

## GUIDELINES FOR SUCCESSFUL BANDSAW OPERATION

### Blade Width Selection

The dimension from tooth tip to back edge of the blade is the blade width. The greater the width, the greater the resistance to deflection while cutting. For straight cutting applications, use the widest blade the machine can accept. For contour cutting use the widest blade that the contour radius will permit. To cut close tolerance radii the following factors must be considered: blade width, material thickness, machinability, feed force, and location of pivot point.

### Teeth Per Inch

The pitch of the blade is defined by the number of teeth per inch (TPI.) Nonferrous materials such as brass, bronze and aluminum require a large chip area. A low TPI, or "coarse pitch," prevents the chips from clogging and binding together in the gullets, which can diminish sawing and damage the blade.

On thin walled pipe, tubing, and sheet goods, many teeth per inch are required to avoid damaging or breaking the teeth. A low TPI blade is the best blade for cutting large cross-sections. The ability of each tooth to cut into the workpiece is increased because the saw's feed pressure is distributed over fewer teeth. A coarse pitch blade increases productivity and provides large chip clearing gullets.

### Blade Break-In

Set bandsaw machine at recommended speed for material to be cut. When cutting easily machined metals, cutting rate should be set at 1/3 to 1/2 the recommended rate for the first 50 to 75 square inches.

When cutting difficult to machine metals, such as tool steels or work hardened alloys, set cutting rate at 75% of the recommended rate for the first 25 square inches. Gradually increase the feed until you achieve the recommended cutting rate after 50 to 60 square inches.

### Tooth Selection

Tooth selection is based on the principle that there is a tooth pitch best suited for the cutting job. Blade selection should be based on the size, shape accuracy, material and cutting rate expected.

Keep in mind these numbers: 3, 6, 12, and 24. There should be a minimum of three teeth in the work at all times for bi-metal bands and a minimum of six teeth for carbon bands. Ideally, 6 – 12 teeth should be in contact with the work; 24 teeth in the work is too many.

### Feed Pressure

Chips tell you what is happening with your feed pressure and your blade. Powdery or fine chips indicate that not enough feed pressure is being applied. Heavy, thick or blue burned chips mean you're pushing the blade too hard, creating too much heat and load for the teeth. Loosely curled chips tell you everything is going well. Speed should be determined by the class of material (this should remain constant.) Feed would be adjusted until desired chip formation is achieved.

## MACHINE CHECKLIST



- The blade tension with a tension meter
- The performance of the chip brush
- The wear and alignment of the blade guides
- The band speed with a tachometer
- The cutting fluid concentration with a refractometer

## CUTTING FLUID

The cutting fluid keeps the blade teeth cool, it prevents the chips from welding to the tooth, and also lubricates the chips, allowing them to move through the cut.

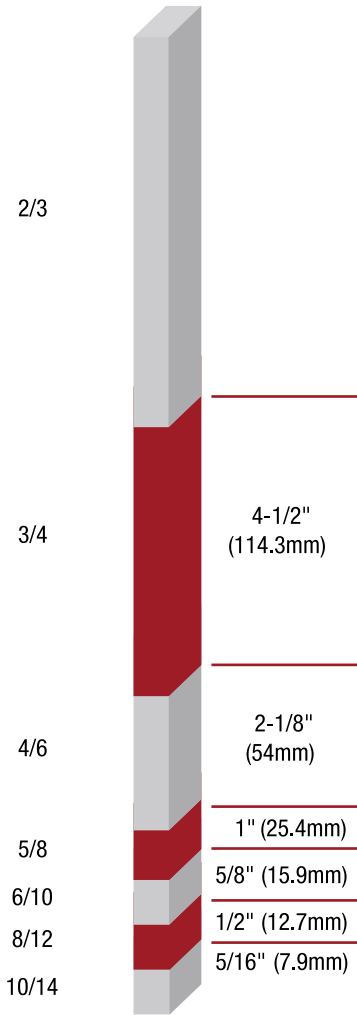
- Use a high quality cutting fluid
- Make sure the cutting fluid is distributed throughout the cut

## TOOTH PITCH SELECTION

For lowest cost per cut, always select the narrowest cross section of the material to be cut for added beam strength, more teeth in cut, longer life, higher band speed, and shortest cut time.

