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B

SECTION B

HOT ROLLED CARBON BARS and STRIP

HOT ROLLED MILD STEEL BARS

ASTM A 36 UNS K02600

Color Marking: Ends painted Blue

Hot Rolled Mild Steel Bars are used for general purpose applications. This steel is a low carbon grade, having good over-all mechanical properies. It is easy to fabricate by the usual structural methods, such as mild cold and hot forming and welding.

ANALYSIS

	Carbon Max.	Manganese	Phosphorus	Sulphur
3/4" and Under	.26	—	.04 Max.	.05 Max.
Over 3/4" to 1 1/2" Incl.	.27	.60/.90	.04 Max.	.05 Max.
Over 1 1/2"	.28	.60/.90	.04 Max.	.05 Max.

APPLICATIONS — This material is used for general purpose structural and miscellaneous non-critical applications that involve mild cold bending, mild hot forming, punching, and welding. Such applications include parts for general machinery, agricultural implements, transportations equipment, etc. It is used where seams and other surface imperfections may be tolerated.

MECHANICAL PROPERTIES — The following values are average for 1" round and may be considered as represenative of this grade:

	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"
ASTM A 36	58/80,000	36,000 Min.	23% Min.

WELDABILITY — This material is easily welded by all welding processes, and the resultant welds and joints are of extremely high quality. The grade of welding rod used depends on welding conditions, such as thickness of section, design, service requirements, etc.

HOT ROLLED MILD STEEL ROUNDS

Stock Lengths 20'

Size in Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar
3/16	.0940	1.879
1/4	.1671	3.341
5/16	.2610	5.220
23/64	.3452	6.904
3/8	.3759	7.517
7/16	.5116	10.23
31/64	.6271	12.54
1/2	.6682	13.36
9/16	.8457	16.91
39/64	.9925	19.85
5/8	1.044	20.88
47/64	1.442	28.83
3/4	1.504	30.07
55/64	1.974	39.48
7/8	2.046	40.93
63/64	2.590	51.80
1	2.673	53.46
1/16	3.017	60.35
1 1/8	3.383	67.66
1/4	4.176	83.53
3/8	5.053	101.1
1/2	6.014	120.3
5/8	7.058	141.2
3/4	8.186	163.7
7/8	9.397	187.9
2	10.69	213.8
1/8	12.07	241.4
1/4	13.53	270.6
3/8	15.08	301.5
1/2	16.71	334.1
5/8	18.42	368.4
3/4	20.21	404.3
7/8	22.09	441.9

NOTE – For Rounds 3" and over, refer to 1018 Special Quality Bars on Page 7 of this section.

HOT ROLLED MILD STEEL SQUARES

Stock Lengths 20'

Size in Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar
1/4	.2127	4.254
5/16	.3323	6.647
3/8	.4786	9.572
7/16	.6514	13.03
1/2	.8508	17.02
5/8	1.329	26.59
3/4	1.914	38.29
7/8	2.606	52.11
1	3.403	68.06
1/8	4.307	86.14
1/4	5.318	106.4
3/8	6.434	128.7
1/2	7.657	153.1
1 5/8	8.987	179.7
3/4	10.42	208.4
7/8	11.96	239.3
2	13.61	272.3
1/4	17.23	344.6
1/2	21.27	425.4
3/4	25.74	514.7
3	30.63	612.6
1/4	35.95	718.9
1/2	41.69	833.8
4	54.45	1089
1/2	68.91	1378
5	85.08	1702
6	122.5	2450

HOT ROLLED MILD STEEL FLATS

Stock Lengths 20'

Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar
1/8 and 3/16 thick – See Flats, Page 15		
1/4 x		
3/8	.3191	6.381
1/2	.4254	8.508
5/8	.5318	10.64
3/4	.6381	12.76
7/8	.7445	14.89
1	.8508	17.02
1 1/8	.9572	19.14
1 1/4	1.064	21.27
1 3/8	1.170	23.40
1 1/2	1.276	25.52
1 5/8	1.383	27.65
1 3/4	1.489	29.78
2	1.702	34.03
2 1/4	1.914	38.29
2 1/2	2.127	42.54
2 3/4	2.340	46.79
3	2.552	51.05
3 1/4	2.765	55.30
3 1/2	2.978	59.56
3 3/4	3.191	63.81
4	3.403	68.06
4 1/4	3.616	72.32
4 1/2	3.829	76.57
5	4.254	85.08
5 1/2	4.679	93.59
6	5.105	102.1
6 1/2	5.530	110.6
7	5.956	119.1
7 1/2	6.381	127.6
8	6.806	136.1
9	7.657	153.1
10	8.508	170.2
11	9.359	187.2
12	10.21	204.2
5/16 x		
1/2	.5318	10.64
5/8	.6647	13.29
3/4	.7976	15.95
7/8	.9306	18.61
1	1.064	21.27
1 1/8	1.196	23.93
1 1/4	1.329	26.59
1 1/2	1.595	31.91
1 3/4	1.861	37.22
2	2.127	42.54
2 1/4	2.393	47.86
2 1/2	2.659	53.18
2 3/4	2.925	58.49
3	3.191	63.81
3 1/4	3.456	69.13
3 1/2	3.722	74.45
4	4.254	85.08
4 1/2	4.786	95.72
5	5.318	106.4
5 1/2	5.849	117.0
6	6.381	127.6
7	7.445	148.9
8	8.508	170.2
3/8 x		
1/2	.6381	12.76
5/8	.7976	15.95
3/4	.9572	19.14
7/8	1.117	22.33
1	1.276	25.52
1 1/8	1.436	28.71
1 1/4	1.595	31.91
1 3/8	1.755	35.10
1 1/2	1.914	38.29
1 5/8	2.074	41.48
1 3/4	2.233	44.67
2	2.552	51.05
2 1/4	2.871	57.43
2 1/2	3.191	63.81
2 3/4	3.510	70.19
3	3.829	76.57
3 1/4	4.148	82.95
3 1/2	4.467	89.33
3 3/4	4.786	95.72
4	5.105	102.1
4 1/4	5.424	108.5
4 1/2	5.743	114.9
5	6.381	127.6
5 1/2	7.019	140.4
6	7.657	153.1
6 1/2	8.295	165.9
7	8.933	178.7
7 1/2	9.572	191.4
8	10.21	204.2
9	11.49	229.8
10	12.76	255.2
11	14.04	280.8
12	15.31	306.3
7/16 x		
1	1.489	29.78
1 1/4	1.861	37.22
1 1/2	2.233	44.67
2	2.978	59.56
2 1/2	3.722	74.45
3	4.467	89.33
1/2 x		
5/8	1.064	21.27
3/4	1.276	25.52
7/8	1.489	29.78
1	1.702	34.03
1 1/8	1.914	38.29
1 1/4	2.127	42.54
1 3/8	2.340	46.79
1 1/2	2.552	51.05
1 5/8	2.765	55.30
1 3/4	2.978	59.56
2	3.403	68.06
2 1/4	3.829	76.57
2 1/2	4.254	85.08
2 3/4	4.679	93.59
3	5.105	102.1
3 1/4	5.530	110.6
3 1/2	5.956	119.1
3 3/4	6.381	127.6
4	6.806	136.1
4 1/2	7.657	153.1
5	8.508	170.2
5 1/2	9.359	187.2
6	10.21	204.2
6 1/2	11.06	221.2
6 3/4	11.49	229.8
7	11.91	238.2
8	13.61	272.3
9	15.31	306.3
10	17.02	340.3
11	18.72	374.4
12	20.42	408.4
5/8 x		
3/4	1.595	31.91
7/8	1.861	37.22
1	2.127	42.54
1 1/8	2.393	47.86
1 1/4	2.659	53.18
1 1/2	3.191	63.81
1 5/8	3.456	69.13
1 3/4	3.722	74.45
2	4.254	85.08
2 1/4	4.786	95.72
2 1/2	5.318	106.4
2 3/4	5.849	117.0
3	6.381	127.6
3 1/4	6.913	138.3
3 1/2	7.445	148.9
4	8.508	170.2
4 1/2	9.572	191.4
5	10.64	212.7
5 1/2	11.70	234.0
6	12.76	255.2
7	14.89	297.8
8	17.02	340.3
9	19.14	382.8
10	21.27	425.4
12	25.52	510.5
3/4 x		
7/8	2.233	44.67
1	2.552	51.05
1 1/8	2.871	57.43
1 1/4	3.191	63.81
1 1/2	3.829	76.57
1 5/8	4.148	82.95
1 3/4	4.467	89.33
2	5.105	102.1
2 1/4	5.743	114.9
2 1/2	6.381	127.6
2 3/4	7.019	140.4
3	7.657	153.1
3 1/4	8.295	165.9
3 1/2	8.933	178.7
4	10.21	204.2
4 1/2	11.49	229.7
5	12.76	255.2
5 1/2	14.04	280.8
6	15.31	306.3
7	17.87	357.3
8	20.42	408.4
10	25.52	510.5
12	30.63	612.6
7/8 x		
1	2.978	59.56
1 1/4	3.722	74.45
1 1/2	4.467	89.33
1 3/4	5.211	104.2
2	5.956	119.1
2 1/4	6.700	134.0
2 1/2	7.445	148.9
2 3/4	8.189	163.8
3	8.933	178.7
3 1/2	10.42	208.4
4	11.91	238.2
4 1/2	13.40	268.0
5	14.89	297.8
5 1/2	16.38	327.6
6	17.87	357.3
7	20.84	416.9
8	23.82	476.4

(Continued next page)

HOT ROLLED MILD STEEL FLATS

Stock Lengths 20'

Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar
1 x		
1 1/4	4.254	85.08
1 1/2	5.105	102.1
1 3/4	5.956	119.1
2	6.806	136.1
2 1/4	7.657	153.1
2 1/2	8.508	170.2
2 3/4	9.359	187.2
3	10.21	204.2
3 1/4	11.06	221.2
3 1/2	11.91	238.2
4	13.61	272.3
4 1/2	15.31	306.3
5	17.02	340.3
5 1/2	18.72	374.4
6	20.42	408.4
7	23.82	476.4
8	27.23	544.5
10	34.03	680.6
12	40.84	816.8
1 1/8 x		
2	7.657	153.1
3	11.49	229.7
4	15.31	306.3
5	19.14	382.9
6	22.97	459.4
1 1/4 x		
1 1/2	6.381	127.6
1 3/4	7.445	148.9
2	8.508	170.2
2 1/4	9.572	191.4
2 1/2	10.64	212.7
2 3/4	11.70	234.0
3	12.76	255.2
3 1/4	13.82	276.4
3 1/2	14.89	297.8
4	17.02	340.3
4 1/2	19.14	382.9
5	21.27	425.4
5 1/2	23.40	467.9
6	25.52	510.5
7	29.78	595.6
8	34.03	680.6
1 1/2 x		
1 3/4	8.933	178.7
2	10.21	204.2
2 1/4	11.49	229.7
2 1/2	12.76	255.2
2 3/4	14.04	280.8
3	15.31	306.3
3 1/2	17.87	357.3
4	20.42	408.4
4 1/2	22.97	459.4
4 3/4	24.25	485.0
5	25.52	510.5
5 1/2	28.08	561.5
6	30.63	612.6
7	35.73	714.7
8	40.84	816.8
1 3/4 x		
2	11.91	238.2
2 1/2	14.89	297.8
3	17.87	357.3
3 1/2	20.84	416.9
4	23.82	476.4
4 1/2	26.80	536.0
5	29.78	595.6
5 1/2	32.76	655.1
6	35.73	714.7
2 x		
2 1/4	15.31	306.3
2 1/2	17.02	340.3
3	20.42	408.4
3 1/2	23.82	476.4
4	27.23	544.5
4 1/2	30.63	612.6
5	34.03	680.6
6	40.84	816.8
7	47.64	952.9
8	54.45	1089
2 1/4 x		
4	30.63	612.6
2 1/2 x		
3	25.52	510.5
3 1/2	29.78	595.6
4	34.03	680.6
4 1/2	38.29	765.7
5	42.54	850.8
6	51.05	1021
8	68.06	1361
3 x		
4	40.84	816.8
4 1/2	45.94	918.9
5	51.05	1021
6	61.26	1225

MILD STEEL HALF ROUNDS

Stock Lengths 20'

Size In Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar
1/2	.334	6.68
5/8	.522	10.44
3/4	.751	15.02
1		1.335 26.70
1 1/2	3.004	60.08

1018 HOT ROLLED BARS

Special Quality

ASTM A 576 UNS G10180

Color Marking: Ends painted Black

A low-carbon steel having a higher manganese content than Mild Steel and certain other low-carbon steels. Being richer in manganese, it is a better steel for carburized parts, since it produces a harder and more uniform case. It also has higher mechanical properties, including Brinell hardness, and better machining characteristics. In its production, special manufacturing controls are used for chemical composition, heating, rolling, surface preparation, etc. The result is a quality product suitable for applications involving forging, heat treating, cold drawing, machining, etc.

ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur
.15/.20	.60/.90	.04 Max.	.05 Max.

APPLICATIONS – Since 1018 is a good carburizing steel, it is especially suitable for parts requiring high surface hardness with a relatively soft core, such as gears, pinions, worms, king pins, chain pins, ratchets, dogs, oil tool slips and liners. 1018 is also often specified for studs, anchor pins, special bolts, tie rods, etc.

MECHANICAL PROPERTIES – The following are average values for 1" round and may be considered as representative of this grade:

	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area	Brinell Hardness
As Rolled	67,000	45,000	36%	58%	137
Normalized	66,000	43,000	37%	60%	137
Annealed	60,000	40,000	38%	62%	121

WELDABILITY – This grade is easily welded by all the welding processes, and the resultant welds and joints are of extremely high quality. The grade of welding rod to be used depends on thickness of section, design, service requirements, etc.

FORGING – Heat to 2150º-2250ºF

NORMALIZING – Heat to 1650º-1750ºF. Cool in air.

ANNEALING – Heat to 1550º-1650ºF. Cool in furnace.

HARDENING – This grade will respond to any of the standard carburizing methods and subsequent heat treatments. For a hard case and a tough core, the following heat treatment is suggested: Carburize at 1650º-1700ºF for approximately eight hours, cool in box, reheat to 1400º-1450ºF, quench in water, and draw at 300º-350ºF.

