

# The Modulating **delta**

## Vent Supplement



### **WARNING**

This document is intended to be used by a qualified heating contractor or service technician. Read all instructions within this document and within the MODULATING DELTA Installation and Maintenance Manual, before proceeding with the installation. It is recommended to follow the procedures in the steps given, skipping or missing procedural steps could result in severe personal injury, death or substantial property damage.

### **NOTICE**

Installation of this appliance must comply with local requirements and codes and with the National Fuel Gas Code NFPA 54, ANSI Z223.1 for installations within the U.S. For installations in Canada the installation must comply with CSA B149.1 or B149.2

Date: 4/27/06



2006-11 Modulating Delta Vent Supl.

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## DEFINITIONS

The following terms are used throughout this manual to bring attention to the presence of potential hazards or to important information concerning the product.

### DANGER

Indicates the presence of a hazardous situation which, if ignored, will result in death, serious injury or substantial property damage.

### WARNING

Indicates a potentially hazardous situation which, if ignored, can result in death, serious injury or substantial property damage.

### CAUTION

Indicates a potentially hazardous situation which, if ignored, may result in minor injury or substantial property damage.

### NOTICE

Indicates special instructions on installation, operation or maintenance, which are important to the equipment but not related to personal injury hazards.

### BEST PRACTICES

Indicates recommendations made by Triangle Tube for the installers which will help to ensure optimum operation and longevity of the equipment.

## INSTALLER

### WARNING

**Read all instructions as outlined in this manual and in the appliance installation manual. Failure to comply with these instructions in the order presented could result in personal injury or death.**

This document is a supplement to the MODULATING DELTA installation and maintenance manual. The purpose of this supplement is for the proper ventilation and installation of the vent and combustion air piping to the appliance.

### WARNING

**All MODULATING DELTA vent and combustion air piping must be installed, terminated and joints sealed as outlined in this manual. Failure to comply with installation procedures outlined in this manual can result in severe personal injury, death or substantial property damage.**

### NOTICE

**If concentric vent/air installation is required an optional kit is available through Triangle Tube.**

## HOMEOWNER

- This manual is intended for use by a qualified heating contractor or service technician.
- Please reference the User Information manual for additional information.
- Ensure this document and all pertaining documents are maintained near the appliance to be used by the qualified heating contractor or service technician.

## SECTION I - PRE- INSTALLATION ITEMS

### Removal of an Existing Appliance from a Common Vent System

#### **DANGER**

**A MODULATING DELTA when vented as a Category I appliance (PG-150 & PG-199 ONLY) may be vented into a common vent system. Do not install a MODULATING DELTA when vented as a Direct Vent or Category III or IV appliance into a common vent with any other gas appliance. This will cause gas spillage or appliance malfunction, resulting in possible severe personal injury, death or substantial property damage.**

When an existing appliance is removed from a common venting system, the common venting system is likely to be too large for proper venting of the remaining appliances. At the time of removal of an existing appliance, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maxi-

mum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CGA B149, Installation Codes. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CGA B149, Installation Codes.

#### **DANGER**

**A MODULATING DELTA when vented as a Category I appliance (PG-150 & PG-199 ONLY) may be vented into a common vent system. Do not install a MODULATING DELTA when vented as a Direct Vent or Category III or IV appliance into a common vent with any other gas appliance. This will cause gas spillage or appliance malfunction, resulting in possible severe personal injury, death or substantial property damage.**

**Combustion Air Contamination**

**WARNING**

If the MODULATING DELTA combustion air inlet is located in any area likely to cause or contain contamination, or if products, which would contaminate the air cannot be removed, the combustion air must be repiped and terminated to another location. Contaminated combustion air will damage the appliance and its burner system, resulting in possible severe personal injury, death or substantial property damage.

**DANGER**

Do not operate a MODULATING DELTA if its combustion air inlet is located near a laundry room or pool facility. These areas will always contain hazardous contaminants.

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the burner and vent system, they can form strong acids. These acids can create corrosion of the heat exchanger, burner components and vent system, causing serious damage and presenting a possible threat of flue gas spillage or water leakage into the surrounding area.

If contaminating chemicals are located near the area of the combustion air inlet, the installer should pipe the combustion air inlet to an outside area free of these chemicals.

**Potential contaminating products**

- Spray cans containing chloro/fluorocarbons
- Permanent Wave Solutions
- Chlorinated wax
- Chlorine - based swimming pool chemicals / cleaners
- Calcium Chloride used for thawing ice
- Sodium Chloride used for water softening
- Refrigerant leaks
- Paint or varnish removers
- Hydrochloric acid / muriatic acid
- Cements and glues
- Antistatic fabric softeners used in clothe dryers
- Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
- Adhesives used to fasten building products and other similar products

Areas likely to contain these products

- Dry cleaning / laundry areas and establishments
- Beauty salons
- Metal fabrication shops
- Swimming pools and health spas
- Refrigeration Repair shops
- Photo processing plants
- Auto body shops
- Plastic manufacturing plants
- Furniture refinishing areas and establishments
- New building construction
- Remodeling areas
- Garages with workshops

**Ventilation and Combustion Air Requirements - Direct Vent**

A Direct Vent appliance utilizes uncontaminated outdoor air (piped directly to the appliance) for combustion.

For Direct Vent installations involving only the MODULATING DELTA, the space / enclosure must provide two openings for ventilation. The openings must be sized to provide 1 square inch of free area per 1,000 BTUH of appliance input. The openings shall be placed 12 inches from the top of the space and 12 inches from the floor of the space.

For installations in which the MODULATING DELTA shares the space with air movers (exhaust fan, clothes dryers, fireplaces, etc.) and other combustion equipment (gas or oil) the space must be provided with adequate air openings to provide ventilation and combustion air to the equipment. To properly size the ventilation / combustion air openings, the installer must comply with the National Fuel Gas Code NFPA 54, ANSI Z223.1 for installations in the U.S or CSA B149.1 and B149.2 for installations in Canada.

**WARNING**

**The space must be provided with ventilation / combustion air openings properly sized for all make-up air requirements (exhaust fans, clothes dryers, fireplaces, etc.) and the total input of all appliances located in the same space as the MODULATING DELTA, excluding the input of a Direct Vent MODULATING DELTA which uses combustion air directly from the outside, thus additional free area for the openings is not required. Failure to provide or properly size the openings could result in severe personal injury, death or substantial property damage.**

**Ventilation and Combustion Air Requirements - Category I, III and IV**

A Category I, III and IV appliance utilizes uncontaminated indoor or outdoor air (surrounding the appliance) for combustion.

**BEST PRACTICES**

**In order to reduce the potential risks associated with indoor contaminants (listed on page 3), flammable vapors and tight housing construction (little or no infiltration air), it is recommended to pipe uncontaminated combustion air directly from the outdoors to the appliance. This practice also promotes higher system efficiency by reducing heated indoor air from being exhausted from the house and replaced by cold infiltration air into the house.**

For installations in which the MODULATING DELTA shares the space with air movers (exhaust fan, clothes dryers, fireplaces, etc.) and other combustion equipment (gas or oil) the space must be provided with adequate air openings to provide ventilation and combustion air to the equipment. To properly size the ventilation / combustion air openings, the installer must comply with the National Fuel Gas Code NFPA 54, ANSI Z223.1 for installations in the U.S or CSA B149.1 and B149.2 for installations in Canada, as referenced in this section of the manual and title Methods of Accessing Combustion Air into a Space.

**WARNING**

**The space must be provided with ventilation / combustion air openings properly sized for all make-up air requirements (exhaust fans, clothes dryers, fireplaces, etc.) and the total input of all appliances located in the same space as the MODULATING DELTA. Failure to provide or properly size the openings could result in severe personal injury, death or substantial property damage.**

**Methods of Accessing Combustion Air Into A Space - Category I, III and IV**

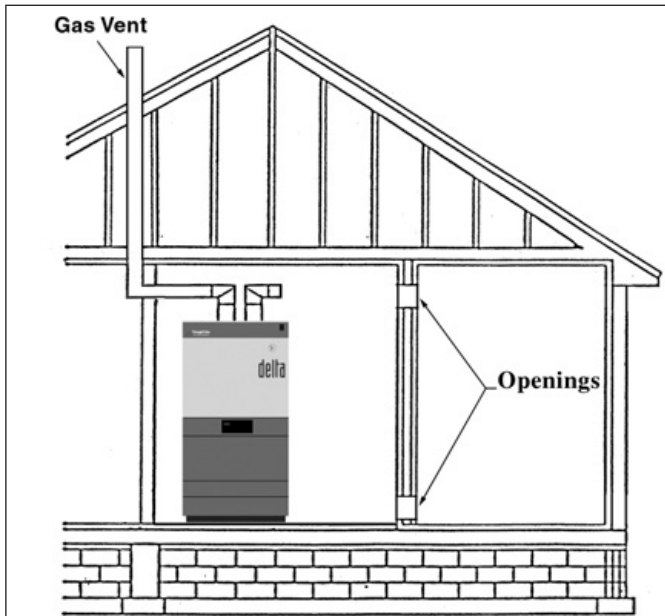
**Indoor Combustion Air**

**NOTICE**

The methods listed in this section for accessing Indoor Combustion Air assume that the infiltration rate is adequate and not less than .40 ACH. For infiltration rates less than .40 ACH, reference the NFPA 54 National Fuel Gas Code for additional guidance.

Opening Size and Location

Openings used to connect indoor spaces shall be sized and located in accordance with the following see Fig. 1:



**Fig. 1: All Combustion Air from Adjacent Indoor Spaces through Indoor Combustion Openings**

- Combining spaces on the same story. Each opening shall have a minimum free area of 1 sq. in./1000 Btu/hr of the total input rating of all gas utilization equipment in the space, but not less than 100 sq. inches. One opening shall commence within 12 inches of the top, and one opening shall commence within 12 inches of the bottom of the enclosure. The minimum dimension of air openings shall be not less than 3 inches.

- Combining spaces in different stories. The volumes of spaces in different stories shall be considered as communicating spaces where such spaces are connected by one or more openings in doors or floors having a total minimum free area of 2 sq. in./1000 Btu/hr of total input rating of all gas utilization equipment.

**Outdoor Combustion Air**

**BEST PRACTICES**

**Isolating the combustion appliance room from the rest of the building and bringing in uncontaminated outside air for combustion and ventilation is always preferred.**

Opening Size and Location

The minimum dimension of air openings shall be not less than 3 inches

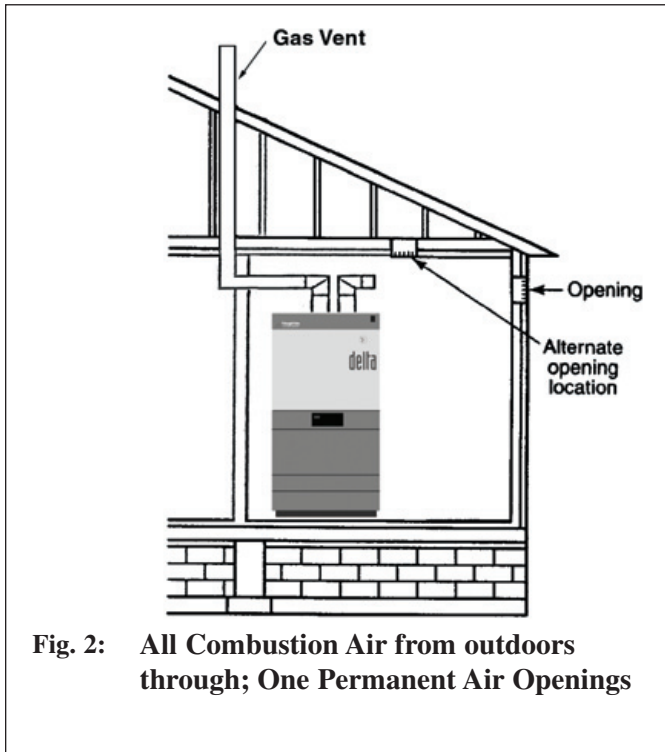
Openings used to supply combustion and ventilation air shall be sized and located in accordance with the following:

One Permanent Opening Method

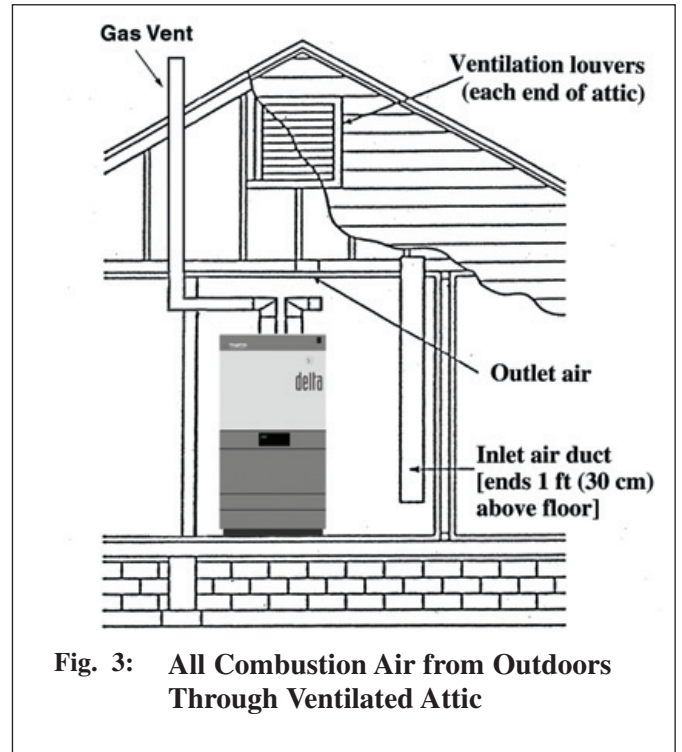
One permanent opening, commencing within 12 in. of the top of the enclosure, shall be provided. See Fig. 2. The equipment shall have clearances of at least 1 inch from the sides and 6 in. from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of the following:

- 1sq. in./3000 Btu/hr of the total input rating of all equipment located in the enclosures, and
- Not less than the sum of the areas of all vent connectors in the space.





