

METHOD FOR INSTALLING A DRILLING APPARATUS ON A RIG
AND FOR PREPARING DRILLING OPERATIONS

The present invention concerns a method for preparing for drilling operations including the single-operation installation of a fully equipped drilling apparatus on a platform placed or anchored on the sea or lacustrine bottom and including an emerged portion, owing to a semi-submersible supply barge.

Several methods exist to carry out drilling in shallow waters, typically up to 300 m. In one of these methods, the drilling is dissociated from the production, and one uses a drilling-only platform called "wellhead platform". This platform is made up of a tower-shaped structure placed on the sea or lacustrine bottom, generally metallic and called "jacket", not inhabited and not equipped, on which a drilling apparatus is installed. This apparatus is only installed to carry out the drilling or well maintenance operations ("work over"). It is made up of a sub-structure, a derrick and drilling equipment, for example a "Blow Out Preventer" (BOP), a handling winch for drill pipes and a chamber to house the measuring apparatuses; such a drilling apparatus is known under the name "derrick set" or "rig" and its mass is generally between 600 and 800 tons.

The platform (the “jacket”) is installed on the borefield before the drilling operation strictly speaking, equipped with its decks, but without the drilling apparatus.

The problem posed then consists of installing a drilling apparatus on the upper deck of such a platform, therefore at a relatively high height above the water level, for example 20 m, as economically as possible, therefore as quickly as possible. The reverse operation must also be able to be carried out economically once the drilling or maintenance operation is completed, for example to reposition the drilling apparatus on another platform.

Moreover, a drilling operation requires many other facilities (technical and residential sites, fluid tanks, helicopter landing platform...), so as to receive the personnel, supply energy, receive and stock the drilling equipment such as drill tubes or drilling mud facilities for instance. These facilities represent very significant volumes and masses (several thousand tons).

One known solution (UK 2199791, FR 2474992) consists of placing, on the platform, a complete superstructure called “top side”, in a single piece, including all of the drilling and production facilities. This facility is generally carried out with one or several large-capacity floating cranes, or using ballastable barges according to the “float over” method. However, the ballasting does not make it possible to raise the superstructure beyond a few meters. Furthermore, this operation is irreversible for the lifetime and exploitation span of the platform.

Another known solution is to use a platform of the self-elevating barge or “jack-up” type placed on the bottom near the platform and of sufficient size to receive the sites and equipment necessary for the drilling. The drilling apparatus rests on cantilevered beams integral with said barge and is translated in a single piece above the platform, possibly at a significant height. However, this is an expensive and mechanically delicate solution. Furthermore, the self-elevating barge, which

is massive, leaves deep imprints on the sea or lacustrine bottom, which make later repositioning of another barge of the same type delicate.

Another solution consists of using a barge or support vessel called “tender” which deposits the drilling apparatus on the platform by parcel from about 30 to 100 tons using its lift means, the drilling apparatus being assembled gradually. This is a long, delicate and risky solution in terms of safety, and is therefore expensive as it requires excellent weather conditions for several days.

The present invention aims to provide an advantageous solution to this problem owing to a single-operation installation method, in a repositionable manner, of a fully equipped drilling apparatus on a platform already equipped with decks provided to support the wellheads and the drilling apparatus. The device which must install the drilling apparatus at a great height provides for the use of a semi-submersible barge. The method is also applicable to a platform anchored on the sea bottom, for example of the “Spar” type, the important thing being that the platform is not subject to heaving movements created by the waves. In the reverse order of the steps, the method is also applicable to the single-operation removal of a fully equipped drilling apparatus.

