



# Active heave compensation system aboard support vessel

Allows sensitive equipment or other loads to be placed on the seabed.  
Gently, and under full control.

SBM uses special vessels to position valuable and sensitive equipment on the seabed at depths down to 3,000 meters. The use of a 150 ton active heave compensation system from VHT enables SBM to carry out this work in a most reliable, efficient and safe manner.

To perform work at depths greater than 3,000 m below sea level, the ships used by SBM are equipped with many advanced systems and technologies. One of these is the active heave compensation system. This system, which compensates for heave caused by ocean swell, allows sensitive equipment or other loads to be placed on the seabed - gently, and under full

control. At the same time, it protects the hoisting cable from potential breakage due to internal resonance caused by wave movement.

## Linear heave compensation

SBM's active heave compensation system operates continuously based on measurements made by the Motion Reference Unit, or MRU. These measurements describe the vertical movements of the ship, and thereby the motion that needs to be compensated for. An advanced and extremely fast controller processes this data and uses this to govern the hydraulic system which controls the hydraulic cylinder. The cylinder is extended or retracted to shorten or lengthen the cable

which is reeled over the cylinder, such that the load is suspended motionless in relation to the seabed.

### Combined hydraulics and air

Mounted below deck, the system can achieve a compensating capacity of at least 90%. What makes this solution unusual is the specially-designed compensation cylinder, which combines both a pneumatic and hydraulic cylinder. The pneumatic compartment bears and compensates for the static load, while the hydraulic compartment provides the forces to compensate for friction losses, inertia and other dynamic effects. Thanks to this unique combination, the required hydraulic capacity is only a fraction of the theoretical peak capacity that would be required from the winch if there were no heave compensation installed.

This has resulted in considerable energy savings. To ensure reliable operation under harsh conditions at sea, the hydraulic cylinder has been treated with Enduroq 2200 surface technology, an extremely wear-resistant and corrosion-resistant cylinder rod finish, especially developed for offshore applications. In addition, essential system components are dual or multiple-redundant; for example, to guarantee the continuity, reliability, and safety of employees and the costly load of up to 150 tons, the VHT CIMS measuring system integrated into the cylinder is equipped with three sensors.

### From design to commissioning

VHT developed the entire system for SBM, also providing the required system components, which were virtually all manufactured in-house. These include the drive section including the hydraulic power unit and the hydraulic cylinder, the air supply unit, plus the control section with software, control cabinets and operator panels. VHT also performed the commissioning. The second system delivered to SBM incorporates additional features, such as remote monitoring.

### Facts & figures

- ▶ Accumulator for energy storage and recovery.
- ▶ Wave amplitude:  $\pm 3$  m.
- ▶ Mean wave periodicity: 10 s.
- ▶ Depth: 3,000 m.
- ▶ Maximum acceleration:  $7\text{m/s}^2$ .
- ▶ Compensating capacity for at least 90% of the load movement (less than 10% residual movement).
- ▶ Capacity: 150 ton single fall.
- ▶ HPU capacity is a fraction of winch theoretical peak capacity.