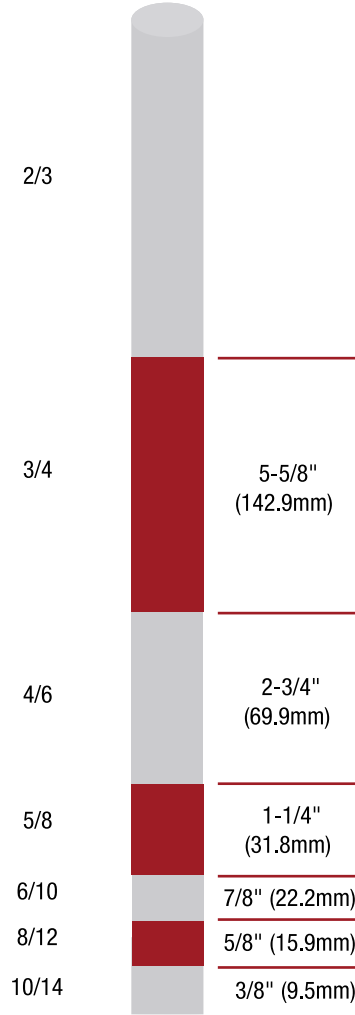
### Solid Square & Rectangle

**Tooth Pitch**   **Cut Width**  
Material Thickness



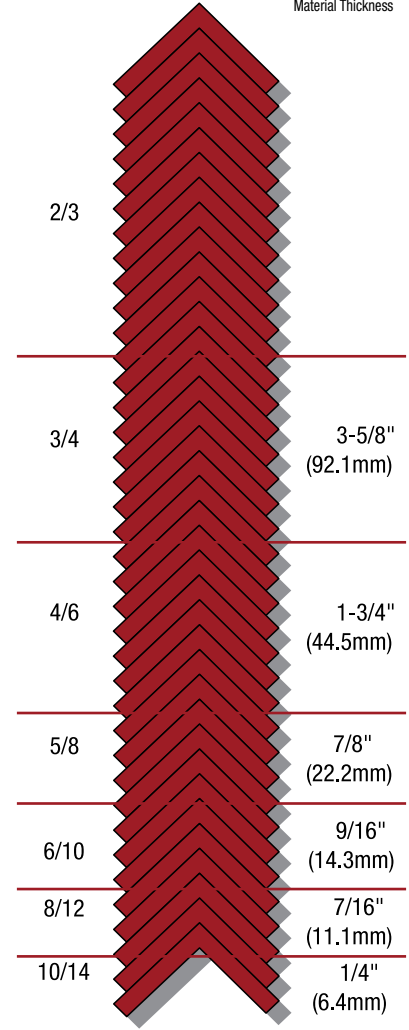
### Solid Round

**Tooth Pitch**  **Cut Width**  
Material Thickness



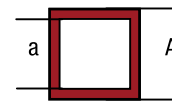
### Structurals

**Tooth Pitch**   **Average Cut Width**  
Material Thickness

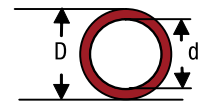


Area = pounds per foot x .294

Aluminium Structural Area - pounds per foot x .85



$A - a = \text{area}$

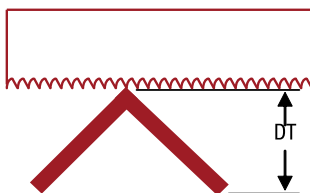


$D = .7854 \times D^2$

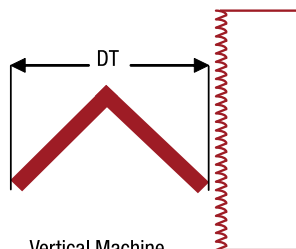
$d = .7854 \times d^2$

$D - d = \text{area}$

$\pi r^2 = \text{area}$



Horizontal Machine



Vertical Machine

$$\frac{\text{area}}{(\text{DT}) \text{ distance of travel}} = \text{average cut width}$$

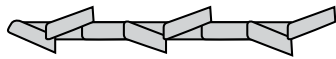
## BANDSAW TERMS

### Tooth Form

**Positive rake.** A positive rake tooth angles forward in the direction of the cutting action. Higher positive rake angles give the most aggressive tooth penetration for easier chip formation. This tooth form is recommended for cutting difficult-to-machine materials, solids, and solid cross sections.

**Straight tooth.** A straight tooth has a 0° cutting face, and is recommended for cutting easy-to-cut, low alloy materials as well as interrupted cuts.

