CLAIMS

1. A cylinder assembly for use in a riser tensioner, the cylinder assembly comprising:

an outer cylinder barrel;

an inner rod barrel disposed within the outer cylinder barrel and extending in a first direction from the outer cylinder barrel;

a first end cap coupled to and closing a first end of the outer cylinder barrel, wherein the first end is extending away from the inner rod barrel;

a second end cap coupled to and closing a second end of the inner rod barrel, wherein the second end is extending away from the outer cylinder barrel;

an internal volume of pressurized gas disposed within a hollow portion of the outer cylinder barrel and the inner rod barrel;

a high pressure seal disposed along a sliding interface between the inner rod barrel and an inner wall of the outer cylinder barrel; and

a fluid reservoir for storing and communicating fluid from the fluid reservoir to the high pressure seal for lubricating the high pressure seal, wherein the fluid reservoir is disposed entirely within the first end cap or the second end cap.

2. The cylinder assembly of claim 1, further comprising a fluid port disposed in the end cap to provide access for refilling the fluid reservoir.

3. The cylinder assembly of claim 1, further comprising a port extending into the internal volume to facilitate communication of gas between the internal volume and an external accumulator.

4. The cylinder assembly of claim 3, wherein the port is disposed through an end cap coupled to an end of the inner rod barrel extending from the outer cylinder barrel or an end of the outer cylinder barrel extending away from the inner rod barrel.

5. The cylinder assembly of claim 3, further comprising a pressure communication port disposed between the port and an upper portion of the fluid reservoir to fluidly couple the port to the upper portion of the fluid reservoir.

6. The cylinder assembly of claim 1, further comprising a piston for maintaining the fluid reservoir at approximately the same pressure as the internal volume of pressurized gas.

7. The cylinder assembly of claim 6, wherein the piston is disposed directly between the internal volume of pressurized gas and the fluid reservoir.

8. The cylinder assembly of claim 6, further comprising a chamber, wherein the piston is disposed in the chamber, wherein the chamber is fluidly coupled to the internal volume of pressurized gas on a first side of the piston, and wherein the chamber comprises the fluid reservoir on the second side of the piston opposite the first side.

9. The cylinder assembly of claim 8, further comprising a port for facilitating communication of pressurized gas between the cylinder assembly and an external accumulator, wherein the port is coupled to the first side of the chamber.

10. The cylinder assembly of claim 1, further comprising a fluid communication tube coupled between the fluid reservoir and the high pressure seal and extending through the internal volume of pressurized gas.

11. The cylinder assembly of claim 10, wherein the fluid communication tube comprises a loop to enable further extension of the fluid communication tube.

12. The cylinder assembly of claim 1, wherein the fluid reservoir is an eccentric volume that is offset relative to a centerline of the cylinder assembly.

13. A method for operating a riser tensioner cylinder, comprising:

sliding an inner rod barrel relative to an outer cylinder barrel of the riser tensioner cylinder;

closing a first end of the outer cylinder barrel via a first end cap, wherein the first end is extending away from the inner rod barrel;

closing a second end of the inner rod barrel via a second end cap, wherein the second end is extending away from the outer cylinder barrel;

applying a spring force for maintaining a desired tension on a riser coupled to the riser tensioner cylinder via an internal volume of pressurized gas disposed within a hollow portion of the outer cylinder barrel and the inner rod barrel;

moving fluid from a fluid reservoir disposed in the riser tensioner cylinder to a high pressure seal between the inner rod barrel and the outer cylinder barrel, in response to an increased pressure of the pressurized gas in the internal volume, wherein the fluid reservoir is disposed entirely in the first or second end caps; and

lubricating the high pressure seal via the fluid.

14. The method of claim 13, further comprising refilling the fluid reservoir via a fluid port extending through the end cap into the fluid reservoir.

15. The method of claim 13, further comprising supplying fluid to the high pressure seal in response to pressurized gas in the internal volume via a piston.

16. The method of claim 13, further comprising routing pressurized gas from the internal volume into a first side of a chamber disposed in the riser tensioner cylinder, pushing a piston from the first side of the chamber to a second side of the chamber having the fluid reservoir, and pushing the fluid from the fluid reservoir to the high pressure seal.

17. The method of claim 13, further comprising routing pressurized gas from the internal volume into an upper portion of the fluid reservoir.

18. The method of claim 13, further comprising facilitating communication of gas between the internal volume and an external accumulator via a port extending into the riser tensioner cylinder.

19. The method of claim 13, wherein moving fluid from the fluid reservoir to the high pressure seal comprises communicating the fluid from the fluid reservoir to the high pressure seal via a fluid communication tube extending through the internal volume.