Design Features of Armstrong Compact Manifolds

Armstrong

INTRODUCTION

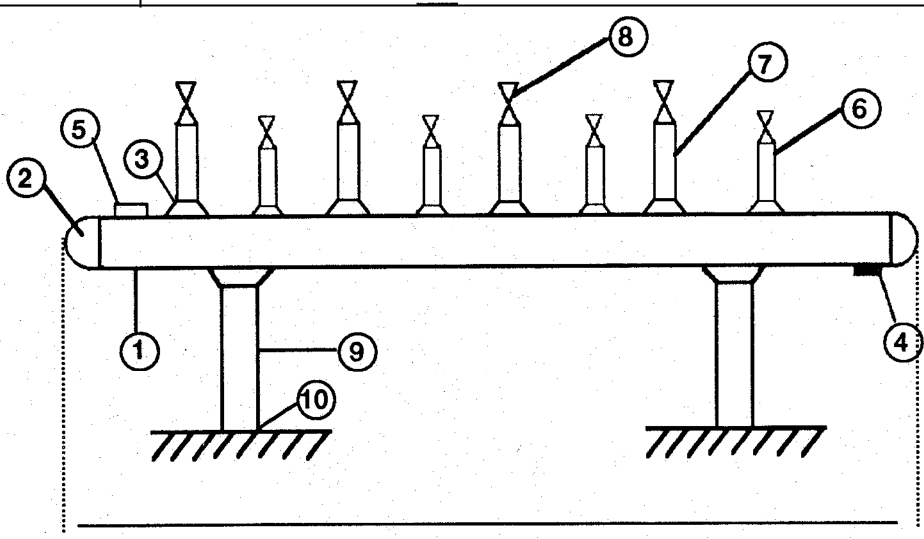
Steam tracers are designed to maintain uniform temperature of a flowing fluid in a primary pipe. The heat from the tracer keeps the fluid from freezing, and can help it to move more easily through the system. Tracers are also used to heat instruments, especially to keep the moisture in the compressed air from freezing. In most cases, tracers are used outdoors to protect against ambient weather, so ambient weather is also then a consideration in tracer system design. Armstrong would like you to consider the steam tracer piping manifolds. Piping manifolds are used to distribute steam into the individual tracing lines, and to collect condensate from the steam traps at the tracer's end. Until now, these manifolds have been fabricated pipe systems consisting of a header which feeds (or collects) through a series of valves. Let's look at the materials and costs involved in manifold construction.

BUILDING A MANIFOLD

When fabricating a manifold, there are quite a few materials that need to be procured, depending on the manifold's size. Here is the materials and cost schedule for a typical 8 station manifold:

PIPING COMPONENTS REQUIRED

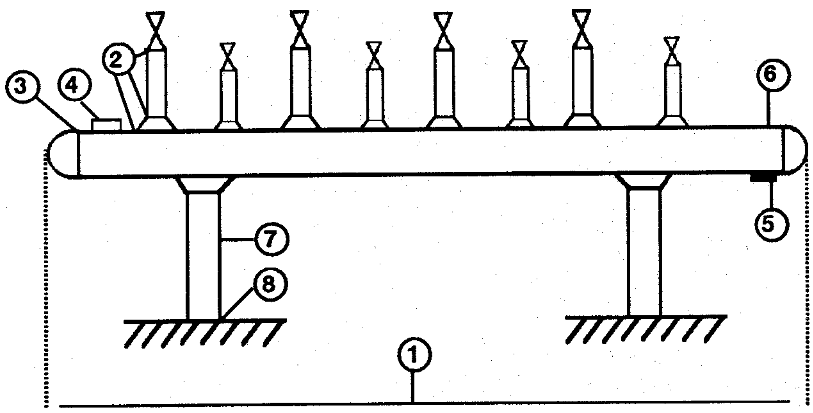
ITEM NO.	QUANTITY	DESCRIPTION
1	1	5 ft. of 3" Schedule 80 pipe
2	2	3" caps
3	8	1/2" boss
4	1	3/4" boss
5	1	I-I /2" boss
6	4	4" long 1/2" nipple
7	4	8" long 1/2" nipple
8	8	Globe or gate valve - steam service
9	2	Steel supports
10	2	Concrete pads (or other support)



STEPS IN FABRICATING

STEP NO.	DESCRIPTION
1	Cut all piping to specified length.
2	24 (1/2") socket welds (3 on each outlet)
3	2 (3") butt welds
4	1(1-1/2") socket weld (steam inlet)
5	1 (3/4") socket weld (drain)
6	Bridge the 3" pipe to prevent distortion'
7	Fabricate the support structure
8	Anchor the support to concrete pad

'With many welded joints in close proximity, the control of distortion due to shrinkage must be considered. In this case, the 3" pipe must be either straightened after welding or strongly supported (bridged) during welding.



