BS EN 15268:2008

# Petrol filling stations — Safety requirements for the construction of submersible pump assemblies

ICS 75.200,

# National foreword

This British Standard is the UK implementation of BS EN 15268:2008.

The UK participation in its preparation was entrusted to Technical Committee PVE/21, Fabricated metallic tanks and equip. for storage tanks and filling stations.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

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EUROPEAN STANDARD

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**EN 15268**

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English Version

# Petrol filling stations - Safety requirements for the construction of submersible pump assemblies

Stations-service - Prescriptions de sécurité pour la construction des assemblages de pompes immergées

Tankstellen - Sicherheitstechnische Anforderungen an die Bauweise von Tauchpumpen-Baugruppen

This European Standard was approved by CEN on 25 July 2008.

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# Foreword

This document (EN 15268:2008) has been prepared by Technical Committee CEN/TC 221 “Shop fabricated metallic tanks and equipment for storage tanks and for 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of an identical text or by endorsement, at the latest by March 2009, and conflicting national standards shall be withdrawn at the latest by March 2009.

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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 Annexes ZA, ZB and ZC, which are integral parts of this document.

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

# Introduction

This document is a type C standard as stated in EN ISO 12100-1.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this European Standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of the type C standard.

## 1 Scope

This European Standard applies to submersible pump assemblies intended for use with dispensers installed at petrol filling stations and used to dispense liquid fuels in accordance with EN 228 and EN 590 into tanks of motor vehicles, light aircrafts, boats and portable containers. The submersible pump assemblies are intended for use and storage at ambient temperatures between –20 °C and +40 °C.

Additional measures can be required for use and storage at temperatures outside this range and are subject to negotiation between the manufacturer and purchaser.

This European Standard specifies requirements for equipment with a maximum working pressure not exceeding 350 kPa (3,5 bar), power consumption not exceeding 7 KW and a maximum power supply voltage of 500 V.

This European Standard specifies requirements for submersible pump assemblies of classes IIA T3 (explosion group IIA and temperature class T3) and IIB T4 (explosion group IIB and temperature class T4) using liquid fuels.

This European Standard deals with all significant hazards, hazardous situations and events relevant to submersible pump assemblies, when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see Clause 4).

This European Standard specifies safety requirements for design, installation, commissioning, use and maintenance.

Noise is not considered a significant hazard for the equipment in the scope of this European Standard.

This European Standard does not cover requirements for mobile equipment.

NOTE 1 For other fuels than those in accordance with EN 228 and EN 590 a manufacturer should consider the need for extra measures (dealing with possible additional or different hazards).

NOTE 2 This European Standard does not include any requirements for metering performance such as may be specified for the EU under the Measuring Instruments Directive nor those specified under the Electromagnetic Compatibility Directive.

NOTE 3 Liquified Petroleum Gas (LPG) is not a liquid in the sense of this document.

This European Standard is not applicable to submersible pump assemblies that are manufactured before the date of its publication as EN.

## 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 228, *Automotive fuels — Unleaded petrol — Requirements and test methods*

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

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

EN 13463-6, *Non-electrical equipment for use in potentially explosive atmospheres — Part 6: Protection by control of ignition source "b"*

EN 13617-1:2004, *Petrol filling stations — Part 1: Safety requirements for construction and performance of metering pumps, dispensers and remote pumping units*

prEN 50495:2006-08, *Safety devices required for the safe functioning of equipment with respect to explosion risks*

EN 60034-1, *Rotating electrical machines — Part 1: Rating and performance (IEC 60034-1:2004)*

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

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

EN 60079-14, *Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in hazardous areas (other than mines) (IEC 60079-14:2002)*

EN 60079-15:2005, *Electrical apparatus for explosive gas atmospheres — Part 15: Construction, test and marking of type of protection "n" electrical apparatus (IEC 60079-15:2005)*

EN 60079-26, *Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga (IEC 60079-26:2006)*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

ISO 1817, *Rubber, vulcanized — Determination of the effect of liquids*

HD 21.13 S1, *Polyvinyl chloride insulated cables of rated voltage up to and including 450/750V — Part 13: Oil resistant PVC sheathed cables with two or more conductors*

HD 22.4 S4, *Cables of rated voltages up to and including 450/750 V and having crosslinked insulation — Part 4: Cords and flexible cables*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

**3.1**
**submersible pump assembly**
comprises the manifold assembly, the fixed or adjustable column pipe assembly and the submersible pumping unit

**3.2**
**column pipe assembly**
means by which the manifold assembly is connected to the submersible pumping unit and which consists of product pipe and electrical conduit

**3.3**
**adjustable length column pipe assembly**
means by which the manifold assembly is connected to the submersible pumping unit and which consists of product pipe and electrical conduit with telescopic coupling

**3.4**
**manifold assembly**
subsystem that provides for external mechanical, hydraulic and electrical connections

**3.5**
**submersible pumping unit**
subsystem including motor and hydraulic system whose inlet is designed to be submerged beneath the fuel level in a storage tank and supply the pumping pressure

**3.6**
**liquid exposure**
where the internal spaces of the submersible pumping unit and column pipe assembly of both electrical and non-electrical components have no explosive atmosphere as these spaces are filled with fuel

**3.7**
**liquid cover (immersion depth)**
height of the liquid level above the inlet of the submersible pump assembly

## 4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this European Standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

**Table 1 — List of significant hazards**

| **Hazards according to EN 1050:1996, Annex A** | | **Significant hazards, danger zones, hazardous situations or events, associated with the covered machinery** | **Safety requirement** |
|---|---|---|---|
| **No.** | **Type of hazard** | **–** | **Clause no.** |
| **1** | **Mechanical hazards** due to:<br>— machine parts or work pieces, e.g.:<br>c) mass and stability (potential energy of elements which may move under the effect of gravity);<br>e) inadequacy of mechanical strength. | Pump falling into the tank | 5.4; 5.5 |
| **2** | **Electrical hazards** due to: | – | – |
| 2.1 | contact of persons with live parts (direct contact) | Electrical components, e.g. motors, solenoid valves, control systems, lighting | 5.1.2; 5.3 |
| 2.2 | contact of persons with parts which have become live under faulty conditions (indirect contact) | Electrical components, e.g. motors, solenoid valves, control systems, lighting | 5.1.2; 5.3 |
| 2.4 | electrostatic phenomena | Ignition of vapour | 5.2.1; 5.3.2; 5.3.3 |
| **3** | **Thermal hazards,** resulting in: | – | – |
| 3.1 | burns and other injuries by possible explosions | Ignition of possible explosive atmosphere by electrical or non-electrical parts or electrical charge | 5.3.1; 5.3.2; 5.3.4; 5.3.5; 5.6 |

