

Starrett®

Precision, **Quality**, Innovation

BAND SAW BLADE REFERENCE GUIDE

Cutting Tables

Troubleshooting

Cut Rate Chart

Cut Off Calculation

Bulletin 1037

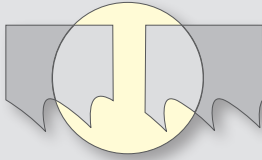
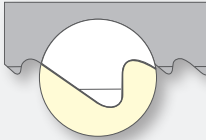



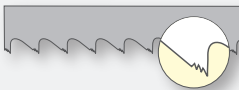
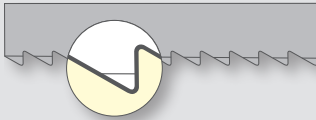
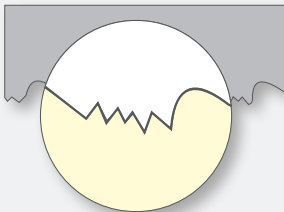
CUTTING TABLE FOR BI-METAL BAND SAW BLADES

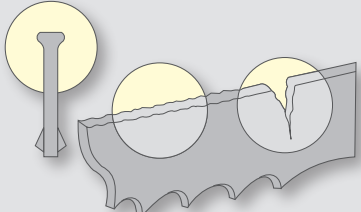
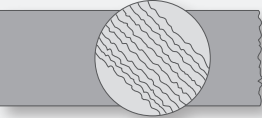
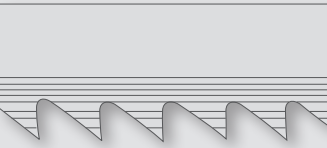
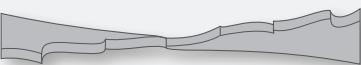
Work Material Type	Work piece dimension (in) 2-5" (20-125mm)		2-5"		50-125mm	
	Speed/Cutting Index ABNT/AISI/SAE	Hardness	Blade Speed ft/min.	Cut Rate in ² /min.	Blade Speed m/min.	Cut Rate cm ² /min.
Carbon Steels	1005-1012	150HB	259-298	30-40	79-91	77-103
	1015-1026	150HB	249-288	27-38	76-88	71-97
	1030-1055, A36	175HB	180-219	20-22	55-67	52-58
	1060-1095	200HB	160-200	15-20	49-61	39-52
Easy-to-machine carbon Steels	1110-1117-1118	150HB	259-321	30-40	79-98	77-103
	1137-1151	175HB	219-259	20-30	67-79	52-77
	1211-1215	150HB	259-321	38-47	79-98	97-120
Manganese steels	1330-1345	200HB	180-219	15-20	55-67	39-52
	1513-1527	150HB	259-298	30-40	79-91	77-103
	1536-1552	175HB	200-259	20-25	61-79	52-65
	1561-1572	200HB	160-200	15-20	49-61	39-52
Molybdenum steels	4012-4024	175HB	200-239	17-22	61-73	45-58
	4030-4042	175HB	190-229	17-20	58-70	45-52
	4047-4068	175HB	180-219	15-20	55-67	39-52
Chrome Moly Steels	4130-4140	200HB	180-219	15-20	55-67	39-52
	4142-4161	200HB	170-209	12-17	52-64	32-45
Nickel Chrome Moly Steels	4320	175HB	200-239	17-22	61-73	45-58
	4340	200HB	180-219	15-20	55-67	39-52
	8115, 8615-8622, 8145, 8625-8637	175HB	200-239	17-22	61-73	45-58
	8640-8660, 8740	200HB	180-219	15-20	55-67	39-52
	8720, 8822	200HB	200-239	17-22	61-73	45-58
	9310	175HB	160-190	7-10	49-58	19-26
Nickel Moly Steels	9430-9445	200HB	180-219	15-20	55-67	39-52
	4625-4626, 4815-4820	175HB	200-239	17-22	61-73	45-58
Chrome Steels	5040-5060	200HB	180-219	15-20	55-67	39-52
	5115-5120	175HB	200-239	17-22	61-73	45-58
	5130-5160	200HB	180-219	15-20	55-67	39-52
	50100, 51100, 52100	225HB	131-160	10-12	40-49	26-32
Chrome Vanadium Steel	6118	175HB	200-239	17-22	61-73	45-58
	6150	200HB	180-219	15-20	55-67	39-52
Silicon steels	9255-9262	200HB	180-219	15-20	55-67	39-52
Tool steels-Cold work	A2-A6, A8-A10	200HB	180-219	7-10	55-67	19-26
	D2-D7, A7	250HB	65-98	5-7	20-30	13-19
	O1, O2, O6, O7	200HB	180-219	10-15	55-67	26-39
Tool steels-Hot work	H10-H19, H21-H42, P20	200HB	131-160	7-10	40-49	19-26
	L2, L6	200HB	170-209	7-10	52-64	19-26
	S1-S7	200HB	131-160	7-10	40-49	19-26
Carbon tool steels	W1-W5	200HB	180-219	10-15	55-67	26-39
Ferritic stainless steels	405, 409, 430, 434, 436, 442, 446	175HB	78-98	7-10	24-30	19-26
High speed steels	M1, M2, M7, M10	225HB	111-131	7-10	34-40	19-26
	M3, M4, M30-M47	225HB	65-98	5-7	20-30	13-19
	T1, T2, T6	250HB	111-131	7-10	34-40	19-26
	T15	250HB	59-88	5-7	18-27	13-19
	T4, T5	250HB	88-121	5-7	27-37	13-19
Austenitic stainless steels	201, 202, 301-305, 308, 321, 347	150HB	98-121	7-10	30-37	19-26
	A286, 309, 310, 314, 316, 317, 330	175HB	68-78	3-5	21-24	10-13

