International Standard

ISO 16900-11

Second edition
2025-01

Respiratory protective devices — Methods of test and test equipment —

Part 11: Determination of field of vision

Appareils de protection respiratoire — Méthodes d'essai et équipement d'essai —

Partie 11: Détermination du champ de vision

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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 document 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).

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This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 15, *Respiratory protective devices*.

This second edition cancels and replaces the first edition (ISO 16900-11:2013), which has been technically revised.

The main changes are as follows:

— equipment for RPD headforms specified to use illuminated eyes;

— mounting the RPD in 8.3 more specified;

— Figure 1 changed to use headforms according to ISO 16900-5;

— in Table 1 the total visual field score (VFS) and the number of critical dots were added;

— application of uncertainty of measurement former Annex A was deleted;

— figures revised where appropriate.

A list of all parts in the ISO 16900 series can be found on the ISO website.

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.

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Introduction

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

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Respiratory protective devices — Methods of test and test equipment —

Part 11: Determination of field of vision

1 Scope

This document specifies the laboratory test method for determining the field of vision for a respiratory protective device (RPD).

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.

ISO 16972, *Respiratory protective devices — Vocabulary and graphical symbols*

ISO 16900-5:2016/Amd 1:2018, *Respiratory protective devices — Methods of test and test equipment — Part 5: Breathing machine, metabolic simulator, RPD headforms and torso, tools and verification tools — Amendment 1: RPD headforms front and side view*

ISO 17420-3, *Respiratory protective devices — Performance requirements — Part 3: Thread connection*

3 Terms and definitions

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

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

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

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

3.1
apertometer
extended hemispherical dome for measuring the angular area of the field of vision (peripheral isopter) of an RPD when mounted on a headform

3.2
peripheral isopter
field of vision while wearing an RPD

Note 1 to entry: The peripheral isopter is indicated by the lighted area.

Note 2 to entry: The peripheral isopter is measured by a solid line connecting the points.

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3.3
visual field score
VFS
summation of grid points contained within the *peripheral isopter* (3.2) shadow cast onto the *apertometer* (3.1) by the RPD

4 Prerequisites

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

a) number of specimens;

b) any preconditioning;

c) use of filter simulator, if applicable;

d) any accessories;

e) appropriate size(s) of RPD headforms to be used.

5 General test requirements

Unless otherwise specified, the values stated in this document are expressed as nominal values. Except for temperature limits, values which are not stated as maxima or minima shall be subject to a tolerance of ±5 %. Unless otherwise specified, the ambient conditions for testing shall be between 16 °C and 32 °C and (50 ± 30) % relative humidity. Any temperature limits specified shall be subject to an accuracy of ±1 °C.

6 Principle

This test quantifies the field of vision of a respiratory protective device (RPD) by measuring the functional visual field score. The RPD is mounted on a RPD headform containing small light sources instead of eyes. The light from the light sources is projected onto the apertometer, creating a light area outlined by a shadow that follows the periphery of the visual obstruction of the RPD system. The light area represents the visual field, or peripheral isopter. A quantitative value for the visual field score is obtained by comparing the peripheral isopter with a visual field score defined for different segments of the unrestricted field of vision.

7 Equipment

The following equipment shall be used for determining the visual field score:

a) RPD headforms in accordance with ISO 16900-5:2016/Amd 1:2018, 4.1 and Annex A, containing illuminated eyes;

b) apertometer: see Figure 1;

c) visual field score plotting chart: see Figure 2.

8 Procedure

8.1 Sample preparation

Prepare the RPD in its as worn state in accordance with the information supplied by the manufacturer. Accessories that can obscure vision, such as demand valve or filter(s), or filter simulator in accordance with ISO 16900-5 for devices containing the thread connection in accordance with ISO 17420-3 shall be attached to the RPD during testing. The RPD headform size(s) appropriate to the size of RPD being tested (see Clause 4) shall be selected for the test.

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8.2 Apertometer setup

Position the RPD headform correctly within the apertometer (see Figure 1).

The RPD headform is positioned correctly when the points of light emission (see Figure A.1) from the illuminated eyes are aligned with the 90° meridians on the dome, symmetrically about the centre line of the dome and the horizontal axis of the RPD headform is coincident with the axis of the apertometer.

