UDC 669.146.99-41-122.2 : 669.268.7 : 620.1

January 1992

Cold reduced blackplate in coil form for the production of tinplate or electrolytic chromium/chromium oxide coated steel

English version of DIN EN 10 205

DIN EN 10 205

Kaltgewalztes Feinstblech in Rollen zur Herstellung von Weißblech oder von elektrolytisch spezialverchromtem Stahl

This standard, together with DIN EN 10 203, supersedes DIN 1616, October 1984 edition.

European Standard EN 10 205 : 1991 has the status of a DIN Standard.

A comma is used as the decimal marker.

National foreword

This standard has been prepared by ECISS/TC 26.

The responsible German body involved in the preparation of this standard was the *Normenausschuß Eisen und Stahl* (Steel and Iron Standards Committee), Technical Committee 02 *Verpackungsblech*.

This standard supersedes DIN 1616 except for the specifications for tinplate which are now covered in a separate standard (DIN EN 10 203). It specifies technical delivery conditions for blackplate in coil form from which tinplate and electrolytic chromium/chromium oxide coated steel is manufactured and also covers double reduced blackplate sheet.

When ordering blackplate, material numbers as shown in the table below may be used instead of the designations given in tables 2 and 3.

Steel grades	
Material designation (cf. tables 2 and 3)	Material number
T 50	1.0371
T 52	1.0372
T 57	1.0375
T 61	1.0377
T 65	1.0378
DR 550	1.0373
DR 620	1.0374
DR 660	1.0376

The DIN Standards corresponding to the European Standards referred to in clause 2 of the EN are as follows:

European Standard	DIN Standard
prEN 10 109	DIN EN 10 109 (at present at the stage of draft)
EN 10 002-1	DIN EN 10 002 Part 1
EN 10 202	DIN EN 10 202
EN 10 203	DIN EN 10 203

Continued overleaf.
EN comprises 8 pages.

Standards referred to

(and not included in **Normative references**)

DIN EN 10 002 Part 1	Tensile testing of metallic materials; method of test at ambient temperature
DIN EN 10 109 Part 1	(at present at the stage of draft) Metallic materials; hardness testing; Rockwell scales N and T (scales 15 N, 30 N, 45 N, 15 T, 30 T and 45 T)
DIN EN 10 202	Cold reduced electrolytic chromium/chromium oxide coated steel
DIN EN 10 203	Cold reduced electrolytic tinplate

Previous editions

DIN 1540: 04.70; DIN 1616: 05.67, 03.81, 10.84.

Amendments

In comparison with DIN 1616, October 1984 edition, the following amendments have been made.

a) The scope of the standard has been limited to cover blackplate in coil form.

b) Grade T 70 blackplate is no longer specified; double reduced blackplate has been introduced.

c) The presentation of the text has been brought into line with that of DIN EN 10 203.

International Patent Classification

C 22 C 38/00
C 25 D 7/06
G 01 N 3/44

Editor's note

This standard reproduces the official text of the English version of EN 10 205 as issued by CEN. In its preparation for publication as DIN EN 10 205 (English version), certain points have been noted which we consider to be in need of correction. These have been marked +). The suggested amendments are given below and will be forwarded to the responsible CEN Secretariat for its consideration.

In presentation, orthography, punctuation and hyphenation, the aim has been to implement the PNE Rules consistently. Obvious errors (e.g. redundancies and omissions) have been rectified without further reference.

Suggested amendments

1 *For ease of comprehension, in the heading of table 1, reference has been made to Rockwell hardness HR 30 Tm and the thickness, which also makes the text more consistent with the German version.*

2 *To avoid confusion, in the headings of columns 3, 5 and 7 of table 1 and in the heading of column 5 of table 2, 'limit deviations' (which is the common technical term) has been substituted for 'range of sample average'.*

3 *In the footnote to table 2, 'under surface' should preferably read 'underside' or 'bottom face'.*

4 *To make the sense complete, the heading of subclause 12.3 must read '0,2 % proof stress' instead of 'Tensile'.*

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10 205

November 1991

UDC 669.146.99-41-122.2 : 669.268.7 : 620.1

Descriptors: Iron and steel products, cold rolled products, blackplate, tinplate, chromium plating, electrodeposited coatings, mechanical properties, dimensional tolerances, form tolerances, sampling, tests.

