Carga a barcaza de 71 fundaciones de hormigón (GBS) del parque eólico marino Fecamp. Puerto de Le Havre, Francia

Load-Outs of 71 Gravity Bases Structures (GBS) of Fecamp Wind Offshore Farm. Port of Le Havre - France

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RESUMEN

Sarens fue contratado para izar, transportar y cargar sobre barcazas 71 fundaciones de hormigón (GBS) de 5.000 T cada una del parque eólico marino Fecamp. Para izar cada GBS, Sarens diseñó un sistema a medida pórtico compuesto de dos partes que se podían mover por separado sobre equipos de transporte modulares autopropulsados (SPMT). Tras izar el GBS, se colocaba sobre 180 SPMT para su transporte a la barcaza. Sarens también instaló un sistema de lastrado en cada una de las tres barcazas que se usaron durante las operaciones. Para evitar retrasos, Sarens realizó un proceso de carga de 24 horas para las barcazas. Se cargaron tres GBS en cada barcaza, en una operación continua de un máximo de 38 horas.

ABSTRACT

Sarens was commissioned for lifting, transport and load-outs of 71 x 5.000 T/each GBS of the Fecamp Wind Offshore Farm. To lift each GBS, a Gantry system was specifically created for this work, consisting of two different units which are moved around site on SPMT (Self Propelled Modular Trailers). After lifting the GBS, it is positioned on 180 SPMT for transport on Barges. Sarens has also installed on each of the three barges a ballasting system to be used during loading operations. To avoid any delays, Sarens did a 24-hour loading process for the barges. Three GBS were loaded on each barge, in a continuous operation of maximum 38 hours.

PALABRAS CLAVE: Construcción de estructuras, gatos de cable, izados, pórticos, descargas, lastrados.
KEYWORDS: Construction of structures, Strand Jacks, Lifting, Gantry, SPMT, Load-Outs, Ballasting.

1. Introduction

Sarens was commissioned by the consortium Bouygues Travaux Publics, Saipem and Boskalis for the lifting, transport and load-out operations from their manufacturing site in Le Havre on

cargo barges of the 71 x 5.000 T/each GBS. These GBS will become the sea foundations for wind turbine generators of the Fecamp Wind Offshore Farm.

Each GBS has an external diameter of 31m at the base and a height ranging between 48 and 54 meters.

Depending on the height of the GBS, they will be installed on the final sea bed in waters between 25 and 30 m depth

The Fecamp offshore windfarm, located approximately between 13 and 22 km off the Normandy coast, will generate enough energy to provide sustainable electricity for more than 770,000 inhabitants.

2. Client's mandatory requirements

One of the main reasons why Sarens scored this huge project was to develop a Technical Solution and an installation Method of Statement fulfilling all our client's mandatory needs. These can be summarized as follows:

- The GBS had to be fabricated at ground level and not 1,5/2 m above (as usually happens when they need to be transported by SPMTs). This meant that for the transports of the GBS a lifting system had to be implemented in order to get room below them for the installation of the SPMTs (see figures 3, 5, 8, 9 y 10).
- All the equipments to handle the GBS from its fabrication position till the cargo barges deck, can't overload the maximum site ground and quay pressures (GBP: Ground Bearing Pressures). This meant that for the lifting and transport of the GBS, the lifting gantry and the amount of SPMTs had to spread the 5.000t self-weight of the GBS to reach values below the maximum GBP. But with these amounts of SPMTs still was not enough to drive them on the quay. So for at this spot Sarens had to supply a spanning steel platform of 11,8m length and a width of 38m (almost all along the barge beam) to avoid the part of the quay that was not strong enough for the driving of the SPMTs on it (see figures 1, 12 and 13).

Figure 1: Spanning steel platform 11,8m length.

