CLAIMS

1. A method for completing a wellbore in a subsurface formation, the method comprising:

providing a packer assembly having a first mechanically-set packer as a first zonal isolation tool, and a second zonal isolation tool, wherein each of the first and second zonal isolation tools comprises an internal bore for receiving production fluids, and alternate flow channels, and the first mechanically-set packer comprises:

an inner mandrel as the internal bore,

alternate flow channels along the inner mandrel, and

a sealing element external to the inner mandrel;

connecting the packer assembly to a sand screen, the sand screen comprising a base pipe, a surrounding filter medium, and alternate flow channels, wherein:

the base pipe has an inner bore in fluid communication with the internal bore of the first and second zonal isolation tools, and

the alternate flow channels of the sand screen are in fluid communication with alternate flow channels of the first and second zonal isolation tools;

running the packer assembly and connected sand screen into the wellbore;

setting the first mechanically-set packer by actuating the sealing element into engagement with the surrounding subsurface formation;

injecting a gravel slurry into the wellbore; and

injecting the gravel slurry at least partially through the alternate flow channels to allow the gravel slurry to bypass the sealing element so that the wellbore is gravel-packed within an annular region between the sand screen and the surrounding formation below the packer assembly.

2. The method of claim 1, wherein the filtering medium of the sand screen comprises a wire-wrapped screen, a membrane screen, an expandable screen, a sintered metal screen, a wire-mesh screen, a shape memory polymer, or a pre-packed solid particle bed.

3. The method of claim 1, wherein the second zonal isolation tool is a gravel-based zonal isolation tool comprising:

an upstream manifold configured to receive the gravel slurry;

a gravel-packing conduit in fluid communication with the upstream manifold and extending longitudinally away from the upstream manifold, the gravel-packing conduit having a plurality of ports to place the gravel-packing conduit in fluid communication with an annulus between the second zonal isolation tool and the surrounding wellbore, and having a plug proximate a lower end of the gravel-packing conduit to isolate the gravel-packing conduit from a downstream flow path;

a transport conduit in fluid communication with the upstream manifold and in fluid communication with the downstream flow path, the transport conduit serving as the alternate flow channels for the second zonal isolation tool; and

a leak-off conduit comprising permeable media in order to place the leak-off conduit in fluid communication with the annulus but filtering gravel-packing particles during a gravel-packing procedure, the leak-off conduit comprising a longitudinal tubular body in fluid communication with the downstream flow path.

4. The method of claim 3, wherein the gravel-based zonal isolation tool is at least 40 feet in length.

5. The method of claim 1, wherein the second zonal isolation tool comprises a second mechanically-set packer constructed in accordance with the first mechanically-set packer, and being arranged within the packer assembly as substantially a mirror image of the first mechanically-set packer.

6. The method of claim 1, wherein the second zonal isolation tool comprises a swellable packer adjacent the first mechanically-set packer.

7. The method of claim 1, wherein:

the second zonal isolation tool comprises a second mechanically-set packer constructed in accordance with the first mechanically-set packer; and

the packer assembly further comprises a swellable packer intermediate the first and second mechanically-set packers, the swellable packer having alternate flow channels fluidly connected with the alternate flow channels of the first and second mechanically-set packers.

8. The method of claim 7, wherein the second mechanically-set packer is arranged within the packer assembly as substantially a mirror image of the first mechanically-set packer.

9. The method of claim 1, wherein the step of further injecting the gravel slurry through the alternate flow channels comprises bypassing the packer assembly so that the wellbore is gravel-packed above and below the packer assembly after the first and second mechanically-set packers have been set in the wellbore.

