SLOVENSKI STANDARD
SIST EN 13160-4:2003

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Sistemi za kontrolo tesnosti - 4. del: Sistemi za detekcijo puščanja tekočin in/ali plinov v vmesnih prostorih in zadrževalnikih

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

Leckanzeigesysteme - Teil 4: Flüssigkeits- und/oder Gassensorensysteme in Leckage oder Überwachungsräumen

Systemes indicateurs de fuites - Partie 4: Systèmes de détection de liquide et/ou gaz dans des espaces de confinement ou des espaces interstitiels

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ICS:

23.020.01	Vsebniki za shranjevanje tekočin na splošno	Fluid storage devices in general

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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
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 13160-4:2003) 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of an identical text or by endorsement, at the latest by November 2003, and conflicting national standards shall be withdrawn at the latest by November 2003.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: Tank gauge leak detection systems

Part 6: Sensors in monitoring wells

Part 7: General requirements and test methods for interstitial spaces, leak protecting linings and leak protecting jackets

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 III for use in the interstitial space of double-skin systems or in leakage containments of single skin systems designed for water polluting fluids. This European Standard is not applicable to leak detection systems using non re-usable sensors.

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

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 General

General principles according to EN 13160-1.

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

Liquid or vapour sensors shall be installed in such a way that they can detect specific liquids or their vapours present in or entering the leakage containment or interstitial space.

The leakage containment can take the form of a

— sump or riser containing spills from leaks in double wall lines or pumps;

— bund, designed to contain leakage from a storage tank or from any other facility containing liquids;

— other facilities in which sensors can be installed to detect the presence of liquids or vapours.

5 Interstitial space

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

The design of the interstitial space intended to detect liquid shall allow detection of a minimum amount of 10 l of a specific liquid present in or entering the interstitial space.

The interstitial space shall allow an installation of the sensor at the deepest point of the interstitial space.

The interstitial space shall be constructed so that the leakage liquid shall reach the deepest point of the interstitial space.

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 interstitial space shall be capable of being tested for integrity.

6 Leakage containment

The design of leakage containment intended to detect liquid shall allow detection of a minimum amount of 10 l of a specific liquid present in or entering the containment.

The number of sensors of the system shall correspond to the intended number of low points in the leakage containment.

NOTE The design of a leakage containment should allow that liquid leaking from any point in the primary system will collect in at least one of a number of low points in the leakage containment.

The leakage containment shall be liquid tight and impervious to the stored product, water or any other substance with which it is likely to come into contact, and shall have no outlets below the level of the maximum contained volume.

If protection against ingress of water is not possible, technical measures have to be taken to avoid impairment of the function of the leak detector.

No penetrations through the walls of the leakage containment shall be made which might interfere with its functions as leakage containment.

It shall be possible to test the leakage containment for leaks.

If the leakage containment is used as a bund for a primary system holding liquids then the walls of the bund shall fully surround the system and shall be capable of containing the entire contents of the primary system.

7 Liquid sensor

Liquid sensors shall detect specific liquids they can normally come into contact with (e. g. stored product, water).

Liquid sensors shall comply with the test criteria according to clauses 10 or 11, as appropriate.

8 Vapour sensor

Vapour sensors shall detect specific vapours from stored products.

Vapour sensors shall comply with the test criteria according to clause 12.

9 Leak indicating device

A leak indicating device shall be provided.

An alarm shall indicate when the presence of stored product and/or water is detected.

10 Type test of the liquid sensors

10.1 Test objective

The aim of the test is to verify the suitability of a sensor system to detect the ingress of liquid into the interstitial space or leakage containment, where this space is normally dry. Tests shall be performed to verify:

— the response time of the sensor system in indicating the presence of liquid, where the liquid level is rising at a given rate;

— the recovery time of the sensor system from a liquid-indicating condition following its removal from the presence of liquid.

A sensor system shall be qualified for use with each type of liquid that it shall be required to detect. Where possible, tests shall be performed using these actual liquids, however where significant hazards may result, a less harmful test liquid may be used having similar chemical and physical properties. For example, a substitute for petroleum spirit would be petroleum naphtha (an aliphatic petroleum distillate).

10.2 Evaluation

Tests shall be deemed to have been passed where:

— the presence of liquids is not indicated when no liquid is present;

— the presence of liquid is indicated within 30 min after liquid is first introduced into the test system at the rate of 10 l/h;

— the presence of liquid is indicated within 6 min after liquid is first introduced into the test system at the rate of 50 l/h;

— the sensor has a measurable recovery time of max 20 h after removal of the test liquid.

