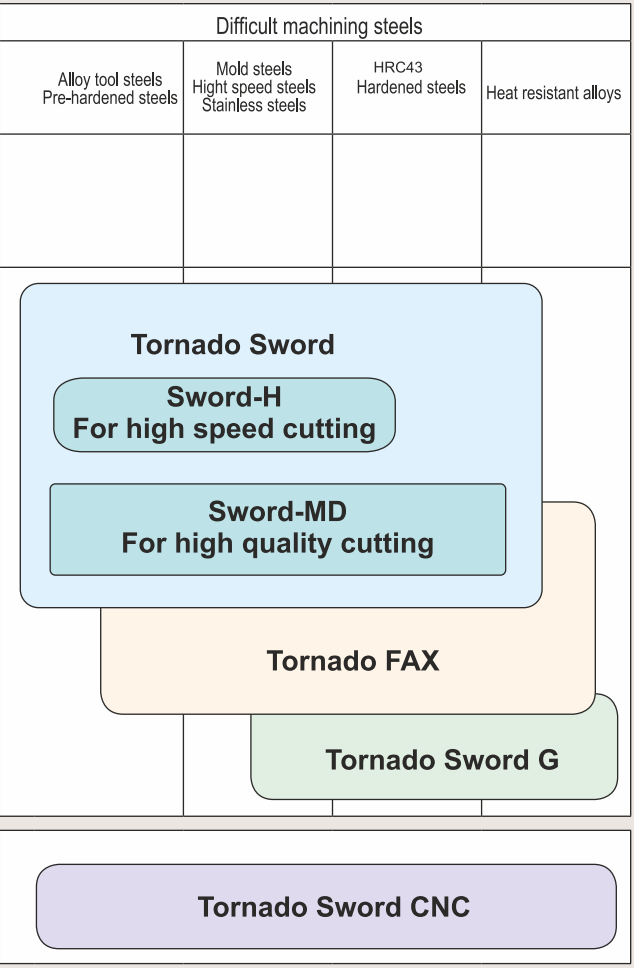
NACHI

メタルバンドソー

Metal Band Saw Blades

Tornado Series selection

Work material / Machine		Section steels: Light gauge steels, H・C・L section steels, Thin pipe, Steel sheet	Section steels: Section steels, H section steels, Thick pipe	Nonferrous metal: Aluminum alloys, Copper alloys, Carbon	General steels: Structural steels	General steels: Carbon steels	General steels: Alloy steels
General-purpose	Section steels HK,HKA ST GT,GTA	Tornado PM-K For Section steels					
	Solids H,HA HFA HBA,PBA TC,TB S GA SGA	Tornado PM		PM-H For high speed cutting			
		High speed & Long life					
CNC CNC machine	Solids HFA300CNC HFA400CNC HFA500CNC SGA410CNC SGA8010CNC SGA8513CNC	Tornado PM CNC					



Description of Mark		Explanation		Explanation
	TiCN	TiCN multi layer Coat	HSS Co	Cobalt HSS
	FAX	Hight Grade Powder HSS	バイメタル	Bi-Metal constructiom
	SW	Hight Alloy HSS	VL	Variable teeth pitch
	PM	Cobalt HSS		

Stocking marks
● : Stocked items
△ : Manufactured upon request
No mark : Not manufactured

Selection Chart

Type	Features	Product Name	Tooth Material	Wear Resistant	Chipping Resistant
For cut off Machine	For Non Special Steels and Other Metals	Tornado PM	PM	4	5
	For Non Special Steels and Other Metals on CNC Machine comppatable	Tornado PM CNC		4	4
	For Non Special Steels and Other Metals High Speed Cutting	Tornado PM-H		4	4
	For Sections and Pipes. Low Noise and Vibration	Tornado PM-K [1]		4	7
	General purpose for difficult-to-cut materials	Tornado Sword	SW	5	3
	For hard steels - CNC compatable	Tornado Sword CNC		5	3
	For high speed cutting for Mould and Die steels	Tornado Sword - H		5	4
	For Accurate Cutting of Die and Mould steels	Tornado Sword - MD		6	3
	High hardness difficult to cut material	Tornado FAX	FAX	5	4
	For best tool life in case of hard and tough steels	Tornado G-FAX		8	2
	For best tool life in case of hard and tough steels	Tornado Sword G	SW	8	2

