Description

This invention relates to tieback connections.

It is common practice in offshore oil and gas production to have the wellhead and related casing hangers mounted at the ocean floor with the xmas tree and other production equipment mounted above the water on a production platform. In such situations tieback conductors are used to connect the subsea wellhead equipment to the platform mounted production equipment. In a typical application the high pressure 18 3/4 inch casing head housing must be tied back to the production platform.

One example of a production tieback in shown in US Patent No. 4343495 wherein item 10 is a casing head housing which is tied back to a production platform by connector 14 and conductor 12. Connector 14 is joined to housing 10 by threaded engagement.

Another example of a tieback is disclosed in US Patent No. 3497243 wherein the conductor pipe 12 is threaded into wellhead housing 11.

Another tieback system is shown in US Patent No. 4046405 wherein the connections include threads, latching mechanisms and an axially threaded nut.

US-A-3608932 describes a connector having a tubular body connected to a tubular pin member by a locking ring. The locking ring is carried by a tubular member and can be moved to engage a groove in the pin member in response to upward movement of a sleeve member.

According to the present invention there is provided a subsea wellhead comprising a wellhead housing having an upper tapered seat and an internal groove below said seat, a tieback connector comprising an annular body having a shoulder for landing on said tapered seat of the wellhead housing, a locking ring for engaging said groove and a sleeve which can be raised relative to said annular body to cause said locking ring to move to a position where it can engage said groove, characterised in that said body shoulder is an external downwardly facing shoulder sized to be landed on said housing seat and said body has an internal upwardly facing shoulder,

said sleeve is positioned within said annular body and has an external upwardly facing shoulder and upper external threads, means being provided to prevent rotation of said sleeve within said annular body,

said locking ring is carried by said external sleeve shoulder,

said annular body has a lower end with a lower outer tapered surface which tapers upwardly and outwardly, and said connector includes an actuator ring threaded onto said sleeve external threads and engaging said annular body internal shoulder, the arrangement being such that, in use, when said body shoulder is landed on a wellhead housing seat, rotation of said actuator ring raises said sleeve to raise said locking ring into surrounding relationship to the lower end of the annular body and thus wedge said locking ring outward to set said locking ring into said housing internal groove, continued rotation of said actuator ring then tensioning said sleeve to preload the engagement between said wellhead housing seat and said body shoulder. The invention also provides a subsea wellhead incorporating such a tieback connector.

The present tieback connector does not need to be threadedly attached to the wellhead housing to which it is engaged. Also the tieback connector can be pre-loaded when attached to the wellhead housing.

The invention will be described now by way of example and with particular reference to the accompanying drawings. In the drawings:

Figure 1 is a sectional view of the improved tieback connector of the present invention in its unset position within the wellhead housing to which it is to be attached.

Figure 2 is another sectional view of the improved tieback connector of the present invention after it has been attached to the wellhead housing and the connector has been pre-loaded.

The normal subsea wellhead is positioned on the ocean floor and a platform has its support structure mounted on ocean floor around the subsea wellhead and production equipment is positioned above water level on platform. A tieback connector or casing extends from tieback connector to production equipment on the platform.

Tieback connector includes body which is generally tubular in shape and has outer downwardly facing shoulder which is adapted to engage upwardly facing seat on wellhead housing. Grooves in shoulder are filled with high pressure gasket type seal rings for sealing against seat 18. The upper interior includes threads into which tieback conductor is engaged. Tieback connector also includes sleeve which is positioned within body 14 and actuator ring 30 which is positioned between the upper exterior portion of sleeve 28 and the interior of body 14. Pins 32 having their shanks 34 positioned within openings in sleeve 28 and their heads 36 positioned within vertical slots 38 within body 14 at a position below shoulder 16 as shown in FIGURE 1. The lower exterior of sleeve 28 includes upwardly facing shoulder 40 and the lower interior of sleeve 28 includes threads 42 into which ring 44 is threaded and buttress threads 45 thereabove with the buttress threads 45a on the exterior of split latching ring 46 engaging the threads 45. Split latching ring 46 includes internal threads 48 which

have their lower surfaces tapering upwardly and outwardly and their upper surfaces being substantially normal to the axis of sleeve 28. Threads 48 are relatively fine with respect to threads 45 so that there is limited relative rotation between split latching ring 46 and sleeve 28. This structure provides the support for subsequent conductor strings (not shown) to be run and to be latched in place by ring 46 since less than a full turn of the string is required to complete the setting of split latching ring 46. The upper exterior of sleeve 28 includes threads 50 into which threads 52 on the interior of actuator ring 30 engage. Actuator ring 30 includes upper slots 66 which are engaged by a suitable tool (not shown) for setting of the assembly as hereinafter described. Actuator ring 30 is retained within body 14 between internal upwardly facing shoulder 56 and snap ring 58 which is positioned within groove 60 around the upper interior of body 14 immediately below threads 16.

