

ESTIMATED MECHANICAL PROPERTIES OF STEEL

The mechanical properties shown below are for general information purposes and are for steels in the as-rolled condition except where noted.

Estimated minimum values for hot rolled and cold drawn carbon steel bars can normally be expected in sizes ranging from $\frac{3}{4}$ " to $1\frac{1}{4}$ ", and are based on standard tensile test specimens with 2 inch gauge lengths per ASTM E8. Yield strength values shown for the quenched and tempered condition are determined by the .2% offset method per ASTM E8.

Case Hardening or Low Carbon Bars (as rolled)

SAE	Condi- tion of Steel	Tensile Strength KSI	Yield Strength KSI	% Elong. in 2"	% Red. of Area	Hardness		Machin- ability Rating (C1212 = 100)
						Br.	R	
M1020	Hot R'd.	55	30	25	50	111	B62	50
1018	Hot R'd.	58	36	25	50	116	B65	52
	Cold Dr.	64	54	15	40	126	B70	70
	Core Props: carburized at 1700°F., cooled, reheated to 1425°, 350° Q & T.							
		92,00	56	27	48	195	B92	—
10L18	Cold Dr.	64	54	15	40	126	B70	80
1020	Hot R'd.	55	30	25	50	111	B62	52
1025	TG&P	58	32	25	50	116	B65	50
12L14	Cold Dr.	78	60	10	35	165	B85	180
12L14 + Te	Cold Dr.	78	60	10	35	165	B85	250
1215	Cold Dr.	78	60	10	35	165	B85	136
1117	Hot R'd.	62	34	23	47	121	B68	80
	Cold Dr.	69	58	15	40	137	B75	90
	Core Props: carburized at 1700°F., cooled, reheated to 1450°, 350° Q & T.							
		96.5	59	23	53	195	B92	—
11L17	Hot R'd.	62	34	23	47	121	B68	100
	Cold Dr.	69	58	15	40	137	B75	125
	Core Props: carburized at 1700°F., cooled, reheated to 1450°, 350° Q & T.							
		97	60	23	52	197	B92	—
86L20	Hot R'd.	91	66	25	64	185	B90	88
	Cold Dr.	103	86	23	58	210	B95	92
	Core Props: carburized at 1700°F., cooled, reheated to 1550°, 300° Q & T.							
		135	105	21	54	262	C26	—
E4320	Hot R'd.	84	61	29	58	165	B85	55
	Cold Dr.	98	81	18	54	205	B94	60
	Core Props: carburized at 1700°F., cooled, reheated to 1500°, 300° oil Q & T.							
		218	178	14	48	429		
4615-17	Hot R'd.	82	62	28	65	185	B90	58
	Cold Dr.	99	84.6	19	61	210	B95	64
	Core Props: carburized at 1700°F., cooled, reheated to 1550°, 300° oil Q & T.							
		110	80	25	61	229	C20	—
4620	Hot R'd.	85	63	28	64	185	B90	58
E4620	Cold Dr.	101	85	22	60	207	B94	64
	Core Props: carburized at 1700°F., cooled, reheated to 1550°, 300° oil Q & T.							
		120	89	22	55	2448	C24	—
C8615/8617	Hot R'd.	82	60	31	62	150	B80	70
	Core Props: carburized at 1700°F., cooled, reheated to 1550°, 300° oil Q & T.							
		109	76	17	52	255	C25	—
8620	Hot R'd.	89	65	25	63	190	B91	60
	Cold Dr.	102	85	22	58	210	B95	63
	Core Props: carburized at 1700°F., cooled, reheated to 1550°, 300° oil Q & T.							
		129	99	21	52	255	C25	—

Medium Carbon or Direct Hardening Bars

1035	Hot R'd.	72	39.5	18	40	143	B90	65
	Water Quenched, 1550°F. — Tempered 1000°F.							
		103	72	23	59	201	B94	

(Continued)

ESTIMATED MECHANICAL PROPERTIES OF STEEL**Medium Carbon or Direct Hardening Bars**

