



**Castle Metals®**



Alloy Steel



*Your foremost provider  
of specialty products,  
services and solutions*

Quirk Guide



# Alloy Steel Quik Guide

DESCRIPTION	AISI GRADE	SIZE ROUND INCHES	CONDITION	QUALITY	SPECIFICATIONS	TYPICAL PROPERTIES -1" HR UNLESS NOTED OTHERWISE				
						TENSILE KSI	YIELD KSI	%EL. 2"	% R.A.	HBW
<b>LOW CARBON ALLOY</b> CASE HARDENING STEELS MACHINABLE PURECUT 20® OFFERS IMPROVED MACHINABILITY WITHOUT LEAD HIGH WEAR RESISTANCE WHEN CASE HARDENED INCREASING ALLOY CONTENT FOR IMPROVED HARDENABILITY AND TOUGHNESS HIGHER QUALITIES FOR CRITICAL APPLICATIONS	8620	3/4 – 12	HR	CQ	ASTM A29 ASTM A322 ASTM A108(CF)	93	65	25	63	162
		10.5 – 24	RT-FGD							
		1/4 – 6	CF							
	E8620	2 3/4 – 10 1/2 – 2.75	HR CF	AQ/BQ	ASTM A534 AMS 2301 AMS 6274 ASTM A108(CF)	93	65	25	63	162
	86L20	1/4 – 4	HR / CF	CQ	ASTM A29 ASTM A108(CF)	93	65	25	63	162
	PURECUT 20®	3/8 – 4	HR / CF	CQ	ASTM A29 ASTM A108(CF)	93	65	25	63	162
	E4320	3/4 – 10	HR	AQ/BQ	ASTM A29 ASTM A322 ASTM A534 AMS 2301	120	78	20	50	248
	4820	3/4 – 10	HR / CF	BQ	ASTM A29 ASTM A322 ASTM A534 ASTM A108(CF)	110	73	22	56	221
	E3310	2 – 11	HR – ANN	BQ	ASTM A29 ASTM A322 ASTM A534	90 ANN	72	27	64	235 MAX
	E9310	1 – 10	HR – ANN	AQ/BQ	ASTM A322 ASTM A534 AMS 6260 AMS 2301 ASTM A29 ASTM A108(CF)	119 ANN	64	17	42	229 MAX
3/8 – 3		CF – ANN	248 MAX							
E9310 VAR	1 – 10	HR N&T RT	PREMIUM AQ	AMS 6260 AMS 6265 AMS 6267 AMS 2300 ASTM A108(CF)	–	–	–	–	229 MAX	
	1/2 – 2.75	CF N&T							248 MAX	

**NOMENCLATURE:**

HR – HOT ROLL – ORIGINAL AS ROLLED SURFACE FROM STEEL MILL. MEETS ASTM A29 TOLERANCES.

FGD – HOT FORGED – TYPICAL FOR SIZES OVER 10" WHEN HR CAPABILITIES DIMINISH.

CF – COLD FINISH – INCLUDES ROUGH TURNED, COLD DRAWN, TURNED & POLISHED, TURNED GROUND & POLISHED – MEETS ASTM A108 TOLERANCES.

RT – ROUGH TURN – TYPICALLY HR SIZES OVER 6" THAT CAN'T BE CD OR T&P.

CD – COLD DRAWN – HR DRAWN THRU A DIE- WORK HARDENS SOFTER LOW CARBON STEELS FOR IMPROVED MACHINABILITY SURFACE REMOVAL OF DECARB AND ALLOWABLE MILL DEFECTS EXPECTED PER ASTM A108.

T&P – CNC HIGH SPEED PRECISION TURNED & POLISHED. SIZES THRU 6" AT HA INDUSTRIES, DIV. OF CASTLE METALS. CONSIDERED SEAM & DECARB FREE- PREFERRED FOR ALLOYS WITH DEMANDING APPLICATIONS.

TGP – TURNED & POLISHED THEN CENTERLESS GROUND TO FINAL SIZE. SIZES THRU 6" AT HA INDUSTRIES, DIV. OF CASTLE METALS.

ANN – ANNEAL - SOFTENING HR BY HEATING AND FURNACE COOLING TO PROVIDE MACHINABILITY. FOR MEDIUM C ALLOYS, LAMELLAR PEARLITE (LP) ANNEAL IS OPTIMUM AND FOR HIGH C ALLOYS (S2100) SPHEROIDIZED ANNEAL IS BEST.

N – NORMALIZE – HEATING TO ~1650/1700F AND AIR COOLING. REFINES GRAIN AND HOMOGENIZES MICROSTRUCTURE. REDUCES BANDING OR MICROSEGREGATION. PROVIDES UNIFORM HARDNESS, IMPROVES MACHINABILITY AND RESPONSE TO HARDENING.