**Table 1** *(continued)*

| **Hazards according to EN 1050:1996, Annex A** | | **Significant hazards, danger zones, hazardous situations or events, associated with the covered machinery** | **Safety requirement** |
|---|---|---|---|
| **No.** | **Type of hazard** | **–** | **Clause no.** |
| **7** | **Hazards generated by materials and substances** (and their constituent elements) processed or used by the machinery | – | – |
| 7.1 | Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts | Exposure to fuel | 5.1.3; 5.2.1; 5.2.2; 5.2.3; 5.7 |
| 7.2 | Fire or explosion hazard | Electrical and non-electrical parts | 5.1; 5.3; 5.6; 5.7 |
| **10** | **Unexpected start-up, unexpected overrun/overspeed** (or any similar malfunction) from: | – | – |
| 10.1 | Failure/disorder of the control system | Unexpected liquid flow | 5.1.2 |
| 10.2 | Restoration of energy supply after an interruption | Unexpected liquid flow | 5.1.2 |
| 10.3 | External influences on electrical equipment | Unexpected liquid flow | 5.1.2 |
| 10.6 | Errors made by the operator (due to mismatch of machinery with human characteristics and abilities) | Unexpected liquid flow | 5.1.2; 7.2; 7.3 |
| **11** | **Impossibility of stopping the machine in the best possible conditions** | Unexpected liquid flow | 5.1.2; 7.2 |
| **13** | **Failure of the power supply** | Unexpected liquid flow | 5.1.2 |
| **14** | **Failure of the control circuit** | Unexpected liquid flow | 5.1.2 |
| **15** | **Errors of fitting** | Leakage | 7.2; 7.3 |
| **16** | **Break-up during operation** | Leakage | 5.2; 5.4; 5.7 |

# 5 Safety requirements and/or protective measures

## 5.1 General

**5.1.1** Submersible pump assemblies and components shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of EN ISO 12100-1 and -2 for hazards relevant but not significant, which are not dealt with by this European Standard (e.g. sharp edges).

NOTE For hazards which are to be reduced by the application of a B-level standard or analogous standards such as EN 13463-1, EN 60730-2-10, EN 60529 and EN 60204-1, the manufacturer should carry out a risk assessment to establish the requirements of the B-standard. This specific risk assessment is part of the general risk assessment of the machine.

**5.1.2** Electrical equipment of submersible pump assemblies shall conform to EN 60204-1. The electrical motor shall conform to the requirements of EN 60034-1. The earth bonding of connecting parts shall be mounted in such a way that there is no dangerous electric potential difference. If necessary, connectors for earth bonding shall be foreseen.

NOTE Additional information on the application of converter-fed motors can be found in CLC/TS 60034-17. Major concerns include over-temperature high frequency and overvoltage effects as well as bearing currents. The expression "electrically in contact" does not necessarily involve the use of a conductor.

Aspects to be considered during installation are listed in Clause 7.

**5.1.3** The submersible pump assembly shall be designed and constructed to ensure that there is no leakage during normal operating conditions.

## 5.2 Components

**5.2.1** All parts exposed to the effects of the fuel or fuel vapour shall be constructed of materials compatible with the fuel they are intended to pump. They shall be chemically and dimensionally stable and resistant to attack by vapour and liquid fuel.

**5.2.2** Submersible pump assemblies connected to pressurised piping shall have a pressure relief device that limits the maximum pressure to 350 kPa (3,5 bar).

**5.2.3** All pressurized parts of submersible pump assemblies shall be designed and constructed for the maximum working pressure for which they are intended.

## 5.3 Requirements for explosion prevention and protection of equipment and components

**5.3.1** In accordance with EN 13463-1:2001, 5.2, the submersible pump assembly and all parts of it shall be subjected to a formal documented hazard analysis that identifies and lists all of the potential sources of ignition by the submersible pump assembly and the measures to be applied to prevent them from becoming effective.

**5.3.2** Capacitors used in the submersible pump assembly shall be designed to be discharged to an energy level of 0,2 mJ or below within a maximum of 10 s after disconnection of the submersible pump assembly.

**5.3.3** Parts of the equipment exposed to a potentially explosive atmosphere and susceptible to electrostatic charge shall comply with EN 13463-1:2001, 7.4.

NOTE Further guidance on this topic is given in CLC/TR 50404.

**5.3.4** The external junction box shall meet requirements for equipment category 2.

**5.3.5** Plugs and sockets and similar connectors for internal connections in ignition capable circuits shall be deemed to be normally sparking unless they require a separating force of at least 15 N or they are prevented by mechanical means from loosening or separating (EN 60079-15:2005, 20.3).

Terminals shall be so designed that after proper connection of the conductors, the creepage distances and the clearances comply with the requirements of EN 60079-7.

Connection facilities shall accommodate at least the size of conductor appropriate to the rated current of the apparatus. Connections within electrical apparatus and forming an integral part of that apparatus shall not be subject to undue mechanical stress. Only the following means for the connection of conductors are permitted:

a) screwed fasteners with means of locking;

b) crimping;

c) soldering, provided that the conductors are not supported by the soldered connection alone;

d) brazing;

e) welding;

f) connections made by spring pressure; contact pressure on the electrical connections shall be maintained and not be affected by dimensional changes of insulating materials in service, due to factors such as temperature or humidity;

g) any means of connection complying with the following requirements:

Connectors shall be:

1) fixed to their mountings without possibility of self-loosening;

2) constructed in such a way that the conductors cannot slip out from their location during tightening of the terminal;

3) such that proper contact is assured without damage to the conductors that would impair the ability of the conductors to fulfil their function, even if multi-stranded conductors are used in terminals intended for direct clamping of a conductor.

NOTE Special precautions against electrolytic corrosion should be considered.

