

UMBILICAL FIELD CONNECT

The present disclosure claims priority to U.S. Provisional Application No. 61/088,107, filed on Aug. 12, 2008, the disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

The present disclosure relates generally to umbilicals employed in subsea development projects, and more specifically, to a solution for connecting an umbilical to another device, such as a second umbilical or an umbilical termination assembly.

2. Description of the Related Art

Subsea oil and gas fields often employ subsea well equipment that is located on the seabed and tied back to a surface structure, such as a production facility and/or ship. An umbilical is often used to convey fluids and/or send electrical and other communication signals between the surface structure and the subsea well equipment. The umbilical can be many miles long with large and heavy end terminations, making it difficult to handle and/or deploy.

Over time, the length and weight of umbilicals has continued to increase. As a result of the increased size, the transportation and installation of the umbilicals is becoming more and more difficult. For example, in some cases it may be difficult to locate an available sea-going vessel that has the capacity to ship and install a very large umbilical.

A known solution for handling a very long umbilical includes cutting the umbilical and installing a subsea umbilical termination assembly (“SUTA”) on one end and a Cobra Head on the other end. The connections between each end of the umbilical and the SUTA and Cobra Head are generally made in the factory by, for example, welding. The two umbilical segments with the attached SUTA and Cobra Head can then be separately transported to the deployment site and connected. This approach has a number of disadvantages, including that the on-site connection of the two segments of the umbilical with a SUTA and Cobra Head is performed below the surface of the ocean using an ROV. Furthermore, the SUTA and Cobra Head equipment is costly and often requires several months to manufacture.

FIG. 1 illustrates an example of a SUTA 10 connected to an umbilical 20. SUTA 10 can be relatively large, often weighing several thousand pounds. It is known to connect the umbilical 20 and SUTA 10 using a connection assembly comprising a split barrel 30, an armor pot assembly 40, and one or more bend restrictor clamps 50, all of which can be bolted together. Because of the size and weight of the SUTA, packing and handling during transportation and deployment of the umbilicals can be difficult. Additionally, the connection between the umbilical and SUTA can potentially be a weak point during transportation of the unit to the deployment site. Consequently, damage can occur at the connection, which can result in the need for costly repairs.

The present disclosure is directed to overcoming, or at least reducing the effects of, one or more of the issues set forth above.

SUMMARY OF THE DISCLOSURE

An embodiment of the present disclosure is directed to an umbilical field connect assembly. The umbilical field connect assembly comprises: a first umbilical portion comprising two or more first bundled members chosen from electrical cables,

fluid conduits, and optical fibers; a second umbilical portion comprising two or more second bundled members chosen from electrical cables, fluid conduits, and optical fibers; a first housing assembly having a first end coupled to the first umbilical portion and a second end comprising a first coupling plate having a plurality of first couplings chosen from male and female couplings positioned therein, one of the plurality of first couplings being positioned at an end of each of the first bundled members; a second housing assembly having a third end coupled to the second umbilical portion and a fourth end comprising a second coupling plate having a plurality of second couplings chosen from male and female couplings positioned therein, one of the second couplings being positioned at an end of each of the second bundled members. The first housing and the second housing can be positioned so that each of the first couplings join with one of the second couplings to form mated coupling pairs, whereby the first bundled members of the first umbilical portion and the second bundled members of the second umbilical portion can be joined in a manner that effectively provides for a single functioning umbilical assembly.

Another embodiment of the present disclosure is directed to a field connect for an umbilical termination assembly. The field connect comprises an umbilical comprising two or more bundled members chosen from electrical cables, fluid conduits and optical fibers; an umbilical termination assembly (UTA) comprising two or more members chosen from electrical cables, fluid conduits; and optical fibers; a first housing assembly having a first end coupled to the umbilical and a second end comprising a first coupling plate having a plurality of first couplings positioned therein, one of the plurality of first couplings being positioned at an end of each of the first bundled members; a second housing assembly having a third end coupled to the UTA and a fourth end comprising a second coupling plate having a plurality of second couplings positioned therein, the second couplings being positioned at an end of each of the second bundled members. The first housing and the second housing can be positioned so that each of the first couplings join with one of the second couplings to form mated coupling pairs, whereby the first bundled members of the first umbilical portion and the members of the UTA are joined in a manner that effectively provides for a functioning connection between the umbilical and the UTA.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an example of a SUTA connected to an umbilical.