T – TEMPER – HEATING BELOW CRITICAL TEMPERATURES TO SOFTEN NORMALIZED OR QUENCH HARDENED MATERIAL. IN QUENCHED MATERIAL, TEMPERED MARTENSITE IS PRODUCED.

Q&T – QUENCH & TEMPER- HEATING ABOVE CRITICAL TEMPERATURES, QUECHING IN A LIQUID MEDIA AND TEMPERING TO DESIRED HARDNESS, STRENGTH AND/OR TOUGHNESS.

HA INDUSTRIES, DIV. OF CASTLE METALS, PROVIDES LP ANNEAL, NORMALIZE, N&T, Q&T AND NQ&T.

Q&T "STRESS FREE" FROM 3/4" THRU 12" RDS PROVIDES NO RESIDUAL STRESS AND UNIFORM PROPERTIES WITH NO DISTORTION DURING SUBSEQUENT PROCESSING.

CQ ALLOYS MEET H-BAND PER ASTM A304.

PLEASE INQUIRE FOR OUR SELECTION OF HEXES, FLATS AND SQUARES

CQ – COMMERCIAL QUALITY  
EF – ELECTRIC FURNACE QUALITY

AQ – AIRCRAFT QUALITY  
BQ – BEARING QUALITY

BMS – BOEING MATERIAL SPEC  
P&W – PRATT & WHITNEY

RELATIVE MACHINABILITY RATING (ASI 1212 CD = 100%)	CHEMICAL COMPOSITION RANGES OR MAX LIMITS (%)								
	C	MN	P	S	SI	NI	CR	MO	OTHER
65 CD	.18/.23	.70/.90	.035	.04	.15/.35	.40/.70	.40/.60	.15/.25	–
50	.18/.23	.70/.90	.025	.015	.15/.35	.40/.70	.40/.60	.15/.25	OXYGEN .0020
83	.18/.23	.70/.90	.035	.040	.15/.35	.40/.70	.40/.60	.15/.25	PB .15/.35
83	.18/.23	.70/.90	.035	.02/.04	.15/.35	.40/.70	.40/.60	.15/.25	BI TREATED
60 ANN-CD	.17/.22	.45/.65	.025	.015	.15/.35	1.65/2.00	.40/.60	.20/.30	OXYGEN .0020
55 ANN-CD	.18/.23	.50/.70	.025	.015	.15/.35	3.25/3.75	–	.20/.30	OXYGEN .0020
50 ANN-CD	.08/.13	.45/.60	.025	.015	.15/.35	3.25/3.75	1.40/1.75	–	OXYGEN .0020
50 ANN-CD	.08/.13	.40/.70	.025	.015	.15/.35	3.00/3.50	1.00/1.40	.08/.15	OXYGEN .0020
40 ANN	.08/.13	.40/.70	.015	.015	.15/.35	3.00/3.50	1.00/1.40	.08/.15	–





