Claims

1. A method of manufacturing a configurable pre-machined forging suitable for use with both a multiple bore tubing hanger or a mono bore tubing hanger, the method comprising:

providing a configurable common master valve block with a main bore, the main bore extending axially through the common master valve block from a bottom end of the common master valve block to a top end of the common master valve block along a main central axis of the common master valve block, the common master valve block having an upper cylindrical portion centered around the main central axis, a lower cylindrical portion, and a valve portion that is located axially between the upper cylindrical portion and the lower cylindrical portion;

after providing the configurable common master valve block, identifying a target subsea assembly to which the common master valve block is to be secured, the target subsea assembly having a mono bore subsea completion with a wellhead assembly and a tubing hanger landed therein with a single production bore along a central axis of the tubing hanger, or a multiple bore subsea completion with the wellhead assembly and the tubing hanger landed therein with the production bore offset from the central axis of the tubing hanger; and

machining an outer surface of the lower cylindrical portion to remove excess material; wherein

if the target subsea assembly has the mono bore subsea completion, then the machining of a lower interface at the bottom end of the common master valve block is centered around the main central axis;

if the target subsea assembly has the multiple bore subsea completion, then the machining of the lower interface at the bottom end of the common master valve block has an eccentric interface axis that is parallel to, and offset from, the main central axis;

if the target subsea assembly has the mono bore subsea completion, then the machining of the outer surface of the lower cylindrical portion so that the lower cylindrical portion is centered around the main central axis; and

if the subsea assembly has the multiple bore subsea completion, machining the outer surface of the lower cylindrical portion so that the lower cylindrical portion is centered around the eccentric interface axis.

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

providing a production master valve and a production swab valve in the valve portion along the main bore;

providing a crossover bore extending within the common master valve block from a first crossover outlet at a first side of the common master valve block to a second crossover outlet at a second side of the common master valve block, the crossover bore containing at least one crossover isolation valve;

providing a main lateral bore extending from the main bore to a main bore outlet at the first side of the common master valve block;

providing an annulus bore outlet located at the second side of the common master valve block; wherein

a position of the first crossover outlet, the second crossover outlet, the crossover isolation valve, the main bore outlet, the annulus bore outlet, the production master valve, and the production swab valve is predetermined and standardized, irrespective of the common master valve block being configured for the multiple bore tubing hanger or the mono bore tubing hanger.

3. The method according to claim 1, further comprising:

providing a crossover bore extending within the common master valve block from a first crossover outlet at a first side of the common master valve block to a second crossover outlet at a second side of the common master valve block;

forming a main lateral bore in fluid communication with the main bore and having a production wing valve;

forming an annulus lateral bore in fluid communication with a master block annulus bore, the master block annulus bore extending axially through the common master valve

block and being parallel to, and offset from, the main bore, the annulus lateral bore having an annulus wing valve; and wherein

the crossover bore is in fluid communication with the main lateral bore radially interior of or radially exterior of the production wing valve;

the crossover bore is in fluid communication with the annulus lateral bore radially interior of or radially exterior of the annulus wing valve;

the production wing valve has a common location regardless if the subsea assembly has the mono bore subsea completion or the multiple bore subsea completion; and

the annulus wing valve has a common location regardless if the subsea assembly has the mono bore subsea completion or the multiple bore subsea completion.

4. The method according to claim 1, further comprising providing a crossover bore extending within the common master valve block from a first crossover outlet at a first side of the common master valve block to a second crossover outlet at a second side of the common master valve block, wherein the crossover bore is machined within the common master valve block so that the crossover bore extends entirely within the common master valve block.

5. The method according to claim 1, further comprising after identifying the target subsea assembly to which the common master valve block is to be secured, forming a master block annulus bore extending axially through the common master valve block and being parallel to, and offset from, the main bore, wherein the master block annulus bore is machined to be in fluid communication with a tubing hanger annulus bore within the multiple bore tubing hanger.

6. The method according to claim 1, further comprising after identifying the target subsea assembly to which the common master valve block is to be secured, forming a master block annulus bore extending axially through the common master valve block and being parallel to, and offset from, the main bore, wherein the master block annulus bore is machined to be in fluid communication with an outer annular space that is sealed from and radially outward from, the mono bore tubing hanger.

7. The method according to claim 1, wherein the lower cylindrical portion of the common master valve block has a lower axis that is parallel to, and offset from, the main central axis before identifying the target subsea assembly to which the common master valve block is to be secured.

8. The method according to claim 1, wherein the lower cylindrical portion of the common master valve block has a lower axis that is co-liner with the main central axis before identifying the target subsea assembly to which the common master valve block is to be secured.

