A manifold for a lube oil or oil seal apparatus includes a block having a plurality of ports on exterior surfaces. A plurality of passages extend through the block to fluidically couple certain of the ports. In one aspect, a pair of ports on different exterior surfaces are coupled by a common passages to enable a fluid operative device attachable to one of the ports to be mounted on either side of the manifold. In another aspect, mounting connections are provided on the block for attachment to complementary mounting connections on a filter to directly mount the filter to the block. In another aspect, certain of the ports are defined for receiving a fluid responsive instrument.
MANIFOLD FOR LUBE AND SEAL OIL APPARATUS

BACKGROUND

Large process pumps and drivers often use hydrodynamic bearings due to their established reliability over anti-friction bearings at high bearing surface velocity. The oil film that forms in bearings provides the needed separation between the pump shaft and pump bearings. This continuously replenished oil film also removes bearing heat and wear particles. A constant oil supply is essential to keep the bearing system in balance. A loss of oil supply means a loss of cooling, loss of oil film properties, and eventually the loss of a bearing.

FIG. 1 shows a prior art API610, 8th edition Lube Oil System schematic. The base system requires the main lube oil pump to be shaft driven off of the process pump. A single auxiliary lube oil pump is electric motor driven. The balance of the system includes an oil reservoir, single shell and tube cooler, and a duplex filter. Each pump is equipped with its own relief and check valves. Typical pump drivers include turbines, AC motors, DC motors, process equipment shafts, and air motors. Instrumentation includes three pressure switches, one pressure differential indicator, two pressure gauges, two thermometers and a sight glass on the oil reservoir.

An essential element to maintaining a constant oil supply requires continual and frequent maintenance of the filter element. Replacing the filter element regularly increases bearing life. In order to avoid a lengthy disruption of the operation of the pump for filter cleaning, a duplex filter is typically employed. The duplex filter is equipped with two closely coupled, two-positioned, three-way, continuous flow transfer valves. This feature allows one filter to be on-line; while the other filter is being serviced.

Due to the number of separate elements described above which are employed in an API Standard lube oil system, manifolds are employed in the form of solid metal blocks have a plurality of bores of varying sizes drilled in through from various exterior surfaces and interconnected internally within the block with or without check valves to provide fluid flow passages between various lube oil system components coupled to the manifold.

However, prior manifold designs have been provided with a limited versatility. For example, prior lube oil system manifold designs have the duplex filter mounted separately from the manifold and connected to the manifold by typically lengthy pipes, each with its own end fittings. This has resulted in increased complexity of the construction to the lube oil system as well as increasing the cost of the system.

Prior lube oil system manifolds have also been provided with single component connections on one exterior surface of the manifold. This has resulted in a need to construct two oppositely formed manifolds for left and right-hand manifold mounting on the lube oil system platform. This has further increased the cost of the lube oil system and has required additional components due to the need for two different manifold designs.

Finally, prior lube oil systems have the instrumentation mounted in pipes, rather than to the manifold, which has increased the assembly time and cost of the lube oil system.

Thus, it would be desirable to design a manifold for a lube oil system which simplifies the mounting of the lube oil system filter as well as providing dual mounts for many of the components of a lube oil system which are connected to the manifold to enable the use of the same manifold of both left and right-hand lube oil system configurations. It would also be desirable to provide a manifold for a lube oil system that has direct mounting for instrumentation on the manifold.

SUMMARY

The present invention is a manifold for a lube oil or seal oil apparatus.

In one aspect, the manifold includes a block having a plurality of exterior surfaces with a plurality of ports formed on the exterior surfaces. A plurality of passages are formed in the block and fluidically coupled to certain of the ports. Two ports on one external surface of the block having mounting fitting connections associated therewith. A filter with complementary connections mounted to the mounting fittings on the block in fluid flow communication with certain of the passages in the block.

In another aspect, the manifold includes a block having a plurality of exterior surfaces with a plurality of ports formed on the exterior surfaces. A plurality of passages are formed in the block and fluidically coupled to certain of the ports. At least one pair of ports associated with a common passage disposed on different exterior surfaces of the block, the pair of at least one port providing alternate fluidic couplings to an identical fluid operative device coupled to either of the ports on the different surfaces of the block.

In yet another aspect, the manifold includes a file block having a plurality of exterior surfaces with a plurality of ports formed on the exterior surfaces. A plurality of passages are formed in the block and fluidically coupled to certain of the ports. Certain of the plurality of ports are adapted for mounting fluidic operative instruments on the block.

