Draft Indian Standard

ALUMINIUM AND ALUMINIUM ALLOYS: INGOTS FOR REMELTING AND CASTINGS FOR GENERAL ENGINEERING PURPOSES: SPECIFICATION

(*Fourth Revision*)

1 SCOPE

This standard covers the requirements of aluminium and its alloys in form of ingots for remelting and castings for general engineering purposes.

(Note: Standard specifies the chemical composition of ingots, chemical composition of castings and mechanical properties of separately cast test bar of castings).

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicted were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

IS No.	*Title*
504: Part 1 To 12: 2002	Chemical analysis of aluminium and its alloys: Parts 1 to 12 (*second revision*)
504: Part 13 to 16: 2003	Chemical analysis of aluminium and its alloys: Parts 13 to 16 (*second revision*)
1500: Part 1 : 2019/ISO 6506-1 : 2014	Metallic materials — Brinell hardness test: Part 1 Test method (*fifth revision*)
1500: Part 2 : 2021/ISO 6506-2 : 2017	Metallic materials — Brinell hardness test: Part 2 Verification and calibration testing machines (*fifth revision*)
1500: Part 3: 2019/ISO 6506-3 : 2014	Metallic materials —Brinell hardness test : Part 3 Calibration of reference blocks (*fifth revision*)
1500: Part 4: 2019/ISO 6506-4 : 2014	Metallic materials - Brinell hardness test: Part 4 table of hardness values (*fifth revision*)
IS 1608 (Part 1) : 2022/ISO 6892-1 : 2019	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (*fifth revision)*
1608: Part 2:	Metallic materials — Tensile testing Part 2 : Method of test at

2020/ISO 6892-2: 2018	elevated temperature (*fourth revision*)
1608: Part 3: 2018/ISO 6892-3 : 2015	Metallic materials - Tensile testing: Part 3 method of test at low temperature
2479:1981	Colour code for identification of aluminium and aluminium alloys for general engineering purposes (*second revision*)
3658:1999	Code of practice for liquid penetrant flaw detection (second revision)
5047: Part 1: 1986	Glossary of terms relating to aluminium and aluminium alloys : Part 1 Unwrought and wrought metals (*second revision*)
5047: Part 2: 1979	Glossary of terms relating to aluminium and aluminium alloys : Part 2 Plant and operations, thermal treatment, control and testing, finishing
5047: Part 3: 1979	Glossary of terms relating to aluminium and aluminium alloys : Part 3 Geometrical properties and tolerance, structural and surface defects
5052:1993	Aluminium and its alloys — Temper designations (*first revision*)
10259:1982	General condition of delivery and inspection of aluminium and aluminium alloy products

3 DEFINITION AND TERMINOLOGY

3.1 Cast

The product of either one furnace melt, or a number of furnace melts where such are aggregated and mixed prior to sampling or pouring.

3.2 Ingot for remelting:

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

3.3 Casting

General term for products at or near their finished shape, formed by solidification of metal or alloy in a mould.

3.4 Sand Casting

Casting formed in a sand mould.

3.5 Chill Casting

A casting formed in a metallic mould, the molten metal being introduced by gravity and solidification under atmospheric pressure.

3.6 Low pressure die casting

Process in which molten metal is injected into a permanent metal mould and solidified under low pressure.

3.7 Pressure die casting

Casting formed in a metal mould, the molten metal being introduced under high pressure.

3.8 Investment Casting (lost wax)

Two step process comprising fabrication of a ceramic mould around a wax or thermoplastic pattern, which is lost during this process, and pouring of metal into this mould.

3.9 Hot tearing

Tendency for a crack to form in a casting due to the development of internal stress during solidification.

3.10Pressure tightness

Tendency not to leak during pressure testing.

3.11 Impurities

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

4SUPPLY OF MATERIAL

General requirements relating to the supply of material shall conform to IS 10259.

5 DESIGNATION

5.1 Alloy designation

The alloy designation shall be in accordance with Annex A.

5.2 Temper designations

The following abbreviations shall be used for the conditions of heat-treatment, referred to in Tables 2, 3, 4 and B.1:

M as cast;

O annealed;

T1 controlled cooling from casting and naturally aged;

T4 solution heat-treated and naturally aged, where applicable;

T5 controlled cooling from casting and artificially aged or over-aged;

T6 solution heat-treated and fully artificially aged;

T64 solution heat-treated and artificially under-aged;

T7 solution heat-treated and artificially over-aged (stabilized).

NOTE - For aluminium casting alloys, solution heat-treatment involves quenching from elevated temperatures and distortion may occur.

5.3 Casting processes

The following abbreviations shall be used for the different casting processes:

S sand casting;

K chill or permanent mould casting;

D pressure die-casting;

L investment casting.

5.4 Product designation

The designation shall appear on the drawings.

An example of material designation with casting process and temper is

IS AC-AlSi7Mg-K-T6, which indicates aluminium casting alloy AC-AlSi7Mg chill cast, solution heattreated and fully artificially aged.

6 CHEMICAL COMPOSITION

6.1 The chemical composition of ingots for remelting and castings shall conform to the requirement given in Table 1.

6.2 When specified, analysis of elements for which specific limits are given in Table 1 only shall be carried out. Analysis for other elements shall be carried out only when agreed between manufacturer and purchaser. This particularly applies to modifying or refining elements such as sodium, strontium, antimony and phosphorous.

6.3 The chemical analysis shall be carried out in accordance with IS 504 or any other established instrumental/chemical method. In case of dispute the procedure specified in latest addition of IS 504 shall be the referee method. However, when the method is not available, the referee method shall be as agreed to between the purchaser and the manufacturer**.**

6.4 When samples are required to determine the chemical analysis of ingots or castings by emission spectrometry, they shall be taken from the melt at the time the ingots or castings are made and shall be cast into a metallic die.

6.5 If analysis by emission spectrometry is to be carried out after casting, it is recommended that a part of casting is remelted and cast into a metallic die to avoid the effects of segregation.

7 Mechanical properties

7.1 General

The mechanical properties for separately cast test pieces for sand cast, chill cast, investment cast and pressure die cast conditions shall be in accordance with tables 2, 3, 4 and B.1.

For each alloy, mechanical properties are only specified for the commonly used methods of casting and for commonly used tempers. For other processes and tempers, characteristics: mechanical properties shall be agreed between manufacturer and purchaser.

