

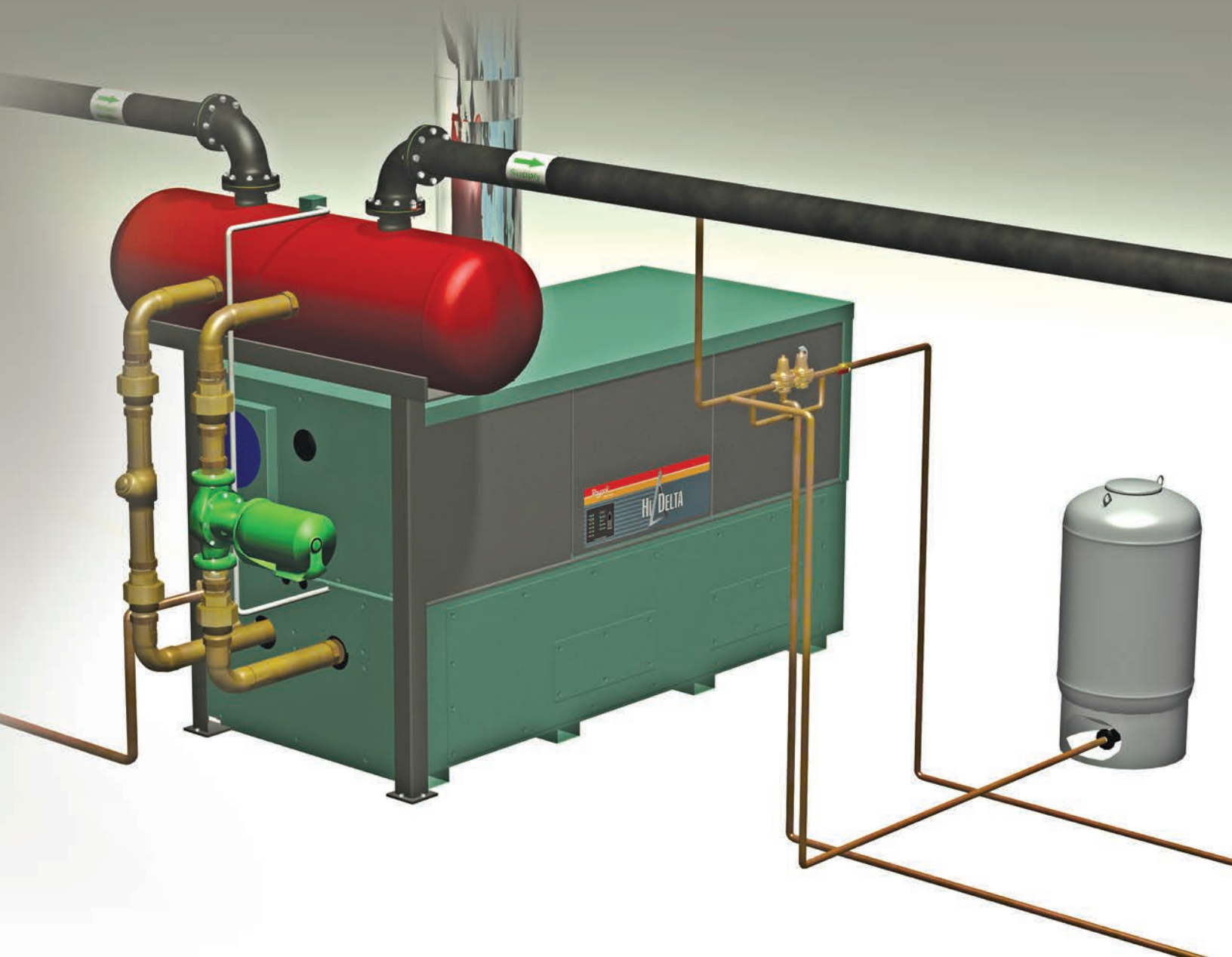
Buffer / Decoupler

Systems and Tanks

Model size

40 H • 60 H • 80 V • 115 V • 140 V Gallon

- Applications
- Sizing
- System Design



Buffer / Decoupler Systems



In recent years there have been many energy saving improvements to controls and hydraulics associated with Hydronic Piping Systems. Some of these may result in reduced performance for high recovery boilers if they reduce system flow or volume enough to cause continuous or intermittent short cycling based on small system volume. There is an easy remedy! Raypak has developed an array of properly-sized Buffer / Decoupler systems and tanks. For Hydronic systems, a primary/secondary design is widely accepted to afford optimum energy savings in multiple boiler installations. The energy savings is even more dramatic when adapted to direct DHW systems. In each case, a decoupler is employed. If system flow calculations indicate the need for a small Buffer / Decoupler, now it can be properly and economically sized, combined with the decoupler function and is included during the design phase. This small Buffer / Decoupler approach retains the virtually-zero standby loss during off periods that is unique to high recovery boilers.

Rapid system temperature fluctuations can result from several design conditions. Some stem from recently advanced technology, some from less desirable and often outdated design approaches. Examples are: Light Loads, Low System Flow Rates, and Rapid Load Changes caused by large zones in

small systems. Sometimes the culprits are the antiquated outdoor reset three-way valve designs, or systems incorporating the energy wasting central hydronic boiler fired in summer for DHW-only using heat exchangers.