**5.3.6** Components made of light metal alloys shall comply with the requirements of EN 13463-1:2001, 8.2.

**5.3.7** Submersible pumping units for use in areas where category 2 equipment is required shall comply with one of the requirements given in Table 2:

**Table 2 — Requirements for areas where category 2 is required**

| Options | Non-electrical parts | Electrical parts |
|---|---|---|
| Option A | EN 13463-1 (cat. 2) | EN 60079-0 (cat. 2) |
| Option B | EN 13463-1 (cat. 3) + liquid exposure IPL1 (EN 13463-6) | EN 60079-15 (cat. 3) + liquid exposure SIL1 (prEN 50495:2006-08) |
| Option C | No ignition source in normal operation + liquid exposure IPL1 (EN 13463-6) | special requirements (Annex C) + liquid exposure SIL1 (prEN 50495:2006-08) |

**5.3.8** Parts of submersible pumping units for use in areas where category 1 equipment is required shall comply with one of the requirements in Table 3:

**Table 3 — Requirements for areas where category 1 is required**

| Options | Non-electrical parts | Electrical parts |
|---|---|---|
| Option A | EN 13463-1 (cat. 1) | 60079-26 (cat. 1) |
| Option B | EN 13463-1 (cat. 2) + liquid exposure IPL1 (EN 13463-6) | EN 60079-0 (cat. 2) + liquid exposure SIL1 (prEN 50495:2006-08) |
| Option C | No ignition source in normal operation + liquid exposure IPL1 (EN 13463-6) + liquid cover monitoring device SIL1 (prEN 50495:2006-08) | special requirements (Annex C) + liquid exposure SIL1 (prEN 50495:2006-08) + liquid cover monitoring device SIL1 (prEN 50495:2006-08) |

The liquid cover according to Table 3, option C, can be reached by use of an external level control device, which shuts off the submersible pumping unit at a certain minimum fuel level in the tank. This minimum fuel level shall be set 100 mm above the highest product inlet.

**5.3.9** The manifold assembly shall meet the requirements of EN 60079-0 and EN 13463-1 for category 2 equipment. Field electrical connections of submersible pump assemblies shall conform to electrical requirements of EN 60079-14 for category 2 equipment. Cables used in explosive atmospheres shall comply with either EN 60079-14 and HD 21.13 S1 or EN 60079-14 and HD 22.4 S4 or shall fulfil the requirements of EN 13617-1:2004, 5.3.2.4.

## 5.4 Mechanical stability

**5.4.1** For pumps with adjustable column pipe assemblies means shall be provided to maintain the fixed position of the pumping unit.

**5.4.2** When installed and operated in accordance with the manufacturers instructions the submersible pump assembly shall not break free of its anchorage.

## 5.5 Handling

The manufacturer of submersible pump assemblies shall provide integral device or devices or shall identify auxiliary supporting devices to achieve safe handling of the machine, or define methods for safe handling in the information for use.

## 5.6 Additional requirements for components

All integral piping and pipe work fittings operating at pump working pressures, and all sealing surfaces shall have melting points greater than 310 °C.

## 5.7 Leak detection facility

The submersible pump assembly shall have the capability for connection of a leak detection system, which will shut-off the submersible pump in the event of a leak in the connected pipe work. For guidance see Annex D.3.

# 6 Verification of the safety requirements and/or protective measures

## 6.1 General

**6.1.1** The conformity with the requirements of clauses 5 and 7 shall be verified with one or more of the following methods, as relevant:

— visual inspection;

— measurement and testing;

— functional testing;

— design verification.

Details of the methods of verification and the criteria for acceptance are included in the requirements and/or can be found in Table 4.

**Table 4 — Testing requirements**

| Test | Requirement | Clause | Test method |
|---|---|---|---|
| **Mechanical type test** | | | |
| Adjustable length column pipe assembly strength test | There shall be no movement in the adjustable length column pipe assembly. | 5.4.1 | B.2 |
| **Hydraulic type tests** | | | |
| Material compatibility | There shall be no leakage. | 5.2.1 | B.3 |
| Hydrostatic burst strength | There shall be no rupture or permanent distortion of the liquid handling part. External leakage from joints or seals does not constitute a failed test. | 5.2.3 | B.4 |
| Pressure test | There shall be no leakage to the outside or to wiring compartments of the submersible pumping assembly, and there shall be no evidence of casting porosity. | 5.2.3 | B.5 |
| Liquid exposure temperature rise test<br>(not applicable to Table 2, option A and Table 3, option A) | The temperature of the part of the submersible pump assembly exposed to explosive atmosphere shall not exceed:<br>- 130 °C for category 2 (T4) and 195 °C for category 2 (T3), applicable to Table 2, option B and C;<br>- 103 °C for category 1 (T4) and 155 °C for category 1 (T3), applicable to Table 3, option B and C. | 5.3.7<br>5.3.8 | B.12 |
| **Routine hydraulic/pressure tests** | | | |
| Internal air pressure test | Under stable conditions there shall be no decrease of pressure from the initial applied pressure. | 5.1.3 | B.6 |
| Electrical housing test | There shall be no decrease of pressure. | 5.1.3 | B.7 |
| Pressure relief device test | The device shall function correctly. | 5.2.2 | B.8 |
| **Routine electrical tests** | | | |
| Continuity of the protective bonding circuit | The continuity shall be $< 0{,}1\ \Omega$ for 10 s. | 5.1.2 | B.9 |
| Insulation resistance | Insulation resistance shall be $> 1\ M\Omega$. | 5.1.2 | B.10 |
| Voltage test | Insulation, no failure at $U_{ac}$ = (1 000 + 2$U$) V, where $U$ is the working voltage. | 5.1.2 | B.11 |

**6.1.2** All routine tests shall be performed on 100 % of production.

# 7 Information for use

## 7.1 General

Information for use shall be provided in accordance with Clause 6 of EN ISO 12100-2:2003 and with the following.

## 7.2 Marking

### 7.2.1 General marking

Submersible pump assemblies shall bear at least the following minimum markings:

— business name and full address of the manufacturer and, where applicable, his authorised representative;

— designation of the machinery;

— mandatory marking;

NOTE For machines and their related products intended to be put on the market in the EEA, CE marking as defined in the applicable European directive(s), e.g. Machinery, Lifts, Explosive Atmospheres ATEX, Pressure Equipment.

