

CHEMICAL ANALYSIS

MECHANICAL PROPERTIES

ALLOY STEELS

GRADE	CARBON	MANGANESE	SULFUR	PHOSPHOROUS	SILICON	CHROMIUM	MOLYBDENUM	OTHER	TENSILE	YIELD	ELONG.	RED/AREA	MACH%	HB
CD Ann. 4130	.28/.33	.40/.60	.04	.035	.15/.35	.80/1.1	.15/.25	-	95,000	80,000	18%	40%	70%	179
HR Ann. 4140	.38/.43	.75/1.0	-	-	-	.80/1.1	.15/.25	-	89,000	62,000	26%	58%	57%	190
HTSR, TG&P 4140	.38/.45	.75/1.0	.04	.035	-	.80/1.1	.15/.25	-	120,000	100,000	20%	50%	55%	255
CD Ann. 41L40	.38/.43	.75/1.0	.04	.035	.15/.35	.80/1.1	.15/.25	Pb .15/.25	105,000	85,000	15%	45%	86%	187
HR HT 4150	.48/.53	.75/1.0	.040	.035	.15/.35	.80/1.1	.15/.25	-	115,000	95,000	16%	50%	50%	269/321
HR Q&T 4142	.40/.45	.75/1.0	.040	.035	-	.80/1.1	.15/.25	-	110,000	95,000	18%	50%	55%	255
HR Ann. 4340	.38/.43	.60/.80	.040	.035	-	.70/.90	.20/.30	Ni 1.65/2.0	100,000	65,000	20%	45%	50%	212
CD Ann. 86L20	.018/.023	.70/.90	.04	.035	.15/.35	.40/.60	.15/.25	Ni .40/.70 Pb .15/.35	95,000	80,000	15%	50%	86%	179
5160	.56/.64	.75/1.0	.40	.035	-	.70/.90	-	-	128,000	90,000	12%	35%	-	269

STANDARD CARBON REPHOSPHORIZED & RESULFURIZED STEELS

GRADE	CARBON	MANGANESE	SULFUR	PHOSPHOROUS	SILICON	CHROMIUM	MOLYBDENUM	OTHER	TENSILE	YIELD	ELONG.	RED/AREA	MACH%	HB
12L14	.15	.85/1.15	.26/35	.04/.09	-	-	-	Pb .15/.35	70,000	60,000	15%	35%	193%	165
1215	.09	.75/1.05	.26/35	.04/.09	-	-	-	-	80,000	60,000	10%	35%	136%	165

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STANDARD CARBON & RESULFURIZED STEELS

GRADE	CARBON	MANGANESE	SULFUR	PHOSPHOROUS	SILICON	CHROMIUM	MOLYBDENUM	OTHER	TENSILE	YIELD	ELONG.	RED/AREA	MACH%	HB
CD 1018	.15/.20	.60/.90	.050	.040	–	–	–	–	64,000	54,000	15%	40%	66%	126
HR 1020	.18/.23	.30/.60	.050	.040	–	–	–	–	54,000	30,000	25%	50%	52%	111
TG&P 1045	.43/.50	.60/.90	.050	.040	–	–	–	–	91,000	77,000	12%	35/45	56%	179
HR A-36	.26/.29	.60/.90	.050	.040	–	–	–	–	58,000/ 80,000	MIN 36,000	21%	–	–	116-167
Stressproof®	.40/.48	1.35/1.65	.24/.33	.040	.15/.30	–	–	Ni .006/.009	132,300	100,000	12%	34%	83%	269

STAINLESS STEELS

GRADE	CARBON	MANGANESE	SULFUR	PHOSPHOROUS	SILICON	CHROMIUM	MOLYBDENUM	OTHER	TENSILE	YIELD	ELONG.	RED/AREA	MACH%	HB
303	.15	2.00	.15	.20	1.00	17.0/19.0	.75	Ni 8.0/10.0	85,000/ 95,000	30,000/ 40,000	45/55	50/60	73%	160/180
304	.08	2.00	.030	.045	1.00	18.0/20.0		Ni 8.0/10.5 N .10	80,000/ 90,000	30,000/ 40,000	55/65	65/75	45%	150/180
316	.08	2.00	.030	.045	1.00	16.0/18.0	2.0/3.0	Ni 10.0/ 14.0	75,000/ 90,000	30,000/ 40,000	40/50	60/70	40%	150/180
416	.15	1.25	.15	.060	1.00	12.0/14.0		N .10 Zr or Mo .60	80,000/ 100,000	55,000/ 65,000	15/25	40/50	90%	190/220
440C	.95/1.20	1.00	.030	.040	1.00	16.0/18.0	.75	–	110,000	65,000	14%	25%	40%	260

CHEMICAL ANALYSIS

STEEL PLATE

GRADE	CARBON	MANGANESE	SULFUR	PHOSPHOROUS	SILICON	CHROMIUM	MOLYBDENUM	OTHER	TENSILE	YIELD	ELONG.	RED/AREA	MACH%	HB
A-36	.25/.29	.80/1.20	.05	.04	.00/.30	–	–	–	58,000/ 80,000	36,000	20/30	–	–	–
A572-50	.23	1.35	.05	.04	.15/.40	–	–	–	65,000	50,000	15/17	–	–	–
A-588	.19/.20	.75/1.35	.05	.04	.15/.65	.40/.70	–	Ni .50 Cu .20/.40	63,000/ 70,000	42,000/ 50,000	18/21	–	–	–
AR	Chemical & mechanical properties vary. Brinells of 235, 350, 400, 425, & 500 can be achieved depending on amounts of Ni, B, Cr, & Mo added & quenching & tempering processes used.													
A514/T-1®	Chemical analysis varies depending on the mill process. In general all grades will have .12-.21% carbon and various amounts of Cr, Ni, Mo and V. Boron is added to increase hardenability.								100,000/ 130,000	90,000/ 100,000	16/18	–	–	235/293

MECHANICAL PROPERTIES

DRILL ROD

GRADE	CARBON	MANGANESE	SULFUR	PHOSPHOROUS	SILICON	CHROMIUM	MOLYBDENUM	OTHER	TENSILE	YIELD	ELONG.	RED/AREA	MACH%	HB
W-1	1.00	.40	.20	–	–	–	–	–	Mechanical properties vary depending on hardening process. Typical stock bars are annealed.					
O-1	.95	1.20	.35	–	.35	.50	–	W .50						
A-2	1.00	.70	–	–	–	5.00	1.10	V .25						

ALUMINUM

GRADE	COPPER	SILICON	MAGNE- SIUM	CHRO- MIUM	TENSILE	YIELD	ELONG.	GRADE	COPPER	SILICON	MAGNE- SIUM	CHRO- MIUM	TENSILE	YIELD	ELONG.
6063-T5	–	0.40	.20	–	27,000	21,000	12	2011-T3	5.5	–	–	–	55,000	43,000	15
6061-T6	0.28	0.6	1.0	0.20	45,000	40,000	12	2024-T3	4.4	–	1.5	–	70,000	50,000	18
5052-H32	–	–	2.5	0.25	33,000	28,000	12	5086-H32	–	–	4.0	0.15	42,000	30,000	12
7075-T6	1.60	–	2.5	0.23	83,000	73,000	11	3003-H22	0.12	–	–	–	23,000	20,000	12