

Piping Layout & Stress Analysis for Ammonia Urea Complex

Key Features

Technology:

AutoCAD 2015

Intergraph CAESAR II

Nozzle Pro

Duration:

The project was completed in 1 month

Deliverables:

1. Piping Stress Reports
2. C2 File
3. Simplified reports for Support design with I-Sections
4. GA drawings, Isometrics, Pipe Support fabrication drawings
5. Bill of Material

The Client

An Indian company specializing in Rural Agricultural & Vinyl Chloride Business, that has manufacturing units for Fertilizer, Chloro-Vinyl, Chloro-Alkali & Cement along with agriculture produce processing facilities like Sugar factories.

The Business Need

The client required Rishabh Engineering to execute a brownfield job, which involved interchange of process piping of two Urea Reactors that were connected in series and the stress analysis of the new layout. The Urea Reactors are a part of an Ammonia-Urea Complex.

Rishabh's Solution

Since the project's scope was critical & challenging having a very specific, restrictive specifications, Rishabh called the senior design engineers for on-site checks and execute piping layout & stress analysis for the Ammonia Urea Complex for the client. The team consisted of 02 members (1 stress engineer & 1 piping designer), with the following scope of work:

- Checking the proposed layout for the line from Urea Mixer to bottom of Reactor B; line from top of Reactor B to bottom of Reactor A; line from Reactor A to the Stage Rectifying Column.
- The arrangement previously was the reverse of the proposed layout, i.e. the piping lines connected the Urea Mixer to the bottom of Reactor A, emerged from the top of Reactor A and into the bottom of Reactor B, followed by line emerging from top of Reactor B to the Stage Rectifying Column.

- Site visits to evaluate the feasibility of piping layout and support at site and flexibility analysis of new and existing piping lines, along with verification of work included in scope provided by client.
- Preparation of GA Drawings, Isometrics, Bill of Material and Pipe Support Fabrication Drawing to suit the existing structure with minimum possible modifications.
- Proposing anchor location near tie-in point and its anchoring details with cement concrete slab or structure (whichever was applicable).
- Provision of Specifications, material of construction and vendor details for proposed spring hangers and its accessories.
- Submission of Stress Analysis & FEA reports to qualify the proposed layout for the brownfield project.
- Evaluation and analysis of each component of the system to calculate the stress and lifecycle of the system.
- Additionally, Rishabh undertook special structural support design and analysis for a guide with cantilever support (having a length of 4meter).

Challenges identified during the project execution:

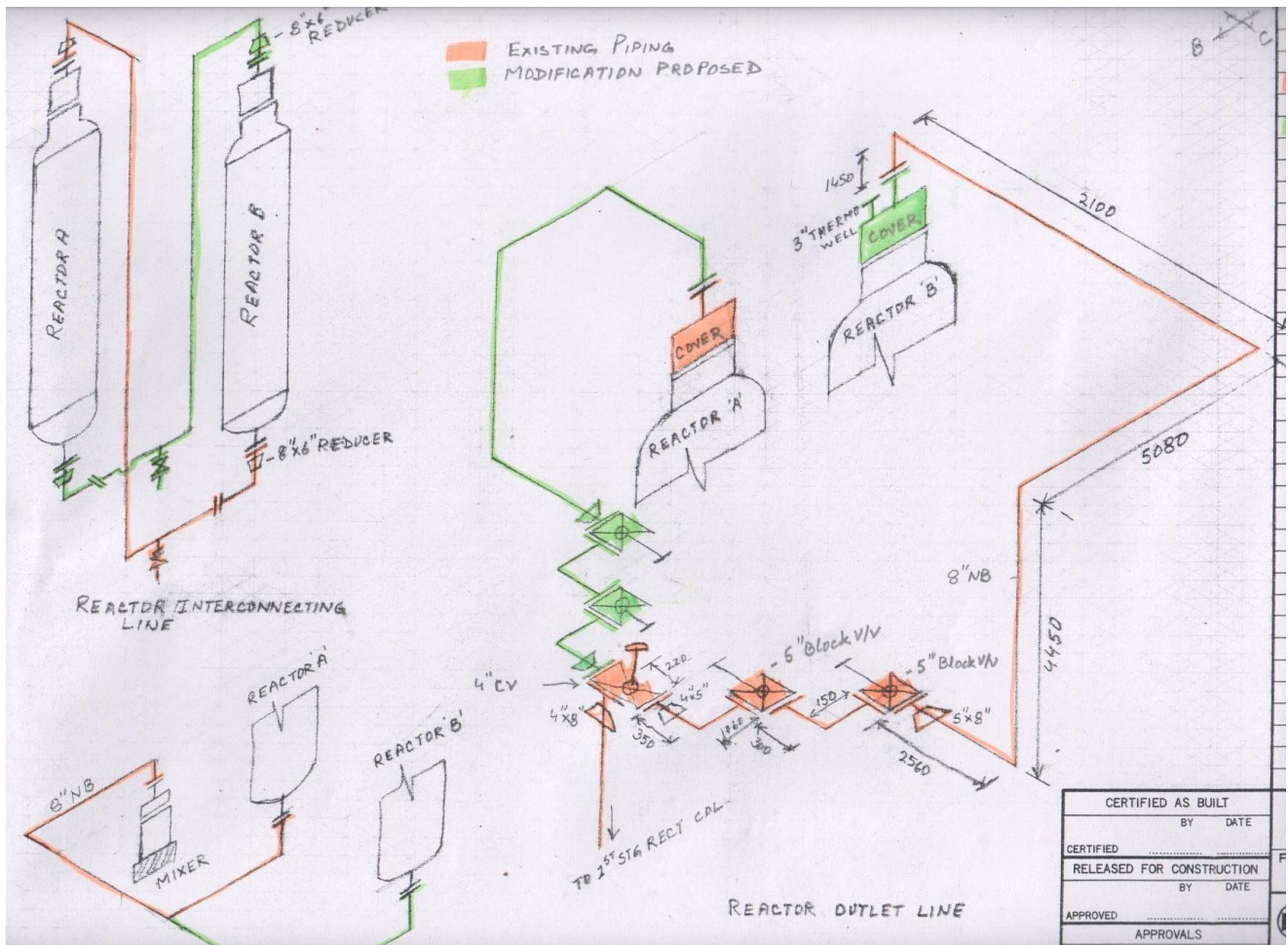
- To deliver accurate analysis and design for an SS 316 Gr. L line (critical service) handling extremely high pressure (225 bar) balancing the support loads, nozzle load qualifications within allowable limits while staying on budget.
- The line consists of highly expensive SS 316 Gr. L material and there was no scope to add to the existing pipe structure due to price constraint. Moreover, being a Brownfield project the new design needed to work within the space originally allocated.
- The existing system used special support structures and specialized forged fittings for which the Stress Intensification Factor (SIF) needed to be manually inputted into the software.
- Since the Urea unit was 20 yrs. old, it used a degenerated and rusted spring hanger support that needed to be redesigned. Unfortunately, the Tag plate was corroded and not visible, so Rishabh had suggested client go with installation of a new spring hanger having specification as per the new analysis with vendor details.

