Installation, Operation, and Maintenance

Tubular Indoor Gas Fired Duct Furnace

Model Number
GUNE

J30-09453

⚠SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

June 2014

GUNE-SVX001A-EN

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠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, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE:	Indicates a situation that could result in equipment or property-damage only accidents.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

Failure to follow instructions could result in death or serious injury.

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⚠ WARNING

Safety Alert!

You MUST follow all instructions below. Failure to do so could result in death or serious injury.

For Your Safety

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

If you smell gas:

1. Open windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. Immediately contact your gas supplier.

⚠ WARNING

Hazardous Gases and Flammable Vapors!

Failure to observe following instructions could result in death or serious injury. 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 or lead to excessive carbon monoxide. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual.

Approved for Use in California

⚠ WARNING

Toxic Hazard!

Install, operate, and maintain unit in accordance with the manufacturer's instructions to avoid exposure to fuel substances, or substances from incomplete combustion, which can cause death or serious illness. The state of California has determined that these substances may cause cancer, birth defects, or other reproductive harm.

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, shipment and installation problems such as loose wires, leaks, and loose fasteners may occur. It is the installer's responsibility to inspect and correct any problem that may be found.

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.

General Safety Information

⚠ WARNING

Safety Alert!

You MUST follow all instructions below. Failure to do so could result in death or serious injury.

- **The tubular duct furnace design is certified by ETL for use with natural and propane (LP) gases. ANSI and NFPA Standards as well as Canadian installation codes referred to in this manual are the ones that were applicable at the time the design was certified. In addition, the tubular duct furnace may be installed on the downstream side of a cooling unit, without need of a bypass duct.**
- **Installation must be made in accordance with local codes, or in absence of local codes, with the latest edition of the National Fuel Gas Code, ANSI Standard Z223.1 (NFPA 54).**

  All of the ANSI and NFPA Standards referred to in these installation instructions are those that were applicable at the time the design of this appliance was certified. The ANSI Standards are available from the CSA Information Services, (800) 463-6727, as well as at www.ansi.org. The NFPA Standards are available from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169, as well as at www.nfpa.org. These duct furnaces are designed for use in airplane hangars when installed in accordance with current ANSI/NFPA No. 409 and in public garages when installed in accordance with current NFPA No. 88A and NFPA No. 88B.

  If installed in Canada, the installation must conform with local building codes, or in absence of local building codes, with CSA-B149.1 "Installation Codes for Natural Gas Burning Appliances and Equipment" or CSA-B149.2 "Installation Codes for Propane Gas Burning Appliances and Equipment." These indoor duct furnaces have been designed and certified to comply with CSA 2.6. Also refer to "Aircraft Hangars," p. 10 and "Public Garages," p. 10.
- **Do not alter the duct furnace in any way or damage to the unit and/or severe personal injury or death could occur!**
- **This product must be installed by a licensed plumber or gas fitter when installed within the Commonwealth of Massachusetts.**
- **Turn off the gas supply and disconnect all electric power, including remote disconnects before servicing unit. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized and the gas can not be inadvertently turned on. Failure to turn off gas or disconnect power before servicing could result in death or serious injury.**

- **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 external wiring must conform to applicable local codes, and to the latest edition of the National Electric Code ANSI/NFPA No. 70.**
- **All gas connections should be made and leak-tested by a suitable qualified individual, per instructions in this manual. Also follow procedures listed in "Gas Equipment Start-Up," p. 30.**
- **Use only the fuel for which the duct furnace is designed (see rating plate). 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.**

Important: Do not attempt to convert the duct furnace for use with a fuel other than the one intended. Such conversion is dangerous, as it could create the risks listed previously.

- **Use only the fuel for which the heater is designed (see rating plate). 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.**
- **Make certain that the power source conforms to the electrical requirements of the heater.**
- **Do not depend upon a thermostat or other switch as a sole means of disconnecting power when installing or servicing heater. Always disconnect power at main circuit breaker as described above. Failure to do so could result in fatal electric shock.**
- **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 between the service panel and the heater. To ensure a proper ground, the grounding means must be tested by a qualified technician.**
- **Do not insert fingers or foreign objects into the heater or its combustion air moving device. Do not block or tamper with the heater in any manner while in operation or just after it has turned off, as some parts may be hot enough to cause injury.**
- **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.**
- **The open end of gas piping systems being purged shall not be discharged into areas where there are sources of ignition or into confined spaces UNLESS precautions are taken as follows: 1) by ventilation of the space, 2) by control of purging rate, 3) by elimination of all hazardous conditions. All precautions must be taken to perform this operation in a safe manner!**

Unless otherwise specified, the following conversions may be used for calculating SI unit measurements:

1 foot = 0.305 m	1 inch = 25.4 mm
1 gallon = 3.785 L	1 pound = 0.453 kg
1 psig = 6.894 kPa	1 cubic foot = 0.028m^3
1000 BTU per hour = 0.293 kW	1 inch water column = 0.249 kPa
1000 BTU/Cu.Ft. = 37.5 MJ/m3	Liter/second = CFM x 0.472
Meter/second = FPM ÷ 196.8	

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Revision History

GUNE-SVX001A-EN (16 Jun 2014)

- First version of this literature

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Model Number Description

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
G	U	N	E	0	2	0	A	H	A	1	0	0	0	0	B

Digit 1 — Gas Heating Equipment

G = Gas Heating Equipment

Digit 2 — Product Type

U = Tubular Duct Furnace

Digit 3 — Fuel Type

N = Natural Gas
P = Propane Gas (LP)

Digit 4 — Developmental Sequence

E = Current Developmental Sequence

Digits 5, 6, 7 — Input Capacity (MBh)

010 = 100
015 = 150
020 = 200
025 = 250
030 = 300
035 = 350
040 = 400

Digit 8 — Main Power Supply

A = 115/60/1
B = 230/60/1
C = 208/60/3
D = 230/60/3
E = 460/60/3
F = 575/60/3
G = 208/60/1

Digit 9 — Gas Control Option

H = Electronic Modulating w/Room Sensing
J = Electronic Modulating w/Duct Thermostat
L = Electronic Modulation w/External 4–20 mA Input
M = Electronic Modulation w/External 0–10 Vdc Input
T = Single-Stage, Direct Spark Ignition
V = Two-Stage, Direct Spark Ignition
W = Electronic Modulation w/Duct Thermostat/Room Override Stat

Digit 10 — Design Sequence

A = First Design

Digit 11 — Heat Exchanger Material

1 = Standard (Aluminized Steel)
2 = 409 Stainless Steel

Digit 12, 13, 14 — Reserved for Future Use

0 = Not Used

Digit 15 — Miscellaneous

0 = None
B = Air Pressure Switch for Above 5,000 Feet
G = Horizontal and Vertical Louvers
W = Stainless Steel Drain Pan

General Information

Important: *It is the equipment owners responsibility to provide any scaffolding or other apparatus required to perform emergency service or annual/periodic maintenance to this equipment*

The Tubular Indoor Gas-Fired Duct Furnace is a factory assembled, power vented, and low static pressure type duct furnace with a low profile cabinet. The duct furnace can also be easily field converted to separated combustion. The design is certified by ETL as providing a minimum of 82 percent thermal efficiency, and approved for use in California. Do not alter these units in any way. If you have any questions after reading this manual, contact the manufacturer.

Figure 1. Front

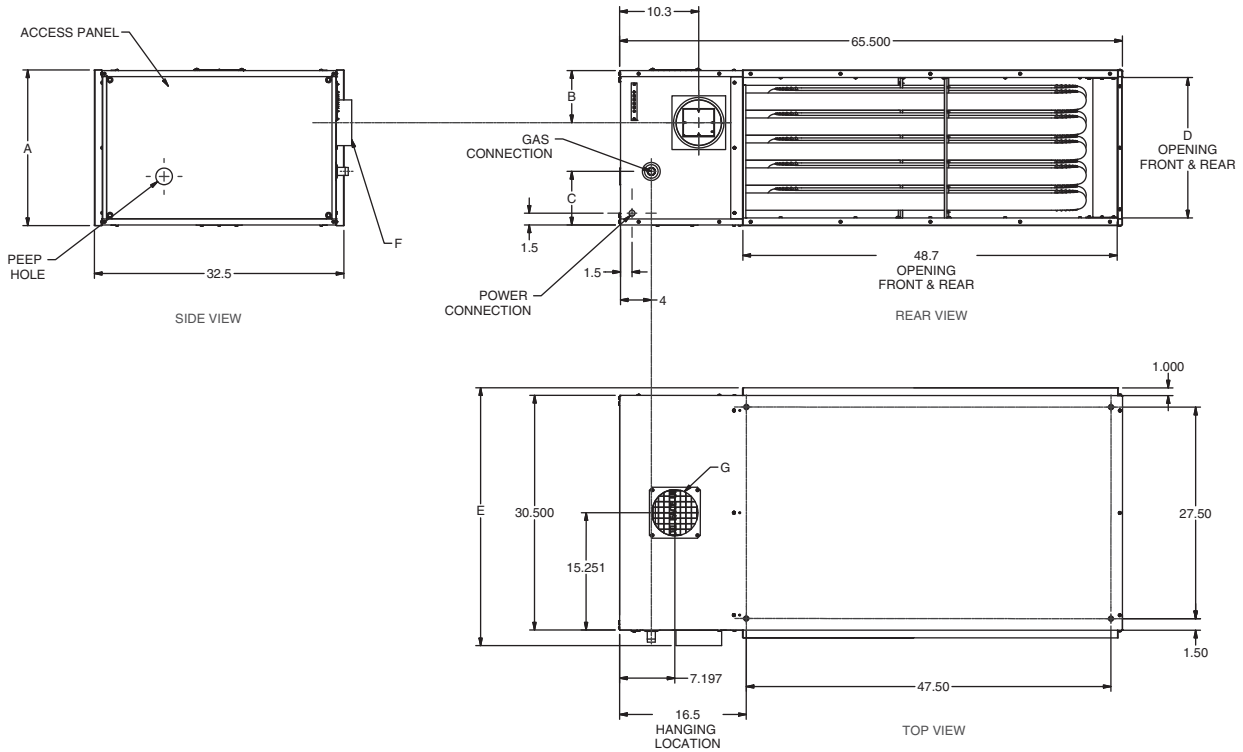
Figure 2. Back

Dimensional Data and Weights

Table 1. Dimensional data and weights—tubular duct furnace dimensions, inches (mm)

Unit Capacity	100	150	200	250	300	350	400
"A" Overall Unit Height	10.3 (262)	13.7 (348)	17 (432)	20.2 (513)	23.5 (597)	26.7 (678)	30 (762)
"B" Height to Centerline Flue	7.6 (193)	10.5 (267)	11.9 (302)	6.8 (173)	8.4 (213)	10 (254)	11.6 (295)
"C" Height to Gas Connection	2.5 (64)	3.7 (94)	5.3 (135)	7 (178)	7 (178)	8.7 (221)	10.3 (262)
"D" Opening Height, Front & Rear	8.5 (216)	11.7 (297)	15 (381)	18.2 (462)	21.5 (546)	24.7 (627)	28 (711)
"E" Overall Unit Depth	32.7 (831)	32.7 (831)	32.7 (831)	33.5 (851)	33.5 (851)	33.5 (851)	33.5 (851)
"F" Flue Size Diameter	5 (127)	5 (127)	5 (127)	6 (152)	6 (152)	6 (152)	6 (152)
"G" Air Inlet Size Diameter	5 (127)	5 (127)	5 (127)	6 (152)	6 (152)	6 (152)	6 (152)
Gas Inlet, Natural Gas, inches	1/2	1/2	1/2	3/4	3/4	3/4	3/4
Gas Inlet, Natural Gas, inches	1/2	1/2	1/2	3/4	3/4	3/4	3/4
Approximate Unit Weight, lb (kg)	160 (73)	221 (100)	250 (113)	270 (122)	296 (134)	321 (146)	355 (161)
Approximate Ship Weight, lb (kg)	270 (122)	331 (150)	360 (163)	403 (183)	429 (195)	454 (206)	488 (221)

Figure 3. Tubular duct furnace dimensions



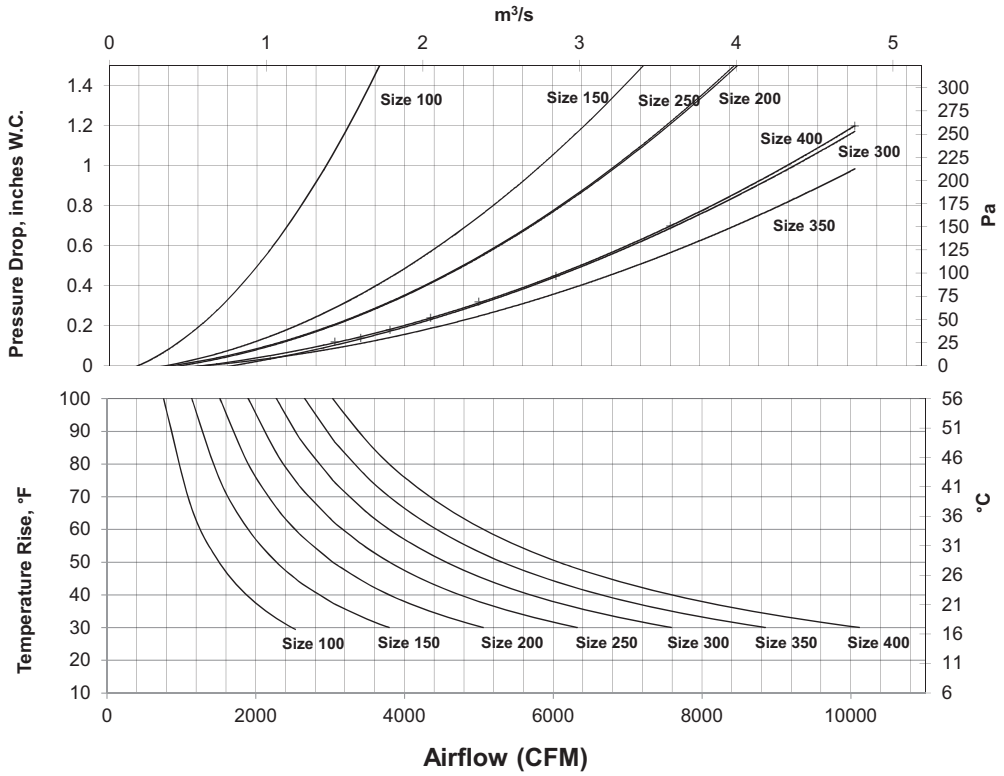
Performance Data

Table 2. Tubular duct furnace performance data

Unit Size	Input (Max) MBh (kW)	Input (Min) MBh (kW)	Output MBh (kW)	Min CFM (m^3/s)	Temp rise °F (°C)	P.D. in. wc (kPa)	Max CFM (m^3/s)	Temp rise °F (°C)	P.D. in. wc (kPa)
100	100	50	82	758	100	0.07	2528	30	0.65
	(29.3)	(14.6)	(24.0)	(0.357)	(56)	(0.017)	(1.193)	(17)	(0.16)
150	150	75	123	1137	100	0.03	3792	30	0.44
	(43.9)	(21.9)	(36.0)	(0.536)	(56)	(0.007)	(1.789)	(17)	(0.11)
200	200	100	164	1517	100	0.04	5057	30	0.54
	(58.6)	(29.3)	(48.0)	(0.715)	(56)	(0.009)	(2.386)	(17)	(0.13)
250	250	125	205	1896	100	0.08	6321	30	0.76
	(73.2)	(36.6)	(60.0)	(0.894)	(56)	(0.019)	(2.983)	(17)	(0.19)
300	300	150	246	2275	100	0.03	7585	30	0.69
	(87.8)	(43.9)	(72.0)	(1.074)	(56)	(0.007)	(3.579)	(17)	(0.16)
350	350	175	287	2654	100	0.07	8849	30	0.76
	(102.5)	(51.2)	(84.1)	(1.252)	(56)	(0.017)	(4.176)	(17)	(0.19)
400	400	200	328	3034	100	0.08	10,114	30	0.70
	(117.1)	(58.6)	(96.1)	(1.431)	(56)	(0.019)	(4.773)	(17)	(0.17)

