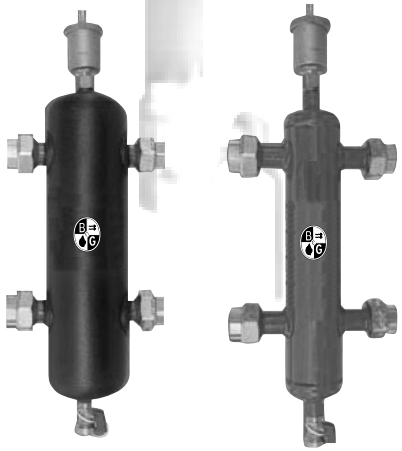
ITT

Bulletin A-451

Bell & Gossett® Primary-Secondary Header Model PSH

Flanged



Threaded

Engineered for life

The History of Primary-Secondary Pumping

Did you know that Bell & Gossett invented Primary-Secondary Pumping? This widely popular pumping arrangement was conceived by B&G in 1954. It was originally developed as a method of increasing allowable system temperature drops while protecting the boiler. In fact, this method allows low and medium temperature systems to be used while maintaining the temperature drops usually seen in high temperature systems. It also holds the benefits of decreased pumping horsepower and improving system control. System control characteristics were made smoother because the pressure drop across the control valves caused by a single high head pump has been eliminated. This method proved to be a success, and to make it simpler, the first primary-secondary device was born just a few years later – the B&G Primary-Secondary Fitting. It provided a simplified and fool-proof method of installing primary-secondary circuits.

FIGURE 1: B&G PRIMARY-SECONDARY FITTINGS

More than fifty years later, the primary-secondary pumping arrangement is still widely used. It still provides the same advantages as always, but at a higher rate when used with today's evolving equipment. The growing popularity of condensing and other modern boilers has made the use of primary-secondary piping more important. Ironically, these new style high efficient boilers have a greater flow resistance than their predecessors. However, by hydraulically separating the flow in each circuit, the flow through the high flow resistance boiler does not restrict the flow in the secondary circuits. This allows each leg of the circuit to be run at their optimal flow rates and temperatures, raising the overall system efficiency.

We've done it again! To simplify the piping arrangement and adapt to the ever-changing hydronic market, Bell & Gossett is proud to introduce the Primary-Secondary Header (PSH). This device simplifies the primary-secondary circuit pumping and eliminates several components. This results in cost savings since this single unit is less expensive and faster to install than the all the extra components.

Description

The B&G Model PSH, also known in the industry as a low-loss header, is a combination air separator and manifold that creates independent primary and secondary circuits. It is equipped with a purge valve allowing the user to remove any debris collected at the bottom of the vessel and an air vent to release air trapped in the system. Insulation also comes standard, eliminating the formation of condensate on the PSH body.

How does it work?

The B&G PSH efficiently separates the primary and secondary circuits by acting as a closely spaced tee, which is normally seen in a traditional primary-secondary piping. However, the PSH does more than just separating the circuits – this highly engineered product also acts as an air and dirt separator. The vessel is designed to create a low velocity area allowing air to rise to the top and sediment to sink to the bottom.