Blade Material
FAX: High performance high alloy high speed SW: High alloy high speed
PM: High performance cobalt high HSSCo: Cobalt High

Selection Teeth

- Solids

Size of Material	Pitch																	
			(1.25)		(2)		(3)		(4)		6		8		10	12	14	18
mm	0.75/1	1/1.5	½	1.5/2		2/3		3/4		4/6	5/7	6/10		8/12				
~4																		
~10																		
~20																		
~40																		
~60																		
~100																		
~150																		
~200																		
~300																		
~400																		
~600																		
~800																		
800~																		

Application Machines	
	For Cut Off Machine
	For Rortary Machine
	For Contour Machine

In case of Bundle Cutting of round bars, please select one TPI lower than applicable for bundle length.

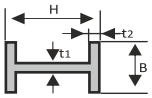
◎ : Excellent ○ : Good × : Not Used (No mark) : Not recommended

	Structurals, Tubing		Solids						
	SS, SM, SN Light gauge steels H-C-L section steels Thin pipe Steel sheet	**SS, SM, SN** Section steels H section steels Thick pipe	**SS, SC, SM** Structural steels	**SC** Carbon steels	**Scr, SCM** Alloy steels	**SKS, NAK** Alloy tool steels Pre-hardened steels	Mould steels High speed steels Stainless steels	Heat resistant alloys	Aluminum alloys Copper alloys Carbon
	○	○ [1]	◎	◎	◎	◎	○		○
	×	×	◎	◎	◎	◎	○	○	○
	×	×	◎	◎	◎	◎	○		○
	◎	◎	○	○			×	×	
	×	×	○	◎	◎	◎	◎	○	○
	×	×	○	◎	◎	◎	◎	○	○
	×	×	○	◎	◎	◎	○	○	○
	×	×		○	○	◎	◎	◎	
	×	×		○	○	◎	◎	○	
	×	×		○	○	◎	◎	◎	
	×	×		○	○	◎	◎	◎	

Note 1) In case of large selfstressing materials, band saw may be jammed by its stress.
We recommend "WT type band saw blade" to avoid this jamming.

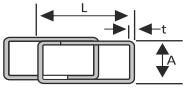
● Structural steels and tubes

● H section steels



Size of Material				TPI
H	B	t_1	t_2	
300	150	6	9	5/7
400	200	8	13	3/4
500	200	10	16	3/4
600	200	11	17	3/4
700	300	13	24	3/4
800	300	14	26	2/3,3/4
900	300	16	28	2/3

● Light gauge steels



Size of Material			TPI
L	A	T	
60	30	1.6	14
75	45	1.6	12
100	50	2.0	8/12
125	50	3.2	8/12
150	65	3.2	6/10
200	75	4.0	6/10
250	75	4.5	5/7

● Tube

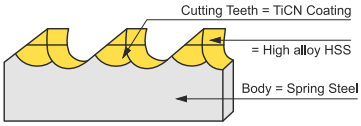
t \ D	TPI						
	20	40	60	80	120	160	200
2	14	14	14	14	14	14	14
4	14	14	12	12	8/12	8/12	6/10
6		8/12	8/12	6/10	6/10	5/7	5/7
8			6/10	6/10	5/7	5/7	4/6
10				5/7	5/7	4/6	4/6
12					4/6	4/6	4/6

In case of cutting sections, please select a TPI such that any time at least two teeth are engaged in the section.

