



AEROSPACE MATERIAL SPECIFICATION

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AMS 2232D

Superseding AMS 2232C

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TOLERANCES Carbon Steel Sheet, Strip, and Plate

1. **PURPOSE:** To publish established manufacturing tolerances.
2. **APPLICATION:** Tolerances shown herein apply, unless otherwise agreed upon by purchaser and vendor. These tolerances apply to all conditions and are based on individual measurements, unless otherwise noted. The term "excl" is used to apply only to the higher figure of the specified range.
3. **THICKNESS:**
 - 3.1 **Cold Rolled Sheet, Coils and Cut Lengths (See Note 1):**

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TABLE I

Tolerance, Inch, Plus and Minus
Width Ranges, Inches

Nominal Thickness Inch	Over	Over	Over	Over	Over	Over	Over	Over	Over
	12	15	24	32	40	48	60	72	80
	to	to	to	to	to	to	to	to	
	15	24	32	40	48	60	72	80	
	incl	incl	incl	incl	incl	incl	incl	incl	
Up to 0.0112, incl	--	--	--	0.0015	--	--	--	--	--
0.0113 to 0.0194, incl	0.002	0.002	0.002	0.002	0.002	0.002	--	--	--
0.0195 to 0.0388, incl	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	--
0.0389 to 0.0567, incl	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.006
0.0568 to 0.0709, incl	0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.006
0.0710 to 0.0971, incl	0.005	0.005	0.005	0.006	0.006	0.006	0.007	0.007	0.007
0.0972 to 0.1419, incl	0.005	0.006	0.006	0.006	0.006	0.007	0.007	0.007	0.008
0.1420 and over	0.006	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.009

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3.2 Cold Rolled Strip (See Note 2):

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TABLE II

	<u>Tolerance, Inch</u>							
	<u>Width Ranges, Inches</u>							
	0.500 to 1, excl	1 to 3, excl	3 to 6, incl	Over 6 to 9, incl	Over 9 to 12, incl	Over 12 to 16, incl	Over 16 to 20, incl	Over 20 to 23-15/16, incl
Up to 0.007, excl	0.00050	0.00050	0.00050	--	--	--	--	--
0.007 to 0.009, excl	0.00075	0.00075	0.00075	--	--	--	--	--
0.009 to 0.013, excl	0.00075	0.00075	0.00075	0.001	0.001	0.001	0.001	0.001
0.013 to 0.020, excl	0.00075	0.00075	0.00075	0.001	0.001	0.0015	0.0015	0.0015
0.020 to 0.023, excl	0.001	0.001	0.001	0.0015	0.0015	0.0015	0.0015	0.0015
0.023 to 0.026, excl	0.001	0.001	0.001	0.0015	0.0015	0.002	0.002	0.002
0.026 to 0.029, excl	0.001	0.0015	0.0015	0.002	0.002	0.002	0.002	0.002
0.029 to 0.032, excl	0.0015	0.0015	0.0015	0.002	0.002	0.002	0.002	0.002
0.032 to 0.035, excl	0.0015	0.0015	0.002	0.002	0.002	0.002	0.002	0.002
0.035 to 0.040, excl	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
0.040 to 0.050, excl	0.002	0.002	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
0.050 to 0.069, excl	0.002	0.002	0.0025	0.0025	0.0025	0.003	0.003	0.003
0.069 to 0.100, excl	0.002	0.002	0.0025	0.003	0.003	0.0035	0.0035	0.0035
0.100 to 0.161, excl	0.002	0.002	0.003	0.003	0.003	0.0035	0.0045	0.005
0.161 to 0.200, excl	0.0025	0.0035	0.004	0.004	0.0045	0.0045	0.005	0.005
0.200 to 0.250, excl	0.003	0.004	0.0045	0.0045	0.005	0.0055	0.0055	0.0055

