

Installation & Operation Manual

NCB-H Condensing Combi-Boilers

Model

NCB-190/060H
NCB-190/080H
NCB-240/110H
NCB-240/130H
NCB-250/150H



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

* The wetted surface of this product contacted by consumable water contains less than one quarter of one percent (0.25%) of lead by weight.



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.

Contents

1. About the Boiler	7	7. Connecting the Power Supply	74
1.1 Included Items	7	8. Installing a Cascade System	75
1.2 Accessories	7	8.1 Connecting Water Supplies	75
1.3 Specifications	8	8.2 Cascade System - Recirculation System Application Example	78
1.4 Components	11	8.3 Connecting the Communication Cables	80
1.5 Dimensions	13		
1.6 Rating Plate	14		
2. Installing the Boiler	15	9. Installing a Common Vent System	82
2.1 Choosing an Installation Location	15	9.1 About the Common Vent System	82
2.2 Mounting the Boiler to the Wall	17	9.2 Navien Common Vent Collar Kit (Backdraft Damper)	87
3. Installing the System Piping	19	9.3 Starting the Common Vent System	88
3.1 Installing a Space Heating System	19	9.4 Connecting and Terminating the Vent Pipe	91
3.2 Installing a Domestic Hot Water (DHW) System	23	9.5 Setting Up the Common Vent System	92
3.3 Connecting the Condensate Drain	26	9.6 Common Vent Termination Clearances	92
3.4 Filling the System	29	9.7 Installing a Condensate Drain	93
3.5 Testing the Water System	30	9.8 Exhaust Vent Termination Clearances (For Direct Vent)	95
3.6 Considerations for System Applications	31	9.9 Maintenance	97
3.7 Examples of Electrical Connections	40		
4. Connecting the Gas Supply	51	10. Installation Checklist	98
4.1 Gas Pipe Sizing Tables	54	11. Operating the Boiler	101
4.2 Measuring the Inlet Gas Pressure	55	11.1 Operating the Boiler for the First Time	101
5. Venting for Combustion Air	57	11.2 Turning the Boiler On or Off	102
5.1 Venting the Boiler	58	11.3 Start-Up Wizard	103
5.2 About the Vent Installation Detector	60	11.4 Adjusting the Temperature	103
5.3 Selecting a Vent Type	62	11.5 Accessing Basic Menu Items	105
5.4 Selecting Vent Pipe Materials	66	11.6 Accessing Advanced Menu Items	112
5.5 Measuring Vent Length	67	11.7 Understanding Error Codes	121
5.6 Terminating the Vent	68		
6. Setting the DIP Switches	72	12. Appendixes	123
6.1 DIP Switch 1 (6 switch unit)	72	12.1 Gas & High Altitude Conversion	123
6.2 Dip Switch 2 (8 switch unit)	72	12.2 Wiring Diagram	131
		12.3 Ladder Diagram	132
		12.4 Outdoor Temperature Sensor	133
		12.5 Outdoor Reset Control	133
		12.6 Component Assembly Diagrams and Parts Lists	135

Safety Information

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



DANGER

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



WARNING

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

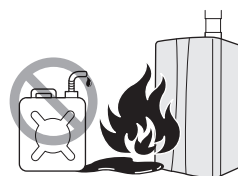


CAUTION

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



DANGER



If you smell gas:

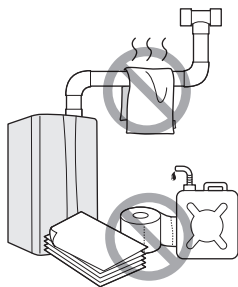
- Do not try to light any appliance.
- Do not touch any electrical switches or use landline phones.
- From a neighbor's phone, call your gas provider and follow their instructions.
- If you cannot reach your gas provider, call the fire department.
- Do not return to your home until authorized by your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

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

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



WARNING



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



CAUTION

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

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



WARNING

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



DANGER



To prevent burns:

- Use the lowest operating temperature setting necessary to provide comfortably-hot water.
- If your household has children or elderly or disabled residents, consider using a lower temperature setting.
- Do not leave children, the elderly, or disabled persons unsupervised.
- Do not allow small children to play unsupervised in the bathroom.
- Do not allow anyone to change the water temperature while hot water is running.
- Read all the instructions in this manual carefully before changing the temperature setting.
- Feel the water before using it on children, the elderly, or the disabled.
- If it is necessary to set the water temperature above 125°F (52°C), consider installing a thermostatically-controlled mixing valve or temperature-limiting valve. Contact a licensed plumber or your local plumbing authority for more information.



DANGER



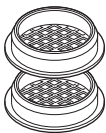
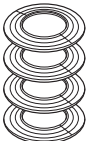
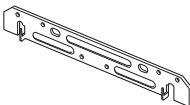




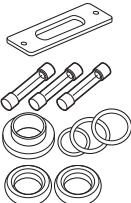
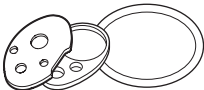
This boiler's DHW temperature is set to 120°F (49°C) at the factory for your safety and comfort. Increasing the temperature increases the risk of accidental scalding. Water temperatures at or above 125°F (52°C) can cause instant scalding, severe burns, or death. Before you decide to change the temperature setting, read the following charts carefully.

Water Temperature	Time in which a young child can suffer a full thickness (3rd degree) burn
160°F (70°C)	Less than 1 second
140°F (60°C)	1 second
130°F (55°C)	10 seconds
120°F (49°C)	10 minutes
100°F (37°C)	very low scald risk

1. About the Boiler

1.1 Included Items


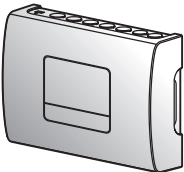
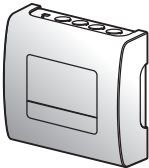


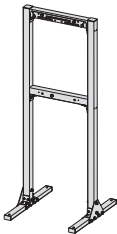
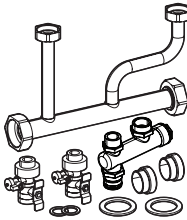



When you open the box, you will find the following items with the boiler. Check the box for each of the following items before installing the boiler.

	
Installation & Operation Manual, User's Information Manual	Quick Installation Manual
	
2 in Vent Termination Caps (x2)	2 in Wall Flanges (x4)
	
Wall Mounting Bracket	Tapping Screws & Anchors (x4)
	
Pressure Relief Valve, Heating	Propane Conversion Kit*
	
Outdoor Temperature Sensor and Cable	Spare Parts
	
High Altitude Conversion Kit (Natural Gas Only)*	

* High Altitude Conversion kit and Propane Conversion kit are attached to the inside of Product's case.

1.2 Accessories

The following optional accessories are available for the boiler.

	
Condensate Neutralizer Kit	Zone Controller (FMZ-40/60)
	
Zone Controller (FMZ-20/30)	Universal Temperature Sensor (with clip)
	
Navi-Link (Wi-Fi Control System)	Ready-Link Rack
	
Navien Manifold System	NaviClean
	
HotButton Push Button	HotButton Wall Plate

Note

The Universal Temperature Sensor can be used as a System Temperature Sensor or a DHW Tank Sensor.

1.3 Specifications

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

Space Heating Specifications

Navien 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					
NCB-190/060H	11	60	56	49	95.0	12-30 psi	1 in NPT
NCB-190/080H	11	80	74	64	95.0		
NCB-240/110H	13	110	102	89	95.0		
NCB-240/130H	13	130	120	104	95.0		
NCB-250/150H	14	150	138	120	95.0		

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.

Domestic Hot Water Specifications

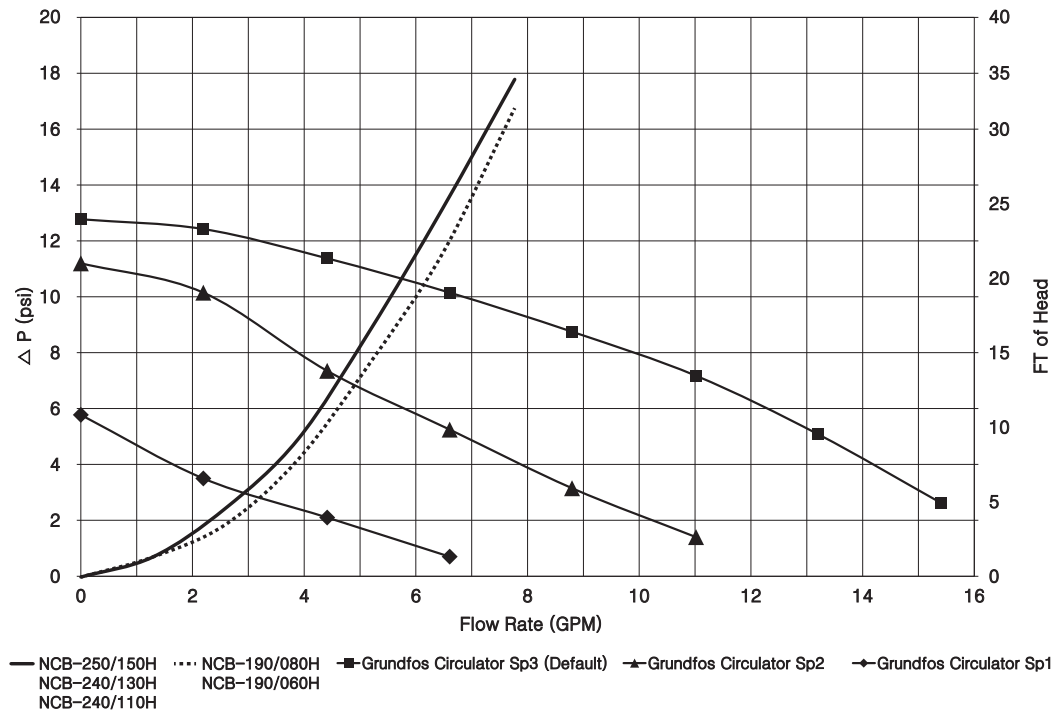
Item		NCB-190/060H	NCB-190/080H	NCB-240/110H	NCB-240/130H	NCB-250/150H
Input Ratings	Min	10,700	10,700	13,300	13,300	14,000
	Max	160,000	160,000	199,900	199,900	210,000
Water Pressure		15-150 psi				
Minimum Flow Rate		0.5 GPM (1.9 L/m)				
Flow Rate (DHW)	35°F (19°C) Temp Rise	8.2 GPM (31.1 L/m)		10.4 GPM (39.5 L/m)		10.8 GPM (40.9 L/m)
	45°F (25°C) Temp Rise	6.4 GPM (24.2 L/m)		7.9 GPM (30 L/m)		8.4 GPM (31.8 L/m)
	67°F (37°C) Temp Rise	4.3 GPM (16.2 L/m)		5.4 GPM (20.3 L/m)		5.6 GPM (21.2 L/m)
	77°F (43°C) Temp Rise	3.7 GPM (14.0 L/m)		4.7 GPM (17.8 L/m)		4.9 GPM (18.5 L/m)
DHW Supply Connection Size		3/4 in NPT				
Cold Water Input Connection Size		3/4 in NPT				

