UDC 669.14.018.26-122.4-418 : 620.1 March 1986

Steel flat products

# Hot rolled sheet and strip

## Technical delivery conditions

## Mild unalloyed steels for immediate cold forming

DIN 1614 Part 2

Flacherzeugnisse aus Stahl; warmgewalztes Band und Blech; technische Lieferbedingungen; weiche unlegierte Stähle zum unmittelbaren Kaltformgeben

This standard, together with DIN 1614 Part 1, March 1986 edition, supersedes DIN 1614 Part 1, September 1974 edition.

*In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.*

See Explanatory notes for connection with Standard ISO 3573 – 1976 published by the International Organization for Standardization (ISO) and with EURONORM 111-77 published by the European Coal and Steel Community.

## Contents



## 1 Field of application

1.1 This standard applies to hot rolled flat products (sheet, strip and bars or wide strip) made from the mild unalloyed steels listed in table 1 and intended for immediate cold forming.

1.2 This standard shall only be applied to longitudinally slit strip by special agreement.

1.3 Unless otherwise specified in this standard, the general technical delivery conditions laid down in DIN 17 010 shall also apply for the supply of these products.

1.4 This standard does not apply to hot rolled flat products made from

- mild unalloyed steels for cold reducing (see DIN 1614 Part 1),
- general structural steels (see DIN 17 100),
- weldable normalized fine grain structural steels (see DIN 17 102),
- steels with high temperature strength (see DIN 17 155),
- steels for quenching and tempering (see DIN 17 200),
- case hardening steels (see DIN 17 210).

## 2 Concepts

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

2.2 Strip is a flat product which is wound to form a coil immediately after the final rolling pass or after having passed the installations connected to the roll. In the rolled condition, strip has slightly curved edges but can also be supplied with trimmed 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 of 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.

## 3 Dimensions and permissible dimensional deviations

DIN 1016 or DIN 1543 shall apply for the dimensions and permissible dimensional deviations.

Continued on pages 2 to 5

## 4 Masses

The mass of the steels specified in this standard shall be calculated taking the density as 7,85 kg/dm$^3$.

## 5 Classification into grades

5.1 This standard covers the steel grades listed in table 1 which are characterized by their mechanical properties and are intended for immediate cold forming (e.g. by means of stamping, folding, bending, pressing, drawing, cold rolling into sections or cold extrusion).

5.2 The choice of the the steel grade is left to the discretion of the purchaser. It is recommended that the supplier be consulted, if necessary, in order to decide which steel grade and which surface finish are suitable for the intended application.

## 6 Designation and ordering

6.1 The standard designation for a steel complying with the requirements of this standard shall consist of

- the term "steel";
- the number of this standard;
- the symbol or material number identifying the steel grade (see table 1).

Example:

**Steel DIN 1614 – StW 22**

or

**Steel DIN 1614 – 1.0332**

6.2 The specifications of the dimensional standard shall apply for the standard designation of the products.

6.3 The order shall provide all information necessary for a clear description of the products required, as well as their condition and testing. If the designations as specified in subclauses 6.1 and 6.2 are not adequate for this purpose, the additional information required (e.g. if surface finish other than that specified in subclause 7.7.2 or 7.7.3, or any additional properties are required (see subclauses 7.7.4 and 7.7.7)) shall be appended to these. It shall also indicate whether the products to be supplied are to be suitable for the fabrication of a particular workpiece (see subclause 7.4.2).

## 7 Requirements

### 7.1 Steelmaking process

The steelmaking process is left to the discretion of the manufacturer; the purchaser shall be informed, on request, of the type of process used.

### 7.2 Type of deoxidation

7.2.1 The type of deoxidation of steel grade StW 22 is left to the discretion of the manufacturer.

7.2.2 Steel grade StW 23 may be supplied in the rimming (U) or specially killed (RR) condition. The type of deoxidation required shall be stated in the designation.

7.2.3 Steel grade StW 24 shall be supplied specially killed (RR).

### 7.3 Chemical composition

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

### 7.4 Selection of properties

Depending on any 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 steel grades StW 24 and RRStW 23, and of six weeks for grades UStW 23 and StW 22, after the products have been made available as agreed, shall apply in this respect.

