OFFSHORE WIND CRANES
ABOUT HUISMAN

Huisman is a worldwide operating company with extensive experience in the design and manufacturing of heavy construction equipment for world’s leading companies in the oil & gas, renewables and leisure markets. Our product range can be divided into six main categories: Cranes, Pipelay Equipment, Drilling Equipment, Winches, Vessel Designs and Specials. Our projects vary from stand-alone to highly engineered and integrated systems, from concept to installation and life time support.

GLOBAL OPERATIONS
A global market requires global and local solutions. Therefore, Huisman has expanded its engineering and production capacity from Schiedam, The Netherlands, to Svádkov, Czech Republic, in 1997 and in 2007 to Fujian, China. The newest production facility in Santa Catarina, Brazil, is operational since 2015. Generating over 115,000m² of total production surface. All facilities play an important role in the Huisman production force ever since. For additional local sales, engineering and service support Huisman holds offices in Houston (USA), Perth (Australia), Bergen (Norway) and Singapore.

QUALITY
The equipment delivered by Huisman is often the critical main equipment on board and its reliability is of utmost importance to our clients. Delivering high quality products has therefore been a key company value since our establishment. As a result, our equipment is internationally known for its high quality and reliability during operations. It meets the most stringent performance criteria and is certified by recognised authorities such as Lloyd’s, DNV, ABS, TÜV, API, etc.

SERVICE
A dedicated worldwide operating service team of skilled professionals is on stand-by to provide advice, training and service support before, during and after installation and delivery. Our service network is managed from Huisman in The Netherlands and our local service offices in Navegantes (Brazil), Houston (USA), Perth (Australia) and Singapore are on stand-by to provide service support on location as well as by remote access.

TRAINING
Huisman founded the Huisman Academy in 2011. This Schiedam-based training facility is used to support Huisman clients in operating and maintaining their equipment in the most effective and safe way.

SAFETY, HEALTH AND ENVIRONMENT
We have high values on being a responsible company. Therefore, the safety, environmental and health impact of our operations is a priority within all stages of our projects.

RELIABLE PARTNER
Due to our strong belief in long lasting partnerships with our clients, our commitment to finding new technical solutions and our dedication to delivering turnkey projects, we are internationally valued as a solid, reliable partner. Our extensive track record and the large number of long-lasting client relationships prove that we deliver state-of-the-art equipment, fully tested, within schedule and ready for commercial operation.

TURNKEY DELIVERY
Our in-house design and engineering expertise in combination with our production, testing, commissioning and installation facilities, enable us to deliver custom-designed equipment on a turnkey basis.

INNOVATIVE SOLUTIONS
We are constantly working on new solutions and systems, which we believe add value to the market’s existing technologies. These innovations have been implemented into many of our products. As we have extensive operational experience with a wide variety of heavy construction equipment, we are able to use the best solutions for new products and projects. Our internal disciplines include Mechanical, Structural, Naval, Hydraulical, Electrical and Software Engineering.
LEG ENCIRCLING CRANES

WORLD’S LARGEST

TRENDS
Huisman developed an innovative Leg Encircling Crane range for the installation of increasingly larger offshore wind turbines and turbine foundations.

As offshore wind is still fighting a battle to reduce costs and become a competitive source of energy, wind turbines keep on increasing in size to reap the benefits of economies of scale and increase efficiency.

From a contractor’s perspective, this trend requires larger cranes in both lifting capacity and available hook height. As weight efficiency is highly important for jack-up vessels, a lightweight crane is paramount to achieve the most efficient installation vessel design possible. For high-capacity cranes, it is beneficial to build the crane around one of the jack-up legs. A so-called Leg Encircling Crane has a relatively low own weight, it optimally transfers forces into the vessel structure and optimizes the available deck space. Also, Huisman’s Leg Encircling Crane features a very small tailswing, further optimising free deck space.

LIGHTWEIGHT DESIGN
To achieve an own weight that is approximately equal or less than its lifting capacity, Huisman utilized a design philosophy that has proven its value in the offshore oil and gas industry. By using high grade steel, a low construction weight is achieved. Allowing an increased remaining payload on the jack-up vessel compared to conventional leg encircling cranes.

