

CLAIMS

1. A hydro-mechanical running tool (160) that is adapted to install a casing packoff assembly (170) having a metal to metal sealing system in a wellhead (100) through a blowout preventer, the hydro-mechanical running tool (160) comprising:

an upper tool portion (161) comprising a central rotating body (162c) and an upper hydraulic housing (162h) disposed around at least a part of said central rotating body (162c);

a lower tool portion (166) that is adapted to be threadably coupled to a casing packoff assembly (170) during installation of said casing packoff assembly (170) in a wellhead (100), wherein said central rotating body (162c) is adapted to be rotated relative to said upper hydraulic housing (162h) and said lower tool portion (166) while a pressure (163t) is imposed on at least said central rotating body (162c) and said lower tool portion (166); and

a thrust bearing (161t) positioned between said central rotating body (162c) and said upper hydraulic housing (162h), said thrust bearing (161t) being adapted to facilitate said rotation of said central rotating body (162c) relative to said upper hydraulic housing (162h) while said pressure (163t) is imposed.

2. The hydro-mechanical running tool (160) of claim 1, further comprising a lower spring-loaded sleeve (162d) coupled to said central rotating body (162c), wherein said lower spring-loaded sleeve (162d) is adapted to be rotated with said central rotating body (162c) relative to said lower tool portion (166).

3. The hydro-mechanical running tool (160) of claim 2, wherein said lower spring-loaded sleeve (162d) is further adapted to energize a lock ring (173r) of a casing packoff assembly (170) that is removably coupled to said lower tool portion (166) so as to lock said casing packoff assembly (170) into a wellhead (100).

4. The hydro-mechanical running tool (160) of claim 1, wherein said central rotating body (162c) comprises a neck (160n) that extends through a central bore (160b) of said upper hydraulic housing (162h), said neck (160n) being adapted to rotate said central rotating body (162c).

5. The hydro-mechanical running tool (160) of claim 1, wherein said lower tool portion (166) is adapted to energize a metal to metal sealing system of a casing packoff assembly

(170) while a pressure (163t) is imposed on at least said central rotating body (162c) and said lower tool portion (166).

5 6. The hydro-mechanical running tool (160) of claim 1, wherein said upper hydraulic housing (162h) comprises an inner hydraulic housing (162a) and an outer hydraulic housing (162b) coupled to said inner hydraulic housing (162a), said inner and outer hydraulic housings (162a, 162b) defining a cavity (161a) in said upper hydraulic housing (162h).

10 7. The hydro-mechanical running tool (160) of claim 6, wherein said upper hydraulic housing (162h) comprises a piston (161p) disposed in said cavity (161a), said piston (161p) being adapted to move within said cavity (161a) in a substantially axial direction.

 8. A method for installing a casing packoff assembly (170) having a metal to metal sealing system in a wellhead (100) through a blowout preventer with a hydro-mechanical running tool (160) as claimed in any one of claims 1-7, the method comprising:

15 removably coupling said casing packoff assembly (170) to said hydro-mechanical running tool (160);

 lowering said casing packoff assembly (170) and said hydro-mechanical running tool (160) into said wellhead (100) through said blowout preventer and landing said casing packoff assembly (170) on a support shoulder (135) of a casing slip hanger (129);

20 energizing a metal seal ring (175) of said casing packoff assembly (170) so as to create a metal to metal seal between said casing packoff assembly (170) and a casing (110) supported in said wellhead (100) by said casing slip hanger (129), wherein energizing said metal seal ring (175) comprises imposing a pressure (163t) on at least said hydro-mechanical running tool (160); and

25 rotating at least a portion of said hydro-mechanical running tool (160) relative to at least a portion of said casing packoff assembly (170) while maintaining said imposed pressure (163t).

30 9. The method of claim 8, further comprising locking at least said upper tool portion (161) of said hydro-mechanical running tool (160) into said wellhead (100) prior to imposing said pressure (163t), wherein locking at least said upper tool portion (161) into said wellhead

(100) comprises energizing an upper lock ring (161r) of said hydro-mechanical running tool (160) with a hydraulically movable piston (161p).

10. The method of claim 8, wherein energizing said metal seal ring (175) comprises telescopically moving said lower tool portion (166) of said hydro-mechanical running tool (160) relative to said upper tool portion (161) and shearing a plurality of shear pins (177) coupling an upper packoff body (171) of said casing packoff assembly (170) to a lower packoff body (174) of said casing packoff assembly (170).

11. The method of claim 8, wherein rotating said at least said portion of said hydro-mechanical running tool (160) relative to at least said portion of said casing packoff assembly (170) while maintaining said imposed pressure (163t) comprises engaging a castellated interface (165c, 165n) on a lower end of said hydro-mechanical running tool (160) with a castellated interface (173c, 173n) on a lock ring energizing mandrel (173) that is threadably coupled to a packoff body (171) of said casing packoff assembly (170) and threadably rotating at least a portion of said lock ring energizing mandrel (173) relative to said packoff body (171), wherein threadably rotating at least said portion of said lock ring energizing mandrel (173) comprises threadably rotating an upper mandrel sleeve (173u) of said lock ring energizing mandrel (173) relative to a lower mandrel sleeve (173L) of said lock ring energizing mandrel (173).