TORNADO SWORD G

Features

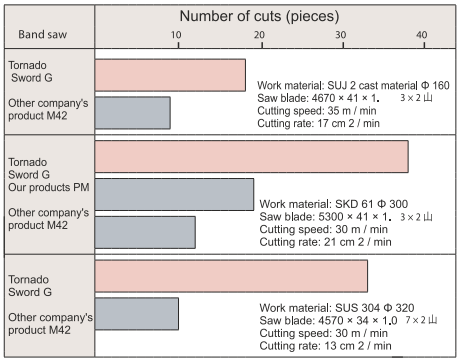
- High Alloy HSS with TiCN Coating gives longer tool life.
- Excellent anti-adhesion.
- Excellent chip flow.



Work Materials

- (32HRC) Tempered steels (to 32HRC)
- Mold steels
- HSS
- Stainless steels
- High-temperature steels

Performance



Stocked Sizes P12

TORNADO SWORD CNC
TORNADO PM CNC

Features

- Longer fatigue life by body material of spring steels.
- Faster cutting by positive rake and wide gullets.
- Smooth finish and straight cut.

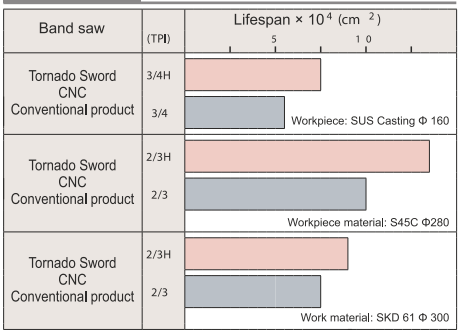
Work Materials

- Structural steels
- Alloy steels
- Stainless steels
- High-temperature steels
- Tool steels

Applicable Machines

HFA-300CNC、400CNC、500CNC
SGA410CNC、SGA8010CNC、SGA8513CNC

Performance

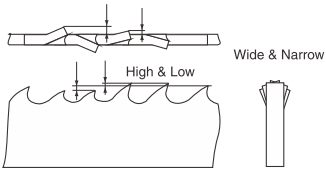


Stocked Sizes P10、8

TORNADO SWORD MD

Features

- Long tool life by high alloy HSS.
- Smooth finish and straight cut.



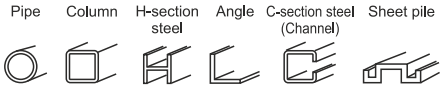
TORNADO PM-K

Features

- Suitable for profiles and bundles.
- Excellent chipping and low vibration in VL pitch pattern.
- Longer life by tooth made from Super HSS.

Work Materials

- Structure materials



TORNADO SWORD

- It is suitable for Stainless steels

TORNADO SWORD CNC

- Appliable for CNC machine by adoption of tough spring steels as the body material. For difficult to cut steels.

How to order

Type Full length Width Number of Teeth

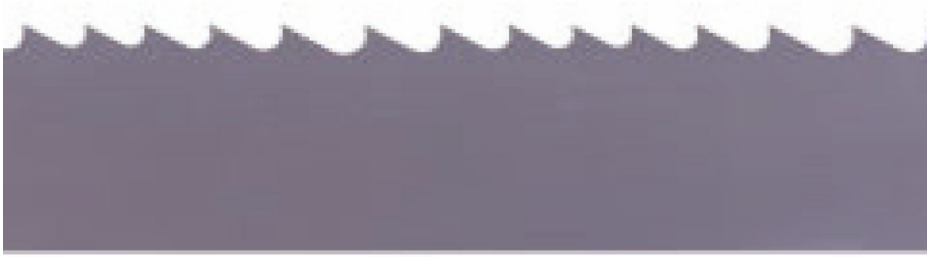
Stocking marks
●:Stocked items
△:Manufactured upon request
No mark:Not manufactured

Width	Thickness	Stock TPI						
		0.75/1	1/1.5	1/2	1.5/2	2/3	3/4	4/6
27	0.95						△	△
34	1.07					△	△	
41	1.3					△	△	
54	1.6		△	△	△			
67	1.6	△	△	△	△			

Metal Band Saw Blades for Cut Off Machine

TORNADO PM

• Applicable from solid material to variant material.



