hammer, for example, to increase the life expectancy of the components of a subsea control pod, particularly in these remote locations where maintenance may be difficult.

SUMMARY

[0004A] According to a first aspect, there is provided a subsea drilling system, comprising: a blowout preventer stack; a blowout preventer subsea control pod configured to control an operation of the blowout preventer stack and comprising a fluid system, the fluid system comprising: a primary fluid flow path including an inlet and an outlet, the inlet connectable to a fluid supply source, the outlet connectable to a component of the blowout preventer stack controllable by the fluid supply source; a surge relief valve connected within the primary fluid flow path between the inlet and the outlet; and a control valve connected within the primary fluid flow path between the surge relief valve and the outlet such that hydraulic pressure surges received within the primary fluid flow path are dampened, at least partially, by the surge relief valve before received by the control valve.

[0004B] According to a second aspect, there is provided a fluid system for a subsea drilling system including a component controllable by the fluid system, comprising: a primary fluid flow path including an inlet and an outlet, the inlet connectable to a fluid supply source, the outlet connectable to the component; a surge relief valve connected within the primary fluid flow path between the inlet and the outlet, the surge relief valve movable between at least two positions and biased towards one of the positions; and a control valve connected within the primary fluid flow path between the surge relief valve and the outlet such that hydraulic pressure surges received within the primary fluid flow path are dampened, at least partially, by the surge relief valve before received by the control valve.

[0004C] According to a third aspect, there is provided a subsea drilling system including: a subsea component controllable by fluid actuation; and a fluid system for fluidly controlling the component, the fluid system comprising: a primary fluid flow path connectable between a fluid supply source and the subsea component; a fluid pulsation dampener configured to dampen an amplitude of a fluid pulse and connected within the primary fluid flow path; a surge relief valve connected within the primary fluid flow path downstream of the fluid pulsation dampener such that fluid surges received within the primary fluid flow path are dampened, at least partially, by the fluid pulsation dampener before received by the surge relief valve; and a control valve connected within the primary fluid flow path downstream of the surge relief valve such that hydraulic pressure surges received within the primary fluid

flow path are dampened, at least partially, by the surge relief valve before received by the control valve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] For a detailed description of the preferred embodiments of the invention, reference will now be made to the accompanying drawings in which:

[0006] FIG. 1 shows a schematic view of a subsea drilling system in accordance with one or more embodiments of the present disclosure;

[0007] FIG. 2 shows a perspective view of a subsea drilling system in accordance with one or more embodiments of the present disclosure;

[0008] FIG. 3A shows a diagram of a fluid system for a subsea drilling system in accordance with one or more embodiments of the present disclosure;

[0009] FIG. 3B shows a diagram of a fluid system for a subsea drilling system in accordance with one or more embodiments of the present disclosure;

[0010] FIG. 4 shows a cross-sectional view of a surge relief valve in accordance with one or more embodiments of the present disclosure;

[0011] FIG. 5 shows a prospective outer view of a surge relief valve in accordance with one or more embodiments of the present disclosure;

[0012] FIG. 6 shows a prospective partially exploded view of a surge relief valve in accordance with one or more embodiments of the present disclosure;

[0013] FIG. 7 shows a cross-sectional view of a surge relief valve in accordance with one or more embodiments of the present disclosure; and

[0014] FIG. 8 shows a schematic cross-sectional view of a fluid pulsation dampener in accordance with one or more embodiments of the present disclosure.

DETAILED DESCRIPTION

[0015] The following discussion is directed to various embodiments of the invention. The drawing figures are not necessarily to scale. Certain features of the embodiments may be shown exaggerated in scale or in somewhat schematic form and some details of conventional elements may not be shown in the

CLAIMS

What is claimed is:

1. A subsea drilling system, comprising:

a blowout preventer stack;

a blowout preventer subsea control pod configured to control an operation of the blowout preventer stack and comprising a fluid system, the fluid system comprising:

a primary fluid flow path including an inlet and an outlet, the inlet connectable to a fluid supply source, the outlet connectable to a component of the blowout preventer stack controllable by the fluid supply source;

a surge relief valve connected within the primary fluid flow path between the inlet and the outlet; and

a control valve connected within the primary fluid flow path between the surge relief valve and the outlet such that hydraulic pressure surges received within the primary fluid flow path are dampened, at least partially, by the surge relief valve before received by the control valve.