### 7.5 Mechanical properties

7.5.1 For products ordered in accordance with subclause 7.4.1 and in the as delivered conditions given in subclauses 7.7.1 and 7.7.2, the tensile strength, yield stress and elongation after fracture values as specified in table 1 shall apply for a period of

- 6 months for grades StW 24 and RRStW 23,
- 8 days for grades UStW 23 and StW 22,

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

7.5.2 The values listed in table 1 shall apply for longitudinal test pieces for flat products less than 600 mm in width, and for transverse test pieces for flat products not less than 600 mm in width.

7.5.3 The yield stress values shall apply for the 0,2 % proof stress, $R_{p\,0,2}$, if the yield stress cannot be easily recognized, otherwise the values shall apply for the lower yield stress, $R_{eL}$.

### 7.6 Weldability

The steels specified are suitable for welding by the usual processes. It is, however, desirable that the welding process be specified at the time of ordering. In the case of flat products which have not been descaled, the welding process shall allow for the presence of a layer of scale.

### 7.7 Surface condition

7.7.1 Flat products complying with this standard are usually supplied in the as-rolled condition, i.e. with a non-descaled surface.

7.7.2 Where the as delivered condition

- chemically descaled (pickled) and oiled, or
- chemically descaled (pickled) and unoiled

is required, this shall be clearly specified in the order (see subclause 6.3).

Note. If the products are supplied in the unoiled condition, there is an increased risk of the flat products becoming scratched or scored on either the manufacturer's or the user's premises. Furthermore, there is an increased risk of rust formation.

01-12-10; 2:22PM; ; # 24/ 41



7.7.3 The following as delivered conditions are also permitted if specially agreed at the time of ordering:

- mechanically descaled, oiled;
- mechanically descaled, unoiled;
- straightened;
- skin-passed, the maximum degree of skin passing being 5 %.

7.7.4 If the products are intended for vitreous enamelling, galvanizing or the application of other types of surface coating, this shall be specially stated at the time of ordering.

7.7.5 An application appropriate to the flat product grade, assuming proper processing, shall not be impaired by the surface condition. Pores, small grooves, small pits, slight scratches and coil breaks left by uncoiling are permitted. The proportion of surface defects is generally higher where the products are supplied in coils than when they are supplied in sheets.

7.7.6 If the flat products are not supplied in a descaled condition, it shall be possible to remove the scale from the whole length and width by the usual methods within an appropriate period. The surface shall therefore be free from oils and greases and from dyes which cannot be removed by normal descaling, except for agreed colour markings or inscriptions on the permissible rough-rolled ends.

7.7.7 Hot rolled strip made from the steels specified in this standard is susceptible to breaking on uncoiling. Reduced susceptibility of the strip to breaking on uncoiling shall be specially agreed at the time of ordering, it being assumed that the uncoiling equipment corresponds to the state of the art.

### 7.8 Edge condition

7.8.1 Depending on the order, the flat products shall be supplied either with mill edges (NK) or trimmed edges (GK).

7.8.2 The edge condition shall not impair the application of the flat products, assuming proper processing.

## 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 complying with DIN 50049 be furnished.

8.1.2 If it is agreed that a document be furnished which, in accordance with DIN 50049, requires that tests be carried out on the consignment itself, then the specifications of subclauses 8.2 to 8.6 shall apply.

### 8.2 Acceptance units

8.2.1 The cast shall be the acceptance unit.

8.2.2 The acceptance unit shall consist of flat products of the same steel grade and nominal thickness.

8.2.3 Subject to special agreement at the time of ordering, the acceptance unit may be 40 t units or any fraction of a 40 t unit of flat products of the same steel grade and nominal thickness.

### 8.3 Number of tests

One tensile test shall be carried out per acceptance unit in order to determine the mechanical properties (see subclause 7.5).

### 8.4 Sampling

8.4.1 The test pieces for the tensile test shall be taken longitudinally to the direction of rolling for product widths less than 600 mm, and transversely to the direction of rolling for product widths not less than 600 mm. They shall not be worked on both surfaces.

8.4.1.1 The test pieces shall be taken after one wap of the outer end of the coil. The test pieces shall be taken at a point midway between the long edge and the centre line.

