British Standard

BRITISH STANDARD

BS EN ISO
9934-2:2002

Non-destructive testing — Magnetic particle testing —

Part 2: Detection media

The European Standard EN ISO 9934-2:2002 has the status of a British Standard

ICS 19.100

British Standards

National foreword

This British Standard is the official English language version of EN ISO 9934-2:2002. It is identical with ISO 9934-2:2002. It supersedes BS 4069:1982 and BS 5044:1973 which are withdrawn.

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

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

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This British Standard, having been prepared under the direction of the Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 19 December 2002

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English version

Non-destructive testing - Magnetic particle testing - Part 2: Detection media (ISO 9934-2:2002)

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This European Standard was approved by CEN on 14 July 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document EN ISO 9934-2:2002 has been prepared by Technical Committee CEN/TC 138 "Non-destructive testing", the secretariat of which is held by AFNOR, in collaboration with Technical Committee ISO/TC 135 "Non-destructive testing".

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 June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003.

Annexes A, B and C are normative

This standard consists of the following parts:

EN ISO 9934-1, *Non-destructive testing - Magnetic particle testing - Part 1: General principle (ISO 9934-1:2001).*

EN ISO 9934-2, *Non-destructive testing - Magnetic particle testing - Part 2: Detection media (ISO 9934-2:2002).*

EN ISO 9934-3, *Non-destructive testing - Magnetic particle testing - Part 3: Equipment (ISO 9934-3:2002).*

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, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the significant properties of magnetic particle testing products (including magnetic ink, powder, carrier liquid, contrast aid paints) and the methods for checking their properties.

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 1330-1, *Non destructive testing - Terminology - Part 1: List of general terms.*

EN 1330-2, *Non destructive testing - Terminology - Part 2: Terms common to the non-destructive testing methods.*

EN 10083-1, *Quenched and tempered steels - Part 1: Technical delivery conditions for special steels.*

EN 10204, *Metallic products - Types of inspection documents.*

EN 12157, *Rotodynamic pumps - Coolant pumps units for machine tools - Nominal flow rate, dimensions.*

EN ISO 2160, *Petroleum products - Corrosiveness to copper - Copper strip test (ISO 2160:1998).*

EN ISO 3059, *Non-destructive testing - Penetrant testing and magnetic particle testing - Viewing conditions (ISO 3059:2001).*

EN ISO 3104, *Petroleum products - Transparent and opaque liquids - Determination of kinematic viscosity and calculation of dynamic viscosity (ISO 3104:1994).*

EN ISO 9934-1, *Non-destructive testing - Magnetic particle testing - Part 1: General principle (ISO 9934-1:2001).*

EN ISO 9934-3, *Non-destructive testing - Magnetic particle testing - Part 3: Equipment (ISO 9934-3:2002).*

prEN ISO 12707, *Non-destructive testing - Terminology - Terms used in magnetic particle testing (ISO/DIS 12707:2000).*

ISO 2591-1, *Test sieving - Part 1: Methods using test sieves of woven wire cloth and perforated metal plate.*

ISO 4316, *Surface active agents - Determination of pH of aqueous solutions - Potentiometric method.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1330-1, EN 1330-2 and prEN ISO 12707 together with the following apply.

3.1
batch
quantity of material produced during one manufacturing operation having uniform properties throughout and with a unique identifying number or mark

4 Safety precautions

The materials used in magnetic particle inspection and those used in their testing include chemicals that can be harmful, flammable and/or volatile. All necessary precautions should be observed. All relevant regulations, including national and local regulations pertaining to health and safety, anti-pollution requirements etc., shall be observed.

5 Classification

5.1 General

The magnetic particle materials covered by this specification shall be classified as follows.

5.2 Magnetic inks

Magnetic inks shall consist of finely divided coloured or fluorescent magnetic particles in a suitable carrier liquid. They shall form a uniform suspension when agitated.

Magnetic inks may be produced from products supplied as concentrates, including paste and powders, or ready for use.

5.3 Powders

Powders for the dry technique shall consist of finely divided coloured and/or fluorescent magnetic particles.

6 Testing and test certificate

6.1 Type testing and batch testing

Type testing and batch testing of magnetic particle materials shall be carried out in accordance with the requirements of EN ISO 9934-1, EN ISO 9934-2, and EN ISO 9934-3.

Type testing is carried out in order to demonstrate suitability of a product for the intended use. Batch testing is carried out in order to demonstrate conformity of the characteristics of a batch to the product type specified.

The supplier shall provide a test certificate showing compliance with this standard having used the methods detailed. This certificate shall include results obtained and tolerances allowed.

If any changes are made to the detection media, then a new type test shall be performed.

6.2 In service testing

In service testing is carried out to demonstrate the continued performance of the detection media.

7 Requirements and test methods

7.1 Performance

7.1.1 Type testing and batch testing

Type testing and batch testing shall be carried out according to annex A using the reference blocks types 1 or 2 as described in annex B.

7.1.2 In service testing

In service testing shall be carried out according to annex A using one of the reference blocks types 1 or 2 as described in annex B or a test block which exhibit similar discontinuities to those normally found in components typically processed in the equipment.

7.1.3 Contrast aid paints

Type testing and batch testing shall be carried out according to 7.1.1 after having applied the paint in accordance with the manufacturer instructions and using a type test approved, compatible magnetic ink.