Split lock ring 62 is positioned on external shoulder 40 of sleeve 28 and below the lower end of body 14 which is provided with external cam surface 64 which is tapered downwardly and inwardly to coact with split lock ring 62 during setting. Seal ring 67 is positioned in groove 68 in the exterior of actuator ring 30 to seal between the exterior of actuator ring 30 and the interior of body 14. Seal ring 70 is positioned in groove 72 in the upper exterior of sleeve 28 to seal between the exterior of sleeve 28 and the interior of actuator ring 30.

As shown in FIGURE 2, setting of tieback connector 12 is achieved by rotation of actuator ring 30. The threads 50 and 52 between sleeve 28 and actuator ring 30 causes sleeve 28 to move upwardly with respect to body 14. This upward movement causes split lock ring 62 to be moved upwardly by its engagement with shoulder 40 and such movement causes it to be cammed outwardly by surface 64 on the lower end of body 14 into tight engagement within running groove 74 on the interior of wellhead housing 20. Once lock ring 62 is set, further rotation creates a tension in sleeve 28 which preloads the joint to ensure tight engagement of shoulder 16 and seal rings 24 with seat 18 on the interior upper end of wellhead housing 20.

Claims

1. A subsea wellhead comprising a wellhead housing (20) having an upper tapered seat (18) and an internal groove (74) below said seat (18), a tieback connector comprising an annular body (14) having a shoulder (16) for landing on said tapered seat (18) of the wellhead housing, a locking ring (62) for engaging said groove (74) and a sleeve (28) which can be raised relative to said annular body (14) to cause said locking ring (62) to move to a position where it can engage said groove (74), characterised in that said body shoulder (16) is an external downwardly facing shoulder (16) sized to be landed on said housing seat (18) and said body has an internal upwardly facing shoulder (56),
said sleeve (28) is positioned within said annular body (14) and has an external upwardly facing shoulder (40) and upper external threads (50), means (32, 38) being provided to prevent rotation of said sleeve (28) within said annular body (14),
said locking ring (62) is carried by said external sleeve shoulder (40),
said annular body (14) has a lower end with a lower outer tapered surface (64) which tapers upwardly and outwardly, and said connector includes an actuator ring (30) threaded onto said sleeve external threads (50) and engaging said annular body internal shoulder (56), the arrangement being such that, in use, when said body shoulder (16) is landed on a wellhead housing seat (18), rotation of said actuator ring (30) raises said sleeve (28) to raise said locking ring (62) into surrounding relationship to the lower end of the annular body and thus wedge said locking ring (62) outward to set said locking ring (62) into said housing internal groove (74), continued rotation of said actuator ring (30) then tensioning said sleeve (28) to preload the engagement between said wellhead housing seat (18) and said body shoulder (16).

2. A subsea wellhead according to claim 1 including sealing means (22,24) carried by said body (14) for providing a high pressure gasket seal against a sealing surface (18) of the wellhead housing (20) when said connector is secured.

3. A subsea wellhead according to claim 2 wherein said sealing means includes:
at least one groove (22) in said exterior shoulder (16) of said body (14), and
a high pressure sealing gasket (24) positioned within said groove (22).

4. A subsea wellhead according to claim 1 wherein said rotation preventing means includes
at least one pin (32) mounted in a slot (38) within said annular body (14) which pin extends axially therein and has its other end secured within said sleeve (28).



have their lower surfaces tapering upwardly and outwardly and their upper surfaces being substantially normal to the axis of sleeve 28. Threads 48 are relatively fine with respect to threads 45 so that there is limited relative rotation between split latching ring 46 and sleeve 28. This structure provides the support for subsequent conductor strings (not shown) to be run and to be latched in place by ring 46 since less than a full turn of the string is required to complete the setting of split latching ring 46. The upper exterior of sleeve 28 includes threads 50 into which threads 52 on the interior of actuator ring 30 engage. Actuator ring 30 includes upper slots 66 which are engaged by a suitable tool (not shown) for setting of the assembly as hereinafter described. Actuator ring 30 is retained within body 14 between internal upwardly facing shoulder 56 and snap ring 58 which is positioned within groove 60 around the upper interior of body 14 immediately below threads 16.

