[0009a] In one aspect, there is provided a fluid flow control assembly capable of being disposed in a bore of a subterranean formation via a production tubing and adjacent to a packer assembly, comprising: a plurality of valves comprising: a first valve in communication with a first actuator, the first valve positionable adjacent to a first port of the production tubing and adapted to allow fluid flow from the production tubing to a screen, a second valve in communication with a second actuator, the second valve positionable between a second port of the production tubing and a wash pipe adjacent to the production tubing and adapted to allow the fluid flow to an upper portion of the bore, the second valve adapted to allow fluid flow between an inner volume of the production tubing and the wash pipe, and a third valve in communication with a third actuator, the third valve positioned downhole from the second valve and positionable adjacent to the wash pipe, the third valve adapted to allow fluid flow between a first portion of the bore and a second portion of the bore further from the surface of the bore than the first portion; wherein the fluid flow control assembly is configurable to be set to a plurality of positions in accordance with control signals from a surface unit identifying the plurality of positions, wherein the plurality of positions comprises: the first valve, the second valve, and the third valve being separately actuated to open or closed positions in accordance with respective ones of the control signals; and a set and test position allowing pressure to be applied to the packer assembly; a reverse position allowing excess slurry to be removed by reverse circulation via the wash pipe and the second port in accordance with control signals identifying the reverse position; and a squeeze position allowing frac fluid to be pumped to a perforated portion of the subterranean formation via the first port in accordance with control signals identifying the squeeze position.

[0009b] In another aspect, there is provided a method comprising: running a production tubing in a bore of a subterranean formation, the production tubing comprising a screen, a fluid flow control assembly, and a packer assembly, the fluid flow control assembly comprising a first valve in communication with a first actuator and a second valve in communication with a second actuator; responsive to first signals received from a surface component, configuring the fluid flow control assembly to a circulating position by the first actuator actuating the first valve to an

open position and the second actuator actuating the second valve to the open position separate from the first actuator actuating the first valve to the open position, to allow slurry comprising a liquid carrier and particulate material to flow to the screen and at least some of the liquid carrier to return to an upper portion of the bore, wherein at least some of the particulate material is deposited internal to the screen; and responsive to second signals received from the surface component, configuring the fluid flow control assembly to a production mode position by the first actuator actuating the first valve to a closed position and the second actuator actuating the second valve to the closed position separate from the first actuator actuating the first valve to the closed position, to allow hydrocarbons to flow to the upper portion of the bore, wherein the hydrocarbons are allowed to flow to the upper portion of the bore through a single trip in the bore.

[0009c] In another aspect, there is provided an assembly capable of being disposed in a bore of a subterranean formation, the assembly comprising: a production tubing; a packer assembly positioned exterior to the production tubing; a fluid control assembly positioned proximate to the packer assembly, the fluid control assembly comprising a plurality of actuators configured for receiving signals from a surface component, the plurality of actuators comprising a first actuator, a second actuator, and a third actuator; a plurality of valves, each one valve of the plurality of valves being separately controllable by a respective one actuator of the plurality of actuators in accordance with the signals to control direction of fluid flow in the bore, the plurality of valves comprising: a first valve in communication with the first actuator, the first valve positioned adjacent to a first port of the production tubing and adapted to allow fluid flow from the production tubing to a screen, a second valve in communication with the second actuator, the second valve positioned adjacent to a second port of the production tubing and adapted to allow fluid flow between an inner volume of the production tubing and a wash pipe of the fluid control assembly, the wash pipe adapted to allow the fluid flow to an upper portion of the bore, and a third valve in communication with the third actuator, the third valve positioned downhole from the second valve and adjacent to the wash pipe, the third valve adapted to