NCB-H Internal Pump

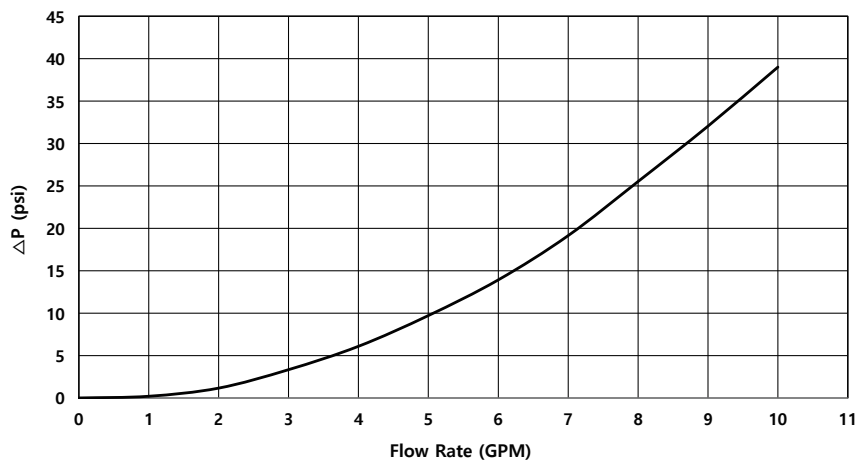
The NCB-H boiler is equipped with an internal circulation pump. The following table provides detailed information on the pump used for the boiler and the performance curve.

Item	Pump Model
NCB-190/060H, NCB-190/080H, NCB-240/110H, NCB-240/130H, NCB-250/150H Internal Circulation Pump	Grundfos UPS 15-78 CIAO2 (Part Number: 30023987A)

NCB-H Flow Performance Curve



NCB-H DHW Pressure Drop Curve



General Specifications

Item		NCB-190/060H	NCB-190/080H	NCB-240/110H	NCB-240/130H	NCB-250/150H
Dimensions		17.3 in (W) x 29.3 in (H) x 12.8 in (D)				
Boiler Weight		87 lbs (40 kg)		96 lbs (44 kg)		
Boiler Weight with Water		93 lbs (42 kg)		102 lbs (46 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		-0.01 in WC to -0.31 in WC		-0.06 in WC to -0.24 in WC		-0.06 in WC to -0.26 in WC
Propane Gas Manifold Pressure		-0.04 in WC to -0.33 in WC		-0.06 in WC to -0.26 in WC		-0.06 in WC to -0.28 in WC
Flow Rate (DHW)	35°F (19°C) Temp Rise	8.2 GPM (31.1 L/m)		10.4 GPM (39.5 L/m)		10.8 GPM (40.9 L/m)
	45°F (25°C) Temp Rise	6.4 GPM (24.2 L/m)		7.9 GPM (30 L/m)		8.4 GPM (31.8 L/m)
	67°F (37°C) Temp Rise	4.3 GPM (16.2 L/m)		5.4 GPM (20.3 L/m)		5.6 GPM (21.2 L/m)
	77°F (43°C) Temp Rise	3.7 GPM (14.0 L/m)		4.7 GPM (17.8 L/m)		4.9 GPM (18.5 L/m)
Gas Connection Size		3/4 in NPT				
Power Supply	Main Supply	120V AC, 60Hz				
	Maximum Power Consumption	Up to 15 amperes				
Materials	Casing	Cold-rolled carbon steel				
	Heat Exchangers	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) 2 in or 3 in Stainless Steel				
	Intake	2 in or 3 in PVC, CPVC, polypropylene 2 in or 3 in Special Gas Vent Type BH (Class III, A/B/C) 2 in or 3 in Stainless Steel				
	Vent Clearance	0 in to combustibles				
Safety Appliances		Flame Rod, APS, Ignition Operation Detector Water Temperature High Limit Switch, Exhaust Temperature High Limit Sensor, Water Pressure Sensor, Burner High Limit Fuse, Vent Installation Detector				

