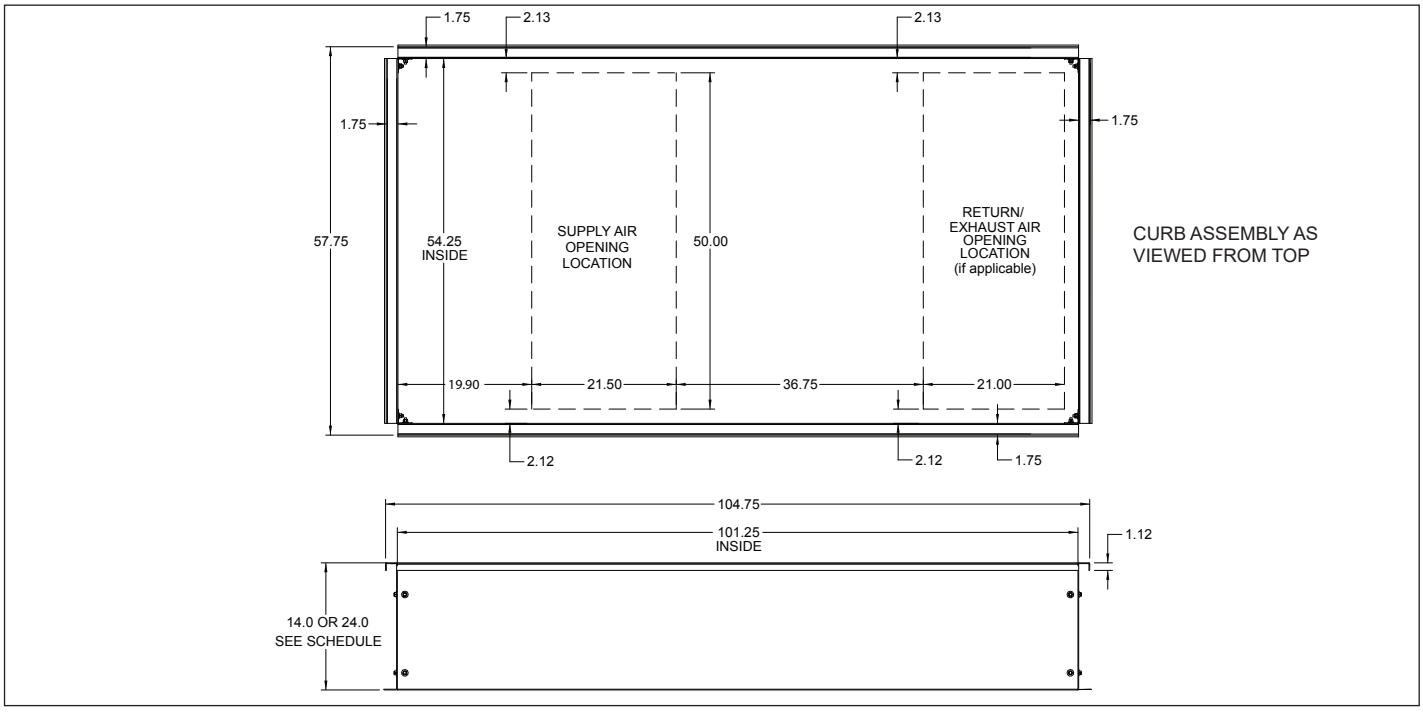
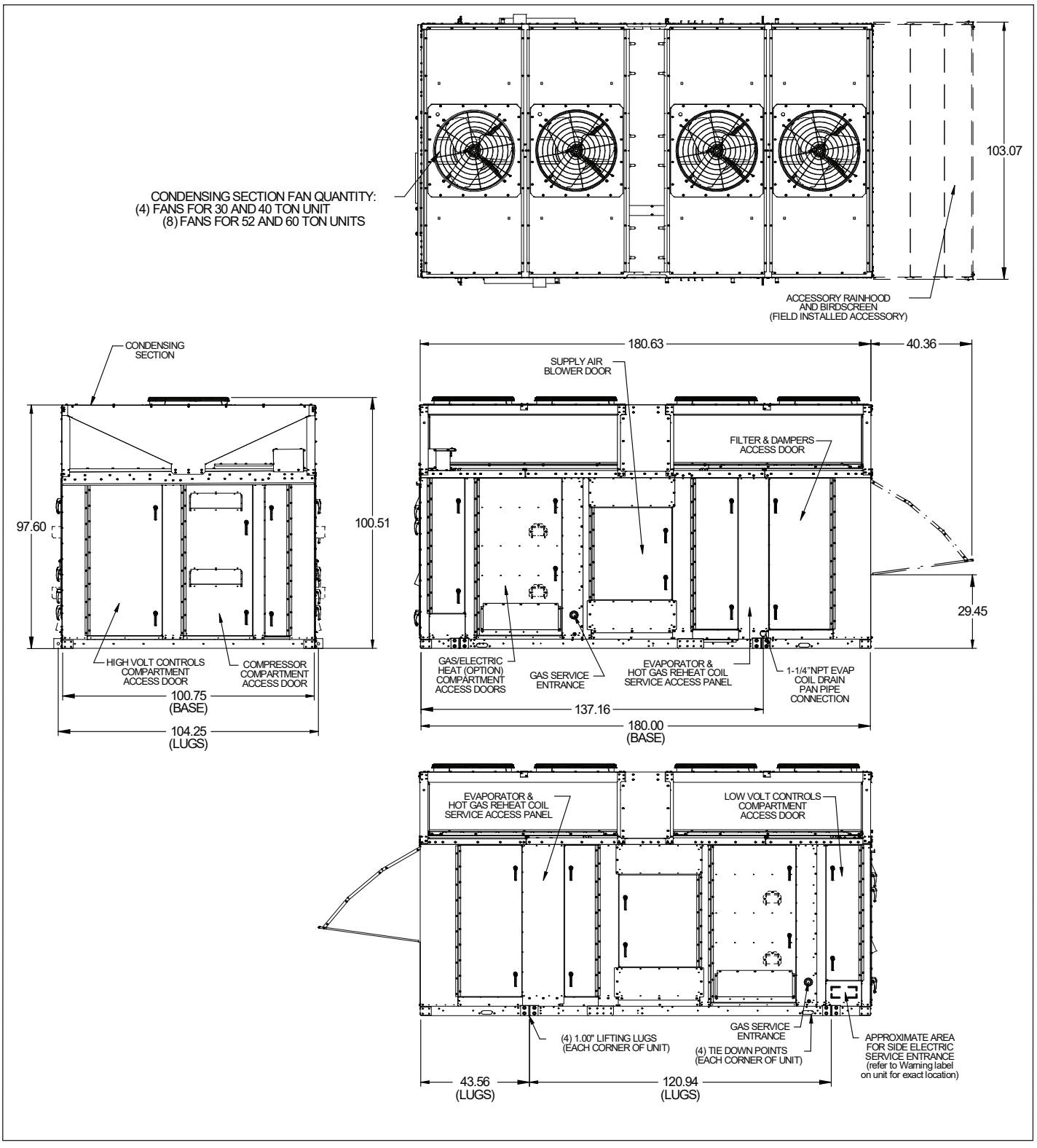


Table 45.3 - Roof Curb Weight (approx) - lbs.

Section	Description	Weight
Roof Curb	14” - Insulated	210
	24” - Insulated	318

DIMENSIONS - D-CABINET SIZE UNIT

Figure 46.1 - Unit Dimensions (inches)



DIMENSIONS - D-CABINET SIZE UNIT BASE / ROOF CURB

Figure 47.1 - Unit Base Dimensions (inches)

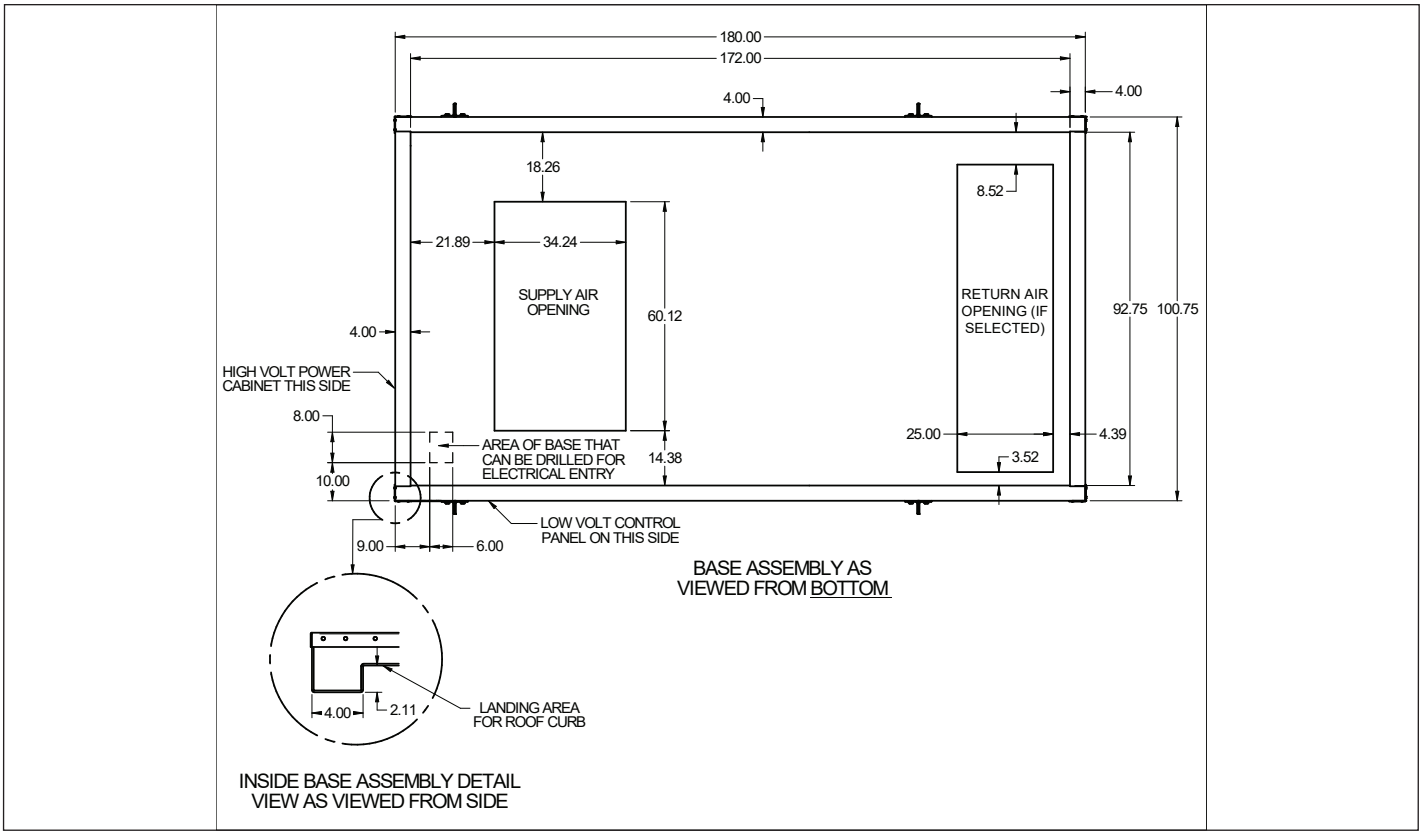


Figure 47.2 - Roof Curb Dimensions (inches)

