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Sliedrecht

Shipyards - the Netherlands
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Hendrik-Ido-Ambacht
Heusden
Kinderdijk
Krimpen aan den IJssel
Sliedrecht

Shipyards - P.R. of China
Dalian

Sites - the Netherlands
Apeldoorn
Delfgauw
Dordrecht
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Goes
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Sliedrecht
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Wayne, NJ

Representative offices
Beijing - P.R. of China
Mumbai - India
New Delhi - India
St. Petersburg - Russia

Regional IHC Organizations worldwide
Dubai - United Arab Emirates
Tianjin/Tanggu & Guangzhou - P.R. of China
Hendrik-Ido-Ambacht - The Netherlands
Lagos - Nigeria
Singapore - Republic of Singapore

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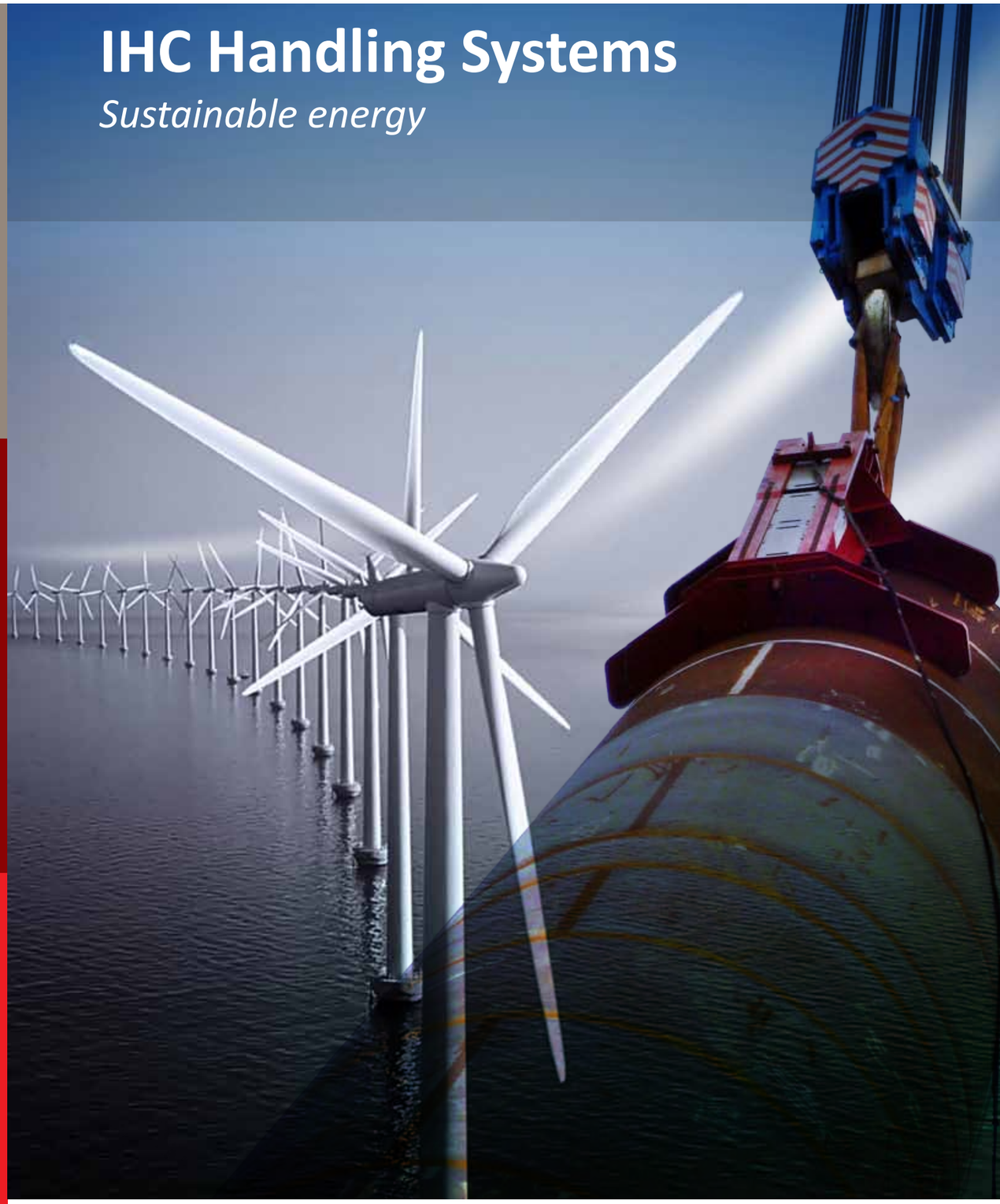
The technology innovator.

