



## **BANDSAWING**

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- 3 HSS and coatings
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- 7 Speeds and feeds
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## **CIRCULAR SAWING**

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- 17 Positioning of workpiece
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## A BANDSAW AROUND THE WORLD

*French: une scie-ruban*

*German: eine Bandsäge*

*Italian: una sega a nastro*

*Spanish: una sierra cinta*



In bandsawing, a continuous bandsaw blade cuts in one direction with a uniform cutting action and evenly distributed, low individual tooth load. Chips produced have a constant thickness.

Bandsaws can be used for cut-off operation, straight sawing or contour sawing.

Three types of bandsawing machines are available:

- vertical, mainly used for contour sawing
- horizontal, for productive cut-off operations
- pendular machines.

**TOOL MAKER'S TIP**

*Use TiN coated  
bandsaws for longer  
blade life and  
resistance to  
abrasion*

**HSS**

- Seldom used

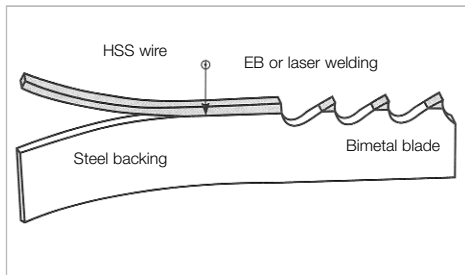
**HSS-E**  
8% cobalt

- Basic choice

**HSS-E-PM**

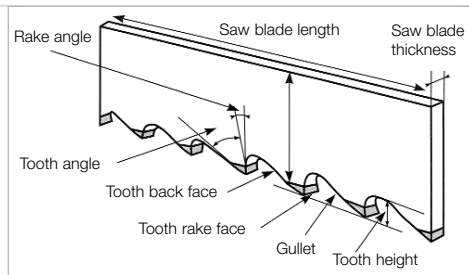
- For high performance and long tool life
- For nickel alloys, titanium alloys and hard steels





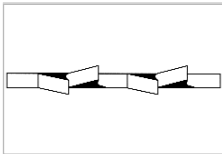
### Bimetal saw concept

In bimetal saws, a HSS wire is welded by electron beam or laser on a steel backing



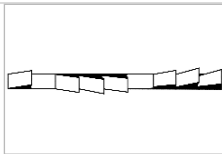
### Vocabulary





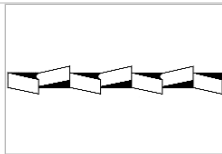
#### Raker set

- 3-tooth sequence, left, right, straight
- Reduces tooth load, for heavy cutting
- Uniform set angle
- Preferred for ferrous applications



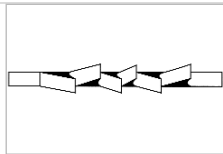
#### Wave set

- Progressive sine-wave offset pattern with fine pitch
- Reduces tooth load
- Smoother in thin wall sections
- Also for high speed cutting at reduced cutting depth



#### Alternate set

- 2-tooth sequence, left, right
- Preferred for non-ferrous metals

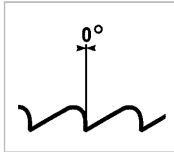
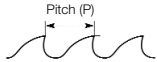


#### Variable (multipitch) set

- One unset tooth (raker) in each repeating pitch sequence
- Only the largest tooth in each sequence is unset
- Appropriate for most applications

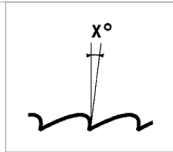


### Tooth pitch



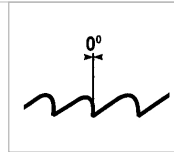
#### Fixed pitch

- General purpose use
- Good chip carrying capacity



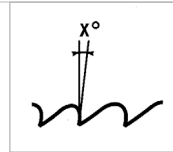
#### Fixed pitch positive

- General purpose use
- Good chip carrying capacity



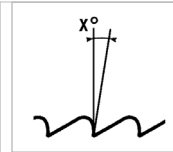
#### Variable pitch

- Smooth cutting
- Reduces harmonic vibrations and noise
- Good chip carrying capacity
- Long blade life



