INTERNATIONAL STANDARD

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Respiratory protective devices — Methods of test and test equipment —

Part 10: Resistance to ignition, flame, radiant heat and heat

Appareils de protection respiratoire — Méthodes d'essai et équipement d'essai —
Partie 10: Résistance à la combustion, à la flamme, à la chaleur radiante et à la chaleur

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Foreword

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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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 15, *Respiratory protective devices*.

ISO 16900 consists of the following parts, under the general title *Respiratory protective devices — Methods of test and test equipment*:

— *Part 1: Determination of inward leakage*

— *Part 2: Determination of breathing resistance*

— *Part 3: Determination of particle filter penetration*

— *Part 4: Determination of gas filter capacity and migration, desorption and carbon monoxide dynamic testing*

— *Part 5: Breathing machine, metabolic simulator, RPD headforms and torso, tools and verification tools*

— *Part 6: Mechanical resistance/strength of components and connections*

— *Part 7: Practical performance test methods*

— *Part 8: Measurement of RPD air flow rates of assisted filtering RPD*

— *Part 9: Determination of carbon dioxide content of the inhaled air*

— *Part 10: Resistance to ignition, flame, radiant heat, and heat*

— *Part 11: Determination of field of vision*

— *Part 12: Determination of volume-averaged work of breathing and peak respiratory pressures*

— *Part 13: RPD using regenerated breathable gas and special application mining escape RPD: Consolidated test for gas concentration, temperature, humidity, work of breathing, breathing resistance and duration*

— *Part 14: Measurement of sound level*

Introduction

This part of ISO 16900 is intended as a supplement to the relevant performance standards for respiratory protective devices. Test methods are specified for complete or parts of devices. If deviations from the test method given in this part of ISO 16900 are necessary, these deviations will be specified in the relevant performance standard.

The following definitions apply in understanding how to implement an ISO International Standard and other normative ISO deliverables (TS, PAS, IWA):

— "shall" indicates a requirement;

— "should" indicates a recommendation;

— "may" is used to indicate that something is permitted;

— "can" is used to indicate that something is possible, for example, that an organization or individual is able to do something.

3.3.1 of the ISO/IEC Directives, Part 2 (sixth edition, 2011) defines a requirement as an "expression in the content of a document conveying criteria to be fulfilled if compliance with the document is to be claimed and from which no deviation is permitted".

3.3.2 of the ISO/IEC Directives, Part 2 (sixth edition, 2011) defines a recommendation as an "expression in the content of a document conveying that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others or that a certain course of action is preferred, but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited".

Respiratory protective devices — Methods of test and test equipment —

Part 10:
Resistance to ignition, flame, radiant heat and heat

1 Scope

This part of ISO 16900 specifies the methods for resistance to ignition, flame, radiant heat, and heat.

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.

ISO 6941, *Textile fabrics — Burning behaviour — Measurement of flame spread properties of vertically oriented specimens*

ISO 13506, *Protective clothing against heat and flame — Test method for complete garments — Prediction of burn injury using an instrumented manikin*

ISO 16900-5[1)], *Respiratory protective devices — Methods of test and test equipment — Part 5: Breathing machine/metabolic simulator/RPD headforms/torso, tools and transfer standards*

ISO 16972, *Respiratory protective devices — Terms, definitions, graphical symbols and units of measurement*

ASTM D6413, *Standard Test Method for Flame Resistance of Textiles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16972 and the following apply.

3.1
static test
where the specimen is maintained still over the flame for the exposure

3.2
dynamic test
where the specimen is moving over the flame for the exposure

4 Prerequisites

The performance standard shall indicate the conditions of the test. This includes the following:

— type of test method(s);

— RPD exposure area to be tested;

— number of specimens;

1) To be published.

— temperature and time for exposure;

— any preconditioning;

— mounting and orientation of specimens.

5 General test requirements

Unless otherwise specified, the values stated in this part of ISO 16900 are expressed as nominal values. Except for temperature limits, values which are not stated as maxima or minima shall be subjected to a tolerance of ±5 %. Unless otherwise specified, the ambient temperature for testing shall be between 16 °C and 32 °C, (50 ± 30) % RH and any temperature limits specified shall be subjected to an accuracy of ±1 °C.

Where the assessment of the pass/fail criterion depends on a measurement, an uncertainty of measurement as described in Annex A will be given.

6 Test methods

6.1 Resistance to hot particles (embers/sparks/ash)

6.1.1 Principle

To determine the effect of the exposure, the test consists of exposing those parts specified in the performance standards to a heated wire.