2. The subsea drilling system of claim 1, wherein the blowout preventer stack is hydraulically coupled to the fluid system of the blowout preventer subsea control pod.

3. The subsea drilling system of claim 2, further comprising a lower marine riser package that includes the blowout preventer subsea control pod.

4. The subsea drilling system of claim 3, further comprising a riser with the lower marine riser package coupled to the riser.

5. The subsea drilling system of claim 2, wherein the control valve comprises a sub-plate mounted valve and a pilot-operated valve.

6. A fluid system for a subsea drilling system including a component controllable by the fluid system, comprising:

a primary fluid flow path including an inlet and an outlet, the inlet connectable to a fluid supply source, the outlet connectable to the component;

a surge relief valve connected within the primary fluid flow path between the inlet and the outlet, the surge relief valve movable between at least two positions and biased towards one of the positions; and

a control valve connected within the primary fluid flow path between the surge relief valve and the outlet such that hydraulic pressure surges received within the primary fluid flow path are dampened, at least partially, by the surge relief valve before received by the control valve.

7. The fluid system of claim 6, further comprising a fluid pulsation dampener connected within the primary fluid flow path between the inlet and the surge relief valve such that fluid surges received within the primary fluid flow path are dampened, at least partially, by the fluid pulsation dampener before received by the surge relief valve.

8. The fluid system of claim 6, wherein the control valve comprises a sub-plate mounted valve.

9. The fluid system of claim 6, wherein the control valve comprises a pilot-operated valve, and wherein the system further comprising:

a secondary fluid flow path including an inlet and an outlet, the inlet connectable to the primary fluid flow path to receive fluid from the fluid supply source, the outlet connectable to the control valve; and

a pilot valve connected within the second fluid flow path between the inlet and the outlet.

10. The fluid system of claim 9, wherein the surge relief valve comprises a pilot-operated valve, wherein the secondary fluid flow path includes a second outlet, wherein the second outlet is connectable to the surge relief valve, and wherein a second pilot valve is connected within the second fluid flow path between the inlet and the second outlet.

11. The fluid system of claim 10, wherein at least one of the first pilot valve and the second pilot valve comprises a solenoid-operated direct drive valve.

12. The fluid system of claim 6, wherein the component comprises a blowout preventer controllable by the fluid supply source.

13. The fluid system of claim 6, further comprising a pressure regulator connected within the primary fluid flow path between the inlet and the surge relief valve.

14. A subsea drilling system including:

a subsea component controllable by fluid actuation; and

a fluid system for fluidly controlling the component, the fluid system comprising:

a primary fluid flow path connectable between a fluid supply source and the subsea component;

a fluid pulsation dampener configured to dampen an amplitude of a fluid pulse and connected within the primary fluid flow path;

a surge relief valve connected within the primary fluid flow path downstream of the fluid pulsation dampener such that fluid surges received within the primary fluid flow path are dampened, at least partially, by the fluid pulsation dampener before received by the surge relief valve; and

a control valve connected within the primary fluid flow path downstream of the surge relief valve such that hydraulic pressure surges received within the primary fluid flow path are dampened, at least partially, by the surge relief valve before received by the control valve.

15. The subsea drilling system of claim 14, wherein the control valve comprises a sub-plate mounted valve.

16. The subsea drilling system of claim 15, wherein the control valve comprises a pilot-operated valve, the fluid system further comprising:

a secondary fluid flow path connectable in parallel to the primary fluid flow path to receive fluid from the fluid supply source; and

a pilot valve connected within the second fluid flow path upstream of the control valve.

17. The subsea drilling system of claim 16, wherein the surge relief valve comprises a pilot-operated valve, the fluid system further comprising a second pilot valve connected

within the second fluid flow path in parallel with the first pilot valve and upstream of the surge relief valve.

18. The subsea drilling system of claim 16, further comprising at least one of:

a check valve connected within the second fluid flow path upstream of the pilot valve;

a pressure gauge connected within the second fluid flow path upstream of the pilot valve;

an accumulator connected within the second fluid flow path upstream of the pilot valve;

a pressure regulator connected within the second fluid flow path upstream of the pilot valve; and

a filter connected within the second fluid flow path upstream of the pilot valve.

19. The subsea drilling system of claim 14, wherein the fluid pulsation dampener comprises a pre-charged in-line fluid dampener.