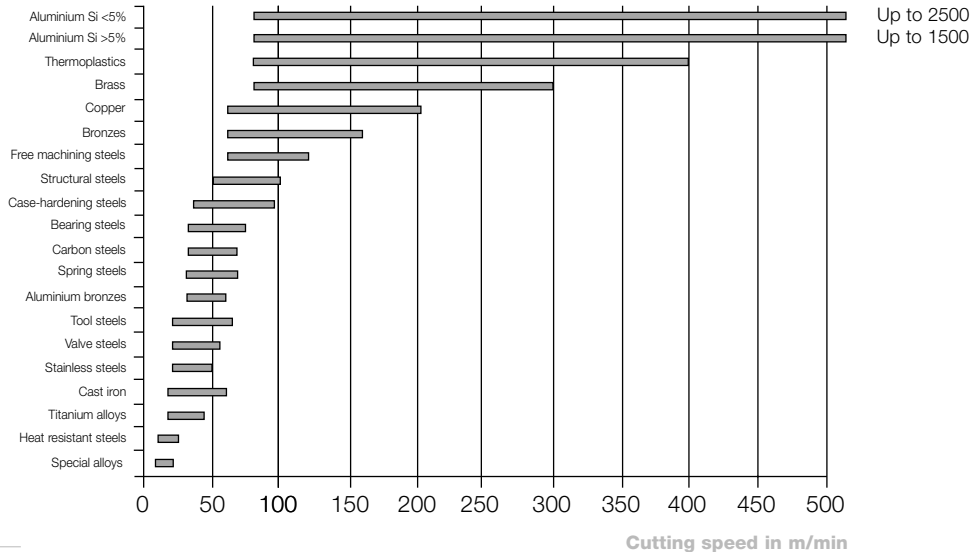
#### Variable pitch positive

- Smooth cutting
- Reduces harmonic vibrations and noise
- Good chip carrying capacity and easy chip formation
- Good tooth penetration
- Long blade life



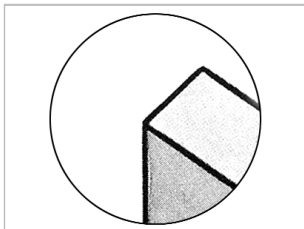
#### Hook positive

- Allows coarse pitch on narrow blades
- Easy chip formation
- Good chip carrying capacity
- Use in cast iron and non-metallic applications (wood, plastics, composites)



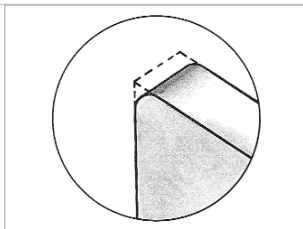


**TOOL MAKER'S TIP**  
*Break-in is necessary  
for long blade life*



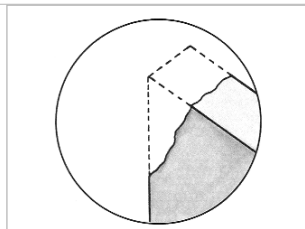
**New blade**

- Razor-sharp tooth



**With break-in**

- Micro-fine radius
- Break-in is done by reducing the feed rate/force control to achieve a cutting rate approximately 20 to 50% of the normal cutting rate.



