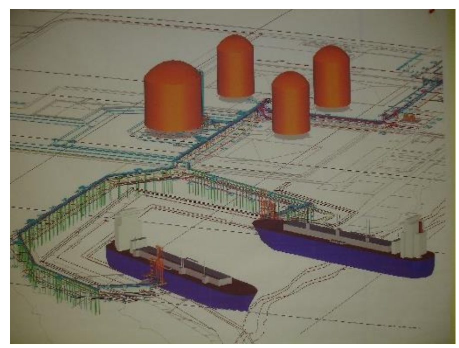
QWIK GUIDE: INSULATION PERFORMANCE AT CRYOGENIC TEMPERATURES

This Qwik Guide examines the performance of typically-used insulants at cryogenic (e.g. liquid natural gas/LNG) temperatures. While there is some movement within Standards organizations (e.g. ASTM and CINI) to require physical properties to be measured at lower temperatures, the majority of insulant physical properties continue to be measured under ambient conditions - - raising obvious questions about their in-situ performance at -265°F.

ASTM C591 (the governing standard for polyisocyanurate) for instance requires thermal conductivity (k-factor) measurements at a range of temperatures from -200°F to +200°F. CINI requires, for select insulants, not only k-factors at LNG temperatures (-265°F), but also compressive strengths. CINI has interestingly thus far decided not to establish standards for aerogel insulants since so little is actually understood about their performance.

When an engineer/specifier evaluates alternative insulants for an LNG application, fortunately the k-factors across the spectrum from the pipe surface to the ambient jacket are increasingly available - - as well as certain other data. Also, fortunately, reputable insulant manufacturers increasingly strive to ensure engineers, decision-makers, as well as software programs such as thickness-calculator 3E Plus® have the most recent brand-specific data - - across the range of temperatures - - verified and audited by independent third-parties. Thus owners and stakeholders can increasingly mitigate risks that unfortunately have occurred due to, for instance, using old data, generic-not-brand-specific data, undisclosed data, and data from insulant test specimens that are not representative of the product delivered.



Yet what happens when a decision-maker has insufficient data? For instance regarding:

- Actual flexibility of elastomeric insulants at cryogenic temperatures
- Resilience of aerogel insulants after compression at cryogenic temperatures (and resultant k-factor degradation)
- Failure risk of cellular glass sealants on LNG pipe
- Dimensional stability of an insulant at -265°F
- Thermal aging at cryogenic temperatures
- And on…

The good news is that decision-makers can depend on two approaches:

1) Empirical evidence: concerns about an insulant's physical properties can likely be negated by decades of successful performance;
2) *Logical thinking*: absent credible data and empirical evidence, stakeholders can still utilize logical extrapolation and challenge insulant suppliers with relevant questions: for instance, one assumes it is logical - - yet is it?
   - to surmise that compressive strength increases as temperature decreases;
   - to deduce that flexibility is reduced at lower temperatures and brittleness increases, yet under what circumstances might the insulant break or shatter;
   - to assume that *thermal aging* essentially stops at LNG temperatures;
   - that Water Absorption does not occur at -265F, yet of course water absorption is presumed to occur when the system is at ambient (e.g. maintenance periods) and then absorbed water turns to ice;
   - to consider which insulant with maximum water absorption per the governing ASTM specification can maintain thermal conductivities within design margins.

Obviously this is a complex discussion, and again we encourage you to read more information at Dyplast.com. Yet the larger point is that given the enormous investments inherent in LNG facilities, and the elasticity of profit margins, more *due diligence* in insulant performance is prudent.

Info@Dyplast.com *www.dyplast.com*
305-921-0100