



JOHNSON VERTICAL BAND SAWS INSTRUCTION MANUAL AND PARTS LIST

SECTION I – Manual



FOR MODELS

E-16

V-16

V-24

VH-24

V-40

VH-40

MODEL: _____

SERIAL NUMBER: _____

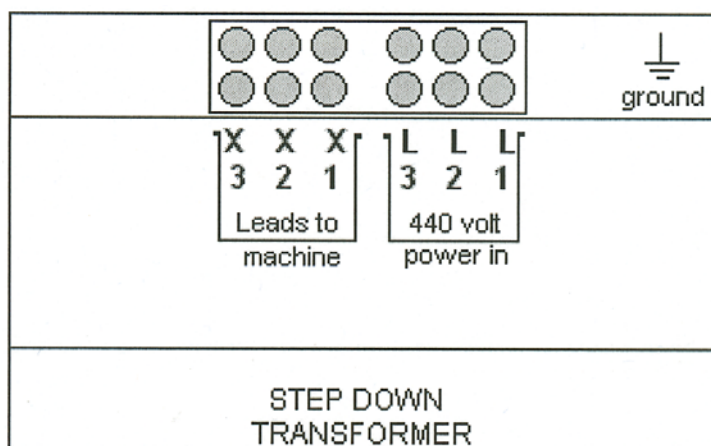
DATE PURCHASED: _____

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If machine is to be operated At 440 volt 3 phase power, please read the following warning.

WARNING!

This machine must be wired by a qualified electrician. Do not connect 440-volt power directly to this machine. The use of the step down transformer supplied with this machine must be used. Failure to do so may affect warranty, if damage occurs from improper wiring.



FOREWORD

These instructions cover the installation and operation of vertical band saws. Attention to maintenance and service will afford many years of trouble free operation. We suggest that these instructions be retained by the department or individual responsible for the machine and kept in a readily accessible location for reference purposes.

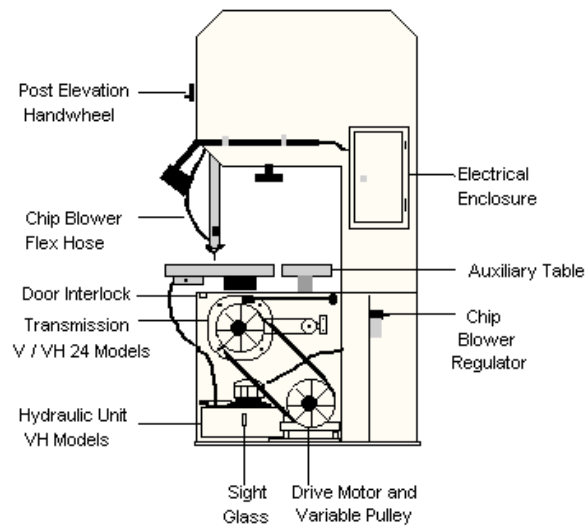
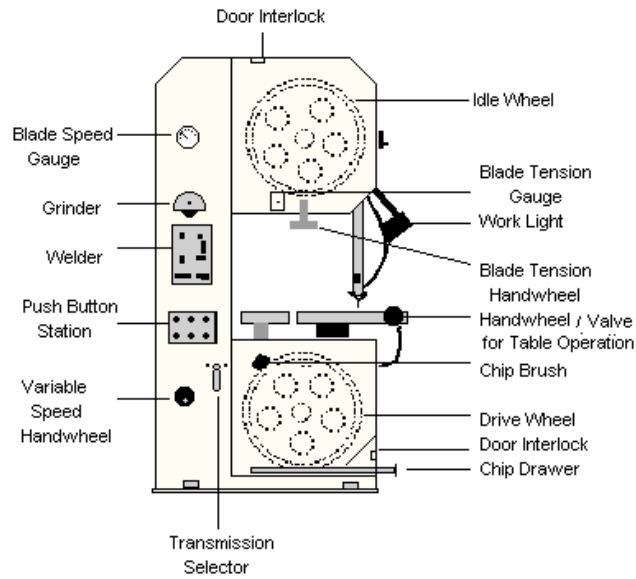
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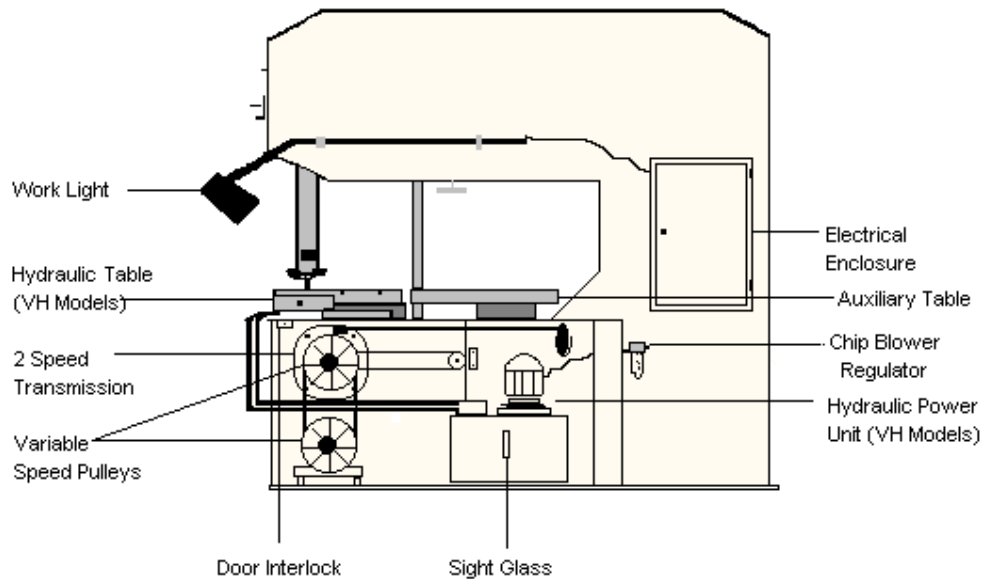
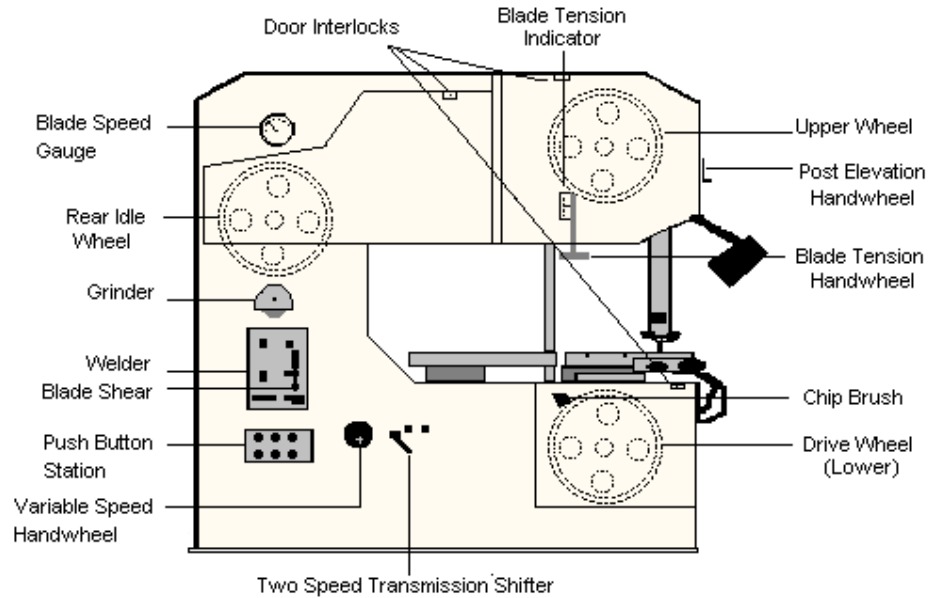
SPECIFICATIONS

Model Number:		V-16	V-24/VH-24	V-40/VH-40
Capacity:				
Throat	Inches	16	23-1/2	41
Work Height	Inches	11	12-1/2	12-1/2
Table:				
Work Table	Inches	23-1/2 x 23-1/2	26-3/8 x 26-3/8	26-3/8 x 26-3/8
Auxiliary	Inches	--	9 x 22-3/8	15-1/2 x 21-1/2
Height from Floor	Inches	38	42	41
Travel-Manual or Hydraulic	Inches	--	10	10
Tilt-Left	Degree	10	10	10
Tilt-Right	Degree	30	30	30
Table Weight Capacity	Lbs.	850	850	850
Blade:				
Width Minimum	Inches	1/8	1/8	1/8
Width Maximum	Inches	5/8	1	3/4
Length Minimum/Maximum	Inches	128/133	178/187	134/140 (2 wheels)
Length Minimum/Maximum	Inches	--	--	186/189 (3 wheels)
Wheel Diameter	Inches	16-1/2	24-1/2	16-1/2
Band Speed:				
Low Range	FPM	60 to 590	50 to 425	50 to 425
High Range	FPM	--	425 to 4250	425 to 4250
Drive Motor	HP	1	2.2	2.2
Welder Capacity:	Inches	1/8 – 5/8	1/8 – 1	1/8 – 1
VH models equipped with hydraulic table				
Hydraulic Motor:	HP	--	1/3	1/3
Height of Machine:	Inches	72	90	78
Floor Space:	Inches	38 x 25	60 x 60	72 x 60
Shipping Weight:				
Manual Table	Lbs.	1000	2025	2025
Hydraulic Table	Lbs.	--	2225	2395