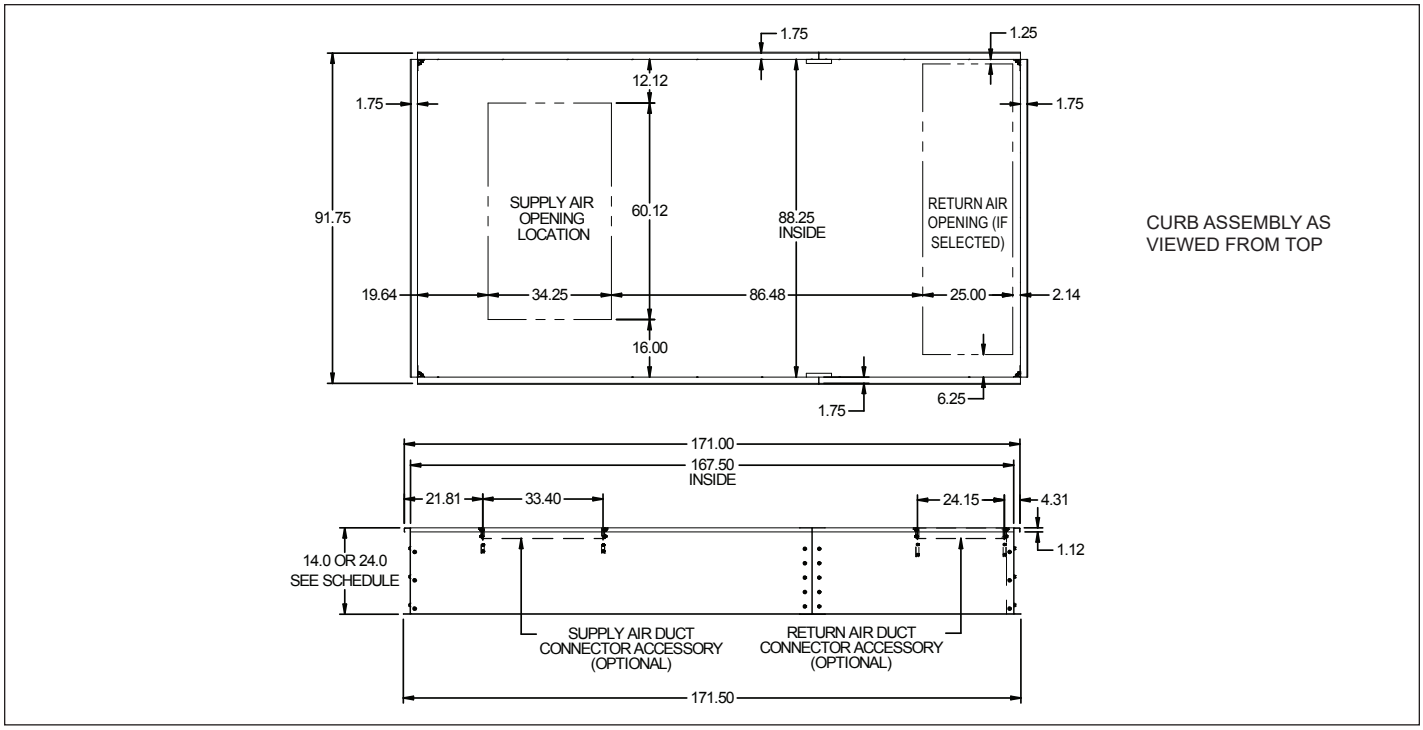
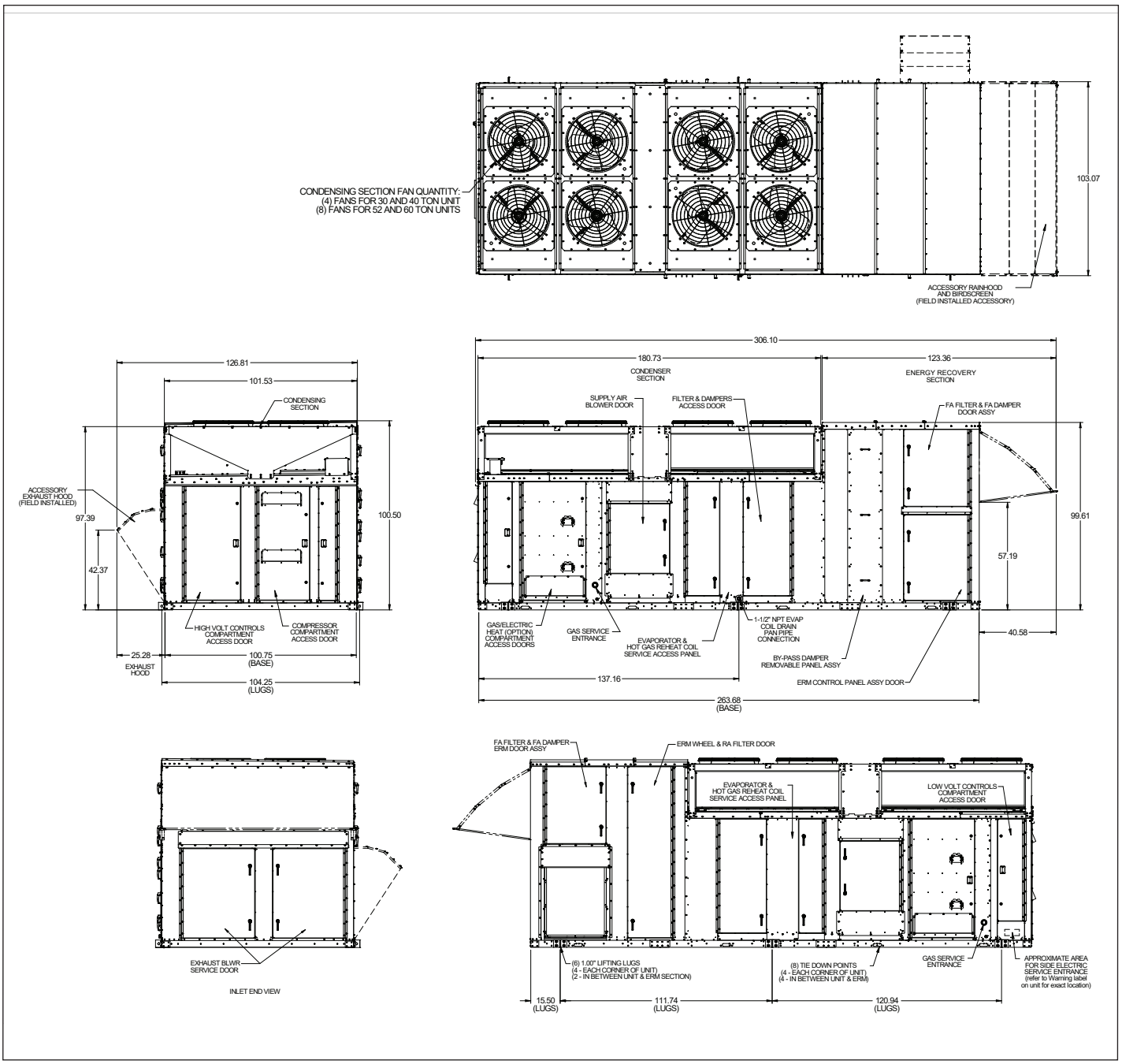


Table 47.3 - Roof Curb Weight (approx) - lbs.

Section	Description	Weight
Roof Curb	14” - Insulated	430
	24” - Insulated	547

DIMENSIONS - D-CABINET SIZE UNIT (WITH ENERGY RECOVERY)

Figure 48.1 - Unit Dimensions (inches)



DIMENSIONS - D-CABINET UNIT BASE/ROOF CURB (W/ENERGY RECOVERY)

Figure 49.1 - Unit Base Dimensions (inches)

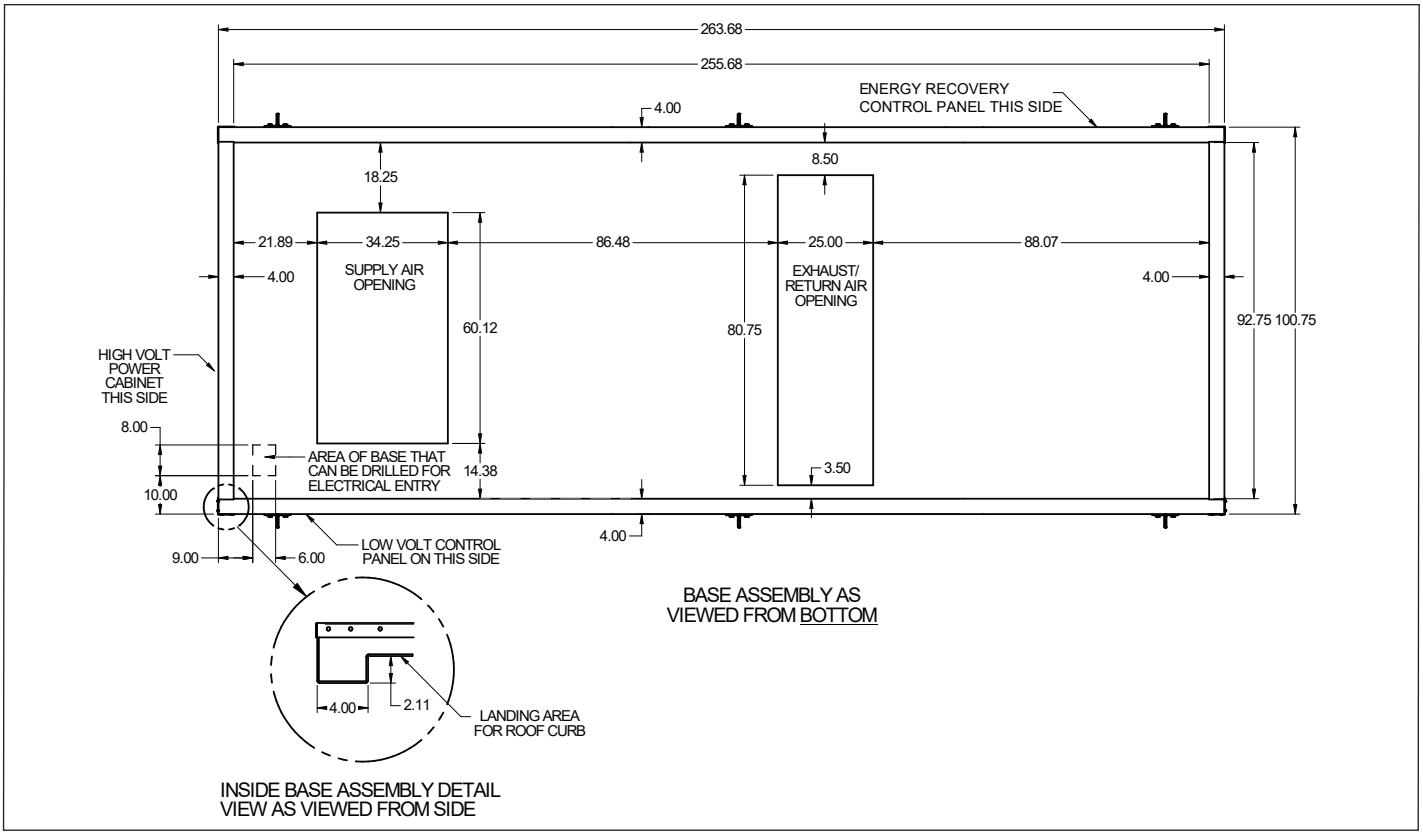


Figure 49.2 - Roof Curb Dimensions (inches)

