



# Venting Kit Installation Instructions for UHXNEGVT1XXXX Negative Pressure (Vertical, CATI ) UHXPOSHZ1XXXX Positive Pressure (Horz/Vert, CATIII )

**IMPORTANT NOTES:**

1. This kit is design certified in compliance with ANSI Z21.56/CSA 4.7 for use with Hayward's Universal H-Series gas heaters. These heaters have manufacturing model numbers ending in 'FDN' or 'FDP'.
2. These kits facilitate unit exhaust vent pipe termination. For UHXNEGVT1 vertical, with galvanized and/or non-sealed vent pipe and vent terminals. Or For UHXPOSHZ1 either horizontal or vertical, with special-ordered stainless steel pipe and vent terminals. See kit matchups in Table1 below.

<b>Table1 Kit and Model Matchup</b>					
<b>Kit Part Number</b>	<b>For Use With Heater Model</b>	<b>Description</b>	<b>Vent Pipe Application</b>	<b>Vent Pipe Material</b>	<b>Vent Termination Requirement</b>
UHXNEGVT11506	H150FD	Negative pressure CATI, vertical venting applications	Vent pipe to be installed according to the Category I venting tables in the National Fuel Gas Code (ANSI Z223.1/NFPA 54)	Single or double wall, galvanized, non-sealed vent pipe	Vertical only, termination above roof of house/building
UHXNEGVT12006	H200FD				
UHXNEGVT12506	H250FD				
UHXNEGVT13008	H300FD				
UHXNEGVT13508	H350FD				
UHXNEGVT14008	H400FD				
UHXNEGVT15008	H500FD				
UHXPOSHZ11506	H150FD	Positive pressure CATIII horizontal or vertical venting applications	50 ft. max with 1 elbow, 40 ft. max with 2 elbows, 30 ft. max with 3 elbows	Single or double wall sealed stainless steel vent Pipe	Horizontal or vertical termination immediately outside of house/building wall
UHXPOSHZ12006	H200FD				
UHXPOSHZ12504*	H250FD				
UHXPOSHZ12506					
UHXPOSHZ13008	H300FD				
UHXPOSHZ13508	H350FD				
UHXPOSHZ14006**	H400FD				
UHXPOSHZ14008					
UHXPOSHZ15006**	H500FD				

\* Kit must be accompanied by UHXHFA004 or UHXDVA004

\*\* Kit must be accompanied by UHXHFA006 or UHXDVA006

3. Installation of these kits to be conducted by a qualified technician, specifically trained and experienced in the installation of this type of heating equipment. The contractor must be properly licensed as required by location. This kit must be installed in accordance with all local and state codes.
4. The installation of this kit must conform to the latest edition for the National Fuel Gas Code (ANSI Z223.1/NFPA54), the vent manufacturer's installation instructions, and with the requirements of the local authority having jurisdiction. Design certification of this kit is in compliance with ANSI Z21.56 /CSA4.7. For Canadian installations, this kit is to be installed in accordance with the standard CAN/CGA B149.1 - Installation Codes for Gas Burning Appliances and Equipment and/or local codes.
5. Multiple positive pressure / CAT III units must not be vented using common venting or vent terminations. Never common vent (negative CAT I or positive CAT III) these heaters with other gas-burning appliances.
6. See figure1 for kit contents. Do not interchange parts from other kits. Positive and negative adapters are not interchangeable.
7. Heaters installed indoors or shelters are likely to experience increased hours of operation. Proper air and vent installation, maintenance and service are essential to the heater reliability and longevity.

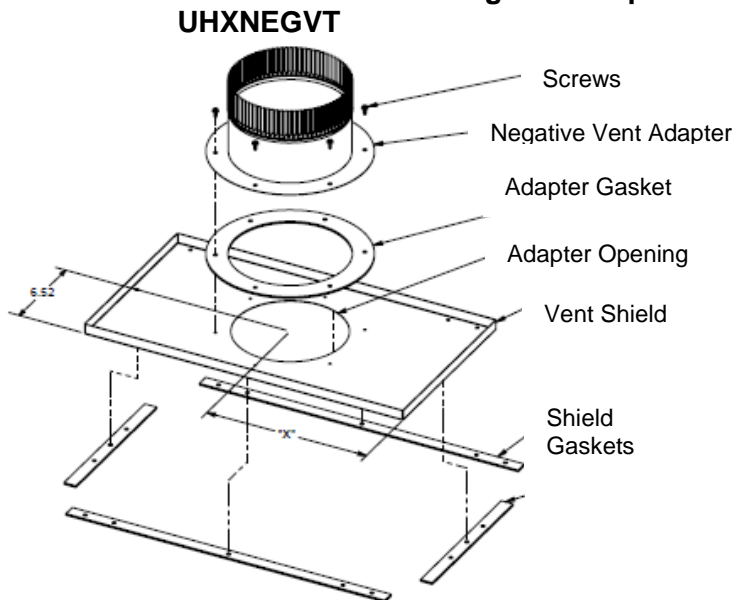
**▲ WARNING:** If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, injury, or death.

