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Unalloyed aluminium ingots for remelting — Classification and composition

Aluminium non allié en lingots pour refusion — Classification et composition

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Foreword

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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 document 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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 4, *Unalloyed (refined) aluminium ingots*.

This second edition cancels and replaces the first edition (ISO 115:2003), which has been technically revised.

The main changes are as follows:

— five grades were added to Table 2.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Unalloyed aluminium ingots for remelting — Classification and composition

1 Scope

This document defines the requirements for grades of unalloyed aluminium ingots intended for remelting. It specifies the classification and designation applicable to these grades, the conditions in which they are produced, their properties and the marks by which they are identified.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Order

The order, in the form agreed upon between the supplier and the purchaser, shall contain the following information:

a) designation of the unalloyed aluminium in accordance with this document or the customer code after agreement between the supplier and the purchaser;

b) specification of the form of the products, including the mass and dimensions of individual ingots and bundles;

c) quantity: mass, in tonnes (quantity tolerances if required);

d) any requirements for certificates of conformity, test and/or analysis reports or inspection certificates;

e) any additional requirements agreed between the supplier and the purchaser.

5 Requirements

5.1 Production and manufacturing processes

The production and manufacturing processes shall be left to the discretion of the manufacturer.

No obligation shall be placed on the manufacturer to use the same processes for subsequent and similar orders.

5.2 Quality control

The supplier shall be responsible for carrying out all inspection and tests required by this document prior to shipment of the product. If the purchaser wishes to inspect the product at the supplier's works, the purchaser shall stipulate this at the time of placing the order.

5.3 Chemical composition

Each grade of unalloyed aluminium, including refined aluminium, with a specified minimum aluminium content shall be in accordance with the designations and chemical composition given in Table 1.

Each grade of unalloyed aluminium without a specified minimum aluminium content shall be in accordance with the designations and chemical compositions given in Table 2.

The compositions, except that for aluminium, shown in Table 1 and Table 2 are given in maximum mass fractions, in per cent.

For the interpretation of the results of chemical analysis, the number representing the result of the determination of an element content shall be rounded to the same number of decimal places as the corresponding number in this document.

The writing rules for designations and chemical compositions shall be applied in accordance with Annex A.

If the purchaser requires content limits for elements not specified in this document, these limits shall be stated on the order, after agreement between the supplier and the purchaser.

Table 1 — Unalloyed aluminium with specified minimum aluminium content — Chemical composition in maximum mass fractions

Designation	Si	Fe	Cu	Mn	Mg	Zn	Ti	Ga	V	Others each	Al min.
Al 99,995[a]	0,002 0	0,002 0	0,002 0	0,001	0,003 0	0,001	0,001	0,002	0,001	0,001	99,995
Al 99,990[a]	0,003 0	0,003 0	0,004 0	0,001	0,003 0	0,001	0,001	0,002	0,001	0,001	99,990
Al 99,99[a]	0,004 0	0,003 0	0,002 0	0,001	0,001 0	0,004	0,002	0,003 0	0,001	0,001	99,99
Al 99,98[a]	0,006	0,006	0,002 0	0,002	0,002	0,004	0,002	0,003	0,001	0,001	99,98
Al 99,97[a]	0,008	0,008	0,004	0,003	0,002	0,005	0,002	0,004	0,001	0,001	99,97
Al 99,94[a]	0,030	0,030	0,005	0,010	0,010	0,010	0,005	0,02	—	0,010	99,94
Al 99,70[a]	0,10	0,20	0,01	—	0,02	0,03	0,02	0,03	0,03	0,03	99,70
Al 99,7E[a, b]	0,07	0,20	0,01	0,005	0,02	0,04	—	—	—	0,03	99,70
Al 99,6E[a, c]	0,10	0,30	0,01	0,007	0,02	0,04	—	—	—	0,03	99,60

[a] Cd + Hg + Pb max. 0,009 5; As max. 0,009.

[b] B max. 0,04; Cr max. 0,004; Mn + Ti + Cr + V max. 0,020.

[c] B max. 0,04; Cr max. 0,005; Mn + Ti + Cr + V max. 0,030.

