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**Surface quality classes for hot-rolled  
bars and wire rod**

*Classes de qualité de surface des barres et fils-machine laminés à chaud*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

This second edition cancels and replaces the first edition (ISO 9443:1991), which has been technically revised.

The following changes have been made in comparison with the first edition:

- the surface quality classes 5 to 12 (12A) have been removed;
- the surface classes 1 to 4 have been kept and renamed A, B, D and E and an additional surface quality class has been introduced as surface quality class C;
- the difference between shallow and sharp discontinuities has been removed due to the impracticality to differentiate between the two;
- the admissible portion of defective material  $z_a$  and  $z_b$  has been removed and only  $z$  has been kept.

# Surface quality classes for hot-rolled bars and wire rod

## 1 Scope

This document specifies technical delivery requirements for the surface quality of round bars, squares, hexagons and wire rod in the hot rolled condition with nominal dimensions  $d_N$  from 5 mm to 200 mm. This document is applicable to bright products and tool steels, if agreed at the time of enquiry and order between manufacturer and purchaser.

By agreement between manufacturer and purchaser, this document can also be applied to other special profiles.

This document is particularly applicable to steels for engineering and structural applications.

This document does not include any requirements for the permissible depth of surface decarburization.

NOTE The determination of depth of surface decarburization is presented in ISO 3887.

The material standards for steel bars and wire rod can exclude the application of one or other of the surface quality classes of this document. They can also cover requirements for surface quality which deviate from this document. In these cases the requirements of the material standard prevail.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6929, *Steel products — Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6929 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1 delivery lot

quantity of steel of the same type and the same dimension ordered with the same requirements for the surface quality and delivered at the same time, unless otherwise specified in the order or appropriate product standard

### 3.2 discontinuity

geometric irregularity projecting inwards

### 3.3 imperfection

*discontinuity* (3.2) with a depth smaller than or equal to the specified limiting value which may be left without repair

### 3.4

#### defect

*discontinuity* (3.2) with a depth greater than the specified limiting value

### 3.5

#### portion z

maximum admissible portion of defective material in the *delivery lot* (3.1) in percentage of the delivered mass

## 4 Ordering and designation

### 4.1 Ordering

If the appropriate International Standard specifying the quality requirements for the material does not contain exact specifications for the required surface quality class and the admissible portion of defective material, the following details shall be given in the following order.

- a) The surface quality class (see [Table 1](#)) unless class A or default class.
- b) The maximum admissible portion z of defective material in the total delivery lot (for the default value see [Table 1](#), other values can be agreed at the time of enquiry and order).
- c) The type of verification, which is left to the producer if not specified at the time of enquiry and order.

NOTE A guideline for applying surface quality classes is given in [Annex A](#).

### 4.2 Designation

The required surface finish shall be designated according to [Table 1](#). Two examples are given of possible designations based on the sampling method specified by the purchaser (e.g. test plan, statistical process control, etc.).

EXAMPLE 1 For an agreed surface quality class B and a maximum admissible portion z of defective material of 1 % (default value) in the total delivery lot.

**Surface quality ISO 9443 – class B**

EXAMPLE 2 For an agreed surface quality class C and a maximum admissible portion z of defective material of 0,5 % in the total delivery lot.

**Surface quality ISO 9443 – class C – z 0,5**

## 5 Requirements

The surface quality shall comply with the requirements of surface quality classes defined in [Table 1](#) (see also [Figure 1](#)) and shall be specified or agreed in accordance with [4.1](#) and [4.2](#).

The handling of defective material should also be agreed upon at the time of enquiry and order; for example, whether it shall be sent back to the manufacturer or scrapped, etc. This also applies if the total delivery is accepted.

## 6 Testing

### 6.1 General

6.1.1 The manufacturer takes, under their own responsibility and according to their own judgement, suitable measures to supervise their production in view of the specified surface quality requirements.

NOTE At the present state of development, facilities for the continuous testing of the specific surface quality classes at high temperatures do not exist. After rolling, the wire rod manufacturer can normally only check the ends of the coils for compliance with surface quality requirements.

**6.1.2** The purchaser is free to check the surface quality of the delivered material by methods they regard as suitable. However, disputes shall be resolved by measuring depths of discontinuities by the techniques specified in [6.2.3.2](#).

## 6.2 Test methods

### 6.2.1 General

**6.2.1.1** The methods used for detecting discontinuities and measuring the depth of discontinuities shall be sufficiently accurate and shall give reproducible results.

**6.2.1.2** Non-destructive methods (see [6.2.2.2](#) and [6.2.3.1](#)) and also technological methods (see [6.2.2.3](#)) may be used.

NOTE Given the limitations of continuous inspection equipment for wire rod relative to the exactness of imperfection depth measurements, it is normally only possible to inspect the ends of the coils. Therefore, it cannot be proved that no value greater than the specified value is to be found in the coil as a whole.

**6.2.1.3** In cases of dispute, the measurements carried out in accordance with [6.2.3.2](#) on products in the delivery condition shall be decisive.

### 6.2.2 Methods for the detection of discontinuities

**6.2.2.1** The following methods or other suitable ones can be used for the detection of surface discontinuities.

**6.2.2.2** The following non-destructive methods may be taken into consideration:

- visual examination;
- magnetic flux methods, for example, magnetic particle inspection or probe methods, the methods can be manual or automatized;
- inductive methods (eddy current);
- dye penetrant methods.

**6.2.2.3** The following technological test methods may be taken into consideration:

- hot-upsetting tests;
- cold compression tests;
- torsion tests (see ISO 7800).

### 6.2.3 Methods for measuring the depth of discontinuities

**6.2.3.1** By non-destructive test methods such as the following:

- magnetic flux measurement with rotating or stationary probes;
- inductive methods;
- potential probe method using direct current;

— ultrasonic tests.

