IEC 61285

Edition 3.0 2015-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial-process control – Safety of analyser houses

Commande des processus industriels – Sécurité des bâtiments pour analyseurs

IEC 61285:2015-02(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.110; 25.040.40

ISBN 978-2-8322-2228-7

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INDUSTRIAL-PROCESS CONTROL – SAFETY OF ANALYSER HOUSES

FOREWORD

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International Standard IEC 61285 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2004. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

a) incorporation of previously issued corrigendum;
b) minor updates to several sections and references.

The text of this standard is based on the following documents:

FDIS	RVD
65B/954/FDIS	65B/966/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Process analysers measure the characteristics of a process stream continuously and automatically. The process sample is introduced automatically and the system is designed for unattended operation and minimal maintenance.

The placement of devices for process analysis in analyser houses is beneficial for technical and economic reasons:

– in order to facilitate appropriate environmental conditions;

– to simplify servicing and maintenance issues;

– to enable the use of a common infrastructure (see 3.5).

This document is designed to set forth minimum safety requirements for typical analyser houses (AHs). It is superseded in all cases by national, local, or corporate requirements, if other or more stringent requirements will apply.

INDUSTRIAL-PROCESS CONTROL – SAFETY OF ANALYSER HOUSES

1 Scope

This International Standard describes the physical requirements for the safe operation of the process analyser measuring system installed in an analyser house (AH) in order to ensure its protection against fire, explosion and health hazards. This standard applies for analyser houses with inner and/or external potential explosive atmospheres and it applies to hazards caused by toxic substances or asphyxiant gases. (Refer to national guidelines on toxic hazards.)

This standard does not address facilities where solids (dust, powder, fibres) are the hazard.

This standard does not seek to address all functional safety issues related to analyser houses.

Clause 4 addresses the location of the AH and connection within the process plant areas.

Clause 5 addresses the design, construction and layout of the AH. It does not address parts of the analyser measuring system installed in other locations such as sample conditioning rooms (SCR) or switchgear rooms.

Clause 6 addresses measures for reducing the danger of explosion for AHs while permitting maintenance of equipment with the power on and the case open.

For most fluids, the major constraint is that the concentration of vapours, which are toxic for personnel, is lower than the lower explosive (flammable) limit (LEL) (see Clause 7).

Using n-Pentane as an example, the LEL is 1,4 % or 14 000 × 10^{-6}, the level immediately dangerous to life or health (which is the maximum level from which a worker could escape within 30 min without any escape-impairing symptoms or any irreversible health effects) is only 0,5 % or 5 000 × 10^{-6}.

Clause 7 addresses those measures for protecting personnel from materials in the atmosphere of AHs that are hazardous to health.

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.

IEC 60079-0:2011, *Explosive atmospheres – Part 0: General requirements*

IEC 60079-10-1:2008, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-20-1:2010, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

3 Terms and definitions

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

3.1
analyser cabinet
small housing in which analysers are installed individually or grouped together

Note 1 to entry: Maintenance is performed from outside the cabinet with the door(s) open.

3.2
analyser shelter
structure with one or more sides open and free from obstruction to the natural passage of air, in which one or more analysers are installed

Note 1 to entry: The maintenance of the analysers is normally performed in the protection of the shelter.

3.3
analyser house
AH
enclosed building or part of a building containing process analysers and associated equipment where streams for analysis are brought in and which is regularly entered by authorized personnel

Note 1 to entry: An AH is not a permanent workplace. Within the scope of this standard, the term AH is used regardless of the structure configuration as either a room, a walk-in cabinet, an analyser container or an analyser building and whether or not it is an integral part of, or attached to, another structure.

3.4
sample conditioning room
SCR

room that is separated from the AH and has modules for sample conditioning, auxiliary material, or sample disposal equipment

3.5
infrastructure
required means and supply with auxiliaries to operate an AH with all equipment therein, for example, instrument air, nitrogen, water, power supply, incidental disposal of waste and disposal of substances introduced to be analysed

Note 1 to entry: The infrastructure occasionally comprises the fundament of an AH, the positioning of gas bottles and containers for gas supply and test gases. The infrastructure comprises in addition the ventilation and climatisation of the AH and the needed alarm devices within and outside of the AH.