Notes:
1. Ratings are shown for unit installations at elevations between 0 and 2,000 feet (610m).
2. For unit installations in U.S.A. above 2,000 feet (610 m), the unit input must be field derated 4 percent for each 1,000 feet (305 m) above sea level; refer to local codes, or in absence of local codes, refer to the latest edition of the National Fuel Gas Code, ANSI Standard Z223.1 (NFPA 54).
3. For installations in Canada, any references to deration at altitudes in excess of 2,000 feet (610 m) are to be ignored. At altitudes of 2,000 to 4,500 feet (610 to 1372 m), the unit must be field derated and be so marked in accordance with the ETL certification.
4. See Table 10 and Table 11, p. 29 for U.S.A. and Canadian field deration information.

Figure 4. Temperature rise and pressure drop graph



Installation

Locating Units

NOTICE:

Equipment Damage!

Do not install unit heaters in corrosive of flammable atmospheres! Premature failure of, or severe damage to the unit will result!

NOTICE:

Equipment Damage!

Avoid locations where extreme drafts can affect burner operation. Duct furnaces must not be installed in locations where air for combustion would contain chlorinated, halogenated or acidic vapors. If located in such an environment, premature failure of the unit will occur!

Important: Location of unit heaters is related directly to the selection of sizes. Basic rules are as follows,

Clearances

⚠ WARNING

Combustible Materials!

Failure to maintain proper clearance between the unit heat exchanger, vent surfaces and combustible materials could cause a fire which could result in death or serious injury or property damage. Refer to Table 3 for proper clearances.

Maintain adequate clearances around air openings into the combustion chamber:

Table 3. Minimum safety clearances[a]

Sides	6 inches (152 millimeters)
Top	6 inches (152 millimeters)
Bottom	6 inches (152 millimeters)
Flue	6 inches (152 millimeters)

(a) When clearances required for accessibility are greater than the minimum safety clearances, the accessibility clearances take precedence.

Accessibility Clearance

The duct furnace must have 18 inches (457 mm) clearance on the control cabinet end. Provision should also be made to assure accessibility for recurrent maintenance purposes.

Atmospheric Considerations

Atmospheres containing commercial solvents or chlorinated hydrocarbons will produce corrosive acids when coming in contact with the flames. This will greatly reduce the life of the gas duct furnace and may void the warranty. Avoid such areas.

Important: If the gas duct furnace is to be used in a building classified as having a hazardous atmosphere, the installation must comply with the standards set by the National Board of Fire Underwriters. Consult the authorities having jurisdiction before starting the job.

The duct furnace must be installed on the positive pressure side of the air circulation blower.

Aircraft Hangars

In aircraft hangars, duct furnaces must be at least 10 feet (3.05 m) above the upper surface of wings or engine enclosures of the highest aircraft to be stored in the hangar and 8 feet (2.4 m) above the floor in shops, offices, and other sections of the hangar where aircraft are not stored and housed. Refer to current ANSI/NFPA No. 409, Aircraft Hangars. In Canada, installation is suitable in aircraft hangars when acceptable to the enforcing authorities.

Public Garages

In repair garages, duct furnaces must be installed in a detached building or room separated from repair areas as specified in the latest edition of NFPA 88B, Repair Garages.

In parking structures, duct furnaces must be installed so that the burner flames are located a minimum of 18 inches (457 mm) above the floor or protected by a partition not less than 18 inches (457 mm) high. Refer to the latest edition of NFPA 88A, Parking Structures.

In Canada, installation must be in accordance with the latest edition of CSA B149 “Installation Codes for Gas Burning Appliances and Equipment.”

Important:

- *The duct furnace must be installed such that the gas ignition control system is not directly exposed to water spray, rain, or dripping water.*
- *Duct furnaces should not be installed to maintain low temperatures and/or freeze protection of buildings. A minimum of 50°F (10°C) thermostat setting must be maintained.*

If duct furnaces are operated to maintain lower than 50°F (10°C), hot flue gases are cooled inside the heat exchanger to the point where water vapor (a flue gas by-product) condenses onto the heat exchanger walls. The result is a mildly corrosive acid that prematurely corrodes the aluminized steel heat exchanger and can actually drip water down from the duct furnace onto the floor surface below. Additional duct furnaces should be installed if a minimum 50°F (10°C) thermostat setting cannot be maintained.

Ductwork

Properly designed and installed ductwork, providing a uniformly distributed flow of air across all surfaces of the heat exchanger, is essential to satisfactory unit performance and life of the equipment.

All duct connection flanges/seams must be sealed to prevent air leaks. Sealant/tape must be suitable for temperatures of 250°F (121°C) minimum.

Note: Any attempts to straighten the 90° duct connection flanges on the duct furnaces will affect the operation of the furnace and will void the warranty.

If uniform air distribution is not obtained, install additional baffles and/or turning vanes in the ductwork.

Figure 5 and Figure 6 illustrate recommended ductwork designs for both the straight-through and elbowed air inlet arrangements.

Access panels large enough to observe smoke and reflected light, and to detect the presence of leaks in the heating equipment, are required both upstream and downstream from gas duct furnaces. These panels must be sealed to prevent air leaks. If allowed by local regulations, install canvas connectors between the ductwork and fan discharge opening to eliminate the transmission of mechanical vibration.

Air Flow

The installation is to be adjusted to obtain an air throughput within the range specified on the appliance rating plate.

Combustion Inlet Air Ventilation

Inlet Air From Another Room

If the duct furnace is installed in a separate room or compartment, provide two inlet air openings. The size of each vent opening should be no less than one square inch (6.452 square centimeters) of free area for each 1000 Btu/h (293 W) input. Each opening must not be less than 100 square inches (645 square centimeters).

Inlet Air From Outdoors

If the enclosed space is to have inlet combustion air from the outside, the vent opening should be no less than one square inch (6.452 square centimeters) of free area for each 2500–3000 Btu/h (733–879 W) input. Each opening must not be less than 100 square inches (645 square centimeters).

Bypass

When a gas duct furnace is installed to operate in conjunction with a summer air conditioning system, the CFM air delivery of the system blower should be adjusted to meet the design air volume requirements for cooling. If this CFM delivery is greater than that required for heating, resulting in a low air temperature rise, install a damper bypass around the gas duct furnace to bypass a portion of the air.

Figure 5. Recommended ductwork design for straight-through arrangement

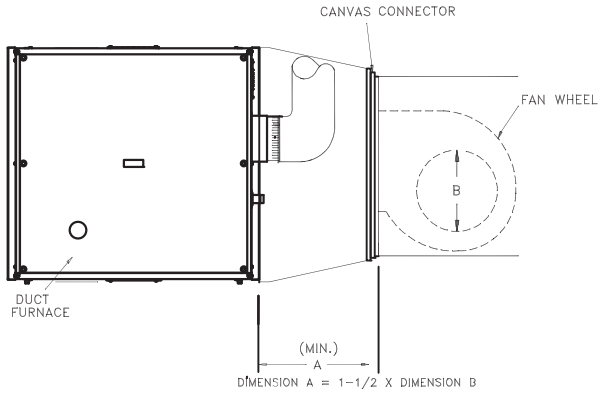
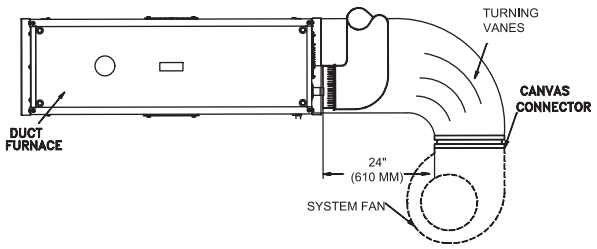
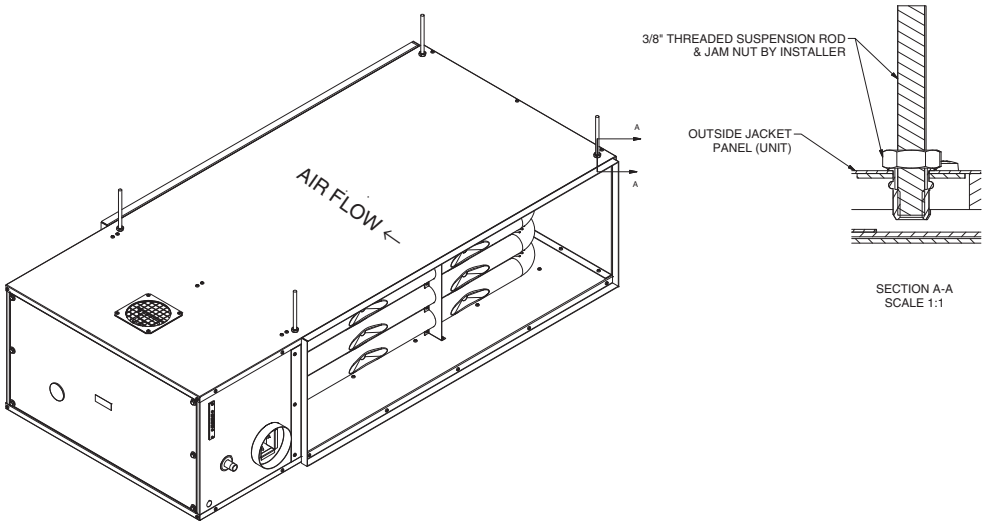


Figure 6. Recommended ductwork design for elbowed arrangement



Suspension

Figure 7. Typical suspension



⚠WARNING

Heavy Object!

Make certain that the lifting methods used to lift the duct furnace are capable of supporting the weight of the heater during installation. See Table 1, p. 8 for unit weights.

Ensure that all hardware used in the suspension of each duct furnace is more than adequate for the job.

Make certain that the structure to which the duct furnace is to be mounted is capable of safely supporting its weight. Under no circumstances must the gas lines, venting system, or the electrical conduit be used to support the duct furnace. Do not allow objects (i.e. ladder) or people to lean against the gas lines, venting system, or electrical conduit for support.

Failure to follow these instructions could result in death, serious injury, and property damage.

NOTICE:

Equipment Damage!

The duct furnace must be hung level from side to side and front to back, from four suspension points provided at the top of the unit. Failure to do so will result in poor performance and/or premature failure of the unit. Refer to Figure 7 for typical suspension. DO NOT mount duct furnaces in series (one in front of another).

Important: Minimum safety clearances must also be maintained; see Table 3, p. 10. When service/accessibility clearances are greater than minimum safety clearances, service/accessibility clearances take precedence. Refer to "Clearances," p. 10.

Conversion of access side

The tubular duct furnace is built and shipped as right side access—when looking in the direction of airflow, gas and flue connections, control cabinet access are on the right hand side and the combustion air inlet is on top. When looking in the direction of airflow, you will be facing the entering air side of the duct furnace. To convert the unit to left side access:

1. Before suspending unit, flip the duct furnace 180° width-wise (not rotated) so the gas and flue connections are still on the entering air side of the duct furnace.
2. Remove the four (4) screws holding the combustion air inlet screen (now located on the bottom of the unit); the screen and gasket can be removed and set aside.
3. Remove the four (4) screws holding the block-off plate (now located on the top of the unit); the plate and the gasket can be removed and set aside.
4. Reinstall the block-off plate and its gasket on the bottom of the unit using the four (4) screws.
5. Reinstall the combustion air inlet screen and its gasket on the top of the unit using the four (4) screws.

It is not required to switch the combustion air inlet screen and block-off plate locations once the unit has been flipped. However, due to combustion noise, it is recommended to keep the air inlet screen on top for overhead installations.

Important: If unit access side is converted, ensure accessibility clearance is taken into account for the new control cabinet end of the unit before suspension/installation.

Gas Pipe Sizing

⚠WARNING

Fire Hazard!

Do not connect gas piping to this unit until a supply line pressure/leak test has been completed. Connecting the unit before completing the pressure/leak test may damage the unit gas valve and result in a fire hazard, which could result in death, serious injury, and property damage.

NOTICE:

Equipment Damage!

