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Hydronic System Piping Alternatives

This is the first of a two-part article on hydronic system piping alternatives. Part two will appear in the next issue of Tech Talk.

"Hydronics" is the science and art of heating or cooling using water as the heat transfer medium. Obviously, physical laws provide the framework for designing the system. If you violate those laws, your system just won't work as you thought it would, so the "science" part of the definition is crucial. Equally important, the word "art" means that you have a lot of room for creativity in designing a system to meet your customer's requirements. Systems don't have to be cookie-cutter copies of each other, and from your customer's point of view, it's far better that they are not. Applying imagination in the solution of your customer's problem may give you and him a much better result. Among the choices you have available is the selection of the piping system type.

A hydronic piping system must provide an adequate flow of water to each heat-transfer terminal device so that it will provide satisfactory comfort conditions. The definitions of "adequate flow" and "satisfactory comfort" vary from project to project, and your selection of the piping system can have a big effect on meeting the customer's requirements.

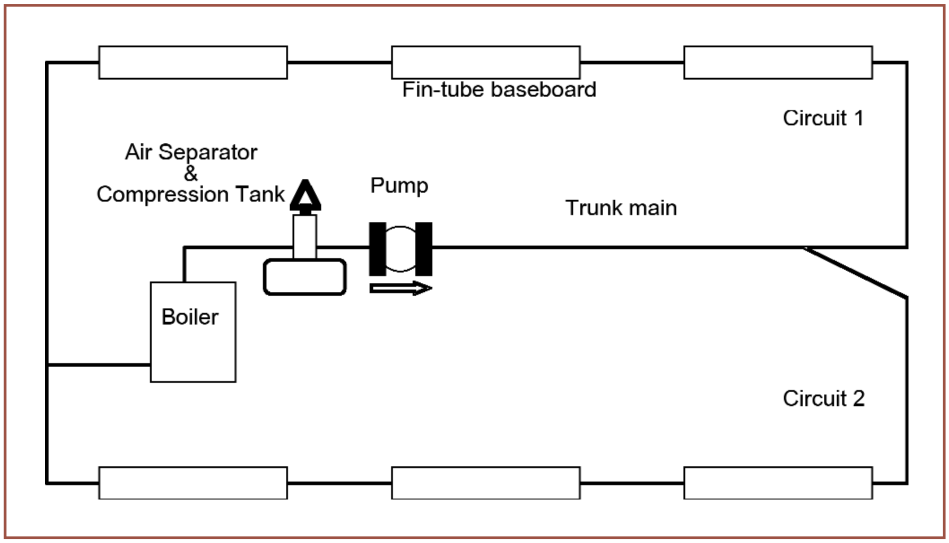

Figure 1. Series Loop System with Two Piping Circuits

Piping Systems—Their Strengths and Drawbacks

The first, and simplest, is the series loop system. As the name implies, all the components in this system are connected in series except the compression tank. All the flow passes through each component in turn. Therefore, the pipe size is constant and easy to determine. The rise in pressure at the pump is equal to the sum of the pressure drops of all the system components. The heat transfer terminal units are part of the loop, so their pipe size often dictates the maximum flow that's possible to obtain within the accepted limits of friction loss rate or velocity.

If the system requires more flow than the terminal units can handle, then the entire system may be designed as two piping circuits as shown above in **Figure 1**.

The total flow passes through the boiler and a "trunk main", which has no terminal units in it. At some point, the trunk main divides into smaller pipes that are the same size as the terminal unit piping. This is commonly found in residential systems that use fin-tube baseboard terminals made of 3/4 inch copper tubing. Larger diameter units are available for commercial or industrial use.

Notice that the rise in temperature at the boiler is equal to the sum of the temperature drops in the baseboard radiation. For a given boiler supply temperature, too many feet of baseboard radiation in a circuit will result in a water temperature too low to provide heat at the end of the circuit.

For example: Assume that the system uses typical 3/4 inch fin-tube baseboard units. A flow rate of 3.5 gpm of water with no additives in 3/4 inch pipe will result in a friction loss rate of 4.5 feet of head loss per 100 feet of pipe length, just within the generally accepted ASHRAE Handbook recommendations for sizing hydronic system piping. With typical 180°F supply temperature and a 20 degree design temperature drop, these baseboard units can provide about 600 BTU/hr ft. The manufacturers often rate

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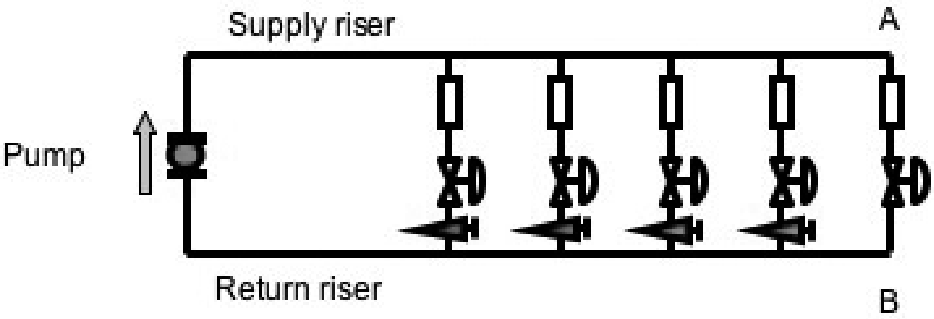
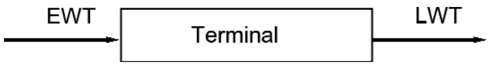
their units on average water temperature (AWT). In this case, that would be (180+160) / 2, or 170 AWT. This heating capacity will vary from one manufacturer to another, but assume it's true for this discussion. You can see that a flow of 3.5 gpm at a 20 degree delta tee (ΔT) will provide about 35,000 BTU/hr, or enough for 58.3 feet of baseboard. Anything greater than that will get a water flow too cool to provide the rated heat output.



"A-B branch", including the terminal, control valve, and balancing valve.

Figure 3.

