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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION - МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ - ORGANISATION INTERNATIONALE DE NORMALISATION

Optics and optical instruments — Visual acuity testing — Correlation of optotypes

Optique et instruments d'optique — Méthode d'essai de l'acuité visuelle — Corrélation entre les optotypes

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Descriptors : optics, optical equipment, tests, visual acuity tests, optotypes.

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Optics and optical instruments — Visual acuity testing — Correlation of optotypes

1 Scope and field of application

This International Standard specifies the method of correlation between a given set of optotypes and the standard optotype (Landolt ring) specified by ISO 8596.

2 Reference

ISO 8596, *Optics and optical instruments — Visual acuity testing — Standard optotype and its presentation.*¹⁾

3 Test requirements for optotypes

For correlation of optotypes to the standard optotype, the specifications of ISO 8596 apply unless they are restricted in the following.

3.1 Optotype sizes and standard optotype grades

Optotype size is specified in terms of the size of some critical detail defined for each set of optotypes. In the case of the standard Landolt ring, the critical detail is the gap size. In the case of a set of optotypes (for example optotypes for illiterates) where there is no dimension common to the different members of the set, the members of a set of a specified size shall have the same relative sizes as a set of different size. The size shall be identified by a specified dimension of one member of the set.

If letters or figures are used for visual acuity measurement, then it should be observed that they normally show large differences in respect of recognizability, even if their size and thickness of stroke is identical. This disadvantage can be reduced by choosing letters or figures which are comparable to each other.

The optotype sizes (grades) specified in ISO 8596 shall be used. Enough grades or steps shall be used to establish a frequency of seeing curve for the standard optotype and the optotype being investigated.

3.2 Test area

The test area shall be circular with a diameter of $4^\circ \pm 10\%$. The surrounding field having a diameter of $15^\circ \pm 10\%$, shall be illuminated homogeneously so that it does not influence the measurement.

The luminance of surrounding field shall not be higher than that of the test area.

3.3 Presentation of the optotypes

In making a measurement of visual acuity with the 8 position Landolt ring, 120 presentations shall be made one ring at a time with the ring positions for successive presentations arranged in random order. In the case of the optotypes to be correlated, these shall also be presented one at a time in random order until a series of 120 presentations has been completed. In the 120 presentations, the different optotypes in each set shall be represented approximately the same number of times.²⁾ The comparison shall start with a grade of optotypes large enough to yield a frequency of seeing of 100%. Measurements shall be made with both 8 position rings and the optotypes of the same size being correlated. When this has been completed, the procedure shall be repeated with smaller and smaller sizes until the failure rate corresponds to the level of guessing. Each optotype shall be exposed for 3 s with an interval of 4 s between exposures. If possible, the comparison of optotypes shall be made by means of binocular measurement.

3.4 Corrective lenses

The test subjects shall be fully corrected with spectacles.

3.5 Test distance

The test distance shall be performed at a distance of $5\text{ m} \pm 1\%$ between the subject and the optotype.

1) At present at the stage of draft.

2) The number 120 is divisible by 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 30, 40 and 60. Hence, with sets of optotypes having any of these numbers of different optotypes, it is possible for each optotype to be represented with the same number of times in 120 presentations.

3.6 Luminance

The luminance of the test area shall be 200 ± 50 cd/m² and shall be the same for the Landolt ring as for the optotypes to be correlated. The permissible deviation shall not exceed 10 %. The luminance of the optotypes themselves shall not exceed 10 % of the luminance of the test area.

4 Assignment of an acuity score

If, before the end of the test, the subject makes a point of no longer being able to recognize the test types, the subject shall be requested to make a guess. The subject shall not be informed before the end of the test whether or not any mistakes were made. The number of errors per optotype size shall be recorded. From the raw data, an allowance for guessing shall be made and the frequency of seeing will be assessed for each optotype size. For the various grades, plot the frequencies of seeing against the logarithm of the size of the critical detail. The points on the graph for each type of optotype shall be fitted with an ogive curve represented by the integral of the probability curve. Any of the usual methods of fitting this curve may be used. From the curves, the optotype sizes at which the frequency of seeing is 50 % shall be estimated. These represent the thresholds for the two types of optotypes, from which the acuity scores shall be derived.

5 Assessing the equivalence of two kinds of optotypes

The measurements described in clause 4 shall be repeated with ten or more subjects with correction and normal vision (5/5 or better).

The threshold values for each kind of optotype shall be averaged. If the two averages differ by more than 0,05 log units, the two sets of optotypes cannot be said to be equivalent. They can be made equivalent by enlarging or contracting the size of the non-standard optotypes by a factor equal to the ratio of the visual acuity for the non-standard optotypes to the visual acuity for the standard optotypes.

