भारतीय मानक

Indian Standard

IS 617 : 2024

सामान्य इंजीनियरिंग प्रयोजनों के लिए रीमेल्टिंग और कास्टिंग के लिए एल्यूमीनियम और एल्यूमीनियम मिश्रधातु सिल्लियां — विशिष्टि

(चौथा पुनरीक्षण)

Aluminium and Aluminium Alloys Ingots for Remelting and Castings for General Engineering Purposes — Specification

(Fourth Revision)

ICS 77.120.10

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Ores and Feed Stock for Aluminium Industry, its Metals/Alloys and Products Sectional Committee, MTD 07

FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Ores and Feed Stock for Aluminium Industry, its Metals/Alloys and Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1955 and subsequently revised in 1959, 1975 and 1994. This revision has been undertaken to update the standard based on the manufacturing and trade practices followed in the country.

The main modifications made in the revision are as follows:

a) Sixty three new grades of aluminium and aluminium alloys have been incorporated in the standard;

b) Aluminium designation nomenclature based on numerical symbol, in line with international practices has been included; and

c) Comparison of IS grades designation with JIS, EN and AA designation Annex C has been added.

While formulating this standard assistance is drawn from following International standards:

a) ISO 3522 : 2007 ‘Aluminium and aluminium alloys — Castings — Chemical composition and mechanical properties’; and

b) ISO 17615: 2007 ‘Aluminium and aluminium alloys — Alloyed ingots for remelting — Specifications’.

The composition of the Committee responsible for the formulation of this standard is given in Annex E. Annex B and Annex C are for guidance purpose only.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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 standards given in Annex D contain provisions, which through reference in this text constitute provision of this standard. At the time of publication, the editions indications 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 edition of these standards.

3 DEFINITION AND TERMINOLOGY

For the purpose of this standard, the definitions as given in IS 5047 (Part 1) and IS 5047 (Part 2) and the following shall apply.

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.

3.10 Pressure 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.

4 SUPPLY 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 Table 2, Table 3, Table 4 and Table 5:

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; and

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; and

L investment casting.

5.4 Product Designation

The product 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 heat-treated and fully artificially aged. Following sequence needs to be followed: alloy designation (*see* 5.1), casting process (*see* 5.3) temper designation (*see* 5.2).

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 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 in IS 504, the referee method shall be as agreed to between the purchaser and the manufacturer.

6.3 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.

6.4 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 (APPLICABLE FOR ONLY CASTINGS)

7.1 General

The mechanical properties for separately cast test pieces for sand cast, chill cast and investment cast conditions shall be in accordance with Tables 2, Table 3 and Table 4 respectively.

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 mechanical properties shall be agreed between manufacturer and purchaser.

In case of non-availability of separately cast test samples, test piece machined from the castings may be tested. The form, size and location of test pieces, and the minimum mechanical test values to be obtained from them, shall be as agreed to between the supplier and the purchaser. However, agreed value tensile properties should not be less than 75 percent of the specified value.

NOTE — The mechanical properties of pressure die castings are dependent on injection parameters, the mechanical properties given in Table 5 are for guidance only.

7.2 Tensile Tests

Tensile Tests shall be carried out in accordance with IS 1608 (Part 1).

7.3 Test Pieces

7.3.1 *General*

This standard does not specify the exact design of test pieces (separately cast test bars). Design of test pieces shall be as agreed between manufacturer and purchaser. However, the following conditions (*see* 7.3.2) 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:

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

b) As cast diameter shall be a minimum of 12.0 mm; and

c) The gauge length and parallel length shall conform to IS 1608 (Part 1).

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;

a) They shall be cast into metallic moulds;

b) As cast diameter shall be a minimum of 12.0 mm; and

c) The gauge length and parallel length shall conform to IS 1608 (Part 1).

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:

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

b) As cast diameter shall be a minimum of 5.0 mm; and

c) The gauge length and parallel length shall conform to IS 1608 (Part 1).

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

7.3.2.5 *Pressure die cast bars*

The mechanical properties of some of the pressure die cast bars are given in Table 5 of Annex B for guidance purpose only.

7.4 Hardness

Hardness testing shall be carried out as per IS 1500 (Part 1) 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, hardness shall be as 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 tested in special cases subject to agreement between the purchaser and the supplier. The details of the test methods to be used, the frequency of inspection and standards of acceptance should based on mutual agreement of purchaser and manufacturer.