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

Pipe Sizing

To provide adequate gas pressure to the gas unit heater, size the gas piping as follows:

1. Find the ft^3/h by using the following formula:

$$ft^3/h = \frac{\text{Input BTU/h}/1000}{1{,}000}$$

2. Refer to Table 4, p. 14. Match "Length of Pipe in Feet" with appropriate "Gas Input - ft^3/h" value. This value can then be matched to the pipe size at the top of the column.

   Example:

   It is determined that a 67-foot (20.4-m) run of gas pipe is required to connect a 200 MBtu gas unit heater to a 1,000 Btu/ft^3 (0.29 kW) natural gas supply.

$$\frac{200{,}000\ \text{BTU/h}}{1{,}000\ \text{BTU/ft}^3} = 200\ ft^3/h$$

Using Table 4, a 1-inch pipe is needed.

Note: Refer to "General Safety Information," p. 3 for English/Metric unit conversion factors.

Important:

- *If more than one unit heater is to be served by the same piping arrangement, the total ft^3/h input and length of pipe must be considered.*
- *If the gas unit heater 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. He/She will 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 make sure that the existing line is of adequate size to handle the combined load.

Table 4. Gas pipe size[a]

Nominal Iron Pipe Size (in)	Internal Diameter (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	120	97	82	73	66	61	57	53	50	44	40	37	35
		(4.96)	(3.40)	(2.75)	(2.32)	(2.07)	(1.87)	(1.73)	(1.61)	(1.50)	(1.42)	(1.25)	(1.13)	(1.05)	(0.99)
3/4	0.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72
		(10.2)	(7.08)	(5.66)	(4.81)	(4.28)	(3.91)	(3.54)	(3.34)	(3.11)	(2.92)	(2.63)	(2.38)	(2.18)	(2.04)
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135
		(19.3)	(13.2)	(10.6)	(9.06)	(8.07)	(7.36)	(6.80)	(6.23)	(5.80)	(5.52)	(4.96)	(4.53)	(4.11)	(3.82)
1-1/4	1.380	1400	950	770	660	580	530	490	460	430	400	360	325	300	280
		(39.6)	(26.9)	(21.8)	(18.7)	(16.4)	(15.0)	(13.9)	(13.0)	(12.2)	(11.3)	(10.2)	(9.20)	(8.50)	(7.93)
1-1/2	1.610	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430
		(59.5)	(41.3)	(33.4)	(28.0)	(25.5)	(22.9)	(21.2)	(19.5)	(18.4)	(17.6)	(15.6)	(14.2)	(13.0)	(12.2)
2	2.067	3950	2750	2200	1900	1680	1520	1400	1300	1220	1150	1020	950	850	800
		(112)	(77.9)	(62.3)	(53.8)	(47.6)	(43.0)	(39.6)	(36.8)	(34.5)	(32.6)	(28.9)	(26.9)	(24.1)	(22.7)
2-1/2	2.469	6300	4350	3520	3000	2650	2400	2250	2050	1950	1850	1650	1500	1370	1280
		(178)	(123)	(99.7)	(85.0)	(75.0)	(68.0)	(63.7)	(58.0)	(55.2)	(52.4)	(46.7)	(42.5)	(38.8)	(36.2)
3	3.068	11000	7700	6250	5300	4750	4300	3900	3700	3450	3250	2950	2650	2450	2280
		(311)	(218)	(177)	(150)	(135)	(122)	(110)	(105)	(97.7)	(92.0)	(83.5)	(75.0)	(69.4)	(64.6)
4	4.026	23000	15800	12800	10900	9700	8800	8100	7500	7200	6700	6000	5500	5000	4600
		(651)	(447)	(362)	(309)	(275)	(249)	(229)	(212)	(204)	(190)	(170)	(156)	(142)	(130)

Notes:
1. Determine the required ft^3/h by dividing the input by 1,000.
   For SI/metric measurements: convert Btu/h to kW. Multiply the unit's inputs (kW) by 0.0965 to determine m^3/h.
2. For natural gas: select pipe size directly from the table.
3. For propane gas: multiply the ft^3/h value by 0.633; then, use the table.
   Refer to the metric conversion factors listed in "General Safety Information," p. 3 for SI Unit measurement conversions.

(a) Maximum capacity of pipe in ft^3/h of gas (m^3/h) for gas pressures of 0.5 psig (3.5 kPa) or less, and a pressure drop of 0.5 in. wc (124.4 Pa), based on a 0.60 specific gravity gas.

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 manifold pressure and a gas supply capable of supplying its full rated capacity as specified in Table 4. A field LP tank regulator must be used to limit the supply pressure to a maximum of 14 inches wc (3.5 kPa). All piping should be sized in accordance with the latest edition of ANSI Standard Z223.1 (NFPA 54), National Fuel Gas Code; in Canada, according to CSA B149. See Table 1, p. 8 and Table 4 for correct gas piping 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. Standard duct furnaces, optional two-stage and modulation units are supplied with a combination valve which includes:
   a. Manual "A" valve
   b. Manual "B" valve
   c. Solenoid valve
   d. Pressure regulator

   Pipe directly into the combination valve (see Figure 8, p. 15).
6. Gas valve has a pressure test post requiring a 3/32-inch hex head wrench to read gas supply and manifold pressures. Open 1/4 turn counterclockwise to read, turn clockwise to close and re-seat. A 5/16-inch ID hose fits the pressure post.
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 (see Figure 8).
8. Make certain that all connections have been adequately doped and tightened.

⚠WARNING

Hazard of Explosion!

Failure to follow proper safe leak test procedures could result in death or serious injury or equipment or property-only-damage. NEVER use an open flame to detect gas leaks. You MUST use a leak test solution for leak testing.

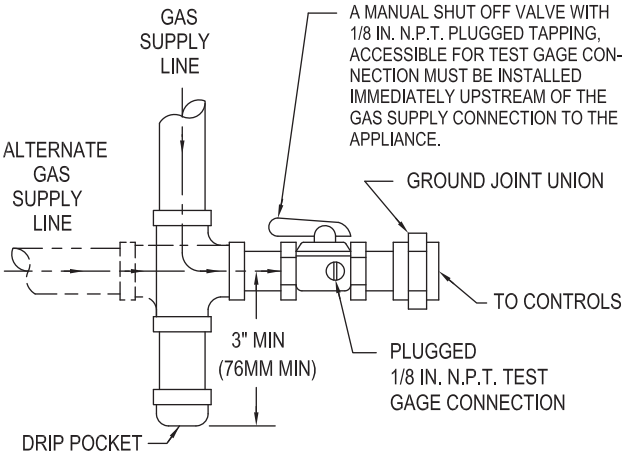
NOTICE:

Valve Damage!

Do not over tighten the inlet gas piping into the valve. This may cause stresses that will crack the valve!

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

Figure 8. Pipe installation, standard controls



The appliance and its individual shutoff valve must be disconnected 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).

Table 5. Gas supply pressure[a]

Heating Value		Natural Gas 1,050 BTU/Ft^3 (39.1 MJ/m^3)	Propane Gas 2,500 BTU/Ft^3 (93.1 MJ/m^3)
Manifold Pressure			
Single Stage Application	(inch wc)	3.5	10.0
	(kPa)	(0.87)	(2.49)
Two Stage Application - High Fire	(inch wc)	3.5	10.0
	(kPa)	(0.87)	(2.49)
Two Stage Application - Low Fire	(inch wc)	1.1	3.8
	(kPa)	(0.27)	(0.95)
Modulating Application - High Fire	(inch wc)	3.5	10.0
	(kPa)	(0.87)	(2.49)
Modulating Application - Low Fire	(inch wc)	0.9	3.5
	(kPa)	(0.22)	(0.87)
Minimum Supply Pressure			
Single Stage Application	(inch wc)	5.0	11.0
	(kPa)	(1.24)	(2.74)
Two Stage Application	(inch wc)	6.5	11.5
	(kPa)	(1.62)	(2.86)
Modulating Application	(inch wc)	6.5	11.5
	(kPa)	(1.62)	(2.86)
Maximum Pressure	(inch wc)	14.0	14.0
	(kPa)	(3.49)	(3.49)

Note: Refer to "Tubular Duct Furnace—High Altitude Deration," p. 29for altitudes greater than 2,000 feet (610 m).

(a) Applicable for units installed at or below 2,000 feet (610 m) altitude.

Venting

Note: All vertical and horizontal venting arrangements for Tubular Duct Furnaces are Category III venting.

ANSI now organizes vented appliances into four categories.

Table 6. Venting categories

	Non-Condensing	Condensing
Negative Vent Pressure	I	II
Positive Vent Pressure	III	IV

Category I. Includes non-condensing appliances with negative vent pressure, like the traditional atmospheric unit heater.

Category II. Groups condensing appliances with negative vent pressure.

Category III. Appliances are non-condensing and operate with a positive vent pressure.

Category IV. Covers condensing appliances with positive vent pressure.

Venting for Power Vented Duct Furnaces (Category III)

⚠WARNING

Carbon Monoxide Poisoning!

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 time! Failure to follow these instructions could result in Carbon Monoxide Poisoning (symptoms include grogginess, lethargy, inappropriate tiredness, or flu-like symptoms) which could result in death or serious injury.

⚠WARNING

Combustible Materials!

Failure to maintain proper clearance between the vent pipe and combustible materials could cause a fire which could result in death or serious injury or property damage. Refer to Table 3, p. 10 for proper clearances.

Important: All duct furnaces must be vented!

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, or applicable provisions of local building codes for power vented units. Refer to Figure 9, p. 19 through Figure 17, p. 24. For installations in Canada, see "Additional Requirement for Canadian Installations," p. 17.

Do not damper or add heat recovery devices to the flue piping. Failure to open such a damper prior to operating gas unit will result in the spillage of flue gas into the occupied space.

Vent pipe material must be in compliance with UL 1738 for installations in the United States, and UL S636 for installations in Canada. Refer to Table 7 for vent termination clearance requirements.

Through the wall vents for these appliances shall NOT terminate over public walkways, or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment.

The vent pipe equivalent length must be 5 feet (1.5 m) minimum and must not exceed 50 feet (15.2 m). Equivalent length is the total length of straight sections PLUS 10 feet (3.05 m) for each 90° elbow, and 4 feet (1.22 m) for each 45° elbow.

Maintain 6 inches (152 mm) between vent pipe and combustible materials. A minimum of 12 inches (305 mm) of straight pipe is required from the venter outlet before installing an elbow in the vent system. An elbow should never be attached directly to the venter!

⚠WARNING

Proper Vent Pipe Required!

Never use a pipe of a diameter other than that specified in Table 1, p. 8! Never use PVC or other non-metallic pipe for venting! Failure to follow instructions could result in death, serious injury, and property damage.

Any run of single wall vent pipe exposed to cold air or passing through an unheated space must be insulated with insulation suitable to 550°F (288°C).

The vent system must be installed to prevent collection of condensate. Vertical vent pipes should be equipped with condensate drains. Pitch horizontal pipes downward 1/4 inches per foot (2 mm/m) toward outlet for condensate drainage.

Horizontal portions of the venting system shall be supported at maximum intervals of 4 feet (1.2 m) to prevent sagging. In Canada, support at a maximum of 3 feet (1 m) intervals.

⚠WARNING

Carbon Monoxide!

Never operate duct furnaces without combustion air and flue gas piping in place. Each unit MUST have an individual vent pipe and vent terminal per furnace section! Each unit MUST NOT be connected to other vent systems or to a chimney. 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! Failure to follow these instructions could result in death or serious injury.

Table 7. Vent systems termination clearance requirements

Structure / Object	Minimum Clearance for Termination Locations	
	USA	CANADA
Door, window, or gravity vent inlet; combustion air inlet for other appliances	9 in. for 10,000 to 50,000 Btu/h input; 12 inches for input exceeding 50,000 Btu/h	9 inches (230mm) for 10,000 to 50,000 Btu/h input; 12 inches (305mm) for input exceeding 50,000 Btu/h
Forced air inlet within 10 feet	3 feet above	6 feet (1.8 m)
Adjoining Building or parapet	10 feet	10 feet (3.04 m)
Adjacent public walkways	7 feet above grade	7 feet (2.1 m) above grade
Electric, gas meters & regulators	4 feet horizontal	3 feet (0.9 m) horizontally from meter/regulator assembly. 6 feet (1.8 m), any direction, from a gas service regulator vent outlet
Above grade level[(a)]	1 foot	1 foot (0.3 m)

(a) Minimum above maximum snow depth, or per local code, whichever is greater.

Additional Requirement for Canadian Installations

Refer to specification table and installation manual for proper usage.

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

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

Vertically Vented Duct Furnaces (Category III)

⚠WARNING

Important Safety Precautions!

Failure to follow instructions below could result in death, serious injury, and property damage.

Observe the following precautions when venting the unit:

1. Use flue pipe of the same size as the flue connections on the gas duct furnace (see Table 1, p. 8). All heaters should be vented with UL Listed (UL 1738 in United States, UL S636 in Canada) double wall or single wall vent pipe, a factory built chimney, or a lined brick and mortar chimney that has been constructed in accordance with the National Building Code.
2. Provide as long a vertical run of flue pipe at the duct furnace as possible. A minimum of 5 feet (1.5 m) of vertical flue is required. The top of the vent pipe should extend at least 2 feet (0.61 m) above the highest point on the roof. Install a weather cap over the vent opening; cap should be a Breidert Type L or Fields Starkap vent cap. Consideration should be made for anticipated snow depth. See Figure 9, p. 19.
3. Slope horizontal runs upward from the duct furnace at least 1/4 inch per foot (21 mm/m) minimum. Horizontal runs should not exceed 75 percent of the vertical height of the vent pipe, or chimney, above the flue pipe connections, up to a maximum length of 10 feet (3 m). Horizontal portions of the venting system shall be supported at minimum intervals of 4 feet (1.2 m) in the United States, and at minimum intervals of 3 feet (1 m) in Canada. See Figure 9, p. 19.
4. Use as few elbows as possible.
5. Avoid running vent pipe through unheated spaces.
6. When this cannot be avoided, insulate the pipe to prevent condensation of moisture on the walls of the pipe.
7. Do not damper the flue piping. Failure to open such damper prior to operating the duct furnace will result in the spillage of flue gas into the occupied space.
8. Avoid installing units in areas under negative pressure due to large exhaust fans or air conditioning. When required, a flue vent fan should be installed in accordance with the instructions included with the fan.
9. Vent connectors serving Category I and Category II heaters shall not be connected into any portion of mechanical draft systems operating under positive pressure.

