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MANIFOLD FOR USE WITH A PRESSURE TRANSMITTER

BACKGROUND OF THE INVENTION

The present invention relates to a field
5 mounted measurement transmitter measuring a process
variable representative of a process. More
particularly, the invention relates to a manifold for
use with a transmitter for coupling the transmitter to
process fluid transmitting fluid pressure to a
10 differential pressure sensing means.

It has been an industry standard practice to
use a flange adaptor and valve manifold to couple
process conduits to pressure transmitters. The manifold
connects a process conduit carrying a pressurized fluid
15 to the flanged surface on a pressure transmitter. Often
times, an H-shaped manifold is used between the conduit
and the transmitter flange. Typically, manifolds had an
inlet surface for receiving a process fluid opposite an
outlet surface connected to the transmitter. In other
20 words, the inlet surface was parallel to the outlet
surface. Furthermore, manifolds were used with
additional flanges or adaptor plates to attach the
transmitter or process conduit. These assemblies are
large, heavy, take up space, and have a number of joints
25 and connections which promotes leaking of the fluid, and
do not provide flexibility in installation.

Additionally, certain transmitter applications
have specific requirements during transmitter use
placing demands on the manifold which must be satisfied.
30 For example, in the natural gas industry measurement
accuracy is vital and must be taken into consideration
when installing a manifold. In the power industry, in

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process calibration is important, and must be considered when installing a manifold.

There is a continuing need for a space-saving manifold used to couple pressure transmitters to process conduits which inhibits leaking and which permits flexibility and ease in installation and use.

SUMMARY OF THE INVENTION

A manifold includes a body having generally planar inlet surface. The inlet surface includes a first inlet and a second inlet, adapted for coupling to a pressurized process fluid. An outlet surface on the manifold is adapted for coupling to a co-planar transmitter and is at a right angle relative to the inlet surface. The manifold includes an equalizing valve surface opposite the outlet surface, and a perimeter therebetween.

The outlet surface includes first and second outlets in fluid communication with the first and second inlets, respectively. Isolator valves selectively isolate the outlets from the inlets. In one embodiment, an equalizer valve selectively couples the first outlet to the second outlet and a vent valve selectively vents the first outlet and the second outlet to the atmosphere. In another embodiment, two equalizer valves and vent valve are utilized.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a perspective view of a manifold embodying features of the present invention.

FIG. 2 shows another perspective view of the manifold of FIG. 1.

FIG. 3 shows a first end view of the manifold of FIG. 1.

FIG. 4 shows a second end view of the manifold of FIG. 1.

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FIG. 5 shows a third end view of the manifold of FIG. 1.

FIG. 6 shows a fourth end view of the manifold of FIG. 1.

5 FIG. 7 shows a cross-section view of the manifold of FIG. 1.

FIG. 8 shows a first side view of the manifold of FIG. 1.

10 FIG. 9 shows a second side view of the manifold of FIG. 1.

FIG. 10 shows another cross-section view of the manifold of FIG. 1.

FIG. 11 is a schematic flow diagram of the manifold of FIG. 1.

15 FIG. 12 is a side view of the manifold of FIG. 1, shown connected to the transmitter and the process conduit.

FIG. 13 shows a perspective view of another manifold embodying features of the present invention.

20 FIG. 13A shows another perspective view of the manifold of FIG. 13.

FIG. 14 shows a perspective view of another manifold embodying features of the present invention.

25 FIG. 15 shows a cross-sectional view of the manifold of FIG. 14.

FIG. 16 shows a perspective view of another manifold embodying features of the present invention with the transmitter and process conduits.

30 FIG. 17 shows another perspective view of the manifold of FIG. 16.

FIG. 18 shows a plan view of the manifold of FIG. 16.

FIG. 19 is a schematic flow diagram of the manifold of FIG. 16.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A manifold constructed in accordance with the present invention is shown in FIGS. 1-12 and is indicated generally at 10. As shown in FIGS. 1 and 2, manifold 10 is preferably a single cast piece and having an "H"-shaped body cross-section which includes a first member 12, second member 20, and third member 46. The first and third members 12, 46 act as side portions while the second member 20 acts as a cross portion therebetween. Generally planar first member 12 includes an inlet surface 14. Inlet surface 14 is provided with a first inlet 16 and a second inlet 18.

