

Installation & Operation Manual

NFB Condensing Boilers

Model | NFB-301C
NFB-399C



Keep this manual near this boiler for future reference whenever maintenance or service is required.

WARNING

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

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

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.

The installation must conform with local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.

Requirements for the State of Massachusetts

NOTICE BEFORE INSTALLATION

This appliance must be installed by a licensed plumber or gas fitter in accordance with the Massachusetts Plumbing and Fuel Gas Code 248 CMR Sections 4.00 and 5.00.

IMPORTANT: In the State of Massachusetts (248 CMR 4.00 & 5.00)

For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. **INSTALLATION OF CARBON MONOXIDE DETECTORS.** No installation or replacement of a vented gas appliance shall be permitted unless a battery powered or electrically hard wired carbon monoxide detector is present on the same floor as the appliance or on the next adjacent floor when the appliance is located in a crawl space unless the appliance is located in a detached, uninhabitable garage. For all residential dwellings, a carbon monoxide detector must also be present on each habitable level of the dwelling. These requirements shall not be deemed to waive any additional requirements imposed by M.G.L. c. 148 §26F1/2.
2. **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
3. **SIGNAGE.** Whenever any through-the-wall vent is installed less than seven feet above the finished grade, a metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight feet above grade directly in line with the exhaust vent terminal. The sign shall read, in print size no less than 0.5 inches in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS"**.
4. **INSPECTION.** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.09 and 5.12.

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Safety Information

The following safety symbols are used in this manual. Read and follow all safety instructions in this manual precisely to avoid unsafe operating conditions, fire, explosion, property damage, personal injury, or death.

DANGER

Indicates an imminently hazardous situation which, if not avoided, could result in severe injury or death.

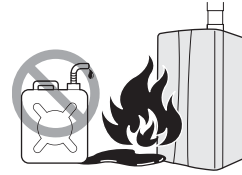
WARNING

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

CAUTION

Indicates a potentially hazardous situation that, if not avoided, could result in property damage.

DANGER



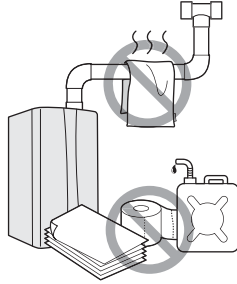
If you smell gas:

- Do not try to light any appliance.
- Do not touch any electrical switches or use landline phones.
- From a neighbor's phone, call your gas provider and follow their instructions.
- If you cannot reach your gas provider, call the fire department.
- Do not return to your home until authorized by your gas supplier or the fire department.

Do not use or store flammable products, such as gasoline, solvents, or adhesives in the same room or area as the boiler.

- The boiler has a main burner flame that can turn on at any time and can ignite flammable vapors. Vapors from flammable liquids can explode and catch fire, causing death or severe burns.
- Vapors cannot be seen and are heavier than air. They can travel long distances along the ground and can be carried from other rooms to the boiler's main burner flame by air current.
- Keep all flammable products far away from the boiler and store them in approved containers. Keep the containers closed tightly and out of the reach of children and pets.

 **WARNING**



- **Do not store or use gasoline or other flammable liquids near this boiler.**
Doing so may result in fire or explosion.
- **Do not place combustibles, such as newspapers or laundry, near the boiler or venting system.**
Doing so may result in a fire.
- **Do not place or use hair sprays, spray paints, or any other compressed gases near the boiler or venting system, including the vent termination.**
Doing so may result in fire or explosion.
- **Do not operate the boiler with the front cover opened.**
Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death.
- **Do not operate this boiler without proper venting.**
Doing so may result in fire or carbon monoxide (CO) poisoning, which may result in property damage, personal injury, or death.
- **Do not touch the power cord or internal components of the boiler with wet hands.**
Doing so may result in electric shock.

 **CAUTION**

- **Do not turn on the boiler unless the water and gas supplies are fully opened.**
Doing so may damage the boiler.
- **Do not use this boiler for anything other than its intended purpose, as described in this manual.**
- **Do not remove the front cover unless the power to the boiler is turned off or disconnected.**
Failure to do so may result in electric shock.
- **When servicing the controls, label all wires prior to disconnecting them.**
Failure to do so may result in wiring errors, which can lead to improper or dangerous operation. Verify proper operation after servicing.
- **Do not use unapproved replacement or accessory parts.**
Doing so may result in improper or dangerous operation and will void the manufacturer's warranty.
- **Do not place anything in or around the vent terminals, such as a clothes line, that could obstruct the air flow in or out of the boiler.**
- **This boiler has been approved for use in the USA and Canada only.**
Using the boiler in any other country will void the manufacturer's warranty.

California law requires the following Prop 65 warning to be provided:






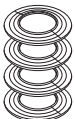

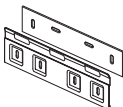


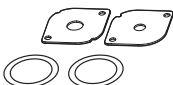
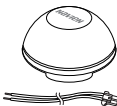

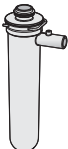
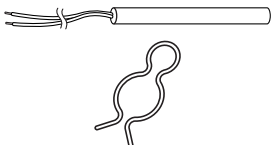
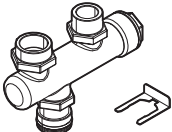
WARNING



Cancer and Reproductive Harm -
www.P65Warnings.ca.gov.

1. About the Boiler

1.1 Included Items

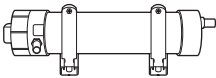
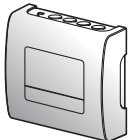
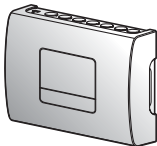
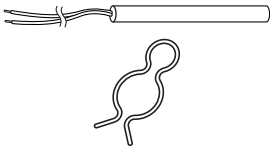

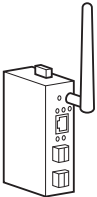
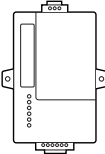
When you open the box, you will find the following items with the boiler. Check the box for each of the following items before installing the boiler.

	
Installation & Operation Manual, User's Information Manual	Quick Installation Manual
	
3 in Vent Termination Caps (x2)	3 in Wall Flanges (x4)
	
Air Vent	Wall Mounting Bracket (with Anti-Vibration Rubber Pad) * Included in the L box
	
Tapping Screws & Anchors (x6)	Pressure Relief Valve (50 psi)
	
Conversion Kit for High Elevation and Propane	Outdoor Temperature Sensor and Cable
	
Air Vent Bushing [1¼ in to ¾ in (NFB-301C)] [1½ in to ¾ in (NFB-399C)]	Condensate Trap
	
Universal Temperature Sensor (with Clip)	PRV-Air Vent Adapter (with Clip)

	
Caps (x2)	Double Nipple (¾ in to ¾ in)

1.2 Accessories

The following optional accessories are available for the boiler.

	
Light Commercial Neutralizer Kit (Optional Neutralizer Tank for Larger Cascade Systems)	Zone Controller (FMZ-20/30)
	
Zone Controller (4 or 6 Zones) (FMZ-40/60)	Universal Temperature Sensor (with Clip)
	
Navi-Link (Wi-Fi Control System)	Modbus/BACnet Gateway & Power Adaptor
	
LonWorks Gateway	


Note

The universal temperature sensor can be used as a system temperature sensor or a DHW tank sensor.

1.3 Specifications

The following tables list the specifications for the boiler. Additional specifications for water, gas, electricity, and vent connections are provided in the Installation section.

Space Heating Specifications

Navien Commercial Condensing Boiler Space Heating Ratings									Other Specifications		
Model Number ¹	Heating Input (MBH)		Gross Output ² (MBH)	Net AHRI Rating Water ³ (MBH)	Thermal Efficiency ² (%)	Boiler Water Content (Gallons)	Water Pressure	Water Connection Size (Supply, Return)			
	Min.	Max.									
NFB-301C	20	301	293	255	97.5	7.6	12-160 psi	1¼ in NPT			
NFB-399C	26	399	389	338	97.5	9.6		1½ in NPT			

Note

1. Ratings are the same for natural gas models converted to propane use.
2. Based on U.S. Department of Energy (DOE) test procedures.
3. The net AHRI water ratings shown are based on a piping and pickup allowance of 1.15. Consult Navien before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping system, etc.

General Specifications

Item		NFB-301C	NFB-399C
Dimensions		25.1 in (W) × 22.3 in (D) × 32.8 in (H)	
Boiler Weight		243 lb (110 kg)	278 lb (126 kg)
Boiler Weight with Water		307 lb (139 kg)	371 lb (168 kg)
Installation Type		Indoor Wall-Hung	
Venting Type		Forced Draft Direct Vent	
Ignition		Electronic Ignition	
Natural Gas Supply Pressure (from source)		3.5 in-10.5 in WC	
Propane Gas Supply Pressure (from source)		8.0 in-13.0 in WC	
Natural Gas Manifold Pressure		-0.06 to -0.87 in WC	-0.03 to -1.85 in WC
Propane Gas Manifold Pressure		-0.01 to -0.92 in WC	-0.01 to -0.90 in WC
Gas Connection Size		³ / ₄ in NPT	
Power Supply	Main Supply	120 V AC, 60 Hz	
	Maximum Power Consumption	Less than 12 amperes	
Materials	Casing	Cold-rolled carbon steel	
	Heat Exchangers	Stainless Steel	
Venting	Exhaust	3 in or 4 in PVC, CPVC, approved polypropylene, approved stainless steel 3 in or 4 in Special Gas Vent Type BH (Class III, A/B/C)	
	Intake	3 in or 4 in PVC, CPVC, polypropylene, stainless steel 3 in or 4 in Special Gas Vent Type BH (Class III, A/B/C)	
	Vent Clearance	0 in to combustibles	
Safety Devices		Flame Rod, APS, Ignition Operation Detector, Water Temperature High Limit Switch, Exhaust Temperature High Limit Sensor, Water Pressure Sensor	

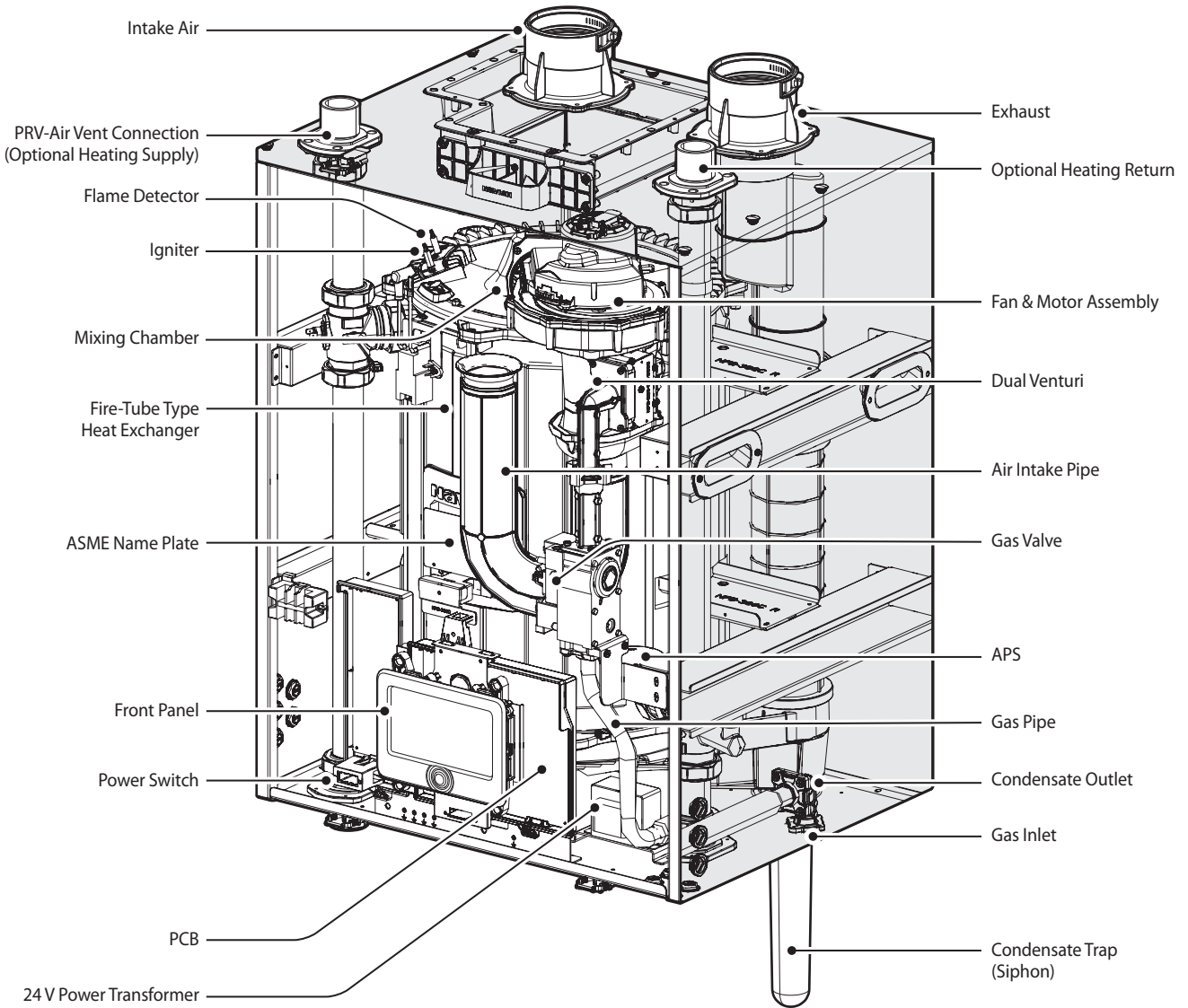
Temperature Setting Range

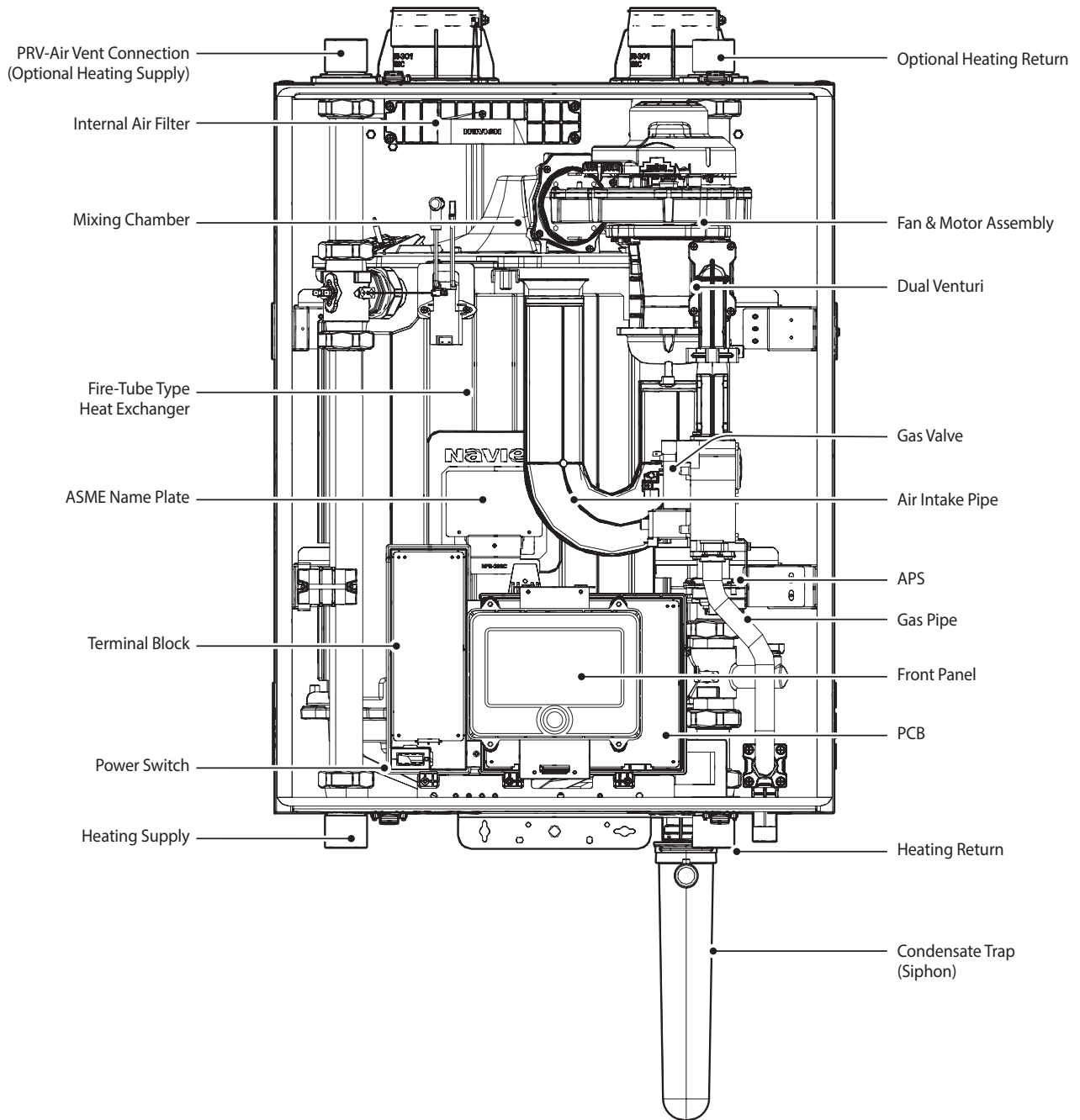
Item		Temperature Setting Range	Remarks
Space Heating	Supply	77-190°F (25-88°C)	Actual supply and return temperatures vary depending on the selected outdoor reset curve.
	Return	68-158°F (20-70°C)	

Note For more information about the space heating temperature setting range, refer to “11.5.2 Setting the Space Heating Operation” on page 93.

1.4 Components

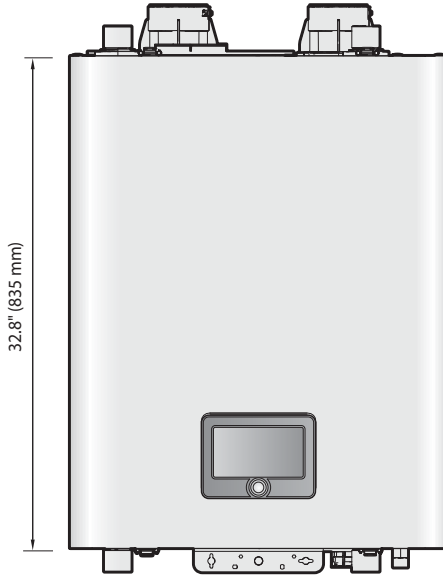
The following diagram shows the key components of the boiler. Component assembly diagrams and particular parts lists are included in the Appendixes.





1.5 Dimensions

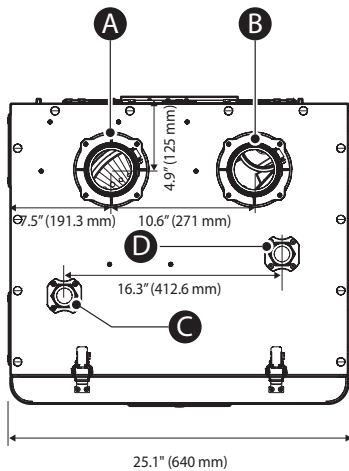
The following diagrams show the dimensions of the boiler and the table lists the supply connections.



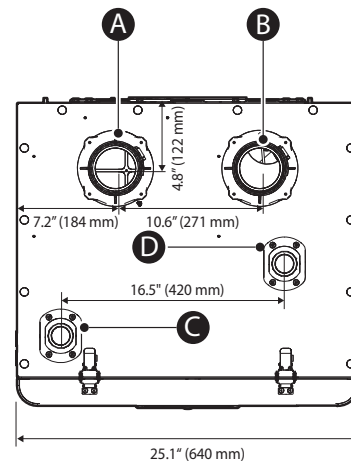
Supply Connections

	Description	Diameter	
		NFB-301C	NFB-399C
A	Air Intake	3 in	
B	Exhaust Gas Vent	3 in	
C	PRV-Air Vent Connection (Optional Heating Supply)	1 1/4 in	1 1/2 in
D	Optional Heating Return	1 1/4 in	1 1/2 in
E	Heating Supply	1 1/4 in	1 1/2 in
F	Condensate Outlet	3/4 in	
G	Heating Return	1 1/4 in	1 1/2 in
H	Gas Connection	3/4 in	

Overhead View

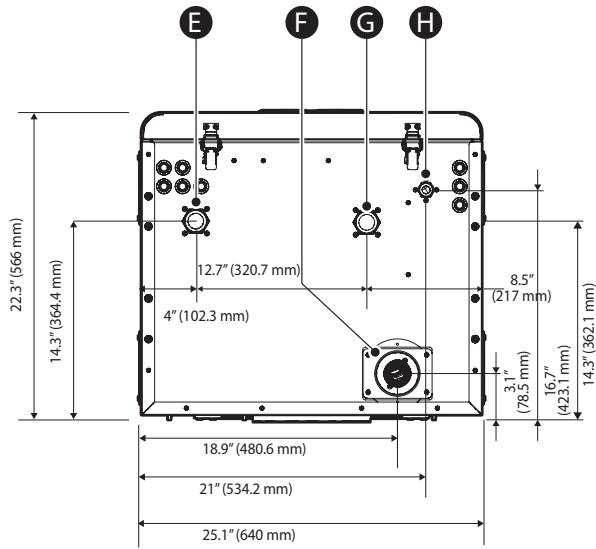


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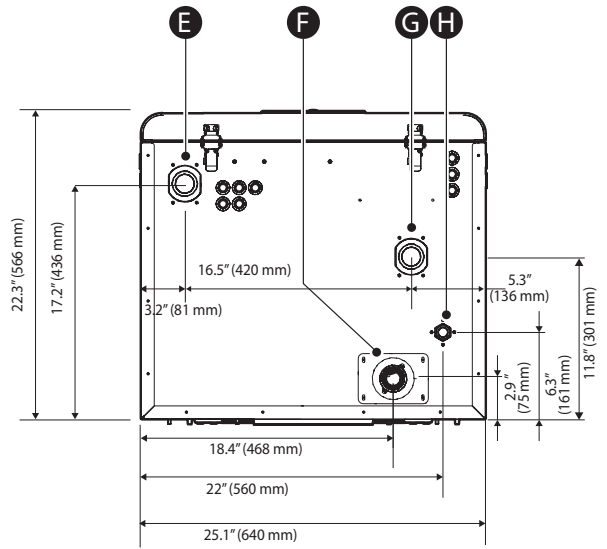


<NFB-399C>

Supply Connections



<NFB-301C>



<NFB-399C>

1.6 Rating Plate





The Navien NFB boilers come from the factory configured for use with Natural Gas (NG). **Before starting the installation**, check the rating plate located on the side of the boiler to ensure that the boiler matches the gas type, gas pressure, water pressure, and electrical supply available in the installation location. **If the boiler does not match each of these ratings, do not install the boiler.** If conversion to Propane Gas is required, the included gas conversion kit must be used. Refer to “12.1 Gas & High Altitude Conversion” on page 110 for details.

Rating Plate, *Plaque Signalétique

Direct Vent Boiler *Évacuation directe chaudière
Navien Inc.
20 Goodyear, Irvine, CA 92618
Tel: (949) 420 – 0420

Direct vent indoor installation, *Évacuation directe installation intérieure

Model No. , *Numéro de modèle NFB-399C	Type of Gas, * Type de gaz NG
Max./Min. Input Rating (Heating), *Entrée GPL max. 399,000 / 26,600 Btu/h	Heating Capacity, * Capacité de chauffage 389,000 Btu/h
Category of boiler, * Catégorie de chaudière Category IV	Net AHRI Rating, * Régime de AHRI 338,000 Btu/h
Max. Inlet Gas Pressure, * Pression max. de gaz d'entrée	10.5 Inches W.C. * pouces W.C.
Min. Inlet Gas Pressure, * Pression min. de gaz d'entrée	3.5 Inches W.C. * pouces W.C.
Manifold Pressure, * Pression d'admission	-0.60 Inches W.C. * pouces W.C.
Electrical Rating, * Régime nominal électrique	AC *c.a. 120 Volts 60Hz Use less than 12 Amp, * Utilise moins de 2A
Minimum relief valve capacity, * Capacité minimuma soupape.	399 lbs/hr ANSI Z21.13-2017 · CSA 4.9-2017

Orifices necessary for LP conversion are provided. *Les injecteurs nécessaires à la conversion au GPL sont fournis.

Failure to use the correct gas can cause problems which can result in death, serious injury or property damage. *Le fait de ne pas utiliser le bon gaz peut causer des problèmes qui peuvent mener à la mort, causer des blessures graves ou endommager la propriété.

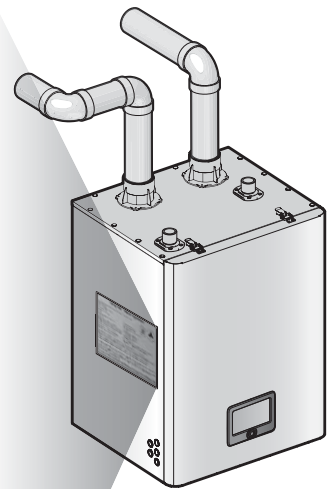
Consult your installation manual for more information. *Consultez votre manuel d'installation pour plus d'information.

This appliance is certified for use at altitudes up to 4,500 ft (1,370 m) in accordance to the latest CAN/CGA 2.17-High Altitude Installation procedures at normal manifold pressure. This appliance has also been tested up to 10,100 ft(3,078 m).
For installations at altitudes up to 10,100 ft(3,078 m), follow the directions provided in the High Altitude Installations sections of the Installation Manual. *Cet appareil est certifié pour une utilisation à des altitudes de 0 à 4,500 pieds (1,370 m) conformément aux toutes les procédures d'installation à haute altitude CAN/CGA 2.17 à une pression normale. Cet appareil a été testé jusqu'à 10,100 pieds (3,078 m). Pour les instructions d'installation à une altitude supérieure à 10,100 pieds, suivez les instructions fournies dans la section des installations à haute altitude du manuel d'installation.

This appliance must be installed in accordance with local codes or in the absence of local codes, the most recent edition of National Fuel Gas Code, ANSI Z223. 1, in Canada use CAN/CGA B149. 1 or 2 installation codes for Gas Burning Appliances.
 *Cet appareil doit être installé conformément aux codes locaux, ou s'il n'y a pas de codes locaux, la plus récente version du National Fuel Gas Code des E.-U., ANSI Z223. 1, au Canada utilisez les codes d'installation CAN/CGA B149. 1 ou 2 pour les appareils à gaz.

FOR YOUR SAFETY *POUR VOTRE SÉCURITÉ

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other gas appliances. *Ne rangez pas et n'utilisez pas d'essence ou d'autres liquides ou vapeurs inflammables près de cet appareil ou de tout autre appareil électroménager.



WARNING

Ensure that the gas type and power source specifications match what is listed on the rating plate. Using a different gas type will cause abnormal combustion and boiler malfunction. Using abnormally high or low AC voltage may cause abnormal operation, and may reduce the life expectancy of the product.

This appliance complies with the requirements of SCAQMD Rule 1146.2 for NOx emissions of 14 ng/J or 20 ppm at 3% O₂.

2. Installing the Boiler

2.1 Removing the Wood Pallet from the Boiler

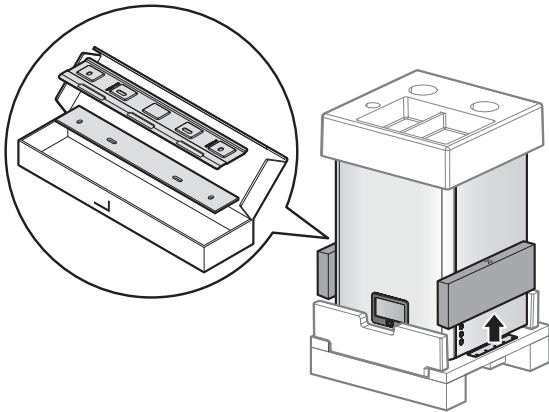
After you open the box, remove the wood pallet and the pallet brackets and then install the boiler.

CAUTION

After opening the box, verify that all included accessories are present in the accessory box and upper container.

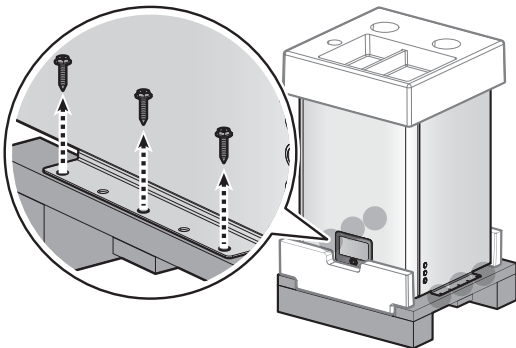
Removing the Wood Pallet and the Pallet Brackets

1. Remove the L and R boxes.

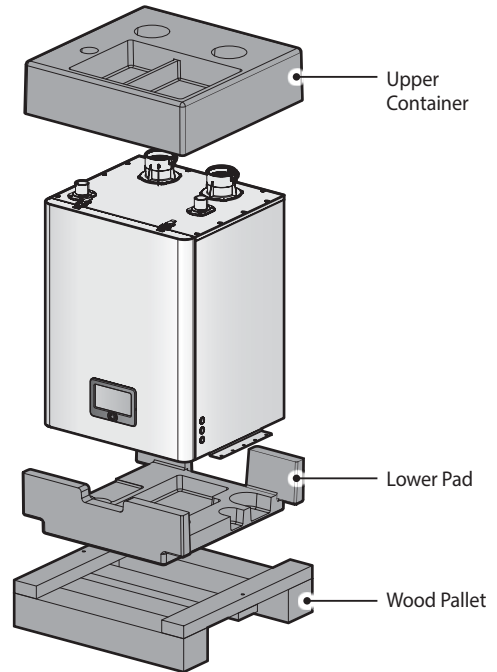


Note Do not discard the L box, as it contains the wall-mounting bracket and the anti-vibration rubber pad.

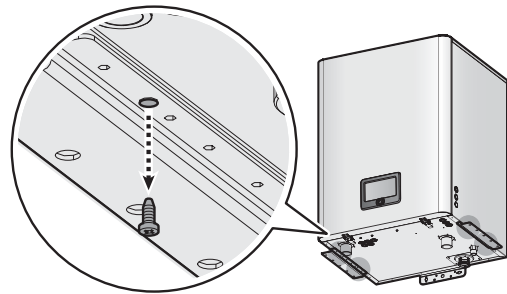
2. Loosen the eight screws that secure the wood pallet on the bottom left and right sides of the boiler.



3. Remove the wood pallet, the upper container, and the lower pad.



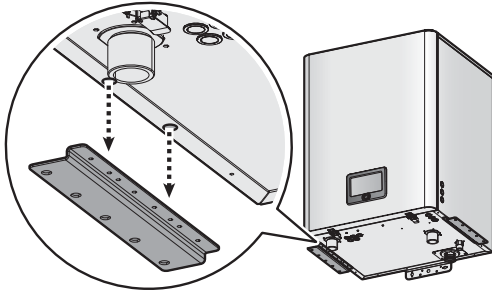
4. Loosen the eight screws that secure the pallet brackets.



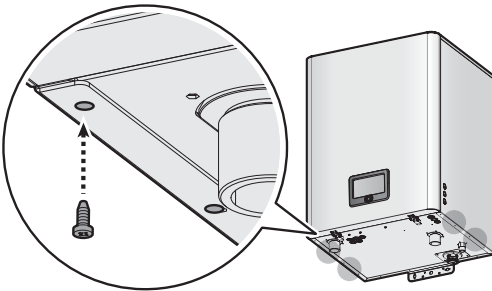
CAUTION

Keep the removed screws in a safe place. The screws will be used again in Step 6.

5. Remove the two pallet brackets.



6. Tighten the eight screws into the original position.



! CAUTION

Ensure that the screws have been retightened. If you do not retighten the screws, the boiler's airtightness will decrease.

2.2 Choosing an Installation Location

When choosing an installation location, you must ensure that the location provides adequate clearance for the boiler, adequate venting and drainage options, and sufficient access to gas, water, and electrical supplies. Carefully consider the following factors when choosing an installation location:

Compliance Requirements

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1-latest edition.
- Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, when required.
- National Electrical Code.
- For Canada only: B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1, CSA-B214-12 Installation code for hydronic heating systems, and any local codes.

Access to Utilities

- Water – the installation location should be near where the domestic water supply enters the building.
- Gas – the installation location should be near where the gas supply enters the building.
- Electricity – the installation location should be near where the electrical supply enters the building.

Humidity and Contact with Water

When installing the boiler, avoid places with excessive humidity. The boiler has electric gas ignition components. Excessive moisture can get inside the boiler and damage the ignition system. The boiler must be installed in a way to ensure that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during operation and service.

Flooring

The boiler must not be installed on carpeting.

! WARNING

Do not install a boiler on carpeting even if a foundation is used. Fire can result in severe personal injury, death, or substantial property damage.

Adequate Drainage

The boiler produces a significant amount of condensate during operation. The boiler should be located near a suitable drain and where damage from a possible leak will be minimal. Installing the boiler in a location without a drain will void the warranty and Navien will not be responsible for water damages that occur as a result. For more information about condensate drainage, refer to “3.2 Connecting the Condensate Drain” on page 27.

The boiler must be located in an area where leakage of the unit or connections will not result in damage to the area adjacent to the appliance or to lower floors of the structure. When such locations cannot be found, installation of an adequately drained drain pan under the boiler is highly recommended. When installing the drain pan, ensure that the installation does not restrict combustion air flow.

Adequate Venting and Ventilation

Select a location that requires minimal venting. Consider venting restrictions caused by windows, doors, air intakes, gas meters, foliage, and other buildings. For more information about venting, refer to “5. Venting for Combustion Air” on page 52.

To ensure adequate venting and ventilation, follow these guidelines:

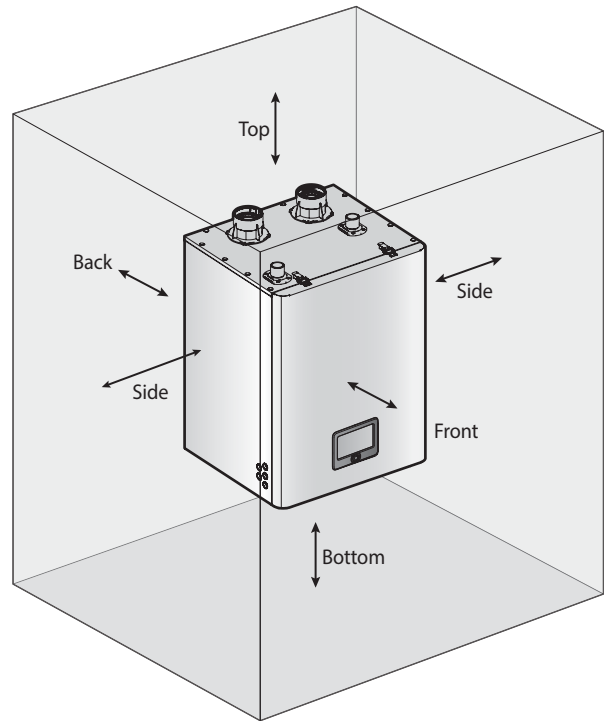
- Maintain proper clearances from any openings in the building.
- Install the boiler with a minimum clearance of 12 in (305 mm) above the level required by local codes and weather conditions.
- Maintain a minimum clearance of 4 ft (1.2 m) from heating and cooling vents.
- Do not enclose the vent termination.
- Install the exhaust vent in an area that is free from any obstructions, where the exhaust will not accumulate.
- Do not install the boiler where moisture from the exhaust may discolor or damage walls.
- Do not install the boiler in bathrooms, bedrooms, or any other occupied rooms that are normally kept closed or not adequately ventilated.
- Installations inside closets or small rooms without proper ventilation must use direct vent piping systems (vent pipes for intake from outside and exhaust to outside).

Adequate Installation Clearances

CAUTION

Do not install the boiler on carpeting.

Install the boiler in an area that allows for service and maintenance access to utility connections, piping, filters, and traps. Based on the installation location, ensure that the following clearances are maintained:



Clearance from:	Indoor Installation
Top	12 in (305 mm) minimum
Back	0.5 in (13 mm) minimum
Front	24 in (610 mm) minimum
Sides	6 in (152 mm) minimum
Bottom	16 in (406 mm) minimum

⚠ CAUTION

It is necessary to leave clearance for service access.

Clean, Debris and Chemical-free Combustion Air

- Do not install the boiler in areas where dust and debris may accumulate or where hair sprays, spray detergents, chlorine, or similar chemicals are used.
- Do not install the boiler in areas where gasoline or other flammables are used or stored.
- Ensure that combustible materials are stored away from the boiler and that hanging laundry or similar items do not obstruct access to the boiler or its venting.

High Elevation Installations

This unit may be installed at elevations up to 10,100 ft (3,078 m) for use with natural gas and propane. Refer to "6. Setting the DIP Switches" for the appropriate altitude setting.

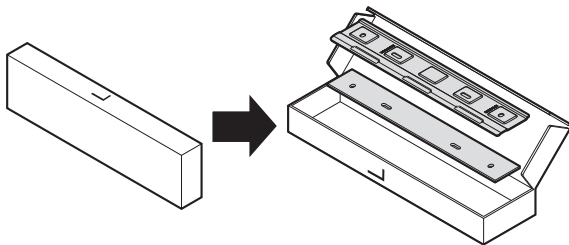
2.3 Mounting the Boiler to the Wall

Ensure the wall for which the boiler is intended to be mounted is composed of either, cement, brick, block or wooden studs spaced 16 inches apart from center.

Ensure the wall is capable of supporting at least 400 pounds for the NFB-399C model. (350 pounds for the NFB-301C)

To mount the boiler to the wall:

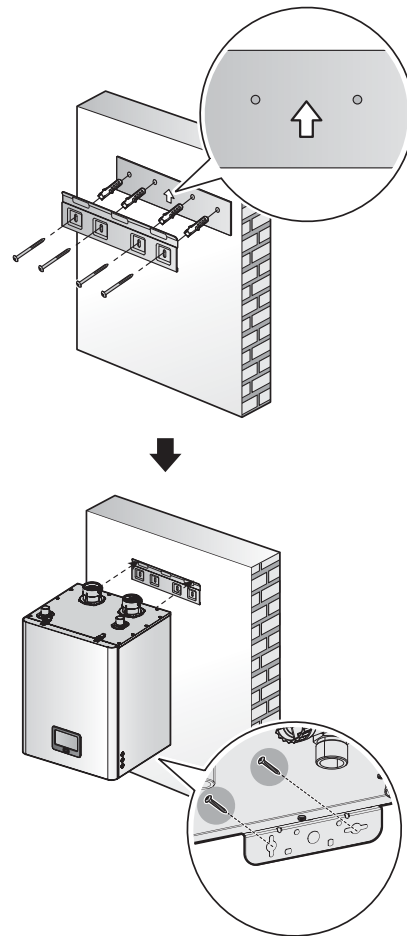
1. Remove the wall bracket from the L box.



2. Mount the wall bracket and the boiler following the instructions below for your installation type.
 - Mounting to a wood studded wall:
Mount the wall bracket using the lag bolts provided.
 - Mounting to a concrete wall:
Mount the wall bracket using the anchor bolts provided. To mount the anchor bolts, drill a 3/8" diameter hole 3-1/2" deep and insert anchor.
 - Mounting to a metal studded wall:
Mount the wall bracket using field supplied toggle bolts capable of supporting 100 pounds each.

Note

- The wall bracket and the anti-vibration rubber pad are contained in the L box.
- The wall bracket should be installed horizontally.
- All 4 holes of the wall bracket must be inserted with the anchor bolts to affix the bracket.
- The anti-vibration rubber pad must be located between the wall and the bracket.
- The anti-vibration rubber pad must be mounted with its arrow mark (↑) facing upward.





WARNING

- **The boiler is heavy.** Always lift the unit with assistance. Be careful not to drop the boiler while lifting or handling it to avoid bodily injury or damage to the unit. It is recommended to use a lifting device when lifting the product. The maximum load of the device should be based on the weight of the appliance with water.
- **Do not** rest the boiler on the bottom end after removing it from the shipping carton. Doing so may result in excessive pressure on protruding pipes and resulting in product damage. If you must put the boiler down, lay it on its back or put it inside the protective shipping base.
- If a separate installation structure is provided, it must be fixed on the floor with a stud.
- Make sure that the wall bracket is installed horizontally using leveling tool.
- Be careful not to drop any foreign objects into the intake or exhaust vents during installation.



CAUTION

Do not mount the boiler to drywall that has not been reinforced.

3. Installing the System Piping

Prior to connecting piping to the boiler, flush the entire system to ensure it is free of sediment, flux, solder, scale, debris or other impurities that may be harmful to the system and boiler. During the assembly of the heating system, it is important to keep the inside of the piping free of any debris including construction dust, copper burr, sand and dirt.

For retrofits, all system piping including radiators, must be cleaned of all build-up including sludge and scale. All systems, old and new, must be cleaned to remove flux, grease and carbon residue. Navien recommends cleaning the boiler system with cleaning products specially formulated for boiler systems. For retrofit applications with heavy limescale and sludge deposits, a heavier duty cleaner may be required. For information on performing the cleaning, follow the instructions included with the boiler system cleaner products.

WARNING

Failure to rid the heating system of the contaminants listed above will void your warranty and may result in premature heat exchanger failure and property damage.

3.1 Installing a Space Heating System

The fire-tube type heat exchanger of the Navien NFB boiler is designed to attain the highest level of heat transfer in a compact design. To accomplish this, the heated gas flows through a series of small-diameter tubes, maximizing the heat transfer area. To maintain the efficient and reliable operation of the heat exchanger, and to avoid heat exchanger failure, it is critical to ensure the rules and guidelines in this section are followed.

CAUTION

Failure to follow the instructions provided in this section will void the warranty and may result in property damage, fire, serious injury or death.

3.1.1 Guidelines for a Space Heating Installation

Read and follow the guidelines listed below to ensure safe and proper installation of a boiler heating system.

Freeze Protection for a Space Heating System

- Freeze protection products may be used for the space heating system. Freeze protection for new or existing systems requires specially formulated glycol, which contains inhibitors to prevent the glycol from attacking the metallic system components.
- Before using freeze protection products, ensure that system fluid contains proper glycol concentration and the inhibitor level is appropriate. Navien recommends against exceeding a 50% concentration of glycol.
- When using the freeze protection products, the system must be tested at least once a year, and as recommended by the manufacturer of the glycol solution.
- When using the freeze protection products, allowance should be made for expansion of the glycol solution.
- Freeze damage is not covered by the warranty.
- The use of glycol results in a greater head loss due to its higher viscosity compared to water. See page 26 for additional information regarding the use of glycol.

WARNING

For systems requiring freeze protection, use only inhibited propylene glycol, specially formulated for hydronic heating systems; use of other types of antifreeze may be harmful to the system and will void the warranty.

System Pressure

- The Navien NFB boiler is intended solely for use in pressurized closed loop heating systems operating with 12-160 psi water pressure at the boiler outlet. To obtain the minimum system design pressure, follow the piping diagrams illustrated in this section.
- The Navien NFB boiler's space heating system is not approved for operation in an "open system", thus it cannot be used for direct potable water heating or to process heating in open loop systems.

Oxygen Elimination

This boiler may only be installed in a pressurized closed-loop heating system, free of air (oxygen) and other impurities. To avoid the presence of oxygen, ensure all of the air is removed from the system during commissioning via strategically placed and adequately sized air removal devices, located throughout the heating system.

Note See the examples of system application at the end of this section detailing the installation location of the air removal device(s).

WARNING

- Immediately repair any leaks in the system piping to avoid adding make-up water. Make-up water adds oxygen and minerals to the system that may lead to heat exchanger failure.
- Failure to follow these instructions may result in poor performance, unnecessary wear of system components and premature failure.

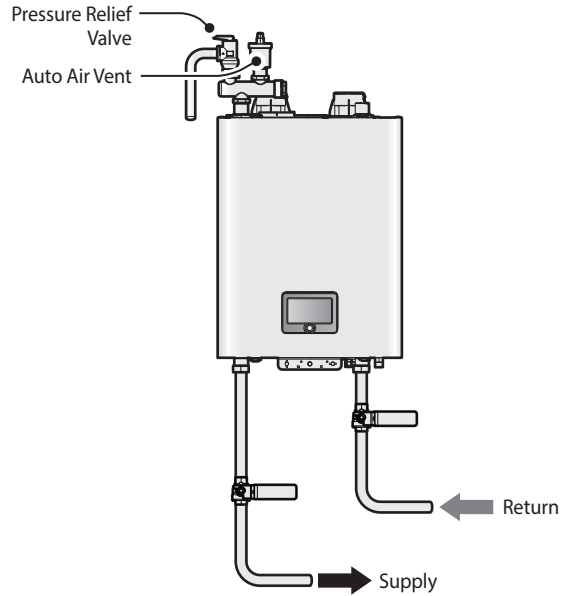
CAUTION

Do not solder piping directly onto the water connections, as the heat may cause damage to internal components. Use threaded water connections only.

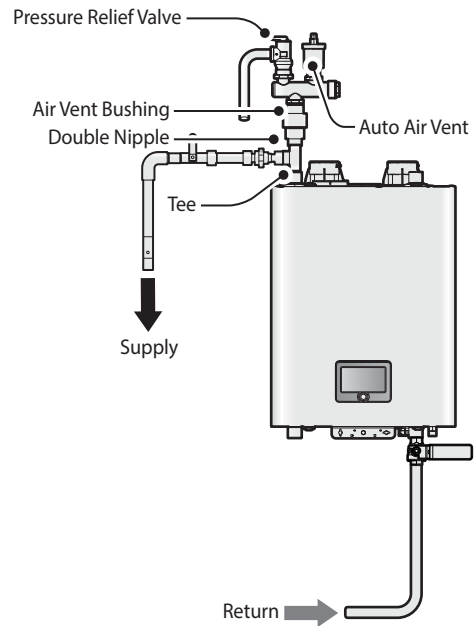
3.1.2 Essential Elements in a Space Heating System

Boiler Piping Options

The following illustrations show various boiler piping options.

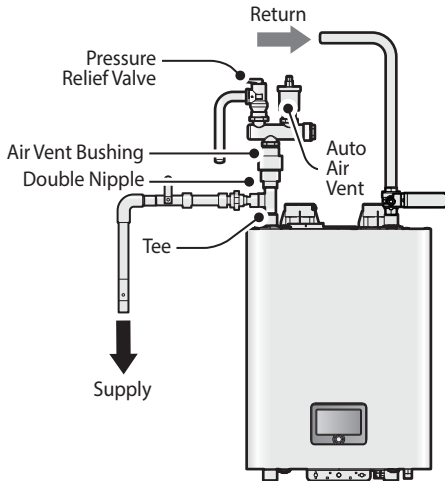


<Supply / Return Bottom>

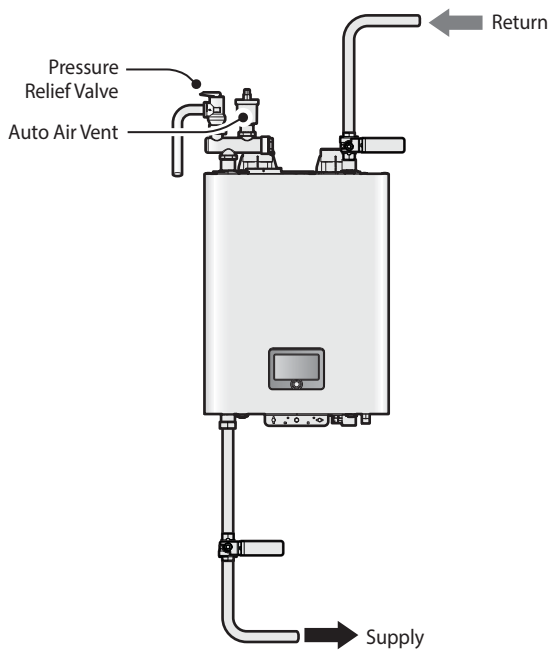


<Supply Top / Return Bottom>

Note To apply the supply top piping, install a tee to the air vent connection and connect a double nipple to the tee and the air vent bushing.