10. The method of claim 1, wherein the sand screen comprises:

a) a first conduit forming a primary flow path in fluid communication with the inner mandrel of the first mechanically-set packer, the first conduit having at least one section along its length that is permeable and at least one section along its length that is impermeable;

b) at least one shunt tube along the length of the first conduit, the at least one shunt tube being in fluid communication with one of the alternate flow channels of the first mechanically-set packer to transport gravel slurry;

c) a second conduit comprising a secondary flow joint, wherein the second conduit also has at least one section along its length that is permeable and at least one section along its length that is impermeable, and where one of the at least one permeable sections of the second conduit is in fluid communication with one of the at least one permeable sections of the first conduit, thereby providing fluid communication between the first and second conduits; and

d) the filtering medium, the filtering medium being designed to retain particles larger than a predetermined size while allowing fluids to pass into the permeable sections of the first and second conduits.

11. The method of claim 10, wherein:

the filtering medium comprises a first filtering screen placed along the permeable sections of the first conduit, and a second filtering medium placed along the permeable sections of the second conduit; and

the first conduit and the second conduit each comprises a tubular body having a cylindrical wall, with the first conduit and the second conduit running substantially parallel to one another within the wellbore.

12. The method of claim 1, wherein:

the wellbore has a lower end defining an open-hole portion;

running the packer assembly and sand screen into the wellbore along the open-hole portion; and

setting the packer within the open-hole portion of the wellbore.

13. A method for completing a wellbore, the wellbore having a lower end defining an open-hole portion, and the method comprising:

running a gravel pack zonal isolation apparatus into the wellbore, the zonal isolation apparatus comprising:

a sand control device having:

an elongated base pipe,

a filter medium circumferentially surrounding at least a portion of the base pipe, and

at least one alternate flow channel along the base pipe; and

at least one packer assembly, each of the at least one packer assembly comprising:

a first mechanically set packer having an upper sealing element,

a second mechanically set packer having a lower sealing element,

a swellable packer element between the upper sealing element and the lower sealing element that swells over time in the presence of a fluid, and

one or more alternate flow channels along the first mechanically-set packer, the swellable packer element, and the second mechanically-set packer to permit a gravel pack slurry to by-pass the at least one packer assembly;

positioning the zonal isolation apparatus in the open-hole portion of the wellbore;

setting each of the first and second mechanically-set packers by actuating the respective sealing elements into engagement with the surrounding open-hole portion of the wellbore;

injecting a gravel slurry into an annular region formed between the sand control device and the surrounding open-hole portion of the wellbore;

further injecting the gravel slurry through the alternate flow channels to allow the gravel slurry to bypass the at least one packer assembly so that the

open-hole portion of the wellbore is gravel-packed above and below the at least one packer assembly after the packer has been set in the wellbore.

14. The method of claim 13, wherein positioning the zonal isolation apparatus comprises positioning the zonal isolation apparatus such that a first of the at least one packer assembly is above or proximate the top of a selected subsurface interval.

15. The method of claim 13, wherein each of the first and second mechanically-set packers further comprises:

an inner mandrel;

a movable piston housing around the inner mandrel; and

one or more flow ports providing fluid communication between the alternate flow channels and a pressure-bearing surface of the piston housing.

16. The method of claim 15, further comprising:

running a setting tool into the inner mandrel of the first and second mechanically-set packers;

moving the setting tool along the inner mandrels, thereby releasing the movable piston housing on each of the first and second mechanically-set packers; and

communicating hydrostatic pressure to the piston housings through the one or more flow ports, thereby allowing the respective piston housings to slide, and thereby actuating the respective upper and lower sealing elements against the surrounding wellbore.

17. The method of claim 16, wherein releasing the movable piston housings comprises shifting respective release sleeves in the first and second mechanically-set packers by pulling the setting tools along the inner mandrels.

18. The method of claim 17, wherein:

each of the first and second mechanically-set packers further comprises a centralizer; and

moving the respective piston housings further actuates the respective centralizers into engagement with the surrounding open-hole portion of the wellbore.

19. The method of claim 18, further comprising:

actuating the respective centralizers in the mechanically-set packers into engagement with the surrounding wellbore by applying hydrostatic pressure to the respective piston housings.

