



 Anupam metals India

Shine across the world



# Rods, Bars, Hollow Bar & Wire



## Chemical Requirements<sup>A</sup>

UNS Designation <sup>B</sup>	Type	Composition, %									
		Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Other Elements
Austenitic Grades											
N08367	...	0.030	2.00	0.040	0.030	1.00	20.0-22.0	23.5-25.5	6.0-7.0	0.18-0.25	Cu 0.75
N08700	...	0.04	2.00	0.040	0.030	1.00	19.0-23.0	24.0-26.0	4.3-5.0	...	Cu 0.50 Cb 8 × C min 0.40 max
S20100	201	0.15	5.5-7.5	0.060	0.030	1.00	16.0-18.0	3.5-5.5	...	0.25	...
S20161	...	0.15	4.0-6.0	0.045	0.030	3.0-4.0	15.0-18.0	4.0-6.0	...	0.08-0.20	...
S20162	...	0.15	4.0-8.0	0.040	0.040	2.5-4.5	16.5-21.0	6.0-10.0	0.50-2.50	0.05-0.25	...
S20200	202	0.15	7.5-10.0	0.060	0.030	1.00	17.0-19.0	4.0-6.0	...	0.25	...
S20500	205	0.12-0.25	14.0-15.5	0.060	0.030	1.00	16.5-18.0	1.0-1.7	...	0.32-0.40	...
S20910	XM-19	0.06	4.0-6.0	0.045	0.030	1.00	20.5-23.5	11.5-13.5	1.50-3.00	0.20-0.40	Cb 0.10-0.30, V 0.10-0.30
S21800	...	0.10	7.0-9.0	0.060	0.030	3.5-4.5	16.0-18.0	8.0-9.0	...	0.08-0.18	...
S21900	XM-10	0.08	8.0-10.0	0.045	0.030	1.00	19.0-21.5	5.5-7.5	...	0.15-0.40	...
S21904	XM-11	0.04	8.0-10.0	0.045	0.030	1.00	19.0-21.5	5.5-7.5	...	0.15-0.40	...
S24000	XM-29	0.08	11.5-14.5	0.060	0.030	1.00	17.0-19.0	2.3-3.7	...	0.20-0.40	...
S24100	XM-28	0.15	11.0-14.0	0.045	0.030	1.00	16.5-19.0	0.50-2.50	...	0.20-0.45	...
S28200	...	0.15	17.0-19.0	0.045	0.030	1.00	17.0-19.0	...	0.75-1.25	0.40-0.60	Cu 0.75-1.25
S30200	302	0.15	2.00	0.045	0.030	1.00	17.0-19.0	8.0-10.0	...	0.10	...
S30215	302B	0.15	2.00	0.045	0.030	2.00-3.00	17.0-19.0	8.0-10.0	...	0.10	...
S30400	304	0.08	2.00	0.045	0.030	1.00	18.0-20.0	8.0-11.0	...	...	...
S30403	304L <sup>C</sup>	0.030	2.00	0.045	0.030	1.00	18.0-20.0	8.0-12.0	...	...	...
S30451	304N	0.08	2.00	0.045	0.030	1.00	18.0-20.0	8.0-11.0	...	0.10-0.16	...
S30452	XM-21	0.08	2.00	0.045	0.030	1.00	18.0-20.0	8.0-10.0	...	0.16-0.30	...
S30453	304LN	0.030	2.00	0.045	0.030	1.00	18.0-20.0	8.0-11.0	...	0.10-0.16	...
S30454	...	0.03	2.00	0.045	0.030	1.00	18.0-20.0	8.0-11.0	...	0.16-0.30	...
S30500	305	0.12	2.00	0.045	0.030	1.00	17.0-19.0	11.0-13.0	...	...	...
S30800	308	0.08	2.00	0.045	0.030	1.00	19.0-21.0	10.0-12.0	...	...	...
S30815	...	0.05-0.10	0.80	0.040	0.030	1.40-2.00	20.0-22.0	10.0-12.0	...	0.14-0.20	Ce 0.03-0.08
S30900	309	0.20	2.00	0.045	0.030	1.00	22.0-24.0	12.0-15.0	...	...	...
S30908	309S	0.08	2.00	0.045	0.030	1.00	22.0-24.0	12.0-15.0	...	...	...
S30940	309Cb	0.08	2.00	0.045	0.030	1.00	22.0-24.0	12.0-16.0	...	...	Cb 10×C-1.10
S31000	310	0.25	2.00	0.045	0.030	1.50	24.0-26.0	19.0-22.0	...	...	...
S31008	310S	0.08	2.00	0.045	0.030	1.50	24.0-26.0	19.0-22.0	...	...	...
S31040	310Cb	0.08	2.00	0.045	0.030	1.50	24.0-26.0	19.0-22.0	...	...	Cb 10×C-1.10
S31254	...	0.020	1.00	0.030	0.010	0.80	19.5-20.5	17.5-18.5	6.0-6.5	0.18-0.22	Cu 0.50-1.00
S31400	314	0.25	2.00	0.045	0.030	1.50-3.00	23.0-26.0	19.0-22.0	...	...	...
S31600	316	0.08	2.00	0.045	0.030	1.00	16.0-18.0	10.0-14.0	2.00-3.00	0.10	...
S31603	316L <sup>C</sup>	0.030	2.00	0.045	0.030	1.00	16.0-18.0	10.0-14.0	2.00-3.00	0.10	...
S31635	316Ti	0.08	2.00	0.045	0.030	1.00	16.0-18.0	10.0-14.0	2.00-3.00	0.10	Ti 5×(C+N)-0.70
S31640	316Cb	0.08	2.00	0.045	0.030	1.00	16.0-18.0	10.0-14.0	2.00-3.00	0.10	Cb 10×C-1.10
S31651	316N	0.08	2.00	0.045	0.030	1.00	16.0-18.0	10.0-14.0	2.00-3.00	0.10-0.16	...
S31653	316LN	0.030	2.00	0.045	0.030	1.00	16.0-18.0	10.0-13.0	2.00-3.00	0.10-0.16	...
S31654	...	0.03	2.00	0.045	0.030	1.00	16.0-18.0	10.0-13.0	2.00-3.00	0.16-0.30	...
S31700	317	0.08	2.00	0.045	0.030	1.00	18.0-20.0	11.0-15.0	3.0-4.0	0.10	...
S31725	...	0.030	2.00	0.045	0.030	1.00	18.0-20.0	13.5-17.5	4.0-5.0	0.20	...
S31726	...	0.030	2.00	0.045	0.030	1.00	17.0-20.0	14.5-17.5	4.0-5.0	0.10-0.20	...
S31727	...	0.030	1.00	0.030	0.030	1.00	17.5-19.0	14.5-16.5	3.8-4.5	0.15-0.21	Cu 2.8-4.0
S32053	...	0.030	1.00	0.030	0.010	1.00	22.0-24.0	24.0-26.0	5.0-6.0	0.17-0.22	...
S32100	321	0.08	2.00	0.045	0.030	1.00	17.0-19.0	9.0-12.0	...	...	Ti 5×(C+N)-0.70 <sup>D</sup>
S32654	...	0.020	2.0-4.0	0.030	0.005	0.50	24.0-25.0	21.0-23.0	7.0-8.0	0.45-0.55	Cu 0.30-0.60
S34565	...	0.030	5.0-7.0	0.030	0.010	1.00	23.0-25.0	16.0-18.0	4.0-5.0	0.40-0.60	Cb 0.10
S34700	347	0.08	2.00	0.045	0.030	1.00	17.0-19.0	9.0-12.0	...	...	Cb 10×C-1.10
S34800	348	0.08	2.00	0.045	0.030	1.00	17.0-19.0	9.0-12.0	...	...	Cb 10×C-1.10, Ta 0.10 Co 0.20
Austenitic-Ferritic Grades											
S31100	XM-26	0.06	1.00	0.045	0.030	1.00	25.0-27.0	6.0-7.0	...	...	Ti 0.25
S31803	...	0.030	2.00	0.030	0.020	1.00	21.0-23.0	4.5-6.5	2.5-3.5	0.08-0.20	...
S32101	...	0.040	4.0-6.0	0.040	0.030	1.00	21.0-22.0	1.35-1.70	0.10-0.80	0.20-0.25	Cu 0.10-0.80
S32202	...	0.030	2.00	0.040	0.010	1.00	21.5-24.0	1.00-2.80	0.45	0.18-0.26	...
S32205	...	0.030	2.00	0.030	0.020	1.00	22.0-23.0	4.5-6.5	3.0-3.5	0.14-0.20	...
S32304	...	0.030	2.50	0.040	0.030	1.00	21.5-24.5	3.0-5.5	0.05-0.60	0.05-0.20	Cu 0.05-0.60
S32506	...	0.030	1.00	0.040	0.015	0.90	24.0-26.0	5.5-7.2	3.0-3.5	0.08-0.20	W 0.05-0.30
S32550	...	0.04	1.50	0.040	0.030	1.0	24.0-27.0	4.5-6.5	2.9-3.9	0.10-0.25	Cu 1.50-2.50
S32750	...	0.030	1.20	0.035	0.020	0.80	24.0-26.0	6.0-8.0	3.0-5.0	0.24-0.32	Cu 0.50
S32760 <sup>E</sup>	...	0.030	1.00	0.030	0.010	1.00	24.0-26.0	6.0-8.0	3.0-4.0	0.20-0.30	Cu 0.50-1.00 W 0.50-1.00
Ferritic Grades											