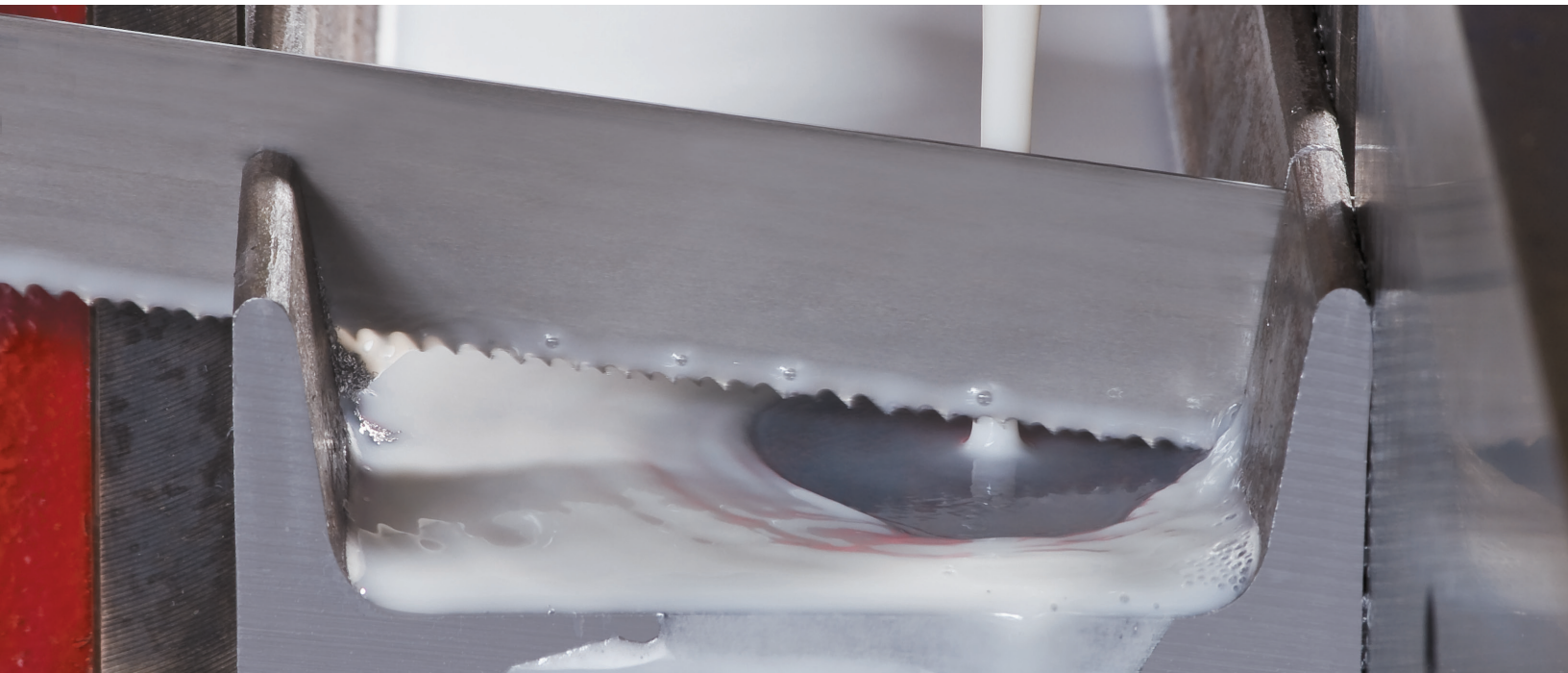


Work Material Type	Work piece dimension (in) 2-5" (20-125mm)		2-5"		50-125mm	
	Speed/Cutting Index ABNT/AISI/SAE	Hardness	Blade Speed ft/min.	Cut Rate in ² /min.	Blade Speed m/min.	Cut Rate cm ² /min.
Easy-to-machine Stainless Steels	330	150HB	98-141	10-12	30-43	26-32
	416, 420F, 430F	150HB	141-180	12-15	43-55	32-39
Martensitic stainless steels	403, 410, 420, 422, 501, 502	175HB	98-131	7-10	30-40	19-26
	440A-C, 414, 431	225HB	88-98	7-10	27-30	19-26
Hardened Stainless Steel	15-5PH, 17-4PH, 17-7PH	200HB	68-88	5-7	21-27	13-19
Cast iron	Class 20	125HB	160-200	27-38	49-61	71-97
	Class 40	200HB	121-160	20-30	37-49	52-77
	Malleable 60-40-18	150HB	200-249	20-25	61-76	52-65
	Malleable 80-55-06	225HB	121-160	12-17	37-49	32-45
Nickel alloys	Hastelloy, Rene 41	250HB	49-68	2-2	15-21	6-6
	Inconel 600, 601	250HB	59-78	5-7	18-24	13-19
	Inconel 625, 718, Waspaloy	250HB	59-78	2-5	18-24	6-13
	Monel 400, 401	250HB	68-88	5-7	21-27	13-19
	Monel K500	250HB	59-78	2-5	18-24	6-13
Titanium alloys	Alpha, Alpha-Beta, Beta	325HB	45-59	2-2	14-18	6-6
	Titanium 99%	150HB	68-88	2-5	21-27	6-13
Refractory metals	Columbium	-	59-78	2-2	18-24	6-6
	Molybdenum	-	78-98	2-2	24-30	6-6
	Tantalum	-	49-59	2-2	15-18	6-6
Copper alloys	Tempered Aluminum Bronze	30HRC	78-98	3-5	24-30	10-14
	Tempered Beryllium Copper	38HRC	39-55	1-2	12-17	3-6
	Aluminum Bronze	70HRB	164-190	15-20	50-58	39-52
	Phosphor Bronze	70HRB	150-190	20-25	46-58	52-65
	Copper 99%	50HRB	141-180	17-22	43-55	45-58
	Copper Belirio	70HRB	170-190	10-15	52-58	26-39
	Yellow/Red Brass	70HRB	200-259	20-25	61-79	52-65
	Easy machining brass	70HRB	219-249	25-30	67-76	65-77
Aluminum Alloys	1200	30HB				
	2024	120HB				
	5052	50HB	393-442	30-43	120-135	77-110
	6061	110HB				
	7075	160HB				