8.3 Mounting the RPD

Mount the RPD on the selected RPD headform in accordance with the information supplied by the manufacturer. Position the RPD symmetrically on the RPD headform. In the case of RPD with an asymmetric Respiratory Interface design or assembly, this is not possible and the respiratory Interface shall just be centralised about the vertical centre line. It may be necessary to apply a friction reducing material such as talcum powder to the RPD headform to allow the RPD to slide more easily over the RPD headform surface during adjustment.

If the RPD has wearer-adjustable head harness straps, tighten the straps to the extent that would be expected when wearing the device as specified by the manufacturer. The RPD shall not be mounted on the RPD headform in an inappropriate position in an attempt to maximize the visual field score.

Dimensions in millimetres

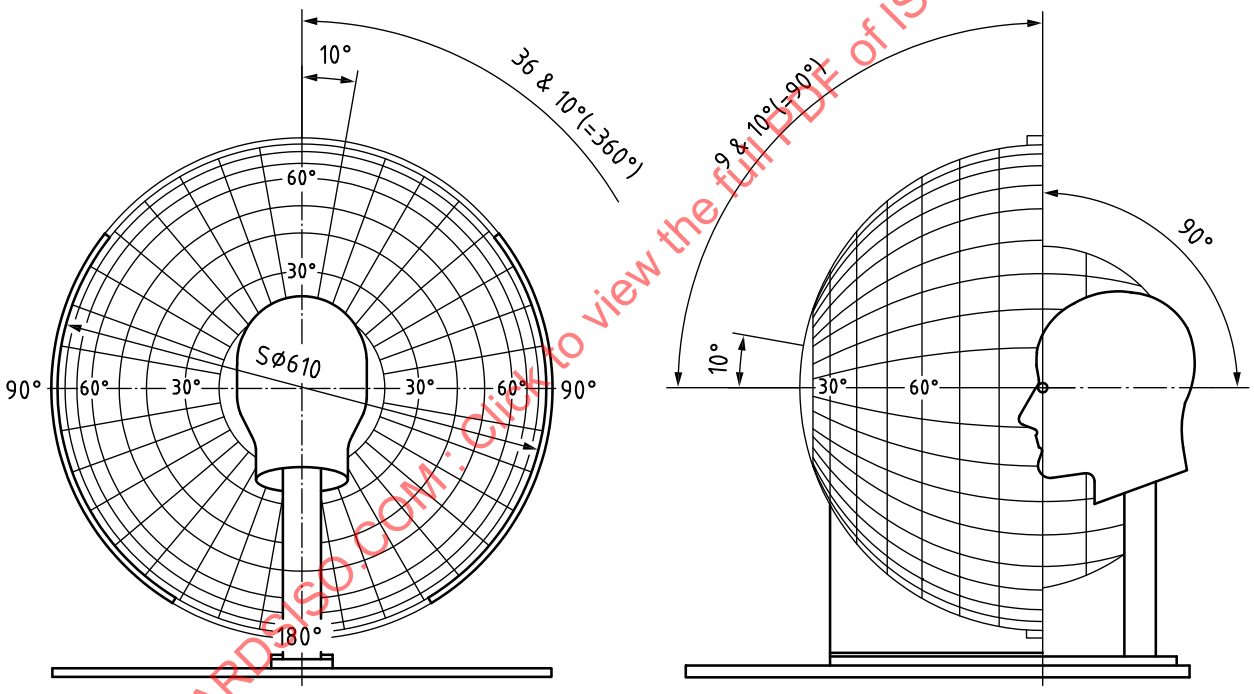

Figure 1 — Position of RPD headform in apertometer

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Switch on both illuminated eyes and re-adjust the RPD position on the RPD headform so that the shadow on the apertometer is symmetrical about the vertical centre line such that the point at which the shadow crosses the horizontal centre line on the left and right sides is within 5° of each other. An example is shown in Figure 3.

8.4 Mapping the field of vision

Using the visual field score plotting chart (see Figure 2), transfer the outline of the light projected onto the apertometer's surface onto the chart by marking the point at which the light changes to a shadow along each of the 36 meridians within the apertometer. Once the points have been plotted along each meridian, connect the points from one meridian to the next, following the curve of the shadow on the apertometer. The solid line connecting the points represents the peripheral isopter for the RPD.