Continued

UNS Designation <sup>B</sup>	Type	Composition, %									
		Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Other Elements
S40500	405	0.08	1.00	0.040	0.030	1.00	11.5–14.5	0.50	...	...	Al 0.10–0.30
S40976	...	0.030	1.00	0.040	0.030	1.00	10.5–11.7	0.75–1.00	...	0.040	Cb 10×(C+N)-0.80
S42900	429	0.12	1.00	0.040	0.030	1.00	14.0–16.0	...	...	...	...
S43000	430	0.12	1.00	0.040	0.030	1.00	16.0–18.0	...	...	...	...
S44400	444	0.025	1.00	0.040	0.030	1.00	17.5–19.5	1.00	1.75–2.50	0.035	Ti+Cb 0.20+4 × (C+N)-0.80
S44600	446	0.20	1.50	0.040	0.030	1.00	23.0–27.0	0.75	...	0.25	...
S44627	XM-27 <sup>F</sup>	0.010 <sup>G</sup>	0.40	0.020	0.020	0.40	25.0–27.5	0.50	0.75–1.50	0.015 <sup>G</sup>	Cu 0.20 Cb 0.05–0.20
S44700	...	0.010	0.30	0.025	0.020	0.20	28.0–30.0	0.15	3.5–4.2	0.020	C+N 0.025 Cu 0.15
S44800	...	0.010	0.30	0.025	0.020	0.20	28.0–30.0	2.00–2.50	3.5–4.2	0.020	C+N 0.025 Cu 0.15

### Martensitic Grades

S40300	403	0.15	1.00	0.040	0.030	0.50	11.5–13.0	...	...	...	...
S41000	410	0.08–0.15	1.00	0.040	0.030	1.00	11.5–13.5	...	...	...	...
S41040	XM-30	0.18	1.00	0.040	0.030	1.00	11.0–13.0	...	...	...	Cb 0.05–0.30
S41400	414	0.15	1.00	0.040	0.030	1.00	11.5–13.5	1.25–2.50	...	...	...
S41425	...	0.05	0.50–1.00	0.020	0.005	0.50	12.0–15.0	4.0–7.0	1.50–2.00	0.06–0.12	Cu 0.30
S41500	<sup>H</sup>	0.05	0.50–1.00	0.030	0.030	0.60	11.5–14.0	3.5–5.5	0.50–1.00	...	...
S42000	420	0.15 min	1.00	0.040	0.030	1.00	12.0–14.0	...	...	...	...
S42010	...	0.15–0.30	1.00	0.040	0.030	1.00	13.5–15.0	0.35–0.85	0.40–0.85	...	...
S43100	431	0.20	1.00	0.040	0.030	1.00	15.0–17.0	1.25–2.50	...	...	...
S44002	440A	0.60–0.75	1.00	0.040	0.030	1.00	16.0–18.0	...	0.75	...	...
S44003	440B	0.75–0.95	1.00	0.040	0.030	1.00	16.0–18.0	...	0.75	...	...
S44004	440C	0.95–1.20	1.00	0.040	0.030	1.00	16.0–18.0	...	0.75	...	...

