

BUREAU OF INDIAN STANDARDS

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Draft Indian Standard

**WROUGHT ALUMINIUM AND ALUMINIUM ALLOY SHEET AND STRIP FOR GENERAL
ENGINEERING PURPOSES — SPECIFICATION**

[Fifth Revision of IS 737]

ICS 77.150.10

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

Last date of comments
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FOREWORD

This Indian Standard (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1956 and revised in 1965, 1974, 1986 and 2008. While reviewing this standard a need was felt to include grades used extensively at present in the industry.

In the present revision, following modification have been made:

- a) Total 42 new grades are added in this revision, while retaining 30 grades mentioned in previous;
and
- b) Efforts have been taken to incorporate all the grades of wrought al and al alloy sheet and strip presently used and prevalent in the Indian market.

For the purpose of 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.

*Draft Indian Standard***WROUGHT ALUMINIUM AND ALUMINIUM ALLOY SHEET AND STRIP
FOR GENERAL ENGINEERING PURPOSES — SPECIFICATION
(Fifth Revision)****1 SCOPE**

This standard covers the requirements for wrought aluminium and aluminium alloy sheet and strip for general engineering purposes.

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 indicated 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.

<i>IS No.</i>	<i>Title</i>
IS 504 : 1963	Methods of chemical analysis of aluminium and its alloys
IS 1599 : 2023/ISO 7438 : 2020	Metallic Materials — Bend test (<i>fifth revision</i>)
IS 1608 (Part 1) : 2022/ ISO 6892-1 : 2019	Metallic materials — Tensile testing : Part 1 Method of test at room temperature (<i>fifth revision</i>)
IS 2676 : 1981	Dimensions for wrought aluminium and aluminium alloys sheet and strip (<i>first revision</i>)
IS 5047	Glossary of terms relating to aluminium and aluminium alloys
Part 1: 1986	Part 1: Unwrought and wrought metals (<i>second revision</i>)
Part 2: 1979	Part 2 plant and operations, thermal treatment, control and testing, finishing
IS 5052: 1993	Aluminium and its alloys — Temper designations (<i>first revision</i>)
IS 10259: 1982	General condition of delivery and inspection of aluminium and aluminium alloy products (<i>first revision</i>)

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 Heat Treatment Batch

A quantity of material of one alloy of the same dimensions and produced in the same way, solution-treated and subsequently precipitation treated in one furnace load. More than one heat-treatment batch may comprise a furnace load.

3.2 Sheet/ Strip

Hot or cold rolled product of rectangular section, over 0.15 mm but less than 6.0 mm thick. It may be either in straight length or in coil form.

4 ORDERING INFORMATION

The ordering information shall include the following information:

- a) Alloy/ temper;
- b) Finish (Mill Finish or Colour);
- c) Quantity in kg. Pieces can also be given for sheets;
- d) Quantity Tolerances;
- e) Size – Thickness x Width x Length (T x W x L) in mm for Sheets and T x W for Coils;
- f) Coil ID & Coil Weight for Strips/Coils;
- g) Core/spool requirement for Coils; and
- h) Packing mode.

5 SUPPLY OF MATERIAL

General requirements for the supply of aluminium and aluminium alloy sheet and strip shall conform to IS 10259.

6 FREE FROM DEFECTS

The material shall be sound and free from harmful defects for the intended application.

7 CHEMICAL COMPOSITION

The material when analysed as per IS 504 or any other instrumental / chemical method shall conform to the requirements given in Table 1. In case of dispute, the procedure given in IS 504 shall be the referee method.

However, when the method is not given in IS 504 the referee method shall be as agreed between the purchaser and manufacturer.

8 MECHANICAL PROPERTIES

8.1 The material when tested in accordance with IS 1608 shall conform to the values given in Table 2 for grades mentioned in Table 1. Mechanical properties of the grades mentioned in Table 1 not mentioned in Table 2 may be subject to mutual agreement between purchaser and manufacturer.

8.1.1 The tensile test piece shall be rectangular section and conform to the dimension as given in IS 1608 with a gauge length of 50 mm. The test piece shall be cut transverse to the direction of rolling for sheet and strip 300 mm wide and over and parallel to the direction of rolling for sheet and strip under 300 mm wide. When the width of the material to be tested is insufficient to permit preparation of the standard tensile test piece, a piece of the full width of the material may be used.

