

ASTM - A666/A666M

SPECIFICATION FOR ANNEALED OR COLD-WORKED AUSTENITIC STAINLESS STEEL SHEET, STRIP, PLATE, AND FLAT BAR

This specification covers austenitic stainless steels in the annealed and normally required cold-worked conditions for various structural, architectural, pressure vessel, magnetic, cryogenic, and heat-resisting applications.

❖ Chemical Composition :-

The steel shall conform to the requirements as to chemical composition specified in Table 1, and shall conform to applicable requirements specified in the current edition of Specification A 480/A 480M. **Table 1^{A, B}**

Type	UNS Designation	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Other Elements
201	S20100	0.15	5.5–7.5	0.06	0.03	0.75	16.0–18.0	3.5–5.5	N 0.25
201L	S20103	0.03	5.5–7.5	0.045	0.03	0.75	16.0–18.0	3.5–5.5	N 0.25
201LN	S20153	0.03	6.4–7.5	0.045	0.015	0.75	16.0–17.5	4.0–5.0	N 0.10–0.25, Cu 1.00
202	S20200	0.15	7.5–10.0	0.06	0.03	0.75	17.0–19.0	4.0–6.0	N 0.25
...	S20400	0.03	7.0–9.0	0.04	0.03	1	15.0–17.0	1.50–3.00	N 0.15–0.30
205	S20500	0.12–0.25	14.0–15.0	0.06	0.03	0.75	16.5–18.0	1.00–1.75	N 0.32–0.40
301	S30100	0.15	2	0.045	0.03	1	16.0–18.0	6.0–8.0	N 0.10
301L	S30103	0.03	2	0.045	0.03	1	16.0–18.0	6.0–8.0	N 0.20
301LN	S30153	0.03	2	0.045	0.03	1	16.0–18.0	6.0–8.0	N 0.07–0.20
302	S30200	0.15	2	0.045	0.03	0.75	17.0–19.0	8.0–10.0	...
304	S30400	0.08	2	0.045	0.03	0.75	18.0–20.0	8.0–10.5	N 0.10
304L	S30403	0.03	2	0.045	0.03	0.75	18.0–20.0	8.0–12.0	N 0.10
304N	S30451	0.08	2	0.045	0.03	0.75	18.0–20.0	8.0–10.5	N 0.10–0.16
304LN	S30453	0.03	2	0.045	0.03	0.75	18.0–20.0	8.0–12.0	N 0.10–0.16
316	S31600	0.08	2	0.045	0.03	0.75	16.0–18.0	10.0–14.0	Mo 2.00–3.00
316L	S31603	0.03	2	0.045	0.03	0.75	16.0–18.0	10.0–14.0	Mo 2.00–3.00
316N	S31651	0.08	2	0.045	0.03	0.75	16.0–18.0	10.0–14.0	Mo 2.00–3.00, N 0.10–0.16
XM-11	S21904	0.04	8.0–10.0	0.06	0.03	0.75	19.0–21.5	5.5–7.5	N 0.15–0.40
XM-14	S21460	0.12	14.0–16.0	0.06	0.03	0.75	17.0–19.0	5.0–6.0	N 0.35–0.50

^A Types XM-10 and XM-19, which appeared in Specification A 412, do not appear as XM-10 is no longer produced and XM-19 is covered in Specification A 240/A 240M. ^B Maximum unless otherwise indicated.

❖ Mechanical Properties :-

The material shall conform to the mechanical properties specified in Table 2 and Table 3, or Table 2 and Table 4.

		psi	MPa	psi	MPa	< 0.015 in.	≥ 0.015 to ≤ 0.030 in.	> 0.030 in
201	S20100 PSS ^(D)	95000	655	45000	310	40	40	40
	FB ^(E)	75000	515	40000	275	...	...	40
201L	S20103	100000	690	50000	345	40	40	40
201LN	S20153	100000	690	50000	345	40	40	40
205	S20500	115000	790	65000	450	40	40	40
301L	95 S30103550220					45	241	100
301LN	S30153	80000	550	35000	240	45	241	100
301	S30100	90000	620	45000	310	40	40	40

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301L	S30103	100000	690	50000	345	40	40	40
301LN	S30153	100000	690	50000	345	40	40	40
302	S30200 PSS	85000	585	45000	310	40	40	40
	FB	90000	620	45000	310	...	...	40
304	S30400 PSS	80000	550	45000	310	35	35	35
	FB	90000	620	45000	310	...	...	40
304L	S30403	80000	550	45000	310	40	40	40
304N	S30451	90000	620	45000	310	40	40	40
304LN	S30453	90000	620	45000	310	40	40	40
316	S31600 PSS	85000	585	45000	310	35	35	35
	FB	90000	620	45000	310	...	...	40
316L	S31603	85000	585	45000	310	35	35	35
316N	S31651	90000	620	45000	310	35	35	35

(C)

