

Alumínium és alumíniumötvözetek. Ötvözött alumíniumtömb. Követelmények

Az MSZ EN 1676:1999 helyett.

Aluminium and aluminium alloys. Alloyed ingots for remelting. Specifications

E nemzeti szabványt a Magyar Szabványügyi Testület a nemzeti szabványosításról szóló 1995. évi XXVIII. törvény alapján teszi közzé. A szabvány alkalmazása e törvény 6. §-ának (1) bekezdése alapján önkéntes. A törvény 6. §-ának (2) bekezdése értelmében műszaki tartalmú jogszabály hivatkozhat olyan nemzeti szabványra, amelynek alkalmazását úgy kell tekinteni, hogy azzal az adott jogszabály vonatkozó követelményei is teljesülnek. A szabvány alkalmazása előtt győződjön meg arról, hogy jelent-e meg módosítása, helyesbítése, nincs-e visszavonva, vagy műszaki tartalmú jogszabály hivatkozik-e rá.

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Nemzeti előszó

Az eredeti EN 1676:2010 európai szabvány terjedelme 14 oldal.

A szabvány megvásárolható vagy megrendelhető az MSZT Szabványboltban (1082 Budapest, Horváth Mihály tér 1., levélcím: 1450 Budapest 9., Pf. 24, telefon: 456-6892, telefax: 456-6884), illetve elektronikus formában beszerezhető a <http://www.mszt.hu/webaruhaz> címen.

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English Version

Aluminium and aluminium alloys - Alloyed ingots for remelting - Specifications

Aluminium et alliages d'aluminium - Lingots pour refusion
en aluminium allié - Spécifications

Aluminium and Aluminiumlegierungen - Legiertes
Aluminium in Masseln - Spezifikationen

This European Standard was approved by CEN on 6 February 2010.

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Contents

Page

Foreword.....	3
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Ordering information	6
5 Requirements	7
5.1 Production and manufacturing processes	7
5.2 Quality control.....	7
5.3 Chemical composition	7
5.4 Freedom from defects	11
5.5 Form of products	11
6 Product inspection and testing methods	11
6.1 Chemical analysis.....	11
6.2 Chemical composition limits	11
6.3 Rounding rules for determination of compliance	12
7 Inspection documents.....	12
8 Marking of products	12
9 Packaging	12
10 Delivery documents.....	13
11 Complaints	13
Bibliography	14

Foreword

This document (EN 1676:2010) 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 September 2010, and conflicting national standards shall be withdrawn at the latest by September 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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This document supersedes EN 1676:1996.

Within its programme of work, Technical Committee CEN/TC 132 entrusted CEN/TC 132/WG 10 "Castings" to revise EN 1676:1996.

In addition to some additional minor and editorial changes, the following technical modifications were introduced during the revision:

- a) New normative references were added (EN 12258-1, EN 14242 and EN 14361). Normative reference to EN ISO 9000-1 was deleted.
- b) Term and definition 3.8, order document, was added.
- c) New notes on Clauses 5.3 and 5.5 were added.
- d) Clause 6.1, Chemical analysis, was modified.
- e) New note on Clause 6.2 was added.
- f) Clause 6.3, Rounding rules for determination of compliance, was added.
- g) In Table 1, the following alloys were deleted:
 - 1) EN AB-45200 [EN AB-AI Si₅Cu₃Mn];
 - 2) EN AB-51000 [EN AB-AI Mg₃(b)];
 - 3) EN AB-71000 [EN AB-AI Zn₅Mg].
- h) In Table 1, the following new alloys were added:
 - 1) EN AB-21200 [EN AB-AI Cu₄MnMg];
 - 2) EN AB-43500 [EN AB-AI Si₁₀MnMg];
 - 3) EN AB-44500 [EN AB-AI Si₁₂(Fe)(b)];
 - 4) EN AB-45500 [EN AB-AI Si₇Cu_{0,5}Mg];

EN 1676:2010 (E)

- 5) EN AB-48100 [EN AB-AI Si₁₇Cu₄Mg];
 - 6) EN AB-51500 [EN AB-AI Mg₅Si₂Mn];
 - 7) EN AB-71100 [EN AB-AI Zn₁₀Si₈Mg].
- i) In Table 1, footnotes “b” to “f” were added.
 - j) A Bibliography was also added.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This European Standard defines the requirements for grades of alloyed aluminium ingots intended for remelting.