Two-pipe Direct-return System for Heating or Cooling



Where ΔT = (EWT-LWT)

$$\text{Heat transferred in baseboard} = 500 \times \text{Flow} \times (\Delta T_{\text{baseboard}})$$

$$\text{Heat transferred in circuit} = 500 \times \text{Flow} \times (\Delta T_{\text{circuit}})$$

$$\frac{\text{Heat transferred in unit}}{\text{Heat transferred in circuit}} = \frac{500 \times \text{Flow} \times \text{Unit } \Delta T}{500 \times \text{Flow} \times \text{Circuit } \Delta T}$$

Terminal flow and circuit flow are identical, allowing calculation of the unit temperature change.

$$\text{Unit } \Delta T = \frac{\text{Heat transferred in unit}}{\text{Heat transferred in circuit}} \times \text{Circuit } \Delta T$$

Note: EWT = Entering Water Temperature
LWT = Leaving Water Temperature

Figure 2. How to Calculate the Unit ΔT

Some designers recognize that the average water temperature used to select the fin-tube doesn't really apply to all of the baseboard units. Those units in the beginning of the circuit see a higher average water temperature, those at the end see a lower average temperature as shown above in **Figure 2**.

An experienced designer will sometimes decrease the length of the first units, and increase the length of the last ones, providing more or less length to make up for the difference in AWT. Here's an example:

Use the unit ΔT formula to compute the actual AWT as it changes from the beginning of the circuit toward the end of the circuit, and adjust the length of the units accordingly.

Why is there so much emphasis on fin-tube baseboard radiation in a discussion of series loop piping systems?

- Hydronic coils arranged in a series loop may require very high pump head.

- Chilled water coils must be able to de-humidify as well as cool the air. Series loop arrangements quickly provide water that is too warm to de-humidify the air in downstream coils.

- Bell & Gossett prefers to select those kinds of devices for the same entering temperature, which is why they are rarely used in a series loop piping arrangement.

Series loop arrangements clearly have some limitations, but they can be very useful in small systems, especially heating systems. Control of the heat output is difficult to achieve by varying the flow since a reduction anywhere in the circuit changes it everywhere. On the other hand, a simple series loop circuit used to heat a room or set of rooms that have similar heat loss and usage characteristics can easily be controlled by a single thermostat and two-way, two-position valve. The series loop circuit then becomes a "zone".

Many manufacturers of the fin-tube units provide some means for controlling the rate of air convection across the unit, which can provide some measure of local control without changing the water flow rate. In larger systems, the series loop might be used as a small secondary zone with water supplied from a separately pumped primary loop.

The Two Pipe System

The one-pipe series loop system has some characteristics that limit its application. These include:

- **High pump head**. The pump head must be equal to the sum of the design head loss of all the components installed in series.

- **Varying supply temperature.** Each unit in series changes the water temperature going to the next.

- **Difficulty in controlling heat transfer by throttling the water flow.** A reduction of flow in any terminal reduces the flow in every terminal in series.

Two-pipe systems avoid these drawbacks, making them the preferred piping layout for many hydronic system designers. ASHRAE defines a "two-pipe system" as a, "...piping system in which the fluid withdrawn from the supply

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passes through a heating or cooling unit to a separate return main."

Two important aspects of this kind of piping system are illustrated in the definition:

- Two-pipe systems work very well in either heating or cooling applications since each terminal unit sees roughly the same supply temperature.
- The system has separately sized supply and return pipes.

Direct Return or Reverse Return

Figure 3 shows a two-pipe, direct return system for heating or cooling. "Direct return" indicates that the first terminal to get water from the supply is also the first to return it, making the path through that terminal the shortest. Each terminal unit represents a distinct path from the pump and back to it, so each one could be equipped with a control valve to vary flow and therefore vary the rate of heat transfer for that terminal. If the supply pipe is reasonably well insulated, each terminal will get the same supply temperature, an especially important consideration in chilled water systems. The size of the supply and return pipes is not a constant since the design flow rate changes as water is delivered to—and returned from—each successive terminal unit.

The friction head loss rate in each pipe section can be calculated knowing the pipe size and design flow. Total friction head loss in each pipe section is then the product of friction loss rate and equivalent length of the section. Head loss in the terminal, the control valve and balancing valve can be obtained from the component manufacturers. In a typical closed system, the pump is selected to provide:

- The flow required by all of the terminals

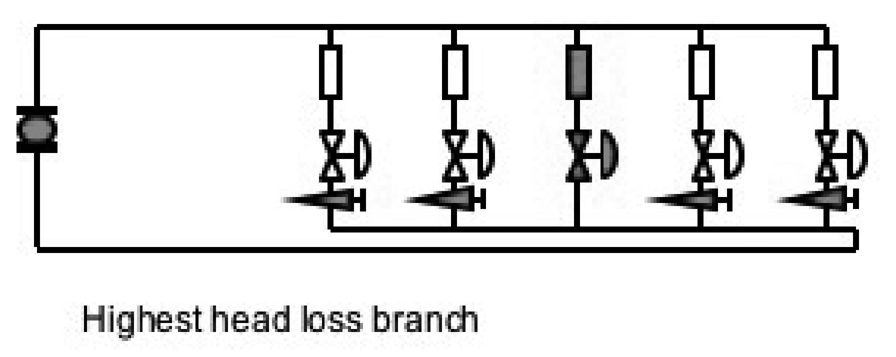

Figure 4. Reverse Return Piping

- The friction head loss of the greatest head loss circuit

Often, the highest head loss circuit is the one most distant from the pump since it has the greatest length of pipe, and perhaps the greatest number of fittings. On the other hand, it could well be that high head loss in a terminal and control valve installed closer to the pump could determine the pump head requirement. Sometimes a designer will incorrectly assume that the most remote terminal circuit is necessarily the one that must be used to determine the pump head.

The inequality of friction head loss among all the terminal unit circuits of a large direct return system can cause the flow to be poorly distributed, causing problems of inadequate heat transfer, excessive energy use and high operating costs. Proper application of control and balancing valves can insure that each terminal circuit gets its proportion of the total design flow, but good piping design can make this chore a lot easier.