— year of construction, that is the year in which the manufacturing process is completed;

— designation of series or type, if any;

— serial or identification number, if any;

— rating information (mandatory for electrotechnical products: voltage, frequency, power, etc.).

The information printed directly on the submersible pump assembly shall be permanent and remain throughout the expected life of the equipment.

The marking plate shall be located so that it is readily visible and can be read with the submersible pumping assembly installed in its normal operational location.

### 7.2.2 Additional marking for use in explosive atmospheres

For use in explosive atmospheres the following additional marking shall apply:

— 

— number of this European Standard, i.e. EN 15268;

— symbol for explosion group IIA or IIB;

— temperature class T3 or T4;

— ambient temperature range if it is outside the temperature range of –20 °C to +40 °C;

— number of the type test certificate;

— symbol "X" following the number of the test certificate if applicable;

— if applicable, additionally required information according to types of ignition protection.

EXAMPLE 1 Marking example for a submersible pump assembly of category 2:

CE XXXX;  II 2 G

EN 15268 IIB T3

NB YY ATEX ZZZZ X

with

| | |
|---|---|
| CE XXXX | CE marking and number of notified body responsible for the control of the quality system of the manufacturer during the control period; |
|  | explosion protection marking; |
| II 2 | equipment group and category of the submersible pump assembly; |
| G | type of explosive atmosphere, with G for gas, vapour or mist; |
| EN 15268 | number of the product standard; |
| IIB | explosion group; |
| T3 | temperature class; |
| NB YY ATEX ZZZZ X | number of the EU type test certificate. |

EXAMPLE 2 Marking example for a submersible pump assembly of categories 1 and 2:

CE XXXX,  II 1/2 G

EN 15268 IIA T3

NB YY ATEX ZZZZ X

with

| | |
|---|---|
| CE XXXX | CE marking and number of notified body responsible for the control of the quality system of the manufacturer during the control period; |
|  | explosion protection marking; |
| II 1/2 | equipment group and category of the submersible pump assembly, with the components inside the tank fulfilling the requirements for category 1 and the rest of the components fulfilling the requirements for category 2; |
| G | type of explosive atmosphere, with G for gas, vapour or mist; |
| EN 15268 | number of the product standard; |
| IIA | explosion group; |
| T3 | temperature class; |
| NB YY ATEX ZZZZ X | number of the EU type test certificate. |

### 7.3 Accompanying documents

Instructions for the safe transportation, storage, installation (see also Annex D), operation and maintenance of the submersible pump assemblies shall be provided in accordance with 6.5 of EN ISO 12100-2:2003 and additionally shall contain the following specific information:

a) the types of fuel the assembly is intended for;

b) instruction for the use of leak detection and the required characteristics of it;

c) the specification of the spare parts to be used, where these affect the health and safety of operators;

d) instructions for the equipotential bonding and the connection to earth.

All equipment shall be accompanied by instructions including at least the following particulars:

e) a recapitulation of the information with which the equipment is marked, except for the serial number, together with any appropriate additional information to facilitate maintenance (e.g. address of the importer, repairer);

f) description of the intended use of the equipment;

g) instructions for safe use:

   1) putting into service;

   2) use;

   3) assembling and dismantling;

   4) maintenance (servicing and emergency repair);

   5) installation;

   6) adjustment;

h) where necessary, an indication of any special hazard arising from the use of the equipment e.g. danger areas in front of pressure-relief devices;

i) where necessary, training instructions;

j) details which allow a decision to be taken beyond any doubt as to whether an item of equipment in a specific category can be used safely in the intended area under the expected operating conditions;

k) NOTE This information is generated as a consequence of carrying out the ignition hazard assessment.

l) pressure parameters, maximum surface temperatures and other limit values;

m) where necessary, special conditions of use, including particulars of possible misuse which experience has shown might occur;

n) where necessary, the essential characteristics of accessories which may be fitted to the equipment.

The instructions shall contain text, drawings and diagrams necessary for the putting into service, maintenance, inspection, checking of correct operation and, where appropriate, repair of the equipment, together with all useful instructions, in particular with regard to safety.

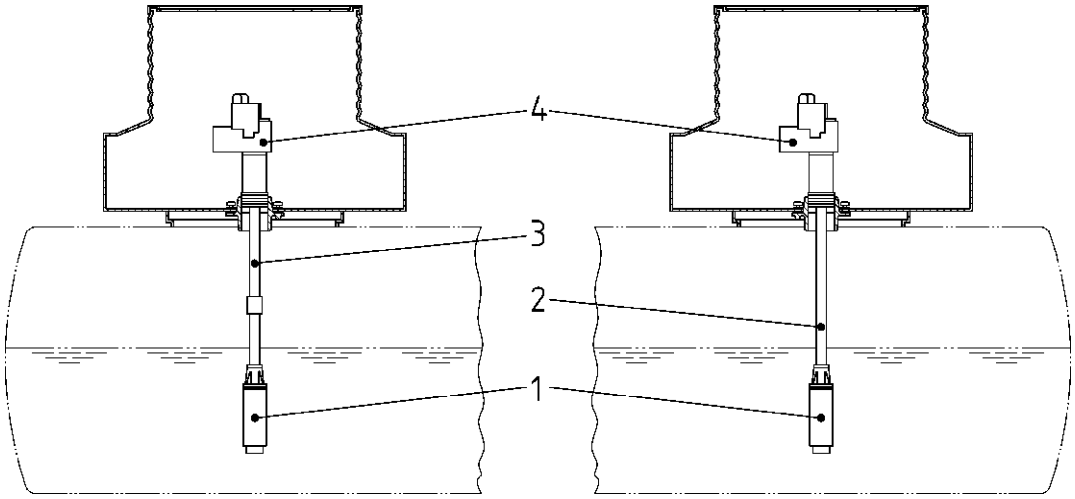
The instruction handbook shall provide the following information on noise emission:

o) the A-weighted emission sound pressure level at work stations where this exceeds 70 dB; should this level not exceed 70 dB, this fact shall be indicated.