It specifies the classifications and designations applicable to these grades, the conditions in which they are produced, their properties and the marks by which they are identified.

2 Normative references

The following referenced documents are indispensable for the application 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 1780-1, *Aluminium and aluminium alloys — Designation of alloyed aluminium ingots for remelting, master alloys and castings — Part 1: Numerical designation system*

EN 1780-2, *Aluminium and aluminium alloys — Designation of alloyed aluminium ingots for remelting, master alloys and castings — Part 2: Chemical symbol based designation system*

EN 1780-3, *Aluminium and aluminium alloys — Designation of alloyed aluminium ingots for remelting, master alloys and castings — Part 3: Writing rules for chemical composition*

EN 12258-1:1998, *Aluminium and aluminium alloys — Terms and definitions — Part 1: General terms*

EN 14242, *Aluminium and aluminium alloys — Chemical analysis — Inductively coupled plasma optical emission spectral analysis*

EN 14361, *Aluminium and aluminium alloys — Chemical analysis — Sampling from metal melts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12258-1:1998 and the following apply.

3.1 alloy

metallic material, homogeneous on a macro scale, consisting of two or more elements so combined that they cannot readily be separated by physical means

[EN 12258-1:1998, 3.2.1]

3.2 alloying element

metallic or non-metallic element intentionally added to, or naturally contained by, a basic metal and the amount of which is controlled within specific upper and lower limits for the purpose of giving that metal certain special properties

[EN 12258-1:1998, 3.2.2]

3.3 impurity

metallic or non-metallic element present but not intentionally added to a metal, and the minimum content of which is not controlled

[EN 12258-1:1998, 3.2.3]

3.4

casting alloy

alloy primarily intended for the production of castings

[EN 12258-1:1998, 3.2.5]

3.5

ingot for remelting

metal cast into a form suitable for remelting which has been processed, as appropriate, to adjust the chemical composition and to remove certain metallic or non-metallic impurities

[EN 12258-1:1998, 3.4.2]

3.6

casting

unwrought product at or near finished shape, formed by solidification of the metal in a mould

[EN 12258-1:1998, 3.5.1]

3.7

melt

quantity of molten metal that has simultaneously undergone the same preparatory treatment in the furnace before the casting operation

[EN 12258-1:1998, 6.1.3]

3.8

order document

document or set of documents to which supplier and purchaser agreed at the time of ordering

NOTE An order document may be an order of the purchaser confirmed by the supplier or a quotation of the supplier confirmed by the purchaser.

4 Ordering information

The order document shall define the product required and shall contain the following information:

- a) designation of the aluminium alloy according to this European Standard (or the purchaser code after agreement between the supplier and the purchaser);
- b) form of the product;
- c) quantity:
 - 1) mass (in metric tonnes);
 - 2) tolerance quantity, 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, such as metallurgical structure, samples, delivery details, etc.

5 Requirements

5.1 Production and manufacturing processes

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

Unless it is explicitly stated in the order document, no obligation shall be placed on the manufacturer to use the same processes for subsequent and similar orders. However, the supplier should inform the purchaser of any change that may affect the quality of the ingots or the final products.

5.2 Quality control

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

5.3 Chemical composition

Each grade of alloyed aluminium ingot for remelting shall be in accordance with the designations and chemical composition specified in Table 1.

NOTE For unalloyed aluminium ingots, see EN 576.

For alloys that are not in Table 1, the writing rules for designations and chemical compositions, as specified in EN 1780-1, EN 1780-2 and EN 1780-3, shall be applied.