<sup>A</sup> Maximum, unless range or minimum is indicated.

<sup>B</sup> Designations established in accordance with Practice E527 and SAE J 1086.

<sup>C</sup> For some applications, the substitution of Type 304L for Type 304, or Type 316L for Type 316 may be undesirable because of design, fabrication, or service requirements. In such cases, the purchaser should so indicate on the order.

<sup>D</sup> Nitrogen content is to be reported for this grade.

<sup>E</sup> % Cr + 3.3 × % Mo + 16 × % N ≥ 40.

<sup>F</sup> Nickel plus copper shall be 0.50 % max.

<sup>G</sup> Product analysis tolerance over the maximum limit for carbon and nitrogen shall be 0.002 %.

<sup>H</sup> Wrought version of CA 6NM.



## Mechanical Requirements

Type	Condition	Finish	Diameter or Thickness, in. (mm)	Tensile Strength, min		Yield Strength, <sup>A</sup> min		Elongation in 2 in. (50 mm) <sup>B</sup> or 4D min %	Reduction of Area, <sup>C,D</sup> min, %	Brinell Hardness, <sup>E</sup> max
				ksi	MPa	ksi	MPa			
Austenitic Grades										
N08367	A	hot-finished or cold-finished	all	95	655	45	310	30	50	...
N08700	A	hot-finished or cold-finished	all	80	550	35	240	30	50	...
201, 202	A	hot-finished or cold-finished	all	75	515	40	275	40	45	...
S20161	A	hot-finished	all	125	860	50	345	40	40	255
S20162	A	hot-finished or cold finished	all	125	860	50	345	40	40	311
205	A	hot-finished or cold finished	all	100	690	60	414	40	50	...
XM-19	A	hot-finished or cold-finished	all	100	690	55	380	35	55	...
	As hot-rolled	hot-finished or cold-finished	up to 2 (50.8), incl	135	930	105	725	20	50	...
			over 2 to 3 (50.8 to 76.2), incl	115	795	75	515	25	50	...
			over 3 to 8 (76.2 to 203.2), incl	100	690	60	415	30	50	...
S21800	A	hot-finished or cold-finished	all	95	655	50	345	35	55	241
XM-10, XM-11	A	hot-finished or cold-finished	all	90	620	50	345	45	60	...
XM-29	A	hot-finished or cold-finished	all	100	690	55	380	30	50	...
XM-28	A	hot-finished or cold-finished	all	100	690	55	380	30	50	...
S24565	A	hot-finished or cold-finished	all	115	795	60	415	35	40	...
S28200	A	hot-finished or cold finished	all	110	760	60	410	35	55	...
302, 302B, 304, 304LN, 305, 308, 309, 309S, 309Cb, 310, 310S, 310Cb, 314, 316, 316LN, 316Cb, 316TI, 317, 321, 347, 348	A	hot-finished	all	75 <sup>F</sup>	515	30 <sup>F</sup>	205	40 <sup>G</sup>	50	...
		cold-finished	up to ½ (12.70) incl	90	620	45	310	30	40	...
			over ½ (12.70)	75 <sup>F</sup>	515	30 <sup>F</sup>	205	30	40	...
304L, 316L	A	hot-finished	all	70	485	25	170	40 <sup>G</sup>	50	...
		cold-finished	up to ½ (12.70) incl.	90	620	45	310	30	40	...
			over ½ (12.70)	70	485	25	170	30	40	...
304N, 316N	A	hot-finished or cold-finished	all	80	550	35	240	30	...	...
202, 302, 304, 304N, 316, 316N	B	cold-finished	up to ¾ (19.05) incl	125	860	100	690	12	35	...
304L, 316L			over ¾ (19.05) to 1 (25.40)	115	795	80	550	15	35	...
			over 1 (25.40) to 1¼ (31.75)	105	725	65	450	20	35	...
			over 1¼ (31.75) to 1½ (38.10)	100	690	50	345	24	45	...
			over 1½ (38.10) to 1¾ (44.45)	95	655	45	310	28	45	...
304, 304N, 316, 316N	S	cold-finished	up to 2 (50.8) incl	95	650	75	515	25	40	...
304L, 316L			over 2 to 2½ (50.8 to 63.5) incl	90	620	65	450	30	40	...
			over 2½ to 3 (63.5 to 76.2) incl	80	550	55	380	30	40	...
XM-21, S30454, S31654	A	hot-finished or cold-finished	all	90	620	50	345	30	50	...
XM-21, S30454 S31654	B	cold-finished	up to 1 (25.40) incl	145	1000	125	860	15	45	...
			over 1 (25.40) to 1¼ (31.75)	135	930	115	795	16	45	...
			over 1¼ (31.75) to 1½ (38.10)	135	895	105	725	17	45	...