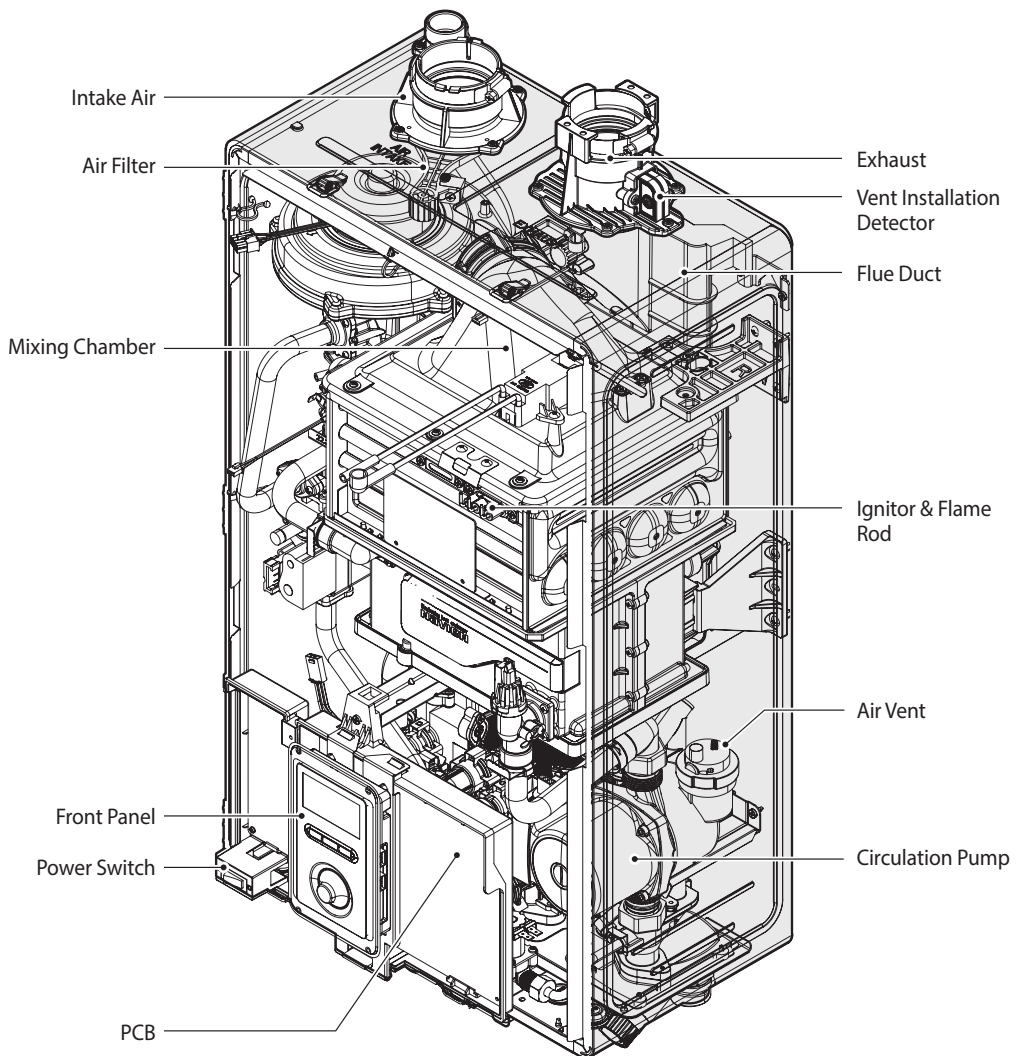
Temperature Setting Range

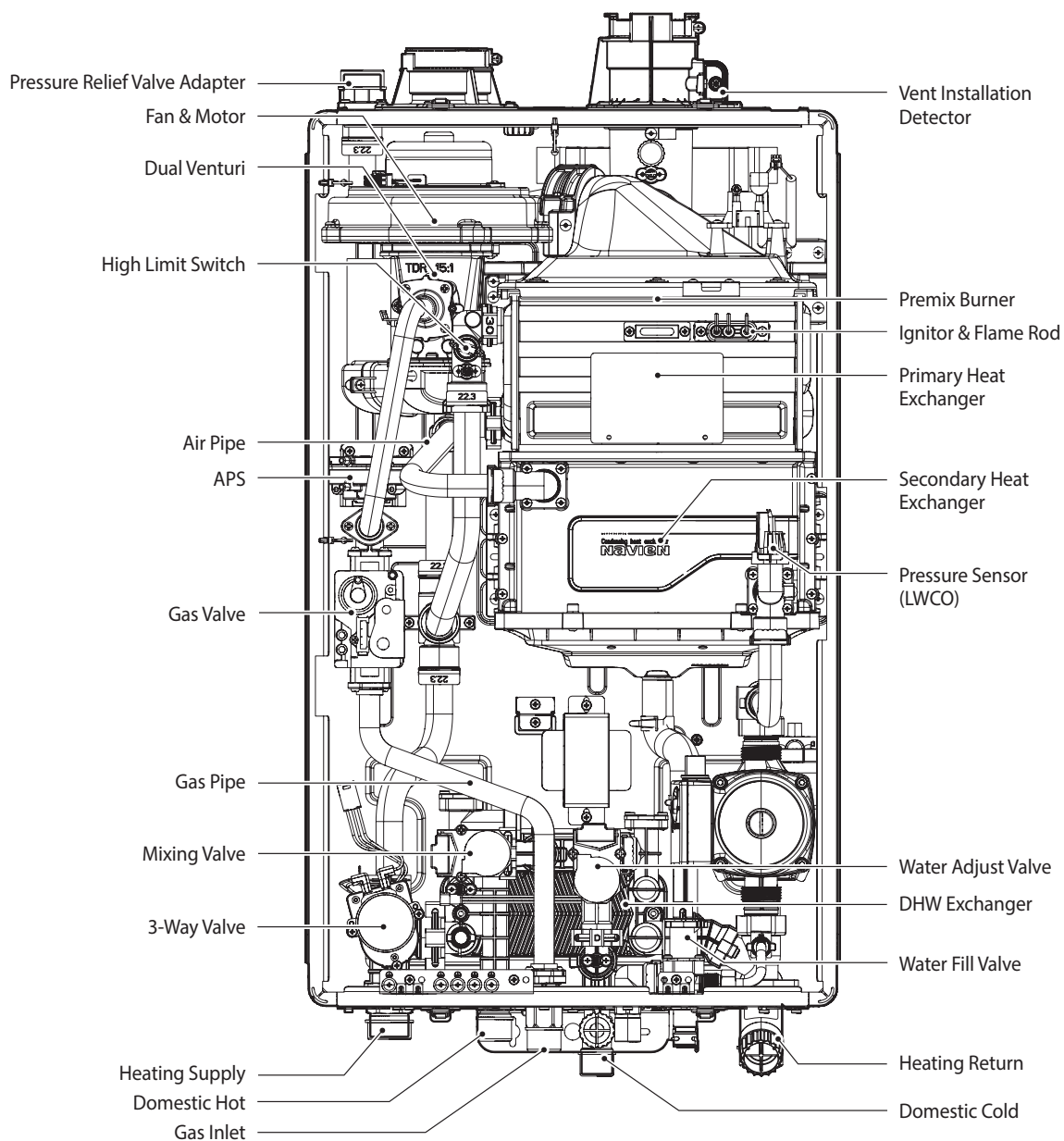
Item		Temperature Setting Range	Remarks
Space Heating	Supply	77–185°F (25–85°C)	Actual supply and return temperatures vary depending on the selected outdoor reset curve.
	Return	68–158°F (20–70°C)	
DHW		86°F–140°F (30°C–60°C)	

Note For more information about the space heating temperature setting range, refer to “11.5.2 Setting the Space Heating Operation” on page 107.

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.





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







Overhead View



1.6 Rating Plate

The Navien NCB-H boilers come from the factory configured for use with Natural Gas (NG). **Before starting the installation, check the rating plate located on the side of the boiler to ensure that the boiler matches the gas type, gas pressure, water pressure, and electrical supply available in the installation location. If the boiler does not match each of these ratings, do not install the boiler.** If conversion to Propane Gas is required, the included gas conversion kit must be used. Refer to “12.1 Gas & High Altitude Conversion” on page 123 for details.

Rating Plate, *Plaque Signalétique

Combination Boiler *Chaudière combinaison 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 NCB-250/150H		   
Max. Input Rating (DHW), *Entrée GPL max. 210,000 Btu/h Max. Input Rating (Heating), *Entrée GPL max. 150,000 Btu/h Category of boiler, *Catégorie de chaudière Category IV Max. Inlet Gas Pressure, *Pression max. de gaz d'entrée Min. Inlet Gas Pressure, *Pression min. de gaz d'entrée Manifold Pressure, *Pression d'admission Electrical Rating, *Régime nominal électrique Minimum relief valve capacity, *Capacité minimum soupape.	Type of Gas, *Type de gaz NG Min. Input Rating, *Débit calorifique max. 14,000 Btu/h Heating Capacity, *Capacité de chauffage 140,000 Btu/h Net AHRI Rating, *Régime de AHRI 121,000 Btu/h 10.5 Inches W.C., *pouces W.C. 3.5 Inches W.C., *pouces W.C. -0.26 Inches W.C., *pouces W.C. AC *c.a. 120 Volts 60Hz Use less than 15 Amp, *Utilise moins de 15A 200 lbs/hr ANSI Z21.13-2017 • CSA 4.9-2017	

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

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

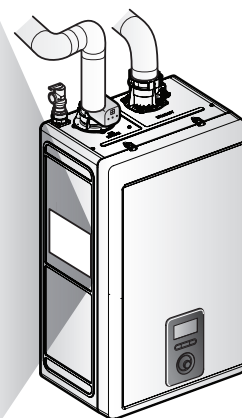
Consult your installation manual for more information. *Consultez votre manuel d'installation pour plus d'information.

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

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

FOR YOUR SAFETY *POUR VOTRE SÉCURITÉ

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



WARNING

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

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

2. Installing the Boiler

2.1 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:



WARNING

Do not install outdoors. Outdoor installation may result in property damage, severe personal injury, or death. Damage to the boiler resulting from installation outdoors is not covered by warranty.



CAUTION

Review all of the installation information in this manual before starting installation. Consider all the requirements for venting, piping, condensate removal, and wiring.

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 Appliances 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.

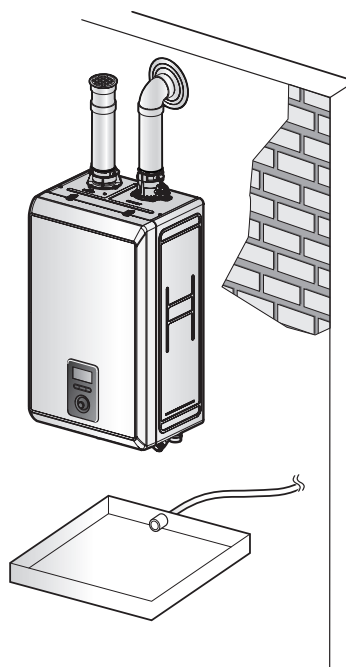
Humidity and Contact with Water

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

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 “3.3 Connecting the Condensate Drain” on page 26.

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



Adequate Venting and Ventilation

Select a location that requires minimal venting. Consider venting restrictions caused by windows, doors, air intakes, gas meters, foliage, and other buildings. For more information about venting, refer to “5. Venting for Combustion Air” on page 57.

To ensure adequate venting and ventilation, follow these guidelines:

- Maintain proper clearances from any openings in the building.
- 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.
- 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.

Proximity to Fixtures and Appliances

Install the boiler near fixtures that deliver or use hot water, such as bathroom, kitchen, and laundry room faucets. Select a location that minimizes the water piping required between major fixtures. If the distances are long or if the user requires “instant” hot water, installation of a recirculation line which circulates domestic hot water back to the boiler from the furthest fixture is recommended. Insulate as much of the hot water supply and recirculation lines as possible. For more information about the water supply, refer to “3.2 Installing a Domestic Hot Water (DHW) System” on page 23.

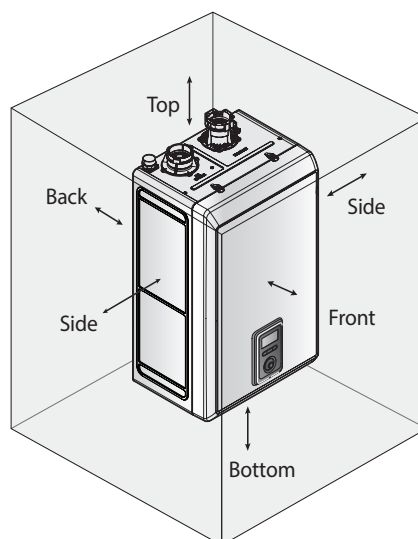
Adequate Installation Clearances



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.

Note The combustion air must be free of flammable vapors or corrosive chemical fumes. Common corrosive chemical fumes to avoid include fluorocarbons and other halogenated compounds such as Freon, trichloroethylene, perchloroethylene, chlorine, all of which can be found in refrigerants or solvents. When these chemicals burn, they produce acids that corrode the stainless steel heat exchanger, gaskets, and the flue and vent system.

Operating Temperature

The ambient temperature at the installation location must be above freezing temperature and below 100°F (38°C).

High Elevation Installations

- This unit may be installed at elevations up to 10,100 ft (3,078 m) for use with natural gas and propane. Refer to "6. Setting the DIP Switches" on page 72 for the appropriate altitude setting.
- Natural gas units require the use of a high elevation kit if installed at an elevation of 5,400 ft (1,646 m) or higher.



CAUTION

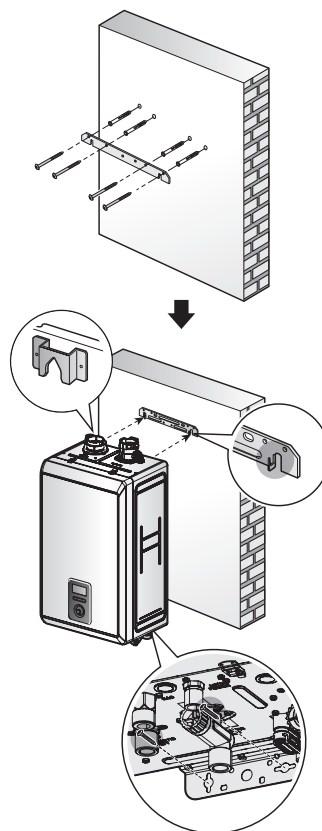
Follow the instructions in the guide provided with the high altitude conversion kit when replacing with the kit's gas orifice. Failure to follow the instructions may result in property damage, personal injury, or death.

