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PROPERTY INSURANCE COMMITTEE
Prevention Specifications

CEA Specifications for fire-fighting systems using a gaseous extinguishant

Requirements and test methods for pressure reduction devices for inert gas systems

CEA 4025: February 2000 (en)

(EFSAC endorsed)

Contents

1 Scope and field of application

These CEA Specifications specify requirements and describe test methods for pressure reduction devices of Inert Gas-Fire Extinguishing Installations, which are mounted in the pipework and reduce the pressure of the flowing gas. The reduction of the pressure (designed pressure drop) is caused by a non-adjustable localised reduction of the cross section. The dimension and the design of the pressure reduction device will influence the flow rate and the pressure in the downstream pipework.

These CEA Specifications should only be used as guidance for testing pressure reduction devices which work on different principles.

All pressure data in these CEA Specifications are given as gauge pressure, unless otherwise stated.

Note 1 bar = 10^5 N m^{-2} = 100 kPa

2 References

These CEA Specifications incorporate by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to these CEA Specifications only when incorporated in them by amendment or revision. For undated references the latest edition of the publication referred to applies.

- IEC 68-2-6, 1995, Basic environmental testing procedures, Part 2: Tests; Test Fc: Vibration (sinusoidal)

3 Definitions

For the purpose of these CEA Specifications the following definitions apply.

Design pressure:
Pressure in the container at 15 °C

Flow rate:
Mass flow of gaseous extinguishing agent against time.

Inert Gas:
Non liquefied gas or mixture of gases which extinguish the fire mainly by reducing the oxygen-concentration in the protected zone, like Argon, Nitrogen or CO_2 or mixtures of these gases.

Inert Gas installation:
Fire extinguishing installation in which the Inert Gas is stored at ambient temperature.

Test sample:
Component or assembly of components to test.

Working pressure:
The highest possible pressure in the component. The working pressure is calculated from the design pressure and has to take into account filling tolerances and a storage temperature of 50 °C.

4 Requirements

4.1 Material

The pressure reduction device shall be made of metal and shall be resistant to media with which it will come into contact.

The function of the pressure reduction device shall not be adversely affected by ageing or environmental influences.

4.2 Connection threads

Connection threads and flanges shall comply with European standards, European national standards or ISO- standards.

4.3 Cross section

The minimum dimension of any individual orifice of the pressure reduction device shall not be less than 3 mm.

4.4 Pressure

Pressure reduction devices shall be designed for a working pressure, which has to be calculated from the design pressure.

Pressure reduction devices shall show no sign of deterioration which could impair proper function at 1,5 times their working pressure, when tested as specified in clause 5.4.

4.5 Strength

Pressure reduction devices shall not burst when subjected to a test pressure of three times the working pressure, when tested as specified in clause 5.5.

4.6 Flow rate

The manufacturer shall submit a formula which describes the flow rate of the extinguishing agent through the pressure reduction device in kg per second in the pressure range from 2 bar to the working pressure and in the temperature range -50 °C to 30 °C.

The performance characteristics shall be tested as described in clause 5.6.

4.7 Corrosion

The performance of the pressure reduction devices shall not be adversely affected as a result of the corrosion test as described in clause 5.7.

4.8 Stress corrosion

Any copper alloy part used in pressure reduction devices shall not crack, when tested as described in clause 5.8.

4.9 Vibration

Pressure reduction devices assembled from several parts shall not be damaged, when tested as described in clause 5.9.

4.10 Marking and data

Pressure reduction devices shall be marked with the following information:

a) the markings required by European or National Standards and

b) manufacturers or suppliers name or trademark and

c) model designation/nominal size and

d) orifice size and

e) serial or batch number

The marking shall be visible when the device is installed, non-detachable, non-flammable, permanent and legible.

4.11 Documentation

4.11.1 The manufacturer shall prepare and maintain documentation which specifies the installation, operation, routine testing and maintenance of the component and all other aspects relating to its incorporation within a fire extinguishing system.

4.11.2 The documentation shall be submitted to the testing authority and shall comprise at least the following:

a) a general description of the equipment, including a list of its features and functions.

b) a technical specification including:

- the working pressure
- the suitability for use in various environments
- mounting instructions

c) maintenance instructions

4.11.3 The manufacturer shall also prepare, maintain and submit the following detailed documentation:

- description of the overall mechanical design including
  - the main parts of the component and their tasks
  - the way in which the parts interact
  - component lists
  - layouts
  - design drawings
  - special informations of manufacturing details influencing the flow characteristics (e.g. inlet of orifice plates)

This documentation shall also comprise details of any components specific to the manufacturer.

4.11.4 All documentation normally supplied by and specified by the manufacturer for use by the end user shall be supplied with the device and constitute part of the supply.

5 Tests

5.1 Test conditions

The components shall be tested assembled as recommended for installation by the manufacturer. The tests shall be carried out at a temperature of (25 ± 10) °C, except when otherwise stated.

5.2 Test samples and order of tests

When testing a type of pressure reduction device with only one size, three test samples A, B, C are needed. The order of tests is shown in table 1.

Table 1: Order of tests for one size			
Test sample	**A**	**B**	**C**
5.3 Compliance	1	1	1
5.4 Pressure	2		
5.5 Strength	4		
5.6 Flow rate	3	2/4	2
5.7 Corrosion		3	
5.8 Stress corrosion			4
5.9 Vibration			3

When testing a series of identical design, three test samples A, B, C of three different sizes 1, 2, 3 (bottom, middle and top end of range) and one test sample of each of the other sizes, but a maximum of five other sizes, will be required. The order of tests is shown in table 2.