IHC Handling Systems

Sustainable energy



The technology innovator.

Your world, our challenge

Introduction

The renewable industry and especially the offshore wind industry are booming markets. For example, the EU has agreed that by 2020, at least 20% of the generated energy must be green and that the emission of hazardous substances must have been reduced by 20% in comparison to 1990. A large proportion of these ambitious agreements can be achieved by installing wind turbines at sea.
The offshore wind business is clearly a growth market. Especially offshore, sizeable wind farms will be created during the coming decades and not just in Europe; the USA and China will follow suit.

The most important development with regard to current and future wind turbines is that the capacity per turbine will increase. This means that they are constantly becoming larger and heavier and are being installed further away from the coast in deeper water. This development also has an impact on their foundations. The commonly used monopiles must also develop and alternative foundation technologies are already being applied on a small scale.

No limits, no boundaries



IHC Handling Systems

IHC Handling Systems has been ahead of these developments for many years now. How? Innovation and thinking in terms of the market are deeply entrenched in our company's DNA. We enjoy limitless conceptualisation. No limits, no boundaries. This means that issues such as 'large', 'heavy' and 'deep' are relative terms to us. The crux is identifying opportunities and translating these into practical applications. As a global expert in the field of tools for installing foundations and structures, we know our market. And it - in turn - is fully aware of what we have to offer as a technology innovator, as a reliable partner and as a producer of efficient fail-safe tools to ensure the best possible safety.

IHC Handling Systems is a part of IHC Merwede. This global group has three specialised divisions: *Dredging & Mining*, *Technology & Services* and *Offshore & Marine*. All of which are not only excellent technology innovators in their own field, but also collaborate excellently. This ranges from the development and construction of advanced vessels for the dredging and offshore industries - including the related equipment and innovative tools - to the delivery of long-term service in the shape of research, maintenance and training. IHC Handling Systems is part of the Technology & Services division and of the new business unit, IHC Offshore Wind, which brings together the expertise of the various IHC Merwede units.

Monopiles

Hoisting capacity increase
Currently, monopiles are the most employed form of foundations for offshore wind turbine generators (WTG). More than 70% of current wind turbines are supported by a monopile. Wind turbines are constantly getting bigger and heavier and being installed on bigger (in diameter and length) piles. IHC Handling Systems meets the challenge of pushing back the frontiers of this growth process head on often in partnership with IHC Hydrohammer. After all, a heavier pile not only demands a tool with a greater capacity for upending and hoisting that pile, but also a larger pile hammer. For the record: IHC's first upending tool from 2001 had a hoisting capacity of 250 tons. In 2010, the capacity has been increased to 700 tons. Concepts for 1,000 tons and higher are currently nearing the end of development!

Fast, efficient and cost-cutting
IHC Handling Systems' innovative upending tool means it is unnecessary to weld trunnions onto the monopiles or to machine holes in them. It works immediately without requiring any additional tools and/or any repair work. In short: efficient, time and cost cutting and safe!

Monopile sealing plugs

Monopile plugs were designed to seal monopiles. As soon as the sealing plugs have been installed onshore, the monopile can be lowered into the water. A tug can immediately take the monopile to the required site. No pontoon or transport ship is required.

The upending tool can, subsequently, be attached to the floating monopile allowing it to be hoisted directly from the water.

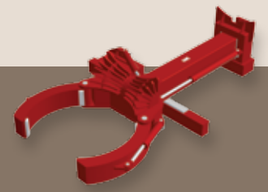
Stacking frame

This is a set of two frames on a ship's deck which hold three monopiles. The upending tool can upend the monopile from a single position in the frame. All the monopiles in the stacking frame can be manoeuvred hydraulically to this position.

This offers significant benefits. It, for example, allows multiple monopiles to be carried on a relatively small deck space and no crane is required to position them. Moreover, the frames make additional sea-fastening during transport unnecessary.

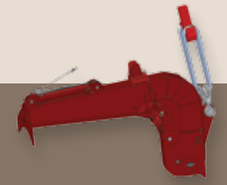
Upending saddle and hook

These saddles and hooks hold the bottom of a monopile in place and work as a crossover point.
This equipment can be combined with the stacking frame.



Pile guiding and positioning frame

The pile guiding and positioning frame is located on the deck of the installation vessel. It consists of two arms that can be hydraulically opened and closed.
The frame keeps the monopile in position vertically once its bottom has been positioned on the seabed and the upending tool has been removed.
The verticality of the monopile can be optimised using the positioning cylinders.



