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Overfill prevention devices for static tanks for liquid petroleum fuels

Überfüllsicherungen für ortsfeste Tanks für flüssige Brenn- und Kraftstoffe

Dispositifs limiteurs de remplissage pour réservoirs statiques pour carburants pétroliers liquides

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Overfill prevention devices for static tanks for liquid petroleum fuels

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This European Standard was approved by CEN on 8 April 2004.

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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 Central Secretariat has the same status as the official versions.

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Foreword

This document (EN 13616:2004) 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of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by April 2006.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of the Equipment and protective systems intended for use in potentially explosive atmospheres Directive (ATEX)[1)], Electromagnetic Compatibility Directive (EMC)[2)] and Construction Products Directive (CPD)[3)].

For the relationship with the Directives 94/9/EC, 89/336/EEC and 89/106/EEC, respectively see informative annexes ZA, ZB and ZC which are an integral part of this document.

By application of this European Standard presumption is given, that the Essential Safety Requirements of the ATEX, EMC and CPD Directives are met.

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

1) Directive 94/9/EC of the European Parliament and of the Council of 23 March 1994 on the approximation of the laws of the Member States concerning Equipment and protective systems intended for use in potentially explosive atmospheres (OJEC L 100).

2) Directive 89/336/EEC of the European Parliament and of the Council of 03 May 1989 on the approximation of the laws of the Member States concerning Electromagnetic compatibility (OJEC L 139).

3) Directive 89/106/EEC of the European Parliament and the Council of 21 December 1988 on the approximation of the laws of the Member States concerning Construction products (OJEC L 40).

Introduction

This document has been written to limit environmental damage and the risk of pollution to water and any fire or explosion risk during the filling of storage tanks with liquid petroleum fuels.

This document has been written by CEN/TC 221 covering the whole range of static shop fabricated tanks and their equipment for the storage of liquid petroleum fuels.

1 Scope

This standard specifies the minimum performance and construction requirements for various types of overfill prevention devices which are limited to static tanks of shop fabricated manufacture both metallic and non metallic. It covers devices for underground tanks and also above ground tanks with a maximum height of 5 m.

To cover the different types of overfill prevention devices, two types have been developed:

— Type A: An overfill prevention device where the operation does not depend on the road tank vehicle or supply system;

— Type B: An overfill prevention device where the operation depends on the road tank vehicle or the supply system.

This standard applies to overfill prevention devices for liquid petroleum fuels, having a flash point up to but not exceeding 100 °C. The requirements apply to overfill prevention devices suitable for use at ambient temperatures in the range from –25 °C to +60 °C, and subject to normal operational pressure variations.

Additional measures may be required for use at temperatures outside this range and are the subject of negotiation between the manufacturer and its client.

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 590, *Automotive fuels — Diesel – Requirements and test methods*

EN 954–1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

EN 50014, *Electrical apparatus for potentially explosive atmospheres — General requirements*

EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety « i »*

EN 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements (IEC 60204-1:1997)*

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

EN 61000-6-1, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards; Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1:1997, modified)*

EN 61000-6-2, Electromagnetic compatibility (EMC) - Part 6-2: Generic standards; Immunity for industrial environments (IEC 61000-6-2:1999, modified)

EN 61000-6-3, *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards; Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3:1996, modified)*

EN 61000-6-4, *Electromagnetic compatibility (EMC) - Part 6-4: Generic standards; Emission standard for industrial environments (IEC 61000-6-4:1997, modified)*

3 Terms, definitions and abbreviated terms

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

3.1
overfill prevention device
device forming part of a supply system which automatically prevents the liquid level in the storage tank exceeding a maximum filling level

3.2
maximum filling level
permitted filling level authorised by the local safety regulations

3.3
supply system
connection hoses, fittings and any fixed pipework through which the liquid is delivered to the storage tank from the road tank vehicle

3.4
road tank vehicle
any mobile tank carrying liquids intended for discharging into a static storage tank

3.5
level L_1
level at which the overfill prevention device stops or severely restricts the liquid delivery. This level is set such that, if emptying of the vehicle delivery hose and of supply pipe occurs, level L_2 is not exceeded

