FLOW MODULE PLACEMENT BETWEEN A SUBSEA TREE AND A TUBING HANGER SPOOL

A subsea wellhead assembly positions a flow module between an outboard flowline of a subsea tree and a tubing hanger spool flowline. The subsea production assembly includes a wellhead, a tubing hanger spool disposed on the wellhead, and a subsea tree disposed on the tubing hanger spool. Production fluid may flow from the wellhead through the tubing hanger spool, and then through the tree. A tubing hanger spool frame mounts to and extends laterally from the tubing hanger spool and supports a downstream flowline having an upward facing hub. A tree frame mounts to and extends laterally from the subsea tree and supports an upstream flowline having an upward facing hub. A flow module having downward facing flowlines that couple to the hubs so that the weight of the flow module is distributed between the frames of the tubing hanger spool and the subsea tree.
FLOW MODULE PLACEMENT BETWEEN A SUBSEA TREE AND A TUBING HANGER SPOOL

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

This invention relates in general to subsea production apparatus and, in particular, to an improved flow module placement between a subsea tree and a tubing hanger spool.

[0002] 2. Brief Description of Related Art

A conventional subsea wellhead assembly includes a wellhead housing that supports one or more casing hangers located at upper ends of strings of casing extending into the well. A tubing hanger spool or “THS” is landed on the wellhead assembly. A production tree or “tree” is landed on the THS for controlling the production of well fluids. The tree usually carries a choke and valves to control the flow of well fluids and sensors to monitor the flow of well fluids.

[0003] The subsea tree will control the flow of hydrocarbons out of the wellhead, and direct the hydrocarbons to associated equipment, such as manifolds, flowlines, and the like for further operation. Subsea trees may have a flow module, such as a choke bridge module, manufactured as an integral component of the subsea tree and used to control fluid flow out from the tree to external components. Generally, these flow modules are installed along with the subsea tree, but positioned within the tree so that the flow module may be retrieved without having to retrieve the full tree. Portions of the tree, such as flow meters, or chokes that control the flow of hydrocarbons through the outboard flowlines, may wear and fatigue at rates faster than the remaining portions of the subsea tree. Using a flow module containing these components puts more of the retrievable portions of the tree on a recoverable module that allows you to retrieve those portions for repair without disturbing the well completion and associated barrier valves.

[0004] In some vertical tree installations, the subsea trees sit on top of a tubing hanger spool. An outboard flowline then runs from the flow module on the subsea tree to a tubing hanger spool flowline. The tubing hanger spool flowline then runs to external equipment such as a manifold or a facility. This outboard flowline from the flow module is generally quite long and must wind through the subsea tree in order to connect with the tubing hanger spool flowline. As a result, there is a significant pressure drop through the outboard flowline from the flow module. In addition, the longer outboard flowline from the flow module leads to a greater heat loss from the well fluid into the surrounding environment. This can lead to an increase in the viscosity of the well fluid. An increased well fluid viscosity necessitates additional work input to move the fluid through the outboard flowline from the flow module. Furthermore, the length of the outboard flowline from the flow module increases the total area from which leaks can form; thus the longer outboard flowline from the flow module increases the likelihood of leak development. The length of the outboard flowline from the flow module may also cause an increase in the cost of production. This results from both the increase in the amount of material needed to construct the line and the increased labor cost to construct the lengthy outboard flowline from the flow module. Thus, there is a need for an improved flow module placement between a subsea tree and a tubing hanger spool that overcomes these problems.

SUMMARY OF THE INVENTION

[0007] These and other problems are generally solved or circumvented, and technical advantages are generally achieved, by preferred embodiments of the present invention that provide an improved flow module placement between a subsea tree and a tubing hanger spool, and a method for the same.

[0008] In accordance with an embodiment of the present invention, a subsea production assembly is disclosed. The subsea production assembly includes a wellhead having an axis, and a tubing hanger spool disposed on the wellhead axially above the wellhead so that production fluid may flow from the wellhead through the tubing hanger spool. A tubing hanger spool frame mounts to and extends laterally from the tubing hanger spool. A downstream flowline having an upward facing hub is supported by the tubing hanger spool frame. The assembly includes a subsea tree disposed on the tubing hanger spool axially above the tubing hanger spool so that production fluid may flow from the tubing hanger spool through the tree. The tree has a frame tree mounted to and extending laterally from the subsea tree. An upstream flowline is supported by the tree frame and connected to the tree, the upstream flowline having an upward facing hub. The assembly includes a flow module having downward facing flowlines that couple to the hubs, such that flow from the tree passes in a flow path from the upstream flowline through the flow module and the downstream flowline. The weight of the flow module is distributed between the frame of the tubing hanger spool and the frame of the subsea tree.