TROUBLESHOOTING

Blade Effect	Probable Cause	Solution
<p>Blade Breakage</p>  <p>(straight break indicates fatigue)</p>	<p>Incorrect blade. Incorrect blade tension. Excessive feed. Incorrect cutting fluid. Pressure blocks too tight. Blade rubbing on wheel flange. Guide arms too far apart. Side guides too tight.</p>	<p>Check tooth selection. Adjust the blade tension, refer to operator's manual. Reduce feed pressure. Check coolant recommendations. Adjust the guides. Adjust wheel alignment. Adjust guide arms closer to material. Adjust guides.</p>
<p>Premature Wear of the Teeth</p> 	<p>Blade on machine backwards. Improper blade break-in procedure. Hard Material or heavy surface scale. Hard Material. Improper cutting fluid or mix ratio. Speed or feed too high.</p>	<p>Install blade correctly. Refer to recommended procedures. Check material hardness and surface conditions. Increase feed pressure. Follow coolant mixing procedures. Check cutting recommendations.</p>
<p>Cut Unspecified</p> 	<p>Guide arms too far apart. Blade worn out. Over or under feeding. Improper tooth pitch. Cutting fluid not applied properly. Guides worn or loose.</p>	<p>Adjust guide arms closer to material. Replace blade. Check cutting recommendations. Use proper tooth selection. Adjust coolant nozzles. Tighten or replace guides.</p>
<p>Cutting Deviation</p> 	<p>Over feeding. Low band tension. Tooth set damaged. Guide arms loose or space too wide.</p>	<p>Check cutting recommendations. Refer to operator's manual. Check material hardness, replace blade. Adjust guides and guide arms.</p>
<p>Chips Residues in the Teeth</p> 	<p>Worn or missing chip brush. Improper or lack of cutting fluid. Wrong coolant rate. Excessive feed or speed. Incorrect blade pitch.</p>	<p>Replace or adjust chip brush. Check coolant flow and fluid type. Check coolant type and ratio. Reduce speed or feed. Use proper tooth selection.</p>
<p>Tooth - Breaking Away</p> 	<p>Saw guides not properly adjusted. Incorrect feed or speed. Incorrect blade. Material moved in vise.</p>	<p>Align or adjust saw guides. Refer to cutting recommendations. Use proper blade type and pitch. Inspect and adjust vise.</p>
<p>Wear Only on One Side of the Teeth</p> 	<p>Material with impurities. Wheel with worn flange and band rising out of the track. Guide rubbing on set. Chipping teeth and embedding within the material.</p>	<p>Replace material. Align or replace wheel. Adjust and align guide. Replace blade and apply correct break-in.</p>
<p>Breaks of the Teeth</p> 	<p>Improper blade break-in procedure. Speed too slow. Feed pressure too high. Tooth jammed in cut. Poor cutting fluid application or ratio. Hard material or heavy scale. Wrong blade pitch. Work spinning or loose nested bundles. Cut beginning over the corner of the material.</p>	<p>Follow proper break-in procedure. Refer to cutting recommendations. Reduce feed pressure. Low speed and high cutting pressure. Adjust coolant flow and ratio. Check material or surface hardness. Use proper tooth selection. Tighten vise or use nesting clamps. Start the cut slowly.</p>