Split lock ring 62 is positioned on external shoulder 40 of sleeve 28 and below the lower end of body 14 which is provided with external cam surface 64 which is tapered downwardly and inwardly to coact with split lock ring 62 during setting. Seal ring 67 is positioned in groove 68 in the exterior of actuator ring 30 to seal between the exterior of actuator ring 30 and the interior of body 14. Seal ring 70 is positioned in groove 72 in the upper exterior of sleeve 28 to seal between the exterior of sleeve 28 and the interior of actuator ring 30.

As shown in FIGURE 2, setting of tieback connector 12 is achieved by rotation of actuator ring 30. The threads 50 and 52 between sleeve 28 and actuator ring 30 causes sleeve 28 to move upwardly with respect to body 14. This upward movement causes split lock ring 62 to be moved upwardly by its engagement with shoulder 40 and such movement causes it to be cammed outwardly by surface 64 on the lower end of body 14 into tight engagement within running groove 74 on the interior of wellhead housing 20. Once lock ring 62 is set, further rotation creates a tension in sleeve 28 which preloads the joint to ensure tight engagement of shoulder 16 and seal rings 24 with seat 18 on the interior upper end of wellhead housing 20.

Claims

1. A subsea wellhead comprising a wellhead housing (20) having an upper tapered seat (18) and an internal groove (74) below said seat (18), a tieback connector comprising an annular body (14) having a shoulder (16) for landing on said tapered seat (18) of the wellhead housing, a locking ring (62) for engaging said groove (74) and a sleeve (28) which can be raised relative to said annular body (14) to cause said locking ring (62) to move to a position where it can engage said groove (74), characterised in that said body shoulder (16) is an external downwardly facing shoulder (16) sized to be landed on said housing seat (18) and said body has an internal upwardly facing shoulder (56),
said sleeve (28) is positioned within said annular body (14) and has an external upwardly facing shoulder (40) and upper external threads (50), means (32, 38) being provided to prevent rotation of said sleeve (28) within said annular body (14),
said locking ring (62) is carried by said external sleeve shoulder (40),
said annular body (14) has a lower end with a lower outer tapered surface (64) which tapers upwardly and outwardly, and said connector includes an actuator ring (30) threaded onto said sleeve external threads (50) and engaging said annular body internal shoulder (56), the arrangement being such that, in use, when said body shoulder (16) is landed on a wellhead housing seat (18), rotation of said actuator ring (30) raises said sleeve (28) to raise said locking ring (62) into surrounding relationship to the lower end of the annular body and thus wedge said locking ring (62) outward to set said locking ring (62) into said housing internal groove (74), continued rotation of said actuator ring (30) then tensioning said sleeve (28) to preload the engagement between said wellhead housing seat (18) and said body shoulder (16).

2. A subsea wellhead according to claim 1 including sealing means (22,24) carried by said body (14) for providing a high pressure gasket seal against a sealing surface (18) of the wellhead housing (20) when said connector is secured.

3. A subsea wellhead according to claim 2 wherein said sealing means includes:
at least one groove (22) in said exterior shoulder (16) of said body (14), and
a high pressure sealing gasket (24) positioned within said groove (22).

4. A subsea wellhead according to claim 1 wherein said rotation preventing means includes
at least one pin (32) mounted in a slot (38) within said annular body (14) which pin extends axially therein and has its other end secured within said sleeve (28).

5. A subsea wellhead according to any preceding claim including means (58,60) securing said actuating ring (30) within said annular body (14) and against said internal body shoulder (56).

6. A subsea wellhead according to any preceding claim, wherein said wellhead housing seat (18) and said external body shoulder (16) are tapered downwardly and inwardly and including gasket means (24) positioned to provide a high pressure seal between said housing seat (18) and said body shoulder (16).

7. A subsea wellhead according to claim 6, wherein said locking ring is a split locking ring (62) having an internal tapered surface and said annular body (14) has a tapered surface (64) on its lower end which coacts with the locking ring tapered surface to wedge the locking ring (62) outward into engagement with said groove (74).