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

Table 1 — Chemical compositions of alloyed ingots

expressed in percentage by mass

Alloy Group	Alloy designation		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Ti ^d	Others ^{a, e}		Aluminium
	Numerical	Chemical symbols												Each	Total	
AlCu	EN AB-21000	EN AB-Al Cu ₄ MgTi	0,15 (0,20)	0,30 (0,35)	4,2 to 5,0	0,10	0,20 to 0,35 (0,15 to 0,35)	-	0,05	0,10	0,05	0,05	0,15 to 0,25 (0,15 to 0,30)	0,03	0,10	Remainder
	EN AB-21100	EN AB-Al Cu ₄ Ti	0,15 (0,18)	0,15 (0,19)	4,2 to 5,2	0,55	-	-	-	0,07	-	-	0,15 to 0,25 (0,15 to 0,30)	0,03	0,10	Remainder
	EN AB-21200	EN AB-Al Cu ₄ MnMg	0,10	0,15 (0,20)	4,0 to 5,0	0,20 to 0,50	0,20 to 0,50 (0,15 to 0,50)	-	0,03 (0,05)	0,05 (0,10)	0,03	0,03	0,05 (0,10)	0,03	0,10	Remainder
AlSiMgTi	EN AB-41000	EN AB-Al Si ₂ MgTi	1,6 to 2,4	0,50 (0,60)	0,08 (0,10)	0,30 to 0,50	0,50 to 0,65 (0,45 to 0,65)	-	0,05	0,10	0,05	0,05	0,07 to 0,15 (0,05 to 0,20)	0,05	0,15	Remainder
AlSi7Mg	EN AB-42000	EN AB-Al Si ₇ Mg	6,5 to 7,5	0,45 (0,55)	0,15 (0,20)	0,35	0,25 to 0,65 (0,20 to 0,65)	-	0,15	0,15	0,15	0,05	0,20 ^f (0,25)	0,05	0,15	Remainder
	EN AB-42100	EN AB-Al Si ₇ Mg _{0,3}	6,5 to 7,5	0,15 (0,19)	0,03 (0,05)	0,10	0,30 to 0,45 (0,25 to 0,45)	-	-	0,07	-	-	0,18 ^f (0,25)	0,03	0,10	Remainder
	EN AB-42200	EN AB-Al Si ₇ Mg _{0,6}	6,5 to 7,5	0,15 (0,19)	0,03 (0,05)	0,10	0,50 to 0,70 (0,45 to 0,70)	-	-	0,07	-	-	0,18 ^f (0,25)	0,03	0,10	Remainder
AlSi10Mg	EN AB-43000	EN AB-Al Si ₁₀ Mg(a)	9,0 to 11,0	0,40 (0,55)	0,03 (0,05)	0,45	0,25 to 0,45 (0,20 to 0,45)	-	0,05	0,10	0,05	0,05	0,15	0,05	0,15	Remainder
	EN AB-43100	EN AB-Al Si ₁₀ Mg(b)	9,0 to 11,0	0,45 (0,55)	0,08 (0,10)	0,45	0,25 to 0,45 (0,20 to 0,45)	-	0,05	0,10	0,05	0,05	0,15	0,05	0,15	Remainder
	EN AB-43200	EN AB-Al Si ₁₀ Mg(Cu)	9,0 to 11,0	0,55 (0,65)	0,30 (0,35)	0,55	0,25 to 0,45 (0,20 to 0,45)	-	0,15	0,35	0,10	-	0,15 (0,20)	0,05	0,15	Remainder
	EN AB-43300	EN AB-Al Si ₉ Mg	9,0 to 10,0	0,15 (0,19)	0,03 (0,05)	0,10	0,30 to 0,45 (0,25 to 0,45)	-	-	0,07	-	-	0,15	0,03	0,10	Remainder
	EN AB-43400	EN AB-Al Si ₁₀ Mg(Fe)	9,0 to 11,0	0,45 to 0,9 (1,0)	0,08 (0,10)	0,55	0,25 to 0,50 (0,20 to 0,50)	-	0,15	0,15	0,15	0,05	0,15 (0,20)	0,05	0,15	Remainder
	EN AB-43500	EN AB-Al Si ₁₀ MnMg ^b	9,0 to 11,5	0,20 (0,25)	0,03 (0,05)	0,40 to 0,80	0,15 to 0,60 (0,10 to 0,60)	-	-	0,07	-	-	0,15 (0,20)	0,05	0,15	Remainder
AlSi	EN AB-44000	EN AB-Al Si ₁₁	10,0 to 11,8	0,15 (0,19)	0,03 (0,05)	0,10	0,45	-	-	0,07	-	-	0,15	0,03	0,10	Remainder
	EN AB-44100	EN AB-Al Si ₁₂ (b)	10,5 to 13,5	0,55 (0,65)	0,10 (0,15)	0,55	0,10	-	0,10	0,15	0,10	-	0,15 (0,20)	0,05	0,15	Remainder
	EN AB-44200	EN AB-Al Si ₁₂ (a)	10,5 to 13,5	0,40 (0,55)	0,03 (0,05)	0,35	-	-	-	0,10	-	-	0,15	0,05	0,15	Remainder
	EN AB-44300	EN AB-Al Si ₁₂ (Fe)(a)	10,5 to 13,5	0,45 to 0,9 (1,0)	0,08 (0,10)	0,55	-	-	-	0,15	-	-	0,15	0,05	0,25	Remainder
	EN AB-44400	EN AB-Al Si ₉	8,0 to 11,0	0,55 (0,65)	0,08 (0,10)	0,50	0,10	-	0,05	0,15	0,05	0,05	0,15	0,05	0,15	Remainder
	EN AB-44500	EN AB-Al Si ₁₂ (Fe)(b)	10,5 to 13,5	0,45 to 0,90 (1,0)	0,18 (0,20)	0,55	0,40	-	-	0,30	-	-	0,15	0,05	0,25	Remainder