Table

Branch to riser pressure drop ratio	Percentage of design flow in end circuit
4:1	95
2:1	90
1:1	80

The "branch to riser pressure drop ratio" is a useful tool in designing direct return piping systems that can provide a large proportion of design flow to all terminals while minimizing balancing requirements, and maybe even decreasing the pump head required.

In **Figure 3**, the branch pressure drop is defined between points "A" and "B". It includes the pressure drop due to friction, calculated at design flow, in all the components between the supply and the return mains. The "riser pressure drop" includes total supply plus return main pressure drop, also calculated at design flow. A high branch to riser pressure drop ratio can supply close to design flow in the most distant terminal without using any balancing devices at all. (see Table at left).

There are limits in trying to obtain a high branch to riser ratio. If the supply and return main pipe sizes are selected for very low pressure drop, pump head requirements will be reduced, but the average flow velocity may not be great enough to move entrained air bubbles to the point of air separation. On the other hand, choosing control valves with higher pressure-drop tends to improve their

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"valve authority," while increasing the branch pressure drop. As in most things, good judgment is required to achieve a balance between conflicting design requirements.

Some of these issues can be avoided by using reverse return piping (**Figure 4**).

In this kind of piping scheme, the first terminal supplied with water is the last one to return it, thus making every terminal about equally far from the pump in terms of developed pipe length and friction head loss. Because of this, each terminal will see approximately the same differential pressure. If all the terminals and control valves have similar head loss and flow requirements, then reverse return piping will provide each terminal with a high proportion of design flow, with only minimal balancing effort required assuming that the pump has been properly selected.

If one of the terminals requires significantly greater flow or head loss than the rest of them, then the pump and piping system must be selected accordingly. Balancing devices of some kind must be used to prevent the excess flow that will otherwise occur in the lower head-loss terminals. Under these circumstances, it may be wiser to use a direct return system to avoid the additional cost of the reverse return piping. Sometimes the most important factor is the space saved in pipe chases. A common rule of thumb suggests that reverse return piping be considered if the branch pressure drops and flow requirements are within 25 percent of one another.

Dual Temperature Systems

The two-pipe system is capable of providing either heating or cooling, but can't provide both at the same time. Variations of the basic two-pipe design exist which can supply both heating and cooling simultaneously. A "three pipe system" allowed for cooling in one part of the system with heating in another. It used a special three-way valve to supply either hot or cool water to the coil and a common "third pipe" to return both the heating and cooling water. Because it allowed significant mixing of the hot and cool water, it has been judged to be inefficient, and is therefore rarely seen anymore.

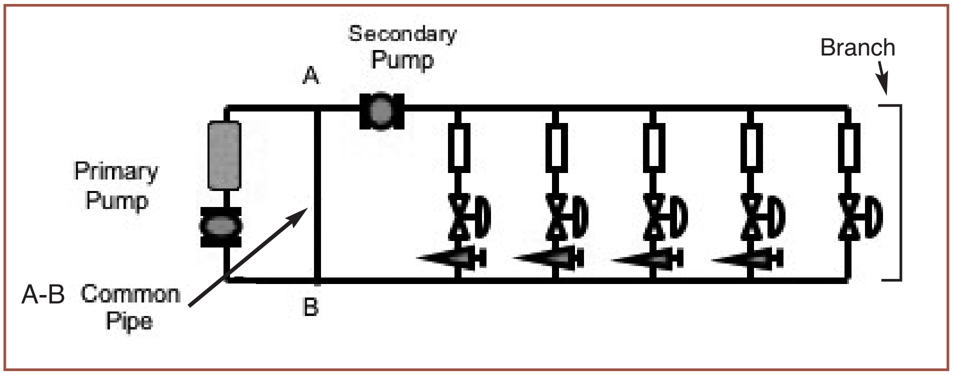

Figure 5. Simple Primary-Secondary Piping Scheme

A "four-pipe system" can also provide simultaneous heating and cooling. Each coil is equipped with both heating and cooling supply and return piping and special valves to eliminate mixing of the two streams. You could think of it as two separate two-pipe systems that use the same heat transfer terminal.

Two-pipe system design is important because these systems represent the great majority of hydronic systems being built today. Careful design of the piping system is fundamental to the success of any hydronic project.

Primary-Secondary Systems

In the two-pipe system, the pump flow requirement is determined by the sum of the terminal flow requirements, but the pump head requirement is determined by the total head loss in the circuit having the greatest head loss at design flow. Clearly, if there are multiple flow paths, and if the pump is providing enough head to overcome the head lost in the worst-case circuit; it must be providing more than enough head for all the "less-than-worst-case" circuits. Good judgment in selecting pipe sizes, control valves and balancing devices can go a long way toward ensuring that each one of those circuits gets its proper share of the flow.

Still, large systems with many terminals, many possible flow paths, and many control valves can present a formidable challenge to the designer who is trying to insure that every terminal unit can get enough flow to provide adequate heat transfer under all circumstances. One solution to this problem is primary-secondary pumping.

Gil Carlson, the late Director of Technical Services at Bell & Gossett, invented primary-secondary pumping as a way of providing adequate flow to all the units of a large heating system by dividing it into a set of smaller, easier-to-control sub-circuits, each one independent of the others. This independence means that the action of a pump or control valve in one loop has little effect on flow in another loop. The key to this flow independence is low head loss in the pipe that is common to both of the piping circuits.

In **Figure 5**, a primary loop with its own primary pump and a boiler or chiller is connected to a secondary loop with a separate secondary pump, coils and control valves. To achieve low head loss, the common pipe is designed for low head loss by making it short in length and large in diameter for the flow rate it carries. The primary pump is pumping upward, and the secondary pump is pumping to the right. Using familiar concepts like conservation of mass and

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conservation of energy, a designer can quickly demonstrate that flow in one loop has no effect on flow in the other, as long as the common pipe is designed for low head loss. For example, suppose that the secondary pump is turned off.