English version

Cold reduced blackplate in coil form for the production of tinplate or electrolytic chromium/chromium oxide coated steel

Fer noir laminé à froid, en bobine destiné à la fabrication de fer blanc ou de fer chromé électrolytique

Kaltgewalztes Feinstblech in Rollen zur Herstellung von Weißblech oder von elektrolytisch spezialverchromtem Stahl

This European Standard was approved by CEN on 1991-11-30. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Contents

Foreword

This European Standard has been drawn up by ECISS/TC 26 'Tinplate and blackplate' whose Secretariat is held by BSI. It was agreed by ECISS/TC 26 at its meeting in November 1989 where the following countries were represented: Belgium, France, Germany, Italy, Netherlands, Norway, Spain and United Kingdom.

This European Standard was approved by CEN on 1991-10-07.

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

1 Scope

This European Standard specifies requirements for single and double cold reduced blackplate in the form of coils which are intended for manufacturing tinplate or electrolytic chromium/chromium oxide coated steel in accordance with EN 10 203 or EN 10 202.

Single reduced blackplate is specified in nominal thicknesses that are multiples of 0,005 mm from 0,17 mm up to and including 0,49 mm. Double reduced blackplate is specified in nominal thicknesses that are multiples of 0,005 from 0,14 mm up to and including 0,29 mm.

This standard applies to coils in nominal minimum widths of 600 mm either with trimmed or untrimmed edges.

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 undated references, the latest edition of the publication referred to applies.

prEN 10 109	Metallic materials; hardness test. Part 1: Rockwell superficial hardness (scales 15 N, 30 N, 45 N, 15 T, 30 T and 45 T)
EN 10 002-1	Metallic materials; tensile testing. Part 1: Method of test at ambient temperature
EN 10 202	Cold reduced electrolytic chromium/chromium oxide coated steel
EN 10 203	Cold reduced electrolytic tinplate

3 Definitions

For the purposes of this European Standard, the following definitions apply:

3.1 blackplate: Cold reduced low carbon mild steel, normally oiled, for the production of tinplate or electrolytic chromium/chromium oxide coated steel in accordance with EN 10 202 or EN 10 203.

3.2 single cold reduced: A term used to describe blackplate which has been reduced to the desired thickness in a cold reduction mill and subsequently annealed and temper rolled.

3.3 double cold reduced: A term used to describe blackplate which has had a second major reduction after annealing.

3.4 batch (box) annealed (BA): Annealed by the process in which the cold reduced strip is annealed in tight coil form, within a protective atmosphere, for a predetermined time-temperature cycle.

3.5 continuously annealed (CA): Annealed by the process in which cold reduced coils are unwound and annealed in strip form within a protective atmosphere.

3.6 finish: The appearance of the surface of blackplate, resulting from controlled preparation of the work rolls used for final stages of rolling.

3.6.1 shot blast finish: A finish resulting from the use of temper mill work rolls that have been shot-blasted.

3.6.2 smooth finish: A finish resulting from the use of temper mill work rolls that have been ground to a high degree of polish. This finish is used for the production of bright finish tinplate.

3.6.3 stone finish: A finish characterized by a directional pattern, resulting from the use of final mill work rolls that have been ground to a lower degree of polish than those used for the smooth finish.

3.7 coil: A rolled flat strip product which is wound into regularly superimposed laps so as to form a coil with almost flat sides.

3.8 bow

3.8.1 longitudinal (line) bow: Residual curvature in the strip remaining along the direction of rolling.

3.8.2 transverse (cross) bow: A mode of curvature in the strip such that the distance between its edges parallel to the rolling direction is less than the strip width.

3.9 centre buckle (full centre): An intermittent vertical displacement or wave in the strip occurring other than at the edges.

3.10 edge wave: An intermittent vertical displacement occurring at the strip edge when the strip is laid on a flat surface. This parameter is only applicable to material supplied with trimmed edges.

3.11 feather edge (transverse thickness profile): The variation in thickness, characterized by a reduction of thickness close to the edges, at right angles to the rolling direction. This parameter is only applicable to material supplied with trimmed edges.

3.12 burr: Metal displaced beyond the plane of the surface of the strip by shearing action.

3.13 rolling width: The width of the strip perpendicular to the rolling direction.

