SLOVENSKI STANDARD
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Vgrajeni gasilni sistemi - Sistemi s pršečo vodo - 15. del: Protokol preskušanja sistemov z odprtimi šobami za požarno zaščito turbin v ohišjih do 260 m³

Fixed firefighting systems - Water mist systems - Part 15: Test protocol for combustion turbines in enclosures not exceeding 260 m³ for open nozzle systems

Ortsfeste Brandbekämpfungsanlagen - Feinsprüh-Löschanlagen - Teil 15: Brandversuchsprotokoll für Verbrennungsturbinen in Gehäusen bis 260 m³ für offene Düsensysteme

Installations fixes de lutte contre l'incendie - Systèmes à brouillard d'eau - Partie 15 : Protocole d'essai des systèmes à buses ouvertes pour turbines à combustion situées dans des enceintes ne dépassant pas 260 m³

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Fixed firefighting systems - Water mist systems - Part 15: Test protocol for combustion turbines in enclosures not exceeding 260 m³ for open nozzle systems

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 191.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 14972-15:2020) has been prepared by Technical Committee CEN/TC 191 "Fixed firefighting systems", the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

EN 14972, *Fixed firefighting systems — Water mist systems*, consists of the following parts:

— Part 1: *Design, installation, inspection and maintenance*;

— Part 2: *Test protocol for shopping areas* for automatic nozzle systems

— Part 3: *Test protocol for office, school class rooms and hotel for automatic nozzle systems*;

— Part 4: *Test protocol for non-storage occupancies for automatic nozzle systems*;

— Part 5: *Test protocol for car garages for automatic nozzle systems*;

— Part 6: *Test protocol for false floors and false ceilings for automatic nozzle systems*;

— Part 7: *Test protocol for commercial low hazard occupancies for automatic nozzle systems*;

— Part 8: *Test protocol for machinery in enclosures exceeding 260 m^3 for open nozzle systems*;

— Part 9: *Test protocol for machinery in enclosures not exceeding 260 m^3 for open nozzle systems*;

— Part 10: *Test protocol for atrium protection with sidewall nozzles for open nozzle systems*;

— Part 11: *Test protocol for cable tunnels for open nozzle systems*;

— Part 12: *Test protocol for commercial deep fat cooking fryers for open nozzle systems*;

— Part 13: *Test protocol for wet benches and other similar processing equipment for open nozzle systems;*

— Part 14: *Test protocol for combustion turbines in enclosures exceeding 260 m^3 for open nozzle systems;*

— Part 15: *Test protocol for combustion turbines in enclosures not exceeding 260 m^3 for open nozzle systems;*

— Part 16: *Test protocol for industrial oil cookers for open nozzle systems;*

— Part 17: *Test protocol for residential occupancies for automatic nozzle systems*.

NOTE This list includes standards that are in preparation and other standards may be added. For current status of published standards refer to www.cen.eu.

1 Scope

This document specifies fire testing requirements for water mist systems used for fire protection of combustion turbines in enclosures with volumes not exceeding 260 m^3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN 14972-1:2019, *Fixed firefighting systems — Water mist systems — Design, installation, inspection and maintenance*

EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 14972-1 apply.

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

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 General requirements

4.1 The water mist system, operating without manual intervention, shall successfully complete all described performance fire tests for their specific applications.

4.2 The fire tests shall be conducted until the fire is extinguished, as required by the applicable fire test.

4.3 System components, component locations, operating conditions and test enclosure details shall remain unaltered throughout all of the fire tests for a given application.

4.4 All fire tests shall be conducted using the specifications from the manufacturer's DIOM manual (design, installation, operation and maintenance manual) in regard to nozzle placement, spray flux, and spray duration. Sprays can be continuous or intermittent in time. In the case of intermittent, or cycled, sprays, the time period during which the system is not discharging shall not be greater than 50 % of one complete on/off cycle. The system off period shall not exceed one minute.