[0009] In accordance with another embodiment of the present invention, another subsea production assembly is disclosed. The subsea production assembly includes a wellhead having an axis, and a tubing hanger spool disposed on the wellhead axially above the wellhead so that production fluid may flow from the wellhead through the tubing hanger spool. A tubing hanger spool frame mounts to and extends laterally from the tubing hanger spool. A downstream flowline having an upward facing hub is supported by the tubing hanger spool frame, the upward facing hub secured to the tubing hanger spool frame. A subsea tree is disposed on the tubing hanger spool axially above the tubing hanger spool so that production fluid may flow from the tubing hanger spool through the tree. A tree frame mounts to and extends laterally from the subsea tree. An upstream flowline is supported by the tree frame and connects to the tree, the upstream flowline having an upward facing hub secured to the tree frame. The assembly includes a choke bridge module having downward facing flowlines that couple to the hubs, such that flow from the tree passes in a flow path from the upstream flowline through the choke bridge module and the downstream flowline. The weight of the choke bridge module is distributed between the frame of the tubing hanger spool and the frame of the subsea tree. The hub of the downstream flowline is at a lower elevation than the hub of the upstream flowline. The tree frame includes a hub supporting portion that supports the hub of the upstream flowline that is at a higher elevation than, but not directly above, the tubing hanger spool frame. The tubing hanger spool frame includes a hub supporting portion that supports the hub of the downstream flowline and is at a lower elevation than, but not directly below, the tree frame. Any weight transferred to the upward facing hubs by the choke bridge module is further transferred to the tubing hanger spool frame and the subsea tree frame.
In accordance with yet another embodiment of the present invention, another subsea production assembly is disclosed. The subsea production assembly includes a wellhead having an axis, and a tubing hanger spool disposed on the wellhead axially above the wellhead so that production fluid may flow from the wellhead through the tubing hanger spool. A tubing hanger spool frame mounts to and extends laterally from the tubing hanger spool. A downstream flowline having a horizontally facing hub is supported by the tubing hanger spool frame, the horizontally facing hub secured to the tubing hanger spool frame. The assembly includes a subsea tree disposed on the tubing hanger spool axially above the tubing hanger spool so that production fluid may flow from the tubing hanger spool through the tree. A tree frame mounts to and extends laterally from the subsea tree. An upstream flowline is supported by the tree frame and connects to the tree, the upstream flowline having a horizontally facing hub secured to the tree frame. The downstream flowline horizontally facing hub and the upstream flowline horizontally facing hub are on opposite sides of and facing horizontally away from the tree. The assembly includes a choke bridge module having downward facing flowlines with horizontal terminations that couple to the hubs, such that fluid from the tree passes in a flow path from the upstream flowline through the choke bridge and the downstream flowline. The weight of the choke bridge module is distributed between the frame of the tubing hanger spool and the frame of the subsea tree. The hub of the downstream flowline is at a lower elevation than the hub of the upstream flowline. The tree frame includes a hub supporting portion that supports the hub of the upstream flowline that is at a higher elevation than, but not directly above, the tubing hanger spool frame. The tubing hanger spool frame includes a hub supporting portion that supports the hub of the downstream flowline and is at a lower elevation than, but not directly below, the tree frame. Any weight transferred to the horizontally facing hubs by the choke bridge module is further transferred to the tubing hanger spool frame and the subsea tree frame.

In accordance with still another embodiment of the present invention, a method for assembling a subsea production assembly is disclosed. The method begins by landing and setting a tubing hanger spool on a subsea wellhead, the tubing hanger spool including a tubing hanger spool flowline having a tubing hanger spool hub at a first location. The method then runs, lands, and sets a subsea tree on the tubing hanger spool, the subsea tree including a subsea tree flowline having a subsea tree hub located proximate to the first location. The method then runs, lands, and sets a flow module on the subsea tree and the tubing hanger spool, such that the weight of the flow module is partially supported by the subsea tree and partially supported by the tubing hanger spool.