**Without break-in**

- Premature tooth breakage



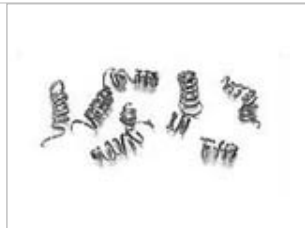
**Very fine or pulverized chips**

- Increase the feed rate
- Or lower band speed



**Thick, heavy or blue-colored chips**

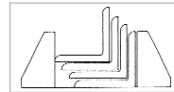
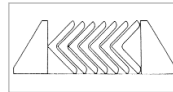
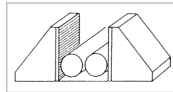
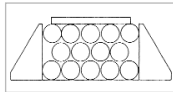
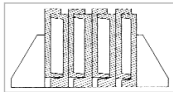
- Decrease the feed rate



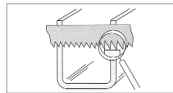
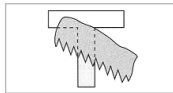
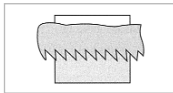
**Loosely rolled chips**

- Ideal cutting conditions

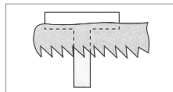
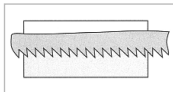
### Methods of clamping workpieces



### Positioning of blade and workpiece



Right



Wrong

Select saws  
with large teeth

Select saws  
with small teeth

Select saws  
with small teeth

| <b>Problem</b>               | <b>Solutions</b>  |
|------------------------------|---|
| Tooth stripping and chipping | Reduce feed and increase speed. Use finer tooth pitch. Increase coolant flow. Check workpiece clamping. |
| Inaccurate cut               | Reduce feed. Check coolant flow. Adjust blade tension and guides. Check for tooth set damage.           |
| Blade stalling in work       | Increase band tension. Increase speed. Reduce feed. Check for blade wear or chips.                      |
| Chip welding                 | Increase coolant flow. Reduce speed. Use coarser tooth pitch.   |
| Premature blade wear         | Use coarser tooth pitch. Increase feed or decrease speed. Check coolant flow.                           |
| Premature dulling of teeth   | Check blade fixture. Increase feed. Check blade break-in. Check coolant flow and type.                  |
| Teeth fracture               | Check speed and feed. Adjust saw guides. Check chip brush.  |
| Blade breakage               | Use finer tooth pitch and finer blade. Reduce blade tension and feed. Check coolant. Adjust speed.      |



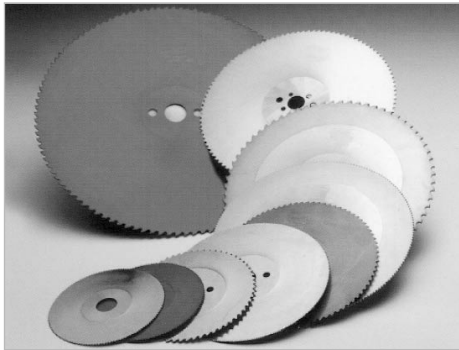
**A CIRCULAR SAW  
AROUND THE WORLD**

*French: une scie  
circulaire*

*German: eine  
Kreisäge*

*Italian: una sega  
circolare*

*Spanish: una sierra  
circular*



- Circular saws are used for high performance cutting of all forms of ferrous and non-ferrous metals: billets, tube, profile, bar, rounds, etc...
- Circular saws are available as:
  - solid saws
  - with HSS segments riveted onto a steel body, useful when large saw diameter is required.

### **HSS et HSS-E**

- Basic choice

### **HSS-E**

- For longer tool life
- For difficult-to-machine alloys

### **TiCN Grey-violet**

- For abrasive materials
- For hard steels, titanium alloys and stainless steels
- For higher cutting speeds (up to 90% higher)

### **TiN Gold**

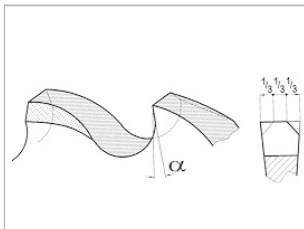
- Multi-purpose
- For steels, tubes and profiles
- For higher cutting speeds (up to 50% higher)

### **TiAlN Black-violet**

- For hard steels, stainless steels and cast iron
- For materials with low thermal conductivity
- For dry cutting
- For higher cutting speeds (+60%)