7.2 Colour

The colour of magnetic particles detection media under working conditions shall be stated by the supplier.

The colour of the batch test sample shall not differ from the colour of the type test sample when visually compared.

7.3 Particle size

7.3.1 Method

The method for determination of particle size is dependent on the range of the particle size distribution.

NOTE For magnetic inks the particle-size-distribution can be determined by the Coulter Method or an equivalent method (see Bibliography).

7.3.2 Definition of the particle size

The range of particle size shall be as follows:

-lower diameter d_l: no more than 10 % of the particles shall be smaller than d_l;

-average diameter d_a: 50 % of the particles shall be larger and 50 % smaller than d_a;

-upper diameter d_u: no more than 10 % of the particles shall be larger than d_u.

7.3.3 Requirements

d_l, d_a and d_u shall be reported. For magnetic inks sizes shall lie in the range $d_l \geq 1{,}5$ µm and $d_u \leq 40$ µm.

NOTE For powders d_l is generally ≥ 40 µm.

7.4 Temperature resistance

There shall be no degradation of the product after 5 minutes heating at the maximum temperature specified by the supplier. This shall be verified by repeating the performance test as specified in 7.1.1.

7.5 Fluorescent coefficient and fluorescent stability

To carry out these tests it is necessary to use dry powder. For magnetic inks the magnetic particle solid content shall be used.

7.5.1 Type testing

7.5.1.1 Method

The fluorescent coefficient β in cd/W is defined as follows:

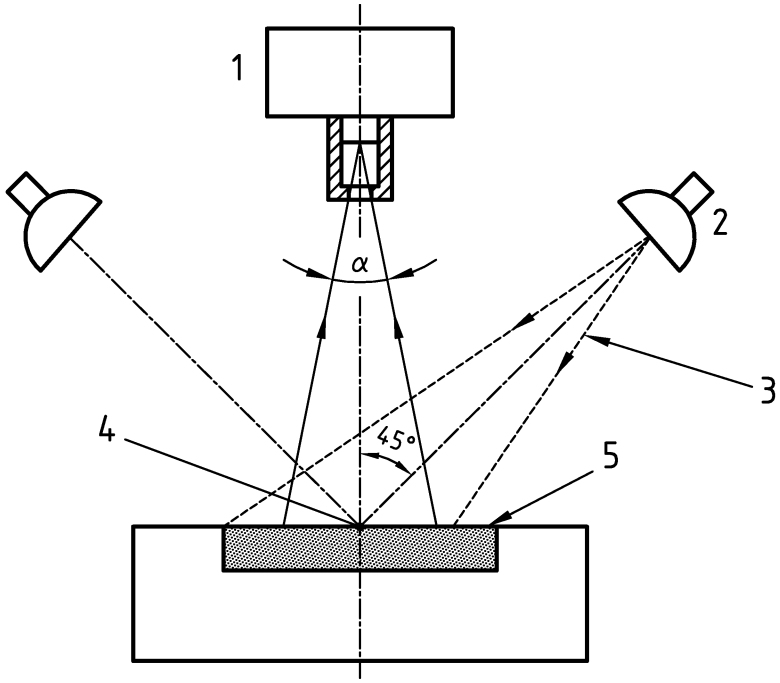
$\beta = L/E_e$

where L = luminance in cd/m² of a plane powder surface;

E_e = level of UV-irradiance in W/m² at the surface of the powder.

The arrangement of the apparatus used is shown in Figure 1.

The powder surface shall be evenly irradiated with UV(A) at an angle of 45° (± 5°). Luminance shall be measured with a suitable meter with an accuracy of ± 10 %. It shall measure the luminance from the powder surface and be unaffected by areas outside of the target area. The level of irradiance shall be measured with a meter conforming to EN ISO 3059 with its UV sensor replacing the powder surface.



Key

1 Measurement of luminance
2 Lamp
3 UV radiation
4 Measurement point of the irradiance
5 Powder surface

Figure 1 - Determination of the fluorescent coefficient β for magnetic particles

NOTE A recommended arrangement is using a luminance meter with a 200 cd/m² range and a viewing angle (α) of 20º placed 80 mm above the plane powder surface, diameter 40 mm. UV (A) lamps are placed so as to give an even irradiance at the powder surface, with E_e between 10 W/m² and 15 W/m².

7.5.1.2 Requirements

The fluorescent coefficient (β) shall be greater than 1,5 cd/W.

7.5.1.3 Fluorescence stability

The sample shall first be tested according to the method described in 7.5.1.1.

The sample shall then be exposed and re-tested as described in 7.5.1.1 after 30 minutes of exposure to UV-A irradiance of 20 W/m² (minimum). The fluorescent coefficient shall not decrease more than 5 %.

7.5.2 Batch testing

Batch testing shall be carried out according to 7.5.1.1. The fluorescent coefficient shall be within 10 % of the type test value.

7.6 Fluorescence of carrier liquid

The fluorescence of the carrier liquid shall be checked by visually comparing with quinine sulphate solution when irradiated with UV-A of at least 10 W/m².

The concentration of the quinine sulphate solution shall be 7×10^{-9} M (5,5 ppm) in 0,1 N H_2SO_4.

