

Title of Invention: Subsea Fluid Delivery System And Method

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FIELD OF THE INVENTION

[0001] The inventions relate to a system and method for delivering fluid under pressure for use subsea.

BACKGROUND OF THE INVENTION

[0002] Subsea devices often require fluids, e.g. hydraulic fluids or chemicals for injection and the like. These fluids are typically delivered to the device under pressure. As subsea devices are deployed deeper and deeper, the pressures required have increased.

[0003] Existing installation workover control systems are limited in the projects on which they can be used, in part due to the pressure ratings of umbilicals used to provide fluids under pressure from a source of fluids, e.g. a surface vessel, to devices subsea that need that fluid. Deepwater trees, for example, will or currently need fluid pressures in the ranges that exceed 10,000 psi.

[0004] Additionally, umbilicals from the surface currently need to contain a plurality of fluid conduits which increases cost and complexity. The greater the number of required conduits, the greater the cost associated with the umbilical.

BRIEF DESCRIPTION OF THE DRAWINGS

[0001] The various drawings supplied herein are representative of one or more embodiments of the present inventions.

[0002] **Fig. 1** is a planar view in of an exemplary system;

[0003] **Fig. 2** is a cross-sectional view of an exemplary conduit;

[0004] **Fig. 3** is a planar view of a second exemplary system; and

[0005] **Fig. 4** is a flowchart of an exemplary method.

**DETAILED DESCRIPTION OF
EXEMPLARY EMBODIMENTS OF THE INVENTIONS**

[0005] Referring now to **Fig. 1**, system 1 is adapted to provide fluid under pressure to a subsea device, e.g. a device adapted for use in an installation workover control system. In a preferred embodiment, system 1 comprises fluid source 10 located distally from seabed 100 and adapted to provide fluid 5 suitable for use with the subsea device, e.g. to provide a subsea installation workover function; fluid pressurizer 20 in fluid communication with fluid source 10, fluid pressurizer 20 adapted to pressurize fluid 5 to a first pressure; fluid pressure intensifier 30 adapted to be located subsea, fluid pressure intensifier 30 further adapted to receive fluid 5 at a first fluid pressure and output fluid 5 at a fluid pressure higher than the first fluid pressure; and fluid conduit 40 in fluid communication with fluid pressurizer 20 and fluid pressure intensifier 30.

[0006] Fluid source 10 may be located on vessel 2 but does not have to be. In a preferred embodiment, fluid source 10 is located distally from seabed 100 such as near or at the water surface. Fluid 5 may be a control fluid, a tree chemical fluid, or the like, or a combination thereof.

[0007] Fluid pressurizer 20 is adapted to provide a pressure substantially lower than the delivery pressure required for injection of fluid 5 to subsea device 110. Fluid pressurizer 20 may be located proximate the surface or subsea distally from fluid pressure intensifier 30 and may be part of fluid source 10, i.e. integrated with fluid source 10, or otherwise in fluid communication with fluid source 10 such as via fluid conduit 11.

[0008] Fluid pressurizer 20 is in fluid communication with fluid pressure intensifier 30, which is located proximate seabed 100, such as via fluid conduit 40. In preferred embodiments, fluid pressure intensifier 30 may be located on seabed 100 or near seabed 110 such as on an ROV (not shown in the figures). Fluid pressure intensifier 30 is adapted to provide fluid 5 to one or more subsea devices, e.g. subsea device 110, at higher fluid pressure

than fluid pressurizer 20 provides. In an embodiment, fluid pressure intensifier 30 is adapted to provide a pressure substantially higher than 10,000 PSI and, more preferably, in the range of around 15,000 to around 20,000 psi.

[0009] In certain embodiments, fluid pressure intensifier 30 comprises a plurality of fluid pressure intensifiers 30 connected in series, parallel, or a combination thereof. One or more fluid pressure intensifiers 30 may utilize proportional hydraulic valves.

[0010] In a preferred embodiment, fluid conduit 40 is an umbilical which may further comprise one or more fluid conduits 42, electrical power conduits 43, data conduits 44, or a combination thereof.

[0011] System 1 may further comprise surface control panel 4 operatively in communication with fluid pressurizer 20, fluid pressure intensifier 30, or both.

[0012] In an alternative embodiment, system 1 is adapted to provide an installation workover control system and comprises fluid source 10 located distally from seabed 100 and adapted to provide fluid 5 suitable for use with a subsea installation workover function; fluid pressurizer 20 in fluid communication with fluid source 10, fluid pressurizer 20 adapted to pressurize fluid 5 to a first pressure; fluid pressure intensifier 30 located at a surface location, fluid pressure intensifier 30 further adapted to receive fluid 5 at a first fluid pressure and output fluid 5 at a fluid pressure higher than the first fluid pressure; and fluid conduit 40 in fluid communication with fluid pressurizer 20 and fluid pressure intensifier 30.