Clearly, the primary pump will circulate water across the low head-loss common pipe instead of through the higher head loss of the secondary circuit. If manual or automatic control valves are installed, then it's possible to show that any of three situations can occur:

❶ Primary Flow is Equal to Secondary Flow

In this case, there is no flow in the common pipe, and the tees at "A" and "B" that connect the two loops have no branch flow. At each tee the run-flow in equals the run-flow out, and the branch flow equals zero, an example of conservation of mass. The temperature supplied by the primary circuit equals the temperature supplied to the secondary circuit, and the return temperature from the secondary is equal to the return temperature in the primary. The magnitude of the change in temperature in each loop is the same because the heat transferred from one loop must be equal to the heat transferred into the other. In each loop, heat transfer is a function of flow and temperature change.

❷ Primary Flow is Greater Than Secondary Flow

In this case, water must be diverted at point "A", making the primary supply temperature equal to the secondary supply temperature. At point "B", the secondary return mixing with the flow across the common pipe means that the primary return temperature will not be the same as the secondary return.

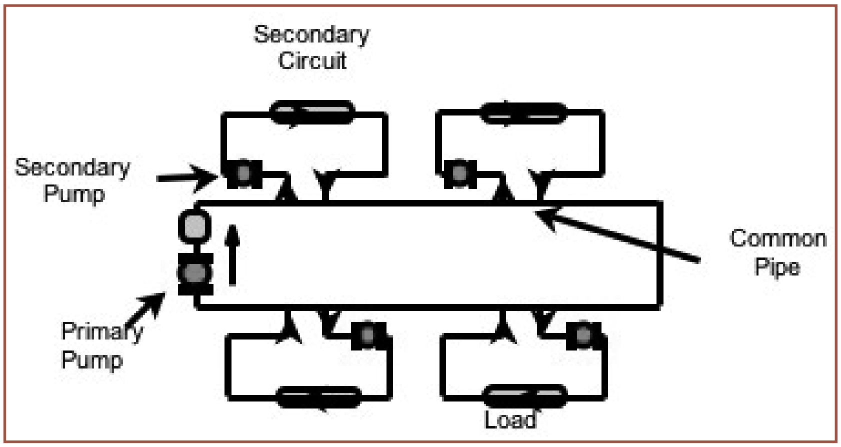

Figure 6. Primary-secondary System with One-pipe Scheme

❸ Primary Flow is Less than Secondary Flow

In this case, flow in the common pipe is reversed, mixing at "A" and diverting at "B". Now the secondary return and primary return temperatures are the same, but the supply temperatures are not the same.

A primary-secondary system with many terminals could be designed using either one-pipe or two-pipe principles. Let's first consider a primary-secondary system designed using the one-pipe scheme in **Figure 6**.

The primary loop and its pump provide flow through the boiler or chiller and through the main that connects to each terminal. At each terminal, the closely spaced tees provide a low pressure-drop common pipe connection. A secondary pump governs flow in each terminal. The simplest control scheme turns on the secondary pump when flow is required and turns it off to allow the flow to bypass the secondary circuit if flow is not required in the terminal. Many other methods for controlling the secondary supply temperature exist too.

Many of the advantages and drawbacks discussed in more elementary one-pipe systems continue to apply here as well, such as simplicity in laying out the primary piping and terminals seeing different supply temperatures. Designers who are aware of these limitations have successfully used one-pipe primary-secondary systems for years.

In similar fashion, a primary-secondary piping system could be designed on two-pipe principles, which can be seen in **Figure 7**.

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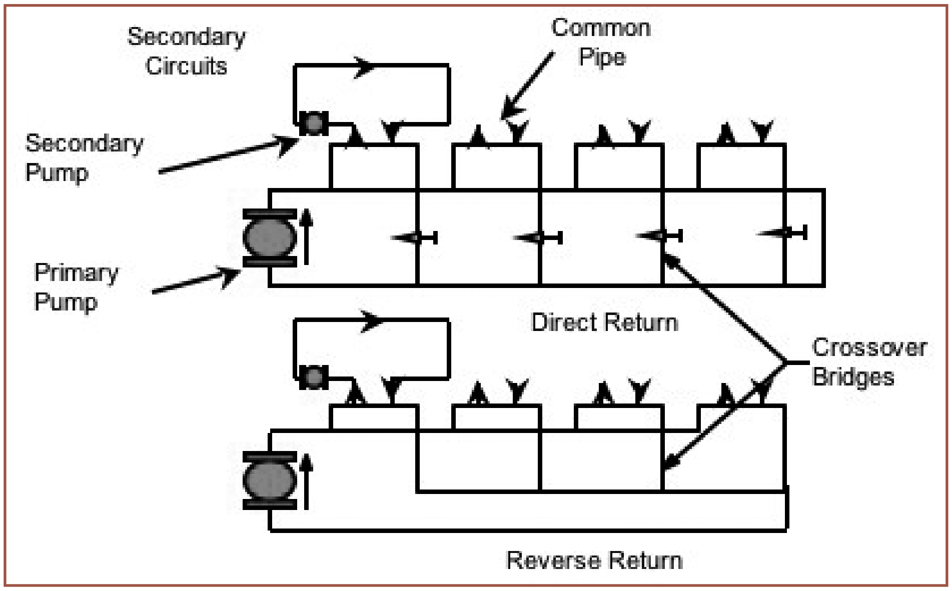

Figure 7. Primary Secondary Piping System Based on Two Pipe Principles

Vacuum Return Condensate Systems

Should you replace your vacuum return condensate system with a standard unit?

A review of the startup of a steam heating system will point out some important facts. Depending on the outside weather, a heating system will cycle many times.

At the beginning of a system startup on a two-pipe steam system, the steam mains, radiators, and dry return lines are drained, and the entire system above the boiler waterline contains air. When steam is admitted to the heating zone, it must first push the air out of the steam mains and radiators through thermostatic traps or air vent valves. Steam traps are normally installed on each radiator and at the end of the steam main. As the air is vented, it is displaced by steam, and heating begins. Usually the radiation at the point where the steam main enters the building will begin to receive heat first. As air is vented along the length of the steam main, additional radiation will begin to receive steam. Depending on the length of the steam main and the size of the vents, it may require 5 to 20 minutes until the entire system is vented and heat is distributed throughout the building.

