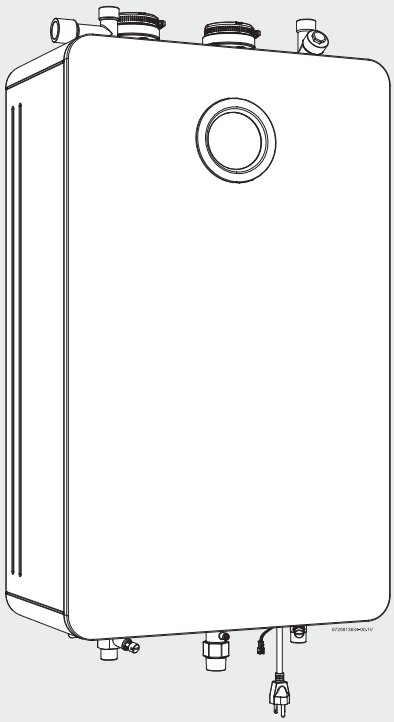


WARNING:
Follow each appliance's instructions precisely.
Installation and service must be performed by a trained and certified installer, service agency or the gas supplier.

Application drawings in this manual are conceptual only and do not purport to address all design, installation, code, or safety considerations.

The diagrams in this manual are for reference use by code officials, designers and licensed installers. It is expected that installers have adequate knowledge of national and local codes, as well as accepted industry practices, and are trained on equipment, procedures, and applications involved. Drawings are not to scale.

Refer to the appliance and accessory installation manuals for additional detailed information!

Greentherm T9800/T9900 SE(C) 160/199

RESIDENTIAL AND COMMERCIAL TANKLESS WATER HEATERS

BOSCH

Applications Manual

C US

LOW-LEAD

ENERGY STAR

LOW NOx EMISSIONS

Table of Contents

1 Key to symbols and safety instructions

1.1 Key to symbols

Warnings

Warnings in this document are identified by a warning triangle printed against a grey background. Keywords at the start of a warning indicate the type and seriousness of the ensuing risk if measures to prevent the risk are not taken.

The following keywords are defined and can be used in this document:

- **DANGER i**ndicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor to moderate injury.
- **NOTICE** is used to address practices not related to personal injury.

Important information

This symbol indicates important information where there is no risk to people or property.

1.2 Safety

Please read safety precautions before installation

WARNING:

- These instructions are intended as an aid to qualified licensed service personnel for proper installation, adjustment and operation of this unit. Read these instructions thoroughly before attempting installation or operation. Failure to follow these instructions may result in improper installation, adjustment, service or maintenance and possibly resulting in fire, electrical shock, property damage, personal injury or death.

WARNING:

- Disconnect all power to the unit before starting any service and maintenance. Failure to do so could cause severe electrical shock resulting in personal injury or death.

WARNING: INSTALLATION REQUIREMENTS

- Installation or servicing of this unit can be hazardous due to parts, compo nents and system pressure. Qualified and proper trained service personnel should perform installation and repai r . Failure to do so could cause severe electrical shock resulting in personal injure or death.

2 Introduction

This Applications Manual is intended to present some of the most common applications of the Bosch Greentherm tankless water heaters. Application drawings are shown with both piping and corresponding electrical schematics where applicable. Auxiliary equipment depicted does not necessarily represent any one manufacturer or specific model number. There are a wide variety of techniques, practices and piping strategies possible when installing water heating appliances. It is the responsibility of the installing contractor to determine the best solution for the application.

NOTICE: All drawings are conceptual in nature and do not address all design, installation or safety considerations. Additional safety and/or auxiliary equipment may be needed. Drawings are for reference use by officials, designers and licensed installers. It is expected that installers have adequate knowledge of accepted industry practices for the equipment, procedures, and applications involved. It is the responsibiltiy of the installer to ensure that the installation is in accordance with local building codes.

Although this manual covers many common applications for our products, system possibilities are virtually endless. Should you encounter an application that is not covered in this manual or have any questions regarding any of its content, we encourage you to contact your local sales representative or us directly at Bosch Thermotechnology Corp.

This manual is not a substitute for any of the appliance installation manuals. All specifications are subject to change.

Installation must conform with local codes or, in the absence of local codes, the National Fuel Gas Code ANSI Z223.1/NFPA 54.

In Canada: Installation must conform with CGA B149.(1,2) INSTALLATION CODES and/or local installation codes.

3 Water heater sizing and specifications

This section describes the water heaters available from Bosch Thermotechnology Corp. and provides a general overview to the specifications of each particular model. More detailed information is contained in the installation manuals. Download manuals at www.bosch-climate.us.

3.1 Sizing tankless water heaters

Rule of thumb sizing

The tables below provide a general rule of thumb when sizing for most residential applications. For commercial applications or for a more detailed sizing method, use the Sizing by Chart instructions below in conjunction with the charts on the next page.

Sizing by Chart

- Measure the flow rates at each fixture that will be used simultaneously and add them together. If only one application will be used at a time measure each fixture and use the maximum flow rate observed.
- Using a known volume container, record several fill times. Perform the calculation below to determine the flow rate (a one gallon fill time of 30 seconds is 2.0 gallons per minute (GPM):

$$\text{Flow rate (GPM)} = \frac{\text{Volume (gallons)}}{\text{Fill time (sec)}} \times 60\frac{\text{sec}}{\text{min}}$$

- Using a thermometer, measure the incoming water temperature. For reference, see average ground water temperature map. Subtract this temperature from the desired hot water temperature to get the degree rise. If the desired hot water temperature is 120F and incoming temperature is 55F, the desired degree rise is 65F.

EXAMPLE:

- Required flow rate of 2.0 GPM at a 65˚F rise.
- Refer to the graphs on page 10.

See Table 1 for multiple fixture possibilities and hot water flow rates at given inlet water temperatures with a water heater set point temperature of 120°F.

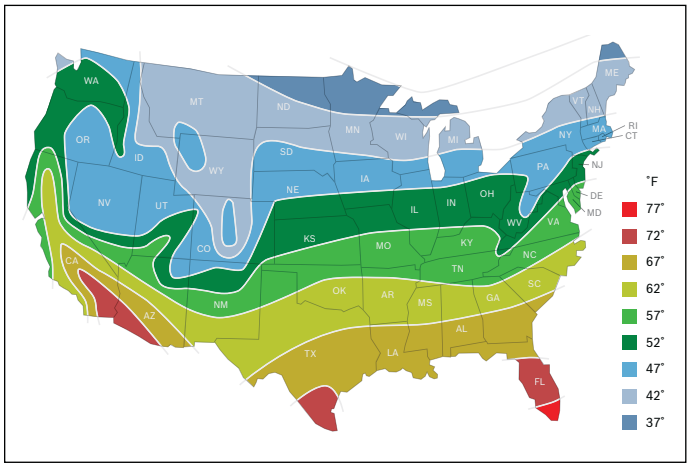


Figure 1 Average ground water temperatures

Model	Inlet temperature (°F)								
	77°	72°	67°	62°	57°	52°	47°	42°	37°
9800 SE 199	9.3 GPM	8.3 GPM	7.5 GPM	6.9 GPM	6.3GPM	5.9 GPM	5.5 GPM	5.1 GPM	4.8 GPM
9800 SE 160	7.5 GPM	6.7 GPM	6.1 GPM	5.6 GPM	5.1 GPM	4.8 GPM	4.4 GPM	4.1 GPM	3.9 GPM

Table 1 Maximum hot water flow rate at 120°F set point temperature

Showerhead - 2 GPM @ 70 PSI with a 70% flow on the hot side & 30% on cold mix

Sink faucet - 1 GPM @ 70 PSI with a 80% flow on the hot side & 20% on cold mix

3.2 Tankless water heater accessories

Accessory	Part Number
Neutralizer (NBT-23)	7738005514
Cable to control external pump	7736504585
External NTC	7736504583
30' extension cable for outdoor HMI	7736504943
Wifi module	7736504944
Wired remote with wifi	7736504945
Wired remote without wifi	7736504946
Intelligent Cascading Kit	7709003962
Aquastat Connector	7736504584
LPG conversion kit for 199 model	7736504550
LPG conversion kit for 160 model	7736504551

Table 2

3.3 Tankless water heater specifications

Description	Unit	T9800 SE 160	T9800 SE 199
Performance			
Maximum gas input[2]	BTU/hr (kW)	160,000 (46.64)	199,000 (58.3)
Minimum input[3]	BTU/hr (kW)	9,000 (2.6)	9,000 (2.6)
Maximum output	BTU/hr (kW)	157,608 (46.2)	197,010 (57.7)
Thermal efficiency (Efficiency in %)	%	> 99%	> 99%
Maximum flow rate at a 35 °F (19.4 °C) rise[1]	GPM (l/min)	9.0 (34)	11.2 (42.4)
Maximum flow rate at a 45 °F (25 °C) rise	GPM (l/min)	7.0 (26.7)	8.7 (27.7.9)
Maximum flow rate at a 55 °F (30.6 °C) rise	GPM (l/min)	5.8 (21.9)	7.2 (27.5)
Maximum flow rate at a 75 °F (41.7 °C) rise	GPM (l/min)	4.2 (15.9)	5.2 (19.7)
Maximum flow rate at a 90 °F (50 °C) rise	GPM (l/min)	3.5 (13.2)	4.4 (16.6)
Temperature Control[4]			
Selection range	°F (°C)	100 - 120[3] (38 - 49)	100 - 120[3]) (38 - 49)
Default temperature[5]	°F (°C)	120 (49)	120 (49)
Temperature stability[6]	°F (°C)	± 2 (± 1)	± 2 (± 1)
Gas Requirement			
Gas connection	inches	¾	¾
Inlet gas pressure range NG / LP[7]	Inch W.C.	3.5" - 10.5" / 8" - 13"	3.5" - 10.5" / 8" - 13"
Water			
Top hot water connection NPT	inches	¾"	¾"
Top cold water connection NPT	inches	¾"	¾"
Minimum water flow[8]	GPM (l/min)	0.45 (1.7)	0.45 (1.7)
Maximum water pressure	PSI (bar)	150 (10.3)	150 (10.3)
Minimum recommended water pressure	PSI (bar)	18 (1.2)	18 (1.2)
Minimum well pressure	PSI	30	30
Water valve material	—	Polymer (PPS) (Polypropylene	Polymer (PPS) (Polypropylene
Combustion			
CO level	ppm	≤ 250 (measured)	≤ 250 (measured)
CO2 level (set from factory)	%	see installation manual	see installation manual
Weight			
Net weight	pounds (kg)	73.2 (33.20)	77.5 (35.15)
Gross weight	pounds (kg)	79.37 (36.0)	83.67 (37.95)
Electrical			
Voltage	V AC	120	120
Frequency	Hz	60	60
Amperage (Idle)	mA	40	40
Amperage (operation)	A	≤ 2.7	≤ 2.7
Water protection[9]	IP	X4D	X4D
Venting			
Venting category	–	IV	IV
Approved vent or combustion air pipe material - United States	–	PP flexible/concentric/rigid, PVC sched. 40, PVC-DWV, CPVC sched. 40, ABS-DWV sched. 40	
Approved vent or combustion air pipe material - Canada	–	CSA or ULC certified only (ULCS636)	

Table 3

[1] These flow are based upon setting the unit to higher temperatures and then mixing down using cold water after the unit, to reach these flow rates.

[2] Input rating is based on sea level operation and need not be changed for operation up to 2000 ft (610 m) elevation. For operation at elevations above 2000 ft (610 m), input rating is automatically reduced at the rate of 4 percent for each 1000 ft (305 m) above sea level.