8.2 Bend Test (for Material 2.6 mm and Thinner)

Unless otherwise stated, the bend test piece shall be not less than 15 mm wide, of convenient length and cut with its longer axis transverse to the direction of rolling. The longer edges shall be carefully rounded and smoothed longitudinally so that the cross-section of the test piece has approximately semi-circular ends.

8.2.1 The test piece may be bent by hand to a U-form, and the piece thus obtained shall subsequently be closed in a vice until the inner surfaces of the test piece are twice the specified radius apart (or are in general contact, if the test piece is to be closed flat).

8.2.2 When tested in accordance with 0 the outer surface of the bend shall not show any visible crack (*see* IS 1599).

9 CONDITION

The material shall be supplied in the condition as required by the purchaser. While specifying the condition, the temper designations laid down in IS 5052 shall be followed.

10 DIMENSIONS AND TOLERANCES

The dimensions and tolerances of sheet and strip shall be as specified in IS 2676.

11 SELECTION OF TEST SAMPLES

11.1 Sheet and Strip of Aluminium or Non-Heat Treatable Aluminium Alloy

Material of the same thickness, produced in the same way, and of the same nominal composition shall be grouped into batches of not more than 4 000 kg. However, if a sheet or strip in a single coil exceeds 4 000 kg in weight, it shall be deemed to represent one batch

11.1.1 Mechanical tests shall be carried out on each batch for determining conformity of the material to this standard.

11.1.2 Before the test samples are cut off, they shall be marked to identify them with the batch they represent. The test sample shall be taken from the material as supplied and shall not be further annealed or mechanically worked. The test samples may be cut and prepared from the margins of the material before cutting it to size.

11.1.3 Sheet and Strip of Heat-Treatable Aluminium Alloys

One test sample shall be cut from a sheet or strip selected from each heat treatment batch. Before the test samples are cut off, they shall be marked to identify with the heat treatment batch they represent-

11.1.4 Unless otherwise agreed, the test samples shall be tested in the O, T4 or T6 conditions (that is in the same condition in which the material is to be supplied). The test sample, after heat treatment, shall not be mechanically worked before being tested.

11.1.5 Material in the 'O' condition, when heat-treated, may have properties of the order of 15 MPa less than the specified properties for the T4 or T6 conditions as appropriate.

11.1.5.1 Unless otherwise agreed, the tests shall be carried out either in T4 or in T6 condition. The test samples shall not be further heat-treated or mechanically worked (except for making the test piece) before being tested. The test samples may be cut from the margins of the material before cutting it to size.

12 TEST CERTIFICATE AND RETESTS

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

13 PACKAGING

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

13.1 MARKING

The material shall be marked with the following;

- a) Indication of the source of manufacture;
- b) Grade designation, cast or lot and size designation;
- c) Quantity;
- d) Date of manufacture; and
- e) Shelf life, if applicable.

13.2 BIS Certification Marking

The material may also be marked with the Standard Mark

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-

SI No.	IS Desig	ISO Desig	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Others (Each) ¹	Others (Total) ₂	Al	Remarks
12.	19350	1235	-	-	0.05	0.05	0.05	-	0.10	0.06	0.03	-	99.35 ¹	V: 0.05; Si+ Fe:0.65
13.	19002	1100	-	-	0.05-0.20	0.05	-	-	0.10	-	0.05	0.15	99.00 ¹ , Min	Si+Fe:0.95
14.	19000		0.5	0.7	0.1	0.1	0.2	-	0.10	-			99.00 ¹ , Min	Cu+Mg+Si+P+ Mn+Zn= 1.0
15.	19000A	1200			0.05	0.05	-	-	0.10	0.05	0.05	0.15	99.00 ¹ , Min	Si + Fe: 1.00 ³
16.	24345		0.50-1.2	0.7	3.8-5.0	0.3-1.2	0.20-0.80	0.3	0.2	0.3				
17.	24345A	2014	0.50 - 1.2	0.7	3.9 - 5.0	0.40 - 1.2	0.20 - 0.8	0.10	0.25	0.15	0.05	0.15	Remainder	
18.	24345B	2014A	0.5 - 0.9	0.50	3.9 - 5.0	0.40 - 1.2	0.20 - 0.8	0.10	0.25	0.15	0.05	0.15	Remainder	Zr + Ti : : 0.20
19.	24530	2024	0.50	0.50	3.8 - 4.9	0.30 - 0.9	1.2 - 1.8	0.10	0.25	0.15	0.05	0.15	Remainder	
20.	26388	2219	0.20	0.30	5.8-6.8	0.20 - 0.40	0.02	-	0.10	0.02-0.10	0.05	0.15	Remainder	V - 0.05 - 1.5 Zr - 0.10 - 0.25
21.	31000		0.6	0.7	0.10	0.8 - 1.5	0.10	0.20	0.20	0.2			Remainder	
22.	31000A	3103	0.50	0.7	0.10	0.9 - 1.5	0.30	0.10	0.20	-	0.05	0.15	Remainder	Zr+Ti: 0.10
23.	31200	3003	0.6	0.7	0.05-0.20	1.0-1.5	-	-	0.10	-	0.05	0.15	Remainder	
24.	31400	3102	0.4	0.7	0.10	0.05-0.40	-	-	0.30	0.1	0.05	0.15	Remainder	

