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PRESSURE-COMPENSATED FLOW SHUT-OFF SLEEVE FOR WELLHEAD AND SUBSEA WELL ASSEMBLY INCLUDING SAME

FIELD OF THE INVENTION

The present invention relates generally to flow shut-off sleeves for use in oil and gas wells, and more particularly to a flow shut-off sleeve that can provide pressure-compensated shut-off for a surface or subsea wellhead.

BACKGROUND

A common offshore technique involves drilling a first section of the hole and installing conductor pipe, or jetting in the conductor pipe, with an external wellhead housing at the upper end. The external wellhead housing will be located approximately at the sea floor. Then, the operator drills the well to a second depth and installs a first section of casing. An internal or high-pressure wellhead housing is usually located at the upper end of the first string of casing. This first string of casing will be cemented in the well, with cement returns flowing up around the casing, through the conductor pipe and out flow ports located in the external wellhead housing. These flow ports remain open after cementing.

The operator retrieves the running tool for the internal wellhead housing and connects a drilling riser and blowout preventer to the internal wellhead housing. The operator will then drill the well to greater depths and normally install at least two more strings of casing. Each string of casing has a casing hanger at its upper end which will land and seal in the internal wellhead housing.

As shown in Figures 7A and 7B, in some areas, the conventional technique described above is not satisfactory. For example, one area in the Gulf of Mexico has an over pressured sand formation 700 approximately 500-1000 feet below the sea bed 702. This formation has a pressure that is higher than the pressure at the sea floor by approximately 50-250 pounds per square inch (psi). When drilled into, the formation 708 tends to wash out, with water and sand flowing upward 704 to the sea floor 702. If the shallow water flow 704 is not contained, structural integrity of the conductor pipe 706 will be compromised.

Various techniques have been employed to overcome the shallow water flow problem. A cement is available that is of a foaming-type that can be employed to retard washout. U.S. Pat. No. 5,184,686 discloses a system for avoiding washout. However, that system requires using two different size drilling risers at various stages of the drilling. This makes the technique very expensive.

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In another prior art system, as shown, for example, in Figures 1 and 2 of U.S. Pat. No. 5,660,234, incorporated by reference herein, an external wellhead housing 19 has a number of flow ports 21. An external valve sleeve 23 mounts to the exterior of the external wellhead housing 19. The external valve sleeve 23 is axially movable between an open position (Figure 1 of U.S. Pat. No. 5,660,234) and a closed position (Figure 2 of U.S. Pat. No. 5,660,234), blocking flow through the flow ports 21. However, the external valve sleeve 23 is mounted to the exterior of the external wellhead housing 19 and the elastomer seal is exposed to increased wear and possible damage from cement returns and/or water flowing conditions, as shown by the damaged seal 125 in Figure 1A.

As shown, for example, in Figure 2 of U.S. Pat. No. 5,660,234, mud mat 11 is a type of a base that locates on the sea floor 12. The well may be jetted to a first depth, normally a few hundred feet, and conductor pipe 13 installed. The conductor pipe 13, normally about 36 inches in diameter, may be installed in a conventional manner. The mud mat 11 may be carried to the sea floor 12 as the conductor pipe 13 is installed. The conductor pipe 13 is supported on the mud mat 11 by a landing sub 15. The landing sub 15 is a tubular member that latches into the mud mat 11 and is connected into the conductor pipe 13.

The conductor pipe 13 has an extension 17 that extends above the landing sub 15 a few feet to support an external or low-pressure wellhead housing 19. The external wellhead housing 19 is a large tubular member having a plurality of flow ports 21 spaced around its circumference. An external valve sleeve 23 mounts slidably to the exterior of the external wellhead housing 19. The external valve sleeve 23 has seals 24 and may move between an open position, as shown in Figure 2 of U.S. Pat. No. 5,660,234, to a closed position, as shown in Figure 3 of U.S. Pat. No. 5,660,234. When moved downward to the closed position, the external valve sleeve 23 will block any flow through the flow ports 21. The external valve sleeve 23 may be in the open position initially.