**▲ WARNING:** This product must be installed and serviced by authorized personnel, qualified in pool/spa heater installation. Improper installation and/or operation can create carbon monoxide gas and flue gases that can cause serious injury, property damage, or death

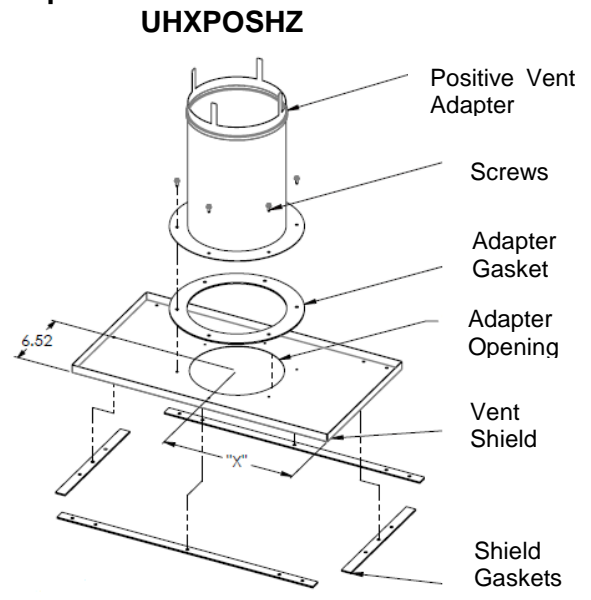
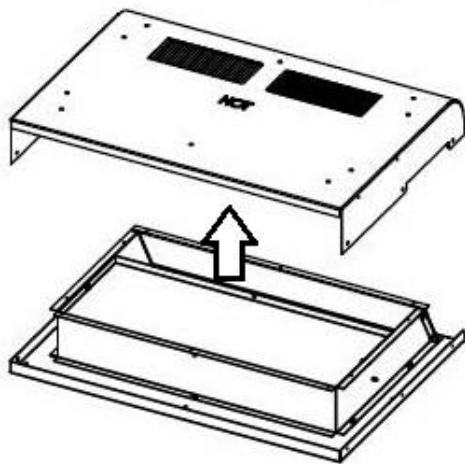
**Clearances:** The heater must be installed with service and installation clearances to combustible materials as shown in Table 2. This heater may be installed on combustible floors. Do not install heater in a closet or confined space (see National Fuel Gas Code ANSI Z223.1/NFPA54).

Table2: Indoor Installation Required Clearances (in.)	
Heater Panel	Required Clearance
Top	36
Front	18
Back	6
Water Connection Side	12
Opposite Water Side Connection	6