3.14 consignment: A quantity of material of the same specification made available for dispatch at the same time.

3.15 pallet: Base platform on which a coil is placed to facilitate ready transportation.

3.16 anvil effect: The effect which a hard anvil can produce on the numerical hardness value obtained when a hardness test is performed on very thin material supported on such an anvil.

4 Information to be supplied by the purchaser

4.1 General

The following information shall be as given on ordering to assist the manufacturer in supplying the correct material:

a) the designation as given in clause 5;

b) the quantity, expressed in terms of mass;

c) for single reduced blackplate, the finish required; see 6.2.1;

d) the orientation of the coils at delivery, i.e. with the cores vertical or horizontal; see clause 14;

e) whether the coil shall be supplied with the edges trimmed or not.

NOTE: Appropriate classifications are suitable for shaping operations such as stamping, drawing, folding, beading and bending, and assembly work such as joint forming and welding. The end use should be borne in mind when the classification is selected.

4.2 Options

In the event that the purchaser does not indicate his wish to implement any of the options included in this standard and does not specify his requirements at the time of ordering, the product shall be supplied on the following basis:

a) for double reduced blackplate, with a stone surface finish (see 6.2.2);

b) the location of each joint shall be indicated by a piece of non-rigid material and punched holes (see 10.3);

c) coated with a suitable oil (see 6.3);

d) with an internal diameter of 420 (+10/−15) (see clause 14).

4.3 Additional information

When ordering, the user shall supply all the necessary information concerning:

a) his production facilities which he anticipates will be appropriate to the ordered blackplate;

b) the intended end use.

5 Designation

5.1 Single reduced blackplate

For the purposes of this standard, single reduced blackplate is designated in terms of a temper classification based on the Rockwell HR 30 Tm hardness values as given in table 1.

Single reduced material covered by this standard shall be designated by the following characteristics, in the order given :

a) a description of the material (i.e. blackplate coil);

b) the number of this European Standard (EN 10 205);

c) the temper designation in accordance with table 1;

d) the type of annealing if required by the user (see 8.1);

e) the type of finish (see 3.6);

f) the dimensions of the thickness and width, in mm;

g) whether mill edge or trimmed.

EXAMPLE:

Blackplate EN 10 205 –
T61 – CA – stone 0,20 × 800, trimmed

5.2 Double reduced blackplate

For the purposes of this standard, double reduced blackplate is designated in terms of a system of mechanical property classifications based on the 0,2 % proof stress as given in table 2.

Double reduced material covered by this standard shall be designated by the following characteristics, in the order given:

a) a description of the material (i.e. blackplate coil);

b) the number of this European Standard (EN 10 205);

c) the mechanical property designation (see table 2);

d) the type of annealing, if required by the user (see 8.1);

e) the dimensions of the thickness and width, in mm;

f) whether mill edge or trimmed.

EXAMPLE:

Blackplate EN 10 205 –
DR 620 – CA – 0,18 × 750, mill edge

6 Manufacturing features

6.1 Manufacture

The methods of manufacture of blackplate are the province of the manufacturer and are not specified in this standard.

The purchaser shall be informed if any alteration is made to the method of manufacture that will affect the coating operation and the properties of the blackplate.

NOTE: It is recommended that the manufacturer supply to the purchaser such details of the manufacturing process as may assist the purchaser in his efficient use of the blackplate.

6.2 Finish

6.2.1 Single reduced blackplate

Single cold reduced blackplate can be supplied with either a smooth, stone or shot blast finish, and the finish required shall be specified at the time of the ordering (see 4.1 c)).

6.2.2 Double reduced blackplate

Double cold reduced blackplate is usually supplied with a stone surface finish (see 3.6.3).

6.3 Oiling

To avoid corrosion, blackplate shall be normally supplied with a sufficient layer of a suitable non-mineral, protective oil. The oil shall be removed by an adequate in-line cleaning process before any subsequent coating.

If blackplate is required without an oil coating, this shall be indicated at the time of ordering (see 4.2 c)).

NOTE: If unoiled blackplate is supplied, there is an increased risk of surface corrosion.

6.4 Defects

The producer is expected to employ his normal quality control and line inspection procedures to ensure that the blackplate manufactured is in accordance with the requirements of this standard.

