



SLOVENSKI STANDARD
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Nerjavna jekla - 2. del: Tehnični dobavni pogoji za korozijsko odporne pločevine in trakove za splošno uporabo

Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes

Nichtrostende Stähle - Teil 2: Technische Lieferbedingungen für Blech und Band aus korrosionsbeständigen Stählen für allgemeine Verwendung

Aciers inoxydables - Partie 2: Conditions techniques de livraison des tôles et bandes en acier de résistance à la corrosion pour usage général

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ICS:

77.140.20	Visokokakovostna jekla	Stainless steels
77.140.50	Ploščati jekleni izdelki in polizdelki	Flat steel products and semi-products

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English Version

Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes

Aciers inoxydables - Partie 2: Conditions techniques de livraison des tôles et bandes en acier de résistance à la corrosion pour usage général

Nichtrostende Stähle - Teil 2: Technische Lieferbedingungen für Blech und Band aus korrosionsbeständigen Stählen für allgemeine Verwendung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 459/SC 5.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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 CEN-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 10088-2:2021) has been prepared by Technical Committee CEN/TC 459/SC 5 “Steels for heat treatment, alloy steels, free-cutting steels and stainless steels”, stainless steels, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 10088-2:2014.

In comparison with the previous edition, the following technical modifications have been made:

- addition of austenitic grade 1.4382, 1.4682, 1.4420, 1.4678, austenitic-ferritic grade 1.4637, ferritic grade 1.4622, martensitic grade 1.4060.

EN 10088, under the general title *Stainless steels*, consists of the following parts:

- *Part 1: List of stainless steels* (including a table of European Standards, in which these stainless steels are further specified, see Annex B);
- *Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resistant steels for general purposes;*
- *Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resistant steels for general purposes;*
- *Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes;*
- *Part 5: Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes.*

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prEN 10088-2:2021 (E)**Introduction**

The European Committee for Standardization (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents applied to seven steel grades.

CEN takes no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have ensured CEN that they are willing to negotiate licenses, under reasonable and non-discriminatory terms and conditions, with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with CEN. Information may be obtained from:

Grade 1.4637, 1.4662

Outokumpu Stainless AB
SE-77480 Avesta, Sweden

Grade 1.4420, 1.4622

Outokumpu Oyj
FI-00180, Helsinki, Salmisaarenranta 11, Finland

Grade 1.4062

Ugitech
F-73403 Ugine Cedex, France

Grade 1.4062

Industeel
F-71200 Creusot, 56 Rue Clemenceau, France

Grade 1.4646, 1.4611, 1.4613

Acciai Speciali Terni
I-05100 Terni, Italy

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. CEN shall not be held responsible for identifying any or all such patent rights.

1 Scope

This document specifies the technical delivery conditions for hot or cold rolled sheet/plate and strip of standard grades and special grades of corrosion resistant stainless steels for general purposes.

NOTE General purposes include the use of stainless steels in contact with foodstuffs.

The general technical delivery conditions specified in EN 10021 apply in addition to the specifications of this document, unless otherwise specified in document.

This document does not apply to components manufactured by further processing of the product forms listed above with quality characteristics altered as a result of such further processing.

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.

EN 10021, *General technical delivery conditions for steel products*

EN 10027-1, *Designation systems for steels — Part 1: Steel names*

EN 10027-2, *Designation systems for steels — Part 2: Numerical system*

EN 10079:2007, *Definition of steel products*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

EN 10163-2, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 2: Plate and wide flats*

EN 10168, *Steel products — Inspection documents — List of information and description*

EN 10204, *Metallic products — Types of inspection documents*

EN 10307, *Non-destructive testing — Ultrasonic testing of austenitic and austenitic-ferritic stainless steels flat products of thickness equal to or greater than 6 mm (reflection method)*

EN ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1)*

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing (ISO 377)*

EN ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid (ISO 3651-2)*

EN ISO 4885, *Ferrous materials — Heat treatments — Vocabulary (ISO 4885)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1)*

EN ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1)*

EN ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (ISO 6508-1)*

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EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1)*

EN ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature (ISO 6892-2)*

EN ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition (ISO 14284)*

3 Terms and definitions

For the purposes of this document, the terms and definitions regarding types of heat-treatment in EN ISO 4885 and regarding product forms in EN 10079:2007 and the following apply.