<Supply Top / Return Top>



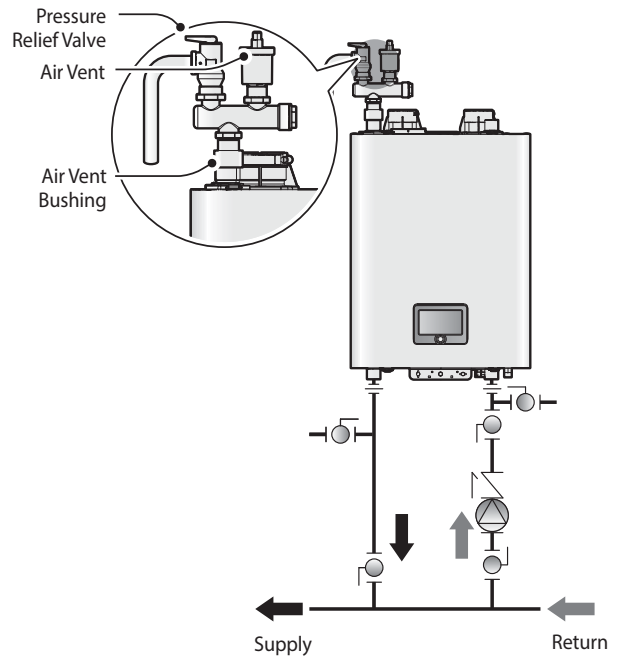
<Supply Bottom / Return Top>

Note Use the supplied caps to close off any unused supply or return connections.

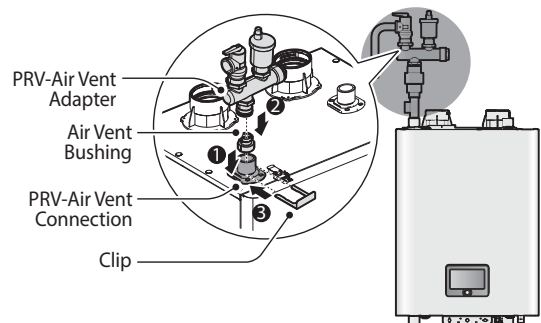
Air Vent

The Navien NFB boiler comes with an air vent and an adapter bushing that must be connected to the air vent connection. The vent efficiently removes the air from the space heating system. The following figure illustrates an example of a typical air vent installation.

Note Install the pressure relief valve onto the adapter before the air vent. The pressure relief valve may interfere with the air vent if not installed first.



Note After installing the air vent bushing to the air vent connection and inserting the PRV-air vent adapter into the air bushing, install the provided clip between the air vent bushing and the PRV-air vent adapter to secure the adapter to the fitting.



Low Water Cut Off (LWCO) Device

Internal LWCO

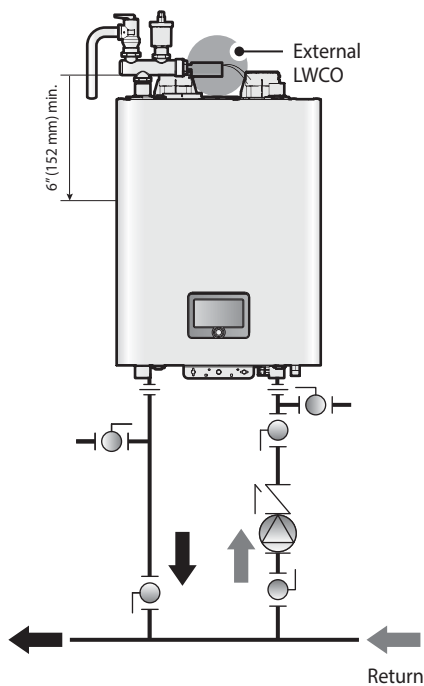
The Navien NFB boiler is equipped with a factory-installed, pressure-sensing type low water cutoff (LWCO) device. The minimum operation pressure for this device is 6 psi by default.

Note When the built-in water pressure sensor detects insufficient water level in the boiler, error code E302 is displayed on the front panel requiring a manual boiler reset.

Refer to local codes to determine if a LWCO device is required for your system and ensure that the built-in device meets the requirements.

External LWCO

If local codes require a separate LWCO device, install one separately. Combining the LWCO with the air vent simplifies the installation. The following illustration shows an example of a separately installed external LWCO.



The external LWCO must be installed at least 6 in (152 mm) above the top of the heat exchanger. Refer to "3.6.2 Wiring Diagram - External LWCO" on page 36 for typical wiring connections of the LWCO to the boiler PCB.

Note If an optional external LWCO is not installed, use the supplied caps to close off the end of the PRV-air vent adapter.

Backflow Preventer

Install a backflow preventer valve in the make-up water supply to the boiler as required by local codes.

Expansion Tank

An expansion tank must be installed in the space heating piping to prevent excessive pressure from building in the system. See the examples of system application on page 33, 34, and 35. Refer to the expansion tank manufacturer's instructions for additional details.

Follow the guidelines below when installing an expansion tank.

- Connect an air separator to the expansion tank only if the air separator is located on the suction side of the system pump.
- Install the make-up water connection at the same location as the expansion tank's connection to the system.
- When replacing an expansion tank, consult the expansion tank manufacturer's literature for proper sizing.
- For diaphragm expansion tanks, always install an automatic air vent on the top side of the air separator to remove residual air from the system.

Isolation Valves and Unions

- Full port ball valves are required for the boiler system. Failure to use full port ball valves could result in a restricted flow rate through the boiler.
- Check valves are recommended for installation. Failure to install check valves could result in a reverse flow condition during pump(s) off cycle.
- Unions are recommended for unit serviceability.

Pressure Relief Valve

To complete the space heating system installation, you must install a 3/4 in pressure relief valve (up to 150 psi max.) on the space heating hot water outlet. An ASME approved 50 psi pressure relief valve for space heating systems is supplied with the boiler.



WARNING

- Installing the pressure relief valve improperly may result in property damage, personal injury, or death. Follow all instructions and guidelines when installing the pressure relief valve. The valve should be installed only by a licensed professional.
- The pressure relief valve must be installed at the boiler outlet and in the vertical position, as shown in this section, with the drain pipe outlet exiting the side of the pressure relief valve horizontally and elbowing down.



CAUTION

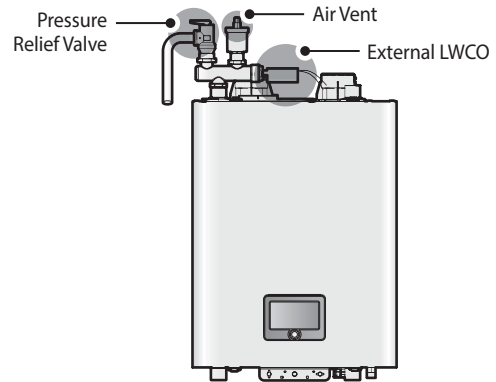
Install the pressure relief valve as close to the boiler as possible. No other valve should be installed between the pressure relief valve and boiler.

When installing the pressure relief valve, follow these guidelines:

- Ensure that the valve's discharge capacity is equal to or greater than the maximum pressure rating of the boiler's space heating system.
- Ensure that the maximum BTU/H rating on the pressure relief valve is equal to or greater than the maximum input BTU/H rating of the boiler.
- Direct the discharge piping of the pressure relief valve so that hot water does not splash on the operator or equipment.
- Attach the discharge line to the pressure relief valve and install the end of the line within 6-12 in (150-300 mm) above the floor.
- Ensure that the discharge line provides complete and unobstructed drainage. Do not install a reducing coupling or other restrictions on the discharge line.

If the relief valve discharges periodically, this may be caused by thermal expansion when the expansion tank is full or undersized. Do not plug the relief valve.

The illustration below shows an example of a pressure relief valve and an air vent installed with the PRV-air vent adapter included in the accessory box. Use the included nipple to attach the pressure relief valve to the adapter.



Note

Depending on the installation conditions, pressure relief valves (not included and for separate purchase) of up to 150 psi can be used.



CAUTION

All separately purchased pressure relief valves must be ASME certified.

3.1.3 Space Heating System Piping

When connecting the space heating system, follow these guidelines:

- Carefully tighten all connections to avoid damage to fittings.
- After installing the boiler, check the space heating system's operation and inspect for leaks.

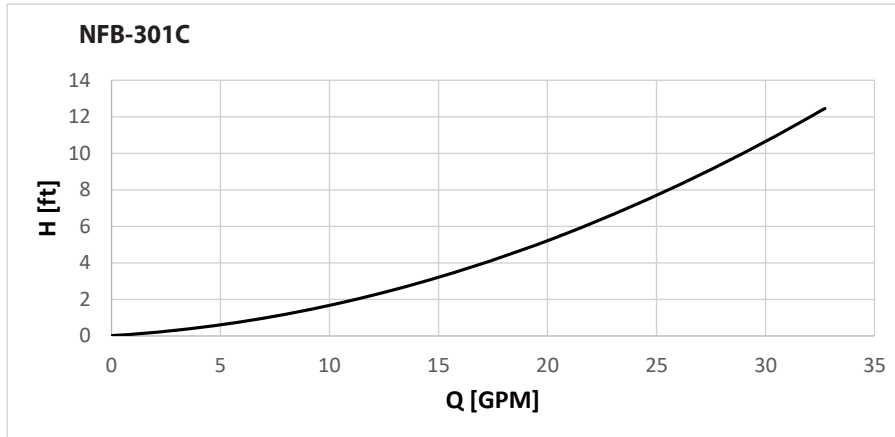
Pump Specifications

Model	Temp. Rise	Pump Model			
		Grundfos	Taco	Bell & Gossett	Armstrong
NFB-301C	20°F	UPS26-150	2400-60	NRF-36	E8.2
	25°F	UPS26-150	0013	NRF-36	E7.2
	35°F	UPS26-99	0010	NRF-36	E7.2
NFB-399C	20°F	UPS26-150	2400-60	NRF-45	E11.2
	25°F	UPS26-150	0013	NRF-45	E8.2
	35°F	UPS26-99	0010	NRF-36	E7.2

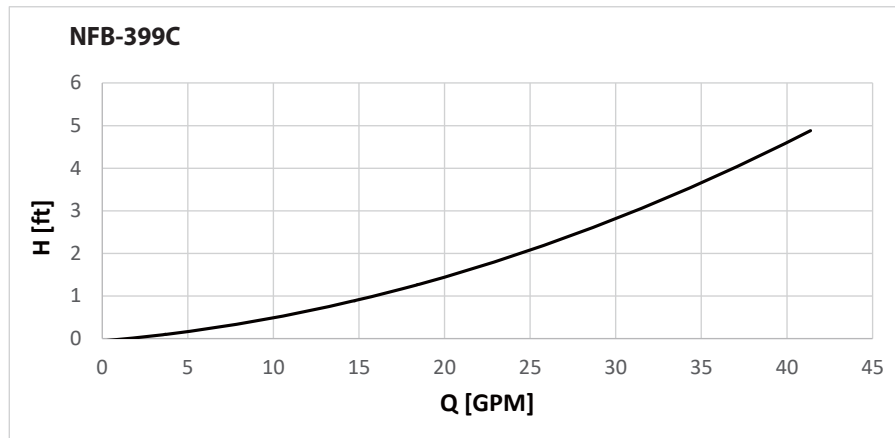
Note

If you are not using one of the pumps listed in the above tables, use a pump with an integral check valve or install a check valve at the pump outlet. Refer to the performance curve on page 25 to select a pump that suits your application. The dry contacts on the boiler can supply up to a maximum of 5 A current at the boiler pump connection terminal.

PQ Curve



Q [GPM]	0.0	5.0	11.5	14.5	17.0	19.0	22.0	25.0	28.0	30.0	32.5
H [ft]	0.0	0.7	2.0	3.0	4.0	4.5	6.0	7.8	9.9	11.0	12.6



Q [GPM]	0.0	5.0	10.5	15.5	20.0	24.6	27.0	30.0	35.0	40.0	42.0
H [ft]	0.0	0.2	0.5	1.0	1.5	2.0	2.4	2.8	3.6	4.5	4.8

Maximum and Minimum Flow Rates through the Boiler

Model	Minimum Pipe Diameter	Maximum Flow (GPM)	Minimum Flow (GPM)
NFB-301C	1 1/4"	32	10
NFB-399C	1 1/2"	42	12

Temperature Rise Conditions

Model	20°F ΔT @ 100% water		25°F ΔT @ 100% water		35°F ΔT @ 100% water	
	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)
NFB-301C	29	10.5	24	7.4	17	4.0
NFB-399C	39	4.3	31	3.0	22	1.8

Pump Sizing for Use with Glycol

The use of glycol results in a greater head loss due to its higher viscosity compared to water. Heat transfer is also reduced as the glycol concentration increases. The corrected flow rate and head loss values below must be used when sizing the boiler pump in order to maintain similar performance as using 100% water for the heating system. Refer to the chart below.

Model	20°F ΔT @ 30% glycol		25°F ΔT @ 30% glycol		35°F ΔT @ 30% glycol	
	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)
NFB-301C	32	12.6	25	8.9	18	4.8
NFB-399C	42	5.2	33	3.6	24	2.2

Model	20°F ΔT @ 50% glycol		25°F ΔT @ 50% glycol		35°F ΔT @ 50% glycol	
	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)
NFB-301C	35	14.7	28	10.4	20	5.6
NFB-399C	46	6.0	37	4.2	26	2.5

Minimum Flow Rates through the Boiler for Use with Glycol

Model	Minimum Flow (GPM)	
	For Use With 30% glycol	For Use With 50% glycol
NFB-301C	11	12
NFB-399C	13	14

3.2 Connecting the Condensate Drain

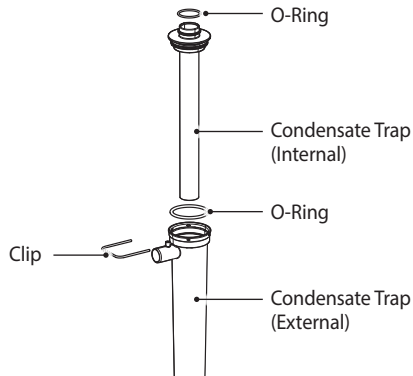
The Navien NFB boiler creates condensation when it operates. This condensation has an acidic pH of 3-5. Follow all local codes and regulations when disposing of condensate from the boiler. Navien recommends draining the condensate into a laundry tub, as the alkali in laundry detergent will neutralize the acid in the condensate. However, other suitable waste drain locations may be used according to the local codes.

CAUTION

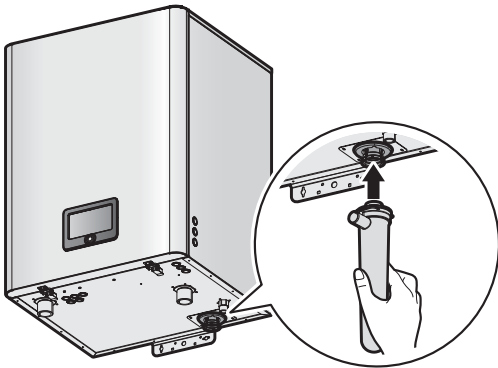
- Do not cap or plug the integrated condensate line. If prevented from draining, condensate can damage the boiler.
- The condensate line must have a negative slope to drain properly.

To attach the condensate trap to the boiler:

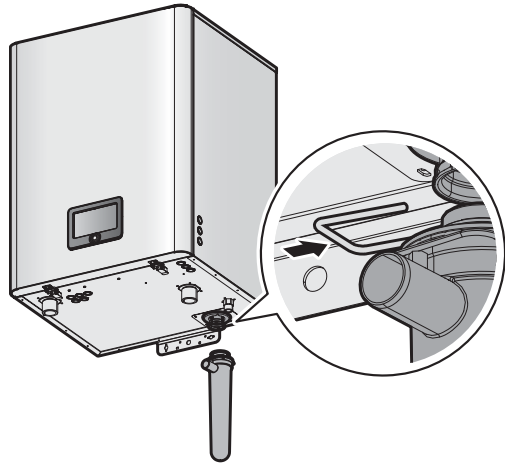
1. Check for all components of the condensate trap as shown below.



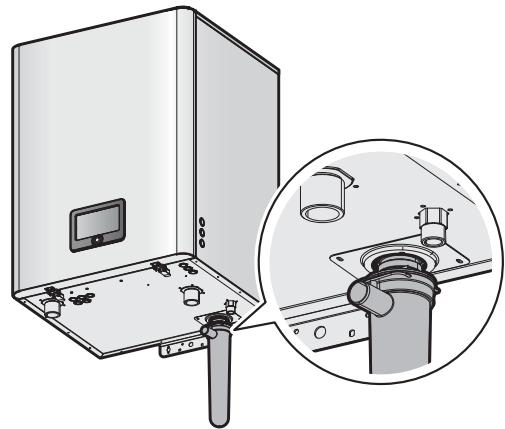
2. Insert the condensate trap to the drain adapter at the bottom of the boiler.



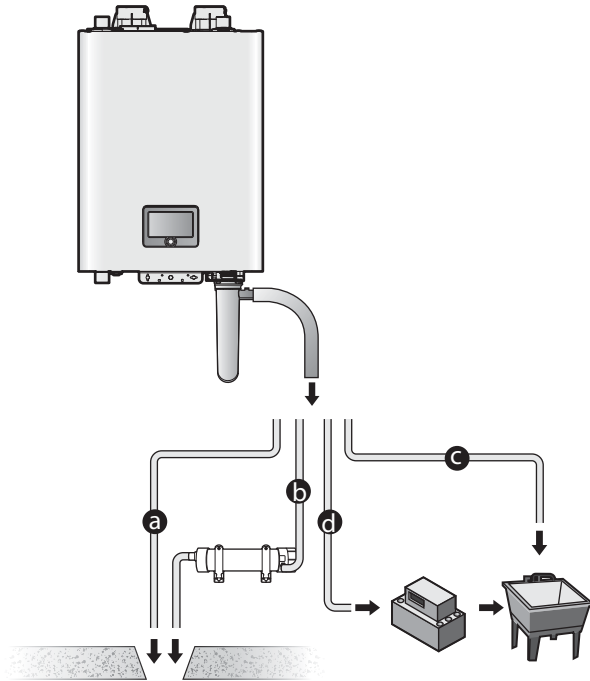
3. Attach the clip to the condensate trap.



4. Ensure that the condensate trap is firmly fixed to the bottom of the boiler.



Before connecting the condensate drain, choose one of the following disposal options:



a. From the boiler directly into an external drain.

Note Do not install a fixed connection for the drain.

b. From the boiler, through a neutralizing agent, and then into an external drain (refer to “3.2.1 Light Commercial Condensate Neutralizer Kit” on page 28).

Note If you choose this option, the neutralizing agent must be replaced periodically. Depletion of the neutralizing agent will vary, based on the usage rate of the boiler. During the first year of operation, the neutralizer should be checked every few months for depletion and replaced as needed.

c. From the boiler into a laundry tub.

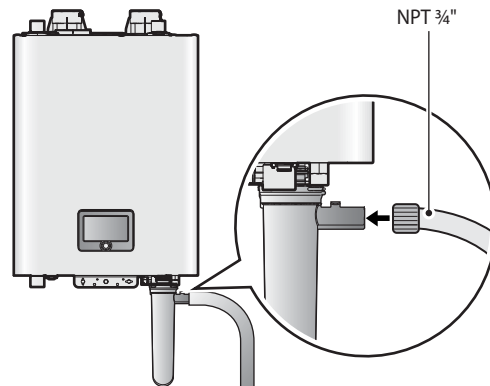
Note The bottom of the boiler must be higher than the top of the laundry tub to use this option. The condensate line must have a negative slope to drain properly.

d. From the boiler into a condensate pump, and then into a laundry tub.

Note A pump can be used when there is a long distance between the boiler and the laundry tub or when the bottom of the boiler is lower than the top of the laundry tub.

To connect the condensate drain:

1. Connect a drain line to the $\frac{3}{4}$ in fitting at the bottom of the boiler.
Use only corrosion-resistant material for the drain line, such as PVC or CPVC. Do not reduce the size of this fitting or the drain line to less than $\frac{3}{4}$ in.



2. Place the free end of the drain line into an appropriate drain.
3. If you are using a condensate pump, ensure that the pump allows for up to 6 GPH of drainage for each boiler in the system.
4. If you are not using a condensate pump, ensure that the drain line is pitched downward at a minimum slope of $\frac{1}{4}$ in per foot.

3.2.1 Light Commercial Condensate Neutralizer Kit

WARNING

- To avoid damaging the appliance, the neutralizer inlet and discharge must be lower than the condensate drain.
- Do NOT allow exhaust flue gases to vent through the neutralizer. Leakage can cause injury or death from carbon monoxide.
- The connection between the appliance and the neutralizer must be installed properly to prevent the backflow of condensate into the appliance.
- Do not connect more than one appliance to the neutralizer.

If option 'b' (p. 28) is selected as the disposal option, the Navien light commercial condensate neutralizer kit is recommended. The condensate from the appliance flows through the neutralizing media and increases the pH of the condensate. An increased pH prevents corrosion of the installation's drainage system and the public sewer system.

Installation

- The inlet has a center connection port on the side of the unit and the outlet has a side connection.
- Install the neutralizer on the wall or the floor and secure it using the brackets supplied with the kit.
- When mounting on the wall or floor, the neutralizer must be installed in a **horizontal** position as shown in Figure 1 below.
- Ensure that the condensate runs freely to the drain.
- Ensure all connections are made to prevent the backflow of condensate. Use corrosion resistant piping and secure all piping to prevent movement.

Note Do not install condensate piping in areas where the temperature drops below freezing point. Protect piping in high pedestrian areas from damage and vibration.

- For increased safety when the condensate drain blocks, install a Y-fitting. Connect the Y-fitting as shown in the installation diagram and ensure that the condensate runs freely to the drain.
- Ensure that the discharge connection is accessible. Access to the discharge connection is required for maintenance and pH testing.
- If there is insufficient gradient for drainage, install a drainage pump designed for boiler condensate removal.

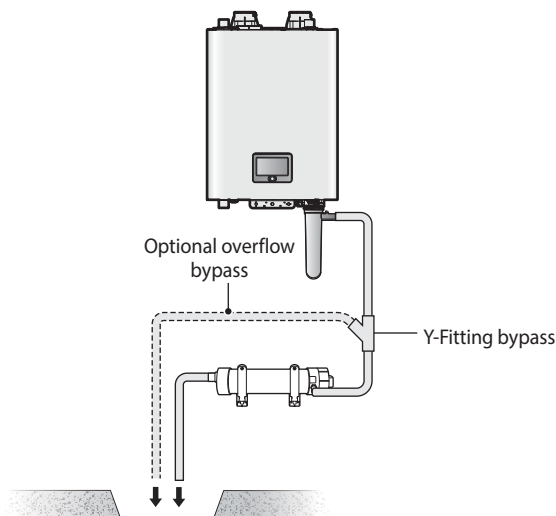


Figure 1. Neutralizer Installation Example

Maintenance

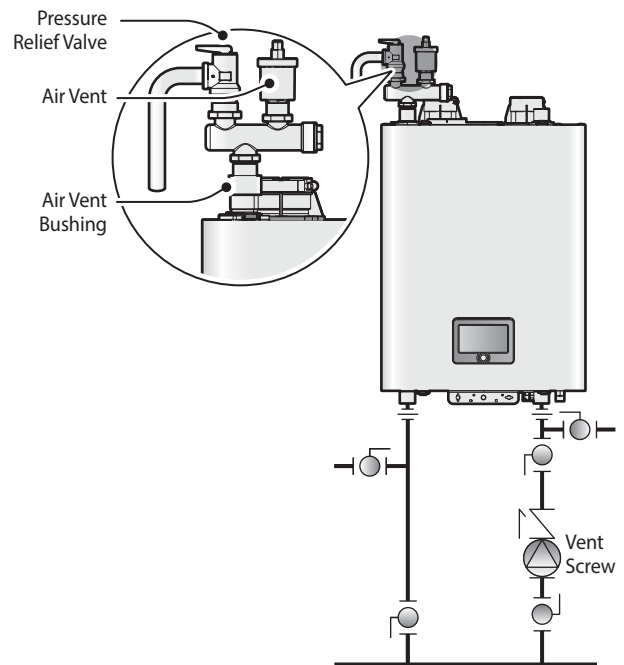
Periodically monitor the level of media in the neutralizer and test the pH level at the outlet. We recommend an annual pH test using recognized test strips or an electronic pH meter to obtain precise measurements. Replace the neutralizing media when the pH drops below the minimum level required by the local water authority. If the pH level is not specified, replace the neutralizing media when the pH is below 6.0. For replacement media, contact your local Navien distributor.

3.3 Filling the System

Before filling the boiler, completely unscrew and remove the air vent cap to enable the system to fill properly. Also, loosen the vent screws on the system and boiler pumps to prevent the air from being trapped inside the pumps.

Note If the air vent cap is only partially loosened, the air vent may not allow for the boiler to fully purge. The cap must be completely unscrewed and removed to complete the procedure.

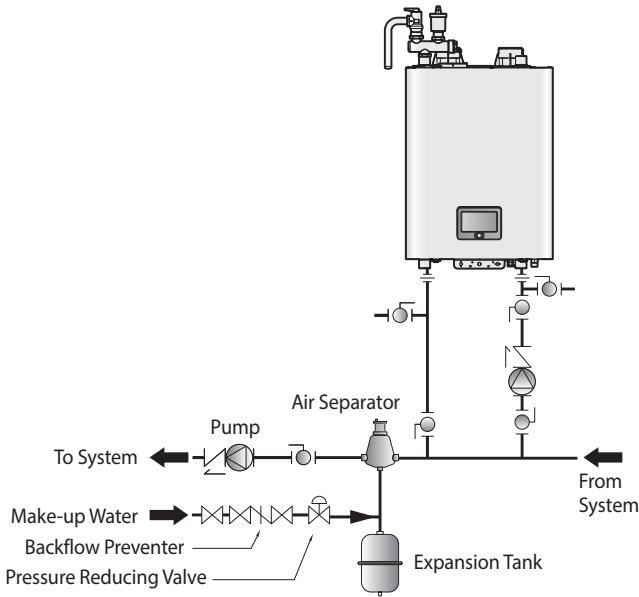
Tighten the air vent cap and tighten the vent screws on the pumps when the system is full.



Note Ensure that the vent cap is re-installed and the vent screws on the system and boiler pumps are properly tightened before testing or operating the system.

3.3.1 Make-up Water Connection

An external make-up water connection is required. The illustration below shows an example of an external water supply connected to the system piping.



3.4 Testing the Water System

WARNING

Ensure that the boiler is full of water before firing the burner. Operating the unit without completely filling it will damage the boiler. Such damage is not covered by the warranty, and may result in property damage, severe personal injury, or death.

Perform a leak test after installing the boiler's water system to make sure that the system has been installed properly. Follow the instructions below to perform a leak test on the water system.

1. Fill the system only after ensuring that the water chemistry meets the requirements.

Contaminant	Maximum Allowable Level
Total Hardness	Up to 200 mg/l (12 grains/gallon)
Aluminum	0.05 to 0.2 mg/l
Chloride	Up to 250 mg/l
Copper	Up to 1.0 mg/l
Iron	Up to 0.3 mg/l
Manganese	Up to 0.05 mg/l
pH	6.5 to 8.5
Sulfate	Up to 205 mg/l
Total Dissolved Solids (TDS)	Up to 500 mg/l
Zinc	Up to 5 mg/l
Chlorine	Up to 4 mg/l

Note Proper maintenance of the boiler is required when water quality does not meet standards. Damage caused by poor water quality is not covered under warranty. The table above shows the maximum contaminant levels allowed. If you suspect that your water is contaminated in any way, discontinue the use of the boiler and contact an authorized technician or licensed professional.

2. Close the manual and automatic air vents and the boiler drain valve.
3. Fill the boiler to the correct system pressure. The correct pressure will vary with each application. The typical cold water fill pressure for a residential system is 12 psi. The pressure will rise when the boiler is turned on and the system water temperature increases. The operating pressure must never exceed the relief valve pressure setting.
4. At initial fill and during boiler start-up and testing, check the system thoroughly for leaks. Repair any leaks before proceeding further.



WARNING

Eliminate all system leaks. The continual introduction of fresh makeup water will reduce boiler life. Minerals can build up in the heat exchanger, reducing heat transfer, overheating the heat exchanger and causing heat exchanger failure.

The system may have residual substances that could affect water chemistry. After the system has been filled and leak tested, verify that water pH and chlorine concentrations are within the acceptable range by performing sample testing.



CAUTION

Purge the air inside the system to avoid damage to the boiler.

3.5 Considerations for System Applications

Read and follow the guidelines listed below when installing system piping for the Navien NFB boiler:

- System application drawings are intended to explain the system piping concept only.
- For the upstream side of all pumps, use straight pipes with a minimum inside diameter of 1/2 in (12 mm).
- Provide a system expansion tank following the guidelines on page 22.
- System installations must comply with all local codes.

Air Removal

The boiler and system piping layout must be configured to promote the removal of air from the system. Air vents and bleeders must be strategically placed throughout the system to aid in purging the air from the system during commissioning of the boiler. The system must also employ the use of an air removal device, such as an air scoop or an air eliminator designed to remove the air from the water as it flows through the system.

Follow the installation instructions included with the air removal device when placing it in the system; air removal devices generally work better when placed higher in the system. Always locate air removal devices in areas of the system that have a guaranteed positive pressure, e.g., in close proximity to the water fill and expansion tank.

Note

Connecting an air vent on top of the boiler is recommended.

Expansion Tank

The expansion tank must be sized in accordance with the water volume of the system as well as the firing rate of the appliance. It is important to locate the expansion tank, and make-up water connection, on the inlet side of any pump in the system, as doing so will guarantee the lowest pressure in the system will be at least equal to the tank and make-up water pressure.

Ensure the expansion tank cannot become isolated from the boiler anytime the system is operating. Failure to follow these instructions may lead to discharge from the pressure relief valve, which may result in property damage or injury.

Note

The installation of check valves, motorized valves or other shutoff devices (other than for the purpose of servicing) are not permitted between the location of the "Closely Spaced Tees" and the expansion tank.

Air Handler Interface

The Navien NFB boiler can control the operation of an air handler when a thermostat is used in combination with the air handling unit. The Air Handler Interface is designed to stop air handler operation when the boiler's space heating function is not operating due to DHW supply demands, boiler errors, or low water conditions.

The air handler contacts (A/H) turn off when the following conditions arise:

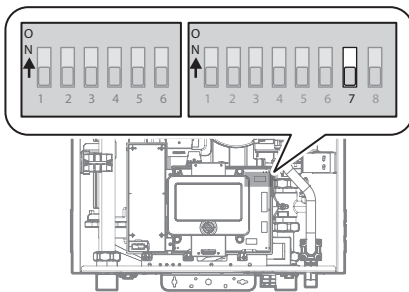
- The PCB DIP SW2 #7 is set to ON.
- Thermostat is turned off.
- The boiler is supplying DHW, or it is in stand-by mode for DHW demand.
- Level 2 or higher errors occur.
- The boiler is turned off.

Configuring a Zone System

The NFB boiler can control up to 3 pump zones using the built-in dry contacts. After installing the system, the boiler operation must be configured accordingly using the front panel.

Thermostat Configuration for the Air Handler Interface

Set the PCB DIP SW2 #7 to down position (OFF) to use a thermostat with the Air Handler.



Refer to “3.6.7 Wiring Diagram - Air Handler” on page 42 for wiring connections.

DHW System

Use an indirect tank when configuring a DHW system that consists of basic boiler applications or cascade applications.

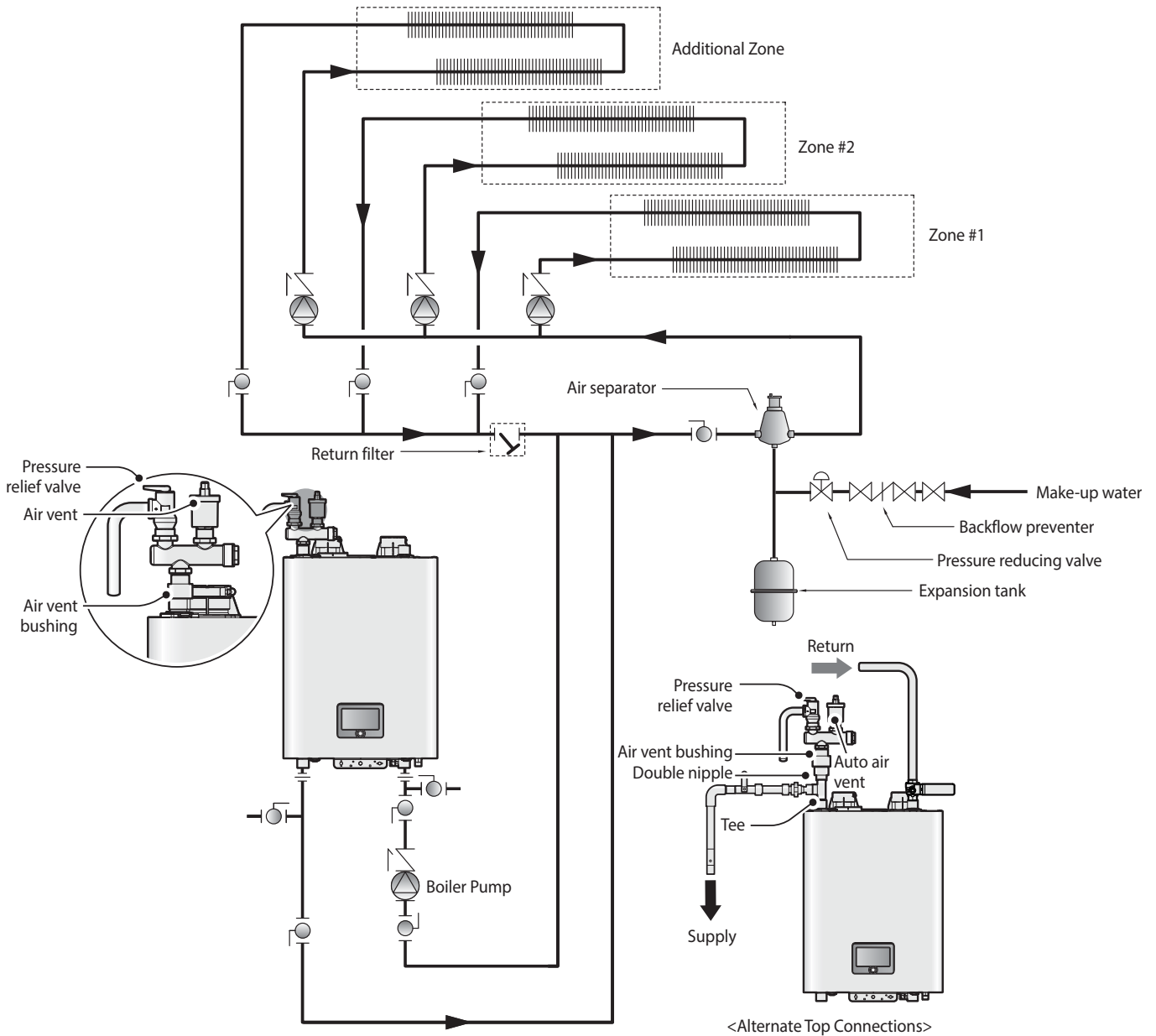
WARNING

- The boiler, when used in conjunction with an air conditioning system, must be installed so that the chilled medium is piped in parallel with the heating boiler. Appropriate valves must be used to prevent the chilled medium from entering the boiler.
- If the boiler is connected to heating coils located in air handling units where they can be exposed to refrigerated air, use flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

3.5.1 Examples of System Applications

Refer to the following examples to properly implement a system for space heating, DHW supply, or both. These examples are provided to suggest basic guidelines when you install the boiler system. However, the actual installation may vary depending on the circumstances, local building codes, or state regulations. Check the local building codes and state regulations thoroughly before installation, and comply with them fully.

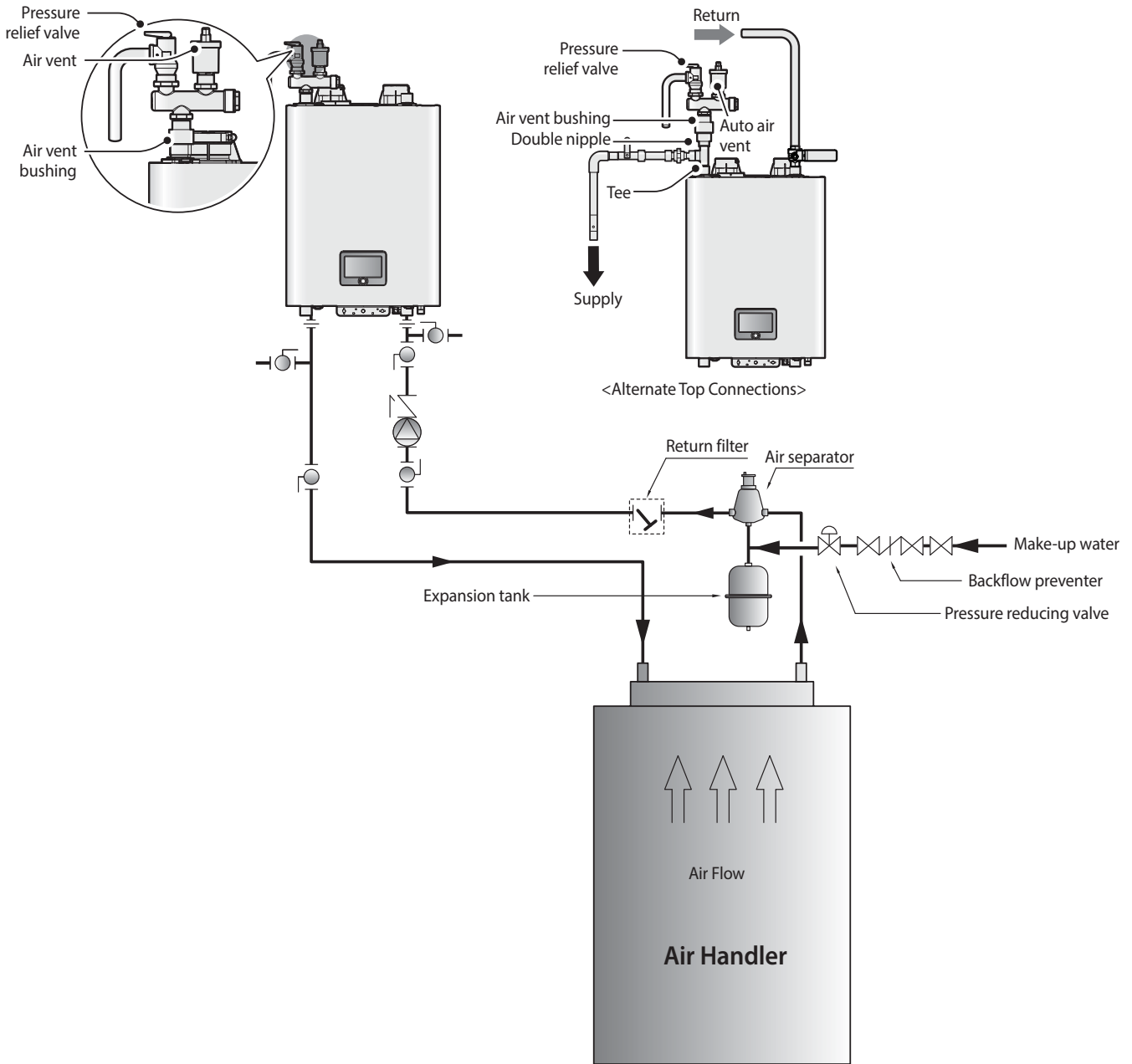
3.5.2 System Application - Zone System with Pumps (Primary/Secondary Piping)



Note

- System application drawings are intended to explain the system piping concept only.
- Install a filter in the system return to remove foreign objects from the system. Foreign objects inside the system may result in abnormal system operation.
- Refer to “3.3 Filling the System” on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
- Use a pump with an integral check valve or install a check valve at the pump outlet.
- Refer to “3.6.6 Wiring Diagram - Generic Zone System with Circulators” on page 42 for wiring connections.
- Depending on the installation environment, the supply top and return top piping option can be applied.

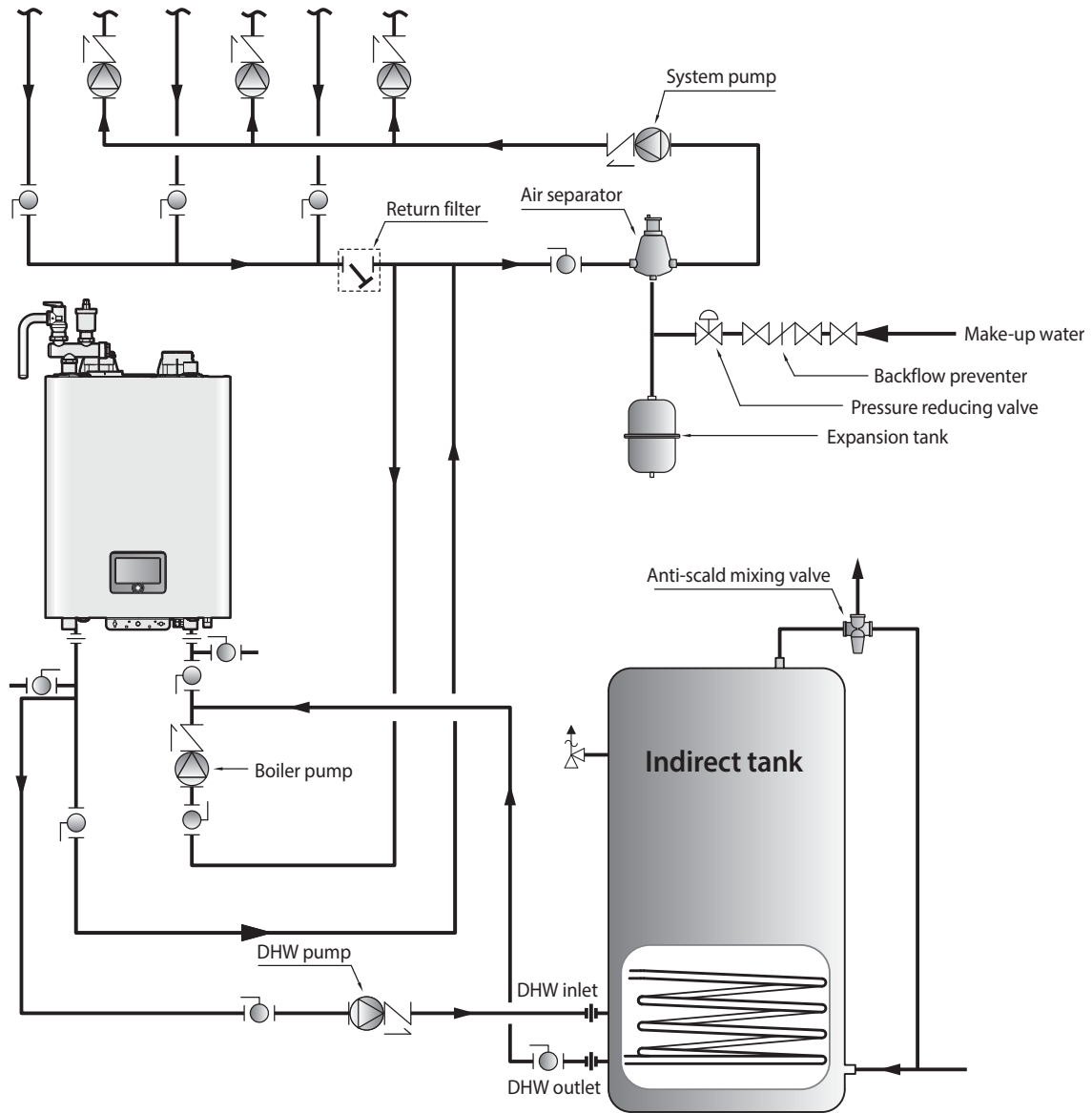
3.5.3 System Application - Air Handler System



Note

- System application drawings are intended to explain the system piping concept only.
- Install a filter in the system return to remove foreign objects from the system. Foreign objects inside the system may result in abnormal system operation.
- Refer to “3.3 Filling the System” on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
- Air handlers with an internal pump shall be piped either with a crossover pipe at the AHU or in a primary/secondary configuration with the boiler.
- Refer to the “3.6.7 Wiring Diagram - Air Handler” on page 42 for wiring connections.
- You can use a secondary piping configuration for the air handler system to maintain optimal flow and heat capacity.
- Depending on the installation environment, the supply top and return top piping option can be applied.

3.5.4 System Application - DHW System with Indirect Tank (Primary/Secondary Piping)



Note

- System application drawings are intended to explain the system piping concept only.
- Install a filter in the system return to remove foreign objects from the system. Foreign objects inside the system may result in abnormal system operation.
- Refer to “3.3 Filling the System” on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
- Refer to the “3.6.8 Wiring Diagram - DHW System with Indirect Tank” on page 43 for wiring connections.

3.6 Examples of Electrical Connections

WARNING

Improperly connecting the electrical supplies can result in electrical shock and electrocution. Follow all applicable electrical codes of the local authority having jurisdiction. Connecting the electrical components should be performed only by a licensed professional.

CAUTION

Label all wires before disconnecting them when you work on the controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

Note The installation must comply with National Electrical Code and any other national, state, provincial or local codes or regulations. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes. Wiring must be N.E.C. Class 1. If original wiring as supplied with boiler must be replaced, use only type 105 °C wire or equivalent. Boiler must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

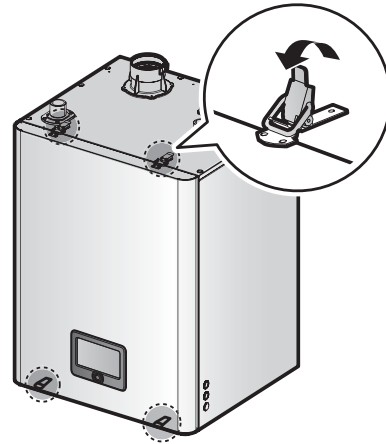
3.6.1 Accessing the Terminal Strips

DANGER

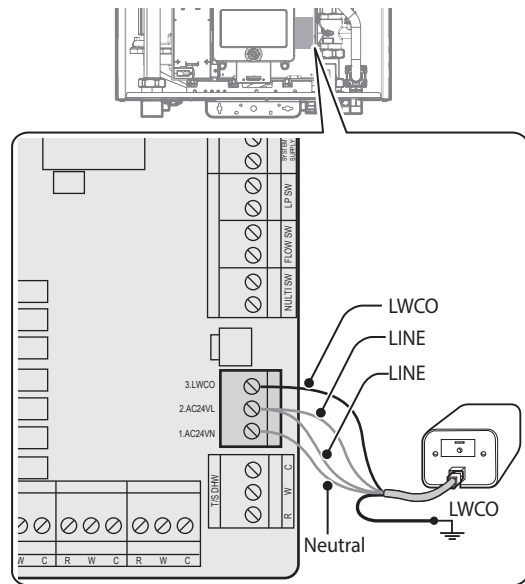
You must ensure that the boiler is disconnected from the electrical supply before carrying out any servicing inside the boiler and, particularly, on the electric terminal strips.