[3] When converted to LPG the minimum input is 17 000 BTU/hr (5 kW).

[4] With constant flow.

[5] Can be reprogrammed to achieve up to 140 °F (60 °C).

[6] Requirements: Steady flows, single unit installations, up to 140 °F (60 °C).

[7] To measure Gas Pressure, see installation manual - Measuring Gas Pressure, chapter 4.13, page 36.

[8] Refers to activation point. Deactivation point value is 0.35GPM (1.3 l/min).

[9] Protection against water drops.

4 Applications

4.1 Single T9800 Installation

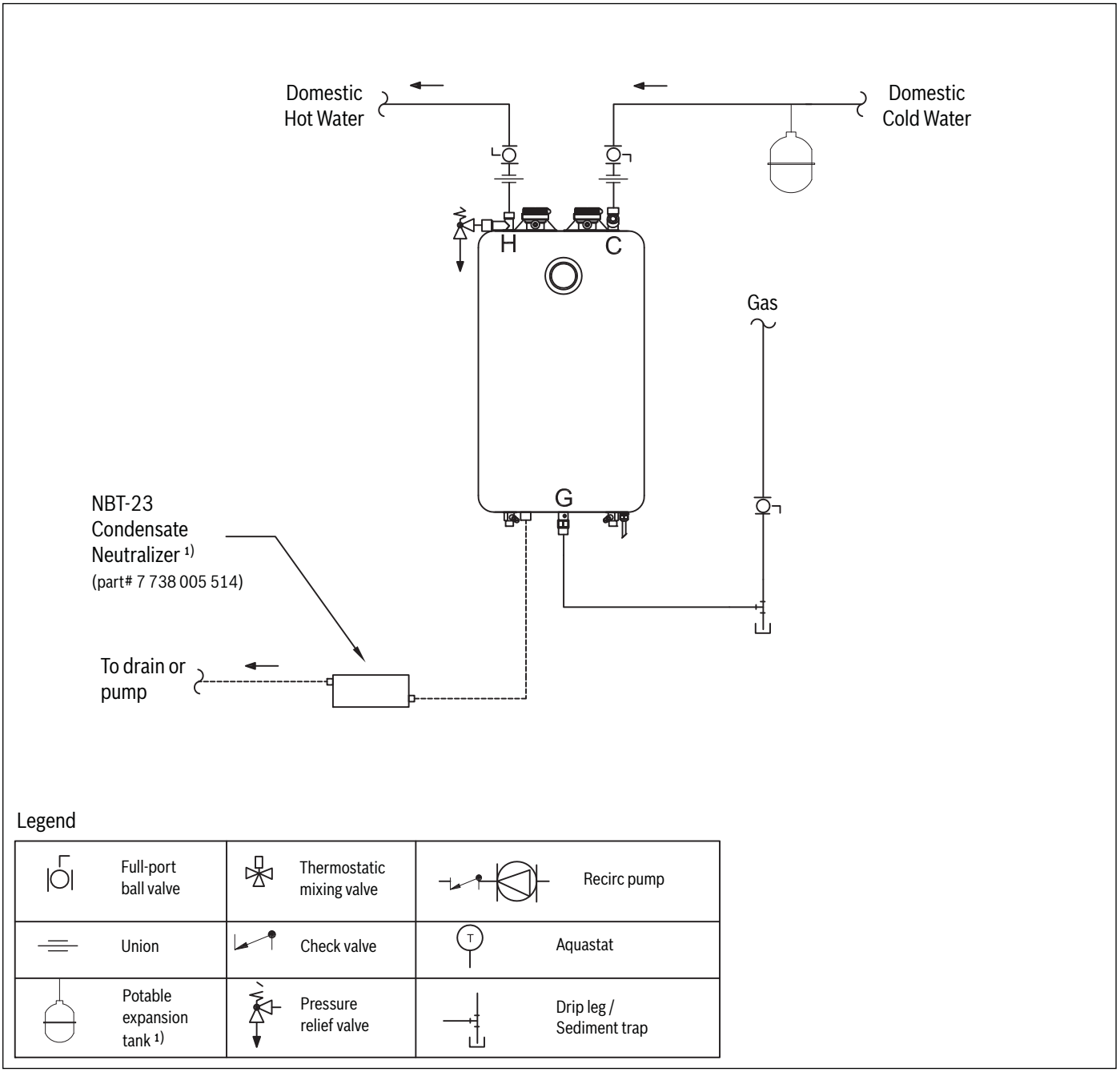


Figure 2

1) as required by local code.

DISCLAIMER: This drawing is conceptual in nature, not to scale and for reference only. Additional functional, installation, and safety devices may be needed or required. All work pertaining to the installation shall be in full compliance with all legal requirements, including national and local codes. Best installation practices should be followed.

4.2 Pump sizing for circulation

The following section outlines pump sizing for domestic hot water recirculation and tank loading. Only models approved for such applications are listed in this section.

- ► Pump must be bronze or stainless steel and designed for potable water systems.
- ► Size the pump according to the pressure drop curve of your Greentherm model (fig. 1 below) and the loop pressure drop tables.
- ► Maximum flow allowed for tank loading through the pump loop is 5 GPM.
- ► Must be 0.45 gpm to activate unit
- ► DHW recirc loop pump must circulate enough gpm to account for normal loop heat loss and to ensure that the recirc pump eventually satisfies and turns off

For direct DHW recirculation and tank loading applications:
Run the system for 30 minutes to remove debris from the plumbing. Then remove the unit's inlet water filter to decrease pressure drop through the system. If the inlet water filter, when removed, contains debris, it is recommended to install a 40 mesh Y-strainer (installer supplied) on the cold water inlet.

Pressure drop curve

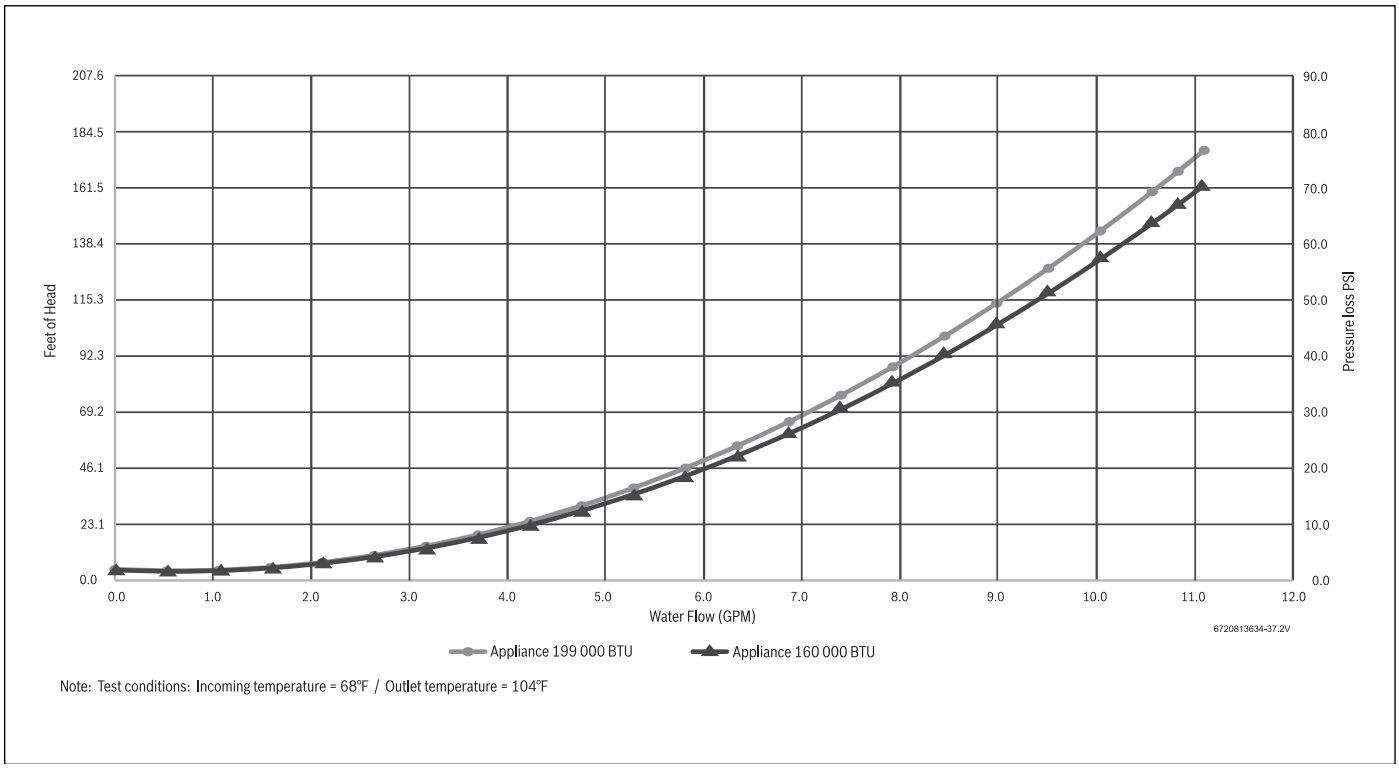


Figure 3

4.3 Domestic hot water recirculation

Hot water recirculation is a technology that provides hot water virtually instantly at the point of use by circulating hot water through your home's domestic hot water pipes.

The benefit of hot water recirculation is a reduction in the amount of water wasted while waiting for hot water to arrive at the point of use. Homeowners have also grown to appreciate hot water recirculation because it eliminates the need to wait for hot water.

The Greentherm 9000 models have been designed for hot water recirculation. The T9900 models have an integrated pump making hot water recirculation a snap. The T9800 models have the capability of controlling an external pump by switching power ON and OFF to the pump.

4.3.1 Activating hot water recirculation

The process outlined in section 4.3.1 applies to the Greentherm T9800 and T9900 models.

1. Starting from the home screen showing the set point temperature, touch the ⮌ key on the water heater's controls to enter the menus.
   Display shows **P4 Information**