# Annex A
(informative)

# Subsystems of submersible pump assemblies

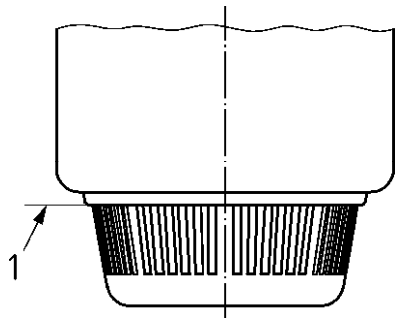
For the purpose of this specification the submersible pump assembly will be broken into several sub systems: The submersible pump unit, the manifold assembly and the column pipe assembly. A diagram of the components is shown in Figures A.1 and A.2:




**Key**

1 submersible pumping unit
2 column pipe assembly
3 adjustable length column pipe assembly
4 manifold assembly

**Figure A.1 — Typical submersible pump assembly**




**Key**

1 highest product inlet

**Figure A.2 — Product inlet of a submersible pump assembly**

# Annex B
(normative)

# Test methods

## B.1 General

All pressures are gauge (over pressure) readings.

All tests shall be performed at (20 ± 5) °C unless otherwise stated.

## B.2 Adjustable length column pipe assembly

In its fully extended position one of the two ends of the variable length column pipe assembly is to be securely affixed and on the other end a minimum tensile force of 4 500 N is to be applied along the length of the pipe for a minimum duration of 10 s. No variation of the aligned length is allowed to occur.

## B.3 Compatibility of parts

The parts shall be immersed in the test liquid, ISO 1817 liquid C, for not less than 1 000 h. The parts shall then be tested at $\left(525\ ^{+10}_{0}\right)$ kPa, $\left[\left(5{,}25\ ^{+0{,}1}_{0}\right)\text{bar}\right]$ for at least 60 s in an assembly that is constructed for normal use or an assembly that is constructed for test purposes but simulates normal use. There shall be no leakage.

For parts using the same material and similar mechanical construction only a representative part need be tested.

## B.4 Hydrostatic burst strength

Liquid handling parts of submersible pump assembly housings shall be exposed to a hydrostatic pressure of $\left(1{,}4\ ^{+0{,}01}_{0}\right)$ MPa $\left[\left(14\ ^{+0{,}1}_{0}\right)\text{ bar}\right]$ for a duration of at least 60 s. Following the hydrostatic test the requirements of B.5 shall be met. Water may be used as the test liquid.

## B.5 Pressure leakage

In preparing for this test, the means for pressure relief in the submersible pumping system are to be closed. Fluid handling parts of the submersible pumping system shall be exposed to a pressure of $\left(525\ ^{+10}_{0}\right)$ kPa $\left[\left(5{,}25\ ^{+0{,}1}_{0}\right)\text{bar}\right]$ for a duration of at least 60 s. Water may be used as the test liquid.

## B.6 Internal air pressure test

All pressurised housings of the submersible pump assembly shall be pressurised with air to a pressure of $\left(350\ ^{+10}_{0}\right)$ kPa $\left[\left(3{,}5\ ^{+0{,}1}_{0}\right)\text{bar}\right]$ for a duration of 60 s.

## B.7 Electrical housing test

Electrical housings shall be pressurised with air to an internal pressure of minimum 350 kPa (3,5 bar) for a time period of at least 60 s.

## B.8 Pressure relief device test

All finished relief devices shall be tested for functionality. The device shall relieve pressure when applied from the pipeline side and the relief pressure shall not exceed 350 kPa (3,5 bar). Water may be used as the test liquid.

## B.9 Continuity of the protective bonding circuit

The test for continuity shall be performed according to EN 60204-1:2006, 18.2:

A PELV source with a current of 10 A at 50 Hz or 60 Hz shall be used. The current shall be applied for 10 s. The tests shall be performed between the main PE terminal and various metal parts that are part of the protective bonding circuit, such as frames, etc.

## B.10 Insulation resistance tests

The test shall be performed in accordance with EN 60204-1:2006, 18.3:

The insulation resistance shall be measured at a minimum of DC voltage of 500 V, between each power connection and the PE terminal and each other.

## B.11 Voltage test

The test shall be performed in accordance with EN 60204-1:2006, 18.4:

A voltage of (1 000 + 2*U*) V at 50 Hz or 60 Hz shall be applied for 1 s between the power supply terminal and the PE terminal. Alternatively a DC voltage of 1 400 V may be used.

## B.12 Liquid exposure temperature rise test

A submersible pump assembly shall be installed in a tank with the inlet point submerged 100 mm and run at full load at 25 % flow capacity until the temperature of the part of the submersible pump assembly exposed to explosive atmosphere is constant. The flow shall be stopped and the motor shall continue to run until this temperature does not rise more than 2 K per hour or the thermal cut out operates. The test fluid shall be diesel according to EN 590 or a fluid of similar properties.

The test shall be performed with the most adverse conditions at the most unfavourable voltage between 90 % and 110 % of the rated voltage of the motor, unless the manufacturer can demonstrate that other standards prescribe other tolerances for equivalent industrial electrical apparatus.

NOTE Additional information on the application of converter-fed motors can be found in CLC/TS 60034-17. Major concerns include over-temperature high frequency and overvoltage effects as well as bearing currents. The expression "electrically in contact" does not necessarily involve the use of a conductor.

The temperature of the part of the submersible pump assembly exposed to explosive atmosphere shall not exceed 130 °C for category 2 (T4) and 195 °C for category 2 (T3), 103 °C for category 1 (T4) and 155 °C for Category 1 (T3).

# Annex C
(normative)

# Alternative requirements for explosion prevention and protection of the electrical motor

## C.1 Protection of the electrical motor

The moulded motor windings shall be protected against contact with the liquid by encapsulation in a steel housing.

The minimum nominal conductor dimension of wires used for windings shall be 0,25 mm. The insulation system of the motor shall be in accordance with class B of EN 60079-7. No part of an electrical apparatus shall reach a temperature exceeding that determined by the thermal stability of the materials used. Furthermore, no surface of any part of an electrical apparatus including the surface of internal parts to which the potentially explosive atmosphere might have access shall reach a temperature exceeding the maximum surface temperature.

The rotor shall be manufactured using diecast procedure or the bars of cage rotors shall fit tightly in the slots and shall be brazed or welded to the shortcircuiting rings unless the bars and rings of the cages are manufactured as a single unit.