MACHINE FEATURES V-16 / V & VH 24



MACHINE FEATURES V / VH-40



MACHINE UNPACKING AND INSTALLATION

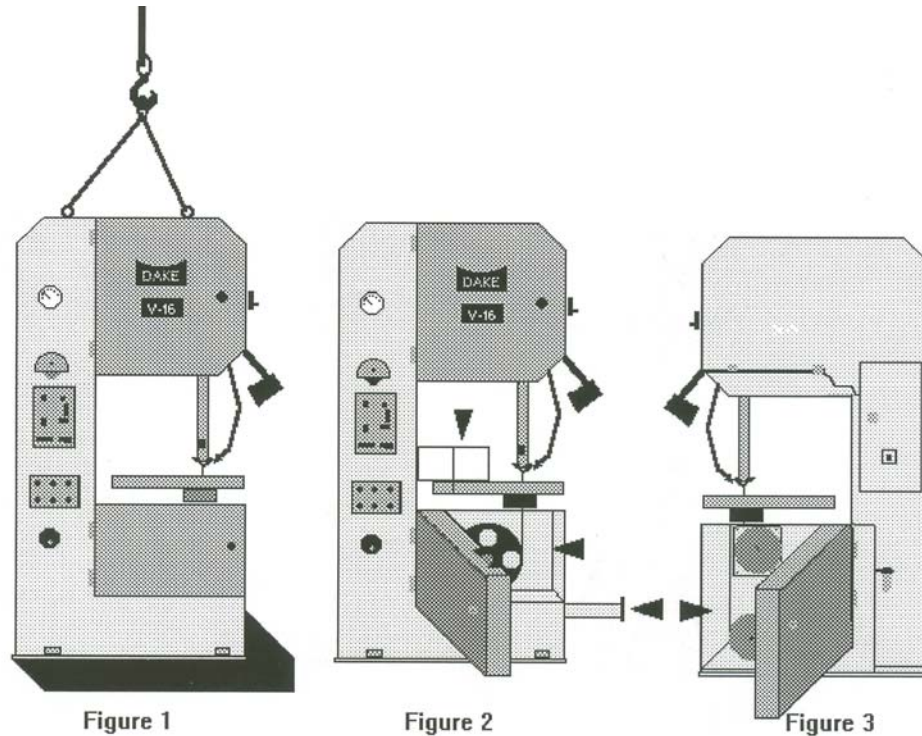


Figure 1

Figure 2

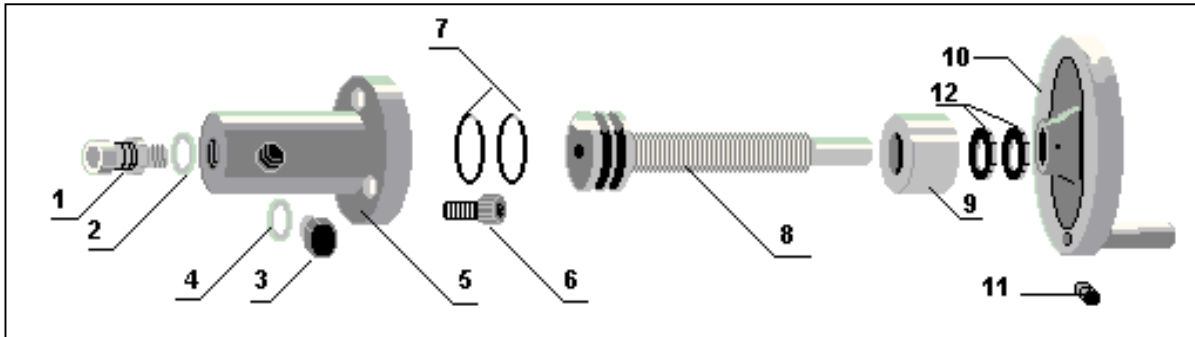
Figure 3

UNLOADING: Remove the shrink-wrap covering the machine, carefully as not to damage painted surfaces, electrical or hydraulic parts. **Carefully inspect the machine for physical damage. If damage is noted, notify the truck line at once. They may require inspection, and that a claim be filed.** Check that all standard accessories are with the machine. Some accessories may be boxed or placed behind access doors or chip drawer. (See figure 2 & 3) The band saws are provided with lifting eyes that screw into the top of the machine. These lifting eyes may be located in any of the compartments shown by arrows in figure 1 & 2 above. Particular care should be taken in selecting areas of the machine for handling, as electrical components and adjustment knobs can be marked up or damaged. **WARNING: Machine table may NOT be used as a lifting point. Damage to the saw and alignment problems could result.** Remove the mounting bolt nuts from the machine. Using the lifting eyes, remove the machine from the skid and put in place. (See figure 1)

INSTALLATION: Location of the machine should take into consideration the ability to traverse large work pieces. The machine is provided with holes in the base to anchor the unit to the floor. Shims should be used to properly level the unit. The saw is shipped with an anti-rust protective coating on machined metal surfaces. Surfaces should be cleaned with the appropriate solvent and then coated with a light film of oil.

ELECTRICAL: The machine is wired to be operated with an input voltage of 230, 3 phase, 60 htz (+/- 10%) or with a Dake external step down transformer from 460v to 230v. If any adjustments or changes are needed a qualified electrician should perform them. See detailed information as provided in a circuit diagram #80587.

FILLING THE SPEED REGULATOR



1. Turn the saw on.
2. Screw the handwheel in.
3. Turn the saw off once handwheel is in.
4. Remove the mounting screws (item 6).
5. Remove the plug from the cylinder (Item 3).
6. Turn screw out.
7. Add oil (Lightweight hydraulic oil) slowly while turning the wheel out.
8. When it is completely full, replace the plug (Item 3).
9. Re-mount the cylinder to the saw body.
10. Turn on the saw and adjust to the desired speed.
11. When saw is at maximum RPM, re-adjust the lock nuts on Item 8

MACHINE OPERATION

Prior to performing any cutting with the machine, it is recommended that the personal become familiar with the various controls and accessories.

PRECAUTIONS

- No loose clothing.
- Eye protection should be worn.
- All guards must be in position.
- Table is secured in place and locked. Table load capacity should be noted and not exceeded.
- Extra supports may be required for large or cumbersome components.
- Irregular shapes and small objects should be secured by means of a clamp or suitable fixture.
- Machine and surrounding should be kept free of tools, scrap and foreign objects.
- Machine should be locked out before making any adjustments.
- Care in uncoiling, and coiling and installation of blades should be observed. Gloves recommended.
- Storage of blades in an area near the machine will allow operating personal, to use the proper blade for each operation.
- Machine is furnished with electrical door interlocks. These interlocks should periodically be checked for proper operation.

WHEEL ALIGNMENT

V-16 & V / VH-24

Note: This alignment is factory set, but may need adjustment when replacing blade.

Two wheel machines have a bottom wheel that drives the saw blade and a top idle wheel that is adjustable to facilitate blade tracking. The edges of the wheels are fitted with a composite material to accommodate the tooth set.

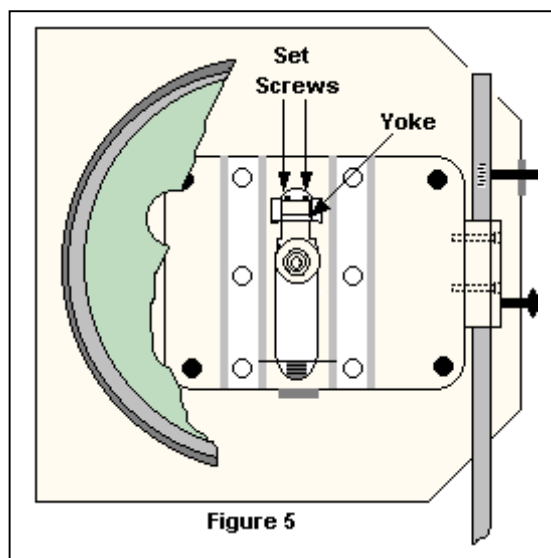
The idle wheel may be adjusted by loosening the knurled locking collar and turning the black knob in the center of the wheel. Turning the knob in a **clockwise** manner runs the blade toward the **back** edge of the band wheel. A **counter clockwise** movement will move the blade toward the **front** edge of the band wheel.

Correct tracking takes place when the blade runs approximately in the center of the wheel.

NOTE: The main casting with adjusting screws have been preset at the factory during assembly utilizing special fixtures. No adjustment should be attempted.

V-40 / VH-40

Machines with two idle wheels in addition to the drive wheel possess tracking control on each wheel. The top band wheel is set at the factory and no future adjustment should be necessary. *All adjustments should be performed utilizing the third band wheel. If difficulty is encountered in tracking, the top wheel may be reset as if the machine were to be used in the two wheel mode.



NOTE: With the V / VH-40 machines, it is possible to have the blade appear to be tracking properly but in actuality the two band wheels can be adjusted so they form an intersecting planes, rather than a common plane or parallel plane. This will result in excessive wear on the crown on the band wheel by the blade teeth, and severe cases, the composite material will shred or actually come loose from the band wheel.

*If the blade does not track properly against the back up guide bearing, there is a small amount of lateral adjustment in the top wheel. (See figure 5) Loosen the set screws and slide the yoke to make the blade line up properly with the backup guide bearing.

BLADE INSTALLATION

Blade selection is based on the many factors and complexity of the work to be cut.

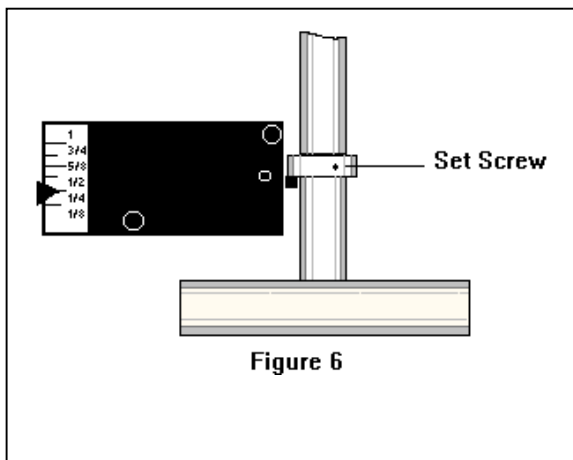
The blade placed on the band wheels with teeth facing toward the operator and down toward the top of the worktable. Tension the blade to remove slack. Rotate the wheels by hand to ensure tracking is correct, and blade will not “pop” off when machine is started. If tracking is incorrect, adjust before starting machine.

BLADE TENSIONING

The blade indicator is located inside the upper wheel compartment, on the lower left side of the idle wheel. (See machine features graphic) The indicator has an arrow mounted on the horizontal plane, with a corresponding scale for blade tensioning. The scale has two legends, one reads inches from 0 - 1", the second reads mm 0 - 25 mm. This allows tensioning either standard or metric blade widths.

With out tension on the blade, the indicator should read zero. As tension is applied to the blade the needle will move accordingly, and should be tightened until the correct blade width is indicated on this gauge. Example: Installing a 1/2" blade on the machine, tighten the handwheel until the indicator's arrow is pointing to the 1/2" mark on the scale. Before starting the machine check the blades tracking by hand as described in an earlier section.

This indicator has been calibrated at the factory. If recalibration is ever needed follow the steps below.



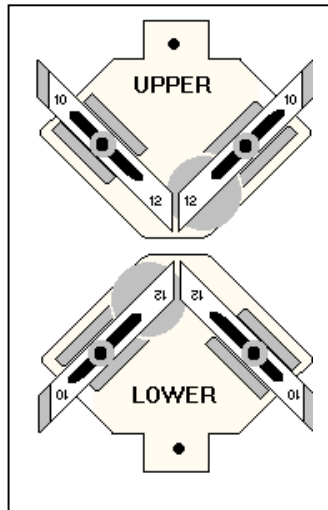
Using a blade tension gauge, (many times the company that you purchase blades from can furnish you with this gauge) tension the blade to the proper PSI. The PSI will vary from blade types (carbon, Bi-metal) and blade widths. This information can be obtained from your blade supplier. When proper tension is achieved, loosen the setscrew in the collar on the tensioning wheel shaft. (See figure 6) Adjust this collar up or down on the shaft until the arrow is pointing to the corresponding blade width. on the indicator. Tighten setscrew.

