INTERNATIONAL STANDARD

ISO 6361-5

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Wrought aluminium and aluminium alloys — Sheets, strips and plates —

Part 5: Chemical composition

Aluminium et alliages d'aluminium corroyés — Tôles, bandes et tôles épaisses —

Partie 5: Composition chimique

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 6361-5 was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 6, *Wrought aluminium and aluminium alloys*.

ISO 6361 consists of the following parts, under the general title *Wrought aluminium and aluminium alloys — Sheets, strips and plates*:

— *Part 1: Technical conditions for inspection and delivery*

— *Part 2: Mechanical properties*

— *Part 3: Strips: Tolerances on shape and dimensions*

— *Part 4: Sheets and plates: Tolerances on shape and dimensions*

— *Part 5: Chemical composition*

Wrought aluminium and aluminium alloys — Sheets, strips and plates —

Part 5: Chemical composition

1 Scope

This part of ISO 6361 specifies the chemical composition of wrought aluminium and aluminium alloys.

NOTE 1 The chemical composition limits of aluminium and aluminium alloys specified in this part of ISO 6361 are identical with those registered with the Aluminum Association 1525 Wilson Boulevard, Suite 600, Arlington, VA22209, USA, for the corresponding alloys.

NOTE 2 The "Teal Sheets" are available at http://www.aluminum.org/tealsheets.[1)]

In case there is a discrepancy in the values listed in Table 1 with those listed in the "Teal Sheets", the composition limits registered with The Aluminum Association and published in the "Teal Sheets" are considered to be the controlling composition.

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.

ISO 209, *Aluminium and aluminium alloys — Chemical composition*

ISO 3134-1, *Light metals and their alloys — Terms and definitions — Part 1: Materials*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3134-1 apply.

4 Chemical composition

The chemical designations are specified in ISO 209.

The chemical composition of the aluminium and aluminium alloys is specified in percentage by mass in Table 1.

1) This information is given for the convenience of users of this document and does not constitute an endorsement by ISO.

Limits of impurities are expressed as a maximum. Limits of alloying elements shown as a range are specified as a minimum for unalloyed aluminium, and as a remainder for aluminium alloys.

For the purposes of determining conformance to these limits, an observed value or a calculated value obtained from analysis is rounded off, in accordance with the rules for rounding given in Annex A.

The conformance does not preclude the possible presence of other elements that are not specified. If the purchaser's requirements necessitate limits for any other element that is not specified, these shall be agreed upon between the supplier and the purchaser.

5 Writing rules

5.1 Standard limits for alloying elements and impurities are expressed in percentage by mass to the following decimal places:

- less than 0,001 %: 0,000*X*;
- 0,001 % but less than 0,01 %: 0,00*X*;
- 0,01 % but less than 0,10 %:
  - unalloyed aluminium made by a refining process 0,0*XX*;
  - others 0,0*X*;
- 0,10 % to 0,55 %: 0,*XX*;
- over 0,55 %: 0,*X*; *X*,*X*; *XX*,*X*.

Exception: combined Si + Fe limits for 1xxx designations shall be expressed as 0,*XX* or 1,*XX*.

5.2 The mass fraction of aluminium for unalloyed aluminium made by a refining process is the difference between 100,00 % 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 is rounded to the second decimal place before subtracting.

For unalloyed aluminium not made by a refining process, the mass fraction of aluminium is the difference between 100,00 % and the sum of all other metallic elements present in amounts of 0,010 % or more, each expressed to the second decimal place before determining the sum.

6 Alloy designation

The numerical designation systems used are given in the International Alloy Designations and Chemical Composition Limits for Wrought Aluminium and Wrought Aluminium Alloys (Teal sheets).

7 Sequence of elements

Standard limits for alloying elements and impurities are expressed in the following sequence: silicon, iron, copper, manganese, magnesium, chromium, zinc, titanium, remarks, other elements: each, other elements: total, aluminium.

Limits of additional specified elements are inserted in alphabetical order of their chemical symbols under “Remarks”.

