ASCENT

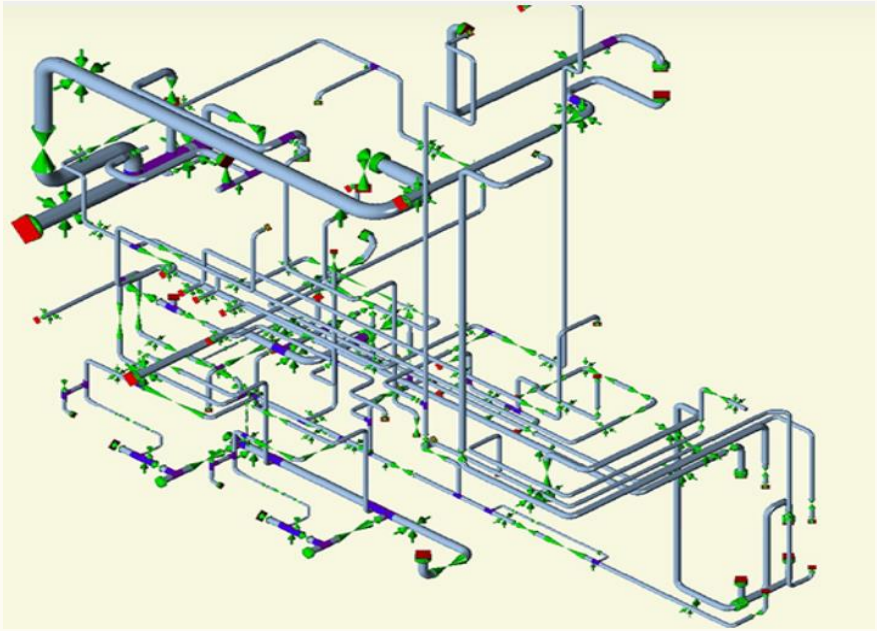
Piping Design & Finite Element Analysis

Company Profile

WHO WE ARE

At Ascent, we are a leading provider of piping stress analysis solutions, dedicated to delivering exceptional engineering services to industries worldwide. With an unwavering commitment to excellence and a highly skilled team of professionals, we have established ourselves as the go-to experts in the field.

EXPERTS IN PIPING & FEA ANALYSIS



CONTACT US

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Website: www.ascentengineering.com (Coming Soon)

LinkedIn: Ascent Piping Design & Finite Element Analysis: Company Page Admin | LinkedIn

Tel: 00201211529813, 00201207344900, 00971557363707

OUR TEAM

Our team consists of highly qualified and experienced professionals who are passionate about their craft. From mechanical engineers to structural analysts, we have assembled a diverse group of experts who possess a deep understanding of piping systems and stress analysis techniques. We stay up-to-date with the latest industry advancements and continuously improve our skills to provide you with the best possible solutions.

WHERE WE OPERATE

Our offices are strategically located in Cairo, Bangalore, and Dubai, enabling us to effectively serve clients across multiple regions and industries. These locations position us at the crossroads of innovation and opportunity, ensuring seamless collaboration and timely delivery of engineering solutions.

INDUSTRIES WE SERVE

Our expertise in piping stress analysis extends across various industries, including oil and gas, petrochemicals, power generation, chemical processing, pharmaceuticals, and more. We have successfully completed projects of all sizes, ranging from small-scale installations to large industrial complexes, earning the trust of clients around the world.

STATIC ANALYSIS METHODOLOGY

If structural integrity, excessive deformation, or static loading conditions are affecting your operations, our global team of experts is dedicated to addressing these challenges with precision and reliability. **Static analysis methodology** is best suited for:

- Dead weight / sustained load analysis
- Expansion analysis
- Thermal displacement evaluation
- Component load evaluation
- Fatigue analysis
- Flange analysis
- Seismic analysis
- Wind analysis
- Snow load and ice loads
- Nozzle load evaluation to WRC-537 / 297
- Loads on equipment (e.g., vessels, coolers, pumps, and compressors) evaluation and design to meet industry standards.
- Recommend pipe layout and Isometric updates based on stress analysis recommendations.
- Pipe hangers and supports selection in accordance with MSS SP-58 and MSS SP-69.
- Local stress analysis calculation based on Kellogg Method.

OUR PRODUCTS & SERVICES

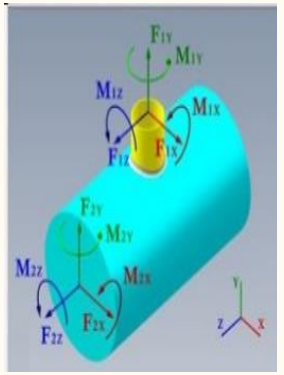
SUPPORT DESIGN & SELECTION

At Ascent, we are experienced in sizing and selecting the most appropriate supporting system to ensure a safe and reliable operation.

EXPANSION LOOP & EXPANSION JOINT DESIGN

We are talented in providing the best industry standard solution to manage your piping thermal displacement issues.

NOZZLE LOAD EVALUATION



Our proficiency in API-610, API-617, API-661, API-560, and NEMA turbines ensures that we have the knowledge and capabilities to swiftly address any challenges you face. With our tailored solutions, your annoying threats become nothing more than a distant memory.

DYNAMIC ANALYSIS METHODOLOGY

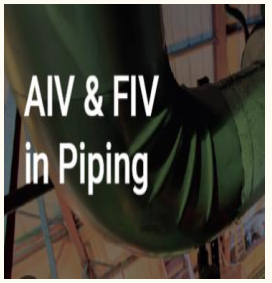
If vibration, dynamics or noise are impacting your operations, we have expert people across the globe who wake up every day focused on these issues.