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Type	Condition	Finish	Diameter or Thickness, in. (mm)	Tensile Strength, min		Yield Strength, <sup>A</sup> min		Elongation in 2 in. (50 mm) <sup>B</sup> or 4D min %	Reduction of Area, <sup>C,D</sup> min, %	Brinell Hardness, <sup>E</sup> max	
				ksi	MPa	ksi	MPa				
S30815	A	hot-finished or cold-finished	over 1½ (38.10) to 1¾ (44.45)	all	87	860	100	690	18	45	...
					87	600	45	310	40	50	...
S31254	A	hot-finished or cold-finished	all	95	650	44	300	35	50	...	
S31725	A	hot-finished or cold-finished	all	75	515	30	205	40	...	...	
S31726	A	hot-finished or cold-finished	all	80	550	35	240	40	...	...	
S31727	A	hot-finished or cold-finished	all	80	550	36	245	35	...	217	
S32053	A	hot-finished or cold-finished	all	93	640	43	295	40	...	217	
S32654	A	hot-finished or cold-finished	all	109	750	62	430	40	40	250	
Austenitic-Ferritic Grades											
XM-26	A	hot-finished or cold-finished	all	90	620	65	450	20	55	...	
S31803	A	hot-finished or cold-finished	all	90	620	65	448	25	...	290	
S32056	A	hot-finished or cold-finished	all	90	620	65	450	18	...	302	
S32101	A	hot-finished or cold-finished	all	94	650	65	450	30	...	290	
S32202	A	hot-finished or cold-finished	all	94	650	65	450	30	...	290	
S32205	A	hot-finished or cold-finished	all	95	655	65	450	25	...	290	
S32304	A	hot-finished or cold-finished	all	87	600	58	400	25	...	290	
S32550	A	hot-finished or cold-finished	all	109	750	80	550	25	...	290	
S32550	S	cold-finished	all	125	860	105	720	16	...	335	
S32750	A	hot-finished or cold-finished	up to 2 (50.8) incl	116	800	80	550	15	...	310	
S32760	A	hot-finished or cold-finished	over 2 (50.8)	110	760	75	515	15	...	310	
			all	109	750	80	550	25	...	290	
S32760	S	cold-finished	all	125	860	105	720	16	...	335	
Ferritic Grades											
405 <sup>H</sup>	A	hot-finished	all	...	...	...	...	...	...	207	
		cold-finished	all	...	...	...	...	...	...	...	217
429	A	hot-finished	all	70	480	40	275	20	45	...	
		cold-finished	all	70	480	40	275	16	45	...	
430	A	hot-finished or cold-finished	all	60	415	30	207	20	45	...	
		hot-finished or cold-finished	all	60	415	20	140	20	45	244	
S40976	A	hot-finished or cold-finished	all	60	415	20	140	20	45	244	
S44400	A	hot-finished	all	60	415	45	310	20	45	217	
		cold-finished	all	60	415	45	310	16	45	217	
446, XM-27	A	hot-finished	all	65	450	40	275	20	45	219	
		cold-finished	all	65	450	40	275	16	45	219	
S44700	A	hot-finished	all	70	480	55	380	20	40	...	
		cold-finished	all	75	520	60	415	15	30	...	
S44800	A	hot-finished	all	70	480	55	380	20	40	...	
		cold-finished	all	75	520	60	415	15	30	...	
Martensitic Grades											
403, 410	A	hot-finished	all	70	480	40	275	20	45	...	
		cold-finished	all	70	480	40	275	16	45	...	
403, 410	T	hot-finished	all	100	690	80	550	15	45	...	
		cold-finished	all	100	690	80	550	12	40	...	
XM-30	T	hot-finished	all	125	860	100	690	13	45	302	
		cold-finished	all	125	860	100	690	12	35	...	
403, 410	H	hot-finished	all	120	830	90	620	12	40	...	
		cold-finished	all (rounds only)	120	830	90	620	12	40	...	
XM-30	A	hot-finished	all	70	480	40	275	13	45	235	
		cold-finished	all	70	480	40	275	12	35	...	

Continued

Type	Condition	Finish	Diameter or Thickness, in. (mm)	Tensile Strength, min		Yield Strength, <sup>A</sup> min		Elongation in 2 in. (50 mm) <sup>B</sup> or 4D min %	Reduction of Area, <sup>C,D</sup> min, %	Brinell Hard- ness, <sup>E</sup> max
				ksi	MPa	ksi	MPa			
414	A	hot-finished or cold-finished	all	...	...	...	...	...	...	298
414	T	hot-finished or cold-finished	all	115	790	90	620	15	45	...
S41425	T	hot-finished	all	120	825	95	655	15	45	321
S41500	T	hot-finished or cold-finished	all	115	795	90	620	15	45	295
420	A	hot-finished	all	...	...	...	...	...	...	241
		cold-finished	all	...	...	...	...	...	...	255
S42010	A	hot-finished	all	...	...	...	...	...	...	235
		cold-finished	all	...	...	...	...	...	...	255
431	A	hot-finished or cold-finished	all	...	...	...	...	...	...	285
440A, 440B, and 440C	A	hot-finished	all	...	...	...	...	...	...	269
		cold-finished	all	...	...	...	...	...	...	285

<sup>A</sup> Yield strength shall be determined by the 0.2 % offset method in accordance with Test Methods and Definitions A370. An alternative method of determining yield strength may be used based on a total extension under load of 0.5 %.

<sup>B</sup> For some specific products, it may not be practicable to use a 2-in. or 50-mm gage length. The use of sub-size test specimens, when necessary, is permissible in accordance with Test Methods and Definitions A370.

<sup>C</sup> Reduction of area does not apply on flat bars 3/16 in. (4.76 mm) and under in thickness as this determination is not generally made in this product size.

<sup>D</sup> The material shall be capable of meeting the required reduction of area where listed, but actual measurement and reporting of the reduction of area are not required unless specified in the purchase order.

<sup>E</sup> Or equivalent Rockwell hardness.

<sup>F</sup> For extruded shapes of all Cr-Ni grades of Condition A, the yield strength shall be 25 ksi (170 MPa) min and tensile strength shall be 70 ksi (480 MPa) min.

<sup>G</sup> For shapes having section thickness of 1/2 in. (12.5 mm) or less, 30% min. elongation is acceptable.

<sup>H</sup> Material shall be capable of being heat treated to a maximum Brinell hardness of 250 when oil quenched from 1750°F (953°C).