These criteria shall be satisfied over the range of environmental conditions specified in the test in 10.4.

The system shall remain in the alarm condition until the sensor has recovered and the alarm has been reset.

10.3 Test equipment

A test vessel in the form of a flat-bottomed vertical cylinder, having a horizontal cross-sectional area of (0,1 ± 0,002) m^2 (i.e. a liquid depth of 0,01 m corresponds to a volume of 1 l) and a minimum depth of 0,6 m. One or more fittings flush with the inside surface of the vessel shall be provided in the floor of the vessel for the introduction of liquids. A similar fitting shall be provided having a drain cock capable of emptying the vessel at a rate of 5 l/min.

Suitable quantities of each liquid for qualification (or suitable test liquids).

A calibrated metering pump (with a reservoir of minimum 6 l capacity) capable of delivering liquid into the test vessel, at the rates specified in 10.2, with an accuracy of 2 %.

An environmental chamber the temperature of which can be varied over the range from - 25 °C to + 70 °C with 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 a range from – 50 °C to + 40 °C with an accuracy of 2 K.

A stop clock having a time indication in steps of 1 s to a minimum total of 24 h, with an accuracy of 2 s.

10.4 Test method

10.4.1 Preparation

The sensor under test shall befixed in its normal orientation ensuring contact with the floor of the test vessel but away from any ports for the entry or extraction of liquid. The manufacturer's fittings should be used wherever possible. The test vessel and metering pump reservoir shall be mounted inside the environmental chamber. The sensor under test shall be connected to the leak indicating device which shall be mounted outside the environmental chamber in ambient laboratory conditions.

Prior to the series of tests for each liquid for which the sensor system shall be qualified, the metering pump reservoir shall be charged with the appropriate liquid or test liquid.

Power shall be applied to the sensor system, which shall then be initialised by means specified in the manufacturer's operating instructions to obtain fully operational conditions.

10.4.2 Stabilisation

Prior to each test to be conducted, and with the sensor system fully operational, the environmental chamber shall be preset to the required test temperature and shall be allowed to stabilize for 30 min after the internal temperature reaches the prescribed test temperature ± 2 K.

10.4.3 Procedure

For each test to be conducted, the following procedure shall be used:

— the leak indicating device shall be checked. If the presence of liquid is indicated, the test shall be terminated;

— the metering pump shall be set to the specified pumping rate;

— zero the stop clock;

— the metering pump shall be started;

— at the moment liquid starts to flow from the inlet fitting into the test vessel, the stop clock shall be started;

— at the moment when the leak indicating device first indicates the presence of liquid, by means specified in the manufacturer's instructions, or if the maximum response time is exceeded, the stop clock and the metering pump shall be stopped;

— the stop clock elapsed time (measured response time) shall be recorded;

— zero the stop clock;

— the test vessel drain cock shall be opened;

— at the moment the vessel is empty of liquid the stop clock shall be started;

— at the moment when the leak indicating device indicates the absence of liquid, by means specified in the manufacturer's instructions, or if a period of 20 h is exceeded the stop clock shall be stopped;

— the stop clock elapsed time (measured recovery time) shall be recorded.

10.4.4 Test schedule

10.4.4.1 The following series of tests shall be performed twice for each liquid for which the sensor system is to be qualified:

10.4.4.2 Environmental temperature: - 20 °C [- 40 °C]

Metered pump rate: 10 l/h

Maximum response time: 30 min

10.4.4.3 Environmental temperature: - 20 °C [- 40 °C]

Metered pump rate: 50 l/h

Maximum response time: 6 min

10.4.4.4 Environmental temperature: + 20 °C [+ 40 °C]

Metered pump rate: 10 l/h

Maximum response time: 30 min

10.4.4.5 Environmental temperature: + 20 °C [+ 40 °C]

Metered pump rate: 50 l/h

Maximum response time: 6 min

10.4.4.6 Environmental temperature: + 60 °C

Metered pump rate: 10 l/h

Maximum response time: 30 min

10.4.4.7 Environmental temperature: + 60 °C

Metered pump rate: 50 l/h

Maximum response time: 6 min

Where the freezing point of the liquid for qualification is above - 25 °C [- 45 °C], tests 10.4.4.2 and 10.4.4.3 shall be performed at a temperature equal to the freezing point plus 5 K.