Several attempts were made to improve the balance of heating in the large single zone steam heating systems. Orifices were used to reduce the amount of steam flowing to radiation at the supply end of the steam main. Adjustable air vent valves were installed on steam radiators in one-pipe steam systems. These attempts, of course, helped but they could not adjust to different degree-days, and the heating balance still suffered.

New system approach

Vacuum systems were developed to overcome these difficulties. These systems use a vacuum pump on the end of the return line to maintain a vacuum of 3” to 8” Hg in the system. With a vacuum pump, air is removed from the line. When the system is cold and the thermostatic radiator traps are open, air is removed from the radiation and steam supply lines. With a large percentage of the air removed by the vacuum pump and an increased differential across the system, steam flow is several times faster than in a standard atmospheric return system. This allows for a much improved heat balance and a faster system startup.

The vacuum return systems offer additional system benefits in that condensate is returned faster, reducing surge in the boiler due to condensate holdup in the system.

Condensate holdup in the system can cause frequent low water cutoff at the boiler. Also, when condensate is returned in large slugs, flooding of the boiler can occur. With the additional differential across the system, engineering design manuals allow for reduced return line pipe sizes. With the use of lift fittings, low condensate return lines can be drained without the use of additional condensate return pumps located in pits.

It is not uncommon today to find buildings replacing old vacuum pumps with standard atmospheric condensate units. Before this decision is made, all the advantages of a vacuum system should be considered. Often these buildings will have windows opened on one side because of excessive heat, while another part of the building is cold. Or you may find noisy return systems because the smaller return pipe sizes do not allow adequate return of the condensate.

The only way to eliminate the vacuum unit and maintain proper heat balance is to rezone the steam distribution lines. This involves additional thermostats, zone control valves in the steam supply, and complete repiping, which is impractical on most buildings. Alternative methods of increasing the steam pressure or installing individual thermostatic radiator valves usually do not work.

Vacuum unit performance

To obtain proper vacuum unit performance, it is necessary for the return

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In a system like this, each secondary circuit sees the same primary supply temperature because of the “crossover bridge” that connects the primary supply to the primary return. These bridges provide a place for installing the tees that define the common pipe connection between the primary and the secondary circuits. The bridges can be installed using direct return or reverse return. Once again, the earlier analysis of simpler two-pipe systems can be applied here, with similar conclusions.

Figure 7 does not show details in the secondary circuits, but each terminal in the secondary circuit could be controlled by a two-way valve or a three-way valve and bypass. Balancing valves in the crossover bridges of a reverse-return system may not be required if the same primary flow and head loss is required in each case. The reverse-return arrangement makes each circuit equally far from the primary pump, thus equalizing the piping head loss.

Over the years, primary-secondary pumping has become a common way of solving many problems in hydronics. Large chiller plants, small radiant panel systems, and multiple boiler systems often use the principles of primary-secondary pumping to provide economy and control.

This article was written by Bell & Gossett engineers and was originally published in *Plumbing Systems & Design*. Reprinted with permission. Part 2 of this article will appear in the next issue of Tech Talk.

Specifying Tips

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piping to be tight, and the thermostatic traps must be properly maintained to control the temperature of the condensate return. Since the system is under vacuum and the flash temperature is reduced, 180° F is normally considered the maximum condensate return temperature for proper operating efficiencies in a vacuum system. Higher condensate temperatures or live steam can cause cavitation in the pumps which shortens mechanical seal life.

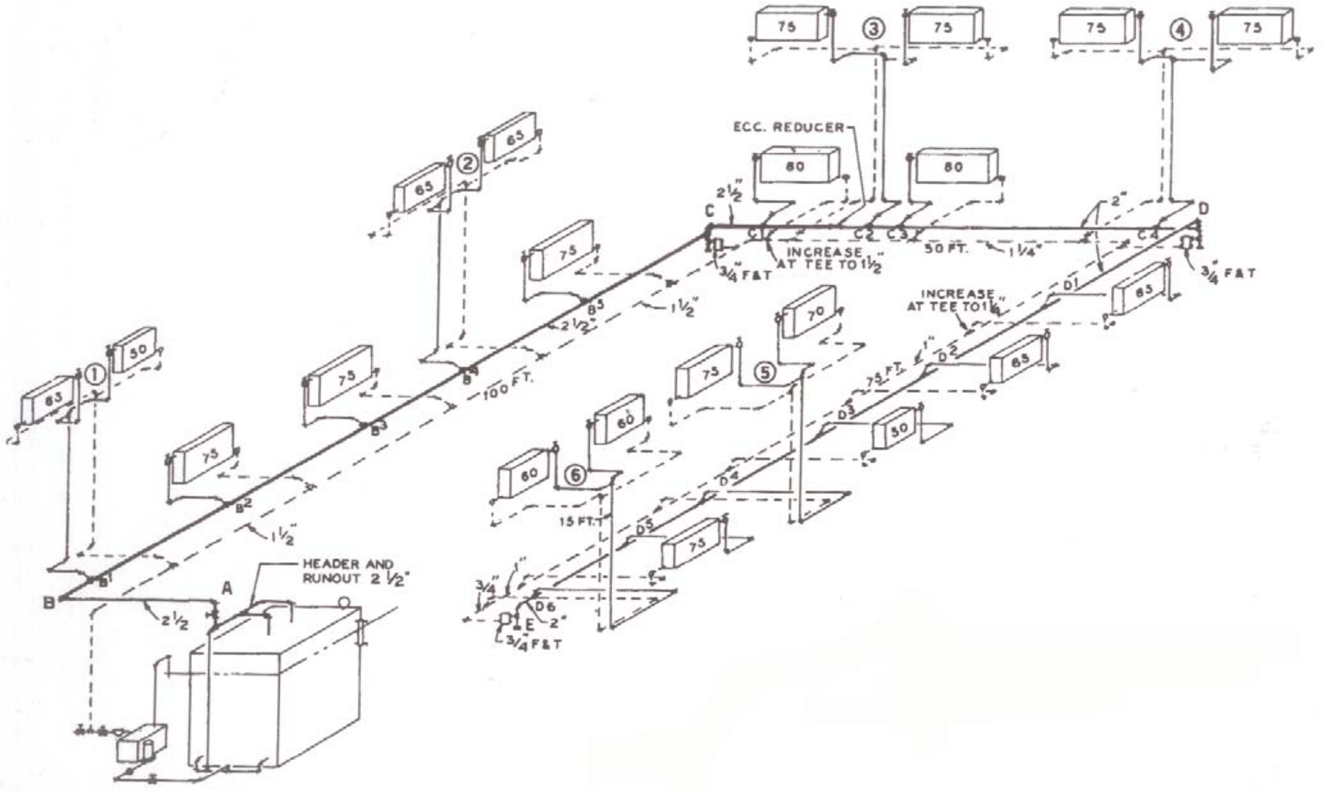
Modern vacuum return units are available with separate air removal and condensate pumps. The separate pumps offer many advantages over older units having a common air and water pump. The modern units allow individual sizing of air capacity and water capacity to handle increased air leakage. The separate vacuum pumps permit the use of a temperature limit switch in the return line to cut out the vacuum operation when return temperatures are excessive due to improper maintenance of steam traps. Often the vacuum is not required when the system is up to operating temperature.