Upending tool

IHC's first upending tool from 2001 had a hoisting capacity of 250 tons. In 2010, the capacity has been increased to 700 tons. Concepts for 1,000 tons and higher are currently nearing the end of development!

Jackets & tripods

Internal lifting tools

Internal lifting tools are hydraulically activated and fail-safe lifting tools which clamp from the inside of a pile. The diameter range is from 16” up to 106” and ILT’s are globally used among the majority of offshore contractors.

Hydraulic levelling tools

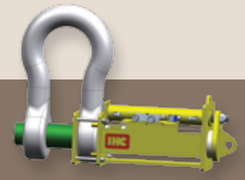
Hydraulic levelling tools are designed for levelling a jacket or tripod after installation on the seabed. Can be used above water as well as subsea. The accurate levelling function is hydraulically operated from the surface.

Jackets & tripods

Frameworks, both jackets and tripods, have not been used much as foundations so far. The reason being that current projects are relatively close to the coast in shallow water. Monopiles offer economic and practical advantages at such locations. When these locations are full, installation will take place in deep water locations. The general expectation is that more jackets or tripods will be used. The increased capacity of wind turbines may also be a reason to prefer jackets.

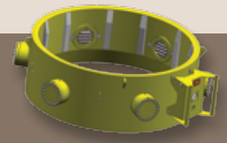
IHC Handling Systems wants to participate in this future development with the experience it has gained in the oil and gas industry. Jackets are usually used in this context. A difference with the offshore wind projects is that dozens of jackets will be required there while only one jacket is required for each project in the oil and gas industry.

This demands a more serial installation and, therefore, a process that runs smoothly. IHC Handling Systems contributes to this by developing new smart tools. Depending on the method and required procedure, onshore installation of the handling equipment can be applied to save on precious offshore time or a more traditional method can be selected by installing the handling equipment offshore.



Hydraulic release shackles

Standard type of shackles equipped with a cylinder to engage or release the pin hydraulically from the surface. No divers are required which results in a safe working procedure. Several options can be added to the systems which are available with capacities from 17t up to 2000t.



Temporary jacket pile grippers

Hold a jacket or a tripod rigidly in vertical direction with respect to the driven pile. This allows for jacket stability during grouting, retaining the elevated position after levelling and securing the stucture during storms.

Gravity Based Structured Foundation

More quickly and safely

Gravity-based Foundations (GBFs) have not been used much as wind turbine foundations yet. Most foundations are still anchored to the seabed, which is not the case with regard to these concrete GBF structures.

Although this method does not require the lifting or hoisting of steel piles, IHC Handling Systems has already been involved in the installation of a few Gravity-based Foundations by supplying hydraulic plate shackles. These connect the crane to the Gravity-based Foundations and as soon as this is in position, the hydraulically operated shackles are released under water.

Releasing takes place from the installation vessel deck and without the intervention of a diver.

This and other generally applicable handling and lifting tools such as pin release mechanisms are used to ensure that GBFs are dropped to the sea floor more quickly and safely.

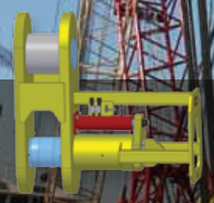


Plate shackles

Hydraulic release shackles

Trendsetter, no follower

New ideas

IHC Handling Systems is always developing innovative tools for the constantly shifting market. We are often the trendsetter instead of a follower. The concepts may relate to improving existing products or to completely new ideas. We are currently developing the following concepts:

1 **Levelling tools for post-piling foundations;**

2 **Levelling tools for pre-piling foundations;**

3 **Temporary and re-usable pile grippers;**

4 **Combination of levelling tool and pile gripper;**

5 **Monopile guide and positioning frame;**

6 **Transition Piece hydraulic lifting beam;**

7 **Jigger winch on upending tool;**

8 **Connection of floating monopiles;**

9 **Piling and levelling template.**

‘Lots of reasons why, only two reasons how!’

Job done

Together we achieve...

Looking back at IHC Handling Systems' history we see an involvement in more than 20 renewable offshore projects to date. Over the years, these projects have varied from simple lifts to innovative and challenging new installation methods from which IHC Handling Systems gained a huge amount of experience and knowledge. Using this knowledge for new installation 'problems' and/or new customers in existing or even new geographic markets helps the industry in general and will contribute to IHC Handling Systems' mission statement:

'Leading supplier of high-quality handling systems and services and problem solver for handling issues'