

Installation & Operation Manual

NHB Condensing Boilers

Model | NHB-055
NHB-080
NHB-110
NHB-150



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.

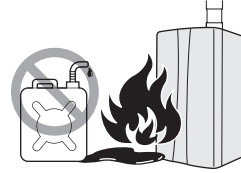
WARNING

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:

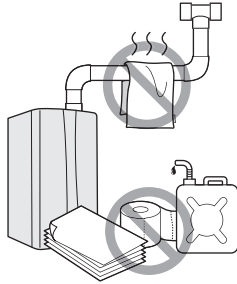
- Do not try to light any appliance.
- Do not touch any electrical switches or use landline phones.
- From a neighbor's phone, call your gas provider and follow their instructions.
- If you cannot reach your gas provider, call the fire department.
- Do not return to your home until authorized by your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





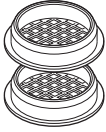
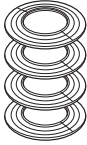
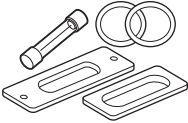

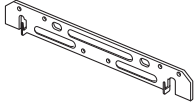


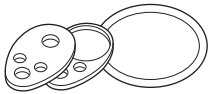


CAUTION

- **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.

1. About the Boiler

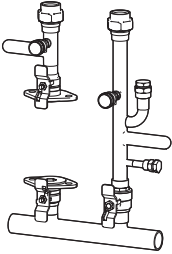
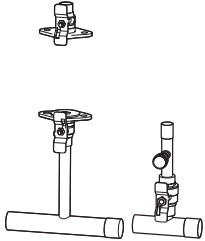
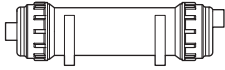
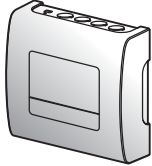
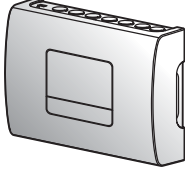
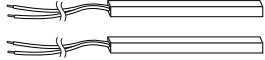
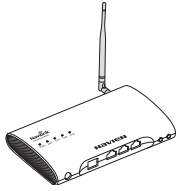
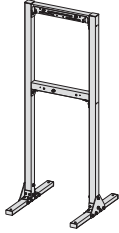
1.1 Included Items

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
	
2 in Vent Termination Caps (x2)	2 in Wall Flanges (x4)
	
Spare Parts	Air Vent
	
Wall Mounting Bracket	Tapping Screws & Anchors (x4)
	
Pressure Relief Valve, Heating	Conversion Kit
	
Outdoor Temperature Sensor and Cable	Air Vent Bushing (3/4in to 1/2in)

1.2 Accessories


The following optional accessories are available for the boiler.

	
Navien Manifold System (for primary zone)	Navien Manifold System (for secondary zone)
	
Condensate Neutralizer Kit	Zone Controller (FMZ-20/30)
	
Zone Controller (FMZ-40/60)	System Supply/Return Temperature Sensors
	
Navi-Link (Wi-Fi Control System)	Ready-Link Rack

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 Condensing Boiler Space Heating Ratings								Other Specifications	
Model Number ¹	Heating Input (MBH)		Heating Capacity ² (MBH)	Net AHRI Rating Water ³ (MBH)	AFUE ² (%)	Water Pressure	Water Connection Size (Supply, Return)		
	Min	Max							
NHB-055	8	55	51	44	95	12–30 psi	1 in NPT		
NHB-080	8	80	74	64	95				
NHB-110	10	110	102	89	95				
NHB-150	10	150	138	120	95				

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	NHB-055	NHB-080	NHB-110	NHB-150
Dimensions	17in (W) x 12in (D) x 24in (H)		17in (W) x 13in (D) x 24in (H)	
Weight	73 lb (33 kg)		80 lb (36 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–13.5 in WC			
Natural Gas Manifold Pressure	-0.03 in WC	-0.08 in WC	-0.10 in WC	-0.40 in WC
Propane Gas Manifold Pressure	-0.03 in WC	-0.07 in WC	-0.09 in WC	-0.30 in WC
Gas Connection Size	3/4 in NPT			
Power Supply	Main Supply	120V AC, 60Hz		
	Maximum Power Consumption	Less than 10 amperes		
Materials	Casing	Cold-rolled carbon steel		
	Heat Exchangers	Primary and Secondary: Stainless Steel		
Venting	Exhaust	2 in or 3 in PVC, CPVC, approved polypropylene* 2 in or 3 in Special Gas Vent Type BH (Class III, A/B/C)		
	Intake	2 in or 3 in PVC, CPVC, polypropylene 2 in or 3 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			

*Approved polypropylene systems include:

- Duravent Polypro (Single Wall): 2PPS-xxx (2"), 3PPS-xxx (3")
- Centrotherm Innoflue SW: ISxx02xx (2"), ISxx03xx (3")

Refer to manufacturer's literature for detailed information.

Temperature Setting Range

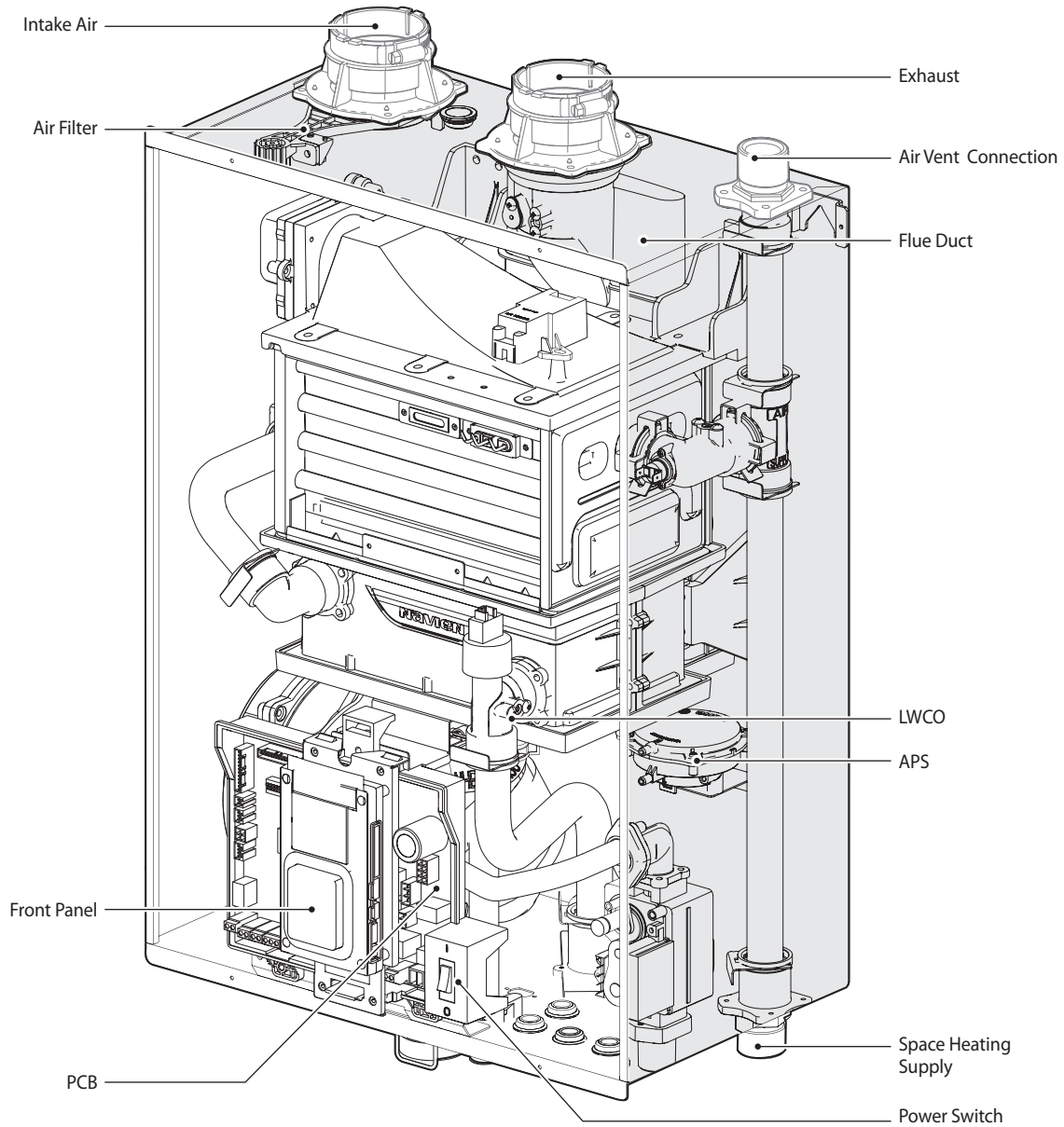
Item	Temperature Setting Range	Remarks
Space Heating	Supply	Actual supply and return temperatures vary depending on the selected outdoor reset curve.
	Return	

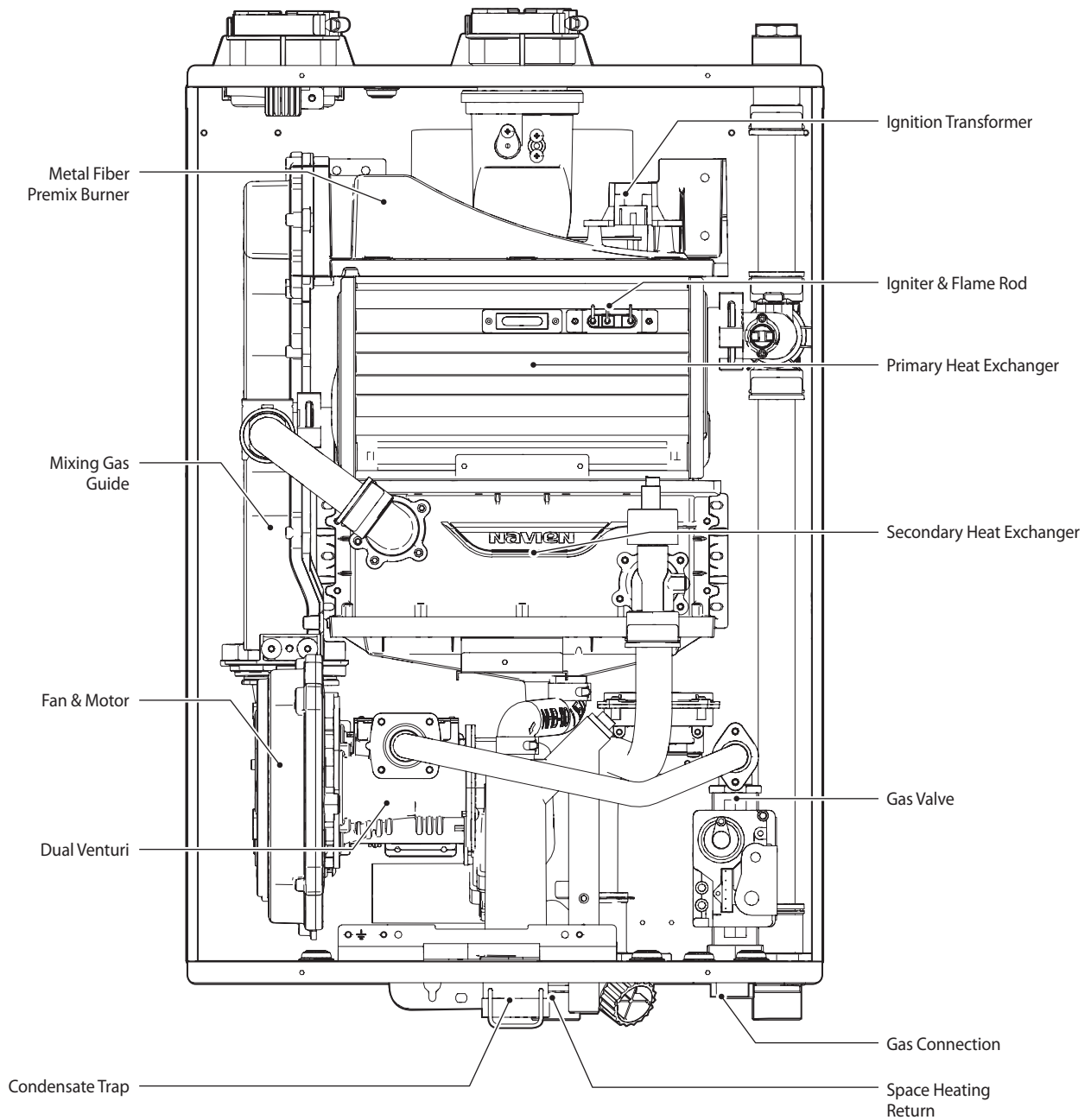
Note

For more information about the space heating temperature setting range, refer to "Setting the Heat Load for the Outdoor Reset Control Mode" on page 79.

1.4 Components

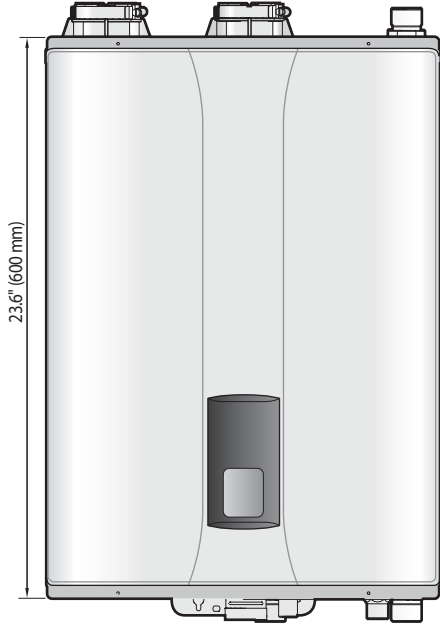
The following diagram shows the key components of the boiler. Component assembly diagrams and particular parts lists are included in the Appendixes.





1.5 Dimensions

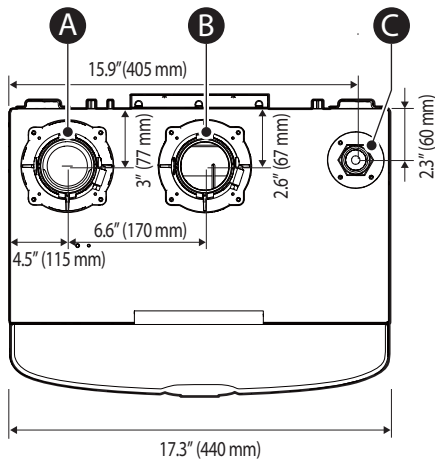
The following diagrams show the dimensions of the boiler and the table lists the supply connections.



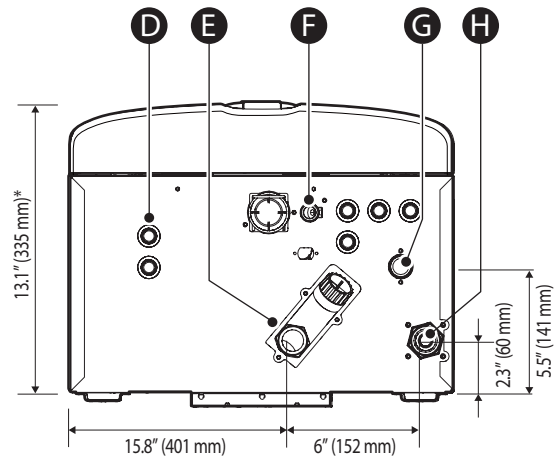
Supply Connections

	Description	Diameter
A	Air Intake	2 in
B	Exhaust Gas Vent	2 in
C	Air Vent Connection	$\frac{3}{4}$ in
D	Rubber Grommet	1 in
E	Space Heating Return	1 in
F	Condensate Outlet	$\frac{1}{2}$ in
G	Gas Connection	$\frac{3}{4}$ in
H	Space Heating Supply	1 in

Overhead View



Supply Connections








* NHB-055/080: 11.8" (300 mm)

1.6 Rating Plate

The Navien NHB 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 Conversion” on page 86 for details.

Rating Plate, *Plaque Signalétique

Direct Vent Boiler * Évacuation directe chaudière		 
Navien, Inc. 20 Goodyear, Irvine, CA 92618 Tel: 1-800-519-8794		
Direct vent indoor installation, * Évacuation directe installation intérieure		
Model No., *Numéro de modèle	Type of Gas, *Type de gaz	 
NHB-150	NG	
Max./Min. Input Rating (Heating), *Entrée GPL max./min	Heating Capacity, *Capacité de chauffage	
150,000 Btu/h / 10,000 Btu/h	138,000 Btu/h	
Category of boiler, *Catégorie de chaudière	Net AHRI Rating, *Régime de AHRI	
Category IV	120,000 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	-0.40 Inches W.C., *pouces W.C.	
Electrical Rating, *Régime nominal électrique	AC *c.a. 120 Volts 60Hz Use less than 6 Amp, *Utilise moins de 6A	
Minimum relief valve capacity, *Capacité minimum soupape.	189 lbs/hr ANSI Z21.13-2014 · CSA 4.9-2014	

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.

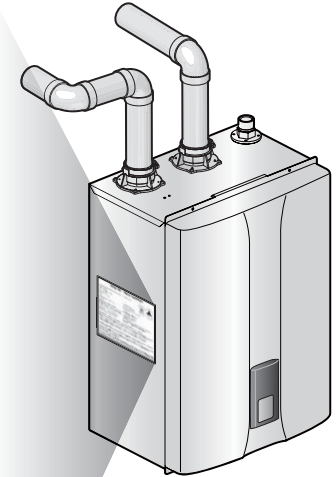
Consult your installation manual for more information. *Consultez votre manuel d'installation pour plus d'information.

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. For installation instructions at altitudes higher than 4,500 ft, please contact Navien.
 *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. Pour les installations à élévations en haut de 4,500 pieds, appeler le bureau de Navien.

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 É.-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 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. Water spray or droppings 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.

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 22.

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 the Boiler” on page 41.

To ensure adequate venting and ventilation, follow these guidelines:

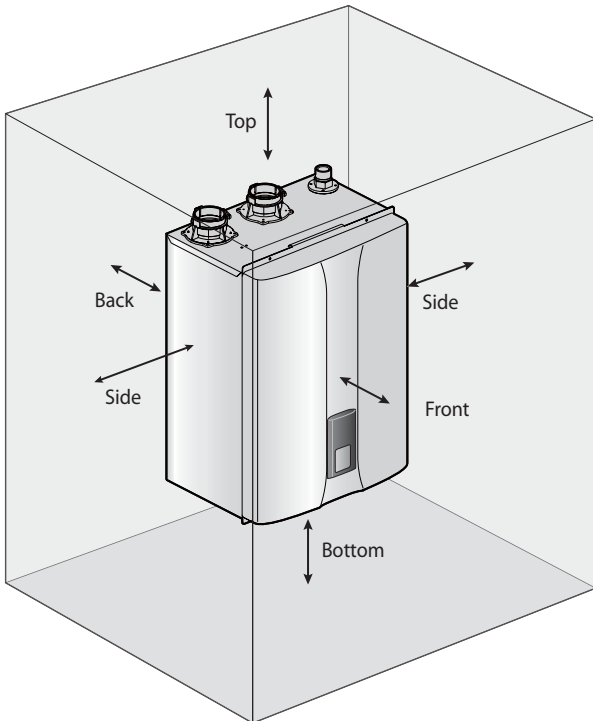
- Maintain proper clearances from any openings in the building.
- Install the boiler with a minimum clearance of 12 in (300 mm) above the level required by local codes and weather conditions.
- Maintain a minimum clearance of 4 ft (1.2 m) from heating and cooling vents.
- Do not enclose the vent termination.
- 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.

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	9 in (229 mm) minimum
Back	0.5 in (13 mm) minimum
Front	4 in (100 mm) minimum
Sides	3 in (76 mm) minimum
Bottom	12 in (300 mm) minimum

! CAUTION

It is necessary to leave clearance for service access.

Clean, Debris and Chemical-free Combustion Air

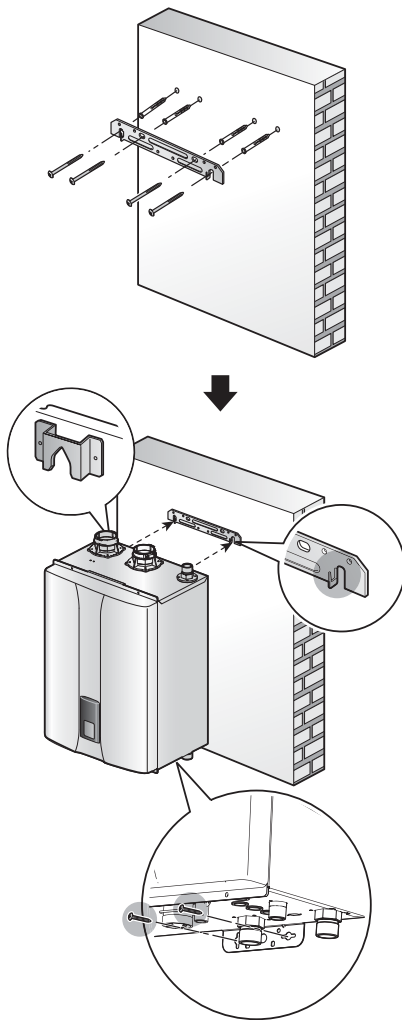
- Do not install the boiler in areas where dust and debris may accumulate or where hair sprays, spray detergents, chlorine, or similar chemicals are used.
- Do not install the boiler in areas where gasoline or other flammables are used or stored.
- Ensure that combustible materials are stored away from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

2.2 Mounting the Boiler to the Wall

Navien NHB boilers come with an upper mounting bracket that is pre-drilled at 16 in (400 mm) on center for easy installation on standard wall studs. If the strength of the wall is insufficient or if the framing is non-standard or uneven, reinforce the area before installing the boiler. Avoid installation on common walls as the unit will make some operational noises while it is running.

To mount the boiler to the wall:

1. Affix the bracket securely to the wall and ensure that it is level and that it can support the weight of the boiler.
2. Align the grooves on the back of the boiler with the tongues on the mounting bracket and hang the boiler on the bracket.
When mounted with the mounting bracket, the boiler will have a $\frac{3}{8}$ in (16 mm) clearance from the back of the wall.
3. Install two set screws through the bracket at the bottom of the boiler to secure the boiler on the wall.



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.
- **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.

CAUTION

Do not mount the boiler to dry wall that has not been reinforced.

3. Installing the System Piping

Prior to connecting plumbing 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 primary and secondary heat exchangers of the Navien NHB boiler are designed to attain the highest level of heat transfer in a compact design. To accomplish this, the heating water flows through a series of tubes (secondary heat exchanger) and finned tubes (primary heat exchanger), designed to maximize the heat transfer area. To maintain the efficient and reliable operation of the heat exchangers, 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 35% 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.

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 NHB boiler is intended solely for use in pressurized closed loop heating systems operating with 12-30 psi water pressure at the boiler outlet. To obtain the minimum system design pressure, follow the piping diagrams illustrated in this section.
- The Navien NHB 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 of any kind.

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, in case an additional air removal device is required for a specific application.

WARNING

- Immediately repair any leaks in the system plumbing 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.

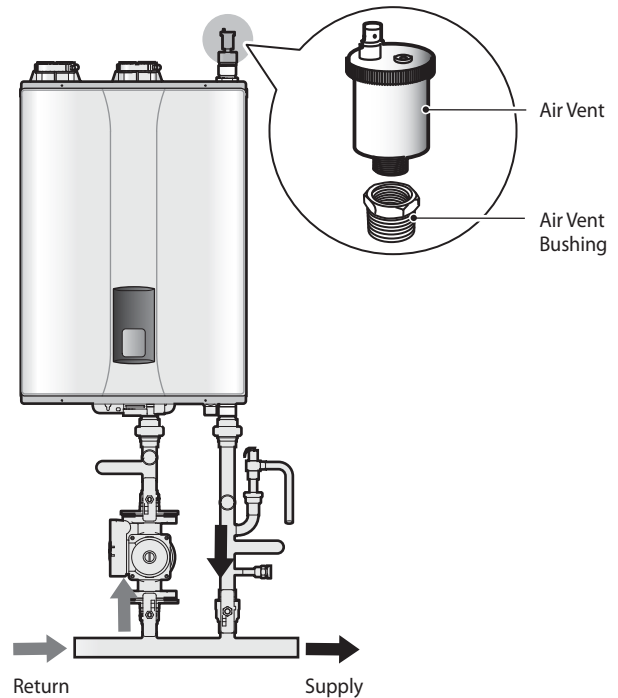
CAUTION

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

3.1.2 Essential Elements in a Space Heating System

Air Vent

The Navien NHB 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.



Also, an external LWCO and a pressure relief valve can be installed at the air vent connection. Refer to "Low Water Cut Off (LWCO) Device" on page 18 and "Pressure Relief Valve" on page 19.

Note Before installing the vent line and any vent fittings, you must be familiar with the LWCO and pressure relief valve installation guidelines.

Low Water Cut Off (LWCO) Device

Internal LWCO

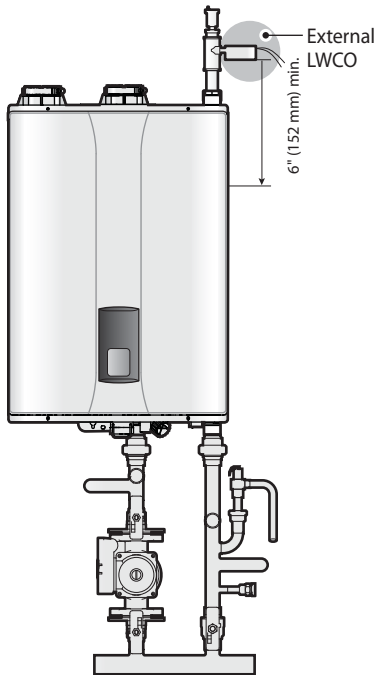
The Navien NHB boiler is equipped with a factory-installed, pressure-sensing type low water cutoff (LWCO) device. The minimum operation pressure for this device is 6 psi by default.

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 31 for typical wiring connections of the LWCO to the boiler PCB.

Backflow Preventer

Install a backflow preventer valve in the make-up water supply to the unit 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 at the end of this section for the installation location. 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 $\frac{3}{4}$ in, 30 psi (max.) pressure relief valve on the space heating hot water outlet. An ASME approved HV pressure relief valve for space heating system 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.

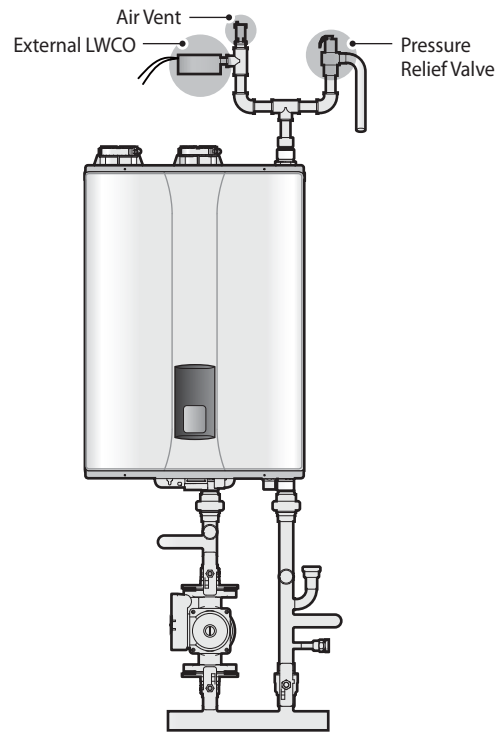
When installing the pressure relief valve, follow these guidelines:

- 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.

