TRANE®

Installation Operation and Maintenance

Separated Combustion Indirect Gas Fired Indoor Make-up Air Units

Models

"A" and later Design Sequence

GXAA10	GXAA30	GXAA60	GYAA50	GYAA12
GXAA15	GXAA35	GXAA70	GYAA60	
GXAA20	GXAA40	GXAA80	GYAA70	
GXAA25	GXAA50	GXAA12	GYAA80	

July 2005

MUA-SVN01A-EN

Notice

NOTICE:
Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

WARNING – Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION – Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION – Indicates a situation that may result in equipment or property-damage-only accidents.

This booklet describes proper installation, operation, and maintenance procedures for air cooled systems. By carefully reviewing the information within this manual and following the instructions, the risk of improper operation and/or component damage will be minimized.

It is important that periodic maintenance be performed to help assure trouble free operation. A maintenance schedule is provided at the end of this manual. Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

Literature References

- GMND-IOM-1
  Seperated Combustion, Indoor Duct Furnace Manual
- GRAA-IOM-2
  Evaporative Cooling Manual

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Model Number
Indirect-Fired Indoor MUAH

Indirect Fired Indoor MUAH Model Nomenclature

GXA A 40 P B A FO P 1 B C 1 A 1 A 0 +
1 5 10 15 19 21

Digits 1 - *Gas Heating Equipment*
G = Gas Heating Equipment

Digits 2 - *Unit Type*
X = Separate Combustion Indoor Makeup Air Handler
Y = Duct Furnace Only

Digits 3 - *Furnace Type*
A = Standard Temp Rise LH (20-60°F)
B = Standard Temp Rise RH (20-60°F)
C = High Temp Rise LH (60-90°F)
D = High Temp Rise RH (60-90°F)

Digits 4 - *Development Sequence*
Current Design

Digits 5,6 - *Input Capacity*
10 = 100 MBH
15 = 150 MBH
20 = 200 MBH
25 = 250 MBH
30 = 300 MBH
35 = 350 MBH
40 = 400 MBH
50 = 500 MBH
60 = 600 MBH
70 = 700 MBH
80 = 800 MBH
12 = 1200 MBH

Digits 7 - *Venting Type*
P = Power Venting

Digits 8 - *Main Power Supply*
A = 115/60/1 Main Power Supply
B = 208/60/1 Main Power Supply
C = 230/60/1 Main Power Supply
D = 208/60/3 Main Power Supply
E = 230/60/3 Main Power Supply
F = 460/60/3 Main Power Supply
G = 575/60/3 Main Power Supply

Digits 9 - *Gas Control Option*
A = Single Stage Gas (Standard)
B = Two Stage Gas
C = Hydraulic Modulating (60-100)
D = Hydraulic Modulating (75-200)
E = Hydraulic Modulating, w/bypass and limit (60-100)
F = Hydraulic Modulating, w/bypass (75-200)
G = Electronic Modulating w/Room Stat
H = Electronic Modulating w/Duct Stat
J = Electronic Modulating w/Duct Sensing and Overd. Stat
K = Electronic Modulating w/Ext. 4-20 MA Input Furnace 1
L = Electronic Modulating w/Ext. 4-20 MA Input all Furnace
M = Electronic Modulating w/Ext. 0-10 VDC Input Furnace 1
N = = Electronic Modulating w/Ext. 0-10 VDC Input all Furnace
P = Two Stage Discharge Air Temp Control
R = Three Stage Discharge Air Temp Control
T = Four Stage Discharge Air Temp Control
U = S-350; 2-Stage Modulating Electronic Control System
W = S-350; 3-Stage Modulating Electronic Control System
X = S-350; 4-Stage Modulating Electronic Control System
Y = S-350; 6-Stage Modulating Electronic Control System

Digits 10 - *Design Sequence*
Current Design

Digits 12 - *Fuel Type*
N = Natural Gas
P = LP Gas (Propane)
L = Natural Gas w/100% Lockout

Digits 13 - *Heat Exchanger*
1 = Aluminized Steel Heat Exchanger
2 = 409 Stainless Steel (1st Furn Only)
3 = 409 Stainless Steel (All Furnaces)
4 = 321 Stainless Steel (1st Furn Only)
5 = 321 Stainless Steel (All Furnaces)
6 = 409 Stainless Stl Pkg (1st Furn Only)
7 = 409 Stainless Stl Pkg (All Furnaces)
8 = 321 Stainless Stl Pkg (1st Furn Only)
9 = 321 Stainless Stl Pkg (All Furnaces)

Digits 14 - *Indoor Arrangement*
A = Indoor Duct Furnace (Cap. 50-120 Only)
B = Blower (Standard)
D = Blower (Standard) Evap. Cooling
G = Blower (High CFM)
K = Blower (High CFM)/Coil Cabinet

Digits 15 - *Indoor Heating Unit Motor Selection*
0 = No Selection (Duct Furnace)
A = 1/2 HP w/Contactor
B = 3/4 HP w/Contactor
C = 1 HP w/Contactor
D = 1 1/2 HP w/Contactor
E = 2 HP w/Contactor
F = 3 HP w/Contactor
G = 5 HP w/Contactor
H = 1/2 HP w/Magnetic Starter
J = 3/4 HP w/Magnetic Starter
K = 1 HP w/Magnetic Starter
L = 1 1/2 HP w/Magnetic Starter
N = 2 HP w/Magnetic Starter
P = 3 HP w/Magnetic Starter
Q = 5 HP w/Magnetic Starter
R = 7 1/2 HP w/Magnetic Starter
T = 10 HP w/Magnetic Starter
U = 15 HP w/Magnetic Starter

Model Number
Indirect-Fired Indoor MUAH

Digits 16 - *Motor Speed*
- 0 = No Motor Speed (Duct Furnace)
- 1 = Single Speed ODP 1800 RPM
- 2 = Single Speed TEFC 1800 RPM
- 3 = Single Speed High Eff. ODP 1800 RPM
- 4 = Single Speed High Eff. TEFC 1800 RPM
- 5 = Two Speed, One Winding, ODP 1800/900 RPM
- 6 = Two Speed, Two Winding, ODP 1800/1200 RPM

Digits 17 - *Coil Options*
- 0 = No Cooling Coil
- A = DX Coil; 4-Row Single Circuit
- B = DX Coil; 4-Row Dual Circuit
- C = DX Coil; 6-Row Single Circuit
- D = DX Coil; 6-Row Dual Circuit
- E = Chilled Water Coil; 4-Row
- G = Chilled Water Coil; 6-Row

Digits 18 - *Air Inlet Configuration*
- 0 = No Air Inlet Config. (Duct Furn.)
- 1 = Single, Horizontal Inlet
- 2 = Single, Horizontal Inlet w/Air Hood
- 3 = Bottom Return Air (RA)
- 4 = Outside Air/Return Air (OA/RA)
- 5 = Outside and Return Air w/Air Hood

Digits 19 - *Air Control/Damper Arrangement*
- 0 = No Air Control/Damper Arr.
- A = Outside Air, 2-Pos. Motor/Spring Return
- B = Return Air, 2-Pos. Motor/Spring Return
- C = OA/RA, 2-Pos. Spring Return
- Q = OA/RA, Mod. Motor w/CO_2 Monitor Sensor
- E = OA/RA, Mod. Motor w/Mix Air Control/Min. Pot./Sr.
- H = OA/RA, Mod. Motor w/Mix Air Control/Sr.
- K = OA/RA, Mod. Motor w/Min. Pot./Sr.
- M = OA/RA, Mod. Motor w/Dry Bulb/Mix Air Control/Min/Sr.
- N = OA/RA, Mod. Motor w/Enthalpy Cntrl Economizer/Sr.
- P = OA/RA, Mod. Motor w/Pres. Cntrl (Space Press)
- R = OA/RA, Mod. Motor w/S-350-P Prop. Mix Air Cntrl/Sr.
- U = OA/RA, Motor w/Ext 0-10 VDC/4-20 MA Analog/Sr.
- W = ASHRAE Cycle I
- X = ASHRAE Cycle II
- Y = ASHRAE Cycle III
- Z = Manual Dampers

Digits 20 - *California Shipment*
- 0 = Non California Shipment
- 1 = California Shipment

Digits 21 - *Misc. Equipment Options*
- A = High Altitude Orifices
- B = 12" (305MM) Evaporative Media (Celdek™)
- C = Moisture Eliminators
- D = Horizontal Return
- E = Air Flow Proving Switch
- F = Freezestat w/Time Delay
- G = Fan Time Delay
- H = Return Firestat
- J = Supply Firestat
- K = Manual Blower Switch
- M = Input De-rate
- N = Double Wall Construction
- P = Low Leak Damper
- Q = Clogged Filter Switch
- R = High/Low Gas Pressure Limit Switch
- T = Status Indicator Lamp
- V = Manual Reset High Limit Switch
- W = 8" (203MM) Evaporative Media (Glasdek™)
- X = 12" (305MM) Evaporative Media (Glasdek)
- Y = Ambient Lockout
- Z = Freezestat for Evaporative Cooler
- 1 = 1" (25MM) Permanent Filter (std)
- 2 = 2" (51MM) Permanent Filter
- 3 = 2" (51MM) Throwaway Filter
- 4 = 1" (25MM) 30% Pleated Media Filter
- 5 = 2" (51MM) 30% Pleated Media Filter
- 6 = Service Convenience Package
- 8 = Hinged Service Access Door

Pre-installation Checklist

⚠ WARNING

Fiberglass Wool!

Product contains fiberglass wool. Disturbing the insulation in this product during installation, maintenance or repair will expose you to airborne particles of glass wool fibers and ceramic fibers known to the state of California to cause cancer through inhalation. Glass wool fibers may also cause respiratory, skin or eye irritation.

⚠ WARNING

Hazardous Gases and Flammable Vapors!

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

Receiving Instructions

Inspect shipment immediately when received to determine if any damage has occurred to the unit during shipment. After the unit has been uncrated, check for any visible damage to the unit. If any damage is found, the consignee should sign the bill of lading indicating such damage and immediately file claim for damage with the transportation company.

Installer's Responsibility

Installer Please Note: This equipment has been test fired and inspected. It has been shipped free from defects from our factory. However, during shipment and installation, problems such as loose wires, leaks or loose fasteners may occur. It is the installer's responsibility to inspect and correct any problems that may be found.

Pre-Installation Instructions

When the unit is received and uncrated, check the external data plate and all labels on the unit for type of gas, electrical, and operational specifications to confirm that these agree with those at point of installation. The unit is equipped with an Indoor Duct Furnace; also check the data plate and all labels located on each furnace.

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Make-up Air Units with multiple furnaces are shipped in sections. Each section has a label with:

1. Order No.
2. Model No.
3. Unit No.
4. Part No.

Each should be clearly marked on the unit. Make certain that the order, model, and part numbers agree on each section to be connected together.

Inspect shipment immediately when received to determine if any damage has occurred to the crate during shipment.

After the unit has been uncrated, check for any visible damage to the unit. Check motor position and turn blower wheel to determine if damage has occurred to these critical parts.

If any damage is found, the consignee should sign the bill of lading indicating such damage and immediately file claim for damage with transportation company.

General Information

⚠ WARNING

Hazardous Service Procedures!

The maintenance and trouble shooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

⚠ WARNING

Hazardous Gases and Flammable Vapors!

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

⚠ WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Never service any component without first disconnecting all electrical and gas supplies to the unit or severe personal injury or death may occur.

1. Installation must be made in accordance with local codes, or in absence of local codes, with ANSI Standard Z223.1-2002 (N.F.P.A. No 54) "National Fuel Gas Code", or the latest edition of. All ANSI and NFPA Standards referred to in these installation instructions are the ones that were applicable at the time the design of this appliance was certified. The ANSI Standards are available from the American Gas Association, 1515 Wilson Boulevard, Arlington, Virginia 22209. The NFPA Standards are available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269. The heaters are designed for use in airplane hangers when installed in accordance with ANSI/NFPA No. 409 and in public garages when installed in accordance with the NFPA No. 88A and NFPA No. 88B.

2. If installed in Canada, the installation must conform with local building codes, or in the absence of local building codes, with the current CGA-B149.1 or B149.2 "Installation Codes for Gas Burning Appliances and Equipment". These indoor duct furnaces have been designed for and certified to comply with CGA 2.6. *For more information, refer to the section: Canadian Specific Installation.*

3. No alterations are to be made on this equipment. By altering the duct furnace in any way or damage to the unit, severe personal injury or death will occur.

The duct furnace section of these make-up air units are certified by CSA International for use with natural and LP (propane) gases!

4. Make certain that the power sources conform to the requirements of the heater.

5. Follow installation instructions carefully to avoid creating unsafe conditions. All wiring should be done and checked by a qualified electrician, using copper wire only. All gas connections should be made and leak-tested by a suitably qualified individual, per instructions in this manual.

6. Use only the fuel for which the heater is designed (see nameplate). Using LP gas in a heater that requires natural gas, or vice versa, will create the risk of gas leaks, carbon monoxide poisoning and explosion.

7. Make certain that power source conforms to electrical requirements of heater. Disconnect power before installing or servicing heater. If power disconnect is out of sight, lock it in open position and tag it to prevent unexpected application of power. Failure to do so could result in fatal electric shock.

Location Considerations

8. Special attention must be given to any grounding information pertaining to this heater. To prevent the risk of electrocution, the heater must be securely and adequately grounded. This should be accomplished by connecting a grounded conductor from the service panel to the conduit box of the heater. To ensure proper ground, the grounding means must be tested by qualified field electrician.

9. Do not insert fingers or foreign objects into the heater or its air moving device. Do not block or tamper with the heater in any manner while in operation or just after it has been turned off, as some parts may be hot enough to cause injury.

10.This heater is intended for general heating applications only. It must not be used in potentially dangerous locations such as flammable explosive, chemical-laden or wet atmospheres.

In cases in which property damage may result from malfunction of the heater, a backup system or a temperature sensitive alarm should be used.

Location Considerations
Before placing the Make-Up Air unit in its permanent location, make certain that the structure is capable of carrying the additional load of this equipment. Check the unit weight given at the end of this manual.

Refer to unit data plate for required clearances to combustible material, and venting installing instructions, Figure 8, for manufacturer's recommendations.

⚠ WARNING

Serviceability Requirements!

Do not place unit in a location where service personnel can not safely service the equipment. Failure to maintain proper and safe working conditions could result in death or serious injury.

Note: When selecting a location for these Make-Up Air Units, both the size of the unit and the heating requirements of the building must be considered.

Note: The furnace section(s) of this unit is equipped for bottom access serviceability only! Provide adequate clearance (base rail to floor is 18-inches minimum).

Combustion Air Considerations
The presence of chlorine vapors or other corrosive vapors in the combustion air supply for gas-fired heating equipment presents a potential corrosive hazard. Chlorine will, when exposed to flame, precipitate from the compound (usually freon or degreaser vapors) and go into solution with any condensation that is present in the heat exchanger or associated parts.

The result is hydrochloric acid which will readily attack all metals, including 300 grade stainless steel. Care should be taken to separate these vapors from the combustion process.

Locations To Avoid
Unit heaters should not be installed within corrosive or flammable atmospheres. Do not locate any gas fired heater where air for combustion contains chlorinated vapors or acid fumes.

CAUTION

Equipment Damage!

Presence of air impurities may cause premature failure of the heat exchanger and void the manufacturers warranty.

The venting system must be installed in accordance with heater manufacturer's instructions. The venting system is an integral part of the unit and must not be altered in the field! Refer to venting installation instructions for more detail.

Mounting Height
1. When a Gas Fired Make-Up Air Handler is discharging directly into the heated space, a mounting height of eight feet (2.4m) above the floor is recommended. Less efficient air distribution results at higher levels.

2.When Gas Fired Indoor Make-Up Air Handlers are installed in airplane hangars, NFPA specifies that the units must be at least ten feet (3.0m) above the upper surface of wings or engine enclosures of the highest aircraft to be stored in the hangar. This measurement should be made from the wing or engine enclosure (whichever is higher from the floor) to the bottom of the heater. Heaters must be installed at least eight feet (2.4m) above the floor in shops, offices, and other sections of the hangar where aircraft are not stored or housed. Refer to NFPA 409 Aircraft Hangars.

3.In parking structures, Gas Fired Indoor Make-Up Air Handlers must be installed so that the burner flames are located 18 in. (457mm) above the floor or protected by a partition not less than 18 in. (457mm) high as specified in NFPA 88A Parking Structures.

4.In public repair garages, Gas Fired Make-Up Air Handlers must be installed in a detached building or room separated from repair areas as specified in NFPA 88B Repair Garages.

Rigging/ Suspension

⚠ WARNING

Heavy Objects!

Do not use cables (chains or slings) except as shown. Each of the cables (chains or slings) used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements may cause equipment or property-only damage. Failure to properly lift the unit may result in death or serious injury. See details on this page.

⚠ WARNING

Improper Unit Lift!

Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in death or serious injury or possible equipment or property-only damage.

Rigging/Suspension

Ascertain that the structure to which the single, dual, triple furnace and air handler sections is to be mounted is capable of supporting its weight. Under no circumstances must the gas lines, the venting system or the electrical conduit be used to support the heater; or should any other objects (i.e. ladder, person) lean against the heater, gas lines, venting system or the electrical conduit for support.

The unit should never be lifted by any unit component other than the base rail assembly. Unit components other than base rail assembly are not designed to support the total weight and may break, causing personal injury or unit damage.

Units can be set on field furnished supports/cradle with access available to furnace bottom section, or suspended by rod hangers from the sub-frame (and lifting brackets).

Important!

Any unit containing a side base rail longer than 104" (2.6m) requires additional field furnished supports by a qualified installer. Refer to all dimensional data in this manual. If further information is required, contact the manufacturer's technical service department.

The unit must be hung level from side to side and front to back. It is recommended to use the (9/16" diameter) hanging holes in the skid rail, and 1/2" threaded rod or pipe, and/or whatever other supports may be required to adequately support the unit. A field supplied cradle or other means of support may also be required. The installer is responsible for determining adequate and safe suspension methods.

Rig unit using either belt or cable slings. Use spreader bars to protect the top of the unit when it is lifted. Make sure all hardware used in the lifting/mounting process is tightened and secured.

Refer to Figures 1 and 2 for Single Furnace Make-Up Air Unit rigging requirements. Refer to Figures 3, 4 and 5 for Dual/Triple Furnace Make-Up Air Unit rigging requirements, which ships to the site in two sections (Figure 3 is the air handler section and 4 and 5 are the furnace sections.).

On units with a total length of less than 104" (2642mm), excluding evaporative cooler, two holes are provided in the base rail on each side of the unit. Slide pipes beneath the unit through these holes and attach rigging to pipes for lifting the unit.

On units with a total length of a 104" (2642mm) or greater, excluding evaporative cooler, lifting lugs/brackets attached to the base rail are provided. Once the unit is set in place these lifting brackets may be removed if required.

Attach rigging to lugs/brackets for lifting the unit. For distance between lifting lugs/brackets and total unit lengths, refer to the Dimensional Data section of this manual.

Rigging/ Suspension

Figure 1: *Hoisting of the make-up air unit (single furnace) without lifting brackets.*

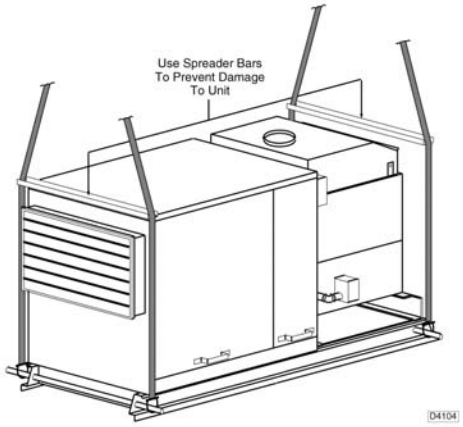


Figure 2: *Hoisting of the make-up air unit (single furnace) with lifting brackets.*

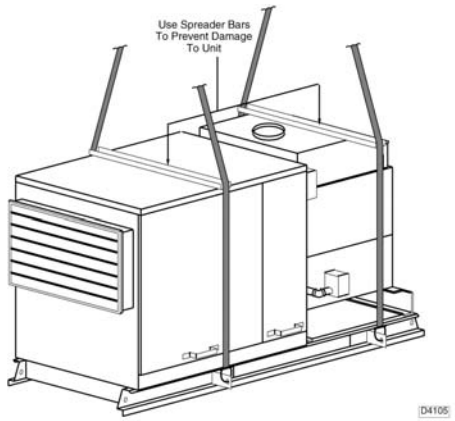


Figure 3: *Hoisting make-up air handler unit*

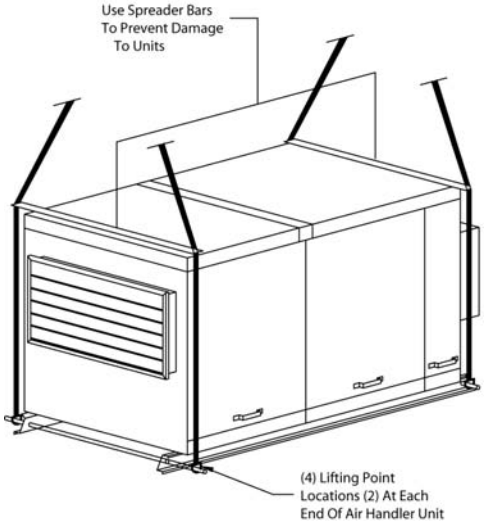


Figure 4: *Hoisting double furnace unit*

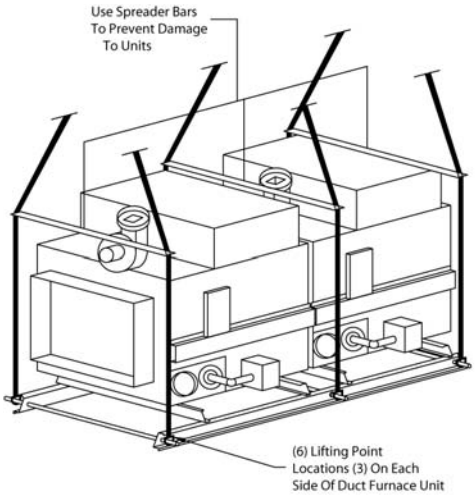
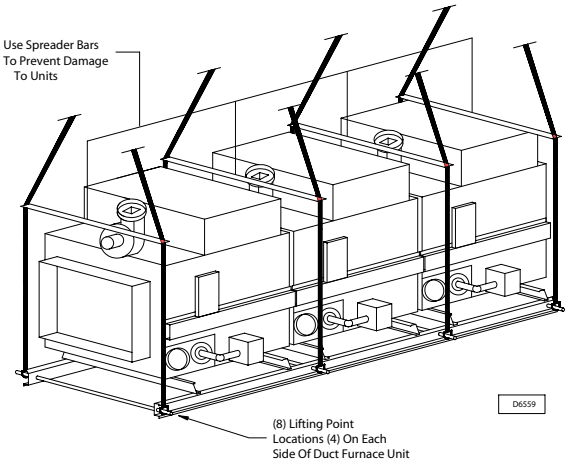


Figure 5: *Hoisting triple furnace unit*



Refer to Figures 3, 4 and 5 for dual/triple furnace make-up air rigging requirements. Dual/triple furnace units ship to the site in two sections. Figure 3 is the air handler section; Figure 4 and 5 are the furnace sections.