Horizontally Vented Duct Furnaces (Category III)

⚠WARNING

Important Safety Precautions!

Failure to follow instructions below could result in death, serious injury, and property damage.

Observe the following precautions when venting the unit:

1. Horizontal venting arrangements are designed to be used with single wall or double wall vent pipe. Horizontal venting arrangements must terminate external to the building using UL 1738 vent pipe in the United States. For installations in Canada, use vent

pipe conforming with UL S636, local building codes, or in the absence of local building codes, with current CSA-B149.1 Installation Codes for Natural Gas Burning Appliances and Equipment, or CSA-B149.2 Installation Codes for Propane Gas Burning Appliances and Equipment.

⚠WARNING

Risk of Carbon Monoxide Poisoning with Type B Vent!

Do not use a Type B (double wall) vent internally within the building on power vented units! Type B vent does not seal well under positive pressure and could result in exhaust fume leaks. Failure to follow these instructions could result in death or serious injury.

2. Single wall and double wall venting components which are UL Listed and approved for Category III positive pressure venting systems MUST be used.
3. A Breidert Type L or Fields Starkap vent cap must be supplied by the customer for each power vented unit. The vent pipe diameter MUST be as specified in Table 1, p. 8 (“F” Flue Size Diameter). All unit sizes are factory equipped with the required flue size collar.
4. The vent terminal must be at least 12 inches (305 mm) from the exterior of the wall that it passes through to prevent degradation of the building material by flue gases. Minimum and maximum wall thickness for the venting system consist of 4-1/4 inches (105 mm) to 8-1/2 inches (216 mm) for 5-inch (127-mm) diameter vent pipe and 5-3/4 inches (146 mm) to 11-1/2 inches (292 mm) on 6-inch (152-mm) vent pipe.
5. Through the wall vent for these appliances shall NOT terminate over public walkways, or over an area where the condensate or vapor could create a nuisance or hazard, or could be detrimental to the operation of regulators, relief valves, or other equipment. Figure 10, p. 19 and Table 7, p. 17 for vent terminal height and snow consideration requirements.
6. The vent pipe equivalent length must not exceed 50 feet (15.2 m). Equivalent length is the total length of straight sections PLUS 10 feet (3.05 m) for each 90° elbow and 4 feet (1.22 m) for each 45° elbow.
7. Maintain clearance between the vent pipe and combustible materials in accordance with the vent pipe manufacturer’s instructions.
8. The vent system must be installed to prevent collection of condensate. Pitch horizontal portions of vent pipe downward 1/4 inch per foot (21 mm/m) toward the outlet for condensate drainage.See Figure 10, p. 19.
9. Horizontal portions of the venting system shall be supported at maximum intervals of 4 feet (1.2 m) in the United States, and at minimum intervals of 3 feet (1 m) in Canada.
10. Insulate single wall vent pipes exposed to cold air or running through unheated areas.
11. Each unit must have an individual vent pipe and vent terminal! Each unit MUST NOT be connected to other vent systems or to a chimney.

Figure 9. Vertically vented Category III, standard combustion

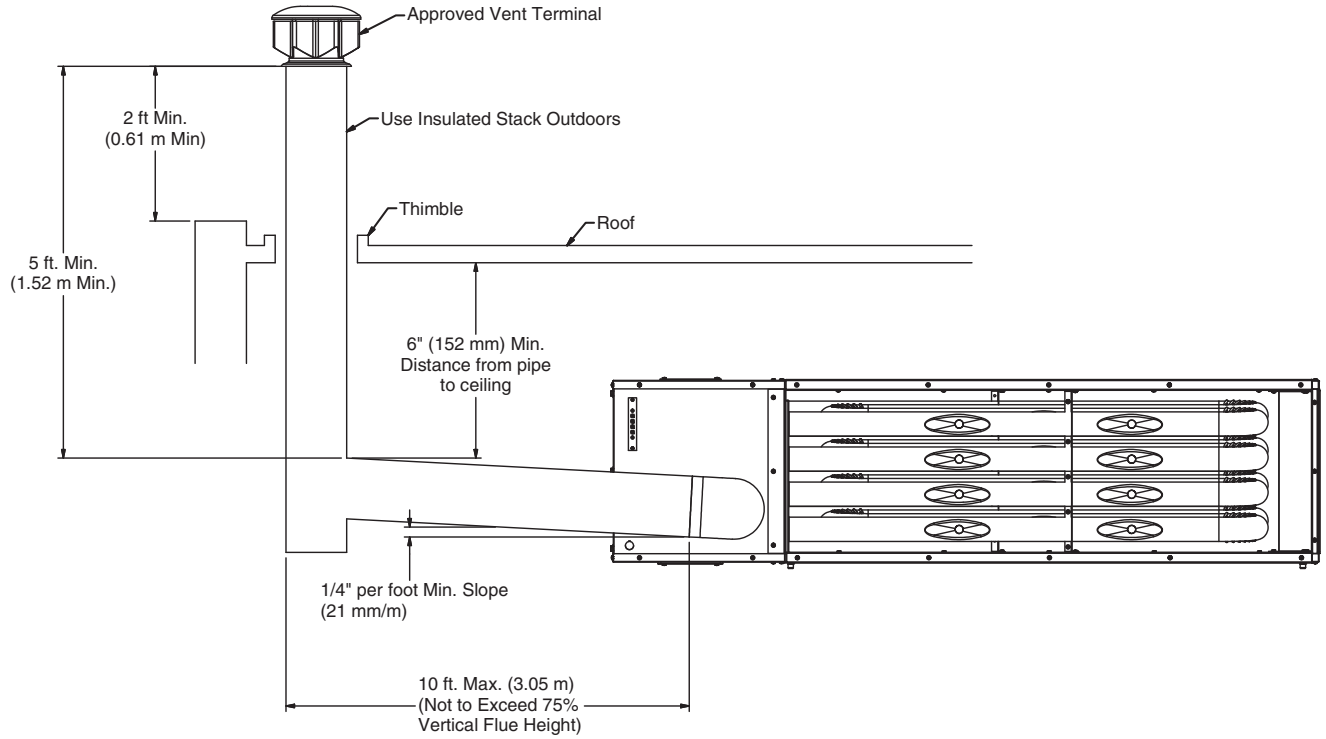
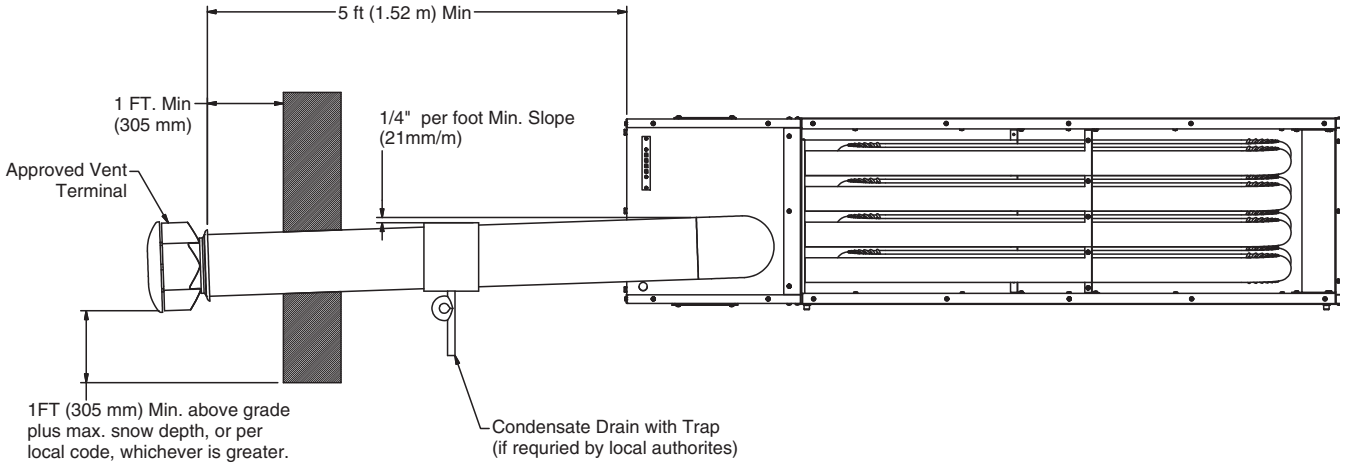


Figure 10. Horizontally vented Category III, standard combustion



Combustion Air

Notes:

- *Combustion and exhaust venting instructions below describe two-pipe venting of a duct furnace configured for separated combustion.*
- *If converting the duct furnace to separated combustion, use the air inlet conversion kit that shipped loose with the unit.*
- *If venting a separated combustion duct furnace concentrically (through one roof or wall termination), a Combustion Air Inlet Kit (X7) is required and instructions included with the kit should be followed with regards to vent pipe installation.*

To convert the unit to separated combustion remove screen and mounting plate from air inlet on top panel of unit by removing four (4) screws. Secure ship loose inlet collar and gasket to inlet opening re-using the four (4) screws removed in previous step. The access panel must also be sealed using the ship loose gasket. Cut gasket to lengths listed in Table 8. Remove paper backing and adhere to access panel making certain that the entire perimeter is covered (see Figure 22, p. 26). After supply power line is run to main control board, seal the gap between cord and hole in rear panel with silicone sealant.

⚠WARNING

Carbon Monoxide Poisoning!

Never operate separated combustion duct furnaces without combustion air and flue gas piping in place. Each duct furnace MUST have its own combustion air system and MUST NOT be connected to other vent systems or to a chimney. 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! Failure to follow these instructions could result in Carbon Monoxide Poisoning (symptoms include grogginess, lethargy, inappropriate tiredness, or flu-like symptoms) which could result in death or serious injury.

1. In the United States, the combustion air system installation must be in accordance with the latest edition of ANSI Z223.1 (NFPA 54) National Fuel Gas Code. In Canada, installation must be in accordance with CSA-B149.1 “Installation Code for Natural Gas Burning Appliances and Equipment” and CSA-B149.2 “Installation Code for Propane Burning Appliances and Equipment.”
2. A Breidert Type L or Fields Starkap, furnished by the customer, must be installed at the termination point of the combustion air system. See Figure 11, p. 21 and Figure 12, p. 22.
3. Each duct furnace MUST have its own combustion air system. It MUST NOT be connected to other air intake systems.
4. Combustion air intake duct may be PVC, CPVC, Type B vent, single wall, double wall or other material approved by local code authority. Never use duct size other than diameter stated in these instructions.
5. Long runs of single wall combustion air 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 inches per foot (21 mm/m) toward the inlet cap to facilitate drainage. Vertical combustion air pipes should be piped as depicted in Figure 11.
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 equals the total length of straight pipe, plus 10 feet (3.05 m) for each 90° elbow and 4 feet (1.22 m) for each 45° elbow.

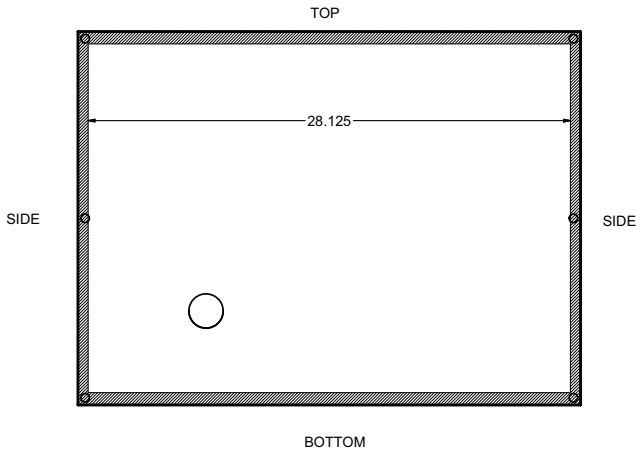
Note: For optimum performance keep the combustion air system as straight as possible.

8. Each slip joint must be secured with at least three corrosion resistant screws. Two full turns of 3M™ #425 Aluminum Foil Tape or its equivalent must then 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 overheard building structures at 4 feet (1.22 m) maximum intervals in the United States and at 3 feet (1 m) maximum intervals in Canada.

Table 8. Gasket lengths

Unit Size	Top / Bottom Gasket Length (in)	Qty	Right / Left Gasket Length (in)	Qty
010	8-3/4	2	28-1/8	2
015	12	2	28-1/8	2
020	15-1/4	2	28-1/8	2
025	18-1/2	2	28-1/8	2
030	21-3/4	2	28-1/8	2
035	25	2	28-1/8	2
040	28-1/4	2	28-1/8	2

Figure 11. Access panel seal



Exhaust Venting

⚠ WARNING

Carbon Monoxide Poisoning!

Never operate separated combustion duct furnaces without combustion air and flue gas piping in place. Each duct furnace MUST have its own combustion air system and MUST NOT be connected to other vent systems or to a chimney. 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! Failure to follow these instructions could result in Carbon Monoxide Poisoning (symptoms include grogginess, lethargy, inappropriate tiredness, or flu-like symptoms) which could result in death or serious injury.

1. In the United States, vent system installation must be in accordance with the latest edition of ANSI Z223.1 (NFPA 54) National Fuel Gas Code. In Canada, installation must be in accordance with CSA-B149.1 “Installation Code for Natural Gas Burning Appliances and Equipment” and CSA-B149.2 “Installation Code for Propane Burning Appliances and Equipment.”
2. A Breidert Type L or Fields Starkap, furnished by the customer, must be installed at the termination point of the vent system. See Figure 12 and Figure 13, p. 22.
3. Each duct furnace MUST have its own vent system. It MUST NOT be connected to other vent systems or to a chimney.
4. Use UL 1738 listed single wall pipe for the vent system. For installations in Canada, use UL S636 listed vent pipe conforming with local building codes, or in the absence of local building codes, with current CSA-B149.1 “Installation Codes for Natural Gas Burning Appliances and Equipment” or CSA-B149.2, “Installation Codes for Propane Gas Burning Appliances and Equipment.”

⚠ WARNING

Proper Vent Pipe Required!