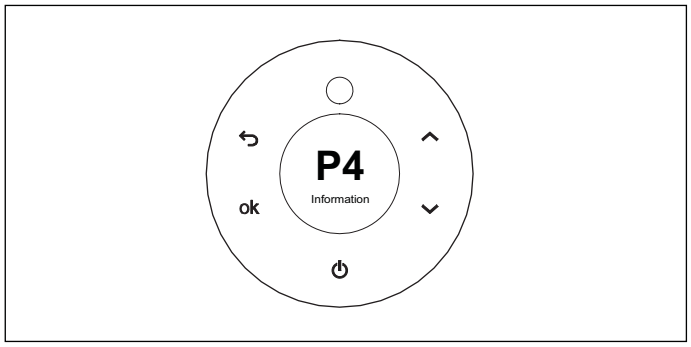


Figure 4

2. Touch the ⌃ or ⌄ key to scroll through the menus until the display shows **SA Settings**

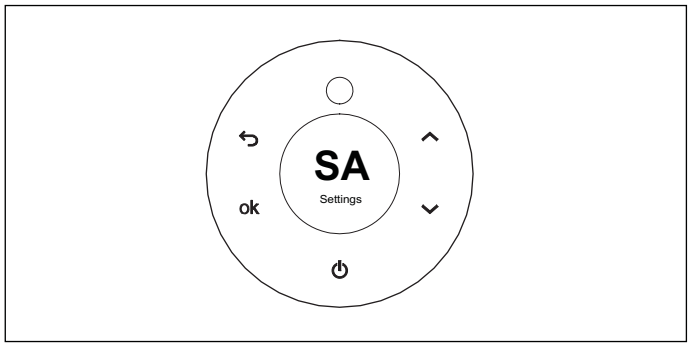


Figure 5

3. Touch the **ok** key.
   Display shows **A0 Clock/Date.**

4. Use the ⌃ or ⌄ keys to scroll through the menus until the display shows **A1 Recirculation**.

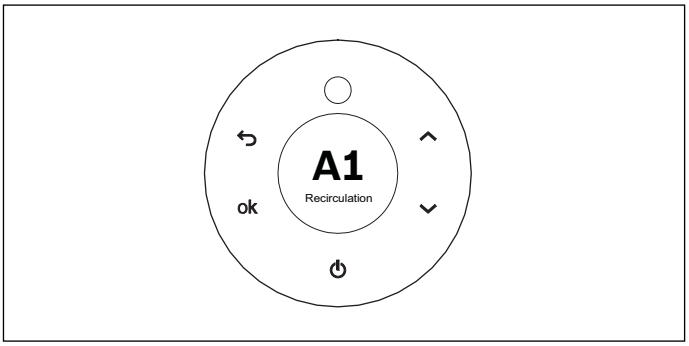


Figure 6

5. Touch the **ok** key
   Display shows **HR House recirculation**

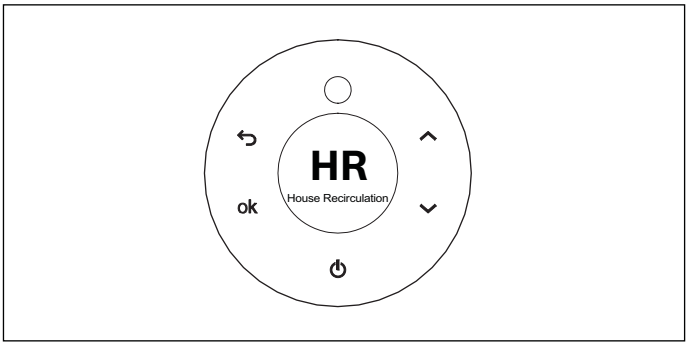


Figure 7

6. Touch the **ok** key.
   The display shows **AA Always Active**

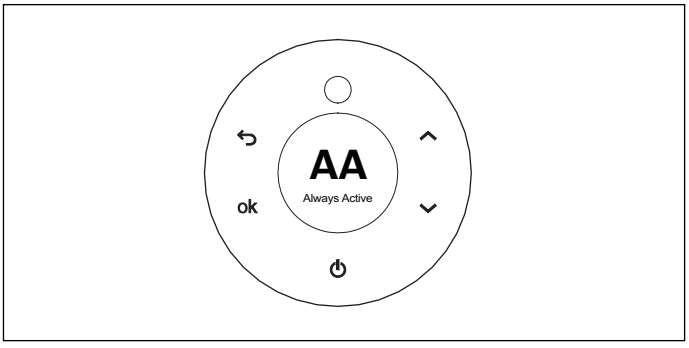


Figure 8

7. There are two scheduling options:
   - **AA Always Active**
   - **SCH Schedule**

AA Always Active
Keeps your home's domestics hot water pipes always heated by measuring the water at the inlet temperature sensor inside the water heater and turning the pump and burner ON as necessary.

a. To engage the **AA Always Active** mode use the ^ or v keys to scroll through the menus until the display shows **AA Always Active** and then press the **ok** key.

SCH Schedule
Allows you to select the days and times when the recirculation mode is active. **SCH Schedule** keeps your home's domestics hot water pipes always heated by measuring the water at the inlet temperature sensor inside the water heater and turning the pump and burner ON as necessary only during the selected days and times.

a. To activate the **SCH Schedule** mode use the ^ or v keys to scroll through the menus until the display shows **SCH Schedule**.

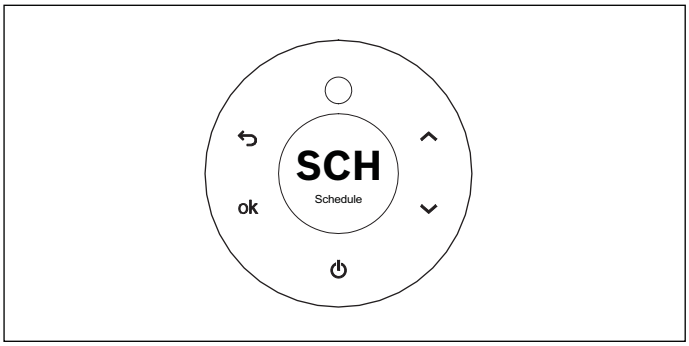


Figure 9

b. Press the **ok** key.
The display shows a bar graph for each day of the week.

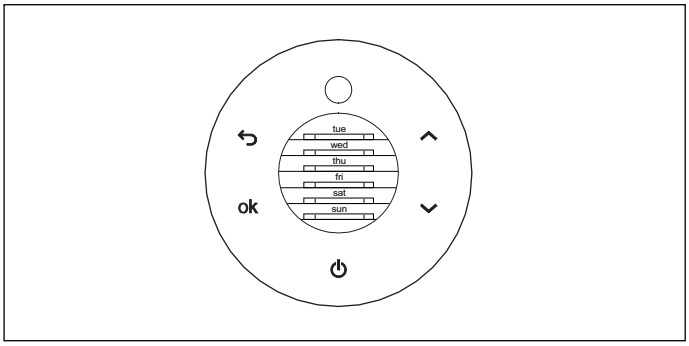


Figure 10

c. Use the ^ or v keys to select the day you would like to activate recirculation.

d. Touch the **ok** key.
The display shows the scheduling menu for the selected day.

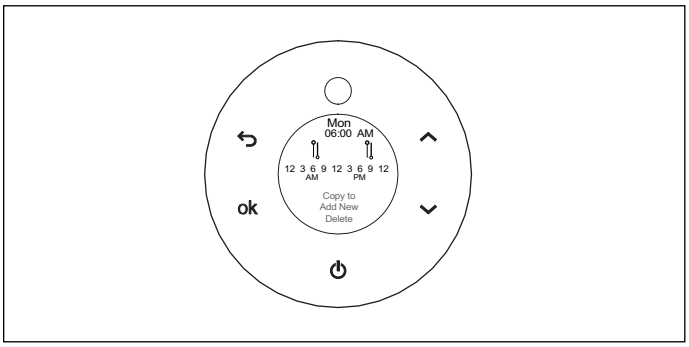


Figure 11

e. Use the ^ or v keys to select the time when you would like to activate recirculation

f. Touch the **ok** key to create a time slot when recirculation will be active.

g. Use the ^ or v keys to select the time when you would like to deactivate recirculation

h. Touch the **ok** key to complete the time slot when recirculation will be active.

i. Repeat the previous four steps to add additional time slots that you would like recirculation to be active

j. To activate recirculation on a different day of the week, you can either use the **copy to** feature or use the ↩ key to return to the bar graph of the days of the week and repeat the previous several steps.

Activating recirculation mode does not mean the pump and burner are ON. When recirculation is active, the pump and burner will turn ON according to the inlet water temperature sensor readings.

4.3.2 Adjusting the recirculation settings

The pump and burner turn ON and OFF based on a delta between the set point temperature on the water heater and the inlet water temperature sensor value. This delta is called the **comfort level**.

The higher the comfort level, the smaller the delta between the set point temperature on the water heater and the inlet water temperature sensor value, resulting in a hotter recirculation system.

The smaller the comfort level, the larger the delta between the set point temperature on the water heater and the inlet water temperature sensor value, resulting in a cooler recirculation system.

Below is a graph illustrating how the comfort level value changes the recirculation system's temperature.

Recirculation logic

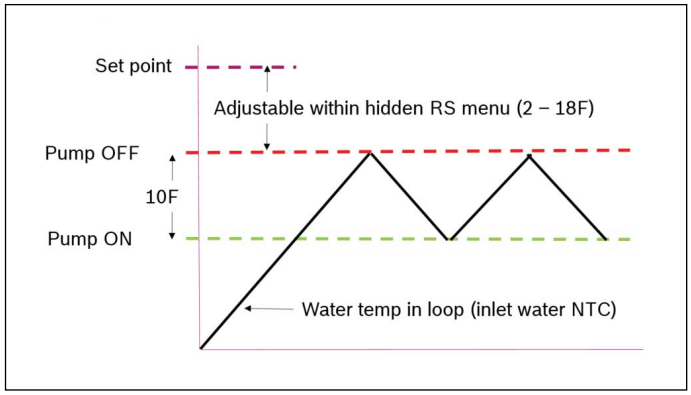


Figure 12 Pump activation and deactivation thresholds

Comfort level	Delta T (°F)
1	18
2	16
3	14
4	12
5	10
6	8
7	6
8	4
9	2

Table 4 RS Menu

The **comfort level** can be adjusted to achieve the desired balance between readiness of hot water at the point of use and energy consumption.

A higher comfort level will result in longer pump run times, which will consume more electricity and gas.

4.3.3 Adjusting the comfort Level

1. Starting from the home screen showing the set point temperature, touch the ⮌ key on the water heater's controls to enter the menus.
   Display shows **P4 Information**

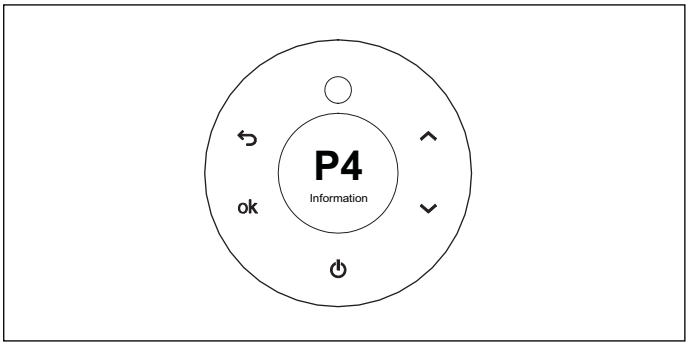


Figure 13

2. Touch the ⌃ or ⌄ keys to scroll through the menus until the display shows **AU Technical Settings**.

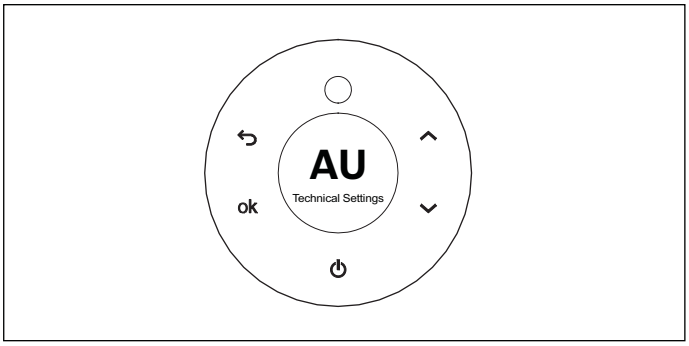


Figure 14

3. Touch the **ok** key.
   The display shows the menu to enter the password.
4. Enter the password, **1886**, using ⌃ or ⌄ and **ok** keys to unlock technical settings menu.

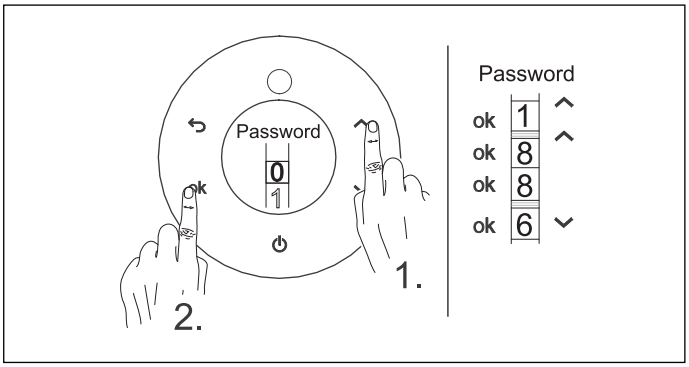


Figure 15

5. Display shows a green check mark indicating the passcode has been accepted. The display will return to the home screen showing the set point temperature.