SAE	Condi- tion of Steel	Tensile Strength KSI	Yield Strength KSI	% Elong. in 2"	% Red. Area	Hardness		Machin- ability Rating (C1212 = 100)
						Br.	R	
<i>(Continued)</i>								
M1044	Hot R'd.	80	44	16	40	166	B86	65
1045	Hot R'd.	82	45	16	40	162	B84	56
	Cold Dr.	91	77	12	35	180	B89	65
	Water Quenched, 1550°F. — Tempered 1000°F.	120	90	18	52	240	C22	—
1045	TG&P	82	45	16	40	162	B84	56
1137	Cold Dr.	88	48	15	35	180	B89	70
	Oil Quenched, 1550°F. — Tempered 1000°F.	112	88	21	56	255	C25	—
1141	Hot R'd.	94	51.5	15	35	190	B91	65
	Cold Dr.	105	88	10	30	210	B95	70
	Oil Quenched, 1550°F. — Tempered 1000°F.	126	100	19	54	277	C29	—
1141	TG&P	94	51.5	15	35	190	B91	65
1141	Drawn, G&P	105	88	10	30	205	B94	70
11L41	Hot R'd.	94	51.5	15	35	185	B90	95
	Cold Dr.	105	88	10	30	205	B94	100
	Oil Quenched, 1550°F. — Tempered 1000°F.	126	101	20	54	277	C29	—
1144	Hot R'd.	97	53	15	35	210	B95	64
	Cold Dr.	108	90	10	30	217	C22	80
	Oil Quenched, 1550°F. — Tempered 1000°F.	129	100.5	18	53	278	C30	—
E4130	*Hot R'd.	86	56	29	57	185	B90	65
	*Cold Dr.	98	87	21	52	200	B93	70
	Water Quenched, 1575°F. — Tempered 1000°F.	146	133	17	50	293	C31	—
4140	*Hot R'd.	89	62	26	58	190	B91	57
	*Cold Dr.	102	90	18	50	228	B98	66
	Oil Quenched, 1550°F. — Tempered 1000°F.	153	131	16	45	302	C32	—
4147-50	*Hot R'd.	100	66	21	51	195	B92	54
	Oil Quenched, 1550°F. — Tempered 1000°F.	158	134	14	42	311	C33	—
41L40-42	*Hot R'd.	91	63	27	58	185	B90	87
	*Cold Dr.	103	93	19	51	228	B98	90
	Oil Quenched, 1550°F. — Tempered 1000°F.	156	133	16	44	311	C33	—
41L47/50 Rounds	*Hot R'd.	103	69	23	51	205	B94	80
	*Cold Dr.	112	95	16	43	228	B98	85
	Oil Quenched, 1550°F. — Tempered 1000°F.	162	138	14	40	311	C33	—
4150 Mod. RS Flats, Sqs.	*Hot R'd.	103	69	23	51	205	B94	73
	Oil Quenched, 1550°F. — Tempered 1000°F.	160	135	14	41	311	C33	—
4340 C4340	*Hot R'd.	101	69	21	45	210	B95	45
	*Cold Dr.	111	99	16	42	228	B98	55
	Oil Quenched, 1550°F. — Tempered 1000°F.	182	162	15	40	363	C39	—
E6150	*Hot R'd.	91	58	22	53	185	B90	50
	Oil Quenched, 1550°F. — Tempered 1000°F.	155	132	15	44	302	C32	—
E8740	*Cold Dr.	107	96	17	48	228	B98	66
	Oil Quenched, 1525°F. — Tempered 1000°F.	152	129	15	44	302	C32	—

(Continued)

*Annealed

ESTIMATED MECHANICAL PROPERTIES OF STEEL**High Carbon or Direct Hardening Bars**

SAE	Condi- tion of Steel	Tensile Strength KSI	Yield Strength KSI	% Elong. in 2"	% Red. of Area	Hardness		Machin- ability Rating (C1212 = 100)
						Br.	R	
(Continued) 1095	Hot R'd.	120	66	10	25	271	C28	—
	Water Quenched, 1450°F. — Tempered 800°F.	200	138	12	37	390	C42	—
52100	*Hot R'd.	100	81	25	57	192	—	39
	*Cold Dr.	107	87.5	17	54	229	—	41
	SP. Ann							

Heat Treated Bars/Minimum Mechanical Properties

Properties are at center of bars up to 1½", and at mid-radius of bars over 1½".
Yield strength — 0.2% or .02% offset as indicated per ASTM E8.