8.4.1.2 The test pieces shall be deformed as little as possible as they are cut. If shears or cutting torches are used, sufficient material allowance, which shall be removed by machining, shall be made.

### 8.5 Test methods to be applied

8.5.1 The chemical composition shall be determined by the methods [1]) described by the Chemists' Committee of the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgy Engineers).

8.5.2 The mechanical tests shall be carried out at ambient temperature (15 to 35 °C, as specified in DIN 50014).

8.5.3 The tensile test shall be carried out as specified in DIN 50145, on a test piece with a gauge length $L_0 = 80$ mm and width $b_0 = 20$ mm as specified in DIN 50114 for flat product thicknesses less than 3 mm, on proportional test pieces with a gauge length $L_0 = 5d_0$ ($L_0 = 5{,}65 \times \sqrt{\text{cross section}}$ for rectangular test pieces) as specified in DIN 50125 for flat product thicknesses not less than 3 mm. The results of the tensile tests shall be related to the actual dimensions of the test pieces.

### 8.6 Retests

The specifications of DIN 17010 shall apply to retests.

## 9 Marking and packaging

### 9.1 Marking

Flat products complying with this standard shall be marked with a durable tie-on label or adhesive strip containing the delivery information according to the details of designation given in the relevant dimensional standards. Additional marking shall be by special agreement.

### 9.2 Packaging

The coils shall be bound in such a way that they cannot be damaged and so that no waps may come undone in the course of normal careful loading, transportation and storage.

---

1) See the "Standards and other documents referred to" clause.

Table 1. **Classification into grades and mechanical properties of hot rolled flat products intended for immediate cold forming**

| Steel grade | | Type of deoxidation [1] | Chemical composition [2] % by mass (Maximum) | | Maximum yield stress [3], [5] ($R_{p\,0,2}$ or $R_{eL}$) [4] N/mm² | Maximum tensile strength [3] N/mm² | Minimum elongation after fracture [3], [6] % | |
|---|---|---|---|---|---|---|---|---|
| Symbol | Material number | | C | N | | | $L_0 = 80$ mm | $L_0 = 5d_0$ |
| StW 22 | 1.0332 | Optional | 0,10 | 0,007 [7] | – | 440 | 25 | 29 |
| UStW 23 | 1.0334 | U | 0,10 | 0,007 [7] | – | 390 | 28 | 33 |
| RRStW 23 | 1.0398 | RR | 0,10 | [8] | – | 420 | 27 | 31 |
| StW 24 | 1.0335 | RR | 0,08 | [8] | 320 | 410 | 30 | 34 |

1) See subclause 7.2.

2) As determined in the cast analysis. Other elements, except manganese and aluminium, shall not be added to the melt without the approval of the purchaser.

3) The values stated apply for product thicknesses from 2 to 8 mm in the as delivered condition as specified in subclauses 7.7.1 and 7.7.2. Higher or lower values of thickness and other as delivered conditions (see e.g. subclause 7.7.3) may be agreed at the time of ordering.

4) See subclause 7.5.3.

5) The minimum value of yield stress ($R_{p\,0,2}$ or $R_{eL}$) may be assumed to be 200 N/mm² for steel grade UStW 23 and 215 N/mm² for the other steel grades.

6) See subclause 8.5.3.

7) The values represent the content of free nitrogen.

8) The nitrogen must be fixed. The steel shall thus contain at least 0,02 % of metallic aluminium. The addition of other nitrogen-fixing elements shall be agreed with the purchaser.

## Standards and other documents referred to

DIN 1016 Steel flat products; hot rolled strip, hot rolled sheet under 3 mm thick; dimensions, permissible dimensional deviations and deviations of form and mass

DIN 1543 Steel flat products; hot rolled plate and sheet 3 to 150 mm thick; permissible dimensional deviations, deviations of mass and form

DIN 1614 Part 1 Steel flat products; hot rolled sheet and strip; technical delivery conditions; mild unalloyed steels for cold reducing

DIN 17 010 General technical delivery conditions for steel and steel products

DIN 17 100 Steels for general structural purposes; quality standard

DIN 17 102 Weldable normalized fine grain structural steels; technical delivery conditions for plate, strip, wide flats, sections and bars

