CLAIMS:

1. A wellbore control system (100) for a wellhead having a tubing hanger (104), comprising:

a hydraulic fluid source (112);

a first drive line (108) passing through the tubing hanger (104) and in communication with the hydraulic fluid source (112);

a second drive line (110) passing through the tubing hanger (104) and in communication with the hydraulic fluid source (112);

a downhole control switch (122) in fluid communication with the first drive line (108) and the second drive line (110), the first downhole control switch (122) moving from a first position to a second position when each of a pressure of the first drive line (108) and a pressure of the second drive line (110) are within a first pressure band and the first drive line pressure exceeds the second drive line pressure by at least a first predetermined value; and

a control line (136,138) connected to the downhole control switch (122), the control line being operably connectable to a downhole device (132).

2. The system (100) according to Claim 1, further comprising a second downhole control switch (122) connected to the first drive line (108) and the second drive line (110), the second downhole control switch moving from a first position to a second position when each of the pressure of the first drive line (108) and the pressure of the second drive line (110) are within a second pressure band and the pressure of the first drive line (108) exceeds the pressure of the second drive line (110) by at least a second predetermined value.

3. The system (100) according to Claim 2, wherein values of the second pressure band are different from values of the first pressure band.

4. The system (100) according to any preceding Claim, wherein the first downhole control switch (122) is dormant when the difference between the pressure of the first drive line and the pressure of the second drive line, defining a pressure differential, occurs outside of the first pressure band and the second downhole control switch is dormant when the pressure differential occurs outside of the second pressure band.

5. The system (100) according to any preceding Claim, further comprising

a third downhole control switch (122) connected to the first drive line and the second drive line, the third downhole control switch moving from a first position to a second position when each of the pressure of the first drive line and the pressure of the second drive line are within a third pressure band and the first drive line pressure exceeds the second drive line pressure by at least a third predetermined value; and

a fourth downhole control switch (122) connected to the first drive line and the second drive line, the fourth downhole control switch moving from a first position to a second position when each of the pressure of the first drive line and the pressure of the second drive line are within a fourth pressure band and the first drive line pressure exceeds the second drive line pressure by at least a fourth predetermined value.

6. The system (100) according to any preceding claim, wherein actuation of each of the first and second downhole control switches (122) latches the respective downhole control switch into an actionable state wherein the respective downhole control switches are actuated in response to a pressure differential greater than a predetermined amount irrespective of the pressure band.

7. The system (100) according to claim 6, wherein each of the first and second downhole control switches (122) that are latched in the actionable state are released from the actionable state when the pressure of each of the first and second drive lines reach a predetermined latch release pressure, the predetermined latch release pressure being greater than the pressure bands corresponding to each of the downhole control switches.

8. The system (100) according to any preceding Claim, wherein the hydraulic fluid source (112) comprises a first control valve for outputting hydraulic fluid at a first drive line pressure and a second control valve for outputting hydraulic fluid at a second drive line pressure.

9. A method for actuating a plurality of wellbore devices (132), the method comprising:

(a) providing a hydraulic fluid source (112), the hydraulic fluid source having a first output for outputting hydraulic fluid at a first drive line pressure and a second output for outputting hydraulic fluid at a second drive line pressure, the pressure differential between the first drive line pressure and the second drive line pressure defining a drive line pressure differential;

(b) providing a first drive line (108) and a second drive line (110), each drive line passing through a tubing hanger (104), the first drive line being in communication with the first output and the second drive line being in communication with the second output;

(c) connecting a first downhole control switch (122) to the first drive line (108) and the second drive line (110), the first downhole control switch moving from a first position to a second position when each of the first drive line pressure and the second drive line pressure are within a first pressure band and the drive line pressure differential exceeds a first predetermined value;

(d) connecting a second downhole control switch (122) to the first drive line (108) and the second drive line (110), the second downhole control switch moving from a first position to a second position when each of the first drive line pressure and the second drive line pressure are within a second pressure band and the drive line pressure differential exceeds a second predetermined value;

(e) connecting a pair of hydraulic control lines (136,138) to each of the first and second downhole control switches, each pair of hydraulic control lines

transmitting hydraulic pressure in response to the position of the respective downhole control switch;

(f) increasing the first drive line pressure and the second drive line pressure while keeping the drive line pressure differential below the first predetermined value until the first and second drive line pressures are within the first pressure band; and

(g) actuating the first downhole control switch (122) by increasing the first drive line pressure differential to greater than the first predetermined value.