Another aspect, the invention is a method of manufacturing a manifold for a lube oil or seal oil apparatus. The method comprises the steps of:

forming a block with a plurality of exterior surfaces;

forming a plurality of ports on the exterior surfaces;

forming a plurality of passages in the block fluidically coupled to certain of the ports;

providing two of the ports with mounting connections; and

mounting a filter with complementary mounting connections to the mounting connections on the block to fluidically couple the filter to the two ports and at least one of the passages in the block.

In another aspect, the method may alternately include the step of interconnecting certain ports on different exterior surfaces of the block with a common passage to facilitate the mounting of a fluid operative device to the ports on at least two different exterior surfaces of the block.
[0020] In yet another aspect, the method may include the step of providing mounting connections on the block for directly mounting fluid operative instruments on the block.

[0021] The present manifold affords numerous advantages over previous manifolds for lube oil or seal oil systems. The present manifold allows the lube oil or seal oil filter to be mounted directly to the manifold thereby eliminating interconnecting piping, reducing pressure drop within the oil flow circuit, and reducing assembly costs required to mount the filter to the system. The manifold also allows the orientation of the main and auxiliary lube oil or seal oil pumps to be located on either side of the manifold thereby again reducing the cost to assemble the system. The present manifold also allows the orientation of heat exchanger to be located on either side of the manifold again reducing costs to assemble the apparatus.

[0022] The present manifold also provides connection points for pressure, differential pressure, and temperature sensors on the manifold thereby contributing to a cost reduction in assembling the apparatus. The manifold is designed to accommodate multiple circuits, such a lube oil system and a seal oil system, and variations thereof. The manifold is internally cored to support the need for low pressure capacities associated with lube oil systems, and the flexibility to obtain high pressures associated with a seal oil system.

[0023] The present manifold also provides additional advantages including lower pressure drop, flexibility of design and cost reductions through the elimination of previously required piping and connection components.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The various features, advantages and other uses of the present invention will become more apparent by referring to the following detailed description and drawing in which:

[0025] FIG. 1 is a schematic diagram of a prior art API 610, 8th edition, lube oil system;

[0026] FIG. 2 is a front elevational view of a prior art lube system manifold showing the fluid mounting connections to a duplex filter;

[0027] FIG. 3 is a schematic diagram of the piping and instrumentation of a lube oil system manifold according to the present invention;

[0028] FIG. 4 is a rear left perspective view of a manifold according to the present invention showing the interior bore flow passages;

[0029] FIG. 5 is a front elevational view of the manifold of FIGS. 2-4 with the filter mounted on one surface;

[0030] FIG. 6 is a plan view of the manifold shown in FIG. 5;

[0031] FIG. 7 is a left-hand elevational view of the manifold shown in FIG. 5;

[0032] FIG. 8 is a right-hand elevational view of the manifold shown in FIG. 5;

[0033] FIG. 9 is a bottom elevational view of the manifold shown in FIG. 5;

[0034] FIG. 10 is a rear elevational view of the manifold shown in FIG. 5;

[0035] FIG. 11 is an enlarged, frontal, elevational view of the manifold shown in FIG. 5, depicting a portion of the internal bore flow passages;

[0036] FIG. 12 is an enlarged, bottom, elevational view of the manifold shown in FIG. 5, depicting a portion of the internal bore flow passages;

[0037] FIG. 13 is an enlarged, left-hand, elevational view of the manifold shown in FIG. 5, depicting a portion of the internal bore flow passages; and

[0038] FIG. 14 is an enlarged, right side, elevational view of the manifold shown in FIG. 5, depicting a portion of the internal bore flow passages.

DETAILED DESCRIPTION

[0039] Referring now to the drawing, and to FIGS. 2-14 in particular, there is depicted a manifold 20 for use in connecting various components of a lube oil or seal oil supply system of a large process pump and drive apparatus.

[0040] The various components are attached to various ports on the manifold 20 and piped to other components in the pump and drive apparatus to complete the oil flow circuit of the pump and drive apparatus.

[0041] The manifold 20, according to the present invention, preferably is formed of a sold block of high strength material, such as a metal, preferably steel.

[0042] The block 20, which may have any shape, by example only has a generally polygonal shape in the form of a square or a rectangle formed by a front surface 22, a back or rear surface 24, opposed left and right side surfaces 26 and 28, a top surface 30 and a bottom surface 32.

[0043] A plurality of ports are formed on the various surfaces of the manifold 20 and internally coupled in fluid communication with selected other ports to provide fluid flow connections and passageways between various components mounted on the manifold 20 in fluid communication with the ports.