Sl.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Others (Each)	Others (Total)	Aluminium	Remarks
25.	31500		0.4	0.7	0.20	1.0 - 1.5	0.6-1.3	-	0.20	0.20	-	-	Remainder	
26.	31500A	3004	0.30	0.7	0.25	1.0 - 1.5	0.8-1.3	-	0.25	--	0.05	0.15	Remainder	
27.	31500B		0.4	0.7	0.1	0.30 - 0.8	0.20 - 0.8	0.10	0.20	-	-	-	Remainder	
28.	31500C	3105 A	0.6	0.7	0.30	0.30 - 0.8	0.20 - 0.8	0.20	0.25	0.10	0.05	0.15	Remainder	
29.	31540	3104	0.6	0.8	0.05-0.25	0.8-1.4	0.8-1.3	-	0.25	0.10	0.05	0.15	Remainder	V- 0.05; Ga - 0.05
30.	31542	3005	0.6	0.7	0.30	1.0-1.5	0.20-0.6	0.10	0.25	0.10	0.05	0.15	Remainder	
31.	40800		0.6-0.95	0.6-0.95	0.2	0.1	0.1	-	0.2	0.2	-	-	98.0, Min	
32.	41352	4015	1.4-2.2	0.7	0.2	0.6-1.2	0.10-0.50	-	0.2	-	0.05	0.15	Remainder	
33.	41800	4006	0.8-1.2	0.50- 0.8	0.1	0.05	0.01	0.20	0.05	-	0.05	0.15	Remainder	
34.	44000	4343	6.8-8.2	0.8	0.25	0.10	-	-	0.2	--	0.05	0.15	Remainder	
35.	45000	4045	9.0-11.0	0.8	0.30	0.05	0.05	-	0.10	0.20	0.05	0.15	Remainder	
36.	51000A	5005	0.30	0.7	0.20	0.20	0.50-1.1	0.10	0.25	-	0.05	0.15	Remainder	
37.	51000B	5050	0.40	0.7	0.20	0.10	1.1-1.8	0.10	0.25	-	0.05	0.15	Remainder	

