FLUID FLOW CONTROL DEVICE AND METHOD FOR USE OF SAME

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ABSTRACT

A fluid flow control device for use in a wellbore to control the inflow of production fluids comprises a tubular member having at least one fluid passageway and a sand control screen positioned exteriorly therearound. The sand control screen has a filter medium section that defines a first annular region with the tubular member and a housing section that defines a second annular region adjacent to the fluid passageway. A sealing member is positioned within the second annular region. A hydraulic pressure source is selectively in fluid communication with the sealing member to operate the sealing member from a nonsealing position wherein fluid flow through the fluid passageway is allowed, to a sealing position wherein fluid flow through the fluid passageway is prevented.
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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation-in-part application of co-pending application Ser. No. 10/227,935, entitled Fluid Flow Control Device and Method for Use of Same, filed on Aug. 26, 2002.

TECHNICAL FIELD OF THE INVENTION

[0002] This invention relates, in general, to sand control and flow control in a well that traverses a hydrocarbon bearing subterranean formation and, in particular, to a fluid flow control device including a sand control screen that selectively controls the inflow of formation fluids.

BACKGROUND OF THE INVENTION

[0003] Without limiting the scope of the present invention, its background will be described with reference to producing fluid from a subterranean formation, as an example.

[0004] After drilling each of the sections of a subterranean wellbore, individual lengths of relatively large diameter metal tubulars are typically secured together to form a casing string that is positioned within each section of the wellbore. This casing string is used to increase the integrity of the wellbore by preventing the wall of the hole from caving in. In addition, the casing string prevents movement of fluids from one formation to another formation. Conventionally, each section of the casing string is cemented within the wellbore before the next section of the wellbore is drilled.

[0005] Once this well construction process is finished, the completion process may begin. The completion process comprises numerous steps including creating hydraulic openings or perforations through the production casing string, the cement and a short distance into the desired formation or formations so that production fluids may enter the interior of the wellbore. The completion process may also include installing a production tubing string within the well casing which is used to produce the well by providing the conduit for formation fluids to travel from the formation depth to the surface.

[0006] To selectively permit and prevent fluid flow into the production tubing string, it is common practice to install one or more sliding sleeve type flow control devices within the tubing string. Typical sliding sleeve type flow control devices comprise a generally tubular body portion having side wall inlet openings formed therein and a tubular flow control sleeve coaxially and slidably disposed within the body portion. The sleeve is operable for axial movement relative to the body portion between a closed position, in which the sleeve blocks the body inlet ports, and an open position, in which the sleeve uncovers the ports to permit fluid to flow inwardly therethrough into the interior of the body and thus into the interior of the production tubing string. The sliding sleeves thus function as movable valve elements operable to selectively permit and prevent fluid inflow. Generally, cylindrical shifter tools, coaxially lowered into the interior of the tubing string, are utilized to shift selected ones of the sliding sleeves from their closed positions to their open positions, or vice versa, to provide subsurface flow control in the well.

[0007] It has been found, however, that typical sliding sleeve type flow control devices are not suitable in completions requiring sand control as they are not compatible with typical sand control screens. Recently, a device has been proposed that combines sand control and fluid flow control, which was disclosed in U.S. Pat. No. 5,896,928. Specifically, the device includes a generally tubular body for placement into the wellbore. The tubular body has a sand control screen at an outer surface for preventing sand from entering into tubular body. After the fluid flows through the sand control screen it must pass through a labyrinth. A slidable sleeve on the labyrinth controls the fluid velocity therethrough. The slidable sleeve is moved by a remotely and electrically-operated device placed in the tubular body. The fluid leaving the labyrinth passes to the tubing string for carrying the fluid to the surface.

[0008] It has been found, however, that the labyrinth type flow control devices are difficult and expensive to manufacture and can be unreliable under certain inflow conditions. Accordingly, need has arisen for a fluid flow control device for controlling the inflow of formation fluids in a completion requiring sand control. A need has also arisen for such a fluid flow control device that is not difficult or expensive to manufacture. Further, a need has arisen for such a fluid flow control device that is reliable in a variety of flow conditions.

SUMMARY OF THE INVENTION

[0009] The present invention disclosed herein comprises a fluid flow control device for controlling the inflow of formation fluids in completions requiring sand control and a method for use of the same. The fluid flow control device of the present invention is not difficult or expensive to manufacture. In addition, the fluid flow control device of the present invention is reliable in a variety of flow conditions.

[0010] The fluid flow control device comprises a tubular member having at least one fluid passageway in a sidewall section thereof. A sand control screen is positioned exteriorly around the tubular member. The sand control screen has a filter medium section that defines a first annular region with the tubular member and a housing section that defines a second annular region with the tubular member that is adjacent to the fluid passageway.

[0011] A sealing member is positioned within the second annular region. The sealing member has a first position wherein fluid flow is permitted through the fluid passageway and a second position wherein fluid flow is prevented through the fluid passageway. A hydraulic pressure source is selectively in fluid communication with the sealing member and is used to operate the sealing member from the first position to the second position.

[0012] In one embodiment of the present invention, the sealing member is a sliding sleeve. In another embodiment, the sealing member is an expandable bladder. In embodiments using the expandable bladder, the hydraulic pressure may be applied directly to the interior of the expandable bladder. Alternatively, the fluid flow control device may include a cylinder positioned within the second annular region. Together, the cylinder and the housing section form first and second chambers therebetween with the first and
second chambers having a piston therebetween. In this configuration, the first chamber is selectively in fluid communication with the hydraulic pressure source and the second chamber is in fluid communication with the expandable bladder sealing member.

[0013] In one embodiment, the hydraulic pressure source is a control line extending from a surface location to the sand control screen. The hydraulic control line has a first section with a terminus that is selectively in fluid communication with the sealing member. The hydraulic control line also has a second section that passes through the first annular region and extends downhole of the sand control screen. In another embodiment, the pressure source is the wellbore fluid surrounding the sand control screen in the wellbore.

[0014] The fluid flow control device may include a valve positioned within a fluid communication path between the hydraulic pressure source and the sealing member to selectively prevent and permit fluid communication between the hydraulic pressure source and the sealing member. In one embodiment, the valve is a eutectic valve. In another embodiment the valve is a rupture disk. The fluid flow control device may also include a sensor positioned on the fluid flow control device to sense at least one downhole parameter such as temperature, pressure, fluid composition and the like.

[0015] The fluid flow control device of the present invention may further include an energy conductor that extends from a surface location to the sand control screen. The energy conductor provides power and communications to the sensor and the valve. The energy conductor may pass through the first annular region and extend downhole of the sand control screen. In one embodiment, the energy conductor is an electrical conductor. In another embodiment, the energy conductor is a fiber optic conductor. In this embodiment, the fiber optic conductor may provide information relating to downhole parameters, such as temperature and pressure, to the surface location from a location proximate the sand control screen.

[0016] In another aspect, the present invention comprises a system for controlling production fluid flow in a wellbore that comprises first and second sand control screens in a sand control screen assembly positioned within the wellbore. A hydraulic fluid conduit is coupled to the first and second sand control screens such that increasing the pressure within the hydraulic fluid conduit to a first predetermined level prevents production fluid flow through the first sand control screen and increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level prevents production fluid flow through the second sand control screen.

[0017] In one embodiment, the first sand control screen may have a rupture disk operably associated therewith that bursts at a pressure less than the first predetermined level. In this embodiment, the second sand control screen may have a rupture disk operably associated therewith that bursts at a pressure between the first predetermined level the second predetermined level.

[0018] In yet another aspect, the present invention comprises a system for controlling production fluid flow in a wellbore that comprises first and second flow control devices positioned within the wellbore. A hydraulic fluid conduit is coupled to the first and second flow control devices such that increasing the pressure within the hydraulic fluid conduit to a first predetermined level prevents production fluid flow through the first flow control device and increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level prevents production fluid flow through the second flow control device.

