

1 Claims

- 2
- 3 1. A subsea in-line tee arrangement configured to be located in a pipeline of a subsea
- 4 production system, the subsea in-line tee arrangement comprising:
- 5 a subsea in-line tee; and
- 6 a removable module;
- 7 wherein the removable module comprises at least one connector for connecting the
- 8 module to the in-line tee and an interface for connecting the module to at least one
- 9 process apparatus;
- 10 wherein the removable module defines two distinct flow paths, the two distinct flow
- 11 paths comprising a flow path for routing production fluid from a subsea well to the
- 12 interface and a flow path between the interface and the at least one connector for
- 13 routing the production fluid from the interface to the in-line tee;
- 14 wherein the removable module is configured to be assembled with a jumper flowline
- 15 to receive the production fluid from the subsea well via the jumper flowline and
- 16 connect the jumper flowline and the subsea in-line tee.
- 17
- 18 2. The subsea in-line tee arrangement according to ~~any preceding claim 1~~, wherein the
- 19 interface of the removable module is configured to receive a process apparatus
- 20 and/or multiple process apparatus.
- 21
- 22 3. The subsea in-line tee arrangement according to claim 2, wherein the process
- 23 apparatus comprises a flow loop configured such that to ~~such that the~~ enable
- 24 production fluid from the subsea well is able to join the in-line tee via the jumper
- 25 flowline and removable module assembly.
- 26
- 27 4. The subsea in-line tee arrangement according to any of claims 1 to 3, wherein the in-
- 28 line tee comprises an isolation valve.
- 29
- 30 5. The subsea in-line tee arrangement according to any preceding claim, wherein the
- 31 removable module comprises an isolation valve.
- 32
- 33 6. The subsea in-line tee arrangement according to any preceding claim, wherein the at
- 34 least one connector of the removable module is a first connector, wherein the
- 35 removable module further comprises a second connector, and wherein the flow path

- 1 for routing production fluid from a subsea well to the interface is defined between the
2 second connector and the interface.
- 3
- 4 7. The subsea in-line tee arrangement according to claim 6, wherein the second
5 connector is configured to connect the module to a jumper flowline.
- 6
- 7 8. The subsea in-line tee arrangement according to any preceding, wherein the
8 interface is a dual bore interface.
- 9
- 10 9. The subsea in-line tee arrangement according to any preceding claim, wherein the
11 interface is a multi-bore interface.
- 12
- 13 10. The subsea in-line tee arrangement according to any preceding claim, wherein the
14 removable module comprises one or more control lines selected from the group
15 comprising: hydraulic, electrical and/or fibreoptic control lines.
- 16
- 17 11. The subsea in-line tee arrangement according to claim 10, wherein the removable
18 module comprises a control interface connected to the one or more control lines and
19 configured to connect to a corresponding control interface of a process apparatus.
- 20
- 21 12. The subsea in-line tee arrangement according to claim 10 or claim 11, wherein the
22 one or more control lines are connected to and supplied from an umbilical.
- 23
- 24 13. The subsea in-line tee arrangement according to any of claims 10 to 12, wherein the
25 one or more control lines are integrated internally within the removable module.
- 26
- 27 14. The subsea in-line tee arrangement according to any preceding claim, wherein the
28 interface of the removable module is configured to be connected to a process
29 apparatus configured to perform one or more functions selected from the group
30 comprising: fluid control, fluid sampling, fluid diversion, fluid recovery, fluid injection,
31 fluid circulation, fluid access, fluid measurement, flow measurement, fluid metering
32 and/or gas lift operations.
- 33
- 34 15. A subsea in-line tee installation located in a subsea production pipeline of a subsea
35 production system, the installation comprising:
36 a subsea in-line tee integrated into a subsea production flowline;
37 a removable module assembled with a jumper flowline; and

- 1 at least one process apparatus;
 2 wherein the removable module comprises at least one connector connecting the
 3 module to the in-line tee and an interface connecting the module to the at least one
 4 process apparatus;
 5 wherein the removable module defines two distinct flow paths, the two distinct flow
 6 paths comprising a flow path for routing production fluid from a subsea well to the
 7 interface and a flow path between the interface and the at least one connector for
 8 routing production fluid from the interface to the in-line tee; and
 9 wherein the removable module is configured to receive production fluid from the
 10 subsea well via the jumper flowline and connect the jumper flowline and the subsea
 11 in-line tee.
- 12
- 13 16. The subsea in-line tee installation according to claim 15, wherein the at least one
 14 process apparatus is configured to perform one or more functions selected from the
 15 group comprising: fluid control, fluid sampling, fluid diversion, fluid recovery, fluid
 16 injection, fluid circulation, fluid access, fluid measurement, flow measurement, fluid
 17 metering and/or gas lift operations.
- 18
- 19 17. The subsea in-line tee installation according to claim 15 or claim 16 wherein the
 20 process apparatus comprises a choke valve.
- 21
- 22 18. A method of installing a removable module to a ~~pre-installed subsea in-line tee; the~~
 23 ~~method comprising:~~
 24 ~~providing a subsea in-line tee pre-installed into a subsea production system and~~
 25 comprising a connector;
 26 ~~providing wherein the~~ removable module comprises ~~esing~~ at least one connector and
 27 an interface for connecting the module to at least one process apparatus;
 28 wherein the removable module defines two distinct flow paths, the two distinct flow
 29 paths comprising a flow path for routing production fluid from a subsea well to the
 30 interface and a flow path between the interface and the at least one connector for
 31 routing production fluid from the interface to the in-line tee; and
 32 wherein the removable module is assembled with a jumper flowline and is configured
 33 to receive production fluid from the subsea well via the jumper flowline and connect
 34 the jumper flowline and the subsea in-line tee;
 35 wherein the method comprises:

- 1 _deploying the removable module subsea; and
2 coupling the at least one connector of the removable module to the connector of the
3 subsea in-line tee.
4
- 5 19. The method according to claim 18, wherein the connector of the in-line tee is
6 connected to a pre-installed flow component and wherein the method comprises
7 carrying out the step of removing the pre-installed flow component from the
8 connector of the subsea in-line tee before the removable module is coupled to the in-
9 line tee.
10
- 11 20. The method according to claim 19, wherein the pre-installed flow component is a
12 flow cap.
13
- 14 21. The method according to any of claims 18 to 20, wherein the at least one connector
15 is a first connector and the removable module comprises a second connector
16 coupled to a jumper flowline and forming a jumper flowline and removable module
17 assembly.
18
- 19 22. The method according to claim 21, wherein the method comprises coupling the
20 removable module and jumper flowline assembly to the connector of the subsea in-
21 line tee.
22
- 23 23. The method according to any of claims 18 to 22, wherein the method comprises
24 connecting a process apparatus to the interface of the removable module.