[0044] According to one feature of the present invention, at least one and preferably several of the internal bore passageways provide identical function ports on two different surfaces, such as the front surface 22 and the rear surface 24, of the manifold 20 to provide increased flexibility in using the manifold 20 with different pump and drive configurations in both left-hand and right-hand mounting configurations. The dual ports enable fluid connections to the same component to be made on either of the different surfaces of the manifold 20.

[0045] The various bores or passageways within the manifold 20 will now be described in combination with the respective ports associated with each passageway on the exterior surfaces of the manifold 20.

[0046] As shown in FIGS. 4, 5, and 11-14, a first passageway 40 is formed internally within the manifold 20 and is fluidically coupled to a first port 42, also labeled on the rear surface 24, a second port 44 also labeled PCV-1-out, on the rear surface 24 and a pair of third and forth ports 46 and 48, both located on the front surface 22 of the manifold 20.
and labeled RPIC. A fifth port 50 opens from the passageway 40 on the bottom surface 32 of the manifold 20. The port 50 is, by way of example only, in one application labeled TK and provided with a conduit connection to an oil reservoir.

[0047] As shown in FIGS. 4-14, a pair of relief valves 52 and 54, which can be RPIC-LEN Sun Relief Valve Cartridges, are mounted in the passage 40 through the ports 46 and 48 to provide pressure relief between the passageway 40 and a second fluid flow passage 60. The passage 60 is actually formed of two separate passages 62 and 64 which are substantially identically constructed. The passage 62 includes first and second ports 66 and 68 labeled P3 and located on the front and rear surfaces 22 and 24, respectively, each also located on the front and rear surfaces 22 and 24 of the manifold 20. The passage 64 includes ports 70 and 72 labeled P4. Interconnecting bores extend as part of each of the passages 62 and 64 to the relief valves 52 and 54.

[0048] The connections to the ports P3 and P4, which have mounting holes formed on each of the front and rear surfaces 22 and 24 of the manifold 20 as shown in FIGS. 5 and 10, respectively, receive pipe or conduit connections to a main pump motor and an auxiliary pump motor, each fluidically coupled to an oil reservoir, all not shown.

[0049] Also mounted at one end portion of each of the passages 62 and 64 are check valves, such as CXHA-XAN Sun check valve cartridges. The check valves are denoted by reference numbers 71 and 73 as shown in FIG. 3, and provide unidirectional fluid flow from the passages 62 and 64 to a third main passage 80. The passage 80 includes a pair of ports 82 and 84, labeled HEA1 and T1-I, which provide external connection to an oil cooler, not shown. Another port 85 is on the top surface 30 of the manifold 20 and is interconnected with the passage 80. This port 85, also labeled GP7, can be used to provide an external connection to an external block and bleed valve and pressure gauge, not shown.

[0050] As shown in FIGS. 4-8 and 10, two additional bores extend from ports 86 and 88 of the top surface 30 of the manifold 20 to a open connection with the passage 80. These bores 86 and 88 provide access for mounting of the check valves 70 and 72 in the passage 80 at the junction of selected portions of the passage 80 and the passage 60 as described above and shown in FIG. 3.

[0051] A fourth passage 100 is also formed internally within the manifold 20 and includes ports 102, 104, 106 and 108. The ports 102 and 104, also labeled T1-2 and HEA2, are located on the front and rear surfaces 22 and 24, respectively, of the manifold 20 and provide fluid connections for conduits from the external oil cooler and a temperature gauge. The port 108, also labeled GP8, is located on the top surface 30 provides an external access for a peripheral gauge or valve, as may be needed in certain applications.

[0052] The port 106 is located on the left side surface of the manifold 20 and provides a flow path to an external filter 10.

[0053] A fifth passage 120 is also formed internally within manifold 20. The passage 120 includes a plurality of outlets paired on the front and rear surfaces 22 and 24 of the manifold 20. The port pair includes outlets 122 and 124, also labeled GP3 and GP1 respectively, port pair 126 and 128, also labeled GP4 and GP2, and port pair 130 and 132, also labeled GP5 and PCVIN. Additional ports on the passage 120 include ports 134 and 136 located on the bottom surface 30 of the manifold 20. The port 134 is also labeled GP6. The port 136 on the bottom surface 32 is labeled LOS and provides a fluid connection to an external lube oil supply. One last port 140 is coupled in fluid communication with the passageway 120 and opens to the left side surface 26 of the manifold 20. The outlet 140 is also labeled F2.