Note: It is better to over tension the blade than to run it under tensioned.

BLADE GUIDES

Your machine has come equipped with a set of interchangeable "V" type blade guides. A set of guides consist of two each left hand and two each right hand guide inserts. The standard guides furnished are 10 / 12 mm guides. Other sizes are optional, and can be purchased separately, or as a five piece set. The five-piece set includes 3 / 4 mm (1/8 - 1/4") 6 / 8 mm (5/16 - 3/8") 10 / 12 mm (standard set 1/2 - 5/8") 16 / 20 mm (3/4") and 25 / 32 mm (1") **The blade width will dictate the size blade guide to be used.**

Note: Never use blades larger than the rated capacity of the machine. Never use blades narrower than guide insert. Damage will occur to guide insert and blade. Blade insert must correspond with blade width.

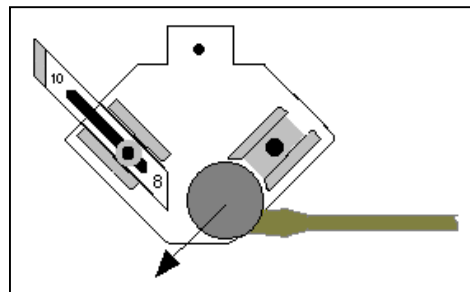


An analysis of the work to be performed should be made and the proper blade selected. The blade should always be inspected before installing on the machine. Things to look for should be the smoothness on the sides and back edge of the weld, look for any missing teeth, or impacted chips. The blade guides may now be selected and inserted into both the upper and lower guide holders. Proper adjustment of these guides takes place when they form a complete “V” shape (see graphic below) and support the blade equally on each side. A couple of thousands on each side of the blade will provide the running clearance and support for contour sawing.

Note: Blade guides should be cleaned of chips each blade change or more frequently if required.

BLADE GUIDES

The back end roller that supports the back of the blade on each guide holder contains a hardened cap over a set of ball bearings. This should be checked periodically for free movement so it is allowed to rotate freely as the back of the blade comes in contact with the face of this roller. Noticeable friction in this assembly indicates it should be replaced. This can be done by removing the right hand guide insert, moving the left hand guide up away from the bearing face. Loosen the setscrew on the bottom of the guide holder and sliding the old bearing and shaft out and a new one in. Tighten the setscrew and re-adjust the guides. See graphic below.



The “V” type solid blade guides and holder assemblies as furnished standard with the machine are recommended for the majority of cutting applications. This is true for the cutting of materials at blade speeds in the low range.

If the machine is operated in the high range, it should be operated with the high-speed roller guides, supplied with this machine, installed.

NOTE: If machine is operated in excess of above, abnormal blade wear and breakage may occur, due to the increased heat developed with the standard solid guides.

HIGH SPEED ROLLER GUIDES

Applications and Advantages:

Friction and abrasive cutting, filing operations, aluminum and woodcutting.

These guides eliminate having to change inserts when changing to blades of different widths.

Requirements for Installation:

These roller guides must be installed using a new 1/2" blade width band for proper alignment. The 1/2" band should be tracked within the approximate center line of the band wheels.

Note: Be certain band wheels are clean are free of any foreign material build up before proceeding.

Tools / Hardware Required:

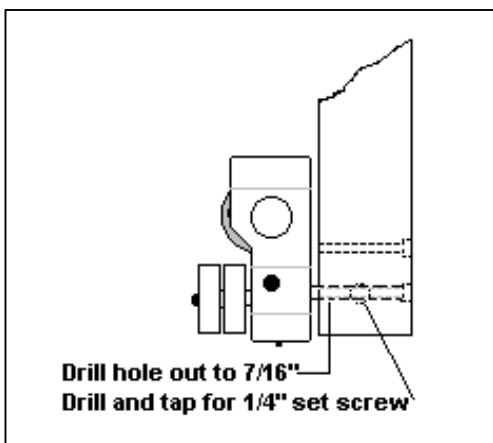
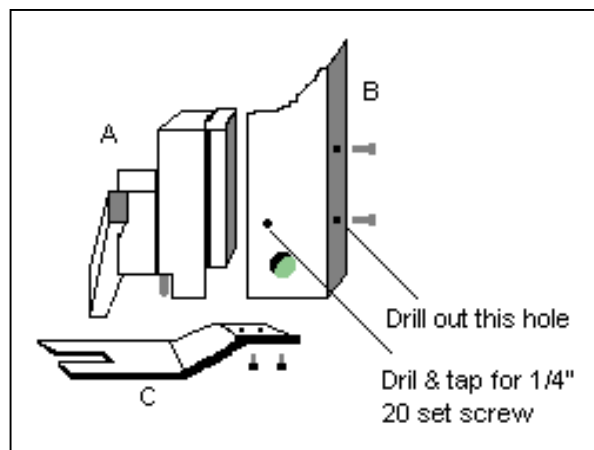
Drill - 7/16"

Drill and tap for 1/4" 20 set screw

1/4" 20 set screw 1/4 - 3/8" long

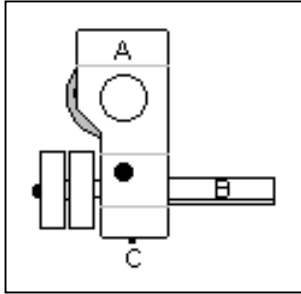
Upper Guide Installation:

1: Remove the existing guide holder assembly (part A) via the 2 countersunk socket head cap screws located on the backside of the moveable guide arm post. (Part B) Store the original guide holder assembly for future use. Remove the lower (red painted, part C) hold down foot located at the bottom of the movable guide arm post. (See graphic below)



2: With a 7/16" drill the bottom guide-mounting hole out. Drill from the front of the guidepost, to a depth of approx. 1". The hole should be just deep enough to stop short of breaking through the countersunk portion of the hole.

3: Drill and tap a hole for a 1/4" 20 set screw approx. 1/2 - 3/4" back from the front edge of the guidepost. This hole must be centered (intersect) with the 7/16" hole. As shown above.



4: Insert the mounting stud (B) into the guide casting (A). Keep the stud flush with the front of the casting. Keeping the mounting stud flat area on the bottom, tighten securely the set screw (C) on the bottom of the casting.

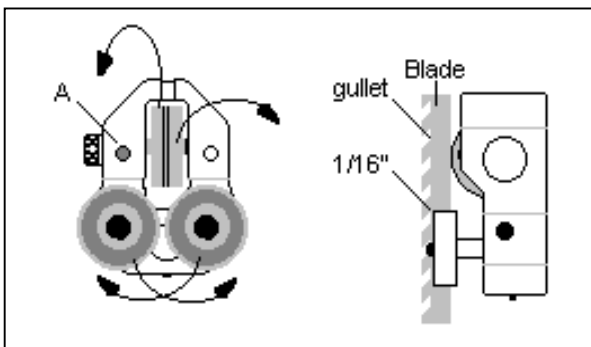
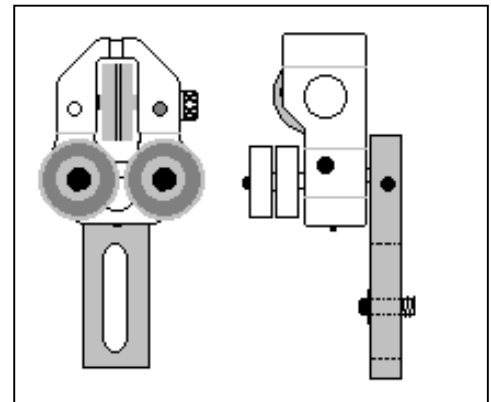
5: Insert this stud and guide assembly into the 7/16" hole in the guidepost. Make sure upper roller guide is plumb with the guidepost. Lightly tighten set screw you installed in the guidepost.

Lower Guide Installation:

6: Remove lower blade guide. Replace this guide with the high speed guide containing the mounting bracket with slotted hole, reusing existing nuts / bolts.

Position assembly upward along the slotted bracket, so that the guide body casting has enough clearance to allow the work table to be tilted for angle cutting. Tighten the socket head cap screw or nut.

Note: Make certain that if a socket head cap screw is used, it does not bottom out into the main saw casting item 1. Shorten the cap screw if necessary



7: Alignment of Upper / Lower Guides:

With blade properly tensioned and tracked, position the back-up roller by loosening the set screw (A) on the front of the guide casting, and move the knurled knob left to right until blade is in alignment with the groove in the bearing. Rotate the knurled knob until you have approx. 1/16" clearance from the back of the blade to the front edge of the back-up roller. Tighten set screw (A).

The two roller bearings below the back up bearing can be adjusted in and out, left and right. Loosen the set screws that retain the bearing stems into the casting. Using the single bearing assembly, position these bearings approx. 1/16" behind the deepest gullet of the blade.

The single bearing assembly along with the adjustability of the upper guide roller will service blades from 1/4" to 3/4". The double roller set is used only when blade of 1/2" to 1" are used. **Note: The adjustments are the same for both single and double bearing assemblies.**

Rotate eccentric bearing stems until both blade and the back up bearing groove are parallel with each other. Set screws should be just snug up until actual alignment is confirmed.

Repeat this process for the lower guide assembly.

Note: Upper guide stud may be adjusted in or out in the guide post to allow proper clearance for blade, and for alignment with lower guide.

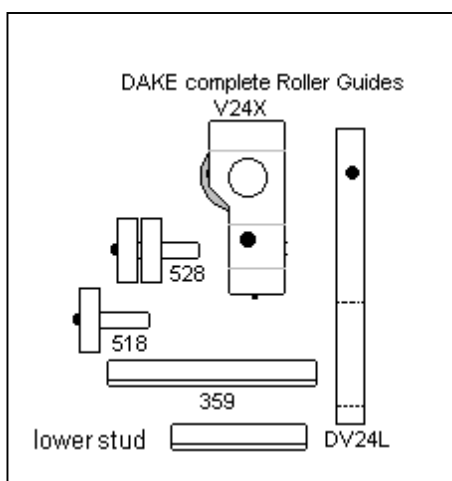
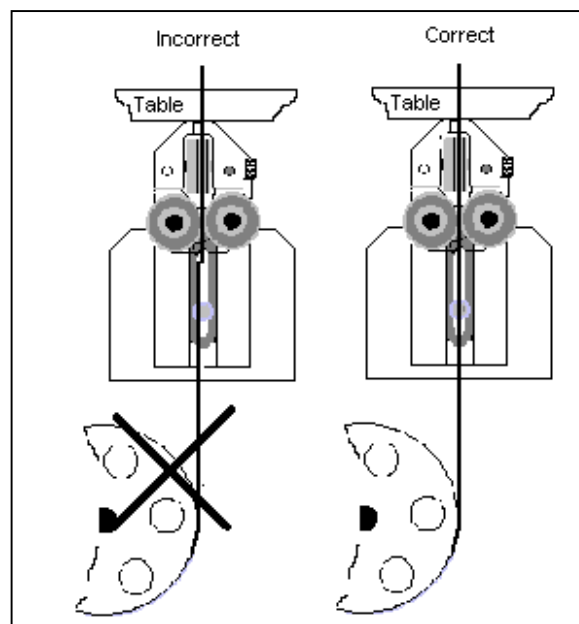
Align backup bearing as previously described for upper guide. Tighten both set screws when alignment is confirmed.