E.N. No.	Type and Application	Chemical composition & max						Physical Properties min			Limiting Size (diameter or width) Across Plats)	Condition	Brinell No.
		C	Mn	Ni	Cr.	Mo.	Others	T.I t/sq	EI %	Izod ft.lbs			
IA	Free cutting machining Steel for low duty bolts, nuts, studs etc	.07/.15	.80/1.20	-	-	-	s. .2/.3 P. .07 Si. .10	32	10	-	17/32" and less Over 17/32" to 1-1/2" Over 1-1/2" to 2 1/2" Over 2 1/2"to 4" 4" Other finishes	Cold rolled or Cold drawn	-
								28	14	-			
								25	14	-			
								23	14	-			
								23	26	-			
3	20 CARBON STEEL for nicraft sockets Plug ends, lightly stressed levers, bolts nuts	.25	1.0				S & P .06 Si .05/.35	25/35	25		6"	As rolled	
3B	20 CARBON STEEL Cold drawn	.25	1.0	-	-	-	S & P .06 Si. .35	28	25	-	-	Normalised	-
8	40 CARBON STEEL without grain size control. For motor connecting rods, crankshafts, bolts and machine details in general.	.35/.45	.6/1.0				Si. 06/.36 S & P .06	35	20		6"	Normalized	152/2/207
								Q 10	20	10	2 1/2"	H & T	179/229
								H 45	20	10	7/8"	H & T	201/255
								35	17	-	6"	N & CD	152/207
								Q 40	17		2 1/2	H & T & CD	169/229
								R 45	17	-	7/8"	H & T & CD	201/225
8M	40 Carbon Steel Free cutting	.35/45	.9/1.30	-	-	-	S .12/.20 P .06 Si. .25	35	20	-	6"	Normalized	152/2/207
								Q 40	22	25	2"	H & T	179/229
								R 45	20	40	1/2"	H & T	201/255
								38	12	-	1 1/2"max	Cold drawn	229/max
16	Manganese-Molydenum steel. suitable for tensile ranges of 45/75 tons according to the ruling section.	.30/.40	1.3/1.8	-	-	.20/.35	S & P .05	R. 35	22	40	6"	H & T	201-255
								S. 50	20	40	4"	H & T	223-277
								T. 55	18	40	2.1/2"	H & T	248-302
								U. 60	17	35	1.1/8"	H & T	269-321
								V. 65	16	40	7/8"	H & T	293-341
18	1percent Chromium Steel suitable for tensile ranges of 45/65 tons according to the ruling section	.35/45	.60/.95	-	.85/1.15	-	S.& P. .05	R. 45	22	40	4" PS 32	H & T	201/255
								S. 50	20	40	2 1/2" " 36	H & T	223/277
								T. 55	18	40	1.1/8" " 4.1	H & T	2448/302



## EN SERIES STEEL

E.N. No.	Type and Application	Chemical composition & max						Physical properties min			Limiting Size (diameter or width) Across Plates)			Condition	Brinell No.
		C	Mn	Ni	Cr.	Mo.	Others	T.I t/sq	El %	lzod ft. lbs					
19	1 percent chromium Molybdenum steel Suitable for tensile ranges of 45/80 tons according to the ruling section of the part	.35/.45	.50/80	-	.90 1.50	.2/4	S&P .05 Si 0.10/.35	R. 45	22	40	6"	PS	32	H & T	201/255
								S. 50	20	40	4"	-	36	H & T	223/177
								T. 55	18	40	2 1/2"	-	41	H & T	248/302
								U. 60	17	35	2 1/2"	-	46	H & T	269/321
								V. 65	16	35	1.1/8"	-	50	H & T	293/341
								W. 70	15	30	1.1/8"	-	55	H & T	311/375
								Y. 80	10	10	1"	-	64	H & T	363/415
21	1 1/2 percent Nickel-Chromium Molybdeum steel. Suitable for tensile ranges of 50/100 tons according to the ruling section of the part	.35/45	.45/7	1.3/ 1.8	.9/1.4	.2/35	Si 10/35 S.P 0.05	S. 50	22	40	6"	PS	36	H & T	223/277
								T. 55	20	40	4"	-	41	H & T	248/302
								U. 60	18	35	4"	-	46	H & T	269/321
								V. 65	17	35	2 1/2"	-	50	H & T	293/341
								W. 70	16	30	1.1/8"	-	55	H & T	311/375
								X. 75	15	25	1.1/8"	-	59	H & T	341/388
								Y. 80	10	25	1.1/8"	-	64	H & T	363/415
								Z. 100		8	1.1/8"	-	80	H & T	444 Min
31	1 percent Carbon Chromium steel For parts of maximum hardness such as ball races.	.9/1.2	.3/.75	-	1/1.6	-	S. & P .05 Si .10/.35	-	-	-	-	-	-	-	-
36A	3 percent Nickel- Chromium	.15	.3/6	3/3.75	.6/1.1	-	Si .10/.35	55	15	35	-	-	-	-	-
36B	Case-hardening steel	.12/.18	.3/6	3/3.75	.6/1.1	-	-	65	13	30	-	-	-	-	-
36C	3 percent Nickel Chromium Molybdenum Case Hardening steel	.12/.18	.3/6	3/3.75	.6/1.1	.1/.25	Si .10/.35	65	13	30	-	-	-	-	-
41A	1-1/2 percent Chromium aluminium Molybdenum Nitriding steel	.25/.35	.65	.40	1.4/ 1.8	.1/.25	Si .1/.45 AL .9/1.3 S.&P .05	R 45	20	40	6"			H & T	201/255
								S 50	19	40	4"			H & T	223/277
								T 55	17	35	2 1/2"			H & T	248/302
41B	As above (EN,41A)	.35/.45	.65	.40	1.4/ 1.8	.1/.25	Si .1/.45 S.&P .05 AL .9/1.3	R. 45	20	40	-			H & T	201/255
								S. 50	19	40			H & T	223/277	
								T. 55	17	35			H & T	248/302	
42	Carbon spring steel for oil. Hardening and tempering. Suitable for laminated coil springs	.7/.85	.55/.75	-	-	-	Si .1/.40	-	-	-	-	-	-	-	-
47	1 percent Chromium-Vanadium spring steel for oil hardening and tempering	.45/.55	.5/.8	-	.8/1.2	-	Va 15 min Si .50 S.&P .05	-	-	-	-	-	-	-	-
353	1.1/4 percent, Nickel Chromium Case Hardening steel	.20	.50/1.0	1.0/ 1.5	.75/ 1.25	.08/ .15	Si .35 S.&P .05	65	12	20	-	-	-	-	-
354	1-3/4 percent Nickel-Chromium Molybdeum Case Hardening steel	20	.50/1.0	1.5/ 2.0	.75/ 1.25	10/ .20	Si .35 S.&P .05	75	12	20	-	-	-	-	-