4.5 In conjunction with the performance fire tests, all twin fluid water mist systems shall be subjected to a straight discharge test with no fire to evaluate the resulting discharge and oxygen concentration. This evaluation shall be conducted using the maximum extinguishing agent flow and pressure. The discharge duration for the test shall be the maximum required for the system and occupancy to be protected. Oxygen measurements shall be recorded at a location(s) within the test enclosure. This information shall be used to evaluate personnel safety, and shall be accounted for in the manufacturer's DIOM manual.

4.6 In addition to the fire tests, an optional spray cooling test may be conducted, and the results are to be analysed by heat transfer calculations. No direct spray impingement onto the turbine casing is

allowed in real installations unless otherwise proven by the heat transfer calculations using the spray cooling test results.

4.7 Up to a maximum of 5 nozzles used in the fire tests shall be kept for later verification.

5 Test enclosure requirements

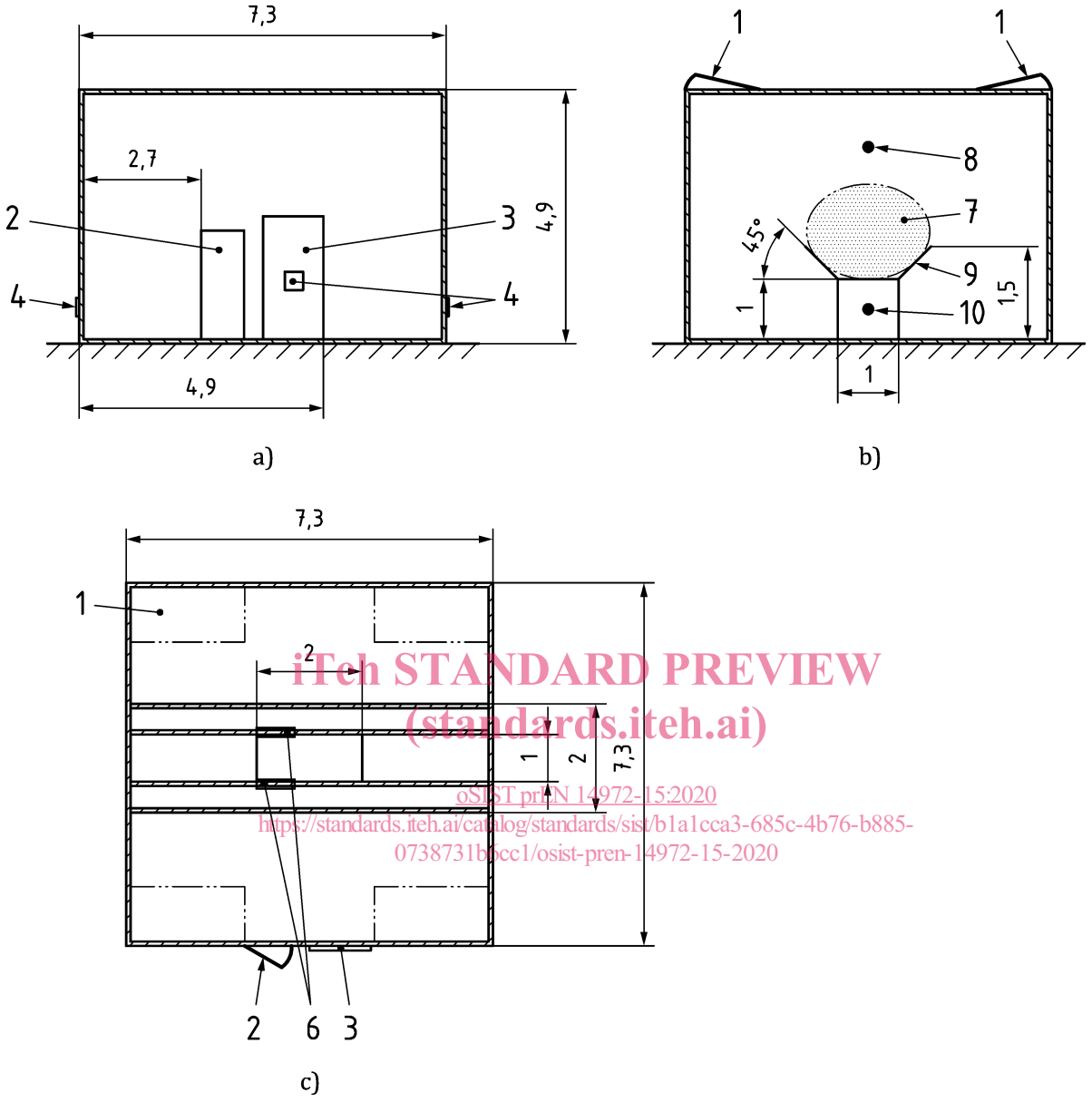
The test enclosure area has main dimensions of 7,3 m by 7,3 m by 4,9 m high (see Figure 1).

