

MAINTENANCE FREE BOLT CONNECTIONS

APPLICATION OF SMART BOLTS AND MONITORING

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BACKGROUND

The safe operation of the turret mooring systems, single point moorings and swivels relies on proper functioning of heavy duty bolted connections. Operators, owners and regulators have an incentive to check the integrity of such bolted connections. The integrity is verified by confirming sufficient pre-tension in the bolts. Currently, this is a manual job, often in a hazardous zone. It is therefore a costly exercise, exposing crew to unfavourable conditions and risks. Often these activities prove to be unnecessary, as the bolts appear to have normally sufficient pre-tension. With this proposal, a smarter solution is developed by creating a digital twin of the bolt, fed by continuous real time monitoring. Using monitoring tools with robust sensor techniques, intrusion of the corrosion protection may be eliminated.

Recent developments in bolts, such as the super bolt, may further increase the reliability of the bolted connection.

The objectives of the proposed JIP are therefore:

- To increase confidence of the bolted connection, at any time
- To decrease cost of integrity checks on heavy duty bolted connections

WHAT WILL BE DONE

A proper digital twin of the heavy duty bolted connection will be assessed on different aspects, made in a probabilistic form, utilising the Bayesian Believe Network. Such a network requires sub-structuring of the bolted connection in its main contributors to the reliability. Starting from the expected loads such as pre-tension and temperature changes, the response is predicted. An ultrasonic sensor is developed that can measure the pre-tension or the changes thereof, compensated for temperature conditions. Available tools are proposed and made offshore proof. The measurement data is used to update the predictions regarding pre-tension in the bolts. Such data includes the bolt pretension, but may also include temperatures and accelerations. Both laboratory and field tests are proposed to proof the working of the monitoring system.

Alternative bolting arrangements may be part of the scope as well. Superbolts and similar arrangements are being developed. There are several advantages regarding required pre-tension on the smaller bolts and ease of monitoring. The approach as outlined above will also be applied on such arrangements.

Guidelines are prepared to encourage industrial use of monitoring systems and alternative bolting arrangements.

CONTACT INFORMATION

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