1/8 Hard

Type	UNS Designation	Tensile Strength, min		Yield Strength, min		Elongation in 2 in. or 50 mm, min, %		
		psi	MPa	psi	MPa	< 0.015 in.	≥ 0.015 to ≤ 0.030 in.	> 0.030 in
201	100000 55000	S20100690380	45 45	45 105000	55000			
201L			110000		60000	S20103725380	35	35
	35		115000		65000			
201LN			100000		55000	S20153760415	35	35
	35		110000		60000			
205			40			S20500790450	40	40
301	S30100690380		40	40	40			
301L			S30103760415			35	35	35
301LN	S30153	110000	760	60000	415	35	35	35
302	S30200	100000	690	55000	380	35	35	35

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304	S30400	100000	690	55000	380	35	35	35
304L	S30403	100000	690	55000	380	30	30	30
304N	S30451	100000	690	55000	380	37	37	37
304LN	S30453	100000	690	55000	380	33	33	33
316	S31600	100000	690	55000	380	30	30	30
316L	S31603	100000	690	55000	380	25	25	25
316N	S31651	100000	690	55000	380	32	32	32

1/4 Hard

Type	UNS Designation	Tensile Strength, min		Yield Strength, min		Elongation in 2 in. or 50 mm, min, %		
		psi	MPa	psi	MPa	< 0.015 in.	≥ 0.015 to ≤ 0.030 in.	> 0.030 in
201	S20100	125000	860	75000	515	25	25	25
201L	S20103	120000	825	75000	515	25	25	25
201LN	S20153	120000	825	75000	515	25	25	25
202	S20200	125000	860	75000	515	12	12	...
...	S20400	140000	965	100000	960	20	20	20
205	S20500	125000	860	75000	515	45	45	45
301	S30100	125000	860	75000	515	25	25	25
301L	S30103	120000	825	75000	515	25	25	25
301LN	S30153	120000	825	75000	515	25	25	25
302	S30200	125000	860	75000	515	10	10	12
304	S30400	125000	860	75000	515	10	10	12
304L	S30403	125000	860	75000	515	8	8	10
304N	S30451	125000	860	75000	515	12	12	12
304LN	S30453	125000	860	75000	515	10	10	12

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316	S31600	125000	860	75000	515	10	10	10
316L	S31603	125000	860	75000	515	8	8	8
316N	S31651	125000	860	75000	515	12	12	12
XM-11	S21904	130000	895	115000	795	15	15	...

1/2 Hard

Type	UNS Designation	Tensile Strength, min		Yield Strength, min		Elongation in 2 in. or 50 mm, min, %		
		psi	MPa	psi	MPa	< 0.015 in.	≥ 0.015 to ≤ 0.030 in.	> 0.030 in
201	S20100	150000	1035	110000	760	15	18	18
201L	S20103	135000	930	100000	690	22	22	20
201LN	S20153	135000	930	100000	690	22	22	20
205	S20500	150000	1035	110000	760	15	18	18
301	S30100	150000	1035	110000	760	15	18	18

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301	S30100	185000	1275	140000	965	8	9	9
302	S30200	185000	1275	140000	965	3	4	4

- (A) This specification defines minimum properties only and does not imply a range. Depending on the work hardening characteristics of the particular grade, either the yield or the tensile strength can be the controlling factor in meeting the properties. The noncontrolling factor normally will exceed considerably the specified minimum.
- (B) Type 201 is generally produced with a chemical composition balanced for rich side (Type 201-1) or lean side (Type 201-2) austenite stability depending on the properties required for specific applications.
- (C) Annealed material that naturally meets mechanical properties may be applied.
- (D) PSS means plate, strip, sheet.
- (E) FB means flat bar.

TABLE 3: FREE BEND REQUIREMENTS

Annealed and 1/16 and 1/8 Hard					
Type	UNS Designation	Thickness ≤ 0.050 in.		Thickness > 0.050 to ≤ 0.1874 in.	
		Included Bend Angle, °	Bend Factor	Included Bend Angle, °	Bend Factor
201	S20100	180	1	180	1
201L	S20103	180	1	180	1
201LN	S20153	180	1	180	1
202	S20200	180	1	180	1
...	S20400	180	1	180	1
205	S20500	180	1	180	1
301	S30100	180	1	180	1
301L	S30103	180	1	180	1
301LN	S30133	180	1	180	1

302	S30200	180	1	180	1
304	S30400	180	1	180	1
304L	S30403	180	1	180	2
304N	S30451	180	1	180	1
304LN	S30453	180	1	180	2
316	S31600	180	1	180	2
316L	S31603	180	1	180	2
316N	S31651	180	1	180	1
XM-11	S21904	180	1	180	1
XM-14	S21460	180	1	180	2
1/4 Hard					
Type	UNS Designation	Thickness ≤ 0.050 in.		Thickness > 0.050 to ≤ 0.1874 in.	
		Included Bend Angle, °	Bend Factor	Included Bend Angle, °	Bend Factor
201	S20100	180	1	90	2
201L	S20103	180	1.5	135	1.5
201LN	S20153	180	1.5	135	1.5
202	S20200	180	2	90	2
...	S20400	180	1	90	2
205	S20500	180	1	90	2
301	S30100	180	1	90	2
301L	S30103	180	1.5	90	1.5
301LN	S30153	180	1.5	90	1.5
302	S30200	180	1	90	2
304	S30400	180	1	90	2
304L	S30403	180	2	90	3
304N	S30451	180	1	90	2