Note - The mechanical properties of pressure die castings are very dependent on injection parameter, and the properties in Table B.1 are for guidance only.

7.2 Tensile tests

Tensile Tests shall be carried out in accordance with IS 1608.

7.3 Test pieces

7.3.1 *General*

This standard does not specify the exact design of test pieces (separately cast test bars) which shall be by agreed between manufacturer and purchaser. However the following conditions will apply.

7.3.2 ***Separately cast test bars***

7.3.2.1 When tensile tests are required on separately cast test bars then the test bars shall be cast at the same time and from the same melt or melts as the castings. When applicable they shall be heat treated with the castings.

7.3.2.2 *Sand cast pieces*

The following conditions apply to sand cast test pieces:

1) they shall be cast in sand moulds without artificial chilling; using the same sand system as used for the casting;

2) as cast diameter shall be a minimum of 12.0 mm;

3) the gauge length and parallel length shall conform to IS 1608.

NOTE: Test pieces may be tested in the machined or unmachined condition.

7.3.2.3 *Chill cast pieces*

The following conditions shall apply to chill cast pieces;

1) they shall be cast into metallic moulds;

2) as cast diameter shall be a minimum of 12.0 mm:

3) the gauge length and parallel length shall conform to IS 1608.

NOTE : Test pieces may be tested in the machined or unmachined condition.

7.3.2.4 *Investment cast pieces*

The following conditions shall apply to investment cast test pieces:

1) They shall be cast entirely in a ceramic mould without artificial chilling;

2) as cast diameter shall be a minimum of 5.0 mm.

3) the gauge length and parallel length shall conform to IS 1608.

NOTE: Test pieces may be tested in the machined or unmachined condition.

7.3.2.5 *Pressure die cast bars*

Pressure die cast test pieces are not normally produced. The values given in Table 1 are for guidance only. These are not typical values but are the minimum values that may be expected from separately pressure die cast test pieces of 20.0 mm^2 cross sectional area with a minimum thickness of 2.0 mm.

7.3.3 *Test pieces taken from castings*

7.3.3.1 If test pieces are taken form castings then their geometry, location, test frequency and values relevant shall be agreed between manufacturer and purchaser.

7.3.3.2 For circular test pieces the minimum diameter shall be 4.0 mm.

For proof stress and tensile strength, the values obtained in the castings may be greater than the values specified in tables 2, 3, 4 or not less than 70% of the values specified.

For elongation, the values obtained from castings may be greater than the values specified in the tables or up to 50% less in some locations.

NOTE : This does not apply to pressure die castings.

7.3 Hardness

Hardness testing shall be carried out as per IS 1500 on porosity free areas of castings, or on the portion of a broken test piece which has not been stressed(not applicable for ingots). For each alloy, Hardness is only specified for the commonly used methods of casting and for commonly used tempers. For other processes and tempers, characteristics: Hardness shall be agreed between manufacturer and purchaser.

8 FREEDOM FROM DEFECTS

8.1 Ingots

The ingots shall be clean and free from harmful defects.

8.2 Castings

The castings shall be clean, sound and free from harmful defects.

8.2.1 Each casting shall be inspected for cracks. The dye penetrant test (see IS 3658) process may be used to detect cracks if required by the purchaser and standard of acceptance shall be mutually agreed to between the supplier and the purchaser. The castings may be repaired by the supplier without detriment to the ultimate use of the casting, but the decision to repair the type of defect should be mutually agreed to between the supplier and the purchaser.

8.2.2 Radiography/ Ultrasonic tests may be applied in special cases subject to agreement between the purchaser and the supplier. The details of the techniques to be used, the frequency of inspection and standards of acceptance should be mutually agreed.

9 SAMPLING

9.1 Chemical Analysis

9.1.1 *Lot*

The ingots/castings produced from the same cast of 1 000 kg or part thereof shall constitute a lot.

9.1.2 For chemical composition, at least three samples randomly shall be selected throughout the casting process for each lot.

9.1.3 Special care shall be taken during sampling of the ingots or castings. In all cases, first drillings shall be discarded till a clean oxide-free surface is reached.

9.2 Tensile Test for Castings (if required)

9.2.1 One separately cast test sample shall be selected from each lot or heat-treatment batch not exceeding 1 000 kg.

9.2.1.1 Adequate number of separately cast test samples shall be prepared for tensile test from each cast so that it is possible to carry one test for each lot/heat treatment batch and samples are available for retest.

9.2.2 The metal for the test samples shall be taken from the casting mould, crucible or ladle from which, the castings are poured.

9.2.3 *Treatment of Test Samples*

8.2.3.1 In case of non-heat-treated castings, the test samples shall not be heat-treated, hammered, or otherwise treated (except by machining to the shape of the test piece) before they are tested.

9.2.3.2 In case of heat-treated castings, the test samples shall be heat-treated with the castings they represent. The test samples before or after heat-treatment shall not be hammered or otherwise treated, except by machining to the shape of the round test piece, if necessary.

10 PRESSURE TEST

When required by the purchaser, each casting shall be pressure tested. Full details of the required/agreed test medium, test pressure and time under test shall be indicated-in the test schedule, Castings shall not be impregnated or otherwise treated by a process designed to improve pressure-tightness except as indicated in the test schedule.

11 RETEST

For the purpose of this standard, retest clauses as given in IS 10259 shall apply

12 PACKAGING

For the purpose of this standard, the following packaging methods and those given in IS 10259 shall apply.

12.1 Ingot, each weighing below 25 kgs shall be stacked in a bundle weighing in the range of 500 – 1,100 Kg and shall then be strapped for ease of handling using forklift.

12.2 T-Bars and Sow ingots shall be sold as equivalent ingots with individual weights around 200 – 1 000 kg each. The shapes and size of sow ingots and T-bars are designed for ease of handling by forklift trucks.

12.3 The strapping of ingots for Level-A packaging given in IS 10259 shall apply.

13 MARKING

For the purpose of this standard, the following marking and labelling methods and those given in IS 10259 shall apply.

13.1 Ingots/castings shall be suitably marked for identification, with the following details:

a) Lot or heat-treatment batch number;
b) Alloy and temper designations; and
c) Indication of the source of manufacture**.**

13.2 If required, ingots/castings may also be colour coded in accordance with IS 2479.

d) The ingots may also be marked with the Standard Mark.

