INTERNATIONAL STANDARD

ISO 18490

First edition
2015-06-01

Non-destructive testing — Evaluation of vision acuity of NDT personnel

Essais non destructifs — Évaluation de l'acuité visuelle du personnel END

Reference number
ISO 18490:2015(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

ISO 18490 was prepared by European Committee for Standardization (CEN) in collaboration with ISO/TC 135, *Non-destructive testing*, SC 7, *Personnel Qualification*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Introduction

Standards for NDT Personnel qualification and certification require that the visual acuity of inspection personnel is verified as being appropriate to their function. By meeting the near vision acuity level defined in this International Standard, such requirements of ISO 9712 and EN 4179 will be met. The purpose of this International Standard is to provide a detailed, standardised procedure for the evaluation of near vision acuity for such personnel under defined lighting conditions.

The test is not medical in nature and is intended to objectively ensure adequate near vision perception without reliance on reading ability or text identification. Because it is extremely difficult to demonstrate any equivalency in near vision tests, this International Standard has been prepared in order that an international system may be used without any need to demonstrate equivalence and is the recommended method of determining near vision acuity for NDT Personnel.

Non-destructive testing — Evaluation of vision acuity of NDT personnel

1 Scope

This International Standard specifies the form of the optotype, the quality requirements for the chart, the test procedure, and the acceptance level for near vision acuity of NDT personnel. It also addresses the qualification requirements for personnel permitted to carry out the test.

This International Standard only addresses near vision acuity under defined conditions similar to those encountered during routine NDT inspection. It does not address an individual's overall visual acuity and users are advised to consider the need for a general eye examination by specialist medical personnel to ensure general vision acuity is appropriate for job function.

This International Standard does not address colour vision requirements.

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 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

EN 4179[1)] *Aerospace series — Qualification and approval of personnel for non-destructive testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9712 and EN 4179 and the following apply.

3.1
optotype
E shaped character of defined proportions and of various sizes that are used to verify near vision acuity

3.2
eyewear
any form of lens or protective transparent material placed or used between the human eye and the work piece during routine NDT inspection operations

4 Chart print quality

It is recognized that charts produced locally will have varying print quality and resolution. The chart design, including the two separate blocks of characters, and the procedure has been developed to ensure that meeting the defined level will demonstrate compliance. Failure to meet the defined level of acuity, in some cases, may be due to the quality of the test chart produced. Care should be exercised to ensure that the quality of the test chart is appropriate and where personnel fail to meet the required level, the quality of the chart should be reviewed before declaring that an individual has inadequate near vision.

1) Under a Memorandum of Understanding, this is identical to NAS 410: Certification and Qualification of Non destructive Test Personnel.

5 Health and safety

Care shall be exercised when measuring or verifying the eye to chart distances.

6 Personnel administering the test

Personnel administering the near vision acuity test shall be trained and familiar with the requirements before administering this test and be designated by a Level 3. Such designation (including Level 3 self-designation) shall be made in writing and form as part of the formal records for that individual.

Medical personnel including optometrists are not exempt from this requirement.

7 Test charts

Test charts shall be prepared in accordance with this International Standard. Charts shall be printed in black ink on white paper of an adequate quality and using equipment that ensures the print quality is suitable for the purpose. Charts shall be printed in black ink on white paper using equipment that ensures the print quality is suitable for the purpose. The printing equipment and the paper used shall be of an adequate quality for the purpose. This shall be verified practically by using magnification. The two blocks of optotypes (see Annex A) have been developed to accommodate the different types of printing equipment commonly encountered. The block which prints best shall be used. This can be determined under good lighting conditions using approximately 10× magnification. Inspect lines 9 and 10 and verify that the lines forming the limbs of the E characters in line 9 are all continuous and of an even appearance. There shall not be any spread of the print material such that the gaps between the limbs are not visible. Line 10 characters may not all be perfectly formed due to the very small size and since it is not necessary to distinguish this line for compliance, the quality of this line does not form part of the acceptance criteria for the chart. It is, however, required that the overall shape of each optotype shall be discernible under magnification with the limbs and gaps being evident.

