

Cryogenic vessels — Methods for performance evaluation of thermal insulation

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British Standard

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National foreword

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English version

Cryogenic vessels — Methods for performance evaluation of thermal insulation

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de la performance de l'isolation thermique

Kryo-Behälter — Verfahren zur Bewertung des
Wärmedämmvermögens

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CEN

European Committee for Standardization
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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 268, Cryogenic vessels, the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an indetical text or by endorsement, at the latest by May 1999, and conflicting national standards shall be withdrawn at the latest by May 1999.

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Introduction

Traditionally in Europe, there have been different ways of defining the insulation performance. A requirement exists therefore to harmonize such methods of evaluating insulation performance for different cryogenic vessels.

To aid the understanding of this standard, see the logic diagram in Figure 1.

1 Scope

This standard defines a practical method for determining the heat leak performance of cryogenic vessels. The methods include measurement on both open and closed systems.

This standard neither specifies the requirement levels for insulation performance nor when the methodology defined is applied. These requirements may be defined in design or operational standards/regulations.

2 Definitions

For the purpose of this standard, the following definitions apply.

2.1

open system

during test, a system is considered open when it is kept at a constant pressure (e.g. atmospheric pressure) and when the gas produced by the evaporation of the test fluid is continuously released to the atmosphere

2.2

closed system

during test, a system is considered closed when the mass of the contents is kept constant with no input or output of product

2.3

heat leak performance

the quantity of heat transferred per unit time from the ambient air to the contents of the inner vessel

NOTE In an open system the heat leak causes a loss of product. In a closed system it causes a rise in pressure.

2.4

holding time, open system

the time expected to elapse from initial filling level until the vessel is empty (no more liquid), calculated from heat leak data

2.5

holding time, closed system

the time elapsed from establishing the initial filling condition until the pressure has risen, due to heat leak, to the set pressure of the pressure limiting device

NOTE A pressure limiting device is either a safety valve or a rupture disc or a back pressure regulator or any other device installed to limit the system pressure under normal operating conditions.

2.5.1

equilibrium holding time

the holding time calculated from a specified heat leak assuming that liquid and vapour are constantly in equilibrium

2.5.2

optimum equilibrium holding time

the equilibrium holding time calculated from heat leak data for a vessel when filled with the quantity of product giving the longest holding time

2.5.3

static experimental holding time

a) when the critical pressure is greater than the set pressure of the limiting device, the holding time of a closed system measured on a stationary vessel filled with a quantity of product which is calculated to fill the tank to its gross volume without hydrostatic deformation, with saturated liquid at the set pressure of the pressure limiting device

b) when the critical pressure is less than the set pressure of the limiting device, the holding time of a closed system measured on a stationary vessel initially filled with the least mass of the specified product determined as follows:

— the maximum allowable mass of filling;

or

— the quantity of product which fills the vessel to its gross volume, without hydrostatic deformation, with liquid saturated to 99 % of its gross volume at the critical pressure.

3 General conditions for all methods

The measurements described in this standard shall be carried out under the following conditions.

3.1 The cryogenic fluid used for testing shall be chosen by the manufacturer. Liquid nitrogen should normally be used except in cases where the vessel to be tested is designed for a specific cryogenic fluid.

3.2 The liquid and gaseous phases shall be in equilibrium at the beginning of a test. When a test is carried out at a higher pressure than one bar gauge, it is important that the liquid equilibrium pressure is not lower than this test pressure.

3.3 The test environment shall be stable and constant during the test. It shall be as close as possible to the following reference conditions:

— ambient temperature: 15 °C;

— atmospheric pressure: 1 013 mbar.

For products except carbon dioxide and nitrous oxide:

— vessel reference pressure: 1 013 mbar.

For carbon dioxide and nitrous oxide:

— vessel reference pressure: 15 bar (gauge).