BS EN 10251:2015

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Magnetic materials — Methods of determination of the geometrical characteristics of electrical steel sheet and strip

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee ISE/108, Magnetic Alloys and Steels.

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

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EN 10251

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English Version

Magnetic materials - Methods of determination of the geometrical characteristics of electrical steel sheet and strip

Matériaux magnétiques - Méthodes de détermination des caractéristiques géométrique des tôles électriques en acier

Magnetische Werkstoffe - Verfahren zur Bestimmung der geometrischen Kenngrößen von Elektroblech und -band

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European foreword

This document (EN 10251:2015) has been prepared by Technical Committee ECISS/TC 108 “Steel sheet and strip for electrical applications”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by February 2016, and conflicting national standards shall be withdrawn at the latest by February 2016.

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1 Scope

This European Standard is intended to define the test methods used for the determination of the following geometrical characteristics of electrical steel sheet and strip:

— flatness;

— residual curvature;

— edge camber;

— deviation from the shearing line due to internal stresses;

— burr height of cut edges.

This European Standard applies to electrical steel sheet and strip intended for the construction of magnetic circuits and corresponding to Clauses B2, C21 and C22 of IEC 60404-1:2000.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
flatness (wave factor)
property of a sheet or length of strip which is characterized by the wave factor, i.e. by the relation of the height of the wave to its length

Note 1 to entry: For examples of waves, see Figure 1.

3.2
residual curvature
permanent curvature in the direction of rolling of an unwound strip

3.3
edge camber
greatest distance between a longitudinal edge of the sheet and the line joining the two ends of the measured section corresponding to this edge

Note 1 to entry: See Figure 3.

3.4
deviation from the shearing line due to internal stresses
greatest distance between corresponding points on the two cut edges of a sheet cut longitudinally

Note 1 to entry: See Figure 4.

3.5
burr height
difference between the thicknesses measured respectively at the cut edge of the sheet and at a distance of 10 mm from this edge

Note 1 to entry: See Figure 5.

4 Test Methods

4.1 Flatness

4.1.1 Test specimen

The test specimen shall consist of a sheet or a length of strip, the size of which is defined in the product standard.

4.1.2 Measuring procedure

The test specimen shall be placed on a surface table sufficiently large that the specimen does not overhang the edges. It shall then be lifted up on one edge and allowed to fall back. The height of the maximum wave (h) and the length of the wave (l) shall be measured with a rule graduated in millimetres (see Figure 2).

4.2 Residual curvature

4.2.1 Test specimen

The test specimen shall consist of a sample 500 mm in length and of width equal to the delivered width of the sheet or strip. The axis of the test specimen shall be parallel to the direction of rolling of the sheet or strip.

4.2.2 Measuring procedure

The test shall consist of placing the test specimen vertically against a supporting plate. The top of the test specimen shall be held against the supporting plate over a height of 30 mm with its convex surface facing the plate. The distance (a) between the bottom edge of the test specimen and the supporting plate shall then be measured at the axis of the test specimen (see Figure 6). The clamping force shall be sufficient to allow the full width of the test specimen to be in contact with the support (see in Figures 7 and 8 examples of clamping systems).

4.3 Edge camber

4.3.1 Test specimen

The test specimen shall consist of a sheet or a length of strip, the size of which is defined in the product standard.

4.3.2 Measuring procedure

The test specimen shall be placed on a surface table. A rule shall be placed in contact with the extremities of the concave side and the maximum gap (e) between the edge and the rule shall be measured.

4.4 Deviation from the shearing line due to internal stresses

4.4.1 Test specimen

The test specimen shall consist of a sheet or a length of strip, the size of which is defined in the product standard.

4.4.2 Measuring procedure

The test specimen shall be split along the central axis (middle of the width) in longitudinal direction. The two parts, neither of which shall be turned over, shall be weighted so that they remain flat. The two cut edges shall then be brought together again so as to give the smallest gap. The maximum distance (c) between the two cut edges shall be measured.

4.5 Burr height

4.5.1 Test specimen

The test specimen shall consist of a sheet or a length of strip, the size of which is defined in the product standard. The effective length for the measurement shall be 1 m.

4.5.2 Measuring procedure

The burr height shall be determined by using a linear measuring device such as a comparator.

The device shall have the following characteristics:

— resolution : 1 µm;

— uncertainty : ± 2 µm;

— axial movement of the sliding anvil shall be obtained without rotation;

— dimension of the sliding anvil : 16 mm x 8 mm;

— applied force on the sliding anvil : 4 N ± 0,2 N.

