
International Standard



3522

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Cast aluminium alloys — Chemical composition of cast aluminium alloys and mechanical properties of sand cast aluminium alloys

Alliages d'aluminium moulés — Composition chimique des alliages d'aluminium moulés et caractéristiques mécaniques des alliages d'aluminium moulés en sable

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3522 was developed by Technical Committee ISO/TC 79, *Light metals and their alloys*, and was circulated to the member bodies in May 1980.

It has been approved by the member bodies of the following countries :

Austria	Ireland	Romania
China	Japan	South Africa, Rep. of
Czechoslovakia	Korea, Rep. of	Sweden
France	Mexico	Switzerland
Germany, F. R.	Netherlands	United Kingdom
Hungary	Norway	USSR
India	Poland	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
Canada
Italy
USA

This International Standard cancels and replaces ISO Recommendations R 164-1960, R 208-1961 and R 2147-1971, of which it constitutes a technical revision.

Cast aluminium alloys — Chemical composition of cast aluminium alloys and mechanical properties of sand cast aluminium alloys

1 Scope and field of application

This International Standard specifies :

- the chemical composition of cast aluminium alloys;
- minimum values for the mechanical properties of sand cast reference test pieces cast separately from the casting.

NOTE — General conditions for the control and delivery of cast aluminium alloys will form the subject of a future International Standard. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements.

2 References

- ISO/R 190, *Tensile testing of light metals and their alloys*.¹⁾
- ISO/R 2107, *Light metals and their alloys — Temper designations*.
- ISO 2379, *Aluminium alloy sand castings — Reference test bar*.

3 Chemical composition

Methods of analysis shall be at the discretion of the supplier.

In case of dispute over composition, another analysis shall be carried out in accordance with existing International Standards and the results obtained by these methods shall be accepted.

1) The revision of ISO/R 190 will be incorporated in ISO 6892.

3.1 Sand cast and shell cast alloys

Table 1 — Chemical composition of sand cast, permanent mould cast and shell cast alloys, %

Alloys	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Be	Ti	Al					
Al-Cu4 Ni2 Mg2	min.	—	—	3,5	—	1,2	—	1,7	—	—	—	—	The remainder					
	max.	0,7	0,7	4,5	0,6	1,8	0,2	2,3	0,1	0,05	0,05	0,2						
Al-Cu4 Mg Ti	min.	—	—	4,2	—	0,15	—	—	—	—	—	0,05		The remainder				
	max.	0,30	0,35	5,0	0,10	0,35	0,05	0,10	0,05	0,05	—	0,35						
Al-Cu4 Ti	min.	—	—	4,0	—	—	—	—	—	—	—	0,05			The remainder			
	max.	0,25	0,25	5,0	0,10	0,05	0,10	0,2	0,05	0,05	—	0,30						
Al-Si5	min.	4,5	—	—	—	—	—	—	—	—	—	—				The remainder		
	max.	6,0	0,8	0,10	0,5	0,1	0,1	0,1	0,1	0,1	—	0,20						
Al-Si5 Mg	min.	3,5 ¹⁾	—	—	—	0,5	—	—	—	—	—	—					The remainder	
	max.	6,0	0,6	0,1	0,6	0,9	0,1	0,1	0,1	0,05	—	0,2						
Al-Si5 Cu1 Mg	min.	4,5	—	1,0	—	0,4	—	—	—	—	—	—						The remainder
	max.	5,5	0,6	1,5	0,5	0,6	0,3	0,5	0,1	0,1	—	0,2						
Al-Si5 Cu3	min.	4,0	—	2,0	0,2	—	—	—	—	—	—	—						
	max.	6,0	0,8	4,0	0,6	0,15	0,3	0,5	0,1	0,05	—	0,2						
Al-Si6 Cu4	min.	5,0	—	3,0	0,2	—	—	—	—	—	—	—	The remainder					
	max.	7,0	1,0	5,0	0,6	0,3	0,3	2,0	0,2	0,1	—	0,2						
Al-Si7 Mg	min.	6,5	—	—	—	0,20	—	—	—	—	—	—		The remainder				
	max.	7,5	0,5	0,20	0,6	0,4	0,05	0,3	0,05	0,05	—	0,20						
Al-Si10 Mg	min.	9,0	—	—	—	0,15	—	—	—	—	—	—			The remainder			
	max.	11,0	0,60	0,10	0,6	0,40	0,05	0,1	0,05	0,05	—	0,20						
Al-Si12	min.	11,0	—	—	—	—	—	—	—	—	—	—				The remainder		
	max.	13,5	0,70	0,10	0,5	0,10	0,1	0,1	0,1	0,05	—	0,20						
Al-Si12 Cu	min.	11,0	—	—	—	—	—	—	—	—	—	—					The remainder	
	max.	13,5	0,90	1,2	0,5	0,3	0,30	0,5	0,20	0,1	—	0,2						
Al-Mg3	min.	—	—	—	—	2,5	—	—	—	—	—	—						The remainder
	max.	0,5	0,5	0,10	0,6	4,5	0,1	0,05	0,2	0,05	0,05	0,2						
Al-Mg3 Si2	min.	0,9	—	—	—	2,5	—	—	—	—	—	—						
	max.	2,2	0,5	0,10	0,6	4,5	0,4	0,05	0,2	0,05	0,05	0,2						
Al-Mg5 Si1	min.	0,5	—	—	—	4,0	—	—	—	—	—	—	The remainder					
	max.	1,5	0,5	0,10	0,5	6,0	0,05	0,2	0,05	0,05	—	0,2						
Al-Mg6	min.	—	—	—	—	4,5	—	—	—	—	—	—		The remainder				
	max.	0,50	0,5	0,10	0,6	7,0	0,5	0,05	0,2	0,05	0,05	0,2						
Al-Mg10	min.	—	—	—	—	9,5	—	—	—	—	—	—			The remainder			
	max.	0,30	0,3	0,10	0,15	11,0	—	0,10	0,10	0,05	0,05	0,05						
Al-Zn5 Mg	min.	—	—	—	—	0,5	0,15	—	4,5	—	—	0,10				The remainder		
	max.	0,3	0,8	0,35	0,4	0,70	0,60	0,05	6,0	0,05	0,05	0,30						