Blade Effect	Probable Cause	Solution
<p>Wear on the Back of the Blade</p> 	<p>Excessive back-up guide preload. Low blade tension. Blade worn out. Excessive feed rate or pressure. Damaged or worn pressure block. Guide arms spaced too far apart or too tight. Blade rubbing band wheel flanges. Incorrect guide alignment.</p>	<p>Adjust pressure block. Refer to operator's manual. Replace blade. Reduce feed rate or pressure. Replace pressure block. Adjust guides. Adjust wheel alignment. Align guides.</p>
<p>Wavy Cut</p>  <p>(cardboard surface, vibration and/or risks)</p>	<p>Dull or damaged blade. Incorrect feed or speed. Blade not supported properly. Low blade tension. Incorrect tooth pitch. Guide arms too far apart.</p>	<p>Install new blade. Refet to cutting recommendations. Adjust or tighten guide arms. Refer to operator's manual. Use proper tooth selection. Adjust guide arms closer to material.</p>
<p>Frayed Lines of Loss Hangs</p> 	<p>Saw side guides too tight. Blade riding too high in guide. Blade teeth riding on band wheel surface. Wrong blade width for machine. Chips being carried back into cut. Worn or damaged guides. Insufficient cooling flow.</p>	<p>Adjust guides properly. Adjust rollers or pressure blocks. Adjusting tracking or replace wheel. Refer to operator's manual. Replace or adjust chip brush. Replace guides. Adjust coolant flow.</p>
<p>Blade Twisted</p> 	<p>Blade binding in cut. Guides misaligned. Side guides are too tight. Work loose in vise. Feed too heavy. High blade tension. Worn wheels. Guides arms too far apart.</p>	<p>Adjust feed. Adjust and align guides. Adjust guides. Adjust vise. Reduce feed pressure. Refer to operator's manual. Machine or replace wheels. Adjust guide arms closer to material.</p>