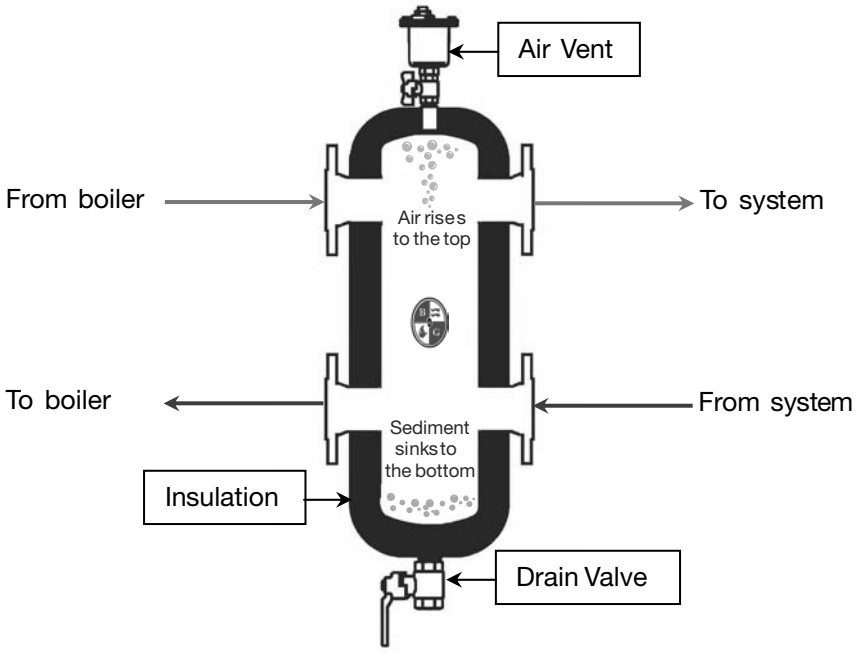


FIGURE 2: B&G PRIMARY-SECONDARY HEADER (PSH)

There are three possible flow paths, which are all dependent on the flows within the primary and secondary circuits.

Flow Path #1: Flow in the primary circuit is equal to flow in the secondary circuit (refer to Figure 3). This is an example of a balanced flow where the flow and temperature from the boiler is equal to that of the distribution system. The hot water from the boiler remains near the top two ports, Port 1 and Port 2. A similar situation occurs on the bottom ports, Port 3 and Port 4 – the flow and temperature from the system are equal to the flow and temperature of the fluid going back to the boiler. In cases like this, mixing with the PSH body is very minimal.

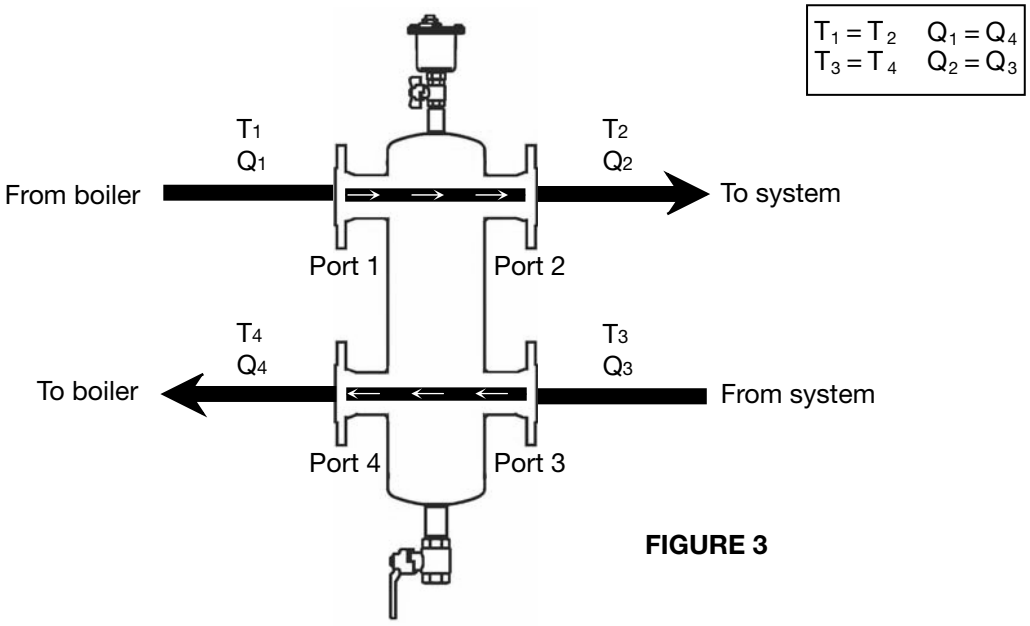


FIGURE 3

Flow Path #2: Flow in the secondary circuit is greater than flow in the primary circuit (refer to Figure 4). Since the flows are no longer balanced, the temperature going to the secondary circuit is no longer the same as the temperature from the boiler. This is primarily due to mixing of the supply and return fluids within the PSH body. To satisfy the system demand, a portion of the fluid returning from the system at Port 3 mixes with the fluid entering the PSH from the boiler at Port 1. This situation results in a lower temperature flow at T_2 going to the system. The formula to calculate T_2 is shown in the appendix on the back page.