[0019] In a further aspect, the present invention comprises a system for controlling production fluid flow in a wellbore that comprises first and second sand control screens in a sand control screen assembly positioned within the wellbore. A hydraulic fluid conduit is coupled to the first and second sand control screens. An energy conductor is coupled to the first and second sand control screens. The energy conductor provides a signal to open a valve operably associated with the first sand control screen such that hydraulic pressure is communicated from the hydraulic fluid conduit to the first sand control screen to prevent production fluid flow therefrom. Likewise, the energy conductor provides a signal to open a valve operably associated with the second sand control screen such that hydraulic pressure is communicated from the hydraulic fluid conduit to the second sand control screen to prevent production fluid flow therefrom.

[0020] In another aspect, the present invention comprises a system for controlling production fluid flow in a wellbore that comprises first and second flow control devices positioned within the wellbore. A hydraulic fluid conduit is coupled to the first and second flow control devices. An energy conductor is coupled to the first and second flow control devices. The energy conductor provides a signal to open a valve operably associated with the first flow control device such that hydraulic pressure is communicated from the hydraulic fluid conduit to the first flow control device to prevent production fluid flow therefrom. Likewise, the energy conductor provides a signal to open a valve operably associated with the second flow control device such that hydraulic pressure is communicated from the hydraulic fluid conduit to the second flow control device to prevent production fluid flow therefrom.

[0021] The present invention also comprises a system for controlling production fluid flow through multiple sand control screens in a sand control screen assembly positioned within a wellbore that involves coupling a hydraulic fluid conduit to the multiple sand control screens in the sand control screen assembly; increasing the pressure within the hydraulic fluid conduit to a first predetermined level to prevent production fluid flow through a first sand control screen and increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level to prevent production fluid flow through a second sand control screen.

[0022] The present invention further comprises a method for controlling production fluid flow through multiple flow control devices positioned within a wellbore that involves coupling a hydraulic fluid conduit to the multiple flow control devices, increasing the pressure within the hydraulic fluid conduit to a first predetermined level to prevent production fluid flow through a first flow control device and increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level to prevent production fluid flow through a second flow control device.
In addition, the present invention comprises a method for controlling production fluid flow through multiple sand control screens in a sand control screen assembly positioned within a wellbore that involves coupling a hydraulic fluid conduit to the multiple sand control screens in the sand control screen assembly, coupling an energy conductor to the multiple sand control screens in the sand control screen assembly, signaling a valve operably associated with a first sand control screen to actuate to an open position via the energy conductor, communicating hydraulic pressure from the hydraulic fluid conduit to the first sand control screen to prevent production fluid flow therethrough, signaling a valve operably associated with a second sand control screen to actuate to an open position via the energy conductor and communicating hydraulic pressure from the hydraulic fluid conduit to the second sand control screen to prevent production fluid flow therethrough.

Further, the present invention comprises a method for controlling production fluid flow through multiple fluid control devices positioned within a wellbore that involves coupling a hydraulic fluid conduit to the multiple fluid control devices, coupling an energy conductor to the multiple fluid control devices, signaling a valve operably associated with a first fluid control device to actuate to an open position via the energy conductor, communicating hydraulic pressure from the hydraulic fluid conduit to the first fluid control device to prevent production fluid flow therethrough, signaling a valve operably associated with a second fluid control device to actuate to an open position via the energy conductor and communicating hydraulic pressure from the hydraulic fluid conduit to the second fluid control device to prevent production fluid flow therethrough.

In another aspect, the present invention involves a method for controlling the flow of production fluids through a fluid flow control device. The method comprises positioning the fluid flow control device downhole, the fluid flow control device including a tubular member having at least one fluid passageway and a sand control screen positioned exteriorly around the tubular member, the sand control screen having a filter medium section defining a first annular region with the tubular member and a housing section defining a second annular region with the tubular member adjacent to the fluid passageway. The method also involves flowing fluid through the sand control screen and the fluid passageway, applying a hydraulic pressure to a sealing member positioned within the second annular region and operating the sealing member from a nonsealing position to a sealing position when it is desirable to prevent fluid flow through the fluid passageway.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the features and advantages of the present invention, reference is now made to the detailed description of the invention along with the accompanying figures in which corresponding numerals in the different figures refer to corresponding parts and in which:

FIG. 1 is a schematic illustration of an offshore oil and gas platform operating a plurality of fluid flow control devices according to the present invention;

FIG. 2 is a half sectional view of a fluid flow control device according to the present invention positioned in its fully open position;

FIG. 3 is a half sectional view of a fluid flow control device according to the present invention positioned in a choking position;

FIG. 4 is a half sectional view of a fluid flow control device according to the present invention positioned in a choking position;

FIG. 5 is a half sectional view of a fluid flow control device according to the present invention positioned in a choking position;

FIG. 6 is a half sectional view of a fluid flow control device according to the present invention positioned in its fully closed position;

FIG. 7 is a half sectional view of a fluid flow control device according to the present invention positioned in its fully open position;

FIG. 8 is a half sectional view of a fluid flow control device according to the present invention positioned in its closed positions;

FIG. 9 is a half sectional view of a fluid flow control device according to the present invention having a sleeve positioned exteriorly of the base pipe and positioned in its open position;

FIG. 10 is a half sectional view of a fluid flow control device according to the present invention having a sleeve positioned exteriorly of the base pipe and positioned in its closed positions;

FIG. 11 is a half sectional view of a fluid flow control device according to the present invention in its open position;

FIG. 12 is a half sectional view of a fluid flow control device according to the present invention in its closed positions;

FIG. 13 is a half sectional view of a fluid flow control device according to the present invention in its open position;

FIG. 14 is a half sectional view of a fluid flow control device according to the present invention in its closed positions;

FIG. 15 is a half sectional view of a fluid flow control device according to the present invention in its open position; and

FIG. 16 is a half sectional view of a fluid flow control device according to the present invention in its closed positions.

DETAILED DESCRIPTION OF THE INVENTION

While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides many applicable inventive concepts which can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention, and do not delimit the scope of the present invention.

Referring initially to FIG. 1, an offshore oil and gas platform operating a plurality of fluid flow control devices is schematically illustrated and generally designated 10. A
semi-submersible platform 12 is centered over submerged oil and gas formations 14, 16 located below sea floor 18. A subsea conduit 20 extends from a wellhead installation 22 to a subsea installation 24. A wellbore 26 extends through the various earth strata including formations 14, 16. A casing string 28 is cemented within wellbore 26 by cement 30. Casing string 28 includes perforations 32 and perforations 34 that respectively allow formation fluids from formations 14, 16 to enter the interior of casing string 28.

Positioned within casing string 28 and extending from wellhead installation 22 is a tubing string 36. Tubing string 36 provides a conduit for formation fluids to travel from formations 14, 16 to the surface. A pair of packers 38, 40 provide a fluid seal between tubing string 36 and casing string 28 and define a production interval adjacent to formation 14. Likewise, packers 42, 44 provide a fluid seal between tubing string 36 and casing string 28 and define a production interval adjacent to formation 16.

Positioned within tubing string 36 in the production interval adjacent to formation 14 are fluid flow control devices 46, 48 and 50. Likewise, positioned within tubing string 36 within the production interval adjacent to formation 16 are fluid flow control devices 52, 54 and 56. As explained in greater detail below, each of the fluid flow control devices 46-56 may provide not only fluid flow control capability but also sand control capability. In those cases, fluid flow control devices 46-50 and fluid flow control devices 52-56 represent multiple sand control screens in a sand control screen assembly.