Dimensions and Weights

Table 1: Indoor Arrangement B weights

Input Capacity	Shipping Weight	Unit Size	Shipping Weight	Unit Size	Shipping Weight
GXAA10	638 lbs	GXAA30	959 lbs	GXAA60	1362 lbs
GXAA15	667 lbs	GXAA35	1005 lbs	GXAA70	1432 lbs
GXAA20	798 lbs	GXAA40	1070 lbs	GXAA80	1533 lbs
GXAA25	825 lbs	GXAA50	1169 lbs		

Note: The approximate shipping weights are for a basic unit. These weights do not include the motor, cooling coil, optional outside air hood, flex connector kit, or any options.

Table 2: Indoor Arrangement D weights

Input Capacity	Shipping Weight	Unit Size	Shipping Weight	Unit Size	Shipping Weight
GXAA10	805 lbs	GXAA30	1184 lbs	GXAA60	1586 lbs
GXAA15	833 lbs	GXAA35	1230 lbs	GXAA70	1657 lbs
GXAA20	995 lbs	GXAA40	1309 lbs	GXAA80	1772 lbs
GXAA25	1022 lbs	GXAA50	1366 lbs		

Table 3: Indoor Arrangement G weights

Input Capacity	Shipping Weight	Unit Size	Shipping Weight	Unit Size	Shipping Weight
GXAA20	988 lbs	GXAA40	1336 lbs	GXAA70	1678 lbs
GXAA25	1038 lbs	GXAA50	1374 lbs	GXAA80	1792 lbs
GXAA30	1215 lbs	GXAA60	1609 lbs	GXAA12	2246 lbs
GXAA35	1259 lbs				

Table 4: Indoor Arrangement K weights

Input Capacity	Shipping Weight	Unit Size	Shipping Weight	Unit Size	Shipping Weight
GXAA10	930 lbs	GXAA30	1351 lbs	GXAA60	1745 lbs
GXAA15	956 lbs	GXAA35	1395 lbs	GXAA70	1814 lbs
GXAA20	1115 lbs	GXAA40	1482 lbs	GXAA80	1936 lbs
GXAA25	1165 lbs	GXAA50	1501 lbs		

Table 6: Cooling Coil weights

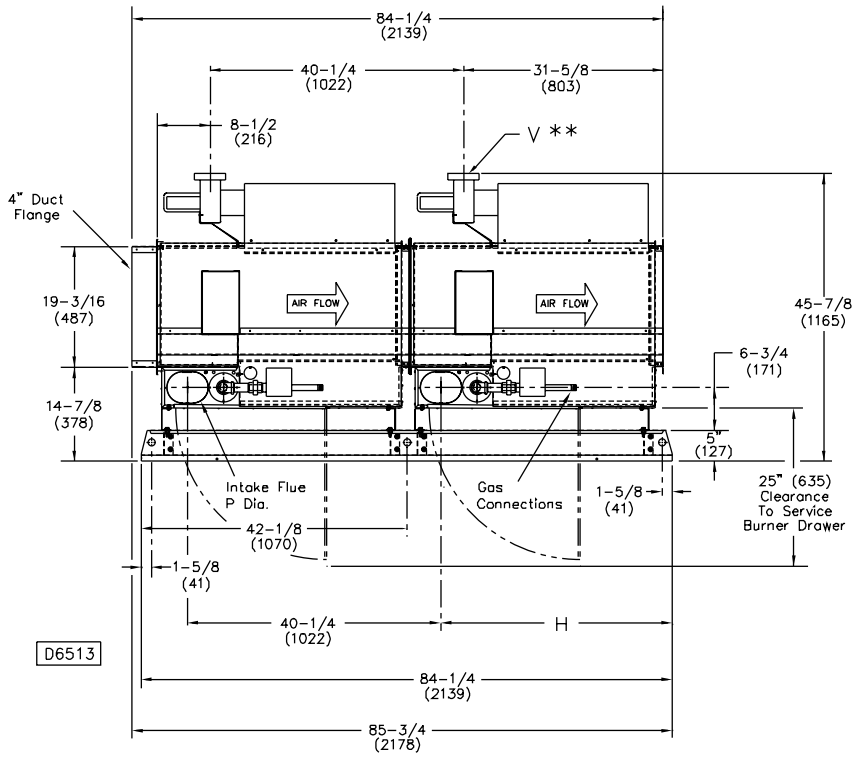
Input Capacity	DX Coil		Chilled Water Coil	
	4-Row	6-Row	4-Row	6-Row
10,15	70 lbs	95 lbs	170 lbs	222 lbs
20,25,50	95 lbs	130 lbs	215 lbs	287 lbs
30,35,60,70	119 lbs	166 lbs	264 lbs	359 lbs
40,80	130 lbs	182 lbs	284 lbs	389 lbs

Table 5: Motor shipping weights

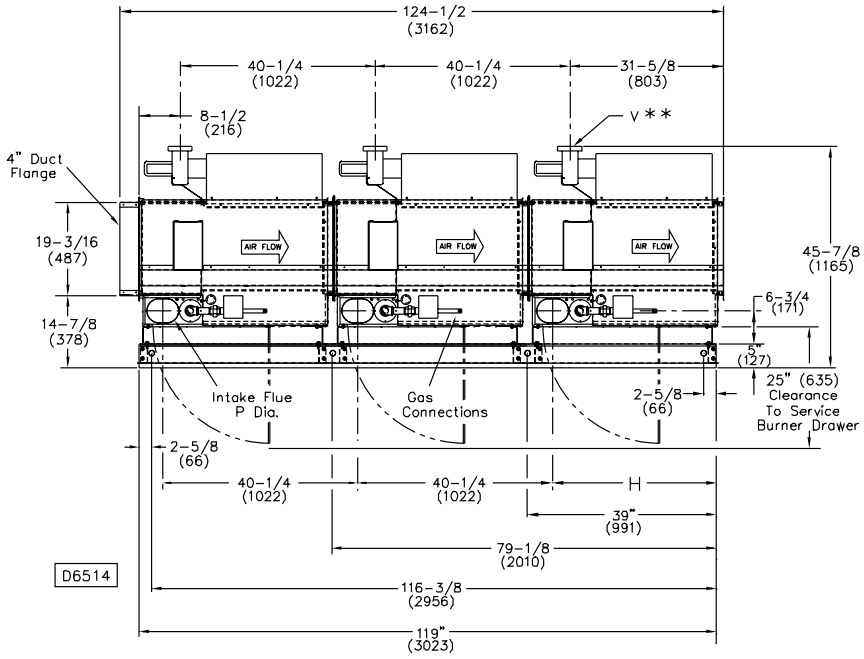
Motor Size	Motor Type									
	Open Drip Proof			Open Drip Proof				Totally Enclosed		
	115/1/60	208/1/60	230/1/60	208/3/60	230/3/60	460/3/60	575/3/60	115/1/60	208/1/60	230/1/60
1 HP	30 lbs	30 lbs	30 lbs	27 lbs	27 lbs	27 lbs	29 lbs	34 lbs	34 lbs	34 lbs
1 1/2 HP	40 lbs	40 lbs	40 lbs	29 lbs	29 lbs	29 lbs	32 lbs	42 lbs	42 lbs	42 lbs
2 HP	66 lbs	66 lbs	66 lbs	37 lbs	37 lbs	37 lbs	36 lbs	53 lbs	53 lbs	53 lbs
3 HP	80 lbs	80 lbs	80 lbs	48 lbs	48 lbs	48 lbs	61 lbs	74 lbs	74 lbs	74 lbs
5 HP	-	-	-	84 lbs	84 lbs	84 lbs	73 lbs	88 lbs	88 lbs	88 lbs
7 1/2 HP	-	-	-	99 lbs	99 lbs	99 lbs	105 lbs	-	-	-
10 HP	-	-	-	118 lbs	118 lbs	118 lbs	116 lbs	-	-	-
15 HP	-	-	-	150 lbs	150 lbs	150 lbs	150 lbs	-	-	-

Dimensions and Weights

Indoor Arrangement A
Input Capacities GYAA 50/80



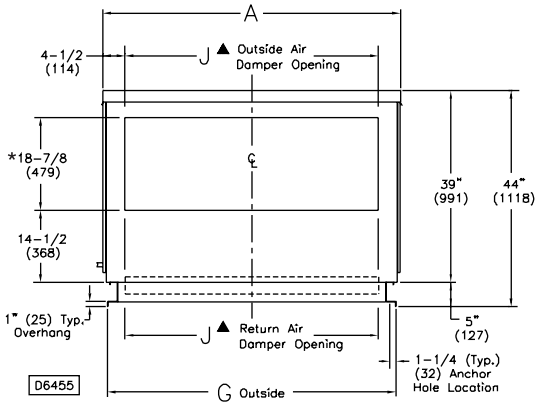
Indoor Arrangement A
Input Capacities GYAA 12



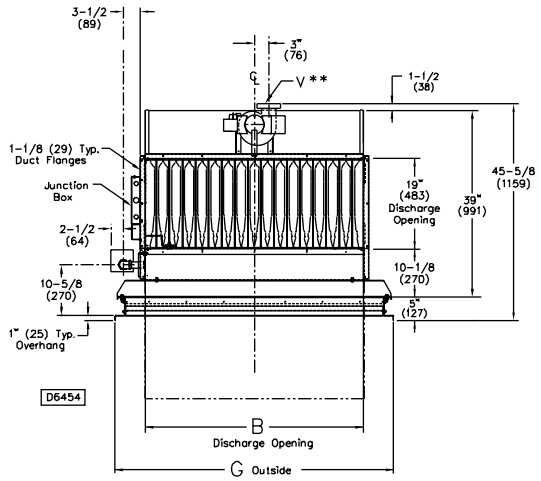
Dimensions and Weights

Typical Intake Air (end view)

Not applicable to arrangement A or D



Typical Discharge (end view)



Input Capacity	A	B	C	D	G	H	J[1]	L	U	V (dia)**	NAT	LP
GSAA10	32 7/8 (835)	15 9/16 (395)	16 7/8 (418)	19 3/8 (492)	30 3/16 (767)	37 1/16 (640)	24 (610)	-	-	4 (102)	1/2	1/2
GSAA15	32 7/8 (835)	18 5/16 (465)	16 7/8 (418)	19 3/8 (492)	30 3/16 (767)	37 1/16 (640)	24 (610)	-	-	4 (102)	1/2	1/2
GSAA20	43 7/8 (1114)	23 13/16 (605)	21 15/16 (557)	24 7/8 (632)	41 3/16 (1046)	37 7/16 (678)	35 (889)	-	-	5 (127)	1/2	1/2
GSAA25	43 7/8 (1114)	29 15/16 (745)	21 15/16 (557)	24 7/8 (632)	41 3/16 (1046)	37 7/16 (678)	35 (889)	-	-	5 (127)	1/2	1/2 or 3/4
GSAA30	54 7/8 (1394)	34 13/16 (884)	27 7/16 (697)	30 3/8 (772)	52 3/16 (1326)	36 11/16 (640)	46 (1168)	-	-	6 (152)	3/4	1/2 or 3/4
GSAA40	60 3/8 (1534)	45 13/16 (1164)	30 13/16 (841)	33 3/16 (841)	57 11/16 (1465)	36 11/16 (640)	51 1/2 (1308)	-	-	6 (152)	3/4	1/2 or 3/4
GSAA50	43 7/8 (1114)	29 15/16 (745)	21 15/16 (557)	24 7/8 (632)	42 1/16 (1068)	37 7/16 (678)	35 (889)	-	-	5 (127)	3/4	1/2 or 3/4
GSAA60	54 7/8 (1394)	34 13/16 (884)	27 7/16 (697)	30 3/8 (772)	53 1/16 (1348)	36 11/16 (640)	46 (1168)	-	-	6 (152)	3/4	1/2 or 3/4
GSAA70	54 7/8 (1394)	40 5/16 (1024)	27 7/16 (697)	30 3/8 (772)	53 1/16 (1348)	36 11/16 (640)	46 (1168)	-	-	6 (152)	3/4	1/2 or 3/4
GSAA80	60 3/8 (1534)	45 13/16 (1164)	30 13/16 (841)	33 1/8 (841)	58 9/16 (1487)	36 11/16 (640)	51 1/2 (1308)	181 1/4 (4604)	177 (4495)	6 (152)	3/4	1/2 or 3/4
GSAA12	60 3/8 (1534)	45 13/16 (1164)	30 13/16 (841)	33 1/8 (841)	58 9/16 (1487)	36 11/16 (640)	51 1/2 (1308)	218 1/4 (5544)	217 (5512)	6 (152)	3/4	1/2 or 3/4

Notes:

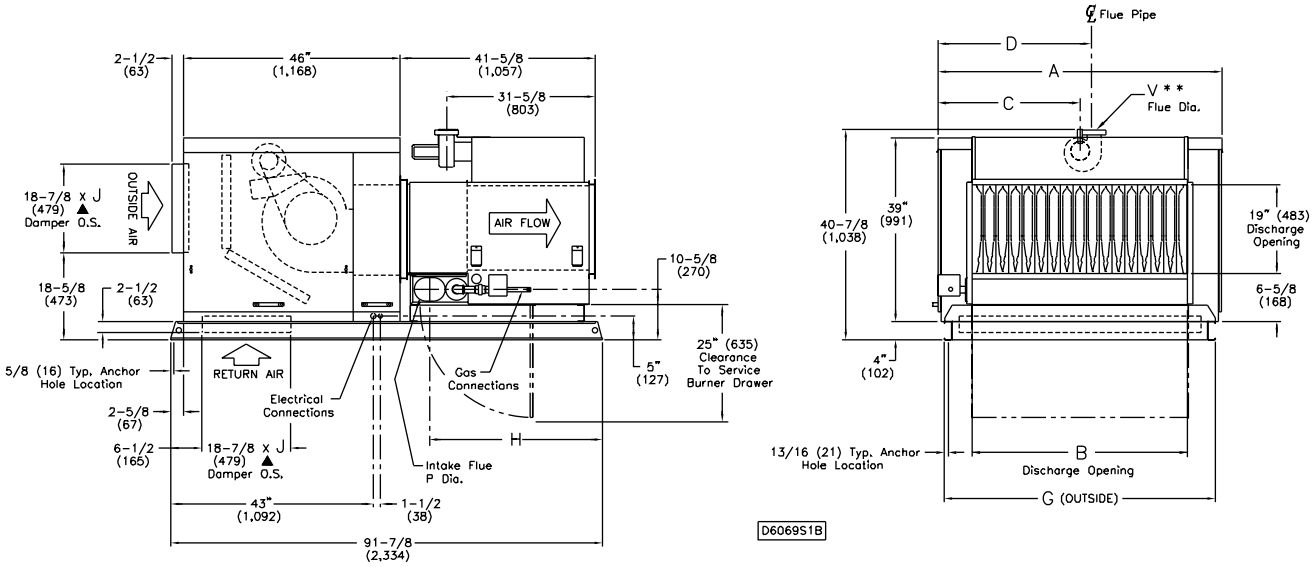
Unless otherwise noted, the end views and dimensional data shown in the drawings and table are applicable to Indoor Arrangement B,D,G,K. Dimensions are in inches. Dimensions in parenthesis are in millimeters.

J^1 = Outside dimension for the return air damper.

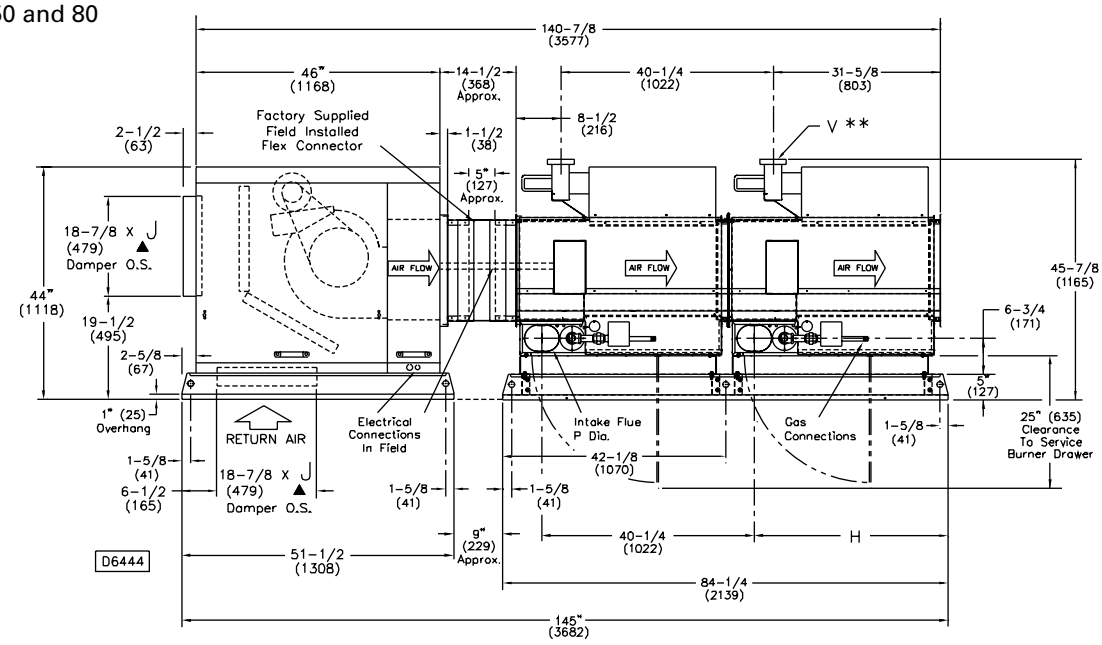
** = Flue opening: The 4 to 5-inch reducer adaptor is to be field installed for unit capacities 10 and 15. The 5 to 6-inch increaser adaptor is supplied by the manufacturer for unit capacities 30, 35, 40, 60, 70, 80 and 12 (requirement for each furnace flue).

Dimensions and Weights

Indoor Arrangement B
Input Capacities GXAA 10 and 40
(ships in single section)

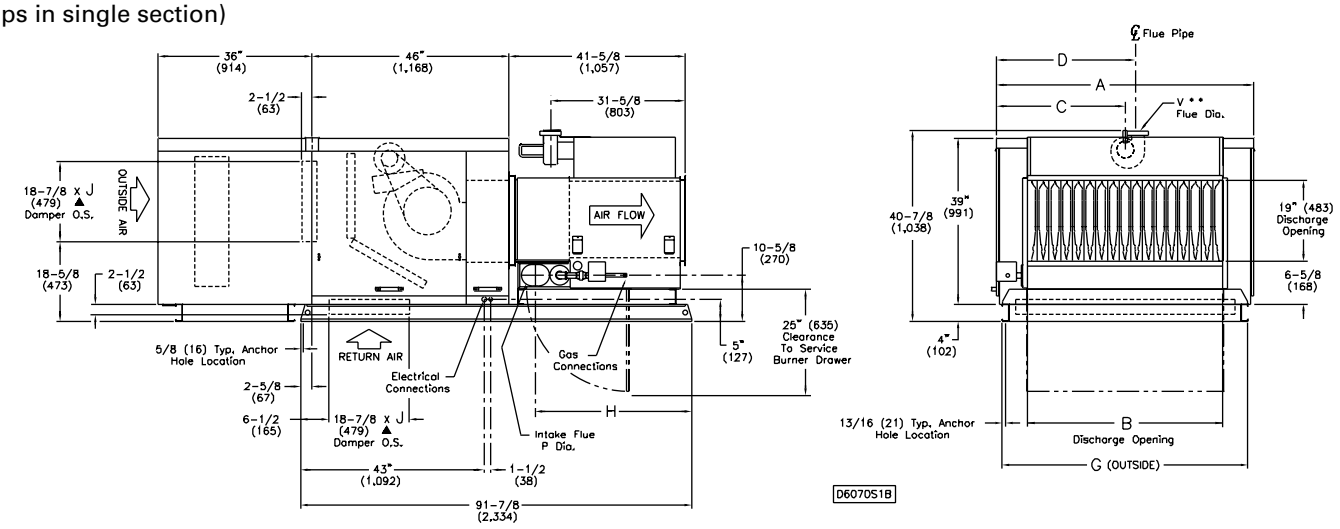


Indoor Arrangement B
Input Capacities GXAA 50 and 80
(ships in two sections)

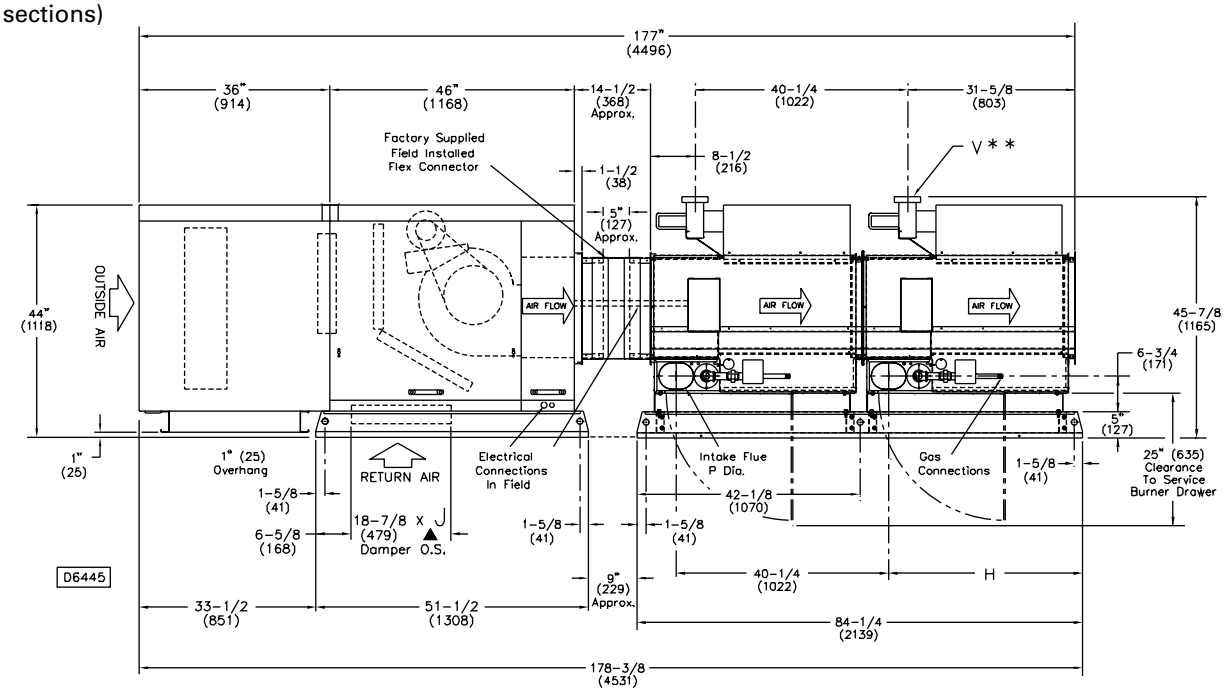


Dimensions and Weights

Indoor Arrangement D
Input Capacities GXAA 10 and 40
(ships in single section)

