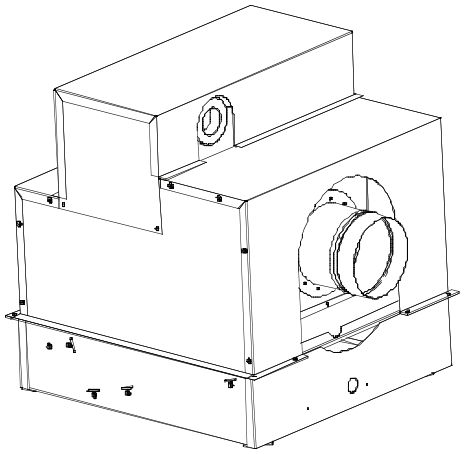
INSTALLATION & OPERATING INSTRUCTIONS

Condensing Heat Exchanger (CHX)

Models 500, 750, 1000, & 1500



For Hi Delta Models 402B–2002B

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

FOR YOUR SAFETY: Do not store or use gasoline or other flammable vapors and liquids or other combustible materials in the vicinity of this or any other appliance. To do so may result in an explosion or fire.

WHAT TO DO IF YOU SMELL GAS:

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

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

This manual should be maintained in legible condition and kept adjacent to the heater or in a safe place for future reference.

Raypak® A Rheem® Company

CATALOG NO. 1000.56C Effective: 02-19-10 Replaces: 09-28-07 P/N 241007 Rev. 4

Rev. 4 reflects the following:
Changes to: Figures 3-8 on pages 8-11, Figures 11-19 on pages 15-19, Table D on page 20, Table E on page 24, Table F on page 30.
Additions: California low-lead requirements on page 6, Replacement Parts information on pages 34 and 35.

CONTENTS

WARNINGS

Pay Attention to These Terms

DANGER:	Indicates the presence of immediate hazards which will cause severe personal injury, death or substantial property damage if ignored.
WARNING:	Indicates the presence of hazards or unsafe practices which could cause severe personal injury, death or substantial property damage if ignored.
CAUTION:	Indicates the presence of hazards or unsafe practices which could cause minor personal injury or product or property damage if ignored.
NOTE:	Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

WARNING: Do not use this heater that this CHX is attached to if any part has been under water. Immediately call a qualified service technician to inspect the heater and to replace any part of the control system and any gas control which has been under water.

WARNING: To minimize the possibility of improper operation, serious personal injury, fire, or damage to the heater:

- Heater should never be covered or have any blockage to the flow of fresh air to the heater.

CAUTION: If this heater is to be installed above radiation level, it must be provided with a low water cut-off device at the time of heater installation.

GENERAL SAFETY

To meet commercial hot water use needs, the high limit safety control on this water heater is adjustable up to 210°F. However, water temperatures over 125°F can cause instant severe burns or death from scalds. When supplying general purpose hot water, the recommended initial setting for the temperature control is 125°F.

This section applies to Hot Water Supply Boilers and Hot Water Heaters ONLY. For sanitary rinse applications where outlet temperatures of 180°F to 195°F are required, a boiler is recommended since the 210°F limit on water heaters will NOT allow the heater to maintain these desired sanitary rinse temperatures.

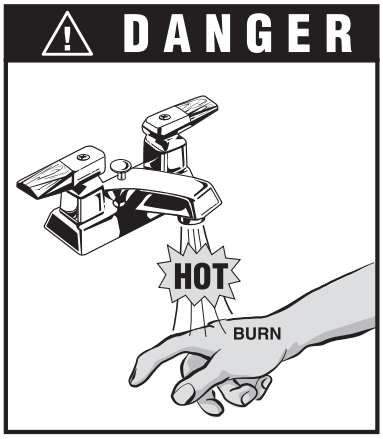
Safety and energy conservation are factors to be considered when setting the water temperature on the thermostat. The most energy-efficient operation will result when the temperature setting is the lowest that satisfies the needs of the application.

Water temperature over 125°F can cause instant severe burns or death from scalds. Children, disabled and elderly are at highest risk of being scalded.

- Feel water before bathing or showering.
- Temperature limiting valves are available.

NOTE: When this water heater is supplying general purpose hot water for use by individuals, a thermostatically controlled mixing valve for reducing point of use water temperature is recommended to reduce the risk of scald injury. Contact a licensed plumber or the local plumbing authority for further information.

Maximum water temperatures occur just after the heater's burner has shut off. To determine the water temperature being delivered, turn on a hot water faucet and place a thermometer in the hot water stream and read the thermometer. Consult the Hi Delta Installation and Operation Instructions (Catalog Numbers 1000.501 or 1000.511) for control and hot water requirements.



Water temperature over 125°F can cause instant severe burns or death from scalds.

Children, disabled, and elderly are at highest risk of being scalded.

See instruction manual before setting temperature at water heater.

Feel water before bathing or showering.

Temperature limiting valves are available, see manual.

Time/Temperature Relationships in Scalds

The following chart details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

Water Temp.	Time to Produce Serious Burn
120°F	More than 5 minutes
125°F	1-1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1-1/2 seconds
155°F	About 1 second

Table courtesy of The Shriners Burn Institute

Table A: Time to Produce Serious Burn

INTRODUCTION

Raypak strongly recommends that this manual be reviewed thoroughly before installing your Raypak heater. Please review the Safety section before installing the heater. The factory warranty does not apply to heaters that have been improperly installed or operated; refer to the Warranty section.

Installation and service must be performed by a qualified installer, service agency, or gas supplier. If, after reviewing this manual, you still have questions which this manual does not answer, please contact your local Raypak representative or Raypak corporate headquarters.

Thank you for purchasing a Raypak product. We hope you will be pleased with the high quality and durability of our equipment.

This manual applies only to CHX systems in conjunction with a Hi Delta heater, sizes 402B-2002B. It does not cover either the installation or operation of a Hi Delta heater that is not CHX-equipped. For those units refer to the manual shipped with the heater.

Unpacking

On receipt of your CHX it is suggested that you visually check for external damage to the shipping crate. If the crate is damaged, make a note to that effect on the Bill of Lading when signing for the shipment. Remove the CHX from the shipping packaging. Report any damage to the carrier immediately.

On occasion, items are shipped loose. Be sure that you receive the correct number of packages as indicated on the Bill of Lading.

Claims for shortages and damages must be filed with the carrier by consignee. Permission to return goods must be received from the factory prior to shipping. Goods returned to the factory without an authorized Returned Goods Receipt number will not be accepted. All returned goods are subject to a restocking charge.

When ordering parts, you must specify the model and serial number of the heater. When ordering under warranty conditions, you must also specify the date of installation.

Purchased parts are subject only to replacement under the manufacturer's warranty. Debits for defective replacement parts will not be accepted and will only be replaced in kind per Raypak's standard warranties. Altering the agency ratings of the vessel also violates national, state, and local approval codes.

INSTALLATION

WARNING: Improper installation, adjustment, alteration, service or maintenance may damage the equipment, create a hazard resulting in asphyxiation, explosion or fire, and will void the warranty.

These instructions are intended only for use by qualified personnel, specifically trained and experienced in the installation of this type of heating equipment and related system components. Installation and service personnel may be required by some states to be licensed. If your state is such, be sure your contractor bears the appropriate license.

Persons not qualified shall not attempt to fix this equipment nor attempt repairs according to these instructions.

Installation Codes

Installations must follow these codes:

- Local, state, provincial, and national codes, laws, regulations and ordinances
- National Fuel Gas Code (NFGC), ANSI Z223.1-latest edition
- For Canada only: CAN/CGA B149.1 and .2 Installation Code and C.S.A. C22. 1 C.E.C. Part 1
- CSA verified compliance with California AB1953 and Vermont Legislative Act 193 requirements.

Equipment Base

The CHX should be mounted on a level, structurally sound surface. The CHX is approved for and can be installed on a combustible surface but must NEVER be installed on carpeting. Gas-fueled equipment installed in enclosed parking garages must be located at least 18 in. above the floor.

CAUTION: The cap should be located in an area where water leakage will not result in damage to the area adjacent to the heater or to the structure. when such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the CHX.

The CHX must be mounted on a rack for connection to the Hi Delta heaters. The following racks will allow

installation of the CHX either directly behind the Hi Delta heater OR above the Hi Delta heater. These racks are shown throughout this manual.

• 009528 - CHX Rack Kit for 402B - 902B Hi Delta
• 009529 - CHX Rack Kit for 992B - 2002B Hi Deltas

In addition to the racks noted above, an integral rack is available factory-mounted to the appropriate CHX. These are available using the following part numbers:

• 011640 - CHX/Rack Kit Short 402B/502B
• 011641 - CHX/Rack Kit Short 652B
• 011642 - CHX/Rack Kit Short 752B/902B
• 011643 - CHX/Rack Kit Short 992B
• 011644 - CHX/Rack Kit Short 1262B
• 011645 - CHX/Rack Kit Short 1532B
• 011646 - CHX/Rack Kit Short 1802B/2002B

Dimensional data for the CHX can be found on the submittal sheets, Cat. No. 1000.81.

Clearances

Heater Side	Min. Clearance from Combustible Surfaces	Recommended Service Clearance
Floor*	0"	0"
Rear	0"	0"
Right (Water Inlet)	0"	12"
Left (Water Outlet)	0"	12"
Top	0"	36"
Vent	1"	1"

*Do not install on carpeting.

Table B: Clearances - Indoor, Alcove and Outdoor Installations.

Raypak CHXs are design certified by ANSI/CSA for outdoor installation. Roof water drainage must be diverted away from heaters installed under overhangs.

WARNING: Do not install the CHX outdoors if freezing conditions are typical. The condensate will freeze and back up the flue system.

Combustion and Ventilation Air

This heater must be supplied with sufficient quantities of non-contaminated air to support proper combustion and equipment ventilation. All installations must comply with the requirements of the NFGC (U.S.) and B149 (Canada), and all local codes.

NOTE: The CHX does not require air for combustion. Consult the Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511) for combustion air requirements for the heater itself.

NOTE: In calculating free area, the required size of openings for combustion, ventilation, and dilution air shall be based on net free area of each opening. If the free area through a design of louver or grill is known, it shall be used in calculating the size opening required to provide the free area specified. For additional information, refer to the latest NFGC requirements.

CONNECTING THE CHX

NOTE: Connect the vent before connecting the water piping.

Install unions on water inlet and outlet of CHX for ease of maintenance. The CHX requires cleaning as often as once per year.

Typical Hi Delta connections to CHX are shown in Figures 1 through 8. Hi Temp RTV (GE 106 or equivalent) is required to seal the vents as shown in Figures 9 and 10.

NOTE: Assembly instructions for racks are included with rack kits.

NOTE: It is reccomended that the vent adapters be preassembled without RTV to ensure proper orientation and fit.

NOTE: Refer to the Heatfab Saf-T Vent CI Plus Installation and Maintenance Instructions (PI-CCINS 020607) for specific vent assembly instructions.

Connecting the CHX to the heater:

1. Apply a bead of high temp RTV within approximately 1/4 in. of the edge of the CHX Vent Inlet Adapter, then assemble it to the Heater Vent Outlet Adapter ensuring that the band clamp tabs are aligned (see Fig. 1). Attach and tighten the band clamp.

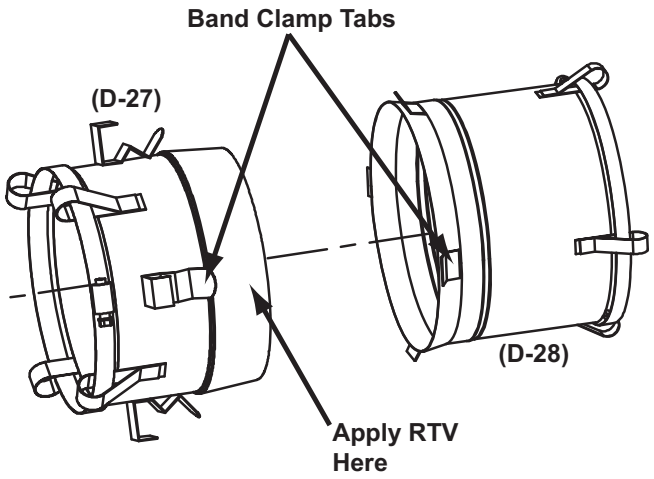


Fig. 1: Connect the CHX Vent Inlet Adapter to the Heater Vent Outlet Adapter

2. Apply a bead of high temp RTV within approximately 1/4 inch of the edge of the CHX Exhaust Inlet. Install the CHX/Heater Vent Adapter Assembly, created in step 1, onto the CHX Exhaust Inlet (vent adapter must overlap onto exhaust inlet/outlet by at least 1/2 in.) and secure by tightening the hose clamp provided. Refer to the bottom of Fig. 2.

3. Position the CHX so that the CHX/Heater Vent Adapter Assembly aligns with the Hi Delta Exhaust Outlet and install as described in step 2. See top of Fig. 2.

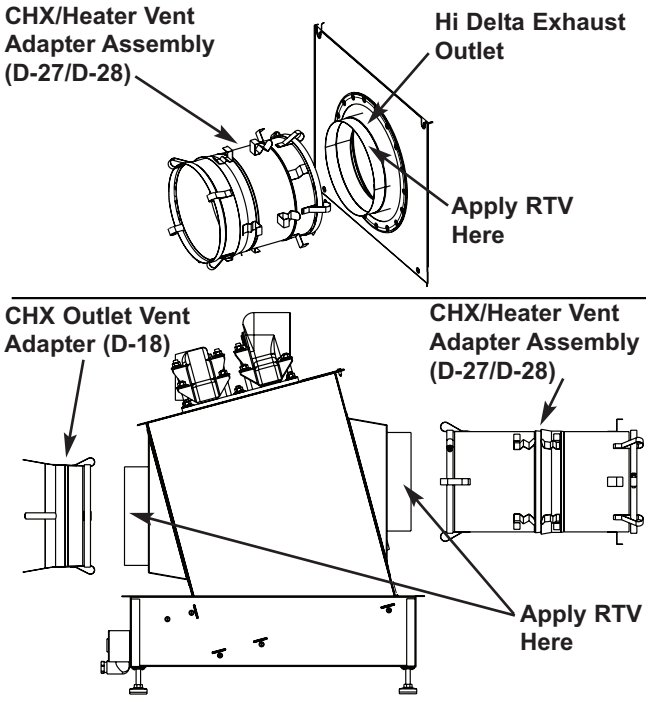


Fig. 2: Proper Orientation of Vent Adapters for Installation, Hi Delta Exhaust Outlet (Top) and CHX Inlet/Outlet (Bottom)

4. Install the CHX Outlet Vent Adapter (see Fig. 2) and then install venting and water piping according to your installation. See Fig. 3 through 10 for more information about various CHX configurations. Refer to the following sections for specific information about venting and water piping.