Re-adjust side rollers. (Graphic in previous column) Set the side clearance distance between rollers and saw blade, leaving about a .004 gap.

Note: If the adjustment setting for side clearance between roller and blade is not enough, the side rollers will cause the blade to miss-track or be pushed outward from the guide rollers.

Note: If blade alignment from band wheel to roller guides is necessary, do so by rotating eccentric shafts on the roller guides. Then lock them in place with the set screws.

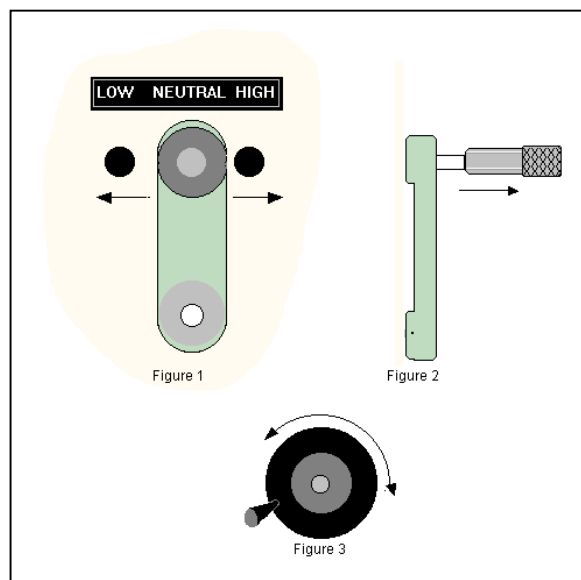
After all adjustments have been made, tighten all components tight.



BAND SPEED SELECTION

The saw blade is driven by a single speed transmission on the 16" machine and dual speed transmissions on the 24" and 40" machines. The shifting lever on the larger models has three positions. (Figure 1) The center being the neutral position, for set up. With the machine off, move the shift lever to the left for low speed range (50-500 FPM) and to the right for the high speed range. (500-5000 FPM) To shift the machine the shift lever handle must be pulled outward and then shifted left or right. (Figure 2)

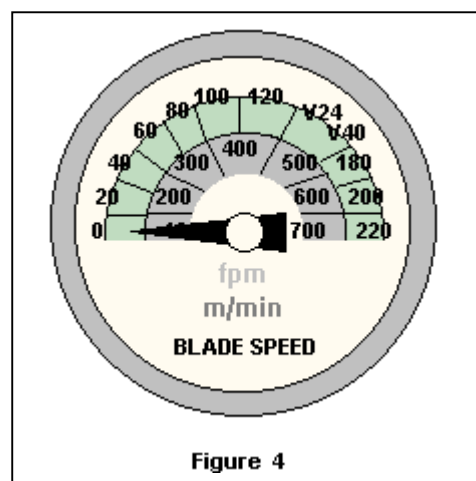
WARNING: NEVER SHIFT WHILE THE MOTOR IS RUNNING. THIS WILL CAUSE EXTENSIVE DAMAGE TO THE DRIVE TRAIN.



Note: Occasionally the drive wheel may have to be jogged by hand to engage the transmission lever.

The variable speed is achieved through the use of a variable regulator. (Figure 3) This is turned clockwise or counter clockwise to obtain an increase or decrease in blade speed, in either range. Adjust until desired speed is reached as read on the blade speed gauge. (Figure 4)

WARNING: DO NOT ADJUST THE VARIABLE SPEED CONTROL (FIGURE 3) SPEED UNLESS THE MACHINE IS IN OPERATION! FAILURE TO DO SO WILL CAUSE SEALS TO FAIL, AND RENDER THE UNIT INOPERABLE.



SAW BLADE SELECTION

There are numerous types of saw blades available depending upon the application. Tooth pitch, form, tooth set, and blade composite make up all contribute to the desired cut. Blade speeds and feed are also a factors. The complexity of the subject cannot be properly detailed in this manual, and it is suggested that you contact your local blade supplier for more detailed information and recommendations for the application.

Below is a chart that can be used as a **guide line** for blade selection and a percentage chart for determining the speeds and feeds for material after determining the Rockwell hardness.

The chart below shows material shape and sizes of square solid, round solid, and tubing, channel, and angle. The size range from 0" - 12" is diameter; the column under the shapes gives recommendation of a vari-tooth blade. Example: 4" round solid, will require a 3/4 pitch blade.

Note: For structurals and tubing, determine the average width of cut.

Blades must be broke in properly, for longest life and best cut finish. Break in cutting should be done at 1/3-1/2 normal cutting rate, for the 50-100 square inches.

NOTE: Below are the three most commonly used types of blades. The Bi-Metal blade is the most durable, for standard types of cutting applications. The teeth are made of high speed steel and welded to a backing material. The cutting edge contains 8% cobalt with a Rc of 64 to 68. (These blades are more difficult to weld than standard carbon.) The carbon blade is the least expensive with reduced blade life. The back of the blade is made of hardened material with a Rc of 31 to 37 and tooth hardness of 64 to 66. The carbide tipped blade has carbide inserts welded to the blade teeth with a Ra rating of 92

SAW BLADE SELECTION

	MATERIAL SHAPE ■	MATERIAL SHAPE ●	MATERIAL SHAPE ○ H ^
MATERIAL IN INCHES	TOOTH SELECTION	TOOTH SELECTION	TOOTH SELECTION
0	14 / 18	14 / 18	14 / 18
.1	14 / 18	14 / 18	14 / 18
.2	14 / 18	14 / 18	14 / 18
.3	10 / 14	14 / 18	10 / 14
.4	8 / 12	10 / 14	8 / 12
.5	8 / 12	8 / 12	6 / 10
.6	6 / 10	8 / 12	5 / 8
.7	6 / 10	6 / 10	5 / 8
.8	5 / 8	6 / 10	5 / 8
.9	5 / 8	5 / 8	5 / 8
1	5 / 8	5 / 8	4 / 6
1 1/4	4 / 6	5 / 8	4 / 6
1 1/2	4 / 6	4 / 6	4 / 6
1 3/4	4 / 6	4 / 6	4 / 6
2	4 / 6	4 / 6	3 / 4
2 1/4	4 / 6	4 / 6	3 / 4
2 1/2	3 / 4	4 / 6	3 / 4
2 3/4	3 / 4	4 / 6	3 / 4
3	3 / 4	3 / 4	3 / 4
3 1/4	3 / 4	3 / 4	3 / 4
3 1/2	3 / 4	3 / 4	3 / 4
3 3/4	3 / 4	3 / 4	2 / 3
4	3 / 4	3 / 4	2 / 3
5	2 / 3	3 / 4	2 / 3
6	2 / 3	3 / 4	2 / 3
7	2 / 3	2 / 3	1.4 / 2.5
8	1.4 / 2.5	2 / 3	1.4 / 2.5
9	1.4 / 2.5	2 / 3	1.4 / 2.5
10	1.4 / 2.5	1.4 / 2.5	1.4 / 2.5
11	1.4 / 2.5	1.4 / 2.5	1.4 / 2.5
12	1.4 / 2.5	1.4 / 2.5	1.4 / 2.5

SPEEDS AND FEEDS

As important as proper blade selection, is proper feeds and speeds for the different materials to be cut. It is impossible to determine absolute rates for each material and machine, below is a chart that will give you starting points for most applications; keeping in mind these are only approximations.

The left hand column, labeled Material tells you the family, the column Alloy lists the types that are within that family of material. The top six columns give material dimensions. Below these column are listed the recommended FPM and SIPM for that material type. Example: Carbon steel with a alloy make up classified as 1030, with a diameter of 4" will be cut at 329 FPM and SIPM of 14, shown as fpm 329 sipm 14.