FIG. 2 illustrates an umbilical field connect assembly, according to an embodiment of the present disclosure.

FIG. 3 illustrates a portion of an umbilical having two or more bundled members.

FIG. 4 illustrates first and second housing assemblies prior to coupling, according to an embodiment of the present disclosure.

FIG. 5 illustrates a coupling plate having a plurality of female couplings and guide pins holes positioned therein, according to an embodiment of the present disclosure.

FIG. 6 illustrates a coupling plate having a plurality of male couplings and guide pins positioned therein, according to an embodiment of the present disclosure.

FIG. 7 illustrates an exploded view of a coupler assembly, according to an embodiment of the present application.

FIG. 8 illustrates an umbilical field connect assembly, according to an embodiment of the present disclosure.

FIG. 9 illustrates a split clamp casing assembly, according to an embodiment of the present disclosure.

FIGS. 10 and 11 illustrate a field connect assembly for an umbilical termination assembly, according to an embodiment of the present disclosure.

FIG. 12 illustrates a subsea well assembly, according to an embodiment of the present disclosure.

While the disclosure is susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the disclosure is not intended to be limited to the particular forms disclosed. Rather, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the disclosure as defined by the appended claims.

DETAILED DESCRIPTION

FIG. 2 illustrates an umbilical field connect assembly **100** according to an embodiment of the present disclosure. Umbilical field connect assembly **100** includes a first umbilical portion **110a** and a second umbilical portion **110b**. An umbilical portion **110** can include two or more bundled members **115**, similarly as illustrated in FIG. 3. Bundled members **115** can be chosen from fluid conduits, such as hydraulic lines and tubes for carrying fluids, such as oil or gas; and electrical cables and/or optical fibers for carrying electrical or optical signals for controlling or otherwise communicating with, for example, the subsea well equipment. Umbilicals can extend between a surface structure or ship and subsea well equipment, as is well known in the art.

Referring again to FIG. 2, umbilical field connect assembly **100** includes a first housing assembly **120a** and a second housing assembly **120b**, which are shown coupled together. FIG. 4 illustrates the first and second housing assemblies prior to coupling. The first housing assembly has a first end coupled to the first umbilical portion **110a**. A bend restrictor assembly **130a** comprising one or more bend restrictor segments **132a** and bend restrictor clamps **134a** can be employed. Bend restrictor assembly **130a** is positioned proximate the first housing assembly **120a** to prevent overbending of the umbilical adjacent to the field connect assembly **100**.

As shown in FIG. 4, first housing assembly **120a** has a second end **140a**, the details of which are more clearly shown in FIGS. 5 and 7. Second end **140a** includes a first coupling plate **142a** (See FIG. 5) having a plurality of female couplings **144a** and **146a** and guide pin holes **148a** that are positioned therein. Generally one of the plurality of female couplings is positioned at an end of each of the first bundled members **115** (See FIG. 3) of the umbilical portion **110a**.

Referring back to FIG. 2, second housing assembly **120b** has a third end coupled to the second umbilical portion **110b**. Similarly as described above for umbilical portion **110a**, a bend restrictor assembly **130b** comprising one or more bend restrictor segments **132b** and bend restrictor clamps **134b** can be employed proximate the second housing assembly **120b**.

Second housing assembly **120b** has a fourth end **140b**, the details of which are more clearly shown in FIGS. 6 and 7. The fourth end includes a coupling plate **142b** (See FIG. 6) having a plurality of male couplings **144b** and **146b** and guide pins **148b** that are positioned therein. Generally one of the plurality of male couplings is positioned at an end of each of the first bundled members **115** (See FIG. 3) of the umbilical portion **110b**. Any suitable type of female couplings and male couplings can be employed. Examples of such couplings are well known in the art. The female couplings **144a** and **146a** and the guide pin holes **148a** of first housing assembly **120a** can be respectively aligned with the male couplings **144b** and **146b**

and guide pins **148b** of second housing assembly **120b**. The first and second housing assemblies **120a** and **120b** can then be positioned adjacent each other so that the male couplings are received by the female couplings. In this manner, the bundled members **115** of the first umbilical portion **110a** and the bundled members **115** of the second umbilical portion **110b** can be joined in a manner that effectively provides for a single functioning umbilical assembly **190**. The guide pin holes **148a** and guide pins **148b** function to align coupler plates **142a** and **142b** and to prevent the two coupler plates from encroaching on a minimum gap allowance between the female couplings and the male couplings.