9 SAMPLING

9.1 Chemical Analysis

9.1.1 *Lot*

The ingots/castings produced from the same cast shall constitute a lot.

9.1.2 For chemical composition at least three samples randomly shall be tested from each lot in case of ingots and at least one sample from each lot shall be tested in case of castings.

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

9.2.1 One separately cast test sample shall be selected from each lot.

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*

9.2.3.1 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 (OPTIONAL TEST)

If required by the purchaser each casting shall be pressure tested. Details such as test medium test pressure and time under test shall be as per agreement between purchaser and manufacturer. All castings shall be leak proof.

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 kg shall be stacked in a bundle weighing in the range of 500 kg to 1 200 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 kg to 1 500 kg each. The shapes and size of sow ingots and T-bars are designed for ease of handling by forklift trucks.

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) Product designation as mentioned in 5.4; and

c) Indication of the source of manufacture**.**

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

13.3 BIS Certification Marking

The products (s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provision of the *Bureau of Indian Standards 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

(*Clause* 6.1)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
i)	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
ii)	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
		AlCu4MgTi	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	1.0	9.0 to 11.0	0.6	0.2 to 0.40	—	0.5	0.8	0.1	0.1	0.2	—	—	Remainder
iii)	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
		Al3Si	2.6 to 3.1	0.15	0.03	0.03	—	—	—	—	0.01	—	—	0.03	0.15	Remainder

Table 1 (*Continued*)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		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 6.0	0.6	0.1	0.5	0.1	—	0.1	0.1	0.1	0.05	0.2	—	—	Remainder
		AlSi5(a)	4.5 to 6.0	1.3	0.1	0.5	0.5	0.2	0.1	0.1	0.1	0.1	0.2	—	—	Remainder
		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
iv)	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
v)	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 Si7Mg0.3(a)	6.5 to 7.5	0.19 (0.10)	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

Table 1 (*Continued*)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		AlSi7Mg0.3(b)	6.50 to 7.50	0.5	0.2	0.6	0.20 to 0.40	—	0.05	0.3	0.05	0.05	0.2	—	—	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(b)	10.0 to 13.0	1.0	0.4	0.5	0.2	—	0.1	0.2	0.1	0.1	0.2	—	—	Remainder
vi)	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
		AlSi10Mg(b)	10.0 to 13.0	1.0	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

Table 1 (*Continued*)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		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
vii)	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
		AlSi5Cu3Mn(b)	5.0 to 7.0	1.0	2.0 to 4.0	0.5	0.5	0.2	0.35	1.0	0.2	0.1	0.2	—	—	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	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
		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	0.2	0.1	0.2	—	—	Remainder

Table 1 (*Continued*)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
viii)	AlSi9Cu	AlSi7Cu2	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	0.25	0.15	0.25 (0.2)	0.05	0.15	Remainder
		Al Si7Cu2(a)	7.50 to 8.50	0.60	1.40 to 2.0	0.30	0.35 to 0.45	—	0.20	0.40	0.10	0.03	0.20	—	—	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
		AlSi8Cu1.5Mg	8.6 to 9.4	0.2	1.6 to 2.0	0.1	0.4 to 0.6	—	—	0.1	—	—	0.2	0.05	0.15	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 Si9Cu1Mg(a)	8.50 to 10.00	0.50	0.05 to 0.25	0.40 to 0.60	0.20 to 0.50	—	0.15	0.15	0.10	0.10	0.05 to 0.15	—	—	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	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	3.0	0.25	0.25	0.25 (0.2)	0.05	0.25	Remainder

Table 1 (*Continued*)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		Al Si11Cu3(Fe)	9.6 to 12.0	1.3	1.5 to 3.5	0.6	0.35	—	0.5	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	1.0	1.0	0.2	0.1	0.1	0.2	—	—	Remainder
		AlSi10Cu	9.0 to 11.5	1.0	0.7 to 2.5	0.5	0.3	—	0.5	2.0	0.3	0.2	0.2	—	—	Remainder
		AlSi10Cu(a)	9.00 to 10.00	1.3	0.6	0.3	0.4 to 0.6	—	0.5	0.5	—	0.1	—	—	—	Remainder
		AlSi9Cu3(b)	8.5 to 10.5	1.2	2 to 4	0.5	0.5 to 1.5	1.0	1.0	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	0.2	0.2	0.3	—	—	Remainder
ix)	AlSi12Cu	Al Si12Cu	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
		AlSi12Cu(a)	11.0 to 13.5	1.3	1.2	0.5	0.3	—	0.3	0.5	0.2	0.1	—	—	—	Remainder
		AlSi12Cu(b)	9.00 to 13.50	1.30	1.2	0.55	0.40	0.1	0.50	0.60	0.20	0.20	0.20	—	—	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

