Claims

What is claimed is:

1. A wellhead assembly 10 comprising:

an inner annulus 32 in a wellbore 11;

an outer annulus 30 circumscribing the inner annulus 32;

a tubular 28 between the inner and outer annuli 32, 30 and

characterized by a relief valve 52 set in the tubular 28 configurable in a closed position that has a pressure seal between the inner annulus 32 and outer annulus 30, selectively moveable from the closed position to an open position in which flow communicates through the relief valve 52 between the inner annulus 32 and outer annulus 30, and selectively moveable from the open position to the closed position.

2. The wellhead assembly 10 of claim 1, characterized in that the relief valve 52 is selectively moveable between the open and closed positions in response to a designated pressure differential between the inner annulus 32 and outer annulus 30.

3. The wellhead assembly 10 of claim 2, characterized in that the relief valve 52 comprises a valve seat 72 having a surface in pressure communication with one of the inner annulus 32 or the outer annulus 30 and that is biased to a closed position by a spring 77.

4. The wellhead assembly 10 of claim 3, characterized by a passage 82 that leads through the wellhead from one of the annuli 30, 32.

5. The wellhead assembly 10 of any of claims 1-4, characterized in that a pressure sensor 50 is in one of the inner annulus 32 or outer annulus 30.

6. The wellhead assembly 10 of any of claims 1-5, characterized in that the inner annulus 32 is a tubing annulus and the outer annulus 30 is a casing annulus and the pressure relief valve 52 allows flow from the casing annulus to the tubing annulus when in the open position.

7. The wellhead assembly 10 of any of claims 1-6, further characterized by a blocking sleeve 64 selectively mounted within one of the annuli 30, 32 and into sealing contact with a vent side of the relief valve 52 to block flow through the relief valve 52.

8. A method of managing pressure in an annulus 30, 32 of a wellbore 10 comprising:

providing a tubular 28 in the wellbore 11 to define an inner annulus 32 circumscribed by the tubular 28 and an outer annulus 30 that circumscribes the tubular 28; and

characterized by providing a vent valve 52 through a wall of the tubular 28 that opens when a pressure difference between the inner annulus 32 and outer annulus 30 causes a pressure differential across the wall of the tubular 28 that is above a designated pressure differential and closes when a pressure difference between the inner annulus 32 and outer annulus 30 causes a pressure differential across the wall of the tubular 28 is below the designated pressure differential.

9. The method of claim 8, further characterized by monitoring pressure in the inner or outer annulus 32, 30.

10. The method of any of claims 8 or 9, characterized by the inner annulus 30 being a tubing annulus and the outer annulus is a casing annulus, and wherein the annulus having a higher pressure is the outer annulus 30.

11. The method of any of claims 8-10, further characterized by disabling the vent valve 52 by inserting a bridging sleeve 64 in the tubular adjacent the vent valve 52.

12. The method of any of claims 8-11, further characterized by venting flow from the inner or outer annulus 32, 30 having the higher pressure through a wellhead and out of the wellbore 11.

13. A wellhead assembly 10 set on a well comprising:

a string of tubing 22 suspended in the well;

a string of inner casing 28 surrounding the string of tubing 22 in the well;

a string of outer casing 18 surrounding the string of inner casing 28;

an inner annulus 32 in a wellbore 11 between the string of tubing 22 and the strings of casing 18, 28;

an outer annulus 30 between the inner and outer strings of casing 28, 18; and

characterized by a pressure relief valve 52 set in a passage in a side wall of the inner casing that blocks flow through the passage when a pressure difference between the inner annulus 32 and outer annulus 30 is less than a designated pressure differential and is selectively moveable out of the passage when a pressure difference between the inner annulus 32 and outer annulus 30 is greater than a designated pressure differential so that flow communicates through the passage from the outer annulus 30 to the inner annulus 32.

