SLOVENSKI STANDARD
SIST EN 13160-2:2003

01-december-2003

Sistemi za kontrolo tesnosti - 2. del: Tlačni in vakuumski sistemi

Leak detection systems - Part 2: Pressure and vacuum systems

Leckanzeigesysteme - Teil 2: Über- und Unterdrucksysteme

Systemes de détection de fuites - Partie 2: Systemes en pression et en dépression

Ta slovenski standard je istoveten z: **EN 13160-2:2003**

ICS:

23.020.01	Vsebniki za shranjevanje tekočin na splošno	Fluid storage devices in general
23.160	Vakumska tehnologija	Vacuum technology

SIST EN 13160-2:2003 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13160-2

May 2003

ICS 23.020.01; 23.040.99; 29.260.20

English version

Leak detection systems - Part 2: Pressure and vacuum systems

Systèmes de détection de fuites - Partie 2: Systèmes en pression et en dépression

Leckanzeigesysteme - Teil 2: Über- und Unterdrucksysteme

This European Standard was approved by CEN on 10 March 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Ref. No. EN 13160-2:2003 E

Contents

Foreword

This document (EN 13160-2:2003) has been prepared by Technical Committee CEN/TC 221, "Shop fabricated metallic tanks and equipment for storage tanks and for service stations", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2003, and conflicting national standards shall be withdrawn at the latest by November 2003.

This European Standard consists of 7 parts:

Leak detection systems;

Part 1: General principles

Part 2: Pressure and vacuum systems

Part 3: Liquid systems for tanks

Part 4: Liquid and/or vapour sensor systems for use in leakage containments or interstitial spaces

Part 5: Dynamic tank gauge leak detection systems

Part 6: Sensor in monitoring wells

Part 7: General requirments and test methods for interstitial spaces, leak protecting linings and leak protecting jacktes

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements for leak detection systems class I for use with double-skin systems, designed for water polluting fluids.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 764, *Pressure equipment - Terminology and symbols - Pressure, temperature, volume.*

EN 13160–1:2003, *Leak detection systems — Part 1: General principles.*

EN 13160–4, *Leak detection systems — Part 4: Liquid and/or vapour sensor systems for use in leakage containments or interstitial spaces.*

EN 13160–7, *Leak detection systems — Part 7: General requirements and test methods for interstitial spaces, leak protecting linings and leak protecting jackets.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 13160-1:2003 apply.

4 Symbols and abbreviations

g is the force of gravity, in metres per second squared

h is the maximum filling height of the tank, in metres

h_G is the maximum height of the groundwater related to the lowest point of the tank, in metres

h_1 is the filling height of the interstitial space due to alarm pressure p_{AE} , in metres

l is the length of the interconnecting line, in metres

p_{AA} is the relative pressure at control point "alarm off", in Pascal

p_{AE} is the relative pressure at control point "alarm on", in Pascal

p_{PA} is the relative pressure at control point "pump off", in Pascal

p_{PE} is the relative pressure at control point "pump on", in Pascal

p_0 is the operating pressure according to EN 764, in Pascal

V is the proportional reduction of the interstitial space caused by ingress of liquid for assurance of the alarm, in per cent

V_1 is the volume of the interstitial space at filling height h_1, in cubic metres

V_0 is the entire volume of the interstitial space, in cubic metres

ρ_G is the density of the groundwater, in kilograms per cubic metre

ρ_P is the density of the stored product in the tank, in kilograms per cubic metre

5 General

General principles according to EN 13160-1.

Where the requirement is for low temperature performance the alternative test temperature is shown in brackets [...].

6 Interstitial space

General requirements concerning the interstitial space according to EN 13160-7.

The test methods for class I leak detection systems apply to interstitial space:·

— for tanks with an interstitial space volume ≤ 8 m^3 ;

— for pipes with an interstitial space volume ≤ 10 m^3.

The entire interstitial space shall be capable of being filled with air or an inert gas and shall be gas tight, or it shall be capable of sustaining a vacuum.

The walls of the interstitial space shall withstand the pressure of the system or the vacuum pulled on the system.

For a tank the system shall be designed so that there are no connections to the inner tank through the interstitial space below the maximum filling level.

For a pipe the system shall be designed so that there are no connections to the inner pipe through the interstitial space.

The internal diameter for the two connections to the interstitial space shall be at least 4 mm.

One connection to the interstitial space of a double skin pipework shall be at the opposite end of the pipework to the connected leak detector.

7 Vacuum and pressure leak detectors

7.1 General

The vacuum or pressure used by the system, including changes of pressure caused by variations in temperature shall not exceed the design parameter of tank, leak protecting lining, leak protecting jacket or pipe. Where the pressure in the interstitial space may exceed 90 % of the maximum allowable pressure a pressure relief valve shall be fitted, which shall be conform to annex A.

In a vacuum system at every low point of the interconnecting lines between the vacuum leak detector and the interstitial space a condensate trap shall be installed.

Leak detectors shall be designed so that it is possible to check the parameter of the system (i.e. pressure switch settings) and to simulate alarm conditions.