Table 2 — Unalloyed aluminium without specified minimum aluminium content — Chemical composition in maximum mass fractions

Designation	Si	Fe	Zn	Ga	V	Others each	Others total	Al
P0202A[a]	0,02	0,02	0,02	0,02	0,01	0,01	0,02	Remainder
P0304A[a]	0,03	0,04	0,03	0,03	0,01	0,01	0,02	Remainder
P0404A[a]	0,04	0,04	0,03	0,03	0,01	0,01	0,03	Remainder
P0406A[a]	0,04	0,06	0,03	0,03	0,02	0,02	0,04	Remainder
P0506A[a]	0,05	0,06	0,03	0,03	0,02	0,02	0,05	Remainder
P0608A[a]	0,06	0,08	0,03	0,03	0,02	0,02	0,05	Remainder
P0610A[a]	0,06	0,10	0,03	0,04	0,02	0,02	0,05	Remainder
P1020A[a]	0,10	0,20	0,03	0,04	0,03	0,03	0,10	Remainder
P1020G[a, b]	0,10	0,20	0,03	0,04	0,03	0,03	0,10	Remainder
P1520A[a]	0,15	0,20	0,03	0,04	0,03	0,03	0,10	Remainder
P1535A[a]	0,15	0,35	0,03	0,04	0,03	0,03	0,10	Remainder

[a] Cd + Hg + Pb max. 0,009 5; As max. 0,009.

[b] Mg max. 0,003; Na max. 0,001 0; Li max. 0,000 1.

5.4 Freedom from contamination and hazardous materials

The ingots shall be free from asbestos and other hazardous foreign materials and show no indication of increased radioactivity.

To a standard agreed between the supplier and the purchaser, the ingots shall be free from a) to c), if they are harmful in use:

a) visible surface conditions and contamination such as grease, dirt, products of corrosion, dross or any other foreign bodies including paint, apart from that which is approved for marking purposes;

b) metallic or non-metallic inclusions;

c) gas porosity.

The ingots may have shrinkage holes or cavities which can retain water. Ingots shall therefore be thoroughly dried and preheated by the purchaser before charging to a melting furnace, in order to reduce the risk of violent explosions.

5.5 Form of products

There are several possible shapes of ingots, e.g.:

— trapezoidal, which can be stacked;

NOTE This type of ingot can have one or more notches to enable it to be divided into pieces if required.

— T-bars, sows or other shapes.

The shape, the dimensions, the dimensional tolerances and the tolerances on unit masses of the individual ingots and bundles shall be defined by agreement between the supplier and the purchaser at the time of ordering.

6 Product inspection and testing methods

6.1 General

Sampling procedures and analytical tests shall be carried out in accordance with a relevant national analytical standard. The results shall be traceable to reference materials or certified reference materials (see ISO Guide 30). The accuracy of analytical procedures shall be verified.

The melt shall be clearly identified by means of a traceable number. The shape of the samples and the sampling conditions for chemical analysis shall be so designed that they are representative of the melt being cast. At least two analytical samples shall be taken, one from the beginning and one from the end of every melt. They shall be taken during casting, from the distribution system or directly from molten metal freshly poured into moulds.

Each analytical sample shall be suitably machined and, on analysis by emission spectrometry, shall be sparked at least twice. The result of the analysis shall be the arithmetic mean of the values obtained from the sparked samples.

Each sample shall meet the specified composition limits. The analysis of the melt shall be the arithmetic mean of the results of the analysis of all the samples taken from this melt.

The manufacturer shall determine and periodically check the analytical accuracy of each element analysed. The manufacturer shall be able to demonstrate the validity of the whole test procedure, including sampling, sample preparation and measurement.

Test reports shall be retained and retrievable for a minimum of three years.

The analytical method is at the discretion of the supplier, who shall use methods acceptable at international level.

6.2 Chemical analysis of main impurities

All analytical samples shall be analysed for the main impurities that are listed in Table 1 or Table 2. The analytical results shall be indicated on the analysis certificate.

6.3 Chemical analysis of trace impurities

The trace impurities are impurities not listed in Table 1 and Table 2. For the grades where maximum values of trace impurities are specified by footnotes, e.g. Cd, Hg, Pb, As, the supplier shall establish and maintain a quality plan which specifies the frequency of tests and the analytical procedure.

Small traces of Na and Li impurities can cause severe problems during casting and rolling and with the quality of some special products. Therefore, the producer of the ingots should carry out analyses for these elements and indicate the results (in mass fractions to four decimal places) on the analysis certificate. For these elements and for other impurities that can cause similar problems, closer limits than those in Table 2 may be specified by agreement between the supplier and the purchaser.