**Fig. 2: All Combustion Air from outdoors through; One Permanent Air Openings**

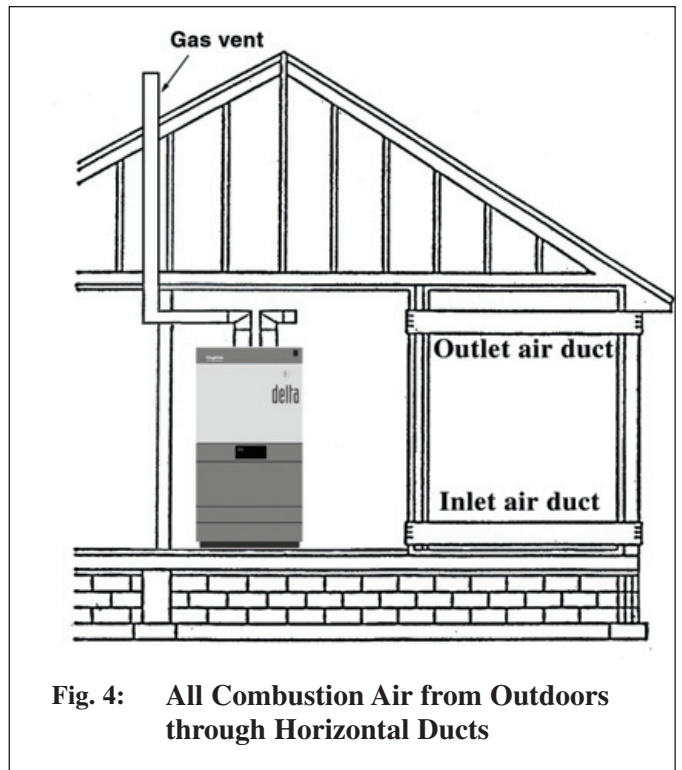


**Fig. 3: All Combustion Air from Outdoors Through Ventilated Attic**

Two Permanent Openings Method.

Two permanent openings, one commencing within 12 in. of the top and one commencing within 12 in. of the bottom of the enclosure, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors, as follows:

- Where directly communicating with the outdoors or where communication to the outdoors is through vertical ducts, each opening shall have a minimum free area of 1 sq. in./4000 Btu/hr of total input rating of all equipment in the enclosure. See Fig.3.
- Where communicating with the outdoors is through horizontal ducts, each opening shall have a minimum free area of not less than 1 sq.in./2000 Btu/hr of total input rating of all equipment in the enclosure. See Fig. 4.



**Fig. 4: All Combustion Air from Outdoors through Horizontal Ducts**

**Combination of Indoor and Outdoor Combustion Air**

**Indoor Openings:** Where used, openings connecting the interior spaces shall comply with the Indoor Combustion Air section on page 5.

**Outdoor Opening(s) Location.** Outdoor opening(s) shall be located in accordance with the Outdoor Combustion Air section.

**Outdoor Opening(s) Size.** Outdoor opening(s) shall be calculated in accordance with the following:

- The ratio of the interior spaces shall be the available volume of all communicating spaces divided by the required volume.
- The outdoor size reduction factor shall be 1 minus the ratio of interior spaces.
- The minimum size of outdoor opening(s) calculated in accordance with the above outdoor air section multiplied by the reduction factor. The minimum dimension of air openings shall not be less than 3 in.

**Vent/Combustion Air Piping and Materials**

**NOTICE**

Installation of the vent and combustion air piping must comply with local codes and requirements and with the National Fuel Gas Code NFPA 54, ANSI Z223.1 and/or Standard for Chimneys, Vent and Solid Fuel Burning Appliances, NFPA211 for installations in the U.S. or with CSA B149.1 or B149.2 for installations in Canada.

The MODULATING DELTA is certified per ANSI Z21.10.3 and CSA 4.3 as a Category I or III or IV (indoor air) or Direct Vent (sealed combustion) appliance. A Category I, III and IV appliance utilizes uncontaminated indoor or outdoor air (surrounding the appliance) for combustion. A Direct Vent appliance utilizes uncontaminated outdoor air (piped directly to the appliance) for combustion. See Table 1 for a breakdown of model numbers and venting options.

**Table 1: Venting Options**

Model Number	Venting Options
PG-150 PG-199	Category I or III or Direct Vent
PG PLUS-150 PG PLUS-199	Category IV or Direct Vent

**BEST PRACTICE**

In order to reduce the potential risks associated with indoor contaminants (listed on page 3), flammable vapors and tight housing construction (little or no infiltration air), it is recommended to pipe uncontaminated combustion air directly from the outdoors to the appliance. This practice also promotes higher system efficiency by reducing heated indoor air from being exhausted from the house and replaced by cold infiltration air into the house.

## Vent Piping Materials - Category I

### WARNING

The vent materials must meet the listed requirements in this manual. Failure to comply with these material requirements could result in severe personal injury, death or substantial property damage.

#### Piping and Fittings

- B-Vent
- Approved Metal Chimney Lining System
- Other approved Gas Vent Systems Per NFPA 54 and/or NFPA 211 or CSA B149 for Canada.

### WARNING

**DO NOT** mix vent components from different vent systems. Ensure all piping and fittings, joints are sealed and secured. Failure to comply with these requirements could cause vent failure resulting in leakage of flue products into the living space surrounding the appliance.

## Vent Piping Materials - Category III, IV and Direct Vent

### WARNING

The vent materials must meet the listed requirements in this manual. Failure to comply with these material requirements could result in severe personal injury, death or substantial property damage.

#### 3" Diameter AL29-4C® Piping and Fittings

The following is a list of approved vent manufactures and vent systems:

- Heat-Fab (Saf-T-Vent®)
- ProTech Systems (Fas NSeal®)
- Flex-L (Star-34)
- Z-Flex (Z-Vent III™)
- Metal-Fab, Inc (Corr Guard)

## Combustion Air Piping and Materials -Direct Vent

### WARNING

The combustion air materials must meet the listed requirements in this manual. Failure to comply with these material requirements could result in severe personal injury, death or substantial property damage.

#### 3" Diameter Combustion Air Piping and Fittings

- PVC Schedule 40 - ANSI/ASTM D1785
- PVC-DWV - ANSI/ASTM D2665
- CPVC Schedule 40 - ANSI/ASTM F441
- ABS-DWV Schedule 40 - ANSI/ASTM D2661
- Galvanized Metal Vent
- Flexible Metal Vent

#### Pipe Cement and Primer

- PVC - ANSI/ASTM D2564
- CPVC - ANSI/ASTM F493
- ABS - ANSI/ASTM D2235

### NOTICE

For installations in Canada, all piping, fittings and cement/primer material must comply with CSA or ULC certification.

### NOTICE

**DO NOT** mix components from different systems. Seal all piping and fittings.

## SECTION II - DIRECT VENT INSTALLATION OF VENT/AIR PIPING

A Direct Vent appliance utilizes uncontaminated outdoor air (piped directly to the appliance) for combustion.

### Direct Vent - Vertical - Thru the Roof or An Unused Chimney

#### NOTICE

Installation of the vent and combustion air piping must comply with local codes and requirements and with the National Fuel Gas Code NFPA 54, ANSI Z223.1 for installations in the U.S. or CSA B149.1 or B149.2 for installations in Canada.

#### NOTICE

When using an unused chimney as a means of a raceway for the vent, the surrounding space within the chimney cannot be used to draw combustion air or vent another appliance.

#### WARNING

A gas vent extending through a roof should not terminate near an adjacent wall or below any building extensions such as roof eaves, balconies or decks. Failure to comply with the required clearances could result in severe personal injury, death or substantial property damage.

The installer has two options when direct venting vertically, Concentric or Two Pipe. Both vent options are shown in Figs. 5 & 6 and are available in accessory kits through Triangle Tube. See Fig. 6 page 10 for Two Pipe installation details or the MODULATING DELTA Concentric Vent Installation Manual for additional Concentric details.

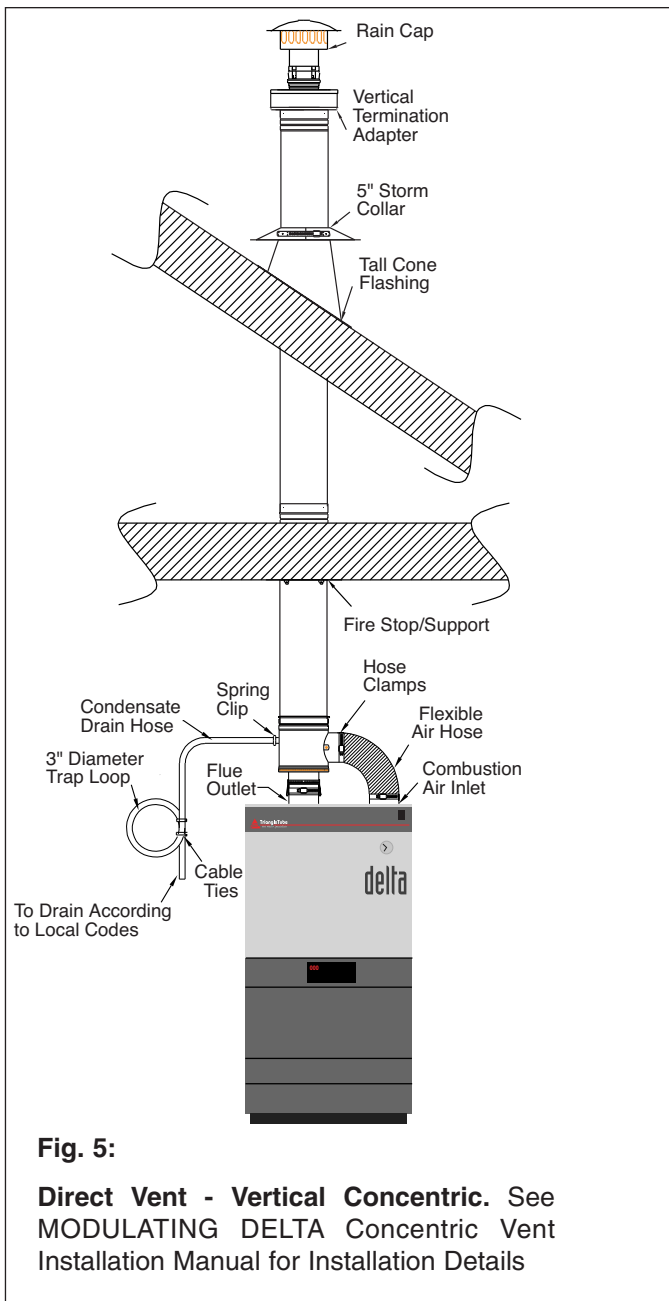
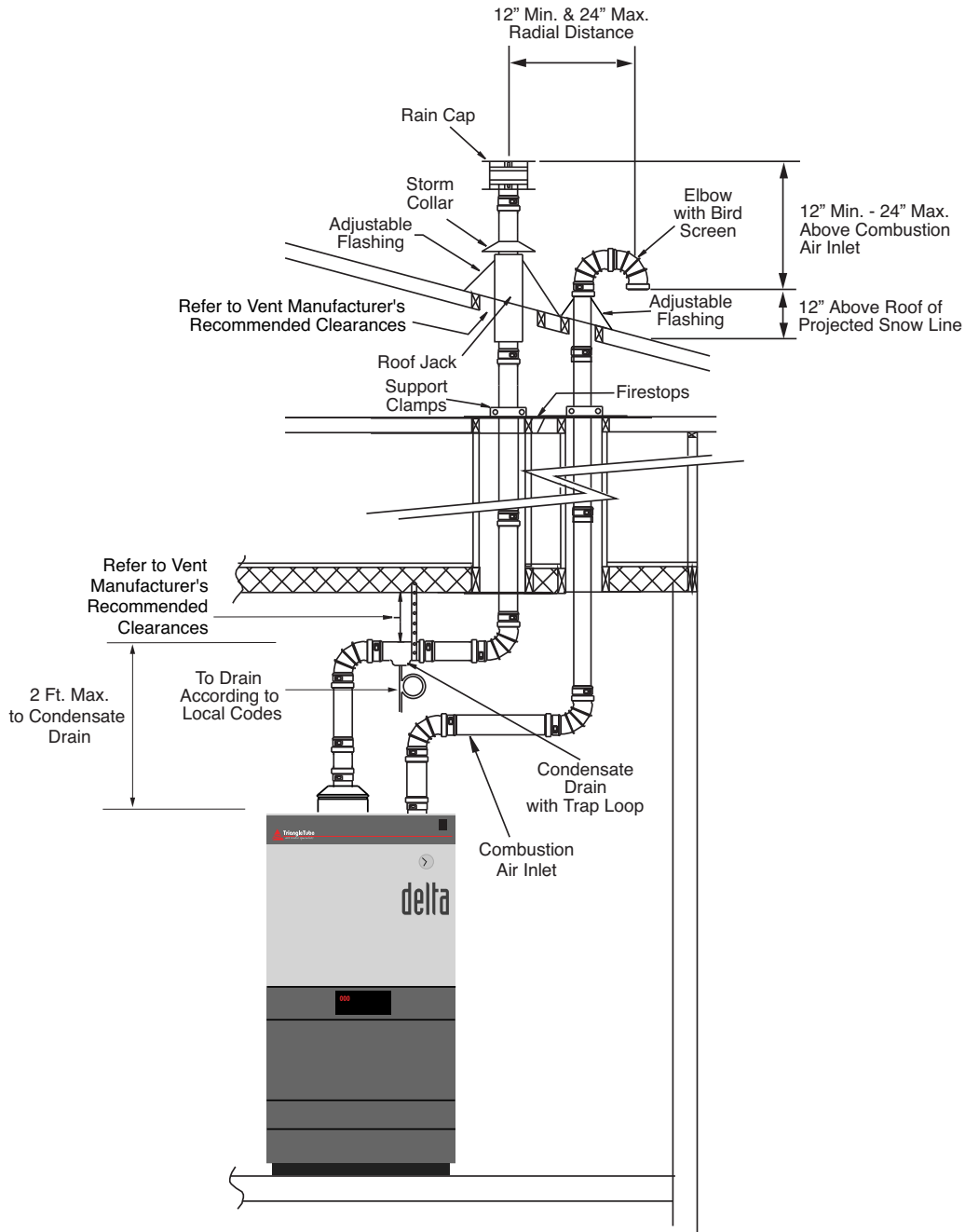


