DOWNHOLE PRESSURE MAINTENANCE SYSTEM USING REFERENCE PRESSURE

TECHNICAL FIELD

The present disclosure relates generally to a downhole pressure maintenance system, and specifically a pressure maintenance system that maintains a pressure within an isolated annulus of a wellbore within a predetermined pressure range.

BACKGROUND

After a well is drilled and a target reservoir has been encountered, completion and production operations are performed, which may include gravel packing operations. Generally, gravel packing operations include placing a lower completion assembly, which forms part of a working string, downhole within a target reservoir in a formation. In a multi-zone completion, a number of packers are located within the lower completion assembly and are activated to isolate a portion of a wellbore annulus formed between the working string and the casing (if a cased hole) or the formation (if an open hole). Each of these portions may be production zones that are subsequently packed with gravel or coarse sand. Often, after one of the packers is set but prior to the gravel packing of the production zones, each production zone is isolated from the wellbore hydrostatic pressure. As the formation absorbs drilling fluids from each production zone, the wellbore annulus pressure within each of the production zones may drop, which may cause collapse of an open hole or influx of sand in an unconsolidated cased hole installation.

The present disclosure is directed to a downhole pressure maintenance system that overcomes one or more of the shortcomings in the prior art.

SUMMARY

According to an aspect of the present disclosure, there is provided a method of providing pressure maintenance including: positioning a completion string within a wellbore, the completion string having an internal surface that at least partially defines an internal region and

an external surface that at least partially defines an external region; isolating a portion of the external region from a wellbore hydrostatic pressure; fluidically connecting the internal region to the isolated portion of the external region via a first flow path; providing a first valve that controls the flow of a first fluid through the first flow path, the first valve comprising a first pressure differential sensor; opening the first valve when the first pressure differential sensor measures a pressure differential between an external pressure within the isolated portion of the external region and a reference pressure that is less than a first pressure threshold; closing the first valve when the pressure differential between the external pressure and the reference pressure is greater than or equal to the first pressure threshold; providing a second valve that controls the flow of the first fluid through the first flow path, the second valve comprising a second pressure differential sensor; opening the second valve when the second pressure differential sensor measures a pressure differential between an internal pressure associated with the internal region and the external pressure that is less than a second pressure threshold; and closing the second valve when the pressure differential between the internal pressure and the external pressure within the isolated portion of the external region is greater than or equal to the second pressure threshold.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the present disclosure will be understood more fully from the detailed description given below and from the accompanying drawings of various embodiments of the disclosure. In the drawings, like reference numbers may indicate identical or functionally similar elements.

CLAIMS:

1. A method of providing pressure maintenance comprising:

positioning a completion string within a wellbore, the completion string having an internal surface that at least partially defines an internal region and an external surface that at least partially defines an external region;

isolating a portion of the external region from a wellbore hydrostatic pressure;

fluidically connecting the internal region to the isolated portion of the external region via a first flow path;

providing a first valve that controls the flow of a first fluid through the first flow path, the first valve comprising a first pressure differential sensor;

opening the first valve when the first pressure differential sensor measures a pressure differential between an external pressure within the isolated portion of the external region and a reference pressure that is less than a first pressure threshold;

closing the first valve when the pressure differential between the external pressure and the reference pressure is greater than or equal to the first pressure threshold;

providing a second valve that controls the flow of the first fluid through the first flow path, the second valve comprising a second pressure differential sensor;

opening the second valve when the second pressure differential sensor measures a pressure differential between an internal pressure associated with the internal region and the external pressure that is less than a second pressure threshold; and

closing the second valve when the pressure differential between the internal pressure and the external pressure within the isolated portion of the external region is greater than or equal to the second pressure threshold.

2. The method of claim 1, further comprising providing a flow control valve that controls the flow of the first fluid through the first flow path.

3. The method of claim 1, further comprising:

pressurizing an accumulator that is located within the completion string and that is in fluid communication with the external region to the external pressure, wherein pressurizing the accumulator comprises flowing a second fluid from the external region in a direction towards the accumulator; and

closing a fifth valve that controls the flow of the second fluid when a fifth pressure differential sensor measures a pressure differential between the first flow path and the external pressure that is greater than a fifth pressure threshold associated with the fifth pressure differential sensor.

4. The method of claim 1, wherein the first pressure differential sensor comprises a spring.

5. The method of claim 1, wherein the reference pressure is the wellbore hydrostatic pressure.