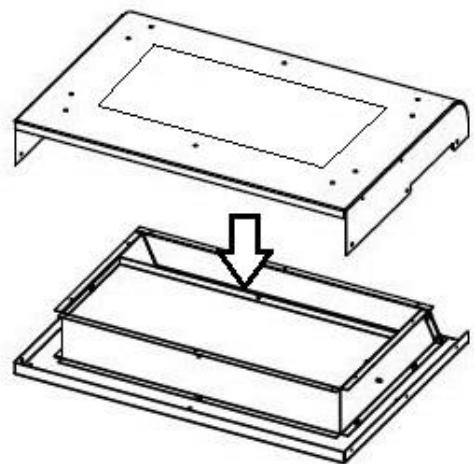
**Figure1 Adapter Kit Components**



**Factory Shipped Top Flue Cover**



**Kit Supplied Top Flue Cover**



## INSTALLATION PROCEDURE:

1. If connected, turn pump, main gas valve, and heater power off.
2. Locate the heater as close as practical to the gas vent exit also following Table 2 clearances and IO Manual supplied with product.
3. Replace Top Flue Cover on heater with version supplied in Vent Kit (see Figure1). This will provide an opening for the vent.
  - a) Use multiple containers to hold the different screws during this process. All screws removed during this procedure will be needed to reassemble the heater.
  - b) Remove each Upper End Cap and Trim Panel to the heater (see Figure2 for screw locations).
  - c) Remove Rear Access Panel.
  - d) Remove the original Top/Rear Panel (see Figure3) and discard.
  - e) Install the Top/Rear Panel supplied with the Vent Kit using the correct screws. The appropriate screws must be used for each panel re-install.
  - f) Re-install the End Caps and Rear Access Panel.
4. Remove the Heat Barrier and Rain Guard, discard both parts (See Figure4).
5. Install the vent pipe adapter plate included in this kit into the heater using the #10 screws included with this kit. Ensure drain opens are at the rear and the supplied gaskets are in place under the vent pipe adapter plate before installing (See Figure5).
6. Install the new filler plate included with this kit over the vent pipe adapter and secure with screws from step 3 above (See Figure6).
7. Remove heater front access door. Confirm that both pressure switches are present (blower vacuum and vent pressure see Figure7) and that the hoses connections for these pressure switches are connected appropriately see Figure8).
8. For previously manufactured model heaters, the vent pressure switch is located on the side panel or was not provided in the unit. For these models the kit contains a vent pressure switch, jumper wire and length of hose for kit operation.
  - a) Connect the jumper wire included with this kit onto one of the terminals on the provided vent pressure switch.
  - b) Unplug the in-line quick connect on the red wire in the heater wire harness and connect the vent pressure switch in series with the red wire. See excerpt from heater wiring schematic in Figure9.
  - c) If you are refitting a heater with an FDXLRGK1xxx kit, you will need to splice into the wire harness red wire which attaches to the water pressure switch. The vent pressure switch should be in series with the water pressure switch as shown in Figure9.
  - d) Attach the pressure switch tubing to the vent pressure switch and to the vent pressure tap on the blower outlet. See Figure8 for vent pressure tap location. The vent pressure tap may be located on the opposite side of the blower housing. Consult dealer or factory to ensure proper pressure switch and hose connections. See heater IO Manual supplied with heater for additional details.
9. If installing the kit on model H400FDP, you must also replace the existing blower air inlet restrictor with the new one included in the kit.
  - a) Remove the blower air plate (see Figure8) and discard. Save the screws as they will be needed to install the new plate.
  - b) Install the new blower plate included in the kit using the screws from disassembly.
10. If heater is to be installed above 2000ft altitude the vent pressure switch and air inlet plate may need to be replaced. The High Altitude Conversion Kit FDXLHAK1931 will also be required for the installation. Instructions to install the high altitude components are provided in the kit.
11. Re-install heater front access door.
12. **Connect vent piping system to heater at newly installed vent adapter. Confirm installation follows air supply and flue gas vent system sections provided in this instruction and the vent manufactures instructions.**
13. If connected, turn pump, main gas valve, and heater power back on. Activate heater and check for proper function.

Figure2: Screw Locations on Side of Unit

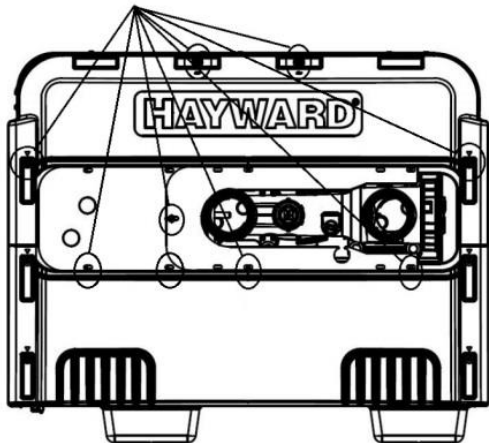
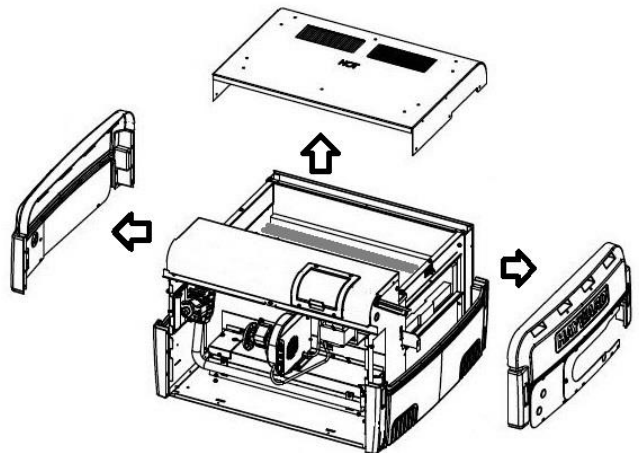
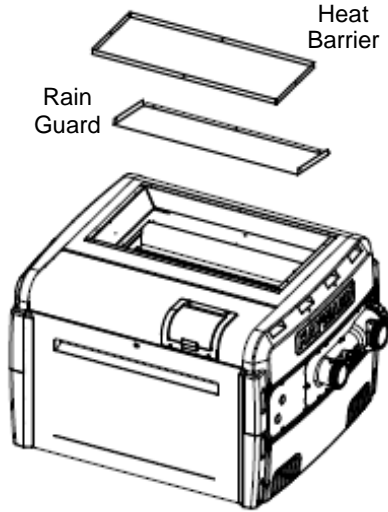