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

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

3.1**stainless steels**

steels with at least 10,5 % of chromium and maximum 1,20 % of carbon

[SOURCE: EN 10020:2000, 3.2.2]

Note 1 to entry: Stainless steels are further subdivided in accordance with their main property into corrosion resistant steels, heat resistant steels and creep resistant steels.

Note 2 to entry: One type steel in Table 7 in prEN 10088-1:2021 and five types of steel in Table 9 in prEN 10088-1:2021 contain less chromium than the minimum defined for stainless steels, but are included in the heat- resistant and creep- resistant steels standards respectively, because they form a part of these two families of steels.

3.2**corrosion resistant steels**

steels with at least 10,5 % Cr and max. 1,20 % C if their resistance to corrosion is of primary importance

3.3**general purposes**

purposes other than the special purposes referred to in the Bibliography

3.4**standard grades**

grades with a relatively good availability and a wider range of application

3.5**special grades**

grades for special use and/or with limited availability

4 Designation and ordering

4.1 Designation of steel grades

The steel names and steel numbers (see Tables 1 to 4) were formed in accordance with EN 10027-1 and EN 10027-2 respectively.

A complete overview of all grades that are in this document is given in Annex A.

4.2 Designation to be used on ordering

The complete designation for ordering a product according to this document shall contain the following information:

- desired quantity;
- product form (strip or sheet/plate);
- where an appropriate dimensional standard is available (see Annex B) the number of the standard, plus any choice of requirements;
- if there is no dimensional standard, the nominal dimensions and tolerances required;
- type of material (steel);
- number of this document;
- steel name or steel number;
- if for the relevant steel in the table for the mechanical properties more than one treatment condition is covered, the symbol for the desired heat treatment or cold worked condition;
- desired process route (see symbols in Table 6);
- if a verification of internal soundness is required, flat products with thickness ≥ 6 mm shall be tested in accordance with EN 10307;
- any additional optional tests or inspections (see 7.2.3 d));
- standard designation for a test report 2.2 or, if required, any other type of inspection document in accordance with EN 10204 (see 7.2.1).

EXAMPLE 10 plates according to EN ISO 18286 with thickness = 8 mm, width = 2 000 mm, length = 5 000 mm; tolerances on width and length class B, flatness tolerance class N made of steel EN 10088-2 with the name X5CrNi18-10 and the number 1.4301 in process route 1D (see Table 6), inspection certificate 3.1 as specified in EN 10204:

10 plates EN ISO 18286 —, 8 × 2000 × 5000 B
Steel EN 10088-2 — X5CrNi18-10+1D
EN 10204 — 3.1

or

10 plates EN ISO 18286 —, 8 × 2000 × 5000 B
Steel EN 10088-2 — 1.4301+1D
EN 10204 — 3.1

prEN 10088-2:2021 (E)**5 Classification of grades**

Steels covered in this document are classified according to their structure into:

- austenitic steels,
- austenitic-ferritic steels,
- ferritic steels,
- martensitic steels,
- precipitation hardening steels.

See also prEN 10088-1:2021, Annex C.

6 Requirements**6.1 Steelmaking process**

Unless a special steelmaking process is agreed at the time of enquiry and order, the steelmaking process for steels conforming to this document shall be at the discretion of the manufacturer.

6.2 Delivery condition

The products shall be supplied in the delivery condition agreed at the time of enquiry and order by reference to the process route given in Table 6 and, where different alternatives exist, to the treatment conditions given in Tables 7 to 11, 17 and 18 (see also Annex B).

6.3 Chemical composition

6.3.1 The chemical composition requirements given in Tables 1 to 4 apply with respect to the chemical composition according to the cast analysis.

6.3.2 The product analysis may deviate from the limiting values for the cast analysis given in Tables 1 to 4 by the values listed in Table 5.

6.4 Chemical corrosion properties

Referring to resistance to intergranular corrosion as defined in EN ISO 3651-2, for austenitic and austenitic-ferritic and ferritic steels the specification in Tables 7 to 9 applies.