The gap between the rotor and the stator shall not fall below 0,2 mm under most adverse conditions. The specified intervals for maintenance or bearing replacement shall be mentioned in the user's manual. The bearings may be designed for the equipment life cycle.

Temperature limiters shall be designed to protect also the winding insulation according to the thermal (insulation) class given in EN 60079-7.

## C.2 Liquid exposure

The liquid exposure shall be ensured as follows:

The submersible pump assembly shall be designed such that after every regular pump shut-off during its operation the entire internal area in contact with the fuel including the motor and the non-electrical components under normal conditions shall remain liquid exposed using the following monitoring concept.

A temperature limiter shall be embedded into the motor windings, which automatically shuts off the submersible pumping unit in the event of an unusual increase of the winding temperature. Automatic reset shall be prevented by a latch-out device until the error is eliminated. The temperature limiter shall be effective and independent from the external motor control element. The latch-out may be implemented in the external motor control element.

The external motor control element shall monitor the relevant safety parameters.

NOTE The monitored parameters are amongst others: short circuit, cable break, overload, phase breakdown, dry run.

When using the liquid exposure protection according to EN 13463-6 (see Table 2) the maximum surface temperature on the device shall not exceed the lower temperature class minus 5 K.

# Annex D
(informative)

# Guidance for the application, installation and maintenance of submersible pump assemblies and the connected pipe work

## D.1 Training

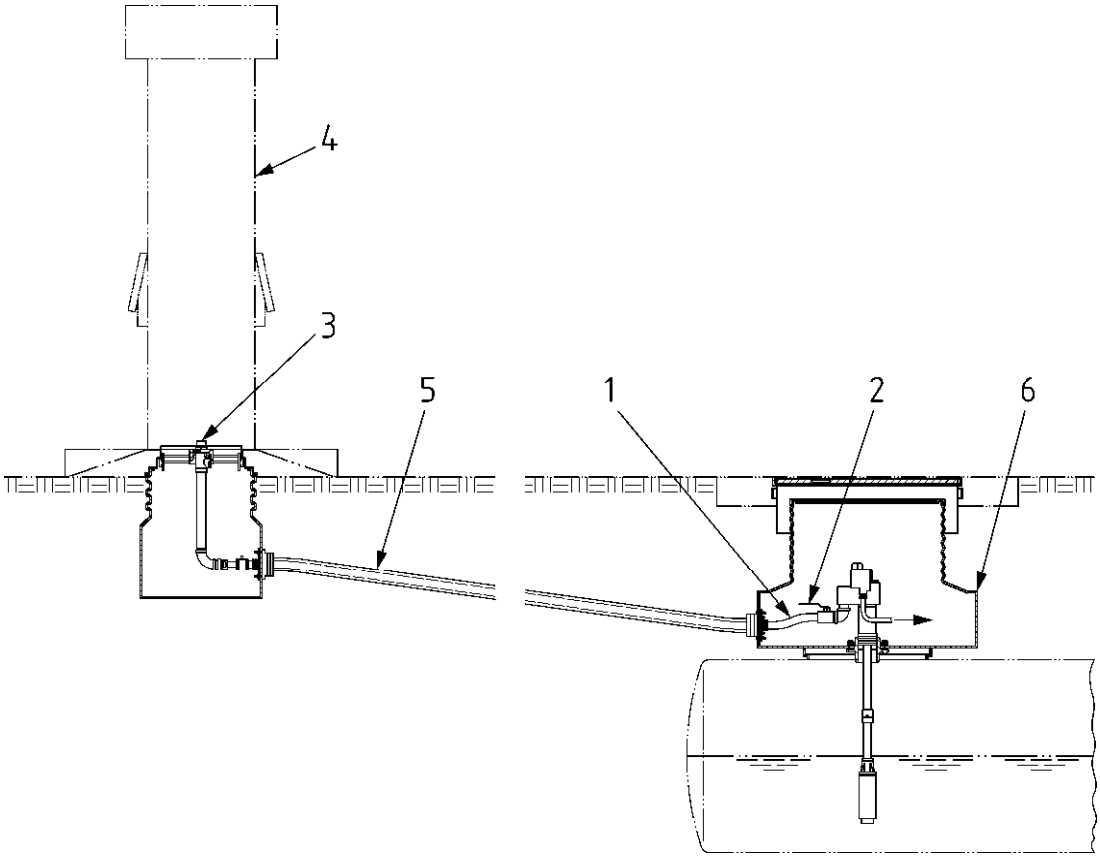
Only trained and competent staff should install or maintain submersible pump assemblies.

## D.2 Submersible pump assembly location

The submersible pumping unit should be placed inside the tank with the manifold assembly situated in the tank chamber.

Fill points should be separate from a tank chamber containing a manifold assembly. The submersible pump should be installed so that its inlet is at least 25 mm above the fill pipe outlet.

The manifold assembly should be positioned at such a height in the tank chamber to permit ready access to the manifold assembly and tank fittings, see Figure D.1.




**Key**

1 flexible pipe work connector
2 isolation valve
3 shear valve
4 dispenser
5 pipe work
6 tank chamber

**Figure D.1 — Installation of a submersible pump assembly in a tank and connection with a dispenser**

## D.3 Leak detection

A leak in a pressurised system can cause high losses of fuel with associated safety and environmental consequences and for this reason it is recommended that a leak detection system should be used. On a double skin pipe work it is possible to fit a class I or class III leak detection system in accordance with EN 13160-2 and -4.

If a leak is detected the system should shut off the submersible pump. If more than one submersible pump assembly is connected to the affected pipe work all these submersible pump assemblies should be shut off at the same time.

Other methods which monitor pressure decay in the primary pipe can be installed in pipe work. These systems only operate effectively when the submersible pump is in rest. During the operation of the

submersible pump any leakage smaller or equal to the flow rate created by the nozzle operation cannot be detected using these methods.

## D.4 Pipe work

It is recommended that all pressurised pipe work should be double skin with an interstitial space for leak detection.

When rigid pipe work materials are attached to a manifold assembly, flexible pipe work connectors should be installed between the manifold assembly and the pipe work to eliminate pipe work stress and absorb any vibration from the submersible pump assembly.

All pipe work should fall towards the tanks enabling draining of the pipe work.