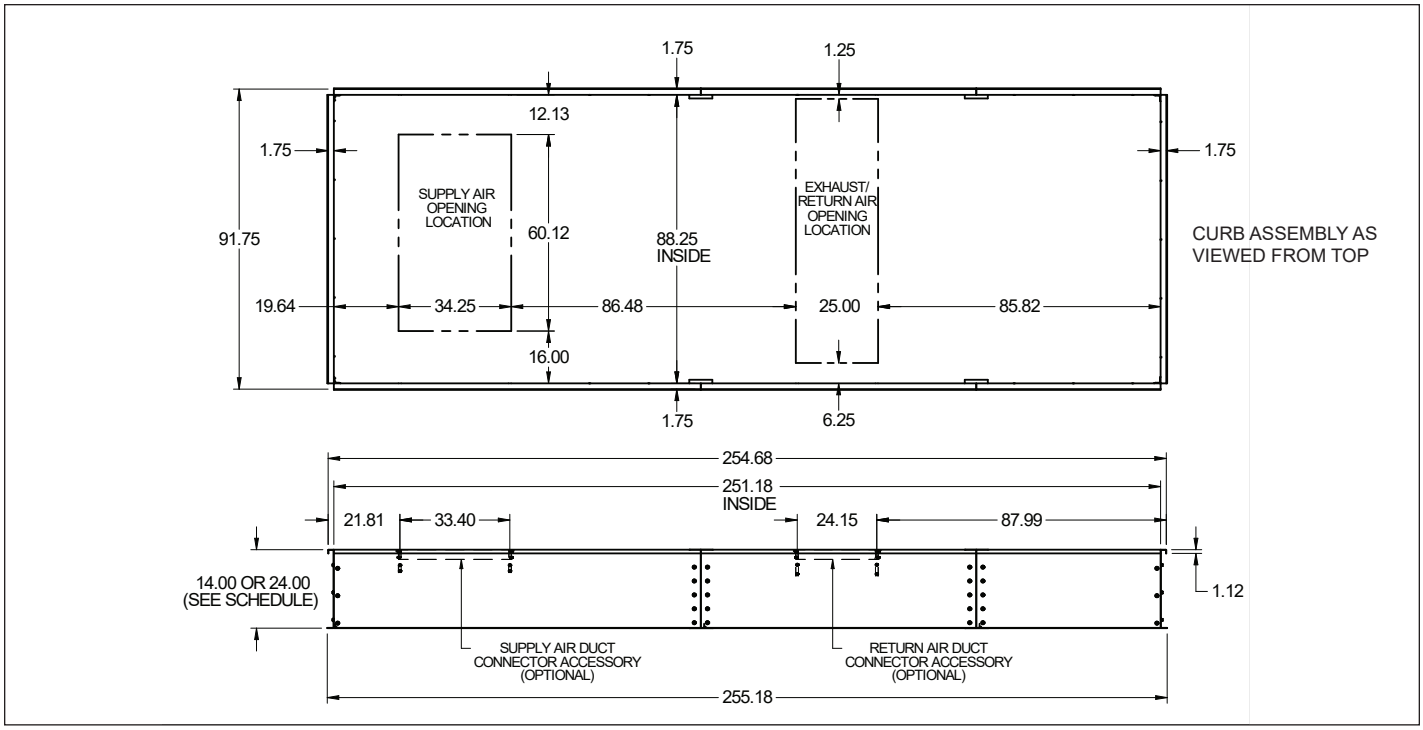


Table 49.3 - Roof Curb Weight (approx) - lbs.

Section	Description	Weight
Roof Curb	14" - Insulated	503
	24" - Insulated	737

BASE MODEL WEIGHTS

Table 50.1 - Approximate Base Model Weight - (lbs.)

Weights shown are approximate and may not include all features included with the selected unit. For more specific weight totals for the selected unit(s), refer to either the Submittal Package or the Order Detail.

Section	Description		Cabinet Size B	C	D
Base Unit	07 Ton		2377		
	10 Ton		2489		
	13 Ton		2570		
	15 Ton		2585	2710	
	20 Ton		2685	2894	
	26 Ton			2898	
	30 Ton			2907	6464
	40 Ton				6656
	52 Ton				6974
	60 Ton				6974
Dampers	Fresh Air Only (Digit 7=D, E, F)		40	45	200
	Fresh & Return Air (Digit 7=A, B, C, R)		80	95	362
Hot Gas Reheat	07, 10 Ton		22		
	13 Ton		26		
	15, 20 Ton		26	64	
	26 Ton			64	
	30 Ton			64	70
	40 Ton				70
	52, 60 Ton				80
Supply Air Fan (Direct Drive)	ANPL 11”, 12”		34		
	ANPA 12”		35		
	ANPA 14”		51		
	ANPA 16”		57	57	
	ANPA 16” Dual			114	
	ANPA 20”			97	97
	ANPA 25”				163
	ANPA 25” Dual				326
Motors ① (most common)	1HP		29	29	29
	1-1/2HP		37	37	37
	2HP		40	40	40
	3HP		69	69	69
	5HP		84	84	84
	7-1/2HP		115	115	115
	10HP		128	128	128
	15HP		211	211	211
	20HP		232	232	232
Power Option	Deadfront Disconnect (pick one)	None	0	0	0
		60A & 100A	5	5	5
		200A	10	10	10
		400A			10
		600A			15
	Convenience Outlet (pick one)	None	0	0	0
		Powered by Others	2	2	2
		Powered by Unit	40	40	40

Section	Description		Cabinet Size B	C	D
Heat Option ②	Electric ③	10 & 20kW	164	164	
		30 & 40kW	174	174	328
		50 & 60kW	185	185	
		70 & 80kW	195	195	348
		100kW	205	205	
		100 & 120kW			370
		140 & 160kW			390
		200kW			410
	Natural Gas (Ratings with * are available as LP)	150MBH *	128		
		200MBH *	154		
		250MBH *	154		
		300MBH *	234	256	
		400MBH *	234	308	308
		500MBH *		308	308
		600MBH		313	468
		800MBH			468
		900MBH *			616
		1000MBH *			616
		1200MBH			936
		1400MBH			936
		1600MBH			936
		175 MBH - 94%	158		
		225 MBH - 94%	160		
		310 MBH - 94%	173		
		350 MBH - 90%		316	
		450 MBH - 90%		320	320
		620 MBH - 94%			346
		850 MBH - 87%			628
		950 MBH - 87%			628
		1220 MBH - 87%			814
		1420 MBH - 87%			814
	Auxiliary Electric Heat Adder ③④	20kW	164	164	
		40kW			328
Integral Energy Recovery Wheel Option ⑤	Energy Recovery Wheel Section	None	0	0	0
		36” Wheel (21=F)	1013		
		46” Wheel (21=G)	1088		
		58” Wheel (21=H)			3083
		68” Wheel (21=J)			3224
		74” Wheel (21=K)			3348
		81” Wheel (21=L)			3403
	Exhaust Air Fan	None	0	0	0
		11”	114		
		16”	126		
		20”	148		
		ANPA 20”			97
		ANPA 25”			163
		ANPA 25” Dual			326
	Motors ① (most common)	Refer to Supply Fan Motor for comparable weights	*		*
	Energy Wheel Electric Preheat ③	None	0	0	0
		20kW Nominal	103		103
		40kW Nominal			108
Inlet Hood	(Ships loose for field installation)		170	72	112

① Motors weights shown are for Open Drip Proof (ODP), 1800RPM motors and are each. If the configuration is a dual fan design, multiply the weight shown by two.

② If equipped with the hot water heat option, please consult the Order Detail or Submittal Package for the option weight.

③ 20kW electric heat is derated for 208V and 230V.

④ Auxiliary Electric Heat weight adder is additive for certain Natural and Propane Gas heat rating weights.

⑤ For weights of Energy Recovery Module on C-Cabinet (if applicable), refer to the Installation & Service Manual for that section.

For weights of the Power Exhaust Module (Units with Digit 7=C or F) or Barometric Relief Damper Module (Units with Digit 7=R), please consult the Submittal Package for the option weight.

OPTION AND ACCESSORY PRESSURE DROP TABLES

Table 51.1 - Pressure Drop Data - B-Cabinet Sized Unit Supply Fan - ("W.C.) ①②

Feature/CFM			1111	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000	4500	5000	5500	6000
Unit	Evaporator Coil	7 & 10 Ton	0.06	0.08	0.10	0.13	0.16	0.19	0.22	0.25	0.28	0.35	0.42	0.50	0.58	0.67	0.76
		13, 15, & 20 Ton	0.05	0.05	0.07	0.09	0.11	0.13	0.15	0.18	0.20	0.25	0.30	0.36	0.42	0.48	0.55
	Hot Gas Reheat Coil	7 & 10 Ton	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.06	0.07	0.08
		13, 15, & 20 Ton	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.06
Filters	2” Primary	MERV 10	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11
		MERV 13	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15	0.17	0.20	0.23
		MERV 15	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.19
	4” Secondary	MERV 13	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.07	0.09	0.11	0.12	0.14	0.16	0.19
		MERV 14	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.16	0.18	0.21	0.24	0.27	0.30
Air Control	Rainhood		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	Dampers		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05
Electric Heat	10 & 20kW		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	30 & 40kW		-	-	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04
	50 & 60kW		-	-	-	-	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.09
	70 & 80kW		-	-	-	-	-	-	-	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.09
Gas Heat	150MBH	High Temp Rise	0.03	0.03	0.04	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.05	0.06	0.07	0.08	0.10	0.11	0.15	-	-	-	-	-
	200MBH	High Temp Rise	-	-	0.06	0.08	0.09	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.10	0.11	0.13	0.16	0.21	0.27	0.34	-	-	-
	250MBH	High Temp Rise	-	-	-	-	0.09	0.11	0.14	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	0.13	0.16	0.21	0.27	0.34	0.43	0.52	0.62
	300MBH	High Temp Rise	-	-	-	-	-	0.07	0.08	0.09	0.11	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	-	-	0.09	0.12	0.14	0.17	0.20	0.23
	400MBH	High Temp Rise	-	-	-	-	-	-	-	-	0.11	0.14	0.17	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	-	-	-	-	0.14	0.17	0.20	0.23
	175MBH		-	-	-	0.10	0.13	0.16	0.19	0.22	0.26	0.34	0.44	0.54	0.65	-	-
	225MBH		-	-	-	-	0.13	0.16	0.19	0.22	0.26	0.34	0.44	0.54	0.65	0.78	0.91
	310MBH		-	-	-	-	-	-	-	0.17	0.20	0.25	0.32	0.38	0.46	0.53	0.62
Gas Heat + Aux/ Supplemental Electric	150MBH	High Temp Rise	0.03	0.04	0.04	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.05	0.06	0.08	0.09	0.11	0.12	0.17	-	-	-	-	-
	200MBH	High Temp Rise	-	-	0.07	0.08	0.10	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.10	0.12	0.14	0.17	0.22	0.28	0.36	-	-	-
	250MBH	High Temp Rise	-	-	-	-	0.10	0.12	0.15	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	0.14	0.17	0.22	0.28	0.36	0.44	0.54	0.64
	300MBH	High Temp Rise	-	-	-	-	-	0.07	0.09	0.10	0.12	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	-	-	0.11	0.13	0.16	0.19	0.22	0.25
	400MBH	High Temp Rise	-	-	-	-	-	-	-	-	0.12	0.15	0.18	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	-	-	-	-	0.16	0.19	0.22	0.25
	175MBH		-	-	-	0.11	0.13	0.16	0.20	0.23	0.27	0.35	0.45	0.55	0.67	-	-
	225MBH		-	-	-	-	0.13	0.16	0.20	0.23	0.27	0.35	0.45	0.55	0.67	0.80	0.93
	310MBH		-	-	-	-	-	-	-	0.18	0.21	0.27	0.33	0.40	0.47	0.55	0.64
Energy Recovery Module	Supply Side	2” MERV 10 OA Filters	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.07	0.09	0.11	0.13	0.16	0.18	-
		36” Wheel (21=F)	0.35	0.39	0.46	0.54	0.62	0.70	0.78	0.86	0.94	-	-	-	-	-	-
		46” Wheel (21=G)	0.23	0.26	0.31	0.36	0.41	0.46	0.51	0.57	0.62	0.73	0.85	0.96	1.08	1.21	-
	Exhaust Side	2” MERV 10 RA Filters	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.07	0.09	0.11	0.13	0.16	0.18	-
		36” Wheel (21=F)	0.48	0.53	0.61	0.69	0.77	0.85	0.94	1.02	1.11	-	-	-	-	-	-
		46” Wheel (21=G)	0.36	0.39	0.45	0.50	0.56	0.62	0.67	0.73	0.79	0.91	1.04	1.16	1.29	1.43	-

① Option and accessory static pressure drop data shown are approximate. Please consult the Submittal Package for static pressure drop data at conditions other than shown above.

