

# DRIVING OF MONOPILES GREATER THAN 8M TOP DIAMETER

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## BACKGROUND

As turbine capacity increases the size of the foundation required to support the turbine also increases. In the case where monopiles are used for foundations the diameters of the pile will increase. The top of the monopile is where the hammer impacts the pile. Currently hammers exist to drive piles of 8 meter in diameter. The monopiles designed for the next generation of turbine could require top diameters beyond 8 meters.

## OBJECTIVE

Acteon company, Menck GmbH, builds and operates hydraulic hammers for offshore pile driving. Based on market information that monopile top diameters will be growing beyond 8 meters, Menck undertook a study to determine:

- Could >8 meter diameter piles be installed with existing hammer technology.
- What supply chain would be required to provide the equipment.

## METHODS

- Menck engineering group undertook a review of global forging capacity to identify foundries with required capacity and capability.
- Alternatives to 1 part anvil identified and modelled from an engineering, manufacturing and operations point of view.
- Transfer of power from center to outer edge of anvil and pile modelled with Ansys.
- Drivability with 2-part anvil systems performed to confirm operations performance.

## RESULTS

- Review of global forging capacity identified foundry that would meet the required quality for Menck hammers. Discussion with these foundries identified that none had the capacity to forge anvils > 8 meter. The cost to build the capacity was identified at being US\$ 50 to US\$ 60 million. It would be uneconomical to build the capacity.
- Existing hammer technology could be used to install new larger monopiles.
- The 2-part anvil option identified as the only viable solution.
- Initial design for adaptor completed showing a lead time of 12 to 18 months for project specific followers.
- Drivability calculations completed with adaptor set-up



*Menck 3500KJ hammer with Anvil for up to 7.5 meter diameter*



*Menck 4400KJ hammer with Anvil for up to 8 meter diameter*



*Menck 4400KJ hammer with anvil for up to 8 meter diameter and adaptor >9.5 meters*

## CONCLUSIONS

- One-part anvils >8 meter in size will not be possible due to global lack of quality forging capacity.
- An adaptation will be required to enable 8 meter anvil hammers to drive piles of diameters beyond 8 meter.
- The hammer adaptations will be project specific for the project. It will need to be designed and developed for the project at least 18 months before offshore installation.
- The adaptations need to be accounted for in the drivability calculations at the start of the project.

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