BRITISH STANDARD

BS EN
1715-1 : 1998

Aluminium and aluminium alloys — Drawing stock

Part 1. General requirements and technical conditions for inspection and delivery

The European Standard EN 1715-1 : 1997 has the status of a British Standard

ICS 77.150.10

National foreword

This British Standard is the English language version of EN 1715-1 : 1998.

The UK participation in its preparation was entrusted by Technical Committee NFE/35, Light metals and their alloys, to Subcommittee NFE/35/5, Wrought aluminium and aluminium alloys, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled 'International Standards Correspondence Index', or by using the 'Find' facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 10, an inside back cover and a back cover.

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English version

Aluminium and aluminium alloys — Drawing stock — Part 1: General requirements and technical conditions for inspection and delivery

Aluminium et alliages d'aluminium — Fil machine — Partie 1: Exigences générales et conditions techniques de contrôle et de livraison

Aluminium und Aluminiumlegierungen — Vordraht — Teil 1: Allgemeine Anforderungen und technische Lieferbedingungen

This European Standard was approved by CEN on 1997-08-21. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 132, Aluminium and aluminium alloys, the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 1998, and conflicting national standards shall be withdrawn at the latest by March 1998.

Within its programme of work, Technical Committee CEN/TC 132 entrusted CEN/TC 132/WG 4, Wires and drawing stock, to prepare the following standard:

EN 1715-1 *Aluminium and aluminium alloys — Drawing stock — Part 1 : General requirements and technical conditions for inspection and delivery*

This standard is part of a set of four standards. The other standards deal with:

EN 1715-2 *Aluminium and aluminium alloys — Drawing stock — Part 2 : Specific requirements for electrical applications*

EN 1715-3 *Aluminium and aluminium alloys — Drawing stock — Part 3 : Specific requirements for mechanical uses (excluding welding)*

EN 1715-4 *Aluminium and aluminium alloys — Drawing stock — Part 4 : Specific requirements for welding applications*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope

This part of EN 1715 specifies the general drawing stock characteristics to be satisfied by unalloyed aluminium and aluminium alloy drawing stock delivered in the form of coils with a unit weight ranging between 1 t and 3 t and obtained by common industrial processes.

It also specifies the technical conditions for inspection and delivery of these products.

These general characteristics and conditions apply to drawing stock intended for the following three main fields of application:

– electrical conductors of aluminium and aluminium alloys;

– wires for general mechanical uses;

– wires for brazing and welding.

The specific requirements to drawing stock for these applications are specified in parts 2, 3 and 4 of EN 1715.

It does not apply to wires which are drawn, but only to drawing stock which is produced by hot-working.

NOTE 1. Manufacture of drawing stock:

two main methods exist for the manufacture of drawing stock:

– continuously cast rod (CCR):

a section is cast continuously in the groove of a wheel, the groove being closed by an endless strip;

the solid and still hot section is rolled in a multistand rolling mill to the required diameter;

the drawing stock rod thus produced is wound continuously to form coils 1 t to 3 t in weight;

– hot rolled rod (HRR):

a wirebar of diameter 100 mm to 150 mm is heated and rolled to the required diameter;

the coils produced, weighing up to about 100 kg are butt welded together and wound to form coils with unit weight of 1 t to 3 t.

NOTE 2. It is also possible to obtain drawing stock by extrusion.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 515	*Aluminium and aluminium alloys — Wrought product — Temper designations*
EN 573-3	*Aluminium and aluminium alloys — Chemical composition and forms of wrought products — Part 3 : Chemical composition*
EN 573-4	*Aluminium and aluminium alloys — Chemical composition and forms of wrought products — Part 4 : Forms of product*
EN 10002-1	*Metallic materials — Tensile testing — Part 1 : Method of test (at ambient temperature)*
EN 10204	*Metallic products — Types of inspection documents*
EN 1715-2	*Aluminium and aluminium alloys — Drawing stock — Part 2 : Specific requirements for electrical applications*
EN 1715-3	*Aluminium and aluminium alloys — Drawing stock — Part 3 : Specific requirements for mechanical uses (excluding welding)*
EN 1715-4	*Aluminium and aluminium alloys — Drawing stock — Part 4 : Specific requirements for welding applications*

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 drawing stock

Intermediate wrought solid product manufactured by hot working with cross-section approximately circular along its entire length, delivered in coils and in a single length, and with a unit weight normally ranging between 1 t and 3 t.

3.2 cast

Quantity of liquid metal in the furnace that has simultaneously undergone the same treatment before continuously casting and rolling or casting into wirebar or extrusion ingot.

