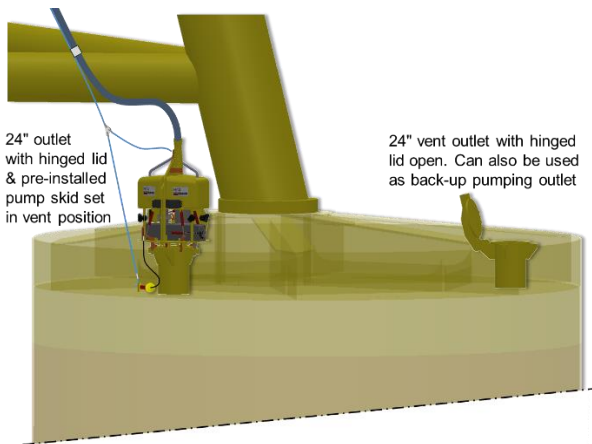


Bucket Foundation Installation Services

High capacity pump skids with integrated instrumentation

The new generation pump skids developed by NGI and FRAMO targets bucket installation for fixed structures in shallow waters and difficult soil conditions

The shallow water pump skids have been developed for installation in water depths down to ~150m and are surface operated self-contained units. The pump skids are normally pre-rigged to the buckets, by means of special rigging pump skids with umbilical's are easily recovered. The hardware strategy is based on two 24" outlets on each bucket for adequate venting through the splash zone. The pre-rigged pump skid is installed in one of the outlets and set in venting position. The other vent outlet can be closed by remote actuation and the pump skid is set in pumping position in order to commence suction penetration. As a contingency, a self-contained back-up pump skid can be deployed in the vent outlet and by closing the sea port on the pre-rigged pump, suction penetration can be continued without recovery of the failed pump skid.



Bucket outfitting with pre-rigged pump skid and vent

The pump skid is optimized with respect to dimensions and weight (~700 kg dry) and has several functions:

- Reversed pump flow for cycling
- Venting mode utilizing the full venting area of the outlet
- Provide and control water supply for skirt tip water injection system if used
- Various closure and release functions

The well proven and robust TK150 centrifugal pump has an open impeller design and is not sensitive for pumping dispersed material. The pumping capacity is typical 400m³/hr at dP 4 Bar. The cavitation pressure for this pump has been proven to be as low as 0.1 Bar absolute, which is important in shallow waters.

The pump skid is equipped with several cameras for remote operation and control, the integrated instrumentation monitors the following parameters:

- Inside and outside penetration depth
- Soil heave and bottom clearance
- Pumped water flow and leakage monitoring
- Total and differential pressure in bucket
- Tilt
- Volume and pressure of water injection if used

Pumps and hydraulic functions are operated by PLC control. Data is presented in customized real-time software and can also be streamed on local network to multiple clients on board or onshore.

Parked pump skids on deck and FRAMO Transrec umbilical winches with fairleads on telescopic arms which can be slewed and boomed up