To this end, it proposes a method for preparing for drilling operating including the single-operation installation, in a repositionable manner, of a fully equipped drilling apparatus on a platform anchored or placed on a sea or lacustrine bottom, in which the emerged portion includes at least one upper deck designed to receive at least one wellhead and a drilling apparatus, said method using a semi-submersible supply barge including a longitudinal axis in which the hull comprises two essentially parallel protrusions defining a space, said barge including lift means supported by the protrusions as well as ballasting and deballasting means,

characterized in that it includes the following steps:

- 1) The loading of interface means on the lift means of the barge,
- 2) The loading of a drilling apparatus on said interface means,
- 3) The transit of the supply barge to the proximity of the platform with the drilling apparatus integral with the interface means,
- 4) When the barge has arrived in the vicinity of said platform, the elevation of the interface means and of the drilling apparatus by deballasting of said barge and by actuation of the lift means, so as to place said interface means at a height above the water greater than that of the upper deck of said platform,
- 5) The maneuver of the supply barge so as to place the emerged part of said platform between the two protrusions of the supply barge,
- 6) The descent and placement on the upper deck of said platform of the interface means and the drilling apparatus, by ballasting of the supply barge and by actuation of the lift means.

In the first step, one installs, on the lift means of the barge, at its protrusions, means which will be used as interface between the barge and the drilling apparatus, then between the platform and the drilling apparatus, the barge being for example at dock in a port installation, using lift means such as cranes of the pier or the barge.

During the second step, the drilling apparatus is arranged on the interface means via its sub-structure, in one or several operations by using lift means such as cranes of the dock or the barge.

During the transit which is the subject matter of the third step, the assembly formed by the interface means and the drilling apparatus is made integral with the lift means and this lift means is preferably placed in the low position to improve the stability of the barge.

In the fourth step of the method, when the barge arrives in the immediate vicinity of the platform, the drilling apparatus and the interface means are raised by deballasting of the barge and using the lift means, successively or simultaneously. By combining the two, one manages to lift the assembly to a significant height.

In the following step, the barge maneuvers so as to come closer to the platform and place the emerged part of said platform between its protrusions. So as not to risk damaging the platform, the barge will have previously proceeded with its anchoring, either using anchors, or by dynamic positioning, or by a combination of the two. The maneuver is therefore carried out by using its ground tackles and/or its dynamic positioning.

The drilling apparatus and the interface means are then lowered and placed on the upper deck of the platform, for example by rapid ballasting of the barge and/or rapid lowering of the lift means.

Lastly, one installs connection means between the barge and the platform provided with the drilling system, for example a bridge for personnel, electrical lines and fluid channels. The large drilling materials, for example the drill pipes, are delivered on the platform gradually using cranes loaders which equip the barge. The size of the barge enables it to accommodate all of the equipment (technical and residential sites, energy production, mud plant, helicopter platform...) with a view to providing logistical support for a drilling operation.

Once the drilling apparatus is deposited on the platform and the barge is moved away from the platform, it is advantageous to cover the space between the protrusions of the hull of the barge using a removable or retractable device, of the folding deck or articulated hatch cover type. One thereby considerably increases

the available deck surface for arrangement of the drilling material, for example the drill pipes, and to facilitate the carrying out of the drilling operations. This device, once extended, can also contribute to the rigidity of the structure of the barge.

In certain cases, the platform is not resistant enough to support the weight of a fully equipped drilling apparatus, including the drill tubes, and its interface means, for example when said platform is old and partially corroded. In this case, it is advantageous to act such that the transfer of the weight of the drilling apparatus on the platform, during the sixth step, is partial, i.e. its weight is distributed over the lift supports of the barge and on the deck. Strength sensors (strain gauges, for example) arranged, for example, between the interface means and the deck on which they rest, and power assistance are necessary to offset the inevitable movements of the barge and therefore of the lift means. In this case, for the drilling operation, the barge remains positioned such that the platform remains between its protrusions and steps seven and eight do not take place.

The interface means can be formed by a structure including, for example, two essentially parallel beams, arranged during the first step essentially orthogonally to the longitudinal axis of the barge and resting at their end on the lift means of the barge.