3.3 manufacturing batch

Quantity of final product produced from the same cast, during the same manufacturing run and treatment charge with the same temper and diameter.

3.4 delivery batch

Quantity of final product produced from the same cast, temper, diameter, and forming part of the same shipment.

4 Orders or tenders

The order or tender shall define the product in detail and shall contain the following information:

a) the type of product:
- – product identification: drawing stock;
- – designation of the aluminium grade or aluminium alloy in accordance with EN 573-3;
- – unit mass of the coil;

b) the dimensions expressed in millimetres:
- – nominal diameter of the drawing stock;
- – dimensions of coils;

c) the temper of the material for delivery in accordance with EN 515;

d) reference to the relevant parts of this standard;

e) quantity:
- – mass (in metric tons);
- – tolerances on quantity (if required);

f) any special requirement agreed between supplier and purchaser, for instance:
- – properties other than those specified in EN 1715-2, EN 1715-3 or EN 1715-4;
- – loose or tight winding;
- – surface protection;
- – special packaging;
- – special marking;
- – any requirement for certificates of conformity, test and/or analysis reports or inspection certificates.

EXAMPLE:

Drawing stock in EN-AW-6101, diameter 9,5 mm, T4 temper, unit mass 2 000 kg, coils with inner diameter 540 mm, height 850 mm, 50 t according to EN 1715-1 and EN 1715-2.

5 Requirements

5.1 Production and manufacturing processes

Unless otherwise specified in the order, the production and manufacturing processes shall be left to the discretion of the producer.

Unless it is explicitly stated in the order no obligation shall be placed on the producer to use the same processes for subsequent and similar orders.

In the case of special requirements it is recommended that trial quantities be produced to confirm that requirements are met.

5.2 Quality control

The producer shall be responsible for the performance of all inspection and tests required by the relevant European Standard and/or a particular specification, prior to shipment of the product. If the purchaser wishes to inspect the product at the producer's works, he shall notify the supplier at the time of placing the order.

The traceability of the products shall be provided at the producer's premises over a period to be agreed between the parties.

5.3 Families of aluminium and aluminium alloys used

Aluminium and aluminium alloys commonly used for the production of drawing stock are listed in table 1, together with their field of application which refers to the relevant part of this standard.

NOTE. The alloys are divided into two classes:
- – class A, alloys produced in large quantities in Europe;
- – class B, alloys corresponding to specific applications, limited to certain countries.

5.4 Technical specifications

Drawing stock covered by this standard shall meet the following general minimum requirements.

5.4.1 *Chemical composition*

Chemical composition shall be in accordance with EN 573-3.

If the purchaser requires tighter content limits of the specified elements or content limits for elements not specified in the above standard, these limits shall be stated on the order, after agreement between the supplier and the purchaser.

5.4.2 *Temper*

The choice of the temper of delivery of the alloy shall be the purchaser's responsibility. It is determined by the type of application.

The temper shall be specified in accordance with EN 515.

The usual tempers for drawing stock products shall be in accordance with EN 1715-2, EN 1715-3 and EN 1715-4.

If no temper is specified when ordering, then the temper F (as fabricated) shall be supplied.

5.4.3 *Internal quality and surface appearance*

The product shall be free of any defect detrimental to wire drawing and to subsequent uses.

The product shall be free of inclusions, cracks, blisters and shall have the surface as follows:
- – smooth;
- – no overfill or sharp edges;
- – no lapping or seaming;
- – no abnormal oxidation or cracked lubricant stains;
- – no foreign matter or dirt.

5.4.4 *Physical and mechanical properties (specified or typical)*

These are specific to each field of application, and are indicated for alloys of class A in the specific parts of this standard.

Properties others than those specified in EN 1715-2 or those indicated as typical in EN 1715-3 and EN 1715-4 may be provided after agreement between purchaser and supplier at the time of placing the order.