## D.5 Check valve

In order to allow proper functioning of pressurised pipe work leak detection, pressure testing and pipe work maintenance, there should be no other check valves or pressure relief valves installed in the pipe work in addition to the check valve and pressure relief valve included in the manifold assembly.

## D.6 Shear valve

A shear valve in accordance with EN 13617-3 should be installed in a pressurised pipe work at each dispenser to prevent outflow of fuel in the event of a fire or accidental impact on the dispenser.

## D.7 Isolation valve

An isolation valve should be installed at the discharge of the manifold assembly, to facilitate isolation of the pressurised pipe work and minimise spillage during maintenance. A valve for draining of the pipe work into the tank should be positioned after the isolation valve, if the pump system does not include a means for drainage.

## D.8 Electrical isolation

A correctly rated, clearly marked and accessible switch or circuit breaker for each submersible pump assembly according to 5.3 of EN 60204-1:2006 should be provided in a location remote from the dispensers and the submersible pump assembly, in order to shut off power safely for maintenance and other works. The power to a submersible pump controller if fitted should also be isolated by this device.

## D.9 Manifolding of pipe lines and siphoning of tanks

Submersible pump assemblies may operate singly, together or may be arranged to respond to pumping demand. When more than one submersible pump assembly supply the same pipe line and are installed in separate tanks a siphon system should connect those separate tanks.

Manifolded submersible pump assemblies installed in separate tanks should be provided with inline check valves and pressure relief valves installed at the outlet of each submersible pump assembly. The pressure relief valve should be rated at a maximum of 350 kPa (3,5 bar).

If one submersible pump assembly is used for pumping from more than one tank, a siphon system should connect those tanks.

Siphon loop pipe work should be installed at least 25 mm below the intake of the submersible pump assembly or inlet pipe.

Submersible pump assemblies may include a device that creates a vacuum to prime a siphon system between two tanks. A check valve to maintain a vacuum in the siphon system should be installed in the field.

Pipe work of siphon systems should have a minimal nominal inside diameter of at least 50 mm and be sloped to a high point in the pipe work where the vacuum source from the manifold assembly is connected to the pipe work of the siphon system. The slope of the pipe work of the siphon system should be at least 1 %. When two submersible pump assemblies are installed in tanks that are siphoned, both vacuum sources maybe used to prime the siphon system. The joined vacuum sources should be attached at the highest point in the siphon loop pipe work. An isolation valve should be installed in the siphon system to ensure that the tanks connected by the system can be isolated in order that work may be carried out or for a delivery to take place.

## D.10 Cathodic protection

Normally the submersible pump assembly should be electrically bonded with all metallic tanks and pipes. However, this may not be the case for tanks with cathodic protection. During the design of the petrol filling stations, designers should take due consideration of any impact cathodic protection may have on the safety of the electrical equipment and wiring. Expert advice should be obtained from the appropriate engineers.

## D.11 Maintenance

The maintenance should be in accordance with the manufacturer's instruction.

The solenoid valve on dispensers should be tested to ensure that it is seated correctly, and that pipe work testing is against the valve seating and not the nozzle seating.

Seals on the manifold assembly and pipe fittings connected should be visually inspected for fuel leaks. A check on the tightness of all fittings should also be made.

Pump pressure relief valve should be tested, either at the manifold assembly or through a test port on the shear valve.

Electrical switches inside pump controllers should be inspected for wear or arcing. Switches showing signs of arcing or welding should be changed.

Voltage to the coil of the switch should be inspected for bleed voltage from the dispenser solid-state relays when the submersible pump assembly is off. Excessive voltages can accelerate contact wear and weld contacts in the pump controller causing the submersible pump assembly to run continuously.

## D.12 Above ground tanks

Submersible pumps may also be installed on above ground tanks with the manifold assembly exposed to open air.

Submersible pump assemblies installed on above ground tanks with the dispenser installed below the manifold assembly should be equipped with positive shut off valves that automatically close when the submersible pumping unit is off, and open only when the submersible pumping unit is in use. The shut off valve should be installed and adjusted so that liquid cannot flow by gravity from the tank to the dispenser in the event of a leak in the pipe work or hose when the dispenser is not in use.

# Annex ZA
(informative)

## Relationship between this European Standard and the Essential Requirements EU Directive 94/9/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive ATEX 94/9/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**WARNING**: Other requirements and other EU directives may be applicable to the products falling within the scope of this standard.

**Table ZA.1 — Correspondence between this European Standard and Directive 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres — Annex II**

| Clause(s)/ subclause(s) of this EN | Essential requirements (ERs) of Directive 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres | | Qualifying Remarks/ Notes |
|---|---|---|---|
| 5 | 1 | Common requirements | Applicable |
| 5 | 1.0 | General requirements | Applicable |
| 5.1; 5.3 | 1.01 | Principles of integrated explosion safety | Applicable |
| 5.1.3; 5.2; 5.4 | | Prevent formation of explosive atmospheres | Applicable |
| 5.1; 5.3 | | Prevent ignition of explosive atmosphere | Applicable |
| – | | Limit range of explosion flames and pressures | Not applicable |
| 5.1 | 1.0.2 | Design after due analysis of possible operating faults | Applicable |
| 7.3 | 1.0.3 | Special checking and maintenance conditions | Applicable |
| 1; 5.1.2; 5.2; 5.3; 5.4 | 1.0.4 | Designed to cope with surrounding area conditions | Applicable |
| 7.2 | 1.0.5 | Marking | Applicable |
| 7.3 | 1.0.6 | Instructions | Applicable |
| 7.3 | (a) | All equipment must be accompanied by instructions | Applicable |
| 7.3 | | Recapitulation of marking information | Applicable |
| 7.3 | | Instructions for safe installation, use, maintenance | Applicable |
| – | | Indication of danger areas by pressure relief devices | Not applicable |
| 7.3 | | Training instructions | Applicable |
| 7.3 | | Assessment of safe operation in expected conditions | Applicable |
| 7.1; 7.2 | | Electrical, pressure, temperature parameter limits | Applicable |
| 7.3 | | Special conditions of use and possible misuse | Applicable |
| – | | Essential characteristics of tools that may be fitted | Not applicable |
| 7.1; 7.3 | (b) | Instructions-translation into Community languages | Applicable |
| 7.1; 7.3 | (c) | Instructions- diagrams necessary for correct use etc. | Applicable |
| 7.1; 7.3 | (d) | Literature must not contradict instructions for safety | Applicable |
| 5.1; 5.2.1; 5.3.6; 5.6 | 1.1 | Selection of materials | Applicable |
| 5.3.2; 5.3.6 | 1.1.1 | Materials must not trigger off an explosion | Applicable |
| – | 1.1.2 | No reaction of materials and explosive atmosphere | Not applicable |
| 5.2.1 | 1.1.3 | No reduction of protection due to corrosion, wear, etc. | Applicable |
| 5 | 1.2 | Design and construction | Applicable |
| 5.1; 5.3 | 1.2.1 | Technological knowledge of explosion protection | Applicable |
| 5.1; 5.2; 7.3 | 1.2.2 | Replacement components to function properly | Applicable |
| – | 1.2.3 | Enclosed structures and prevention of leaks | Not applicable |
| – | 1.2.4 | Dust deposits | Not applicable |

