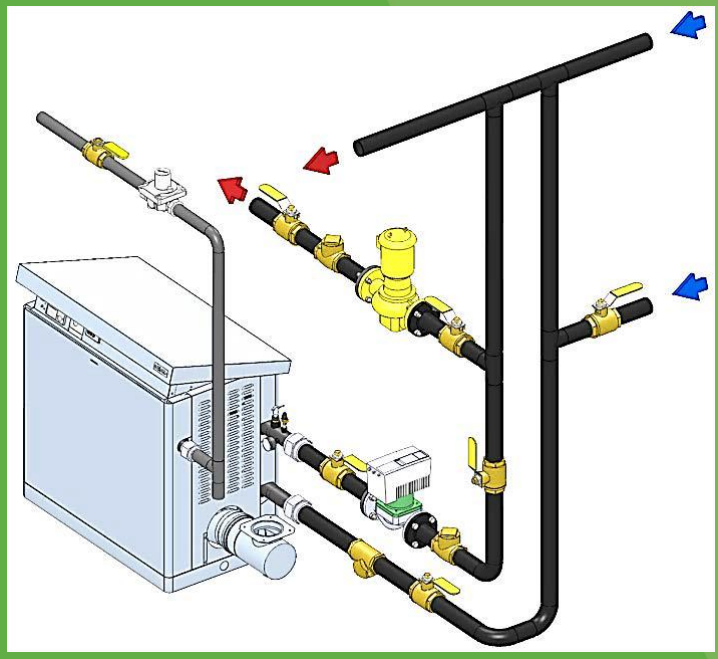
Technical Application Guide

Modulex EXT Series
Piping Application Guide

Modulating and Condensing Boilers

Applies to the following Modulex EXT Series models:

- MLX EXT 450 2S
- MLX EXT 600 2S
- MLX EXT 800 2S
- MLX EXT 1100 2S
- MLX EXT 1500 2S
- MLX EXT 2300 2S
- MLX EXT 2600 2S
- MLX EXT 3000 2S



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SECTION 1: MANDATORY REQUIREMENTS

The following actions are mandatory to ensure proper piping and drainage of the Modulex EXT system.

CAUTION!

Local codes and authorities must be consulted prior to installation.

- AERCO requires that the boiler loop to be de-coupled from the system loop. This can be achieved by one of the following:
  - Employing primary-secondary piping.
  - Installing a hydraulic separator between the boiler and the system loop.
  - Installing a heat exchanger (e.g. plate heat exchanger) between the boiler and the system loop. **If water treatment used in the system is not Aluminum compatible, the use of a heat exchanger between the system and the boiler piping is MANDATORY.**
- AERCO requires cleaning of the whole system and to fit a mandatory Y-strainer on the return pipe to the boiler, equipped with isolation valves (See Figure 13 through 20 at the end of this document).
- For boiler replacement installations, cleaning of the whole system is required before connecting the Modulex boiler (See Section 2.3 for Flushing, Treatment, and Cleansing tips and guidelines). Failure to clean a system will limit it from the full benefits offered by the high efficiency Modulex boiler.
- Boiler drain valve and condensate drain trap should be arranged to permit the fluids to drain freely, by gravity, to a convenient floor drain.
- For units installed in environments likely to experience freezing temperatures, it is necessary to ensure that the condensate line and exhaust manifold are equipped with suitable freeze protection, such as a heat trace line.
- Relief valve must be installed vertically in the top, side, or to a valveless header connected to the water supply outlet.
- Locate water supply and return fittings (i.e. unions, elbows, etc.) a minimum of 6 inches from the boiler fittings to prevent interference with the removal of the boiler panels and covers.
- All piping and electrical connections (i.e. service switches, conduit boxes, etc.) should be located at a minimum of 6 inches from the boiler panels and covers.
- For all outdoor applications, electrical connections must either be NEMA4 rated or protected by a suitable outdoor enclosure.
- See Table 1 (Section 3) for sizing guidelines for the mandatory primary pump and boiler strainer.
- A discharge pipe must be used and must not have an internal cross-sectional area less than the outlet of the relief valve.
- The discharge pipe must be installed so that there will be no danger of scalding to the boiler attendants. See Figure 1, below, for a discharge pipe example on the Modulex boiler.
- The relief valve point of discharge piping must have provisions for proper drainage.

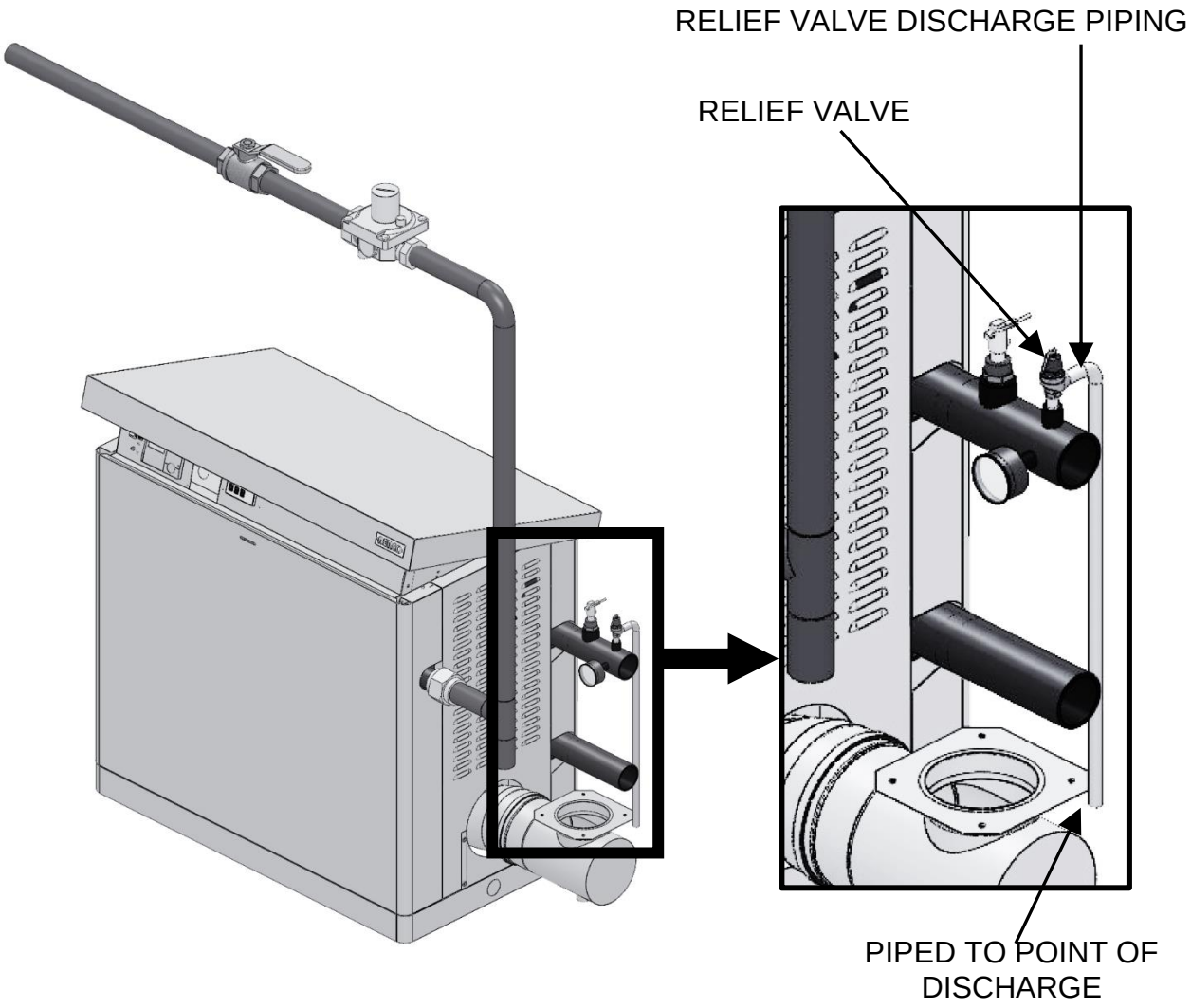


Figure 1: Relief Valve Point of Discharge Example

SECTION 2: BOILER QUALITY AND MAINTENANCE

2.1. BOILER WATER CHEMISTRY

2.1.1. Reaction of Metals to Water Chemistry

A neutral water pH must be maintained because, although the aluminum alloys used in the construction of Modulex EXT boilers resist acidic conditions, they are still vulnerable to highly alkaline environments (pH of 9.0 and above). **THE WATERSIDE pH MUST BE MAINTAINED BETWEEN 6.5 and 8.0.**

Metals such as aluminum, steel, iron, and copper used in hydronic heating systems are highly reactive to acidic and alkaline environments; the water must be treated with protectants and buffers to prevent corrosion. Most chemical water treatments have been developed to protect an array of metals.

2.1.2. Scale and Corrosion

Free oxygen can cause the formation of rust (iron oxides), which degrade metallic materials. Magnetite is formed in un-inhibited water if there is electrolytic action in the presence of oxygen. Sludge is formed when calcium compounds, primarily CaCO3, are heated. Rust and magnetite, when combined with sludge, can form a very hard scale, which significantly reduces system efficiency and life expectancy of the heating system. Scale reduces heat exchange due to its low heat conductivity and so may cause very dangerous localized overheating. Waterside corrosion of all heating circuit surfaces is also a major concern.

2.1.3. Make-up or Feed Water Quality

Make-up or feed water is water added to a closed hydronic system to replenish water lost through evaporation, maintenance, or leakage. The quality of make-up or feed water, which may contain dissolved oxygen, minerals and other dissolved contaminants, is extremely important. Such introduced water must be chemically treated or strictly limited when ensuring neutral chemical conditions in boiler system water. Generally, any closed hydronic heating system should be restricted from receiving untreated makeup water of no more than 5% of the total volume of system water per year. Reverse osmosis, deionized, distilled or mineral treated water should not be used.

2.1.4. Treating Water to Prevent Freezing

When using anti-freeze solutions, their compatibility with the AERCO Modulex aluminum heat exchanger and other components of the heating system must be determined prior to use. **TRADITIONAL HVAC PROPYLENE GLYCOL IS NOT SUITABLE FOR ALUMINUM HEAT EXCHANGERS: the pH of glycol at various dilutions is in excess of 9.5, whereas the pH must be within 6.5 and 8.0 for use with aluminum.** There are several suitable aluminum safe propylene glycols available that can provide the same levels of burst, freeze and corrosion inhibiting protection as traditional propylene glycols. Consult Section 2.3 for recommendations on glycol solutions. If a glycol solution is used as anti-freeze protection, a backflow preventer must be installed upstream of the fill/makeup valve.

Only virgin glycol should be used for systems requiring freeze protection, and it must be treated with an inhibitor compatible with the particular chemical treatment being used in the system. Note that glycol must be changed from time to time due to its limited useful life.

2.1.5. Water Treatment Certification

When using chemical treatments in hydronic systems, it is necessary to ensure that the chosen treatment is appropriate and certified by the manufacturer for such environments. The manufacturer should also guarantee that the treatment, when applied according to the manufacturer's recommendations, will not

cause harm to the boiler, pumps, piping, and other components of the hydronic boiler system.

2.2. TESTING AND MAINTENANCE OF WATER QUALITY

Water in the installation should be checked, monitored, and treated for the following:

- **Hardness** – High hardness of the available water is measured in grains of hardness and indicates the quantity of minerals (mostly calcium and magnesium) which are dissolved in the water. Hardness substantially contributes to the formation of scaling, which is highly undesirable. The total hardness must be less than 200 ppm (11.7 grains/gallon).
- **Artificial Softness** – Do NOT use artificially softened water. Artificial softening agents generally use salt, which creates a chloride water chemistry, a major contributor to the corrosion of the types of metals used in hydronic systems. Elevated salt levels also contribute to higher conductivity levels, another undesirable characteristic in hydronic systems.
- **Chloride** – Chloride salts result from the combination of chlorine gas with a metal and are instrumental in accelerating corrosion in the types of metals used in hydronic systems. Chlorides may be introduced into the water naturally. Concentrations of chlorides in system water should be less than 150 ppm.
- **Conductivity** – Dissolved metals and minerals increase the conductivity of water and indicate not only the presence of undesired corrosive agents, but also contribute to the transfer and migration of ions and charged particles in the water that contribute to fouling of sensors, valves, and other devices used in the system. Additionally, high conductivity contributes to galvanic corrosion, in which one metal will preferentially corrode when in contact with another type of metal, when both are in contact with an electrolyte. Conductivity should be less than 3000 µS.
- **pH** – The pH, a measure of the acidic, neutrality, and alkalinity of the water, **MUST ALWAYS BE WITHIN 6.5 AND 8.0 FOR BOILERS USING ALUMINUM ALLOYS**, such as the Modulex boiler system.
- **Oxygen** – All precautions should be taken to avoid the formation and localization of oxygen in the water of a heating system. Water that is low in minerals (soft water) absorbs oxygen much more readily than mineralized (hard) water. For this reason it is necessary that in heating systems using floor radiant heating, the plastic pipes used be impermeable to oxygen.
- **Scale and Corrosion** – The use of an inhibitor is advisable to treat feed and make-up water and to protect heating systems against scale, corrosion and microbiologic growth. To prevent freezing, an anti-freezing agent is advisable. Qualified companies can also provide boiler de-scaling.
- **Total Solids** – preferably less than 500 ppm, but a requirement of less than 1000 ppm.
- Water treatment is also advisable in the following cases:
    - Very large heating systems
    - High quantities of replenished water due to leakages or maintenance work

2.3. SYSTEM FLUSHING, TREATMENT, AND CLEANSING

Note that prior to cleaning the heating system, **the boiler MUST be isolated from the piping to prevent infusion of containments, including sludge, into the boiler**. Section 2.3 provides recommendations for flushing, cleaning, and treating the water used in the Modulex EXT boiler system.

IMPORTANT!

Cleaning solution and inhibitors used must be compatible with heat exchanger material. Corrosion/scale inhibitor will be ineffective if added to a dirty system; therefore, it is very important to clean the system first.

Water treatments used must be compatible with EPDM gaskets used in the Modulex Boiler. (EPDM = Ethylene Propylene Diene Manomer).