The carrier liquid under test shall exhibit no more fluorescence than the quinine sulphate solution.

7.7 Flash point

For magnetic inks, other than water based, the flash point (open cup method) of the carrier fluid shall be reported.

7.8 Corrosion induced by detection media

7.8.1 Corrosion testing on steel

The corrosive effect on steel shall be tested and reported according to annex C.

7.8.2 Corrosion testing of copper

The corrosive effect on copper shall be tested according to EN ISO 2160.

7.9 Viscosity of the carrier liquid

The viscosity shall be tested according to EN ISO 3104.

The dynamic viscosity shall not be higher than 5 mPa·s at 20 °C (± 2 °C)

7.10 Mechanical stability

7.10.1 Long term test (endurance test)

The manufacturer shall show that the detection media is unaffected by use in a typical magnetic particle testing bench over a period of 120 h.

This may be proven in a magnetic particle testing bench bench or by using an arrangement to simulate this; a recommended arrangement is as follows:

a 40 l sample of the detection media shall be contained in a corrosion resistant reservoir fitted with a centrifugal pump. The detection media shall be recirculated and the flow interrupted by a valve.

Technical data:

Type of the sump pump	EN 12157 - T 160-270-1
Diameter of the return flow	RI 1" NB pipe
Cycle time	

— valve opened 5 s

— valve closed 5 s

The detection media shall be checked with a reference block (see 7.1.1) before use and after 120 h.

Any discernible change in the quality of indications shall be cause for rejection.

7.10.2 Short term test

7.10.2.1 Equipment

A stirring arrangement similar to Figure 2 shall be used.

1) Speed of stirring blade: (3 000 $^{0}_{-300}$) rpm.

2) Stirring cup: Capacity 2 l.

3) Reference blocks type 1 and type 2 as detailed in annex B.

4) UV-A source to give irradiance of 10 W/m², to the requirement of EN ISO 3059.

7.10.2.2 Procedure

Stir a 1 l sample for 2 h. Compare the indications on reference block N° 1 and N° 2 produced by the stirred probe and the reference probe.

7.10.2.3 Requirements

Any discernible change in the quality of indications shall be cause for rejection.

7.11 Foaming

Foaming shall be checked during mechanical stability test to 7.10.1 or 7.10.2. Significant foaming shall be cause for rejection.

7.12 pH

The pH of aqueous carrier liquids shall be determined according to ISO 4316. The value shall be reported.

7.13 Storage stability

The expiry date shall be given by the producer and shall be marked on each original container.

7.14 Solids content

The recommended magnetic particle content in g/l of magnetic inks shall be given by the supplier.

7.15 Sulphur and halogen content

For products designated low in sulphur and halogens, the sulphur and halogen content shall be determined by a suitable method which is accurate to ± 10 ppm at 200 ppm of sulphur/halogens.

— Sulphur content shall be less than 200 ppm (± 10);

— Halogens content shall be less than 200 ppm (± 10), (halogens shall be taken as chlorine + fluorine).

8 Testing requirements

Testing shall be carried out according to the requirements of Table 1.

Type testing (Q) and batch testing (B) shall be the responsibility of the supplier or manufacturer. In service testing (P) shall be the responsibility of the user.

9 Test report

As agreed at the time of the order, the manufacturer or the supplier of the magnetic particle testing materials shall provide a certificate of compliance according to EN 10204.

Results of all tests required in Table 1 shall be reported.

10 Packaging and labelling

Packaging and labelling shall be in accordance with all applicable national and local regulations. Containers shall be compatible with the detection media. Containers shall be marked with the following information:

— product identification;

— type of detection media;

— batch number;

— date of manufacture;

— expiry date.

Table 1 - Testing requirements

Properties	Contrast aid paints	Dry detection media	Organic carrier liquid	Aqueous suspension ready for use	Organic suspension ready for use	Method	
						Clause	Standard/Remarks
Performance	Q/B	Q/B/P		Q/B/P	Q/B/P	7.1	
Colour	Q/B/P	Q/B/P	Q	Q/B/P	Q/B/P	7.2	by comparison
Particle size		Q/B		Q/B	Q/B	7.3	
Temperature resistance	Q	Q	Q	Q	Q	7.4	
Fluorescence coefficient		Q/B		Q/B	Q/B	7.5	
Fluorescence stability		Q		Q	Q	7.5.1.3	
Flash point	Q/B		Q/B		Q/B	7.7	
Fluorescence of carrier liquid		Q/B	Q/B	Q/B		7.6	by comparison
Corrosion on steel	Q			Q		7.8.1	
Corrosion on copper				Q	Q	7.8.2	EN ISO 2160
Viscosity			Q	Q/B	Q/B	7.9	EN ISO 3104
Mechanical stability:							
short test				Q/B	Q/B	7.10	
long term test				Q	Q	7.10	
Foaming			Q	Q/B	Q/B	7.11	
pH (aqueous products)				Q		7.12	ISO 4316
Storage stability	Q	Q/B	Q/B	Q/B	Q/B	7.13	
Sulphur & Halogen content	B		B	B	B	7.15	NOTE Only for products designated low in sulphur/halogen

