Houlders

PILE GRIPPER SYSTEMS
Accurate positioning and restraint of offshore construction piles

- Accurate handling of piles up to 8.0m in diameter
- Pile positioning and adjustment within large envelopes
- Piles restrained in the vertical to +/- 0.5°

Design Team of the Year
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When it comes to pile foundations, offshore contractors continually look to improve installation accuracy and safety while reducing project durations.

Houlder has responded to this challenge for key players in wind energy and oil & gas with deck equipment that positions piles and restrains them against environmental forces as they are driven into the seabed.

Houlder brings significant experience of naval architecture, offshore construction, equipment design, and vessel integration engineering to these projects. Clients benefit from a wholly turn key approach from a supplier with a full understanding of handling components at sea.

THE CHALLENGE

Pile dimensions vary from jacket pin-piles to 8m diameter monopiles and water depths reach 60m and beyond. Varying vessel charters, project durations and economic drivers also mean one size rarely fits all. Houlder has therefore developed a range of handling equipment to be installed on or below deck level off the vessel stern, port or starboard. Houlder engineering ensure piles can be maintained in place and to the required tolerances.

Houlder pile gripping equipment is designed to operate against tide, current, wind and waves. The hydraulically driven arms and frames provide resistance to lateral forces of up to 240 tonnes in all directions.

This equates to the following conditions

+ Wave Height up to 4.6m Hmax (approximately 2.3m Hs)
+ Current of up to 2.5 knots

Equipment has been designed a range of applications from rapid deployment of pin pile foundations to the safe installation of 900t, 8m diameter steel in 40m of water.

VESSELS

Houlder equipment is designed for heavy lift and jack up vessels operating on some of the world’s most challenging offshore and subsea construction projects. Deck, Stern and hull installations are all possible thanks to Houlder’s integration experience.

Examples include;

The Derrick Barge Azerbaijan (DBA) installation vessel operating in the Caspian Sea in water depths from 75 meters to 550 meters. Its current scope of work includes the transportation and installation of jackets and subsea structures alongside the laying of over 360 km pipelines.

The MPI Discovery construction jack up operates across the North Sea region in up to 40m of water. The Discovery is designed to transport, lift and install wind turbines and their foundations. Key features include a 1,000-tonne main crane, a 50-tonne auxiliary crane, accommodation for 112 persons and an ability to jack with 6,000 tonnes of cargo.
HYDRAULIC & CONTROL SYSTEMS

Houlder pile handling equipment typically utilises hydraulic power to drive motion control actuating cylinders. This is provided by an independent, stand alone and self-contained HPU installed on the vessel deck.

Control typically comes from a single cRIO controller which runs bespoke software. This cRIO controller is located within a central Control Cabinet which also houses a standalone safety system and all other associated control system hardware.

A chest pack controller provides operator interaction with the system. The chest pack incorporates a single HMI screen and control joystick for pile positioning. The HMI screen displays system information and alarm data.

The controller also interfaces with the HPU, hydraulic manifold plates, chest pack, hydraulic cylinders, cylinder position data, locking pins and warning beacons and alarms.

TURNKEY DELIVERY

Clients have benefited from Houlder’s turnkey approach – taking accountability from initial design through integration with the vessel and setting to work. It does this by forming fully integrated project teams that ensure design work benefits from our practical knowledge and operational expertise. The company also designs and installs any deck strengthening or other vessel modifications as required.

This joined up approach provides significant efficiency savings during fabrication and installation.

QHSE

Houlder equipment is designed to appropriate Class Rules. Work is carried out in line with ISO 9001:2008 Certified Quality management systems.

Houlder ensure safe operation through thorough accidental load calculations and Failure Mode and Effect Analysis (FMEA) on all our equipment. An air gap is maintained between the equipment and piles to prevent damage and minimise the risk of clashing. Control loop systems keep components aligned within very small tolerances. (+/- 5mm).

Operators are protected by safe access stairways and platforms and audio and visual alarms.

Overall risks associated with human intervention is minimised by a single joystick control for all normal operations.

* Note equipment is designed to clients’ specific project needs
Houlder equipment is already having a positive impact on the oil & gas and offshore renewables sectors. The following examples have been chosen to demonstrate applications of our handling equipment expertise.

**PIN PILE FRAME INSTALLATION FRAME**

Pin piles are often used to secure jacket foundations. Their installation requires a cost effective solution that minimises vessel modification for quick and straightforward mobilisation.