2.2 Mounting the Boiler to the Wall

Navien NCB-H 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 $\frac{5}{8}$ 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.
- Install the boiler in the upright, vertical position. Installation in any other orientation will result in improper boiler operation and property damage, and could result in serious personal injury or death.



CAUTION

- Ensure that the structure of the installation location is sturdy enough to support the full weight of the installed boiler, including the water contained in the heat exchanger and related piping.
- The wall must be vertical, and it must be capable of carrying the weight of the boiler.
- Do not mount the boiler to drywall that has not been reinforced.

3. Installing the System Piping

Prior to connecting piping to the boiler, flush the entire system to ensure it is free of sediment, flux, solder, scale, debris or other impurities that may be harmful to the system and boiler. During the assembly of the heating system, it is important to keep the inside of the piping free of any debris including construction dust, copper burrs, 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 water-tube type heat exchanger of the Navien NCB-H boiler is designed to attain the highest level of heat transfer in a compact design. To maintain the efficient and reliable operation of the heat exchanger, and to avoid heat exchanger failure, it is critical to ensure the rules and guidelines in this section are followed.



WARNING

- To avoid damaging the connectors on the boiler, use two wrenches when tightening piping to the boiler. Use one wrench to prevent the connector at the boiler from turning, and use the other wrench to tighten the connection. Damaged connectors may result in system leaks.
- Properly support the piping with hangers. Do not allow the piping to be supported by the boiler or its accessories.



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.
- The use of glycol results in a greater head loss due to its higher viscosity compared to water.



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 NCB-H 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 NCB-H 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 appliances, 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 appliances, in case an additional air removal appliances is required for a specific application.



WARNING

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



CAUTION

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

3.1.2 Essential Elements in a Space Heating System

Low Water Cut Off (LWCO) Appliance

Internal LWCO

The Navien NCB-H boiler is equipped with a factory-installed, pressure-sensing type low water cutoff (LWCO) device. The minimum operation pressure for this device is 7.3 psig.

Note

- The boiler performs water replenishment automatically when the built-in water pressure sensor detects insufficient water level in the boiler system.
- If the water replenishment is not completed after 5 minutes, error code E351 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. Install a backflow preventer in the make-up water line to the unit if required by local codes.

External LWCO

Install a separate LWCO device if required by local codes. The following figure illustrates an example of typical LWCO installation.

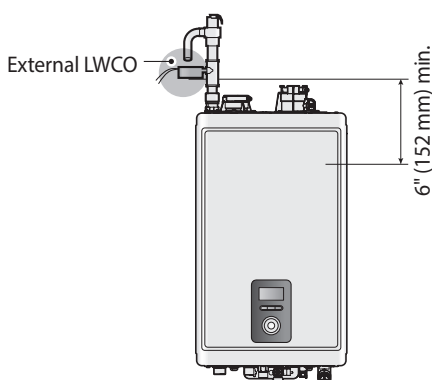


Figure 1. External LWCO
(without Navien Manifold System)

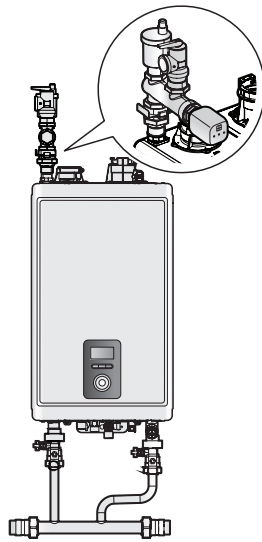


Figure 2. External LWCO
(with Navien Manifold System)

The external LWCO must be installed at least 6 in (152 mm) above the top of the heat exchanger. Refer to the following diagram for typical wiring connections of the LWCO to the boiler PCB.

Note

The LWCO device may require annual inspection and maintenance. Refer to the instructions that are provided with the LWCO device for complete procedures.



WARNING

Ensure the power is turned off while making wiring connections. Boiler components or the boiler may fail and result in serious injury, or death if power is supplied during wire connection. Product failures caused by incorrect installation are not covered by warranty.

Backflow Preventer

Install a backflow preventer valve in the make-up water supply to the unit as required by local codes. Installation of a backflow preventer or an actual disconnection from city water supply may be required.

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.
- The make-up water connection can be attached 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.

Magnetic Filtration

The NaviClean magnetic filter is an optional accessory. This must be connected to the space heating return in the near boiler piping to protect the boiler from iron oxide (magnetite). Refer to the included instructions for installation details.

Pressure Relief Valve

To complete the space heating system installation, you must install a $\frac{3}{4}$ in, Maximum 30psi pressure relief valve on the top of the boiler. 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 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.

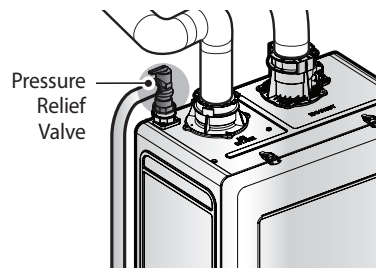
When installing the pressure relief valve, follow these guidelines:

- 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 run the end of the line to within 6-12 in (150-300 mm) of the floor drain, making the discharge clearly visible.
- Do not direct the discharge line to a location where freezing could occur.
- Ensure that the discharge line is not plugged or obstructed.
- After filling and pressurizing the system, test the relief valve operation by lifting the lever. If the valve fails to operate correctly, immediately replace the relief valve.

- 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.

Refer to the following illustration and install a pressure relief valve to the pressure relief valve adapter located on the top corner of the NCB-H boiler. Watts M330-M1 pressure relief valve (3/4 in, HV, Max 30 psi) is provided with the boiler.



WARNING

To avoid water damage or scalding, direct the discharge line to a safe place for disposal.



CAUTION

- All field supplied pressure relief valves must be ASME certified.
- To avoid potential property damage or personal injury, check the pressure relief valve at least once every three years by manually operating the valve to ensure proper operation.
- Before manually operating the valve, check the discharge line and make sure that the hot discharge water will not cause personal injury or property damage. Contact with the discharged water may result in severe personal injury.

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

Navien is not responsible for performance issues of the domestic system by scaling or accumulation of dirt; suitable steps shall be taken by the installer and user to avoid water quality related issues.

Freeze Protection

Navien recommends heat tracing and insulating the DHW water pipes. Pipe enclosures may be packed with insulation for added freeze protection. Freeze damage is not covered by the warranty.

3.2.2 Essential Elements in a DHW System

DHW Heat Exchanger

The DHW heat exchanger is installed inside the Navien NCB-H boiler.

Drain and Isolation Valves

Install drain and isolation service valves on the inlet and outlet of the DHW heat exchanger, so it can be flushed free of possible build-up caused by dirt or hard water. The optional Navien Plumb-Easy Kit is recommended.

Pressure Relief Valve for DHW

To complete the installation of the DHW system, you must install an approved $\frac{3}{4}$ in, maximum 150 psi pressure relief valve on the domestic hot. The Navien NCB-H boiler has a built-in high temperature shut off switch, so install a "pressure only" relief valve.



WARNING

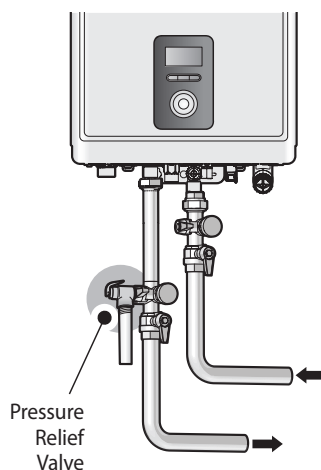
Installing the pressure relief valve improperly may result in property damage, personal injury, or death. Follow all instructions and guidelines when installing the pressure relief valve. The valve should be installed only by a licensed professional.

The DHW pressure relief valve is not supplied, but is required.

The following examples are pressure relief valves approved for use

with the boiler:

- Wilkins P-1000A (Zurn Industries)
- Conbraco 17-402-04
- Watts Industries 3L (M7)
- Cash Acme FWL-2, $\frac{3}{4}$ in



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 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 DHW 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 operator, or any nearby equipment.
- Attach the discharge line to the pressure relief valve and run the end of the line to within 6-12 in (150-300 mm) of the floor.
- Ensure that the discharge line allows for free and complete drainage without restriction. Do not install a reducing coupling or other restrictions on the discharge line.
- If the relief valve discharges periodically, this may be due to thermal expansion in a closed water supply system. Contact the water supplier or local plumber on how to correct the situation. Do not plug the relief valve.

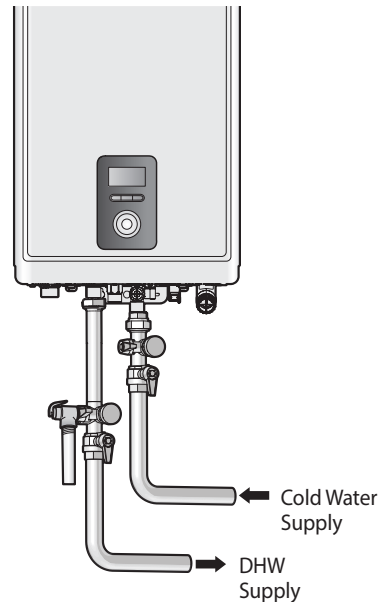
3.2.3 DHW System Piping



CAUTION

To comply with ASME or CRN requirements, an additional high temperature limitation appliance may be needed. Consult your local code requirements to determine if this appliance is required.

Refer to the following illustration for a typical DHW piping example for the boiler.