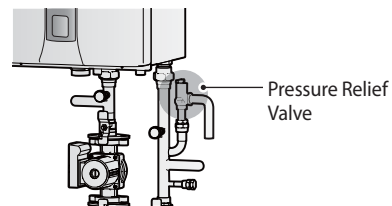
There are two pressure relief valve installation methods. In Method 1, the pressure relief valve is installed on top of the boiler and in Method 2 it is installed in a manifold system.

If the installed system does not have a Navien manifold system, install a pressure relief valve with the air vent. The illustration below shows an example of a pressure relief valve installed with the air vent.



Method 1.

Refer to the following illustration for a pressure relief valve installation in the space heating system. A Watts M330-M1 pressure relief valve ($\frac{3}{4}$ in, HV, Max 30 psi) is provided with the boiler.



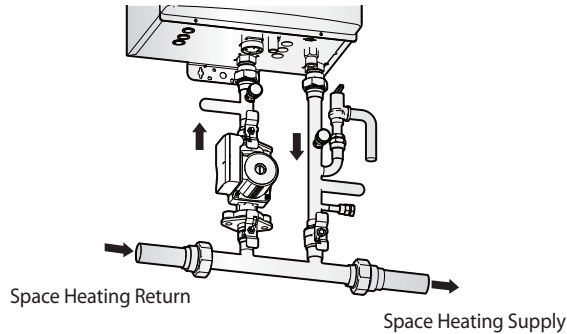
Method 2.

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.

The optional Navien manifold system enables easy separation of the boiler (primary loop) from the system (secondary loop(s)). Refer to the illustration below for an example of the piping connections for a Navien manifold system (primary zone).



The following tables list the specifications for the available pumps and Navien's manifold system. If you are not using one of the pumps listed below, you must use a circulator with check valve installed at pump outlet or a pump with an integral check valve.

Model Number

Item	NHB-055	NHB-080	NHB-110	NHB-150
Manifold System	GFFM-MSOZUS-001			

Pump Specifications

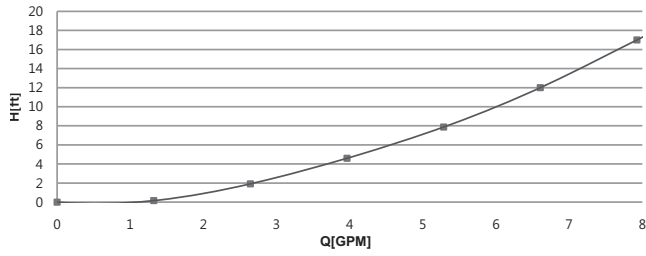
Manufacturer	NHB-055/080/110	NHB-150
Grundfos	UPS 15-58	UPS 26-99
Armstrong	Astro 230CI	Astro 280CI
Taco	0015-MSF3-IFC	0013-F3
Wilo	Star S 16F	N/A
Bell & Gossett	NRF-25	NRF-36

Note

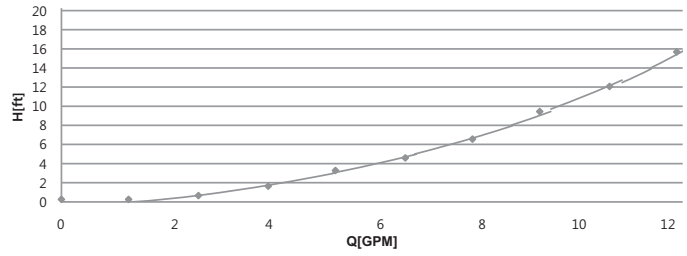
If you are not using one of the pumps listed in the above tables, use a pump with an integral check valve or install a check valve at the pump outlet. Refer to the performance curves on page 21 to select a pump that suits your application. The boiler can supply up to a maximum of 2A current at the boiler pump connection terminal.

PQ Curves

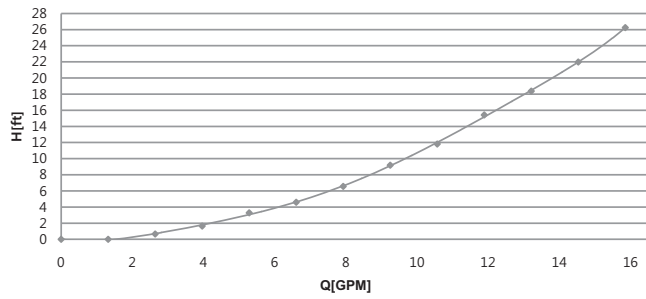
NHB-055/080



NHB-110



NHB-150



Temperature Rise Conditions

Model	20°F ΔT		30°F ΔT		40°F ΔT	
	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)	Flow Rate (GPM)	Head (Ft)
NHB-055	5.1	7.4	3.4	3.5	2.6	2.1
NHB-080	7.4	15.2	4.9	6.9	3.7	4.1
NHB-110	10.2	11.3	6.8	5.0	5.1	2.8
NHB-150	13.8	20.7	9.2	9.2	6.9	5.2

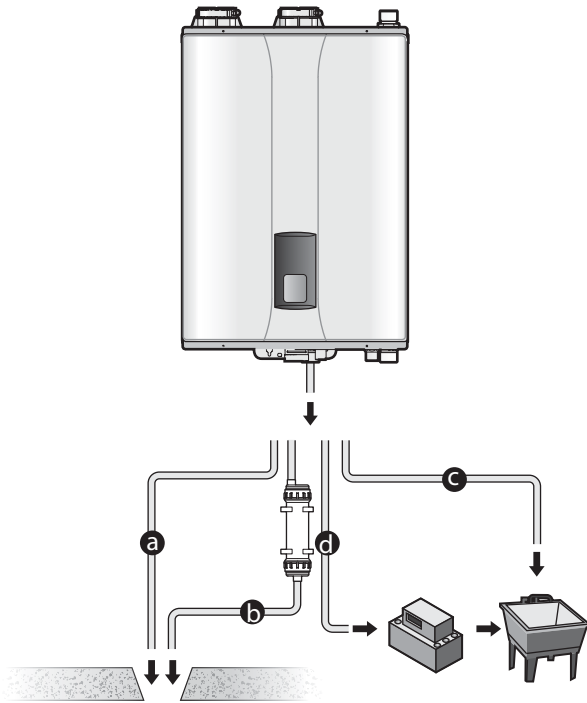
3.2 Connecting the Condensate Drain

The Navien NHB 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. We recommend 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.

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 Condensate Neutralizer Kit" on page 23).

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.

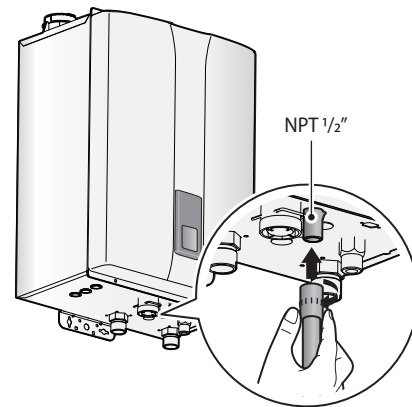
- d. From the boiler into a condensate pump, and then into a laundry tub.

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 $\frac{1}{2}$ 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 $\frac{1}{2}$ 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 2 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 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 to prevent the backflow of condensate into the appliance.
- Do not connect more than one appliance to the neutralizer.

If option 'b' (p. 22) is selected as the disposal option, the Navien 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 and the outlet has an offset connection.
- Install the neutralizer on the wall or the floor and secure it using the brackets supplied with the kit.
- If the neutralizer is installed horizontally, rotate the neutralizer to position the outlet at the highest point (Figure 1).
- If the neutralizer is mounted vertically, ensure that the outlet is higher than the inlet (Figure 2).
- 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 and water heater condensate removal.

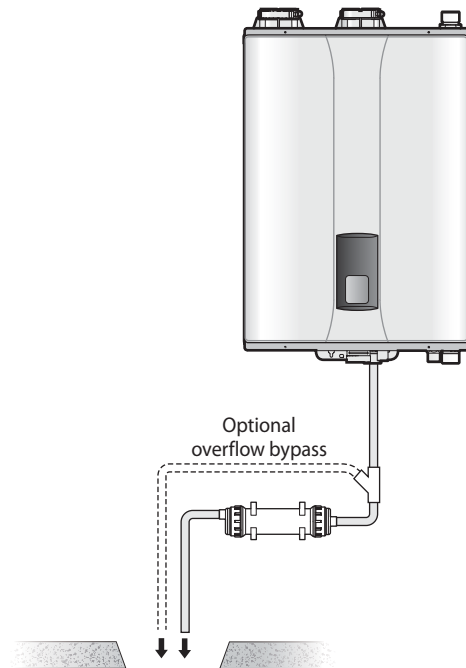


Figure 1. Horizontal installation

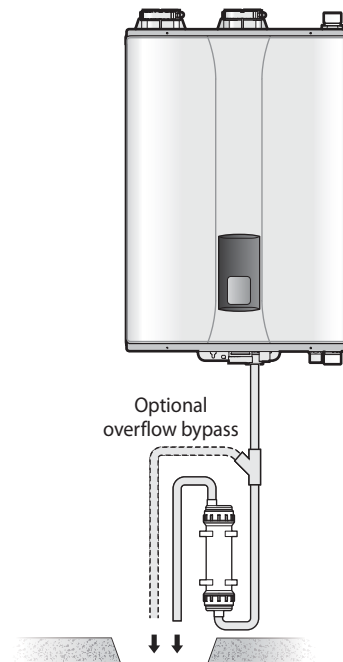


Figure 2. Vertical installation

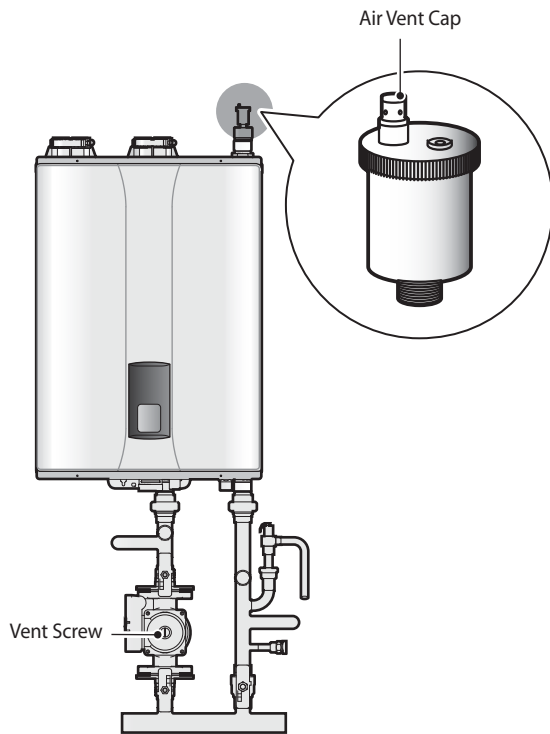
Maintenance

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, 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.

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

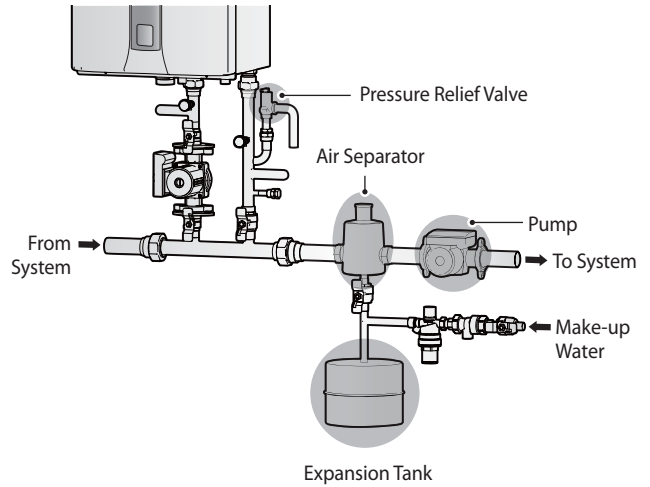


Note

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 fill 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 fill 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	200 mg/l (12 grains/gallon)
Aluminum	0.05 to 0.2 mg/l
Chloride	250 mg/l
Copper	1.0 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
pH	6.5-8.5
Sulfate	205 mg/l

- Close the manual and automatic air vents and the boiler drain valve.
- 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.
- 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

Before operating the boiler for the first time, ensure that the boiler system is filled with water. Purge the air inside the system to avoid damage to the boiler.

3.5 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.

3.5.1 Considerations for System Applications

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

- System application drawings are intended to explain the system piping concept only.
- When installing a mixing valve on the DHW piping, ensure that the cold water pressure does not exceed the hot water pressure.
- 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 18.
- Installations must comply with all local codes. In Massachusetts, a vacuum relief valve must be installed in the cold water line per 248 CMR.

Air Removal

The boiler and system plumbing layout must be configured to promote the removal of air from the water. 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 a strategically located 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 flow checks, 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

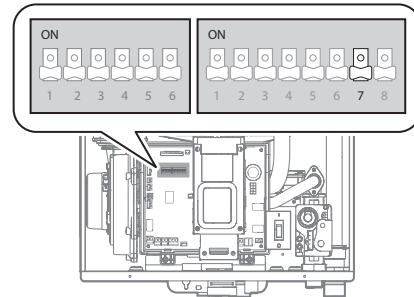
The Navien NHB boiler can control the operation of an air handler when a thermostat is used in combination with the air handling unit. The Air Handler Interface is designed to stop air handler operation when the boiler's space heating function is not operating due to DHW supply demands, boiler errors,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

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.

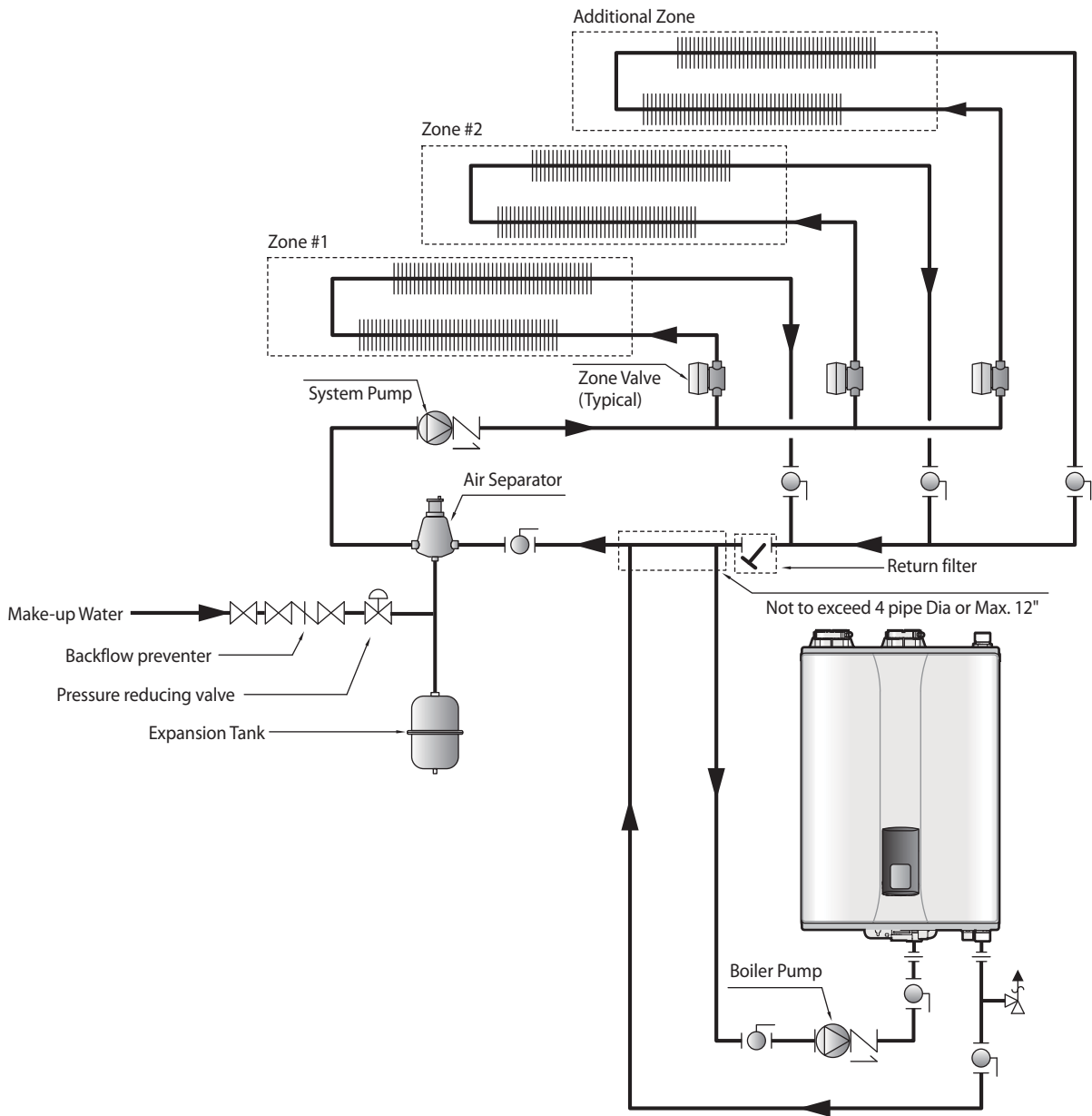


Refer to the "3.1.1 Guidelines for a Space Heating Installation" on page 34 for wiring connections.

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.

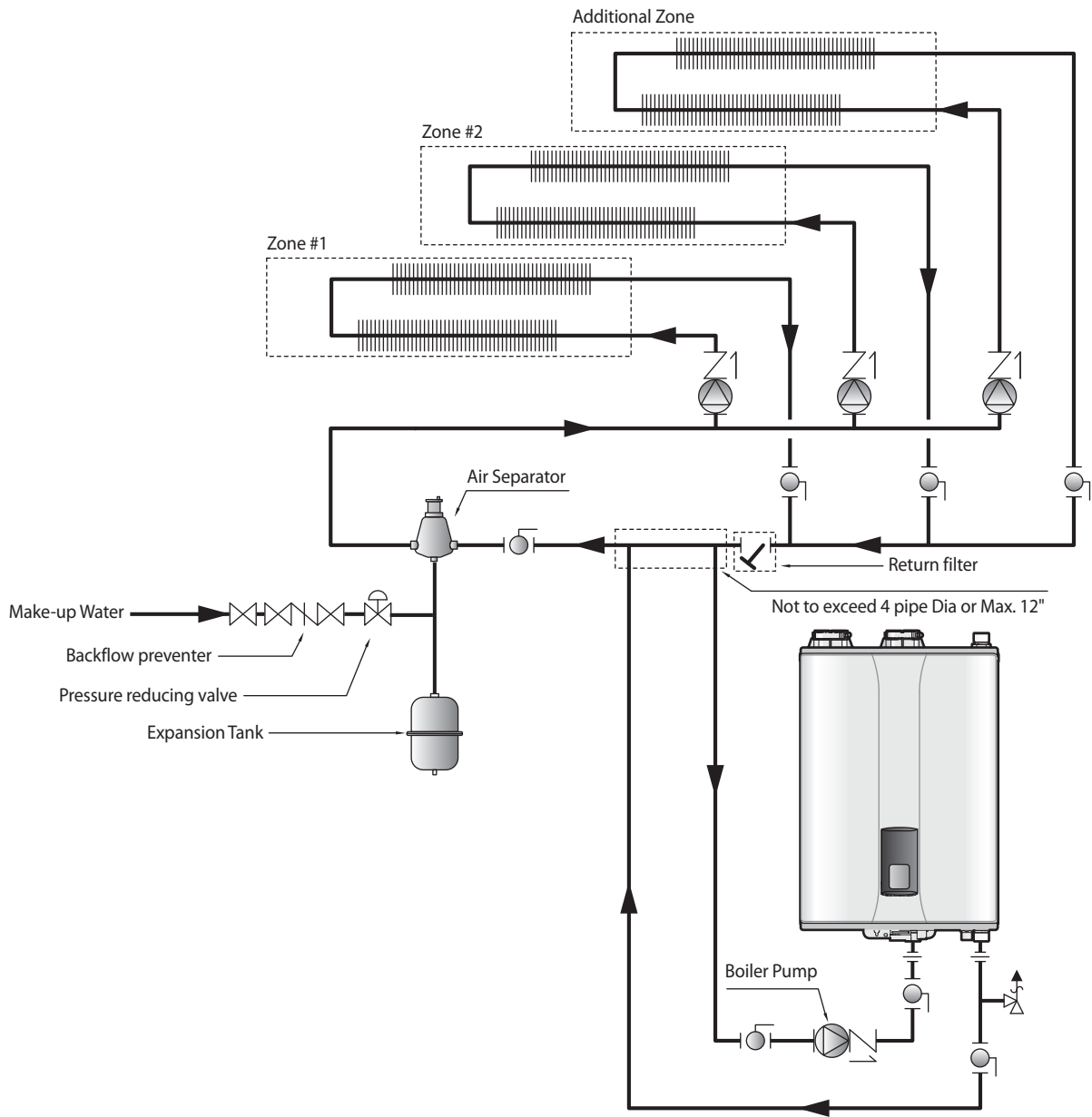
3.5.2 System Application - Zone System with Zone Valves



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 24 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 "3.6.4 Wiring Diagram - Generic Zone System with Zone Valves" on page 33 for wiring connections.

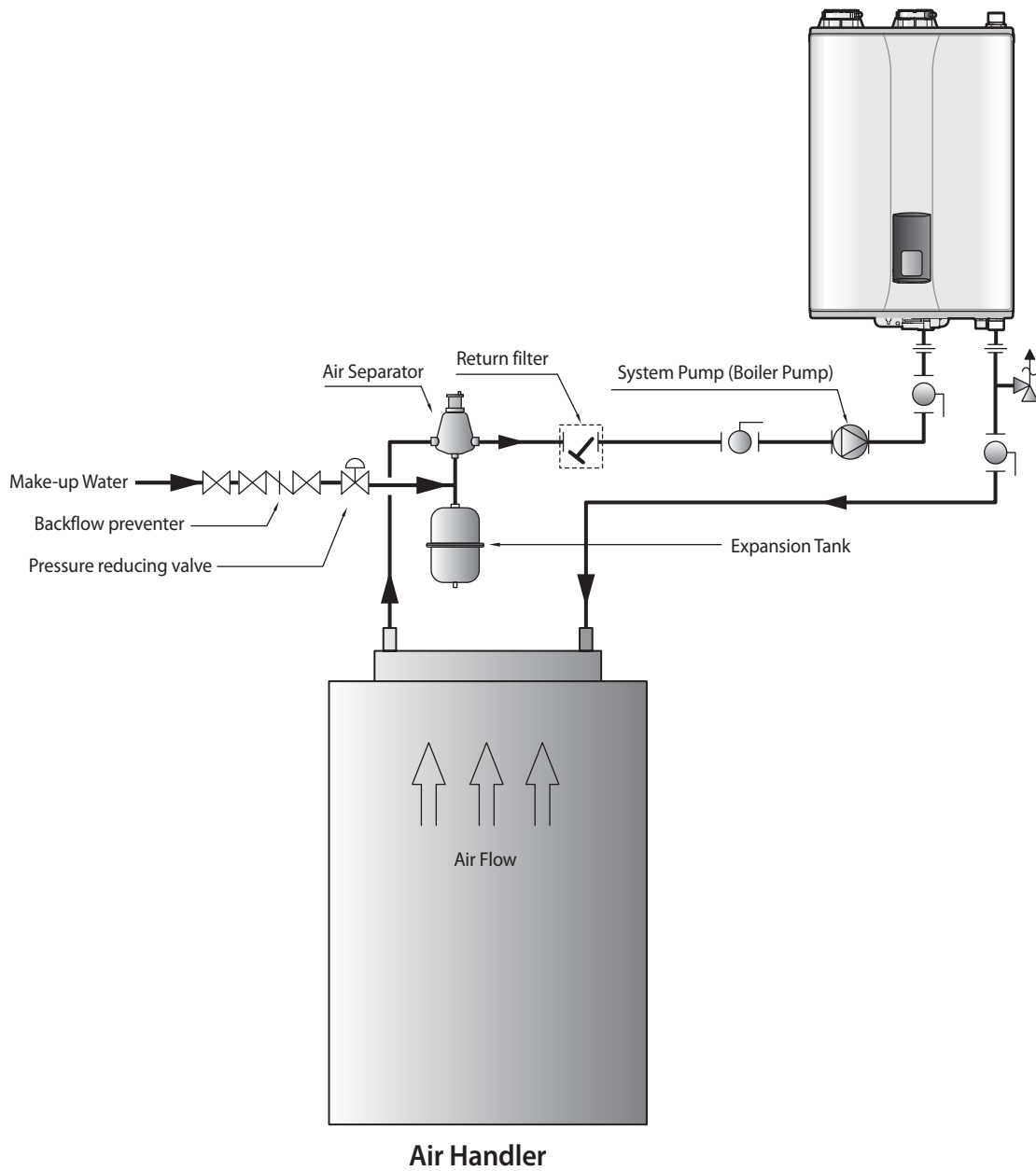
3.5.3 System Application - Zone System with Pumps



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 24 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 "3.6.5 Wiring Diagram - Generic Zone System with Circulators" on page 33 for wiring connections.