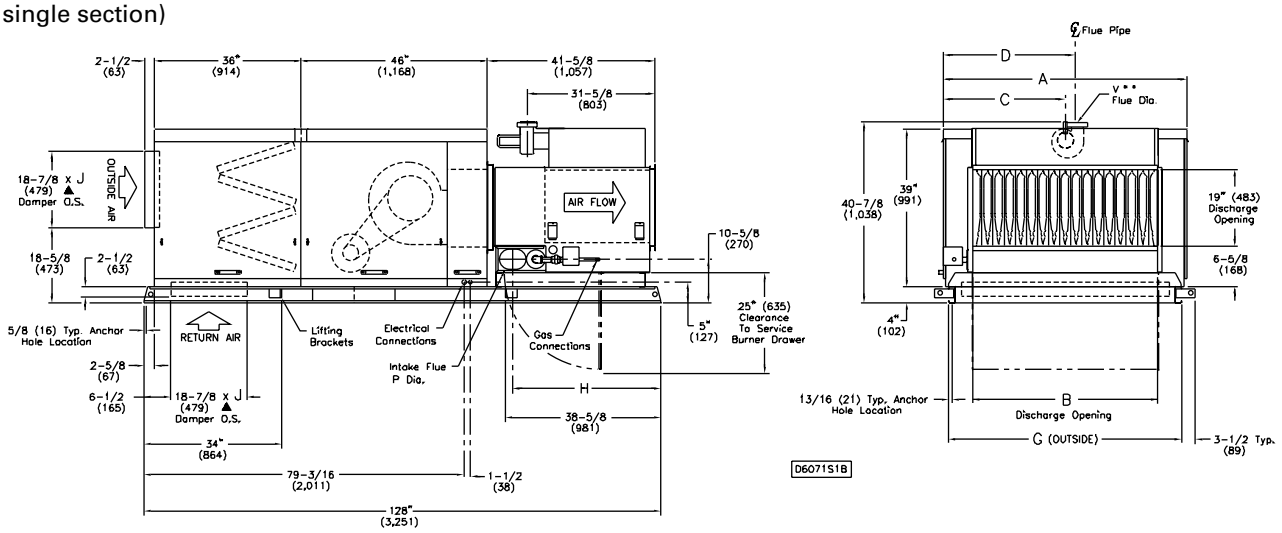


Indoor Arrangement D
Input Capacities GXAA 50 and 80
(ships in two sections)

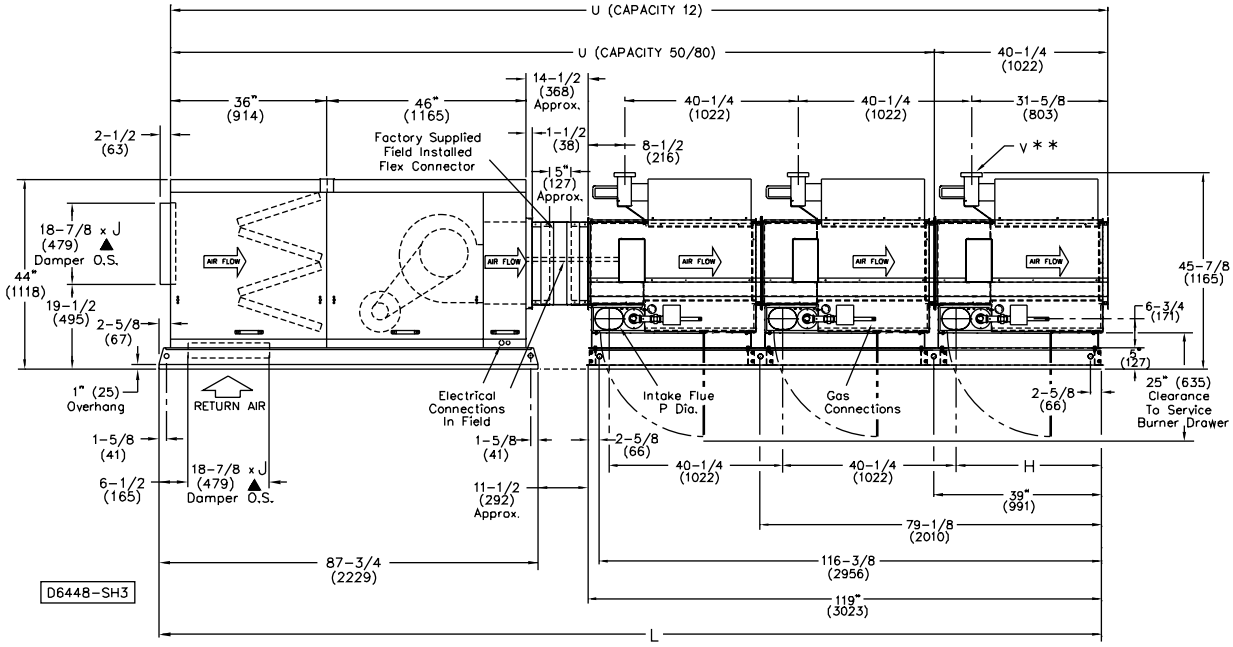


Dimensions and Weights

Indoor Arrangement G
Input Capacities GXAA 20 and 40
(ships in single section)

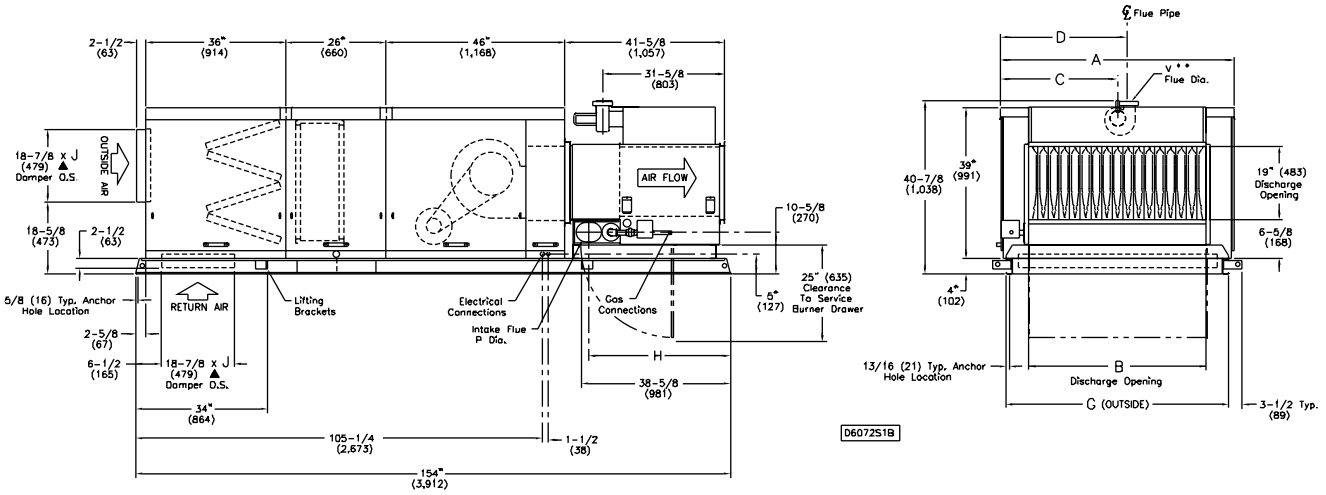


Indoor Arrangement G
Input Capacities GXAA 50 and 12
(ships in two sections)

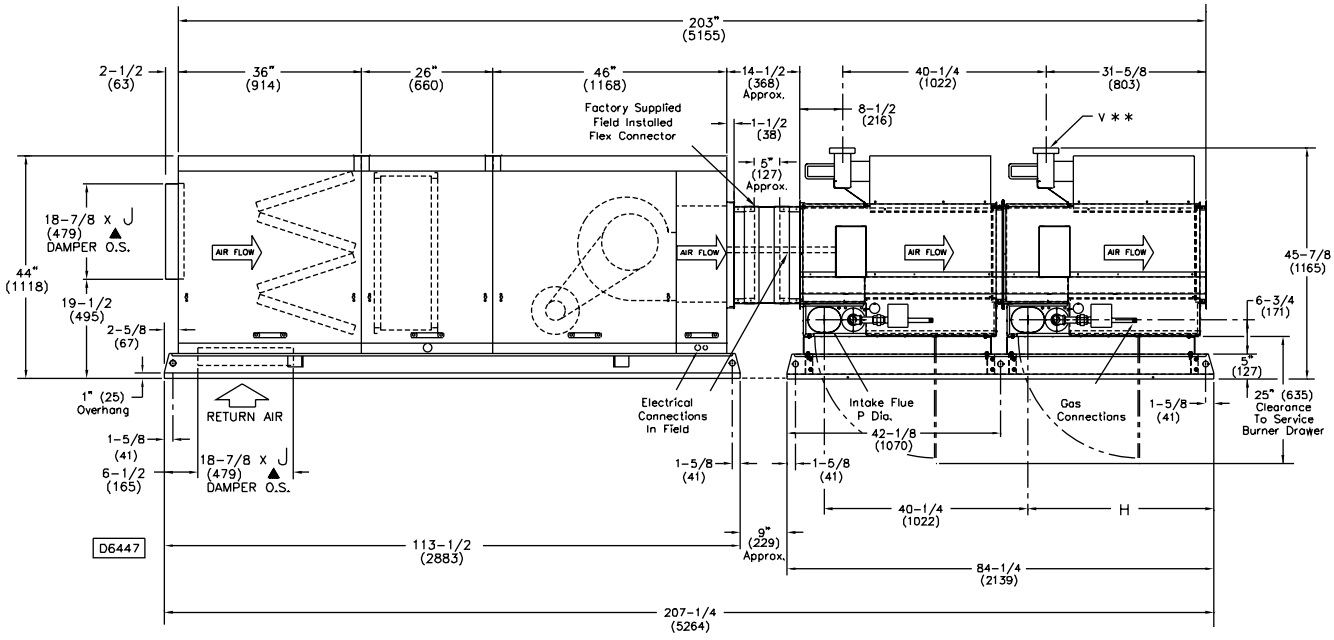


Dimensions and Weights

Indoor Arrangement K
Input Capacities GXAA 10 and 40
(ships in single section)



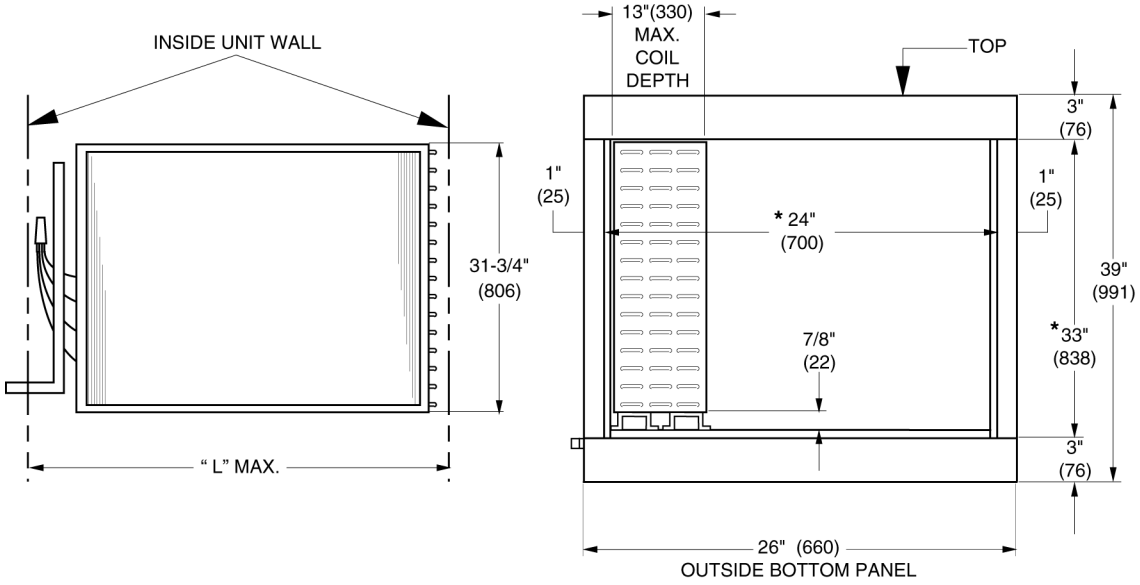
Indoor Arrangement K
Input Capacities GXAA 50 and 80
(ships in two sections)



Dimensions and Weights

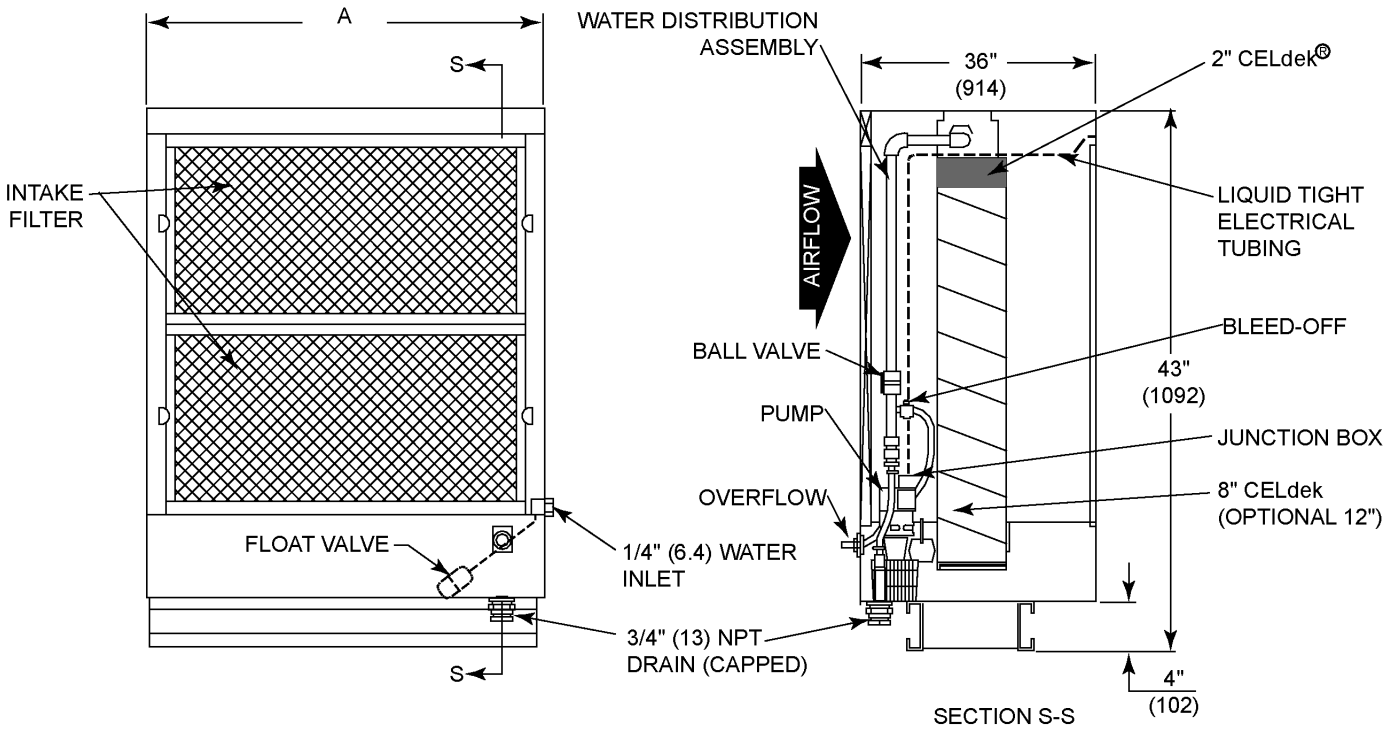
Coil Module

UNIT SIZE	" L" INSIDE MAX. CABINET OPENING
10/15	31-1/4" (794)
20/25/50	42-1/4" (1073)
30/35/60/70	53-1/4" (1353)
40/80	58-3/4" (1492)



Dimensions and Weights

Evaporator Cooling Unit

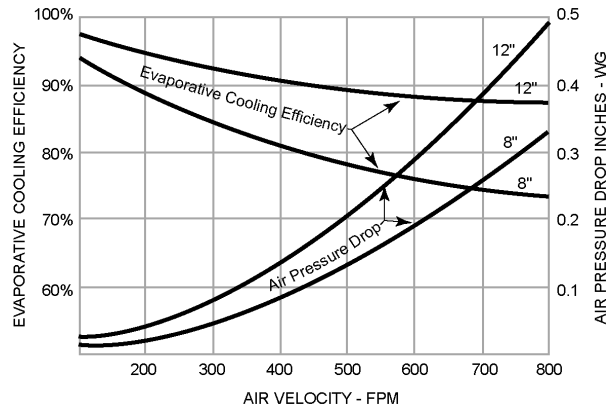


Dimensional data

Unit Size	A
10/15	32 7/8" (835)
20/25/50	43 7/8" (1114)
30/35/60/70	54 7/8" (1394)
40/80	60 3/8" (1534)

Performance data

CFM		8" or 12" Media	
(cu. m/s)	(cu. m/s)	Face Area	Size
Min.	Max.	Ft.^{2} (m^2)	In. (mm)
800 (.378)	4500 (2.124)	7.01 (0.65)	31 x 32 9/16 (787 x 827)
1600 (.755)	5500 (2.596)	9.38 (0.87)	31 x 43 9/16 (787 x 1106)
2400 (1.133)	8500 (4.012)	11.75 (1.09)	31 x 54 9/16 (787 x 1386)
3200 (1.510)	8500 (4.012)	12.92 (1.20)	31 x 60 (787 x 1524)



Evaporative Cooler Efficiency/Air Pressure Drop Chart

Installation

Refer to all dimensional data within the manuals equipped with your unit.

Single Furnace Units
Single furnace units (capacities 10-40) consist of a furnace section and an air handler section mounted on a common base rail.

Multiple Furnace Units
Multiple furnace units consist of two sections: a furnace section with two duct furnaces (capacities 50-80) or three duct furnaces (capacity 12) mounted on a common base rail; and a separate air handler section mounted on its own base rail. A flexible connector kit is also equipped with your unit. Each section has a label with Order No., Model No., Unit No., and Part No. marked on it. Make certain that the order, model, and part numbers agree on each section to be connected together.

The two sections should be moved individually and mounted in their permanent location (see "Suspension & Rigging" sections). Ensure that both flange assemblies are in alignment with a 5 inch (127mm) space between the flange assemblies. See the following instructions for installation of the flexible connector kit between the two sections.

Installing Flexible Connector
Refer to Figures 6A thru 6E.

Materials required:
- Flex connector
- RTV sealant
- Sealout tape
- Sheet metal screws

1. Make sure that the furnace section and the air handler section are in alignment and installed with a 5 inch (127mm) space between the flange assemblies.

2. Remove the top extension panel of the duct furnace for access to the inside bottom flange assemblies.

3. Measure flexible connector in the flat to confirm that it is correct for the unit being installed. Refer to Table 1. Make a 90 degree bend 4 inches (102mm) from one end of the flexible duct connector.

4. Measure the distance from the top of the flange assembly to the slot at the bottom of the flange assembly. Make a second 90 degree bend at the measured distance from the first bend in the flexible duct connector.

5. Slide the flexible connector through the slots in the flange assemblies until the vertical part is tight against the sides of the flange assemblies.

6. Bend second vertical section up around the flanges. Make sure all bends are straight and even for proper fit.

7. Bend down top section of flexible connector. Cut metal parts of flexible connector to overlap the 4 inch section by at least 1-1/2 inches (38mm), but cut the fabric portion 1-1/2 inches longer than the metal.

8. Screw metal portions of flexible connector to the flange assemblies using drill screws. Space the screws approximately 4 to 6 inches (102 to 152mm) on center. Fasten the bottom section in place by screwing down from the inside. Fasten the overlapped area with two screws in the metal on each side of the fabric. Seal the fabric joint with RTV sealer and allow to cure. Replace and reseal top extension panel on furnace section.

9. Apply sealing tape to seams between flanges and flexible connector and to vertical flange connections. Test for air leaks during initial start-up. Reseal as required.

Table 7: Flexible Connector Kit

Input Capacity	Approx. straight length of flexible connector required
50	102 (2.59 m)
60	114 (2.90 m)
70	124 (3.15 m)
80/12	135 (3.43 m)

Installation

Figure 6A

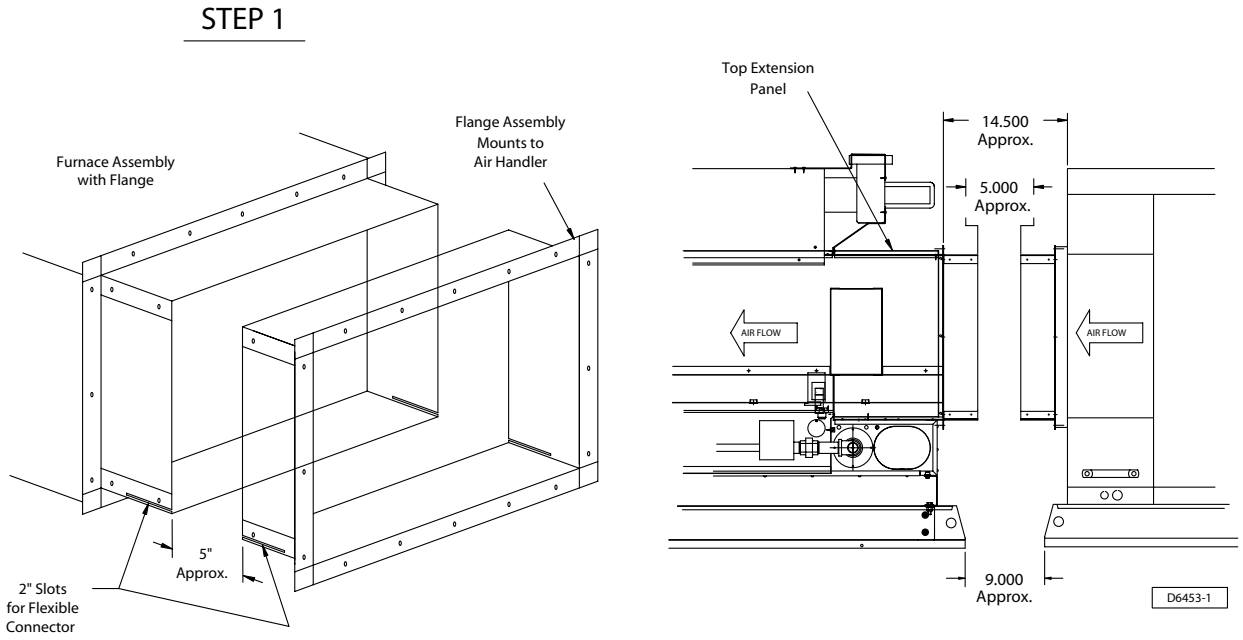
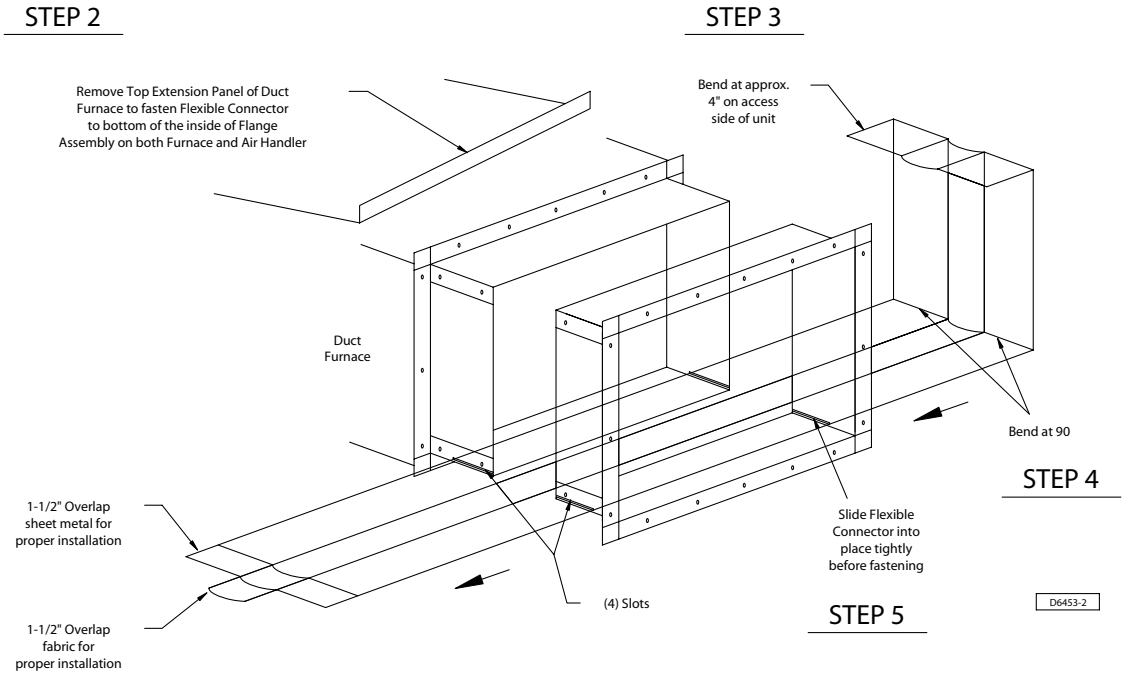