Planar second member 20 is generally perpendicular to first member 12 and generally upstanding thereon. Second member 20 includes an outlet surface 22 and an equalizing valve surface 24 generally opposite and parallel to outlet surface 22. Outlet surface 22 is provided with a first outlet 26 and a second outlet 28. Outlets 26 and 28 are spaced apart by generally 1.3 inches (3.3 centimeters) (DIN) and adapted for direct coupling to a co-planar transmitter of the type shown in U.S. Patent No. Des. 317,266 commonly assigned with the present application. In contrast, conventional transmitters have a spacing of 2 1/8 inches (5.4 centimeters) (DIN). Equalizing valve surface 24 is provided with a boss 30 having an equalizing chamber 32. Second member 20 also comprises a first perimeter wall 34 and a second perimeter wall 36. First perimeter wall 34 is provided with a boss 38 having a first blocking chamber 40 therein. Second perimeter wall 36 is provided with a boss 42 having a second blocking chamber 44 therein.

A generally planar third member 46 is perpendicular to the second member 20 and generally

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parallel to first member 12. Third member 46 includes a venting surface 48 opposite from inlet surface 14. Venting surface 48 is provided with a first vent 50 and a second vent 52. In a preferred embodiment, the
5 spacing between vents 50 and 52 is 2 1/8 inches (5.4 centimeters) (DIN). A plurality of spaced-apart mounting holes 54 are provided.

FIG. 12 shows a process conduits 56a, 56b connected to inlets 16, 18 and a transmitter housing 58
10 connected to outlets 26, 28. Fluid preferably flows into manifold 10 in a direction indicated by arrows 60 at inlets 16, 18 and out of the manifold 10 at either or both outlets 26, 28 into transmitter 58, or either or both vents 50, 52 to the atmosphere or other containment
15 or pressure source during calibration. Manifold 10 is attached to and supported by stand 61.

As also shown in FIG. 3, first member 12 is rectangular and inlets 16, 18 are recesses in generally planar inlet surface 14. Inlets 16, 18 are preferably
20 provided between the planes of outlet surface 22 and equalizing valve surface 24. Mounting holes 54 extend through first member 12.

Inlets 16 and 18 are preferably threaded to receive a threaded low pressure and high pressure
25 conduit containing the pressurized process fluid. Both of conduits 56 are connected directly to inlets 16, 18. It is to be understood, however, that other connection configurations, such as connection assemblies between conduits 56a, 56b and manifold 10 are contemplated.
30 Inlet 16, 18 are spaced-apart a distance of about 2 1/8 inches, the industry standard for conduit spacing.

As shown in FIG. 4, third member 46 is also rectangular and generally the same size as first member 12. Vents 50, 52 are recesses in generally planar

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venting surface 48 and perpendicular thereto. Vents 50, 52 are provided between the planes formed by outlet surface 22 and equalizing valve surface 24. Mounting holes 54 extend through third member 46 and are perpendicular to its surface. Vents 50, 52 are preferably threaded to receive a valve, or the like. Additionally, another manifold can be coupled to the vents to permit transmitter stacking.

As shown in FIGS. 5 and 6, generally cylindric blocking chambers 40, 44 are threaded recesses in bosses 38, 42, respectively. Blocking chambers 40, 44 are adapted for receiving blocking valves, described below.

FIG. 7 shows a cross-section of second member 20. A first passage is within second member 20 and provides communication from first inlet 16 to first blocking chamber 40 and first vent 50. First passage 62 also provides communication with first outlet 26 at first opening 64. A second passage 66 is also within second member 20 and provides communication from second inlet 18 to second blocking chamber 44 and second vent 52. Second passage 66 also provides communication with second outlet 28 at second opening 68. The openings 64, 68 are positioned to allow maximum drain potential. Blocking valves 70, 72 in blocking chambers 40, 44 selectively open and close, or "block", communication from inlets 16, 18. Also, venting valves 74, 76 selectively open and close communication of the passages 62, 66 with the atmosphere.

