

Steel flat products
Cold rolled sheet and strip
Technical delivery conditions
Mild unalloyed steels for cold forming**DIN**
1623
Part 1Flacherzeugnisse aus Stahl; kaltgewalztes Band und Blech;
technische Lieferbedingungen; weiche unlegierte Stähle zum KaltumformenSupersedes
November 1972 edition*As it is current practice in standards published by the International Organization for Standardization (ISO), the comma has been used throughout as a decimal marker.*

For connection with International Standard ISO 3574 – 1976 published by the International Organization for Standardization (ISO) and EURONORM 130 – 77 published by the European Coal and Steel Community, see Explanatory notes.

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1 Field of application

1.1 This standard applies to cold rolled mild unalloyed steel flat products (sheet and strip), without coating, in thicknesses up to and including 3 mm as specified in table 1. These steel products are suitable for cold forming and decorative electroplating but not for case hardening and quench hardening or quenching and tempering. Subject to agreement, this standard may also be applied to cold rolled flat products made of these steels in thicknesses over 3 mm up to approx. 4 mm.

1.2 In addition to the details specified in this standard, the general technical delivery conditions for steel and steel products given in DIN 17 010 shall apply unless anything to the contrary has been specified in the following.

1.3 This standard does *not* apply to

- cold rolled sheet and strip made of steel for general engineering purposes (see DIN 1623 Part 2, revised edition being prepared),
- cold rolled mild unalloyed steel sheet and strip for enamelling (see DIN 1623 Part 3),
- cold rolled mild unalloyed steel sheet and strip in rolling widths up to 650 mm (see DIN 1624),
- cold rolled sheet and strip with minimum yield strength, for cold forming (see *Stahl-Eisen-Werkstoffblatt* (Iron-steel material sheet) 093-75),
- blackplate (see DIN 1616),
- magnetic steel sheet and strip (see DIN 46 400 Part 1 to Part 3).

Continued on pages 2 to 8

2 Concepts

2.1 Flat products have an almost rectangular cross section with a width much greater than the thickness.

2.2 Strip is a flat product which immediately after the final rolling pass or after having passed the continuous pickling furnace or furnace installations connected to the roll, is wound to form a coil. In the rolled condition, strip has slightly curved edges but can also be supplied with cut edges or made by slitting a wider strip.

2.3 Sheet is a flat product of unspecified edge form which is supplied in panels usually for quadrangular (square or rectangular) shape, but also of any other shape (e.g. of round shape or as specified in a drawing). Its edges are rough (e.g. slightly curved) or mechanically cut.

2.4 Flat products that have undergone a reduction in cross section of at least 25 % by cold rolling without pre-heating are regarded as cold rolled.

3 Dimensions and permissible dimensional deviations

As regards the dimensions and permissible dimensional deviations DIN 1541 shall apply.

4 Weight

The weight of the steels specified in this standard shall be calculated on the basis of a density of 7,85 kg/dm³.

5 Classification of grades

5.1 This standard covers the steel grades listed in table 1.

5.2 The selection of the steel grade is left to the discretion of the purchaser. It is recommended consulting the supplier, if necessary, which steel grade and which surface finish are suitable for the intended purpose and application.

6 Designation

6.1 The complete designation of a flat product grade in accordance with this standard shall include the following:

- symbol or material number signifying the steel grade (see column 1 and column 2 of table 1),
- symbol signifying the surface appearance (see column 3 of table 2) and
- code letter signifying the surface finish (see column 3 of table 2).

6.2 Where necessary, it shall be clearly indicated whether the product is to comply with additional requirements with regard to suitability for surface coating (see subclause 7.9) or delivery in the not cold rerolled condition (see subclause 7.8.2) or with uncoiled surface (see subclause 9.2.2). If the products are to be suitable for the production of a particular workpiece (see subclause 7.4.2), this shall be specified when ordering.

Examples:

Grade St 12 steel (material number 1.0330) with normal cold rolled surface (O3) and "rough" (r) surface finish:

St 12 O3 r or 1.0330 O3 r

Rimmed (U) grade St 13 steel (material number 1.0333) with best surface (O5) and "smooth" (g) surface finish:

USt 13 O5 g or 1.0333 O5 g

6.3 If the designation does not contain any information relating to the characteristics given in subclauses 6.1 and 6.2, the products covered by this standard shall be supplied as follows:

- O3 surface appearance,
- "matt" surface finish,
- skin passed,
- oiled.