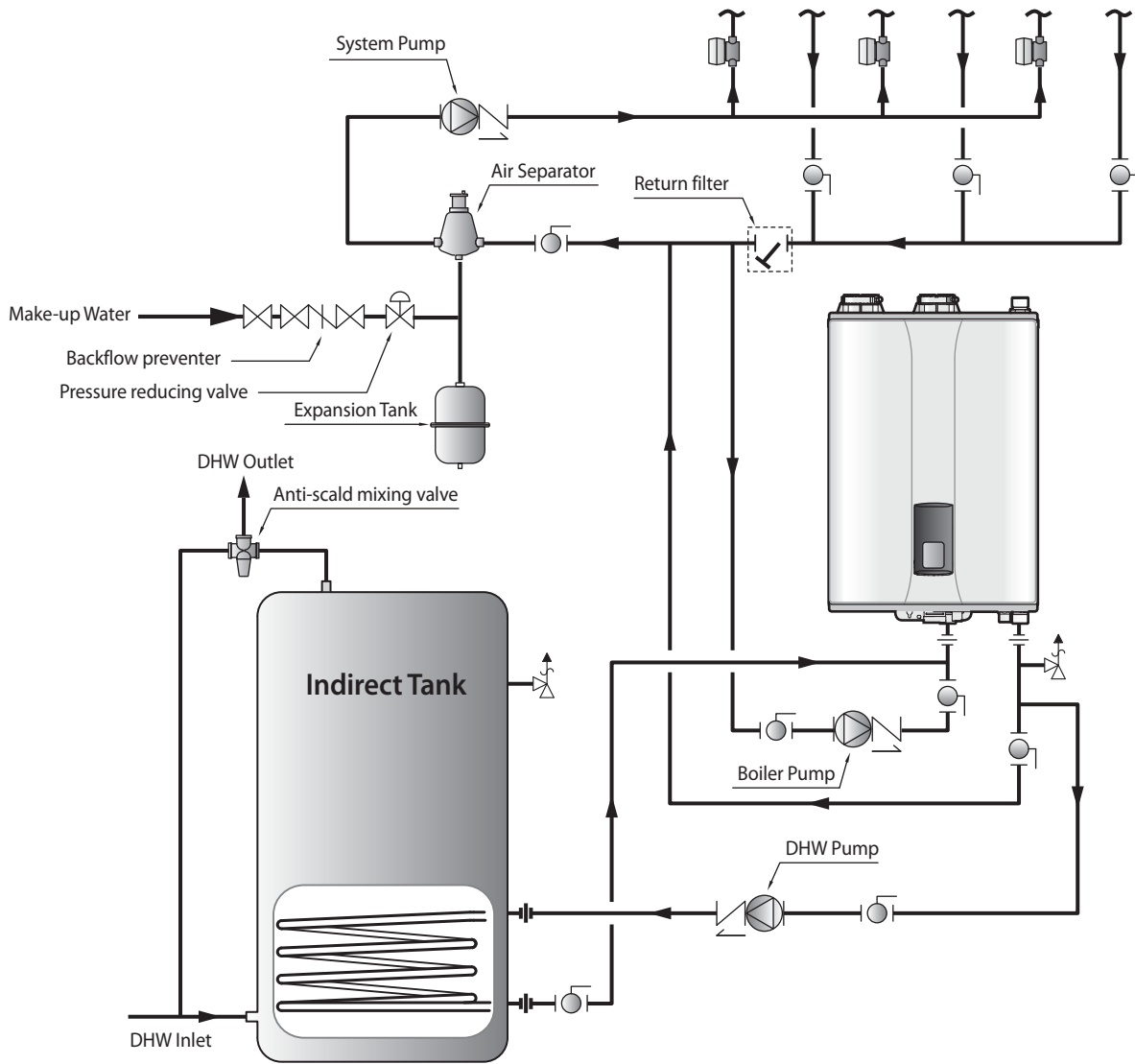
3.5.4 System Application - Air Handler System



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 24 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 "3.6.6 Wiring Diagram - Air Handler" on page 34 for wiring connections.
- You can use a secondary piping configuration for the air handler system to maintain optimal flow and heat capacity.

3.5.5 System Application - DHW System with Indirect Tank



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 24 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 the "3.6.7 Wiring Diagram - DHW System with Indirect Tank" on page 34 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.

3.6.1 Accessing the Terminal Strips

DANGER

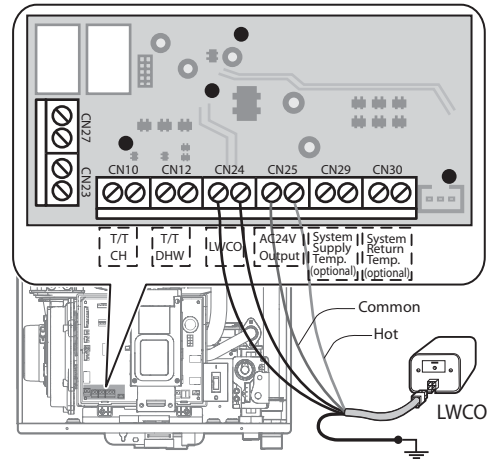
You must ensure that the boiler is disconnected from the electrical supply before carrying out any servicing inside the boiler and, particularly, on the electric terminal strips.

To access the PCB, carefully follow the steps below:

1. Turn off the power supply to the boiler.
2. Remove the boiler's front cover by loosening the four screws.



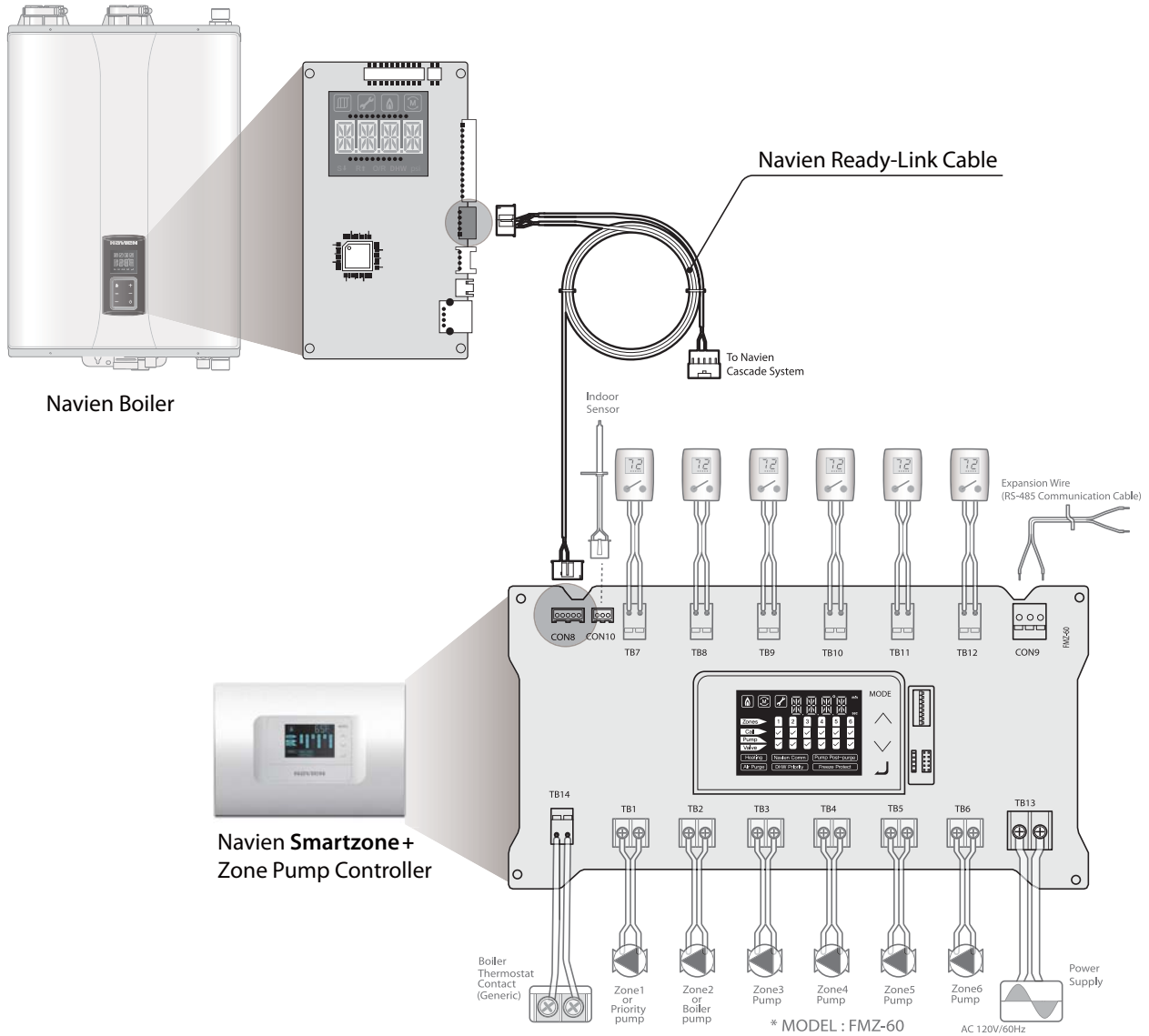
3.6.2 Wiring Diagram - External LWCO



- Note**
- Remove the factory installed jumper on the LWCO terminals (CN24) prior to connecting the LWCO.
 - The boiler supplies 24 VAC at the LWCO power terminals (CN25).

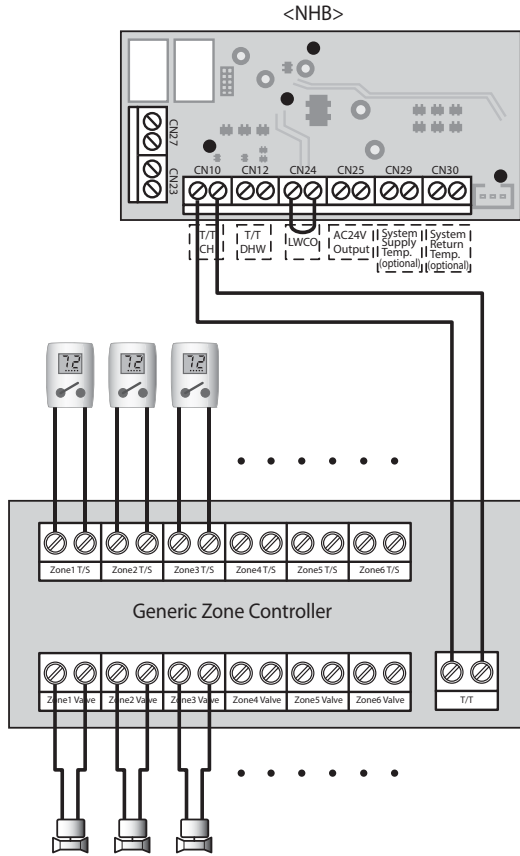
3.6.3 Wiring Diagram - the Navien SmartZone +

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.

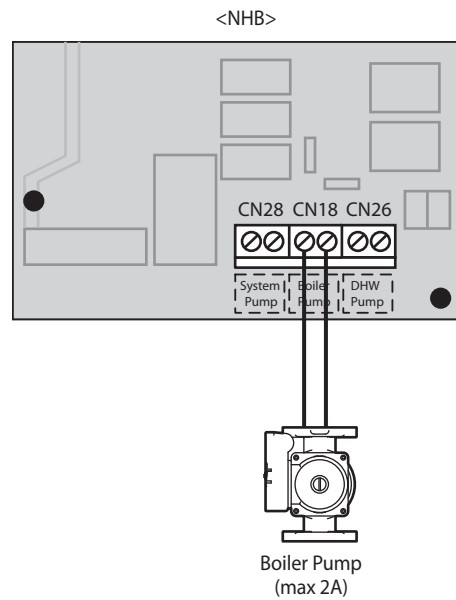
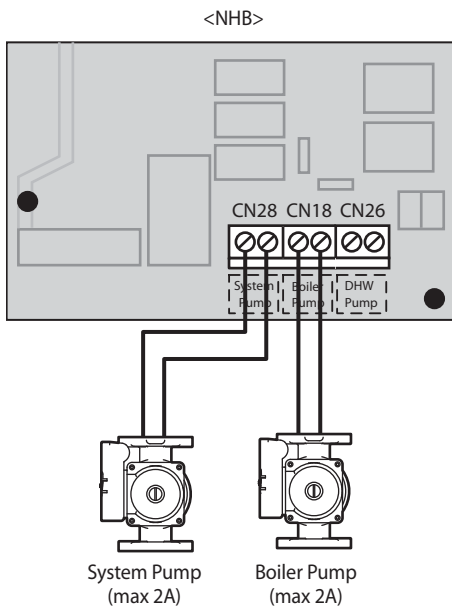
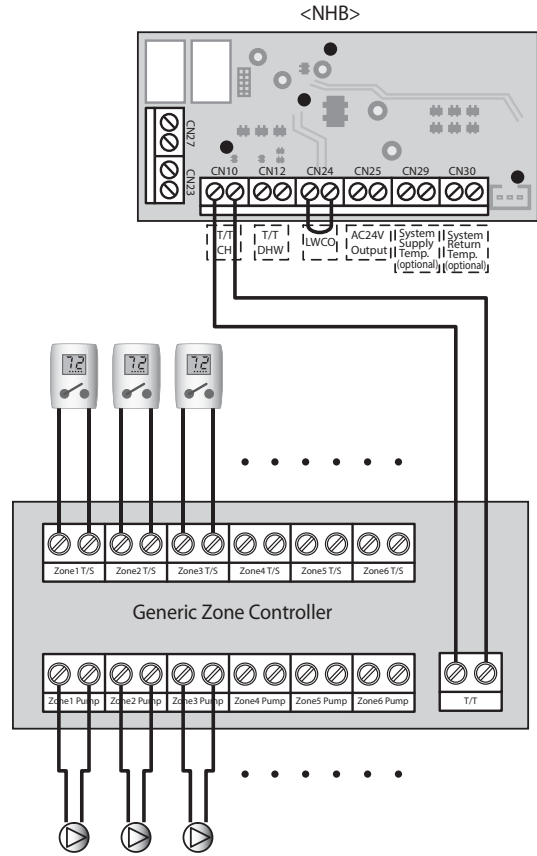


Refer to the user manual that is supplied with the Navien Smartzone+ zone pump controller for details.

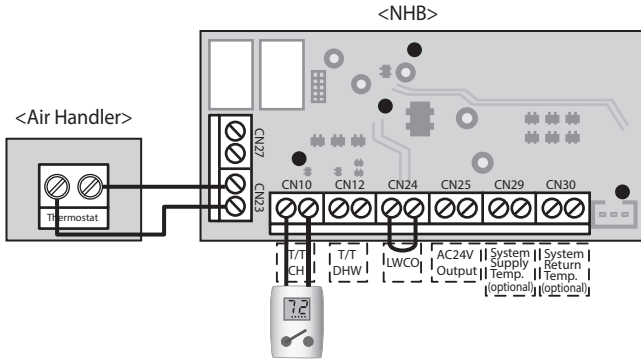
3.6.4 Wiring Diagram - Generic Zone System with Zone Valves



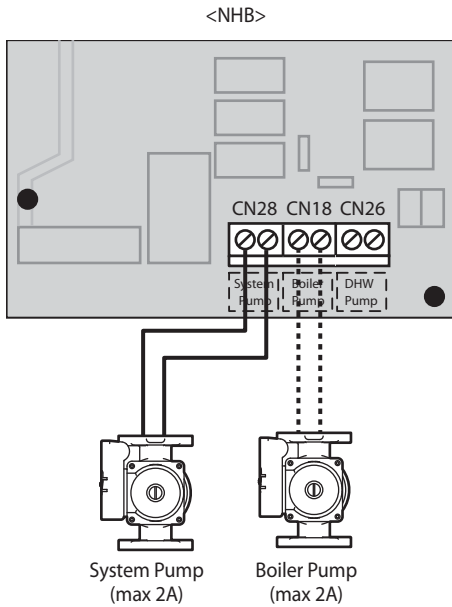
3.6.5 Wiring Diagram - Generic Zone System with Circulators



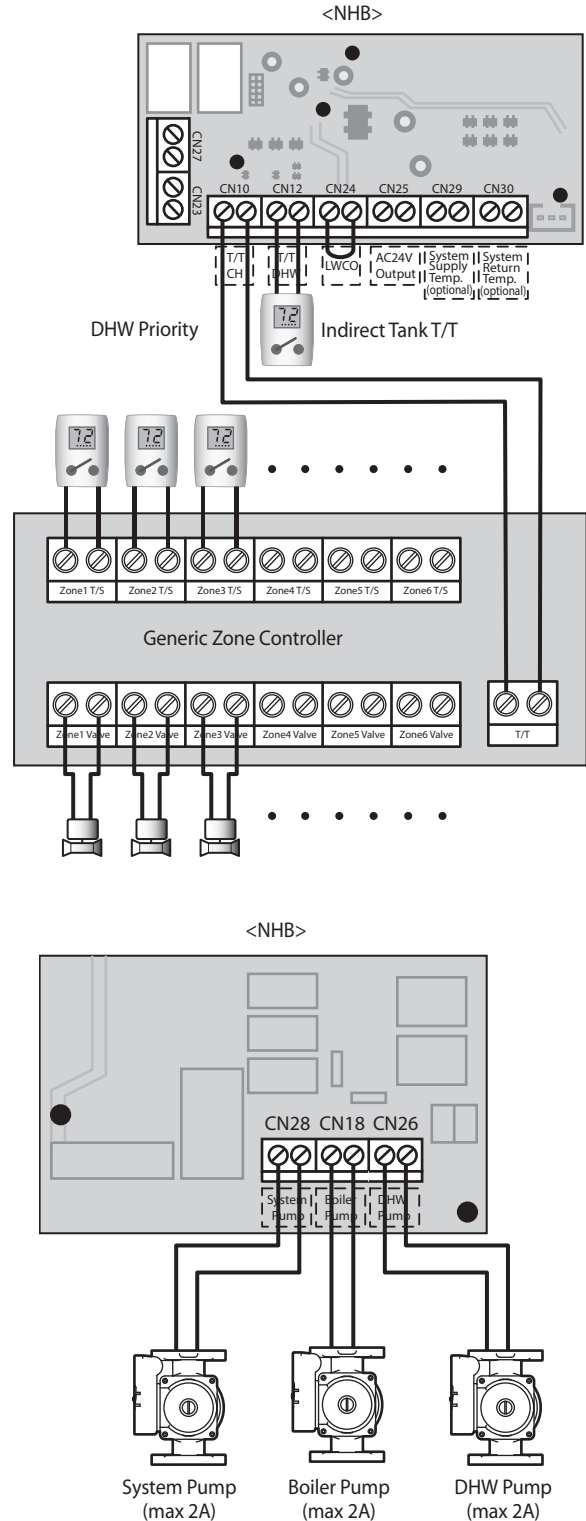
3.6.6 Wiring Diagram - Air Handler



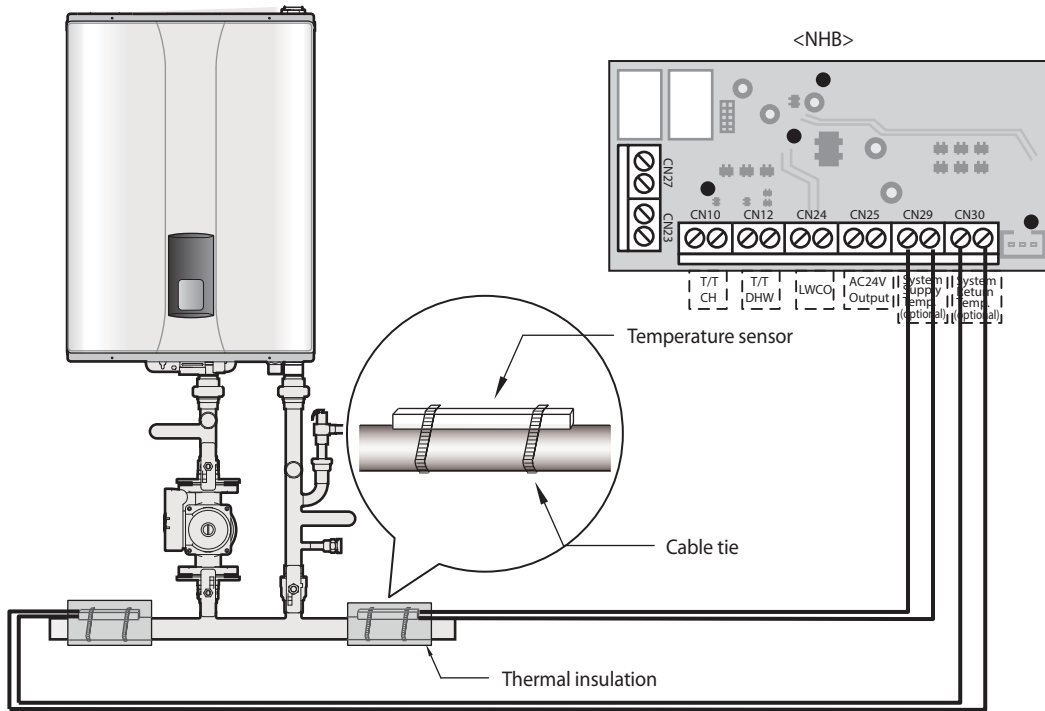
If you are using the navien manifold system, connect the pump wires to the system pump. If you are not using the navien manifold system, connect the pump wires to either the system pump or the boiler pump.



3.6.7 Wiring Diagram - DHW System with Indirect Tank



3.6.8 Wiring Diagram - Optional Supply/Return Temperature Sensors



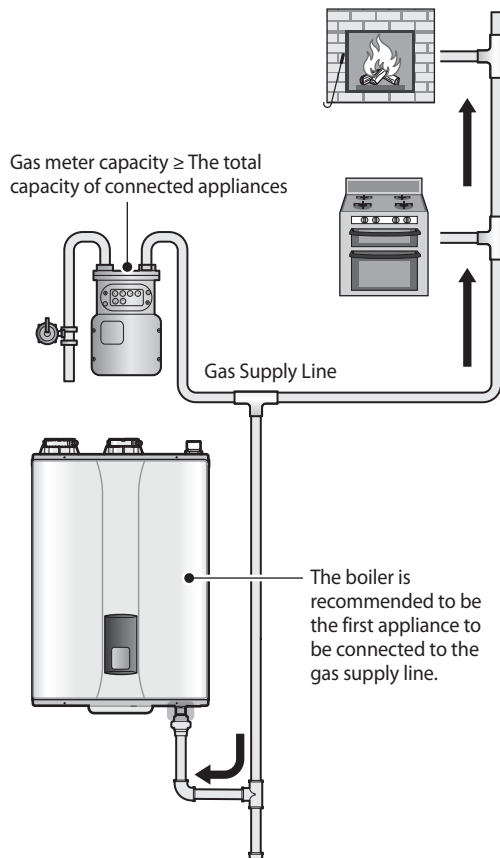
Note Refer to "6.1 PCB DIP Switches" on page 48 to control the boiler supply or return water temperature using the external temperature sensors, and set the DIP switches accordingly.

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.



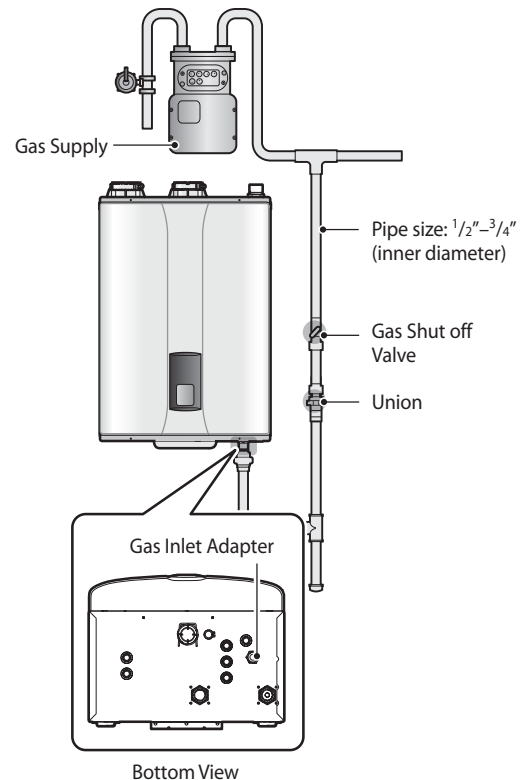
To connect the gas supply:

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 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.
- $\frac{1}{2}$ in rigid pipe can be used; refer to the sizing tables on the preceding pages for limitations. Avoid using $\frac{1}{2}$ in corrugated connectors or tubing as noise may occur.



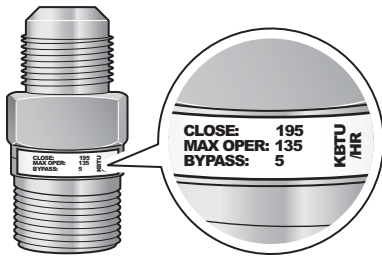
Corrugated Connector

- 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

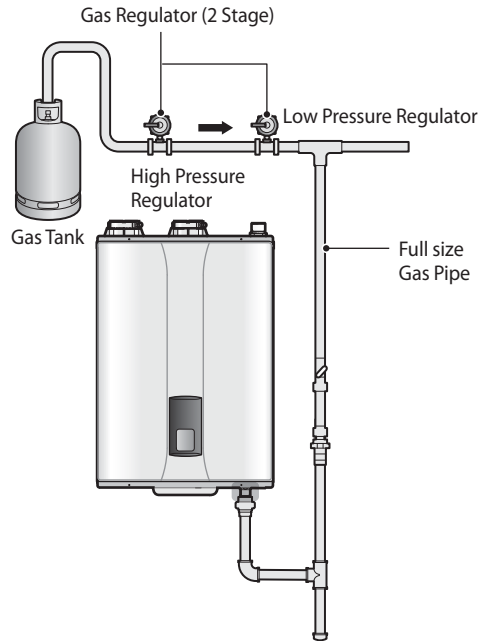
Prior to using an excess flow valve (EFV) in the gas line, check the manufacturer's minimum and maximum flow capacity rating. An improperly sized EFV will not allow for a full flow of gas to the boiler and may cause improper operation.



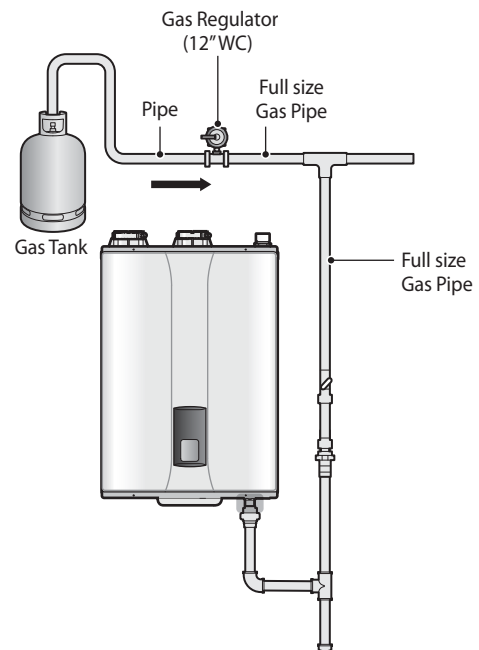
Excess Flow Valve

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)
1/2 in	454	312	250	214	190	172	158	147	138	131	116
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)
1/2 in	291	200	160	137	122	110	101	94	89	84	74	67	62
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



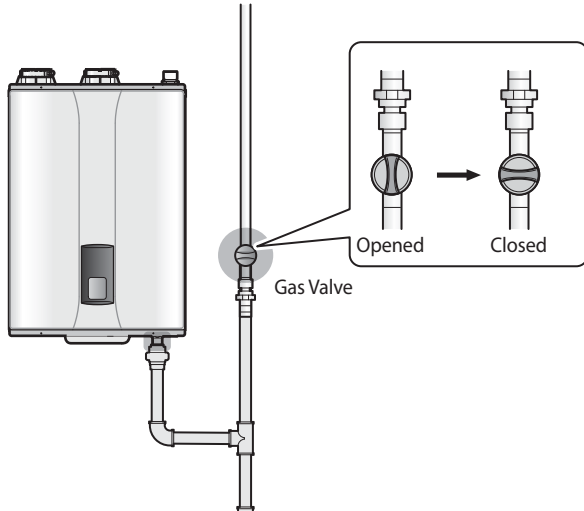
WARNING

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

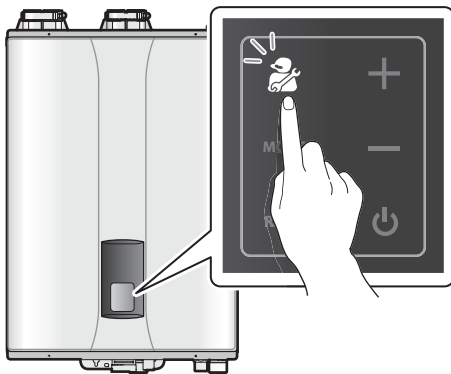
- The inlet gas pressure must be maintained between 3.5 in and 10.5 in WC for natural gas and between 8.0 in and 13.5 in WC for liquefied propane.
- The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test 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.