The size of the optotype is important and the prepared charts include size verification marks. Printed charts shall be verified to be the correct size by measurement. The annotated 250 mm distance between the defined marks shall be measured and shall not be less than 245 mm nor be more than 255 mm. Printing errors could affect vertical and horizontal scaling differently; therefore, before use, it shall be verified that the basic shape of the individual optotype characters is square. This may be verified on the larger characters.

Prepared charts shall comprise two blocks each having 10 lines of 5 optotypes. The height of each line, h, in mm, shall be as shown in Table A.1 and the spacing of the optotypes shall be as shown in Annex B. Each individual optotype shall be randomly orientated by rotating by a multiple of 90°. There shall be no other printing or marking within or near to the optoptype blocks. An example chart is shown in Annex C. The actual chart to be administered to a candidate shall not be made available to that person prior to the test. A number of charts with different sequences of optotypes shall be used to ensure objective testing. Demonstration charts may be provided to show what will be required during the test.

8 Test procedure

8.1 General

Prior to the test being carried out, it is necessary to ensure that properly prepared charts of verified quality are available. Tests shall be administered at a pace and in a manner that puts the candidate at ease.

8.2 Illumination level

The test shall be administered under controlled lighting conditions. Visible, white light, minimum 500 lx, maximum 750 lx shall be used to evenly illuminate the chart. This shall be measured at the position of the chart using a calibrated visible light meter. Some ambient light in the surrounding area may be beneficial

but this should be lower than the test level. Higher levels of background may adversely affect results. Spurious light sources, bright objects, etc. should not be present within the field of view of the candidate.

8.3 Eye to chart distance

The chart shall be positioned perpendicular to the line of sight on a flat surface and the candidate shall move towards the chart to the test distance of 400 ± 25 mm. At no time shall the candidate be permitted to get closer to the chart. A ruler or gauge stick may be used to verify the test distance; while traceable calibration is not required, the accuracy of measurement shall be appropriate.

8.4 Eyewear

Candidates shall wear the same eyewear, if any, as used during routine NDT inspection. This may be personal protective equipment and/or corrective lenses. Lenses used during an eye examination and not intended for regular use shall not be permitted.

Where corrective lenses are necessary to achieve the required level of near vision acuity, this shall be specifically recorded as part of the results of the test.

8.5 Candidate's responses

It is expected that the candidate will be able to identify the orientation of each of the individual optotypes. The normal response will be to define where the open end of the E character is, so responses of "UP, DOWN, LEFT, and RIGHT" would most frequently be used. However, any unambiguous form of response, verbal or visible, may be used. The candidate and the test administrator shall establish the method of communication prior to the administration of the test.

8.6 The test

The test shall be carried out under the conditions defined above and shall not be limited to a test of an individual eye. Both eyes shall be used together as for normal NDT inspection. Limited or no vision in one eye does not preclude a candidate from taking the test; however, care should be exercised to make sure that any other requirements for binocular vision are accommodated.

The test administrator will have established which of the two blocks of optotypes are to be administered as the test and the chart may optionally be identified by a pen line through the redundant block.

The candidate shall identify the characters starting from the left side of line 1 moving to the right until a response is given for each of the five characters. This shall be repeated for lines 2 onwards until the candidate reaches the limit of their capability.

Confidence can affect results and candidates shall be encouraged to provide answers even when they express some uncertainty in their ability to identify the characters. The larger characters should be easily identifiable and should be used to relax the candidate and ensure good communication between test administrator and candidate before the limit of acuity is reached. The test administrator should prepare a results sheet in advance or record the candidate's response in a manner that allows verification of correctness.

9 Acceptance level

Near vision acuity is considered acceptable where the candidate correctly identifies all the individual optotypes, 5 out of 5 on each line, for lines 1 to 9 inclusive.

When a candidate fails to achieve this, the test administrator shall verify that the test chart or test conditions were not the cause of failure before sending the candidate for further tests for corrective lenses or a more comprehensive assessment of near vision acuity. A further test shall be carried out using the prescribed corrective eyewear in the event of an initial failure.