Sl.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Mangnese	Magnesium	Chromium	Zinc	Titanium	Others (Each)	Others (Total)	Aluminium	Remarks
38.	51300A		0.6	0.9	0.3	0.2 - 0.7	0.20 - 0.9	0.2	0.4	0.2	-	-	Remainder	
39.	52000		0.6	0.7	0.1	0.5	1.7 - 2.6	0.25	0.2	0.2	-	-		Cr + Mn = 0.5
40.	52000A	5251	0.4	0.5	0.15	0.10 - 0.50	1.7 - 2.4	0.15	0.15	0.15	0.05	0.15	Remainder	
41.	52300		0.8	0.9	0.2	0.5- 1.0	1.5 - 2.4	0.20	0.40	0.20	-	-	Remainder	
42.	52300B		0.6	0.4 - 0.7	0.2	1.1 - 1.15	1.3 - 1.7	0.2	0.4	0.2	-	-	Remainder	
43.	52302	5049	0.40	0.50	0.10	0.50 - 1.1	1.6 - 2.5	0.30	0.20	0.10	0.05	0.15	Remainder	
44.	53000		0.6	0.5	0.1	0.5	2.8- 4.0	0.25	0.2	0.2	-	-		Cr + Mn :0.5
45.	53000A	5754	0.4	0.40	0.10	0.50	2.6-3.6	0.30	0.20	0.15	0.05	0.15	Remainder	Cr + Mn: 0.10-0.6
46.	53800	5052	0.25	0.40	0.10	0.10	2.2 - 2.8	0.15 - 0.35	0.10	-	0.05	0.15	Remainder	
47.	54000	5154A	0.50	0.50	0.10	0.50	3.1 - 3.9	0.25	0.20	0.20	0.05	0.15	Remainder	Cr+ Mn: 0.10 - 0.50
48.	54300		0.4	0.7	0.1	0.5-1.0	4.0-4.9	0.25	0.2	0.2	-	-	Remainder	
49.	54300A	5083	0.40	0.40	0.10	0.40-1.0	4.0-4.9	0.05 - 0.25	0.25	0.15	0.05	0.15	Remainder	
50.	54380	5086	0.40	0.50	0.10	0.20-0.7	3.5-4.5	0.05-0.25	0.25	0.15	0.05	0.15	Remainder	Zr 0.05
51.	55000		0.6	0.7	0.1	0.05	4.5 - 5.5	0.25	0.2	0.2	0.05	0.15	Remainder	Cr + Mn 0.50
52.	64430		0.6-1.3	0.6	0.10	0.4-1.0	0.4-1.2	0.25	0.1	0.2	-	-	Remainder	
53.	64430A	6351	0.7-1.3	0.5	0.1	0.4 - 0.8	0.4 -0.8	-	0.20	0.2	0.05	0.15	Remainder	
54.	64430B	6081	0.7 - 1.1	0.5	0.1	0.10- 0.45	0.6 -1.0	0.1	0.2	0.15	0.05	0.15	Remainder	

Sl.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Others (Each)	Others (Total)	Aluminium	Remarks
55.	65028		0.4-0.8	0.7	0.15-0.40	0.2	0.7-1.2	0.15-0.35	0.2	0.2	-	-	Remainder	
56.	65028A	6061	0.40 - 0.8	0.7	0.15-0.40	0.15	0.8 - 1.2	0.04-0.35	0.25	0.15	0.05	0.15	Remainder	
57.	65032		0.4-.0.8	0.7	0.15-0.40	0.2-0.8	0.7-1.2	0.15- 0.35	0.20	0.2			Remainder	
58.	65032A	6261	0.40 - 0.7	0.40	0.15-0.40	0.20 - 0.35	0.7-1.0	0.10	0.20	0.10	0.05	0.15	Remainder	
59.	65430	6082	0.7-1.3	0.50	0.10	0.40-1.0	0.6-1.2	0.25	0.20	0.10	0.05	0.15	Remainder	
60.	71000	7072	-	-	0.10	0.10	0.10	-	0.8-1.3	--	0.05	0.15	Remainder	Si + Fe: 0.7
61.	74530		0.4	0.7	0.2	0.2-0.7	1.0 - 1.5	0.2	4.0- 5.0	0.2			Remainder	
62.	74538	7039	0.30	0.40	0.10	0.10-0.40	2.3-3.3	0.15-0.25	3.5-4.5	0.1	0.05	0.15	Remainder	
63.	75530	7005	0.35	0.40	0.10	0.20-0.7	1.0-1.8	0.06 - 0.20	4.0-5.0	0.01 - 0.06	0.05	0.15	Remainder	Zr: 0.08 - 0.20
64.	76528	7075	0.40	0.50	1.2-2.0	0.30	2.1-2.9	0.18-0.28	5.1-6.1	0.20	0.05	0.15	Remainder	
65.	76528A	7175	0.15	0.20	1.2 - 2.0	0.10	2.1-2.9	0.18 -2.8	5.1-6.1	0.10	0.05	0.15	Remainder	
66.	81000	8021	0.15	1.2-1.7	0.05	-	-	-	-	-	0.05	0.15	Remainder	
67.	81000B	8021B	0.40	1.1-1.7	0.05	0.03	0.01	0.03	0.05	0.05	0.03	0.10	Remainder	
68.	81400	8011	0.50 - 0.9	0.6-1.0	0.10	0.20	0.05	0.05	0.10	0.08	0.05	0.15	Remainder	
69.	81472	8079	0.05-0.30	0.7-1.3	0.05	-	-	-	0.10	-	0.05	0.15	Remainder	
70.	81400A	8011A	0.40-0.8	0.50-1.0	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.15	Remainder	