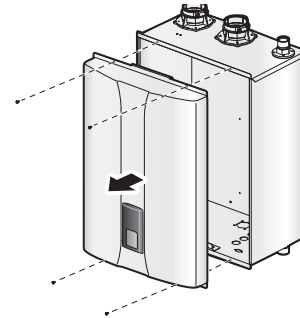


2. Turn on the boiler. On the Front Panel, press and hold the Diagnostics Button for over 5 seconds until "1.PAR" is displayed.

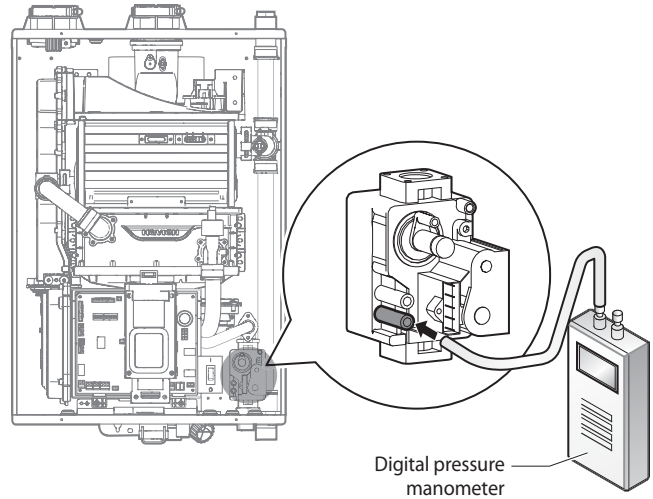


3. Press the + (Up) button two times to change the display to "3.OPR".
4. Press the Mode button once to access the Operation Mode menu.
5. Press the + (Up) button until "MAX2" is displayed.
6. Press the Reset button twice to return to normal operation mode.
7. Run space heating. The gas in the gas supply line will be purged.
8. Leave the boiler on until the boiler shuts down due to a lack of gas supply, and then turn off the boiler.

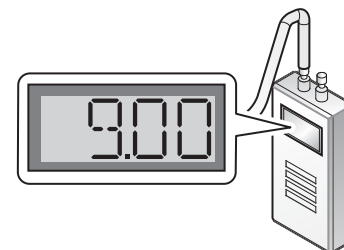
9. Remove the front cover by loosening the 4 Phillips head screws securing it to the case.



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



11. Re-open the manual gas valve and check for leaks.
12. Activate multiple zones to ramp the boiler up to its maximum firing rate.
13. 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 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:

- Do not install the boiler in areas with contaminated air (containing a high level of dust, sawdust, sand, flour, aerosols, or any other such airborne contaminants), as contaminants can cause operational problems. The warranty does not cover damage caused by contaminants in the installation area. If you must install the boiler in an area with contaminated air, use direct venting to supply air from outside the building. We recommend regular filter cleaning and maintenance in these areas.
- 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 or vent stack.
- For horizontal runs, slope the horizontal section upward toward the vent termination at a rate of $\frac{1}{4}$ 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.
- 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.
- Provide a minimum of 1 foot clearance from the bottom of the exhaust above the expected snow accumulation level. Snow removal may be necessary to maintain clearance.
- 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.

5.1 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.

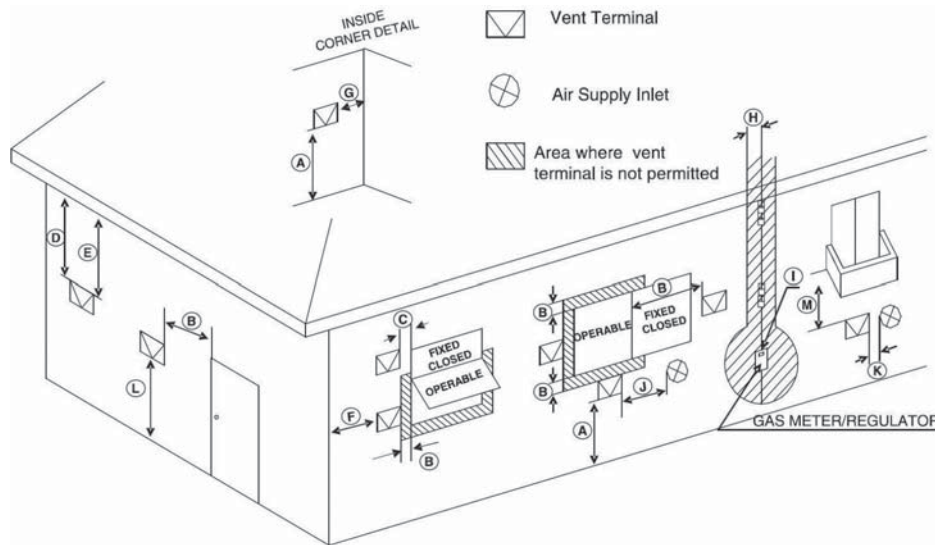
Navien also recommends installing a new vent system with this appliance. If reusing an existing vent system, thoroughly inspect it for punctures, cracks, or blockages prior to connecting it to the boiler.

Direct Venting

The boiler uses a 2 in or 3 in diameter exhaust and a 2 in or 3 in diameter air intake ducts. To ensure the draw of air directly from and exhaust of air 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 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	*
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)

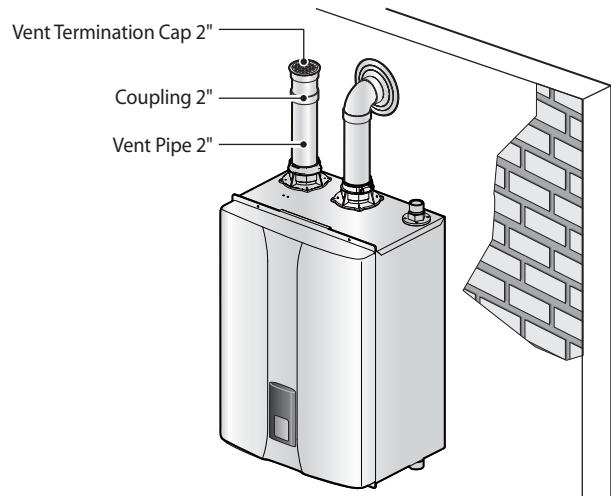
If, at any time, the installation location could experience negative pressure, there is a possibility of back drafting cold air through the boiler's heat exchanger. This situation could lead to the freezing of the heat exchanger and malfunction of the boiler.

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 44 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.**

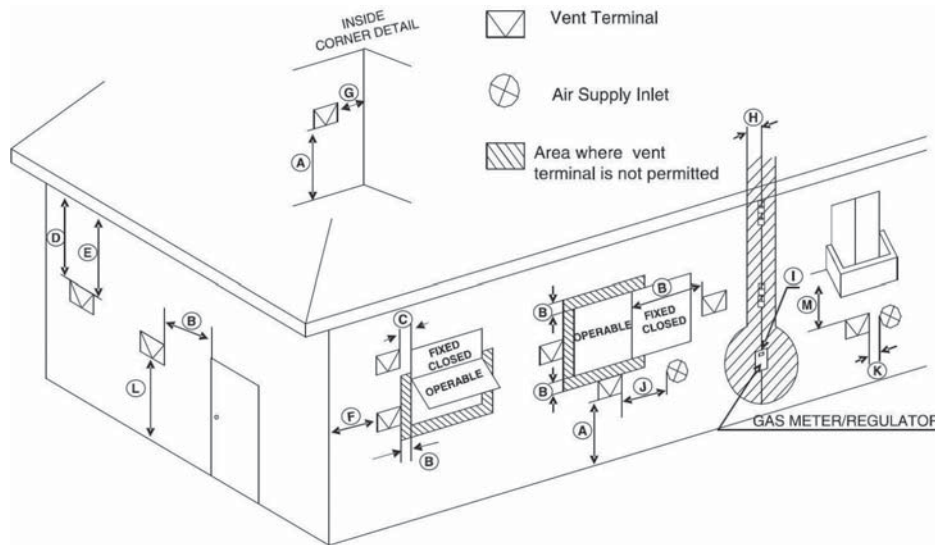
To use non-direct venting for the boiler:

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. Provide two openings to allow for circulation of combustion air as specified by ANSI Z223.1/NFPA 54 or CAN/CGA B-149.1:

	NHB-055	NHB-080	NHB-110	NHB-150
Maximum Input (BTU/H)	55,000	80,000	110,000	150,000
Outdoor make up air is provided, a minimum free area of 1 in ² , per 4,000 BTU/H	14 in ² 6 in (W) x 3 in (H) or 5 in round	20 in ² 7 in (W) x 3 in (H) or 5 in round	28 in ² 10 in (W) x 3 in (H) or 6 in round	40 in ² 10 in (W) x 4 in (H) or 7 in round
Indoor make up air is provided, a minimum free area of 1 in ² per 1,000 BTU/H	55 in ² 7 1/2 in (W) x 7 1/2 in (H)	80 in ² 9 in (W) x 9 in (H)	110 in ² 10 1/2 in (W) x 10 1/2 in (H)	150 in ² 12 1/4 in (W) x 12 1/4 in (H)



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.

5.2 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 Schedule 40 (Solid Core) CPVC Schedule 40 or 80 (Solid Core) Approved polypropylene**
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)**

* 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.

** Approved Polypropylene Systems include:

DuraVent Polypro (Single Wall) : 2PPS-xxx (2"), 3PPS-xxx (3")

Centrotherm InnoFlue SW: ISxx02xx (2"), ISxx03xx (3")

Refer to manufacturer's literature for detailed installation instructions.

For 3" venting, use the following polypropylene parts:

DuraVent: 2PPS-X3L (2"-3" Increaser)

Centrotherm: ISEI0203 or ISIA0203 (2"-3" Increaser)



CAUTION

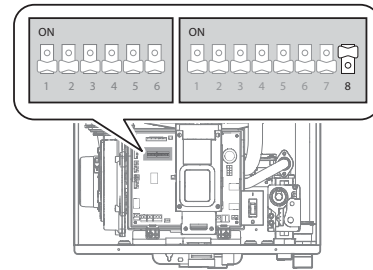
- This boiler has a built-in control to limit the exhaust temperature to 149°F (65°C). As a result, the boiler can be vented with Schedule 40 PVC.
- In high temperature applications, the exhaust temperature can exceed 149°F (65°C). In that case, you must use Schedule 40 or 80 CPVC or Approved Polypropylene in the USA or Type BH Special Gas Vent Class IIB (CPVC) or Class IC (Polypropylene) that conforms to ULC-S636 in Canada.
- In systems with 2 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 3 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.

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 does not operate without an exhaust thermostat installed.
- When you set PCB DIP switch 2 #8 to On, ensure that CPVC piping is used for exhaust venting.



5.3 Measuring Vent Length

The maximum vent length when using 2 in exhaust ducts is 60 ft (18 m). The maximum vent length when using 3 in vent ducts is 150 ft (45 m). The intake duct length may be identical to the exhaust duct length. Maximum vent lengths reduces according to the number of elbows used, as shown in the following table:

Vent Size	Maximum Length	Maximum # of Elbows	Equivalent Length
2 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 8 linear feet of vent Each 45° elbow equates to 4 linear feet of vent
3 in	150 ft (45 m)	8	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

Note

- The Maximum Length does not include any elbows.
- If using a concentric termination as shown on page 47, count this as 5 linear feet (1.5 m) of vent.

5.4 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 PP components can be used as terminations:

Duravent

- 2PPS-E90L (2" 90° Elbow)
- 3PPS-E90L (3" 90° Elbow)
- 2PPS-E45L (2" 45° Elbow)
- 3PPS-E45L (3" 45° Elbow)
- 2PPS-TL (2" Tee)
- 3PPS-TL (3" Tee)
- 2PPS-BG (2" Birdscreen)
- 3PPS-BG (3" Birdscreen)

Centrotherm

- ISELL0287 (2" 87° Elbow)
- ISELL0387 or ISEL0387 (3" 87° Elbow)
- ISELL0245 (2" 45° Elbow)
- ISELL0345 or ISEL0345 (3" 45° Elbow)
- IST02 (2" Tee)
- IST03 (3" Tee)
- IASPP02 (2" Birdscreen)
- IASPP03 (3" Birdscreen)

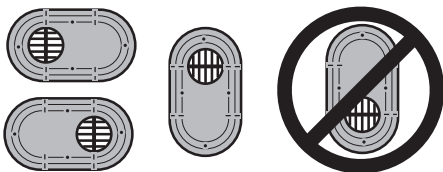
Along with 2 in and 3 in PVC concentric terminations shown on page 46, the following terminations can also be used:

- IPEX Low Profile Termination Kits
 - 2 in Low Profile Vent Kit #196984
 - 3 in Low Profile Vent Kit #193985
- Duravent PolyPro Horizontal Concentric Termination Kit
 - 2 in x 4 in Concentric Vent Kit #2PPS-HKL
 - 3 in x 5 in Concentric Vent Kit #3PPS-HKL

Refer to the vent manufacturer's instructions for detailed installation procedures.

⚠ CAUTION

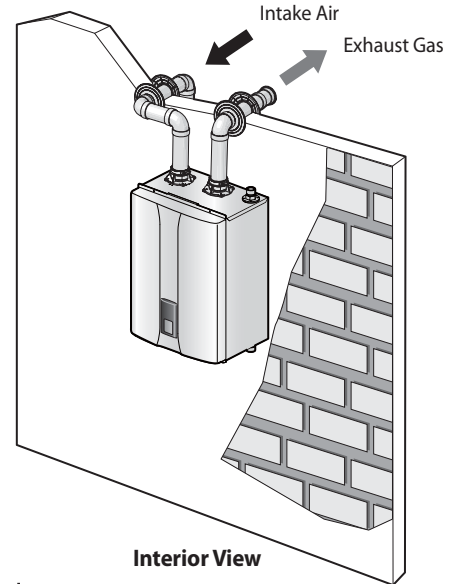
- **Minimum Clearance to Metering devices and Relief equipment.** Maintain a minimum horizontal clearance of 4 ft (1.22 m) from electric meters, gas meters, regulators, and relief equipment. Do not install the boiler above or below electric meters, gas meters, regulators, or relief equipment unless a 4 ft (1.22 m) horizontal clearance is maintained.
- Refer to the figure below for the orientation of vent termination if the IPEX low profile vent kit is used for termination.



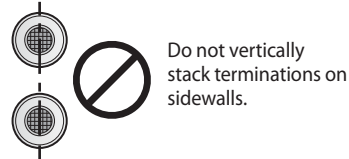
Indoor Boiler Installation Venting Examples

The following are some possible indoor venting options:

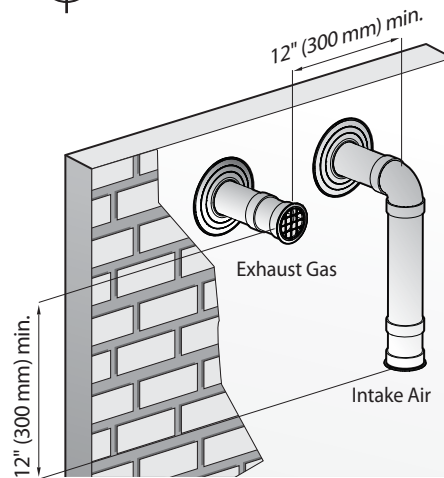
- 2 in or 3 in Two-pipe Sidewall Venting



Interior View

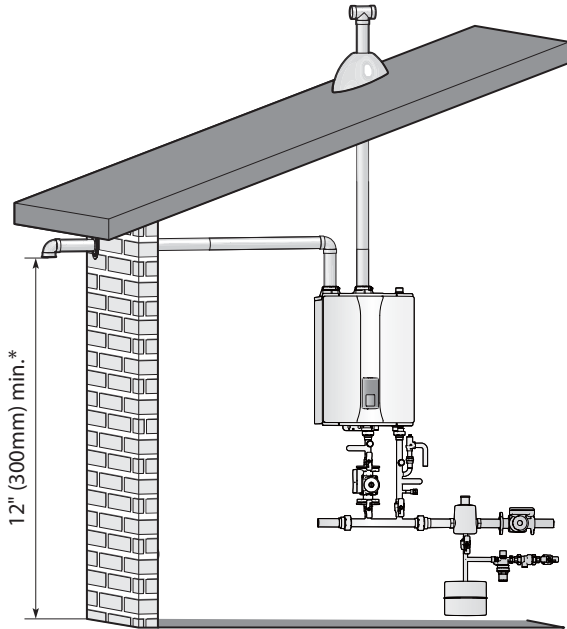


Do not vertically stack terminations on sidewalls.



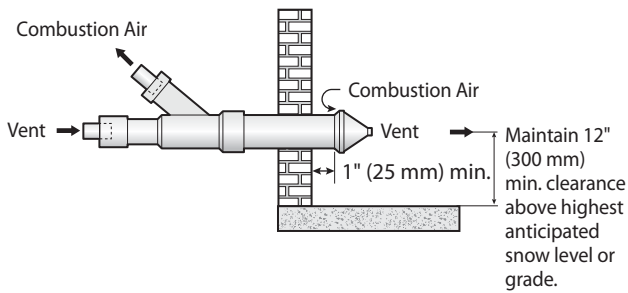
Exterior View

- Non-concentric Sidewall Venting – Air is drawn from a different location that is at least 12 in (300 mm) away from the exhaust termination. Try to minimize the length of the intake air pipe with this venting.

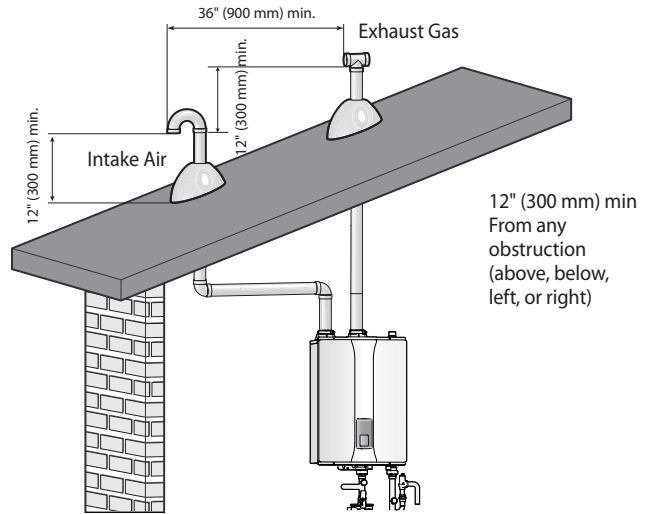


* 12" (300mm) above the highest anticipated snow level, or as required by local codes, whichever is greater.

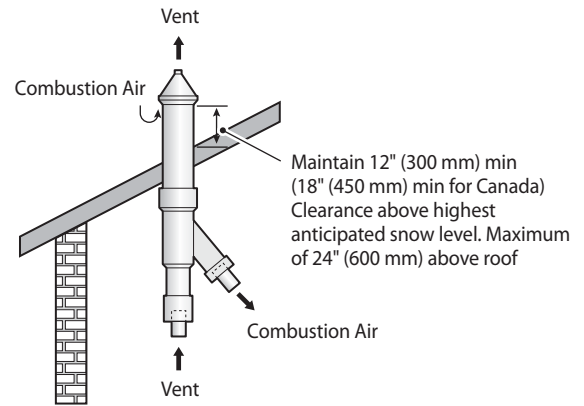
- Concentric Sidewall Venting



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



- Concentric Roof Venting



6. Setting the DIP Switches

CAUTION

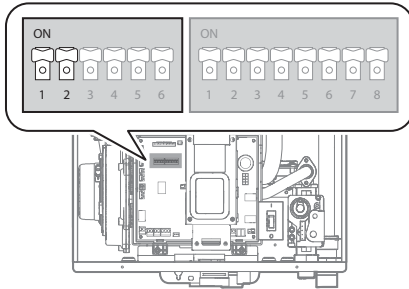
Do not remove the front cover unless the power to the boiler is turned off or disconnected. Failure to do so may result in electric shock.

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

6.1 PCB DIP Switches

DIP Switch 1 (6 switch unit)

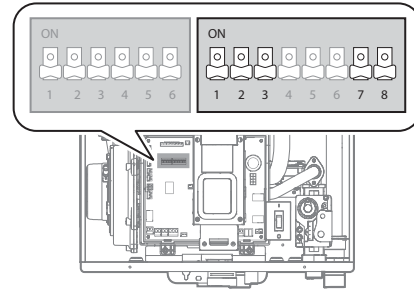
The DIP SW 1 on the circuit board configures the operation status and model/capacity settings.



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

Dip Switch 2 (8 switch unit)

The DIP SW 2 on the circuit board configures the temperature control modes, country, and enables or disables the space heating thermostat.



Switch	Function	Setting	
1 & 2	Space Heating Temperature Control	Supply Temperature	1-OFF, 2-OFF
		Return Temperature	1-ON, 2-OFF
		System Supply Temperature (with optional sensor)	1-OFF, 2-ON
		System Return Temperature (with optional sensor)	1-ON, 2-ON
3	DHW Tank Temperature Control	DHW Supply Temperature	3-OFF
		DHW System Supply Temperature (with optional sensor)	3-ON
7	Space Heating Thermostat	Used	7-OFF
		Unused	7-ON
8	Exhaust Temperature Control	Used	8-OFF
		Unused	8-ON

Note

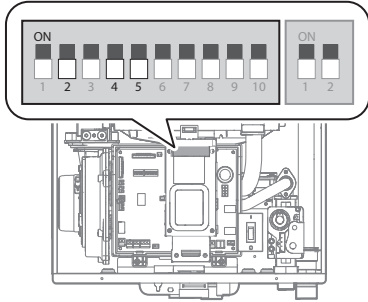
When PCB DIP switch 2 #8 is set to On, ensure that CPVC piping is used for exhaust venting.

6.2 Front Panel Dip Switches

Dip Switch 1 (10 switch unit)

The DIP SW 1 on the front panel configures the temperature unit and high altitude settings.

Before changing the settings, lift the rubber cover to access the front panel DIP switches.

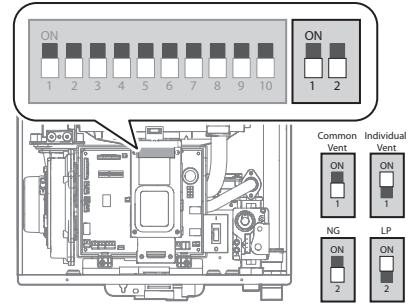


Switch	Function	Setting				
2	Temperature Unit	<table border="1"> <tr> <td>°C (Celsius)</td> <td>2-ON</td> </tr> <tr> <td>°F (Fahrenheit)</td> <td>2-OFF</td> </tr> </table>	°C (Celsius)	2-ON	°F (Fahrenheit)	2-OFF
°C (Celsius)	2-ON					
°F (Fahrenheit)	2-OFF					

Dip Switch 2 (2 switch unit)

The DIP SW 2 on the front panel configures settings for the type of gas.

Before changing the settings, lift the rubber cover to access the front panel DIP switches.



Switch	Function	Setting	
1	Cascade Vent Settings	Common Vent	1-OFF
		Individual Vent	1-ON
2	Gas Type	Natural Gas	2-OFF
		Propane Gas	2-ON

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 plumbing and gas piping is complete and the boiler has been filled with water.
- Do not connect the boiler to a 220-240V AC power supply. Doing so will damage the boiler and void the warranty.
- All the Navien NHB boilers are supplied with a factory-installed, 3-pronged (grounded) plug. The boiler's current rating is 5 A and can be plugged into any grounded electrical outlet adjacent to the boiler. A dedicated power supply is not required.
- If local codes require the boiler to be wired directly, remove and discard the factory-installed plug. Install a power switch between the breaker and the boiler to facilitate end-user maintenance and servicing. Connect the boiler to a 110-120V AC at 60 Hz with a maximum of 10A.
- The boiler must be electrically grounded. If using the power plug, ensure that the electrical outlet you connect the boiler to is properly grounded. If wiring the boiler directly to a power supply, do not attach the ground wire to gas or water pipes as plastic pipe or dielectric unions may prevent proper grounding.

- 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

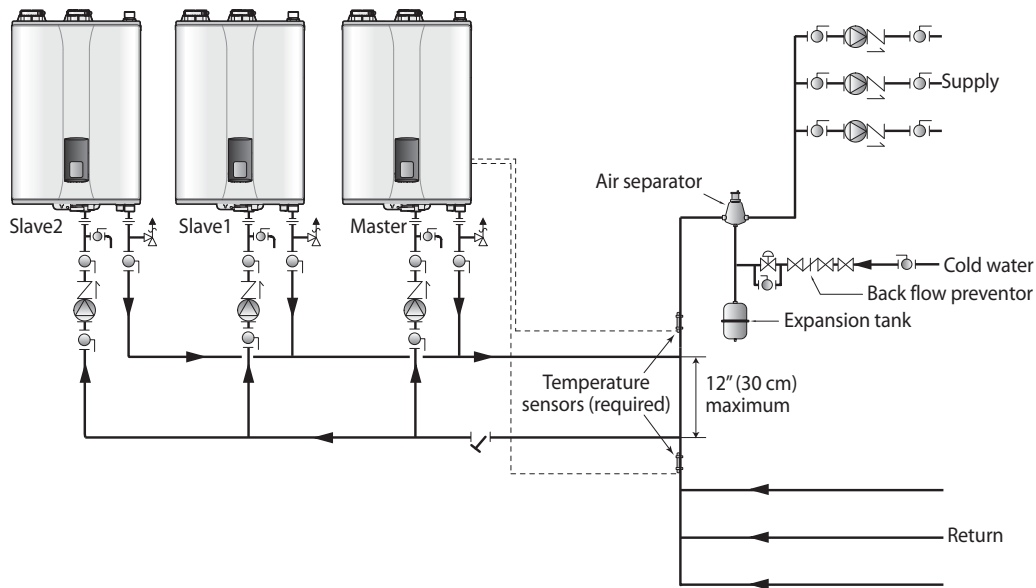
When installing a cascade system, carefully consider the design of the system and the features of the installation location. Follow all local codes and regulations, as well as all guidelines for installing the boiler. The following sections describe additional considerations that are specific to installing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

8.1 Connecting Water Supplies

Several options are available for plumbing 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 16 boilers to meet high-volume heating demands. Some possible connection options include the following:

- Example of a Basic Cascade System Application

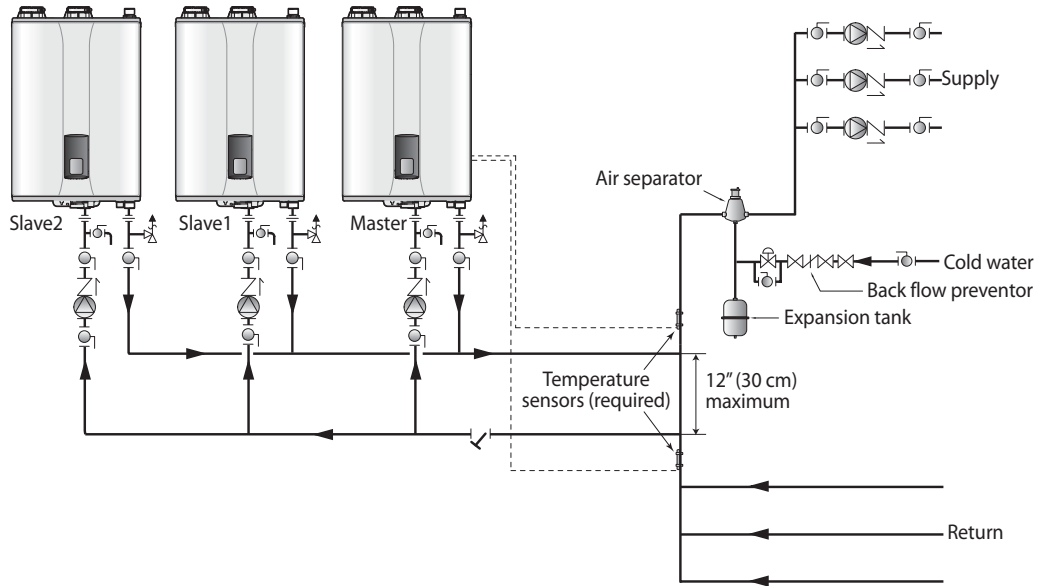


[NHB-110/ 150]

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 24 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 system supply/return temperature sensors (#GXXX001417) must be installed for cascade system operation.
- Adjust the settings at the master unit as the cascade system uses only the master unit settings. Changes made to the slave units are ignored.
- Refer to "Setting the Cascade Staging Adjustments" on page 84 to make adjustments to the boiler staging settings. By default, boilers will be added to the system when the input capacity exceeds 70%, and removed when the input capacity falls below 30%.

