

Design and Analysis of Belly Mounted LNG Semitrailer

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Abstract

A semitrailer is a type of mobile pressure vessel used for storage and transportation of liquefied natural gas (LNG) at cryogenic temperature. The system includes a mobile chassis, vacuum jacketed vessel to store a gas in its liquid state, a support system for connecting inner vessel to outer vessel, operation box to accommodate piping for loading and unloading purpose. There is vacuum between inner vessel and outer vessel and it is created by insulation of material to prevent warm air from coming in contact of inner vessel.

It is highly necessary to critically design the different components of a cryogenic LNG semitrailer pressure vessel as inner vessel is subjected to pressure of 7 bar and temperature of -1620 C and outer vessel is subjected to ambient temperature and pressure conditions. Various international codes such as ASME, British Standards and Australian Standards are used for designing such pressure vessels also. Analysis of the critical junctions like spoke type supports, longitudinal supports, connection between wings and outer shell and between kingpin support system and outer vessel are required to perform because of its critical application.

The project report include the mechanical design calculations of inner vessel and outer vessel using ASME Section VIII division I and CGA-341, Specification for Insulated Cargo Tank for Non-flammable Cryogenic Liquids respectively. Major components including spoke type, longitudinal supports member, connection between wings outer shell, the junction of kingpin support system and outer vessel are analysed with combined mechanical loading conditions using ANSYS in accordance with CGA-341. The stress analysis of piping is done in accordance with ASME B31.3, Process piping using Bentley Autopipe. The results are found to be safe.