Fig. 5:

**Direct Vent - Vertical Concentric.** See MODULATING DELTA Concentric Vent Installation Manual for Installation Details



**Fig. 6:**  
Direct Vent - Vertical Two Pipe

## Determine Termination Location

Locate the vent and combustion air termination using the following guidelines:

1. The total length of the vent or combustion air piping must not exceed the limits given in Table 2 on page 22.

### NOTICE

**Do not include the two 90° elbows or rain cap used to terminate the combustion air inlet or vent when determining the total length of pipe.**

2. The combustion air piping must terminate in an upside down “U” shape fashion using two 90° elbows and must be installed 12 inches above the roof or projected snowline, as shown in Fig. 6 page 10.
3. The vent must terminate vertically with a rain cap and must be located 12 to 24 inches above the combustion air inlet as shown in Fig. 6 page 10.
4. The combustion air inlet and vent terminations must be located a radial distance of 12 to 24 inches from centerline as shown in Fig. 6 page 10.
5. The following should be considered when determining the location of the vent and combustion air termination:
  - a. Locate the vent termination where flue vapors will not damage surrounding shrubs, plants or air conditioning equipment or be objectionable to the homeowner.
  - b. The flue products will form a noticeable plume as they condense in colder air. Avoid terminating the vent in areas where the plume could obstruct window views.
  - c. Prevailing winds could cause freezing of flue condensation and a buildup of water / ice on surrounding plants, building surfaces or combustion air inlet.
  - d. Avoid locations where prevailing winds could affect the performance of the appliance or cause recirculation of the flue gases, such as inside corners of buildings or near adjacent buildings or vertical surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.
  - e. Do not terminate the vent above any doors or windows: flue condensate could freeze causing ice formations.
6. The vent termination must also maintain the following clearances; as shown in Fig.13, page 21.
  - a. At least 6 feet from adjacent walls
  - b. No closer than 5 feet below roof over hangs
  - c. At least 7 feet above any public walkways
  - d. At least 3 feet above any forced air intake within 10 feet (does not apply to the combustion air inlet of a direct vent appliance).
  - e. No closer than 12 inches below or horizontally from any door or window or gravity air inlet.
  - f. Must be at least 4 feet from any electric meters, gas meters-regulators, relief valves or other equipment. Never terminate the vent above or below any of these items within 4 feet horizontally.
7. Locate the vent termination and combustion air inlet in a manner to protect from damage by foreign objects, such as stones or balls or subject to buildup of leaves or sediment.
8. Do not connect any other appliance to the vent pipe or multiple appliances to a common vent pipe.
9. The vent system must contain a condensate trap located no higher than 2 feet above the appliance. As shown in Fig. 6 page 10.

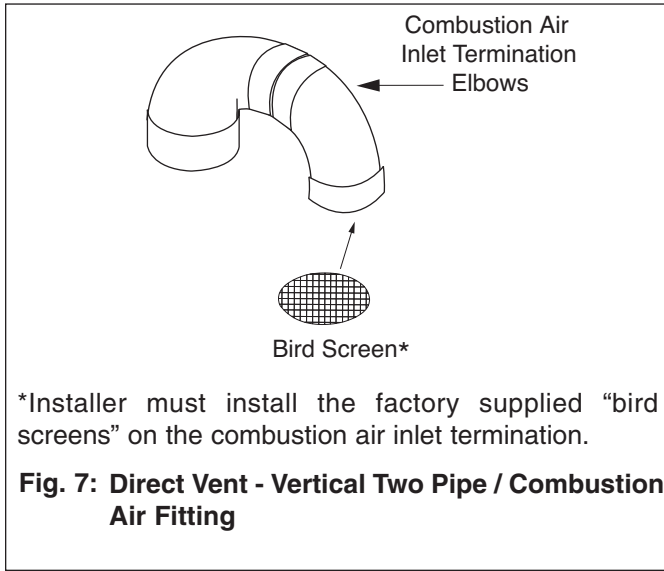
## Direct Vent - Vent Installation - Thru the Roof

1. Vent and Combustion Air Penetration
  - Vent pipe penetration maintain vent manufacturer's required clearances to combustibles & non-combustibles. Refer to vent manufacturer's installation instructions for details
  - Combustion air pipe penetration can maintain zero clearance.
2. The installer must use a galvanized metal thimble for the vent pipe penetration.
3. Locate the vent and combustion air pipe penetrations to provide minimum clearances as described in Fig. 6 page 10.
4. The installer must comply with all local codes for isolating the vent pipe as it passes through floors, ceilings and roofs.

- The installer should provide adequate flashing and sealing boots sized for the vent pipe and combustion air pipe.

### Termination Fittings - Vertical Two Pipe

- The combustion air pipe termination must include a factory supplied "bird screen" as shown in Fig. 7. The bird screen should be inserted inside the termination.



- The combustion air piping must terminate in an upside down "U" shape fashion using two 90° elbows as shown in Figs. 6 & 7.
- The vent piping must terminate vertically with a rain cap as shown in Fig. 6 page 10.

### WARNING

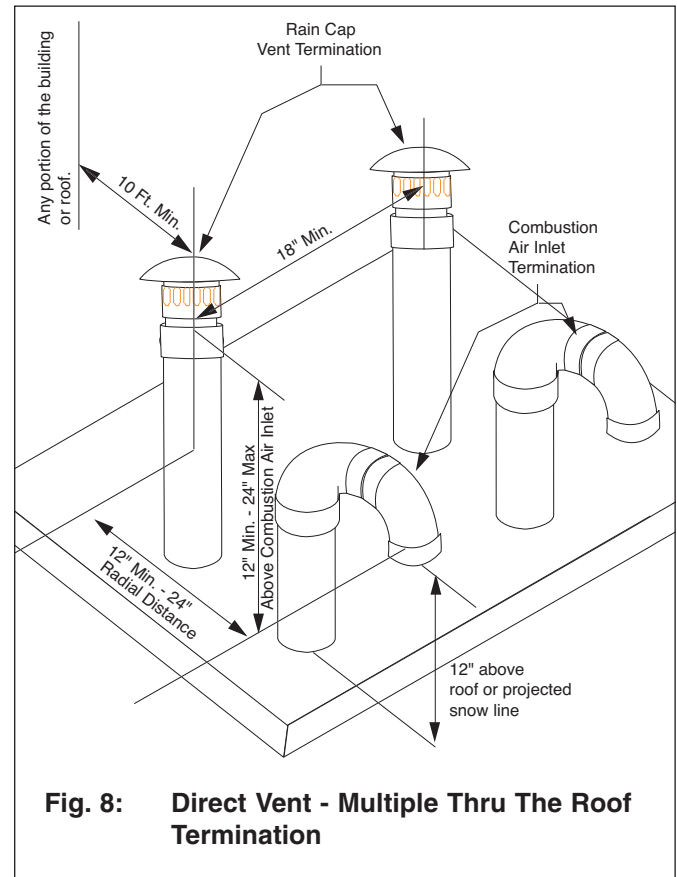
Do not extend the vent pipe outside the roof beyond the given dimensions shown in Fig. 6, page 10. Extended exposure of the vent pipe could cause condensate to freeze and block the vent pipe.

### Direct Vent - Multiple Installation - Thru the Roof

- On installations of multiple MODULATING DELTAS, terminate each vent and combustion air piping as described in this manual.
- The roof penetration of the vent and combustion air piping should be such that the vent and combustion air terminations are a minimum 18 inches from the adjacent vent pipe of the other appliance for installations in the U.S. as shown in Fig. 8. For installations in Canada, provide clearances as required by CSA B149.1 or 149.2.

### NOTICE

The combustion air inlet of the MODULATING DELTA is defined as being part of a direct vent system. It is not considered as a forced air intake. The required clearance of an adjacent appliance vent to a forced air inlet does not apply in a multiple installation of MODULATING DELTAS.



**NOTICE**

Installation of the vent and combustion air piping must comply with local codes and requirements and with the National Fuel Gas Code NFPA 54, ANSI Z223.1 for installations in the U.S. or CSA B149.1 or B149.2 for installations in Canada.

**NOTICE**

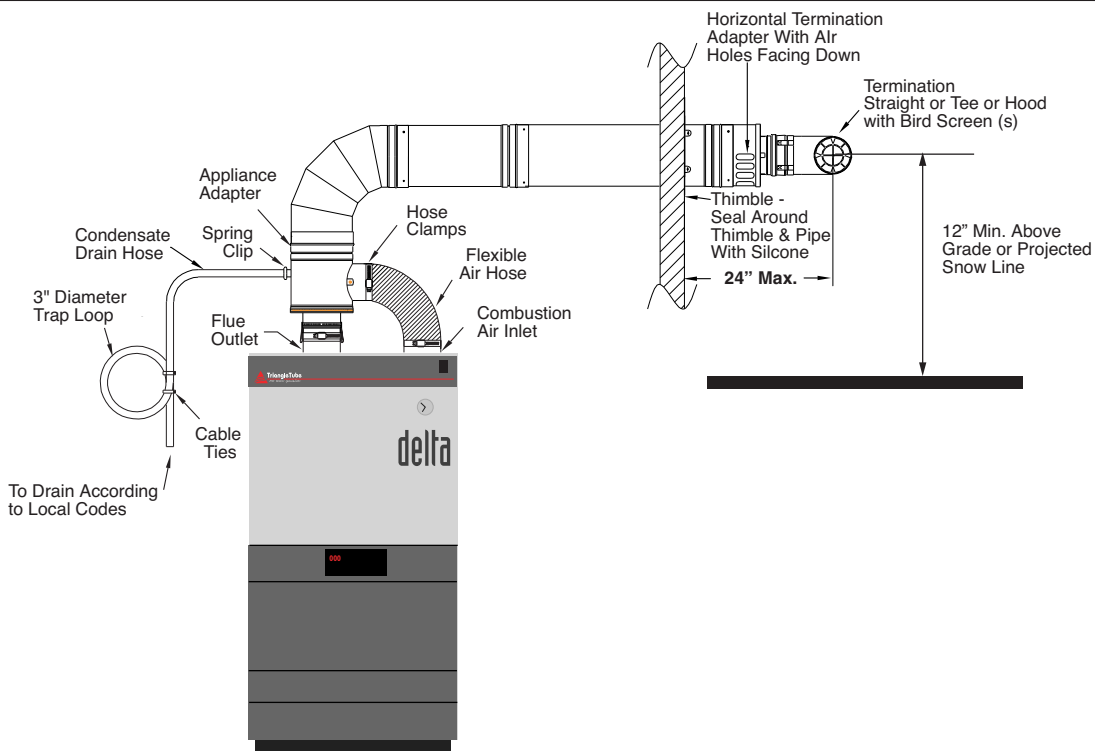
For direct vent installations in the Commonwealth of Massachusetts, the installer must comply with the additional requirement outlined on pages 33 and 34.

**WARNING**

A gas vent extending through a sidewall should not terminate near an adjacent wall or below any building extensions such as roof eaves, balconies or decks. Failure to comply with the required clearances could result in severe personal injury, death or substantial property damage.