Design and Operating Conditions:

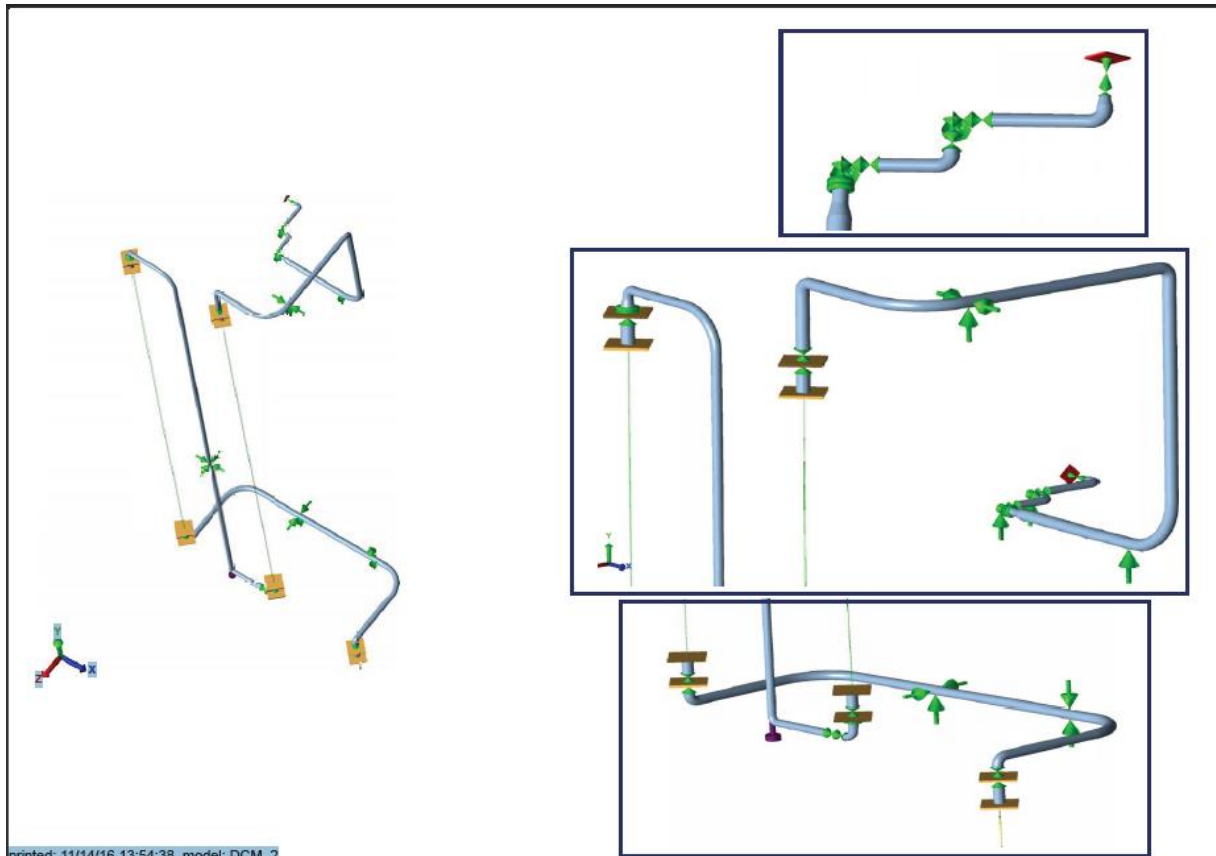
Parameter	Value
Design Pressure	225 bar (3271 Psi)
Design Temperature	200° C (392 °F)
Operating Pressure	196 bar (2844 Psi)
Operating Temperature	190 °C (374°F)
Hydro Test Pressure	338 bar (4907 Psi)
Media	Carbamate, NH ₃ (Liq), CO ₂ (Gas)
Density of Media	1000kg/m ³ (62.43 Lb/ft ³)