The test specimen shall be held flat on a surface table. The linear measuring device shall be rigidly fixed on a stand so that the movement of the anvil is perpendicular to the table (see Figure 9).

The surface of contact of the sliding anvil shall be parallel to the surface table. The verification of this parallelism can be made using a thickness of the sample. The difference in the distance from any point on the surface of the supporting table shall not exceed 2 µm. A three point adjusting surface table is necessary.

The test shall consist of measuring the thickness of the sheet at 10 mm from the cut edge (h_1) and the thickness of the cut edge (h_2), the sliding anvil having its larger dimension (16 mm) parallel to the cut edge (see Figure 10).

A measurement shall be made every 50 mm, by moving the test specimen, the burr height being characterized by the mean value of the 20 measurements and by the indication of the maximum value obtained.

It is permissible to cut the test specimen into lengths of at least 50 mm or multiples of 50 mm. If this is done, the cuts shall be made so that the burrs are on the same side of the sheet as the burr which is to be measured.

During the measurements, the temperature shall be constant.

5 Test report

The test report, when requested, shall contain the following as appropriate:

a) reference to this European Standard;

b) type and designation of the magnetic steel sheet tested;

c) one or more of the following, depending on the requirements of the product standard:

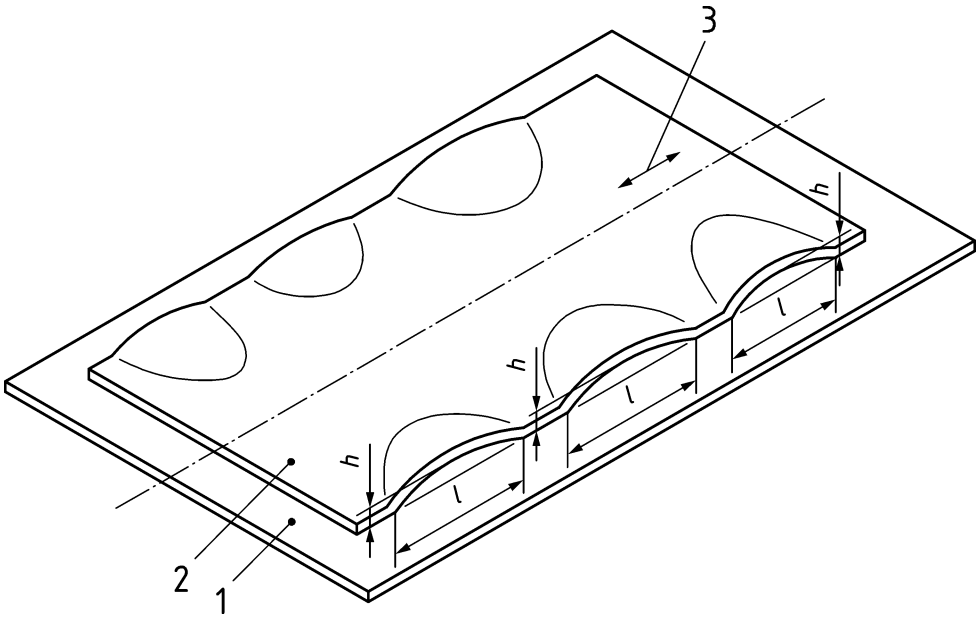
   1) length (l) of wave in millimetres, to the nearest 10 mm, height (h) of wave in millimetres, to the nearest 1 mm and wave factor (w) in percent, to the nearest 0,1 %;

2) deviation (a) in millimetres characterizing the residual curvature, to the nearest 1 mm;

3) variation (c) from the shearing line in millimetres, to the nearest 0,1 mm;

4) distance (e) in millimetres characterizing the edge camber, to the nearest 0,1 mm;

5) arithmetic mean value and maximum value of burr height.