Our dynamic analysis methodology is another effective tool, which includes modal, harmonic, response spectrum and time history analysis. It is best suited towards:

- Seismic analysis
- Wind analysis
- Relief valve operation
- Fluid hammer analysis
- Vibration analysis
- Slug flow analysis
- Flow-Induced Turbulence (FIT) Analysis
- Flow-Induced Vibration (FIV) Analysis
- Acoustic-Induced Vibration (AIV) Analysis
- Multiphase and Slug Flow Analysis
- Small-Bore Connections (SBC) Assessment
- Dynamic Analysis of Water Hammer Loads

OUR PRODUCTS & SERVICES

VIBRATION ANALYSIS



Ascent has many success stories in assessing and mitigating AIV & FIV phenomenon in accordance with Energy Institute, *Guidelines for the avoidance of vibration induced fatigue failure in process pipework.*

RELIEF VALVE

Dynamic forces associated with relieving devices can cause considerable mechanical damage to equipment and supports. At Ascent, we have the expertise who calculate, assess and design the most safe and reliable system to accommodate PSV dynamic forces.

WATER HAMMER LOADS ASSESSMENT

Our team of experts employs advanced modeling techniques to accurately predict and evaluate the impact of transient pressure surges, enabling you to mitigate the risks associated with water hammer events and ensure the reliability and longevity of your piping infrastructure.

FINITE ELEMENT ANALYSIS METHODOLOGY

At ASCENT, we harness the power of **Finite Element Analysis (FEA)** to provide advanced engineering design solutions. This method allows us to simulate and analyze complex structures under real-world conditions with exceptional precision. By dividing components into smaller, manageable finite elements, we evaluate stress, strain, and deformation to predict performance, optimize designs, and ensure structural integrity. Our expertise in FEA helps clients mitigate risks, reduce costs, and enhance efficiency, delivering robust and reliable engineering solutions tailored to their specific needs.

- Structural Stress and Strain Analysis
- Fatigue Life Evaluation
- Vibration and Modal Analysis
- Fatigue and Fracture Mechanics
- Buckling Analysis
- Nonlinear Material and Contact Analysis
- Seismic and Blast Load Analysis
- Nozzle Reinforcement Design
- Local Thin Area (LTA) and Corrosion Assessment

OUR PRODUCTS AND SERVICES

STRUCTURE ANALYSIS

At Ascent, we utilize advanced modeling and simulation techniques in ANSYS to accurately predict and evaluate structural behavior under various loading conditions. This enables us to mitigate risks associated with stress concentrations, dynamic loads, and buckling, ensuring the integrity, reliability, and long-term performance of our clients critical structures.

NON LINEAR ANALYSIS

Our specialized team provides advanced **nonlinear FEA analysis** to address complex material behavior, large deformations, or contact interactions critical challenges.

Our methodology covers a wide range of nonlinear phenomena, including material plasticity, hyperelasticity, creep, and advanced contact mechanics. By utilizing cutting-edge simulation tools, we accurately capture real-world conditions, enabling us to optimize designs, prevent failure, and enhance the reliability and safety of your structures and components under the most demanding scenarios.

PRESSURE VESSEL DESIGN

We specialize in delivering comprehensive pressure vessel design solutions in full compliance with **ASME Section VIII, Division 1 and Division 2** standards. Our expertise ensures that each vessel is engineered to withstand internal and external pressures safely and efficiently.

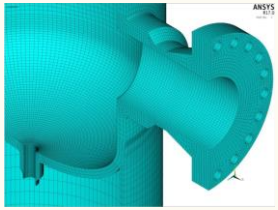
With advanced design methodologies, including detailed stress analysis, fatigue assessment, and optimization of reinforcement for nozzles and supports, we provide tailored solutions that balance performance, safety, and cost-effectiveness. Whether designing new vessels or evaluating existing ones, we help clients achieve regulatory compliance, enhance operational reliability, and extend service life. Trust us to turn complex design challenges into robust, code-compliant results.

OUR PRODUCTS AND SERVICES

ASME SEC VIII DIV.1

Our team of experts utilizes advanced design and analysis techniques to engineer pressure vessels in full compliance with **ASME Section VIII, Division 1** standards. We accurately predict and evaluate the effects of internal and external pressures, ensuring optimal wall thickness, safe nozzle placement, and effective reinforcement design. By addressing key factors such as joint efficiency, corrosion allowances, and allowable stresses, we help you mitigate risks, achieve code compliance, and enhance the safety, reliability, and longevity of your pressure vessel systems.