DIN 17 155 Creep resistant steel plate and strip; technical delivery conditions

DIN 17 200 Steels for quenching and tempering; technical delivery conditions

DIN 17 210 (at present at the stage of draft) Case hardening steels; technical delivery conditions

DIN 50 014 Atmospheres and their technical application; standard atmospheres

DIN 50 049 Documents on materials testing

DIN 50 114 Testing of metallic materials; tensile test on sheet and strip with a thickness not exceeding 3 mm, without using an extensometer

DIN 50 125 Testing of metallic materials; tensile test pieces

DIN 50 145 Testing of metallic materials; tensile test

*Handbuch für das Eisenhüttenlaboratorium* [2] (Handbook for the ferrous metallurgy laboratory):

volume 2 A: *Die Untersuchung der metallischen Stoffe* (Investigation of metallic materials);

volume 3 A: *Probenahme* (Sampling)

volume 5: *Normen, Begriffe, Definitionen und ausgewählte Kapitel der Röntgenfluoreszenzspektrometrie und Statistik* (Standards, terminology and selected sections relating to X-ray fluorescence spectrometry and statistics)

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

## Previous editions

DIN 1614 Part 1: 09.74

## Amendments

The following amendments have been made in comparison with DIN 1614 Part 1, September 1974 edition.

a) The requirements to be met by products intended for immediate cold forming, which were previously specified in DIN 1614 Part 1, are now covered by the present standard.

b) The specifications relating to the type of deoxidation for steel grade StW 22 (see table 1) have been changed.

c) Steel grade RRStW 23 (see table 1) has been included for the first time.

d) The requirements have been supplemented by giving maximum values for the carbon and nitrogen contens (see table 1).

## Explanatory notes

This Part of DIN 1614 specifies the technical delivery conditions for flat hot rolled products for immediate cold forming made from mild unalloyed steels which were previously covered by DIN 1614 Part 1 (September 1974 edition), together with the grades intended for further processing by cold reducing. Splitting up of the technical delivery conditions according to the intended application of the steels appeared appropriate. It simplifies the comparison with international and regional standards already published or planned in accordance with this scheme and further will permit a more rapid updating of the individual parts according to the state of the art.

All participants in the discussions were agreed that the classification of the steel grades should be harmonized with that of the new delivery conditions for cold reduced flat products made from mild unalloyed steels (see DIN 1623 Part 1, February 1983 edition). For this reason, the specially killed steel grade RRStW 23 was added to the previous series and the type of deoxidation of grade StW 22 (previously rimming) was made optional, i.e. left to the discretion of the manufacturer. The requirements on the chemical composition made in DIN 1623 Part 1 were also adopted by general agreement into the present standard.

The discussions regarding the requirements on the mechanical properties of the steels were also a matter for debate, above all in relation to the request by representatives of the automobile industry for the specification of values of yield stress and for the extension of the field of application of table 1 to descaled flat products. Maximum values of yield stress for steel grade StW 24 and minimum values to be anticipated for the yield stress of all grades (see footnote 5 to table 1) have been included in the present standard. All the values given in table 1 apply to products from 2 to 8 mm in thickness in the as-rolled condition and in the chemically descaled (pickled) condition.

The table below compares the steel grades specified in the present standard with the grades specified in ISO 3573 – 1976, Hot-rolled carbon steel sheet of commercial and drawing qualities and those in EURONORM 111, Continuously hot-rolled non-coated mild unalloyed steel sheet and strip for cold forming (March 1977 edition).

| Steel grade as in DIN 1614 Part 2 | Comparable steel grades as in | |
|---|---|---|
| | ISO 3573 – 1976 | EURONORM 111 |
| – | HR 1 | FeP 10 |
| StW 22 | HR 2 | FeP 11 |
| UStW 23 | (HR 3) | FeP 12 |
| RRStW 23 | – | – |
| StW 24 | HR 4 | FeP 13 |

The comparison is based on the values of tensile strength and elongation after fracture. Neither the ISO Standard nor the EURONORM specify the yield stress of the steels.

## International Patent Classification

C 22 C 38/00