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Leak detection systems - Part 1: General Principles

Leckanzeigesysteme - Teil 1: Allgemeine Grundsätze

Systèmes de détection de fuites - Partie 1: Principes généraux

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Leak detection systems - Part 1: General Principles

Systèmes de détection de fuites - Partie 1: Principes généraux

Leckanzeigesysteme - Teil 1: Allgemeine Grundsätze

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 393.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (prEN 13160-1:2010) has been prepared by Technical Committee CEN/TC 393 “Equipment for storage tanks and for filling stations”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, ZB and ZC, which are integral parts of this document.

Annexes A, B, D and E are informative. Annex C is normative.

This document includes a Bibliography.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

This document will supersede EN 13160-1:2003.

According to EN 13160-1:2003 the following fundamental changes are given:

— audible alarm changed in accordance with EN 60073;

— information concerning environmental aspects included;

— referred standards updated.

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

1 Scope

This European Standard specifies the general principles for leak detection systems for use with double-skin tanks, single-skin tanks and pipework designed for water polluting fluids.

2 Normative references

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

EN 13160-2:2003, *Leak detection systems — Part 2: Pressure and vacuum systems*

EN 13160-3:2003, *Leak detection systems — Part 3: Liquid systems for tanks*

EN 13160-4:2003, *Leak detection systems — Part 4: Liquid and/or vapour sensor systems for use in leakage containments or interstitial spaces*

EN 13160-5:2004, *Leak detection systems — Part 5 : Tank gauge leak detection systems*

EN 13160-6:2003, *Leak detection systems — Part 6 : Sensors in monitoring wells*

EN 13160-7:2003, *Leak detection systems — Part 7: General requirements and test methods for interstitial spaces, leak protecting linings and leak protecting jackets*

EN 13352, *Specification for the performance of automatic tank contents gauges*

EN 13463-1:2001, *Non-electrical equipment intended for use in potentially explosive atmospheres — Part 1: Basic method and requirements*

EN 60079-0, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements (IEC 60079-0:2004, modified)*

EN 60079-6, *Explosive atmospheres — Part 6: Equipment protection by oil immersion "o" (IEC 60079-6:2007)*

EN 60079-2, *Electrical apparatus for explosive gas atmospheres — Part 2: Pressurized enclosures "p" (IEC 60079-2:2001)*

EN 60079-5, *Explosive atmospheres — Part 5: Equipment protection by powder filling "q" (IEC 60079-5:2007)*

EN 60079-1, *Electrical apparatus for explosive gas atmospheres — Part 1: Flameproof enclosures "d" (IEC 60079-1:2003)*

EN 60079-7, *Explosive atmospheres — Part 7: Equipment protection by increased safety "e" (IEC 60079-7:2006)*

EN 60079-11, *Explosive atmospheres — Part 11: Equipment protection by intrinsic safety "i" (IEC 60079-11:2006)*

EN 60079-18, *Electrical apparatus for explosive gas atmospheres — Part 18: Construction, test and marking of type of protection encapsulation "m" electrical apparatus (IEC 60079-18:2004)*

EN 60079-25, Electrical apparatus for explosive gas atmospheres — Part 25: Intrinsically safe systems (IEC 60079-25:2003)

EN 60073, *Basic and safety principles for man-machine interface, marking and identification — Coding principles for indicators and actuators (IEC 60073:1996)*

EN 60335–1, *Household and similar electrical appliances – Safety — Part 1 : General requirements (IEC 60335-1:2001, modified)*

EN 60529, *Degrees of protection provided by enclosures (IP-code) (IEC 60529:1989)*

EN 60730–1, *Automatic electrical controls for household and similar use — Part 1 : General requirements (IEC 60730-1:1999, modified)*

EN 61010–1, *Safety requirements for electrical equipment for measurement, control and laboratory use — Part 1: General requirements (IEC 61010-1:2001)*

ISO 2859–1, *Sampling procedures for inspection by attributes — Part 1 : Sampling schemes indexed by acceptance quality limit (AQL) for lot-by lot inspection*

3 Classes of leak detection systems

For the purpose of this standard the following classes apply in order of protection for the level of safety or environmental protection required:

Class I: Systems of this class will detect a leak above or below the liquid level in a double-skin system. They are inherently safe and will detect a leak before any liquid can enter the environment (i. e. pressure or vacuum systems).

Class II: Systems of this class will detect a leak above or below the liquid level in a double-skin system with the possibility of the leak detection liquid leaking into the environment (i. e. liquid monitoring system).

Class III: Systems of this class will detect a leak below the liquid level in a tank or in a pipework system. These systems are based on liquid and/or vapour sensors located in leakage containment or interstitial space. A possibility exists of product entering the environment.

Class IV: Systems of this class will detect, to specific levels of probability, specified rates of change of tank contents (i. e. leakages into or out of the tank). A strong possibility exists that product will enter the environment in the event of a leak.

Class IV A: Dynamic leak detection systems will by reconciliation also indicate leaks in the connected pipework

Class IV B: Static tank gauge leak detection systems or statistical quiet period leak detection systems will only indicate leaks from a tank.