As shown in FIG. 8, equalizing valve surface 24 comprises a boss 30 having a generally cylindric equalizing chamber 32 as a threaded recess therein. Equalizing chamber 32 includes an equalizing opening 78 which extends through second member 20 into outlets 26, 28, as shown in FIG. 9. Outlets 26, 28 are sealingly

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compatible with respect to inlet portion of transmitter 58. The sealing compatibility is due to seal rings (not shown) placed around the outlets 16, 18 and by the position of mounting holes 54 which match that of the
5 corresponding mounting holes in transmitter 58 to receive mounting bolts 59. The sealing engagement must be fully hermetical to provide the required accuracy of measurement by transmitter 58.

FIG. 10 shows a cross-section of second member
10 20. In addition to passages 62, 66, second member 20 comprises equalizing passages 80 which provide communication between outlets 26 and 28 through equalizing chamber 32. Equalizing valve 82 in
15 equalizing chamber 32 selectively opens and closes communication between outlets 26 and 28.

Blocking valves 70, 72, venting valves 74, 76 and equalizing valve 82 are isolator valves of a known structure which includes a valve stem portion disposed inside of members and carrying a valve member. Valves
20 can be of identical structure each carrying, at the free end of the inside valve stem, a conical or spherical valve member. Each valve also has an actuating stem projecting outwardly from the manifold 10. The free end of each actuating stem can be provided with a handle as
25 is well known in the art.

In one preferred mode of operation, high pressure process flow is connected by one of conduits 56a, 56b to first inlet 16, and low pressure process flow is connected by the other of conduits 56a, 56b to
30 second inlet 18. Correspondingly, high pressure flow port of the transmitter 58 is connected to the first outlet 26 and low pressure flow port of the transmitter is connected to second outlet 28.

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A schematic representation of the manifold 10 is shown in FIG. 11. To achieve a direct communication of an inlet of a high pressure process flow to a high pressure flow port blocking valve 70 is open while blocking valve 72, venting valves 74, 76 and equalizing valve 82 are closed. To achieve a direct communication of the low pressure process flow to a low pressure flow port, blocking valve 72 is open while blocking valve 70, venting valves 74, 76 and equalizing valve 82 are closed. To achieve an equalized pressure whereby the low pressure process fluid is directed to both the high and low pressure ports, blocking valve 72 and equalizing valve 82 are open while blocking valve 70 and venting valves 74 and 76 are closed. To achieve an equalized pressure whereby the high pressure process fluid is directed to both the high and low pressure sensors, blocking valve 70 and equalizing valve 82 are open while blocking valve 72 and venting valves 74 and 76 are closed. For achieving a state where both the high and low pressure process fluid is vented at the manifold 10, resulting in zero differential pressure at the transmitter 58, all the valves are open. In order to have zero pressure at the outlets 26 and 28, blocking valves 70, 72 are closed and venting valves 74, 76 are open.

FIGS. 13 and 13A show another embodiment of the invention indicated generally as manifold 10a, wherein otherwise similar parts have similar reference numbers. Vents 90, 92 are recessed in perimeter walls 34 and 36 instead of third member 46. Vents 90, 92 are preferably threaded to receive a valve or the like, of known structure as disclosed above.

FIG. 14 shows a perspective view of another manifold embodying features of the present invention and

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indicated generally at 10b, wherein similar parts have similar reference numbers. Perimeter walls 34 and 36 include vent chambers 93 and 94, respectively, as threaded recesses therein. Venting chambers 93 and 94
5 are in communication with blocking chambers 40, 44, respectively, and are adapted to receive vent valves 95, 96 or the like. Third member 46 includes end 97 with vent ports 98a, 98b recessed therein.

