DRAFT INTERNATIONAL STANDARD

ISO/DIS 20088-1

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Determination of the resistance to cryogenic spillage of insulation materials —

Part 1:
Liquid phase

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

ICS: 75.200

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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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. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

ISO 20088 Part 1 was prepared by Technical Committee ISO/TC 67, Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries, JWG 13 Resistance to cryogenic spillage.

Further parts of the ISO 20088 are planned for future publication:

Part 2 – Vapour phase;

Part 3 – High pressure jet release.

Introduction

The test described in the procedure described in this part of ISO 20088 is one in which some of the properties of cryogenic spillage protection materials can be determined. This test is designed to give an indication of how cryogenic spillage protection materials will perform in a sudden exposure to cryogenic liquid.

The dimensions of the test specimen can be smaller than typical items of structure and plant and the release of liquid can be substantially less than that which might occur in a credible event. However, individual thermal and mechanical loads imparted to the cryogenic spillage protection materials, from the cryogenic spillage defined in the procedure described in this part of ISO 20088, have been shown to be similar to those by large-scale cryogenic spillage.

Determination of the resistance to cryogenic spillage of insulation materials - Part 1: Liquid

CAUTION — the attention of all persons concerned with managing and carrying out cryogenic spillage test is drawn to the fact that liquid nitrogen testing can be hazardous and that there is a danger of 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 shall be identified and provided. Appropriate training shall be given to relevant personnel.

1 Scope

This part of ISO 20088 describes a method for determining the resistance to liquid cryogenic spillage on Cryogenic Spillage Protection (CSP) systems. It is applicable where CSP systems are installed on carbon steel and will be in contact with cryogenic fluids.

Liquid nitrogen is used as the cryogenic medium since it has a lower boiling point than liquid natural gas or liquid oxygen. Additionally, it can be safely used for experiment.

Future parts of the standard will cover vapour phase and high pressure jet exposure conditions.

The test laboratory is responsible to conduct an appropriate risk assessment according to local regulation in order to consider the impact of liquid and gaseous nitrogen exposure to equipment and personnel.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 630-1, *Structural steels – Part 1: General technical delivery conditions for hot-rolled products.*

ISO 845, *Cellular plastics and rubbers -- Determination of apparent density*

ISO 8301, *Determination of steady-state thermal resistance and related properties -- Heat flow meter apparatus.*

ISO 22899-1, *Determination of the resistance to jet fires of passive fire protection materials Part 1: General Requirements.*

EN 10029, *Tolerances on dimensions, shape and mass for hot rolled steel plates 3mm thick or above.*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
Floating Liquid Natural Gas
FLNG
floating liquid natural gas facilities such as LNG-FPSO (floating production storage and offloading), LNGFSRU (floating storage and re-gasification unit)

3.2
Cryogenic spill
cryogenic spill in relation to this standard is defined to be the unintended exposure to cryogenic liquid (CL) at -196°C

3.3
Cryogenic spill protection
CSP
coating or cladding arrangement, or free-standing system which, in the event of a cryogenic spill, will provide thermal protection to restrict the heat transfer rate of the substrate

3.4
limiting temperature
minimum temperature that the equipment, assembly or structure to be protected may be allowed to reach

3.5
release point
assembly from which the cryogenic fluid flows out

3.6
sponsor
person or organization who/which requests a test

3.7
specimen owner
person or company that holds/produces a material to test

4 Test configurations

4.1 General

There is one basic configuration under which the test can be conducted. This is a liquid configuration where the material to be tested is rapidly exposed to liquid nitrogen in a pool at a temperature of -196°C. For reasons of clarity, flexible hoses used for fume extraction are not shown in figures 1 to 4 below.

4.2 Sample holder

Samples will be tested in a sample holder with exact dimension as specified in ISO 22899-1.

5 Construction of the test items and substrates

5.1 General

The key items required for the test are

- a liquid nitrogen injection point,
- a sample holder;
- the insulation part.

It is important to reduce vapour generation during the liquid nitrogen dumping. Flexible hoses are to be used without forced ventilation.

5.2 Material

The material normally used is a 10 mm thick steel plate complying with ISO 630-1, Grade Fe 430. An all welded construction shall be used and all welds shall be 5 mm fillet and continuous unless otherwise stated. All dimensions are in millimetres and, unless otherwise stated, the following tolerances shall be used:

— whole number ±1,0 mm;

— decimal to point ,0 ± 0,4 mm;

— decimal to point ,00 ±0,2 mm;

— angles 0’ 30”;

— radii 0,4 mm.

5.3 Injection set-up

The liquid nitrogen is contained within a tank of a constant surface area of 0,5625m^2 either a square base of 750mm or circular base of 846mm diameter. The release orifice shall be 100 mm in diameter.

When there is 250 l of non-boiling liquid nitrogen within the tank, the test is ready to start. The injection tank shall be constructed of cryogenic resistant stainless steel and insulated with flexible aerogel blanket if necessary.

