

CLAIMS

1. An apparatus for adjusting a wind turbine system, the apparatus comprising:
a structure comprising a top surface opening and a bottom surface opening
5 opposite to the top surface opening, the structure configured to receive a mast of the
wind turbine system through the top surface opening and the bottom surface opening;
a jacking mechanism operable to raise or lower the structure with respect to
the mast of the wind turbine system; and
a locking mechanism configured to releasably secure the structure to the wind
10 turbine system.
2. The apparatus as claimed in claim 1, wherein the jacking mechanism
comprises a hydraulic jacking mechanism.
- 15 3. The apparatus as claimed in claim 1 or 2, wherein the jacking mechanism
comprises a plurality of inner jacks and a plurality of outer jacks, wherein the
plurality of inner jacks and the plurality of outer jacks are arranged extending
upwardly from the structure and spaced apart in elevation from each other.
- 20 4. The apparatus as claimed in claim 3, wherein each of the inner jacks and the
outer jacks comprises a piston configured to extend outwardly and engage a
complementary mating element provided along the mast of the wind turbine system.
5. The apparatus as claimed in claim 1, wherein the jacking mechanism
25 comprises a rack and pinion mechanism.
6. The apparatus as claimed in any one of claims 1 to 5, wherein the structure
comprises a buoyant structure including a hull having an outer hull shape selected
from the group consisting of circular, ellipsoid and geodesic horizontal cross-section,
30 wherein the top surface opening is a deck opening of the buoyant structure and the
bottom surface opening is a keel opening of the buoyant structure.

7. The apparatus as claimed in any one of claims 1 to 6, further comprising a caisson configured to receive a rotor blade of a plurality of rotor blades of the wind turbine system, the caisson being installed onto the structure.

5 8. The apparatus as claimed in claim 7, wherein the caisson comprises a pocket for the rotor blade to park therein.

9. The apparatus as claimed in claim 7 or 8, wherein the caisson comprises a caisson opening for the rotor blade to enter into the caisson.

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10. The apparatus as claimed in claim 9, wherein the caisson opening is arranged to be located under a rotation arc of the rotor blades.

11. The apparatus as claimed in any one of claims 7 to 10, wherein the caisson
15 comprises a stairway to accommodate access to at least part of the received rotor blade.

12. The apparatus as claimed in any one of claims 7 to 11, wherein the caisson
further comprises a sleeve configured to encircle at least part of the mast of the wind
20 turbine system.

13. The apparatus as claimed in any one of claims 7 to 12, further comprising a
barrel assembly comprising a storage unit configured to hold a replacement rotor
blade, a barrel configured to move the replacement rotor blade into the caisson for
25 assembly onto the wind turbine system when performing a replacement of rotor blade
for the wind turbine system, and a gear mechanism configured to operate movements
of the barrel.

14. The apparatus as claimed in claim 13, further comprising a robotic arm
30 configured to assemble the replacement rotor blade onto the wind turbine system.

15. The apparatus as claimed in any one of claims 1 to 6, further comprising a
swivel mechanism configured to adjust an assembly comprising rotor blades, a nacelle
and an engine room of the wind turbine system between an operational position to a

docking position, wherein at the operational position, the rotor blades are at a 0-180 degree position along a vertical plane that is substantially parallel to a longitudinal axis of the mast, and at the docking position, the rotor blades are positioned along a tilted plane at an angle with respect to the longitudinal axis of the mast, the angle
5 being more 0 degree but less than 180 degree.

16. The apparatus as claimed in any one of claims 1 to 15, further comprising a hoisting support platform configured to provide access to the mast of the wind turbine system, the hoisting support platform being lifted up or down alongside the mast.

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17. A mast of a wind turbine system, the mast comprising:
a mating element configured to releasably couple to a complementary mating component provided by a structure,

wherein the mast is configured to be received by the structure through a top surface opening of the structure and a bottom surface of the structure, the bottom
15 surface being opposite to the top surface opening; and

the mating element and the complementary mating component are configured to facilitate an operation of a jacking mechanism disposed on the structure to raise or lower the structure with respect to the mast.