3.3 Hot Rolled Sheet, Coils and Cut Lengths (See Note 3):

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TABLE III

Nominal Thickness Inch	<u>Tolerance, Inch, Plus and Minus</u>								
	<u>Width Ranges, Inches</u>								
	Over 12 to 15 incl	Over 15 to 20 incl	Over 20 to 32 incl	Over 32 to 40 incl	Over 40 to 48 incl	Over 48 to 60 incl	Over 60 to 72 incl	Over 72 to 80 incl	Over 80
0.0499 to 0.0508, incl	0.005	0.005	0.005	0.005	0.005	--	--	--	--
0.0509 to 0.0567, incl	0.005	0.006	0.006	0.006	0.006	0.006	0.007	--	--
0.0568 to 0.0709, incl	0.006	0.006	0.006	0.006	0.006	0.007	0.007	--	--
0.0710 to 0.0821, incl	0.006	0.007	0.007	0.007	0.007	0.007	0.008	0.008	--
0.0822 to 0.0971, incl	0.006	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.010
0.0972 to 0.1799, incl	0.007	0.008	0.008	0.009	0.010	0.010	0.011	0.012	0.012
0.1800 to 0.2299, incl	0.007	0.008	0.009	0.009	0.010	--	--	--	--

3.4 Hot Rolled Plate (See Note 4):

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TABLE IV

		<u>Tolerance, Inch, Plus</u>											
		<u>Width Ranges, Inches</u>											
		Up	Over	168									
		to	to	to	to	to	to	to	to	to	to	and	
Nominal Thickness (T)		48	60	72	84	96	108	120	132	144	168	over	
Inches		incl	excl										
Up to	1/4 , excl	0.080T	0.093T	0.107T	0.113T	0.140T	0.160T	0.187T	0.213T	0.245T	--	--	
1/4 to	5/16, excl	0.080T	0.080T	0.093T	0.107T	0.113T	0.140T	0.160T	0.187T	0.220T	0.260T	--	
5/16 to	3/8 , excl	0.067T	0.080T	0.080T	0.093T	0.107T	0.113T	0.140T	0.160T	0.200T	0.227T	--	
3/8 to	7/16, excl	0.060T	0.067T	0.080T	0.080T	0.093T	0.107T	0.113T	0.140T	0.173T	0.200T	0.227T	
7/16 to	1/2 , excl	0.053T	0.060T	0.067T	0.080T	0.080T	0.093T	0.107T	0.113T	0.147T	0.173T	0.200T	
1/2 to	5/8 , excl	0.053T	0.053T	0.060T	0.067T	0.080T	0.080T	0.093T	0.107T	0.127T	0.147T	0.173T	
5/8 to	3/4 , excl	0.053T	0.053T	0.053T	0.060T	0.067T	0.080T	0.080T	0.093T	0.107T	0.120T	0.147T	
3/4 to	1 , excl	0.047T	0.053T	0.053T	0.053T	0.060T	0.067T	0.080T	0.080T	0.093T	0.107T	0.127T	
1 to	2 , excl	0.047T	0.047T	0.053T	0.053T	0.053T	0.060T	0.067T	0.080T	0.080T	0.093T	0.107T	
	2	0.047T	0.047T	0.047T	0.053T	0.053T	0.060T	0.067T	0.080T	0.080T	0.087T	0.093T	

4. WIDTH:

4.1 Cold and Hot Rolled Sheet, Not Resquared, Coils and Cut Lengths:

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TABLE V

Nominal Width Inches	Tolerance, Inch Plus Only
Over 12 to 30, incl	1/8
Over 30 to 48, incl	3/16
Over 48 to 60, incl	1/4
Over 60 to 80, incl	5/16
Over 80	3/8

4.2 Cold Rolled Strip, Mill Edge:

TABLE VI

Nominal Width Inches	Tolerance, Inch Plus and Minus
Over 1/2 to 2 , incl	1/32
Over 2 to 5 , incl	3/64
Over 5 to 10 , incl	5/64
Over 10 to 15 , incl	3/32
Over 15 to 20 , incl	1/8
Over 20 to 23-15/16, incl	5/32