In the embodiment illustrated in FIGS. 4 to 6, the first housing assembly **120a** includes female couplings and the second housing assembly **120b** includes male couplings. In other embodiments, the first housing assembly **120a** can include a plurality of couplings, including one or more each of both male and female couplings. Similarly, the second housing assembly **120b** can also include a plurality of couplings including one or more each of both male and female couplings, each of which corresponds to a mating coupling in the first housing assembly **120a**. Any arrangement of male and/or female couplings can be employed that will effectively join the bundled members of the first and second housing assemblies.

The first and second housing assemblies will now be described in greater detail. As illustrated in FIG. 4, housing assemblies **120a** and **120b** can include armor pots **150a** and **150b**, respectively. Armor pots are well known in the art, and can include an outer casing **152** through which bundled members **115** extend, as illustrated in FIG. 8. The armor pot can include a casting resin, or potting resin, (not shown) inside the outer casing **152**. The casting resin forms a resin matrix that can function to connect the armor pot to the umbilical, holding the bundled members of the umbilical in place so that they are not pulled out from the umbilical when force is applied to the field connect assembly **100**. Armor pots **150a** and **150b** can also be connected to the bend restrictor assemblies **130** via a flange assembly **156** (See FIG. 8). Any other suitable means for making the connection, such as welding, can also be employed in place of or in addition to the flange assembly **156**.

Referring again to FIG. 4, armor pots **150a** and **150b** are also connected to split barrel assemblies **160a** and **160b**, respectively. The connection between the armor pots and the split barrel assemblies can be made in any suitable manner, including using a flange assembly, a latching mechanism and/or by welding.

The outer casings of split barrel assemblies **160a** and **160b** include two halves **162** and **163**. The outer casing half **162** and/or the outer casing half **163** can each be separately removed to allow easy access to the bundled members **115** that are illustrated in FIG. 8.

Split barrel assembly **160a** and/or split barrel assembly **160b** can include an electrical termination **165**. Such electrical terminations are well known in the art for connecting electrical cables generally. In the present disclosure, electrical termination **165** allows for two or more electrical cables from the umbilical portions **110a** and **110b** to be connected in the field connect assembly **100** using a single male electrical coupling **146b** and female electrical coupling **146a** (See FIG. 6). Multiple electrical terminations **165** can be employed in a split barrel assembly, depending upon the number of electrical cables to be connected. Employing such electrical terminations can reduce the complexity and size requirements of the field connect assembly **100**.

Referring again to FIG. 4, the first split barrel assembly **160a** and the second split barrel assembly **160b** are respectively connected to coupling plate seating flanges **143a** and **143b**. The connections can be made in any suitable manner, such as by bolting, welding or by other means. As is more clearly illustrated in the exploded view of the coupler assembly **145** of FIG. 7, coupling plates **142a** and **142b** are positioned in coupling plate seatings **147a** and **147b** to form the mating ends **140a** and **140b** of the field connect assembly **100**.

First housing assembly **120a** and second housing assembly **120b** can be fastened together in any suitable manner so that the female couplings **144a** and **146a** and guide pin holes **148a** of the first coupling plate **142a** and the male couplings **144b** and **146b** and guide pins **148b** of the second coupling plate **142b** are held together between the first coupling plate seating flange **143a** and the second coupling plate seating flange **143b**. In an embodiment, the first and second housing assemblies can be fastened using a technique that allows for easy decoupling of the housing assemblies. For example, the first split barrel assembly can be bolted to the second split barrel assembly, or the first and second split barrel assemblies can be fastened using a quick locking means. In other embodiments, the first and second housing assemblies can be permanently fastened together, such as by welding or any other suitable means.

In an embodiment, a split clamp casing assembly **170**, illustrated in FIG. 9, is fastened around the first and second housing assemblies **120a** and **120b** of FIG. 2. This can provide additional protection and support to the field connect assembly **100**. In an embodiment, split clamp casing assembly **170** is bolted together to form a casing around the first split barrel assembly **160a**, the coupler assembly **145** and the second split barrel assembly **160b**. The split clamp casing assembly **170** may provide a suitable lifting point for the field connect assembly **100**.