6 Meaningfulness of the difference between the two averages

The meaningfulness of the difference between the two averages can be studied by

- a) comparing the overlap of the frequency distributions of the two sets of scores;
- b) using standard statistical procedures to evaluate the significance of the difference between the averages;
- c) plotting a frequency distribution of the differences between the scores on the separate tests to evaluate the tendency to be high or low on both tests;
- d) using the method of linear regression.



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FORM 7

INTERNATIONAL ORGANIZATION FOR STANDARDIZATIONМЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИORGANISATION INTERNATIONALE DE NORMALISATION

Optics and optical instruments - Visual acuity testing -
Standard optotype and its presentation

Optique et instruments d'optique - Méthode d'essai de l'acuité visuelle -
Optotype normalisé et son présentation

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1 Scope

This international standard gives recommendations for the measurement of distance visual acuity under daylight conditions for the purposes of certification or licensure.

It is not intended as a standard for clinical measurements or for the certification of blindness or partial sight.

2 References

ISO/DIS 8597 Optics and optical instruments - Visual acuity testing - Correlation of optotypes

For the clinical use see also the document "Consilium Ophthalmologicum Universale - Visual Functions Committee: "Visual Acuity Measurement Standard"

3 Standard optotype

The standard optotype is the Landolt ring as shown in Table 1. A Landolt ring whose outer diameter d is seen at an angle of 5 minutes and whose width as well as the gap in its continuity are seen at an angle of 1 minute, represents the standard optotype for the visual acuity grade 1. The Landolt ring shall be presentable in 8 different positions.

For the purpose of measuring visual acuity the standard optotype or other optotypes which have been correlated by the method of ISO/DIS 8597 should be used.

Note: Any documentation of test results shall clearly indicate the instrument and the kind of optotype used to obtain the results in question.

4 Visual acuity grades and standard optotype grades

The acuity values for the size of the optotype shall be graduated logarithmically. The quotient of the size of a test type and that of the next smaller one shall be $10\sqrt{10} = 1.2589$ (standard series R_a 10 ISO R 3).

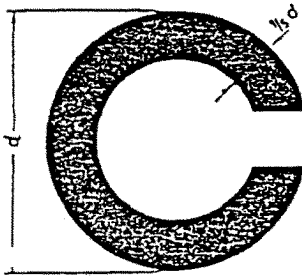
In Table 1 the values in parentheses shall be used for denominating the visual acuity grades.

Optotypes of the acuity grades 0.05; 0.06; 0.08; 2.0 may be omitted if necessary. Addition of further acuity grades is permitted.

Definition:

Acuity grade is the reciprocal of the gap width of a Landolt ring given in minutes of arc as shown in table 1.

Table 1. Visual acuity grades



Acuity grade	Log gap size	Optotype size		Minimum number of presentations
		Angle for gap and ring width minutes of arc	permissible deviation	
0.05	+1.3	20'	+ 5 %	2
0.063 (0.06)	+1.2	16'		
0.08	+1.1	12.5'		
0.1	+1	10'		3
0.125	+0.9	8'		
0.16	+0.8	6.3'		
0.2	+0.7	5'		5
0.25	+0.6	4'		
0.32 (0.3)	+0.5	3.2'		
0.4	+0.4	2.5'		
0.5	+0.3	2'		
0.63 (0.6)	+0.2	1.6'		
0.8	+0.1	1.25'		
1.0	0	1'	5	
1.25	-0.1	0.8'		
1.6	-0.2	0.63'		
2.0	-0.3	0.5'	+ 10 %	5

5 Test area and spacing between standard optotypes

The field shall extend at least 0.5°*) in each direction from the contour of the optotypes to the border of the test field. When more than one standard optotype is used on a common test area, the specifications given in Table 2 apply. Where more than one acuity grade is used on the test area, the spacing for the largest optotype applies.

Table 2. Spacing between standard optotypes (border to border)

Acuity grades	Minimum spacing between standard optotypes
smaller than 0.05	2 x width of gap in Landolt ring
0.06 to 0.125	diameter of Landolt ring
0.16 to 0.32	1,5 x diameter of Landolt ring
0.4 to 1.0	2 x diameter of Landolt ring
above 1.0	3 x diameter of Landolt ring

Table 2 applies for horizontal and vertical spacings.

The background to the optotypes shall appear uniformly bright and without any variation of colour or texture which could indicate the orientation of the symbols. Where the different orientations are achieved by rotation of the optotypes this rotary movement shall not be noticeable by the subject.

*) This value was altered from 1° to 0.5° for practical reasons. As many test fields have a width of approximately 4°, the value of 1° would mean that only 2° are left for the optotypes. This is too small, especially for the case where 5 presentations in different positions are required.

If no objections against this alteration reach the secretariat within four weeks after issuing this paper, this footnote will be deleted and the new value of 0.5° will be introduced into the DIS.