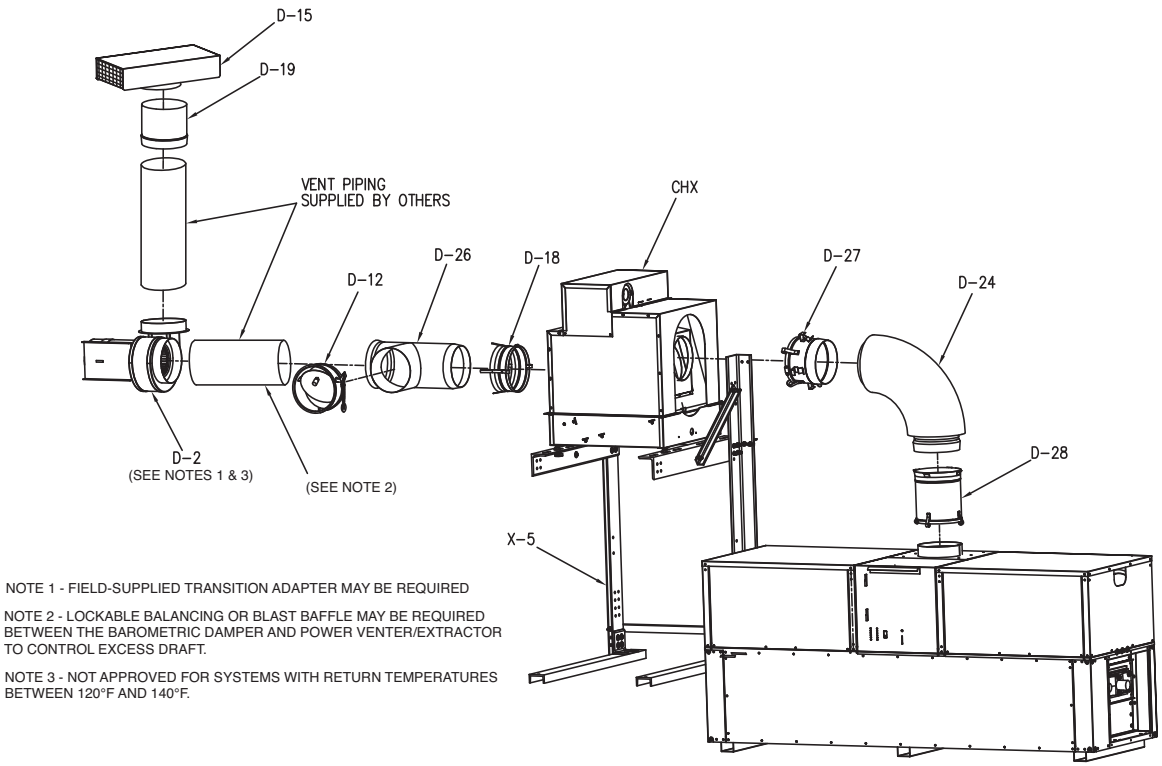


Fig. 3: Hi Delta with Top-Mounted CHX and Power Venter

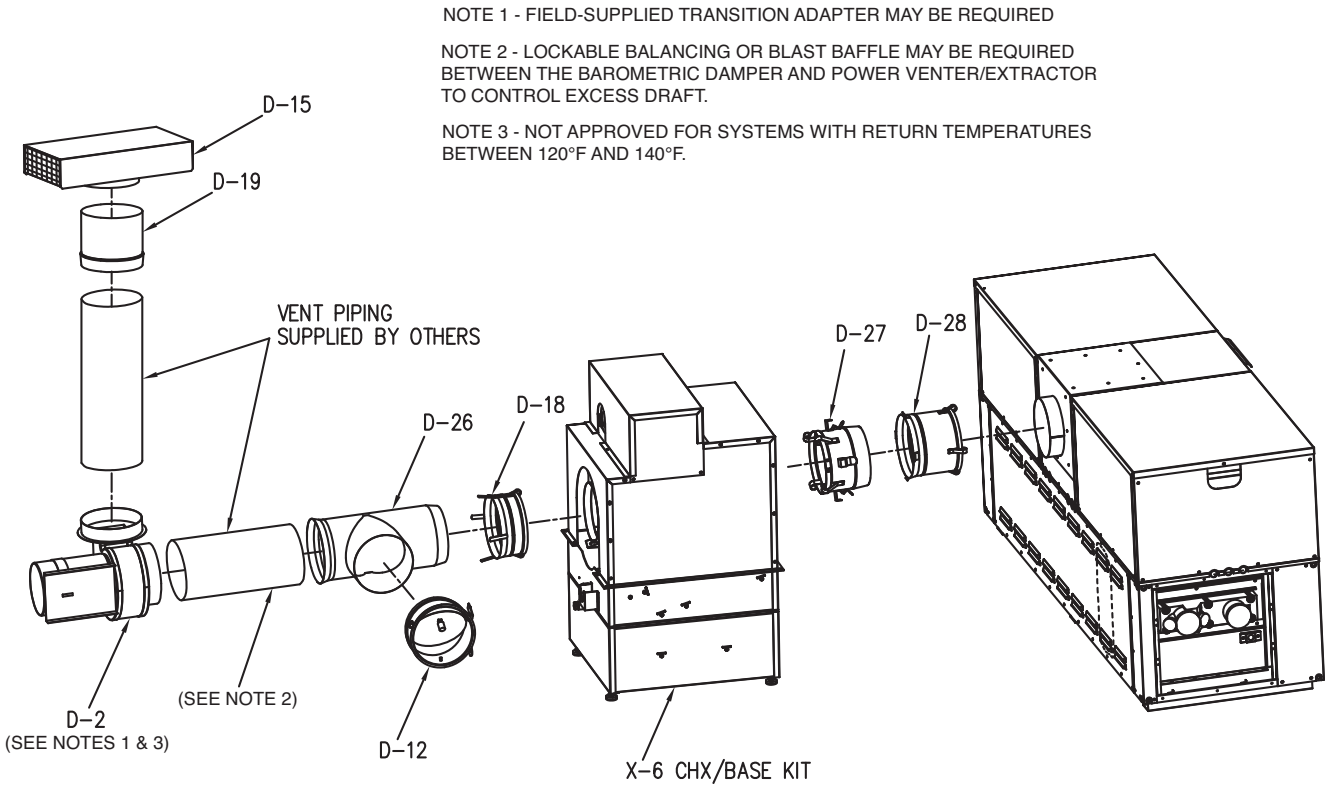


Fig. 4: Hi Delta with Rear-Mounted CHX and Power Venter

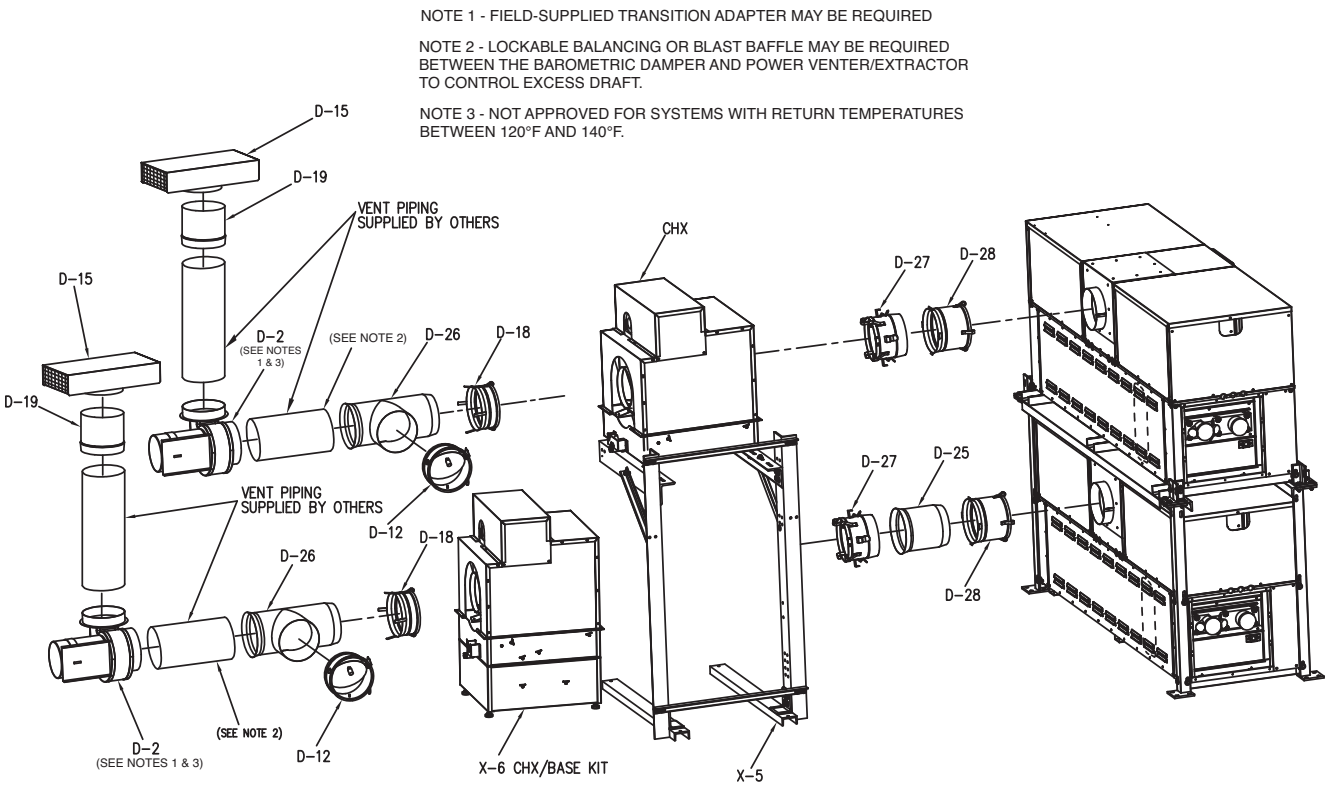


Fig. 5: Stacked Hi Deltas with Rear-Mounted CHXs and Power Venters

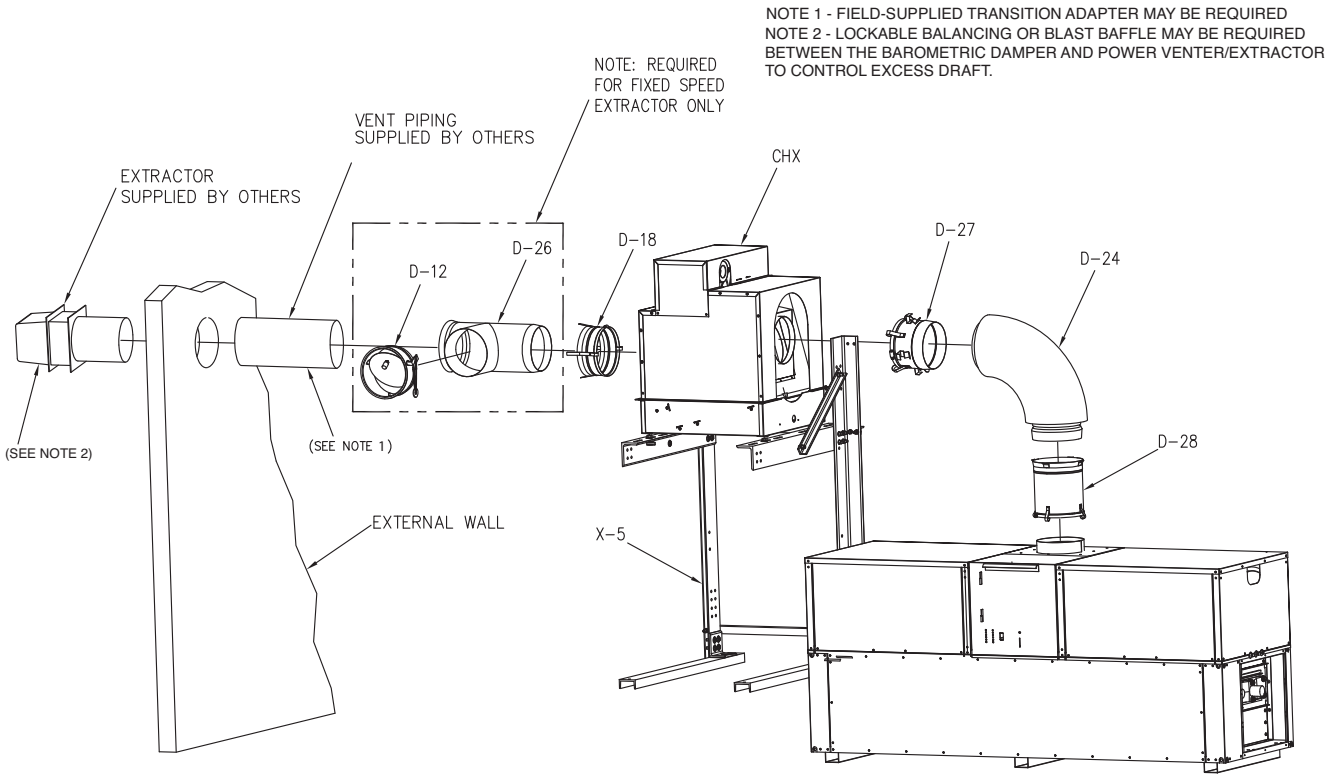


Fig. 6: Hi Delta with Top-Mounted CHX and Extractor

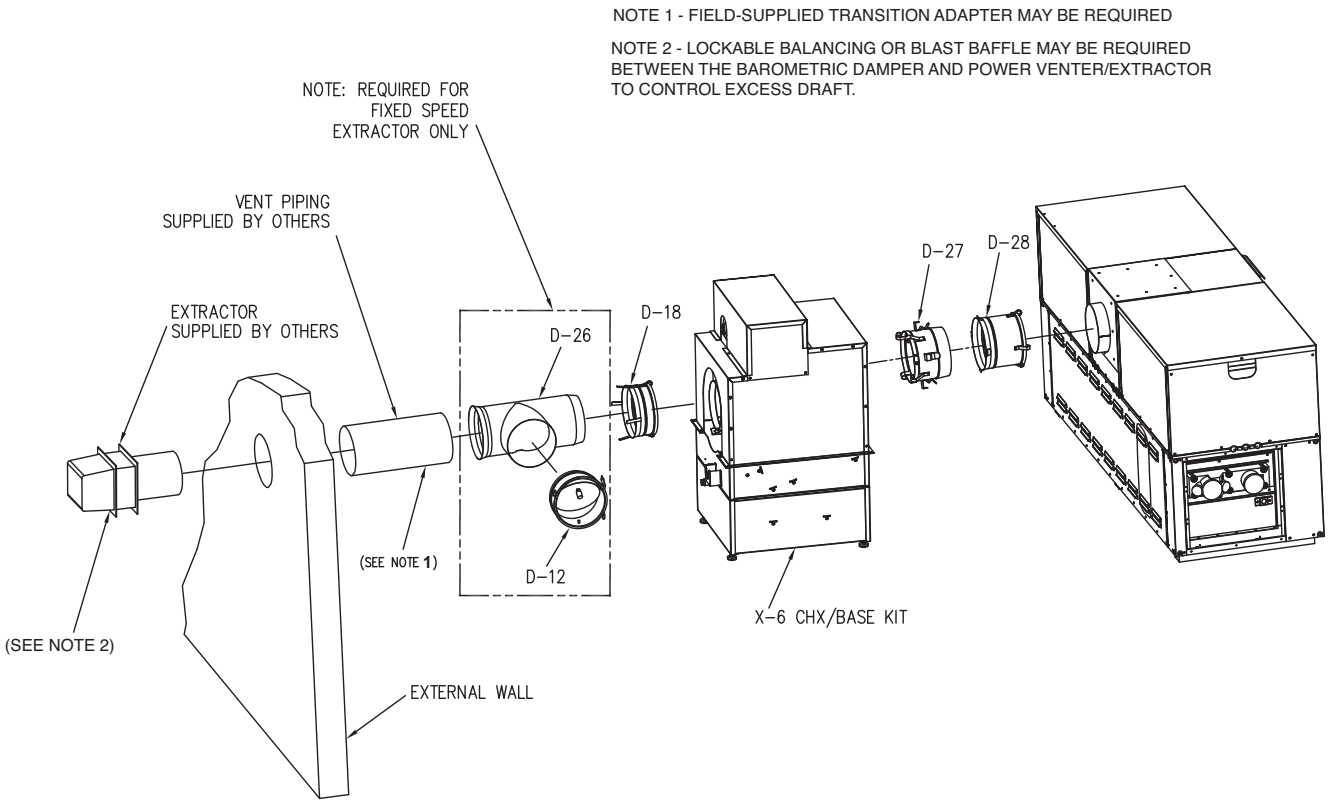


Fig. 7: Hi Delta with Rear-Mounted CHX and Extractor

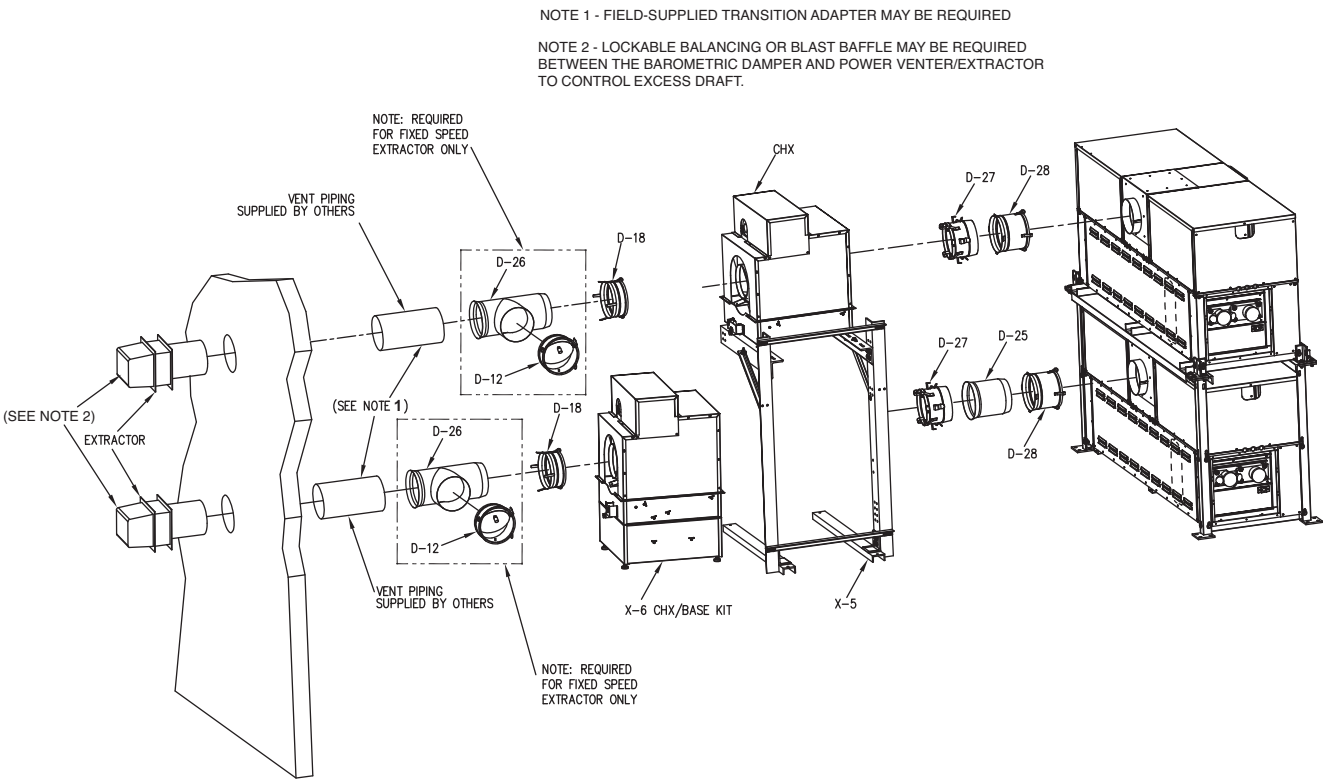
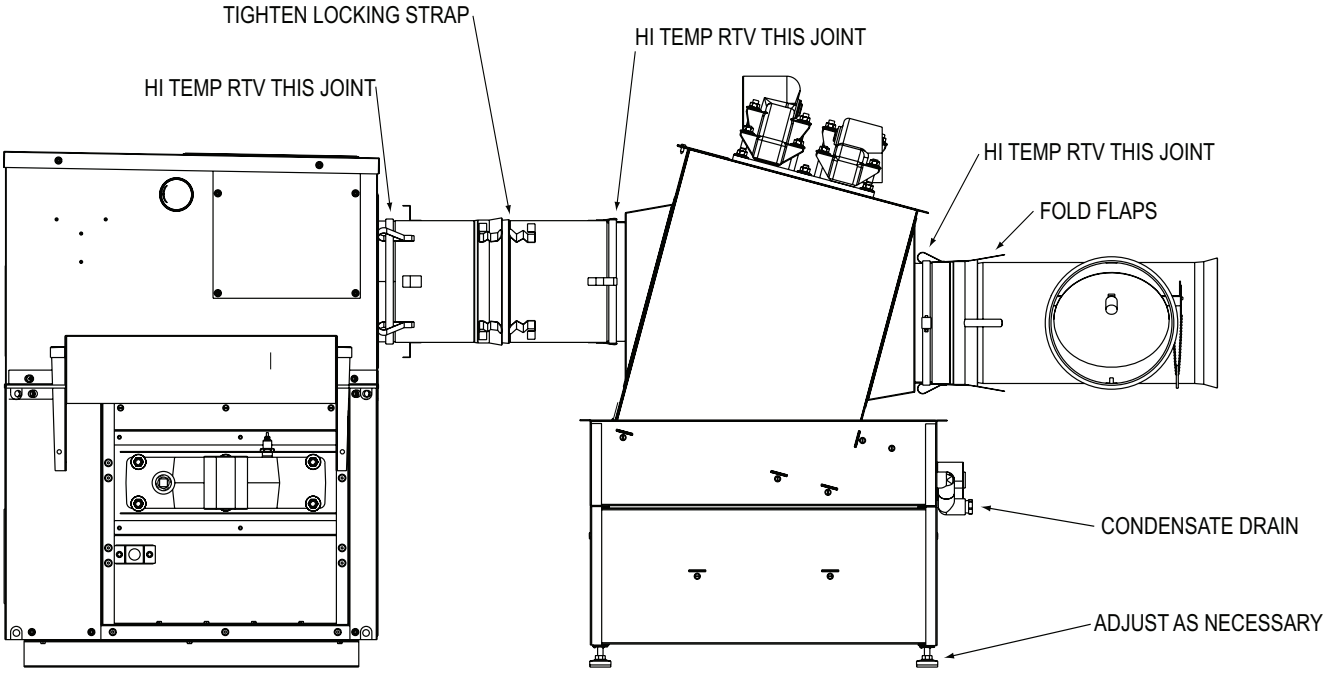


Fig. 8: Stacked Hi Deltas with Rear-Mounted CHXs and Extractors



NOTE: CHX flue in/out may be different for different models based on:
- Vertical location
- General appearance
- With or without added extensions