To access the PCB, carefully follow the steps below:

1. Turn off the power supply to the boiler.
2. Unfasten the 4 latches (2 at the top and 2 at the bottom) to remove the front cover and gain access to the internal components.

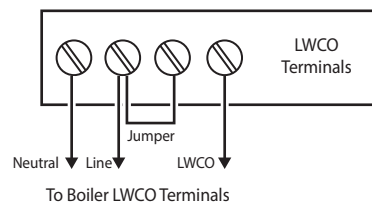


3.6.2 Wiring Diagram - External LWCO



Note The boiler supplies 24 VAC at the LWCO power terminals (CNC3).

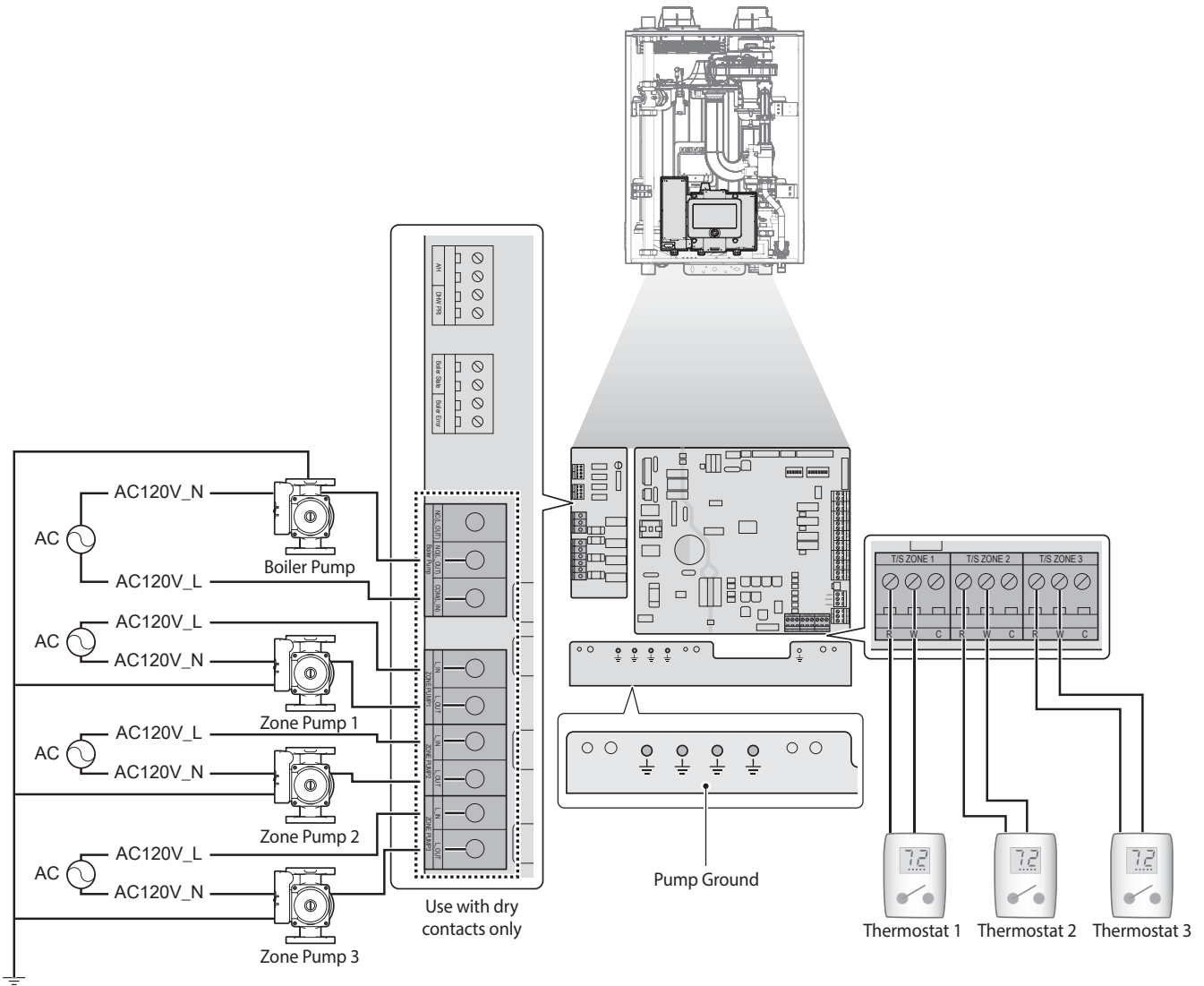
For terminal type LWCO devices, a typical wiring method is shown below (same voltage for control and burner circuit):



3.6.3 Wiring Diagram - Zone Pump System

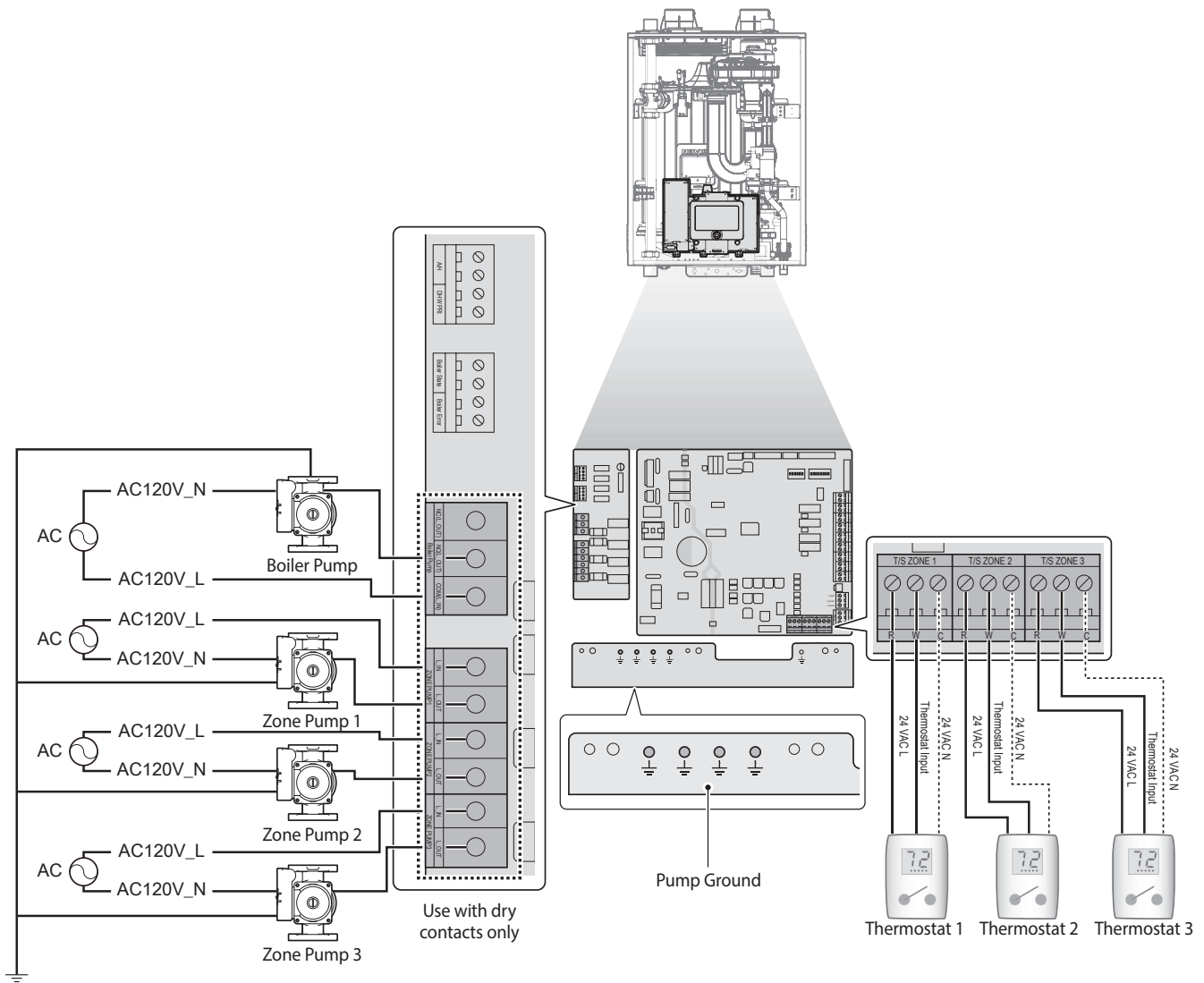
The NFB Boilers can operate a heating system with up to 3 zones. The following is the wiring diagram for a zone pump system with 3 zones.

Zone Pump Dry Contact Connections (No 24 VAC Power) and Thermostats without 24 VAC Power



Note The rated load of the provided dry contacts are designed to be 5 A/120 V per each output.

Zone Pump Dry Contact Connections (No 24 VAC Power) and Thermostats with 24 VAC Power



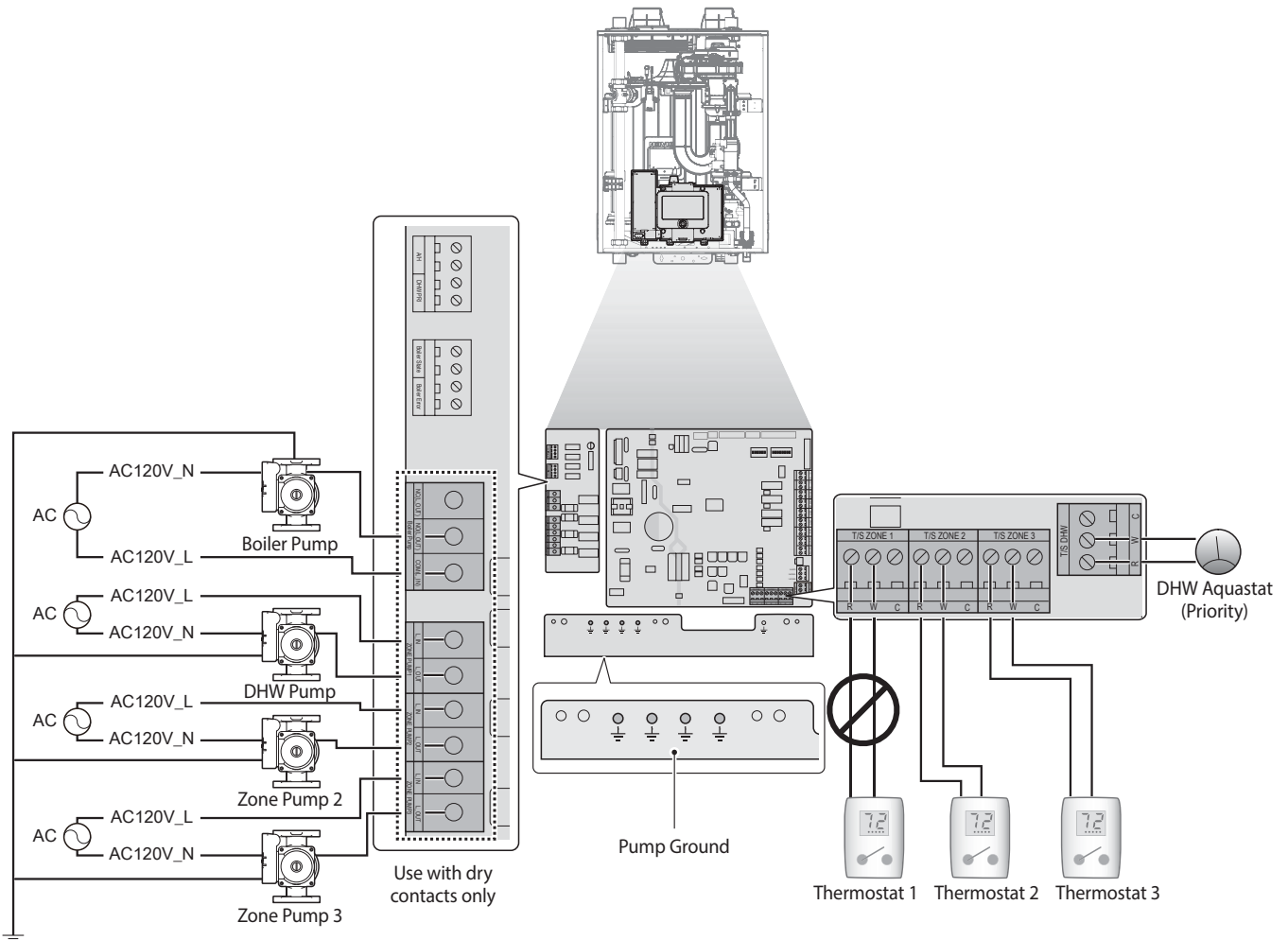
Note

- If you have a 24 V thermostat, connect it to the R & C terminals on the boiler's PCB.
- The C terminals are for optional connections with 24 V thermostat COMMON.
- The rated load of the provided dry contacts are designed to be 5 A/120 V per each output.

3.6.4 Wiring Diagram - Zone Pump System with DHW Tank

The NFB Boilers can operate a heating system with up to 2 zones and 1 DHW Tank. The following is the wiring diagram for a zone pump system with 2 zones and 1 DHW Tank.

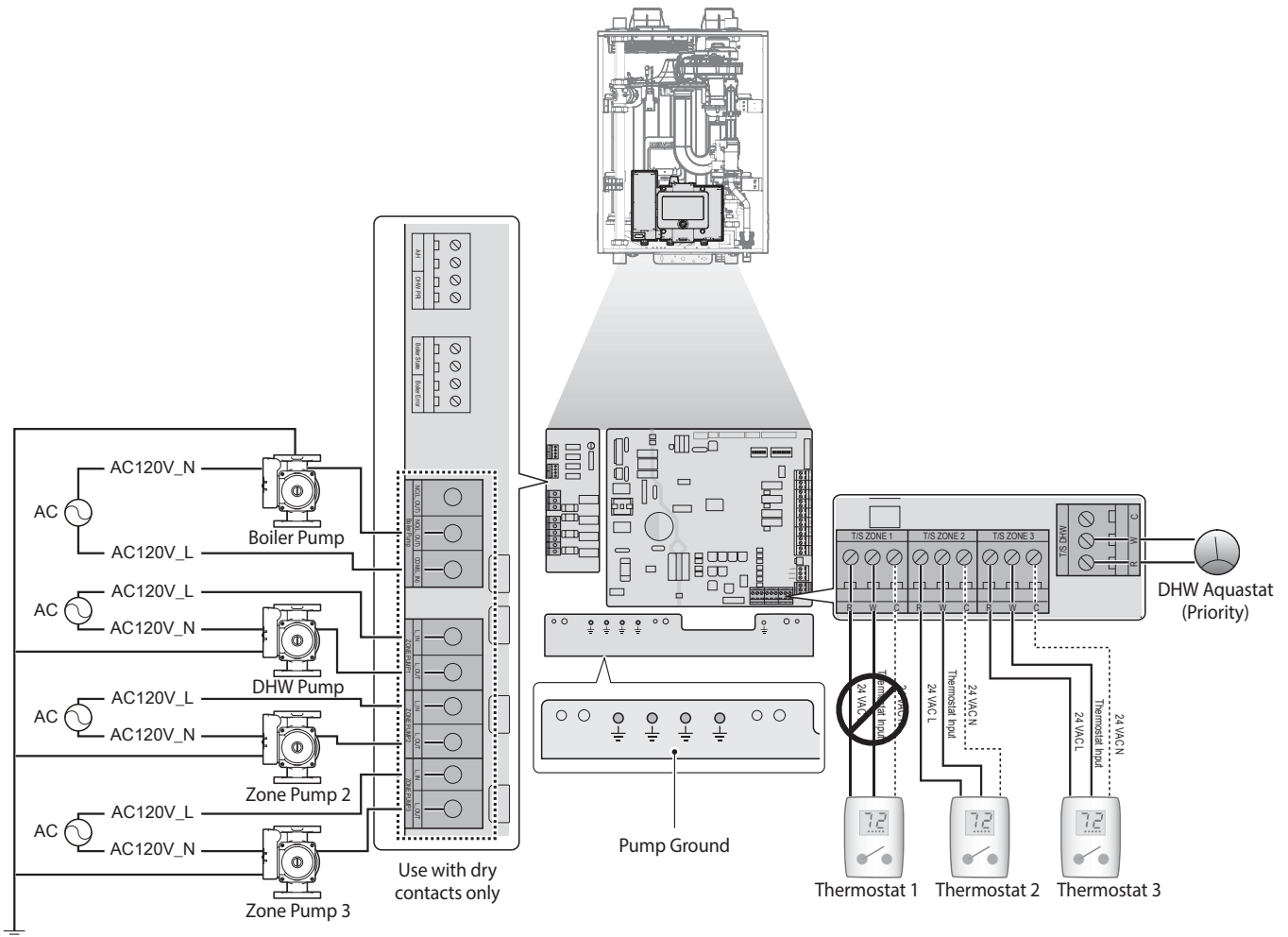
Zone Pump Dry Contact Connections (No 24 VAC Power) and Thermostats/DHW Aquastat without 24 VAC Power



Note

- If the DHW Tank is connected to the terminal, the T/S Zone 1 input is not available.
- Pumps are connected through dry contact connections.
- The rated load of the provided dry contacts are designed to be 5 A/120 V per each output.

Zone Pump Dry Contact Connections (No 24 VAC Power) and Thermostats/DHW Aquastat with 24 VAC Power



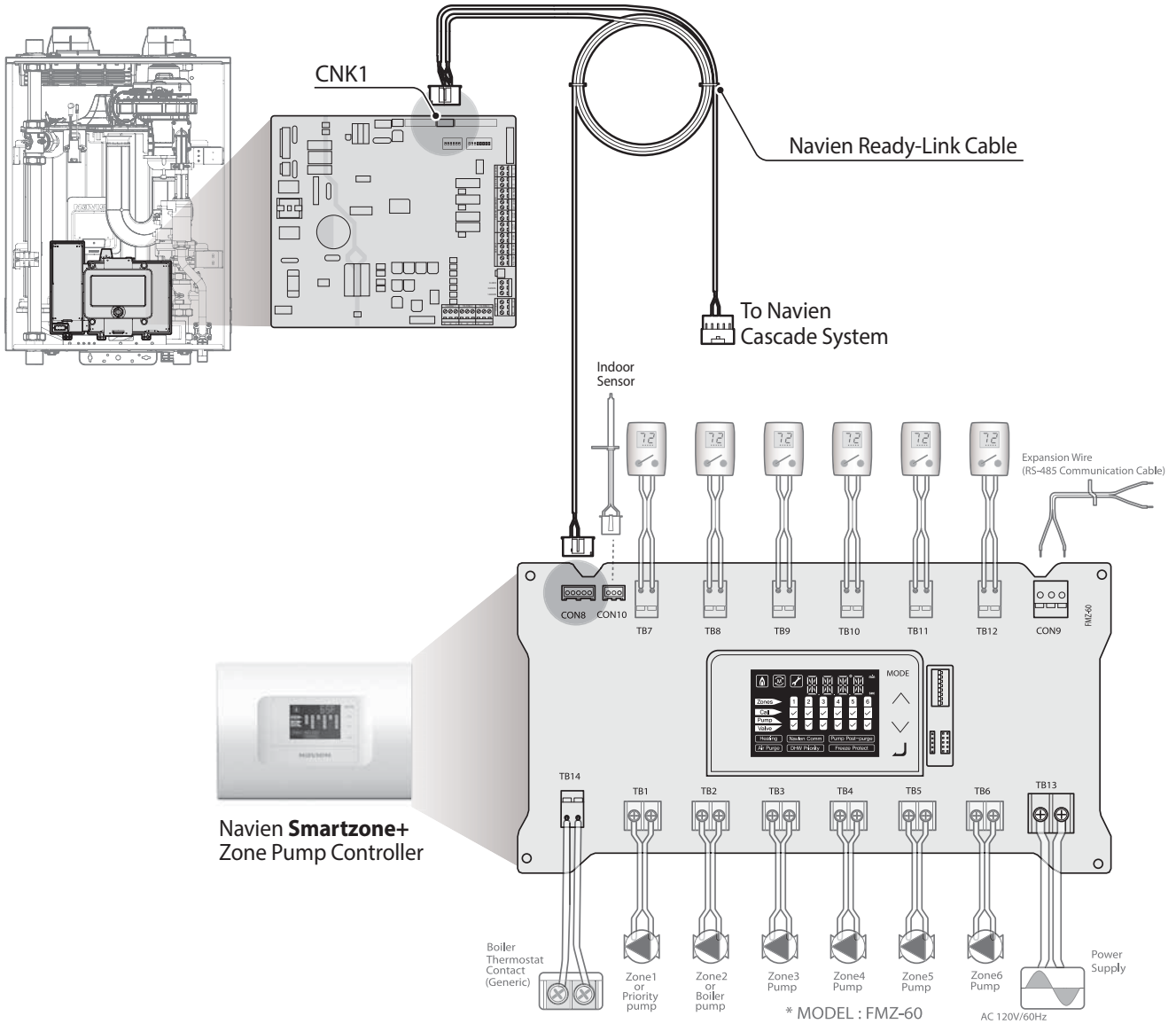
Note

- The C terminals are for optional connections with 24 V thermostat COMMON.
- If the DHW Tank is connected to the terminal, the T/S Zone 1 input is not available.
- Pumps are connected through dry contact connections.
- The rated load of the provided dry contacts are designed to be 5 A/120 V per each output.


3.6.5 Wiring Diagram - the Navien SmartZone +

The Navien Smart Zone + controller may be used with the NFB Boilers to operate a heating system with more than 3 zones.

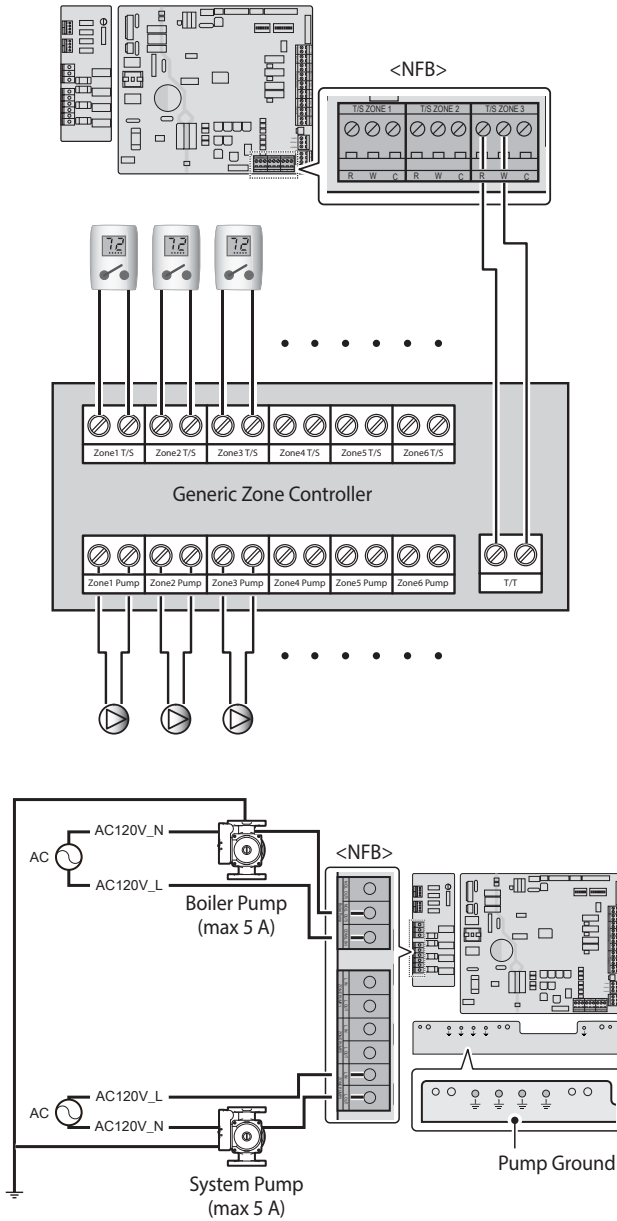
When Navien boilers are used with a Navien Smartzone+ zone pump controller, an RS-485 data communication link is established through the Ready-link connection. This allows the controller and the boiler to share operational information and to control the zones more efficiently by minimizing unnecessary pump operation. The communication link also provides an optimal control environment for freeze protection.



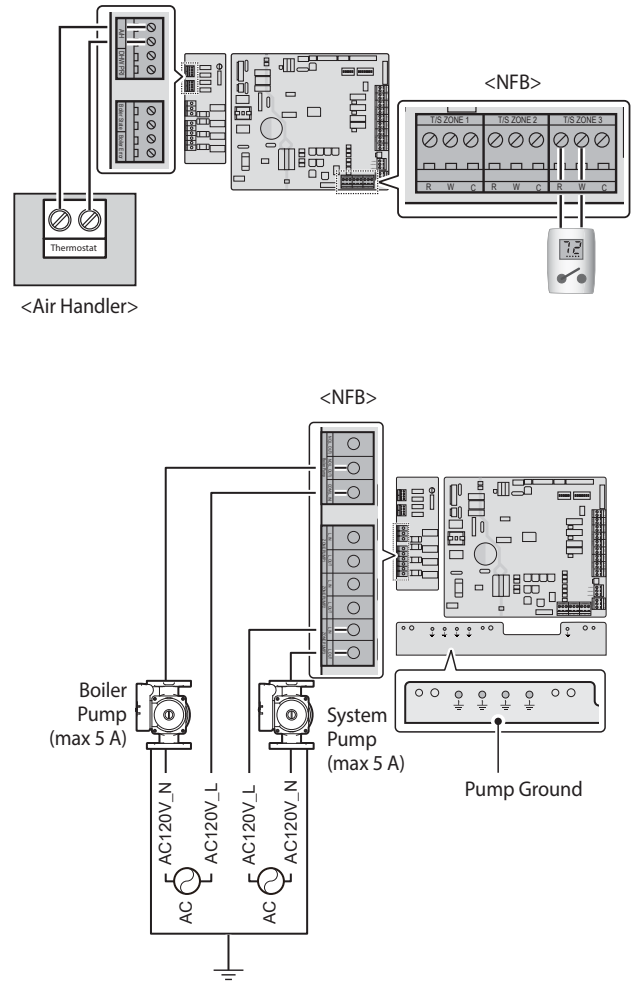
Refer to the user manual that is supplied with the Navien Smartzone+ zone pump controller for details.

Note The Navien zone controller option in the Ext Connection menu must be set to "ON." To view the Navien zone controller setting, tap the Set button  > **Ext Connection** on the front panel.

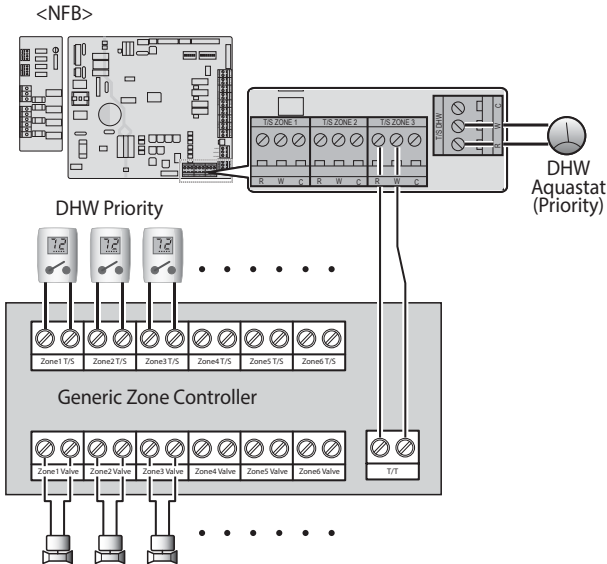
3.6.6 Wiring Diagram - Generic Zone System with Circulators



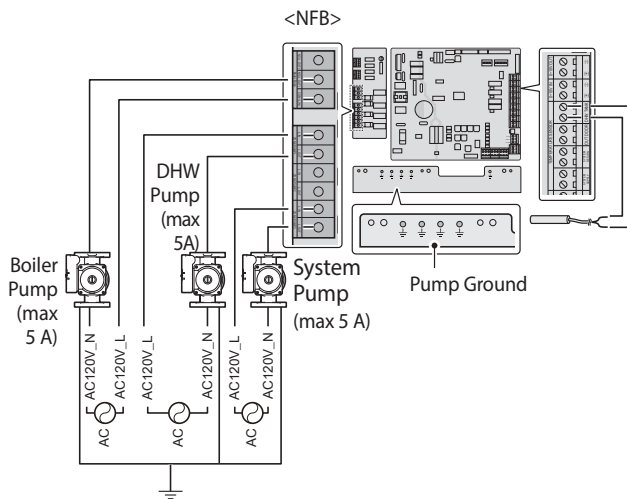
3.6.7 Wiring Diagram - Air Handler



3.6.8 Wiring Diagram - DHW System with Indirect Tank



Note When using zone controllers, the DHW demand lines must be connected to the NFB boilers.

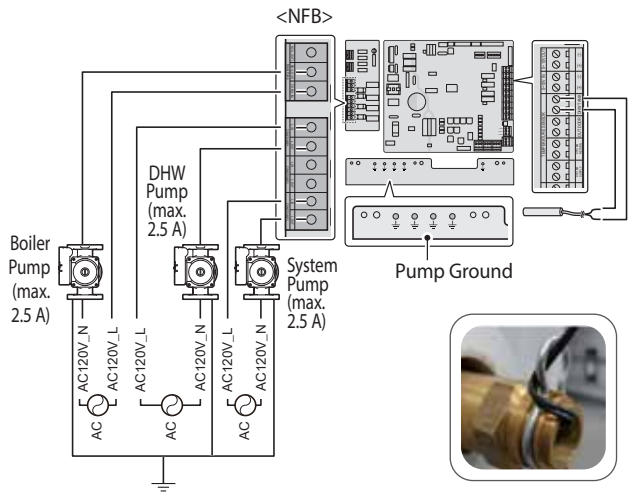


When connecting the DHW Tank Sensor

The Navien Universal Temperature sensor can be used as a DHW Tank Sensor. When installing the Universal Temperature sensor to the boiler, follow these guidelines:

- This sensor is compatible for use with aquastat immersion wells. Attach an aquastat immersion well to the DHW tank before installing the sensor.
- When installing the sensor to the tank, verify that the sensor is completely inserted into the immersion well.
- Install the included clip on the groove on the immersion well as shown in the illustration.
- Insert the wire through the available eyelet on the clip then wrap it around the clip once to fix the sensor to the well.
- Complete the installation by connecting the wires to the DHW Tank terminals located on the PCB.

Note When inserting the sensor into the immersion well, heat conductive paste can be used to improve thermal transfer between the two components.



Note Use only Navien Universal Temperature sensor.

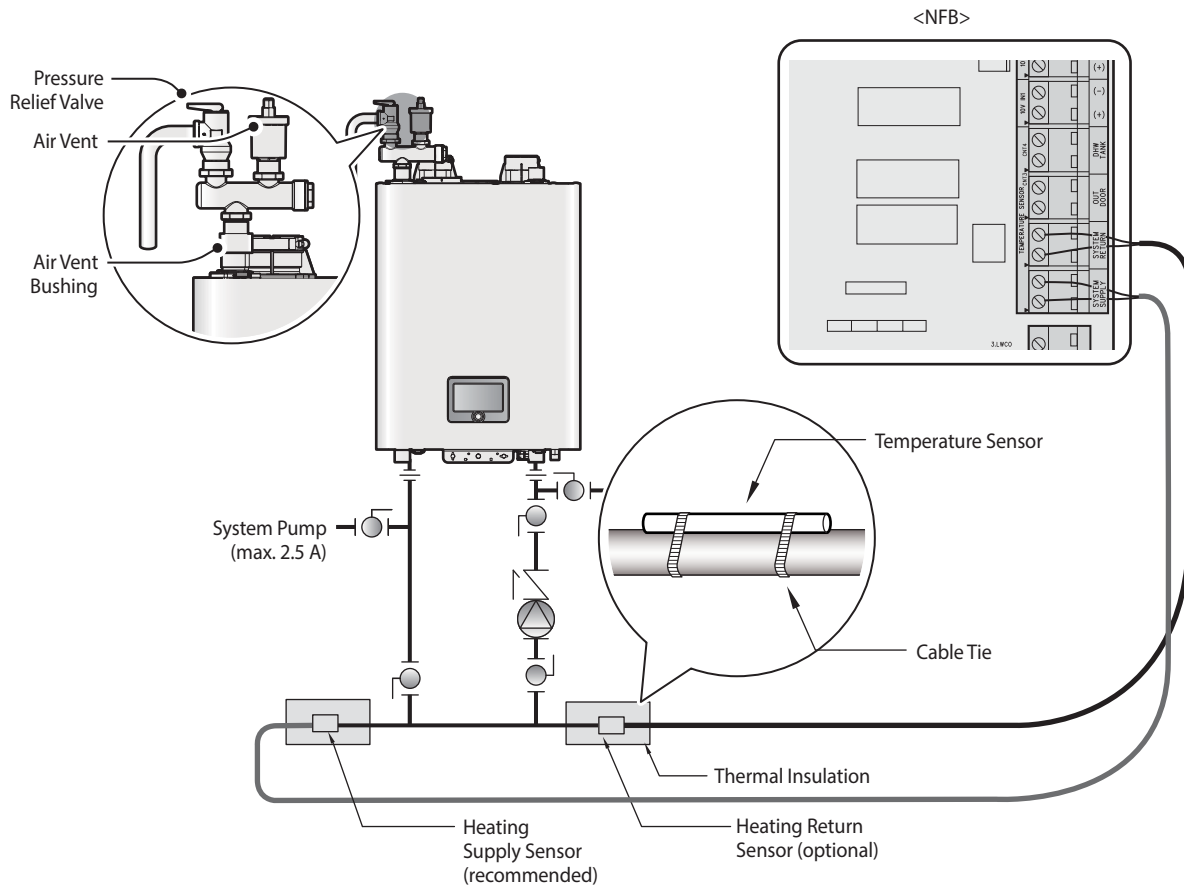
When installing the DHW Tank Sensor




! WARNING

Use only the Navien Universal Temperature sensor (#GXXX001769). The use of other sensors may result in higher water temperatures than expected.

3.6.9 Wiring Diagram - Optional Supply/Return Temperature Sensors



Note

- To control the boiler supply or return water temperature using the external temperature sensors, configure the system accordingly.
- On the front panel, tap the Control button () > **SH Control**, and select one of the SH Control Method options.
- Additional universal temperature sensors are available for purchase where Navien products are sold.
- Refer to "11.5.2 Setting the Space Heating Operation" on Page 93 for details.

3.7 Connecting External devices (Field Wiring Guidelines)

To connect external devices to the controller terminals of the main PCB, remove the front cover, and then refer to “11.5.2 Setting the Space Heating Operation”. For detailed wiring information, refer to “3.6 Examples of Electrical Connections”.

3.7.1 Thermostat

Connect thermostats to the T/S ZONE1, 2, and 3 terminals (**CNC1**, **CNC5**, and **CNC6**). Also, install thermostats in walls where they are not interfered with by vents, hot or cold water pipe lines, lighting, televisions, or sunlight.

Note If the Pump1 Setting menu on the SH Control menu is set to **Zone1 Pump**, Thermostat 1 cannot be used.

3.7.2 DHW Thermostat

Connect an indirect water heater (DHW) thermostat to the T/S DHW terminal (**CNC7**).

Note

- If the DHW Demand menu on the DHW Control menu is set to **Tank Sensor**, the DHW thermostat is ignored.
- If the Pump1 Setting menu on the SH Control menu is set to **Zone1 Pump**, the DHW thermostat is ignored.

3.7.3 DHW Tank Sensor

Connect the Navien universal temperature sensor (#GXXX001769) to the DHW TANK terminal (**CNT4**).

The boiler tank temperature can be adjusted if a DHW tank sensor is installed. If the tank temperature decreases below the set temperature of 5°F (3°C), the boiler starts and stops operating when the set temperature is reached. The values of the DHW Demand On/Off Differential can be adjusted by setting the parameters.

Note

- If the DHW Demand menu on the DHW Control menu is set to **Aquastat**, the DHW tank sensor is ignored.
- If the Pump1 Setting menu on the SH Control menu is set to **Zone1 Pump**, the DHW tank sensor is ignored.
- If the Navien universal temperature sensor (#GXXX001769) is not compatible with the DHW tank, use a DHW thermostat to control the boiler.

3.7.4 System Supply/Return Sensor

Connect the system supply/return sensors to the SYSTEM SUPPLY terminal (**CNT1**) and the SYSTEM RETURN terminal (**CNT2**).

If the Navien universal temperature sensor (#GXXX001769) is installed to the secondary loop, the system supply unit temperature can be adjusted. It controls the boiler's heat and maintains the system supply temperature at the set temperature.

Note To select the space heating control method, tap the Control button (🔧) > **SH Control** on the screen, and then select **Sys Supply** (System Supply Temperature) or **Sys Return** (System Return Temperature) on the SH Control Method menu.

3.7.5 Outdoor Temperature Sensor

Connect the Navien outdoor temperature sensor to the OUTDOOR terminal (**CNT3**). Also, install the sensor on the wall and avoid areas with temperature fluctuations due to direct sunlight, and where the temperature may not be representative of the true outdoor temperature.

3.7.6 Flow Switch

Remove the jumper cable connected to the FLOW SW terminal (**CNC9**) and connect a flow switch to the FLOW SW terminal (**CNC9**). The flow switch is installed at the bottom of the boiler and is used to check water flow through the boiler.

3.7.7 Manual Reset Safety Switch

Connect an external safety device, such as a louver switch or a low gas pressure switch, to the MANUAL terminal (**CNC8**). Only external safety devices with relay output contacts are available. Even if an error from the connected external safety device occurs, the error is cleared with a manual reset.

Note To select the contact type for the connected external safety device, tap the Set button (⚙️) > **Ext Connection** on the screen, and then select **N-Open** (Normal open type) or **N-Closed** (Normal closed type).

3.7.8 Auto Reset Safety Switch

Connect an external safety device, such as a louver switch or a low gas pressure switch, to the AUTO terminal (**CNC10**). Only external safety devices with relay output contacts are available. An error alert from the connected external safety device is released automatically based on the connected external safety device settings.

Note To select the contact type for the connected external safety device, tap the Set button (⚙️) > **Ext Connection** on the screen, and then select **N-Open** (Normal open type) or **N-Closed** (Normal closed type) on the Auto Reset Safety Switch menu.

3.7.9 Modbus/BACnet

If a Modbus/BACnet gateway is installed, connect the RS-485 cables to the 3-pin terminal block located on the right side of the front panel. For detailed wiring information, refer to the Modbus/BACnet Installation manual.

Note To provide sufficient communication quality and sensitivity, use twisted pair cables such as UTP or CAT5 cables.

3.7.10 0-10 V VDC Input

Connect a 0-10 V VDC input signal to the 0-10 V IN terminal (**CNU1**), if the BMS system requires 0-10 V signals to control the set temperature.

Note If the BMS Status menu on the EMS Set menu is set to **Enabled**, the set temperature is automatically controlled based on the input signals.

3.7.11 0-10 V VDC Output

Depending on the space heating control methods, the supply or return water temperature can be measured with 0-10 V signal output. The current temperature in the BMS system can be monitored using this signal output.

3.7.12 Air Handler

The air handler provides output through the boiler controller depending on the space heating operation status. If space heating is in operation, the air handler's contact is on. If the space heating is not in operation, the air handler's contact is off. When using an air handler, set the air handler to operate during the operation of space heating only.

3.7.13 DHW Priority

The DHW priority provides output through the boiler controller. When the DHW mode is on while there is a space heating demand, the DHW priority's contact is on. Other than during this status, the DHW priority's contact is off. Use a DHW priority to check the status of the zone controller or DHW priority.

3.7.14 Boiler State

The boiler state contact outputs from the boiler controller. The boiler state contact is turned on during combustion. Other than this status, the boiler state contact is turned off. Use a boiler state contact to check the boiler status.

3.7.15 Boiler Error

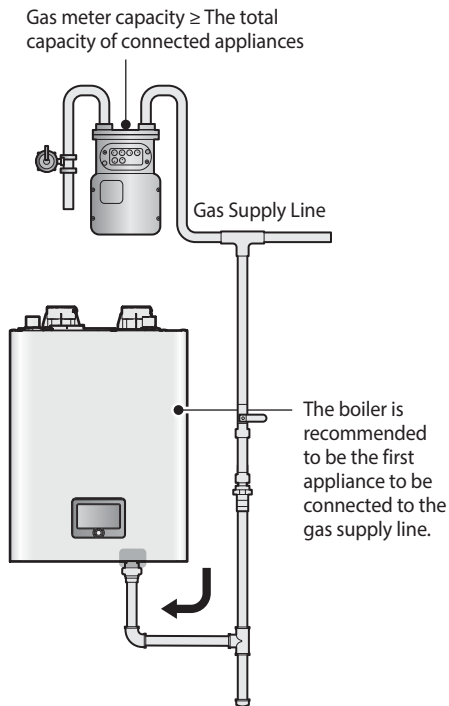
The boiler error contact provides a boiler error status. The boiler error contact is turned on when an error occurs. Other than this, the boiler error contact is turned off. Use a boiler error contact to check the boiler error status.

4. Connecting the Gas Supply

WARNING

- Before connecting the gas supply, determine the gas type and pressure for the boiler by referring to the rating plate. Use only the same gas type indicated on the rating plate. Using a different gas type will result in abnormal combustion and malfunction of the boiler. Gas supplies should be connected by a licensed professional only.
- The appliance and its gas connection must be leak tested before placing the appliance in operation.
- This boiler cannot be converted from natural gas to propane or vice versa without a Navien gas conversion kit. Do not attempt a field conversion of this boiler without a Navien gas conversion kit. Doing so will result in dangerous operating conditions and will void the warranty.

Navien recommends connecting the boiler as the first device downstream of the gas meter, to ensure a sufficient gas supply.



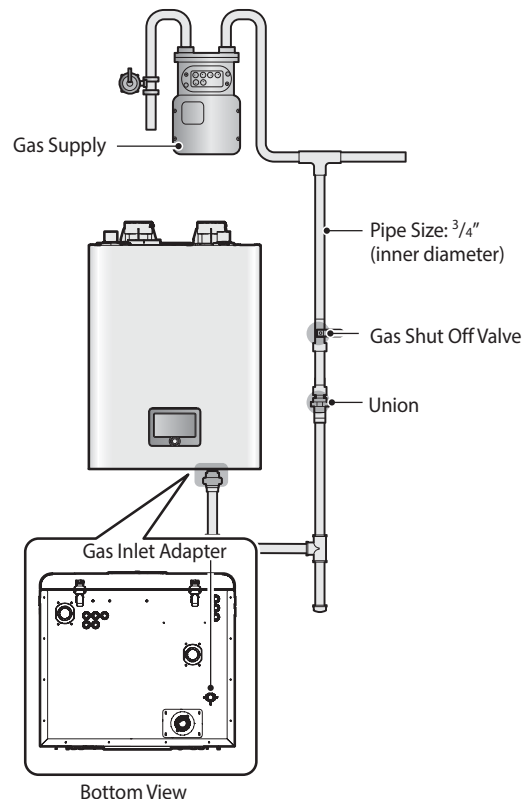
To connect the gas supply:

1. Determine the gas type and pressure for the boiler by referring to the rating plate.
2. Perform a pressure test on the main gas supply line.
3. Purge the gas line of any debris.
4. Determine the proper size and type for the gas line. Refer to the tables that follow.

Note Refer to the instructions provided with the gas regulator for the minimum pipe distance between the regulator and the appliance.

5. Install certified full port valves on the gas supply line and boiler.
6. Connect the gas supply line.
7. Test the supply line, all connection points, and the boiler for gas leaks.

Note Tighten the boiler connection valves with care to avoid damage.



CAUTION

- Install a manual gas shut-off valve between the gas supply line and the boiler.
- A sediment trap must be provided upstream of the gas controls.

Note

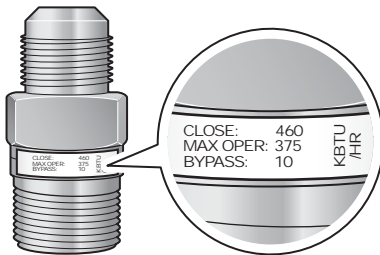
- Tighten the boiler connection valves with care to avoid damage.
- The gas connection fitting on all boilers is $\frac{3}{4}$ in.
- $\frac{3}{4}$ in rigid pipe can be used; refer to the sizing tables on the preceding pages for limitations. Avoid using $\frac{3}{4}$ in corrugated connectors or tubing as noise may occur.

**Corrugated Connector**

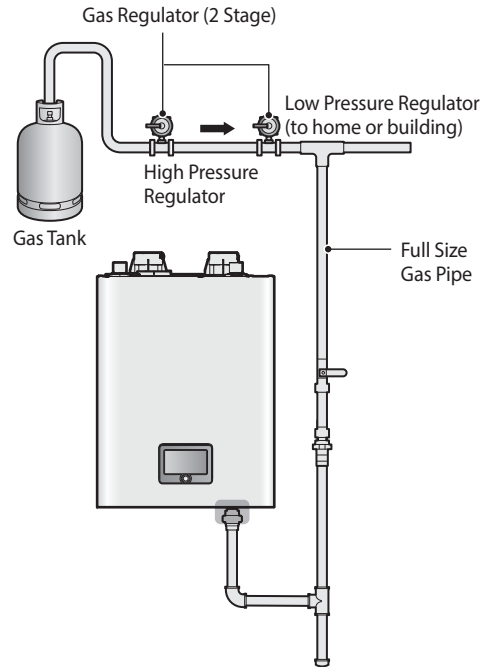
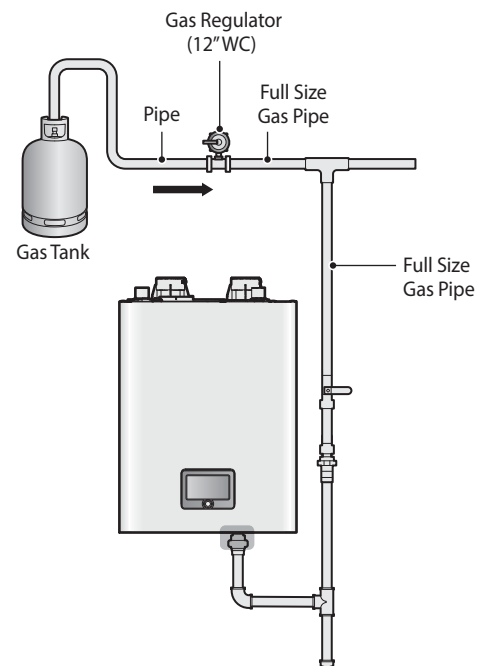
- When using flexible gas lines, ensure that the pipe's inner diameter and connector is sufficient to supply the required BTUs. Also, ensure that the flexible line has no crimps or tight bends in it, as this will restrict gas flow.
- When using rigid pipe, Navien recommends the installation of a union on the gas supply line close to the boiler, to facilitate any future maintenance or service.

**CAUTION**

Prior to using an excess flow valve (EFV) in the gas line, check the manufacturer's minimum and maximum flow capacity rating. An improperly sized EFV will not allow for a full flow of gas to the boiler and may cause improper operation.

**Excess Flow Valve**

Typical LP Gas piping examples:

2 Stage System with Multiple Regulators (Recommended)**Single Regulator System**

4.1 Gas Pipe Sizing Tables

The following tables are referenced from 2012 National Fuel Gas Code for reference only. Please consult the gas pipe manufacturer for actual pipe capacities.

Maximum Natural Gas Delivery Capacity

In Cubic Feet (ft³) per Hour (0.60 Specific Gravity; 0.5 in WC Pressure Drop). Contact your gas supplier for BTU/ft³ ratings. Use 1,000 BTU/ft³ for simplified calculations. This table is recommended for supply pressures less than 6 in WC.