Table 1 — Chemical composition

Alloy number	Chemical composition (mass fraction) %											
	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Remarks	Others[a]		Al
										Each	Total[b]	min.
1050	0,25	0,40	0,05	0,05	0,05		0,05	0,03	V 0,05	0,03		99,50[c]
1050A	0,25	0,40	0,05	0,05	0,05		0,07	0,05		0,03		99,50[c]
1070	0,20	0,25	0,04	0,03	0,03		0,04	0,03	V 0,05	0,03		99,70[c]
1070A	0,20	0,25	0,03	0,03	0,03		0,07	0,03		0,03		99,70[c]
1080	0,15	0,15	0,03	0,02	0,02		0,03	0,03	Ga 0,03, V 0,05	0,02		99,80[c]
1080A	0,15	0,15	0,03	0,02	0,02		0,06	0,02	Ga 0,03	0,02		99,80[c]
1085	0,10	0,12	0,03	0,02	0,02		0,03	0,02	Ga 0,03, V 0,05	0,01		99,85[c]
1100	Si + Fe 0,95 max.		0,05 to 0,20	0,05			0,10			0,05	0,15	99,00[c]
1100A	Si + Fe 1,00 max.		0,05 to 0,20	0,05	0,10		0,10	0,10		0,05	0,15	99,00[c]
1200	Si + Fe 1,00 max.		0,05	0,05			0,10	0,05		0,05	0,15	99,00[c]
1230A	Si + Fe 0,70 max.		0,10	0,05	0,05		0,05			0,03		99,30[c]
2014	0,50 to 1,2	0,7	3,9 to 5,0	0,40 to 1,2	0,20 to 0,8	0,10	0,25	0,15		0,05	0,15	Remainder
2014A	0,50 to 0,9	0,50	3,9 to 5,0	0,40 to 1,2	0,20 to 0,8	0,10	0,25	0,15	Ni 0,10, Zr+Ti: 0,20	0,05	0,15	Remainder
2017	0,20 to 0,8	0,7	3,5 to 4,5	0,40 to 1,0	0,40 to 0,8	0,10	0,25	0,15		0,05	0,15	Remainder
2017A	0,20 to 0,8	0,7	3,5 to 4,5	0,40 to 1,0	0,40 to 1,0	0,10	0,25		Zr+Ti: 0,25	0,05	0,15	Remainder
2618A	0,15 to 0,25	0,9 to 1,4	1,8 to 2,7	0,25	1,2 to 1,8		0,15	0,20	Ni 0,8 to 1,4, Zr+Ti: 0,25	0,05	0,15	Remainder
2219	0,20	0,30	5,8 to 6,8	0,20 to 0,40	0,02		0,10	0,02 to 0,10	V 0,05 to 0,15, Zr 0,10 to 0,25	0,05	0,15	Remainder
2024	0,50	0,50	3,8 to 4,9	0,30 to 0,9	1,2 to 1,8	0,10	0,25	0,15		0,05	0,15	Remainder
2124	0,20	0,30	3,8 to 4,9	0,30 to 0,9	1,2 to 1,8	0,10	0,25	0,15		0,05	0,15	Remainder
3003	0,6	0,7	0,05 to 0,20	1,0 to 1,5			0,10			0,05	0,15	Remainder
3103	0,50	0,7	0,10	0,9 to 1,5	0,30	0,10	0,20		Zr+Ti 0,10	0,05	0,15	Remainder
3203	0,6	0,7	0,05	1,0 to 1,5			0,10			0,05	0,15	Remainder
3004	0,30	0,7	0,25	1,0 to 1,5	0,8 to 1,3		0,25			0,05	0,15	Remainder
3104	0,6	0,8	0,05 to 0,25	0,8 to 1,4	0,8 to 1,3		0,25	0,10	Ga 0,05, V 0,05	0,05	0,15	Remainder
3005	0,6	0,7	0,30	1,0 to 1,5	0,20 to 0,6	0,10	0,25	0,10		0,05	0,15	Remainder
3105	0,6	0,7	0,30	0,30 to 0,8	0,20 to 0,8	0,20	0,40	0,10		0,05	0,15	Remainder

Table 1 (*continued*)

