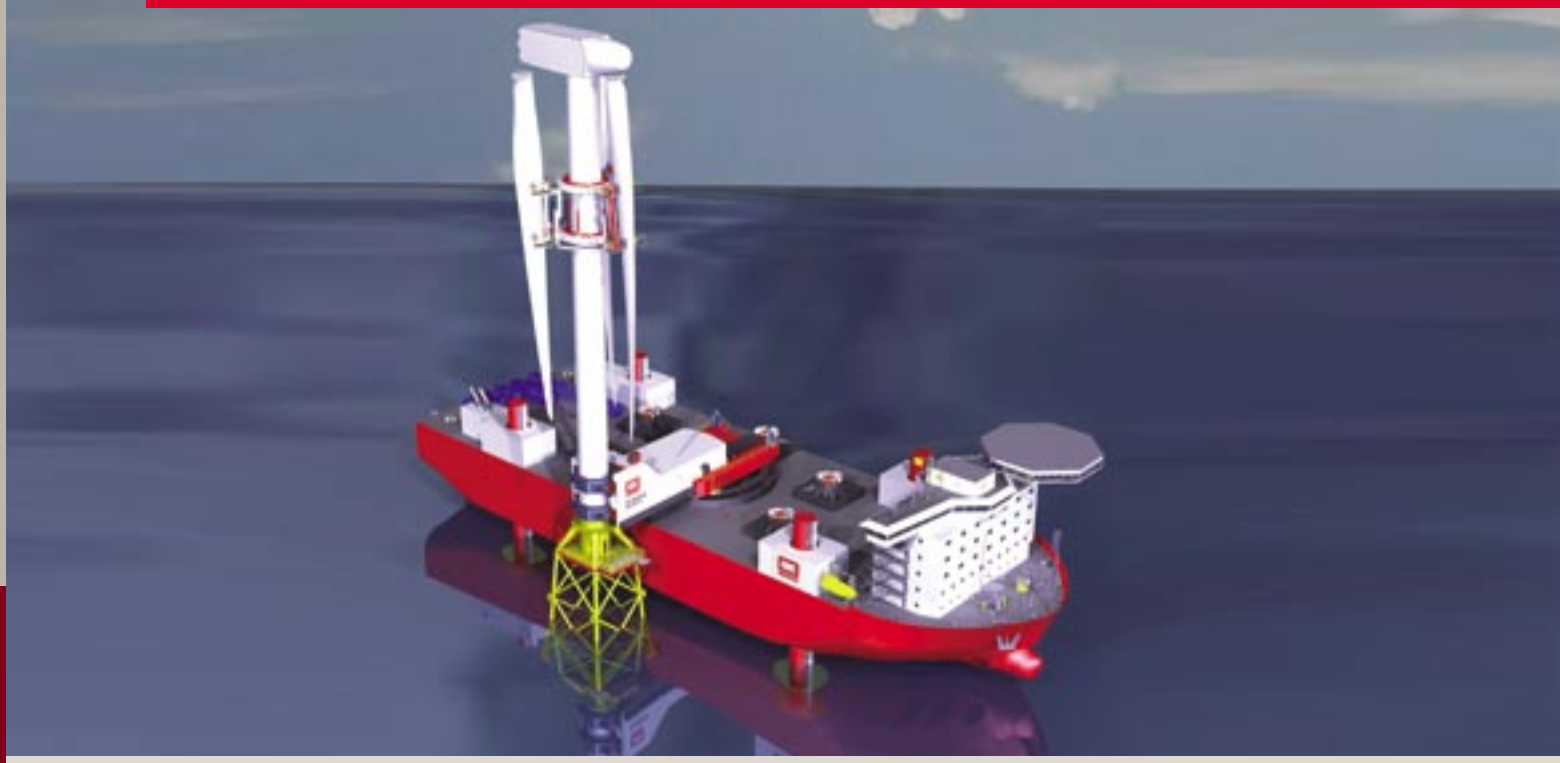
IHC Merwede Blade Installation System



Description

Blade installation is a critical phase of offshore wind construction, due to the sensitivity of the lifted blade to wind, its vulnerability and the accuracy required to properly align the blade and hub flanges.