Fig. 9: Sealing Rear-Mounted CHX on the Hi Delta

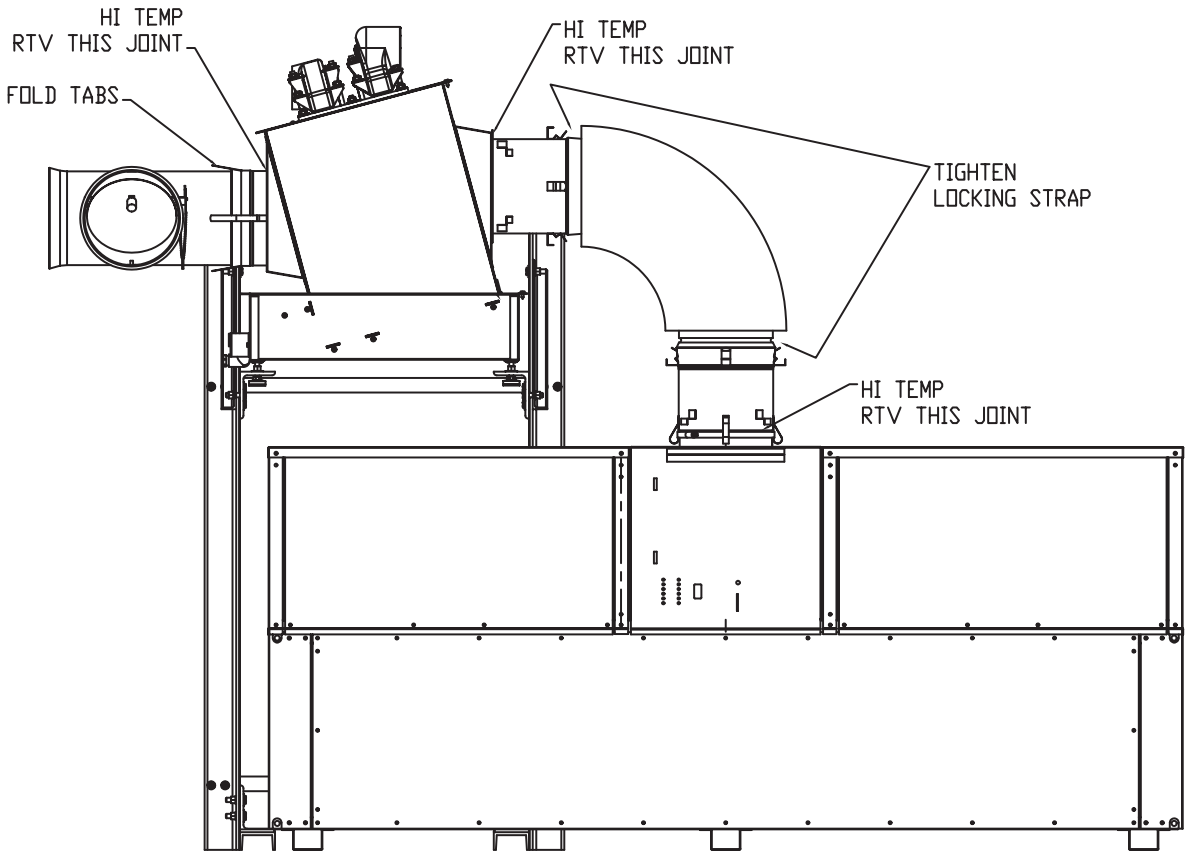


Fig. 10: Sealing Top-Mounted CHX on the Hi Delta

VENTING CONNECTIONS

CAUTION: Proper installation of flue venting is critical for the safe and efficient operation of the heater.

NOTE: For vent systems not shown in this section please contact your local authorized representative.

CAUTION: Stable vent pressure is critical to the safe and proper operation of the heater. A combination of barometric dampers, balancing / blast baffles, extractors, or draft inducers may be required to stabilize the vent pressure.

Appliance Categories

Appliances are divided into four categories based on the pressure produced in the exhaust and the likelihood of condensate production in the vent.

Category I: A heater which operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

Category II: A heater which operates with a non-positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

Category III: A heater which operates with a positive vent pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

Category IV: A heater which operates with a positive vent pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

NOTE: For additional information on appliance categorization, see appropriate ANSI Z21 Standard and the latest edition of the ANSI Z223.1, National Fuel Gas Code or in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of local building codes.

Max. Inlet Water Temp. to CHX	*Fixed-speed, Roof-mounted Barometric Damper*	*Fixed-speed, Inline Barometric Damper*	*Fixed-speed, Wall- or Ceiling-mounted Barometric Damper*	*Variable-speed, Roof-mounted, No Barometric Damper*
Up to 100°F	Category I PVC* or “B” Vent	Category IV PVC*	Category I PVC* or “B” Vent	Category IV PVC*
Up to 120°F	Category I CPVC* or “B” Vent	Category IV CPVC*	Category I CPVC* or “B” Vent	Category IV CPVC*
120°F to 140°F	Category IV CPVC*	**Not Recommended**	**Not Recommended**	Category IV CPVC*
Above 140°F Steady State	Category I “B” Vent	Category IV AL29-4C	Category I “B” Vent	Category IV AL29-4C

Note *: If PVC or CPVC vent is utilized, the optional vent temperature limit switch is required.

Table C: Vent Category Requirements

WARNING: Contact the manufacturer of the vent material if there is any question about the heater categorization and suitability of a vent material for application on a category III or IV vent system. Using improper venting materials can result in personal injury, death or property damage.

WARNING: When utilizing PVC or CPVC vent material, in conjunction with the CHX, a vent temperature limit switch must be field installed. See PVC/CPVC vent switch section for more information.

Support of Vent Stack

The weight of the vent stack or chimney must not rest on the heater vent connection. Support must be provided in compliance with applicable codes. The vent should also be supported to maintain proper clearances from combustible materials.

Use insulated vent pipe spacers where the vent passes through combustible floors, roofs, and walls.

Vent Terminal Location

NOTE: During winter months check the vent cap and make sure no blockage occurs from build-up of snow. Condensate can freeze on the vent cap. Frozen condensate on the vent cap can result in a blocked flue condition.

Give special attention to the location of the vent termination to avoid the possibility of property damage or personal injury.

1. Gases may form a white vapor plume in winter. The plume could obstruct a window view if the termination is installed in close proximity to windows.

2. Prevailing winds could cause freezing of condensate and water/ice build-up on building, plants or roof.

3. The bottom of the vent terminal and the air intake shall be located at least 12 in. above grade, including normal snow line.

4. Uninsulated single-wall metal vent pipe shall not be used outdoors in cold climates for venting gas utilization equipment.

5. Through-the-wall vents for Category II and IV heaters and non-categorized condensing heaters shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment. Where local experience indicates that condensate is a problem with Category I and III heaters, this provision shall also apply.

6. Locate and guard vent termination to prevent accidental contact by people and pets.

7. DO NOT terminate vent in window well, stairwell, alcove, courtyard or other recessed area, unless previously approved by local authority.

8. DO NOT terminate above any door, window, or gravity air intake. Condensate can freeze causing ice formations.

9. Locate or guard vent to prevent condensate from damaging exterior finishes. Use a rust-resistant

sheet metal backing plate against brick or masonry surfaces.

10. DO NOT extend exposed vent pipe outside of building. Condensate could freeze and block vent pipe.

11. Multiple direct vent caps, when installed in the same horizontal plane, must have a 4 ft minimum clearance from the side of one vent cap to the side of the adjacent vent cap(s).

U.S. Installations

Refer to latest edition of the National Fuel Gas Code. Vent termination requirements are as follows:

1. Vent must terminate at least 4 ft below, 4 ft horizontally, or 1 ft above any door, window or gravity air inlet to the building.

2. The vent must not be less than 7 ft above grade when located adjacent to public walkways.

3. Terminate vent at least 3 ft above any forced air inlet located within 10 ft.

4. Vent must terminate at least 4 ft horizontally, and in no case above or below unless 4 ft horizontal distance is maintained, from electric meters, gas meters, regulators, and relief equipment.

5. Terminate vent at least 6 ft away from adjacent walls.

6. DO NOT terminate vent closer than 5 ft below roof overhang.

Installations in Canada

Refer to the latest edition of CAN/CGA-B149.1 and B149.2.

A vent shall not terminate:

1. Directly above a paved sidewalk or driveway which is located between two single family dwellings and serves both dwellings.

2. Less than 7 ft (2.13m) above a paved sidewalk or paved driveway located on public property.

3. Within 6 ft (1.8m) of a mechanical air supply inlet to any building.

4. Above a meter/regulator assembly within 3 ft (900mm) horizontally of the vertical center-line of the regulator.

5. Within 6 ft (1.8m) of any gas service regulator vent outlet.

6. Less than 1 ft (300mm) above grade level.

7. Within 3 ft (1m) of a window or door which can be opened in any building, any non-mechanical air supply inlet to any building or to the combustion air inlet of any other appliance.

8. Underneath a verandah, porch or deck, unless:

   - The verandah, porch or deck is fully open on a minimum of two sides beneath the floor, and

   - The distance between the top of the vent termination and the underside of the verandah, porch or deck is greater than 1 ft (30cm).

Venting Installation Tips

Support piping:

- Horizontal runs- at least every 5 ft.
- Vertical runs - use braces under or near elbows.

WARNING: Examine the venting system at least once a year. Check all joints and vent pipe connections for tightness, corrosion or deterioration.

Venting Configurations

The following is a detailed explanation of each venting system WITH CHX, its installation requirements, and the components used.

For heaters connected to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the latest edition of National Fuel Gas Code, or in Canada, the latest edition of CAN/CGA-B149.1 and .2 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of local building codes.

WARNING: Do not install the CHX outdoors if freezing conditions are typical. The condensate will freeze and back up the flue system.