### SIGNS AND ABBREVIATIONS

H & T Hardened and Tempered      CD Cold drawn.      CR Cold Rolled.      PS Proof Stress.  
 N. Normalised      <Maximum

## STANDARD CARBON NON-RESULFURIZED STEELS CHEMICAL COMPOSITION LIMITS

ASTM/AISI Grade	UNS Number	C	Mn	P Max.	S Max.
1005	G10050	0.06max.	0.35max.	0.040	0.050
1006	G10060	0.08max.	0.25-0.40	0.040	0.050
1008	G10080	0.10max.	0.30-0.50	0.040	0.050
†1008	SHEET	0.10max.	0.50max.	0.030	0.035
†1009	SHEET	0.15max.	0.60max.	0.030	0.035
1010	G10100	0.08-0.13	0.30-0.60	0.040	0.050
1010	SHEET	0.08-0.13	0.30-0.60	0.030	0.035
MT1010	TUBE	0.05-0.15	0.30-0.60	0.035	0.035
1011	G10110	0.08-0.13	0.60-0.90	0.040	0.050
1012	G10120	0.10-0.15	0.30-0.60	0.040	0.050
1013	G10130	0.11-0.16	0.50-0.80	0.040	0.050
1015	G10150	0.13-0.18	0.30-0.60	0.040	0.050
1016	G10160	0.13-0.18	0.60-0.90	0.040	0.050
1017	G10170	0.15-0.20	0.30-0.60	0.040	0.050
1018	G10180	0.15-0.20	0.60-0.90	0.040	0.050
1019	G10190	0.15-0.20	0.70-1.00	0.040	0.050
1020	G10200	0.18-0.23	0.30-0.60	0.040	0.050
1020	TUBE	0.17-0.23	0.30-0.60	0.035	0.035
1020	PLATE	0.17-0.23	0.30-0.60	0.035	0.04
M1020	—	0.17-0.24	0.25-0.60	0.040	0.050
1021	G10210	0.18-0.23	0.60-0.90	0.040	0.050
1022	G10220	0.18-0.23	0.70-1.00	0.040	0.050
1023	G10230	0.20-0.25	0.30-0.60	0.040	0.050
1025	G10250	0.22-0.28	0.30-0.60	0.040	0.050
1026	G10260	0.22-0.28	0.60-0.90	0.040	0.050
1026	TUBE	0.22-0.28	0.60-0.90	0.035	0.035
1030	G10300	0.28-0.34	0.60-0.90	0.040	0.050
1035	G10350	0.32-0.38	0.60-0.90	0.040	0.050
1037	G10370	0.32-0.38	0.70-1.00	0.040	0.050
1038	G10380	0.35-0.42	0.60-0.90	0.040	0.050
1040	G10400	0.37-0.44	0.60-0.90	0.040	0.050
1042	G10420	0.40-0.47	0.60-0.90	0.040	0.050
1043	G10430	0.40-0.47	0.70-1.00	0.040	0.050
1044	G10440	0.43-0.50	0.30-0.60	0.040	0.050
M1044	—	0.40-0.50	0.25-0.60	0.040	0.050
1045	G10450	0.43-0.50	0.60-0.90	0.040	0.050
1046	G10460	0.43-0.50	0.70-1.00	0.040	0.050
1050	G10500	0.48-0.55	0.60-0.90	0.040	0.050

ASTM/AISI Grade	UNS Number	C	Mn	P Max.	S Max.
1050	SHEET	0.47-0.55	0.60-0.90	0.030	0.035
1053	G10530	0.48-0.55	0.70-1.00	0.040	0.050
1055	G10550	0.50-0.60	0.60-0.90	0.040	0.050
1059	G10590	0.55-0.65	0.50-0.80	0.040	0.050
1060	G10600	0.55-0.65	0.60-0.90	0.040	0.050
1064	G10640	0.60-0.70	0.50-0.80	0.040	0.050
1065	G10650	0.60-0.70	0.60-0.90	0.040	0.050
1070					G10700
0.65-0.75	0.60-0.90	0.040	0.050		
1074	G10740	0.70-0.80	0.50-0.80	0.040	0.050
††1074	STRIP	0.69-0.80	0.50-0.80	0.030	0.035
1075	G10750	0.70-0.80	0.40-0.70	0.040	0.050
1078	G10780	0.72-0.85	0.30-0.60	0.040	0.050
1080	G10800	0.75-0.88	0.60-0.90	0.040	0.050
1084	G10840	0.80-0.93	0.60-0.90	0.040	0.050
1086	G10860	0.80-0.93	0.30-0.50	0.040	0.050
1090	G10900	0.85-0.98	0.60-0.90	0.040	0.050
1095	G10950	0.90-1.03	0.30-0.50	0.040	0.050
††1095	STRIP	0.90-1.04	0.30-0.50	0.030	0.035