9. The method according to claim 1, wherein the wellhead assembly is one of a wellhead housing or a tubing spool.

10. A method of completing a subsea hydrocarbon well with a configurable pre-machined forging suitable for use with both a multiple bore tubing hanger or a mono bore tubing hanger, the method comprising:

providing a configurable common master valve block with a main bore, the main bore extending axially through the common master valve block from a bottom end of the common master valve block to a top end of the common master valve block along a main central axis of the common master valve block, the common master valve block having an upper cylindrical portion centered around the main central axis, a lower cylindrical portion, and a valve portion that is located axially between the upper cylindrical portion and the lower cylindrical portion;

after providing the configurable common master valve block, identifying a target subsea assembly to which the common master valve block is to be secured, the target subsea assembly having a mono bore subsea completion with a wellhead assembly and a tubing hanger landed therein with a single production bore along a central axis of the tubing hanger, or a multiple bore subsea completion with the wellhead assembly and the tubing hanger landed therein with the production bore offset from the central axis of the tubing hanger; and

machining an outer surface of the lower cylindrical portion to remove excess material; wherein

if the subsea assembly has the mono bore subsea completion, machining an outer surface of the lower cylindrical portion so that the lower cylindrical portion is centered around the main central axis; and

if the subsea assembly has the multiple bore subsea completion, machining the outer surface of the lower cylindrical portion so that the lower cylindrical portion is centered around an eccentric interface axis; and

securing the common master valve block to the subsea assembly so that the main bore is in fluid communication with the production bore.

11. The method according to claim 10, further comprising forming a master block annulus bore extending axially through the common master valve block and being parallel to, and offset from, the main bore, wherein if the subsea assembly has the mono bore subsea completion, the master block annulus bore is formed farther from the main bore than if the subsea assembly has the multiple bore subsea completion.

12. The method according to claim 10, further comprising:

providing a production master valve and a production swab valve in the valve portion of the main bore;

providing a master block annulus bore extending axially through the common master valve block parallel to and offset from the main bore, the master block annulus bore having an annulus master valve and annulus swab valve in the valve portion;

providing a crossover bore extending within the common master valve block from a first crossover outlet at a first side of the common master valve block to a second crossover outlet at a second side of the common master valve block, the crossover bore containing at least one crossover isolation valve;

providing a main lateral bore extending from the main bore to a main bore outlet at the first side of the common master valve block;

providing an annulus bore outlet located at the second side of the common master valve block; wherein

a position of the first crossover outlet, the second crossover outlet, the main bore outlet, the annulus bore outlet, the production master valve, the production swab valve, and the crossover isolation valve is the same irrespective of the common master valve block being configured for the multiple bore subsea completion or the mono bore subsea completion.

13. The method according to claim 10, further comprising:

if the subsea assembly has the mono bore subsea completion, machining a lower interface in the bottom end of the common master valve block that is centered around the main central axis; and

if the subsea assembly has the multiple bore subsea completion, machining the lower interface in the bottom end of the common master valve block that has the eccentric interface axis that is parallel to, and offset from, the main central axis.

14. The method according to claim 10, further comprising:

providing a crossover bore extending within the common master valve block from a first crossover outlet at a first side of the common master valve block to a second crossover outlet at a second side of the common master valve block;

providing a main lateral bore extending from the main bore to a main bore outlet at the first side of the common master valve block;

providing an annulus bore outlet located at the second side of the common master valve block; wherein

a position of the first crossover outlet, the second crossover outlet, the main bore outlet, and the annulus ore outlet is the same, irrespective of the common master valve block being configured for the multiple bore tubing hanger or the mono bore tubing hanger.

15. The method according to claim 10, further comprising:

providing a crossover bore extending within the common master valve block from a first crossover outlet at a first side of the common master valve block to a second crossover outlet at a second side of the common master valve block;

forming a main lateral bore in fluid communication with the main bore and having a production wing valve;

forming an annulus lateral bore in fluid communication with a master block annulus bore, the master block annulus bore extending axially through the common master valve block and being parallel to, and offset from, the main bore, the annulus lateral bore having an annulus wing valve; and wherein

the crossover bore is in fluid communication with the main lateral bore radially interior of or radially exterior of the production wing valve; and

the crossover bore is in fluid communication with the annulus lateral bore radially interior of or radially exterior of the annulus wing valve.