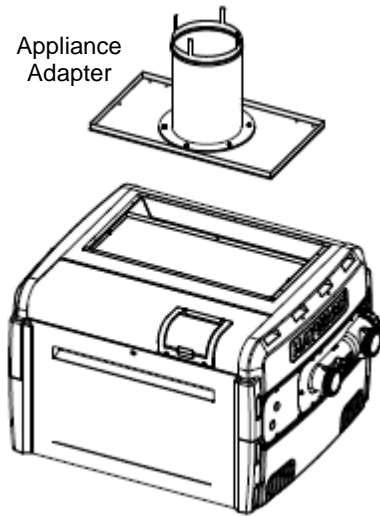
Figure3: Panel Disassembly



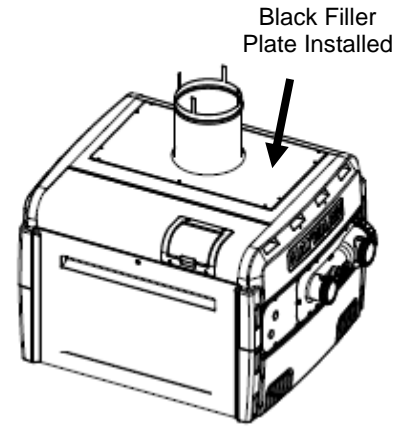
**Figure4 Component Removal**



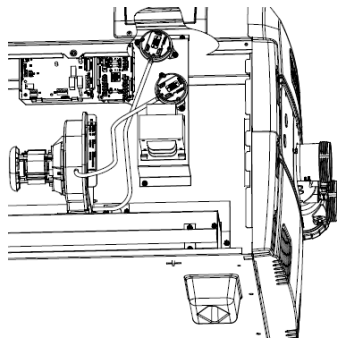
**Figure5 Adapter Install**



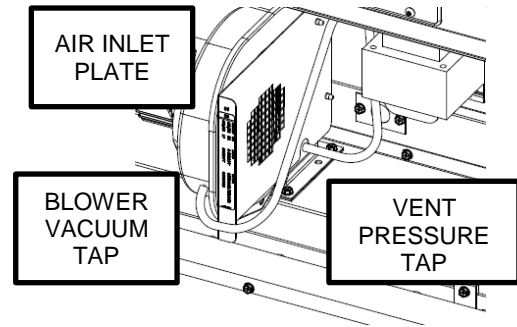
**Figure6 Flue Filler Plate Install**



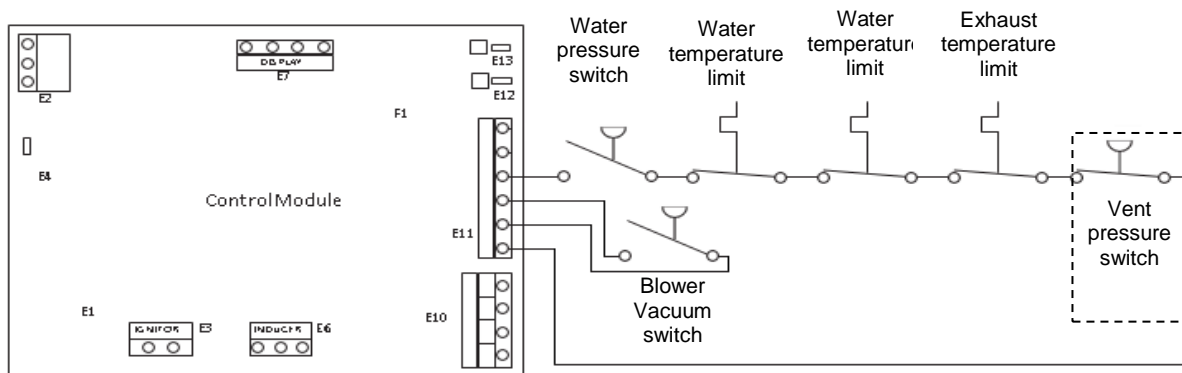
**Figure7 Pressure Switches FD**



**Figure8 Pressure Switch Hose Connections**



**Figure9: Control Safety Circuits**



**AIR SUPPLY:**

Indoor installations and installation in shelters must be provided with adequate combustion and ventilation air openings to assure proper heater operation. These openings must be sized according to the requirements stated in paragraphs below **(ALL AIR SUPPLY FROM INSIDE THE BUILDING or ALL AIR SUPPLY FROM OUTDOORS)** whichever applies to the installation. These air openings must never be obstructed when heater is in operation. **223.1/NFPA54 require these spaces be provided with 2 permanent openings, one commencing within 12 inches of the bottom and one commencing within 12 inches of**

**the top of the enclosure.** The openings shall communicate directly or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors. Ducts shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall not be less than 3 inches. When air blowers are used in spa/hot tub installations and are located in proximity to the heater communicating with the same air, caution must be observed to ensure sufficient combustion and ventilation air is available to the heater. **Note Table2 clearances and Table3 air requirements must be followed.**