13.3 BIS Certification Marking

The material may also be marked with the Standard Mark.

13.3.1 The products (s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provision of the BIS Act, 2016 and the Rules and Regulations framed thereunder, and the product may be marked with the standard mark.'

Table 1 Chemical compositions of ingots for remelting and castings of Aluminium and aluminium alloys

Chemical composition. % (mass fraction).Max limits																
Sl No.	**Alloy group**	**Chemical symbols**	**Si**	**Fe**	**Cu**	**Mn**	**Mg**	**Cr**	**Ni**	**Zn**	**Pb**	**Sn**	**Ti**	**Others[a]**		**Aluminium**
														Each	Total	
1	Al	Al 99.0	0.5	0.6	0.2	0.2	0.05	_	0.1	0.1	—	—	—	—	—	Al >= 99.0
		Al 99.5	0.15	0.3	0.02	0.03	0.005	—	—	0.05	—	—	0.02	0.03	—	Al >= 99.5
		Al 99.7	0.1	0.2	0.01	0.05	0.02	0.004	—	0.04	—	—	—	0.03	—	Al >=99.7
2	AlCu	Al Cu4Ti(a)	0.18 (0.15)	0.19 (0.15)	4.2 to 5.2	0.55	—	—	—	0.07	—	—	0.15 to 0.30 (0.15 to 0.25)	0.03	0.1	Remainder
		Al Cu4MgTi	0.2 (0.15)	0.35 (0.3)	4.2 to 5.0	0.1	0.15 to 0.35 (0.20 to 0.35)	—	0.05	0.1	0.05	0.05	0.15 to 0.30 (0.15 to 0.25)	0.03	0.1	Remainder
		Al Cu5MgAg[b]	0.05	0.1	4.0 to 5.0	0.20 to 0.40	0.15 to 0.35 (0.20 to 0.35)	—	—	0.05	—	—	0.15 to 0.35	0.03	0.1	Remainder
		Al Cu5 NiCoZr[c]	0.3	0.5	4.5 to 5.5	0.20 to 0.30	0.05 (0.10)	—	1.3 to 1.8	0.05	0.05	0.05	0.15 to 0.25	0.05	0.15	Remainder
		AlCu4Ti(b)	0.25	0.25	4.0 to 5.0	0.1	0.1	_	0.1	0.1	0.05	0.05	0.20 to 0.30	—	—	Remainder
		AlCu4NiMg	0.7	0.7	3.5 to 4.5	0.6	1.2 to 1.8	_	1.7 to 2.3	0.1	0.05	0.05	0.2	—	—	Remainder
		AlCu10MnMg	2.5	1	9.0 to 11.0	0.6	0.2 to 0.40	_	0.5	0.8	0.1	0.1	0.2	—	—	Remainder
3	AlSi	Al Si9	8.0 to 11.0	0.65 (0.55)	0.1 (0.08)	0.5	0.1	—	0.05	0.15	0.05	0.05	0.15	0.05	0.15	Remainder
		Al Si11	10.0 to 11.8	0.19 (0.15)	0.05 (0.03)	0.1	0.45	—	—	0.07	—	—	0.15	0.03	0.1	Remainder
		Al Si12(a)	10.5 to 13.5	0.55 (0.4)	0.05 (0.03)	0.35	—	—	—	0.1	—	—	0.15	0.05	0.15	Remainder
		Al Si12(b)	10.5 to 13.5	0.65 (0.55)	0.15 (0.1)	0.55	0.1	—	0.1	0.15	0.1	—	0.2 (0.15)	0.05	0.15	Remainder
		Al Si12(Fe)	10.5 to 13.5	1.0 (0.45 to 0.90)	0.1 (0.08)	0.55	—	—	—	0.15	—	—	0.15	0.05	0.25	Remainder
		AlSi5	4.5 to	0.6	0.1	0.5	0.1	—	0.1	0.1	0.1	0.05	0.2	—	—	Remainder

Chemical composition. % (mass fraction).Max limits																
Sl No.	**Alloy group**	**Chemical symbols**	**Si**	**Fe**	**Cu**	**Mn**	**Mg**	**Cr**	**Ni**	**Zn**	**Pb**	**Sn**	**Ti**	**Others[a]**		**Aluminium**
														Each	Total	
			6.0													
		AlSi5Cu4	4.0 to 6.0	0.8	3.0 to 4.5	0.55	0.25	0.15	0.3	0.55	0.15	0.05	0.2	_	_	Remainder
4	AlSiMgTi	Al Si2MgTi	1.6 to 2.4	0.6 (0.5)	0.1 (0.08)	0.30 to 0.50	0.45 to 0.65 (0.50 to 0.65)	—	0.05	0.1	0.05	0.05	0.05 to 0.20 (0.07 to 0.15)	0.05	0.15	Remainder
5	AlSi7Mg	Al Si7Mg	6.5 to 7.5	0.55 (0.45)	0.2 (0.15)	0.35	0.20 to 0.65 (0.25 to 0.65)	—	0.15	0.15	0.15	0.05	0.05 to 0.25 (0.05 to 0.20)	0.05	0.15	Remainder
		Al Si7Mg0.3	6.5 to 7.5	0.19 (0.15)	0.05 (0.03)	0.1	0.25 to 0.45 (0.30 to 0.45)	—	—	0.07	—	—	0.08 to 0.25 (0.10 to 0.18)	0.03	0.1	Remainder
		Al Si7Mg0.6	6.5 to 7.5	0.19 (0.15)	0.05 (0.03)	0.1	0.45 to 0.70 (0.50 to 0.70)	—	—	0.07	—	—	0.08 to 0.25 (0.10 to 0.18)	0.03	0.1	Remainder
		AlSi7Mg0.3Ti	6.5 to 7.5	0.5	0.1	0.3	0.20 to 0.45	—	0.1	0.1	0.1	0.05	0.2	—	—	Remainder
		AlSi10Mg(a)	10.0 to 13.0	0.6	0.1	0.5	0.1	—	0.1	0.1	0.1	0.05	0.2	_	_	Remainder
		AlSi10Mg(b)	10.0 to 13.0	1	0.4	0.5	0.2	—	0.1	0.2	0.1	0.1	0.2	_	_	Remainder
6	AlSi10Mg	Al Si9Mg	9.0 to 10.0	0.19 (0.15)	0.05 (0.03)	0.1	0.25 to 0.45 (0.30 to 0.45)	—	—	0.07	—	—	0.15	0.03	0.1	Remainder
		Al Si10Mg	9.0 to 11.0	0.55 (0.45)	0.1 (0.08)	0.45	0.20 to 0.45 (0.25 to 0.45)	—	0.05	0.1	0.05	0.05	0.15	0.05	0.15	Remainder
		AlSi10Mg(a)	10.0 to 13.0	0.6	0.1	0.5	0.1	—	0.1	0.1	0.1	0.05	0.2	_	_	Remainder