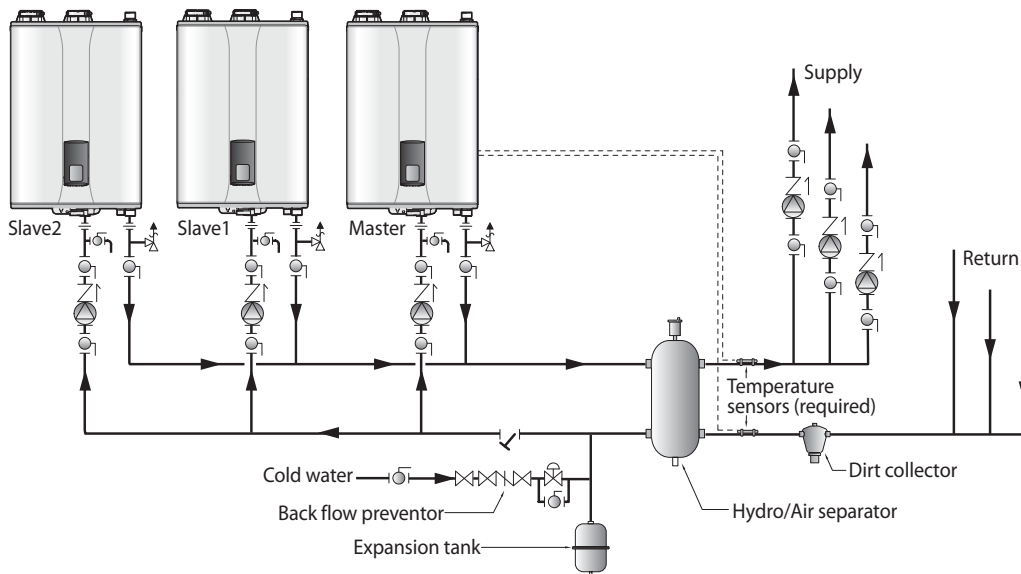
• System Application #1- Cascade System with Closely Spaced Tees



Note

- Connect the “CH Demand (CHT/T or Zone controller)” to the master unit.
- Connect the supply/return sensors to CN29 (supply) and CN30 (return) terminals on the master unit PCB.
- Connect the outdoor sensor (optional) to the master unit.
- Install system pumps to the units (master and slave) as required by the system configuration.

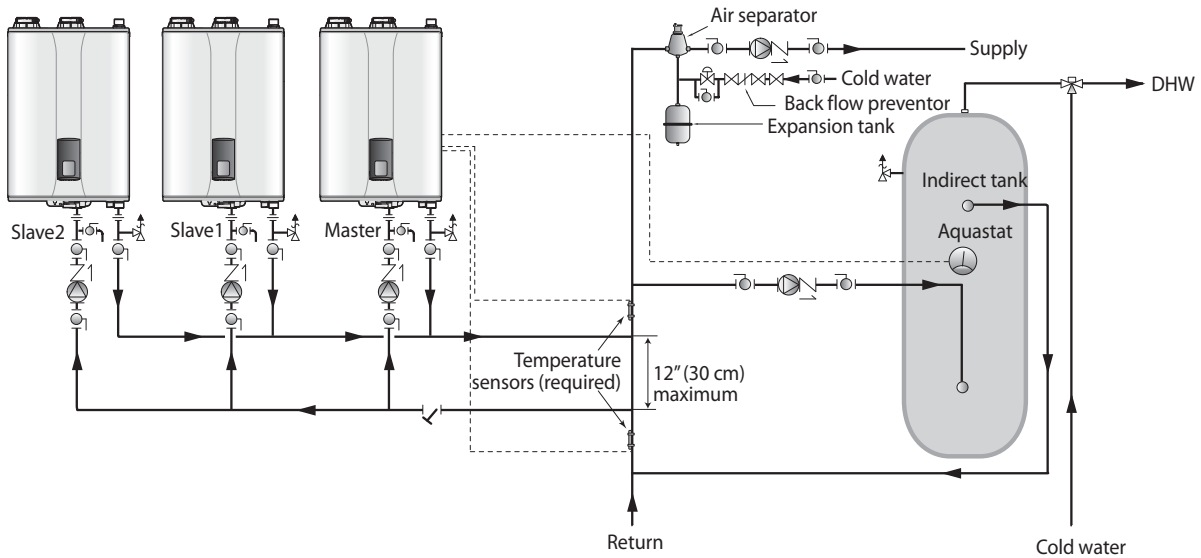
• System Application #2- Cascade System with Hydro Separator



Note

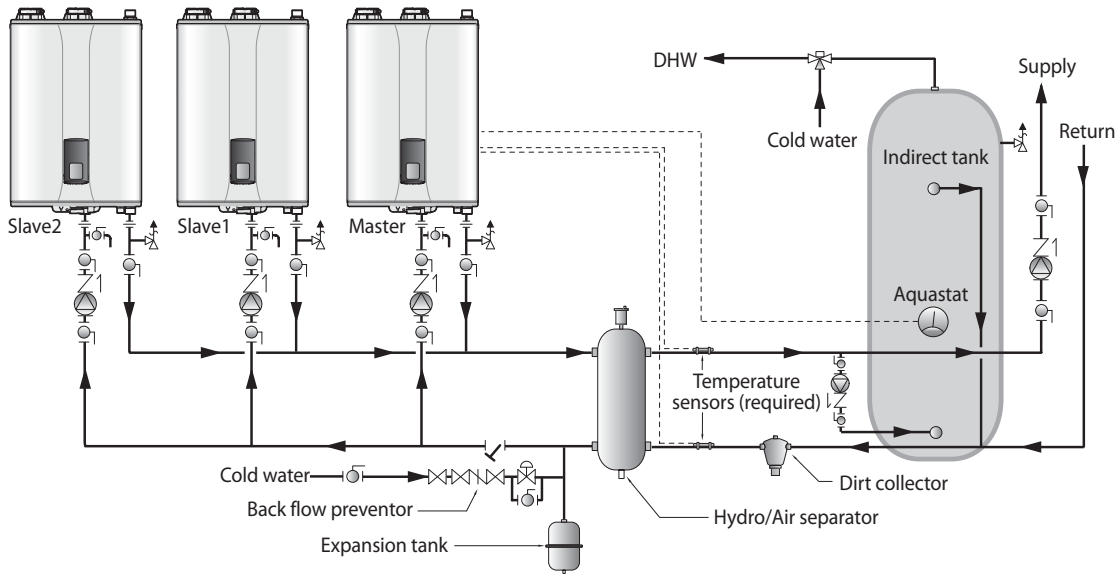
- Connect the “CH Demand (CHT/T or Zone controller)” to the master unit.
- Connect the supply/return sensors to CN29 (supply) and CN30 (return) terminals on the master unit PCB.
- Connect the outdoor sensor (optional) to the master unit.
- Install system pumps to the units (master and slave) as required by the system configuration.
- Connect zone pumps to the zone controller.

• System Application #3- Cascade System with DHW Indirect Tank (for High DHW Demand)



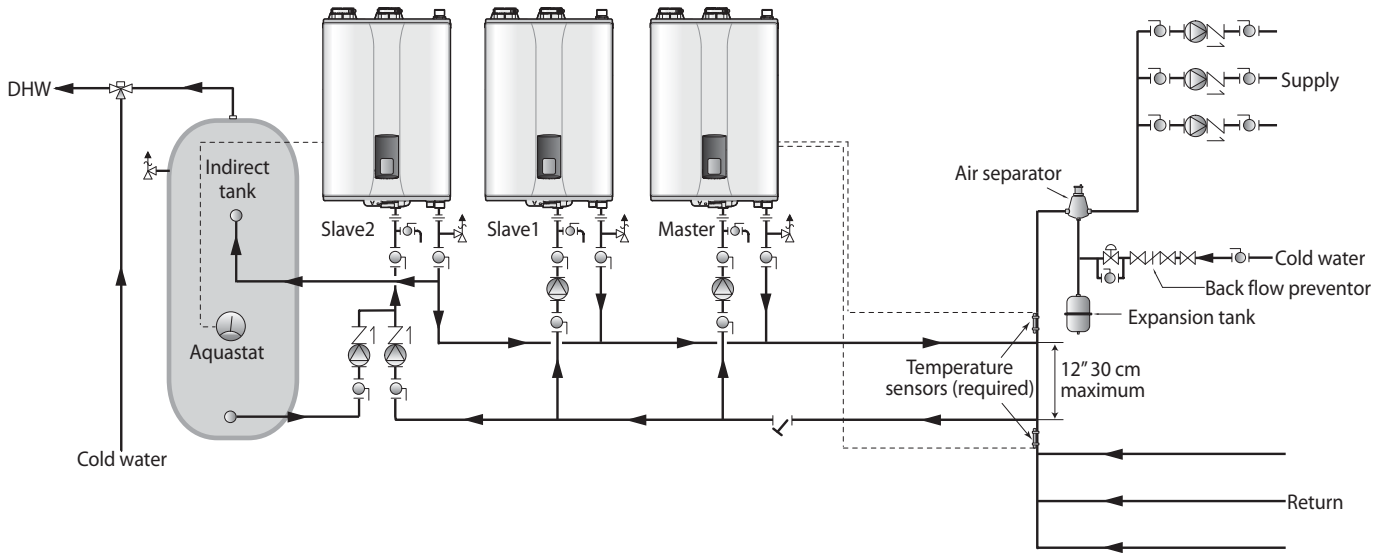
- Note**
- In this configuration, the full capacity of all boilers will be prioritized to the DHW demand.
 - The aquastat on the DHW indirect tank must be connected to the master unit.
 - Connect the DHW pump to the master unit.

• System Application #4- Cascade System with DHW Indirect Tank (for High DHW Demand)



- Note**
- In this configuration, the full capacity of all boilers will be prioritized to the DHW demand.
 - The aquastat on the DHW indirect tank must be connected to the master unit.
 - Connect the DHW pump to the master unit.

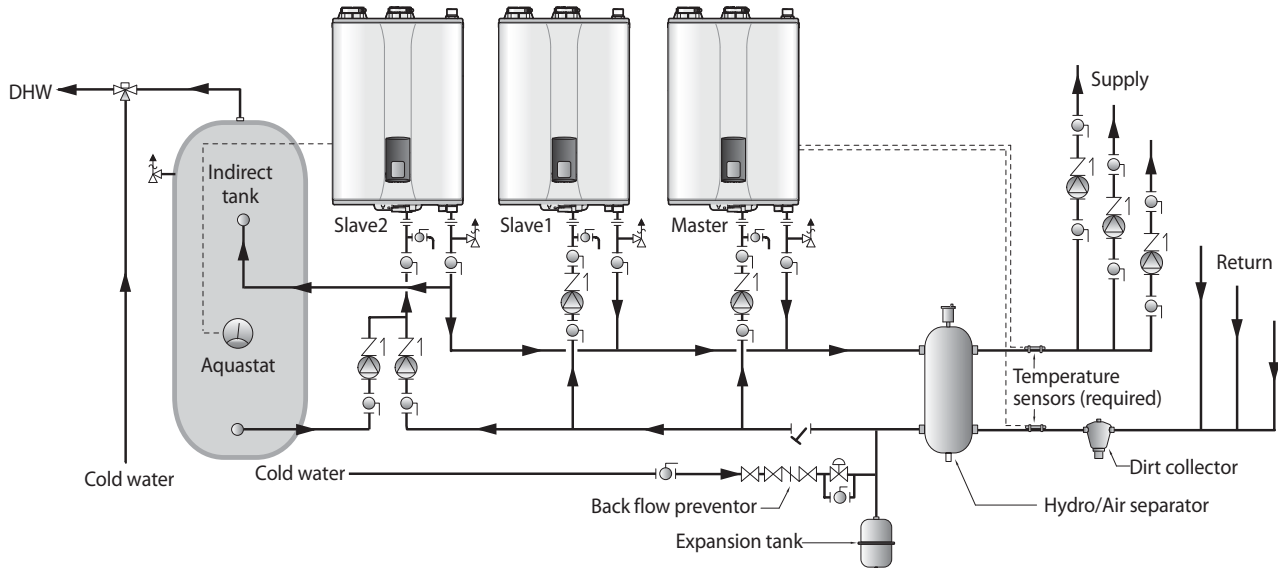
• System Application #5- Cascade System with DHW Indirect Tank (for Low DHW Demand)



Note

- In this configuration, space heating and DHW can operate simultaneously.
- The aquastat on the DHW indirect tank must be connected to a slave unit.
- If a dedicated slave 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 slave unit.

• System Application 6 - Cascade System with DHW Indirect Tank (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 slave unit.
- If a dedicated slave 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 slave unit.

8.1.1 Piping Sizes and Considerations

When plumbing 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.

NHB-110

Qty	Flow Rate (GPM) @ 20°F ΔT	Recommended Boiler Pipe Sizes (2-4 ft/s)
2	20.4	1- 1/2"
3	30.6	2"
4	40.8	2"
5	51	2- 1/2"
6	61.2	2- 1/2"
7	71.4	3"
8	81.6	3"
9	91.8	3- 1/2"
10	102	3- 1/2"
11	112.2	3- 1/2"
12	122.4	3- 1/2"
13	132.6	4"
14	142.8	4"
15	153	4"
16	163.2	4"

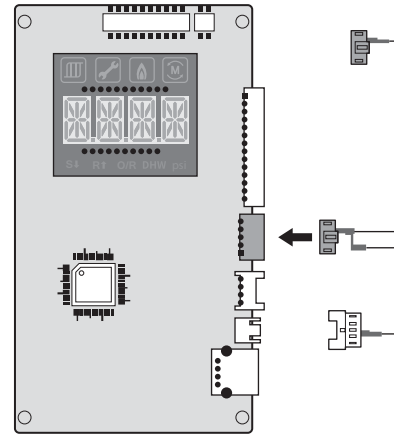
NHB-150

Qty	Flow Rate (GPM) @ 20°F ΔT	Recommended Boiler Pipe Sizes (2-4 ft/s)
2	27.6	2"
3	41.4	2"
4	55.2	2- 1/2"
5	69	3"
6	82.8	3"
7	96.6	3- 1/2"
8	110.4	3- 1/2"
9	124.2	3- 1/2"
10	138	4"
11	151.8	4"
12	165.6	4"
13	179.4	5"
14	193.2	5"
15	207	5"
16	220.8	5"

8.2 Connecting the Communication Cables

Up to 16 boilers can be connected with Navien Ready-Link communication cables. Select one of the boilers in the cascade system as the master boiler, and then connect the other boilers to it as slaves. Before making any connections, ensure that the power is turned off to all boilers.

Connect the Ready-Link cables to the J6 ports on the right side of the front panel:

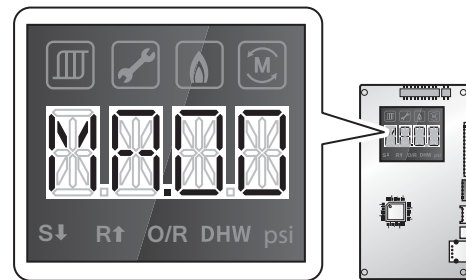


8.2.1 Configuring the Communication Settings

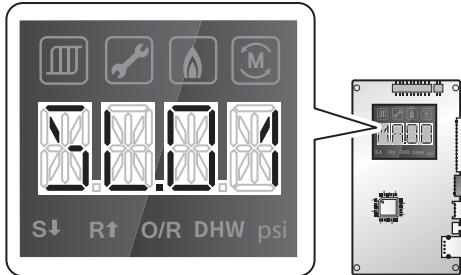
After connecting the Ready-Link communication cables, restore power to the boiler and turn on all boilers using the Power button.

To configure the communication settings:

1. On the master boiler, press and hold the **Diagnostic** and **Up(+)** buttons for more than 5 seconds. "MA.00" will appear on the display to confirm that this boiler is set as the master.



2. On the slave boiler, press and hold the **Diagnostic** and **Down(-)** buttons for more than 2 seconds. "SL.01" will appear on the display to confirm that this boiler is set as a slave.



3. Repeat step 2 to configure the rest of the slave boilers in the system.
4. On the master boiler, press and hold the **Diagnostic** and **Up(+)** buttons for more than 5 seconds. All the display screens on the configured boilers will return to the temperature display.

Note

- To add additional slaves at a later time, repeat step 2.
- To cancel the cascade communication setup, on the master boiler, press and hold the **Diagnostic** and **Reset** buttons for more than 5 seconds. The boilers will revert to independent operation. Repeat steps 1-4 to reassign the master boiler.

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 8 Navien NHB 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 NHB 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.
 - backflow vent dampers must be installed in the exhaust duct of each boiler unit.
 - **use direct vent systems** (with separate intake and exhaust lines).
- This manual covers the installation of a common vent system for **NHB boilers only**.

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

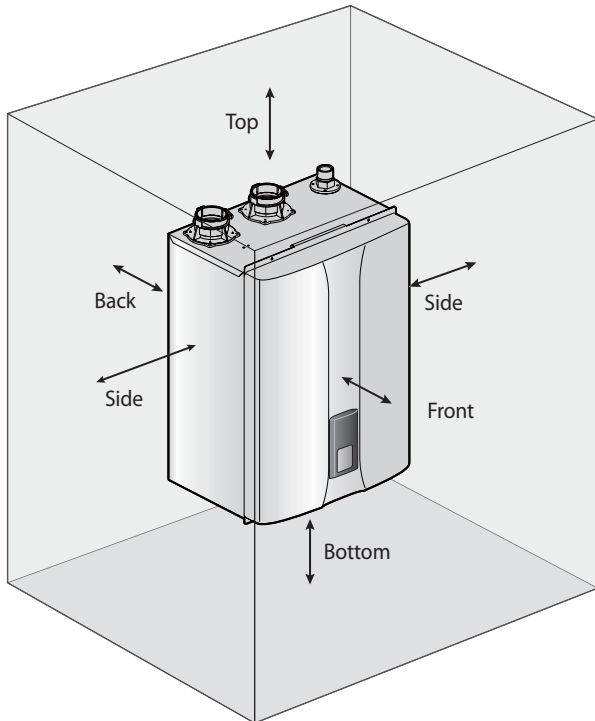
- Check to see if all contents are included in the package (refer to the “Included Items” on page 62).
- A maximum of 8 NHB boilers may be connected to one common vent system. In a cascade system that has more than 8 boilers, use 2 common vent systems, or consult Navien.
- Use only the PVC cements specified in this manual 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 only for direct 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. Provide a minimum of 1 foot (30 cm) clearance from the bottom of the exhaust of the expected snow accumulation level. Snow removal may be necessary to maintain clearance.
- 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.
- 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	9 in (229 mm) minimum
Back	0.5 in (13 mm) minimum
Front	4 in (100 mm) minimum
Sides	3 in (76 mm) minimum
Bottom	12 in (300 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)

Vent Pipe Pitch and Supports

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

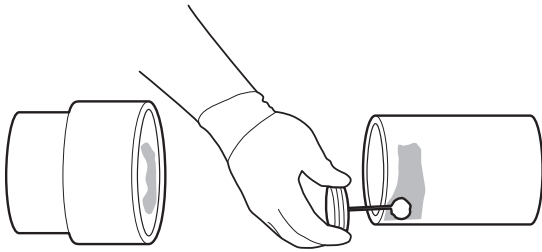
Connecting Pipes with Cement

CAUTION

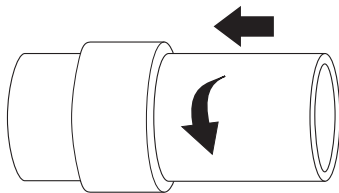
The vapors from primers and solvent cements can make you dizzy and are dangerous to your health. Ensure that the work area is well ventilated, or wear an approved organic vapour respirator when working with primers and solvent cements.

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.
- Use solvent type cement only.
- 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 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.

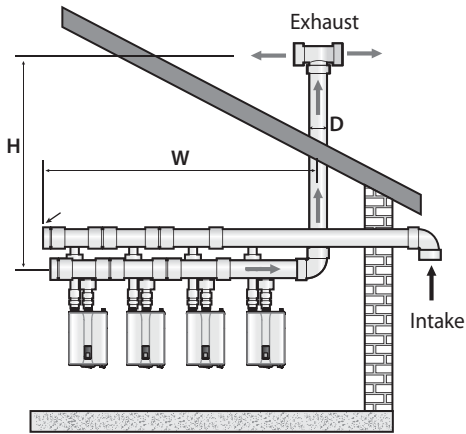
DANGER

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

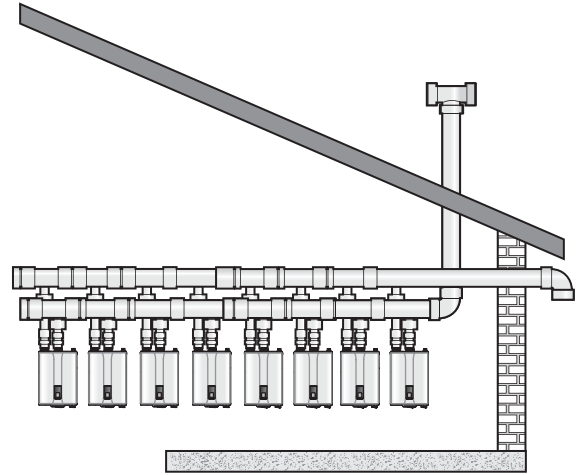
Follow the instructions listed below to determine the length of a common vent.

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.



Example of a Typical Installation (Direct Vent Only)

The following illustration depicts an example of a common vent system installed for a cascade system of 8 Navien NHB boiler units.



Note

The illustration is intended for reference purposes only.

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

Vent Length for NHB Boiler Units

Required Load (Total BTU/H)	Model	Total Length (ft)			
	NHB-110/150	D=3"	D=4"	D=6"	D=8"
300,000	2	60	106	200	
450,000	3	40	71	160	
600,000	4	30	53	120	
750,000	5	24	42	96	150
900,000	6		35	80	142
1,050,000	7		30	68	121
1,200,000	8		26	60	106

Note

Every 90° elbow used is equivalent to 8 linear feet (2.4 m) of vent length.

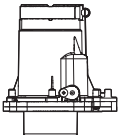

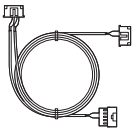
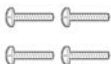
9.2 Navien Backflow Damper (Back-draft Damper)

The Navien backflow damper prevents backflow (back-draft) at the exhaust vent while the boiler unit operates.

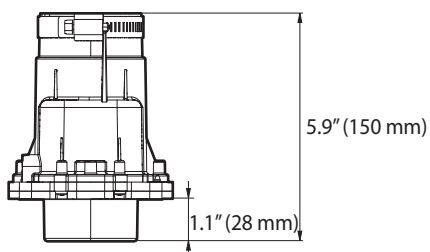
By closing the exhaust vent as soon as the combustion cycle ends, the Navien backflow damper retains heat in the system for longer periods. This improves the system's thermal efficiency.

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

Included Items

Backflow Damper	
Installation Manual	
Ready-Link communication cable	
Screw (4 ea)	

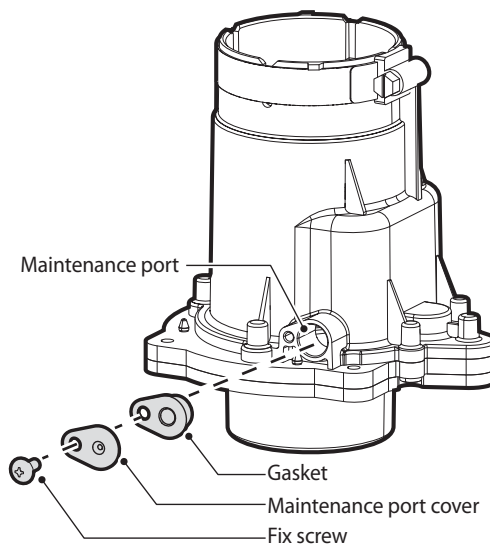
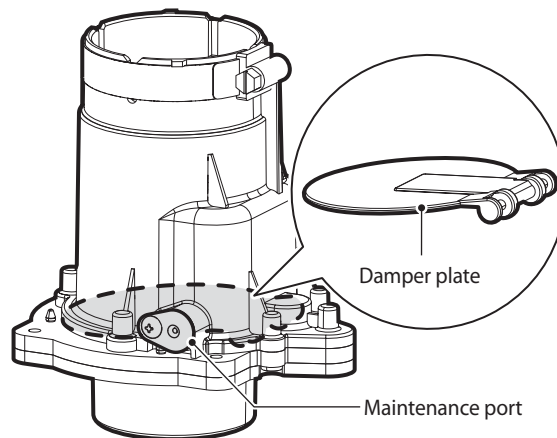
Specifications



Part Name	Backflow Damper
Part No.	30014367A
Material	PP (Polypropylene)

Maintenance Port

Navien Backflow Damper has a maintenance port to allow you to easily inspect the operating condition of the damper plate.



Refer to <9.8 Maintenance> for detailed inspection procedures. Navien Backflow Damper (Back-draft Damper)

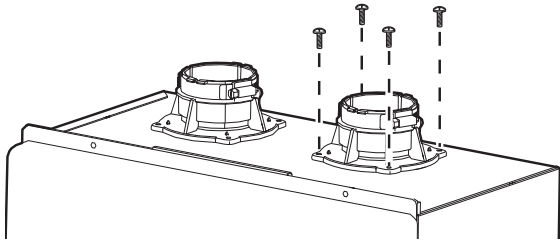
Note When using a common vent in a cascade system, backflow devices are required to prevent exhaust from entering the building.