Sl.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Mangnese	Magnesium	Chromium	Zinc	Titanium	Others (Each)	Others (Total)	Aluminium	Remarks
71.	81400B	8111	0.30 - 1.1	0.40 - 1.0	0.10	0.10	0.05	0.05	0.10	0.08	0.05	0.15	Remainder	
72.	82300	8006	0.40	1.2-2.0	0.3	0.30-1.0	0.10	-	0.10	-	0.05	0.15	Remainder	

Footnote :

1"Others" includes listed elements for which no specific limit is shown as well as unlisted metallic elements. The producer may analyze samples for trace elements not specified in the 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 non-conforming.

Table 2 Mechanical properties of wrought aluminium and aluminium alloy sheet and strip

(Clause 8)

S.No.	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness					Bend Test, radius of bend
				MPa	MPa		(Min)					
				Min	Min	Max	0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1.	19990	1199	O	-	-	65	-	30	35	40	45	close
			H14 or H24	-	80	100	-	7	6	10	12	1/2t
			H18 or H28	-	100	-	-	3	4	5	6	1t
2.	19850	1085	O	15	55	95	20	25	30	35	35	close
			H12	55	70	110	3	4	6	8	8	close
			H14	65	85	120	2	3	4	5	5	1t
			H16	75	100	135	1	2	3	4	4	1.5t
			H18	-	120	-	1	2	3	4	4	-
3.	19800	1080	O	15	55	95	20	25	30	35	35	close
			H12 or H22	55	70	110	3	4	6	8	8	close
			H14 or H24	65	85	120	2	3	4	5	5	1t
			H16 or H26	75	100	135	1	2	3	4	4	1.5t
			H18	-	120	-	1	2	3	4	4	
4.	19800A	1080A	O	15	60	90	26	28	28	28	31	0.5t
			H12	55	80	120	5	6	6	6	7	0.5t
			H14	70	100	140	4	4	4	4	5	1t
			H16	90	110	150	2	2	2	2	3	1t
			H18	105	125	-	2	2	2	2	2	-

S.No.	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
				Min	Min	Max						
5.	19700	1070	O	15	55	95	20	25	30	35	35	close
			H12 or H22	55	70	110	3	4	6	8	8	close
			H14 or H24	65	85	120	2	3	4	5	5	1t
			H16 or H26	75	100	135	1	2	3	4	4	1.5t
			H18	-	120	-	1	2	3	4	4	-
6.	19700A	1070A	O	15	60	90	23	25	25	25	29	0.5t
			H12	55	80	120	5	6	6	6	7	0.5t
			H14	70	100	140	4	4	4	4	5	1t
			H16	90	110	150	2	2	2	2	3	1t
			H18	105	125	-	2	2	2	2	2	-
7.	19600	1060	O	-	-	95	-	25	25	29	32	close
			H14 or H24	-	95	125	-	4	5	6	6	0.5t
			H18 or H28	-	125	-	-	3	3	4	4	1t
8.	19500	1050	O	20	60	100	15	20	20	25	30	close
			H12 or H22	65	80	120	3	4	6	8	8	0.5t
			H14 or H24	75	95	125	2	3	4	5	5	0.5t
			H16 or H26	85	120	145	1	2	3	4	4	2t
			H18	-	125	-	1	2	3	4	4	-
9.	19500A	1050A	O	20	65	95	20	22	22	22	26	-
			H14	85	105	145	2	3	3	3	4	-
			H18	120	120	140	1	2	2	2	2	-
10.	19350	1235 and 1200	O	25	75	105	17	22	22	30	30	Close
			H12 or H22	75	95	125	3	4	6	8	8	0.5 t
			H14 or H24	95	120	145	2	3	4	5	5	1t
			H16 or H26	115	135	165	1	2	3	4	4	2t
			H18	130	150	-	1	2	3	4	4	-

