Pipe Stress Analysis of Nitrogen Pipework for Highview Power Storage

Client Confidential, UK

The Problem

Our client was awarded the contract to design, supply and install a new Liquid Nitrogen (LN) tank farm for Highview Power Storage. MMI were appointed to undertake the pipe stress analysis of the the inside battery limits (ISBL) liquid supply and gas balance lines and the associated pipe lines internal to the storage vessel, for the operating and design conditions (i.e. maximum pressure and temperature variations). The scope of work also included structural integrity checks of the associated pipe supports for the imposed pipe reactions.

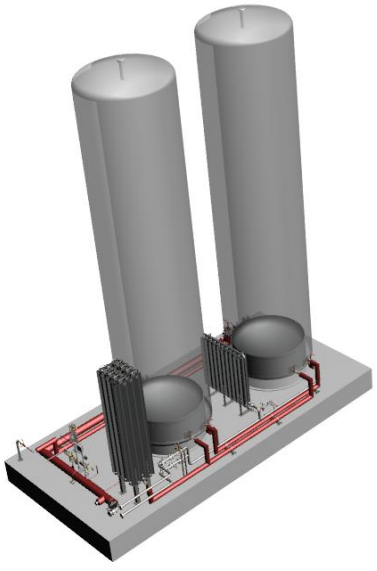
Our Approach

The methodology employed to analyse the nitrogen pipework included reviewing all pipework support drawings in order to accurately capture the support conditions. The pipework was then assessed against the requirements of ASME B 31.3 using a PSA5 model of pipework system. PSA5 analysis results were used to extract pipework support and anchor reactions. The pipework supports were subsequently checked for the applied loads using guidance from BS5950.

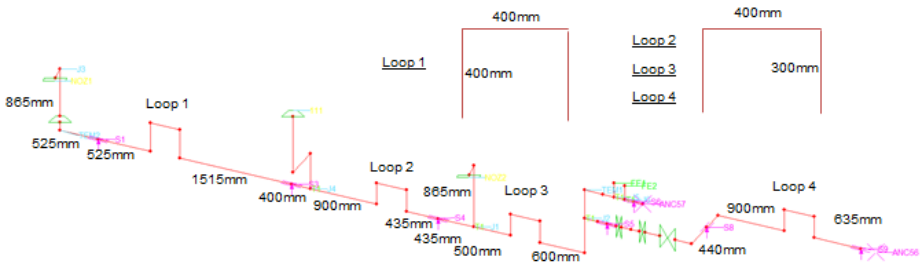
Outcome

The results for the original design indicated unacceptable high stresses within the pipework at gas balance line and liquid supply line. In order to reduce these stresses MMI made a number of recommendations, including:

(1) Add four expansion loops to the gas balance line between supports.
(2) All pipework should be checked on-site to ensure there is a minimum 25mm clearance in all directions.
(3) Add four expansion loops to the liquid supply line.
(4) All supports should be checked on site to ensure all anchor bolts have the minimum allowable edge distance.



Proposed ISBL Arrangement



Recommended Modifications for Gas Balance Line

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