CUT RATE CHART

CUTTING RATE

Bar		Cutting Rate in Square Inches per Minute																	
Diameter	Area (in ²)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Minutes per Cut																			
1.00	0.79	.79	.39	.26	.20	.16	.13	.11	.10	.09	.08	.07	.07	.06	.06	.05	.05	.05	.04
1.25	1.23	1.2	.61	.41	.31	.25	.20	.18	.15	.14	.12	.11	.10	.09	.09	.08	.08	.07	.07
1.50	1.77	1.8	.88	.59	.44	.35	.29	.25	.22	.20	.18	.16	.15	.14	.13	.12	.11	.10	.10
1.75	2.41	2.4	1.2	.80	.60	.48	.40	.34	.30	.27	.24	.22	.20	.19	.17	.16	.15	.14	.13
2.00	3.14	3.1	1.6	1.0	.79	.63	.52	.45	.39	.35	.31	.29	.26	.24	.22	.21	.20	.18	.17
2.25	3.98	4.0	2.0	1.3	1.0	.80	.66	.57	.50	.44	.40	.36	.33	.31	.28	.27	.25	.23	.22
2.50	4.91	4.9	2.5	1.6	1.2	1.0	.82	.70	.61	.55	.49	.45	.41	.38	.35	.33	.31	.29	.27
2.75	5.94	5.9	3.0	2.0	1.5	1.2	1.0	.85	.74	.66	.59	.54	.49	.46	.42	.40	.37	.35	.33
3.00	7.07	7.1	3.5	2.4	1.8	1.4	1.2	1.0	.88	.79	.71	.64	.59	.54	.50	.47	.44	.42	.39
3.25	8.30	8.3	4.1	2.8	2.1	1.7	1.4	1.2	1.0	.92	.83	.75	.69	.64	.59	.55	.52	.49	.46
3.50	9.62	9.6	4.8	3.2	2.4	1.9	1.6	1.4	1.2	1.1	1.0	.87	.80	.74	.69	.64	.60	.57	.53
3.75	11.04	11.0	5.5	3.7	2.8	2.2	1.8	1.6	1.4	1.2	1.1	1.0	.92	.85	.79	.74	.69	.65	.61
4.00	12.57	12.6	6.3	4.2	3.1	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.0	1.0	.90	.84	.79	.74	.70
4.25	14.19	14.2	7.1	4.7	3.5	2.8	2.4	2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.0	.95	.89	.83	.79
4.50	15.90	15.9	8.0	5.3	4.0	3.2	2.7	2.3	2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.0	.94	.88	
4.75	17.72	17.7	.89	5.9	4.4	3.5	3.0	2.5	2.2	2.0	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1.0	1.0
5.00	19.64	19.6	9.8	6.5	4.9	3.9	3.3	2.8	2.5	2.2	2.0	1.8	1.6	1.5	1.4	1.3	1.2	1.2	1.1
5.25	21.65	21.6	10.8	7.2	5.4	4.3	3.6	3.1	2.7	2.4	2.2	2.0	1.8	1.7	1.5	1.4	1.4	1.3	1.2