Figure 6B



Installation

Figure 6C

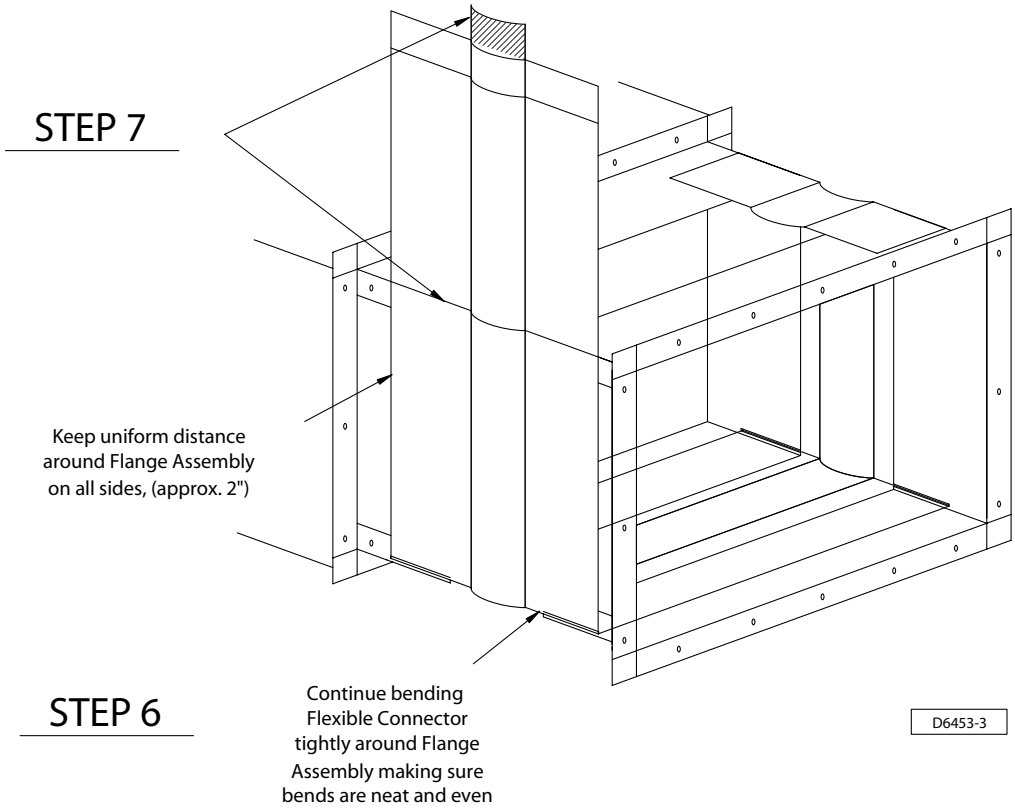
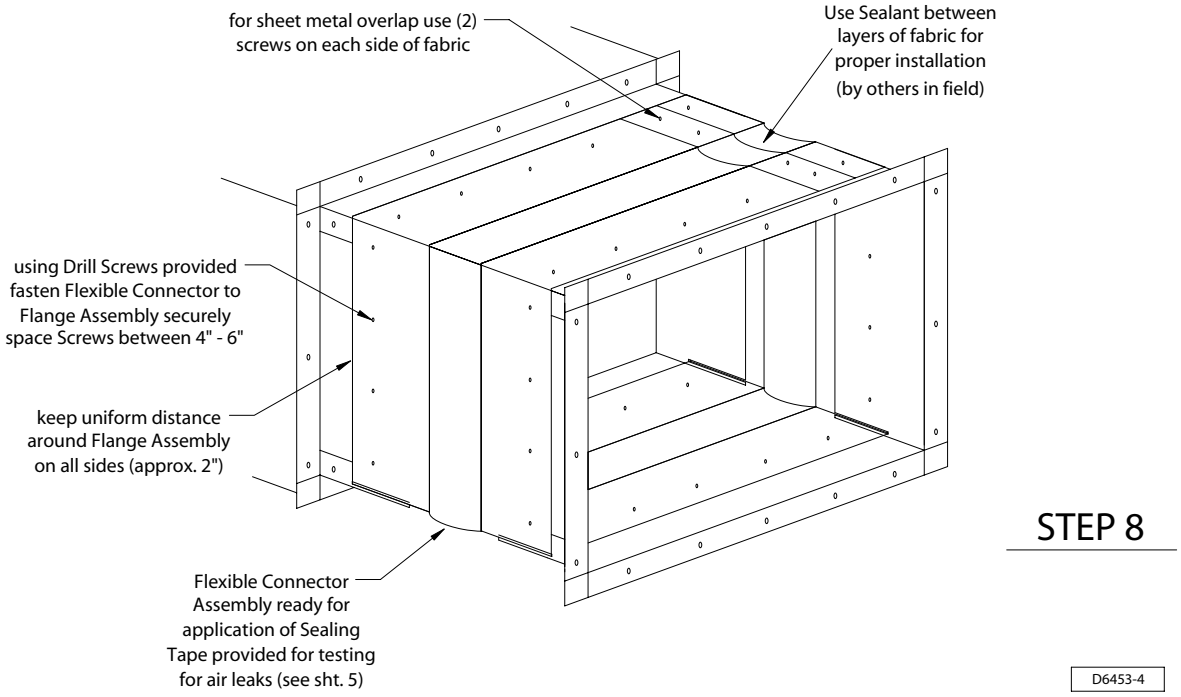
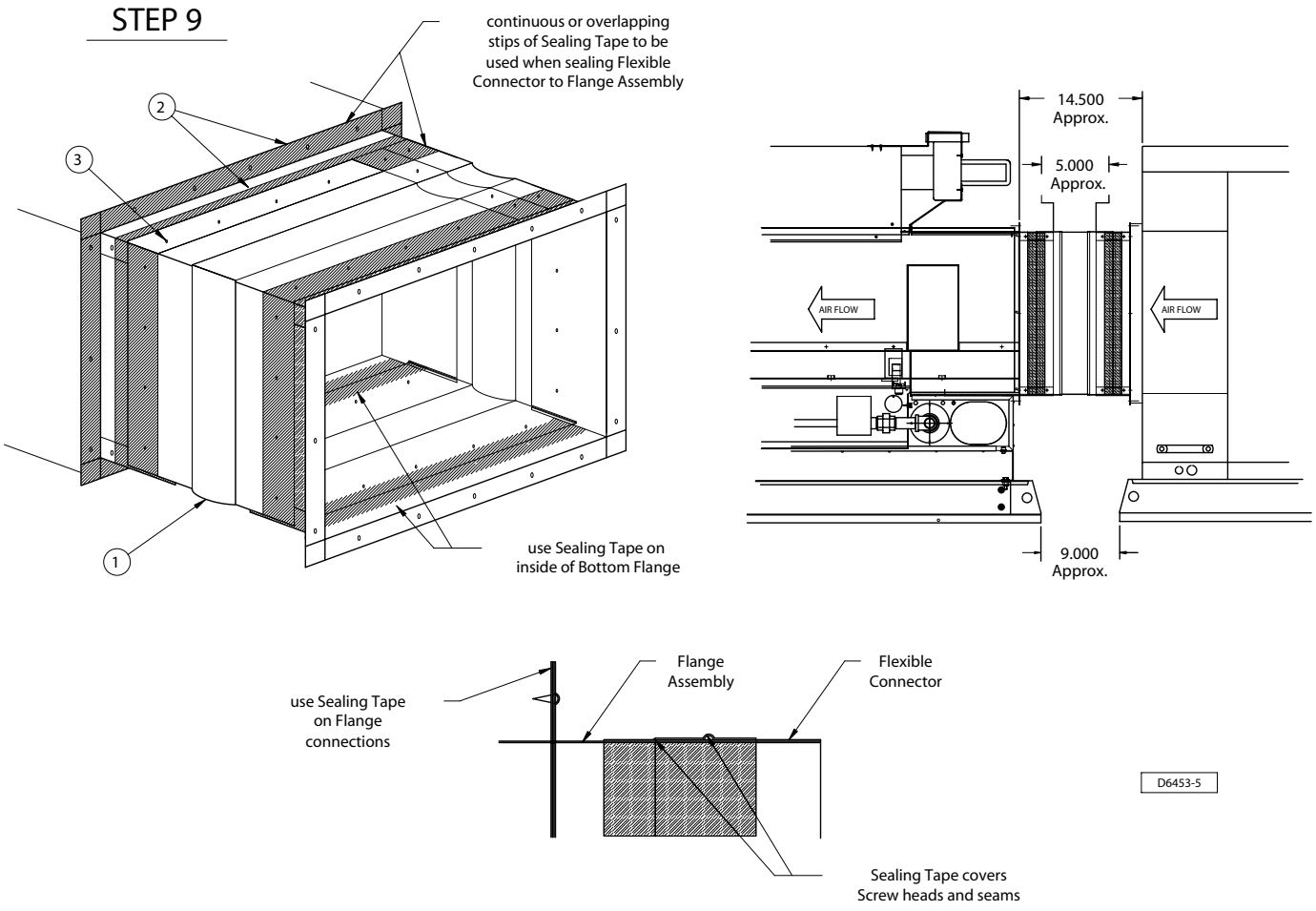


Figure 6D



Installation

Figure 6E



Installation

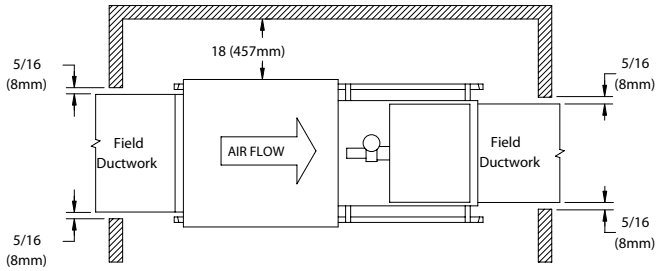
Installation Clearances
Minimum clearances to combustible material are shown on the unit data plate. It is important that clearances be maintained for servicing the unit, and that minimum clearances are provided from the unit to combustible material. Clearances around the field installed optional outside air hood (if unit is to be connected to one) must be unobstructed. See Figure 7.

⚠ WARNING!
Combustible Materials!
Maintain proper clearance between the unit heat exchanger, vent surfaces and combustible materials. Refer to unit nameplate and installation instructions for proper clearances. Improper clearances could result in a fire hazard. Failure to maintain proper clearances could result in death or serious injury or property damage.

Every gas appliance should be located with respect to building construction and other equipment so as to permit access to the unit. Clearances between vertical walls and the vertical sides of the heater should be no less than 18 inches (457mm). Minimum clearance between the top of the heater and the ceiling is 6 inches (152mm). The minimum clearance to the bottom of the furnace is 25 inches (635mm). The minimum clearance from combustibles to the flue collector is 6 inches (152mm). The minimum clearance from combustibles to the outside of the flue pipe is 6 inches (152mm). See Figure 7.

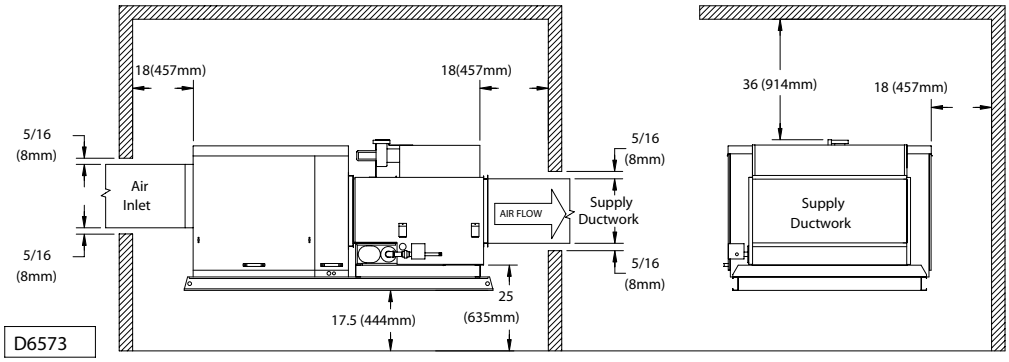
Note: It is recommended that adequate clearance be kept to the bottom of the furnace(s) to make sure a service technician can safely service the unit(s).

⚠ WARNING!
Heavy Objects!
- The unit should never be lifted by furnace sections, blower/housing/filter/sections, motor mounts or flue connections. These are not designed to support total weight of unit.
- Make certain that the lifting methods used to lift the Make-up Air Unit are capable of supporting the weight of the heater during installation.
- Make certain the structure to which heater is to be mounted is capable of safely supporting its weight. Under no circumstances must the gas lines or electrical conduit be used to support the heater.
- Inspect the suspension and/or support for the make-up air unit to ensure that all fasteners are tight and the unit is secure before working underneath the unit. Failure to follow the above recommendations above could result in death or serious injury or equipment or property damage.



Note: Recommended ceiling clearance 36" (914mm) is from the ceiling to the top of the furnace venting collar assembly.

Figure 7: Manufacturer's recommended service clearance



Installation

⚠ WARNING!

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Access Panel Removal

Unless your unit is equipped with optional hinged access doors, the air handler sections are equipped with access panels that are held in place with two "grip" latches.

To remove these access panels: use a slotted head screw driver to turn the latch screw-head counter-clockwise. Using the handle provided, push the panel upwards. Pull the bottom of the panel out and lower the panel to disengage it from the top lip.

To replace access door panels: guide the panel door upwards on the tracks, and push up into the top lip, swing and lower the panel in place until it engages with the bottom panel. Turn the screw-head on each latch clockwise. The screw must turn freely one quarter turn before resistance is felt in order for the lock to engage. If latch does not hold, turn screw counter-clockwise several turns and repeat the above procedure.

Venting

All venting installations shall be in accordance with the latest edition of Part 7, "Venting of Equipment", of the National Fuel Gas Code, ANSI Z223.1-20029 (or the latest edition), or applicable provisions of local building codes.

⚠ WARNING!

Carbon Monoxide Hazard!

Your venting system must not be blocked by any snow, snow drifts or any foreign matter. Inspect your venting system to ensure adequate ventilation exists at all times. The venting system is an integral part of the units and must not be altered in the field. Carbon monoxide poisoning symptoms include grogginess, lethargy, inappropriate tiredness or flu like symptoms. Failure to properly vent combustion gases could result in death or serious injury.

Table 8: Vent Clearance Requirements

Structure	Minimum Clearances for Termination Locations
Door, window or any gravity air inlet	4 feet below 4 feet horizontally 1 foot above
Forced air inlet within 10 feet	3 feet above
Adjoining building or parapet	6 feet
Adjacent public walkways	7 feet above grade

Note: If the vent terminal is to be installed near ground level, the vent terminal must be positioned at least six inches (152 MM) above the maximum anticipated snow depth.

Combustion Air Piping

1. The combustion air system installation must be in accordance with the current National Fuel Gas Code - NFPA 54 or ANSI Z223.1 National Fuel Gas Code. In Canada, installation must be in accordance with CAN/CGA-B149.1 Installation Code for Natural Gas Burning Appliances and Equipment, or CAN/CGA-B149.2 Installation Code for Propane Burning Appliances and Equipment.

2. A Breidert Type L or Fields inlet cap furnished by the customer must be installed at the termination point of the combustion air system. See Figures 8 through 9.

Note: The top of the cap is to be no less than 12-inches from the top of the exhaust vent cap. (Canadian duct furnaces include inlet caps.)

3. Each duct furnace MUST have its own combustion air system. It MUST NOT be connected to other air intake systems.

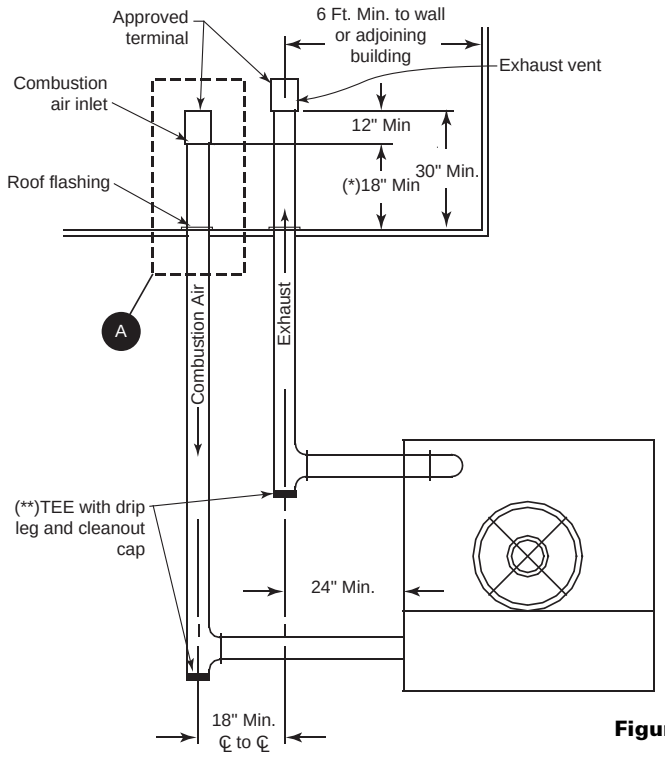
4. Use single wall pipe constructed of 24-gauge galvanized steel, or material of equivalent durability and corrosion resistance for the combustion air system.

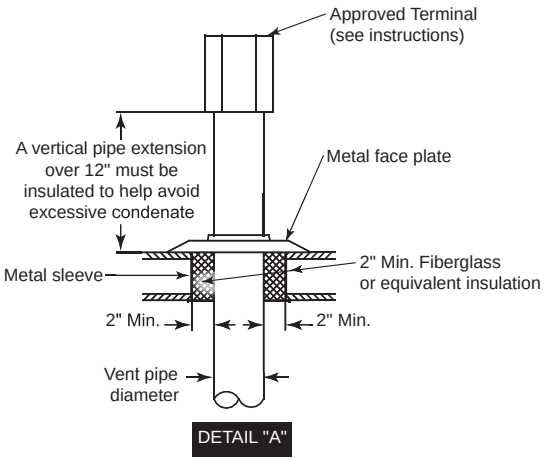
⚠ WARNING!

Material Hazard!

Pipe diameter and material used should be as specified by the installing contractor. See flue diameter for recommended pipe sizing. Never use PVC or other non-metallic pipe for venting. Failure to properly size and vent combustion gases could result in death, serious injury or equipment damage.

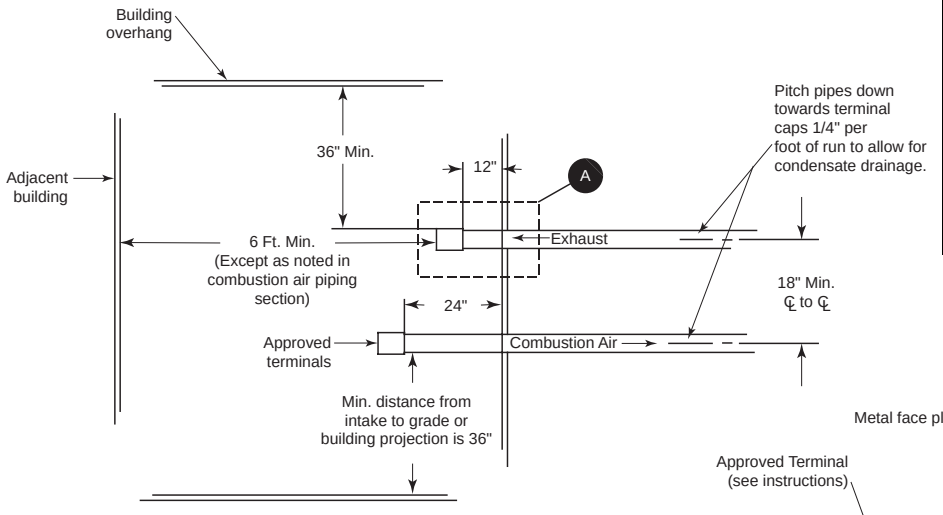
Installation





* Size according to expected snow depths.
** If excessive condensation develops, a drip leg with a condensate drain may be required. Insulating pipes may eliminate the excessive condensate.

Figure 8: Vertical Intake/Vent Installation



Flue sizes:	
Unit	**Flue Outlet Dia.**
100/175	4" - Reducer required and supplied by installer.
200/250	5" - No adaptor required.
300/400	6" - Increase required and supplied by manufacturer.

Exception: The CSA requires manufacturer to supply Canadian units with flue reducers or increasers.

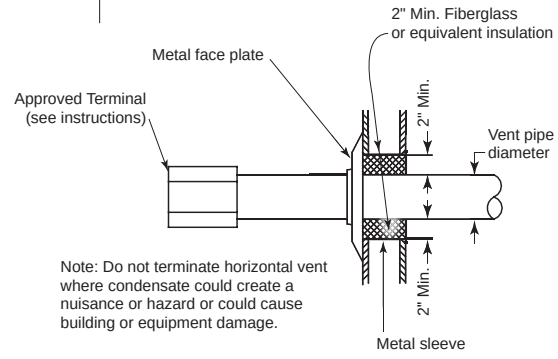


Figure 9: Horizontal Intake/Vent Installation

Installation

5. Long runs of single wall combustion piping passing through an unheated space may require insulating if condensation becomes noticeable.

6. The combustion air system must be installed to prevent collection of condensate. Pitch horizontal pipes downward 1/4-inch per foot toward the inlet cap to facilitate drainage. Vertical combustion air pipes should be arranged as depicted in Figure 8.

7. The equivalent length of the combustion air system must not be less than 5-feet (1.5 M) and must not exceed 50-feet (15.2 M). Equivalent length is the total length of straight sections plus 15-feet (4.6 M) for each 90° elbow and 5-feet (1.5 M) for each 45° elbow.

