INTERNATIONAL STANDARD

ISO 8457-2

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Steel wire rod —

Part 2:
Quality requirements for unalloyed steel wire rods for conversion to wire

Fil-machine en acier —

Partie 2: Prescriptions de qualité pour fil-machine en acier non allié destiné à la fabrication de fils

Reference number
ISO 8457-2 : 1989 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8457-2 was prepared by Technical Committee ISO/TC 17, *Steel*.

ISO 8457 consists of the following parts, under the general title *Steel wire rod*:

— *Part 1: Dimensions and tolerances*

— *Part 2: Quality requirements for unalloyed steel wire rods for conversion to wire*

— *Part 3: Quality requirements for wire rods for the manufacture of welding electrodes*

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Steel wire rod —

Part 2:
Quality requirements for unalloyed steel wire rods for conversion to wire

1 Scope

1.1 This part of ISO 8457 specifies requirements for wire rods of unalloyed steel listed in table 1, of diameters 5 mm and over, and which are intended for conversion to wire by cold drawing or by cold rolling.

1.2 The wire rods may be of round, half-round, square, hexagonal or rectangular cross-section, the dimensions and tolerances of which are given in ISO 8457-1.

1.3 This part of ISO 8457 does not cover the following steel wire rods, some of which are covered by other International Standards:

— wire rod intended for cold heading (covered by ISO 4954 : 1979, *Steels for cold heading and cold extruding*);

— wire rod intended for the manufacture of welding electrodes (to be covered by ISO 8457-3[1]);

— wire rod intended for quenching and tempering or surface hardening.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8457. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8457 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 377 : 1985, *Wrought steel — Selection and preparation of samples and test pieces.*

ISO 404 : 1981, *Steel and steel products — General technical delivery requirements.*

ISO 3887 : 1976, *Steel, non-alloy and low-alloy — Determination of depth of decarburization.*

ISO 4948-2 : 1981, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics.*

ISO 8457-1 : 1989, *Steel wire rod — Part 1: Dimensions and tolerances.*

3 Definition and designation

For the purposes of this part of ISO 8457, the following definition applies.

wire rod: A hot-rolled finished product hot wound into irregular coils primarily intended for wire drawing.

Designation

The designations of steel types as shown in table 1 are in accordance with ISO 4948-2, as follows:

1CDXX	Base steel
2CDXX	Quality steel
3CDXX	Special steel

In addition, suffixes A and B have been added to indicate steels with differing manganese ranges.

4 Ordering

4.1 General

The purchaser shall state in his enquiry and order:

a) the nominal size (see ISO 8457-1);

b) the designation of steel type (see table 1);

c) the quantity ordered (in tonnes), tolerance on mass of consignment, and delivery instructions;

d) coil mass, limitations on coil mass, and mass tolerance if required.

1) To be published.

4.2 Options

Certain options for grades 2CDXX and 3CDXX are permitted by this part of ISO 8457 and the purchaser may also state in his enquiry and order his requirements as shown below:

a) whether a product analysis is required (see 5.2.2);

b) special limitations on surface defect depth;

c) whether a test for detection of surface defects is required and the test to be used (see 5.3.1 to 6.3);

d) whether wire rod with a surface condition other than "hot-rolled, not surface treated", is required;

e) depth of decarburization (see 5.3.3);

f) limitation of non-metallic inclusion content (for grade 3CDXX only);

g) the required type of test certification document (see 6.2).

5 Requirements

5.1 Manufacture of the steel

5.1.1 Unless otherwise agreed on the order, the process used in making the steel is left to the discretion of the manufacturer.

When he so requests, the user shall be informed what steel-making process is being used for the manufacture of quality and special steels.

5.2 Chemical composition

5.2.1 The chemical composition of the steel, as given by the cast analysis, shall be in accordance with the specifications in table 1.

5.2.2 The permissible deviations between the specified cast analysis and the product analysis shall be those specified in table 2.

