TECHNICAL SPECIFICATION

ISO/TS 13075

First edition
2009-04-01

Gaseous-media fire-extinguishing systems — Engineered extinguishing systems — Flow calculation implementation method and flow verification and testing for approval

Systèmes d'extinction d'incendie utilisant des agents gazeux — Systèmes d'extinction centralisés — Méthode de mise en œuvre des calculs d'écoulement, contrôle de l'écoulement et essai de réception

Reference number
ISO/TS 13075:2009(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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.

ISO/TS 13075 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 8, *Gaseous media and firefighting systems using gas*.

Introduction

The requirement for the guidance and validation tests specified in this Technical Specification arises from the necessity to address the proper design of piping networks for engineered systems. The proper design of the piping network and sizing of the nozzle orifices used to control the agent flow is necessary to assure that the agent is distributed properly in the enclosure(s), the minimum nozzle pressure is met and the required discharge time is achieved. The minimum flow calculation requirements and the methods to validate the flow calculations are provided.

It is intended that information and experience from the use of this document in practice will be gathered and incorporated into a future revision of ISO 14520-1.

Gaseous-media fire-extinguishing systems — Engineered extinguishing systems — Flow calculation implementation method and flow verification and testing for approval

1 Scope

This Technical Specification provides recommendations for developing a flow calculation method for predicting critical flow parameters and an acceptable degree of accuracy for the proper design of piping networks for engineered systems.

2 Normative references

The following referenced documents are indispensable for the application of this document. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14520-1, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14520-1 apply.

4 Calculation method implementation

The following parameters should be considered in developing a flow calculation method (software):

a) percent of agent in pipe;

b) minimum and maximum discharge time;

c) minimum and maximum pipeline flow rates;

d) minimum and maximum agent velocities in the pipelines;

e) variance of piping volume to each nozzle;

f) maximum nozzle pressures variance within a pipe arrangement;

g) minimum nozzle pressure;

h) nozzle and/or pressure-reducing orifices, maximum and minimum area relative to inlet pipes area;

i) maximum imbalance agent-arrival time and maximum imbalance agent-run-out time between nozzles;

j) types of tee splits and related critical lengths;

k) tee orientation;

l) minimum and maximum flow split;

m) pipe and fitting types;

n) elevation changes;

o) system design temperature;

p) system operating temperatures;

q) maximum pipe pressures downstream of a pressure reducing orifice.

5 Minimum accuracy recommendations

5.1 Recommended design limits for inclusion in the flow calculation method — Software

The following design limits should be included inside the flow calculation method and verified by testing:

a) container volume, fill density, storage pressure and temperature;

b) nozzle-area ratio, considering nozzle types and sizes;

c) nozzle pressure;

d) system discharge time;

e) tee split ratios, bull and side tees;

f) tee orientations for liquefied gases;

g) critical piping distance around tees for liquefied gases;

h) degree of imbalance between nozzles for liquefied gases;

NOTE This can be expressed as nozzle liquid arrival and run-out time imbalances, by pipe-volume imbalances or other methods used to control the imbalance in pipe layouts.

i) minimum and maximum agent velocities/flowrates;

j) percent extinguishant in pipe;

k) system pipe volume;

l) pipe and fitting types and schedules;

m) maximum pressure downstream of a pressure reducing orifice;

n) pressure reducer orifice and area ratio.

6 Recommended testing procedure for system flow-calculation method — Software validation

6.1 General

6.1.1 Method 1

This method of validation consists of the following steps.

a) Five systems of three or four nozzles (these are the system-manufacturer-submitted tests) are designed utilizing the flow calculation method that is being validated, constructed and discharge tested.

b) A report containing the test-data results and the calculation predictions is sent to the approval authority for examination.

c) Upon a positive examination of the pre-witness tests reports, the approval authority proceeds with testing.

d) Two of the system-manufacturer-submitted tests are set up and discharge tested to confirm the test results already submitted to the approval authority.

e) The approval authority may ask for the design of at least three more tests that include a specific set of design limits, in accordance with Clause 4, as stated by the manufacturer.

f) The tests shall be designed, constructed and discharge tested with the approval authority present.

g) All these tests shall pass the requirements in accordance with Clause 7.

h) The system being tested should be maintained and tested at a design temperature, usually 21 °C; however, the test may be conducted at different temperatures with appropriate temperature correction calculations.

i) When the flow-calculation software is capable of predicting calculation at temperatures other than the design reference temperature, usually 21 °C, verification tests should be conducted throughout the temperature range specified.

6.1.2 Method 2 — Modular validation process for calculation software

a) Phase one: The validation process starts with the testing of the components being used in a gas extinguishing system. Therefore, it is necessary to determine the friction factor of the components and the mass flow at the nozzle.

b) Phase two: The incorporation of the determined values into the mathematic algorithm and the physical bases for the flow calculation are check by the approved body. Therefore, it is necessary for the designer of the software to document the entire mathematical model behind the software.

c) Phase three: The validation tests are carried out. Therefore, it is necessary to test at least five different systems; a specific set of design limits in accordance with Clause 4 should be included. All these tests shall pass the requirements in accordance with Clause 7.

6.2 System design for testing

The systems being tested should be designed at the limits of the flow calculation method software and should consider the hardware limitations.

The following flow calculation method design limits should be included in the system piping layouts being tested:

a) cylinder volume, fill density storage pressure and temperature;

b) nozzle-area ratio (considering nozzle types and sizes);

c) pressure-reducing-orifice area ratio,

d) maximum pressure downstream of the pressure-reducing orifice,

e) nozzle pressure for liquefied gases;

f) system discharge time;

g) tee split ratios, bull and side tees;

h) tee orientations for liquefied gases;

i) critical piping distance around tees for liquefied gases;

j) degree of imbalance between nozzles;

NOTE This can be expressed as nozzle liquid-arrival and run-out time imbalances, by pipe-volume imbalances or other methods used to control the imbalance in pipe layouts.

k) minimum and maximum agent velocities/flowrates;

l) percent of the agent in the pipe or system-pipe volume;

m) pipe and fitting types and schedules and critical distance for liquefied gases.

7 Pass/fail criteria

The system-discharge time, the nozzle pressure and the quantity of agent delivered from each nozzle are measured in the discharge tests.

These measurements are compared to the predicted values from the software/methodology with the following pass/fail requirements:

a) system discharge time: ± 1 s, or ± 10 % of the discharge time relative to the specified value if over 10 s;

b) nozzle pressure: ± 10 % relative to the determined value;

c) quantity of extinguishant discharged: ± 10 % relative to the predicted value;

d) maximum pressure downstream of pressure reducing orifice: ± 20 % relative to the predicted value.

These pass/fail criteria should be evaluated with regard to the aim that the calculation method leads to reliable engineered systems with regards to predicted mass, discharge time, distribution, maximum pressure in the pipe systems (for non-liquefied gases) and minimum pressures at the nozzles (for liquefied gases).