6.1.2 Apparatus

The test rig consists of a loop of Nichrome wire as shown in Figure 1.

The Nichrome wire shall be connected to a power supply. A wire temperature of (500 $^{+50}_{0}$) °C shall be maintained.

6.1.3 Procedure

The RPD shall be mounted on the manikin (e.g. RPD torso and head form in accordance with ISO 16900-5) to simulate the correct wearing position.

The RPD test locations chosen shall include each material and material interface that is exposed during use.

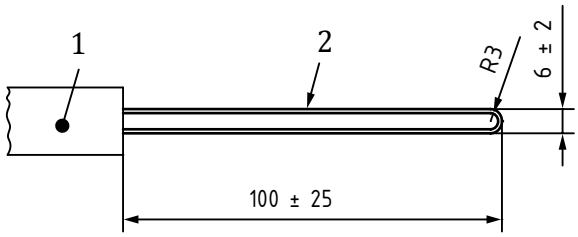
The heated wire shall be placed on each test location for (3 $^{+1}_{0}$) s.

Carry out a visual inspection during the test in order to establish whether the test specimen ignites or melts through as specified in the RPD performance standard.

Observe whether or not the specimen melts or ignites.

6.1.4 Test report

The test report shall include information regarding those parameters specified in Clause 4, together with information, whether or not the specimen melts or ignites.



Key

1 handle

2 nichrome wire with a diameter of 1 mm

Figure 1 — Nichrome wire configuration

6.2 Resistance to flame

6.2.1 Six burner static

6.2.1.1 Principle

The test consists of exposing the specimen specified in the performance standards to a flame of an array of six burners at (950 ± 50) °C for the required time exposure of 5 s.

6.2.1.2 Apparatus

The test rig consists mainly of a propane cylinder with flow control device, flow meter, pressure gauge, flashback arrester, RPD head form size medium in accordance with ISO 16900-5, and six propane Teclu burners which are adjustable in height. Figures 2 and 3 show schematic diagrams of the apparatus and the top view of the arrangements of the burners. The purity of the propane shall be a minimum of 95 %.

6.2.1.3 Procedure

Mount the specimen on the RPD head form size medium or any suitable alternative such that the external parts have direct exposure to the flame. Before lighting the burners, position the specimen centrally above the array of burners and individually adjust the height of each burner such that the distance between the burner tip and specimen is 250 mm. Figure 2 shows the adjustment of the burner tips of one example of specimen.

Determine the leakage of the test specimen for type T respiratory interfaces by applying 1 000 Pa negative pressure and measuring the pressure drop within one minute.

For type L respiratory interfaces, the pressure in the respiratory interface prior to the flame exposure shall be measured when a positive pressure is applied by a flow of 1,5 l/min.

With the specimen removed from above the burners, fully open the propane control valve on each of the burners. Initially, close the air control valve on each of the burners. Ignite the burners and adjust the propane cylinder output regulator to a pressure such that a flow meter in the main propane supply line indicates a total flow to all burners of (21 ± 0,5) l/min propane.

A mineral insulated thermocouple probe with a diameter of 1,5 mm shall be used to measure flame temperature. The temperature shall be measured at a point 250 mm above the upper tip of any burner in the centre of the flame. All burners shall give flame temperature within the tolerance required (950 ± 50) °C. The burners shall be adjusted to their correct position (height) before measuring any flame temperature.

In order to achieve the correct temperature, it may be necessary to adjust the air control valve on each burner to an optimum and to shield the whole test rig from the effect of external air flows.

Expose the specimen to the flames for the required time exposure ±0,5 s.

Determine again the leakage of the test specimen for type T respiratory interfaces by applying at 1 000 Pa negative pressure and measuring the pressure drop within one minute.

For type L respiratory interfaces, the pressure in the respiratory interface following the flame exposure shall be measured when a positive pressure is applied by a flow of 1,5 l/min.

Observe whether or not the specimen drips, burns through, the duration of any after-flame, and the results of the leak tightness determination

6.2.1.4 Test report

The test report shall include information regarding those parameters specified in Clause 4 together with information whether or not the specimen drips, burns through, the duration of any after-flame, and the results of the leak tightness determination.