5.3 Defects

5.3.1 The steel shall be free from pipe, harmful segregation, surface flaws and other defects detrimental to its further processing and end use.

NOTE — Normal segregation of rimming steel is allowable.

5.3.2 When agreed at the time of enquiry and order, rods in all grades (except 1CDXX grades), for special purposes and requiring special limitations on surface defect depth, shall be tested for maximum permissible depth of defect in accordance with 6.3.1. The maximum permissible defect depth shall be negotiated at the time of enquiry and order but the values given in table 3 may be used as a basis for negotiation.

5.3.3 When agreed at the time of enquiry and order, rods in grades 3CD45 and higher carbon shall be tested for the depth of decarburization in accordance with 6.3.3. The maximum average permissible depth of decarburization shall be negotiated at the time of enquiry and order but the values given in table 4 may be used as a basis for negotiation.

5.3.4 When agreed at the time of enquiry and order, rods in grade 3CDXX shall be tested for limitation of non-metallic inclusion content. The limits of acceptance shall be negotiated at the time of enquiry and order.

6 Inspection and testing

6.1 General

6.1.1 If acceptance tests have been agreed, the general conditions of clause 5 of ISO 404 regarding inspection, testing and conformity of the product are valid, and furthermore, the conditions given in 6.2 and 6.3 shall be observed.

6.1.2 In the selection and preparation of samples and test pieces, the general conditions given in ISO 377 are valid, and furthermore, the conditions given in 6.2 and 6.3 shall be observed.

6.1.3 Samples shall be taken at least 300 mm from one of the ends of the coil. In cases of dispute, this distance shall be as indicated in table 5.

6.2 Inspection and testing procedures and types of documents

6.2.1 The inspection procedures and the types of documents of ISO 404 which may be agreed upon at the time of enquiry and order are summarized in table 6.

6.2.2 If agreed at the time of enquiry and order that a test report is to be provided, then this shall cover

a) the statement that the material complies with the requirements of the order, and

b) the results of the cast analysis for all elements specified for the steel supplied.

6.2.3 If agreed at the time of enquiry and order that an inspection certificate (IC or ICP) or an inspection report (IR) is to be provided (see table 6), then the specific inspections and tests described in 6.3 shall be carried out and their results shall be certified in the document.

In addition, the document shall cover

a) the statement that the material complies with the requirements of the order, and

b) the results of all specific inspections and tests agreed upon at the time of enquiry and order.

For grade 1CD8, the statement of compliance document (SC) can be supplied by agreement.

6.3 Specific inspection and testing

6.3.1 General

6.3.1.1 The acceptance units relating to each specified test are given in table 6a).

6.3.1.2 Where appropriate, tests shall be conducted in accordance with the procedures stated in the appropriate International Standard.

6.3.2 Surface quality tests

6.3.2.1 General

In order to examine the surface condition, one coil per each 10 t of a test unit with a minimum of three test pieces shall be examined. All samples shall conform to the requirements of the order.

Tests for surface condition may be conducted either qualitatively or quantitatively as agreed upon at the time of enquiry and order.

Where qualitative tests only are specified, tests described in 6.3.2.2 to 6.3.2.5, or other agreed appropriate tests, such as 6.3.2.6, shall be employed. If the steel fails to meet the requirements of the specified tests, the steel may be subjected to the tests given in 6.3.2.6. and 6.3.2.7.

In the event of a dispute, the quantitative test given in 6.3.2.7 shall be adopted as the referee test, and 90 % of all samples shall conform with the requirements of the order, and this shall indicate conformity of the steel with the requirements of this International Standard. However, in no case shall values exceed the limit by greater than 0,5 % of the diameter.

NOTE — Since it is not possible to detect, on coils, all surface imperfections which may be detrimental to further processing, a certain portion of the length of the wire rod may have such imperfections. The maximum permissible percentage of length shall be agreed between purchaser and supplier at the time of enquiry and order.