In the illustrated embodiment, there are three fluid flow control devices 46, 48, 50 associated with formation 14 and three fluid flow control devices 52, 54, 56 associated with formation 16. Accordingly, the inflow of fluid from formation 14 and formation 16 may be controlled. For example, if the reservoir pressure of formation 14 is significantly higher than the reservoir pressure of formation 16, fluid flow control devices 46, 48, 50 may be used to choke the fluid flow from formation 14 to a greater extent than fluid flow control devices 52, 54, 56 will choke the fluid flow from formation 16. In addition, the fluid flow control devices of the present invention are independently controllable within each production interval via one or more control conduits 58 that extend from the surface to each of the flow control devices 46-56. For example, certain ones of fluid flow control devices 46, 48, 50 may be used to choke or even close off certain sections of the production interval adjacent to formation 14 to prevent the production of water or other undesirable fluids. Similarly, one or all of the fluid flow control devices associated with a particular production interval may be adjusted over time as the adjacent formation becomes depleted or as downhole equipment experiences wear.

It should be understood by those skilled in the art that even though FIG. 1 has depicted an offshore production operation, the fluid flow control devices of the present invention are equally well suited for onshore operations. Also, even though FIG. 1 has depicted a cased wellbore, the fluid flow control devices of the present invention are equally well suited for use in open hole completions. Further, even though FIG. 1 has depicted a single wellbore 26, it should be understood by those skilled in the art that the fluid flow control devices of the present invention are equally well suited for use in wellbores having other configurations such as wellbores having multilateral configurations. For example, one of the flow control devices of the present invention may be positioned proximate the junction in a primary completion string with additional flow control devices of the present invention positioned adjacent to production intervals traversed by the main wellbore. In this case, fluids from the branch wellbore flow through the flow control devices into the primary completion string at the junction and are commingled with fluids from the other production intervals traversed by the main wellbore. As explained in greater detail below, the inflow into the primary completion string from the intervals traversed by the main wellbore as well as the branch wellbore may be controlled by operating the various fluid flow control devices of the present invention.

Referring next to FIG. 2, a fluid flow control device of the present invention is depicted and generally designated 60. Fluid flow control device 60 includes a sand control screen 62. Sand control screen 62 includes a base pipe 64 that has a plurality of openings 66 that allow the flow of production fluids into the production tubing. Even though openings 66 are depicted as round openings, it should be understood by those skilled in the art that openings of other configurations may alternatively be used and are considered within the scope of the present invention. For example, openings 66 could alternatively have a non circular shape such as an oval shape, a square shape, a rectangular shape or other similar shapes. Accordingly, the term openings as used herein is intended to encompass any type of discontinuity in base pipe 64 that allows for the flow of fluids therethrough including, but not limited to, perforations, holes and slots of any configuration that are presently known in the art or subsequently discovered. In addition, the exact number and size of openings 66 are not critical to the present invention, so long as sufficient area is provided for fluid production and the integrity of base pipe 64 is maintained. Openings 66 form a particular hole pattern in base pipe 64, the importance of which will be explained in more detail below.

Positioned around base pipe 64 is a filter medium 68. In the illustrated embodiment, filter medium 68 is a fluid-porous, particulate restricting material such as a plurality of layers of a wire mesh that are diffusion bonded or sintered together to form a porous wire mesh screen designed to allow fluid flow therethrough but prevent the flow of particulate materials of a predetermined size from passing therethrough. Disposed around filter medium 68 is an outer shroud 70. Outer shroud 70 has a plurality of openings 72 which allow the flow of production fluids therethrough. The exact number, size and shape of openings 72 are not critical to the present invention, so long as sufficient area is provided for fluid production and the integrity of outer shroud 70 is maintained. Outer shroud 70 is designed to protect filter medium 68 during installation of
fluid flow control device 60 into the wellbore as well as during production therethrough.

[0052] Positioned coaxially within base pipe 64 is a sleeve 74. Sleeve 74 is slideable coupled within base pipe 64 using detents such as collets or pins (not pictured) or other suitable devices that are well known to those skilled in the art. Sleeve 74 has a plurality of openings 76. As with openings 66 of base pipe 64, openings 76 of sleeve 74 may have a geometric configuration that is suitable for allowing the flow of production fluids therethrough. While the illustrated embodiment depicts openings 76 of sleeve 74 as having the same shape and size as openings 66 of base pipe 64, this relationship is not required by the present invention. For example, a fluid flow control device of the present invention could have slotted openings in sleeve 74 while having round openings in base pipe 64. In the illustrated embodiment, the hole pattern of openings 66 of base pipe 64 and openings 76 of sleeve 74 have substantially the same geometry. In addition, openings 66 of base pipe 64 and openings 76 of sleeve 74 are substantially aligned with one another. Accordingly, when fluid flow control device 60 is in the depicted configuration, the pressure drop in the production fluids traveling therethrough is at a minimum and fluid flow control device 60 is considered to be in its fully opened position. Specifically, to enter in the interior of fluid flow control device 60, the fluid must travel through an entry opening, one of the openings 66 of base pipe 64, an annulus 78 between base pipe 64 and sleeve 74 and an exit opening, one of the openings 76 of sleeve 74. As openings 66 of base pipe 64 and openings 76 of sleeve 74 are substantially aligned with one another, the distance the fluid is required to flow in annulus 78 is at a minimum.

[0053] Referring now to FIG. 3, therein is depicted a fluid flow control device of the present invention that is generally designated 80. The construction of fluid flow control device 80 is substantially identical to the construction of fluid flow control device 60 of FIG. 2. Fluid flow control device 80 is operated using a mechanical shifter 82 that may be carried downhole on a wireline 84. To allow shifter tool 84 to interact with sleeve 74, the interior side surfaces of sleeve 74 may have formed therein a longitudinally spaced series of annular, traversed notches, that receive a key set carried on mechanical shifter 82. Once mechanical shifter 82 is received by sleeve 74, sleeve 74 may be slidably shifted in the axial direction as can be seen by comparing the position of sleeve 74 relative to base pipe 64 in FIGS. 2 and 3.

[0054] In the illustrated embodiment, sleeve 74 has been axially repositioned to increase the pressure drop experienced by production fluids traveling through annulus 78. Specifically, as the set of openings 66 of base pipe 64 and the set of openings 76 of sleeve 74 have substantially the same hole pattern, when openings 66 and openings 76 are axially misaligned, the distance the formation fluids must travel within annulus 78 is increased, thereby increasing the pressure drop in the formation fluids. The amount of this pressure drop or choking is determined based upon a number of factors including the extent of the misalignment of openings 66 relative to openings 76, the thickness of annulus 78, the viscosity of the formation fluids and the like. In addition, the surface characteristics of either the exterior of sleeve 74 or the interior of base pipe 64 or both may be configured to further control the pressure drop. For example, grooves, channels, knurling, other turbulizing surfaces or the like may be added to one or both of the surfaces to increase the turbulence in the fluid flow thereby increasing the pressure drop across a given distance. Accordingly, once fluid flow control device 80 is installed downhole, the desired amount of pressure drop may be obtained by selectively misaligning openings 66 relative to openings 76 by axially shifting sleeve 74 relative to base pipe 64. Also, it should be noted that sensors, such as position sensors, pressure sensors, temperature sensors, fluid composition sensors and the like may be used in conjunction with mechanical shifter 82 to determined the desired extent of the misaligning of openings 66 relative to openings 76, as explained in greater detail below.

[0055] Referring next to FIG. 4, therein is depicted a fluid flow control device of the present invention that is generally designated 90. Fluid flow control device 90 is constructed in a manner substantially identical to fluid flow control device 60 of FIG. 2. In the illustrated embodiment, fluid flow control device 90 is operated by an electromechanical shifter 92 that is run downhole on an electric line 94. Electromechanical shifter 94 may be received within sleeve 74 in a manner similar to that described above with reference to mechanical shifter 82 of FIG. 3. Once in place, electromechanical shifter 92 may be energized via electric line 94 such that sleeve 74 may be rotatably shifted relative to base pipe 64.