9.3 Starting the Common Vent System

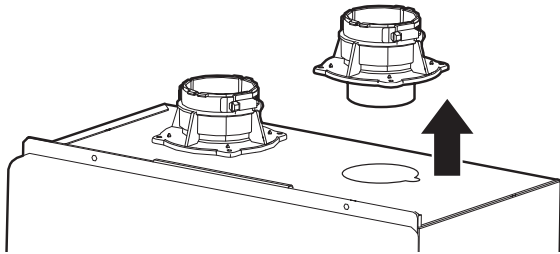
9.3.1 Backflow Damper Assembly

Follow the instructions below to assemble the backflow damper on the NHB boiler unit:

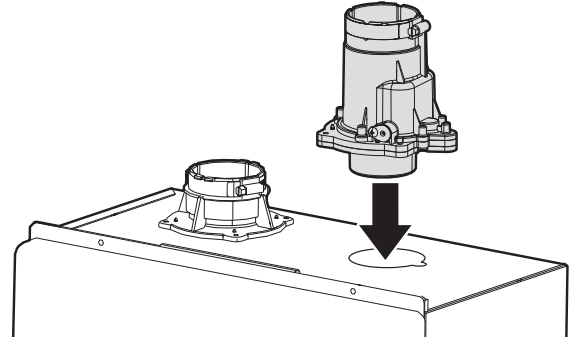
1. Remove the screws from the exhaust vent adapter.



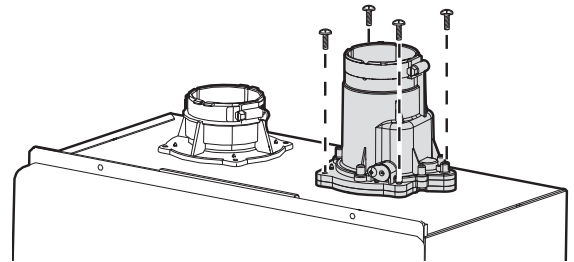
2. Detach the exhaust vent adapter.



3. Connect the backflow damper to the exhaust duct of the boiler unit.

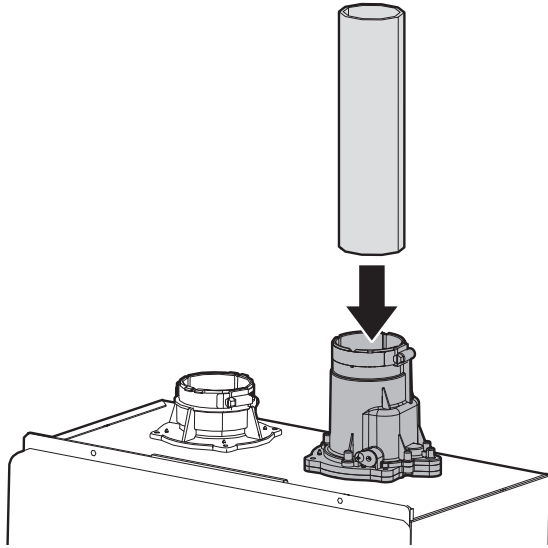


4. Tighten the four mounting screws to secure the backflow damper in place. The screws (x 4) are supplied with the backflow damper.

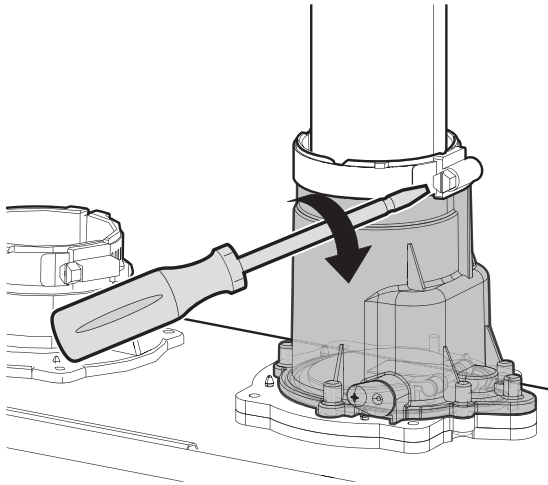


9.3.2 Connecting the Pipe to the Damper

1. Insert 2" vent pipe to the backflow damper to start the vent run.

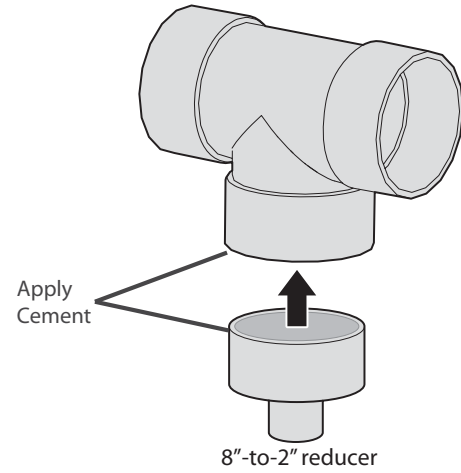


2. Completely slide the vent pipe ends into the transition fitting. Tighten the clamp with a screwdriver to properly seal the joint.



9.3.3 Assembling the T Joint

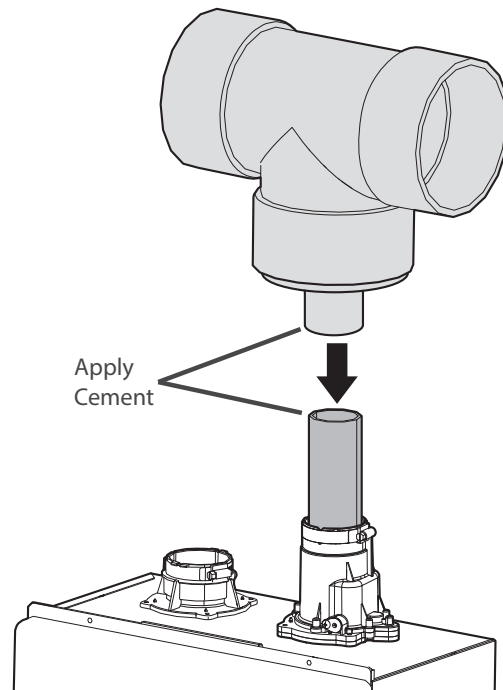
1. Connect an 8"-to-2" reducer to the 8" tee. Apply solvent cement to the mating surfaces.



Note

Multiple reducers can be used to allow proper connection of 2" vent pipe to the common vent system.

2. Assemble the tee joint assembly (8"-to-2" reducer + tee joint) to the vent pipe. Apply solvent cement to the mating surfaces.

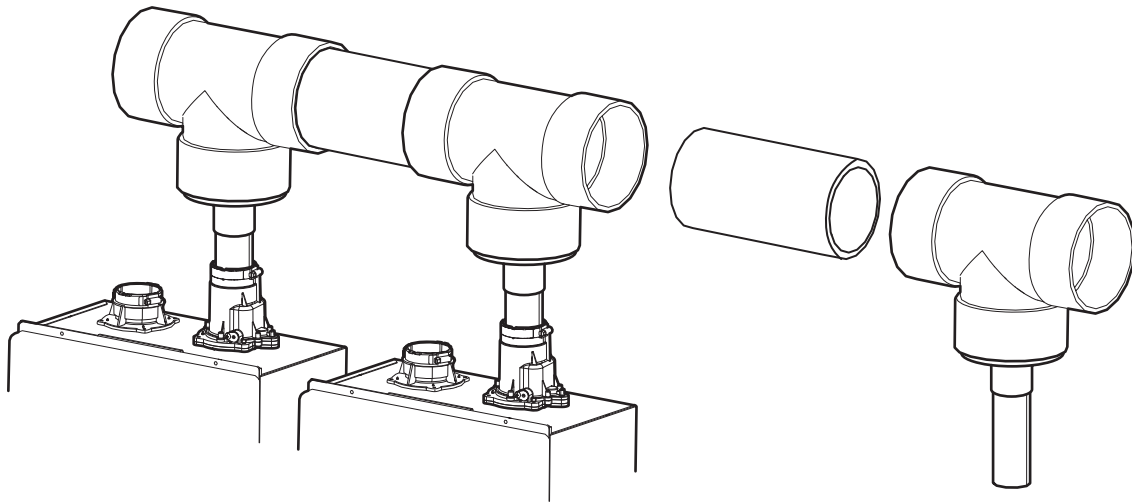


9.4 Connecting and Terminating the Vent Pipe

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.

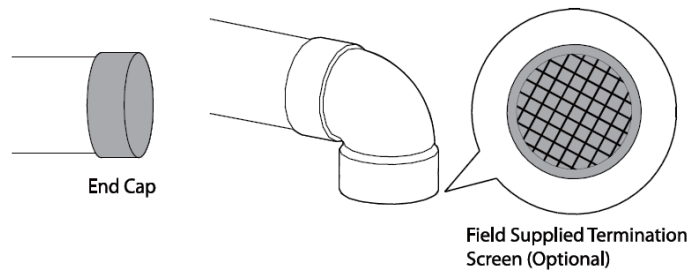
9.4.1 Connecting the Main Pipe Runs to T Joint

After connecting the tee joint to the 8"-to-2" reducer, connect the main trunk pipe to each side of the tee. Each trunk pipe is connected to the other tee joint. Refer to <"Connecting Pipes with Cement"> on page 60 for more information.



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

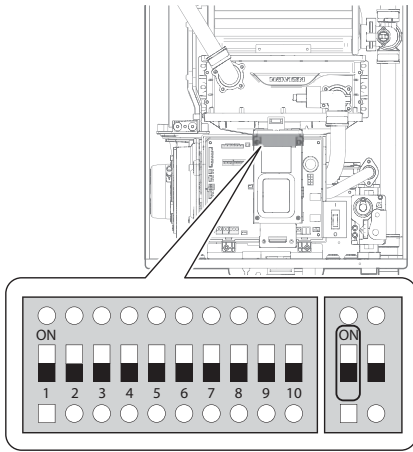
The illustration is intended for reference purposes only.

9.5 Setting Up the Common Vent System

DANGER

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

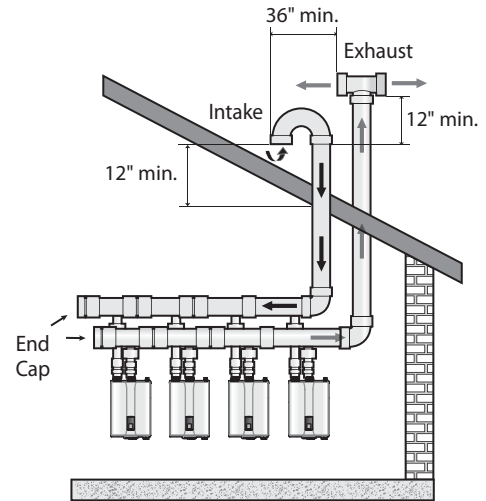
Refer to the following figures when setting DIP switches.



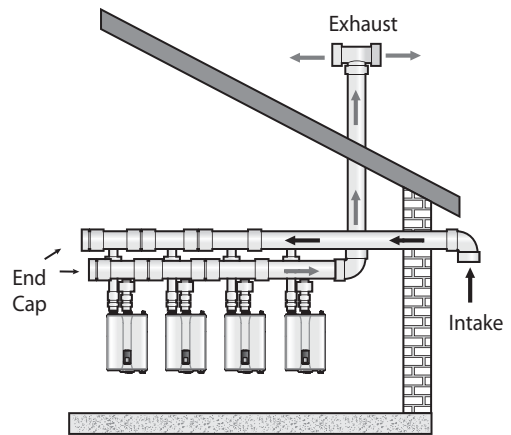
Switch (2-Switch DIP)	Function	Setting	
1	Cascade Vent Settings	Common Vent	1-OFF
		Individual Vent	1-ON

9.6 Common Vent Termination Clearances

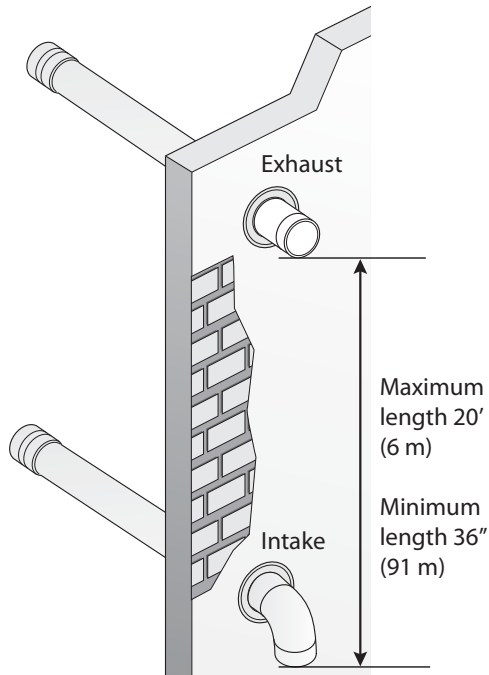
9.6.1 Direct Vent Application – Vertical Installation



9.6.2 Venting Intake and Exhaust to Different Locations



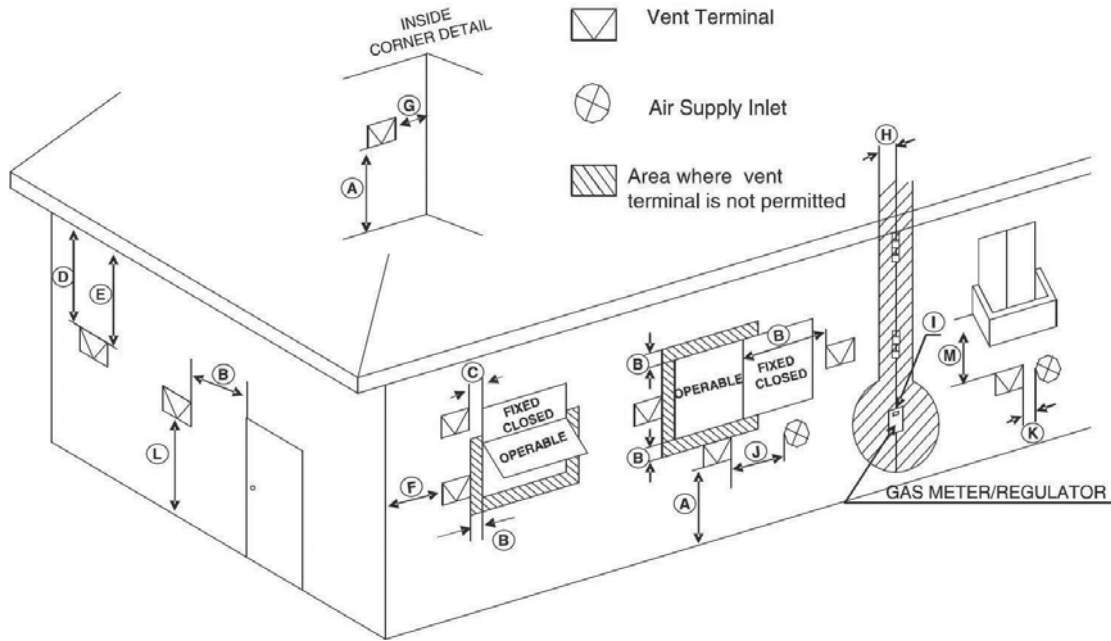
9.6.3 Direct Vent Application – Horizontal Installation



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.

9.7 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	12 in (30 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.

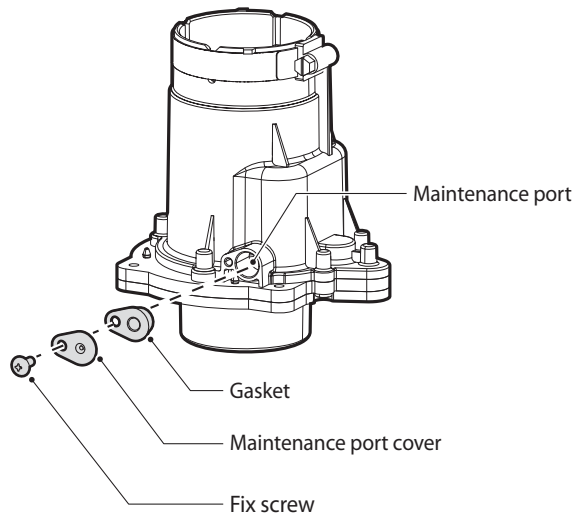
‡ Permitted only if the veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

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

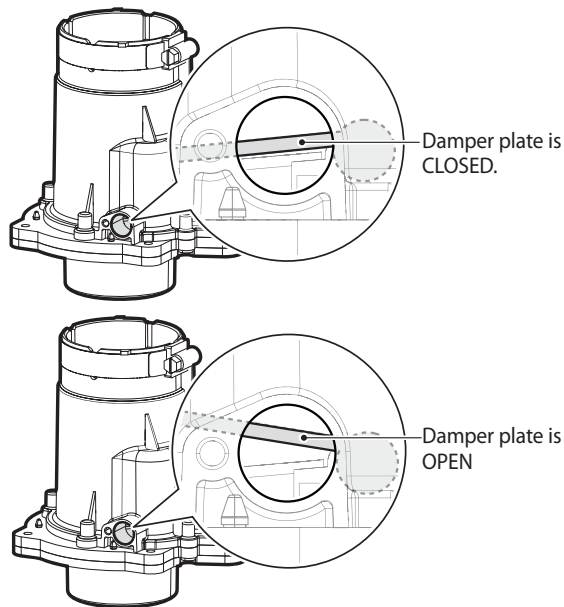
9.8 Maintenance

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

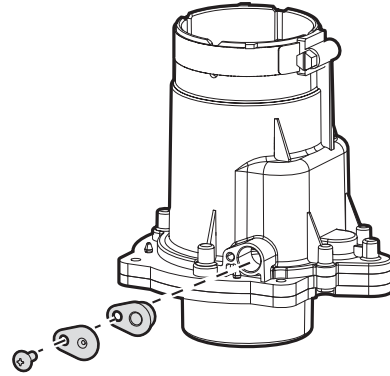
1. Remove the screw that fixes the maintenance port cover to the backflow damper, and then remove the gasket and the maintenance port cover.



2. Through the maintenance port, check the operating condition of the damper plate inside the backflow damper.



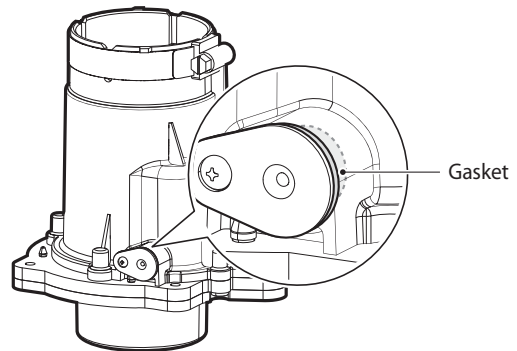
3. Reinstall the gasket and maintenance port cover, and then fix them with a set screw.



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 Owner’s 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.navien.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 1/2 or 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 30 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 2 in or 3 in PVC, CPVC, polypropylene, Type BH Special Gas Vent (ULC-S636) for Category IV boilers (Canada), 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?		
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 plugged into a properly grounded outlet?		
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 switch setting (DIP SW 2, set of 8)	Yes	No
Is switch #1 set correctly for Return Water Control (ON) or Supply Water Control (OFF)?		
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?		

Front Panel DIP switch setting (DIP SW 1, set of 10)	Yes	No
Is switch #2 set correctly for Celsius (ON) or Fahrenheit (OFF)?		
Is switch #4 and #5 are set correctly for the installation altitude?		

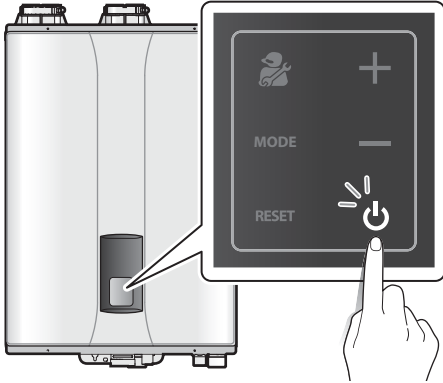
Front Panel DIP switch setting (DIP SW 2, set of 2)	Yes	No
Is switch #2 set correctly for natural gas (OFF) or propane gas (ON)?		

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 or off, press the Power button for 0.3 seconds.



When the power is on, the boiler supply water temperature will appear with the water pressure on the front panel display at 5 second intervals.

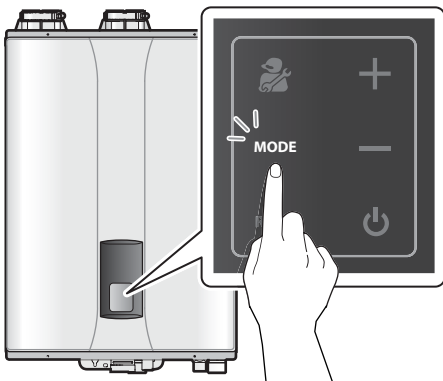
Note When displaying the boiler supply water temperature, the supply or return water icon turns on, depending on the space heating control mode.

11.2 Adjusting the Temperature

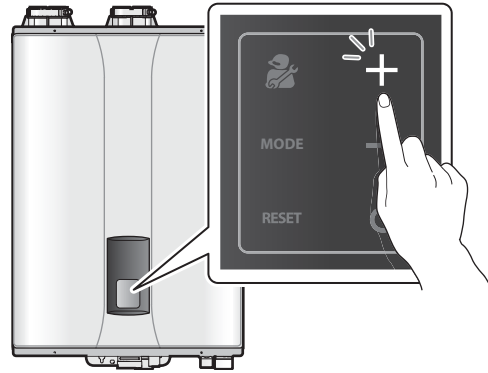
11.2.1 Adjusting the Space Heating Temperature

To adjust the heating temperature:

1. Press the Mode button. The space heating mode icon turns on.



2. Press the + (Up) or - (Down) buttons until the desired temperature appears on the display.



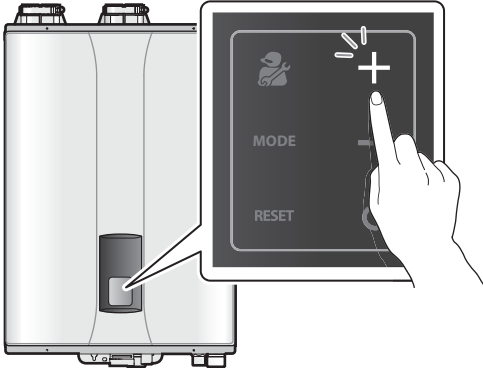
You can adjust the temperature while the display is flashing. Once the display stops flashing, the temperature setting is stored.

- Note**
- The Outdoor Reset Control will take precedence over this temperature setting.
 - 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 range in the parameter settings menu.
 - The boiler will retain your settings during a power outage.

11.2.2 Adjusting the DHW Indirect Supply Temperature

To adjust the water temperature:

1. Press the Mode button twice. The DHW mode icon turns on.
2. Press + (Up) or – (Down) buttons until the desired temperature appears on the display.



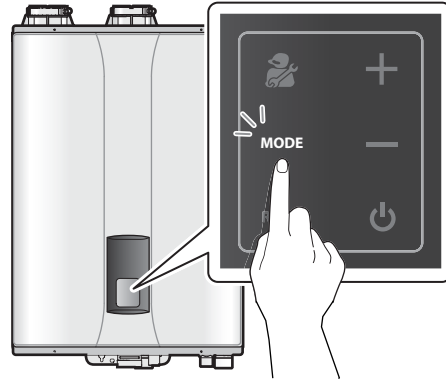
You can adjust the temperature while the display is flashing. Once the display stops flashing, the temperature setting is stored.

Note

- Take note of the original DHW indirect supply temperature in case you want to restore it to the default.
- The default DHW temperature range is 104°F (40°C, Absolute MIN) to 180°F (82°C, Absolute MAX).
- You can adjust the temperature range in the parameter settings menu.
- The boiler will retain your settings during a power outage.





11.3 Viewing Basic Information









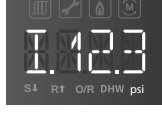

To view information about the boiler, press the Mode button three times. "INFO" will appear on the display.



Press the + (Up) or – (Down) buttons to switch between the information types.

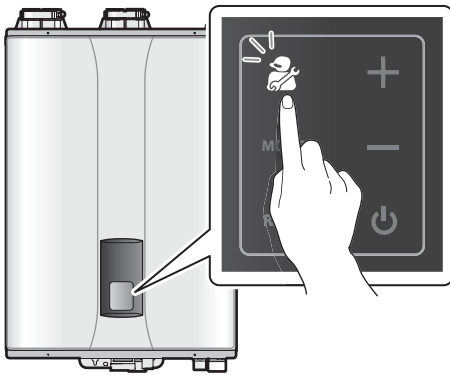
Display	Description
	Space heating supply water temperature (°F)
	Space heating return water temperature (°F)
	Outdoor air temperature (°F) (from Outdoor Temperature Sensor)
	Outdoor reset curve (load type) -: Not in use. 1: Finned tube baseboard 2: FAN coil 3: Cast iron baseboard 4: Low mass radiant 5: High mass radiant 6: Radiator 7: Custom (set by installer)
	Boost interval time in minutes (set by installer)

Display	Description
	Space heating water pressure in PSI
	DHW priority time
	System supply water temperature (°F) (with optional temperature sensor)
	System return water temperature (°F) (with optional temperature sensor)


Display	Description
	Space heating return water temperature (°F)
	Not Available
	Not Available
	Not Available
	Outdoor air temperature (°F) (from Outdoor Temperature Sensor)
	Outdoor reset curve (load type) -: Not in use. 1: Finned tube baseboard 2: FAN coil 3: Cast iron baseboard 4: Low mass radiant 5: High mass radiant 6: Radiator 7: Custom (set by installer)
	Boost interval time in minutes (set by installer)
	Space heating water pressure in PSI
	Heat capacity
	Flame detector AD reading (0-255)

11.4 Viewing Service Information

To view the service information, press the Diagnostics button.









Press the + (Up) or - (Down) buttons to switch between the information types.

Display	Description
	Space heating supply water temperature (°F)

Display	Description
	Blower fan motor target RPM (x 10)
	Blower fan motor current RPM (x 10)
	APS target voltage
	APS current voltage
	Exhaust gas temperature (°F)
	Model type (55, 80, 110, 150)
	Gas type (NG, LP)
	Altitude setting ---: 0-2,000 ft LV1: 2,000-5,400 ft LV2: 5,400-7,700 ft LV3: 7,700-10,100 ft
	Number of operating units in cascade mode
	Cascade mode operation information.

