

CLAIMS:

1. A subsea well apparatus, comprising,
 - a subsea tree having at least one hydraulically-operated valve for controlling fluid flow within the subsea tree;
 - a control module operably installed with the subsea tree, the control module having a hydraulic line extending from the control module to the at least one hydraulically-operated valve to operate the valve, the subsea tree being configured to establish a closed hydraulic system with an external device;
 - an input receptacle in fluid communication with the control module and configured to receive hydraulic fluid from the external device and supply the hydraulic fluid to the control module; and
 - an output receptacle in fluid communication with a hydraulic fluid return line extending from the control module and configured to direct hydraulic fluid to the external device.
2. The apparatus according to claim 1, wherein, a hydraulic section of an ROV further comprises a return pairing for a hydraulic return interface to the input receptacle.
3. The apparatus according to claim 2, further comprising a pump located within the ROV to repressurize control fluid returning from the control module to the hydraulic return interface and circulate the repressurized fluid back thru the output receptacle.
4. The apparatus according to claim 2, wherein a workover umbilical connected at one end to a hydraulic fluid source further comprises an electrical line connected to a power

source on a vessel, and connects at another end to the ROV to provide power to the control module.

5. The apparatus according to claim 4, wherein the electrical line further provides power and electrical signals to an electronic module located on the ROV, the electronic module converting the power and electrical signals to serve an electronic module located on the subsea tree, the electronic modules connected to each other via power and control lines.

6. A subsea well apparatus during a workover mode, comprising,
a hydraulically-operated subsea valve;
a control module operably installed with a subsea tree, the control module having a hydraulic fluid line extending from the control module to the hydraulically-operated subsea valve on the subsea tree;

a junction operably installed with the subsea tree and configured to engage an external device to receive hydraulic fluid from the external device and to vent hydraulic fluid from the subsea valve to the external device;

a hydraulic fluid supply line to couple hydraulic fluid from the junction to the control module; and

a hydraulic fluid return line to couple hydraulic fluid vented from the hydraulically-operated subsea valves to the junction.

7. The apparatus according to claim 6, wherein:

a hydraulic section of an ROV further comprises a return pairing for interface with the supply and return lines at the junction;

a workover umbilical connected at one end to a hydraulic fluid source further comprises an electrical line connected to a power source on a vessel, and connects at another end to the ROV to provide power to the control module.

8. The apparatus according to claim 7, wherein the electrical line further provides power and electrical signals to an electronic module located on the ROV, the electronic module converting the power and electrical signals to serve an electronic module located on the subsea tree, the electronic modules connected to each other via power and control lines.

9. A method for operating subsea hydraulic valve of a subsea tree during workover operations, the subsea tree having a control module for operating hydraulic valves of the tree and a junction coupled by a supply line to the control module to provide hydraulic fluid to the control module, the method comprising:

connecting a workover umbilical to an ROV having a hydraulic section;

flying the ROV to the junction and coupling the hydraulic section with the hydraulic supply line and the hydraulic section with the return line ;

establishing a closed hydraulic loop between the hydraulic section of the ROV and the control module;

dispensing hydraulic fluid to the control module from the ROV and venting hydraulic fluid from a subsea hydraulic valve thru the return line to the ROV; and

increasing the pressure of hydraulic fluid vented from the subsea hydraulic valve to thereby recirculate hydraulic fluid to the control module.

10. The method according to claim 9, further comprising workover mode.

11. The method according to claim 9 further comprising providing power to the ROV and the subsea tree via the workover umbilical.

12. The method according to claim 9 further comprising providing power and electrical signals to the ROV and the subsea tree via the workover umbilical.

13. The method according to claim 9 further comprising:
increasing pressure of hydraulic fluid and recirculating hydraulic fluid back to the control module.

14. The method according to claim 13, wherein the pressure of the hydraulic fluid is increased by a pump located in the ROV:

wherein junction plate has an input receptacle in fluid communication with the supply line and an output receptacle in fluid communication with the return line.