Never use a pipe of a diameter other than that specified in Table 1, p. 8! Never use PVC or other non-metallic pipe for venting! Failure to follow instructions could result in death, serious injury, and property damage.

5. Any run of single wall vent pipe passing through an unheated space must be insulated with an insulation suitable to 550°F (288°C).
6. The vent system must be installed to prevent collection of condensate. Pitch horizontal pipes downward 1/4 inch per foot (21 mm/m) towards the vent cap to facilitate drainage. Vertical vent pipes should be piped as depicted in Figure 14 and Figure 15, p. 23.
7. The equivalent length of the vent system must not be less than 5 feet (1.5 m) and must not exceed 50 feet (15.2 m). Equivalent length equals the total length of straight pipe plus 10 feet (3.05 m) for each 90° elbow and 4 feet (1.22 m) for each 45° elbow.
8. For horizontal combustion air systems longer than 5 feet (1.5 m), the system must be supported from overheard building structures at 4 feet (1.22 m) maximum intervals in the United States and at 3 feet (1 m) maximum intervals in Canada.
9. The exhaust vent system must remain at a minimum distance of 6 inches (152 mm) from all combustible materials. Any part of the vent system that passes through a combustible material must be properly insulated.

Note: Increasing the clearance distances 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 4 inches (102 mm) greater in diameter is required. The opening must be insulated and flashed in accordance with applicable installation codes. See Figure 14, p. 23 and Figure 16, p. 24.

A HORIZONTAL section of an exhaust vent system that passes through a combustible wall must be constructed and insulated as shown in Figure 15, p. 23 and Figure 17, p. 24.

Figure 12. Vertical inlet/vent locations, separated combustion

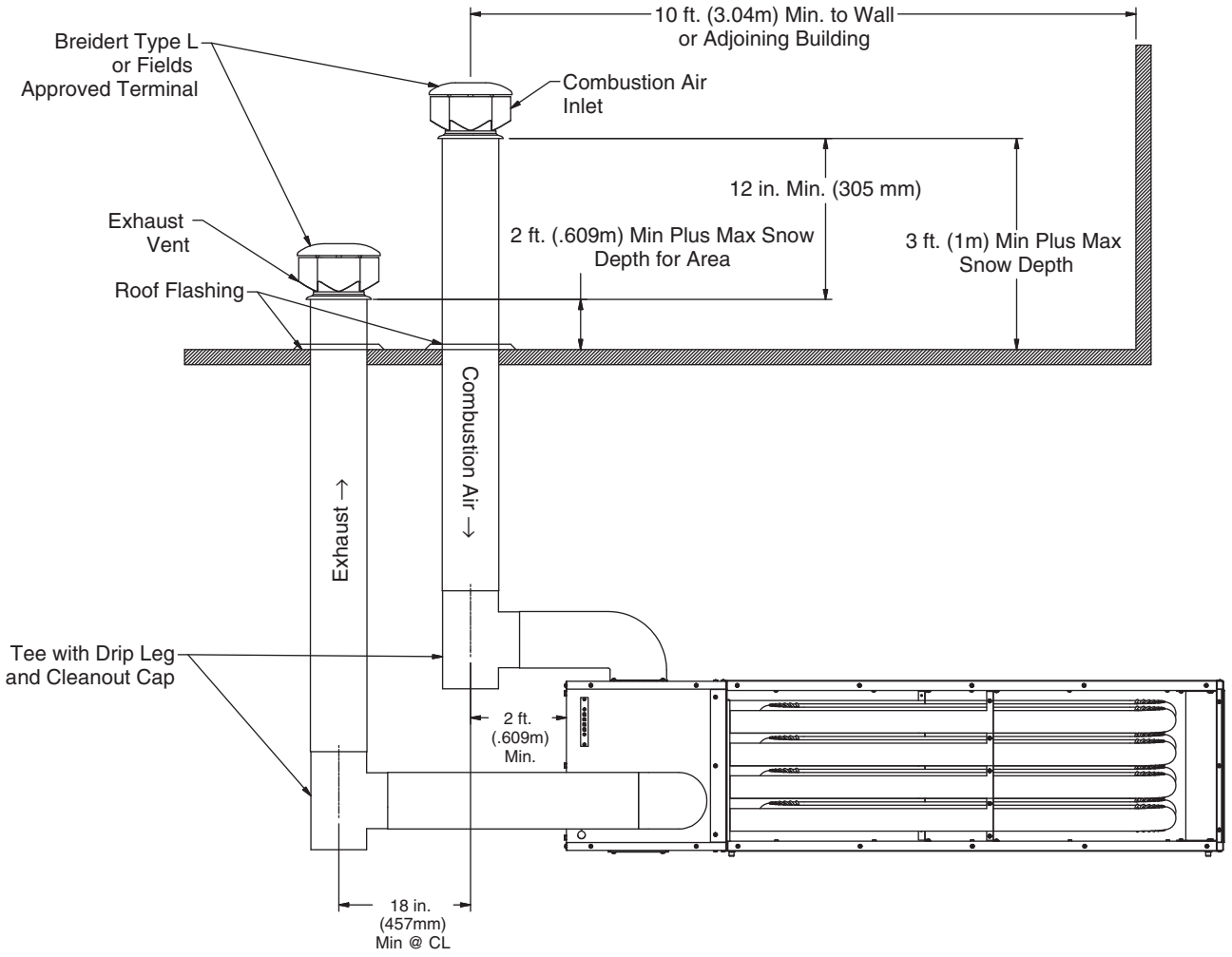


Figure 13. Horizontal inlet/vent locations, separated combustion

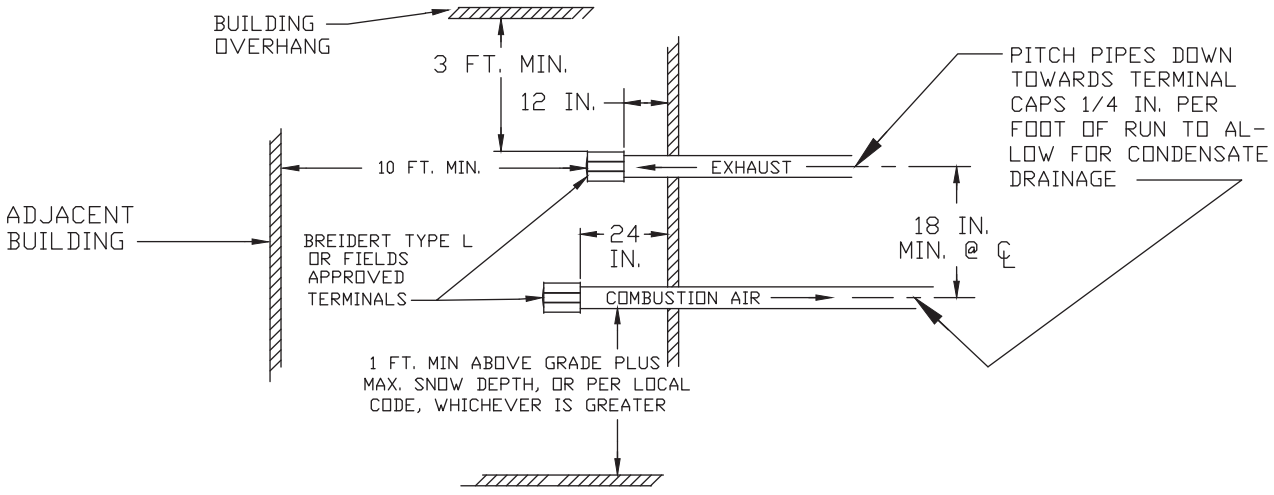


Figure 14. Vertical arrangement, single wall vent system to single wall termination

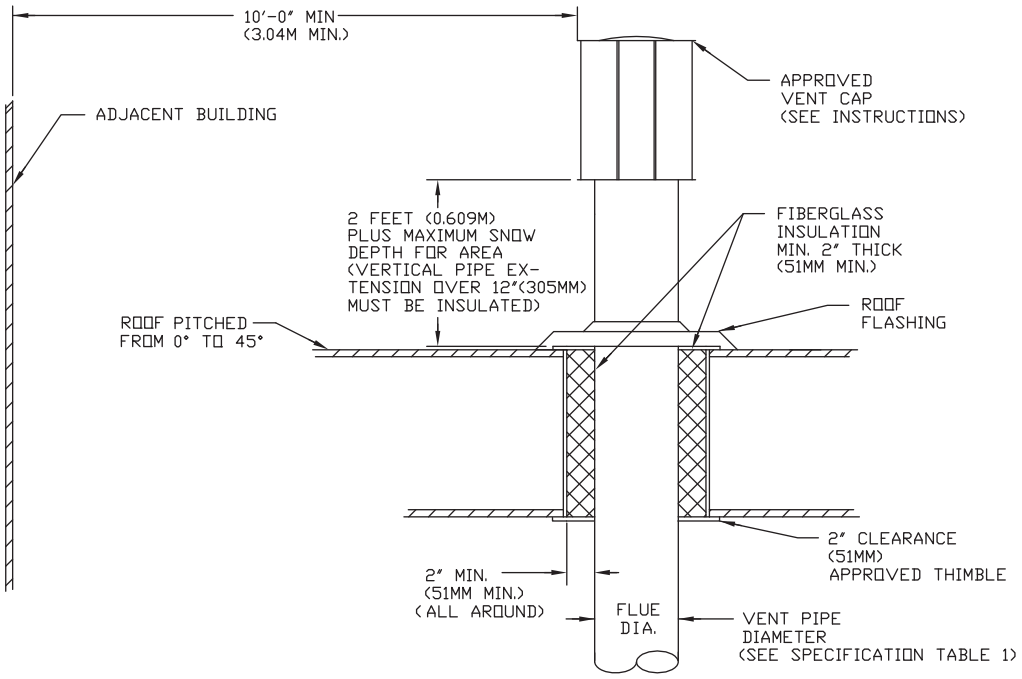


Figure 15. Horizontal arrangement, single wall vent system to single wall termination

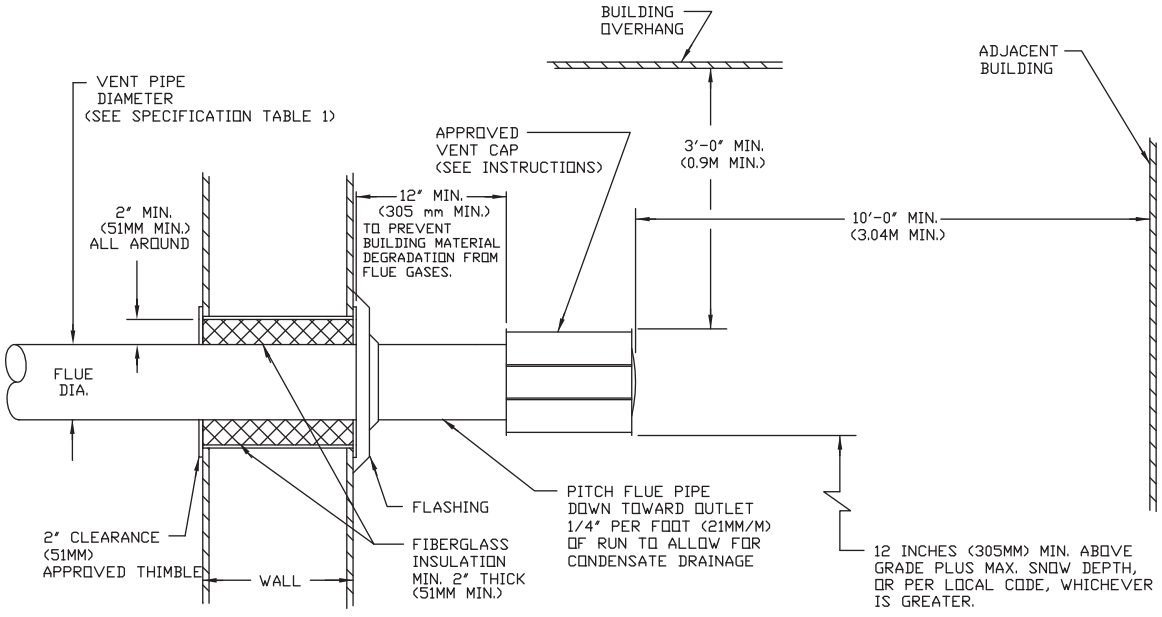


Figure 16. Vertical arrangement, single wall vent system to double wall termination