10. The method according to claim 9, wherein the first pressure band does not overlap with the second pressure band so the second downhole control switch (122) is not actuated in step (g).

11. The method according to claim 9 or claim 10, further comprising the steps of:

returning the drive line pressure differential to less than the predetermined value;

increasing the first drive line pressure and the second drive line pressure, while keeping the drive line pressure differential below the second predetermined value, until the first and second drive line pressures are within the second pressure band; and

actuating the second downhole control switch (122) by increasing the first drive line pressure differential to greater than the second predetermined value.

12. The method according to any of claims 9 to 11, wherein the step of returning the drive line pressure differential to less than the predetermined value deactivates the first downhole control switch (122).

13. The method according to any of claims 9 to 12, wherein step (g) causes the first downhole control switch (122) to latch into an actionable state, and wherein the step of increasing the drive line pressure differential to greater than the second predetermined value, while the first and second drive line pressures are within the

second pressure band, actuates the first downhole control when the first downhole control is in the actionable state.

14. The method according to claim 13, further comprising the step of unlatching the first downhole control by increasing the first and second drive line pressures to greater than a predetermined unlatch pressure, the predetermined unlatch pressure being greater than the pressure of the first and second pressure bands.

15. A method for actuating a plurality of wellbore devices (132), the method comprising:

(a) providing a hydraulic fluid source (112), the hydraulic fluid source having a first output for outputting hydraulic fluid at a first drive line pressure and a second output for outputting hydraulic fluid at a second drive line pressure, the pressure differential between the first drive line pressure and the second drive line pressure defining a drive line pressure differential;

(b) providing a first drive line (108) and a second drive line (110), each drive line passing through a tubing hanger, the first drive line being in communication with the first output and the second drive line being in communication with the second output;

(c) connecting a plurality of downhole control switches (122) to the first drive line and the second drive line, each of the plurality of downhole control switches moving from a first position to a second position when the first drive line pressure and the second drive line pressure are within a unique pressure band corresponding to each of the respective plurality of downhole control switches and the drive line pressure differential exceeds a respective predetermined value;

(d) connecting one of a plurality of control lines (136,138) from each of the plurality of downhole control switches to one of a plurality of downhole devices;

(e) increasing the first drive line pressure and the second drive line pressure, while keeping the drive line pressure differential below each of the predetermined values until the first and second drive line pressures are within a

pressure band corresponding to a first one of the plurality of downhole control switches; and

(f) actuating a first one of the downhole control switches (122) by increasing the first drive line pressure differential to greater than the respective predetermined value for the first one of the downhole control switches, the actuation of the first one of the downhole control switches causing actuation of the downhole device connected thereto by one of the control lines.

16. The method according to claim 15, wherein the pressure bands corresponding to each of the plurality of downhole control switches (122) do not overlap.

17. The method according to claim 15 or claim 16, further comprising the steps of:

returning the drive line pressure differential to less than the respective predetermined value for the first one of the downhole control switches (122);

increasing the first drive line pressure and the second drive line pressure, while keeping the drive line pressure differential below the each of the respective predetermined values, until the first and second drive line pressures are within a pressure band corresponding to a second one of the plurality of downhole control switches (122); and

actuating the second one of the plurality of downhole control switches by increasing the first drive line pressure differential to greater than the predetermined value for the second one of the plurality of downhole control switches (122).

18. The method according to any of claims 15 to 17, wherein the step of returning the drive line pressure differential to less than the predetermined value for the first one of the plurality of control switches deactivates the first one of the plurality of control switches (122).

19. The method according to any of claims 15 to 18, wherein one or more of the plurality of downhole control switches (122) are latched into an actionable state when actuated, and wherein the step of increasing the drive line pressure differential to

greater than the respective predetermined value actuates each of the plurality of downhole control switches that are in the actionable state.