12. A system for installing an emergency casing packoff assembly (170) in a wellhead (100) through a blowout preventer with a hydro-mechanical running tool (160) as claimed in any one of claims 1-7 comprising said packoff assembly and said hydro-mechanical running tool, wherein said packoff assembly (170) is adapted to be removably coupled to said hydro-mechanical running tool (160) and comprises;

an upper packoff body (171);

a lower packoff body (174) releasably coupled to said upper packoff body (171);

a metal seal ring (175) that is adapted to create a metal to metal seal between said packoff assembly (170) and a casing (110) supported in a wellhead (100) when a pressure thrust load is imposed on said packoff assembly (170); and

a lock ring energizing mandrel (173) threadably coupled to said upper packoff body (171), wherein at least a portion of said lock ring energizing mandrel (173) is adapted to be threadably rotated relative to said upper packoff body (171) so as to

lock said packoff assembly (170) into said wellhead (100) while said imposed pressure thrust load is maintained on said packoff assembly (170).

13. The system of claim 12, wherein said packoff assembly (170) further comprises a plurality of shear pins (177) that are adapted to releasably couple said lower packoff body (174) to said upper packoff body (171).

14. The system of claim 13, wherein said upper packoff body (171) of said packoff assembly (170) is adapted to shear said plurality of shear pins (177) when said hydro-mechanical running tool (160) imposes a pressure thrust load on said packoff assembly (170), and wherein said metal seal ring (175) of said packoff assembly (170) is adapted to be energized so as to create a metal to metal seal between said packoff assembly (170) and a casing (110) supported in said wellhead (100) when said plurality of shear pins (177) are sheared by said pressure thrust load.

15. The system of claim 12, wherein said lock ring energizing mandrel (173) of said packoff assembly (170) comprises:

a castellated interface (173c, 173n) that is adapted to engage a castellated interface (165c, 165n) on said hydro-mechanical running tool (160);

an upper mandrel sleeve (173u) that is threadably coupled to said upper packoff body (171); and

a lower mandrel sleeve (173L) that is coupled to said upper mandrel sleeve (173u) at a slidable interlocking interface (173i), said lower mandrel sleeve (173L) having a tapered surface (173s) that is adapted to slidingly interface with a tapered surface (173x) of a lock ring (173r) of said packoff assembly (170) so as to energize said lock ring (173r) into a lock ring groove (104) of said wellhead (100).

16. The system of claim 12, wherein said at least said portion of said lock ring energizing mandrel (173) of said packoff assembly (170) is adapted to be threadably rotated along a threaded interface (173t) with said upper packoff body (171) by said hydro-mechanical running tool (160) while a pressure (163t) is imposed on said hydro-mechanical running tool (160) and said packoff assembly (170).

17. A method for installing an emergency casing slip hanger assembly (129) and an emergency casing packoff assembly (170) comprising a metal to metal sealing system into a wellhead (100) through a blowout preventer, the method comprising:

5 lowering said slip hanger assembly (129) into said wellhead (100) through said blowout preventer with a slip hanger assembly running tool supported by a tubular support (126) so as to land said slip hanger assembly (129) on a support shoulder (102) of said wellhead (100), said slip hanger assembly (129) comprising a slip bowl (130) and a plurality of slips (131) that are releasably coupled to said slip bowl (130) by
10 a plurality of first shear pins (132);

imposing a pressure thrust load (128) on said slip hanger assembly running tool so as to shear said plurality of first shear pins (132) and to drop said slips (131) into contact with a casing (110) positioned in said wellhead (100);

setting said slips (131) so as to support said casing (110);

15 retrieving said slip hanger assembly running tool from said wellhead (100) through said blowout preventer;

lowering said packoff assembly (170) into said wellhead (100) through said blowout preventer with a hydro-mechanical running tool (160) as claimed in any one of claims 1-7 so as to land said packoff assembly (170) on a support shoulder (135)
20 of said slip hanger assembly (129), said packoff assembly (170) comprising an upper packoff body (171) and a lower packoff body (174) that is releasably coupled to said upper packoff body (171) with a plurality of second shear pins (134);

imposing a pressure (163t) on said packoff assembly (170) and at least a portion of said
25 hydro-mechanical running tool (160) so as to shear said plurality of second shear pins (134) and to energize said metal seal ring (175) so as to create a metal to metal seal between said packoff assembly (170) and said casing (110);

rotating at least a portion of said hydro-mechanical running tool (160) relative to at least a portion of said packoff assembly (170) so as to lock said packoff assembly (170)
30 into said wellhead (100) while maintaining said imposed pressure (163t); and

retrieving said hydro-mechanical running tool (160) from said wellhead (100) through said blowout preventer.