Raypak's recognized seasonal efficiency optimization using primary / secondary system designs often avoids all need for Buffer / Decoupler. Refer to the Raypak website, www.Raypak.com for a whitepaper by Larry Ashton, PE. When more volume is needed, properly-sized Buffer / Decoupler tanks are the answer.

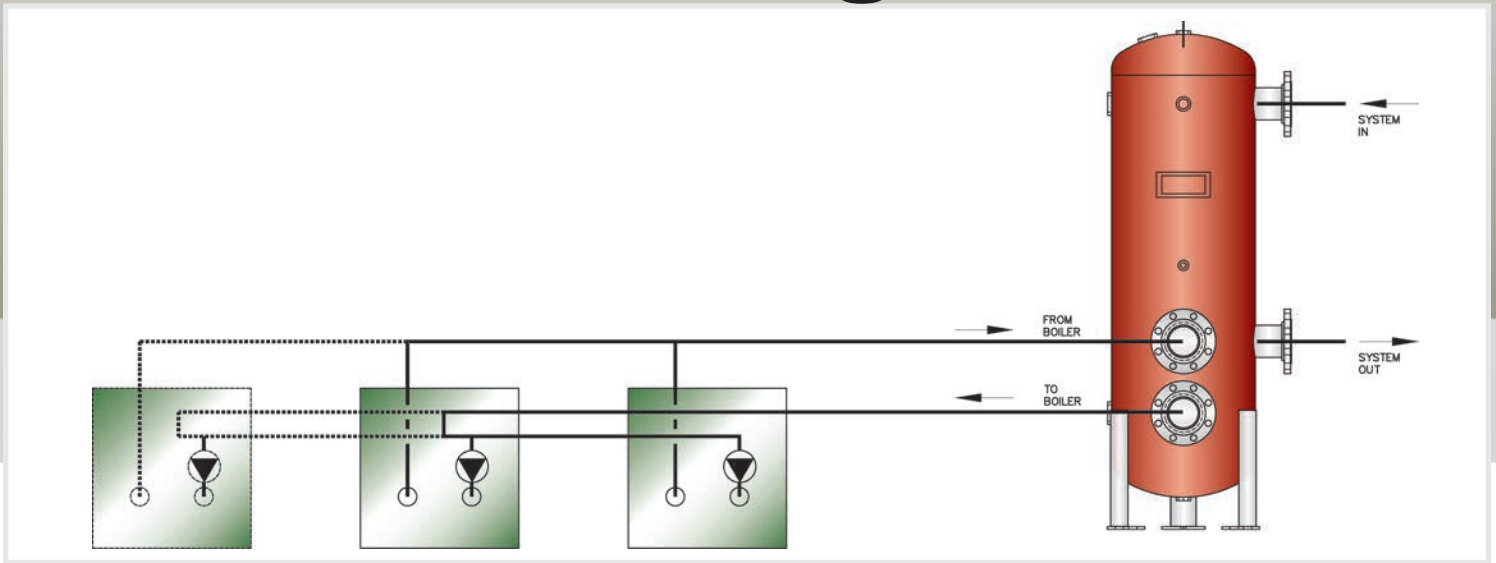
When you add the water content of a Buffer / Decoupler tank, some may say that you have the equivalent of a low-recovery boiler. NOT SO! A separate minimally-sized and well-insulated Buffer / Decoupler tank mitigates virtually all radiation loss and keeps the warm water in the system, not in the boiler or exposed to the flue. The extra water is then available to handle rapid or unusual demand changes for whatever the reason. The high-recovery boiler still stages or modulates, and turns off on light loads. Combined with Raypak's standard EconoMaster™ residual heat recovery control, this eliminates the hot chimney effect. Low-recovery water-filled boilers stay heated even during light demand, so the hot chimney is ever present.

A bonus benefit that accrues when using vertical Buffer / Decoupler tanks is their inherent ability to serve as the system air separator. The port configuration of Raypak's vertical Buffer / Decoupler was laid out to match the flow pattern of an air separator. By properly selecting the volumes associated with each boiler system, we are able to achieve very efficient air separation. Combining the functions into one piece of equipment keeps the equipment design clean and limits the number of connections, while still providing proper boiler operation.

This brochure describes several systems and applications where buffering additional volume is frequently needed, with proper sizing guidelines, and piping diagrams. Drawings are also included. Raypak offers tanks to add the water volume needed without over sizing. For most systems, with single or multiple boilers, properly-sized Buffer / Decoupler tanks will range between 40 and 140 gallons; custom-sized tanks are also available. All Raypak Buffer / Decoupler tanks are specially designed to incorporate the necessary number and size of connections to match typical system piping requirements, without increasing field piping costs. They are also constructed in accordance with ASME codes and are National Board listed.



Buffer / Decoupler Sizing



Buffer / Decoupler – When Needed?