Note: for optimum performance, keep the combustion air system as straight as possible.

8. Each slip joint must be secured with at least three corrosion resistant screws. Two full turns of 3 M, #425 aluminum foil tape or its equivalent must be used to seal each joint. General Electric® RTV-108, Dow-Corning® RTV-732, or an equivalent may be used instead of tape.

9. For horizontal combustion air systems longer than 5-feet (1.5 M), the system must be supported from overhead building structures at 3-foot (1 M) intervals.

Exhaust Venting

1. The combustion air system installation must be in accordance with the current National Fuel Gas Code - NFPA 54 or ANSI Z223.1 National Fuel Gas Code. In Canada, installation must be in accordance with CAN/CGA-B149.1 Installation Code for Natural Gas Burning Appliances and Equipment, or CAN/CGA-B149.2 Installation Code for Propane Burning Appliances and Equipment.

2. A Breidert Type L or Fields vent cap furnished by the customer must be installed at the termination point of the combustion air system. See Figures 8 through 9.

Note: Canadian duct furnaces include inlet caps and a reducer/increaser (if required).

3. Each duct furnace MUST have its own combustion air system. It MUST NOT be connected to other air intake systems or to a chimney.

4. Use single wall pipe constructed of 24-gauge galvanized steel, or material of equivalent durability and corrosion resistance for the vent system. For installation in Canada, use pipe constructed from 0.025-inch thick aluminum or 0.018-inch thick stainless steel.

⚠ WARNING!

Material Hazard!

Pipe diameter and material used should be as specified by the installing contractor. See flue dia. for recommended pipe sizing. Never use PVC or other non-metallic pipe for venting. Failure to properly size and vent combustion gases could result in death, serious injury or equipment damage.

5. Any run of single wall vent piping passing through an unheated space must be insulated with an insulation suitable to 550° F.

6. The combustion and exhaust vent air systems must be installed to prevent collection of condensate. Pitch horizontal pipes downward 1/4-inch per foot (21 MM/M) toward the terminal caps to facilitate drainage (Figure 9). Vertical vent pipes should be arranged as shown in Figure 8.

7. The equivalent length of the combustion air system must not be less than 5-feet (1.5 M) and must not exceed 50-feet (15.2 M). Equivalent length is the total length of straight sections plus 15-feet (4.6 M) for each 90° elbow and 5-feet (1.5 M) for each 45° elbow.

8. Each slip joint must be secured with at least three corrosion resistant screws. Two full turns of 3 M, #425 aluminum foil tape or its equivalent must be used to seal each joint. General Electric® RTV-108, Dow-Corning® RTV-732, or an equivalent may be used instead of tape.

9. For horizontal vent systems longer than 5-feet (1.5 M), the system must be supported from overhead building structures at 3-foot (1 M) intervals.

10. The exhaust vent system must remain at a minimum of 6-inches from all combustible materials. Any part of the vent system that passes through a combustible material must be properly insulated.

Note: Increasing the clearance distance may be necessary if there is a possibility of distortion or discoloration of adjacent materials.

For a vertical vent pipe section that passes through a floor or roof, an opening of 4-inches (102 MM) greater in diameter is required. The opening must be insulated and flashed in accordance with applicable installation codes.

A horizontal section of an exhaust vent system that passes through a combustible wall must be constructed and insulated as shown in Figure 9-Detail A.

11. The top of a vertically vented exhaust system must extend at least 3-feet (1 M) above the roof surface that it passes through. The point of termination for a horizontally vented exhaust system must at least 12-inches (305 MM) from the exterior wall that it passes through. In addition, the termination point must be at least 3-feet (1 M) above grade or above the snow line, more than 6-feet (2 M) from the combustion air inlet of another appliance, more than 3-feet (1 M) from any building opening, and more than 4-feet (1.3 M) from, and not directly above any electric meter, gas meter, regulator, or relief equipment. See Figures 8 and 9.

Installation

Duct Connections
All ductwork must be properly supported so that no strain is put on the unit. Do not alter or bend the discharge duct flanges supplied on your make-up air unit.

Duct connections must have a removable access panel in the duct which is connected to a duct furnace. The duct openings shall be accessible when the unit is installed in service, and shall be of such size that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heating element. The covers for the panels shall be attached in such a manner as to prevent leaks. Ducts (or optional outside air hoods) exposed to the outdoors must be insulated and sealed to prevent water from entering either the unit or building through the duct.

If a single, double or triple duct furnace only unit is connected to a return air duct, or any other inlet air restriction, the appliance shall be installed on the positive pressure side of the air circulating blower.

When connecting return air duct to Standard or High CFM cabinets, attach duct to return air opening flange when no dampers are used. Otherwise, if dampers are used, attach return air duct around collar at bottom of damper assembly. Also refer to the Dimensional Data section of this manual, Submittal Data Sheets and Indoor Duct Furnace Manual specified for your unit.

Gas Piping††
All gas piping must be installed in accordance with local codes. It is required that a ground union be installed adjacent to the gas valve of each duct furnace, and a ground union be installed just external of each duct furnace for unit servicing. On vertical runs, a drip leg should be provided upstream of any control manifold. A gas shutoff valve should be, or may be required by local codes, installed upstream of the external ground union for each duct furnace. A 1/8 inch N.P.T. plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the unit gas supply connection.

⚠ WARNING!
Explosive Vapors!
- Do not purge gas supply lines into areas where there are ignition sources or into confined spaces. Always assure adequate space ventilation to remove a build up of vapors. Control the purging rate and eliminate any sources of ignition.
- Do not connect gas piping to this unit until the gas supply line has been pressure/leak tested. Excessive pressure during a pressure test of the supply line could damage the gas valve.
- Do not rely on a gas shutoff valve to isolate the unit while conducting gas pressure/leak tests.
- Do not over-tighten the inlet gas piping at unit gas valve. Excessive stresses could crack the gas valve.
- Never use an open flame to detect gas leaks. Gas vapors from improper purging or damaged and leaking gas valves could lead to an explosion or fire. Failure to follow all of the recommendations above could result in death or serious injury or equipment or property damage.

†† *For complete Gas Piping Installation, see page 29 & 30 of this manual.*

The gas line should be supported so that no strain is placed on the unit. Pipe compounds which are not soluble to liquid petroleum gases must be used on threaded joints.

The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.5 kPa).

The appliance must be isolated from the gas supply piping system by closing the individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 kPa).

For additional gas piping information, including pipe sizing and drip leg installation, refer to Separated Combustion Indoor Gas-Fired Duct Furnace Installation and Service Manual.

For additional piping information, refer to the National Fuel Gas Code Z233.1 (latest edition).

Note: If the gas duct furnace is to be fired with LP gas, consult local LP gas dealer for piping size information.

Note: Unit installation for use with propane (bottled) gas must be made by a qualified LP gas dealer or installer. He will help insure proper joint compounds are used for making pipe connections; that air is purged from lines; that a thorough test is made for leaks before operating the unit; and that it is properly connected to propane gas supply system.

Before any connection is made to an existing line supplying other gas appliances, contact the local gas company to make certain that the existing line is of adequate size to handle the combined load. Check all connections for leaks with soap solution.

Installation

Gas Piping Installation

CAUTION!

Equipment Damage!

- To avoid damage or possible personal injury, do not connect gas piping to the unit until a supply line pressure/leak test has been completed. Connecting the unit before completing the pressure/ leak test may damage the gas valve and could result in a fire hazard.

- Do not rely on a shut-off valve to isolate the unit while conducting gas pressure/leak tests. These valves may not completely shut off, exposing the gas valve to excessive pressure and damages.

Pipe Sizing: To provide adequate pressure to the gas duct furnace, size the gas piping as follows:

1. Find cu. ft./hr. by using the following formula:

$$\frac{\text{Cu. ft./hr.}}{\text{BTU}} = \text{Input}$$

2. Refer to Table 9. Match length of pipe in feet with appropriate gas input - Cu. ft./hr. figure. This figure can then be matched to the pipe size at the top of the column.

Example: It is determined that a 67 foot (20.4) run of gas pipe is required to connect a 200 MBTU gas duct furnace to a 1,000 BTU/cu. ft. (0.29kW) natural gas supply.

$$\frac{\text{200,000 BTU/Hr}}{\text{1,000 BTU/cu. ft.}} = \text{200 Cu. ft./hr.}$$

Using Table 9, a 1-inch pipe is needed.

Note: See General Safety Information section for English/Metric unit conversion factors.

If more than one duct furnace is to be served by the same piping arrangement, the total cu. ft./hr. input and length of pipe must be considered. If the duct furnace is to be fired with LP gas, consult your local LP gas dealer for pipe size information.

Heater installation for use with propane bottled gas must be made by a qualified LP gas dealer or installer to ensure that proper joint compounds are used for making pipe connections; that air is purged from lines; that a thorough test is made for leaks before operating the heater; and that it is properly connected to the propane gas supply system.

Before any connection is made to the existing line supplying other gas appliances, contact the local gas company to ensure that the existing line is of adequate size to handle the combined load.

Table 9: Gas pipe size

Nominal Iron Pipe Size (in.)	Internal Dia. (in.)	Length of Pipe, Feet (meters)													
		10 (3.0)	20 (6.1)	30 (9.1)	40 (12.2)	50 (15.2)	60 (18.3)	70 (21.3)	80 (24.4)	90 (27.4)	100 (30.5)	125 (38.1)	150 (45.7)	175 (53.3)	200 (61.0)
1/2	0.622	175 (4.96)	120 (3.40)	97 (2.75)	82 (2.32)	73 (2.07)	66 (1.87)	61 (1.73)	57 (1.61)	53 (1.50)	50 (1.42)	44 (1.25)	40 (1.13)	37 (1.05)	35 (0.99)
3/4	0.824	360 (10.2)	250 (7.08)	200 (5.66)	170 (4.81)	151 (4.28)	138 (3.91)	125 (3.54)	118 (3.34)	110 (3.11)	103 (2.92)	93 (2.63)	84 (2.38)	77 (2.18)	72 (2.04)
1	1.049	680 (19.3)	465 (13.2)	375 (10.6)	320 (9.06)	285 (8.07)	260 (7.36)	240 (6.80)	220 (6.23)	205 (5.80)	195 (5.52)	175 (4.96)	160 (4.53)	145 (4.11)	135 (3.82)
1 1/4	1.38	1400 (39.6)	950 (26.9)	770 (21.8)	660 (18.7)	580 (16.4)	530 (15.0)	490 (13.9)	460 (13.0)	430 (12.2)	400 (11.3)	360 (10.2)	325 (9.20)	300 (8.50)	280 (7.93)
1 1/2	1.610	2100 (59.5)	1460 (41.3)	1180 (33.4)	990 (28.0)	900 (25.5)	810 (22.9)	750 (21.2)	690 (19.5)	650 (18.4)	620 (17.6)	550 (15.6)	500 (14.2)	460 (13.0)	430 (12.2)
2	2.067	3950 (112)	2750 (77.9)	2200 (62.3)	1900 (53.8)	1680 (47.6)	1520 (43.0)	1400 (39.6)	1300 (36.8)	1220 (34.5)	1150 (32.6)	1020 (28.9)	950 (26.9)	850 (24.1)	800 (22.7)
2 1/2	2.469	6300 (178)	4350 (123)	3520 (99.7)	3000 (85.0)	2650 (75.0)	2400 (68.0)	2250 (63.7)	2050 (58.0)	1950 (55.2)	1850 (52.4)	1650 (46.7)	1500 (42.5)	1370 (38.8)	1280 (36.2)
3	3.068	11000 (311)	7700 (218)	6250 (177)	5300 (150)	4750 (135)	4300 (122)	3900 (110)	3700 (105)	3450 (97.7)	3250 (92.0)	2950 (83.5)	2650 (75.0)	2450 (69.4)	2280 (64.6)
4	4.026	23000 (651)	15800 (447)	12800 (362)	10900 (309)	9700 (275)	8800 (249)	8100 (229)	7500 (212)	7200 (204)	6700 (190)	6000 (170)	5500 (156)	5000 (142)	4600 (130)

Note:

1 Maximum capacity of pipe in cubic feet of gas per hour (cubic meters per hour) for gas pressures of 0.5 psig (3.5 kPa) or less, and a pressure drop of 0.5 inch water column (124.4 Pa).

2 Determine the required Cu. Ft./Hr. by dividing the rated heater input by 1000. For SI/Metric measurements: Convert unit Btu. /Hr. to kW. Multiply the units input (kW) by 0.0965 to determine Cubic Meters/Hour.

3 For natural gas, select the pipe size directly from the table

4 For propane gas, multiply the Cu. Ft./Hr. (cubic meters per hour) value by 0.633.

Installation

Pipe Installation

1. Install the gas piping in accordance with applicable local codes.

2. Check gas supply pressure. Each duct furnace must be connected to a gas supply capable of supplying its full rated capacity at a pressure not less than 5.5" W.C. (1.4 kPa), and not greater than 14" W.C. (3.5 kPa) for natural gas. The manifold pressure for natural gas must be 3.5" W.C. (0.9 kPa). For propane gas operation, the manifolded pressure must be 10.5" W.C. (2.6 kPa). For propane, the minimum supply pressure must be 13.0" W.C. (3.2 kPa). A field LP tank regulator must be used to limit the supply pressure to a maximum of 14" W.C. (3.5 kPa). All piping should be sized in accordance with ANSI Standard Z223.1-1992, (or the latest edition) National Fuel Gas Code; in Canada, according to CAN/CGA B149. See Table 9 (of this manual) for correct gas pipe size. If gas pressure is excessive on natural gas applications, install a pressure regulating valve in the line upstream from the main shutoff valve.

3. Adequately support the piping to prevent strain on the gas manifold and controls.

4. To prevent the mixing of moisture with gas, run the take-off piping from the top, or side of the main.

5. Duct furnaces are shipped with a combination valve which includes:

a. Manual "A" valve
b. Manual "B" valve
c. Solenoid valve
d. Pilot safety
e. Pressure regulator

Pipe directly to the combination valve. Figure 10.

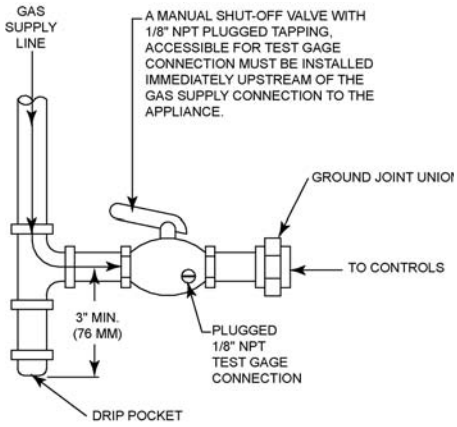


Figure 10: Pipe installation (standard controls).

6. A 1/8" (3.2 mm) NPT plugged tapping, accessi.ble for test gauge connection, must be installed immediately upstream of the gas supply connection to the appliance.

7. Provide a drip leg in the gas piping near the gas duct furnace. A ground joint union and a manual gas shutoff valve should be installed ahead of the unit heater controls to permit servicing. The manual shutoff valve must be located external to the jacket. Figure 10.

8. Ensure all connections have been adequately doped and tightened.

CAUTION

Equipment Damage!

Do not over tighten the inlet gas piping into the valve. This may cause stress and crack the valve.

Note: Use pipe joint sealant resistant to the action of liquefied petroleum gases regardless of gas conducted.

⚠ WARNING

Hazardous Gases and Flammable Vapors!

-Never use an open flame to detect gas leaks. Explosive conditions may exist which will result in death or personal injury.
-Check all pipe joints for leakage using a soap solution or other approved method.

The appliance and its individual shutoff valve must be connected from the gas supply piping system during any pressure testing of that system in excess of 1/2 psig (3.5 kPa).

The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 kPa).

Installation

Modulating Gas Control *(Optional)*

Electronic: On units equipped with electronic modulating control, follow control manufacturer's installation instructions for sensing of outlet air temperature.

Electrical Connections

⚠ WARNING!

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

All electrical connections must conform to: ANSI/NFPA No. 70-2002 (or latest edition) National Electrical Code and applicable local codes. In Canada, to the Canadian Electrical Code, Part I CSA Standard C22.1.

Single furnace make-up air packaged units are wired at the factory and are ready to be connected. Multiple furnace make-up air units are shipped in two parts, the air handler section and the furnace section. After mounting the two sections and installing the flexible duct connector, connect the free end of the flexible conduits from the air handler section to the junction box on the duct furnace. Each wire has a distinctive marking. Connect each wire to its respectively marked terminal in the duct furnace junction box. See Figure 11. Actual unit wiring will differ according to the options chosen. Each unit is shipped with its own wiring diagram; refer to this wiring diagram for all electrical connections to the unit.

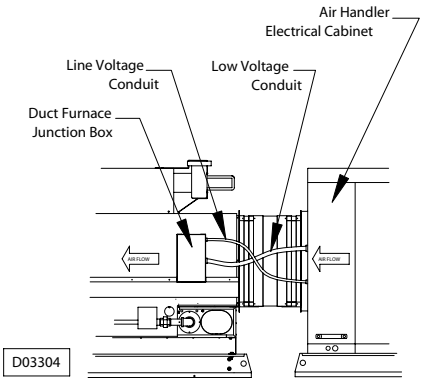


Figure 11

All line voltage and thermostat connections are made in the Electrical Cabinet. See Figure 12. Line voltage connections are made at the High Voltage Terminal Block. Thermostat connections are made at the Main Connection Board. See Figure 13.

⚠ WARNING!

Live Electrical Components!

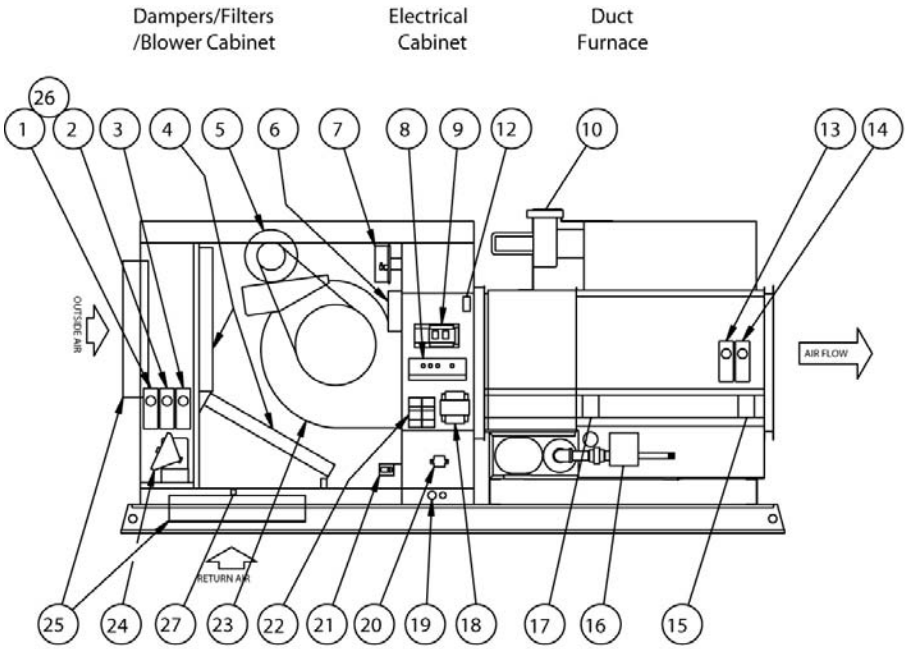
During installation, testing, servicing and trouble shooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Locate the thermostat in accordance with the instructions supplied with the thermostat. All field wiring must have a minimum temperature rating of 85°C (185°F). Control wiring shall be a minimum of 18 gauge wire size. Control wiring must be sized for length of run.

Locate line voltage disconnect box per local codes. If mounting the disconnect box to the unit, never mount it to a unit access panel. Possible locations include the front of the blower or filter section. See Figure 14. Electrical conduit must be routed so as not to interfere with removal of any access panel.

Note: Should any original wire supplied with the unit have to be replaced, it must be replaced with wiring having a temperature rating of at least 105°C (221°F).

Installation



1. Mixed Air Controller
2. Return Firestat
3. Economizer
4. Filters
5. Blower Motor
6. Reverse Air Flow Switch
7. Clogged Filter Switch
8. High Volt. Barrier, Lamp & Circuit Breaker Mount
9. Main Connection Board with Fan Time Delay and Function Relays
10. Power Venter Motor Assembly (includes Relay and Air Pressure Switch)
11. Ignition Module (not shown-located in burner compartment)
12. Time Delay Freezestat
13. Supply Firestat
14. Duct Thermostat
15. Safety Limit Switch
16. Gas Valve
17. Primary High Limit Switch
18. Transformer
19. Electrical Wiring Inlet
20. High Voltage Terminal Block
21. Door Safety Switch
22. Contactor
23. Centrifugal Blower
24. Damper Motor
25. Outside and Return Dampers
26. Ambient Lockout
27. CO_2 Monitor

Figure 12: Make-up air unit standard blower cabinet, single-duct, with various options shown.

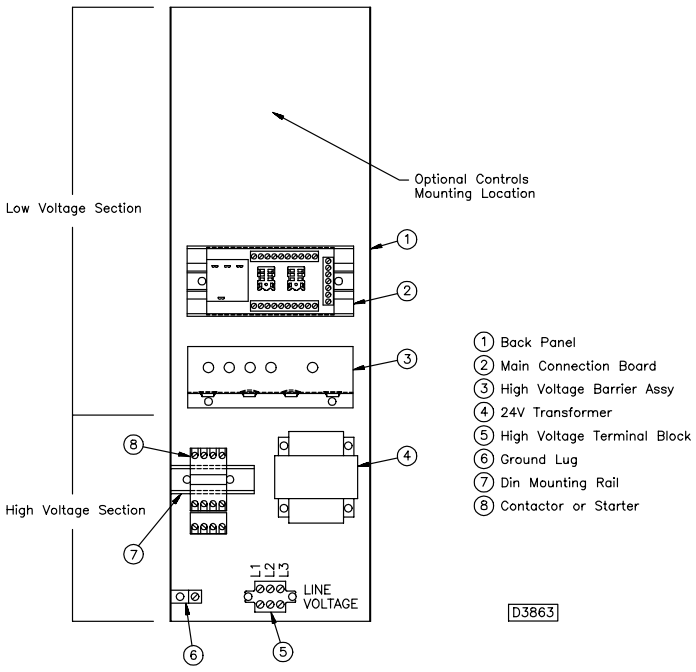


Figure 13: Electrical Cabinet

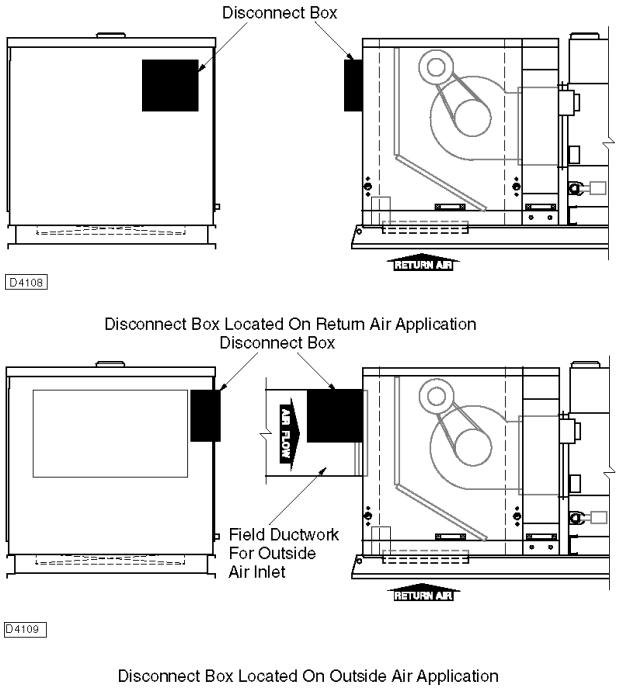


Figure 14: Disconnect Box Locations

Installation

DX Coil Equipped Units *(Optional)*
See Coil Installation/Maintenance Manual for Refrigerant Piping, Liquid and Suction Line Components, Refrigerant Charging and Thermal Expansion Valve Adjustment. Remove coil cabinet access door located next to blower section. Cut holes in fixed door to allow suction and liquid line passage. Provide weatherproof seal around suction and liquid lines at piping plate when installed.