Class V: Systems of this class may detect liquid loss in tanks or pipes below the liquid level. Product will enter the environment before the leak is detected (i. e. sensors in monitoring wells).

For examples for the different classes see annex A.

4 Terms and definitions

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

4.1
atmospheric pressure conditions
pressures ranging from 0,08 MPa (0,8 bar) to 0,11 MPa (1,1 bar)

4.2
leak detection system
includes all equipment required to indicate a leak

NOTE Main components could include the interstitial space, leak protecting linings, leak protecting jacket, leak indicating device, leak detector, system pipework, leak detecting media, monitoring wells or sensors.

4.3
interstitial space
space between the walls of double-skin systems. It provides the passage for fluids which may enter the interstitial space

4.4
double-skin tank
tank constructed with an inner and outer wall with an interstitial space where the maximum filling level of the tank does not exceed the height of the interstitial space

4.5
single-skin tank
tank constructed with a single wall

4.6
leak protecting lining
internal layer which solely or in conjunction with an intermediate material produces a suitable interstitial space

4.7
leak protecting jacket
external layer which solely or in conjunction with an intermediate material produces a suitable interstitial space

4.8
intermediate layer
material used to separate the inner and outer tank walls, the intermediate layer may or may not be attached to either one or both walls, it provides separation of the inner and outer walls

4.9
double-skin pipework
pipework constructed with an inner and outer wall with an interstitial space

4.10
single-skin pipework
pipework constructed with a single wall

4.11
vacuum leak detector
a leak detector for vacuum detects a leak using air as the leak detection medium, with vacuum leak detectors an alarm is triggered by rise of pressure in the interstitial space in the event of a leak

4.12
pressure leak detector
a leak detector for pressure detects a leak using air or inert gas as the leak detection medium. With pressure leak detectors, in the event of a leak, an alarm is triggered by a drop in the pressure within the interstitial space

4.13
leak detector for liquid systems
indicates a leak using liquid as a leak detection medium, any leak in either of the system walls is indicated by a drop of the leak detection fluid level

4.14
liquid sensor
device which will detect liquid

4.15
vapour sensor
device which will detect gas and vapour

4.16
leak indicating device
indicates the operational and the alarm status of any connected sensors or leak detectors

4.17
tank gauge leak detection system
a tank gauge system measures the volume of liquid stored in a tank, a loss can be indicated where the volume of liquid drawn from the tanks is monitored independently from the gauge and reconciled with changes in the stored volume, a loss can also be indicated by analysis of the changes in "static" liquid volume during periods when no additions to, or depletions, from the tank are taking place

4.17.1
static leak detection
where a tank integrity test is carried out by the gauge whilst no additions to or depletions from the tank contents are being made

4.17.2
dynamic leak or loss detection
where the tank contents gauge forms part of an integrated detection system and is used to detect a leak or loss during normal operation where additions to or depletion from the tank contents may be made, a loss can be detected in tanks and pipeworks, connected with the tank, which may indicate a leak

4.17.3
statistical quiet period leak detection
where the gauge system collects data during intervals (which are shorter than required for static leak detection) between dispensing and delivery operations, the data are then analyzed to determine if a loss has occurred, which may indicate a leak

4.17.4
tank integrity test
test which is capable of detecting a leakage rate in accordance with a given test procedure, the test takes into account the thermal expansion of the liquid being stored, evaporative losses and the effects of any other variables including groundwater level

4.18
monitoring wells
wells installed into the ground around a storage system, positioned to ensure that any liquid or vapour from a leakage from the system will reach one of them

NOTE The monitoring well is used to ensure that the leakage can be detected visually or by sensors.

4.19
leakage containment
system, which is designed to prevent leakage from a primary system entering the environment and which enables the detection of leakage

4.20
frost protected area
area where the temperature will not go below 0 °C

4.21
stop valve
valve used to prevent the passage of liquid beyond a fixed point in a connecting line

4.22
sensor system
arrangement whereby liquid and/or vapour sensors are used in leakage containments or interstitial spaces and are monitored by a leak indicating device for the purpose of detecting leaks

5 Requirements

5.1 General

Leak detection systems shall trigger the alarm in the event of a leak or in the event of malfunctions of the leak detection system. All leak detection systems shall indicate every leak by a visual and audible alarm.

In the event of a power interruption, the leak detection system shall be designed to resume normal operation on the restoration of the power supply.

Leak detection systems shall be designed for operation under atmospheric conditions according to 4.1.

The components of a leak detection system intended for installation in the open air shall be suitable to operate in a temperature range of -20 °C to +60 °C or –40 °C to +40 °C.

Components of a leak detection system intended for installation in frost-protected area shall be suitable to operate in a temperature range of -5 °C to +50 °C.

Components of a leak detection system intended for installation in underground tanks shall be suitable to operate in a temperature range of -5 °C to +30 °C.