6.4 The order shall specify the quantity of product, the form of product (sheet or strip), the applicable dimensional standard, the symbol or material number of the flat product grade and the dimensions required.

Example:

20 tonnes of grade USt 13 O5 g sheet (material number 1.0333 O5 g) of 0,80 mm in thickness, 1000 mm in width, with cut edges (GK), 3000 mm in length, permissible dimensional deviation (standard deviation) as in DIN 1541:

20 t sheet DIN 1541 — USt 13 O5 g —
0,80 X 1000 GK X 3000

or 20 t sheet DIN 1541 — 1.0333 O5 g —
0,80 X 1000 GK X 3000

7 Requirements

7.1 Steelmaking process

The steelmaking process is left to the discretion of the manufacturer; on request the purchaser will be notified of the type of process used.

7.2 Type of deoxidation

7.2.1 The type of deoxidation of grade St 12 steel is left to the discretion of the manufacturer.

7.2.2 Grade St 13 steel may be supplied in the rimmed (U) or specially killed (RR) condition. The type of deoxidation required shall be stated in the designation.

7.2.3 Grade St 14 steel shall be supplied in the specially killed (RR) condition

7.3 Chemical composition

The values applicable for the cast analysis are given in table 1.

7.4 Choice of properties

Depending on the agreement reached at the time of ordering, all steel grades supplied which are covered by this standard shall

7.4.1 either comply with the requirements specified in table 1,

7.4.2 or be suitable for the production of a particular workpiece. In this case the rejection rate arising during processing and attributable to the material shall not exceed a specific proportion which is to be agreed. A period of 6 months for grades St 14 and RR St 13, and of 6 weeks for grades USt 13 and St 12, after the products have been made available as agreed, shall apply in this respect.

7.5 Mechanical and technological properties

7.5.1 For products ordered according to subclause 7.4.1, the tensile strength, yield strength, elongation after fracture and hardness values as specified in table 1 and the minimum cupping test values as shown in figure 1 shall apply for a period of

- 6 months for grades St 14 and RR St 13,
- 8 days for grades USt 13 and St 12,

after the products have been made available as agreed on ordering.

7.5.2 The tensile strength values apply to transverse specimens. The yield strength values apply to the 0,2 % proof stress ($R_{p0,2}$) if the yield strength is not clearly distinctive, otherwise the values apply to lower yield strength (R_{eL}).

7.5.3 The maximum hardness values given in table 1 are mean values from three tests. The maximum individual value obtained in these tests shall not exceed the value given in the table by more than two points.

7.5.4 The minimum cupping test values as shown in figure 1 are mean values from three tests. No individual value of these tests shall exceed the given minimum mean values by more than 0,3 mm.

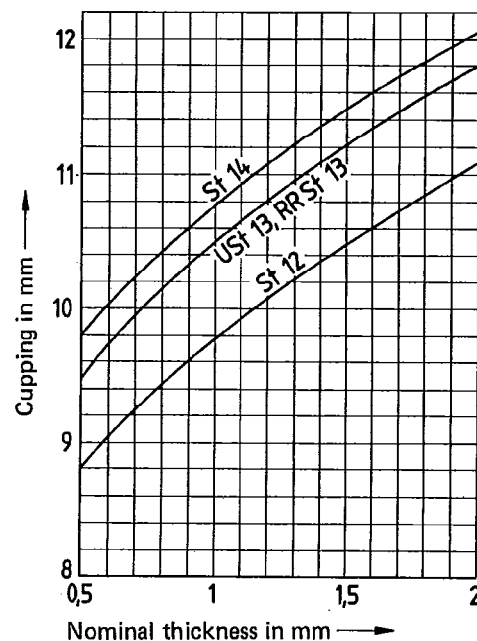


Figure 1. Minimum cupping test values (see also subclause 7.5.4)

7.6 Weldability

The steels specified are suitable for the usual welding processes.