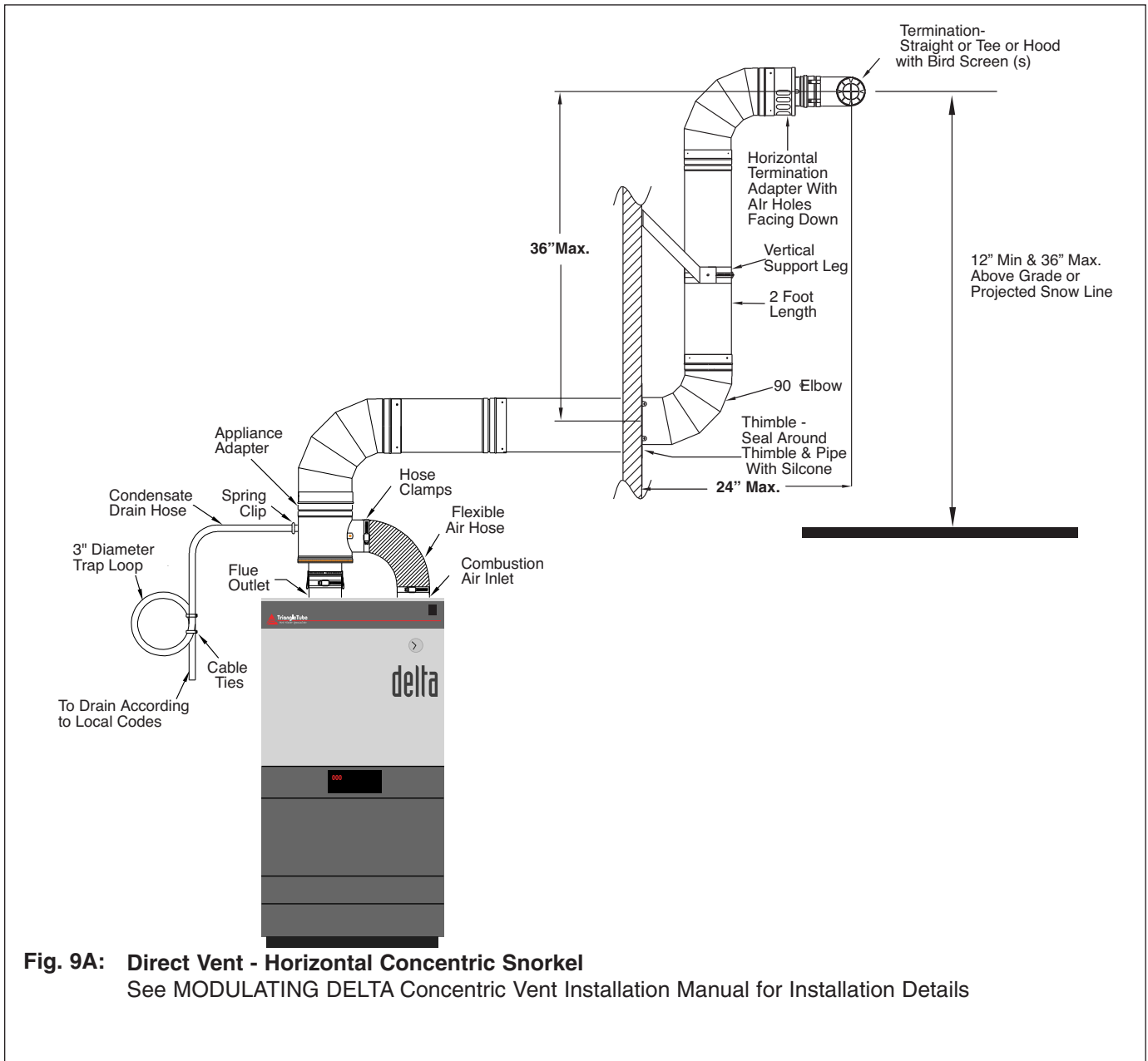
**Direct Vent -Horizontal**

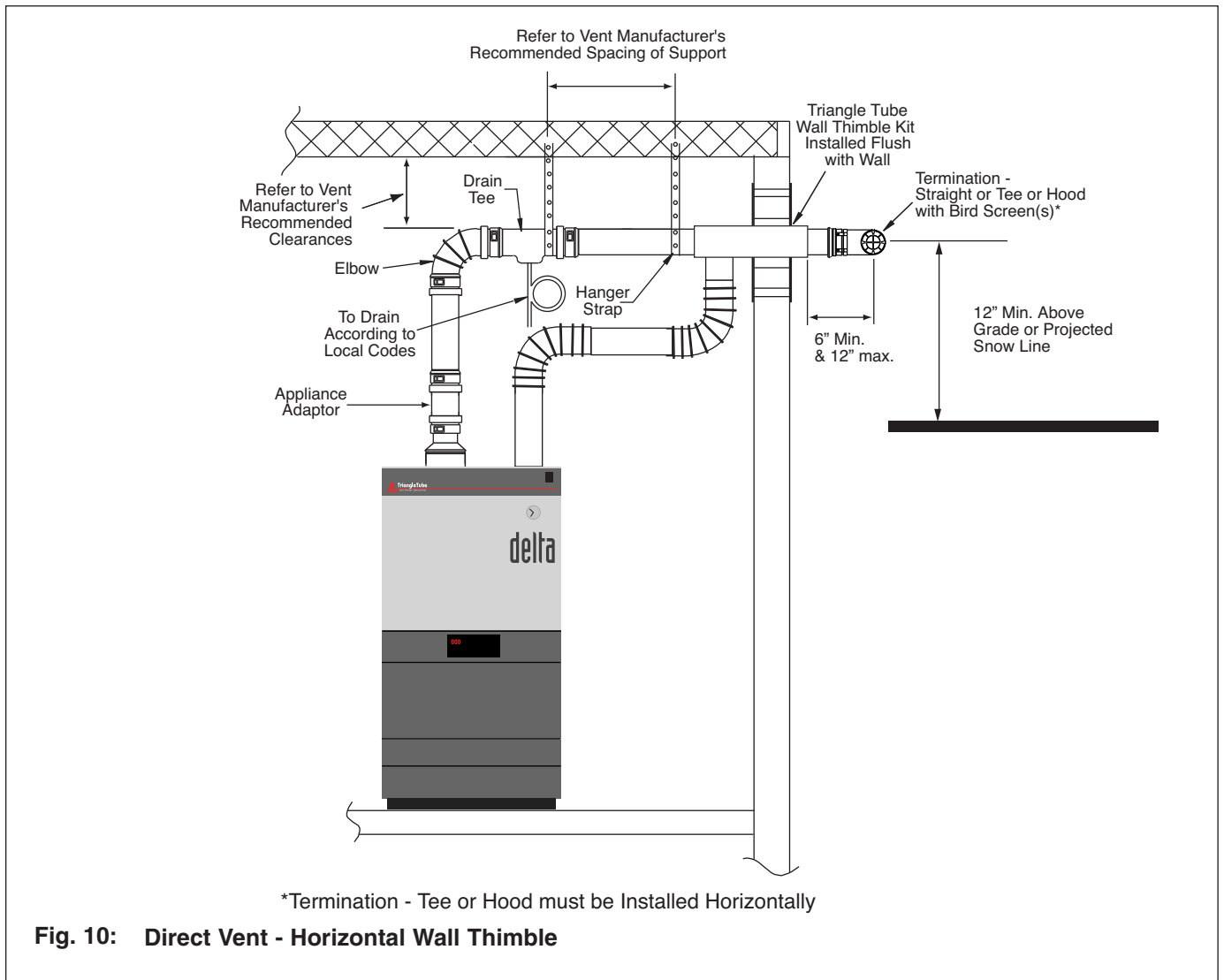
The installer has three options when direct venting horizontally, Concentric, Wall Thimble or Two Pipe. The three vent options are shown in Figs. 9 through 11A pages 13 through 18. Both the Concentric and Wall Thimble options are available in accessory kits through Triangle Tube. See Figs. 10 & 11 for Wall Thimble and Two Pipe installation details or the MODULATING DELTA Concentric Vent Installation Manual for additional Concentric details. Both the Concentric and Two Pipe can snorkel up outside the building a maximum of 36”.



**Fig. 9: Direct Vent - Horizontal Concentric**  
See MODULATING DELTA Concentric Vent Installation Manual for Installation Details







**Note:** Use Locking Bands inside the Thimble Box against the inside and outside End Caps to prevent movement of the vent piping.