- Any time reduced system volume can cause short cycling.
- Multi-zone system can reduce flow and available volume to the boiler.
- Main circulator with a VFD often reduces system flow below boiler flow rate.
- Three-way valves utilized to achieve outdoor reset.
- VFD's and/or 2-way zone valves can reduce system flow and available water volume below boiler minimum.

Buffer / Decoupler sizing

The primary factors presented here that make a Buffer / Decoupler tank appropriate is system flow that is lower than the on-line boiler flow or low system volume with light loads that would otherwise result in short-cycling of the boiler (When using multiple boilers use the boiler minimum firing rate and boiler flow with only one boiler on). When these conditions exist the following equation may be utilized to size the Buffer / Decoupler tank:

$$\text{Boiler firing rate} \div 1000 \times \text{Efficiency}\% \div 100 \times \text{Min firing rate } \% \div 100 \times 0.15 = \text{Buffer / Decoupler tank in gallons.}$$

To use this equation first determine the following:

- The rated firing rate of selected boiler
- The certified boiler efficiency at full input rate

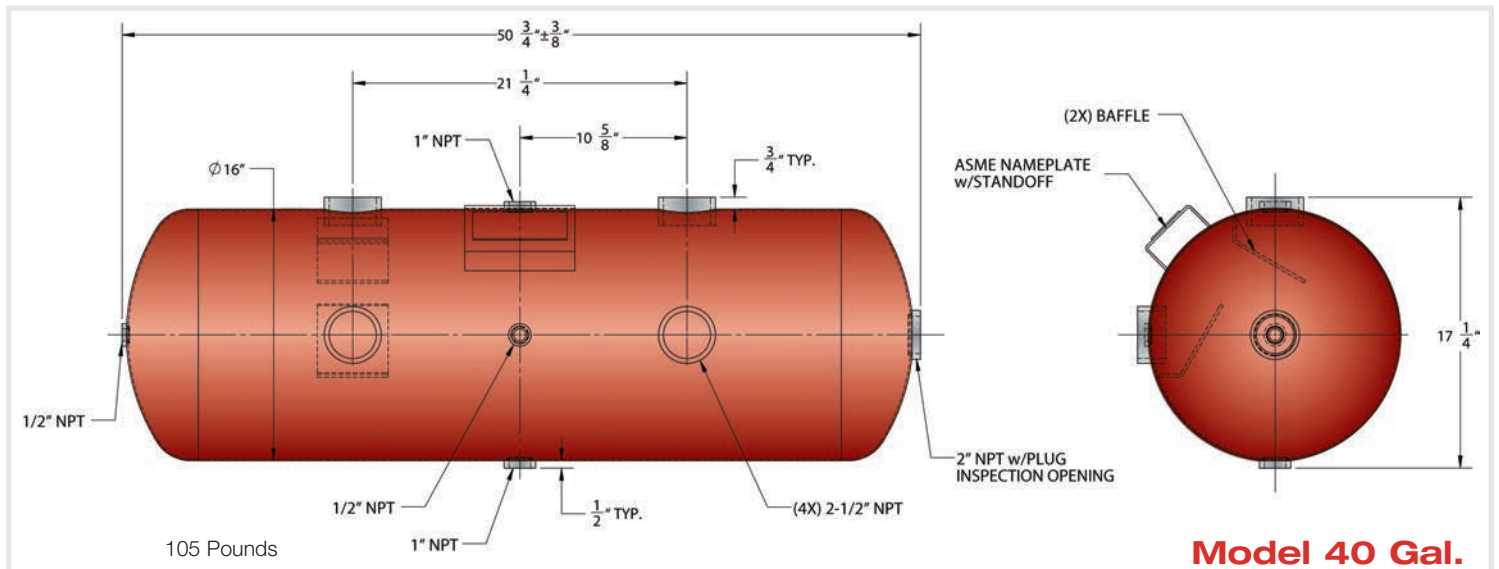
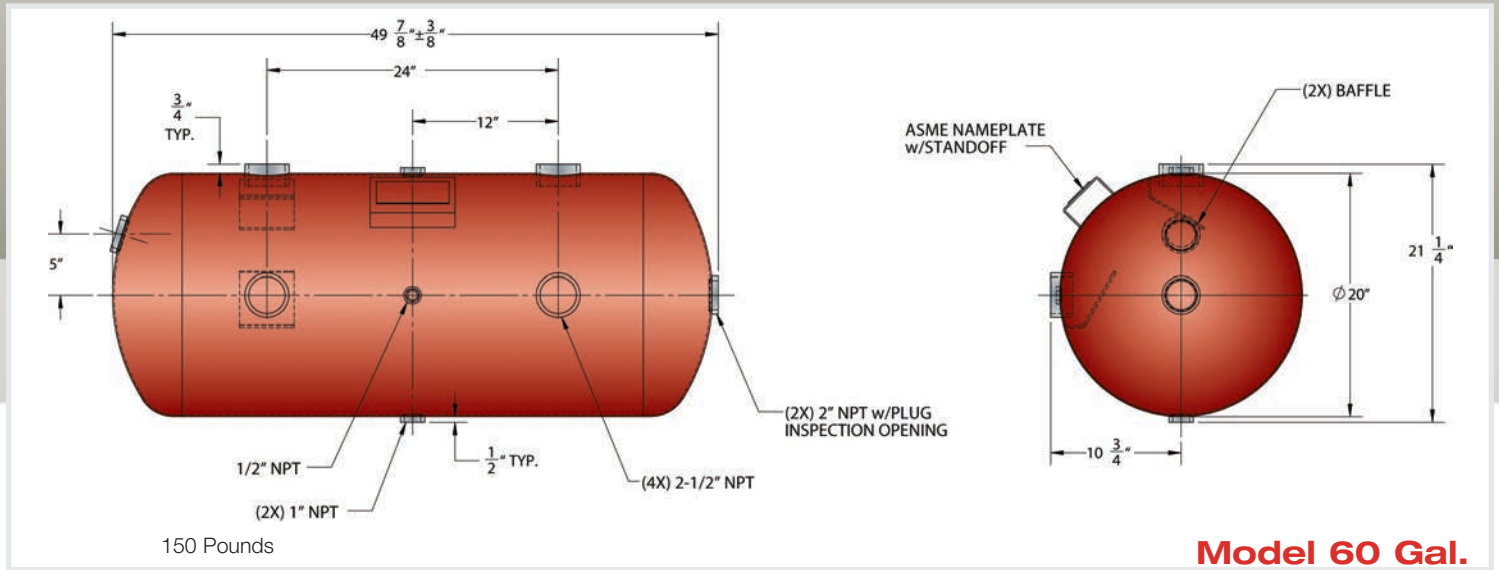
- The minimum boiler firing rate percentage
Examples:

- **Model 753A MVB**
Boiler rated input = 750,000 Btuh
Boiler Efficiency = 87%
Minimum firing rate = 14% of rated input
 $750,000 \div 1000 \times 87 \div 100 \times 14 \div 100 \times 0.15 = 14$ gallons
Select 40 gallon standard tank
- **Model 1505A XTherm**
Boiler rated input = 1,500,000 Btuh
Boiler Efficiency = 96%
Minimum firing rate = 14% of rated input
 $1,500,000 \div 1000 \times 96 \div 100 \times 14 \div 100 \times 0.15 = 30$ gallons
Select 40 gallon standard tank

- **Note 1:** When the minimum system flow is greater than the boiler flow and the minimum active system volume is greater than that calculated by the above equation the Buffer tank is not needed.
- **Note 2:** All Buffer / Decoupler tanks shown perform the intended decoupling function.
- **Note 3:** All Raypak vertical Buffer / Decoupler tanks contain a 1" NPT fitting at the top. If the tank is mounted at the system high point, it can also serve as the mounting location for the air vent. This eliminates the need for an additional field connection.
- **Note 4:** For information regarding typical minimum and maximum variable primary pump flows in multiple boiler systems, see www.raypak.com tech corner, Larry Ashton's white paper on optimizing efficiency with multiboiler system.