Pipe Size	Length (including fittings)										
	10 ft (3 m)	20 ft (6 m)	30 ft (9 m)	40 ft (12 m)	50 ft (15 m)	60 ft (18 m)	70 ft (21 m)	80 ft (24 m)	90 ft (27 m)	100 ft (30 m)	125 ft (38 m)
3/4 in	360	247	199	170	151	137	126	117	110	104	92
1 in	678	466	374	320	284	257	237	220	207	195	173
1 1/4 in	1,390	957	768	657	583	528	486	452	424	400	355
1 1/2 in	2,090	1,430	1,150	985	873	791	728	677	635	600	532
2 in	4,020	2,760	2,220	1,900	1,680	1,520	1,400	1,300	1,220	1,160	1,020
2 1/2 in	6,400	4,400	3,530	3,020	2,680	2,430	2,230	2,080	1,950	1,840	1,630
3 in	11,300	7,780	6,250	5,350	4,740	4,290	3,950	3,670	3,450	3,260	2,890
4 in	23,100	15,900	12,700	10,900	9,660	8,760	8,050	7,490	7,030	6,640	5,890

In Cubic Feet (ft³) per Hour (0.60 Specific Gravity; 3.0 in WC Pressure Drop). Contact your gas supplier for BTU/ft³ ratings. Use 1,000 BTU/ft³ for simplified calculations. This table is recommended for supply pressures of 6 in WC or greater.

Pipe Size	Length (including fittings)										
	10 ft (3 m)	20 ft (6 m)	30 ft (9 m)	40 ft (12 m)	50 ft (15 m)	60 ft (18 m)	70 ft (21 m)	80 ft (24 m)	90 ft (27 m)	100 ft (30 m)	125 ft (38 m)
3/4 in	949	652	524	448	397	360	331	308	289	273	242
1 in	1,787	1,228	986	844	748	678	624	580	544	514	456
1 1/4 in	3,669	2,522	2,025	1,733	1,536	1,392	1,280	1,191	1,118	1,056	936
1 1/2 in	5,497	3,778	3,034	2,597	2,302	2,085	1,919	1,785	1,675	1,582	1,402
2 in	10,588	7,277	5,844	5,001	4,433	4,016	3,695	3,437	3,225	3,046	2,700
2 1/2 in	16,875	11,598	9,314	7,971	7,065	6,401	5,889	5,479	5,140	4,856	4,303
3 in	29,832	20,503	16,465	14,092	12,489	11,316	10,411	9,685	9,087	8,584	7,608
4 in	43,678	30,020	24,107	20,632	18,286	16,569	15,243	14,181	13,305	12,568	11,139

Maximum Liquefied Propane Delivery Capacity

In Thousands of BTU/H (0.5 in WC pressure drop)

Pipe Size	Length (including fittings)												
	10 ft (3 m)	20 ft (6 m)	30 ft (9 m)	40 ft (12 m)	50 ft (15 m)	60 ft (18 m)	80 ft (24 m)	100 ft (30 m)	125 ft (38 m)	150 ft (45 m)	175 ft (53 m)	200 ft (60 m)	250 ft (76 m)
3/4 in	608	418	336	287	255	231	212	197	185	175	155	140	129
1 in	1,150	787	632	541	480	434	400	372	349	330	292	265	243
1 1/4 in	2,350	1,620	1,300	1,110	985	892	821	763	716	677	600	543	500
1 1/2 in	3,520	2,420	1,940	1,660	1,480	1,340	1,230	1,140	1,070	1,010	899	814	749
2 in	6,790	4,660	3,750	3,210	2,840	2,570	2,370	2,200	2,070	1,950	1,730	1,570	1,440

4.2 Measuring the Inlet Gas Pressure



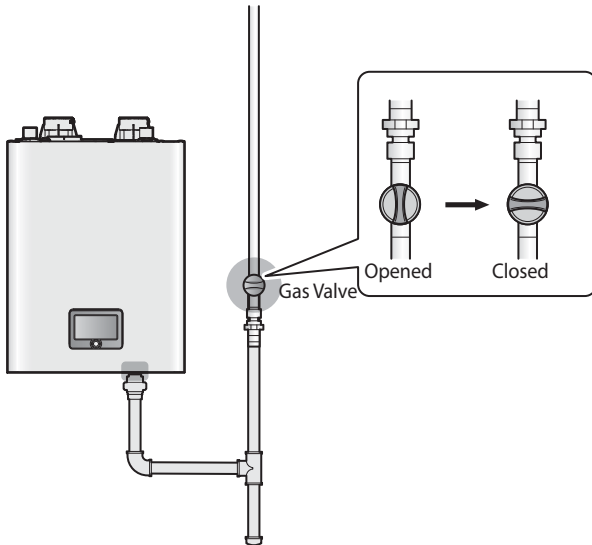
WARNING


The boiler cannot function properly without sufficient inlet gas pressure. Measuring the inlet gas pressure should be performed by a licensed professional only.

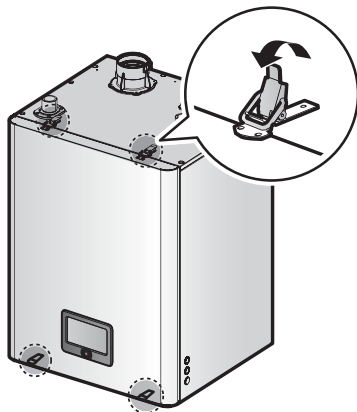
- The inlet gas pressure must be maintained between 3.5 in and 10.5 in WC for natural gas and between 8.0 in and 13.0 in WC for liquefied propane.
- The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi (3.5 kPa).
- The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi (3.5 kPa).

To measure the inlet gas pressure:

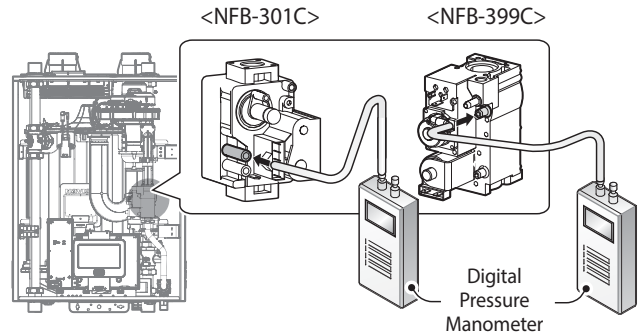
1. Shut off the manual gas valve on the gas supply line.



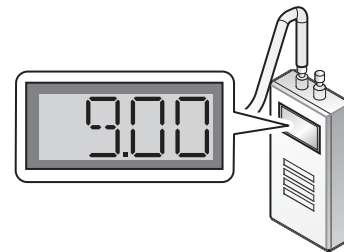
2. Turn on the boiler. On the front panel, tap the Set button  > **Service** > **Setting Op-mode** on the screen.
3. To select the operation mode, tap **2Step MAX**.
4. Tap **Close** to return to normal operation mode.
5. Run space heating. The gas in the gas supply line will be purged.
6. Leave the boiler on until the boiler shuts down due to a lack of gas supply, and then turn off the boiler.
7. Unfasten the 4 latches (2 at the top and 2 at the bottom) to remove the front cover and gain access to the internal components.



8. Loosen the screw indicated in the figure below and connect a manometer to the pressure port. Reset the manometer to zero before use.



9. Re-open the manual gas valve and check for leaks.
10. Activate multiple zones to ramp the boiler up to its maximum firing rate.
11. When the boiler reaches its maximum firing rate, check the inlet gas pressure reading on the manometer. The gas pressure must fall within the ranges specified on page 8.



5. Venting for Combustion Air

Additional Guidelines for Combustion Air

- Combustion air piping to the outside is recommended. (Direct Venting)
- The NFB-C boiler may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option on page 55, specific conditions and considerations must be followed.

WARNING

- Do not install the boiler or combustion air piping in areas with contaminated air (containing a high level of dust, sawdust, sand, flour, aerosols, fluorine or chlorine compounds), as contaminants can cause severe problems.
- Pool and laundry products and common household cleaning products can contain corrosive compounds. If any of the chemicals or vapors enter the boiler, this can result in serious product damage that can even cause the potential for flue gas leakage in extreme cases.
To prevent the potential of severe personal injury or death, check for areas and products listed in the following tables before installing the boiler or air inlet piping.
If contaminants are found in the combustion air, you MUST Remove contaminants permanently or Relocate air inlet and vent terminations to other clean areas.
- The warranty does not cover damage caused by air contaminants.
- If you must install the boiler in an area with contaminated air, use direct venting to supply clean air from outside the building. We recommend regular filter cleaning and maintenance in these areas.

Corrosive Contaminants

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
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products

Corrosive Sources

Dry cleaning/laundry areas and establishments
Swimming pools
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
Garages with workshops

5.1 Venting the Boiler

WARNING

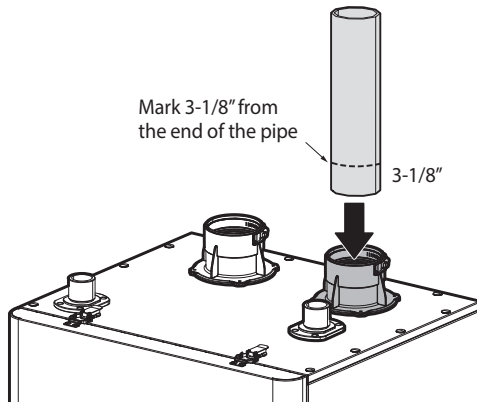
Improper venting of the boiler can result in excessive levels of carbon monoxide, which can lead to severe personal injury or death. **This boiler must be vented in accordance with the “Venting of Equipment” section of the latest edition of the ANSI Z223.1/NFPA 54 Natural Fuel Gas Code in the USA and/or the “Venting systems and air supply for boilers” section of the latest version of the CAN/CGA B149.1 Natural Gas and Propane Installation Code in Canada, as well as all applicable local building codes and regulations.** Follow all instructions and guidelines when venting the boiler. Venting should be performed only by a licensed professional.

The boiler must be properly vented to ensure a constant supply of clean intake air and to ensure that exhaust air is properly removed from living areas. When venting the boiler, follow these guidelines:

- For best results, keep the venting system as short and straight as possible.
- Locate the boiler as close as possible to the vent termination.
- Do not connect the boiler vent to a vent for any other gas boiler from a different manufacturer.
- For horizontal runs, slope the horizontal section upward toward the vent termination at a rate of 1/4 in per foot (2% slope).
- Create an airtight seal at each joint in the exhaust and intake air pipes from the boiler collar to the vent termination.

Connecting the Pipe to the Vent Collar

1. Measure 3-1/8" inches from the end of the vent pipe, then draw a mark at that distance.

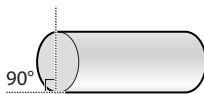


2. Insert the pipe into the vent collar to start the vent run. Make sure to completely slide the vent into the collar until the end makes contact with the bottom of the socket.

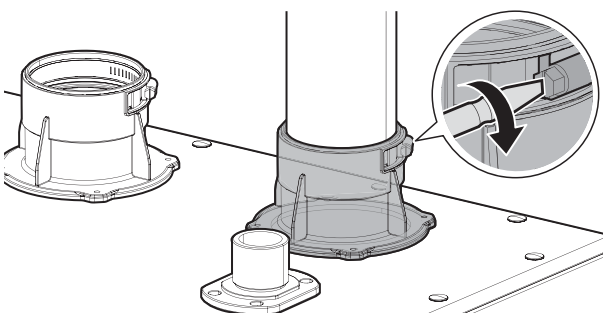
Note Verify that 3-1/8" of the pipe has been completely inserted into the collar and that the mark is no longer visible.

WARNING

Ensure that the vent pipe is properly beveled prior to installation and that the pipe is fully connected to the exhaust gas vent fitting. Failure to properly bevel and install the pipe can lead to gasket failure and flue gas leakage, which may result in serious injury or death.

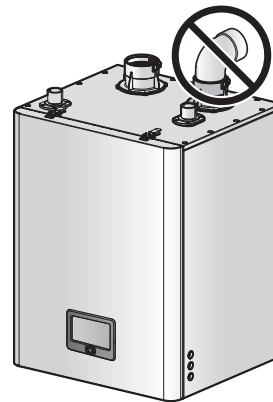


3. Tighten the clamp with a screwdriver to properly seal the joint.



CAUTION

Do not start the vent run with a street elbow at the vent collar. Using an elbow directly at the collar will not allow for a tight seal between the appliances and vent pipe. A length of straight pipe must be used when starting the vent run.



- To avoid moisture and frost build-up and to maintain clearances to openings on adjacent homes, 45° elbows, 90° elbows, or tees may be attached to the end of the termination vent pipe to direct the exhaust plumes away from buildings, as long as the total allowable vent lengths, maximum number of elbows, and distances to air intake restrictions are observed.
- Do not store hazardous or flammable substances near the vent termination.
- If this boiler will be installed in areas where snow is known to accumulate, protect the vent termination from blockage.
- Ensure that the vent termination is at least 12 in (305 mm) above ground, 12 in (305 mm) above the highest anticipated snow level, or as required by local codes, whichever is greater.
- Support the vent pipe with hangers at regular intervals or as required by local codes.
- Exhaust and intake air pipes must be glued and properly supported at least every 4 ft (1.2 m).
- The vent for this appliance shall not terminate over public walkways; or near soffit vents or crawl space vents or where condensate or vapor could create a nuisance or hazard or cause property damage; or where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

DANGER

If the connections leak, harmful flue gas may cause personal injury or death. After completing the installation and filling the boiler with water, turn on the boiler and test for leaks using a bubble test kit. After applying the soap solution, bubbles will form on the connection if any leaks exist.

5.2 Selecting a Vent Type

All boilers are prepared at the factory to be direct vented (sealed combustion). Navien recommends direct air vent installations whenever possible to avoid back drafting cold air through the boiler unit. If you cannot use a direct vent, ensure that an ample supply of make-up air is available in the installation location.

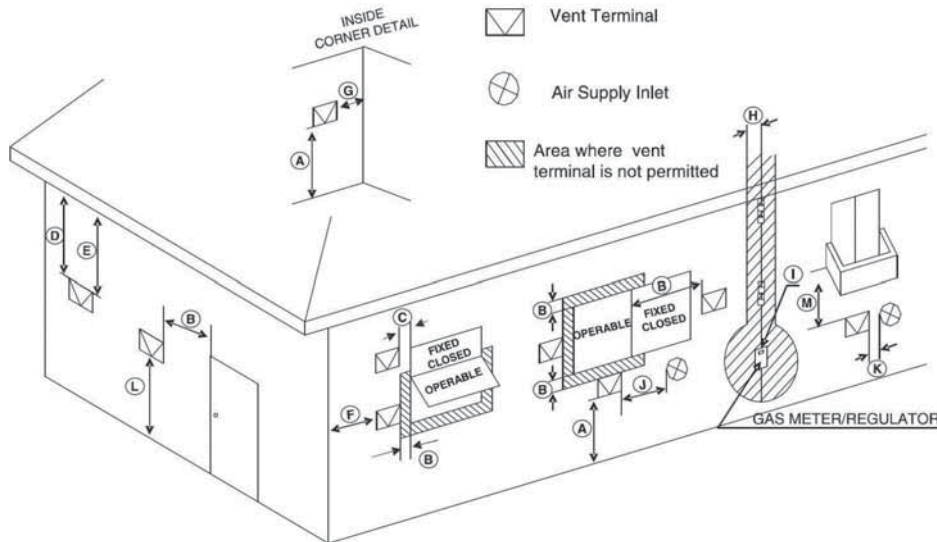
Navien also recommends installing a new vent system with this appliance. If reusing an existing vent system, thoroughly inspect it for punctures, cracks, or blockages prior to connecting it to the boiler.

Direct Venting

The boiler uses a 3 in or 4 in diameter exhaust and a 3 in or 4 in diameter air intake ducts. To ensure the draw of air directly from and exhaust of gases directly to the outside of the building, create an airtight seal from the boiler collar to the vent termination.

Intake materials can be made of ABS, PVC, CPVC, PP, galvanized or stainless steel, corrugated aluminum or any other such materials. If you use a corrugated material, ensure that there is not inadvertent crimping of, or damage to, the intake air pipe.

When using direct venting, maintain the following venting clearances, as required by **ANSI Z21.10.3 and the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and CAN/CGA B149.1 Natural Gas and Propane Installation Code:**



Ref	Description	Canadian Direct Vent Installations ¹	US Direct Vent Installations ²
A	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B	Clearance to window or door that may be opened	36 in (91 cm)	12 in (30 cm)
C	Clearance to permanently closed window	*	*
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	*	*
E	Clearance to unventilated soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	*	*
H	Clearance to each side of center line extended above meter/regulator assembly	3 ft (91 cm) within a height 15 ft above the meter/regulator assembly	*

Ref	Description	Canadian Direct Vent Installations ¹	US Direct Vent Installations ²
I	Clearance to service regulator vent outlet	3 ft (91 cm)	*
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	36 in (91 cm)	12 in (30 cm)
K	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m) [†]	*
M	Clearance under veranda, porch deck, or balcony	12 in (30 cm) [‡]	*

¹ In accordance with the current CSA B149.1 Natural Gas and Propane Installation Code

² In accordance with the current ANSI Z223.1/NFPA 54 National Fuel Gas Code

[†] A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

[‡] Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

Non-Direct Venting (Single Pipe)

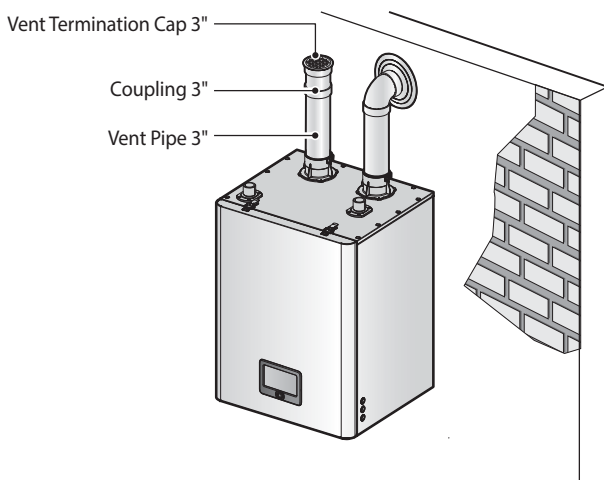
If, at any time, the installation location could experience negative pressure, there is a possibility of back drafting cold air through the boiler's heat exchanger. This situation could lead to the freezing of the heat exchanger and malfunction of the boiler.

However, building codes in most jurisdictions disallow negative pressures in residences. In a home with a well-balanced air supply, the heat exchanger should not be in danger of freezing. Because the cause of back drafting is not considered a manufacturing problem, any freezing damage which occurs from back drafting will not be covered by the Navien warranty. If there is any question about the possibility of back drafting in the installation location, use a direct venting system for the boiler.

When using non-direct venting, maintain non-direct vent clearances shown on page 56 as required by **ANSI Z21.10.3 and the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and CAN/CSA B149.1 Natural Gas And Propane Installation Code.**

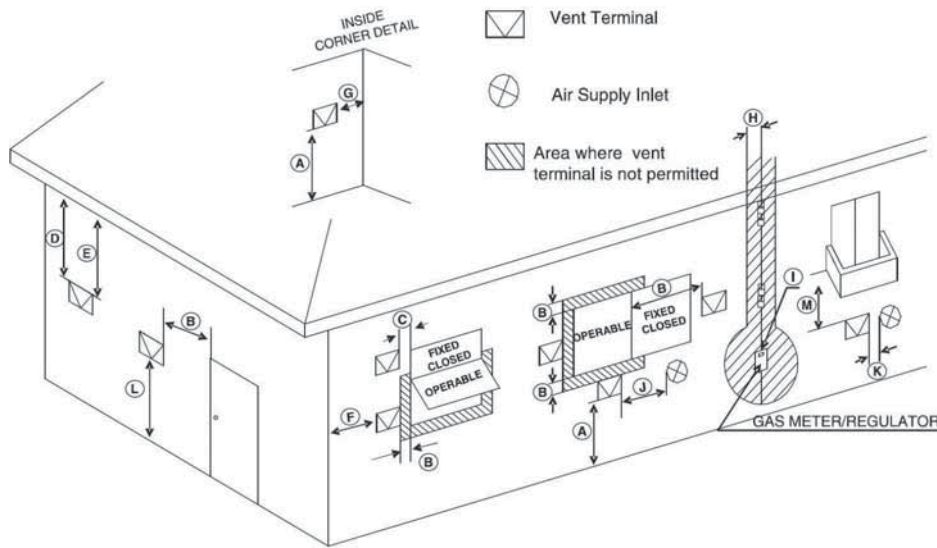
To use non-direct venting for the boiler:

1. Insert the termination end cap into the intake air duct. Do not glue the end cap, to allow for easy removal and cleaning of the cap.



2. The equipment room **MUST** be provided with properly sized openings to assure adequate combustion air.
3. Combustion air requirements are based on the latest edition of the National Fuel Gas Code, NFPA 54 / ANSI Z223.1; in Canada refer to the latest edition of CGA Standard CAN/CSA B149.1.

	NFB-301C	NFB-399C
Maximum Input (BTU/H)	301,000	399,000
Outside air from 2 openings directly from outdoors	A minimum free area of 1 in ² per 4,000 BTU/H	
	75 in ²	100 in ²
Outside air from 2 ducts directly from outdoors	A minimum free area of 1 in ² per 2,000 BTU/H	
	150 in ²	200 in ²
Inside air from 2 ducts delivered from interior space	A minimum free area of 1 in ² per 1,000 BTU/H	
	300 in ²	400 in ²
Outside air from 1 openings directly from outdoors	A minimum free area of 1 in ² per 3,000 BTU/H	
	100 in ²	134 in ²



Ref	Description	Canadian Non-Direct Vent Installations ¹	US Non-Direct Vent Installations ²
A	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B	Clearance to window or door that may be opened	36 in (91 cm)	48 in (120 cm) below or to side of opening; 12 in (30 cm) above opening
C	Clearance to permanently closed window	*	*
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	*	*
E	Clearance to unventilated soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	*	*
H	Clearance to each side of center line extended above meter/regulator assembly	36 in (91 cm) within a height 15 ft (4.57 m) above the meter/regulator assembly	*
I	Clearance to service regulator vent outlet	36 in (91 cm)	*
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	36 in (91 cm)	48 in (120 cm) below or to side of opening; 12 in (30 cm) above opening
K	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	36 in (91 cm) above if within 10 ft (3 m) horizontally
L	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m) [†]	*
M	Clearance under veranda, porch deck, or balcony	12 in (30 cm) [‡]	*

¹ In accordance with the current CSA B149.1 Natural Gas and Propane Installation Code

² In accordance with the current ANSI Z223.1/NFPA 54 National Fuel Gas Code

[†] A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

[‡] Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

5.3 Selecting Vent Pipe Materials

Venting requirements differ in the US and Canada. Consult the following chart or the most recent edition of ANSI Z223.1/NFPA 54 or CAN/CGA B149.1, as well as all applicable local codes and regulations when selecting vent pipe materials. Do not use cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) for the exhaust vent.

Locale	Recommended Vent Materials
USA	<ul style="list-style-type: none"> PVC/CPVC Schedule 40 or 80 (Solid Core) Approved Polypropylene (PP) Approved Stainless Steel (SS)
Canada*	<ul style="list-style-type: none"> Type BH Special Gas Vent Class IIA (PVC) Type BH Special Gas Vent Class IIB (CPVC) Type BH Special Gas Vent Class IIC (Polypropylene/Stainless Steel)

* For installation in Canada, field-supplied plastic vent piping must comply with CAN/CGA B149.1 (latest edition) and be certified to the Standard For Type BH Gas Venting Systems, ULC-S636. Components of this listed system must not be interchanged with other vent systems or unlisted pipes or fittings. All plastic components and specified primers and glues of the certified vent system must be from a single system manufacturer and must not be intermixed with another system manufacturer's parts. The supplied vent connector and vent termination are certified as part of the boiler.

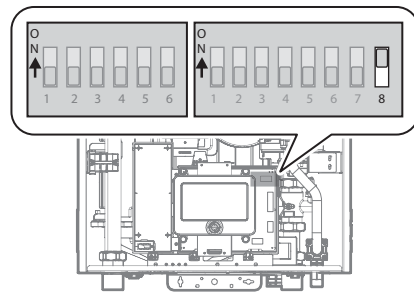
CAUTION

- This boiler has a built-in control to limit the exhaust temperature to 149°F (65°C). As a result, the boiler can be vented with Schedule 40 PVC.
- In high temperature applications, the exhaust temperature can exceed 149°F (65°C). In that case, you must use Schedule 40 or 80 CPVC, Approved Polypropylene, or Stainless Steel in the USA or Type BH Special Gas Vent Class IIB (CPVC) or Class IC (Polypropylene/Stainless Steel) that conforms to ULC-S636 in Canada.
- In systems with 3 in vents, if the exhaust temperature exceeds 149°F (65°C), CPVC pipe (field supplied) must be used for the first 3 feet of equivalent pipe length. For systems with 4 in vents, if the exhaust temperature exceeds 149°F (65°C), CPVC pipe (field supplied) must be used for the first 5 in of equivalent pipe length.

This product is set to use **PVC** as the default vent pipe material. If you require that return water hotter than 140°F (60°C) to circulate back to boiler, the DIP switch must be configured (**DIP Switch 2, switch #8 to ON position**). Otherwise, the boiler will control and maintain the flue and DHW temperature below 150°F (65°C) and 140°F (60°C) respectively.

Note

- When PCB DIP switch 2 #8 is set to Off (factory default), the boiler will not operate if the internal exhaust thermostat is disconnected or damaged.
- When you set PCB DIP switch 2 #8 to On, ensure that CPVC, PP, or SS piping is used for exhaust venting.



The following **polypropylene** vent components are approved for use with this appliance:

Duravent PolyPro® SW (Rigid)

3PPS-xxx (3") or 4PPS-xxx(4")
3PPS-ADL (3" Appliance Adapter)

Duravent PolyPro® (Flexible)

3PPS-FLEXxx (3")
3PPS-FAM (3" Rigid-to-Flex Male Adapter)

Centrotherm Innoflue® SW (Rigid)

ISxx03xx (3") or ISxx04xx (4")
ISAAL0303 (3" Appliance Adapter)

Hart & Cooley Polyflue™ SW (Rigid)

3PF-xx (3") or 4PF-xx (4")
3PF-PVD-PF (3" Appliance Adapter)

Z-Flex Z-DENS SW (Rigid)

2ZD_ (3" or 4")
2ZDCPVCg3 (3" Appliance Adapter)

The following **stainless steel** vent components are approved for use with this appliance:

Duravent FasNSeal® (Rigid)

FSA-PVC3 or FSA-PVC4 (3" or 4" PVC to FasN Seal Appliance Adapter)
FSxxxx03 or FSxxxx04 (3" or 4")

Heat Fab Saf-T Vent® EZ Seal

9301PVC or 9401PVC (3" or 4" PVC/CPVC Outlet Boiler Adapter)
93xx or 94xx (3" or 4")

5.4 Measuring Vent Length

The maximum vent length when using 3 in exhaust ducts is 60 ft (18 m). The maximum vent length when using 4 in vent ducts is 150 ft (45 m). The intake and exhaust vent pipes can be of different lengths as the boiler will adjust for pressure imbalances within the system. Maximum vent lengths are reduced according to the number of elbows used, as shown in the following table:

Vent Size	Maximum Length	Maximum # of Elbows	Equivalent Length
3 in	60 ft (18 m)	6	Reduce the maximum vent length accordingly for each elbow used: <ul style="list-style-type: none"> • Each 90° elbow equates to 5 linear feet of vent • Each 45° elbow equates to 3 linear feet of vent
4 in	150 ft (45 m)	8	

- Note**
- The Maximum Length does not include any elbows.
 - The use of a PVC or polypropylene termination kit counts as 5 linear feet (1.5 m) of vent.
 - The use of a tee counts for the same equivalent length as a 90° elbow for the vent size.

5.5 Terminating the Vent

Before installing the boiler, determine what type of vent termination is appropriate for the installation location and situation. Examples in this section describe typical venting configurations, but they do not include all possible options.

The following **PVC** vent terminations are approved for use with this appliance:

- PVC concentric Vent Kit (for condensing appliances):
 - 3 in Vent Kit
 - 4 in Vent Kit
- IPEX Low Profile Termination Kit:
 - 3 in Low Profile Vent Kit #196985
 - 4 in Low Profile Vent Kit #196986

The following **polypropylene** vent terminations are approved for use:

- Duravent PolyPro Horizontal Concentric Termination Kit
 - 3 in x 5 in Concentric Vent Kit #3PPS-HKC
 - 4 in x 6 in Concentric Vent Kit #4PPS-HKC
- Centrotherm Innoflue Low Profile Termination Kit
 - 3 in Vent Kit #ISLPT0303
- **Centrotherm** Concentric Vent Kit
 - 3 in Vent Kit #ICWT352

- Hart & Cooley Polyflue Horizontal Termination Kit
 - 3 in Vent Kit #3PF-HCT
 - 4 in Vent Kit #4PF-HCT

The following **polypropylene** vent components are approved for use as terminations:

Duravent PolyPro®

- 3PPS-E90L or 4PPS-E90L (3" or 4" 90° Elbow)
- 3PPS-E45L or 4PPS-E45L (3" or 4" 45° Elbow)
- 3PPS-TL or 4PPS-TL (3" or 4" Tee)
- 3PPS-BG or 4PPS-BG (3" or 4" Birdscreen)

Centrotherm Innoflue®

- ISEL0387 or ISEL0487 (3" or 4" 87° Elbow)
- ISEL0345 or ISEL0445 (3" or 4" 45° Elbow)
- IST03 or IST04 (3" or 4" Tee)
- IASPP03 or IASPP04 (3" or 4" Birdscreen)

Hart & Cooley Polyflue™

- 3PF-90 or 4PF-90 (3" or 4" 90° Elbow)
- 3PF-45 or 4PF-45 (3" or 4" 45° Elbow)
- 3PF-T or 4PF-T (3" or 4" Tee)
- 3PF-HVST or 4PF-HVST (3" or 4" Birdscreen)

Z-Flex Z-DENS

- 2ZDE387 or 2ZDE487 (3" or 4" 90° Elbow)
- 2ZDE345 or 2ZDE445 (3" or 4" 45° Elbow)
- 2ZDTT3 or 2ZDTT4 (3" or 4" Tee)
- 2ZDES3 or 2ZDES4 (3" or 4" Birdscreen)

The following **stainless steel** (AL29-4C) vent components are approved for use as terminations:

Duravent FasNSeal®

- FSELB9003 or FSELB9004 (3" or 4" 90° Elbow)
- FSELB8803 or FSELB8804 (3" or 4" 88° Elbow)
- FSELB4503 or FSELB4504 (3" or 4" 45° Elbow)
- FST3 or FST4 (3" or 4" Tee)
- FSBS3 or FSBS4 (3" or 4" Birdscreen)

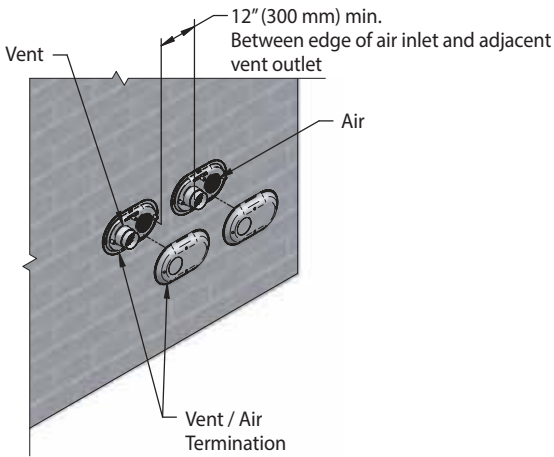
Heat Fab Saf-T Vent® EZ Seal

- 9314(LR) or 9314TERM (3" 90° Elbow)
- 9414(LR) or 9414TERM (4" 90° Elbow)
- 9311 or 9411 (3" or 4" 45° Elbow)
- 9390TEE or 9490TEE (3" or 4" Tee)
- 9392 or 9492 (3" or 4" Birdscreen)

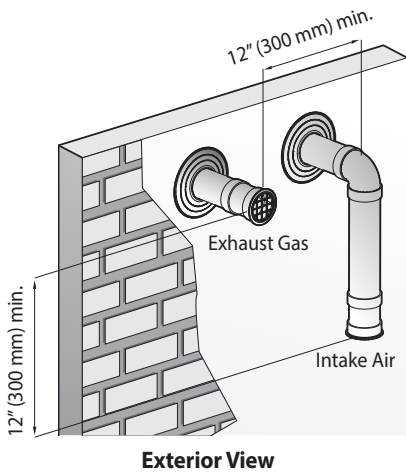
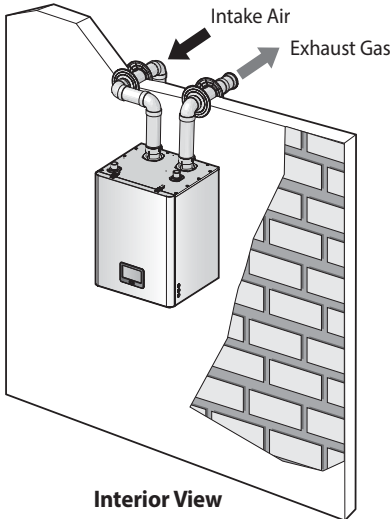
Indoor Boiler Installation Venting Examples

The following are some possible indoor venting options:

- Multiple Vent / Air Terminations



- 3 in or 4 in Two-pipe Sidewall Venting

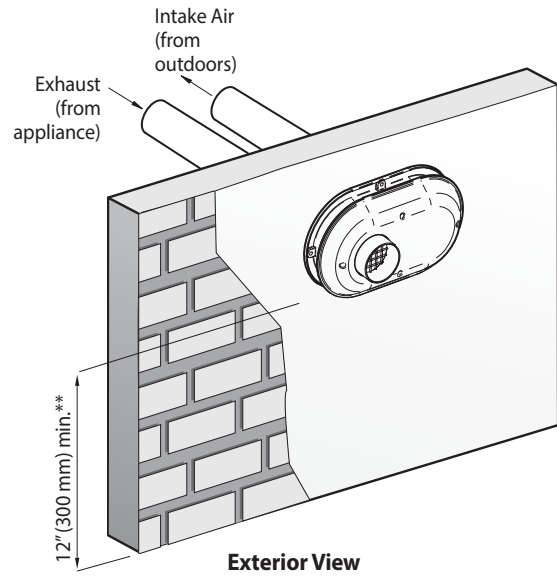


Note For cascade applications, the required horizontal clearance between terminations is 12" for both sidewall and vertical venting installations.



Do not vertically stack concentric terminations on sidewalls.

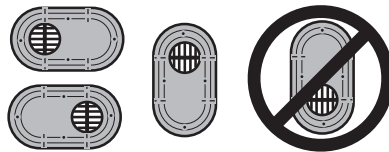
- Low Profile Two-Pipe Sidewall Venting*



* IPEX and Centrotherm Low Profile terminations only

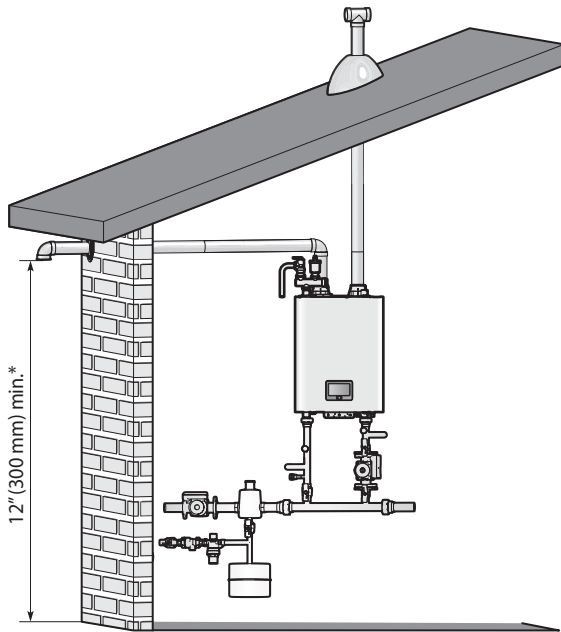
** Clearance above highest anticipated snow level or grade, or as required by local codes, whichever is greater

Note Only the following orientations are allowed for twin pipe terminations.



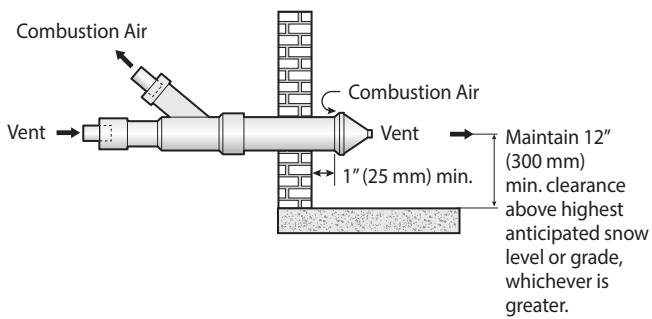
Indoor Boiler Installation Venting Examples (continued)

- Non-Concentric Sidewall Venting - Air is drawn from a different location that is at least 12 in (300 mm) away from the exhaust termination. The exhaust termination can be located either on the sidewall or roof. Try to minimize the length of the intake air pipe when installing the vent.



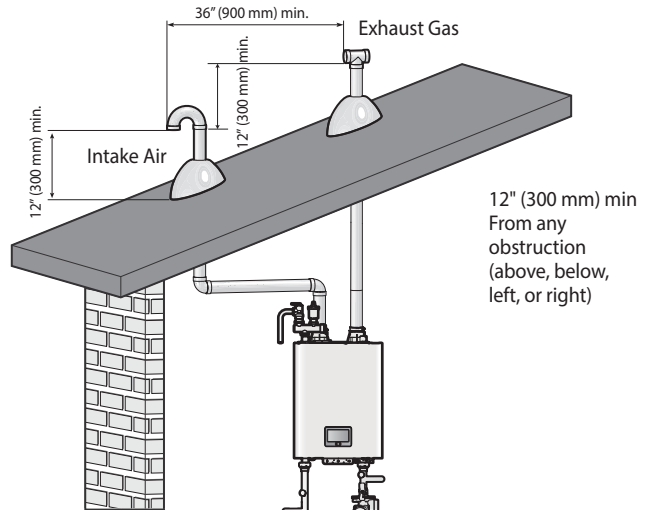
* 12" (300 mm) above the highest anticipated snow level, or as required by local codes, whichever is greater.

- Concentric Sidewall Venting

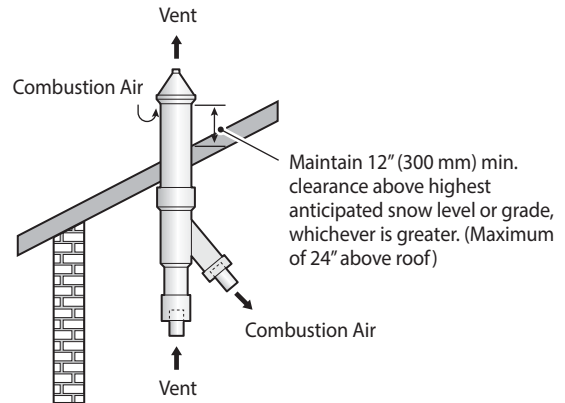


Indoor Boiler Installation Venting Examples (continued)

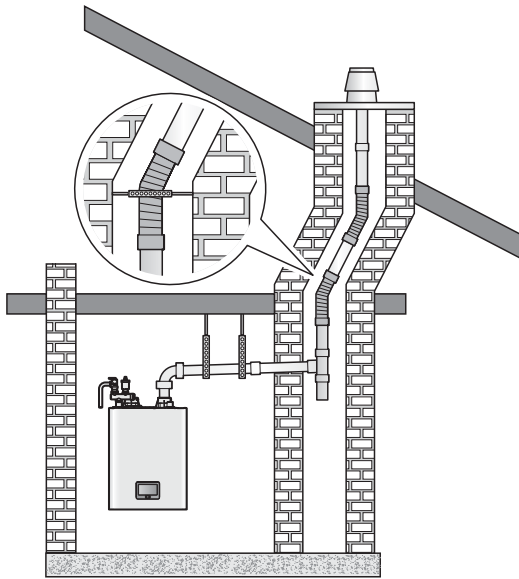
- 3 in or 4 in Two-pipe Vertical Venting – Intake and exhaust pipes do not have to terminate in the same area.



- Concentric Roof Venting



- Flexible Vent Systems (Polypropylene)



Note

- Only VERTICAL installations are allowed. Horizontal terminations are prohibited.
- The use of proper adapters and supports are required to fully complete the installation.

The following table lists the flexible vent models that are approved for use with this appliance in addition to the maximum allowable vent lengths for the desired vent system.

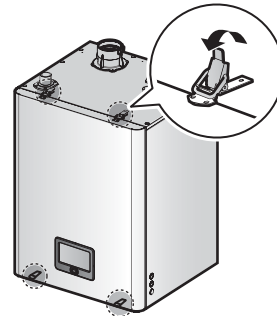
Model Type	Vent Dia.	Flexible PP
		DuraVent PolyPro Flex
NFB-301C/399C	3 in	50 ft

- Only the flexible vent models listed above are approved for use with this boiler.
- All flexible vent pipe must be installed VERTICALLY through the roof. No horizontal terminations are permitted.
- Use a 3 in snap fit coupler or the DuraVent PolyPro® Single Wall vent pipes to connect the DuraVent PolyPro® Flex 3 in vent pipes to the exhaust.
- After installation, ensure that the vent system is tightly sealed at the joints.
- All installations using the flexible vent materials must be in INDIRECT vent applications only.
- Refer to the vent manufacturer’s literature for detailed information and guidelines.

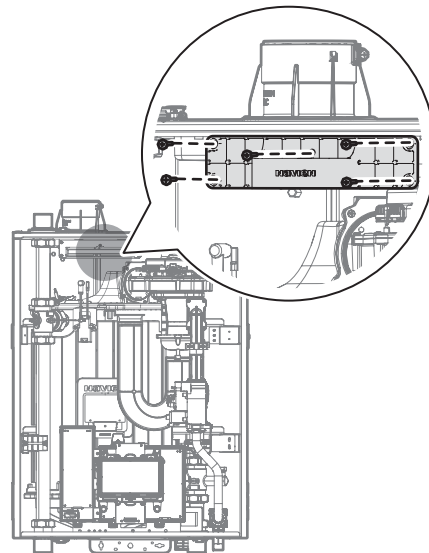
5.6 Removing the Internal Air Filter

The NFB boiler is equipped with an internal air filter designed to protect the combustion system from dust and debris. This filter should be inspected and replaced as needed or at least every two years. Follow the instructions below to remove and replace the internal air filter.

1. Unfasten the 4 latches (2 at the top, 2 at the bottom) to remove the front cover and gain access the internal components.

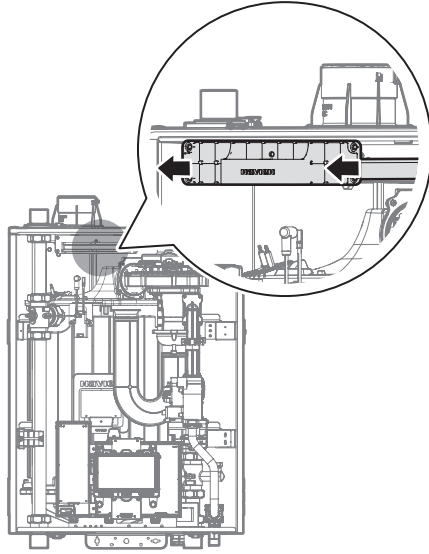


2. Remove the five screws on the internal air filter using a Phillips-head screwdriver.



3. Remove the filter from the boiler and replace with a new filter.

Note One Replacement filter is included. Additional filters can be ordered through authorized Navien distributors.



! CAUTION

- If the air filter is not replaced, it may result in poor performance of the boiler.
- If the internal air filter is fully blocked with dust and debris, an error code may occur due to intake blockage being detected in the boiler.

6. Setting the DIP Switches

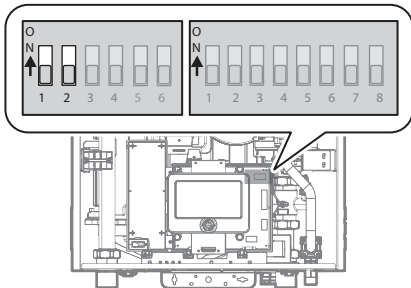
⚠ CAUTION

Do not remove the front cover unless the power to the boiler is turned off or disconnected. Failure to do so may result in electric shock.

The boiler has 2 sets of DIP switches on the main circuit board (PCB). DIP switches are used to control the functionality of the boiler. Set the DIP switches appropriately, based on the installation environment.

6.1 DIP Switch 1 (6 Switch Unit)

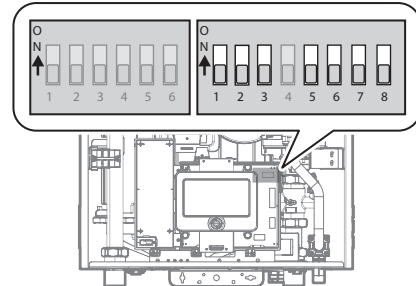
The DIP SW 1 on the circuit board configures the operation status and model/capacity settings.



Switch	Function	Setting	
1 & 2	Operation Status	Normal Operation	1-OFF, 2-OFF
		2Step MAX	1-ON, 2-OFF
		1Step MIN	1-OFF, 2-ON
		1Step MAX	1-ON, 2-ON

6.2 DIP Switch 2 (8 Switch Unit)

The DIP SW 2 on the circuit board configures the gas type, country, and enables or disables the space heating thermostat.



Switch	Function	Setting	
1	Gas Type	Natural Gas	1-OFF
		Propane Gas	1-ON
2 & 3	High Altitude*	0-1,999 ft (0-609 m)	2-OFF, 3-OFF
		2,000-5,399 ft (610-1,645 m)	2-ON, 3-OFF
		5,400-7,699 ft (1,646-2,346 m)	2-OFF, 3-ON
		7,700-10,100 ft (2,347-3,078 m)	2-ON, 3-ON
4	Reserved	-	-
5 & 6	Country	US/Canada	5-OFF, 6-OFF
7	Space Heating Thermostat	Used	7-OFF
		Unused	7-ON
8	Exhaust Temperature Control	Used	8-OFF
		Unused	8-ON

*For high altitude installations, the gas orifice plate must be replaced with the proper orifice for use above 5,400 ft. Refer to "12.1 Gas & High Altitude Conversion" for details.

Note When PCB DIP switch 2 #8 is set to On, ensure that CPVC, approved polypropylene, or stainless steel is used for exhaust venting.

7. Connecting the Power Supply

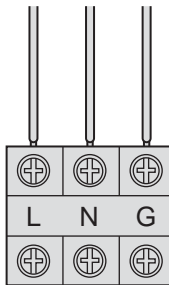


WARNING

Improperly connecting the power supply can result in electrical shock and electrocution. Follow all applicable electrical codes of the local authority having jurisdiction. In the absence of such requirements, follow the latest edition of **the National Electrical Code (NFPA 70) in the USA or the latest edition of CSA C22.1 Canadian Electrical Code Part 1 in Canada.** Connecting the power supply should be performed only by a licensed professional.

When connecting the power supply, follow these guidelines:

- Do not connect the electric supply until all piping and gas piping is complete and the boiler has been filled with water.
- Do not connect the boiler to a 220-240 V AC power supply. Doing so will damage the boiler and void the warranty.
- Connect the building wires 'L', 'N', 'G' to the terminal block according to the printed specifications on the boiler PCB. The 'G' terminal should be connected to the building ground.



