Neptune Vortex Shedding Sleeves (NEP-VSS) Polyurethane (PU) Strakes

Effective and efficient vortex-induced vibration (VIV) suppression polymer Polyurethane (PU) strakes for drilling risers. Optimised for VIV suppression efficiency and long-term structural integrity. Bespoke design available to suit specific client and operation requirements. Designed and engineered using a combination of advanced Computational Fluid Dynamics (CFD) analysis, Finite Element Analysis (FEA), laboratory testing, prototype testing, factory acceptance testing and field-proven data. Track record of successful offshore applications to drilling risers.

<table>
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<th>Client</th>
<th>BP Exploration &amp; Production</th>
<th>Time</th>
<th>2017-2019</th>
</tr>
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<tbody>
<tr>
<td>Location</td>
<td>Deepsea Aberdeen, West of Shetland, UKCS</td>
<td>Man-hours</td>
<td>-</td>
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Vortex-induced vibration (VIV) occurs when a sufficiently bluff body, such as plain drilling riser, is exposed to a fluid flow. Vortices created behind the body by flow separation are unsteady and unsymmetrical in nature, which results in a periodic variation of flow field across the flow direction and leads to cross-flow oscillation. If the vortex shedding frequency approaches a structural natural frequency of the riser string, violent vibration is induced due to resonance (known as ‘lock-in’) and may significantly reduce the fatigue life of the riser. Deepwater riser and drilling equipment are particularly susceptible to VIV due to the typically higher current velocity, the increased string length and the floating characteristic of the semi-submersible rig.

Figure 1: Unsymmetrical vortex shedding behind a plain drilling riser, causing cross-flow VIV. Taken from Neptune’s CFD analysis.

The most effective solution to mitigate against VIV is to use a vortex suppression device. Neptune’s Vortex Shedding Sleeves (NEP-VSS) Polyurethane (PU) strakes are engineered to suppress the VIV by up to 99%. In essence, the protruding strake fins disrupt the shedding patterns of vortices around the riser, and the helical profile reduces their correlation along the riser. This effectively breaks the vortex streets into series of smaller vortices that are randomly phased, resulting in a net flow field that is almost symmetrical across the flow direction.
Hydrodynamic characteristics of **NEP-VSS**, which are controlled by the strake fin height and helical pitch, are optimised using Computational Fluid Dynamics (CFD) analysis and calibrated against experimental and field-proven data. To prevent damage during deployment and recovery operations, the structural strength and flexibility of **NEP-VSS** are rigorously engineered using Finite Element Analysis (FEA) and have passed multiple integrity tests. **NEP-VSS** has a track-record of successful offshore applications to drilling risers, e.g. for deepwater fields in the UK Continental Shelf.

- **Neptune** Subsea Engineering has successfully developed what is now a field-proven efficient and effective vortex suppression system **NEP-VSS**.
- **Neptune** Subsea Engineering has full capability to customize **NEP-VSS** design to vast majority of client and operational requirements.
- **Neptune** Subsea Engineering has full in-house structural and CFD analysis to optimise strake geometry. Any riser/pipe size and profile can be catered for.
- FE based analysis used optimise structural integrity of the **NEP-VSS**.
- CFD analysis utilised efficiently and accurately calculate hydrodynamic coefficients of submerged bodies of a riser string, including bodies with complex geometry.

**Features:**
- Geometry can be customised to client and operational requirements. Diameter, length, pitch, strake height and profile and can all be customised.
- Large selection of marine-grade polymer materials available to suit client specific operational and loading requirements.
- High-speed mould manufacture using rapid prototyping
- CRA banding for robust retention
- Anti-dropped object protection features
- Open or closed section geometry available
- Locking lugs facilitate rapid installation onshore or offshore
- Neptune Subsea Engineering is able to accurately predict frequency and amplitude of any variant of NEP-VSS system, to arrive to an optimum solution for the client operational requirements.

**Figure 3:** NEP-VSS Polyurethane (PU) strakes installed on drilling riser.

**Figure 4:** FEA to optimise the impact-resistance and anti-snagging capacity of the NEP-VSS Polyurethane (PU) strakes. Crush test carried out on a prototype to verify the structural integrity.
Figure 5: NEP-VSS Polyurethane (PU) strakes installed on drilling riser being deployed from BP’s Deepsea Aberdeen semi-submersible rig, West of Shetland, UKCS.
Figure 6: 9" NEP-VSS Polyurethane (PU) strakes installed on dual bore riser onshore and being deployed from BP’s Deepsea Aberdeen semi-submersible rig, West of Shetland, UKCS.