

Service platform	Description
<b>General</b>	Project support during concept planning or FEED (for all disciplines below).
<b>Static equipment and structures</b>	<p>Piping systems, including supports, structures and small-bore attachments face vibration and fatigue risks due to various static and transient causes.</p> <p>Many jurisdictions require screening and vibration analysis to avoid fatigue failures. Services include:</p> <ul style="list-style-type: none"> <li>• Topsides/onshore and subsea piping vibration and fatigue assessments to the Energy Institute's guidelines for the avoidance of vibration-induced fatigue failures (AVIFF)</li> <li>• Multiphase flow, transients (water hammer), structural dynamics and pipe stress analysis</li> <li>• On-site investigation and troubleshooting of piping and static equipment vibration issues</li> <li>• Advanced engineering (eg, fitness-for-service level 3, non-linear FEA, CFD)</li> </ul>
<b>Machinery analysis</b> (for compressors, pumps and systems)	<p>Compressors, pumps and other production systems can experience significant vibration risks. Vibration and dynamics analyses are needed during the design of these systems, or when modifying existing processes (management of change).</p> <p>Studies are defined by API (eg, API 618, 619, 674, 688), ISO or other industry guidelines. Topics include mechanical resonance, pulsations, surge, rotor dynamics, skid and structural dynamics, foundation design, small-bore piping and pipe stress.</p>
<b>Rotating equipment reliability</b>	<p>A suite of reliability services to support rotating equipment. Standard reliability services include condition monitoring programs, performance monitoring, balancing, alignments and condition assessments.</p> <p>Specialist reliability services include reliability-centred maintenance (RCM), failure mode and effects analysis (FMEA), spares optimization, maintenance program builds, and reliability, availability and maintainability (RAM) modelling.</p>
<b>Noise management</b>	<p>Our noise group specializes in providing environmental and occupational noise services and solutions focused on improving the health, safety and environmental performance of our operations.</p> <p>Noise needs to be considered in many contexts including environmental approval, regulatory compliance, management of health and safety, community relations and operational efficiency.</p> <p>When noise becomes excessive it requires elimination, mitigation or management. Our services include noise surveys, monitoring and prediction to detailed design of engineering noise controls.</p>
<b>Field engineering and troubleshooting</b>	<p>Our global team of field engineers provide specialist troubleshooting, failure analysis, and baseline and performance testing. This work involves vibration, stress, and noise analysis for rotating equipment, piping systems and structures.</p> <p>There are three levels of service, depending on the customer's needs:</p> <ol style="list-style-type: none"> <li>1. Measurements, analysis, troubleshooting and recommendations</li> <li>2. Implementation support ranging from mitigation solutions, supervision and turnkey support</li> <li>3. Value-added support for operations teams (long-term support role for operators)</li> </ol>
<b>Anti-vibration products</b>	<p>Our anti-vibration products are made specifically for vibrating pipework and machinery. This includes standard anti-vibration clamps and absorbers.</p> <p>Damped clamps, braces and supports are available for more demanding applications. The robust damping technology (DamperX™) absorbs vibration and is superior to standard anti-vibration clamps and supports.</p>

Service platform	List of services
<b>General</b>	<ul style="list-style-type: none"> <li>- Project FEED or planning support</li> </ul>
<b>Static equipment and structures</b>	<ul style="list-style-type: none"> <li>- Risk-based, piping vibration and fatigue assessments (as per EI AVIFF guidelines)</li> <li>- Acoustic-induced vibration (AIV), acoustic fatigue (for API 521)</li> <li>- Flow-induced vibration, turbulence and pulsation (FIV, FIT, FLIP), singing risers assessment and detailed analysis, vortex-induced vibration (thermowells)</li> <li>- Small-bore piping design review</li> <li>- Multiphase and slugging flow</li> <li>- Structures and piping systems</li> <li>- Subsea piping vibration and dynamics</li> <li>- Transients (water hammer, gas/fluid hammer)</li> <li>- Pipe stress analysis</li> <li>- API 579 fitness-for-service level 3 and advanced engineering, non-linear FEA, CFD</li> <li>- Detailed pipework fatigue analysis</li> <li>- Intrinsically safe and subsea monitoring systems</li> <li>- Tubing assessment for dynamic loading</li> <li>- FEA, CFD simulation and modeling services</li> </ul>
<b>Machinery analysis</b> (for compressors, pumps and systems)	<ul style="list-style-type: none"> <li>- Pulsation and mechanical analyses for compressors and pumps (per API 618, API 619, API 674, API 688, GMRC high-speed spec, ISO 13631)</li> <li>- Rotor dynamics and torsional analysis</li> <li>- Surge dynamics (centrifugal compressors) including system piping and unit interaction</li> <li>- Skid, foundation and structural design (machinery systems)</li> <li>- Small-bore piping design, pipe stress analysis and piping vibration on machinery systems</li> <li>- Package design support</li> <li>- FEA, CFD simulation and modeling services</li> </ul>
<b>Rotating equipment reliability</b>	<ul style="list-style-type: none"> <li>- Monitoring (vibration, oil analysis, thermography, performance)</li> <li>- Condition monitoring program assessments and audits</li> <li>- Lubrication schedule design, review and optimisation</li> <li>- Reliability-centred maintenance (RCM), failure mode effects analysis (FMEA)</li> <li>- Maintenance and monitoring program strategy and build</li> <li>- Remaining useful life assessments (Health Checks)</li> <li>- Reliability, availability, maintainability modeling (RAM),</li> <li>- Digital reliability (proactive program management diagnostics)</li> </ul>
<b>Noise management</b>	<ul style="list-style-type: none"> <li>- Noise design studies</li> <li>- Workplace and environmental noise surveys</li> <li>- Whole-body vibration and hand-arm vibration (HAVS)</li> <li>- Noise exposure management system development and implementation</li> <li>- Environmental noise impact assessments</li> <li>- Noise control and mitigation</li> <li>- Underwater noise</li> </ul>
<b>Field engineering and troubleshooting</b>	<ul style="list-style-type: none"> <li>- Troubleshooting and measurement services for rotating equipment, piping and structures</li> <li>- Vibration, pulsation, torsional, transients, stress, modal, ODS and noise analysis</li> <li>- Piping and small-bore vibration testing</li> <li>- Root cause analysis (RCA)</li> <li>- Machinery focused services:               <ul style="list-style-type: none"> <li>o Factory and site acceptance testing (FAT, SAT), machinery run-up/ coast-down</li> <li>o Performance testing, shaft power measurement</li> <li>o Dynamic balancing, shaft alignment</li> </ul> </li> </ul>
<b>Anti-vibration products</b>	<ul style="list-style-type: none"> <li>- DamperX™ clamps and braces (damping solutions)</li> <li>- Vibration absorbers</li> <li>- Vibration clamps</li> <li>- Turnkey vibration mitigation</li> </ul>
<b>Training</b>	<ul style="list-style-type: none"> <li>- Certified training programs (vibration, lubrication, thermography)</li> <li>- General seminars, courses and custom training for above disciplines (half day to three-day courses)</li> </ul>