WHAT IS CLAIMED IS:

1. A seal assembly for a high pressure pump, comprising:

a back-up ring having a head and an extension extending from the head, wherein the extension includes an interior surface that extends axially away from and radially inwardly from the head; and

a spring energized seal having a jacket having a first end, a second end and a sealing portion formed at the second end of the jacket, the sealing portion including an inner extension portion and an outer extension portion, an annular spring pocket being formed between the inner extension portion and the outer extension portion, an annular spring disposed within the annular spring pocket of the jacket, wherein at least a portion of the jacket fits around the extension of the back-up ring wherein the annular spring is not directly adjacent to the back-up ring, wherein the jacket comprises an interior surface having a curved portion , and wherein the back-up ring has a minimum inner diameter, ID_{BUR}, the spring energized seal has a minimum inner diameter, ID_{SES}, and ID_{SES} is less than ID_{BUR}.

2. A seal assembly for a high pressure pump, comprising:

a back-up ring having a head and an extension extending from the head;

a spring energized seal at least partially disposed around the extension of the back-up ring, the spring energized seal comprising a jacket having a head formed at a first end, a sealing portion formed at a second end spaced apart from the first end, the sealing portion including an inner extension portion and an outer extension portion, an annular spring pocket being formed between the inner extension portion and the outer extension portion, an angled internal surface extending between the first end of the jacket and the second end of the jacket; and an annular spring disposed within the annular spring pocket of the jacket; and

a gap between the extension of the back-up ring and the angled internal surface of the jacket of the spring energized seal, wherein the gap extends at least partially along the length of the angled internal surface of the jacket of the spring energized seal, wherein the annular spring is not directly adjacent to the back-up ring, wherein the jacket comprises an interior surface having a curved portion, and wherein the back-

up ring has a minimum inner diameter, ID_{BUR}, the spring energized seal has a minimum inner diameter, ID_{SES}, and ID_{SES} is less than ID_{BUR}.

3. A seal assembly for a high pressure pump, comprising:

a spring energized seal comprising:

a jacket having a head formed at a first end of the jacket, an annular lip extending axially from the head of the jacket, and a sealing portion formed at a second end of the jacket at a distance from the first end, wherein the sealing portion includes an inner extension portion and an outer extension portion, a spring portion being formed between the inner extension portion and the outer extension portion; and

an annular spring disposed within the spring portion;

a back-up ring having a head formed at a first end of the back-up ring and an extension extending from the head of the back-up ring; and

a first gap circumscribing the head of the back-up ring between an exterior surface of the head of the back-up ring and an interior surface of the annular lip of the head of the jacket, wherein the annular spring is not directly adjacent to the back-up ring, wherein the jacket comprises an interior surface having a curved portion, and wherein the back-up ring has a minimum inner diameter, ID_{BUR}, the spring energized seal has a minimum inner diameter, ID_{SES}, and ID_{SES} is less than ID_{BUR}.

4. The seal assembly of claim 1, wherein ID_{SES} is less than or equal to 99% ID_{BUR}.

5. The seal assembly of any of claims 1, 2, and 3, wherein the sealing portion of the spring energized seal is adapted to contact a shaft disposed within the seal assembly and a housing in which the seal assembly is installed.

6. The seal assembly of claim 3, wherein the first gap has a radial width, W_{FG}, and the seal assembly has an outer diameter, OD_{SA}, and W_{FG} is less than or equal to 5% OD_{SA}.

7. The seal assembly of claim 3, wherein the first gap has a radial width, W_{FG}, and W_{FG} is less than or equal to 0.1 mm.

8. The seal assembly of claim 1, wherein the interior surface of the back-up ring forms an angle, γ, with respect to a longitudinal axis and γ is greater than or equal to 0.25°.

9. The seal assembly of any of claims 2 and 3, wherein the head of the back-up ring includes a lower surface and the head of the jacket includes an upper surface in contact with the lower surface of the head of the back-up ring.

10. The seal assembly of any of claims 2 and 3, wherein the sealing portion of the jacket of spring energized seal is adapted to contact a shaft installed within the seal assembly and a second gap is formed between the extension of the back-up ring and the jacket.

11. The seal assembly of claim 3, wherein the first gap is adapted to allow the back-up ring to move in any radial direction relative to the spring energized seal.

12. The seal assembly of any of claims 1, 2, and 3, wherein the back-up ring comprises a polymer.

13. The seal assembly of any of claims 1, 2, and 3, wherein the jacket of the spring energized seal comprises a fluoropolymer.

14. The seal assembly of any of claims 1, 2 and 3, wherein the seal assembly is adapted to withstand a pressure of greater than or equal to 5,000 psi.

15. The seal assembly of claim 10, further comprising a third gap established between the jacket and a housing in which the seal assembly is configured to be installed.