Table 2: Order of tests for a series				
Test sample	**A1**	**A2**	**A3**	**other**
5.3 Compliance	1	1	1	1
5.4 Pressure	2	2	2	
5.5 Strength		4		
5.6 Flow rate	3/5	3	3	
5.7 Corrosion	4			
5.8 Stress corrosion			5	
5.9 Vibration			4	

5.3 Compliance

A visual and measurement check shall be made to determine whether the test samples correspond to the description in the technical literature (drawings, parts lists, description of functions, operating and installation instructions), and whether the samples comply with these CEA Specifications.

5.4 Pressure

This test relates to the requirements specified in clause 4.4.

Connect the inlet of the test sample to a suitable hydraulic pressure supply and block the outlet. Vent the system and increase the pressure at a rate of (5 ± 1) bar/s up to the test pressure +5/-0 %.

Maintain this pressure for a period of (10 +1/-0) min. At the end of this period release the hydraulic pressure.

5.5 Strength

This test relates to the requirements specified in clause 4.5.

Connect the inlet of the test sample to a suitable hydraulic pressure supply and block the outlet. Vent the system and increase the pressure at a rate of (5 ± 1) bar/s up to the test pressure +5/-0 %.

Maintain this pressure for a period of (10 +1/-0) min. At the end of this period release the hydraulic pressure.

5.6 Flow rate

This test relates to the requirements of clause 4.6.

Checks shall be made to determine whether the test samples comply with the flow rate indicated by the manufacturer. Deviations may not exceed ±10 %. The test set-up is shown in Figure 1.

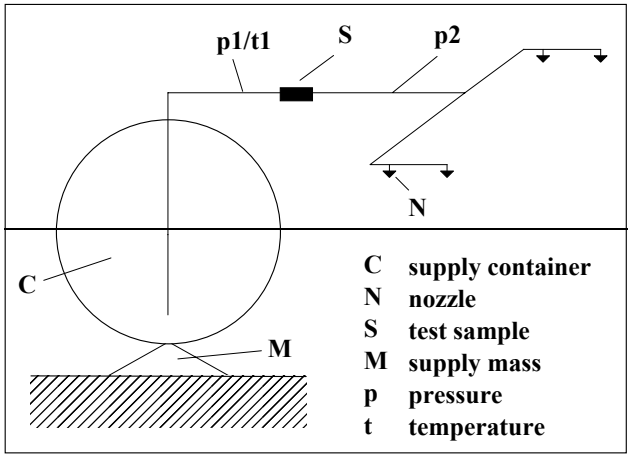

Figure 1: Test configuration for flow rate test

A straight pipe is connected to the outlet of the sample. The pressure measuring point p_2 is attached to this pipe at a distance from the sample of at least 10 times the internal diameter of the pipe. At the end of the measuring line, one or more nozzle(s) shall be fitted, which have to be dimensioned with regard to the pressure drop to be realised.

5.7 Corrosion

This test relates to the requirements of clause 4.7.

A sample shall be suspended freely in its normal installation attitudes.

The test set-up comprises a container 5 litres in volume, made of heat-resistant glass and with a corrosion-resistant cover which is shaped to prevent condensate dripping onto the samples. (If a container 10 litres in volume is used, the quantities of chemicals given below shall be doubled.) The container is heated electrically and the side walls are cooled with water. A thermostat regulates the heating so as to maintain a temperature of approximately 45 °C inside the container. During testing water is passed through a cooling coil wrapped around the container; it should flow fast enough that its temperature at the discharge point is below 30 °C.

The combination of heating and cooling is designed to insure that vapours will condense on the surface of the samples. The sulphur dioxide atmosphere is generated in the 5-litre container with a solution of 20 g of sodium thiosulphate ($Na_2S_2O_3 \times 5H_2O$) in 500 cm^3 of distilled water, to which 20 cm^3 of dilute sulphuric acid is added daily. The dilute sulphuric acid comprises 128 cm^3 of one molar sulphuric acid (H_2SO_4) dissolved in 1 litre of distilled water. The test samples shall be removed from the container after 8 days; the container shall be cleaned. Then the procedure described above is repeated for a further period of 8 days.

After a total of 16 days, the samples are removed from the container and allowed to dry for seven days at a temperature of (20 ± 5) °C at maximum relative humidity of 70 %.

5.8 Stress corrosion

This test relates to the requirements of clause 4.8.

Use a suitable container of known litre capacity fitted with a capillary tube vent. The aqueous ammonia solution shall have a specific weight of 0.94 kg/l ±2 %. The container is filled with (10 ± 0,5) ml of the solution for each litre of container volume.

Degrease the sample for test and expose for 10 -0/+1 days to the moist atmosphere of ammonia and air, at a temperature of (34 ± 2) °C. The samples are positioned (40 ± 5) mm above the level of the liquid.

After testing, the samples are cleaned and dried and subjected to careful visual examination. Any cracking shall be clearly apparent.

5.9 Vibration (sinusoidal)

This test relates to the requirements of clause 4.9.

The sample is attached to a vibration table using fixing materials provided by the manufacturer.

The test apparatus and procedure shall be as described in IEC 68-2-6: 1995, Test FC:

- Frequency range: 10 to 150 Hz
- Acceleration amplitude
  - 10 to 50 Hz: 1,0 g_n
  - 50 to 150 Hz: 3,0 g_n
- Sweep rate: 1 octave per 30 minutes
- Number of sweepes: 0,5 per axis
- Number of axes: 3 mutually perpendicular

No deterioration or detachment of parts shall occur. The samples shall be able to function after the vibration test.

5.10 Other tests

Where special designs or new manufacturing methods make it necessary to conduct additional testing, this is to be carried out after consultation with the manufacturer.