[0056] In the illustrated embodiment, sleeve 74 has been rotated ninety degrees relative to base pipe 64. This rotation increases the distance between openings 76 of sleeve 74 and openings 66 of base pipe 64. Accordingly, the formation fluid being produced into fluid flow control device 90 must travel an increased distance in annulus 78 relative to the position shown in FIG. 2. This increased distance equates to an increased pressure drop in the formation fluids. The desired amount of pressure drop may be achieved by selecting the amount of circumferential misalignment between openings 76 of sleeve 74 and openings 66 of base pipe 64. Also, it should be noted that sensors, such as position sensors, pressure sensors, temperature sensors, fluid composition sensors and the like may be used in conjunction with electromechanical shifter 92, these sensors may be permanently disposed downhole or may be carried downhole with the electromechanical shifter 92.

[0057] Referring next to FIG. 5, therein is depicted a fluid flow control device of the present invention that is generally designated 100. Fluid flow control device 100 is constructed in substantially the same manner as fluid flow control device 60 of FIG. 2. Fluid flow control device 100 is operated using a downhole electrical motor 102 that is positioned within annulus 78 between sleeve 74 and base pipe 64. Downhole electrical motor 102 receives power from energy conductors 104 that may extend to the surface or may extend to a downhole electrical power source such as a battery pack or a downhole electrical generator. Downhole electrical motor 102 includes a control circuit that commands downhole electrical motor 102 to shift sleeve 74 relative to base pipe 64 when it is desirable to adjust the pressure drop in the production fluids being produced therethrough. A pair of pressure sensors 106, 108 are used to monitor the pressure on the exterior of fluid flow control device 100 and the pressure on the interior of fluid flow control device 100, respectively.
The pressure information may be carried to the surface via energy conductors 104 where it may be processed then command signals may be returned to the control circuit of downhole electrical motor 102. Alternatively, the pressure information may be sent directly to the control circuit of downhole electrical motor 102 from pressure sensors 106, 108 to initiate operation of downhole electrical motor 102. Additionally, sleeve 74 may include a position sensor that identifies the relative position of sleeve 74 and base pipe 64 to further refine the operation of shifting sleeve 74. The position sensor may be powered by energy conductors 104 and may send signals to the surface or directly to the control circuit of downhole electrical motor 102.

In the illustrated embodiment, downhole electrical motor 102 is operable to axially adjust the position of sleeve 74 relative to base pipe 64 and rotatably adjust the position of sleeve 74 relative to base pipe 64. By comparing FIGS. 2 and 5, it can be seen that sleeve 74 has been axially and rotatably adjusted relative to base pipe 64. Accordingly, the distance between openings 76 of sleeve 74 and openings 66 of base pipe 64 has been increased, which in turn increases the distance the production fluids must travel in annulus 78 resulting in an increase in the pressure drop in the production fluids. This embodiment of fluid flow control device 100 is particularly suitable for precision control of the pressure drop due to the interaction of pressure sensors 106, 108, the position sensor and the control circuit of downhole electrical motor 102.

Referring now to FIG. 6, therein is depicted another embodiment of a fluid flow control device of the present invention that is generally designated 110. Fluid flow control device 110 is constructed in substantially the same manner as fluid flow control device 60 of FIG. 2 with the exception that fluid flow control device 110 includes a plurality of seals 112 carried by base pipe 64. The operation of fluid flow control device 110 is hydraulically controlled in a conventional manner by increasing and decreasing the pressure within hydraulic control lines 114, 116 which allows sleeve 74 to axially shift relative base pipe 64. As described above, as openings 76 of sleeve 74 become misaligned with openings 66 of base pipe 64, the pressure drop in the formation fluids being produced therethrough increases. In the illustrated embodiment, however, when sleeve 74 is shifted to the illustrated position relative to base pipe 64, fluid production through fluid flow control device 110 is prevented as each of the openings 76 of sleeve 74 are positioned between a pair of seals 112. Accordingly, fluid flow control device 110 can be operated from a fully opened position (see FIG. 2) to a fully closed position as well as various chocking positions therebetween.

Referring next to FIG. 7, therein is depicted a fluid flow control device of the present invention that is generally designated 120. Fluid flow control device 120 is constructed in substantially the same manner as fluid flow control device 60 of FIG. 2, however, sleeve 74 as depicted in FIG. 2 has been replaced with sleeve 122. Sleeve 122 includes a plurality of openings 124 that form a hole pattern with a geometry that is different from the hole pattern of openings 66 of base pipe 64. Fluid flow control device 120 is operated using a downhole electrical motor 126 which is operable to rotatably shift sleeve 122 relative to base pipe 64. This rotation aligns the various columns of openings 124 of sleeve 122 with openings 66 of base pipe 64. In the illustrated configuration, each opening 66 of base pipe 64 is aligned with an opening 124 of sleeve 122. When sleeve 122 is rotated using downhole electrical motor 126, however, some of the openings 66 of base pipe 64 will no longer be aligned with an opening 124 of sleeve 122. Accordingly, the pressure drop in the production fluids is controlled by adjusting the relative alignment of openings 124 of sleeve 122 with openings 66 of base pipe 64.

Referring now to FIG. 8, therein is depicted another embodiment of a fluid flow control device of the present invention that is generally designated 130. Fluid flow control device 130 includes a sand control screen 132. Sand control screen 132 includes a base pipe 134 that has a series of openings 136 that are circumferentially spaced therearound. Sand control screen 132 has a pair of screen connectors 138, 140 that attach a sand control screen 142 to base pipe 134. Screen connectors 138, 140 may be attached to base pipe 134 by welding or other suitable technique. Sand control screen 142 may comprise a screen wire wrapped around a plurality of ribs to form turns having gaps therebetween which allow the flow of formation fluids therethrough but which block the flow of particulate matter therethrough. The number of turns and the size of the gaps between the turns are determined based upon the characteristics of the formation from which fluid is being produced and the size of the gravel to be used during a gravel packing operation, if any.

Screen connectors 138, 140 attach sand control screen 142 to base pipe 134 such that an annulus 144 is formed between sand control screen 142 and base pipe 134. It should be noted that centralizers or other support members may be disposed within annulus 144 to support sand control screen 142 and maintain the standoff between sand control screen 142 and base pipe 134. Coupled to the upper end of screen connector 140 is a housing member 146. Housing member 146 forms an annulus 148 with base pipe 134 adjacent to openings 136. Disposed within annulus 148 is a sliding sleeve 150 having a collet member on its lower end and having a pair of seals 151 disposed on the interior side thereof to provide a seal against base pipe 134 and a pair of seals 153 disposed on the exterior side thereof to provide a seal against housing member 146.

Disposed exteriorly of base pipe 134 and extending from the surface is a hydraulic fluid conduit 152. One portion of hydraulic fluid conduit 152 extends into a fluid passageway 154 within housing member 146. Disposed within fluid passageway 154 is a valve 156, such as a eutectic valve, a rupture disk or the like. Another portion of hydraulic fluid conduit 152 extends into and through housing member 146 and screen connector 140 into annulus 144. This portion of hydraulic fluid conduit 152 extends through annulus 144 to exit sand control screen 132 through screen connector 138.

Importantly, this portion of hydraulic fluid conduit 152 runs within a recess or channel in housing member 146 and on the inside of sand control screen 142, instead of the outside of sand control screen 142, which removes the need to bond hydraulic fluid conduit 152 to the exterior of sand control screen 142 which would block the inflow of formation fluids through those portions of sand control screen 142.
covered by the banding material. Also, this portion of hydraulic fluid conduit 152 is protected by having sand control screen 142 positioned exteriorly thereof. Alternatively, the channel on the exterior of housing member 146 could be extended along the exterior of sand control screen 142 such that hydraulic fluid conduit 152 could be positioned within the channel for protection. As can be seen in FIG. 8, hydraulic fluid conduit 152 is capable of providing operating fluid to fluid flow control device 130 and is also capable of providing operating fluid to other devices downhole of fluid flow control device 130 such as additional fluid flow control devices positioned further downhole.