7.7 Surface condition

7.7.1 Surface appearance

7.7.1.1 Surface appearances O3 and O5 as specified in table 3 are suitable for all steel grades covered by this standard. The surface appearance required shall be given in the designation (see clause 6).

Table 1. Classification of steel grades for cold rolled flat products and properties in the condition on delivery at room temperature between 15 and 35 °C in accordance with DIN 50 014

Steel grade	Type of deoxidation ¹⁾	Chemical composition ²⁾ in %			Tensile strength N/mm ²	Yield strength ($R_{p0,2}$ or R_{eL}) ³⁾ max. ⁴⁾	Elongation after fracture $L_0 = 80$ mm % min. ⁵⁾	Hardness ⁶⁾			Cupping ⁷⁾ mm min.
Symbol	Material number	C	I	N max.				HRBm	HRFm	HR 30 Tm max.	
St 12	1.0330	Optional	0,10	0,007 ⁸⁾	270 to 410	280	28	65	94	60	See figure 1.
USt 13	1.0333	U	0,10	0,007 ⁸⁾	270 to 370	250	32	57	90	55	
RR St 13	1.0347	RR	0,10	⁹⁾	270 to 370	240	34	55	88	53	
St 14	1.0338	RR	0,08	⁹⁾	270 to 350	210 ¹⁰⁾	38	50	86	50	

1) See subclause 7.2.

2) Applies to the cast analysis. Other elements — except for manganese and aluminium — shall not be added to the melt without the approval of the purchaser.

3) See subclause 7.5.2.

4) For thicknesses equal to or less than 0,7 mm, maximum values higher by 20 N/mm² are permitted for the 0,2 % proof stress. The values in the table do not apply to very light skin passed products as described in subclause 7.8.2.

5) For thicknesses equal to or less than 0,7 mm, minimum values lower by 2 units are permitted for the elongation after fracture.

6) See subclauses 7.5.3 and 8.5.5.

7) See subclause 7.5.4.

8) The values apply to the content of free nitrogen.

9) The nitrogen shall be fixed. Therefore, the steel shall contain at least 0,02 % of metallic aluminium. The use of other elements for fixing the nitrogen shall be agreed with the purchaser.

10) For thicknesses equal to or exceeding 1,5 mm, a 0,2 % proof stress not exceeding 225 N/mm² is permitted.

Note. The first part of the symbol signifying the surface appearance is the letter O and not the digit 0 (nought).

7.7.1.2 Flat products with surface appearance O3 shall have this surface on both sides. Flat products ordered with surface appearance O5 may normally have one O3 surface, provided that no characteristic of the O3 surface will have a negative effect on the O5 surface; this applies also to a later processing of the products. If both sides are required to have surface appearance O5, a special note shall be made to this effect on ordering.

7.7.2 Surface finish

7.7.2.1 Flat products ordered with surface appearance O3 may be supplied with a matt or rough finish, products with surface appearance O5 may have a particularly smooth, matt or rough surface with the characteristics described in table 2. The surface finish required shall be given in the designation (see clause 6).

7.7.2.2 If no details are given on ordering, the flat products shall be supplied with a "matt" surface finish.

7.8 Stretcher strain marks

7.8.1 The flat products are generally subjected to a skin pass at the manufacturer's works. Following this procedure, they can be processed within a specified period after they have been made available. For this period freedom from stretcher strain marks is ensured.

Regarding the absence of stretcher strain marks the following periods shall apply:

- 10 weeks for grades St 12 O5 and USt 13 O5, provided that the flat products are stored under normal conditions and are worked prior to processing,

- 6 months for grades RR St 13 and St 14; the products made of these steel grades may be processed by the purchaser without prior working.

7.8.2 If the flat products are ordered in the "not skin passed" condition, they are generally supplied with a very light skin pass. Stretcher strain marks in the condition on delivery and on deep-drawn parts are permitted. Surface appearance O5 is not suitable for this type of product. In addition, no requirements shall be made with regard to a certain type of surface finish nor to maximum values for the yield strength.

7.9 Suitability for surface coating

7.9.1 The processor has to make the appropriate preparations for surface coating.

7.9.2 All flat product grades and surfaces are suitable for varnish coating.

7.9.3 Both surface appearances are suitable for spray painting. The characteristics of spray painted surfaces correspond to those described in table 2.

