

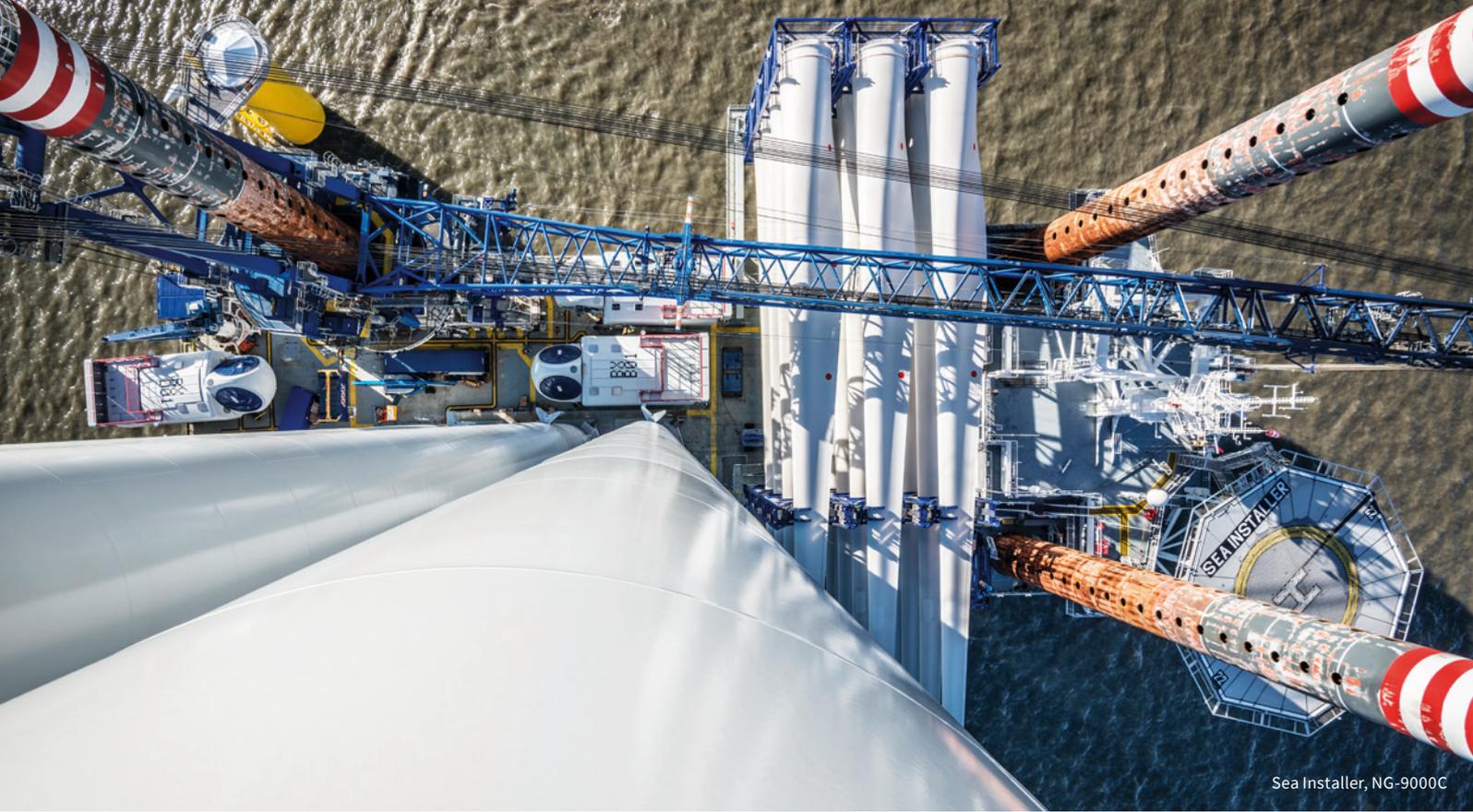
**Offshore Wind Installation
and Maintenance**

Optimized for Every Business Case



A safe, stable and solid platform is essential when handling heavy and delicate components. Especially when these large and heavy structures are installed at considerable heights, with technicians simultaneously performing assembly tasks at these heights. GustoMSC is the world market leader in mobile offshore unit designs and equipment. Based on an extensive track record, we have designed a wide range of jack-up and vessel solutions for the offshore wind industry, each optimized for a specific set of safe, efficient and reliable operations.

