Stress analysis of an LPG storage tank load line

Foundation settlement, thermal contraction at −30 °C, flashing downstream of a control valve and a high-SIF branch: four effects that pull a tank line in opposite directions, resolved in one EN 13480 model.

PROJECT DATA

Scope	Stress analysis of the piping circuits of an LPG storage tank
Code	EN 13480-3 (metallic industrial piping)
Software	Hexagon CAESAR II, as specified by the client
Operating temperature	−30 °C
Key issues	Tank settlement, roof contraction, flashing-induced vibration, unreinforced branch connections

KEY POINTS

- Agree the permanent and elastic parts of the settlement with the tank vendor before defining load cases.
- Roof-mounted supports move: impose contraction, settlement and roof deflection together.
- Downstream of control valves, screen for flashing-induced vibration and restrain only the directions that need it.
- Check the SIF of unreinforced branches early; with thin headers it can govern the whole line.

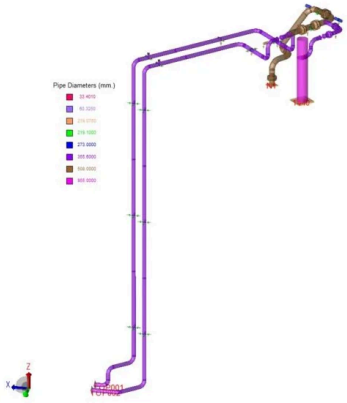


Fig. 1 — LPG tank load line, CAESAR II model coloured by pipe diameter.

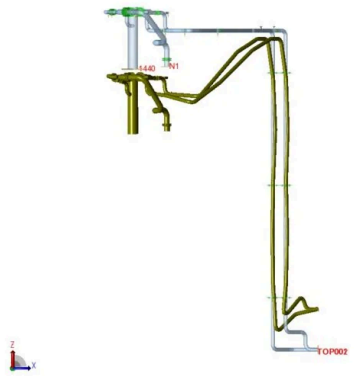


Fig. 2 — Combined deformed shape: tank contraction, foundation settlement and roof deflection.

OUTCOME

The result was a support layout that is stiff where vibration requires it and flexible where contraction and settlement require it, practical to build on the roof structure, and documented in a report that the client could verify point by point. The same approach applies to other software and codes: the studio also works with Bentley AutoPIPE and to ASME B31.3.



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