Leak detection systems and/or their components intended for installation in a potentially explosive atmosphere shall be explosion protected. If there exists the possibility of an explosive atmosphere being present within the leak detection system and/or its components these shall be explosion protected.

The leak detection systems shall be designed for installation in such a way to prevent accidental disconnection of the equipment's power supply. Plug and socket connections or switches are only permitted if their interruption triggers off an alarm.

The leak detection system shall be capable of being tested or capable of simulating a leak condition. Disconnections of any sensor or transducer or a short circuit in connecting cables shall result in an alarm condition. All indications and sounders shall be capable of being tested.

The leak detection systems shall be designed so that correct operation can be verified.

The leak detection systems shall be used and maintained in accordance with the manufacturer's instruction.

If a leak detector serves more than one tank or pipework equipment is required which shows or allows to test in an event of an alarm which tank or pipework leaks.

5.2 Avoidance or reduction of ignition sources

5.2.1 General requirements

All electrical and non-electrical equipment and components, intended for use in potentially explosive atmospheres, shall be designed and constructed according to good engineering practice and in conformity with the required categories for group II equipment to ensure avoidance of any ignition source. To classify the

category of the equipment it shall be subjected to an ignition hazard assessment in accordance with 5.2 of EN 13463-1:2001.

The suitable category for the explosion protected equipment parts, for use in certain areas of the leak detection systems, are detailed in annex B.

5.2.2 Electrical equipment for leak detection systems

5.2.2.1 General

Any electrical equipment, which is intended for use in or which may be exposed to potentially explosive atmospheres, shall comply with the requirements according to EN 60079-0 to EN 60079-2, EN 60079-5 to EN 60079-7, EN 60079-11, EN 60079-18 or EN 60079-25 as appropriate, or any other means of protection. All electrical equipment shall comply with the requirements according to EN 60073, EN 60335-1, EN 60730-1 and EN 61010-1 and shall fulfil minimum IP 30 according to EN 60529.

The electrical equipment shall be protected from any external influences such that it will withstand the temperature, chemical and mechanical impact that are to be expected on site.

5.2.2.2 Inspection of the electrical equipment

Electrical equipment shall be inspected visually to confirm that it is constructed in accordance with the electrical diagrams and certificates of conformity provided by the manufacturer.

5.2.3 Non electrical equipment for leak detection systems

Non electrical equipment, intended for use in potentially explosive atmospheres, shall comply with the requirements of EN 13463-1 and, where relevant, the European standard for the specific type of ignition protection selected.

Non electrical equipment shall be protected from any external influence such that it will withstand the temperature, chemical and mechanical impact that are to be expected on site.

5.3 Leak indicating device

The operating condition shall be clearly indicated, i. e. by a "green" light.

The visual alarm shall be clearly indicated, i. e. by a "red" light.

It shall be impossible to switch off the visual alarm while the system is powered on and an alarm condition exists.

The audible alarm shall be an up-and-down signal according to EN 60073, suitable for continuous operation and shall be designed for muting.

All leak indicating devices shall be designed for connecting an additional alarm. The output parameter shall be stated.

All indicators shall be equipped with a device for testing the operating condition of the alarm.

5.4 Function test of the audible alarm transmitter

5.4.1 Test objective

The test objective is to ensure that the alarm is loud enough to be heard and that the volume level is maintained for a minimum period of 36 h.

5.4.2 Preparation

For the purpose of this test the leak detector with the signal device shall be mounted with the fastening device supplied by the manufacturer to a solid and reverberant wall. A wall is considered solid if a section of the wall having a surface area of 1 m^2 weighs at least 200 kg and reverberant if it has an absorption coefficient for sound of $s \leq 0,05$.

5.4.3 Evaluation

The test will be deemed to have been passed if the measured value for the continuous sound level is ≥ 70 dB (A) after the fatigue test.

5.4.4 Test method

The audible signal device shall be sounded continuously for at least 36 h in a fatigue test. On completion of the fatigue test the sound level shall be measured by a continuous signal. The arithmetic mean shall be taken from at least three measuring points.

These measuring points shall be located approximately equidistant on a hemisphere extending over the leak detector front. The radius of the hemisphere shall be r = 1 m. The outer measuring points are to be chosen such that the radius describes an angle of 45 ° referred to the leak detector or indicator front at these points.

5.5 Device categories for explosion-proof parts of the leak detection system

See annex B.

5.6 Inspection of equipment

The user shall ensure before use of the equipment that,

— the electrical equipment and the system shall be suitable for its application in a hazardous area and

— the equipment has been installed in accordance with the manufacturer's instructions.

5.7 Instruction

All leak detection systems shall be accompanied by instruction as to:

— safe installation, use and maintenance;

— assessment of safe operation condition and possible misuse;

— limitation of equipment, e.g. temperature, pressure regulation;

— essential characteristic of tools used;

— training needed for safe use of equipment.

— The standards for which the system has been tested e. g. for electromagnetic compatibility (EMC) compliance or low voltage directive.

6 Environmental aspects

Environmental aspects should be considered according to Annex E.