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Determination of the resistance to cryogenic spillage of insulation materials —

Part 3: Jet release

Détermination de la résistance des matériaux d'isolation thermique suite à un refroidissement cryogénique —

Partie 3: Émission sous forme de jet

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 9, *Liquefied natural gas installations and equipment*.

A list of all parts in the ISO 20088 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The test is intended to be, as far as practicable, representative of a potential accidental pressurized release of cryogenic liquid natural gas (LNG) manufactured in industrial plants. The test includes:

a) an initial enhanced cooling effect due to the momentum driven liquid contact with the substrate;

b) a localized force that may be expected in a cryogenic jet release.

This test is designed to give an indication of how cryogenic spill protection systems will perform when subjected to a sudden cryogenic jet release.

The dimensions of the test specimen might be smaller than typical items of structure and plant. The liquid cryogenic jet mass flow rates can be substantially less than that which might occur in a credible event. However, the thermal and mechanical loads imparted to the cryogenic spill protection systems from the cryogenic jet release, described in this document, are representative of a cryogenic LNG jet release with hole size 20 mm or less and release pressure less than or equal to 6 barg.

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CAUTION — The attention of all persons concerned with managing and carrying out cryogenic spill tests is drawn to the fact that liquid nitrogen testing can be hazardous and that there is a danger of condensing liquid oxygen (fire/explosion), receiving a 'cold burn' and/or the possibility that harmful gases (risk of anoxia) can be evolved during the test. Mechanical and operational hazards can also arise during the construction of the test elements or structures, their testing and disposal of test residues. An assessment of all potential hazards and risks to health shall be made and safety precautions identified and provided. Appropriate training and Personal Protection Equipment shall be given to relevant personnel. The test laboratory is responsible for conducting an appropriate risk assessment in order to consider the impact of liquid and gaseous nitrogen exposure to equipment, personnel and the environment.

1 Scope

This document describes a method for determining the resistance of a cryogenic spill protection (CSP) system to a cryogenic jet as a result of a pressurized release which does not result in immersion conditions. It is applicable where CSP systems are installed on carbon steel and will be in contact with cryogenic fluids.

A cryogenic jet can be formed upon release from process equipment operating at pressure (e.g. some liquefaction processes utilize 40 to 60 bar operating pressure). Due to high pressure discharge, the cryogenic spillage protection can be compromised by the large momentum combined with extreme cryogenic temperature.

Although the test uses liquid nitrogen as the cryogenic liquid, the test described in this document is representative of a release of LNG, through a 20 mm orifice or less, at a release pressure of 6 barg or less, based upon simulated parameters 1 m from the release point. Confidence in this test being representative is based upon a comparison of the expected dynamic pressure of the simulated release in comparison with dynamic pressure from releases in accordance with this document.

It is not practical in this test to cover the whole range of cryogenic process conditions found in real plant conditions; in particular the test does not cover high pressure cryogenic jet releases that might be found in refrigeration circuits and in LNG streams immediately post-liquefaction.

Liquid nitrogen is used as the cryogenic medium due to the ability to safely handle the material at the pressures described in this document. The test condition is run at nominally 8 barg pressure.

ISO 20088-1 covers cryogenic release scenarios which can lead to pooling conditions for steel work protected by cryogenic spill protection as a result of a jet release or low pressure release of LNG or liquid nitrogen. ISO 20088-2 covers vapour phase exposure conditions as a result of a jet release or low pressure release of LNG or liquid nitrogen.

2 Normative references

There are no normative references in this document.