In addition, Huisman is one of few companies worldwide to have the experience to successfully construct large diameter slew bearings. By applying Huisman’s segmented slew bearing, the overturning moment is transferred into the vessel structure in a highly homogeneous way. This allows further reduction of the steel structure as peak forces are omitted.

OPTIMISED FREE DECK SPACE
Jack-up vessels use their deck to transport wind turbine components. Increasing the available deck space increases the number of components that can be transported at once, reducing installation costs by reducing the number of harbour calls that the vessel must make.

The Huisman Leg Encircling Crane optimises the free deck space by integrating the crane with the jack-up leg structure. Furthermore, the design focuses on reducing the tail swing of the crane as much as possible. For example, the 1,500mt Leg Encircling Crane has a required leg opening of 11m and a tail swing of only 14.5m at operator cabin level.

In order to allow storage of the boom over the forward leg, the Leg Encircling Crane can be outfitted with Huisman’s parallel boom to further optimise the available deck space. Huisman recently was awarded the contract for van Oord’s Aeolus.

ELECTRIC DRIVE SYSTEM
For large capacity heavy lift cranes, Huisman maintains a philosophy of applying a fully electric drive system. The lessons learned in the offshore oil and gas industry also apply in the heavy lift wind turbine installation industry. Electric drive systems are very maintenance friendly as they are easier to maintain, and maintenance costs are significantly lower. Also, electric drive systems are much more energy efficient than hydraulic systems. This reduces the required vessel grid size and limits power usage during operation. In addition, as a significant portion of the drive system is installed outside, the omission of a hydraulic system removes the risk on oil spills.

It is evident that cranes used for installing a source of renewable energy must limit their ecological footprint as much as possible.

LEG ENCIRCLING CRANE RANGE

<table>
<thead>
<tr>
<th>Type</th>
<th>Max SWL</th>
<th>Boom length</th>
<th>Leg opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEC 35,000</td>
<td>800mt @ 25m</td>
<td>85m</td>
<td>8.5m</td>
</tr>
<tr>
<td>LEC 65,500</td>
<td>1,500mt @ 33m</td>
<td>110m</td>
<td>11.0m</td>
</tr>
<tr>
<td>LEC 80,000</td>
<td>2,000mt @ 32m</td>
<td>110m</td>
<td>11.0m</td>
</tr>
<tr>
<td>LEC 100,000</td>
<td>2,500mt @ 32m</td>
<td>110m</td>
<td>11.0m</td>
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PEDESTAL MOUNTED CRANES

FOR WIND TURBINE INSTALLATION

With a track record of over 100 deliveries, Huisman is a renowned supplier of high end Pedestal Mounted Cranes. Huisman’s philosophy focuses on weight reduction, tail swing reduction and the reduction of operational expenses.

LIGHTWEIGHT DESIGN
Huisman’s Pedestal Mounted Cranes are designed to be as lightweight as possible to maximise the payload of a jack-up vessel. Generally speaking, Huisman’s Pedestal Mounted Cranes weigh less than their lifting capacity due to the use of high grade steel and an intelligent design.

OPTIMISED FREE DECK SPACE
For cranes up to 800mt, a jack-up vessel’s leg aperture is relatively large compared to the slew bearing diameter required for that lifting capacity. Therefore, for lifting capacities up to 800mt it is efficient to install a Pedestal Mounted Crane instead of a Leg Encircling Crane.

For Pedestal Mounted Cranes, the remaining free deck space is equally important. Therefore, Huisman’s Pedestal Mounted Cranes are designed such that winches are installed in the enclosed crane house, therefore allowing for a very small tail swing. This allows the crane to be installed in close proximity of the jack-up leg to fully utilise the remaining deck space.

An additional advantage of installing the drive system inside the enclosed crane house is that the crane house protects the system including the winch and wire rope from the harsh marine environment.