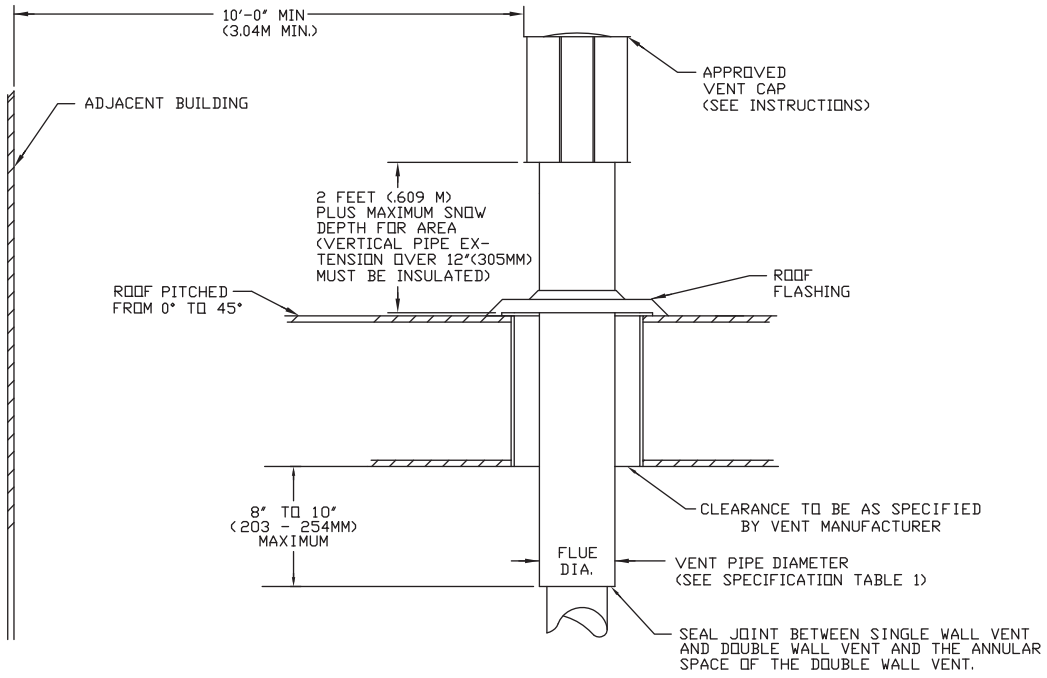
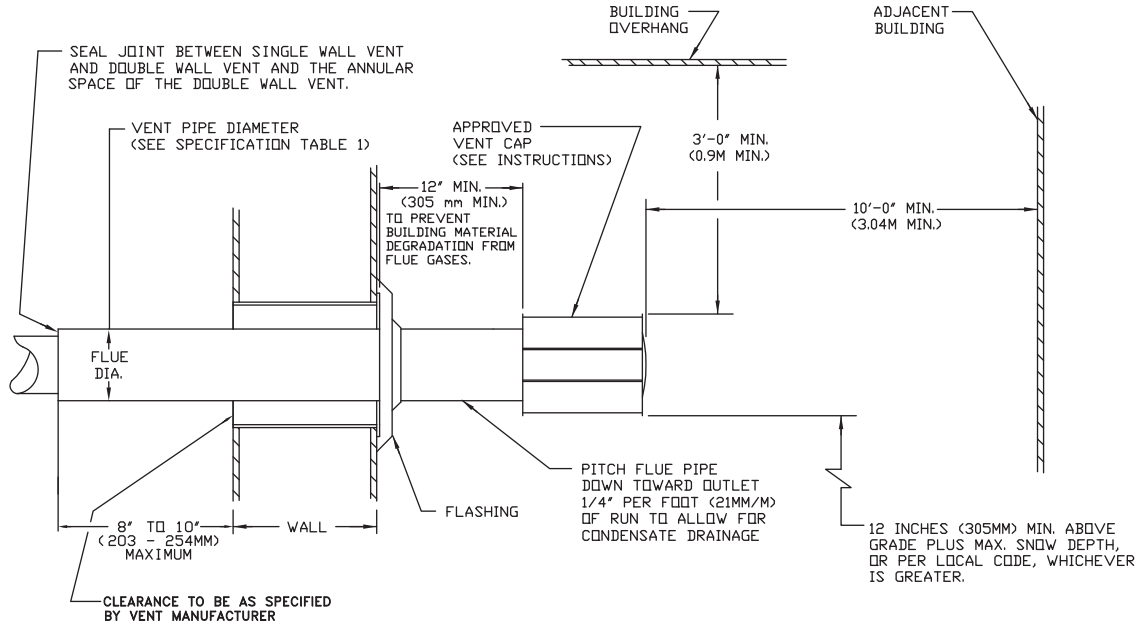


Figure 17. Horizontal arrangement, single wall vent system to double wall termination



Electrical Connections

⚠WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized.

Standard units are shipped for use on 115-volt, 60-hertz, single phase electric power. The duct furnace data plate and electrical rating of the transformer should be checked before energizing the duct furnace electrical system. All external wiring must conform to the latest edition of ANSI/NFPA No. 70, United States National Electrical Code, and applicable local codes; in Canada, to the Canadian Electrical Code, Part 1, CSA Standard C22.1.

⚠WARNING

Use Voltmeter Across Terminals to Check for Power!

Do not use any tools (i.e., screwdriver, pliers, etc.) across terminals to check for power. Use a voltmeter. Failure to do so could result in death or serious injury, and property damage.

It is recommended that the electrical power supply to each duct furnace be provided by a separate, fused, and permanently live electrical circuit. A disconnect switch of suitable electrical rating should be located as close to the gas valve and controls as possible. Each duct furnace must be electrically grounded in accordance with the latest edition of the United States National Electrical Code, ANSI/NFPA No. 70, or CSA Standard C22.1. Refer to Figure 18, p. 25 through Figure 22, p. 26.

Thermostat Wiring and Location

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

Mount the thermostat approximately 5 feet (1.5 m) above the floor, in an area where it will be exposed to a free circulation of average temperature air. Always refer to the thermostat instructions, as well as the duct furnace wiring diagram, and wire accordingly.

Avoid mounting the thermostat in the following locations:

1. Cold Areas—Outside walls or areas where drafts may affect the operation of the control.
2. Hot Areas—Areas where the sun's rays, radiation, or warm air currents may affect the operation of the control.
3. Dead Areas—Areas where the air cannot circulate freely, such as behind doors or in corners.

Figure 18. Low-voltage thermostat wiring, single-stage

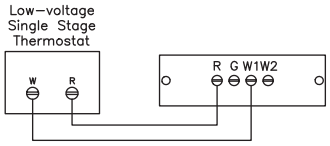


Figure 19. Low-voltage thermostat wiring, two-stage

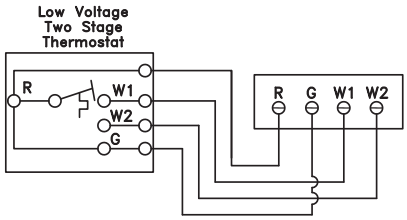
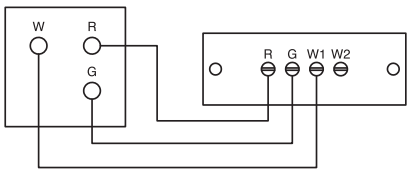


Figure 20. Low-voltage T834H or T834N (or equivalent) thermostat wiring, single-stage



Note: The start-up fan delay should not exceed 30 seconds from a cold start.

Important: For all wiring connections, refer to the wiring diagram shipped with your unit (either affixed to the inside of the control access panel or enclosed in the installation instructions envelope). Should any original wire supplied with the unit have to be replaced including high limit wires, it must be replaced with wiring material having a temperature rating of at least 221°F (105°C).

Standard single stage and optional two stage wiring diagrams are included in this manual. Duct furnaces equipped with modulating gas controls and other optional equipment will be shipped with a unit-specific wiring diagram.

Figure 21. Tubular duct furnaces equipped with natural gas or propane (LP) gas, single-stage

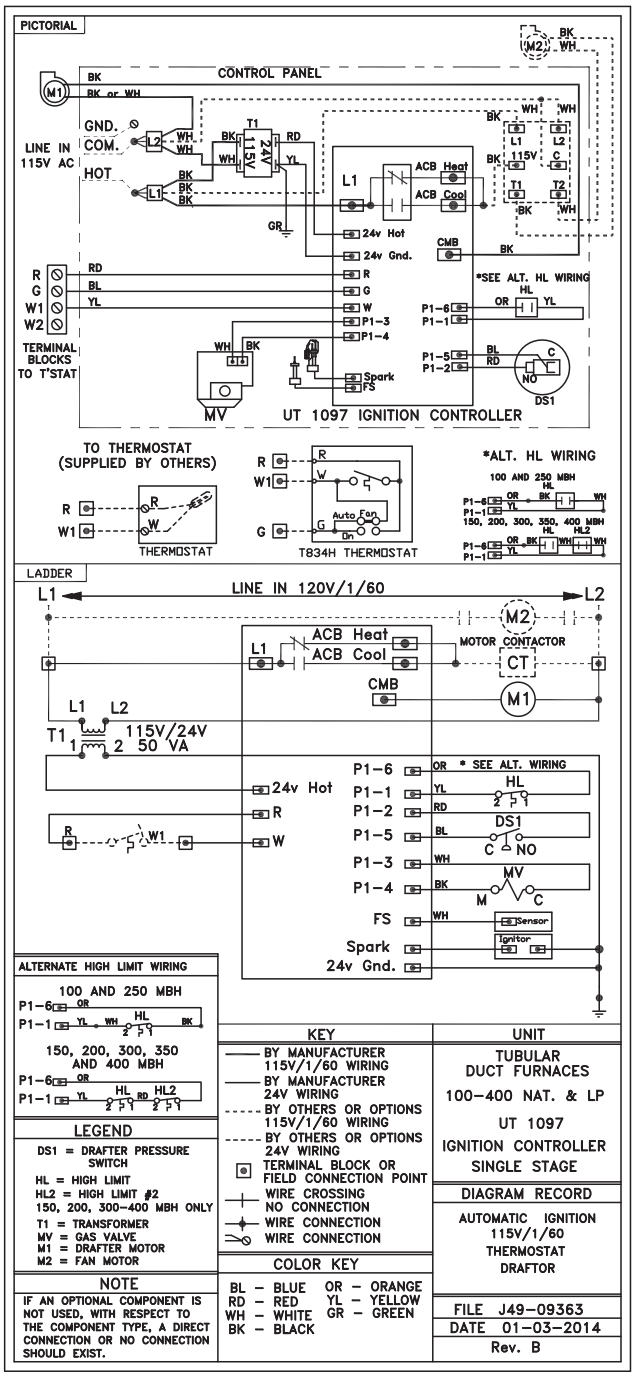
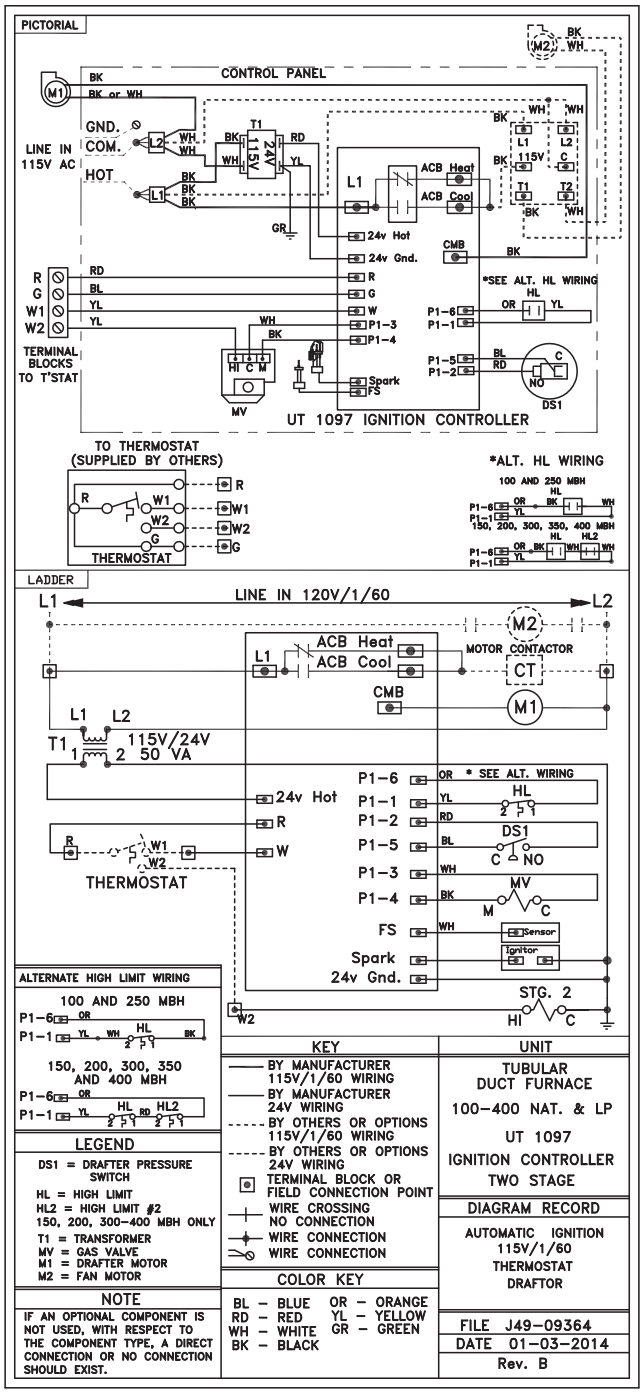


Figure 22. Tubular duct furnaces equipped with natural gas or propane (LP) gas, two-stage



Operation

Tubular Duct Furnace Direct Spark Ignition

Explanation of Controls

1. The duct furnace is equipped with a power vent system that consists of a power vent motor and blower, pressure switch, and sealed flue collector in place of a conventional gravity vent draft diverter.

⚠WARNING

Risk of Fire and Carbon Monoxide Poisoning!

The pressure switch MUST NOT be bypassed. The unit MUST NOT be fired unless the power venter is operating. Failure to follow these instructions could result in death or serious injury.

2. The power vent motor is energized by the room thermostat through the integrated control board when a demand for heat is sensed. The pressure switch measures the flow through the vent system and energizes the direct spark ignition system, beginning the pre-purge timing when the flow is correct.
3. The direct spark ignition system consists of an integrated control board, a spark ignitor, a flame sensor, and a gas valve. When the pre-purge period ends, the direct spark ignition system is energized, and the gas valve opens to supply gas to the burners. When the thermostat is satisfied, the vent system is de-energized and the gas valve closes to stop the flow of gas to the unit. Refer to Figure 23.
4. The high limit switch interrupts the flow of electric current to the control board if the duct furnace becomes overheated, interrupting the flow of gas to the gas valve. The duct furnace will begin a post-purge period. When the post-purge period ends, the power vent motor is de-energized.
5. Once the thermostat is satisfied, the duct furnace will begin a post-purge period. When the post-purge period ends, the power vent motor is de-energized.
6. The wall thermostat, supplied optionally, is a temperature sensitive switch that operates the power vent and direct spark ignition system to control the temperature of the space being heated.The thermostat must be mounted on a vertical, vibration-free surface free of air currents and in accordance with the furnished instructions (also refer to “Electrical Connections,” p. 25).

Start-Up

Note: See lighting instruction plate equipped on the unit.

⚠WARNING

Hazard of Explosion!

Failure to follow proper safe leak test procedures could result in death or serious injury or equipment or property-only-damage. NEVER use an open flame to detect gas leaks. You MUST use a leak test solution for leak testing.

1. Open the manual gas valve in the gas supply line to the duct furnace. Loosen the union in the gas line to purge it of air. Tighten the union and check for leaks.
2. Open the supply gas valve on the duct furnace.
3. Turn ON the electrical power.
4. Turn on the system fan (provided by others).

Note: Failure to turn on system fan when duct furnace is running will cause the unit to trip on high limit. This may result in damage to the duct furnace and heat exchanger.