These methods can only determine the depth of discontinuities approximately.

**6.2.3.2** In case of dispute the exact determination of the depth of a discontinuity on products in the delivery condition shall be carried out by examining a metallographic specimen. The depth is measured in the radial direction and the measurement shall be decisive (see also [Table 1](#), footnote b).

**6.2.4 Production tests on trial batches**

When receiving inspection reveals questionable quality, the processing of a trial batch may be agreed upon in order to reveal whether the material is acceptable for the intended application. In this case the size of the trial batch has to be agreed upon.

**7 Repairs**

Imperfections shall be smoothly removed by grinding within the dimensional tolerance limits (see, however, footnote b to [Table 1](#)) if agreed by the purchaser.

Repair by welding is only permitted if agreed by the purchaser. No impairment of the material properties (e.g. excessive hardening, crack formation) shall result from this.

**Table 1 — Surface quality classes**

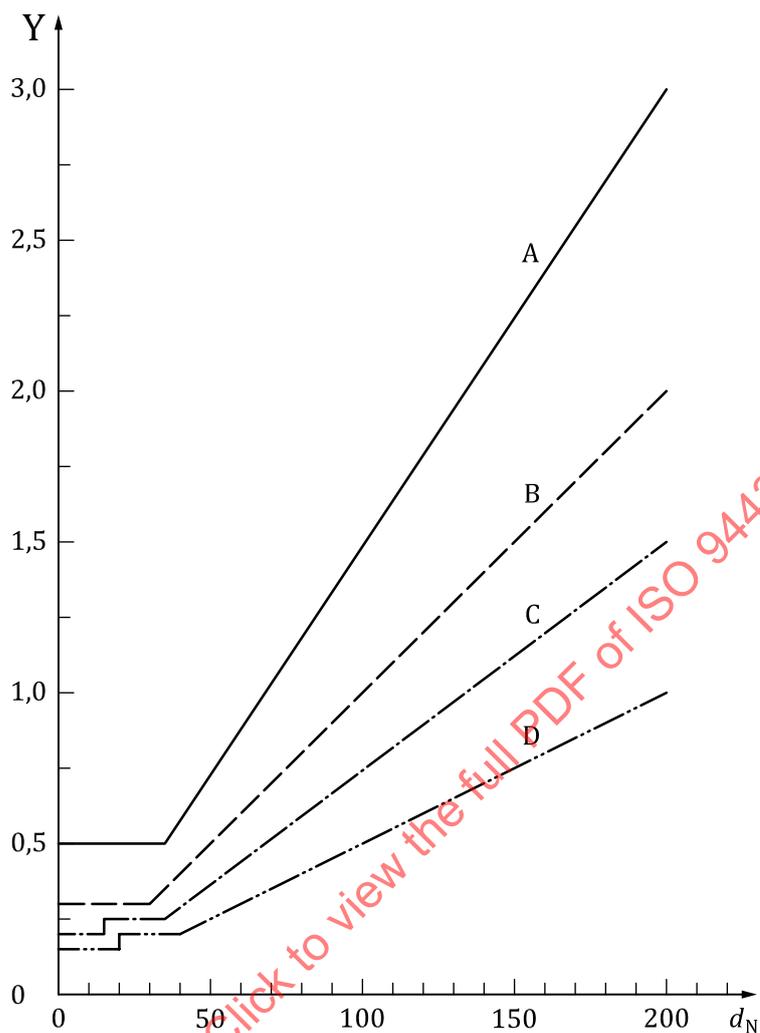
Surface quality classes		Nominal dimension <sup>a</sup> <i>d<sub>N</sub></i> mm	Maximum permissible depth of surface discontinuities <sup>b</sup> mm	Portion z (default value) %
ISO classes	Old ISO classes			
Products to be further processed by machining or by forging				
A	1	$5 \leq d_N \leq 35$	0,50	2
		$35 < d_N \leq 200$	$0,015 \times d_N$	
B	2	$5 \leq d_N \leq 30$	0,30	1
		$30 < d_N \leq 200$	$0,01 \times d_N$	
C		$5 \leq d_N \leq 15$	0,20	1
		$15 < d_N \leq 35$	0,25	
		$35 < d_N \leq 200$	$0,0075 \times d_N$	
D	3	$5 \leq d_N \leq 20$	0,15	0,5
		$20 < d_N \leq 40$	0,20	
		$40 < d_N \leq 200$	$0,005 \times d_N$	
E	4	$5 \leq d_N \leq 200$	to be agreed, pdf <sup>c</sup>	0,2

*d<sub>N</sub>* is the nominal dimension that means diameter for rounds and distance across flats for squares and hexagons.

<sup>a</sup> Bars are generally not rolled in dimensions of less than about 15 mm, wire rod is usually rolled in dimensions between 5,5 mm and 25 mm. The maximum dimensions of bright bars and profiles may be limited due to the manufacturing method.

<sup>b</sup> The depth of surface discontinuities is measured from the actual surface of the product in radial direction. The dimensional tolerance shall also be considered when determining the section of the finished part which is ensured to be free of defect.

<sup>c</sup> pdf = practically defect free. This surface quality class shall be better than class D. It is dependent upon the steel production process and its quality control because existing non-destructive inspection techniques cannot measure such minor discontinuities. The specific means of assuring this quality depend upon the customer's intended application and the requirements and the method of control shall be agreed upon between the parties.

**Key**

A surface quality class A

B surface quality class B

C surface quality class C

D surface quality class D

 $d_N$  nominal dimension in mm

Y maximum permissible depth of surface discontinuities, in mm

**Figure 1 — Surface quality classes**