**Table ZA.1** *(continued)*

| **Clause(s)/ subclauses) of this EN** | **Essential requirements (ERs) of Directive 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres** | | **Qualifying Remarks/ Notes** |
|---|---|---|---|
| 5.3 | 1.2.5 | Additional means of protection | Applicable |
| 7.3 | 1.2.6 | Safe opening | Applicable |
| – | 1.2.7 | Protection against other hazards | Not applicable |
| 5.1.1 | 1.2.7 | Physical injury – direct or indirect | Applicable |
| 5.6; B.12 | 1.2.7 | Surface temperatures | Applicable |
| 5.1 | 1.2.7 c) | Non-electrical dangers | Applicable |
| – | 1.2.8 | Overloads | Not applicable |
| – | 1.2.9 | Flameproof enclosure systems | Not applicable |
| 5.3.1; 5.3.2; 5.3.5 | 1.3 | Potential ignition sources | Applicable |
| 5; C.1 | 1.3.1 | Hazards arising from different ignition sources | Applicable |
| 5.3.2; 5.3.3 | 1.3.2 | Hazards arising from static electricity | Applicable |
| 5.3.6 | 1.3.3 | Hazards arising from stray electric and leakage | Applicable |
| 5.3.5; B.12; C.1; C.2 | 1.3.4 | Hazards arising from overheating | Applicable |
| – | 1.3.5 | Hazards arising from pressure compensations | Not applicable |
| 4 | 1.4 | Hazards arising from external effects | Applicable |
| 7.3 | 1.4.1 | Safety in the presence of voltage, humidity, vibration etc. | Applicable |
| 5.1.2; 5.2.1 | 1.4.2 | Mechanical and thermal stress, aggressive substances | Applicable |
| 5.3.8 | 1.5 | Requirements in respect to safety-related devices | Applicable |
| – | 1.5.1 | Detection of failure of safety devices-fail safe | Not applicable |
| – | 1.5.2 | System security in the event of safety device failure | Not applicable |
| – | 1.5.3 | Emergency stop control lockout devices | Not applicable |
| – | 1.5.4 | Control and display units | Not applicable |
| 5.3.4; 5.3.5 | 1.5.5 | Explosion protection devices (measuring functions) | Applicable |
| – | 1.5.6 | Serviceability of devices with a measuring function | Not applicable |
| – | 1.5.7 | Safety factor of devices with a measuring function | Not applicable |
| – | 1.5.8 | Risks arising from software | Not applicable |
| – | 1.6 | Integration of safety requirements relating to systems | Not applicable |
| – | 1.6.1 | Manual override | Not applicable |
| – | 1.6.2 | Emergency shut down – accumulated energy | Not applicable |
| – | 1.6.3 | Power failure | Not applicable |
| – | 1.6.4 | Hazards arising from connections | Not applicable |
| – | 1.6.5 | Warning devices | Not applicable |
| 5.6; 5.7 | 2.0 | Supplementary requirements of equipment | Applicable |
| 5.3.8 | 2.1 | Requirements for category 1 of equipment group II | Applicable |
| – | 2.1.1 | Explosive atmospheres due to gases/vapours/hazes | Not applicable |
| 5.3.8; C | 2.1.1.1 | No sources of ignition even in the event of rare incidents either an independent second means of protection or protection ensured in the event of 2 independent faults | Applicable |
| 5.3.5; B.12; C.1; C.2 | 2.1.1.2 | Temperature limits on surfaces can never be exceeded | Applicable |
| – | 2.1.1.3 | Opening of parts having possible sources of ignition | Not applicable |

**Table ZA.1** *(concluded)*

| **Clause(s)/ subclause(s) of this EN** | **Essential Requirements (ERs) of Directive 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres** | | **Qualifying Remarks/ Notes** |
|---|---|---|---|
| – | 2.1.2 | Explosive atmospheres caused by air/dust mixtures | Not applicable |
| 5.3.4; 5.3.7; 5.3.9 | 2.2 | Requirements for category 2 of equipment group II | Applicable |
| – | 2.2.1 | Explosive atmospheres due to gases/vapours/mists | Not applicable |
| 5.3.7 | 2.2.1.1 | No sources of ignition in the event of operating faults | Applicable |
| 5.3.5; B.12; C.1: C.2 | 2.2.1.2 | Stated surface temperatures are not exceeded | Applicable |
| – | 2.2.1.3 | Opening parts having possible sources of ignition | Not applicable |
| – | 2.2.2 | Explosive atmospheres caused by air/dust mixtures | Not applicable |
| – | 2.3 | Requirements for category 3 of equipment group II | Not applicable |
| – | 3 | Supplementary requirements in respect of protective systems | Not applicable |

# Annex ZB
(informative)

## Relationship between this European Standard and the Essential Requirements EU Directive 98/37/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive Machinery 98/37/EC, amended by 98/79/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard (except clauses 5.3 and 7.2.2 and Annex C) confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements (except Essential Requirement Noise) of that Directive and associated EFTA regulations.

**WARNING**: Other requirements and other EU directives may be applicable to the product falling within the scope of this standard.

# Annex ZC
(informative)

## Relationship between this European standard and the essential requirements of EU directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard, except clauses 5.3, 7.2.2 and Annex C, confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

**WARNING**: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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