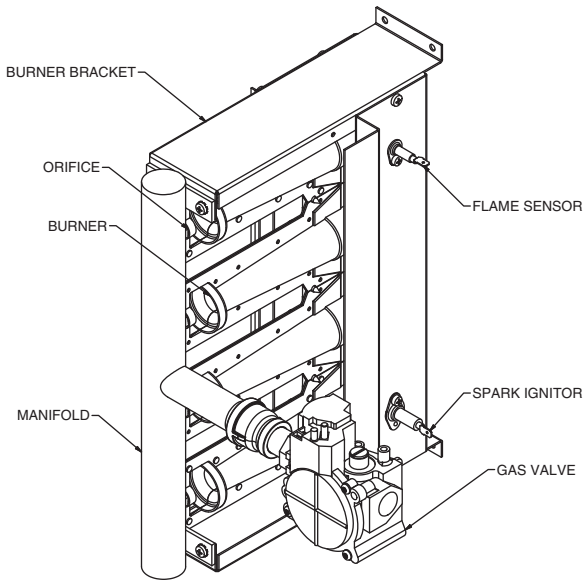
5. The unit should be under the control of the thermostat.Turn the thermostat to the highest point and determine that the power vent motor starts and the burners ignite. Turn the thermostat to the lowest point and determine that the power vent motor shuts off and the burners are extinguished.
6. Turn the thermostat to the desired position.
7. See “Gas Input Rate,” p. 28.

Shut Down

1. Turn the valve selector lever to the “OFF” position.
2. Turn off the electricity.
3. To relight, follow “Start-Up,” p. 27 instructions.

See Figure 23, p. 28 and Figure 24, p. 32 for parts identification.

Figure 23. Direct spark ignition system, tubular duct furnace



Gas Input Rate

Check the gas input rate as follows (refer to "General Safety Information," p. 3 for metric conversions).

NOTICE:

Heater Damage!

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

1. Turn off all gas appliances that use gas through the same meter as the duct furnace.
2. Turn the gas on to the duct furnace.
3. Clock the time in seconds required to burn one 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.

$$\frac{3600 \text{ (seconds per hour) X Btu/ft}^3}{\text{Time (seconds)}} = \text{Input Rate}$$

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 percent of the gas Btu/h input rating (see Table 2, p. 9), adjust the gas pressure.

Adjusting Gas Pressure

Natural Gas. Best results are obtained when the duct furnace is operating at its full rated input with the manifold pressure of 3.5 inches wc (0.9 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:

1. Attach manometer at the pressure tap plug adjacent to the control outlet.
2. Remove the regulator adjustment screw cap, located on the combination gas valve.
3. With a small screwdriver, rotate the adjustment screw counterclockwise to decrease pressure, or clockwise to increase pressure.
4. Replace regulator adjustment screw cap.

Propane (LP) Gas. An exact manifold pressure of 10.0 inches wc (2.5 kPa) must be maintained for proper operation of the duct furnace. If the duct furnace is equipped with a pressure regulator on the combination gas valve, follow Step 1 through Step 4 (above). If the duct furnace is not so equipped, the propane gas supply system pressure must be regulated to attain this manifold operating pressure.

Table 9. Main burner orifice schedule standard altitude(a)

Input in 1000 Btu	Type of Gas	Natural	Propane	# of Burner Orifices
	Heating Value	1,050 Btu/ft³ (39.1 MJ/m³)	2,500 Btu/ft³ (93.1 MJ/m³)	
	Manifold Pressure	3.5 inches wc (0.87 kPA)	10 inches wc (2.49 kPA)	
100	ft³/h orifice drill	93 3.40 mm	40 45	2
150	ft³/h orifice drill	140 3.40 mm	60 45	3
200	ft³/h orifice drill	186 3.40 mm	80 45	4
250	ft³/h orifice drill	233 3.40 mm	100 45	5
300	ft³/h orifice drill	280 3.40 mm	120 45	6
350	ft³/h orifice drill	326 3.40 mm	140 45	7
400	ft³/h orifice drill	372 3.40 mm	140 45	8

Note: When installed in Canada, any references to deration at altitudes in excess of 2,000 feet (610 m) are to be ignored. At altitudes of 2,000 to 4,500 feet (610 to 1372 m), the unit must be field derated and be so marked in accordance with ETL certification. See Table 10 and Table 11, p. 29 for field deration information.

(a) This schedule is for units at operating at normal altitudes of 2,000 feet (610 m) or less.

Tubular Duct Furnace—High Altitude Deration

This tubular duct furnace has been manufactured utilizing standard burner orifices and a normal manifold pressure setting as per the specifications shown on your unit rating plate.

All unit deration must be done through field adjustments by a qualified technician. Once the proper adjustments are made in the field, attach label #J17-06459 to the unit, and record adjusted manifold pressure, altitude of the unit installation, the technician's name, and the date on the label using a permanent marker.

Refer to "Adjusting Gas Pressure," p. 28 for adjusting the manifold pressure.

Table 10. High altitude deration—United States

Altitude		Manifold Pressure				BTU Output[a]
		Natural Gas[b]		Liquid Propane[c]		
Feet	Meters	Inches wc	Pa	Inches wc	Pa	Percentage
0–2,000	0–610	3.5	872	10.0	2491	100%
2,001–3,000	611–915	3.2	797	9.2	2292	96%
3,001–4,000	916–1,220	2.9	722	8.4	2092	92%
4,001–5,000	1,221–1,525	2.7	673	7.7	1918	88%
5,001–6,000	1,526–1,830	2.4	598	7.0	1744	84%
6,001–7,000	1,831–2,135	2.2	548	6.4	1594	80%
7,001–8,000	2,136–2,440	2.0	498	5.7	1420	76%
8,001–9,000	2,441–2,745	1.8	448	5.1	1270	72%
9,001–10,000	2,746–3,045	1.6	399	4.6	1145	68%

Note: Consult local utility for actual heating value.

(a) Deration based on ANSI Z223.1 (NFPA 54).
(b) Table based on heating value of 1,050 Btu/ft^3 at sea level.
(c) Table based on heating value of 2,500 Btu/ft^3 feet at sea level.

Table 11. High altitude deration —Canada

Altitude		Manifold Pressure				BTU Output[a]
		Natural Gas[b]		Liquid Propane[c]		
Feet	Meters	Inches wc	Pa	Inches wc	Pa	Percentage
0–2,000	0–610	3.5	872	10.0	2491	100%
2,001–3,000	611–915	3.2	797	9.2	2292	96%
3,001–4,000	916–1,220	2.9	722	8.4	2092	92%
4,001–5,000	1,221–1,371	2.8	697	7.9	1968	90%

Note: Consult local utility for actual heating value.

(a) Deration based on CGA 2.17-M91.
(b) Table based on heating value of 1,050 Btu/ft^3 feet at sea level.
(c) Table based on heating value of 2,500 Btu/ft^3 at sea level.

Gas Equipment Start-Up

Customer _____ **Job Name & Number** _____

Pre-inspection information (with power and gas off)

Type of Equipment:	Duct Furnace	Type of Gas (Natural or LP)	
Serial Number:		Tank Capacity	____lb ____kg
Name Plate Voltage:		Rating	____Btu@ ____°F
Name Plate Amperage			____kW@ ____°C
Model Number			

Table 12. Startup checklist

	Verify Task Completed
Are all panels, doors, vent caps in place?	
Has the unit suffered any external damage? If so, identify 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 wholesaler or 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 all controls for proper settings.	
Gas Heating (with power and gas on)	
Inlet gas pressure. ____ inches wc or ____ kPa	
Burner ignition.	
Manifold gas pressure.____ inches wc or ____ kPa	
Check electronic 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 _____ inches wc	
Cycle by thermostat or operating control.	
Combustion reading	
Carbon Monoxide _____ PPM	
Carbon Dioxide _____%	
Remarks	

Maintenance

Periodic Service

⚠WARNING

Hazardous Voltage and Gas!

Failure to turn off gas or disconnect power before servicing could result in an explosion or electrocution which could result in death or serious injury. Turn off the gas supply and disconnect all electric power, including remote disconnects, before servicing the unit. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized.

Important: The duct furnace and vent system should be checked once a year by a qualified technician.

All maintenance/service information should be recorded accordingly in "Gas Equipment Start-Up," p. 30.

⚠WARNING

Check Gas Tightness of Safety Shut-Off Valves Annually!

Gas tightness of the safety shut-off valves must be checked at least on an annual basis. Failure to ensure gas tightness of the safety shut-off valves could result in an explosion which could result in death or serious injury.

To check gas tightness of the safety shut-off valves, turn off the manual valve upstream of the appliance combination control. Remove 1/8-inch pipe plug on the inlet side of the combination control and connect a manometer to that tap. Turn the manual valve ON to apply pressure to the combination control. Note the pressure reading on the manometer, then turn the valve OFF. A loss of pressure indicates a leak. If a leak is detected, use soap solution to check all threaded connections. If no leaks are found, combination control is faulty and must be replaced before putting appliance back in service.

⚠WARNING

Check and Test Safety Devices!

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, and ensure that all are operating effectively. Failure to do so could result in unsafe conditions and could result in death, serious injury or property damage.

All Maintenance/Service info should be recorded accordingly in "Gas Equipment Start-Up," p. 30. Should maintenance be required, perform the following inspection and service routine:

1. Inspect the area near the unit to be sure that there is no combustible material located within the minimum safety clearance requirements listed in Table 3, p. 10.

⚠WARNING

Risk of Fire!

Under no circumstances should combustible material be located within the clearances specified in this manual. Failure to provide proper clearance could result in death or serious injury, and property damage.

2. Turn off the manual gas valve and electrical power to the duct furnace.
3. Remove access panel.
4. To clean or replace the burners:
   a. Disconnect the gas inlet pipe.
   b. Remove the four (4) screws that hold the manifold in place, and remove the manifold, gas valve, and gas inlet pipe assembly.
   c. Visually inspect the burners and heat exchanger tubes for signs of soot or debris.
   d. If burners require cleaning, they can be cleaned with a wire brush and/or compressed air.
   e. If inside surface of heat exchanger tubes require cleaning, remove manifold bracket sub-assembly by removing four (4) screws holding it in place.
5. With the burners removed, use a flexible wire brush and compressed air to clean the inside surfaces of the heat exchanger tubes.
6. Inspect air inlet for blockage/debris. Clear if any found.
7. Reassemble the duct furnace by replacing all parts in reverse order.
8. Complete the appropriate unit start-up procedure as given in the Operation section of this manual (see lighting instruction plate on the access side of the unit).
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, stopping the operation of the gas duct furnace. The gas valve should close tightly, completely extinguishing the flame on the burners.

NOTICE:

Power Vent Motor Damage!

Never over oil the power vent motor or premature failure may occur!

11. Check lubrication instructions on power vent motor. If oiling is required, add one or two drops of electric motor oil as follows:
    a. Light Duty—After 3 years or 25,000 hours of operation.

b. Average Duty—Annually after 3 years or 8,000 hours of operation.

c. Heavy Duty—Annually after 1 year or at least 1,500 hours of operation.

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

Identification of Parts Tubular Duct Furnace

Figure 24. Tubular duct furnace, exploded view

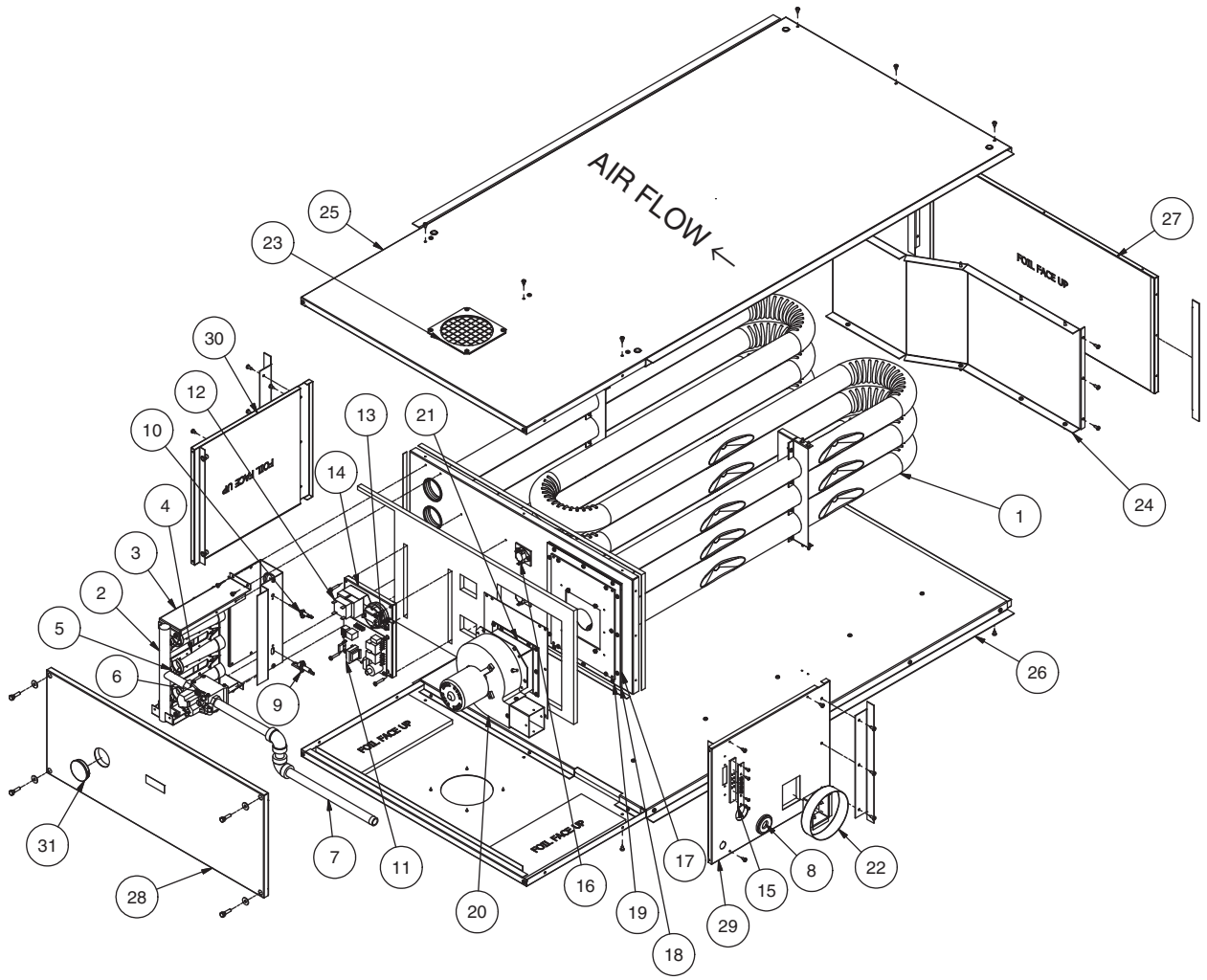


Table 13. Tubular duct furnace component index

1. Vestibule panel/tube assembly (heat exchanger)
2. Manifold
3. Manifold bracket/sub assembly
4. Inshot burner
5. Burner orifice
6. Gas valve
7. Gas inlet pipe
8. Gas inlet grommet
9. Flame sensor
10. Spark ignitor
11. Control board
12. Transformer
13. Air pressure switch
14. Control sub-panel
15. Terminal block plate
16. High limit switch
17. Flue collector
18. Flue collector gasket
19. Flue collector cover panel
20. Power vent assembly
21. Power vent extension/stand-off
22. Flue collar
23. Air inlet screen
24. Baffle
25. Top panel
26. Bottom panel
27. Left side panel
28. Right side/Access panel
29. Rear panel
30. Front panel
31. Peep hole sight glass

How To Order Replacement Parts

Please send the following information to your local representative: if further assistance is needed, contact the manufacturer's customer service department.