GustoMSC | NOY



Sea Installer, NG-9000C

Installation and Maintenance from Safe & Stable Platforms

GustoMSC has designed the vast majority of the offshore wind jack-ups and vessels operating to date. Since 2002, these GustoMSC jack-ups with integrated jacking systems, vessels and cranes have installed over 4,000 turbines and foundations. This large installed base provides the necessary operational intelligence to further optimize our solutions for the offshore wind turbine installation and maintenance market. Our designs and associated equipment have proven to be stable and solid platforms to work from, increasing efficiency, reliability and safety while reducing operational and investment risks.

Current trends and developments in the offshore wind industry are shaping the installation fleet of the future. With our large portfolio, GustoMSC is constantly setting new standards for efficient, reliable, and safe offshore wind installation and maintenance while minimizing the impact on the environment. Known for our jack-ups, GustoMSC has also been involved in designing heavy lift crane vessels, like Seaway Strashnov, Seaway Yudin and Svanen. Each vessel has contributed to the efficiency and capacity of the offshore industry.

Our jack-up designs are characterized by a high survival capability, thus increasing weather windows, and a large deck space suitable for the transportation of the ever larger and heavier WTG components. Adequate spaces for storage of spares and tools, and customized accommodation make working at sea more efficient

and agreeable. The jack-ups and vessels are equipped with cranes with great hook heights, while the robust DP capability allows for safe and quick positioning on site.

Through our involvement in both designs and associated equipment, GustoMSC can offer integrated solutions that maximize the performance of the unit and its equipment. This is of key importance particularly in jack-ups where the jacking system is integral to the design. Through our engineering services during the operational support phase of our designs and equipment, GustoMSC has gained a wealth of experience and understanding of our clients' offshore operations. This allows us to further improve our designs and equipment. By continuing to innovate based on proven technology, we can minimize the risk in a project while maximizing performance.



Steady Top Feeder Vessel (STFV)



Ensis 5000



Cadeler, NG-20000X F-Class

Smart technology to meet future demands

The expected weights and heights above sea level of next generation turbines are considerable and exceed the capabilities of most of the existing fleet. GustoMSC is involved in these developments through the design of increasingly large Wind Turbine Installation (WTI) vessel designs, larger capacity jacking systems and heavy lift cranes. To meet future demands, our latest designs are outfitted with smart technologies like telescopic boom technology, and features such as battery hybrid solutions, power regeneration and sophisticated electrical and control systems with which CO₂ emissions can be reduced by up to 20% compared to similar units. As a future option, the jack-ups and vessels can be prepared to run on alternative fuels or fuel cells to reduce their environmental footprints even further.

Besides the ever-larger offshore wind turbines, the expansion to new areas such as Japan, Taiwan, and the USA is challenging the current installation concepts. In parallel to the above technology, GustoMSC has been developing the Steady Top Feeder Vessel as a floating vessel feeder solution and the ENSIS series of heavy lift crane vessels as a solution for foundation installation.

The Steady Top Feeder Vessel (STFV) is a specially designed transport vessel able to load WTG components in port and transport them directly to the field. The STFV offers the flexibility of a floating vessel feeder solution while maximizing workability and minimizing the risk of operations. The solution is an attractive alternative or complement to the self-transiting WTI jack-up

particularly when local or project-specific conditions make using a self-transiting WTI jack-up less ideal.

While jack-ups serve both the foundation and turbine installation market, heavy lift crane vessels are increasingly used for the installation of foundations and transformer stations. The GustoMSC designed ‘Seaway Strashnov’, equipped with a 5,000 t GustoMSC crane, has shown that heavy lift crane vessels are an effective solution for ever-increasing foundation weights. The ENSIS series of heavy lift crane vessels will play an increasingly large role for floating installations, aiming to optimize installation and logistics. By applying GustoMSC’s in-depth knowledge and analysis capabilities, combined with our proven approach to integrating the key mission equipment such as heavy lift cranes, and upending and grippers, we can provide the next generation installation capability with our ENSIS designs.