A vacuum return unit with separate vacuum pumps can improve operating efficiencies. Normally, a vacuum unit maintains the system under vacuum all the time unless the unit is manually set to condensate-service only. With a separate vacuum pump, an aquastat can be installed on the zone steam main, and the vacuum pump wired to start in response to temperature increase in the steam supply line. During normal operation, smaller horsepower rated motors are operated in response to a vacuum or high water signal. Vacuum boiler feed systems are also available for systems involved in boiler conversions. New boilers often have considerably less water storage capacity, making it necessary to install a boiler feed receiver to store the system condensate until it is required by the boiler. With the vacuum pump installed on the boiler feed receiver, the condensate returns under vacuum directly into the boiler feed receiver. It is then stored under vacuum until it is required by the boiler water level control.

If you are considering a change to eliminate a vacuum return pump (or if you made such a change), the system operation and resulting fuel cost will probably increase. If the system was originally designed for vacuum service, it should be properly maintained and continue to operate under vacuum.

This article was written by Bell & Gossett engineers and was originally published in *Heating/Piping/Air Conditioning*.

Modern Vacuum Return Unit Layout



Don’t Risk Your Reputation!

Low Pressure Steam Systems Must Not Be Pressure Leak Tested

Avoid this situation!

Effective November 1 2004, Domestic Pump and Hoffman Pump condensate return, boiler feed, vacuum heating, clinical and industrial vacuum units are all being shipped with a new, larger warning label.

Domestic Pump and Hoffman Pump are making every effort to eliminate any misunderstanding regarding pressurization of our receivers. Always remember to isolate your Domestic or Hoffman pump unit from the system when performing a pressure leak test. A guide review of the warning labels on the unit and the instruction manual can prevent a dangerous and costly situation.

Heed the warning labels on Domestic Pump and Hoffman Pump condensate return, boiler feed, vacuum heating, clinical and industrial vacuum units

For more than 55 years, Domestic Pump literature and warning labels on the units have indicated a warning against pressurizing receivers. In addition, the labels at the right will be applied to each unit.

Labels are being applied to multiple locations on the unit so that even casual perusal will note them and hopefully eliminate potentially hazardous situations before they occur. In addition to the warning labels, installation and operation manuals are being updated to reflect the new labels and will continue to contain the warning messages shown on the right in various key places to prevent miscommunication.

Don’t risk your reputation by pressure leak testing low pressure steam systems. Protect yourselves and your customers by educating them. When you take short cuts, or don’t know the answer, the final cost can be very high. Contact your Bell & Gossett Representative about classes, which qualify for Continuing Education Credit and come learn with us.

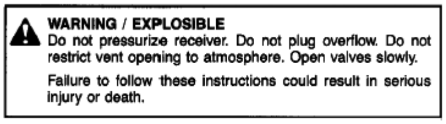
Several users in recent years have ignored the warning labels and created hazardous situations for themselves and for their customers. The net result, seen at left in the form of a receiver failure, created a very hazardous situation for a customer. Fortunately, only egos were bruised and no one was hurt. Steam systems have been around for many years. They still need to be properly cared for and treated with respect.

For answers to your steam and hydronic heating questions, contact your local Bell & Gossett Representative.

WARNING

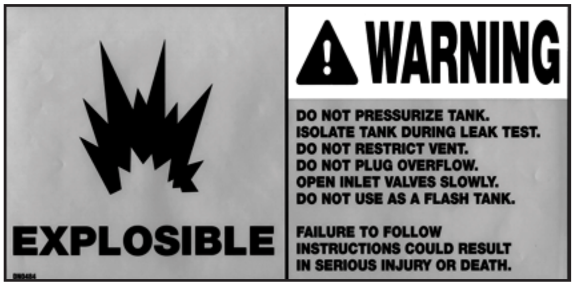
EXPLOSIBLE

ISOLATE TANK DURING LEAK TEST



WARNING / EXPLOSIBLE
Do not pressurize receiver. Do not plug overflow. Do not restrict vent opening to atmosphere. Open valves slowly.

Failure to follow these instructions could result in serious injury or death.



EXPLOSIBLE

WARNING

DO NOT PRESSURIZE TANK.
ISOLATE TANK DURING LEAK TEST.
DO NOT RESTRICT VENT.
DO NOT PLUG OVERFLOW.
OPEN INLET VALVES SLOWLY.
DO NOT USE AS A FLASH TANK.

FAILURE TO FOLLOW INSTRUCTIONS COULD RESULT IN SERIOUS INJURY OR DEATH.