MATERIAL	ALLOY	1/2"	1"	2"	4"	7"	12"
ALUMINUM ALLOY	1100,2011,2017,2024	fpm 568 sipm 7	fpm 577 sipm 11	fpm 536 sipm 16	fpm 498 sipm 21	fpm 451sipm 23	fpm 389 sipm 24
	3003,5052,5086,6061	fpm 568 sipm 7	fpm 577 sipm 11	fpm 536 sipm 16	fpm 498 sipm 21	fpm 451sipm 23	fpm 389 sipm 24
	6063,6101,6262,7075	fpm 568 sipm 7	fpm 577 sipm 11	fpm 536 sipm 16	fpm 498 sipm 21	fpm 451sipm 23	fpm 389 sipm 24
COPPER ALLOY	356,360	fpm 511 sipm 7	fpm 501 sipm 10	fpm 482 sipm 14	fpm 448 sipm 19	fpm 406 sipm 21	fpm350 sipm 22
	353	fpm 454 sipm 6	fpm 445 sipm 8	fpm 429 sipm 12	fpm 399 sipm 17	fpm 361 sipm 19	fpm311 sipm 19
	1452,187	fpm 426 sipm 6	fpm 418 sipm 8	fpm 402 sipm 12	fpm 374 sipm 16	fpm 338 sipm 18	fpm 292 sipm 18
	380,544	fpm 397 sipm 5	fpm 390 sipm 7	fpm 375 sipm 11	fpm349 sipm 15	fpm 316 sipm 16	fpm 272 sipm 17
	173,932	fpm 358 sipm 5	fpm 351 sipm 7	fpm 338 sipm 10	fpm 314 sipm 13	fpm 284 sipm 15	fpm 245 sipm 15
	330,365	fpm 324 sipm 4	fpm 317 sipm 6	fpm 305 sipm 9	fpm 284 sipm 12	fpm 257 sipm 13	fpm 222 sipm 14
	623,624	fpm 301 sipm 4	fpm 295 sipm 6	fpm 284 sipm 8	fpm 264 sipm 11	fpm 239 sipm 12	fpm 206 sipm 13
	230,260,272	fpm 278 sipm 4	fpm 273 sipm 5	fpm 263 sipm 8	fpm 244 sipm 10	fpm 221 sipm 11	fpm 191 sipm 12
	280,464,632,655	fpm 278 sipm 4	fpm 273 sipm 5	fpm 263 sipm 8	fpm 244 sipm 10	fpm 221 sipm 11	fpm 191 sipm 12
	101,102,110,122,172	fpm 267 sipm 3	fpm 262 sipm 5	fpm 252sipm 7	fpm 234 sipm 10	fpm 212 sipm 11	fpm 183 sipm 11
	1751,182,220,510	fpm 267 sipm 3	fpm 262 sipm 5	fpm 252 sipm 7	fpm 234 sipm 10	fpm 212 sipm 11	fpm 183 sipm 11
	625,706,715,934	fpm 267 sipm 3	fpm 262 sipm 5	fpm 252 sipm 7	fpm 234 sipm 10	fpm 212 sipm 11	fpm 183 sipm 11
	630	fpm 261 sipm 3	fpm 256 sipm 5	fpm 246 sipm 7	fpm 229 sipm 10	fpm 207 sipm 11	fpm 179 sipm 11
811	fpm 244 sipm 3	fpm 239 sipm 5	fpm 230 sipm 7	fpm 214 sipm 9	fpm 194 sipm 10	fpm 167 sipm 10	
RESULFURIZED CARBON STEEL	12L14	fpm 483 sipm 6	fpm 473 sipm 9	fpm 455 sipm 13	fpm 424 sipm 18	fpm 383 sipm 20	fpm 321 sipm 20
	1213,1215	fpm 454 sipm 6	fpm 445 sipm 8	fpm 429 sipm 12	fpm 399 sipm 17	fpm 361 sipm 19	fpm 311 sipm 19
	1117	fpm 386 sipm 5	fpm 379 sipm 7	fpm 364 sipm 11	fpm 339 sipm 15	fpm 307 sipm 16	fpm 265 sipm 16
	1137	fpm 329 sipm 4	fpm 323 sipm 6	fpm 311 sipm 9	fpm 289 sipm 12	fpm 262 sipm 14	fpm 262 sipm 14
	1141,1144	fpm 318 sipm 4	fpm 312 sipm 6	fpm 300 sipm 9	fpm 279 sipm 12	fpm 253 sipm 13	fpm 218 sipm 13
1144 HI STRESS	fpm 318 sipm 4	fpm 312 sipm 6	fpm 300 sipm 9	fpm 279 sipm 12	fpm 253 sipm 13	fpm 218 sipm 13	
CARBON STEEL	1030	fpm 375 sipm 5	fpm 367 sipm 7	fpm 254 sipm 10	fpm 329 sipm 14	fpm 298 sipm 15	fpm 257 sipm 16
	1008,1015,1020,1025	fpm 363 sipm 5	fpm 356 sipm 7	fpm 343 sipm 10	fpm 319 sipm 14	fpm 289 sipm 15	fpm 249 sipm 15
	1035	fpm 352 sipm 5	fpm 345 sipm 7	fpm 332 sipm 10	fpm 309 sipm 13	fpm 280 sipm 14	fpm 241 sipm 14
	1018,1021,1025	fpm 341 sipm 4	fpm 334 sipm 6	fpm 321 sipm 9	fpm 299 sipm 13	fpm 271 sipm 14	fpm 234 sipm 14
	1026,1513	fpm 341 sipm 4	fpm 334 sipm 6	fpm 321 sipm 9	fpm 299 sipm 13	fpm 271 sipm 14	fpm 234 sipm 14
	A36 (SHAPES),1040	fpm 307 sipm 4	fpm 301 sipm 6	fpm 289 sipm 8	fpm 269 sipm 12	fpm 243 sipm 13	fpm 210 sipm 13
	1042,1541	fpm 284 sipm 4	fpm 278 sipm 5	fpm 268 sipm 8	fpm 249 sipm 11	fpm 225 sipm 12	fpm 195 sipm 12
	1044,1045	fpm 250 sipm 3	fpm 245 sipm 5	fpm 236 sipm 7	fpm 219 sipm 9	fpm 198 sipm 10	fpm 171 sipm 11
	1060	fpm 227sipm 3	fpm 223 sipm 4	fpm 214 sipm 6	fpm 199 sipm 9	fpm 180 sipm 9	fpm 156 sipm 10
1095	fpm 210 sipm 3	fpm 206 sipm 4	fpm 198 sipm 6	fpm 184 sipm 8	fpm 167 sipm 9	fpm 144 sipm 9	
NI-CR-MO ALLOY STEEL	8615,8620,8622	fpm 273 sipm 4	fpm 267 sipm 5	fpm 257 sipm 7	fpm 239 sipm 10	fpm 216 sipm 11	fpm 187 sipm 12
	4340,E4340,8630	fpm 250 sipm 3	fpm 245 sipm 5	fpm 236 sipm 7	fpm 219 sipm 9	fpm 198 sipm 10	fpm 171 sipm 11
	8640	fpm 227 sipm 3	fpm 223 sipm 4	fpm 214 sipm 6	fpm 199 sipm 9	fpm 180 sipm 9	fpm 156 sipm 10
	E9310	fpm 199 sipm 3	fpm 195 sipm 4	fpm 188 sipm 5	fpm 174 sipm 7	fpm 158 sipm 8	fpm 136 sipm 8
TOOL STEEL	L-6	fpm 216 sipm 3	fpm 212 sipm 4	fpm 204 sipm 6	fpm 189 sipm 8	fpm 171 sipm 9	fpm 148 sipm 9
SHOCK RESISTING TOOL STEEL	S-1	fpm 227 sipm 3	fpm 223 sipm 4	fpm 214 sipm 6	fpm 199 sipm 9	fpm 180 sipm 9	fpm 156 sipm 10
	S-5	fpm 159 sipm 2	fpm 156 sipm 3	fpm 150 sipm 4	fpm 140 sipm 6	fpm 126 sipm 7	fpm 109 sipm 7
	S-7	fpm 142 sipm 2	fpm 139 sipm 3	fpm 134 sipm 4	fpm 125 sipm 5	fpm 113 sipm 6	fpm 97 sipm 6

MATERIAL	ALLOY	1/2"	1"	2"	4"	7"	12"
COLD-WORK TOOL STEEL	A-6	fpm 227 sipm 3	fpm 223 sipm 4	fpm 214 sipm 6	fpm 199 sipm 9	fpm 180 sipm 9	fpm 156 sipm 10
	A-2	fpm 204 sipm 3	fpm 200 sipm 4	fpm 193 sipm 6	fpm 179 sipm 8	fpm 162 sipm 8	fpm 140 sipm 9
	A-10	fpm 182 sipm 2	fpm 178 sipm 3	fpm 171 sipm 5	fpm 159 sipm 7	fpm 144 sipm 7	fpm 125 sipm 8
	D-2	fpm 102 sipm 1	fpm 100 sipm 2	fpm 96 sipm 3	fpm 90 sipm 4	fpm 81 sipm 4	fpm 70 sipm 4
HOT-WORK TOOL	H-11,H-12,H-13	fpm 216 sipm 3	fpm 212 sipm 4	fpm 204 sipm 6	fpm 189 sipm 8	fpm 171 sipm 9	fpm 148 sipm 9
OIL HARDENING TOOL STEEL	0-1	fpm 227 sipm 3	fpm 223 sipm 4	fpm 214 sipm 6	fpm 199 sipm 9	fpm 180 sipm 9	fpm 156 sipm 10
	0-6	fpm 216 sipm 9	fpm 212 sipm 12	fpm 204 sipm 6	fpm 189 sipm 8	fpm 171 sipm 9	fpm 148 sipm 9
WATER-HARD TOOL STEEL	W-1	fpm 256 sipm 3	fpm 251 sipm 5	fpm 241 sipm 7	fpm 224 sipm 10	fpm 203 sipm 11	fpm 175 sipm 11
HIGH-SPEED TOOL STEEL	M-1	fpm 125 sipm 2	fpm 122 sipm 2	fpm 118 sipm 3	fpm 110 sipm 5	fpm 99 sipm 5	fpm 86 sipm 5
	M-2,M-42,T-1	fpm 114 sipm 1	fpm 111 sipm 2	fpm 107 sipm 3	fpm 100 sipm 4	fpm 90 sipm 5	fpm 78 sipm 5
	T-15	fpm 79 sipm 1	fpm 78 sipm 1	fpm 75 sipm 2	fpm 70 sipm 3	fpm 63 sipm 3	fpm 54 sipm 3
ALLOY STEEL	A242(1) COR-TEN A	fpm 341 sipm 4	fpm 334 sipm 6	fpm 321 sipm 9	fpm 299 sipm 13	fpm 271 sipm 14	fpm 234 sipm 14
	A242(2) COR-TEN B	fpm 307 sipm 4	fpm 301 sipm 6	fpm 289 sipm 8	fpm 269 sipm 8	fpm 243 sipm 13	fpm 210 sipm 13
	300M,HY-80,HY-100	fpm 182 sipm 2	fpm 178 sipm 3	fpm 171 sipm 5	fpm 159 sipm 7	fpm 144 sipm 7	fpm 125 sipm 8
	HP 9-4-20,HP 9-4-25	fpm 119 sipm 2	fpm 117 sipm 2	fpm 113 sipm 3	fpm 105sipm 4	fpm 95 sipm 5	fpm 82 sipm 2
MN ALLOY STEEL	1330	fpm 250 sipm 3	fpm 245 sipm 5	fpm 236 sipm 7	fpm 219 sipm 9	fpm 198 sipm 10	fpm 171 sipm 11
	1345	fpm 238 sipm 3	fpm 234 sipm 4	fpm 225 sipm 7	fpm 209 sipm 9	fpm 189 sipm 10	fpm 163 sipm 10
CR-MO ALLOY STEEL	41L40	fpm 312 sipm 4	fpm 306 sipm 6	fpm 295 sipm 9	fpm 274 sipm 12	fpm 248 sipm 13	fpm 214 sipm 13
	4130	fpm 307 sipm 4	fpm 301 sipm 6	fpm 289 sipm 8	fpm 269 sipm 12	fpm 243 sipm 13	fpm 210 sipm 13
	e.t.d.'150	fpm 284 sipm 4	fpm 278 sipm 5	fpm 268 sipm 8	fpm 249 sipm 11	fpm 225 sipm 12	fpm 195 sipm 12
	4140,4142	fpm 284 sipm 4	fpm 278 sipm 5	fpm 268 sipm 8	fpm 249 sipm 11	fpm 225 sipm 12	fpm 195 sipm 12
	4145	fpm 238 sipm 3	fpm 234 sipm 4	fpm 225 sipm 7	fpm 209 sipm 9	fpm 189 sipm 10	fpm 163 sipm 10
	4150	fpm 227 sipm 3	fpm 223 sipm 4	fpm 214 sipm 6	fpm 199 sipm 9	fpm 180 sipm 9	fpm 156 sipm 10
CR ALLOY STEEL	5160	fpm 250 sipm 3	fpm 245 sipm 5	fpm 236 sipm 7	fpm 219 sipm 9	fpm 198 sipm 10	fpm 171 sipm 11
	6150	fpm 238 sipm 3	fpm 234 sipm 4	fpm 225 sipm 7	fpm 209 sipm 9	fpm 189 sipm 10	fpm 163 sipm 10
	E52100	fpm 182 sipm 2	fpm 178 sipm 3	fpm 171 sipm 5	fpm 159 sipm 7	fpm 144 sipm 7	fpm 125 sipm 8
CR STAINLESS STEEL	420	fpm 216 sipm 3	fpm 212 sipm 4	fpm 204 sipm 6	fpm 189 sipm 8	fpm 171 sipm 9	fpm 148 sipm 9
	430	fpm 170 sipm 2	fpm 167 sipm 3	fpm 161 sipm 5	fpm 149 sipm 6	fpm 1235sipm 7	fpm 117 sipm 7
	410,502	fpm 159 sipm 2	fpm 156 sipm 3	fpm 150 sipm 4	fpm 140 sipm 6	fpm 126 sipm 7	fpm 109 sipm 7
	414	fpm 131 sipm 2	fpm 128 sipm 2	fpm 123 sipm 4	fpm 115 sipm 5	fpm 104 sipm 5	fpm 90 sipm 6
	431	fpm 108 sipm 1	fpm 106 sipm 2	fpm 102 sipm 3	fpm 95 sipm 4	fpm 86 sipm 4	fpm 74 sipm 5
	440C	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
MOLD STEEL	P-20	fpm 261 sipm 3	fpm 256 sipm 5	fpm 246 sipm 7	fpm 229 sipm 10	fpm 207 sipm 11	fpm 179 sipm 11
STAINLESS STEEL	CUSTOM 450,456	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
AUSTENITIC STAINLESS STEEL	304,324	fpm 136 sipm 2	fpm 134 sipm 3	fpm 129 sipm 4	fpm 120 sipm 5	fpm 108 sipm 6	fpm 93 sipm 6
	304L	fpm 131 sipm 2	fpm 128 sipm 2	fpm 123 sipm 4	fpm 115 sipm 5	fpm 104 sipm 5	fpm 90 sipm 6
	347	fpm 125 sipm 2	fpm 122 sipm 2	fpm 118 sipm 3	fpm 110 sipm 5	fpm 99 sipm 5	fpm 86 sipm 5
	316,316L	fpm 114 sipm 1	fpm 111 sipm 2	fpm 107 sipm 3	fpm 100 sipm 4	fpm 90 sipm 5	fpm 78 sipm 5
	18-18-2,309	fpm 102 sipm 1	fpm 100 sipm 2	fpm 96 sipm 3	fpm 90 sipm 4	fpm 81 sipm 4	fpm 70 sipm 4
	310	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	22-13-5	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3