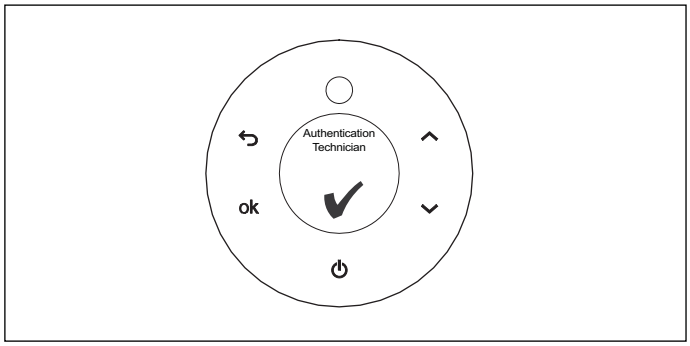


Figure 16

6. Touch the ⮌ key on the water heater's controls to enter the menus.
   Display shows **P4 Information**.

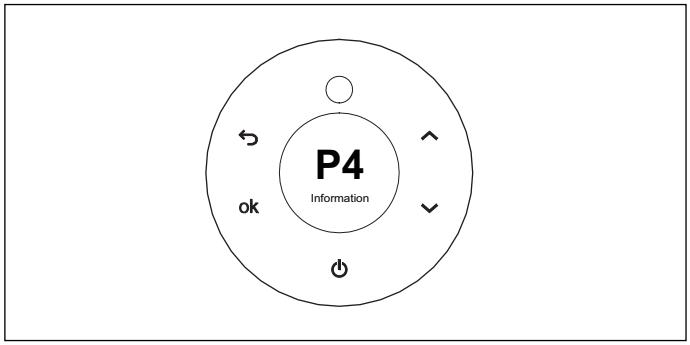


Figure 17

7. Use the ⌃ or ⌄ keys to scroll through the menus until the display shows **RS Recirculation Settings.**

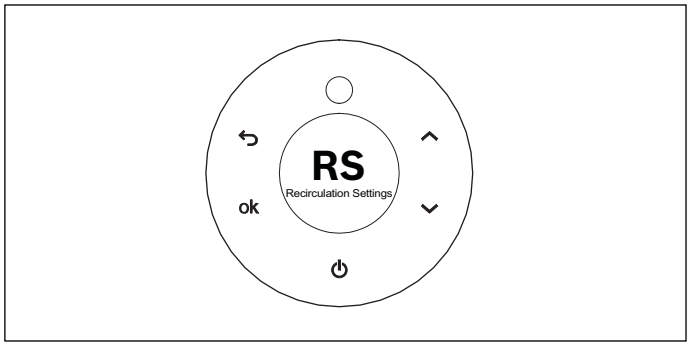


Figure 18

8. Touch the **ok** key.
   The display shows selected comfort level

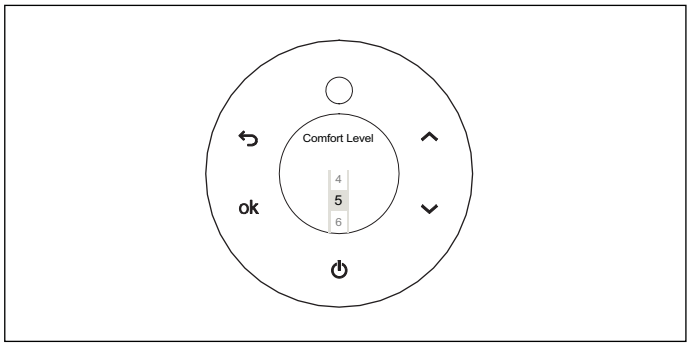


Figure 19

9. Use the ⌃ or ⌄ keys to select the desired comfort level.
10. Touch the ⮌ key to save the desired comfort level

4.3.4 Recirculation with the Greentherm T9900 models

The T9900 models have an integrated pump making hot water recirculation a snap.

Refer to figure 20 for the pressure vs flow curve of the integrated pump to determine through the recirculation system.

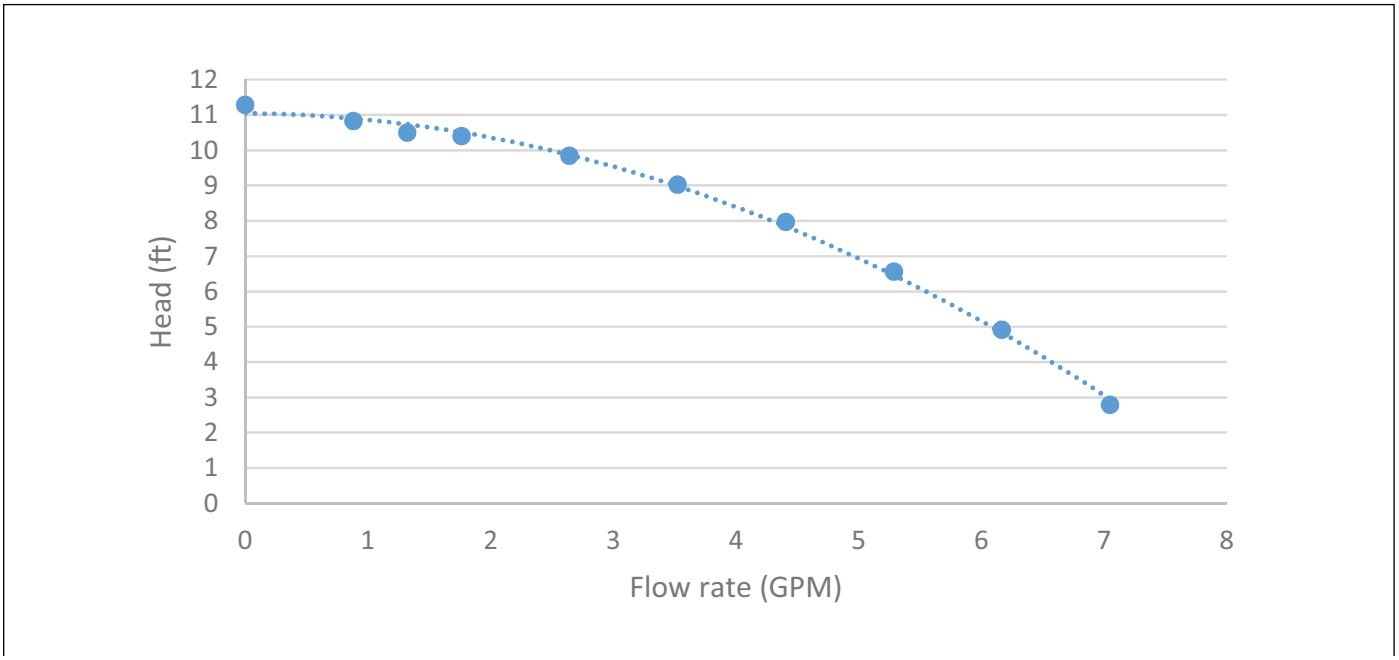


Figure 20

The flow rate through the recirculation system must be larger than the activation flow rate of the Greentherm water heater, 0.4 GPM.

A flow rate through the recirculation system greater than 1GPM is recommended.

4.3.5 Recirculation with the Greentherm T9800 models

Recirculation with the T9800 models requires the installation of an external pump.

The T9800 models have the capability of controlling an external pump by switching power ON and OFF to the external pump using the accessory pump cable kit 7736504585. See figure 21.

Use only bronze or stainless steel pumps. Do not use pumps of iron construction as they will oxidize and pose health risks.

Refer to pump manufactures pressure vs flow specifications to select a pump that will provide adequate flow through the recirculation system.

The flow rate through the recirculation system must be larger than the activation flow rate of the Greentherm water heater, 0.4 GPM.

A flow rate through the recirculation system greater than 1GPM is recommended.

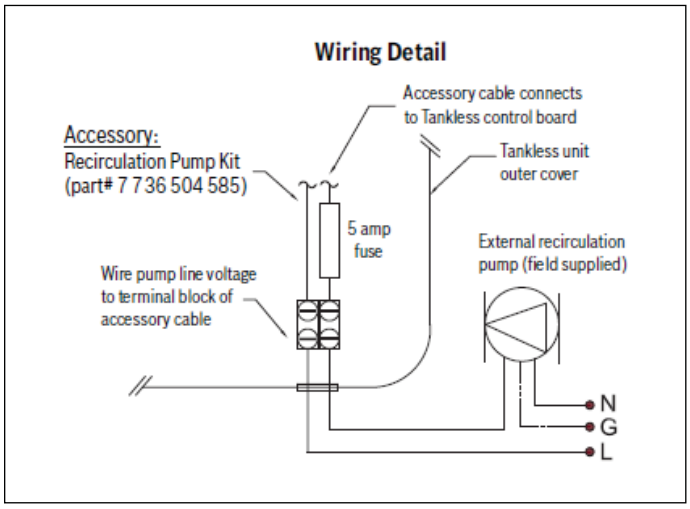


Figure 21

4.3.6 Recirculation system types

There are two basic types of recirculation systems.

- **Dedicated return line** making a complete hot water loop from the water heater to each water point of use and back to the water heater.
- **Cross-over valve** that connects the hot water line to the cold water line at the farthest fixture.

4.3.6.1 Recirculation system with dedicated return line

The preferred recirculation system use a dedicated return line. See figure 22..

Recirculation system using a dedicated return line are typically found in newly built homes.

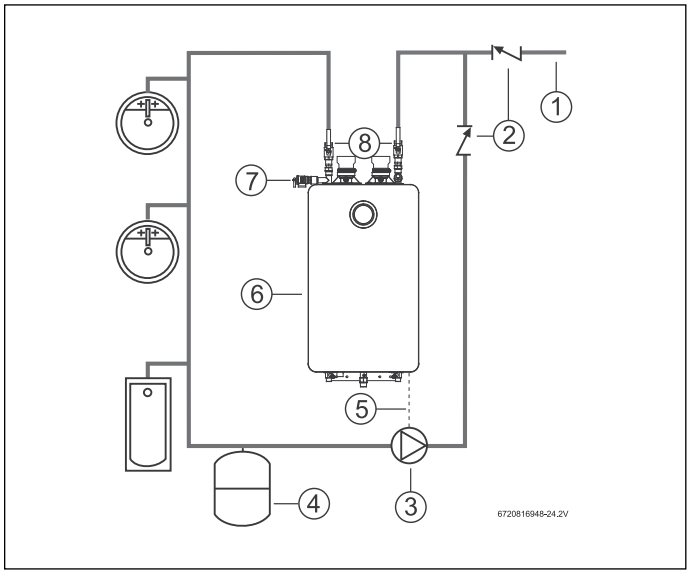


Figure 22 Recirculation application with dedicated return line

[1] Cold water supply
[2] Check valve, field supplied
[3] Circulator pump, field supplied
[4] Expansion tank, field supplied
[5] Circulator cable accessory
[6] Greentherm T9800 SE / SEC
[7] PRV
[8] Shutoff valves, field supplied

4.3.6.2 Recirculation system using a cross-over valve

Cross-over valves are not allowed in some states and localities. Verify with your local codes if cross-over valves are allowed.

Homes built without a dedicated return line can have a cross-over valve installed under the sink located farthest from the water heater allowing for recirculation.