Table 1 (*Continued*)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		AlSi11MgNi	10.0 to 12.0	1.0	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
		AlSi10MnMg	9.0 to 11.5	0.25 (0.2)	0.05 (0.03)	0.4 to 0.8	0.1 to 0.6 (0.15 to 0.6)	—	—	0.07	—	—	0.20 (0.15)	—	—	Remainder
x)	AlSi14Cu	AlSi14Cu	13.50 to 16.00	1.30	4.0 to 6.00	0.50	0.50	0.1	0.50	1.40	0.10	0.10	—	—	—	Remainder
		AlSi14Cu(a)	14.50 to 15.50	0.70 to 0.90	1.50 to 2.50	0.30	0.20 to 0.30	—	0.30	0.90	—	0.10	—	—	—	Remainder
xi)	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
xii)	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
		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

Table 1 (*Concluded*)

Chemical Composition Percent (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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		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	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
		AlMg2	0.2 to 0.4	0.65 to 0.80	0.10	0.45 to 0.55	1.70 to 2.30	—	0.080	0.10	0.050	0.050	0.080	—	—	Remainder
		AlMg	8.50 to 9.30	0.35 to 0.45	0.10 to 0.20	0.30 to 0.49	0.30 to 0.39	—	0.10	0.15	0.10	0.10	0.05 to 0.14	—	—	Remainder
xiii)	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
xiv)	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

NOTES
1 Figures in brackets are ingot compositions where they differ from the castings.
2 Limits are expressed as a maximum. unless shown as a range.
3 Aluminium shall be determined by difference. Impurity levels specified above are maximum values unless otherwise specified.
4 "Others" includes the listed elements for which no specific limits are mentioned and also unlisted metallic elements. Identification of unlisted elements shall be as per the mutual agreement between the manufacturer and the purchaser.

[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

(*Clauses* 5.2 *and* 7.1)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength Rm MPa *Min*	Proof Stress Rp 0.2 MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	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	—	—	—	—
ii)	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	—	—	—

Table 2 (*Continued*)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength Rm MPa *Min*	Proof Stress Rp 0.2 MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		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	—
			T6	—	—	—	—
		AlSi10Mg(a)	M	165	—	5	—
		AlSi10Mg(b)	M	165	—	5	—
		AlSi12MgCu	M	—	—	—	—
		AlSi11MgMn	M	—	—	—	—
			T5	170	—	1.5	—
			T6	240	—	—	—

Table 2 (*Continued*)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength Rm MPa *Min*	Proof Stress Rp 0.2 MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		AlSi11MgNi	T5	—	—	—	—
			T6	140	—	—	—
			T7	175	—	—	—
iii)	AlSiMgTi	AlSi2MgTi	M	140	70	3	50
			T6	240	180	3	85
iv)	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
v)	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
vi)	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

Table 2 (*Concluded*)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength Rm MPa *Min*	Proof Stress Rp 0.2 MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
vii)	AlSi9Cu	AlSi7Cu2	M	150	90	1	60
		AlSi8Cu3	M	150	90	1	60
		AlSi9Cu1Mg	M	135	90	1	60
viii)	AlSi12Cu	AlSi12(Cu)	M	150	80	1	50
ix)	AlMg	AlMg3	M	140	70	3	50
		AlMg5	M	160	90	3	55
		AlMg5(Si)	M	160	100	3	60
		AlMg0.6	M	140	—	3	—
		AlMg0.4	T4	275	—	8	—
x)	AlZnMg	AlZn5Mg	T1	190	120	4	60
xi)	AlZnSiMg	AlZn10Si8Mg	T1	220	200	1	90
1 N/mm^2 = 1 MPa.							