After the installation of the external wellhead housing 19, the drilling rig at the surface of the sea may drill the well to a second depth. This second depth will stop a short distance above water-producing formation 25, for example, about 200 feet. The water-producing formation 25 is a loose, unconsolidated sand formation that produces water and has a formation pressure that is about 50-250 pounds per square inch (psi) greater than the pressure at the sea floor 12. Without precautions, water and sand from the water-producing formation 25 will flow up the well to the sea floor 12 and wash out the well

to a very large diameter. Consequently, the operator will terminate drilling the second phase of the well at a point above the water-producing formation 25.

The operator then installs a first string of casing 27. In one exemplary embodiment, the casing 27 is 26 or 28 inches in diameter and is supported by a scab hanger 29 at its upper end. The operator cements the casing 27 in place, as indicated by numeral 31. The cementing operation is conventional. While pumping cement, the operator may position the scab hanger 29 a short distance above its landing profile to allow cement returns to flow up and out the flow ports 21. The operator may land and seal the scab hanger 29 in an internal profile in the landing sub 15 below the external wellhead housing 19. A split ring 30 on the scab hanger 29 latches into a groove in the landing sub 15 to retain the scab hanger 29 to the landing sub 15. The split ring 30 is released to snap into the groove by the running tool (not shown in U.S. Pat. No. 5,660,234) for the scab hanger 29. An annulus seal is installed between the scab hanger 29 and the landing sub 15.

After the cement has set, the operator then drills a pilot hole (not shown in U.S. Pat. No. 5,660,234) through the water-producing formation 25, terminating a short distance below the water-producing formation 25. The pilot hole may be about 12.25 inches in diameter, and known drilling fluid additives may be employed to retard washout in the water-producing formation 25. After drilling, the operator swabs the pilot hole with a foaming-type cement. The foaming-type cement permeates the loose sand, creating a hardened mud cake annulus in the well to retard washout. The operator then reams out this third section of the well to approximately 23 to 26 inches in diameter.

The third hole section is indicated by numeral 33. It is large enough to accept a second string of casing 35 which is preferably about 20 inches in diameter. The second string of casing 35 has an internal or high-pressure wellhead housing 37 at its upper end. The internal wellhead housing 37 is of a conventional type and inserts within the external wellhead housing 19 generally as shown in U.S. Pat. No. 5,029,647, July 19, 1991. The external valve sleeve 23 is mounted to the exterior of the external wellhead housing 19 and may be exposed to increased wear and damage during cementing operations. Furthermore, the external valve sleeve 23 is mounted to the exterior of the external wellhead housing 19 throughout the drilling operations that lead up to the installation and landing of the internal wellhead housing 37, and may become closed inadvertently during those or other prior drilling operations.

In still another prior art system, as shown in Figures 1 and 2, a high-pressure wellhead housing 119 has a number of flow ports 121. An internal valve sleeve 123 mounts to the exterior of the high-pressure wellhead housing 119, between the exterior of the high-pressure wellhead housing 119 and an interior surface of a conductor housing 130 attached to a conductor pipe 118. The internal valve sleeve 123 is axially movable between an open position (Figure 1), which permits flow, indicated by arrows 143, through the flow ports 121, and a closed position (Figure 2), blocking the flow 143 through the flow ports 121, causing a pressure uplift and/or buildup, indicated by arrows 243.

For example, a running tool 139 (shown in phantom) may cause a skirt 141 (shown in phantom) to press down on an ear 129 of an actuator sleeve 128, causing the actuator sleeve 128 to actuate an actuator rod 127, causing the internal valve sleeve 123, along with associated seals 125 and 126, to move axially from the open position, as shown in Figure 1, which permits the flow 143 through the flow ports 121, to the closed position, as shown in Figure 2, which blocks the flow 143 through the flow ports 121, causing the pressure uplift 243.