- Unit number
- Serial number
- Part description and number as shown in Figure 24/Table 13, p. 32 or in the Replacement Parts Catalog

Troubleshooting

⚠ WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors 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.

Table 14. Tubular duct furnace troubleshooting guide

Symptoms	Possible Cause(s)	Corrective Action
Flame pops back.	Burner orifice too small.	Check with local gas supplier for proper orifice size and replace. Refer to "Gas Input Rate," p. 28.
Noisy flame.	Irregular orifice causing whistle or resonance.	Replace orifice.
	Excessive gas input.	Test and reset manifold pressure (refer to Table 5, p. 15.)
Yellow tip flame. **Note:** Some yellow tipping on LP gas is permissible.	Clogged main burners.	Clean main burner ports.
	Misaligned orifices.	Replace manifold assembly.
	Insufficient combustion air.	Refer to "Clearances," p. 10 and "Venting," p. 16 to ensure unit is properly mounted and vented.
	Unit possibly over fired.	Check gas input and manifold pressures.
	Partially blocked flue vent pipe.	Check flue vent pipe and clear as needed.
Floating flame.	Blocked venting.	Check flue vent pipe and clear as needed.
	Insufficient combustion air.	Check combustion air inlet openings and/or vent pipe and clear as needed.
	Blocked heat exchanger.	Clean heat exchanger. Refer to "Maintenance," p. 31.
	Air leak into combustion chamber or flue collector.	Check flue collector and clear as needed.
Gas odor. **Shut off gas supply immediately!**	Gas leak. **Shut off gas supply immediately!**	Inspect all gas piping and repair accordingly.
	Leaking gas test port on valve.	Check to ensure gas test ports are sealed.
	Blocked heat exchanger.	Clean heat exchanger. Refer to "Maintenance," p. 31.
	Blocked flue collector.	Check flue collector and clear as needed.
	Negative pressure in the building.	Refer to "Installation," p. 10.
Delayed ignition.	Improper ground.	Check grounding wires and spark ignitor connections.
	Bad or broken spark cable.	Inspect spark cable connections andcuts. Replace if necessary.
	Faulty control board.	Check to ensure spark ignitor is energized after pre-purge period.
	Pressure regulator set too low.	Test and reset manifold pressure (refer to Table 5, p. 15.)
	Main burner orifices dirty.	Clean or replace orifices.
	Improper venting.	Refer to "Venting," p. 16.

Table 14. Tubular duct furnace troubleshooting guide

Symptoms	Possible Cause(s)	Corrective Action
Failure to ignite.	Gas leak. **Shut off gas supply immediately!**	Open all manual valves, check for leaks. Inspect all gas piping and repair accordingly.
	No power supply to the unit.	Turn on power supply, check fuses and replace if bad.
	Thermostat not calling.	Turn up thermostat. Check for 24 V on terminals R and W1 on terminal strip.
	Defective high limit switch.	Check switch for continuity if open with no heat present; replace.
	Defective air pressure switch.	Check switch operation to ensure switch closes after power vent purge period. If it does not make, check tubing connections for blockage.
	Defective spark ignitor, gas valve, thermostat or transformer.	Check for continuity and voltage in safety and control circuits; replace an item where continuity or voltage not found.
	Loose wiring.	Check all wiring per diagram.
	Improper ground.	Check all ground wires and connections.
	Improper thermostat or transformer wiring.	Check both for wiring according to diagram.
Condensation.	Improper venting.	Refer to "Venting," p. 16.
	Unit under fired.	Check gas supply pressures to the unit. Refer to Table 5, p. 15.
	Building/space too cold.	A minimum of 50°F (10°C) thermostat setting must be maintained to deter formation of condensation. Refer to "Installation," p. 10.
Burners will not shut off.	Thermostat located improperly.	Relocate thermostat away from outside wall or drafts.
	Improper thermostat wiring.	Check thermostat circuit for open and close on heater terminal strip "R" and "W."
	Shorted circuit.	Check thermostat circuit for shorts or any staples piercing wires.
	Defective thermostat.	If thermostat is calling after set point has been satisfied, replace.
	Defective/sticking gas valve.	Check for 24 V on gas valve terminals when thermostat not calling. Replace if necessary.
	Defective control board.	Check for 24 V at terminals "R" and "W." If not present and board is not in flash code mode, replace board.
	Excessive gas supply pressure.	Refer to Table 5, p. 15.
Rapid burner cycling.	Loose electrical connections at thermostat or gas valve.	Tighten all electrical connections.
	Unit cycling on high limit.	Check for proper air supply across heat exchanger and proper gas supply.
	Thermostat located improperly.	Relocate thermostat away from outside wall or drafts.
	Defective high limit switch.	Jumper high limit switch wiring (orange and yellow wires). If burner operating normally, replace switch.
Not enough heat.	Incorrect gas input.	Refer to "Gas Input Rate," p. 28.
	Unit undersized.	Is the unit output sized correctly for the heat loss of the space? Has the space been enlarged? Is the unit located in the space properly (refer to "Installation," p. 10)?
	Thermostat malfunction.	Check thermostat circuit; 24 V on terminals "R" and "W" on terminal strip.
	Unit cycling on high limit.	Check air movement across the heat exchanger. Check gas input to ensure unit is not over fired. Check heat exchanger to ensure unit is not dirty.
	Incorrect orifice sizes.	Check orifice size (refer to "Gas Input Rate," p. 28).
	Incorrect airflow.	See blower manufacturer for corrective action(s).

Table 14. Tubular duct furnace troubleshooting guide

Symptoms	Possible Cause(s)	Corrective Action
Too much heat.	Unit is over fired.	Refer to "Gas Input Rate," p. 28. Check orifice size. Replace if too large.
	Thermostat malfunction.	Check thermostat for operation, to ensure circuit open and closes.
	Unit runs continuously.	Check wiring per diagram. Check operation at the gas valve. Look for a short in thermostat circuit.
	Defective gas valve.	Replace valve and check pressure setting (see Table 5, p. 15).
	Excessive gas supply pressure.	Refer to Table 5, p. 15.
	Incorrect airflow.	See blower manufacturer for corrective action(s).
Cold air is delivered during heater operation.	Incorrect manifold pressure or gas input.	Test and reset manifold pressure (see Table 5, p. 15.)
	Incorrect airflow.	See blower manufacturer for corrective action(s).
High limit is tripping.	Unit is over fired.	Refer to "Gas Input Rate," p. 28. Check orifice size. Replace if too large.
	Incorrect airflow.	See blower manufacturer for corrective action(s).
	Defective high limit switch.	Check operation of switch. If switch is open during operation, check gas pressure and/or CFM; adjust accordingly. If switch is open during start-up, replace switch.
	Defective control board.	Check for 24 V on line side of high limit. Constant voltage should be recorded. If not, control board is suspect. Check flash code.
Power ventor will not run.	No power supply to the unit.	Turn on power supply, check fuses and replace if bad.
	Thermostat not calling.	Turn up thermostat. Check for 24 V on terminals R and W1 on terminal strip.
	Loose wiring or connection.	Check all wiring in the power vent circuit to ensure good connection, including "neutral."
	Motor overload protection is tripping or bad motor.	Check for 115V between motor leads and check amp draw of motor. Replace if necessary.
	Defective control board.	Check for continuous 115 V on terminal "CBM Blower" and neutral during call for heat. If not present and all checks are normal, replace.
	Motor not oiled.	Refer to "Maintenance," p. 31.
Power venter turns on and off during operation.	Power venter improperly wired.	Check power venter circuit per wiring diagram.
	Main burner did not light on call for heat.	Check motor voltage and amp draw against motor name plate, replace if motor found defective.
	Defective control board.	Check for continuous 115 V on terminal "CBM Blower" and neutral during call for heat. If not present and all checks are normal, replace.
	Motor not oiled.	Refer to "Maintenance," p. 31.
Power venter will not stop.	Power venter improperly wired.	Check power venter circuit per wiring diagram.
	Main burner did not light on call for heat.	Heater is in lockout mode; check flash code table for problem.
	Defective control board.	If no flash codes present along with no call for heat, replace control board.
Noisy power venter.	Power venter wheel loose.	Replace or tighten.
	Power venter wheel is dirty.	Clean power venter wheel.
	Power venter wheel is rubbing on housing.	Realign power venter wheel.
	Bearings are dirty.	Oil bearing on power venter motor (refer to label on motor).

⚠ WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.

No cycling or appliance power or thermostat call for heat since appliance failure has occurred:

1. Check the system thermostat to make sure it is calling for heat. (Do not cycle the thermostat on and off at this time.)
2. Remove the appliance burner compartment door. Do not interrupt power to the control board by opening any electrically interlocked panels.
3. Observe the LED indicator on the control board (a green LED labeled "OK" indicates system faults); check and repair system as noted in the chart to the right.

Note: Air flow proving switch and power venter hose barbs must be free of any dust or debris at all times. Periodically check these openings and/or if any problems occur.

Table 15. Tubular duct furnace troubleshooting with LED indicator assistance

LED Status	Indicates	Check / Repair
Slow Flash	Control OK, no call for heat.	Not Applicable
Fast Flash	Control OK, call for heat present.	Not Applicable
Steady Off	Internal control fault, or no power.	1. Line voltage on terminals 120 and C on transformer. 2. Low voltage (24 V) on terminals 24 and C on transformer. 3. 5 Amp fuse on circuit board.
Steady On	Control internal failure or bad ground.	1. Common side of transformer grounded to chassis. 2. Loose spark ignitor.
2 Flashes	In lockout from failed ignitions or flame losses.	1. Gas supply off or gas supply pressure too low. 2. Flame sense rod contaminated or loose wire. 3. Gas valve switch is off or wires are not connected. 4. Broken or cracked porcelain on flame probe or spark ignitor.
3 Flashes	Pressure Switch open with inducer on or closed with inducer off.	1. Obstructions or restrictions in appliance air intake or flue outlet are preventing proper combustion airflow. 2. Moisture or debris in tubing that connects pressure switch and draft inducer. 3. Airflow switch jumpered or mis-wired.
4 Flashes	Limit or rollout switch is open.	1. Open manual reset rollout switch. 2. Gas pressure too high, over fire condition. 3. Incorrect airflow due to blockage or motor not operating.
5 Flashes	Flame sensed while gas valve is off.	Flame probe mis-wired or shortened.
6 Flashes	On-board microprocessors disagree.	Thermostat is interfering with control board.

Warranty

The “Manufacturer” warrants to the original owner at original installation site that the above model Gas-Fired Heater (“the Product”) will be free from defects in material or workmanship for (1) year from the date of shipment from the factory, or one and one-half (1-1/2) years from the date of manufacture, whichever occurs first. The Manufacturer further warrants that the complete heat exchanger, flue collector, and burners be free from defects in material or workmanship for a period of ten (10) years from the date of manufacture. If upon examination by the Manufacturer the Product is shown to have a defect in material or workmanship during the warranty period, the manufacturer will repair or replace, at its option, that part of the Product which is shown to be defective.

This limited warranty does not apply:

- if the product has been subjected to misuse or neglect, has been accidentally or intentionally damaged, has not been installed, maintained, or operated in accordance with furnished written instructions, or has been altered or modified in any way by any unauthorized person.
- to any expenses, including labor or material, incurred during removal or reinstallation of the Product
- to any damage due to corrosion by chemicals, including halogenated hydrocarbons, precipitated in the air
- to any workmanship of the installer of the Product

This limited warranty is conditional upon:

- advising the installing contractor, who in turn notify the distributor or manufacturer
- shipment to the Manufacturer of that part of the Product thought to be defective. Goods can only be returned with prior written approval of the Manufacturer. All returns must be freight prepaid.
- determination in the reasonable opinion of the Manufacturer that there exists a defect in material or workmanship

Repair or replacement of any part under this Limited Warranty shall not extend the duration of the warranty with respect to such repaired or replaced part beyond the stated warranty period.

THIS LIMITED WARRANTY IS IN LIEU OF ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, AND ALL SUCH OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS LIMITED WARRANTY. IN NO EVENT SHALL THE MANUFACTURER BE LIABLE IN ANY WAY FOR ANY CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OF ANY NATURE WHATSOEVER, OR FOR ANY AMOUNTS IN EXCESS OF THE SELLING PRICE OF THE PRODUCT OR ANY PARTS THEREOF FOUND TO BE DEFECTIVE. THIS LIMITED WARRANTY GIVES THE ORIGINAL OWNER OF THE PRODUCT SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY BY JURISDICTION.

Note: In the interest of product improvement, we reserve the right to make changes without notice.

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