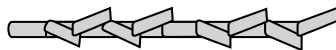
### Tooth Set



**Raker set.** These are individually set teeth – first right then left – followed by an unset tooth. The unset tooth (raker tooth) allows for fast chip removal and a straight cutting action. This tooth set is recommended for general purpose cutting applications.



**Wavy set.** Wavy set teeth are set in groups, right and left, in varying degrees. Wavy set teeth are recommended for cutting light metal sections, such as sheet, tubing and small solid shapes.



**Modified raker set.** Variable set teeth are set in alternating groups with a single unset tooth (raker tooth). When these are combined with the varying set angles of the teeth, a faster, smoother, and quieter cutting action is achieved. Variable tooth blades perform extremely well on most applications and provide fast cutting on solids, shapes, structurals and piping.

### Tooth Type



**Regular.** This is a conventional tooth with a 0° rake angle, ideal for a wide range of general purpose cutting applications.



**Hook.** This tooth type has a 10° positive rake angle for fast cutting with less feed pressure. The rounded gullets allow for fast chip removal and are generally used for cutting nonmetallics and nonferrous metals.



**Skip.** This tooth type has a 0° rake angle with shallow gullets and evenly spaced teeth for efficient chip removal. It is used for cutting large sections of soft, nonferrous metal and nonmetal material, such as wood, composition materials, cork and plastic.



**Variable.** A traditional tooth form that offers a 0° rake angle, varying gullet depths and tooth sizes. Designed to reduce harmonic vibration, this blade efficiently removes chips, extending blade life in solids and structurals.



**Variable Positive.** Variable positive tooth form offers varying gullet depth, tooth sizes and a positive rake angle for maximum cutting speeds and better tooth penetration in harder to machine materials.



**Duplex.** Duplex blades offer deep, chip clearing gullets, increased tooth strength, and a high positive rake angle. This results in faster sawing rates and improved finishes. Duplex blades are recommended for production cutting work hardened metals, tool steels, and exotic alloys.

## RECOMMENDED BANDSAW OPERATING SPEEDS (FPM TABLE)

### BAND SPEEDS

based on 4" material

### INCREASE

for smaller sizes 2" +10%

### DECREASE

for larger sizes 6" -10%

CARBON STEELS		ALLOY STEELS		TOOL & MOLD STEELS		STAINLESS STEELS		SUPER ALLOYS	
MATERIAL	FPM	MATERIAL	FPM	MATERIAL	FPM	MATERIAL	FPM	MATERIAL	FPM
1008	320	150	250	A10	160	230	150	A286	90
1015	320	1330	220	A2	180	303	140	Astroloy	60
1018	300	1345	210	A6	200	304	120	Hastelloy	70
1020	320	4130	270	D2	90	309	90	Incoloy 800	90
1021	300	4140	250	H11	190	310	80	Incoloy 900	60
1022	300	4145	210	H12	190	316	100	Inconel	60
1025	320	4340	220	H13	190	324	100	Inconel 625	100
1026	300	5160	220	L6	190	347	110	Monel	70
1030	330	6150	210	M1	110	410	140	Nickel 200	80
1035	310	8616	240	M42	100	414	110	Pyromet X15	120
1040	270	8620	240	O1	200	416	190	Titanium	70
1042	250	8630	220	O6	190	420	190	Waspalloy	70
1044	220	8640	200	P20	230	430	150	WF11	60
1045	220	9310	170	S1	200	431	90		
1060	200	52100	160	S5	140	450	80		
1095	180	300M	160	S7	120	502	140		
1117	340	41L40	270	T1	100	2205	80		
1137	290	A242	280	T15	70	18-8-2	90		
1141	280	e.t.d.	250	W1	220	22-13-5	60		
1144	280	HP 9-4-20	100			440C	80		
1213	380	HP 9-4-25	100			440F	160		
1215	380	HY-100	160			M225	90		
1513	300	HY-80	160			Nitronic 50	60		
1541	250					Nitronic 60	60		
A36	270					SS-PH	80		

## BLADE BREAK-IN

It is important to run all new bandsaw blades at a reduced rate to break them in. This helps to remove any uneven edges that are imparted on cutting tools during the manufacturing processes, and can double the life of the blade.