② If equipped with the hot water heat option, please consult the Submittal Package for static pressure drop at design conditions.

OPTION AND ACCESSORY PRESSURE DROP TABLES

Table 52.1 - Pressure Drop Data - C-Cabinet Sized Unit Supply Fan - ("W.C.) ①②

	Feature/CFM		3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	10000	12000
Unit	Evaporator Coil		0.11	0.15	0.18	0.21	0.25	0.29	0.32	0.36	0.40	0.44	0.49	0.53	0.58	0.67	0.87
	Hot Gas Reheat Coil		0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.10	0.13	0.18
Filters	2” Primary	MERV 10	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.09	0.10	0.11	0.12	0.16
		MERV 13	0.04	0.05	0.07	0.08	0.09	0.11	0.12	0.14	0.16	0.17	0.19	0.21	0.23	0.27	0.35
		MERV 15	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.14	0.16	0.17	0.19	0.22	0.29
	4” Secondary	MERV 13	0.05	0.06	0.07	0.07	0.09	0.10	0.11	0.12	0.13	0.14	0.16	0.17	0.19	0.22	0.29
		MERV 14	0.08	0.10	0.11	0.13	0.15	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.34	0.43
Air Control	Rainhood		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.04
	Dampers		0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.14
Electric Heat	10 & 20kW		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	30 & 40kW		0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06
	50 & 60kW		0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.10
	70 & 80kW		0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.11	0.13
	100kW		-	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.11	0.13
Gas Heat	300MBH		0.07	0.09	0.11	0.14	0.17	0.21	0.25	0.30	0.35	-	-	-	-	-	-
	400MBH	High Temp Rise	0.09	0.11	0.14	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.14	0.17	0.20	0.24	0.28	0.33	0.37	0.43	0.48	0.54	-	-
	500MBH	High Temp Rise	-	-	0.14	0.18	0.21	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.20	0.24	0.28	0.33	0.37	0.43	0.48	0.54	0.67	0.98
	600MBH	High Temp Rise	-	-	-	0.21	0.25	0.29	0.33	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	0.37	0.42	0.46	0.51	0.56	0.61	0.71	0.94
	350MBH	High Temp Rise	0.14	0.18	0.23	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.25	0.31	0.36	0.42	0.47	0.53	0.58	0.64	0.70	0.75	-	-
	450MBH	High Temp Rise	-	-	0.23	0.28	0.34	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.36	0.42	0.47	0.53	0.58	0.64	0.70	0.75	0.87	1.09
Gas Heat + Aux/ Supplemental Electric	300MBH		0.08	0.09	0.12	0.14	0.18	0.22	0.26	0.31	0.36	-	-	-	-	-	-
	400MBH	High Temp Rise	0.10	0.12	0.15	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.15	0.18	0.21	0.25	0.29	0.34	0.39	0.44	0.50	0.56	-	-
	500MBH	High Temp Rise	-	-	0.15	0.18	0.22	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.21	0.25	0.29	0.34	0.39	0.44	0.50	0.56	0.69	1.00
	600MBH	High Temp Rise	-	-	-	0.22	0.26	0.30	0.34	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	-	-	0.39	0.43	0.48	0.52	0.57	0.62	0.73	0.96
	350MBH	High Temp Rise	0.14	0.19	0.24	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.26	0.32	0.37	0.43	0.48	0.54	0.60	0.66	0.71	0.77	-	-
	450MBH	High Temp Rise	-	-	0.24	0.29	0.35	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.37	0.43	0.48	0.54	0.60	0.66	0.71	0.77	0.88	1.12
Energy Recovery Module	**Supply Side**	2” MERV 10 OA Filters	0.04	0.02	0.03	0.03	0.04	0.05	0.11	0.12	0.13	0.15	0.16	0.18	0.20	-	-
		46” Wheel (EWM 7=M)	0.59	0.69	0.80	0.90	1.01	1.12	1.23	-	-	-	-	-	-	-	-
		58” Wheel (EWM 7=M)	0.37	0.44	0.51	0.59	0.66	0.73	0.81	0.89	0.97	1.05	1.13	1.21	1.30	-	-
	Exhaust Side	2” MERV 10 RA Filters	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.13	0.15	0.16	0.18	0.20	-	-
		46” Wheel (EWM 7=M)	0.74	0.85	0.96	1.08	1.19	1.30	1.42	-	-	-	-	-	-	-	-
		58” Wheel (EWM 7=M)	0.53	0.61	0.68	0.76	0.84	0.92	1.00	1.08	1.17	1.26	1.35	1.44	1.53	-	-

① Option and accessory static pressure drop data shown are approximate. Please consult the Submittal Package for static pressure drop data at conditions other than shown above.

② If equipped with the hot water heat option, please consult the Submittal Package for static pressure drop at design conditions.

OPTION AND ACCESSORY PRESSURE DROP TABLES

Table 53.1 - Pressure Drop Data - D-Cabinet Sized Unit Supply Fan - ("W.C.) ①

Feature/CFM			4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000
Unit	Evaporator Coil	30 & 40 Ton	0.17	0.24	0.32	0.41	0.51	0.62	0.73	0.86	0.99	-	-	-	-	-	-
		52 & 60 Ton	-	0.14	0.18	0.23	0.29	0.35	0.42	0.49	0.57	0.65	0.74	0.83	0.92	1.03	1.13
	Hot Gas Reheat Coil	30 & 40 Ton	0.05	0.06	0.09	0.11	0.13	0.16	0.19	0.22	0.26	-	-	-	-	-	-
		52 & 60 Ton	-	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.11	0.13	0.14	0.16	0.18	0.20
Filters	2” Primary	MERV 10	0.01	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.15
		MERV 13	0.05	0.07	0.08	0.10	0.12	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.30	0.32
		MERV 15	0.02	0.03	0.04	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25
	4” Secondary	MERV 13	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.20	0.22	0.24
Air Control	Rainhood		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	Dampers		0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10
Electric Heat	40kW		0.03	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.12	0.13
	80kW		0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06
	120kW		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	160kW		-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	200kW		-	-	-	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Gas Heat	400MBH	Low Temp Rise	0.08	0.11	0.16	0.21	0.27	0.34	0.43	-	-	-	-	-	-	-	-
	500MBH	High Temp Rise	0.09	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	0.16	0.21	0.27	0.34	0.43	0.52	0.62	-	-	-	-	-	-
	600MBH	High Temp Rise	-	0.13	0.17	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.15	0.17	0.20	0.22	0.25	0.28	0.32	0.35	0.39	-	-	-
	800MBH	High Temp Rise	-	-	0.17	0.21	0.25	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.20	0.22	0.25	0.28	0.32	0.35	0.39	0.42	0.46	0.51
	900MBH		-	-	-	0.51	0.64	0.79	-	-	-	-	-	-	-	-	-
	1000MBH		-	-	-	-	0.64	0.79	0.96	1.15	1.35	-	-	-	-	-	-
	1200MBH		-	-	-	-	-	0.53	0.63	0.73	0.84	0.96	1.09	1.22	-	-	-
	1400MBH		-	-	-	-	-	-	-	0.73	0.84	0.96	1.09	1.22	-	-	-
	1600MBH		-	-	-	-	-	-	-	-	0.84	0.96	1.09	1.22	1.36	1.51	1.67
	850MBH - 87%		-	-	0.56	0.72	0.90	1.11	-	-	-	-	-	-	-	-	-
	950MBH - 87%		-	-	-	0.72	0.90	1.11	1.34	1.59	-	-	-	-	-	-	-
	1220MBH - 87%		-	-	-	-	-	1.00	1.15	1.31	1.47	1.64	1.83	-	-	-	-
	1420MBH - 87%		-	-	-	-	-	-	1.15	1.31	1.47	1.64	1.83	2.02	2.22	-	-
	450MBH - 94%		0.14	0.21	0.28	0.36	0.45	0.56	0.67	0.80	0.93	1.08	-	-	-	-	-
	620MBH - 94%		-	-	0.24	0.30	0.36	0.43	0.50	0.58	0.66	0.75	0.84	0.94	1.05	1.16	1.28
Gas Heat + Aux/ Supplemental Electric	400MBH	Low Temp Rise	0.11	0.15	0.20	0.26	0.33	0.41	0.50	-	-	-	-	-	-	-	-
	500MBH	High Temp Rise	0.12	0.18	-	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	0.20	0.26	0.33	0.41	0.50	0.60	0.71	-	-	-	-	-	-
	600MBH	High Temp Rise	-	0.17	0.21	-	-	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	0.20	0.23	0.26	0.30	0.33	0.37	0.41	0.45	0.50	-	-	-
	800MBH	High Temp Rise	-	-	0.21	0.26	0.31	-	-	-	-	-	-	-	-	-	-
		Low Temp Rise	-	-	-	-	-	0.26	0.30	0.33	0.37	0.41	0.45	0.50	0.54	0.59	0.64
	450MBH - 94%		0.17	0.24	0.32	0.41	0.51	0.62	0.74	0.88	1.02	1.17	-	-	-	-	-
	620MBH - 94%		-	-	0.29	0.35	0.42	0.49	0.57	0.66	0.75	0.84	0.95	1.05	1.17	1.29	1.41
Energy Recovery Module	Supply Side	2” MERV 10 OA Filters	-	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.11	0.13	0.14	0.16	0.17	0.19	0.21
		58” Wheel	-	0.58	0.70	0.82	0.94	1.06	-	-	-	-	-	-	-	-	-
		68” Wheel	-	0.45	0.54	0.63	0.72	0.81	0.91	1.01	1.11	-	-	-	-	-	-
		74” Wheel	-	0.38	0.46	0.54	0.62	0.70	0.78	0.87	0.96	1.04	1.13	1.22	-	-	-
		81” Wheel	-	0.32	0.38	0.45	0.52	0.59	0.66	0.73	0.80	0.88	0.95	1.03	1.11	1.19	1.28
	Exhaust Side	2” MERV 10 RA Filters	-	0.04	0.05	0.07	0.08	0.10	0.11	0.13	0.15	-	-	-	-	-	-
		58” Wheel	-	0.61	0.74	0.88	1.01	1.15	-	-	-	-	-	-	-	-	-
		68” Wheel	-	0.48	0.58	0.69	0.80	0.91	1.03	1.15	1.27	-	-	-	-	-	-
		74” Wheel	-	0.41	0.50	0.60	0.70	0.80	0.90	1.01	1.12	1.24	1.36	1.49	-	-	-
		81” Wheel	-	0.35	0.43	0.51	0.59	0.68	0.77	0.87	0.97	1.07	1.18	1.29	1.41	1.53	1.65

① Option and accessory static pressure drop data shown are approximate. Please consult the Submittal Package for static pressure drop data at conditions other than shown above.

MAINTENANCE

General Maintenance

⚠ WARNING

1. When the dead front disconnect switch(es) (for main unit and/or powered convenience outlet option) is in the "OFF" position, supply power remains energized at the line (supply) side of the dead front disconnect switch(es). The switch body is located inside of another junction box to protect against contact with the live wiring. The junction box must not be disassembled unless the main power supply from the building to the unit is de-energized.
2. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.
3. This unit contains R-410A high pressure refrigerant. Hazards exist that could result in personal injury or death. Installation, maintenance, and service must only be performed by an HVAC technician qualified in R-410A refrigerant and using proper tools and equipment. Due to the high pressure of R-410A refrigerant, DO NOT USE service equipment or tools designed for refrigerants other than R410A.