S.No.	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
				Min	Min	Max						
11.	19002	1100	O	25	75	105	17	22	22	30	30	close
			H12 or H22	75	95	125	3	4	6	8	8	close
			H14 or H24	95	120	145	2	3	4	5	5	1t
			H16 or H26	115	135	165	1	2	3	4	4	2t
			H18	130	150	-	1	2	3	4	4	-
12.	19000	1200	O	25	75	105	17	22	22	30	30	close
			H12 or H22	75	95	125	3	4	6	8	8	close
			H14 or H24	95	120	145	2	3	4	5	5	1t
			H16 or H26	115	135	160	1	2	3	4	4	2t
			H18	130	150	-	1	2	3	4	4	-
13.	19000A	1200	O	25	75	105	17	22	22	22	30	close
			H12 or H22	75	95	125	3	4	6	8	8	close
			H14 or H24	95	120	145	2	3	4	5	5	1t
			H16 or H26	115	135	165	1	2	3	4	4	2t
			H18	130	150	-	1	2	3	4	4	close
14.	24345		O	-	-	240	-	14	14	14	14	close
			T4	240	380	-	-	13	14	14	14	3.0t
			T6	345	425	-	-	6	6	6	6	5t
15.	24345A	2014	O	-	-	220	16	16	16	16	16	0.5t
			T4	240	395	-	14	14	14	14	14	3.0t
			T6	390	440	-	6	6	6	7	7	5t
16.	24345B	2014A	O	-	-	220	16	16	16	16	16	-
			T3 or T4	240	395	-	14	14	14	14	14	-
			T6	380	440	-	6	6	6	7	7	-

S.No	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
				Min	Min	Max						
17.	24530	2024	O	-	-	220	12	12	12	12	12	close
			T4	275	425	-	12	15	15	15	15	3t
			T6	345	440	-	5	5	5	5	5	-
18.	26388	2219	O	-	-	220	-	12	12	12	12	4t
			T6	250	370	-	-	6	6	7	8	5t
19.	31000		O	-	90	115	-	20	23	24	24	Close
			H12 or H22	-	115	150	-	5	6	7	8	Close
			H14 or H24	-	130	180	-	3	4	5	5	1/2t
			H16 or H26	-	150	195	-	2	3	4	4	1t
			H18	-	170	-	-	2	2	3	3	3t
20.	31000A	3103	O	35	90	130	17	19	19	19	21	-
			H 14	120	140	180	2	2	2	2	4	-
			H18	165	185	-	1	2	2	2	2	-
21.	31200	3003	O	35	95	135	18	20	22	22	25	Close
			H12 or H22	85	120	155	3	6	7	8	9	Close
			H14 or H24	115	140	180	2	4	4	5	6	0.5t
			H16 or H26	145	165	205	1	3	3	4	4	2t
			H18	165	180	-	1	2	2	3	3	-
22.	31500		O	-	125	165	-	16	16	18	20	Close
			H12 / H22	-	150	210	-	5	5	6	8	Close
			H14 / H24	-	190	245	-	3	4	5	5	1/2t
			H16 / H26	-	215	275	-	2	2	3	4	1/2t
			H18 / H28	-	245	-	-	1	1	1	2	1t

S.No	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
				Min	Min	Max						
23.	31500A	3004	O	60	155	195	10	14	16	18	18	0t,0.5t
			H12 or H22	145	195	245	3	3	4	5	5	1t
			H14 or H24	175	225	65	1	3	3	4	4	1.5t
24.	31500B		O	-	115	150	-	16	16	18	20	Close
			H12 or H22	-	140	200	-	5	5	6	8	1/2t
			H14 or H24	-	180	235	-	3	4	5	5	1t
			H16 or H26	-	205	260	-	2	2	3	4	2t
			H18	-	240	-	-	1	1	1	2	4t
25.	31500C	3105	O	40	100	155	14	15	15	15	17	0.5t
			H12	105	130	180	3	4	4	4	4	1.5t
			H14	130	150	200	2	2	2	2	2	2.5t
			H16	160	175	225	1	2	2	2	2	
			H18	180	195		1	1	1	1	1	
26.	31540	3104	O	60	155	195	10	14	16	18	18	0.5t
			H12 or H22	145	195	245	1	3	4	5	5	1t
			H14 or H24	175	225	265	1	3	3	4	4	1.5t
27.	31542	3005	O	45	120	165	14	16	18	18	-	0t
			H12 or H22	120	135	185	1	2	2	2	-	1t
			H14 or H24	145	165	215	1	1	2	2	-	2t
			H16 or H26	165	195	245	1	1	2	2	-	3t
			H18	205	225	-	1	1	2	2	-	-
28.	40800		O	-	85	120	19	20	23	25	30	close
			H12 or H22	-	105	140	4	5	6	7	8	close
			H14 or H24	-	125	160	1/3	3	4	5	5	1/2t
			H16 or H26	-	150	180	1/2	2	3	4	4	1t
			H18	-	175	-	1	2	2	3	3	3t