COST OF FABRICATION

By evaluating the cost of materials and construction steps, total cost of the 8 station manifold can be calculated:

MATERIALS	
Pipe components	$100.00
Valves (8 valves x $25)	$400.00
LABOR	
Fabrication (20 hours x **$25)**	**$500.00**
Mounting (8 hours x $25)	$200.00
MISCELLANEOUS	
Support structure	$175.00
Concrete pads	$25.00
TOTAL	$1400.00
OPTIONAL	
Insulation	$130.00
Aluminum jacket insulation cover	$400.00
TOTAL W/OPTIONS	$1930.00

If you feel your costs differ significantly from above, you can use the right hand side of this page to develop actual total cost.

OTHER CONSIDERATIONS

- Fabricated manifolds require a variety of pipe accessories, and considerable time and labor are involved in construction.
- The 5 feet of 3" pipe will occupy a large “footprint”, possibly interfering with plant traffic and safety lanes. The manifold positioning should be considered in the initial plant layout, which doesn’t always happen.
- It’s difficult to be sure all accessories are ordered, received, and shortages are allowed for.
- Insulation is heavy, expensive and difficult to remove.
- Globe and gate valves can be a problem on steam service, metal seats are likely to leak.
- Supervision, design and order processing costs for multiple parts are operations that must be considered.

CONCLUSION

A traditional steam distribution or condensate collection manifold, when fabricated, can be expensive. The major material cost is for valves. The major working cost is for the welding of fittings and accessories.

If the valve price or amount of work required could be lowered, a major cost reduction could be realized. Unfortunately, a lower priced valve has yet to be discovered, but we have found a way to reduce the work required in constructing manifolds.

ARMSTRONG MANIFOLDS

Armstrong Representatives working with engineering and construction firms have developed a unique manifold system. The goal during development was to realize a cost savings plus provide features that would make the system:

- a compact, easy to install system;
- serviceable on site by using special, repairable valves;
- a long life system, especially the valves;
- a single source, easy to specify system;
- a quality product.

The result is a manifold series available in steam distribution (MSD) or condensate collection (MCC) variations. It is a monoblocksteel forging, machined to accept valve internals. This makes the manifold one big valve body eliminating the connecting piping and welds.

VALVES

A piston valve (see page **6** for explanation of valve operations) was selected as the valve for the manifold. The piston valve was selected due to its good performance in steam system service. The seals in the piston valve are easy to replace on site, unlike gate, globe or ball valves. The seat seals can also be tightened while the system is operating, another unique feature.

MOUNTING

The manifold has significantly less weight and bulk than a fabricated manifold. Since it can be installed in an upright position, valuable floor space can be saved. Mounting supports and concrete pads are not needed. The manifold has threaded bosses on the back so that it can be secured on any suitable metal frame already present, such as an I beam.

SIZES

The manifold is available with either 4, 8, or 12 outlets of 1/2" size, either SW or NPT. The steam distribution model (MSD) has a l-l /2" SW inlet and provision for a drain fitting and trap. The condensate collection model (MCC) incorporates a siphon drain tube to drain the entire manifold when draining to an overhead return system. The siphon tube outlet is 3/4" NPT.