NOTE 1 EN ISO 3651-2 is not applicable for testing martensitic and precipitation hardening steels.

NOTE 2 The corrosion resistance of stainless steels is very dependent on the type of environment and can therefore not always be clearly ascertained through laboratory tests. It is therefore advisable to draw on the available experience of the use of the steels.

6.5 Mechanical properties

6.5.1 The mechanical properties at room temperature as specified in Tables 7 to 11 apply for the relevant specified heat treatment condition. This does not apply to the process route 1U (hot rolled, not heat treated, not descaled).

If by agreement at the time of ordering the products shall be supplied in a non-heat-treated condition, the mechanical properties specified in Tables 7 to 11 shall be obtained from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

For the process route 1M and 2M for patterned finish the mechanical properties specified in Tables 7 to 11 do also not apply. In this case agreements shall be made at the time of enquiry and order, e.g. performing a bend test according to EN ISO 7438.

For cold worked products, the tensile strength levels at ambient temperature as specified in Table 17 apply. The available tensile strength levels in the cold worked condition are indicated in Table 19.

Alternatively, cold worked products can be ordered according to their 0,2 % proof strength as given in Tables 18 and 20.

NOTE Austenitic steels are insensitive to brittle fracture in the solution annealed condition. As they do not have a pronounced transition temperature, which is characteristic of other steels, they are also useful for application at cryogenic temperatures.

6.5.2 The values in Tables 12 to 16 apply for the 0,2 %- and 1 % proof strength at elevated temperatures.

6.6 Surface quality

Slight surface imperfections, inherent in the rolling process, are permitted.

When products are delivered in coil form, the degree and extent of such imperfections may be expected to be greater, due to the impracticability of removing short lengths of coil. For hot-rolled quarto-plates (symbol P in Tables 7 to 11), the requirements in EN 10163-2, class A2, apply unless otherwise agreed. For other products, where necessary, more precise requirements on surface quality may be agreed at the time of enquiry and order.

Products delivered with hot-rolled or cold-rolled finishes (see Table 6) shall, unless otherwise agreed, be supplied with only one surface inspected to the required finish (the prime surface). In such instances, the manufacturer should indicate the prime surface, by marking the material or the packaging, or by some other agreed method. The default method is to mark the prime surface, and to make this surface the top surface of plates, sheets and cut lengths, or the outside surface of coiled products.

6.7 Internal soundness

The products shall be free of internal defects which would exclude them from being used for their usual purpose. Ultrasonic testing of austenitic and austenitic-ferritic stainless steel flat products ≥ 6 mm may be agreed at the time of enquiry and order in accordance with EN 10307.

6.8 Formability at room temperature

Cold formability may be verified by elongation in the tensile test.

6.9 Dimensions and tolerances on dimensions and shape

The dimensions and the tolerances on dimensions and shape shall be agreed at the time of enquiry and order, as far as possible with reference to the dimensional standards listed in Annex B. EN ISO 18286 shall normally only be applied for product form P (individually rolled plates, "quarto plates") and not for product form H (continuously rolled strip and plate), for which EN ISO 9444-2 shall be applied. When applying EN ISO 18286, tolerances on width and length class A shall apply, unless specifically agreed otherwise at the time of enquiry and order.

6.10 Calculation of mass and tolerances on mass

6.10.1 When calculating the nominal mass from the nominal dimensions the values given in EN 10088-1 shall be used as a basis for the density of the steel concerned.

6.10.2 If the tolerances on mass are not specified in the dimensional standard listed in Annex B, they may be agreed at the time of enquiry and order.

prEN 10088-2:2021 (E)**7 Inspection and testing****7.1 General**

The appropriate process control, inspection and testing shall be carried out to ensure that the product complies with the requirements of the order.

This includes the following:

- suitable frequency of verification of the dimensions of the products;
- adequate intensity of visual examination of the surface quality of the products;
- appropriate frequency and type of test to ensure that the correct grade of steel is used.

The nature and frequency of these verifications, examinations and tests is determined in the light of the degree of consistency that has been determined by the evidence of the quality system. In view of this, verifications by specific tests for these requirements are not necessary unless otherwise agreed.