6 Definition of the standard optotype

The standard optotype presented shall appear with sharply defined contours to an observer with a visual acuity of at least 1.0 at an observation distance of $1/3$ of the distance at which the test types are designed to be used. Test types presented in instruments shall be observed with a magnification of 3. The optotypes shall not differ noticeably in contrast and contour.

7 Presentation of the standard optotype

7.1 Positions of optotype

The optotype shall be presented in at least the number of different positions per acuity grade shown in Table 1. In 50% of these positions the gap shall be either vertical or horizontal. In the case of an odd number of presentations this shall be rounded to the next larger integer. The sequence of presentations shall be as diversified as possible and shall be randomly ordered. If the standard optotype is presented singly, this shall be specially mentioned in the test result.

Remark: Generally if correlated optotypes are used, at least 5 presentations shall be made for each size. Since the number varies the choice of optotypes shall be as diversified as possible and shall be randomly ordered.

7.2 Viewing distance for distance visual acuity testing

The test shall be performed with a minimum viewing distance of 4 m between subject (entrance pupil) and optotype. The actual distance used in the test shall be indicated.

7.3 Criterion for determination and assignment of visual acuity grade

The specification of the performance level at which the presentation of optotypes is terminated depends upon the number of optotypes used for each size. Three or more called correctly is considered passing if the total number is five; four or more if the total number is six or seven; five or more if the total number is eight or nine; and six or more if the total number is ten.

Preferred numbers of presentation are 5, 8 or 10. In each case, the minimum called correctly represents approximately 60% of the total. The test shall be terminated at the first grade at which the number called correctly falls below the passing level. The visual acuity assigned shall be one grade larger, in accordance with table 1.

8 Luminance

In measuring the visual acuity the luminance and contrast conditions shall be such that consistent results may be expected for a normal eye. The luminance of the test area shall be as given in Table 3.

Table 3.

luminance range	general surrounding luminance as a fraction of the luminance of the test area	
80 - 320 cd/m ²	field $\leq 10^\circ$	field $> 10^\circ$
	$> 0,1$ $> 0,25$	$> 0,1^*$
* not brighter than 10° field		

The luminance of the optotype shall not be more than 15 % of that of the test area taking into account the room illumination. The surrounding field (test room) shall be darker than the test area. However, within an area of 10° diameter the luminance of the surrounding field shall not be less than $1/10$ nor more than $1/4$ of the luminance of the test area. There shall not be any direct or indirect glare source (light source, reflected image of a light source, glossy or very bright mat surface) within the field of view. White light within a colour temperature range of 2500° K to 7000° K shall be used.

A N N E X

Table for comparison of visual acuity grades

Visual acuity	Designation used for viewing distance		
	5 m	6 m	20 feet \approx 6 m
0.05	5/100	6/120	20/400
0.063 (0.06)	5/80	6/96 (6/100)	20/320
0.08	5/63 (5/60)	6/75	20/250
0.1	5/50	6/60	20/200
0.125	5/40	6/48 (6/50)	20/160
0.16	5/32 (5/30)	6/38 (6/40)	20/125
0.2	5/25	6/30	20/100
0.25	5/20	6/24 (6/25)	20/80
0.32 (0.3)	5/16 (5/15)	6/19 (6/20)	20/64 (20/60)
0.4	5/12.5	6/15	20/50
0.5	5/10	6/12	20/40
0.63 (0.6)	5/8	6/9.6 (6/10)	20/32 (20/30)
0.8	5/6.3 (5.6)	6/7.5	20/25
1.0	5/5	6/6	20/20
1.25	5/4	6/4.8 (6/5)	20/16
1.6	5/3.2 (5.3)	6/3.8 (6/4)	20/12.5
2.0	5/2.5	6/3	20/10

The values in parentheses shall be used only for the purpose of identifying the acuity grade.

Table 1. Visual acuity grades

Acuity grade	Log gap size	Optotype size		Minimum number of presentations	
		Angle for gap and ring width minutes of arc	permissible deviation		
0.05	+1.3	20'	+ 5 %	2	
0.063 (0.06)	+1.2	16'			
0.08	+1.1	12.5'		3	
0.1	+1	10'			
0.125	+0.9	8'			
0.16	+0.8	6.3'		5	
0.2	+0.7	5'			
0.25	+0.6	4'		+ 5 %	5
0.32 (0.3)	+0.5	3.2'			
0.4	+0.4	2.5'			
0.5	+0.3	2'			
0.63 (0.6)	+0.2	1.6'			
0.8	+0.1	1.25'			
1.0	0	1'			
1.25	-0.1	0.8'			
1.6	-0.2	0.63'			
2.0	-0.3	0.5'	+ 10 %		5