How to order

Type Full length Width Number of Teeth

(Unit) : mm

Width	Thickness	Stock TPI								
		0.75/1	1/1.5	1/2	1.5/2	2/3	3/4	4/6	5/7	6/10
27	0.95					△		△	△	△
27	1.07						△	△		
34	1.07					△	△	△		
41	1.3					△	△	△		
41	1.5				△					
54	1.6		△	△	△	△	△			
67	1.6		△	△	△	△				
80	1.6	△								

How to order

Type Full length Width Number of Teeth

(Unit) : mm

Width	Thickness	Stock TPI			
		2	3	4	6
27	0.95		△	△	△
34	1.07	△	△	△	
41	1.3	△	△		

Stocking marks

●:Stocked items

△:Manufactured upon request

No mark:Not manufactured

Metal Band Saw Blades for Cut Off Machine

TORNADO PM-WT

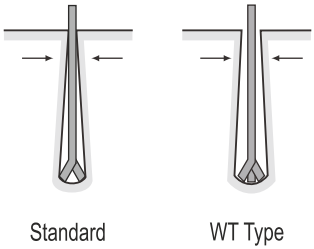
- WT Type Bandsaw blade

How to order

Type Full length Width Number of Teeth

(Unit) : mm

Width	Thickness	Stock	
		TPI	
		2/3	3/4
41	1.3	△	△
54	1.6	△	△
67	1.6	△	△



Standard WT Type

TORNADO PM-K

- This band saw blade having variable teeth pitch and strong teeth form is suitable for cutting of profiles and bundles.

How to order

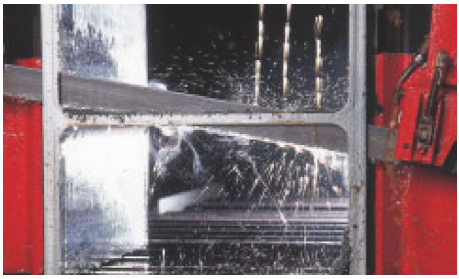
Type Full length Width Number of Teeth

FAX バイメタル

(Unit) : mm

Width	Thickness	Stock		
		TPI		
		2/3K	3/4K	4/6K
27	0.95		△	△
34	1.07		△	△
41	1.3		△	
54	1.6	△	△	
67	1.6	△	△	

Stocking marks
●:Stocked items
△:Manufactured upon request
No mark:Not manufactured



- WT Type Bandsaw blade

In case of large self-stressing materials, band saw may be jammed by its stress. We recommend "WT type band saw blade" to avoid this jamming.

Metal Band Saw Blades for Cut Off Machine

TORNADO SWORD-H

- Applicable for high speed cutting by its sharp tooth design.

How to order

Type Full length Width Number of Teeth

SW バイメタル

(Unit) : mm

Please specify thickness only for width 54

Width	Thickness	Stock TPI	
		2/3H	3/4H
27	0.95		△
34	1.07	△	△
41	1.3	△	△
54	1.3	△	
54	1.6	△	
67	1.6	△	

TORNADO FAX

- It is suitable for efficient cutting of hard to cut structural and tubing.

How to order

Type Full length Width Number of Teeth

FAX バイメタル

(Unit) : mm

Width	Thickness	Stock TPI		
		1/2	2/3	3/4
27	0.95		△	△
27	1.07		△	△
34	1.07		△	△
41	1.3		△	△
54	1.6	△	△	
67	1.6	△	△	

TORNADO SWORD-MD

- Possible on a smooth cutting surface, and a small cutting resistance.