Table 1. Alloys list			
Alloy designation	**Mechanical uses** (see EN 1715-3)	**Welding applications** (see EN 1715-4)	**Electrical applications** (see EN 1715-2)
1 000 series			
EN AW-1098 [Al 99,98]	A	B	—
EN AW-1090 [Al 99,90]	B		—
EN AW-1080A [Al 99,8 (A)]	A	A	—
EN AW-1070A [Al 99,7]	A		
EN AW-1370 [E-Al 99,7]	—	—	A
EN AW-1050A [Al 99,5]	A	A	
EN AW-1350 [E-Al 99,5]	—	—	A
EN AW-1450 [Al 99,5Ti]	—	B	—
EN AW-1200 [Al 99,0]	B	—	—
2 000 series			
EN AW-2011 [Al Cu6BiPb]	A	—	—
EN AW-2014A [Al Cu4 SiMg (A)]	A	—	—
EN AW-2017A [Al Cu4 MgSi (A)]	A	—	—
EN AW-2117 [Al Cu2,5Mg]	A	—	—
EN AW-2319 [Al Cu6Mn (A)]		B	—
EN AW-2024 [Al Cu4Mg1]	A	—	—
EN AW-2030 [Al Cu4 PbMg]	B	—	—
3 000 series			
EN AW-3003 [Al Mn1Cu]	A	—	—
EN AW-3103 [Al Mn1]	A	B	—
4 000 series			
EN AW-4043A [Al Si5 (A)]	—	A	—
EN AW-4045 [Al Si10]	—	B	—
EN AW-4047A [Al Si12 (A)]	—	A	—
EN AW-4046 [Al Si10Mg]	—	B	—
5 000 series			
EN AW-5005 [Al Mg1 (B)]	B	—	—
EN AW-5305 [Al 99,85Mg1]	B	—	—
EN AW-5505 [Al 99,9Mg1]	B	—	—
EN AW-5110 [Al 99,85Mg0,5]	B	—	—
EN AW-5210 [Al 99,9Mg0,5]	B	—	—
EN AW-5018 [Al Mg3Mn0,4]	—	B	—
EN AW-5019 [Al Mg5]	A	—	—
EN AW-5119 [Al Mg5(A)]		B	
EN AW-5149 [Al Mg2Mn0,8(A)]		B	
EN AW-5249 [Al Mg2Mn0,8Zr]		B	
EN AW-5051A [Al Mg2(B)]	A		
EN AW-5251 [Al Mg2]	A		

Table 1. Alloys list *(continued)*

Alloy designation	**Mechanical uses** (see EN 1715-3)	**Welding applications** (see EN 1715-4)	**Electrical applications** (see EN 1715-2)
5 000 series			
EN AW-5052 [Al Mg2,5]	A		
EN AW-5154A [Al Mg3,5 (A)]	A	A	
EN AW-5354 [Al Mg2,5MnZr]		B	
EN AW-5554 [Al Mg3Mn(A)]		B	
EN AW-5654 [Al Mg3,5Cr]		B	
EN AW-5754 [Al Mg3]	A	A	
EN AW-5356 [Al Mg5Cr (A)]		A	
EN AW-5456A [Al Mg5Mn1 (A)]		B	
EN AW-5556A [Al Mg5Mn]		A	
EN AW-5082 [Al Mg4,5]	B		
EN AW-5183 [Al Mg4,5Mn0,7 (A)]		A	
EN AW-5086 [Al Mg4]	A		
EN AW-5087 [Al Mg4,5MnZr]		A	
6 000 series			
EN AW-6101 [E-AlMgSi]			A
EN AW-6201 [E-AlMg0,7Si]			A
EN AW-6401 [Al 99,9MgSi]	B		
EN AW-6012 [Al MgSiPb]	B		
EN AW-6060 [Al MgSi]	A		
EN AW-6061 [Al MgSiCu]	A		
EN AW-6063 [Al Mg0,7Si]	A		
EN AW-6082 [Al Si1MgMn]	A		
7 000 series			
EN AW-7020 [Al Zn4,5Mg1]	B		
EN AW-7050 [Al Zn6CuMgZr]	B		
EN AW-7075 [Al Zn5,5MgCu]	A		

5.4.5 ***Diameter and tolerances***

Drawing stock shall be supplied in accordance with the tolerances on diameter and circularity specified in table 2 for the different ranges of nominal diameter.

The nominal diameter shall be that agreed by supplier and purchaser and shall be specified on the order.

The diameter of a given sample shall be the mean value of two measurements made at right angles to each other at the same cross section.

Each supplier shall respect for all delivery batches the specified tolerance of ± 5 % around the nominal diameter specified on the order.

The deviation in circularity shall be taken as the difference between the minimum and maximum values obtained by measurement at the same cross section.

NOTE 1. Other nominal diameters (outside of these different ranges) can be agreed and can be covered by this standard after agreement between purchaser and supplier.

NOTE 2. The preferred diameters are those indicated as typical nominal diameter.

5.4.6 ***Coil dimensions and tolerances***

The drawing stock shall be delivered in coils of a single length with nominal unit mass M_o typically between 1 000 kg and 3 000 kg.

Coil dimensions for drawing stock shall be in accordance with table 3.

Other dimensions can be agreed (which may be the case especially for extruded drawing stock) after prior agreement between purchaser and supplier.