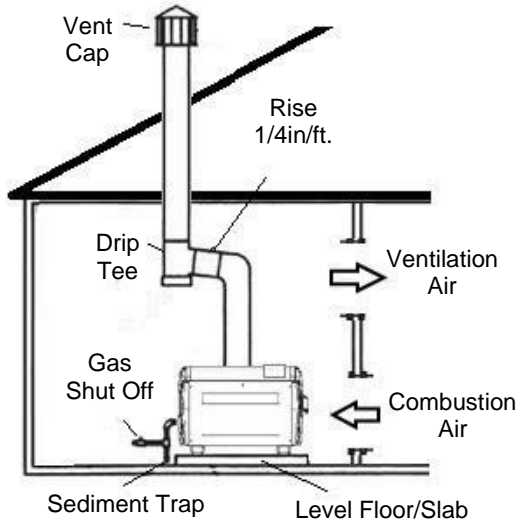
**ALL AIR SUPPLY FROM INSIDE THE BUILDING:** The confined space shall be provided with 2 permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space (a space whose volume is not less than 50 cubic feet per 1,000 btu/hr. of total input all gas utilization equipment installed in the combined space shall). Each opening shall have a minimum free area of 1 square inch per 1,000 btu/hr. of the total input, but not less than 100 square inches. See Table3 and Figure10.

**ALL AIR SUPPLY FROM OUTDOORS:** When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 btu/hr of total input see Table3 and Figure11a. When communicating with the outdoors (either directly or through vertical ducts), each opening shall have a minimum free area of 1 square inch per 4,000 btu/hr of total input rating of all equipment in the enclosure. See Table3 and Figure11b. When installing a heater below ground (**in a pit, for use with Natural Gas only**), combustion and ventilation air openings must be provided as shown in Figure12.

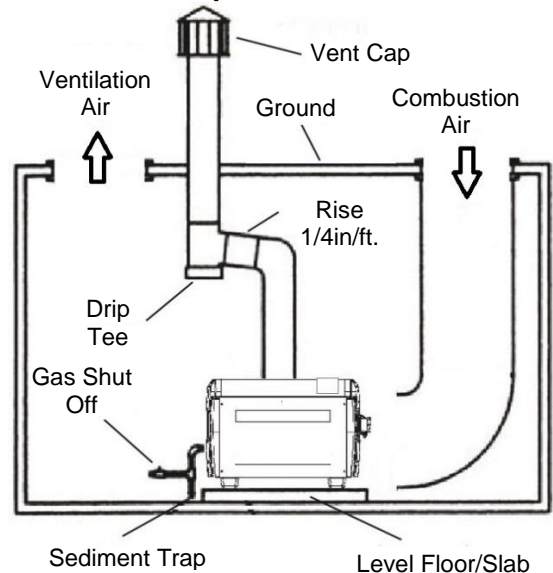
Free Area per Total Btu Requirement	Total Input (Btu/hr)	Combustion Air Free Area Required	Ventilation Air Free Area Required
1 sq. in. per 1,000 Btu/hr (Indoor Air)	150,000	150	150
	200,000	200	200
	250,000	250	250
	300,000	300	300
	350,000	350	350
	400,000	400	400
1 sq. in. per 2,000 Btu/hr (Outdoor Air thru Horz duct)	150,000	75	75
	200,000	100	100
	250,000	125	125
	300,000	150	150
	350,000	175	175
	400,000	200	200
1 sq. in. per 4,000 Btu/hr (Outdoor Air direct or thru Vert duct)	150,000	37.5	37.5
	200,000	50	50
	250,000	62.5	62.5
	300,000	75	75
	350,000	87.5	87.5
	400,000	100	100
	500,000	125	125

\*For detailed methods of providing combustion and ventilation air, see latest edition of the National Fuel Gas Code (ANSI Z223.1/NFPA 54)

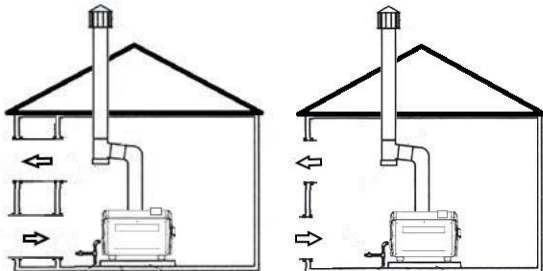
**Figure10: Air from Inside Building Installation  
1 in2 per 1,000 btu/hr**