AERCO recommends the following cleaning solution, inhibitor, and antifreeze products. Visit www.aerco.com for Product Fact sheet and Material Safety Data Sheets:

- **Water Quality Testing — X100 Quick Test Kit**
  Part number 99152-1
- **Corrosion/Scale Inhibitor — Sentinel X100 Liquid Inhibitor**
  4 x 1 gallon case – part number 99153-2
  5 gallon jug – part number 99153-1
- **Boiler Noise Reducer — Sentinel X200 Liquid Noise Inhibitor**
  4 x 1 gallon case – part number 99154-2
  5 gallon jug – part number 99154-1
- **System Cleaner — Sentinel X300 Liquid System Cleaner**
  4 x 1 gallon case – part number 99199-2
  5 gallon jug – part number 99199-1
- **Cleaning solution — Sentinel X400 Liquid System Restorer**
  4 x 1 gallon case – part number 99155-2
  5 gallon jug – part number 99155-1
- **Antifreeze — Sentinel X500 Liquid Inhibited Antifreeze**
  5 gallon jug – part number 99156-1
  55 gallon jug – part number 99156-2
  275 gallon tote – part number 99156-3

When cleaning, treating, and maintaining, a heating system, consult a qualified professional. The following are AERCO's tips/guidelines for cleaning a heating system – these do NOT take precedence over detailed instructions from qualified professionals.

2.3.1. System Flushing Recommendations

- Use an appropriate amount of cleaning solution, carefully following the manufacturer's instructions. Follow the manufacturer's recommendations when introducing cleaning agents into the system.
- Ensure that the cleaning solution is circulated thoroughly in the system.
- Flush the system thoroughly to remove the maximum amount of contaminants. When emptying the system, make sure it is done as quickly as possible using all drain off points and ensuring all low lying pipework is fully drained. Opening all bleed valves ensures the system will be completely emptied.

- A reliable test to determine if a system is clean is if the Total Dissolved Solids (TDS) of the water being drained is within 10% of the make-up water TDS. This indicates that sufficient contamination has been flushed from the system. If the difference in TDS is more than 10%, repeat the cleaning process until that is achieved. A turbidity test can be used as an alternate way to determine if a system is clean.
- For boiler retrofit/replacement installation, repeat the cleaning process until the draining water is clear. Once clear, the above TDS comparison (or a turbidity test) should be performed.
- If a flushing machine is used in the cleaning process, carefully follow the manufacturer's instructions. If the flushing machine is designed to flush individual zones, the TDS comparison must be made between each zone and the make-up water, or the turbidity test performed for each zone.
- Add corrosion and scale inhibitor after the system has been declared clean, using the appropriate amount recommended by the manufacturer. Introduce the Multi-Metal protector/scale inhibitor to the system following the manufacturer's instructions. Adding inhibitor to a dirty system reduces its effectiveness. It is better to add more inhibitor (exceed the recommended amount) than less.

When refilling the system, ensure the boiler is not air-bound by opening the pressure-relief valve on the rear of the boiler. Leave the relief valve open until a steady flow of water is observed. Close the valve and finish filling the system.

2.3.2. Water Quality Maintenance and Boiler Warranty

Heat exchanger failures due to improperly cleaned/treated and poorly maintained water are not covered under warranty. Scheduled system/boiler water maintenance is required to maintain the heat exchanger warranty. AERCO shall reserve the right to require maintenance records when evaluating warranty claims.

2.3.3. Water Treatment Certification

When using chemical treatments in hydronic systems, it is necessary to ensure that the chosen treatment is appropriate and certified by the manufacturer for such environments. The manufacturer should also guarantee that the treatment, when applied according to the manufacturer's recommendations, will not cause harm to the boiler, pumps, piping, and other components of the hydronic boiler system.

2.3.4. Water Treatment Analysis and Scheduling

The proper mixture of water, chemical treatment, and glycol (if used) should be ascertained based on a sample of the system water and the make-up water. Your local water treatment company, or one of the manufacturers listed below, may analyze your sample. Adjust the chemical composition of your system water based on the analysis. After this initial analysis, the chemical composition of your system water should be tested at the beginning of each heating season. For boilers operating year round, this analysis should be made at least twice a year.

2.3.5. Hydronic System Water Testing and Treatment Resources

On the internet at www.awt.org, you may find a listing of water treatment firms and manufacturers of chemical treatments developed for use in multi-metal hydronic systems. Click on the "Find a Water Treater" button to access this list.

Below is a list of companies providing water treatment systems certified as safe for use in multi-metal hydronic systems, including aluminum boilers. Contact any of the individuals listed for more information.

Fernox
Hydronic Agencies Ltd.
Sean Leonard
Edmonton, AB, CANADA
Phone: (780) 452-8661
Toll Free: (877) FERNOX4U
(877-337-6694)
Fax: (780) 488-2304
sales@hydronicagencies.com
www.hydronicagencies.com

Fernox USA
Cookson Electronics
Brian Conrad
Altoona PA
Phone: (814) 946-1611
Toll Free (800) 289-3797
Fax: (814) 944-8094
fernox_americas@cooksonelectronics.com
www.fernox.com

H-O-H Water Technology, Inc.
Steve Sadowski
Greendale, WI
Phone: (414) 421-2070,
Toll Free: (800) 944-9746
Fax: (414) 421-2077
ssadowski@hohwatertechnology.com
www.hohwatertechnology.com

Rhomar Water Management, Inc.
Dwight Hedgepeth
Springfield, MO
Phone: (417) 862-2600,
Toll Free: (800) 543-5975
Fax: (417) 862-6410
peggy@rhomarwater.com
www.rhomarwater.com

SECTION 3: BOILER LOOP DESIGN GUIDELINES

For proper and safe operation of the water tube Modulex boiler, the primary (boiler) loop piping and the associated fittings and accessories must be designed/selected as discussed in the following sections. **Table 1** shows the required minimum flow rates at various system designed temperature rises. Also shown are pressure drops through strainers typically needed in the boiler loop (see **paragraph 4.2** for strainer requirement details).

The following primary/secondary piping design guidelines should be used for AERCO Modulex Boiler installations. The data was calculated based upon systems with Return Water Temperatures above 80°F. A 20 mesh strainer (or finer) is required at each boiler inlet. Water flow rates and pressure drops shown below are for the boiler loop. Boiler water flow rates vary with system design parameters. **The boiler loop fittings and strainer pressure drops shown below are examples only – actual pressure drops will vary depending on actual piping layout and strainer size/type used.**

3.1. Flow Rate & Pressure Drops: Models EXT 450 2S, 600 2S, 800 2S & 1100 2S

TABLE 1.1: Light Commercial: 50° F ΔT Water Flow

50°F ΔT Water Flow	EXT 450 2S	EXT 600 2S	EXT 800 2S	EXT 1100 2S
Water Flow (GPM) @ **Max. ΔT of 50°F**	18	24	30	41
Water Pressure Drop (Ft. of Hd.) across Boiler @ 50°F ΔT Flow	2.1	1.7	1.6	1.8
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	0.50	0.89	0.41	0.80
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve)	0.81	1.47	0.65	1.23
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 50°F	**3.44**	**4.09**	**2.67**	**3.82**
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	1-1/2"	1-1/2"	2"	2"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	99127-1	99127-1	99127-2	99127-3
Kit includes: Pump Flange Size	1-1/2"	1-1/2"	1-1/2"	2"
Kit includes: Circuit Setter Size (NPT)	1-1/2"	1-1/2"	2"	2"

TABLE 1.2: Light Commercial: 40° F ΔT Water Flow				
40°F ΔT Water Flow	**EXT 450 2S**	**EXT 600 2S**	**EXT 800 2S**	**EXT 1100 2S**
Water Flow @ **40°F ΔT** G = Gallons per Min	22	30	37	52
Water Pressure Drop (Ft. of Hd.) across Boiler @ 40°F ΔT Flow	3.3	2.6	2.6	2.7
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	0.78	0.41	0.64	1.26
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve)	1.30	0.65	1.01	1.89
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 40°F	5.35	3.69	4.22	5.89
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	1-1/2"	2"	2"	2"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	99127-1	99127-2	99127-2	99127-3
Kit includes: Pump Flange Size	1-1/2"	1-1/2"	1-1/2"	2"
Kit includes: Circuit Setter Size (NPT)	1-1/2"	1-1/2"	2"	2"

TABLE 1.3: Light Commercial: 30° F ΔT Water Flow				
30°F ΔT Water Flow	**EXT 450 2S**	**EXT 600 2S**	**EXT 800 2S**	**EXT 1100 2S**
Water Flow (GPM) @ **30°F ΔT**	30	39	49	69
Water Pressure Drop (Ft. of Hd.) across Boiler @ 30°F ΔT Flow	5.7	4.6	4.6	4.8
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	0.41	0.73	1.14	1.09
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve). NOTE: Reducing coupling not applied to MLX-909 and MLX-1060 because boiler line size is already 2-1/2"	0.65	1.12	1.70	1.24
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 30°F	**6.8**	**6.43**	**7.47**	**7.10**
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	2"	2"	2"	2-1/2"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	**99127-2**	**99127-3**	**99127-3**	**99127-4**
Kit includes: Pump Flange Size	1-1/2"	2"	2"	2"
Kit includes: Circuit Setter Size (NPT)	2"	2"	2"	2-1/2"

TABLE 1.4: Light Commercial: 20° F ΔT Water Flow				
20°F ΔT Water Flow	**EXT 450 2S**	**EXT 600 2S**	**EXT 800 2S**	**EXT 1100 2S**
Water Flow (GPM) @ **Min. ΔT of 20°F**	42	56	71	99
Water Pressure Drop (Ft. of Hd.) across Boiler @ 20°F ΔT Flow	11.8	9.2	9.7	9.5
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	0.92	0.80	1.26	2.46
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve). NOTE: Reducing coupling not applied to MLX-909 and MLX-1060 because boiler line size is already 2-1/2"	1.49	0.91	1.49	2.71
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 20°F	**14.19**	**10.91**	**12.41**	**14.71**
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	2"	2-1/2"	2-1/2"	2-1/2"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	**99127-3**	**99127-4**	**99127-4**	**99127-5**
Kit includes: Pump Flange Size	2"	2"	2"	1-1/2"
Kit includes: Circuit Setter Size (NPT)	2"	2-1/2"	2-1/2"	2-1/2"

3.2. Flow Rate & Pressure Drops: Models EXT 1500 2S, 2300 2S, 2600 2S & 3000 2S

TABLE 2.1: Commercial: 50° F ΔT Water Flow				
50°F ΔT Water Flow	**EXT 1500 2S**	**EXT 2300 2S**	**EXT 2600 2S**	**EXT 3000 2S**
Water Flow (GPM) @ **Max. ΔT of 50°F**	56	84	99	113
Water Pressure Drop (Ft. of Hd.) across Boiler @ 50°F ΔT Flow	2.6	3.3	3.6	3.0
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	0.29	0.64	0.29	0.37
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve)	0.41	0.91	0.33	0.433
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 50°F	**3.32**	**4.83**	**4.22**	**3.75**
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	3"	3"	4"	4"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	**99127-6**	**99127-7**	**99127-7**	**99127-7**
Kit includes: Pump Flange Size	2"	3"	3"	3"
Kit includes: Circuit Setter Size (NPT)	2-1/2"	3"	3"	3"

TABLE 2.2: Commercial: 40° F∆T Water Flow				
40°F ΔT Water Flow	**EXT 1500 2S**	**EXT 2300 2S**	**EXT 2600 2S**	**EXT 3000 2S**
Water Flow (GPM) @ **Max. ΔT of 40°F**	70	106	123	141
Water Pressure Drop (Ft. of Hd.) across Boiler @ 40°F ΔT Flow	3.6	4.9	5.2	4.6
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	0.45	1.00	0.45	0.58
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve)	0.63	1.42	0.50	0.66
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 40°F	**4.69**	**7.35**	**6.20**	**5.83**
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	3"	3"	4"	4"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	**99127-7**	**99127-7**	**99208-3**	**99208-3**
Kit includes: Pump Flange Size	3"	3"	3"	3"
Kit includes: Circuit Setter Size (NPT)	3"	3"	3"	3"

TABLE 2.3: Commercial: 30° F∆T Water Flow				
30°F ΔT Water Flow	**EXT 1500 2S**	**EXT 2300 2S**	**EXT 2600 2S**	**EXT 3000 2S**
Water Flow (GPM) @ **Max. ΔT of 30°F**	94	141	164	188
Water Pressure Drop (Ft. of Hd.) across Boiler @30°F ΔT Flow	5.2	9.5	9.8	8.5
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	0.79	1.79	0.79	1.04
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve)	1.12	3.81	0.88	1.15
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 40°F	**7.17**	**15.11**	**11.52**	**10.72**
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	3"	3"	4"	4"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	**99127-7**	**99208-5**	**99208-5**	**99208-6**
Kit includes: Pump Flange Size	3"	3"	3"	3"
Kit includes: Circuit Setter Size (NPT)	3"	3"	3"	3"

