A method of producing a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well is provided. The method comprises providing a filter arrangement comprising an inlet end and an outlet end, connecting the inlet end to a first fluid flow passageway using a first hydraulically operated connector, and connecting the outlet end to a second fluid flow passageway using a second hydraulically operated connector.
FILTRATION SYSTEMS FOR CHEMICAL FLUIDS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] Embodiments of the present invention relate to filtration systems for chemical fluids, in particular chemical fluids used in hydrocarbon extraction wells.

[0003] 2. Description of the Prior Art

[0004] Flow lines and pipelines conveying hydrocarbons are subject to build-up of hydrates (which are crystalline in nature) which impede and may block the flow of hydrocarbons if not prevented or reduced. It is standard practice to inject mono ethylene glycol (MEG), which is a hydrate inhibitor, into such flow lines and pipelines for the prevention of hydrate formation and for the absorption of moisture. This process is normally carried out, in downtime, when production hydrocarbon fluid is not passing through the flow line or pipeline concerned. In offshore subsea control systems, the MEG is typically injected into an umbilical topside before being distributed through the subsea control system via MEG injection valves which are mounted on a suitable host structure subsea, such as one on a manifold or a Christmas tree or on the seabed, which host structure could be semi-permanent in that it is retrievable. A MEG filtration system comprising a filter module is inserted in the flow line or pipeline immediately before the MEG injection valves to clean the MEG before injection.

[0005] This filter module is required because the MEG fluid is retrieved, after use and recycled in a recycling plant installed topside to remove the hydrates, pollutants from the well and water. The filter module collects contaminants suspended in the MEG and protects the inner surfaces of subsea MEG injection equipment from mechanical abrasion, resulting in improved performance in equipment reliability and longevity. The module will require changing at intervals and therefore a method is needed of achieving this without the risk of MEG, risk of pollution and ingress of sea water.

[0006] As the MEG filter module is mounted on the host structure subsea, a remote method using an ROV is required to remove and re-install the filter module when required. As shown in FIG. 1, a typical ROV retrievable MEG filter module has a filter arrangement comprising a spool with one or more in-line filters 1 arranged in a 180 degree loop, the arrangement extending from an inlet end 2 to an apex region 3 and back to an outlet end 4. ROV actuated mechanically clamped connectors 5 and 6 respectively connect the inlet 2 and the outlet 4 to end connectors 7 and 8 of a MEG input passageway 9 and a MEG output passageway 10 which are mounted on a host structure 11, such as one on a pipeline end manifold (PLEM) or a Christmas tree. Isolation valves are placed both upstream of inlet end 2 and downstream of outlet end 4 in order to isolate the MEG flow to allow filter module replacement. Once the new filter module is latched in place, the isolation valves are returned to their open positions to re-commence the flow of MEG. Each of the connectors 5 and 6 requires an ROV to actuate its mechanical clamps and to disconnect it by rotating a clamp actuating mechanism 12 in order to remove or reinstall the filter module—see FIG. 1a which is a plan view of one of the connectors showing its clamps 13. Furthermore, the method of mounting the current filter module in a horizontal configuration severely restricts the access for an ROV. Thus the current process of MEG filter replacement is difficult, time consuming and therefore expensive.

BRIEF SUMMARY OF THE INVENTION

[0007] According to an embodiment of the present invention, there is provided a method of producing a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well. The method comprises providing a filter arrangement comprising an inlet end and an outlet end, connecting the inlet end to a first fluid flow passageway for the fluid using a first hydraulically operated connector, and connecting the outlet end to a second fluid flow passageway using a second hydraulically operated connector.

[0008] According to another embodiment of the present invention, there is provided a method of producing a filtration system for filtering a chemical fluid used in a subsea hydrocarbon extraction well. The method comprises providing a filter arrangement, and connecting opposite ends of the filter arrangement to respective fluid flow passageways by hydraulically operated connectors using a remotely operated vehicle which operates the connectors in a hot stab manner.

[0009] According to another embodiment of the present invention, there is provided a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well. The system comprises a filter arrangement comprising an inlet end and an outlet end, the inlet end being connected to a first fluid flow passageway by a first hydraulically operated connector, and the outlet end being connected to a second fluid flow passageway by a second hydraulically operated connector.

[0010] Embodiments of the present invention also provide a hydrocarbon extraction well including a filtration system according to other embodiments of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

[0012] FIG. 1 shows a known form of filtration system;

[0013] FIG. 1a shows part of the filtration system shown in FIG. 1; and

[0014] FIG. 2 shows a filtration system according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] FIG. 2 (in which items which correspond with items in FIG. 1 have the same reference numerals as in FIG. 1) illustrates an application of an embodiment of the present invention which includes the introduction of annulus flowline hydraulically operated connectors 14 and 15 to replace connectors 5 and 6. Each of connectors 14 and 15 is, by way of example, a Vetco Gray 2 ⅝" flowline hydraulic connector part number A110312-9, to connect the MEG filter arrangement to the semi-permanent infrastructure. These connectors require hydraulic actuation, which is via hydraulic pipes 16 and 17 respectively, connected to a vertically mounted ROV hot stab connector portion 18 at the top of the 180 degree loop, that is on the apex region 3 of the filter arrangement. The hydraulic connectors 14 and 15 are self-sealing, thus preventing the ingress of seawater and the expulsion of MEG during filter arrangement change. Each connector has a latch mechanism which is hydraulically driven open and closed by the supply from the ROV hot stab on two separate circuits. A
mechanism is engaged on the close stroke which mechanically latches the connector and the respective one of connectors 7 and 8 together. This means, should a hydraulic leak occur on the latch circuit, the connector will not de-latch. The system remains in stasis when the ROV’s hot stab is removed and until it is hydraulically driven open. The connectors 14 and 15 are latched to the end connectors 7 and 8, in each case by an annular piston within the connector body moving downwards, forcing a locking ring radially inwards by means of a surface machined on the internal diameter of the piston. Each locking ring mates with a machined profile on the respective one of end connectors 7 and 8, maintaining sufficient force to maintain the loading of a sealing gasket. The hot stab hydraulic circuit is capable of actuating both connectors 14 and 15 simultaneously. A manual over-ride is provided (not shown) should the hydraulic actuation fail whereby the ROV can mechanically separate the two parts of each hot stab connection.