## STANDARD CARBON-RESULFURIZED STEELS\* CHEMICAL COMPOSITION LIMITS†

ASTM/AISI Grade	UNS Number	C	Mn	P Max.	S
1108	G11080	0.08/0.13	0.60/0.80	.040	0.08/0.13
1109	G11090	0.08/0.13	0.60/0.90	.040	0.08/0.13
1110	G11100	0.08/0.13	0.30/0.60	.040	0.08/0.13
1116	G11160	0.14/0.20	1.00/1.40	.040	0.16/0.23
1117	G11170	0.14/0.20	1.00/1.30	.040	0.08/0.13
1118	G11180	0.14/0.20	1.30/1.60	.040	0.08/0.13
1119	G11190	0.14/0.20	1.00/1.30	.040	0.24/0.33
1132	G11320	0.27/0.34	1.35/1.65	.040	0.08/0.13
1137	G11370	0.32/0.39	1.35/1.65	.040	0.08/0.13
1139	G11390	0.35/0.43	1.35/1.65	.040	0.13/0.20
1140	G11400	0.37/0.44	0.70/1.00	.040	0.08/0.13
1141	G11410	0.37/0.45	1.35/1.65	.040	0.08/0.13
1144	G11440	0.40/0.48	1.35/1.65	.040	0.24/0.33
1145	G11450	0.42/0.49	0.70/1.00	.040	0.04/0.07
1146	G11460	0.42/0.49	0.70/1.00	.040	0.08/0.13
1151	G11510	0.48/0.55	0.70/1.00	.040	0.08/0.13
ASTM A 311 or STRESSPROOF® FATIGUE PROOF®	G11440	0.40/0.48	1.35/1.65	.040	0.24/0.33
	G11440	0.40/0.48	1.35/1.65	.040	0.24/0.33

\*The above chemistries are Recognized Industry Standards for Bar Products.

†When lead is added to a grade (e.g., 11L17), the limits of lead are 0.15%/0.35%.

\* The above chemistries are Recognized Industry Standards for Bar Products, unless otherwise noted. Plate, sheet, and tubing may be slightly different.

†When lead is added to a grade (e.g., 10L18), the limits of lead are 0.15% / 0.35%.

**STANDARD CARBON — REPHOSPHORIZED  
AND RESULTURIZED STEELS\*  
CHEMICAL COMPOSITION LIMITS**

ASTM/AISI Grade	UNS Number	C Max	Mn	P	S	Pb
1211	G12110	.13	.60/.90	.07/.12	.10/.15	—
1212	G12120	.13	.70/1.00	.07/.12	.16/.23	—
1213	G12130	.13	.70/1.00	.07/.12	.24/.33	—
1215	G12150	.09	.75/1.05	.04/.09	.26/.35	—
12L13	G12134	.13	.70/1.00	.07/.12	.24/.33	.15/.35
12L14	G12144	.15	.85/1.15	.04/.09	.26/.35	.15/.35
INcut®100/ 1214SA	—	.09	.85/1.15	.04/.09	.26/.35	Bismuth .05min. (.10 Nom)
INcut®200	—	.09	.85/1.15	.04/.09	.26/.35	Bismuth .15min (.20Nom)

\* The above chemistries are Recognized Industry Standards for Bar Products, unless otherwise noted. Plate, sheet, and tubing may be slightly different.

†When lead is added to a grade (e.g., 10L18), the limits of lead are 0.15% / 0.35%.

**STANDARD CARBON — REPHOSPHORIZED  
AND RESULTURIZED STEELS\*  
CHEMICAL COMPOSITION LIMITS**

ASTM/AISI Grade	UNS Number	C	Mn	P Max.	S Max.	Former StdSAE
1513	G15130	0.10/0.16	1.10/1.40	.040	.050	—
1518	G15180	0.15/0.21	1.10/1.40	.040	.050	—
1522	G15220	0.18/0.24	1.10/1.40	.040	.050	—
1524	G15240	0.19/0.25	1.35/1.65	.040	.050	1024
1525	G15250	0.23/0.29	0.80/1.10	.040	.050	—
1526	G15260	0.22/0.29	1.10/1.40	.040	.050	—
1527	G15270	0.22/0.29	1.20/1.50	.040	.050	1027
1533	G15330	0.30/0.37	1.10/1.40	.040	.050	—
1534	G15340	0.30/0.37	1.20/1.50	.040	.050	—
1536	G15360	0.30/0.37	1.20/1.50	.040	.050	1036
1541	G15410	0.36/0.44	1.35/1.65	.040	.050	1041
1544	G15440	0.40/0.47	0.80/1.10	.040	.050	—
1545	G15450	0.43/0.50	0.80/1.10	.040	.050	—
1547	G15470	0.43/0.51	1.35/1.65	.040	.050	—
1548	G15480	0.44/0.52	1.10/1.40	.040	.050	1048
1551	G15510	0.45/0.56	0.85/1.15	.040	.050	1051
1552	G15520	0.47/0.55	1.20/1.50	.040	.050	1052
1553	G15530	0.48/0.55	0.80/1.10	.040	.050	—
1561	G15610	0.55/0.65	0.75/1.05	.040	.050	1061
1566	G15660	0.60/0.71	0.85/1.15	.040	.050	1066
1570	G15700	0.65/0.75	0.80/1.10	.040	.050	—
1572	G15720	0.65/0.76	1.00/1.30	.040	.050	1072
1580	G15800	0.75/0.88	0.80/1.10	.040	.050	—
1590	G15900	0.85/0.98	0.80/1.10	.040	.050	—

\*The above chemistries are Recognized Industry Standards for Bar Products. Plate, sheet.

## TYPICAL MECHANICAL PROPERTIES OF STANDARD CARBON STEELS

- These figures show the APPROXIMATE ranges of mechanical properties of steels in common use in 1" Rounds and cannot be used as a basis of acceptance or rejection of material.
- They are NOT GUARANTEED and are given only as an indication of what may be expected and should under no circumstances be used in specifying the raw materials. It must not be assumed that these properties will be obtained in all cases, as they vary widely with permissible variations in analysis, size of section, rolling conditions, grain size, and methods of heat treatment.
- Dependable mechanical properties can only be obtained through carefully controlled heat treatment or special processing.