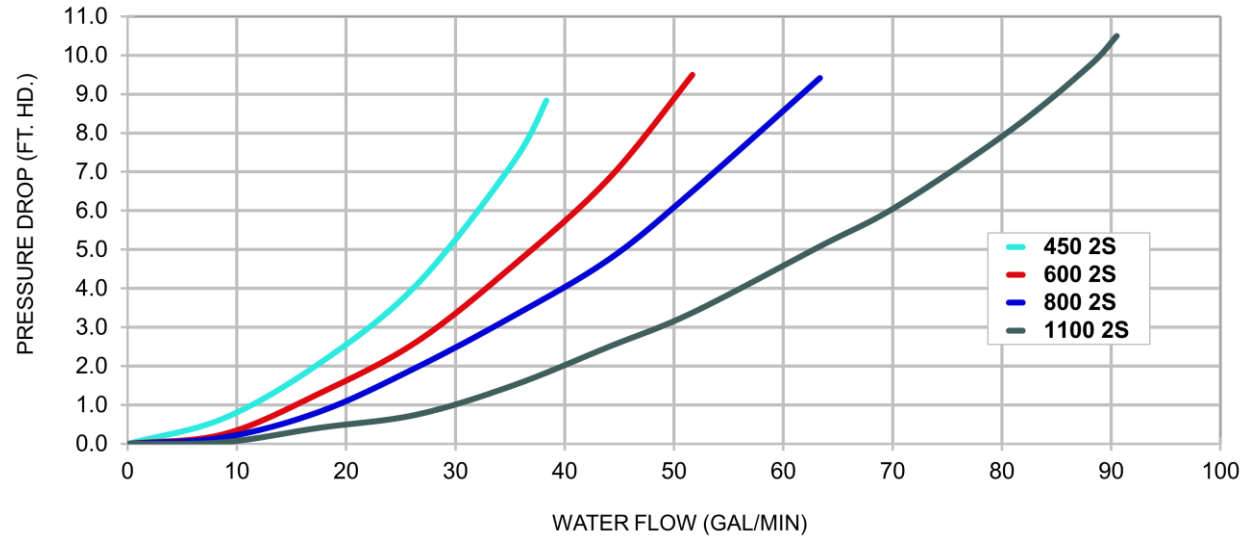
TABLE 2.4: Commercial: 25° F ΔT Water Flow				
25°F ΔT Water Flow	**EXT 1500 2S**	**EXT 2300 2S**	**EXT 2600 2S**	**EXT 3000 2S**
Water Flow (GPM) @ **Max. ΔT of 25°F**	113	169	197	225
Water Pressure Drop (Ft. of Hd.) across Boiler @20°F ΔT Flow	7.9	16.4	17.7	13.1
Strainer ΔP (Ft. of Hd.) – ('Y' Strainer, 20 mesh)	1.14	2.57	1.14	1.49
ΔP (Ft. of Hd.) – (20' SCH.40, 4 x 90°, 2 x reducing couplings, 2 x Ball Valve)	2.27	4.97	1.79	2.31
Total Primary Loop ΔP (Ft. of Hd.) @ ΔT of 25°F	**11.28**	**23.95**	**20.65**	**16.92**
Strainer, Pipes, Valves and Fittings Sizes used to estimate ΔP for above piping configurations	3"	3"	4"	4"
Recommended AERCO Pump + Circuit Setter Kit for piping configurations not exceeding the above example	**99208-4**	**99208-7**	**99208-7**	**99208-7**
Kit includes: Pump Flange Size	3"	3"	3"	3"
Kit includes: Circuit Setter Size (NPT)	3"	3"	3"	3"

3.3. PRIMARY PUMP

The primary pump shall have a discharge pressure able to assure the designed water flow rate, taking into account pressure drop losses as shown in Figure 2. When selecting a pump, take into account the pressure drop across the boiler, fittings, accessories and piping. The primary pump electrical connection shall be made at terminals A10 and N as shown in Figure 3.

Pumps shall be calculated by installers or engineers according to boiler and system parameters. The waterside resistance curve of the boiler is shown in Figure 2. The pump is not an integral part of the boiler.

NOTE: Select the pump flow rate so that the boiler water outlet temperature is 190°F (87.8°C) or below.



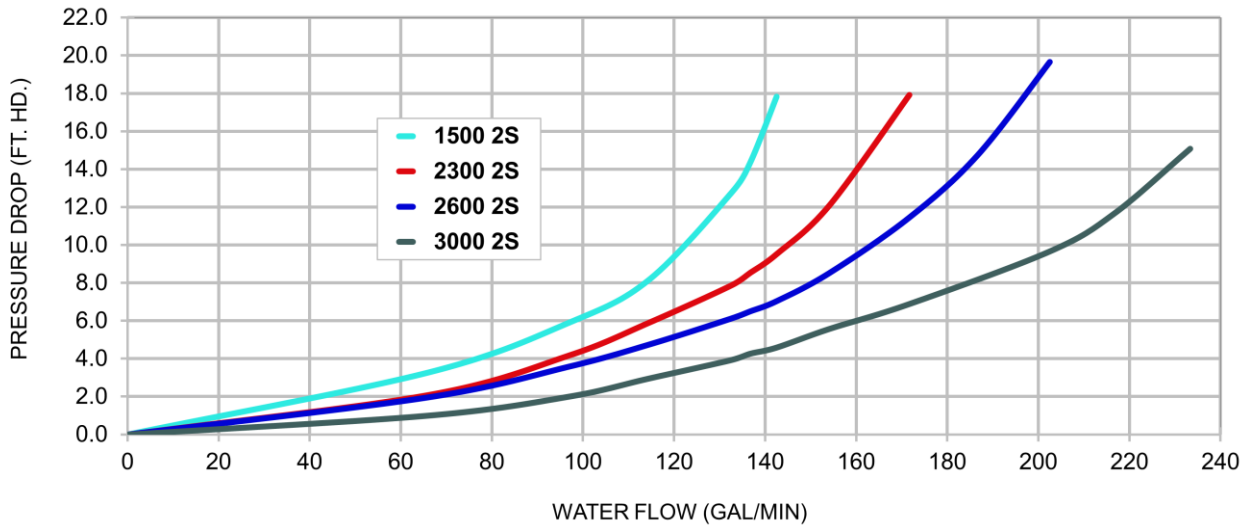


Figure 2: Water Side Pressure Loss Charts

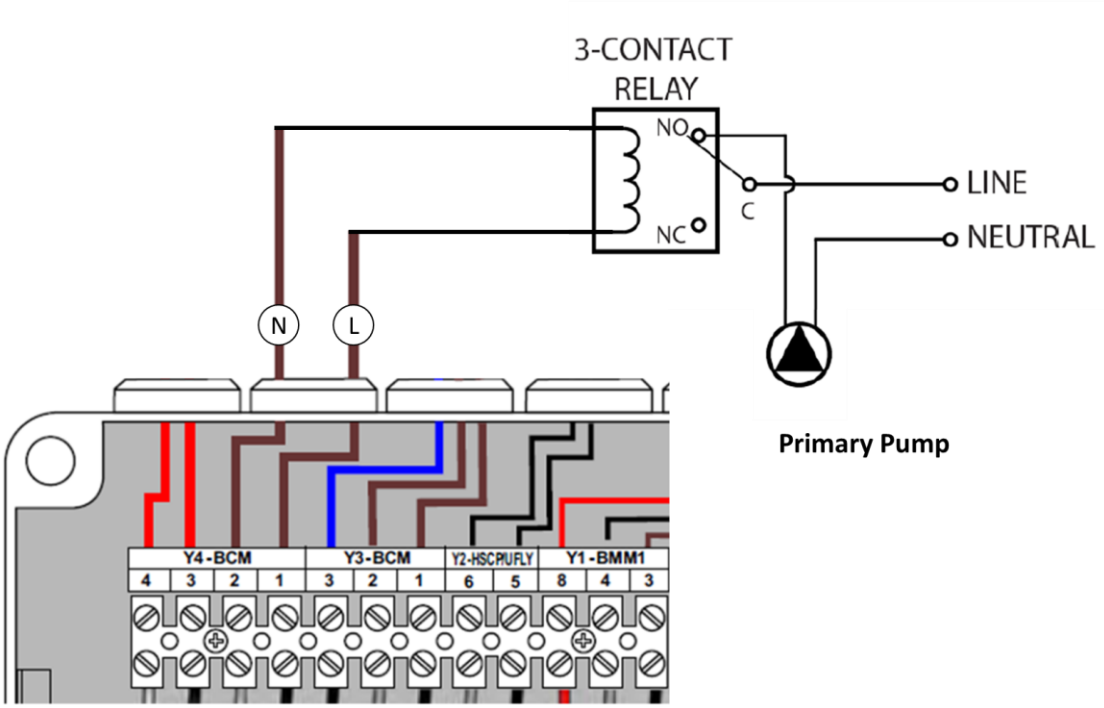


Figure 3: Electrical Connection of Primary Pump

WARNING!
There is 120 VAC between terminals **Y4-1** and **Y4-2** whenever the boiler is ON.

3.4. STRAINERS

AERCO requires the installation of a Y strainer to keep dirt out of the system and boiler. The strainer should be installed in the return piping with isolation valves to allow for cleaning as necessary. The Y strainer shall have a 20 mesh or finer strainer. Such filter shall protect the boiler from heating system dirt. It should be regularly cleaned to prevent problems.

3.5. ISOLATION VALVES

It is MANDATORY that ball or other type of shut-off valves be installed in the system supply and return piping to isolate the boiler if necessary. In this case the boiler can be disconnected or drained without having to drain the whole system.

WARNING!
NEVER bypass safety devices, such as safety valves and expansion vessels.

3.6. AIR VENTING OF THE HEATING SYSTEM

The Modulex boiler comes standard with an automatic air vent inside the boiler (see Figure 4a and 4b). This vent is for the boiler only and not the entire heating system. An effective air vent for air removal for the entire heating system must be installed in the highest point of the system piping.

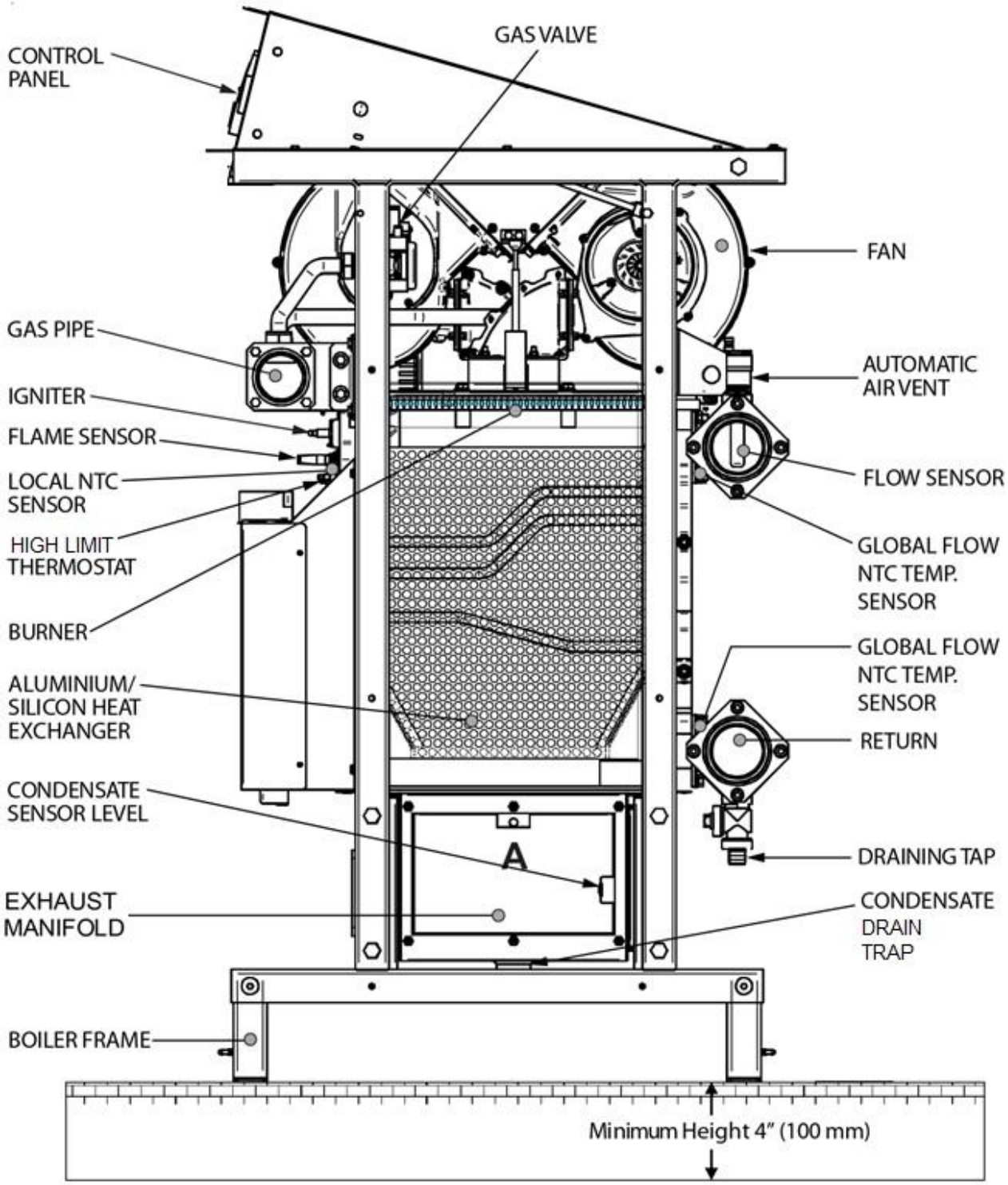


Figure 4a: MODULEX EXT Main Components (Right Side View) (EXT 450 2S - 1100 2S))

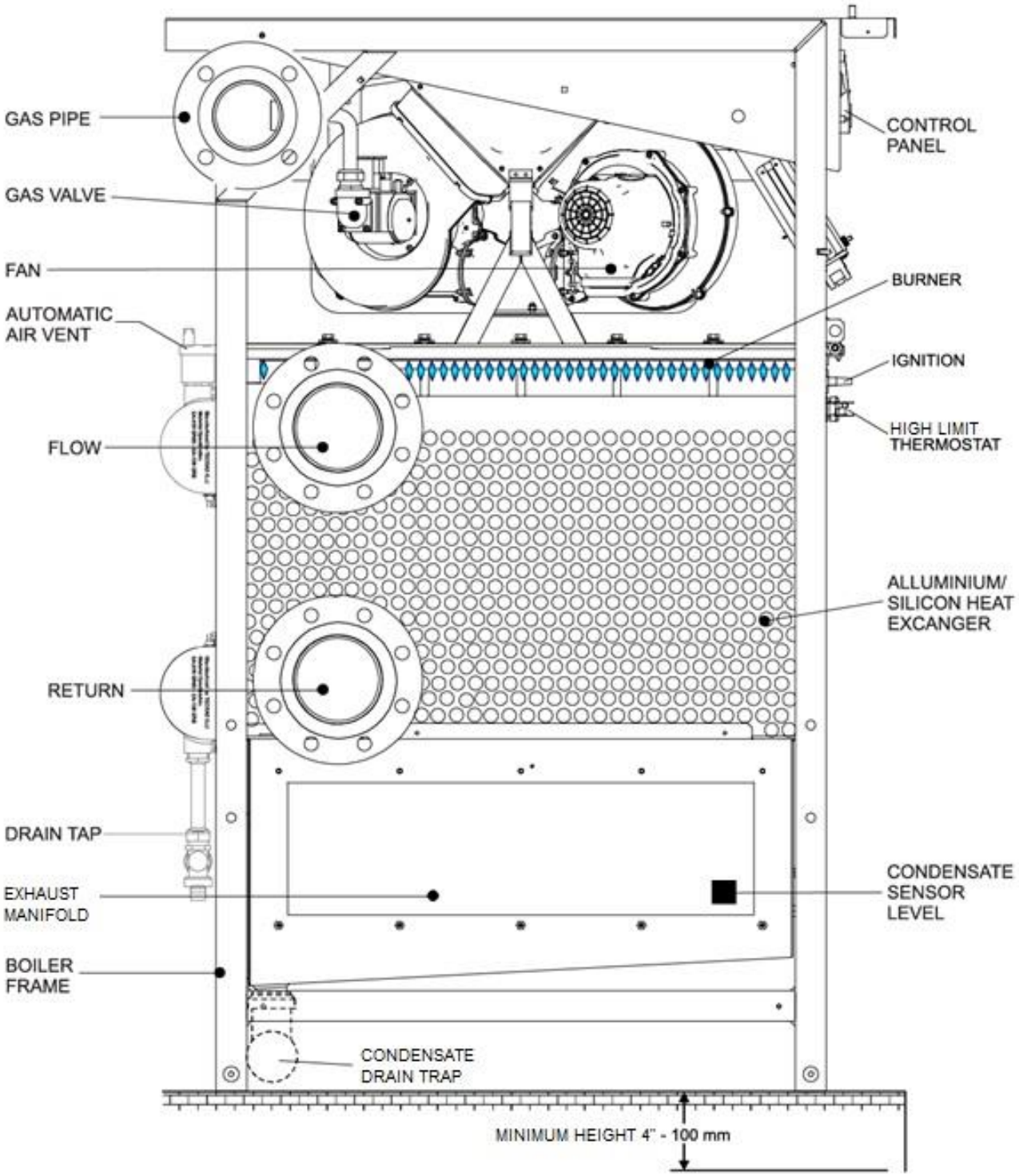


Figure 4b: MODULEX EXT Main Components (Left Side View)
(EXT 1500 2S - 3000 2S)