As the industry moves forward in maximizing efficiency in foundation installation and methodology in installing the next and future generations of wind turbines, both our jack-up and vessel designs are constantly being further developed to enable the industry to realize these future ambitions.

As part of NOV, we can offer complete turn-key project support, including engineering and design, installation, commissioning, operational support, training, and worldwide after-market services.



Heavy Lift Cranes

Our heavy lift portfolio includes tub mounted and leg encircling cranes specifically designed for the demanding field of offshore heavy lifting. The telescopic leg crane offers an innovative combination of high hoisting capability for WTG installation and heavy load capability for installing foundations. The telescopic boom avoids protrusion of a very long crane boom outside the hull dimensions during transit, increasing the transit conditions and maneuverability in ports. In terms of both capacity and lifting height, whether retracted or extended, these leg cranes are future proof for the maintenance and installation of new generation offshore WTGs. For heavy lift vessels, a complete new series of tub cranes has been developed based on latest technologies to meet the demand for installation of very heavy and tall foundations.



Rack & Pinion Jacking System with VSD

Variable Speed Drive offers a variety of outstanding features from an operational and safety point of view. The main advantages are the simple speed control, accelerating stepless from zero to full speed, and an equal load distribution over the different leg chords of the truss legs. This reduces wear and tear on the leg rack and the pinion and therefore drastically increases the number of allowable jacking cycles over the full lifetime of the jack-up. This VSD Rack and Pinion Jacking System has become a uniquely integrated piece of associated equipment, offering high performance, reliability and safety for these wind installation jack-ups.



Operator Support System

Analyzing real-time data to increase efficiency and safety. Human operators still actively control the equipment and the process flow. The OSS enables the operator to work more efficiently by having all relevant information available real time. At the same time, safety is maximized because the information of multiple sub-systems can be combined, and manual misinterpretation can be prevented. The OSS connects systems, extracts and intelligently combines the available data and translates the relevant information into valuable information to support operations.

The NG series is a range of multi-purpose, self-propelled jack-ups designed to undertake fully loaded voyages to the installation sites and to perform DP-positioning during jacking operations.

The Steady Top Feeder Vessel is a transport vessel design to load WTG components in port and transport them to the field. At site, in dynamic positioning mode, a dedicated WTI jack-up will be able to lift-off WTG components safely from an integrated Barge Master motion compensation platform.

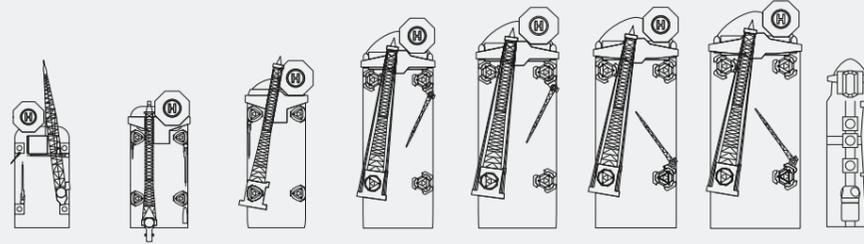
The ENSIS series of heavy lift crane vessel designs have been specifically developed for the foundation installation market. Optimized for fast installation of large XL monopiles and jacket foundations, ENSIS enables a wide range of activities in the offshore construction and decommissioning market.