The internal diameter of the leak detector-to-interstitial space interconnecting lines shall be minimum:

6 mm for air based systems;

4 mm for inert gas based systems.

The total flow resistance of the interconnecting lines between the leak detector and the double skin tank or pipe may be not more than 1 kPa (10 mbar) at (85 ± 15) l/h. This requirement is fulfilled for air-based systems, when the length (l) of the interconnecting line is $l \leq 50$ m for an inner diameter of the interconnecting line of 6 mm.

The leak detector-to-interstitial space interconnecting lines shall be colour-coded as follows:

— measuring line: red

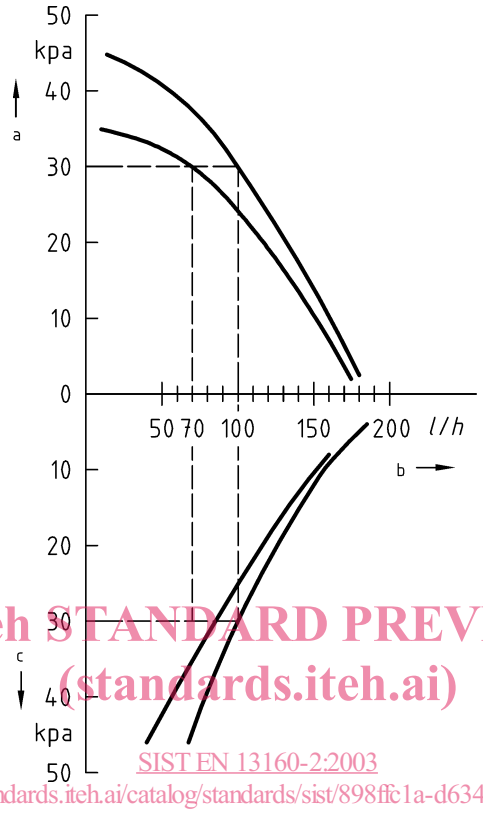
— suction and pressure line: white or clear

— exhaust line: green.

A vacuum leak detector shall only serve one tank or pipework.

A pipework may consist of several sections of a pipework where the interstitial spaces are connected.

In the alarm pressure a leak detector shall deliver a volume flow of (85 ± 15) l/h, see Figure 1.



Key

a Pressure
b Volume flow rate
c Vacuum

Figure 1 — Example of volume flow of a leak detector with 30 kPa alarm set point

7.2 Pressure leak detectors

7.2.1 Humidity of the pressurising gas

The gas used for pressurisation shall have a relative humidity not exceeding 10 %. If air is used a dry filter according to annex B or other drying devices may be used.

7.2.2 Pressure leak detectors for tanks

The alarm pressure shall be higher by 3 000 Pa than the maximum pressure exerted by the maximum filling height of the tank including any operating pressure, as specified in Equation (1) or exerted by the maximum height of the groundwater related to the lowest point of the tank, as specified in Equation (2).

$$p_{AE} = 3000\ \text{Pa} + \rho_P \cdot h \cdot g + p_0 \quad (1)$$

$$p_{AE} = 3000\ \text{Pa} + \rho_G \cdot h_G \cdot g \quad (2)$$

7.2.3 Pressure leak detectors for pipe work

The alarm set point pressure shall be higher than the maximum operating pressure of the inner pipe by at least 0,1 MPa (1 bar).

7.2.4 Pressure leak detectors without integrated pressure generator

The requirements of 7.2.1 shall be met for pressure generation. The minimum alarm pressure shall be determined according to 7.2.2 and 7.2.3. The interstitial space shall be free of liquid.

NOTE Where pressure leak detectors without integrated pressure generator are to be used on tanks, these should be equipped with a suction line, which is led down to the lowest point of the interstitial space to have the possibility to suck off any existing liquid before pressurising the interstitial space.

Pressure leak detectors without integrated pressure generation are only suitable for use on tanks and pipeworks for a temperature range from -5 °C to +30 °C. In order to avoid false alarm and/or unacceptable high pressures in the interstitial space, the alterations in pressure due to temperature shall be considered when determining the operating pressure and the alarm set points of leak detectors.

7.3 Vacuum leak detectors

7.3.1 General

The interstitial space negative pressure shall - up to the occurrence of a leak - be maintained below atmospheric pressure.

The vacuum leak detectors used for flat-bottomed tanks with double bottom, shall resist the expected pressure in the case of a leak.

The alarm shall be ensured according to 7.3.2. If this is not possible, a liquid sensor shall be installed according to EN 13160-4 at the lowest point of the interstitial space additionally to the vacuum leak detector.

7.3.2 Assurance of the alarm

For assurance of the alarm the volume of the interstitial space has to be reduced by increasing liquid, see Equation (3):

$$V = (1 - \frac{100000\ \text{Pa} - p_{\text{PA}}}{100000\ \text{Pa} - p_{\text{AE}}}) \cdot 100 \quad \text{in \%} \tag{3}$$

Due to the alarm pressure p_{AE} the interstitial space is filled (in the case of a leak) up to the height h_1 compared with the lowest point of the tank, see Equation (4):

$$h_1 = \frac{p_{\text{AE}}}{g \cdot \rho_{\text{P}}} \quad \text{or} \quad h_1 = \frac{p_{\text{AE}}}{g \cdot \rho_{\text{G}}} \tag{4}$$

Under consideration of tank geometry the volume of the interstitial space V_1 at filling height h_1 has to be determined by calculation (or by measurement in litres), see EN 13160-7.