However, the production of blackplate coils in continuous strip mill operations does not afford the opportunity for removal of all blackplate that does not comply with the requirements of this standard. If, when processing blackplate coil, the user (or his agent) encounters recurring defects which are incompatible with the end use (see 4.3 b)), it is essential – where practicable – that he stops processing the coil and advises the supplier.

The user is expected to have adequate handling and roller levelling equipment and to take reasonable care during these operations.

7 Specific requirements

Blackplate shall comply with the appropriate requirements of clauses 8 to 10.

When tests are carried out to verify compliance with the requirements of clauses 8 and 9, samples shall be selected from consignments in accordance with clause 11.

Coils shall be dispatched as described in clause 14.

8 Mechanical properties

8.1 General

For the purposes of this standard, single reduced blackplate is classified into temper grades based on Rockwell HR 30Tm hardness values and double reduced blackplate classification is based on the 0,2 % proof stress properties and Rockwell HR 30 Tm hardness values.

Other mechanical properties will significantly influence the performance of blackplate in processing, and the subsequent intended end use will vary depending on the steel type and the methods of casting, annealing and temper rolling employed.

NOTE: By agreement, the type of annealing for blackplate, i.e. BA or CA (see 3.4 or 3.5) may be specified when ordering.

8.2 Single reduced blackplate

The hardness value for single reduced blackplate shall be as given in table 1 when tested as described in 12.2.

8.3 Double reduced blackplate

When tested as described in 12.2 and 12.3, the mechanical properties shall be as given in table 2.

NOTE: For routine testing, the 0,2 % proof stress may be determined using the springback test as described in annex A. However, in cases of dispute, the method given in 12.3 is used.

Table 1: Rockwell hardness values for single reduced blackplate +)

Temper designation	Rockwell hardness HR 30 Tm for blackplate of thickness					
	$x \leq 0{,}21$ mm		$0{,}21 < x \leq 0{,}28$ mm		$x > 0{,}28$ mm	
	Nominal value	Limit deviations	Nominal value	Limit deviations	Nominal value	Limit deviations
T 50	53 max.		52 max.		51 max.	
T 52	53	±4	52	±4	51	±4
T 57	58	±4	57	±4	56	±4
T 61	62	±4	61	±4	60	±4
T 65	65	±4	65	±4	64	±4

Table 2: Mechanical properties of double reduced blackplate +)

Mechanical property	Average 0,2 % proof stress N/mm²		Average Rockwell hardness HR 30 Tm [1])	
	Nominal value	Permitted range	Nominal value	Limit deviations
DR 550	550	480 to 620	73	±3
DR 620	620	550 to 690	76	±3
DR 660	660	590 to 730	77	±3

[1]) It is important to distinguish HR 30 Tm from HR 30 T, the former denoting that depressions on the under surface +) of the test piece are permitted (cf. EURONORM 109).

9 Tolerances on dimensions and shape

9.1 General

Tolerances on dimensions (i.e. thickness and linear dimensions) and shape (i.e. edge camber, lateral weave) are specified in 9.2 to 9.5 together with appropriate methods of measurement.

9.2 Coil width

The width of the coil shall be measured across each sample sheet, selected in accordance with clause 11, to the nearest 0,5 mm. The width shall be measured across the centre of the sample sheet, at right angles to the rolling direction, with the sample sheet lying on a flat surface. The measured width shall be not less than the ordered width and shall not exceed the ordered width by more than 3 mm for trimmed coil.

9.3 Coil thickness

9.3.1 General

The transverse thickness profile shall be measured using the micrometer method described in 12.1.2. All other thicknesses shall be determined by the weighing method (see 12.1.1) or by direct measurement using the micrometer method (see 12.1.2). However, in cases of dispute and for all retests, except for transverse thickness profile, the weighing method shall be used.

9.3.2 Thickness of a coil

The thickness of sample sheets shall not deviate from the nominal thickness of the coil by more than ±8,5 %.

9.3.3 Average thickness of a consignment

The average thickness of a consignment, determined by the weighing method described in 12.1.1, on the sample sheets selected in accordance with 11.1, shall not deviate from the ordered nominal thicknes by more than:

a) ±2,5 % for consignments comprising more than 15 000 m, or

b) ±4 % for consignments comprising 15 000 m or less.