[0016] According to an embodiment of the present invention, the filtration system is on a subsea structure. In this case, typically, the connectors are hydraulically operated by a remotely operated vehicle (ROV). The ROV causes hydraulic fluid to be supplied to operate said connectors via respective lines from a connector portion with which the ROV engages. According to an embodiment of the present invention, the ROV engages the connector portion in a hot stab manner.

[0017] According to an embodiment of the present invention, the filter arrangement extends from the inlet end to an apex region and from the apex region to the outlet end. According to an embodiment of the present invention, a connector portion is provided at the apex region.

[0018] An embodiment of the present invention replaces the mechanically clamped connectors of a MEG filter module with field proven, hydraulically operated connectors operated by ROV hydraulic power by a hot stab hydraulic connection, thus enabling a quick connect/disconnect capability.

[0019] Subsea hot stab connectors, which are high pressure operated, are designed to be ROV operated. One part of such a connector, in an embodiment of the present invention, is attached to the filter arrangement and the ROV inserts another part into the connector so that high pressure hydraulic fluid is supplied to operate the hydraulically operated connectors.

[0020] The advantages of using the hot stab operated hydraulic connectors are improved flexibility for ROV access, reduced time for removal and replacement of filters, less risk of environmental pollution and sea water ingress, reduction in cost of filter exchange, and use of proven hydraulic connection technology.

What is claimed is:

1. A method of producing a filtration system for filtering a chemical fluid used in a hydrocarbon extraction well, the method comprising:
   - providing a filter arrangement comprising an inlet end and an outlet end;
   - connecting the inlet end to a first fluid flow passageway using a first hydraulically operated connector; and
   - connecting the outlet end to a second fluid flow passageway using a second hydraulically operated connector.

2. The method according to claim 1, wherein the well is a subsea well, the filtration system being on a subsea structure.

3. The method according to claim 2, wherein the connectors are hydraulically operated by a remotely operated vehicle.

4. The method according to claim 3, wherein the remotely operated vehicle causes hydraulic fluid to be supplied to operate the connectors via respective lines from a connector portion with which the remotely operated vehicle engages.

5. The method according to claim 4, wherein the remotely operated vehicle engages the connector portion in a hot stab manner.

6. The method according to claim 1, wherein the filter arrangement further comprises an apex region, wherein the filter arrangement extends from the inlet end to the apex region and from the apex region to the outlet end.

7. The method according to claim 3, wherein the filter arrangement further comprises an apex region, wherein the filter arrangement extends from the inlet end to the apex region and from the apex region to the outlet end, and wherein the connector portion is at the apex region.

8. The method according to claim 7, wherein the remotely operated vehicle engages the connector portion in a hot stab manner.

9. A method of producing a filtration system for filtering a chemical fluid used in a subsea hydrocarbon extraction well, the method comprising:
   - providing a filter arrangement and connecting opposite ends of the filter arrangement to respective fluid flow passageways by hydraulically operated connectors using a remotely operated vehicle which operates the connectors in a hot stab manner.

10. The method according to claim 9, wherein the remotely operated vehicle causes hydraulic fluid to be supplied to operate the connectors via respective lines from a connector portion with which the remotely operated vehicle engages.

11. The method according to claim 9, wherein the filter arrangement comprises an apex region, wherein the filter arrangement extends between the ends via the apex region.

12. The method according to claim 10, wherein the filter arrangement comprises an apex region, wherein the filter arrangement extends between the ends via an apex region, and wherein the connector portion is at the apex region.

13. A filtration system for filtering a chemical fluid used in a hydrocarbon extraction well, the system comprising:
   - a filter arrangement comprising an inlet end and an outlet end, the inlet end being connected to a first fluid flow passageway by a first hydraulically operated connector, and the outlet end being connected to a second fluid flow passageway by a second hydraulically operated connector.

14. The system according to claim 13, wherein the filtration system is on a subsea structure of a subsea hydrocarbon extraction well.

15. The system according to claim 13, wherein the filtration arrangement further comprises an apex region, wherein the filter arrangement extends from the inlet end to the apex region and from the apex region to the outlet end.

16. The filtration system according to claim 15, wherein the filter arrangement further comprises a connector portion at the apex region, the connector being configured to engage an remotely operated vehicle for hydraulic operation of the connectors.

17. A hydrocarbon extraction well comprising the filtration system according to claim 13.

18. A hydrocarbon extraction well comprising the filtration system according to claim 14.

19. A hydrocarbon extraction well comprising the filtration system according to claim 15.

20. A hydrocarbon extraction well comprising the filtration system according to claim 16.