[0013] Fluid pressure intensifier 30 may be further adapted to be driven hydraulically from the surface.

[0014] In the operation of an exemplary embodiment, fluid under pressure may be provided for subsea use such as with a subsea installation workover control system by pumping fluid 5 at a first fluid pressure from a first location to fluid pressure intensifier 20

located subsea; increasing the fluid pressure to a higher pressure at the subsea fluid pressure intensifier 20; and providing the increased pressure fluid 5 for use subsea.

[0015] In an embodiment, fluid 5 is pumped at a first fluid pressure from a pump located at a surface location or a pump located subsea, e.g. fluid pressurizer 20, but not located proximate fluid pressure intensifier 30.

[0016] The foregoing disclosure and description of the inventions are illustrative and explanatory. Various changes in the size, shape, and materials, as well as in the details of the illustrative construction and/or a illustrative method may be made without departing from the spirit of the invention.

CLAIMS:

We claim:

1. A method of providing fluid under pressure for subsea use, comprising:
 - a. pumping a fluid at a first fluid pressure from a first location to a fluid pressure intensifier located subsea;
 - b. increasing the first fluid pressure to a higher fluid pressure at the fluid pressure intensifier located subsea; and
 - c. providing the higher fluid pressure fluid to a device for use subsea.
2. The method of claim 1, wherein the fluid is pumped at a first fluid pressure from at least one of (i) a pump located at a surface location or (ii) a pump located subsea but not located proximate the fluid pressure intensifier.
3. The method of claim 1, wherein:
 - a. the device is a component of a subsea installation workover control system; and
 - b. the fluid is adapted to be used with the device for a subsea installation workover control system function.
4. A system for providing fluid under pressure for subsea use, comprising:
 - a. a fluid source located distally from a seabed and adapted to provide a fluid suitable for use with a subsea device;
 - b. a fluid pressurizer in fluid communication with the fluid source, the fluid pressurizer adapted to pressurize the fluid to a first pressure;
 - c. a fluid pressure intensifier located subsea, the fluid pressure intensifier further adapted to receive the fluid at the first fluid pressure and output the fluid at a fluid pressure higher than the first fluid pressure; and

- d. a fluid conduit in fluid communication in between the fluid pressurizer and the fluid pressure intensifier.
5. The system of claim 4, wherein the subsea device is adapted to provide a predetermined installation workover function.
6. The system of claim 4, wherein the fluid is at least one of (i) a control fluid or (ii) a tree chemical fluid.
7. The system of claim 4, wherein the fluid pressurizer is adapted to provide fluid at a fluid pressure substantially lower than the delivery pressure required for injection of fluid to a subsea device.
8. The system of claim 4, wherein the fluid pressurizer is located at least (i) proximate the surface or (ii) subsea distally from the fluid pressure intensifier.
9. The system of claim 4, wherein the fluid pressure intensifier is adapted to provide a pressure substantially higher than 10,000 PSI.
10. The system of claim 4, further comprising a surface control panel operatively in communication with at least one of (i) the fluid pressurizer or (ii) the fluid pressure intensifier.
11. The system of claim 4, wherein the fluid conduit is an umbilical.
12. The system of claim 11, wherein the umbilical further comprises at least one of (i) a fluid conduit, (ii) an electrical power conduit, and (iii) a data conduit.
13. The system of claim 4 the fluid pressure intensifier comprises a plurality of fluid pressure intensifiers.
14. The system of claim 13, wherein a first of the plurality of fluid pressure intensifiers is fluidly connected to at least one other of the plurality of fluid pressure intensifiers.
15. The system of claim 13, wherein the plurality of fluid pressure intensifiers are fluidly interconnected in at least one of a series or parallel fluid connection.

16. A system for providing an installation workover control system, comprising:
- a. a fluid source located distally from a seabed and adapted to provide a fluid suitable for use with a subsea installation workover function;
 - b. a fluid pressurizer in fluid communication with the fluid source, the fluid pressurizer adapted to pressurize the fluid to a first pressure;
 - c. a fluid pressure intensifier located at a surface location, the fluid pressure intensifier further adapted to receive fluid at a first fluid pressure and output the fluid at a fluid pressure higher than the first fluid pressure; and
 - d. a fluid conduit in fluid communication with the fluid pressurizer and the fluid pressure intensifier.
17. The system of claim 16, wherein the fluid pressure intensifier is adapted to be driven hydraulically from the surface.