INTERVENTION WORKOVER CONTROL SYSTEMS

Field of the Invention

This invention relates to apparatus for use in providing an intervention workover control system for a underwater well.

Background of the Invention

Intervention workover control systems (IWOCS) for subsea hydrocarbon wells are typically designed and manufactured to suit specific variations of applications, such as mounting on mud mats or a lower marine riser package (LMRP) and having different lengths of hydraulic flying lead (HFL). This invention enables a flexible alternative with a modular approach, requiring minimal engineering to meet a wide range of applications.

Summary of the Invention

According to the invention, there is provided apparatus for use in providing an intervention workover control system for an underwater well, comprising:

a first structure, comprising an umbilical termination unit, said first structure having means for connecting to a hydraulic flying lead;

first support means, for use with said first structure, for supporting at least one electrical flying lead and second support means, for use with said first structure for supporting a hydraulic flying lead; and

second and third structures, there being third support means, for use with at least one of said second and third structures, for supporting at least one electrical flying lead, which structures can be connected to respective ones of opposite sides of said first structure, wherein said first, second and third structures are adapted so that:

to provide an intervention workover control system of a first configuration, said first structure is usable with said second and third structures connected to respective ones of opposite sides of said first structure; and

to provide an intervention workover control system of a second configuration, said first structure is usable without said second and third structures connected to it.

Typically, fourth support means are provided, for use with said second and third structures, for use in supporting such a hydraulic flying lead in an intervention workover control system of said first configuration.

Typically, the apparatus is adapted so that such a hydraulic flying lead is supported by said second support means in an intervention workover control system of said second configuration.

Typically, the apparatus is adapted so that at least one such electrical flying lead is supported by said third support means in an intervention workover control system of said first configuration.

Typically, the apparatus is adapted so that at least one such electrical flying lead is supported by said first support means in an intervention control system of said second configuration.

Each of said second and third structures could be provided with means for engaging with an upright member located on or for location on a bed of a body of water, for supporting an intervention workover control system of said first configuration. Such engaging means could be generally tubular.

Said first structure could include means for engaging with an upright member, for supporting an intervention control system of said second configuration.

The apparatus could include at least one further structure, providing a parking position for equipment and for attachment to one of said second and third structures in an intervention workover control system of said first configuration or to said first structure in an intervention workover control system of said second configuration.

The apparatus could include at least one further structure for carrying further equipment and for attachment to one of said second and third structures in an intervention workover control system of said first configuration or to said first structure in an intervention workover control system of said second configuration.

Typically though, the apparatus could include:

at least one further structure, providing a parking position for equipment and for attachment to one of said second and third structures in an intervention workover control system of said first configuration or to said first structure in an intervention workover control system of said second configuration; and

at least one further structure, for carrying further equipment and for attachment to the other of said second and third structures in an intervention workover control system of said first configuration or to said first structure in an intervention workover control system of said second configuration.

Such further equipment could comprise at least one of hydraulic gauges and remotely operated vehicle (ROV) connections and ROV-operated valves.

The invention also comprises a method of providing an intervention workover control system for an underwater well, comprising the steps of providing apparatus according to the invention and using the apparatus to form a system according to the first or second configuration.

Where the intervention workover control system is of the first configuration it could be located on a mud mat on a bed of a body of water.

Where the intervention workover control system is of the second configuration it could be located on a lower marine riser package.

Brief Description of the Drawings

Fig. 1 shows parts of apparatus according to an embodiment of the invention before assembly in an IWOCS of a first configuration; and

Fig. 2 shows parts of the apparatus before assembly in an IWOCS of a second configuration.

Detailed Description of the Invention

The following describes the use of apparatus according to an embodiment of the invention to provide two different IWOCS configurations – that is a first configuration (see Fig. 1) in which parts of the apparatus provide an IWOCS on a mud mat on the seabed and a second configuration (see Fig. 2) in which parts of the apparatus provide an IWOCS on a LMRP.

More particularly, the overall apparatus comprises: a first modular structure in the form of a subsea umbilical termination unit (SUTU) 1 having a plate 2 providing a parking (and flushing) position for a HFL; second and third modular structures 3 and 4; a further structure 5 (providing a parking plate during intervention workover for a hydraulic stabplate long-term protective cover of a subsea tree); and further structures 6 and 7 comprising ROV intervention panels carrying hydraulic gauges and ROV-operated valves.

