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 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*
IS 1599 : 2019	Method for bend test (*fourth revision*)
IS 1608 Part 1: 2022/ ISO 6892-1	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (*fifth revision*)
2676: 1981	Dimensions for wrought aluminium and aluminium alloys sheet and strip (*first revision*)
IS 5047	Glossary of terms relating to aluminium and aluminium alloys
5047: Part 1: 1986	Part 1: Unwrought and wrought metals (*second revision*)
5047: Part 2: 1979	Part 2 plant and operations, thermal treatment, control and testing, finishing
5047: Part 3: 1979	Part 3 geometrical properties and tolerance, structural and surface defects
5052: 1993	Aluminium and its a1loys — Temper designations (*first revision*)
10259: 1982	General condition of delivery and inspection of aluminium and aluminium alloy products (*first revision*)

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

5General 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 analyzed 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

1.1 **8.1** The material when tested in accordance with IS 1608 shall conform to the values given in

1.2

1.3

~~**Table 2**~~.

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 in 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 smoothened 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 arc 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.

Table 1 Chemical composition of wrought aluminium and aluminium alloy sheet and strip
(Composition limits are in weight percent maximum, unless shown otherwise)

(*Clause* 0)

SL No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Mangnese	Magnesium	Chromium	Zinc	Titanium	Each	Others	Aluminium	Remarks
1	19900	1190	0.05	0.07	0.01	0.01	0.01	0.01	0.02	-	0.01		99.90[1]	V + Ti = 0.01 B: 0.01 Ga : 0.02
2	19990	1199	0.006	0.006	0.006	0.002	0.006	-	0.006	0.002	0.002		99.991, Min	Ga: 0.005; V: 0.005
3	19850	1085	0.10	0.12	0.03	0.02	0.02		0.03	0.02	0.01		99.85[1]	Ga: 0.03; V: 0.05
4	19800	1080	0.15	0.15	0.03	0.02	0.02	-	0.03	0.03	0.02		99.80, Min	Ga: 0.03; V: 0.05
5	19800A	1080A	0.15	0.15	0.03	0.02	0.02	-	0.06	0.02	0.02		99.80[1]	Ga- 0.03
6	19700	1070	0.2	0.25	0.04	0.03	0.03	---	0.04	0.03	0.03		99.70, Min	V: 0.05
7	19700A	1070A	0.20	0.25	0.03	0.03	0.03	-	0.07	0.03	0.03	-	99.70[1]	
8	19600	1060	0.25	0.35	0.05	0.03	0.03	---	0.05	0.03	0.03		99.60, Min	V: 0.05
9	19500	1050	0.25	0.40	0.05	0.05	0.05	-	0.05	0.03	0.03	-	99.50, Min	V: 0.05
10	19500A	1050A	0.25	0.40	0.05	0.05	0.05	-	0.07	0.05	0.03	-	99.50[1]	
11	19450	1145	-	-	0.05	0.05	0.05	-	0.05	0.03	0.03	-	99.45[1]	Si+Fe: 0.55 V : 0.05

S.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Mangnese	Magnesium	Chromium	Zinc	Titanium	Each	Total	Aluminium	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	[2]
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	[2]
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	

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S.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Mangnese	Magnesium	Chromium	Zinc	Titanium	Each	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	0.6	0.7	0.30	0.30 - 0.8	0.20 - 0.8	0.20	0.40	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	Each	Total	Aluminium	Remarks
38	51300	5010	0.40	0.7	0.25	0.10 - 0.30	0.20 - 0.6	0.15	0.30	0.10	0.05	0.15	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[3]
48	54300		0.4	0.7	0.1	0.5-1.0	4.0-4.9	0.25	0.2	0.2				
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	
51	55000		0.3	0.4	0.1	0.05- 0.20	4.5 - 5.6	0.05 - 0.20	0.1		0.05	0.15	Remainder	

S.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Mangnese	Magnesium	Chromium	Zinc	Titanium	Each	Total	Aluminium	Remarks
52	64430		0.6-1.3	0.6	0.10	0.4-1.0	0.4-1.2	0.25	0.1	0.2				
53	64430 A	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	
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	0.05	0.15	Remainder	
56	65028 A	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				Either Mn or Cr shall be present
58	65032 A	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	76528 A	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	

S.No.	IS Desig	ISO Desig	Silicon	Iron	Copper	Mangnese	Magnesium	Chromium	Zinc	Titanium	Each	Total	Aluminium	Remarks
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	814	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	
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	

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

(Clause 1.1 and 0)