⚠ CAUTION

When servicing the unit, some components may be hot enough to cause pain or injury. Allow time for cooling of hot components before servicing.

IMPORTANT

Start-up and adjustment procedures must be performed by a qualified service agency.

All cooling and heating equipment should be serviced before each season to assure proper operation. The following items may require a more frequent service schedule based on the environment in which the unit is installed and the frequency of the equipment operation.

Before You Begin

1. Turn off power to the unit at the disconnect switch. If equipped with gas heating option, turn all hand gas valves to the "OFF" position.

   Note: The dead front disconnect switch, if included, is factory installed in the controls/compressor compartment section (refer to the figures on pages 36 through 39). The disconnect switch is designed so that it must be turned "OFF" before entry to the compartment can be obtained. When in the "OFF" position, power is disconnected to all unit wiring electrically following the switch (see WARNING).
2. For units equipped for dual power supply sources, both sources of power must be disconnected to prevent electrical shock and equipment damage.
3. Open the power compartment, controls compartment, and blower access doors. Refer to Figures 33.1 through 35.1 for location of doors and internal components.
4. Check that the supply voltage matches the unit supply voltage listed on the Unit Serial Plate. Verify that all wiring is secure and properly protected. Trace circuits to insure that the unit has been wired according to the wiring diagram.
5. Check that fuses or circuit breakers are in place and sized correctly.

Fan Assembly

Direct drive fans include a direct coupled motor. Belt drive fan assemblies include the bearings, drive sheaves, belts, and auto belt tensioner.

For belt driven fans, most bearings are permanently lubricated, except for pillow block bearings or those identified with grease fittings. For blower bearings that are not permanently lubricated, lubricate according to the manufacturer's instructions. Bearings should be checked for any unusual wear and replaced if needed.

For belt driven fans, drive sheaves should be checked at the same time the bearings are inspected. Check to make sure the sheaves are in alignment and are securely fastened to the blower and motor shafts.

Belt should be rechecked shortly after the unit has been installed to check that the belt tension is being maintained by the auto belt tensioner. After the initial start-up, monthly checks are recommended to monitor the belt for wear.

Electrical Wiring

The electrical wiring should be checked annually for loose connections or deteriorated insulation.

Motors

Most motors require lubrication and are identified as such on the motor nameplate. For motors that are not permanently lubricated, lubrication intervals are recommended by the motor manufacturer based on a number of factors, including motor speed, operating hours, temperature, etc. Lubricate the motor according to the manufacturer's instructions.

Outdoor Air Sensor, Supply Air Sensor, and Return Air Sensor (if applicable)

1. Remove sensor from mounting bracket.
2. Remove any dust or dirt that may be clogging the screen material covering the air sample inlet openings on the end of the sensor probe. If required, remove the screened tip of the sensor and use a neutral detergent and water solution to clean the screen material. Do not use ethyl alcohol, hydrocarbons, ammonia, or derivatives.

Air Filters

If the unit is supplied with a dirty filter switch, replace the air filters any time the Carel controller provides a dirty filter alarm notice.

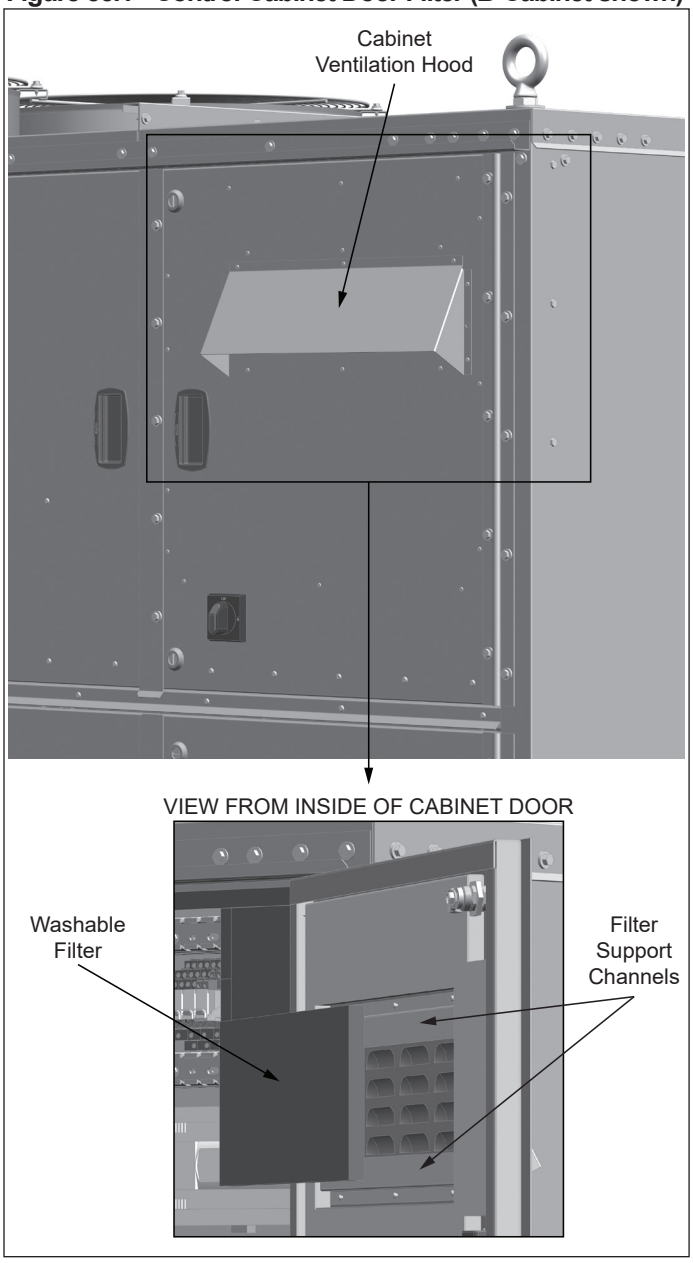
Units without a dirty filter pressure switch should have the air filters checked monthly. Replace if necessary. In dirty atmospheres, air filter maintenance may be required more often. Pleat direction must be vertical to ensure optimum performance.

Control Cabinet Door Filter

A reusable rigid polyester filter is located inside the control cabinet door. B and C-Cabinet units have a single filter as shown in Figure 55.1 while D-Cabinet units have two filters.

Inspect the filter(s) with the same frequency as the air filters (see previous section). If necessary, the filter may be removed and washed with water. Allow to dry and reinstall within the filter support channels in the door.

Figure 55.1 - Control Cabinet Door Filter (B-Cabinet shown)



Cooling Coil Drain Pan and Drain System

The drain pan, trap, and drain pipe must be cleaned regularly to avoid blockage that can reduce or stop water flow as follows:

1. At the beginning of the cooling season, inspect and clean the entire cooling coil cabinet and condensate drain pan to remove contaminants.
2. Inspect and clean the condensate drain trap and piping. The use of a cleanout opening at the top of the trap (see Figure 8.2) can help facilitate this maintenance.
3. Fill the trap with water to ensure proper operation and replace the cap on the cleanout opening to close the system.
4. During the end of cooling season shutdown of the system, disconnect and remove all water from the trap and drain to prevent freeze damage. If local building codes permit, the trap may be filled with an antifreeze solution.
5. If the unit is used year round, regularly inspect and clean the cooling coil cabinet, condensate drain pan, and trap/drain system to ensure proper function.
6. Depending on climate, freeze protection of the trap may be required during non-cooling days.

Refrigeration System Coil Maintenance

1. Periodically, inspect the coils (evaporator, condenser, and hot gas reheat if applicable) for signs of corrosion and leaks. Repair and replacement of the coil and the connecting piping, valves, etc., must be performed as needed by a qualified technician.
2. Should the coil surface need cleaning, caution should be exercised in selecting the cleaning solution as well as the cleaning equipment. Improper selection can result in damage to the coil and/or health hazards. Cleaning solutions must not be corrosive or cause damage to copper tube/aluminum fin, or all aluminum coils. Clean the coil from the leaving air-side so that foreign material will be washed out of the coil rather than pushed further in. Be sure to carefully read and follow the cleaning fluid manufacturer's recommendations before using any cleaning fluid.

   Note: The condenser coil is constructed of aluminum materials and contains refrigerant under high pressure. Do not use acidic solutions to clean the coil, as it could lead to corrosion.

Inlet Hood

If the unit is equipped with an outside air inlet hood, check to ensure the inlet screen behind the hood is clean and free of debris.

Duct Furnace

When providing annual maintenance for the duct furnace, keep the unit free from dust, dirt, grease and foreign matter. Pay particular attention to:

1. The power exhauster discharge opening and the combustion air inlet louvers.
2. The main burner orifices (avoid the use of hard, sharp instruments capable of damaging surfaces for cleaning these orifices). To check the main burner orifices, see Manifold Assembly Removal section below.
3. The heat exchanger should be checked annually for cracks. If a crack is detected, the heat exchanger should be replaced before the unit is put back into service.
4. The gas valves and piping should be checked annually for general cleanliness and tightness.
5. The gas controls should be checked to ensure that the unit is operating properly.
6. If equipped with the standard efficiency (81%) gas heat option:
   a. Inspect and clean the condensate drain tray located under the heat exchanger tube openings.
   b. Inspect and clean the condensate drain tubes located on the end of the drain tray that are routed to the outside of the cabinet. Ensure that the tubes are not kinked or blocked.
7. If equipped with the hybrid efficiency (D-Cabinet only) or high efficiency (90% or 94%) gas heat option:
   a. Inspect and clean the condensate drain trap and piping.
   b. Fill the trap with water to ensure proper operation.
   c. If a condensate neutralizer tube is installed, recharge per the neutralizer tube manufacturer's instructions.
   d. Check the condensate overflow switch for cleanliness and proper operation.

Manifold Assembly Removal

1. Shut off gas and electric supply.
2. Open the duct furnace control access compartment doors.
3. Disconnect gas manifold at ground union joint.
4. Remove the screws holding the manifold to the heat exchanger support.
5. Slide the manifold through the manifold bracket.
6. Clean the orifices as necessary.
7. Slide the manifold back into the manifold bracket and reinstall the screws that hold the manifold to the heat exchanger support.
8. Reconnect the gas line to the manifold at the ground joint union.
9. Turn on the electric and gas supply.
10. Check the ground union joint for leaks with a soap solution. Tighten if necessary.
11. Close the duct furnace control access compartment doors.

Hot Water Heat Coil Maintenance

If the unit is supplied with a factory installed hot water heat coil, check the following:

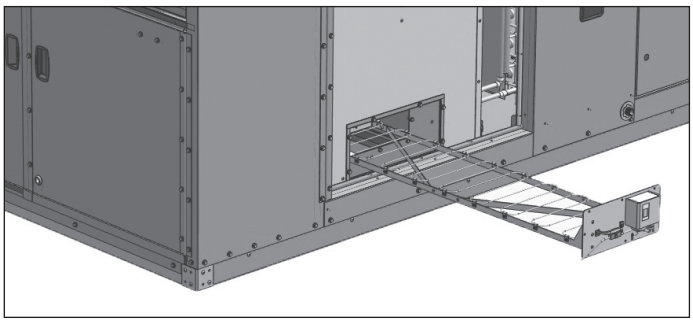
1. Periodically, inspect the coils for signs of corrosion and leaks. Repair and replacement of the coil and the connecting piping, valves, etc., must be performed as needed by a qualified technician.
2. **For cleaning the external surface of the coil and fins with compressed air and/or vacuum:** The coil can remain in the unit or be removed. Use compressed air blown into the leaving air side of the coil and/or vacuum from the entering air side of the coil to avoid pushing foreign material further into the coil.
3. **For cleaning the external surface of the coil and fins with a cleaning solution:** The coil must be removed from the unit. Caution should be exercised in selecting the cleaning solution as well as the cleaning equipment. Improper selection can result in damage to the coil and/or health hazards. Cleaning solutions must not be corrosive or cause damage to copper tube/aluminum fin coils. Be sure to carefully read and follow the cleaning fluid manufacturer's recommendations before using any cleaning fluid.
4. Maintain the circulated fluid free of sediment, corrosive products and biological contaminants. Periodic testing of the fluid followed by any necessary corrective measures along with maintaining adequate fluid velocities and proper filtering of the fluid is required.

