SVENSK STANDARD SS-EN 50402

Fastställd	Utgåva	Sida	Ansvarig kommitté
2018-01-24	2	1 (1+98)	SEK TK 31

Elektrisk utrustning för detektering och mätning av syre eller brännbara eller giftiga gaser och ångor – Funktionssäkerhet hos fast monterade system för detektering

Electrical apparatus for the detection and measurement of combustible or toxic gases or vapours or of oxygen – Requirements on the functional safety of fixed gas detection systems

Som svensk standard gäller europastandarden EN 50402:2017. Den svenska standarden innehåller den officiella engelska språkversionen av EN 50402:2017.

Nationellt förord

Tidigare fastställd svensk standard SS-EN 50402, utgåva 1, 2007 och SS-EN 50402/A1, utgåva 1, 2008, gäller ej fr o m 2020-02-04.

ICS 13.320.00

Denna standard är fastställd av SEK Svensk Elstandard,
som också kan lämna upplysningar om **sakinnehållet** i standarden.
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Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50402

March 2017

ICS 13.320

Supersedes EN 50402:2005

English Version

Electrical apparatus for the detection and measurement of combustible or toxic gases or vapours or of oxygen - Requirements on the functional safety of gas detection systems

Matériel électrique pour la détection et la mesure des gaz ou vapeurs combustibles ou toxiques, ou de l'oxygène - Exigences relatives à la fonction de sécurité des systèmes de détection de gaz

Elektrische Geräte für die Detektion und Messung von brennbaren oder toxischen Gasen und Dämpfen oder Sauerstoff - Anforderungen an die funktionale Sicherheit von Gaswarnsystemen

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 50402:2017 E

SEK Svensk Elstandard

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European foreword

This document (EN 50402:2017) has been prepared by CLC/SC 31-9 “Electrical apparatus for the detection and measurement of combustible gases to be used in industrial and commercial potentially explosive atmospheres” of CLC/TC 31 “Electrical apparatus for potentially explosive atmospheres” and by CLC/TC 216 “Gas detectors”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-02-04
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2020-02-04

This document supersedes EN 50402:2005.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

EN 50402:2017 includes the following significant technical changes with respect to EN 50402:2005:

— In general, the standard is updated to consider the modifications in the second edition of EN 61508 for hardware and software. Route 2 of the second edition of EN 61508 will not be permitted for gas detection equipment.

— The standard is updated for the SIL 1 requirements to be in line with the second edition of EN 50271 specifying the minimum requirements for functional safety for performance approved gas detectors, gas detection apparatus and complete gas detection systems.

— The latest revisions of the metrological standards have been considered.

— SIL 4 has been deleted as being not appropriate to gas detection.

— Clauses 4 and 5 have been updated for more detailed specification.

— Clause 6 for software is new.

— Clauses 7 to 11 are restructured for clarification of requirements and relation to EN 61508.

— Clause 10 is specifying more details for the customer information.

— The former normative Annex D is now Clause 12.

— The former informative Annex A has been deleted. Relevant text was moved to Clauses 7 to 9.

— The new informative Annex D is providing information on failure modes of sensing elements.

Introduction

This European Standard specifies requirements for the functional safety of gas detection systems. It encompasses criteria for reliability, avoidance of faults and fault tolerance. Functional safety is that part of the overall safety which relates specifically to the measures required within the gas detection system to avoid or to handle failures so that the safety function is ensured. This includes not only design and the development process requirements of the gas detection system but also the information requirements for planning, putting into operation, maintenance and repair.

This European Standard is dedicated to the manufacturer. Information important for the safe use of the device (gas detection system) will be specified in the instruction manual.

Gas detection systems will fail to function if dangerous failures occur in the equipment used. Failure to function will also occur if such systems are not installed or maintained in an appropriate manner. In some applications, failures of this type will dominate the functional safety achieved. This European Standard is only targeted at reducing equipment failures to levels appropriate to the application. Users of gas detection systems will therefore need to ensure installation and maintenance of such systems is carried out according to the instruction manual. This European Standard does not specify the physical positioning of measuring points / locations.