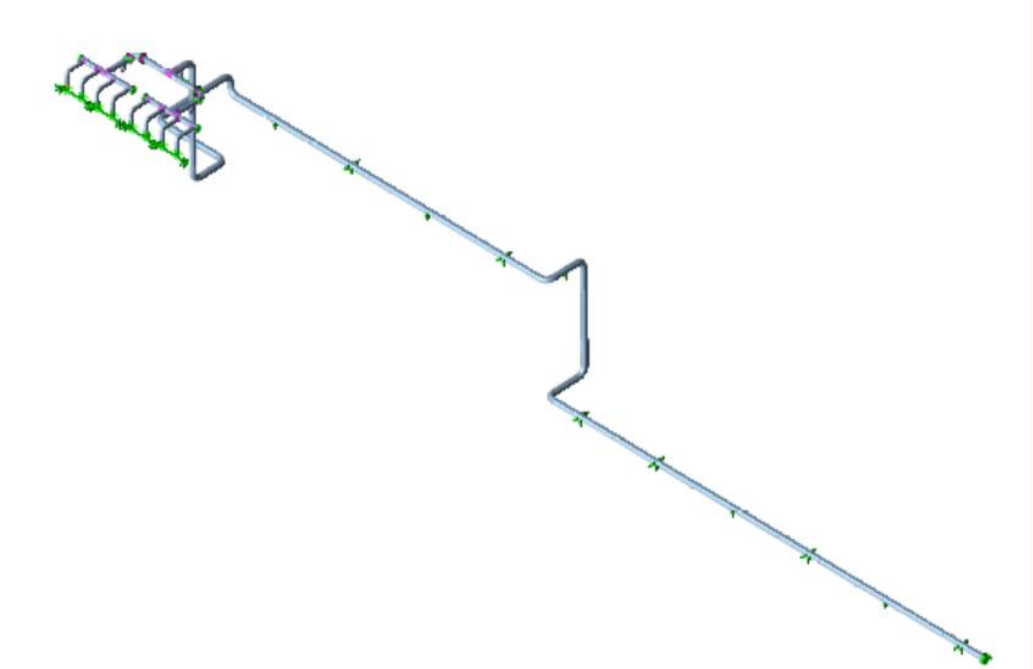
ASME SEC VIII DIV.2



Our team leverages cutting-edge expertise to design pressure vessels in accordance with **ASME Section VIII, Division 2**, focusing on **Part 5 – Design by Analysis (DBA)** methodologies. Using advanced finite element analysis (FEA), we conduct comprehensive evaluations of stresses, fatigue, and buckling to ensure the vessel's performance under complex loading conditions. By applying detailed analysis for local stress, plastic collapse, and cyclic loading, we optimize designs to maximize safety, minimize material usage, and meet stringent code requirements. Trust us to deliver reliable, efficient, and innovative pressure vessel solutions that push the boundaries of engineering excellence.

PROJECT: KASHAGAN FIELD DEVELOPMENT

CLIENT: NORTH CASPIAN OPERATING COMPANY



We have designed the piping system connected to Temperature Swing Adsorber Regeneration Gas Cooler and ensured compliance to ASME B31.3 allowable limits.

The gas was designed to run at a pressure of 105 Bar.G. and a temperature of 315 Deg.C. The specified pipework was constructed of LTCS: A333-6 rated to CL900 RTJ ASME B16.5/B16.47-A.

We determined the pipe stresses for various load cases and documented the forces and moments at the adsorber connections, at pipe anchor points and at supports. We considered a vertical expansion loop to overcome overstresses in strategic locations where it was not possible to reroute the pipes.

We have assessed predetermined trunnions and dummy legs utilizing Kellogg Method to ensure the local stresses are not exceeded to a damaging effect.

Each flange within the system's boundary limits were assessed to Flange Leakage Calculation - ASME III Div 1 NC 3658 to ensure a leak free flange joints against all predefined load cases.

Swing Adsorber Regeneration Gas Cooler allowable Nozzle Loads were evaluated to (API 661) limits.

PROJECT: OFFAHORE METHANOL INJECTION PACKAGE PIPING SYSTEM

CLIENT: Repsol

We have designed the piping system connecting offshore methanol injection package and methanol injection drum to ensured compliance to ASME B31.3 allowable limits.

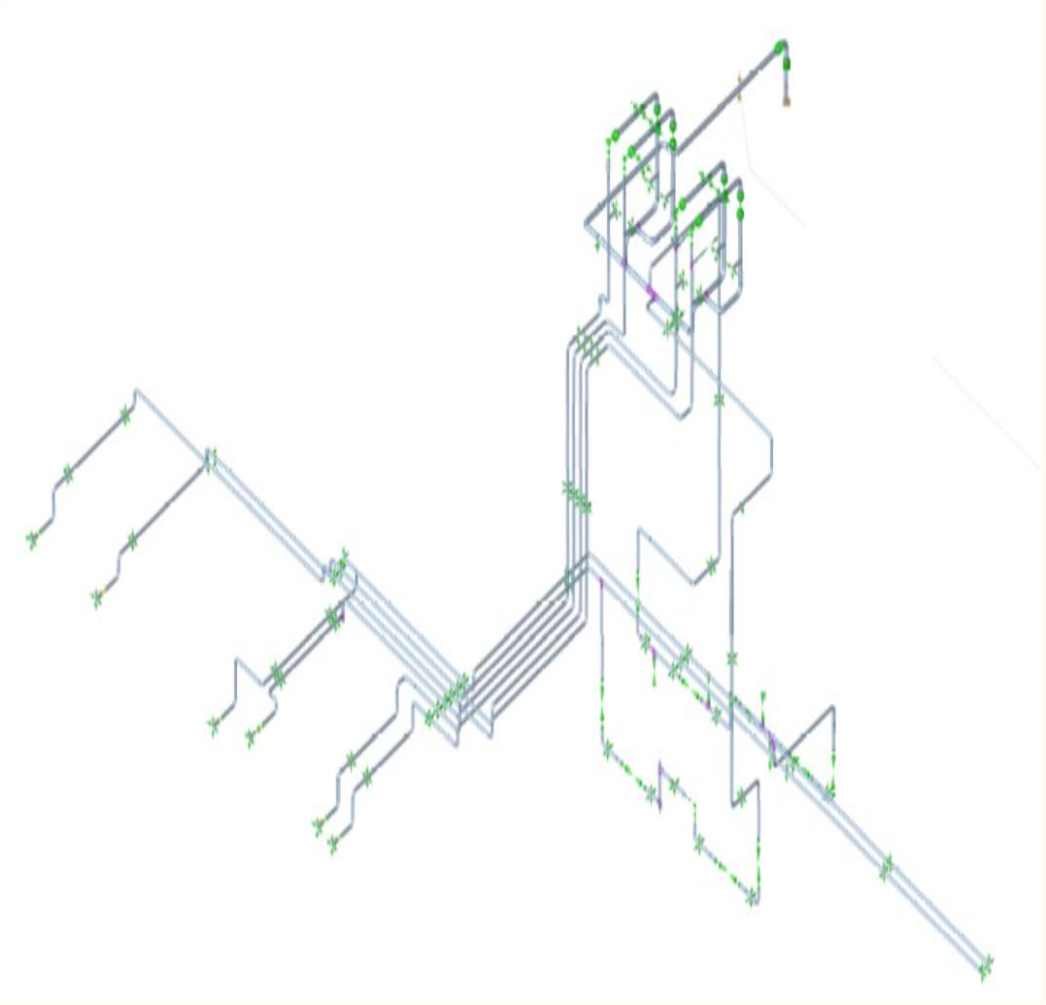
The methanol injection system was designed to run at a pressure of 690 Bar.G. and a temperature of 80 Deg.C. The specified pipework was constructed of A790-UNS S31803-1 rated to API-6A 10K RTJ.