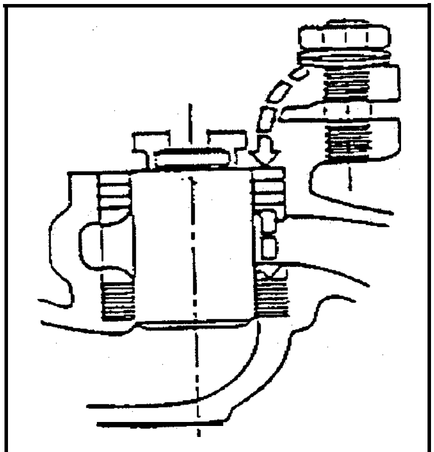
MANIFOLD COMPARISON

CONVENTIONAL MANIFOLDS	ARMSTRONG MSD-MCC MANIFOLD
DESIGN - INSTALLATION	
Configuration depends upon location onsite - heavy costs result from: ● complicated design, assembly and installation; ● errors in measurements; ● shortage or excess of supplies on site.	Steam tracing distribution manifolds and condensate collection manifolds can be **standardized to** one single type of manifold. Design and installation generate minimal cost since all components are incorporated in a one-piece body.
OCCUPIED GROUND SPACE	
MAXIMUM One manifold consists of: ● 12 outlets (70 to 85 inches long) ● 12 returns (70 to 85 inches long) ● i.e. a total length of 140 to 170 inches Consequences: traffic hazard and restricted visibility for supervision and safety purposes.	MINIMUM ● one compact manifold with 12 outlets and 12 returns is 41 inches long (valves opened.) ● adaptable to any frame or confined space, thanks to limited size. ● will not restrict circulation or visibility. ● upright mounting is possible, further reducing space requirements.
VALVE SYSTEM Gate valves or 800 lbs. globe valves with or without hardfaced seats. Difficult on-site maintenance.	PISTON VALVES, 1/2" ● sealing system designed is specifically for steam systems. ● leak-tightness is obtained in lateral contact, by a stainless steel piston and resilient washers. ● unique design results in automatic and continuous retightening of sealing rings. ● all sealing parts can be replaced **on site.**
SUPPORT	
Heavy and large sized conventional manifolds require massive supports such as concrete blocks.	**Threaded holes** at the back of the manifold body allow installation of all parts on any support structure.
INSULATION	
Whatever the type, high insulation cost is due to large size of the manifold and geometry of the tracers. Traps and valves are difficult to insulate.	Insulation cost is low, owing to the compactness of manifold. Easily removable and re-usable, the standardized **insulating jacket** will perfectly cover the compact manifold, leaving the valve handwheels free.

PISTON VALVE FEATURES AND OPERATION

The piston valve is an original sealing system. It is completely different from gate, globe or ball valves.

The closing of flow is accomplished by a stainless steel piston, not a gate, plug, or ball. The piston slides through the center of the seals to provide both flow closure and bonnet sealing.



Belleville Spring Washer Assembly

SEAL COMPRESSION

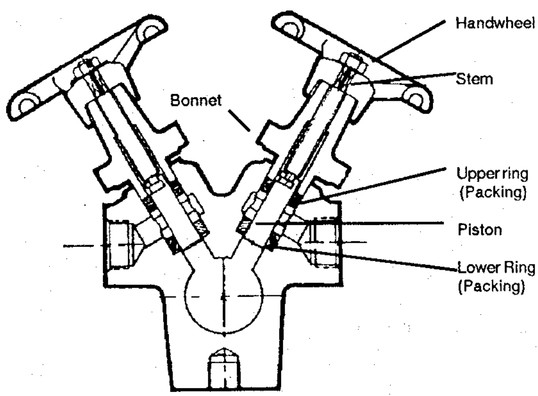
There are two sets of seals.

The upper seals prevent bonnet leakage. The lower seals prevent flow leakage across the valve.

Due to heating - cooling and expansion - contractions, the seals must be constantly compressed against the piston. This compression force is supplied by thrust washers installed under the bonnet nuts. The conical shaped (Belleville) thrust washers automatically compensate for thermal variations during operation. The thrust from the washers is automatically transmitted to both the upper and lower seals, assuring proper shut off.

SEAL CONSTRUCTION

The lower seal (lower valve ring) is a sandwiched rubber, metal and non-asbestos complex. The metal gives dimensional stability when the valve is open. In this case, the seal is being compressed but with the valve open, the piston is away from the seal. The metal rings keep the seal from expanding into the flow path. The rubber gives the seal some resiliency, so that on valve closure, the piston slides through, and good seating occurs. The lower seals are supported at the bottom by a support gland which keeps them from deforming under the constant thrust.