Annex A
(normative)

Format and size of the optotypes

Table A.1 — Size of the optotypes

Line number	1	2	3	4	5	6	7	8	9	10
Height, h, in mm	5,00	4,00	3,00	2,00	1,75	1,50	1,25	1,00	0,75	0,50

The format of the optotypes for the left hand block (Block A) and the right hand block (Block B) of the reading chart are shown in Figures A.1 and A.2.

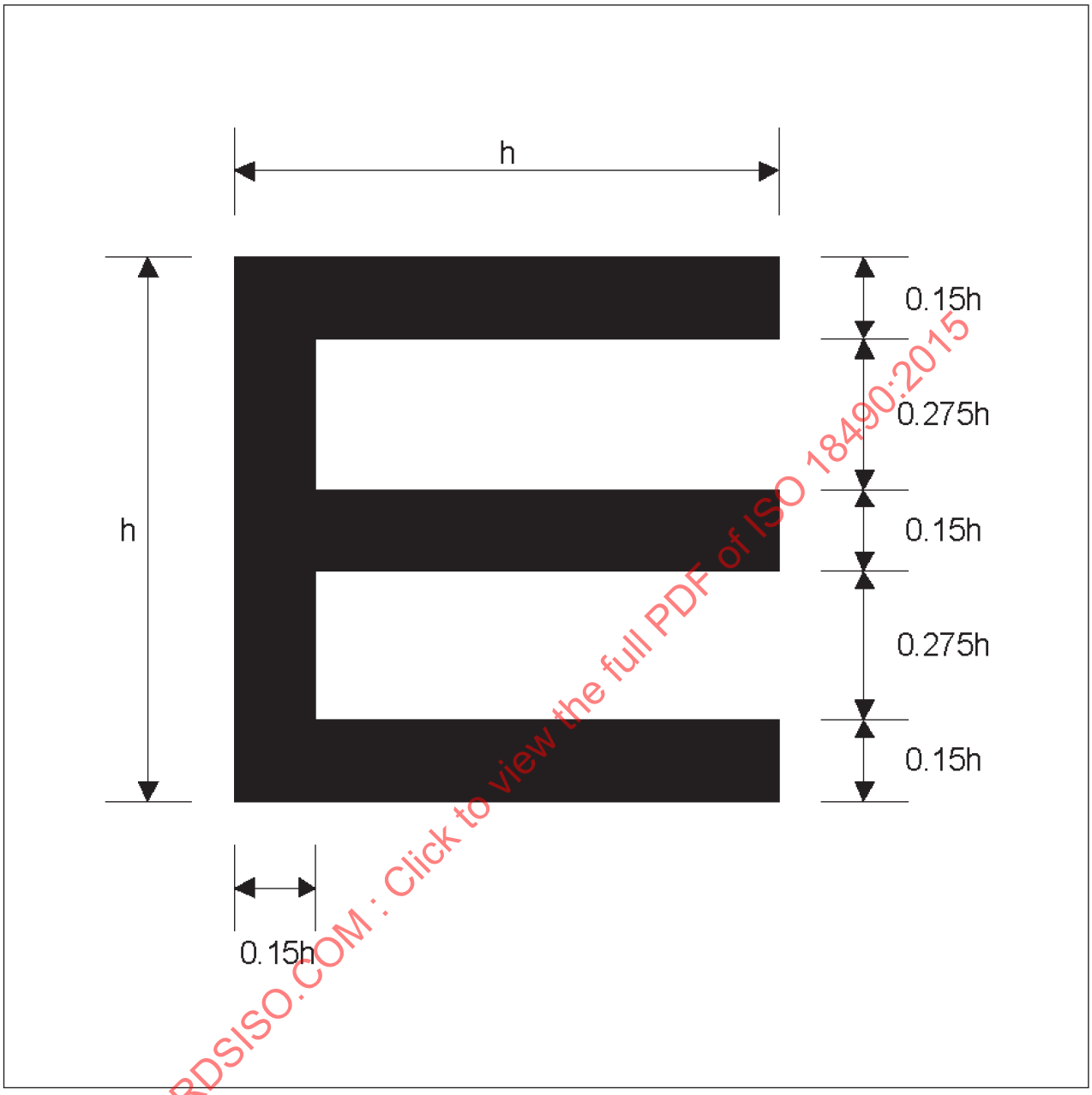

Figure A.1 — Optotype format Block A

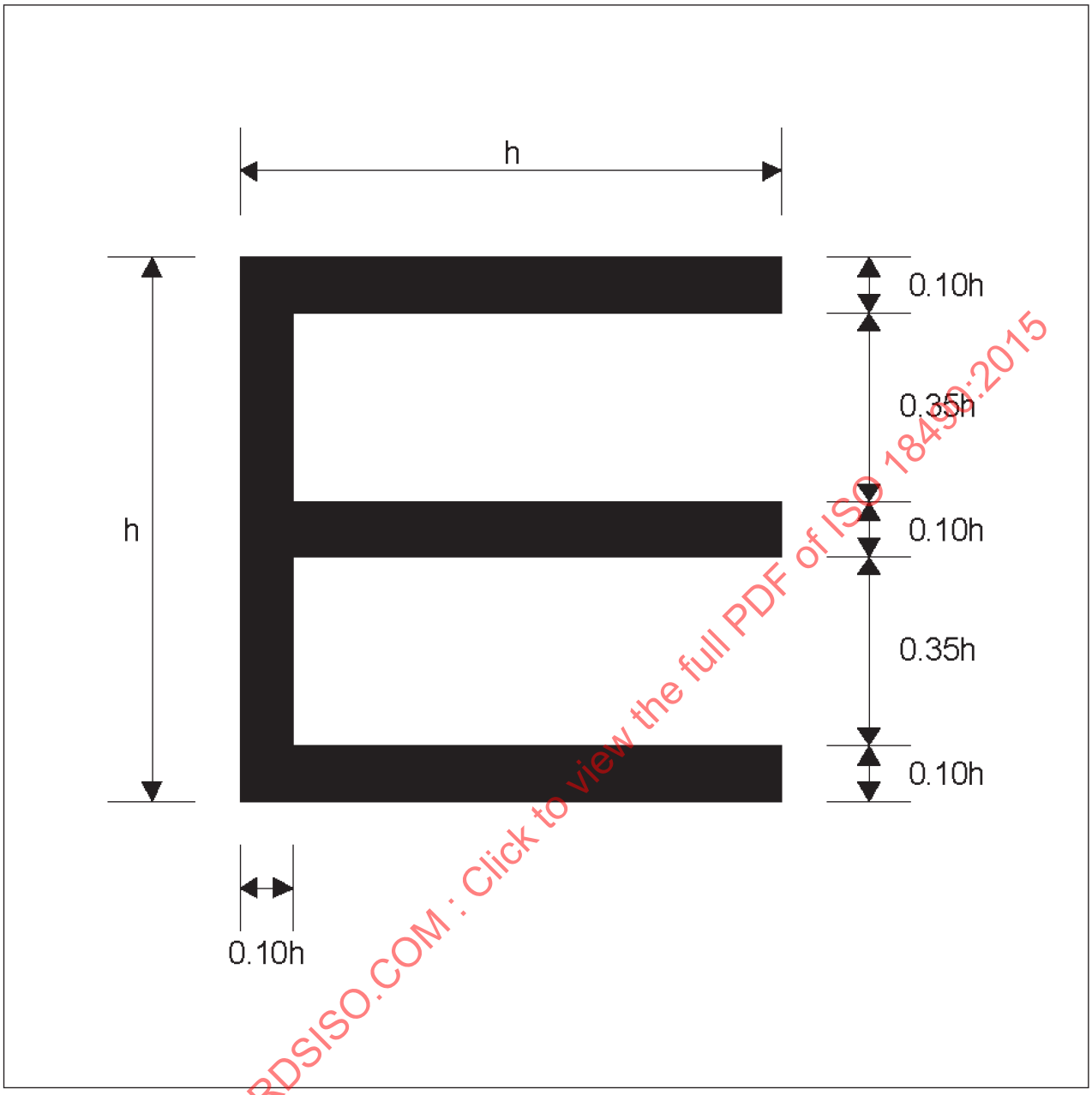

Figure A.2 — Optotype format Block B