When installing the DHW system, follow these guidelines:

- Use only pipes, fittings, valves, and other components (such as solder), that are approved for use in potable water systems.
- Tighten the connection valves with care to avoid damage.
- Navien recommends using unions and manual shut-off valves on domestic cold and domestic hot.
- Keep the hot water piping system as short as possible, to deliver hot water to the fixtures more quickly.
- Recirculation controls are included with the boiler for use of an optional external recirculation system.
- To conserve water and energy, insulate the DHW supply and DHW recirculation lines (if applicable). Do not cover the drains or pressure relief valves.
- After installing the boiler, clean the cold water inlet filter. Then, test the boiler for proper DHW supply and inspect for leaks. Instruct the boiler owner that the filter must be cleaned periodically to maintain proper DHW flow.

3.3 Connecting the Condensate Drain

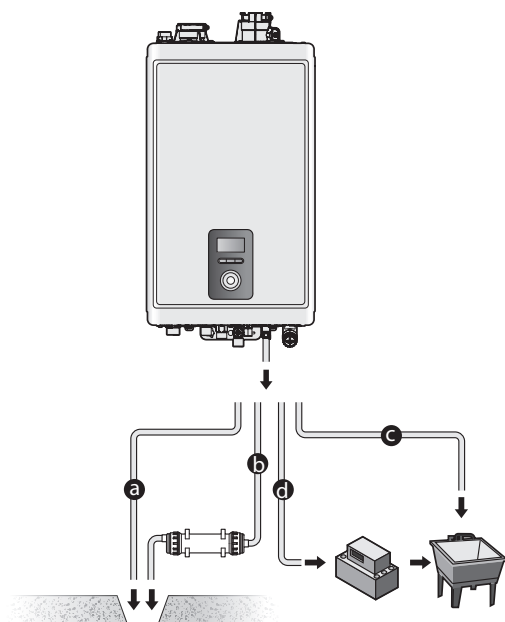
The Navien NCB-H boiler creates condensation when it operates. This condensation has an acidic pH of 3-5. Follow all local codes and regulations when disposing of condensate from the boiler. We recommend draining the condensate into a laundry tub, as the alkali in laundry detergent will neutralize the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



CAUTION

- Fill the condensate trap with water after installing the condensate drain pipe.
- 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.
- Do not use condensate for drinking or for consumption by animals.

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



- From the boiler directly into an external drain
- From the boiler, through a neutralizing agent, and then into an external drain

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.

- 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.

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

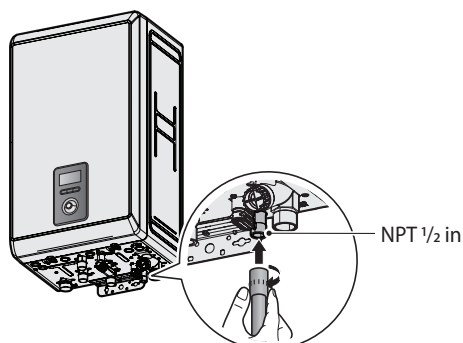
Note

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.

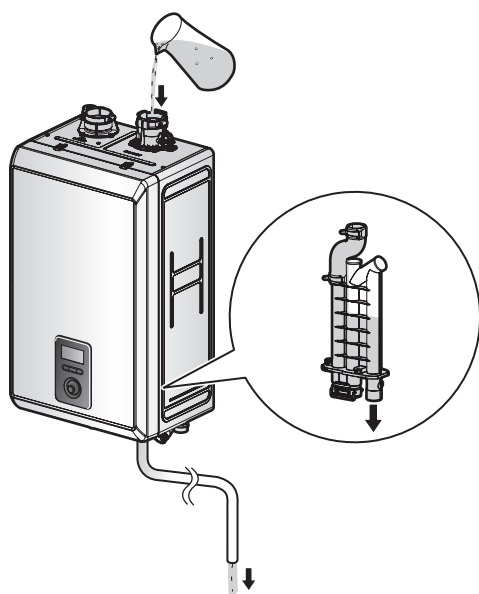
To connect the condensate drain:

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.
 - 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.
 - 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. Fill the condensate trap by pouring water into the boiler's exhaust vent until water flows through the condensate drain.



CAUTION

The condensate line must remain unobstructed, allowing for the free flow of condensate. If condensate freezes in the line, or if the line is obstructed in any other manner, condensate can exit from the tee, resulting in potential water damage.

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.

As part of this annual maintenance procedure, make sure to clean out the condensate trap which may contain excess debris. Drain the condensate within the trap, then replace with fresh water using the provided access port.

3.3.1 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.
- Make sure to use a proper neutralizer based on the boiler input rating and/or the rate of condensate produced by the appliance.

If option 'b' is selected for condensate disposal, 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.

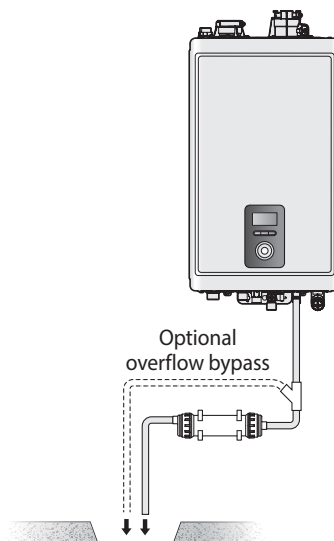


Figure 1. Horizontal installation

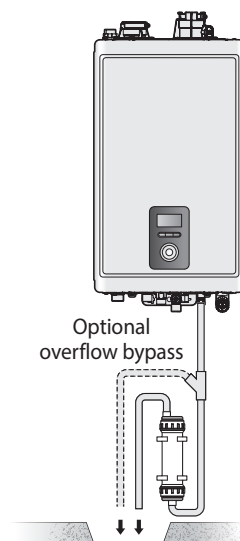


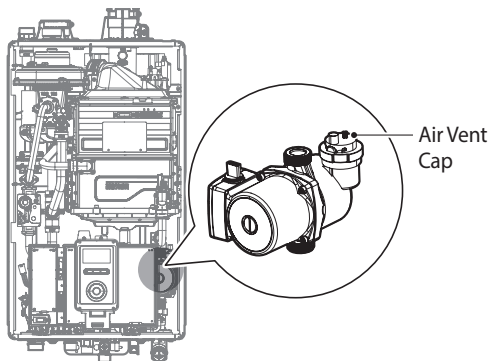
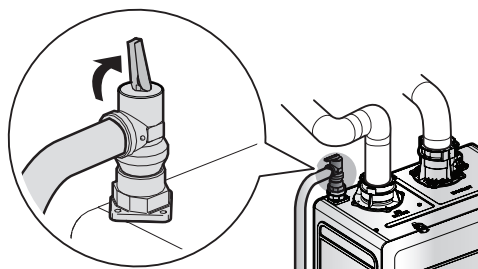
Figure 2. Vertical installation

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.

3.4 Filling the System

Before filling the boiler, open the pressure relief valve by lifting the lever on top, and loosen the air vent cap to allow the system to fill properly. Close the pressure relief valve when the system is full.

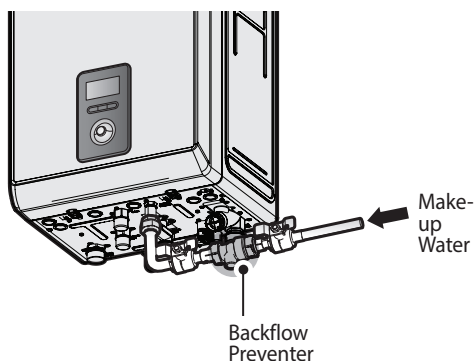


CAUTION

Ensure that the pressure relief valve is closed before testing or operating the system.

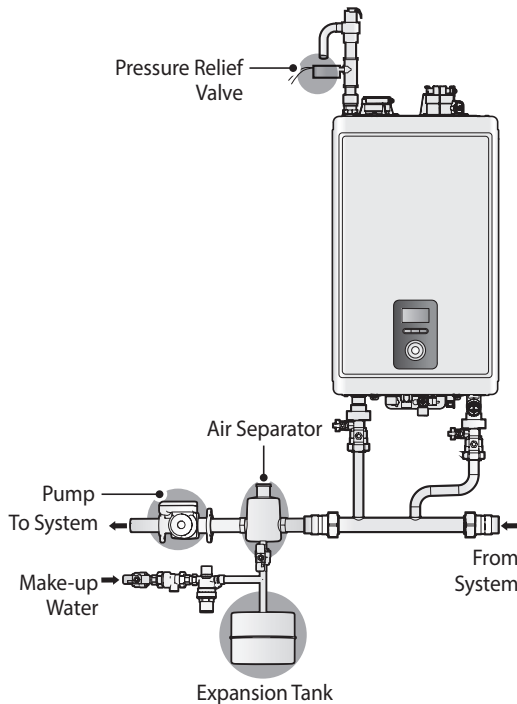
3.4.1 Built-in Water Fill Connection

The Navien NCB-H boiler is equipped with an auto-feeding water connection and motorized feeding valve. Therefore, installation of additional system water fill connection is not necessary in most cases. See the following figure for an example of a water fill installation using the built-in connection.



3.4.2 External Water Fill Connection

External water fill connection may be installed on the system piping if it is required for specific applications. See the following figure for an example of external water fill installation on the system piping.



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

Note

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

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



WARNING

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

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



CAUTION

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.

3.6 Considerations for System Applications

Read and follow the guidelines listed below when installing system piping for the Navien NCB-H boiler:

- System application drawings are intended to explain the system piping concept only.
- For the upstream side of all pumps, use straight pipes with a minimum inside diameter of $\frac{1}{2}$ in (12 mm).
- Provide a system expansion tank following the guidelines on page 21.
- 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 piping layout must be configured to promote the removal of air from the system. Air vents and bleeders must be strategically placed throughout the system to aid in purging the air from the system during commissioning of the boiler. The system must also employ the use of an air removal appliance, such as an air separator 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 appliance when placing it in the system; air removal appliances generally work better when placed higher in the system. Always locate air removal appliances in areas of the system that have a guaranteed positive pressure, e.g., in close proximity to the water fill and expansion tank.

Expansion Tank

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

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

Note

The installation of check valves, motorized valves or other shutoff appliances (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 NCB-H 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.