Chemical composition. % (mass fraction).Max limits																
Sl No.	**Alloy group**	**Chemical symbols**	**Si**	**Fe**	**Cu**	**Mn**	**Mg**	**Cr**	**Ni**	**Zn**	**Pb**	**Sn**	**Ti**	**Others[a]**		**Aluminium**
														Each	Total	
		AlSi10Mg(b)	10.0 to 13.0	1	0.4	0.5	0.2	—	0.1	0.2	0.1	0.1	0.2	_	_	Remainder
		Al Si10Mg(Fe)	9.0 to 11.0	1 (0.45 to 0.9)	0.1 (0.08)	0.55	0.20 to 0.50 (0.25 to 0.50)	—	0.15	0.15	0.15	0.05	0.2 (0.15)	0.05	0.15	Remainder
		Al Si10Mg(Cu)	9.0 to 11.0	0.65 (0.55)	0.35 (0.3)	0.55	0.20 to 0.45 (0.25 to 0.45)	—	0.15	0.35	0.1	—	0.2 (0.15)	0.05	0.15	Remainder
		AlSi12MgCu	11.0 to 12.5	0.7 to 1.1	1.75 to 2.5	0.5	0.3	—	0.3	1.5	0.05	0.1	0.2	_	_	Remainder
7	AlSi5Cu	Al Si5Cu1Mg	4.5 to 5.5	0.65 (0.55)	1.0 to 1.5	0.55	0.35 to 0.65 (0.40 to 0.65)	—	0.25	0.15	0.15	0.05	0.05 to 0.25 (0.05 to 0.20)	0.05	0.15	Remainder
		Al Si5Cu3	4.5 to 6.0	0.6 (0.5)	2.6 to 3.6	0.55	0.05	—	0.1	0.2	0.1	0.05	0.25 (0.2)	0.05	0.15	Remainder
		Al Si5Cu3Mg	4.5 to 6.0	0.6 (0.5)	2.6 to 3.6	0.55	0.15 to 0.45 (0.20 to 0.45)	—	0.1	0.2	0.1	0.05	0.25 (0.2)	0.05	0.15	Remainder
		Al Si5Cu3Mn(a)	4.5 to 6.0	0.8 (0.7)	2.5 to 4.0	0.20 to 0.55	0.4	—	0.3	0.55	0.2	0.1	0.2 (0.15)	0.05	0.25	Remainder
		Al Si6Cu4(a)	5.0 to 7.0	1.0 (0.9)	3.0 to 5.0	0.20 to 0.65	0.55	0.15	0.45	2	0.3	0.15	0.25 (0.2)	0.05	0.35	Remainder
		AlSi5Cu3Mn(b)	4.0 to 6.0	0.8	2.0 to 4.0	0.2 to 0.60	0.15	-	0.3	0.5	0.1	0.1	0.2	—	—	Remainder
		AlSi5Cu3Mn(c)	4.0 to 6.0	0.6	2.8 to 3.8	0.2 to 0.60	0.05	-	0.2	0.15	0.1	0.05	0.2	—	—	Remainder
		AlSi5CuMg	4.5 to 6.0	0.8	1.0 to 1.5	0.5	0.3 to 0.6	-	0.3	0.5	0.2	0.1	0.2	—	—	Remainder
		AlSi6Cu4(b)	5.0 to 7.0	1.0	3.0 to 5.0	0.2 to 0.60	0.1 to 0.30	-	0.3	2.0	0.2	0.1	0.2	—	—	Remainder

Chemical composition. % (mass fraction).Max limits																
Sl No.	**Alloy group**	**Chemical symbols**	**Si**	**Fe**	**Cu**	**Mn**	**Mg**	**Cr**	**Ni**	**Zn**	**Pb**	**Sn**	**Ti**	**Others[a]**		**Aluminium**
														Each	Total	
		AlSi8Cu(a)	7.5 to 9.5	1.3	3.0 to 4.0	0.5	0.3		0.5	3.0	0.3	0.2	0.2	_	_	Remainder
		AlSi8Cu(b)	7.5 to 9.5	1.0	3.0 to 4.0	0.5	0.1		0.5	2.9	_	0.35	_	_	_	Reminder
		AlSi7Cu	6.0 to 8.0	0.8	1.5 to 2.5	0.2 to 0.6	0.3	-	0.3	1	0.2	0.1	0.2	_	_	Remainder
		AlSi10Cu	9.0 to 11.5	1	0.7 to 2.5	0.5	0.3		0.5	2	0.3	0.2	0.2	_	_	Remainder
8	AlSi9Cu	Al Si7Cu2	6.0 to 8.0	0.8 (0.7)	1.5 to 2.5	0.15 to 0.65	0.35	—	0.35	1	0.25	0.15	0.25 (0.2)	0.05	0.15	Remainder
		Al Si7Cu3Mg	6.5 to 8.0	0.8 (0.7)	3.0 to 4.0	0.20 to 0.65	0.30 to 0.60 (0.35 to 0.60)	—	0.3	0.65	0.15	0.1	0.25 (0.2)	0.05	0.25	Remainder
		Al Si8Cu3	7.5 to 9.5	0.8 (0.7)	2.0 to 3.5	0.15 to 0.65	0.05 to 0.55 (0.15 to 0.55)	—	0.35	1.2	0.25	0.15	0.25 (0.2)	0.05	0.25	Remainder
		Al Si9Cu1Mg	8.3 to 9.7	0.8 (0.7)	0.8 to 1.3	0.15 to 0.55	0.25 to 0.65 (0.30 to 0.65)	—	0.2	0.8	0.1	0.1	0.10 to 0.20 (0.10 to 0.18)	0.05	0.25	Remainder
		Al Si9Cu3(Fe)	8.0 to 11.0	1.3 (0.6 to 1.2)	2.0 to 4.0	0.20 to 0.55	0.05 to 0.55 (0.15 to 0.55)	0.15	0.5	1.2	0.35	0.25	0.25 (0.2)	0.05	0.25	Remainder
		Al Si9Cu3(Fe)(Zn)	8.0 to 11.0	1.3 (0.6 to 1.2)	2.0 to 4.0	0.55	0.05 to 0.55 (0.15 to 0.55)	0.15	0.55	3	0.35	0.25	0.25 (0.2)	0.05	0.25	Remainder
		Al Si11Cu2(Fe)	10.0 to 12.0	1.1 (0.45 to 1.0)	1.5 to 2.5	0.55	0.3	0.15	0.45	1.7	0.25	0.25	0.25 (0.2)	0.05	0.25	Remainder
		Al Si11Cu3(Fe)	9.6 to 12.0	1.3	1.5 to 3.5	0.6	0.35	—	0.45	1.7	0.25	0.25	0.25	—	—	Remainder
		AlSi9Cu3(a)	8.5 to 10.5	1.2	2.0 to 4.0	0.5	0.5 to 1.5	1	1	0.2	0.1	0.1	0.2	_	_	Remainder
		AlSi10Cu	9.0 to	1	0.7 to	0.5	0.3		0.5	2	0.3	0.2	0.2	_	_	Remainder

