BRITISH STANDARD

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Non-destructive testing — Visual testing — Equipment

The European Standard EN 13927:2003 has the status of a British Standard

ICS 19.100

Confirmed
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National foreword

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The UK participation in its preparation was entrusted to Technical Committee WEE/46, Non-destructive testing, which has the responsibility to:

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Non-destructive testing - Visual testing - Equipment

Essais non destructifs - Contrôle visuel - Equipement

Zerstörungsfreie Prüfung - Sichtprufüng - Geräte

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 13297:2003) has been prepared by Technical Committee CEN/TC 138 “Non-destructive testing” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2003, and conflicting national standards shall be withdrawn at the latest by August 2003.

Annex A is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard describes general requirements for equipment used in visual testing.

The application of equipment is necessary in visual testing when:

— objects, which are visually or on account of environmental factors not accessible, need to be made accessible to viewing;

— the test sensitivity is insufficient;

— an imaging record is required.

This European Standard includes the verification of equipment.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1330-10:2003, *Non-destructive testing – Terminology - Part 10: Terms used in visual testing*

EN 13018:2001, *Non-destructive testing – Visual testing – General principles*

ISO 3057, *Non-destructive testing – Metallographic replica techniques of surface examination*

ISO 3058, *Non-destructive testing – Aids to visual inspection – Selection of low-power magnifiers*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1330-10:2003 apply.

4 Classification

Equipment which is used in visual testing is classified according to the visual testing technique (direct or remote as described in EN 13018) and is outlined further in informative annex A.

5 Verification

5.1 General

Verification shall be carried out to ensure that the equipment or test arrangement (system) will fulfil its test function. This may include checking the mechanical, optical and electronic capability of the equipment.

The verification of the system and the test sensitivity shall be by comparison with the specification in the test documentation. When comparing, testing parameters shall be as follows.

— System sensitivity or resolution will be assessed by using a resolution target or demonstration testpiece as per the test documentation. (See 6.3 for selection considerations and target types.)

— Equipment and conditions shall be arranged as per the actual test with the whole system.

Attention shall be given to the acceptance criteria and the expected orientation of indications. For electronic systems care needs to be taken with orientation of the arrangement such that indications are not falsely hidden in the image transfer from optical to electronic form. For example an indication could be hidden or indistinguishable due to the method of image sensor operation.

Verification test parameters shall be recorded at the time of test. Test parameters required shall include:

— illumination;

— target type and size;

— target to optic or image sensor distance;

— magnification.

The verification test parameters and results shall be included in the post test documentation.

5.2 Verification frequency

Verification shall be made at the start and end of every test session. It is also recommended that the verification is checked once every four hours.

The check can be a simpler form of the verification.

Verification shall be repeated when the operator suspects that a malfunction has occurred.

When the verification or check fails a retest shall be required of all areas covered since the previous satisfactory check.

6 Requirements for typical equipment used for visual testing

6.1 General equipment selection

All equipment shall be selected in consideration of the conditions on site and usage so that:

— they conform with applicable safety regulations;

— attached parts are secure;

— mechanical strength is suitable for the task;

— temperature range is suitable for the task.

Where equipment is to be used underwater or in a corrosive environment, additional attention shall be paid to:

— corrosion resistance;

— water tightness to the expected depth of immersion;

— avoidance of an accumulation of gas bubbles at the water to glass interface;

— method of handling underwater.

Where equipment is to be used in an ionising radiation environment, additional attention shall be paid to:

— handling in a time-saving manner in consideration of exposure to ionising radiation;

— decontamination;

— resistance to the levels of ionising radiation expected during service of the chosen materials, especially glass and electric/electronic parts;

— influence of ionising radiation on image quality and how this can be kept low by corresponding measures (e.g. shielding).

6.2 Lighting

6.2.1 Lighting equipment selection

Lighting equipment shall be selected for their applicability by considering the relevant points from the following list:

— light intensity;

— light frequency (stroboscopic light);

— spectral range of light output (colour temperature);

— beam geometry;

— position of light focus.

6.2.2 Lighting requirements

The light intensity shall be checked by calibrated equipment against the requirements of the test documentation and 5.3 of EN 13018:2001.