20. The method of clam 19, wherein applying hydrostatic pressure to the piston housings moves the respective piston housings to act on the respective centralizers, which in turn actuates the upper and lower sealing elements against the surrounding wellbore.

21. The method of claim 16, further comprising:

producing hydrocarbon fluids from the open-hole portion of the wellbore.

22. A gravel pack zonal isolation apparatus, comprising:

a sand control device having:

an elongated base pipe extending from a first end to a second end,

at least one alternate flow channel along the base pipe extending from the first to the second end, and

a filter medium radially surrounding the base pipe along a substantial portion of the base pipe so as to form a sand screen; and

at least one packer assembly, each of the at least one packer assembly comprising:

an upper mechanically-set packer having a sealing element, and

a lower mechanically-set packer having a sealing element, wherein:

the upper packer and the lower packer each comprises at least one alternate flow channel in fluid communication with the at least one alternate flow channel in the sand control device to divert gravel pack slurry past the upper mechanically set packer and the lower mechanically set packer during a gravel-packing operation; and

each of the upper packer and lower packer comprises:

an inner mandrel,

a movable piston housing retained around the inner mandrel,

one or more flow ports providing fluid communication between the alternate flow channels and a pressure-bearing surface of the piston housing,

a release sleeve along an inner surface of the inner mandrel, the release sleeve being configured to move in response to movement of a setting tool within the inner mandrel and thereby expose the one or more flow ports to hydrostatic pressure during the gravel-packing operation.

23. The apparatus of claim 22, wherein the filter medium for the sand screen comprises wound wires, a wire mesh, or combinations thereof.

24. The apparatus of claim 23, further comprising:

a swellable packer intermediate the upper mechanically-set packer and the lower mechanically-set packer, the swellable packer having an element that swells over time in the presence of a fluid; and

wherein the swellable packer comprises at least one alternate flow channel in fluid communication with the at least one alternate flow channel in the upper mechanically set packer and the lower mechanically set packer to divert gravel pack slurry past the upper mechanically set packer and the lower mechanically set packer during a gravel-packing operation.

25. The apparatus of claim 22, wherein at least one of the at least one packer assembly is placed at the first end of the sand control device.

26. The apparatus of claim 22, wherein at least one of the at least one packer assembly is placed between two joints of the elongated base pipe intermediate the first and second ends.

27. The apparatus of claim 22, wherein:

the elongated base pipe comprises multiple joints of pipe connected end-to-end forming the first end of the sand control device and a second end of the sand control device; and

the gravel pack zonal isolation apparatus comprises an upper packer assembly placed at the first end of the sand control device, and a lower packer assembly placed at the second end of the sand control device.

28. The apparatus of claim 27, wherein the upper packer assembly and the lower packer assembly are spaced apart along the joints of pipe so as to straddle a selected subsurface interval within a wellbore.

29. The apparatus of claim 23, wherein the elements for the first and second mechanically set packer elements are elastomeric cup-type elements.

30. The apparatus of claim 23, wherein the sand screen comprises:

a) a first conduit forming a primary flow path in fluid communication with the inner mandrels of the upper and lower packers, the first conduit having at least one section along its length that is permeable and at least one section along its length that is impermeable;

b) at least one shunt tube along the length of the first conduit, the at least one shunt tube being in fluid communication with one of the alternate flow channels of the upper and lower packers to transport gravel slurry;

c) a second conduit comprising a secondary flow joint, wherein the second conduit also has at least one section along its length that is permeable and at least one section along its length that is impermeable, and wherein one of the at least one permeable sections of the second conduit is in fluid communication with one of the at least one permeable sections of the first conduit, thereby providing fluid communication between the first and second conduits; and

d) the filter medium, the filter medium being designed to retain particles larger than a predetermined size while allowing fluids to pass into the permeable sections of the first and second conduits.