allow fluid flow between a first portion of the bore and a second portion of the bore further from the surface of the bore than the first portion, wherein the fluid flow control assembly is configurable to a set and test position allowing pressure to be applied to the packer assembly in accordance with control signals identifying the set and test position by: the first valve being actuated to a closed position by the first actuator in accordance with a first one of the control signals identifying the set and test position, the second valve being actuated to a closed position by the second actuator in accordance with a second one of the control signals identifying the set and test position, and the third valve being actuated to a closed position by the third actuator in accordance with a third one of the control signals identifying the set and test position; wherein the fluid flow control assembly is configurable to a squeeze position allowing frac fluid to be pumped to a perforated portion of the subterranean formation via the first port in accordance with control signals identifying the squeeze position by: the first valve being actuated to an open position by the first actuator in accordance with a first one of the control signals identifying the squeeze position, the second valve being actuated to the closed position by the second actuator in accordance with a second one of the control signals identifying the squeeze position, and the third valve being actuated to the closed position by the third actuator in accordance with a third one of the control signals identifying the squeeze position, wherein the fluid flow control assembly is configurable to a reverse position allowing excess slurry to be removed by reverse circulation via the wash pipe and the second port in accordance with control signals identifying the reverse position by: the first valve being actuated to the closed position by the first actuator in accordance with a first one of the control signals identifying the reverse position, the second valve being actuated to the open position by the second actuator in accordance with a second one of the control signals identifying the reverse position, and the third valve being actuated to the closed position by the third actuator in accordance with a third one of the control signals identifying the reverse position.

[0010] In one embodiment~~aspect~~, a fluid flow control assembly is described that includes at least one actuator and valves. The actuator can receive signals from a surface component. The valves can be in communication with the actuator and can be controllably actuated by the actuator in accordance with the signals to control direction of fluid flow in the bore.

[0011] In another embodiment~~aspect~~, a method is described for preparing a bore for hydrocarbon production. Production tubing is run in the bore. The production tubing includes a screen, a fluid flow control assembly, and a packer assembly. The fluid flow control assembly includes at least one actuator that can receive signals from a surface component and includes valves in communication with the actuator. In response to signals received from the surface component, the fluid flow control assembly is configured to a circulating position by actuating the valves to an open position to allow slurry to flow to the screen and at least some of the liquid carrier of the slurry to return to an upper portion of the bore. The slurry can also include particulate material. In response to signals received from the surface component, the fluid flow control assembly is configured to a production mode position by actuating the valves to a closed position to allow hydrocarbons to flow to the upper portion of the bore.

[0012] In another embodiment~~aspect~~, a fluid flow control assembly is described that includes at least one actuator and valves in communication with the actuator. The actuator can receive signals from a surface component. The valves can be controllably actuated by the actuator in accordance with the signals to control

Claims

What is claimed is:

1. A fluid flow control assembly capable of being disposed in a bore of a subterranean formation, comprising:

at least one actuator capable of receiving signals from a surface component;

a plurality of valves in communication with the at least one actuator and capable of being controllably actuated by the at least one actuator in accordance with the signals to control direction of fluid flow in the bore.

2. The fluid flow control assembly of claim 1, wherein the plurality of valves comprise:

an inner diameter closure mechanism;

a gravel exit port closing sleeve; and

a return and reversing valve.

3. The fluid flow control assembly of claim 2, wherein the inner diameter closure mechanism comprises at least one of a ball or a sleeve.

4. The fluid flow control assembly of claim 1, wherein the at least one actuator is in communication with the surface component through a control line.

5. The fluid flow control assembly of claim 4, wherein the at least one actuator is in communication with the surface component by at least one of hydraulically or electrically.

6. The fluid flow control assembly of claim 1, wherein the at least one actuator comprises a control module that is electrically powered and configured to process the signals received from the surface component and actuate the plurality of valves in accordance with the signals.

7. The fluid flow control assembly of claim 6, wherein the control module is configured to receive the signals wirelessly from the surface component.

8. The fluid flow control assembly of claim 1, wherein the fluid flow control assembly is capable of being positioned on a production tubing having a screen and a packer assembly.

9. The fluid flow control assembly of claim 8, wherein the fluid flow control assembly is capable of being positioned uphole from the screen.

10. The fluid flow control assembly of claim 1, comprising a crossover portion having a plurality of ports therethrough, the plurality of valves being capable of controlling fluid flow through the plurality of ports.