Note The rated current of the wires is 12 A.

- When connecting an external pump to the boiler, connect it to the external pump terminal of the boiler PCB. Connect the wires referring to the following table. The pump ground should be connected to the boiler and the building ground. For details, refer to the "12.2 Wiring Diagram" on page 116.

1. Boiler Pump	N-phase	<->	1. Building wire	N-phase
2. Building wire	L_IN-phase	<->	2. Boiler PCB	L_IN-phase
3. Boiler Pump	L_IN-phase	<->	3. Boiler PCB	L_OUT-phase

Note The maximum current of the pump is 5 A.

- We recommend using a surge protector to protect the boiler from power surges.
- If there is a power failure in cold weather areas, the freeze prevention system in the boiler will not operate and may result in the heat exchanger freezing. In cold areas where power failures are common, you must completely drain the boiler to prevent damage if power cuts last for extended periods. A battery back-up (available at most computer retailers) may be used to supply hot water during power outages. Damage caused by freezing is not covered under warranty.



CAUTION

Label all wires before disconnecting them when you work on the controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

8. Installing a Cascade System

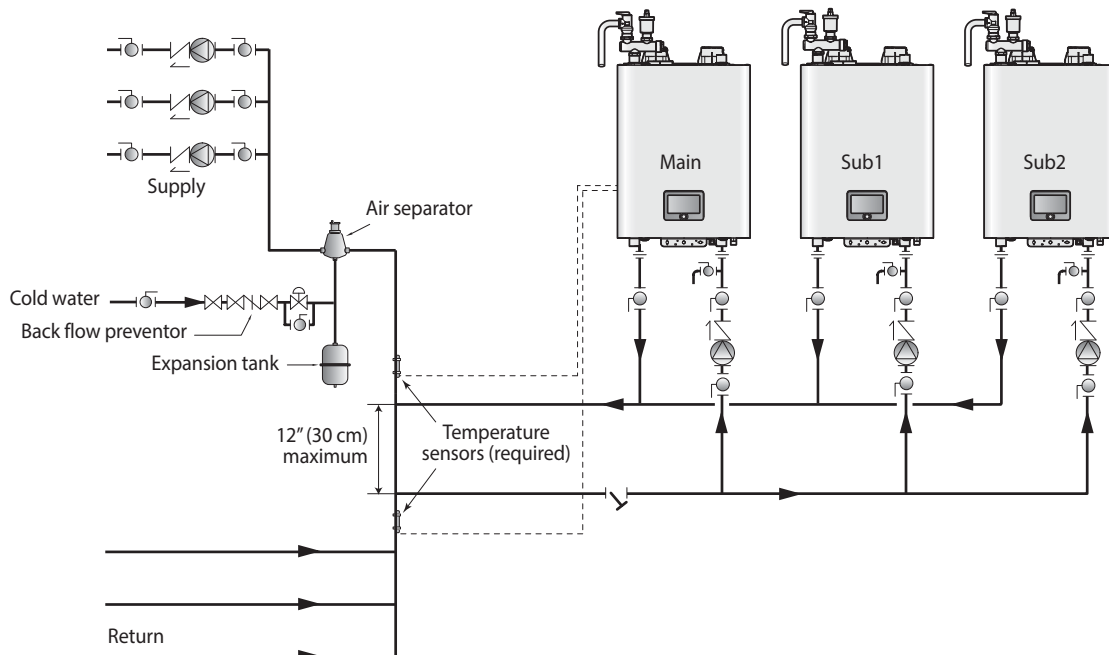
When installing a cascade system, carefully consider the design of the system and the features of the installation location. Follow all local codes and regulations, as well as all guidelines for installing the boiler. The following sections describe additional considerations that are specific to installing cascade systems. Read them carefully before designing or installing the system.

8.1 Connecting Water Supplies

Several options are available for configuring a cascade system of boilers. The options shown here are only examples. The setup you choose will vary based on the installation location, local building codes, and other factors. Follow all applicable regulations when installing a cascade system.

You can connect up to 32 boilers to meet high-volume heating demands. Some possible connection options include the following:

- Example of a Basic Cascade System Application

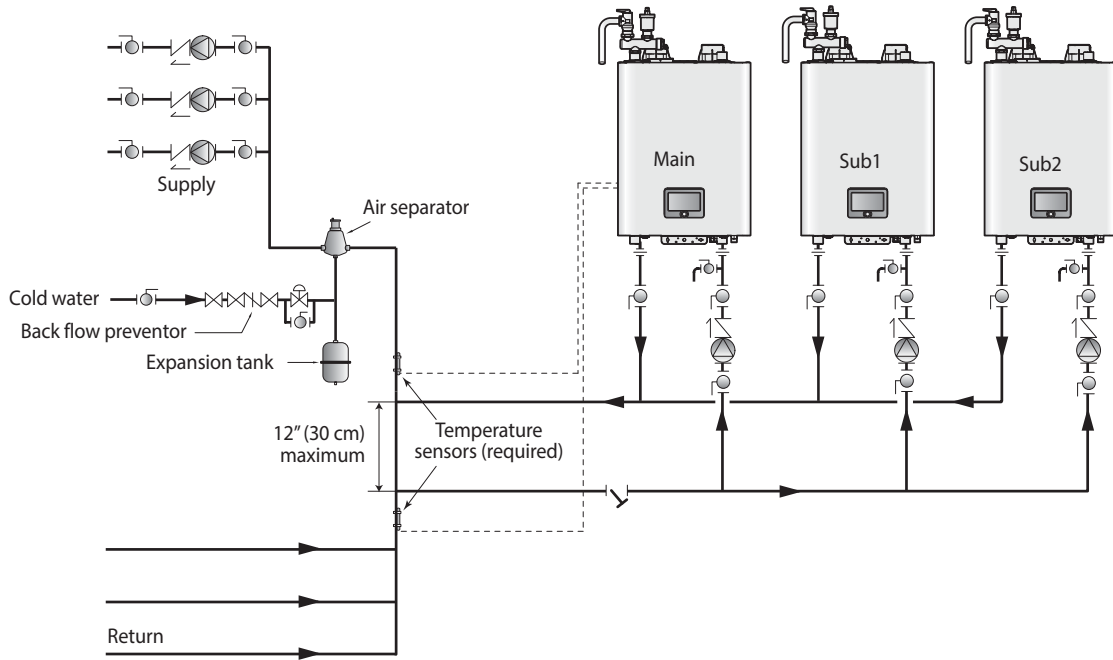


[NFB-301C/399C]

Note

- System application drawings are intended to explain the system piping concept only.
- Install a filter in the system return to remove foreign objects from the system. Foreign objects inside the system may result in abnormal system operation.
- Refer to "3.3 Filling the System" on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
- Use pumps with integral check valves or install check valves at the pump outlets.
- Navien universal temperature sensors (#GXXX001769) must be installed for cascade system operation.
- Adjust the settings at the main unit as the cascade system uses only the main unit settings. Changes made to the sub units are ignored.
- Refer to "11.6.4 Configuring a Cascade System" on page 103 to make adjustments to the boiler staging settings. By default, boilers will be added to the system when the input capacity exceeds 60%, and removed when the input capacity falls below 30%.
- Depending on the installation environment, the supply top and return top piping option can be applied.

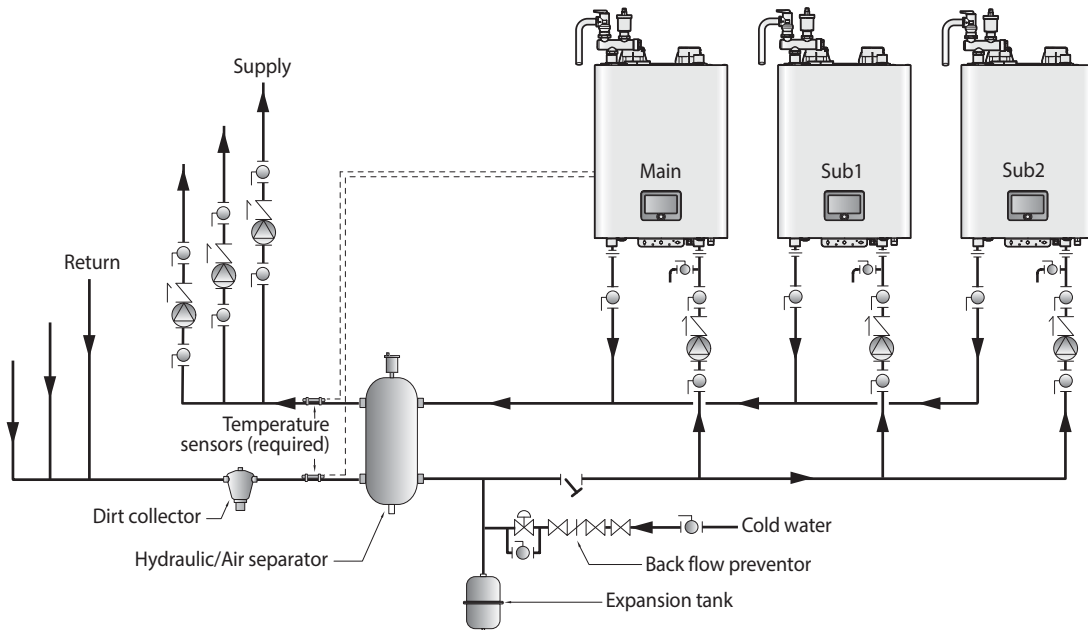
• System Application #1- Cascade System with Closely Spaced Tees



Note

- Connect the "SH Demand (SH T/T or Zone controller)" to the main unit.
- Connect the universal temperature sensors to SUPPLY and RETURN terminals of the CNT1/CNT2 terminal strip on the main unit PCB.
- Connect the outdoor sensor (optional) to the main unit.
- Depending on the installation environment, the supply top and return top piping option can be applied.
- Multi-zone temperature function is also available for this application.

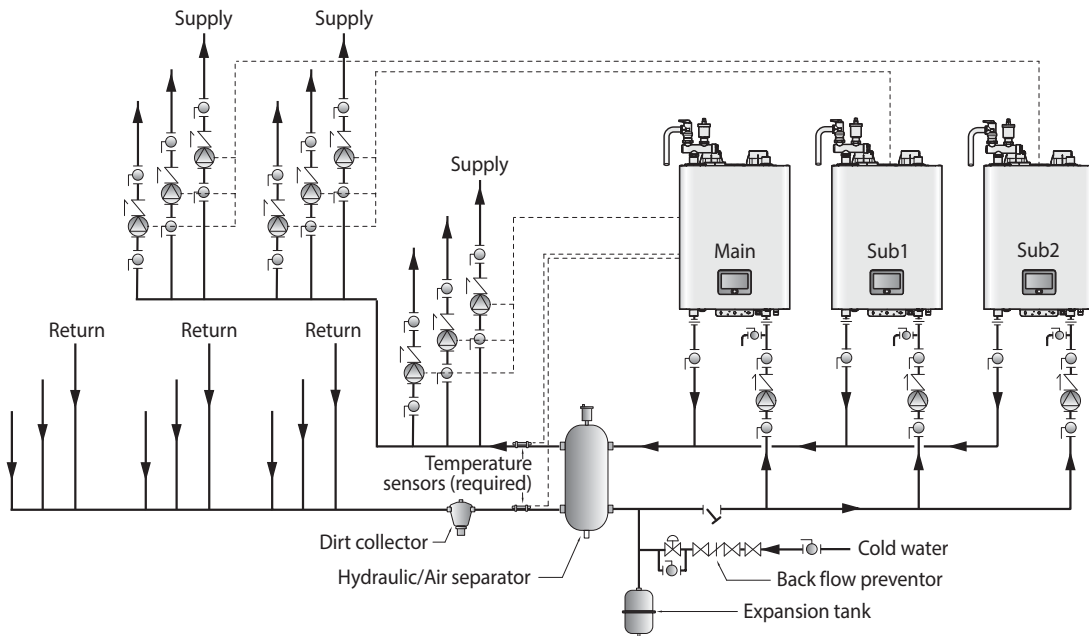
- System Application #2- Cascade System with Hydraulic Separator




Note

- Connect the "SH Demand (SHT/T or Zone controller)" to the main unit.
- Connect the universal temperature sensors to SUPPLY and RETURN terminals of the CNT1/CNT2 terminal strip on the main unit PCB.
- Connect the outdoor sensor (optional) to the main unit.
- Depending on the installation environment, the supply top and return top piping option can be applied.

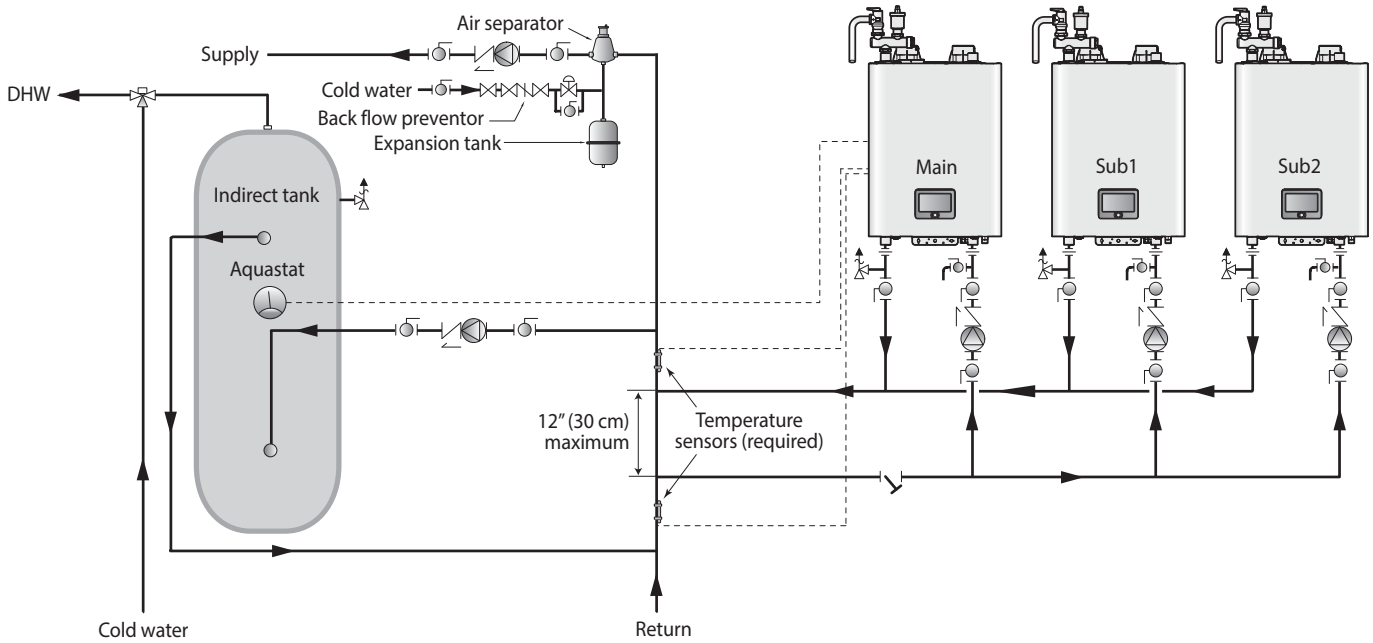
• System Application #3 - Cascade System with Zone Pump Control



Note

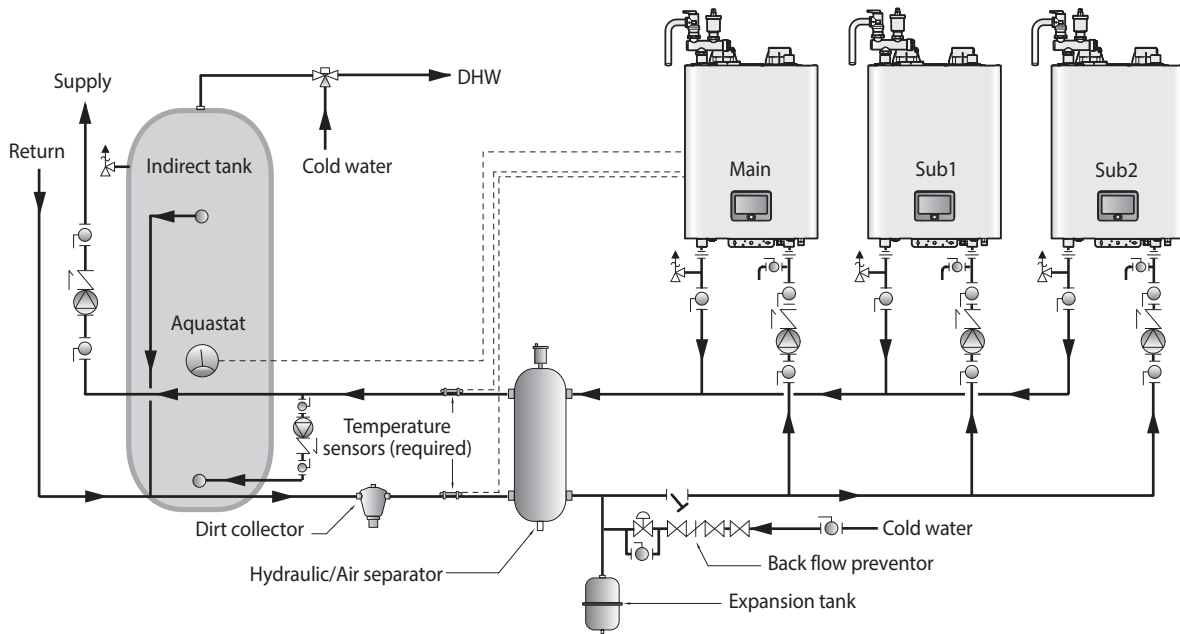
- Both the main unit and sub units use zone pumps for this application. To enable this feature, tap the Control button  > **SH Control** and set the Zone Setting to "OFF."
- Connect the zone pump to the main unit or subunit, and connect the "SH Demand (SHT/T)" to the zone that the pump is connected to.
- Connect the supply/return sensors to SUPPLY and RETURN terminals of the CNT1/CNT2 terminal strip on the main unit PCB.
- Connect the outdoor sensor (optional) to the main unit.
- Depending on the installation environment, the supply top and return top piping option can be applied.
- Multi-zone temperature function is not available for this application.

• System Application #4 - Cascade System with DHW Indirect Tank and Closely Spaced Tees



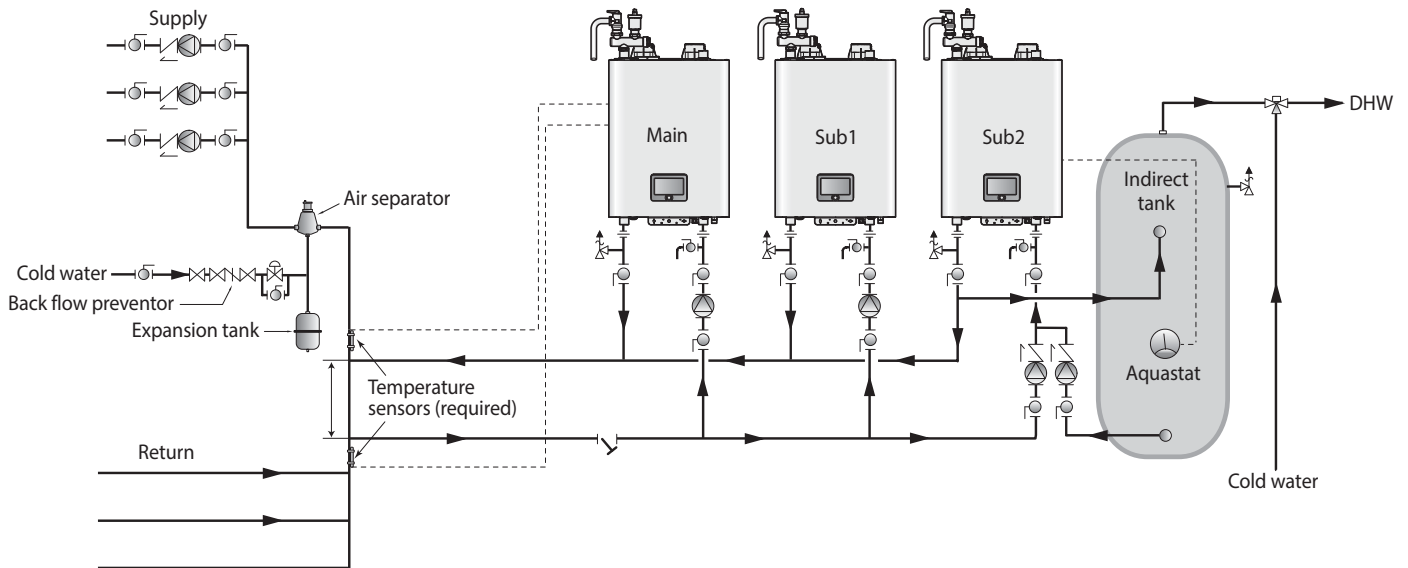
- Note**
- Connect the aquastat on the DHW indirect tank to the main unit.
 - Connect the DHW pump to the main unit.
 - Depending on the installation environment, the supply top and return top piping option can be applied.

• System Application #5 - Cascade System with DHW Indirect Tank and Hydraulic Separator



- Note**
- Connect the aquastat on the DHW indirect tank to the main unit.
 - Connect the DHW pump to the main unit.
 - Depending on the installation environment, the supply top and return top piping option can be applied.

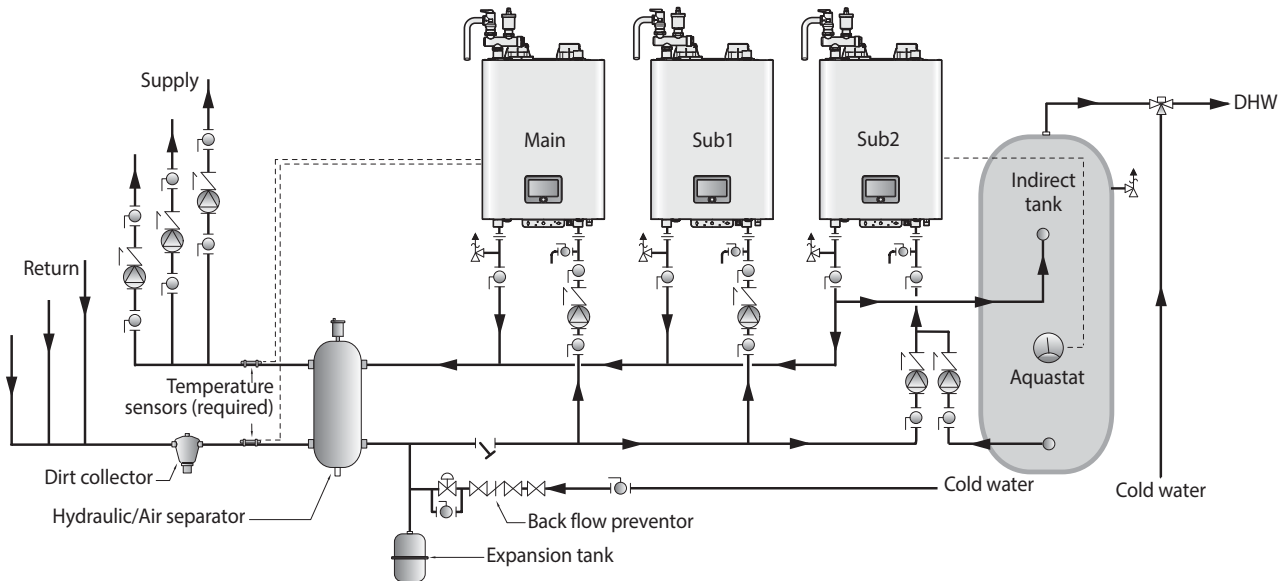
- System Application #6- Cascade System with DHW Indirect Tank and Tank and Closely Spaced Tees (for Low DHW Demand)



Note

- In this configuration, space heating and DHW can operate simultaneously.
- The aquastat on the DHW indirect tank must be connected to a sub unit.
- If a dedicated sub unit is used, the input capacity requirement of the indirect tank shall not exceed the capacity of the single boiler.
- Connect the DHW pump to the sub unit.

- System Application #7 - Cascade System with DHW Indirect Tank and Hydraulic Separator (for Low DHW Demand)



Note

- In this configuration, space heating and DHW can operate simultaneously.
- The aquastat on the DHW indirect tank must be connected to a sub unit.
- If a dedicated sub unit is used, the input capacity requirement of the indirect tank shall not exceed the capacity of the single boiler.
- Connect the DHW pump to the sub unit.

8.1.1 Piping Sizes and Considerations

When configuring a cascade system, consider the following pipe diameters and flow rates. Note that flow rates above 4 ft/s may cause pipe erosion or velocity noise. These specifications may vary depending on installation conditions.

NFB-301C

Qty	Flow Rate (GPM) @ 20 °F ΔT	Recommended Boiler Pipe Sizes (2-4 ft/s)
2	58	2-½"
3	87	3"
4	116	4"
5	145	4"
6	174	5"
7	203	5"
8	232	5"
9	261	5"
10	290	6"
11	319	6"
12	348	6"
13	377	6"
14	406	6"
15	435	7"
16	464	7"

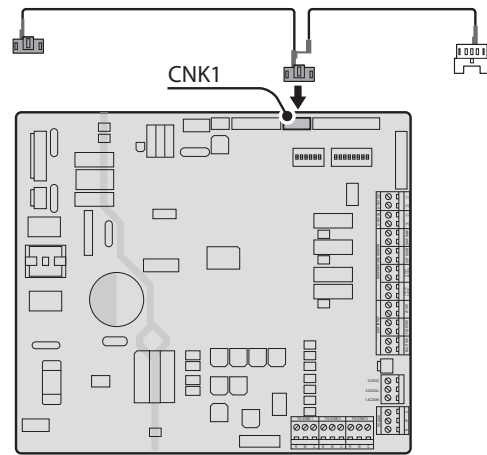
NFB-399C

Qty	Flow Rate (GPM) @ 20 °F ΔT	Recommended Boiler Pipe Sizes (2-4 ft/s)
2	76	3"
3	114	3-½"
4	152	4"
5	190	5"
6	228	5"
7	266	5"
8	304	6"
9	342	6"
10	380	6"
11	418	7"
12	456	7"
13	494	7"
14	532	8"
15	570	8"
16	608	8"

8.2 Connecting the Communication Cables

Up to 32 boilers can be connected with Navien Ready-Link communication cables. Select one of the boilers in the cascade system as the main boiler, and then connect the other boilers to it as sub boilers. Before making any connections, ensure that the power is turned off to all boilers.

Connect the Ready-Link cables to the CNK1 terminal strip on the PCB:



8.2.1 Configuring the Communication Settings

After connecting the Ready-Link communication cables, restore power to the boiler and turn on all boilers using the Power button.

To configure the communication settings, refer to "11.6.4 Configuring a Cascade System" on page 103.

9. Installing a Common Vent System

9.1 About the Common Vent System

The Navien Common Vent System* provides an easy way to install the vent system for up to 4 Navien NFB Boiler units. By sharing the main intake and exhaust vent pipes, effective system venting is available with less venting materials and minimal number of penetrations on the walls or roofing.

* Independently tested and approved by CSA

Read all safety messages and carefully follow the guidelines in this manual when installing a common vent system for the NFB boiler units.



WARNING

Improper venting of the boiler units can result in excessive levels of carbon monoxide, which can lead to severe personal injury or death. **The boiler units must be vented in accordance with the “Venting of Equipment” section of the latest edition of the ANSI Z223.1/NFPA 54 Natural Fuel Gas Code in the USA, as well as all applicable local building codes and regulations.** Follow all instructions and guidelines when venting the boiler units. Venting should be performed only by a licensed professional.

9.1.1 Guidelines for a Common Vent System



CAUTION

- To ensure the correct operation of the common vent system,
 - a cascade communication cable **MUST** be installed between all units in the common vent system by the installer.
 - the Navien Common Vent Collar Kit must be installed in the exhaust collar of each boiler unit.
 - **use direct vent** (with separate intake and exhaust lines) or **indirect vent** (combustion air drawn from room) systems.
- Do not mix different model units within one common vent system. Model types of all the water heater units in a common vent system must be identical.
- This manual covers the installation of a common vent system for **NFB-C boilers only**.

To ensure the safe and correct installation of the common vent system, carefully follow the instructions and guidelines.

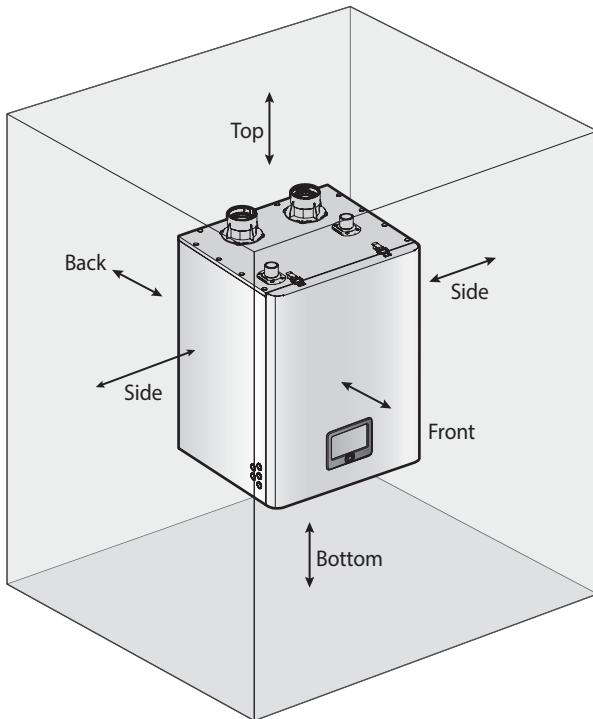
- Check to see if all contents are included in the package (refer to the “Included Items” on page 77).
- A maximum of 4 NFB boilers may be connected to one common vent system. In a cascade system that has more than 4 boilers, use 2 common vent systems, or consult Navien.
- Use only approved PVC/CPVC cements specified when connecting pipes, joints, or elbows.
- Position the boiler units as close as possible to the vent termination.
- Install a new vent system with this appliance. If an existing vent system is reused, thoroughly inspect it for punctures, cracks, or blockages prior to connecting it to the boiler unit.
- The common vent system covered in this manual is approved for direct and indirect venting applications.
- Horizontal vent pipe runs must be supported every 4 feet (1.2 m) (minimum). All vertical vent pipe runs must be supported every 6 feet (1.8 m) (minimum). Support the vent pipe with hangers at regular intervals or as required by local codes.
- Install a backflow damper for each boiler unit. Use only the damper specified in this manual.
- To avoid moisture and frost build-up and to maintain clearances to openings on adjacent homes, 45° elbows, 90° elbows, or tees may be attached to the end of the termination vent pipe to direct the exhaust plumes away from buildings, as long as the total allowable vent lengths, maximum number of elbows, and distances to air intake restrictions are observed.
- If the boiler units will be installed in areas where snow is known to accumulate, protect the vent termination from blockage. Ensure that the vent termination is at least 12 in (305 mm) above ground, 12 in (305 mm) above the highest anticipated snow level, or as required by local codes, whichever is greater. Snow removal may be necessary to maintain clearance.
- Support the vent pipe with hangers at regular intervals or as required by local codes.
- The vent for this appliance shall not terminate over public walkways; or near soffit vents or crawl space vents or where condensate or vapor could create a nuisance or hazard or cause property damage; or where condensate or vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Adequate Installation Clearances

CAUTION

Do not install the boiler on carpeting.

Install the boiler in an area that allows for service and maintenance access to utility connections, piping, filters, and traps. Based on the installation location, ensure that the following clearances are maintained:



Clearance from:	Indoor Installation
Top	12 in (305 mm) minimum
Back	0.5 in (13 mm) minimum
Front	24 in (610 mm) minimum
Sides	6 in (152 mm) minimum
Bottom	16 in (406 mm) minimum

CAUTION

It is necessary to leave clearance for service access.

Clean, Debris and Chemical-Free Combustion Air

- Do not install the boiler in areas where dust and debris may accumulate or where hair sprays, spray detergents, chlorine, or similar chemicals are used.
- Do not install the boiler in areas where gasoline or other flammables are used or stored.
- Ensure that combustible materials are stored away from the boiler and that hanging laundry or similar items do not obstruct access to the boiler or its venting.

General and Local Standards Information

When installing and operating the common vent system, the following standards and regulations must be complied with and adhered to:

- Local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/NFPA 54.
- Appliance manufacturer's Installation Instructions.
- Regulations on the supervision of construction.
- Statutory provisions.
- Installation and service work must be carried out by licensed professionals only.

Risk Guidelines

- Ensure that all common vent system components are manufactured and installed in accordance with valid standards, regulations, and safety engineering rules.
- To avoid risk, the common vent system must be installed and used only for the original purpose described in this manual.
- Defects or damages found in a common vent system must be addressed and repaired immediately.
- For roof or chimney modifications, refer to the relevant industrial safety regulations.
- Works on roofs and facades are dangerous. Comply with all relevant regulations.

Cutting and Assembling Common Vent System Components

Standard tools are suitable for the cutting and assembly of common vent system components. Follow the guidelines listed below when working with the components.

- When cutting vent components, ensure that the cuts are straight. Chamfer and deburr all edges before installing the components.
- All vent joints must be fully tightened.
- Before operating the system, ensure that the installed vent system is clean and free of debris.
- Ensure that the vent system is rigidly supported according to the manual's instructions.

Selecting Vent Pipe Materials

Consult the following chart or the most recent edition of ANSI Z223.1/NFPA 54, as well as all applicable local codes and regulations when selecting vent pipe materials. This appliance should be vented with materials approved for Category IV gas appliances. Do not use cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) for the exhaust vent. See below for recommended vent materials.

Locale	Recommended Vent Materials
USA	<ul style="list-style-type: none">• PVC Schedule 40 (Solid Core)• CPVC Schedule 40 or 80 (Solid Core)• UL1738 approved PVC or CPVC• Centrotherm Innoflue Polypropylene (PP)• Approved Stainless Steel (SS)
Canada	ULC-S636 (Refer to page 63)

Vent Pipe Pitch and Supports

For horizontal runs, slope the horizontal section upward toward the vent termination at a rate of $\frac{1}{4}$ " per foot (2% slope).

Connecting Pipes with Cement

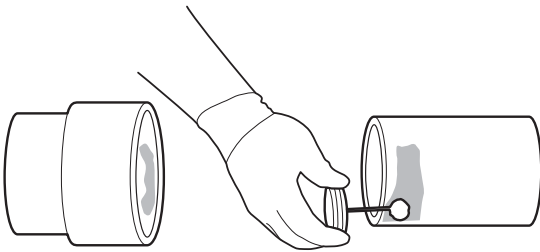


CAUTION

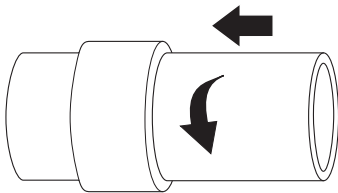
The vapors from primers and solvent cements can cause nausea and can be dangerous to your health. Ensure that the work area is well ventilated, or wear an approved organic vapor respirator when working with primers and solvent cements.

To connect the vent pipes using cement:

1. Spread an even layer of solvent cement on the inside of the pipe fitting and the outside of the pipe.



2. Align the pipe with the pipe fitting and twist the pipe a quarter turn as you insert it into the fitting. Twisting the pipe spreads the solvent cement evenly to ensure a solid joint.



3. Hold the pipe and pipe fitting together for about 15 seconds until the cement sets.

Note

- Use approved solvent type cement for the proper vent materials.
- Check the date of manufacture before using the cement. Ensure that cement was not manufactured more than 2 years prior to using it.
- Ensure that the inside of the pipe fitting and the outside of the pipe, where cement will be applied, is clean.
- Apply an even layer of cement over all mating surfaces.
- Use primer in temperatures lower than 32°F (0°C).
- Use solvent cement in room temperatures higher than 32°F (0°C).
- Installing vent pipe with cement in cold ambient temperatures can result in longer cure times.



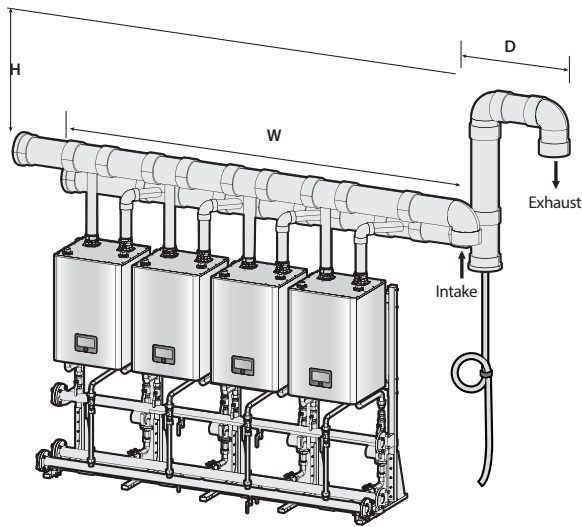
DANGER

Be careful not to apply force or impact to pipes after making connections. An impact may break the bond and harmful gas might leak inside the room.

9.1.2 Determining the Length of a Common Vent System

Follow the instructions listed below to determine the length of a common vent.

1. Add the BTU/H input ratings for each unit in the cascading system to determine the total BTU/H rating.
2. Determine the total length (L) of the common vent, which consists of the horizontal width (W) and the vertical height (H):
Total length (L) = W + H.



Note

- Every 90° elbow used is equivalent to 8 linear feet (2.4 m) of vent length.
- The pipe branch that connects the individual appliance to the common vent trunk must not exceed within 20 equivalent feet.

Common Vent Length Table [Total Length (L) = W + H]

Vent Length for NFB Boiler Units

Required Load (Total BTU/h)	Model	Total Length (ft)		
	NFB-301C	D=4"	D=6"	D=8"
602,000	2	71	160	
903,000	3	42	96	150
1,204,000	4	35	80	142

Required Load (Total BTU/h)	Model	Total Length (ft)		
	NFB-399C	D=4"	D=6"	D=8"
798,000	2	53	120	
1,197,000	3	35	80	142
1,596,000	4	26	60	106

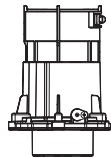

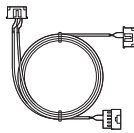
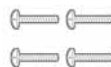
9.2 Navien Common Vent Collar Kit (Back-draft Damper)

The Navien Common Vent Collar Kit prevents backflow (back-draft) at the exhaust vent while the boiler unit operates.

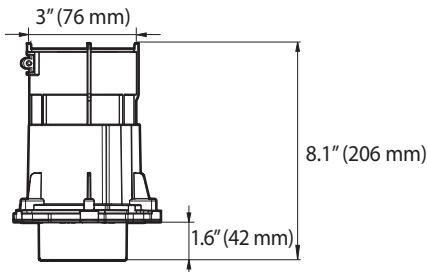
By closing the exhaust vent as soon as the combustion cycle ends, the Navien Common Vent Collar Kit retains heat in the system for longer periods.

Note When using a common vent in a cascade system, backflow devices are required to prevent exhaust from entering the building.

Included Items

Common Vent Collar Kit	
Installation Manual	
Ready-Link communication cable	
Screw (4 ea)	

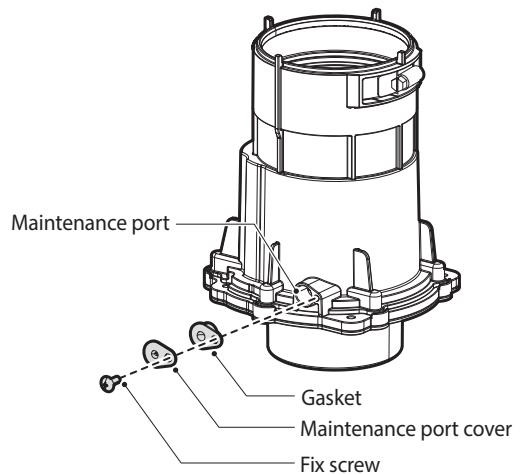
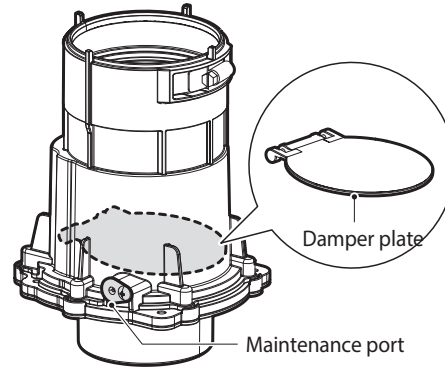
Specifications



Part Name	Common Vent Collar Kit
Part No.	30022799A
Material	PP (Polypropylene)

Maintenance Port

Navien Common Vent Collar Kit has a maintenance port to allow you to easily inspect the operating condition of the damper plate.



Refer to "9.9 Maintenance" for detailed inspection procedures of the Navien Common Vent Collar Kit (back-draft damper).

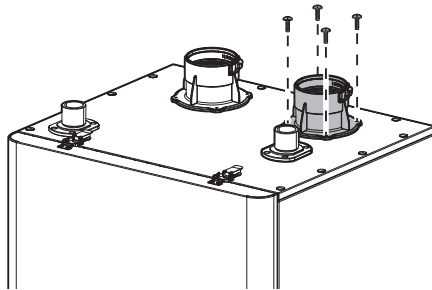
Note When using a common vent in a cascade system, backflow devices are required to prevent exhaust from entering the building.

9.3 Starting the Common Vent System

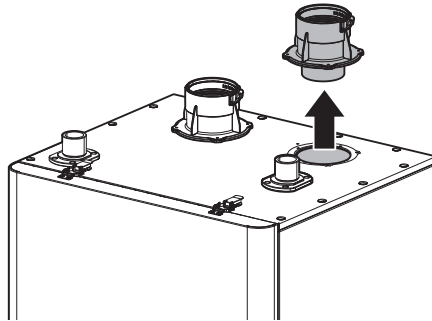
9.3.1 Common Vent Collar Kit Assembly

Follow the instructions below to assemble the Common Vent Collar Kit on the NFB boiler unit:

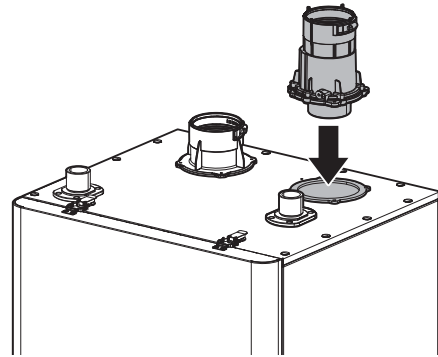
1. Remove the screws from the exhaust vent adapter.



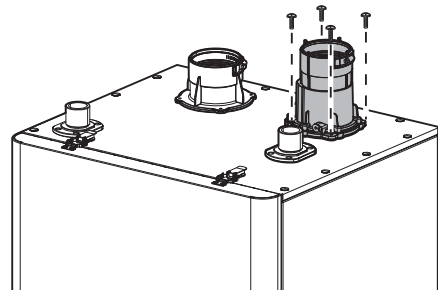
2. Detach the exhaust vent adapter.



3. Connect the Common Vent Collar Kit to the exhaust duct of the boiler unit.

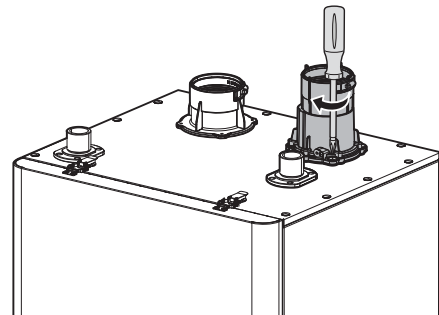


4. Tighten the four mounting screws to secure the Common Vent Collar Kit in place. The screws (x 4) are supplied with the Common Vent Collar Kit.



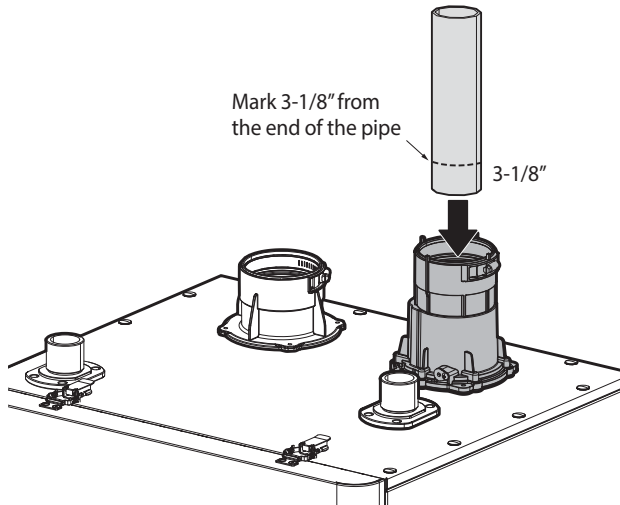
WARNING

If the original vent collar must be repaired or reassembled, ensure that it is tightened by using the 4 provided screws.



9.3.2 Connecting the Pipe to the Common Vent Collar Kit

1. Measure 3-1/8" from the end of the vent pipe, then draw a mark at that distance.

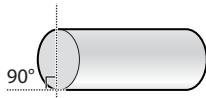


2. Insert the vent pipe into the vent collar to start the vent run. Make sure to completely slide the vent into the collar until the end makes contact with the bottom of the socket.

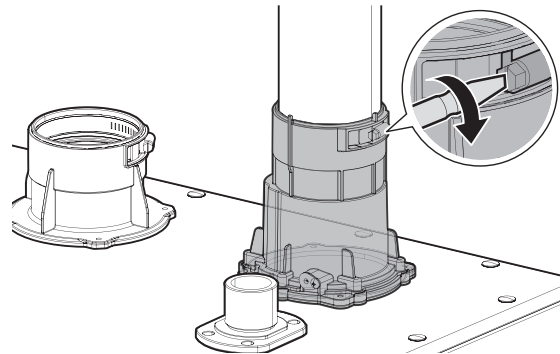
Note Verify that 3-1/8" of the pipe has been completely inserted into the collar and that the mark is no longer visible.

WARNING

Ensure that the vent pipe is properly beveled prior to installation and that the pipe is fully connected to the exhaust gas vent fitting. Failure to properly bevel and install the pipe can lead to gasket failure and flue gas leakage, which may result in serious injury or death.

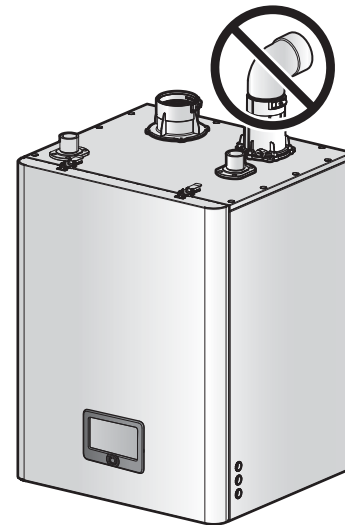


3. Tighten the clamp with a screwdriver to properly seal the joint.



CAUTION

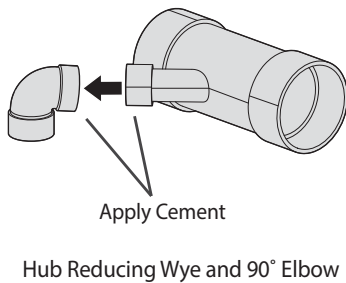
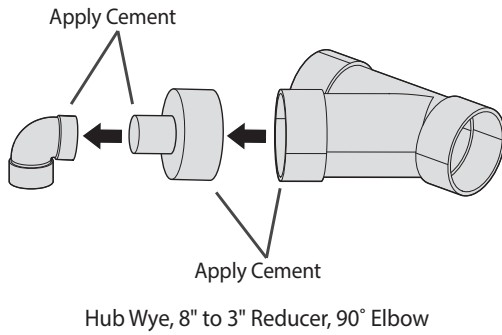
Do not start the vent run with a street elbow at the vent collar. Using an elbow directly at the collar will not allow for a tight seal between the appliances and vent pipe. A length of straight pipe must be used when starting the vent run.