CLAIMS

1. A method for completing a wellbore in a subsurface formation, the method comprising:

providing a packer assembly having a first mechanically-set packer as a first zonal isolation tool, and a second zonal isolation tool, wherein each of the first and second zonal isolation tools comprises an internal bore for receiving production fluids, and alternate flow channels, and the first mechanically-set packer comprises:

an inner mandrel as the internal bore,

alternate flow channels along the inner mandrel,

a movable piston housing around the inner mandrel,

one or more flow ports providing fluid communication between the alternate flow channels and pressure-bearing surface of the piston housing; and

a sealing element external to the inner mandrel;

connecting the packer assembly to a sand screen, the sand screen comprising a base pipe, a surrounding filter medium, and alternate flow channels, wherein:

the base pipe has an inner bore in fluid communication with the internal bore of the first and second zonal isolation tools, and

the alternate flow channels of the sand screen are in fluid communication with alternate flow channels of the first and second zonal isolation tools;

running the packer assembly and connected sand screen into the wellbore;

running a setting tool into the inner mandrel of the first mechanically-set packer;

moving the setting tool along the inner mandrels, thereby releasing the movable piston housing on the first mechanically-set packer; and

communicating hydrostatic pressure to the piston housings through the one or more flow ports, thereby allowing the piston housings to slide, and thereby actuating the sealing element against the surrounding wellbore; and

injecting a gravel slurry into the wellbore; and

injecting the gravel slurry at least partially through the alternate flow channels to allow the gravel slurry to bypass the sealing element so that the

wellbore is gravel-packed within an annular region between the sand screen and the surrounding formation below the packer assembly.

2. The method of claim 1, wherein the filtering medium of the sand screen comprises a wire-wrapped screen, a membrane screen, an expandable screen, a sintered metal screen, a wire-mesh screen, a shape memory polymer, or a pre-packed solid particle bed.

3. The method of claim 1 or 2, wherein the second zonal isolation tool is a gravel-based zonal isolation tool comprising:

an upstream manifold configured to receive the gravel slurry;

a gravel-packing conduit in fluid communication with the upstream manifold and extending longitudinally away from the upstream manifold, the gravel-packing conduit having a plurality of ports to place the gravel-packing conduit in fluid communication with an annulus between the second zonal isolation tool and the surrounding wellbore, and having a plug proximate a lower end of the gravel-packing conduit to isolate the gravel-packing conduit from a downstream flow path;

a transport conduit in fluid communication with the upstream manifold and in fluid communication with the downstream flow path, the transport conduit serving as the alternate flow channels for the second zonal isolation tool; and

a leak-off conduit comprising permeable media in order to place the leak-off conduit in fluid communication with the annulus but filtering gravel-packing particles during a gravel-packing procedure, the leak-off conduit comprising a longitudinal tubular body in fluid communication with the downstream flow path.

4. The method of claim 3, wherein the gravel-based zonal isolation tool is at least 40 feet in length.

5. The method of claim 1 or 2, wherein the second zonal isolation tool comprises a second mechanically-set packer constructed in accordance with the first mechanically-set packer, and being arranged within the packer assembly as substantially a mirror image of the first mechanically-set packer.

6. The method of claim 1 or 2, wherein the second zonal isolation tool comprises a swellable packer adjacent the first mechanically-set packer.

7. The method of claim 1 or 2, wherein:

the second zonal isolation tool comprises a second mechanically-set packer constructed in accordance with the first mechanically-set packer; and

the packer assembly further comprises a swellable packer intermediate the first and second mechanically-set packers, the swellable packer having alternate flow channels fluidly connected with the alternate flow channels of the first and second mechanically-set packers.

8. The method of claim 7, wherein the second mechanically-set packer is arranged within the packer assembly as substantially a mirror image of the first mechanically-set packer.

9. The method of any one of claims 1 to 8, wherein the step of further injecting the gravel slurry through the alternate flow channels comprises bypassing the packer assembly so that the wellbore is gravel-packed above and below the packer assembly after the first and second mechanically-set packers have been set in the wellbore.