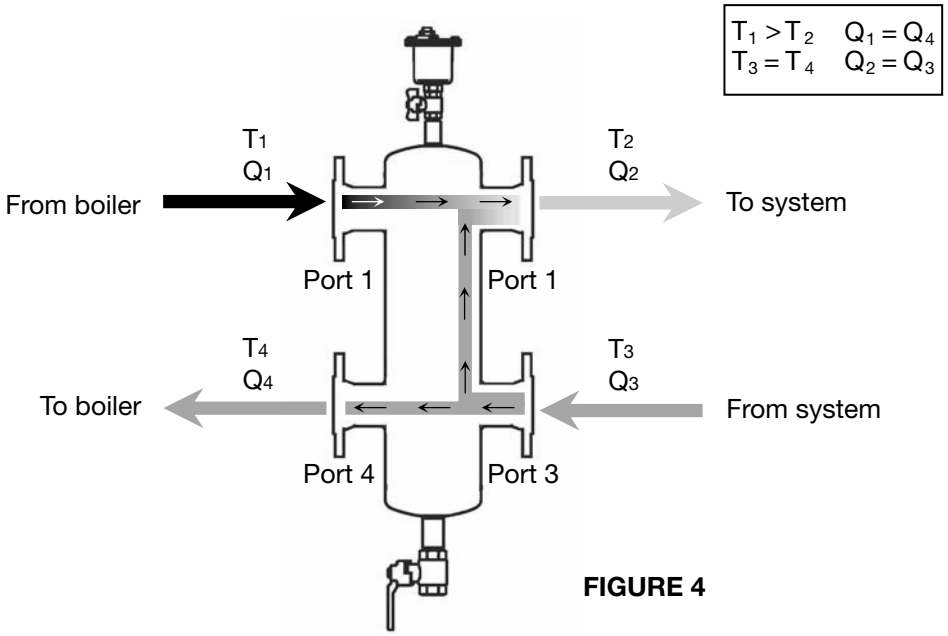


FIGURE 4

Flow Path #3: Flow in the primary circuit is greater than flow in the secondary circuit (refer to Figure 5). This is another case of an unbalanced flow. This time, the system requirement is less than the boiler output. The flow returning from the system, Q_3, mixes with the hot water from the boiler, Q_1. This results in an increase in boiler return temperature. The formula to calculate T_4 is shown in the appendix on the back page.

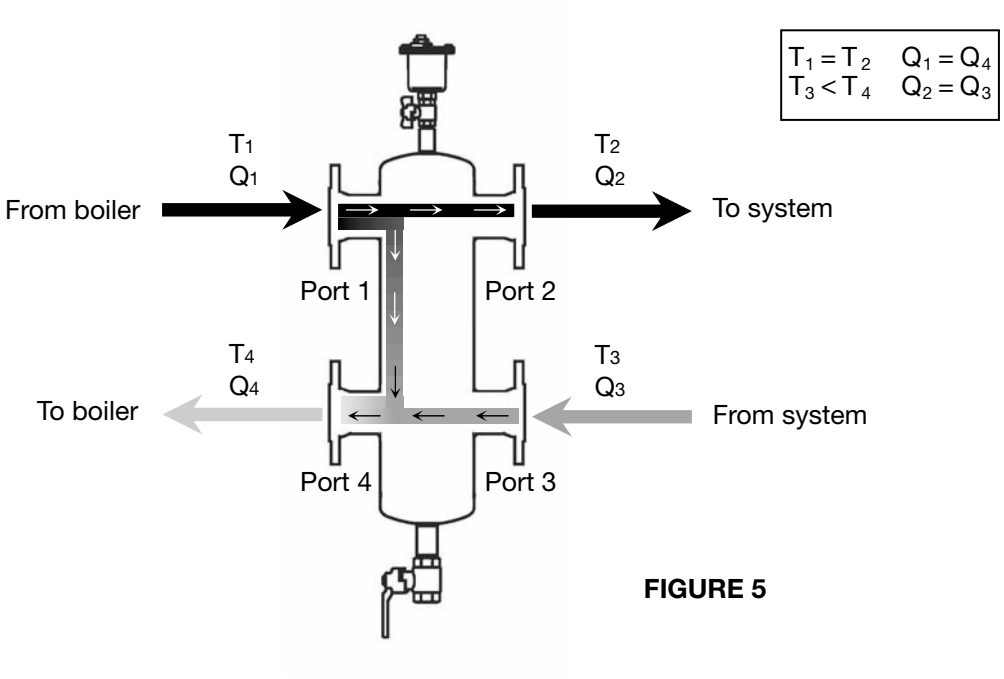


FIGURE 5

In all three cases described, the air and dirt are separated from the fluid as it enters the PSH body. The air rises to the top vessel and vented to the atmosphere via the automatic air vent while the sediment sinks to the bottom, which could be removed through the drain valve.