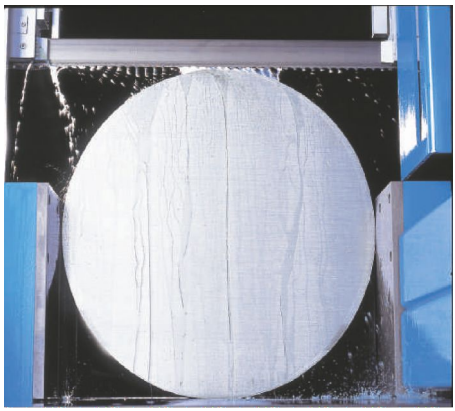
How to order

Type Full length Width Number of Teeth

FAX バイメタル

(Unit) : mm

Width	Thickness	Stock TPI			
		1/1.5MD	1.5/2MD	2/3MD	3/4MD
27	0.95				△
34	1.07			△	△
41	1.3		△	△	△
54	1.6	△	△	△	
67	1.6	△	△	△	



TORNADO G-FAX

- Applicable for difficult to machine materials, structures, tubes etc. For longer tool life in hardened steels

How to order

Type Full length Width Number of Teeth

TiCN FAX バイメタル

(Unit)：mm

Width	Thickness	Stock TPI	
		2/3	3/4
27	0·95		△
34	1·07	△	△
41	1·3	△	△
54	1·6	△	
67	1·6	△	

TORNADO SWORD G

- Applicable for difficult to machine materials, structures, tubes etc.. For longer tool life in hardened steels.

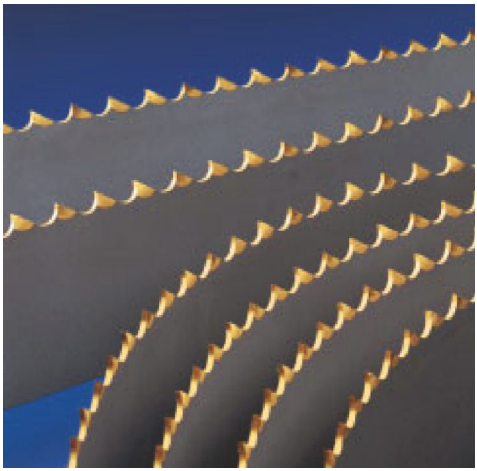
How to order

Type Full length Width Number of Teeth

TiCN FAX バイメタル

(Unit)：mm

Width	Thickness	Stock TPI	
		2/3	3/4
27	0·95		△
34	1·07	△	△
41	1·3	△	△
54	1·6	△	
67	1·6	△	



Stocking marks

●：Stocked items

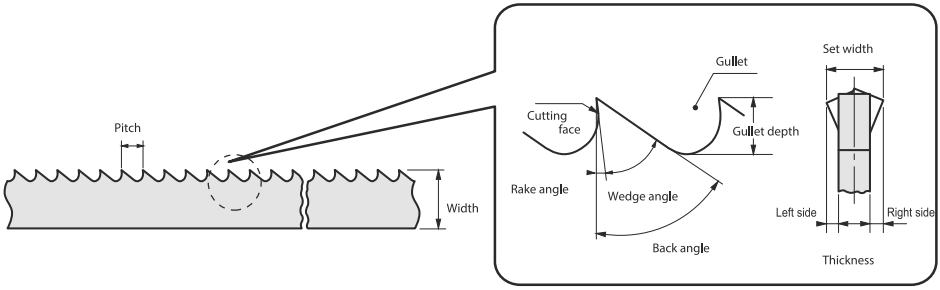
△：Manufactured upon request

No mark：Not manufactured

Packing quantity of metal band saw for cut-off machine Packed Quantity

Technical Reference

Nomenclature



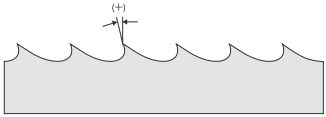
Tooth form

Regular tooth form

Regular tooth with rake angle of 0°is suitable for cutting short-chipping materials and high-carbon steels, tool steels and cast irons.
This tooth form can be usually used for work piece with thin-plates.

Hook tooth form

Hook tooth with positive rake angle is suitable for long-chipping, tough materials, non-ferrous metals.

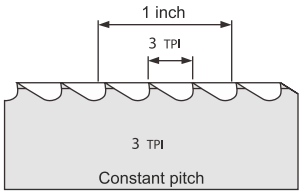


Tooth pitch

Tooth pitch is defined as the number of teeth per inch(TPI).