Alloy number	Chemical composition (mass fraction) %											
	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Remarks	Others[a]		Al
										Each	Total[b]	min.
4006	0,8 to 1,2	0,50 to 0,8	0,10	0,05	0,01	0,20	0,05			0,05	0,15	Remainder
4007	1,0 to 1,7	0,40 to 1,0	0,20	0,8 to 1,5	0,20	0,05 to 0,25	0,10	0,10	Ni 0,15 to 0,7, Co 0,05	0,05	0,15	Remainder
4015	1,4 to 2,2	0,7	0,20	0,6 to 1,2	0,10 to 0,50		0,20			0,05	0,15	Remainder
5005	0,30	0,7	0,20	0,20	0,50 to 1,1	0,10	0,25			0,05	0,15	Remainder
5010	0,40	0,7	0,25	0,10 to 0,30	0,20 to 0,6	0,15	0,30	0,10		0,05	0,15	Remainder
5110A	0,15	0,25	0,20	0,20	0,20 to 0,6		0,03			0,05	0,10	Remainder
5021	0,40	0,50	0,15	0,10 to 0,50	2,2 to 2,8	0,15	0,15			0,05	0,15	Remainder
5026	0,55 to 1,4	0,20 to 1,0	0,10 to 0,8	0,6 to 1,8	3,9 to 4,9	0,30	1,0	0,20	Zr 0,30	0,05	0,15	Remainder
5040	0,30	0,7	0,25	0,9 to 1,4	1,0 to 1,5	0,10 to 0,30	0,25			0,05	0,15	Remainder
5042	0,20	0,35	0,15	0,20 to 0,50	3,0 to 4,0	0,10	0,25	0,10		0,05	0,15	Remainder
5049	0,40	0,50	0,10	0,50 to 1,1	1,6 to 2,5	0,30	0,20	0,10		0,05	0,15	Remainder
5449	0,40	0,7	0,30	0,6 to 1,1	1,6 to 2,6	0,30	0,30	0,10		0,05	0,15	Remainder
5050	0,40	0,7	0,20	0,10	1,1 to 1,8	0,10	0,25			0,05	0,15	Remainder
5251	0,40	0,50	0,15	0,10 to 0,50	1,7 to 2,4	0,15	0,15	0,15		0,05	0,15	Remainder
5052	0,25	0,40	0,10	0,10	2,2 to 2,8	0,15 to 0,35	0,10			0,05	0,15	Remainder
5154	0,25	0,40	0,10	0,10	3,1 to 3,9	0,15 to 0,35	0,20	0,20		0,05	0,15	Remainder
5154A	0,50	0,50	0,10	0,50	3,1 to 3,9	0,25	0,20	0,20	Mn+Cr: 0,10 to 0,50	0,05	0,15	Remainder
5254	Si + Fe 0,45 max.		0,05	0,01	3,1 to 3,9	0,15 to 0,35	0,20	0,05		0,05	0,15	Remainder
5454	0,25	0,40	0,10	0,50 to 1,0	2,4 to 3,0	0,05 to 0,20	0,25	0,20		0,05	0,15	Remainder
5754	0,40	0,40	0,10	0,50	2,6 to 3,6	0,30	0,20	0,15	Mn+Cr: 0,10 to 0,6	0,05	0,15	Remainder
5456	0,25	0,40	0,10	0,50 to 1,0	4,7 to 5.5	0,05 to 0,20	0,25	0,20		0,05	0,15	Remainder
5059	0,45	0,50	0,25	0,6 to 1,2	5,0 to 6,0	0,25	0,40 to 0,9	0,20	Zr: 0,05 to 0,25	0,05	0,15	Remainder
5070	0,25	0,40	0,25	0,40 to 0,8	3,5 to 4,5	0,30	0,40 to 0,8	0,15		0,05	0,15	Remainder
5082	0,20	0,35	0,15	0,15	4,0 to 5,0	0,15	0,25	0,10		0,05	0,15	Remainder
5182	0,20	0,35	0,15	0,20 to 0,50	4,0 to 5,0	0,10	0,25	0,10		0,05	0,15	Remainder
5083	0,40	0,40	0,10	0,40 to 1,0	4,0 to 4,9	0,05 to 0,25	0,25	0,15		0,05	0,15	Remainder
5383	0,25	0,25	0,20	0,7 to 1,0	4,0 to 5,2	0,25	0,40	0,15	Zr 0,20	0,05	0,15	Remainder

Table 1 (*continued*)