3.6
maintenance
servicing, inspection, repair, improvement and weakness analysis of process analyser devices and infrastructure

3.7
toxic substances
gaseous or liquid substances that, if released in a room, will cause a health hazard by contact with the skin or by inhalation from the surrounding atmosphere

3.8
safety back-up
additional personnel, in constant contact with a person or persons in hazardous working condition, who could assist or call for additional help

3.9
external explosion hazard
hazard existing when the AH is erected at a location where flammable substances may ingress from the outside resulting in dangerous concentrations of flammable gases and vapours inside the AH

3.10
internal explosion hazard
hazard existing when a flammable mixture can result from release of samples or auxiliary supplies inside the AH

3.11
lower explosive limit
LEL
volume ratio of the flammable gas or vapour in air below which an explosive gas atmosphere will not be formed

3.12
explosive gas atmosphere
mixture with air, under atmospheric conditions, of a flammable material in the form of gas or vapour in which, after ignition, combustion spreads through the unconsumed mixture

3.13
hazardous area
area in which an explosive gas atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of devices

3.14
non-hazardous area
area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of the analysers

3.15
zone 0
area in which an explosive gas atmosphere is present continuously or for long periods or frequently

[SOURCE: IEC 60079-10-1:2008, 3.6]

3.16
zone 1
area in which an explosive gas atmosphere is likely to occur in normal operation occasionally

[SOURCE: IEC 60079-10-1:2008, 3.7]

3.17
zone 2
area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only

[SOURCE: IEC 60079-10-1:2008, 3.8]

3.18
source of release
a point or location from which a gas, vapour, mist or liquid may be released into the atmosphere so that an explosive gas atmosphere could be formed

[SOURCE: IEC 60079-10-1:2008, 3.9]

3.19
grades of release
there are three basic grades of release, as listed below in order of decreasing frequency and likelihood of the explosive gas atmosphere being present:

a) continuous grade;

b) primary grade;

c) secondary grade.

A source of release may give rise to any one of these grades of release, or to a combination of more than one

[SOURCE: IEC 60079-10-1:2008, 3.10]

3.20
continuous grade of release
release which is continuous or is expected to occur frequently or for long periods

[SOURCE: IEC 60079-10-1:2008, 3.11]

3.21
primary grade of release
release which can be expected to occur periodically or occasionally during normal operation

[SOURCE: IEC 60079-10-1:2008, 3.12]

3.22
secondary grade of release
release which is not expected to occur in normal operation and, if it does occur, is likely to do so only infrequently and for short periods

[SOURCE: IEC 60079-10-1:2008, 3.13]

3.23
release rate
quantity of flammable gas, vapour or mist emitted per unit time from the source of release

[SOURCE: IEC 60079-10-1:2008, 3.14]

3.24
flashpoint
lowest liquid temperature at which, under certain standardized conditions, a liquid gives off vapours in a quantity such as to be capable of forming an ignitable vapour/air mixture

3.25
ignition temperature
T-rating
value of ignition temperature as given in IEC 60079-20-1

3.26
equipment protection level
EPL
level of protection assigned to equipment based on its likelihood of becoming a source of ignition and distinguishing the differences between explosive gas atmospheres, explosive dust atmospheres, and the explosive atmospheres in mines susceptible to firedamp

[SOURCE: IEC 60079-0:2011, 3.26]

3.27
containment system
parts within the room or building containing the hazardous substance that may constitute an internal source of release

4 Location of AHs and connection within the process plant areas

4.1 General

When determining the location of the AH, the following factors should be considered.

4.2 Response time

Line lengths from sample points to the analysers shall be estimated and the necessary flow rates calculated to determine whether resultant dead times, sample deterioration and flow rates are acceptable.

4.3 Utilities

Connection lengths to all utilities such as air, steam, electricity, sample return, signals, etc. shall be estimated.

4.4 Safety

4.4.1 Location

The AH should preferably be located away from external sources of toxic or flammable release, and in a place where accumulation of these substances is not likely to occur.

4.4.2 Escape

Escape routes shall be determined and remain unobstructed and where possible be oriented away from hazardous areas.

4.4.3 Area classification

Area classification for the AH interior and for the ventilation air source shall be determined by the process plant safety authority or user.

4.4.4 Peripheral hazards

Consideration shall be given to the possibility of analysers or their sample lines creating a hazard in the AH or any adjacent room.

4.5 Access

Access is needed both for maintenance personnel and for supplies. AHs should be located at ground level or with access to an elevator. Consideration should be given to the requirements of heavy supplies such as gas cylinders and safe removal/installation of analysers.

Maintenance access to process equipment such as a heat exchanger shall also be considered. In addition access is needed to isolation valves for auxiliary supplies, sampling points and sampling streams outside the AH, in order to render the AH safe as fast as possible. Access is also needed to an external isolation switch for electrical power to shut the entire AH down.