S.No	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
				Min	Min	Max						
29.	41352	4015	O	45	-	150	20	20	20	20	20	
			H12	90	120	175	4	4	4	4	4	
			H14	120	150	200	2	3	3	3	3	
			H16	150	170	220	1	2	2	2	2	
			H18	180	200	250	1	1	1	1	1	
30.	41800	4006	O	40	95	130	17	19	19	19	22	0t,1t
			H12	90	120	160	4	4	4	4	5	1.5t
			H14	120	140	180	3	3	3	3	3	0t,2t
31.	51000A	5005	O	-	105	150	-	18	18	18	22	close
			H12	85	120	160	-	2	2	2	4	0.5t
			H14	105	140	180	-	2	2	2	3	1.5t
			H16	125	160	200	-	2	2	3	3	3t
			H18	-	185	-	-	2	2	2	2	
32.	51000B	5050	O	45	130	170	16	17	17	17	19	0.5t
			H12	130	155	195	2	2	2	2	4	
			H14	150	175	215	2	2	2	2	3	
			H16	170	195	235	1	2	2	2	2	
			H18	190	220		1	2	2	2	2	
33.	51300 A		O	35	90	130	17	19	19	19	21	1t
			H12	85	110	155	2	3	3	3	4	2t
			H14	115	140	175	2	2	2	2	3	2.5t
			H16	140	155	195	1	2	2	2	2	2.5t
			H18	160	175		1	2	2	2	2	
34.	52000		O	60	175	215	13	16	16	16	18	Close
			H x 2	125	200	240	3	3	4	5	6	1/2t
			H x 4	175	230	275	2	2	2	3	4	1t

S.No	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
				Min	Min	Max						
35.	52000		H x 6	190	235	295	1	2	2	3	-	-
			H x 8	215	265	-	1	1	2	3	-	-
36.	52000A	5251	O	60	160	200	13	14	14	14	16	0.5t
			H12	150	190	230	3	4	4	4	5	2t
			H14	170	210	250	2	2	2	2	3	2.5t
			H16	200	230	270	1	2	2	2	3	3.5t
			H18	230	255		1	2	2	2	2	-
37.	52300		O	75	160	210	-	12	14	16	18	Close
			H12 or H22	140	170	220	-	4	5	6	7	1t
			H14 or H24	180	190	250	-	4	4	5	5	2t
			H16 or H26	200	225	285	-	3	3	4	-	-
			H18	225	250	-	-	2	2	3	-	-
38.	52300B		O	-	160	210	-	12	13	14	14	Close
			H12 or H22	-	190	260	-	4	4	5	5	2t
			H14 or H24	-	220	280	-	3	3	4	4	3t
			H16 or H26	-	250	300	-	2	2	3	3	-
			H18	-	270	-	-	2	2	3	3	-
39.	52302	5049	O	80	190	240	12	14	14	14	16	1t
			H12	170	220	270	4	5	5	5	6	-
			H14	190	240	280	3	3	3	3	4	-
			H16	220	265	305	2	3	3	3	3	-
			H18	250	290	-	1	2	2	2	2	-
40.	53000		O	85	210	270	-	12	14	16	18	Close
			H 12	160	240	290	-	4	5	6	7	1t
			H 14	220	270	320	-	3	3	5	5	2t
			H 16	225	290	340	-	2	2	4	0	0
			H 18	235	310	0	-	2	2	3	0	0