FIGS. 10 and 11 illustrate a field connect assembly **200** for an umbilical termination assembly, according to another embodiment of the present disclosure. The field connect assembly **200** is similar to the field connect assembly **100**, described above, except that field connect **200** is designed for connection to an umbilical termination assembly ("UTA") **210**. Umbilical termination assembly **210** may be any device, other than an umbilical, into which an umbilical may be connected, including a subsea umbilical termination assembly ("SUTA"). Such UTAs and SUTAs are well known in the art.

The field connect assembly **200** comprises housing assemblies **120a** and **120b**. Housing assembly **120b** has a first end coupled to an umbilical **110** and includes an armor pot **150** and a split barrel assembly **160b**, similarly as described above for housings **120a** and **120b** in the drawings of FIGS. 2 to 9. A bend restrictor assembly **130** can also be employed similarly as described above.

The housing **120a** of FIG. 10 can have any suitable design or structure that would provide for acceptable coupling to UTA **210** and housing assembly **120b**. In an embodiment, housing assembly **120a** comprises a split barrel assembly **160a** coupled directly to UTA **210**. The split barrel assembly **160a** can be similar to the split barrel assemblies discussed herein above. The UTA can include two or more members **115** chosen from electrical cables, fluid conduits and optical fibers, which extend through split barrel assembly **160a**, similarly as shown in FIG. 8 above.

A coupling assembly **145**, similar to that shown in FIG. 7, can be used to join the housing assemblies **120a** and **120b** of FIGS. 10 and 11. Female couplings **144a**, **146a** and guide pin holes **148a** and male couplings **144b**, **146b** and guide pins

148b, as illustrated in FIGS. **5** and **6**, can be interchangeably used as part of either of housings **120a** or **120b** of FIGS. **10** and **11**, so as to provide a functioning coupling assembly **145**. In an embodiment, a plurality of couplings, including one or more each of both male and female couplings, can be employed in the housings **120a**, with corresponding mating couplings being employed in housing **120b**.

In an embodiment, a split clamp casing assembly **170**, as illustrated in FIG. **9**, is fastened around the first and second housing assemblies **120a** and **120b** of FIG. **10**. This can provide additional protection and support to the field connect assembly **200**. For example, split clamp casing assembly **170** can be bolted together to form a casing around the first split barrel assembly **160a**, the coupler assembly **145** and the second split barrel assembly **160b**.

FIG. **12** illustrates a subsea well assembly **250**, according to an embodiment of the present application. The subsea well assembly **250** can comprise, among other things, a subsea well device **225**, such as, for example, a SUTA, positioned below the surface of the ocean. In an embodiment, an umbilical **110** can be connected to the subsea well device using a field connect assembly **200**, as described herein above. In an embodiment, an umbilical **110** can be connected to the subsea well device **225**, wherein the umbilical **110** comprises a plurality of umbilical portions **110a**, **110b** coupled together using the field connect assembly **100**, as described herein above.

Although various embodiments have been shown and described, the present disclosure is not so limited and will be understood to include all such modifications and variations as would be apparent to one skilled in the art.

What is claimed is:

1. A subsea umbilical field connect assembly comprising:
 - a first subsea umbilical portion comprising two or more first bundled members chosen from electrical cables, fluid conduits, and optical fibers;
 - a second subsea umbilical portion comprising two or more second bundled members chosen from electrical cables, fluid conduits, and optical fibers;
 - a first housing assembly having a first end coupled to the first subsea umbilical portion and a second end comprising a first coupling plate having a plurality of first couplings chosen from male and female couplings positioned therein, one of the plurality of first couplings being positioned at an end of each of the first bundled members;
 - a second housing assembly having a third end coupled to the second subsea umbilical portion and a fourth end comprising a second coupling plate having a plurality of second couplings chosen from male and female couplings positioned therein, one of the second couplings being positioned at an end of each of the second bundled members;wherein the first housing and the second housing can be positioned so that each of the first couplings join with one of the second couplings to form mated coupling pairs, whereby the first bundled members of the first umbilical portion and the second bundled members of the second umbilical portion can be joined in a manner that effectively provides for a single functioning umbilical assembly.
2. The umbilical field connect of claim 1, wherein the first bundled members and the second bundled members each comprise at least one fluid conduit.
3. The umbilical field connect of claim 1, wherein the first bundled members and the second bundled members each comprise a plurality of fluid conduits.