5 Design, construction and layout of AHs

5.1 General

Analysers and analyser sampling systems require varying degrees of protection depending on the sample and the type of analyser, the importance of the application and the environment in which it has to operate. Where the construction and maintenance requirements are not suitable for the working environment, additional protection such as AHs should be provided. This additional protection is to ensure satisfactory performance of the instrument and to facilitate maintenance.

The selection of the housing depends on a number of factors such as

– classification of the area in which the analyser and/or sample system is to be located;
– range of ambient conditions at the site, including temperature, rain, humidity, snow, wind, dust, sand, direct sunlight, and corrosive atmosphere;
– environment specified by the analyser vendor for reliable, accurate, and safe operation;
– protection required for equipment and personnel during maintenance;
– maintenance and accessibility requirements of the system components;
– process conditions/environment of the area in which the AH is to be located (for example, loading, unloading or transferring of chemicals or equipment, noise, vibration, chemical releases, etc.).

Clause 5 primarily describes AH located in hazardous (classified environments) and/or into which flammable or toxic samples are introduced. Those AH located in an unclassified area and into which no flammable or toxic samples, services, calibration mixtures or air from a hazardous location are introduced need only provide the environment necessary for accurate and reliable operation.

5.2 General requirements

This clause addresses the general requirements for safe operation of an AH regardless of leakage or flammable material (see Clause 6) or material hazardous to health (see Clause 7).

5.3 Dimensions and layout

The size of the AH depends on the number, size and access requirements of the analysers and auxiliary equipment. Allowance shall be made for any ventilation, drainage, spare parts storage, electrical distribution, local recording, etc. Recommended minimum dimensions are 2,4 m length and width and 2,3 m headroom. The absolute minimum unobstructed headroom should be 2,0 m. Spare space of 30 % is recommended to facilitate later equipment addition. Suspended ceilings, cable trenches and other dead air spaces should be avoided.

5.4 Structural requirements

5.4.1 Construction materials

Local requirements such as for anti-static properties, corrosion, fire and weather resistance shall be determined and appropriate material selected.

5.4.2 Walls

Where equipment is supported from the walls, appropriate reinforcement may be required. Wall penetrations should be minimized and sealed where appropriate with materials meeting the relevant structural and safety requirements (for example, watertight, fire-retardant, flame-resistant, mechanical strength, etc.).

5.4.3 Floors and foundation

Floors should be non-porous, non-slip and resistant to materials likely to be spilled on them. Requirements for floor cleaning, such as a slight slope and drain, should be considered. If a floor drain is installed, it should be free draining to the outside of the AH, where the liquid can be properly disposed of. Measures should be taken to prevent the entry of extraneous liquids. Such measures can include raising the floor above the exterior grade level or providing a step or ramp at the entrance or by appropriately sealing the house at the base.

5.4.4 Doors

Doors shall open outwards and be self-closing or controlled with an alarm device. Doors shall be fitted with a "panic bar" so that they may be opened from the inside even if locked for use as emergency escape. The doors shall contain windows with shatter-resistant safety glass. An additional emergency exit, remote from the first, shall be considered depending on the floor area of the AH, if access to the main door can be impeded either internally or externally. Doors used to separate Ex zones are subject to specific requirements as given in IEC 60079-10-1:2008, Clause A.2. Where the AH is part of a building, other safety considerations may override this.

5.4.5 Windows

Windows shall be made of shatter-resistant safety glass and shall be fixed closed. Where Ex-hazards may arise, windows shall be gas-tight. The AH shall have observation windows that assure an unobstructed view into the room. Observation windows in the door(s) are preferable.

5.4.6 Roof

The roof shall be designed for appropriate loads (for example, snow, wind, equipment, people, etc.).

5.5 Equipment

5.5.1 Lighting

Lighting or emergency lights shall be operational at all times. Light level shall be that required for all works or the level specified by authorities having jurisdiction.

5.5.2 Communications

Where safety alarm(s) from the surrounding plant cannot be detected inside the AH, they shall be repeated inside the AH. An appropriate device for communication to a permanently manned location shall be available.

5.5.3 Piping, tubing and valves

Containment systems inside the AH shall be designed such that no hazardous material can escape into the AH under normal operation. The functions and content of piping, tubing and valves shall be clearly marked. Isolation valves shall be external to the AH. Streams for disposal shall be treated according to their hazard, for example, collected in closed systems or transported to facilities outside the AH. Any lines capable of delivering unacceptable high quantities of hazardous material under fault conditions into the AH shall have flow restrictors