Houlder’s solution is a frame that can restrain and adjust piles in the x-y planes.

This solution delivers;

+ Accurate handling of piles up to 1-3m in diameter
+ Pile positioning and adjustment within +/- 2m envelope
+ Hydraulically adjusting piles to maintain vertical alignment +/- 0.5°
+ Opposing lateral environmental forces of up to 75t
+ 2m Clearance from vessel edge
+ Protecting piles with a pad interface and 50mm air gap
+ Can be partially retracted prior to sail away from monopile
+ Limits human intervention strictly to a control area
+ Road transportable for installation at a nominated quay.

The equipment is hydraulically powered via a Houlder supplied HPU which delivers 260 bar and 220 l/m. The equipment is controlled by a simple and easy to use control pendant, similar to that used on overhead cranes.

Installation of the equipment is quick as the equipment can be pre-assembled on the quayside prior to the host vessel arriving.
WIND TURBINE FOUNDATION ARMS  
(STERN MOUNTED)

Houlder designed a pair of restraining arms mounted near the keel of the vessel. This solution means the 200t equipment uses minimal deck space and the whole system hinges at the base to be allow secure stowage during transit.

This solution delivers;

+ Accurate handling of piles up to 4.7m in diameter
+ Pile positioning and adjustment within +/- 3m envelope
+ Hydraulically adjusting piles to maintain vertical alignment +/- 0.5°
+ Opposing lateral environmental forces of up to 150t to 240t – equivalent to 2.3m Hs waves & 2.5 knots current
+ 12m Clearance from vessel edge
+ Protecting piles with a roller interface and 50mm air gap
+ Can be partially retracted for port entry and prior to sail away from monopile
+ 10 minute deployment time.

The equipment is hydraulically powered via a client supplied HPU which delivers 300 bar and 400 l/m. The equipment is controlled by an advanced HMI unit on a control console, which clearly identifies the pile location relative to the vessel position.

The entire installation and set to work of the equipment was performed by Houlder. This included the design and installation of additional underdeck stiffening, hydraulic pipework and electrical cabling.
Houlder designed a cantilevered pair of arms to be installed at deck level port or starboard. The lightweight structure (300t) upends flush with the main deck for stowage during transit and aligns with deck strong points to minimise requirement for ship modifications.

This solution delivers;

+ Accurate handling of piles up to 6-8m in diameter
+ Pile positioning and adjustment within +/- 1.5m envelope
+ Hydraulically adjusting piles to maintain vertical alignment +/- 0.5°
+ Opposing lateral environmental forces of up to 240t – equivalent to 2.3m Hs waves & 2.5 knots current
+ 12m Clearance from vessel edge
+ Protecting piles with a roller interface and 50mm air gap
+ Can be fully retracted for port entry and prior to sail away from monopile
+ Straightforward mobilisation & demobilisation (designed for short term 6 month projects)
+ 10 minute deployment time.

The equipment is hydraulically powered and controlled by an advanced HMI unit on a control console which clearly identifies the pile location within the operating envelope.

The equipment is designed to be easily installed on deck and picks up on vessel strong points. This eliminates the requirement for underdeck stiffening works. Installation times are reduced by preassembly on the quayside.
WIND TURBINE FOUNDATION ARMS
(HULL MOUNTED)

Houlder has designed a gripper frame for operation when a deck cantilever is impractical. These arms have a fixed beam connection to the installation vessel hull at the keel area but can be fully retracted onto the deck for transit.

This solution delivers;

+ Accurate handling of piles up to 6-8m in diameter
+ Pile positioning and adjustment within +/- 1.5m envelope
+ Hydraulically adjusting piles to maintain vertical alignment +/- 0.5°
+ Opposing lateral environmental forces of up to 200t – equivalent to 2.5m Hs waves & 2.5 knots current
+ 7m clearance from vessel edge
+ Protecting piles with a roller interface and 50mm air gap. Can be fully retracted for port entry and prior to sail away from monopile
+ Straightforward mobilisation & demobilisation (designed for short term projects).

Despite the fixed beam connection, the hydraulic power and control allow easy deployment from a stowed deck position. The HMI control console clearly and accurately reports the pile’s position relative to the vessel.

The equipment is designed to be installed utilising deck strong points to minimise the need for vessel modifications and reduce installation times. Preassembly at the quayside further supports effective installation.
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