SECTION 4: CSD-1 MANIFOLD ASSEMBLY (SUPPLIED)

The installation of a flow switch, pressure/temperature gauge, and an ASME compliant safety pressure relief valve designed for the boiler output capacity is required. These major components are supplied with the boiler and must be assembled and wired when installing the boiler at the site. The manifold assembly components supplied are:

- Pressure Relief Valve (3/4" for EXT 450 2S – 1100 2S, 1-1/2" for EXT 1500 2S – 3000 2S)
- Flow Switch
- Pressure/Temperature Gauge

NOTE: Units ship with an 80 psi relief valve. For higher or lower system pressure, a different rated relief valve must be field supplied.

Full instructions for installing these components are included in the Modulex EXT Installation, Operation & Maintenance Guides.

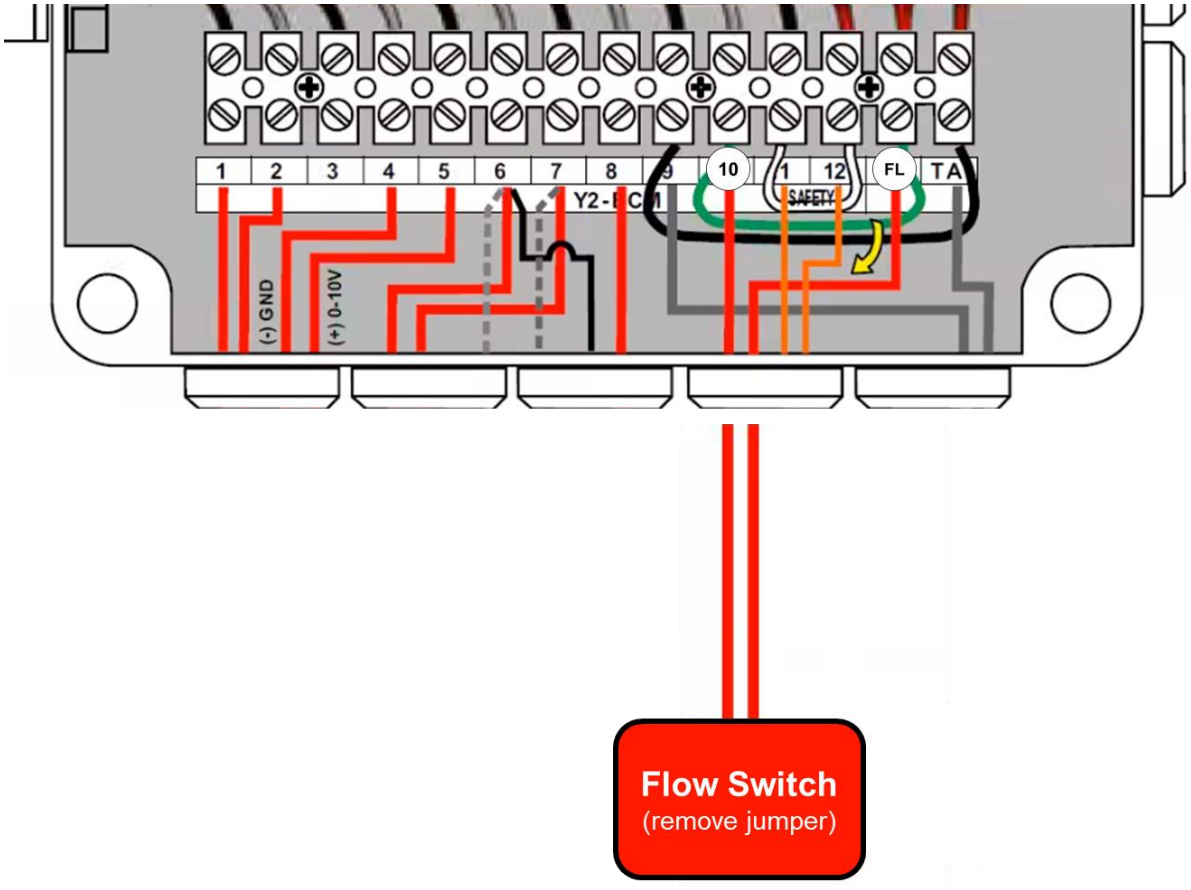


Figure 5: Input/Output Box and Flow Switch Connection

The pressure relief valve and all other manifold components are shown in Figures 5 and 6.

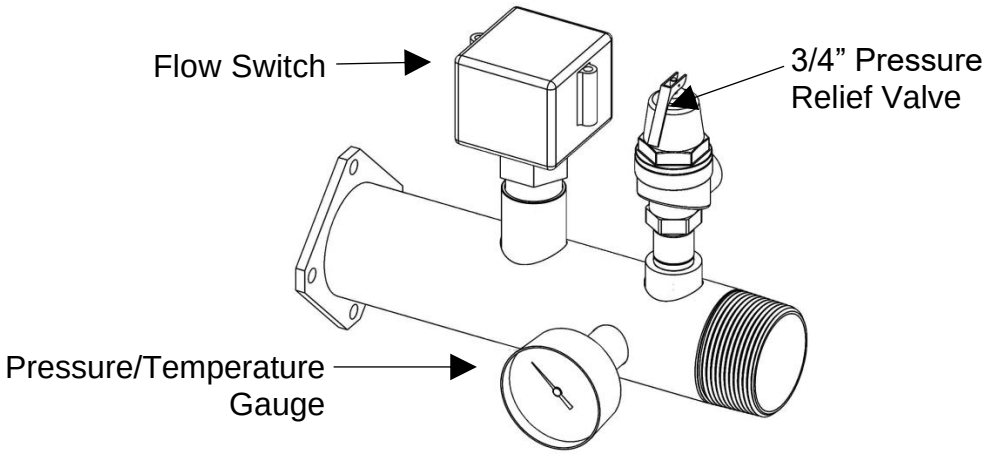


Figure 6: Manifold Assembly and Components for EXT 450 2S, 600 2S, 800 2S & 1100 2S

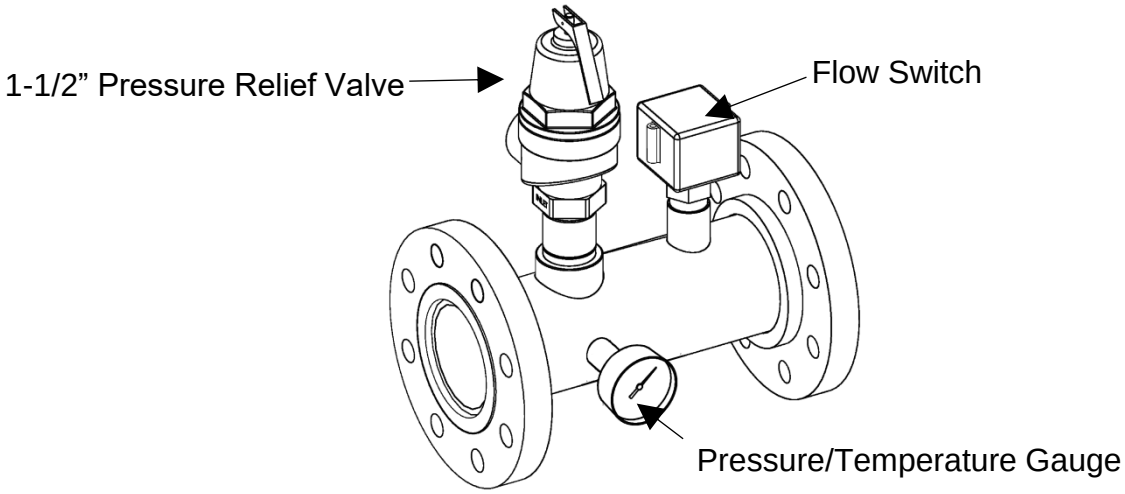


Figure 7: Manifold Assembly and Components for EXT 1500 2S, 2300 2S, 2600 2S & 3000 2S

To install the pressure relief valve and the other components shown, complete the instructions below.

NOTE: Use Teflon tape or a suitable pipe joint compound for component and piping connections described in the following steps. Refer to Figure 5 and 6, above, for component identification.

4.1. Installing the Pressure Relief Valve and Other Components

1. Attach manifold to the outlet supply connection on the boiler via the flanged connections.
2. Cut the flow switch paddle. For EXT models 450 2S to 1100 2S, cut for 2-1/2" pipe, and for EXT models 1500 2S to 3000 2S, cut for 4" pipe as directed in the flow switch paddle packaging. For installations expecting less than a 10 gpm flow, adjust switch as follows:
   a) With no flow, turn adjustment screw on the switch counter-clockwise until the switch trips.
   b) Then turn screw 1/2 turn clock-wise and continue installation.

3. Connect the following components to the tapped holes in the manifold assembly (Fig. 6 & 7):
   - 3/4" Pressure Relief Valve
   - Flow Switch
   - Pressure/Temperature Gauge

NOTE: Ensure that the flow switch is installed with the "flow" arrow pointing in the direction of the flow.

4. Check to ensure that all components are securely tightened and that the flow switch paddle moves freely without interference.
5. Locate the BMM module with the "FL" label (Figure 7), and remove the black jumper wire from the terminals of the connector shown in the detail of Figure 7. Connect the two flow switch wires to the two terminals. Flow switch wires have no polarity, so can be inserted without regard to position.

SECTION 5: CONNECTING SUPPLY & RETURN PIPING

5.1. BOILER CONNECTIONS

Upon delivery, the various models of Modulex EXT boilers are configured with connections for water, gas, air intake, and flue exhaust. Note that references to right-hand or left-hand orientation refer to the right-hand or left-hand side when viewed facing the front of the boiler. Some of these connections may be changed from one side to the other. Refer to section 5.4 for a description of where side connections are located, which connection locations may be changed, and the instructions for performing the changes.

5.2. PRIMARY-SECONDARY PIPING

Primary-secondary piping must be utilized. This can be accomplished by using a common pipe (see Figure 13, 14, 17 and 18) or a hydraulic separator (see Figure 15, 16, 19 and 20). Primary – secondary piping decouples the boiler loop from the system loop, making it independent from system loop pressure fluctuations associated with opening/closing of zone valves or 3-way valves.

5.3. ADDITIONAL SUPPLY AND RETURN PIPING

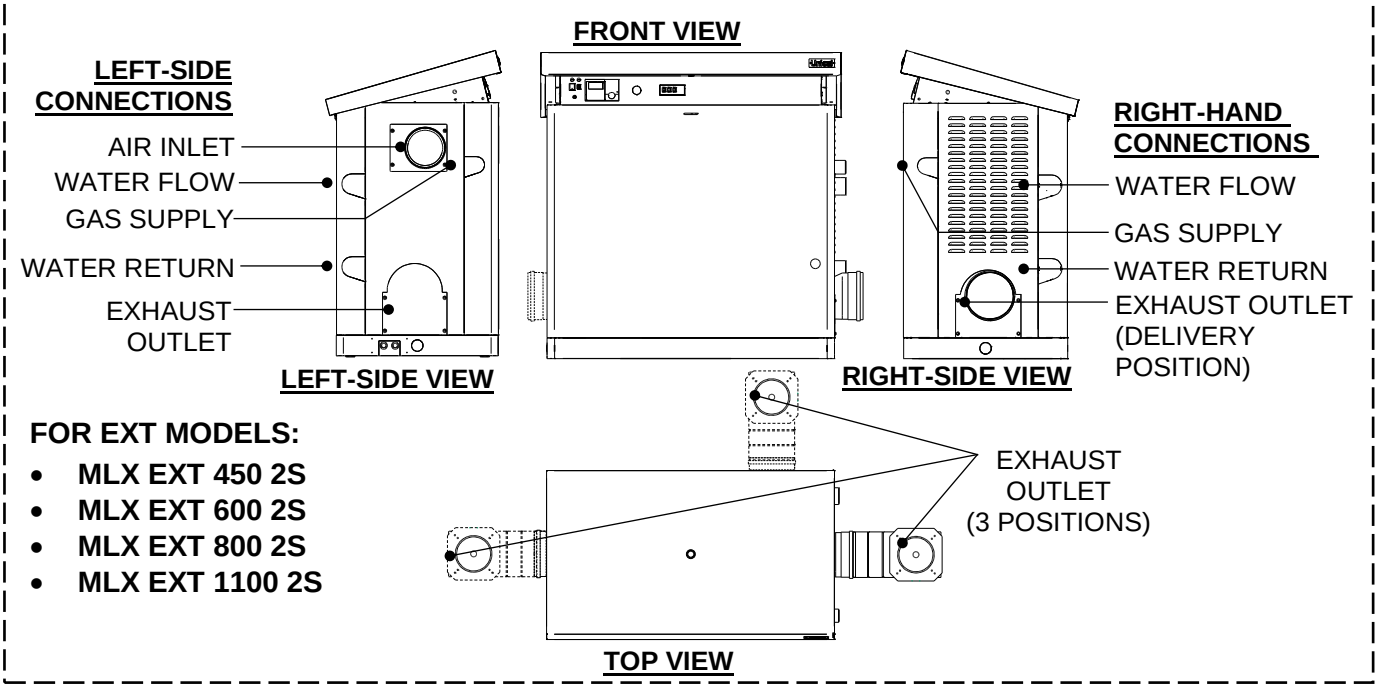
(PER ANSI Z21.13A)
When used in connection with a refrigeration system, the boiler must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the medium from entering the boiler. The boiler piping system of a hot water boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of boiler water during the cooling cycle.