FIG. 15 shows a cross-section view of the
10 manifold 10b of FIG. 14 taken along lines 15-15, and depicting passageways therein. Inlets 16, 18 are in communication with blocking chambers 40, 44, respectively, via passageways 100, 102, respectively. Blocking chambers 40, 44 are in communication with
15 venting chambers 93, 94, respectively, via passageways 104, 106, respectively. Additionally, venting chambers 93, 94 are in communication with vent ports 98a, 98b via passageways 108, 109, respectively. Vent ports 98a, 98b are in communication with the atmosphere.

FIG. 16 shows a perspective view of another
20 manifold, indicated at 10c, embodying features of the present invention, and shown with process conduits 56a, 56b and transmitter 58, wherein like parts are indicated with like reference numerals. Inlet 16, 18 are adapted
25 to receive process conduit 56, and outlets 26, 28 are adapted to receive transmitter 58. Perimeter walls 34, 36 are provided with bosses 120, 122, respectively, having blocking chambers 126, 128, respectively, therein. Blocking chambers 126, 128 are adapted to receive valves
30 132, 134, respectively, or the like.

FIG. 17 shows a perspective view of manifold
10c but inverted with respect to the view of FIG. 16. Equalizing valve surface 140 is provided with bosses 142, 144 having equalizing chambers 146, 148,

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respectively, therein. Equalizing chambers 146, 148 are adapted to receive valves 150, 152, or the like. Perimeter wall 34 includes venting chamber 154 adapted to receive valve 156, or the like, and third member 46
5 includes a single vent port 158 on end 160.

FIG. 18 shows a plan view of manifold 10c oriented as in FIG. 16 and depicting passageways in phantom. Inlets 16, 18 are in communication with blocking chambers 126, 128 through passageways 170, 172,
10 respectively. Blocking chambers 126, 128 are in communication with outlets 26, 28, respectively, via passageways 174, 176. Outlets 26, 28 are in communication with equalizing chambers 146, 148, respectively, through passageways 178, 180,
15 respectively. Equalizing chambers 146, 148 are in communication with each other and venting chamber 154 through passageway 182. Venting chamber 154 is in communication with vent port 158 through passageway 184, and vent port 158 is in communication with the
20 atmosphere.

A schematic representation of manifold 10 is shown in FIG. 19. In one preferred mode of operation, high pressure process flow is connected by one of conduits 56a, 56b to first inlet 16, and low pressure
25 process flow is connected by the other of conduits 56a, 56b to second inlet 18. Correspondingly, high pressure flow port of the transmitter 58 is connected to first outlet 26 and low pressure flow port of the transmitter is connected to second outlet 28. To achieve a direct
30 communication of an inlet of a high pressure process flow to a high pressure flow port, blocking valve 132 is open while blocking valve 134, venting valve 156 and equalizing valves 150, 152 are closed. To achieve a similar state with respect to the high pressure flow

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port, but where the low pressure flow port is vented, valves 152 and 156 are opened. To achieve a direct communication of the low pressure process flow to a low pressure flow port, blocking valve 134 is open while
5 blocking valve 132, venting valve 156 and equalizing valves 150, 152 are closed. For achieving a similar state with respect to the low pressure flow port but where the high pressure flow port is vented, valves 150, 156 are opened. To achieve an equalized pressure
10 whereby the low pressure process fluid is directed to both the high and low pressure ports, blocking valve 134 and equalizing valves 150, 152 are open while blocking valve 132 and venting valve 156 are closed. To achieve an equalized pressure whereby the high pressure process
15 fluid is directed to both the high and low pressure sensors, blocking valve 132 and equalizing valve 150, 152 are open while blocking valve 134 and venting valve 156 are closed. For achieving a state where both the high and low pressure process fluid is vented at the
20 manifold 10, resulting in zero differential pressure at the transmitter 58, all the valves are open. In order to have zero pressure at the outlets 26 and 28, blocking valves 130, 134 are closed and venting valve 156 and equalizing valves 150, 152 are open. During normal
25 operation, blocking valves 132, 134 and venting valve 156 are open. Leakage of process by equalizing valves 150, 152 is vented through venting valve 156 and does not affect the opposite side outlet 26 or 28 and thus provides more accurate metering.