Buffer / Decoupler

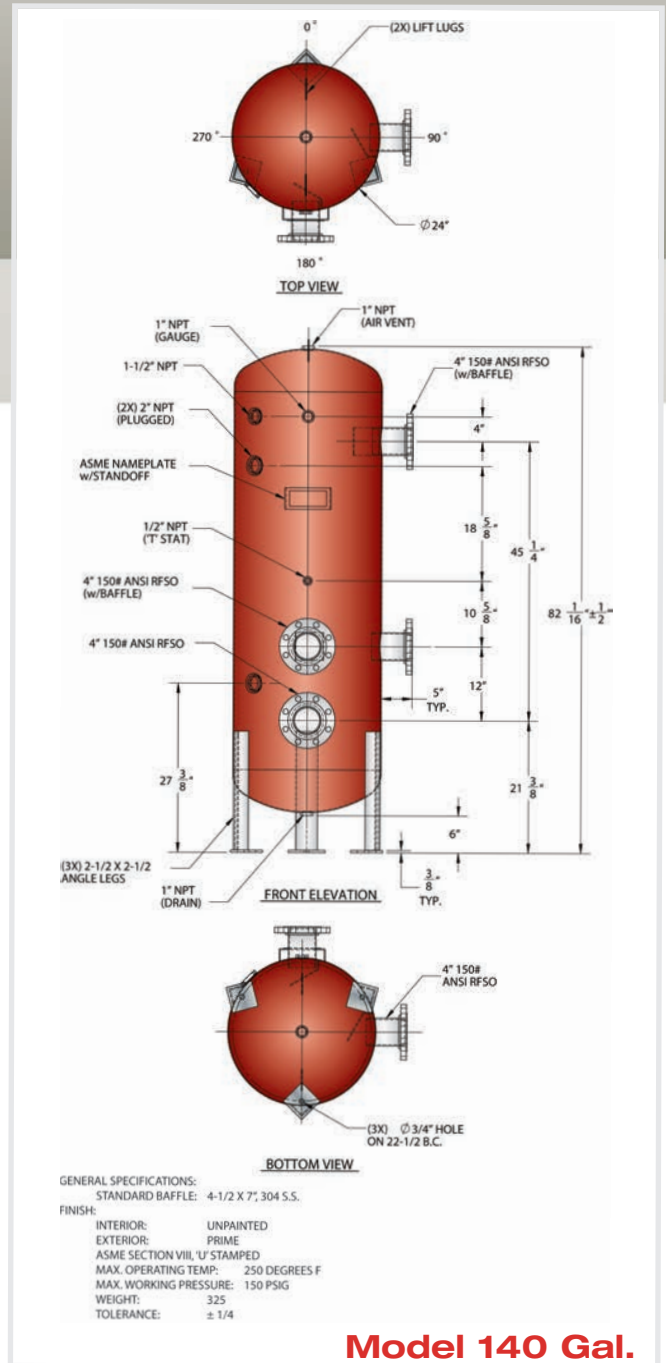
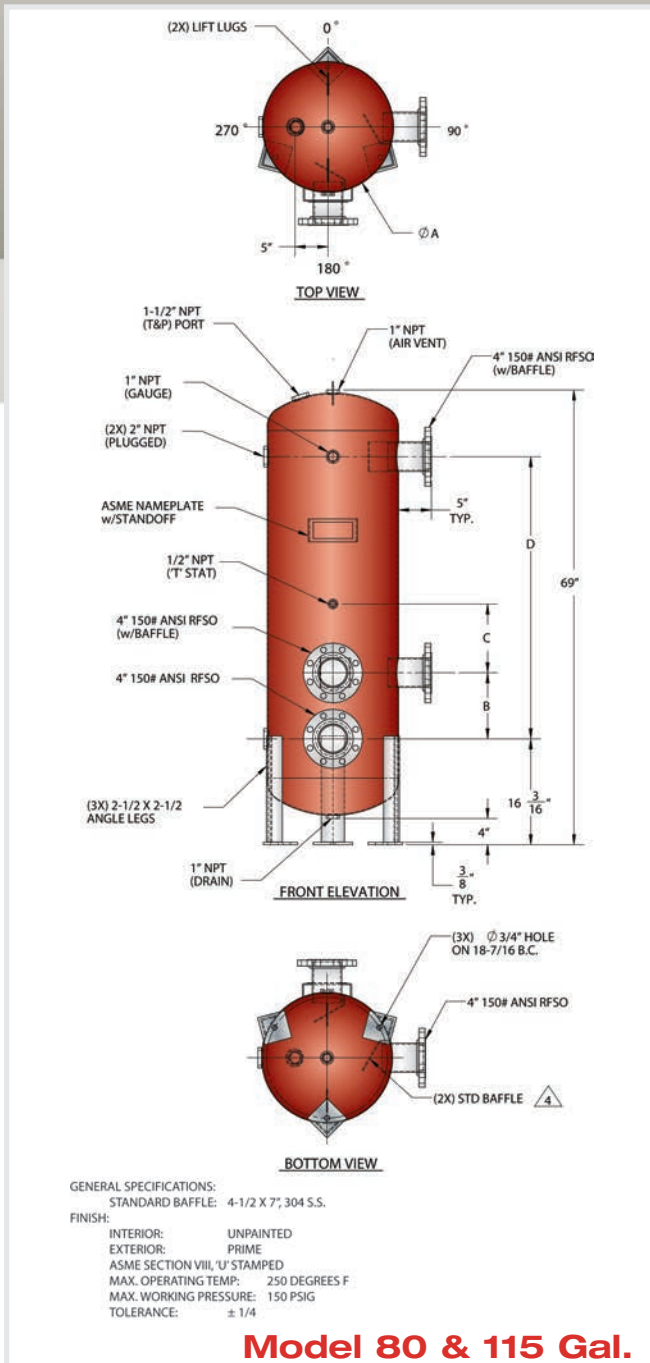
Horizontal Configuration



- Optional mounting kits are available for use with Hi-Delta boilers.