304LN	S30453	180	2	90	3
316	S31600	180	2	90	2
316L	S31603	180	2	90	3
316N	S31651	180	1	90	2
XM-11	S21904	90	2	90	2
1/2 Hard					
Type	UNS	Thickness ≤ 0.050 in.	Thickness > 0.050 to ≤ 0.1874 in.		

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Annealed and 1/16 and 1/8 Hard			
Type	UNS	Thickness \leq 0.050 in.	Thickness $>$ 0.050 to \leq 0.1874 in.

TABLE 4: V-BLOCK BEND REQUIREMENTS

201	S20100	135	2	135	3
201L	S20103	135	2	135	3
201LN	S20153	135	2	135	3
202	S20200	135	4	135	4
205	S20500	135	2	135	3
301	S30100	135	2	135	3
301L	S30103	135	2	135	3
301LN	S30153	135	2	135	3
302	S30200	135	2	135	3
304	S30400	135	2	135	3
304L	S30403	135	5	135	6
304N	S30451	135	3	135	4
304LN	S30453	135	4	135	5
316	S31600	135	5	135	6
316L	S31603	135	6	135	7
316N	S31651	135	5	135	6

1/4 Hard

Type	UNS Designation	Thickness ≤ 0.050 in.		Thickness > 0.050 to ≤ 0.1874 in.	
		Included Bend Angle, °	Bend Factor	Included Bend Angle, °	Bend Factor
201	S20100	135	2	135	3
201L	S20103	135	2	135	3
201LN	S20153	135	2	135	3

205	S20500	135	2	135	3
301	S30100	135	2	135	3
301L	S30103	135	2	135	3
301LN	S30153	135	2	135	3
302	S30200	135	2	135	3
304	S30400	135	2	135	3
304L	S30403	135	5	135	6
304N	S30451	135	3	135	4
304LN	S30453	135	4	135	5

316	S31600	135	5	135	6
316L	S31603	135	6	135	7
316N	S31651	135	5	135	6
1/2 Hard					
Type	UNS Designation	Thickness ≤ 0.050 in.		Thickness > 0.050 to ≤ 0.1874 in.	
		Included Bend Angle, °	Bend Factor	Included Bend Angle, °	Bend Factor
201	S20100	135	4	135	4

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201L	S20103	135	4	135	4
201LN	S20153	135	4	135	4
205	S20500	135	4	135	4
301	S30100	135	4	135	4
301L	S30103	135	4	135	4
301LN	S30153	135	4	135	4
302	S30200	135	4	135	4
304	S30400	135	4	135	4
304L	S30403	135	7	135	8
304N	S30451	135	5	135	6
304LN	S30453	135	6	135	7
316	S31600	135	7	135	8
316L	S31603	135	8	135	9
316N	S31651	135	7	135	8
3/4 Hard					
Type	UNS Designation	Thickness ≤ 0.050 in.		Thickness > 0.050 to ≤ 0.1874 in.	
		Included Bend Angle,°	Bend Factor	Included Bend Angle,°	Bend Factor
201	S20100	135	6	135	7
205	S20500	135	6	135	7
301	S30100	135	6	135	7
302	S30200	135	8	135	9
Full Hard					
Type	UNS Designation	Thickness ≤ 0.050 in.		Thickness > 0.050 to ≤ 0.1874 in.	
		Included Bend Angle,°	Bend Factor	Included Bend Angle,°	Bend Factor
201	S20100	135	6	135	8
205	S20500	135	6	135	8
301	S30100	135	6	135	8
302	S30200	135	8	135	10

❖ **General Requirements :-**

The following requirements for orders for material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 480/A 480M or A 484/A 484M:

1. Process,
2. Special tests,
3. Heat treatment,
4. Dimensions and permissible variations, 5. Number of tests/test methods.

❖ **Test Methods :-**

1. Tension Test:

The yield strength shall be determined by the offset method as described in Test Methods and Definitions A 370. An alternative method of determining field strength may be used based on the following total extension under load:

Yield Strength, min. psi	Total Extension under Load in 2 in. Gage Length, incl.
45 000	0.0071
75 000	0.0098
110 000	0.0125
135 000	0.0144
140 000	0.0148

2. Bend Test:

Bend-test specimens shall withstand cold bending without cracking when subjected to either the free bend method or the controlled-bend (V-block) method at the condition specified by Table 3 or Table 4, respectively.

Keyword

- astm a666 type 304 pdf
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- astm a666 type 316
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