3.6
level L_2
level at which the overfill prevention device prevents any further product, apart from a permissible leak rate, entering the storage tank at, or prior to, the maximum filling level

3.7
leak rate
permitted rate of liquid allowed to pass through the overfill prevention device after final closure

3.8
overfill prevention controller
connects to sensors mounted in or on the storage tank and provides a permissive or non permissive output, hereinafter referred to as a controller

3.9
liquid level detection device
device mounted in a storage tank for detecting liquid at a predetermined level and connected to a controller, hereinafter referred to as a sensor

3.10
permissive
output state of the overfill prevention controller fitted to the road tank vehicle or supply system which permits liquid delivery

3.11
non-permissive
output state of the overfill prevention controller fitted to the road tank vehicle or supply system which does not permit liquid delivery

3.12
shutdown volume
volume of liquid which will flow into the storage tank after the detection of the potential overfill, and before the complete shutoff

3.13
residual volume
amount of liquid which is in the supply system at the moment of shutdown. This extra volume shall be taken into account when setting the sensor level to avoid filling above the maximum filling level

3.14
interface
point of transfer of specified information

3.15
vapour tight overfill prevention device
device which does not permit vapour to pass from the ullage space through the device in normal operation

3.16
PID - Product Identification Device

3.17
PRD - Product Recognition Device

4 General requirements

4.1 Functional criteria

4.1.1 On filling the storage tank to a level L_1, at this level, a complete and automatic closure or automatic severe restriction of the flow shall be effected.

4.1.2 After initial closure, if provided, the contents of the delivery hose and preferably the delivery pipe shall be emptied into the storage tank.

4.1.3 Final automatic closure shall occur once level L_2 has been reached (final closure may be achieved at level L_1). At level L_2, no further liquid other than the allowable leak rate (see 5.4) shall enter the tank.

4.1.4 The performance of the overfill prevention device shall not be adversely affected by the flow rate taking into account the following:

a) the liquid level in the storage tank before and during delivery; or

b) the level of liquid in the road tank vehicle or the supply system before and during delivery.

4.1.5 Where the overfill prevention device requires an auxiliary energy source, the filling process shall not commence or shall automatically stop in the event of failure of that energy source.

4.1.6 The operation of the overfill prevention device shall not generate pressure in excess of the designed criteria for the supply system.

4.2 Construction

4.2.1 All construction materials shall be compatible with the temperature range of –25 °C to +60 °C and with the liquid and its vapour phase being stored, the manufacturer shall specify all materials in contact with the liquid.

4.2.2 When the overfill prevention device forms part of an earth continuity path it shall be conductive.

4.2.3 The overfill prevention device shall be of a durable construction. Durability shall be tested in accordance with 5.5.4.7 and annex A.

4.2.4 All parts of the overfill prevention device situated either internally or externally on the tank shall withstand static negative and positive pressure test to comply with 5.5.3. Any resultant deformation shall not prevent the device fully functioning.

4.2.5 The overfill prevention device shall prevent or severely restrict vapour flowing from the ullage space into the fill pipe.

4.3 Avoidance or reduction of ignition sources

4.3.1 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 to 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.

Explosion protection measures shall be taken in accordance with annex E.

4.3.2 Electrical equipment

Any electrical equipment, intended for use in potentially explosive atmospheres, shall comply with the requirements according to EN 50014 and, where relevant, the European Standard for the specific type of ignition protection selected, see Table E.1.

4.3.3 Non-electrical equipment

Any 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.

5 Overfill prevention device Type A

5.1 Classification

Two subtypes of devices are defined for Type A:

- Overfill prevention device by gravity fill only: Subtype A1;
- Overfill prevention device by gravity or pump fill: Subtype A2.

5.2 Flow rate

5.2.1 Overfill prevention device by gravity fill only (see annex C.1)

The device shall work at 0,2 m/s minimum linear velocity and 15 kPa static pressure after closure.

The device shall work at 3 m/s maximum linear velocity and 200 kPa static pressure after closure.

5.2.2 Overfill prevention device by gravity or pump fill (see annex C.1)

The device shall work at 0,2 m/s minimum linear velocity and 15 kPa static pressure after closure.