5.50	23.76	23.8	11.9	7.9	5.9	4.8	4.0	3.4	3.0	2.6	2.4	2.2	2.0	1.8	1.7	1.6	1.5	1.4	1.3
5.75	25.97	26.0	13.0	8.7	6.5	5.2	4.3	3.7	3.2	2.9	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.4
6.00	28.27	28.3	14.1	9.4	7.1	5.7	4.7	4.0	3.5	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.8	1.7	1.6
6.25	30.68	30.7	15.3	10.2	7.7	6.1	5.1	4.4	3.8	3.4	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.8	1.7
6.50	33.18	33.2	16.6	11.1	8.3	6.6	5.5	4.7	4.1	3.7	3.3	3.0	2.8	2.6	2.4	2.2	2.1	2.0	1.8
6.75	35.78	35.8	17.9	11.9	8.9	7.2	6.0	5.1	4.5	4.0	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.1	2.0
7.00	34.48	38.5	19.2	12.8	9.6	7.7	6.4	5.5	4.8	4.3	3.8	3.5	3.2	3.0	2.7	2.6	2.4	2.3	2.1
7.25	41.28	41.3	20.6	13.8	10.3	8.3	6.9	5.9	5.2	4.6	4.1	3.8	3.4	3.2	2.9	2.8	2.6	2.4	2.3
7.50	44.18	44.2	22.1	14.7	11.0	8.8	7.4	6.3	5.5	4.9	4.4	4.0	3.7	3.4	3.2	2.9	2.8	2.6	2.5
7.75	47.17	47.2	23.6	15.7	11.8	9.4	7.9	6.7	5.9	5.2	4.7	4.3	3.9	3.6	3.4	3.1	2.9	2.8	2.6
8.00	50.27	50.3	25.1	16.8	12.6	10.1	8.4	7.2	6.3	5.6	5.0	4.6	4.2	3.9	3.6	3.4	3.1	3.0	2.8
8.25	53.46	53.5	26.7	17.8	13.4	10.7	8.9	7.6	6.7	5.9	5.3	4.9	4.5	4.1	3.8	3.6	3.3	3.1	3.0
8.50	56.75	56.7	28.4	18.9	14.2	11.3	9.5	8.1	7.1	6.3	5.7	5.2	4.7	4.4	4.1	3.8	3.5	3.3	3.2
8.75	60.13	60.1	30.1	20.0	15.0	12.0	10.0	8.6	7.5	6.7	6.0	5.5	5.0	4.6	4.3	4.0	3.8	3.5	3.3
9.00	63.62	63.6	31.8	21.2	15.9	12.7	10.6	9.1	8.0	7.1	6.4	5.8	5.3	4.9	4.5	4.2	4.0	3.7	3.5
9.25	67.20	67.2	33.6	22.4	16.8	13.4	11.2	9.6	8.4	7.5	6.7	6.1	5.6	5.2	4.8	4.5	4.2	4.0	3.7
9.50	70.88	70.9	35.4	23.6	17.7	14.2	11.8	10.1	8.9	7.9	7.1	.64	5.9	5.5	5.1	4.7	4.4	4.2	3.9
9.75	74.66	74.7	37.3	24.9	18.7	14.9	12.4	10.7	9.3	8.3	7.5	6.8	6.2	5.7	5.3	5.0	4.7	4.4	4.1
10.0	78.54	78.5	39.3	26.2	19.6	15.7	13.1	11.2	9.8	8.7	7.9	7.1	6.5	6.0	5.6	5.2	4.7	4.6	4.4