An advantage of a preferred embodiment is a shorter flow path from the flow module to external production devices. This leads to a reduction in the pressure drop across the system, and a reduction in the amount of heat lost through the outboard flowlines. In addition, the shorter flowline provides fewer opportunities for leaks to occur. Still further, the disclosed embodiments allow for production of the subsea production assembly at a reduced cost. This arises as a result of the significant decrease in the amount of material needed to connect the flow module to the external production devices, and a decrease in the man-hours needed to construct the tree and flow module.

BRIEF DESCRIPTION OF THE DRAWINGS

So that the manner in which the features, advantages and objects of the invention, as well as others which will become apparent, are attained, and can be understood in more detail, more particular description of the invention briefly summarized above may be had by reference to the embodiments thereof which are illustrated in the appended drawings that form a part of this specification. It is to be noted, however, that the drawings illustrate only a preferred embodiment of the invention and are therefore not to be considered limiting of its scope as the invention may admit to other equally effective embodiments.

FIG. 1 is a schematic representation of an embodiment of the present invention.
FIG. 2 is a schematic top view representation of the embodiment of FIG. 1.
FIG. 3 is a schematic representation of an alternative embodiment of the present invention.
FIG. 4 is a schematic top view representation of the embodiment of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be described more fully hereinafter with reference to the accompanying drawings which illustrate embodiments of the invention. This invention may, however, be embodied in many different forms and should not be construed to be limited to the illustrated embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout, and the prime notation, if used, indicates similar elements in alternative embodiments.

In the following discussion, numerous specific details are set forth to provide a thorough understanding of the present invention. However, it will be obvious to those skilled in the art that the present invention may be practiced without such specific details. Additionally, for the most part, details concerning rig operation, well drilling, downhole well completion, and the like have been omitted inasmuch as such details are not considered necessary to obtain a complete understanding of the present invention, and are considered to be within the skills of persons skilled in the relevant art.

Referring to FIG. 1, a subsea production system includes a subsea wellhead, a tubing hanger spool, a subsea tree, and a flow module. Subsea wellhead is disposed within a wellbore located at a sea floor. Tubing hanger spool is positioned on subsea wellhead and is coupled to subsea wellhead such that a tubing hanger (not shown) and an associated tubing string (not shown) may be suspended from tubing hanger spool. The tubing string may run down into the wellbore to a production zone to serve as a production flowline for hydrocarbons produced from the subsea strata.

Tubing hanger spool may include a tubing hanger spool frame supporting tubing hanger spool and a tubing hanger spool flowline, such as tubing hanger spool framed tubing hanger spool flowline or tubing hanger spool flowline. Tubing hanger spool flowline may couple to additional flowlines that in turn couple to subsea manifolds, facilities (not shown), or the like. An opposite end of tubing hanger spool flowline may terminate at an upward facing hub proximate to an exterior of tubing.
hanger spool frame 35. Frame 35 is supported by tubing hanger spool 15 and extends laterally from tubing hanger spool 15. A person skilled in the art will understand that upward facing hub 33 may comprise a male or female piping connection of any suitable variety to receive an outboard flowline 39 of flow module 19.

[0022] Subsea tree 17 lands on and secures to tubing hanger spool 15 such that hydrocarbons produced from the wellbore may flow from tubing hanger spool 15 into the flowlines of subsea tree 17. Subsea tree 17 may include a series of valves 21 that may operate to direct or shut off the flow of fluid through subsea production system 11. Subsea tree 17 includes a tree frame 23, shown schematically in FIG. 1. Tree frame 23 is supported by and extends laterally from subsea tree 17. Subsea tree 17 also includes an inboard flowline 25. Inboard flowline 25 may extend from valves 21 to a point on tree frame 23 proximate to an exterior of subsea tree 17. Outboard flowline 25 may terminate in an upward facing hub 27. Upward facing hub 27 may comprise a male or female piping connection adapted to receive an inboard flowline 29 of flow module 19. Preferably, upward facing hub 33 and upward facing hub 27 may be located on the same exterior side of subsea production system 11. Upward facing hub 27 is located a higher elevation than upward facing hub 33 is this embodiment. In other embodiments, upward facing hub 27 may be at a lower elevation than upward facing hub 33 or at the same elevation as upward facing hub 33.