The enclosure shall be constructed of wood or metal frame with an inner lining of minimum 13 mm gypsum or 0,7 mm galvanized steel. To minimize leakages, all joints and gaps shall be sealed.

At 2,74 m from one of the enclosure corners, in one of the walls parallel to the turbine equipment mock-up, a 0,8 m by 2,0 m high personnel door shall be installed with a locking mechanism.

A 1,2 m by 2,4 m high removable panel shall also be installed for test enclosure access (the personnel door can be constructed within this panel). A minimum of two hinged ceiling hatches measuring approximately 0,9 m by 1,8 m shall be installed in opposite diagonal corners for heat and smoke release at the conclusion of the fire test. The floor shall be non-combustible and any floor drainage or vent openings shall be sealed during testing. A small louvered vent can be provided to allow the intake of air, to prevent excessive suctioning of the walls and ceiling and maintain structural integrity of the fire test enclosure.

Dimensions in metres



Key

a)	elevation view	b)	side view
c)	plan view		
1	ceiling hatch	7	imaginary turbine body
2	door	8	exposed spray fire
3	removable panel (1,2 m × 1,2 m)	9	sheet metal
4	windows	10	shielded spray fire
6	baffles (0,5 m × 1 m)		

NOTE Door may be built within removable panel.

Figure 1 — Test enclosure and combustion turbine simulator steel plate

6 Combustion turbine mock-up requirements

The combustion turbine casing mock-up is simulated with a horizontal flat steel plate and steel baffles to provide shielded spaces for fires (see Figure 1). The specific details and thermal mass of the obstructions are not simulated.

The combustion turbine mock-up unit should be centred along the longer wall dimension in the test enclosure.

A horizontal hot rolled 1,0044 steel plate according to EN 10025-2 or other equivalent steel, 1,0 m wide by 2,0 m long by 5 cm thick, is placed at 1 m elevation on steel legs at the four corners of the plate. This is located in the centre of the room or at a location within the test cell to be selected after the nozzles are installed (as per manufacturer's specifications). This allows the fire to be placed in an area considered the most challenging to the specific system being tested. In lieu of actual turbine casing material, which is typically ductile iron, the test plate is constructed of hot rolled 1,0044 steel or other equivalent steels.

Horizontal 0,85 mm thick galvanized steel sheet metal shall be placed at an elevation of 1 m on steel legs, on both sides of the 1,0044 steel table, so that the combustion turbine mock-up extends longitudinally the entire length of the enclosure (see Figure 1).

The underside curvature of the turbine is simulated with 0,85 mm thick galvanized sheet metal directed upward at an angle of 45 degrees on either side of the steel plate and horizontal sheet metal extension surface. These side pieces also extend longitudinally the entire length of the enclosure, rising to a height of 1,5 m above the horizontal sheet metal and steel plate surfaces. The total width of the mock-up is 2,0 m. There should be a minimal gap between the various steel table and sheet metal surfaces to permit water run-off. For ease of conducting the optional spray cooling test (see 4.6), it is recommended to either butt up or simply attach the table and sheet metal extension surfaces with screw fasteners.