Key

1 surface table
2 sheet
3 rolling direction
h height of wave (mm)
l length of wave (mm)

Figure 1 — Example of wave

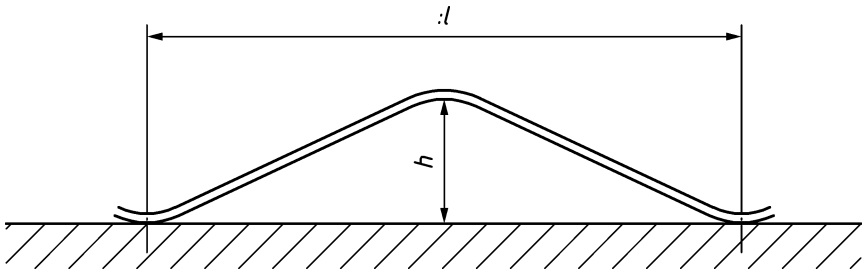


Figure 2 — Wave factor

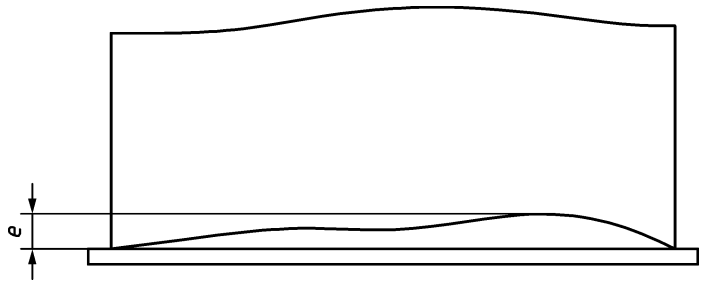
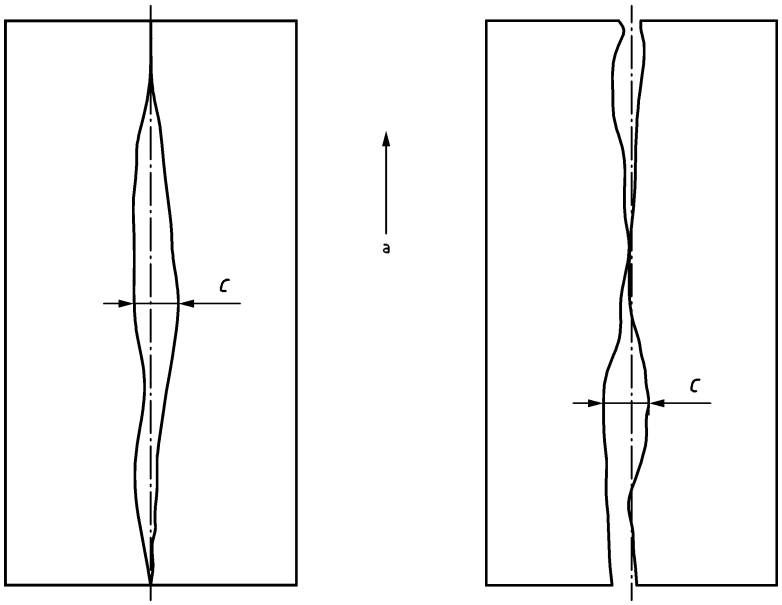


Figure 3 — Verification of the edge camber



a) convex gap b) concave gap

Key

a rolling direction

Figure 4 — Deviation from the shearing line due to internal stresses

Dimensions in millimetres

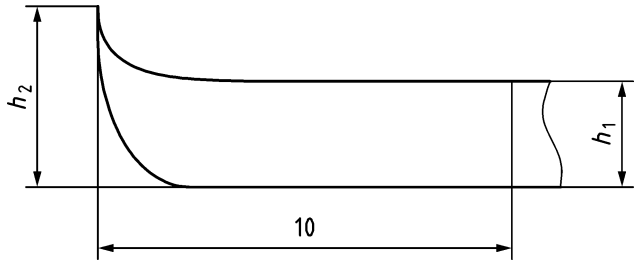
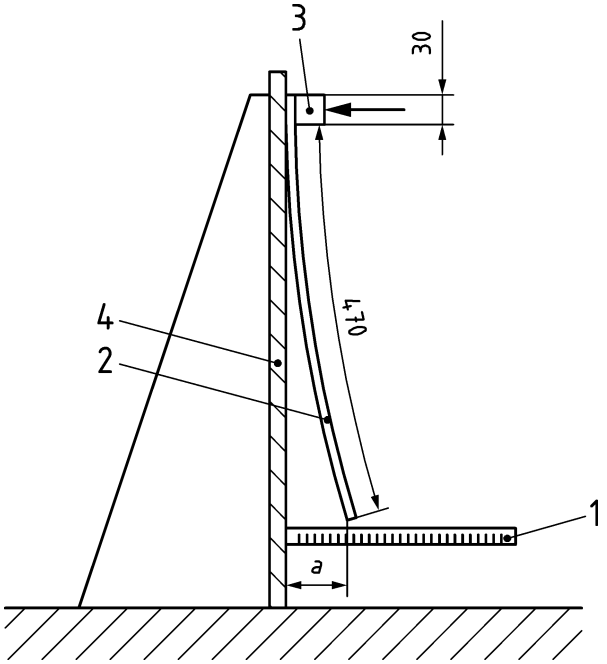