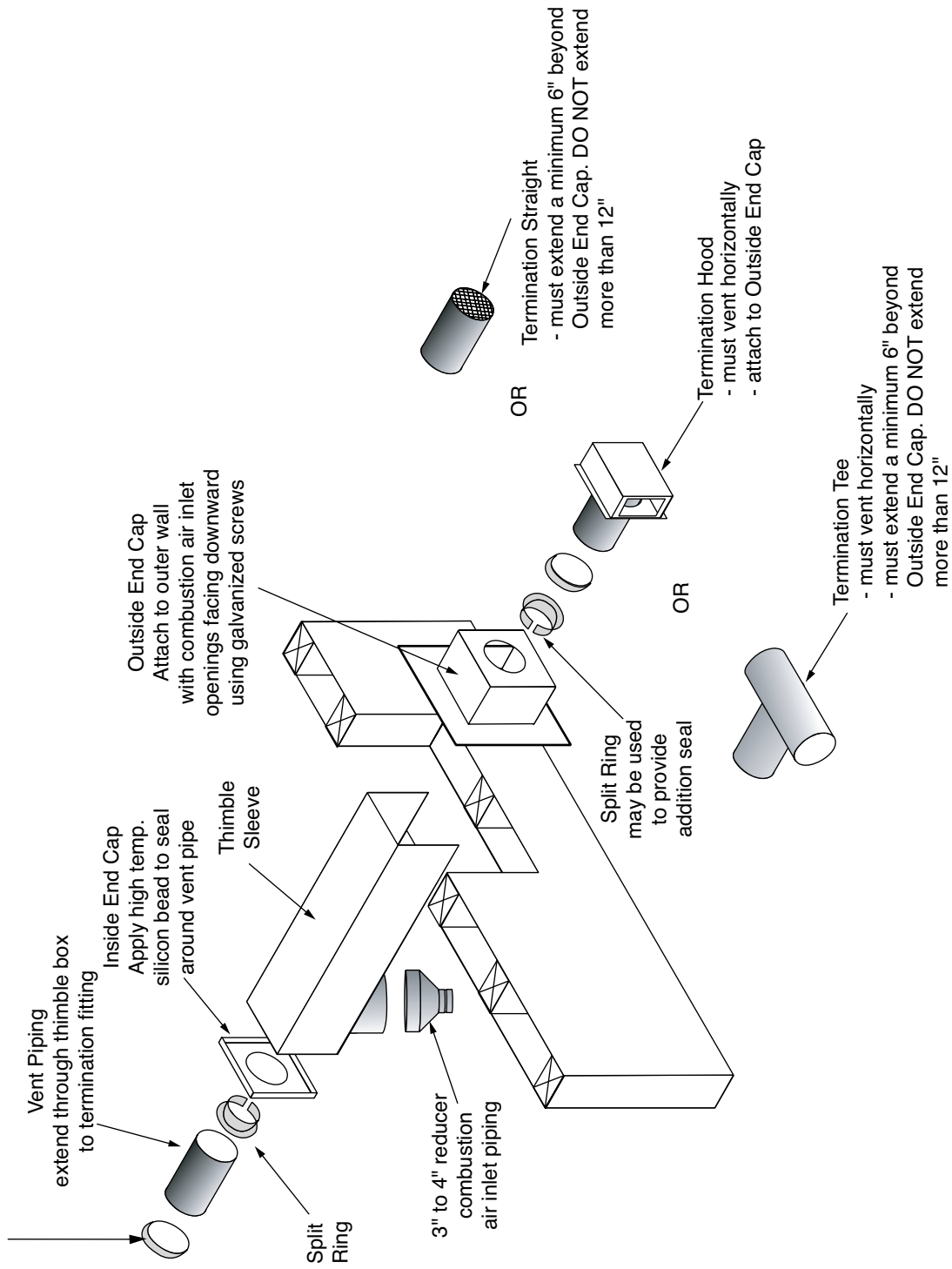


Fig. 10A: Direct Vent - Horizontal Wall Thimble Termination Assembly

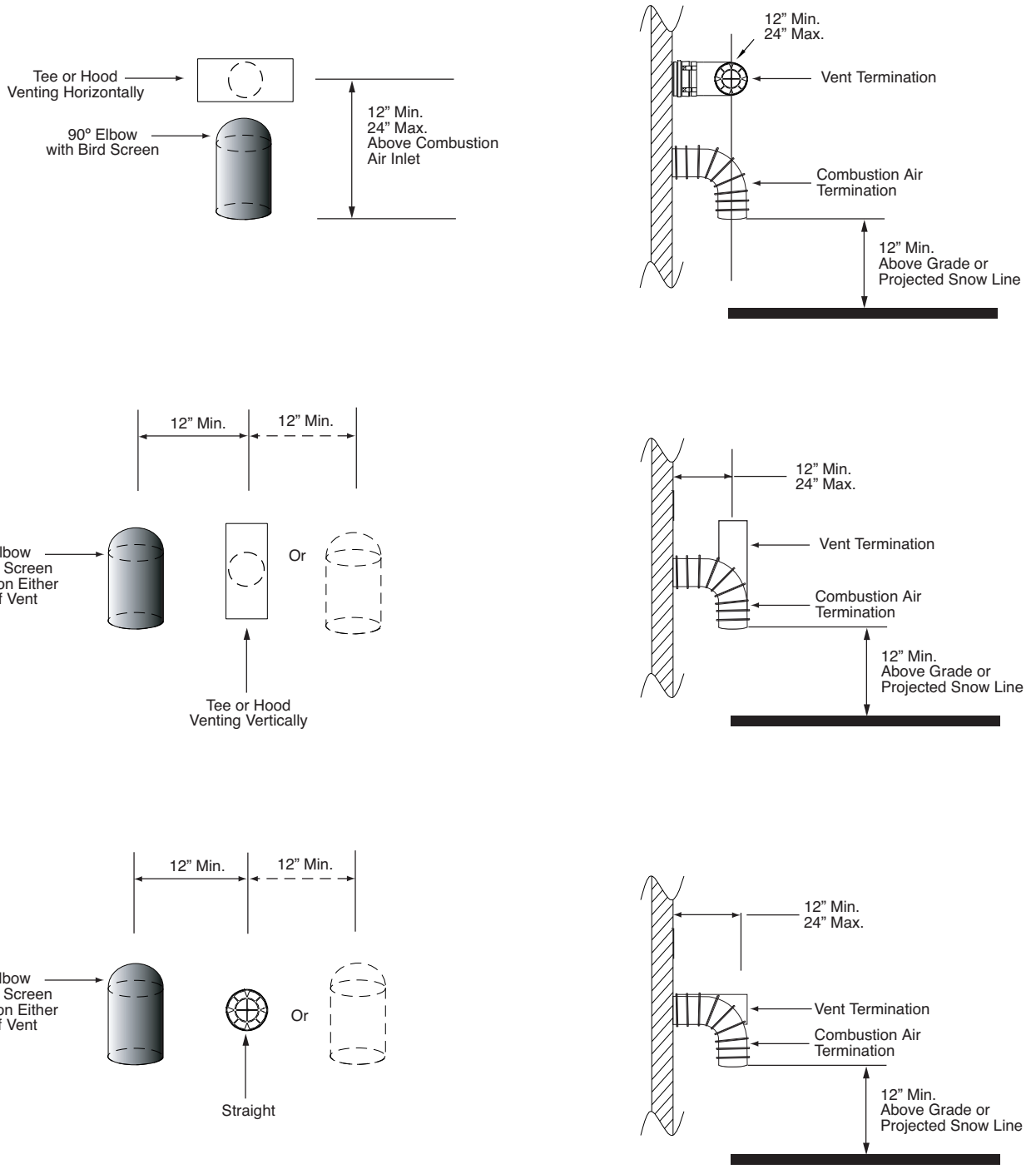


Fig. 11: Direct Vent - Horizontal Two Pipe Termination Options

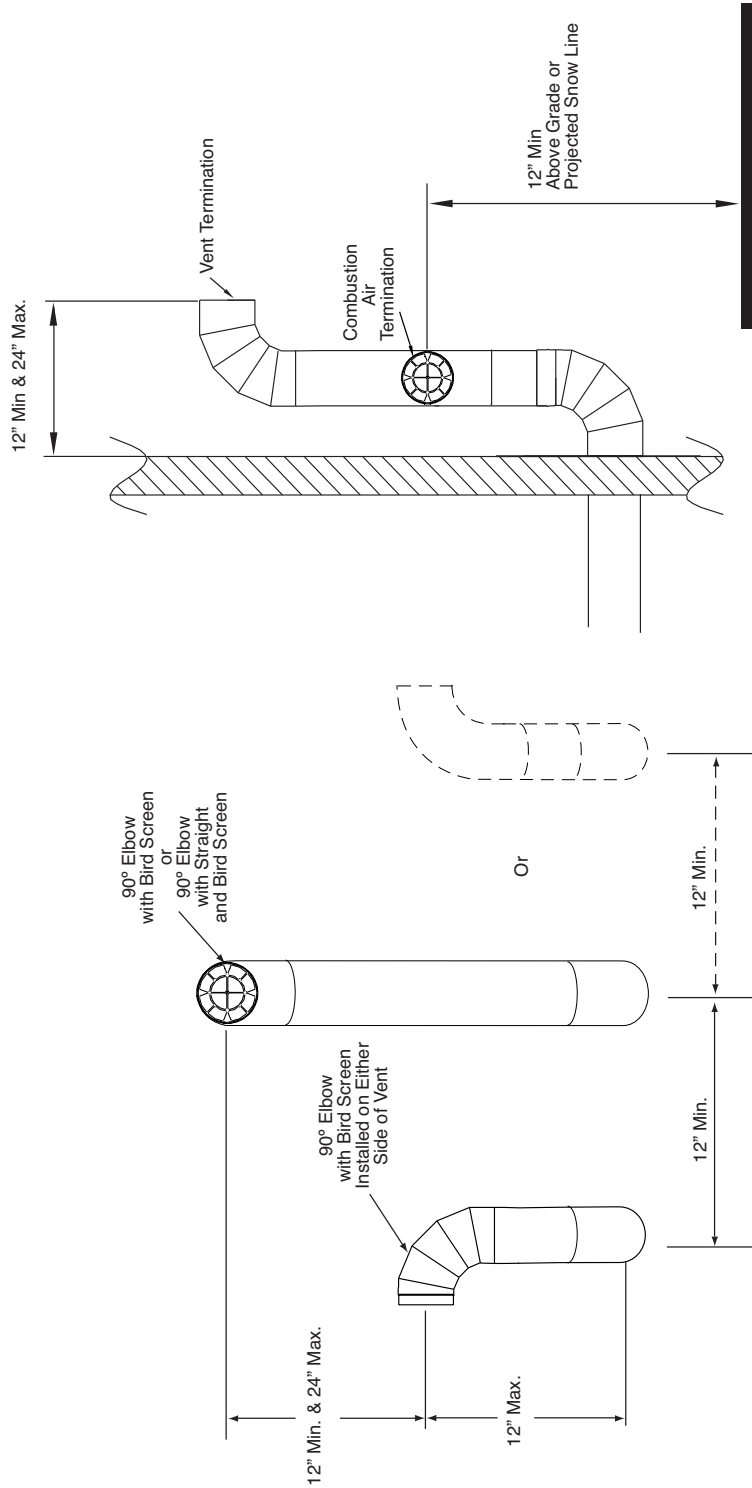


Fig. 11A: Direct Vent - Horizontal Two Pipe Snorkel Terminations

### Determine Termination Location

Locate the vent and combustion air termination using the following guidelines:

1. The total length of the vent or combustion air piping must not exceed the limits given in Table 2 on page 22.

#### NOTICE

**DO NOT include the 90° elbow when used to terminate the combustion air inlet or vent termination (Tee, Hood, Straight or Elbow) when determining the total length of pipe.**

2. The combustion air piping must terminate as shown in Figs: 9 through 11 pages 13 through 18 and must be installed a minimum 12 inches above grade or projected snowline.
3. The vent piping must terminate vertically as shown in Figs: 10 through 11 pages 15 through 18.

#### NOTICE

**The combustion air inlet and the vent termination must reside in the same pressure zone/area of the building.**

#### WARNING

**Do not extend the vent pipe outside the sidewall beyond the given dimensions shown in Figs: 10 through 11 pages 15 through 18. Extended exposure of the vent pipe could cause condensate to freeze and block the vent pipe.**

4. The combustion air inlet and vent terminations must be located a minimum of 12 inches from centerlines as shown in Figs. 11 and 11A, pages 17 & 18 when venting with two pipes.
5. The following should be considered when determining the location of the vent and combustion air termination:
  - a. Locate the vent termination where flue vapors will not damage surrounding shrubs, plants or air conditioning equipment or be objectionable to the homeowner.
  - b. The flue products will form a noticeable plume as they condense in colder air. Avoid terminating the vent in areas where the plume could obstruct window views.
6. The vent termination must also maintain the following clearances; as shown in Fig.13, page 21.
  - a. At least 6 feet from adjacent walls
  - b. No closer than 5 feet below roof overhangs
  - c. At least 7 feet above any public walkways
  - d. At least 3 feet above any forced air intake within 10 feet (does not apply to the combustion air inlet of a direct vent appliance).
  - e. No closer than 12 inches below or horizontally from any door or window or gravity air inlet.
  - f. Must be at least 4 feet from any electric meters, gas meters-regulators, relief valves or other equipment. Never terminate the vent above or below any of these items within 4 feet horizontally.
7. Locate the vent termination and combustion air inlet in a manner to protect from damage by foreign objects, such as stones or balls or subject to buildup of leaves or sediment.
8. Do not connect any other appliance to the vent pipe or multiple appliances to a common vent pipe.
9. The vent system must contain a condensate trap located no higher than 2 feet above the appliance.

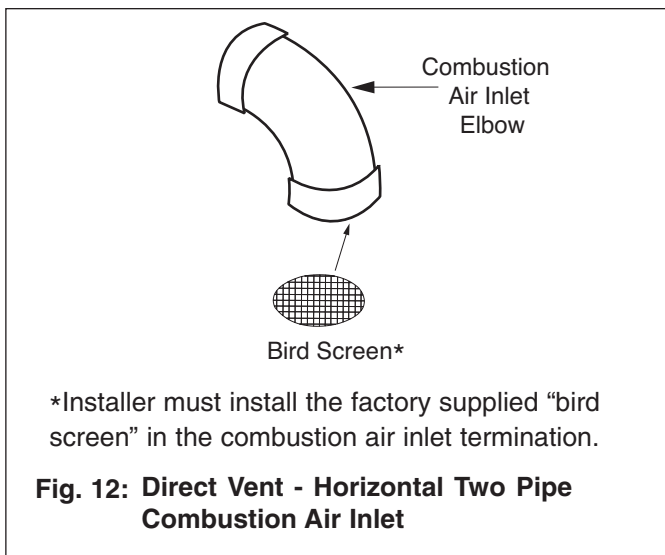
## Direct Vent - Vent Installation - Horizontal

### 1. Vent and Combustion Air Penetration

- Vent pipe penetration : Maintain a minimum 2-inch clearance to combustible wall and 1-inch clearance to non-combustible in the absence of the vent manufacturer's recommended clearance when penetrating a sidewall
  - For a zero clearance of the vent and combustion air refer to the Direct Vent Horizontal Concentric or Wall Thimble Kits.
  - Wall Thimble Kit
  - Requires a 5 1/2 inch x 5 1/2 inch penetration through any type of wall.
  - Maximum wall thickness is 11 inches.
2. The installer must use a galvanized metal thimble for the vent pipe penetration when venting with two pipes.
  3. Locate the vent and combustion air pipe penetrations to provide minimum clearances as described in Figs. 10 through 11, pages 15 through 18.
  4. The installer must comply with all local codes for isolating the vent pipe as it passes through floors and walls.
  5. The installer should seal all exterior wall openings with an exterior silicon caulk.

### Termination Fitting - Direct Vent Horizontal Two Pipe

1. The combustion air pipe termination must include a factory supplied "bird screen" as shown in Fig. 12. The bird screen should be inserted inside the termination.



2. The combustion air piping must terminate using a 90° elbow as shown in Figs. 11 & 11A, pages 17 & 18.
3. The vent piping must terminate as shown in Figs. 11 & 11A, pages 17 & 18.

### WARNING

**Do not extend the vent pipe outside the sidewall beyond the given dimensions shown in Figs. 11 and 11A, pages 17 & 18. Extended exposure of the vent pipe could cause condensate to freeze and block the vent pipe.**

### Termination Fittings - Direct Vent Horizontal Wall Thimble

1. The combustion air and vent piping must terminate as shown in Figs: 10 and 10A pages 15 & 16.

### WARNING

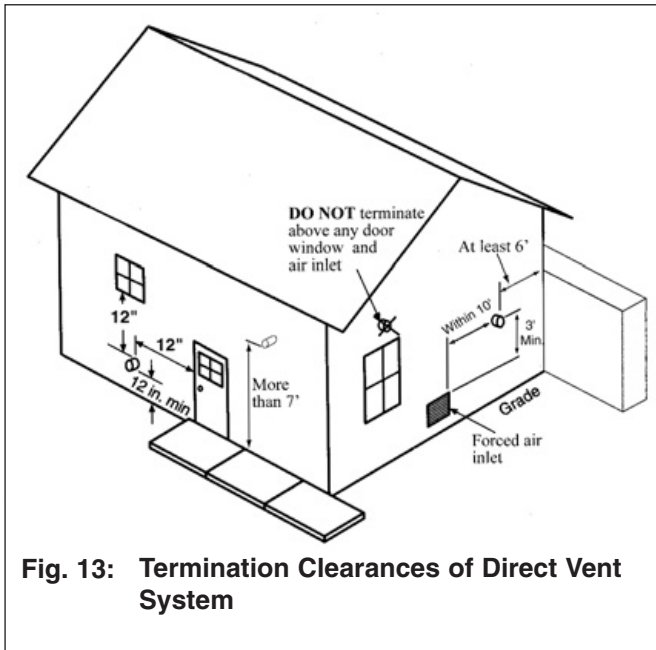
**Do not extend the vent pipe outside the sidewall beyond the given dimensions shown in Figs. 10 and 10A, pages 15 & 16. Extended exposure of the vent pipe could cause condensate to freeze and block the vent pipe.**

### Direct Vent - Multiple Installation - Horizontal

1. On installations of multiple MODULATING DELTAS, terminate each vent and combustion air piping as described in this manual.
2. The wall penetration of the vent and combustion air piping should be such that the vent and combustion air terminations are a minimum 18 inches from the adjacent vent pipe of the other appliance for installations in the U.S. For installations in Canada, provide clearances as required by CSA B149.1 or 149.2.