Tradename or Grade	Thermal Condition	Tensile Strength (KSI) Range or Min.	Min. Yield Strength (KSI)	Min. % Elong. in 2"	Min. % Red. of Area	Surface Hardness		Machin- ability Rating (1212 = 100)	
						Brinell	HRC		
ASTM A182 Gr. F22 C1.3	HR								
ASTM A739 Gr. B22	N&T	75-95	45	20	45	156/207	—	—	
ASTM A193 Gr. B7 (4140)	HR & CF QTSR	Thru 1½" Over 1½-2½"	130 125	110 105	16 16	50 50	269/321 269/321	28/34 25/34	55 55
ASTM A434 CL. BC		Over 2½-4"	115	95	16	50	269/321	25/34	55
Through 7"		Over 4-7"	110	85	18	50	269/321	24/32	55
4140/42 ASTM A434 CL. BCCF DGP	HR QTSR	Over 7-9½" Over 9½"	105 —	80 —	15 —	40 —	269/321 —	28/34 —	55 —
Thru 1"		110	130	16	50	269/321	28/34	55	
4340 ASTM A434 CL. BD	QTSR TGP	Thru 1½" Over 1½-2½"	155 150	130 120	14 14	35 35	302/363 302/363	32/39 32/39	52 52
		Over 2½-4"	140	110	14	35	302/363	32/39	52
		Over 4-7"	135	105	14	35	302/363	32/89	52
		Over 7-9½"	130	100	14	35	302/363	32/39	52
		Over 9½"	130	100	14	35	302/363	32/39	52
MIL-S-1222 Gr. B16	HR	Thru 2½"	125	110	18	50	255/302	25/32	—
ASTM A193 Gr. B16 CMV	QTSR	Over 2½-3"	120	110	18	50	255/302	25/32	—
Stressproof ASTM A311 CL. B	CD As Drawn Heavy Draft	Thru 2" Over 2-3" Over 3-4½"	115 115 115	100 100 100	8 8 8	25 20 20	— — —	— — —	83 83 83
SAE 1144									
Fatigue-Proof SAE 1144	Elevated Temp Drawn	140	125	5	15	280 Min.	30 Min.	80	
e.t.d. 150	Elevated Temp Drawn	150	130	10 (Mean)	37 (Mean)	302 Min.	32 Min.	—	
41L40/42/47	HR & CF QTSR	125	100	15	45	269/321	27/34	70	
4150 Mod. RS HR Square	Norm & SR Thru 6"	—	—	—	—	241/302	23/32	62	

(Continued)

* Annealed

** Not governed by agency requirements. Test results vary, but approach 7-9½" properties.

ESTIMATED MECHANICAL PROPERTIES OF STEEL

Heat Treated Bars/Minimum Mechanical Properties

Tradename or Grade	Thermal Condition	Tensile Strength (KSI) Range or Min.	Min. Yield Strength (KSI)	Min. % Elong. in 2"	Min. % Red. of Area	Surface Hardness		Machin- ability Rating (1212 HRC = 100)	
						Brinell	HRC		
<i>(Continued)</i>									
4150 Mod. RS HR Rounds	QTSR	Thru 1½"	130	110	16	50	262/311	27/33	62
		Over 1½-2½"	125	105	16	50	262/311	27/33	62
		Over 2½-4"	115	95	16	45	262/311	27/33	62
		Over 4-7"	110	85	16	45	262/311	27/33	62
		7-9½"	105	80	15	40	262/321	27/34	62
		Over 9½"	—	—	—	—	—	—	—

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