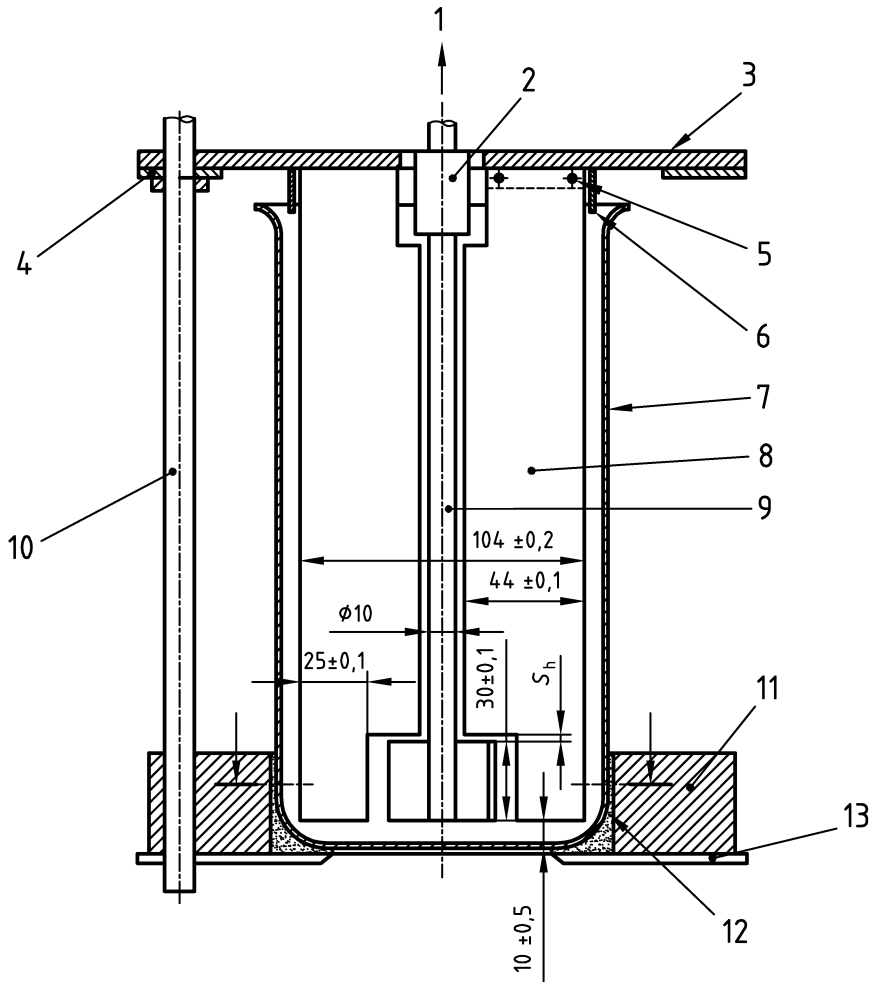
NOTE

Q : type testing

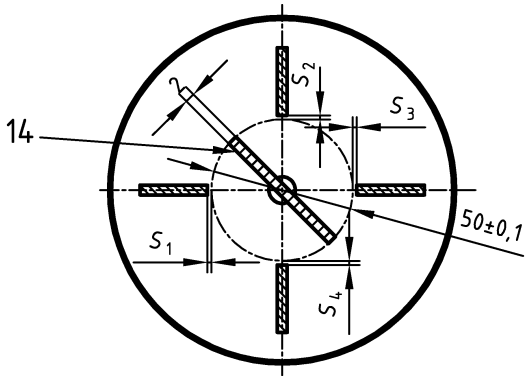
B : batch testing

P : in service testing

Dimensions in millimetres



Material: non ferromagnetic steel protected against corrosion



Gap dimensions
$s_h = 2 \pm 0,5$
$s_1, \ldots, s_4 = 2 \pm 0,5$ ($s_1 + s_3$) / 2 = 2 ± 0,2 ($s_2 + s_4$) / 2 = 2 ± 0,2

Tolerances are to be ensured in the 4 blade positions

Key

1 Motor
2 Clutch
3 Motor plate
4 Support ring distance setting 10 mm from the bottom
5 Fixture by angle profiles
6 Spraying plate
7 Cup ISO 3819 - HF 2000
8 4 stator plates, 2 mm thick - Height of support ~ 170 mm
9 Axle
10 3 supports
11 Pilot ring
12 Felt
13 Basic plate
14 Blade

Figure 2 - Construction of the stirring arrangement to 7.10.2

Annex A
(normative)

Procedure for type, batch and in service testing

A.1 Preparation of the detection media

The detection media shall be prepared in accordance with the manufacturer's instructions.

A.2 Cleaning of the reference blocks

The reference block shall be cleaned by a suitable method to ensure that it is free from fluorescent material, oxide, dirt and grease and has a water break free surface.

A.3 Application of the detection media

Detection media shall be applied to reference blocks No. 1 and No. 2 as detailed in annex B in accordance with EN ISO 9934-1.

Spraying: 3 s to 5 s.

Specimen pitch angle: 45° ± 10°.

Spraying direction: 90° ± 10° to the surface under examination.

A.4 Inspection and interpretation

A.4.1 Inspection

Test pieces shall be inspected under viewing conditions described in EN ISO 3059.

A.4.2 Interpretation

A.4.2.1 Type and batch testing

The test shall be carried out three times and an average of the results shall be used. Indications shall be evaluated visually or by an equivalent measuring method.