We determined the pipe stresses for various load cases and documented the forces and moments at the Vessel / Shell and Tube Heat Exchanger Nozzle connections, at pipe anchor points and at supports. We considered a vertical expansion loop to overcome overstresses in strategic locations where it was not possible to reroute the pipes.

We calculated PSV (Liquid) Thrust forces which were considered in the analysis to build an acurate and reliable model.

We assessed predetermined trunnions and dummy legs utilizing Kellogg Method to ensure the local stresses are not exceeded to a damaging effect.

Each flange within the system's boundary limits were assessed to Flange Leakage Calculation - ASME III Div 1 NC 3658 to ensure a leak free flange joints against all predefined load cases.



PROJECT: Riyas NGL PKG2 Storage & Export Facilities
CLIENT: TÉCNICAS REUNIDAS

We have designed the piping system connecting offshore methanol injection package and methanol injection drum to ensured compliance to ASME B31.3 allowable limits.

The methanol injection system was designed to run at a pressure of 690 Bar.G. and a temperature of 80 Deg.C. The specified pipework was constructed of A790-UNS S31803-1 rated to API-6A 10K RTJ.

We determined the pipe stresses for various load cases and documented the forces and moments at the Vessel / Shell and Tube Heat Exchanger Nozzle connections, at pipe anchor points and at supports. We considered a vertical expansion loop to overcome overstresses in strategic locations where it was not possible to reroute the pipes.

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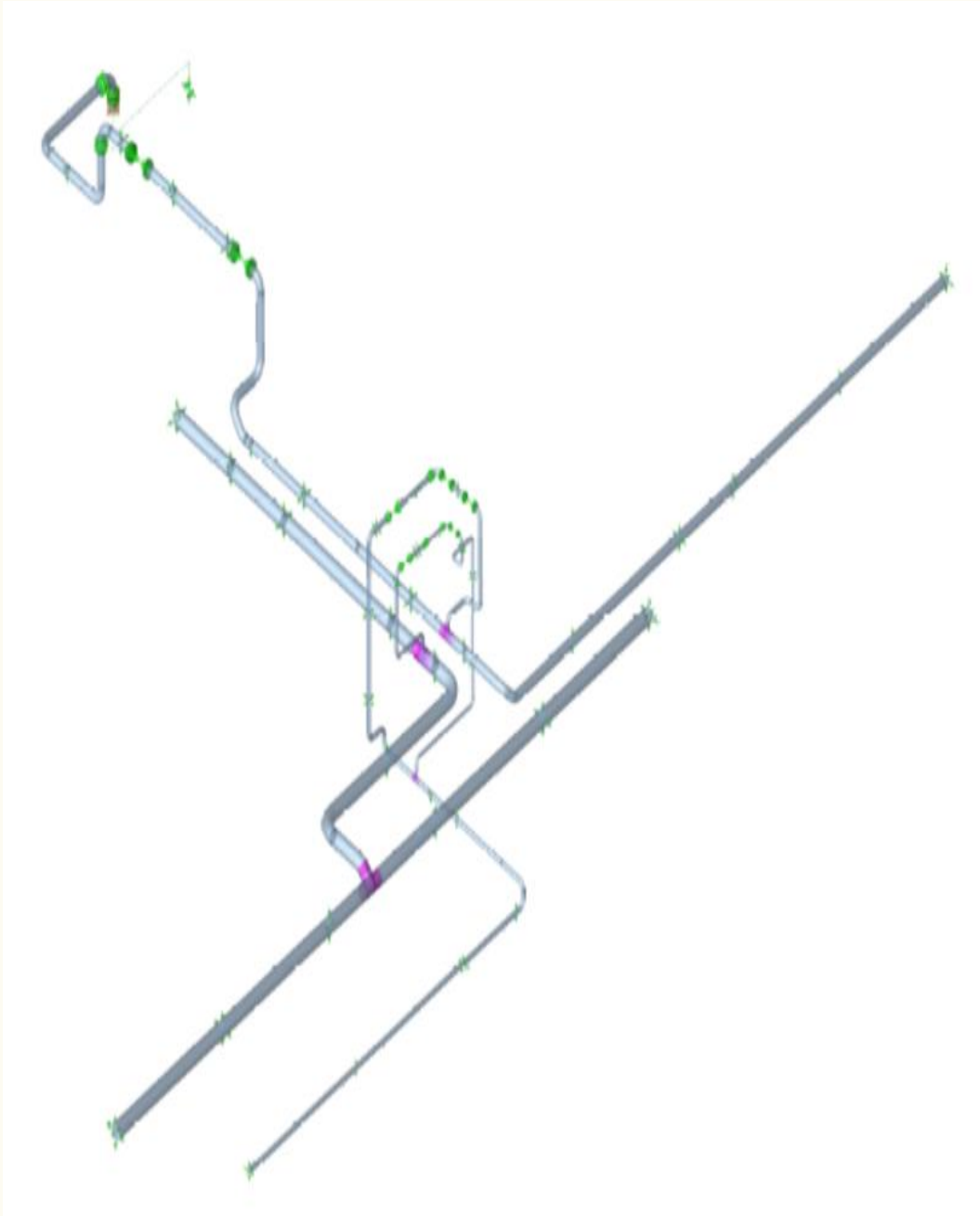


