CLAIMS

What is claimed is:

1. A modular stress joint for compensating for forces applied to a subsea structure, the modular stress joint comprising:

   a base member having a first end and a second end, wherein the base member comprises a first length and a first wall thickness; and

   at least one additional member secured to the second end of the base member, wherein each of said at least one additional members comprises an additional length and an additional wall thickness, wherein a sum of the first length and the additional length defines a total length, wherein a combination of the first wall thickness and the additional wall thickness defines an overall wall thickness, and wherein the total length and the overall wall thickness correspond to forces applied to a subsea structure secured to said base member, said at least one additional member, or combinations thereof.

2. The modular stress joint of claim 1, wherein the base member comprises a tapered body, wherein the first end comprises a first width, and wherein the second end comprises a second width less than the first width.

3. The modular stress joint of claim 2, wherein the base member further comprises a lower portion at the first end having a third width greater than the first width, and wherein the base member further comprises a curvature between the lower portion and the first end adapted to compensate for the expected forces and prevent damage to the subsea structure.

4. The modular stress joint of claim 2, wherein the base member further comprises at least one curvature between the first end and the second end, and wherein the curvature comprises a radius adapted to compensate for the expected forces and prevent damage to the subsea structure.

5. The modular stress joint of claim 1, further comprising a swivel flange secured to the base member.

6. The modular stress joint of claim 1, further comprising at least one connector secured between the base member and said at least one additional member.

7. The modular stress joint of claim 6, wherein the base member, said at least one additional member, or combinations thereof comprise a first material having a first modulus of elasticity, and wherein said at least one connector comprises a second material having a second modulus of elasticity greater than the first modulus of elasticity.

8. The modular stress joint of claim 6, wherein the base member, said at least one additional member, or combinations thereof comprise exterior threads formed thereon, and wherein said at least one connector comprises interior threads formed therein, complementary to and adapted to receive the exterior threads.

9. The modular stress joint of claim 1, wherein said at least one additional member comprises a number of additional members selected to provide the total length, the overall wall thickness, or combinations thereof.

10. A modular stress joint for compensating for forces applied to a subsea structure, the modular stress joint comprising:

a first member having a first end, wherein the first member comprises a first material having a first modulus of elasticity;

a second member having a second end, wherein the second member comprises the first material having the first modulus of elasticity; and

a connector secured to the first end of the first member and the second end of the second member, thereby connecting the first member to the second member, wherein the connector comprises a second material having a second modulus of elasticity greater than the first modulus of elasticity.

11. The modular stress joint of claim 10, wherein the first member, the second member, or combinations thereof comprise exterior threads formed thereon, and wherein the connector comprises interior threads formed therein, complementary to and adapted to receive the exterior threads.

12. The modular stress joint of claim 10, wherein the first member further comprises a tapered body with the first end and an additional end, wherein the first end comprises a first width, and wherein the additional end comprises an additional width greater than the first width.

13. The modular stress joint of claim 12, wherein the first member further comprises a lower portion at the first end having a second width greater than the additional width, and wherein the first member further comprises a curvature between the lower portion and the additional end adapted to compensate for the expected forces and prevent damage to the subsea structure.

14. The modular stress joint of claim 12, wherein the first member further comprises at least one curvature between the first end and the additional end, and wherein the curvature comprises an elliptical shape adapted to compensate for the expected forces and prevent damage to the subsea structure.

15. The modular stress joint of claim 10, further comprising a swivel flange secured to the first member.

16. The modular stress joint of claim 10, wherein the first member comprises a first length and a first wall thickness, wherein the second member comprises a second length and a second wall thickness, wherein a sum of the first length and the second length defines a total length, wherein a combination of the first wall thickness and the second wall thickness defines an overall wall thickness, and wherein the total length and the overall wall thickness correspond to forces applied to a subsea structure secured to the second member.

17. The modular stress joint of claim 16, further comprising at least one additional member connected to the second member, wherein each of said at least one additional member comprises an additional length and an additional wall thickness, wherein a sum of the first length, the second length, and each additional length defines the total length, and wherein a combination of the first wall thickness, the second wall thickness, and each additional wall thickness defines the overall wall thickness.