7.9.4 All flat product grades are suitable for the application of a metallic anticorrosive coating (using zinc or lead, for example) by hot dip galvanizing.

7.9.5 Surface appearances O3 and O5 are suitable for decorative electroplating. The characteristics of decorative electroplated surfaces conform to those described in table 2. It is recommended using surface appearance O5 for parts demanding special surface coating.

7.9.6 If surface coating in accordance with subclauses 7.9.4 and 7.9.5 is required, this shall be stated on the order.

Table 2. Symbols for and characteristics of surface appearance and surface finish (see subclause 7.7)

	Designation	Symbol	Characteristics
Surface appearance ¹⁾	Normal cold rolled surface	O3	Defects not impairing the forming process and surface coating are permitted.
	Best surface	O5	As for O3. However, the better surface shall be practically free from surface defects liable to impair the uniform appearance of a high class paint finish or of an electrolytic coating (see subclause 7.7.1.2).
Surface finish ^{2), 3)}	Especially smooth	b	The surface shall have a uniformly smooth (bright) finish. Guideline value of average peak-to-valley height R_a : not exceeding 0,4 μm
	Smooth	g	The surface shall have a uniformly matt finish. Guideline value of average peak-to-valley height R_a : not exceeding 0,9 μm
	Matt	m	The surface shall have a uniformly matt finish. Guideline value of average peak-to-valley height R_a : between 0,6 and 1,9 μm
	Rough	r	The surface exhibits a larger peak-to-valley height. Guideline value of average peak-to-valley height R_a : greater than 1,6 μm

¹⁾ See subclauses 7.7.1 and 7.8.2.

²⁾ See subclause 7.7.2.

³⁾ Other guideline values or smaller ranges of average peak-to-valley heights may be agreed on ordering.

8 Testing

8.1 Tests to be carried out and documents on materials testing

8.1.1 The purchaser may stipulate, for all steel grades specified in this standard, that one of the documents on materials testing in accordance with DIN 50 049 be furnished.

8.1.2 If it is agreed that a document be furnished which, in accordance with DIN 50 049, requires that tests be carried out on the consignment itself, then the specifications of subclauses 8.2 to 8.6 shall apply.

8.2 Test units

8.2.1 The usual test unit shall be 20 t or parts thereof, for flat products of the same grade and nominal thickness. A coil greater than 20 t in mass shall be regarded as one test unit.

8.2.2 Subject to special agreement at the time of ordering, the test unit may be 10 t or parts thereof, for flat products of the same grade and nominal thickness.

8.3 Number of tests

A series of tests comprising all the tests required for verifying the specified properties shall be carried out for each test unit in accordance with subclause 8.2. However, only two of the three possible properties dealt with in table 1 (tensile strength, hardness, cupping) may be chosen by the purchaser for acceptance purposes.

8.4 Sampling

8.4.1 The specimens shall be taken at 90° to the direction of rolling of the flat products and shall not have any surface treatment on either side. In the case of strip, the specimens shall be taken from the beginning or end of the coil. In the case of sheet, the selection of the specimen for sampling purposes and the position of the specimen on the sheet are left to the discretion of the person authorized for acceptance testing.

8.4.2 A deformation of the specimens during cutting shall be avoided as far as possible. If shears or flame cutters are used, provisions are to be made for an adequate allowance; the additional material is then to be removed by machining.

8.5 Test methods to be applied

8.5.1 The chemical composition shall be determined by the methods described by the Chemists' Committee of the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgy Engineers).

8.5.2 The mechanical and technological tests shall be carried out at room temperature.

8.5.3 The tensile test shall be carried out on a flat specimen DIN 50 114 — 20 X 80 as described in DIN 50 145. The results of the tensile test shall be related to the actual dimensions of the specimen.

8.5.4 The cupping test shall be carried out in accordance with DIN 50 101 Part 1.

8.5.5 The hardness test shall be carried out on the basis of DIN 50 103 Part 1 and Part 2. However, by way of departure from these standards, a visible deformation on the back side of the specimen is permitted. The values determined in this way shall be identified by using symbols HRBm, HRFm and HR 30 Tm so as to differentiate them from the hardness values determined on thicker products (which are not allowed to exhibit a visible deformation on the back side of the specimen).