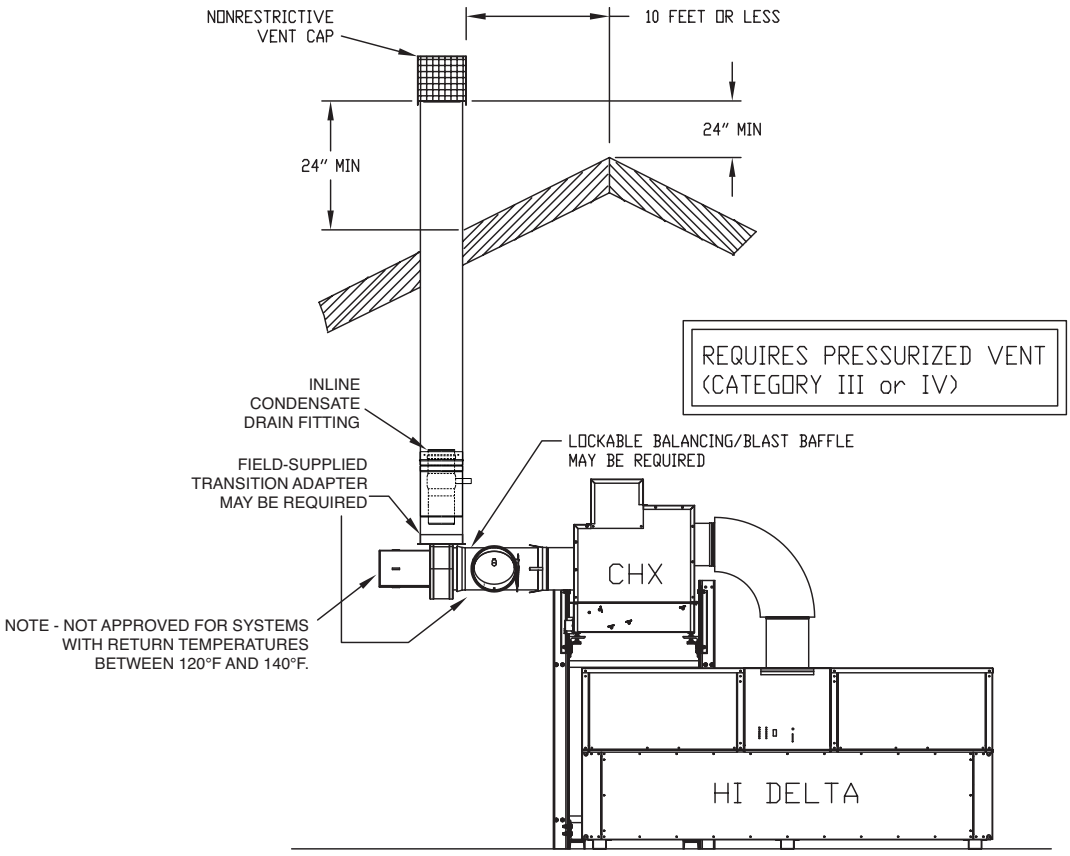


Fig. 11: Vertical Venting with Top-Mounted CHX

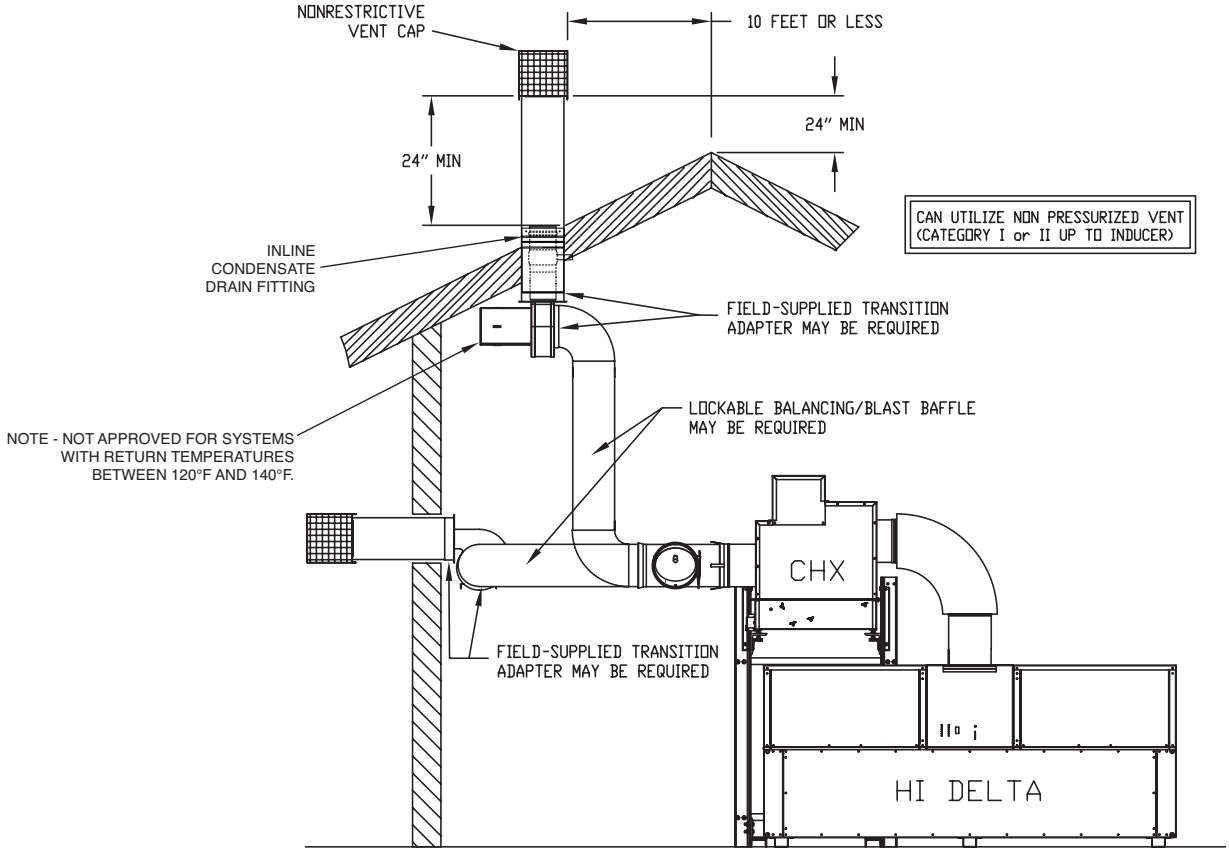


Fig. 12: Top-Mounted CHX with Fixed-Speed Draft Inducer

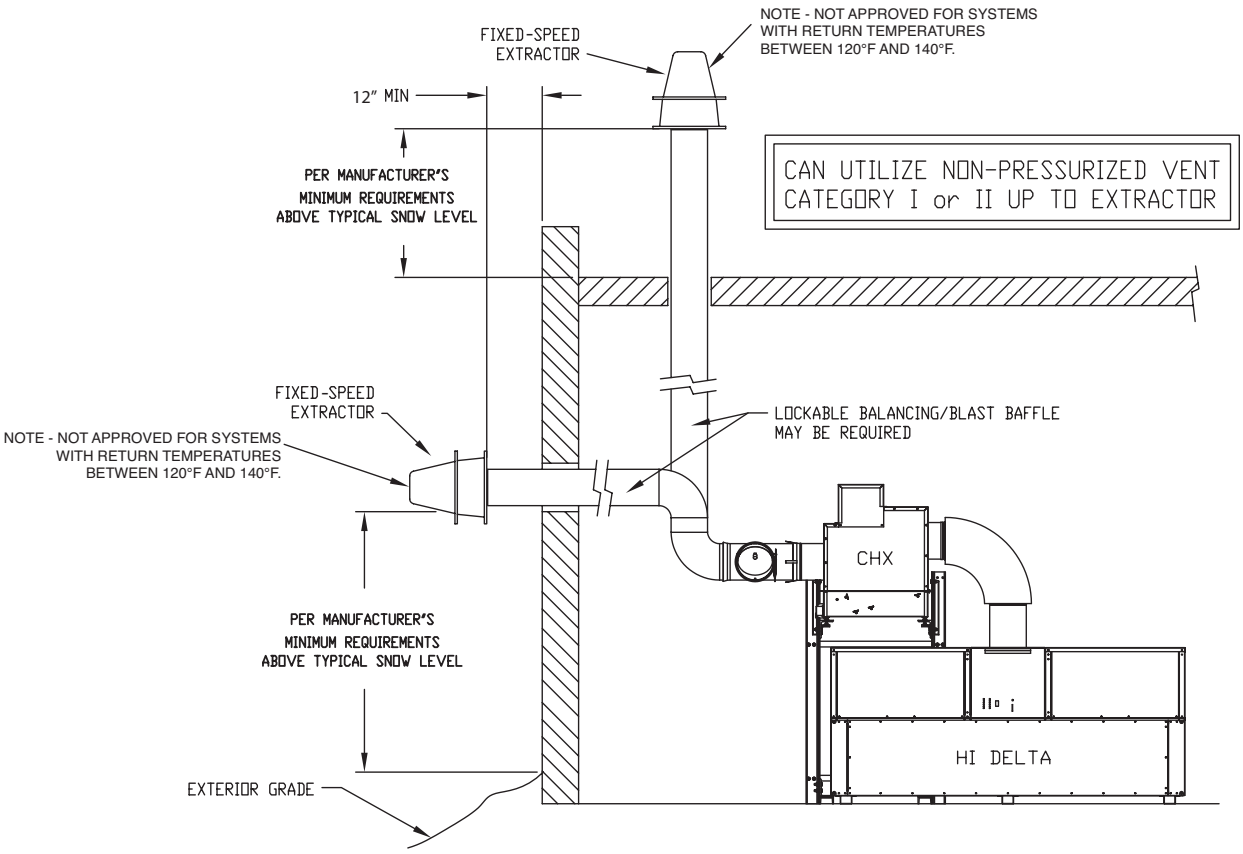


Fig. 13: Top-Mounted CHX with Fixed-Speed Extractor

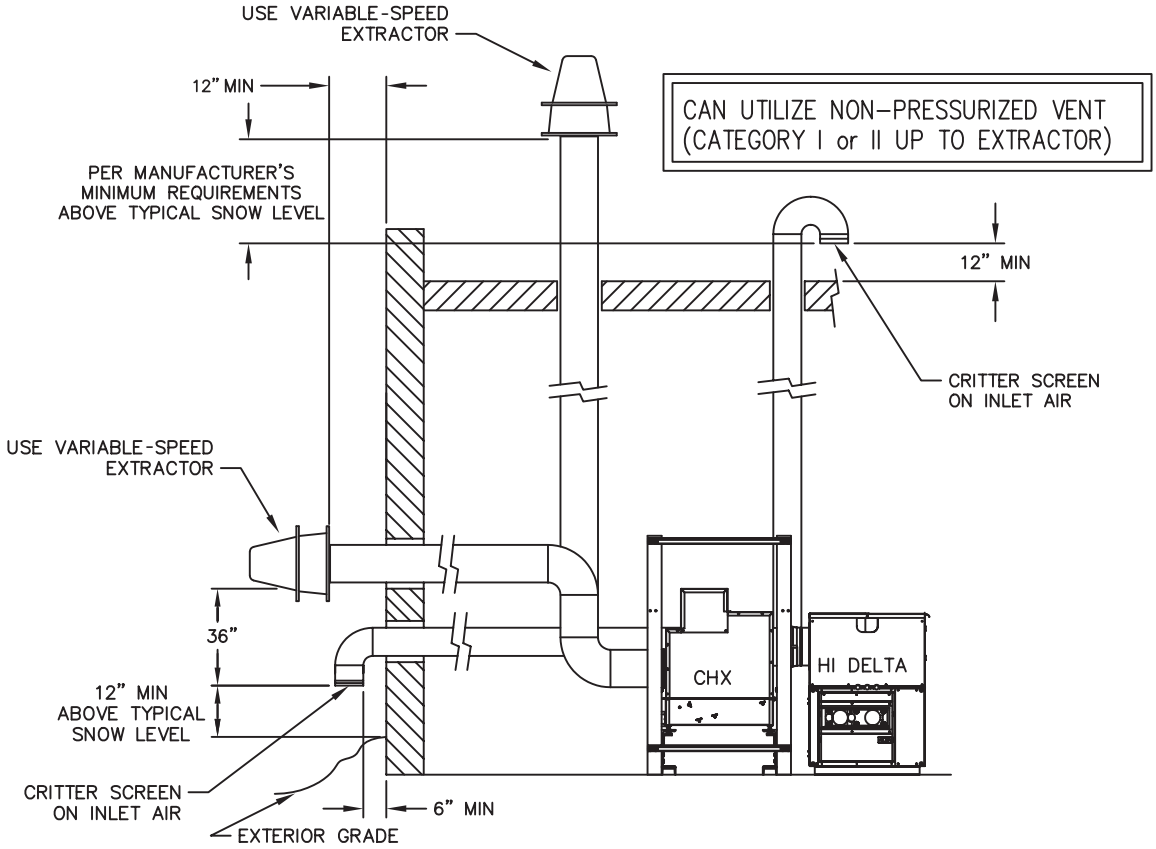


Fig. 14: Rear-Mounted CHX with Variable-Speed Extractor (Direct Vent)

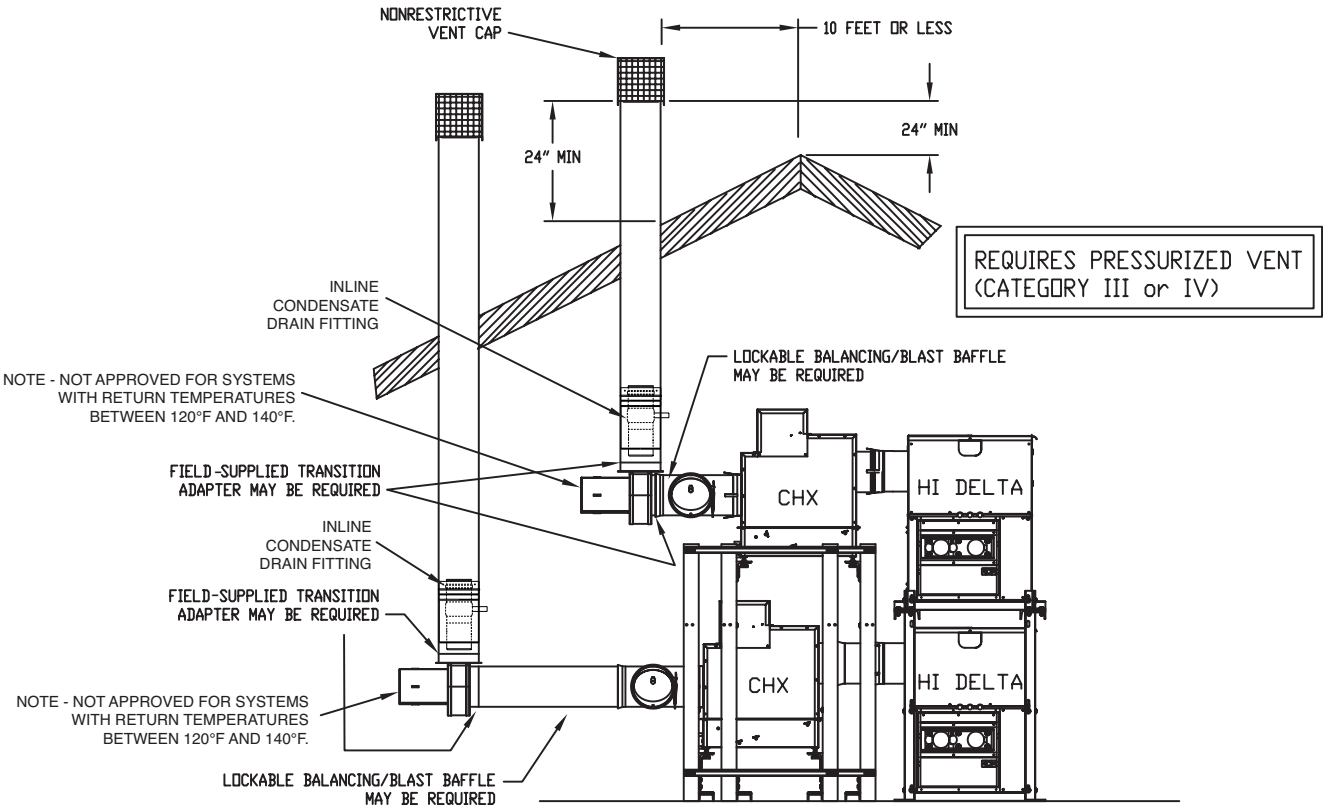


Fig. 15: Stacked CHXs with Fixed-Speed Draft Inducers

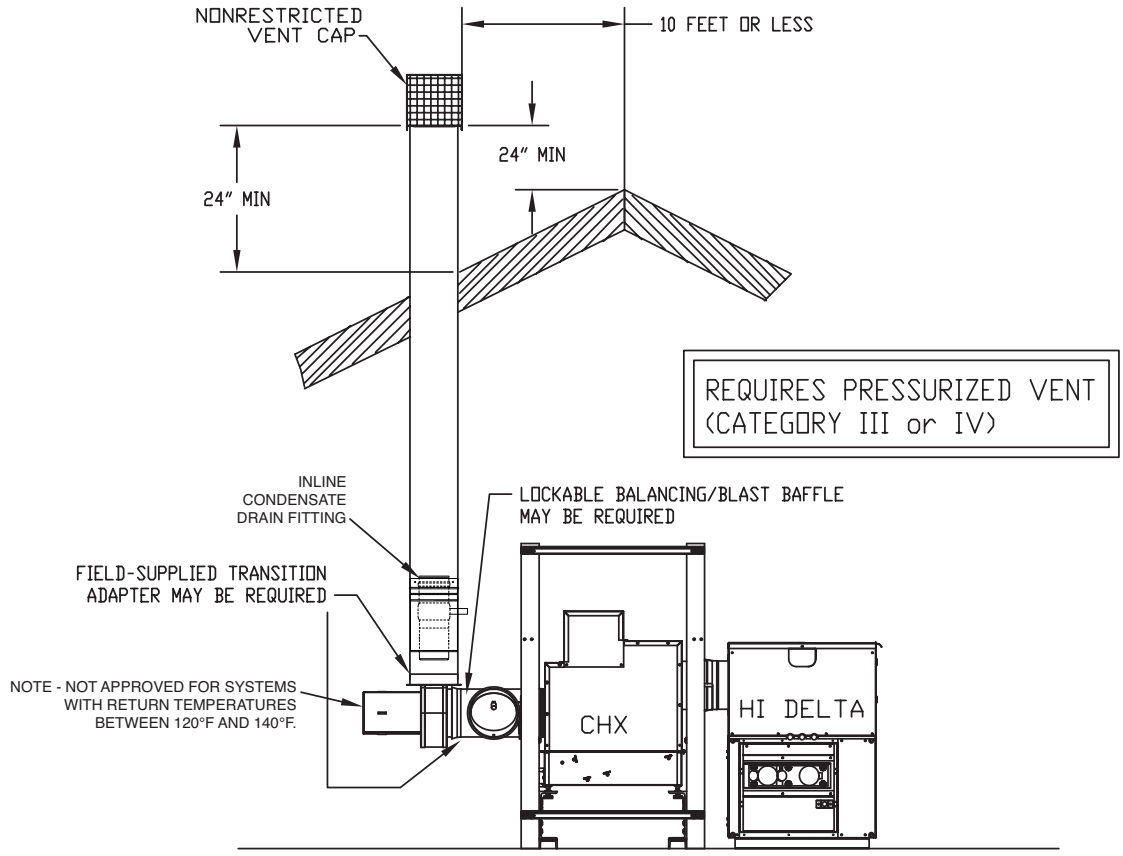


Fig. 16: Rear-Mounted CHX with Fixed-Speed Draft Inducer

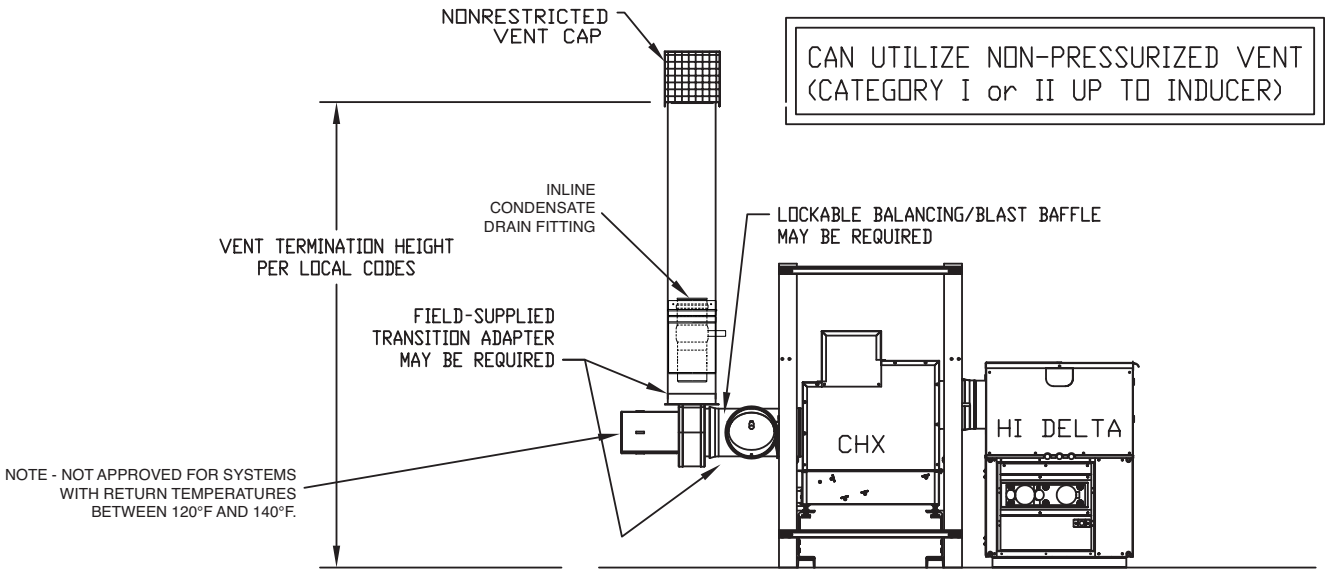


Fig. 17: Outdoor Rear-Mounted CHX with Fixed-Speed Draft Inducer

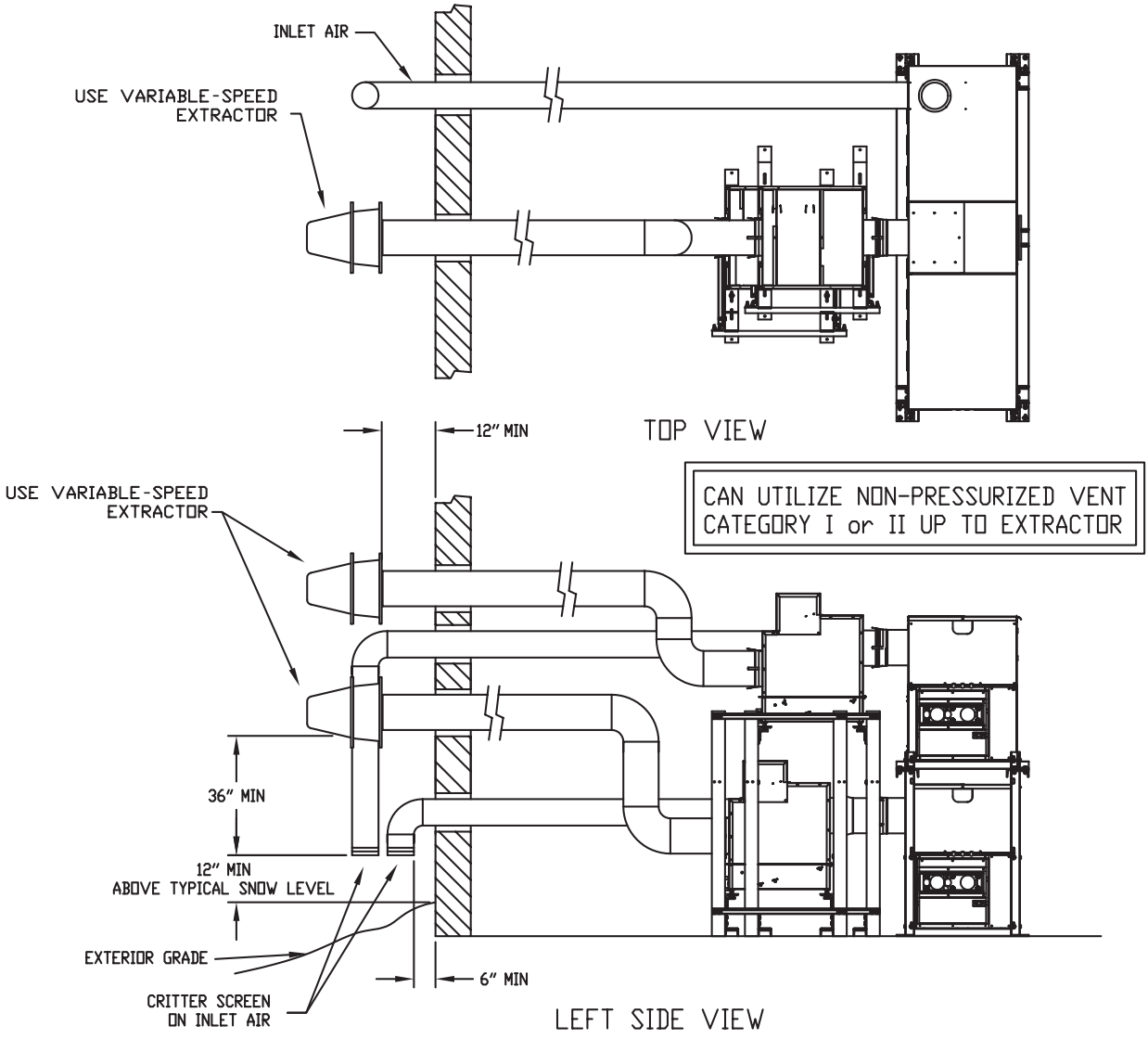


Fig. 18: Stacked CHXs with Variable-Speed Extractors

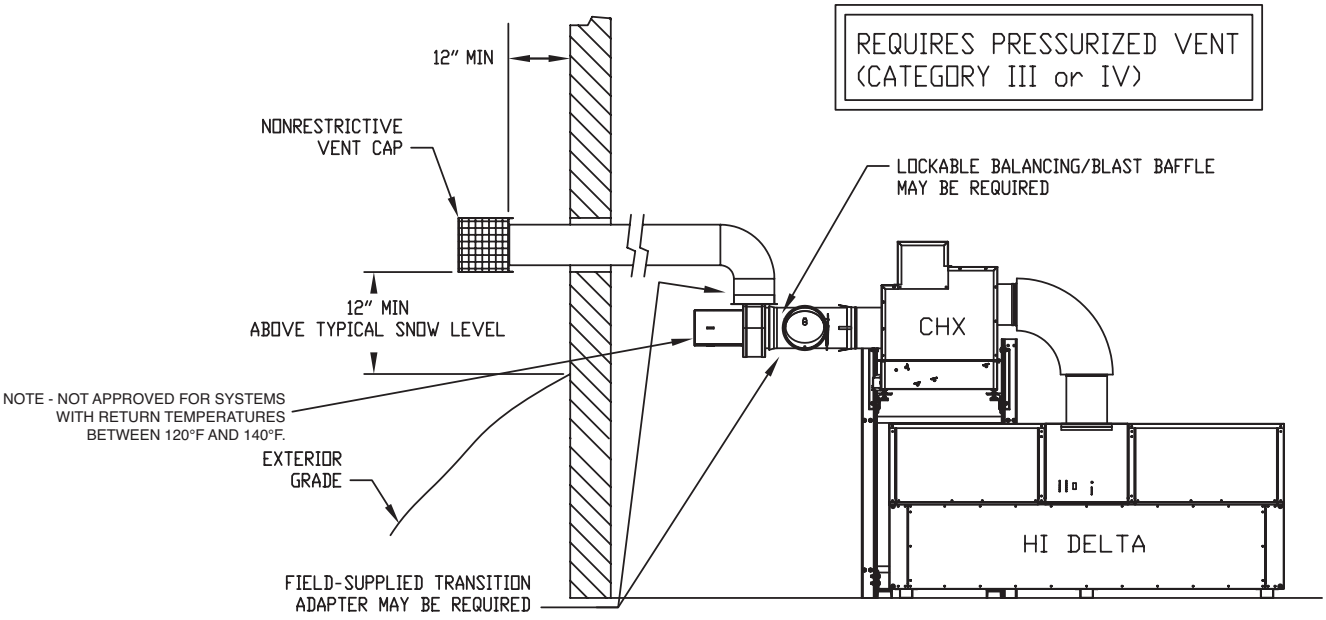


Fig. 19: Top-Mounted CHX with Fixed-Speed Draft Inducer

WARNING: All condensation should be disposed of according to local, county, state, and federal laws. Refer to NFGC, for additional information.

The CHX can generate up to 1 (one) gallon per hour (GPH) of condensate for every 100,000 BTUH input. For example, the maximum condensation rate for the Hi Delta 502 is 5 GPH and the Hi Delta 2002 is 20 GPH. On sizes 500-1000, the condensate drain connection is 1/2 NPT. On size 1500, the condensate drain connection is 3/4 NPT.