18. A method for compensating for forces applied to a subsea structure, the method comprising the steps of:

engaging a base member between a first structure and a second structure, wherein the base member comprises a first length and a first wall thickness;

engaging at least one additional member with the base member, wherein each of said at least one additional members comprises an additional length and an additional wall thickness, wherein a sum of the first length and the additional length defines a total length, wherein a combination of the first wall thickness and the additional wall thickness defines an overall wall thickness, and wherein the total length and the overall wall thickness correspond to forces applied to the first structure, the second structure, or combinations thereof; and

engaging the second structure to said at least one additional member.

19. The method of claim 18, wherein the step of engaging said at least one additional member to the base member comprises engaging a connector to an end of the base member and engaging an end of an additional member to the connector, wherein the base member and the additional member comprise a first material having a first modulus of elasticity, and wherein the connector comprises a second material having a second modulus of elasticity greater than the first modulus of elasticity.

20. The method of claim 19, wherein the step of engaging the connector the end of the base member and the step of engaging the end of the additional member to the connector comprise engaging exterior threads of the base member and the additional member with complementary interior threads of the connector.

21. The method of claim 18, wherein the first structure comprises a subsea wellhead or a surface vessel, and wherein the second structure comprises a subsea conduit.

22. The method of claim 18, wherein the first structure comprises a first portion of a subsea conduit, and wherein the second structure comprises a second portion of the subsea conduit.

CLAIMS

1. A modular stress joint for connection between a subsea structure and a compatible engagement structure, for compensating for forces applied to the subsea structure, the modular stress joint comprising:

    a base member connected to the subsea structure by means of a swivel flange securing the base member therethrough, the base member having a first end and a second end, wherein the base member comprises a first length and a first wall thickness; and

    a plurality of additional members secured to the second end of the base member, comprising additional lengths and additional wall thicknesses, wherein at least one of the plurality of additional members comprises a different length, diameter, shape, wall thickness, material, or combination thereof, from other additional members of the plurality of additional members,

    wherein a sum of the first length and the additional lengths defines a total length, wherein a combination of the first wall thickness and the additional wall thicknesses defines an overall wall thickness, and wherein the total length and the overall wall thickness correspond to forces applied to the subsea structure secured to said base member, said at least one additional member, or combinations thereof.

2. The modular stress joint of claim 1, wherein the base member comprises a tapered body, wherein the first end comprises a first width, and wherein the second end comprises a second width less than the first width.

3. The modular stress joint of claim 2, wherein the base member further comprises a lower portion at the first end having a third width greater than the first width, and wherein the base member further comprises a curvature between the lower portion and the first end adapted to compensate for the expected forces and prevent damage to

the subsea structure.

4. The modular stress joint of claim 2, wherein the base member further comprises at least one curvature between the first end and the second end, and wherein the curvature comprises a radius adapted to compensate for the expected forces and prevent damage to the subsea structure.

5. The modular stress joint of claim 1, further comprising at least one connector secured between the base member and said plurality of additional members.

6. The modular stress joint of claim 5, wherein the base member, said plurality of additional members, or combinations thereof comprise a first material having a first modulus of elasticity, and wherein said at least one connector comprises a second material having a second modulus of elasticity greater than the first modulus of elasticity.

7. The modular stress joint of claim 5, wherein the base member, said plurality of additional members, or combinations thereof comprise exterior threads formed thereon, and wherein said at least one connector comprises interior threads formed therein, complementary to and adapted to receive the exterior threads.

8. A modular stress joint for compensating for forces applied to a subsea structure, the modular stress joint comprising:

a first member having a first end, wherein the first member comprises a first material having a first modulus of elasticity, wherein the first end of the first member is connected to the subsea structure by means of a swivel flange securing the first member therethrough;

a second member having a second end, wherein the second member comprises the first material having the first modulus of elasticity;

a connector secured to the second end of the first member and the first end of the

second member, thereby connecting the first member to the second member, wherein the connector comprises a second material having a second modulus of elasticity greater than the first modulus of elasticity; and

at least one additional member connected to the second end of the second member, wherein the at least one additional member comprises a different length, diameter, shape, wall thickness, materials, or combination thereof, from the second member.