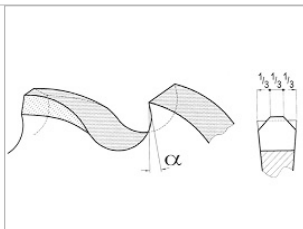
### **CrN Metal**

- Low friction coatings preventing gumminess and built-up edges
- For copper alloys, bronze, brass and aluminium
- For higher cutting speeds (up to 70% higher)



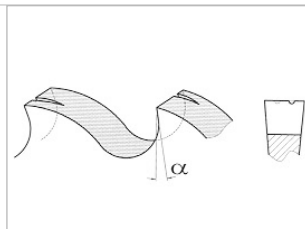
#### **BW or ACME**

Generally used for cutting thin walled steel tubes (3- and 4 mm pitch)



#### **C or Heller forms**

Generally used for cutting flat sections or thick walled tubes (greater than 4 mm pitch)



#### **BC or Chipbreaker**

For cutting thin walled tubes and small profiles.

Improves the quality of the cut

Improves performance

### Pitch choice for plain section

| Pitch (mm) | Material thickness (mm) |
|------------|-------------------------|
| 3          | 3-5                     |
| 4          | 5-10                    |
| 5          | 10-15                   |
| 6          | 15-30                   |
| 7          | 20-35                   |
| 8          | 25-40                   |
| 10         | 30-50                   |
| 12         | 35-60                   |
| 14         | 40-80                   |

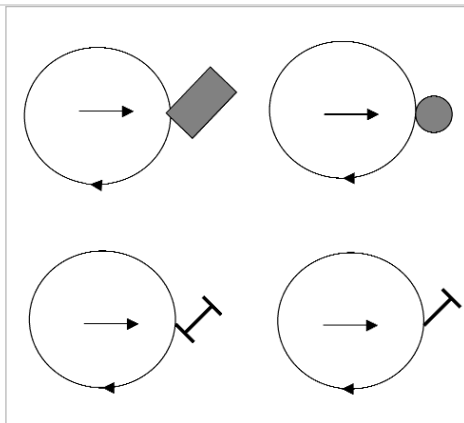
### Pitch choice for tubes and profiles

For tubes and profiles, make sure that at least two teeth are in contact with the workpiece.





| <b>Material</b>                 | <b>Cutting speed<br/>(m/min)</b> | <b>Feed<br/>(mm/min)</b> |
|---------------------------------|----------------------------------|--------------------------|
| Steels 35-50 kg/mm <sup>2</sup> | 28-35                            | 70-160                   |
| Steels 50-65 kg/mm <sup>2</sup> | 20-28                            | 60-120                   |
| Steels 70-85 kg/mm <sup>2</sup> | 15-22                            | 40-100                   |
| Hardened steels                 | 12-18                            | 25-50                    |
| Austenitic stainless steels     | 5-12                             | 30-45                    |
| Martensitic stainless steels    | 7-10                             | 20-35                    |
| Cold rolled profiles            | 25-40                            | 80-130                   |
| Tubes with thin walls           | 40-80                            | 80-150                   |
| Tubes with thick walls          | 30-50                            | 70-130                   |
| Girders                         | 19-30                            | 70-130                   |
| Grey cast iron                  | 12-25                            | 80-110                   |
| Aluminium                       | 900-1500                         | 1200-1400                |
| Copper                          | 80-400                           | 400-600                  |
| Brass                           | 400-600                          | 800-1000                 |
| Bronze                          | 40-120                           | 400-800                  |
| Titanium alloys                 | 10-15                            | 80-160                   |
| Hard plastics                   | 900-1500                         | 1200-1400                |



| Problem          | Causes  |
|------------------|---|
| Premature wear   | Pitch too large<br>Excessive cutting speed<br>Wrong feed<br>Cooling inadapted<br>Wrong positioning of the workpiece |
| Teared-off teeth | Wrong pitch<br>Excessive feed<br>Poor cooling   |
| Saw breakage     | Seizing-up due to poor sharpening<br>Excessive feed<br>Clamping problem   |