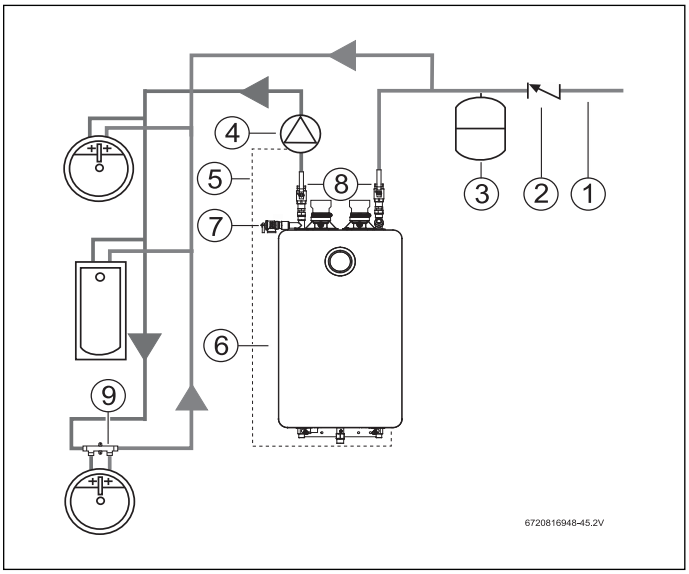


Figure 23 Recirculation application using cold water line & cross-over valve

[1] Cold water supply
[2] Check valve, field supplied
[3] Expansion tank, field supplied
[4] Circulator pump, field supplied
[5] Circulator cable accessory
[6] Greentherm T9800 SE / SEC
[7] PRV
[8] Shutoff valves, field supplied
[9] Cross-over valve, field supplied

The pressure drop through the cross-over valve can be very high resulting a flow rate below the minimum activation flow rate required by the water heater.

Installing two cross-over valves will reduce the pressure drop through the recirculation system resulting in a larger water flow rate. See figure 24 for an illustration of how to install two cross-over valves under the sink located farthest from the water heater.

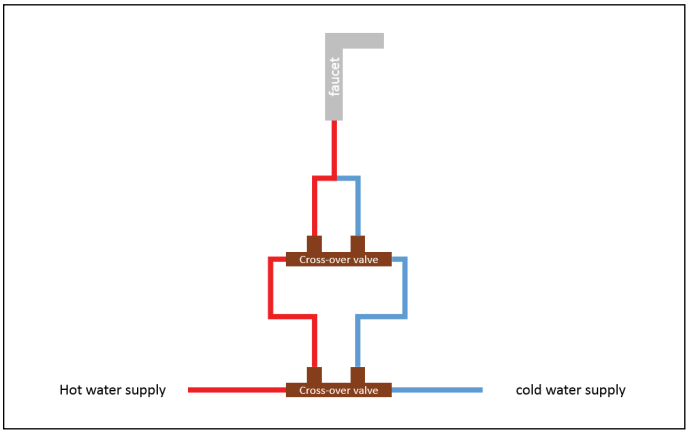


Figure 24

DISCLAIMER: These drawings are conceptual in nature, not to scale and for reference only. Additional functional, installation, and safety devices may be needed or required. All work pertaining to the installation shall be in full compliance with all legal requirements, including national and local codes. Best installation practices should be followed.

4.3.7 Determining the flow rate through the recirculation system

There are three steps to calculating the flow rate though the recirculation system.

1. First, obtain the head vs flow rate chart for the pump.
2. Second, sum the pressure drop for the recirculation system a various flow rates to create a pressure vs flow rate chart
3. Lastly, overlay the head vs flow rate chart for the pump on top of the pressure drop vs flow rate curve of the recirculation system and the point where the two graphs intersect is the calculated flow rate through the recirculation system.

> The Greentherm 9000 has an **operational menu** that shows the actual flow rate being measured by the water heater.

4.3.7.1 Determining the flow rate through the recirculation system with a dedicated return line

Below is the head vs flow rate curve for the T9900 pump

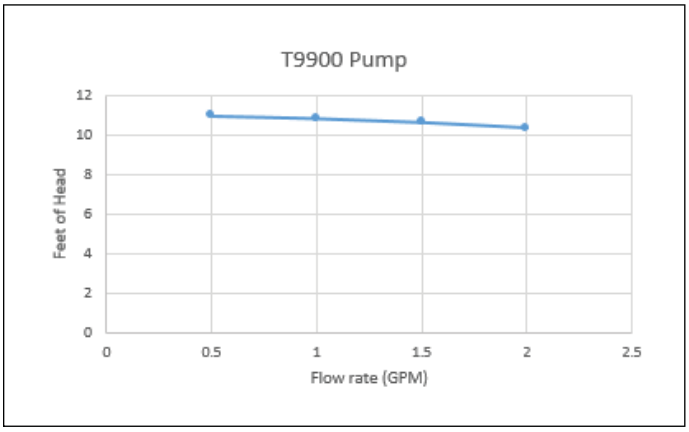


Figure 25

Below is an illustration of the recirculation loop with identified components.

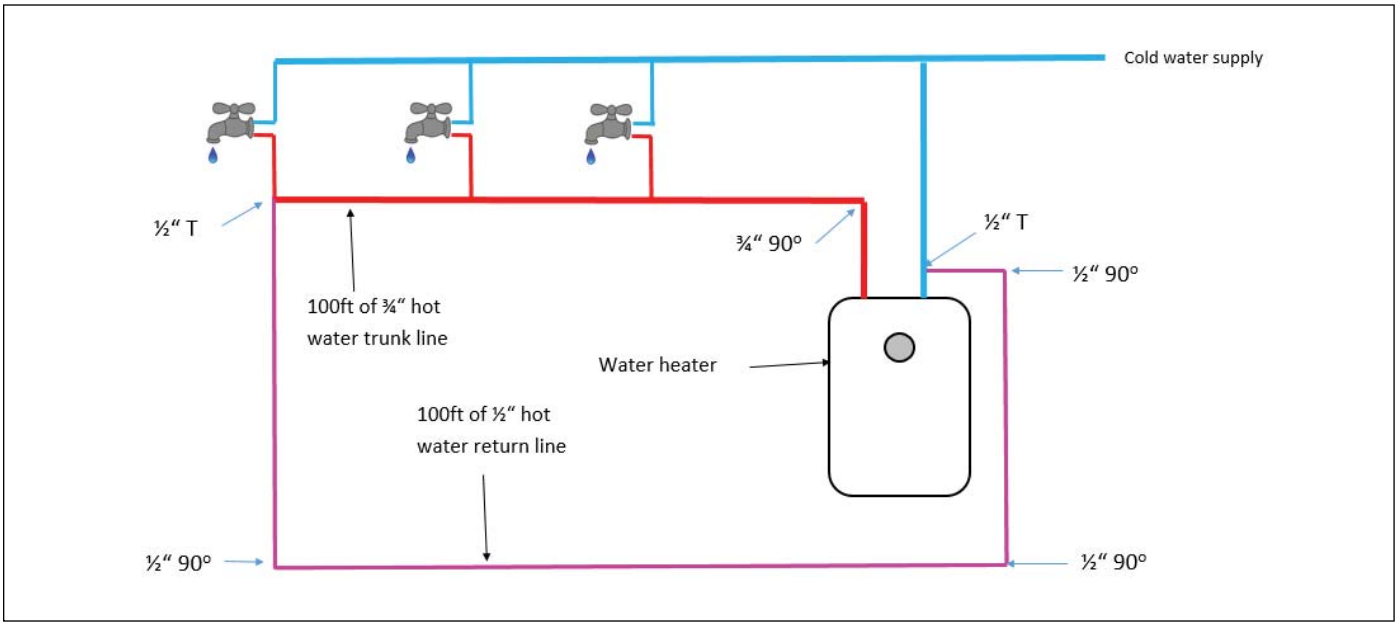


Figure 26

DISCLAIMER: This drawing is conceptual in nature, not to scale and for reference only. Additional functional, installation, and safety devices may be needed or required. All work pertaining to the installation shall be in full compliance with all legal requirements, including national and local codes. Best installation practices should be followed.

Below is the table summing up the pressure drop of each component in the recirculation loop at various flow rates.

Item in recirculation loop	Pressure drop at 0.5 GPM	Pressure drop at 1.0 GPM	Pressure drop at 1.5 GPM	Pressure drop at 2.0 GPM
3/4" copper 90°	0.002 feet of head	0.006 feet of head	0.014 feet of head	0.023 feet of head
100ft of 3/4" hot water trunk line	0.089 feet of head	0.319 feet of head	0.676 feet of head	1.151 feet of head
1/2" copper T	0.005 feet of head	0.019 feet of head	0.040 feet of head	0.068 feet of head
1/2" copper 90°	0.005 feet of head	0.019 feet of head	0.040 feet of head	0.068 feet of head
100ft of 1/2" copper hot water return line	0.524 feet of head	1.888 feet of head	3.998 feet of head	6.808 feet of head
1/2" copper 90°	0.005 feet of head	0.019 feet of head	0.040 feet of head	0.068 feet of head
1/2" copper 90°	0.005 feet of head	0.019 feet of head	0.040 feet of head	0.068 feet of head
1/2" copper T	0.005 feet of head	0.019 feet of head	0.040 feet of head	0.068 feet of head
T9900 water heater	4.114 feet of head	4.494 feet of head	5.512 feet of head	7.158 feet of head
Total:	**4.754 feet of head**	**6.802 feet of head**	**10.400 feet of head**	**17.542 feet of head**

Table 5

Below is the graph of the pressure drop through the recirculation loop at various flow rates.

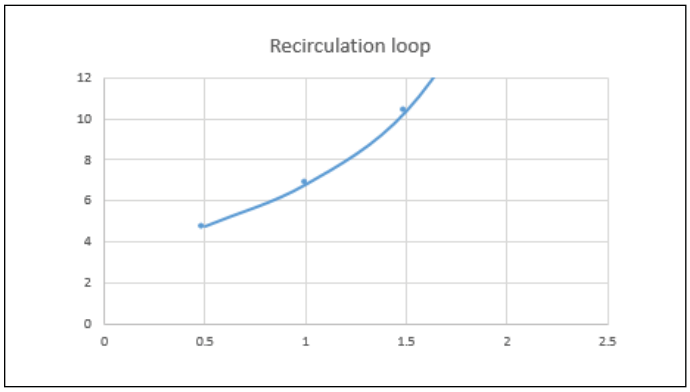


Figure 27

When the pump chart is overlaid on top of recirculation loop curve, the intersection point indicates that the flow rate in this example will be about 1.55 GPM.