10. The method of claim 1, wherein the sand screen comprises:

a) a first conduit forming a primary flow path in fluid communication with the inner mandrel of the first mechanically-set packer, the first conduit having at least one section along its length that is permeable and at least one section along its length that is impermeable;

b) at least one shunt tube along the length of the first conduit, the at least one shunt tube being in fluid communication with one of the alternate flow channels of the first mechanically-set packer to transport gravel slurry;

c) a second conduit comprising a secondary flow joint, wherein the second conduit also has at least one section along its length that is permeable and at least one section along its length that is impermeable, and where one of the at least one permeable sections of the second conduit is in fluid communication with one of the at least one permeable sections of the first

conduit, thereby providing fluid communication between the first and second conduits; and

d) the filtering medium, the filtering medium being designed to retain particles larger than a predetermined size while allowing fluids to pass into the permeable sections of the first and second conduits.

11. The method of claim 10, wherein:

the filtering medium comprises a first filtering screen placed along the permeable sections of the first conduit, and a second filtering medium placed along the permeable sections of the second conduit; and

the first conduit and the second conduit each comprises a tubular body having a cylindrical wall, with the first conduit and the second conduit running substantially parallel to one another within the wellbore.

12. The method of any one of claims 1 to 11, wherein:

the wellbore has a lower end defining an open-hole portion;

running the packer assembly and sand screen into the wellbore along the open-hole portion; and

setting the packer within the open-hole portion of the wellbore.

13. A method for completing a wellbore, the wellbore having a lower end defining an open-hole portion, and the method comprising:

running a gravel pack zonal isolation apparatus into the wellbore, the zonal isolation apparatus comprising:

a sand control device having:

an elongated base pipe,

a filter medium circumferentially surrounding at least a portion of the base pipe, and

at least one alternate flow channel along the base pipe; and

at least one packer assembly, each of the at least one packer assembly comprising:

a first mechanically set packer having an upper sealing element,

a second mechanically set packer having a lower sealing element,

a swellable packer element between the upper sealing element and

the lower sealing element that swells over time in the presence of a fluid, and

one or more alternate flow channels along the first mechanically-set packer, the swellable packer element, and the second mechanically-set packer to permit a gravel pack slurry to by-pass the at least one packer assembly and

the first mechanically-set packer further comprising

an inner mandrel;

a movable piston housing around the inner mandrel; and

one or more flow ports providing fluid communication between the alternate flow channels and a pressure-bearing surface of the piston housing;

positioning the zonal isolation apparatus in the open-hole portion of the wellbore;

running a setting tool into the inner mandrel of the first mechanically-set packer;

moving the setting tool along the inner mandrels, thereby releasing the movable piston housing on the first mechanically-set packer; and

communicating hydrostatic pressure to the piston housings throughthe one or more flow ports, thereby allowing the respective piston housings to slide, and thereby actuating the respective upper and lower sealing elements against the surrounding wellbore;

injecting a gravel slurry into an annular region formed between the sand control device and the surrounding open-hole portion of the wellbore;

further injecting the gravel slurry through the alternate flow channels to allow the gravel slurry to bypass the at least one packer assembly so that the open-hole portion of the wellbore is gravel-packed above and below the at least one packer assembly after the packer has been set in the wellbore.

14. The method of claim 13, wherein positioning the zonal isolation apparatus comprises positioning the zonal isolation apparatus such that a first of the at least one packer assembly is above or proximate the top of a selected subsurface interval.

15. The method of claim 13 or 14, wherein releasing the movable piston housings comprises shifting respective release sleeves in the first and second mechanically-set packers by pulling the setting tools along the inner mandrels.

16. The method of claim 15, wherein:

each of the first and second mechanically-set packers further comprises a centralizer; and

moving the respective piston housings further actuates the respective centralizers into engagement with the surrounding open-hole portion of the wellbore.