Patentansprüche

1. Unterwasserbohrkopf umfassend ein Bohrkopfgehäuse, das ein abgeschrägtes Auflager (18) und eine interne Rille (74) unter dem Auflager (18) aufweist, einen Verbinder, der einen ringförmigen Körper (14) umfaßt, welcher eine Schulter (16) zum Aufliegen auf dem abgeschrägten Auflager (18) des Bohrkopfgehäuses aufweist, ein Sperring (62) zum Eingriff in die Rille (74) und eine Hülse (28), welche relativ zu dem ringförmigen Körper (14) angehoben werden kann, damit der Sperring (62) sich in eine Stellung bewegt, wo er in die Rille (74) eingreift, **dadurch gekennzeichnet,**
daß die Körperschulter (16) eine externe nach unten gewendete Schulter (16) ist, die so bemessen ist, daß sie auf dem Gehäuseauflager (18) aufzulegen ist und wobei der Körper eine interne aufwärts gewendete Schulter (56) aufweist,
daß die Hülse (28) innerhalb des ringförmigen Körpers (14) angeordnet ist und eine externe aufwärts gewendete Schulter (40) und ein oberes externes Gewinde (50) aufweist, wobei eine Einrichtung (32, 38) vorgesehen ist, um die Drehung der Hülse (28) innerhalb des ringförmigen Körpers (14) zu verhindern,
daß der Sperring (62) durch die externe Hülsenschulter (40) getragen wird, der ringförmige Körper (14) ein unteres Ende mit einer unteren außen abgeschrägten Fläche (64) aufweist, welche aufwärts und auswärts abgeschrägt ist, und wobei der Verbinder einen Betätigungsring (30) umfaßt, der auf dem externen Schultergewinde (50) geschraubt ist und die interne Schulter (56) des ringförmigen Körpers eingreift, wobei die Anordnung so ist, daß beim Gebrauch, wenn die Körperschulter (16) auf den Bohrgehäuseauflager (18) liegt, eine Drehung des Betätigungsrings (30) die Hülse (28) anhebt, um den Sperring (62) anzuheben in eine umgebende Beziehung zu dem unteren Ende des ringförmigen Körpers und dadurch den Sperring (62) nach außen verkeilt, um den Sperring (62) in die interne Gehäuserille (74) zu bringen, und fortgesetzte Drehung des Betätigungsringes (30) die Hülle (28) spannt, um den Eingriff zwischen dem Bohrkopfgehäuseauflager (18) und der Körperschulter (16) vorzubelasten.

2. Unterbohrkopf gemäß Anspruch 1, der Dichtmittel (22, 24) einschließt, die durch den Körper (14) getragen werden, zum Liefern einer Hochdruckdichtung gegen eine Dichtfläche (18) des Bohrkopfgehäuses (20) wenn der Verbinder befestigt wird.

3. Unterwasserbohrkopf gemäß Anspruch 2, worin die Dichtmittel umfassen:
mindestens eine Rille (22) in der äußeren Schulter(16) des Körpers (14) und
eine Hochdruckdichtung (24), die in der Rille (22) angeordnet ist.

4. Unterwasserbohrkopf nach Anspruch 1, worin die Drehverhinderungseinrichtung umfaßt:
mindestens ein Stift (32) der in eine Aufnahme (38) innerhalb des ringförmigen Körpers vorgesehen ist, wobei der Stift sich axial darin erstreckt und sein anderes Ende in der Hülse (28) befestigt ist.

5. Unterwasserbohrkopf nach einem der vorangegangenen Ansprüche mit einer Einrichtung (58, 60), welche den Betätigungsring (30) innerhalb des ringförmigen Körpers (14) und gegen die interne Körperschulter (56) hält.

6. Unterwasserbohrkopf nach einem der vorangegangenen Ansprüche, worin ein Bohrkopfgehäuseauflager (18) und eine externe Körperschulter (16) nach unten und innen abgeschrägt sind und Dichtmittel (24) umfaßt, die vorgesehen sind, um eine Hochdruckdichtung zwischen dem Gehäuseauflager (18) und der Körperschulter (16) zu liefern.

7. Unterwasserbohrkopf nach Anspruch 6, worin der Sperring ein Spaltsperring (62) ist, der eine interne abgeschrägte Fläche aufweist und wobei der ringförmige Körper (14) eine abge-

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schrägte Fläche (64) an seinem unteren Ende aufweist, welche mit der abgeschrägten Fläche des Sperrings zusammen wirkt, um den Sperring (62) außwärts in Eingriff mit der Rille (74) zu verkeilen.