6.3.2.2 Alternating torsion test

The principle of the test is the detection of potential surface defects which may appear after twisting the test piece on its axis a specified number of times in one direction followed by twisting in the opposite direction to return the test piece to its original position.

The test is applicable to rods of diameters indicated in table 7, but is not carried out on grades having a carbon content greater than or equal to 0,63 % (m/m).

The test piece is obtained by using a straight piece of as-rolled rod of length 50 times the diameter, with a maximum length of 500 mm.

The method of test consists of twisting the test piece on its axis through 360° to the left a minimum number of times as indicated in table 8, then twisting the same number of times through 360° to the right to return the test piece to its original position. The speed at which twisting is done shall be as uniform as possible, and must not cause the test piece to heat up quickly. The result shall be considered satisfactory if the operation is completed for the minimum number of twists indicated in table 8, and no ruptures, splits or cracks are observed on the specimen surface.

Should any such defects be observed, the depth of defect shall be measured on a further test piece taken from the same coil, using the quantitative test given in 6.3.2.7 on a further test piece taken from the same coil for compliance with the requirements of the order.

6.3.2.3 Upsetting (Dump) test

This test is designed to reveal the potential surface defects appearing after compressing the test piece along its axis.

The testing machine may be a press and shall have a guiding device that allows a rectilinear displacement following the same direction as that of the crushing. The surfaces between which the test piece is compressed shall be parallel, perpendicular to the test piece axis, and shall not deform during testing.

The test piece is upset when hot or cold using a press until its length is reduced to 50 % of its original length. The result shall be considered satisfactory if the deformed rod surface is devoid of splits and cracks. Should any such defects be observed, the depth of defect shall be measured on a further test piece taken from the same coil, using the quantitative test given in 6.3.2.7 for compliance with the requirements of the order.

6.3.2.4 Deep-etch test

This test is intended to reveal the potential surface defects after the test piece has been deep-etched in an aqueous solution of either sulfuric acid or hydrochloric acid.

The etching solution to be used shall be at the option of the manufacturer, and shall be one of the following:

a)	sulfuric acid, ϱ 1,84 g/ml	1 part by volume
	water	9 parts by volume
b)	hydrochloric acid, ϱ 1,19 g/ml	1 part by volume
	water	1 part by volume

The test piece which shall be at least 150 mm in length is etched by immersing it in the etching solution a) or b) at a temperature between 60 °C and 70 °C until the oxide is removed, so that any potential surface defects become visible. The etched surface of the test piece is then rinsed immediately with running water and dried with methylated spirits or industrial ethyl alcohol.

The duration of the test shall not exceed 15 min.

The results shall be considered satisfactory if there are no visible surface defects. Should any such defects be observed, the depth of defect shall be measured on a further test piece taken from the same coil using the quantitative test given in 6.3.2.7 for compliance with the requirements of the order.

6.3.2.5 Magnetic particle test

This test is intended to reveal the potential surface defects after the test piece has been submitted to an appropriate magnetic particle test, which shall be agreed upon at the time of enquiry and order.

6.3.2.6 File test

This test is intended for rods which are required to meet special surface conditions, and consists of determining the depth of defects by removal of the defect by abrasion.

This test is carried out by using a file to remove defects until they are no longer visible without the aid of magnifying instruments. The depth of the defect, assessed by determining the difference in thickness before and after filing, measured perpendicular to the surface, is then determined.

6.3.2.7 Microscopic test

For rods which are required to meet special surface conditions, a microscopic examination may be conducted on a microspecimen suitably prepared and magnified at least X 100.

6.3.3 Decarburization test

This test is applicable only to grade designations CD 45 and over.

In order to examine for decarburization, ten samples shall be selected by the purchaser from each acceptance unit. This examination is considered to be satisfactory if at least 90 % of the results conform to the requirements of the order with no value to exceed the limit by more than 0,5 % of the diameter.

The wire rod shall be tested for decarburization in accordance with one of the methods given in ISO 3887, which is to be agreed upon at the time of enquiry and order.

In case of dispute, the decarburization shall be checked by microscopic measurements in accordance with ISO 3887.