Gas detection systems may differ widely in structure, complexity and performance. They may not be handled in a uniform manner like low complexity devices, for this reason a general specification of requirements is not possible.

Gas detection systems therefore need to be divided into functional modules for validation to ensure that systems which have different structures are handled according to appropriate procedures. A gas detection system will not normally include all the modules covered by this European Standard. Requirements are specified for each of these modules in terms of hierarchical levels which represent one of the constituents of functional safety performance. The hierarchical levels are termed as SIL-capabilities, with SIL-capability 1 representing the minimum and SIL-capability 3 the maximum levels of functional safety to comply with this European Standard. The SIL-capability of a module is related to the maximum safety integrity level that may be claimed for a safety function which uses modules of that specified SIL-capability. Modules will be characterized in terms of their SIL-capability. Information is also required on failure rate characteristics of modules or related physical components to enable the manufacturer to determine the overall level of functional safety of a gas detection system. In this way, the manufacturer will take account of both random failures of hardware components and systematic failures in hardware and software. This European Standard also specifies the requirements that will enable determination of whether the gas detection system has a low enough failure rate when used in conjunction with other equipment necessary for functional safety.

This European Standard will enable the functional safety characteristics of the gas detection system to be determined from the characteristics of its modules and components (see Annex C). This will enable a gas detection system to be used as a part of an overall safety system. The characterization including the determination of a SIL-capability and failure rate data will only need to be carried out once for a particular module or component.

Depending on characterization of each module and component, the properties of each chosen safety function of the whole gas detection system will be specified. The procedure for determining the SIL-capability of a safety function of a gas detection system will only need to be repeated for each new combination of modules and components. Different combinations of equivalent modules may lead to gas detection systems which reach different SIL-capabilities.

In this way a flexible adoption of the gas detection system into different applications will be possible without repeating all steps of the validation procedure for every new configuration.

This European Standard does not include requirements for availability which will need to be considered separately.

This European Standard is dedicated to manufacturers and is applicable to gas detection systems or parts of them (e.g. gas detection transmitters or gas detection control units) as basis for functional safety testing. It supplements the requirements of the relevant metrological standards. It should not be confused with EN 60079–29–3 which is dedicated to system integrators to give guidance for combining gas detection apparatus with other equipment (e.g. gas processing, filters, valves) not provided by the gas detection manufacturer but part of a safety function under the responsibility of the system integrator.

1 Scope

This European Standard is applicable to detection and measurement apparatus and systems for flammable or toxic gases or vapours or oxygen. It covers apparatus intended to measure reliably, gas concentration and to provide an output signal (alarm and/or measurement signal), the purpose of which is to give a warning of a potential hazard.

This European Standard is a product standard which is based on EN 61508 (all parts) and for gas detection systems covers both low and high demand mode at SIL capabilities of 1, 2 or 3 only. Gas detection apparatus and gas detection systems are developed as generic products. This European Standard covers part of the phase 10 “realization” of the overall safety lifecycle defined in EN 61508-1:2010, Figure 2. Configuration and integration into specific applications is not covered by this European Standard.

In the event of conflict between the requirements of this European Standard and those of EN 61508, EN 50402 will take precedence.

NOTE 1 Applications requiring a SIL capability of 4 for a gas detection system are not practicable.

This European Standard is dedicated mainly to fixed apparatus and systems. However, it can also be applied to transportable gas detectors which are intended to be used as temporary replacements for fixed apparatus.

This European Standard supplements the requirements of the European Standards for electrical apparatus for the detection and measurement of flammable gases, vapours (e.g. EN 60079-29-1 or EN 60079-29-4), toxic gases (e.g. EN 45544) or oxygen (e.g. EN 50104).

NOTE 2 These European Standards are called in the text “metrological standards”.