Figure 5 — Burr height (h)

Explanation to Figure 5: $h = h_2 - h_1$

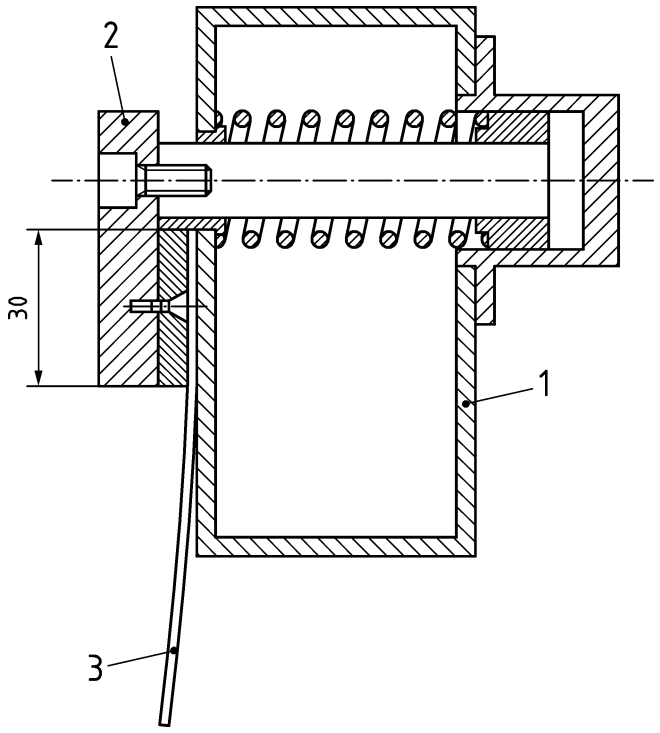
Dimensions in millimetres



Key

1 graduated rule
2 test specimen
3 clamping device
4 supporting plate

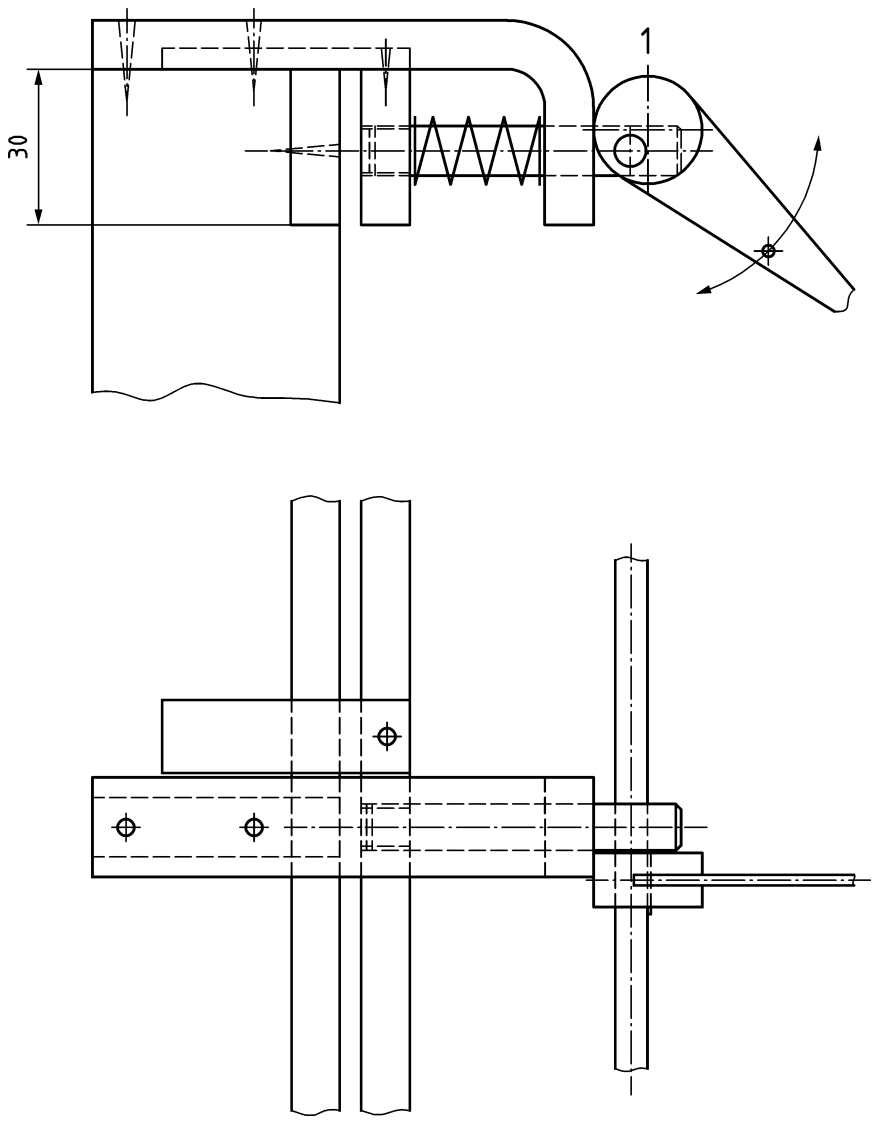
Figure 6 — Measuring device



Key

1 fixed support
2 clamping device
3 test specimen

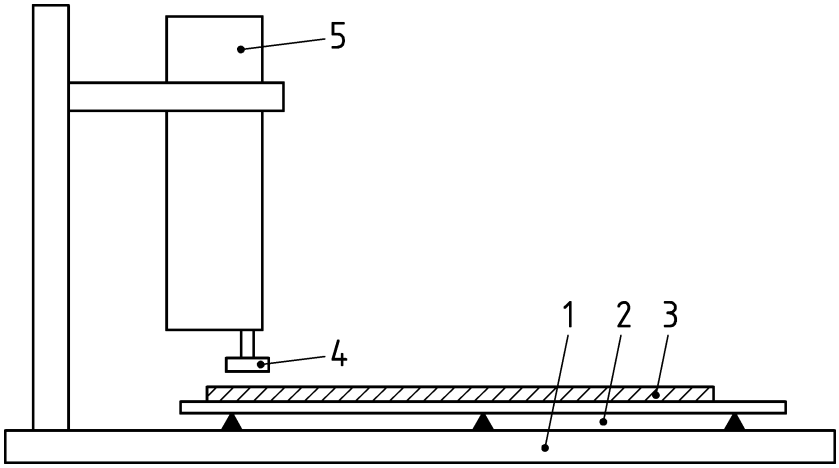
Figure 7 — Example of clamping system (Type A)



Key

1 eccentric

Figure 8 — Example of clamping system (Type B)