PROJECT: Low Temperature Embrittlement Study
CLIENT: Atlantic Liquified Natural Gas

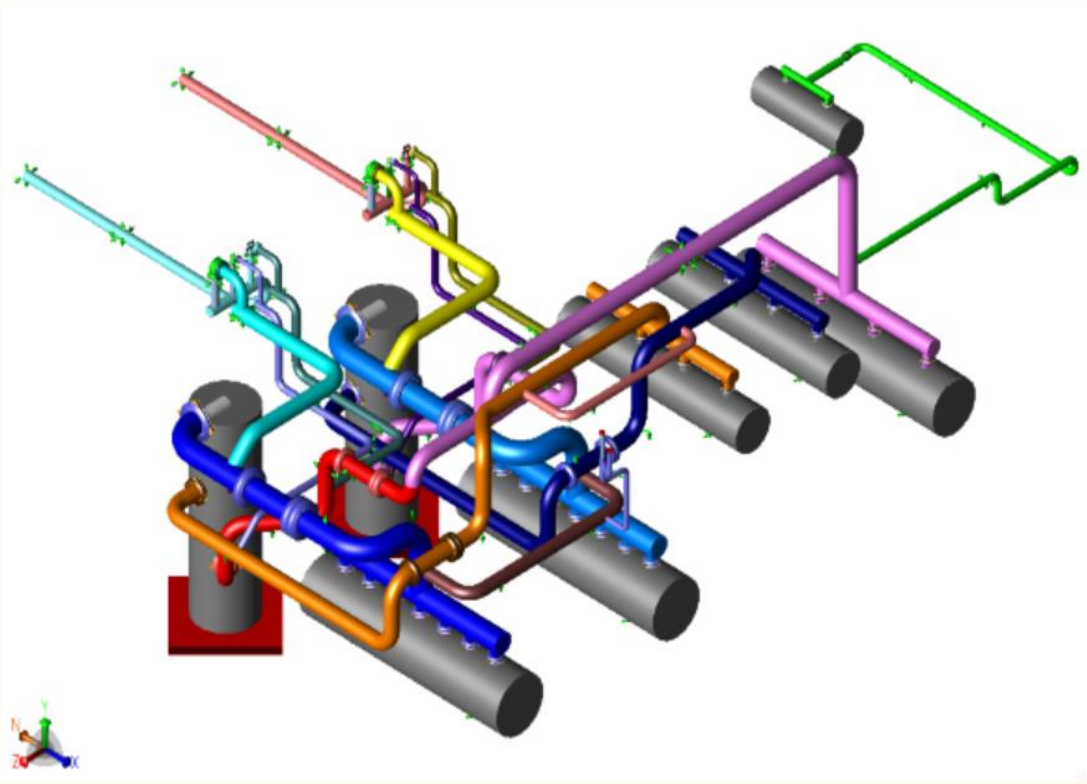
Ascent engineering was requested to conduct a study to identify potential risks of Brittle fracture. The request came following our client recommendation to conduct a comprehensive assessment in compliance to Part 3 of API 579-1/ASME FFS-1 2016.

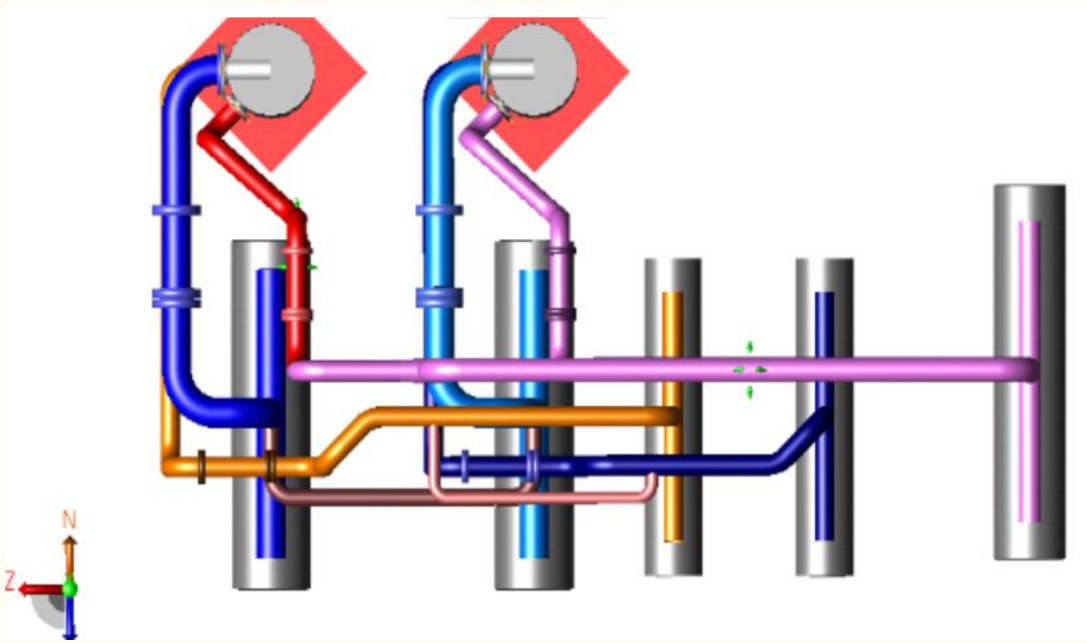
The FFS Level 1 analysis adopted a conservative approach by using the lowest temperature and highest pressure for combined load in the absence of detailed blowdown Pressure/Temperature profiles.

Determination of the combined longitudinal stress ratio SR-3 was based on detailed pipe stress analysis using proprietary Caesar II V12 software. The Caesar models were rebuilt from isometrics and other materials provided by the client.