7.2 Agreement on tests and inspection documents

7.2.1 Products complying with this document shall be ordered and delivered with one of the inspection documents as specified in EN 10204. The type of document shall be agreed upon at the time of enquiry and order. If the order does not contain any specification of this type, a test report 2.2 shall be issued.

7.2.2 If it is agreed to issue a test report 2.2 in accordance with EN 10204 it shall indicate the following information:

- a) information groups A, B and Z of EN 10168;
- b) results of the cast analysis in accordance with Table 1 to 4 with code numbers C71 to C92 in EN 10168.

7.2.3 If the issuing of an inspection certificate 3.1 or 3.2 according to EN 10204 has been agreed, specific inspections according to 7.3 shall be carried out and the following information shall be given in the inspection document with the code numbers and details required by EN 10168:

- a) under 7.2.2 a);
- b) under 7.2.2 b);
- c) results of the mandatory tests in Table 21, second column, by “m”;
- d) results of any optional tests or inspections agreed at the time of enquiry and order.

7.3 Specific inspection and testing**7.3.1 Extent of testing**

The tests to be carried out, either mandatorily (m) or by agreement (o) and the composition and size of the test units, and the number of sample products, samples and test pieces to be taken are given in Table 21.

7.3.2 Selection and preparation of samples and test pieces

7.3.2.1 Sampling and sample preparation shall be in accordance with the requirements of EN ISO 14284 and EN ISO 377. In addition, the stipulations in 7.3.2.2 apply for the mechanical tests.

7.3.2.2 The test samples for the tensile test shall be taken in accordance with Table 23 in such a way that they are located halfway between the centre and a longitudinal edge. If it has been agreed that impact tests shall be carried out, the test samples shall be taken from the same location.

The samples shall be taken from products in the delivery condition. If agreed, the samples may be taken before flattening. For samples to be given a simulated heat treatment the conditions for annealing, hardening and tempering shall be agreed.

7.3.2.3 Samples for the hardness test and for the resistance to intergranular corrosion test, where requested, shall be taken from the same locations as those for the mechanical tests. For direction of bending the test piece in the resistance to intergranular corrosion test, see Figure 1.

7.4 Test methods

7.4.1 The chemical analysis shall be carried out using appropriate European Standards. The choice of a suitable physical or chemical analytical method for the analysis shall be at the discretion of the manufacturer. The manufacturer shall declare the test method used if required.

NOTE The list of available European Standards on chemical analysis is given in CEN/TR 10261.

7.4.2 The tensile test at room temperature shall be carried out in accordance with EN ISO 6892-1 taking into account the additional or deviating conditions specified in Table 23, footnote a.

The tensile strength, elongation, after fracture and the 0,2 % proof strength shall be determined. In addition, for austenitic steels only, the 1 %-proof strength shall be determined.

7.4.3 If a tensile test at elevated temperature has been ordered, this shall be carried out in accordance with EN ISO 6892-2. If the proof strength shall be verified, the 0,2 %-proof strength shall be determined, for ferritic, martensitic, precipitation hardening and austenitic-ferritic steels. In the case of austenitic steels, the 0,2 %- and the 1 %-proof strength shall be determined.

7.4.4 If an impact test has been ordered, it shall be carried out in accordance with EN ISO 148-1 on test pieces with a V-notch. The impact test shall be performed according to EN ISO 148-1 with a striker radius of 2 mm (KV₂). The average obtained from three test pieces is considered to be the test result (see also EN 10021).

7.4.5 The Brinell hardness test shall be carried out in accordance with EN ISO 6506-1, the Rockwell hardness test in accordance with EN ISO 6508-1, and the Vickers hardness test in accordance with EN ISO 6507-1.

7.4.6 The resistance to intergranular corrosion shall be tested in accordance with EN ISO 3651-2.

7.4.7 Dimensions and dimensional tolerances of the products shall be tested in accordance with the requirements of the relevant dimensional standards, where available.

7.5 Retests

See EN 10021.

8 Marking

8.1 Unless otherwise agreed in the order, with the exception mentioned in 8.4, each product shall be marked with the information given in Table 22.

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8.2 Unless otherwise agreed the method of marking and the material of marking in accordance to 8.1 shall be at the option of the manufacturer.