A.4.2.1.1 Reference block type 1

The indications shall be compared to those produced by the reference detection media (e.g. by a photograph).

The result shall be reported.

A.4.2.1.2 Reference block type 2

The cumulative length of the indications shall be reported.

A.4.2.2 In service testing

Using test block type 1 or type 2 the indications produced shall be compared with known results.

A.5 Contrast aid paint

Contrast aid paint shall be tested in accordance with A.1 to A.4.2.1, except that the contrast aid paint shall be applied in accordance with the manufacturer's instructions after cleaning the reference test block (see A.2).

Annex B
(normative)

Reference blocks

B.1 Reference block type 1

B.1.1 Description

The reference block is a disc with 2 types of natural cracks in the surface as seen in Figure B.1. It shall contain coarse cracks and fine cracks produced by grinding and stress corrosion. The block is permanently magnetized by a central conductor through the hole. Evaluation of a detection media is made by visual or other appropriated method of comparison of the indications.[1)]

B.1.2 Manufacturing

Material preparation: using steel (Grade 90MnCrV8) the surfaces shall be plane ground to 9,80 mm ± 0,05 mm then hardened at 860 °C ± 10 °C for 2 h and quenched in oil to give a surface hardness 63 HRC to 70 HRC.

Process: grind at a velocity of 35 m/s, using grit size 46J7 with infeed of 0,05 mm per surface, indexing 2,0 mm. Black oxidize at 145 °C to 150 °C for 1,5 h.

Magnetization: magnetization shall be achieved using a central conductor and direct current at a value of 1 000 A (peak).

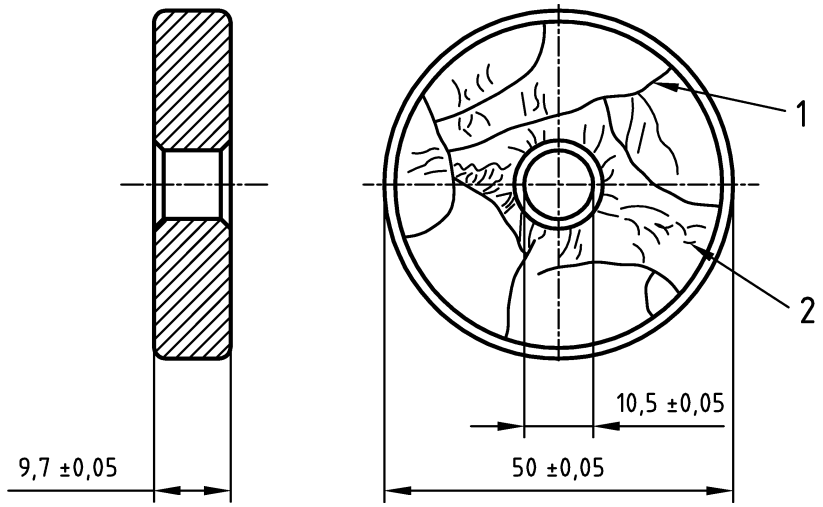
B.1.3 Verification

Initial assessment: fluorescent detection media shall be used and the results recorded.

Identification: each reference block shall be uniquely identified. A certificate stating its conformance with EN ISO 9934-2 is supplied with the reference block.

1) For information, Block N° 1 was described in a German patent: G 01 N 27/84 Auslegeschrift 23 57 220; this patent expired on 1990.

Dimensions in millimetres



Key

1 Grinding cracks
2 Stress-corrosion cracks

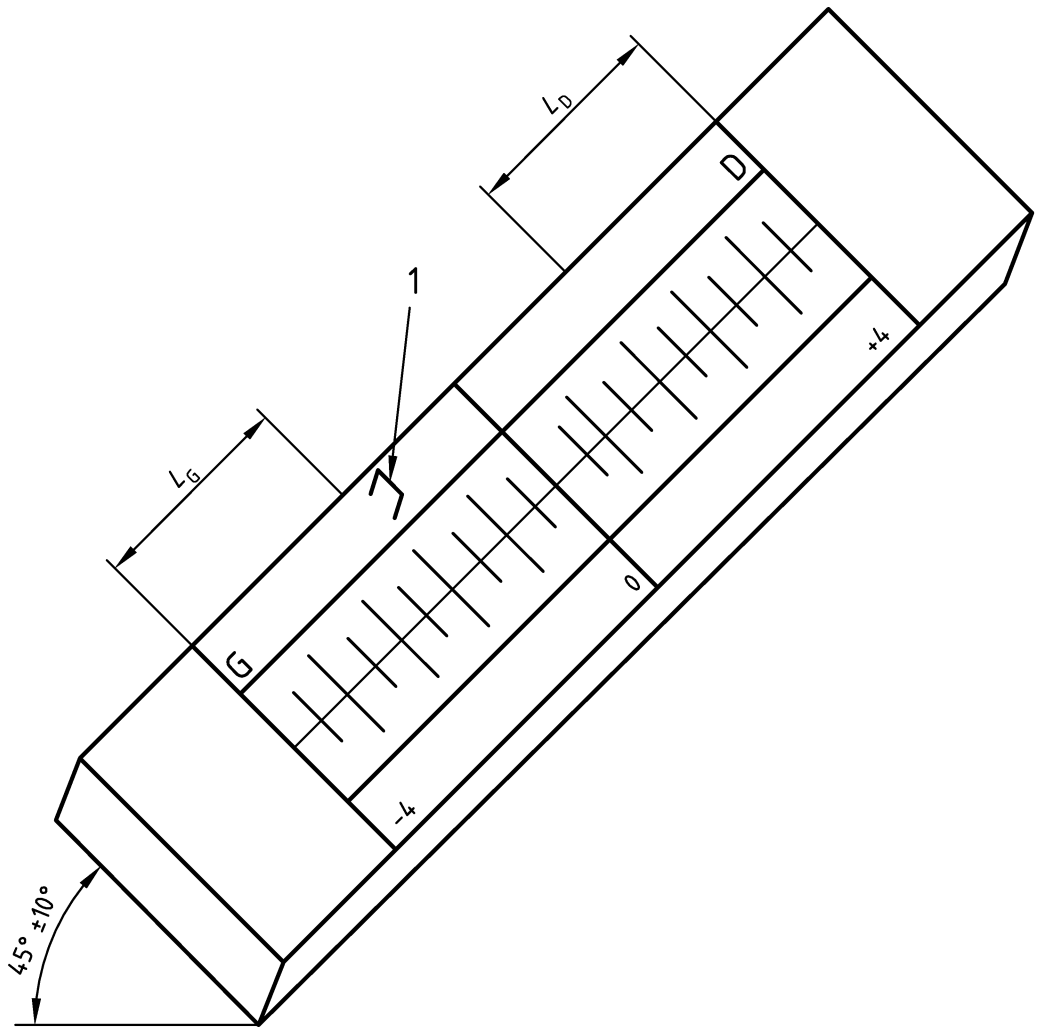
Figure B.1 - Typical reference block type 1