20. The method according to any of claims 15 to 19, further comprising the step of unlatching each of the plurality of downhole control switches (122) that are in the actionable state by increasing the first and second drive line pressures to greater than a predetermined unlatch pressure.

CLAIMS

1. A method for actuating a plurality of wellbore devices, the method comprising:

(a) providing a hydraulic fluid source, the hydraulic fluid source having a first output for outputting hydraulic fluid at a first drive line pressure and a second output for outputting hydraulic fluid at a second drive line pressure, the pressure differential between the first drive line pressure and the second drive line pressure defining a drive line pressure differential;

(b) providing a first drive line and a second drive line, each drive line passing through a tubing hanger, the first drive line being in communication with the first output and the second drive line being in communication with the second output;

(c) connecting a first downhole control switch to the first drive line and the second drive line, the first downhole control switch moving from a first switch first position to a first switch second position when each of the first drive line pressure and the second drive line pressure are within a first pressure band and the drive line pressure differential exceeds a first predetermined value;

(d) connecting a second downhole control switch to the first drive line and the second drive line, the second downhole control switch moving from a second switch first position to a second switch second position when each of the first drive line pressure and the second drive line pressure are within a second pressure band and the drive line pressure differential exceeds a second predetermined value, and wherein the first pressure band does not overlap with the second pressure band so the second downhole control switch is not actuated in the step of actuating the first downhole control switch;

(e) connecting a pair of hydraulic control lines to each of the first and second downhole control switches, each pair of hydraulic control lines transmitting a hydraulic pressure in response to the first downhole control switch being in the first switch first or second position, or the second control switch being in the second switch first or second position;

(f) increasing the first drive line pressure and the second drive line pressure while keeping the drive line pressure differential below the first predetermined value until the first and second drive line pressures are within the first pressure band; and

(g) actuating the first downhole control switch by increasing the drive line pressure differential to greater than the first predetermined value.

2. The method according to claim 1, further comprising the steps of:

returning the drive line pressure differential to less than the first predetermined value;

increasing the first drive line pressure and the second drive line pressure, while keeping the drive line pressure differential below the second predetermined value, until the first and second drive line pressures are within the second pressure band; and

actuating the second downhole control switch by increasing the drive line pressure differential to greater than the second predetermined value.

3. The method according to claim 2, wherein the step of returning the drive line pressure differential to less than the first predetermined value deactivates the first downhole control switch.

4. The method according to claim 2, wherein the step of actuating the first downhole control switch causes the first downhole control switch to latch into an actionable state, and wherein the step of increasing the drive line pressure differential to greater than the second predetermined value, while the first and second drive line pressures are within the second pressure band, actuates the first downhole control switch when the first downhole control switch is in the actionable state.

5. The method according to claim 4, further comprising the step of unlatching the first downhole control switch by increasing the first and second drive line pressures to greater than a predetermined unlatch pressure, the predetermined unlatch pressure being greater than the pressure of the first and second pressure bands.

6. A method for actuating a plurality of wellbore devices, the method comprising:

(a) providing a hydraulic fluid source, the hydraulic fluid source having a first output for outputting hydraulic fluid at a first drive line pressure and a second output for outputting hydraulic fluid at a second drive line pressure, the pressure differential between the first drive line pressure and the second drive line pressure defining a drive line pressure differential;

(b) providing a first drive line and a second drive line, each drive line passing through a tubing hanger, the first drive line being in communication with the first output and the second drive line being in communication with the second output;

(c) connecting a plurality of downhole control switches to the first drive line and the second drive line, each of the plurality of downhole control switches moving from a first position to a second position when the first drive line pressure and the second drive line pressure are within a unique pressure band corresponding to each of the respective plurality of downhole control switches and the drive line pressure differential exceeds a respective predetermined value, wherein the pressure bands corresponding to each of the plurality of downhole control switches do not overlap;

(d) connecting one of a plurality of control lines from each of the plurality of downhole control switches to one of a plurality of downhole devices;

(e) increasing the first drive line pressure and the second drive line pressure, while keeping the drive line pressure differential below each of the predetermined values until the first and second drive line pressures are within a pressure band corresponding to a first one of the plurality of downhole control switches; and

(f) actuating a first one of the downhole control switches by increasing the drive line pressure differential to greater than the respective predetermined value for the first one of the downhole control switches, the actuation of the first one of the downhole control switches causing actuation of the downhole device connected thereto by one of the control lines.