- There GBS had to be loaded out in each cargo barge in a maximum time window of 38 hours to ensure that the marine spread used for the installation offshore of the GBSs (offshore Heavy Lifting Vessel Sleipnir with 2x10.000t cranes on board) does not suffer any downtime. This meant that besides all the normal considerations for this type of manoeuvrers and as the internal ballasting system of the cargo barges was not quick enough, Sarens had to implement a 24-hour loading process for the barges including a huge external ballasting system that secured a high speed to achieve those 38 hours. At each side of the cargo barges, Sarens had to implement 6

huge pumps of 900 m^3/hour single capacity (see figures 2,12 and 13).

Figure 2: Detail of 3 of the 12 900 m^3/hour pumps

3. Summary of works performed by Sarens

To lift each of the GBS, a gantry system was specifically designed for this task, consisting of two independent parts which are moved around site on SPMT that can be installed in between the steel base frames of the gantry columns (see figure 10).

Each part of the gantry has on top of it 4x850t Strand Jacks to lift the GBS. After being positioned the two parts around each GBS, the load is secured by four lugs (one per each Strand Jack, see figures 8 and 9), and the two parts of the gantry system are interconnected by data cables so that they can operate as one single gantry. Once the gantry was assembled and previous to the starting of these operations, it was certified by an external party with a 100% load test at the site.

After lifting the GBS, it is positioned on 180 SPMT for transport to the cargo barges waiting for them at the quay side. The 180 lines are divided in 8 SPMTs trains to cover as much as possible the full shadow of the GBS (except the parts reserved for the barge grillage supports).

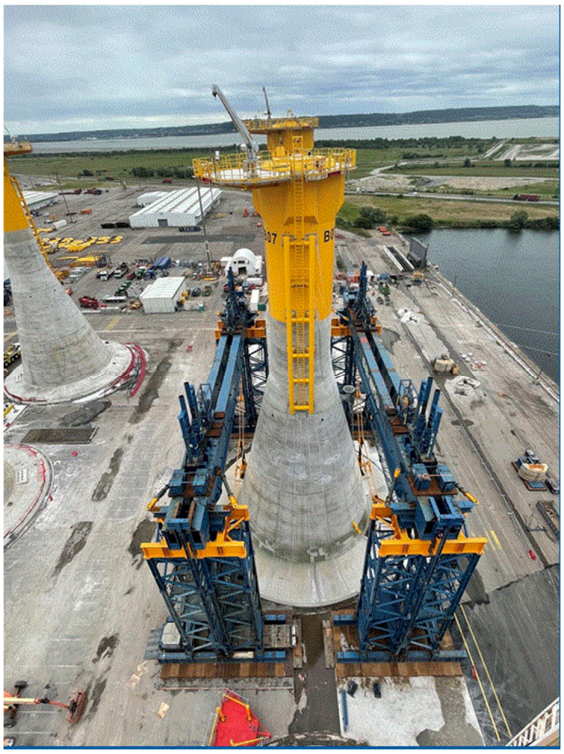

Figure 3: Top view of the 2 parts of the lifting gantry

Each SPMT line has a double hydraulic suspension, with 2 wheels per suspension and gross capacity of 48 tons (42,5 tons net ones). Each train of SPMTs is composed of several individual modules of 4, 5 or 6 lines couple in a row and/or side by side to adjust the final amount of lines required for each train. On the next figure 4 it is showed the general dimensions of a standard 4 SPMT line module.

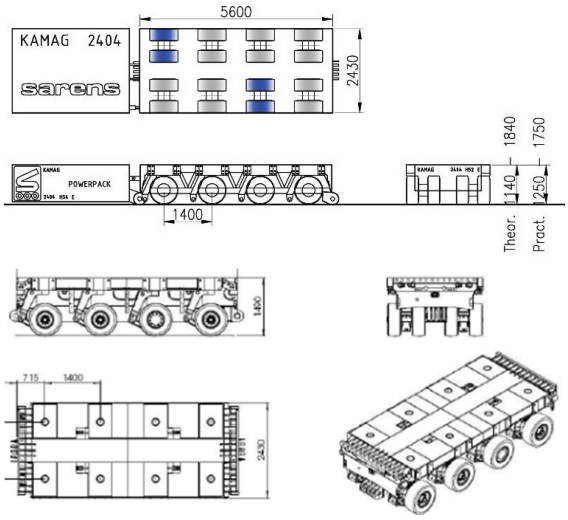

Figure 4: General dimensions of a 4 axel line SPMT.