Chemical composition. % (mass fraction).Max limits																
Sl No.	**Alloy group**	**Chemical symbols**	**Si**	**Fe**	**Cu**	**Mn**	**Mg**	**Cr**	**Ni**	**Zn**	**Pb**	**Sn**	**Ti**	**Others[a]**		**Aluminium**
														Each	Total	
			11.5		2.5											
		AlSi9Cu3(b)	8.5 to 10.5	1.2	2 to 4	0.5	0.5 to 1.5	1	1	0.2	0.1	0.1	0.2	_	_	Remainder
		AlSi9Cu2	8.5 to 9.5	0.4 to 0.6	1.75 to 2.5	0.8	0.15	-	0.8	0.5	0.1	0.1	0.2	_	_	Remainder
		AlSi11Cu2(Fe)	9.6 to 12.0	1.3	1.5 to 3.5	0.5	0.3	_	0.5	1	0.2	0.2	0.3	_	_	Remainder
10	AlSi12Cu	Al Si12(Cu)	10.5 to 13.5	0.8 (0.7)	1.0 (0.9)	0.05 to 0.55	0.35	0.1	0.3	0.55	0.2	0.1	0.2 (0.15)	0.05	0.25	Remainder
		Al Si12Cu1(Fe)	10.5 to 13.5	1.3 (0.6 to 1.2)	0.7 to 1.2	0.55	0.35	0.1	0.3	0.55	0.2	0.1	0.2 (0.15)	0.05	0.25	Remainder
		Al Si12CuMgNi	10.5 to 13.5	0.7 (0.6)	0.8 to 1.5	0.35	0.8 to 1.5 (0.9 to 1.5)	—	0.7 to 1.3	0.35	—	—	0.25 (0.2)	0.05	0.15	Remainder
		AlSi12Cu2Mg	11.0 to 12.5	0.7 to 1.1	1.75 to 2.5	0.5	0.3	—	0.3	1.5	0.05	0.1	0.2	_	_	Remainder
		AlSi11MgMn	10.0 to 13.0	0.6	0.1	0.3 to 0.7	0.2 to 0.6	—	0.1	0.1	0.1	0.05	0.2	_	_	Remainder
		AlSi11MgNi	10.0 to 12.0	1	0.7 to 1.5	0.5	0.8 to 1.5		0.7 to 1.5	0.5	0.1	0.1	0.2	_	_	Remainder
11	AlSi17Cu	Al Si17Cu4Mg	16.0 to 18.0	1.3 (1.0)	4.0 to 5.0	0.5	0.45 to 0.65	—	0.3	1.5	—	0.3	—	—	—	Remainder
12	AlMg	Al Mg3	0.55 (0.45)	0.55 (0.45)	0.1 (0.08)	0.45	2.5 to 3.5 (2.7 to 3.5)	—	—	0.1	—	—	0.2 (0.15)	0.05	0.15	Remainder
		Al Mg5	0.55 (0.45)	0.55 (0.45)	0.1 (0.05)	0.45	4.5 to 6.5 (4.8 to 6.5)	—	—	0.1	—	—	0.2 (0.15)	0.05	0.15	Remainder

Chemical composition. % (mass fraction).Max limits																
Sl No.	**Alloy group**	**Chemical symbols**	**Si**	**Fe**	**Cu**	**Mn**	**Mg**	**Cr**	**Ni**	**Zn**	**Pb**	**Sn**	**Ti**	**Others[a]**		**Aluminium**
														Each	Total	
		Al Mg5(Si)	1.5 (1.3)	0.55 (0.45)	0.05 (0.03)	0.45	4.5 to 6.5 (4.8 to 6.5)	—	—	0.1	—	—	0.2 (0.15)	0.05	0.15	Remainder
		Al Mg9	2.5	1.0 (0.5 to 0.9)	0.1 (0.08)	0.55	8.0 to 10.5 (8.5 to 10.5)	—	0.1	0.25	0.1	0.1	0.2 (0.15)	0.05	0.15	Remainder
		Al Mg5Si2Mn(Fe) d	1.8 to 2.6	0.2 (0.3)	0.05 (0.07)	0.5 to 0.8	5.0 to 6.0 4.8 to 6.0	—	—	0.07	—	—	0.2 (0.25)	0.05	0.15	Remainder
		AlMg0.6	0.3	0.6	0.1	0.3 to 0.7	0.6	—	0.1	0.1	0.05	0.05	0.2	_	_	Remainder
		AlMg0.4	0.25	0.4	0.1	0.1	0.4	—	0.1	0.1	0.05	0.05	0.2	_	_	Remainder
		AlMg3Si	1	0.8	0.1	0.4 to 0.6	2.5 to 4.0	_	0.1	0.4	0.1	0.1	0.2	_	_	Remainder
13	AlZnMg	Al Zn5Mg	0.3 (0.25)	0.8 (0.7)	0.15 to 0.35	0.4	0.40 to 0.70 (0.45 to 0.70)	0.15 to 0.60	0.05	4.50 to 6.00	0.05	0.05	0.10 to 0.25 (0.12 to 0.20)	0.05	0.15	Remainder
14	AlZnSiMg	Al Zn10Si8Mg	7.5 to 9.0 (7.7 to 8.3)	0.3 (0.27)	0.1 (0.08)	0.156 (0.1)	0.2 to 0.4 (0.25 to 0.4)	—	—	9.0 to 10.5	—	—	0.15	0.05	0.15	Remainder
	NOTE 1 Figures in brackets are ingot compositions where they differ from the castings. NOTE 2 Limits are expressed as a maximum. unless shown as a range. Note 3 :Aluminium shall be determined by difference. Impurity levels specified above are maximum values unless otherwise specified.															
	a) "Others" does not include modifying or refining elements such as Na. Sr. Sb and P. b) Ag = 0.4 to 1.0. c) Zr = 0.10 to 0.30 ;Ti+ Zr=0.50 max. Sb : 0.10 to 0.40. Co = 0.10 to 0.40 . Sb +Co =0.60 max d) Be =0.01 max															