	NITRONIC 50,60	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
MATERIAL	ALLOY	1/2"	1"	2"	4"	7"	12"
MARTENSITIC STAINLESS STEEL	GREEK ASCOLOY	fpm 108 sipm 1	fpm 106 sipm 2	fpm 102 sipm 3	fpm 95 sipm 4	fpm 86 sipm 4	fpm 74 sipm 5
FREE MACHINING STAINLESS STEEL	416	fpm 216 sipm 3	fpm 212 sipm 4	fpm 204 sipm 6	fpm 189 sipm 8	fpm 171 sipm 9	fpm 148 sipm 9
	440 F	fpm 182 sipm 2	fpm 178 sipm 3	fpm 171 sipm 5	fpm 159 sipm 7	fpm 144 sipm 7	fpm 125 sipm 8
	203 EZ,430 F	fpm 170 sipm 2	fpm 167 sipm 3	fpm 161 sipm 5	fpm 149 sipm 6	fpm 135 sipm 7	fpm 117 sipm 7
	303,303 PB,303 SE	fpm 159 sipm 2	fpm 156 sipm 3	fpm 150 sipm 4	fpm 140 sipm 6	fpm 126 sipm 67	fpm 109 sipm 7
FREE MACHINING STAINLESS STEEL	416	fpm 216 sipm 3	fpm 212 sipm 4	fpm 204 sipm 6	fpm 189 sipm 8	fpm 171 sipm 9	fpm 148 sipm 9
	440 F	fpm 182 sipm 2	fpm 178 sipm 3	fpm 171 sipm 5	fpm 159 sipm 7	fpm 144 sipm 7	fpm 125 sipm 8
	203 EZ,430 F	fpm 170 sipm 2	fpm 167 sipm 3	fpm 161 sipm 5	fpm 149 sipm 6	fpm 135 sipm 7	fpm 117 sipm 7
	303,303 PB,303 SE	fpm 159 sipm 2	fpm 156 sipm 3	fpm 150 sipm 4	fpm 140 sipm 6	fpm 126 sipm 67	fpm 109 sipm 7
FERRITIC AUSTENITIC S.S.	FERRALIUM 255	fpm 102 sipm 1	fpm 100 sipm 2	fpm 96 sipm 3	fpm 90 sipm 4	fpm 81 sipm 4	fpm 70 sipm 4
	2205	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
PRECIPITATION HARDENABLE STAINLESS STEEL	15-5 PH	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	17-4 PH,17-7 PH	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	AM 350,AM 355	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	PH 13-8 MO	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	PH 14-8 MO	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	PH 15-7 MO	fpm 85 sipm 1	fpm 84 sipm 2	fpm 80 sipm 2	fpm 75 sipm 3	fpm 68 sipm 4	fpm 58 sipm 4
MAGNESIUM ALLOY	AZ31B MAG- NESIUM ALLOY	fpm 568 sipm 7	fpm 557 sipm 11	fpm 536 sipm 16	fpm 498 sipm 21	fpm 451 sipm 23	fpm 389 sipm 24
IRON BASE SUPER ALLOY	PYROMET X-15	fpm 136 sipm 2	fpm 134 sipm 3	fpm 129 sipm 4	fpm 120 sipm 5	fpm 108 sipm 6	fpm 93 sipm 6
	A286	fpm 102 sipm 1	fpm 100 sipm 2	fpm 96 sipm 3	fpm 90 sipm 4	fpm 81 sipm 4	fpm 70 sipm 4
	INCOLOY 800,801	fpm 102 sipm 1	fpm 100 sipm 2	fpm 96 sipm 3	fpm 90 sipm 4	fpm 81 sipm 4	fpm 70 sipm 4
COBALT BASE ALLOY	ASTROLOY M	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
	WF-11	fpm 74 sipm 1	fpm 72 sipm 1	fpm 70 sipm 2	fpm 65 sipm 3	fpm 59 sipm 3	fpm 51 sipm 3
TITANIUM ALLOY	TI-3Al-8V-6CR-4MO-4Zr	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1
	TI-8Mo-8V-2Fe-3Al	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1	fpm 91 sipm 1
	TI-2Al-11Sn-5Zr-1Mo	fpm 85 sipm 1	fpm 84 sipm 2	fpm 80 sipm 2	fpm 75 sipm 3	fpm 68 sipm 4	fpm 58 sipm 4
	TI-5Al-2.5Sn	fpm 85 sipm 1	fpm 84 sipm 2	fpm 80 sipm 2	fpm 75 sipm 3	fpm 68 sipm 4	fpm 58 sipm 4
	TI-6Al-2Sn-4Zr-2Mo	fpm 85 sipm 1	fpm 84 sipm 2	fpm 80 sipm 2	fpm 75 sipm 3	fpm 68 sipm 4	fpm 58 sipm 4
	TI-6Al-4V	fpm 79 sipm 1	fpm 78 sipm 1	fpm 75 sipm 2	fpm 70 sipm 3	fpm 63 sipm 3	fpm 54 sipm 3
	TI-7Al-4Mo	fpm 74 sipm 1	fpm 72 sipm 1	fpm 70 sipm 2	fpm 65 sipm 3	fpm 59 sipm 3	fpm 51 sipm 3
	TI-8Al-1Mo-1V	fpm 74 sipm 1	fpm 72 sipm 1	fpm 70 sipm 2	fpm 65 sipm 3	fpm 59 sipm 3	fpm 51 sipm 3
NICKEL ALLOY	NICKEL 200,201,205	fpm 97 sipm 1	fpm 95 sipm 2	fpm 91 sipm 3	fpm 85 sipm 4	fpm 77 sipm 4	fpm 66 sipm 4
NICKEL BASE ALLOY (*HASTELLOY)	INCONEL 625	fpm 114 sipm 1	fpm 111 sipm 2	fpm 107 sipm 3	fpm 100 sipm 4	fpm 90 sipm 5	fpm 78 sipm 5
	INCOLOY 802,804	fpm 102 sipm 1	fpm 100 sipm 2	fpm 96 sipm 3	fpm 90 sipm 4	fpm 81 sipm 4	fpm 70 sipm 4
	MONEL R405	fpm 97 sipm 1	fpm 95 sipm 2	fpm 91 sipm 3	fpm 85 sipm 4	fpm 77 sipm 4	fpm 66 sipm 4
	20CB3	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	MONEL 400,401	fpm 85 sipm 1	fpm 84 sipm 2	fpm 80 sipm 2	fpm 75 sipm 3	fpm 68 sipm 4	fpm 58 sipm 4
	*B,B-2,C,C-22	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1
	*C-276,C-4	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1
	*F,G,G-2,3,G-30	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1
	*N,S,W,X , INCOLOY 825	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1