The device shall work at 3 m/s maximum linear velocity and 400 kPa or 800 kPa static pressure after closure.

5.3 Pressure surge

5.3.1 Overfill prevention device by gravity fill

Any pressure surge created by the overfill prevention device at closure exceeding 300 kPa shall not exceed a period of more than 10 ms.

5.3.2 Overfill prevention device by gravity or pump fill

For pump with a performance of 400 kPa any pressure surge created by the overfill prevention device at closure exceeding 600 kPa shall not exceed a period of more than 10 ms.

For pump with a performance of 800 kPa any pressure surge created by the overfill prevention device at closure exceeding 1200 kPa shall not exceed a period of more than 10 ms.

5.4 Requirements for A1 and A2 overfill prevention devices

The device shall not have a leak flow rate greater than 150 l/h after closure at operational pressure.

All overfill prevention devices shall be conductive with the resistance value not greater than $10^6\ \Omega$;

A vapour tight overfill prevention device shall be tested according to 5.5.4.8, all other devices shall be tested according to 5.5.4.9.

5.5 Test method

5.5.1 General

One overfill prevention device shall be type tested in accordance with the following tests.

The manufacturer shall compile a list of all components and shall supply specifications to demonstrate that these components will not be adversely affected in the temperature range of –25 °C to +60 °C.

For all tests other than 5.5.2 and 5.5.3, the overfill prevention device shall be installed in accordance with the manufacturer's instructions in a test rig layout as shown in annex B.1.

When an auxiliary power source is used, then it shall be disconnected to insure that the device shall close at level L_2.

The tests shall be carried out on one sample unit in the sequence listed below.

5.5.2 Chemical suitability test

The complete overfill prevention device, or parts normally exposed to petroleum liquid or vapours, shall be subjected to a test cycle as below using the test liquid with the following composition:

- 41,5 % in volume of toluene;
- 41,5 % in volume of iso octane;
- 15 % in volume of methanol;
- 2 % in volume of iso butanol.

If parts of the device are subjected to contact with liquid or vapour, the device shall not be disassembled for this test. Non-contact parts may be protected simulating typical installation or protection by screening, jacketing, etc.

Test cycle consists of:

a) total immersion in test liquid for 24 h at (20 ± 1)°C;

b) total immersion in saturated vapour of test liquid for 24 h at (20 ± 1)°C;

c) total immersion in test liquid for 24 h at (20 ± 1)°C;

d) 1 h drying at (20 ± 1)°C.

After this test, the device shall be inspected and there shall be no signs of damage, distortion or obvious malfunction. The remaining type approval tests shall then be carried out in sequence.

5.5.3 Pressure tests

Where any part of overfill prevention device is designed to be installed inside of the tank, it shall be placed in a closed pressure vessel and subjected to an internal and then to an external pressure for (60 ± 5) min for each test. The overfill prevention device or any components of it shall not suffer any damage during this test.

The equipment shall be subjected to the following pressures:

— negative pressure: $\left(30^{0}_{-5}\right)$ kPa ;

— pressure: $\left(100^{+10}_{0}\right)$ kPa .

5.5.4 Function tests

5.5.4.1 General

The overfill prevention device shall be mounted in accordance with manufacturer's instructions in a test rig layout shown in Figure B.1.

The test liquid for these tests can be water containing a corrosion preventing agent or an aliphatic petroleum distillate. The following tests shall be performed for the subtypes A1 and A2.

5.5.4.2 Level L_1 closure test

The device shall be tested at the minimum and maximum permissible flow rate according to 5.2. The device shall be closed at level L_1.

The maximum pressure surge shall not exceed that as specified in 5.3.

After initial level L_1 closure test, the supply system shall be allowed to drain down according to manufacturer's instructions and verified to have occurred.

5.5.4.3 Level L_2 closure test

Repeat test according to 5.5.4.2 and on reaching level L_1, adjust flow control valve within 1 min to provide the minimum flow rate as specified in 5.2 and check the device as fully closed at level L_2.

5.5.4.4 Leak tightness after closure test

After closure at level L_2, measure the leakage rate through the assembly within 1 min. This shall not exceed the value as specified in 5.4.