After the internal valve sleeve 123 has closed the flow ports 121, the operator may retrieve the running tool 139 and, as shown in Figure 2, connect a drilling riser 245 that includes a blowout preventer. The operator may then drill the well to greater depths, installing additional strings of casing. These strings of casing may be supported and sealed by casing hangers that land conventionally within the high-pressure wellhead housing 119. However, the internal valve sleeve 123 is not pressure-compensated and/or pressure-balanced and may be exposed to pressure uplift 243 when in the closed position, possibly leading to ratchet failure and/or flow 143 through the flow ports 121, potentially causing detrimental well washout. Similar problems are believed to arise with the internal valve sleeve assembly available from FMC Subsea Drilling System as the Rigid-Lock Annulus Seal Assembly.

SUMMARY

The present invention is directed to a pressure-compensated flow shut-off sleeve assembly that overcomes or at least minimizes some of the drawbacks of prior art valve sleeves.

In one illustrative embodiment, a flow shut-off sleeve assembly adapted to be coupled to a subsea wellhead housing disposed within a conductor housing, which opens and closes

at least one flow port in the conductor housing to annular fluid flow is provided. As used herein, the terms "couple," "couples," "coupled" or the like, are intended to mean either indirect or direct connection. Thus, if a first device "couples" to a second device, that connection may be through a direct connection or through an indirect connection via other devices or connectors. The flow shut-off sleeve assembly includes an internal annular flow shut-off sleeve disposed around an exterior portion of the subsea wellhead housing and an external annular flow shut-off sleeve disposed around an exterior portion of the internal annular flow shut-off sleeve. The external annular flow shut-off sleeve is movable axially relative to the internal annular flow shut-off sleeve between an open position wherein the at least one flow port is open to annular fluid flow and a closed position, wherein the at least one flow port is closed to annular fluid flow.

The internal annular flow shut-off sleeve may include at least one first opening disposed therein and the external annular flow shut-off sleeve may include at lest one second opening disposed therein. In the open position, the at least one first opening of the internal annular flow shut-off sleeve is substantially aligned with the at least one second opening of the external annular flow shut-off sleeve. In the closed position, the at least one first opening of the internal annular flow shut-off sleeve is substantially nonaligned with the at least one second opening of the external annular flow shut-off sleeve. A shearable attachment, which secures the internal annular flow shut-off sleeve to the external annular flow shut-off sleeve temporarily in the open position, may also be provided. The shearable attachment hold the flow shut-off sleeves in the open position during landing. At least one shear screw may be provided to substantially permanently secure the internal annular flow shut-off sleeve to the external annular flow shut-off sleeve after annular fluid has passed through the at least one flow port and the flow shut-off sleeves have been moved to the closed position.

In another illustrative embodiment, a subsea well assembly including the flow shut-off sleeve according to the present invention is provided. The subsea well assembly includes a subsea wellhead housing coupled to a string of casing extending through a string of conductor pipe. The conductor pipe is coupled to a conductor housing. The conductor housing has a sidewall including at least one flow port and a support profile. The support profile supports the subsea wellhead housing and the string of casing. The subsea well assembly further includes the flow shut-off sleeve assembly according to the present

invention. The internal annular flow shut-off sleeve of the assembly is disposed around an exterior portion of the subsea wellhead housing.

BRIEF DESCRIPTION OF THE DRAWINGS

A complete understanding of the present disclosure and advantages thereof may be acquired by referring to the following description taken in conjunction with the accompanying drawings, in which the leftmost significant digit(s) in the reference numerals denote(s) the first figure in which the respective reference numerals appear, wherein:

Figure 1 schematically illustrates a longitudinal sectional view of a conventional subsea wellhead system showing the landing of a high-pressure wellhead housing, with flow ports open and internal valve sleeve in an open position.

Figure 1A is an enlarged view of the external valve sleeve and damaged elastomer seal shown in Figure 1.

Figure 2 schematically illustrates another longitudinal sectional view of the conventional subsea wellhead system of Figure 1, with flow ports closed and the internal valve sleeve in a closed position.