6.4 Sampling from ingots

Sampling from ingots is only appropriate when analytical data of samples from the melt, for example, of trace impurities, are not available. After agreement between the supplier and the purchaser, analytical data from samples taken from ingots may be used as an indication of the composition of the metal, provided that the data are averages from samples taken from different ingots of one melt at a large number of different positions within the ingots, according to a documented and justified sampling plan.

7 Inspection documents

The consignment shall be accompanied by an analysis certificate listing the results of the chemical analysis of the main impurities as specified in 6.2 and any other elements which have been requested in advance.

8 Marking of products

Each individual ingot shall be marked with the manufacturer's identity.

Unless otherwise indicated on the order, each bundle of ingots and each non-bundled ingot, such as a T-bar or sow, shall be marked with a) below, with the optional addition of b) and/or c):

a) the designation of the grade of unalloyed aluminium;

b) the melt number;

c) the unit mass.

The method of marking is left to the discretion of the supplier, but it shall be indelible and shall not be a source of contamination.

Each bundle of ingots or each non-bundled ingot, such as a T-bar or sow, shall carry a warning about the need for the purchaser to thoroughly dry and preheat the ingot before melting, as related to the need to remove entrapped water from shrinkage cracks and cavities.

9 Packaging

Small ingots shall be supplied in bundles suitable for stacking. The bundles shall be securely strapped in order to be handled without breakage.

If not otherwise agreed between supplier and purchaser, each bundle shall only consist of one melt.

10 Delivery documents

The delivery documents shall accompany the delivery and shall include:

a) the manufacturer's identity;

b) the order number;

c) the designation of the grade of unalloyed aluminium and of the form of the ingots;

d) the melt number(s);

e) the results of chemical analysis for all main impurities, i.e. those impurities for which specific limits are listed in Table 1 or Table 2, in the same sequence as given in the relevant tables, and other impurities as agreed between the supplier and the purchaser;

f) the unit and total mass.

11 Complaints

Chemical and physical anomalies can give rise to complaints if they affect the processing or the end use of the relevant finished products.

The purchaser shall enable the supplier to check the validity of the complaint. The purchaser shall provide one or more of the following:

— a piece of ingot showing the objectionable condition, with its complete identification;

— a specimen of the finished product, or an intermediate state, obtained from the metal in question, with all the details necessary for identification;

— an explanation of how or why the questioned condition is objectionable for the ingot or for the finished product;

— details of conditions of processing and inspection in the intermediate stages.

Annex A
(normative)

Rules for writing the designation and the chemical composition of unalloyed aluminium

A.1 Designation of unalloyed aluminium with specified minimum aluminium content

The designation for unalloyed aluminium for general application with specified minimum aluminium content shall consist of the international chemical symbol for the metal (Al) followed by the percentage purity expressed to two or three decimal places.

EXAMPLE 1 Al 99,98

EXAMPLE 2 Al 99,995

The symbol Al shall be separated from the percentage purity by a blank space.

The designation for unalloyed aluminium for electrotechnical applications shall consist of the international chemical symbol for the metal (Al) followed by the percentage purity expressed to one decimal place and the letter E.

EXAMPLE 3 Al 99,7E

The symbol Al shall be separated from the percentage purity by a blank space.

A.2 Designation of unalloyed aluminium without specified minimum aluminium content

This designation system shall consist of four-digit numerical designations prefixed by the letter P and suffixed by the letter A. The first two numerical digits, XX, shall indicate the two digits to the right of the decimal marker in the limit for maximum silicon, 0,XX. The last two remaining numerical digits, YY, shall indicate the two digits to the right of the decimal marker in the limit for maximum iron, 0,YY.

EXAMPLE P1020A

Variations in a basic unalloyed aluminium, i.e. having the same individual silicon and iron limits but having different individual limits for elements other than silicon and iron, shall be identified by substituting a serial letter in place of the letter A. The serial letters shall be assigned in alphabetical sequence starting with B but omitting I, O and Q.

Only those grades of unalloyed aluminium without a specified minimum aluminium content which have been registered at the International Registration Record for Unalloyed Aluminium by The Aluminum Association are included in Table 2.

A.3 Chemical composition of unalloyed aluminium with specified minimum aluminium content

The limits for impurities shall be expressed in mass fractions to the number of decimal places as specified in Table 1. The minimum aluminium content shall be specified.

The aluminium content for unalloyed aluminium with a specified minimum aluminium content shall be the difference between 100 % and the sum of all other metallic elements present in amounts of 0,001 0 % or more each, expressed to the third decimal place before determining the sum, which shall be rounded to the number of decimal places given in Table 1 (second or third decimal place), before subtracting.