MATERIAL	ALLOY	1/2"	1"	2"	4"	7"	12"
NICKEL BASE ALLOY (*HASTELLOY)	INCONEL 751,X750	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1
	WASPALLOY	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1	fpm 79 sipm 1
	MONEL K500	fpm 74 sipm 1	fpm 72 sipm 1	fpm 70 sipm 2	fpm 65 sipm 3	fpm 59 sipm 3	fpm 51 sipm 3
	INCOLOY 901,903,926	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
	INCONEL 600,718	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
	NI-SPAN-C 902	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
	NIMONIC 263	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
	RENE 41,UDIMET 500	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
	NIMONIC 75	fpm 57 sipm 1	fpm 56 sipm 1	fpm 54 sipm 2	fpm 50 sipm 2	fpm 45 sipm 2	fpm 39 sipm 2
CAST IRONS PEARLITIC MALLEABLE	ASTM A220 (50005)	fpm 273 sipm 4	fpm 267 sipm 5	fpm 257 sipm 7	fpm 239 sipm 10	fpm 216 sipm 11	fpm 187 sipm 12
	ASTM A220 (60004)	fpm 193 sipm 3	fpm 189 sipm 4	fpm 182 sipm 5	fpm 169 sipm 7	fpm 153 sipm 8	fpm 132 sipm 8
	ASTM A220 (70003)	fpm 165 sipm 2	fpm 161 sipm 3	fpm 155 sipm 5	fpm 144 sipm 6	fpm 131 sipm 7	fpm 133 sipm 7
	ASTM A220 (80002)	fpm 142 sipm 2	fpm 139 sipm 3	fpm 134 sipm 4	fpm 125 sipm 5	fpm 113 sipm 6	fpm 97 sipm 6
	ASTM A220 (90001)	fpm 114 sipm 1	fpm 111 sipm 2	fpm 107 sipm 3	fpm 100 sipm 4	fpm 90 sipm 5	fpm 78 sipm 5
GRAY IRON AUSTENITIC	ASTM A436 (1B)	fpm 170 sipm 2	fpm 167 sipm 3	fpm 161 sipm 5	fpm 149 sipm 6	fpm 135 sipm 7	fpm 117 sipm 7
	ASTM A436 (2)	fpm 159 sipm 2	fpm 156 sipm 3	fpm 150 sipm 4	fpm 140 sipm 6	fpm 125 sipm 7	fpm 109 sipm 7
	ASTM A436 (2B)	fpm 142 sipm 2	fpm 139 sipm 3	fpm 134 sipm 4	fpm 125 sipm 5	fpm 133 sipm 6	fpm 97 sipm 6
DUCTILE AUSTENITIC	ASTM A439 (D-2)	fpm 91 sipm 1	fpm 89 sipm 2	fpm 86 sipm 2	fpm 80 sipm 3	fpm 72 sipm 4	fpm 62 sipm 4
	ASTM A439 (D2-B)	fpm 68 sipm 1	fpm 67 sipm 1	fpm 64 sipm 2	fpm 60 sipm 3	fpm 54 sipm 3	fpm 47 sipm 3
MALLEABLE	ASTM A47(50&53ksi)	fpm 341 sipm 4	fpm 334 sipm 6	fpm 321 sipm 9	fpm 299 sipm 13	fpm 271 sipm 14	fpm 234 sipm 14
GRAY IRON	ASTM A48 (20ksi)	fpm 261 sipm 3	fpm 256 sipm 5	fpm 246 sipm 7	fpm 229 sipm 10	fpm 207 sipm 11	fpm 179 sipm 11
	ASTM A48 (40ksi)	fpm 204 sipm 3	fpm 200 sipm 4	fpm 193 sipm 6	fpm 179 sipm 8	fpm 162 sipm 8	fpm 140 sipm 9
	ASTM A48 (60ksi)	fpm 114 sipm 1	fpm 111 sipm 2	fpm 107 sipm 3	fpm 100 sipm 4	fpm 90 sipm 5	fpm 78 sipm 5
DUCTILE	ASTM A536 (60-40-18)	fpm 409 sipm 5	fpm 401 sipm 8	fpm 396 sipm 11	fpm 359 sipm 15	fpm 325 sipm 17	fpm 280 sipm 17
	ASTM A536 (88-55-06)	fpm 273 sipm 4	fpm 267 sipm 5	fpm 257 sipm 7	fpm 239 sipm 10	fpm 216 sipm 11	fpm 187 sipm 12
	ASTM A536 (100-70-03)	fpm 210 sipm 3	fpm 206 sipm 4	fpm 198 sipm 6	fpm 184 sipm 8	fpm 167 sipm 9	fpm 144 sipm 9
	ASTM A536 (120-90-02)	fpm 136 sipm 2	fpm 134 sipm 3	fpm 129 sipm 4	fpm 120 sipm 5	fpm 108 sipm 6	fpm 93 sipm 6

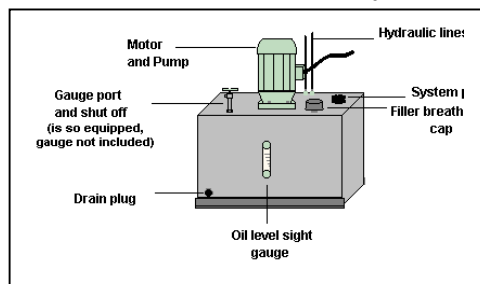
RATE REDUCTION FOR HARD MATERIALS

Below is a matrix for speed reduction for hard materials. Find the material hardness, either Rockwell (Rc) or Brinell (Bhn), and reduce both band speed and cutting rate by the percentage shown.

HARDNESS (Rc) Rockwell	HARDNESS (Bhn) Brinell	SPEED / CUTTING RATE REDUCTION
Up to 20	226	0%
22	237	5%
24	247	10%
26	258	15%
28	271	20%
30	286	25%
32	301	30%
34	319	33%
36	336	35%

HYDRAULIC FEED TABLE

Machines equipped with a hydraulic feed table (VH models) have a pumping unit in the base. The system has an adjustable relief valve, which is factory preset at 400 p.s.i. This setting may be reduced to afford greater sensitivity for cutting soft or thin materials. Pressures may be lowered by turning the square nut located on the top right hand side of the reservoir. (See below graphic) The systems oil level must be checked periodically to assure the oil levels are maintained at the full level of the sight glass.



The feed table regulator will provide a smooth movement to the table. If the feed appears to be intermittent it is probably due to air in the system. This is normally exhausted by running the table in and out a few times.

WELDING INSTRUCTIONS

GENERAL DESCRIPTION

Note: Always wear eye protection when using this welder or grinder!

Your Dake vertical band saw is equipped with a "resistance-type" butt welder. The two clamp jaws of the welder hold the blade ends together. When the welding start knob is turned fully clockwise past the zero setting, electric current flows through the blade ends creating enough heat to soften and join them.

Note: This welder is suitable to weld
Metal blades 3 x 0.5 - 25 x 0.8mm
bi-metal blades 6 x 0.9 - 25 x 0.9mm

This welder should not be used for welding 2% and 3% tungsten-alloyed metal cutting blades or HSS blades.

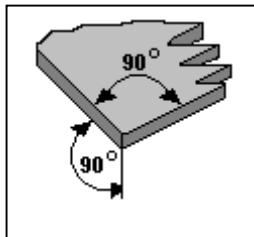
The approximate values for bi-metal blades are indicated in the matrix in the next column.

Note: * The weld current step and upsetting pressure step have to be increased with some saw manufactures. The saw blade has to be metallurgically clean and no tooth may enter into the welding seam.

BANDSAW mm	WELDING CURRENT step *)	UPSETTING PRESSURE step *)	UPSETTING WAY mm	ANNEALING COLOR	ANNEALING TIME SEC.
6 x 0.9	1 - 2	1	2.5	DARK RED	15
10 x 0.9	1 - 2	1	3.0	DARK RED	15
12 x 0.6	1 - 2	1	3.0	DARK RED	15
12 x 0.9	1 - 2	1	3.0	DARK RED	15
13 x 0.7	1 - 2	1 - 2	3.0	DARK RED	15
16 x 0.7	1 - 2	1 - 2	3.0	DARK RED	15
19 x 0.9	1 - 2	1 - 2	3.0	DARK RED	15
25 x 0.9	1 - 2	1 - 2	3.5	DARK RED	15

1. PREPARATION OF BLADE

Before welding the blade ends should be cleaned or rubbed with emery cloth on both sides of the blade to a length of 1", until they are metallurgically clean over the entire width.

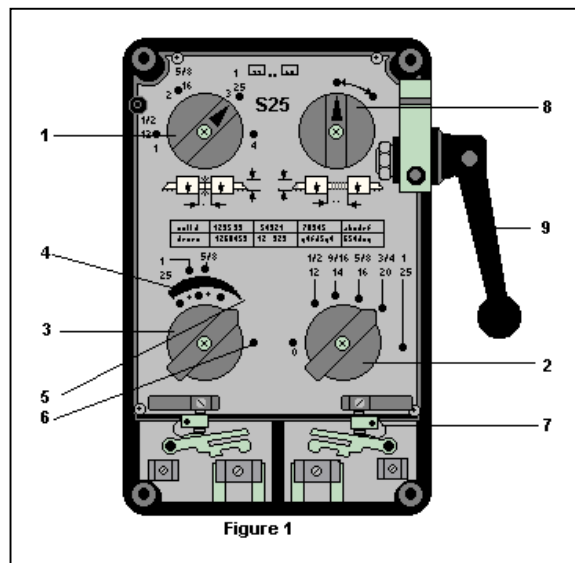


Cut the blade ends accurately and at right angles. (See graphic below) Check abutment against the stop for a cut at right angles. Proper welding can only be achieved if the blade ends are cut without a burr and at right angles. (Also see trouble shooting section)

2. ADJUSTMENT

The initial jaw gap and upset force must be adjusted and proportioned to the cross sectional area of the blade being welded. A greater jaw gap will allow a wider or thicker blade to reach proper welding temperature. A greater upset pressure produces the same unit pressure in welding a wider or thicker blade.

Set the welding current switch (1 figure 1), upsetting pressure switch (2 figure 1) and the upsetting way switch (3 figure 1) to the blade width to be welded. In view of the wide range of material qualities and thickness scale values are only guide values, which have been calculated for commercial blades of 0.65 mm thick. Trial welds should determine the correct settings for different steel qualities and thickness. Particularly thin blades (0.4 mm) should be welded with a short upsetting way, high current and weak upsetting pressure. *Example: Blade width is 1/2". Current switch is set to 1/2" (number 1) position. The upsetting pressure switch is set to 1/2" (number 1) position. The upsetting way switch is set to the 1/2" position.*



3. CLAMPING THE BLADE ENDS

Insert the blade ends in the clamping jaws so that the joint is exactly in the center of the jaws. To protect the jaws the blades should be inserted so the teeth are aligned at the front stops. Only blades without teeth should be aligned at the rear stops. Leave slack in the blade coil, the blade must be free so it can move easily during welding.

4. WELDING



Turn the upsetting switch (3 figure 1) past the position (5 figure 1) to welding (6 fig. 1) and lock it for about 3 seconds until the welding is completed. The current is switched off automatically.

Sparks spray out during welding, therefore stand at the side of the machine.

WARNING: BLADE WILL BE HOT!

5. ANNEALING



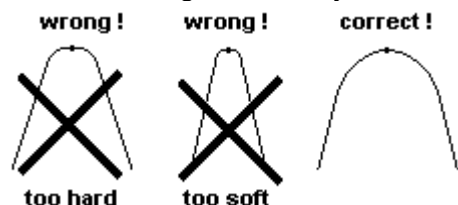
When the blade is heated in the butt welding process, the steel at the point of the weld "air hardens" and becomes brittle. The anneal on/off knob is used to anneal the weld by reheating it. This returns the blade close to its original condition.