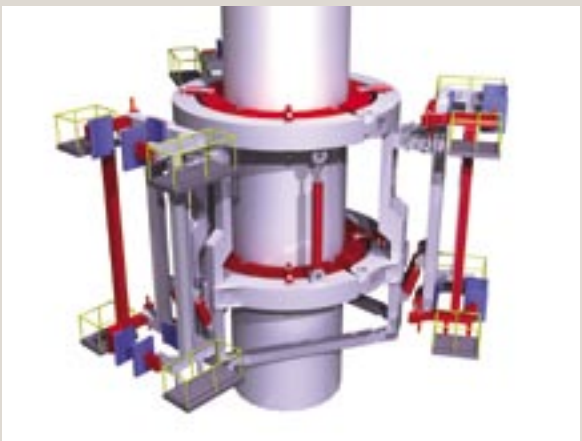
The Blade Installation System has been developed to improve the safety and efficiency of blade installation operations, and can be used in conjunction with a wide variety of installation vessels and techniques.

Ideally the system is mounted onto a tower and loaded with blades at port, with the tower and blades transported vertically to site for installation.

Alternatively blades and towers can be transported to site and the system mounted around the tower and loaded with blades on the vessel's deck, prior to installation to the foundation.

The system is secured to the tower using two sets of friction clamps. The clamps are linked with hydraulic cylinders that create a walking action to drive the carousel upwards and downwards as required.

Each of the 3 blade grippers features hydraulic actuation to allow precise alignment of the blades within the hub.



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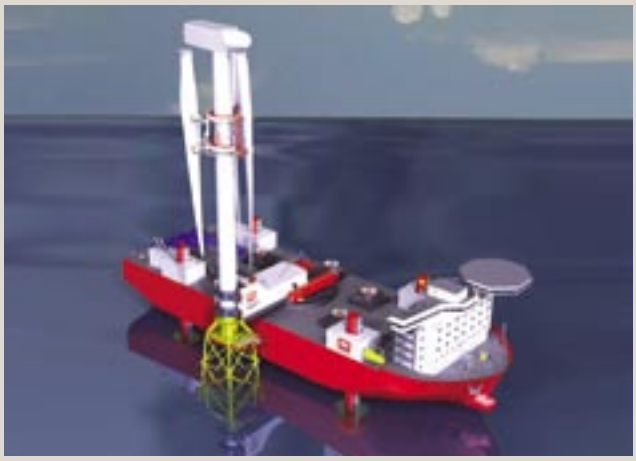
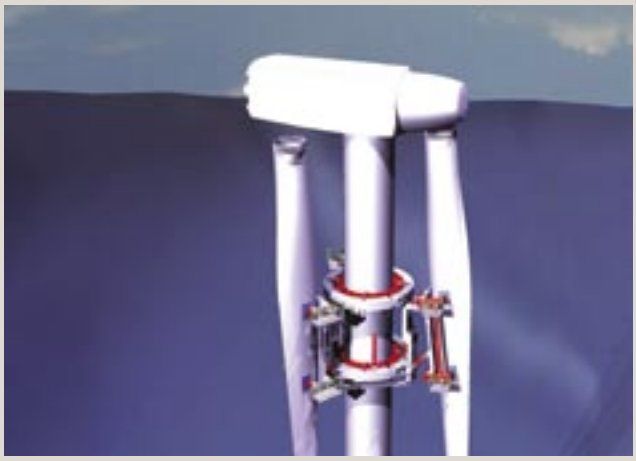
Features and Benefits

- Reduced sensitivity to wind during installation operations – increased workability
- Increased protection of blade root and hub structure during installation
- Ability to accommodate straight and tapered tower sections
- Ability to climb and descend – allows system removal at deck level reducing working at height requirements
- Blade clamps incorporate hydraulic actuation to allow manipulation and fine alignment ensuring precise positioning of blades
- Additional tooling packages can be added to allow maintenance activities to be completed

Operational Steps

- Tower transferred to foundation – using either a ship's crane or turbine handling system
- If not already installed onshore, nacelle is installed using ship's crane
- Nacelle and hub rotated to align 1st blade
- Blade inserted into hub by system ascending tower
- Clamp opens to release 1st blade
- System lowered to allow nacelle rotation
- Hub & nacelle rotated into position for 2nd blade
- 2nd and 3rd blades installed by system ascending tower
- System descends to tower base for removal





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