The DX Coil has a 300 ft/min. (1.524 m/s) minimum and a 600 ft/min. (3.048 m/s) maximum velocity through the coil requirement. This is due to prevention of coil icing or condensate blow-off. To calculate the velocity through the coil, apply the following formula:

$$\frac{\text{Cooling Air Flow in CFM (m3/s)}}{\text{Coil Surface Area in ft2 (m2)}}$$

Condensate drain piping must have a P-trap in line immediately downstream of drain pan connection, external to the unit, to prevent possible outside air leakage into unit. The P-trap shall be of sufficient differential to overcome negative pressure of the indoor air blower and help prevent drain pan overflowing. A minimum height difference of 2" (51mm) is required. See Figure 15.

Before unit operation begins, the P-trap must be primed with either water (summer) or glycol (winter).

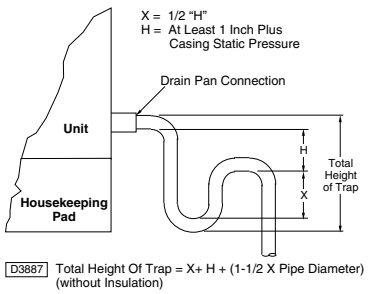


Figure 15: Condensate piping

Chilled Water Coil Equipped Units *(Optional)*
See Coil Installation/Maintenance Manual for General Coil Piping Recommendations. Remove coil cabinet access door, cut holes in door to allow chilled water piping passage. Provide weatherproof seal around chilled water pipes at piping plate when installed.

The Chilled Water Coil has a 600 ft/min (3.048 m/s) maximum velocity through the coil requirement. This is due to prevention of condensate blow-off. To calculate the velocity through the coil apply the following formula:

$$\frac{\text{Cooling Air Flow in CFM (m3/s)}}{\text{Coil Surface Area in ft2 (m2)}}$$

Condensate Drain piping must have a P-trap in line immediately downstream of drain pan connection, external to the unit, to prevent possible outside air leakage into unit. The P-trap shall be of sufficient differential to overcome negative pressure of the indoor air blower. A minimum height difference of 2" is required. See Figure 15. Before unit operation begins, prime P-trap with either water (summer) or glycol (winter).

Evaporative Cooler Equipped Units *(Optional)*
Refer to Evaporative Cooler Installation and Service Manual for water and electrical connections.

Electrical Data

Table E1: Full Load Amperes

Open Drip Proof - Single Speed, 1800 RPM ODP							
HP	115/1/60	208/1/60	230/1/60	208/3/60	230/3/60	460/3/60	575/3/60
0.5	9.8	5.4	4.9	2.2	2.0	1.0	0.8
0.8	13.8	7.6	6.9	3.1	2.8	1.4	1.1
1.0	16.0	8.8	8.0	4.0	3.6	1.8	1.4
1.5	20.0	11.0	10.0	5.7	5.2	2.6	2.1
2.0	24.0	13.2	12.0	7.5	6.8	3.4	2.7
3.0	34.0	18.7	17.0	10.6	9.6	4.8	3.9
5.0	56.0	30.8	28.0	16.7	15.2	7.6	6.1
7.5	-	-	-	24.2	22.0	11.0	9.0
10.0	-	-	-	30.8	28.0	14.0	11.0
15.0	-	-	-	46.2	42.0	21.0	17.0

Table E2: Single Speed Ratings

High Efficiency - Single Speed, 1800 RPM HE					Totally Enclosed Fan Cooled - Single Speed, 1800 RPM TEFC				
HP	208/3/60	230/3/60	460/3/60	575/3/60	HP	208/3/60	230/3/60	460/3/60	575/3/60
1.0	3.6	2.8	1.4	1.1	1.0	3.5	3.6	1.8	1.5
1.5	5.0	3.8	1.9	1.8	1.5	4.8	4.7	2.4	1.9
2.0	6.7	5.4	2.7	2.3	2.0	6.0	5.8	2.9	2.3
3.0	9.2	8.0	4.0	3.2	3.0	9.0	8.8	4.4	3.5
5.0	14.7	12.8	6.4	5.2	5.0	14.0	13.2	6.6	5.3
7.5	22.1	19.2	9.6	7.7	7.5	21.0	20.0	10.0	8.0
10.0	29.0	25.2	12.6	10.1	10.0	28.0	27.0	13.5	10.8
15.0	40.0	36.0	18.0	14.5	15.0	41.0	38.6	19.3	15.4

Table E3: Multi-Speed Ratings

2-Speed/1-Winding, 1800/900 RPM				2-Speed/2-Winding, 1800/1200 RPM			
HP	208/3/60	230/3/60	460/3/60	HP	208/3/60	230/3/60	460/3/60
1.0	3.3/1.5	3.2/1.4	1.6/0.7	1.0	3.4/2.1	3.2/2.0	1.5/1.0
1.5	5.0/2.2	4.8/2.0	2.4/1.0	1.5	5.0/2.6	4.8/2.9	2.3/1.3
2.0	6.5/2.9	6.3/2.6	3.2/1.3	2.0	6.5/3.6	6.3/3.5	3.0/1.7
3.0	9.0/3.4	8.0/3.3	3.8/1.6	3.0	9.3/4.9	8.5/4.6	4.6/2.7
5.0	15.0/6.2	14.0/6.0	6.8/2.8	5.0	14.5/7.3	13.0/7.0	6.5/4.0
7.5	21.0/7.5	19.5/7.5	10.0/4.0	7.5	20.0/11.0	19.0/10.0	10.5/5.5
10.0	29.0/9.6	25.0/9.3	12.0/4.3	10.0	27.0/14.0	25.0/12.5	13.5/7.2
15.0	42.0/18.0	38.0/14.0	18.0/6.0	15.0	45.5/27.5	41.0/23.0	20.5/11.5

Note:
Full Load Current for motors is based upon The National Electrical Code 2002 Article - 430, Tables 148-150
Full Load Current may vary for some motors. Refer to the motor data plate when setting Over Current Protection Devices.
575 Volt, 2-speed motors are special order.

Sequence of Operation

Operation

Separated Combustion Indoor Gas-Fired Duct Furnace
All units are equipped with an intermittent ignition pilot system. The pilot is lit and extinguished each cycle of unit heating operation. See Figure 16.

On natural gas units, the ignitor will continue to spark and pilot gas will continue to flow until the pilot flame is proven.

LP (propane) units are equipped with 100% lockout. The lockout function shuts off the main and pilot gas valves if the pilot gas fails to ignite within 90 seconds of the onset of trial for ignition.

The gas control system operates at 24 VAC and is supplied by a step down transformer found in the electrical cabinet that will match the unit line voltage specified. See Figures 12 through 14 for unit controls location.

Do not use a thermostatic fan control switch when either two-stage firing or modulated gas controls are used.

Burner Components
Intermittent Pilot Ignition

1 Main Burners
2 Burner Manifold
3 Air Shutters
4 Burner Springs
5 Main Burner Orifice
6 Transformer
7 Pilot Tubing
8 a. Main Gas Valve (Honeywell®)
b. Main Gas Valve (White Rogers®)
9 Honeywell Ignitor
10 Honeywell Pilot Burner
11 Honeywell Pilot Orifice
12 Honeywell Electrode/Sensor Lead
13 Combination Johnson® Gas Valve/Ignitor
14 Johnson Pilot Burner
15 Johnson Sensor Probe
16 Johnson Sensor Probe Lead
17 Johnson Electrode Lead
18 Johnson Pilot Orifice

Note: Item #14 and #17 are one assembly. They do not pull apart.

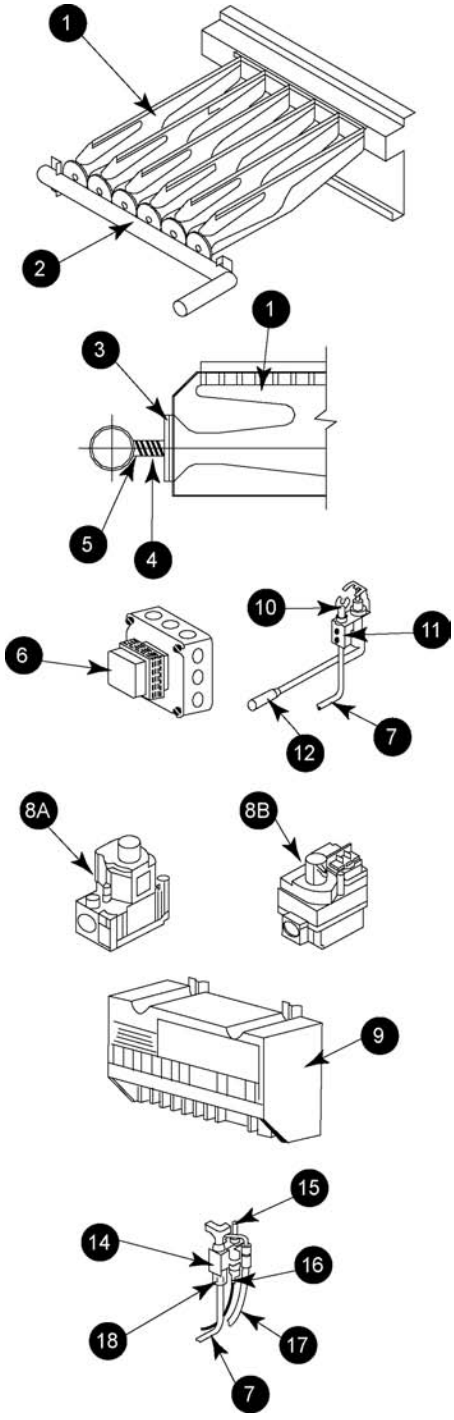


Figure 16: Burner Components

Sequence of Operation

Gas Input Rate

CAUTION!

Equipment Damage!

Never over fire the duct furnace, as this may cause unsatisfactory operation, or shorten the life of the heater.

Check the gas input rate as follows.

1. Turn off all gas appliances that use gas through the same meter as the unit heater.

2. Turn the gas on to the unit heater.

3. Clock the time in seconds required to burn 1 cubic foot of gas by checking the gas meter.

4. Insert the time required to burn one cubic foot of gas into the following formula and compute the input rate.

$$\frac{3600 \text{ (sec. per hr.)} \times \text{BTU/Cu/Ft}}{\text{Time (Sec.)}} = \text{Input Rate}$$

For example, assume the BTU content of one cubic foot of gas is 1000, and that it takes 18 seconds to burn one cubic foot of gas.

$$\frac{3600 \times 1000}{18} = 200{,}000$$

Note: If the computation exceeds, or is less than 95% of the gas BTU/hr. input rating, adjust the gas pressure.

Adjust the gas pressure as follows:

1. Natural Gas: Best results are obtained when the duct furnace is operating at its full rate input with the manifold pressure of 3.5 inches W.C. (0.87 kPa). Adjustment of the pressure regulator is not normally necessary since it is preset at the factory. However, field adjustment may be made as follows:
   a Attach manometer at the pressure tap plug below the control outlet.
   b Remove the regulator adjustment screw cap, located on the combination gas valve.
   c With a small screwdriver, rotate the adjustment screw clockwise to increase pressure.
   d Replace regulator adjustment screw cap.

2. Propane Gas: An exact manifold pressure of 10.0 inches W.C. (2.49 kPa) must be maintained for proper operation of the duct furnace. If the unit is equipped with a pressure regulator on the combination gas valve, follow steps "a" through "d" above. If the unit is not equipped, the propane gas supply system pressure must be regulated to attain this manifold operating pressure.

Table 10: Main Burner Orifice Schedule*

* Input in 1000 BTU	Type of Gas	Natural	Propane	No. of Burner Orifices
	Heating Value	1075 BTU/Ft^3 (40.1 mj/m^3)	2500 BTU/Ft^3 (93.1 mj/m^3)	
	Manifold Pressure	3.5*W.C. (0.9 kPa)	10.5* W.C. (2.6 kPa)	
100	Ft^3/Hr Orifice Drill	96/42	40/54	4
125		120/42	50/54	5
150		140/42	60/54	6
175		163/42	70/54	7
200		186/42	80/54	8
225		210/42	90/54	9
250		233/42	100/54	10
300		280/42	120/54	12
350		326/42	140/54	14
400		372/42	160/54	1 6

*This schedule is for units operating at normal altitudes of 2000 ft. (610m) or less. Special orifices are required for installations above 2000 feet (610m). When installed in Canada, any references to duration at altitudes in excess of 200 feet (610m) are to be ignored. At altitudes of 2000 to 4500 feet (610 to 1372m), the unit heaters must be orificed to 90% of the normal altitude rating, and be so marked in accordance with the C.S.A. certification.

Pilot Adjustment

1. Remove the **pilot adjustment cap**.

2. Adjust the pilot screw to provide a properly sized flame.

3. A proper flame is a soft, steady flame that envelops 3/8 to 1/2 inch (9.5 to 12.7 mm) of the sensor probe.

4. Replace the pilot adjustment cap.

Manifold Pressure Adjustment

If the manifold pressure requires adjustment, remove the cap from the pressure regulator and turn the adjustment screw clockwise to increase the pressure, and counterclockwise to decrease the pressure. The adjusted manifold pressure should not vary more than 10% from the pressures specified in Table 10.

Sequence of Operation

CAUTION!

Equipment Damage!

Never operate the unit beyond the specified limits or severe damage to, or premature failure to the unit will occur.

Explanation of Controls

1. Each Separated Combustion Duct Furnace comes equipped with a power vent system that consists of a power vent motor and blower, pressure switch, and sealed flue collector.

CAUTION!

Equipment Damage!

The addition of external draft hoods or power vents are not permitted. Addition of such devices may cause serious unit malfunction or failure.

2. The power vent is energized by the room thermostat when a demand for heat is sensed. The pressure switch measures the differential pressure between the air inlet and the exhaust vent systems. If the differential is correct, the indirect spark ignition system is energized.

⚠ WARNING!

Personal Injury!

Never fire the unit if the power vent is inoperable. Failure to follow proper start-up sequence could result in death or serious injury.

3. The indirect spark ignition system consist of an ignition module, a dual combination gas valve, and a spark-ignited pilot burner. When the pressure switch is closed, the pilot valve opens as a spark is generated to light the pilot. When the flame is sensed by the flame sensing circuit, the spark ceases, and the main gas valve opens to supply gas to the main burners. Once the thermostat is satisfied, the vent system and gas valve are simultaneously de-energized, stopping all gas flow to the unit.

4. The high limit switch interrupts the flow of electrical current to the main gas valve if the duct furnace becomes overheated.

5. The optional fan switch delays the operation of the fan for 60 to 90 seconds once the thermostat is closed, and continues fan operation for 60 to 90 seconds after the thermostat opens. The start-up fan delay must not exceed 90-seconds from a cold start.

6. The wall thermostat, supplied optionally, is a temperature sensitive switch that operates the vent and ignition systems to control the temperature of the space being heated.

Note: The thermostat must be mounted on a vertical, vibration-free surface, free from air currents, and in accordance with the furnished instructions.

Initial Lighting

1. Open the manual gas valve, in the gas supply line to the duct furnace. Loosen the union in the gas supply line to purge it of air. Tighten the union, and check for leaks.

⚠ WARNING

Hazardous Gases and Flammable Vapors!

-Never use an open flame to detect gas leaks. Explosive conditions may exist which will result in death or personal injury.
-Check all pipe joints for leakage using a soap solution or other approved method.

2. Turn on electrical power. The duct furnace should now be under the control of the thermostat. Set the thermostat to it's highest setting, the power vent motor should start and the burner ignition occur. Turn the thermostat to the lowest setting. The burners and power vent should stop operating immediately. Reset the thermostat to the desired operational setting.

Primary Air Shutter Adjustment

3. After the unit has been operating for a minimum of 15-minutes, adjust the primary air flow to the burners. Turn the friction-locked, manually-rotate air shutters clockwise to close, and the counterclockwise to open.

4. For correct air adjustment, close the shutter until yellow tips in the flame appear. Open the air shutter to the point just beyond where the yellow tipping disappears, Figure 16.

Note: A momentary and spasmodic orange flash in the flame may occur. This is caused by the burning of airborne dust particles, and should not be confused with yellow tipping, which is a stable, or permanent situation when there is insufficient primary air.

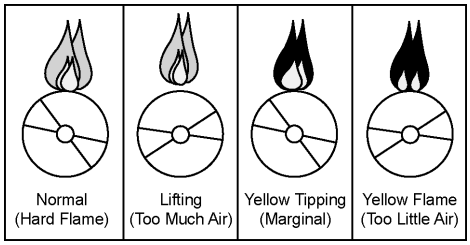


Figure 16: Main burner flames

Shut Down

1. Turn the valve selector knob to the OFF position.

2. Turn off the electricity.

3. To relight, follow "initial lighting" instructions.

Sequence of Operation

Gas Control System
The standard unit comes equipped for single stage operation. Unit heating operation is accomplished at full input.

Each duct furnace is equipped with an individual ignition control system which consists of the following components: ignition control module, gas valve and pilot burner.

The **ignition control module** is the heart of the ignition control system. This control initiates all gas flow, provides means to light the pilot burner, proves and monitors the pilot burner operation.

The **gas valve** consists of two operators which provide gas to the pilot and main burners. Both operators are energized and de-energized by the ignition control module each heating cycle.

The **pilot burner** includes an ignitor and flame sense probe. The ignitor provides the spark, originating at the ignition control module, to light the pilot. The ignition control module proves and monitors the pilot flame through the flame sensing probe.

Sequence of Operation
All units follow the same basic sequence of operation and is as follows:

1. Thermostat calls for heat. Drafter relay energizes drafter with call for heat.

2. Pressure switch closes circuit to ignition control module.

3. Ignition control module energizes pilot operator of gas valve and initiates spark at ignitor of the pilot burner.

4. Pilot burner ignition is proven to the ignition control by the flame sense probe and sparking of the ignitor is discontinued.

5. Once pilot burner operation is proven, the ignition control module energizes the main burner operator of the gas valve, allowing gas flow to the main burners.

6. Approximately 60 seconds after the main burners light, the fan time delay initiates fan operation.

7. Thermostat is satisfied and call for heat is removed. Drafter relay de-energizes drafter with removal of call for heat.

8. Ignition control module de-energizes pilot and main burner operators of the gas valve, ceasing all gas flow.

9. Approximately two minutes after satisfying the thermostat, fan operation ceases.

***Optional* Gas Controls**
These units are available with optional gas controls which will give either multi-stage or modulating operation. The sequence of operation of those units equipped with these optional gas controls differs only at what rate each duct furnace's main burners ignite and operate at, or the order of duct furnace firing for those units equipped with two or three duct furnaces.

Two Stage Units: Two stages of heating; first stage is 50% of full rate, second stage is 100% of full rate. Main burner ignition is at first stage only.

Three Stage Units: Dual duct furnace models: First furnace is equipped with two stage heating; second furnace is equipped with single stage heating but fired independently, giving three stages of heating.

Triple duct furnace models: Each duct furnace is equipped with single stage heating but fired independently, giving three stages. Each stage is 33% of the unit's full input rate. Duct furnace one will always light first and disengage last.

Four Stage Units: Dual duct furnace models only. Each duct furnace is equipped with two stage heating but fired independently, giving four stages. Each stage is 25% of the units full input rate. Duct furnace one will always light first and disengage last.

Six Stage Units: Triple duct furnace models only. Each duct furnace is equipped with two stage heating but fired independently giving six stages. Each stage is 16.5% of the units full input rate. Duct furnace one will always light first and disengage last.

Electronic Modulation Units:
These units are equipped with an electronic modulating control which provides unit firing capabilities of 40 to 100% of the units full input rate. This control is found in the gas train downstream of the gas valve and allows main burner ignition only at the maximum rate. A thermostat with remote setpoint adjustment modulates the gas input.

Multi-Stage w/Electronic Modulation Units: These dual and triple duct furnace models are equipped with an electronic modulating control on duct furnace one and single or two stage heating on each successive duct furnace. Furnace one (modulated) will fire first and disengage last. Additional stages of heat will engage after furnace one has fired at maximum modulation capability for the duration of the delay setting. The amount of modulation and each stage size depends upon unit size and the number of stages. See Table 12.

Table 12: Modulation/Stage sizing

Unit Config.		% of Gas Input to Unit		
No. of Stages	No. of Furnaces	Stage Size (% of full input)	Modulation Capabilities	Turndown
2	1	50	40-100	2.5 to 1
	2	50	20-100	5 to 1
3	3	33	13.3-100	7.5 to 1
4	2	25	20-100	5 to 1
6	3	16.5	13.3-100	7.5 to 1

Start-Up Procedure

System Start-Up
Before starting the unit, use the "Installation Check Sheet" (located on page 40) and read the Separated Combustion Indoor Duct Furnace Manual entirely in conjunction with the procedures outlined below to ensure that the unit is completely and properly installed and ready for start up.

⚠ WARNING

Personal Hazards!

It is the installer's responsibility to check all safety controls! Check and test the operational functions of all safety devices supplied with this unit. Failure to do so could result in unsafe conditions and could result in death, serious injury or property damage.

1.Inspect all wiring connections; connections should be clean and tight. Trace circuits to insure that actual wiring agrees with the "as wired" diagrams provided with the unit. Information in the wiring diagram title block should match the data appearing on the unit nameplate.

2.Lubricate all electrical motors according to the manufacturer's recommendations.

3.Verify that the system switch is in the OFF position.

4.Check unit supply voltage to ensure that it is within the utilization range.

5.Inspect the interior of the unit; remove any debris or tools which may be present.

⚠ WARNING

Hazardous Service Procedures!

The maintenance and trouble shooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Starting Unit in Heating Mode
1.Close the unit disconnect switch which provides power to the unit.

2.Set the thermostat/switching sub base as indicated below: a. position the heating system switch at either HEAT or AUTO; b. set the fan switch to AUTO.

3.Place the system switch in the ON position. With the thermostat calling for heat, unit operation is automatic.

Starting Unit in Cooling Mode
1.Close the unit disconnect switch which provides power to the unit.

2.Set the thermostat/switching sub base as indicated below: a. position the cooling system switch at either COOL or AUTO; b. set the fan switch to AUTO.

3.Place the system switch in the ON position.

With the thermostat calling for cooling, unit operation is automatic.

Final Checkout
Run the unit sequentially through its stages of heating and cooling. Once proper unit operation is verified, perform these final steps:

1.Inspect unit for debris and/or misplaced tools and hardware.

