

Case study | VACON® NXP Liquid Cooled

VACON® drives power jacket lift systems for complex offshore projects

The lifting capacity of this giant vessel is enhanced by winches powered by Danfoss Drives DC bus technologies. This design facilitates faster dismantling of offshore oil platforms and their submerged structures, with a lower environmental impact than conventional techniques.



Photo courtesy: Frans Berkelaar

All over the planet, drilling platforms installed to exploit oil and gas fields have ended, or are about to end, their operational life.

A typical case is the North Sea area, where most of the fixed offshore platforms built during the '70s and '80s are no longer active. To safeguard the marine environment, most of them will have to be removed and dismantled, requiring complex engineering operations.

Speed up removal to reduce dismantling costs

The traditional method for dismantling an offshore structure is to sequentially dismantle its modules, setting up a marine site. It is a long, risky process and particularly expensive because of the need to operate in a difficult and unpredictable environment.

An innovative jacket lifting system significantly speeds up the removal operations to be carried out at sea. This concept transfers most of the dismantling operations to a shipyard on the ground, delivering significant benefits in terms of time, costs and environmental compatibility.

Powerful performance in extreme conditions

With one of the best power/size ratios available in the market, VACON® NXP Liquid Cooled drives are ideal for applications where space is at a premium or air cooling is difficult. Heavy industries with harsh operating conditions, such as in marine, offshore and mining environments benefit from the drive's compact design and robust reliability.

These liquid-cooled AC drives are available in many variants, from a single dedicated drive to large-scale common DC bus systems. Thanks to the enclosure protection rating up to IP54, these drives can be installed almost anywhere on a vessel. This eliminates the load on air-conditioning systems in electrical rooms reducing costs and installation time; and makes them ideal for retrofitting.



Flexibility is the key

Another critical requirement of this project was the compactness of all electrical equipment, which had to comply with precise dimensional constraints, due to the particular physical characteristics of the vessel. Specifically, all the 80 electrical panels that house the drives, power supplies and cooling circuits supplied by Danfoss had to fall within the maximum width of 2.2 m, corresponding to the span of the load-bearing structures of the vessel. It was also necessary to ensure transport sections not exceeding 1.5 m so they could pass through the hatches already existing in the hull.

Mauro Cedro concludes: "A unique and complex project like this required maximum flexibility and competence; key elements that led the customer to choose Danfoss as reliable partner. All the inevitable difficulties and critical issues were dealt within a spirit of great collaboration, even on a personal level, demonstrating adaptability to fully satisfy all the needs of the end customer".

VACON® NXP Liquid Cooled drives.

The largest installation and construction vessel in the world

The largest installation and construction vessel in the world has a length of 382 m and a width of 124 m. The bow is an operational bay of 122 m long and 59 m wide that literally can 'embrace' an entire offshore oil platform. Thanks to the particular cutting and lifting equipment mounted on the ship, it can remove the platform structure by loading it on board in a single operation. A vessel like this can cut, lift and transport the entire emerged structure of a platform (the so-called topside) **weighing up to 48,000 tons.**

Innovative jacket lift system

To dismantle an offshore platform it is necessary to remove not only its emerged part (topside), but also the submerged metal structure to which it is supported the so-called 'jacket'. This ingenious lifting system is composed of two huge 170 m long tiltable beams combined with an enormous system of winches and transmissions capable of loading the entire structure, lifting it quickly from the seabed. The innovative structure, installed in the stern area of the vessel, facilitates removal or installation of submerged structures weighing up to 20,000 tons, in a single operation.

The solution consists of a set of lifting hoists (main hoist system) designed to lift the load and a system

of winches that allows the tilting of the large support beams (derrick hoist system). The main hoist system comprises 12 double capstan winches with a nominal pull of 180 tons which enable a useful hook pull of about 48,000 tons. The winch derrick system comprises 8 single drum winches with a pull of 180 tons that guarantee an efficient tension of about 20,000 tons.

One of the main engineering difficulties is the guarantee of absolute system reliability, in any operational and environmental condition. In fact, the operation of lifting these huge structures is so critical that it can't be stopped once started, under penalty of instability of the ship. Therefore, the complex lifting system is designed in a totally redundant way, to avoid any component failure endangering the success of the lifting operation. From sensors to control systems, from motors to power supplies, **each subsystem has been designed and built to guarantee total operational reliability.**

Robust drives and power supplies

Each of the lifting machines that make up the main host is equipped with 8 motors 300 kW each with 75% redundancy. This means that the system is capable of operating at its nominal capacity even with 2 failed motors. *"In doing so," explains Mauro Cedro, Project Manager Danfoss Drives Italia, "We can always guarantee the full pulling force even if we lose the functionality of an entire transmission."*

The entire jacket lifting system uses 200 motors driven by 200 highly-efficient drives, and 80 Active Front End (AFE) regenerative power supplies. The system also includes engines for auxiliary systems, such as winders, lubrication systems, cooling circuit and other service functions.

Mr. Cedro continues: *"VACON® NXP Liquid Cooled drives with highly efficient regenerative technology are installed. The total installed electric power of the lifting system is over 40 MW and its optimal management is an equally critical factor of the project. During the complex operation of lifting the jacket, the system works with a dynamically variable pull and brake combination, so that the regenerative drives absorb and deliver power to the corresponding sections of the system, without wasting energy and pouring excess power on the on-board electrical network. In addition, all electrical equipment supplied by Danfoss had to exceed the required strength and resilience requirements of such a demanding operating environment, such as a construction vessel."*

All equipment has been designed and built in accordance with the stringent regulations of the certifying body in charge Lloyd's Register marine classification society.





Delivering maintenance value for the largest construction vessel in the world

To complement the drives which control the winch hoist motors, Danfoss was asked to provide a package that included system design, commissioning, spare parts, and 36 months of on-site extended warranty.

DrivePro® services are a convenient and cost-effective way of delivering ongoing support for the customer. This is a really important factor in major projects like this winch system, where the cost of downtime can very quickly run into tens or even hundreds of thousands of Euros. With DrivePro® services integrated into the agreement, customers can buy Danfoss drives with confidence, knowing that they're not buying just a chunk of hardware but a comprehensive and completely dependable solution for their needs.

The support package provided for the drives on these winches is made up of services from the DrivePro® portfolio. These include DrivePro® Preventative Maintenance, DrivePro® Remote Expert Support, DrivePro® Spare Parts, and DrivePro® Extended Warranty.

- DrivePro® Preventative Maintenance ensures that the drives on the vessel are maintained in peak condition. Any operational anomalies are spotted early before they can progress to faults
- DrivePro® Remote Expert Support gives the vessel maintenance crew instant access to Danfoss engineers should they have a problem
- DrivePro® Spare Parts ensures that any replacement parts that may be needed are always readily to hand
- DrivePro® Extended Warranty provides long-term peace of mind