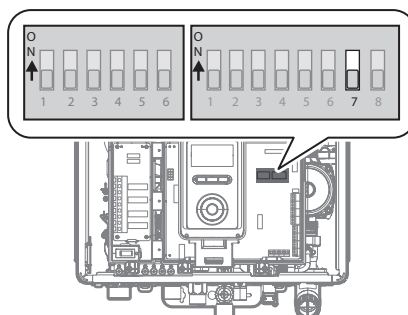


CAUTION

- **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.
- Configure only the DIP switches that require adjustment according to the instructions in this manual. Do not adjust any other DIP switches.

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 50 for wiring connections.



WARNING

- Do not turn the power on until electrical wiring is finished. Disconnect power before servicing. Death or serious injury from electrical shock may result if power is supplied to the boiler during electrical wiring or servicing.
- 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.

Configuring a Zone System

The NCB-H boiler can control up to 3 zones utilizing zone valves or zone pumps. After installing the system, the boiler operation must be configured accordingly using the front panel.

To configure a zone system:

On the front panel, press the Menu button (**M**) to enter the setting menu, and then select 1-2. Zone Settings > 2. Zone Settings.

3.6.1 Temperature Control Device Applications

NCB-H series boilers come with a water flow adjustment valve and cold water mixing valve included as to ensure a stable supply of hot water without requirements for additional direct water pressure control valves (flow restrictors) or mechanical mixing valves.

- When setting up the system, do not install water pressure control valves or flow restrictors on the direct water supply lines unless if required by local codes.
- When setting up the system, do not install additional mechanical mixing valves on the DHW supply line unless if required by local codes.

Water Adjustment Valve

The adjustment valve works in conjunction with the flow sensor to detect and control the direct water flow within the system, and is installed on the water piping module. Refer to "1.4 Components" on page 11 for details.

Mixing Valve

The mixing valve controls the amount of cold water that is mixed with the hot water in order to provide a stable supply of DHW. It is installed on the water pipe module. Refer to "1.4 Components" on page 11 for details.

3.6.2 Examples of System Applications

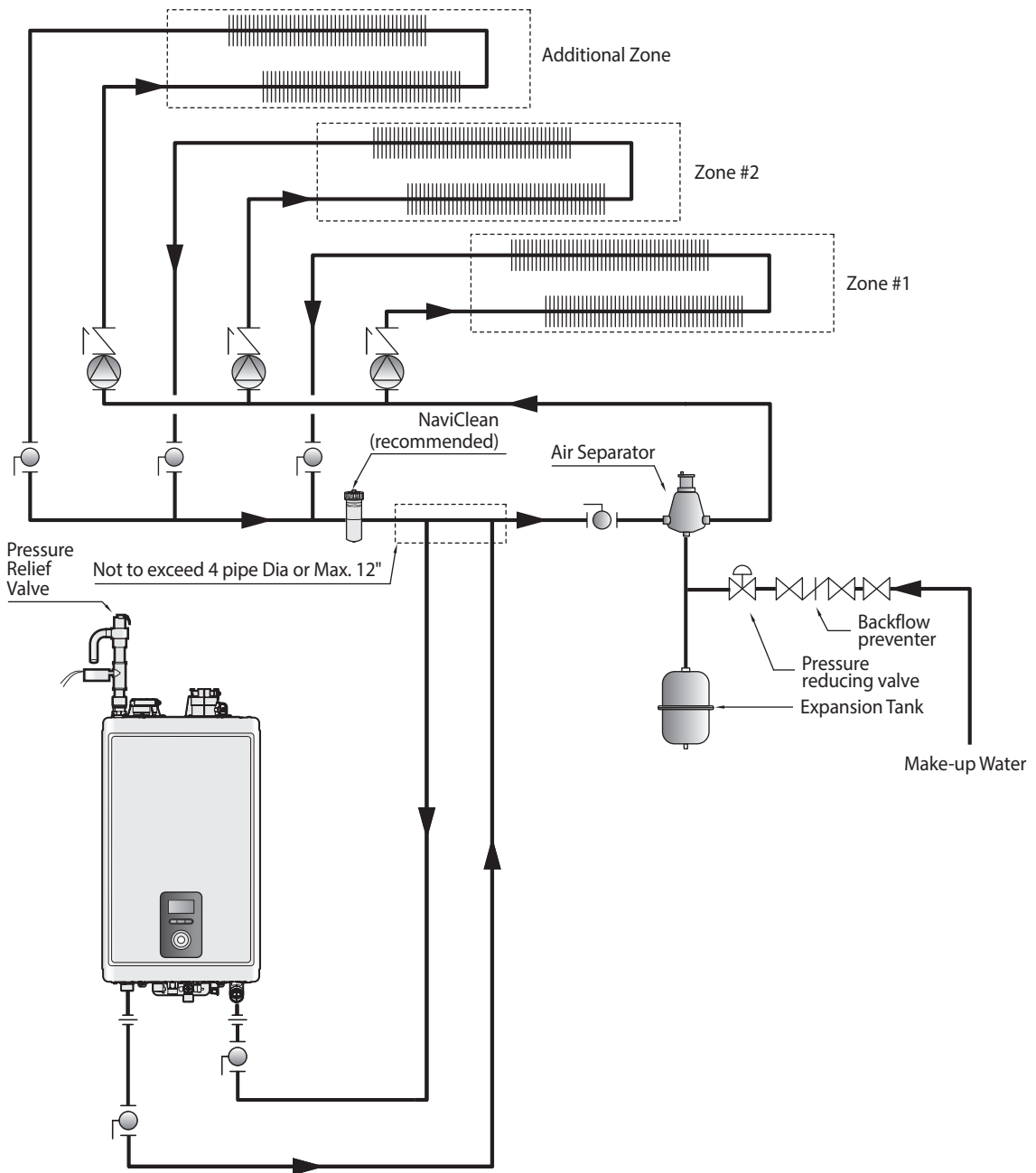
Refer to the following examples to properly implement a system for space heating, DHW supply, or both. These examples are provided to suggest basic guidelines when you install the boiler system. However, the actual installation may vary depending on the circumstances, local building codes, or state regulations.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



WARNING

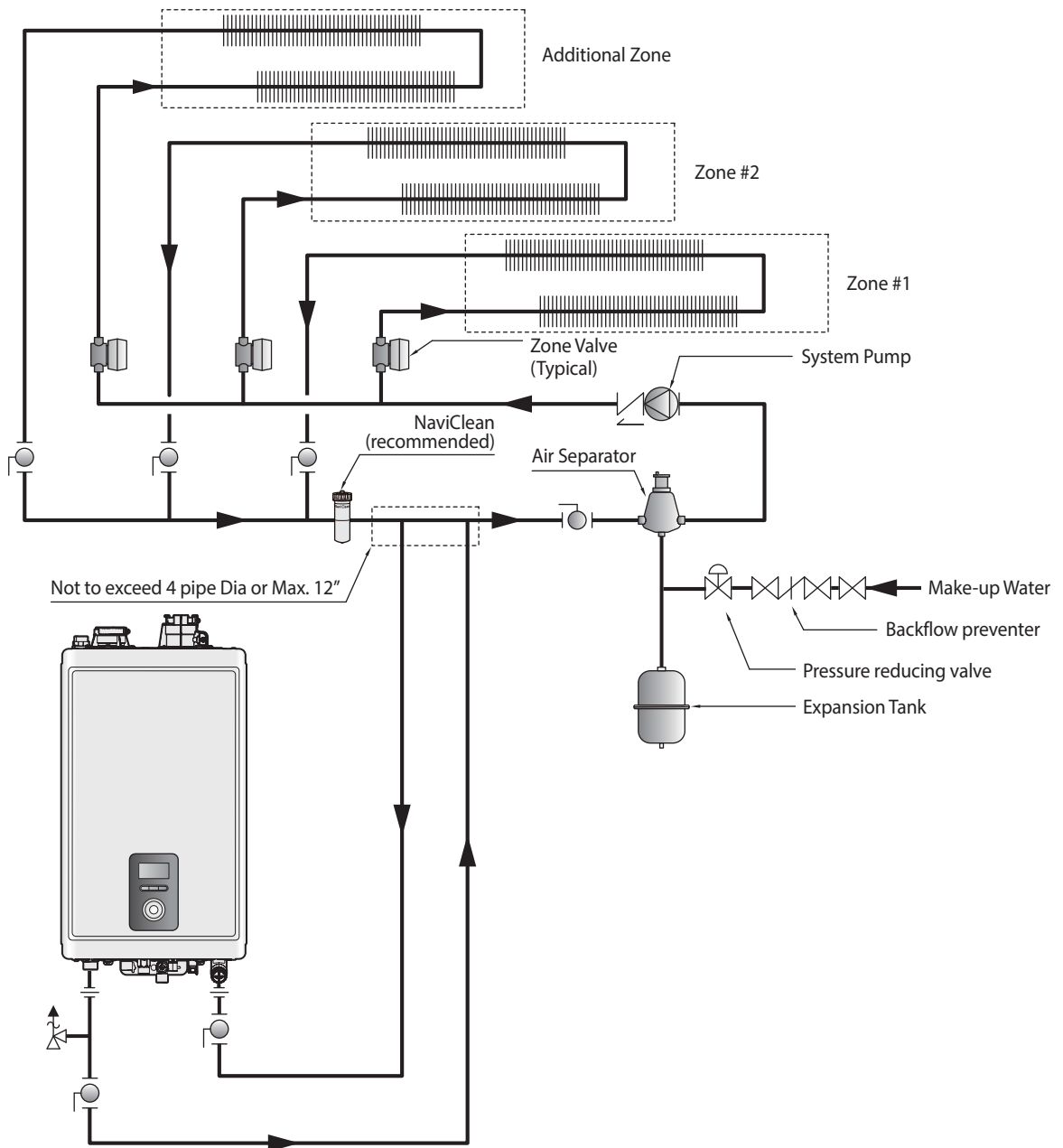
Ensure the power is turned off while making wiring connections. Boiler components or the boiler may fail and result in serious injury or death if power is supplied during wire connection. Product failures caused by incorrect installation are not covered by warranty.