### NOTICE

**The combustion air inlet of the MODULATING DELTA is defined as being part of a direct vent system. It is not considered as a forced air intake. The required clearance of an adjacent appliance vent to a forced air inlet does not apply in a multiple installation of MODULATING DELTAS.**



**Fig. 13: Termination Clearances of Direct Vent System**

### Combustion Air Adapter

1. The installer must clean and deburr pipe.
2. Prior to inserting the pipe, inspect the combustion air adapter to verify there is no obstruction or packing material inside the adapter.
3. Apply silicon to seal the pipe and to ease insertion onto the adapter.
4. Insert the pipe onto the adapter until it is fully seated.
5. Secure the combustion air pipe with screw(s).

### Vent Condensate Drain

A vent condensate drain and drain tube should be installed near the appliance to prevent any potential condensate from entering the flue ways on the appliance. See Figs. 6 and 10 through 11 pages 10 and 15 through 18.

#### WARNING

**Failure to provide a vent condensate drain close to the appliance could allow acidic flue gas condensate to enter into the appliance flue ways causing premature failure of the appliance.**

### Condensate Drain Tube

To prevent flue gases from entering into the building it is important the drain tube is fashioned into a "pigtail" trap as shown in Fig. 6 and 10 through 11 pages 10 and 15 through 18.

The drain tube must be filled with water to prevent flue gases from emitting into the building prior to operating the appliance.

#### NOTICE

**Periodically inspect the water level in the condensate drain tube. If low, add water as needed to maintain trap level.**

If water in drain tube evaporates rapidly due to ambient conditions, propylene glycol may be added or substituted to reduce evaporation.

Pipe the condensate drain tube to a suitable place of drainage or to a condensate pump or sump. Consult local authorities regarding disposal of flue gas condensate into public waste water system.

### Vent Appliance Adapters - Direct Vent

The MODULATING DELTA requires the use of an appliance adapter as approved by the one of vent manufacturers listed on page 8.

#### WARNING

**Failure to use an approved vent appliance adapter may create improper vent connection and potential flue gas leakage. Do not mix the manufacturer appliance adapter with other manufacturers' vent components, the vent system could fail or improperly seal, causing leakage of flue products into the building.**

1. Prior to installing the appliance adapter, inspect the flue hood and verify there is no obstruction or packing material inside.
2. Ensure the appliance adapter banding strap is loose prior to installation.
3. Apply silicon as necessary to seal adapter to appliance.
4. Secure adapter to appliance by tightening adapter banding strap.



**Vent and Combustion Air Piping Installation Guidelines**

1. The installer should install the vent / combustion air piping working from the appliance to the piping termination. The piping should not exceed the lengths given in Table 2 for either the vent or combustion air.
2. The installer should cut the pipe if required to the appropriate lengths and deburr the inside and outside.
3. The installer should chamfer the outside of the pipe.
4. The installer should dry assemble the combustion air system prior to assembling any joints to ensure proper fit.
5. The pipe ends and fittings should be cleaned and dried thoroughly prior to assembly of the joint.
6. Refer to vent manufactures instructions for proper sealing of the vent system.
7. The installer should use perforated metal strap hangers or equivalent pipe hangers to support the piping. The hangers must be spaced at a maximum of every 5 feet of horizontal or vertical run of piping. A support must be placed near the appliance and where the vent turns vertical. Do not penetrate any part of the piping or vent system with fasteners.
8. The vent and combustion air piping should be sloped continuously from the termination back to the appliance with at least 1/4 inch drop per foot of run. Do not allow any sags in the run of piping.

9. Maintain minimum clearances per vent manufacture’s instructions for both, combustible or non-combustible materials. The installer must seal any wall, floor or ceiling penetrations as per local code requirements.
10. The vent piping does not require any insulation. The installer may opt to insulate the vent piping in those portions of the piping that pass through unheated spaces such as crawl spaces or attics. In these areas the installer may apply fiberglass insulation to the outside of the vent pipe.

**NOTICE**

**Table 2 references a long radius 90° elbow. For each additional 90° elbow within the system, the installer must reduce the maximum allowable length by 7 feet. If a short radius 90° elbow is used the maximum allowable length must be reduced by 10 feet for each short radius 90° elbow. If a 45° elbow is used the maximum allowable length must be reduced by 3 feet for each 45° elbow.**

**BEST PRACTICE**

**It is recommended that the installer uses the same number of elbows and length of piping on the venting system and the combustion air inlet.**

**TABLE 2**

MODULATING DELTA Model	Maximum Allowable Vent or Combustion Air Piping Length			
	3 inch Diameter Vent or Combustion Air Piping			
	Feet	Elbows	Feet	Elbows
PG-150 PG-199 PG PLUS-150 PG PLUS-199	60	0	46	2

### SECTION III - CATEGORY III OR IV INSTALLATION OF VENT/AIR PIPING

A Category III or IV appliance utilizes uncontaminated indoor or outdoor air (surrounding the appliance) for combustion.

#### Category III or IV - Vertical - Thru the Roof or An Unused Chimney

**NOTICE**

Installation of the vent and combustion air piping must comply with local codes and requirements and with the National Fuel Gas Code NFPA 54, ANSI Z223.1 for installations in the U.S. or CSA B149.1 or B149.2 for installations in Canada.

**NOTICE**

When using an unused chimney as a means of a raceway for the vent, the surrounding space within the chimney cannot be used to draw combustion air or vent another appliance,

**WARNING**

A gas vent extending through a roof should not terminate near an adjacent wall or below any building extensions such as roof eaves, balconies or decks. Failure to comply with the required clearances could result in severe personal injury, death or substantial property damage.

#### Determine Termination Location

Locate the vent and combustion air termination using the following guidelines:

1. The total length of the vent must not exceed the limits given in Table 3 on page 30.

**NOTICE**

**Do not include the rain cap used to terminate the vent when determining the total length of pipe.**

2. The combustion air piping must terminate at the appliance with a 90° elbow.
3. The vent must terminate vertically with a rain cap and must be located 12 inches above the roof or projected snowline as shown in Fig. 14.

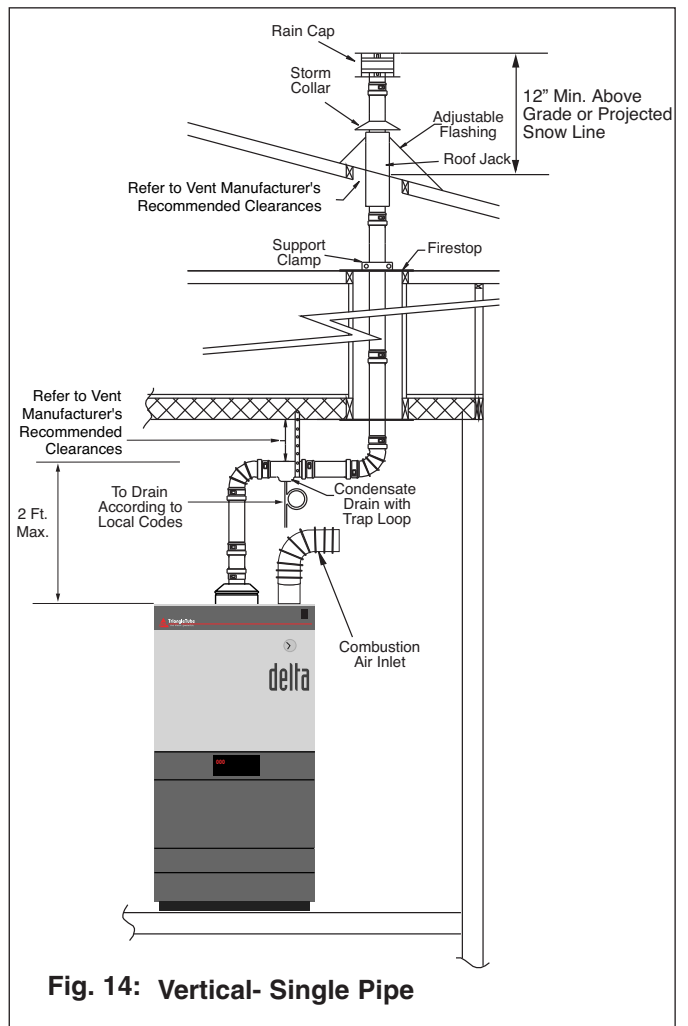


Fig. 14: Vertical- Single Pipe

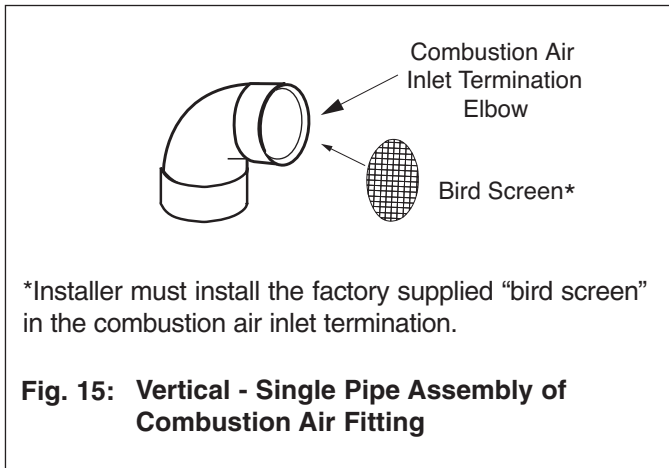
4. The following should be considered when determining the location of the vent termination:
  - a. Locate the vent termination where flue vapors will not damage surrounding shrubs, plants or air conditioning equipment or be objectionable to the homeowner.
  - b. The flue products will form a noticeable plume as they condense in colder air. Avoid terminating the vent in areas where the plume could obstruct window views.
  - c. Prevailing winds could cause freezing of flue condensation and a buildup of water / ice on surrounding plants or building surfaces.
  - d. Avoid locations where prevailing winds could affect the performance of the appliance or cause recirculation of the flue gases, such as inside corners of buildings or near adjacent buildings or vertical surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.
  - e. Do not terminate the vent above any doors or windows: flue condensate could freeze causing ice formations.
  - f. Locate or guard the vent termination to prevent possible condensate damage to exterior finishes.
  - g. Avoid locations of possible accidental contact of flue vapors with persons or pets.
5. The vent termination must also maintain the following clearances; as shown in Fig.19, page 28.
  - a. At least 6 feet from adjacent walls
  - b. No closer than 5 feet below roof over hangs
  - c. At least 7 feet above any public walkways
  - d. At least 3 feet above any forced air intake within 10 feet.
  - e. No closer than 4 feet below or horizontally from any door or window or gravity air inlet.
6. Locate the vent termination in a matter to protect from damage by foreign objects, such as stones or balls or subject to buildup of leaves or sediment.
7. Do not connect any other appliance to the vent pipe or multiple appliances to a common vent pipe.
8. The vent system must contain a condensate trap located no higher than 2 feet above the appliance. As shown in Fig. 14 page 23.

**Category III or IV - Vent Installation - Thru the Roof**

1. Vent Penetration
  - Vent pipe penetration maintain vent manufacture's required clearances to combustibles & non-combustibles. Refer to vent manufacture's instructions for details
2. The installer must use a galvanized metal thimble for the vent pipe penetration.
3. Locate the vent pipe penetration to provide minimum clearances as described in Fig. 14 page 23.
4. The installer must comply with all local codes for isolating the vent pipe as it passes through floors, ceilings and roofs.
5. The installer should provide adequate flashing and sealing boot sized for the vent pipe.

**Termination Fittings - Thru the Roof**

1. The combustion air pipe termination must include a factory supplied "bird screen" as shown in Fig. 15. The bird screen should be inserted inside the termination.



**Fig. 15: Vertical - Single Pipe Assembly of Combustion Air Fitting**

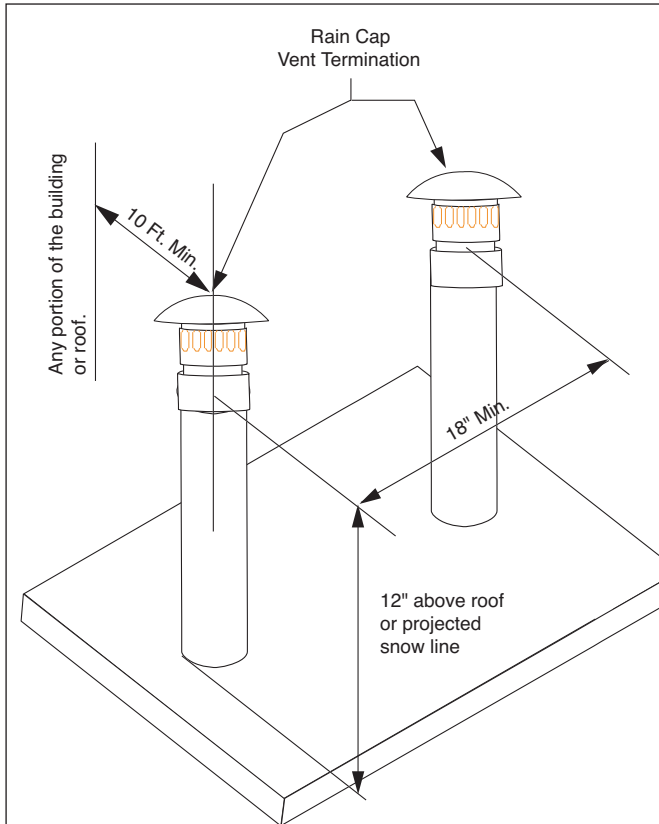
2. The combustion air piping must terminate at the appliance with a 90° elbow.
3. The vent piping must terminate vertically with a coupling as shown in Fig.14 page 23.