Note The length of vent pipe from the unit to the common vent main trunk pipe must not exceed 20 equivalent feet.

9.3.3 Assembling the Wye Joint

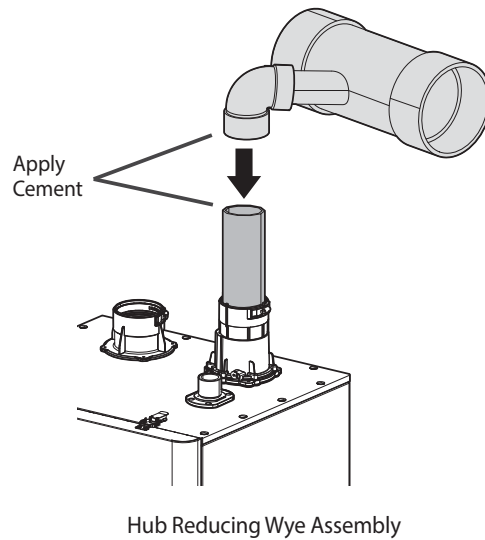
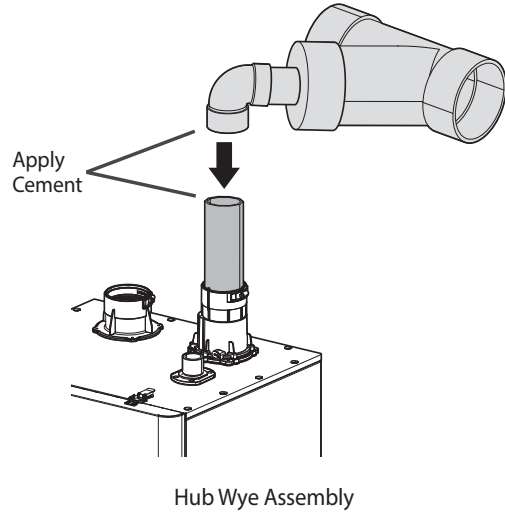
1. Assemble the hub wye, the 8" to 3" reducer, and the 90° elbow into the common vent. You can also use the hub reducing wye and the 90° elbow to assemble the common vent. Apply the proper solvent cement to the mating surfaces.



Note

Multiple reducers can be used to allow proper connection of 3" vent pipe to the common vent system.

2. Assemble the wye joint or wye assembly to the vent pipe. Apply solvent cement to the mating surfaces.



Note

The options shown here are only examples. The setup you choose will vary based on the installation location, local building codes, and other factors. The installer is responsible for all equipment and detailing required by local codes.



DANGER

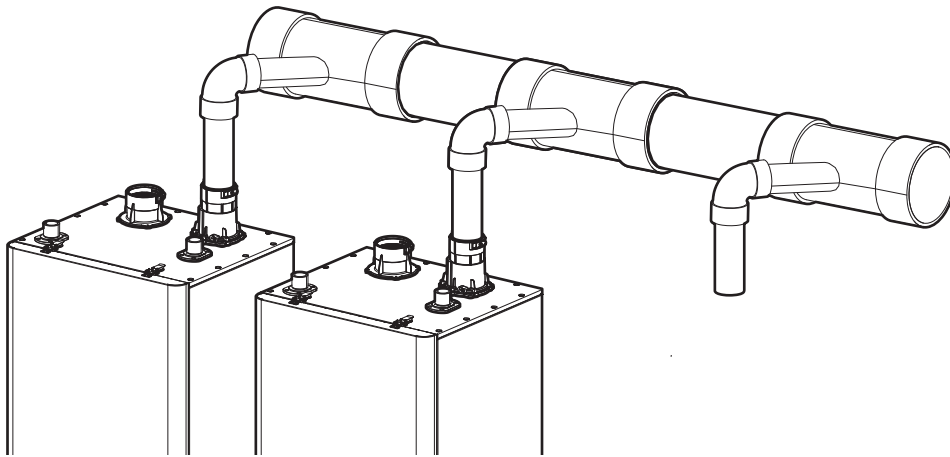
If the connections leak, harmful flue gas may cause personal injury or death. After completing the installation and filling the boiler with water, turn on the boiler and test for leaks using a bubble test kit. After applying the soap solution, bubbles will form on the connection if any leaks exist.

9.4 Connecting and Terminating the Vent Pipe

Refer to the following example to install the common vent system. The installation area should be measured to ensure that sufficient space is available to install the boiler units and the common vent system. Ensure that the common vent system is installed near the boiler units while satisfying all clearance requirements that are specified in this manual as well as the Installation Manuals supplied with the boiler units.

9.4.1 Connecting the Main Pipe Runs to Wye Joint or Wye Assembly

After connecting the wye joint or wye assembly, connect the main trunk pipe to each side of the wye joint or wye assembly. Each trunk pipe is connected to the other wye joint or wye assembly. Refer to "Connecting Pipes with Cement" on page 75 for more information.

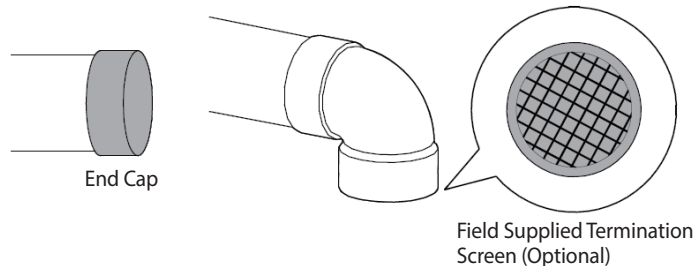


Note

- The pipe branch that connects the individual appliance to the common vent trunk must be within 20 equivalent feet.
- It is recommended to install the exhaust vent pipe end connected to the trunk pipe at a 45° angle in relation to the exhaust direction. (The exhaust resistance increases if connected to the trunk pipe at a 90° angle.)

9.4.2 Installing the System Termination

End caps, pipe elbows or tee joints can be used at the open ends of the intake and exhaust vent pipes. Refer to the following installation examples that depict how the parts are fitted at the end of the common vent system piping.



Note

The illustration is intended for reference purposes only.

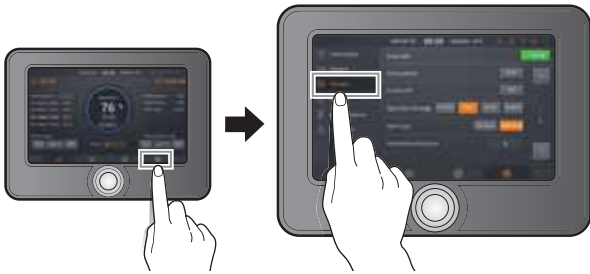
9.5 Setting up the Common Vent System

DANGER

Incorrect settings may lead to severe personal injury, death, or property damage.

Refer to the following figures when setting the common vent type.

1. Tap the Set button  > **Cascade**.



2. Set the vent type referring to the following table.

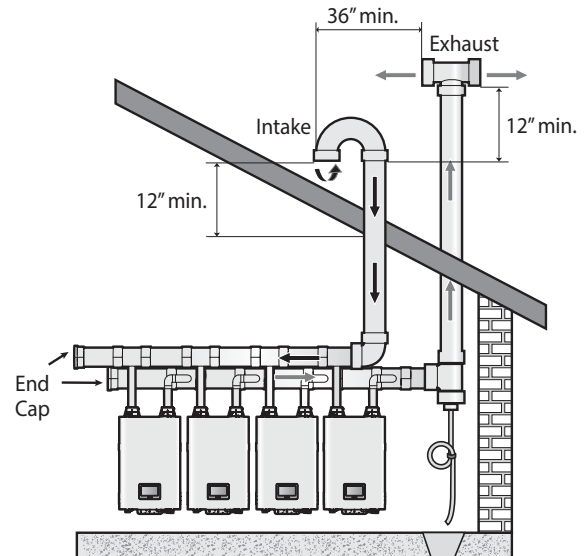
Item	Description
Vent type	Set the ventilation type. <ul style="list-style-type: none"> • Setting range: Common/Individual • Default: Common

Note

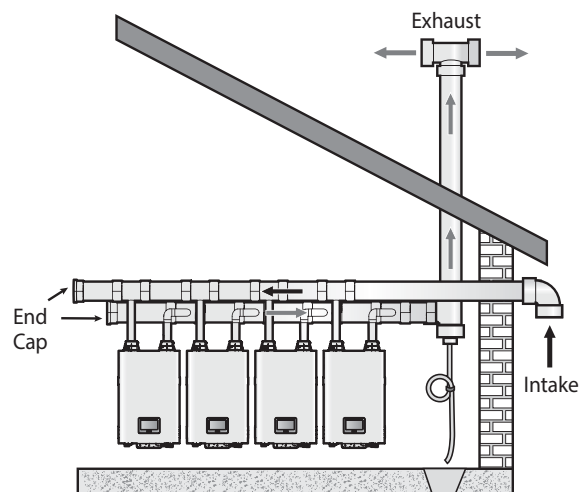
For more information on the vent type settings, refer to "11.6.4 Configuring a Cascade System" on page 103.

9.6 Common Vent Termination Clearances

9.6.1 Direct Vent Application – Vertical Installation



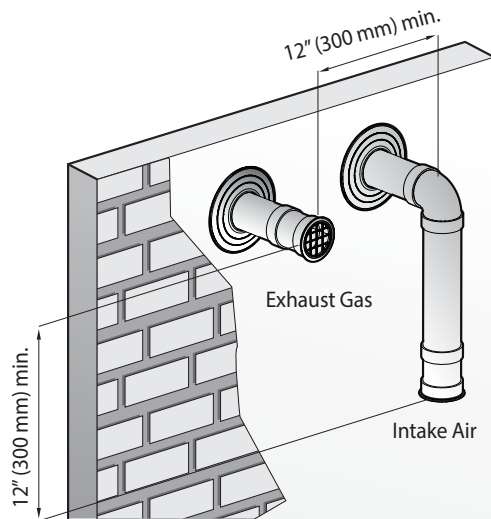
9.6.2 Venting Intake and Exhaust to Different Locations



Note

End caps used at the end of the common vent trunk is recommended for maintenance and service. A 90° elbow that connects from the main trunk to the individual unit is also acceptable.

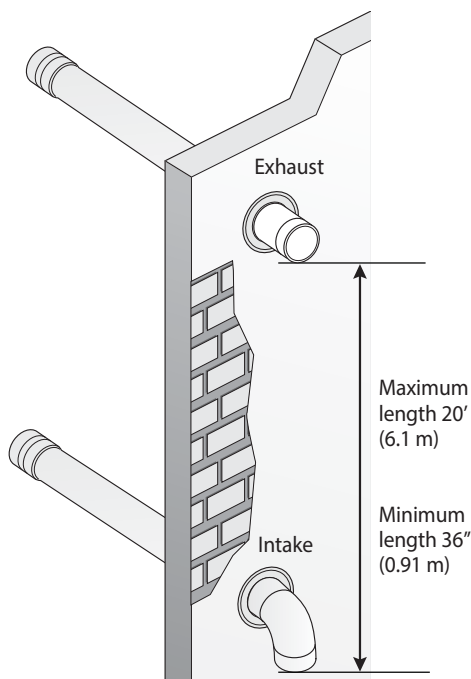
9.6.3 Direct Vent Application – Horizontal Installation



Note

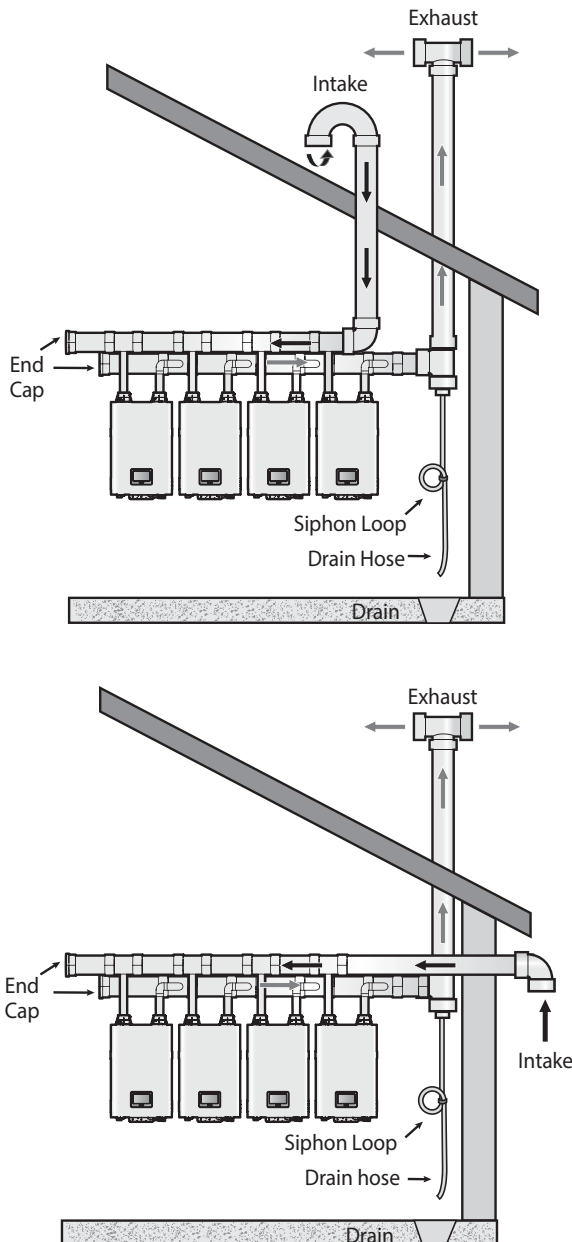
- The illustration is intended for reference purposes only.
- Direct the exhaust away from any building openings.
- During cold weather situations, the temperature of the exhaust will be much warmer than the ambient air. Therefore, you will see water vapor being produced at the termination.

In cases where a 12" horizontal clearance is not possible, provide a vertical clearance of at least 36" with the exhaust above the intake but do not exceed 20'.



9.7 Installing a Condensate Drain

Refer to the following examples to install a condensate drain hose (field supplied) to the common vent system. The condensate drain hose prevents condensate or rain from entering the exhaust system and gathering above the Common Vent Collar Kit.



To install a condensate drain to the common vent system:

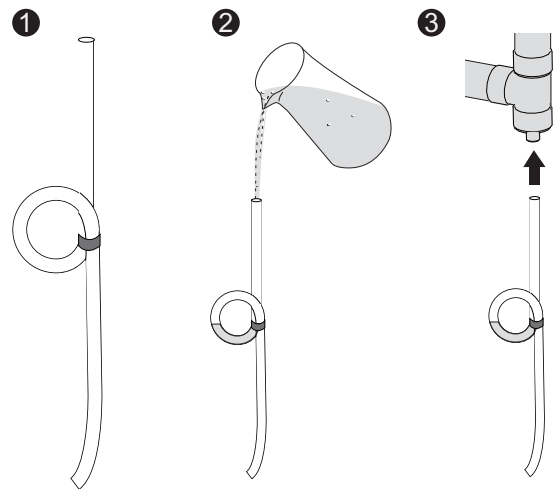
1. Form a loop with a drain hose and fix it with a tie.

Note

- While shaping the hose, do not bend the hose excessively. The hose will be deformed and the flow will be restricted if the hose is bent in sharp angles.
- Do not fix the hose too tight when tying the hose to form the loop. The hose will be deformed and the flow will be restricted if the tie is too tight.

2. Prime the loop using tap water.

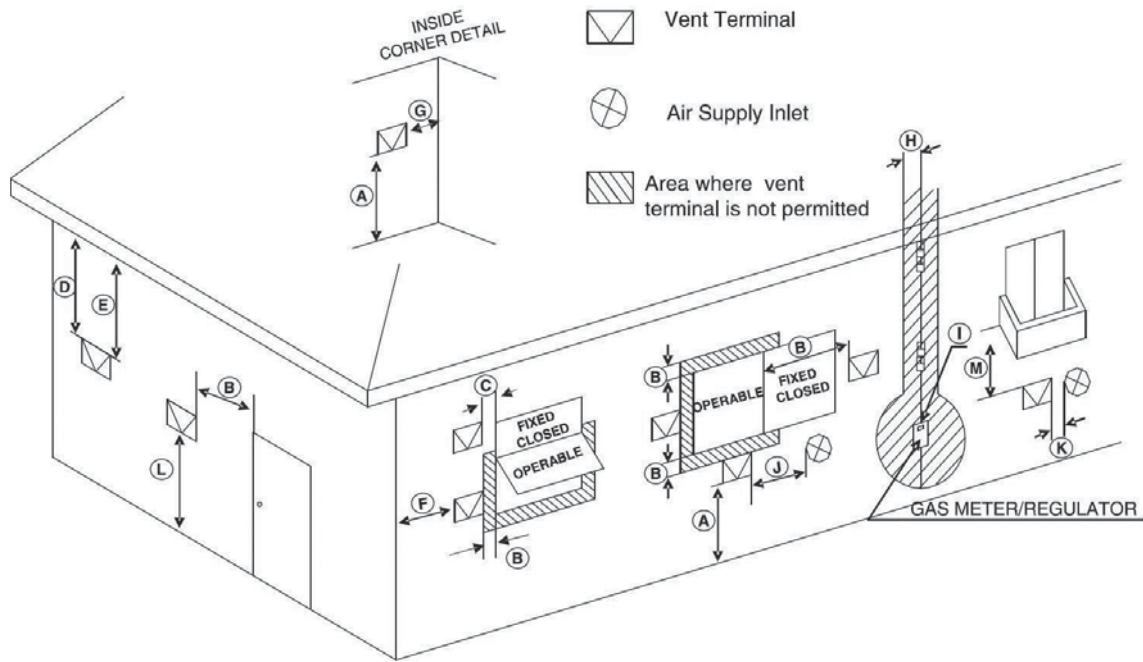
3. Install the hose to the cascade system and direct the end of the hose to a drain.



WARNING

After installing the condensate drain hose, check the loop again to ensure that the prime water is not spilled. The loop (siphon) must be primed with water before running the system to prevent toxic exhaust gas from leaking into the installation site.

9.8 Exhaust Vent Termination Clearances (For Direct Vent)



Ref	Description	Canadian Direct Vent Installations ¹	U.S. Direct Vent Installations ²
A	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B	Clearance to window or door that may be opened	36 in (91 cm)	12 in (30 cm)
C	Clearance to permanently closed window	*	*
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	*	*
E	Clearance to unventilated soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	*	*
H	Clearance to each side of center line extended above meter/regulator assembly	3 ft (91 cm) within a height 15 ft above the meter/regulator assembly	*
I	Clearance to service regulator vent outlet	3 ft (91 cm)	*
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	36 in (91 cm)	12 in (30 cm)
K	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	*
M	Clearance under veranda, porch deck, or balcony	12 in (30 cm)‡	*

¹ In accordance with the current CSA B149.1 Natural Gas and Propane Installation Code

² In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code

† A vent shall not terminate directly above a sidewalk or a paved driveway that is located between two single family dwellings, that serves both dwellings.

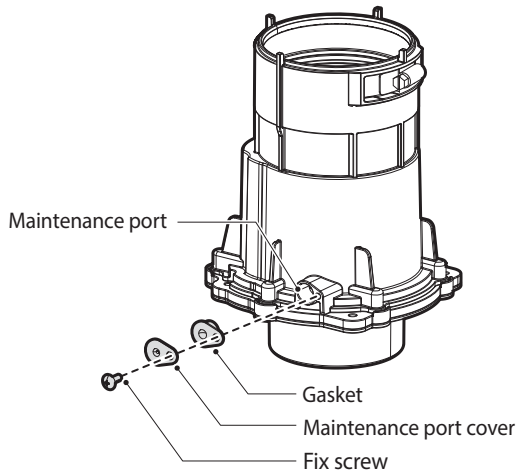
‡ Permitted only if the veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

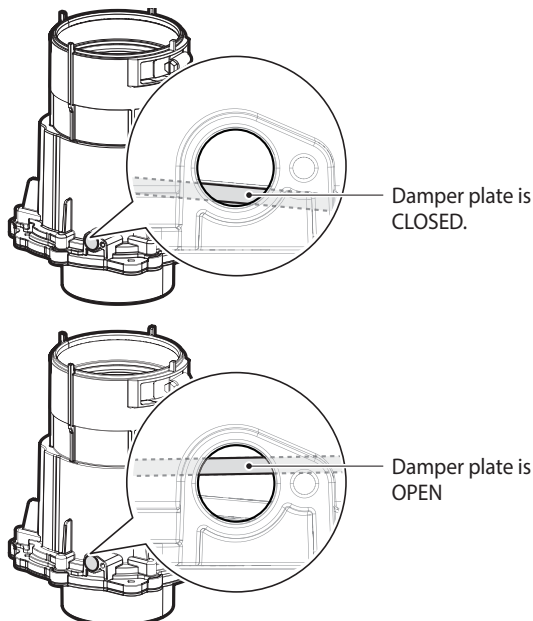
9.9 Maintenance

Periodically check the damper condition inside the Common Vent Collar Kit through the maintenance port to ensure optimal performance of the system. Follow the instructions to check the damper condition and replace the Common Vent Collar Kit if necessary.

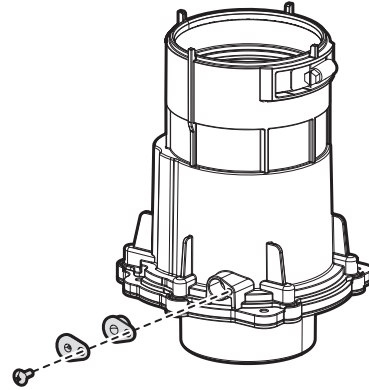
1. Remove the screw that fixes the maintenance port cover to the Common Vent Collar Kit, and then remove the gasket and the maintenance port cover.



2. Through the maintenance port, check the operating condition of the damper plate inside the Common Vent Collar Kit.



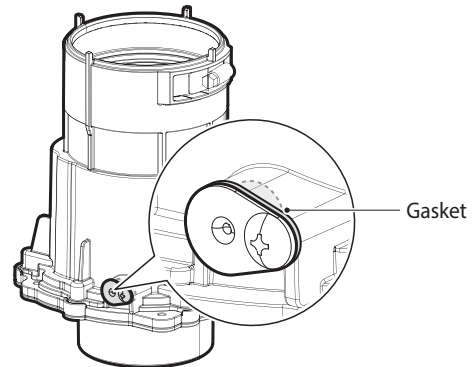
3. Reinstall the gasket and maintenance port cover, and then fix them with a set screw.



4. Visually inspect the maintenance port to ensure that the gasket is properly installed between the maintenance port and the maintenance port cover.

WARNING

Ensure that the gasket is properly installed under the maintenance port cover, after checking the operating condition of the damper plate through the maintenance port. Harmful exhaust gas may leak if the gasket is not installed, or if it is not installed properly.



10. Installation Checklist

After installing the boiler, review the following checklist. You should be able to answer "Yes" to all of the items in the checklist. If not, review the appropriate sections to complete the installation. To troubleshoot any operational problems refer to "Troubleshooting" in the User's Information Manual.

If you have additional questions or need assistance with installation, contact Technical Support at 1-800-519-8794 or 1-949-420-0420, or refer to the technical support section of Navien's website (www.navieninc.com).

Installing the Boiler	Yes	No
Have you maintained the required clearances from building openings and intake air vents?		
Have you minimized the distance between the boiler and the vent termination?		
Have you maintained the proper service and maintenance clearances?		
Is the make-up air supply sufficient for proper operation?		
Is the make-up air supply free from dust, dirt, corrosive elements, and flammable vapors?		
Is the boiler and vent piping clear of combustible materials, including clothing, cleaning materials, and rags?		

Connecting the Gas Supply	Yes	No
Does the gas supply match the type specified on the boiler's rating plate?		
Is the gas line at least $\frac{3}{4}$ in ID (Inner Diameter)?		
Is the gas supply line sufficient in length and diameter to deliver the required BTUs?		
Have you measured the pressure of the gas supply line?		
Is the gas supply pressure within the recommended ranges specified in this manual?		
Is the gas supply line equipped with a manual shut-off valve?		
Have you tested the gas line pressure and all fittings for leaks?		
Has the gas company inspected the installation, if required?		

Connecting the Space Heating Piping	Yes	No
Has the system been filled (less than 150 psi) and purged of air?		
Does the piping incorporate means for air removal (scoop, separator, etc.)?		
Is there an expansion tank installed and set to the proper system pressure?		
If antifreeze has been used, is it the proper type and is the concentration appropriate?		
If an external low water cut off (LWCO) is installed, is it wired to the boiler?		

Connecting a Pressure Relief Valve	Yes	No
Have you installed an approved pressure relief valve on the boiler?		
Does the rating of the pressure relief valve match or exceed the maximum BTU rating of the boiler?		
Is the pressure relief valve $\frac{3}{4}$ in on the space heating outlet?		
Have you installed the pressure relief valve on the space heating supply pipe near the boiler?		
Have you installed a discharge drain tube from the pressure relief valve to within 6-12 in (150-300 mm) of the floor?		

Connecting the Condensate Drain	Yes	No
Have you installed a condensate drain line from the boiler to a drain or laundry tub?		

Venting the Boiler	Yes	No
Have you vented the boiler with 3 in or 4 in PVC, CPVC, polypropylene, Type BH Special Gas Vent (ULC-S636) for Category IV boilers (Canada), AL29-4C stainless steel, or in accordance with all local codes and the guidelines in this manual?		
Have you ensured that ABS or PVC cellular core pipe has not been used as venting for the boiler?		
Is the vent sloped upward toward the vent termination at a rate of $\frac{1}{4}$ in per foot (2% grade)?		
Are all vent runs properly supported?		
Is the vent termination properly supported?		
Are the air intake and exhaust connections on the flue and vent lines correctly sealed?		
Have you installed end caps on the exhaust and intake pipes?		
Have you checked the venting for leaks?		
Is the vent termination at least 12 in (300 mm) above the exterior grade?		
For INDIRECT common vent systems, have you ensured that sufficient make-up air is available?		
Is the total vent length within the maximum vent length restriction?		

Connecting the Power Supply	Yes	No
Is the supplied voltage 110-120V AC?		
Is the boiler connected to a properly grounded power supply?		
If you have made a direct power supply connection, have you installed a power switch to facilitate end-user maintenance?		
Have you checked the polarity of the electrical connection?		

PCB DIP SW 2 setting (Set of 8)	Yes	No
Is switch #1 set correctly for the gas type used? (NG-OFF, LP-ON)		
If continuous boiler operation is required, is switch #7 in the up (ON) position?		
If high temperature venting has been installed (CPVC or polypropylene), is switch #8 in the up (ON) position?		

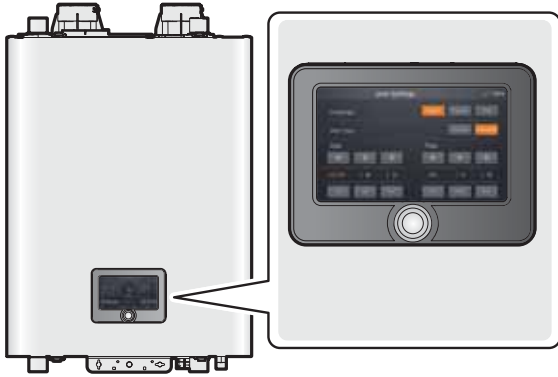
Operating the Boiler	Yes	No
Have you given the Installation & Operation Manual and User's Information Manual to the owner for future reference?		
Have you shown the owner how to shut off the gas in case of an emergency?		

11. Operating the Boiler

11.1 Turning the Boiler On or Off

To turn the boiler on:

1. Connect the boiler to the power supply. When the power is on, the User Settings screen is displayed.



2. Select the language you want to use and set the vent type, current date, and time by tapping your selections on the screen.
3. Tap **Done** on the top right of the screen to complete the settings.



11.1.1 Turning the Space Heating On or Off

To turn the Space Heating on or off, tap **SH ON** on the top left of the screen.



11.1.2 Turning the DHW On or Off

To turn the DHW on or off, tap **DHW ON** on the top right of the screen.



11.2 Adjusting the Temperature

11.2.1 Adjusting the Space Heating Temperature

To adjust the heating temperature on the screen, tap **-** or **+** to select the space heating temperature in the SH Set Temp menu. The current temperature setting is displayed in the menu.



Note

- The space heating temperature cannot be adjusted if the boiler is operating as a sub unit in a cascade system. The main unit's set temperature will be displayed on the screen.
- In case of outdoor reset sensor malfunction, the boiler will operate at this set temperature.
- Take note of the original heating temperature in case you want to restore it to the default.
- The default space heating supply water temperature range is 104°F (40°C, Absolute MIN) to 180°F (82°C, Absolute MAX).
- The default space heating return water temperature range is 86°F (30°C, Absolute MIN) to 149°F (65°C, Absolute MAX).
- You can adjust the temperature ranges in the parameter settings menu.

11.2.2 Adjusting the DHW Indirect Supply Temperature

To adjust the water temperature on the screen, tap **-** or **+** to select the DHW Indirect Supply temperature in the DHW Set Temp menu. The current temperature setting is displayed in the menu.



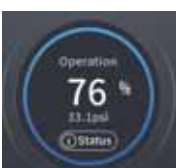


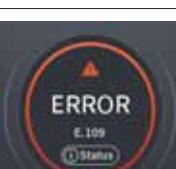



Note

- Take note of the original DHW indirect supply temperature in case you want to restore it to the default.
- When using the DHW tank temperature sensor, the default range is 86°F (30°C) to 162°F (72°C, [Absolute Max - 18°F (10°C)]).
- When using the Aquastat, the default range is 104°F (40°C, Absolute Min.) to 180°F (82°C, Absolute Max.).
- You can adjust the temperature ranges in the parameter settings menu.

11.3 About the Operating Status Information

The following table provides detailed information for the operating status displays that appear when using the boiler.

Item	Operating Status Displays	Description
Standby		The boiler is on standby for a new operation.
Start Up		The boiler operation has started. (The pre-purge is being performed by operating the fan and the pump is operating.)
Operation		The flame has been detected. The heat is being controlled via ratio control.
Post Purge		Combustion has stopped. The post-purge is being performed by operating the fan.
Set Point Match		The set temperature has been reached and combustion has stopped. The boiler is on standby for a new operation until reignition is required.
ERROR		Combustion has stopped due to an error. To view detailed error information, tap the operating status display.
Alarm		An alarm has occurred. Boiler operation may be restricted. To view detailed alarm information, tap the operating status display.

11.4 Resetting the Boiler

If an error message appears during boiler operation, reset the boiler to resolve the problem. Press and hold the Reset button on the front panel to reset the boiler.

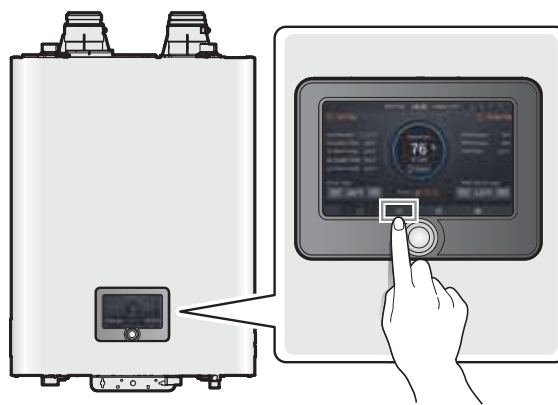


If resetting the boiler does not solve the problem, refer to the “Troubleshooting” section in the User’s Information Manual or contact Technical Support at 1-800-519-8794.


11.5 Accessing Basic Menu Items

In the Control menu, you can view the boiler’s operating conditions; configure the space heating and DHW temperatures.

Tap the Control button  to enter the Control menu.



11.5.1 Viewing Basic Information


To view information about the boiler, tap the Control button  > **Status** on the screen.

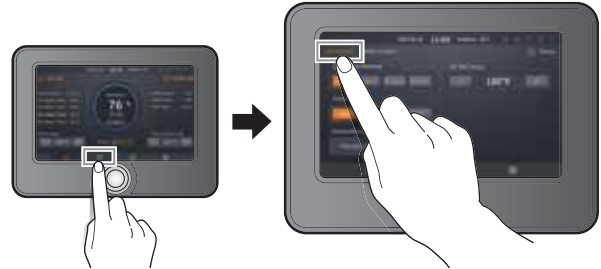


Tap an item to view the information.

Item	Description
1. SH Set Temp	Space heating set temperature (°F)
2. DHW Set Temp	DHW indirect supply temperature (°F)
3. SH Supply Temp	Heating supply temperature (°F)
4. SH Return Temp	Boiler return temperature (°F)
5. System Supply Temp	System supply temperature (°F)
6. System Return Temp	System return temperature (°F)
7. Outdoor Temp	Outdoor temperature (°F)
8. Exhaust Temp	Exhaust temperature (°F)
9. Approx. Boiler Flow	Flow rate (GPM)
10. Water Pressure	Water pressure (psi)
11. Flame Value	Flame detector AD value <ul style="list-style-type: none"> • Flame On: 8bit AD values equal to or lower than 70 • Flame Off: 8bit AD values equal to or higher than 175
12. Heat Capacity	Heat capacity (%)
13. Target RPM	Set fan speed (RPM)
14. Current RPM	Fan speed (RPM)
15. Target APS	Set APS voltage (V)
16. Current APS	APS voltage (V)


11.5.2 Setting the Space Heating Operation

To set the boiler's space heating operation, tap the Control button  > **SH Control** on the screen.



Tap an item to set the space heating operation settings.

Item	Description
1. SH Control Method	Select a heating control type. <ol style="list-style-type: none"> 1. Supply: Supply temperature 2. Return: Return temperature 3. System Supply: System Supply temperature 4. System Return: System Return temperature <ul style="list-style-type: none"> • Default: Supply
2. Pump1 Setting	Set the Pump1. <ul style="list-style-type: none"> • Zone1 Pump: The DHW pump is not used and three zone pumps are available • DHW Pump: The DHW pump is used and two zone pumps are available • Default: DHW Pump
3. Zone Setting	Enable or disable the zone-specific temperature control function. <ul style="list-style-type: none"> • Default: Disable <p>Note If enabled, you can set the zone priority by tapping Priority Set. For more information about the zone-specific temperature control, refer to "Setting Zone-Specific Temperature Control Function in Detail."</p>
4. Outdoor Reset / Detailed Settings	Set the Outdoor Reset Control function. <p>Note For more information about detailed settings, refer to "Setting Outdoor Reset Control Function in Detail."</p>

Item	Description
5. SH Set Temp	<p>Set space heating target temperature.</p> <ul style="list-style-type: none"> • Supply set temperature <ul style="list-style-type: none"> - Setting range: 104°F (40°C)-180°F (82°C) - Default: 180°F (82°C) • Return set temperature <ul style="list-style-type: none"> - Setting range: 86°F (30°C)-149°F (65°C) - Default: 149°F (65°C) <p>Note To change the setting ranges, tap the Set button  > Parameter on the screen, and then adjust the values for the Supply/Return absolute Min/Max point items. For more information about detailed settings, refer to "11.6.3 Setting the Operation Parameters."</p>

CAUTION

An outdoor sensor error may occur if the Outdoor Reset Control mode is enabled without the outdoor sensor installed.

Note In the Outdoor Reset Control mode, the boiler's water temperature is regulated according to the outdoor temperature to maximize boiler efficiency and reduce energy usage.

Setting Zone-Specific Temperature Control Function in Detail

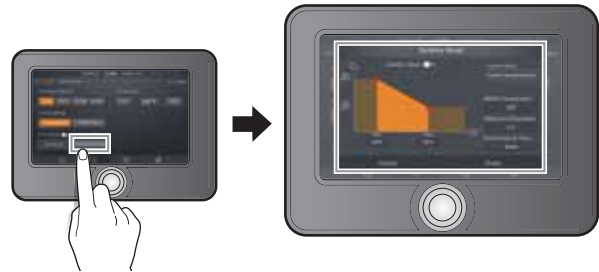
This function allows you to set different temperatures for each zone. If Zone Setting is enabled, you can set the temperature for each zone and each zone will be controlled by the set temperature. If simultaneous demands for several zones occur, the temperature will be controlled by the zone with higher priority. You can set the priority in the pop-up window that appears when tapping **Priority Set**. This function is disabled automatically if Outdoor Reset, BMS Status, and Navien zone controller are enabled.

In cascade mode, two types of space heating modes are available depending on the settings for the Zone Setting menu.

- When Zone Setting is enabled: Zone-specific temperatures are applied and up to three zone pumps connected to the main unit are available.
- When Zone Setting is disabled: The temperature of SH Set Temp is applied and every zone pump of the main unit and subunits are available.

Setting Outdoor Reset Control Function in Detail

To set the outdoor reset control function in detail, tap **Detailed Settings** on the Outdoor Reset menu.



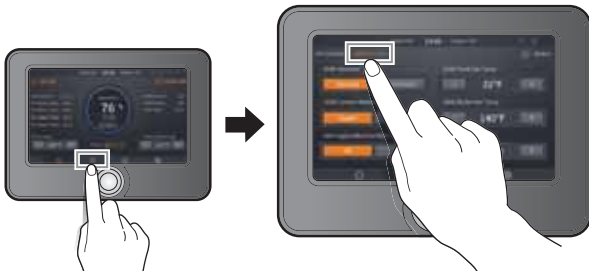
Item	Description
1. Outdoor Reset	<p>Enable or disable the outdoor reset function.</p> <ul style="list-style-type: none"> • Default: Enabled
2. Min	<p>Set the minimum outdoor reset temperature for outdoor reset control.</p> <ul style="list-style-type: none"> • Setting range: -4°F (20°C)-[Max-9°F (5°C)] • Default: 14°F (-10°C)
3. Max	<p>Set the maximum outdoor reset temperature for outdoor reset control.</p> <ul style="list-style-type: none"> • Setting range: [Min + 9°F (5°C)]-104°F (40°C) • Default: 70°F (21°C)
4. Curve select	<p>Select the outdoor reset load.</p> <ul style="list-style-type: none"> • Default: Finned Tube Baseboard
5. WWSD Temperature	<p>Enable or disable the Warm Weather Shut Down temperature function.</p> <ul style="list-style-type: none"> • Setting range: OFF, 50°F (10°C)-104°F (40°C) • Default: OFF <p>Note If the outdoor reset temperature exceeds the set temperature, all SH demands are ignored.</p>
6. WWSD On Differential	<p>Enable or disable the Warm Weather Shut Down On Differential temperature function.</p> <p>Note If the outdoor reset temperature is lower than the set temperature, this feature is enabled depending on SH demands.</p>

Item	Description
7. Boost Interval Time	Set the boost interval set time (min). <ul style="list-style-type: none"> Setting range: 0-120 min Default: 0 min

Note To change the set temperature range (Y-axis in the graph), tap the Set button (⚙️) > **Parameter** on the screen, and then adjust the values for the Supply/Return absolute Min/Max point items. For more information about detailed settings, refer to "11.6.3 Setting the Operation Parameters."

11.5.3 Setting the DHW Operation (Indirect)

To set the boiler's indirect DHW operation, tap the Control button (🔧) > **DHW Control** on the screen.



Tap an item to set the DHW operation settings.

Item	Description
1. DHW Demand	Select a device for sensing the DHW demand. <ol style="list-style-type: none"> Aquastat Tank Sensor <ul style="list-style-type: none"> Default: Aquastat
2. DHW Control Method	Select a DHW control type. <ol style="list-style-type: none"> Supply System Supply <ul style="list-style-type: none"> Default: Supply
3. Anti Legionella* function	Enable or disable the protection against legionella bacteria. <ul style="list-style-type: none"> Setting range: ON/OFF Default: OFF
4. DHW Tank Set Temp	Set the DHW tank target temperature. <ul style="list-style-type: none"> Setting range: 86°F (30°C)-[Supply Absolute MAX Set-point-18°F (10°C)] Default: 122°F (50°C)

Item	Description
5. DHW Boiler Set Temp	Set the DHW boiler target temperature. The setting range varies depending on the DHW demand types. <ul style="list-style-type: none"> When an aquastat is used, the setting range is same as the DHW temperature setting range. When a tank sensor is used: <ul style="list-style-type: none"> [DHW Tank Set temp + 18°F (10°C)]-Supply Absolute MAX Set-point 180°F (82°C) Default: 180°F (82°C)
6. DHW Priority time	Set the DHW priority time. <ul style="list-style-type: none"> Setting range: 0-180 min Default: 30 min

Note To change the absolute max values of the DHW tank set temperature and the DHW boiler set temperature, tap the Set button (⚙️) > **Parameter** on the screen, and then adjust the values for the Supply Absolute Max Set-point items. For more information about detailed settings, refer to "11.6.3 Setting the Operation Parameters."

*This function will provide protection from growth of legionella bacteria in the DHW tank only. It will not protect water supply piping.

A mixing valve must be installed on the DHW supply line when this mode is enabled as water temperatures will exceed 140°F (60°C).

11.5.4 Viewing Error History

When an error occurs, an error code is displayed on the status display in the center of the screen. If you tap the status display on the screen, an error pop-up will be displayed.

To view the error history, tap **Open** in the pop-up window. To return to the main screen, tap **Close**.



Errors are displayed on the screen, with the error codes, time of occurrence, and the total run time.

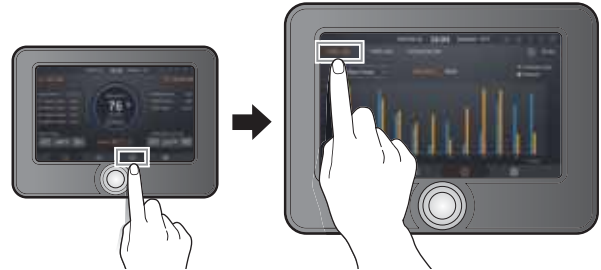
Tap **Done** to return to the previous screen or menu.



Note To view the error history in the EMS menu, tap the EMS button (⚙️) on the main screen, and then tap **Error** on the top right of the screen.

11.5.5 Viewing Other System Information

To view the miscellaneous system information, tap the EMS button (⚙️) > **EMS Info** on the screen.

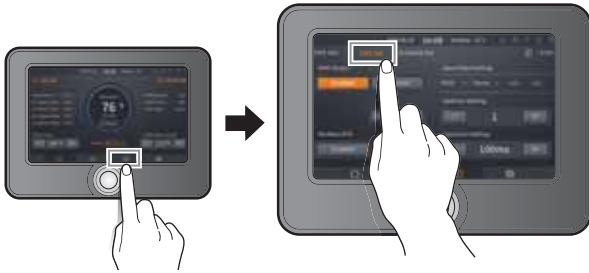


Tap the dropdown button (▼) to switch between the information items.

Item	Description
SH Run Time	View space heating operation logs. • Display option: Monthly/Daily
DHW Run Time	View DHW operation logs. • Display option: Monthly/Daily
SH Gas Usage	View space heating gas consumption. • Display option: Monthly/Daily
DHW Gas Usage	View DHW gas consumption. • Display option: Monthly/Daily
Live Status	View current Status values.

11.5.6 Setting General Building Management System (BMS) Information

To set the general Building Management System (BMS) information, tap the EMS button (🔌) > **EMS Set** on the screen.

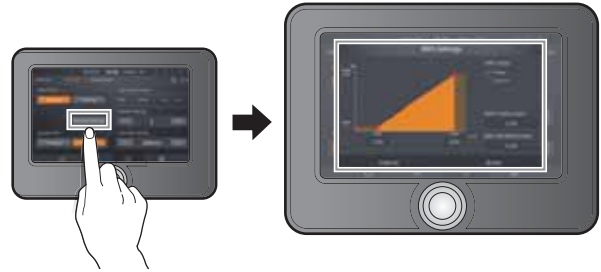


Item	Description
1. BMS Status	Enable or disable the Building Management System (BMS) function.
2. BMS Status / Detailed Settings	Set the Building Management System (BMS) function. Note For more information about detailed settings, refer to "Setting Detailed Building Management System (BMS) information."
3. BMS Communication Protocol	Enable or disable the BMS Communication Protocol function. • Default: Disabled • If Enabled is selected, you can use Modbus communication.
4. Baud Rate Setting	Set the Baud rate and parity type.
5. Address Setting	Set the BMS Communication Protocol address. • 0: Broadcast messages • 1-100: Available address numbers for each unit • Default: 1
6. Time Out Setting	Set the timeout after transmission. • Setting range: 100 ms-1000 ms • Default: 100 ms

Note For more details on how to set up BMS gateway, refer to the Modbus/BACnet or LonWorks Installation and Operation Manuals.


Setting Detailed Building Management System (BMS) information

The boiler's firing rate and set point can be controlled by 0-10 V Building Management System (BMS) input, if BMS Status is set to **Enabled**. If BMS Status is set to **Disabled**, 0-10 V Building Management System (BMS) input is ignored. To set the detailed Building Management System (BMS) information, tap **Detailed Settings** on the BMS Status menu.

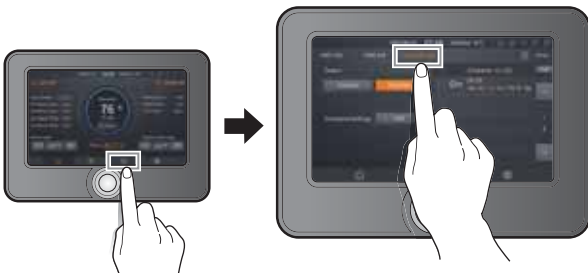


Item	Description
1. Min (Firing rate)	Set the minimum firing rate for BMS control. • Setting range: 0.1%-[2. Max (Firing rate) - 20%] • Default: Boiler MIN HC
2. Max (Firing rate)	Set the maximum firing rate for BMS control. • Setting range: [1. Min (Firing rate) + 20%]-100% • Default: 100%
3. Min (Volts)	Set the minimum voltage for BMS control. • Setting range: 0 V-[Volts Max - 1 V] • Default: 2 V
4. Max (Volts)	Set the maximum voltage for BMS control. • Setting range: [Volts Min + 1 V]-10 V • Default: 10 V
5. BMS mode	Select the BMS mode (Firing rate or Setpoint). • Default: Firing Rate
6. BMS Enable Volts	Set the BMS activation voltage. Boilers operates when the input voltage exceeds the set voltage. • Setting range: 0 V-10 V • Default: 2 V

Item	Description
7. BMS off Differential	<p>Set the BMS off differential voltage. Boiler stops operating when the input differential voltage is lower than the set voltage.</p> <ul style="list-style-type: none"> Setting range: 0 V-BMS Enable Volts Default: 0.5 V

Note To change the set temperature range (Y-axis in the graph) when **Setpoint** is selected, tap the Set button  > **Parameter** on the screen, and then adjust the values for the Supply/Return absolute Min/Max point items. For more information about detailed settings, refer to “11.6.3 Setting the Operation Parameters.”

11.5.7 Setting Schedule

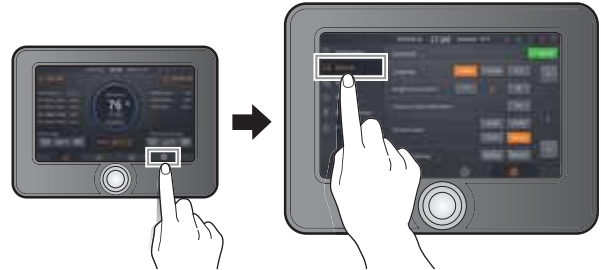


If Status is set to **Enabled**, the boiler will turn on or off depending on the set schedule. The schedule setting feature is deactivated if Status is set to **Disabled**.