Dimensions in millimetres

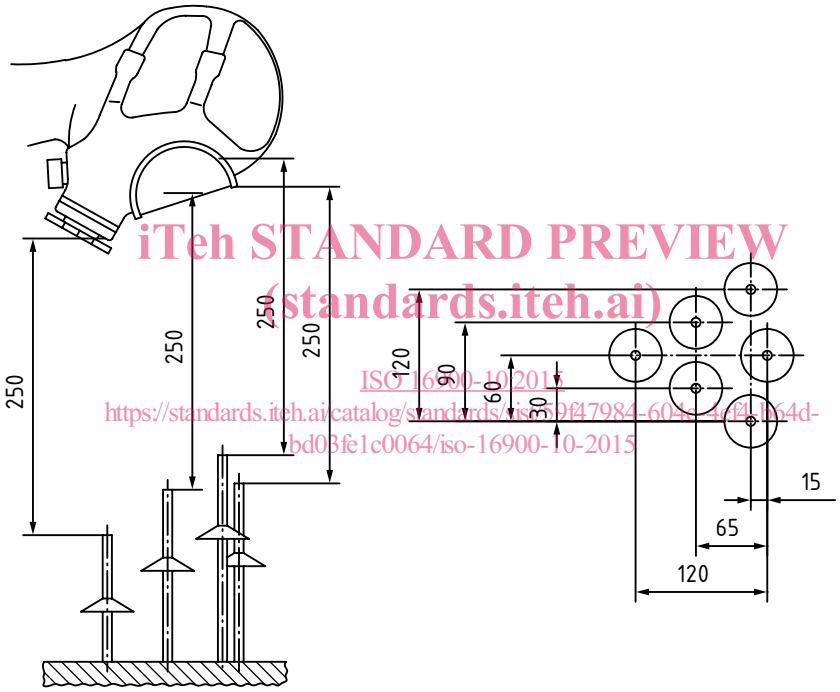
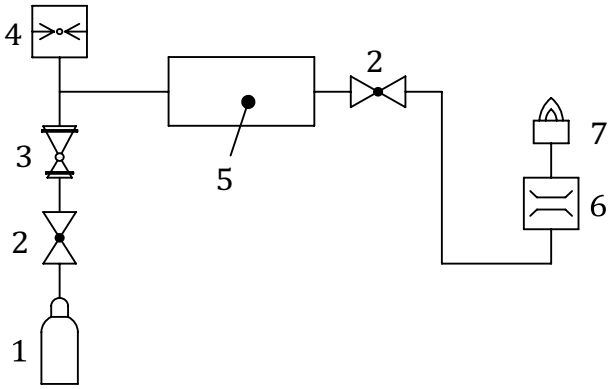


Figure 2 — Typical schematic diagram of arrangement of six burner static test



Key

1	propane cylinder	5	flame arrester
2	valve	6	flow meter
3	pressure reducer	7	six burner array
4	pressure gauge		

Figure 3 — Schematic diagram of propane supply for six burner static test

6.2.2 Six burner dynamic

6.2.2.1 Principle

The test consists of exposing the specimen specified in the performance standards through a flame at (800 ± 50) °C to determine the effect of the exposure.

6.2.2.2 Apparatus

The test rig consists mainly of a propane cylinder with flow control device, flow meter, pressure gauge, flashback arrester, propane Teclu burners which are adjustable in height and specimen support, and rotation motor with speed controller. Figures 4 and 5 show schematic diagrams of the apparatus and the top view of the arrangements of the six burners. The purity of the propane shall be a minimum of 95 %.

6.2.2.3 Procedure

The specimen shall be fitted on the specimen support which may be an RPD head form size medium in accordance with ISO 16900-5. If the specimen is not equipped with a head harness, the material of the specimen shall be clamped in an appropriate clamping device such that the material is horizontal. The distance between the outer surface of the specimen and the burner tips shall be adjusted to 250 mm. Figure 4 shows the adjustment of the burner tips of one example of specimen.

The pressure reducer shall be adjusted to approximately 15 kPa. It shall be ensured that the control device for propane gas on the burners is fully opened and that the control device for air is fully closed. The temperature of the flame 250 mm above the burner tip shall be (800 ± 50) °C.

A mineral insulated thermocouple probe with a diameter of 1,5 mm shall be used to measure flame temperature. The temperature shall be measured at a point 250 mm above the upper tip of any burner in the centre of the flame. All burners shall provide a flame temperature of (800 ± 50) °C. The burners shall be adjusted to their correct position (height) before measuring any flame temperature.

The specimen (on the head form size medium) or the specimen material (in the clamp) shall be rotated once through the flame at a velocity of (6 ± 0,5) cm/s.

Observe whether or not the specimen drips, the duration of any after-flame, or any other damage to the specimen.