9.3.4 Thickness variation across the width

The thickness of either of the two individual test pieces, determined in accordance with 12.1.1, shall not deviate from the actual average thickness of the whole sample sheet by more than 4 %.

NOTE: This is only applicable to blackplate supplied as trimmed.

9.3.5 Feather edge (transverse thickness profile)

The minimum thickness, when measured by the micrometer method (see 12.1.2), shall not differ from the actual centre thickness of the sample sheet by more than 8 %.

NOTE: This is only applicable to blackplate supplied as trimmed.

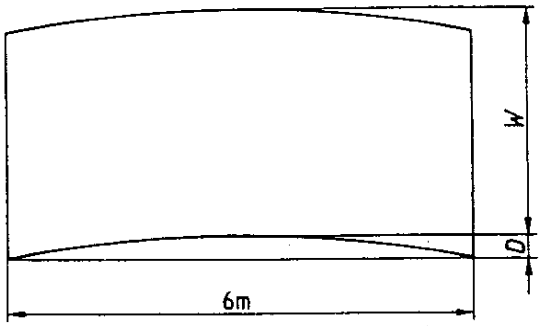
9.4 Edge camber of trimmed coils

Edge camber is the maximum deviation (in the plane of the sheet) of an edge from a straight line forming a chord to its extremities (see figure 1).

The edge camber expressed as a percentage is given by the following:

$$\text{edge camber (\%)} = \frac{\text{deviation } (D)}{\text{length of cord (6 m)}} \times 100$$

The edge camber, measured over a distance (chord length) of 6 m, shall not exceed 0,1 % (i.e. 6 mm).



W = rolling width

D = deviation from a straight line

Figure 1: Edge camber of coils

9.5 Lateral weave (short pitch camber) of coils

Lateral weave is the deviation of a mill-trimmed edge from a straight line lying in the same plane and forming a chord to it over a relatively short distance.

The lateral weave, measured over a chord length of 1 m, shall not exceed 1,0 mm when measured prior to shearing.

NOTE: If the coil is used for scroll shearing, the permissible values shall be agreed upon between the manufacturer and the purchaser.

10 Joints within a coil

10.1 General

The producer shall ensure continuity of the coils within the limits of the mass ordered, if necessary by means of electrically welded joints made after cold reduction. Requirements relating to the numbers, locations and dimensions of the joints permitted within a coil are given in 10.2 to 10.4.

10.2 Number of joints

The number of joints in a coil shall not exceed three in lengths of 10 000 m.

10.3 Location of joints

The location of each joint in a coil shall be indicated clearly.

NOTE: The location of each joint may be indicated, e.g. by the insertion of a piece of non-rigid material

and punched holes. However, alternative methods may be agreed between the producer and the purchaser at the time of ordering.

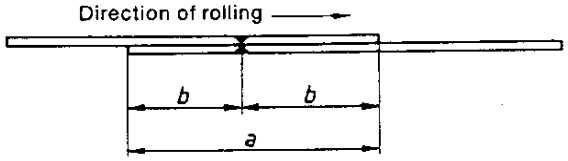
10.4 Dimensions of joints

10.4.1 Thickness

The total thickness of any joint shall not exceed three times the nominal thickness of the material.

10.4.2 Overlap

In any lap joint, the total length of overlap shall not exceed 10 mm. The free overlap shall not exceed 5 mm (see figure 2).



a = total length of overlap

b = free overlap

Figure 2: Joint overlap

11 Sampling

11.1 General

When tests are carried out to assess compliance with the requirements for surface appearance (see 6.2) tolerances on dimensions and shape (see clause 9) and mechanical properties (see clause 8), sample sheets of the blackplate coil shall be selected in accordance with 11.2. Before any tests are carried out, the oil shall be removed.

11.2 Selection of sample sheets

Samples shall be taken from each coil, at a distance not less than 5 m from the coil end:

a) for verification of mechanical properties, two sets of sample sheets;

b) for verification of the dimensions, shape and surface, five sets of sample sheets .