B.2 Reference block type 2

B.2.1 Description

Reference block type 2 is a self contained unit requiring no external magnetic field induction. It comprises 2 steel bars and two permanent magnets as shown in Figure B.2. It shall be calibrated such that the +4 mark represents +100 A/m and the -4 mark represents -100 A/m

Indication lengths give a measure of performance. Indications start at the ends and decrease towards the centre. Increased length show better performance. Results shall be the cumulative length of the left and right hand indications.



Key

1 Spray direction

NOTE At the centre, 2 steels bars: (10×10×100) mm with a gap of 0,015 mm.

Figure B.2 - Reference block type 2

B.2.2 Manufacturing

B.2.2.1 Machine 2 square bars in steel grade C15 in accordance with EN 10083-2, 10 mm square and 100,5 mm ± 0,5 mm in length. Machine a bar holder and two protective tips in non magnetic material to hold and protect the magnets (see Figure B.2).

B.2.2.2 Grind one face of each bar to $R_a \approx 1{,}6$ µm and flatness < 5 µm.

Caution: the temperature of the bar should not exceed 50 °C.

B.2.2.3 Demagnetize the two bars.

B.2.2.4 Insert between the ground faces of the two bars a sheet of aluminium having a thickness of 15 µm, then place the set in the bar holder.

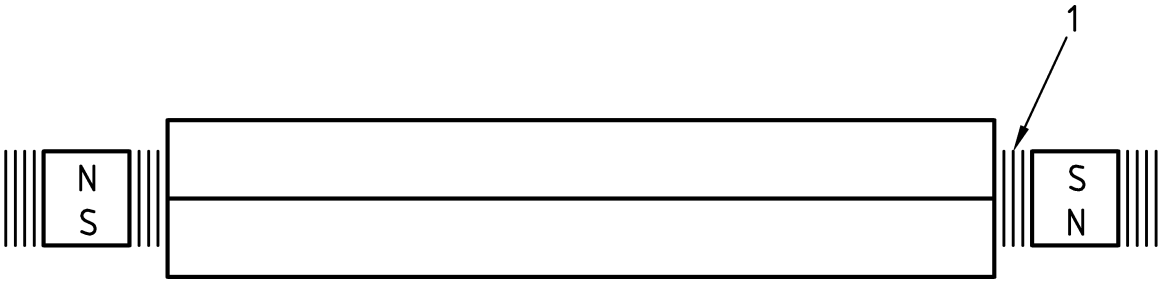
B.2.2.5 Clamp the bars in position.

B.2.2.6 Fit the magnets' protective tips.

B.2.2.7 Grind the upper surface of the assembly to $R_a \approx 1{,}6$ µm.

B.2.2.8 Remove the magnets' protective tips.

B.2.2.9 Insert the magnets (small door catch type: for example CF 12-6N[2)] as shown by the schema (Figure B.3). The shunts in steel with thickness of 0,2 mm are used to adjust the value of the magnetic field.



