FLOATING OFFSHORE STRUCTURES WITH ROUND PONTOONS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims benefit of U.S. provisional patent application Serial No. 62/419,828 filed November 9, 2016, and entitled "Floating Offshore Structures with Round Pontoons," which is hereby incorporated herein by reference in its entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

BACKGROUND

[0003] Field of the Disclosure

[0004] The disclosure relates generally to floating offshore structures. More particularly, the disclosure relates to buoyant semi-submersible offshore platforms for offshore drilling and/or production operations. Still more particularly, the disclosure relates to the geometries of the hulls of semi-submersible offshore platforms, and in particular, the horizontal pontoons of the hull.

[0005] Background to the Disclosure

[0006] In oilfield activities, semi-submersible floating structures or platforms are used for various types of offshore operations including offshore drilling and production of oil and gas, as well as offshore construction operations. Conventional semi-submersible offshore platforms typically include a hull that provides sufficient buoyancy to support a work deck above the surface of the water, as well as rigid and/or flexible piping or risers extending from the platform to the seafloor. The hull often includes a horizontal base that supports a plurality of vertically oriented columns, which in turn support the work deck above the surface of the water. In general, the size of the pontoons and the number of columns are governed by the size and weight of the work platform and associated payload to be supported by the hull.

BRIEF SUMMARY OF THE DISCLOSURE

[0007] According to a first aspect of the present disclosure, there is provided a floating offshore structure, including: a buoyant hull including a first column, a second column, and a pontoon coupled to the first column and the second column, wherein each column is vertically oriented and the pontoon extends horizontally from the first column to the second column; wherein each column has a central axis, an upper end, and a lower end; wherein the pontoon includes a first tubular member and a second tubular member positioned laterally adjacent to the first tubular member, wherein each tubular member has a central axis, a first end coupled to the lower end of the first column, and a second end coupled to the lower end of the second column; where the central axis of the first tubular member and the central axis of the second tubular member are disposed in a common horizontal plane; wherein each column comprises a plurality of vertically oriented tubular members, wherein each tubular member of each column has an upper end, a lower end, and an outer cylindrical surface; wherein a first connection assembly couples the first end of the first tubular member of the pontoon to the lower end of one of the tubular members of the first column; wherein a second connection assembly couples the first end of the second tubular member of the pontoon to the lower end of one of the tubular members of the first column; wherein each connection assembly comprises a plurality of vertical brackets disposed along the outer surface of the corresponding tubular member of the column, wherein the vertical brackets of the first connection

assembly define a circular recess that receives the first end of the first tubular member of the pontoon and the vertical brackets of the second connection assembly define a circular recess that receives the first end of the second tubular member of the pontoon.

[0007a] According to a second aspect of the present disclosure, there is provided a floating offshore structure, including: a buoyant hull including a first column, a second column, and a pontoon coupled to the first column and the second column, wherein each column is vertically oriented and the pontoon extends horizontally from the first column to the second column; wherein each column has a central axis, an upper end, and a lower end; wherein the pontoon includes a first tubular member and a second tubular member positioned laterally adjacent to the first tubular member, wherein each tubular member has a central axis, a first end coupled to the lower end of the first column, and a second end coupled to the lower end of the second column; wherein the central axis of the first tubular member and the central axis of the second tubular member are disposed in a common horizontal plane; wherein the pontoon includes a heave plate fixably coupled to the first tubular member and the second tubular member, wherein the heave plate extends horizontally between the first tubular member and the second tubular member, wherein the heave plate extends axially relative to the central axes of the tubular members from the first ends of the tubular members to the second ends of the tubular members, wherein the heave plate is configured to be disposed subsea to dampen vertical motion of the floating offshore structure.

[0008] According to a third aspect of the present disclosure, there is provided a floating offshore structure, including: a buoyant hull including a first column, a second column, and a pontoon extending from the first column to the second column; wherein each column is vertically oriented and has a central axis, an upper end, and a lower end; wherein the pontoon includes a first cylindrical tubular member and a second cylindrical tubular member oriented parallel to the first tubular member, wherein the second cylindrical tubular member is positioned laterally adjacent to the first cylindrical tubular member, wherein each tubular member is horizontally oriented and has a central axis, a first end coupled to the lower end of the first column, and a second end coupled to the lower end of the second column; wherein the pontoon includes a heave plate fixably coupled to the first tubular member and the second tubular member, wherein the heave plate extends horizontally between the first tubular member and the second tubular member, wherein the heave plate extends axially relative to the central axes of the tubular members from the first ends of the tubular members to the second ends of the tubular members, wherein the heave plate is configured to be disposed subsea to dampen vertical motion of the floating offshore structure.

[0009] Embodiments described herein comprise a combination of features and characteristics intended to address various shortcomings associated with certain prior devices, systems, and methods. The foregoing has outlined rather broadly the features and technical characteristics of the disclosed embodiments in order that the detailed description that follows may be better understood. The various characteristics and features described above, as well as others, will be readily apparent to those skilled in the art upon reading the following detailed description, and by referring to the accompanying drawings. It should be appreciated that the conception and the specific embodiments disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes as the disclosed embodiments. It should also be realized that such equivalent constructions do not depart from the spirit and scope of the principles disclosed herein.

