

Creating a “summer/winter” pellet boiler system

Description: Some residential hydronics systems provide domestic hot water as an ancillary load to space heating. When including a pellet boiler in such a system it can also supply some energy for domestic water heating. This webinar shows how to do this in a way that operates the pellet boiler and the auxiliary boiler at high efficiency.

Learning Objectives:

- Describe the pros and cons of using a pellet boiler for year round DHW
- Understand how a 3-way valve is used for diverting flow
- Understand the reason for piping the aux boiler through upper portion of buffer tank.
- Describe differences in 3-way valve design and function.

Design Assistance Manual for High Efficiency Low Emissions Biomass Boiler Systems

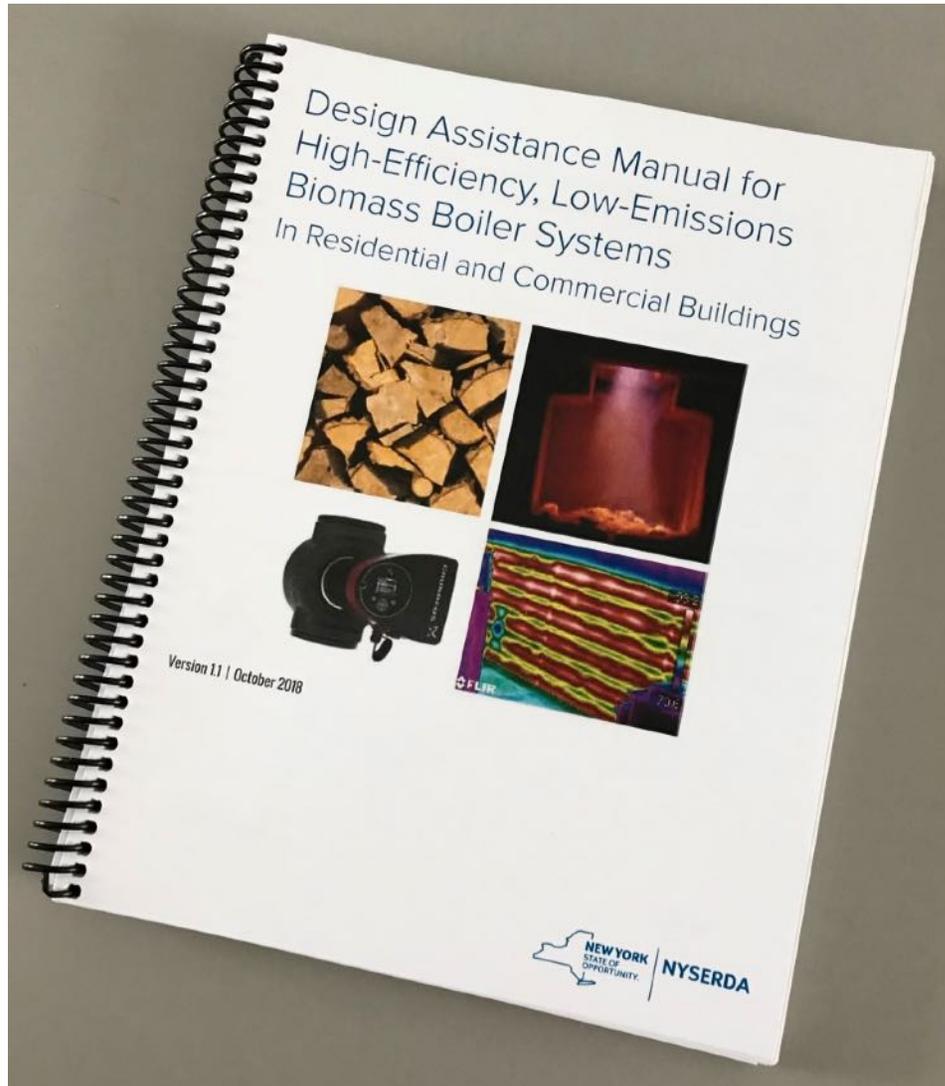


Table of Contents:

1. Introduction
2. Cordwood Gasification Boilers
3. Pellet-Fired Boilers
4. Boiler Air Supply & Venting Systems
5. Thermal Storage
6. Heat Emitters & Distribution Systems
7. System Design Details
8. System Templates

It's available as a FREE downloadable PDF at:

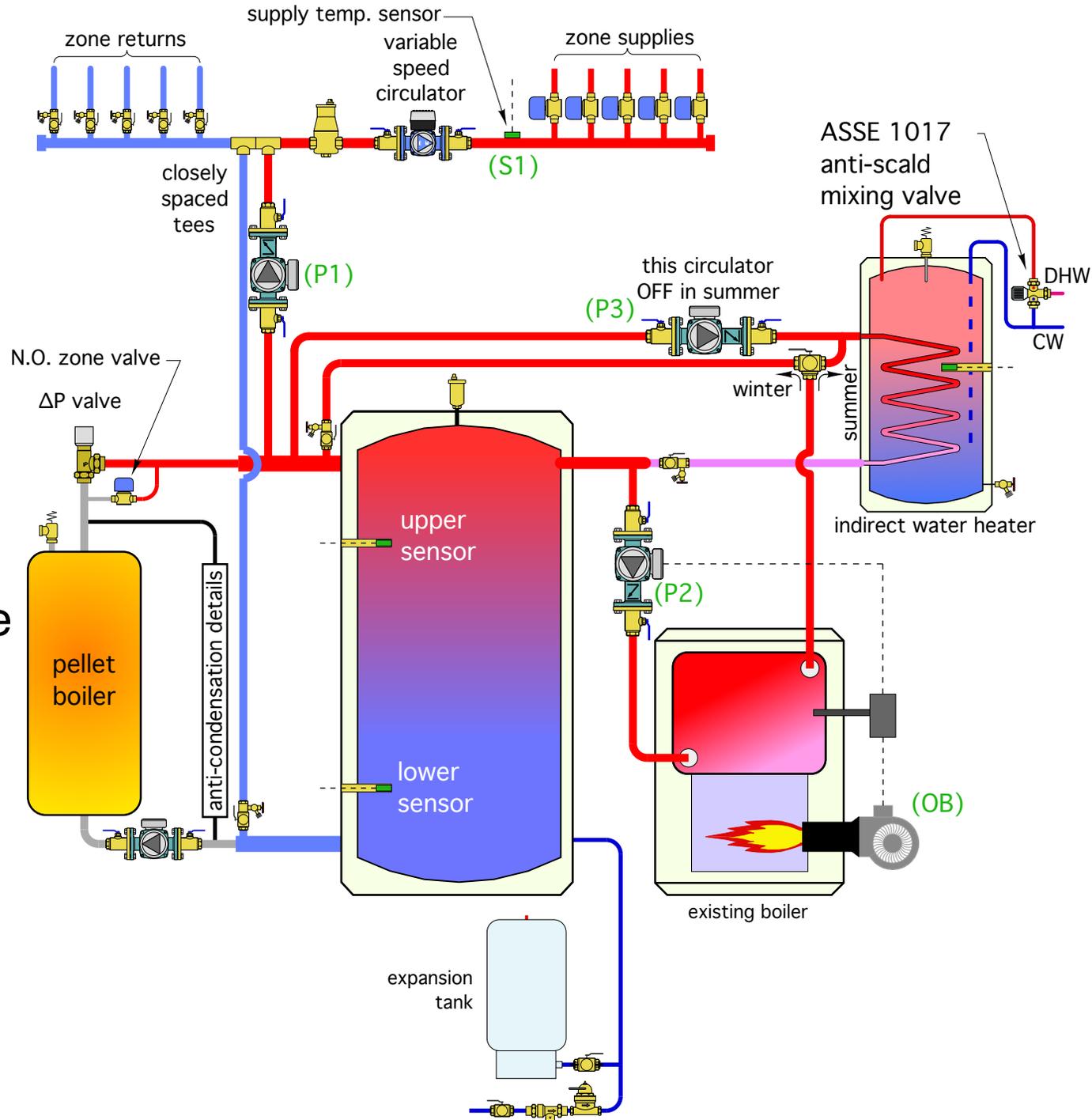
<https://www.nyserda.ny.gov/-/media/Files/EERP/Renewables/Biomass/Design-Assistance-Biomass-Boiler.pdf>

Common scenarios

- Many pellet boilers are retrofits to ***existing*** residential hydronic systems ***that already have indirect water heaters***.
- ***The existing boiler will be retained for backup heat***, and the indirect water heat will also remain.
- The internal heat exchanger coil in many indirects is relatively small and intended to operate with high supply water temperature.
- **The standby heat loss of a thermal storage tank adds to building cooling load in summer.**
- In commercial or municipal “garage” type buildings the need for DHW is relatively low, and likely doesn’t justify the use of an indirect water heater, over a simple 30 gallon electric water heater.

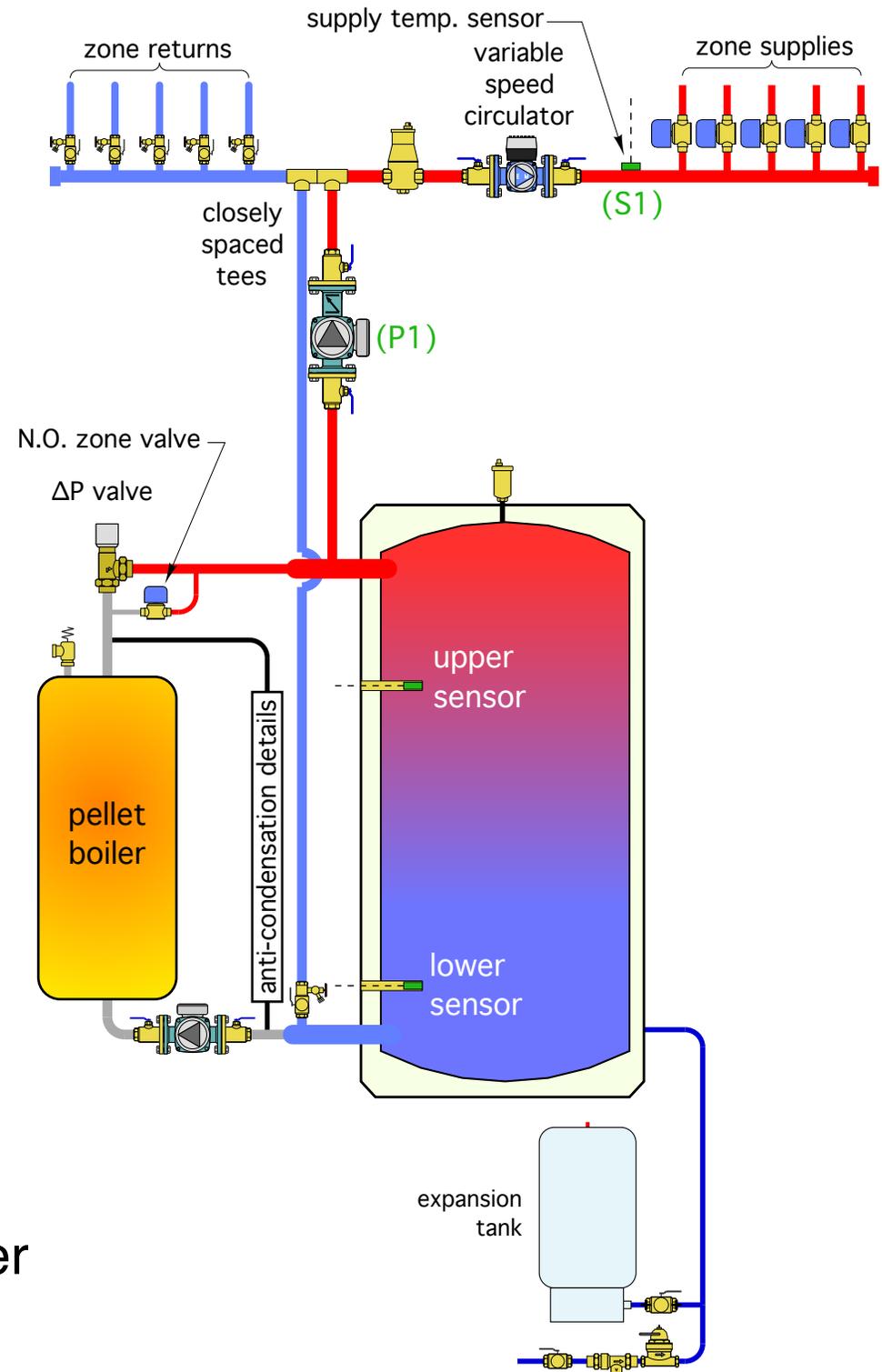
The overall system:

- Pellet boiler with anti-condensation protection
- 2-pipe buffer tank configuration
- VS distribution circulator w/ zone valves
- Auxiliary boiler could be new or existing (retrofit)
- Indirect water heater could be new or exiting (retrofit)

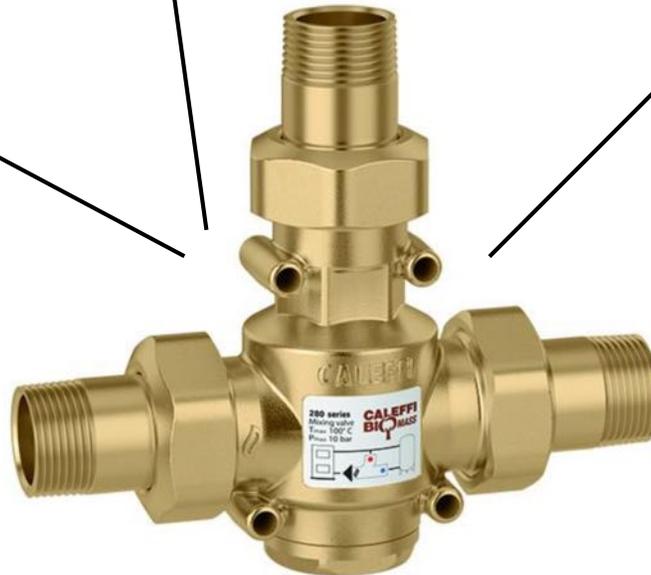
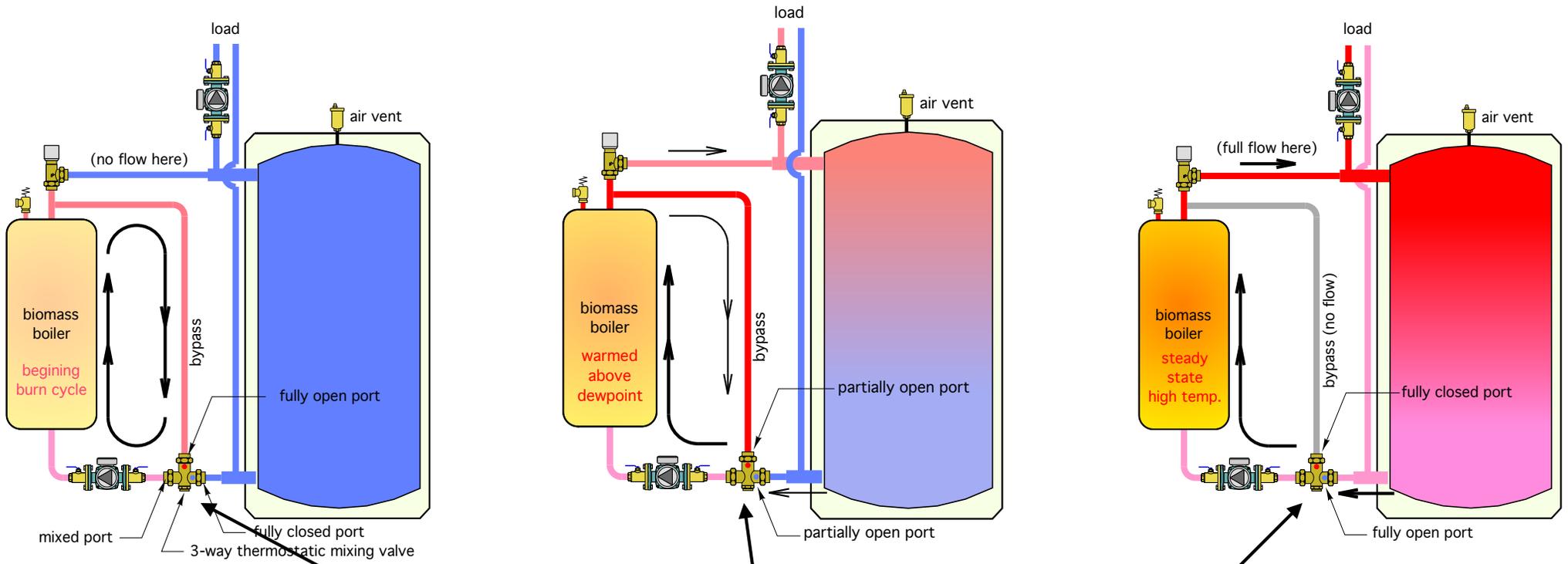


The pellet boiler subsystem:

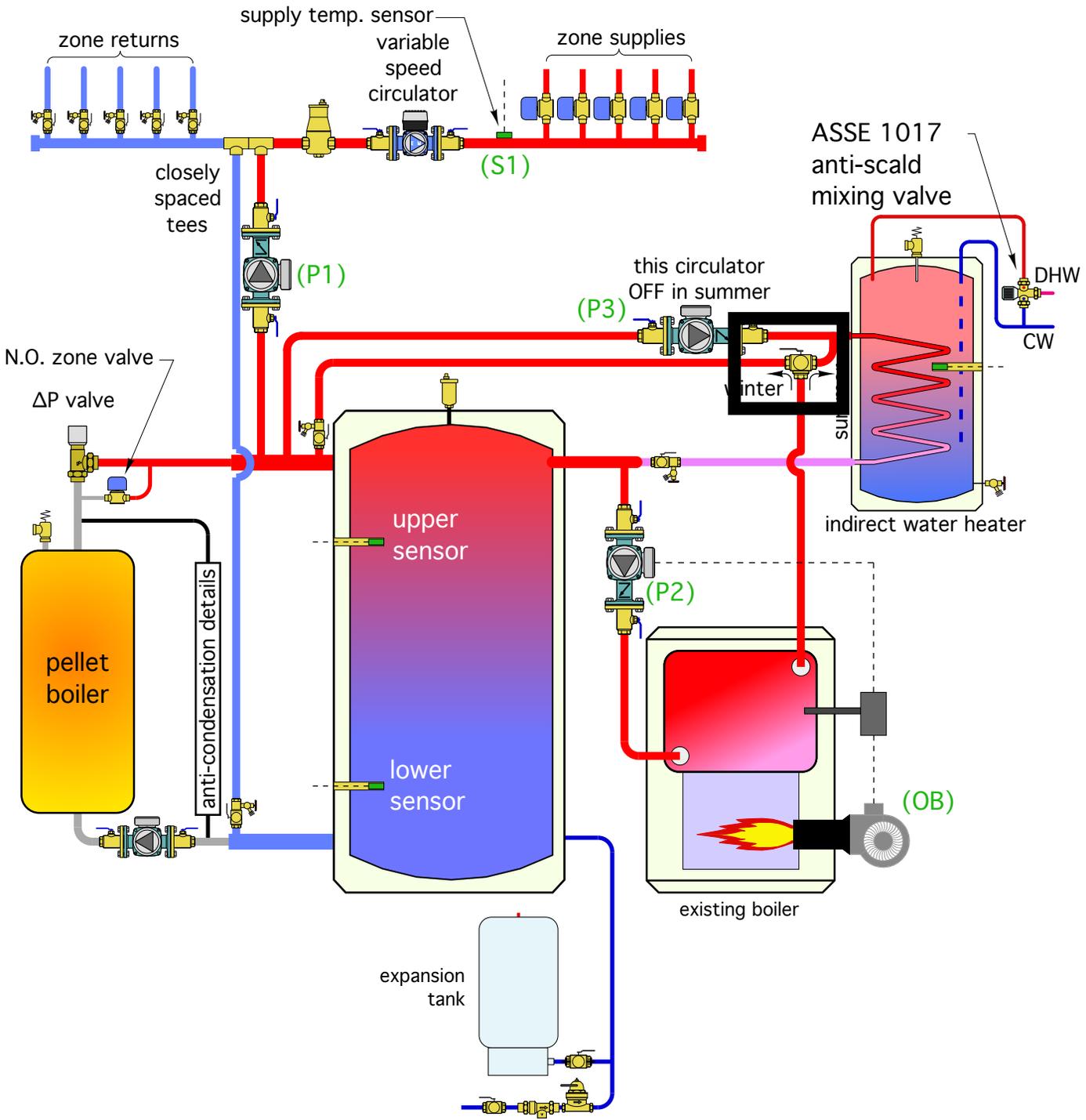
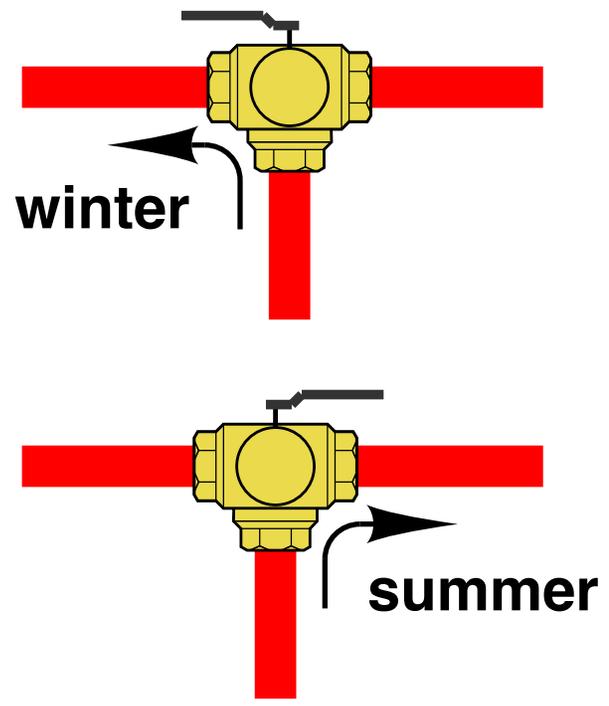
- Pellet boiler, when allowed to operate, fires based on upper and lower tank temperatures
- Pellet boiler = ON when upper tank sensor drops to or below some minimum value.
- Pellet boiler = OFF when lower tank sensor climbs to or above some maximum value.
- ΔP valve (set for 1 to 1.5 psi) prevents flow returning from load from passing through pellet boiler when it is off.
- N.O. zone valve opens during power outage to allow thermosiphoning