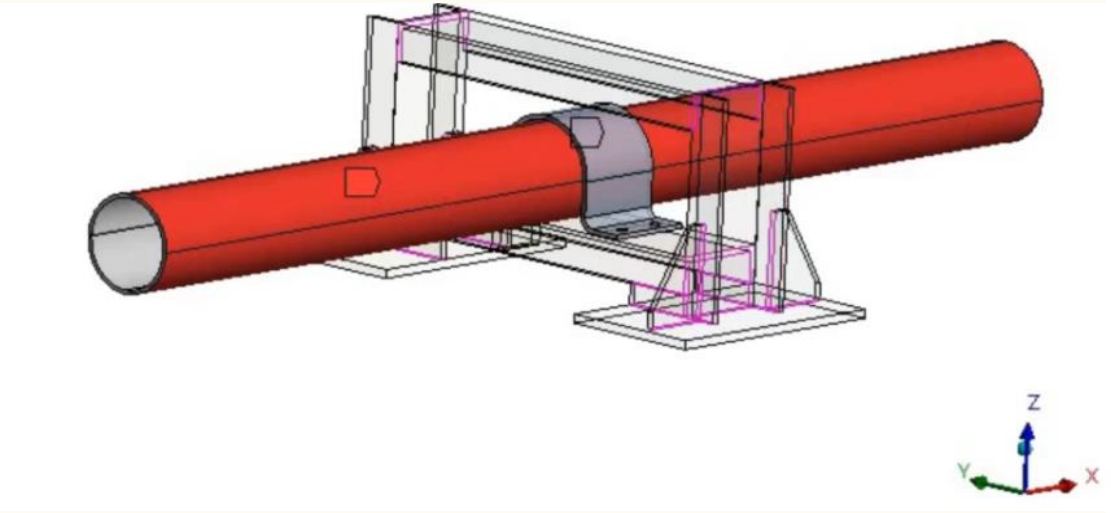
The FFS Level 1 assessment SR1 & SR2 was conservatively determined considering the maximum scenario pressure acting coincidently with the coldest scenario temperature. For the FFS Level 2 analysis; the SR1 & SR2 ratios were determined using coincident temperature and pressure combinations along the blowdown curve.

For lines where the calculated values of SR1 & SR2 does not qualify the material for use at the scenario temperature the line is considered to have failed the FFS Level 1 assessment and no further analysis is required. For lines that pass this step, stress analysis using Caesar II was then performed to obtain the maximum longitudinal stress for the final SR-3 calculation.



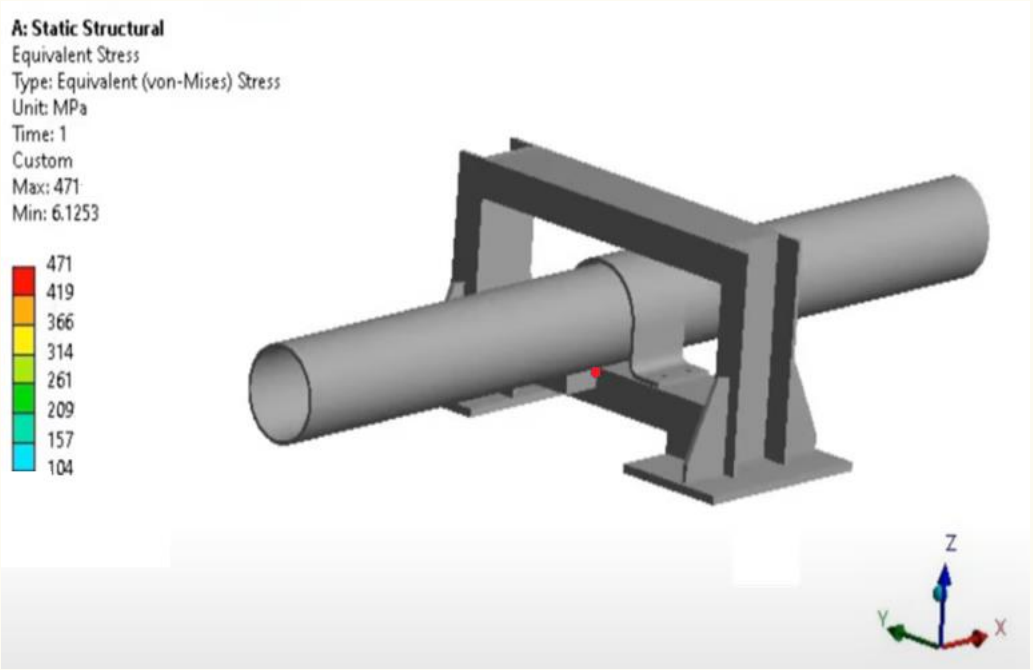


PROJECT: SPECIAL CLAMP SUPPORT DETAILED NONLINEAR ANALYSIS
CLIENT: Técnicas Reunidas



The project involved conducting a detailed non-linear analysis of a clamped piping support system. The support was a critical component in a high-stress piping network, designed to withstand significant thermal, pressure, and vibration loads. The client sought an accurate assessment of the structural integrity under various load conditions, including transient scenarios, to identify potential failure modes. Given the complex geometry of the clamps and the nonlinear material behavior of the support components, a high-fidelity simulation was essential to ensure compliance with industry standards and operational safety.

The challenges in this analysis included accurately modeling the contact interactions between the pipe and the clamps, as these interfaces introduced nonlinearity due to friction and potential separation. Furthermore, the material properties of the clamps required a plasticity model to capture stress-strain behavior beyond the elastic limit. To resolve these challenges, our team leveraged the advanced capabilities of Ansys Workbench. We employed a combination of nonlinear contact formulations and augmented Lagrange techniques to ensure stable and accurate simulations. The material nonlinearity was captured using bilinear isotropic hardening models, validated against material test data. Adaptive meshing strategies were used to manage computational cost. Ultimately, the study provided the client with actionable insights into the support system's performance, enabling design optimization and improved reliability.