Constant pitch

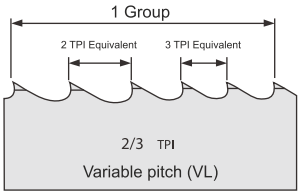
Constant pitch has uniform tooth spacing.
2･3･4



Variable pitch(VL)

Variable pitch has different tooth spacing within one tooth interval.
This pitch is marked by two dimensions, example 4/6(TPI).

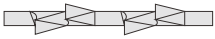
2/3･3/4･4/6



Type of tooth set

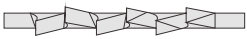
By means of the tooth set, with which the teeth alternately protrude to the left and right beyond the level of the band body, free-cutting action of the band saw blade is achieved.

Standard tooth set



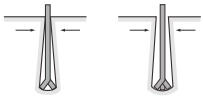
Three tooth sequence- left, right, straight, used in constant pitch.

Group tooth set



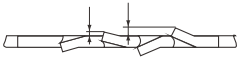
Multi-tooth sequence depending on tooth pitch, used in variable pitch.

■ WT Type Bandsaw Blade for residual stress material



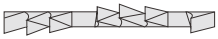
In case of large self-stressing materials, band saw may be jammed by its stress. We recommend “WT type band saw bland” to avoid this jamming.

Combination tooth set



It comsists of a di dierent multi - tooth of set width, used in High & Low tooth form.

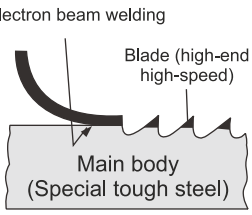
Wave tooth set

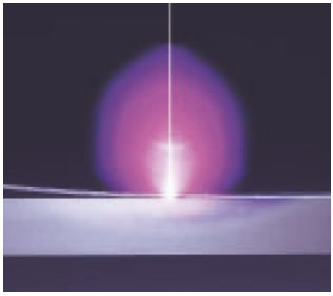


Wave tooth set is used in fine pitch Tooth and suited for such as sheet metal, thin walled pipes and profiles.a

Tooth material & Bi-Metal Construction

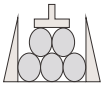
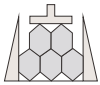
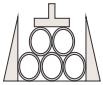
Tooth material is made from Powder HSS or Super HSS and body material is made from spring steels. Tooth and body are welded strongly by electronic beam welding.





Various Clamping Methods based on the shape of materials and sections.

Bundle cutting in general is a complex process, resulting in chipping of teeth while cutting.
The primary difficulties include moving of one element in the bundle during cutting,
imroper clamping and wrong selection of TPI etc.
Following are the guidelines to clamp the bundles.

Shape	Clamp method by bundle number				
	1 Piece	2 Piece	3 Piece	4 Piece	5 Piece
Round bar					
Hexagonal bar					
H-section steel					
Pipe					
Square pipe					
Groove shape steel					
Chevron steel					
C-section steel					
Rail					

