PCN24/PSL44

Visual acuity and colour perception guidance document

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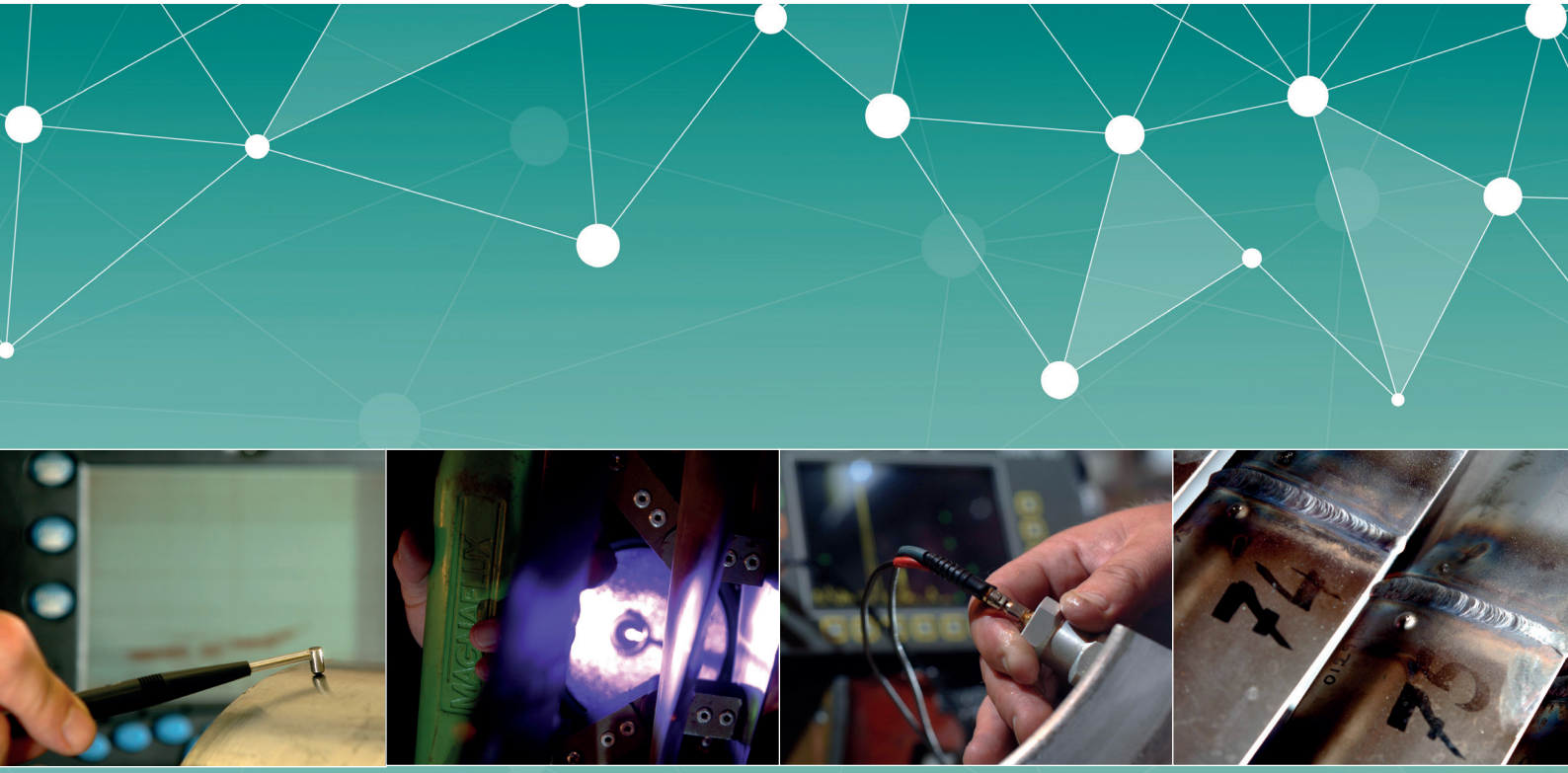
A division of BINDT THE BRITISH INSTITUTE OF NON-DESTRUCTIVE TESTING



Contents

The British Institute of Non-Destructive Testing is an accredited Certification Body offering personnel and quality management systems assessment and certification against criteria set out in international and European standards through the PCN Certification Scheme.

