

MONOPILE UPENDING TOOL (MP-UT)

Remotely controlled, safe and efficient upending of large monopiles



Application

- + Construction of Offshore Wind Farms (OWFs) – Monopile Foundations Installation

Short Description

- + The Upending Tool locks into the top of monopiles under remote control to enable the crane to lift them into the vertical position. The tool then disengages remotely and is returned to the deck.

BENEFITS

The main advantages of the Lifting and Upending Tool are as follows:

- Proven track record with zero project downtime
- Wireless remote control for self-engagement with the pile, which helps to avoid personnel going into more hazardous locations
- Ideal solution when longer piles would hang over the edge of the vessel, as it eliminates the need for human intervention

OPERATIONAL RECORD

Houlder has recently supplied two (2) Pile Upending Tools to ensure safe and effective monopile foundation installations for the Rampion Offshore Windfarm. The tools were leased to E.ON to aid the installation of 116 turbine foundations over a 10 month period which was completed ahead of schedule.

The project was an overall success as Houlder supplied a highly innovative piece of equipment which met E.ON's exact requirements. The equipment had no recorded downtime throughout the installation works which was a huge contribution to the success of the foundation installation programme.

RELEVANT CODES, STANDARDS & LEGISLATION

Goods will conform to all relevant design codes for Lifting Equipment:

- ISO 9001 Certification
- DNV 2.22 Lifting Appliances
- Lifting Equipment Compliance Certification Operations Manual

Also in accordance with the most recent versions of, or similar to:

- Design according to the regulations stated in the European Machinery Directive Regulations and derived standards (e.g. EN ISO 14122)
- Noble Denton Guidelines 0030 – Guidelines for the Marine Transportations
- DNV Rules for Planning and Execution of Marine Operations (DNV-OS-J101)
- DNV-GL Guidelines (DNVGL-ST-N001)
- Applicable Danish Law
- International Maritime Organization Standards & Guidelines
- SOLAS & MARPOL

TECHNICAL DETAILS

DESIGN PARAMETERS

The specific details of the current lifting tools are as follows:

- Monopile Upending & Lifting Tool (By Flange)
- 855t Lift Capacity (variable depending on Environmental conditions)
- 5m flange OD, 4.4m ID (Monopile / Jacket / TP top flange diameter)
- Wireless remote operation
- DNV type approval
- Available for hire / purchase from January 2017

The main design parameters are presented below:

Main Monopile Parameters

Flange Diameter	6.5m
Monopile Weight (max)	648t
Monopile Length (max)	60m

OPERATING CONDITIONS

The main operational conditions are presented below. The design limit of the Monopile Upending and Lifting Tool is pending on the alpha factor.

Operating Conditions

Max Hs	2.5m
Max Current Speed (TBC)	2kts
Max Wind Speed	16m/s

HIRE OPTIONS

Houlder currently has two tools available for hire.

SYSTEM SPECIFICATION

In recognition of the system requirements and in response to general requirements, the main design specifications of the MP Upending and Lifting tool are listed below:

- Tool engages with the underside of the flange of the monopile. The installation tolerances will comply with fabrication tolerances. The flange diameter is 6.5m
- Capable of lifting monopiles with a maximum weight of approximately 648t and maximum length of 60m
- Weight of Tool is approximately 45t
- Ensure that the monopile is not overstressed for any temporary load cases throughout its operation (i.e. engagement, lifting etc.)
- Designed such that it can be remotely operated (wireless electronic control system) for engagement/disengagement to/from the monopile
- Will provide the remote operator with confirmation that the Tool is engaged as per the design requirements and that the lifting operation is safe to commence
- Designed such that it is inherently safe inasmuch that it would not lose the load should power be terminated from the Tool or whilst there is any load born by the Tool
- Will have an integrated power supply and contain a secondary means of operation should the primary controls and or power system fail
- Provides sufficient protection on areas that physically interface with the TP such that the Tool will not cause any form of damage which may affect the performance of the monopile (no damage to MP corrosion protection or flange geometry)
- Complies with all relevant design codes for Lifting Equipment; subject to conformity assessment
- Suitably rated for use in an offshore environment and have suitable connection points (sea-fastening pad eyes) for sea-transit/storage
- Seafastening position on deck to allow maintenance access to tool
- Supplied with all essential spares and accessories for the Tool to function
- Supplied with certified lifting accessories required for the operation of the Tool (including lifting accessories to connect to the hook of the crane)
- Designed such that it is inherently safe and does not present a risk to health or environment
- Complies with all relevant design codes
- Workability and geometry of upending hinge to be considered with operation of Tool
- Survey system to be implemented on Tool

SYSTEM COMPONENTS

The allows for various modifications to suit the diameter, weight and flange dimensions of your project.

The system is made up of the following main items and components:

1. Main Structural Body
2. Locking Latch Assembly (2)
3. Locking Latch Cylinder
4. Accumulators (4)
5. Tilt Cylinder
6. 700t Wide Body Shackles (2)
7. Endless Sling (2)
8. Spacers (x3)

SEAFASTENING

Houder include a docking station for effective seafastening.

FUNCTION SET UP

- Visually check Tool for obvious sign of damage and hydraulic leaks
- Ensure all batteries are fully charged and wireless connection is working
- Pressurise accumulators
- Check the lifting latches engages and disengages as required and ensure wireless control box indicates this correctly. This can be verified against the visual indicator located on top of the Tool
- Re-pressurise accumulators if required
- Attach guide ropes to either side of Tool
- Visually check lifting gear for any obvious signs of damage



OPERATION

- Attach lifting equipment to Tool and crane
- Personnel are to be located on either side of the monopile holding associated guide rope to aid final positioning of the Tool
- Ensure lifting equipment is straight and true begin lifting the Tool away from the deck/docking station whilst keeping the guide ropes tight
- The lifting Tool is then orientated/rotated to meet its planned orientation, ensuring the offset lifting lugs are approximately in-line with the monopile centre of gravity
- Crane operator is to position the Tool over the end of the monopile using the Tool's mounted cameras. Further guidance to be provided from a 4th person providing feedback via binoculars from a suitable position on deck away from the load path
- Once Tool is in position engage locking pin via the wireless control
- This engagement will be confirmed via the wireless control. This can be verified against the visual indicator located on top of the Tool
- Lifting activities can then commence

RELEASE

- After monopile is in its final position with load removed from the crane, the operator will disengage the lifting latches via the wireless control
- This dis-engagement will be confirmed via the wireless control. This can be verified against the visual indicator located on top of the Tool
- The Tool can then be lifted clear of the monopile and lowered to the vessel deck
- Once Tool is secure in its base station and/or deck, the lifting equipment can be removed
- Visually check Tool for obvious sign of damage and hydraulic leaks
- Turn off electrical components and re-charge batteries

REDUNDANCY INFORMATION

The main method of operation is via the wireless control. In the event of a failure the Tool can be operated by the manual operation of the hydraulic valves. Further redundancy is provided by the use of an emergency hand pump.





Houlder is an independent, innovative offshore engineering company. We build on 30 years' offshore expertise and work closely with clients to design solutions for their technical challenges. We provide complete EPCI services with special equipment, consultancy, project management and engineering solutions for the offshore wind and wider energy sector.

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