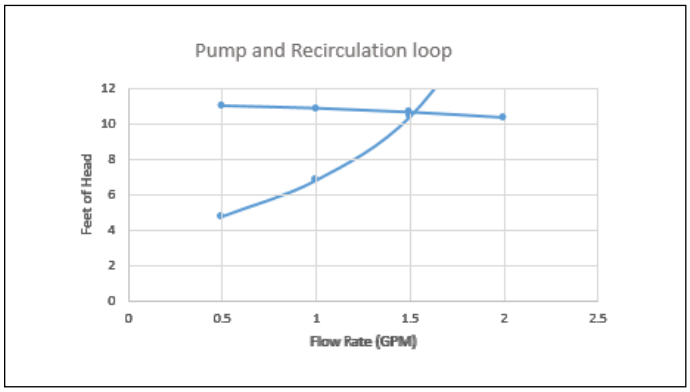


Figure 28

4.3.7.2 Determining the flow rate through the recirculation system with a cross-over valve

Below is the head vs flow rate curve for the T9900 pump

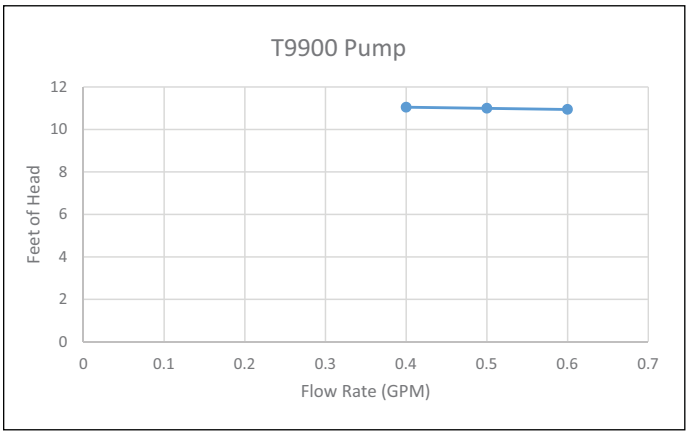


Figure 29

Below is an illustration of the recirculation loop with identified components.

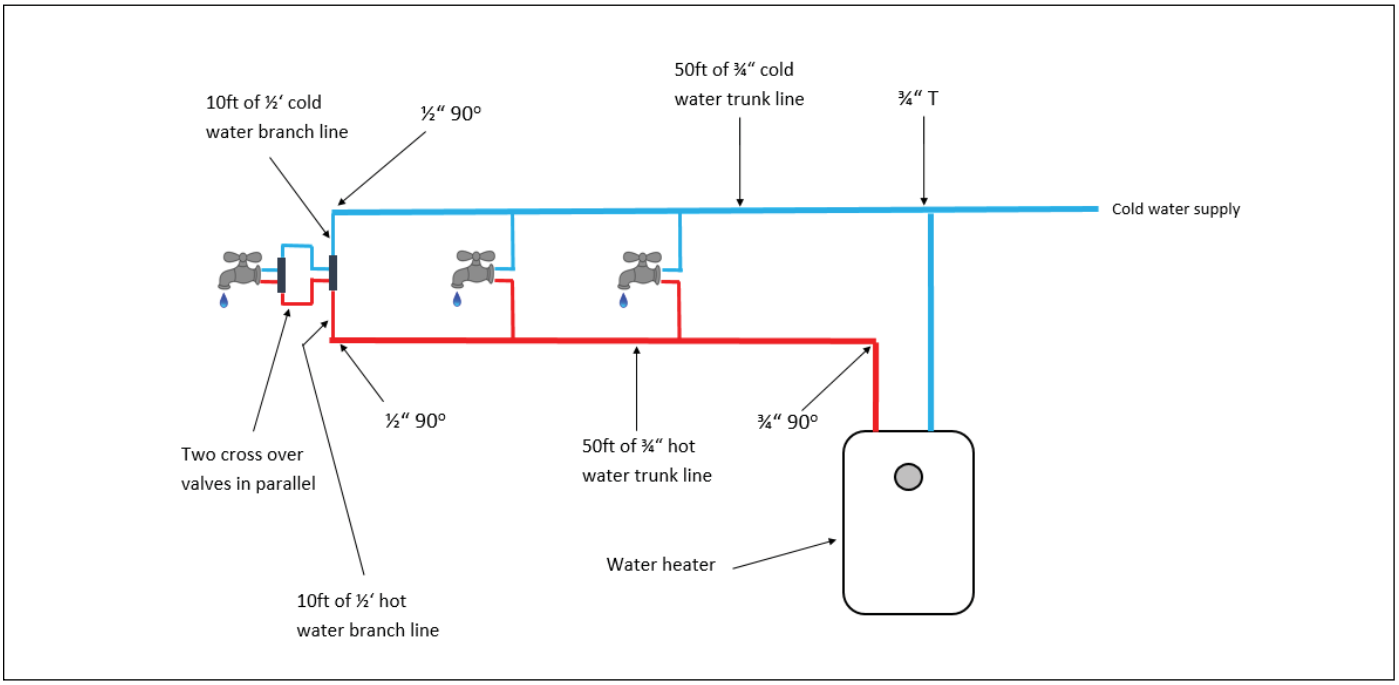


Figure 30

DISCLAIMER: This drawing is conceptual in nature, not to scale and for reference only. Additional functional, installation, and safety devices may be needed or required. All work pertaining to the installation shall be in full compliance with all legal requirements, including national and local codes. Best installation practices should be followed.

Below is the table summing up the pressure drop of each component in the recirculation loop at various flow rates.

Item in recirculation loop	Pressure drop at 0.5 GPM	Pressure drop at 1.0 GPM
3/4" copper 90°	0.001 feet of head	0.002 feet of head
50ft of 3/4" hot water trunk line	0.029 feet of head	0.044 feet of head
1/2" copper 90°	0.003 feet of head	0.005 feet of head
10ft of 3/4" hot water branch line	0.035 feet of head	0.052 feet of head
Two cross-over valves installed in parallel	5.821 feet of head	8.020 feet of head
10ft of 3/4" cold water branch line	0.035 feet of head	0.052 feet of head
1/2" copper 90°	0.003 feet of head	0.005 feet of head
50ft of 3/4" hot water trunk line	0.029 feet of head	0.044 feet of head
3/4" copper T	0.001 feet of head	0.002 feet of head
T9900 water heater	4.113 feet of head	4.114 feet of head
Total:	**10.059 feet of head**	**12.52 feet of head**

Table 6

Figure 31 is the graph of the pressure drop through the recirculation loop at various flow rates.

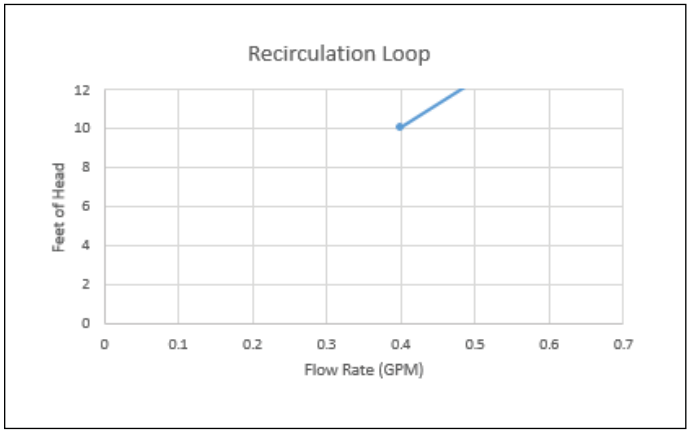


Figure 31

When the pump chart is overlaid on top of recirculation loop curve (figure 32), the intersection point indicates that the flow rate in this example will be about 0.44 GPM, just enough to meet the Greentherm's minimum activation flow rate.

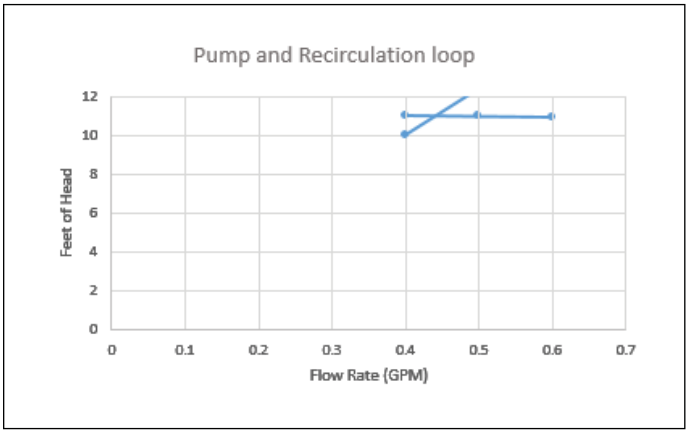


Figure 32

4.4 Tank loading

Tank loading pairs tankless water heaters with storage tanks to maximize peak flow for high demand applications. A tank load system, because of the added storage, can provide a high peak flow with fewer tankless units and lower installed cost.

Tank loading is recommend for high cycle applications such as commercial kitchens with hand sprayers.

These guidelines should be followed to maximize system output:

- Ensure flow through each water heater is between 3.5-5.0 gpm. See recommended pump models in application section of this manual.
- For best performance, plumb the system or configure the tank to draw cold supply water into the water heater during hot water use.
- Maintain a 20 degree temperature difference between tankless set-point and desired tank temperature.
- Do not use a cascading kit in a tank loading application.
- When multiple tankless water heaters are used, the total equivalent length of piping to each unit should be kept roughly equal. A reverse return piping scheme is recommended to equalize flow through each water heater.
- For tank temperature settings above 120°F, the Bosch commercial model should be used.

Recirculation Loop Pressure Drop at 2GPM (Feet of Head)

Material	10ft Pipe	90° Elbow	45° Elbow	Tee Branch
¾" Type L Copper	0.48	0.1	0.03	0.15
1" Type L Copper	0.14	0.04	0.02	0.07
1.25" Type L Copper	0.06	0.02	0.01	0.04
1.5" Type L Copper	0.03	0.01	<0.01	0.02
2" Type L Copper	0.01	<0.01	<0.01	0.01

Table 7 Source: 2009 International Plumbing Code

Pressure drop vs. flow

# of units	T9800 SE 160	T9800 SE 199
1	20 feet of head @ 4gpm	21 feet of head @ 4gpm
2	20 feet of head @ 8gpm	21 feet of head @ 8gpm
3	20 feet of head @ 12gpm	21 feet of head @ 12gpm
4	20 feet of head @ 16gpm	21 feet of head @ 16gpm
5	20 feet of head @ 20gpm	21 feet of head @ 20gpm
6	20 feet of head @ 24gpm	21 feet of head @ 24gpm
7	20 feet of head @ 28gpm	21 feet of head @ 28gpm
8	20 feet of head @ 32gpm	21 feet of head @ 32gpm
9	20 feet of head @ 36gpm	21 feet of head @ 36gpm
10	20 feet of head @ 40gpm	21 feet of head @ 40gpm

Table 8

EXAMPLE:
Sizing a pump for a 4GPM tank loading DHW system with a T 9800 SE 199 and a 20 ft total loop length.

Head Loss	**Loop Component**
22.00 ft	T 9800 SE 199 (See Fig.2)
1.00 ft	20 ft of ¾ copper
0.80 ft	8 x ¾" 90 elbows
+ 0.30 ft	2 x ¾" Tees (branch)
24.1ft	**Minimum Pump Head at 4.0 gpm**

Once the loop head loss has been calculated, use the pump manufacturer's performance curves to select the proper potable water circulator at the required flow rate.