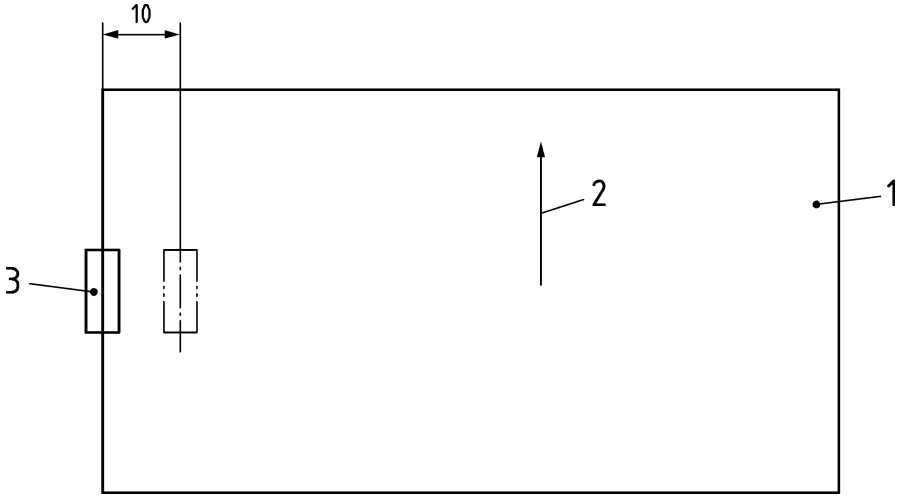


Key

1 supporting base
2 test specimen supporting table
3 test specimen
4 moving anvil
5 linear measuring device

Figure 9 — System for measuring burr height

Dimensions in millimetres



Key

1 test specimen
2 movement direction of the test specimen
3 anvil

Figure 10 — Position of the moving anvil

Bibliography

IEC 60404-1:2000, *Magnetic materials — Part 1: Classification*

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