5.5.4.5 Pressure surge test

The maximum pressure surge generated at the pressure test point on closure of the device shall be measured and shall not exceed the requirement as specified in 5.3. This may be checked simultaneously with flow closure tests according to 5.5.4.2 or 5.5.4.3.

The surge pressure shall be recorded at maximum flow rate in accordance with 5.5.4.2 and 5.3 using a pressure sensor located in the pipework within 200 mm above the device.

The pressure sensor and its measuring system shall have a response time of 1 ms.

Surge test shall be carried out in accordance with Figure B.1 and the bore size of the hose shall be equal to the overfill prevention device size.

5.5.4.6 Mechanical strength

With the valve closed, maintain an internal to external pressure of 1,5 time the maximum static pressure according to 5.2 for (120 ± 10) s. There shall be no permanent deformation after visual examination. The device shall then be submitted to the endurance test.

5.5.4.7 Endurance test

Repeat tests according to 5.5.4.2 and 5.5.4.3 a further 1 500 times each in sequence. Drain down and allow valve to reset after each test sequence is completed.

After the endurance test the device shall be retested for operation in accordance with 5.5.4.2, 5.5.4.3 and 5.5.4.4.

5.5.4.8 Vapour tight test procedure

The device shall be installed in the test rig layout according to Figure B.1. The inlet and outlet of the line shall be closed. The line shall have a 3,5 kPa over pressure applied. The pressure shall remain stable for 5 min at (3,5 ± 0,1) kPa. All joints shall be checked with a leak detection medium. No leaks shall be visible.

5.5.4.9 Non vapour tight test procedure

The device shall be installed in the test rig layout according to Figure B.1. The inlet and the outlet shall be closed. The line shall have a 3,5 kPa over-pressure applied. The volume of air shall be measured by meter over a 5 min period and the results recorded.

A pipe of the same diameter with a 3 mm hole, replacing the Overfill Prevention Device, shall be installed in the test rig. The line shall have a 3,5 kPa over pressure applied. The volume of air shall be measured over a 5 minute period and the results recorded. The device will be accepted if the volume recorded is equal or less than the volume recorded in the pipe with a 3 mm hole.

5.5.4.10 Continuity test

Measure the transition resistance through the body of the overfill prevention device with a resistance meter with a driven potential of more than 500 V, capable of measuring to 1 MΩ according to EN 60204-1 and record the transition resistance.

Record the continuity in Ω to comply with 5.4.

5.5.5 Test frequency

Testing shall be carried out at the following level:

- raw material checks: 5 % ;
- components production checks: 5 %;
- manufactured product checks: 100 %.

Each overfill prevention device shall be tested 5 times in accordance with 5.5.4.2, 5.5.4.3 and once in accordance with 5.5.4.4.

5.6 Test report

Test results shall be recorded in a report.

5.7 Marking

5.7.1 Identification

The device shall be permanently marked with the following information:

— manufacturer's name or mark;

— type and subtype;

— maximum static pressure;

— mandatory markings CE and Ex;

— manufacturing number and year;

— EN number of this standard;

— vapour tight (yes/no).

— temperature range if it is outside the temperature range of –25 °C to +60 °C.

5.7.2 Instruction plate

The overfill prevention device shall be supplied with an instruction plate to be permanently fastened at the filling point. It shall contain the following information:

— manufacturer;

— type and subtype;

— maximum static pressure;

— instructions in the event of overfill prevention device operating;

— temperature range if it is outside the temperature range of –25 °C to +60 °C.

6 Overfill prevention device Type B

6.1 Specific requirements

A Type B overfill prevention device shall consist of equipment on the static storage tank: sensor and on the road tank vehicle: controller, and this forms the "overfill prevention system".

6.2 Equipment on the road tank vehicle

The following equipment may be used in conjunction with the equipment on the road tank vehicle or supply system:

— one or more controllers;

— appropriate devices for stopping the product flow;

— a method of connection from the controller to the storage tank sensor.

6.3 Equipment on the storage tank

The following equipment shall be installed on the storage tank:

— a sensor for each storage tank.

— a method of connection from each storage tank to a controller mounted on the road tank vehicle.