### To break in a blade:

- 1) Set machine to the recommended band speed for the material being cut.
- 2) Multiply the recommended cut time by:
  - a. 2 – for band speeds 250 fpm and higher
  - b. 1.75 – for band speeds 175 to 250 fpm
  - c. 1.5 – for band speeds 120 to 175 fpm
  - d. 1.25 – for band speeds 80 to 120 fpm
  - e. Band speeds less than 80 fpm require minimal break-in
- 3) Gradually increase cutting rate to proper cut time over the next:
  - a. 80 to 100 sq. in.
  - b. 60 to 80 sq. in.
  - c. 40 to 60 sq. in.
  - d. 20 to 40 sq. in.
  - e. 20 or less sq. in.

## FEEDS

Tooth Pitch	10/14	8/12	6/10	5/8	5/7	4/6	3/4	2/3
Multiplier Rate (MR)	.047	.039	.031	.025	.024	.020	.014	.010
(mm)	(1.19)	(.99)	(.79)	(.64)	(.61)	(.51)	(.36)	(.25)

After determining proper tooth pitch and band speed, select the rate MR (multiplier rate) for the tooth pitch being considered and use this formula to determine feedrate:

$$\text{Band Speed} \times \text{MR} = \text{Linear Inches per Minute Rate}$$

For the lowest cost per cut, always select/position the material to obtain the narrowest cross section to be cut for added beam strength, more teeth in cut, longer tool life, higher band speed, and quickest cut time.

When stacking material, multiply the area of each piece by the number of pieces, then divide by the DT (distance of travel) to obtain average cut width for selection of proper tooth pitch.

When using a smaller tooth pitch than normal, use the MR (multiplier rate) listed for the proper selection to minimize over-filling the gullets of the smaller teeth.

For increased production, after determining the beam strength, material clamping, coolant, tooth pitch, and machine condition are all appropriate, the MR (multiplier rate) can be increased up to 25%.

$$\frac{(\text{DT}) \text{ distance of travel}}{\text{Linear in/min}} = (\text{CT}) \text{ cut time}$$

**Example 1:**  
4" X 6" 8620, band speed 240 fpm, recommended tooth pitch 3/4 cutting the 4" width = MR .014  
 $240 \times .014 = 3.36 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{6" (\text{DT})}{3.36 \text{ L in/min}} = 1.79 \text{ min (CT)}$$

(1 min. 47 sec.)

**Example 2:**  
4" X 6" 8620, band speed 215 fpm, recommended tooth pitch 2/3 cutting the 6" width = MR .010       $215 \times .010 = 2.15 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{4"}{2.15} = 1.86 \text{ min (CT)}$$

(1 min. 52 sec.)

**Example 3:**  
4" X 6" 8620, band speed 240 fpm, recommended tooth pitch 3/4 cutting the 4" width = MR .014  
 $240 \times .014 = 3.36 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{6" (\text{DT})}{3.36 \text{ L in/min}} = 1.79 \text{ min (CT)}$$

(1 min. 47 sec.)

**Example 4:**  
4" X 6" 8620, band speed 215 fpm, recommended tooth pitch 2/3 cutting the 6" width = MR .010  
 $215 \times .010 = 2.15 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{4" (\text{DT})}{2.15 \text{ L in/min}} = 1.86 \text{ min (CT)}$$

(1 min. 52 sec.)

**Example 5:**  
2" dia. SS304, band speed 132 fpm, recommended tooth pitch 4/6 cutting the 2" width = MR .020  
 $132 \times .020 = 2.64 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{2" (\text{DT})}{2.64 \text{ L in/min}} = .75 \text{ min (CT)}$$

(45 sec.)

**Example 6:**  
4" X 6", 1/4" wall A36, band speed 270 fpm, recommended tooth pitch 5/8 cutting the .79" avg. cut width = MR .025  
 $270 \times .025 = 6.75 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{6" (\text{DT})}{6.75 \text{ L in/min}} = .88 \text{ min (CT)}$$

(53 sec.)

**Example 7:**  
1" beam, 37.41 lbs/ft A36, band speed 240 fpm, recommended tooth pitch 3/4 cutting the 1.83" avg. cut width = MR .014  
 $240 \times .014 = 3.36 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{4" (\text{DT})}{3.36 \text{ L in/min}} = 1.19 \text{ min (CT)}$$

(1 min. 11 sec.)

**Example 8:**  
2" angle 1/4" wall A36, band speed 300 fpm, recommended tooth pitch 5/8 cutting the .7" avg. cut width = MR .025  
 $300 \times .025 = 7.5 \text{ linear in/min}$

Horizontal Machine      Vertical Machine

$$\frac{1.4" (\text{DT})}{7.5 \text{ L in/min}} = .19 \text{ min (CT)}$$

(11 sec.)