[0023] Flow module 19 may land on upward facing hub 27 and upward facing hub 33 such that inboard flowline 29 of flow module 19 may couple to upward facing hub 27 and an outboard flowline 39 of flow module 19 may couple to upward facing hub 33. Flow module 19 may couple to both tree frame 23 and tubing hanger spool frame 35 such that a portion of the weight of flow module 19 may be supported by tree frame 23, and a portion of the weight of flow module 19 may be supported by tubing hanger spool frame 35.

[0024] During subsea assembly, tubing hanger spool 15 along with tubing hanger spool frame 35 and tubing hanger spool flowline 31, may be run down in a conventional manner, landed, and set on wellhead 13. Similarly, subsea tree 17 and valves 21 along with tree frame 23 and inboard flowline 25 may be run in a conventional manner, landed, and set on tubing hanger spool 15. Preferably, upward facing hub 33 and upward facing hub 27 may be in proximity to one another. Flow module 19 may then be run to subsea production system 11 in a separate trip. Inboard flowline 29 of flow module 19 may be connected to upward facing hub 27, and outboard flowline 39 of flow module 19 may be connected to upward facing hub 33. Thus, increased proximity of upward facing hub 27 and upward facing hub 33 may reduce the length of the inboard and outboard flowlines 29, 39 of flow module 19.

[0025] Referring to FIG. 2, wellhead 13, tubing hanger spool 15, and subsea tree 17 are all coaxial with an axis 12 of wellhead 13. Tree frame 23 is positioned axially over tubing hanger spool frame 35. Flow module 19 may be run to the subsea location and positioned and landed partially on tree frame 23 and partially on tubing hanger spool frame 35 as shown. Preferably, tree frame 23 may include a frame portion 41 extending beyond an edge 43 of tubing hanger spool frame 35. Frame portion 41 may be in the same plane as tree frame 23. Similarly, tubing hanger spool frame 35 may include a frame portion 45 extending beyond an edge 47 of tree frame 23. Frame portion 45 may be in the same plane as tubing hanger spool frame 35. Preferably, frame portion 41 of tree frame 23 may extend from tree frame 23 in a plane parallel to frame portion 45 of tubing hanger spool frame 35. Frame portion 41 may be axially above, but may not be directly over frame portion 45. In this manner, a portion of flow module 19 may extend below tree frame 23 to land on tubing hanger spool frame 35. Flow module 19 may secure to both tree frame 23 and tubing hanger spool frame 35 at frame portion 41 and frame portion 45, respectively. Thus, flow module 19 is supported by both tree frame 23 and tubing hanger spool frame 35. A person skilled in the art will understand that tree frame 23 and tubing hanger spool frame 35 may be formed of any suitable material. For example, both tree frame 23 and tubing hanger spool frame 35 may be constructed of steel beams, plates, or the like.

[0026] As shown in FIG. 2, upward facing hub 27 of inboard flowline 25 may terminate on frame portion 41 of tree frame 23. Upward facing hub 27 may be positioned so that inboard flowline 29 of flow module 19 may stab into upward facing hub 27 during landing of flow module 19. Similarly, upward facing hub 33 of tubing hanger spool flowline 31 may terminate on frame portion 45 of tubing hanger spool frame 35. Upward facing hub 33 may be positioned so that outboard flowline 39 of flow module 19 may stab into upward facing hub 33 during landing of flow module 19. By configuring the position of flow module 19 as illustrated herein, a significant reduction in the length of the combined outboard flowline 39 from flow module 19 and tubing hanger spool flowline 31 to a terminal of additional flowlines 49 for connection to external production devices, such as a manifold or other subsea device, is accomplished. This provides a significant advantage over prior art designs that necessitated that the outboard flowline 39 must wind through subsea tree 17 before connecting to tubing hanger spool flowline 31.