[0066] For example, in the case of valves 156 being rupture disks, the burst rating of the rupture disks for the various flow control devices may be selected such that the flow control devices may be sequentially or selectively operated from their open to their closed positions by incrementally increasing the pressure within hydraulic fluid conduit 152 to various preselected levels. In a substantially vertical well, the burst rating for the rupture disks may be progressively increased for each flow control device from the downhole end of an interval to the uphole end of an interval. Likewise, a substantially horizontal well, the burst rating for the rupture disks may be progressively increased for each flow control device from the heal to the toe of the interval. In this example, the production profile within an interval and within the wellbore is entirely controlled by varying the hydraulic pressure within hydraulic fluid conduit 152.

[0067] In the illustrated embodiment, a sensor 158 is positioned on the exterior of housing member 146. Sensor 158 may provide information relating to a variety of downhole parameters such as pressure, temperature, fluid composition or the like. Sensor 158 is in communication with the surface via energy conductors 160. Energy conductors 160 may provide power and communication capabilities to sensor 158 as well as to valve 156. Alternatively, sensors 158 may be powered by a downhole power source such as a battery, downhole generator or the like. Likewise, communication between sensors 158 and the surface could be achieved using a wireless telemetry system such as acoustic telemetry, electromagnetic telemetry or the like. In the illustrated embodiment and when valve 156 is a eutectic valve, fluid flow control device 130 may be operated to the closed position by conducting energy to valve 156 via energy conductors 160 to melt the eutectic material such that operating fluid from hydraulic fluid conduit 152 may be communicated to sliding sleeve 150. Energy conductors 160 also extend through fluid flow control device 130 in a manner similar to hydraulic fluid conduit 152 by passing through housing member 146, screen connector 140, annulus 144 and screen connector 138 such that energy can be conducted to melt the eutectic material of other valves 156 in other fluid flow control devices either uphole or downhole of fluid flow control device 130. Alternatively, instead of using sensor 158 to obtain information relating to downhole parameters, energy conductors 160 may include a fiber optic cable which may be used to obtain certain downhole parameters such as temperature and pressure at particular locations.

[0068] In operation and referring both to FIGS. 8 and 9, fluid flow control device 130 is used to filter particulate matter out of production fluids and control the flow of fluids into the tubing string. More specifically, when fluid flow control device 130 is in its open position as depicted in FIG. 8, formation fluids are produced through sand control screen 142 into annulus 144. These formation fluids then travel upwardly through screen connector 140 that has a plurality of axially extending openings allowing the formation fluids to pass into annulus 148 above screen connector 140. From annulus 148, fluid communication is allowed through openings 136 such that the formation fluids may travel to the surface via the tubing string.

[0069] If it is determined that production through fluid flow control device 130 should no longer continue, fluid flow control device 130 may be operated to its closed position as depicted in FIG. 9. For example, if sensor 158 has sensed that the formation fluids being produced through fluid flow control device 130 contain an undesirable percentage of water, then a signal may be sent from sensor 158 to the surface or directly to valve 156 via energy conductors 160 indicating such a fluid composition. Thereafter, power may be sent to valve 156 via energy conductors 160 and through appropriate switching or addressing circuitry such that the eutectic material of valve 156 is melted, thereby allowing fluid communication through fluid passageway 154. Thereafter, operating fluid from hydraulic fluid conduit 152 may act on sliding sleeve 150 such that openings 136 of base pipe 134 are no longer in communication with annulus 148. Once in this configuration, fluid flow control device 130 no longer permits formation fluids to flow therethrough.

[0070] Referring now to FIG. 10, therein is depicted another embodiment of a fluid flow control device of the present invention that is generally designated 170. Fluid flow control device 170 includes a sand control screen 172. Sand control screen 172 includes a base pipe 174 that has a series of openings 176. Sand control screen 172 also has a screen support member 178 that is attached by welding or other suitable technique at opposite ends to base pipe 174 and has a series of openings 180. The filter media of sand control screen 172 is depicted as a wire wrapped screen 182 such as that described above with reference to FIG. 8.

[0071] Unlike the previously disclosed fluid flow control devices, fluid flow control device 170 is constructed with a sleeve 184 coaxially positioned exteriorly of base pipe 174. Sleeve 184 has a plurality of openings 186 that have substantially the same geometry as openings 176 of base pipe 174. In the illustrated embodiment, sleeve 184 is closely received around base pipe 174 such that there is a friction fit therebetween. This friction fit can operate substantially as a seal to provide significant resistance to flow between sleeve 184 and base pipe 174 when openings 186 are not aligned with openings 176. Alternatively, an annulus may be formed between sleeve 184 and base pipe 174 operating substantially as annulus 78 discussed above. The operation of fluid flow control device 170 is hydraulically controlled in a conventional manner by increasing and decreasing the pressure within hydraulic control lines 188, 190 which allows sleeve 184 to axially shift relative base pipe 174.

[0072] Referring now to FIG. 11, therein is depicted another embodiment of a fluid flow control device of the present invention that is generally designated 200. Fluid flow control device 200 includes a sand control screen 202. Sand control screen 202 includes a base pipe 204 that has a
series of openings 206 that are circumferentially spaced therearound. Sand control screen 202 has a pair of screen connectors 208, 210 that attach sand control screen 212 to base pipe 204. Screen connectors 208, 210 may be attached to base pipe 204 by welding or other suitable technique. Sand control screen 212 may comprise any type of filter medium such as the depicted wire wrapped screen which allows the flow of formation fluids therethrough but which blocks the flow of particulate matter therethrough.

[0073] Screen connectors 208, 210 attach sand control screen 212 to base pipe 204 such that an annulus 214 is formed between sand control screen 212 and base pipe 204. Coupled to the upper end of screen connector 210 is a housing member 216. Housing member 216 forms an annulus 218 with base pipe 204 adjacent to openings 206. Disposed within annulus 218 is an expandable bladder sealing member 220 that is selectively expandable to provide an annular seal between the exterior of base pipe 204 and interior of housing member 216.

[0074] Disposed exteriorly of base pipe 204 and extending from the surface is a hydraulic fluid conduit 222. One portion of hydraulic fluid conduit 222 extends into a fluid passageway 224 within housing member 216. Disposed within fluid passageway 224 is a valve 226, such as a eutectic valve, a rupture disk or the like. Another portion of hydraulic fluid conduit 222 extends into and through housing member 216 and screen connector 210 into annulus 214. This portion of hydraulic fluid conduit 222 extends through annulus 214 to exit sand control screen 202 through screen connector 208.

[0075] A sensor 228 is positioned on the exterior of housing member 216. Sensor 228 may provide information relating to a variety of downhole parameters such as pressure, temperature, fluid composition or the like. Sensor 228 is in communication with the surface via energy conductors 230. Energy conductors 230 may provide power and communication capabilities to sensor 228 as well as to valve 226. More specifically, energy conductors 230 may provide communications and power to open valve 226 such that operating fluid from hydraulic fluid conduit 222 may be communicated to expandable bladder sealing member 220 when it is desirable to operate fluid flow control device 200 from the open position to the closed position. Energy conductors 230 also extend through fluid flow control device 200 in a manner similar to hydraulic fluid conduit 222 by passing through housing member 216, screen connector 210, annulus 214 and screen connector 208.

[0076] In operation and referring both to FIGS. 11 and 12, fluid flow control device 200 is used to filter particulate matter out of production fluids and control the flow of fluids into the tubing string. More specifically, when fluid flow control device 200 is in its open position as depicted in FIG. 11, formation fluids are produced through sand control screen 212 into annulus 214. These formation fluids then travel upwardly through screen connector 210 that has a plurality of axially extending openings allowing the formation fluids to pass into annulus 218 above screen connector 210. From annulus 218, fluid communication is allowed through openings 206 such that the formation fluids may travel to the surface via the tubing string.