17. The method of claim 16, further comprising:

actuating the respective centralizers in the mechanically-set packers into engagement with the surrounding wellbore by applying hydrostatic pressure to the respective piston housings.

18. The method of clam 17, wherein applying hydrostatic pressure to the piston housings moves the respective piston housings to act on the respective centralizers, which in turn actuates the upper and lower sealing elements against the surrounding wellbore.

19. The method of any one of claims 13 to 18, further comprising:

producing hydrocarbon fluids from the open-hole portion of the wellbore.

20. A gravel pack zonal isolation apparatus, comprising:

a sand control device having:

an elongated base pipe extending from a first end to a second end,

at least one alternate flow channel along the base pipe extending from the first to the second end, and

a filter medium radially surrounding the base pipe along a substantial portion of the base pipe so as to form a sand screen; and

at least one packer assembly, each of the at least one packer assembly comprising:

an upper mechanically-set packer having a sealing element, and

a lower mechanically-set packer having a sealing element, wherein:

the upper packer and the lower packer each comprises at least one alternate flow channel in fluid communication with the at least one alternate flow channel in the sand control device to divert gravel pack slurry past the upper mechanically set packer and the lower mechanically set packer during a gravel-packing operation; and

each of the upper packer and lower packer comprises:

an inner mandrel,

a movable piston housing retained around the inner mandrel,

one or more flow ports providing fluid communication between the alternate flow channels and a pressure-bearing surface of the piston housing,

a release sleeve along an inner surface of the inner mandrel, the release sleeve being configured to move in response to movement of a setting tool within the inner mandrel and thereby expose the one or more flow ports to hydrostatic pressure during the gravel-packing operation.

21. The apparatus of claim 20, wherein the filter medium for the sand screen comprises wound wires, a wire mesh, or combinations thereof.

22. The apparatus of claim 21, further comprising:

a swellable packer intermediate the upper mechanically-set packer and the lower mechanically-set packer, the swellable packer having an element that swells over time in the presence of a fluid; and

wherein the swellable packer comprises at least one alternate flow channel in fluid communication with the at least one alternate flow channel in the upper mechanically set packer and the lower mechanically set packer to divert gravel

pack slurry past the upper mechanically set packer and the lower mechanically set packer during a gravel-packing operation.

23. The apparatus of claim 20, wherein at least one of the at least one packer assembly is placed at the first end of the sand control device.

24. The apparatus of claim 20, wherein at least one of the at least one packer assembly is placed between two joints of the elongated base pipe intermediate the first and second ends.

25. The apparatus of claim 20, wherein:

the elongated base pipe comprises multiple joints of pipe connected end-to-end forming the first end of the sand control device and a second end of the sand control device; and

the gravel pack zonal isolation apparatus comprises an upper packer assembly placed at the first end of the sand control device, and a lower packer assembly placed at the second end of the sand control device.

26. The apparatus of claim 25, wherein the upper packer assembly and the lower packer assembly are spaced apart along the joints of pipe so as to straddle a selected subsurface interval within a wellbore.

27. The apparatus of claim 21, wherein the elements for the first and second mechanically set packer elements are elastomeric cup-type elements.

28. The apparatus of claim 23, wherein the sand screen comprises:

a) a first conduit forming a primary flow path in fluid communication with the inner mandrels of the upper and lower packers, the first conduit having at least one section along its length that is permeable and at least one section along its length that is impermeable;

b) at least one shunt tube along the length of the first conduit, the at least one shunt tube being in fluid communication with one of the alternate flow channels of the upper and lower packers to transport gravel slurry;

c) a second conduit comprising a secondary flow joint, wherein the second conduit also has at least one section along its length that is permeable and at least one section along its length that is impermeable, and wherein one of the at least one permeable sections of the second conduit is in fluid communication with one of the at least one permeable sections of the first conduit, thereby providing fluid communication between the first and second conduits; and

d) the filter medium, the filter medium being designed to retain particles larger than a predetermined size while allowing fluids to pass into the permeable sections of the first and second conduits.