14. The wellhead assembly 10 of claim 13, further characterized by a tubing annulus passage 82 that leads from the inner annulus 32 and to an exterior of the wellhead assembly 10.

15. The wellhead assembly 10 of any claims 13 or 14, further characterized by a pressure sensor 50 in one of the inner annulus 32 or outer annulus 30.

16. The wellhead assembly 10 of any of claims 13-15, characterized by communication between the outer annulus 30 and the exterior of the wellhead assembly 10 consists of a flow path through the pressure relief valve 52.

17. The wellhead assembly 10 of any of claims 13-16, further characterized by a blocking sleeve 64 selectively moveable within the tubing annulus 32 and into sealing contact with a side of the passage.

CLAIMS

1. A wellhead assembly comprising:

an inner annulus in a wellbore;

an outer annulus circumscribing the inner annulus;

a tubular between the inner and outer annuli;

a port formed in a sidewall of the tubular; and

a relief valve comprising:

a body mounted in the port and projecting radially outward from the tubular,

a flow passage in the body having an inner radial end in communication with the inner annulus and an outer radial end radially distal from the inner radial end,

a groove formed in an end of the body distal from the port and that is substantially coaxial with the port,

a valve seat in the body that is biased by a spring to a closed position between the outer radial end and outer annulus, and moveable to an open position set radially inward from the closed position and spaced away from a flow path between the outer radial end and outer annulus, the valve seat further comprising an upper portion having a substantially cylindrical outer surface that selectively moves into the groove when the valve seat is in the closed position, a lower portion having a substantially cylindrical outer surface with a radius exceeding a radius of the upper portion, and a surface in pressure communication with the outer annulus, so that when the valve seat is in the closed position, the valve seat defines a flow barrier between the inner annulus and outer annulus, and when the valve seat is in the open position, the

outer radius is in communication with the inner radius through the flow passage and flow path.

2. The wellhead assembly of claim 1, wherein the valve seat is selectively moveable between the open and closed positions in response to a designated pressure differential between the inner annulus and outer annulus.

3. The wellhead assembly of claim 1, further comprising a pressure sensor in one of the inner annulus or outer annulus.

4. The wellhead assembly of claim 1, wherein the inner annulus is a tubing annulus and the outer annulus is a casing annulus and the pressure relief valve allows flow from the casing annulus to the tubing annulus when in the open position.

5. The wellhead assembly of claim 1, further comprising a blocking sleeve selectively mounted within one of the annuli and into sealing contact with a vent side of the relief valve to block flow through the relief valve.

6. A wellhead assembly set on a well comprising:

a string of tubing suspended in the well;

a string of inner casing surrounding the string of tubing in the well;

a string of outer casing surrounding the string of inner casing;

an inner annulus in a wellbore between the string of tubing and the string of casing;

an outer annulus between the inner and outer strings of casing; and

a pressure relief valve comprising:

a body set in a in a port formed in a side wall of the inner casing,

a passage in the body that extends radially outward from the inner casing,

a valve seat oriented substantially coaxially with the port and moveable between a closed position and between an outer radial end of the passage and the outer annulus to an open position set radially inward from the closed position, and

an annular groove formed in an end of the valve seat distal from the inner casing and that is substantially coaxial with the port,

so that when the valve seat is in the open position the inner radius communicates with the outer radius through the passage.

7. The wellhead assembly of claim 6, further comprising an annular seal set in the groove having an inner radius that is in selective contact with an outer radial surface of the valve seat to define a sealing interface when the valve seat is in the closed position tubing annulus.

8. The wellhead assembly of claim 6, further comprising a pressure sensor in one of the inner annulus or outer annulus.

9. The wellhead assembly of claim 6, wherein communication between the outer annulus and the exterior of the wellhead assembly consists of a flow path through the pressure relief valve.

10. The wellhead assembly of claim 6, further comprising a blocking sleeve selectively moveable within the inner annulus and into sealing contact with a side of the passage.