5.4. CHANGING RIGHT-HAND CONNECTIONS TO LEFT-HAND

5.4.1. Modulex Light Commercial Models EXT 450 2S, 600 2S, 800 2S & 1100 2S

Light Commercial size MODULEX EXT boilers are delivered with all connections installed, (i.e. cold/hot water flow & return, gas, and exhaust outlet) on its RIGHT-HAND side. However, these connections may be relocated in the positions listed below and as shown below.

Water Flow:	Left or right.
Water Return:	Left or right.
Gas Supply:	Left or right.
Exhaust Manifold:	Left, right, or rear.
Air Intake:	Left (only)



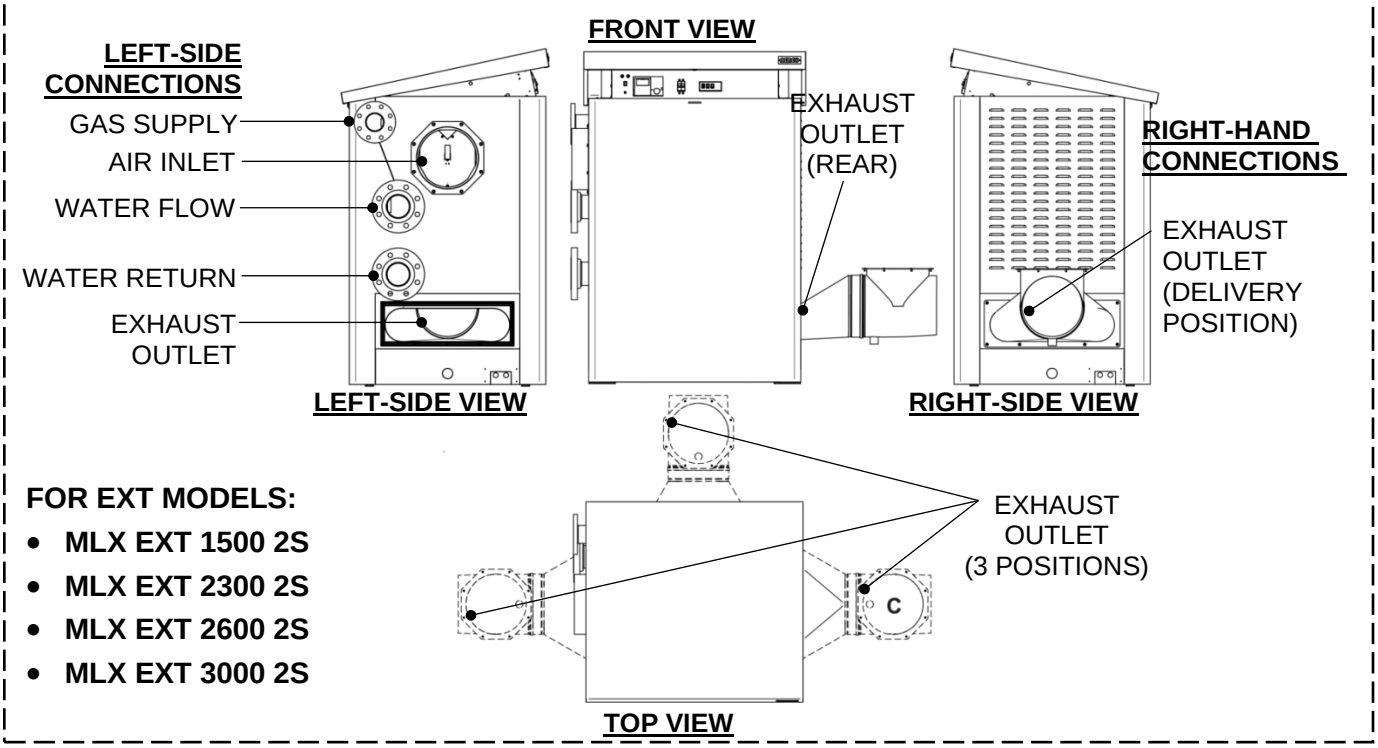
FOR EXT MODELS:

- **MLX EXT 450 2S**
- **MLX EXT 600 2S**
- **MLX EXT 800 2S**
- **MLX EXT 1100 2S**

Figure 8a: Locations for Left-Hand and Right-Hand Connections (EXT 450 2S – 1100 2S)

5.4.2. Modulex Commercial Models EXT 1500 2S, 2300 2S, 2600 2S & 3000 2S

Commercial size MODULEX EXT boilers are delivered with gas and water connections and air intake connection installed on the LEFT-HAND side and the exhaust manifold on the RIGHT-HAND side. Only the position of the exhaust manifold can be changed, it may be installed on the left, right, or rear.



FOR EXT MODELS:

- **MLX EXT 1500 2S**
- **MLX EXT 2300 2S**
- **MLX EXT 2600 2S**
- **MLX EXT 3000 2S**

Figure 8b: Locations for Left-Hand and Right-Hand Connections (EXT 1500 2S – 3000 2S)

5.4.3. Reversing Gas Manifold Connections (EXT 450 2S - 1100 2S)

To move the gas connection from the RIGHT-HAND (standard) side to the LEFT-HAND side, swap the end plate and the gas supply connector screwed onto the gas manifold ends as shown. Ensure that the gaskets for ALL connections are reversed along with the connectors themselves.

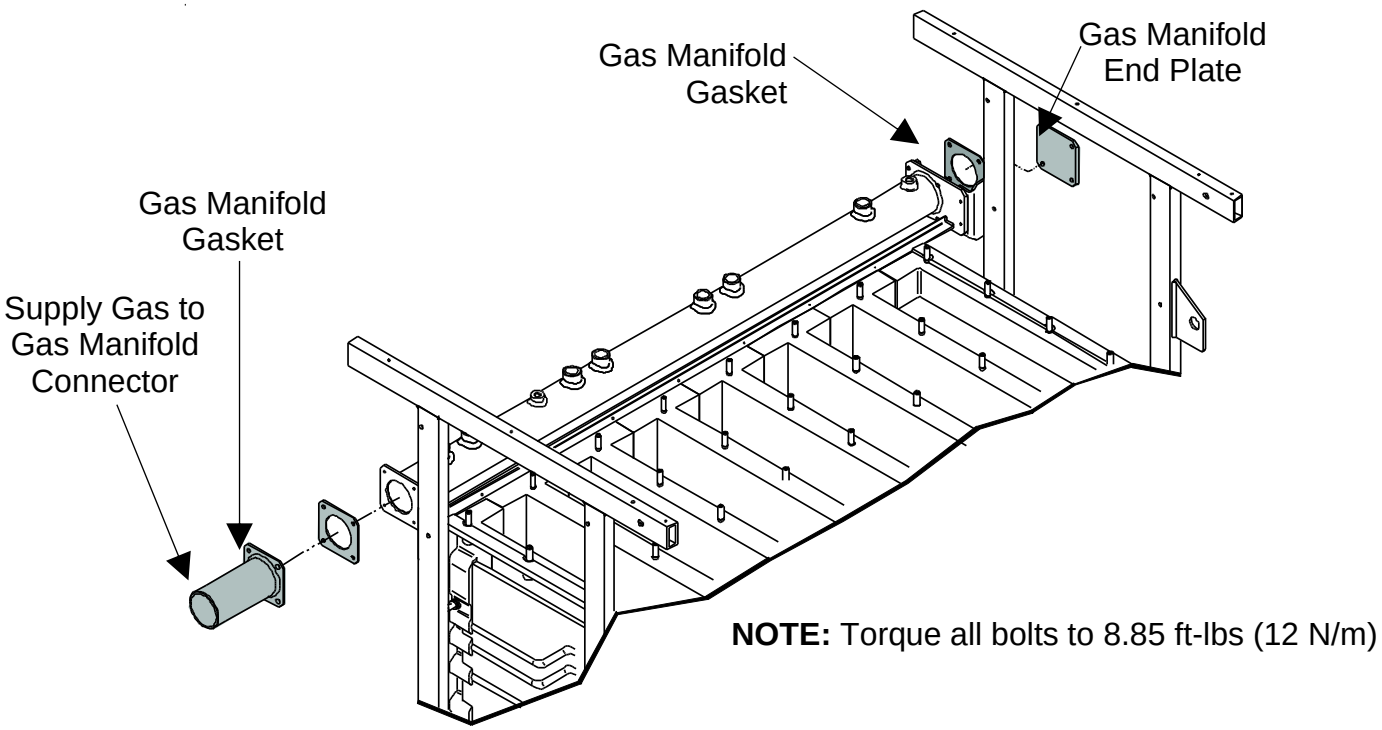


Figure 9: Reversing Gas Connections from RIGHT-HAND to LEFT-HAND for EXT 450 2S – 1100 2S

5.4.4. Reversing Cold/Hot Water Flow & Return Connections (EXT 450 2S - 1100 2S)

Change of Water Flow and Return connections from RIGHT hand to LEFT hand requires reversing Supply, Flow, and Return connectors, moving the Flow and Return Temperture Sensors to the other end, and exchanging positions of the Boiler Sensor KF and Automatic Air Vent.

WARNING!
Ensure that the gaskets for ALL connections are reversed along with the connectors themselves.

Refer to Figure 10 and reverse the connectors and end caps on Supply, Flow, and Return pipes. Ensure that all gaskets are also reversed.

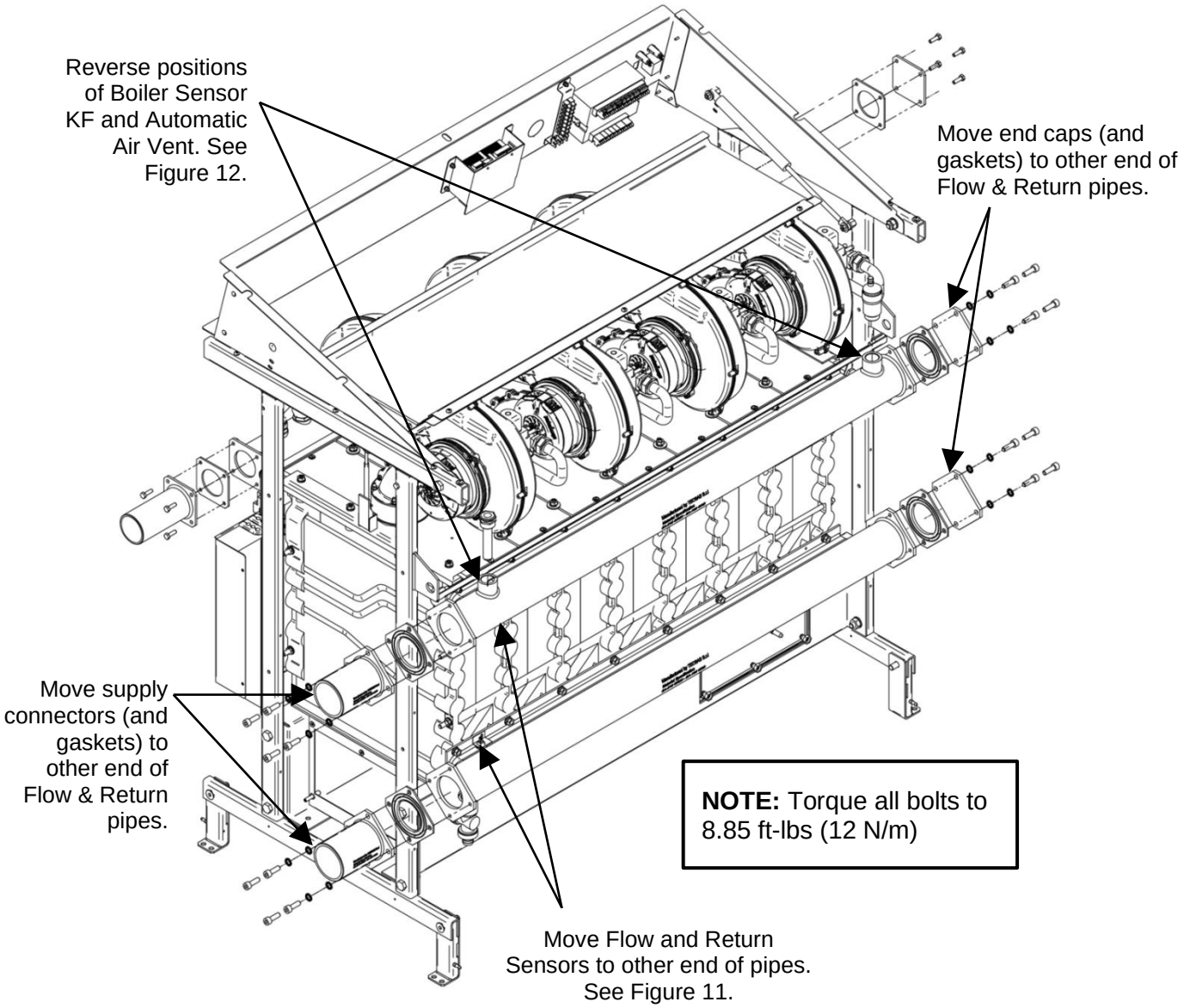


Figure 10: Reversing Cold/Hot Water Flow and Return Connections and Sensors from RIGHT HAND to LEFT HAND

5.4.5. Reversing Flow & Return Temperature Sensors

One sensor is located on top of the lower Return pipe railing, while the other one is located under the upper Flow pipe railing. Move these two sensors to other end of the Flow/Return pipes.