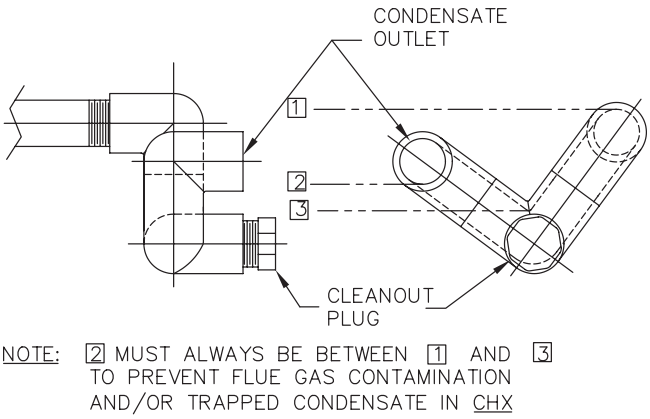


Fig. 20: Condensate Trap Alignment

CONTROLS

WARNING: Installation, adjustment and service of heater controls including timing of various operating functions must be performed by a qualified installer or service agency. Failure to do so may result in control damage, heater malfunction, property damage, personal injury, or death.

WARNING: Turn off the power to the heater before installation, adjustment or service. Failure to do so may result in heater malfunction, property damage, personal injury, or death.

CAUTION: Risk of electric shock. More than one disconnect switch may be required to de-energize the equipment before servicing.

CAUTION: The heater requires forced water circulation when the burners are operating and the pump must be interlocked with the heater. See water connections section for minimum water maximum flow rates and pump selection.

NOTE: Pump should come on when power is first applied to the heater.

WARNING: Only qualified persons shall attempt to repair the heater. Improper adjustment, service or maintenance may damage the equipment, create a hazard resulting in asphyxiation, explosion, fire, electric shock, personal injury or property damage, and will void the warranty.

Optional CHX Flow Switch

This dual-purpose control shuts off heater in case of pump failure or low water condition. Mounted and wired in series with the heater flow switch. Check with manufacturer for proper paddle size. Utilize correct paddle size for proper operation.

NOTE: Flow switch will not operate if flow is less than 20 GPM.

PVC/CPVC Vent Switch

This optional manual reset temperature switch should be mounted directly to the CHX flue discharge adapter if the CHX is vented using PVC or CPVC material. It shuts off the heater in case the flue temperature exceeds the rating of the PVC/CPVC vent material. It is wired in series with the heater safety circuit. Check with Manufacturer about correct temperature setting for proper operation.

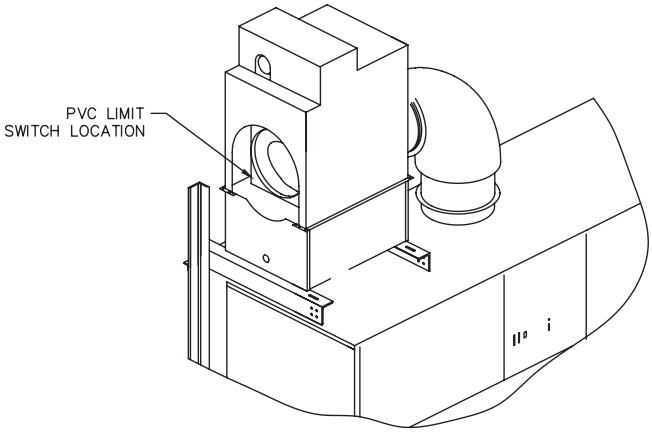


Fig. 21: PVC/CPVC Vent Limit Location

WATER CONNECTIONS

The heater and CHX should be located so that any water leaks will not cause damage to the adjacent area or structures. All units should be plumbed in accordance with the appropriate piping diagram from this section, or per a suitable engineered piping arrangement.

The CHX has 3 fluid connections: inlet water, outlet water, and a condensate drain (see Fig. 20).

CAUTION: The CHX requires forced water circulation when the Hi Delta burner is operating. See Table D for minimum and maximum flow rates. The pump must be interlocked with the heater to prevent its operation without water circulation. Consult the Hi Delta Installation and Operation Instructions for proper wiring.

FLOW RATE REQUIREMENT															
		(10ºF) ΔT		(20ºF) ΔT		(30ºF) ΔT		(40ºF) ΔT		Min Flow			Max Flow		
Hi-Delta Model	CHX Model	GPM	ΔP (ft wc)	GPM	ΔP (ft wc)	GPM	ΔP (ft wc)	GPM	ΔP (ft wc)	GPM	ΔT	ΔP (ft wc)	GPM	ΔT	ΔP (ft wc)
402B	500-6	78	9.9	39	2.6	26	1.2	N/A	N/A	20	39	0.7	90	9	13.0
502B	500-6	N/A	N/A	49	4.2	33	2.4	25	1.1	25	40	1.1	90	11	13.5
652B	500-8	N/A	N/A	64	7.1	42	3.3	32	1.9	32	40	1.9	90	14	13.9
752B	750-8	N/A	N/A	74	10.1	49	4.7	37	2.7	37	40	2.7	90	16	14.8
902B	750-8	N/A	N/A	88	14.6	59	6.7	44	3.9	44	40	3.9	90	20	15.2
992B	1000-10	N/A	N/A	97	12.4	65	5.7	49	3.3	49	40	3.3	132	15	22.3
1262B	1000-12	N/A	N/A	123	21.1	82	9.7	62	5.6	62	40	5.6	132	19	24.1
1532B	1500-12	N/A	N/A	N/A	N/A	100	15.7	75	9.1	75	40	9.1	132	23	26.8
1802B	1500-14	N/A	N/A	N/A	N/A	118	22.8	88	13.1	88	40	13.1	132	27	28.5
2002B	1500-14	N/A	N/A	N/A	N/A	131	28.7	98	16.6	98	40	16.6	132	30	29.3

Notes:
1. ΔP does not include typical piping to/from the tank or primary piping, or bypass piping. The system pressure drop is the sum of the listed ΔP and that of the connected piping. Pumps must be sized accordingly.
2. GPM flow rates are limited by maximum acceptable velocity through heat exchanger tubes. These may be increased 10% for closed heating systems; pressure drop will increase by 21%.

Table D: Heater Rate of Flow and Pressure Drop

Relief Valve Piping

WARNING: Pressure relief valve discharge piping must be piped near the floor close to a floor drain to eliminate the potential of severe burns. Do not pipe to any area where freezing could occur. Refer to local codes.

Hydrostatic Test

Unlike many other types of heaters, Raypak heaters do not require hydrostatic testing prior to being placed in operation. The heat exchanger has already been factory tested and is rated for 160 psi operating pressure. However, Raypak does recommend hydrostatically testing the piping connections to the heater and the rest of the system prior to operation. This is particularly true for hydronic systems using expensive glycol-based antifreeze. Raypak recommends conducting the hydrostatic test before connecting gas piping or electrical supply.

Leaks must be repaired at once to prevent damage to the heater. NEVER use petroleum-based stop-leak compounds.

1. Connect fill water supply. Fill heater with water (be sure bleed valve is open). When water flows from bleed valve, shut off water. Close bleed valve. Carefully fill the rest of the system, being sure to eliminate any entrapped air by using high point vents. Close feed valve. TEST at standard operating pressure for at least 24 hours.

2. Make sure constant gauge pressure has been maintained throughout test.

3. Check for leaks. Repair if found.

Low-Temperature System

Refer to application-specific piping details in this section. The Hi Delta requires a minimum inlet temperature of 105°F. The CHX has no minimum inlet temperature requirement. However, a bypass is required to blend outlet water with the inlet to reduce the likelihood of condensation on the Hi Delta heat exchanger.

Hydronic Heating

Pump Selection

In order to ensure proper performance of your system, you must install a properly-sized pump. Raypak recommends using a 20°F ΔT as design ΔT. (ΔT is the temperature difference between the inlet and outlet water when the boiler is firing at full rate). If a ΔT larger than 20°F is necessary, the bypass must be installed and adjusted to ensure proper hydraulics through the heater while still allowing minimum flow to satisfy the safety flow switch. See Table D for flow rate requirements.

Pressure Drop In Head Feedwater Regulator

Raypak recommends that a feed-water regulator be installed and set at 12 psi minimum pressure at the highest point of system. Install a check valve or back flow device upstream of the regulator, with a manual shut-off valve as required by local codes.

Piping

All high points should be vented. Purge valves and a bypass valve should be installed. A boiler installed above radiation level must be provided with a low water cut-off device. When used in connection with a refrigeration system, the boiler must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler.

The piping system of a hot water heating boiler connected to heating coils located in air handling units where they may be exposed to circulating refrigerated air, must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle. It is highly recommended that the piping be insulated.

Air-Separation/Expansion Tank

All boilers should be equipped with a properly-sized expansion tank as shown in the piping section on the following pages.

Three-Way Valves

Valves designed to blend water temperatures or reduce water circulation through the heater should not be used. Raypak boilers are high-recovery low-mass units not subject to thermal shock. Raypak offers a full line of electric sequencers that produce direct reset of boiler water temperature. Refer to the Controls section

NOTE: The following drawings are only mechanical concept drawings; they are not intended to describe a complete system, nor any particular system.

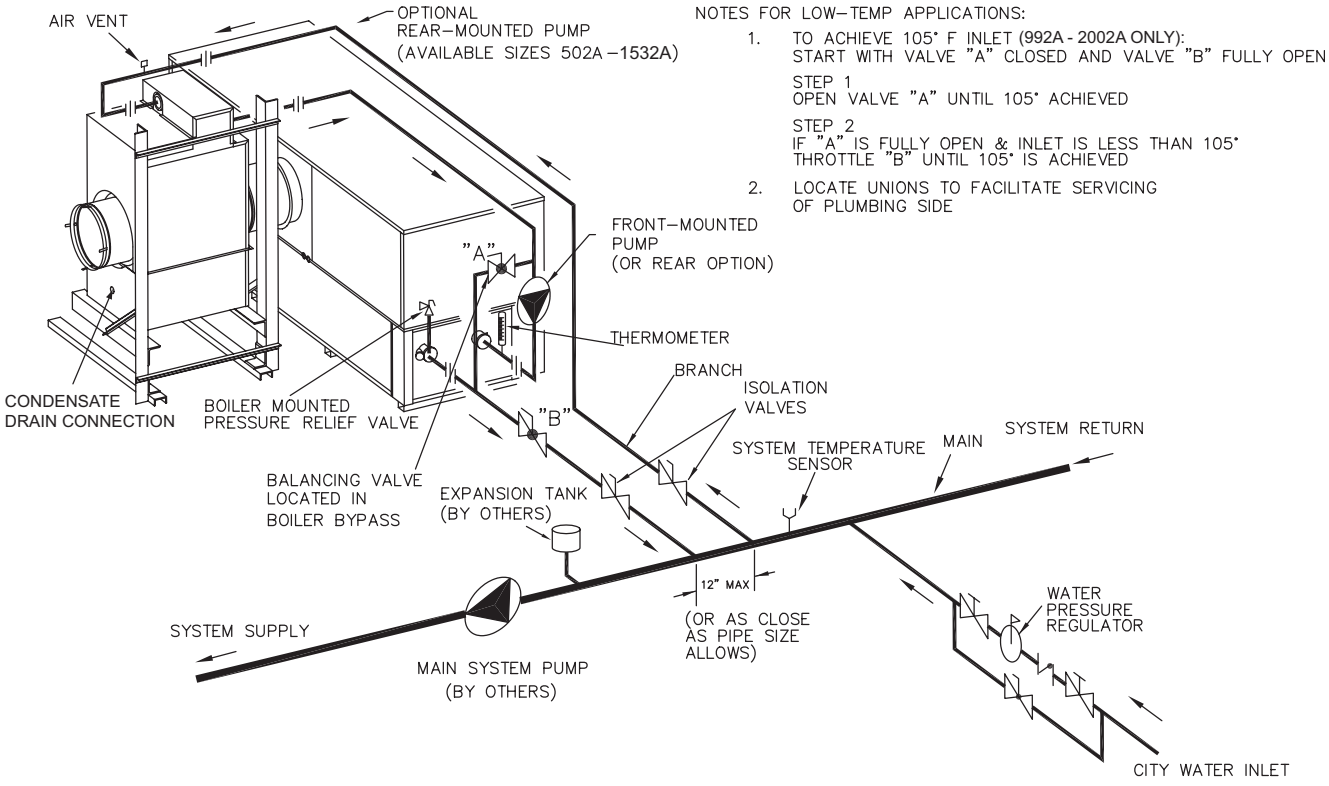


Fig. 22: Single Heater - Primary/Secondary Piping with Top-Mounted CHX

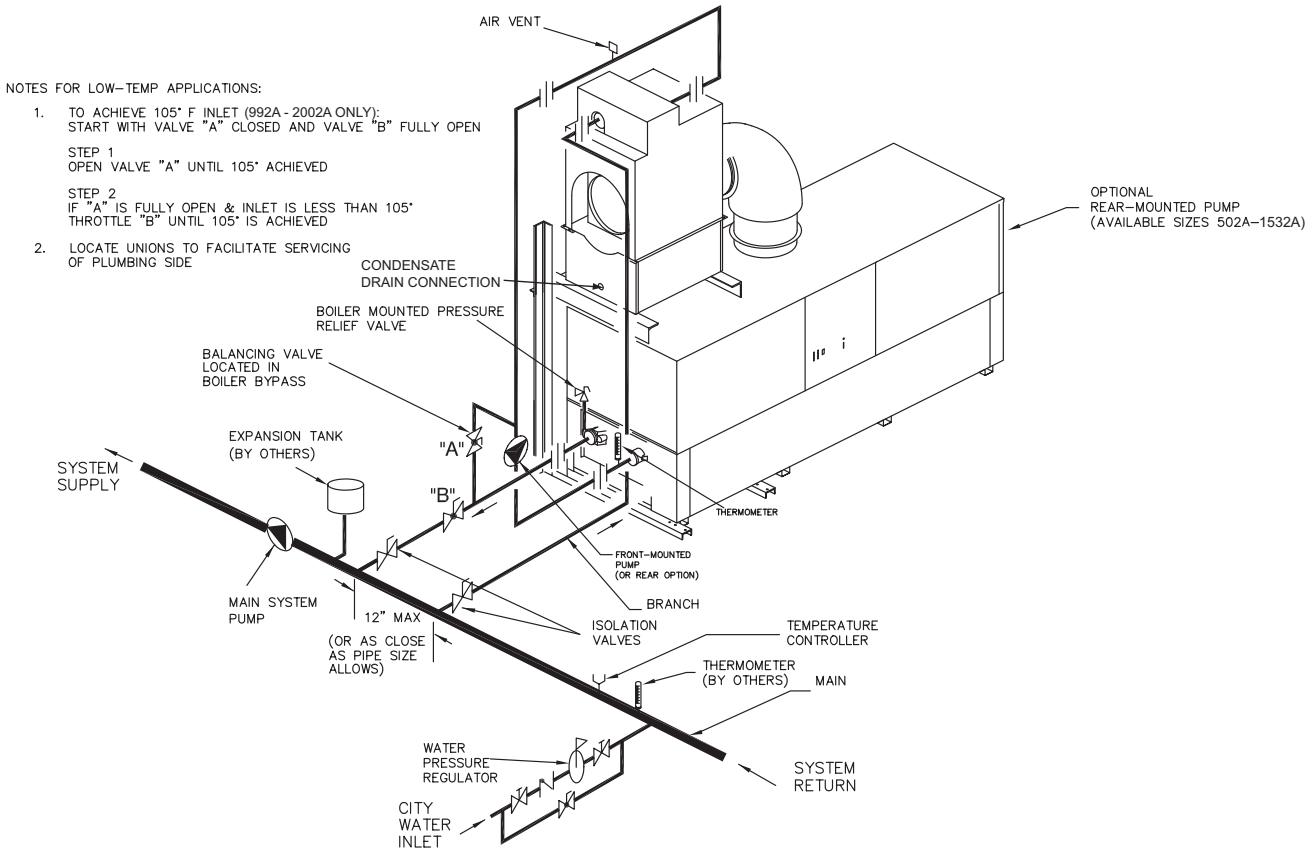


Fig. 23: Single Heater - Primary/Secondary Piping with Rear-Mounted CHX

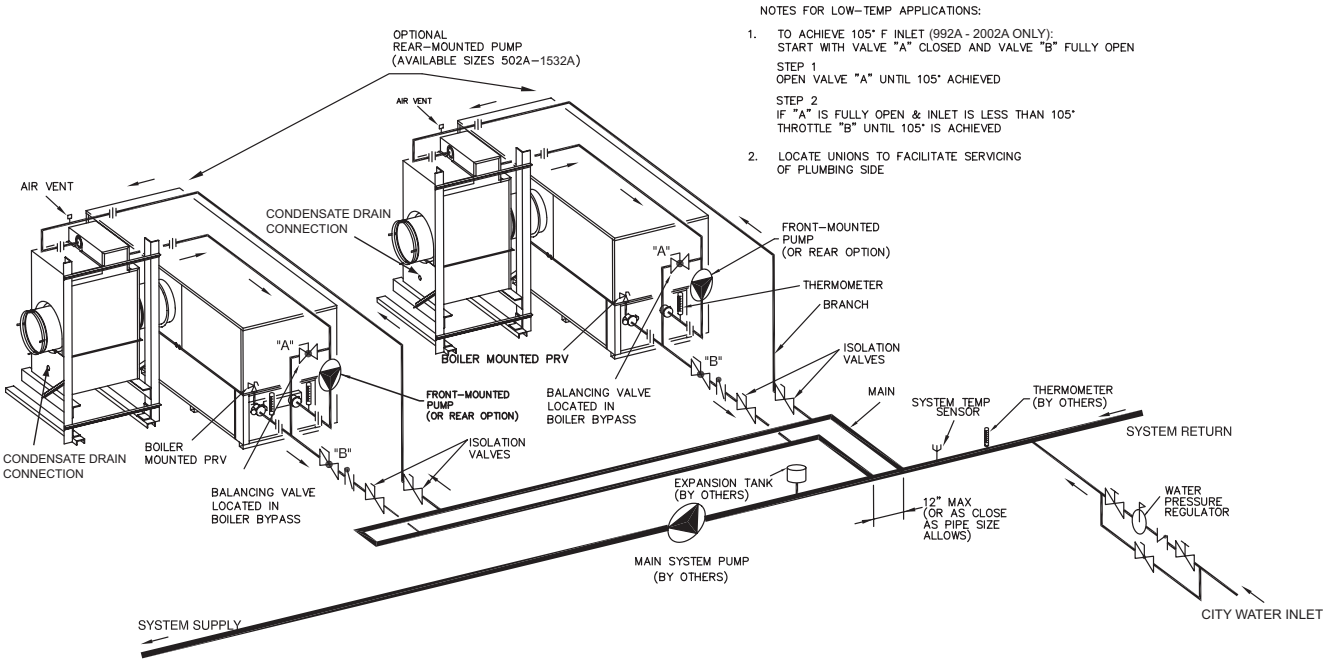


Fig. 24: Dual Heaters - Primary/Secondary Piping with Reverse Return Piping with Rear-Mounted CHXs