The drilling apparatus rests on the interface beams during the entire unfolding of the method. The interface beams rest on the platform during all of the drilling operations, the drilling apparatus resting entirely on said beams. This presents the advantage that the drilling apparatus can later be removed very rapidly with a barge of the same type by carrying out the method in the reverse order of the steps, and for example deposited on another platform. In a known manner, the interface beams also serve to move the drilling apparatus on the upper deck

according to the two directions of the plane, so as to access each of the wellheads provided on the platform.

However, said beams have a length at least equal to the interior spacing of the protrusions of the barge and are therefore longer than the side of the deck on which they rest and, if they stay in place, risk hindering later maneuvers of the barge. Furthermore, the beams then constitute a useless mass on the platform. It can therefore be advantageous to provide that each beam includes a disassemblable portion at each end, made integral during steps one to six of the method for example by splicing, then disassembled using the lift means of the barge.

The method will be better understood upon reading the description which follows and in light of the appended figures, in which:

Figures 1A and 1B are two perspective views of a barge used to implement the method,

Figure 2 is a side view of a fully equipped drilling apparatus, placed on interface beams, designed to be installed on a platform,

Figures 3A to 3N are side views of the barge diagrammatically illustrating the steps of the method,

Figure 4 is a side view of an interface beam,

Figure 5 is a perspective view of an example of barge used by the method. The hull of the semi-submersible barge 1 illustrated in figure 1A includes, at its stern, two protrusions 1a and 1b, which for example extend one of the decks of

the barge and which define a space 2 of sufficient size for the emerged part of a platform to be able to assume a position there, for example in the vicinity of 30 x 40 m. These protrusions are sufficiently resistant to support the weight of a fully equipped drilling apparatus. The barge also includes technical sites 3a and 3b, a helicopter landing platform 4, residential quarters 5, a main crane 6a and a secondary crane 6b which enable it to provide all of the necessary support for a drilling operation. It includes ballasting and deballasting means, for example hollow bodies within its structure, which can be filled with and emptied of sea water or any other fluid owing to pumps (not shown) making it possible to vary the freeboard significantly. It includes a longitudinal axis A-A'.

The barge 1 includes four lift towers 7a and 7b resting on the protrusion 1a, 7c and 7d resting on the protrusion 1b. These lift towers typically have a height of ten to fifteen meters, they include lift supports in which the drilling apparatus can rest via its interface means, and are for example provided with powerful hydraulic winches or any other elevation system permitting them to each lift up to 250 t.

In this figure, the folding deck 8 is folded and the space 2 between the protrusions 1a and 1b of the hull is therefore open. In figure 1B, the folding deck 8 has been extended and drilling equipment such as drill pipes have been arranged there.

The barge of figure 1 is illustrated without propulsion means, but it is obvious that it can be self-propelled. It includes dynamic positioning means, for example multi-direction propellers, not shown.

Figure 2 illustrates a fully equipped drilling apparatus installed on a platform 20. It includes a sub-structure 11, a derrick 12, and drilling equipment such as a BOP 13 and other equipment 14. It rests on interface beams 15a and 15b. The platform 20 includes an emerged portion 21, comprising two decks, including an upper

deck 16 on which interface means 15a and 15b rest. The upper deck 16 is typically at a height of 18 to 20 meters above sea level O.

Figures 3A to 3N illustrate the different steps of the method. In figures 3A to 3E, the drilling apparatus 10 and interface means 15 are installed on lift towers supported by the protrusions of the barge 1a, 1b, for example in a port installation, in five sub-steps; the number of sub-steps can vary depending for example on the capacity of the available lift means and/or the available time for the barge. In the illustrated example, the drilling apparatus 10 is arranged on the lift supports at the low position of the lift towers 7a, 7b, 7c and 7d of the barge.

Figure 3G illustrates the self-propelled transit of the barge supporting the drilling apparatus toward the platform; it can also be towed. During the transit, for example maritime, the barge is ballasted to ensure better stability.