12 Test methods

12.1 Thickness

12.1.1 Weighing method for determination of thickness

12.1.1.1 Determine the thickness of each sample sheet as follows:

a) weigh the sheet to give the mass to the nearest 2 g;

b) measure the length and width of the sheet to the nearest 0,5 mm and calculate the area;

c) calculate the thickness of the sheet, to the nearest 0,001 mm, using the following formula:

$$\text{Thickness (mm)} = \frac{\text{mass (g)}}{\text{area (mm}^2\text{)} \times 0{,}007\,85\ \text{(g/mm}^3\text{)}}$$

12.1.1.2 To determine the average thickness for a consignment, calculate the arithmetic mean of the calculated thickness of all the sample sheets representing the consignment.

12.1.1.3 To determine the variation of thickness within each sample sheet, take two test pieces Y (see figure 3) from the sheet. Weigh each test piece to the nearest 0,01 g, measure the length and width of each test piece to the nearest 0,1 mm, and calculate the thickness of each test piece to the nearest 0,001 mm using the formula given in 12.1.1.1 c).

12.1.2 Micrometer method for measurement of the thickness of trimmed coil

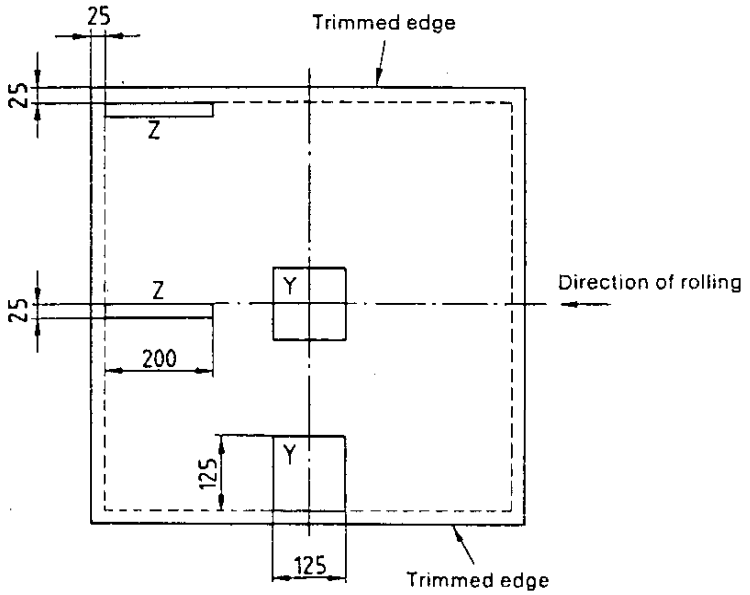
Measure the thickness using a hand-operated, spring loaded micrometer to an accuracy of 0,001 mm

a) for transverse thickness profile, 6 mm from the trimmed edge;

b) for all other thicknesses, at least 10 mm from the trimmed edge.

NOTE: It is recommended that the micrometer should have a ball-ended shank anvil and a curved surface base anvil.

Dimensions in mm



Y = test pieces for hardness and determination of local thickness variation within a sheet

Z = test pieces for tensile or springback tests

Figure 3: Location of test pieces

12.2 Hardness

12.2.1 Test pieces

From each of the sample sheets obtained in accordance with clause 11, take two test pieces, 125 mm × 125 mm, from the positions marked Y in figure 3.

NOTE: The test pieces (Y) taken for determination of the thickness variations within the individual sample sheets may be used also for the hardness determinations, where appropriate.

Before carrying out the hardness tests in accordance with 12.2.2, artificially age the specimens at 200 °C for 20 minutes.

Polish shot blast finish plate with 600 grade emery paper.

12.2.2 Test method

Determine the Rockwell HR 30 Tm indentation hardness either:

a) directly, in accordance with EU 109, or

b) indirectly, on relatively thin sheets (e.g. 0,22 mm and thinner), by determining the HR 15 T hardness in accordance with EU 109 and then converting the HR 15 T values to HR 30 Tm values using table 3.

Make three hardness measurements on each of the test pieces taken in accordance with 12.2.1.

Calculate the representative hardness for the consignment as the arithmetic mean of all the hardness results on all the sample sheets taken from the consignment.

To measure the indentation hardness, use a Rockwell superficial hardness testing machine employing 30 Tm or 15 T scales (see EU 109), as appropriate.

Carry out the tests on test pieces from which all organic coatings have been removed. Avoid testing near the edges of the test pieces because of a possible cantilever effect.