Each of structures 3 and 4 carries supports comprising four posts 8a around which a lengthy HFL 9 can be wound in a “figure of eight” in the first configuration. Typically, the length of such a HFL could be 40 to 80 metres. When used in the first configuration, the structure 1 is fitted with a post 8b for use in supporting such a HFL. For use in the first configuration, each of structures 3 and 4 also carries two conically-ended guide funnels 10 and structure 4

carries support posts 11 and 12 around which lengthy electric flying leads (EFLs) 13 and 14 can be wound. When used in the second configuration but not the first, SUTU 1 is fitted with projections (not shown) around which relatively short EFLs 15 and 16 can be wound and support projections at 17 and 18 for a relatively short HFL 19 (typically 20 to 40 metres long). Also, inside SUTU 1 there is a guide passageway for engagement with a post attached to a LMRP in the second configuration.

Fig. 1 shows parts of the apparatus before assembly in an IWOCS configuration suited for mounting on a mud mat 20 on the seabed.

The structures 3 and 4 are mated with SUTU 1 so that they are attached on respective sides of SUTU 1, with structure 5 attached to the side of structure 4 remote from SUTU 1 and structures 6 and 7 attached to structure 3 on sides remote from SUTU 1. Since the IWOCS is to be mounted on mud mat 20, the HFL 9 is a relatively long one and is supported by posts 8a, around which it is wound in a “figure of eight” shape, and post 8b and relatively long EFLs 13 and 14 are used. The IWOCS assembly thereby formed can either be lowered by a ROV on to mud mat 20 on the seabed with guide posts 21 on the mud mat engaging with and passing through respective ones of guide funnels 10. Alternatively, the IWOCS assembly can be mounted on to the mud mat 20 before lowering to the seabed, using a ROV with through-pin mechanisms which pass through openings in the guide posts 21 and the guide funnels 10 to hold the IWOCS assembly and the mud mat 20 together as they are lowered to the seabed.

Fig. 2 shows parts of the apparatus before assembly in an IWOCS configuration suited for mounting on a post 22 attached to a LMRP, a so-called “LMRP mono-post”. The post 22 is mounted on a flange that is attached, for example by welding, on to a LMRP. Relatively short EFLs 15 and 16 and a relatively short HFL 19 supported by the projections at 17 and 18 are used but the structures 3 and 4 are not used, structure 5 being attached to one side of SUTU 1 and structures 6 and 7 being attached to the opposite side of SUTU 1. The IWOCS assembly thus formed is lowered using a ROV on to the post 22, the latter engaging and passing through the guide passageway provided inside the SUTU 1, so that the assembly lands on top of the LMRP.

The invention has the advantage that the need for field-specific forms of IWOCS is avoided by providing apparatus which can be used to provide the necessary parts for different configurations and the same termination unit can be used in them.

CLAIMS

1. Apparatus for use in providing an intervention workover control system for an underwater well, comprising:

   a first structure (1), comprising an umbilical termination unit, said first structure having means (2) for connecting to a hydraulic flying lead (9 or 19);

   first support means for use with said first structure, for supporting at least one electrical flying lead (15, 16) and second support means (8b or 17, 18), for use with said first structure, for supporting a hydraulic flying lead; and **characterised by**

   second and third structures (3, 4), there being third support means (11, 12), for use with at least one of said second and third structures, for supporting at least one electrical flying lead (13, 14), which structures can be connected to respective ones of opposite sides of said first structure, wherein said first, second and third structures are adapted so that:

      to provide an intervention workover control system of a first configuration, said first structure is usable with said second and third structures connected to respective ones of opposite sides of said first structure; and

      to provide an intervention workover control system of a second configuration, said first structure is usable without said second and third structures connected to it.

2. Apparatus according to claim 1, including fourth support means (8a), for use with said second and third structures (3, 4), for use in supporting such a hydraulic flying lead (9) in an intervention workover control system of said first configuration.

3. Apparatus according to claim 1 or 2, adapted so that such a hydraulic flying lead (19) is supported by said second support means (17, 18) in an intervention workover control system of said second configuration.

4. Apparatus according to any preceding claim, adapted so that at least one such electrical flying lead (13, 14) is supported by said third support means (11, 12) in an intervention workover control system of said first configuration.

5. Apparatus according to any preceding claim, adapted so that at least one such electrical flying lead (15, 16) is supported by said first support means in an intervention control system of said second configuration.