This feature is performed repeatedly on the set day and time, and you can create up to 30 schedules. If you set the schedule mode to **Off**, the boiler will stop operating, regardless of the demand.

11.5.8 Setting General Options

To set up general options, tap the Set button  > **General** on the screen.



Item	Description
1. Language	<p>Select a display language.</p> <ol style="list-style-type: none"> English Français (French) <ul style="list-style-type: none"> Default: English
2. Brightness Control	<p>Set the brightness level.</p> <ul style="list-style-type: none"> Setting range: 0-3 Default: 3
3. Touch screen Calibration	<p>Set the touch screen settings.</p>
4. Screen Saver	<p>Set the time for the screen saver.</p> <ol style="list-style-type: none"> 10min 30min 1 hour Always <ul style="list-style-type: none"> Default: 1hour
5. Memory Backup	<p>You can back up or restore the panel's memory, such as EMS information graph data.</p> <p>Select a memory management type.</p> <ol style="list-style-type: none"> Backup Restore <p>Note To back up data, the type of the file system for USB storage devices must be FAT32. Other types such as SanDisk Cruzer Blade USB flash drives cannot be used for memory backup.</p>

Tap (☑) to go to the next page.



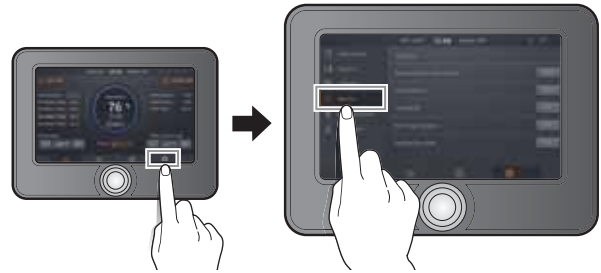
Item	Description
1. Date & Time	Set the date and time by tapping + and -.
2. Temperature Unit	Set a temperature unit. 1. Celsius (°C) 2. Fahrenheit (°F) • Default: Fahrenheit (°F)
3. Pressure Unit	Set a pressure unit. 1. bar 2. psi • Default: psi

11.6 Accessing Advanced Menu Items

11.6.1 Viewing Service Information

To view service information about the boiler:

1. Tap the Set button (⚙) > **Service**.



2. Tap **Open** on the Service Status Information menu.



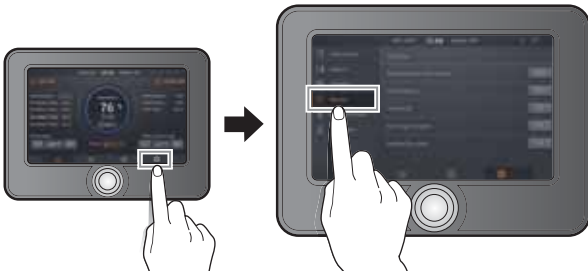
Item	Description
1. Elapsed time after install	Elapsed time since installation
2. HEX Overheat - No. of times	Number of heat exchanger overheating protection activation
3. Flame Loss - No. of times	Number of flame loss/misfire
4. 2nd ignition - No. of times	Number of second ignition
5. 3rd ignition - No. of times	Number of third ignition
6. 4th ignition - No. of times	Number of fourth ignition
7. 5 ~10th ignition - No. of times	Number of tenth ignition

Item	Description
8. ΔT Limit - No. of times	Number of times supply return temperature limit control has activated
9. Supply Limit - No. of times	Number of times Recirculation supply temperature limit control has activated
10. ΔT High - No. of times	Number of times combustion stopped due to supply return temperature

11.6.2 Viewing Input and Output Status

To view the boiler's input and output status:

1. Tap the Set button  > **Service**.




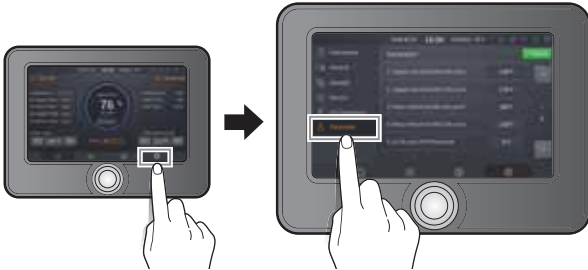
2. Tap **Open** on the In/Out Status menu.



Item	Description
1. SH1 Thermostat Input	Space heating thermostat 1 input status
2. SH2 Thermostat Input	Space heating thermostat 2 input status
3. SH3 Thermostat Input	Space heating thermostat 3 input status
4. DHW Thermostat Input	DHW thermostat 1 input status
5. Boiler Pump Output	Boiler pump output status
6. Zone1 Pump Output	Zone 1 pump output status
7. Zone2 Pump Output	Zone 2 pump output status
8. Zone3 Pump Output	Zone 3 pump output status
9. HTL Input	HTL input status
10. Dual Venturi Output	Dual Venturi output status
11. LWCO Input	LWCO input status
12. Air Handler Output	Air Handler Interface output status
13. DHW Priority Output	DHW priority output status

11.6.3 Setting the Operation Parameters

To set the boiler's operation parameters, tap the Set button () > **Parameter** on the screen.





On the password screen, enter the password.

The default factory password is "1234".

CAUTION

Parameters must be set by a qualified professional with an extensive understanding of the boiler system. Setting parameters improperly may lead to property damage or injury.

Note To save the parameter settings, tap the Save () button on the top right of the screen. If the parameter settings are saved successfully, the Saved () button will be displayed.

Item	Description
1. Supply Absolute MIN Set-point	Set the space heating supply minimum temperature. <ul style="list-style-type: none"> Setting range: 77°F (25°C)-[MAX Set-point – 36°F (20°C)] Default: 104°F (40°C)
2. Supply Absolute MAX Set-point	Set the space heating supply maximum temperature. <ul style="list-style-type: none"> Setting range: [MIN Set-point + 36°F (20°C)] – 190°F (88°C) Default: 180°F (82°C)
3. Return Absolute MIN Set-point	Set the space heating return minimum temperature. <ul style="list-style-type: none"> Setting range: 68°F (20°C)-[MAX Set-point – 18°F (10°C)] Default: 86°F (30°C)
4. Return Absolute MAX Set-point	Set the space heating return maximum temperature. <ul style="list-style-type: none"> Setting range: [MIN Set-point + 18°F (10°C)]-158°F (70°C) Default: 149°F (65°C)
5. SH Burner Off Differential	Set the temperature range to turn off space heating. <ul style="list-style-type: none"> Setting range: 2°F (1°C)-54°F (30°C) Default: 4°F (2°C)
6. SH Burner On Differential	Set the temperature range to turn on space heating. <ul style="list-style-type: none"> Setting range: 2°F (1°C)-54°F (30°C) Default: 5°F (3°C)
7. SH Min Limit	Set the space heating minimum heat capacity limit. <ul style="list-style-type: none"> Setting range: Space heating Min capacity (%)-[space heating min capacity limit -20]) % Default: Boiler's minimum heat capacity
8. SH Max Limit	Set the space heating maximum heat capacity limit. <ul style="list-style-type: none"> Setting range: (Space heating Min capacity limit +20) %-100% Default: 100%
9. SH Min Burning Time	Set the low-load combustion time at initial operation. <ul style="list-style-type: none"> Setting range: 1-20 min Default: 1 min


Item	Description
10. Burning Acceleration Time	Set the time to reach the maximum space heating capacity after initial operation. <ul style="list-style-type: none"> Setting range: 0-20 min Default: 3 min
11. Anti Fast Cycling Time*	Set the anti-fast cycling time. <ul style="list-style-type: none"> Setting range: 0-20 min Default: 3 min
12. DHW Min Limit	Set the DHW supply minimum temperature. <ul style="list-style-type: none"> Setting range: DHW minimum capacity (%) - [DHW MAX capacity limit - 20] % Default: Boiler's minimum heat capacity
13. DHW Max Limit	Set the DHW supply maximum temperature. <ul style="list-style-type: none"> Setting range: [DHW Min capacity limit + 20] %-100% Default: 100%
14. Freeze Protection	Set the pump freeze protection temperature. <ul style="list-style-type: none"> Setting range: 43°F (6°C)-50°F (10°C) Default: 50°F (10°C) <p>Note The system freeze protection temperature is set based on the pump freeze protection temperature.</p>
15. Low System Pressure	Set the low water system pressure. <ul style="list-style-type: none"> Setting range: 4-17 psi Default: 6 psi
16. High System Pressure	Set the low water system pressure. <ul style="list-style-type: none"> Setting range: 40-141 psi Default: 70 psi
17. Boiler pump operation(DHW)	Turn on or turn off the boiler pump in DHW mode. <ul style="list-style-type: none"> Setting range: ON/OFF Default: OFF
18. DHW Pump Operation	Turn on or turn off the DHW pump when space heating and DHW modes are required at the same time while using space heating mode. <ul style="list-style-type: none"> Default: ON

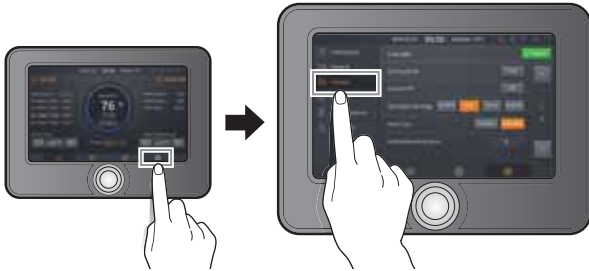
Item	Description
19. Boiler Pump Delay	Set the SH pump over-run time. <ul style="list-style-type: none"> Setting range: ON/OFF Default: OFF
20. DHW Demand On Differential	Set the DHW On temperature when using the DHW temperature sensor. <ul style="list-style-type: none"> Setting range: 0°F (0°C)-18°F (10°C) Default: 5°F (3°C)
21. DHW Demand Off Differential	Set the DHW Off temperature when using the DHW temperature sensor. <ul style="list-style-type: none"> Setting range: 0°F (0°C)-9°F (5°C) Default: 0°F (0°C)
22. Service Notification Time	<ul style="list-style-type: none"> Setting range: 30-3650 days (10 years) It can be set in 10 day increments. Default: 1820 days (5 years)
23. Service Notification Cycle	Set the service notification according to the operating times. <ul style="list-style-type: none"> Setting range: 300-36500 cycles It can be set in 100 cycle increments. Default: 18200 cycles
24. Service Contact Phone Number	View the service contact information.
25. Factory Reset	Initialize all parameter settings (panel and main controller) to factory default.
26. P/W Change	Change the parameter setting password.

- Note**
- If you enter an incorrect password 10 times or do not press any buttons for 5 minutes, the boiler will return to Normal mode.
 - The Factory default password is "1234".
 - When you reset one of the following parameters, the corresponding parameter will be reset automatically:
 - Supply Min or Max capacity limit
 - Return Min or Max capacity limit
 - Lowest Outdoor Temperature or Highest Outdoor Temperature

* The anti-fast cycling time is the duration that the boiler stops its space heating operation when the space heating supply or return temperatures reach the set values for boiler operation stop temperatures. The boiler will not resume space heating until the duration elapses, even when the space heating supply or return temperatures return to within the set ranges.


11.6.4 Configuring a Cascade System

To view and configure the cascade settings, tap the Set button  > **Cascade** on the screen.



Item	Description
1. Setting Mode	<ul style="list-style-type: none"> To enter the Cascade Setting Mode, tap Start. The setting mode is entered and the IDs of all boilers that can communicate with the Main via the RS485 communication line are initialized. If you tap and hold OK for 3 seconds or more while the boilers whose IDs are initialized by the Main are set to the Sub setting mode, the Main gives you the ID and it is displayed on the screen. The Main periodically checks the RS485 communication, and when there is an ID request from the Sub, the ID is sequentially incremented and added to the Sub (1 to 31). Tap OK in the Main to complete the cascade setting. In the Main and the Sub with assigned IDs, the pop-up windows will be closed and the cascade setting mode will be completed. The Home screen is automatically changed into the cascade screen as soon as the cascade setting is complete. In Main setting mode, if no input is detected for 60 minutes, the boiler resumes normal operation without cascading.


Item	Description
2. System Off	<p>Select this option on the main unit of a cascade system to end cascade operation.</p> <ul style="list-style-type: none"> Enter main setting mode to reassign IDs and begin a cascade system again. If a sub unit has a network communication problem, select this option on the sub unit to exclude the individual unit from the cascade system.
3. Operation Strategy	<p>Set the cascade strategy (control type).</p> <ul style="list-style-type: none"> Default: ECO <p>Note For more detailed information on the operation strategies, refer to "Setting the Operation Strategy" on page 105.</p>
4. Vent Type	<p>Set the ventilation type.</p> <ul style="list-style-type: none"> Setting range: Common/Individual Default: Common
5. Initial Activating Units	<p>Set the number of initial activating units in the cascade system.</p> <ul style="list-style-type: none"> Setting range: 0-32 Default: 0

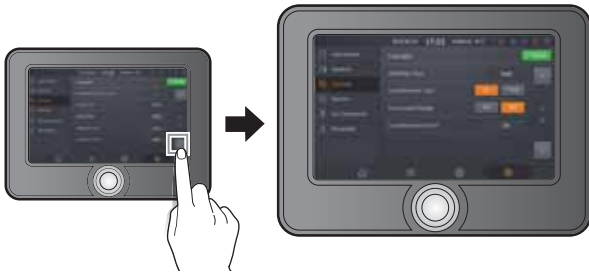
Tap  to go to the next page.



Item	Description
1. Minimum Operation Unit	<p>Set the minimum number of the boilers for the cascade system.</p> <ul style="list-style-type: none"> Setting range: 1-32 Default: 1
2. Unit On HC	<p>Set the heating capacity standard when adding boilers to the cascade system. (Applied if Operation Strategy is set to Custom.)</p> <ul style="list-style-type: none"> Setting range: (Unit Off HC + 20%)-(Max. Cascade heat - 5%) Default: 70%

Item	Description
3. Unit Off HC	Set the heating capacity standard when removing the boilers for the cascade system. (Applied if Operation Strategy is set to Custom .) <ul style="list-style-type: none"> Setting range: (Min. Cascade heat + 5%)-(Unit On HC - 20%) Default: 30%
4. Stabilize Time	Set the stabilization time after changing the number of the boilers for the cascade system. <ul style="list-style-type: none"> Setting range: 3-60 min Default: 5 min
5. On Delay Time	Set the delay time when changing the number of the boilers for Cascade On mode. <ul style="list-style-type: none"> Setting range: 30-240 sec Default: 60 sec

Tap  to go to the next page.





Item	Description
1. Off Delay Time	Set the delay time when changing the number of the boilers for Cascade Off mode. <ul style="list-style-type: none"> Setting range: 30-240 sec Default: 60 sec
2. Lead Rotation Type	Set the rotation type for reassigning the lead boiler. <ul style="list-style-type: none"> ID: The lead boiler is assigned in order of the boiler ID. Time: The lead boiler is assigned in the order of boilers with the shortest uptime during the time set in Lead Rotation Period. Default: ID

Item	Description
3. Force Lead Change	Set Force Lead Change. <ul style="list-style-type: none"> Yes: Reassign the lead boiler regardless of the demand status. No: Reassign the lead boiler when demands are off. Default: Yes
4. Lead Rotation Period	The lead boiler changes automatically at the interval set in Lead Rotation Period to maintain the operation time of all boilers for the cascade system equally. (Boiler operation time standards) <ul style="list-style-type: none"> Setting range: 2-1,000 hours Default: 24 hours

About the Cascade Operation Screens

After completing the cascade system configuration, the cascade operation screen for the main and sub boilers is displayed as follows. You can set the detailed information for the cascade system's main or sub boilers.

- Main screen
 - To adjust the space heating temperature, tap  or .
 - To allow the main boiler to operate, tap **Main**.
 - To allow the boilers to operate in the cascade system, tap **Cascade**.



- Sub screen

To operate or stop operating the sub boilers, tap **ON/OFF**. You cannot adjust the space heating temperature of the sub boilers when the cascade system is configured.



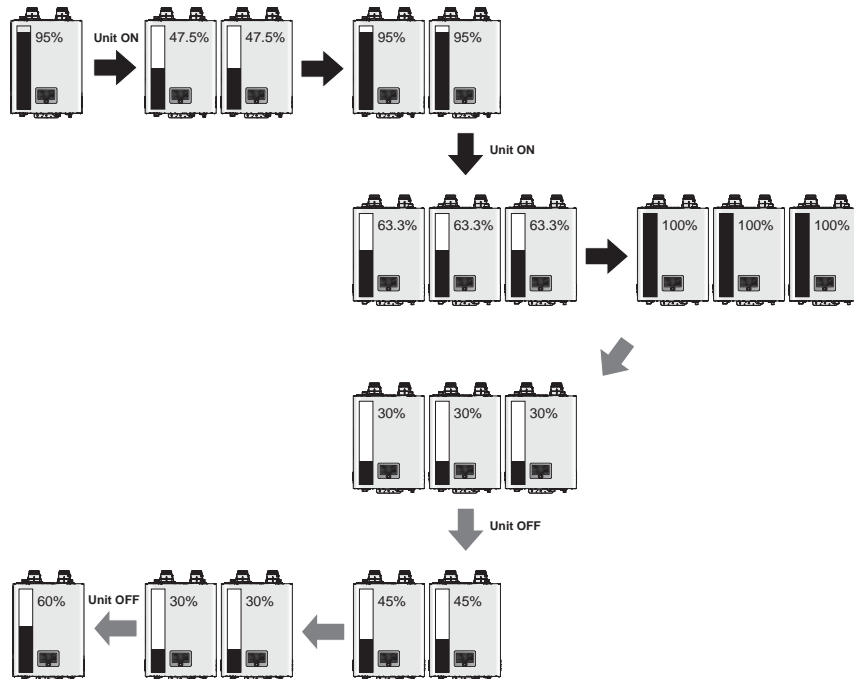
Setting the Operation Strategy

To set the operation strategy (operating algorithm), select the strategy from **Comfort** (default), **Eco**, or **Boost**. The detailed information for each mode is as follows.

	Comfort	Eco	Boost	Custom
Operating method	Late On/Early Off <ul style="list-style-type: none"> Unit On HC: 95% (Late Unit On) Unit Off HC: 30% (Late Unit Off) 	Early On/Late Off <ul style="list-style-type: none"> Unit On HC: 60% (Early Unit On) Unit Off HC: 30% (Late Unit Off) 	Late On/Early Off <ul style="list-style-type: none"> Unit On HC: 95% (Late Unit On) Unit Off HC: 50% (Early Unit Off) 	<ul style="list-style-type: none"> Unit On HC: The value of Unit On HC (Default: 70%) Unit Off HC: The value of Unit Off HC (Default: 30%)
Feature	Optimizes operation of the boiler by preventing frequent stops and starts.	Maximizes boiler efficiency.	Maximizes boiler responsiveness to call for heat.	On/Off cycles are determined by custom settings.
Condensing effectiveness	●●	●●●	●	
Heat responsiveness depending on a small amount of load changes	●●	●	●●●	
Heat responsiveness depending on a large amount of load changes	●●	●●●	●●	

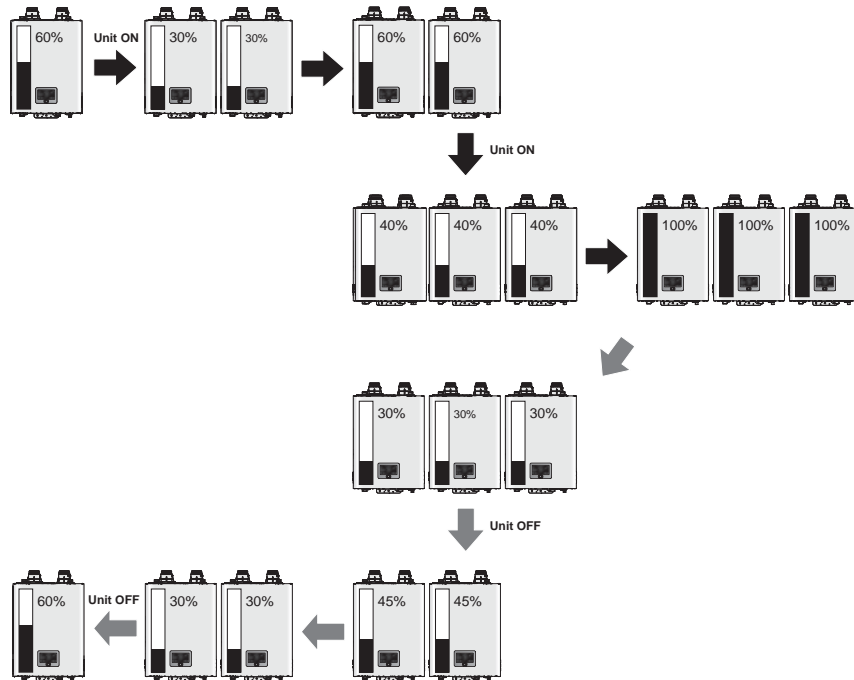
• Comfort

This mode minimizes the amount of times the unit cycles ON and OFF. However, it requires additional unit operation time (Low Off HC). Refer to the following operating diagram for the detailed information.



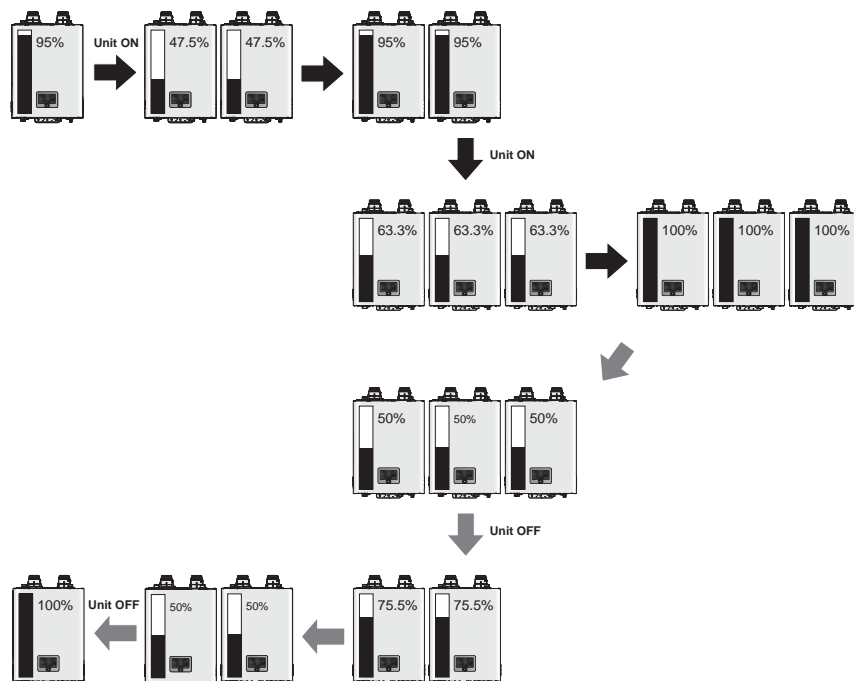
• **Eco**

This mode increases the condensing effectiveness and quickly responds to a large amount of load changes. However, it requires additional unit operation time (Low Off HC) and sensitively responds to a small amount of load changes (Small On/Off gap).



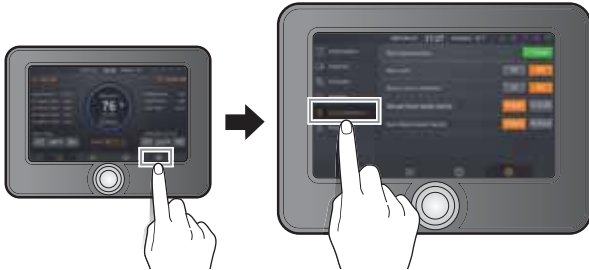
• **Boost**

This mode minimizes the total unit operation time. However, it decreases the condensing effectiveness.



11.6.5 Setting the External Connection

To view and configure the external network connection, tap the Set button (⚙️) > **Ext Connection** on the screen.

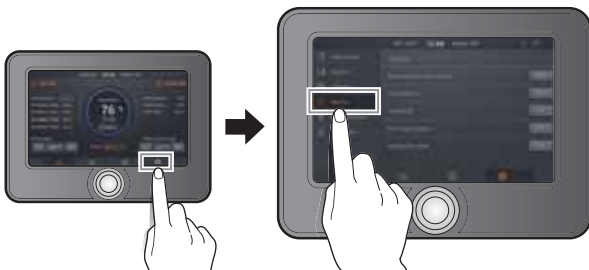


Item	Description
1. Navi-Link	Turn on or turn off the remote control capabilities via the Navi-Link connection. <ul style="list-style-type: none"> Setting range: ON/OFF Default: OFF
2. Navien zone controller	Turn on or turn off the Navien zone controller. <ul style="list-style-type: none"> Setting range: ON/OFF Default: OFF
3. Manual Reset Safety Switch	Select the manual reset safety switch (contact) type. <ul style="list-style-type: none"> Default: N-Open (Normal Open)
4. Auto Reset Safety Switch	Select the Auto reset safety switch (contact) type. <ul style="list-style-type: none"> Default: N-Open (Normal Open)

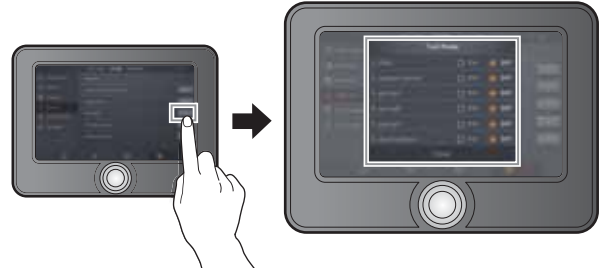
11.6.6 Diagnosing the Boiler System

To run a series of test procedures for a system diagnosis:

1. Tap the Set button (⚙️) > **Service**.



2. Tap **Set** on the Test Mode menu. The Test Mode pop-up is displayed on the screen.

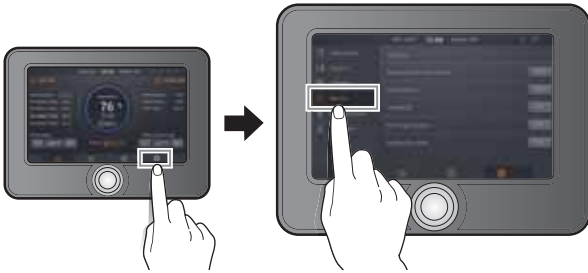


Item	Description
1. Fan	Test the fan operation by manually changing the fan speed. <ul style="list-style-type: none"> From a stopped state, the fan speed gradually increases and reaches the top speed, and then the fan speed decreases until the fan stops operating. Tap ON or OFF to toggle the fan test (ON -> OFF / OFF -> ON).
2. Boiler pump	Test the boiler pump operation. <ul style="list-style-type: none"> The boiler pump is turned on as soon as you enter the test mode. Tap ON or OFF to toggle the pump operation (ON -> OFF / OFF -> ON).
3. Pump 1	Test the pump 1 operation. <ul style="list-style-type: none"> The pump 1 is turned on as soon as you enter the test mode. Tap ON or OFF to toggle the pump operation (ON -> OFF / OFF -> ON).
4. Pump 2	Test the pump 2 operation. <ul style="list-style-type: none"> The pump 2 is turned on as soon as you enter the test mode. Tap ON or OFF to toggle the pump operation (ON -> OFF / OFF -> ON).
5. Pump 3	Test the pump 3 operation. <ul style="list-style-type: none"> The pump 3 is turned on as soon as you enter the test mode. Tap ON or OFF to toggle the pump operation (ON -> OFF / OFF -> ON).
6. Dual Venturi	Test the dual venturi operation. <ul style="list-style-type: none"> The dual venturi is turned on as soon as you enter the test mode. Tap ON or OFF to toggle the dual venturi operation (ON -> OFF / OFF -> ON).

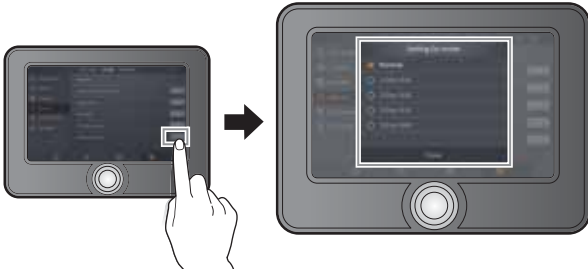
11.6.7 Setting the Operation Modes

To operate the boiler in special operation modes:

1. Tap the Set button (⚙️) > **Service**.



2. Tap **Set** on the Setting Op-mode menu. The Setting Op-mode pop-up is displayed on the screen.



Tap an item to set the operation modes.

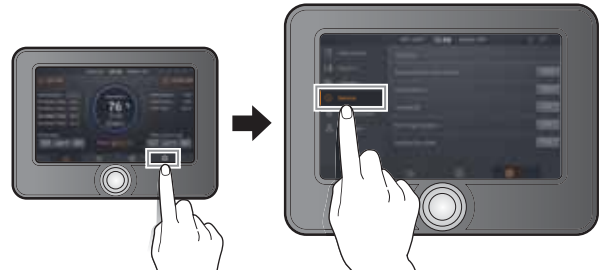
The boiler resumes operation in normal operation mode if no input is detected for 3 hours.

Item	Description
1. Normal	Set the boiler to run in Normal operation mode.
2. 1Step MIN	Set the boiler to run in 1st step minimum operation mode.
3. 1Step MAX	Set the boiler to run in 1st step maximum operation mode.
4. 2Step MIN	Set the boiler to run in 2nd step minimum operation mode.
5. 2Step MAX	Set the boiler to run in 2nd step maximum operation mode.

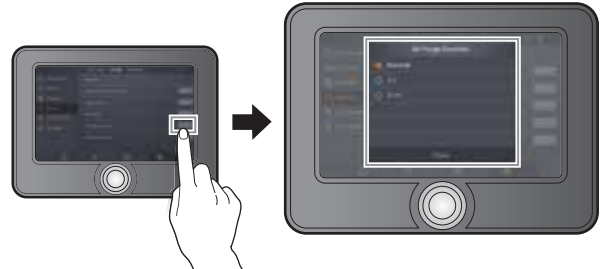
11.6.8 Operating in Air Purge Mode

To operate the boiler in air purge mode:

1. Tap the Set button (⚙️) > **Service**.



2. Tap **Set** on the Air Purge Function menu. The Air Purge Function pop-up is displayed on the screen.



Tap an item to set the parameters for an air purge.

The boiler resumes operation in normal operation mode if no input is detected for 15 minutes.

Item	Description
1. Normal	Set the boiler to run in Normal operation mode without an air purge.
2. SH	Run an air purge on the space heating piping.
3. DHW	Run an air purge on the DHW piping.

11.7 Understanding Error Codes

When an error code appears on the front panel, refer to the following chart for a definition and possible remedy for the situation.

Error Code	Reason	Self-diagnostic/Action
E001	Heat exchanger over temperature	Auto reset/Manual reset/Power On reset
E003	Ignition failure	Manual reset/Power On reset
E004	False flame detection	Auto reset
E012	Flame loss	Manual reset/Power On reset
E016	Heat exchanger overheat	Manual reset/Power On reset
E030	Abnormal operation: exhaust temperature	Auto reset/Manual reset/Power On reset
E031	Burner overheating	Manual reset
E046	Abnormal operation: heat exchanger overheating sensor	Auto reset
E047	Abnormal operation: exhaust thermostat	Auto reset/Manual reset/Power On reset
E060	Abnormal operation: dual venturi	Alarm
E109	Abnormal operation: fan motor	Manual reset/Power On reset
E110	Exhaust vent closed	Manual reset/Power On reset
E127	Abnormal operation: APS	Alarm
E205	Abnormal operation: heating supply thermistor	Auto reset
E218	Abnormal operation: heating return thermistor	Alarm
E278	Abnormal operation: system supply thermistor	Alarm
E279	Abnormal operation: system return thermistor	Alarm
E291	Supply/Return inversion limit	Manual reset/Power On reset
E302	Low water pressure	Manual reset
E352	High water pressure	Auto reset
E353	Abnormal operation: water pressure sensor	Auto reset
E480	Abnormal operation: DHW tank temperature sensor	Alarm
E515	Abnormal operation: PCB component	Alarm/Manual reset/Power On reset
E517	Abnormal operation: DIP switch setting (PCB)	Manual reset/Power On reset
E594	Abnormal operation: EEPROM (PCB)	Alarm
E615	Abnormal operation: MCU	Alarm/Auto reset/Manual reset/Power On reset
E736	Abnormal operation: Cascade communication	Alarm
E740	Abnormal operation: outdoor temperature sensor	Alarm
E765	Abnormal external-pump	Alarm
E774	Manual reset limit	Manual reset
E775	Auto reset limit	Auto reset
E777	Abnormal operation: LWCO limit (external device)	Auto reset
E782	Abnormal operation: boiler communication	Alarm
E784	Abnormal operation: zone controller communication (external device)	Alarm

If these remedies do not resolve the problem, contact Technical Support at 1-800-519-8794.

12. Appendixes

12.1 Gas & High Altitude Conversion

This boiler is configured for Natural Gas at the factory.

- If conversion to Propane Gas is required by the boiler, use the LP CONVERSION KIT supplied with the boiler.
- If the boiler is installed at a high altitude above 5,400ft, use the HIGH ALTITUDE CONVERSION KIT supplied with the boiler.

WARNING

This conversion kit must be installed by a qualified service agency* in accordance with Navien's instructions and all applicable codes and requirements of the authority having jurisdiction. The information in these instructions must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury or death. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer's instructions supplied with the kit.

* A qualified service agency is any individual, firm, corporation or company which either in person or through a representative is engaged in and is responsible for the connection, utilization, repair or servicing of gas utilization equipment or accessories; who is experienced in such work, familiar with all precautions required, and has complied with all of the requirements of the authority having jurisdiction.









In Canada: The conversion shall be carried out in accordance with the requirements of the provincial authorities having jurisdiction and in accordance with the requirements of the CAN-B149.1 and CAN1-B149.2 Installation Code.

Tools Required:

- Phillips Screwdriver
- Flathead Screwdriver
- $\frac{5}{32}$ in or 4 mm Allen Wrench
- T40 or 6.65 mm Star Wrench
- Combustion Analyzer or Dual Port Manometer
- Gas Leak Detector

Included Items:

- Gas Orifice (Table 1)
- Gas Pressure and Conversion Kit Number Labels
NFB-301C Orifice Identification

Gas Type	NG		LP	
Altitude	0-5,399 ft	5,400-10,100 ft	0-5,399 ft	5,400-10,100 ft
Orifice	  Factory Installed	  For High Altitude	  For Sea Level	  For High Altitude
Orifice Size	Ø6.75 / Ø9.25	Ø7.40 / Ø9.60	Ø5.40 / Ø6.75	Ø5.40 / Ø6.65

NFB-399C Orifice Identification









Gas Type	NG		LP	
Altitude	0-5,399 ft	5,400-10,100 ft	0-5,399 ft	5,400-10,100 ft
Orifice	  Factory Installed	  For High Altitude	  For Sea Level	  For High Altitude
Orifice Size	Ø8.35 / Ø11.1	Ø8.65 / Ø11.8	Ø6.55 / Ø9.50	Ø6.55 / Ø9.30

Table 1. Orifice Size

WARNING

- NG and LP high altitude conversion kits and a LP conversion kit are provided with the boiler. Be careful not to confuse the LP conversion kit and LP high altitude conversion kit.
- Make sure that the conversion is completed with the proper orifice. If the installed orifice does not conform to the specifications in Table 1, incomplete combustion may occur, resulting in personal injury or property damage.

Procedure:

1. Turn off power, gas and water supply to the boiler.
2. Unfasten the 4 latches (2 at the top and 2 at the bottom) to remove the front cover and gain access to the internal components. See Figure 1 for illustration of the front cover clamps.

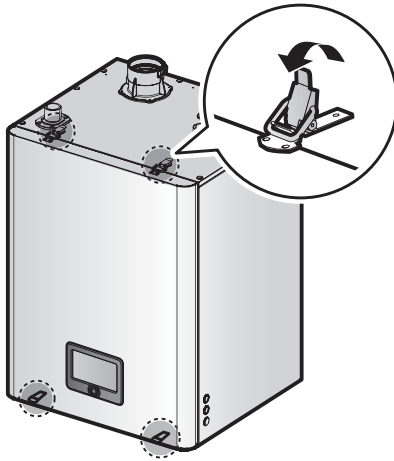


Figure 1. NFB Series Front cover

3. Remove the front cover and place it in a safe location to prevent accidental damage.
4. With the internal components exposed, locate the gas inlet pipe and the gas valve, as shown in Figure 2.

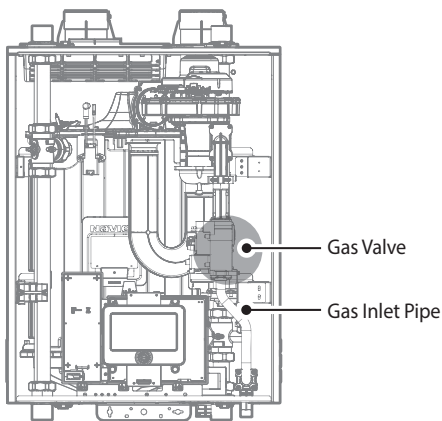


Figure 2. NFB Series Internal Components

5. Remove the clip at location A – the connection above the gas valve where it connects to the gas valve outlet adapter. See Figure 3 for reference.
6. Find location B - the connection above the gas valve where it is attached to the dual venturi. Carefully remove the four screws using a Phillips-head screwdriver and pull the gas valve outlet adapter away from the dual venturi to access the Gas Orifice.

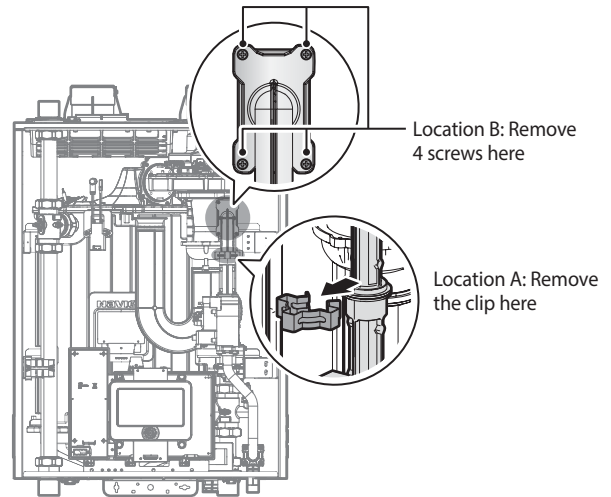


Figure 3. Detaching the Gas Valve Outlet Adapter from the Gas Valve and Fan Motor Assembly

7. Once the Gas Orifice is exposed, remove the four screws that hold the part in place. Remove the Gas Orifice from its housing and prepare the new Gas Orifice for the high altitude conversion for installation.

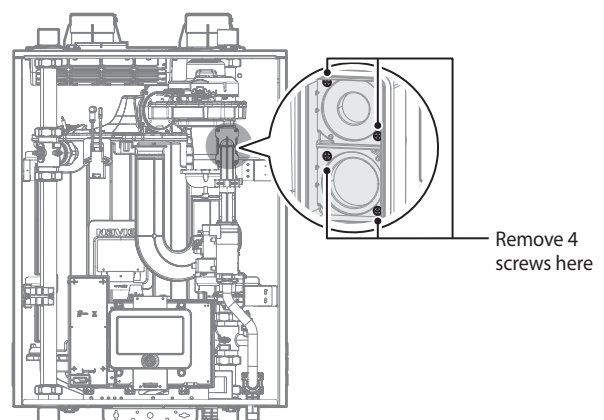


Figure 4. Access to Gas Orifice in Fan Assembly

WARNING

- DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment.
- Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death or substantial property damage. Navien NFB boilers are shipped ready to fire natural gas ONLY.

DANGER

See Figure 5. Inspect the O-ring between the gas valve and gas valve inlet adapter whenever they are disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

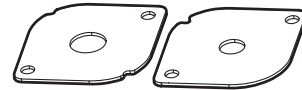


Figure 6. Orifice Identification

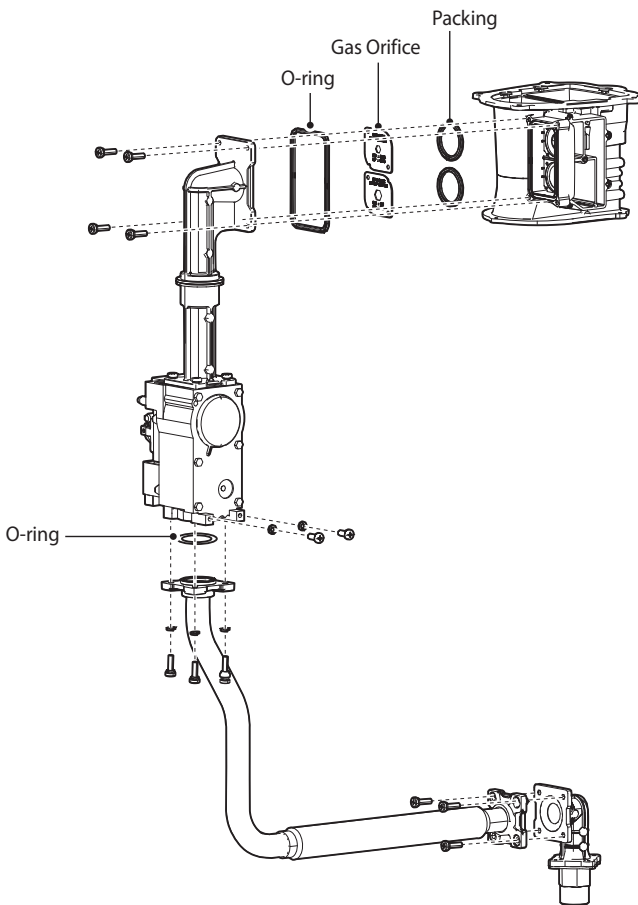
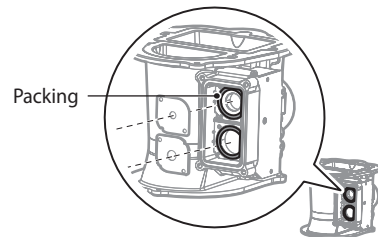


Figure 5. Exploded View of Gas Pipe Assembly

8. Remove the Gas Orifice, ensure that the packing is properly seated inside the port, and then install the new Gas Orifice for use at high altitudes. Ensure that the Orifice is properly seated on the packing inside the port before proceeding to the next step.



9. Replace the gas inlet pipe to its original position and use all screws to secure all connections.

Note Do not overtighten as this may damage or crack the components.

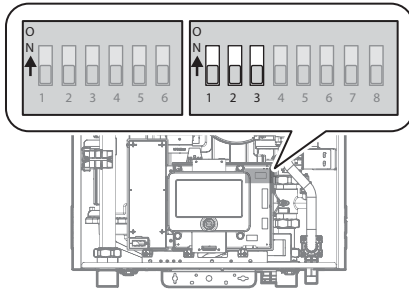
DANGER

Inspect the O-ring between the gas valve and gas valve inlet adapter whenever they are disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

10. Set the PCB DIP switch to change the gas type. For LP, set DIP switch 2 #1 to ON. For NG, set DIP SW2 #1 to OFF.

WARNING

Ensure that you have turned off the power to the boiler before accessing the DIP switches.



Switch	Function	Setting	Comment
1	Gas Type	Natural Gas	1-OFF
		Propane Gas	1-ON
2&3	High Altitude	0-1,999 ft (0-609 m)	2-OFF, 3-OFF
		2,000-5,399 ft (610-1,645 m)	2-ON, 3-OFF
		5,400-7,699 ft (1,646-2,346 m)	2-OFF, 3-ON
		7,700-10,100 ft (2,347-3,078 m)	2-ON, 3-ON

When applying the Gas Orifice for high altitude, set the PCB DIP switches by altitude according to the table above.

- Note**
- This unit may be installed at elevations up to 10,100 ft (3,078 m) for use with natural gas and propane. To use the unit at a specific altitude. The DIP switch should be set as described above.
 - In high altitudes above 2,000 ft (610 m), the unit will derate by 3 % for each 1,000 ft (305 m) of altitude gain.
 - If you install the unit at above 5,400 ft (1,646 m) it is required to change the Gas Orifice for high altitude.
 - NG and LP high altitude conversion kits and a LP conversion kit are provided with the boiler. Be careful not to confuse the LP conversion kit and LP high altitude conversion kit.

DANGER

- When conversion is required, be sure to set the PCB DIP switch 2 #1 according to the supply gas type.
- NG and LP high altitude conversion kits and a LP conversion kit are provided with the boiler. Be careful not to confuse the LP conversion kit and LP high altitude conversion kit.
- For high altitude conversion, check the DIP switches setting value by altitude before setting.
- Failure to properly set the DIP switches could cause carbon monoxide poisoning, resulting in severe personal injury or death.

11. Turn on the gas and water supply to the boiler.

CAUTION

Ensure that the High Altitude setting reflect the actual location of the boiler. If not it may cause personal injury or malfunction of the boiler.

12. Measure and adjust the gas/air ratio.

Option 1. Using Combustion Analyzer (recommended)

- a. Loosen the screw, rotate the plate and remove the gasket to access the emissions monitoring port as shown in Figure 7.
- b. Insert the analyzer into the port as shown in Figure 7.

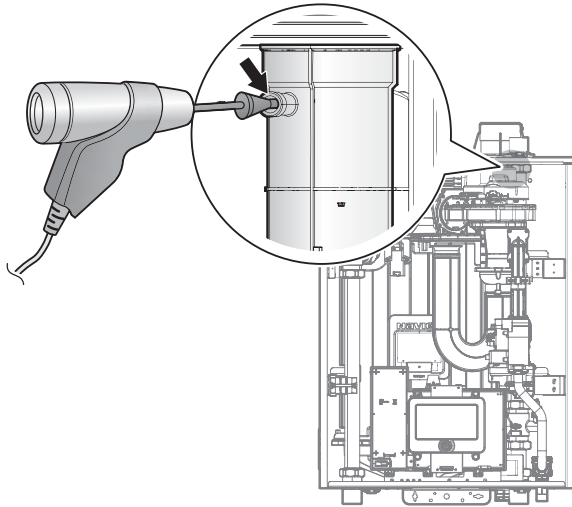


Figure 7. Insert the Analyzer

Model	Altitude	Fuel	High fire	Low fire
			%CO ₂	%CO ₂
NFB-301C	0-5,399 ft	NG	9.2	8.9
		LP	10.8	10.7
	5,400-10,100 ft	NG	8.8	9.0
		LP	9.9	11.0

Model	Altitude	Fuel	High fire	Low fire
			%CO ₂	%CO ₂
NFB-399C	0-5,399 ft	NG	9.4	8.9
		LP	10.6	10.4
	5,400-10,100 ft	NG	8.8	9.0
		LP	9.9	11.0

Table 2. CO₂ value
(CO₂ values must be within 0.5% of the values listed.)

- c. Activate multiple zones and set the boiler to operate at 1Step MIN mode.

Note For operation mode selection, refer to “11.6.7 Setting the Operation Modes” on page 108.

Measure the CO₂ value at low fire. If the CO₂ value is not within 0.5% of the value listed in Table 2, the gas valve set screw will need to be adjusted. If adjustment is necessary, locate the set screw as shown in Figure 8. Using an Allen or Star Wrench, turn the set screw no more than 1/4 turn clockwise to raise or counterclockwise to lower the CO₂ value.

