Claims

1. An apparatus (30, 230, 330, 630, 830) for introducing a fluid into a subsea production flow system, the apparatus comprising:
a first flow path through the apparatus for fluidly coupling a subsea well to a subsea production flow system;
an inlet (36, 736) for receiving the introduced fluid;
a second flow path for fluidly connecting the inlet and the subsea production flow system via at least part of the first flow path;
a valve (40, 240, 340, 440, 740) operable to control the flow of the introduced fluid through the inlet to the subsea production flow system; and
at least one flow barrier (38, 238, 262, 338, 362, 438, 462, 641, 738, 841) in the first flow path, configured to prevent~~ing~~ the passage of the introduced fluid from the inlet to the subsea well.

2. The apparatus (30, 230, 330, 630, 830) ~~according to claim 1, wherein the apparatus is connected to the flow system directly.~~

~~3. The apparatus according to claim 1, wherein the apparatus is connected to one or more flow access apparatus located on the flow system.~~

~~4. The apparatus according to any of claims 1 to 3, wherein the apparatus is configured to be connected to an external flowline connector of the flow system or a manifold thereof, at a location selected from the group consisting of: a jumper flow line connector; upstream of a jumper flow line or a section of a jumper flow line; downstream of a jumper flow line or a section of a jumper flow line; a Christmas tree; a subsea collection manifold system; subsea Pipe Line End Manifold (PLEM); a subsea Pipe Line End Termination (PLET); a subsea Flow Line End Termination (FLET); and a subsea in-line tee (ILT).~~

~~5. The apparatus according to any of claims 1 to 3, wherein the apparatus is configured to be connected to a production riser, such that it is in fluid communication with the production riser.~~

~~6. The apparatus according to any preceding claim, wherein the second flow path connects the inlet to the subsea production flow system via at least a part of the first flow path.~~

~~7. The apparatus according to any preceding claim, wherein the at least one flow barrier is a flow barrier selected from the group comprising: a check valve, a flow restrictor, a choke valve and an adjustable choke valve.~~

~~8.~~ ~~The apparatus~~ according to any preceding claim, wherein the apparatus comprises at least one sensor (39, 239, 261, 339, 361, 439, 461, 639, 661, 739, 761) which is operable to detect a condition indicative of a first treatment chemical in the apparatus~~.~~

~~9.~~ ~~The apparatus according to claim 8,~~and wherein the at least one flow barrier (38, 238, 262, 338, 362, 438, 462,641, 738, 841) is disposed between the inlet (36, 736) and the at least one sensor (39, 239, 261, 339, 361, 439, 461, 639, 661, 739, 761).

~~10.~~3. The apparatus (30, 230, 330, 630, 830) according to claim ~~8 or claim 9~~2, wherein the at least one sensor (39, 239, 261, 339, 361, 439, 461, 639, 661, 739, 761) is operable to transmit a signal to a control module (350, 450) and wherein the valve (40, 240, 340, 440, 740) is operable to control the flow of a second treatment chemical through the inlet (36, 736) to the subsea production flow system in response to a control signal from the control module.

~~11.~~4. The apparatus (30, 230, 330, 630, 830) according to any preceding claim, wherein the first and/or second flow path comprises additional instrumentation for monitoring fluid and/or flow properties such as pressure, temperature, flow rate and fluid composition.

~~12.~~5. The apparatus according to claim ~~11~~4, wherein the instrumentation within the first and/or second flow paths is operable to feedback to a control module, and wherein properties of the flow operation are operable to be adjusted based on said feedback.

~~13.~~6. A method of introducing a fluid to a subsea production flow system, the method comprising:

~~providing~~ using an apparatus (30, 230, 330, 630, 830) which fluidly couples a subsea well ~~connected~~ to a subsea ~~well and a subsea~~ production flow system via a first flow path, the apparatus comprising an inlet (36, 736) for receiving the introduced fluid, a second flow path fluidly connecting the inlet and the subsea production flow system via at least part of the first flow path, a valve (40, 240, 340, 440, 740) operable to control the flow of the introduced fluid through the inlet to the subsea production flow system and at least one flow barrier (38, 238, 262, 338, 362, 438, 462,641, 738, 841) preventing passage of the introduced fluid from the inlet to the subsea well;

flowing a production fluid from the subsea well into the apparatus;

controlling flow of the introduced fluid into the apparatus, through the inlet and in to the subsea production flow system; and

flowing the production fluid and introduced fluid to the subsea production flow system.