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Remove the RPD and re-fit to the RPD headform for a total of three fittings and preparation of three VFS plotting charts.

8.5 Calculating the visual field score (VFS)

The VFS plotting chart (see Figure 2) assigns 118 dots in total. Fifty dots are assigned to the central area, up to 10° circle. The remaining 68 points are assigned to the area beyond 10°. The grid dots are located along 10 meridians (two in each of the upper quadrants, three in each of the lower quadrants) at 25°, 65°, 115°, 155°, 195°, 225°, 255°, 285°, 315°, and 345°.

Outside the central area the dots are distributed along the meridians according to a weighting system that is based on an assessment of the importance of different meridians being within the visual field when wearing RPD. The four peripheral dot groups (2 dots per group) which lie on the 25°, 155°, 195° and 345° meridians are considered of critical importance and therefore called critical dots and shaded in grey (see Figure 2).

Count the VFS grid dots that fall on or inside of the peripheral isopter for the RPD. This number is the VFS. Record the number of mandatory dots within the VFS.

The centre of a dot shall be on or within the peripheral isopter to be counted.

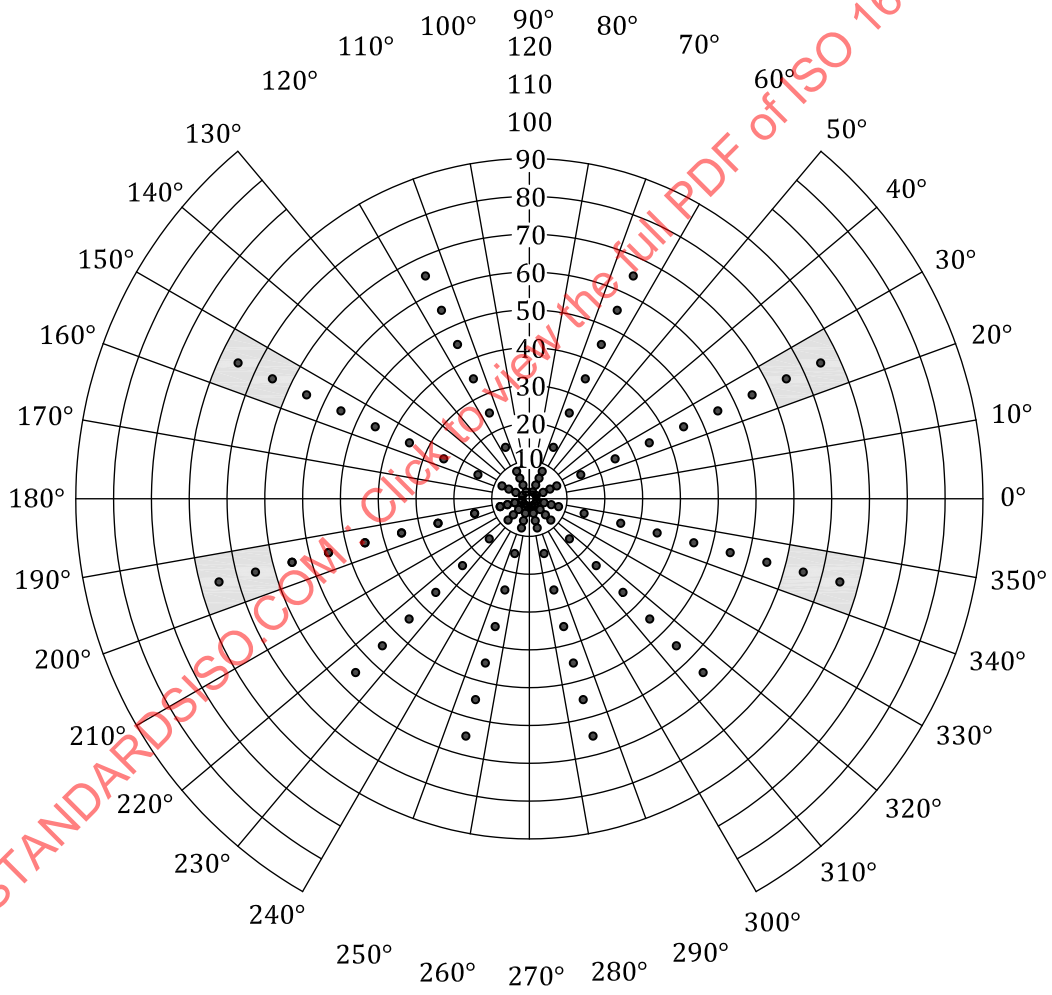

Figure 2 — Visual field score (VFS) plotting chart

The dots within each segment represent the individual points counted to determine the VFS.