[0027] Subsea production system 11 of FIG. 1 may include horizontally facing hubs 34, 28 in place of upwardly facing hubs 33 and 27, respectively, as shown in FIG. 3. As illustrated in FIG. 3, horizontally facing hub 34 may be located at an end of tubing hanger spool flowline 31 and be adapted to receive outboard flowline 39. A person skilled in the art will understand that horizontally facing hub 34 may comprise a male or female piping connection of any suitable variety to receive outboard flowline 39 of flow module 19. Preferably, tubing hanger spool flowline 31 will terminate horizontally on tubing hanger spool frame 35 so that the terminus of tubing hanger spool flowline 31 faces outward away from tubing hanger spool 15. Horizontally facing hub 28 may comprise a male or female piping connection adapted to receive inboard flowline 29 of flow module 19. Preferably, inboard flowline 25 will terminate horizontally on tree frame 23 so that the terminus of inboard flowline 25 faces outward away from subsea tree 17. In addition, horizontally facing hub 34 and horizontally facing hub 28 may be located on the same exterior side of subsea production system 11. As shown, horizontally facing hub 28 is located a higher elevation than horizontally facing hub 34 is this embodiment. A person skilled in the art will understand that horizontally facing hub 28 may be located at the same elevation as horizontally facing hub 34 or at a lower elevation than horizontally facing hub 34. In the illustrated embodiment, outboard flowline 39 and inboard flowline 29 will have horizontal terminations so that ends proximate to horizontally facing hubs 34, 28 may be coupled to horizontally facing hubs 34, 28 to allow for fluid flow between inboard flowline 25 and inboard flowline 29, and outboard flowline 39 and tubing hanger spool flowline 31.
Preferably, horizontally facing hubs 34, 28 face the same horizontal direction and the terminations of outboard and inbound flowlines 39, 29 of flow module 19 face in the same horizontal direction, but opposite that of horizontally facing hubs 34, 28 to allow flowlines 39, 29 to stab into hubs 34, 28.

[0028] As shown in FIG. 4, horizontally facing hub 28 of inboard flowline 25 may terminate on frame portion 41 of tree frame 23. Horizontally facing hub 28 may be positioned so that inboard flowline 29 of flow module 19 may stab into horizontally facing hub 28 during landing of flow module 19. Similarly, horizontally facing hub 34 of tubing hanger spool flowline 31 may terminate on frame portion 45 of tubing hanger spool frame 35. Horizontally facing hub 34 may be positioned so that outboard flowline 39 of flow module 19 may stab into horizontally facing hub 34 during landing of flow module 19. This may be accomplished in part by running flow module 19 to a subsea location proximate to subsea production system 11. Preferably, ends of outboard flowline 39 and inboard flowline 29 are proximate to horizontally facing hub 34 and horizontally facing hub 28, respectively. Flow module 19 may then be shifted horizontally to stab ends of outboard flowline 39 and inboard flowline 29 into horizontally facing hubs 34, 28, respectively. In so doing, a portion of the weight of flow module 19 will be transferred to both frame portion 45 and frame portion 41. As shown in FIG. 4, horizontal shift assistance mechanisms (HSAMs) 51, 53 may be secured to frame portion 41 and frame portion 45, respectively. HSAMs 51, 53 may comprise hydraulic cylinders, mechanical slide screws, or the like. HSAMs 51, 53 will couple to flow module 19 in a manner that allows HSAMs 51, 53 to exert a horizontal force that may shift flow module 19 horizontally to make up the flow connection between outboard flowline 39, and horizontally facing hub 34, and inboard flowline and horizontally facing hub 28. By configuring the position of flow module 19 as illustrated herein, a significant reduction in the length of the combined outboard flowline 39 from flow module 19 and tubing hanger spool flowline 31 to a terminal of additional flowlines 49 for connection to external production devices, such as a manifold or other subsea device, is accomplished. This provides a significant advantage over prior art designs that necessitated that the outboard flowline 39 must wind through subsea tree 17 before connecting to tubing hanger spool flowline 31.

[0029] Accordingly, the disclosed embodiments provide numerous advantages. For example, the disclosed embodiments, provide a shorter flow path from the flow module to external production devices. This leads to a reduction in the pressure drop across the system, and a reduction in the amount of heat lost through the outboard flowlines. In addition, the shorter flowlines provide fewer opportunities for leaks to occur. Still further, the disclosed embodiments allow for production of the subsea production assembly at a reduced cost. This arises as a result of the significant decrease in the amount of material needed to connect the flow module to the external production devices.