Figure 3 schematically illustrates a longitudinal sectional view of a subsea wellhead system according to various embodiments of a method and a device of the present invention, showing the landing of a high-pressure wellhead housing, with flow ports open and an internal annular flow shut-off sleeve and an external annular flow shut-off sleeve in an open position.

Figure 4 schematically illustrates another longitudinal sectional view of the subsea wellhead system of Figure 3, after landing and installation of the high-pressure wellhead housing, with the flow ports open and the internal and external annular flow shut-off sleeves in an open position.

Figure 5 schematically illustrates another longitudinal sectional view of the subsea wellhead system of Figures 3 and 4, with flow ports closed and the internal and external annular flow shut-off sleeves in a closed position.

Figure 6 schematically illustrates another longitudinal sectional view of the subsea wellhead system of Figure 3, after landing and installation of the high-pressure wellhead housing, with the flow ports permanently open and the internal and external annular flow shut-off sleeves in a permanently open and/or disabled position.

Figures 7A and 7B illustrates the phenomenon of washout that can occur in over pressured sand formations.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Illustrative embodiments of the invention are described in detail below. In the interest of clarity, not all features of an actual implementation are described in this specification. It will of course be appreciated that in the development of any such actual embodiment, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill in the art having the benefit of this disclosure.

The details of the present invention will now be described with reference to the figures. As shown in Figure 3, a running tool 339 (shown in phantom) may be employed to apply a large axial force to install a high-pressure internal wellhead housing 319 secured to a string of casing 320 extending through a string of conductor pipe 318 attached to a conductor housing 330. The conductor housing 330 may have a sidewall 331 including a plurality of flow ports 321 and a support profile 340, the support profile 340, for example, supporting a support element 335 secured to an exterior portion of the subsea high-pressure wellhead housing 319, thereby supporting the subsea high-pressure wellhead housing 319 and the string of casing 320. In various illustrative embodiments, the size of the flow ports 321 may be in a range of about 3 inches to about 4 inches in diameter. In various exemplary illustrative embodiments, the size of the flow ports 321 may be about 3.5 inches in diameter.

An internal annular flow shut-off sleeve 324 may be secured to an exterior portion of the subsea high-pressure wellhead housing 319. The internal annular flow shut-off sleeve 324 may have a plurality of first openings 350 disposed therein. In various illustrative embodiments, the size of the first openings 350 may be in a range of about 1 inch to about 2.5 inches in diameter. In various exemplary illustrative embodiments, the size of the first openings 350 may be about 1.25 inches in diameter.

An external annular flow shut-off sleeve 323 may be releasably mounted to an exterior portion of the internal annular flow shut-off sleeve 324. In various illustrative

embodiments, the external annular flow shut-off sleeve 323 may be releasably mounted to an exterior portion of the internal annular flow shut-off sleeve 324 with at least one shearable attachment 322 to the exterior portion of the internal annular flow shut-off sleeve 324. The shearable attachment 322 may include one or more shear pins and/or shear screws, each capable of shearing at about 2255 pounds (lbs) of force, for example. In various illustrative embodiments, for example, the shearable attachment 322 may include a sufficient number of shear pins and/or shear screws to be able to withstand a total shearing force of up to about 50,000 pounds (lbs). In various exemplary illustrative embodiments, the shearable attachment 322 may include about six shear pins and/or shear screws, each capable of shearing at about 2255 pounds (lbs) of force, requiring a total shearing force of about 13,530 pounds (lbs), for example.

The external annular flow shut-off sleeve 323 may have a plurality of second openings 355 disposed therein. In various illustrative embodiments, the size of the second openings 355 disposed in the external annular flow shut-off sleeve 323 may be substantially the same, or substantially similar to, the size of the first openings 350 disposed in the internal annular flow shut-off sleeve 324. In various illustrative embodiments, the size of both the first and second openings 350 and 355, respectively, may be in a range of about 1 inch to about 2.5 inches in diameter. In various exemplary illustrative embodiments, the size of both the first and second openings 350 and 355, respectively, may be about 1.25 inches in diameter.