Where the flash point of the liquid for qualification is below + 70 °C, tests 10.4.4.6 and 10.4.4.7 shall be performed at a temperature equal to the flash point minus 10 K.

10.5 Test results

For each test in the schedule for a particular liquid, the measured response times shall be compared to the relevant criteria listed in 10.2 to determine whether the test has been passed or failed. If any criterium in any test is not met or if at any time a leak is indicated when no liquid is present (other than during the recovery time) the sensor system shall be deemed to have failed the test and shall not qualified for use with that liquid. Any such a failure will not prevent qualification for use with any other liquid for which the test is passed. The worst case response and recovery time for any of the series of tests shall be recorded.

10.6 Sensor marking

Each sensor shall carry the following markings:

— approved liquids – for which the sensor has been tested;

— response time – worst case from any test for each of the approved liquids;

— recovery time – worst case from any test for each of the approved liquids.

Alternatively, the sensor shall be marked with a reference to a specification incorporating the same information.

11 Type test of discriminating liquid sensors

11.1 Discriminating liquid sensors for bulk quantities of stored product and water

11.1.1 Test objective

The aim of the test is to verify the suitability of a sensor system to detect the presence of stored product and water in the monitored area. Tests shall be performed to verify:

— the response time of the sensor system in indicating the presence of the stored product, where the liquid level is rising at a given rate;

— the recovery time of the sensor system from a stored product-indicating condition following its removal from the presence of the stored product.

A sensor system shall be qualified for use with each type of liquid that it shall be required to detect. Where possible, tests shall be performed using these actual liquids, however where significant hazards may result, a less harmful test liquid may be used having similar chemical and physical properties. For example, a substitute for petroleum spirit would be petroleum naphtha (an aliphatic petroleum distillate).

11.1.2 Evaluation

Tests shall be deemed to have been passed where:

— the presence of stored product is not indicated when no stored product is present whether water is present or not;

— with the sensor submerged in water to varying degrees, the presence of stored product is indicated within 30 min after liquid is first introduced into the test system at the rate of 10 l/h;

— with the sensor submerged in water to varying degrees, the presence of stored product is indicated within 6 min after liquid is first introduced into the test system at the rate of 50 l/h;

— the sensor has to have a measurable recovery time of maximum 20 h after removal of the stored product.

These criteria shall be satisfied over the range of environmental conditions specified in the test in 11.1.4.

The system shall remain in the alarm condition until the sensor has recovered and the alarm has been reset.

11.1.3 Test equipment

A test vessel in the form of a flat-bottomed vertical cylinder, having a horizontal cross-sectional area of (0,1 ± 0,002) m^2 (i. e. a liquid depth of 0,01 m corresponds to a volume of 1 l) and a minimum depth of 0,6 m. One or more fittings flush with the inside surface of the vessel shall be provided in the floor of the vessel for the introduction of liquids. Where water is present and the test temperature is such that ice will form, liquid shall also be capable of being introduced into the test vessel from above. A similar fitting shall be provided having a drain cock, or suitable syphon system, capable of emptying the vessel at a rate of 5 l/min.

Suitable quantities of each liquid for qualification (or suitable test liquids).

A calibrated metering pump (with a reservoir of minimum 6 l capacity) capable of delivering liquid into the test vessel, at the rates specified in 11.1.2 within an accuracy of 2 %.

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

A stop clock having a time indication in steps of 1 s to a minimum total of 24 h, with an accuracy of 2 s.

11.1.4 Test method

11.1.4.1 Preparation

The sensor under test shall be fixed in its normal orientation ensuring contact with the floor of the test vessel but away from any ports for the entry or extraction of liquid. The manufacturer's fittings should be used wherever possible. The test vessel and metering pump reservoir shall be mounted inside the environmental chamber. The sensor under test shall be connected to the leak indicating device under test which shall be mounted outside the environmental chamber in ambient laboratory conditions.

Prior to the series of tests for each liquid for which the sensor system shall be qualified, the metering pump reservoir shall be charged with the appropriate liquid or test liquid and the test vessel filled with water to the appropriate level.

Power shall be applied to the sensor system which shall be then initialised by means specified in the manufacturer's operating instructions such that the system is fully operational.

11.1.4.2 Stabilisation

Prior to each test to be conducted, and with the sensor system fully operational, the environment chamber shall be preset to the required test temperature, and shall be allowed to stabilize for 30 min after the internal temperature reaches the prescribed test temperature ± 2 K.