7. The method according to claim 6, further comprising the steps of:

returning the drive line pressure differential to less than the respective predetermined value for the first one of the downhole control switches;

increasing the first drive line pressure and the second drive line pressure, while keeping the drive line pressure differential below the each of the respective predetermined values, until the first and second drive line pressures are within a pressure band corresponding to a second one of the plurality of downhole control switches; and

actuating the second one of the plurality of downhole control switches by increasing the drive line pressure differential to greater than the predetermined value for the second one of the plurality of downhole control switches.

8. The method according to claim 7, wherein the step of returning the drive line pressure differential to less than the predetermined value for the first one of the plurality of control switches deactivates the first one of the plurality of control switches.

9. The method according to claim 6, wherein one or more of the plurality of downhole control switches are latched into an actionable state when actuated, and wherein the step of increasing the drive line pressure differential to greater than the respective predetermined value actuates each of the plurality of downhole control switches that are in the actionable state.

10. The method according to claim 9, further comprising the step of unlatching each of the plurality of downhole control switches that are in the actionable state by increasing the first and second drive line pressures to greater than a predetermined unlatch pressure.

11. A wellbore control system for actuating a plurality of wellbore devices for a wellhead having a tubing hanger, comprising:

a hydraulic fluid source having a first output and a second output;

a first drive line passing through the tubing hanger and in communication with the first output of the hydraulic fluid source;

a second drive line passing through the tubing hanger and in communication with the second output of the hydraulic fluid source;

a first downhole control switch in fluid communication with the first drive line and the second drive line, the first downhole control switch moving from a first switch first position to a first switch second position when each of a pressure of the first drive line and a pressure of the second drive line are within a first pressure band and the first drive line pressure exceeds the second drive line pressure by at least a first predetermined value;

a second downhole control switch connected to the first drive line and the second drive line, the second downhole control switch moving from a second switch first position to a second switch, second position when each of the pressure of the first drive line and the pressure of the second drive line are within a second pressure band and the pressure of the first drive line exceeds the pressure of the second drive line by at least a second predetermined value, wherein values of the second pressure band are different from values of the first pressure band; and

a separate control line connected to each of the downhole control switches, the control line being operably connectable to a downhole device.

12. The system according to claim 11, wherein the first downhole control switch is dormant when the difference between the pressure of the first drive line and the pressure of the second drive line, defining a pressure differential, occurs outside of the first pressure band and the second downhole control switch is dormant when the pressure differential occurs outside of the second pressure band.

13. The system according to claim 11, further comprising a third downhole control switch connected to the first drive line and the second drive line, the third downhole control switch moving from a third switch first position to a third switch second position when each of the pressure of the first drive line and the pressure of the second drive line are within a third pressure band and the first drive line pressure exceeds the second drive line pressure by at least a third predetermined value; and

a fourth downhole control switch connected to the first drive line and the second drive line, the fourth downhole control switch moving from a fourth switch first position to a fourth switch second position when each of the pressure of the first drive line and the pressure of the second drive line are within a fourth pressure band and the first drive line pressure exceeds the second drive line pressure by at least a fourth predetermined value.

14. The system according to claim 11, wherein actuation of each of the first and second downhole control switches latches the respective downhole control switch into an actionable state wherein the respective downhole control switches are actuated in response to a pressure differential greater than a predetermined amount irrespective of either the first or second pressure bands.

15. The system according to claim 14, wherein each of the first and second downhole control switches that are latched in the actionable state are released from the actionable state when the pressure of each of the first and second drive lines reach a predetermined latch release pressure, the predetermined latch release pressure being greater than the pressure bands corresponding to each of the downhole control switches.

16. The system according to claim 11, wherein the hydraulic fluid source comprises a first control valve for outputting hydraulic fluid at the first drive line pressure and a second control valve for outputting hydraulic fluid at the second drive line pressure.