The examples above show the state of the standardization for industrial applications at the time of publishing this European Standard. There may be other metrological standards covering other application fields, for which this European Standard is also applicable.

EN 50271 specifies minimum requirements for apparatus using software and/or digital components. It also defines additional optional requirements for compliance with SIL 1 in low demand mode operation. EN 50402 includes all requirements of EN 50271.

EN 50402 is also dedicated to apparatus and gas detection systems and/or components and should be used instead of EN 50271 in the following cases:

— at SIL 1 when the system contains components not covered by EN 50271;

— at SIL 1 high demand mode operation;

— at SIL 2 and SIL 3;

— at all SILs when non-digital based apparatus is used.

Applying the above-mentioned metrological standards will ensure the performance is adequate in normal operation of a gas detection system. Additionally, the requirements of this European Standard address the functional safety of gas detection systems and encompass criteria for reliability, fault tolerance and avoidance of systematic failures. The avoidance and control of systematic failures will be covered by the requirements for the development processes and techniques and diagnostic measures chosen in the design. This European Standard will lead to the characterization of the gas detection system by a SIL-capability and related hardware failure rate representing a hierarchical order of safety levels. This will allow the user to incorporate the gas detection system into an overall safety system according to the safety integrity levels of EN 61508 (all parts).

This European Standard is applicable for gas detection systems, which may consist of the following functional units:

— gas-sampling;

— sensor;

— signal transmission;

— input to control unit;

— signal processing in control unit;

— output from control unit.

This European Standard does not specify requirements for the installation and maintenance of gas detection systems. It also does not specify the physical positioning of measuring points / locations.

This European Standard does not specify which SIL-capability is sufficient for which application.

NOTE 3 The SIL-capability required for an application will be specified by the user (see Clause 9 and Annex A).

2 Normative references

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

EN 45544-1, *Workplace atmospheres — Electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours — Part 1: General requirements and test methods*

EN 45544-2, *Workplace atmospheres — Electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours — Part 2: Performance requirements for apparatus used for exposure measurement*

EN 45544-3, *Workplace atmospheres — Electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours — Part 3: Performance requirements for apparatus used for general gas detection*

EN 45544-4, *Workplace atmospheres — Electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours — Part 4: Guide for selection, installation, use and maintenance*

EN 50104, *Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods*

EN 50159, *Railway applications - Communication, signalling and processing systems - Safety-related communication in transmission systems*

EN 50270, *Electromagnetic compatibility — Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen*

EN 50271:2010, *Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen - Requirements and tests for apparatus using software and/or digital technologies*

EN 60079-29-1:2016, *Explosive atmospheres - Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases (IEC 60079-29-1:2016)*

EN 60079-29-2, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen (IEC 60079-29-2)*

EN 60079-29-3, *Explosive atmospheres - Part 29-3: Gas detectors - Guidance on functional safety of fixed gas detection systems (IEC 60079-29-3)*

EN 60079-29-4, *Explosive atmospheres - Part 29-4: Gas detectors - Performance requirements of open path detectors for flammable gases (IEC 60079-29-4)*

EN 61326-3-1, *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) - General industrial applications*

EN 61326-3-2, *Electrical equipment for measurement, control and laboratory use — EMC requirements — Part 3-2: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) — Industrial applications with specified electromagnetic environment (IEC 61326-3-2)*

EN 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (IEC 61508-1:2010)*

EN 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 60158-2:2010)*

EN 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements (IEC 61508-3:2010)*

EN 61508-4:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 4: Definitions and abbreviations (IEC 61508-4:2010)*

EN 61508-5:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 5: Examples of methods for the determination of safety integrity levels (IEC 61508-5:2010)*

EN 61508-6, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3 (IEC 61508-6)*

EN 61508-7:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 7: Overview of techniques and measures (IEC 61508-7:2010)*

EN 61784-3:2016, *Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions (IEC 61784-3:2016)*