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



- Note**
- System application drawings are intended to explain the system piping concept only.
 - Install a NaviClean 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 "3.4 Filling the System" on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
 - Use a pump with an integral check valve or install a check valve at the pump outlet.
 - Refer to "3.7.3 Wiring Diagram - Zone Pump System" on page 41 for wiring connections.

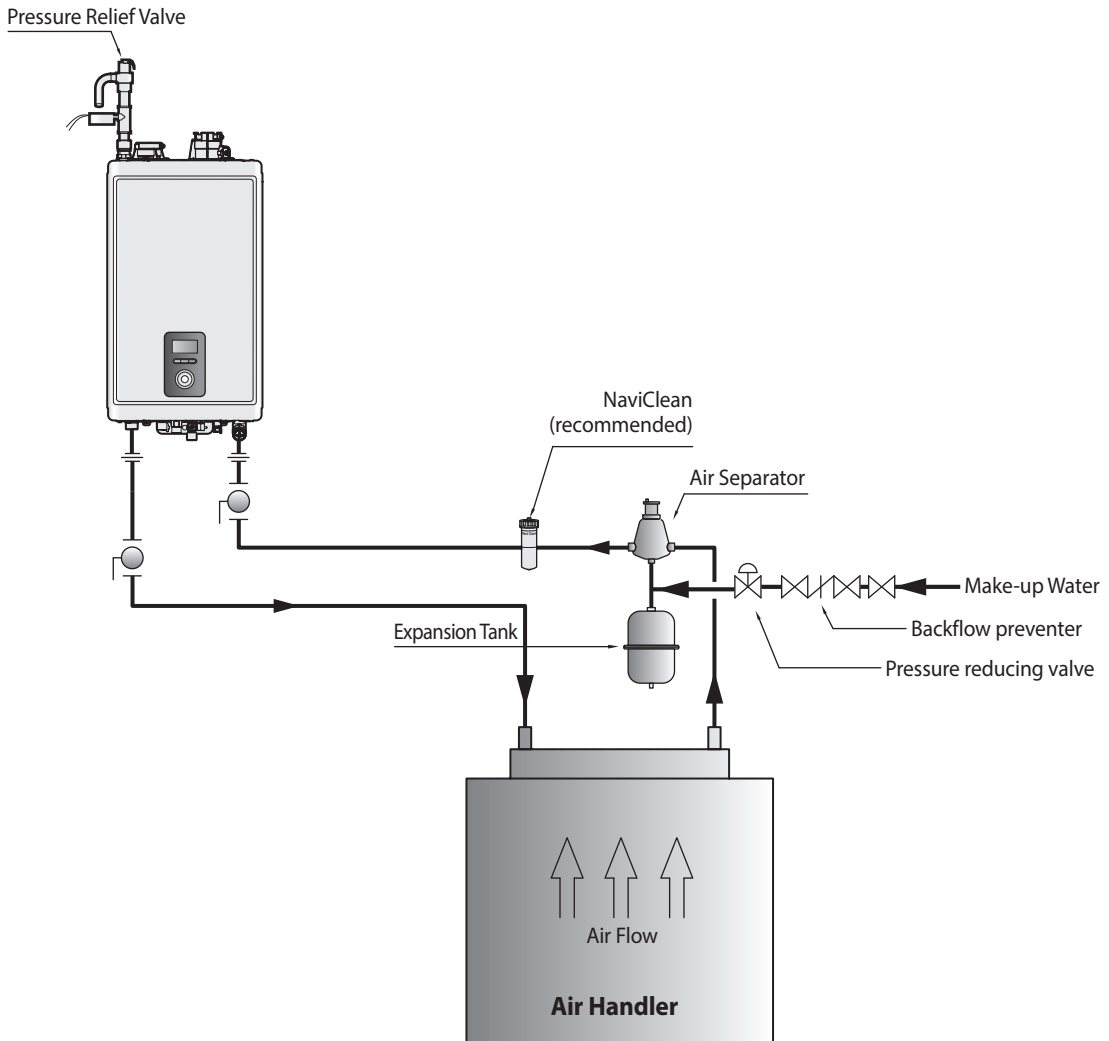
3.6.4 System Application - Zone System with Zone Valves (Primary/Secondary Piping)



Note

- System application drawings are intended to explain the system piping concept only.
- Install a NaviClean 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 "3.4 Filling the System" on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
- Use a pump with an integral check valve or install a check valve at the pump outlet.
- Refer to "3.7.5 Wiring Diagram - Zone Valve System" on page 45 for wiring connections.

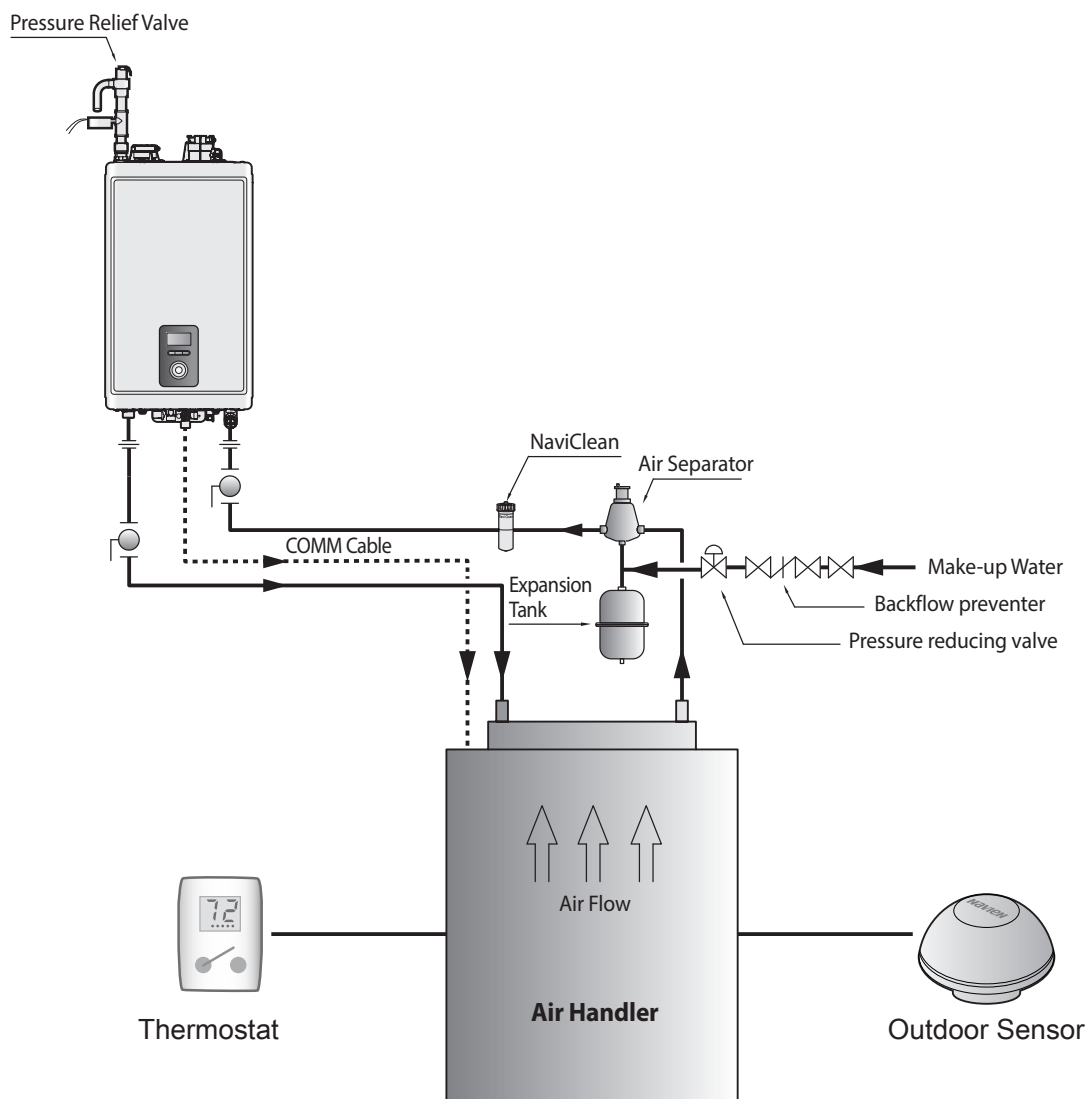
3.6.5 System Application - Air Handler System



Note

- System application drawings are intended to explain the system piping concept only.
- Install a NaviClean 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 “3.4 Filling the System” on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
- Air handlers with an internal pump shall be piped either with a crossover pipe at the AHU or in a primary/secondary configuration with the boiler.
- Refer to the “3.7.9 Wiring Diagram - Air Handler” on page 49 for wiring connections.
- You can use a secondary piping configuration for the air handler system to maintain optimal flow and heat capacity.

3.6.6 System Application - Air Handler System with RS-485 Communication



Note

- System application drawings are intended to explain the system piping concept only.
- Install a NaviClean 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 “3.4 Filling the System” on page 29 for make-up water connections and refer to the requirements of your local codes to ensure compliance.
- Air handlers with an internal pump shall be piped either with a crossover pipe at the AHU or in a primary/secondary configuration with the boiler.
- Refer to the “3.7.9 Wiring Diagram - Air Handler” on page 49 for wiring connections.
- You can use a secondary piping configuration for the air handler system to maintain optimal flow and heat capacity.
- This is for compatible air handlers only.