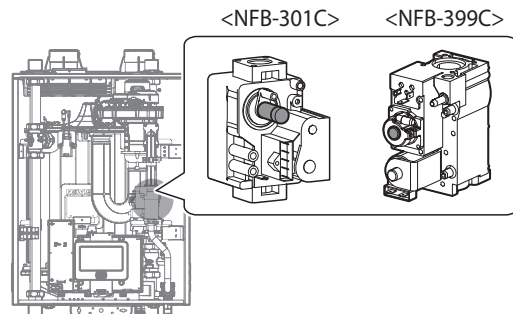


Figure 8. Set Screw Location

Note The set screw is located behind the screw-on cover. This must be removed first.

- d. Activate multiple zones and set the boiler to operate at 2Step MAX mode (refer to “11.6.7 Setting the Operation Modes” on page 108). Measure the CO₂ value at high fire. If the CO₂ values do not match Table 2 at high fire, do not adjust the gas valve. Check for the proper Gas Orifice.

! DANGER

Improper gas valve settings can cause severe personal injury, death or substantial property damage.

Option 2. Using Digital Manometer

- Open the offset pressure port by loosening the screw two turns as shown in Figure 9.

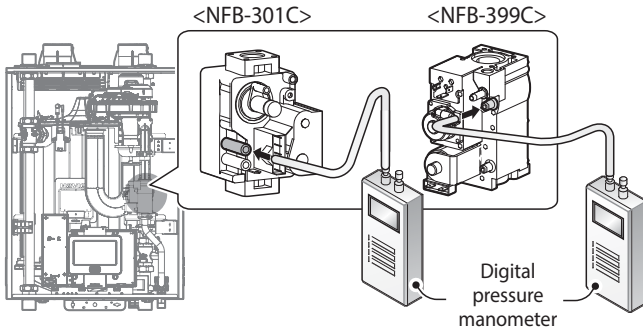


Figure 9. Connect Digital Pressure Manometer

- Connect a manometer to the offset pressure port. For dual port manometers, use the positive pressure side.

Model	Kit Part No.	Gas Type	Offset
NFB-301C	NAC-NH301	NG	-0.06in ± 0.01in
	NAC-LH301	LP	-0.01in ± 0.01in
NFB-399C	NAC-NH399	NG	-0.03in ± 0.01in
	NAC-LH399	LP	-0.01in ± 0.01in

Table 3. Offset value for low fire

- Activate multiple zones and set the boiler to operate at 1Step MIN mode (refer to "11.6.7 Setting the Operation Modes" on page 108). Measure the offset value at low fire and compare it to the values in Table 3. If the offset value is out of range, the gas valve set screw will need to be adjusted.

If adjustment is necessary, locate the set screw as shown in Figure 10. Using an Allen or Star Wrench, turn the set screw no more than 1/4 turn clockwise to raise or counterclockwise to lower the offset value.

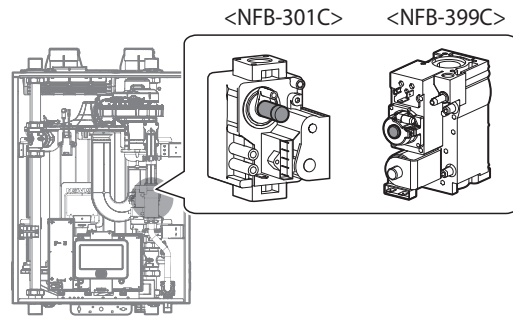


Figure 10. Set Screw Location

Note The set screw is located behind the screw-on cover. This must be removed first.

- At high fire, do not check the offset value and never adjust the gas valve.



DANGER

Improper gas valve settings can cause severe personal injury, death or substantial property damage.

- Once the CO₂ or offset values have been confirmed, apply the included conversion stickers to show that the appliance has been converted to propane gas or high altitude. Place these labels adjacent to the rating plate as shown in Figure 11.

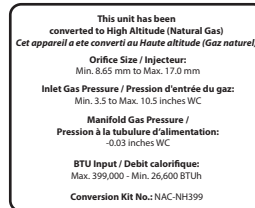
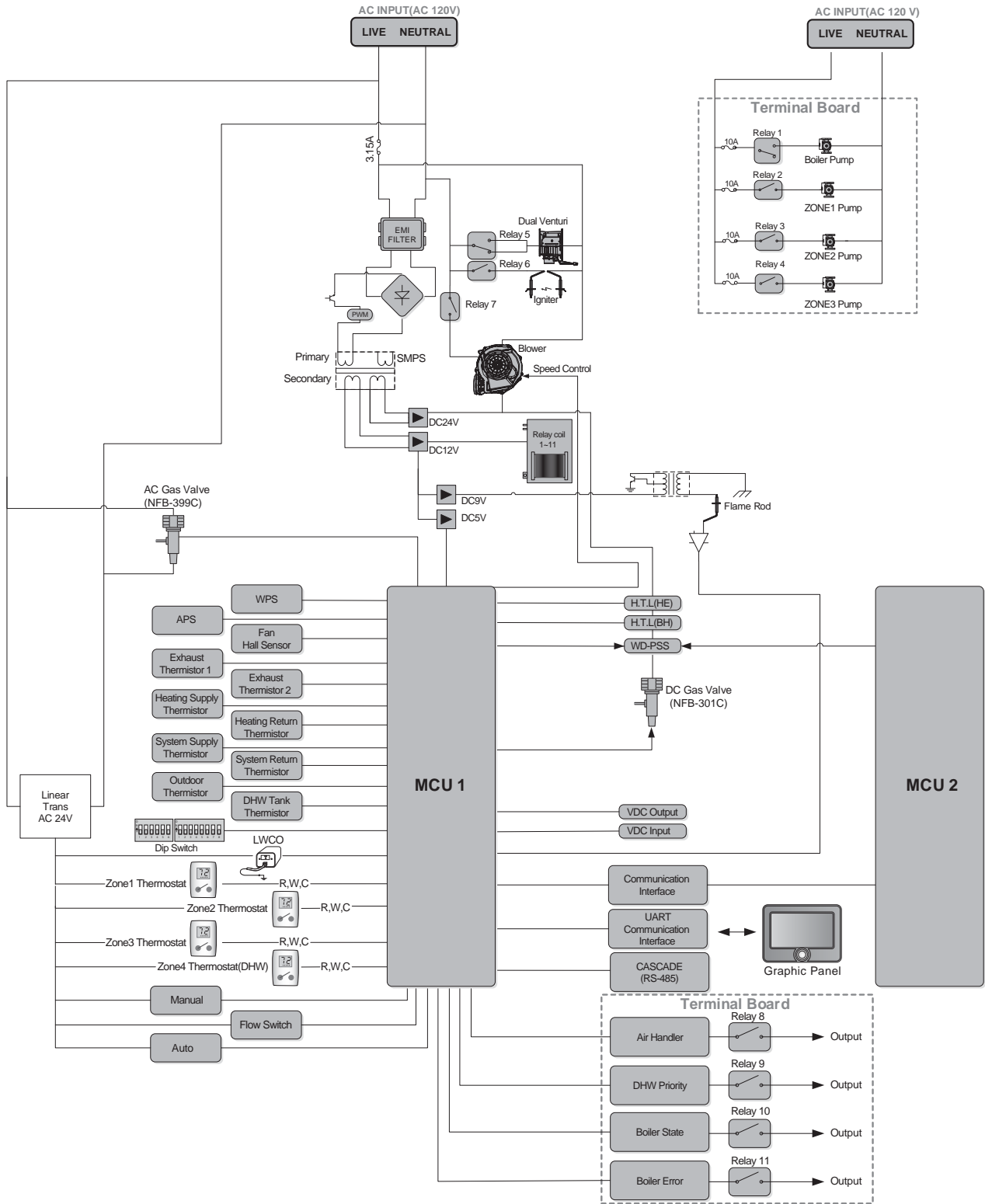


Figure 11. Proper Placement of Gas Conversion Labels

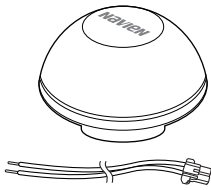
12.3 Ladder Diagram



12.4 Outdoor Temperature Sensor

Outdoor Temperature Sensor Installation

1. Pull out the sensor body from the cap.
2. Attach the body to the wall using the screws/anchors provided with the device.
3. Run the wires into the device body through the grommet opening.
4. Connect the wires to the terminal block.
5. Attach the cap to the body.



Navien Outdoor Temperature Sensor Kit

Outdoor Temperature Sensor Installation Guidelines

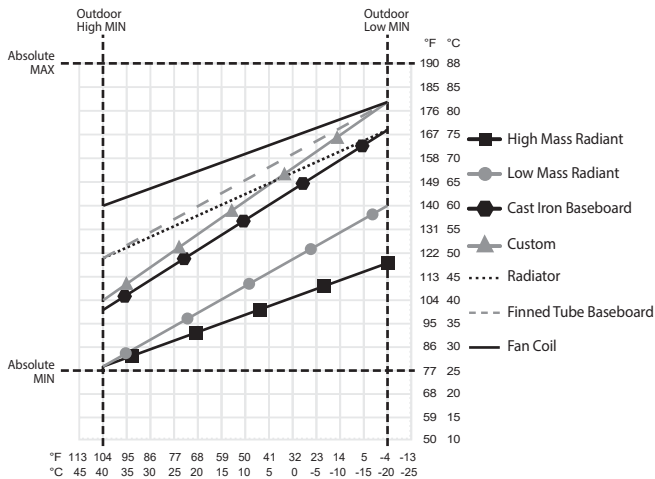
- Avoid areas with temperature fluctuations by direct sunlight, and where the temperature may not be representative of true outdoor temperature.
- Best location to install the temperature sensor is on a North or Northeast side of a structure under eaves where the sensor is shielded from direct sunlight.
- Avoid placing sensor in close proximity of heat sources that may affect correct temperature sensing. (Fans, exhausts, vents, lights)
- Avoid installing the sensor in areas where the sensor is subjected to excessive moisture.
- Use 18 gauge wiring (thermostat wiring) with no splices. (Except at the unit harness connection with blue leader wire.)
- Caution should be taken to avoid potential electromagnetic interference (EMI) by routing separately from potential sources such as line voltage wiring. When necessary, shielded cable may be used.
- Make sure wiring connections are secure before closing the cap.
- The sensor is a water resistant device.
- Any damage to the device may require the replacement of the entire component.

12.5 Outdoor Reset Control

The Outdoor Reset Control feature may be used to enhance energy efficiency while maintaining optimal heating performance. With the Outdoor Reset Control, the space heating temperature setting automatically changes according to the outdoor temperature and the current space heating system application (system load).

You can configure the Outdoor Reset Control settings on the front panel. Refer to “11.5.2 Setting the Space Heating Operation” on page 93 and “11.6.3 Setting the Operation Parameters” on page 101.

Note The Outdoor Reset Control feature requires installation of an outdoor temperature sensor, and it only works when the boiler is running in the normal operation mode. It does not work when the boiler is running in either the Minimum (MIN) or Maximum (MAX) mode, or when the boiler’s front panel displays a fault.



Space Heating Temperature Setting for the Outdoor Reset Control Feature

The following tables list the default space heating temperature range by system heat load and the applicable outdoor temperature ranges.

Outdoor Temperature Sensor Installation Guidelines

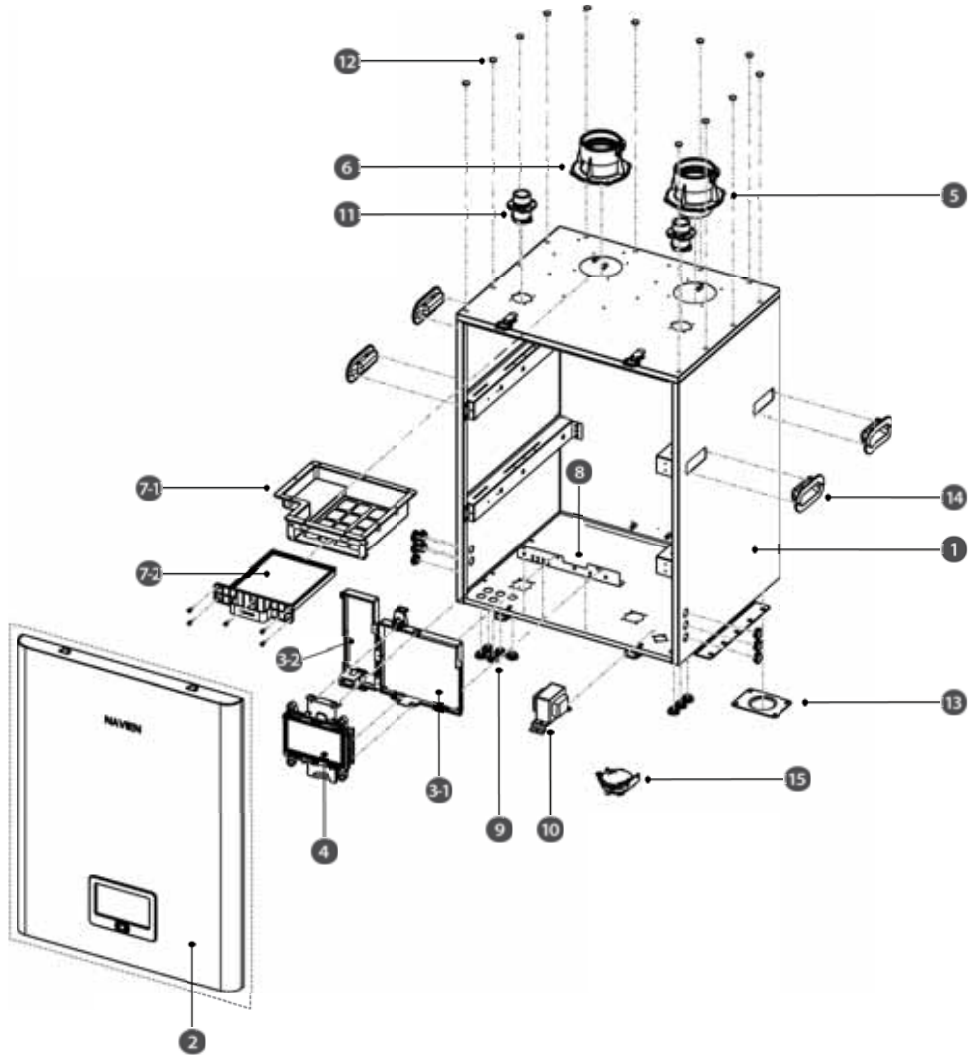
Heat Load	Supply Set Point Range	Return Set Point Range
Finned Tube Baseboard (default)	120-180°F (48.5-82°C)	101-147°F (38-63.5°C)
Fan Coil	140-180°F (60-82°C)	116-147°F (46.5-63.5°C)
Cast Iron Baseboard	100-170°F (37.5-76.5°C)	86-139°F (30-59°C)
Low Mass Radiant	80-140°F (26.5-60°C)	70-116°F (21-46.5°C)
High Mass Radiant	80-120°F (26.5-48.5°C)	70-101°F (21-38°C)
Radiators	120-170°F (48.5-76.5°C)	101-139°F (38-59°C)
Custom	Supply Absolute MIN Set-point - Supply Absolute MAX Set-point	Return Absolute MIN Set-point - Return Absolute MAX Set-point

Outdoor Temperature Range and Default Temperature Settings

Set Point	Range	Remarks
Outdoor Low Temperature	-4°F (-20°C) to Outdoor High Temperature Set Point - 9°F (5°C)	Default: 14°F (-10°C)
Outdoor High Temperature	Outdoor Low Temperature Set Point + 9°F (5°C) to 104°F (40°C)	Default: 70°F (21°C)

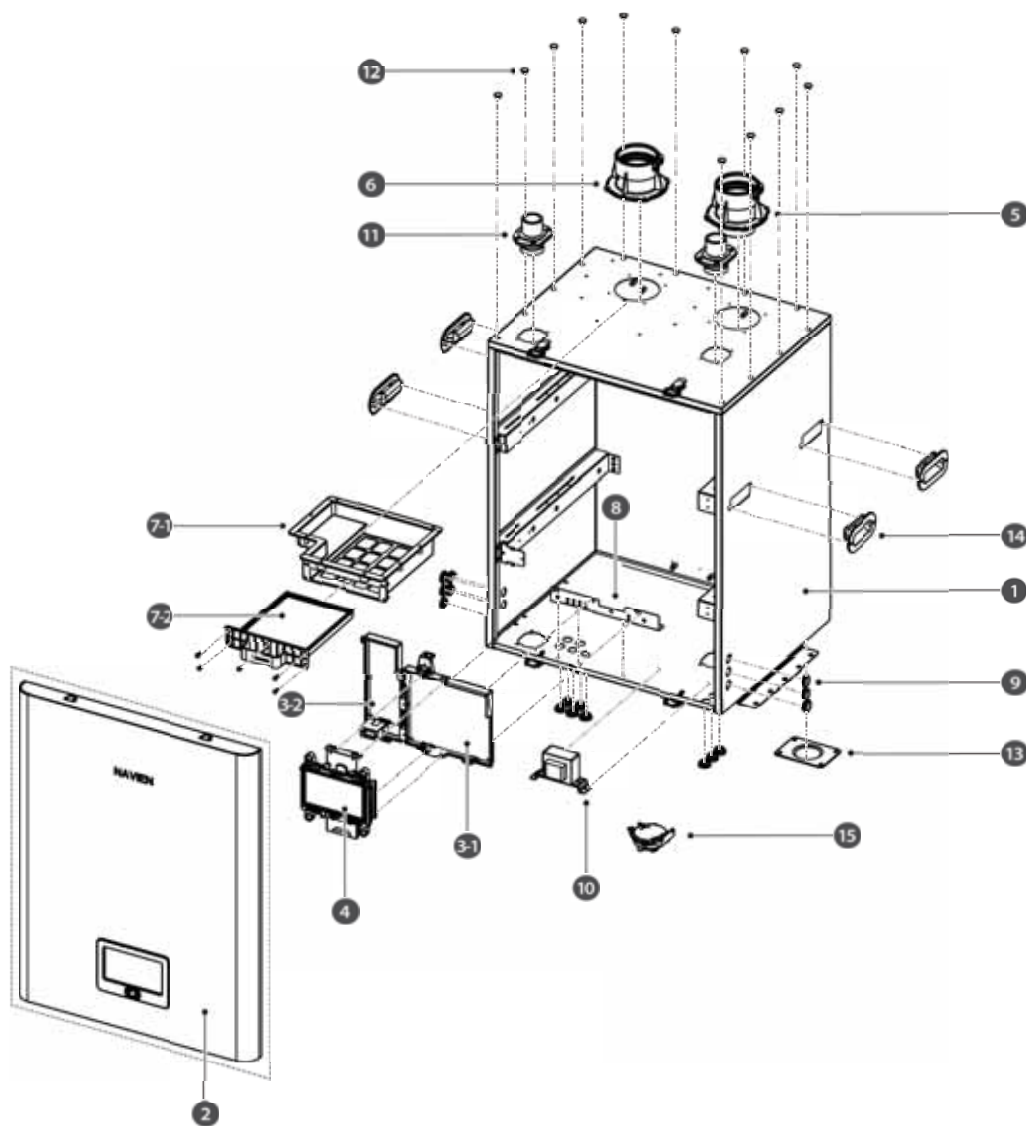
12.6 Component Assembly Diagrams and Part Lists

12.6.1 Case Assembly - NFB-301C



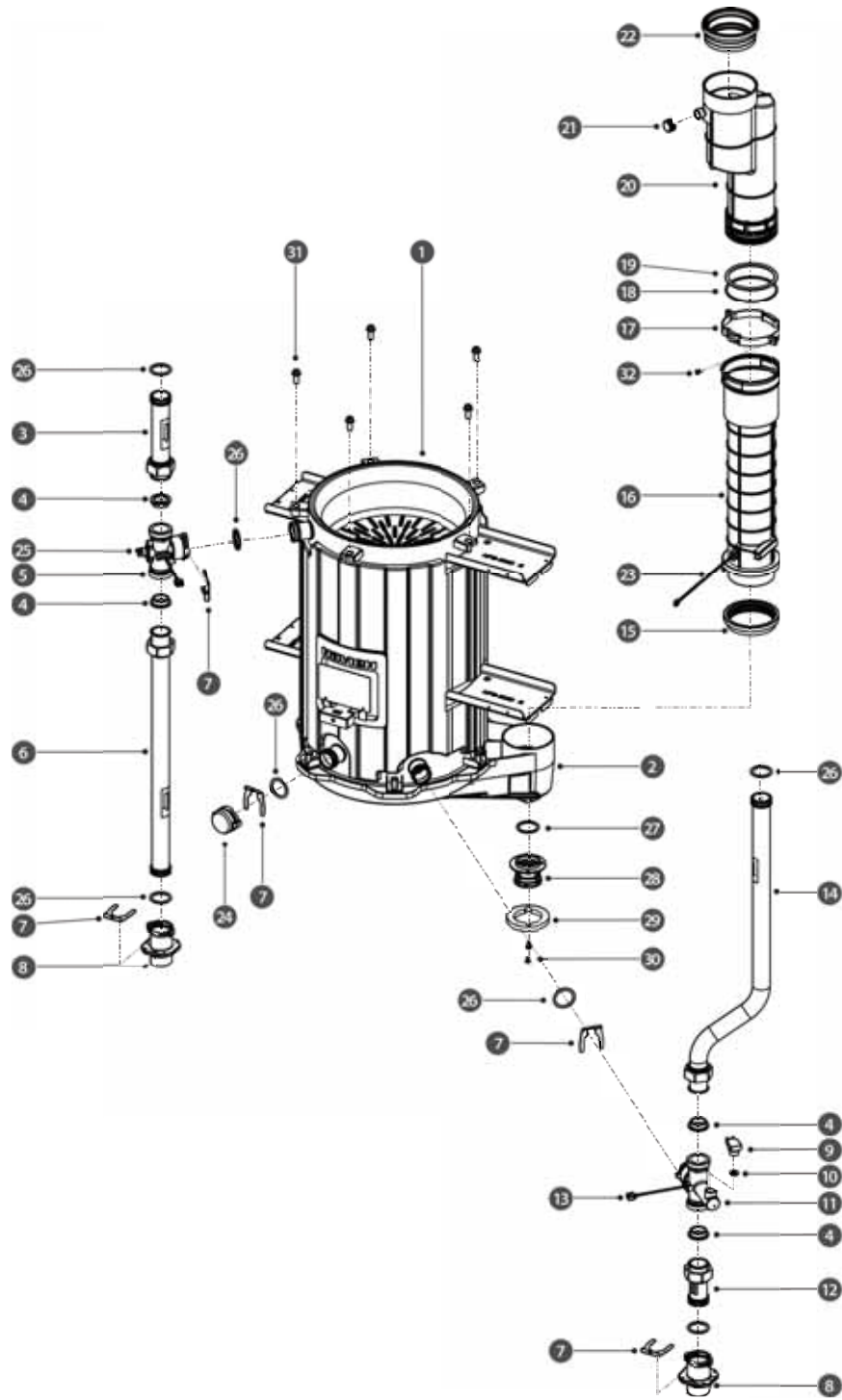
#	Description	Part #	Remark
1	Case Upper	20042573*	
	(SET) Case Upper	30023701*	NFB-301C SERVICE KIT
	Case Middle	20042572*	
	Case Lower	20042571*	
	(SET) Case Lower	30023702*	NFB-301C SERVICE KIT
2	Cover	30020590*	
	(SET)Cover	30023383*	NFB-301C SERVICE KIT
3-1	Main PCB	30020431*	
3-2	Terminal PCB	30020433*	
4	Front Panel	30019786*	
5	Exhaust Duct Assembly	30020520*	
6	Intake Air Duct Assembly	30020519*	
7-1	Air Filter Case	20046047*	
7-2	Air Filter	20046201*	
8	PCB Lower Bracket	20040181*	
9	Rubber Ring	20041970*	
10	24 V Power Transformer	30019688*	
11	Heating Supply Adapter (Air Vent Adapter)	20043650*	
12	Base Packing	20042901*	
13	Drain Pan Adapter Lower Bracket	20043583*	
14	Handle	20044467*	
15	Air Pressure Sensor	30013265*	

12.6.2 Case Assembly - NFB-399C



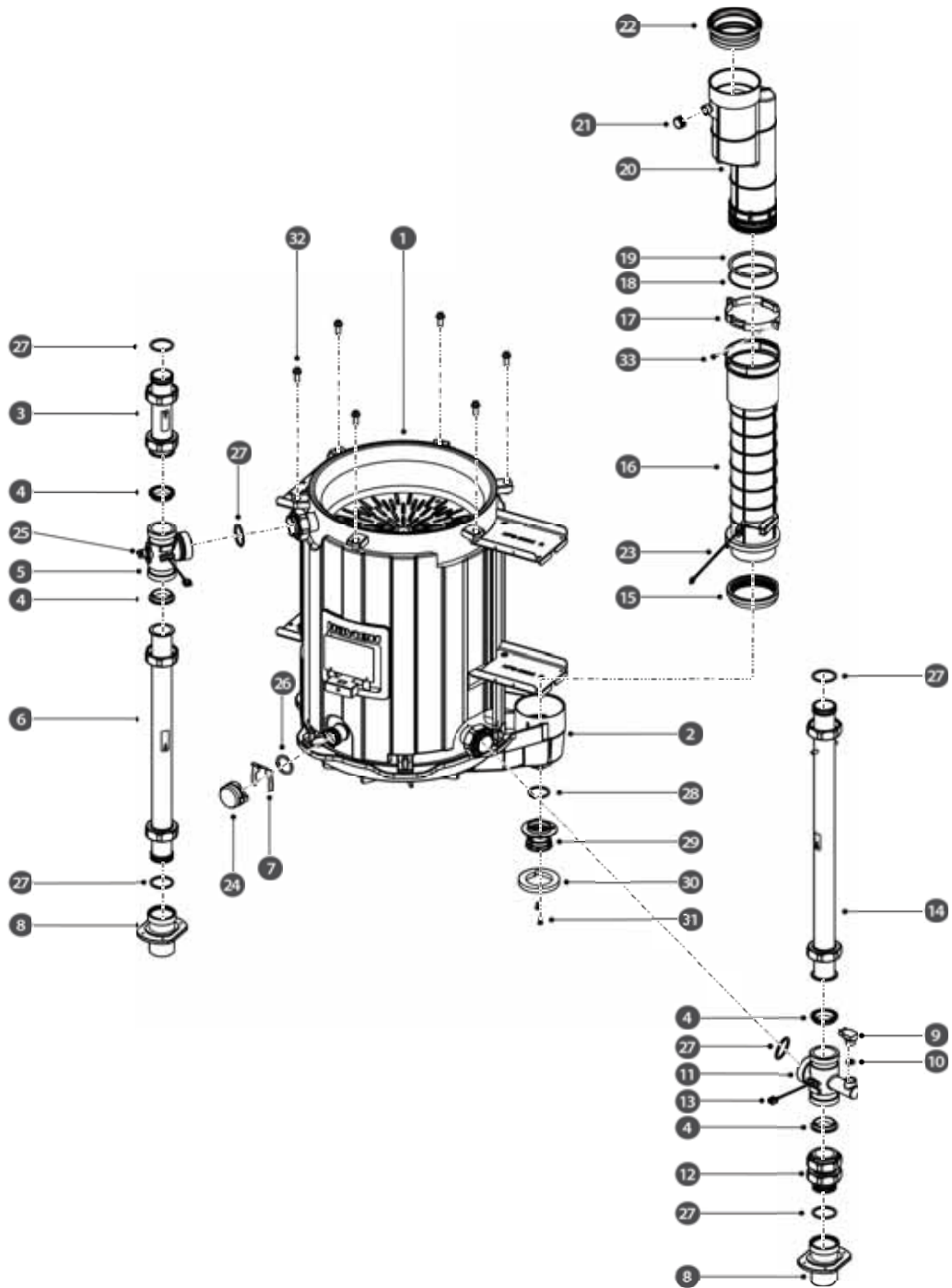
#	Description	Part #	Remark
1	Case Upper	20042659*	
	(SET) Case Upper	30023699*	NFB-399C SERVICE KIT
	Case Middle	20042521*	
	Case Lower	20042517*	
	(SET) Case Lower	30023700*	NFB-399C SERVICE KIT
2	Cover	30020590*	
	(SET)Cover	30023383*	NFB-399C SERVICE KIT
3-1	Main PCB	30020431*	
3-2	Terminal PCB	30020433*	
4	Front Panel	30019786*	
5	Exhaust Duct Assembly	30020520*	
6	Intake Air Duct Assembly	30020519*	
7-1	Air Filter Case	20046047*	
7-2	Air Filter	20046201*	
8	PCB Lower Bracket	20040181*	
9	Rubber Ring	20041970*	
10	24 V Power Transformer	30019688*	
11	Heating Supply Adapter (Air Vent Adapter)	20043267*	
12	Base Packing	20042901*	
13	Drain Pan Adapter Lower Bracket	20043583*	
14	Handle	20044467*	
15	Air Pressure Sensor	30013265*	

12.6.3 Heat Exchanger and Waterway Assembly - NFB-301C



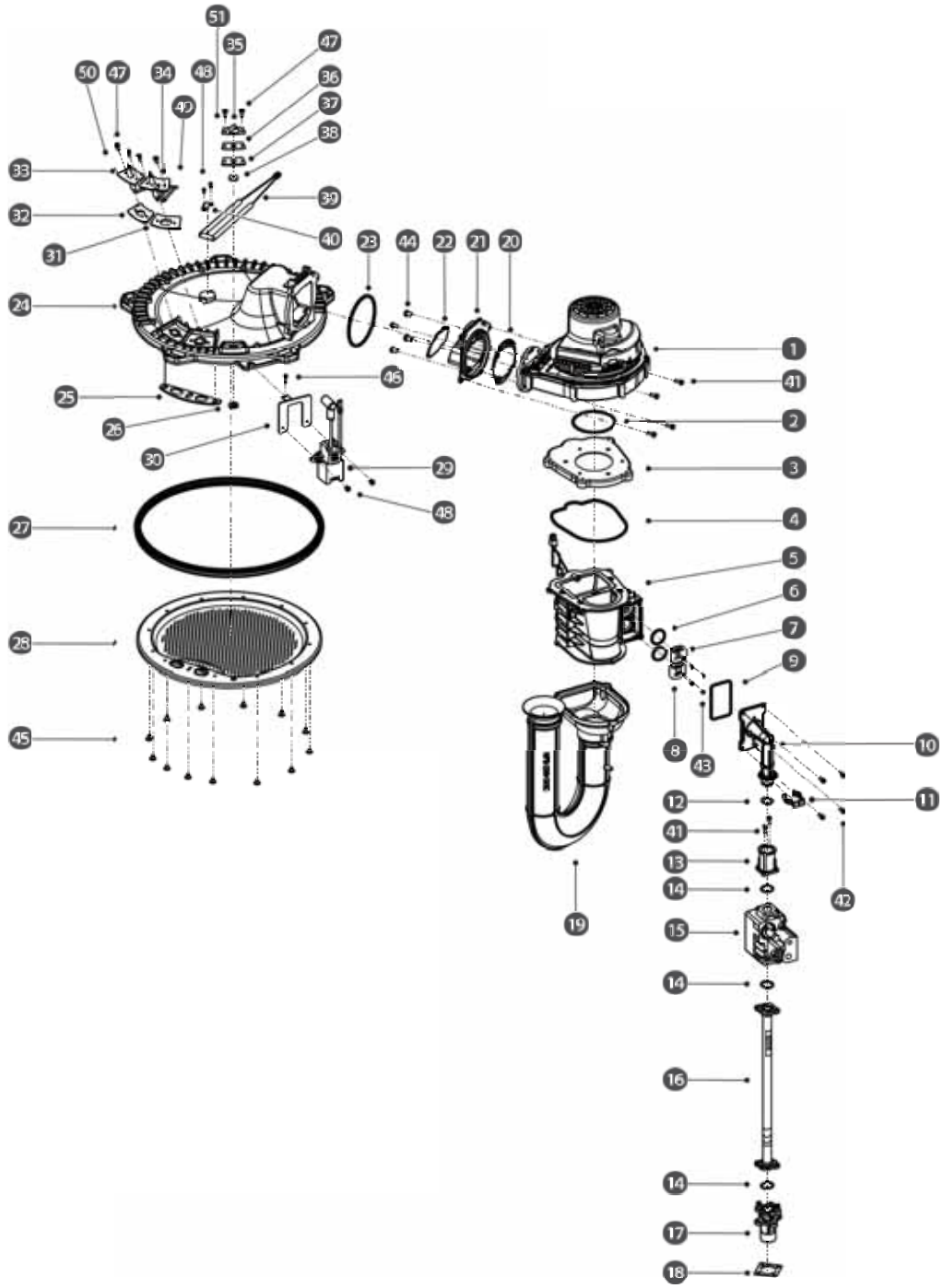
#	Description	Part #	Remark
1	Heat Exchanger Assembly	30021565*	
	(SET) Heat Exchanger Assembly	30023358*	NFB-301C SERVICE KIT
2	Drain Pan Assembly	30020747*	
3	Supply Pipe (Upper)	30020985*	
4	Packing	20041401*	
5	Heat Exchanger Outlet Adapter	30021367*	
6	Supply Pipe (Lower)	30020986*	
7	Fastener	20040255*	
8	Supply/Return Pipe (Lower) Adapter	20040244*	
9	LWCO (Pressure sensor)	30022672*	
10	LWCO (Pressure sensor) Packing	20006873*	
11	Heat Exchanger Inlet Adapter	30020587*	
12	Return Pipe (Lower)	30022921*	
13	Thermistor	30012907*	
14	Return Pipe (Upper)	30022922*	
15	Drain Pan Packing	20040241*	
16	Exhaust Duct (Lower)	20040242*	
17	Exhaust Duct Clip	20042741*	
18	Exhaust Duct Packing (G90)	20022326*	
19	Exhaust Duct Packing (P85)	20042823*	
20	Exhaust Duct (Upper)	20042575*	
21	Exhaust Duct Cap	20029712*	
22	Exhaust Duct Packing (Upper)	20043021*	
23	Thermistor (Exhaust)	30020489*	
24	Heat Exchanger Drain Cap	20042237*	
25	High Limit Switch	30002558*	
26	O-ring (V32)	20041403*	
27	O-ring (P34)	20042298*	
28	Drain Pan Adapter	20043016*	
29	Drain Pan Adapter Packing	20043017*	
30	Screw (M4X10L)	20038753*	
31	Screw (M4X20L)	20042814*	
32	Bolt (M4X10L)	20038757*	

12.6.4 Heat Exchanger and Waterway Assembly - NFB-399C



#	Description	Part #	Remark
1	Heat Exchanger Assembly	30021566*	
	(SET) Heat Exchanger Assembly	30023357*	NFB-399C SERVICE KIT
2	Drain Pan Assembly	30020580*	
3	Supply Pipe (Upper)	30020996*	
4	Packing	20043332*	
5	Heat Exchanger Outlet Adapter	20043652*	
6	Supply Pipe (Lower)	30020596*	
7	Fastener	20040255*	
8	Supply/Return Pipe (Lower) Adapter	20043268*	
9	LWCO (Pressure sensor)	30022672*	
10	LWCO (Pressure sensor) Packing	20006873*	
11	Heat Exchanger Inlet Adapter	30020994*	
12	Return Pipe (Lower)	30020993*	
13	Thermistor	30012907*	
14	Return Pipe (Upper)	30020585*	
15	Drain Pan Packing	20040241*	
16	Exhaust Duct (Lower)	20040242*	
17	Exhaust Duct Clip	20042741*	
18	Exhaust Duct Packing (G90)	20022326*	
19	Exhaust Duct Packing (P85)	20042823*	
20	Exhaust Duct (Upper)	20042575*	
21	Exhaust Duct Cap	20029712*	
22	Exhaust Duct Packing (Upper)	20043021*	
23	Thermistor (Exhaust)	30020489*	
24	Heat Exchanger Drain Cap	20042237*	
25	High Limit Switch	30002558*	
26	O-ring (V32)	20041403*	
27	O-ring (P38)	20023413*	
28	O-ring (P34)	20042298*	
29	Drain Pan Adapter	20043016*	
30	Drain Pan Adapter Packing	20043017*	
31	Screw (M4X10L)	20038753*	
32	Screw (M4X20L)	20042814*	
33	Bolt (M4X10L)	20038757*	

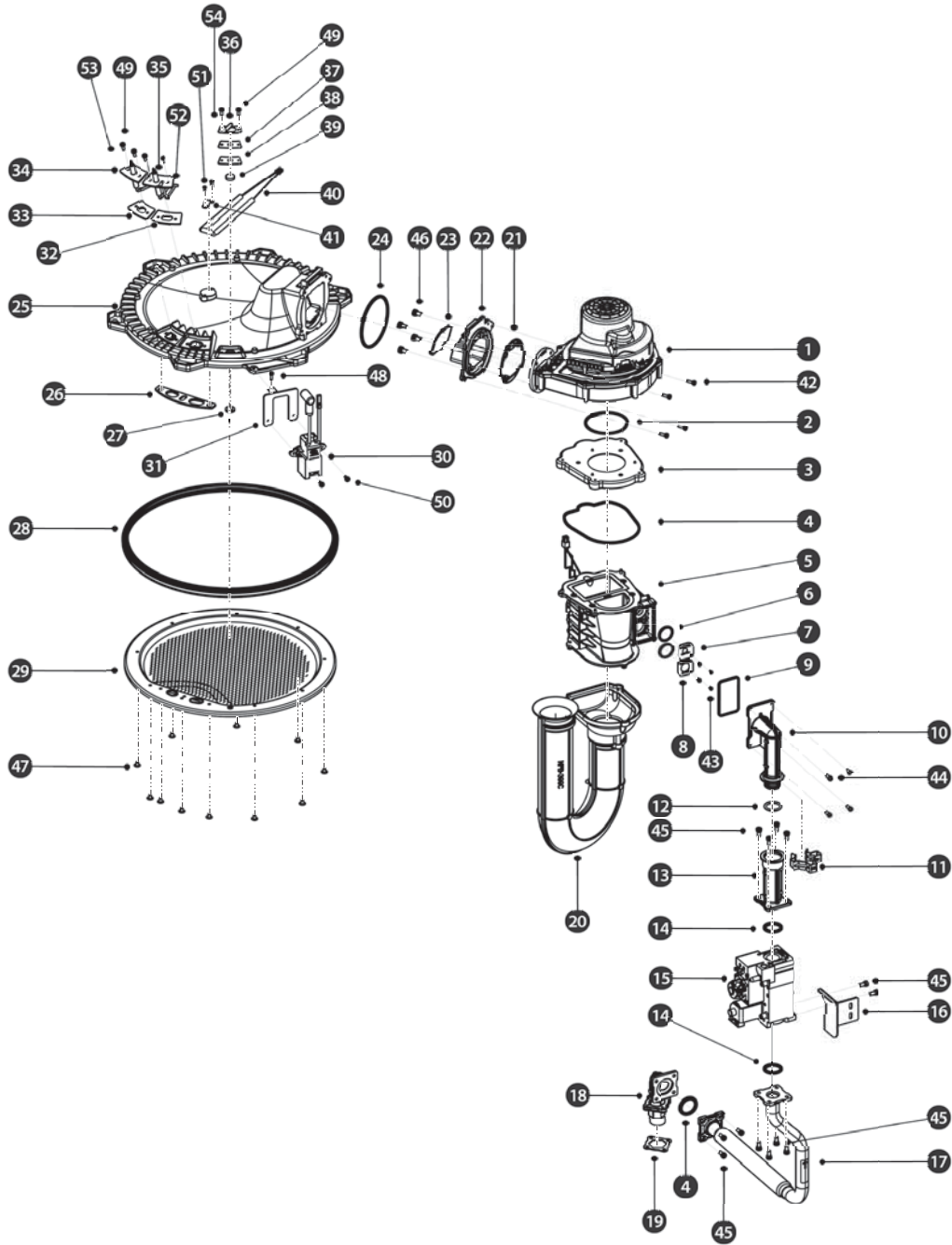
12.6.5 Combustion Parts Assembly - NFB-301C



#	Description	Part #	Remark
1	Fan Assembly	30020992*	
2	Fan Packing	20043751*	
3	Fan Adapter	20043334*	
4	Fan Adapter Packing	20043335*	
5	Dual Venturi	30020804*	
	(SET) Dual Venturi	30023381*	NFB-301C SERVICE KIT
6	Orifice Packing	20042788*	
7	1 Stage Gas Orifice	20043012*	NFB-301C (NG)
		20043013*	NFB-301C (LP, High Altitude Nozzle))
		20046179*	NFB-301C (NG, High Altitude Nozzle)
8	2 Stage Gas Orifice	20043014*	NFB-301C (NG)
		20043015*	NFB-301C (LP)
		20046180*	NFB-301C (NG, High Altitude Nozzle)
		20046181*	NFB-301C (LP, High Altitude Nozzle)
9	Gas Connector Packing	20042800*	
10	Gas Connector (Upper)	20042238*	
11	Fastener	20007878*	
12	O-ring (P18)	20023434*	
13	Gas Connector Adapter	20042239*	
14	O-ring (P20)	20006934*	
15	Gas Valve	30011586*	
16	Gas Pipe	30020753*	
17	Gas Inlet Adapter	20042244*	
18	Gas Inlet Adapter Packing	20023581*	
19	Intake Pipe	30020518*	
20	Fan Outlet Packing	20043320*	
21	Fan Damper Body	20043152*	
22	Fan Damper	20042952*	
23	Fan Damper Body Packing	20043153*	
24	Chamber	20042574*	
25	Packing (Graphite)	20045022*	
26	Packing (Graphite)	20040234*	

#	Description	Part #	Remark
27	Burner Packing	20042913*	
28	Burner	30022740*	
29	Ignition Transformer	30019980*	
30	Ignition Transformer Bracket	20041154*	
31	Igniter Packing	20045644*	
32	Flame Rod Packing	20045645*	
33	Flame Rod	30020805*	
34	Igniter	30020521*	
35	Flame Inspection Window (Upper)	20040231*	
36	Flame Inspection Window (Lower)	20040232*	
37	Flame Inspection Window (Graphite Packing)	20043399*	
38	Flame Inspection Window (Glass)	20040236*	
39	Burner Temperature Fuse	30020776*	
40	Burner Temperature Fuse Bracket	20042386*	
41	Screw (M4×12, Spring Washer)	20043077*	
42	Screw (M4×10, Spring Washer)	20038759*	
43	Screw (M3×5)	20006365*	
44	Screw (M6×12, Spring Washer)	20043735*	
45	Screw (M4×6)	20027618*	
46	Screw (M4×10)	20038757*	
47	Screw (M4×10, STS)	20038758*	
48	Tapite Screw (4×10)	20038753*	
49	(SET) Igniter	30023364*	NFB-301C SERVICE KIT
50	(SET) Flame Rod	30023362*	NFB-301C SERVICE KIT
51	(SET) Flame Inspection Window	30021277*	Compatible with NFB and NFC
52	(SET) Gas Orifice-NG	30023132*	NFB-301C (NG) Nozzle KIT
53	(SET) Gas Orifice-LP	30023130*	NFB-301C (LP) Nozzle KIT
54	(SET) Gas Orifice-NG (High Altitude)	30023131*	NFB-301C (NG-H) Nozzle KIT
55	(SET) Gas Orifice-LP (High Altitude)	30023132*	NFB-301C (LP-H) Nozzle KIT
56	(SET) Chamber Assembly	30023377*	NFB-301C SERVICE KIT

12.6.6 Combustion Parts Assembly - NFB-399C



#	Description	Part #	Remark
1	Fan Assembly	30020992*	
2	Fan Packing	20043751*	
3	Fan Adapter	20043334*	
4	Fan Adapter Packing	20043335*	
5	Dual Venturi	30020801*	
	(SET) Dual Venturi	30023380*	NFB-399C SERVICE KIT
6	Orifice Packing	20042788*	
7	1 Stage Gas Orifice	20042789*	NFB-399C (NG)
		20044123*	NFB-399C (LP, High Altitude Nozzle)
		20046182*	NFB-399C (NG, High Altitude Nozzle)
8	2 Stage Gas Orifice	20042790*	NFB-399C (NG)
		20044125*	NFB-399C (LP)
		20046183*	NFB-399C (NG, High Altitude Nozzle)
		20046184*	NFB-399C (LP, High Altitude Nozzle)
9	Gas Connector Packing	20042800*	
10	Gas Connector (Upper)	20043187*	
11	Fastener	20017724*	
12	O-ring (P24)	20010285*	
13	Gas Connector Adapter	20043188*	
14	Gas Valve Packing (NBR)	20043333*	
15	Gas Valve	30020034*	
16	Gas Valve Bracket	20043584*	
17	Gas Pipe	30020595*	
18	Gas Inlet Adapter	20042667*	
19	Gas Inlet Adapter Packing	20043887*	
20	Intake Pipe	30020599*	
21	Fan Outlet Packing	20043320*	
22	Fan Damper Body	20043152*	
23	Fan Damper	20042952*	
24	Fan Damper Body Packing	20043153*	
25	Chamber	20042538*	
26	Packing (Graphite)	20045022*	

#	Description	Part #	Remark
27	Packing (Graphite)	20040234*	
28	Burner Packing	20042657*	
29	Burner	30022741*	
30	Ignition Transformer	30019980*	
31	Ignition Transformer Bracket	20041154*	
32	Igniter Packing	20045644*	
33	Flame Rod Packing	20045645*	
34	Flame Rod	30020583*	
35	Igniter	30020582*	
36	Flame Inspection Window (Upper)	20040231*	
37	Flame Inspection Window (Lower)	20040232*	
38	Flame Inspection Window (Graphite Packing)	20043399*	
39	Flame Inspection Window (Glass)	20040236*	
40	Burner Temperature Fuse	30020776*	
41	Burner Temperature Fuse Bracket	20042386*	
42	Screw (M4×12, Spring Washer)	20043077*	
43	Screw (M3×5)	20006365*	
44	Screw (M4×10, Spring Washer)	20038759*	
45	Screw (M5×12, Spring Washer)	20043733*	
46	Screw (M6×12, Spring Washer)	20043735*	
47	Screw (M4×6)	20027618*	
48	Screw (M4×10)	20038757*	
49	Screw (M4×10, STS)	20038758*	
50	Taptite Screw (4×10)	20038753*	
51	Screw (M3×6)	20018065*	
52	(SET) Igniter	30023361*	NFB-399C SERVICE KIT
53	(SET) Flame Rod	30023363*	NFB-399C SERVICE KIT
54	(SET) Flame Inspection Window	30021277*	Compatible with NFB and NFC
55	(SET) Gas Orifice-NG	30023698*	NFB-399C (NG) Nozzle KIT
56	(SET) Gas Orifice- LP	30023128*	NFB-399C (LP) Nozzle KIT
57	(SET) Gas Orifice-NG (High Altitude)	30022909*	NFB-399C (NG-H) Nozzle KIT
58	(SET) Gas Orifice-LP (High Altitude)	30023129*	NFB-399C (LP-H) Nozzle KIT
59	(SET) Chamber Assembly	30023376*	NFB-399C SERVICE KIT

Installation & Operation Manual

NFB Condensing Boilers

Getting Service

If your boiler requires service, you have several options for getting service:

- Contact Technical Support at 1-800-519-8794 or on the website: www.navieninc.com.
- For warranty service, always contact Technical Support first.
- Contact the technician or professional who installed your boiler.
- Contact a licensed professional for the affected system (for example, a plumber or electrician).

When you contact Technical Support, please have the following information at hand:

- Model number
- Serial number
- Date purchased
- Installation location and type
- Error code, if any appears on the front panel display.

Version: 1.0 (Nov. 2020)



800.519.8794 | www.navieninc.com
20 Goodyear Irvine, CA 92618