Sl No.	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 6.3	Over 1.3 mm, up to and including 6.3	Over 2.6 mm, up to and including 6.3	
				Min	Min	Max						
41.	53000A	5754	O	80	190	240	12	14	14	14	16	-
			H24 or H34	160	240	280	6	6	6	6	7	-
			H38	230	290	-	3	3	3	3	4	-
42.	53800	5052	O	65	170	215	15	17	17	19	19	1t
			H12 or H22	155	215	265	4	5	5	7	7	1.5t
			H14 or H24	180	235	285	3	4	4	6	6	2t
			H16 or H26	205	255	305	3	3	4	4	4	3t
			H18 or H28	220	270	-	3	3	4	4	4	-
43.	54000	5154A	O	85	215	275	12	13	13	13	15	1t
			H12	190	250	305	3	4	4	4	5	-
			H14	220	270	325	2	3	3	3	3	-
			H18	270	310	-	1	1	1	1	1	-
44.	54300		O	130	265	365	-	12	14	16	16	1t
			H x 2	235	315	395	-	5	6	7	7	2t
			H x 4	275	355	-	-	4	4	5	5	3t
45.	54300A	5083	O	125	275	350	-	16	16	16	16	2t
			H22 or H32	215	305	380	-	8	8	8	8	5t
			H34	270	345	405	-	-	-	6	6	-
46.	54380	5086	O	100	245	305	-	15	15	18	18	2.5t
			H22 or H32	195	275	325	-	6	6	8	8	3t
			H24 or H34	235	305	355	-	4	5	6	6	4t
			H26 or H36	265	325	375	-	3	4	6	6	5t
			H18 or H38	285	345	-	-	3	3	-	-	-
47.	55000		O	130	265	365	-	12	14	16	16	close
			H x 2	220	310	395	-	5	6	7	7	2t
48.	64430		O	-	-	175	-	14	16	16	17	Close
			T4	115	200	-	-	12	15	15	15	2t
			T6	250	295	-	-	5	5	5	6	3t

S.No	IS Designation	ISO Designation	Condition	0.2 percent Proof Stress	Tensile Strength		Elongation on 50mm Gauge Length, Percent, For thickness (Min)					Bend Test, radius of bend
				MPA	MPA		0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and including 1.3 mm	Over 1.3 mm, up to and including 2.6 mm	Over 2.6 mm, up to and including 6.3 mm	
				Min	Min	Max						
49.	65028		O	-		175	-	14	16	16	18	Close
			T4	110	200	-	-	12	15	15	15	2t
			T6	235	280	-	-	5	5	5	6	3t
50.	65028A	6061	O	-	-	145	-	16	16	16	16	1.5t
			T4	110	205	-	-	16	16	16	16	1.5t
			T6	245	295	-	-	10	10	10	10	3t
51.	65032		O	-	-	175	-	14	16	16	18	Close
			T4	110	200	0	-	12	15	15	15	2t
			T6	235	280	0	-	5	5	5	6	3t
52.	65430	6082	O	-	-	150	-	16	16	16	16	2.5 t
			T4	110	205	-	-	15	15	15	15	2t
			T6	260	310	-	-	10	10	10	10	4.5t
53.	74530		T4	175	280	-	-	8	9	9	10	5t
			T6	270	315	-	-	6	7	7	8	5t
54.	74538		O	103	227	-	-	22	22	22	22	1.5t
			T6	330	400	-	-	13	13	14	14	6t
55.	76528	7075	O	-	-	275	-	10	10	11	11	1.5t
			T6	460	525	-	-	6	6	7	7	6t
56.	81000	8021B	H14	-	135	185	2	-	-	-	-	-
57.	81472	8079	H14	-	125	175	2	-	-	-	-	-
58.	81400	8011	O	30	85	130	-	20	23	25	30	close
			H12 or H22	90	105	140	-	5	6	7	8	close
			H14 or H24	110	120	165	-	3	4	5	5	1/2t
			H16 or H26	130	150	180	-	2	3	4	4	1t
			H18	145	175		-	2	2	3	3	3t

59.	81400A	8011A	O	30	85	130	19	21	21	21	24	-
			H14	110	125	165	1	3	3	3	3	-
			H16	130	140	190	1	2	2	2	3	-
			H18	145	160		1	2	2	2	2	-
60.	51300		O	-	95	145	-	14	14	15	16	close
			HX 2	-	130	180	-	6	6	7	8	1/2t
			HX 4	-	150	200	-	4	4	5	6	1t
			HX 6	-	175	215	-	2	2	3	4	2t
			H X8		195	-	-	1	1	1	2	4t

NOTES

1 MPa = 1 N/mm² = 1 MN/m² = 0.102 kgf/mm² = 144.4psi

t is the thickness of the test piece

For thickness 2.6 mm and less, elongation values are for guidance only and not guaranteed. For this purpose, bend test as specified in Cl.0 may be carried