Main particulars

	NG-3750C	NG-5500X	NG-8000X	NG-14000XL	NG-16000X	NG-20000X	NG-25000X	STFV
Function*	WTM	WTM	WTI + WTM	WTI + WFI	WTI + WFI	WTI + WFI	WTI + WFI	Feeder Vessel
Hull length & width (m)	73 x 40	87.5 x 42	108 x 42	142 x 50	148 x 56	152 x 58	160 x 66	120 x 32
Accommodation (#)	90	90	up to 100	up to 130	up to 130	up to 130	up to 130	30
Design speed (kn)	± 6 – 7	± 9 – 10	± 11 – 12	± 10 – 11	± 11 – 12	± 11 – 12	± 11 – 12	± 13
DP Class	DP-2	DP-2	DP-2	DP-2	DP-2	DP-2	DP-2	DP-2
Water depth (m)	45	65	65	70	70	70 – 75	75 – 80	n.a.
Leg length (m)	± 85	± 100	± 100	± 110	± 110	± 120	± 140	n.a.
Leg length below hull (m)	± 70	± 80	± 80	± 85	± 85	± 90	± 100	n.a.
Variable load (t)	1,800	3,000	6,000	8,750	11,500 – 13,000	14,500 – 16,000	18,500 – 21,000	7,000
Deck area (m ²)	1,750	2,000	3,000	4,600	5,400	5,600	6,700	± 3,000
Crane (Retracted mode t@m)	800 @ 26	800 @ 45	1,600 @ 35	2,500 @ 30	2,500 @ 30	3,200 @ 33	≥ 3,200 @ 33	max. 1,500 Lift-Off
Crane (Extended mode t@m)	optional	800 @ 45	1,600 @ 35	1,600 @ 38.5	1,600 @ 38.5	1,600 @ 55	≥ 1,600 @ 55	1,250 design cond.
Hook height above deck	-100	95 – 140	108 – 148	115 – 155	120 – 162	135 – 180	≥ 135 – 180	n.a.
Integrated Systems **	HJ	VSD R&P	VSD R&P	VSD R&P	VSD R&P	VSD R&P	VSD R&P	3D Motion Comp.
Main Crane ***	PC	TLC	TLC	TLC	TLC	TLC	TLC	Skidding system
± 13 – 16 MW Turbine sets	-	1	1 – 2	3 – 4	4 – 5	5 – 6	6 – 7	>1 set
± 20 MW Turbine sets	-	-	1	2	3	4	5	1 set

General deck arrangement

- * WTM Wind Turbine Maintenance
- WTI Wind Turbine Installation
- WFI Wind Foundation Installation
- ** CH Continuous Hydraulic
- VSD R&P VSD Rack & Pinion
- HJ Hydraulic Jacking
- *** PC Pedestal Crane
- TLC Telescopic Leg Crane
- TC Tub Crane

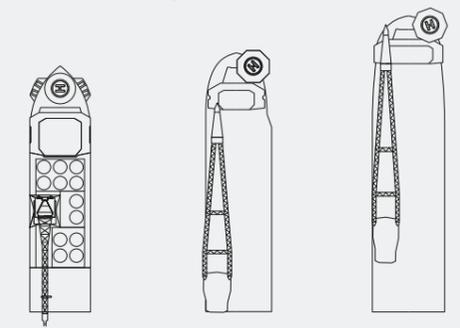


Designs can be customized in accordance with client-specific requirements. All generic designs are based on a telescopic crane and can be customized with different crane types and specifications.

Main particulars

	ENSIS 3000	ENSIS 4000	ENSIS 5000
Function*	WFI	WFI	WFI
Hull length & width (m)	182.5 x 45	185 x 44	226 x 55
Operational draught	8 – 10	9 – 11	8 – 11
Accommodation (#)	125	140	140
Design speed (kn)	14	14	14
DP Class	DP-2	DP-2	DP-2
Position mooring	Optional	Optional	Optional
Deadweight (t)	> 15,000	> 30,000	> 30,000
Deck area (m ²)	3,500	8,500	9,500
Main Crane ***	TC	TC	TC
Crane (Retracted mode t@m)	3,000 @ 27.5	4,000 @ 40	5,000 @ 36
Hook height above deck	97	115	144.5
Auxiliary hook	800	800	1,500
Integrated Systems	Motion compensated gripper and upending hinge		
Typical foundation range			
Monopiles (t)	12x 1,250t 6x 1,750t	Up to 3,000t 4x 2,000t	Up to 4,500t 6x 3,000t
Jackets (m)	4x 25 x 25m	3x 28 x 28m	6x 30 x 30m

General deck arrangement



The Pioneers of Offshore Engineering

GustoMSC is recognized for providing advanced design & engineering consultancy for mobile offshore units and reliable equipment. In close cooperation with our clients, we translate experience, science and technical knowledge into realistic and innovative ideas. In this way, GustoMSC enables and supports safe and efficient operations at sea, contributing to a sustainable future.

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