6.3.4 Product analysis

In order to check chemical analysis, one sample product (i.e., coil sample) shall be taken from each unit of acceptance. The methods used shall be those established by the relevant International Standard. If no International Standards are available, the methods may be agreed upon and specified at the time of enquiry and order.

6.3.5 Retests

6.3.5.1 Where for one or more test units, one or more tests give unsatisfactory results, the manufacturer has the choice of withdrawing the concerned test units (for example, for retreatment or sorting in accordance with ISO 404) or of retaining them. If they are retained, retests shall be carried out according to the following rules.

6.3.5.2 If only one test of the concerned type was carried out on the concerned sample and gave an unsatisfactory result, two new tests of the same type shall be carried out on test pieces taken from the sample concerned.

6.3.5.3 If the test requires a set of samples, and more than two of the set give unsatisfactory results, then a second set of samples, in which the number of samples is twice that in the original set, shall be taken and tested.

6.3.5.4 All retests must give satisfactory results, otherwise the test unit concerned is to be rejected.

7 Marking

Unless otherwise stated, all deliveries shall be clearly marked with the following particulars, and the marking has to be resistant to pickling:

- nominal dimension;
- designation of steel type;
- cast number, except for grade 1CD8;
- manufacturer.

Table 1 — Chemical composition (cast analysis)[1), 2)], % (m/m)