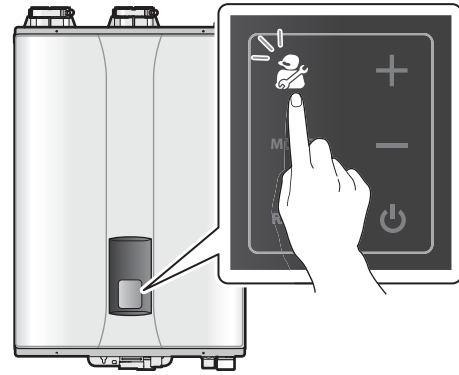
Display	Description
	System supply water temperature (°F) (with optional temperature sensor)
	System return water temperature (°F) (with optional temperature sensor)
	DHW priority time in minutes
	Current exhaust gas temperature2 (°F)
	Current CH demand status
	Current DHW demand
	Currently set space heating temperature (°F)
	Currently set DHW temperature (°F)
	Boiler pump status
	System pump status

Display	Description
	DHW pump status
	Overheating sensing (HTL) status
	Dual venturi status
	Low water cut-off (LWCO) status
	Air handler interface output
	DHW priority status

To exit service information mode, press the Reset button.

11.5 Setting the Operation Mode

1. On the Front Panel, press and hold the Diagnostics Button for over 5 seconds until "1.PAR" is displayed.



2. Press the + (Up) button two times to change the display to "3.OPR".
3. Press the Mode button once to access the Operation Mode menu.
4. To set the boiler to operate at 1-stage MIN, press the + (Up) button until "MIN1" is displayed.
5. To set the boiler to operate at 2-stage MAX, press the + (Up) button until "MAX2" is displayed.
6. To exit the Operation mode setting and return the boiler to normal operation, press the Reset button twice.

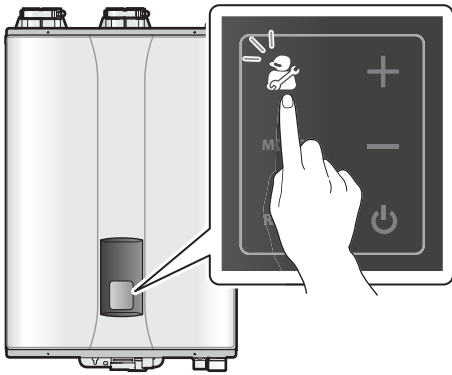
11.6 Setting the Parameters

You can modify parameter settings for boiler operations, such as the space heating and DHW temperature ranges, in different operating conditions. Follow the instructions below to enter the Special Parameter mode and change parameter settings.

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.

1. Press and hold the Diagnostic button for 5 seconds to enter the Special Parameter mode.





2. Press the + or – buttons to move to “1.PAR” (Parameter Setting mode), and then press the Mode button. You will be asked to enter a password (“PASS” is displayed). The factory default password is “1234”.
3. Press the Mode button and enter your 4-digit password. Use the + or – buttons to increase or decrease numbers and the Diagnostic button to move between digits.
4. When you are finished, press the Mode button.
5. Press the + or – buttons to move to a parameter setting, and then press the Mode button to enter the Parameter Edit mode.
6. Press the + or – buttons to change the parameter value.
7. When you are finished, press the Mode button to save the settings.
8. To exit the Special Parameter mode, press the Reset button twice.

Note

- If you enter an incorrect password 10 times or make no inputs 5 minutes, the boiler will return to Normal mode.
- To return to the previous mode, press the Reset button.
- The Factory default password is “1234”.
- If you make no inputs for 10 seconds in the Parameter Edit mode, the current parameter value will be saved automatically.
- Press and hold the Reset button in Parameter Edit mode for 5 seconds to reset individual parameters to their default values.
- When you reset one of the following parameters, the corresponding parameter will be reset automatically:
 - Supply absolute MIN or MAX
 - Return absolute MIN or MAX
 - Lowest Outdoor Temperature or Highest Outdoor Temperature

Configuring the Outdoor Reset Control Mode

Display	Description
	Outdoor Reset enabled
	Outdoor Reset disabled

This mode is used to configure the Outdoor Reset Control mode. This mode is enabled by default from the factory.



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. This mode must remain enabled and the outdoor sensor must be installed to comply with federal efficiency regulations. The Outdoor Reset mode may only be disabled if the boiler is not used for any space heating.

Setting the Heat Load for the Outdoor Reset Control Mode

Display	Description
	Outdoor Reset heat load types 1: Finned tube baseboard 2: FAN coil 3: Cast iron baseboard 4: Low mass radiant 5: High mass radiant 6: Radiator 7: Custom
	Outdoor Reset heat load not selected

This mode is used to configure the heat load type to be used with the Outdoor Reset Control mode.



A preset or user-defined temperature range is selected automatically based on the heat load type selected.

Types of Heat Load

Heat Load	Supply Set Point Range	Return Set Point Range	Remarks
1. Finned Tube Baseboard	120–180°F (48.5–82°C)	101–147°F (38–63.5°C)	Default
2. Fan Coil	140–180°F (60–82°C)	116–147°F (46.5–63.5°C)	
3. Cast Iron Baseboard	100–170°F (37.5–76.5°C)	86–139°F (30–59°C)	
4. Low Mass Radiant	80–140°F (26.5–60°C)	70–116°F (21–46.5°C)	
5. High Mass Radiant	80–120°F (26.5–48.5°C)	70–101°F (21–38°C)	
6. Radiators	120–170°F (48.5–76.5°C)	101–139°F (38–59°C)	
7. Custom	104–180°F (40–82°C)	86–149°F (30–65°C)	User-defined

Heat loads 1-6 show the preset temperature ranges based on the load type selected, while heat load 7 provides a custom temperature range. When the custom temperature range is in use, the boiler operates based on the user-defined “Absolute Min” and “Absolute Max” temperature settings.

Setting the Lowest Outdoor Temperature



Display	Description
	Lowest outdoor temperature (°F)
	Lowest outdoor temperature not in use

This mode is used to configure the lowest outdoor temperature. The boiler will operate at the high end of the supply or return set point range at this outdoor temperature.

Outdoor Low Temperature Setting Range

Range	Remarks
-4°F (-20°C) – [Outdoor High Temperature set point - 9°F (5°C)]	Default: 14°F (-10°C)

Setting the Highest Outdoor Temperature


Display	Description
	Highest outdoor temperature (°F)
	Highest outdoor temperature not in use

This mode is used to configure the highest outdoor temperature. The boiler will operate at the low end of the supply or return set point range at this outdoor temperature.

Outdoor High Temperature Setting Range

Range	Remarks
[Outdoor Low Temperature set point + 9°F (5°C)] – 104°F (40°C)	Default: 70°F (21°C)

Setting the Boost Interval Time


Display	Description
	Boost interval time (min)

The boost interval time may be set to prevent interruption in space heating while using the Outdoor Reset Control mode, due to changes in heat load conditions. With the boost interval time enabled, the boiler increases the space heating supply temperature by 9°F (5°C) and the return temperature by 5°F (3°C) after a set time elapses.

Boost Interval Time and Temperature Setting

Setting	Range	Remarks
Boost Interval Time	OFF (0), 1–120 min	Default: OFF (0)
Boost Temperature	Space Heating Supply (Fixed Value): 9°F (5°C)	
	Space Heating Return (Fixed Value): 5°F (3°C)	


Setting the Max Heat Capacity for Space Heating

Display	Description
	Space heating max heat capacity (%)

This menu is used to configure the desired space heating capacity. When the boiler operates in Normal mode, the space heating capacity is limited to the set value (%).

- Default: 100%
- Range: [Space heating Min heat capacity +20]% – 100%

Setting the Pump Freeze Protection Temperature


Display	Description
	Pump freeze protection temperature (°F)

This menu is used to configure the circulation pump freeze protection temperature.

When the space heating supply temperature stays below the set value for longer than 10 seconds, the boiler runs the circulation pump to prevent freeze damage (the pump runs for 10 minutes, then stops for 1 minute).

- Default: 50°F (10°C)
- Range: 43–50°F (6–10°C)


Setting the Anti-fast Cycling Time

Display	Description
	Anti-fast cycling time (min)

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.

- Default: 3 minutes
- Range: 0–20 minutes


Setting the Pump Overrun Time

Display	Description
	Pump overrun time (min)

The pump overrun time is the duration the circulation pump continues to run between the space heating supply or return temperature reaching the set point and the burner turning off. If the space heating supply or return temperature remains outside of the boiler operation temperature range for a set period, the pump stops for 10 mins, runs again for 5 mins, and then repeats the cycle.

- Default: 40 minutes
- Range: 3–40 minutes


Setting the DHW Max Heat Capacity

Display	Description
	DHW Max heat capacity (%)

This menu is used to configure the desired DHW capacity. When the boiler operates in Normal mode, the DHW capacity is limited to the set value (%).

- Default: 100%
- Range: [DHW Min heat capacity + 20%]–100%

Setting the Burner-Off Temperature Differential


Display	Description
	Burner-off temperature (°F)

During space heating, the boiler turns off the burner when the space heating supply temperature meets or exceeds the burner-off temperature.

Burner-Off Temperature Range

Range	Remarks
2–54°F (1–30°C)	Default: 4°F (2°C)

Setting the Burner-On Temperature Differential


Display	Description
	Burner-on temperature (°F)

During space heating, the boiler turns on the burner when the space heating supply temperature is below the burner-on temperature.

Burner-On Temperature Range

Range	Remarks
2–54°F (1–30°C)	Default: 5°F (3°C)

Setting the Supply Absolute MAX Temperature


Display	Description
	Supply absolute MAX set point (°F)

This menu can be used to change the maximum supply temperature range in Supply Control mode. When Custom mode is configured in Outdoor Reset Control mode, changes to the supply temperature are based on the supply absolute MAX temperature range.

Supply Absolute MAX Temperature Range

Range	Remarks
[MIN set point + 36°F (20°C)] – 194°F (90°C)	Default: 180°F (82°C)

Setting the Supply Absolute MIN Temperature


Display	Description
	Supply absolute Min set point (°F)

This menu can be used to change the minimum supply temperature range in Supply Control mode. When Custom mode is configured in Outdoor Reset Control mode, changes to the supply temperature are based on the supply absolute MIN temperature range.

Supply Absolute MIN Temperature Range

Range	Remarks
77°F (25°C) – [MAX set point - 36°F (20°C)]	Default: 104°F (40°C)

Setting the Return Absolute MAX Temperature


Display	Description
	Return absolute MAX set point (°F)

This menu can be used to change the maximum return temperature range in Return Control mode. When Custom mode is configured in Outdoor Reset Control mode, changes to the return temperature are based on the return absolute MAX temperature range.

Return Absolute MAX Temperature Range

Range	Remarks
[MIN set point + 18°F (10°C)] – 158°F (70°C)	Default: 149°F (65°C)

Setting the Return Absolute MIN Temperature


Display	Description
	Return absolute MIN set point (°F)

This menu can be used to change the minimum return temperature range in Return Control mode. When Custom mode is configured in Outdoor Reset Control mode, changes to the return temperature are based on the return absolute MIN temperature range.

Return Absolute MIN Temperature Range

Range	Remarks
68°F (20°C) – [MAX set point - 18°F (10°C)]	Default: 86°F (30°C)


Setting the Low Water Pressure Limit

Display	Description
	Low water pressure limit

This menu can be used to monitor water pressure limit and water volume levels. If the water pressure drops below the limit pressure, an E302 error occurs. The boiler must be manually reset to clear this error.

- Default: 6 psi
- Range: 4–17 psi



Setting the Initial Start-up Number

Display	Description
	Initial start-up number

This menu may be used to set the number of boiler initially activated during stand-by periods.

- Default: 0 (auto setting: 1)
- Range: 0–16


Setting the Zone Controller Communication

Display	Description
	SmartZone/Ready-Link Connection (On)
	T-T Zone Controller Connection (Off)

Use this menu to operate the boiler with a Navien SmartZone+ controller connected via a Ready-Link cable.

- Default: Off



Setting the DHW Priority Time

Display	Description
	DHW priority time

This menu may be used to set the DHW priority time.

- Default: 30 min
- Range: 0–180 min



Setting the DHW Mode-Boiler Pump

Display	Description
	Do not use boiler pump (No)
	Use boiler pump (Yes)

Use this menu to set the boiler pump operation in DHW mode.

- Default: Off



Setting the DHW Mode-System Pump

Display	Description
	Do not use system pump (No)
	Use system pump (Yes)

Use this menu to set system pump operation for DHW mode.

- Default: Off


Setting the CH Mode-DHW Pump

Display	Description
	Do not use DHW pump (No)
	Use DHW pump (Yes)

Use this menu to set the DHW pump operation for space heating mode. Also, it can be used when space heating and DHW operation requests are received at the same time.


- Default: On

Low Burning Time

Display	Description
	Low burning time during initial heating


- Default: 1 min
- Range: 1–20 min

Burning Acceleration Time

Display	Description
	Burning acceleration time to CH Max during initial heating

- Default: 3 min
- Range: 0–20 min


Setting the Space Heating Min Heat Capacity

Display	Description
	Space heating Min heat capacity (%)

This menu is used to configure the desired space heating minimum capacity. When the boiler operates in Normal mode, the minimum space heating capacity is limited to the set value (%).

- Default: Minimum heat performance available for the unit (%)
- Range: Space heating Min capacity (%) – [space heating Max capacity -20]%


Setting the Space Heating Min Heat Capacity

Display	Description
	DHW Min heat capacity (%)


This menu is used to configure the desired DHW minimum capacity. When the boiler operates in Normal mode, the minimum DHW capacity is limited to the set value (%).

- Default: Minimum heat performance available for the unit (%)
- Range: DHW Min capacity (%) – [DHW Max capacity -20]%

Setting the Warm Weather Shut-down


Display	Description
	Warm weather shut-down temperature

- Default: OFF
- Range: OFF, 50°F (10°C) – 104°F (40°C)


Display	Description
	Warm weather shutdown ON differential

- Default: 5°F (3°C)
- Range: 0°F (0°C) – 36°F (20°C)

Setting the Cascade Staging Adjustments



Display	Description
	Increase or decrease the 70% default Staging ON capacity (40-100% range)

- Default: 0%
- Range: -30 – +30%

Display	Description
	Increase or decrease the 30% default Staging OFF capacity (20-40% range)

- Default: 0%
- Range: -10 – +10%



Setting the Navi-Link Connection

Display	Description
	Navi-Link Connection is enabled (ON)
	Navi-Link Connection is disabled (OFF)

Use this menu to operate the boiler with the Navi-Link Controller connected via a Ready-Link cable.

- Default: OFF

Resetting All Parameters


Display	Description
	Do not reset parameters (No)
	Reset all parameters (Yes)

This menu may be used to reset all the parameters to their factory default settings.

To reset all parameters:

1. Press the + button or - buttons to change the option to “Yes”.
2. Press the Mode button.
3. When “No” appears on the display again, all parameters have been reset.

Setting a New Password

Display	Description
	Change password

This menu may be used to set a new password to access the parameter setting menu.

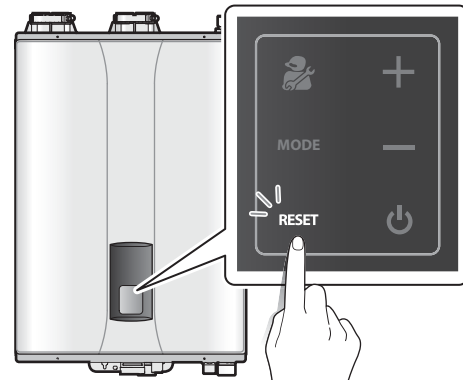
To set a new password:

1. Move to “*.PSC” and press the Mode button. The current password is displayed, with the first digit flashing.
2. Press the + or - buttons to change numbers.
3. Press the Diagnostic button to change places.
4. When you are done setting the password, press the Mode button to save it. The new password is displayed on the front panel for 3 seconds, before the boiler returns to the parameter setting mode.

Note If you do not press the Mode button in 10 seconds after setting a new password, the new password is automatically saved and “*.PSC” is displayed on the front panel.

11.7 Resetting the Boiler

If an error message appears, reset the boiler to resolve the problem. To reset the boiler, press the Reset button.



If resetting the boiler does not solve the problem, refer to the Troubleshooting section of this manual or contact Technical Support at 1-800-519-8794.

12. Appendixes

12.1 Gas Conversion

This boiler is configured for Natural Gas at the factory. If conversion to Propane Gas is required, use the 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
- Combustion Analyzer or Dual Port Manometer
- Gas Leak Detector

Included Items:

- Gas Orifice (refer to below table)

Model	NG		LP	
	1 STAGE	2 STAGE	1 STAGE	2 STAGE
NHB-055	Ø4.20	Ø3.45	Ø3.40	Ø2.80
NHB-080	Ø4.20	Ø3.45	Ø3.40	Ø2.80
NHB-110	Ø4.25	Ø5.00	Ø3.45	Ø3.85
NHB-150	Ø4.60	Ø6.90	Ø3.65	Ø5.25

Table 1. Orifice Size

- Gas Pressure and Conversion Kit Number Labels

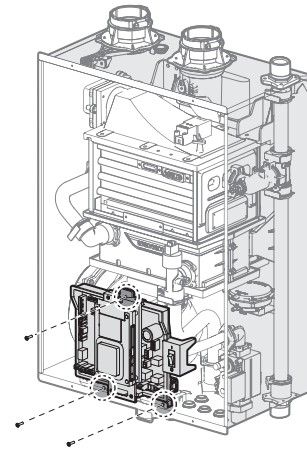
Procedure:

1. Turn off both gas and water supply to the boiler.
2. Using a Phillips screwdriver, remove 4 screws (2 at the top and 2 at the bottom) of the front cover assembly to gain access to the internal components. See Figure 1 for illustration of the front cover on the unit.

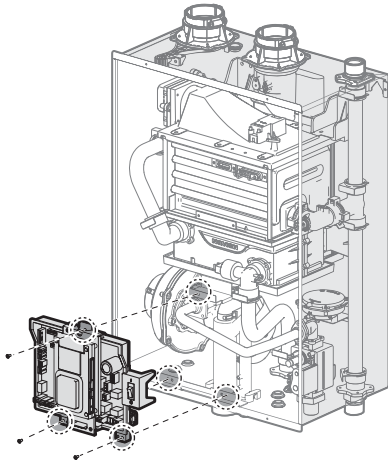


Figure 1. NHB Series Front cover

3. Remove the front cover and place it in a safe location to prevent accidental damage.
4. Label all the wires on the PCB.
5. Disconnect all the wires.
6. Loosen the three screws indicated in the figure.



- Remove the PCB assembly.



- With the internal components exposed, locate the gas inlet pipe and the gas valve in the middle of the unit, as shown in Figure 2.

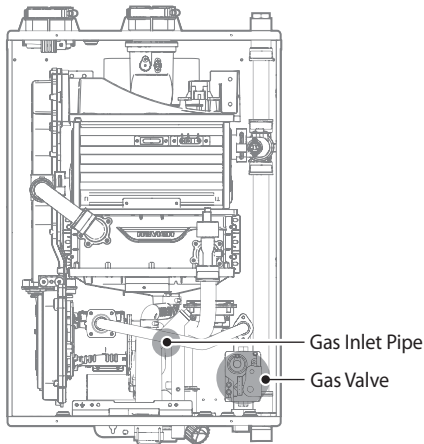


Figure 2. NHB Series Internal Components

- Use a Phillips screwdriver to remove the two screws at location A - the connection below the gas valve where it connects to the pipe. See Figure 3 for reference. Once the screws are removed, carefully separate the pipe from the gas valve.

- Once the gas inlet pipe is detached from the gas valve, find location B - the connection above the gas valve where it is attached to the fan motor assembly. Carefully remove the four screws by hand using a Phillips screwdriver and pull the gas valve away from the fan assembly to access the gas orifice.

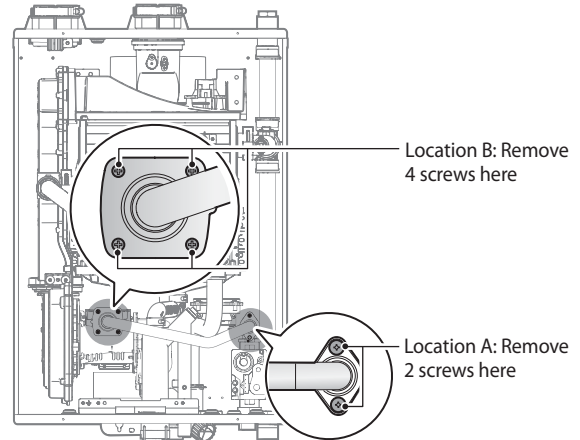


Figure 3. Detaching Gas Valve from Gas Inlet Pipe and Fan Motor Assembly

- Once the Gas Orifice is exposed, remove the two screws that hold the part in place. Remove the Gas Orifice from its housing and prepare the new Gas Orifice for the LP conversion for installation.

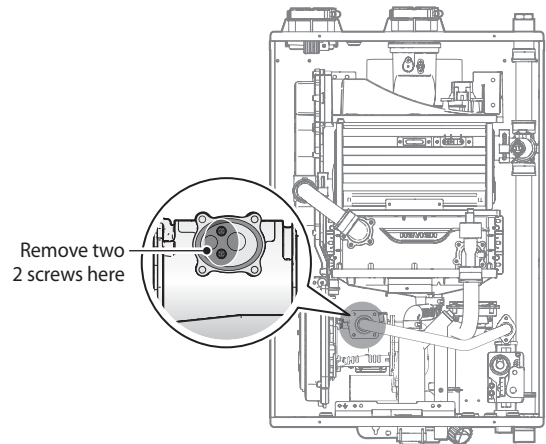


Figure 4. Access to Gas Orifice in Fan Assembly

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 NHB boilers are shipped ready to fire natural gas ONLY.

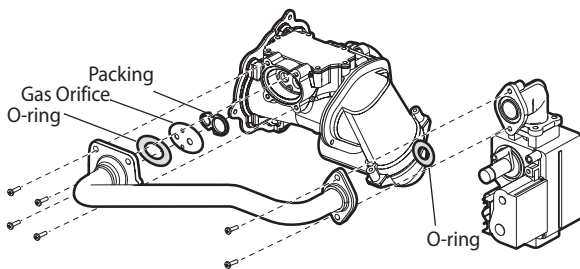


Figure 5. Exploded View of Gas Pipe Assembly

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.

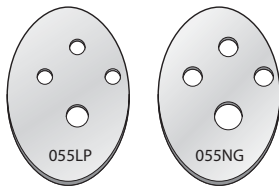
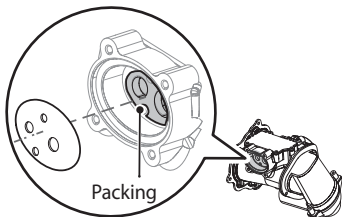


Figure 6. Orifice Identification

12. Remove the Gas Orifice, ensure that the packing is properly seated inside the port, and then install the new Gas Orifice for use with LP gas. Ensure that the Orifice is properly seated on the packing inside the port before proceeding to the next step.



13. 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.

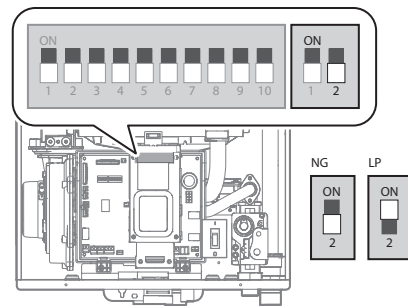
DANGER

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.

14. Place the PCB assembly back on to the boiler and tighten the three screws.
15. Check the labels carefully and then connect all the wires.
16. Set the front panel Dip Switch to change the gas type. For LP, set Dip Switch 2 #2 to On. For NG, set DIP SW2 #2 to Off.

WARNING

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



DANGER

- When conversion is required, be sure to set the front panel DIP switches according to the supply gas type.
- Failure to properly set the DIP switches could cause carbon monoxide poisoning, resulting in severe personal injury or death.

17. Turn on the gas and water supply to the boiler.
18. 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 (Figure 7).

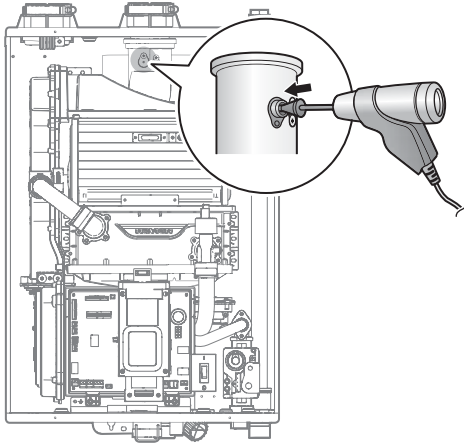


Figure 7. Insert the Analyzer

Model	Fuel	High fire	Low fire
		%CO ₂	%CO ₂
NHB-055	NG	8.9	9.5
	LP	10.2	10.8
NHB-080	NG	8.9	9.5
	LP	10.2	10.8
NHB-110	NG	8.9	9.5
	LP	10.2	10.8
NHB-150	NG	8.9	9.5
	LP	10.2	10.8

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 1-stage MIN mode.

Note For operation mode selection, refer to "11.5 Setting the Operation Mode" on page 77.

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 a ⁵/₃₂ in or 4 mm Allen wrench, turn the set screw no more than ¹/₄ turn clockwise to raise or counterclockwise to lower the CO₂ value.

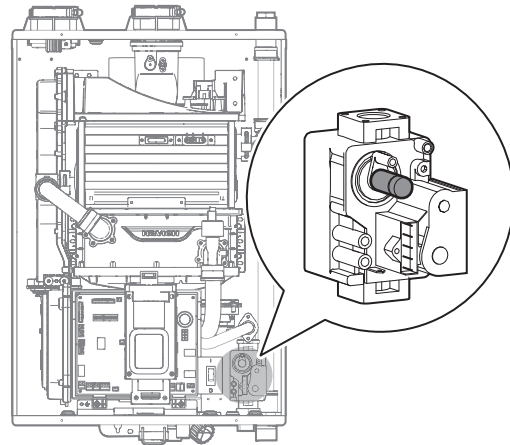


Figure 8. Set Screw Location

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 2-stage D. MAX mode (refer to "11.5 Setting the Operation Mode" on page 77). 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

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

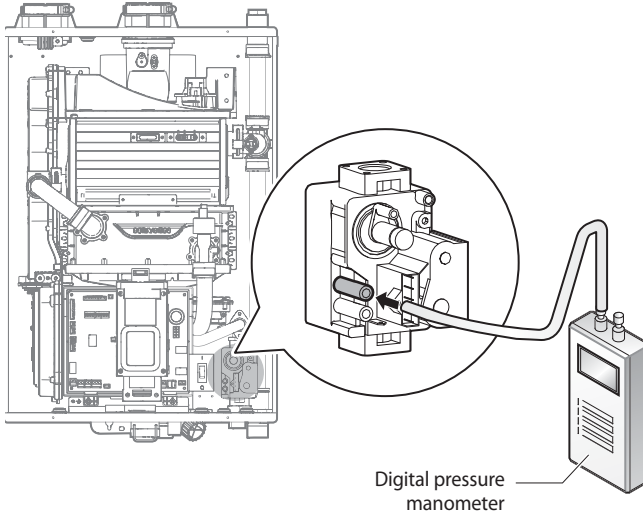


Figure 9. Connect Digital Pressure Monometer

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

Model	Kit Part No.	Gas Type	Offset
NHB-055	NAC-N1	NG	-0.04 in ±0.01 in
	NAC-L1	LP	-0.03 in ±0.01 in
NHB-080	NAC-N2	NG	-0.04 in ±0.01 in
	NAC-L2	LP	-0.02 in ±0.01 in
NHB-110	NAC-N3	NG	-0.04 in ±0.01 in
	NAC-L3	LP	-0.02 in ±0.01 in
NHB-150	NAC-N4	NG	-0.04 in ±0.01 in
	NAC-L4	LP	-0.02 in ±0.01 in

Table 3. Offset value for low fire

- c. Activate multiple zones and set the boiler to operate at 1-stage MIN mode (refer to “11.5 Setting the Operation Mode” on page 77). 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 a $\frac{5}{32}$ in or 4mm Allen wrench, turn the set screw no more than $\frac{1}{4}$ turn clockwise to raise or counterclockwise to lower the offset value.