Hot Water Freeze Stat

If the unit is supplied with a factory installed hot water coil freeze stat, check the following:

1. Disconnect the control wiring from the freeze stat terminals.
2. Remove the screws holding the freeze stat side access panel. Refer to Figure 56.1.
3. Slide the freeze stat assembly out.
4. Examine the freeze stat capillary for cleanliness and/or obstructions as necessary. Ensure the capillary has no kinks or breaks (replace if either of these conditions is present).
5. Replace the freeze stat assembly in reverse order. In replacing the assembly, be certain that the capillary support frame is properly located and supported. Do not force the side access panel. It will not fit if the frame is not properly aligned.
6. Reconnect the control wiring to the freeze stat terminals.

Figure 56.1 - Optional Factory Installed Hot Water Coil Freeze Stat



Energy Recovery Exhaust Assembly

If the unit is equipped with a factory supplied Energy Recovery Exhaust section, check the following:

1. The energy recovery wheel drive belt is a linked belt that resists stretching, however any natural stretching may affect wheel rotation and energy recovery performance. The belt should be checked periodically, especially within the first 400 hours of operation. If too loose, the belt can be tightened by removing link(s) to shorten the belt.
2. The bearings are permanently lubricated and under normal operating conditions maintenance is not required.
3. The wheel is to be checked for cleanliness. In most cases, the counterflow airflow will allow the rotary wheel to self-clean itself of contaminants that may adhere to the surface of the wheel. In situations where self-cleaning is not sufficient, the wheel can be cleaned with a vacuum and brush to clear any buildup.
4. Check wheel to housing seals and replace if worn. To check the seal, slide a piece of paper ("feeler gauge") between the seal and the media at multiple locations on both sides of the bearing beam as you rotate the wheel slowly by hand (clockwise when viewed from the pulley side). Verify that the media slightly grabs the paper during the rotation. If necessary, loosen adjusting screws along the bearing beam and re-set seal to a slight interference fit with the wheel media.

Note: The wheel assembly can be partially slid out of the cabinet for maintenance if desired. The wheel should not be slid out more than 50% of the width to prevent the wheel from tipping out of the cabinet.

Energy Recovery Wheel Electric Preheat

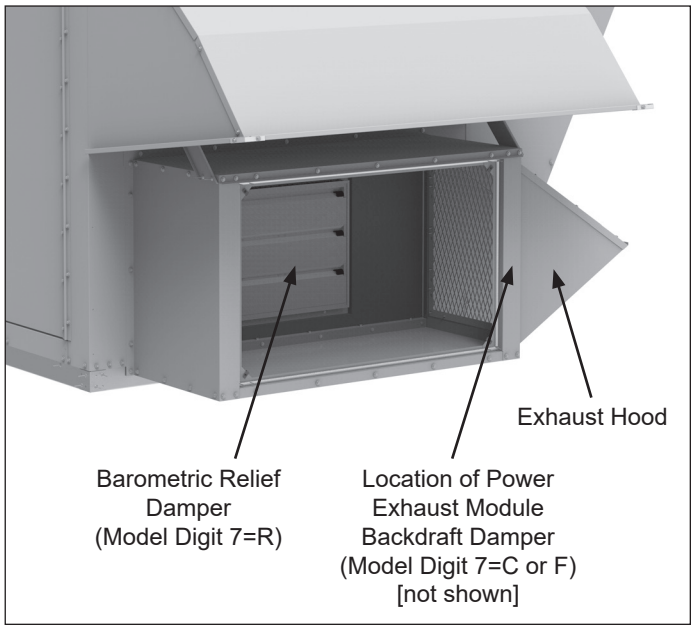
When providing annual maintenance for the electric preheat (if equipped), keep the unit free from dust, dirt, grease and foreign matter. Pay particular attention to:

1. The heating elements should be checked annually for cracks and discoloration. If a crack is detected, the heating elements should be replaced before the unit is put back into service. If the elements are dark gray, airflow across the heating elements should be checked to ensure that a blockage has not occurred or the blower is operating properly.
2. The electrical connections should be checked annually for general cleanliness and tightness.
3. The controls should be checked to ensure that the unit is operating properly.

Exhaust/Barometric Relief Dampers

If the unit is equipped with an exhaust fan (Digit 7=B, C, E, or F) or barometric relief dampers (Digit 7=R), check that the dampers are clean and manually open/close freely. For units with power exhaust, the exhaust backdraft dampers are accessible from inside the exhaust hood. For units with barometric relief, the dampers are accessible from the end panel on the module. Refer to Figure 57.1.

Figure 57.1 - Power Exhaust Module & Barometric Relief Damper Module Access Panel Location



Repeat Start-Up Procedure

Once complete, repeat applicable Start-Up Procedure steps as shown starting on page 17.

SERVICE & TROUBLESHOOTING

⚠WARNING

When servicing or repairing this equipment, use only factory-approved service replacement parts. Refer to the rating plate on the unit for complete unit model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

⚠ CAUTION

Do not reuse any mechanical or electrical components which has been wet. Such component must be replaced.

⚠IMPORTANT

Start-up and adjustment procedures must be performed by a qualified service agency.

To check most of the Possible Remedies in the troubleshooting guide on the following pages, refer to the applicable sections of this manual. The troubleshooting tables are as follows:

- Tables 58.1 and 59.1 - Main Unit
- Tables 60.1 and 61.1 - Gas Heat Option with furnace model Digit 11=6 or 8.

Table 58.1 - Troubleshooting

Trouble	Possible Cause	Possible Remedy
A. Power Failure	1. Disconnect not turned on.	1. Turn on disconnect switch
	2. Blown fuses or open circuit breaker	2. Check and replace or reset
	3. Main power supply for unit turned off	3. Turn on power at main panel
B. Motor Failure	1. See Problem "A"	1. See Problem "A"
	2. Failed motor	2. Check and replace
	3. Loose wiring to motor	3. Check and tighten
	4. Motor overloaded	4. Reset motor starter and check motor load
	5. Improper supply voltage	5. Check and correct
C. Blower Not Turning or Turns Slow	1. See Problems "A" and "B"	1. See Problems "A" and "B"
	2. Broken drive belt	2. Check and replace
	3. Motor undersized for application	3. Contact Factory
	4. Motor voltage too low	4. Check and correct
	5. Supply power line sizing too small	5. Check and correct
	6. Controls are in Unoccupied mode	6. Wait for Occupied mode or override
	7. Controller alarm	7. Check and correct
	8. Blower door open	8. Close the door
D. Insufficient Airflow	1. Motor running backwards	1. Check and correct motor wiring to phase rotation of supply power, reverse any two lines to motor
	2. Fan speed setting too low	2. Check and correct
	3. Dirty or clogged filters or coils	3. Check and clean or replace
	4. Duct system has more static pressure drop than expected	4. Check and correct
	5. Lack of straight duct at unit discharge outlet	5. Install straight duct at discharge per I&S Manual or contact Factory
	6. Dampers and/or discharge registered are closed	6. Check and correct
E. Excessive Airflow	1. Fan speed setting too high	1. Check and correct
	2. Filters not in place	2. Check and reinstall filters
	3. Ductwork grilles or registers not installed	3. Check and install
	4. Duct system has less static pressure drop than expected	4. Check and correct
	5. Access door is open	5. Close all unit side access doors

Table 59.1 - Troubleshooting (Continued)

Trouble	Possible Cause	Possible Remedy
F. Compressor(s) Do Not Operate	1. See Problems “A” and “B”	1. See Problems “A” and “B”
	2. Controls are in Unoccupied mode	2. Wait for Occupied mode or override
	3. Ambient lockout	3. Check and wait or override
	4. Low pressure lockout	4. Check and wait or override
	5. High pressure lockout	5. Check and wait or override
	6. Inter-stage delay	6. Check and wait or override
	7. Airflow proving switch not closing	7. Check and correct
	8. Thermostat not calling for cooling	8. Check and wait or override
	9. Drain pan float switch open	9. Check switch, check drain line (pan, trap, piping) for proper drainage, and verify trap is primed with water
G. Compressor(s) Do Not Cycle Off	1. Supply air temperature not satisfied	1. Compressors will remain on until the supply air setpoint is satisfied
H. Dampers Do Not Operate	1. See Problem “A”	1. See Problem “A”
	2. Failed damper motor(s)	2. Check and replace
	3. Loose wiring to damper motor(s)	3. Check and tighten
	4. Controls are in Unoccupied mode	4. Wait for Occupied mode or override
	5. Ambient lockout	5. Check and wait or override
I. Electric Heat Not Functioning	1. See Problem “A”	1. See Problem “A”
	2. See Problem “D”	2. See Problem “D”
	3. Thermostat not calling for heat	3. Check and wait or override
	4. Limit switches are open	4. Check and correct
	5. Overload relay is tripped	5. Check and correct
	6. Failed heat modules	6. Check and replace
J. Gas Heat Not Functioning Properly	1. See Problem “A”	1. See Problem “A”
	2. See Problem “D”	2. See Problem “D”
	3. Thermostat not calling for heat	3. Check and wait or override
	4. Limit switches are open	4. Check and correct
	5. Main gas supply not turned on	5. Check and correct
	6. Air in gas line	6. Purge per instructions
	7. Loose wiring to ignition controls or gas valves	7. Check and tighten
	8. Failed ignition controller or gas valve	8. Check and replace
	9. Failed flame sensor	9. Check and replace
	10. Improper supply air temperature sensor installation	10. Check and correct
	11. Flame rollout or flashback	11a. Main pressure too high (correct to 14” W.C. max)
		11b. Orifice too large (verify they match the serial plate)
		11c. Manifold pressure too low (reset)
	12. Not enough heat	12a. Unit cycling on high limit (check airflow)
		12b. Main pressure too low (must be 6” W.C. minimum for Natural Gas or 11” W.C. for Propane (LP) Gas)
		12c. Unit undersized for conditions
		12d. Improper supply air temperature sensor installation
	13. Too much heat	13a. Manifold pressure too high (correct to 3.5” W.C.)
		13b. Defective or improperly wired controls
	14. Clogged condensate drain line (condensing or hybrid condensing heat option only)	14. Check condensate drain line, clear as needed

Table 60.1 - Primary Furnace Control Board (VB1200) Error Codes

(Applies to B-, C-, and D-Cabinet Units with Gas Heat Option furnace model number Digit 11=6 or 8) ①