**Figure12: Air Below-Ground  
(Pit for Natural Gas only Installations)  
1 in2 per 4,000 btu/hr**



**Figure11: Air from Outside Building Installation  
a) 1 in2 per 2,000 btu/hr      b) 1 in2 per 4,000 btu/hr**



**FLUE GAS VENTING:**

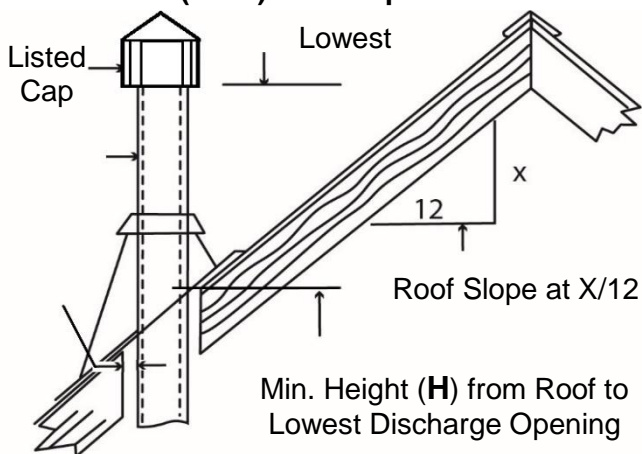
**INSTALLATION WITH NEGATIVE (CAT I ) OR POSITIVE (CAT III ) PRESSURE VENTING SYSTEMS:** The heater is designed for either a negative-pressure or a positive-pressure venting systems when configured with the appropriate adapter kit and venting system. The venting system for a particular site will depend on many factors such as vent termination needs (horizontal / vertical), clearance of vent termination, length of vent and the cost of venting system. Table1 list the required venting kits available for each model heater and vent system application.

**NEGATIVE PRESSURE ( VERTICAL ONLY, CAT I ) VENTING:** Size the vent pipe according to the venting Tables in the National Fuel Gas Code (ANSI Z223.1/NFPA 54) for a Category I gas appliance using single-wall or double-wall (Type B) gas vent. Vent pipe diameter should not be less than the size of the vent pipe adapter on the heater with the appropriate vent kit adapter installed (see Table1). Single-wall vent may be used in conditioned spaces only. Clearance to combustible materials for single-wall vent is 9 inches. Double-wall (Type B) vent may be used in conditioned spaces, but must be used in non-conditioned spaces. Clearance to combustible materials for double-wall vent is 6 inches. Smaller clearances may be available; consult the National Fuel Gas Code.

**CAT I MECHANICAL DRAFT SYSTEMS:** Vent systems requiring power venting must use mechanical draft systems listed in accordance with UL378 Draft Equipment. Selection of power venter and required clearances from combustible materials must follow draft equipment manufacturer’s instructions, National Fuel Gas Code, local codes and the information in this kit.

**NEGATIVE PRESSURE CAT I VENT TERMINATION:** Any vent extending through a roof or wall must be listed double-wall (Type B) vent, and pass through an approved roof jack, or roof thimble. A listed vent cap must be used. Terminations for Gas vents with listed 12in or less diameter size and located not less than 8ft from a vertical wall or similar building feature shall terminate per Figure13 and Table4 using the roof pitch to find the minimum termination height value of H. Terminations for Gas vents with listed 12in or less diameter size located less than 8ft from a vertical wall or similar building feature shall terminate not less than 2ft above the highest point where they pass through the roof and not less than 2ft above any portion of a building within 10ft horizontally

**Figure13: Minimum Height from Roof for (CATI) Vent Cap**



<b>Table4 Height Requirements for Negative Pressure (CATI) Vent Caps (see Figure13)</b>		
<b>Min. Height H from Roof to Lowest Discharge Opening</b>		
<b>Roof Slope</b>	<b>(ft.)</b>	<b>(m)</b>
Flat to 6/12	1.0	0.30
Over 6/12 to 7/12	1.25	0.38
Over 7/12 to 8/12	1.5	0.46
Over 8/12 to 9/12	2.0	0.61
Over 9/12 to 10/12	2.5	0.76
Over 10/12 to 11/12	3.25	0.99
Over 11/12 to 12/12	4.0	1.22
Over 12/12 to 14/12	5.0	1.52
Over 14/12 to 16/12	6.0	1.83
Over 16/12 to 18/12	7.0	2.13
Over 18/12 to 20/12	7.5	2.27
Over 20/12 to 21/12	8.0	2.44

**POSITIVE PRESSURE (HORIZONTAL OR VERTICAL, CAT III ) VENTING:**

When installed according to the following instructions, heaters meet the criteria for category III venting.

**VENT SIZING:** Vent pipe diameter, number of elbows and length of straight must match the values by heater shown in Table8. The vent pipe must be single or double-wall stainless steel sealed vent as listed in Table5. Double-wall vent must be used in non-conditioned spaces. The venting system must be installed in accordance with the vent manufacturer’s installation instructions and guidelines. The installer is urged to visit the vent system manufacturer’s website (see below) and review the installation information found there.