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							
				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)
1	19990		O	-	-	65	-	30	35	40	45	close
			H14/H24	-	80	100	-	7	6	10	12	1/2t
			H18/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 / H22	**55**	**70**	**110**	**3**	**4**	**6**	**8**	**8**	**close**
			H14 / H24	65	85	120	**2**	3	4	5	5	1t
			H16 / H26	**75**	**100**	**135**	**1**	**2**	**3**	**4**	**4**	**1.5t**
			H18 / H28		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	110	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 / H22	**55**	70	110	**3**	4	6	8	8	close
			H14 / H24	**65**	85	120	**2**	3	4	5	5	1t
			H16 / H26	75	110	135	1	2	3	4	4	1.5t
			H18 / H28	-	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		O	-	-	95	**-**	25	25	29	32	close
			H14 / H24	-	95	125	**-**	4	5	6	6	0.5t
			H18 / H28	-	125	-	**-**	3	3	4	4	1t
8	19500	1050	O	20	60	100	**15**	22	25	29	30	close
			H12 / H22	65	80	120	**3**	4	6	8	8	0.5t
			H14 / H24	75	100	135	**2**	4	5	6	6	0.5t
			H16 / H26	85	120	145	1	2	3	4	4	2t
			H18 / H28	-	**125**	-	**1**	2	3	4	4	**1t**
9	19500A	1050A	O	20	65	95	**20**	22	22	22	26	
			H14	85	105	145	**2**	3	3	3	4	
			H18	120		**120**	**1**	2	2	2	2	
10	19350	1235/1200	**O**		**70**	**110**	**17**	**20**	**25**	**29**	**30**	**Close**
			H12 / H22		**90**	**130**	**3**	**5**	**6**	**8**	**8**	**Close**
			H14 / H24		**105**	**140**	**2**	**3**	**4**	**5**	**5**	**1/2t**
			H16 / H26		**125**	**150**	**1**	**2**	**3**	**4**	**4**	**1/2t**
			H18 / H28		**140**	**0**	**1**	**2**	**2**	**3**	**3**	**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							
				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	
11	19002	1100	O	**25**	70	110	**17**	22	22	30	30	close
			H12 / H22	**75**	90	130	**3**	4	6	8	8	close
			H14 / H24	**95**	105	140	**2**	3	4	5	5	0.5t
			H16 / H26	**115**	125	150	**1**	2	3	4	4	0.5t
			H18 / H28	**130**	140	-	**1**	2	3	4	4	1t
12	19000	**1200**	O	-	70	110	**17**	22	22	30	30	close
			H12 / H22	-	90	130	**3**	4	6	8	8	close
			H14 / H24	-	105	140	**2**	3	4	5	5	0.5t
			H16 / H26	-	125	150	**1**	2	3	4	4	0.5t
			H18 / H28	-	140	-	**1**	2	3	4	4	1t
13	19000A	1200	O	25	75	105	**17**	22	22	22	30	close
			H12 / H22	75	95	125	**3**	4	6	8	8	0.5t
			H14 / H24	95	120	145	**2**	3	4	5	5	1t
			H16 / H26	115	135	165	**1**	2	3	4	4	2t
			H18 / H28	130	150	-	**1**	2	3	4	4	
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							
				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	
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	5t
18	26388	2219	O	-	-	220	-	12	12	12	12	4t
			T6	250	370	-	-	6	6	7	8	5t
19	31000		O	-	90	130	**17**	20	23	24	24	Close
			H12 / H22	-	115	150	**3**	5	6	7	8	Close
			H14 / H24	-	130	180	**1**	3	4	5	5	1/2t
			H16 / H26	-	150	195	**1**	2	3	4	4	1t
			H18 / H28	-	170	-	**1**	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	23	24	25	**Close**
			H12 / H22	80	120	155	**3**	6	7	8	9	Close
			H14 / H24	115	140	180	**2**	4	4	5	6	0.5t
			H16 / H26	145	165	205	**1**	3	3	4	4	1t
			H18 / H28	165	180	-	**1**	2	2	3	3	3t
22	31500		O	-	125	165	**10**	16	16	18	20	Close
			H12 / H22	-	150	210	**3**	5	5	6	8	Close
			H14 / H24	-	190	245	**1**	3	4	5	5	1/2t
			H16 / H26	-	215	275	**1**	2	2	3	4	1/2t
			H18 / H28	-	245	-	**1**	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							
				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	
23	31500A	3004	O	60	155	195	**10**	14	16	18	18	**0t**,0.5t
			H12 / H22	145	195	245	**3**	3	4	5	5	1t
			H14 / H24	175	225	280	**1**	3	3	4	4	1.5t
24	31500B		O	-	115	150	**14**	16	16	18	20	Close