[0030] It is understood that the present invention may take many forms and embodiments. Accordingly, several variations may be made in the foregoing without departing from the spirit or scope of the invention. Having thus described the present invention by reference to certain of its preferred embodiments, it is noted that the embodiments disclosed are illustrative rather than limiting in nature and that a wide range of variations, modifications, changes, and substitutions are contemplated in the foregoing disclosure and, in some instances, some features of the present invention may be employed without a corresponding use of the other features. Many such variations and modifications may be considered obvious and desirable by those skilled in the art based upon a review of the foregoing description of preferred embodiments. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

What is claimed is:

1. A subsea production assembly comprising:
a wellhead having an axis;
a tubing hanger spool disposed on the wellhead axially above the wellhead so that production fluid may flow from the wellhead through the tubing hanger spool;
a tubing hanger spool frame mounted to and extending laterally from the tubing hanger spool;
a downstream flowline having an upward facing hub that is supported by the tubing hanger spool frame;
a subsea tree disposed on the tubing hanger spool axially above the tubing hanger spool so that production fluid may flow from the tubing hanger spool through the tree;
a tree frame mounted to and extending laterally from the subsea tree;
an upstream flowline supported by the tree frame and connected to the tree, the upstream flowline having an upward facing hub;
a flow module having downward facing flowlines that couple to the hubs, such that flow from the tree passes in a flow path from the upstream flowline through the flow module and directly to the downstream flowline on the tubing hanger spool; and
wherein the weight of the flow module is distributed between the frame of the tubing hanger spool and the frame of the subsea tree.

2. The subsea production assembly of claim 1, wherein the flow module comprises a choke bridge module.

3. The subsea production assembly of claim 1, wherein the tree frame is located in a plane parallel to and above the tubing hanger spool frame.

4. The subsea production assembly of claim 1, wherein a downward facing flowline that lands on and connects to the hub of the downstream flowline has a greater length than a downward facing flowline that lands on and connects to the hub of the upstream flowline.

5. The subsea production assembly of claim 1, wherein the hubs are located on a same side of the tree.

6. The subsea production assembly of claim 1, wherein the hub of the downstream flowline is at a lower elevation than the hub of the upstream flowline.

7. The subsea production assembly of claim 1, wherein the tree frame includes a hub supporting portion that supports the hub of the upstream flowline that is at a higher elevation than, but not directly above, the tubing hanger spool frame.

8. The subsea production assembly of claim 1, wherein the tubing hanger spool frame includes a hub supporting portion that supports the hub of the downstream flowline and is at a lower elevation than, but not directly below, the tree frame.

9. The subsea production assembly of claim 1, wherein:
   the tree frame includes a hub supporting portion that supports the hub of the upstream flowline that is at a higher elevation than, but not directly above, the tubing hanger spool frame; and
the tubing hanger spool frame includes a hub supporting portion that supports the hub of the downstream flowline and is at a lower elevation than, but not directly below, the tree frame.

10. A subsea production assembly comprising:
a wellhead having an axis;
a tubing hanger spool disposed on the wellhead axially above the wellhead so that production fluid may flow from the wellhead through the tubing hanger spool;
a tubing hanger spool frame mounted to and extending laterally from the tubing hanger spool;
a downstream flowline having an upward facing hub that is supported by the tubing hanger spool frame, the upward facing hub secured to the tubing hanger spool frame; a subsea tree disposed on the tubing hanger spool axially above the tubing hanger spool so that production fluid may flow from the tubing hanger spool through the tree;
a tree frame mounted to and extending laterally from the subsea tree;
an upstream flowline supported by the tree frame and connected to the tree, the upstream flowline having an upward facing hub secured to the tree frame;
a choke bridge module having downward facing flowlines that couple to the hubs, such that flow from the tree passes in a flow path from the upstream flowline through the choke bridge module and the downstream flowline; wherein the weight of the choke bridge module is distributed between the frame of the tubing hanger spool and the frame of the subsea tree; wherein the hub of the downstream flowline is at a lower elevation than the hub of the upstream flowline;
wherein the tree frame includes a hub supporting portion that supports the hub of the downstream flowline that is at a higher elevation than, but not directly above, the tubing hanger spool frame;
wherein the tubing hanger spool frame includes a hub supporting portion that supports the hub of the downstream flowline and is at a lower elevation than, but not directly below, the tree frame; and wherein any weight transferred to the upward facing hubs by the choke bridge module is further transferred to the tubing hanger spool frame and the subsea tree frame.