Its quality shall be such that it shall be durable for at least one year in unheated storage under cover. Corrosion resistance of the product shall not be impaired by the marking.

8.3 One surface of the product shall be marked. This will normally be the prime surface of products, where only one surface is guaranteed to the required standard.

8.4 As an alternative, for items that are wrapped, bundled or boxed, or where the surface is ground or polished, the marking may be applied to the packaging, or to a tag securely attached to it.

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Table 1 — Chemical composition (cast analysis) of austenitic corrosion resistant steels

Steel designation		% by mass ^a										
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu	Others
Standard grades												
X2CrNi18-7	1.4318	0,030	1,00	2,00	0,045	0,015	16,5 to 18,5	-	6,0 to 8,0	0,10 to 0,20	-	-
X4CrNiCu18-7	1.4382	0,05	1,00	2,00	0,045	0,015	17,0 to 19,0	-	6,0 to 8,0	0,050 to 0,15	0,50 to 2,00	-
X10CrNi18-8	1.4310	0,030 to 0,15	2,00	2,00	0,045	0,015	16,0 to 19,0	0,80	6,0 to 9,5	0,10	- ^c	-
X2CrNi18-9	1.4307	0,030	1,00	2,00	0,045	0,015 ^b	17,5 to 19,5	-	8,0 to 10,5	0,10	-	-
X8CrNiS18-9	1.4305	0,10	1,00	2,00	0,045	0,15 to 0,35	17,0 to 19,0	-	8,0 to 10,0	0,10	1,00	-
X2CrNi18-10	1.4311	0,030	1,00	2,00	0,045	0,015 ^b	17,5 to 19,5	-	8,5 to 11,5	0,12 to 0,22	-	-
X5CrNi18-10	1.4301	0,07	1,00	2,00	0,045	0,015 ^b	17,5 to 19,5	-	8,0 to 10,5	0,10	-	-
X6CrNiTi18-10	1.4541	0,08	1,00	2,00	0,045	0,015 ^b	17,0 to 19,0	-	9,0 to 12,0	-	-	Ti: 5 × C to 0,70
X2CrNi19-11	1.4306	0,030	1,00	2,00	0,045	0,015 ^b	18,0 to 20,0	-	10,0 to 12,0	0,10	-	-
X4CrNi18-12	1.4303	0,06	1,00	2,00	0,045	0,015 ^b	17,0 to 19,0	-	11,0 to 13,0	0,10	-	-
X2CrNiMoN17-11-2	1.4406	0,030	1,00	2,00	0,045	0,015 ^b	16,5 to 18,5	2,00 to 2,50	10,0 to 12,5	0,12 to 0,22	-	-
X2CrNiMo17-12-2	1.4404	0,030	1,00	2,00	0,045	0,015 ^b	16,5 to 18,5	2,00 to 3,00	10,0 to 13,0	0,10	-	-
X5CrNiMo17-12-2	1.4401	0,07	1,00	2,00	0,045	0,015 ^b	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	0,10	-	-
X6CrNiMoTi17-12-2	1.4571	0,08	1,00	2,00	0,045	0,015 ^b	16,5 to 18,5	2,00 to 2,50	10,5 to 13,5	-	-	Ti: 5 × C to 0,70
X2CrNiMoN21-9-1 *	1.4420 *	0,030	1,00	2,00	0,045 ^d	0,015	19,5 to 21,5	0,50 to 1,50	8,0 to 9,5	0,14 to 0,25	1,00	-
X2CrNiMo17-12-3	1.4432	0,030	1,00	2,00	0,045	0,015 ^b	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0	0,10	-	-
X2CrNiMo18-14-3	1.4435	0,030	1,00	2,00	0,045	0,015 ^b	17,0 to 19,0	2,50 to 3,00	12,5 to 15,0	0,10	-	-
X2CrNiMoN17-13-5	1.4439	0,030	1,00	2,00	0,045	0,015 ^b	16,5 to 18,5	4,0 to 5,0	12,5 to 14,5	0,12 to 0,22	-	-
X1NiCrMoCu25-20-5	1.4539	0,020	0,70	2,00	0,030	0,010	19,0 to 21,0	4,0 to 5,0	24,0 to 26,0	0,15	1,20 to 2,00	-