6.3 Resolution targets

6.3.1 Resolution target selection

Resolution targets shall be selected for their applicability by considering the relevant points from the following list:

— size of resolution test image;

— contrast ratio;

— monochrome or colour;

— corner and centre resolution;

— horizontal and vertical linearity;

— screen format (e.g. 4/3 ratio);

— distance;

— magnification;

— illumination;

— reflectivity/glare;

— static or dynamic viewing;

— direct unaided or aided test.

6.3.2 Typical resolution targets

Typical resolution targets are given in the following list:

— colour chart;

— line chart;

— grey scale;

— linearity indicator;

— target slot.

Examples of resolution targets are given in annex A.

6.4 Graticule

6.4.1 Graticule selection

Graticules used to assist indication analysis shall be selected for their applicability by considering the relevant points from the following list:

— range of scale;

— accuracy;

— resolution;

— ease of access to measurement point or to interface with image signal;

— mechanism of output;

— interchangeability of graticules.

6.4.2 Graticule requirements

The graticule shall be calibrated to specific standards.

6.5 Replication

Replication techniques shall conform to ISO 3057.

6.6 Mirrors and lenses

6.6.1 Mirrors

Mirrors shall be selected for their applicability by considering the relevant points from the following list:

— flatness or curvature;

— reflectivity;

— aperture.

Low powered magnifying mirrors shall be selected by considering the relevant points from ISO 3058.

6.6.2 Lenses

Lenses shall be selected for their applicability by considering the relevant points from the following list:

— resolution;

— apertures;

— chromatic operation;

— geometric distortion;

— off axis performance.

Low powered magnifying lenses shall be selected by considering the relevant points from ISO 3058.

6.7 Endoscopes, fibrescopes and videoscopes

Endoscopes, fibrescopes and videoscopes shall be selected for their applicability by considering the relevant points from the following list:

— direction of view (e.g. direct-0º, side-90º, inclined forward-45º or retro view-110º);

— focusing range;

— field of view;

— light source;

— manipulation capabilities;

— diameter and length;

— rigidity.

6.8 Photographic and video imaging cameras

Photographic and video imaging cameras shall be selected for their applicability by considering the relevant points from the following list:

— shutter speed;

— flash synchronization speed;

— type of image sensor;

— colour or monochrome;

— resolution;

— sensitivity;

— lens focus range;

— field of view;

— mounting aids to endoscopes, etc;

— auto focus;

— remote zoom and macro function;

— white balance.

The above points can be applied to thermal imaging cameras.

6.9 Video monitors

Video monitors shall be selected for their applicability by considering the relevant points from the following list:

— image size;

— colour or monochrome;

— resolution;

— contrast;

— range of angle of vision;

— refresh rate.

6.10 Image recording equipment

Image recording equipment shall be selected for their applicability by considering the relevant points from the following list:

— resolution (of record compared to inspection resolution);

— length of individual record;

— storage format;

— storage life;

— prevention of overwriting data;

— recording of date, time and unique identification (e.g. picture or electronic text overlay);

— data back up.

6.11 Remote systems

Remote systems shall be selected for their applicability by considering the relevant points from the following list:

— range of motion;

— versatility;

— speed and control level;

— positioning accuracy;

— method of transmission of image data.

Annex A
(informative)

Outline of equipment for visual testing

A.1 General

The equipment listed in A.2, A.3 and A.4 can be used for direct and/or remote visual testing. The equipment can be coupled with remote devices. These lists are not exhaustive.

A.2 Outline of equipment typically used for direct visual testing

The following can be used:

— lighting equipment;

— equipment linked to resolution capability (e.g. resolution target, slot, optical test chart);

— graticule;

— replication;

— mirror;

— lens;

— fibre optics;

— endoscopes;

— optical attenuators and filters (spectral and/or energy adjustments).

A.3 Outline of equipment typically used for remote visual testing

The following can be used:

— fibre optics or endoscopes coupled to opto-electronic devices;

— image sensor;

— photographic camera;

— video camera;

— solid state camera;

— tube camera;

— thermal image camera;

— video monitor;

— image recording equipment;

— digital image processing equipment;

— archival image recording system.

A.4 Outline of resolution targets typically used for visual testing

The following resolution targets have been found to be useful in practice:

— USAF 1951 (positive and negative versions available);

— DIN 25435-4;

— Marconi No. 1 test chart.

This list is not exhaustive and other products may be used. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN/TC 138 of the products named.

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