Boiler anti-condensation protection using 3-way thermostatic valve

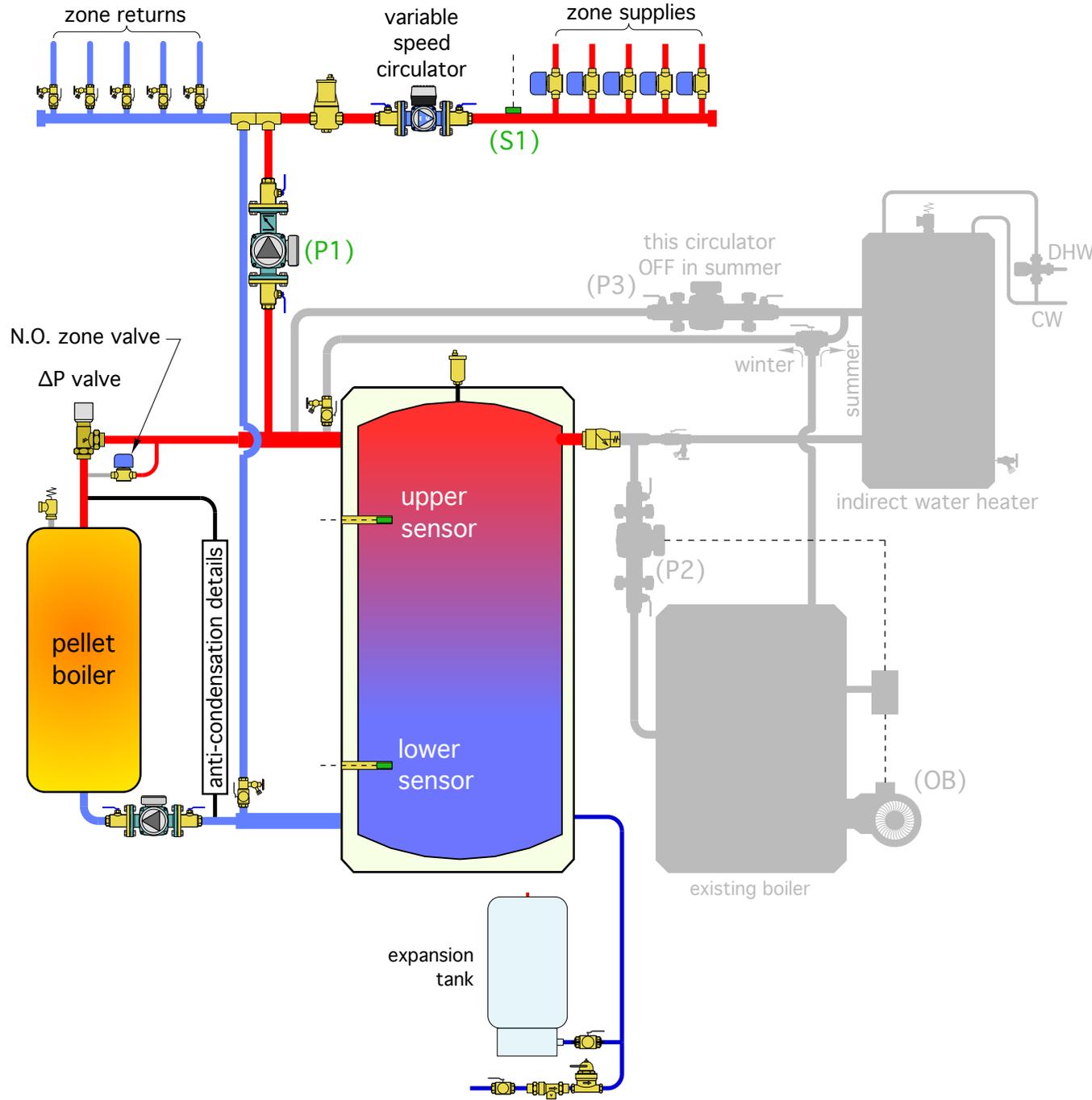


A 3-way ball valve is one key component



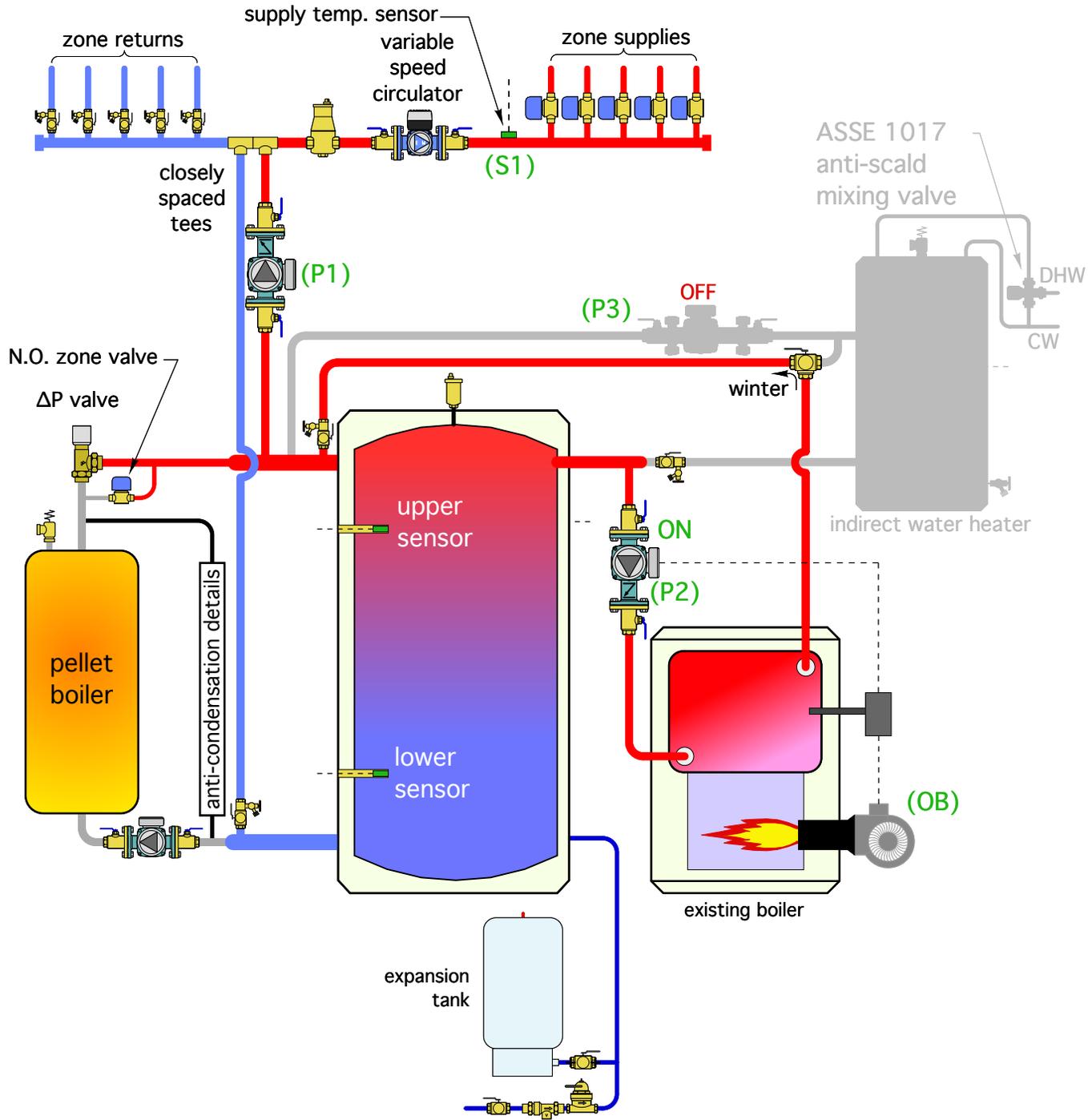
Pellet boiler supplying space heating:

- Variable speed distribution circulator with zone valves
- Circulator (P1) could be variable speed injection circulator to control supply water temperatures



Pellet boiler & aux boiler supplying space heating:

- Only upper portion of thermal storage tank is being heated by aux boiler
- This buffers the auxiliary boiler against the highly zoned distribution system
- This approach is especially well-suited to systems with a low mass auxiliary boiler.