Note. The Rockwell hardness test methods HRBm and HR 30 Tm — but not HRFm — are described in EURONORM 109.

Hardness HRBm shall be determined with thickness s between 0,6 and 1,1 mm, and hardness HR 30 Tm with thickness s equal to or smaller than 0,6 mm.

8.5.6 The surface roughness test shall be carried out in accordance with EURONORM 49.

8.6 Retests

The specifications of DIN 17 010 shall apply to retests.

9 Condition of sheet and strip on delivery

9.1 Marking

Unless otherwise agreed at the time of ordering, flat products shall be identified by a stamp applied on the inspected surface (see also DIN 1599). Only colours which can be easily washed off by means of aqueous alkaline solvents shall be used for this marking.

9.2 Oiling

9.2.1 Flat products as specified in this standard are normally supplied oiled. Both surfaces are given an uniform protective oil layer in order to prevent oxidation of the products for a period of three months, provided that the products are packed, transported, handled and stored under the usual conditions. This oil layer shall be capable of being removed by aqueous alkaline solvents. Further requirements shall be the subject of a particular agreement.

9.2.2 If the products are to be supplied in the unoled condition, which shall be the subject of a particular agreement at the time of ordering, there is an increased risk of the flat products becoming scratched or scored either at the manufacturer's works or when using them. In addition, there is an increased risk of rust formation.

9.3 Packing

Requirements with regard to packing shall be the subject of a particular agreement at the time of ordering. The publications of the German producers of sheet metal giving guidelines on the packing of sheet and galvanized sheet in sheet form and coils shall be observed in this respect ¹⁾.

10 Complaints

DIN 17 010 shall apply to complaints and the settlement of complaints.

¹⁾ Published by *Walzstahl-Vereinigung*, Kasernenstrasse 36, D-4000 Düsseldorf 1

Standards referred to and other documents

- DIN 1541 Steel flat products; cold rolled unalloyed steel sheet and wide strip; dimensions, permissible deviations of size and form
- DIN 1599 Identification marking for steel
- DIN 1616 Tinplate and blackplate in sheet form; grades, dimensions and permissible deviations
- DIN 1623 Part 2 Unalloyed steel sheet; steel sheet for general engineering purposes; quality specifications
- DIN 1623 Part 3 (Preliminary standard) Steel flat products; cold rolled sheet and strip, technical delivery conditions; mild unalloyed steels for vitreous enamelling
- DIN 1624 Steel flat products; cold rolled mild unalloyed steel strip in rolling widths not exceeding 650 mm
- DIN 17 010 General technical delivery conditions for steel and steel products
- DIN 46 400 Part 1 Steel flat products with special magnetic properties; cold and hot rolled, non-oriented magnetic steel sheet and strip, permissible magnetic losses from 0,9 to 3,6 W/kg; technical delivery conditions
- DIN 46 400 Part 2 Steel flat products with special magnetic properties; cold rolled magnetic sheet and strip without final annealing, technical delivery conditions
- DIN 46 400 Part 3 Steel flat products with special magnetic properties; oriented magnetic sheet and strip, technical delivery conditions
- DIN 50 014 Atmospheres and their technical application; standard atmospheres
- DIN 50 049 Documents on materials testing
- DIN 50 101 Part 1 Testing metallic materials; cupping test on sheet and strip with a width equal to or exceeding 90 mm (Erichsen method), thickness range from 0,2 to 2 mm
- DIN 50 103 Part 1 Testing metallic materials; Rockwell hardness testing, methods C, A, B, F
- DIN 50 103 Part 2 Testing metallic materials; Rockwell hardness testing, methods N and T
- DIN 50 114 Testing metallic materials; tensile test on sheet and strip with a thickness not exceeding 3 mm, without using an extensometer
- DIN 50 145 Testing metallic materials; tensile test
- EURONORM 49²⁾ *Rauheitsmessungen an kaltgewalztem Flachzeug aus Stahl ohne Überzug* (Roughness measurements carried out on cold rolled, non-coated steel flat products)
- EURONORM 109²⁾ Conventional Rockwell hardness test, HRN and HRT Rockwell scales, HRB' and HR 30 T' for thin products
- Stahl-Eisen-Werkstoffblatt 093-75*³⁾ *Kaltgewalztes Feinblech und Band mit gewährleisteter Mindeststreckgrenze zum Kaltumformen; Gütevorschriften* (Cold rolled sheet and strip with guaranteed minimum yield strength for cold forming; quality specifications)
- Handbuch für das Eisenhüttenlaboratorium*³⁾ (Handbook for the Ferrous Metallurgy Laboratory), volume 2: *Die Untersuchung der metallischen Stoffe* (Investigation of metallic materials); Düsseldorf 1966
- Volume 5 (Supplementary volume):
- A 4.1 — *Aufstellung empfohlener Schiedsverfahren* (List of recommended arbitration procedures)
- B — *Probenahmeverfahren* (Sampling procedures)
- C — *Analysenverfahren* (Methods of analysis)
- The latest edition shall apply.