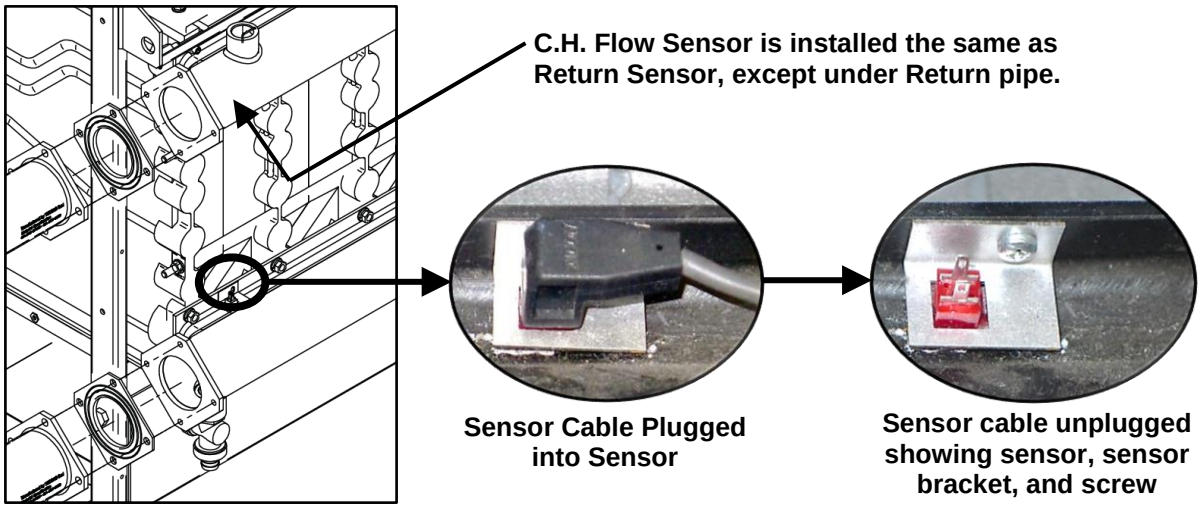


Figure 11: Reversing Flow and Return Temperature Sensors

5.4.6. Reversing the Boiler Sensor KF and Automatic Air Vent

Reverse the positions of the Boiler Sensor KF and Automatic Air Vent located on the top Flow pipe.

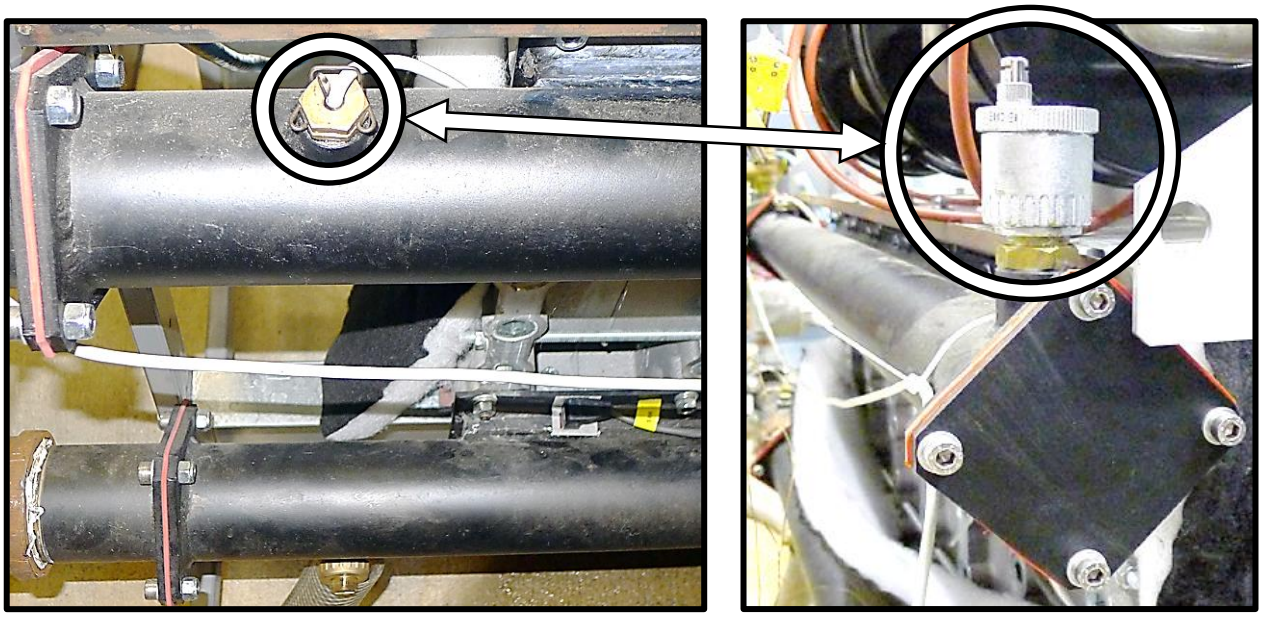


Figure 12: Reversing Boiler Sensor KF with Automatic Air Vent

NOTE: When reversing hydraulic and gas pipe connections, you must close up the chassis openings vacated after the change. See Figure 13.

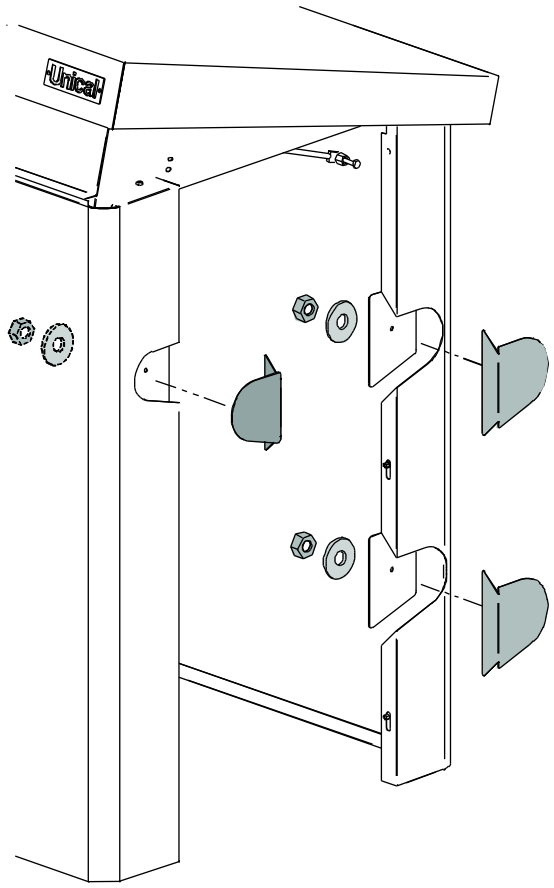


Figure 13: Caps and Plugs Used for Closing Up Vacated Gas and Hydraulic Connection Openings

SECTION 6: SYSTEM FILLING AND DRAINING

The boiler is equipped with its own drain (see Figures 4a and 4b for the drain position). **NEVER USE IT TO DRAIN THE SYSTEM**, since the system dirt could gather in the boiler and compromise its operation. The system itself shall be equipped with its own drain, whose size will depend on the system capacity. The application of a strainer on the return pipe to the boiler is required.

- For filling the system, a filling tap has to be inserted on the system return pipe.
- The filling can also be done through the draining tap on the boiler return manifold (see drain siphon in Figure 4a and drain tap in Figure 4b).
- In both cases, an approved hydraulic disconnection system has to be fitted.
- Before connecting the boiler, carefully rinse out the whole system, as specified in Section 2.3 or by local code and best practices.

SECTION 7: CONDENSATE DRAIN

To maintain proper flow of condensate, the drain pipe must have a slope toward the drain of at least 3/8 in./ft. (30 mm/m). The liquid column inside the condensate siphon needs to be filled with water after installation. Its minimum height when all the fans are in operation must be at least 1 in. (25 mm). In order to prevent ice from forming, the condensate piping must be well insulated. In outdoor applications exposed to freezing temperatures, condensate piping must be installed to prevent freezing. AERCO recommends the installation of standard heat-tape.

A typical condensate drain installation is shown in Figure 11. The parts required to fabricate the condensate drain system are shipped with the accessory kit which is packed separately. Polypropylene pipes are included with each unit. It is important to note that this pipe must be cut to the appropriate length for the Modulex model and prevailing conditions at the installation site. A polypropylene to PVC adapter is provided if a longer condensate drain is required.
Consult local codes with regard to condensate neutralization. Neutralization can be obtained by mixing it with the buildings drain water or with limestone, which normally have a base pH. AERCO offers a condensate neutralizing tank for the purpose.

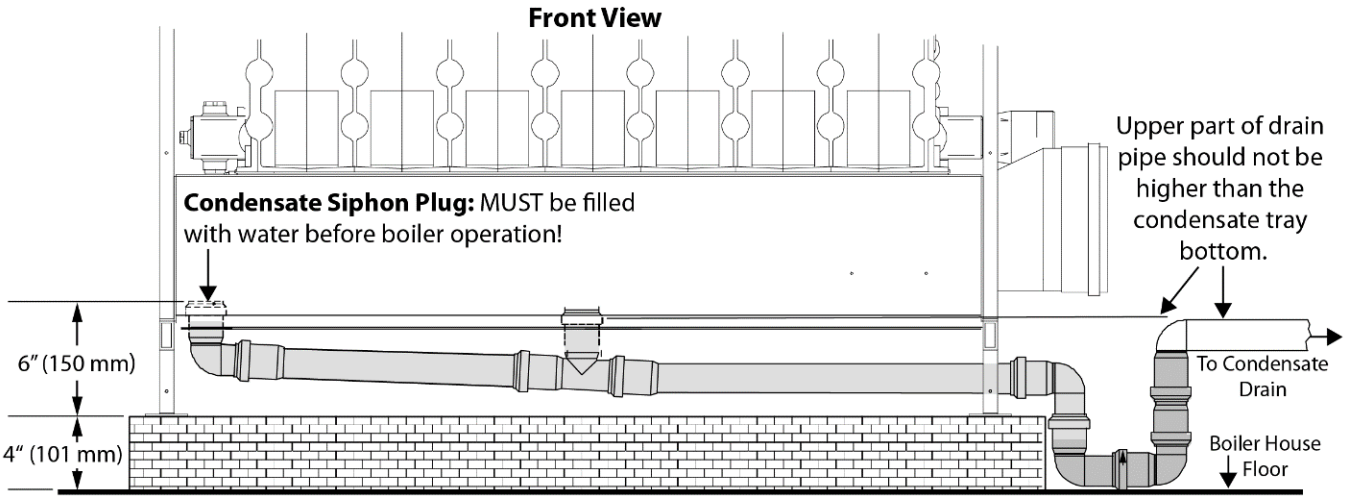


Figure 14: Typical Condensate Drain Installation

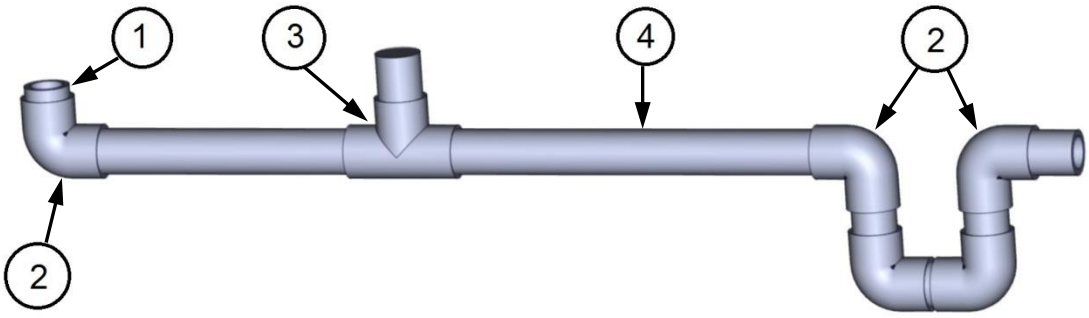


Figure 15: Condensate Drain Assembly Components

ITEM #	QTY.	P/N	DESCRIPTION
1	1		DN 40 PP Cap
2	5	95310512	DN 40 PP Elbow
3	1	95310513	DN 40 PP Tee
4	1 or 2 *	95310515	DN 40 PP Straight Pipe
5	1	93087	1 ¼" PVC Joining Clamp (Optional, only if connecting to PVC instead of PP, not shown)