5.4.7 ***Recommended unit mass and tolerances***

Recommended unit mass for coils are:

1 000 kg, 1 200 kg, 1 500 kg, 1 800 kg, 2 000 kg, 2 200 kg, 2 500 kg, 3 000 kg.

The permissible tolerance on mass for each coil shall be ± 6 % of the nominal unit mass value agreed between manufacturer and purchaser.

Up to 10 % of the shipment can be supplied with coil unit mass down to 50 % of the nominal mass.

5.4.8 ***Coiling***

The standard condition for coiling shall be tightly wound.

The coils shall be cylindrical and shall be supplied with the inside end at the top for coils placed in the vertical axis.

In case of special requirement for unwinding direction (clockwise or anti-clockwise for coils placed in the vertical axis), this shall be stated in the order after agreement between supplier and purchaser.

In the case of heat treatable alloys delivered in the T4 temper, the drawing stock may be loosely wound because of the quenching treatment.

This type of coiling (loosely wound) shall be specified at the placing of the order or tender, if the thermal treatment is made by purchaser on coils delivered by supplier in the F condition.

5.4.9 ***Other requirements***

Other requirements agreed between purchaser and supplier may be specified when ordering.

For instance the drawing stock may be coated, if necessary, with anti-corrosion protection or an agent facilitating unwinding.

In this case, such coating shall not interfere with subsequent drawing operations.

Table 2. Tolerances on diameter and circularity

Dimensions in millimetres

Range of nominal diameter	Tolerance on nominal diameter %	Limit deviation in circularity %	Typical nominal diameter mm
7,0 up to 8,0	± 5	3	7,5
9,0 up to 10,0	± 5	3	9,5
11,0 up to 13,0	± 5	3	12,0
14,0 up to 16,0	± 5	3	15,0
18,5 up to 19,5	± 5	3	19,0
22,0 up to 26,0	± 5	3	24,0

NOTE. The range of nominal diameter given takes into account the different nominal diameters provided by different producers or between different industrial facilities.

Table 3. Dimensions and tolerances of coils

Dimensions in millimetres

	A	B	C
Inside diameter	540 ± 15	750 ± 15	750 ± 15
Outside diameter	1 600 maximum	1 600 maximum	1 600 maximum
Height	865 ± 30	850 ± 30	700 ± 30

6 Product inspection and test methods

6.1 Analysis of chemical composition

The analytical methods shall be at the discretion of the producer who shall use methods accepted at the European or international levels.

The producer shall have a quality assurance system which covers as a minimum the following:

– sampling (for each cast or batch);

– preparation of samples;

– analytical method;

– calibration of the equipment;

– expression of the analytical result.

The analytical samples shall be taken during casting, from the metal distribution system after all additions including the grain refiner (if any). At least three samples shall be taken for each cast. One sample shall be taken at the start of pouring, one approximately halfway through pouring, and one at the end.

When the analysis is carried out by emission spectrometry at least two determinations shall be made on each sample. The sample result shall be the arithmetic mean of the results of the determinations. The final result shall be the arithmetic mean of the results of the samples.

For cast acceptance, each sample shall meet the specified composition limits.

The producer shall determine and periodically check the analytical accuracy of each element analysed.

6.2 Thermal treatment control

The supplier shall take suitable measures to ensure the quality and consistency of thermal treatment if any, especially by process control, adoption of quality assurance procedures and adequate controls on products.

6.3 Mechanical properties

If the tensile testing is specified when ordering, it shall be performed in accordance with EN 10002-1 with the following additional requirement:

Only the values of tensile strength (R_m) and per cent elongation after break (A %) shall be reported, measured on a test specimen with an initial gauge length of 100 mm.

NOTE 1. Other gauge length can be used by agreement between supplier and purchaser.

NOTE 2. On a drawing stock of diameter more than 15 mm, it may be necessary to machine a test-specimen (to be specified at the time of placing the order).

Before determination of compliance, tensile strength values shall be rounded to the nearest 1 MPa in accordance with annex A.

6.4 Surface appearance

Visual inspection of surface appearance shall be carried out without the use of an auxiliary optical instrument (magnifying glass or binocular microscope), ensuring that the requirements of **5.4.3** are met.

6.5 Other tests

Other inspection and testing methods can be requested either in the case of specific standards (for instance electrical conductivity for drawing stock used in electrical applications EN 1715-2) or by agreement between supplier and purchaser.

7 Delivery documents and inspection documents

7.1 Certificate of mass and analysis

The supplier shall provide with each delivery a certificate of mass and analysis which shall contain the following information:

a) the name and address of the supplying company and the producer plant;

b) the name and address of the purchaser;

c) the description of the product in accordance with **4**a), b), c), d) and f);

d) the cast numbers, the number of coils per cast, for each cast, the actual analysis of the elements in the sequence specified by EN 573-3 (according to the requirements of specific standards EN 1715-2, EN 1715-3 or EN 1715-4;

e) total delivered net mass.

