

13. The lockdown member mechanism and running tool as defined in Claim 1, wherein the running tool is actuated to lock the lockdown sleeve to the wellhead.

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~~14. The lockdown mechanism and running tool as defined in Claim 1, wherein each of the first redundant seal and the second redundant seal is separately tested before the running tool is retrieved.~~

10 1415. A lockdown mechanism for securing a casing hanger within a wellhead and sealing an annulus between a casing supported by the casing hanger and the wellhead, the casing hanger supporting a hanger seal for sealing between the casing hanger and the wellhead, the lockdown mechanism comprising:

15 a lockdown sleeve body positioned in the wellhead by the running string for limiting axial movement of the casing hanger by axially securing the casing hanger to the wellhead;

 a first redundant seal fluidly in series with the hanger seal sealing between the lockdown sleeve and the wellhead;

20 a seal sleeve movable with respect to the lockdown sleeve body; and

 a second redundant seal fluidly in series with the hanger seal and actuated for sealing between the seal sleeve and the casing hanger after the first redundant seal is actuated.

1546. The lockdown mechanism as defined in Claim 1415, further comprising:

a running tool including a locking piston moveable in response to fluid
5 pressure in the running tool to temporarily lock the lockdown sleeve to the wellhead and the running tool while the first redundant seal is tested.

1647. The lockdown mechanism and running tool as defined in Claim 1546, wherein the running tool includes a lockdown piston moveable in response
10 to fluid pressure in the running tool to lock the lockdown sleeve to the wellhead.

1748. The lockdown mechanism as defined in Claim 1415, further comprising:

the seal sleeve includes an upper sleeve containing the ratch latch, and a
15 lower sleeve supporting the second redundant seal and a third seal.

1849. The lockdown mechanism as defined in Claim 1546, further comprising:

a ratch latch mechanism for maintaining the second redundant seal in
20 position after the running tool is removed from the wellhead.

1920. The lockdown mechanism and running tool as defined in Claim 1415, wherein the lockdown sleeve body lands on the casing hanger to seal
25 between the lockdown sleeve and the casing hanger with the second redundant seal.

2024. The lockdown mechanism and running tool as defined in Claim 1415, wherein a running tool activates the lockdown sleeve body and positions the first redundant seal for sealing between the lockdown sleeve body and the wellhead.

2122. A method of securing a casing hanger within a wellhead and sealing an annulus between a casing supported by the casing hanger and the wellhead, comprising:

10 supporting a hanger seal on the casing hanger for sealing between the casing hanger and the wellhead;

positioning a lockdown sleeve in the wellhead for limiting axial movement of the casing hanger to the wellhead;

connecting the lockdown sleeve to the wellhead;

15 sealing between the lockdown sleeve and the wellhead with a first redundant seal; and

sealing between the lockdown sleeve and the casing hanger with a second redundant seal.

20 2223. The method as defined in Claim 2122, further comprising:

actuating a running tool to actuate the second redundant seal after actuating the first redundant seal.

2324. The method as defined in Claim 2223, further comprising:

providing a ratch latch mechanism for maintaining an energizing force on the second and third redundant seal after the running tool is removed from the wellhead.

5 2425. The method as defined in Claim 2223, wherein the running tool activates the lockdown sleeve and positions the first redundant seal for sealing between the lockdown sleeve and the wellhead.

10 2526. The method as defined in Claim 2223, wherein fluid pressure in the running tool is responsive to a closure dropped through a running string and landing on a ball seat.

15 2627. The method as defined in Claim 2223, wherein a locking piston is moveable in response to fluid pressure in the running tool to temporarily lock the lockdown sleeve to the running tool while the first redundant seal is tested.

2728. The method as defined in Claim 2122, further comprising:
the second redundant seal is tested after the first redundant seal is tested.

20 2829. The method as defined in Claim 2122, wherein the lockdown sleeve lands on the casing hanger to seal between the lockdown sleeve and the casing hanger with the second redundant seal.

2930. The method as defined in Claim 2223, further comprising:
the first redundant seal is tested after the second redundant seal is tested.