AND MAINTENANCE

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<td>300mt @ 16m</td>
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<td>400mt @ 17m</td>
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SPECIAL PROJECTS

FOR THE WIND TURBINE INSTALLATION

Besides our standard product portfolio, Huisman envisages to develop and build mission equipment for our clients’ special needs.

FOLDABLE OFFSHORE CRANE

Huisman’s Foldable Offshore Crane is designed specifically for Operations and Maintenance (O&M) works on offshore wind turbines. It allows operators to work at 145m above deck, which is sufficient to service 10MW wind turbines. The major advantage of this crane is that due to its foldable boom, the crane can easily be integrated in small - and cost efficient – jack-up vessels. Therefore reducing costs for offshore maintenance. In addition, the geometry of the boom allows for a very low construction weight.

The Foldable Offshore Crane is available in various sizes and can be adapted and finetuned to your specific requirements. For example, the crane can be built as Leg Encircling Crane as well as a pedestal mounted variant.

WIND TURBINE SHUTTLE

To improve efficiency of offshore wind turbine installation and to allow for increasing economies of scale, Huisman developed the Wind Turbine Shuttle: a dynamically positioned, fast sailing wind turbine installation vessel. The vessel can carry and install two fully assembled wind turbines. By combining low vessel motions, compensating systems and an accurate dynamic positioning system, the wind turbine is kept stationary in relation to the fixed foundation during installation.

KEY FEATURES WIND TURBINE SHUTTLE:
- At least 80% workability in annual North Sea conditions
- High transit speed and DP3
- Can transport two fully commissioned wind turbines
- Capable of installing and decommissioning a variety of offshore structures
- LNG fuel ready

KEY FEATURES FOLDABLE OFFSHORE CRANE
- Very small footprint
- Extremely high lifting height
- Low own-weight compared to lifting height
- Simple structure, no heavy telescopic booms
- Leg Encircling or Pedestal Mounted
- Fully electric with frequency controlled drives

INDUSTRY

JUMBO SUPER FLY-JIB

Jumbo, a heavy lift shipping contractor, strategized to expand its business by making its heavy lift cargo vessels suitable for a larger variety of offshore work. Huisman designed and delivered (amongst other upgrades) a super fly-jib for the 900mt cranes on board the ‘Jumbo Javelin’.

This super fly-jib gives the Huisman-built cranes an extended lifting height to allow for transition piece installation offshore.
DRIVING DOWN THE COST OF OFFSHORE FOUNDATIONS
An innovation worth special attention, is Fistuca’s BLUE Piling hammer. In 2015, Huisman joined forces by acquiring a stake in this young company to allow further development of this pile hammer.

Whereas conventional hydraulic hammers use a steel ram to hammer a pile, BLUE Piling Technology uses the combustion of a gas mixture under a water column to create a pressure increase. The pressure accelerates the water upwards and causes a downward force pushing the pile into the soil. The water column then falls back again, delivering a second blow. The exhaust gases are released and the cycle is repeated. This revolutionary concept allows for great advantages:

LOW NOISE LEVELS
Independent party’s noise measurements on our test setup show very low underwater noise levels. Scaling these values to regular offshore conditions and hammer sizes indicates that BLUE Piling Technology will be able to comply with the very strict German offshore noise regulation without requiring noise mitigation. This will pose huge cost savings in the foundation installation process.

LOWER FATIGUE LEVELS
The long duration of the blow results in more pile set per blow. Combined with very low tensile forces this results in a significant decrease of the pile fatigue during installation.

IMPROVED APPLICABILITY
BLUE piling Technology can be used just like a conventional pile driver, on jacket (pin) piles as well as (XL) monopiles.

INCREASED SCALABILITY
BLUE Piling Technology can be scaled far beyond conventional piling hammers, extending the maximum size of monopiles and allow for larger wind turbines and deeper waters.

CONCRETE PILE DRIVING
The very long blow duration (>100 ms) results in very low tensile stresses in the material. This will allow the offshore driving of large reinforced concrete piles, which could result in enormous savings for offshore foundations.