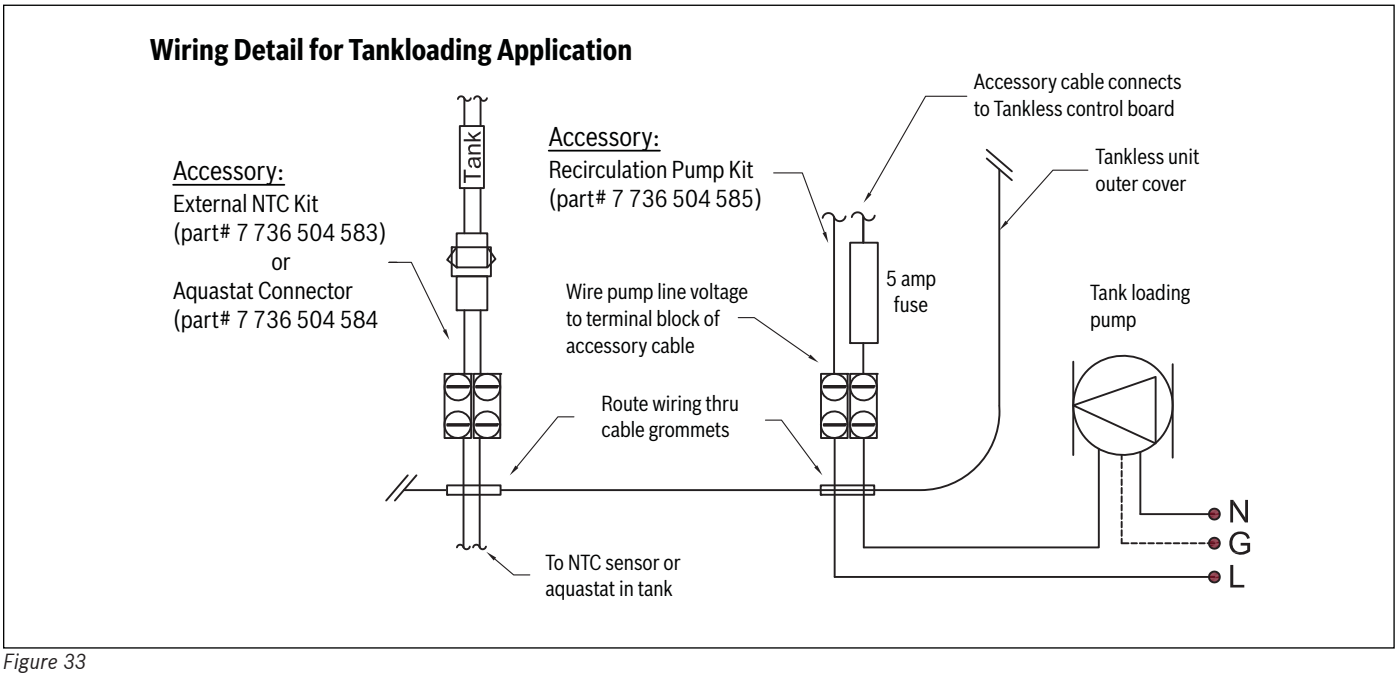
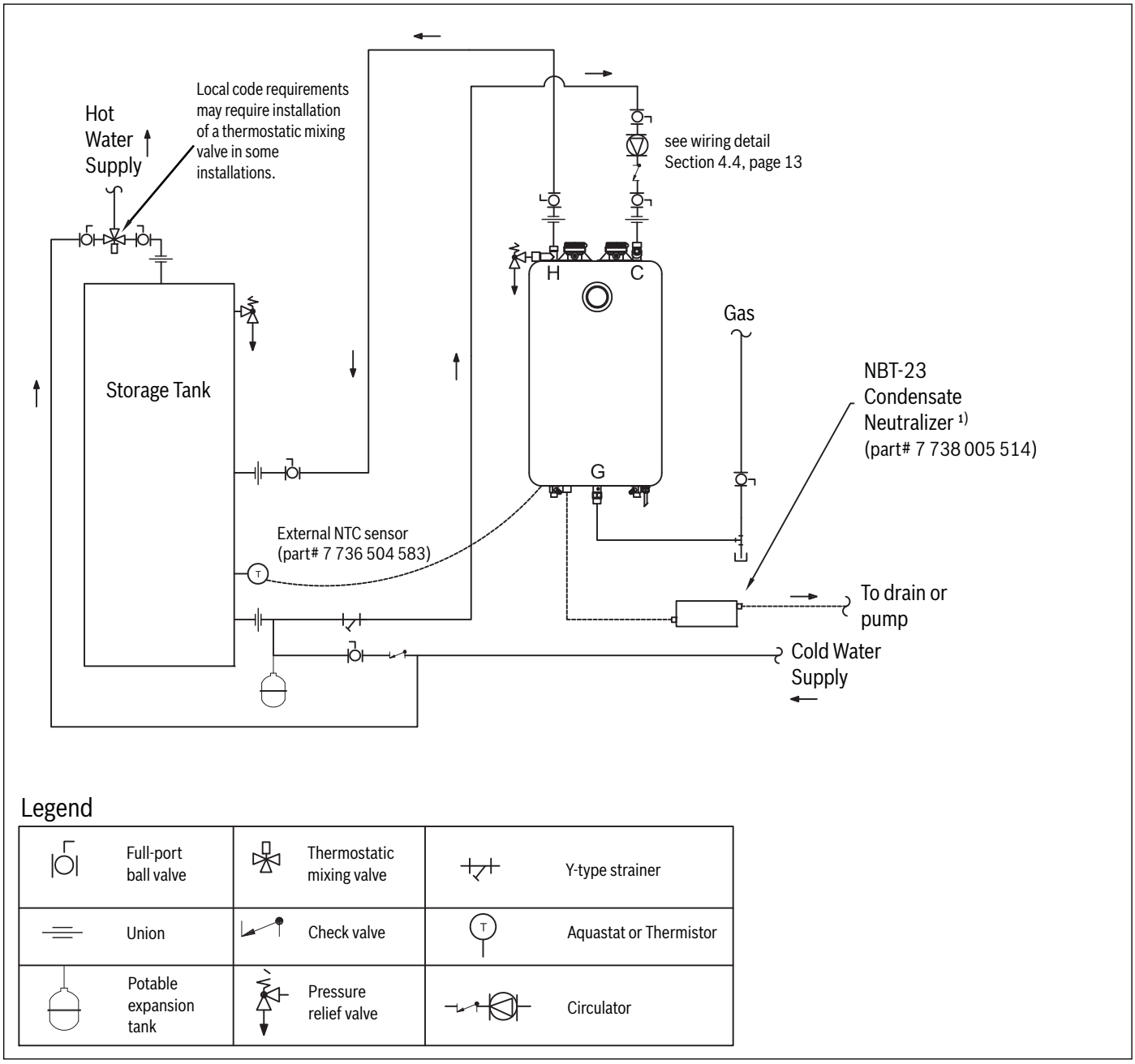


Figure 33

4.4.1 Single T9800 tank loading installation



1) as required by local code.

Recommended Pump:

Manufacturer	Model
Grundfos	UP 26-99 SF
Taco	0013 SF3
B & G	PL-36

Table 9

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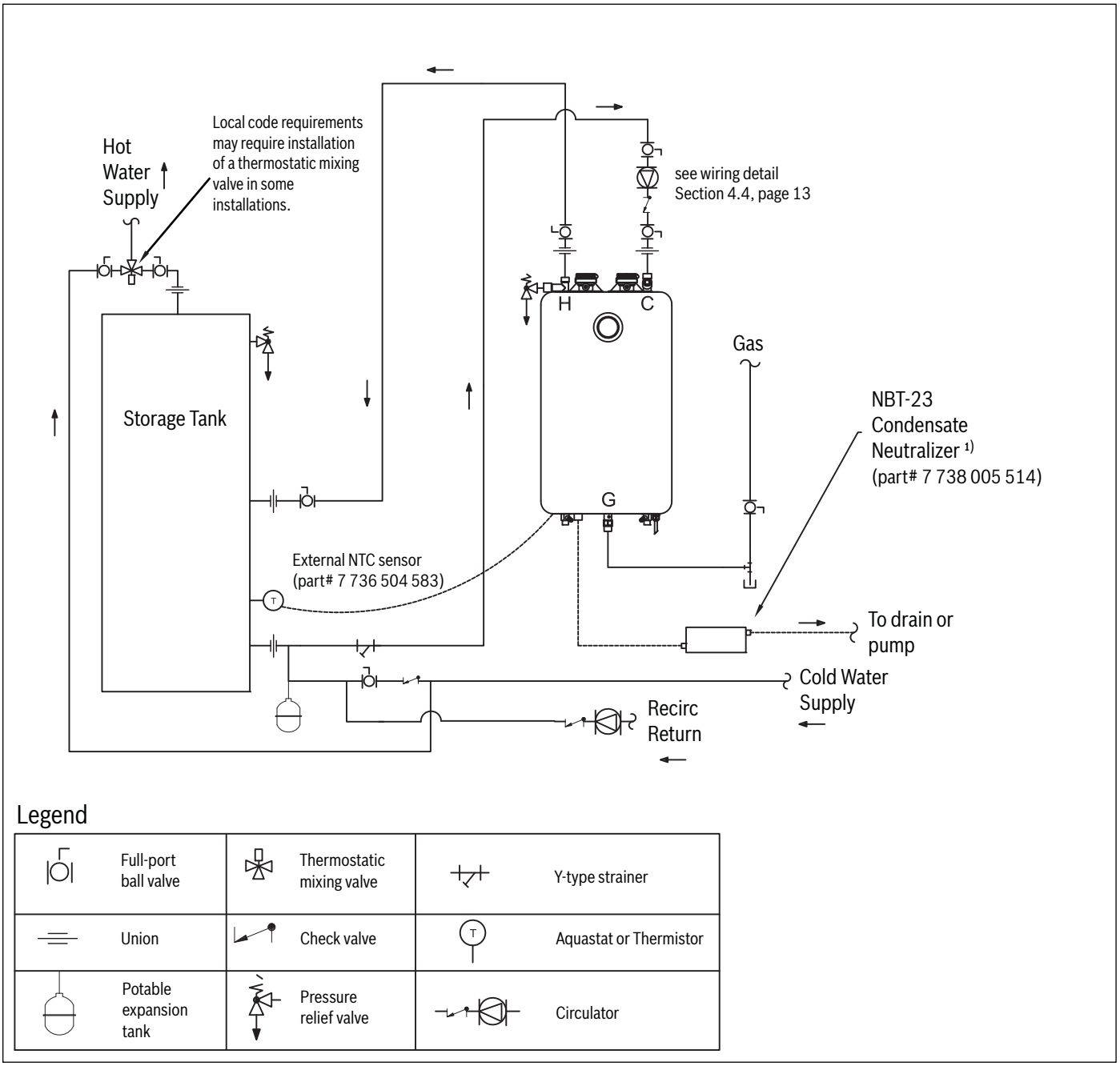
4.4.2 Single T9800 tank loading with recirculation installation



[1]) as required by local code.