4. The umbilical field connect of claim **3**, wherein the first bundled members and the second bundled members each comprise at least one electrical cable.

5. The umbilical field connect of claim **1**, wherein the first housing comprises a first armor pot connected to the first umbilical portion and a first split barrel assembly connected to the first armor pot.

6. The umbilical field connect of claim **5**, wherein the first split barrel assembly comprises a flange that is bolted to a first coupling plate seating flange having a coupling plate seat, the coupling plate being positioned in the coupling plate seat.

7. The umbilical field connect of claim **6**, wherein the second housing comprises a second armor pot coupled to the second umbilical portion and a second split barrel assembly coupled to the second armor pot.

8. The umbilical field connect of claim **7**, wherein the second split barrel assembly comprises a flange that is bolted to a second coupling plate seating flange having a second coupling plate seat, the second coupling plate being positioned in the second coupling plate seat.

9. The umbilical field connect of claim **8**, wherein the first split barrel assembly is bolted to the second split barrel assembly so that the first couplings of the first coupling plate and the second couplings of the second coupling plate are held together between the first coupling plate seating flange and the second coupling plate seating flange.

10. The umbilical field connect of claim **9**, further comprising a split clamp casing assembly that is bolted together to form a casing around the first split barrel assembly, the coupling assembly and the second split barrel assembly.

11. The umbilical field connect of claim **7**, further comprising a first bend restrictor assembly coupled between the first umbilical portion and the first armor pot assembly and a second bend restrictor assembly coupled between the second umbilical portion and the second armor pot assembly.

12. A field connect for an umbilical termination assembly, the field connect comprising:

- a subsea umbilical comprising two or more bundled members chosen from electrical cables, fluid conduits and optical fibers;
- an umbilical termination assembly (UTA) comprising two or more members chosen from electrical cables, fluid conduits; and optical fibers;
- a first housing assembly having a first end coupled to the umbilical and a second end comprising a first coupling plate having a plurality of first couplings positioned therein, one of the plurality of first couplings being positioned at an end of each of the first bundled members;
- a second housing assembly having a third end coupled to the UTA and a fourth end comprising a second coupling plate having a plurality of second couplings positioned therein, the second couplings being positioned at an end of each of the second bundled members;

wherein the first housing and the second housing can be positioned so that each of the first couplings join with one of the second couplings to form mated coupling pairs, whereby the first bundled members of the first umbilical portion and the members of the UTA are joined in a manner that effectively provides for a functioning connection between the umbilical and the UTA.

13. The field connect of claim **12**, wherein the bundled members and the UTA members each comprise at least one fluid conduit.

14. The field connect of claim **12**, wherein the bundled members and the UTA members each comprise a plurality of fluid conduits.

15. The field connect of claim **14**, wherein the bundled members and the UTA members each comprise at least one electrical cable.

16. The field connect of claim **12**, wherein the first housing comprises an armor pot connected to the umbilical and a first split barrel assembly connected to the armor pot.

17. The field connect of claim **16**, wherein the first split barrel assembly comprises a flange that is bolted to a first coupling plate seating flange having a coupling plate seat, the coupling plate being positioned in the coupling plate seat.

18. The field connect of claim **17**, wherein the second housing comprises a second split barrel assembly coupled to the UTA.

19. The field connect of claim **18**, wherein the second split barrel assembly comprises a flange that is bolted to a second coupling plate seating flange having a second coupling plate seat, the second coupling plate being positioned in the second coupling plate seat.

20. The field connect of claim **19**, wherein the first split barrel assembly is bolted to the second split barrel assembly so that the first couplings of the first coupling plate and the second couplings of the second coupling plate are held together between the first coupling plate seating flange and the second coupling plate seating flange.

21. The field connect of claim **16**, further comprising a bend restrictor assembly coupled to the umbilical between the umbilical and the armor pot assembly.

22. A subsea well assembly comprising:

a subsea well device positioned below the surface of the ocean; and

an umbilical connected to the subsea well device using the field connect assembly of claim **12**.

23. A subsea well assembly comprising:

a subsea well device positioned below the surface of the ocean; and

an umbilical connected to the subsea well device, wherein the umbilical comprises a plurality of umbilical portions coupled together using the field connect assembly of claim **1**.