1. Introduction

This document is issued as guidance to PCN examination candidates, PCN certificate holders and Authorised Qualifying Bodies (AQBs) conducting examinations on behalf of BINDT (PCN).

It is a requirement that all examination candidates and holders of PCN certification meet the minimum requirements for visual acuity (VA) and colour perception (CP) as stated in BS EN ISO 9712:2022 (extracts in italics below).

5.5.2 *In respect of certified personnel under their control, the employer shall be responsible for:*

(d) Ensuring that the annual visual acuity requirements of 7.4 are met.

7.4 ***Vision requirements – All levels***

7.4.1 ***General***

Candidates and certificate holders shall maintain and provide documentary evidence of acceptable vision in accordance with 7.4.2 to 7.4.4.

7.4.2 ***Near-vision acuity***

Prior to certification, and annually thereafter, near-vision acuity shall be verified to be in accordance with the requirements of ISO 18490 or shall permit reading a minimum of Jaeger (J) number 1 or Times Roman N4.5 or equivalent letters at not less than 30 cm with one or both eyes, either corrected or uncorrected.

7.4.3 ***Colour vision***

Prior to certification, recertification or renewal, the candidate/certificate holder shall demonstrate that a colour vision test has been administered within the previous five calendar years.

It is required that colour vision and/or greyscale perception be sufficient for the individual to be able to distinguish and differentiate between the colours or shades of grey used in the non-destructive testing (NDT) methods/techniques concerned as specified by the employer.

The colour vision test shall either confirm that the individual has acceptable colour vision without restriction or shall state any limitation(s) on colour perception.

Where any limitation in colour perception exists, the employer shall confirm whether or not this condition results in any limitation(s) to method or application specific techniques.

NOTE: *The Ishihara 24-plate test is an example of a suitable colour vision test.*

7.4.4 ***Personnel administering vision tests***

Near-vision acuity testing, colour vision and/or greyscale perception verification(s) shall be administered by a licensed physician, nurse, ophthalmologist or optometrist or by another trained professional who is approved and documented by a Level 3 personnel acting on behalf of the employer.

BS EN ISO 9712:20222 provides options for visual acuity testing as follows:

1. Visual acuity testing in accordance with BS EN ISO 18490:2015 (Non-destructive testing – Evaluation of vision acuity of NDT personnel). This standard utilises the 'Tumbling E' test for assessing visual acuity (see Annex A).
2. Reading a minimum of Jaeger (J) number 1 or Times Roman N4.5 or equivalent letters at not less than 30 cm.

PCN will recognise both options for near-vision acuity testing as permitted by BS EN ISO 9712:2022 clause 7.4. BS EN ISO 18490 (Non-destructive testing – Evaluation of vision acuity of NDT personnel) is the governing standard for tumbling 'E' testing.

Note: *Tumbling 'E' test charts are available at: www.eminspection.co.uk/vision-charts*

Candidates and employers should make themselves aware of their responsibilities with regard to visual acuity and colour perception testing. The responsibility remains with the employer.

With regard to PCN examination candidates, BINDT advises AQBs that a current VA/CP certificate or documented attestation by the employer is deemed as acceptable documentary evidence of satisfactory vision in accordance with ISO 9712 requirements. Documented employer attestation may be in the form of a compliant statement; however, the employer should retain the results of visual acuity and colour perception tests, as they may be required to provide evidence of testing when requested by BINDT and/or a client.

The AQB may, at its discretion, conduct a suitable VA/CP test prior to examination. This test shall be to satisfy the AQB that the candidate possesses an acceptable level of VA/CP. This does not absolve the employer of their responsibilities under the governing standard. The AQB is required to retain records of any VA/CP tests it conducts. An example form for recording tests conducted by the AQB is attached in Annex D. The AQB may use alternative recording methods at its discretion.