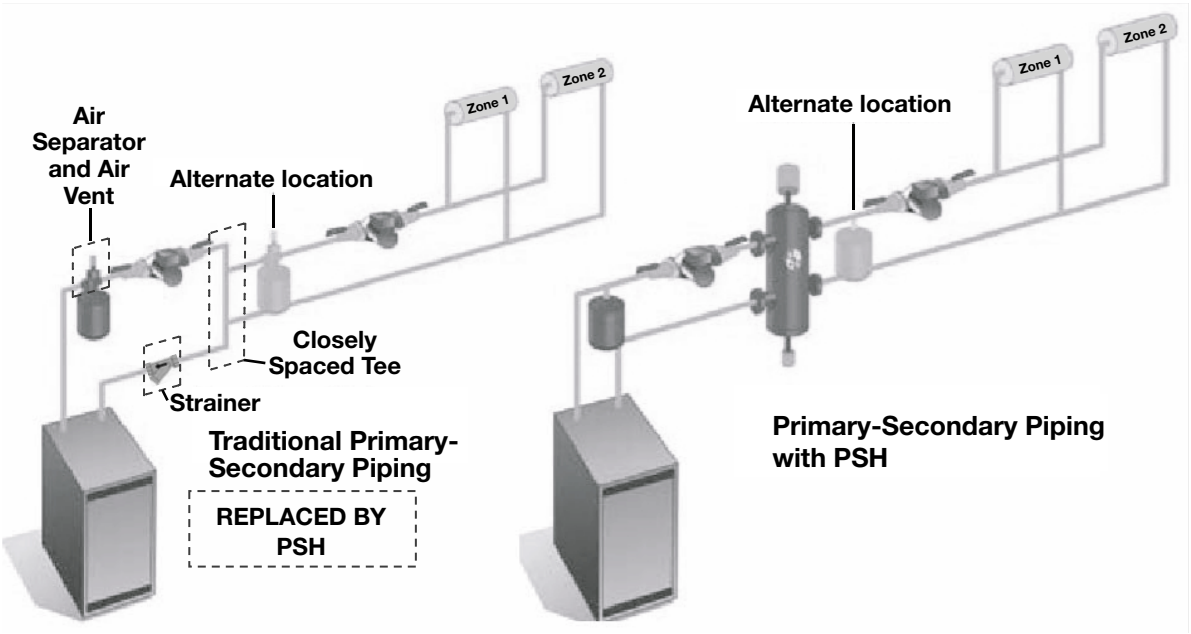
Equipment Selection

The basis of selection begins with the determination of the flow rates in both primary and secondary circuits. The greater of the two flows is the deciding factor in selecting the equipment. The table below may be used to select the suitable PSH for the application. Please note that higher flow rated than recommended will affect the performance of the product.

Model	PSH-1	PSH-1 1/4	PSH-1 1/2	PSH-2	PSH-2 1/2	PSH-3	PSH-4
Connection	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
Max. Flow (GPM)	11	18	26	40	80	124	247

Piping Layout

The PSH is multi-purpose equipment that replaces several components in the system, simplifying piping and reducing installation time.



Benefits, Features and Functions:

- ✔ Hydraulically separates primary and secondary circuits.
- ✔ Separates and vents air from the system.
- ✔ Separates and collects impurities in the circuits.
- ✔ Provides ease of installation. No complicated piping.
- ✔ Reduces installation labor.
- ✔ Reduces amount of fittings and piping.
- ✔ Eliminates strainer, air vent, and air separator.
- ✔ Available in 1" and 4" connections.
- ✔ Epoxy resin painted steel body with brass air vents and drain valve.
- ✔ Insulation is standard.

ITT

Appendix

$$T_2 = \left(\frac{(Q_3-Q_1)T_3 + (Q_1)T_1}{Q_3} \right)$$

$$T_4 = \left(\frac{(Q_1-Q_2)T_1 + (Q_3)T_3}{Q_1} \right)$$

Reference:

“Primary-Secondary Basics” Primary Secondary Pumping Application Manual TEH-775 December 1968.

“Hydraulic Separation.” idronics January 2007:1.

ITT
8200 N. Austin Avenue
Morton Grove, IL 60053
Phone: (847) 966-3700
Fax: (847) 966-9052
www.bellgossett.com

TÜV CERT DIN ISO 9001

ISO 9001 Certified