15. A skid securable to a subsea Remote Operated Vehicle, comprising:

a reservoir for storing hydraulic fluid;

a pump coupled to the reservoir and configured to enable the skid to provide pressurized hydraulic fluid to a subsea device;

a junction configured to removably couple the skid to a corresponding junction of a subsea device, wherein the junction is configured so that pressurized hydraulic fluid is directed from the skid to the subsea device through the junction and hydraulic fluid is vented to the skid from the subsea device through the junction.

16. The skid as recited in claim 15, where in the subsea device is a subsea tree.

CLAIMS

What is claimed is:

1. A subsea well apparatus, comprising,
a subsea tree having a hydraulically-operated valve; and

a control module with the subsea tree;

a hydraulic line extending from the control module to the hydraulically-operated valve to operate the hydraulically-operated valve;

an input receptacle in fluid communication with the control module and in selective fluid communication with a utility skid on a remotely operated vehicle (ROV), so that hydraulic fluid from the ROV is selectively supplied to the control module;

an output receptacle in fluid communication with a hydraulic fluid return line extending from the control module and configured to direct hydraulic fluid to an external device;

a subsea tree electronic module on the subsea tree that is controlled by an ROV electronic module on the ROV by signals communicated to the subsea tree electronic module from the ROV electronic module via a control line, and by power from a power source on a vessel via an electrical line that is part of a workover umbilical that has an end connected to a hydraulic fluid source.
2. The apparatus according to claim 1, further comprising a pump located within the ROV to repressurize control fluid returning from the control module to the hydraulic return interface and circulate the repressurized fluid back thru the input receptacle.
3. A subsea well apparatus during a workover mode, comprising,
a hydraulically-operated subsea valve;

a control module operably installed with a subsea tree, the control module having a hydraulic fluid line extending from the control module to the hydraulically-operated subsea valve on the subsea tree;

a junction operably installed with the subsea tree and configured to engage an external device to receive hydraulic fluid from the external device and to vent hydraulic fluid from the subsea valve to the external device;

a hydraulic fluid supply line to couple hydraulic fluid from the junction to the control module; and

a hydraulic fluid return line to couple hydraulic fluid vented from the hydraulically-operated subsea valves to the junction

wherein a hydraulic section of an ROV further comprises a return pairing for interface with the supply and return lines at the junction;

a workover umbilical connected at one end to a hydraulic fluid source further comprises an electrical line connected to a power source on a vessel, and connects at another end to the ROV to provide power to the control module, and

wherein the electrical line further provides power and electrical signals to an electronic module located on the ROV, the electronic module converting the power and electrical signals to serve an electronic module located on the subsea tree, the electronic modules connected to each other via power and control lines.

4. A method for operating a subsea hydraulic valve of a subsea tree during workover operations, the subsea tree having a control module for operating hydraulic valves of the tree and a junction coupled by a supply line to the control module to provide hydraulic fluid to the control module, the method comprising:

connecting a workover umbilical to an ROV having a hydraulic section;

flying the ROV to the junction and coupling the hydraulic section with the hydraulic supply line and the hydraulic section with a return line;

establishing a closed hydraulic loop between the hydraulic section of the ROV and the control module;

dispensing hydraulic fluid to the control module from the ROV and venting hydraulic fluid from a subsea hydraulic valve thru the return line to the ROV; and

increasing the pressure of hydraulic fluid vented from the subsea hydraulic valve to thereby recirculate hydraulic fluid to the control module.

5. The method according to claim 4, further comprising workover mode.

6. The method according to claim 4 further comprising providing power to the ROV and the subsea tree via the workover umbilical.

7. The method according to claim 4 further comprising providing power and electrical signals to the ROV and the subsea tree via the workover umbilical.

8. The method according to claim 4, wherein the pressure of the hydraulic fluid is increased by a pump located in the ROV:

wherein a junction plate has an input receptacle in fluid communication with the supply line and an output receptacle in fluid communication with the return line.