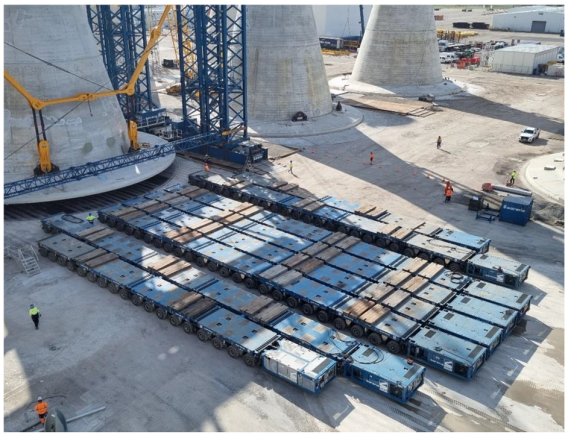

Figure 5: Top view of the 8 SPMT trains (180 lines).

To ensure the success of the operation, Sarens has installed on each of the three cargo barges an external ballasting system capable of measuring the amount of water in the ballast tank, and a series of interconnected pumps for de-ballasting to be used during loading operations. Each barge had its own ballasting system installed, and this external ballasting system was interchangeable among the three barges.

The external ballasting system ensures that as soon as the first lines of SPMT are entering on the spanning steel platform and therefore starting to introduce part of the load of the GBs on the cargo barge, it is required to pump out water from these ballast tanks closer to the quay in order keep levelled all the time the deck of the cargo barge. This operation is a live one, because as soon as more SPMTs are driven in on the deck, more ballast tanks are involved and need to be adjusted. And once all the SPMTs are on the deck, as still they need to keep driving until each final GBs grillage position, part of the ballast tanks that were emptied while the SPMTs were on them, now they have to be filled again pumping water inside.

And beside all this, the water tide at the spot had to be taken in consideration during all the 38 hours window to perform on time the 3 load outs. This means, having to absorb the water different levels (so different cargo barge deck levels over the water) between the maximum and minimum tides every each 12 hours of a complete tide cycle.

This process was repeated 24 times, which will require the participation of a large number of highly specialized personnel, not only for the loading manoeuvre itself, but also for all the operations related to the handling of the winches of the barges, the preparation of the gantry system in each operation or the reconfiguration of the SPMTs prior to the arrival and loading of each barge.

4. Conclusions

It took more than 120 trucks and nearly three months of transport to the port of Le Havre for the Sarens technical team to have all the equipment necessary to carry out the entire operation.

Thanks to an improving learning curve, for the last 24 operations Sarens managed to reduced the 38 hours for loading 3 GBS on a barge to a minimum of just a bit more of 24 hours during the last load outs.

Sarens owns extensive international experience in the assembly and maintenance of wind farms. It has been and it is participating in installations in France such as Saint Nazaire, Provence Grand Large or more recently, in the lifting and transport work for the foundation bases of the new offshore wind farm in Saint Brieuc (off the Brittany coast).

Figure 6: General view from the water of the 71 x 5.000 tons GBS at port of Le Havre.

Figure 7: General view from the bow of the cargo barge before starting the load out of the GBS.

Figure 8: Top view of the lifting gantry ready to lift a GBS.

Figure 9: GBS already lifted and held on the gantry while the SPMTs drive below it.

Figure 10: GBS transferred from the gantry to the SPMTs. Outside part of the gantry removed to star the transport

Figure 11: GBS driving from its fabrication place to the quay.

Figure 12: Top view of the last GBS to be loaded out in the cargo barge. External ballasting system in operation.

Figure 13: Last GBS loaded out in the cargo Barge, ready to be transferred to the deck grillage.