[0054] The ports F1 and F2 are surrounded by a mounting hole connection pattern suitable for alignment with a mating mounting hole connection pattern formed on connection pads 142 and 144 shown in FIG. 7, on a filter means 110. By example only, the filter means can be a duplex filter assembly, such as one sold by INDFJII, as model number IDGL-1-135-1". The duplex filter assembly 110 has an integral transfer valve 146, vent and drain connections, and internal seal. The integral transfer valve 146 is actuated by a manually movable lever 148 to switch the duplex filter 110 from internal connections between a first filter element 150 and a second filter element 152. This allows the non-connected filter element to be replaced, removed for cleaning or repair.

[0055] The port pairs primarily located on the front and back surfaces 22 and 24 of the manifold 20 provide opposed surfaces to enable the manifold 20 to be mounted in different orientations to accommodate left-hand and right-hand pump and drive configurations. For example, the port pairs 66 and 68 for port P3 and 70 and 72 for port P4 are mounted on the front and rear surfaces 22 and 24, respectively. Likewise, ports 122 and 124, GP-3 and GP-1, and ports 126 and 128, GP-4 and GP-2 are aligned on opposite front and rear surfaces 22 and 24 of the manifold 20 to accommodate a single fluid operative component connectable to the passage 120 on either of the front and rear surfaces through one of the aligned ports.

[0056] With any of the ports, if a port on one of the passages in the manifold 20 is not connected to an external instrument or pipe, it is blocked by a threaded cap or other closure member.

[0057] In summary, there has been disclosed a manifold for a pump and driver apparatus which overcomes numerous deficiencies found in prior art pump and driver manifolds. The present manifold allows a lube oil or seal system filter to be mounted directly to the manifold thereby eliminating interconnecting piping, reducing pressure drop within the oil flow circuit, and reducing assembly costs to mount the filter to the system. The manifold also allows the orientation of the main and auxiliary lube oil or seal oil pumps to be located on either side of the manifold thereby again reducing the cost to assemble the system. The present manifold also allows the orientation and heat exchanger to be located on either side of the manifold again reducing costs to assemble the apparatus.

[0058] The present manifold also provides connection points for pressure, differential pressure, and temperature sensors on the manifold thereby contributing to a cost reduction in assembling the apparatus. The manifold is designed to accommodate multiple circuits, such as a lube oil system and a seal oil system, and variations thereof. The manifold is internally cored to support the need for low pressure associated with lube oil systems, and the flexibility to obtain high pressures associated with a seal oil system.
1. A manifold for an oil flow apparatus comprising:
   a block having a plurality of exterior surfaces, a plurality
   of ports formed on the exterior surfaces;
   a plurality of passages in the block fluidically coupled to
   certain of the ports;
   two ports on the block having mounting connections; and
   a filter with complementary connections mounted to the
   mounting connections on the block in fluid flow
   communication with at least one of the internal passages in
   the block.
2. The manifold of claim 1 further comprising:
   a pair of the ports associated with a common passage and
   disposed on different exterior surfaces of the block, the
   pair of ports providing alternate fluidic couplings to an
   identical fluid operative device coupled to either of the
   ports on the different surfaces of the block.
3. The manifold of claim 1 further comprising:
   certain of the plurality of ports adapted for receiving
   fluidic operative instruments.
4. A manifold for an oil flow apparatus comprising:
   a block having a plurality of exterior surfaces, a plurality
   of ports formed on the exterior surfaces;
   a plurality of passages in the block fluidically coupled to
   certain of the ports; and
   a pair of the ports associated with a common passage and
   disposed on different exterior surfaces of the block, the
   pair of ports providing alternate fluidic couplings to an
   identical fluid operative device coupled to either of the
   ports on the different surfaces of the block.
5. A manifold for an oil flow apparatus comprising:
   a block having a plurality of exterior surfaces, a plurality
   of ports formed on the exterior surfaces;
   a plurality of passages in the block fluidically coupled to
   certain of the ports; and
   a pair of the plurality of ports adapted for receiving fluidic
   operative instruments.
6. A method of forming a manifold for one of a lube oil
   system and a seal oil system, the method comprising the
   steps of:
   forming a block with a plurality of exterior surfaces;
   forming a plurality of ports on the exterior surfaces;
   forming a plurality of passages in the block fluidically
   coupled to certain of the ports;
   providing two of the ports with mounting connections;
   and
   mounting a filter with complementary mounting connec-
   tions to the mounting connections on the block to
   fluidically couple the filter to the two ports and at least
   one of the passages in the block.
7. The method of claim 6 further comprising:
   interconnecting certain ports on different exterior surfaces
   of the block with a common passage to facilitate the
   mounting of a fluid operative device to the ports on at
   least two different exterior surfaces of the block.
   * * * * *