CLAIMS

1. A floating offshore structure, comprising:

a buoyant hull including a first column, a second column, and a pontoon coupled to the first column and the second column, wherein each column is vertically oriented and the pontoon extends horizontally from the first column to the second column;

wherein each column has a central axis, an upper end, and a lower end;

wherein the pontoon includes a first tubular member and a second tubular member positioned laterally adjacent to the first tubular member, wherein each tubular member has a central axis, a first end coupled to the lower end of the first column, and a second end coupled to the lower end of the second column;

where the central axis of the first tubular member and the central axis of the second tubular member are disposed in a common horizontal plane;

wherein each column comprises a plurality of vertically oriented tubular members, wherein each tubular member of each column has an upper end, a lower end, and an outer cylindrical surface;

wherein a first connection assembly couples the first end of the first tubular member of the pontoon to the lower end of one of the tubular members of the first column;

wherein a second connection assembly couples the first end of the second tubular member of the pontoon to the lower end of one of the tubular members of the first column;

wherein each connection assembly comprises a plurality of vertical brackets disposed along the outer surface of the corresponding tubular member of the column, wherein the vertical brackets of the first connection assembly define a circular recess that receives the first end of the first tubular member of the pontoon and the vertical brackets of the second connection assembly define a circular recess that receives the first end of the second tubular member of the pontoon.

2. A floating offshore structure, comprising:

a buoyant hull including a first column, a second column, and a pontoon coupled to the first column and the second column, wherein each column is vertically

oriented and the pontoon extends horizontally from the first column to the second column;

wherein each column has a central axis, an upper end, and a lower end;

wherein the pontoon includes a first tubular member and a second tubular member positioned laterally adjacent to the first tubular member, wherein each tubular member has a central axis, a first end coupled to the lower end of the first column, and a second end coupled to the lower end of the second column;

wherein the central axis of the first tubular member and the central axis of the second tubular member are disposed in a common horizontal plane;

wherein the pontoon includes a heave plate fixably coupled to the first tubular member and the second tubular member, wherein the heave plate extends horizontally between the first tubular member and the second tubular member, wherein the heave plate extends axially relative to the central axes of the tubular members from the first ends of the tubular members to the second ends of the tubular members, wherein the heave plate is configured to be disposed subsea to dampen vertical motion of the floating offshore structure.

3. The offshore structure of claim 1, wherein a first edge plate extends from the first tubular member and a second edge plate extends from the second tubular member, wherein the first tubular member, the heave plate, and the second tubular member are disposed between the first edge plate and the second edge plate.

4. The offshore structure of claim 3, wherein the first edge plate extends axially relative to the central axis of the first tubular member from the first end of the first tubular member to the second end of the first tubular member;

wherein the second edge plate extends axially relative to the central axis of the second tubular member from the first end of the second tubular member to the second end of the second tubular member.

5. The offshore structure of claim 4, wherein the first edge plate extends horizontally from the first tubular member and the second edge plate extends horizontally from the second tubular member.

6. The offshore structure of claim 5, wherein the first edge plate, the second edge plate, and the heave plate are vertically centered relative to the first tubular member and the second tubular member.

7. The offshore structure of claim 1, further comprising a first external deck coupled to the lower end of the first column and a second external deck coupled to the lower end of the second column;

wherein the first deck extends horizontally beyond an outer perimeter of the lower end of the first column and the second deck extends horizontally beyond an outer perimeter of the lower end of the second column.

8. The offshore structure of claim 7, wherein each column comprises a plurality of vertically oriented tubular members, wherein each tubular member of each column has an upper end, a lower end, and an outer cylindrical surface;

wherein the first external deck closes off and seals the lower end of each tubular member of the first column and the second deck closes off and seals the lower end of each tubular member of the second column.

9. The offshore structure of claim 1, wherein each tubular member of the pontoon has a circular cross-sectional shape.

10. The offshore structure of claim 9, wherein each tubular member of the pontoon includes a plurality of axially spaced internal annular stiffeners.

11. A floating offshore structure, comprising:

a buoyant hull including a first column, a second column, and a pontoon extending from the first column to the second column;

wherein each column is vertically oriented and has a central axis, an upper end, and a lower end;

wherein the pontoon includes a first cylindrical tubular member and a second cylindrical tubular member oriented parallel to the first tubular member, wherein the second cylindrical tubular member is positioned laterally adjacent to the first cylindrical tubular member, wherein each tubular member is horizontally oriented

and has a central axis, a first end coupled to the lower end of the first column, and a second end coupled to the lower end of the second column;

wherein the pontoon includes a heave plate fixably coupled to the first tubular member and the second tubular member, wherein the heave plate extends horizontally between the first tubular member and the second tubular member, wherein the heave plate extends axially relative to the central axes of the tubular members from the first ends of the tubular members to the second ends of the tubular members, wherein the heave plate is configured to be disposed subsea to dampen vertical motion of the floating offshore structure.

12. The offshore structure of claim 11, wherein a first edge plate extends horizontally from the first cylindrical tubular member and a second edge plate extends horizontally from the second cylindrical tubular member.

13. The offshore structure of claim 12, wherein the first edge plate extends axially relative to the central axis of the first cylindrical tubular member from the first end of the first cylindrical tubular member to the second end of the first cylindrical tubular member;

wherein the second edge plate extends axially relative to the central axis of the second cylindrical tubular member from the first end of the second cylindrical tubular member to the second end of the second cylindrical tubular member.

14. The offshore structure of claim 12, wherein the heave plate, the first edge plate, and the second edge plate are disposed in a common horizontal plane.

15. The offshore structure of claim 11, further comprising a first external deck coupled to the lower end of the first column and a second external deck coupled to the lower end of the second column;

wherein the first deck extends horizontally beyond an outer perimeter of the lower end of the first column and the second deck extends horizontally beyond an outer perimeter of the lower end of the second column.