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18. The mast as claimed in claim 17, wherein the mating element comprises an orifice provided along the mast and configured to couple to the complementary mating component that includes a piston at an extended configuration, the piston being provided by the jacking mechanism.

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19. A system comprising:
an apparatus as claimed in any one of claims 1 to 16; and
a mast as claimed in any one of claims 17 to 18 of a wind turbine system,
wherein the apparatus and the mast are configured to work cooperatively with each
30 other to raise or lower the mast with respect to the structure of the apparatus, or to lock the mast to the structure.

20. A method for adjusting a wind turbine system, the method comprising:

receiving a mast of the wind turbine system through a top surface opening and a bottom surface opening of a structure, the bottom surface opening being opposite to the top surface opening;

5 raising or lowering the structure with respect to the mast of the wind turbine system; and
releasably securing the structure to the wind turbine system.

21. The method as claimed in claim 20, wherein the step of raising or lowering the structure comprises operating a hydraulic jacking mechanism comprising a
10 plurality of inner jacks and a plurality of outer jacks, wherein the plurality of inner jacks and the plurality of outer jacks are arranged extending upwardly from the structure and spaced apart in elevation from each other.

22. The method as claimed in claim 21, wherein the step of raising the structure
15 comprises:

disabling a locking mechanism to release engagement between the structure and the wind turbine system,

extending a piston of at least one inner jack to engage a first complementary orifice provided along the mast of the wind turbine system, and

20 retracting the at least one inner jack.

23. The method as claimed in claim 22, wherein the step of raising the structure further comprises:

25 retracting the piston of the at least one inner jack to release engagement with the first complementary orifice,

extending a piston of at least one outer jack to engage a second complementary orifice provided along the mast of the wind turbine system, and

retracting the at least one outer jack.

30 24. The method as claimed in claim 21, wherein the step of lowering the structure comprises:

retracting a piston of at least one inner jack to release engagement with a first complementary orifice provided along the mast of the wind turbine system,

extending at least one outer jack with a piston of the at least one outer jack engaged with a second complementary orifice provided along the mast of the wind turbine system,

retracting the piston of the at least one outer jack to release engagement with the second complementary orifice; and

enabling a locking mechanism to secure engagement between the structure and the wind turbine system.

25. The method as claimed in claim 24, wherein the step of lowering the structure further comprises:

prior to enabling the locking mechanism, extending the piston of the at least one inner jack to engage a third complementary orifice provided along the mast of the wind turbine system,

extending the at least one inner jack, and

retracting the piston of the at least one inner jack to release engagement with the third complementary orifice.

26. The method as claimed in claim 20, wherein the step of raising or lowering the structure comprises operating a rack and pinion mechanism.

27. The method as claimed in any one of claims 20 to 26, further comprising receiving a rotor blade of a plurality of rotor blades of the wind turbine system in a caisson, the caisson being installed onto the structure.

28. The method as claimed in claim 27, further comprising moving a replacement rotor blade into the caisson by using a barrel assembly and assembling the replacement rotor blade onto the wind turbine system using a robotic arm.

29. The method as claimed in any one of claims 20 to 26, further comprising adjusting an assembly comprising rotor blades, a nacelle and an engine room of the wind turbine system between an operational position to a docking position, wherein at the operational position, the rotor blades are at a 0-180 degree position along a vertical plane that is substantially parallel to a longitudinal axis of the mast, and at the docking position, the rotor blades are positioned along a tilted plane at an angle with

respect to the longitudinal axis of the mast, the angle being more 0 degree but less than 180 degree.

30. The method as claimed in any one of claims 20 to 29, further comprising
5 encircling at least part of the mast of the wind turbine system with a sleeve of the caisson.

31. The method as claimed in any one of claims 20 to 30, further comprising
lifting up or down a hoisting support platform alongside the mast of the wind turbine
10 system to provide access to the mast.