Buffer / Decoupler

Vertical Configuration

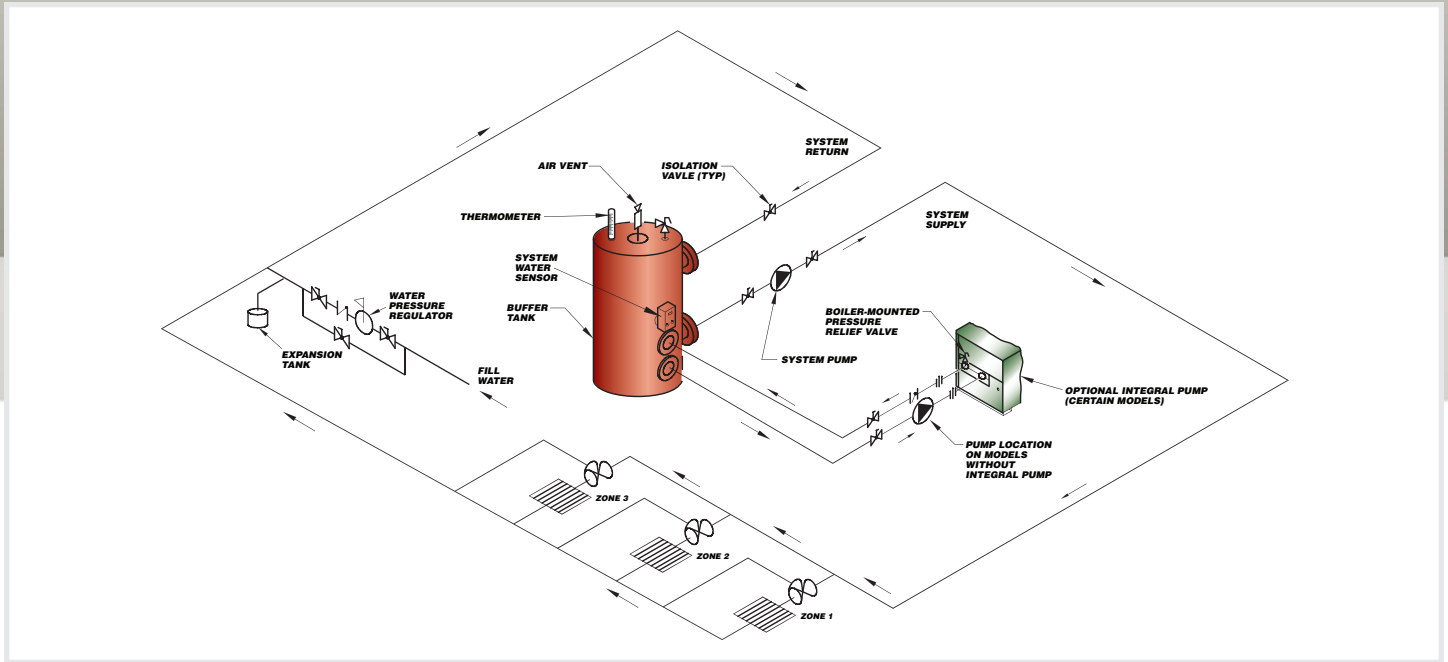


Tank Dimensions & Weight

Gal.	A	B	C	D	Weight
80	20	10	10-1/2	43	200
115	24	11	9-1/8	41-1/4	240

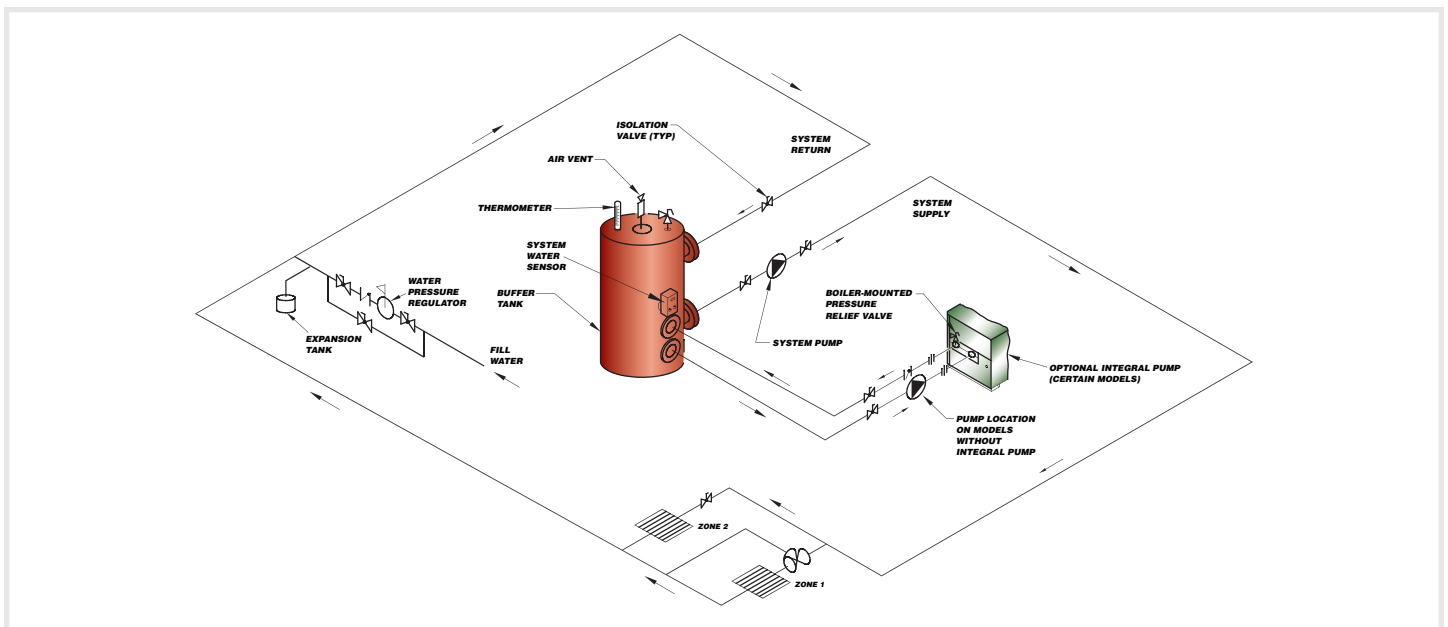
- Custom Buffer / Decoupler tank sizes are available. Please contact your sales rep for sizing and pricing.