Display Code	Description	Additional comments and notes
888	Board Failure *(Up to 10 sec @ power up)*	Verify 24 VAC signal input at connector J6.
Off	UP Mode: Burner state = Off	Normal Operation
Pur	UP Mode: Burner state = Purge	
Ign	UP Mode: Burner state = Ignition	
HEA	UP Mode: Burner state = Warmup	
Run	UP Mode: Burner state = Run	
rEt	UP Mode: Burner state = Retry *(with* **A01** *or* **A02***)*	Retry delay following either a failed ignition or a flame loss.
A01	Failed ignition attempt	
A02	Lost Flame	Ignition was successful but then flame disappeared.
A03	Insufficient Combustion Air	Blocked vent with actuator position de-rated by >20% from FRI setting.
A04	Limited Low Fire *(due to Lost Flame Auto-Adaptation)*	Flame loss at low fire results in an auto-adjustment limit of the burner turndown by adjusting the minimum modulation voltage during the rest of the current cycle or until a CPU reset.
A05	Weak Flame Signal	Flame presence signal of less than 1.5µA indicates an aged flame rod.
A06	No Low Fire Mode *(due to Hi Gas Pressure at Low Fire)*	The Gas Pressure is not modulating down to low fire.
A07	Loss of Inducer Motor Control	The Air Pressure is not modulating down at minimum inducer drive.
A08	Air Sensor Null Pressure Check out-of-tolerance	The Air Pressure sensor zero reading appears to be out-of-tolerance.
A99	COM Error – Secondary Furnace(s)	CRC errors, serial bus loaded down or possibly poor cable/routing.
E01	Failed Ignition	Four failed ignition attempts have occurred.
E02	Primary Limit Failure	Verify Primary Limit input at connector J8 and fuse at F1.
E03	Modulation Valve Failure	The Valve Actuator did not reach a Park or Full On position.
E04	Air Sensor Failure - *Pressure Reading Low*	Includes air switch failure to open during pre-purge switch check, includes insufficient air lockout due to blocked vent.
E05	Air Sensor Failure - *Pressure Reading High*	Includes air switch failure to close during pre-purge switch check.
E06	Gas Sensor Failure - *Pressure Reading Low* *(Possible modulating valve actuator misalignment)*	Verify Gas Pressure Sensor signal input at connector J13.
E07	Gas Sensor Failure - *Pressure Reading High* *(Possible modulating valve actuator misalignment)*	Significant Gas Pressure detected during the Off burner state.
E08	Improper Flame	
E09	No Firing Rate Input	The thermostat “W” input is calling for heat but the FRI is < 2.0 V.
A20	Secondary Furnace A COM Missing	Loss of a previously established serial communication link.
A21	Secondary Furnace A Lockout	Refer to VB1201 secondary board diagnostics table.
A30	Secondary Furnace B COM Missing	Loss of a previously established serial communication link.
A31	Secondary Furnace B Lockout	Refer to VB1201 secondary board diagnostics table.
A40	Secondary Furnace C COM Missing	Loss of a previously established serial communication link.
A41	Secondary Furnace C Lockout	Refer to VB1201 secondary board diagnostics table.
Eid	Invalid I.D. Plug Installed	

① To clear furnace control board error codes, refer to the section “Clearing Furnace Control Board Error Codes” on page 24.

Table 61.1 - Furnace Secondary Control Board (VB1201) Error Codes

(Applies only to C- and D-Cabinet Units with Gas Heat Option furnace model number Digit 11=8) ①

Color	Flashes	Condition
		Error Conditions
N/A	Off	No power to the control board
Red	Steady On	Hard lockout on control fault or no 24 VAC.
	1	Insufficient inducer air pressure when inducer is on.
	2	Inducer air pressure is too high when inducer is off.
	3	Flame circuitry failure - flame is on when it should be off or it is off when it should be on.
	4	Gas valve failure.
	5	Gas valve safety relay failure.
	6	Reserved
	7	Primary limit failure
	8	Gas valve in test mode
	9	Safety startup failed to validate inducer air path.
		Normal and Warning Conditions
Green	Slow	Standby - no communication link established
	Rapid	Standby - in communication with Primary Bus
	1	Call for heat, no gas
	2	Call for heat, gas
Yellow	2	Call for heat, gas, flame rod aged
	Rapid	Retry

① To clear furnace control board error codes, refer to the section “Clearing Furnace Control Board Error Codes” on page 24.

MODEL IDENTIFICATION & SERIAL PLATES

Model Identification

Depending on options included, the unit may have more than one Serial Plate. Figures 62.1 and 62.2 show the Serial Plate for the main unit, while Figures 62.3 and 62.4 show the Serial Plate for the gas heat option. When servicing, repairing or replacing parts on these units, locate the model Serial Plate of the unit and always give the complete Model Number and Serial Number of the unit. The unit Serial Plate is located on the door of the controls cabinet. The gas heat option Serial Plate is located on the gas heat compartment door. For a complete description of the model number, see the Model Nomenclature on pages 63-66. Serial plates shown are examples and may vary slightly from what is on the actual unit(s). Refer to the unit(s) for the actual serial plates.

Figure 62.1
Serial Plate Example - B & C-Cabinet Units

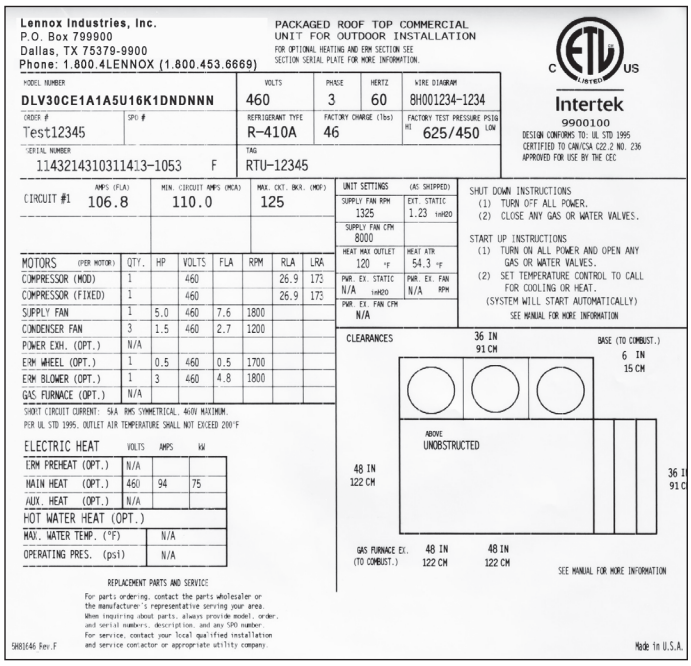


Figure 62.2
Serial Plate Example - D-Cabinet Unit

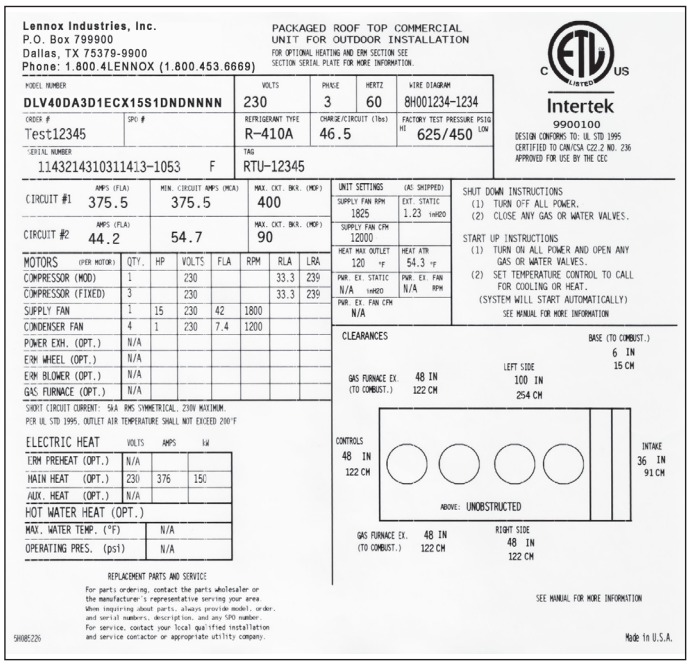


Figure 62.3
Serial Plate Example - B-Cabinet Furnace

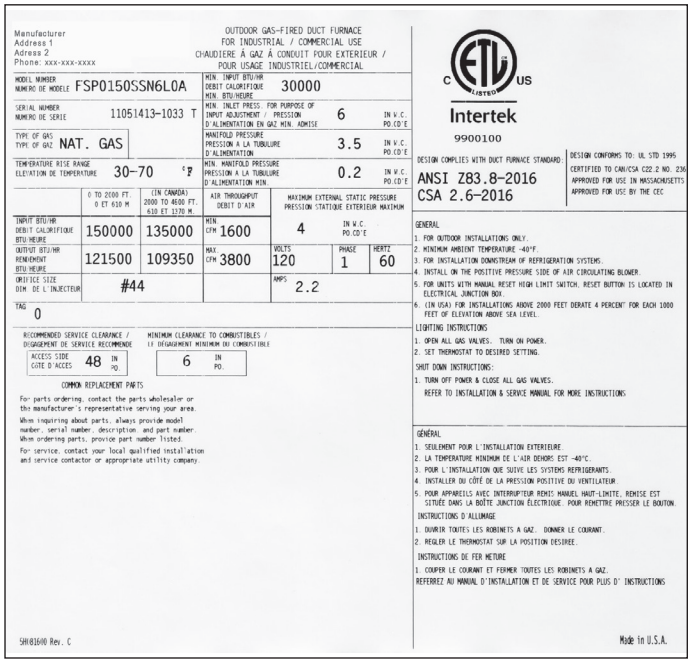
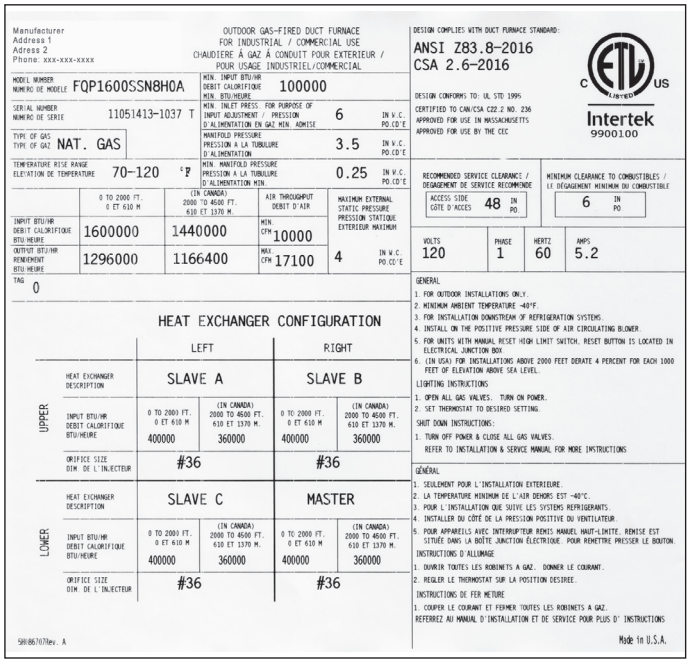


Figure 62.4
Serial Plate Example - C & D-Cabinet Furnaces



MODEL NOMENCLATURE

Model Nomenclature

As noted in the previous section, units may have more than one Serial Plate. If the unit has the gas heat option, the furnace will have its own model number separate from the main unit.

- Table 63.1 shows the nomenclature for the gas heat section option.
- Tables 64.1 and 66.1 on the following pages show the nomenclature for the main unit.

