

CLAIMS

1. A riser segment assembly comprising:
 - a main tube defining a primary lumen;
 - a collar defining a lateral opening in fluid communication with the primary lumen;
 - 5 two flanges each coupled to a different end of the main tube, each flange comprising:
 - a mating face configured to mate with a flange of an adjacent riser segment; and
 - a central flange lumen configured to be in fluid communication with the primary
 - lumen of the main tube;
 - a valve coupled to the lateral opening, the valve having a longitudinal flow axis that is
 - 10 more parallel than perpendicular to a longitudinal axis of the main tube;
 - a first connector secured to the valve, the first connector having a protrusion; and
 - a second connector defining a recess configured to slidably and removably receive the
 - protrusion of the first connector to provide a sealed connection between the first
 - connector and the second connector;
 - 15 a fitting coupled to the collar over the lateral opening and to the valve, the fitting defining
 - a fitting lumen in fluid communication with the lateral opening; and
 - a third connector secured to the fitting and to a first end of the valve,
 - where the first connector is secured to a second end of the valve, and the second
 - connector is coupled to the main tube;
 - 20 where the second connector defines a lumen having an inlet through which fluid can enter
 - the second connector in a first direction, and an outlet through which fluid can
 - exit the second connector in a second direction that is different than the first
 - direction; and
 - where the second connector further defines a secondary lumen with a second exit sealed
 - 25 by a removable cover, the second exit configured such that if the cover is
 - removed, fluid can exit the second connector in a third direction that is different
 - than the first direction and the second direction.

2. The assembly of claim 1, further comprising:

a retainer coupled to the main tube and configured releasably engage the second connector without welding to secure the second connector in fixed relation to the main tube.

5 3. The assembly of claim 2, where the retainer includes a body having a recess configured to receive a portion of the second connector to restrict lateral movement of the second connector relative to the main tube.

10 4. The assembly of claim 3 where the retainer includes one or more movable members pivotally coupled to the body and movable between an open position in which the second connector is permitted to enter or exit the recess of the body, and a closed position in which the one or more movable members prevent the second connector from entering or exiting the recess of the body.

5. A method comprising:

15 lowering a riser segment assembly through a rotary of a drilling rig, where the riser segment assembly includes:

a main tube defining a primary lumen;

a collar defining a lateral opening in fluid communication with the primary lumen;

20 two flanges each coupled to a different end of the main tube, each flange comprising:

a mating face configured to mate with a flange of an adjacent riser segment; and

a central flange lumen configured to be in fluid communication with the primary lumen of the main tube;

25 a valve coupled to the lateral opening, the valve having a longitudinal flow axis that is more parallel than perpendicular to a longitudinal axis of the main tube;

a first connector secured to the valve, the first connector having a protrusion; and

a second connector defining a recess configured to slidably and removably receive the protrusion of the first connector to provide a sealed connection between the first connector and the second connector.

6. The method of claim 5, where the riser segment assembly further comprises:

5 a fitting coupled to the collar over the lateral opening and to the valve, the fitting defining a fitting lumen in fluid communication with the lateral opening;

a third connector secured to the fitting and to a first end of the valve;

where the first connector is secured to a second end of the valve, and the second connector is coupled to the main tube; and

10 where the method further comprising:

connecting, below the rotary, the third connector to the riser segment assembly without welding.

7. A riser segment assembly comprising:

a main tube defining a primary lumen;

15 a collar defining a lateral opening in fluid communication with the primary lumen;

two flanges each coupled to a different end of the main tube, each flange comprising:

a mating face configured to mate with a flange of an adjacent riser segment; and

a central flange lumen configured to be in fluid communication with the primary lumen of the main tube; and

20 a fitting coupled to the collar over the lateral opening and configured to be removably coupled to a valve assembly, the fitting defining a fitting lumen in fluid communication with the lateral opening, the fitting defining a recess configured to removably receive a portion of the valve assembly without threads or welding to permit fluid communication between the fitting lumen and the valve assembly.

25 8. The assembly of claim 7, where the recess of the fitting that is configured to receive the portion of the valve assembly has a longitudinal axis that is substantially parallel to a longitudinal axis of the main tube.