1018 HOT ROLLED BARS (Continued)
1018 HOT ROLLED ROUNDS
Special Quality
Stock Lengths 20'

Size in Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar	Size in Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar
3	24.06	481.1	6 1/2	112.9	2259
1/8	26.10	522.0	3/4	121.8	2436
1/4	28.23	564.6	7	131.0	2619
3/8	30.45	608.9	1/4	140.5	2810
1/2	32.74	654.8	1/2	150.4	3007
5/8	35.12	702.5	3/4	160.5	3211
3/4	37.59	751.7	8	171.1	3421
7/8	40.14	802.7	1/4	181.9	3638
4	42.77	855.3	1/2	193.1	3862
1/8	45.48	909.6	3/4	204.6	4093
1/4	48.28	965.6	9	216.5	4330
1/2	54.13	1083	1/4	228.7	4574
3/4	60.31	1206	1/2	241.2	4824
5	66.82	1336	3/4	254.1	5082
1/4	73.67	1473	10	267.3	5346
1/2	80.86	1617	1/2	294.7	5894
3/4	88.37	1767	11	323.4	6468
6	96.22	1924	12	384.9	7698
1/4	104.4	2088	1/2	417.6	8353

Size in Inches	Hot Rolled Wt./Ft.	Hot Rolled WT 20 FT Bar	Press Forged Rough Turned 1/4" Over	Press Forged Wt./Ft.	Press Forged WT 20 FT Bar
13	451.72	9034	13.250	469.26	9385
1/4	469.26	9385	13.500	487.14	9743
1/2	487.14	9743	13.750	505.35	10107
14	523.89	10478	14.250	542.77	10855
3/8	552.33	11047	14.625	571.71	11434
1/2	561.98	11240	14.750	581.52	11630
3/4	581.52	11630	15.000	601.40	12028
7/8	591.42	11828	15.125	611.47	12229
15	601.40	12028	15.250	621.62	12432
1/2	642.16	12843	15.750	663.05	13261
7/8	673.61	13472	16.125	695.00	13900
16	684.26	13685	16.250	705.81	14116
1/4	705.81	14116	16.500	727.70	14554
1/2	727.70	14554	16.750	749.92	14998
17	772.47	15449	17.250	795.35	15907
1/4	795.35	15907	17.500	818.58	16372
18	866.02	17320	18.250	890.24	17805
1/4	890.24	17805	18.500	914.80	18296
19	964.92	19298	19.250	990.48	19810
1/2	1016.37	20327	19.750	1042.60	20852
3/4	1042.60	20852	20.000	1069.16	21383
20	1069.16	21383	20.250	1096.06	21921
1/2	1123.29	22466	20.750	1150.85	23017
3/4	1150.85	23017	21.000	1178.75	23575
21	1178.75	23575	21.250	1206.98	24140
1/4	1206.98	24140	21.500	1235.55	24711
1/2	1235.55	24711	21.750	1264.45	25289
22	1293.68	25874	22.250	1323.25	26465
3/4	1383.39	27668	23.000	1413.96	28279
23	1413.96	28279	23.250	1444.87	28897
1/4	1444.87	28897	23.500	1476.11	29522
1/2	1476.11	29522	23.750	1507.68	30154
24	1539.59	30792	24.250	1571.83	31437
26	1806.88	36138	26.250	1841.80	36836
1/2	1877.04	37541	26.750	1912.63	38253
28	2095.55	41911	28.250	2133.14	42663
30	2405.61	48112	30.250	2445.87	48917
32	2737.05	54741	32.250	2779.98	55600

FLATS

Carried in ASTM A 36. See page 4 of this section.

1040/42/45 HOT ROLLED BARS

Special Quality

ASTM A 576 UNS G10400, G10420, G10450

Color Marking: Ends painted Red

These are medium-carbon steels. In their production, special controls are used for chemical composition, heating, rolling, surface preparation, etc. As a result of this careful processing, these bars are suitable for applications involving forging, heat treating (including flame hardening), cold drawing, machining, etc.

ANALYSIS

	Carbon	Manganese	Phosphorus	Sulphur
1040	.37/.44	.60/.90	.04 Max.	.05 Max.
1042	.40/.47	.60/.90	.04 Max.	.05 Max.
1045	.43/.50	.60/.90	.04 Max.	.05 Max.

APPLICATIONS – These grades, particularly when heat treated, should be used where greater strength is required than can be obtained from the lower carbon steels. A few of the most frequent uses are for axles, machinery parts, stud bolts, ordinary shafts, pinions, gears, rock screens, forming dies, tool shanks.

MECHANICAL PROPERTIES – The following are average values for 1" round and may be considered as representative:

	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area	Brinell Hardness
As Rolled	90,000	59,000	26%	50%	201
Normalized	87,000	58,000	28%	52%	192
Annealed	80,000	48,000	30%	54%	159

WELDABILITY – These grades, due to higher carbon content, are not readily welded. As carbon content increases, difficulty in welding is likely to develop. With thin sections and flexible design, gas or arc welding may be used without preheating, but in joints over 1/2" to 3/4" thick preheating is necessary. To develop equivalent strength in a weld, a low alloy filler is recommended. Stress relieving is also recommended. The grade of welding rod to be used depends on thickness of section, design, service requirements, etc.

FORGING – Heat to 2100º-2200ºF.

NORMALIZING – Heat to 1600º-1750ºF. Cool in air.

ANNEALING – Heat to 1450º-1550ºF. Cool in furnace.

HARDENING – These grades are essentially water-hardening steels but may be quenched in oil. The recommended quenching temperatures are 1550ºF for water and 1575ºF for oil. A wide range of mechanical properties can be obtained by tempering at different temperatures between 700ºF and 1300ºF. Tempering in the range from 500º to 700ºF should be avoided.