New, larger warning labels

New Fluid Handling System Improves Energy Efficiency, ROI

General Mills installs new, standardized fluid handling system at its Minnesota headquarters complex

The recently completed upgrade and expansion of the heating and cooling systems at the General Mills headquarters complex in Golden Valley, Minnesota, is already meeting the high demands placed on the massive project and is paying a return on the investment. In addition to the upgrade, the project included a change from well water usage to municipal water, and then a facility expansion caused by a merger with Pillsbury. All of this meant that major changes to the decades-old HVAC system would be required.

Before any work began, the contractor and design engineers met to identify the scope of the work needed to completely upgrade and expand the heating and cooling capacity for the six-building, 100-acre complex. Beginning in mid-2001, the team embarked on a complete renovation of the existing heating and cooling system and also construction of a brand new chilled water and heating plant to replace the 30-40 year old buildings and equipment.

The project called for upgrades to existing equipment in order to increase energy efficiency throughout the complex and to match General Mills' company-wide guidelines for product specifications. "The challenge was to create a more user friendly and energy efficient cooling and heating system throughout the complex," said Tim Weiss, project manager for mechanical systems at the General Mills facility. "We had retrofits and bits and pieces of different equipment throughout all the buildings and we realized that the cost for parts for fixing the old equipment was not going to be profitable."

General Mills headquarters in Golden Valley, Minnesota

Metropolitan Mechanical Contractors

General Mills chose Metropolitan Mechanical Contractors, Inc. (MMC), in Eden Prairie, Minnesota, for this project because of their 37 years of experience as a mechanical contractor with extensive work on large production facilities. MMC supported General Mills' product specifications and construction timeline, including plans to construct a central plant for the heating and cooling needs of the entire campus. Products for both the heating and cooling applications would be chosen based on their design, energy savings, ease of use and maintenance benefits. The goal was to create a central heating and cooling facility to meet the demands of the entire 100-acre complex.

"With such a large project, there were many purchasing decisions to be made on the type of chillers, pumps, boilers, controls, and other products," said Brian Gieseke, project manager for Metropolitan Mechanical Contractors. "It came down to what products could meet the exact demands of the project, and it was General Mills' choice. They were well educated on product availability and specifications, and they felt comfortable with the products they chose to meet their requirements."

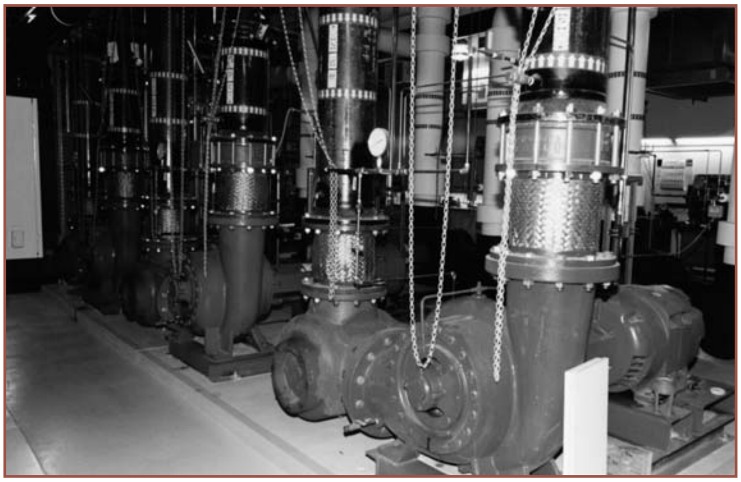
B&G pumps, valves and heat exchangers

After considering the design and application recommendations, General Mills selected Bell & Gossett to provide all the pumps, valves, heat exchangers and related equipment needed for the new heating and cooling system. "The Bell & Gossett pumps are designed the way pumps should be," commented Weiss. "B&G was a perfect fit for our application demands and their equipment met the efficiency requirements set by our corporate standards."

Benefits for all

The project was completed in 26 months.

See General Mills, pg. 10



B&G Series VSCS double suction vertical split case pumps used for condensed water pumping at the General Mills complex

General Mills Case Study

from pg. 9

Besides energy savings, ease of maintenance and comfort, employees at the General Mills complex were quick to notice another important benefit provided by the Bell & Gossett pumping equipment - low noise and vibration throughout the entire system. Before, employees had complained about excessive HVAC-related noise, but now they enjoy a quieter, happier working environment.

An important environmental benefit was achieved through the conversion of the cooling system from a dependence on using well water to a closed loop system. The old system that used more than 1.2 million gallons of well water per day is now an efficient closed loop system running on 20,000 gallons with only a minor top off required every so often.

No less important, the building maintenance and utility departments at General Mills also benefited from the project improvements because they now have the latest, most compatible types of HVAC equipment facility-wide, and that means easier maintenance and readily available, quality replacement parts in the future.

B&G inline pumps and Triple Duty® Valves

Dozens of Bell & Gossett pumps and other HVAC components specified

B.J. Mulcahy Co., Inc., Bell & Gossett's Sales Representative in Minnesota, worked closely with General Mills and Metropolitan Mechanical Contractors to provide a large number of pumps, valves, heat exchangers and other pieces of HVAC equipment for the chilled water, heating water, domestic water re-circulation, and condenser water pumps in the 100+ acre complex. According to B.J. Mulcahy Co., the following Bell & Gossett equipment was installed:

(11) Series 1510 end suction pumps

(10) Series VSC double suction vertical split case pumps

(6) Series VSCS double suction vertical split case pumps

(2) Series 60 inline pumps

(4) Series 80 inline pumps

(3) Series 90 inline pumps

(3) Bronze circulator pumps

(21) Domestic Pump Type B high-temperature condensate pumps

(13) Triple Duty® Valves

(10) Suction diffusers

(3) Technologic® 70E duplex pressure booster systems

(7) Rolairtrol air separators

(7) U-tube heat exchangers

WHAT'S NEW

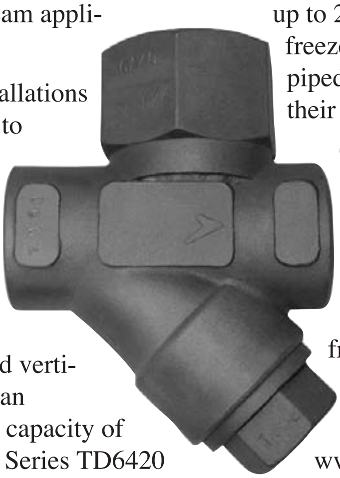
Hoffman Specialty® Introduces Series TD Thermodisc Steam Traps

