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Qualification of LNG STS Transfer Flexibles According to Guideline EN1474-II

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Abstract

This paper will describe some lessons learned from the qualification process of 8” cryogenic multi composite hoses for ship-to-ship transfer of LNG. The available guideline for certifying transfer hoses is the EN1474-II. In addition to this guideline, which was preliminary at the time of use, many other issues need to be detailed and until now leave room for further interpretation.

TNO proposed a multilevel test program combined with developing models that predicts the behavior of the hose system. The test program showed some remarkable results related to the mechanics of the hose. For example the hysteresis provides a damping mechanism for vibrations due to internal and external sources. Also extreme high damage tolerance behavior, in incidents the hose provides a high level of residual safety. The remaining burst pressure is still exceeding the burst pressure requirements of an undamaged hose and no jetting occurs.

With a full scale LNG flow test the flow behavior of the hose is extensively tested. For example the maximum flow of 1500 m³/h has been shown during this test and did not lead to unacceptable pulsation or vibration levels. The prediction model for the friction factor of the 8-inch hose, based on tests at ambient temperature with water, shows the correct trend. The pressure loss depends on the internal pressure in the LNG flow test, which shows the added value of this LNG Flow test.

The gained experience let to a number of recommendations for other LNG qualification projects. For example we recommend to combine tests with analyses to reduce the amount of testing for the complete transfer system and to be able to reapply the result for other configurations. Further specification of requirement than what is described in the EN standard is needed (e.g. excessive vibrations, what is stiffness, permeability). As long as further specification of the test is not provided in standards involvement in the definition of the test program of equipment supplier, end user, certifier and independent research contractor is needed. Finally the results proved that LNG test are still inevitable for flow equipment qualification and model validation.

Introduction

Dynamic transfer of LNG from ship-to-ship is seen as one of the enabling technologies to support a possible LNG supply chain offshore. LNG supply to regasification vessels or the offloading of a floating LNG production unit in the near future must be able to be performed under all weather conditions. The latter has made it necessary to develop alternatives to rigid loading arms, with an additional need for testing and certification. New transfer technologies and methods have to guarantee maximum terminal availability without making concessions to safety and operability. This paper will describe some lessons learned from the qualification process of 8” cryogenic multi composite hoses for ship-to-ship transfer of LNG.

Gutteling, a Dutch manufacturer of flexible composite hoses, and Exmar, a Belgium based shipping company that operates various LNG vessels, have addressed the challenge to justify the safe and reliable operation of a hose