2.Be sure all gas valves and controls are in the operating position if the unit will be operating immediately.

3.Cycle unit on all safety controls to verify proper unit operation.

4.Confirm proper operating control (thermostat or ductstat) operation by cycling unit.

5.Secure all exterior panels in place.

6. Deliver a completed start-up checklist to contractor/customer for turnover and maintenance records.

Start-Up Checklist

Customer _____ Job Name & Number _____

PRE-INSPECTION INFORMATION

With power and gas off.

Type of Equip: Unit Heater Duct Furnace Indoor
Serial Number_____ Model Number _____
Name Plate Voltage:_____Name Plate Amperage:_____
Type of Gas: Natural LP Tank Capacity _____ lbs. Rating: _____ BTU @ ____ °F
_____ kg _____ kW @ ____ °C

- ☐ Are all panels, doors, vent caps in place?
- ☐ Has the unit suffered any external damage? Damage _____
- ☐ Does the gas piping and electric wiring appear to be installed in a professional manner?
- ☐ Has the gas and electric been inspected by the local authority having jurisdiction?
- ☐ Is the gas supply properly sized for the equipment?
- ☐ Were the installation instructions followed when the equipment was installed?
- ☐ Have all field installed controls been installed?
- ☐ Do you understand all the controls on this equipment? (If not, contact your local Trane service rep.)

(DO NOT START this equipment unless you fully understand the controls.)

GENERAL

With power and gas off.

- ☐ Make certain all packing has been removed.
- ☐ Tighten all electrical terminals and connections.
- ☐ Check damper linkages for tightness.
- ☐ Check all fans & blowers for free movement.
- ☐ Check all controls for proper settings.
- ☐ Check all set screws on blowers and bearings.
- ☐ Check belt tightness.

BLOWER

With power on and gas off.

- ☐ Check voltage L1 _____ L2 _____ L3 _____
- ☐ Check rotation of main blower.
- ☐ Check motor amps L1 _____ L2 _____ L3 _____
- ☐ Blower RPM _____
- ☐ Check air filters. (Record quantity & size.)

GAS HEATING

With power and gas on.

- ☐ Inlet gas pressure. ____ in. W.C. or ____ kPa
- ☐ Pilot & main burner ignition.
- ☐ Manifold gas pressure.____ in. W.C. or ____ kPa
- ☐ Cycle on HIGH LIMIT.
- ☐ Cycle firestat and/or freezestat.
- ☐ Check electronic modulation. Set at: _____
- ☐ Check mechanical modulation. Set at: _____
- ☐ Cycle and check all other controls not listed.
- ☐ Check operation of remote panel.
- ☐ Entering air temp. _____ °F or ____ °C
- ☐ Discharge air temp. (high fire) ____ °F. or ____ °C
- ☐ External static pressure ____ in. W.C. or ____ kPa
- ☐ Cycle by thermostat or operating control.

Note: It is recommended that start-up checklist and TB reports are gathered into customer, contractor, service provider and maintenance records.

Adjustment Section

Air Handling Requirements and Adjustments

CAUTION

Equipment Damage!

Remove wooden shipping support from beneath blower housing of Blower Section (if applicable) to prevent possible unit damage or improper unit operation.

Static Pressure through the unit should never exceed 2.0" W.C. (0.50 kPa). Units operate at a temperature rise range of 20 to 90°F (11 to 50°C).

Note: It is important that the final temperature leaving the unit does not exceed 160° F (71°C). When final air throughput adjustments are being made, a check of the discharge air temperature should be made after unit has operated for 15 to 20 minutes.

⚠ WARNING!

Fire Potential!

Failure to prevent continuous cycling on the primary limit could result in death or serious injury or severe unit or property damage due to fire.

Note: At initial unit installation, unit should be started momentarily to confirm proper blower wheel rotation as the unit will deliver some air with the blower wheel running backwards. Two basic air control systems can be used to deliver conditioned air to the occupied space: intermittent or constant fan operation.

Intermittent Fan Operation: The unit employs an air control system which utilizes a fan time delay relay to operate the fan while in the heating mode. If equipped with cooling, the thermostat controls the fan through a relay when in the cooling mode. Refer to unit wiring diagram.

Constant Fan Operation: The unit can be wired to give an air control system which constantly circulates air through the unit and occupied space with constant fan operation. Refer to unit wiring diagram.

⚠ WARNING!

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Note: Check blower belt tension. Proper belt tension is important to the long life of the belt and motor. Proper belt tension will allow the belt to be depressed 1/2" to 3/4".

It is important that the blower motor and the blower wheel pulleys be in good alignment, with the motor and blower shafts parallel.

Belt tension must be adjusted to give approximately 3/4" deflection of the belt when finger pressure is applied to the middle of the belt. See Figure 13. Small changes in this tension may be necessary for optimum operation. Belts will stretch over a period of time, requiring an adjustment to this tension. See MAINTENANCE section for belt and pulley adjustments.

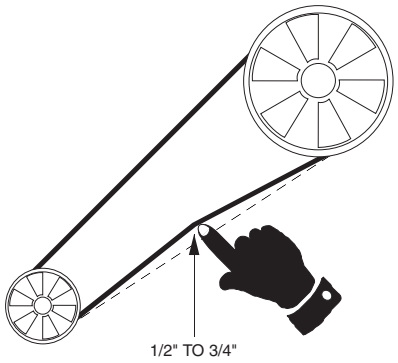


Figure 17

These units are set at the factory for the RPM required to meet the air volume (CFM) and external static pressure ordered. If the estimated external static is incorrect, or changes were made to the duct system, the blower RPM may need to be changed.

Both the Standard and High CFM Blowers use motors which are equipped with adjustable pitch pulleys. After removing belt(s), loosen the pulley set screw and remove the key, turn adjustable half of a pulley clockwise to increase RPM, or counterclockwise to decrease RPM. Insert key, tighten set screw and replace belt(s). Adjust belt tension to give 1/2" to 3/4" belt play when depressed.

Adjustment Section

CAUTION

Equipment Damage!

Blower motor full load amps should never be exceeded. Improper unit operation or motor failure could result.

After changing blower RPM, confirm blower motor full load amps have not been exceeded. See motor data plate for maximum full load amps.

Lighting
Refer to Indoor Duct Furnace Manual for all heating functions - general comments are as follows.

Purge the gas line to the unit of air before attempting to light the pilot. Check for gas leaks.

⚠ WARNING

Hazardous Explosion!

Never use an open flame to detect gas leaks. Explosive conditions may occur. Use a leak test solution or other approved methods for leak testing. Failure to follow recommended safe leak test procedures could result in death or serious injury or equipment or property-only-damage.

This unit is equipped with an intermittent ignition system. A lighting instruction label is attached to the unit. To set the intermittent ignition system into operation, proceed as follows:

1. Turn on the gas valve(s) main manual valve.

2. Turn on electrical power. The unit is now under thermostat control.

3. Set thermostat to highest level. This will initiate the sequence of operation detailed in the Gas Control System section. Check main burners for operation.

4. Set thermostat to lowest level. This will interrupt power to the ignition control and shut off gas. Confirm pilot and main burners have been extinguished.

5. Set the thermostat to the desired setting.

For complete unit shutdown, proceed as follows:

1. Turn off the gas valve(s) main manual valve.

2. Set thermostat to lowest setting.

3. Shut off all electric power.

Gas Input Adjustment
When shipped from the factory, all units are equipped for the average heat content of the gas which is stamped on the unit rating plate.

CAUTION

Equipment Damage!

Since the heat content of gas varies by locality, the input must be checked after installation of the unit. If the unit is over-fired it will shorten the life of the heat exchanger. Never exceed the input on the rating plate.

For an accurate input rate measurement, the following meter method should be used to determine unit input rate. If the meter method is not possible, a manifold pressure check should be made.

Meter Method of Checking Input Rate
1. Obtain the heating value of the gas from the local utility or gas dealer. This should be in units of Btu/ft3 (MJ/m3).

2. Determine the gas flow rate as shown in the following example. EXAMPLE: Assume this unit has a input rate of 250,000 Btu/hr (73.2kW) and the heating value of the gas is 1000 Btu/ft3 (37.3 MJ/m3).

$$\text{Gas Flow Rate} = \frac{250{,}000 \text{ Btu/hr}}{1000 \text{ Btu/ft3} \quad 60 \text{ min/hr}}$$

$$= 4.17 \text{ ft3/min}$$

3. Before determining the gas flow rate to the unit, all other gas appliances connected to the same meter must be turned off.

4. Fire unit according to instructions.

5. After approximately 15 minutes of unit operation, determine volume of gas used in five minutes of unit operation. For the Example above the unit should use 4.17 ft3/min x 5 min or 20.8 ft3 (1.97 L/s x 5 min x 60 s/min = 591L) of gas. Minor input adjustments can be made by removing pressure regulator cap and turning regulator clockwise to increase input or counter clockwise to decrease input. Any appreciable adjustment in input rate should be made by reorificing the gas train.

Adjustment Section

Method to Check Manifold Pressure

1. Close the manual valve of unit gas valve.

2. Install a 1/8" pipe connection in the tapped hole provided in the gas valve body near outlet of the valve.

3. Attach manometer to 1/8" pipe connection by means of a rubber hose.

4. Fire unit according to instructions and observe the pressure and confirm it matches the unit manifold pressure from the unit rating plate.

5. Small variations in the manifold pressure can be made by means of the gas valve pressure regulator. Remove pressure regulator cap and turn regulator clockwise to increase pressure or counter-clockwise to decrease pressure.

Pilot Adjustment

⚠ WARNING!

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

1. Disconnect wire from terminal marked MV at gas valve.

2. Provide call for heat.

3. Pilot adjustment is found on the gas valve. Remove pilot adjustment cap.

4. Adjust the pilot screw to provide properly sized flame.

5. A proper pilot burner flame is a soft steady flame that envelopes 3/8 to 1/2 inch (9.5 to 12.7mm) of the flame sense probe tip.

6. Replace the pilot adjustment cap.

7. Reconnect wire to terminal MV.

Primary Air Shutter Adjustment

After the unit has been in operation for at least 15 minutes, adjust the primary air flow to the burners. Turn the friction-locked manually rotated air shutters clockwise to close, counter clockwise to open. For correct air adjustment, close the air shutter until yellow tips in the flame appear. Then open the air shutter to the point just beyond the position where yellow tipping disappears.

Controls

Primary Limit Control: The primary limit control is a factory installed component surface mounted in the inlet airstream at the end of the heat exchanger. When the temperature reaches the limit setpoint, normally caused by insufficient air throughput, all gas is shutoff. The limit control has an automatic reset and once the unit has cooled, it will reset itself. This is a safety control and if cycling on the primary limit is noted, corrective action must be taken. See unit wiring diagram for electrical location. This control must never be bypassed. Upon completion of unit installation, the primary limit must be checked for proper operation. This can be accomplished by removing power to the indoor air blower and a call for heat.

Clogged Filter Switch *Optional:* The clogged filter switch monitors the pressure differential across the air filters. If this pressure differential becomes too great, the switch will alert of this condition. At this point the air filters must either be cleaned or replaced. The switch will reset itself.

Firestat *Optional:* Located in either the return airstream, the supply airstream, or both, this control monitors temperatures with setpoints which are field adjustable. If the temperature exceeds the setpoint, the control will cease unit operation. To resume unit operation, a manual reset of this control is required.

Freezestat *Optional:* Located in either the return airstream, the supply airstream, or both, this control monitors temperatures with setpoints which are field adjustable. If the temperature does not exceed the setpoint, the control will cease unit operation.

Ambient Lockout *Optional:* Field adjustable setpoints, this control (one per successive furnace on multi-furnace models) ensures each successive furnace is energized only after previous furnace is at full capacity.

Maintenance

⚠ WARNING
Hazardous Service Procedures!

The maintenance and trouble shooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

⚠ WARNING
Personal Hazards!

It is the service technician's responsibility to check all safety controls! Check and test the operational functions of all safety devices supplied with this unit. Failure to do so could result in unsafe conditions and could result in death, serious injury or property damage.

⚠ WARNING
Unit Mounting Integrity!

Inspect the suspension and/or support system for the make-up air unit to ensure that all fasteners are tight and the unit is secure before working underneath the unit. Failure to do so could result in death, personal injury, or property damage.

These units have been developed for indoor installation. Maintenance is required and it is suggested that the following unit servicing and inspections be performed routinely. Also read in entirety and refer to the Separated Combustion Indoor Duct Furnace Manual for maintenance requirements.

Inspect area near unit to be sure that there is no combustible material located within the minimum clearance requirements. See Figure 7. Service panels provide easy access to the blower compartment and the electrical cabinet. To remove the service door from any of these compartments, refer to access panel removal section in beginning of this manual.

⚠ WARNING
Hazard of Explosion and Deadly Gases!

Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids. Failure to follow all proper safe refrigerant handling practices could result in death or serious injury.

1. Follow instructions on pages 44 and 45 of maintenance section for servicing the furnace section of the make-up air unit.

2. Inspect and service the blower section of the system.

3. Inspect and check the operational functions of all safety devices equipped with your unit to ensure that all devices are performing adequately.

High Limit And/Or Safety Limit Maintenance

Single furnace units are equipped with a primary high limit on the upstream side of the heat exchanger and a secondary high limit on the downstream side of the heat exchanger. Multiple furnace units are equipped with a primary high limit on each furnace section and a secondary high limit on the downstream unit. The primary high limit is a disk type switch while the secondary high limit is a capillary switch. To service or replace high limit or safety limit:

1. Turn off the manual gas valve and electrical power to the MS unit.

2. To access the high limits, remove the four screws from the top of the raceway on each furnace section and swing the raceway down. The primary limit can be removed by removing the two screws holding the high limit bracket to the heat exchanger and removing the bracket and limit assembly from the heat exchanger. Note location of and remove wires from limit switch, then remove push nuts and springs holding limit switch to bracket. Re-assemble in reverse order making sure that parts are assembled so that spring pressure holds limit switch securely against bottom header plate of heat exchanger.

Maintenance

3. To remove the secondary high limit, remove the wires from the limit switch, remove the screws and stand-off sleeves holding the limit switch body to the mounting plate. Do not remove the screws holding the mounting plate to the heat exchanger. Slowly pull the switch and capillary assembly out of the retaining tube, taking care to prevent kinking the capillary tube. Reassemble in reverse order, carefully pushing the capillary tube into the retaining tube to prevent kinking the capillary tube.
4. Complete appropriate start-up procedure as given in the "Start-Up" section of this manual.

5. Check Burner Adjustment.

6. Check gas control valves and pipe connection for leaks.

7. Check operation of auto gas valve.

8. Check operation of safety devices.

9. Inspect and service blower section of system.

Seasonal Maintenance
The unit should be thoroughly checked before the start and at the end of each heating and cooling season.

A. Motors and belts should be inspected.

B. Tighten belts if loose.

C. Check and clean DX or Chilled Water coil twice yearly, if unit is so equipped per manufacturer's service manual. Chilled Water coil must be winterized at beginning of heating season (i.e. drain water from coil per manufacturer's instructions).

D. Check air throughput at beginning of heating season to confirm unit operation is within the specified temperature rise range.

E. At beginning of heating season clear Condensate Drain Pan and P-trap of water if unit is equipped with DX or Chilled water coil. Clean out drain pan and fill P-trap with a non-toxic glycol solution.

F. Evaporative cooler must be cleaned and maintained per manufacturer's instruction frequently during the operating season.

G. Inspect Control Dampers during periodic maintenance. Damper pivot points should be cleaned to ensure free damper operation.

H. Blower wheels should be checked periodically for dirt build-up on blades. Clean as required.

Filters
The filter section has been designed to incorporate (as standard) one-inch washable filters. Other optional filter types are also available: 2" washable throwaways; or 1" or 2" hi-efficiency 30% pleated filters. See Table 10.

Table 13: Filter Sizes

Standard CFM Blower Air Filter Size Requirements

Unit Input	Number of Filters	
	16" x 20"	20" x 20"
100 MBH (29.3 kW)	4	
150 MBH (44.0 kW)	4	
200 MBH (58.6 kW)		4
250 MBH (73.2 kW)		4
300 MBH (87.9 kW)	4	2
350 MBH (102.6 kW)	4	2
400 MBH (117.2 kW)		6
500 MBH (146.5 kW)		4
600 MBH (175.8 kW)	4	2
700 MBH (205.1 kW)	4	2
800 MBH (234.4 kW)		6

High CFM Blower Air Filter Size Requirements

Unit Input	Number of Filters	
	16" x 20"	20" x 20"
100 MBH (29.3 kW)	8	
150 MBH (44.0 kW)	8	
200 MBH (58.6 kW)		8
250 MBH (73.2 kW)		8
300 MBH (87.9 kW)	8	4
350 MBH (102.6 kW)	8	4
400 MBH (117.2 kW)		12
500 MBH (146.5 kW)		8
600 MBH (175.8 kW)	8	4
700 MBH (205.1 kW)	8	4
800 MBH (234.4 kW)		12
1200 MBH (351.6 kW)		12

It is recommended that air filters be changed or cleaned at least four times a year. More frequent attention to filters is required if the air being handled by the unit is unusually dirty. Air flow reduction, caused by the dirty air filters, will increase the discharge air temperature and may cause unit cycling on the primary limit.

Filters (by others) should be serviced regularly and changed or washed when necessary to maintain the required air throughput. In a dusty environment, filters may clog up in less than one month.

Maintenance

Periodic Furnace Maintenance

⚠ WARNING
Hazardous Voltage w/Capacitors!
Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Should maintenance of the furnace be required, perform the following inspection and service routine.

⚠ WARNING!
Combustible Materials!
Maintain proper clearance between the unit heat exchanger, vent surfaces and combustible materials. Refer to unit nameplate and installation instructions for proper clearances. Improper clearances could result in a fire hazard. Failure to maintain proper clearances could result in death or serious injury or property damage.

1 Inspect the area near the unit to help ensure there is no combustible material located within the minimum clearance requirements, Table 14.

Table 14: Minimum Clearances

Sides	6" (152mm)
Top	6" (152mm)
Bottom	24" (610mm)
Flue	6" (152mm)

2 Turn off the manual gas valve and electrical power to the duct furnace.

3 To clean or replace the main burners, open the bottom panel and compress the spring by moving the burner toward the manifold. Slide the opposite end of the burner downward from the locating slot while the retaining spring is still compressed. Pull the burners away from the heater.

4 With the burners removed, wire brush the inside surfaces of the heat exchanger.

5 Remove dirt, dust, or other foreign matter from the burners using a wire brush and/or compressed air. Ensure that all parts are unobstructed. Inspect and clean the pilot burner if necessary.

6 Reassemble the gas duct furnace by replacing all parts in reverse order.

7 Light the pilot (see lighting instructions on the unit nameplate). Complete the appropriate unit start-up procedure found in this manual.

8 Check the burner adjustment. See Primary Air Shutter Adjustment (page 43) in this manual.

9 Check all gas control valves and pipe connections for leaks.

10 Check the operation of the automatic gas valve by lowering the setting of the thermostat, and stopping the operation of the gas duct furnace. The gas valve should close tightly, completely extinguishing the flame on the main burners.

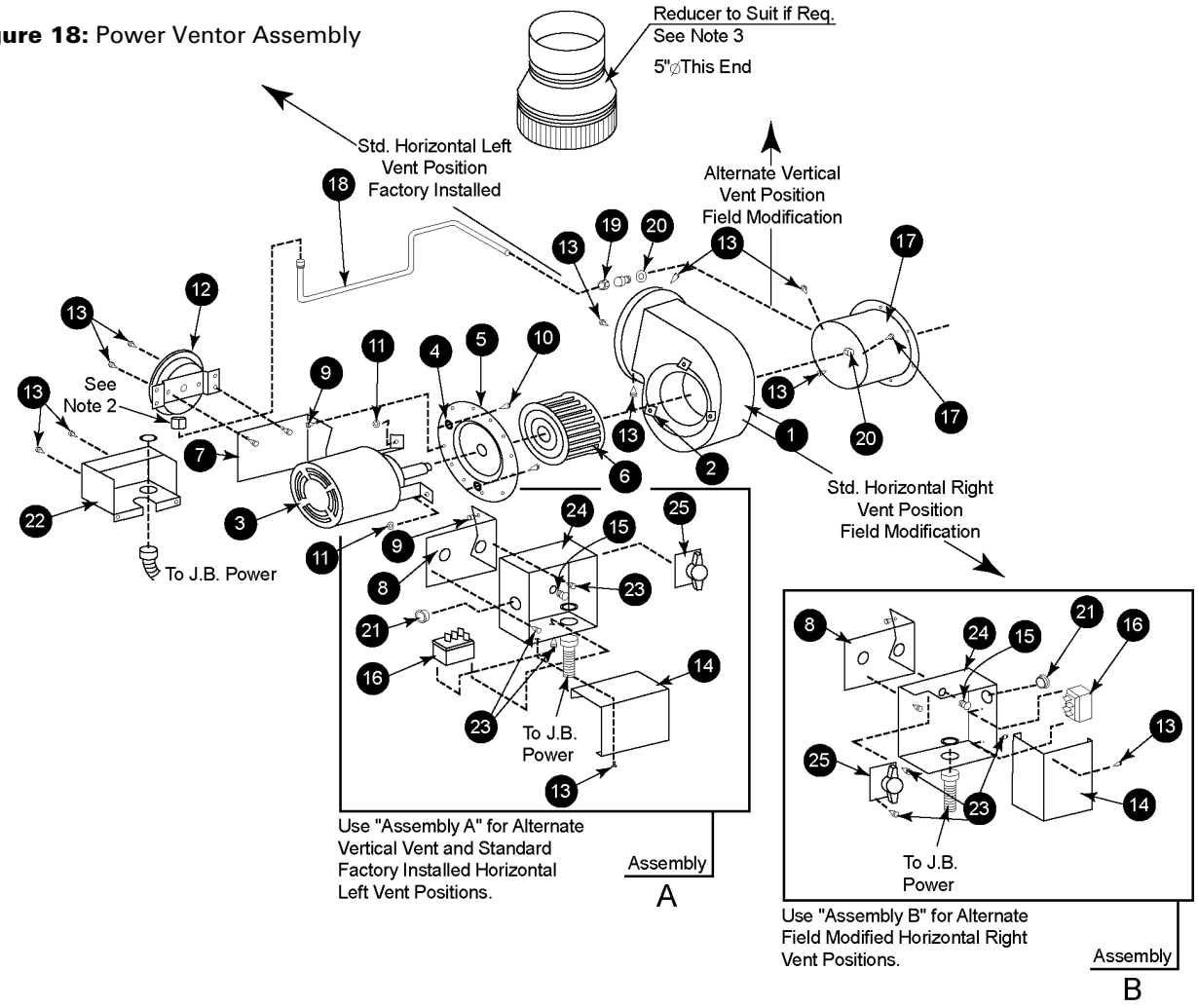
11 Check the operation of the pilot safety device by closing the pilot line valve, extinguishing the pilot flame. Within one minute, the automatic gas valve should close, extinguishing the flame on the main burners.