All candidates and holders of PCN certification are also required to have colour perception that allows them **to distinguish between the colours associated with the relevant NDT method**. The decision regarding the test method designed to meet this requirement remains with the employer.

BINDT recommends the use of the Ishihara 24 -plate test as the base test. For radiography methods, a supplemental greyscale test is also required.

Options for greyscale testing include, but are not limited to, the following:

- Dr Kolbl ONE/TUV/BV eye examination chart (the number of correct readings required is a minimum of 20) (www.winning-teams.com/dkthomas/colortest/shadesofgrey.pdf)
- The Skerik greyscale test: contrast modification. It is required that a contrast of 2% and above shall be clearly discriminated on pattern, while a contrast of less than 1% shall not be visible.

In the event that a colour perception deficiency, indicated by misreading any of the first 17 plates, is detected during the Ishihara test, a further 'trade test' is required to be carried out by the employer to ascertain whether the detected colour perception deficiency affects the individual's ability to perform the NDT for which they are certificated. This trade test is to be documented and the record of the test made available to BINDT upon request. **It is the responsibility of the employer to ensure that a documented process/method exists within their organisation detailing the form of any supplementary trade test taken, how the test is conducted and how the results are documented.**

The employer must also consider new medical issues that may arise that may require candidates or certificate holders to undergo further VA/CP tests, as some medical conditions such as diabetes or a major medical condition can affect both near-vision and/or colour perception.

Following certification, ISO 9712 mandates that **the employer is responsible for ensuring that the tests of visual acuity are carried out at least annually**. Records of tests shall be retained by the employer or responsible agency and provided to PCN upon request. Failure to do so will invalidate all PCN certification.

The colour perception test is required every five years (as a minimum), although most organisations conduct this test on an annual basis along with the visual acuity test.

2. Who can conduct visual acuity and colour perception testing?

BS EN ISO 9712:2022 clause 7.4.4 (Personnel administering vision tests) states:

Near-vision acuity testing, colour vision and/or greyscale perception verification(s) shall be administered by a licensed physician, nurse, ophthalmologist or optometrist or by another trained professional who is approved and documented by a Level 3 person acting on behalf of the employer.

BS EN ISO 18490:2015 Section 6 (Personnel administering the test) states:

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.

The BINDT interpretation of these clauses is as follows:

1. The VA/CP tests may be performed by:
    - A licensed physician;
    - A nurse;
    - An ophthalmologist/optician; or
    - A trained professional who is approved and documented by a Level 3 person acting on behalf of the employer. This may be suitable employees within the organisation. A 'professional person' is open to the interpretation of the employer. BINDT interprets a professional person as being someone holding NDT Level 3 certification or a senior management role within the organisation, for example a Quality Manager, Technical Manager, etc.

2. **All VA/CP testing personnel must receive training** in the requirements associated with the tests and the administering of the tests. This applies to all VA/CP test personnel, irrespective of their designation/role as detailed in (1) above. The training administered must cover the scope of tests administered by the employer of the NDT personnel concerned. This training needs to be in accordance with a documented process and the completion of the training must be documented.

   The employing organisation should ensure that the training delivered encompasses the use of its own internal procedures for VA/CP testing and includes practical demonstrations also taking into consideration, but not limited to, the following:

   - Ascertaining an employee's pre-test visual condition;
   - Lighting conditions;
   - Chart-to-eye distances;
   - Familiarisation with, and the use of, relevant charts;
   - Supplementary trade tests; and
   - Recording of results.

3. All VA/CP testing personnel must be designated as such and authorised by the employer. This designation/authorisation shall be given by a Level 3 assigned with the responsibility to control the process on behalf of the employing organisation.

This interpretation of 'Who can conduct visual acuity and colour perception testing?' is that held by BINDT. It is given as guidance only and the final decisions on the topic remain with the employer and their interpretation of the requirements within the scope of approvals/accreditations under which their company operates.