Buffer / Decoupler Applications



Light Loads

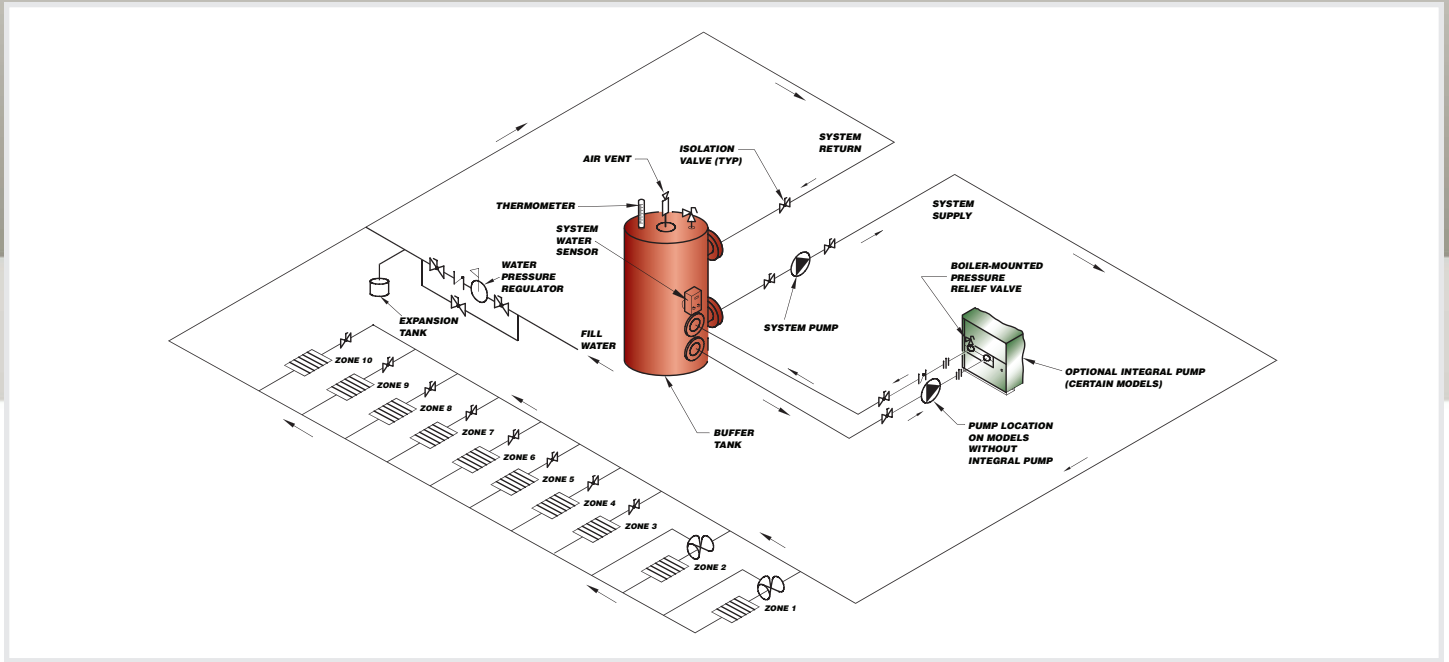
Light loads include a load that is less than the minimum firing rate of the boiler and low volume in the heating loop. This can result in short cycling of the boiler. Adding a Buffer / Decoupler tank that is heated by the boiler will provide a "flywheel effect" where the Buffer / Decoupler tank can carry the heating load for a few minutes with the boiler in the off mode. Also, when the boiler fires it will stay on long enough to reheat the Buffer / Decoupler tank increasing the duration of the off and on cycles.