Recommended Pump:

Manufacturer	Model
Grundfos	UP 26-99 SF
Taco	0013 SF3
B & G	PL-36

Table 10

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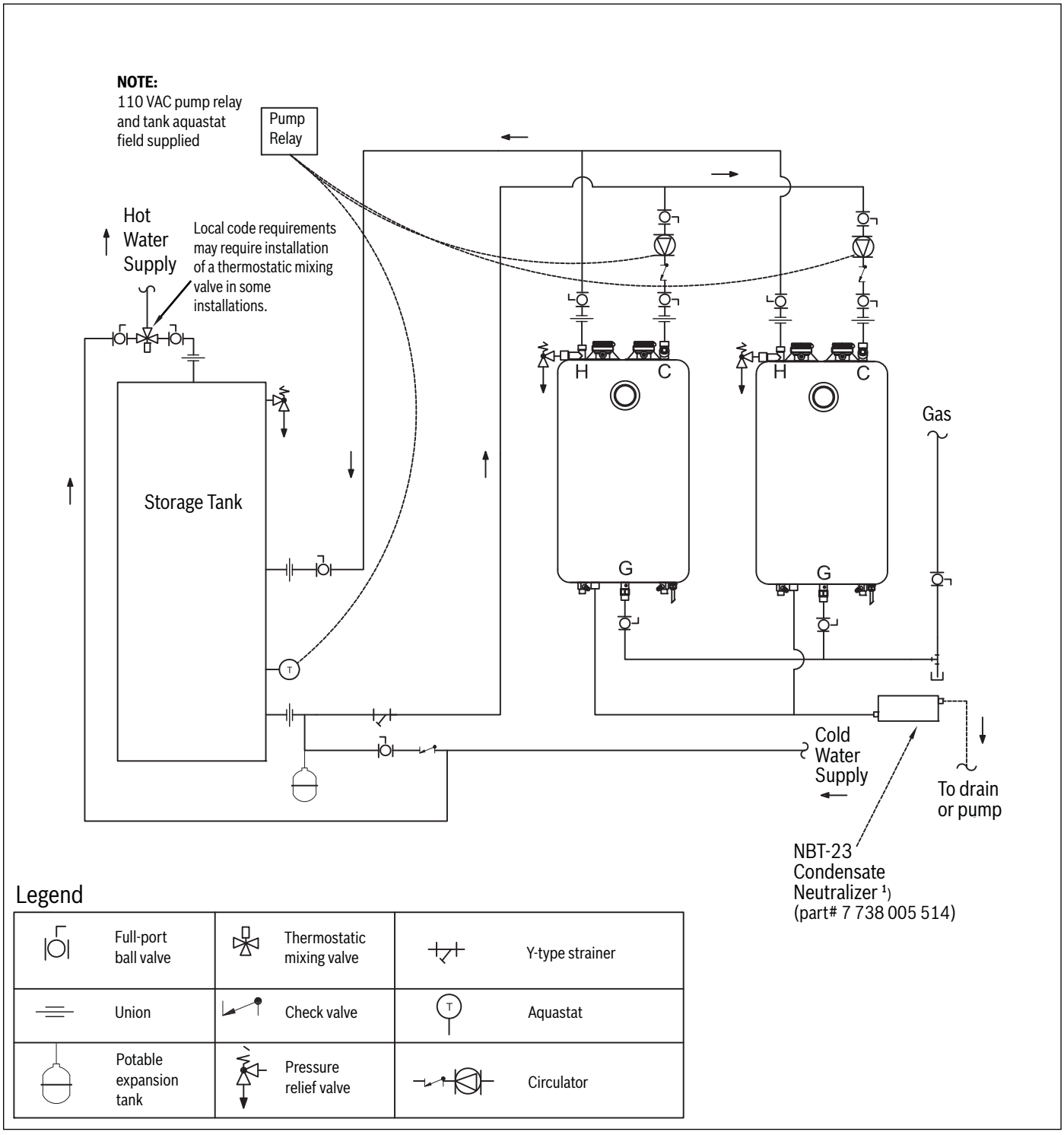
4.4.3 Multiple T9800 tank loading installation



1) as required by local code.

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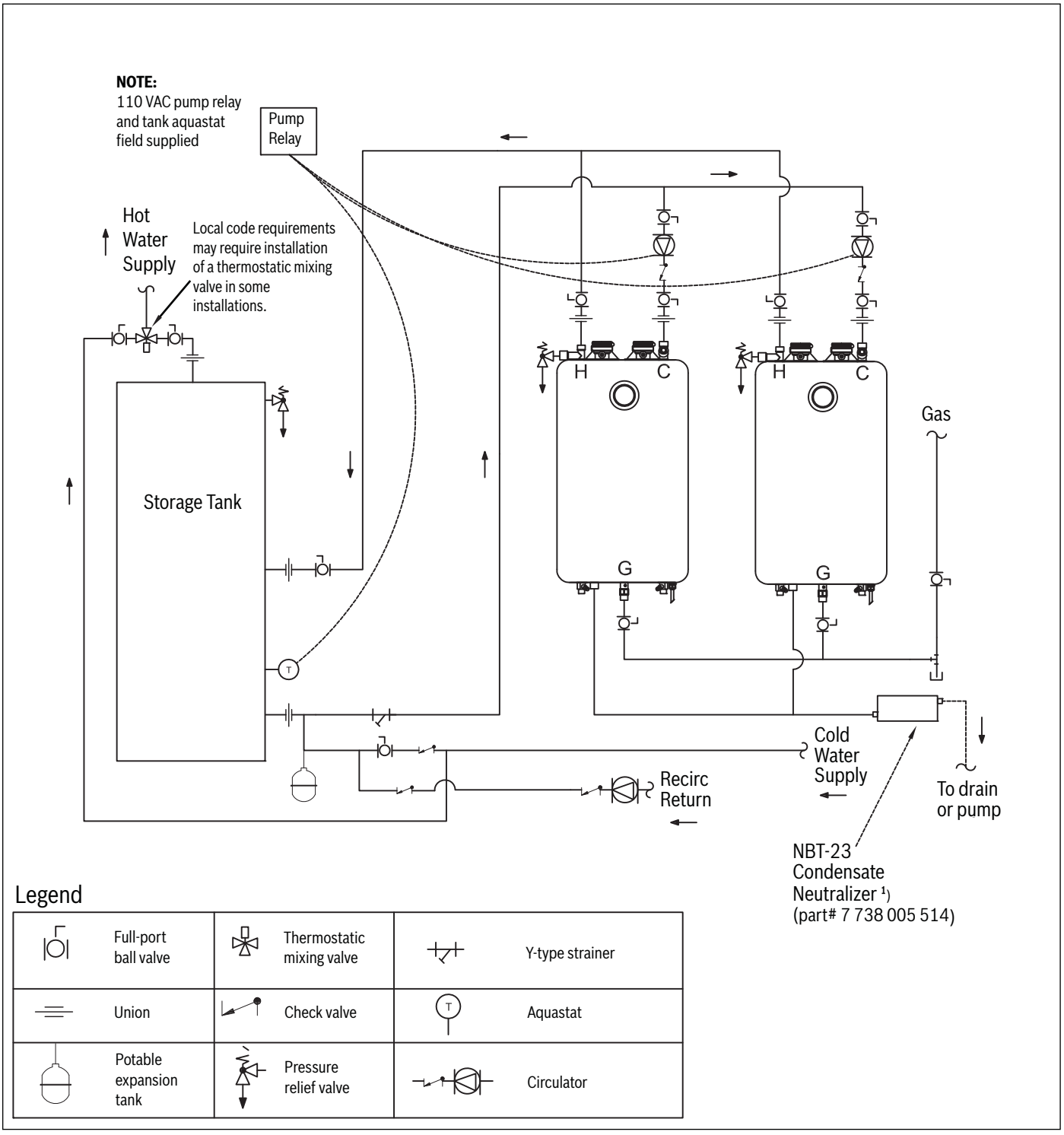
4.4.4 Multiple T9800 tank loading with recirculation installation



1) as required by local code.

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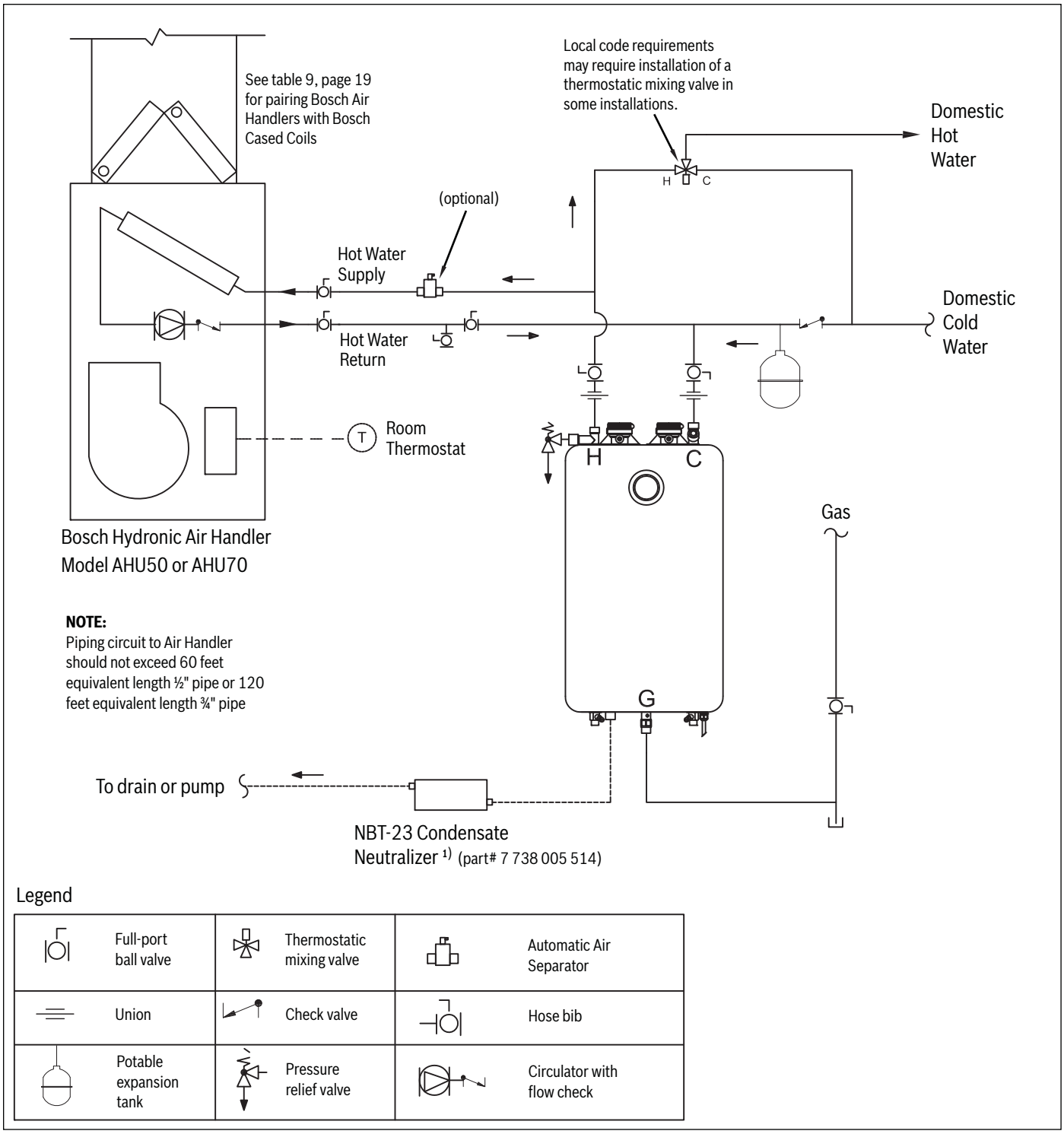
4.5 Space heating

4.5.1 Single T9800 with Bosch air handler installation



Legend

Full-port ball valve	Thermostatic mixing valve	Automatic Air Separator
Union	Check valve	Hose bib
Potable expansion tank	Pressure relief valve	Circulator with flow check

1) as required by local code.

DISCLAIMER: This drawing is conceptual in nature, not to scale and for reference only. Additional functional, installation, and safety devices may be needed or required. All work pertaining to the installation shall be in full compliance with all legal requirements, including national and local codes. Best installation practices should be followed.

4.6 Pairing Bosch air handlers with Bosch cased coils

Hydronic Air Handler Model	Cased Coil Model	Cooling Capacity *		
		Total	SEER	EER
AHU50	BMAC2430BNTD	23400	15	12
	BMAC3036BNTD	32400	15	10
	BMAC4248BNTF	44500	16	11
AHU70	BMAC3036CNTD	32400	15	10
	BMAC4248CNTF	46000	16	11
	BMAC4860CNTF	54000	16	11

Table 11

* Capacity, SEER and EER ratings of the cased coiler models are based on the performance of the cased coil when paired with a Bosch IDS Condenser. Performance will vary if used with a third-party condenser.

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