Previous editions

DIN 1623: 05.32; DIN 1623 Part 1: 01.61, 11.72

Amendments

Compared with the November 1972 edition, the following amendments have been made:

- The field of application has been extended to cover products of thicknesses up to and including 3 mm (subclause 1.1).
- The classification of grades and details on the type of deoxidation (subclause 7.2 and table 1) have been changed (see Explanatory notes).
- Some of the values for the mechanical properties (table 1) have been changed (see Explanatory notes).
- Some of the details on surface appearance and surface finish (table 2) have been changed (see Explanatory notes).

²⁾ Obtainable from *Beuth Verlag GmbH*, Berlin 30

³⁾ Published by: *Verein Deutscher Eisenhüttenleute*; obtainable from *Verlag Stahleisen mbH*, Postfach 82 29, D-4000 Düsseldorf 1

Explanatory notes

This revised edition of DIN 1623 Part 1 takes the technical developments which have occurred since the previous edition of November 1972 into account, in particular in the field of continuous casting, which has assumed an increasingly important role in recent years, including also its role in the manufacture of mild unalloyed steel sheet and strip. Because rimmed steel cannot be used for continuous casting, the U type of deoxidation had to retreat more and more into the background. This led to a change in the grade classification, and it appeared logical to remove the flat products destined for enamelling from DIN 1623 Part 1 and to group them together in a new separate Part 3 (preliminary standard, February 1983 edition).

The main amendments, compared with the November 1972 edition of the standard, are listed below.

Field of application

The field of application has been extended to include product thicknesses up to and including 3 mm. By mutual agreement, the standard may also be applied to greater thicknesses.

Classification of steel grades

In order to create or to improve the preconditions for the use of continuously cast steel in the manufacture of cold rolled flat products, the choice of type of deoxidation for steel grade St 12, which was previously only listed as a rimmed steel, has now been left to the manufacturer's discretion (see subclause 7.2.1). Furthermore, a specially killed alternative, viz. RR St 13, has been added to the rimmed grade USt 13, and thereby the total number of steel grades encompassed has now risen to four.

During the discussions relating to the present edition of the standard, the new specifications in respect of the type of deoxidation for steel grade St 12 were the subject of a great deal of argument and controversy. Some users emphasized the importance of uniformity of workability of the products (deformation behaviour, weldability etc.) in the case of automatic production lines; this uniformity is no longer assured for deliveries of St 12 steel, which may contain, either alone or in combination, both rimmed and killed or specially killed steel. The manufacturers, on the

other hand, argued that an appreciable dispersion of the characteristics always used to occur over the length of the strip, even in the case of the rimmed steel grade, which was the only standardized steel grade at that time. As far as this particular aspect was concerned, one might expect an improvement in the future, viz. a greater uniformity in the processing characteristics of St 12 steel deliveries, because of the increasing percentage of killed steel (from continuous casting) which was anticipated. In table 3 below, the steels covered in this standard are tabulated in comparison with the grades in accordance with EURONORM 130 — Cold rolled non-coated mild unalloyed steel flat products for cold forming; quality standard (May 1977 edition), and also in comparison with the grades of ISO 3574 — Cold reduced carbon steel sheet of commercial and drawing qualities (October 1976 edition). There exists only a limited degree of harmonization. Even in the case of the grades listed on the same line, there are appreciable differences in the values for the mechanical and technological characteristics. It should also be mentioned that the international delivery conditions do not include any specifications relating to the type of deoxidation of the Fe P 01 to Fe P 03 steels, or CR 1 to CR 3 steels nor do they deal with the deep drawing property of the products.