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						TENSILE KSI	YIELD KSI	%EL. 2"	% R.A.	HBW
<p><b>MEDIUM CARBON ALLOY</b></p> <p>THRU HARDENING STEELS</p> <p>MACHINABLE</p> <p>PURECUT 40® &amp; TEL CUT 40® OFFER IMPROVED MACHINABILITY WITHOUT LEAD</p> <p>MACHINABILITY ADDITIVES LESSON TOOL WEAR AND IMPROVE PRODUCTIVITY WITH NO SACRIFICE IN MECHANICAL PROPERTIES OR HEAT TREAT RESPONSE.</p> <p>INDUCTION HARDENABLE</p> <p>INCREASING ALLOY CONTENT FOR IMPROVED HARDENABILITY AND TOUGHNESS</p> <p>HIGHER QUALITIES FOR CRITICAL APPLICATIONS</p>	4130	3/4 – 10	HR – N	AQ	AMS 6370 AMS 2301	97 N	63	25	59	229 MAX
		3/8 – 4	CF – N							241 MAX
	4140	3/4 – 12	HR – ANN	CQ	ASTM A29 ASTM A322 ASTM A108(CF)	95 ANN	60	26	57	229 MAX
		10 – 25	FGD – RT – ANN							241 MAX
		3/16 – 6	CF – ANN							
	41L40	1 – 6	HR – ANN	CQ	ASTM A29 ASTM A322 ASTM A108(CF)	95 ANN	60	26	57	229 MAX
		1/4 – 5	CF – ANN							241 MAX
	PURECUT 40®	3/8 – 4	CF – ANN	CQ	ASTM A29 ASTM A108(CF)	95 ANN	60	26	57	241 MAX
	TELCUT 40®	1/4 – 3	CF – ANN	CQ	ASTM A29 ASTM A108(CF)	95 ANN	60	26	57	241 MAX
	E4140	3/4 – 10	HR – ANN	AQ	AMS 6382	95 ANN	60	26	57	229 MAX
			1/4 – 4							CF – ANN
	4150	1 – 12	HR – ANN	CQ	ASTM A29 ASTM A322 ASTM A108(CF)	100 ANN	48	22	43	229 MAX
		10 – 20	FGD – RT – ANN							
		3/8 – 3	CF – ANN							
	4340	1 – 12	HR – ANN	CQ	ASTM A29 ASTM A322 ASTM A108(CF)	120 ANN	80	18	35	250
		10 – 24	FGD – RT – ANN							
		3/8 – 5	CF – ANN							
	E4340	1 – 10.5	HR – ANN	AQ	AMS 6415 AMS 2301	120 ANN	80	18	35	235 MAX
		1/4 – 1.5	CF – ANN							255 MAX
	E4340 VAR	1.375 – 7.5	HR – ANN	PREMIUM AQ	AMS 6414 AMS 2300	120 ANN	80	18	35	235 MAX
1 – 8.5			HR N&T							269 MAX
E4340 300M	1 – 7	HR – N&T	PREMIUM AQ	AMS 6417 AMS2300	–	–	–	–	311 MAX	
E4330 MOD VAR	1 – 9	HR – N&T	PREMIUM AQ	AMS 6411 AMS 2300 BMS 7-122 P&W FC-17F P&W FC-23D	–	–	–	–	269	
E6150	1 – 6	HR – ANN	AQ	AMS 6448 AMS 2301	103 ANN	74	27	52	235 MAX	
		3/8 – 2							CF – ANN	248 MAX
E8740	3/8 – 2	CF – ANN	AQ	AMS 6322 AMS 2301	97 ANN	65	27	55	241 MAX	
<b>HIGH CARBON ALLOY THRU HARDENING STEEL</b>	52100	2 – 10	HR – SPH ANN	AQ – BQ	AMS 6440 AMS 2301 ASTM A295	94 SPH ANN	62	27	62	207 MAX
		.25 – 3	CF – SPH ANN							241 MAX

RELATIVE MACHINABILITY RATING (ASI 1212 CD = 100%)	CHEMICAL COMPOSITION RANGES OR MAX LIMITS (%)								
	C	MN	P	S	SI	NI	CR	MO	OTHER
70 ANN – CD	.28/.33	.40/.60	.025	.025	.15/.35	–	.80/1.10	.15/.25	–
57 N&T	.28/.33	.65/1.00	.015	.015	.15/.35	1.65/2.00	.75/1.00	.35/.50	V .05/.10
65 ANN – CD	.38/.43	.75/1.00	.035	.04	.15/.35	–	.80/1.00	.15/.25	–
83 ANN – CD	.38/.43	.75/1.00	.035	.04	.15/.35	–	.80/1.00	.15/.25	PB .15/.35
83 CF – ANN	.38/.43	.75/1.00	.035	.02/.04	.15/.35	–	.80/1.00	.15/.25	BI TREATED
83 CF – ANN	.38/.43	.75/1.00	.035	.02/.04	.15/.35	–	.80/1.00	.15/.25	SE TREATED
65 ANN – CD	.38/.43	.75/1.00	.025	.025	.15/.35	–	.80/1.00	.15/.25	–
55 ANN – CD	.48/.53	.75/1.00	.035	.040	.15/.35	–	.80/1.00	.15/.25	–
55 ANN – CD	.38/.43	.60/.80	.035	.040	.15/.35	1.65/2.00	.70/.90	.20/.30	–
55 ANN – CD	.38/.43	.60/.85	.025	.025	.15/.35	1.65/2.00	.70/.90	.20/.30	–
45 ANN	.38/.43	.60/.90	.015	.015	.15/.35	1.65/2.00	.70/.90	.20/.30	–
45 ANN	.38/.43	.60/.90	.010	.010	1.45/1.80	1.65/2.00	.70/.95	.30/.50	V .05/.10
50 ANN – CD	.48/.53	.70/.90	.025	.025	.15/.35	.25	.80/1.10	.06	V .15/.30
65 ANN – CD	.38/.43	.75/1.00	.025	.025	.15/.35	.40/.70	.40/.60	.20/.30	–
40 SPH ANN – CD	.93/1.05	.25/.45	.025	.015	.15/.35	.25	1.35/1.60	.10	OXYGEN .0015 ALUMINUM .050 COPPER .30