4.3 Hot Rolled Plate, Rolled to Width (See Note 5):

TABLE VII

Nominal Width Inches	<u>Tolerance, Inch, Plus Thickness Ranges, Inches</u>			
	Up to 3/8, excl	3/8 to 5/8, excl	5/8 to 1, excl	1 to 2, incl
Up to 20, excl	1/8	1/8	3/16	1/4
20 to 36, excl	3/16	1/4	5/16	3/8
36 and over	5/16	3/8	7/16	1/2

5. LENGTH:

5.1 Cold and Hot Rolled Sheet, Not Resquared:

∅

TABLE VIII

Nominal Length Inches	Tolerance, Inches Plus Only
Over 12 to 30, incl	1/8
Over 30 to 60, incl	1/4
Over 60 to 96, incl	1/2
Over 96 to 120, incl	3/4
Over 120 to 156, incl	1
Over 156 to 192, incl	1-1/4
Over 192 to 240, incl	1-1/2
Over 240	1-3/4

5.2 Cold Rolled Strip:

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TABLE IX

Nominal Width Inches	<u>Tolerance, Inch, Plus Only Length Ranges, Inches</u>		
	24 to 60 incl	Over 60 to 120 incl	Over 120 to 240 incl
Over 1/2 to 12, incl	1/4	1/2	3/4
Over 12 to 23-15/16, incl	1/2	3/4	1

5.3 Plate (See Note 6):

∅

TABLE X

Nominal Widths Inches	Nominal Lengths Inches	Tolerance, Inches, Plus Thickness Ranges, Inches			
		Up to 3/8, excl	3/8 to 5/8, excl	5/8 to 1, excl	1 to 2, incl
Up to 60, excl	Up	1/2	5/8	3/4	1
60 to 84, excl	to	5/8	11/16	7/8	1
84 to 108, excl	120,	3/4	7/8	1	1-1/8
108 and over	excl	7/8	1	1-1/8	1-1/4
Up to 60, excl	120	3/4	7/8	1	1-1/8
60 to 84, excl	to	3/4	7/8	1	1-1/4
84 to 108, excl	240,	7/8	15/16	1-1/8	1-3/8
108 and over	excl	1	1- 1/8	1-1/4	1-3/8
Up to 60, excl	240	1	1- 1/8	1-1/4	1-1/2
60 to 84, excl	to	1	1- 1/8	1-1/4	1-1/2
84 to 108, excl	360,	1	1- 1/8	1-3/8	1-1/2
108 and over	excl	1-1/8	1- 1/4	1-3/8	1-3/4
Up to 60, excl	360	1-1/8	1- 1/4	1-3/8	1-5/8
60 to 84, excl	to	1-1/4	1- 3/8	1-1/2	1-5/8
84 to 108, excl	480,	1-1/4	1- 3/8	1-1/2	1-7/8
108 and over	excl	1-3/8	1- 1/2	1-5/8	1-7/8
Up to 60, excl	480	1-1/4	1- 1/2	1-5/8	1-7/8
60 to 84, excl	to	1-3/8	1- 1/2	1-5/8	1-7/8
84 to 108, excl	600,	1-3/8	1- 1/2	1-5/8	1-7/8
108 and over	excl	1-1/2	1- 5/8	1-3/4	1-7/8
Up to 60, excl	600	1-3/4	1- 7/8	1-7/8	2-1/4
60 to 84, excl	to	1-3/4	1- 7/8	1-7/8	2-1/4
84 to 108, excl	720,	1-3/4	1- 7/8	1-7/8	2-1/4
108 and over	excl	1-3/4	2	2-1/4	2-1/2
Up to 60, excl	720	2	2- 1/8	2-1/4	2-3/4
60 to 84, excl	and	2	2- 1/8	2-1/4	2-3/4
84 to 108, excl	over	2	2- 1/8	2-1/4	2-3/4
108 and over		2	2- 3/8	2-1/2	3

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6. LATERAL BOW (Camber):