1040/42/45 HOT ROLLED ROUNDS

Special Quality

Stock Lengths 20' (Some 30')

Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar	Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar	Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar
3/16	.0940	1.879	2 1/8	12.07	241.4	5 3/4	88.37	1767
3/8	.3759	7.517	1/4	13.53	270.6	6	96.22	1924
7/16	.5116	10.23	3/8	15.08	301.5	1/4	104.4	2088
1/2	.6682	13.36	1/2	16.71	334.1	1/2	112.9	2259
9/16	.8457	16.91	5/8	18.42	368.4	3/4	121.8	2436
5/8	1.044	20.88	3/4	20.21	404.3	7	131.0	2619
21/32	1.151	23.02	7/8	22.09	441.9	1/4	140.5	2810
3/4	1.504	30.07	3	24.06	481.1	1/2	150.4	3007
13/16	1.765	35.29	1/8	26.10	522.0	3/4	160.5	3211
7/8	2.046	40.93	1/4	28.23	564.6	8	171.1	3421
15/16	2.349	46.98	3/8	30.45	608.9	1/4	181.9	3638
1	2.673	53.46	1/2	32.74	654.8	1/2	193.1	3862
1/16	3.017	60.35	5/8	35.12	702.5	3/4	204.6	4093
1/8	3.383	67.66	3/4	37.59	751.7	9	216.5	4330
3/16	3.769	75.38	7/8	40.14	802.7	1/4	228.7	4574
1/4	4.176	83.53	4	42.77	855.3	1/2	241.2	4824
5/16	4.604	92.09	1/8	45.48	909.6	3/4	254.1	5082
3/8	5.053	101.1	1/4	48.28	965.6	10	267.3	5346
7/16	5.523	110.5	3/8	51.16	1023	1/2	294.7	5894
1/2	6.014	120.3	1/2	54.13	1083	11	323.4	6468
9/16	6.526	130.5	3/4	60.31	1206	12	384.9	7698
5/8	7.058	141.2	5	66.82	1336	1/2	417.6	8353
11/16	7.612	152.2	1/4	73.67	1473	13	451.7	9034
3/4	8.186	163.7	1/2	80.86	1617	1/2	487.1	9743
7/8	9.397	187.9						
2	10.69	213.8						
1/16	11.37	227.4						

1040/42/45 HOT ROLLED SQUARES

Special Quality

Stock Lengths 20'

Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar	Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar	Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar
1/2	.8508	17.02	1 3/8	6.434	128.7	3	30.63	612.6
5/8	1.329	26.59	1/2	7.657	153.1	1/2	41.69	833.8
3/4	1.914	38.29	3/4	10.42	208.4	4	54.45	1089
7/8	2.606	52.11	2	13.61	272.3	1/2	68.91	1378
1	3.403	68.06	1/4	17.23	244.6	5	85.08	1702
1/8	4.307	86.14	1/2	21.27	425.4	1/2	102.9	2059
1/4	5.318	106.4	3/4	25.74	514.7	6	122.5	2450

1117 HOT ROLLED BARS

Special Quality

ASTM A 576 UNS G11170

Color Marking: Ends painted Aluminum with Red Stripe

This grade is low-carbon, high-manganese steel. It possesses much of the machining quality of 1212 Screw Stock but with improved mechanical properties. The grade also has excellent carburizing properties.

ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur
.14/.20	1.00/1.30	.04 Max.	.08/.13

APPLICATIONS – This steel is used for manufacturing numerous parts requiring considerable machining and close tolerances, along with a smooth finish. It may be bent or formed where such cold working operations are not too severe. It is especially suitable for carburized parts requiring soft core and high surface hardness such as gears, pinions, worms, king pins, ratchets, dogs, etc.

MECHANICAL PROPERTIES – The following are average values for 1" round and may be considered as representative of the grade:

	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area	Brinell Hardness
As Rolled	69,000	46,000	34%	61%	143
Normalized	68,000	44,000	34%	64%	137
Annealed	62,000	41,000	34%	58%	121

MACHINABILITY – 1117 has a machinability rating of 91%, based on 1212 as 100%. Average surface cutting speed is 150 feet per minute.

WELDABILITY – This grade is not readily welded due to high sulphur content. Gas or arc welding may be used providing joints are preheated. To develop equivalent strength in a weld, a low alloy filler is recommended. Stress relieving after welding is also recommended. The grade of welding rod to be used depends on the thickness of section, design, service requirements. etc.

HARDENING – This grade will respond to any of the standard carburizing methods and subsequent heat treatments. For a hard case and a tough core, the following heat treatment is suggested: Carburize at 1650º-1700ºF for approximately eight hours. Cool in box and reheat to 1400º-1450ºF. Quench in water and draw at 300º-350ºF.