(continued)

Table 1 (continued)

Alloy Group	Alloy designation		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Ti ^d	Others ^{a, e}		Aluminium
	Numerical	Chemical symbols												Each	Total	
AlSi5Cu	EN AB-45000	EN AB-Al Si6Cu4	5,0 to 7,0	0,9 (1,0)	3,0 to 5,0	0,20 to 0,65	0,55	0,15	0,45	2,0	0,30	0,15	0,20 (0,25)	0,05	0,35	Remainder
	EN AB-45100	EN AB-Al Si5Cu3Mg	4,5 to 6,0	0,50 (0,60)	2,6 to 3,6	0,55	0,20 to 0,45 (0,15 to 0,45)	-	0,10	0,20	0,10	0,05	0,20 (0,25)	0,05	0,15	Remainder
	EN AB-45300	EN AB-Al Si5Cu1Mg	4,5 to 5,5	0,55 (0,65)	1,0 to 1,5	0,55	0,40 to 0,65 (0,35 to 0,65)	-	0,25	0,15	0,15	0,05	0,20 ^f (0,25)	0,05	0,15	Remainder
	EN AB-45400	EN AB-Al Si5Cu3	4,5 to 6,0	0,50 (0,60)	2,6 to 3,6	0,55	0,05	-	0,10	0,20	0,10	0,05	0,20 (0,25)	0,05	0,15	Remainder
	EN AB-45500	EN AB-Al Si7Cu0,5Mg	6,5 to 7,5	0,25	0,2 to 0,7	0,15	0,25 to 0,45 (0,20 to 0,45)	-	-	0,07	-	-	0,20 ^f	0,03	0,10	Remainder
AlSi9Cu	EN AB-46000	EN AB-Al Si9Cu3(Fe)	8,0 to 11,0	0,6 to 1,1 (1,3)	2,0 to 4,0	0,55	0,15 to 0,55 (0,05 to 0,55)	0,15	0,55	1,2	0,35	0,15	0,20 (0,25)	0,05	0,25	Remainder
	EN AB-46100	EN AB-Al Si11Cu2(Fe)	10,0 to 12,0	0,45 to 1,0 (1,1)	1,5 to 2,5	0,55	0,30	0,15	0,45	1,7	0,25	0,15	0,20 (0,25)	0,05	0,25	Remainder
	EN AB-46200	EN AB-Al Si8Cu3	7,5 to 9,5	0,7 (0,8)	2,0 to 3,5	0,15 to 0,65	0,15 to 0,55 (0,05 to 0,55)	-	0,35	1,2	0,25	0,15	0,20 (0,25)	0,05	0,25	Remainder
	EN AB-46300	EN AB-Al Si7Cu3Mg	6,5 to 8,0	0,7 (0,8)	3,0 to 4,0	0,20 to 0,65	0,35 to 0,60 (0,30 to 0,60)	-	0,30	0,65	0,15	0,10	0,20 (0,25)	0,05	0,25	Remainder
	EN AB-46400	EN AB-Al Si9Cu1Mg	8,3 to 9,7	0,7 (0,8)	0,8 to 1,3	0,15 to 0,55	0,30 to 0,65 (0,25 to 0,65)	-	0,20	0,8	0,10	0,10	0,18 ^f (0,20)	0,05	0,25	Remainder
	EN AB-46500	EN AB-Al Si9Cu3(Fe)(Zn)	8,0 to 11,0	0,6 to 1,2 (1,3)	2,0 to 4,0	0,55	0,15 to 0,55 (0,05 to 0,55)	0,15	0,55	3,0	0,35	0,15	0,20 (0,25)	0,05	0,25	Remainder
	EN AB-46600	EN AB-Al Si7Cu2	6,0 to 8,0	0,7 (0,8)	1,5 to 2,5	0,15 to 0,65	0,35	-	0,35	1,0	0,25	0,15	0,20 (0,25)	0,05	0,15	Remainder
AlSi(Cu)	EN AB-47000	EN AB-Al Si12(Cu)	10,5 to 13,5	0,7 (0,8)	0,9 (1,0)	0,05 to 0,55	0,35	0,10	0,30	0,55	0,20	0,10	0,15 (0,20)	0,05	0,25	Remainder
	EN AB-47100	EN AB-Al Si12Cu1(Fe)	10,5 to 13,5	0,6 to 1,1 (1,3)	0,7 to 1,2	0,55	0,35	0,10	0,30	0,55	0,20	0,10	0,15 (0,20)	0,05	0,25	Remainder
AlSiCuNiMg	EN AB-48000	EN AB-Al Si12CuNiMg	10,5 to 13,5	0,6 (0,7)	0,8 to 1,5	0,35	0,9 to 1,5 (0,8 to 1,5)	-	0,7 to 1,3	0,35	-	-	0,20 (0,25)	0,05	0,15	Remainder
	EN AB-48100	EN AB-Al Si17Cu4Mg	16,0 to 18,0	1,0 (1,3)	4,0 to 5,0	0,50	0,45 to 0,65 (0,25 to 0,65)	-	0,3	1,5	-	0,15	0,20 (0,25)	0,05	0,25	Remainder