6.1 Cold and Hot Rolled Sheet, Not Resquared, Cut Lengths (See Note 7):

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TABLE XI

Nominal Length Feet	Tolerance Inches
Up to 4, incl	1/8
Over 4 to 6, incl	3/16
Over 6 to 8, incl	1/4
Over 8 to 10, incl	5/16
Over 10 to 12, incl	3/8
Over 12 to 14, incl	1/2
Over 14 to 16, incl	5/8
Over 16 to 18, incl	3/4
Over 18 to 20, incl	7/8
Over 20 to 30, incl	1-1/4
Over 30 to 40, incl	1-1/2

∅ 6.2 Cold and Hot Rolled Sheet, Coils (See Note 7): 1 in. in any 20 feet.

6.3 Cold Rolled Strip (See Note 8):

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TABLE XII

Nominal Width Inches	Tolerance Inches
Up to 1-1/2, incl	1/2 in any 8 ft
Over 1-1/2	1/4 in any 8 ft

6.4 Hot Rolled Plate (See Note 9):

∅

TABLE XIII

Nominal Thickness Inches	Nominal Width Inches	Tolerance Inches
Up to 2, incl	All	1/8 x $\frac{\text{Number of ft of length}}{5}$

7. FLATNESS:

7.1 Cold Rolled Sheet, Not Stretcher Levelled (See Note 10):

∅

TABLE XIV

Nominal Thickness Inch	Nominal Width Inches	Variation From Flat Inch
Up to 0.0448, incl	Over 12 to 36, incl	3/8
Up to 0.0448, incl	Over 36 to 60, incl	5/8
Up to 0.0448, incl	Over 60	7/8
Over 0.0448	Over 12 to 36, incl	1/4
Over 0.0448	Over 36 to 60, incl	3/8
Over 0.0448	Over 60 to 72, incl	5/8
Over 0.0448	Over 72	7/8

∅ 7.2 Cold Rolled Strip: No applicable flatness tolerance exists.

7.3 Hot Rolled Sheet, Not Stretcher Levelled:

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TABLE XV

Nominal Thickness Inch	Nominal Width Inches	Variation From Flat Inch
0.0449 to 0.0567, incl	Over 12 to 36, incl	1/2
0.0449 to 0.0567, incl	Over 36 to 60, incl	3/4
0.0449 to 0.0567, incl	Over 60	1
Over 0.0567	Over 12 to 60, incl	1/2
Over 0.0567	Over 60 to 72, incl	3/4
Over 0.0567	Over 72	1

7.4 Hot Rolled Plate (See Notes 11, 12, 13, 14, and 15):

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TABLE XVI

Nominal Thickness Inches	Variation From Flat, Inches											
	Width Ranges, Inches											
	Up to	36 to	48 to	60 to	72 to	84 to	96 to	108 to	120 to	144 to	168 and Over	
	36 excl	48 excl	60 excl	72 excl	84 excl	96 excl	108 excl	120 excl	144 excl	168 excl		
Up to 1/4, excl	9/16	3/4	15/16	1-1/4	1-3/8	1-1/2	1-5/8	1-3/4	1-7/8	--	--	
1/4 to 3/8, excl	1/2	5/8	3/4	15/16	1-1/8	1-1/4	1-3/8	1-1/2	1-5/8	--	--	
3/8 to 1/2, excl	1/2	9/16	5/8	5/8	3/4	7/8	1	1-1/8	1-1/4	1-7/8	2-1/8	
1/2 to 3/4, excl	7/16	1/2	9/16	5/8	5/8	3/4	1	1	1-1/8	1-1/2	2	
3/4 to 1, excl	7/16	1/2	9/16	5/8	5/8	5/8	3/4	7/8	1	1-3/8	1-3/4	
1 to 2, excl	3/8	1/2	1/2	9/16	9/16	5/8	5/8	5/8	5/8	11/16	1-1/8	1-1/2
2, incl	5/16	3/8	7/16	1/2	1/2	1/2	1/2	9/16	5/8	7/8	1-1/8	