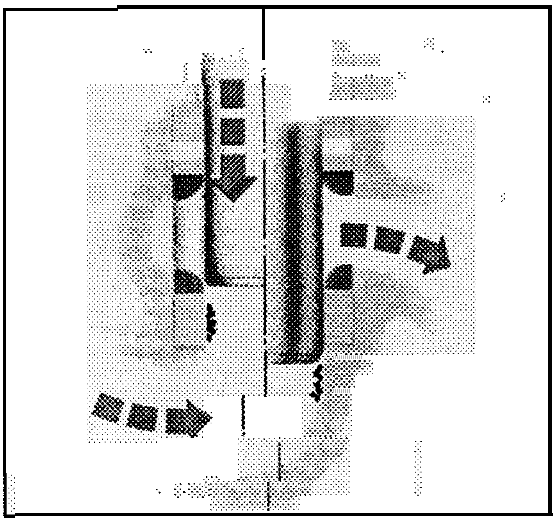
Flow passes through a perforated bushing. The bushing sits between the upper and lower seals, and the piston passes through this bushing also. The sintered steel construction allows the bushing to transmit the thrust from the upper to the lower seal rings.

The upper seals (upper valve ring) are actually a separate washer of PTFE (Chlorine-free teflon) sandwiched by rubber and non-asbestos washers.
Again, the seals are compressed against the piston. The

PTFE washer does soften as temperature rises. The softening helps the washer take the shape of the body and piston to assist sealing. The teflon helps lubricate the piston. Since the piston never clears the upper seals when open, the upper seals don't require metal reinforcement, and the softened PTFE is captured.

SELF CLEANING

Dirt can be the downfall of conventional valves. Steam and condensate transport filings, rust and scale particles, weld beads, etc., which accumulate on or near the valve sealing surface. Trapped particles may prevent a conventional metal to metal seat from sealing. Forcing the valve only damages the seat. Incomplete sealing, lodged particles or damaged seats can quickly steam cut and wire draw.



With the piston valve, the piston passes through the seating surface and there is no metal to metal contact. This action tends to clean both the piston and the seals as it closes.

VALVE SEIZING

Metal to metal seating valves when either heated or over tightened can be extremely difficult to open. Valve seizing when overcome can damage the seating surface, causing leakage and wire drawing. Valve seizing is particularly likely with line contact of the metal seat to the metal gate or plug.

The piston valve does not seat metal to metal, and the sealing occurs on a large area, not a single line. On the 1/2" valve used in the manifold, the lower seal is 7/32" thick and seals over a surface area of 0.176 in^2. Most people are amazed at how easily the valve handle is to turn when opening and closing.

MAINTENANCE

Packing replacement in a standard gate or globe valve is often a difficult operation. Valve plug or seat repair in 1/2" valves is rarely performed because of the costs involved.

The piston valve has a much longer installed service life due to:

1. The unique sealing system which is flexible and self-cleaning.

2. The seals can be restored to original compression by closing the valve, then tightening the bonnet nuts. This squeezes the thrust washers again, recompressing the seals.

3. After several recompressions, the seals can be replaced very quickly, restoring the seals to original condition.

SERVICE CONDITIONS

Outdoor installations on steam service especially in chemical plants will require special precautions for valve construction:

The rubber used in the composite seals must be pre-vulcanized to give it elasticity, strength and stability.

The PTFE ring must be de-chlorinated to prevent corrosion. In not, the chlorine will off-gas when heated, causing severe corrosion in adjacent metal parts.

Threaded parts (stem, bonnet studs and nuts) must be specially coated with valve-quality varnish to resist corrosion and wear.

The thrust washers are zinc and bichromate plated to resist corrosion and preserve their strength.

The piston must be stainless steel to resist corrosion. A rough, corroded surface would destroy softer seals.

Seals are tested by the partial vacuum method.

Upper seals and valve body are tested by hydro-testing at 1-1/2 times design pressure.

CONCLUSION

To sum up, Armstrong has addressed major maintenance factors that would make gate, globe, or ball valves unacceptable for semi-permanent manifold installation. In-line resealability and repairability are achieved by using a piston valve. Without metal to metal seating, seizure, cutting, and leakage can be avoided. The piston valve is a proven system making it the ideal selection for steam service on a manifold installation.

Armstrong

Steam Specialty Products
Armstrong Machine Works

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