Anti-Freezing thermal analysis of Hydra Device Installation

Industry

Hydra equipment manufacturing industry

Overview

The client, a leading supplier and manufacturer of hydra equipment, wanted to test the appropriate functionality of their product - an underground inline water meter. Finite Element thermal analysis carried out by Hitech FEA specialists showed observed that the water could not freeze and the meter was ‘OK’ to operate at the specified extreme climatic conditions.

Business Needs

- Test and validate functionality of different variants of water meters inline meter boxes
- Assess the possibility of freezing of water in internal piping below ground level having different temperature and pressure than the ambient conditions
- Assessment of presence of ambient air in the box pad

Client

Manufacturer and Supplier of hydra equipment, the U.K.

Challenges

- To replicate extreme weather conditions into Numerical model.
- To obtain proper mesh with simplified geometry, components such as fasteners and others needs to identified
- Distortion of small faces and edges while conversion to FE mesh requires repairing
- Gathering data for physical characteristics of soil as well as surface such as temperature and pressure
- Determining critical situations of temperature and air velocity for studying the effects of freezing of water

Hitech’s Solution

- Hitech project engineers studied the input CAD model received from the client and used FEA approach for thermal analysis of internal piping to predict the temperature inside the meter which is installed underground.
- The analysis indicated that temperature did not fall below the critical value to freeze the water carried by internal piping which confirmed correct operations of inline meters
Hitech’s Advantage

- Correct Approach to model extreme ambient operating conditions into mathematical models.
- Value added design support solutions for product development to build high performance, competitive products.
- Excellent project management skills, scalable execution capabilities, and deep domain expertise.
- State-of-the-art modeling capabilities to restore dated design data, explore design alternatives, and revamp existing designs.
- Global presence: U.S., UK, Australia, and the Middle East.

Approach

- From the inputs received in form of native CAD models, details of fasteners and screws were eliminated for a simple geometry.
- Embossing over the parts were removed to avoid mesh distortion and converted and a simplified mesh.
- Distorted edges and faces were repaired which were damaged during the conversion of native CAD geometry to neutral parasolid formats.
- Different situations of temperature and air velocity for worst condition were considered for parts of the meter above the soil and submerged in soil.
- The study showed that the temperature of soil and water in pipes is nearly same, which eliminated any possibility of water freezing.

Benefit

- Thermal conditions at underground level were studied and results were imposed on the meter box for design testing.
- Identification of water conditions before operation allowed the client to install the meters with guarantee of appropriate readings.
- Design of insulation pad was validated and tested without any physical prototype and reduced costs.
- Physical testing and validation of product requires waiting until winter to replicate the real-world conditions which was eliminated with FE analysis and virtual testing.
- Correctness of meter in all weather conditions with the proposed designs.

Client Speaks

“Our weather conditions are very extreme which caused faulty readings and hassle in the past, but Hitech’s teams helped us turn the tables.”

Results

- Accelerated design cycle and validation time which help client introduce his products early.
- Significant reduction in costs and time consumed.
- No losses because of incorrect reading and ruckus once meters were installed.
- Confirmed elimination of faulty reading of meter because of freezing of water.

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