In figure 3H, the barge is beginning to maneuver to come closer to the platform 20, approaching from the rear so as to place the emerged portion 21 of the platform between the protrusions 1a and 1b of the barge. The maneuvers are done by using on ground tackles (not shown) and/or its dynamic anchoring means. The anchors can have been arranged in advance or placed by the barge itself.

In figure 3I, the barge has come closer to the platform 20 and raises the drilling apparatus 10 such that the interface means 15 are higher than the upper deck 16 of the platform 20. This raising is done by deballasting the barge and by actuating the lift towers 7.

In the following step illustrated in figure 3J, the barge has maneuvered so as to place the emerged portion 21 of the platform between the protrusions 1a and 1b of the hull. Figure 3K is an elevation view of the barge, the drilling apparatus 10

and the platform 20 in the same situation. The drilling apparatus 10 is placed on beams 15a (not visible) and 15b, in high position of the lift means 7a, 7b, 7c and 7d, and the emerged portion 21 of the platform is found between the protrusions 1a and 1b of the barge.

As illustrated in figure 3L, the drilling apparatus 10 is slowly lowered so as to make it rest on the upper deck 16 of the platform 20 via interface means 15a and 15b, either by ballasting or by downwardly actuating the lift towers 7a, 7b, 7c and 7d, or by a combination of the two. Buffers (not shown) are arranged between the interface means 15a and 15b and the upper deck 16 of the platform 20 so as to avoid damaging the platform 20 by overly brutal contact with the drilling apparatus 10, for example due to heaving movements of the barge. Once contact is established, the barge continues to deballast to release itself from the drilling apparatus.

In the last step of the method illustrated in figure 3N, the barge immobilizes itself near the platform 20 supporting the drilling apparatus 10, owing to ground tackles (not shown) and/or its dynamic anchoring means. The folding deck 8 is unfolded so as to cover the space 2 between the protrusions 1a and 1b of the barge; drilling equipment is advantageously deposited there.

Lastly, connection means 22 such as bridge, electrical conductors and piping are installed between the barge and the platform 20 so as to enable the drilling operations.

Figure 4 illustrates one of the interface beams 15b (15a, respectively) resting on the upper deck 16 of the platform 20, which includes two disassemblable portions 15c and 15d (15e and 15f, respectively), kept integral with the body of the beam

for example by splicing and which are disassembled once the drilling apparatus is placed on the platform, for example using the cranes 6a and 6b of the barge.

Figure 5 illustrates an example of barge used by the method. Its hull includes, at its rear, two protrusions 1a and 1b which define a space 2 in which the emerged portion 21 of a platform 20 can take position. The protrusions 1a and 1b support four lift towers 7a, 7b, 7c and 7d. The floating docks 30a and 30b and the vertical portions 31a and 31b include hollow volumes which are used as ballasts. The structure 32 receives technical sites and residential sites.

Figures 1A and 1B illustrate an example of barge including a retractable means 8, for example of the folding dock or articulated hatch cover type, making it possible to cover the space 2 when the drilling apparatus 10 has been deposited on the platform 20.

CLAIMS

1. A method for preparing for drilling operations including the single-operation installation, in a repositionable manner, of a fully equipped drilling apparatus (10) on a platform (20) anchored or placed on a sea or lacustrine bottom, whereof the emerged portion (21) includes at least one upper deck (16) designed to receive at least one wellhead and a drilling apparatus, said method using a semi-submersible supply barge (1) including a longitudinal axis (A-A') whereof the hull comprises two essentially parallel protrusions (1a, 1b) defining a space (2), said barge (1) including lift means (7a, 7b, 7c, 7d) supported by the protrusions (1a, 1b) as well as ballasting and deballasting means,

characterized in that it includes the following steps:

- 1) The loading of interface means (15a, 15b) on the lift means (7a, 7b, 7c, 7d) of said barge (1),
- 2) The loading of a drilling apparatus (10) on said interface means (15a, 15b),
- 3) The transit of the supply barge to the vicinity of the platform (20) with the drilling apparatus (10) integral with interface means (15a, 15b),
- 4) When the barge has arrived in the vicinity of said platform (20), the elevation of the interface means (15a, 15b) and of the drilling apparatus (10) by deballasting of said barge and by actuation of the lift means (7a, 7b, 7c, 7d), so as to place said interface means (15a, 15b) at a height above the water higher than that of the upper deck (16) of said platform (20),
- 5) The maneuvering of the supply barge so as to place the emerged portion (21) of said platform (20) between the two protrusions (1a, 1b) of the supply barge,

6) The lowering and placement on the upper deck (16) of said platform (20) of interface means (15a, 15b) and the drilling apparatus (10), by ballasting of the supply barge and by actuation of the lift means (7a, 7b, 7c, 7d).

2. The method according to claim 1, characterized in that it also includes the following steps:

7) The moving away of the barge from the platform (20) and its positioning in the vicinity of said platform, and

8) The arrangement of connecting means (22) between said barge and the drilling apparatus (10) in order to permit the transfer in particular of energy, persons, materials and liquids between the supply barge and the drilling apparatus so as to carry out the drilling operations.

3. The method according to claim 1, characterized in that it also includes the following step:

9) The covering of the space (2) between the two protrusions (1a, 1b) of the barge by extension of a retractable device (8) so as to have a vast deck surface for the drilling operations.

4. The method according to claim 1, characterized in that, in the sixth step, the transfer of the weight of the interface means (15a, 15b) and of the drilling apparatus (10) on the upper deck (16) of said platform (20) is partial, such that said weight is distributed on said platform (20) and on said barge (1) so as to limit the stresses undergone by said platform (20).

5. The method according to any one of the preceding claims, characterized in that said interface means assumes the form of a structure including at least two beams (15a, 15b),

and in that:

- During the first step, said beams (15a, 15b) are arranged on said lift means (7a, 7b, 7c, 7d) essentially orthogonally to the longitudinal axis (A-A') of the barge, a first beam (15a) the furthest forward and a second beam (15b) the furthest back according to said longitudinal axis,
- In the second step, the drilling apparatus (10) is arranged on said beams (15a, 15b),
- In the sixth step, the beams (15a, 15b) are placed on the upper deck (16) of said platform, the drilling apparatus (10) resting on said beams.

6. The method according to claim 5, characterized in that each beam (15a, 15b) includes a disconnectable portion (15c, 15d, 15e, 15f) at each end, integral with said beams during steps one to six of the method,

and in that the method includes an additional step:

- Disconnection of at least one of said disconnectable portions (15c, 15d, 15e, 15f).

7. The method according to any one of claims 1, 4, 5 or 6, characterized in that buffer means are arranged between the upper deck (16) of said platform (20) and the interface means (15a, 15b), so as to allow the placement of said drilling apparatus (10) without impact during the sixth step of the method.

8. A semi-submersible barge specially adapted to the implementation of the method according to any one of the preceding claims, characterized in that it includes two essentially parallel hollow floating docks (30a, 30b), including a pointed stem (33a, 33b), said floating docks each being topped with an essentially vertical hollow structure (31a, 31b) which extends

from the rear of said floating docks to the vicinity of the stem of said floating docks, said vertical structures (31a, 31b) being connected at their apexes by an essentially horizontal structure (32), which extends over the forward part of said vertical structures (31a, 31b) so as to form two protrusions (1a, 1b) defining a space (2) at the rear of said barge, said protrusions supporting lift means (7a, 7b, 7c, 7d).

9. The barge according to claim 8, characterized in that it also includes a retractable means (8) which covers the space (2) between said protrusions (1a, 1b) when it is extended.