Table 2 Mechanical Properties of Sand-Cast Alloys for Separately Cast Test Pieces

Alloy group	Alloy designation	Temper designation	Tensile strength Rm MPa min.	Proof stress Rp0,2 MPa min.	Elongation A % min.	Brinell hardness HBW min.
AlCu	AlCu4Ti	T6	300	200	3	95
		T64	280	180	5	85
	AlCu4Ti(b)	T4	215	--	7	--
		T6	275	--	4	--
	AlCu4MgTi	T4	300	200	5	90
	AlCu5MgAg	T6	480	430	3	115
	AlCu4NiMg	T6	215	--	--	--
	AlCu10MnMg	M	--	--	--	--
AlSi	Al Si11	M	150	70	6	45
	AlSi12(a)	M	150	70	5	50
	AlSi12(b)	M	150	70	4	50
	AlSi5Cu3Mn(b)	M	140	--	2	--
		T6	225	--	--	--
	AlSi5Cu3Mn(c)	T4	--	--	--	--
	AlSi5CuMg	T4	175	--	2	--
		T6	230	--	--	--
	AlSi5	M	120	--	3	--
	AlSi6Cu4(b)	M	160	--	1	--
	AlSi8Cu(a)	M	--	--	--	--
	AlSi7Cu	M	140	--	1	--
	AlSi7Mg0.3Ti	M	135	--	2	--
		T5	160	--	1	--
		T7	160	--	2.5	--
		T6	225	--	--	--
	AlSi10Cu	M	125	--	--	--
	AlSi9Cu3(a)	T5	--	--	--	--
	AlSi9Cu2	M	150	--	1.0	--
		T5	140	--	1.5	--

Alloy group	Alloy designation	Temper designation	Tensile strength Rm MPa min.	Proof stress Rp0,2 MPa min.	Elongation A % min.	Brinell hardness HBW min.
		T6	--	--	--	--
	AlSi10Mg(a)	M	165	--	5	--
	AlSi10Mg(b)	M	165	--	5	--
	AlSi12MgCu	M	--	--	--	--
	AlSi11MgMn	M	--	--	--	--
		T5	170	--	1.5	--
		T6	240	--	--	--
	AlSi11MgNi	T5	--	--	--	--
		T6	140	--	--	--
		T7	175	--	--	--
AlSiMgTi	AlSi2MgTi	M	140	70	3	50
		T6	240	180	3	85
AlSi7Mg	AlSi7Mg	M	140	80	2	50
		T6	220	180	1	75
	AlSi7Mg0.3	T6	230	190	2	75
	AlSi7Mg0.6	T6	250	210	1	85
AlSi10Mg	AlSi9Mg	T6	230	190	2	75
	AlSi10Mg	M	150	80	2	50
		T6	220	180	1	75
	AlSi10Mg(Cu)	M	160	80	1	50
		T6	220	180	1	75
AlSi5Cu	AlSi5Cu1Mg	T4	170	120	2	80
		T6	230	200	-	100
	AlSi5Cu3Mn	M	140	70	1	60
		T6	230	200-	-	90
	AlSi6Cu4	M	150	90	1	60
AlSi9Cu	AlSi7Cu2	M	150	90	1	60
	AlSi8Cu3	M	150	90	1	60
	AlSi9Cu1Mg	M	135	90	1	60
AlSi12Cu	AlSi12(Cu)	M	150	80	1	50
AlMg	AlMg3	M	140	70	3	50
	AlMg5	M	160	90	3	55

Alloy group	Alloy designation	Temper designation	Tensile strength Rm MPa min.	Proof stress Rp0,2 MPa min.	Elongation A % min.	Brinell hardness HBW min.
	AlMg5(Si)	M	160	100	3	60
	AlMg0.6	M	140	--	3	--
	AlMg0.4	T4	275	--	8	--
AlZnMg	AlZn5Mg	T1	190	120	4	60
AlZnSiMg	AlZn10Si8Mg	T1	220	200	1	90
1N/mm2=1 MPa.						

Table 3 Mechanical Properties of Chill Cast Alloys for Separately Cast Test Pieces

Alloy group	Alloy designation	Temper Designation	Tensile strength R_m MPa min.	Proof stress $R_{p0,2}$ MPa min.	Elongation A % min.	Brinell hardness HBW min.
AlCu	AlCu4Ti	T6 T64	330 320	220 180	7 8	95 90
	AlCu4Ti(b)	T4	265	--	13	--
		T6	310	--	9	--
	AlCu4MgTi	T4	320	200	8	95
	AlCu5MgAg	T6	480	430	3	115
	AlCu4NiMg	T6	280	--	--	--
	AlCu10MnMg	M	170	--	--	--
AlSi	Al Si11	M	170	80	7	45
	AlSi12(a)	M	170	80	6	55
	AlSi12(b)	M	170	80	5	55
	AlSi5Cu3Mn(b)	M	160	--	2	--