Recommended Tension					Reading the Chips					
Saw Blades	Width		English System lb/in ² (PSI)	Metric System (kg/cm ²)	Chip Formation	Chip Condition	Chip Color	Blade Speed	Blade Feed	Other
	in	mm								
Primalloy™; Intens™ PRO-VTH; Intens™ PRO; Versatix™ MP; Intens™; Advanz™ MC7, Advanz™ MC5, TS, CS, FS and CG	3/4, 1 end 1-1/4	19, 27 end 34	20,000-35,000	1,400-2,500		Thin and Tightly Curled	Silver	Correct	Decrease	Refer to machine recommendations for correct tooth pitch
Primalloy™; Intens™ PRO-VTH; Intens™ PRO; Versatix™ MP; Intens™; Advanz™ MC7, MC5, Advanz™ TS, CS and FS	1-1/2 or greater	41 or greater	30,000-40,000	2,100-2,800		Powdered	Silver	Decrease	Increase	
Intens™; Intens™ PRO-DIE; Univerz™; Duratec™ SFB; Band Knives High-carbon Steel	Up to 1/2	Up to 16	20,000-25,000	1,400-1,800		Thick and Short	Blue or Brown	Decrease	Decrease	Check cutting fluid
Duratec™ SFB; Duratec™ FC; Band Knives High-carbon Steel	Above 3/4	Above 19	20,000-30,000	1,400-2,100		Thin and Curly	Silver	Correct	Correct	
Power Hacksaw Blades	1-1/2 or less	41 or less	20,000-30,000	1,400-2,100						
Power Hacksaw Blades	1-3/4 or greater	45 or greater	25,000-35,000	1,800-2,500						

The above tension ranges are supplied as a guide for normal average cutting conditions. Insufficient blade tension can affect the cutting efficiency of the blade. Excessive tension may cause breakage of band saw blades.

As a general rule of thumb, the higher end of the tension range should be used when the guide arms are further apart and the lower end of the range should be used when the guide arms are closer together.

CUT-OFF CALCULATION

AREA CALCULATION

Use the measurements below in inches to obtain the area in in².

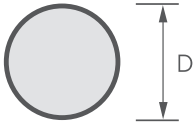
SQUARE

$$\text{area} = L^2$$



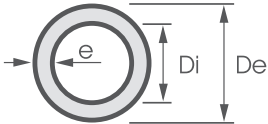
ROUND

$$\text{area} = D^2 \times 0.7854$$



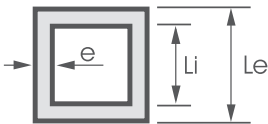
ROUND TUBE

$$\text{area} = (De^2 - Di^2) \times 0.7854$$



SQUARE TUBE

$$\text{area} = Le^2 - Li^2$$



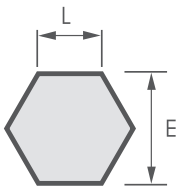
RECTANGLE

$$\text{area} = E \times L$$



HEXAGON

$$\text{area} = \frac{L^2 \times 2.598}{E^2 \times 0.866}$$



TUBE OR STRUCTURAL MATERIAL CUTTING

To calculate the material area, choose the tooth, speed and cutting rate, however correct the cutting feed (cutting time), by multiplying the time calculated by the correction factor, according to table below.

Correction Factor of Cutting Time

2.5
2
1.7
1.4
1.2

NOTE: when dry cutting, adjust the feed pressure to about 40%-50% the normal cutting rate (use data on pages 2 and 3).

NOTE: dry cutting reduces the blade life

EXAMPLE OF CUTTING CALCULATION

Material: austenitic stainless steel (SAE 316)

Format: round

Dimension: 4" (101.6mm)

Speed: 68 to 78ft/min.* (21 to 24 m/min.*)

Cutting Index: 3 to 5in² min* (10 to 13cm² min*)

TC = Cutting Time

$$TC = \frac{A}{IC}$$

A = Material Area

IC = Cutting Index

$$TC = 12.50\text{in}^2 \div 5\text{in}^2/\text{min.} (31.75\text{cm}^2 \div 13\text{cm}^2/\text{min.})$$

$$TC = 2.5 \text{ minutes}$$



For Duratec™ SFB Carbon Steel Blades: adjust the feed pressure to 50% the normal cutting and the Cutting Index to 85%.

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