

CLAIMS

What is claimed is:

1. A protector for an electric submersible pump, the protector comprising:
a shaft extending axially through the protector;
at least one positive-sealing chamber disposed about the shaft;
a shaft tube associated with the chamber, the shaft tube surrounding the shaft; and
a body positioned axially at an end of the chamber, the protector configured to fluidly isolate a volume within the shaft tube from fluids inside and outside of the chamber.
2. The protector of Claim 1, the body comprising a shaft seal about the shaft.
3. The protector of Claim 1, wherein the chamber comprises an elastomer bag.
4. The protector of Claim 1, wherein the at least one positive-sealing chamber comprises at least two positive-sealing chambers and the body is positioned axially between two consecutive positive-sealing chambers, the body comprising a shaft seal about the shaft and the consecutive positive-sealing chambers configured in parallel.
5. The protector of Claim 1, further comprising a shaft seal disposed axially between the positive-sealing chamber and a thrust bearing chamber.
6. The protector of Claim 1, wherein the at least one positive-sealing chamber comprises at least two positive-sealing chambers and the body is positioned axially between two consecutive positive-sealing chambers, the consecutive positive-sealing chambers configured in series with no shaft seal.
7. The protector of Claim 1, the body comprising a compensator configured to compensate for thermal expansion and/or contraction of oil within the shaft tube.
8. The protector of Claim 7, wherein the compensator comprises an elastomer bag, an elastomer bellows, a metal bellows, a movable piston, a volume of compressible gas, or a column of fluid that is denser than well fluid.
9. The protector of Claim 1, further comprising a relief valve configured to relieve excess pressure in the shaft tube.
10. The protector of Claim 1, the protector comprising a plurality of fluid pathways configured to fluidly isolate the volume within the shaft tube from the fluids inside and outside of the chamber into two separate hydraulic circuits.

11. The protector of Claim 1, wherein the positive-sealing chamber is coupled to a bag frame, further comprising at least two coaxial seals between the bag frame and the body, the coaxial seals configured to separate the volume within the shaft tube from the fluids inside and outside of the chamber.

12. A body for a protector of an electric submersible pump, the body configured to be positioned axially between two consecutive positive-sealing chambers of the protector, the body comprising two fluidly isolated hydraulic circuits.

13. A protector comprising at least one body according to Claim 12, a shaft, a plurality of positive-sealing chambers, a shaft tube associated with each chamber, each shaft tube surrounding the shaft, and a shaft seal associated with each body, wherein a first of the two fluidly isolated hydraulic circuits defines a volume partially bounded by the shaft, the shaft tube, and the shaft seal, and a second of the two fluidly isolated hydraulic circuits defines a volume inside and outside the chambers.

14. The protector of Claim 13, further comprising a compensator configured to compensate for thermal expansion and/or contraction of oil in the first of the two fluidly isolated hydraulic circuits.

15. The protector of Claim 14, wherein the compensator comprises an elastomer bag, an elastomer bellows, a metal bellows, a movable piston, a volume of compressible gas, or a column of fluid that is denser than well fluid.

16. The protector of Claim 13, further comprising a relief valve configured to relieve excess pressure in the shaft tube.

17. The protector of Claim 13, wherein the positive-sealing chambers comprise elastomer bags.

18. The protector of Claim 13, wherein the first and second fluidly isolated hydraulic circuits are independent of relative rotational relationship between the positive-sealing chambers and the body.

19. The body of Claim 12, further comprising a shaft seal, wherein the body is configured to couple the two consecutive positive-sealing chambers in parallel.

20. The body of Claim 12, wherein the body is configured to couple the two consecutive positive-sealing chambers in series and the body does not include a shaft seal.