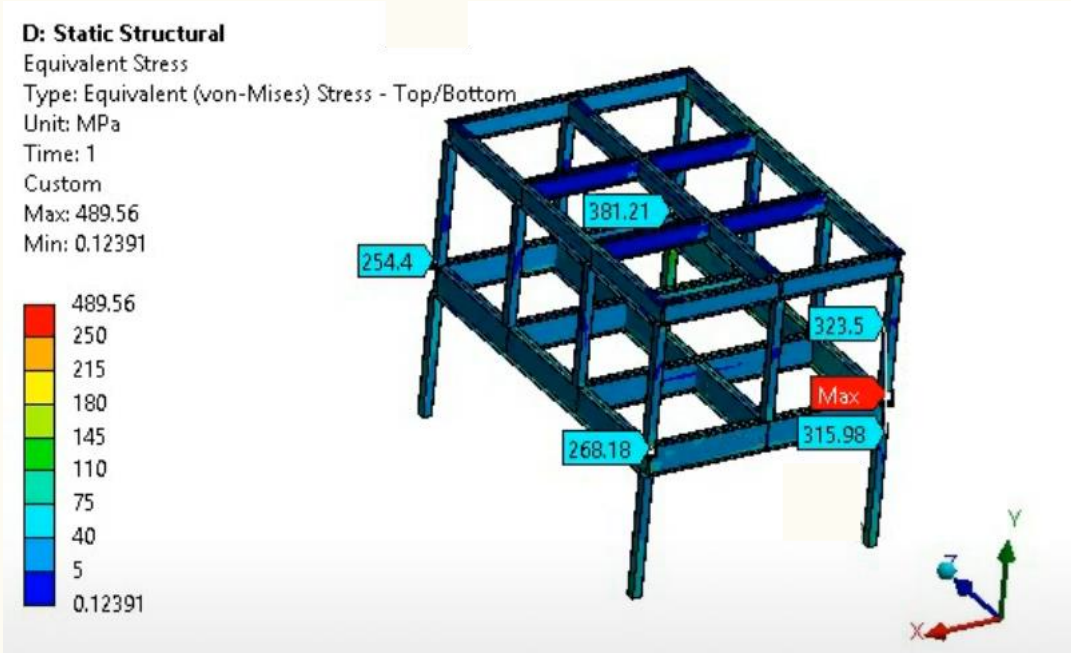
PROJECT: FPSO STRUCTURAL DYNAMIC ANALYSIS

Client: Fluor

The project involved conducting a detailed structural analysis of a Floating Production Storage and Offloading (FPSO) module using Ansys Workbench. The FPSO module is a critical component designed to process, store, and offload hydrocarbons while subjected to complex loading conditions at sea, including wave-induced motions, wind, and operational loads from equipment and piping systems. The client required a comprehensive evaluation of the module's structural integrity to ensure compliance with industry standards, mitigate risks, and enhance the safety and reliability of offshore operations.

The challenges of this analysis included the complexity of simulating the module's behavior under environmental loads, including wave-induced vibrations, and addressing potential fatigue and resonance effects. Achieving convergence in the analysis, particularly in high-stress regions, required careful meshing and load application strategies.

Our team utilized the advanced modeling and simulation tools within Ansys Workbench. Contact interactions and boundary conditions were meticulously defined to replicate real-world operational constraints. For dynamic analyses, harmonic response and transient simulations were performed to evaluate the module's behavior under wave and wind loads. The results were thoroughly validated against industry standards and provided the client with critical insights for design improvements, ensuring the module's robustness and long-term operational safety.



PROJECT: DETAILED DESIGN FOR SLUG CATCHER BOTTOM FILTERS

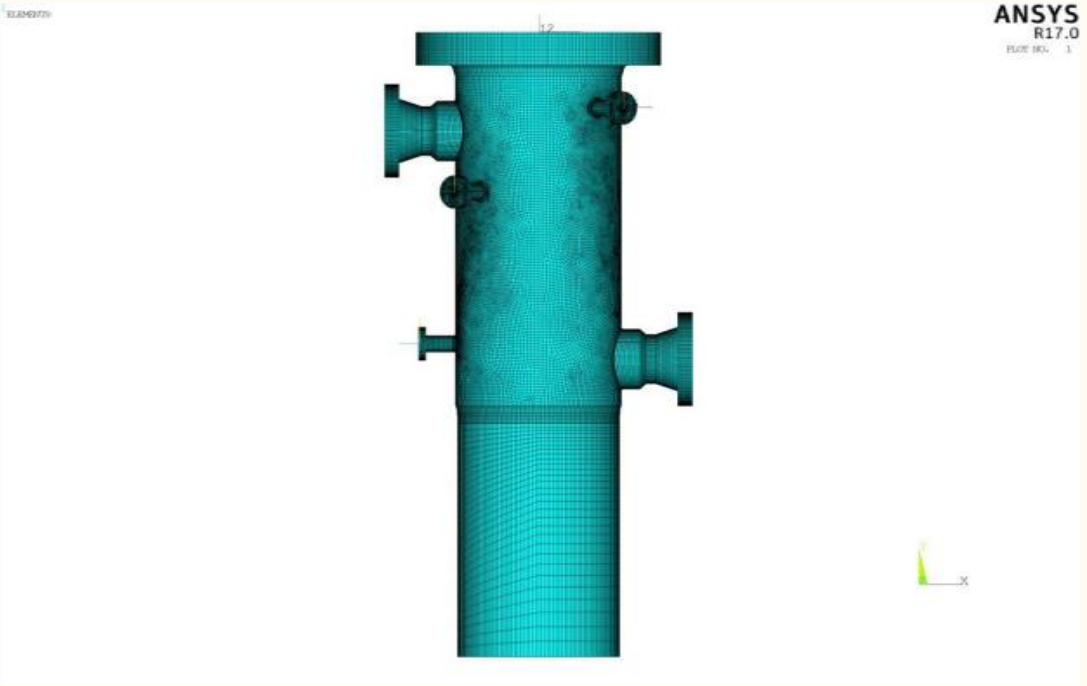
CLIENT: PALL

Ascent Engineering was engaged to design a bottom filter for a slug catcher in compliance with ASME Section VIII, Division 2 Design by Analysis requirements, applying Elastic Stress Analysis procedures. The filter was designed for an operating pressure of 133 barg and a temperature of 80°C.

