

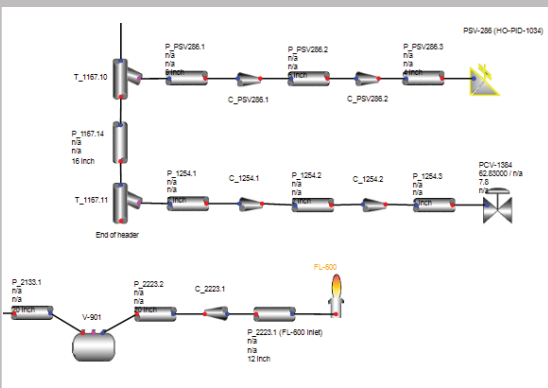
Pressure Relief Device & Flare Studies

ZAP's relief system specialties include PRD sizing, evaluating processes for unprotected equipment, recommending new valves, dispersion screening, flare hydraulics, knockout design, piping design, and pipe stress analysis.



PRESSURE RELIEF DEVICE SIZING

ZAP uses our own proprietary tools as well as publicly available software such as iPRSM to perform detailed analysis of all credible relieving scenarios for relief devices. Findings are used to provide clients with detailed recommendations, including changes to piping and new relief device data sheets ready for quote.

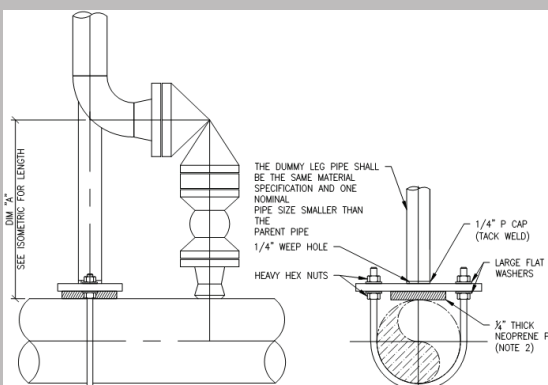
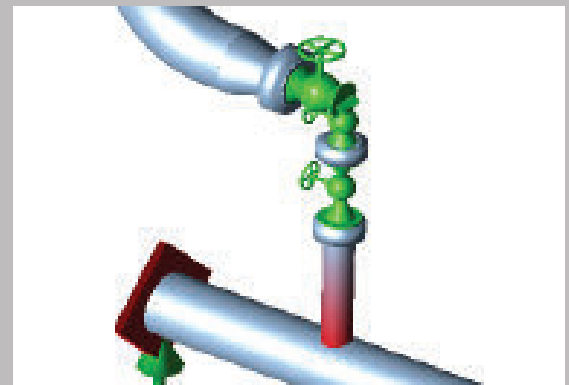


HYDRAULIC MODELING

The entirety of flare systems are modeled to evaluate for hydraulic concerns. Global relief scenarios such as power failure, loss of coolant, or other site-specific scenarios are evaluated to ensure the system is adequate for worst-case scenarios. Data is used to confirm knockout vessel and flare header sizing.

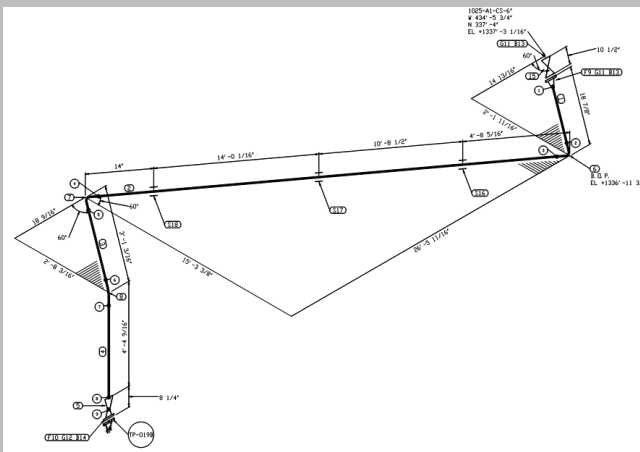
PIPE STRESS ANALYSIS

Existing installations as well as proposed mitigations are evaluated for pipe stress ensuring that relieving conditions do not compromise pipe integrity. CAESAR II software is used for evaluation.



MITIGATION RECOMMENDATIONS

Process engineers work with experienced mechanical and structural designers to ensure practical recommendations are made to mitigate any inadequately protected systems. New valves, piping system changes, or controls modifications are recommended to mitigate inadequacies and operators can take required measures to correct. Additionally, ZAP can develop full construction packages for mitigation.



DETAILED MITIGATION PACKAGES

Optionally, ZAP can develop construction packages with everything needed to mitigate an inadequately protected system including reviews with key stakeholders to implement solutions which will minimize turnover time. This offering can reduce down time by eliminating surprises in the construction phase and can therefore lead to cost savings. Piping design can be relied upon to meet inlet loss and backpressure requirements, avoiding rework.

RELEVANT EXPERIENCE

- ZAP is a voting member of the API Subcommittee on Pressure-Relieving Systems (SCPRS) and sends a designee to participate in the API 520, 521, and 2000 task force meetings. The SCPRS develops and maintains standards and recommended practices covering the sizing, selection, and installation of PRDs.
- Over 6,000 PRDs sized in the last three years.
- Several large relief studies, including a gas plant with approximately 1300 PRDs.
- Multiple relief studies in compressor stations and strong familiarity with turbine compressor stations.
- Relief studies in storage facilities including large tank farms.
- Completed PSV studies in the specialty chemicals industry, including fertilizer facilities.
- Multiple projects executed in the LNG industry including peak-shaving facilities, liquefaction plants, and PSV studies in LNG facilities.
- Familiarity with ammonia terminals, and ammonia specific standards such as the Compressed Gas Association pressure relief valve standards.



PRD DELIVERABLES

- Summary of credible scenarios
- Required & rated relieving rate calculations
- Recommended relief device data sheets
- Protected system critical documentation such as P&IDs and National Board data
- Stress analysis documentation
- Isometrics & BOMs
- Structural drawings
- Flare report including knockout evaluation
- Inlet/discharge hydraulic calculations

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