



Mechanical & Structural Engineering



Solutions for Challenging Engineering Problems

Our Mechanical & Structural Engineering team is internationally recognized as leaders in aging infrastructure services and support. As pioneers of fitness-for-service (FFS) technologies and lead investigators on many international standards, we leverage our design and in-service expertise to ensure assets are safe to operate even with the presence of damage or defects. Our subject matter experts (SMEs) are ready to help owner-operators optimize decisions made at every phase along the equipment lifecycle process.

-  **Reduce the risk of failure**
-  **Decrease downtime**
-  **Decrease maintenance cost**
-  **Increase operational safety**
-  **Increase business value**
-  **Extend equipment life**

FITNESS-FOR-SERVICE (FFS)

FFS assessments determine whether to run, repair, or replace the equipment or piping system. Additionally, the assessment can be used to determine the remaining life and optimize inspection techniques and inspection frequency. We provide proactive and reactive Level 1, Level 2, and Level 3 FFS assessments to help our clients extend equipment life and safely justify continued operation with known damage or defects. We are focused on applying the appropriate level of technology to make practical decisions that impact our clients' objectives regarding safety, reliability, and economics.

DESIGN, RERATES, AND SUITABILITY-FOR-SERVICE (SFS)

Our extensive participation in ASME and API codes and standards uniquely positions us to support both simple and complex design assessments. We maintain an NBIC R-stamp for equipment rerates and regularly perform SFS assessments to establish equipment ratings when original design documentation is lacking. For large-scale projects involving the evaluation of multiple assets, we develop engineering protocol documents to ensure consistency with the methodology and assumptions employed in the assessments and streamline execution of the project.

TURNAROUND SUPPORT

Turnarounds (TARs) are an investment in the reliability and future performance of a site's assets. We offer remote and onsite engineering support during plant outages. Our pre-coordinated turnaround support helps you to expedite decisions during time-critical projects. When employing Equity for shutdown support, you will benefit from the experience and expertise of the onsite engineer, plus you have unlimited access to numerous Equity SMEs. Our goal is to help you deliver the TAR on time, and on budget, while also improving reliability and reducing operational risk.

STRUCTURAL INTEGRITY ASSESSMENTS

Problems with concrete, structures, and foundations are a result of design deficiencies, construction defects, deteriorating conditions, extreme environmental events, and changes in applied loads. Our innovative structural design and integrity assessments provide practical recommendations to help optimize equipment availability, make repair-replace decisions that ensure stability and continued safety, improve performance, and avoid unnecessary repairs or replacements. Our team has the capability and expertise to perform structural assessments for design modifications and repair designs. Our experience with FFS technology and our knowledge of damage mechanisms differentiate us from other engineering firms.

ADVANCED ANALYSIS

We have extensive experience utilizing state-of-the-art analysis techniques and advanced simulation tools to solve the most complex problems. We routinely employ finite element analysis (FEA) to execute the most complex Level 3 FFS assessments including thermal-mechanical fatigue, explicit high-temperature creep, fracture mechanics, and crack-growth assessments, in addition to commonly encountered issues such as excessive volumetric damage (i.e., wall loss) and geometric imperfection or distortion assessments. We are experts in implementing the design-by-analysis procedures in ASME Section VIII Division 2, and we have a proven capability to employ computational fluid dynamics (CFD) when applicable.

BRITTLE FRACTURE SCREENING

Brittle fracture is the sudden, rapid propagation of a crack-like flaw under stress (residual or applied) where the material exhibits little or no evidence of ductility or plastic deformation. Although rare, the consequences of a brittle fracture are typically catastrophic. Our team routinely performs simplified brittle fracture screening assessments as well as advanced fracture mechanics assessments to establish safe operating limits for equipment and piping to prevent brittle fracture failures. We are at the forefront of developing new technology, including more accurate screening procedures, and we can guide owner-operators to the most appropriate assessment methods to ensure safe operation of their equipment and piping.



ATMOSPHERIC STORAGE TANKS (ASTS)

ASTs can present unique challenges that require experienced personnel. We combine the principles of API 653 and API 579-1/ASME FFS-1 to improve safety and reduce unnecessary and untimely maintenance costs on ASTs. We conduct FFS assessments to address a wide array of damage including shell distortions, foundational and edge settlement, environmental damage, and corrosion issues. Employing state-of-the-art technology to assess the mechanical and structural integrity of tanks and terminals will help reduce risk, minimize failures, and save time and money. We leverage our design and in-service expertise to help you make practical decisions to maximize profitability without sacrificing safe operation.

PIPING STRESS & FLEXIBILITY ANALYSES

Our team routinely performs detailed piping flexibility analyses to support FFS evaluations or Code compliance checks in order to qualify sustained and thermal expansion/loading conditions. When needed, we complete field walk-downs and generate isometric layout sketches of systems. We have extensive experience with aboveground and underground piping design Codes, such as *ASME B31.1 Power Piping*, *ASME B31.3 Process Piping*, *ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids*, and *ASME B31.8 Gas Transmission and Distribution Piping Systems*. In the event a piping system does not meet Code requirements with its existing configuration, we will provide detailed plans to guide support or layout modifications, as appropriate, and ensure adequate support and flexibility while preventing excess reaction loads on equipment or restraints.

BOLTED FLANGE ASSESSMENTS & INTELLIJOINT

Our experienced staff offers a total solution to bolted flange joint leakage that can immediately reduce maintenance expenditure, increase reliability, and improve safety. Our team will evaluate bolted flange designs with the intent of minimizing the risk of leakage without damaging any joint components. Assessments can range from design calculations per ASME Section VIII Division 1 or Division 2, to joint optimization per ASME PCC-1 methodologies using our IntelliJoint software, to detailed FEA of complex joint geometries, loading conditions, and/or transient events.

WIND-INDUCED VIBRATION & STRUCTURAL INTEGRITY

We provide advanced analysis and customized solutions to reduce wind-induced vibration risks and ensure long-term reliability. We specialize in advanced vibration diagnostics and dynamic structural analysis, combining field observations, advanced software modeling, and mitigation strategies to deliver solutions for complex vibration challenges in industrial structures.



THE WORK THAT THE TEAM DID WAS VERY VALUABLE. WHOLE TEAM DEMONSTRATED GREAT KNOWLEDGE AND PROFESSIONALISM. THEY PROVIDED COMPREHENSIVE EXPLANATIONS FOR EVERY QUESTION AND DOUBT. THE COOPERATION WAS VERY SUCCESSFUL FROM THE VERY BEGINNING. I AM IMPRESSED WITH YOUR PROFESSIONALISM AND SCOPE OF KNOWLEDGE. **I WILL DEFINITELY RECOMMEND YOUR SERVICES TO OTHERS.**

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