Recommended Cutting Parameters

Work materials		Band dimension(mm) / Work length (mm) / Condition	27 × 0.95	34 × 1.07	41 × 1.3	54 × 1.6	67/80 × 1.6
			200	250	300	500	600
Structural steels	SS＊＊＊ SM＊＊＊ STKM＊＊＊	Cutting speed(m/min)	70～80	60～70	50～60	45～50	40～50
		Cutting rate(cm 2/min)	50～60			50～60	
Cast-hardening steels Automatic steels	S＊＊C SUM＊＊ SNCM＊＊＊	Cutting speed(m/min)	65～80	55～70	50～65	40～55	40～55
		Cutting rate(cm 2/min)	45～55			45～55	
Alloy steels	SCr＊＊＊ SCM＊＊＊	Cutting speed(m/min)	55～70	50～65	45～60	40～55	40～55
		Cutting rate(cm 2/min)	40～50			40～50	
Bearing steels, Spring steels, Tool steels, Tempered steels	SUJ＊＊＊ SUP＊＊＊ SKS＊＊＊ NAK＊＊＊	Cutting speed(m/min)	40～55	40～55	35～50	30～45	30～45
		Cutting rate(cm 2/min)	30～40			25～35	
Mold steels, High-speed steels	SKD＊＊ SKH＊＊	Cutting speed(m/min)	35～45	30～45	25～40	25～40	20～35
		Cutting rate(cm 2/min)	20～30			20～30	
Stainless steels, Heat-resistant steels	SUS＊＊＊ SUH＊＊＊ SKT＊＊＊	Cutting speed(m/min)	30～45	30～45	25～40	25～40	20～35
		Cutting rate(cm 2/min)	20～30			20～30	
Nickel based alloys	Inconel Hastelloy Waspalloy	Cutting speed(m/min)	20～27	15～20	12～18	8～15	8～15
		Cutting rate(cm 2/min)	7～20			5～15	
Aluminum alloys, Aluminum cast alloys	A＊＊＊＊ AC＊＊ ADC＊＊	Cutting speed(m/min)	80～150 (500～2000)	80～150 (500～2000)	80～150 (500～2000)	60～80	60～80
		Cutting rate(cm 2/min)	70～1500			70～1500	
Copper alloys	C＊＊＊＊	Cutting speed(m/min)	60～90 (100～150)	60～90 (100～150)	60～90 (100～150)	40～60	40～60
		Cutting rate(cm 2/min)	40～50			30～40	
Graphitic carbon		Cutting speed(m/min)	70～90 (200～500)	70～90 (200～500)	70～90 (200～500)	50～70	50～70
		Cutting rate(cm 2/min)	45～60			40～50	
Structural		Cutting speed(m/min)	50～80	50～80	50～80	45～65	45～65
		Cutting rate(cm 2/min)	40～70			30～50	

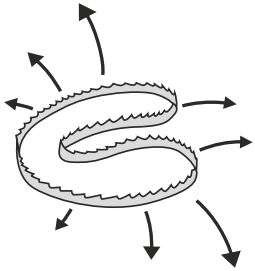
The cutting Parameters suggested above are general guidelines. Fine tuning these parameters according to the work material, Type of Saw Blade and Sawing machine will result in best outcome.