Designation	C		Si		Mn[3)]		P	S
	min.	max.	min.	max.	min.	max.	max.	max.
2CD5A	–	0.06	–	[4)]	[5)]	0.40	0.040	0.040
2CD5B	–	0.06	–	[4)]	[5)]	0.50	0.040	0.040
3CD5A	–	0.06	–	[4)]	[5)]	0.40	0.030	0.030
3CD5B	–	0.06	–	[4)]	[5)]	0.50	0.030	0.030
2CD6	–	0.08	–	[4)]	[5)]	0.50	0.040	0.040
3CD6	–	0.08	–	[4)]	[5)]	0.50	0.030	0.030
1CD8	–	0.10	–	[4)]	[5)]	0.60	0.070	0.060
2CD8	–	0.10	–	[4)]	[5)]	0.60	0.040	0.040
3CD8	–	0.10	–	[4)]	[5)]	0.60	0.030	0.030
2CD10	0.08	0.13	–	[4)]	[5)]	0.60	0.040	0.040
3CD10	0.08	0.13	–	[4)]	[5)]	0.60	0.030	0.030
2CD13A	0.10	0.15	–	[4)]	0.30	0.70	0.040	0.040
2CD13B	0.10	0.15	–	[4)]	0.60	1.00	0.040	0.040
3CD13A	0.10	0.15	–	[4)]	0.30	0.70	0.030	0.030
3CD13B	0.10	0.15	–	[4)]	0.60	1.00	0.030	0.030
2CD15	0.13	0.18	–	[4)]	0.30	0.60	0.040	0.040
3CD15	0.13	0.18	–	[4)]	0.30	0.60	0.030	0.030
2CD18A	0.15	0.20	–	[4)]	0.30	0.70	0.040	0.040
2CD18B	0.15	0.20	–	[4)]	0.60	1.00	0.040	0.040
3CD18A	0.15	0.20	–	[4)]	0.30	0.70	0.030	0.030
3CD18B	0.15	0.20	–	[4)]	0.60	1.00	0.030	0.030
2CD20	0.18	0.23	–	[4)]	0.30	0.60	0.040	0.040
3CD20	0.18	0.23	–	[4)]	0.30	0.60	0.030	0.030
2CD23A	0.20	0.25	0.10	0.35	0.30	0.70	0.040	0.040
2CD23B	0.20	0.25	0.10	0.35	0.60	1.00	0.040	0.040
3CD23A	0.20	0.25	0.10	0.35	0.30	0.70	0.030	0.030
3CD23B	0.20	0.25	0.10	0.35	0.60	1.00	0.030	0.030
2CD25	0.23	0.28	0.10	0.35	0.30	0.60	0.040	0.040
3CD25	0.23	0.28	0.10	0.35	0.30	0.60	0.030	0.030
2CD28A	0.25	0.30	0.10	0.35	0.30	0.70	0.040	0.040
2CD28B	0.25	0.30	0.10	0.35	0.60	1.00	0.040	0.040
3CD28A	0.25	0.30	0.10	0.35	0.30	0.70	0.030	0.030
3CD28B	0.25	0.30	0.10	0.35	0.60	1.00	0.030	0.030
2CD30	0.28	0.33	0.10	0.35	0.30	0.60	0.040	0.040
3CD30	0.28	0.33	0.10	0.35	0.30	0.60	0.030	0.030
2CD33A	0.30	0.35	0.10	0.35	0.30	0.70	0.040	0.040
2CD33B	0.30	0.35	0.10	0.35	0.60	1.00	0.040	0.040
3CD33A	0.30	0.35	0.10	0.35	0.30	0.70	0.030	0.030
3CD33B	0.30	0.35	0.10	0.35	0.60	1.00	0.030	0.030
2CD35A	0.33	0.38	0.10	0.35	0.30	0.70	0.040	0.040
2CD35B	0.33	0.38	0.10	0.35	0.60	1.00	0.040	0.040
3CD35A	0.33	0.38	0.10	0.35	0.30	0.70	0.030	0.030
3CD35B	0.33	0.38	0.10	0.35	0.60	1.00	0.030	0.030
2CD38A	0.35	0.40	0.10	0.35	0.30	0.70	0.040	0.040
2CD38B	0.35	0.40	0.10	0.35	0.60	1.00	0.040	0.040
3CD38A	0.35	0.40	0.10	0.35	0.30	0.70	0.030	0.030
3CD38B	0.35	0.40	0.10	0.35	0.60	1.00	0.030	0.030
2CD40A	0.38	0.43	0.10	0.35	0.30	0.70	0.040	0.040
2CD40B	0.38	0.43	0.10	0.35	0.60	1.00	0.040	0.040
3CD40A	0.38	0.43	0.10	0.35	0.30	0.70	0.030	0.030
3CD40B	0.38	0.43	0.10	0.35	0.30	1.00	0.030	0.030
2CD43A	0.40	0.45	0.10	0.35	0.30	0.70	0.040	0.040
2CD43B	0.40	0.45	0.10	0.35	0.60	1.00	0.040	0.040
3CD43A	0.40	0.45	0.10	0.35	0.30	0.70	0.030	0.030
3CD43B	0.40	0.45	0.10	0.35	0.60	1.00	0.030	0.030
2CD45A	0.43	0.48	0.10	0.35	0.30	0.70	0.040	0.040
2CD45B	0.43	0.48	0.10	0.35	0.60	1.00	0.040	0.040
3CD45A	0.43	0.48	0.10	0.35	0.30	0.70	0.030	0.030
3CD45B	0.43	0.48	0.10	0.35	0.60	1.00	0.030	0.030

Table 1 — Chemical composition (cast analysis)[1),2)], % (*m*/*m*) (*continued*)