[0077] If it is determined that production through fluid flow control device 200 should no longer continue, fluid flow control device 200 may be operated to its closed position as depicted in FIG. 12. For example, if sensor 228 has sensed that the formation fluids being produced through fluid flow control device 200 contain an undesirable percentage of water, then a signal may be sent from sensor 228 to the surface or directly to valve 226 indicating such a fluid composition. Valve 226 is then opened, thereby allowing fluid communication through fluid passageway 224. Thereafter, operating fluid from hydraulic fluid conduit 222 may enter the interior of expandable bladder sealing member 220 such that expandable bladder sealing member 220 is expanded to provide an annular seal between the exterior of base pipe 204 and interior of housing member 216 preventing fluid communication between openings 206 of base pipe 204 and annulus 218. Once fluid flow control device 200 is in this configuration, it may be operated between the open and closed positions by increasing and decreasing the fluid pressure within hydraulic fluid conduit 222 above and below the formation pressure exerted on the exterior of expandable bladder 220.

[0078] Referring now to FIG. 13, therein is depicted another embodiment of a fluid flow control device of the present invention that is generally designated 240. Fluid flow control device 240 includes a sand control screen 242. Sand screen control 242 includes a base pipe 244 that has a series of openings 246 that are circumferentially spaced therearound. Sand control screen 242 has a pair of screen connectors 248, 250 that attach sand control screen 252 to base pipe 244. Screen connectors 248, 250 may be attached to base pipe 244 by welding or other suitable technique. Sand control screen 252 may comprise any type of filter medium such as the depicted wire wrapped screen which allows the flow of formation fluids therethrough but which blocks the flow of particulate matter therethrough.

[0079] Screen connectors 248, 250 attach sand control screen 252 to base pipe 244 such that an annulus 254 is formed between sand control screen 252 and base pipe 244. Coupled to the upper end of screen connector 250 is a housing member 256. Housing member 256 forms an annulus 258 with base pipe 244 adjacent to openings 246. Disposed within annulus 258 is a cylinder 260 and an expandable bladder sealing member 262 that is selectively expandable to provide an annular seal with the exterior of base pipe 244. Disposed between cylinder 260 and housing member 256 is a piston 264 which defines a pair of chambers 266, 268 between cylinder 260 and housing member 256. Chamber 266 may initially be at atmospheric pressure or prepressurized and may contain a compressible fluid such as air or nitrogen, an incompressible fluid such as water or hydraulic fluid or a combination thereof. Likewise, chamber 268 may initially be at atmospheric pressure or prepressurized and may contain a compressible fluid, an incompressible fluid or a combination thereof.

[0080] Disposed exteriorly of base pipe 244 and extending from the surface is a hydraulic fluid conduit 272. One portion of hydraulic fluid conduit 272 extends into a fluid passageway 274 of cylinder 260. Disposed within fluid passageway 274 is a valve 276. Another portion of hydraulic fluid conduit 272 extends into and through housing member 256 and screen connector 250 into annulus 254. This portion of hydraulic fluid conduit 272 extends through annulus 254 to exit sand control screen 242 through screen connector 248.
A sensor 278 is positioned on the exterior of housing member 256. Sensor 278 may provide information relating to a variety of downhole parameters such as pressure, temperature, fluid composition or the like. Sensor 278 is in communication with the surface via energy conductors 280. Energy conductors 280 may provide power and communication capabilities to sensor 278 as well as to valve 276, such as a eutectic valve. More specifically, energy conductors 280 may provide communications and power to open valve 276 such that operating fluid from hydraulic fluid conduit 272 may be communicated to chamber 266 when it is desirable to operate fluid flow control device 240 from the open position to the closed position. Energy conductors 280 also extend through fluid flow control device 240, in a manner similar to hydraulic fluid conduit 272 by passing through housing member 256, screen connector 250, annulus 254 and screen connector 248. Alternatively, hydraulic fluid pressure may be used to burst a rupture disk serving as valve 276 and likewise be communicated to chamber 266.

In operation and referring both to FIGS. 13 and 14, fluid flow control device 240 is used to filter particulate matter out of production fluids and control the flow of fluids into the tubing string. More specifically, when fluid flow control device 240 is in its open position as depicted in FIG. 13, formation fluids are produced through sand control screen 252 into annulus 254. These formation fluids then travel upwardly through screen connector 250 that has a plurality of axially extending openings allowing the formation fluids to pass into annulus 258 above screen connector 250. From annulus 258, fluid communication is allowed through openings 246 such that the formation fluids may travel to the surface via the tubing string.

If it is determined that production through fluid flow control device 240 should no longer continue, fluid flow control device 240 may be operated to its closed position as depicted in FIG. 14. For example, if sensor 278 has sensed that the formation fluids being produced through fluid flow control device 240 contain an undesirable percentage of water, then a signal may be sent from sensor 278 to the surface or directly to valve 276 indicating such a fluid composition. Valve 276 is then opened, thereby allowing fluid communication through fluid passageway 274. Thereafter, operating fluid from hydraulic fluid conduit 272 may enter chamber 266 and act on piston 264 to upwardly shift piston 264. The downward movement of piston 264 forces the fluid within chamber 268 into the interior of expandable bladder sealing member 262 such that expandable bladder sealing member 262 is expanded to provide an annular seal with the exterior of base pipe 244 preventing fluid communication between openings 246 of base pipe 244 and the portion of annulus 258 below expandable bladder sealing member 262. Once fluid flow control device 240 is in this configuration, it may be operated between the open and closed positions by increasing and decreasing the fluid pressure within hydraulic fluid conduit 272 above and below the formation pressure exerted on the exterior of expandable bladder 262.

Referring now to FIG. 15, therein is depicted another embodiment of a fluid flow control device of the present invention that is generally designated 290. Fluid flow control device 290 includes a sand control screen 292. Sand control screen 292 includes a base pipe 294 that has a series of openings 296 that are circumferentially spaced therearound. Sand control screen 292 has a pair of screen connectors 298, 300 that attach sand control screen 302 to base pipe 294. Screen connector 298, 300 may be attached to base pipe 294 by welding or other suitable technique. Sand control screen 302 may comprise any type of filter medium such as the depicted wire wrapped screen which allows the flow of formation fluids therethrough but which blocks the flow of particulate matter therethrough.

Screen connectors 298, 300 attach sand control screen 302 to base pipe 294 such that an annulus 308 is formed between sand control screen 302 and base pipe 294. Coupled to the upper end of screen connector 300 is a housing member 306. Housing member 306 forms an annulus 308 with base pipe 294 adjacent to openings 296. Disposed within annulus 308 is a piston 310 and an annular sealing member 312 that is selectively positionable against an annular seal 314. Piston 310 defines chambers 316, 318, 320. Chambers 316, 318 may initially contain a compressible fluid, an incompressible or a combination thereof and is preferably at atmospheric pressure. Chamber 320 is in communication with annulus 308 via port 322. A fluid passageway 324 extends through housing member 306 having valve 326 such as a eutectic valve positioned therein to selectively permit and prevent fluid communication between chamber 316 and the well annulus. An energy conductors 328 may provide power to valve 326 such that when it is desirable to operate fluid flow control device 290 to the closed position, energy is conducted to valve 326 via energy conductors 328 to melt the eutectic material such that operating fluid from the well annulus may be communicated to chamber 316. Energy conductors 328 also extend through fluid flow control device 290 by passing through housing member 302, screen connector 300, annulus 308 and screen connector 298.

In operation and referring both to FIGS. 15 and 16, fluid flow control device 290 is used to filter particulate matter out of production fluids and control the flow of fluids into the tubing string. More specifically, when fluid flow control device 290 is in its open position as depicted in FIG. 15, formation fluids are produced through sand control screen 302 into annulus 308. These formation fluids then travel upwardly through screen connector 300 that has a plurality of axially extending openings allowing the formation fluids to pass into annulus 308 above screen connector 300. From annulus 308, fluid communication is allowed through openings 296 such that the formation fluids may travel to the surface via the tubing string.