1117 HOT ROLLED ROUNDS

Special Quality

Stock Lengths 20'

Size In Inches	Estimated Weight, Lbs. Per Foot	Estimated Weight, Lbs. 20-Ft. Bar	Size In Inches	Estimated Weight, Lbs. Per Foot	Estimated Weight, Lbs. 20-Ft. Bar
2 1/2	16.71	334.1	6	96.22	1924
3	24.06	481.1	1/4	104.4	2088
1/4	28.23	564.6	1/2	112.9	2259
1/2	32.74	654.8	3/4	121.8	2436
3/4	37.59	751.7	7	131.0	2619
4	42.77	855.3	1/4	140.5	2810
1/4	48.28	965.6	1/2	150.4	3007
1/2	54.13	1083	3/4	160.5	3211
3/4	60.31	1206	8	171.1	3421
5	66.82	1336	1/4	181.9	3638
1/4	73.67	1473	1/2	193.1	3862
1/2	80.86	1617	3/4	204.6	4093
3/4	88.37	1767	9	216.5	4330
			1/2	241.2	4824
			10	267.3	5346
			11	323.4	6468
			12	384.9	7698

1141 HOT ROLLED BARS

Special Quality
ASTM A 576 UNS G11410
Color Marking: Ends painted Purple

This is medium-carbon, manganese steel. It is melted to special bar quality and fine-grain specifications, possessing high consistency and uniformity. Strength characteristics are high in the as-rolled condition, and greater hardness and strength may be obtained through heat treatment. Machinability is excellent, due to addition of sulphur.

ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur
.37/.45	1.35/1.65	.04 Max.	.08/.13

APPLICATIONS – This grade is used to advantage in applications where good machinability combined with higher strength is required, such as axles, studs, bolts, shafts, tie rods, etc.

MECHANICAL PROPERTIES – The following values are average for 1" round and may be considered as representative:

	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area	Brinell Hardness	Izod Impact Ft./Lbs.
As Rolled	95,000	56,000	25%	50%	197	–
Normalized	97,000	58,000	23%	49%	201	45
Annealed	85,000	50,000	26%	53%	174	35

MACHINABILITY – 1141 has a machinability rating of approximately 70%, based on 1212 as 100%. Average surface cutting speed is 115 feet per minute.

WELDABILITY – This grade is not readily welded due to high carbon, manganese, and sulphur content. Gas or arc welding may be performed, provided area to be welded is preheated. Stress relieving after welding is recommended.

FORGING – Heat to 2100º-2200ºF.

NORMALIZING – Heat to 1600º-1700ºF. Cool in air.

ANNEALING – Heat to 1400º-1500ºF. Cool in furnace.

HARDENING – This grade is essentially an oil-hardening steel. It can be water quenched, but great care should be exercised when this is done. Oil quenching temperature is between 1475º and 1550ºF. A wide range of mechanical properties may be obtained by tempering at temperatures between 400º and 1200ºF.

1141 HOT ROLLED ROUNDS

Special Quality

Stock Lengths 20'

Size In Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar	Size In Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar
1 1/8	3.383	67.66	4	42.77	855.3
1/4	4.176	83.53	1/4	48.28	965.6
3/8	5.053	101.1	1/2	54.13	1083
1/2	6.014	120.3	3/4	60.31	1206
5/8	7.058	141.2	5	66.82	1336
3/4	8.186	163.7	1/4	73.67	1473
7/8	9.397	187.9	1/2	80.86	1617
2	10.69	213.8	3/4	88.37	1767
1/8	12.07	241.4	6	96.22	1924
1/4	13.53	270.6	1/4	104.4	2088
3/8	15.08	301.5	1/2	112.9	2259
7/16	15.88	317.6	3/4	121.8	2436
1/2	16.71	334.1	7	131.0	2619
5/8	18.42	368.4	1/4	140.5	2810
3/4	20.21	404.3	1/2	150.4	3007
7/8	22.09	441.9	3/4	160.5	3211
3	24.06	481.1	8	171.1	3421
1/8	26.10	522.0	1/4	181.9	3638
1/4	28.23	564.6	1/2	193.1	3862
3/8	30.45	608.9	9	216.5	4330
1/2	32.74	654.8	1/2	241.2	4824
5/8	35.12	702.5	3/4	254.1	5082
3/4	37.59	751.7	10	267.3	5346

M1044 FLATS (PLOW STEEL)
Merchant Quality

ASTM A 575 UNS G10440

Color Marking: Ends painted Red

Hot Rolled M1044 is a medium-carbon steel used in general purpose applications when special quality is not required. It has good overall properties somewhat higher than low-carbon Mild Steel Flats. This grade may be fabricated using the usual structural methods. It is machinable and is capable of being induction hardened.

ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur
.40/.50	.25/.60	.04 Max.	.05 Max.

APPLICATIONS – This steel is used in the manufacture and maintenance of plows and various other agricultural implements, such as sub-soilers, ditchers, border ridgers, cultivators, furrowers, and harrows. It is also used in the manufacture and maintenance of construction machinery, such as tractors, scrapers, bulldozers, shovels, concrete mixers, etc. Other applications include brake dies, brake bands, racks, slides, etc.

MECHANICAL PROPERTIES – The following values are typical for 1" thickness and may be considered as representative in the as-rolled condition:

Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"	Reduction of Area	Brinell Hardness
90,000	55,000	23%	45%	201

MACHINABILITY – This material is generally machined in the as-rolled condition without difficulty. Average cutting speed is 85 surface feet per minute.