12.3 Tensile +)

12.3.1 Test pieces

For each sheet selected in accordance with clause 11, cut two rectangular test pieces, approximately 200 mm × 25 mm wide, with the rolling direction parallel to the length of the test piece, at positions marked Z in figure 3. Ensure that the edge test pieces clear the edges of the sheet by a minimum of 25 mm.

12.3.2 Test method

Determine the 0,2 % proof stress as described in EN 10 002-1 using the conditions for thin products and test piece type 1, i.e. with a width of (12,5 ± 1) mm and an original gauge length, L_o, of 50 mm.

Carry out one test on each of the test pieces selected in accordance with 12.3.1, i.e. two tests per sample sheet selected.

Calculate the representative 0,2 % proof stress for the consignment as the arithmetic mean of all the proof stress results on all the sample sheets taken from the consignment.

13 Retests

If any of the results obtained are unsatisfactory, the measurements for that particular property shall be repeated twice on new sample sheets taken at a distance not less than

Table 3: Rockwell HR 15 T values and their HR 30 Tm equivalents

HR 15 T value	Equivalent HR 30 Tm value
92,0	80,5
91,5	79,0
91,0	78,0
90,5	77,5
90,0	76,0
89,5	75,5
89,0	74,5
88,5	74,0
88,0	73,0
87,5	72,0
87,0	71,0
86,5	70,0
86,0	69,0
85,5	68,0
85,0	67,0
84,5	66,0
84,0	65,0

HR 15 T value	Equivalent HR 30 Tm value
83,5	63,5
83,0	62,5
82,5	61,5
82,0	60,5
81,5	59,5
81,0	58,5
80,5	57,0
80,0	56,0
79,5	55,0
79,0	54,0
78,5	53,0
78,0	51,5
77,5	51,0
77,0	49,5
76,5	49,0
76,0	47,5

15 m from the coil end. If the results on both repeated tests meet the stated requirements, the consignment represented shall be deemed to comply with this standard, but if the results of either of the retests fail to meet the stated requirements, the consignment represented shall be deemed not to comply with this standard.

14 Dispatch and packaging

Coils shall be dispatched with their cores either in a vertical or horizontal position (see 4.1d)). The orientation shall be specified at the time of ordering. If possible, the internal diameters of the coils shall be within the range 420 (+1,0/−15) mm.

NOTE 1: Blackplate strip is usually supplied in consignments of coils with outside diameters of at least 1200 mm, but a limited number of coils with smaller outside diameters may be included in the consignment.

NOTE 2: If coils with a different internal diameter are required, this should be indicated at the time of ordering (see 4.2 d)).

Annex A

(normative)

The springback test for routine determination of 0,2% proof stress for double reduced material

NOTE: This is not the reference method. In all cases of dispute, the method described in 12.3 shall be used.

A.1 Principle

The springback test provides a simple and rapid means of estimating the tensile yield strength of double reduced products from measurements of thickness and angle of springback of a rectangular strip test piece after forming 180° around a cylindrical mandrel and then releasing.

A.2 Test pieces

The test pieces used are identical to those for the tensile test described in 12.3.1.

A.3 Test method

Make one test on each of the test pieces obtained in accordance with A.2 (i.e. two tests per sheet selected). Carry out the test using the Springback Temper Tester, model G.67.

In making the test, strictly observe the operational instructions provided with the Springback Temper Tester. The principal steps in the test are:

a) measure the thickness of the blackplate test pieces, to the nearest 0,001 mm;

b) insert the test piece into the tester and fix it firmly in the testing position by gently tightening the clamping screw using light finger pressure;

c) bend the test piece through 180° angle against the mandrel by a gentle swing of the forming arm;

d) return the forming arm to its 'start' position and read and record the springback angle directly over the test piece;

e) remove the test piece from the tester and, using the recorded thickness of the test piece and the springback angle, determine the appropriate springback index value from a suitable conversion formula (e.g. Bower) agreed between producer and purchaser.

NOTE: Calibrate each new Springback Temper Tester using the standard tensile test (see 12.3) or another 'reference' Springback Temper Tester. In addition, since malfunctions arising, for example, from excessive wear or inadvertent abuse of the test, may not be readily apparent, it is recommended that the springback temper test readings should be regularly compared with readings of the standard tensile test or a 'reference' Springback Temper Tester. It is also recommended that such direct cross-checks should be further supplemented by a frequent use of reference blackplate samples of known proof stress.