(continued)

Table 1 (concluded)

Alloy Group	Alloy designation		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Ti ^d	Others ^{a, e}		Aluminium
	Numerical	Chemical symbols												Each	Total	
AlMg ^c	EN AB-51100	EN AB-Al Mg3	0,45 (0,55)	0,40 (0,55)	0,03 (0,05)	0,45	2,7 to 3,5 (2,5 to 3,5)	-		0,10	-	-	0,15 (0,20)	0,05	0,15	Remainder
	EN AB-51200	EN AB-Al Mg9	2,5	0,45 to 0,9 (1,0)	0,08 (0,10)	0,55	8,5 to 10,5 (8,0 to 10,5)	-	0,10	0,25	0,10	0,10	0,15 (0,20)	0,05	0,15	Remainder
	EN AB-51300	EN AB-Al Mg5	0,35 (0,55)	0,45 (0,55)	0,05 (0,10)	0,45	4,8 to 6,5 (4,5 to 6,5)	-	-	0,10	-	-	0,15 (0,20)	0,05	0,15	Remainder
	EN AB-51400	EN AB-Al Mg5(Si)	1,3 (1,5)	0,45 (0,55)	0,03 (0,05)	0,45	4,8 to 6,5 (4,5 to 6,5)	-	-	0,10	-	-	0,15 (0,20)	0,05	0,15	Remainder
	EN AB-51500	EN AB-Al Mg5Si2Mn	1,8 to 2,6	0,20 (0,25)	0,03 (0,05)	0,4 to 0,8	5,0 to 6,0 (4,7 to 6,0)	-	-	0,07	-	-	0,20 (0,25)	0,05	0,15	Remainder
AlZnSiMg	EN AB-71100	EN AB-Al Zn10Si8Mg	7,5 to 9,5	0,27 (0,30)	0,08 (0,10)	0,15	0,25 to 0,5 (0,20 to 0,5)	-	-	9,0 to 10,5	-	-	0,15	0,05	0,15	Remainder
NOTE 1 Figures in brackets are casting compositions (prefix EN AC instead of EN AB) where they differ from the ingot. See EN 1706 for information.																
NOTE 2 Limits are expressed as a maximum unless shown as a range.																
<p>^a "Others" does not include modifying or refining elements such as Na, Sr, Sb and P.</p> <p>^b Sr addition is recommended.</p> <p>^c For alloys with Mg ≥ 3 %, the alloy may contain 0,005 % Be max.</p> <p>^d Refining agents such as Ti, B or master alloys containing nucleating particles such as TiB₂ shall not be considered as impurities. Nevertheless, the minimum and maximum content of refining elements shall be agreed between the manufacturer and the purchaser.</p> <p>^e "Others" includes all the elements which are not listed in this Table or without specific values.</p> <p>^f Minimum Ti limits are not required if the grain refining is not required or reached by other means.</p>																

5.4 Freedom from defects

To a standard agreed between supplier and purchaser, the ingots shall be reasonably free from:

- a) visible defects 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 can have shrinkage holes or cracks, which can retain water. They shall therefore be thoroughly dried and preheated before coming in contact with liquid metal to avoid the risk of a violent explosion.