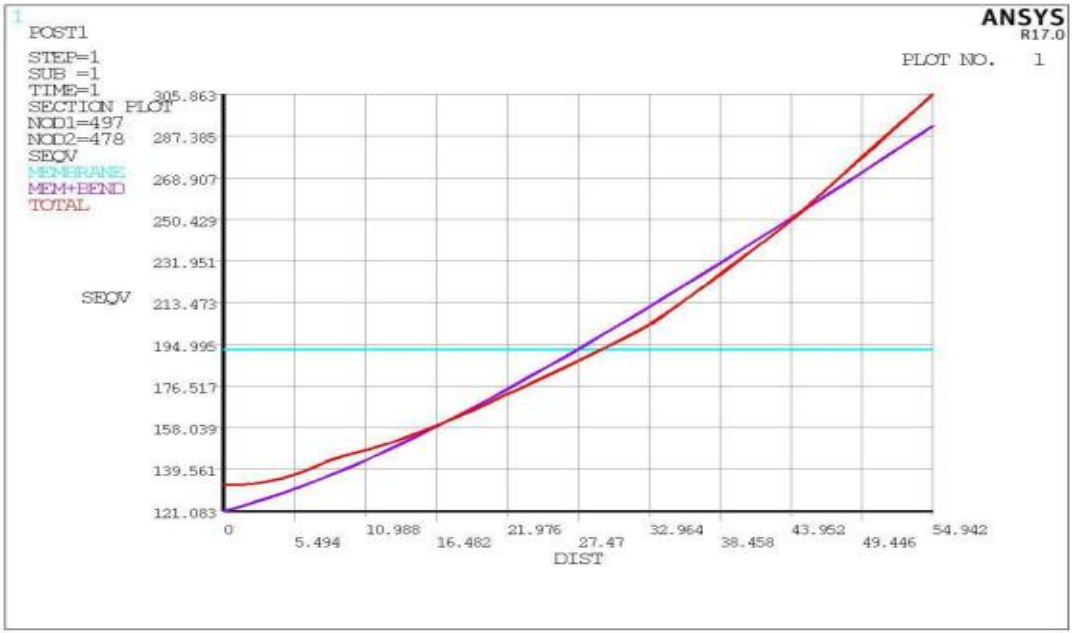
To ensure a robust and code-compliant design, advanced finite element analysis (FEA) techniques were employed. Key aspects of the design included:

- Nozzle N1 and N2 openings exceeding 25% of the cylinder diameter, requiring detailed stress evaluation for local load effects.
- Buckling analysis to verify structural stability under external pressure conditions.
- Flange integrity analysis to confirm adequacy against external loads per design criteria.

By validating each of these critical parameters, Ascent demonstrated a safe, reliable, and optimized solution, reinforcing our commitment to delivering engineering excellence through state-of-the-art analysis capabilities.



Stress Linearization through Neck (SCL-1) For Nozzle N2



OUR CLIENTS

ASCENT HAS A REMARKABLE HISTORY OF SERVING OUR CLIENTS ACROSS THE GLOBE:

- E2G
- Becht
- KBR
- Bechtel
- Thyssenkrupp
- Técnicas Reunidas
- Repsol
- Fluor

WHERE ELSE DO WE EXCEL?

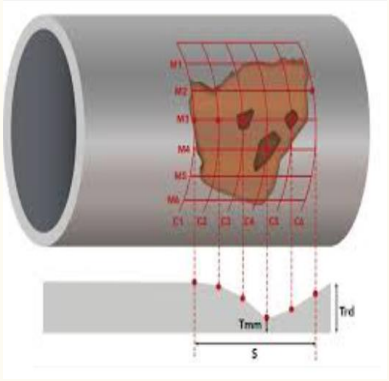
Ascent offers a wide range of services to meet your project needs. Some of our most popular options include:

- Detailed Finite Element Analysis.
- API 579 Fitness for Service Assessment.
- Piping Material Specification.
- Piping Specialty Items and Components Specification.
- Valves Selection and Specifications.
- Special Flange Design and Leakage Determination.
- Avoid Vibration Induced Fatigue Failure in Process Pipework According to EI Guideline.

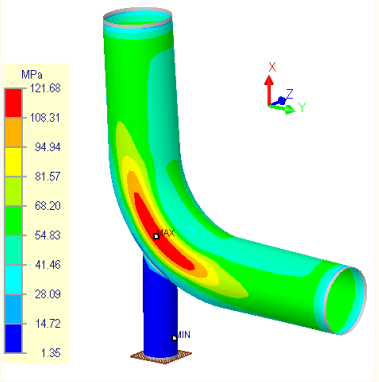
ADDITIONAL SERVICES

At Assent, our mission is to deliver outstanding piping design and analysis services that surpass our clients' expectations. We believe that every project should be a remarkable experience, and we strive to achieve this through innovative solutions, exceptional service, and meticulous attention to detail. We are dedicated to utilizing the highest-quality materials, implementing cutting-edge techniques, and providing unparalleled customer support to ensure the success of every endeavor.

OUR GOAL IS TO MAKE YOUR PROJECT EFFICIENT, SAFE, COST-EFFECTIVE, AND ENVIRONMENTALLY SUSTAINABLE.



API 579 Fitness for Service Assessment



Detailed FEA for Piping Supports