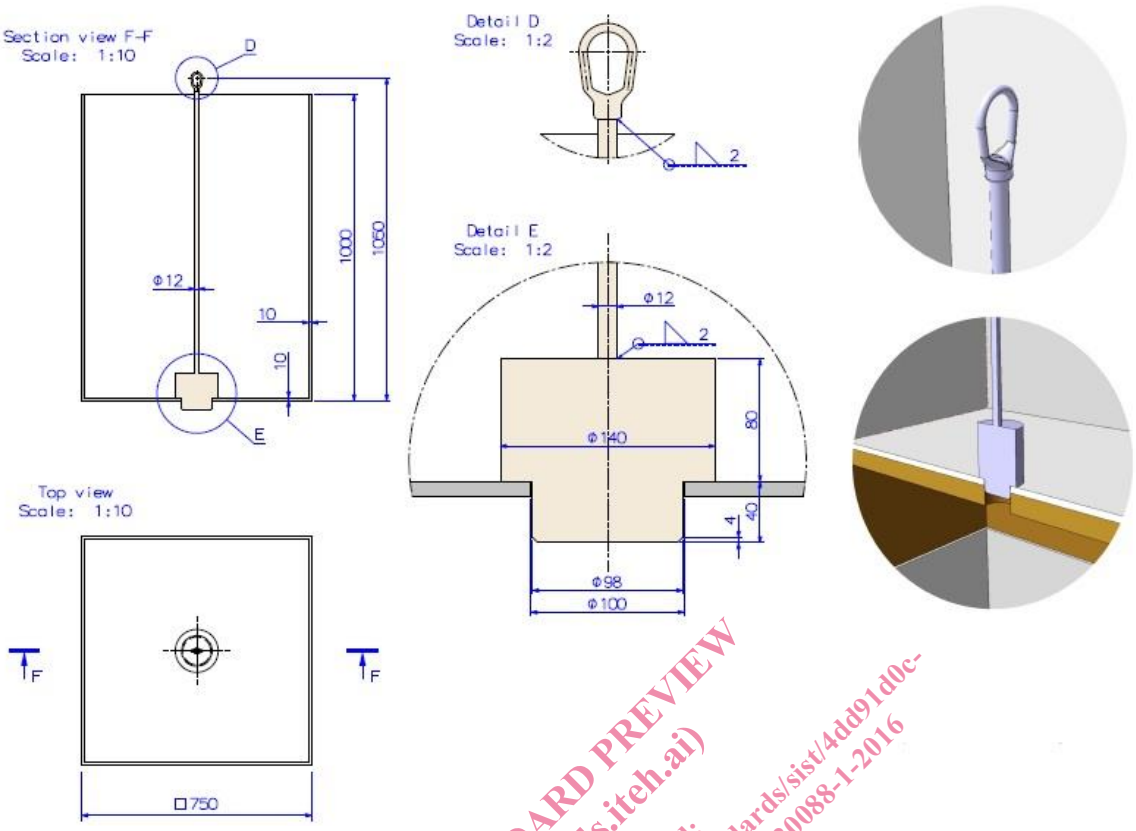

Figure 1 — Layout of a square release tank

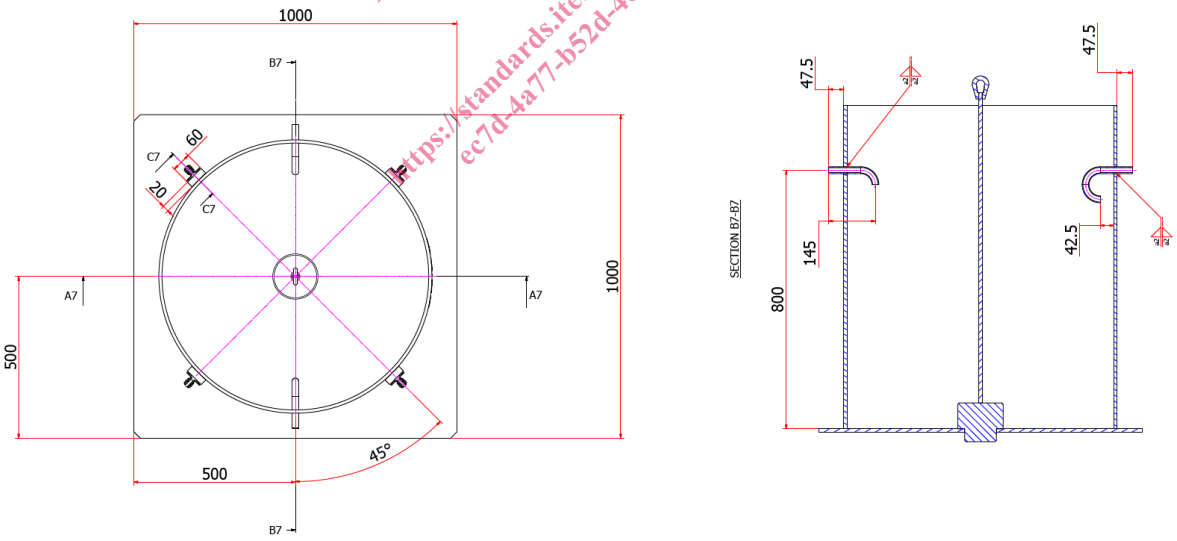

Figure 2 — Layout of a cylindrical release tank

5.4 Specimen support

A square generic support will be used to hold the test sample. It shall be constructed with 10mm carbon steel. The centre of the table is hollow and will receive the sample holder as shown in Figure 3.