Trouble-Shooting

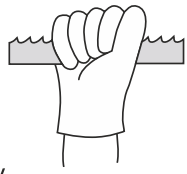
ITEM	COMPLAINT	CAUSE/ OBSERVATION	COUNTERMEASURES
Cutting Quality	Tapper Cutting	EXCESSIVE OR LOW BLADE TENSION	Maintain blade tension between 18 to 20 kgf/sq.mm.(25000 to 28000 PSI)
		WORN OUT BEARINGS OR ROLLERS	Replace bearings / rollers which twist the blade to vertical position/
		GUIDES FAR FROM JOB	Place the moveable side arm closer to the work piece/job.
		EXCESSIVE CUTTING FEED	Change the cutting feed as per recondition for the work material.
		ABNORMAL WEAR ON BLADE	Change the cutting speed as per the recommendation for work material in the next blade. Remember to conduct breaking in of the teeth.
		BAD SURFACE OF CARBIDE GUIDES	Check the three carbide guides and replace them if there is excessive wear.
		JAWS HOLDING JOB ARE LOOSE	Check the jaw pressure and straightness with respect to the job and ensure firm positioning of work under the blade.
	Bad Surface Finish	LARGE TPI	Use suitable TPI as per recommendation for the shape and dimensions of job.
		EXCESSIVE CUTTING FEED	Use recommended cutting feed as per the work material. Optimisation of feed may be required to achieve desired surface finish.
		ABNORMAL WEAR ON BLADE	Improving cutting conditions and choosing the right grade and tooth profile of blade will reduce the wear and improve tool life.
		VIBRATIONS OF MACHINE OR BOW ARM	Machine may need over hauling. A stable and sturdy machine gives best blade performance.
Blade Damage	BLADE BREAKAGE	EXCESSIVE CUTTING FEED	Use recommended cutting feed as per the work material.
		EXCESSIVE BLADE TENSION	Maintain blade tension between 18 to 20 kgf/sq.mm.(25000 to 28000 PSI)
		LOOSE CARBIDE GUIDES	Check the carbide guides and place them close to the blade but not tight. Guides can not restrict the movement of blade.
		LOOSE JAWS HOLDING THE JOB	Jaws clamping the work piece must be firm and must hold the job in place tight.
		CRACKING THE BACK OF BLADE	Check the carbide TOP guide and replace if required. The carbide guide must not have a groove. Periodic replacement of top guide will help better blade life.
		CRACKING FROM THE GULLET OF BLADE	Smaller TPI and higher feed will result in cracking of blade from gullets.
		BLADE SHEARING/SCRACHES ALONG THE LENGTH	Bearings and Rollers guiding the blade before guide arms may be adjusted to avoid shearing of blade. A straight mark alon ghte length of the blade shows fatigue resulting out of bearings and rollers.
		BLADE WEARING/SCRACHES ALONG THE LENGTH	Loosen the Carbide SIDE guides to ensure blade position on the job to be vertical. Replace them if required.
		BLADE RUBBING ON THE COLAR OF THE WHEEL	Machine blade wheels need allignment. A well alligned set of wheels will give best tool life.
		CHIP BRUSH NOT WORKING OR ABSENT	A functional chip brush ensures clean blade entering the job every time. Its absense will result in inconsistant tool life.Machines with Motorised chipbrushes give best tool life and clean cuts.
	Blade Teeth Ripping Off	EXCESSIVE CUTTING FEED	Excessive blade feed results in high impact load on the teeth and hence teeth break. One broken tooth initiates series of teeth breakages. Use Appropriate and recommended feed.
		CHIP BRUSH NOT WORKING OR ABSENT	A tooth with a gullet filled with a chip, when enters the job, results in cracking of the blade from that gullet. Change the chip brush and ensure it is working.
		CUTTING OIL ABSENT	Maintain 5% cutting oil concentration for Band Saw Machines.
		TPI TOO BIG OR FEED TOO HIGH	Use suitable TPI as per recommendation for the shape, dimensions and Bundle size of job.
		HYDRAULIC FEED UNEVEN	Check the hydraulic cylinder and change the oil seals if required. any leakage in the hydraulic system will result in uneven feed of blade and jerks.
		TWISTING OF JOB DURING CUTTING	This happens during bundle cutting when the jobs are not straight or Top Clamp of the Jaw is absent or loose. Take care not to have larger bundles or use straight jobs with firm top clamp near the jaws.
		VIBRATION OF THE MACHINE	Grout the machine well, over haul the machine time to time, avoid blades with constant pitch, tighten the jaws holding the job, check mounting of motor and gear box.
Others	Vibration and Noise	EXCESSIVE CUTTING SPEED	Reduce the blade speed till noise subsides.
		EXCESSIVE BLADE WEAR	Use better grade of blade or use Wide Teeth blades if job is soft,
		TPI TOO SMALL	Use recommended TPI or change to VL type.

Warning

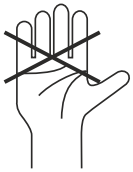
Read this "Attention on safety"



- A bandsaw blades is dangerous. Be fully careful because it has danger when a saw edge is untied and spread.
- Use leather gloves in the installation and the removal of the bandsaw blades.
- Be sure to cut the main power supply of the machine when you replace a bandsaw blade.



- Fix work materials firmly.
- Never touch a bandsaw blades during the rotation.
- Read the instruction manual of the machine, and use it properly.
- Recommend running-in a bandsaw blade to achieve the full life.
- Use the cutting fluids fully which is suitable for work material.



- Be fully careful of the disposal of the bandaw blades which has been used.

Customer Notes

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NACHI

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Dealer's Name