Material Specifications:

- Pipe diameter = 6" & 8"
- Pipe Thickness = 24mm to 31 mm
- Codes = UNS S31602, DIN 1.4435 [Material]; ASTM A 312 [Pipe]; A 182 TP SS316L (UG) [Fittings]
- ASTM A 530 & ANSI B36.19 [Dimension]



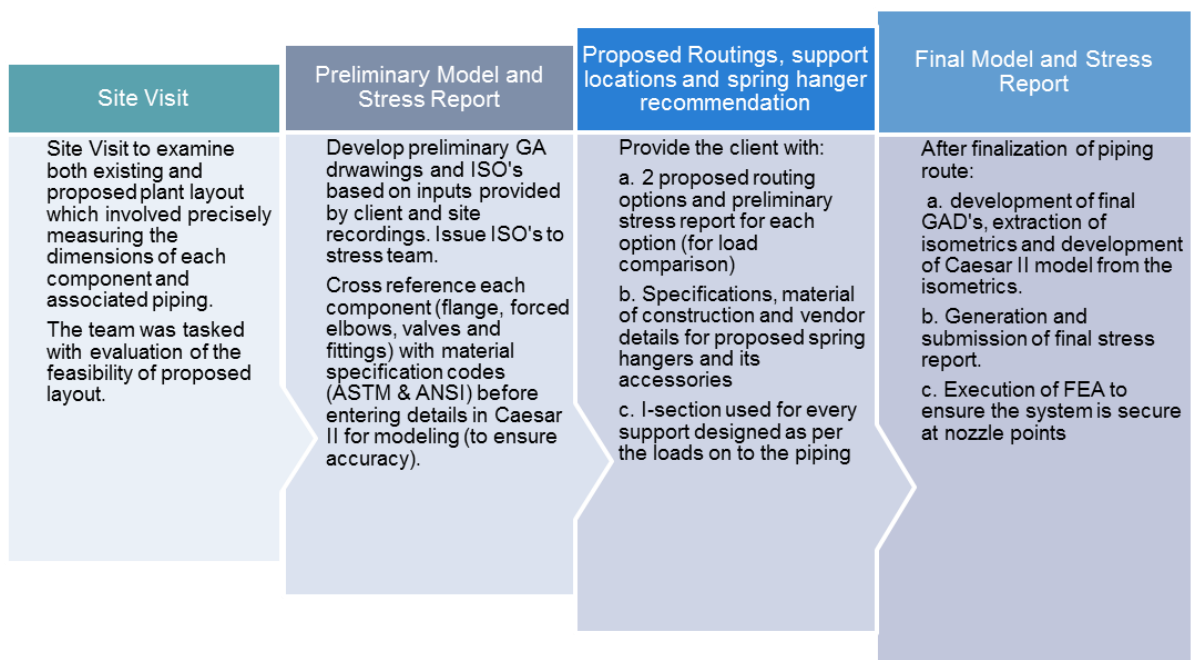
Piping Layout of Ammonia Urea Complex



Stress Analysis for Ammonia Urea Complex

Project Execution Methodology

The project was executed in the following flow:



Technology Used

- 2D Software – AutoCAD 2015
- Stress Analysis Software – Intergraph CAESAR II
- Finite Analysis Software – PRG NOZZLE PRO

Key Deliverables

- Final piping GA Drawings, Isometrics, MTO
- Stress Analysis Report
- Specifications, the material of construction and vendor details for proposed spring hangers and its accessories.
- Simplified reports for Support Design (with I-Sections)
- FEA Report

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About Rishabh Engineering

Rishabh Engineering provides multidisciplinary engineering support services to EPC companies in industries like Oil and Gas, Petrochemical, Power and Water treatment. Our parent company, Rishabh Software is a CMMI level-3, ISO9001 and ISO27001 company that provides services in Software Development, Business Process Outsourcing (BPO) and Engineering Services Outsourcing (ESO) to clients globally. Rishabh has offices in USA, UK and India with their main delivery center in Vadodara, India.