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

(*Clauses* 5.2 *and* 7.1)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength R_m MPa *Min*	Proof Stress $R_{p\ 0.2}$ MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	AlCu	AlCu4Ti	T6	330	220	7	95
			T64	320	180	8	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	—	—	—
ii)	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	—
			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	—	—	—

Table 3 (*Continued*)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength R_m MPa *Min*	Proof Stress $R_{p\ 0.2}$ MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		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	—	—	—
		AlSi5Cu4	M	180	—	2	75
			T6	270	—	1	90
iii)	AlSiMgTi	AlSi2MgTi	M	170	70	5	50
			T6	260	180	5	85
iv)	AlSi7Mg	AlSi7Mg	M	170	90	2.5	55
			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
v)	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

Table 3 (*Concluded*)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength R_m MPa *Min*	Proof Stress $R_{p\ 0.2}$ MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		AlSi10Mg(Cu)	F	180	90	1	55
			T6	240	200	1	80
vi)	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
vii)	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
viii)	AlSi12Cu	AlSi12(Cu)	M	170	90	2	55
		AlSi12CuMgNi	T5	200	185	—	90
			T6	280	240	—	100
ix)	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	—
x)	AlZnMg	AlZn5Mg	T1	210	130	4	65
xi)	AlZnSiMg	AlZn10Si8Mg	T1	280	210	2	105

NOTE — 1 N/mm^2 = 1 MPa.

Table 4 Mechanical Properties of Investment-Cast Alloys for Separately Cast Test Bars

(*Clauses* 5.2 *and* 7.1)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength *R*m MPa	Proof Stress *R*p 0.2 MPa	Elongation *A* % Percent	Brinell Hardness HBW
				Min	*Min*	*Min*	*Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	AlCu	AlCu4MgTi	T4	300	220	5	90
ii)	AlSi	AlSi12(b)	M	150	80	4	50
iii)	AlSi7Mg	AlSi7Mg	M	150	80	2	50
			T6	240	190	1	75
		AlSi7Mg0,3	T6	260	200	3	75
		AlSi7Mg0,6	T6	290	240	2	85
iv)	AlSi5Cu	AlSi5Cu3Mn	M	160	80	1	60
v)	AlSi17Cu	AlSi17Cu4Mg	M	200	180	1	90
			T5	295	260	1	125
vi)	AlMg	AlMg5	M	170	95	3	55

NOTE — $1 N/mm^2 = 1$ MPa.

Annex A

(*Clause* 5.1)

(*Normative*)

WRITING RULES FOR THE DESIGNATION AND CHEMICAL COMPOSITION OF ALLOYED ALUMINIUM INGOTS FOR REMELTING AND CASTINGS

A-1 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; and

c) A letter representing the form of the product;

1) The letter B representing ingots for remelting; and

2) The letter C representing castings.

A-1.1 The letter B or letter 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 order of decreasing nominal mass fractions.

Example: IS AB-Al Si5Cu3

A-1.2 If these mass fractions are equal, the alloying elements shall be arranged in the alphabetical order of the symbols.

Example: IS AB-Al Si12CuMgNi

A-1.3 The chemical symbols for alloying elements shall be restricted to a maximum of four elements.

Example: IS AB-Al Si12CuMgNi

Example: IS AC-Al Si12CuMgNi

The simplest possible designation shall be used.

A-2 ALLOYS WITH SIMILAR COMPOSITIONS

A-2.1 In the case of alloys with similar compositions, the following additional designation shall be used fordistinguishing between alloys in decreasing priority.

A-2.2 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 percent to the nearest 0.1.

Example: IS AB-Al Si7Mg0.3

Example: IS AB-Al Si7Mg0.6

A-3 DISTINGUISHING BY MAIN IMPURITIES

The main impurity or impurities shall be added in parentheses.

Example: IS AB-AlSi10Mg (Cu)

Example: IS AB-Al Si10Mg (Fe)

Example: IS AB-Al Si9Cu3 (Fe) (Zn)

A-4 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: IS AB-Al Si12 (a)

Example: IS AB-Al Si12 (b)

Designation of chemical elements (Symbols):

(1)	(2)	(3)	(4)	(5)
i)	Silver	Ag	Molybdenum	Mo
ii)	Aluminium	Al	Sodium	Na
iii)	Boron	B	Niobium	Nb
iv)	Beryllium	Be	Nickel	Ni
v)	Bismuth	Bi	Phosphorus	P
vi)	Calcium	Ca	Lead	Pb
vii)	Cadmium	Cd	Rare earths	RE
viii)	Cerium	Ce	Antimony	Sb
ix)	Cobalt	Co	Silicon	Si
x)	Chromium	Cr	Tin	Sn
xi)	Copper	Cu	Strontium	Sr
xii)	Iron	Fe	Titanium	Ti
xiii)	Gallium	Ga	Vanadium	V
xiv)	Lithium	Li	Zinc	Zn
xv)	Magnesium	Mg	Zirconium	Zr
xvi)	Manganese	Mn	–	–