1) Material having this silicon content (3,5 %) is used for anodizing.

NOTE — If the purchaser's requirements or product specifications necessitate limits for the contents of elements other than those specified in this table, these shall be agreed upon in the order.

3.2 Pressure die cast alloys

Table 2 — Chemical composition of pressure die cast alloys, %

Alloys		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Be	Ti	Al
Al-Si5 Fe	min.	4,5	—	—	—	—	—	—	—	—	—	—	—	The remainder
	max.	0,6	1,3	0,10	0,5	0,1	—	0,1	0,1	0,1	0,1	—	0,20	
Al-Si6 Cu4 Fe	min.	5,0	—	3,0	0,2	—	—	—	—	—	—	—	—	
	max.	7,0	1,3	5,0	0,6	0,3	—	0,3	2,0	0,2	0,1	—	0,2	
Al-Si8 Cu3 Fe	min.	7,5	—	2,5	—	—	—	—	—	—	—	—	—	
	max.	9,5	1,3	4,0	0,6	0,3	—	0,5	1,2	0,3	0,2	—	0,2	
Al-Si12 Fe	min.	11,0	—	—	—	—	—	—	—	—	—	—	—	
	max.	13,5	1,3	0,10	0,5	0,10	—	0,1	0,1	0,1	0,05	—	0,20	
Al-Si12 Cu Fe	min.	11,0	—	—	—	—	—	—	—	—	—	—	—	
	max.	13,5	1,3	1,2	0,5	0,3	—	0,30	0,5	0,20	0,1	—	0,2	

NOTE — If the purchaser's requirements or product specifications necessitate limits for the contents of elements other than those specified in this table, these shall be agreed upon in the order.

4 Mechanical properties of aluminium alloy sand cast reference test pieces

Mechanical tests shall be carried out in conformity with ISO/R 190 using sand cast reference test pieces prepared in accordance with ISO 2379.

The minimum mechanical properties are given in table 3.

5 Rules for rounding

In interpreting the results of chemical analyses, 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 International Standard.

The following rule shall be applied for rounding such values :

a) When the figure immediately after the last figure to be retained is lower 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 or equal to 5, and is 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 is followed by zeros only, the last figure to be retained remains unchanged if even and is increased by one if odd.

Table 3 — Minimum mechanical properties of aluminium alloy sand cast reference test pieces

Alloys	Temper ¹⁾	Tensile strength	Elongation
		R_m	A
		N/mm ²	%
Al-Cu4 Ni2 Mg2	O	150	
Al-Cu4 Ni2 Mg2	TF	220	
Al-Cu4 Mg Ti	TB	290	4
Al-Cu4 Ti	TF	280	4
Al-Si5	M	120	2
Al-Si5 Mg	TF	230	1
Al-Si5 Cu1 Mg	TF	220	1
Al-Si5 Cu3	M	140	1
Al-Si6 Cu4 Fe	M	140	
Al-Si7 Mg	M	140	2
Al-Si7 Mg	TF	210	1
Al-Si10 Mg	M	150	2
Al-Si10 Mg	TF	220	1
Al-Si12	M	150	3
Al-Si12 Cu	M	150	1
Al-Mg3	M	150	5
Al-Mg6	M	160	2
Al-Mg10	TB	260	8
Al-Zn5 Mg	TA	200	3

1) In accordance with ISO/R 2107, i.e.

M = As manufactured.

TF = Solution heat treated and precipitation treated.

TA = Cooled from an elevated temperature shaping process and naturally aged.

TB = Solution heat treated and naturally aged.

O = Annealed.

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