11. The subsea production assembly of claim 10, wherein the tree frame is located in a plane parallel to and above the tubing hanger spool frame.

12. The subsea production assembly of claim 10, wherein a downward facing flowline that lands on and connects to the hub of the downstream flowline has a greater length than a downward facing flowline that lands on and connects to the hub of the upstream flowline.

13. The subsea production assembly of claim 10, wherein the hubs are located on the same side of the tree.

14. A subsea production assembly comprising:
a wellhead having an axis;
a tubing hanger spool disposed on the wellhead axially above the wellhead so that production fluid may flow from the wellhead through the tubing hanger spool;
a tubing hanger spool frame mounted to and extending laterally from the tubing hanger spool;
a downstream flowline having an horizontally facing hub that is supported by the tubing hanger spool frame, the horizontally facing hub secured to the tubing hanger spool frame; a subsea tree disposed on the tubing hanger spool axially above the tubing hanger spool so that production fluid may flow from the tubing hanger spool through the tree; a tree frame mounted to and extending laterally from the subsea tree; and an upstream flowline supported by the tree frame and connected to the tree, the upstream flowline having an horizontally facing hub secured to the tree frame; wherein the downstream flowline horizontally facing hub and the upstream flowline horizontally facing hub are on a same side of and face horizontally away from the tree; a choke bridge module having downward facing flowlines with horizontal terminations that couple to the hubs, such that flow from the tree passes in a flow path from the upstream flowline through the choke bridge and directly to the downstream flowline on the tubing hanger spool; wherein the weight of the choke bridge module is distributed between the frame of the tubing hanger spool and the frame of the subsea tree; wherein the hub of the downstream flowline is at a lower elevation than the hub of the upstream flowline; wherein the tree frame includes a hub supporting portion that supports the hub of the upstream flowline that is at a higher elevation than, but not directly above, the tubing hanger spool frame;

15. The subsea production assembly of claim 14, wherein the tree frame is located in a plane parallel to and above the tubing hanger spool frame.

16. The subsea production assembly of claim 14, wherein a downward facing flowline that lands on and connects to the hub of the downstream flowline has a greater length than a downward facing flowline that lands on and connects to the hub of the upstream flowline.

17. The subsea production assembly of claim 14 further comprising:
at least one horizontal shift assistance mechanism coupled to at least one of the tree frame and the tubing hanger spool frame; and wherein the horizontal shift assistance mechanism is further coupled to the choke bridge module so that the at least one horizontal shift assistance mechanism may shift the choke bridge module horizontally to connect the downward facing flowlines of the choke bridge module to the horizontally facing hubs.

18. A method for assembling a subsea production assembly, comprising:
(a) landing and setting a tubing hanger spool on a subsea wellhead, the tubing hanger spool including a tubing hanger spool flowline having a tubing hanger spool hub at a first location;
(b) running, landing, and setting a subsea tree on the tubing hanger spool, the subsea tree including a subsea tree flowline having a subsea tree hub located proximate to the first location; then
(c) running, landing, and setting a flow module on the subsea tree and the tubing hanger spool, such that the
weight of the flow module is partially supported by the subsea tree and partially supported by the tubing hanger spool.

19. The method of claim 18, wherein step (c) comprises:
aligning an outboard flowline of the flow module with the tubing hanger spool flowline;
aligning an inboard flowline of the flow module with the outboard flowline of the subsea tree;
stabbing the outboard flowline of the flow module into the tubing hanger spool flowline while stabbing the inboard flowline of the flow module into the inboard flowline of the subsea tree; then
coupling a frame of the flow module to the frame of the subsea tree and a frame of the tubing hanger spool so that the flow module does not move relative to the subsea tree or the tubing hanger spool.

20. The method of claim 19, further comprising stabbing the outboard flowline of the flow module into an upward facing hub of the tubing hanger spool flowline, while stabbing the inboard flowline of the flow module into an upward facing hub of the subsea tree flowline.

21. The method of claim 19, further comprising:
stabbing the outboard flowline of the flow module into a horizontally facing hub of the tubing hanger spool flowline;
stabbing the inboard flowline of the flow module into a horizontally facing hub of the subsea tree flowline; and
actuating a horizontal shift assistance mechanism to shift the flow module horizontally to stab the outboard and inboard flowlines of the flow module in the horizontally facing hubs.

* * * * *