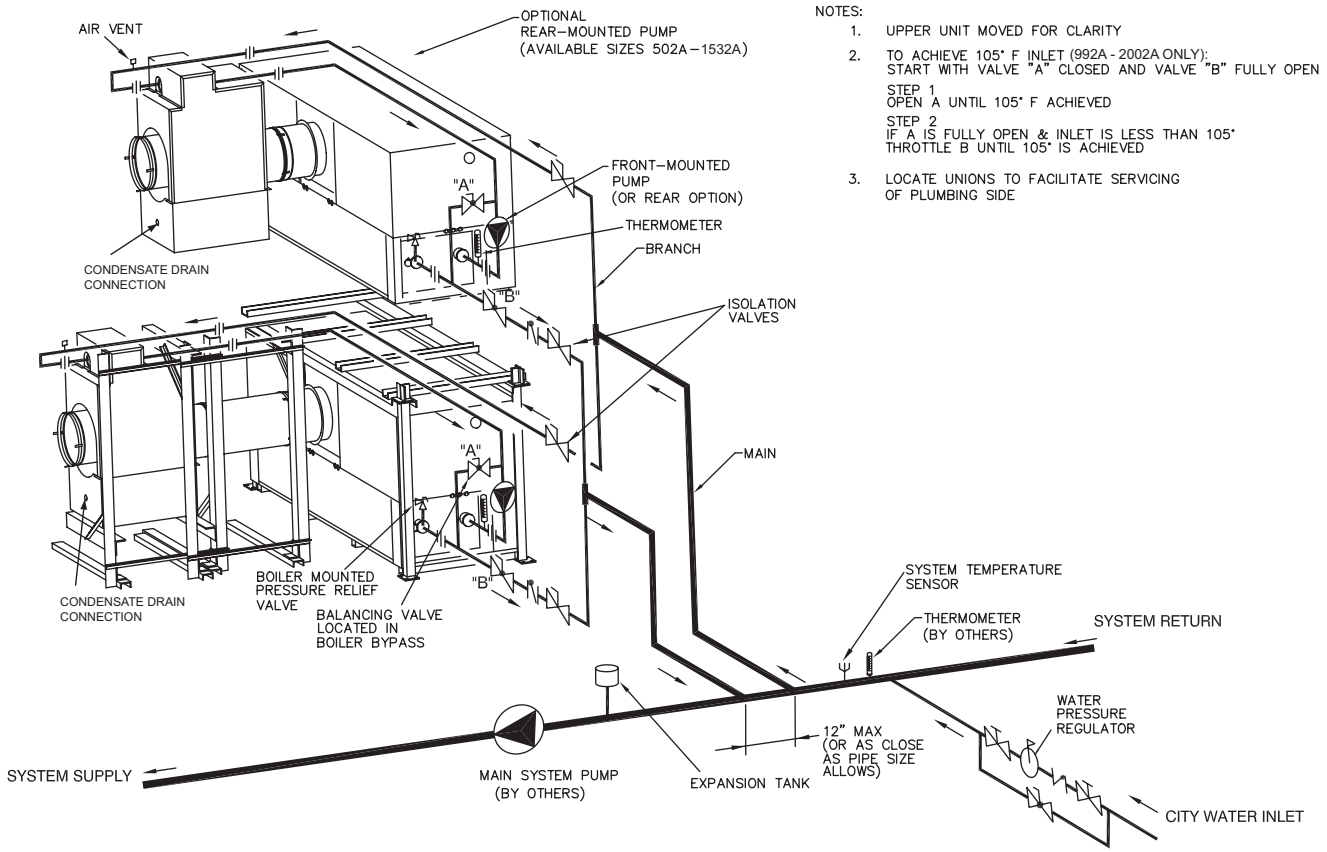


Fig. 25: Dual Heaters - Primary/Secondary Piping with Bullhead Tee Piping with Stacked Rear-Mounted CHXs

Domestic Hot Water

When designing the water piping system for domestic water applications, water hardness should be considered. Table E indicates the suggested flow rates for soft, medium, and hard water. Hardness is specified as grains per gallon.

		Soft Water (0-4 gpg)						Medium Water (5-15 gpg)							Hard Water (16-25 gpg)*						
H-D Model	CHX Model	ΔT (ºF)	GPM	H-D ΔP (ft wc)	CHX ΔP (ft wc)	MTS (in)	SHL (ft wc)	ΔT (ºF)	GPM	H-D ΔP (ft wc)	CHX ΔP (ft wc)	Tubing (50ft) ΔP (ft wc)	MTS (in)	SHL (ft wc)	ΔT (ºF)	GPM	H-D ΔP (ft wc)	CHX ΔP (ft wc)	Tubing (50ft) ΔP (ft wc)	MTS (in)	SHL (ft wc)
402B	500-6	20	40	2.0	0.7	2	2.7	15	52	3.4	1.1	2.5	2	7.0	9	90	10.0	3.1	6.9	2	20.0
502B	500-6	25	40	2.1	0.7	2	2.8	19	52	3.5	1.1	2.5	2	7.2	11	90	10.4	3.1	6.9	2	20.4
652B	500-8	32	40	2.2	0.7	2	2.9	23	55	4.1	1.2	2.8	2	8.2	14	90	10.8	3.1	6.9	2	20.8
752B	750-8	35	42	2.6	0.9	2	3.5	23	63	5.7	1.9	3.6	2	11.1	16	90	11.3	3.6	6.9	2	21.8
902B	750-8	35	51	3.9	1.3	2	5.1	23	76	8.4	2.6	5.1	2	16.1	20	90	11.7	3.6	6.9	2	22.2
992B	1000-10	32	60	2.7	2.2	2 1/2	4.9	23	83	5.2	3.9	2.2	2 1/2	11.4	15	132	13.1	9.2	5.2	2 1/2	27.6
1262B	1000-12	35	71	4.3	3.0	2 1/2	7.3	23	106	9.6	6.2	3.5	2 1/2	19.2	19	132	14.8	9.2	5.2	2 1/2	29.3
1532B	1500-12	35	86	7.1	4.7	2 1/2	11.8	23	129	15.8	9.8	5.0	2 1/2	30.6	23	132	16.5	10.2	5.2	2 1/2	32.0
1802B	1500-14	35	101	10.7	6.3	2 1/2	17.0	27	132	18.3	10.2	5.2	2 1/2	33.7	27	132	18.3	10.2	5.2	2 1/2	33.7
2002B	1500-14	35	112	13.9	7.6	2 1/2	21.4	30	132	19.0	10.2	5.2	2 1/2	34.5	30	132	19.0	10.2	5.2	2 1/2	34.5

SHL = System head loss, ft. Includes 50 eq ft of tubing each way (100 eq ft).
MTS = Minimum tube size
* Must use optional cupro-nickel tubes. If hardness exceeds 25 grains per gallon, a water softening system must also be used.

Table E: Domestic Water Heater Flow Rate Requirements

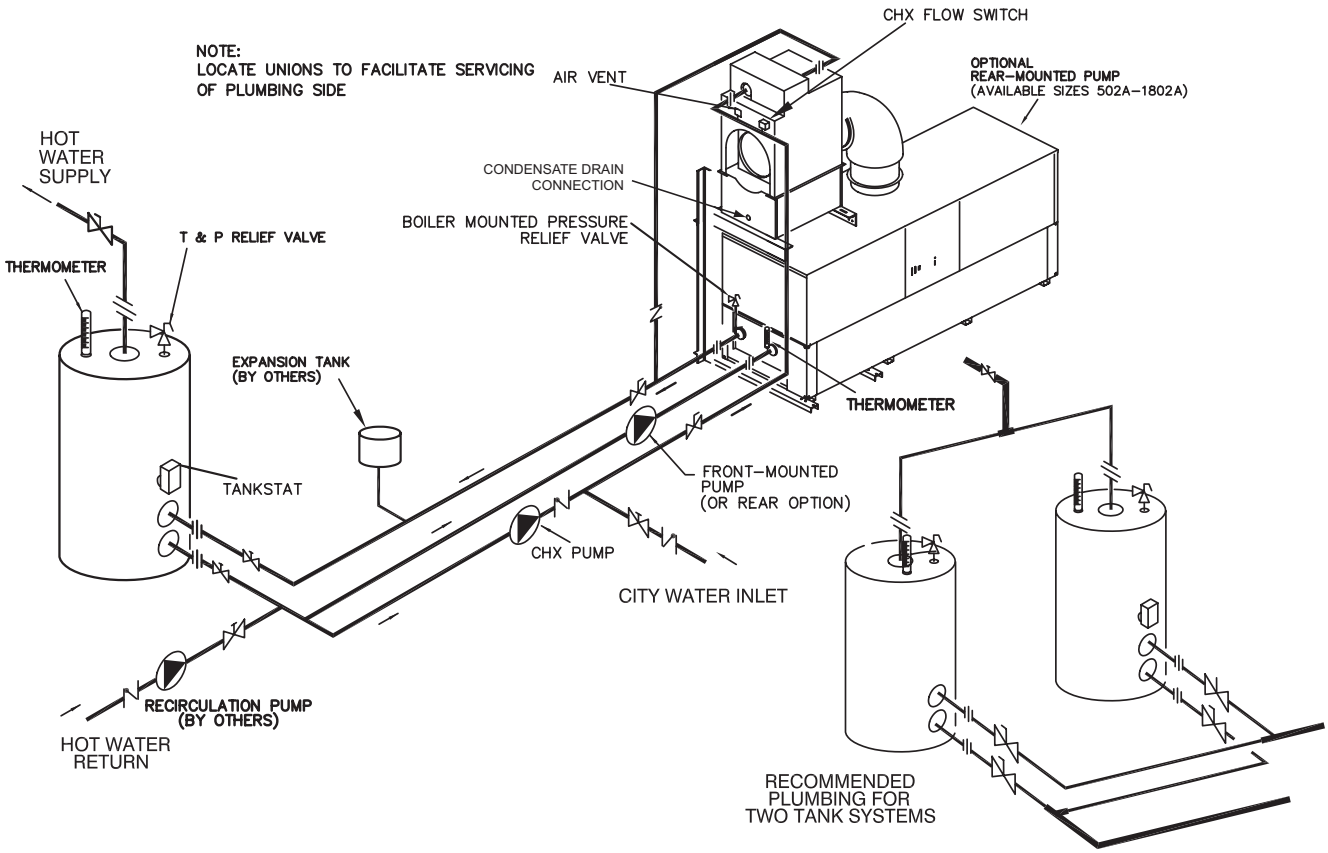


Fig. 26: Single Heater - Domestic Hot Water with Top-Mounted CHX (Dual-Pump)

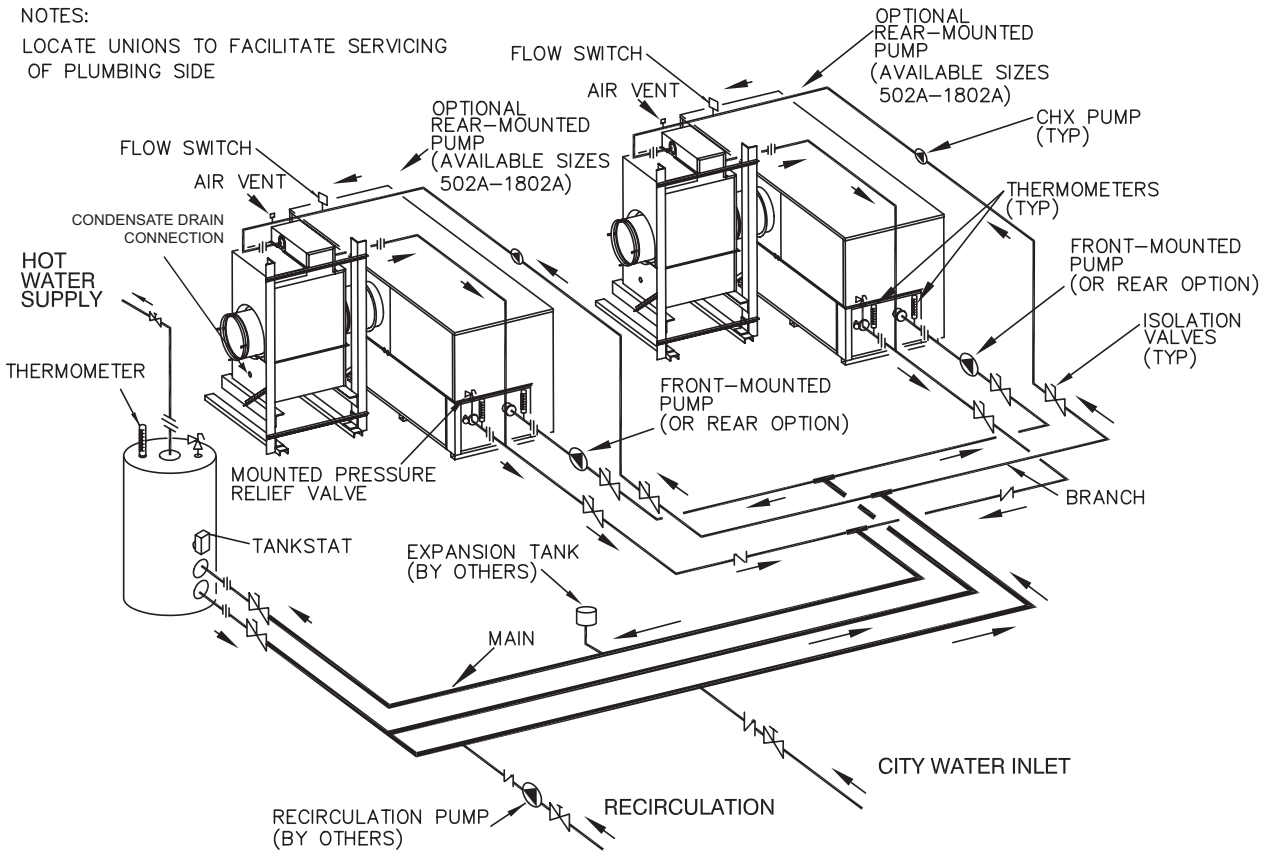


Fig. 27: Dual Heaters - Domestic Hot Water with Bullhead Tee Piping, Side-By-Side with Rear-Mounted CHXs

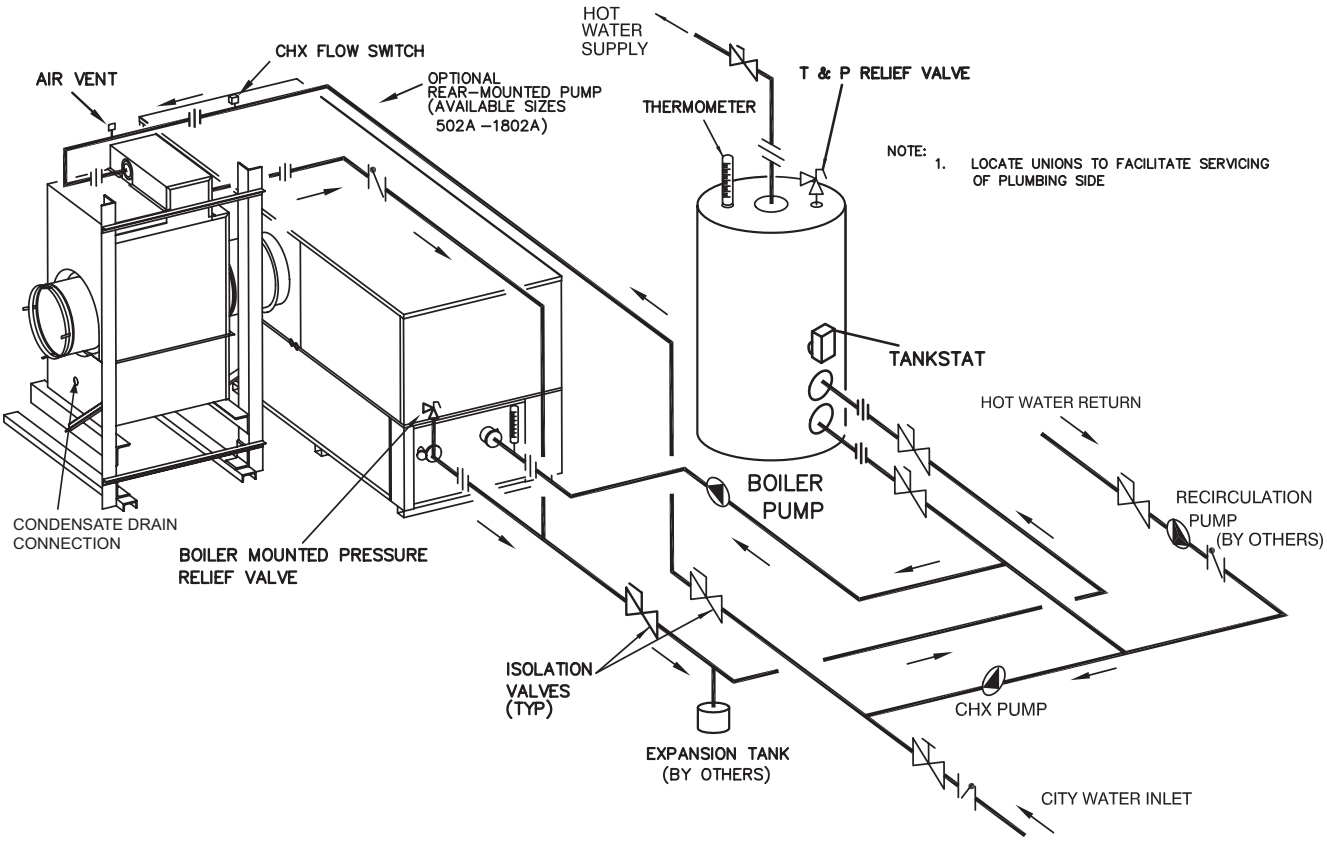


Fig. 28: Single Heater - Domestic Hot Water (Dual-Pump) with Rear-Mounted CHX

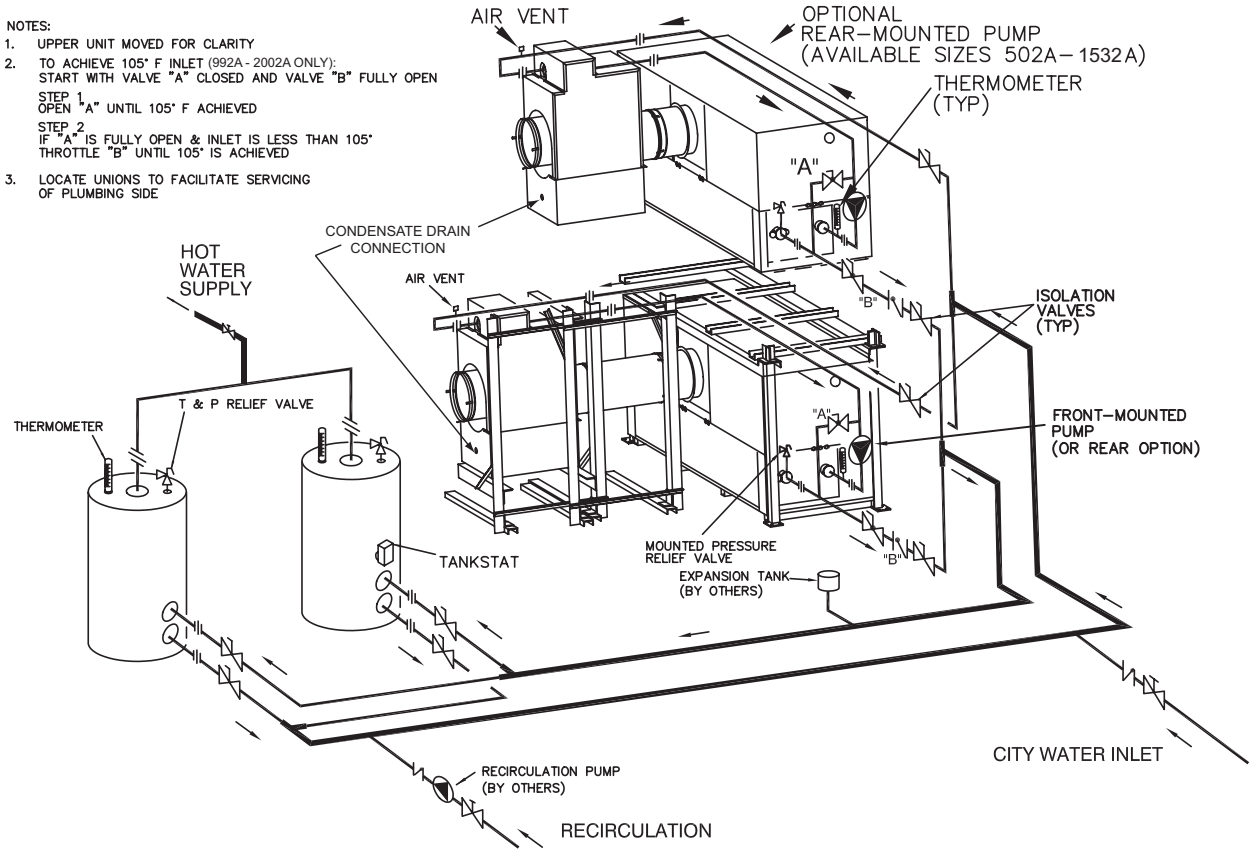


Fig. 29: Dual Heaters - Domestic Hot Water with Bullhead Tee Piping, Stacked Rear-Mounted CHXs and Dual Tanks

POOL HEATING

Hi Delta units are equipped with an external pump and bypass arrangement that blends outlet water with the inlet to increase the inlet water temperature, thereby reducing the likelihood of condensation forming on the heat exchanger. The pump also serves to circulate water through the heater from the main system piping (see Fig. 10-13).