Designation	C		Si		Mn[3)]		P	S
	min.	max.	min.	max.	min.	max.	max.	max.
2CD48A	0,45	0,50	0,10	0,35	0,30	0,70	0,040	0,040
2CD48B	0,45	0,50	0,10	0,35	0,60	1,00	0,040	0,040
3CD48A	0,45	0,50	0,10	0,35	0,30	0,70	0,030	0,030
3CD48B	0,45	0,50	0,10	0,35	0,60	1,00	0,030	0,030
2CD50A	0,48	0,53	0,10	0,35	0,30	0,70	0,040	0,040
2CD50B	0,48	0,53	0,10	0,35	0,60	1,00	0,040	0,040
3CD50A	0,48	0,53	0,10	0,35	0,30	0,70	0,030	0,030
3CD50B	0,48	0,53	0,10	0,35	0,60	1,00	0,030	0,030
2CD53A	0,50	0,55	0,10	0,35	0,30	0,70	0,040	0,040
2CD53B	0,50	0,55	0,10	0,35	0,60	1,00	0,040	0,040
3CD53A	0,50	0,55	0,10	0,35	0,30	0,70	0,030	0,030
3CD53B	0,50	0,55	0,10	0,35	0,60	1,00	0,030	0,030
2CD55A	0,53	0,58	0,10	0,35	0,30	0,70	0,040	0,040
2CD55B	0,53	0,58	0,10	0,35	0,60	1,00	0,040	0,040
3CD55A	0,53	0,58	0,10	0,35	0,30	0,70	0,030	0,030
3CD55B	0,53	0,58	0,10	0,35	0,60	1,00	0,030	0,030
2CD58A	0,55	0,60	0,10	0,35	0,30	0,70	0,040	0,040
2CD58B	0,55	0,60	0,10	0,35	0,60	1,00	0,040	0,040
3CD58A	0,55	0,60	0,10	0,35	0,30	0,70	0,030	0,030
3CD58B	0,55	0,60	0,10	0,35	0,60	1,00	0,030	0,030
2CD60A	0,58	0,63	0,10	0,35	0,30	0,70	0,040	0,040
2CD60B	0,58	0,63	0,10	0,35	0,60	1,00	0,040	0,040
3CD60A	0,58	0,63	0,10	0,35	0,30	0,70	0,030	0,030
3CD60B	0,58	0,63	0,10	0,35	0,60	1,00	0,030	0,030
2CD63A	0,60	0,65	0,10	0,35	0,30	0,70	0,040	0,040
2CD63B	0,60	0,65	0,10	0,35	0,60	1,00	0,040	0,040
3CD63A	0,60	0,65	0,10	0,35	0,30	0,70	0,030	0,030
3CD63B	0,60	0,65	0,10	0,35	0,60	1,00	0,030	0,030
2CD65A	0,63	0,68	0,10	0,35	0,30	0,70	0,040	0,040
2CD65B	0,63	0,68	0,10	0,35	0,60	1,00	0,040	0,040
3CD65A	0,63	0,68	0,10	0,35	0,30	0,70	0,030	0,030
3CD65B	0,63	0,68	0,10	0,35	0,60	1,00	0,030	0,030
2CD68A	0,65	0,70	0,10	0,35	0,30	0,70	0,040	0,040
2CD68B	0,65	0,70	0,10	0,35	0,60	1,00	0,040	0,040
3CD68A	0,65	0,70	0,10	0,35	0,30	0,70	0,030	0,030
3CD68B	0,65	0,70	0,10	0,35	0,60	1,00	0,030	0,030
2CD70A	0,68	0,73	0,10	0,35	0,30	0,70	0,040	0,040
2CD70B	0,68	0,73	0,10	0,35	0,60	1,00	0,040	0,040
3CD70A	0,68	0,73	0,10	0,35	0,30	0,70	0,030	0,030
3CD70B	0,68	0,73	0,10	0,35	0,60	1,00	0,030	0,030
2CD73A	0,70	0,75	0,10	0,35	0,30	0,70	0,040	0,040
2CD73B	0,70	0,75	0,10	0,35	0,60	1,00	0,040	0,040
3CD73A	0,70	0,75	0,10	0,35	0,30	0,70	0,030	0,030
3CD73B	0,70	0,75	0,10	0,35	0,60	1,00	0,030	0,030
2CD75A	0,73	0,78	0,10	0,35	0,30	0,70	0,040	0,040
2CD75B	0,73	0,78	0,10	0,35	0,60	1,00	0,040	0,040
3CD75A	0,73	0,78	0,10	0,35	0,30	0,70	0,030	0,030
3CD75B	0,73	0,78	0,10	0,35	0,60	1,00	0,030	0,030
2CD78A	0,75	0,80	0,10	0,35	0,30	0,70	0,040	0,040
2CD78B	0,75	0,80	0,10	0,35	0,60	1,00	0,040	0,040
3CD78A	0,75	0,80	0,10	0,35	0,30	0,70	0,030	0,030
3CD78B	0,75	0,80	0,10	0,35	0,60	1,00	0,030	0,030
2CD80A	0,78	0,83	0,10	0,35	0,30	0,70	0,040	0,040
2CD80B	0,78	0,83	0,10	0,35	0,60	1,00	0,040	0,040
3CD80A	0,78	0,83	0,10	0,35	0,30	0,70	0,030	0,030
3CD80B	0,78	0,83	0,10	0,35	0,60	1,00	0,030	0,030
2CD83A	0,80	0,85	0,10	0,35	0,30	0,70	0,040	0,040
2CD83B	0,80	0,85	0,10	0,35	0,60	1,00	0,040	0,040
3CD83A	0,80	0,85	0,10	0,35	0,30	0,70	0,030	0,030
3CD83B	0,80	0,85	0,10	0,35	0,60	1,00	0,030	0,030

