application. Thus, there is a continuing need in the art for methods and apparatus for improved time responsiveness of blowout preventers, for example when temperature conditions make the fluid used to actuate the blowout preventers very viscous.

DESCRIPTION

[0005a] According to a first aspect of the present invention, there is provided a flow responsiveness enhancer for improved time responsiveness of a blowout preventer, comprising: at least one section; and a shared pressure line coupled to the at least one section; wherein the at least one section includes: a pair of input ports; a pair of output ports; a first valve system that controls flow from one port of the pair of input ports into the shared pressure line; and a second valve system that controls flow from the shared pressure line into one port of the pair of output ports.

[0005b] According to a second aspect of the present invention, there is provided a system for improved time responsiveness of a blowout preventer, comprising: a power pack to supply pressurized fluid; a control valve system; a blowout preventer having one or more rams; a flow responsiveness enhancer having one or more sections, each section being operatively associated with one ram and fluidly coupled thereto; one or more pairs of control flowlines, each pair of control flowlines being operatively associated with one section of the flow responsiveness enhancer; wherein the control valve system includes a plurality of banked directional valves to selectively flow and return fluid between each section of the flow responsiveness enhancer and the power pack through one pair of control flowlines; wherein the flow responsiveness enhancer comprises a shared pressure line running through each section, and a shared tank line running through each section; and wherein each section of the flow responsiveness enhancer includes a first valve system that controls flow from one pair of control flowlines into the shared pressure line, a second valve system that controls flow from the shared pressure line to one ram and from the one ram into the shared tank line, and a third valve system that controls flow from the shared tank line into the one pair of control flowlines.

[0005c] According to a third aspect of the present invention, there is provided a method for cold flow management of a blowout preventer, comprising: coupling a blowout preventer having a plurality of rams to a control valve system through a flow responsiveness enhancer; actuating one or more rams of the blowout preventer using the control valve system; and combining the flow paths of a plurality of flowlines into

a shared pressure line connected by a valve system to one of the rams of the blowout preventer, wherein the flow responsiveness enhancer comprises a stack of one or more manifolds, each manifold being coupled to one of the plurality of flowlines, and wherein the shared pressure line runs through the stack of one or more manifolds.

[0006] The present disclosure describes a flow responsiveness enhancer for improved time responsiveness of a blowout preventer. The blowout preventer may comprise a plurality of rams. To selectively open or close the rams, each ram may be associated with a corresponding manifold of a plurality of manifolds. The plurality of manifolds may optionally be assembled to form a stack of manifolds. The flow responsiveness enhancer can include at least one manifold, a shared pressure line coupled to the manifold, and a shared tank line coupled to the manifold. Further, each of the plurality of manifold may include a pressure line section coupled to pressure line sections of adjacent manifolds, and a tank line section coupled to tank line sections of adjacent manifolds. When the manifolds are assembled in the stack of manifolds, the pressure line sections form the shared pressure line running through the stack of manifolds, and the tank line sections form the shared tank line running though the stack of manifolds. As used herein, a manifold means any portion of a main conduit with one or more other conduits branching off the portion of main conduit.

[0007] The manifolds can include a pair of inputs that couple to a control cabin, one of the inputs being selected to be a pressure line and the other of the inputs being a return line. In other words, each of the plurality of manifolds forming the stack of manifolds may include a pair of input ports that couple the manifold to the control cabin via a pair of relatively small and long flowlines. One of the pair of small and long flowlines may be referred to as a control-open flowline and the other as a control-close flowline. To open the one ram associated with a particular manifold, the control-open flowline coupled to that manifold may be used as a line supplying flow to the manifold and the control-close flowline coupled that particular manifold may be used as a line returning flow from the manifold. Conversely, to close the one ram, the control-close flowline may be used as a flow supply line and the control-open flowline may be used as a flow return line. The manifolds can further include a pair of outputs that couple to the blowout preventer on the one hand, and to the shared