
**Guidance and recommendations on
design, selection and installation
of vents to safeguard the structural
integrity of enclosures protected by
gaseous fire-extinguishing systems**

*Lignes directrices et recommandations relatives à la conception,
à la sélection et à l'installation d'évents pour préserver l'intégrité
structurelle des enceintes protégées par des systèmes d'extinction
d'incendie à gaz*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and firefighting*, Subcommittee SC 8, *Gaseous media and firefighting systems using gas*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 191, *Fixed firefighting systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces the first edition (ISO/TS 21805:2018), which has been technically revised.

The main changes are as follows:

- subclause [7.8.3](#) has been amended to cross-reference ISO 6183 for vent area calculations for CO₂;
- [Annex A](#) has been added, providing guidance on how testing in order to derive the agent-specific formulae;
- [Annex B](#) has been added, providing guidance on the procedure for developing coefficients for any new agents in the ISO 14520 series.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The guidance presented in this document is based on the results of a joint research programme conducted in 2006 and 2007 by several fire protection system manufacturers and interested parties. The programme of work consisted of several series of tests to evaluate the peak pressure response and pressure-relief vent area effects for each agent addressed in this document. The key data used in the development of this document were the values of peak enclosure pressure response (P_{MAX}) at each value of the volume-normalized pressure-relief vent area of the test enclosure, hereinafter referred to as the “leakage-to-volume ratio” or LVR. Other test parameters (enclosure temperature, agent quantity, discharge time and humidity) were held constant or varied in a specified manner. For each test series employing a single agent, the several pairs of LVR and resultant P_{MAX} values were graphically analysed, and a best-fit correlation curve was determined.

The LVR vs. P_{MAX} correlation curve for each agent or system forms the basis of the associated formulae in cases where the discharge of the agent results in cooling the air temperature below its dew point. Only halocarbon agents cause sufficient cooling to cause humidity-related effects on the peak enclosure pressure. Thus, a correction for humidity effects is included in the formulae for estimating vent area and maximum pressure on the discharge of the following agents:

- FK-5-1-12
- HFC-23
- HFC-125
- HFC-227ea

The humidity corrections used in this document are based on the results of tests conducted with HFC-227ea at different conditions of humidity.

The resulting values for humidity correction will be assumed to be equally applicable to the agents FK-5-1-12, HFC-125 and HFC-23 until further data or analyses indicate otherwise.

The correlations of LVR to maximum negative pressure and maximum positive pressure were based on test work performed in a test chamber at a relative humidity (RH) of approximately 38 %. If the RH in a protected enclosure differs from 38 % then a correction to the estimated maximum negative and positive pressures can be required. See [7.8](#) and [7.9](#) for further information on the effect of humidity. The temperature of the test enclosure was 21°C (nominal) for all tests that form the basis of the estimating methods given in this document.

In conducting the research programme described above, a large number of different venting arrangements were created in the test enclosure. The equivalent leakage area (ELA) for each test was determined by a “door fan test” and data analysis. The average enclosure pressure in effect during the many door fan tests varied from test to test. All values of ELA were normalized to an equivalent enclosure differential pressure of 125 Pa. The resulting enclosure correlations of peak pressure vs. LVR, and any resulting estimate of enclosure pressure-relief vent area, reflect a pressure-relief vent area calculated at an effective enclosure pressure of 125 Pa for a vent with a discharge coefficient of 0,61.

The effectiveness of a gaseous total flooding firefighting system depends, in part, on retention of the air-extinguishant mixture within the protected volume for a period of time. Retention of the extinguishant-air mixture requires that gas exchange (“leakage”) between the enclosure and the ambient environment be restricted. To limit the rate of gas exchange, the enclosure boundary should have a high degree of integrity. To put it another way, the total of the areas of the various penetrations in an enclosure’s bounding surfaces should be low, at least during the gas-retention period (hold time) after the end of the extinguishant discharge.

The addition of a gaseous firefighting extinguishant to an enclosure having a limited pressure-relief vent area will naturally result in a change of pressure therein. If the enclosure is sealed too tightly during the extinguishant discharge, i.e. too little pressure-relief vent area, the pressure change could exceed the structural strength of one or more of its bounding surfaces — windows, doors, walls,

ceiling. Conversely, if the enclosure has too much pressure-relief vent area then gas exchange with the ambient atmosphere will occur rapidly, leading to a short retention time of the extinguishant within the protected volume.

Thus, the use of gaseous firefighting systems should address two performance considerations:

- a) pressure management within the protected volume during the period of extinguishant discharge, and;
- b) retention of the extinguishant-air mixture within the enclosure for a specified period of time after the completion of the discharge.

This document provides guidance for limiting pressure extremes in an enclosure during the discharge of a clean agent fire extinguishing system. This document does not provide the information necessary to determine all of the requirements related to the design, installation, service, maintenance, inspection, test and/or requalification of fire suppression systems.

Some limitations and restrictions apply to the use of the formulae contained in this document. Please refer to the text and notes that follow them.

The information in this document does not supersede the manufacturer's guidance. The information contained in this document is presented as being supplementary to the guidance provided by the respective system manufacturers. Guidance from the system manufacturer should always be followed and used for purposes of system design, installation, operation and maintenance.

It has been assumed in the preparation of this document that the execution of its provisions is entrusted to people appropriately qualified and experienced in the specification, design, installation, testing, approval, inspection, operation and maintenance of systems and equipment, for whose guidance it has been prepared, and who can be expected to exercise a duty of care to avoid unnecessary release of extinguishant.

Guidance and recommendations on design, selection and installation of vents to safeguard the structural integrity of enclosures protected by gaseous fire-extinguishing systems

1 Scope

This document gives guidelines for fulfilling the requirements contained in ISO 6183:2022, 6.4.1 and 7.4.1 and ISO 14520-1:2023, 5.2.1 h) and 5.3 h), in respect to over- and under-pressurization venting and post-discharge extract.

It considers the design, selection and installation of vents to safeguard the structural integrity of enclosures protected by fixed gaseous extinguishing systems and the post-discharge venting provisions where used.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

NOTE For the purposes of this document, the term “bar” signifies “gauge”, unless otherwise indicated. Concentrations or quantities expressed in percentages (%) signify by volume unless otherwise indicated.

3.1

free pressure-relief vent area

sum of all free vent areas of the pressure-relief vents provided

Note 1 to entry: This is determined by the gross pressure-relief vent area multiplied by the vent efficiency.

3.2

gross pressure-relief vent area

total area of the pressure-relief vent

3.3

negative pressure

pressure in the protected room which is lower than the pressure immediately outside the enclosure boundary

3.4

peak pressure

maximum pressure (positive and negative) generated within an enclosure caused by the discharge of the gaseous agent