BINDT accepts that a nominated official* of an AQB, a PCN Level 3 certificate holder or a medical professional possessing documented proof of satisfactory training in the administration of the test and recognised as competent may conduct such tests for candidates and holders of PCN certification.

**Nominated officials must provide proof of appropriate training upon request by BINDT.*

ANNEX A – GUIDANCE ON TEST PROCEDURES AND TEST CHARTS

1 – TEST PROCEDURES REQUIRED BY THE EMPLOYING ORGANISATION AND BINDT AQBS

1.1 Both BS EN ISO 9712:2022 and BS EN ISO 18490:2015 require that personnel conducting VA/CP testing on behalf of an organisation are authorised/nominated to do so and that they have received the appropriate training in the requirements associated with the tests and the administering of the tests.

2 – TEST CHARTS

2.1 Jaeger (J) and Roman (N) test charts

Jaeger (J) and Roman (N) test charts are standard test charts.

2.2 Tumbling 'E' test charts (extracted from BS EN ISO 18490:2015)

Tumbling 'E' test charts are available for download/print at: www.eminspection.co.uk/vision-charts

Tumbling 'E' test charts are required to be prepared in accordance with BS EN ISO 18490:2015. 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 using magnification.

The two blocks of optotypes (see Annex B) have been developed to accommodate the different types of printing equipment commonly encountered. The block that 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 on 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 may 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 ten lines of five optotypes. The height of each line (*h*) in mm, shall be as shown in Table A1 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 optotype 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.

Table A1. Tumbling 'E' charts – 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 B1 and B2 in Annex B.

3 – GUIDANCE TEST PROCEDURE (AS DETAILED IN BS EN ISO 18490)

3.1 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.

3.2 Illumination level

The test shall be administered under controlled lighting conditions. Visible, white light, with a minimum 500 lux and a maximum of 750 lux 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.

3.3 Eye-to-chart distance

The chart shall be positioned perpendicular to the line of sight on a flat surface.

For the Tumbling 'E' test, the candidate shall move towards the chart to the test distance of 400 ± 25 mm.

For Jaeger (J) and Roman test charts, the distance from the eye to the chart shall not be less than 30 cm.

At no time shall the candidate be permitted to move closer to the chart than the minimum distances stated above. 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.

3.4 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.

It must be clearly established prior to the test whether the candidate is taking the test using natural or corrected vision. Both are acceptable; however, the test should replicate the vision status under which the candidate intends to inspect. Particular attention should be given in determining whether the candidate uses contact lenses as routine or indeed whether personnel wearing spectacles actually look through them or peer over the top during the test. The use of normal or corrected vision should be clearly stated on the test certificate.

The candidate must meet the requirements in at least one eye; however, the tests must be conducted using binocular vision (both eyes simultaneously).