12 Inspect and service the blower section of the system.

13 Check and test the operational functions of all safety devices supplied with your unit.

Maintenance

Figure 18: Power Ventor Assembly



Ref. No.	Description
1	Blower Housing Assembly
2	Speed Nut
3	Motor
4	Washer (plain)
5	Plate Adapter
6	Blower Wheel
7	Mounting Bracket (pressure switch)
8	Mounting Bracket (junction box)
9	Screw, S.T.
10	Screw, Machine (L = 3/4")
11	Nut, Keps (Ext. lock washer)
12	Air Pressure Switch*
13	Drill Screw

Ref. No.	Description
14	Junction Box Cover
15	Snap Bushing
16	Relay (motor)
17	Draftor Stack Assembly
18	Tubing (aluminum) Formation
19	Male Connector
20	Locknut
21	Hole Plug
22	Pressure Switch Cover
23	Drill Screw
24	Junction Box Base
25	Relay (purge)

Notes:

*1 For item No. 6, use counter-clockwise rotation.

2 Do not overtighten Celcon™ nut. Hand tighten ONLY. Do not use tools to tighten. *Approximately 1/3 turn maximum or 8-inch pounds is sufficient from the point where the tube does not slip in or out.*

3 Flue sizes:

Unit	Flue Outlet Dia.
100/175	4" - Reducer required and supplied by installer.
200/250	5" - No adaptor required.
300/400	6" - Increase required and supplied by manufacturer.

Exception: The CSA requires manufacturer to supply Canadian units with flue reducers or increasers.

Maintenance

Air Blower
Belt Tension Adjustment Standard CFM Blower belt tension can be adjusted by loosening motor mounting bolts marked A. See Figure 19. To tighten belt, slide motor down motor mounting bracket and re-fasten motor to mounting bracket.

High CFM Blower belt(s) tension can be adjusted by first loosening motor mounting plate bolts marked A. See Figure 19. To tighten belt tension, turn belt tension adjustment screws marked B (Figure 19) counter-clockwise. To loosen belt tension, turn clockwise. Once belt tension has been adjusted, re-fasten motor mounting plate bolts.

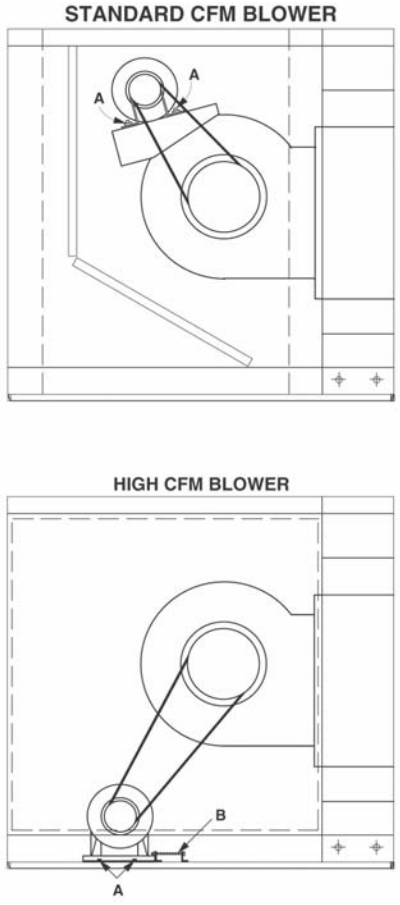


Figure 19: Tightening loose belts

Blower RPM Adjustment
To adjust blower RPM:
1. Loosen and remove belt(s).

2. Match driver pulley to one found in Figure 20.

3. Loosen set screw(s) marked A.

4. If driver pulley is equipped with external key, marked B, remove.

5. Adjust driver pulley pitch diameter for desired speed by opening (slower) or closing (faster) moving parts by half or full turns. Do not open sheave past point where flange projects past the hub end.

6. If driver pulley is equipped with external key, marked B, replace.

7. Tighten set screw(s) marked A.

8. Replace and retention belt(s).

9. Realign drive if necessary.

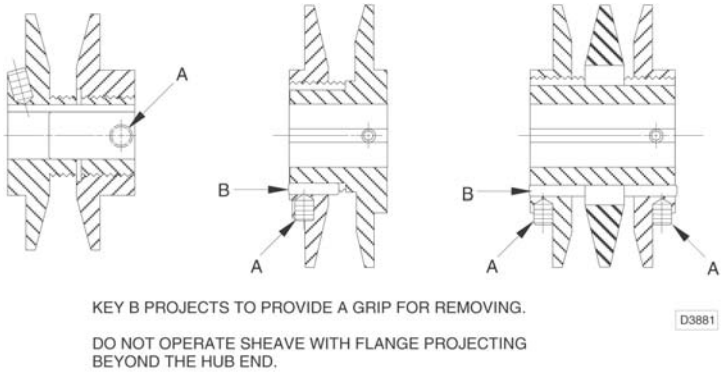


Figure 20: Driver Pulley

Trouble Shooting

For trouble shooting of the duct furnace, refer to the Separated Combustion Indoor Gas-Fired Duct Furnace Installation and Service Manual. For Evaporative Cooler/Cooling Coil equipped units, refer to these specific manuals for additional trouble shooting guides.

For additional trouble shooting, see following Trouble Shooting Guide

⚠ WARNING

Hazardous Service Procedures!

The maintenance and trouble shooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Trouble Shooting Guide for Air Blower

Problem	Probable Cause	Solution
1. Noise	Blower Wheel Hitting Scroll Side	a. Blower wheel not centered in blower housing. b. Damaged blower housing. c. Damaged blower wheel. d. Shaft loose in blower bearing. e. Blower Wheel loose on shaft. f. Blower bearing loose in bearing support.
	Blower Wheel HItting Cutoff	a. Cutoff not secure in blower housing. b. Cutoff damaged. c. Cutoff improperly positioned.
	Drive	a. Pulley not tight on shaft (motor and /or blower wheel). b. Belts too loose. Adjust for belt stretching after 48 hours of operation. c. Belts too tight. d. Belts wrong cross section. e. Belts not matched in length on multi-belt drive. f. Variable pitch pulleys not adjusted so each pulley has same pitch diameter (multi-belt drives). g. Misaligned pulleys. h. Belts worn. i. Motor or motor base loose. j. Belts oily or dirty. k. Improper drive selection.
	Bearing	a. Defective bearing. b. Needs lubrication. c. Loose on bearing support. d. Loose on shaft. e. Seals misaligned. f. Foreign material in bearing. g. Worn bearing. h. Fretting corrosion between inner race and shaft.
	Shaft Seal Squeal	a. Needs lubrication. b. Misaligned.
	Blower Wheel	a. Loose on shaft. b. Defective blower wheel. Do not run the blower. Contact manufacturer. c. Unbalanced. d. Worn as a result of contact with abrasive or corrosive material.
	Housing	a. Foreign material in housing. b. Cutoff or other part loose (rattling during operation).

Trouble Shooting

Trouble Shooting Guide for Air Blower		
Problem	**Probable Cause**	**Solution**
1. Noise	Electrical	a. Lead-in cable not secure. b. AC hum in motor or relay. c. Starting relay chatter. d. Noisy motor bearings. e. Single phasing a 3-phase motor.
	Shaft	a. Bent. b. Undersized. May cause noise at the blower wheel, bearings or pulley. c. If more than two bearings are on a shaft, they must be properly aligned.
	High Air Velocity	a. Duct work too small for application. b. Blower selection too small for application. c. Registers or grilles too small for application. d. Cooling coil with insufficient face area for application.
	Obstruction in high velocity air stream may cause rattle or pure tone whistle.	a. Dampers. b. Registers. c. Grilles. d. Sharp elbows. e. Sudden expansion in duct work. f. Sudden contraction in duct work. g. Turning vanes.
	Pulsation or Surge	a. Blower too large for application. b. Ducts vibrate at same frequency as blower pulsates.
	Rattles and/or Rumbles	a. Vibrating duct work. b. Vibrating cabinet parts. c. Vibrating parts not isolated from building.
2. CFM Low - Insufficient Air Flow	Blower	a. Forward curved blower wheel installed backwards. b. Blower operating backwards. c. Cutoff missing or improperly installed. d. Blower wheel RPM too low.
	Duct System	a. Actual system is more restrictive than expected. b. Dampers closed. c. Registers closed. d. Leaks in supply duct.
	Filters	a. Dirty or clogged.
	Coil - DX or Chilled Water	a. Dirty or clogged.
3. CFM High - Too much air flow	System	a. Oversized duct work. b. Access door open. c. Registers or grilles not installed. d. Filters not in place. e. System resistance lower than anticipated.
	Blower	a. Blower RPM is too great.
4. Blower does not operate	Installation	a. Incorrect electrical connection. b. Wrong voltage. c. Blown fuse.
	Unit	a. Broken belt(s). b. Loose pulleys. c. Power to unit is disconnected. d. Motor overload protector has broken circuit. e. Optional thermostats, firestats, freezestats may lockout blower operation if set incorrect.

Trouble Shooting

Trouble Shooting Guide for Electric Motors		
Problem	**Probable Cause**	**Solution**
1. Motor	Blown fuse or open circuit breaker.	a. Replace fuse or reset circuit breaker.
	Overload trip.	a. Check and reset, if manual.
	Improper line connections.	a. Check connections to unit wiring diagram.
	Improper current supply.	a. Check to determine that power supply agrees with the motor nameplate specifications.
	Mechanical failure.	.a. Determine that motor and drive turn freely. Check bearings.
	Motor overloaded.	a. Reduce load or replace motor.
	With a 3-phase power source, one phase may be open.	a. Check line for open phase.
	Defective capacitor	a. Replace capacitor.
2. Motor Stalls	Wrong application.	a. Consult manufacturer.
	Overloaded motor.	a. Reduce load or replace motor.
	Low line voltage.	a. Check across AC line and correct if possible.
3. Motor runs and then dies down.	Partial loss of line voltage.	a. Check for loose connections. Determine adequacy of main power supply.
4. Motor does not come up to speed	Motor undersized for application.	a. Replace with larger motor.
	Voltage too low at motor terminals.	a. Check across AC line and correct if possible.
	Line wiring to motor is too small.	a. Install larger line wiring.
5. Motor takes too long to accelerate.	Excessive load.	a. Replace with larger motor.
	Loose connection.	a. Check connections and tighten where necessary.
6. Wrong Rotation (3-Phase)	Improperly wired to AC line (wrong sequence of phases)	a. Check unit wiring diagram. Reverse any two line voltage connections.
7. Motor Overheats	Motor overloaded.	a. Replace with larger motor.
	Motor ventilation clogged.	a. Clean motor.
	Motor (3-phase) may have open phase	a. Check to insure that all connections are tight.
	Line voltage too high or too low.	a. Check across AC line and correct if possible.
	Worn blower bearings.	a. Replace blower bearings.
8. Motor Vibrates	Motor mounting bolts loose.	a. Tighten mounting bolts.
	Driven equipment unbalanced.	a. Balance driven equipment.
	Worn motor bearings.	a. Replace motor.
	3-phase motor running on single phase	a. Check for open circuit and correct.
	Bent motor shaft.	a. Replace motor.
9. Rapid Motor Bearing Wear	Excessive overhung load due to over tensioned belt.	a. Reduce belt tension.

Trouble Shooting

Trouble Shooting Guide for Fan Assembly		
Problem	**Probable Cause**	**Solution**
1. Short Belt Life	Spin burns from belt slippage.	a. Tension belt.
	High ambient temperature	a. Use Gripnotch™ belts.
	Grease or oil on belts.	a. Clean belts and pulleys.
	Worn pulleys.	a. Replace pulleys.
	Belt misalignment.	a. Realign drive.
2. Belts turn over in grooves	Damaged belt.	a. Replace belt.
	Excessive vibration.	a. Tension belts. Replace belts if damaged.
	Worn Pulleys	a. Replace pulleys.
	Pulley misalignment.	a. Realign drive.
3.Belt Squeals	Excessive load.	a. High starting load. Re-tension drive.
4. Belt Breakage	Foreign material in drive.	a. Provide drive guard.
	Belts damaged during installation.	a. Replace belts.
	Extreme overload.	a. Eliminate overload.
5. Excessive Vibration	Damaged belt cord section.	a. Replace belts.
	Loose belts.	a. Tension drive.
	Belts improperly tensioned.	a. Tension drive with slack of each belt on the same side of drive.
6. Belts mismatched after service	Belts improperly tensioned, causing more stretch of some belts than others.	a. Replace belts and tension drive with slack of each belt on the same side of the drive.
	Old belts and new belts used on the same drive	a. Replace with new belts
	Different brand name belts used on the same drive.	a. Replace with a set of machine matched belts.
	Driver and driven shafts shifted from parallel	a. Replace belts and install properly.
	Belt cord section damaged during installation.	a. Replace belts and install properly.
Drive fails to adjust	Fretting corrosion (drive allowed to operate at one speed over a period of time).	a. Driver pulley must be disassembled, cleaned and lubricated, then reassembled.

Trouble Shooting Guide for DX Cooling Coil		
Problem	**Probable Cause**	**Solution**
1. No or Insufficient Cooling	Coil icing.	a. Low liquid line pressure* b. Thermal expansion valve.** c. Low air flow across coil.
	Air binding.	a. Purge and charge system.
	Thermal expansion valve. **	a. Bulb mounted at incorrect location. b. Bulb not secured properly.
	Insufficient air flow.	a. See air blower trouble shooting. b. Clogged coil.
	Air bypassing coil.	a. Caulk safe off.
	Undersized system, demand exceeding cooling system capacity.	a. Replace system.*
	Too much outside air.	a. Check outside air dampers.
	Refrigerant leak.	a. Determine leak location and correct.
	Low liquid pressure.	a. Determine cause and correct.*
2. Water in Conditioned Air	Exceeding coil face velocity - 600 fpm.	a. Reduce unit air flow.
	Drain pan P-trap clogged.	a. Clean pan and P-trap.

*Refer to condensing unit installation and service manual.
**Refer to thermal expansion valve installation instruction.

Trouble Shooting

Trouble Shooting Guide for Chilled Water Cooling Coil		
Problem	**Probable Cause**	**Solution**
1. No or Insufficient Cooling	Circulating pump failure.	Repair or replace pump.*
	Chilled water temperature not cool enough.	a. Check chiller.*
	Air binding (air in coil).	a. Circulating pump capacity is inadequate.* b. System piping losses too great.
	Insufficient chilled water flow.	a. See air blower trouble shooting. b. Clogged coil.
	Air bypassing coil.	a. Caulk safe off.
	Undersized system, demand exceeding cooling system capacity.	a. Replace system.*
	Too much outside air.	a. Check outside air dampers.
2. Water in Conditioned Air	Exceeding coil face velocity - 600 fpm.	a. Reduce unit air flow.
	Drain pan P-trap clogged.	a. Clean pan and P-trap.

*Refer to manufacturer's installation and service manual.

Trouble Shooting Guide for Evaporative Cooler		
Problem	**Probable Cause**	**Solution**
1. Media Dry	Insufficient water flow	a. Ball valve adjustment. b. Inspect/clean distributor pipe. c. Clean media.
2. Media contains algae	Too much water flow	a. Use unit supply fan (operating sequence) to dry media daily.
3. Odor in the space	Too much water flow	a. Use unit supply fan (operating sequence) to dry media daily.
4. Mineral build-up on face of media	Bleed-off valve set incorrectly	a. Set bleed-off valve to rate of evaporation locally. b. Perform annual water analysis of PH adjustment. c. Clean pump and distributor piping.
5. Media deterioration	Insufficient water flow	a. See "Media Dry (1)" above.
6. Insufficient water flow	Pump does not operate efficiently	a. Clean inlet basket and pump impeller.
	Pump motor does not function	a. Replace pump motor and clean pump.

Trouble Shooting

Trouble Shooting Guide for Furnace		
Problem	**Probable Cause**	**Solution**
1. Flame lifting from burner ports	Pressure regulator set too high	a. Reset manifold pressure. Refer to Operation section.
	Defective regulator	a. Replace regulator section of combination gas valve or complete valve.
	Burner orifice too large	a. Check with local gas supplier for proper orifice size, and replace. Refer to Operation section of this manual.
2. Flame pops back	Excessive primary air	a. Close air shutter. Refer to operation section.
	Burner orifice too small	a. Check with local gas supplier for proper orifice size and replace. Refer to operation section.
3. Noisy flame	Too much primary air	a. Close air shutter. Refer to operation section.
	Noisy pilot	a. Reduce pilot gas. Refer to operation section.
	Irregular orifice causing whistle or resonance.	a. Replace orifice.
	Excessive gas input	a. Reset manifold pressure. Refer to operation section. Replace regulator section of combination gas valve or complete valve; or Check with local gas supplier for proper orifice size, and replace. Refer to operations section.
4. Yellow tip flame (some yellow tipping on propane gas is permissible)	Insufficient primary air	a. Open air shutter. Refer to operations section.
	Clogged burner ports	a. Clean main burner ports.
	Misaligned orifices	a. Replace manifold assembly.
	Clogged draft hood	a. Clean draft hood.
	Clogged burner ports	a. Clean main burner ports.
	Misaligned orifices	a. Replace manifold assembly.
	Clogged draft hood	a. Clean draft hood.
	Air shutter	a. Check for dust or lint at air mixer opening and around air shutter.
	Insufficient combustion air	a. Check for obstruction in combustion air inlet cap and piping. See installing section.
5. Floating flame	Blocked venting	a. Clean flue. Refer to installing section.
	Insufficient combustion air	a. Check for obstruction in combustion air inlet cap and piping. See installing section.
	Blocked heat exchanger	a. Clean heater.
	Air leak into combustion chamber or draft hood	a. Determine cause and repair accordingly.
6. Gas odor	**Shut off gas immediately !**	a. Inspect all gas piping and repair.
	Blocked heat exchanger/venting.	a. Clean heat exchanger/flue.
	Drafts around heater.	a. Eliminate drafts. Refer to installing section.
	Negative pressure in building	a. See installation section.
	Blocked draft hood	a. Clean draft hood.
7. Delayed ignition	Excessive primary air	a. Close air shutter. Refer to operations section.
	Main burner ports clogged near pilot	a. Clean main burner ports.
	Pressure regulator set too low	a. Reset manifold pressure. Refer to operations section.
	Pilot decreases in size when main burners come on	a. Supply piping is inadequately sized. Refer to installation section.
	Pilot flame too small	a. Clean pilot orifice. Refer to operations section.
	Drafts around ventor	a. Eliminate drafts. Refer to installation section.
	Improper venting	a. Refer to installation section.

*Refer to manufacturer's installation and service manual.

Trouble Shooting

Trouble Shooting Guide for Furnace		
Problem	**Probable Cause**	**Solution**
8. Failure to ignite	Main gas valve off	a. Open all manual gas valves.
	Lack of power at unit	a. Replace fuse or turn on power supply.
	Thermostat not calling for heat	a. Turn up thermostat.
	Defective limit switch	a. Check limit switch with continuity tester. If open, replace high limit.
	Improper thermostat or transformer wiring at gas valve	a. Check wiring per wiring diagrams.
	Defective gas valve	a. Replace gas valve.
	Defective thermostat	a. Check thermostat and replace if defective.
	Defective transformer	a. Ensure 115 volts is supplied to the transformer primary, then check for 24 volts at secondary terminal before replacing.
	Loose wiring	a. Check and tighten all wiring connections per diagrams.
	Defective ignition control	a. Replace, if necessary. Also see W, X & Y symptoms.
9. Condensation of water vapor	Condensation of water vapor	a. Refer to installing section for "venting."
10. Burner won't turn off	Poor thermostat location	a. Relocate thermostat away from drafts.
	Defective thermostat	a. Replace thermostat.
	Improper thermostat or transformer wiring at gas valve	a. Check wiring diagrams.
	Short circuit	a. Check operation at valve. Look for short (such as stables piercing thermostat wiring) and correct.
	Defective or sticking gas valve	a. Replace gas valve.
	Excessive gas supply pressure	a. Refer to operation section.
11. Rapid burner cycling	Loose wire connections at gas valve or thermostat	a. Tighten all connections.
	Excessive thermostat heat anticipator	a. Adjust thermostat for longer cycles. Refer to operations section.
	Unit cycling on high limit	a. Check for proper air supply across heat exchanger.
	Poor thermostat location	a. Relocate thermostat (do not mount thermostat on unit).
	Draft on pilot	a. Eliminate drafts. Refer to installation section.
	Defective ignitor control	a. Replace ignitor.
	Defective high limit	a. Jumper high limit switch terminals 1 and 2. If burner operates normally, replace switch.
12. Noisy power ventor	Power ventor wheel loose	a. Replace or tighten.
	Power ventor wheel dirty	a. Clean power ventor wheel.
	Power ventor wheel rubbing housing	a. Realign power ventor wheel.
	Bearings are dry	a. Oil bearings on power ventor motor. Refer to label on the motor.
13. Pilot will not light or will not stay lit	Main gas valve off	a. Open all manual gas valves.
	Pilot adjustment screw turned too low on combination main gas valve	a. Refer to operations section.
	Air in gas line	a. Purge air from gas line.
	Incorrect lighting procedure	a. Follow lighting instruction label adjacent to gas valve.
	Dirt in pilot orifice	a. Remove pilot orifice. Clean with compressed air or solvent. Do not ream.
	Extremely high or low gas pressure	a. Refer to operations section.
	Defective thermocouple	a. Check thermocouple connection, and replace if defective.
	Drafts around unit	a. Eliminate drafts. Refer to installation section.
	Pilot valve not opening (faulty wiring)	a. Inspect and correct wiring.
	No spark (faulty wiring)	a. Inspect and correct ignition system wiring.
	Defective gas valve	a. Replace gas valve.

*Refer to manufacturer's installation and service manual.

Canadian Specific Installation Information

The following instructions apply to Canadian installations in addition to installation and operating instruction:

1. Installation must conform with local building codes, or in absence of local codes, with current CGA B149.1, Installation Codes for Natural Gas Burning Appliances and Equipment, or CGA B149.2, Installation Codes for Propane Gas Burning Appliances and Equipment.

2. Any reference to U.S. standards or codes in these instructions are to be ignored and the applicable Canadian standards or codes applied.

3. Any references to duration at altitudes in excess of 2000 feet are to be ignored. When installed in Canada at altitudes of 2000 to 4500 feet, the unit heaters must be orificed to 90% of the normal altitude rating, and be so marked in accordance with the C.G.A. certification.

4. Duct furnaces are designed certified to comply with CGA 2.6.

5.In Canada, installation is suitable in airplane hangars when acceptable to the enforcing authorities, and in public garages when installed in accordance with current CGA B149 Installation Codes for Gas Burning Appliances and Equipment.

6. All electrical connections must be in accordance with Canadian Electrical Code, Part 1, CSA Standard C22.1.

7. Canadian units include vent cap and a reducer/increaser (if required) furnished by the manufacturer.

8. In Canada, the vent system must be adequately supported to prevent sagging; but in no case shall the supports be less than every 3 feet.

9. If using a metal vent system under positive gauge pressure in Canada, a slip fit vent connection must be secured by at least two corrosive resistant screws, or other mechanical locking means.

10. Canadian units require the following vent equivalent lengths; 5 feet minimum; 50 feet max.

11. The vent shall not terminate —

a. Less than 6 feet from a combustion air inlet of another appliance.

b. Less than 3 feet from any other building opening or any gas service regulator.

c. Directly above a gas utility meter or service regulator.

12. Vent terminal shall be located not less than one foot above grade.

13. It is recommended that the heater and vent system be checked once a year by a qualified serviceman.

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