**VENT TERMINATION:** The vent system must terminate with a vent terminal approved for this pool heater. Termination may be either horizontal or vertical. See Table5 for approved vent terminals and National Fuel Gas Code (ANSI Z223.1/NFPA 54) or Table6 for termination locations. Horizontal and vertical terminations should always be above the prevailing snow levels

**OBTAINING VENT PIPE AND TERMINATIONS:** A variety of vent components, including terminals, elbows, and straight lengths, are available for use with this appliance. Approved parts are listed in Table5. If you need more specialized fittings, you may order them directly from the manufacturer, or one of their authorized dealers. To locate an authorized dealer for venting parts, contact the appropriate manufacturer

M&G DuraVent Inc.  
6 Jupiter Ln.  
Colonie, NY 12205  
(800) 835-4429  
www.duravent.com  
DuraVent FasNSeal

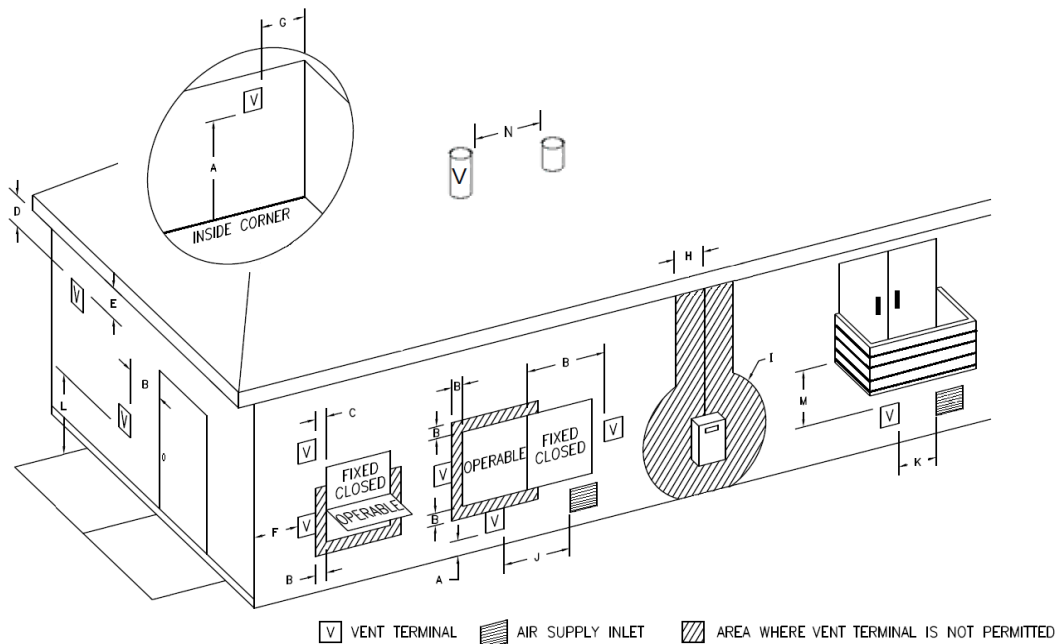
OR  
Selkirk Corporation  
Heatfab Division  
130 Industrial Blvd  
Turners Falls, MA 01376  
(800) 772-0739  
www.heatfab.com  
Heatfab Saf-T Vent EZ  
Seal (CI Plus)

**Table5 Positive-Pressure ( CAT III ) Indoor Vent Kits with Vent Pipe & Terminal Specifications**

Heater Model	Indoor Vent Kit Part Number	Vent Pipe Dia. (in)	# Elbow	Straight Length (ft)	Appliance Adapter	Vent Pipe Type	Additional Heatfab Saf-T Vent EZ Seal (CI Plus) or DuraVent FasNSeal (W2) Required for Install		
							Vent Pipe Part Number	Horizontal Vent Terminal Part Number	Vertical Vent Terminal Part Number
150 200	UHXPOSHZ11506 UHXPOSHZ12006	6	0	50	Heatfab adapter included in kit	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 9614TERM	HeatfabP/N 5600CI
			1	50					
			2	40		Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N 9614TERM	HeatfabP/N CCA06RC
			3	30					
250	UHXPOSHZ12506	6	0	50	Heatfab adapter included in kit	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 5690CI ‡	HeatfabP/N 5600CI
			1	50					
			2	40		Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N CCE06WP ‡	HeatfabP/N CCA06RC
			3	30					
250- FDN (NAT ONLY)	UHXPOSHZ12504	4	0	50	UHXDVA004 (4" Duravent adapter)	Single-Wall	DuraVentP/N FSVLx04 †	DuraVentP/N FSTT4	DuraVentP/N FSRC4
			1	50		Double-Wall	DuraVentP/N W2-x04 †	DuraVentP/N FSTT4	DuraVentP/N W2-RC4
			2	40	UHXHFA004 (4" Heatfab adapter)	Single-Wall	HeatfabP/N 940x *	HeatfabP/N 9414TERM	HeatfabP/N 5400CI
			3	30		Double-Wall	HeatfabP/N CCA04Lx **	HeatfabP/N 9414TERM	HeatfabP/N CCA04RC
300 350 400	UHXPOSHZ13008 UHXPOSHZ13508 UHXPOSHZ14008	8	0	50	Heatfab adapter included in kit	Single-Wall	HeatfabP/N 980x *	HeatfabP/N 5890CI ‡	HeatfabP/N 5800CI
			1	50					
			2	40		Double-Wall	HeatfabP/N CCA08Lx **	HeatfabP/N CCE08WP ‡	HeatfabP/N CCA08RC
			3	30					
400	UHXPOSHZ14006	6	0	50	UHXDVA006 (6" Duravent adapter)	Single-Wall	DuraVentP/N FSVLx06 †	DuraVentP/N FSTT6	DuraVentP/N FSRC6
			1	50		Double-Wall	DuraVentP/N W2-x06 †	DuraVentP/N FSTT6	DuraVentP/N W2-RC6
			2	40	UHXHFA006 (6" Heatfab adapter)	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 9614TERM	HeatfabP/N 5600CI
			3	30		Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N 9614TERM	HeatfabP/N CCA06RC
500	UHXPOSHZ15006	6	0	50	UHXDVA006 (6" Duravent adapter)	Single-Wall	DuraVentP/N FSVLx06 †	DuraVentP/N FSTT6	DuraVentP/N FSRC6
			1	50		Double-Wall	DuraVentP/N W2-x06 †	DuraVentP/N FSTT6	DuraVentP/N W2-RC6
			2	40	UHXHFA006 (6" Heatfab adapter)	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 9614TERM	HeatfabP/N 5600CI
			3	30		Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N 9614TERM	HeatfabP/N CCA06RC