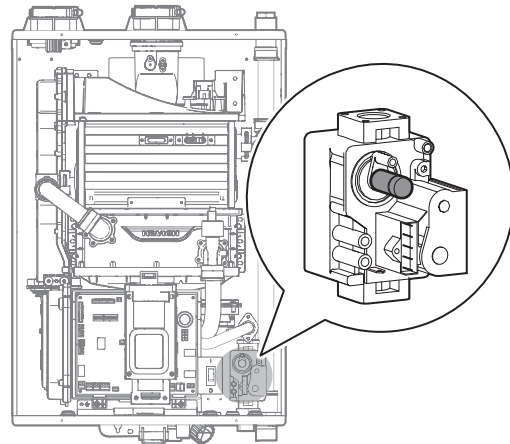


Figure 10. Set Screw Location

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

- d. 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.

- 19. 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. Place these labels adjacent to the rating plate as shown in Figure 11.

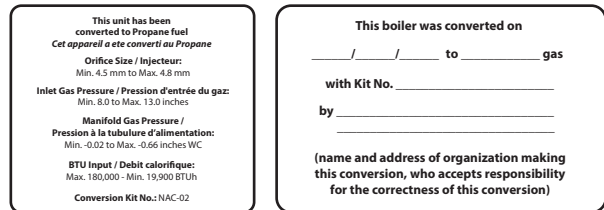
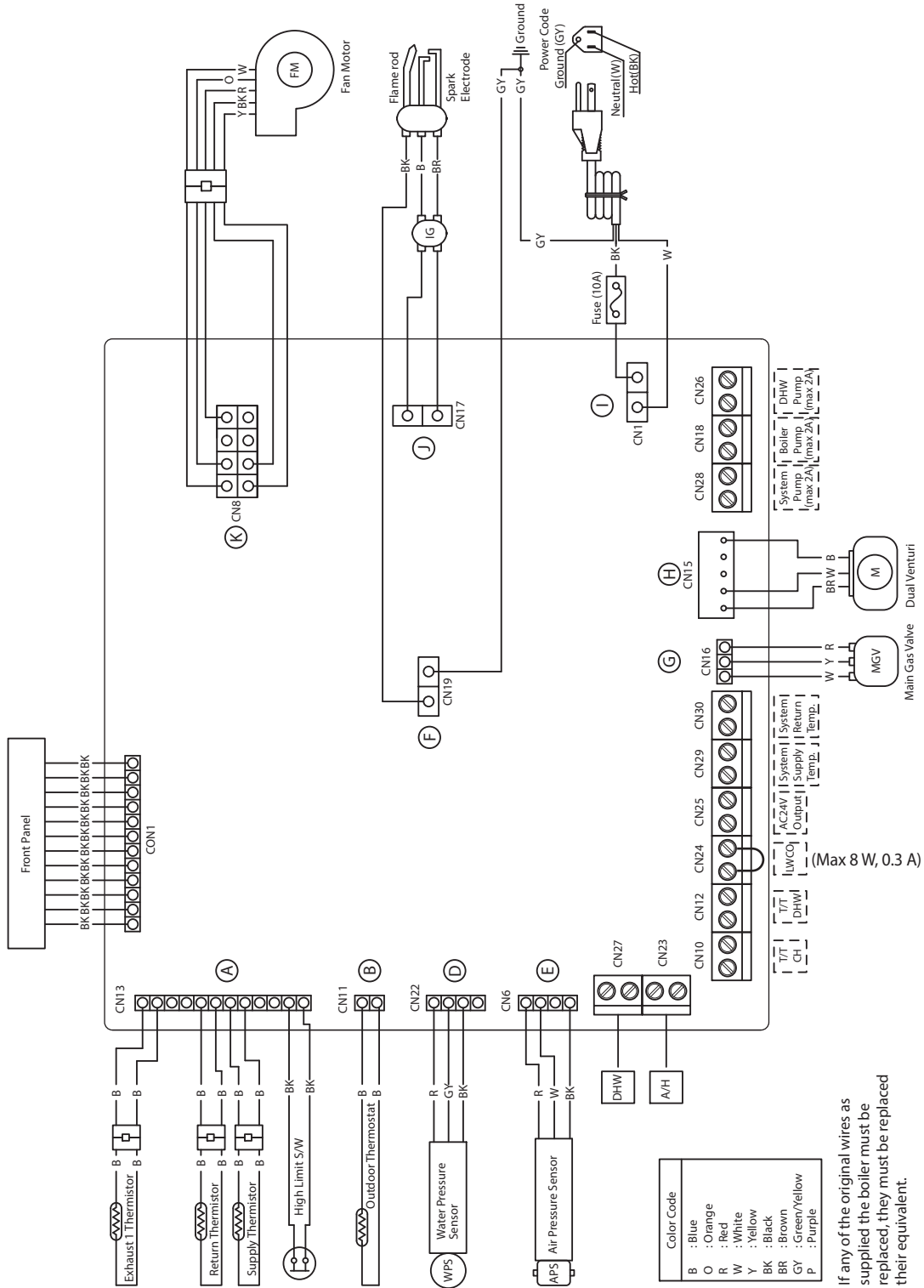
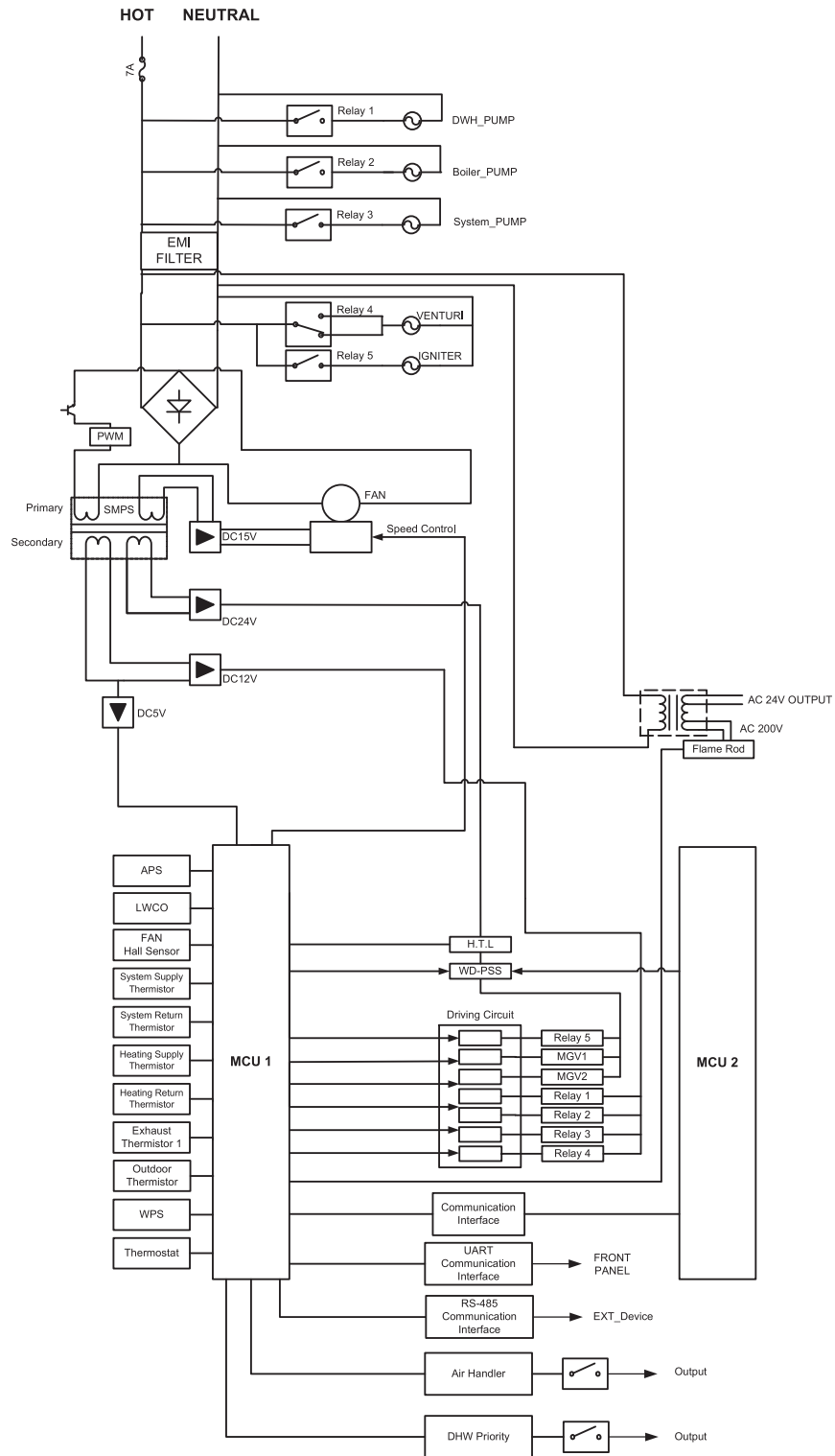


Figure 11. Proper Placement of Gas Conversion Labels

12.2 Wiring Diagram

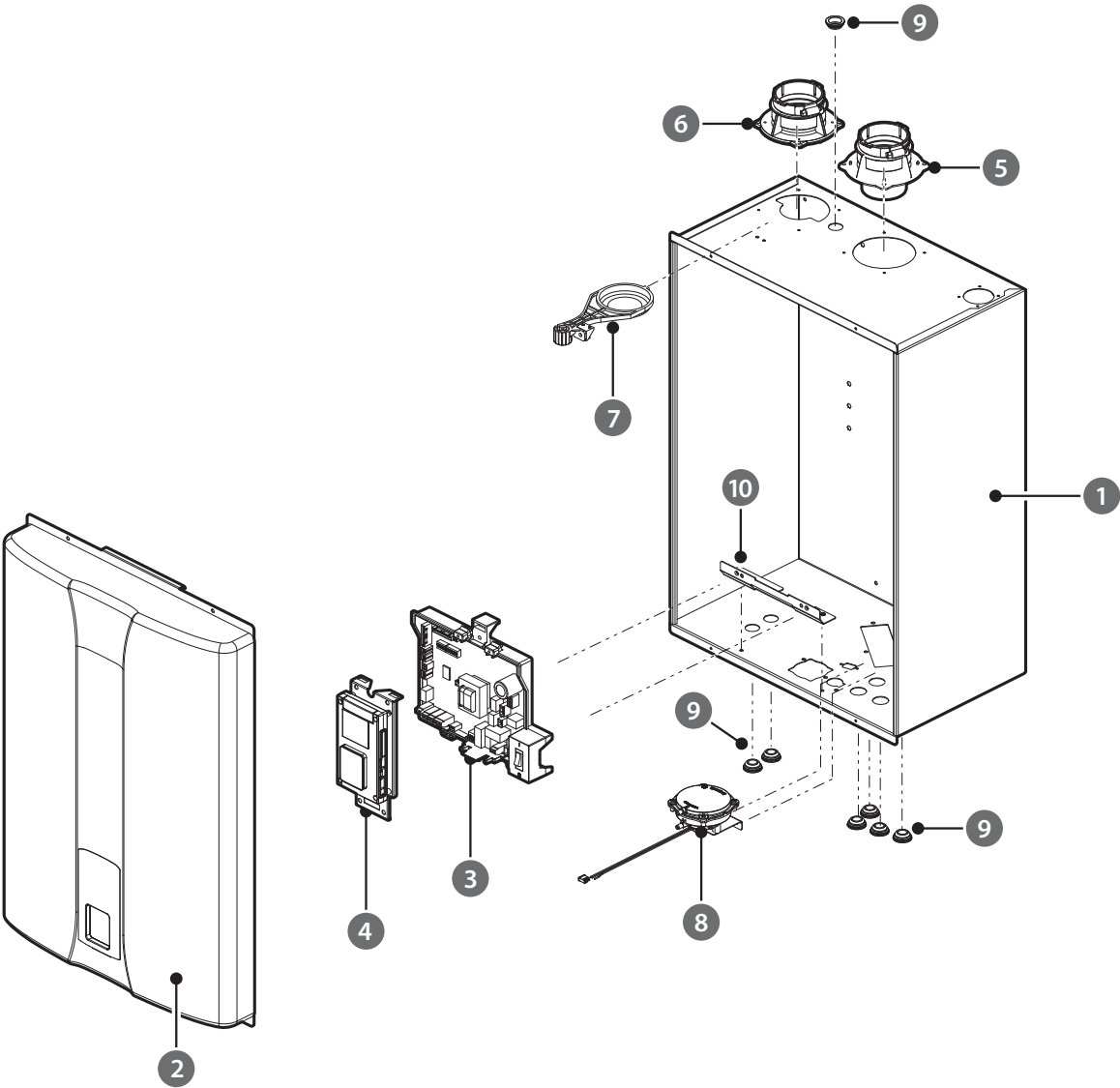


12.3 Ladder Diagram



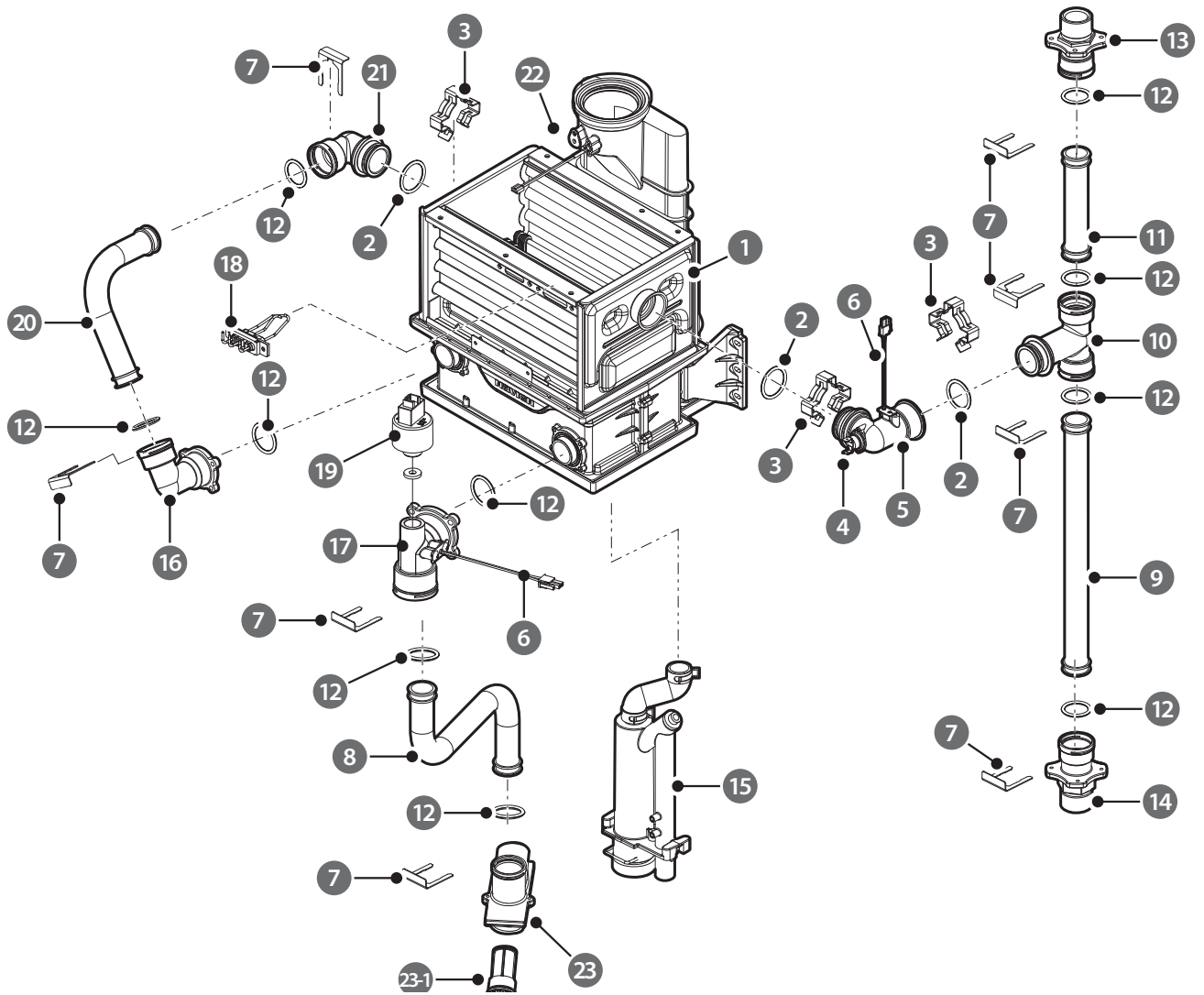
12.4 Component Assembly Diagrams and Parts Lists

12.4.1 Case Assembly



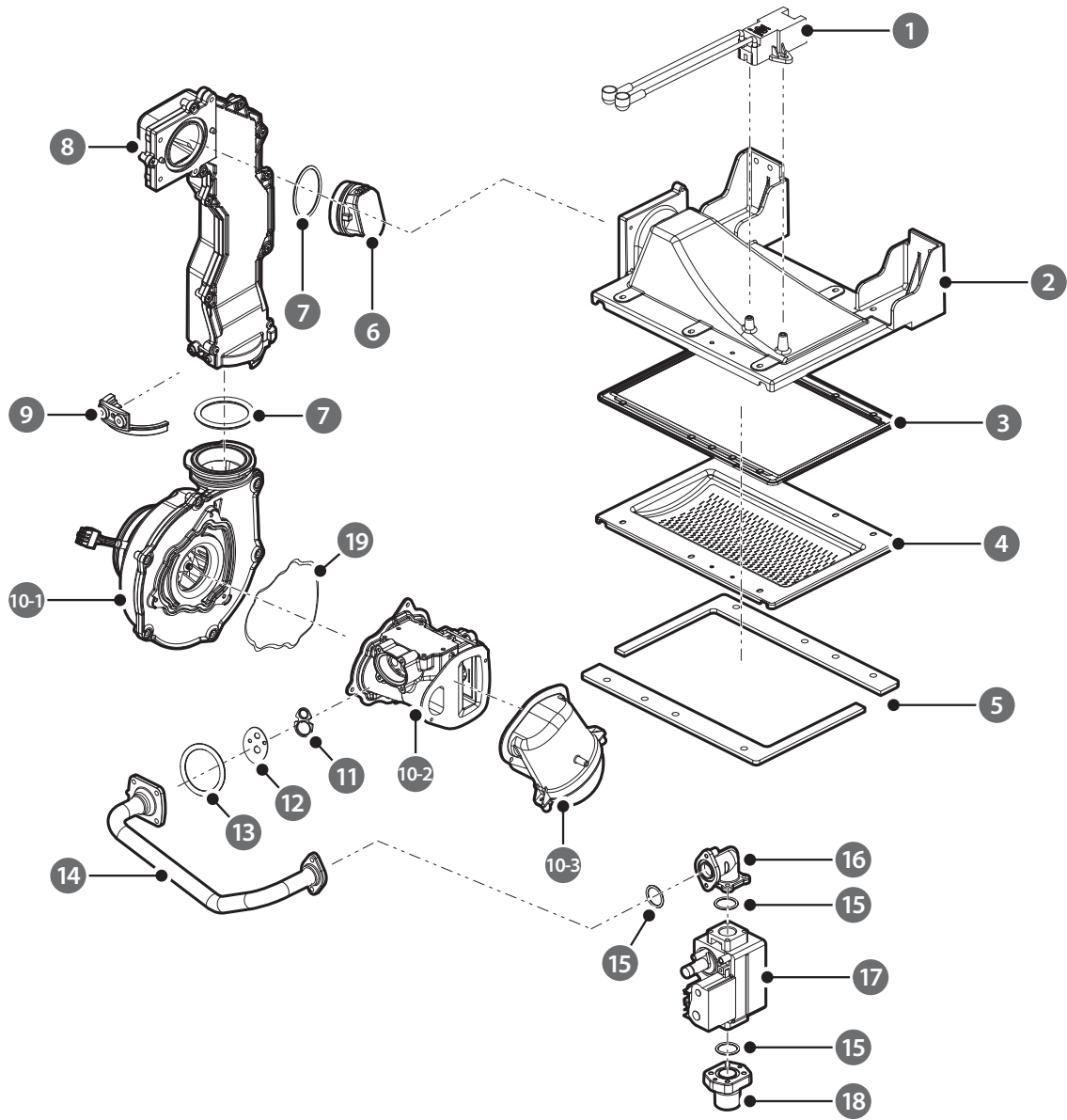
#	Description	Part #	Remark
1	Case	20030085A	NHB-110/150
		20030088A	NHB-055/080
2	Cover	30013463A	
3	PCB	30013044A	
4	Front Panel	30013041A	
5	Exhaust Pipe Assembly	30008673A	
6	Intake Air Duct Assembly	30008662B	
7	Intake Air Filter	20007667A	
8	Air Pressure Sensor	30010238A	
9	Rubber Ring	20029318A	
10	PCB Lower Bracket	20030117A	

12.4.2 Heat Exchanger and Waterway Assembly



#	Description	Part #	Remark
1	Heat Exchanger Assembly	30014219A	NHB-150
		30013575A	NHB-110
		30014060A	NHB-080
		30014218A	NHB-055
2	O-Ring (P29)	20032163A	NHB-110/150
	O-Ring (Φ17.5x2.7t)	20003022A	NHB-055/080
3	Fastener	20017724A	NHB-110/150
		20007853A	NHB-055/080
4	High Limit Switch	30002558A	
5	SC Outlet Adapter	30014032A	NHB-110/150
		30014067A	NHB-055/080
6	Thermistor	30012907A	
7	Fastener	20030608A	NHB-110/150
		20033662A	NHB-055/080
8	Return Pipe	30013501A	NHB-110/150
		30013502A	NHB-055/080
9	Supply Pipe (Lower)	30013505A	NHB-110/150
		30013506A	NHB-055/080
10	Tee Adapter	20030188A	NHB-110/150
		30014259A	NHB-055/080
11	Supply Pipe (Upper)	30013507A	NHB-110/150
		20030201A	NHB-055/080
12	O-Ring (Φ 24.8 x 3.85t)	20032528A	NHB-110/150
	O-Ring (Φ 18.8 x 2.6t)	20003022A	NHB-055/080
13	Air Vent Adapter	20030133A	NHB-110/150
		20033694A	NHB-055/080
14	Heating Supply Adapter	20030136A	NHB-110/150
		20033713A	NHB-055/080
15	Syphon	30015964A	NHB-110/150
		30014024A	NHB-055/080
16	H-Ex Connection Adapter 1	20033547A	NHB-110/150
		20033548A	NHB-055/080
17	Return Adapter	30014055A	NHB-110/150
		30014065A	NHB-055/080
18	Igniter	30012226A	
19	LWCO (Pressure Sensor)	20007924A	
20	H-Ex Connection Pipe	30013503A	NHB-110/150
		30013504A	NHB-055/080
21	H-Ex Connection Adapter 2	20030138A	NHB-110/150
		20026920A	NHB-055/080
22	Thermistor (Exhaust)	30009478A	
23	Heating Return Adapter	30015077A	NHB-110/150
		30015002A	NHB-055/080
23-1	Return Filter	30015339A	

12.4.3 Combustion Parts Assembly

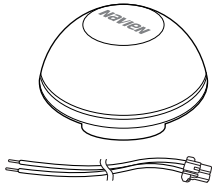


#	Description	Part #	Remark
1	Ignition Transformer	30010455A	
2	Mixed Chamber	20030041A	NHB-110/150
		20030049A	NHB-055/080
3	Chamber Packing	20022743A	NHB-110/150
		20027108A	NHB-055/080
4	Burner	30010246A	NHB-110/150
		30011854A	NHB-055/080
5	Burner Packing	20021677A	NHB-110/150
		20027105A	NHB-055/080
6	Fan Damper	30008825A	
7	Fan Packing	20022744A	
8	Mixed Guide Pipe	30015213A	NHB-110/150
		30013458A	NHB-055/080
9	Fan Bracket	20030471A	
10-1	Fan Assembly	-	NHB-150
		-	NHB-055/080/110
10-2	Dual Venturi	-	NHB-150
		-	NHB-110
		-	NHB-055/080
10-3	Intake Pipe	20031242A	NHB-150
		20030064A	NHB-110
		20031243A	NHB-055/080
11	Orifice Packing	20022660A	
12	Gas Orifice	20032404A	NHB-150 (NG)
		20032403A	NHB-110 (NG)
		20032402A	NHB-055/080 (NG)
		20032407A	NHB-150 (LP)
		20032406A	NHB-110 (LP)
		20032405A	NHB-055/080 (LP)
13	O-Ring (P34)	20019090A	
14	Gas Pipe	30013955A	NHB-150
		30013509A	NHB-110
		30013510A	NHB-055/080
15	O-Ring (P20)	20006934A	
16	Gas Connector	20027149A	
17	Gas Valve	30011586A	
18	Gas Inlet Adapter	20027748A	
19	Venturi Packing	20030060A	

12.5 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

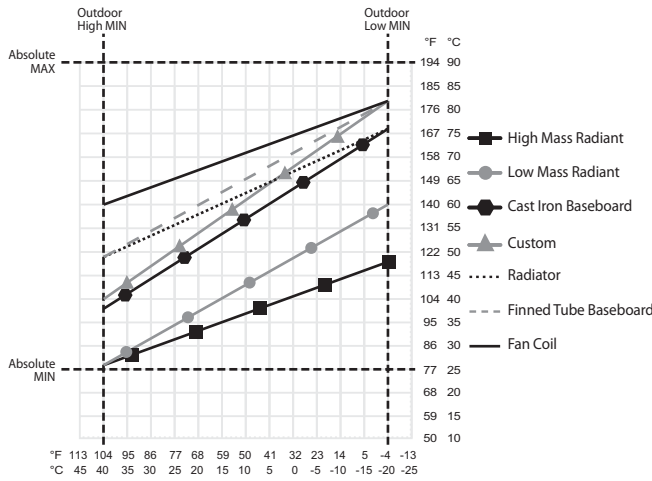
- Avoid areas with temperature fluctuations by direct sunlight, and where the temperature may not be representative of true outdoor temperature.
- Best location to install the temperature sensor is on a North or Northeast side of a structure under eaves where the sensor is shielded from direct sunlight.
- 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.

12.6 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 by entering the Special Parameter Setting mode. Refer 11.6 Setting the Parameters” on page 78.

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	104-180°F (40-82°C)	86-149°F (30-65°C)

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)

Memo

Installation & Operation Manual

NHB 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.navien.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: 2.2 (Feb. 25, 2016)



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