9. The modular stress joint of claim 8, wherein the first member, the second member, or combinations thereof comprise exterior threads formed thereon, and wherein the connector comprises interior threads formed therein, complementary to and adapted to receive the exterior threads.

10. The modular stress joint of claim 8, wherein the first member further comprises a tapered body between the first end and the second end, wherein the first end comprises a first width, and wherein the second end comprises a second width less than the first width.

11. The modular stress joint of claim 10, wherein the first member further comprises a lower portion at the first end having a third width greater than the first width, and wherein the first member further comprises a curvature between the lower portion and the second end adapted to compensate for the expected forces and prevent damage to the subsea structure.

12. The modular stress joint of claim 10, wherein the first member further comprises at least one curvature between the first end and the second end, and wherein the curvature comprises an elliptical shape adapted to compensate for the expected forces and prevent damage to the subsea structure.

13. The modular stress joint of claim 8, wherein the first member comprises a first length and a first wall thickness, wherein the second member comprises a second length and a second wall thickness, wherein each of the at least one additional

members comprises additional lengths and additional wall thicknesses, wherein a sum of the first length, the second length, and the additional lengths defines a total length, wherein a combination of the first wall thickness, the second wall thickness, and the additional wall thicknesses defines an overall wall thickness, and wherein the total length and the overall wall thickness correspond to forces applied to a subsea structure secured to the second member.

14. A method for compensating for forces applied to a subsea structure, the method comprising the steps of:

engaging a base member between a first structure and a second structure by means of a swivel flange securing the base member therethrough, wherein the base member comprises a first length and a first wall thickness;

engaging a plurality of additional members with the base member, wherein said plurality of additional members comprises additional lengths and additional wall thicknesses, wherein at least one of the plurality of additional members comprises a different length, diameter, shape, wall thickness, material, or combinations thereof, from other additional members of the plurality of additional members, wherein a sum of the first length and the additional lengths defines a total length, wherein a combination of the first wall thickness and the additional wall thicknesses defines an overall wall thickness, and wherein the total length and the overall wall thickness correspond to forces applied to the first structure, the second structure, or combinations thereof; and

engaging the second structure to said plurality of additional members.

15. The method of claim 14, wherein the step of engaging said plurality of additional members to the base member comprises engaging a connector to an end of the base member and engaging an end of an additional member to the connector, wherein the base member and the plurality of additional members comprise a first material having

a first modulus of elasticity, and wherein the connector comprises a second material having a second modulus of elasticity greater than the first modulus of elasticity.

16. The method of claim 15, wherein the step of engaging the connector to the end of the base member and the step of engaging the end of the additional member to the connector comprise engaging exterior threads of the base member and the additional member with complementary interior threads of the connector.

17. The method of claim 14, wherein the first structure comprises a subsea wellhead or a surface vessel, and wherein the second structure comprises a subsea conduit.

18. The method of claim 14, wherein the first structure comprises a first portion of a subsea conduit, and wherein the second structure comprises a second portion of the subsea conduit.

19. The modular stress joint of claim 1, further comprising a top flange comprising a tapered body having a lower section and an upper section, wherein the upper section comprises a width corresponding to a dimension of the compatible engagement structure, wherein the lower section comprises a width corresponding to the diameter of the at least one additional members, and wherein the top flange is attached to the at least one additional member via a plurality of through bores accomodating a plurality of connecting members.

20. The modular stress joint of claim 8, further comprising a top flange comprising a tapered body having a lower section and an upper section, wherein the upper section comprises a width corresponding to a dimension of the compatible engagement structure, wherein the lower section comprises a width corresponding to the diameter of the at least one additional member, and wherein the top flange is attached to the second member via a plurality of through bores accommodating a plurality of connecting members.