The external annular flow shut-off sleeve 323 may be movable axially relative to the internal annular flow shut-off sleeve 324, the subsea high-pressure wellhead housing 319, and the conductor pipe sidewall 331 between an open position, as shown in Figure 4, wherein the plurality of first openings 350 of the internal annular flow shut-off sleeve 324 are substantially aligned with the plurality of second openings 355 of the external annular flow shut-off sleeve 323, exposing the plurality of flow ports 321, and a closed position, as shown in Figure 5, wherein the plurality of first openings 350 of the internal annular flow shut-off sleeve 324 are not substantially aligned with the plurality of second openings 355 of the external annular flow shut-off sleeve 323, closing the plurality of flow ports 321.

For example, as shown in Figure 4, the running tool 339 (shown in phantom) may cause a skirt 441 (shown in phantom) to press down on an ear 429 of an actuator sleeve 428, causing the actuator sleeve 428 to actuate an actuator rod 427, causing the external annular

flow shut-off sleeve 323 to move axially from the open position, which permits flow, indicated by arrows 443, through the substantially aligned pluralities of first and second openings 350 and 355, respectively, and through the flow ports 421, to the closed position, as shown in Figure 5, which blocks the flow 443 through the substantially nonaligned pluralities of first and second openings 350 and 355, respectively, and through the flow ports 421, causing a pressure buildup or uplift, indicated by arrows 543. The sealing of the first plurality of openings 350 of the internal annular flow shut-off sleeve is furthered by associated seals 425 and 426, disposed between in the internal annular flow shut-off sleeve 324 and the external annular flow shut-off sleeve 323 adjacent the first plurality of openings 350. In various illustrative embodiments, for example, O-rings may be used for the seals 425 and/or 426. The associated seals 425 and 426 are disposed above and below the first and second plurality of openings 350 and 355 on a same diameter of the internal annular flow shut-off sleeve 324. The external annular flow shut-off sleeve 323 is adapted to slide axially over the pair of seals 425 and 426 to close off flow through the first and second plurality of openings 350 and 355. The associated seals 425 and 426 are pressure balanced.

The closed position, as shown in Figure 5, provides a pressure-compensated and/or pressure-balanced flow shut-off sleeve and assembly for use with a subsea and/or subsurface wellhead. As long as the first and second openings 350 and 355 are substantially the same size and/or similar in size, the closed position, as shown in Figure 5, provides a pressure-compensated and/or pressure-balanced flow shut-off sleeve and assembly for use with a subsea and/or subsurface wellhead, capable of resisting the pressure uplift 543.

The external annular flow shut-off sleeve 323 may be capable of being secured in a substantially permanently open position, as shown in Figure 6, substantially permanently exposing the plurality of flow ports 321. For example, in various illustrative embodiments, the external annular flow shut-off sleeve 323 may be secured in a substantially permanently open position by unfastening and/or shearing the shearable attachment 322 to the exterior portion of the internal annular flow shut-off sleeve 324 and lowering the external annular flow shut-off sleeve 323 to a docking station 600 and locking in place with one or more shear screws 622. Note that this arrangement allows access to, and replacement if needed, of the seals 425 and 426, which may be, for example, O-rings, in various illustrative embodiments, as described above. This arrangement further allows removal of the shear

screw or shear pin fragment left after the shearable attachment 322 to the exterior portion of the internal annular flow shut-off sleeve 324 has been sheared.