WELDABILITY – May be welded with proper precautions. With thin sections and a flexible design, gas or arc welding may be used without preheating; but in joints over 1/2" to 3/4" thick preheating is necessary. To develop equivalent strength in a weld, a low-alloy filler is recommended. Stress relieving is also recommended. The grade of welding rod to be used depends on thickness of section, design, service requirements, etc.

FORGING – Heat to 2100º-2200ºF.

NORMALIZING – Heat to 1550º-1650ºF. Cool in air.

ANNEALING – Heat to 1450º-1550ºF. Cool in furnace. Average Brinell hardness 192.

HARDENING – The recommended quenching temperature is 1450º-1550ºF for oil, or 25º lower for water. Temper to required hardness.

M1044 FLATS (PLOW STEEL)

Stock Lengths 20'

Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar
1/4 x		
1	.8508	17.02
1 1/4	1.064	21.27
1 1/2	1.276	25.52
2	1.702	34.03
2 1/2	2.127	42.54
3	2.552	51.05
3 1/2	2.978	59.56
4	3.403	68.06
5	4.254	85.08
6	5.105	102.1
5/16 x		
1 1/4	1.329	26.59
1 1/2	1.595	31.91
2	2.127	42.54
2 1/2	2.659	53.18
3	3.191	63.81
4	4.254	85.08
6	6.381	127.6
3/8 x		
1	1.276	25.52
1 1/4	1.595	31.91
1 1/2	1.914	38.29
1 3/4	2.233	44.67
2	2.552	51.05
2 1/4	2.871	57.43
2 1/2	3.191	63.81
3	3.829	76.57
3 1/2	4.467	89.33
4	5.105	102.1
5	6.381	127.6
6	7.657	153.1
1/2 x		
5/8	1.064	21.27
3/4	1.276	25.52
1	1.702	34.03
1 1/4	2.127	42.54
1 1/2	2.552	51.05
1 3/4	2.978	59.56
2	3.403	68.06
2 1/4	3.829	76.57
2 1/2	4.254	85.08
3	5.105	102.1

Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar
1/2 x		
3 1/2	5.956	119.1
4	6.806	136.1
4 1/2	7.657	153.1
5	8.508	170.2
6	10.21	204.2
8	13.61	272.3
5/8 x		
1	2.127	42.54
1 1/4	2.659	53.18
1 1/2	3.191	63.81
1 3/4	3.722	74.45
2	4.254	85.08
2 1/2	5.318	106.4
3	6.381	127.6
3 1/2	7.445	148.9
4	8.508	170.2
4 1/2	9.572	191.4
5	10.64	212.7
6	12.76	255.2
8	17.02	340.3
3/4 x		
1	2.552	51.05
1 1/4	3.191	63.81
1 1/2	3.829	76.57
1 3/4	4.467	89.33
2	5.105	102.1
2 1/4	5.743	114.9
2 1/2	6.381	127.6
3	7.657	153.1
3 1/2	8.933	178.7
4	10.21	204.2
4 1/2	11.49	229.7
5	12.76	255.2
6	15.31	306.3
8	20.42	408.4
7/8 x		
1	2.978	59.56
1 1/2	4.467	89.33
2	5.956	119.1
2 1/2	7.445	148.9
3	8.933	178.7
3 1/2	10.42	208.4
4	11.91	238.2
4 1/2	13.40	268.0
5	14.89	297.8
6	17.87	357.3

Size In Inches	Est. Wt., Lbs. Per Foot	Est. Wt., Lbs. 20-Ft. Bar
1 x		
1 1/2	5.105	102.1
2	6.806	136.1
2 1/2	8.508	170.2
3	10.21	204.2
3 1/4	11.06	221.2
3 1/2	11.91	238.2
4	13.61	272.3
4 1/2	15.31	306.3
5	17.02	340.3
6	20.42	408.4
8	27.23	544.5
1 1/4 x		
1 3/4	7.445	148.9
2	8.508	170.2
2 1/2	10.64	212.7
3	12.76	255.2
3 1/2	14.89	297.8
4	17.02	340.3
4 1/2	19.14	382.9
5	21.27	425.4
6	25.52	510.5
1 1/2 x		
2	10.21	204.2
2 1/2	12.76	255.2
3	15.31	306.3
3 1/2	17.87	357.3
4	20.42	408.4
4 1/2	22.97	459.4
5	25.52	510.5
6	30.63	612.6
1 3/4 x		
6	35.73	714.7
2 x		
2 1/2	17.02	340.3
3	20.42	408.4
3 1/2	23.82	476.4
4	27.23	544.5
4 1/2	30.63	612.6
5	34.03	680.6
6	40.84	816.8

REINFORCING STEEL

Deformed Bars – Grade 40

ASTM Specification A 615

Color Marking: Ends painted Blue

ASTM A 615 Specification covers deformed billet-steel concrete-reinforcement bars. The bars are intended for use as reinforcement in reinforced concrete construction. The surface of the bar is provided with small lugs which inhibit longitudinal movement of the bar relative to the concrete which surrounds it.

Bars produced to the above specifications are marked with the size number and letter N.