11. The fluid flow control assembly of claim 1, wherein the at least one actuator comprises a plurality of actuators corresponding to the plurality of valves such that an actuator of the plurality of actuators is configured to control a position of one valve of the plurality of valves.

12. The fluid flow control assembly of claim 1, wherein the at least one actuator is capable of actuating the plurality of valves in response to the signals to cause the fluid flow control assembly to be configured into positions by a single trip through the bore, the positions comprising a run in position, a packer set and test position, a circulating position, a squeeze position, a reverse position, and a production mode position.

13. A method comprising:

running a production tubing in a bore of a subterranean formation, the production tubing comprising a screen, a fluid flow control assembly, and a packer assembly, the fluid flow control assembly comprising (i) at least one actuator capable of receiving signals from a surface component and (ii) a plurality of valves in communication with the at least one actuator;

responsive to signals received from the surface component, configuring the fluid flow control assembly to a circulating position by actuating the plurality of valves to an open position to allow slurry comprising a liquid carrier and particulate material to flow to the screen and at least some of the liquid carrier to return to an upper portion of the bore; and

responsive to signals received from the surface component, configuring the fluid flow control assembly to a production mode position by actuating the plurality of valves to a closed position to allow hydrocarbons to flow to the upper portion of the bore.

14. The method of claim 13, further comprising:

response to signals received from the surface component, configuring the fluid flow control assembly to a packer set and test position by actuating the plurality of valves to the closed position to allow pressure to be applied to the packer assembly to set and test a packer of the packer assembly;

responsive to signals received from the surface component, configuring the fluid flow control assembly to a squeeze position by actuating at least one of the plurality of valves to the open position and remaining valves of the plurality of valves to the closed position to allow frac fluid to be pumped to a perforated portion of the subterranean formation; and

responsive to signals received from the surface component, configuring the fluid flow control assembly to a reverse position by actuating at least one of

the plurality of valves to the open position and remaining valves of the plurality of valves to the closed position to allow excess slurry to be removed by reverse circulation prior to production.

15. The method of claim 14, wherein the at least one actuator comprises a control module that wirelessly receives signals from the surface component.

16. The method of claim 14, wherein the at least one actuator receives signals from the surface component via a control line.

17. The method of claim 13, wherein at least some of the particulate material is deposited internal to the screen and hydrocarbons are allowed to flow to the upper portion of the bore through a single trip in the bore.

18. A fluid flow control assembly capable of being disposed in a bore of a subterranean formation, comprising:

at least one actuator capable of receiving signals from a surface component;

a plurality of valves in communication with the at least one actuator and capable of being controllably actuated by the at least one actuator in accordance with the signals to control direction of fluid flow in the bore to allow a packer to be

set, slurry to be circulated to a screen, and hydrocarbons to be produced, through a single trip in the bore.

19. The fluid flow control assembly of claim 18, wherein the at least one actuator receives signals from the surface component at least one of wirelessly or via a control line.

20. The fluid flow control assembly of claim 19, wherein the at least one actuator is in communication with the surface component by at least one of hydraulically or electrically.

CLAIMS

What is claimed is:

1. A fluid flow control assembly capable of being disposed in a bore of a subterranean formation via a production tubing and adjacent to a packer assembly, comprising:

a plurality of valves comprising:

a first valve in communication with a first actuator, the first valve positionable adjacent to a first port of the production tubing and adapted to allow fluid flow from the production tubing to a screen,

a second valve in communication with a second actuator, the second valve positionable between a second port of the production tubing and a wash pipe adjacent to the production tubing and adapted to allow the fluid flow to an upper portion of the bore, the second valve adapted to allow fluid flow between an inner volume of the production tubing and the wash pipe, and

a third valve in communication with a third actuator, the third valve positioned downhole from the second valve and positionable adjacent to the wash pipe, the third valve adapted to allow fluid flow between a first portion of the bore and a second portion of the bore further from the surface of the bore than the first portion;