30 The previously described embodiments of the present invention have many advantages. Among these advantages is that the manifolds permit substitution of newer "co-planar" transmitters into installations previously occupied by conventional transmitters. Many

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older installations were designed to accommodate conventional transmitters having "H-shaped" flanges, and wider spacing between the ports. Further, some installations do not easily accommodate other manifolds for co-planar transmitters without reconfiguration of the existing conduits and the like. The manifold of the present invention integrates with existing designs and DIN spacing thus reducing overall installation costs and provides convenience.

10 The manifold of the present invention provides several surfaces adapted for mounting to a rigid support. Also, the "right-angle" design of the transmitter mounted perpendicularly to the process conduits provides greater flexibility in transmitter installation. For example, the manifold 10 shown in FIG. 12 can be flipped end for end such that the outlets 26 and 28 are facing the ground or floor and the transmitter will be inverted. Thus, the transmitter can be mounted in different orientations depending on the space constraints of the installation.

20 One preferred mounting of the flange requires inlet surface 14 to face the ground or floor wherein the second outlet 28 is oriented so that the second opening 68 is at the "top" of the second outlet 28. This permits bubbles in the outlet 28 to float directly to the vent 52 and away from the transmitter thus increasing sensor accuracy. The manifold eliminates the need for flanges and coupling assemblies, which inhibits leaks by reducing leak paths. Manifolds 10-10b are particularly suited for the power industry. Manifold 10c is particularly suited for the natural gas industry. It is to be understood, however, that the manifold of the present invention are not intended to be limited to a specific use.

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Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from
5 the spirit and scope of the invention.

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WHAT IS CLAIMED IS:

1. A manifold for use with a pressure sensing transmitter for measuring pressure of a process fluid, the manifold comprising:

a manifold body including a first side member having an inlet surface and a cross member having an outlet surface, the first side member and cross member disposed at an angle to each other;

first and second inlets on the first side member adapted for coupling to the process fluid;

first and second outlets on the outlet surface adapted for coupling to the pressure sensing transmitter;

passageways in the manifold body extending between and connecting the inlets and outlets; and

wherein the plane of the inlet surface is not parallel with the plane of the outlet surface.

2. The manifold of claim 1, wherein the plane of the inlet surface is substantially perpendicular to the plane of the outlet surface.

3. The manifold of claim 1 including a first equalization passageway coupled to the first outlet, a second equalization passageway coupled to the second outlet and an equalization chamber selectively coupling the first equalization passageway with the second equalization passageway.

4. The manifold of claim 3 wherein the equalization chamber is adapted to receive an equalization valve mounted on the cross member opposite the first and second outlets.



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5. The manifold of claim 4 wherein the equalization valve has an axis, the first equalization passageway is substantially parallel with the axis and the second equalization passageway forms an acute angle with the axis.

6. The manifold of claim 3 and further comprising:

- a first blocking chamber in a first blocking chamber plane and disposed within the cross-member wherein the first blocking chamber is in direct communication with the first inlet, first outlet, and equalization chamber; and

- a second blocking chamber in a second blocking chamber plane and disposed within the cross-member wherein the second blocking chamber is in direct communication with the second inlet, second outlet, and the equalization chamber.

7. The manifold of claim 6 wherein the planes of the first and second blocking chambers are generally parallel to each other and generally perpendicular to the planes of the inlet surface and the outlet surface.

8. The manifold of claim 7 and further comprising:

- a first vent chamber in a first vent plane and in communication with the first blocking chamber;

- a second vent chamber in a second vent plane and in communication with the second blocking chamber; and

wherein the first and second vent chambers are disposed within the manifold body.



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9. The manifold of claim 8 wherein the first and second vent planes are generally parallel to the planes of the first and second blocking chambers.

10. The manifold of claim 8 wherein the first and second vent planes are generally perpendicular to the planes of the first and second blocking chambers.

11. The manifold of claim 1 including a first and second equalization chamber wherein the first equalization chamber is in communication with the first outlet, and the second equalization chamber is in communication with the second outlet.