The alarm is considered reliable, if the following condition is fulfilled, see Equation (5):

$$V < \frac{V_1}{V_0} \tag{5}$$

NOTE The above mentioned calculation would be carried out for tanks with a suction line down to the lowest point of the interstitial space. An analog application is required for tanks without a suction line or for pipework, i. e. the line of reference for the height h_1 is the horizontal line through the lowest point, at which the suction line is connected with or ends in the interstitial

space. For tanks with a suction line down to the lowest point of the interstitial space it is the end of the suction line on the lowest point and for tanks without a suction line down to the lowest point of the interstitial space it is the suction nozzle at the top of the tank.

7.3.3 Vacuum leak detectors with integrated vacuum generator

The vacuum pressure (relative value) at the alarm control point shall be at least:

- as high as the pressure computed according to Equation (6):

$$p_{AE} = 3000 \text{ Pa} + \rho \cdot g \cdot h \quad (6)$$

— 3 kPa, if the evacuating line in the interstitial space is led down to the lowest point;

— 25 kPa for flat-bottom tanks with double bottom.

In the suction line a liquid operated or sensor operated device (stop valve) shall be fitted as near as possible to the tank, which in case of suction of liquid avoids further evacuating of the interstitial space and prevents penetrating of liquid in the leak detector.

7.3.4 Vacuum leak detectors without integrated vacuum generator

For the application of these systems the following conditions shall be fulfilled:

— a suction line (for the vacuum pump to be installed outside) which shall be led down to the lowest point of the interstitial space; or

— at above-ground tanks, as an alternative, a control nozzle may be installed at the lowest point of the interstitial space.

The vacuum pressure (relative value) in the alarm control point shall be at least 35 kPa.

The vacuum pressure (relative value) of the operating pressure shall be at least 70 kPa.

To avoid false alarm the alterations in pressure due to temperature shall be considered when determining the switching points.

8 Test

8.1 Type test

8.1.1 Test objective

The testing of the leak detection systems shall prove that the presented systems are able to indicate any leak in the internal and in the external wall of the tank or pipe below the maximum filling level under all working conditions.

The tests shall be deemed to have been passed where:

— the function in the indicated pressure range in view of the temperature range is ensured;

— the system also works in a longer period of time reliably.

The following tests shall be carried out:

— function test;

— test of the reliability.

8.1.2 Test equipment

A pressure and vacuum proved test vessel, volume 1 l, with at least 3 nozzles for the connection of a measuring line, a suction or a pressure line of a leak detector and a ventilation line;

a test vessel, volume 1 l, in the form of an open top flat-bottom vertical cylinder for the test liquid of 30 % glycol and 70 % water;

an environmental chamber the temperature of which can be varied over the range from - 25 °C to + 70 °C within an accuracy of 2 K;

for the test in a temperature range from – 40 °C to + 40 °C an environmental chamber the temperature of which can be varied over the range from – 50 °C to + 40 °C within an accuracy of 2 K

solenoid valve, pressure switch;

cycle counter;

a stop clock having a time indication in steps of 1 s to a minimum total of 1 h, within an accuracy of 2 s;

vacuum pump for the pre-evacuation of the interstitial space;

a calibrated vacuum pump with a pump capacity of (85 ± 15) l/h air;

pressure pump;

measuring instrument for the volume flow with an accuracy of 2 % of the measured value;

bath thermostat;

measuring device for pressure (e. g. manometer or u-tube); with an accuracy of 0,6 % of the full scale range and a division of 0,5 % of the value to be measured.

8.1.3 Pressure limit switch test for vacuum and pressure leak detectors

8.1.3.1 Test objective

The test objective is to guarantee that the pressure/vacuum switch at the specified volume flows gives an alarm at the specified set points.

8.1.3.2 Preparation

The leak detector shall be connected to the suction or pressure line and the measuring line on the test vessel. One nozzle of the test vessel shall be equipped with a regulating valve in the cross section or a controlled solenoid valve shall be installed at the exit of the line. The pressure gauge shall be connected to the measuring line.

The flow meter shall be connected to the exhaust line of the vacuum leak detector or to the intake line of the pressure leak detector.

8.1.3.3 Evaluation

The test shall be deemed to have been passed if:

— the leak detector meets the optical and audible alarm settings given by the manufacturer which shall be based on the calculation in 7.2.2, 7.2.3, 7.3.2 and 7.3.3;

— the optical and audible alarm is triggered at reaching the alarm switch point with ≤ 2 s time delay;

— the pump capacity of the leak detector is P_{AE} = (80 ± 15) l/h at the alarm setting;

— the device or the components do not fail during the load tests.