ANNEX B

MECHANICAL PROPERTIES OF PRESSURE DIE-CAST ALLOYS

(*Clause* 7.3.2.5)

Table 5 Mechanical Properties of Pressure Die-Cast Alloys

(*Clause* 5.2, 7.1 *and* 7.3.2.5)

Sl No.	Alloy Group	Alloy Designation	Temper Designation	Tensile Strength *R*m MPa *Min*	Proof Stress *R*p 0.2 MPa *Min*	Elongation *A* Percent *Min*	Brinell Hardness HBW *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	AlSi	Al Si9	M	220	120	2	55
		Al Si12(Fe)	M	240	130	1	60
ii)	AlSi10Mg	Al Si10Mg(Fe)	M	240	140	1	70
iii)	AlSi9Cu	Al Si8Cu3	M	240	140	1	80
		Al Si9Cu3(Fe)	M	240	140	—	80
		Al Si9Cu3(Fe)(Zn)	M	240	140	—	80
		Al Si11Cu2(Fe)	M	240	140	—	80
		Al Si11Cu3(Fe)	M	240		—	80
iv)	AlSi12Cu	Al Si12Cu1(Fe)	M	240	140	1	70
v)	AlSi17Cu	Al Si17Cu4Mg	M	200	180	—	90
vi)	AlMg	Al Mg9	M	200	130	—	70

NOTE — 1 N/mm^2 = 1 MPa.

ANNEX C

(*Foreword*)

Comparison between Cast Aluminium Alloy Designations

IS, AA, EN and JIS Designation Comparison

Sl No.	*Alloy Designation, IS*	*Corresponding AA Alloy Designation*	*Corresponding EN Alloy Designation*	*Corresponding JIS Designation*
(1)	(2)	(3)	(4)	(5)
i)	Al Cu4Ti	—	EN AC-21100	Al-Cu4Ti
ii)	Al Cu4MgTi	204.0	EN AC-21000	AC1B
iii)	Al Cu5MgAg	A201.0	—	—
iv)	Al Si9	—	EN AC-44400	—
v)	Al Si11	—	EN AC-44000	—
vi)	Al Si12(a)	—	EN AC-44200	
vii)	Al Si12(b)	B413.0	EN AC-44100	AC3A,AI-Si12
viii)	Al Si12(Fe)	A413.0	EN AC-44300	ADC1
ix)	Al Si2MgTi	—	EN AC-41000	—
x)	Al Si7Mg	A356.0	EN AC-42000	AC4C
xi)	Al Si7Mg0.3	A356.0	EN AC-42100	AC4CH
xii)	Al Si7Mg0.6	357.0	EN AC-42200	—
xiii)	Al Si9Mg	—	EN AC-43300	—
xiv)	Al Si10Mg	—	EN AC-43100	AC4A,Al-Si10Mg
xv)	Al Si10Mg(Fe)	—	EN AC-43400	ADC3
xvi)	Al Si10Mg(Cu)	—	EN AC-43200	—
xvii)	Al Si5Cu1Mg	355.0	EN AC-45300	AC4D
xviii)	Al Si5Cu3	—	EN AC-45400	Al-Si5Cu3
xix)	Al Si5Cu3Mg	363.0	EN AC-45100	—
xx)	Al Si5Cu3Mn	—	EN AC-45200	AC2B
xxi)	AlSi5Cu4	—	—	AC2A
xxii)	Al Si6Cu4	—	EN AC-45000	Al-Si6Cu4
xxiii)	Al Si7Cu2	—	EN AC-46600	—
xxiv)	Al Si7Cu3Mg	320.0	EN AC-46300	—
xxv)	Al Si8Cu3	380.0	EN AC-46200	AC4B
xxvi)	Al Si9Cu1Mg	—	EN AC-46400	—
xxvii)	Al Si9Cu3(Fe)	—	EN AC-46000	ADC10
xxviii)	Al Si9Cu3(Fe) (Zn)	—	EN AC-46500	ADC10Z
xxix)	Al Si11Cu2(Fe)	—	EN AC-46100	ADC12Z
xxx)	Al Si11Cu3(Fe)	—	—	ADC12
xxxi)	Al Si12(Cu)	—	EN AC-47000	Al-Si12Cu
xxxii)	Al Si12Cu1(Fe)	—	EN AC-47100	—
xxxiii)	Al Si12CuMgNi	—	EN AC-48000	AC8A
xxxiv)	Al Si17Cu4Mg	B390.0	—	ADC14