If it is determined that production through fluid flow control device 290 should no longer continue, fluid flow control device 290 may be operated to its closed position as depicted in FIG. 16 by opening valve 326, thereby allowing fluid communication through fluid passageway 324. Thereafter, formation fluids from the well annulus may enter chamber 316 and act on piston 310 to downwardly shift piston 310. The downward movement of piston 310 forces annular sealing member 312 against annular seal 314 preventing fluid communication between openings 296 of base pipe 294 and the portion of annulus 308 below annular sealing member 312. Once in this configuration, fluid flow control device 290 no longer permits formation fluids to flow therethrough.

While this invention has been described with reference to illustrative embodiments, this description is not
intended to be construed in a limiting sense. Various modifications and combinations of the illustrative embodiments as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to the
description. It is, therefore, intended that the appended claims encompass any such modifications or embodiments.

What is claimed is:
1. A fluid flow control device for use in a wellbore to control the inflow of production fluids comprising:
   a tubular member having at least one fluid passageway in a sidewall section thereof;
   a sand control screen positioned exteriorly around the tubular member, the sand control screen having a filter medium section defining a first annular region with the tubular member and a housing section defining a second annular region with the tubular member adjacent to the fluid passageway;
   a sealing member positioned within the second annular region, the sealing member having a first position wherein fluid flow is permitted through the fluid passageway and a second position wherein fluid flow is prevented through the fluid passageway; and
   a pressure source that is selectively in fluid communication with the sealing member to operate the sealing member from the first position to the second position.
2. The fluid flow control device as recited in claim 1 wherein the sealing member further comprises a sliding sleeve.
3. The fluid flow control device as recited in claim 1 wherein the sealing member further comprises an expandable bladder.
4. The fluid flow control device as recited in claim 1 further comprising a cylinder positioned within the second annular region, the cylinder and the housing section forming first and second chambers therebetween, the first and second chambers having a piston therebetween, the first chamber selectively being in fluid communication with the pressure source and the second chamber being in fluid communication with an expandable bladder sealing member.
5. The fluid flow control device as recited in claim 1 further comprising a piston positioned within the second annular region, the piston, the tubular member and the housing section forming a first chamber therebetween that is selectively in fluid communication with the pressure source and the piston and the housing section forming a second chamber that is in fluid isolation from the pressure source.
6. The fluid flow control device as recited in claim 1 wherein the pressure source further comprises a hydraulic control line extending from a surface location to the sand control screen, the hydraulic control line having a first section with a terminus that is selectively in fluid communication with the sealing member, the hydraulic control line having a second section that passes through the first annular region and extends downhole of the sand control screen.
7. The fluid flow control device as recited in claim 1 wherein the pressure source further comprises a wellbore pressure source.
8. The fluid flow control device as recited in claim 1 further comprising a valve positioned within a fluid communication path between the pressure source and the sealing member to selectively prevent and permit fluid communication between the pressure source and the sealing member.
9. The fluid flow control device as recited in claim 8 wherein the valve is a eutectic valve.
10. The fluid flow control device as recited in claim 8 wherein the valve is a rupture disk.
11. The fluid flow control device as recited in claim 1 further comprising a sensor positioned on the fluid flow control device to sense at least one downhole parameter selected from the group comprising temperature, pressure and fluid composition.
12. The fluid flow control device as recited in claim 1 further comprising an energy conductor extending from a surface location to the sand control screen, the energy conductor passing through the first annular region and extending downhole of the sand control screen.
13. The fluid flow control device as recited in claim 11 wherein the energy conductor further comprises an electrical conductor.
14. The fluid flow control device as recited in claim 11 wherein the energy conductor further comprises a fiber optic conductor.
15. The fluid flow control device as recited in claim 14 wherein the fiber optic conductor provides information relating to at least one downhole parameter selected from the group comprising temperature and pressure to the surface location from a location proximate the sand control screen.
16. A method for controlling production fluid flow through multiple sand control screens in a sand control screen assembly positioned within a wellbore, the method comprising the steps of:
   coupling a hydraulic fluid conduit to the multiple sand control screens in the sand control screen assembly;
   increasing the pressure within the hydraulic fluid conduit to a first predetermined level to prevent production fluid flow through a first sand control screen; and
   increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level to prevent production fluid flow through a second sand control screen.
17. The method as recited in claim 16 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises bursting a rupture disk operably associated with one of the first and the second sand control screens.
18. The method as recited in claim 16 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises sliding a sleeve operably associated with one of the first and the second sand control screens.
19. The method as recited in claim 16 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises expanding a bladder operably associated with one of the first and the second sand control screens.
20. The method as recited in claim 16 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises shifting a piston between first and second chambers and expanding a bladder operably associated with one of the first and the second sand control screens.
21. The method as recited in claim 16 wherein the first sand control screen is uphole of the second sand control screen.
22. The method as recited in claim 16 wherein the first sand control screen is downhole of the second sand control screen.
23. A method for controlling production fluid flow through multiple flow control devices positioned within a wellbore, the method comprising the steps of:

- coupling a hydraulic fluid conduit to the multiple flow control devices;
- increasing the pressure within the hydraulic fluid conduit to a first predetermined level to prevent production fluid flow through a first flow control device; and
- increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level to prevent production fluid flow through a second flow control device.

24. The method as recited in claim 23 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises bursting a rupture disk operably associated with one of the first and the second flow control devices.

25. The method as recited in claim 23 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises sliding a sleeve operably associated with one of the first and the second flow control devices.

26. The method as recited in claim 23 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises expanding a bladder operably associated with one of the first and the second flow control devices.

27. The method as recited in claim 23 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises shifting a piston between first and second chambers and expanding a bladder operably associated with one of the first and the second flow control devices.

28. The method as recited in claim 23 wherein the first flow control device is upstream of the second flow control device.

29. The method as recited in claim 23 wherein the first flow control device is downstream of the second flow control device.

30. The method as recited in claim 23 wherein the first and second flow control devices further comprise sand control screens.

31. A system for controlling production fluid flow in a wellbore comprising:

- first and second sand control screens in a sand control screen assembly positioned within the wellbore; and
- a hydraulic fluid conduit coupled to the first and second sand control screens such that increasing the pressure within the hydraulic fluid conduit to a first predetermined level prevents production fluid flow through the first sand control screen and increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level prevents production fluid flow through the second sand control screen.

32. The system as recited in claim 31 wherein the first sand control screen has a rupture disk operably associated therewith that bursts at a pressure less than the first predetermined level and the second sand control screen has a rupture disk operably associated therewith that bursts at a pressure between the first predetermined level and the second predetermined level.

33. The system as recited in claim 31 wherein the first and the second sand control screens each further comprises a sliding sleeve operably associated therewith.

34. The system as recited in claim 31 wherein the first and the second sand control screens each further comprises an expandable bladder operably associated therewith.

35. The system as recited in claim 31 wherein the first sand control screen is upstream of the second sand control screen.

36. The system as recited in claim 31 wherein the first sand control screen is downstream of the second sand control screen.

37. A system for controlling production fluid flow in a wellbore comprising:

- first and second flow control devices positioned within the wellbore; and
- a hydraulic fluid conduit coupled to the first and second flow control devices such that increasing the pressure within the hydraulic fluid conduit to a first predetermined level prevents production fluid flow through the first flow control device and increasing the pressure within the hydraulic fluid conduit to a second predetermined level that is greater than the first predetermined level prevents production fluid flow through the second flow control device.

38. The system as recited in claim 37 wherein the first flow control device has a rupture disk operably associated therewith that bursts at a pressure less than the first predetermined level and the second flow control device has a rupture disk operably associated therewith that bursts at a pressure between the first predetermined level and the second predetermined level.

39. The system as recited in claim 37 wherein the first and the second flow control devices each further comprises a sliding sleeve operably associated therewith.