16. The method according to claim 10, further comprising

providing a production master valve and a production swab valve in the valve portion of the main bore;

providing a master block annulus bore extending axially through the common master valve block parallel to and offset from the main bore, the master block annulus bore having an annulus master valve and annulus swab valve in the valve portion; wherein

the production master valve and the production swab valve have common locations regardless if the subsea assembly has the mono bore subsea completion or the multiple bore subsea completion; and

the annulus master valve and annulus swab valve have equispaced defined locations along the master block annulus bore regardless if the subsea assembly has the mono bore subsea completion or the multiple bore subsea completion.

17. A subsea system having a configurable pre-machined forging that is suitable for use with both a multiple bore tubing hanger or a mono bore tubing hanger, the system comprising:

a configurable common master valve block with a main bore, the main bore extending axially through the common master valve block from a bottom end of the common

master valve block to a top end of the common master valve block along a main central axis of the common master valve block, the common master valve block having an upper cylindrical portion centered around the main central axis, a lower cylindrical portion, and a valve portion that is located axially between the upper cylindrical portion and the lower cylindrical portion;

a crossover bore extending within the common master valve block from a first crossover outlet at a first side of the common master valve block to a second crossover outlet at a second side of the common master valve block;

a main lateral bore extending from the main bore to a main bore outlet at the first side of the common master valve block; and

an annulus bore outlet located at the second side of the common master valve block;

a target subsea assembly having one of a mono bore subsea completion with a wellhead assembly and a tubing hanger landed therein with a single production bore along a central axis of the tubing hanger, or a multiple bore subsea completion with the wellhead assembly and the tubing hanger landed therein with the production bore offset from the central axis of the tubing hanger; wherein

a position of the first crossover outlet, the second crossover outlet, the main bore outlet, and the annulus bore outlet is predetermined, irrespective of the common master valve block being configured for the multiple bore subsea completion or the mono bore subsea completion.

18. The system according to claim 17, wherein:

if the target subsea assembly has the mono bore subsea completion, then a lower interface located at the bottom end of the common master valve block is centered around the main central axis; and

if the target subsea assembly has the multiple bore subsea completion, then the lower interface at the bottom end of the common master valve block has an eccentric interface axis that is parallel to, and offset from, the main central axis.

19. The system according to claim 17, wherein the lower cylindrical portion of the common master valve block has a lower axis that is parallel to, and offset from, the main central axis before identifying the target subsea assembly to which the common master valve block is to be secured.

20. The system according to claim 17, wherein the lower cylindrical portion of the common master valve block has a lower axis that is co-liner with the main central axis before identifying the target subsea assembly to which the common master valve block is to be secured.

21. The system according to claim 17, wherein the wellhead assembly is one of a wellhead housing or a tubing spool.

22. The system according to claim 17, further comprising

a production master valve and a production swab valve in the valve portion of the main bore;

a master block annulus bore extending axially through the common master valve block parallel to and offset from the main bore, the master block annulus bore having an annulus master valve and annulus swab valve in the valve portion;

at least one crossover isolation valve in the crossover bore; and wherein

a position of the production master valve, the production swab valve, and the crossover isolation valve is the same irrespective of the common master valve block being configured for the multiple bore subsea completion or the mono bore subsea completion.

23. The system according to claim 17, further comprising:

a production wing valve in the main lateral bore;

an annulus lateral bore in fluid communication with a master block annulus bore, the master block annulus bore extending axially through the common master valve block and being parallel to, and offset from, the main bore, the annulus lateral bore having an annulus wing valve; and wherein

the crossover bore is in fluid communication with the main lateral bore radially interior of or radially exterior of the production wing valve; and

the crossover bore is in fluid communication with the annulus lateral bore radially interior of or radially exterior of the annulus wing valve.

24. The system according to claim 23, further comprising a main bore crossover portion in fluid communication with the main bore by way of the main lateral bore radially interior of or radially exterior of the production wing valve.

25. The system according to claim 23, further comprising an annulus bore crossover portion in fluid communication with the master block annulus bore by way of the annulus lateral bore radially interior of or radially external of the annulus wing valve.

26. The system according to claim 23, further comprising:

a main bore crossover portion in fluid communication with the main bore by way of the main lateral bore radially interior of or radially exterior of the production wing valve;

an annulus bore crossover portion in fluid communication with the master block annulus bore by way of the annulus lateral bore radially interior of or radially external of the annulus wing valve; and wherein

the main bore crossover portion has a main portion set length that is common irrespective of the main bore crossover portion being radially interior of or radially exterior of the production wing valve, and the annulus bore crossover portion has a annulus portion set length that is common irrespective of the annulus bore crossover portion being radially interior of or radially external of the annulus wing valve is so that a location of the first crossover outlet, the second crossover outlet, the main bore outlet, the annulus bore outlet, the production wing valve, and the annulus wing valve is predetermined.