Table 63.1 - Model Nomenclature - Gas Furnace Option

Digits	Indicates	Description		Value	Cabinet		
					B	C	D
1,2,3	Furnace Model Prefix	Single Furnace	Single, Standard Efficiency	FSP	●		
			Single, High Efficiency Condensing	FSC			
		Dual Furnace	Dual, Standard Efficiency	FMP		●	
			Dual, High Efficiency Condensing	FMC			
		Dual Furnace	Dual, Standard Efficiency	FDP			●
			Dual, High Efficiency Condensing	FDC			
		Quad Furnace	Quad, Standard Efficiency	FQP			
			Quad, High Efficiency Hybrid	FQH			
4,5,6,7	Furnace Input Rating	0150 - 150,000 Btu/hr thru 1600 - 1,600,000 Btu/hr		See Previous Column	See Unit Nomenclature		
8	Heat Exchanger	409 Stainless Steel Heat Exchanger		S	●	●	●
9	Ignition System	Direct Spark Ignition		S	●	●	●
10	Gas Type	Natural Gas		N	●	●	●
		Propane (LP) Gas		P			
11	Modulating Capacity Control	Pre-VB1285 Controller	Modulated Single Furnace & Exhauster	6	●		
			Modulated Furnace + Staged Furnace, Constant Speed Exhauster	4		●	
			Modulated Furnace & Exhauster + Staged Furnaces	8		●	●
		VB1285 Controller	Modulated Single Furnace & Exhauster	6	●		
			Same + Split Manifold	B			
			Modulated Single Furnace & Exhauster + Two Stage Furnace	9		●	● (800MBH and Lower)
			Same + Split Manifold	C			
			Modulated Single Furnace & Exhauster + Single Stage Furnaces	A			● (900MBH and Larger)
			Same + Split Manifold	D			
12	Air Temperature Rise	High Air Temperature Rise		H	●	●	●
		Low Air Temperature Rise		L			
		Not Applicable		N			
13	Not Used	Not Currently Used		0	●	●	●
14	Furnace Supply Voltage	115V/1ph (transformer from main supply voltage)		A	●	●	●

MODEL NOMENCLATURE - MODEL DLV

Table 64.1 - Model Nomenclature - Main Unit

Digits	Indicates	Description			Value	Cabinet		
						B	C	D
1, 2, 3	Unit Type	Packaged Ventilation/Dedicated Outside Air System (DOAS)			DLV	●	●	●
4, 5	Unit Nominal Cooling	7, 10, or 13 ton			07, 10, 13	●		
		15 or 20 ton			15, 20	●	●	
		26 ton			26		●	
		30 ton			30		●	●
		40, 52, or 60 ton			40, 52, 60			●
6	Cabinet Size	Refer to Dimensions			B, C, D	●	●	●
7	Air Control Configuration	OA & RA Dampers	No Exhaust		A	●	●	●
			Energy Recovery Exhaust		B	●	●	●
			Power Exhaust		C	●	●	
			Barometric Relief Dampers		R	●	●	
		OA Dampers (No RA)	No Exhaust		D	●	●	●
		OA Dampers (with Exhaust Opening)	Energy Recovery Exhaust		E	●	●	●
			Power Exhaust		F	●	●	
8	Evaporator Coil	High Capacity 4 Row, 14fpi DX Coil	No E-Coat		1	●	●	
			With E-Coat		2	●	●	
		High Capacity 6 Row, 14fpi DX Coil	No E-Coat		3			●
			With E-Coat		4			●
9	Compressor Staging	Tandem Digital Scroll (Digital Modulating + On/Off) (10-30 ton units)			A	●	●	
		Single Digital Scroll (Modulating Digital) (7 ton units only)			B	●		
		Dual Tandem Digital Scroll [(Digital Modulating - On/Off) & (On/Off - On/Off)]			D			●
10	Hot Gas Reheat	No Hot Gas Reheat			0	●	●	●
		Modulating Hot Gas Reheat			1	●	●	●
		Modulating Hot Gas Reheat with E-Coat			2	●	●	●
11	Condensor Arrangement	VFD Head Pressure Control	Microchannel Coils		A	●	●	
			Microchannel Coils with E-Coat (UV)		B	●	●	
		Modulating EC Motor Head Pressure Control (30, 40 Ton)	Microchannel Coils		E			●
			Microchannel Coils with E-Coat		F			●
		Modulating EC Motor Head Pressure Control (52, 60 Ton)	Microchannel Coils		G			●
			Microchannel Coils with E-Coat		H			●
12	Supply Fan Configuration (Direct Drive Plenum Fan)	**Wheel Size (inches)**	**Fan Type**					
		11	Non-Airfoil Fan (ANPL)		K	●		
		12	Non-Airfoil Fan (ANPL)		L	●		
		12	Airfoil Fan (ANPA)		4	●		
		14	Airfoil Fan (ANPA)		7	●		
		16	Airfoil Fan (ANPA)		8	●	●	
		16 x 2	Dual Airfoil Fans (ANPA)		E		●	
		20	Airfoil Fan (ANPA)		A		●	●
		25	Airfoil Fan (ANPA)		C		●	●
		25 x 2	Dual Airfoil Fans (ANPA)		J			●
13	Supply Fan Motor HP (includes VFD)	1 HP			Q	●	●	●
		1-1/2 HP			R	●	●	●
		2 HP			S	●	●	●
		3 HP			T	●	●	●
		5 HP			U	●	●	●
		7-1/2 HP			V	●	●	●
		10 HP			W	●	●	●
		15 HP			X			●
		20 HP			Y			●
14	Fan Motor Type	**Motor Type**	**Supply Fan Motor RPM**	**Exhaust Fan Motor RPM**				
		ODP	1800	1800 or N/A	1	●	●	●
				3600	3			●
				1200	5			●
			3600	1800 or N/A	A	●	●	●
				3600	C			●
				1200	E			●
			1200	1800 or N/A	G	●	●	●
				3600	J			●
				1200	M			●
		TE	1800	1800 or N/A	2	●	●	●
				3600	4			●
				1200	6			●
			3600	1800 or N/A	B	●	●	●
				3600	D			●
				1200	F			●
			1200	1800 or N/A	H	●	●	●
				3600	K			●
				1200	P			●

(continued next page)

MODEL NOMENCLATURE - MODEL DLV - CONTINUED

Table 65.1 - Model Nomenclature - Main Unit (Continued from previous page)

Digits	Indicates	Description			Value	Cabinet		
						B	C	D
15	Unit Supply Voltage	208V/3ph			4	●	●	●
		230V/3ph			5	●	●	●
		460V/3ph			6	●	●	●
		575V/3ph (not available on 52/60 ton D-Cabinet)			7	●	●	●
16	Power Options	**Deadfront Disconnect**	**Convenience Outlet**					
		None	None		N	●	●	●
			Power by Others		Z	●	●	●
		60A	None		D	●	●	
			Unit Powered		E	●	●	
			Power by Others		F	●	●	
		100A	None		G	●	●	●
			Unit Powered		H	●	●	●
			Power by Others		J	●	●	●
		200A	None		K	●	●	●
			Unit Powered		L	●	●	●
			Power by Others		M	●	●	●
		400A	None		P			●
			Unit Powered		Q			●
			Power by Others		R			●
		600A	None		S			●
			Unit Powered		T			●
			Power by Others		U			●
17	Heating Section Type	None			0	●	●	●
		Electric			1	●	●	●
		Natural Gas			2	●	●	●
		Natural Gas with 20kW (nominal) Aux/Supplemental Electric Heat			3	●	●	
		Natural Gas with 40kW (nominal) Aux/Supplemental Electric Heat			3			●
		Propane (LP) Gas			5	●	●	●
		Propane (LP) Gas with 20kW (nominal) Aux/Supplemental Electric Heat			6	●	●	
		Propane (LP) Gas with 40kW (nominal) Aux/Supplemental Electric Heat			6			●
		Hot Water (B- and C-Cabinet Only)			4	●	●	
18	Nominal Heat Capacity	No Heating			N	●	●	●
		Electric (ratings derated for 208V/3ph)	10kW (B), 20kW (D)		1	●		●
			20kW (B, C), 40kW (D)		A	●	●	●
			30kW (B), 60kW (D)		3	●		●
			40kW (B, C), 80kW (D)		B	●	●	●
			50kW (B), 100kW (D)		5	●		●
			60kW (B, C), 120kW (D)		C	●	●	●
			70kW (B), 140kW (D)		7	●		●
			80kW (B, C), 160kW (D)		D	●	●	●
			100kW (B, C), 200kW (D)		E	●	●	●
		Gas (81% Thermal Efficiency)	150 MBH	1 x 150	F	●		
			200 MBH	1 x 200	G	●		
			250 MBH	1 x 250	H	●		
			300 MBH	1 x 300 (B), 2 x 150 (C)	J	●	●	
			400 MBH	1 x 400 (B), 2 x 200 (C, D)	K	●	●	●
			500 MBH	2 x 250	L		●	●
			600 MBH	2 x 300	M		●	●
			800 MBH	2 x 400	Q			●
			900 MBH	2 x 200 + 2 x 250 (stacked)	1			●
			1000 MBH	4 x 250 (stacked)	2			●
			1200 MBH	4 x 300 (stacked)	3			●
			1400 MBH	2 x 300 + 2 x 400 (stacked)	4			●
			1600 MBH	4 x 400 (stacked)	5			●
		Condensing Gas (90-94% Thermal Efficiency)	175 MBH	1 x 175	R	●		
			225 MBH	1 x 225	S	●		
			310 MBH	1 x 310	T	●		
			350 MBH	2 x 175	U		●	
			450 MBH	2 x 225	V		●	●
			620 MBH	2 x 310	P			●
		Hybrid Gas (81% + Condensing	850 MBH	2 x 200 + 2 x 225 (stacked)	6			●
			950 MBH	2 x 250 + 2 x 225 (stacked)	7			●
			1220 MBH	2 x 300 + 2 x 310 (stacked)	8			●
			1420 MBH	2 x 400 + 2 x 310 (stacked)	9			●
		Hot Water Coil	See submittal for performance rating		W	●	●	
19	Temperature Rise	Not Applicable			N	●	●	●
		High Air Temp Rise (70°F to 100°F)			H	●	●	●
		Low Air Temp Rise (30°F to under 75°F)			L	●	●	●
20	Heat Control	No Heating			N	●	●	●
		Modulating			D	●	●	●

(continued next page)

MODEL NOMENCLATURE - MODEL DLV - CONTINUED

Table 66.1 - Model Nomenclature - Main Unit (Continued from previous page)

Digits	Indicates	Description		Value	Cabinet		
					B	C	D
21	Energy Recovery Wheel Diameter ①	None (or Not Applicable for C-Cabinet)		N	●	①	●
		Aluminum 3A Molecular Sieve	36”	F	●		
			46”	G	●		
			58”	H			●
			68”	J			●
			74”	K			●
			81”	L			●
22	Exhaust Fan Configuration (Plenum Fan) ①	**Wheel Size (inches)**	**Fan Type**				
		None (or Not Applicable for C-Cabinet)		N	●	①	●
		11	Non-Airfoil Fan (ANPL) - Belt Drive	1	●		
		16	Airfoil Fan (ANPA) - Belt Drive	2	●		
		20	Airfoil Fan (ANPA) - Belt Drive	3	●		
		20	Airfoil Fan (ANPA) - Direct Drive	A			●
		25	Airfoil Fan (ANPA) - Direct Drive	C			●
		25 x 2	Dual Airfoil Fans (ANPA) - Direct Drive	J			●
23	Exhaust Fan Motor HP ① (includes VFD)	None (or Not Applicable for C-Cabinet)		N	●	①	●
		1 HP		Q	●		●
		1-1/2 HP		R	●		●
		2 HP		S	●		●
		3 HP		T	●		●
		5 HP		U	●		●
		7-1/2 HP		V	●		●
		10 HP		W	●		●
		15 HP		X			●
		20 HP		Y			●
24	Energy Wheel Preheat ①	None (or Not Applicable for C-Cabinet)		N	●	①	●
		20kW (nominal) Electric		2	●		●
		40kW (nominal) Electric		4			●

① For C-Cabinet units that interface to energy recovery exhaust, Digits 21-24 will always be "N". The Wheel Diameter, Exhaust Fan Configuration, Exhaust Fan Motor HP, and Energy Wheel Preheat is called out in the separate model EWM nomenclature (refer to the Installation & Service Manual that shipped with the Energy Recovery Module).

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