The space below the plate is partially shielded from water mist using 1 m high by 0,5 m wide sheet metal baffles. The side baffles should be of 0,85 mm thick galvanized sheet metal construction and removable. They can be installed on support legs and kept in place by being pinched between the underside of the steel plate table and the 45 degree angle extensions and the floor for ease of removal. Placement of additional baffles or obstructions can be needed to prevent the direct impact of mist on the pool or spray test fires.

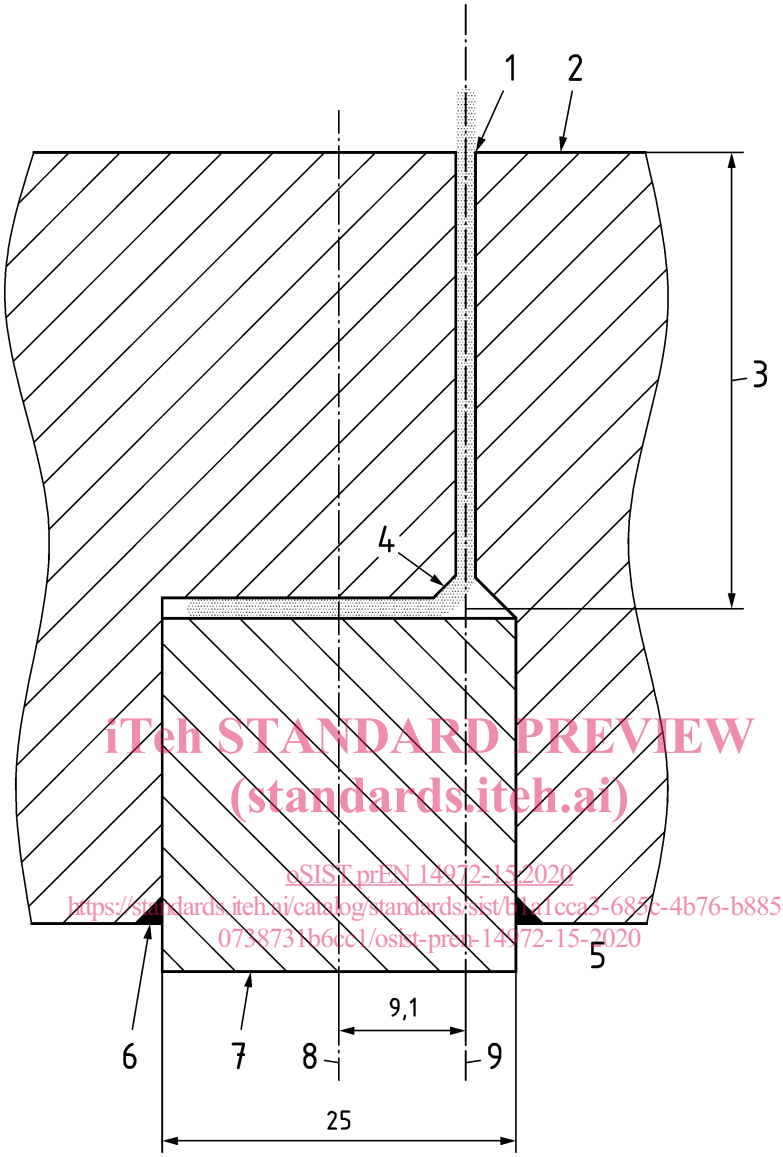
For the optional spray cooling test (see 4.6) the following requirements apply:

The centre of the 1,0044 steel plate is instrumented across its thickness with thermocouples placed at various depths, as described below.

Three thermocouples shall each be embedded near the centre of the plate at approximately 12 mm, 25 mm, and 38 mm below the plate’s top surface. The three Inconel-sheathed thermocouples shall be embedded in the plate by removing cylindrical plugs from the plate.