~~14.~~7. The method according to claim ~~13~~6, comprising preventing or reducing flow of a first treatment chemical into the subsea production flow system.

~~15.~~8. The method according to claim ~~14~~7, comprising detecting in the production fluid a condition indicative of a first treatment chemical by using at least one sensor (39, 239, 261, 339, 361, 439, 461, 639, 661, 739, 761) in the apparatus (30, 230, 330, 630, 830).

~~16.~~9. The method according to claim ~~14~~ 7 or claim ~~15~~8, wherein the introduced fluid is a second treatment chemical and the method comprises controlling the flow of the second treatment chemical into the apparatus (30, 230, 330, 630, 830) for the purpose of dosing the production fluid to counteract an effect of the first treatment chemical.

~~17.~~10. The method according to claim ~~15~~ 8 or ~~16~~claim 9, wherein the condition indicative of a first treatment chemical is a pH outside of a desired pH range, and wherein the second treatment chemical is a base substance, and/or an alkaline or caustic chemical selected to bring the pH of the production fluid to into a desired range.

~~18.~~11. The method according to any of claims ~~15~~ 8 to ~~17~~10, comprising transmitting a signal from the at least one sensor to a control module.

~~19. The method according to claim 18, comprising~~and controlling the valve (40, 240, 340, 440, 740) to control the flow of the second treatment chemical through the inlet to the subsea production flow system in response to a control signal from the control module (350, 450).

~~20.~~12. The method according to claim ~~13, comprising injecting a gas into the subsea production flow system.~~

~~21. The method according to claim 20~~6, wherein the introduced fluid is gas, and wherein the method comprises injecting the gas into the subsea production flow system by controlling flow of the gas into the apparatus~~,~~ (30, 230, 330, 630, 830), through the inlet and into the subsea production flow system.

~~22.~~13. A system for introducing a fluid to a subsea production flow system, the system comprising:

a subsea well;

a subsea production flow system;

an apparatus (30, 230, 330, 630, 830) fluidly coupling the subsea well to the subsea production flow system via a first flow path, wherein the apparatus further comprises an inlet (36, 736) for receiving the introduced fluid, ~~and~~ a second flow path ~~between~~ fluidly connecting the inlet and the subsea production flow system via at least part of the first flow path;

~~wherein the apparatus further comprises~~ a valve (40, 240, 340, 440, 740) operable to control the flow of the introduced fluid through the inlet to the subsea production flow system; and

~~wherein the apparatus further comprises~~ at least one flow barrier (38, 238, 262, 338, 362, 438, 462,641, 738, 841) in the first flow path, preventing the passage of the introduced fluid from the inlet to the subsea well.

~~23.~~14. The system according to claim ~~22~~13, wherein the apparatus (30, 230, 330, 630, 830) is connected to a flow access apparatus (20).

15. The system according to claim 14, wherein the apparatus (30, 230, 330, 630, 830) comprises an interface connected to an interface (22) of the flow access apparatus (20), wherein the interface comprises first and second bores, the first bore being fluidly coupled to the subsea well and the second bore being fluidly coupled to the subsea production flow system, and wherein the first flow path connects the first and second bores.

16. The system according to claim 14 or claim 15~~23~~, wherein the flow access apparatus is connected to:

~~-~~an external ~~a jumper~~ flowline connector of the flow system or a manifold thereof, at a location selected from the group consisting of: a jumper flow line connector; upstream of a jumper flow line or a section of a jumper flow line; downstream of a jumper flow line or a section of a jumper flow line; a Christmas tree; a subsea collection manifold system; subsea Pipe Line End Manifold (PLEM); a subsea Pipe Line End Termination (PLET); a subsea Flow Line End Termination (FLET); and a subsea in line tee (ILT); and

~~24. the~~ a jumper flowline ~~envelope of a subsea tree and a jumper flowline~~ of the production flow system.

~~25.~~17. The system according to claim ~~22~~13, wherein the apparatus is fluidly connected to a production riser.