Properties of the steels (table 1)

The values for the chemical composition and for the tensile strength and cupping have remained unaltered in comparison with the previous edition of the standard.

The same also applies to the maximum values of the yield strength and to the minimum values of the elongation after fracture of grades St 12 and USt 13.

The user's proposal to raise the minimum value of the elongation after fracture of St 12 to 30 % was deferred, after an evaluation of the experimental data submitted by the manufacturers had demonstrated that such an increase would result at the present time in a higher rejection rate which the aforementioned basic grade was unable to bear for economic reasons. However, this question will be raised again when DIN 1623 Part 1 is due for a future revision, because the proportion of rimmed steel used for this particular grade is likely to

Table 3. Comparison of steel grades

Steel grades as in DIN 1623 Part 1	Comparable steel grades as in	
	EURONORM 130 — 77	ISO 3574 — 1976
¹⁾	—	CR 1
St 12	Fe P 01	—
USt 13	Fe P 02	CR 2
RR St 13	—	—
²⁾	Fe P 03	CR 3
St 14	Fe P 04	CR 4
¹⁾ St 10 in the January 1961 edition of DIN 1623.		
²⁾ USt 14 in the January 1961 edition of DIN 1623.		

decrease with the increasing use of the continuous casting process.

For the specially killed grade St 14, the maximum value of the yield strength has been reduced, and the minimum value of the elongation after fracture has been raised. Similarly the maximum value of the yield strength of RR St 13 has been reduced in comparison with the rimmed steel grade, and the minimum value of the elongation after fracture of this grade has been raised accordingly.

All the hardness values of table 1 apply to a test in which the appearance of test indentations on the back side of the specimens is permitted. In accordance with EURO-NORM 109, the designations HRBm, HRFm and HR 30 Tm have been selected for this test. (A request for the publication of a relevant DIN Standard dealing with the above-mentioned type of hardness determination has been made to the *Normenausschuss Materialprüfung* (Materials Testing Standards Committee)). The values of table 1 which apply to the thickness ranges specified in subclause 8.5.5 are based on the results of extensive tests carried out by the manufacturers.

During the negotiations, a proposal came up for discussion that the text of the standard should also include a recommendation to the effect that, for grade St 14, the values for the vertical anisotropy (r) and for the strain hardening exponent (n) may be mutually agreed at the time of placing the purchase order as additional useful parameters for the assessment of the utilization properties. However, there is at present no standardized test method in existence for the determination of these

properties, and consequently a sufficient body of evidence and experience to confirm the reliability of the r and n values as parameters for certain utilization spheres of the products is still lacking; the inclusion of such a recommendation in the standard has therefore been deferred.

Surface condition (table 2)

The O3 and O5 surface appearances have been retained in principle. In the case of the best surface (O5) we have deliberately refrained from citing any examples of permissible defects which are *not* likely to adversely affect the forming operation, or surface coating; the reasons for this are that any quantitative indications in this respect are almost impossible to formulate, and that the intended application of the grade of flat product concerned must always be taken into account. In this connection, reference has also been made to the qualitative descriptions contained in the publication *Oberflächenfehler bei kaltgewalztem Band und Blech* (Surface defects on cold rolled sheet and strip) issued by the *Verein Deutscher Eisenhüttenleute* and also in Standards DIN 4761 and DIN 4764.

The "especially smooth" surface finish category has been incorporated additionally in the table, because the manufacturers have pointed out that there is an increasing demand for this finish. In addition, some of the figures for the guideline values for the average peak-to-valley height of the individual surface finishes have been altered in order to harmonize them with present day customer requirements.

International Patent Classification

B 21 B 1/28

C 21 D 7/02