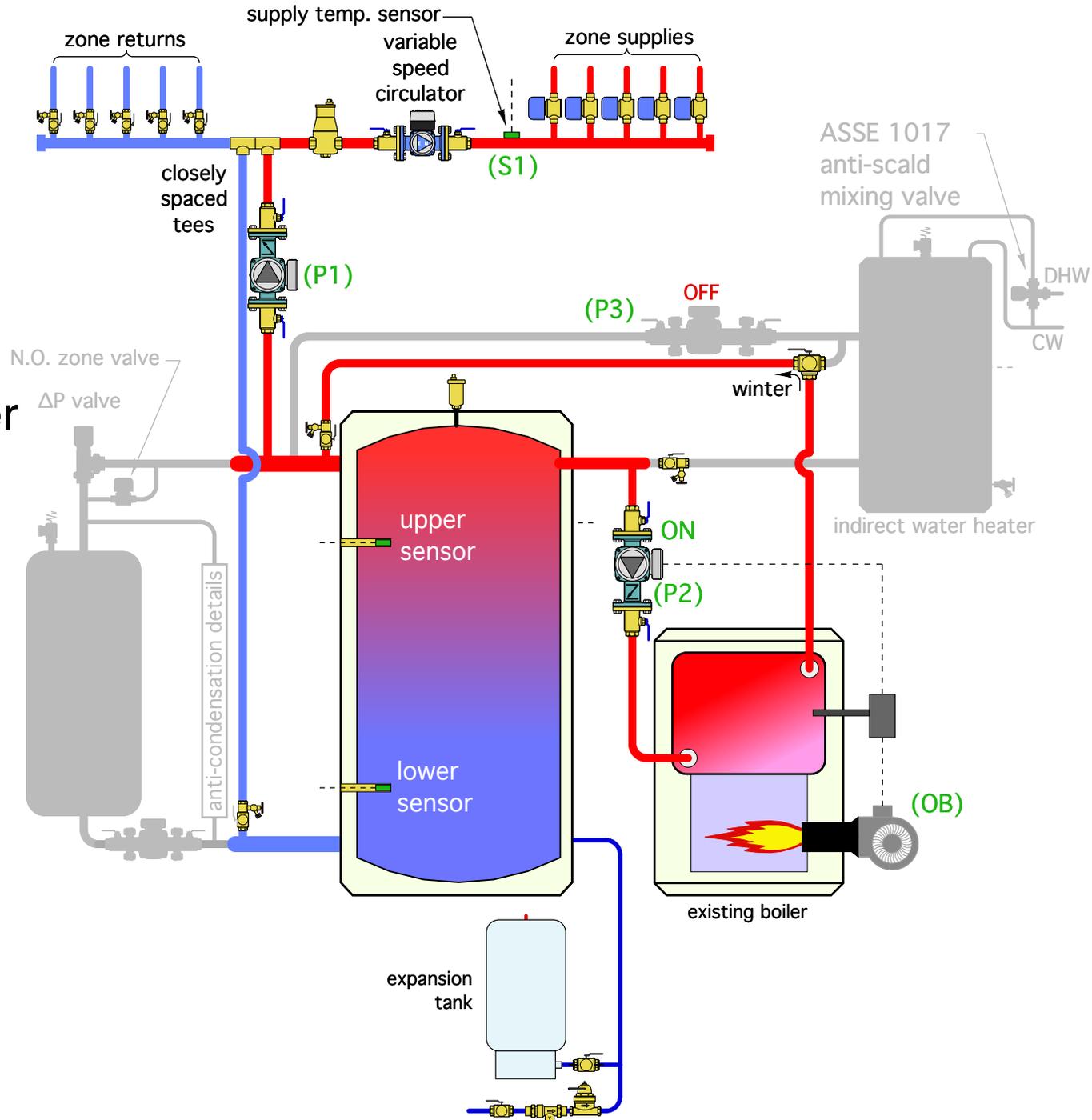
Pellet boiler OFF

Aux boiler supplying space heating:

- Only upper portion of thermal storage tank is being heated by aux boiler

- This buffers the aux boiler against the highly zoned distribution system

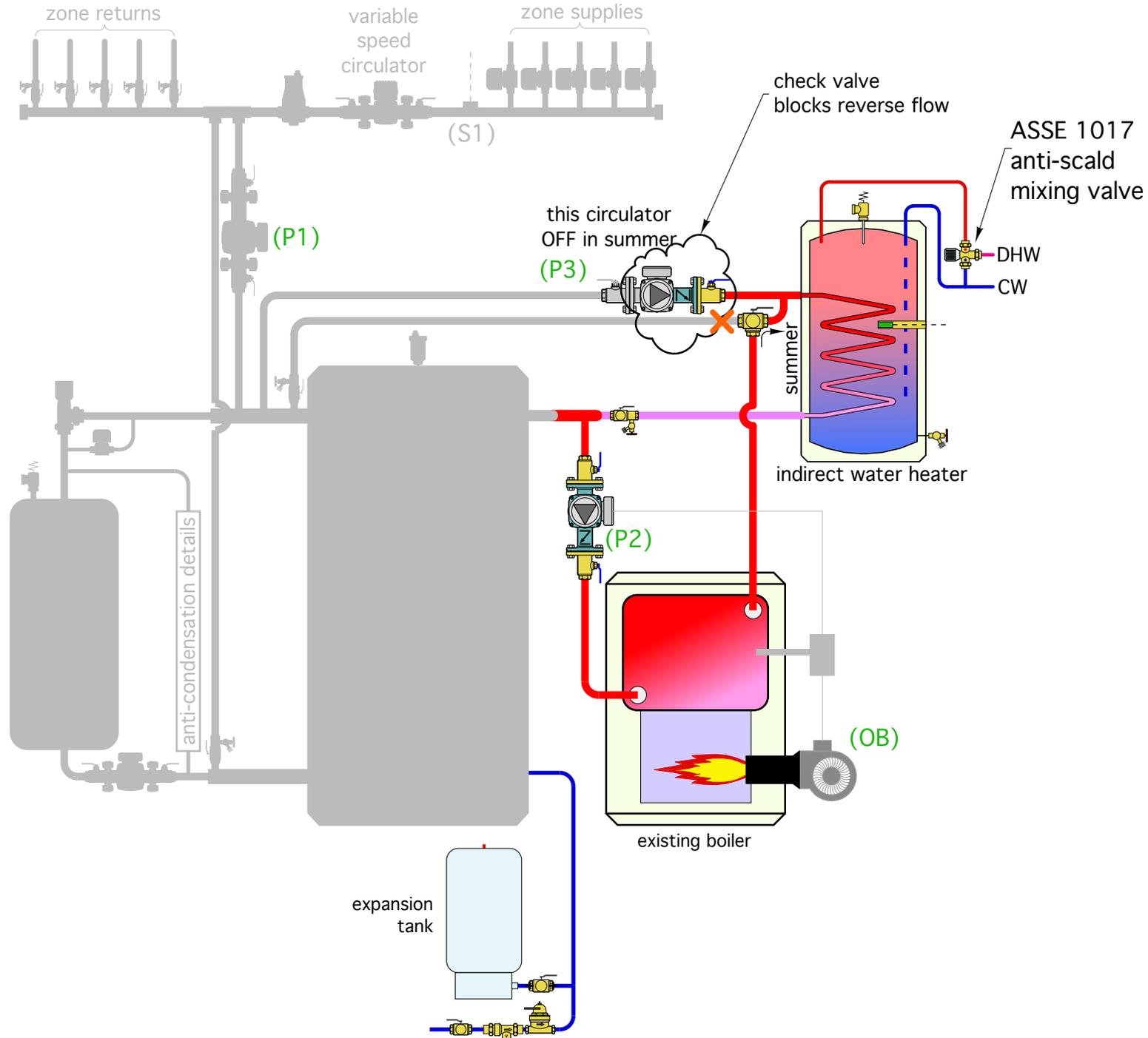
- ΔP valve prevent hot water flow through pellet boiler



Summer mode

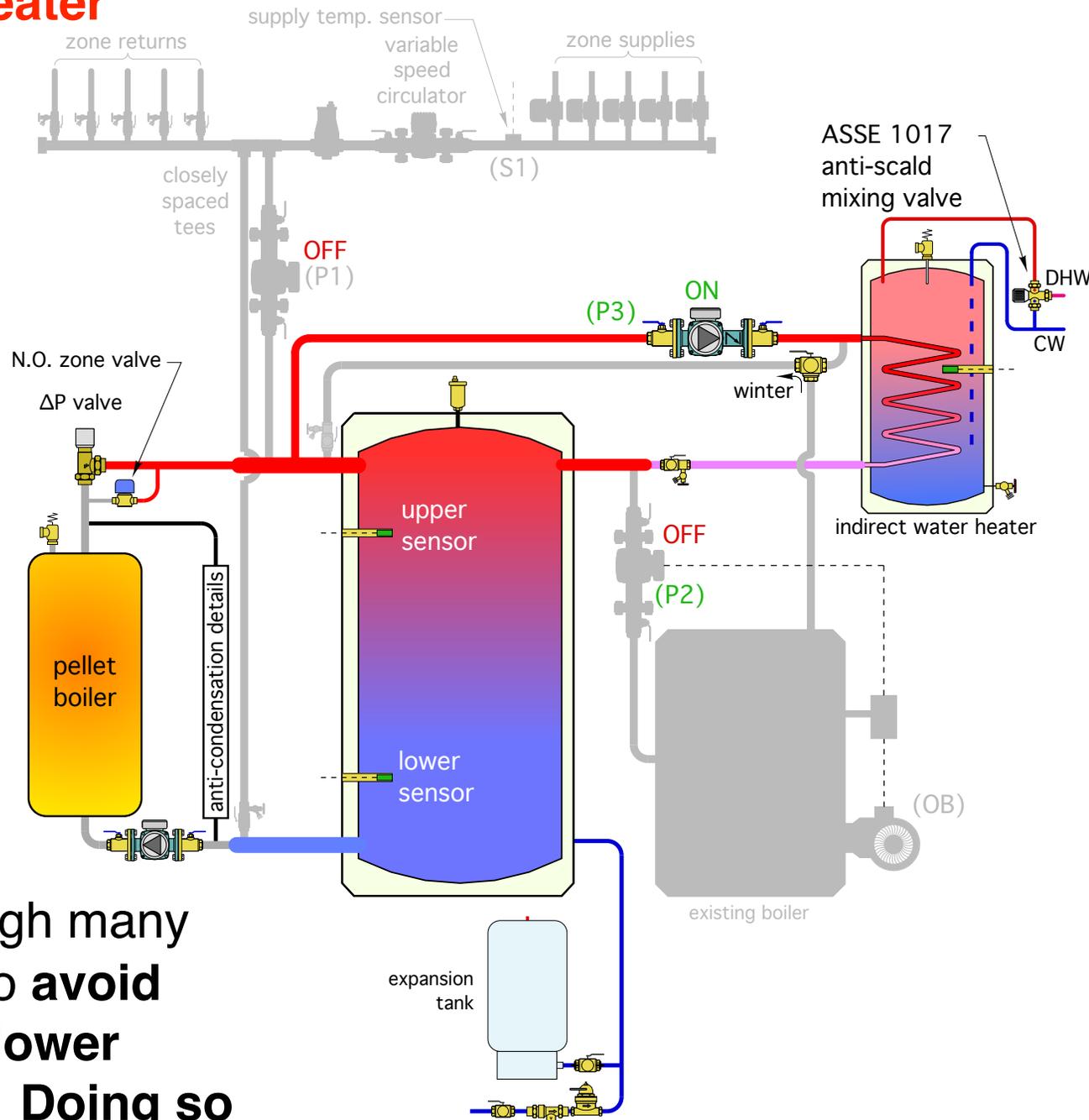
- Ball valve directs flow from boiler into upper coil connection on indirect tank

- Check valve in circulator (P3) prevents back feeding toward thermal storage.



