CLAIMS

What is claimed is:

1. A subsea well connector for connecting a tubular member to a subsea wellhead assembly (14), comprising:

a tieback connector (12) having a stationary connector body (40) and a moveable connector body (27), the stationary connector body (40) and the moveable connector body (27) being annular members and the stationary connector body (40) circumscribing a portion of the moveable connector body (27);

a tie rod (54) extending in an axial direction from the stationary connector body (40), the tie rod (54) having a tie rod profile (56) comprising a plurality of axially spaced apart tie rod grooves on a tie rod outer diameter;

at least one dog ring (62) mounted to the movable connector body, the dog ring having an inner diameter profile (64) circumscribing the tie rod (54), the dog ring (62) being moveable between a lockdown open position where the inner diameter profile of the dog ring (62) is spaced radially outward from the tie rod grooves, and a lockdown engaged position where the inner diameter profile (64) engages the tie rod profile (56), to axially couple the stationary connector body (40) and the moveable connector body (27), wherein the tie rod profile extends an axial height along the rod that is greater than an axial height of the inner diameter profile such that, in the lockdown engaged position, the inner diameter profile is operable to engage different ones of the tie rod grooves of the tie rod profile at a plurality of axial locations along the tie rod profile;

an annular piston (66) circumscribing the dog ring (62), the annular piston (66) having a region with a reduced inner diameter that engages a dog ring outer diameter of the dog ring (62) to retain the dog ring (62) in the lockdown engaged position; and

a cylinder (68) that circumscribes the annular piston (66), defining a lockdown piston cavity (70).

2. The subsea well connector according to claim 1, wherein the dog ring profile comprises a plurality of axially spaced apart dog ring grooves.

3. The subsea well connector according to claim 2, wherein there are fewer of the ring grooves than the tie rod grooves.

4. The subsea well connector according to any preceding claim, further comprising an annular ring (60) secured to an upper end of the moveable connector body (27), wherein the tie rod (54) passes through a hole that extends axially through the annular ring (60), and wherein the dog ring (62) is supported by an upper surface of the annular ring (60).

5. The subsea well connector according to any preceding claim, further comprising a biasing member (76), the biasing member (76) having a first end engaging a top surface of the annular piston (66), urging the annular piston (66) downward to retain the dog ring (62) in the lockdown engaged position.

6. The subsea well connector according to any preceding claim, wherein the dog rig (62) is biased to move to the lockdown open position when the annular piston (66) is in an axially upper location and wherein the dog ring (62) is in the lockdown engaged position when the annular piston (66) is an axially lower location.

7. The subsea well connector according to any preceding claim, further comprising an injection port (74) extending through the cylinder (68) and into the lockdown piston cavity (70), selectively receiving a pressure media for moving the annular piston (66) upward to allow the dog ring (62) to move to the lockdown open position.

8. The subsea well connector according to any preceding claim, the tieback connector (12) further comprising a locking system (18), the locking system (18) being movable between a connector engaged position where the tieback connector (12) is secured to a lock housing (14) of the subsea well connector and a connector unengaged position where the tieback connector (12) is moveable relative to the lock housing (14), the locking system (18) being moveable between the connector engaged position and the connector unengaged position by relative axial movement between the stationary connector body (40) and the moveable connector body(27).

9. The subsea well connector according to claim 8, wherein the dog ring (62) can be in the lockdown engaged position when the tieback connector (12) is in the connector engaged position and when the tieback connector (12) is in the connector unengaged position.

10. The subsea well connector according to any preceding claim, wherein the subsea well connector comprises a plurality of the tie rods (54) spaced around a circumference of the stationary connector body (40).

11. A method of connecting a tubular member to a subsea wellhead assembly (14), the method comprising:

(a) landing a connector assembly (10) on the subsea wellhead assembly (14), the connector assembly (10) having an axially extending tie rod (54) with a tie rod profile (56) comprising a plurality of axially spaced apart tie rod grooves on a tie rod outer diameter, a dog ring (62) with an inner diameter profile circumscribing the tie rod (54), an annular piston (66) circumscribing the dog ring (62), and a cylinder (68) that circumscribes the annular piston (66), defining a lockdown piston cavity (70), wherein the tie rod grooves extend an axial height along the tie rod that is greater than an axial height of the inner diameter profile such that, in the lockdown engaged position, the inner diameter profile is engageable with the tie rod grooves at a plurality of the different axial locations along the tie rod grooves;

(b) injecting a pressure media into the lockdown piston cavity (70) to move the annular piston (66) axially relative to the dog ring (62) so that the dog ring (62) is in a lockdown open position with the dog ring (62) profile radially spaced from the tie rod profile;

(c) securing the connector assembly (10) to the subsea wellhead assembly (12); and

(d) moving the annular piston (66) axially relative to the dog ring (62) and the tie rod (54) to move the dog ring (62) to a lockdown engaged position with the dog ring profile engaging the tie rod grooves, preventing the connector assembly (10) from becoming unsecured from the subsea wellhead assembly (14).

12. The method according to claim 11, wherein the annular piston (66) has a region with a reduced inner diameter, and step (d) includes venting the pressure media from the lockdown piston cavity (70) until the region with the reduced inner diameter engages a dog ring outer diameter of the dog ring (62) to retain the dog ring (62) in the lockdown engaged position.

13. The method according to claim 11 or 12, wherein securing the connector assembly (10) to the subsea wellhead assembly (14) includes moving a moveable connector

body (27) of the connector assembly (10) axially relative to a stationary connector body (40) of the connector assembly (10) so that the tie rod (50) moves axially relative to the dog ring (62).

14. The method according to any of claims 11 to 13, wherein the connector assembly (10) includes a biasing member (76), and wherein venting the pressure media from the lockdown piston cavity (70) causes the biasing member (76) to urging the annular piston (66) downward to retain the dog ring (62) in the lockdown engaged position.

15. The method according to any one of claims 11 to 14, wherein securing the connector assembly to the subsea wellhead assembly includes moving a movable connector body of the connector assembly relative to a stationary connector body of the connector assembly so that the dog ring moves axially in unison with the moveable connector body relative to the tie rod.