ASTM/AISI Grade	Condition of Steel	MECHANICAL PROPERTIES				TYPICAL HARDNESS		Average Machinability % of CD1212
		Tensile Strength ksi†	Yield Strength ksi†	Elongation in2" %	Reduction of Area %	Brinell	Rockwell	
1008	Hot Rolled	42/52	21/31	25/35	50/60	95/120	B60/67	—
	Cold Drawn	50/65	40/55	20/30	40/50	110/140	B63/80	55
1018**	Hot Rolled	55/70	35/50	30/40	55/65	120/140	B67/80	55
	Cold Drawn	70/85	60/75	18/25	45/55	150/180	B80/90	65
	*Carburize 1700°F, Austenitize 1425°F, Water Quench, Temper 350°F (Core)	90	55	26	55	185	B90	—
1020	Hot Rolled	55/70	35/50	30/40	55/65	120/140	B67/80	50
M1044	Hot Rolled	75/85	40/50	12/20	35/45	140/170	B80/87	—
1045	Hot Rolled	90/105	55/65	15/25	35/45	190/220	B90/98	55
	Cold Drawn	90/110	75/90	12/20	30/45	195/230	B90/99	58
	*Austenitize 1550°F, Water Quench, Temper 1000°F	120	92	20	55	255	C25	—
1050	Hard Drawn Stress Relieved — .524 & Under	145 typical	100 min	5 min	—	253 min	C25 min	50
	— .587 – 1.000 Incl	155 typical	125 min	5 min	—	286 min	C30 min	50
	— Over 1.000	150 min	130 min	5 min	—	319 typical	C34 typical	50

\*Typical properties if heat treated as shown

\*\*With the addition of 0.15 % / 0.35% lead, longitudinal mechanical properties are not appreciably affected, and machinability is increased approximately 25%.

†1 ksi = 1000 psi

ASTM/AISI Grade	Condition of Steel	MECHANICAL PROPERTIES				TYPICAL HARDNESS		Average Machinability of CD1212
		Tensile Strength ksi††	Yield Strength ksi††	Elongation in2" %	Reduction of Area %	Brinell	Rockwell %	
1095	Hot Rolled	130/150	75/95	7/17	10/25	260/300	C26/32	—
	Spheroidize Annealed	90/110	55/65	15/25	35/45	190/220	B90/99	42
	*Austenitize 1450°F, Water Quench, Temper 1000°F	170	110	14	38	290	C36	—
1117**	Hot Rolled	65/75	40/50	25/35	55/65	135/155	B74/82	80
	Cold Drawn	80/90	65/80	15/20	45/55	150/190	B80/90	90
	*Carburize 1700°F, Austenitize 1450°F, Water Quench, Temper 350°F (Core)	95	58	24	53	195	B92	—
1137	Hot Rolled	90/105	55/70	15/25	35/50	180/220	B89/98	65
	Cold Drawn	90/110	75/90	9/19	25/35	190/225	B90/99	72
	*Austenitize 1550°F, Water Quench, Temper 1000°F	120	105	18	60	260	C26	—
	*Austenitize 1550°F, Oil Quench, Temper 1000°F	100	88	22	62	225	B98	—
1141**	Hot Rolled	95/110	55/70	15/25	30/45	190/220	B90/99	63
	Cold Drawn	100/120	85/105	8/18	25/35	200/250	B93/C24	70
	*Austenitize 1550°F, Oil Quench, Temper 1000°F	120	90	20	50	250	C24	—
1144	Cold Drawn	100/120	90/110	7/17	20/35	210/250	B96/C24	85
	*Austenitize 1550°F, Oil Quench, Temper 1000°F	122	92	19	50	250	C24	—
ASTM A 311 Class B or STRESSPROOF®	Hard Drawn Stress Relieved (1144) Thru 2"	115 min	100 min	8 min	25 min	235/285	C22/30	83
	Over 2" Thru 3"	115 min	100 min	8 min	20 min	235/285	C22/30	83
	Over 3" Thru 4-1/2"	115 min	100 min	7 min	20 min	235/285	C22/30	83
FATIGUE-PROOF® or Equivalent Mechanical Properties		140 min	125 min	5/15	15/30	280 min†	C30 min†	80

\*Typical properties if heat treated as shown

\*\*With the addition of 0.15 % / 0.35 % lead, longitudinal mechanical properties are not appreciably affected and machinability is increased approximately 25%.

† In the event of disagreement between hardness and tensile strength, the tensile strength shall govern.

†† 1 ksi = 1000 psi

ASTM A 36 BARS AND SHAPES  
Chemical Composition

Thickness or Diameter	C	Mn	P	S	Si
	Max		Max	Max	Max
All Shapes	.26	..	.04	.05	.40
Bars to 3/4" incl.	.26	..	.04	.05	.40
Bars over 3/4" to 1 1/2" incl.	.27	.60/.90	.04	.05	.40
Bars over 1 1/2" to 4" incl.	.28	.60/.90	.04	.05	.40
Bars over 4"	.29	.60/.90	.04	.05	.40

Mechanical Properties

Mechanical Properties	Bars	Shapes
Yield point, min, ksi	36	36
Tensile, ksi	58-80	58-80
Elongation in 8 inches, min, %	20*	20*
Elongation in 2 inches, min, %	23	21

\*For material under 5/16" in thickness or diameter, % Elongation in 8 inches is reduced by 1.25% for each decrease of 1/32" below 5/16" in thickness or diameter. 1 ksi = 1000 psi





Anupam metals INDIA

Regd. Office: 24/1, 2nd Carpenter Street, Near C. P. Tank, Mumbai - 400004.  
Tel: (+91-22) 2381 0301/ 2381 0302 | Fax: (+91-22) 2382 4625

Branch Office: G-39, DDA Flats, Behind Raghushree Market, Ajmeri Gate, Delhi - 110006.  
Tel: (+91-11) 2323 3521 / 2323 9553 | Fax: (+91-11) 2323 6913

Email: [info@anupammembers.com](mailto:info@anupammembers.com) | Website: [www.anupammembers.com](http://www.anupammembers.com)