Alloy number	Chemical composition (mass fraction) %											
	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Remarks	Others[a]		Al
										Each	Total[b]	min.
5086	0,40	0,50	0,10	0,20 to 0,7	3,5 to 4,5	0,05 to 0,25	0,25	0,15		0,05	0,15	Remainder
5088	0,20	0,10 to 0,35	0,25	0,20 to 0,50	4,7 to 5,5	0,15	0,20 to 0,40		Zr 0,15	0,05	0,15	Remainder
6016	1,0 to 1,5	0,50	0,20	0,20	0,25 to 0,6	0,10	0,20	0,15		0,05	0,15	Remainder
6025	0,8 to 1,5	0,7	0,20 to 0,7	0,6 to 1,4	2,1 to 3,0	0,20	0,50	0,20		0,05	0,15	Remainder
6061	0,40 to 0,8	0,7	0,15 to 0,40	0,15	0,8 to 1,2	0,04 to 0,35	0,25	0,15		0,05	0,15	Remainder
6082	0,7 to 1,3	0,50	0,10	0,40 to 1,0	0,6 to 1,2	0,25	0,20	0,10		0,05	0,15	Remainder
7204	0,30	0,35	0,20	0,20 to 0,7	1,0 to 2,0	0,30	4,0 to 5,0	0,20	V 0,10, Zr 0,25	0,05	0,15	Remainder
7010	0,12	0,15	1,5 to 2,0	0,10	2,1 to 2,6	0,05	5,7 to 6,7	0,06	Ni 0,05, Zr 0,10 to 0,16	0,05	0,15	Remainder
7020	0,35	0,40	0,20	0,05 to 0,50	1,0 to 1,4	0,10 to 0,35	4,0 to 5,0		Zr 0,08 to 0,20, Zr+Ti: 0,08 to 0,25	0,05	0,15	Remainder
7021	0,25	0,40	0,25	0,10	1,2 to 1,8	0,05	5,0 to 6,0	0,10	Zr 0,08 to 0,18	0,05	0,15	Remainder
7022	0,50	0,50	0,50 to 1,0	0,10 to 0,40	2,6 to 3,7	0,10 to 0,30	4,3 to 5,2		Zr+Ti: 0,20	0,05	0,15	Remainder
7050	0,12	0,15	2,0 to 2,6	0,10	1,9 to 2,6	0,04	5,7 to 6,7	0,06	Zr 0,08 to 0,15	0,05	0,15	Remainder
7075	0,40	0,50	1,2 to 2,0	0,30	2,1 to 2,9	0,18 to 0,28	5,1 to 6,1	0,20		0,05	0,15	Remainder
7475	0,10	0,12	1,2 to 1,9	0,06	1,9 to 2,6	0,18 to 0,25	5,2 to 6,2	0,06		0,05	0,15	Remainder
7178	0,40	0,50	1,6 to 2,4	0,30	2,4 to 3,1	0,18 to 0,28	6,3 to 7,3	0,20		0,05	0,15	Remainder
8011A	0,40 to 0,8	0,50 to 1,0	0,10	0,10	0,10	0,10	0,10	0,05		0,05	0,15	Remainder
8021	0,15	1,2 to 1,7	0,05							0,05	0,15	Remainder
8079	0,05 to 0,30	0,7 to 1,3	0,05				0,10			0,05	0,15	Remainder

[a] "Others" includes listed elements for which no specific limit is shown, as well as unlisted metallic elements. The producer may analyse samples for trace elements not specified in the registration or specification. However, such analysis is not required and may not cover all metallic "Other" elements. Should any analysis by the producer or the purchaser establish that an "Others" element exceeds the limit of "Each" or that the aggregate of several "others" elements exceeds the limit of "Total", the material shall be considered as non-conforming.

[b] The sum of those "Others": metallic elements 0,010 % or more, each expressed to the second decimal place before determining the sum.

[c] The mass fraction of aluminium for unalloyed aluminium not made by a refining process is the difference between 100 % and the sum of all other metallic elements present in amounts of 0,010 % or more each, expressed to the second decimal place before determining the sum.

Annex A
(normative)

Rules for rounding for determination of compliance

In recording test results, the number representing the result of a test to determine an element concentration shall be expressed to the same number of decimal places as the corresponding limit in this part of ISO 6361.

The following rules shall be used for rounding.

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.

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