After the internal and external annular flow shut-off sleeves 324 and 323, respectively, have closed the flow ports 321, the operator may retrieve the running tool 339 and, as shown in Figure 5, connect a drilling riser 545 (shown in phantom) that includes a blowout preventer. The operator may then drill the well to greater depths, installing additional strings of casing (not shown). These strings of casing may be supported and sealed by casing hangers that land conventionally within the high-pressure wellhead housing 319. Here, unlike with various prior art systems, since the assembly of the internal and external annular flow shut-off sleeves 324 and 323, respectively, is pressure-compensated and/or pressure-balanced, even though the assembly of the internal and external annular flow shut-off sleeves 324 and 323, respectively, may be exposed to pressure uplift 543 when in the closed position, there is much less chance of a ratchet failure and/or return of the flow 443 through the flow ports 321, substantially reducing the possibility of potentially causing a detrimental well washout.

Furthermore, the assembly of the internal and external annular flow shut-off sleeves 324 and 323, respectively, is not mounted to the interior sidewall 331 of the conductor housing 330 throughout the drilling operations that lead up to the installation and landing of the high-pressure wellhead housing 319, and, thus, cannot become closed inadvertently during those or other prior drilling operations, unlike with various prior art systems. Rather, the assembly of the internal and external annular flow shut-off sleeves 324 and 323, respectively, is mounted to an exterior portion of the high-pressure wellhead housing 319 and is, therefore, advantageously installed and landed when the high-pressure wellhead housing 319 is installed and landed.

In various alternative illustrative embodiments, an internal annular flow shut-off sleeve without any openings therein (not shown) may be mounted to a portion of the interior sidewall 331 of the conductor housing 330. Such an internal annular flow shut-off sleeve without any openings therein may be axially movable between an open position (not shown), allowing flow through the flow ports 321, and a closed position (not shown), blocking flow through the flow ports 321. Such an internal annular flow shut-off sleeve, without any openings therein, mounted to a portion of the interior sidewall 331 of the conductor

housing 330, advantageously would not be exposed to increased wear and damage from cementing returns.

Therefore the present invention are well adapted to carry out the objects and attain the ends and advantages mentioned, as well as those that are inherent therein. While the present invention has been depicted, described, and defined by reference to exemplary embodiments of the present invention, such a reference does not imply any limitation of the present invention, and no such limitation is to be inferred. The present invention is capable of considerable modification, alteration, and equivalency in form and function as will occur to those of ordinary skill in the pertinent arts having the benefit of this disclosure. The depicted and described illustrative embodiments of the present invention are exemplary only and are not exhaustive of the scope of the present invention. Consequently, the present invention is intended to be limited only by the spirit and scope of the appended claims, giving full cognizance to equivalents in all respects.

The particular embodiments disclosed above are illustrative only, as the present invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the present invention. Accordingly, the protection sought herein is as set forth in the claims below.

Claims:

1. A flow shut-off sleeve assembly comprising:

an internal annular flow shut-off sleeve adapted to be disposed around an exterior portion of a subsea wellhead housing;

an external annular flow shut-off sleeve disposed around an exterior portion of the internal annular flow shut-off sleeve, the external annular flow shut-off sleeve movable axially relative to the internal annular flow shut-off sleeve between an open position and a closed position; and

an actuator means adapted to be coupled to a running tool and adapted to engage the external annular flow shut-off sleeve to cause it to move axially between the open position and the closed position,

wherein in use the assembly is coupled to a subsea wellhead housing disposed within a conductor housing having at least one flow port such that the at least one flow port is opened to annular fluid flow when the external annular flow shut-off sleeve is in the open position and the at least one flow port is closed to annular fluid flow when the external annular flow shut-off sleeve is in the closed position.

2. A flow shut-off sleeve assembly according to claim 1, wherein the internal annular flow shut-off sleeve comprises at least one first opening disposed therein and the external annular flow shut-off sleeve comprises at least one second opening disposed therein.

3. A flow shut-off sleeve assembly according to claim 2, wherein the at least one first opening of the internal annular flow shut-off sleeve is substantially aligned with the at least one second opening of the external annular flow shut-off sleeve in the open position, and wherein the at least one first opening of the internal annular flow shut-off sleeve is substantially non-aligned with the at least one second opening of the external annular flow shut-off sleeve in the closed position.