Key

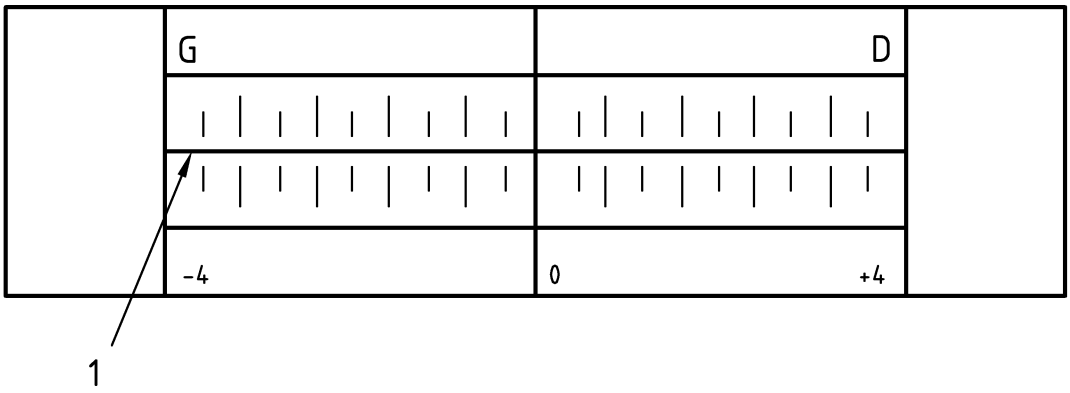
1 Shunt

Figure B.3 - Schema showing the inserted magnets

B.2.2.10 Assemble the magnets' protective tips.

B.2.2.11 Engrave the upper face as shown in Figure B.4. Engraving shall not be closer than 2 mm to the gap.

2) Magnet CF 12-6N produced by ARELEC company is an example of a suitable product commercially available. This information is given for the convenience of users of this standard and does note constitute an endorsement by CEN of the product named.



Key
1 Gap

Figure B.4 - Engraving of reference block type 2

B.2.3 Verification

B.2.3.1 Using a tangential field strength meter, measure the field perpendicular to the artificial defect at the +4 and -4 graduations.

B.2.3.2 Acceptance criteria

Value of the field at graduation -4: - 100 A/m ± 10 %.

Value of the field at graduation +4: + 100 A/m ± 10 %.

If these values are not satisfied, repeat the procedure from B.2.2.9 adjusting the field values with the shunts.

B.2.3.3 Identification

Each reference block type 2 is identified by a unique serial number.

A certificate stating its conformance with EN ISO 9934-2 is supplied with the reference block.

Annex C
(normative)

Corrosion testing of steel

C.1 Principle

The corrosive properties of detection media shall be determined by visual examination of the corrosion traces left on a filter paper by granules previously impregnated with the liquid for examination under specified conditions.

After the corrosion test, the manufacturer of magnetic particle testing products shall report the conditions of the granules. It is, however, recommended to use granules permitting test reproducibility.

If mutually agreed, specific granules can be supplied by the user for the manufacturer to use in corrosion testing of the magnetic particle testing products.

If these are not available or in case of a dispute, the granules defined in C.3 shall be used.

C.2 Apparatus

C.2.1 Petri-dish made of glass, of 100 mm outside diameter.

C.2.2 Pipette with ml scale.

C.2.3 Round filter paper, ø 90 mm, with a 40 mm diameter circle inscribed on it with indelible ink.

C.2.4 Stainless steel spatula.

C.2.5 Mesh 5 sieve in accordance with ISO 2591-1.

C.2.6 Balance accurate to 0,1 g.

C.3 Reagents and materials

C.3.1 Acetone;

C.3.2 Xylene;

C.3.3 Steel granules grade 2C40 (according to EN 10083-1), generally 2,5 × 2,5 mm;

C.3.4 Lamellar graphite general purpose cast iron granules;

(S > 0,18 %, P < 0,12 %) dry machined, approximately 2,5 mm × 2,5 mm.

The granules shall be carefully degreased with xylene in an appropriate equipment.

C.3.5 Hard water.

C.3.6 Different stock solutions shall be prepared:

Solution A: dissolve 40 g $CaCl_2 \bullet 6H_2O$ in distilled water and complete to 1 l.

Solution B: dissolve 44 g $MgSO_4 \bullet 7H_2O$ in distilled water and complete to 1 l.

C.3.7 From these stock solutions prepare three diluted solutions as follows:

a) 2,90 ml of solution A + 0,5 ml of solution B in 1 l of distilled water;

b) 10,7 ml of solution A + 1,7 ml of solution B in 1 l of distilled water;

c) 19 ml of solution A + 3 ml of solution B in 1 l of distilled water.

C.4 Test procedure

C.4.1 Preparation of the solutions (100 ml)

Introduce successively into three 100 ml volumetric flasks the same test portion of the product under examination. Dilute each test portion to the mark using waters of different hardnesses (solutions a, b, c prepared in C.3.7). Proceed similarly for the other 2 concentrations.

C.4.2 Preparation of the granules and filters

The degreased cast iron and steel granules shall first be visually inspected for rust deposits.

Prepare a set of filters bearing ø 40 mm concentric circles inscribed with an oil pencil.

The following is required to test each magnetic particle testing product:

— 9 filters for testing with steel granules (solutions with three different increasing concentrations, prepared from waters with three different hardnesses),

— 9 filters for testing with cast iron granules.

Sieve the granules to remove any undersized particles and traces of dust.

Place the prepared filters in the Petri-dishes. Distribute 2 g ± 0,1 g of granules over the circumscribed area of each filter.

C.4.3 Corrosion testing

Wet the granules in each of the dishes using 2 ml of the relevant solution applied in one application.

Repeat the same operation for each solution with the steel and cast iron granules.

Check that there is no bubble under the filter paper, cover the Petri-dishes.