Alloy group	Alloy designation	Temper Designation	Tensile strength R_m MPa min.	Proof stress $R_{p0,2}$ MPa min.	Elongation A % min.	Brinell hardness HBW min.
		T6	280	--	--	--
	AlSi5Cu3Mn(c)	T4	245	--	8	--
	AlSi5CuMg	T4	230	--	3	--
		T6	280	--	--	--
	AlSi5	M	140	--	4	--
	AlSi6Cu4(b)	M	175	--	1	--
	AlSi8Cu(a)	M	180	--	1.5	--
	AlSi7Cu	M	160	--	2	--
	AlSi7Mg0.3Ti	M	160	--	3	--
		T5	190	--	2	--
		T7	225	--	5	--
		T6	275	--	2	--
	AlSi10Cu	M	150	--	--	--
	AlSi9Cu3(a)	T5	210	--	--	--
	AlSi9Cu2	M	220	--	1.5	--
		T5	200	--	3.0	--
		T6	320	--	2.0	--
	AlSi10Mg(a)	M	190	--	7	--
	AlSi10Mg(b)	M	190	--	5	--
	AlSi12MgCu	M	270	--	1.5	--
	AlSi11MgMn	M	190	--	3	--
		T5	230	--	2	--
		T6	295	--	--	--
	AlSi11MgNi	T5	210	--	--	--
		T6	200	--	--	--
		T7	280	--	--	--
AlSiMgTi	AlSi2MgTi	M	170	70	5	50
		T6	260	180	5	85
AlSi7Mg	AlSi7Mg	M	170	90	2.5	55

Alloy group	Alloy designation	Temper Designation	Tensile strength R_m MPa min.	Proof stress $R_{p0,2}$ MPa min.	Elongation A % min.	Brinell hardness HBW min.
		T6	260	220	1	90
		T64	240	200	2	80
	AlSi7Mg0.3	T6	290	210	4	90
		T64	250	180	8	80
	AlSi7Mg0.6	T6	320	240	3	100
		T64	290	210	6	90
AlSi10Mg	AlSi9Mg	T6	290	210	4	90
		T64	250	180	6	80
	AlSi10Mg	M	180	90	2.5	55
		T6	260	220	1	90
		T64	240	200	2	80
	AlSi10Mg(Cu)	F	180	90	1	55
		T6	240	200	1	80
AlSi5Cu	AlSi5Cu1Mg	T4	230	140	3	85
		T6	280	210	-	110
	AlSi5Cu3	T4	230	110	6	75
	AlSi5Cu3Mg	T4	270	180	2.5	85
		T6	320	280	-	110
	AlSi5Cu3Mn	M	160	80	1	70
		T6	280	230	-	90
	AlSi6Cu4	M	170	100	1	75
AlSi9Cu	AlSi7Cu2	M	170	100	1	75
	AlSi7Cu3Mg	M	180	100	1	80
	AlSi8Cu3	M	170	100	1	75
	AlSi9Cu1Mg	M	170	100	1	75
		T6	275	235	1.5	105
AlSi12Cu	AlSi12(Cu)	M	170	90	2	55
	AlSi12CuMgNi	T5	200	185	-	90
		T6	280	240	-	100

Alloy group	Alloy designation	Temper Designation	Tensile strength R_m MPa min.	Proof stress $R_{p0,2}$ MPa min.	Elongation A % min.	Brinell hardness HBW min.
AlMg	AlMg3	M	150	70	5	50
	AlMg5	M	180	100	4	60
	AlMg5(Si)	F	180	110	3	65
	AlMg0.6	M	170	--	5	--
	AlMg0.4	T4	310	--	12	--
AlZnMg	AlZn5Mg	T1	210	130	4	65
AlZnSiMg	AlZn10Si8Mg	T1	280	210	2	105
$1N/mm^2$=1 MPa.						

Table 4—Mechanical properties of investment-cast alloys for separately cast test bars

Alloy group	Alloy designation	Temper designation	Tensile strength R_m MPa min.	Proof stress $R_{p0,2}$ MPa min.	Elongation A % min.	Brinell hardness HBW min.
AlCu	AlCu4MgTi	T4	300	220	5	90
AlSi	AlSi12(b)	F	150	80	4	50
AlSi7Mg	AlSi7Mg	F	150	80	2	50
		T6	240	190	1	75
	AlSi7Mg0,3	T6	260	200	3	75
	AlSi7Mg0,6	T6	290	240	2	85
AlSi5Cu	AlSi5Cu3Mn	F	160	80	1	60

AlSi17Cu	AlSi17Cu4Mg	F T5	200 295	180 260	1 1	90 125
AlMg	AlMg5	F	170	95	3	55
$1N/mm^2=1$ MPa.						

Annex A

(normative)

Writing rules for the designation and chemical composition of alloyedaluminium ingots for remelting and castings

Basis of codification

The chemical-symbol-based designation shall be constituted successively by the following:

a) the prefix IS, followed by a blank space;

b) the letter A representing aluminium;

c) a letter representing the form of the product:

–the letter B representing ingots for remelting; or

–the letter C representing castings.

The letter B or C shall be separated from the following designation by a hyphen.

Distinguishing by nominal mass fraction

When several alloying elements are deemed to be required in the designation, they shall be arranged in orderof decreasing nominal mass fractions.

EXAMPLE 1 IS AB-Al Si5Cu3

If these mass fractions are equal, the alloying elements shall be arranged in the alphabetical order of thesymbols, as specified in Table A.1.

EXAMPLE 2 IS AB-Al Si12CuMgNi

The chemical symbols for alloying elements shall be restricted to a maximum of four elements.

EXAMPLE 3 IS AB-Al Si12CuMgNi

EXAMPLE 4 IS AC-Al Si12CuMgNi

The simplest possible designation shall be used.

Alloys with similar compositions

In the case of alloys with similar compositions, the following additional designation shall be used fordistinguishing between alloys in decreasing priority.

The alloying element shall be distinguished by the nominal mass fraction (middle of the range) rounded to thenearest integer or, if necessary, to the nearest 0.5, or, for mass fractions less than 1 %, to the nearest 0.1.

EXAMPLE 1 IS AB-Al Si7Mg0.3EXAMPLE 2 IS AB-Al Si7Mg0.6

Distinguishing by main impurities

The main impurity or impurities shall be added in parentheses.

EXAMPLE 1 IS AB-Al Si10Mg(Cu) EXAMPLE 2 IS AB-Al Si10Mg(Fe)

EXAMPLE 3 IS AB-Al Si9Cu3(Fe)(Zn)

Distinguishing by a suffix

If the above provision is not sufficient for differentiating between several alloys, a suffix shall be used: (a), (b), (c)…, according to the date of registration. This suffix shall consist of a lower-case letter placed in parentheses to avoid confusion with the chemical symbols.