			H12 / H22	-	140	200	**3**	5	5	6	8	1/2t
			H14 / H24	-	180	235	**2**	3	4	5	5	1t
			H16 / H26	-	205	260	**1**	2	2	3	4	2t
			H18 / H28	-	240	-	**1**	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 / H22	145	195	245	1	3	4	5	5	1t
			H14 / H24	175	225	280	1	3	3	4	4	1.5t
27	31542	3005	**O**	45	120	165	**14**	16	18	18	-	0t
			H12 / H22	120	135	185	**1**	2	2	2	-	1t
			H14 / H24	145	165	215	**1**	1	2	2	-	2t
			H16 / 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 / H22	-	105	140	**4**	5	6	7	8	close
			H14 / H24	-	125	160	**1/3**	3	4	5	5	1/2t
			H16 / H26	-	150	180	**1/2**	2	3	4	4	1t
			H18 / H28	-	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							
				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	
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	5010	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							
				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	
34	52000		H x 6	190	235	295	**1**	2	2	3	-	-
			H x 8	215	265		**1**	1	2	3	-	-
35	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	
36	52300		O	75	160	210	-	12	14	16	18	Close
			H12 / H22	140	170	220	-	4	5	6	7	1t
			H14 / H24	180	190	250	-	4	4	5	5	2t
			H16 / H26	200	225	285	-	3	3	4	-	
			H18 / H28	225	250	-	-	2	2	3	-	
37	52300B		O	-	160	210	-	12	13	14	14	Close
			H12 / H22	-	190	260	-	4	4	5	5	2t
			H14 / H24	-	220	280	-	3	3	4	4	3t
			H16 / H26	-	250	300	-	2	2	3	3	
			H18 / H28	-	270	-	-	2	2	3	3	
38	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	
39	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							
				Min	Min	Max	0.2 to 0.5 mm	0.5 to 0.8 mm	Over 0.8 mm, up to and	Over 1.3 mm, up to and	Over 2.6 mm, up to and including 6.3	
40	53000A	5754	**O**	80	190	240	**12**	14	14	**14**	16	-
			H24/ H34	160	240	280	**6**	6	6	6	7	-
			H38	230	290	-	**3**	3	3	3	4	-
41	53800	5052	O	65	170	215	**15**	17	17	19	19	1t
			H12 / H22	155	215	265	**4**	5	5	7	7	1.5t
			H14 / H24	180	235	285	**3**	4	4	6	6	2t
			H16 / H26	205	255	305	**3**	3	4	4	4	3t
			H18 / H28	220	270	-	**3**	3	4	4	4	-
42	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	-
43	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
44	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	
45	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			
46	55000		O	**130**	**265**	365	-	12	14	16	16	close
			H x 2	**220**	**310**	395	-	5	6	7	7	2t
47	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							
				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	
48	65028		O	-		175	-	14	16	16	18	Close
			T4	110	200	-	-	12	15	15	15	2t
			T6	235	280	-	-	5	5	5	6	3t
49	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
50	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
51	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
52	74530		T4	175	280	-	-	8	9	9	10	5t
			T6	270	315	-	-	6	7	7	8	5t
53	74538		O	103	227	-	-	22	22	22	22	1.5t
			T6	330	400	-	-	13	13	14	14	6t
54	76528	7075	O	-	-	275	-	10	10	11	11	1.5t
			T6	460	525	-	-	6	6	7	7	6t
55	81000	8021B	H14	-	135	185	2	-	-	-	-	-
56	81472	8079	H14	-	125	175	2	-	-	-	-	-
57	**81400**	**8011**	**O**	**30**	**85**	**120**	**-**	**20**	**23**	**25**	**30**	**close**
			H12 / H22	**85**	**105**	**140**	-	**5**	**6**	**7**	**8**	**close**
			H14 / H24	**105**	**125**	**160**	-	**3**	**4**	**5**	**5**	**1/2t**
			H16 / H26	**130**	**150**	**180**	-	**2**	**3**	**4**	**4**	**1t**
			H18 / H28	**145**	**175**		-	**2**	**2**	**3**	**3**	**3t**

58	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	

NOTES

1 MPa = 1 N/mm^2 = 1 MN/m^2 = 0.102 kgf/mm^2 = 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 inCl. 0 may be carried