An example of a plotted chart fitting is given in Figure 3.

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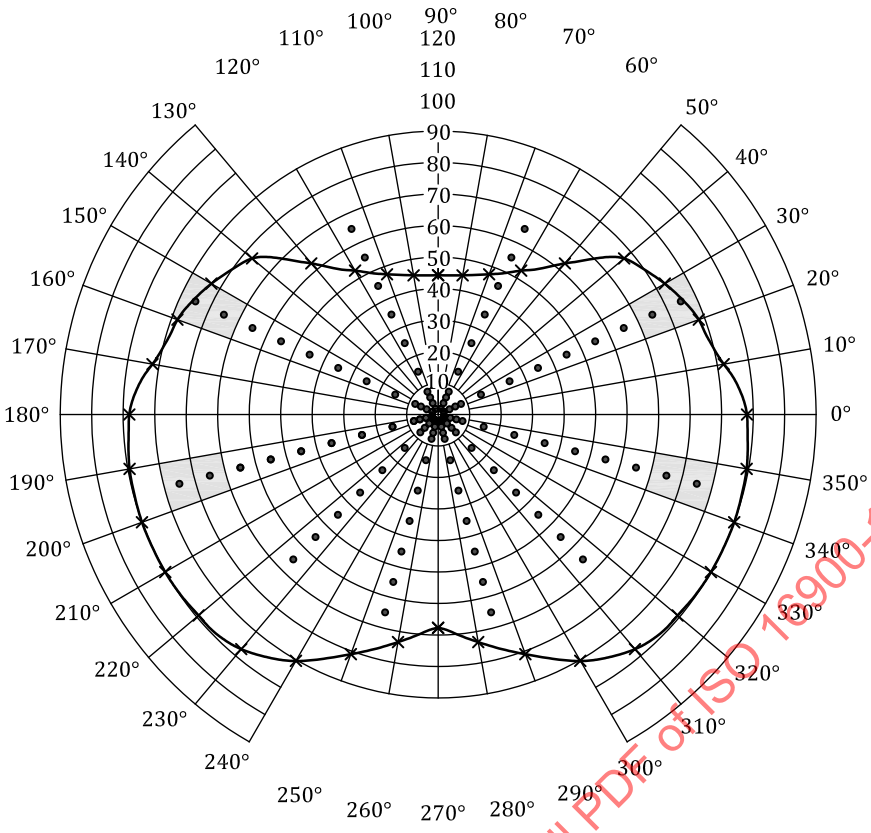

Figure 3 — Example of VFS plotted chart of one fitting

Table 1 — Results table for visual field score (VFS)

Meridian (°)	Number of dots within peripheral isopter outside the 10° circle			
	Fitting 1[a]	Fitting 2	Fitting 3	Average total VFS
25	8	-	-	
65	4	-	-	
115	4	-	-	
155	8	-	-	
195	8	-	-	
225	6	-	-	
255	6	-	-	
285	6	-	-	
315	6	-	-	
345	8	-	-	
Add 50 dots for area inside 10° circle	**50**	**50**	**50**	**50**
Total VFS	114			
Number of critical dots included	8			
Average number of critical dots ≥ 2? Yes/no	Yes			

[a] An example of a visual field score plot is shown in Figure 3 with the results for Fitting 1.

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9 Test report

The test report shall include at least the following information:

a) the identification of the test sample;

b) a reference to this document, i.e ISO 16900-11:2025;

c) use of filter simulator if applicable;

d) any accessories;

e) RPD headform size(s) used;

f) the VFS at each meridian, the number of critical points within the score for each of the three fittings and average total VFS of the three fittings in tabular form such as shown in Table 1.

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