Revendications

1. Tête de puits sous-marine comprenant un boîtier (20) de tête de puits ayant un siège supérieur tronconique (18) et une gorge interne (74) placée sous le siège (18), un raccord intermédiaire comprenant un corps annulaire (14) ayant un épaulement (16) d'appui sur le siège tronconique (18) du boîtier de la tête de puits, une bague de blocage (62) destinée à coopérer avec la gorge (74), et un manchon (28) qui peut être soulevé par rapport au corps annulaire (14) afin que la bague de blocage (62) se déplace vers une position dans laquelle elle peut coopérer avec la gorge (74), caractérisée en ce que l'épaulement (16) du corps est un épaulement externe (16) tourné vers le bas et ayant une dimension telle qu'il peut s'appliquer sur le siège (18) du boîtier et le corps possède un épaulement interne (56) tourné vers le haut,

   le manchon (28) est positionné dans le corps annulaire (14) et a un épaulement externe (40) tourné vers le haut et des filets supérieurs externes (50), un dispositif (32, 38) étant destiné à empêcher la rotation du manchon (28) à l'intérieur du corps annulaire (14),

   la bague de blocage (62) est supportée par l'épaulement externe (40) du manchon,

   le corps annulaire (14) a une extrémité inférieure ayant une surface tronconique externe inférieure (64) qui est tournée vers le haut et vers l'extérieur, et le raccord comporte une bague de manoeuvre (30) vissée sur les filets externes (50) du manchon et placée au contact de l'épaulement interne annulaire (56) du corps, la disposition étant telle que, pendant l'utilisation, lorsque l'épaulement (16) du corps est appliqué sur le siège (18) du boîtier de la tête de puits, la rotation de la bague de manoeuvre (30) soulève le manchon (28) afin que la bague de blocage (62) soit soulevée autour de l'extrémité inférieure du corps annulaire et coince ainsi la bague de blocage (62) à l'extérieur de manière que la bague de blocage (62) soit logée dans la gorge interne (74) du boîtier, la poursuite de la rotation de la bague de manoeuvre (30) créant une tension dans le manchon (28) afin que la coopération entre le siège (18) du boîtier de tête de puits et l'épaulement (16) du corps soit soumise à une charge préalable.

2. Tête de puits sous-marine selon la revendication 1, comprenant un dispositif d'étanchéité (22, 24) porté par le corps (14) et destiné à former un joint d'étanchéité à garniture sous pression élevée contre une surface d'étanchéité (18) du boîtier (20) de tête de puits lorsque le raccord est fixé.

3. Tête de puits sous-marine selon la revendication 2, dans laquelle le dispositif d'étanchéité comporte :

   au moins une gorge (22) formée dans l'épaulement externe (16) du corps (14), et

   une garniture (24) d'étanchéité sous pression élevée, disposée à l'intérieur de la gorge (22).

4. Tête de puits sous-marine selon la revendication 1, dans laquelle le dispositif destiné à empêcher la rotation comporte au moins une broche (32) montée dans une fente (38) du corps annulaire (14), la broche étant disposée axialement dans la fente et son autre extrémité étant fixée à l'intérieur du manchon (28).

5. Tête de puits sous-marine selon l'une quelconque des revendications précédentes, comprenant un dispositif (58, 60) de fixation de la bague de manoeuvre (30) à l'intérieur du corps annulaire (14) et contre l'épaulement interne (56) du corps.

6. Tête de puits sous-marine selon l'une quelconque des revendications précédentes, dans laquelle le siège (18) du boîtier de la tête de puits et l'épaulement externe (16) du corps ont une forme tronconique dirigée vers le bas et l'intérieur, et comprenant

   un dispositif (24) à garniture disposé afin qu'il forme un joint d'étanchéité sous pression élevée entre le siège (18) du boîtier et l'épaulement (16) du corps.

7. Tête de puits sous-marine selon la revendication 6, dans laquelle la bague de blocage est une bague fendue (62) de blocage ayant une surface tronconique interne et le corps annulaire (14) a une surface tronconique (64) placée à son extrémité inférieure et qui coopère avec la surface tronconique de la bague de blocage de manière que la bague de blocage (62) soit coincée vers l'extérieur au contact de la gorge (74).