3.6.7 System Application - Combi Pre-Heat Mode

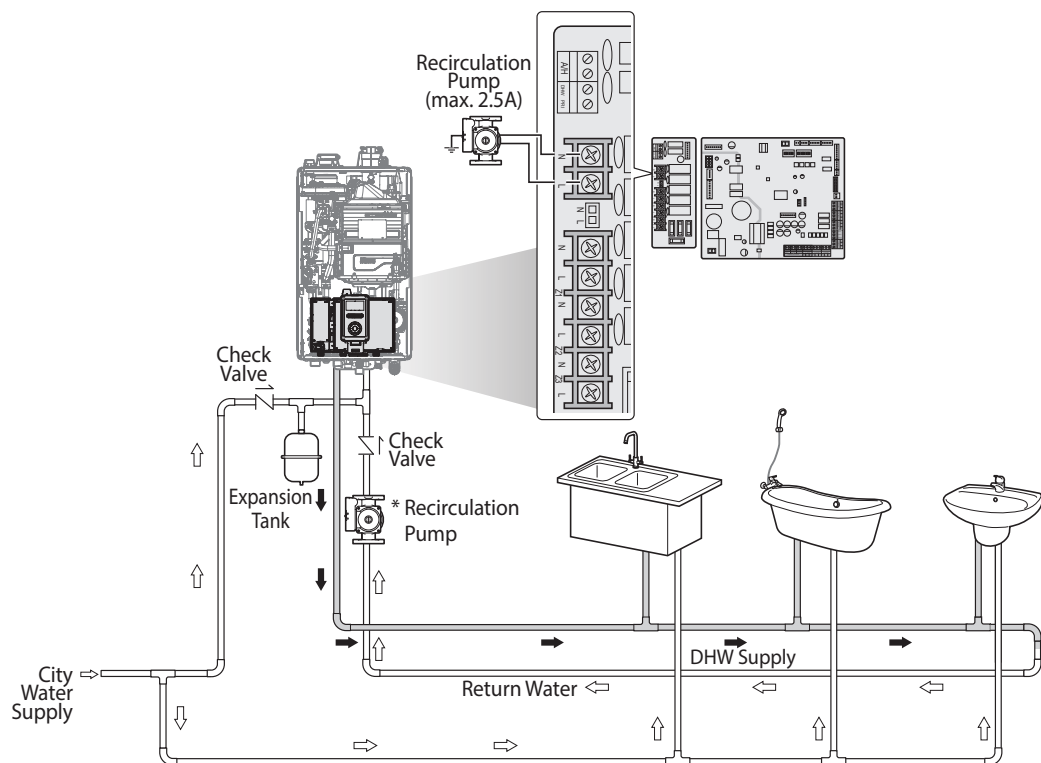
Combi pre-heat allows NCB-H boilers to pre-heat to ensure a quick supply of hot water when there is no external recirculation system. This mode is enabled by default. (Refer to the combi pre-heat section in "11.5.3 Setting the DHW Operation" on page 108 for details.)

3.6.8 External Recirculation with Dedicated Return Line (Always On, Weekly, Intelligent)

External Recirculation Mode

For best performance, select the intelligent or weekly option in the external recirculation DHW recirculation menu.

Note Combi pre-heat is the default mode for DHW recirculation. To select external recirculation, refer to the combi pre-heat and external recirculation sections in "11.5.3 Setting the DHW Operation" on page 108 for details.



* A Taco 008-BC6 or Grundfos 15-42 BUC7 (or equivalent) circulation pump is recommended for use with the NCB-H boiler and DHW recirculation systems.

* When using the external recirculation mode, observe the following maximum recirculation pipe lengths including fittings (3/4" pipe is recommended). Lengths in excess of these limits will require a larger recirculation pump.

Maximum Equivalent Copper Pipe Lengths		
Pipe Diameter	1/2"	3/4"
Maximum Pipe Length	100 ft (30 m)	400 ft (120 m)

Note If a dedicated return line is installed for external recirculation, the Always On, Weekly, and Intelligent modes can be used after installing a recirculation pump.

3.6.9 External Recirculation with HotButton and Dedicated Return Line (HotButton, Aquastat)

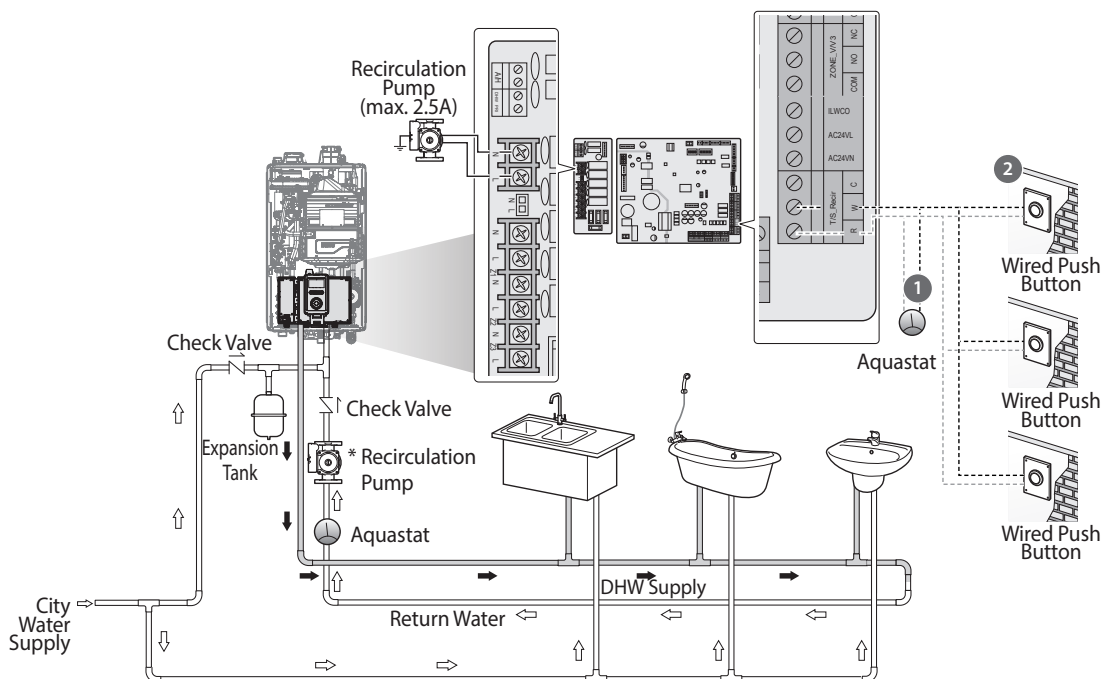
External Recirculation Mode

To use the aquastat mode, install an aquastat to the DHW pipe line and connect to the CNC6 terminal on the PCB. (Refer to "3.7.4 Wiring Diagram - Zone Pump System with DHW Recirculation" on page 43 for details.)

! CAUTION

The aquastat temperature must be set lower than the NCB-H boiler DHW set temperature.

Note Combi pre-heat is the default mode for DHW recirculation. To select external recirculation, refer to the combi pre-heat and external recirculation sections in "11.5.3 Setting the DHW Operation" on page 108 for details.



* A Taco 008-BC6 or Grundfos 15-42 BUC7 (or equivalent) circulation pump is recommended for use with the NCB-H boiler and DHW recirculation systems.

* When using the external recirculation mode, observe the following maximum recirculation pipe lengths including fittings ($\frac{3}{4}$ " pipe is recommended). Lengths in excess of these limits will require a larger recirculation pump.

Maximum Equivalent Copper Pipe Lengths		
Pipe Diameter	$\frac{1}{2}$ "	$\frac{3}{4}$ "
Maximum Pipe Length	100 ft (30 m)	400 ft (120 m)

- Note**
- To use HotButton mode, install a HotButton Push Button(s) and recirculation pump, but not an aquastat (1).
 - To use Aquastat mode, install an aquastat and recirculation pump, but not a HotButton (2).
 - The HotButton push buttons and wall plates are not included with the boiler, but are available for purchase.

3.7 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 abnormal and dangerous operation. Verify proper operation after servicing.

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

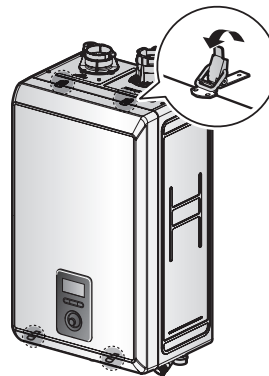
3.7.1 Accessing the Terminal Strips

DANGER

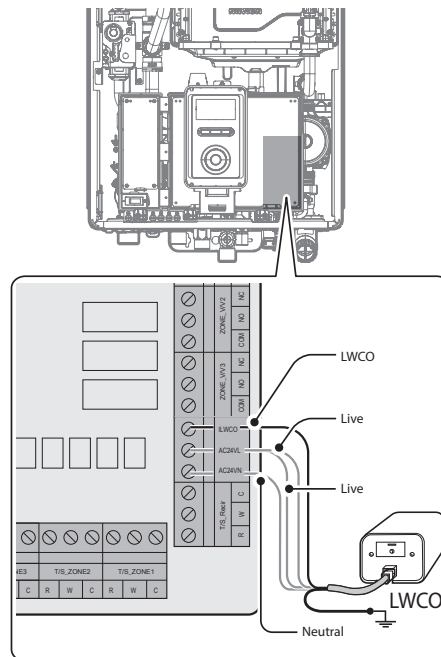
You must ensure that the boiler is disconnected from the electrical supply before carrying out any servicing inside the boiler and, particularly, on the electric terminal strips.

To access the PCB, carefully follow the steps below:

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

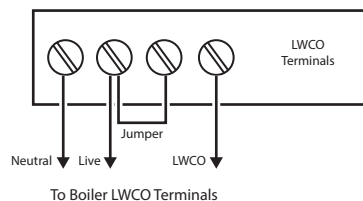


3.7.2 Wiring Diagram - External LWCO



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

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



Installation & Operation Manual

NCB-H Condensing Combi-Boilers

Getting Service

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

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

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

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

Version: 1.0 (November, 2020)



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