7.2 Inspection documents

7.2.1 *General*

If requested by the purchaser on the order, the supplier shall provide one or more of the following documents as applicable.

7.2.2 *Documents established on the basis of inspections and tests performed by qualified personnel who are involved in the manufacturing process and/or belong to the quality control department*

7.2.2.1 *Certificate of conformity*

Document by which the producer certifies that according to inspections and results of representative tests the products for delivery conform to the relevant standards and to the additional requirements in the order, if any.

7.2.2.2 *Test report*

Document by which the producer certifies that the products for delivery conform to the requirements specified on the order. This document details the results of the current production controls carried out on identical products made using the same method as the products for delivery but not necessarily on the products for delivery themselves.

7.2.2.3 *Specific test report*

Document by which the producer certifies that the products for delivery conform to the requirements specified on the order. This document details the chemical composition and the results of prescribed mechanical tests and of any other test specified on the order. It is established on the basis of tests carried out on specimens taken from among the products for delivery themselves. The delivery of such a certificate generally implies inspection tests on individual lots.

7.2.3 Documents established on the basis of inspections and tests performed or supervised by qualified personnel organizationally independent from the manufacturing department, according to the requirements specified on the order and carried out on the products for delivery or on the relevant inspection lot

Inspection certificates in accordance with EN 10204:

– '3.1.A': Certificate issued and validated by an inspector designated by the official regulations, in accordance with these and the corresponding technical rules;

– '3.1.B': Certificate issued by the department independent of the manufacturing process and validated by an authorized representative of the producer independent of the manufacturing department;

– '3.1.C': Certificate issued and validated by an authorized representative of the purchaser, in accordance with the specifications of the order.

8 Marking

Each coil shall be provided with a label indicating:

– name of supplying company;

– name of manufacturer and production plant;

– identification of the alloy;

– temper of delivery;

– nominal diameter of drawing stock;

– identification number of coil referring especially to the cast number;

– net mass of coil.

The label shall be weather resistant and resistant to sunlight. It shall be securely fixed to the coil.

The information on the label shall be unaffected by weather and sun light.

The label shall be visible from outside.

9 Packaging transport and storage

9.1 Packaging

The packaging of coils shall take into account the normal rules for safety during transportation and handling.

The standard form of delivery shall be with the vertical axis on a wooden pallet bound by a sufficient number of tight strips and with protection adapted to the mode of shipment, preventing any damage and preserving the metal from adverse weather and dirt.

The size and the design of the pallets shall be such that, during transport no surface damage can occur between adjacent coils.

Another type of packaging, with the presentation of the coil on a horizontal axis, shall be subject to special agreement between supplier and purchaser.

9.2 Transport and storage

The general conditions of transport and storage shall avoid any defect liable to prevent the subsequent processing of the metal.

The transport shall prevent ingress of water. The product shall be stored in a covered area and protected from sudden and wide variations in temperature, thus avoiding condensation, a potential source of corrosion and drawing difficulties.

These conditions shall also be met by the supplier (if different from the producer) and the purchaser, if these parties take responsibility for transport and/or storage.

10 Disputes

External and internal defects shall be liable to dispute only if they significantly affect the processing method or the quality of the finished product.

In case of a complaint about the quality, the purchaser shall give the supplier the opportunity to check the justification of his complaint.

Complaints about surface defects such as corrosion, dirt stains, shall be deemed inadmissible if the date of complaint is more than one year after the date of delivery.

In the case of a dispute over chemical composition, the purchaser shall supply a sample of the drawing stock and if possible a sample of the processed product to check the analysis.

The dispute can require recourse to an arbitration laboratory to perform any analyses. The supplier and purchaser shall agree to designate this laboratory and the analytical method employed.

Annex A (normative)

Rules for rounding

In recording test results, the number representing the result of a test to determine a given property shall be expressed to the same number of decimal places as the corresponding number in this standard, except for elongation values which shall be recorded with one more decimal place.

The following rounding rules shall be used for determination of compliance with this standard:

a) when the figure immediately after the last figure to be retained is less than five, the last figure to be retained remains unchanged;

b) when the figure immediately after the last figure to be retained is greater than five, or equal to five and followed by at least one figure other than zero, the last figure to be retained is increased by one;

c) when the figure immediately after the last figure to be retained is equal to five and followed by zeros only, the last figure to be retained remains unchanged if even and is increased by one if odd.

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