40. The system as recited in claim 37 wherein the first and the second flow control devices each further comprises an expandable bladder operably associated therewith.

41. The system as recited in claim 37 wherein the first flow control device is upstream of the second flow control device.

42. The system as recited in claim 37 wherein the first flow control device is downstream of the second flow control device.

43. A method for controlling production fluid flow through multiple sand control screens in a sand control screen assembly positioned within a wellbore, the method comprising the steps of:

- coupling a hydraulic fluid conduit to the multiple sand control screens in the sand control screen assembly;
- coupling an energy conductor to the multiple sand control screens in the sand control screen assembly;
- signaling a valve operably associated with a first sand control screen to actuate to an open position via the energy conductor;
- communicating hydraulic pressure from the hydraulic fluid conduit to the first sand control screen to prevent production fluid flow therethrough;
- signaling a valve operably associated with a second sand control screen to actuate to an open position via the energy conductor; and
communicating hydraulic pressure from the hydraulic fluid conduit to the second sand control screen to prevent production fluid flow therethrough.

44. The method as recited in claim 43 wherein each of the steps of communicating hydraulic pressure from the hydraulic fluid conduit further comprises sliding a sleeve operably associated with one of the first and the second sand control screens.

45. The method as recited in claim 43 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises expanding a bladder operably associated with one of the first and the second sand control screens.

46. The method as recited in claim 43 wherein each of the steps of signaling a valve further comprises electrically signaling.

47. The method as recited in claim 43 wherein each of the steps of signaling a valve further comprises optically signaling.

48. The method as recited in claim 43 further comprising the step of sensing at least one downhole parameter proximate the first sand control screen prior to signaling the valve operably associated with the first sand control screen.

49. The method as recited in claim 48 further comprising the step of sensing at least one downhole parameter proximate the second sand control screen prior to signaling the valve operably associated with the second sand control screen.

50. A method for controlling production fluid flow through multiple flow control devices positioned within a wellbore, the method comprising the steps of:
   coupling a hydraulic fluid conduit to the multiple flow control devices;
   coupling an energy conductor to the multiple flow control devices;
   signaling a valve operably associated with a first flow control device to actuate to an open position via the energy conductor;
   communicating hydraulic pressure from the hydraulic fluid conduit to the first flow control device to prevent production fluid flow therethrough;
   signaling a valve operably associated with a second flow control device to actuate to an open position via the energy conductor; and
   communicating hydraulic pressure from the hydraulic fluid conduit to the second flow control device to prevent production fluid flow therethrough.

51. The method as recited in claim 50 wherein each of the steps of communicating hydraulic pressure from the hydraulic fluid conduit further comprises sliding a sleeve operably associated with one of the first and the second flow control devices.

52. The method as recited in claim 50 wherein each of the steps of increasing the pressure within the hydraulic fluid conduit further comprises expanding a bladder operably associated with one of the first and the second flow control devices.

53. The method as recited in claim 50 wherein each of the steps of signaling a valve further comprises electrically signaling.

54. The method as recited in claim 50 wherein each of the steps of signaling a valve further comprises optically signaling.

55. The method as recited in claim 50 further comprising the step of sensing at least one downhole parameter proximate the first flow control device prior to signaling the valve operably associated with the first flow control device.

56. The method as recited in claim 50 further comprising the step of sensing at least one downhole parameter proximate the second flow control device prior to signaling the valve operably associated with the second flow control device.

57. A system for controlling production fluid flow in a wellbore comprising:
   first and second sand control screens in a sand control screen assembly positioned within the wellbore;
   a hydraulic fluid conduit coupled to the first and second sand control screens; and
   an energy conductor coupled to the first and second sand control screens, the energy conductor providing a signal to open a valve operably associated with the first and second sand control screens such that hydraulic pressure is communicated from the hydraulic fluid conduit to the first sand control screen to prevent production fluid flow therethrough and the energy conductor providing a signal to open a valve operably associated with the first and second sand control screens such that hydraulic pressure is communicated from the hydraulic fluid conduit to the second sand control screen to prevent production fluid flow therethrough.

58. A system for controlling production fluid flow in a wellbore comprising:
   first and second flow control devices positioned within the wellbore;
   a hydraulic fluid conduit coupled to the first and second flow control devices; and
   an energy conductor coupled to the first and second flow control devices, the energy conductor providing a signal to open a valve operably associated with the first and second flow control devices such that hydraulic pressure is communicated from the hydraulic fluid conduit to the first flow control device to prevent production fluid flow therethrough and the energy conductor providing a signal to open a valve operably associated with the first and second flow control devices such that hydraulic pressure is communicated from the hydraulic fluid conduit to the second flow control device to prevent production fluid flow therethrough.

59. A method for controlling the flow of production fluids through a fluid flow control device, the method comprising the steps of:
   positioning the fluid flow control device downhole, the fluid flow control device including a tubular member having at least one fluid passageway in a sidewall section thereof and a sand control screen positioned exteriorly around the tubular member, the sand control screen having a filter medium section defining a first annular region with the tubular member and a housing section defining a second annular region with the tubular member adjacent to the fluid passageway;
flowing fluid through the sand control screen and the fluid passageway;
applying a pressure from a pressure source to a sealing member positioned within the second annular region; and
operating the sealing member from a nonsealing position to a sealing position such that fluid flow through the fluid passageway is prevented.

60. The method as recited in claim 59 wherein the step of applying a pressure from a pressure source to a sealing member positioned within the second annular region further comprises applying the pressure to a sliding sleeve.

61. The method as recited in claim 59 wherein the step of applying a pressure from a pressure source to a sealing member positioned within the second annular region further comprises applying the pressure to an expandable bladder.

62. The method as recited in claim 59 wherein the step of applying a pressure from a pressure source to a sealing member positioned within the second annular region further comprises:
applying the pressure into a first chamber defined between a cylinder and the housing section;
shifting a piston positioned within the cylinder and the housing section between the first chamber and a second chamber; and
forcing fluid from the second chamber into an expandable bladder.

63. The method as recited in claim 59 wherein the step of applying a pressure from a pressure source to a sealing member positioned within the second annular region further comprises:
applying the pressure into a first chamber defined between a piston, the tubular member and the housing section;
shifting the piston such that the volume of a second chamber defined between the piston and the housing section and that is in fluid isolation from the pressure source is reduced.

64. The method as recited in claim 59 wherein the step of applying a hydraulic pressure to a sealing member positioned within the second annular region further comprises applying a hydraulic pressure from a hydraulic control line extending from a surface location to the sand control screen and passing the hydraulic control line through the first annular region to extend the hydraulic control line downhole of the sand control screen.

65. The method as recited in claim 59 wherein the step of applying a hydraulic pressure to a sealing member positioned within the second annular region further comprises applying a hydraulic pressure from an annular region between the sand control screen and the wellbore.

66. The method as recited in claim 59 wherein the step of applying a hydraulic pressure to a sealing member positioned within the second annular region further comprises operating a valve positioned within a fluid communication path between the hydraulic pressure source and the sealing member to selectively permit fluid communication between the hydraulic pressure source and the sealing member.

67. The method as recited in claim 66 wherein the step of operating the valve further comprises melting a eutectic wax.

68. The method as recited in claim 59 further comprising the step of sensing at least one downhole parameter selected from the group comprising temperature, pressure and fluid composition with a sensor positioned on the fluid flow control device.

69. The method as recited in claim 59 further comprising the step of extending an energy conductor from a surface location to the sand control screen, passing the energy conductor through the first annular region and extending the energy conductor downhole of the sand control screen.

70. The method as recited in claim 69 further comprising the step of conducting electricity through the energy conductor.

71. The method as recited in claim 69 further comprising the step of conducting light energy through the energy conductor.

72. The method as recited in claim 69 further comprising the step of sending information relating to at least one downhole parameter selected from the group comprising temperature and pressure to the surface location from a location proximate the sand control screen via the energy conductor.