12. The manifold of claim 11 and further comprising a vent in communication with the first and second equalization chambers.

13. The manifold of claim 12:
wherein the first equalization chamber is adapted for accepting a first valve therein for selectively allowing communication between the first outlet and at least one of the second equalization chamber and the vent; and
wherein the second equalization chamber is adapted for accepting a second valve therein for selectively allowing communication between the second outlet and at least one of the first equalization chamber and the vent.

14. The manifold of claim 13 and further including a vent chamber disposed within the manifold body and in communication with the vent and first and second equalization chambers.

15. The manifold of claim 1 including a second side member coupled to the cross member opposite the first side member.



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16. The manifold of claim 15 including a first vent passageway extending from the first outlet to a first vent on the second side member and a second vent passageway extending from the second outlet to a second vent on the second side member.

17. The manifold of claim 15 wherein the first and second side members and the cross member form an "H" configuration.

18. The manifold of claim 1 and adapted to receive a valve wherein the valve is mounted on the cross member and has an axis substantially parallel with the plane of the outlet surface.

19. The manifold of claim 1 and adapted to receive a first valve for selectively allowing fluid communication between the first inlet and the first outlet.

20. The manifold of claim 19 including an inlet passageway extending between the first inlet and the first valve and having an axis substantially parallel with an axis of the first valve and an outlet passageway extending between the first valve and the first outlet and having an axis which forms an acute angle with the axis of the first valve.

21. An H-manifold for use with a pressure sensing transmitter for measuring pressure of a process fluid, the H-manifold comprising:

an inlet face on an inlet portion having a first inlet for coupling to a first pressure source and a second inlet for coupling to a second pressure source;

a cross portion coupled to the inlet face having a mounting face for mounting the pressure transmitter, the mounting face



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- including a first pressure outlet and a second pressure outlet;
- an opposing face on an opposing portion coupled to the cross portion, opposite the inlet face, wherein the inlet face, cross portion and opposing face form an "H" configuration;
- a first passageway extending between the first inlet and the first outlet; and
- a second passageway extending between the second inlet and the second outlet.
22. The H-manifold of claim 21 including:
- a first blocking chamber in communication with the first inlet and the first outlet, the first blocking chamber adapted to receive a first valve mounted on the cross portion for selectively coupling the first inlet to the first outlet; and
- a second blocking chamber in communication with the second inlet and second outlet, the second blocking chamber adapted to receive a second valve mounted on the cross portion for selectively coupling the second inlet to the second outlet.
23. The H-manifold of claim 22, wherein the first and second valves have axes which are substantially parallel to a plane of the cross portion.
24. The manifold of claim 22 and further comprising an equalization chamber in communication with the first and second outlets.
25. The manifold of claim 24 wherein the equalization chamber is in direct communication with the first and second outlets.



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26. The manifold of claim 24 and further including a vent in communication with the equalization chamber.

27. The manifold of claim 28 and further comprising a second equalization chamber in direct communication with the second outlet and the first equalization chamber.

28. The manifold of claim 27 wherein the first and second equalization chambers are each adapted for accepting a valve therein.

29. The manifold of claim 24 wherein the equalization chamber is adapted for accepting a valve therein.

30. The H-manifold of claim 21 including,
a first equalization passageway coupled to the first outlet;
a second equalization passageway coupled to the second outlet; and
an equalization chamber in communication with the first and second equalization passageways, wherein the equalization chamber is adapted to receive valve coupled to the cross portion opposite the first and second outlets for selectively connecting the first and second equalization passageways.

31. The H-manifold of claim 30 wherein the equalization valve has an axis substantially perpendicular with the mounting face of the cross portion.

32. The H-manifold of claim 21 including:
a first vent passageway extending from the first outlet to a vent on the opposing portion; and



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a second vent passageway extending from the first outlet to a vent on the opposing portion.

33. The H-manifold of claim 21 wherein the opposing portion includes mounting holes for mounting to a support.

34. The H-manifold of claim 21 wherein the inlet portion includes mounting holes for mounting to a support stand.