To complete the installation of the pool heater, the pool thermostat needs to be installed in the main return water line. This will ensure that the heater will be energized at the right time. If the main water line is too far away from the heater and the capillary bulb will not reach it, locate the pool thermostat adjacent to the main line and run wires back to the heater.

Adjustment of the bypass valve is critical to proper operation of the heater. The bypass valve should be adjusted to achieve an inlet water temperature of at least 105°F. When starting with a cold pool, make initial adjustments. Make final adjustments when pool water approaches desired temperature. Refer to Table D for required flow rates.

Automatic Chlorinators and Chemical Feeders

All chemicals must be introduced and completely diluted into the pool or spa water before being circulated through the heater. Do not place chlorine tablets or bromine sticks in the skimmer. High chemical concentrations will result when the pump is not running (e.g. overnight).

Chlorinators must feed downstream of the heater and have an anti-siphoning device to prevent chemical backup into the heater when the pump is shut off.

NOTE: High chemical concentrates from feeders and chlorinators that are out of adjustment will cause very rapid corrosion to the heat exchanger in the heater. Such damage is not covered under the warranty.

Winterizing Your Heater

Pool heaters installed outdoors in freezing climate areas should be shut down for the winter. To shut down heater, turn off manual main gas valve and main gas shut-off. Close isolation valves and remove water

piping from the in/out header on the heater. Drain the heater and any piping of all water that may experience below-freezing temperatures.

NOTE: In order to properly winterize the CHX, isolation valves must be closed, drain plugs in header must be removed and compressed air (10 psi min./50 psi max.) used to blow the water out of the CHX tubes.

Pool and Spa Water Chemistry

NOTE: Chemical imbalance can cause severe damage to your heater and associated equipment. Maintain your water pH between 7.4 and 7.8, and total alkalinity between 100 and 150 ppm. If the mineral content and dissolved solids in the water becomes too high, scale forms inside the heat exchanger tubes, reducing heater efficiency and also damaging the heater (Max TDS at 2,500 ppm). If the pH drops below 7.2, the heater will be severely damaged.

NOTE: Heat exchanger damage resulting from chemical imbalance is not covered under the warranty.

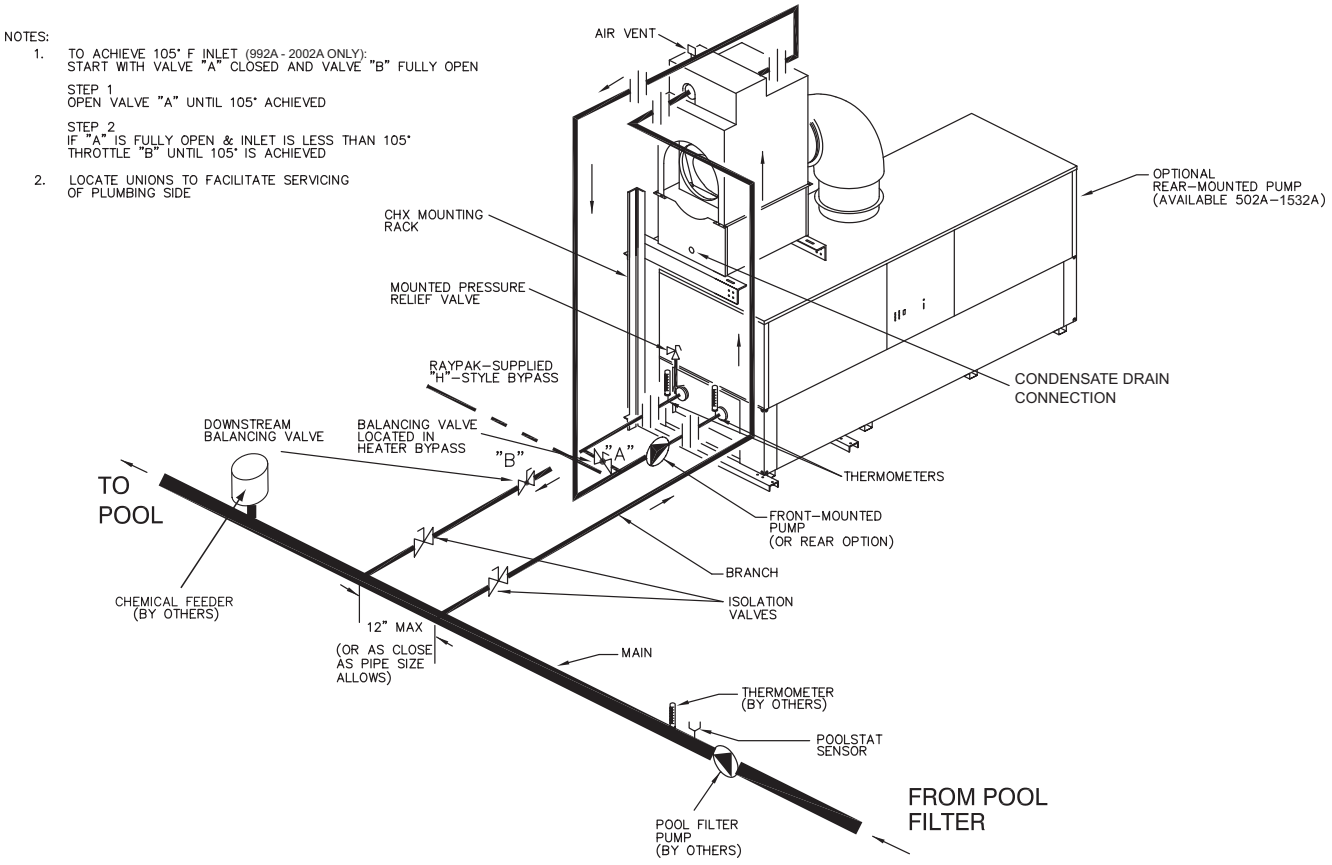


Fig. 30: Single Heater - Pool System Primary/Secondary with Top-Mounted CHX

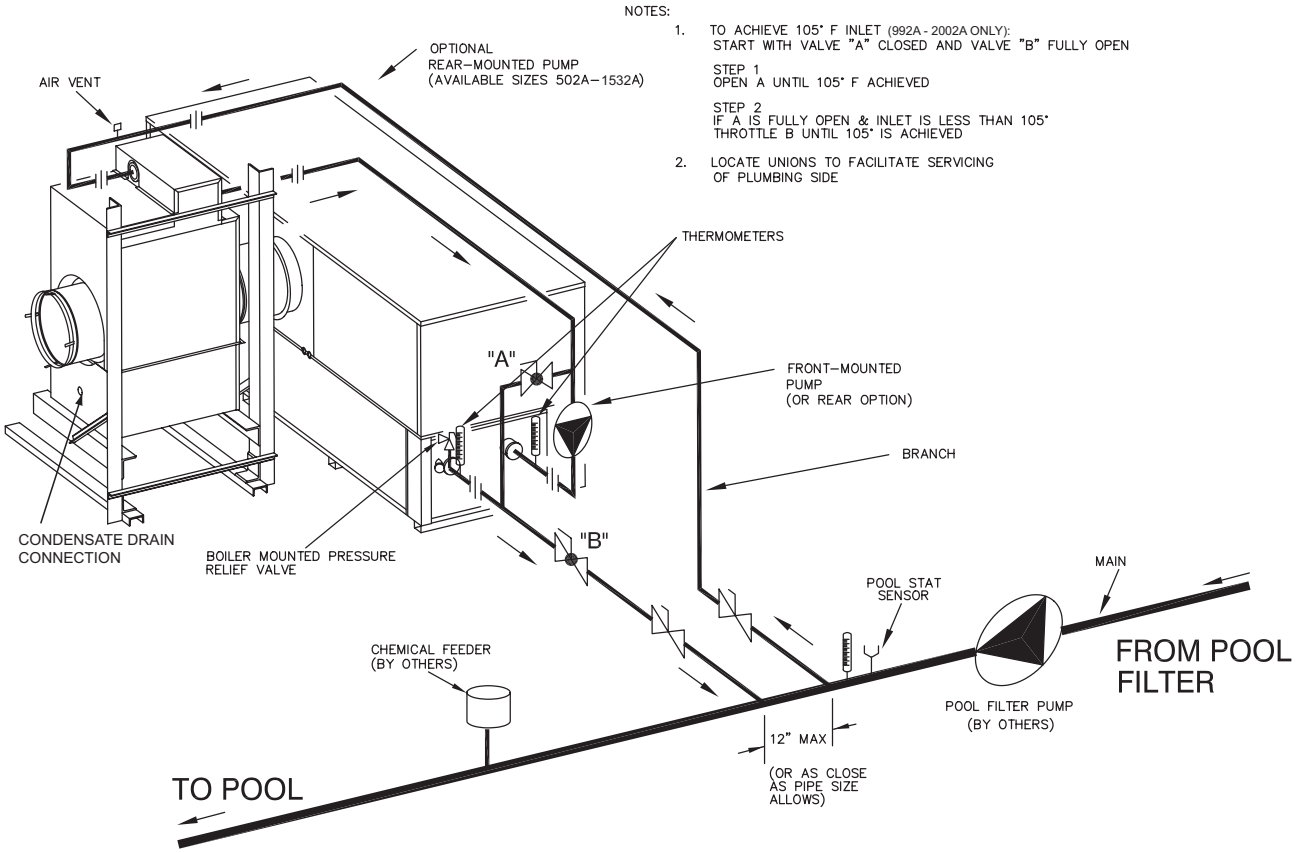


Fig. 31: Single Heater - Pool System Primary/Secondary with Rear-Mounted CHX

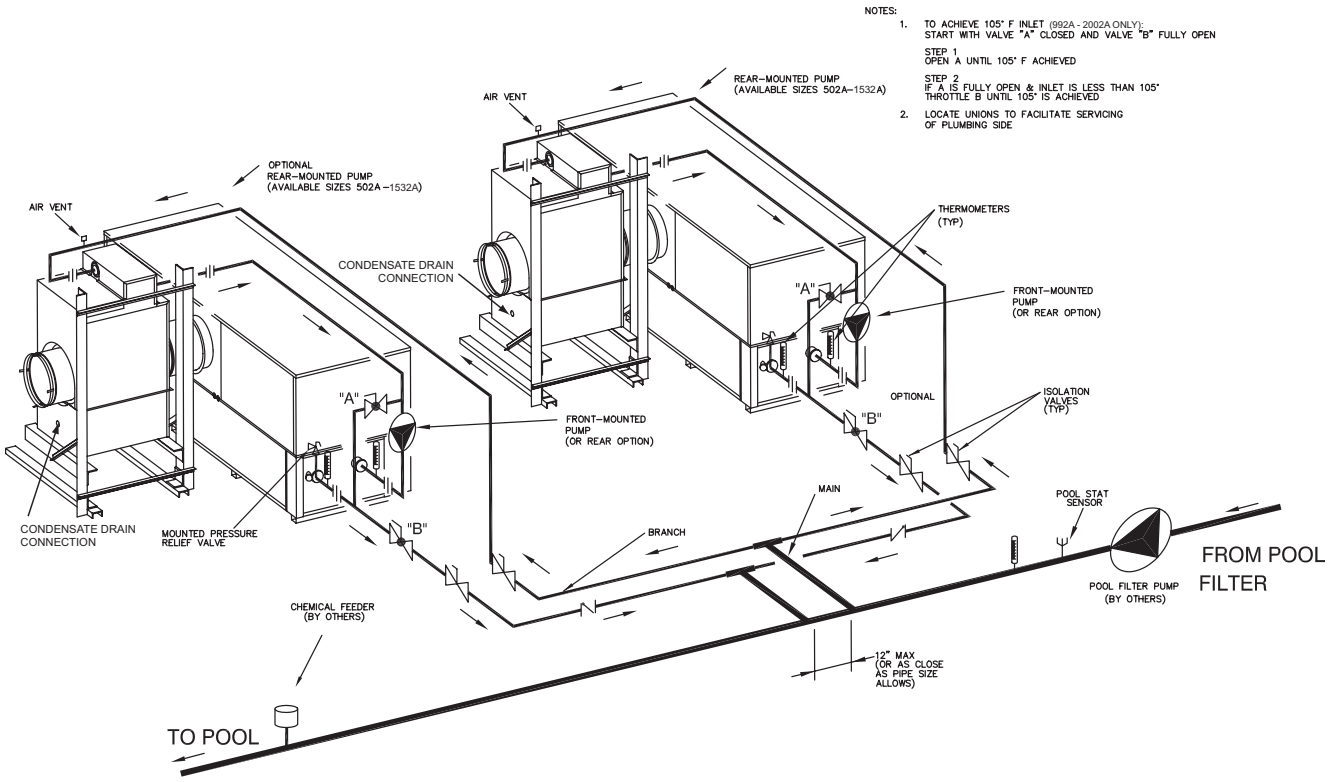


Fig. 32: Dual Heaters - Pool System Primary/Secondary with Bullhead Tee and Rear-Mounted CHXs

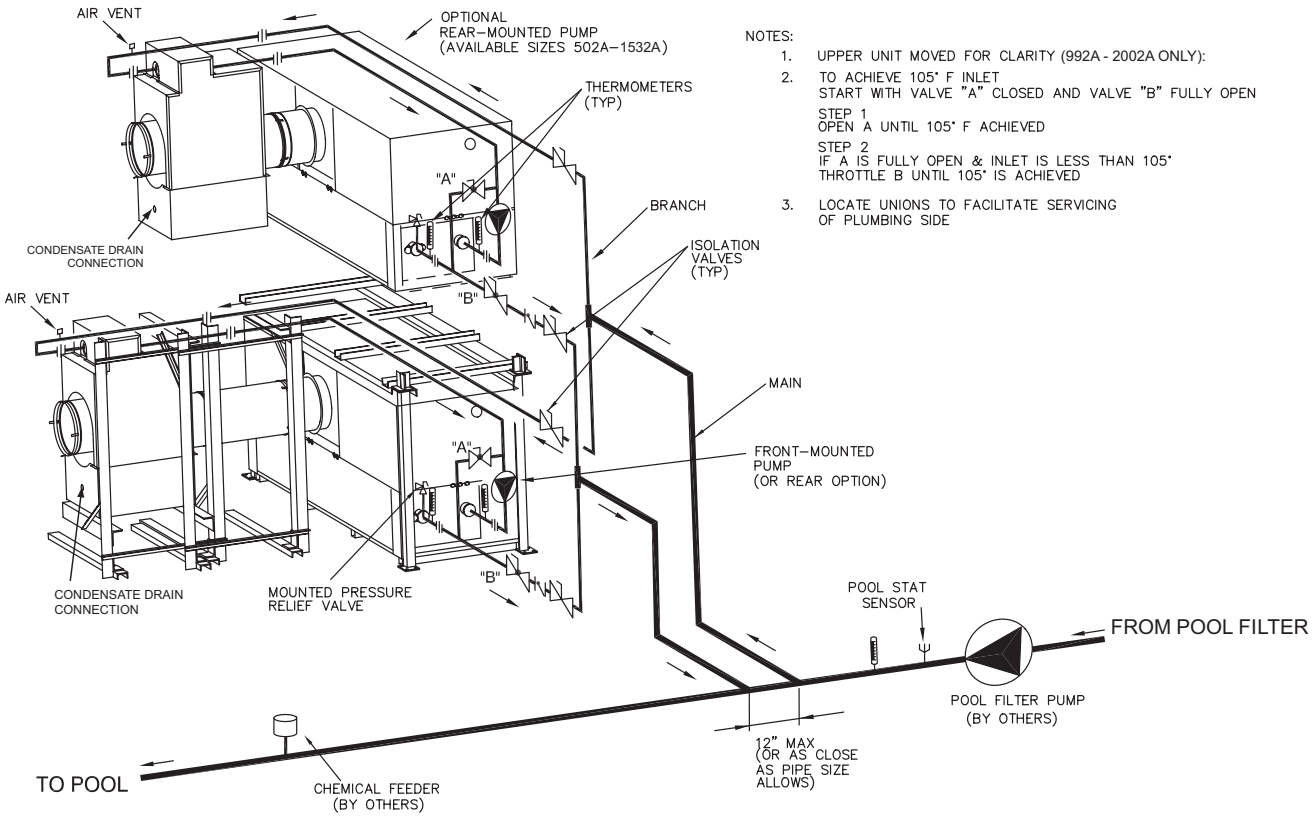


Fig. 33: Dual Heaters - Pool System Primary/Secondary with Bullhead Tee and Stacked Rear-Mounted CHXs

OPERATION

Follow the instructions provided in the Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511).

Pre Start-Up

Fill the System

1. Close manual and automatic air vents and drain cock.
2. Fill to correct system pressure. Correct pressure will vary with each application.
3. Open automatic air vent two turns.
4. Slowly feed water to heater.
5. Starting on the lowest floor, open air vents one at a time until water squirts out. Close vent.
6. Repeat with remaining vents.
7. Close manual water feed valve when correct heater pressure is reached.