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						TENSILE KSI	YIELD KSI	%EL. 2"	% R.A.	HBW	
<b>MEDIUM CARBON ALLOY QUENCHED AND TEMPERED STEELS</b>  THRU HARDENED IN BAR FORM  ELIMINATE PART HEAT TREATING  INDUSTRY STANDARD SPECS  MACHINABLE  HIGH STRENGTH  SUITABLE FOR INDUCTION HARDENING  SUPERCUT 150® OFFERS HIGH STRENGTH AND TOUGHNESS WITH MACHINABILITY ADDITIVES  NIT135M – THIS CR-MO AL. ALLOY WHEN NITRIDED EXHIBITS AN EXTREMELY HARD CASE WITH A STRONG DUCTILE CORE  NIAGARA LASALLE ELEVATED TEMPERATURE DRAW  OIL & GAS SPECIFICATIONS  HA INDUSTRIES PROVIDES Q&T "STRESS FREE" TO VARIOUS INDUSTRY STANDARD AND CUSTOM SPECIFICATIONS	4140	3/8 – 1.5	HR / CF / TGP – Q&T	CQ	ASTM A193 B7 ASTM A434 BC	130	110	16	50	321 MAX (35 RC)	
		>1.5 – 2.5				125	105	16	50		
		>2.5 – 4				115	95	16	50		
		>4 – 7			ASTM A434 BC	110	85	16	45	285/321	
		>7 – 9.5	105			80	15	40	285/341		
		>9.5 – 12	–			RPT	RPT	RPT	RPT	285/341	
		10 – 24	–		–	–	–	–	285/341		
	4150	3/4 – 1.5	HR – Q&T	CQ	ASTM A434 CLASS BD	155	130	14	35	285/341	
		>1.5 – 2.5	HR – Q&T			150	120	14	35	285/341	
		>2.5 – 4	HR – Q&T			140	110	14	14	285/341	
		>4 – 7	HR – Q&T			135	105	14	35	285/341	
		>7 – 9.5	HR – Q&T			130	100	14	35	285/341	
		>9.5 – 12	HR – Q&T			–	RPT	RPT	RPT	RPT	285/341
		10 – 20	FGD – RT – Q&T			–	–	–	–	–	285/341
	4340	3/4 – 1.5	HR – Q&T	CQ	ASTM A434 CLASS BD	155	130	14	35	285/341	
		>1.5 – 2.5	HR – Q&T			150	120	14	35	285/341	
		>2.5 – 4	HR – Q&T			140	110	14	14	285/341	
		>4 – 7	HR – Q&T			135	105	14	35	285/341	
		>7 – 9.5	HR – Q&T			130	100	14	35	285/341	
		>9.5 – 12	HR – Q&T			–	RPT	RPT	RPT	RPT	285/341
		10 – 24	FGD – RT – Q&T			–	–	–	–	–	300/340
	SUPERCUT 150®	1 – 4 1/2	CF – Q&T	CQ	ASTM A108	150	130	14	38	32/37	
	CR – MO – V B16	3/4 – 1.5	CF – Q&T	CQ	ASTM A193 B16	125	105	18	50	321 MAX	
		1 – 2.5	HR – Q&T			125	105	18	50	321 MAX	
>2.5 – 4		HR – Q&T	110			95	17	45	321 MAX		
>4 – 8		HR – Q&T	100			85	16	45	321 MAX		
NIT 135M	2 – 13	HR – Q&T	AQ	AMS 6472 AMS 2301	120	85	15	40	248/293		
	3/4 – 2	CF – Q&T			112	90	16	50	241/285		
ETD 150®	7/16 – 3.5	CF – ETD	CQ	ASTM A108	150	130	10	37	302 MIN (32RC)		
E4130	10 – 26.5	N Q&T FGD – RT – Q&T	EF	API-6A NACE MRO1-75	95	75	18	35	207/235		
E4140	1.5 – 12	HR – Q&T	EF	110 MIN Y.S. API-6A	125	110/140	13	35	285/341		
E4140	2 – 12	HR – Q&T	EF	80 MIN Y.S. API-6A NACE MRO1-75	100	80	20	40	217/235 (18/22 RC)		
E4145M	3 – 11	HR – Q&T	EF	API-6A ASTM A388	140	130	13	45	285/341 (30/36 RC)		
					140	120					
					140	110					
					135	100					
4330 V MOD	2 – 9	HR – Q&T	AQ	AMS 2301-2304 ASTM A388 API-7.1	160	150	15	50	335/375		
8630 MOD	5 – 27	FGD – RT N Q&T	EF	API-6A NACE MRO175 ASTM A388	105	85	18	35	217/235		