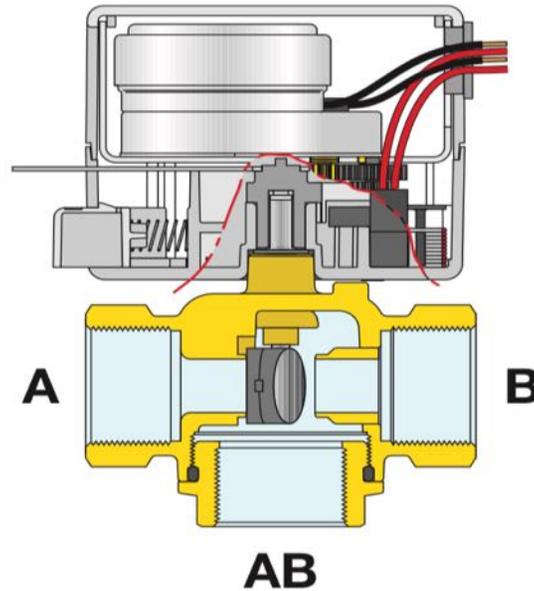
Pellet boiler & thermal storage supply indirects domestic water heater

- Only hottest water from upper portion of thermal storage is supplied to tank coil.
- Indirect tank has substantial thermal mass and thus doesn't need to access the full thermal mass of the thermal storage tank.
- The temperature drop through many indirect tank coils is small - so **avoid returning flow from coil to lower portion of thermal storage. Doing so breaks up stratification in tank.**



It is possible **MOTORIZED** the 3-way valve for summer / winter change over

- Valve would be operated by a summer / winter switch instead of a hand lever.
- Most diverter valves allow flow between AB & B ports when actuator is unpowered. Flow between AB and A ports when actuator is powered. **NOTE**, flow is always possible through AB port.
- 3-position diverter valves have a “no flow” setting.

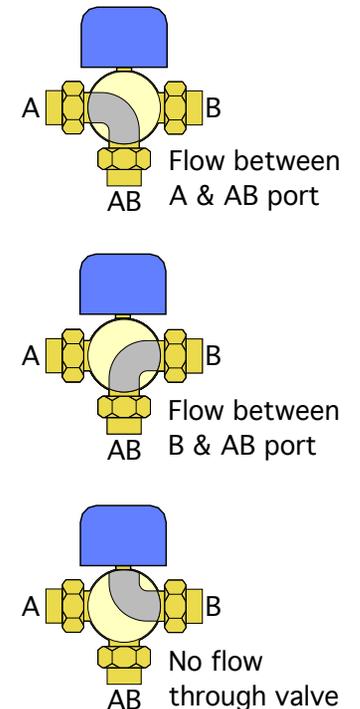


Source: Belimo

3-position diverter valve



Source: ThermAtlantic



RHNY Incentives

Program	System Type	Installation Incentive		Additional Incentive		
Small Biomass Boiler	Advanced Cordwood Boiler with Thermal Storage	25% installed cost (\$7,000 maximum)		-	Recycling \$5,000/unit for old indoor/outdoor wood boiler or \$2,500/unit for old wood furnace	-
	Small Pellet Boiler with Thermal Storage	≤120 kBtu/h (35 kW)	45% installed cost (\$16,000 maximum)	Thermal Storage Adder \$5/gal for each gal above the minimum thermal storage requirement		-
		≤300 kBtu/h (88 kW)	45% installed cost (\$36,000 maximum)			-
Large Biomass Boiler	Large Pellet Boiler with Thermal Storage	>300 kBtu/h (88 kW)	65% installed cost (\$325,000 maximum)		Emission Control System \$40,000	
	Tandem Pellet Boiler with Thermal Storage		75% installed cost (\$450,000 maximum)			
Residential Pellet Stove	Pellet Stove	\$1,500 (\$2,000 for income qualified residents)		-		Recycling \$500 (income qualified residents only)

LMI Incentives - Boilers

Program	System Type		Market Rate Installation Incentive	LMI Installation Incentive
Small Biomass Boiler	Advanced Cordwood Boiler with Thermal Storage		25% installed cost (\$7,000 maximum)	65% installed cost (\$18,000 maximum)
	Small Pellet Boiler with Thermal Storage	≤120 kBtu/h (35 kW)	45% installed cost (\$16,000 maximum)	65% installed cost (\$23,000 maximum)

For more information:

- “Google” Renewable Heat NY
- contact Sue Dougherty at NYSERDA sue.dougherty@nyserda.ny.gov

Thanks for attending this series of webinars.

May 13 2021 1-2 PM

Title: Piping Options For Multiple Thermal Storage Tanks

Description: Some biomass boiler systems are installed in situations where it's impractical to use a single large thermal storage tank. There are several multiple tank options that may be suitable. This webinar shows and describes several ways to configure a multiple tank array and explains tradeoffs in thermal performance. Example systems will be presented.

June 3, 2021

Title: Case study: A pellet boiler system for a highway garage

Description: Large slab-on-grade buildings are ideal candidates for combining a pellet boiler system with floor heating. This webinar will show the details for a system designed to heat a 13,000 square foot highway garage, including system piping, combustion air supply, thermal storage, controls, and a staged modulating/condensing auxiliary boiler system. The concepts shown are scaleable and repeatable for similar structures.

**Additional webinars will be announced for fall 2021
(September, October, November)**

**All of these webinars will be posted on NYSERDA's Renewable Heat
NY website - under "training opportunities" link.**

QUESTIONS ?