Sl No.	*Alloy Designation, IS*	*Corresponding AA Alloy Designation*	*Corresponding EN Alloy Designation*	*Corresponding JIS Designation*
(1)	(2)	(3)	(4)	(5)
xxxv)	Al Mg3	—	EN AC-51000	ADC6,Al-Mg3
xxxvi)	Al Mg5	—	EN AC-51300	ADC5,AC 7A,Al-Mg6
xxxvii)	Al Mg5(Si)	—	EN AC-51400	Al-Mg5Si1
xxxviii)	Al Mg9	518.0	EN AC-51200	Al-Mg10
xxxix)	Al Zn5Mg	712.0	EN AC-71000	Al-Zn5Mg
xl)	Al Zn10Si8Mg	—	—	—

Grades Mentioned in IS 617 : 1994 and its Corresponding Alloy Designation in Present Version of IS 617

Sl No.	*Grades Mentioned in* IS 617 : 1994	*Corresponding Alloy Designation in Present Version of* IS 617
(1)	(2)	(3)
i)	1900	Al99.0
ii)	1950	Al 99.5
iii)	2280	AlCu4Ti(b)
iv)	2285	AlCu4NiMg
v)	2550	AlCu10MnMg
vi)	4223	AlSi5Cu3Mn(b)
vii)	4223 A	AlSi5Cu3Mn(c)
viii)	4225	AlSi5CuMg
ix)	4300	AlSi5
x)	4323	AlSi6Cu4(b)
xi)	4420	AlSi8Cu(a)
xii)	4420A	AlSi8Cu(b)
xiii)	4423	AlSi7Cu
xiv)	4450	AlSi7Mg0.3Ti
xv)	4520	AlSi10Cu
xvi)	4525	AlSi9Cu3(a)
xvii)	4528	AlSi9Cu2
xviii)	4600	AlSi10Mg(a)
xix)	4600A	AlSi10Mg(b)
xx)	4628	AlSi12MgCu
xxi)	4635	AlSi11MgMn
xxii)	4652	AlSi11MgNi
xxiii)	5230	AlMg0.6
xxiv)	5500	AlMg0.4

ANNEX D

(*Clause 2*)

LIST OF REFERRED STANDARDS

IS No.	*Title*	*IS No.*	*Title*
IS 504 (Part 1 to 12) : 2002	Chemical analysis of aluminium and its alloys : Parts 1 to 12 (*second revision*)	IS 3658 : 1999	Code of practice for liquid penetrant flaw detection (*second revision*)
IS 504 (Part 13 to 16) : 2003	Chemical analysis of aluminium and its alloys: Parts 13 to 16 (*second revision*)	IS 5047	Glossary of terms relating to aluminium and aluminium alloys:
IS 1500 (Part 1) : 2019/ISO 6506-1 : 2014	Metallic materials — Brinell hardness test: Part 1 Test method (*fifth revision*)	(Part 1) : 1986	Unwrought and wrought metals (*second revision*)
IS 1608 (Part 1) : 2022/ISO 6892-1 : 2019	Metallic materials — Tensile testing: Part 1Method of test at room temperature (*fifth revision*)	(Part 2) : 1979	Plant and operations, thermal treatment, control and testing, finishing
IS 2479 : 1981	Colour code for identification of aluminium and aluminium alloys for general engineering purposes (*second revision*)	IS 10259 : 1982	General condition of delivery and inspection of aluminium and aluminium alloy products

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Ores and Feedstock for Aluminium Industry, its Metals/Alloys and Products Sectional Committee, MTD 07

Organization	*Representative(s)*
CSIR - Institute of Minerals and Materials Technology, Bhubaneswar	DR KALI SANJAY **(*Chairperson*)**
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Aluminium Secondary Manufacturers Association, New Delhi	SHRI NAVEEN PANT SHRI PRAVEEN DIXIT (*Alternate*)
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SCIENTIST 'C'/DEPUTY DIRECTOR
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