ANNEX B – GUIDANCE ON TUMBLING 'E' OPTOTYPES AND SIZING

Figure B1. Optotype format Block A

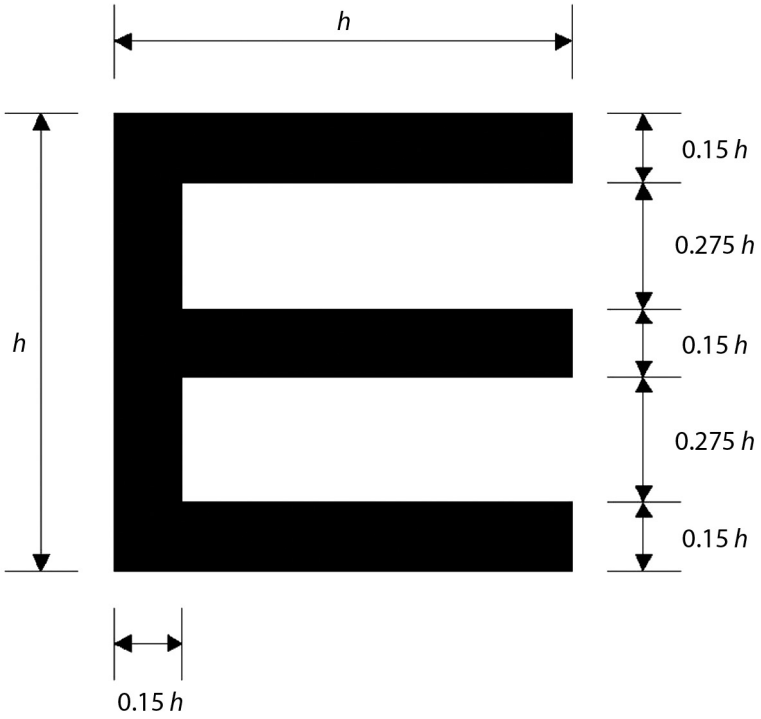


Figure B2. Optotype format Block B

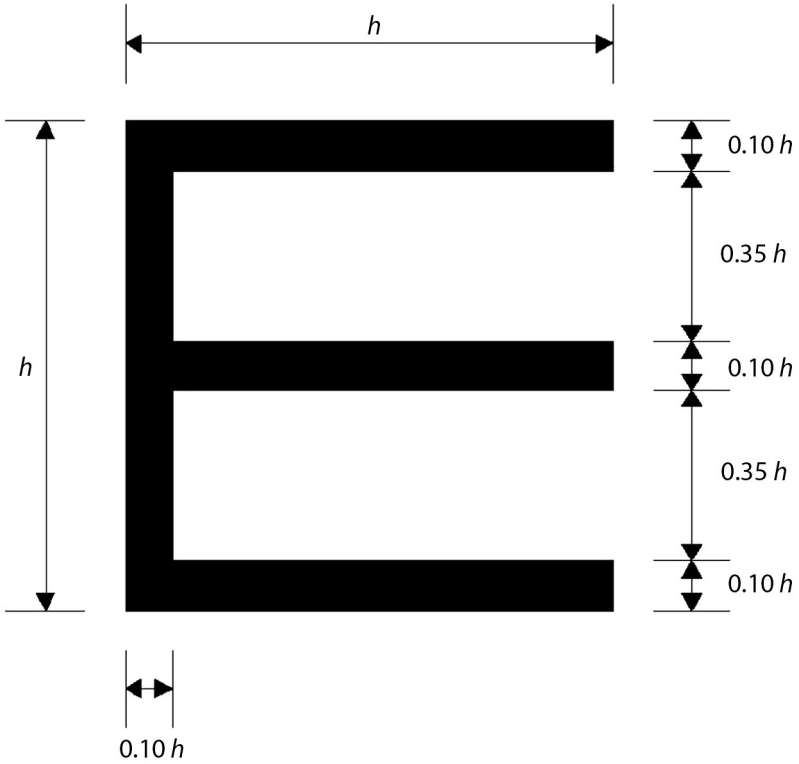
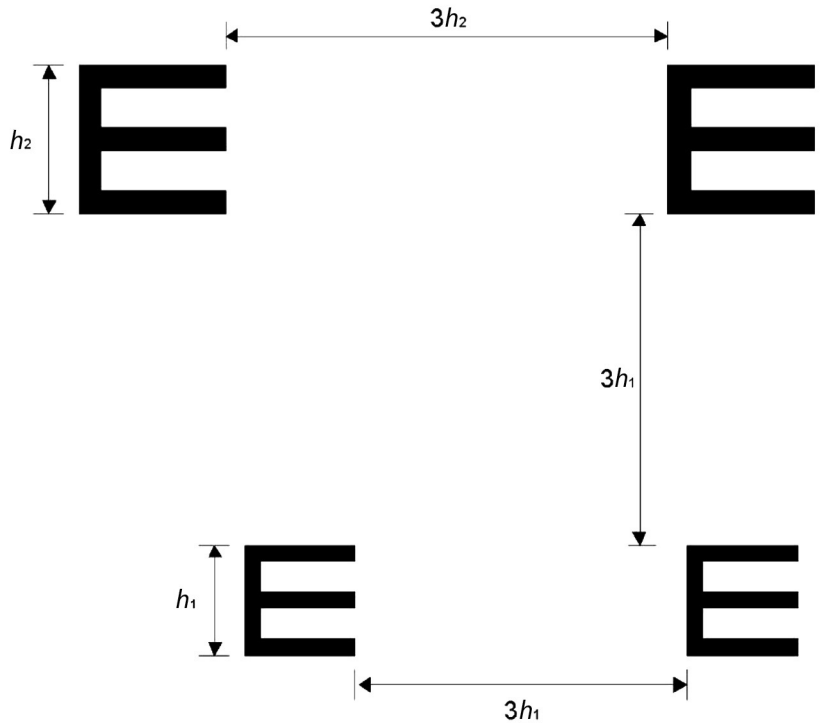
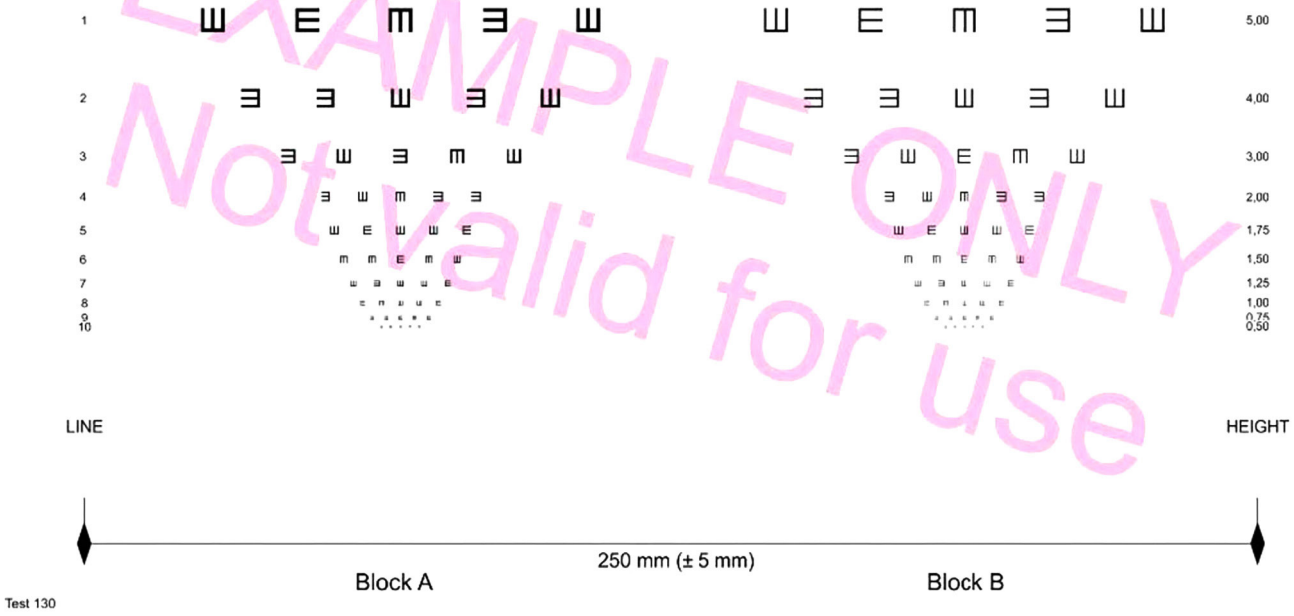


Figure B3. Spacing of the optotypes (the spacing of the optotypes for the two blocks is shown in the diagram below)



ANNEX C – GUIDANCE ON TUMBLING 'E' TEST CHART (NOT TO SCALE)

Figure C1. NDT near-vision acuity test



ANNEX D – RECORD OF VISION TEST

SAMPLE RECORDING CERTIFICATE – This example may be used by organisations providing it complies with their internal procedures and processes. Alternative methods of recording are permitted/acceptable.