wherein the fluid flow control assembly is configurable to be set to a plurality of positions in accordance with control signals from a surface unit identifying the plurality of positions,

wherein the plurality of positions comprises:

the first valve, the second valve, and the third valve being separately actuated to open or closed positions in accordance with respective ones of the control signals; and

a set and test position allowing pressure to be applied to the packer assembly;

a reverse position allowing excess slurry to be removed by reverse circulation via the wash pipe and the second port in accordance with control signals identifying the reverse position; and

a squeeze position allowing frac fluid to be pumped to a perforated portion of the subterranean formation via the first port in accordance with control signals identifying the squeeze position.

2. The fluid flow control assembly of claim 1, wherein the plurality of valves comprise:

an inner diameter closure mechanism;

a gravel exit port closing sleeve; and

a return and reversing valve.

3. The fluid flow control assembly of claim 2, wherein the inner diameter closure mechanism comprises at least one of a ball or a sleeve.

4. The fluid flow control assembly of claim 1, wherein the plurality of actuators are in communication with the surface component through a control line.

5. The fluid flow control assembly of claim 4, wherein the plurality of actuators are in communication with the surface component by at least one of hydraulically or electrically.

6. The fluid flow control assembly of claim 1, wherein the plurality of actuators comprise a plurality of control modules that are electrically powered and configured to process the signals received from the surface component and actuate the plurality of valves in accordance with the signals.

7. The fluid flow control assembly of claim 6, wherein each of the plurality of control modules is configured to receive the signals wirelessly from the surface component.

8. The fluid flow control assembly of claim 1, wherein the fluid flow control assembly is capable of being positioned on the production tubing having the screen and the packer assembly.

9. The fluid flow control assembly of claim 8, wherein the fluid flow control assembly is capable of being positioned uphole from the screen.

10. The fluid flow control assembly of claim 1, comprising a crossover portion having a plurality of ports therethrough, the plurality of valves being capable of controlling fluid flow through the plurality of ports.

11. The fluid flow control assembly of claim 1, wherein one of the first actuator, the second actuator, and the third actuator is configured to control a respective position of a respective one of the first valve, the second valve, and the third valve separately of another of the first actuator, the second actuator, and the third actuator controlling a respective position of another respective one of the first valve, the second valve, and the third valve.

12. The fluid flow control assembly of claim 1, further comprising a plurality of actuators including the first actuator, the second actuator, and the third actuator, wherein each of the plurality of actuators is configured for actuating a respective one of the plurality of valves in response to the signals to cause the fluid flow control assembly to be configured into positions by a single trip through the bore, the positions comprising a run in position, the set and test position, a circulating position, the squeeze position, the reverse position, and a production mode position.

13. A method comprising:

running a production tubing in a bore of a subterranean formation, the production tubing comprising a screen, a fluid flow control assembly, and a packer assembly, the fluid flow control assembly comprising a first valve in communication with a first actuator and a second valve in communication with a second actuator;

responsive to first signals received from a surface component, configuring the fluid flow control assembly to a circulating position by the first actuator actuating the first valve to an open position and the second actuator actuating the second valve to the open position separate from the first actuator actuating the first valve to the open position, to allow slurry comprising a liquid carrier and particulate material to flow to the screen and at least some of the liquid carrier to return to an upper portion of the bore, wherein at least some of the particulate material is deposited internal to the screen; and

responsive to second signals received from the surface component, configuring the fluid flow control assembly to a production mode position by the first actuator actuating the first valve to a closed position and the second actuator actuating the second valve to the closed position separate from the first actuator actuating the first valve to the closed position, to allow hydrocarbons to flow to the upper portion of the bore, wherein the hydrocarbons are allowed to flow to the upper portion of the bore through a single trip in the bore.