**Notes for Table8 Positive-Pressure ( CAT III ) Indoor Vent Kits with Vent Pipe & Terminal Specifications**

- \* For Heatfab single-wall vent pipe section length, "x" to be: 1, 2, 4, 5, or 7, where 1=6 inches, 2=12 inches, 4=18 inches, 5=24 inches, and 7=36 inches.
- \*\* For Heatfab double-wall vent pipe section length, "x" to be: 06, 09, 12, 18, 24, or 36, indicating the length of the vent pipe section in inches.
- † For DuraVent vent pipe section length, "x" to be: 6, 12, 18, 24, or 36, indicating the length of the vent pipe section in inches.
- ‡ For these horizontal terminals, the wall penetration is included from the vent manufacturer. On all others, it must be ordered separately.



**Table9 Positive-Pressure (CAT III ) Vent Termination Clearances**

DIM	Clearance Description	U.S. Installation (1)	Canadian Installation (2)
A	Clearance above grade, veranda, porch, deck, balcony or anticipated snow level	12 in. (305 mm)	12 in. (305 mm). 18 in. (457 mm) above roof surface.
B	Clearance to a window or door that may be opened	12 in. (305 mm) for appliances > 500,000 Btuh (15 kW)	36 in. (914 mm) for appliances > 100,000 Btuh (30 kW)
C	Clearance to a permanently closed		
D	Vertical clearance to a ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the centerline of the terminal	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier
E	Clearance to an unventilated soffit		
F	Clearance to an outside corner		
G	Clearance to an inside corner		
H	Clearance to each side of the centerline extended above electrical meter or gas service regulator as sembly	3 ft. (.9 M) within 15 ft. (4.6 M) above the meter/ regulator assembly	3 ft. (.9 M) within 15 ft. (4.6 M) above the meter/ regulator assembly
I	Clearance to service regulator vent outlet	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	3 ft. (.9 M)
J	Clearance to non ---mechanical air supply inlet to building or the combustion air inlet to any other appliance	9 in. (229 mm) for appliances > 10,000 Btuh (3kW) and <= 50,000 Btuh (15 kW), 12 in. (305 mm) for appliances > 50,000 Btuh (15 kW)	12 in. (305 mm) for appliances > 10,000 Btuh(3kW) and <= 100,000 Btuh (30 kW), 36 in. (914 mm) for appliances > 100,000 Btuh (30 kW)
K	Clearance to a mechanical air supply inlet	3 ft. (.9 M)	6 ft. (1.8 M)
L	Clearance above paved sidewalk or paved driveway located on public property	For clearances not specified in ANSI Z223.1/NFPA 54 or CAN/CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	7 ft. (2.1 M). A vent shall not terminate above a side- walk or paved driveway that is located between two single family dwellings and serves both dwellings.
M	Clearance under a veranda, porch, deck, or balcony	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	12 in. (305 mm). Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
N	Clearance from a plumbing vent stack	3 ft. (.9 M)	3 ft. (.9 M)

(1) In accordance with the current ANSI Z223.1.NFPA 54, National Fuel Gas Code

(2) In accordance with the current CAN / CSA B149.1, Natural Gas and Propane Installation Code.

**⚠ WARNING:**

1. The vent for this appliance shall not terminate: Over public walkways; or Near soffit vents of crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or property damage; or Where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
2. When locating vent terminations, consideration must be given to prevailing winds, location, and other conditions which may cause recirculation of the combustion products of adjacent vents. Recirculation can cause poor combustion, inlet condensate problems, and accelerated corrosion of the heat exchangers.
3. Do not vent under a deck or large overhang. Recirculation could occur and cause performance or system problems.