4. A flow shut-off sleeve assembly according to claim 2, wherein the external annular flow shut-off sleeve is capable of being secured in a substantially

permanently open position, wherein the at least one first opening of the internal annular flow shut-off sleeve is substantially aligned with the at least one second opening of the external annular flow shut-off sleeve.

5. A flow shut-off sleeve assembly according to claim 4, wherein the external annular flow shut-off sleeve is secured to the internal annular flow shut-off sleeve by at least one shear screw.

6. A flow shut-off assembly according to any preceding claim, further comprising a pair of seals disposed between the internal annular flow shut-off sleeve and the external annular flow shut-off sleeve, wherein one of the pair of seals is disposed above the at least one first opening and the other of the pair of seals is disposed below the at least one first opening.

7. A flow shut-off sleeve assembly according to claim 6, wherein the pair of seals comprises a pair of O-rings.

8. A flow shut-off sleeve assembly according to any preceding claim, further comprising a shearable attachment, which secures the external annular flow shut-off sleeve to the internal annular flow shut-off sleeve in a temporary open position.

9. A flow shut-off sleeve assembly according to claim 1, wherein the actuator means comprises an actuator sleeve having an ear which is engaged by a skirt of the running tool and an actuator rod coupled to the actuator sleeve, which engages the external annular flow shut-off sleeve.

10. A subsea well assembly comprising:

a subsea wellhead housing coupled to a string of casing extending through a string of conductor pipe, the conductor pipe coupled to a conductor housing, the conductor housing having a sidewall including at least one flow port and a support profile, the support profile supporting the subsea wellhead housing and the string of casing; and

a flow shut-off sleeve assembly according to claim 1, wherein the flow shut-off sleeve assembly is coupled to the subsea wellhead housing.

11. A subsea well assembly according to claim 10, wherein the internal annular flow shut-off sleeve comprises at least one first opening disposed therein and the external annular flow shut-off sleeve comprises at least one second opening disposed therein.

12. A subsea well assembly according to claim 11, wherein the at least one first opening of the internal annular flow shut-off sleeve is substantially aligned with the at least one second opening of the external annular flow shut-off sleeve in the open position, and wherein the at least one first opening of the internal annular flow shut-off sleeve is substantially non-aligned with the at least one second opening of the external annular flow shut-off sleeve in the closed position.

13. A subsea well assembly according to claim 11, wherein the external annular flow shut-off sleeve is capable of being secured in a substantially permanently open position, wherein the at least one first opening of the internal annular flow shut-off sleeve is substantially aligned with the at least one second opening of the external flow shut-off sleeve.

14. A subsea assembly according to claim 13, wherein the external annular flow shut-off sleeve is secured to the internal annular flow shut-off sleeve by at least one shear screw.

15. A subsea well assembly according to any of claims 10-14, further comprising a pair of seals disposed between the internal annular flow shut-off sleeve and the external annular flow shut-off sleeve, wherein the pair of seals is disposed above and below the at least one first and second openings on a same diameter of the internal annular flow shut-off sleeve and wherein the external annular flow shut-off

sleeve is adapted to slide axially over the pair of seals to close off flow through the at least one first and second openings.

16. A subsea well assembly according to claim 15, wherein the pair of seals comprises a pair of O-rings disposed on the same diameter of the internal annular flow shut-off sleeve so as to make the pair of O-rings pressure balanced.

17. A subsea well assembly according to any of claims 10-16, further comprising a shearable attachment, which secures the external annular flow shut-off sleeve to the internal annular flow shut-off sleeve in a temporary open position.

18. A subsea well assembly according to any of claims 10-17, further comprising an actuator means adapted to be coupled to a running tool and adapted to engage the external flow shut-off sleeve to cause it to move axially between the open position and the closed position.

19. A subsea well assembly according to claim 18, wherein the actuator means comprises an actuator sleeve having an ear which is engaged by a skirt of the running tool and an actuator rod coupled to the actuator sleeve, which engages the external annular flow shut-off sleeve.