Leave the dishes at room temperature (23 ± 1) °C for 2 h ± 10 min, in a place protected from drafts and sunshine.

At the end of this time interval, remove the granules by turning the filter paper upside down by hand.

Rinse copiously with distilled water, dispensed from a water wash bottle, to remove any granules adhering to the paper.

Dip twice in acetone, then dry at room temperature.

C.5 Interpretation of the results

The corrosion marks left on the filter paper after washing and drying shall be immediately interpreted by visual examination without optical instruments. Figure C.1 is intended to facilitate reading.

NOTE A quantitative evaluation of the stained surface can be made using a transparent (1 mm square) paper grid.

Table C.1 - Grading of corrosion stains on the filter paper

Grade	Meaning	Surface description
0	no corrosion	no stain
1	corrosion traces	max. 3 stains of less than 1 mm diameter
2	low corrosion	less than 1 % of the surface
3	average corrosion	more than 1 % and less than 5 % of the surface
4	strong corrosion	more than 5 % of the surface

C.6 Expression of results

In case of uncertainties as to the grade, allocate the higher numbered grade.

The results shall be recorded together with:

— identification of the tested sample;

— product concentration and water hardness;

— any required comment on the test;

— date.

C.7 Uncertainties

The applicability of the test results shall be assessed from tests of:

— repeatability:

two tests carried out by one operator under the same conditions are considered acceptable and valid when the 4 values of the two measuring pairs do not differ by more than one scale unit;

— reproducibility and precision:

two tests carried out in two different laboratories under reproducible analogous conditions are considered acceptable and valid when the readings for the same measurements do not differ by more than one scale unit.

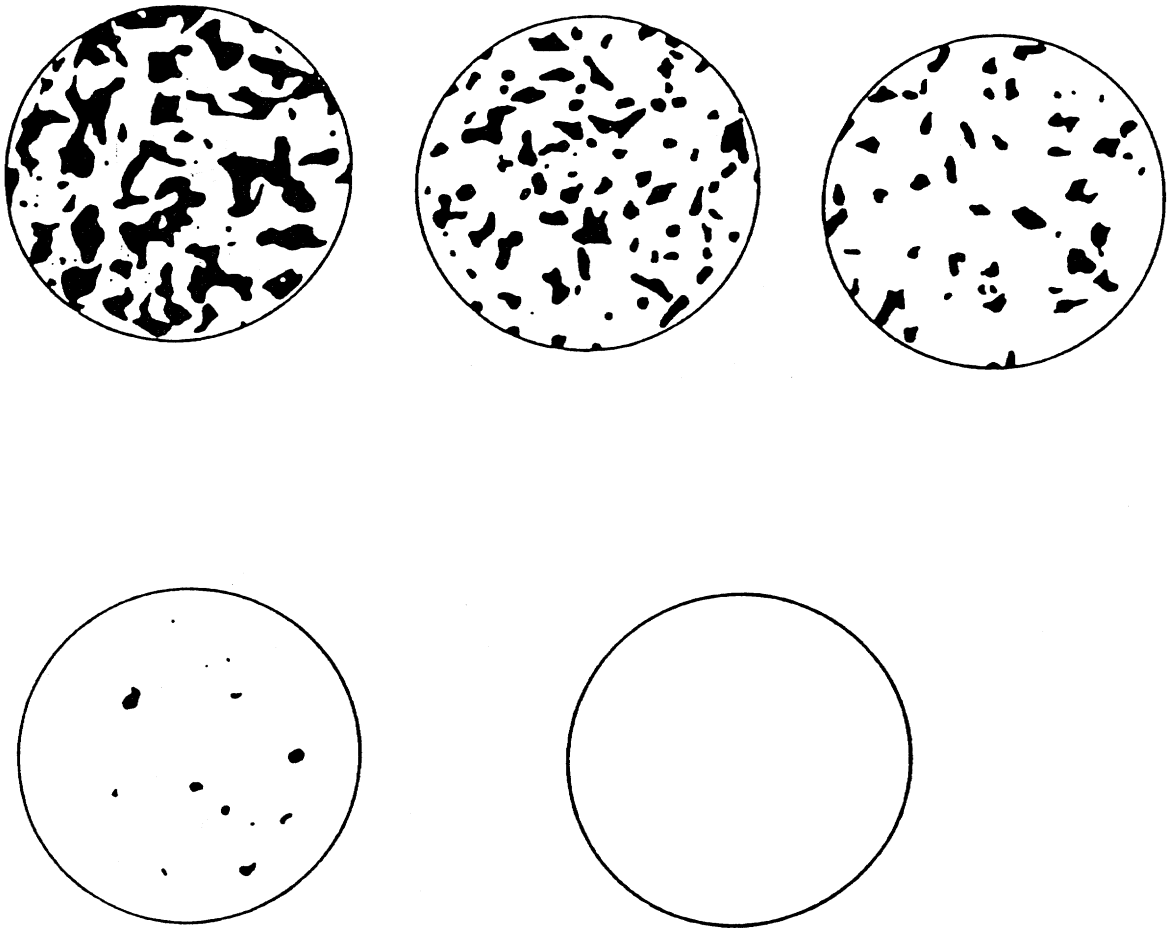


Figure C.1 - Evaluation of corrosion marks

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