Name of individual tested:	
PCN number:	
Employer:	
Address:	
Telephone number:	
Email address:	

RESULT OF NEAR-VISION TEST (record the smallest text capable of being read)

CORRECTED	UNCORRECTED
OPTION 1: Times Roman N: _____ or **OPTION 2:** Jaeger (J) number: _____	**OPTION 1:** Times Roman N: _____ or **OPTION 2:** Jaeger (J) number: _____

OPTION 3: RESULT OF NEAR-VISION TEST – TUMBLING 'E' OPTION
(candidates should correctly identify five out of five on each line and lines 1-9)

Corrected			Uncorrected		
Line 1	☐ Pass	☐ Fail	Line 1	☐ Pass	☐ Fail
Line 2	☐ Pass	☐ Fail	Line 2	☐ Pass	☐ Fail
Line 3	☐ Pass	☐ Fail	Line 3	☐ Pass	☐ Fail
Line 4	☐ Pass	☐ Fail	Line 4	☐ Pass	☐ Fail
Line 5	☐ Pass	☐ Fail	Line 5	☐ Pass	☐ Fail
Line 6	☐ Pass	☐ Fail	Line 6	☐ Pass	☐ Fail
Line 7	☐ Pass	☐ Fail	Line 7	☐ Pass	☐ Fail
Line 8	☐ Pass	☐ Fail	Line 8	☐ Pass	☐ Fail
Line 9	☐ Pass	☐ Fail	Line 9	☐ Pass	☐ Fail

RESULT OF ISHIHARA COLOUR VISION TEST
(record the Ishihara test results and indicate if an alternative (trade) test is suggested)

Please tick the box of the Ishihara plate edition tested: (*Failure to record this will result in the vision test being rejected)* ☐ 17 plates ☐ 24 plates ☐ 38 plates (MINIMUM OF FIRST 17)	Record of the Ishihara plates failed. Please tick the appropriate box: ☐ Plates tested passed with no errors ☐ Plates tested failed, see attached trade test

RESULT OF GREYSCALE TEST

Which greyscale test was used?	Number of correct readings given for the Dr Kolbl ONE/TUV/BV eye examination (20 minimum) Pass ☐ Fail ☐ The Skerik greyscale test: contrast modification – It is required that a contrast of 2% and above shall be clearly discriminated on pattern, while a contrast of less than 1% shall not be visible Pass ☐ Fail ☐

COLOUR VISION TRADE TEST

Name of individual tested:	
PCN number:	
Employer:	
Address:	
Telephone number:	
Email address:	

RESULT OF COLOUR VISION TRADE TEST (WHERE REQUIRED, SEE ABOVE)

The employer should state the NDT methods and associated colours used by the employee

NDT METHOD	ASSOCIATED COLOURS	COLOUR DIFFERENTIATION	CONTRAST DETECTION

RESULT OF OPTIONAL FAR-VISION TEST

CORRECTED	UNCORRECTED
Corrected far-vision acuity shall have a minimum value of 0.8 (or imperial measurement 6/7.5, *ie* the candidate will be able to read the characters on the line marked 7.5 M-units at a distance of 6 metres) ☐ Pass ☐ Fail	Uncorrected far-vision acuity shall have a minimum value of 0.8 (or imperial measurement 6/7.5, *ie* the candidate will be able to read the characters on the line marked 7.5 M-units at a distance of 6 metres) ☐ Pass ☐ Fail

DETAILS OF PERSON CARRYING OUT AND RECORDING ANY OF THE ABOVE TESTS

Signature:	Name of tester:	
	Date of test:	
	Expiry date of test:	
	Note: *maximum 12 months from the date of test but may be prior to that).*	

Organisation and telephone number (please use official stamp if available):

3. Change control record

PCN24/PSL44 – Document issue and review status		
Document issue for review	**Changes/amendments**	**Current document status**
Issue 1	Updated to the PCN24 format.	Issued: July 2025.

Issued by Certification Services Department, The British Institute of Non-Destructive Testing
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