Inspect Venting System

1. Check all vent pipe connections and flue pipe material.
2. Ensure vent terminations are installed per code and are clear of all debris or blockage.
3. Verify connections to be sealed.

Pre Start-Up Check

1. Verify heater is filled with water.
2. Check system piping for leaks. If found, repair immediately.
3. Vent air from system. Repeat steps 4 and 5 under the Fill The System Section above. Air in system can interfere with water circulation and cause improper heat distribution.

Start-Up

Follow the instructions provided in the Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511).

In addition to the tools needed for the Hi Delta start-up, an inclined manometer is required with the CHX start-up.

Use the following start-up procedure for the Hi Delta with CHX, fixed-speed extractor/power venter, and adjustable blast/balancing baffle:

1. Add weights to barometric damper per guidelines provided in Table E.

Hi Delta Model	*No. of Additional Weights*	
	100 Eq Ft	*0 Eq Ft*
402B	2	0
502B	2	0
652B	2	0
752B	2	1
902B	3	1
992B	3	0
1262B	3	0
1532B	4	1
1802B	4	1
2002B	5	2

Table F: Added Weights Guidelines

2. Open adjustable vent baffle approximately halfway.

3. Energize and start up power venter/extractor and the Hi Delta unit. Verify that the power venter/extractor is energized before the blower(s) on the heater.

NOTE: Ensure all stages of the heater are operating before making any adjustments.

4. Adjust baffle until barometric damper is approximately half open.

5. Attach the inclined manometer at blocked vent switch on Hi Delta unit and measure the pressure.

6. If pressure is positive, slowly open adjustable vent baffle until pressure goes down to zero.

7. If baffle is full open and pressure reading at vent switch still remains positive, add weights to barometric damper to bring pressure down to zero. Use the small weights provided with the barometric damper for fine tuning.

8. If pressure at vent switch is negative, throttle adjustable vent baffle to bring up to zero.

Once the vent pressure is set to 0, the Hi Delta heater should be started as per the guidelines in the Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511).

Post Start-Up Check

Follow the instructions provided in the Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511).

MAINTENANCE

Follow the instructions included in Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511), in addition to the following suggested minimum maintenance schedule.

Regular service by a qualified service agency and maintenance must be performed to ensure maximum heater operating efficiency.

Maintenance as outlined below should be performed by the owner.

Daily

1. Check that heater area is free from combustible materials, gasoline, and other flammable vapors and liquids.

2. Check for and remove any obstruction to the flow of combustion or ventilation air to heater.

Monthly

1. Check for piping leaks around pumps, mixing valves, relief valves, and other fittings. If found, repair at once. DO NOT use petroleum-based stop leak compounds.

2. Visually inspect burner flame.

3. Visually inspect venting system for proper function, deterioration or leakage.

4. Check air vents for leakage.

Periodically

1. Check relief valve. Refer to manufacturer's instructions on valve.

2. Test low water cut-off, if used. Refer to manufacturer's instructions.

3. Visually inspect condensate drain hose for proper operation or deterioration (if appropriate). Check for plugged condensate trap. Use cleanout plug to clear trap.

4. Clean screen in vent termination and air intake.

Yearly

At the beginning of each heating season, schedule a service call with a qualified service agency to perform the following items:

1. Check the vent switch pressure with an inclined manometer. For a Hi Delta system, if the pressure is not 0 in. WC, follow the start-up instructions in Section D of the Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511).

2. Visually inspect venting system for proper function, deterioration or leakage.

3. Check that heater area is free from combustible materials, gasoline, and other flammable vapors and liquids.

4. Check for and remove any obstruction to the flow of combustion or ventilation air to heater.

5. Follow Pre Start-up Check in the Operation Section.

6. Check operation of safety devices. Refer to the instructions in the Hi Delta Installation and Operation Instructions (Catalog Number 1000.501 or 1000.511).

7. Follow oil lubricating instructions on pumps and extractor/power venter (when required). Over-oiling will damage the pumps. Water-lubricated pumps do not need oiling.

8. Visually inspect condensate drain piping for proper operation or deterioration (if appropriate). Check for plugged condensate trap. Use cleanout plug to clear trap. To avoid potential of severe burn, DO NOT REST HANDS ON OR GRASP PIPES. Use a light touch – return piping will heat up quickly.

9. Check for piping leaks around pumps, mixing valves, relief valves and other fittings. Repair, if found. DO NOT use petroleum based stop leak.

Cleaning the Chx Heating Surface

NOTE: The CHX heating surface requires cleaning as often as once per year.

The following service procedures must be performed ONLY by a qualified service agency. Heater owner should not attempt these procedures.

NOTE: Do not disconnect the water or vent piping.

1. Remove outer jacket of CHX to gain access to inner chamber.

2. Remove the intake top as shown in Figure 33. Insert a putty knife between the mating surfaces where the Hi-Temp RTV is visible. Clean the hardened RTV with a wire brush. Vacuum all the debris to avoid clogging the condensate drain and piping.

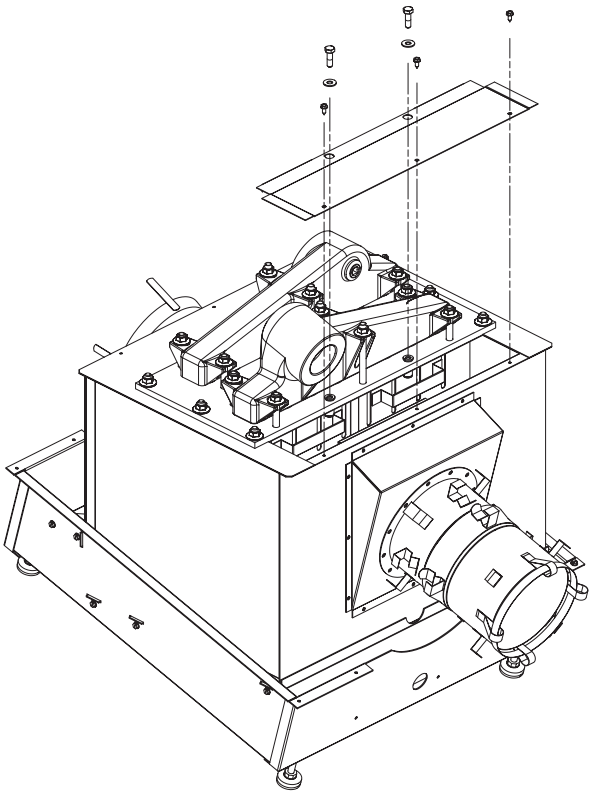


Fig. 34: Heat Exchanger Access for Cleaning

3. Pull out the right side baffle as shown in Figure 34.

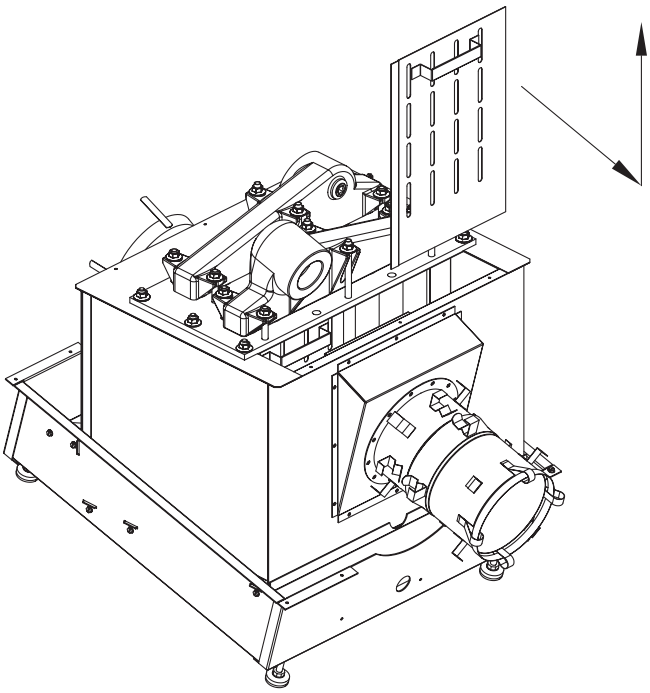


Fig. 35: CHX Right-Side Baffle Removal

4. Slide the left side baffle to the right before it can be pulled out, as shown in Figure 35.

5. The CHX heat exchanger surface is exposed. Flush with water (steam, if available). If hardened deposits are present on the fins, clean with a mild solvent (CLR or equivalent). Rinse with water.

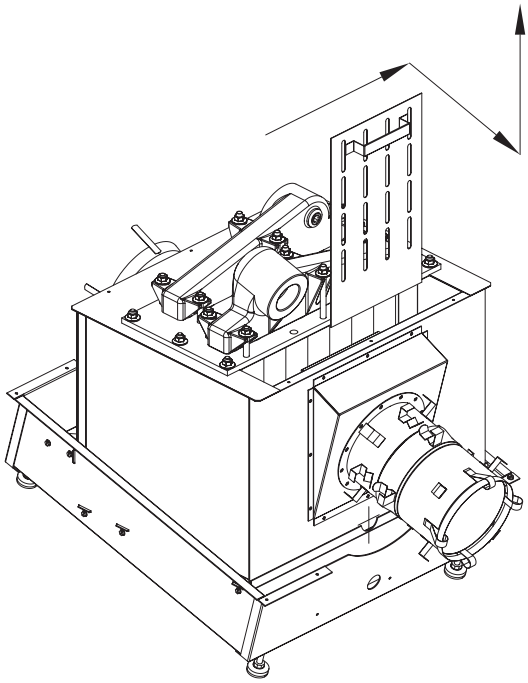


Fig. 36: CHX Left-Side Baffle Removal

WARNING: Do not scrape the heat exchanger surface with sharp objects, as it will damage the black coating, and shorten the life of the CHX.

6. Flush the heat exchanger again, until the drain water is clear from any debris.

7. Clean the baffle surfaces with a wire brush, to remove all deposits.

8. Reinstall the baffles, as shown in Figure 36.

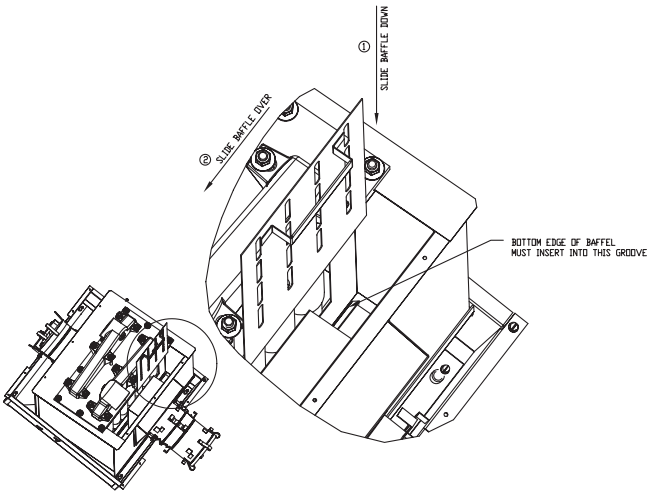


Fig. 37: Reinstallation of CHX Baffles

9. Apply a 1/8 in. line of RTV (GE 106) to the mating surfaces of the flue intake top. Fasten with screws and bolts. Allow 24 hours for curing time before powering the unit.

10. Reinstall outer jacket of CHX.

APPENDIX

Inside Air Contamination

All heaters experience some condensation during startup. The condensate from flue gas is slightly acidic. In most cases the pH level is not harmful to vents or drains. When combustion air is contaminated by vapors from products in areas listed below, the acidic levels in the condensate increase. Higher acidic levels attack many materials, including stainless steel commonly used in high efficiency systems.

The heater can use special corrosion-resistant non-metallic duct for the combustion air intake. You may, however, choose to use outside combustion air for one or more of these reasons:

- Installation is in an area containing contaminants listed below which will induce acidic condensation.
- You want to reduce infiltration into your building through openings around windows and doors.
- You are using AL29-4C stainless steel vent pipe, which is more corrosion-resistant than standard metallic vent pipe. In extremely contaminated area, this may also experience deterioration.

Products causing contaminated combustion air:

- Spray cans containing chloro/fluorocarbons
- Permanent wave solutions
- Chlorinated waxes/cleaners
- Chlorine-based swimming pool chemicals
- Calcium chloride used for thawing
- Sodium chloride used for water softening
- Refrigerant leaks
- Paint or varnish removers
- Hydrochloric acid/muriatic acid
- Cements and glues
- Anti-static fabric softeners used in clothes dryers
- Chloride-type bleaches, detergents, and cleaning solvents\ found in household laundry rooms
- Adhesives used to fasten building products
- Gasoline
- Other similar products.

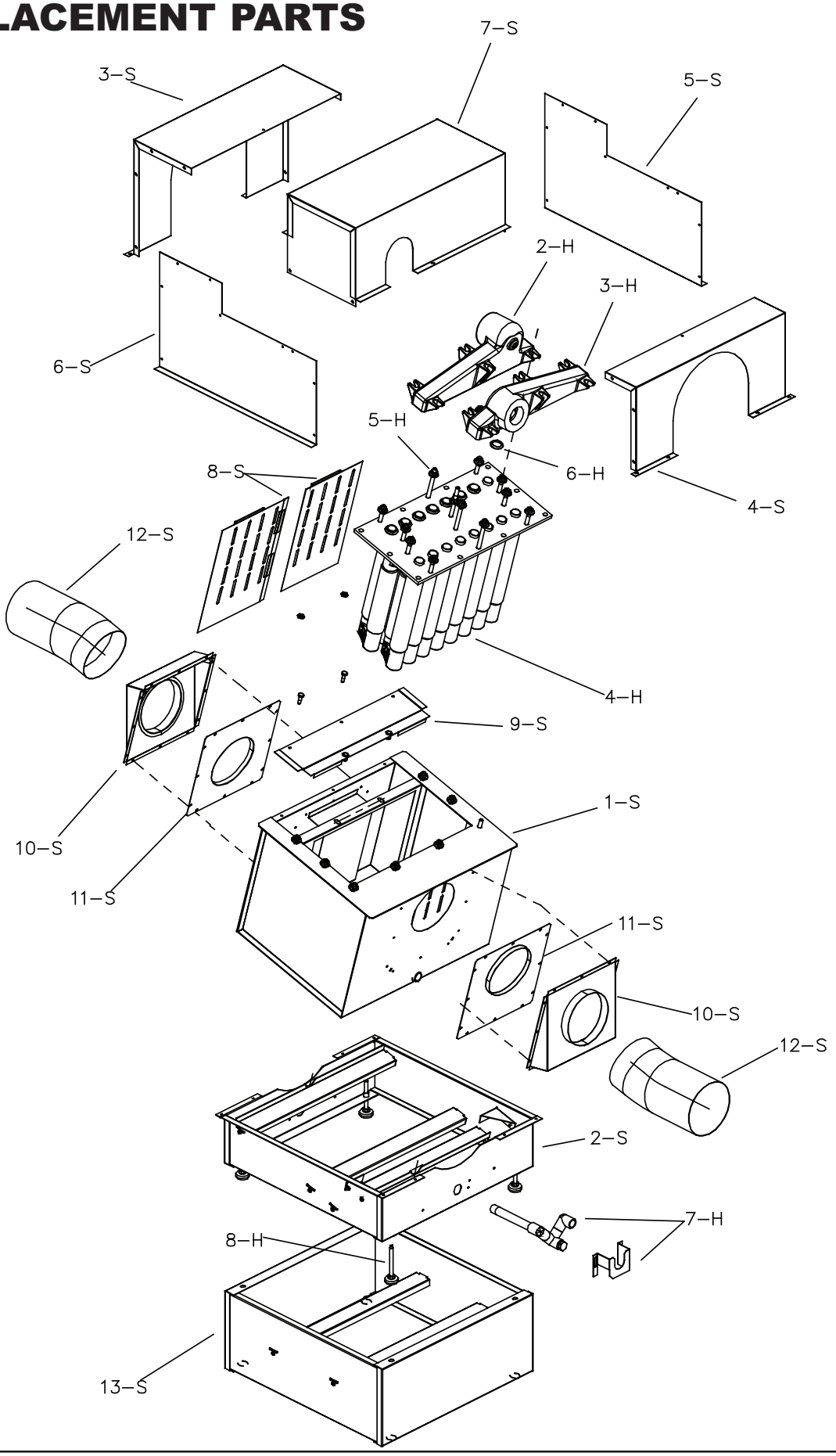
Areas causing contaminated combustion air:

- Dry cleaning/laundry areas and establishments
- Metal fabrication plants
- Beauty shops
- Refrigeration repair shops
- Photo processing plants
- Auto body shops
- Plastic manufacturing plants
- Furniture refinishing areas and establishments
- New building construction
- Remodeling areas.

Check for areas and products as listed above before installing heater. If found:

- Remove products permanently, OR
- Provide outdoor combustion air.

REPLACEMENT PARTS



CHX - Condensing Heat Exchanger

CALL OUT	DESCRIPTION	500-6	500-8	750-8	1000-10	1000-12	1500-12	1500-14
H	**HEAT EXCHANGER**							
1-H	Heat Exchange Assy. Bronze	007618F	007618F	007619F	007620F	007620F	007941F	007941F
2-H	Inlet Header Bronze	007621F	007621F	007621F	007622F	007622F	007622F	007622F
3-H	Outlet Header Bronze	007623F	007623F	007623F	007624F	007624F	007624F	007624F
4-H	Tube Bundle Cupro-Nickle	007625F	007625F	007626F	007627F	007627F	007942F	007942F
5-H	Studbolt	007628F	007628F	007628F	007628F	007628F	007628F	007628F
6-H	Header Gasket Kit	007343F	007343F	007343F	007343F	007343F	007343F	007343F
7-H	Condensing Drain w/Support Bracket	007629F	007629F	007629F	009553F	009553F	009901F	009901F
S	**SHEET METAL**							
1-S	Internal Chamber	009583F	009583F	009584F	009585F	009585F	009586F	009586F
2-S	Base Assy	009587F	009587F	009587F	009588F	009588F	009588F	009588F
3-S	Cover Panel Front	009589F	009589F	009590F	009591F	009591F	009592F	009592F
4-S	Cover Panel Rear	009593F	009593F	009594F	009595F	009595F	009596F	009596F
5-S	Cover Panel Left Side	007642F	007642F	007643F	007644F	007644F	007946F	007946F
6-S	Cover Panel Right Side	007645F	007645F	007646F	007647F	007647F	007947F	007947F
7-S	Header Top Cover	007648F	007648F	007648F	007648F	007648F	007648F	007648F
8-S	Intake Baffles	009542F	009542F	009543F	009544F	009544F	009545F	009545F
9-S	Access Panel	009546F	009546F	009546F	009546F	009546F	009546F	009546F
10-S	Vent Adapter-15 Degree Intake & Exhaust	009547F	009548F	009549F	009550F	009551F	009551F	009552F
11-S	Vent Adapter-Straight Intake & Exhaust	009826F	N/A	009827F	N/A	N/A	009830F	N/A
12-S	Vent Elbow-15 Degree	010816F	N/A	010817F	N/A	N/A	010820F	N/A
13-S	Base Extension	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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