* 1 for MLK 321 – 1123, 2 for MLK 1500 - 3060

SECTION 8: PIPING DIAGRAMS

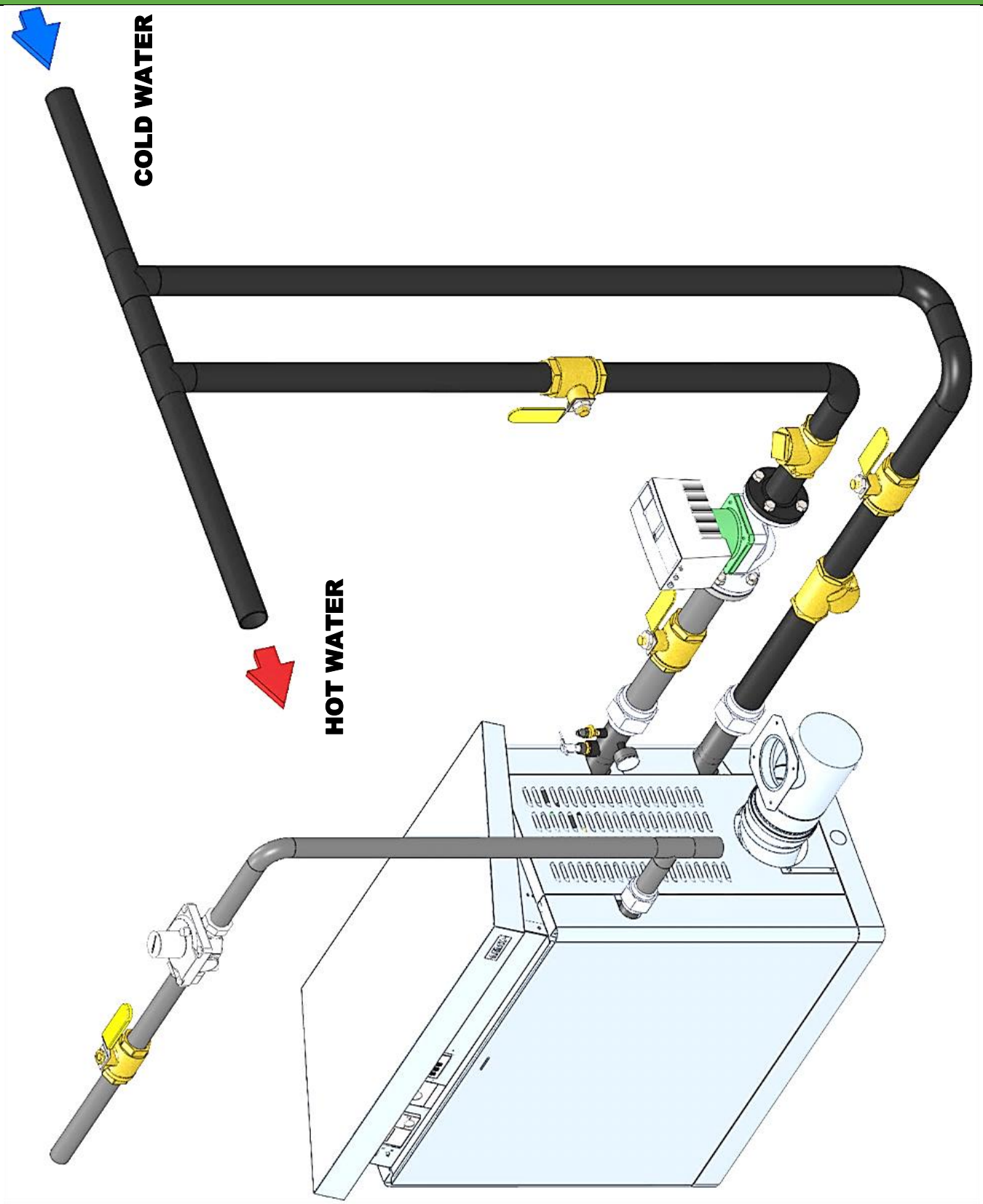


Figure 16: Modulex EXT Single Boiler Installation

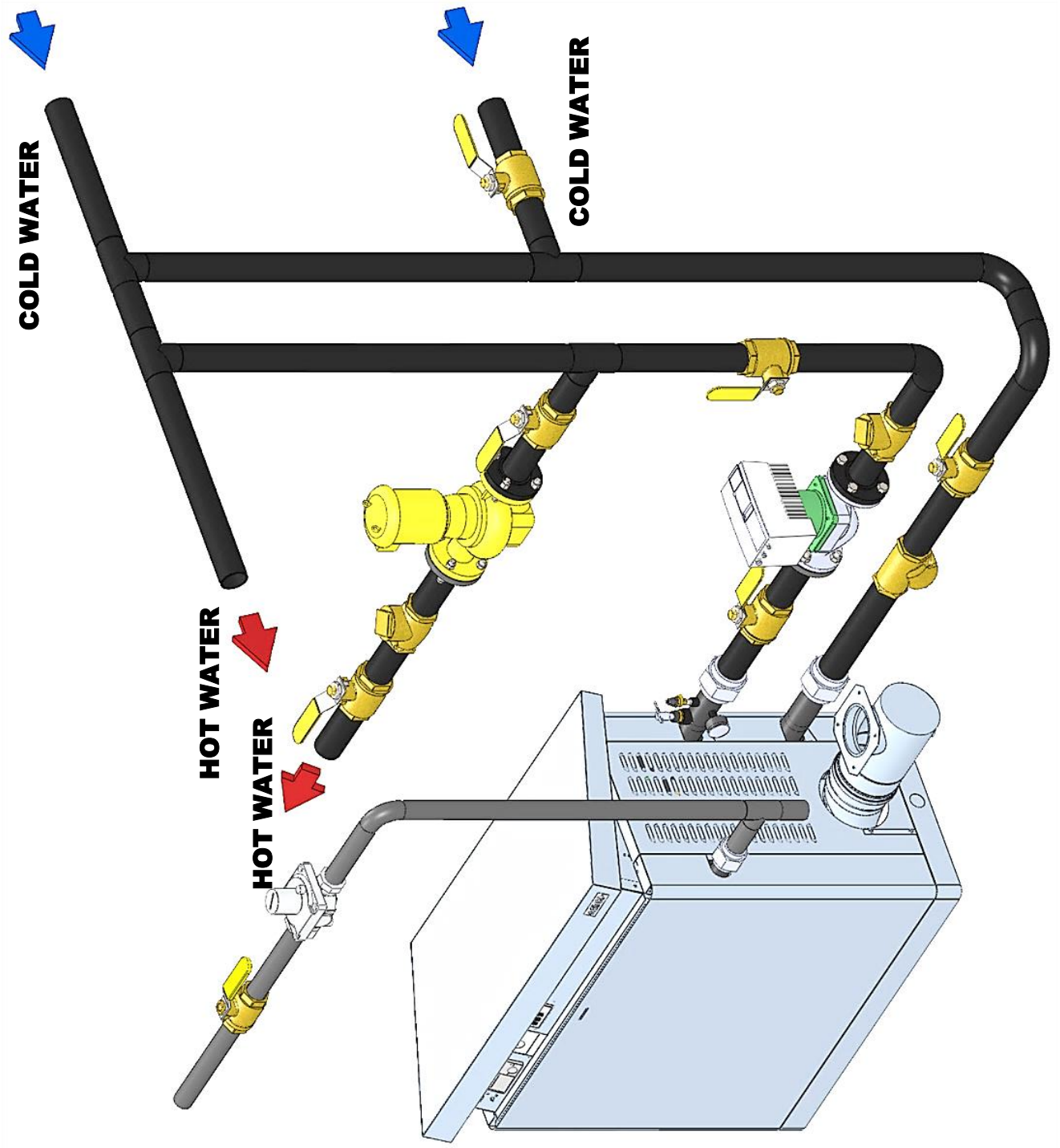


Figure 17: Modulex EXT Single Boiler Installation with DHW Installed

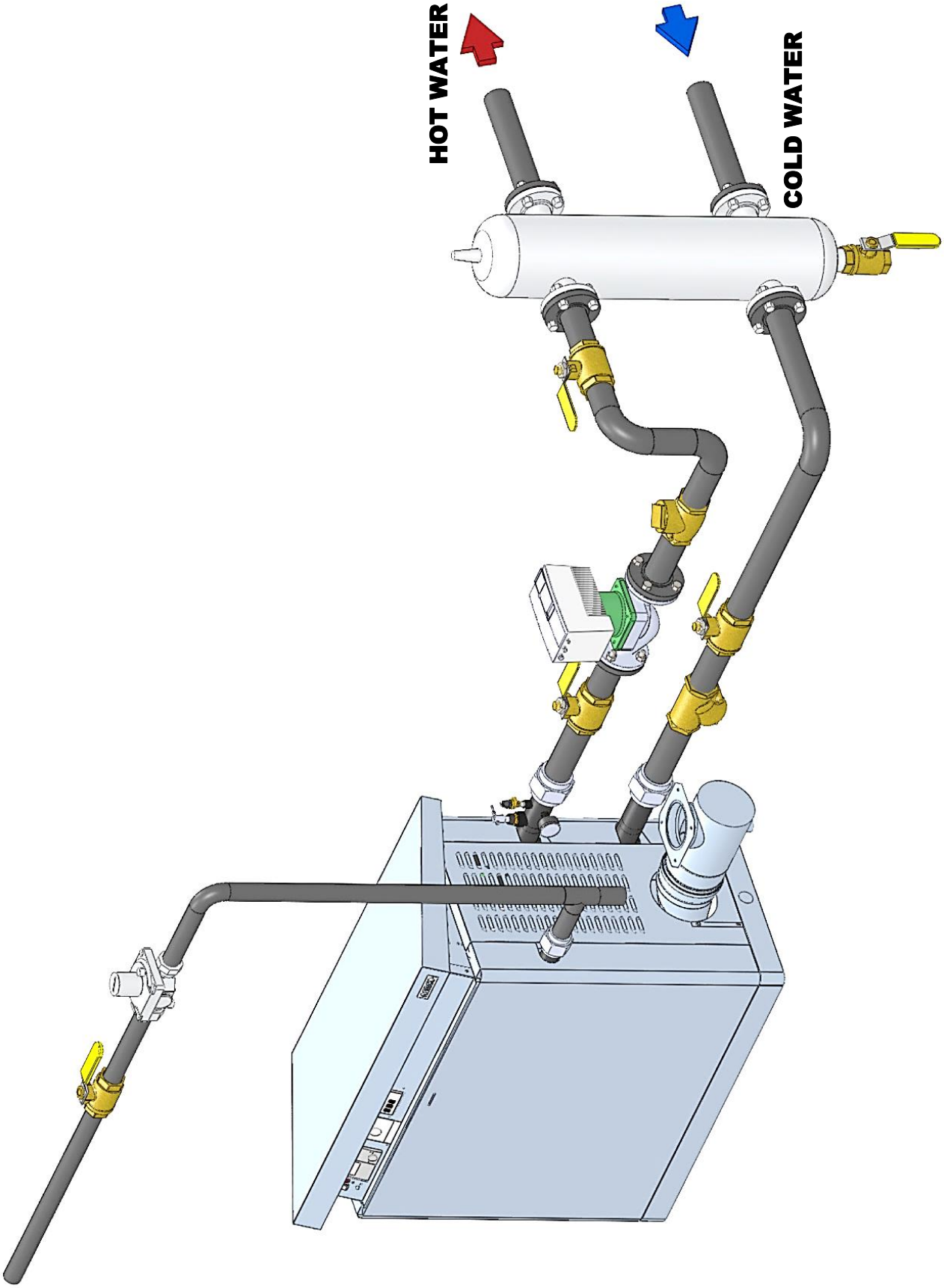


Figure 18: Modulex EXT Single Boiler Installation with Hydraulic Separator Installed

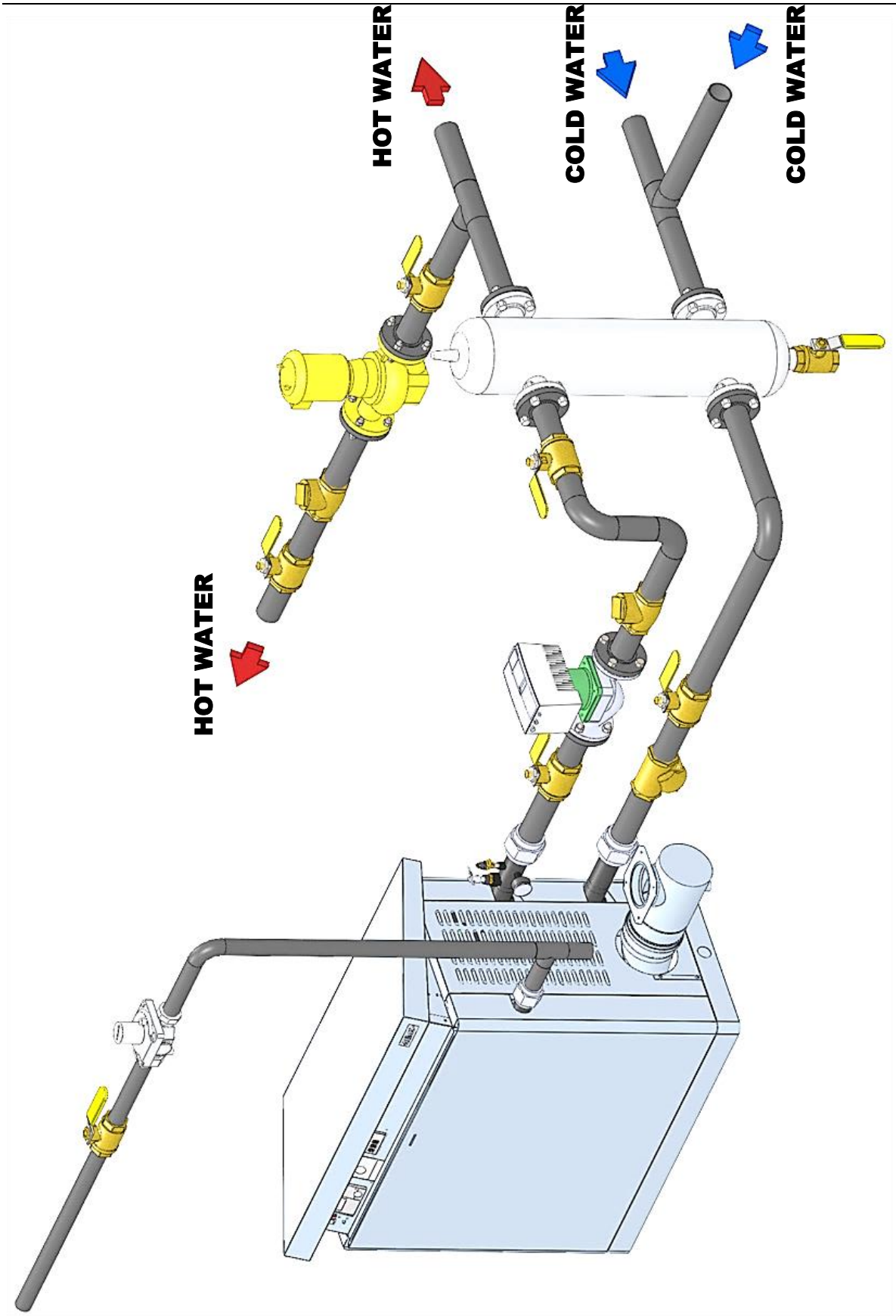


Figure 19: Modulex EXT Single Boiler Installation with Hydraulic Separator and DWH Installed