Hoffman Specialty® is introducing Series TD Thermodisc steam traps to their extensive Bear Trap® product line. The new steam traps are designed for a variety of applications and allow for simplified installation. Typical applications include:

- Drip traps on main steam and supply lines
- Tracer lines
- Laundry and kitchen equipment
- Superheated steam applications
- Outdoor installations that are subject to freezing

Series TD 6520

The two primary trap designs operate both horizontally and vertically. Series TD6520 can withstand a high-pressure capacity of up to 4,700 lbs/hr and the Series TD6420 includes an integral strainer to protect the trap from contamination and can operate with a capacity of up to 2,200 lbs/hr. Both designs are freeze resistant when the trap is piped in vertical orientation due to their self-draining design.



Series TD 6420

The stainless steel construction resists internal and external corrosion as well as reduces water hammer noise. The new traps also operate over a wide pressure range from 2 to 600 psig with a maximum temperature of 800° F.

For more information visit www.hoffmanspecialty.com .

New Balance Valve Literature Available

Circuit Sentry™ Automatic Flow Limiting Valves

Bell & Gossett® has developed new informational literature for the Circuit Sentry™ automatic flow limiting valve. The literature provides an overview of how the Circuit Sentry Valve design allows constant fluid flow and automatically compensates for fluctuating pressure conditions to help deliver peak operating performance from HVAC systems.

The 2-page, 4-color brochure (A-605A) provides a complete description of the product capabilities and usage along with a list of the materials of construction and operating data. A detailed chart is also included to show the broad range of product sizes with a variety of end connections.

A-605A

Circuit Sentry™ Automatic Flow Limiting Valves

Get peak operating performance from HVAC systems automatically

- Keeps constant fluid flow, automatically compensating for fluctuating pressure conditions
- Unique diaphragm pressure control element allows one cartridge for most systems
- Large open flow paths for clog-free operation
- Union connection allows for maximum piping flexibility and elimination of unnecessary pipe fittings
- No requirement on pipe lengths before and after the valve for easier application and piping
- Broad product size range (1/2" to 20")

Bell & Gossett®

ITT Industries

Engineered for life

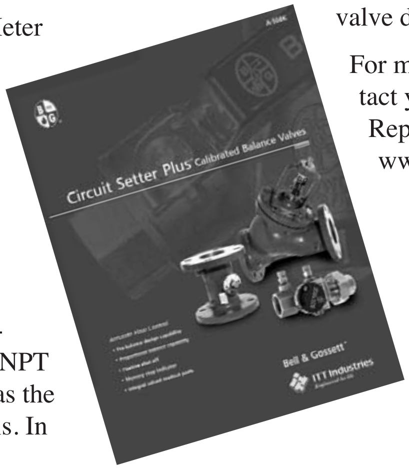
Circuit Setter Plus® Calibrated Balance Valves

A new bulletin for the Circuit Setter Plus® Calibrated Balance Valves describes the advantages of the system balance method and illustrates how the Circuit Setter Plus assures optimum and accurate system flow with minimum operating horsepower.

The bulletin (A-508K) presents detailed valve performance figures and explains typical applications of the valves in balancing and metering flow levels and controlling shut-off. Specific benefits and components of the Circuit Setter Plus highlighted in the literature include:

- Velocity Head Recovery
- Circuit Setter Balance Valve Calculator
- Variable Orifice Flow Meter
- Proportional Balance
- Positive Shut-Off
- Memory Stop
- Readout Valves
- Drain Connection

The bulletin also includes product diagrams that illustrate the dimensions of the NPT and sweat models, as well as the flanged and grooved models. In addition, a detailed description of valve construction is given for each valve design.



Circuit Setter Plus® Calibrated Balance Valves

Bell & Gossett®

ITT Industries

For more information, contact your Bell & Gossett Representative, or visit www.bellgossett.com.

FREQUENTLY ASKED QUESTIONS

www.bellgossett.com

KNOWLEDGE BASE

■ Search our Q&A archives

Q I'm installing a steam coil with a modulating control valve and an F&T trap. Condensate return is a vacuum system. Do I need a vacuum equalizing line with a check valve across the trap? Do you guys have any coil piping details for vacuum return systems?

A Yes, an equalizing line with a check valve will allow condensate to drain if the induced vacuum in the heat exchanger shell (low pressure) gets to be lower than the vacuum in the condensate lines. The "equalizer" will then allow the static head to drain condensate. Ensure that you size the F&T for the worst case, minimum pressure that it's likely to see, and then double check the seat pressure rating to ensure that the trap will continue to open under the highest differential it will encounter. Look for the "Steam Trap Engineering Manual" on our website, and for many different detail drawings, see the Hoffman Specialty product literature at www.hoffmanspecialty.com

Q I am designing the HVAC system for a 300-bed hospital. Chiller capacity is 5000 tons. The chilled water hydraulic system is of the primary chilled water loop type using a variable speed pumping system. Which piping system is the best to use: reverse or direct return piping?

A Most designers use the direct return to avoid the cost of the extra pipe. If you choose to do it that way you will have to ensure that the system is balanced so the last coils will get acceptable flow. Reverse return piping can ease the balance problem a little, assuming that the coils are all within 25% of each other in terms of pressure drop. Be careful to install the DP sensors properly. You can learn more about these important details at the Little Red Schoolhouse Large Chilled Water System Design Seminar. These three-day programs are free of charge - contact your B&G Representative for details.

To view more FAQ's, go to www.bellgossett.com, click on "Knowledge Base", and then enter a key word in the search box.

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