**WARNING**

**Do not extend the vent pipe outside the roof beyond the given dimensions shown in Fig. 14 page 23. Extended exposure of the vent pipe could cause condensate to freeze and block the vent pipe.**

## Category III or IV - Multiple Installation - Thru the Roof

1. On installations of multiple MODULATING DELTAS, terminate each vent pipe as described in this manual.
2. The roof penetration of the vent piping should be a minimum 18 inches from the adjacent vent pipe of the other appliance for installations in the U.S. as shown in Fig. 16. For installations in Canada, provide clearances as required by CSA B149.1 or 149.2.



**Fig. 16: Category III or IV- Multiple Thru The Roof Termination**

## Category III or IV - Horizontal

### NOTICE

Installation of the vent and combustion air piping must comply with local codes and requirements and with the National Fuel Gas Code NFPA 54, ANSI Z223.1 for installations in the U.S. or CSA B149.1 or B149.2 for installations in Canada.

### NOTICE

For direct vent (sidewall) installations in the Commonwealth of Massachusetts, the installer must comply with the additional requirement outlined on pages 33 and 34.

### WARNING

A gas vent extending through a sidewall should not terminate near an adjacent wall or below any building extensions such as roof eaves, balconies or decks. Failure to comply with the required clearances could result in severe personal injury, death or substantial property damage. The installer can vent horizontally with a single pipe as shown in Fig. 17 page 26 and snorkel up outside the building a maximum of 36" as shown in Fig. 17A page 26.

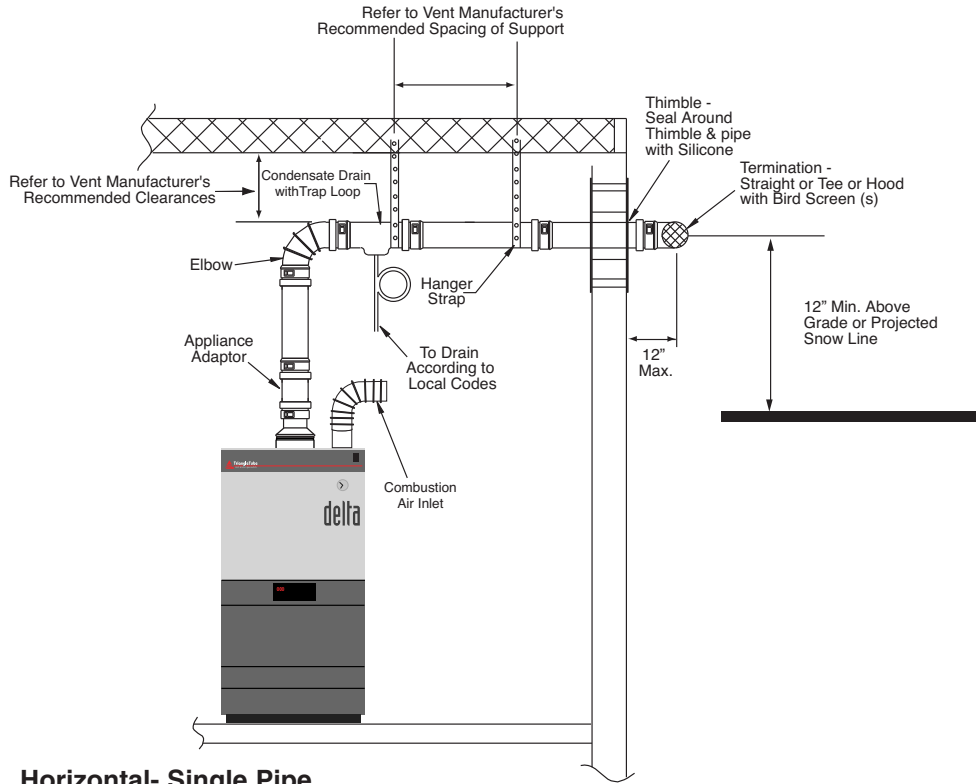


Fig. 17: Horizontal- Single Pipe

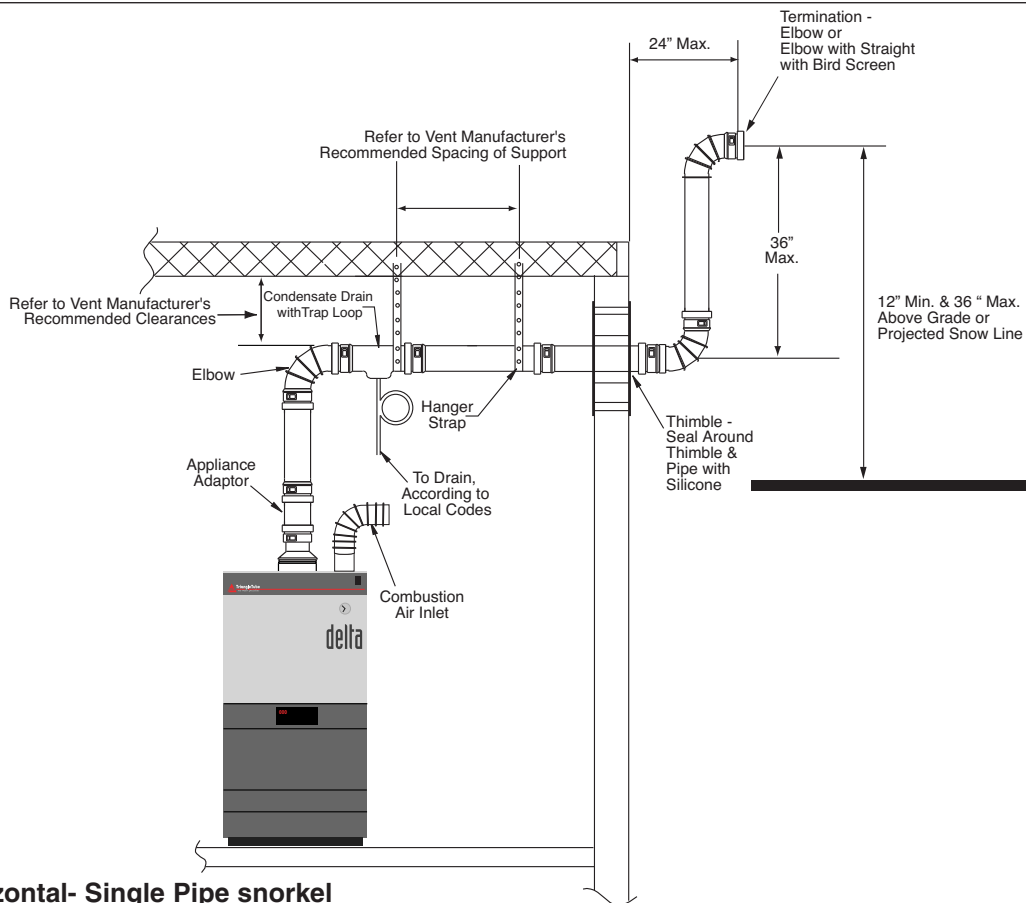


Fig. 17A: Horizontal- Single Pipe snorkel

### Determine Termination Location

Locate the vent and combustion air termination using the following guidelines:

1. The total length of the vent must not exceed the limits given in Table 3 on page 30.

#### NOTICE

**DO NOT include the vent termination (Tee, Hood or Straight) when determining the total length of pipe.**

2. The combustion air piping must terminate at the appliance with a 90° elbow.
3. The vent piping must terminate as shown in Figs. 17 & 17A page 26.

#### WARNING

**Do not extend the vent pipe outside the sidewall beyond the given dimensions shown in Figs. 17 & 17A page 26. Extended exposure of the vent pipe could cause condensate to freeze and block the vent pipe.**

4. The following should be considered when determining the location of the vent termination:
  - a. Locate the vent termination where flue vapors will not damage surrounding shrubs, plants or air conditioning equipment or be objectionable to the homeowner.
  - b. The flue products will form a noticeable plume as they condense in colder air. Avoid terminating the vent in areas where the plume could obstruct window views.
  - c. Prevailing winds could cause freezing of flue condensation and a buildup of water / ice on surrounding plants or building surfaces.
  - d. Avoid locations where prevailing winds could affect the performance of the appliance or cause recirculation of the flue gases, such as inside corners of buildings or near adjacent buildings or vertical surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.
  - e. Do not terminate the vent above any doors or windows: flue condensate could freeze causing ice formations.
  - f. Locate or guard the vent termination to prevent possible condensate damage to exterior finishes.

- g. Avoid locations of possible accidental contact of flue vapors with persons or pets.
5. The vent termination must also maintain the following clearances; as shown in Fig 19, page 28.
    - a. At least 6 feet from adjacent walls
    - b. No closer than 5 feet below roof overhangs
    - c. At least 7 feet above any public walkways
    - d. At least 3 feet above any forced air intake within 10 feet.
    - e. No closer than 4 feet below or horizontally from any door or window or gravity air inlet.
    - f. Must be at least 4 feet from any electric meters, gas meters-regulators, relief valves or other equipment. Never terminate the vent above or below any of these items within 4 feet horizontally.
  6. Locate the vent termination in a manner to protect from damage by foreign objects, such as stones or balls or subject to buildup of leaves or sediment.
  7. Do not connect any other appliance to the vent pipe or multiple appliances to a common vent pipe.
  8. The vent system must contain a condensate trap located no higher than 2 feet above the appliance. As shown in Figs. 17 & 17A page 26.

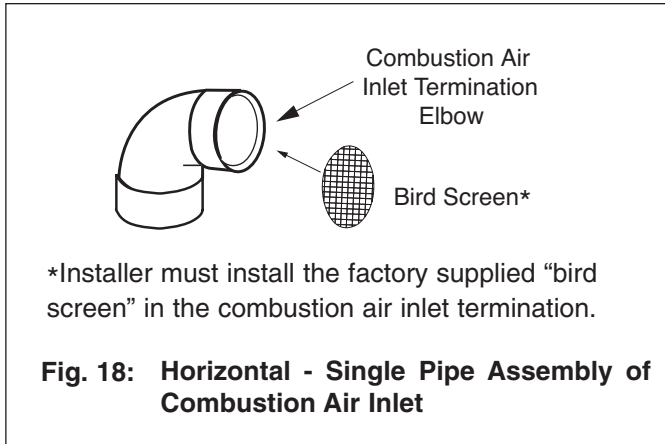
### Category III or IV - Vent Installation - Sidewall

#### 1. Vent Penetration

- Vent pipe penetration maintain a minimum 2-inch clearance to combustible wall and 1-inch clearance to non-combustible in the absence of the vent manufacturer's recommended clearance when penetrating a sidewall.
2. The installer must use a galvanized metal thimble for the vent pipe penetration.
  3. Locate the vent pipe penetration to provide minimum clearances as described in Figs. 17 & 17A, page 26.
  4. The installer must comply with all local codes for isolating the vent pipe as it passes through floors and walls.
  5. The installer should seal all exterior wall openings with an exterior silicon caulk.

**Termination Fittings - Horizontal**

1. The combustion air pipe termination must include a factory supplied "bird screen" as shown in Fig. 18. The bird screen should be inserted inside the termination.



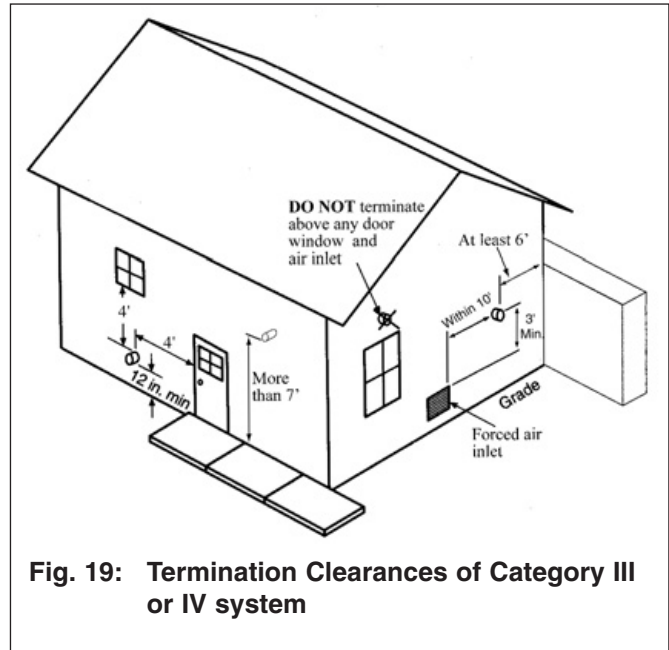
2. The combustion air piping must terminate at the appliance with a 90° elbow.
3. The vent piping must terminate as shown in Fig. 17 & 17A, page 26.

**WARNING**

Do not extend the vent pipe outside the sidewall beyond the given dimensions shown in Figs. 17 & 17A, page 26. Extended exposure of the vent pipe could cause condensate to freeze and block the vent pipe.