Table 1 — Chemical composition (cast analysis)[1),2)], % (m/m) (*concluded*)

Designation	C		Si		Mn[3)]		P	S
	min.	max.	min.	max.	min.	max.	max.	max.
2CD85A	0,83	0,88	0,10	0,35	0,30	0,70	0,040	0,040
2CD85B	0,83	0,88	0,10	0,35	0,60	1,00	0,040	0,040
3CD85A	0,83	0,88	0,10	0,35	0,30	0,70	0,030	0,030
3CD85B	0,83	0,88	0,10	0,35	0,60	1,00	0,030	0,030
2CD88A	0,85	0,90	0,10	0,35	0,30	0,70	0,040	0,040
2CD88B	0,85	0,90	0,10	0,35	0,60	1,00	0,040	0,040
3CD88A	0,85	0,90	0,10	0,35	0,30	0,70	0,030	0,030
3CD88B	0,85	0,90	0,10	0,35	0,60	1,00	0,030	0,030
2CD95A	0,90	0,99	0,10	0,35	0,30	0,70	0,040	0,040
2CD95B	0,90	0,99	0,10	0,35	0,60	1,00	0,040	0,040
3CD95A	0,90	0,99	0,10	0,35	0,30	0,70	0,030	0,030
3CD95B	0,90	0,99	0,10	0,35	0,60	1,00	0,030	0,030

1) Elements not quoted in the table shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purposes of finishing the heat.

2) Copper, nickel and chromium may be restricted and this shall be agreed upon at the time of enquiry and order.

3) For quality steels 2CD15 to 2CD95 and for all special steels (3CDXX), a higher manganese content may be agreed upon at the time of enquiry and order.

4) For rimmed steels, silicon 0,05 % (m/m) max; for killed and semi-killed steels, silicon 0,35 % (m/m) max.

5) Manganese minimum may be subject to agreement at the time of enquiry and order.

Table 2 — Product analysis for fully killed steels

Element	Limit or maximum of specified range % (m/m)	Tolerances over maximum limit or under minimum limit[1)] % (m/m)
Carbon	Up to and including 0,55 Over 0,55	0,03 0,04
Silicon	Up to and including 0,35	0,03
Manganese	Up to and including 1,00 Over 1,00	0,04 0,06
Phosphorus	Up to and including 0,040	0,008
Sulfur	Up to and including 0,040	0,008

1) The deviations apply either above or below the specified limit of the range given for cast analysis but not both above and below for the same element from different sample products from the same cast. When maxima only are specified, the deviations are positive only.

Table 3 — Maximum permissible defect depths

Nominal diameter d mm		Maximum permissible depth of defect[1)] mm		
From	Up to and including	Level 1	Level 2	Level 3
5	30	0,25 + 0,01 d	0,15 + 0,01 d	0,05 + 0,01 d

1) See the note to 6.3.2.1.