The thermocouples shall be inserted to allow the thermocouple wire to follow a horizontal path of sixteen thermocouple diameters in length, thus reducing errors due to the vertical temperature gradient in the plate. A heat conductive and electrically insulating sealant shall be applied, and the steel cylindrical plugs shall be replaced and welded to the plate around the top periphery of the plugs. This can be accomplished by using a 25 mm diameter miller tool, installing the thermocouples, and then refilling the hole with welded 25 mm round bar stock (see Figure 2).

Dimensions in millimetres



Key

1	diameter hole for thermocouple (1,6 mm)	6	weld
2	top	7	A36 plug
3	specified depth	8	main axis
4	45° chamfer	9	2nd axis
5	bottom		

Figure 2 — Detail of embedded thermocouple for spray cooling test

7 Test equipment requirements

7.1 The test laboratory shall be of adequate size with natural or minimal ventilation so as to not interfere with the fire testing within the enclosure or about the mock-up or test fuel package.

7.2 The size of the test laboratory shall not impact extinguishment of any test fires (i.e. depletion of oxygen due to an inadequately sized test laboratory).

7.3 For all fire tests, the ceiling, floor, and walls shall be as dry as possible, with only ambient moisture content allowed. The relative humidity in the test enclosure shall not significantly differ from that of the ambient relative humidity.

7.4 The test enclosures or laboratory shall be at an ambient temperature of 20 °C ± 10 °C prior to the start of the test. The enclosure or hall shall be at as uniform an ambient temperature as reasonably possible. Localized hot or cold spots are not permitted. All non-fire induced drafts shall be eliminated.

7.5 The minimum operating nozzle pressure (as specified by the manufacturer) shall be used for all tests, unless otherwise noted. System operating pressures shall be repeatable to within ± 5 %. If the system pressures cannot be controlled within the specified tolerance, fire tests shall be conducted at the minimum and maximum pressure by using external means to control the system pressure.

7.6 The maximum nozzle ceiling height and spacing (as specified by the manufacturer) shall be used for all tests. This includes utilizing the maximum ceiling spacing of the nozzles from the walls.

7.7 The ceiling nozzle arrangement shall have uniform spacing. The ceiling nozzle spacing from the wall shall be uniform, preferably one half of the main spacing.

7.8 The flow of water mist doorway nozzles, if used, is not permitted to discharge directly into the enclosure. The arrangement and discharge from the doorway water mist nozzles shall not enhance the heat release rate or increase the fire intensity of any fire test arrangement.

7.9 Intermediate pendent or upright nozzles that are not at ceiling level, or wall mounted nozzles, are permitted for the protection of combustion turbines.

8 Instrumentation requirements

The following measurements shall be recorded to within a ± 5 % tolerance level at intervals not exceeding one second using a computerized data acquisition system. Measurements shall begin and end at least one minute prior to ignition and after extinguishment of the test fire(s):

a) fuel pressure and flow at the outlet of fuel pump (fuel flow and pressure shall be measured prior to each test series);

b) fuel temperature within the fuel storage container. All fuels shall be at an ambient temperature of 20 °C ± 10 °C;

c) temperature of fuel in pools with thermocouple located in the approximate centre of the initial fuel layer. All fuels shall initially be at an ambient temperature of 20 °C ± 10 °C;

d) test enclosure temperatures measured in the centre portion of the room at the 1/3, 2/3 and ceiling heights. The enclosure and mock-up shall initially be at an ambient temperature 20 °C ± 10 °C for all tests;

e) temperature of air into the spray fires, measured approximately 50 cm horizontally behind fuel spray nozzle with bare bead thermocouples welded from 0,32 mm (28 gauge) chromel-alumel wire;

f) pool fire temperatures with a thermocouple located approximately 2,5 cm above the initial pool surface and 25 cm within the pool rim;