**Category III or IV - Multiple Installation - Sidewall**

1. On installations of multiple MODULATING DELTAS, terminate each vent pipe as described in this manual.
2. The wall penetration of the vent should be a minimum 18 inches from the adjacent vent pipe of the other appliance for installations in the U.S. For installations in Canada, provide clearances as required by CSA B149.1 or 149.2.



### Combustion Air Adapter

1. The installer must clean, deburr and chamfer the outside of the pipe ends.
2. Inspect the combustion air adapter to verify there is no obstruction or packing material inside the adapter.
3. Apply sealant to pipe and 90° elbow with bird screen.
4. Insert pipe with elbow onto the adapter until it is fully seated.
5. Secure the combustion air pipe with screw(s).

### Vent Appliance Adapters - Category III or IV

The MODULATING DELTA requires the use of an appliance adapter as approved by the one of vent manufacturers listed on page 8.

#### WARNING

**Failure to use an approved vent appliance adapter may create improper vent connection and potential flue gas leakage. Do not mix the manufacturer appliance adapter with other manufacturers' vent components, the vent system could fail or improperly seal, causing leakage of flue products into the building.**

1. Prior to installing the appliance adapter, inspect the flue hood and verify there is no obstruction or packing material inside.
2. Ensure the appliance adapter banding strap is loose prior to installation.
3. Apply silicon as necessary to seal adapter to appliance.
4. Secure adapter to appliance by tightening adapter banding strap.

### Vent Condensate Drain

A vent condensate drain and drain tube should be installed near the appliance to prevent any potential condensate from entering the flue way on the appliance.

#### WARNING

**Failure to provide a vent condensate drain close to the appliance could allow acidic flue gas condensate to enter into the appliance flue ways causing premature failure of the appliance.**

### Condensate Drain Tube

To prevent flue gases from entering into the building it is important the drain tube is fashioned into a "pigtail" trap.

The drain tube must be filled with water to prevent flue gases from emitting into the building prior to operating the appliance.

#### NOTICE

**Periodically inspect the water level in the condensate drain tube. If low, add water as needed to maintain trap level.**

If water in drain tube evaporates rapidly due to ambient conditions, propylene glycol may be added or substituted to reduce evaporation.

Pipe the condensate drain tube to a suitable place of drainage or to a condensate pump or sump. Consult local authorities regarding disposal of flue gas condensate into public waste water system.

### Vent and Combustion Air Piping Installation Guidelines

1. The installer should install the vent / combustion air piping working from the appliance to the piping termination. The piping should not exceed the lengths given in Table 3 page 30 for either the vent or combustion air.
2. The installer should cut the pipe if required to the appropriate lengths and deburr the inside and outside.
3. The installer should chamfer the outside of the pipe.
4. The pipe ends and fittings should be cleaned and dried thoroughly prior to assembly of the joint.
5. Refer to vent manufacturer's instructions for proper sealing of the vent system.
6. The installer should use perforated metal strap hangers or equivalent pipe hangers to support the piping. The hangers must be spaced at a maximum of every 5 feet of horizontal or vertical run of piping. A support must be placed near the appliance and where the vent turns vertical. Do not penetrate any part of the piping or vent system with fasteners.
7. The vent should be sloped continuously from the termination back to the appliance with at least 1/4 inch drop per foot of run. Do not allow any sags in the run of piping.



**WARNING**

Do not pitch the vent away from the appliance. Potential condensate damage to the building exterior or to the surrounding landscape and/or potential risks of icing and blockage of the vent piping could occur.

- 8. Maintain a minimum clearance per the vent manufacturer's instructions for both combustible or non-combustible materials. The installer must seal any wall, floor or ceiling penetrations as per local code requirements.
- 9. The vent piping does not require any insulation. The installer may opt to insulate the vent piping in those portions of the piping that pass through unheated spaces such as crawl spaces or attics. In these areas the installer may apply fiberglass insulation to the outside of the vent pipe.

**NOTICE**

Table 3 references a long radius 90° elbow. For each additional 90° elbow within the system, the installer must reduce the maximum allowable length by 7 feet. If a short radius 90° elbow is used the maximum allowable length must be reduced by 10 feet for each short radius 90° elbow. If a 45° elbow is used the maximum allowable length must be reduced by 3 feet for each 45° elbow.

**BEST PRACTICE**

It is recommended that the installer uses the same number of elbows and length of piping on the venting system and the combustion air inlet.

**TABLE 3**

MODULATING DELTA Model	Maximum Allowable Vent Piping Length			
	3 inch Diameter Vent Piping			
	Feet	Elbows	Feet	Elbows
PG-150 PG-199 PG PLUS-150 PG PLUS-199	60	0	46	2

## SECTION IV - Category I Installation of Vent Air/Piping

### General Requirements - Category I (PG-150 & PG-199 only)

The venting system must be installed in accordance with:

- NFPA 54 National Fuel Gas Code, ANSI Z223.1.
- NFPA 211 Standard for Chimneys, Vent and Solid Fuel Burning Appliances.

For installations in Canada the venting system must be installed in accordance with:

- CSA / B149 Installation Code for Gas Burning Equipment.
- Prior to installing the appliance into an existing chimney or venting system, the vent system should be inspected for condition and obstructions.

#### WARNING

**If the inspection reveals the vent system is not safe for the intended use, it shall be repaired, rebuilt, lined, relined or replaced with a vent or chimney to conform to NFPA 211, latest edition. Failure to conduct such an inspection and/or repair could result in severe personal injury, death or substantial property damage.**

- No portion of the venting system shall extend into or pass through any circulating air duct or furnace plenum.
- The gas venting system shall be installed, in accordance with their listings and the manufacturer's instructions.

### Masonry and Metal Chimneys

- The NFPA code book severely limits the installation of the MODULATING DELTA into a masonry chimney. For applications using either interior or exterior masonry chimney a listed, approved metal chimney lining system should be used.

#### BEST PRACTICE

**For any applications using an exterior chimney it is recommended that an insulated or stainless steel chimney lining system be used.**

#### NOTICE

**A chimney with one or more sides exposed to the outside of the structure is considered to be an exterior chimney.**

- The chimney shall extend at least 5 feet above the highest connected appliance flue collar.
- The chimney shall extend at least 3 feet above the highest point where it passes through a roof of a building and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet.

### Type B Vent Systems

- The vent system should terminate in accordance with NFPA 54, latest edition, provided the termination is at least 8 feet from a vertical wall or similar obstruction.

#### BEST PRACTICE

**The Type B vent system shall extend in a general vertical direction with offsets not exceeding 45°. A vent system having not more than one 60° offset shall be permitted. Any angle greater than 45° is considered horizontal.**

#### BEST PRACTICE

**The total horizontal distance of a vent plus the horizontal vent connector shall not be greater than 75% of the vertical height of the vent.**

### Vent Connectors

- When a vent connector must be located in or pass through an un-conditioned space, attic or crawl space, that portion of the vent connector must be listed as Type B or other approved material having equivalent insulation qualities.
- The minimum clearance to combustibles for single wall vent connectors shall be 6 inches.
- The minimum clearance to combustibles for Type B vent connectors shall be 1 inch or per vent manufacturer's instructions.
- The vent connector shall be installed in a manner to avoid excessive turns or other construction features that create excessive resistance to the flow of the vent gases.

- The vent connector should be installed in a manner without any dips or sags and should slope upward toward the vent or chimney at least 1/4 inch per 1 foot.
- The location of the appliance should be located as close to the vent or chimney to maintain the vent connector length as short as possible.

**BEST PRACTICE**

The maximum horizontal length allowable should not exceed 75% of the height of the vent or chimney assuming no offsets in the vertical vent.

- The entire length of a vent connector shall be readily accessible for inspection, cleaning and replacement.
- The diameter of the vent connector should not be upsized more than two sizes greater than the flue outlet diameter.

**WARNING**

The minimum recommended vent connector given in Table 4 is only a general guideline. The vent system must be designed and installed in compliance with all applicable codes. Failure to properly size and install the vent system could result in severe personal injury, death or substantial property damage.

TABLE 4: Vent Connector Diameter

MODULATING DELTA Model	Min. Recommended Vent Connector Diameter
PG-150	4 inches
PG-199	5 inches

**NOTICE**

There are certain applications for the MODULATING DELTA in which upsizing the vent connector to 5 inches will not result in sufficient maximum capacity requirements. In these applications the installer, after consultation with Triangle Tube Engineering, may upsize the vent connector to 6 inches provided the vent connector and vent system are Type B.

**Common Venting - Category I**

A Category I vented MODULATING DELTA (PG-150 & PG-199) may be vented into a common vent system using the guidelines and sizing Tables of the National Fuel Gas Code NFPA 54 ANSI Z223.1 latest edition.

A Category I vented MODULATING DELTA (PG-150 & PG-199) may also be vented into a common multi story vent using the guidelines and sizing Tables of the National Fuel Gas Code NFPA 54 ANSI Z223.1 latest edition.

**SECTION V - COMMONWEALTH OF MASSACHUSETTS**

**INSTALLATIONS WITH SIDE WALL VENT TERMINATION ELEVATION AT OR BELOW 4 FEET OF GRADE:**

**NOTICE**

The following instructions apply to the installation of a side wall vented appliance whose vent termination and combustion air inlet when applicable is installed at or below a four foot elevation above the grade.

1. If not already present in the structure of the building, a carbon monoxide detector and alarm must be installed in the living area outside the bedroom(s). The carbon monoxide detector and alarm is provided by the installer.

**NOTICE**

The carbon monoxide detector and alarm installed in the living space outside the bedrooms shall comply with NFPA 720 (2005 edition).

2. A carbon monoxide detector and alarm shall be installed in the mechanical room in which the side wall vented appliance is located. The carbon monoxide detector and alarm shall:
  - Be installed on the same 120 volt service circuit as the appliance such that only one service switch services both the appliance and the carbon monoxide detector.
  - Provide battery back-up power in case of power failure

**NOTICE**

The carbon monoxide detector and alarm installed within the same room as the side wall vented appliance must meet ANSI/UL 2034 standards and comply with NFPA 720 (2005 edition). The carbon monoxide detector and alarm must be tested, approved and listed with a Nationally Recognized Testing Lab as recognized under 527 cmr.

3. The side wall vent termination must be approved for the appliance and when applicable the combustion air inlet must be approved for the appliance. Installation of the vent termination and combustion air inlet when applicable shall be in strict compliance with the installation instructions provided with the appliance.

**NOTICE**

The installer must leave the appliance installation manual and any documentation regarding the installation of the venting, vent termination and combustion air inlet when applicable with the appliance upon completion of the installation.

4. A metal or plastic identification plate (provided by the installer) must be mounted on the exterior wall of the building 4 feet directly above the location of the vent termination and combustion air inlet when applicable. The identification plate shall read **“Gas Vent Directly Below”**. The size of the plate and lettering shall be of sufficient size to be easily read from a distance of 8 feet.

## INSTALLATIONS WITH THE SIDE WALL TERMINATION ELEVATION ABOVE 4 FEET OF GRADE:

### NOTICE

The following instructions applied to the installation of a side wall vented appliance whose vent termination and combustion air inlet when applicable is installed above a four foot elevation above the grade.

1. If not already present in the structure of the building, a carbon monoxide detector and alarm must be installed in the living area outside the bedroom(s). The carbon monoxide detector and alarm is provided by the installer.

### NOTICE

The carbon monoxide detector and alarm installed in the living space outside the bedrooms must comply with NFPA 720 (2005 edition).

2. A carbon monoxide detector and alarm shall be installed in the mechanical room in which the side wall vented appliance is located. The carbon monoxide detector and alarm shall:
  - Be either hard wired or battery powered or both

### NOTICE

The carbon monoxide detector and alarm installed within the same room as the direct vent appliance must comply with NFPA 720 (2005 edition).

3. The side wall vent termination must be approved for the appliance and when applicable the combustion air inlet must be approved for the appliance. Installation of the vent termination and combustion air inlet when applicable shall be in strict compliance with the installation instructions provided with the appliance.

### NOTICE

The installer must leave the appliance installation manual and any documentation regarding the installation of the venting, vent termination and combustion air inlet when applicable with the appliance upon completion of the installation.

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### PHASE III INDIRECT FIRED WATER HEATERS



- Exclusive Tank-in-Tank design
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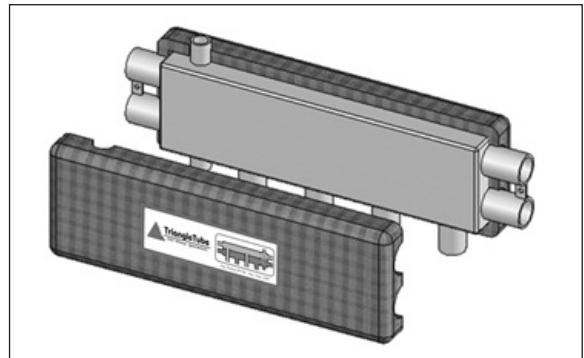


- For domestic water, snow melting, radiant floor, refrigeration
- Plates made of stainless steel, with a 99.9 % copper and brazed, ensuring a high resistance to corrosion
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- Computerized sizing available from Triangle Tube/Phase III
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### MODULATING DELTA CONCENTRIC VENT KIT



### PRIMARY / SECONDARY MANIFOLD



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