14. The method of claim 13, further comprising:

response to third signals received from the surface component, configuring the fluid flow control assembly to a packer set and test position by the first actuator actuating the first valve to the closed position and the second actuator actuating the second valve to the closed position separate from the first actuator actuating the first valve to the closed position to allow pressure to be applied to the packer assembly to set and test a packer of the packer assembly;

responsive to fourth signals received from the surface component, configuring the fluid flow control assembly to a squeeze position by the first actuator actuating the first valve to the open position, the second actuator actuating the second valve to the closed position separate from the first actuator actuating the first valve to the open position, and a third actuator actuating a third valve to the closed position separate from the first actuator actuating the first valve to the open position and the second actuator actuating the second valve to the closed position, to allow frac fluid to be pumped to a perforated portion of the subterranean formation; and

responsive to fifth signals received from the surface component, configuring the fluid flow control assembly to a reverse position by the first actuator actuating the first valve to the closed position, the second actuator actuating the second valve to the closed position, and the third actuator actuating the third valve to the open position, to allow excess slurry to be removed by reverse circulation prior to production.

15. The method of claim 14, wherein the first actuator, the second actuator, and the third actuator comprise control modules that wirelessly receive signals from the surface component.

16. The method of claim 14, wherein the first actuator, the second actuator, and the third actuator receive signals from the surface component via a control line.

17. An assembly capable of being disposed in a bore of a subterranean formation, the assembly comprising:

a production tubing;

a packer assembly positioned exterior to the production tubing;

a fluid control assembly positioned proximate to the packer assembly, the fluid control assembly comprising a plurality of actuators configured for receiving signals from a surface component, the plurality of actuators comprising a first actuator, a second actuator, and a third actuator;

a plurality of valves, each one valve of the plurality of valves being separately controllable by a respective one actuator of the plurality of actuators in accordance with the signals to control direction of fluid flow in the bore, the plurality of valves comprising:

a first valve in communication with the first actuator, the first valve positioned adjacent to a first port of the production tubing and adapted to allow fluid flow from the production tubing to a screen,

a second valve in communication with the second actuator, the second valve positioned adjacent to a second port of the production tubing and adapted to allow fluid flow between an inner volume of the production tubing and a wash pipe of the fluid control assembly, the wash pipe adapted to allow the fluid flow to an upper portion of the bore, and

a third valve in communication with the third actuator, the third valve positioned downhole from the second valve and adjacent to the wash pipe, the third valve adapted to allow fluid flow between a first portion of the bore and a second portion of the bore further from the surface of the bore than the first portion,

wherein the fluid flow control assembly is configurable to a set and test position allowing pressure to be applied to the packer assembly in accordance with control signals identifying the set and test position by:

the first valve being actuated to a closed position by the first actuator in accordance with a first one of the control signals identifying the set and test position,

the second valve being actuated to a closed position by the second actuator in accordance with a second one of the control signals identifying the set and test position, and

the third valve being actuated to a closed position by the third actuator in accordance with a third one of the control signals identifying the set and test position;

wherein the fluid flow control assembly is configurable to a squeeze position allowing frac fluid to be pumped to a perforated portion of the subterranean formation via the first port in accordance with control signals identifying the squeeze position by:

the first valve being actuated to an open position by the first actuator in accordance with a first one of the control signals identifying the squeeze position,

the second valve being actuated to the closed position by the second actuator in accordance with a second one of the control signals identifying the squeeze position, and

the third valve being actuated to the closed position by the third actuator in accordance with a third one of the control signals identifying the squeeze position,

wherein the fluid flow control assembly is configurable to a reverse position allowing excess slurry to be removed by reverse circulation via the wash pipe and the second port in accordance with control signals identifying the reverse position by:

the first valve being actuated to the closed position by the first actuator in accordance with a first one of the control signals identifying the reverse position,

the second valve being actuated to the open position by the second actuator in accordance with a second one of the control signals identifying the reverse position, and

the third valve being actuated to the closed position by the third actuator in accordance with a third one of the control signals identifying the reverse position.

18. The assembly of claim 17, wherein each of the plurality of actuators is configured to receive signals from the surface component at least one of wirelessly or via a control line.

19. The assembly of claim 18, wherein each of the plurality of control modules is in communication with the surface component by at least one of hydraulically or electrically.