9. The assembly of claim 8, where the valve assembly further comprises a first connector configured to be inserted into the recess of the fitting, a second connector configured to be coupled to the main tube, and a valve disposed between the first connector and the second connector.
- 5 10. The assembly of claim 9, where the valve comprises a double-ball valve.
11. The assembly of claim 9, where the second connector defines a lumen having an inlet through which fluid can enter the second connector in a first direction, and an outlet through which fluid can exit the second connector in a second direction that is different than the first direction.
- 10 12. The assembly of claim 11, where the second direction is substantially opposite the first direction.
13. The assembly of claim 11, where the second connector further comprises a secondary lumen with a second exit sealed by a removable cover, the second exit configured such that if the cover is removed, fluid can exit the connector in a third direction that is different than the first
15 direction and the second direction.
14. The assembly of claim 9 further comprising:
a retainer coupled to the main tube and configured releasably engage the second
connector without welding to secure the second connector in fixed relation to the
fitting and the main tube.
- 20 15. The assembly of claim 14, where the retainer includes a body having a recess configured to receive a portion of the second connector to restrict lateral movement of the second connector relative to the main tube.
16. The assembly of claim 15, where the retainer includes one or more movable members pivotally coupled to the body and movable between an open position in which the second
25 connector is permitted to enter or exit the recess of the body, and a closed position in which the

one or more movable members prevent the second connector from entering or exiting the recess of the body.

17. The assembly of claim 9, where the maximum transverse dimension of the assembly is greater than 60.5 inches if the valve assembly is coupled to the fitting, and is less than 60.5 inches if the valve assembly is not coupled to the fitting.

18. The assembly of claim 7, where the fitting and the collar are configured to form a substantially gapless connection comprising:

a female flange having an inward-facing conically tapered sealing surface;

a male flange having an outward-facing conically tapered sealing surface; and

a seal ring having an outward-facing conically tapered surface complementary to the sealing surface of the female flange and an inward-facing conically tapered surface complementary to the sealing surface of the male flange;

where the seal ring is positioned between the male and female flanges with the conically tapered surfaces of the seal ring in contact with the complementary sealing surfaces of the male and female flanges and the male and female flanges are coupled together to form a connection between the primary lumen of the main tube and the fitting lumen of the fitting;

where one of the collar and the fitting defines the female flange, and the other of the collar and the fitting defines the male flange and

where an interface between the male flange and the female flange is substantially free of gaps.

19. The assembly of claim 7, where the collar defines a second lateral opening in fluid communication with the primary lumen of the main tube, the assembly further comprising:

a second fitting coupled to the collar over the second lateral opening and configured to be removably coupled to a second valve assembly, the second fitting defining a second fitting lumen in fluid communication with the second lateral opening.

20. The assembly of claim 19, where the second fitting is substantially similar to the fitting.

21. A method comprising:

lowering a riser segment assembly through a rotary of a drilling rig, where the riser segment assembly includes:

a main tube defining a primary lumen;

a collar defining a lateral opening in fluid communication with the primary lumen;

two flanges each coupled to a different end of the main tube, each flange comprising:

a mating face configured to mate with a flange of an adjacent riser segment; and

a central flange lumen configured to be in fluid communication with the primary lumen of the main tube; and

a fitting secured to the collar over the lateral opening and configured to be removably coupled to a valve assembly, the fitting defining a fitting lumen in fluid communication with the lateral opening, the fitting including a recess configured to removably receive a first connector of the valve assembly without threads or welding to permit fluid communication between the fitting lumen and the valve assembly; and

connecting, below the rotary, the valve assembly to the riser segment assembly without welding, where the valve assembly includes the first connector, a second connector configured to be coupled to the main tube, and a valve disposed between the first connector and the second connector.

22. A riser segment assembly comprising:

a main tube defining a primary lumen;

a collar defining a lateral opening in fluid communication with the primary lumen;

two flanges each coupled to a different end of the main tube, each flange comprising:

a mating face configured to mate with a flange of an adjacent riser segment; and

a central flange lumen configured to be in fluid communication with the primary lumen of the main tube;

a valve coupled to the lateral opening, the valve having a longitudinal flow axis that is more parallel than perpendicular to a longitudinal axis of the main tube;

a first connector secured to a first end of the valve, the first connector having a protrusion;

5 a second connector defining a recess configured to slidably and removably receive the protrusion of the first connector to provide a sealed connection between the first connector and the second connector; and

a third connector secured to a second end of the valve,

10 where the second connector comprises a fitting coupled to the collar over the lateral opening, the fitting defining a fitting lumen in fluid communication with the lateral opening.