MECHANICAL PROPERTIES – The tensile and bend requirements of ASTM Spec. A 615 for deformed bars, Grade 40, are outlined below, minimum properties are as follows:

Bar Designation Number	Tensile Strength (psi)	Yield Strength (psi)	Elongation in 8"
3	70,000	40,000	11%
4,5,6	70,000	40,000	12%
7	70,000	40,000	11%
8	70,000	40,000	10%

Bars are capable of being bent cold around a pin without cracking on the outside of the bent portion, as follows:

Under 3/4" diameter–Will bend 90° around a pin four times own diameter.

3/4" diameter & over–Will bend 90° around a pin five times own diameter.

ROUND REINFORCING BARS
Deformed – Grade 40
Stock Lengths 20', 30', and 40'

Bar Designation Number	Size In Inches	Estimated Weight, Lbs. Per Foot	20' Bar	30' Bar	40' Bar
3	3/8	.3759	7.517	11.28	15.04
4	1/2	.6682	13.36	20.05	26.73
5	5/8	1.044	20.88	31.32	41.76
6	3/4	1.504	30.07	45.12	60.16
7	7/8	2.046	40.93	61.38	81.84
8	1	2.673	53.46	80.19	106.9

HOT ROLLED STRIP FLATS
UNS K02303

Color Marking: Ends painted Blue

This is a low-carbon steel with good ductility.

ANALYSIS

Carbon	Manganese	Phosphorus	Sulphur
.15 Max.	.30/.60	.04 Max.	.05 Max.

APPLICATIONS – Since this steel has good ductility, it is easy to fabricate and is used for a wide variety of purposes, such as for strapping, banding, brackets, ornamental iron work, and similar applications requiring a steel that can be cold formed.

MECHANICAL PROPERTIES – Will bend flat on itself at room temperature, either crosswise or lengthwise, without readily visible cracks along the bend. Average properties are as follows:

Tensile Strength (psi)	Yield Strength (psi)	Elongation in 8"	Reduction of Area
55,000	37,000	30%	55%

WELDABILITY – This grade is easily welded by all the welding processes and the resultant welds and joints are of extremely high quality. The grade of welding rod to be used depends on thickness of section, design, service requirements, etc.

HOT ROLLED STRIP FLATS
Stock Lengths 20'

Thickness In Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar
1/8x		
3/8	.1595	3.191
1/2	.2127	4.254
5/8	.2659	5.318
3/4	.3191	6.381
7/8	.3722	7.445
1	.4254	8.508
1 1/8	.4786	9.572
1 1/4	.5318	10.64
1 3/8	.5849	11.70
1 1/2	.6381	12.76
1 3/4	.7445	14.89
2	.8508	17.02
2 1/4	.9572	19.14
2 1/2	1.064	21.27
2 3/4	1.170	23.40
3	1.276	25.52
3 1/4	1.383	27.65
3 1/2	1.489	29.78
4	1.702	34.03
4 1/2	1.914	38.29
5	2.127	42.54
5 1/2	2.340	46.80
6	2.552	51.05
7	2.978	59.56
8	3.403	68.06
10	4.254	85.08
12	5.105	102.1

Thickness In Inches	Estimated Weight, Lbs. Per Foot	20-Ft. Bar
3/16x		
3/8	.2393	4.786
1/2	.3191	6.381
5/8	.3988	7.976
3/4	.4786	9.572
7/8	.5583	11.17
1	.6381	12.76
1 1/8	.7179	14.36
1 1/4	.7976	15.95
1 3/8	.8774	17.55
1 1/2	.9572	19.14
1 3/4	1.117	22.33
2	1.276	25.52
2 1/4	1.436	28.71
2 1/2	1.595	31.91
2 3/4	1.755	35.10
3	1.914	38.29
3 1/4	2.074	41.48
3 1/2	2.233	44.67
4	2.552	51.05
4 1/2	2.871	57.43
5	3.191	63.81
5 1/2	3.510	70.20
6	3.829	76.57
7	4.467	89.33
8	5.105	102.1
10	6.381	127.6
12	7.657	153.1

1/4 and thicker - ASTM A36 Flat Bars See page 4 of this section

HIGH STRENGTH, LOW-ALLOY STEEL

ASTM A 572 Grade 50 UNS K02303

This material is micro-alloy, in which strengthening is provided by the addition of small amounts of columbium, vanadium or combinations.

ANALYSIS

C	Mn	P	S	Si
.23 Max.	1.35 Max.	.04 Max.	.05 Max.	.04 Max.

Type 1 .005-.05% columbium
Type 2 .010-.15% vanadium
Type 3 .05 max columbium + vanadium > 4 times nitrogen

MECHANICAL PROPERTIES – Minimum properties are as follows:

Tensile Strength (psi)	Yield Strength (psi)	Elongation in 2"
65,000	50,000	21%

APPLICATIONS – This material is used for structural and forged components where as-hot rolled strengths are an important asset.

HARDENING – This material is used in the Hot Worked Condition.

MACHINABILITY – This material has a machinability rating of approximately 70% of 1212.

WELDABILITY – This material is readily weldable using any process developed for plain carbon steels.

WORKABILITY – This material has good formability. Forming is generally done at room temperature.

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