5.5 Form of products

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

- trapezoidal which can be stacked. This type of ingot may have one or more notches to enable it to be divided into pieces if required;
- continuously cast material;
- other shapes.

The dimensions and tolerances on dimensions of the ingots and bundles and the variations on the unit masses shall be agreed between supplier and purchaser at the time of ordering.

NOTE A further form of product can be as liquid metal. See also EN 577.

6 Product inspection and testing methods

6.1 Chemical analysis

Sampling shall be carried out at the time of casting according to EN 14361. The average content of each sample shall be within the specification for the chemical composition.

The range of application and accuracy of the test procedure used shall be validated and proved by the supplier.

In the case of dispute concerning chemical composition, referee analysis shall be carried out in accordance with EN 14242.

NOTE For the fast determination of the chemical composition different spectral analysis methods are used (e.g. S-OES, XRF, GDOES). For S-OES, see EN 14726.

6.2 Chemical composition limits

The chemical composition is specified in Table 1. The figures specify the maximum limit as percentage by mass, unless minimum limits are also shown.

NOTE Table 1 also includes the chemical compositions of castings. These are shown in brackets where they differ from the ingot limits and are taken from EN 1706.

6.3 Rounding rules for determination of compliance

In recording chemical analysis results, the number representing the result for any value specified in this European Standard shall be expressed to the same number of decimal places as the corresponding number in this European Standard.

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

- a) when the figure immediately after the last figure to be retained is less than 5, the last figure to be retained remains unchanged;
- b) when the figure immediately after the last figure to be retained is greater than 5, or equal to 5 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 5 and followed by zeros only, the last figure to be retained remains unchanged if even, and is increased by one if odd.

See also EN 1780-3.

7 Inspection documents

The producer shall supply the grade of aluminium alloy quoted on the order document. By agreement between the supplier and the purchaser or when specified on the order document, the consignment shall be accompanied by a certificate listing the results of the analysis of the chemical elements noted in Table 1 and any other element which may have been previously requested, as a specific inspection.

8 Marking of products

Unless otherwise indicated on the order document, each unit (i.e. bundle of ingots, T-bar or sow) shall bear one or more marks, which show the following:

- the producer identification;
- the alloy designation;
- the melt number;
- the mass of the unit.

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

It is recommended that each unit carries a warning about the risk of explosion when getting in contact with liquid metal without first being properly dried (see 5.4).

9 Packaging

Small ingots shall be gathered together in bundles, the mass of which should not generally exceed one tonne.

Each bundle shall be made from only one melt.

The packaging shall be sufficiently strong for the bundle to be handled without breakage.

10 Delivery documents

The delivery documents shall accompany the delivery and include:

- the producer identification;
- the order number;
- the alloy designation;
- the melt number(s);
- if required, the results of chemical analysis for all elements for which specific limits are shown in Table 1, in the same sequence as given in Table 1 and for all others additionally required or restricted elements;
- the mass of each unit and the total mass delivered;
- the form of the product.

11 Complaints

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

The purchaser shall enable the supplier to check the grounds of the complaint.

He shall provide at least one of the following:

- a piece of relevant ingot, with its complete identification;
- a specimen of a defective semi-finished or final product which was fabricated from the relevant ingot, together with information which gives evidence of a relationship between the defect and the ingot, and details about the fabrication conditions and intermediate controls.

It should be noted that the direct spectrographic analysis of ingot slices can give rise to inaccuracy due to segregation. The sampling and analysis method shall be agreed between supplier and purchaser.

In case of dispute concerning conformity with the requirements of this European Standard or specification stated on the order document, examinations and tests shall be performed by a referee laboratory chosen by mutual agreement between supplier and purchaser. The arbitrator's decision should be final.

Bibliography

- [1] EN 576, *Aluminium and aluminium alloys — Unalloyed aluminium ingots for remelting — Specifications*
- [2] EN 577, *Aluminium and aluminium alloys — Liquid metal — Specifications*
- [3] EN 1706, *Aluminium and aluminium alloys — Castings — Chemical composition and mechanical properties*
- [4] EN 14726, *Aluminium and aluminium alloys — Chemical analysis — Guideline for spark optical emission spectrometric analysis*

ALU-BLOCK KEY