Rapid Load Changes

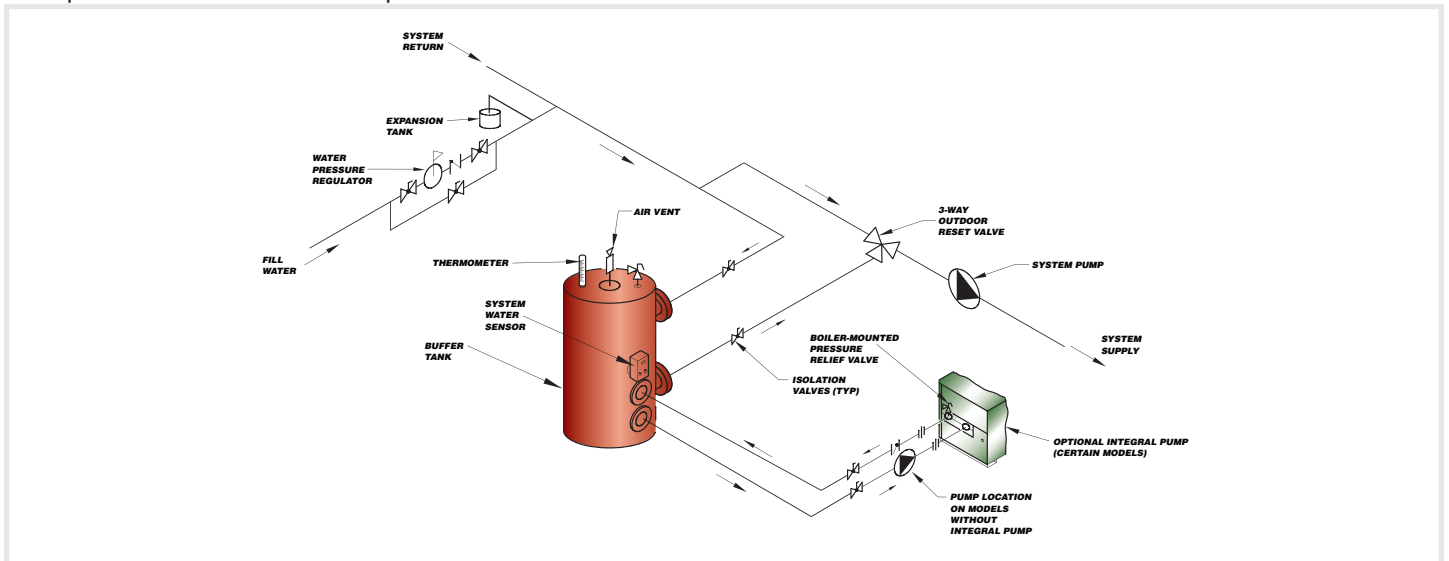
Rapid load changes can result from turning off or on a major zone within the heating system. These rapid changes can be greatly reduced with a properly-applied buffer / decoupler tank.

Buffer / Decoupler Applications



Variable System Flow

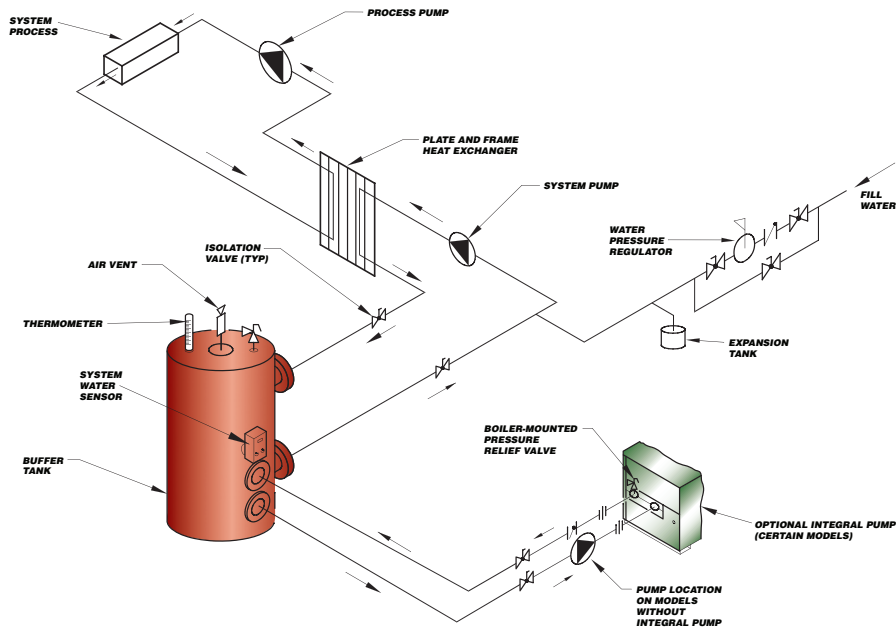
Variable system flow rates occur when variable-speed pumps are applied to the system. Variable system flow also occurs when two-way valves are utilized to control flow to heating zones. During lower system flow operation, the boiler flow rate exceeds the system flow rate, boiler outlet water will short circuit back to the boiler causing a rapid rise in boiler temperature and possibly trip the high-limit. Buffer / Decoupler tanks can stabilize the temperature in these cases.



Three-way Valves

Three-way valves have been utilized in the past to accomplish outdoor reset with high-mass boilers that traditionally require continuous high temperature operation to prevent condensation and/or thermal shock. In such systems the boiler is maintained at or above the highest temperature required and then blended down via the three-way valve to achieve the desired heating loop temperature. Raypak offers several outdoor reset packages that accomplish outdoor reset by directly resetting the boiler operating temperature. However, for some existing systems, or when there is a firm system specification for a three-way valve, the Buffer / Decoupler tank can be plumbed into the boiler loop to create some "flywheel effect".

Buffer / Decoupler Applications



Process Fluid Heating

In some processes or other similar applications, it is necessary to isolate the boiler circulating loop from the fluid being heated. (E.g. plating tanks and aquariums.) In these cases the boiler primary loop often has a low water volume and may require a Buffer / Decoupler tanks.

Indirect For DHW

It is NEVER good to design systems which fire hydronic heating boiler(s) during the warmer weather when space heat is not needed, just to meet domestic water needs. Many existing "summer boiler" installations use an energy-wasting heat exchanger for DHW when no space heating is needed. Separating the domestic water from the space heating source can save far more energy than even a boiler upgrade to a higher efficiency unit. Both upgrades simultaneously are the real solution. Owners repeatedly experience seasonal operating savings well in excess of 50% when this is done, which makes payback very short.