EXAMPLE 1 IS AB-Al Si12(a)

EXAMPLE 2 IS AB-Al Si12(b)

Table A.1 — Designation of chemical elements

Silver	Ag	Molybdenum	Mo
Aluminium	Al	Sodium	Na
Boron	B	Niobium	Nb
Beryllium	Be	Nickel	Ni
Bismuth	Bi	Phosphorus	P
Calcium	Ca	Lead	Pb
Cadmium	Cd	Rare earths	RE
Cerium	Ce	Antimony	Sb
Cobalt	Co	Silicon	Si
Chromium	Cr	Tin	Sn
Copper	Cu	Strontium	Sr
Iron	Fe	Titanium	Ti
Gallium	Ga	Vanadium	V
Lithium	Li	Zinc	Zn
Magnesium	Mg	Zirconium	Zr
Manganese	Mn		

Annex B
(informative)

Mechanical properties of pressure die-cast alloys

Table B.1 — Mechanical properties of pressure die-cast alloys(see 6.2.1.5)

Alloy group	Alloy designation	Temper designation	Tensile strength R_m MPa min.	Proof stress $R_{p0,2}$ MPa min.	Elongation A [a] % min.	Brinell hardness HBW min.
AlSi	Al Si9	F	220	120	2	55
	Al Si12(Fe)	F	240	130	1	60
AlSi10Mg	Al Si10Mg(Fe)	F	240	140	1	70
AlSi9Cu	Al Si8Cu3	F	240	140	1	80
	Al Si9Cu3(Fe)	F	240	140	-	80
	Al Si9Cu3(Fe)(Zn)	F	240	140	-	80
	Al Si11Cu2(Fe)	F	240	140	-	80
	Al Si11Cu3(Fe)	F	240		-	80
AlSi12Cu	Al Si12Cu1(Fe)	F	240	140	1	70
AlSi17Cu	Al Si17Cu4Mg	F	200	180	-	90
AlMg	Al Mg9	F	200	130	-	70
1 N/mm^2 = 1 MPa.						

Annex C
(informative)

Comparison between cast aluminium alloy designations

Table D1 : IS , AA, EN and JIS Designation

alloy designation , IS	Corresponding AA alloy designation	Corresponding EN alloy designation	Corresponding JIS designation
Al Cu4Ti	—	EN AC-21100	Al-Cu4Ti
Al Cu4MgTi	204.0	EN AC-21000	AC1B
Al Cu5MgAg	A201.0	—	—
Al Si9	—	EN AC-44400	—
Al Si11	—	EN AC-44000	—
Al Si12(a)	—	EN AC-44200	
Al Si12(b)	B413.0	EN AC-44100	AC3A,AI-Si12
Al Si12(Fe)	A413.0	EN AC-44300	ADC1
Al Si2MgTi	—	EN AC-41000	—
Al Si7Mg	A356.0	EN AC-42000	AC4C
Al Si7Mg0.3	A356.0	EN AC-42100	AC4CH
Al Si7Mg0.6	357.0	EN AC-42200	—
Al Si9Mg	—	EN AC-43300	—
Al Si10Mg	—	EN AC-43100	AC4A,Al-Si10Mg
Al Si10Mg(Fe)	—	EN AC-43400	ADC3
Al Si10Mg(Cu)	—	EN AC-43200	—
Al Si5Cu1Mg	355.0	EN AC-45300	AC4D
Al Si5Cu3	—	EN AC-45400	Al-Si5Cu3
Al Si5Cu3Mg	363.0	EN AC-45100	—
Al Si5Cu3Mn	—	EN AC-45200	AC2A,AC2B
Al Si6Cu4	—	EN AC-45000	Al-Si6Cu4
Al Si7Cu2	—	EN AC-46600	—
Al Si7Cu3Mg	320.0	EN AC-46300	—

alloy designation , IS	Corresponding AA alloy designation	Corresponding EN alloy designation	Corresponding JIS designation
Al Si8Cu3	380.0	EN AC-46200	AC4B
Al Si9Cu1Mg	—	EN AC-46400	—
Al Si9Cu3(Fe)	—	EN AC-46000	ADC10
Al Si9Cu3(Fe) (Zn)	—	EN AC-46500	ADC10Z
Al Si11Cu2(Fe)	—	EN AC-46100	ADC12Z
Al Si11Cu3(Fe)	—	—	ADC12
Al Si12(Cu)	—	EN AC-47000	Al-Si12Cu
Al Si12Cu1(Fe)	—	EN AC-47100	—
Al Si12CuMgNi	—	EN AC-48000	AC8A
Al Si17Cu4Mg	B390.0	—	ADC14
Al Mg3	—	EN AC-51000	ADC6,Al-Mg3
Al Mg5	—	EN AC-51300	ADC5,AC7A,Al-Mg6
Al Mg5(Si)	—	EN AC-51400	Al-Mg5Si1
Al Mg9	518.0	EN AC-51200	Al-Mg10
Al Zn5Mg	712.0	EN AC-71000	Al-Zn5Mg
Al Zn10Si8Mg	—	—	—

Table D2 **:**Grades mentioned in IS 617 :1994 and its corresponding alloy designation in present version of IS 617

Grades mentioned in IS 617:1994	**corresponding alloy designation in present version of IS 617**
1900	Al99.0
1950	Al 99.5
2280	AlCu4Ti(b)
2285	AlCu4NiMg
2250	AlCu10MnMg
4223	AlSi5Cu3Mn(b)
4223 A	AlSi5Cu3Mn(c)
4225	AlSi5CuMg
4300	AlSi5
4323	AlSi6Cu4(b)
4420	AlSi8Cu(a)
4423	AlSi7Cu
4450	AlSi7Mg0.3Ti
4520	AlSi10Cu
4525	AlSi9Cu3(a)
4528	AlSi9Cu2
4600	AlSi10Mg(a)
4600A	AlSi10Mg(b)
4628	AlSi12MgCu
4635	AlSi11MgMn
4652	AlSi11MgNi
5230	AlMg0.6
5500	AlMg0.4
2550	AlCu10MnMg
4420A	AlSi8Cu(b)