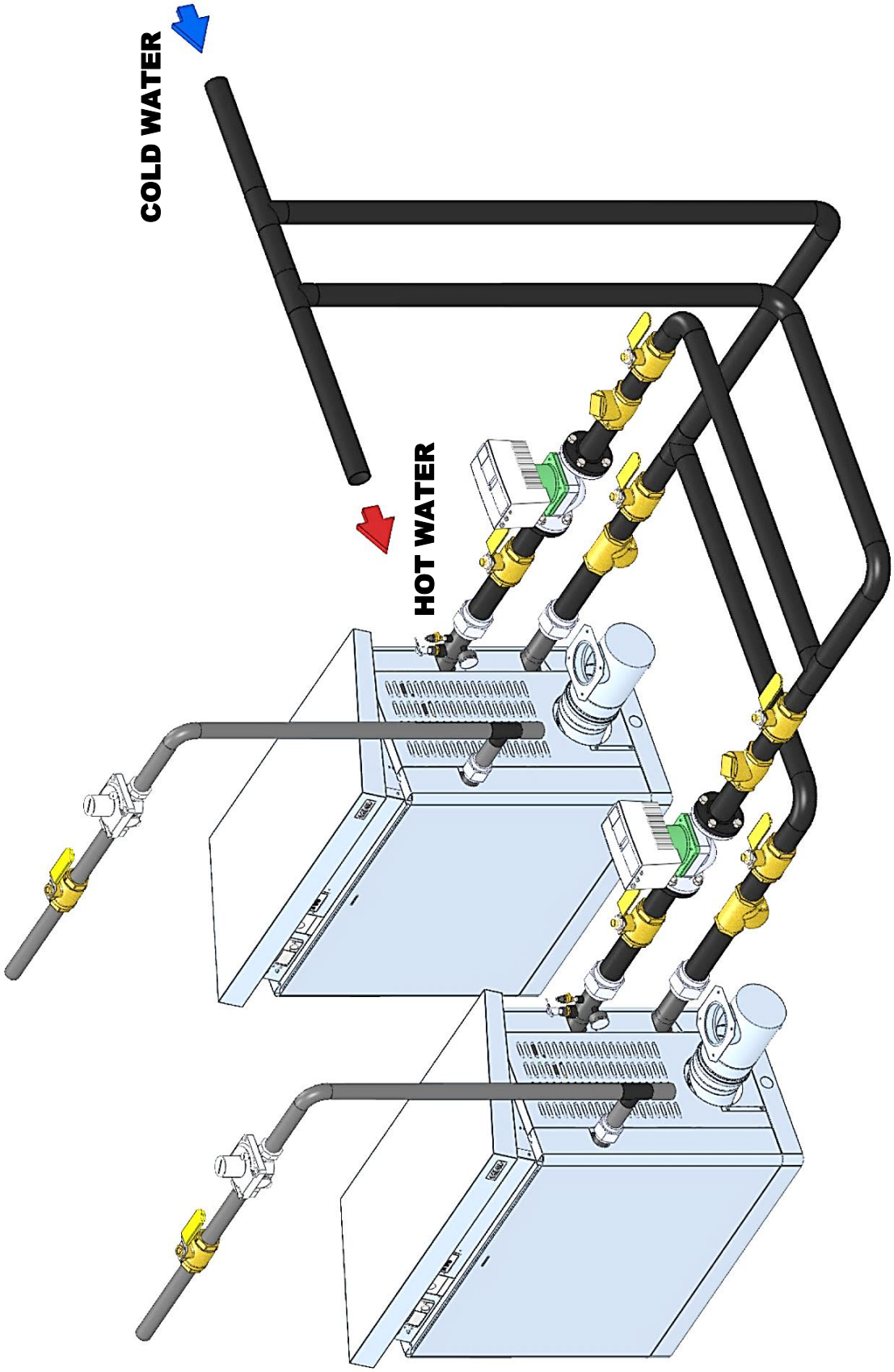


Figure 20: Modulex EXT Multiple Boiler Installation

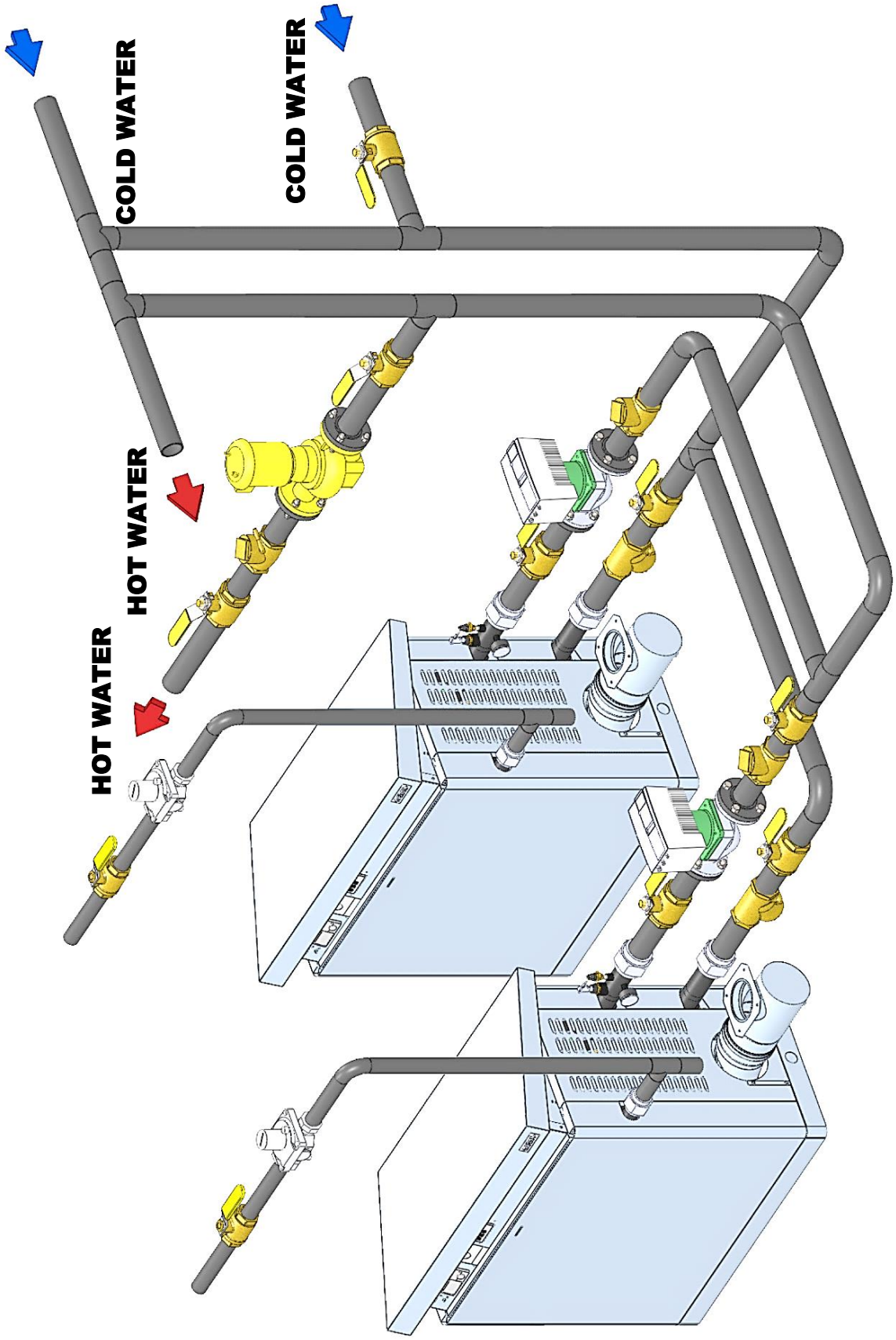


Figure 21: Modulex EXT Multiple Boiler Installation with DHW Installed

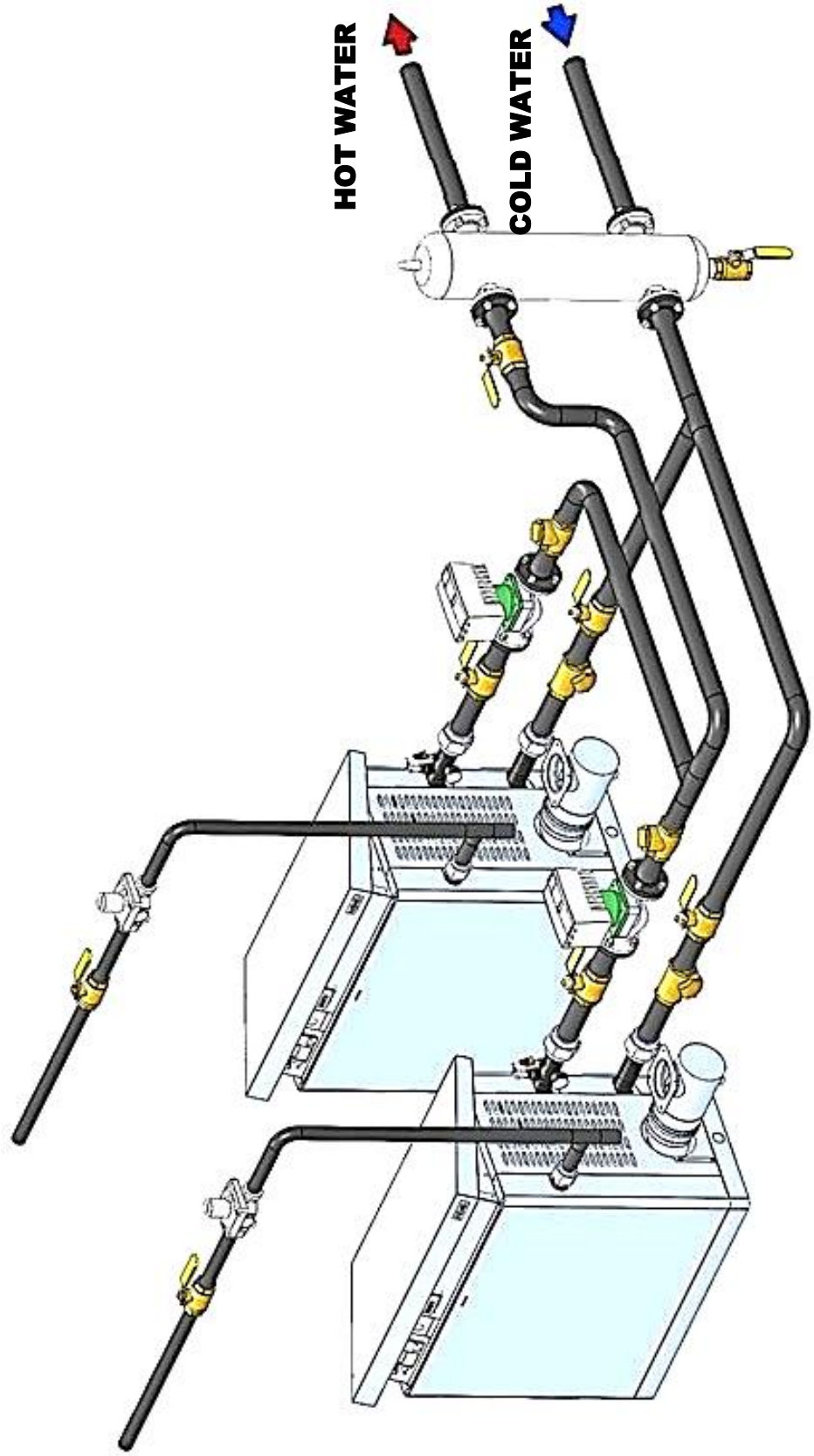


Figure 22: Modulex EXT Multiple Boiler Installation with Hydraulic Separator Installed

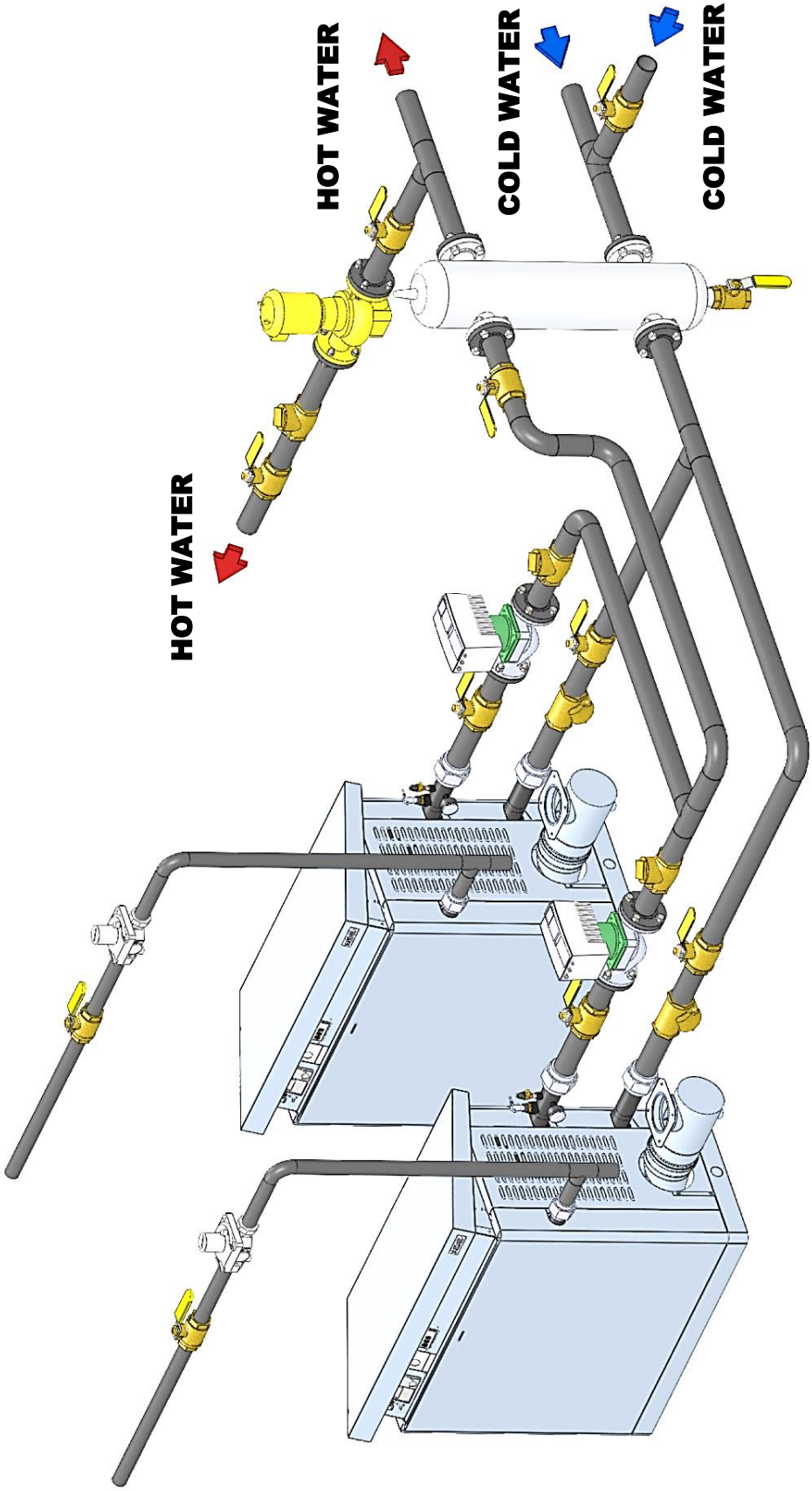


Figure 23: Modulex EXT Multiple Boiler Installation with Hydraulic Separator and DHW Installed