After welding loosen the pressure clamps (7 fig. 1) and set the jaws to the wide annealing position by turning the upsetting pressure switch (2 fig. 1) counter clockwise. Re-clamp the blade so that the weld is in the center between the jaws. Operate the annealing switch (8 fig.1) until the weld becomes dark cherry red. This will take from 1 to 5 seconds depending on the blade width. Allow blade to cool until the blade returns to a dark color. Repeat this process at least three times. Some brittle alloys require more annealing than the standard carbon blades.

Note: It is difficult to weld and anneal bi-metal blades due to the make up of this type of blade. It will take some practice to successfully achieve a suitable weld.

WARNING: BLADE WILL BE HOT!

After annealing bend test your weld:



6. RE-FINISHING THE WELD

Welding burr (flash) can be removed by finishing with a grinding wheel above the welder. Grind in a longitudinal direction, other wise transverse fractures may occur. The proper finish of the blade after grinding, a tempered steel-blue coloring.

Note: Do not over grind, into the blade facing. Remove any burr on the back edge of the blade.

WELDER LAYOUT AND CONTROLS

7. WELDER MAINTENANCE

If the clamping areas of the jaws are dirty or deformed so they do not clamp evenly, good welds cannot be made. Any dirt or metallic debris must be removed from the jaws. The jaws should never be filed. It should only be polished with a proper cleaning material and if absolutely necessary polished with fine emery cloth held on a flat piece of bar stock. The uniformity of current flow and contact pressure can be checked by putting the welder in the annealing position and clamping a piece of blade stock with out a weld in the jaws. When the annealing switch is turned to the heating position the blade should heat uniformly over its entire width. (See fig. 2) If the heating is not uniform the clamping devices should be checked for dirt or misalignment.

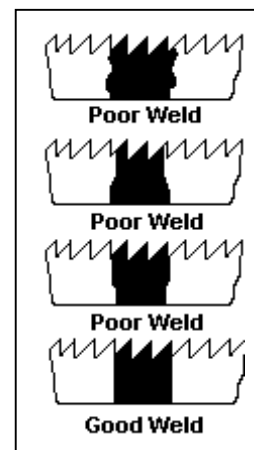


figure 2

8. POOR WELDS / TROUBLE SHOOTING

If the welded seam contains holes, the upsetting pressure should be increased, the welding current reduced or both settings changed. **We must emphasize once again that proper welds cannot be made if the blade ends are not cut square, and properly cleaned.** Welding of blades may take practice, do not be discouraged if your welds are not perfect at first.

Avoid overlapping when welding thin blades. If welder does not give suitable weld, check in coming voltage to the machine. If voltage is low, use next blade size setting. Example: 220 volt machine, incoming voltage is 208 volt, to weld 1/2" blade use 5/8" settings.

If incoming voltage is high reverse this procedure.

If incoming voltage is low, the welder transformer has taps that can be set to a 10% increase or decrease. **SHOCK HAZARD! ONLY A QUALIFIED ELECTRICIAN SHOULD ATTEMPT THIS. ALWAYS CONTACT DAKE BEFORE REMOVING THE WELDER.**

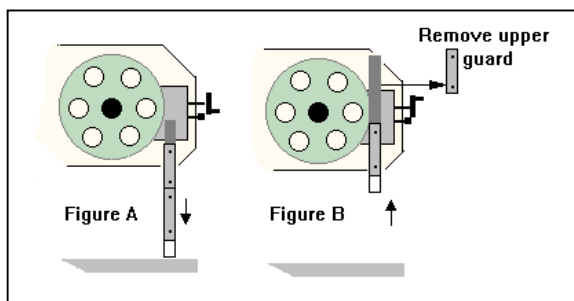
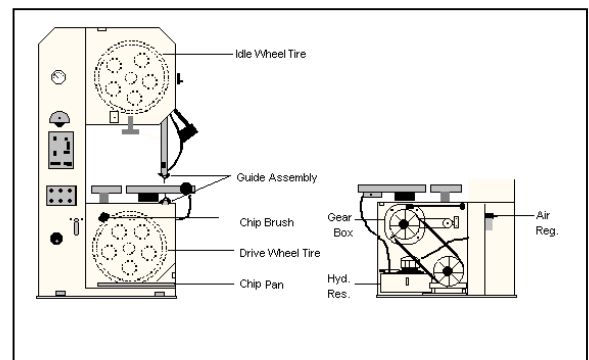
If the welder does not shut off, after the welding cycle, or will not start the welding cycle, a limit switch adjustment is needed.

THE WELDER MUST BE REMOVED FOR THIS ADJUSTMENT. SHOCK HAZARD! ALWAYS CONTACT DAKE BEFORE REMOVING THE WELDER OF MAKING INTERNAL ADJUSTMENTS. A QUALIFIED ELECTRICIAN MUST DO THESE ADJUSTMENT.

MACHINE MAINTENANCE

The maintenance of the machine is naturally based on the usage rather than a time element. The following is a recommendation based-on-average usage, and adjustment to the frequency can be made on an individual basis. See below graphic for locations.

- Chip Pan - clean - as required.
- Band wheel tires - remove embedded chips - weekly.
- Blade guide assemblies - clean - weekly.
- Gear box - drain and refill - yearly
- Monitor Hydraulic Reservoir.
- Drain water from water trap on air regulator weekly.

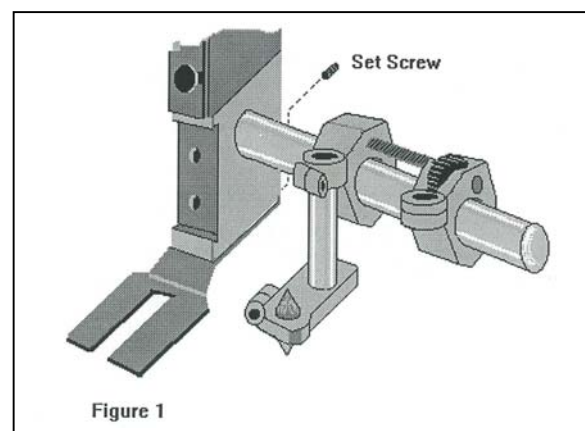


Note: If raising the guide post more than half way up from the table, and guide post cranks up hard, the upper blade guard must be removed. See figure A&B Blade will still be contained in the upper position.

USE OF STANDARD AND OPTIONAL ACCESSORIES

CIRCLE CUTTING (OPTIONAL) (figure 1) (Assembly part number 714801)

The device is used for cutting out perfectly round objects. Insert the round bar into the corresponding hole in the guide post, secure with set screw. Gross radius changes are made moving the cast assemblies on the round bar, fine adjustments are done with the thumb wheel.



RIP FENCE Standard all models (figure 2)

(Part number 714805 – Model 24/40)

(Part number 714869 – Model 16)

Used for cutting material in accurate straight lines. To attach, insert T-bolt provided in the T-slot in the front of the table. Slide into the desired position and tighten handle.

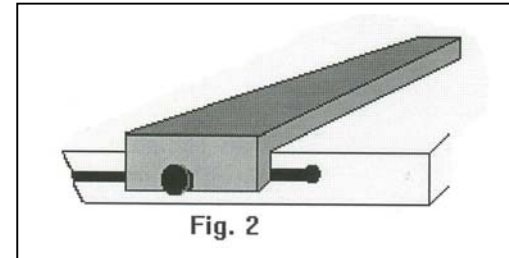


Fig. 2

PROFILE CUTTING ATTACHMENT Standard on VH-24 / VH-40 models (figure 3)

(Part number 714821)

This device is used for cutting irregular shapes with the use of the hydraulic table. Set the chain up as shown in figure 3. Set the material in the holder and guide with the hand wheel on the right side of the table. The excess chain should be coiled out of the way, while operating the machine.

Note: *When chain is not engaged in the rear sprocket the angle of cut is controlled by guiding the handles on the holder.*

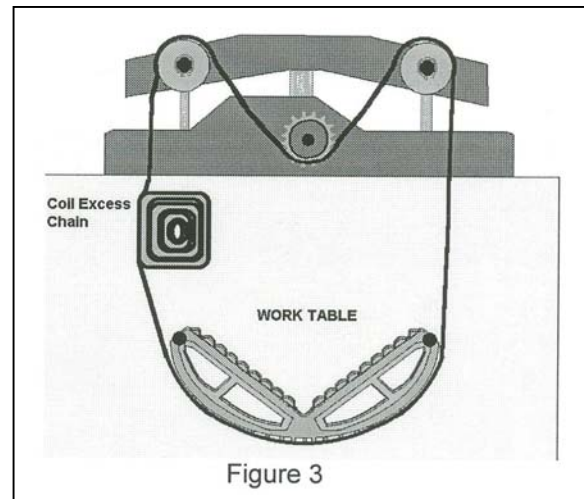


Figure 3

PROTRACTOR HEAD Standard on 24/40 models. Optional for 16 models (figure 4)

(Assembly Part number 714800 24/40 Models)

(Assembly Part number 75561 16 Models)

Used for cutting angles 90 degrees to 45 degrees in relation to the blade. It is fastened to the table by means of T-bolts. The L-shaped bar is used for additional support of the work.

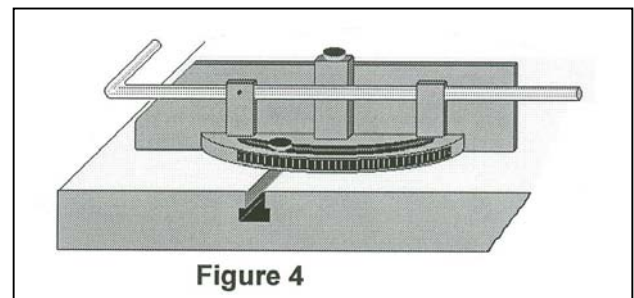
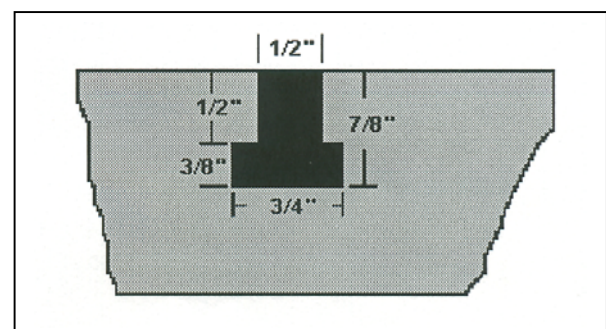


Figure 4

T-SLOTS

T-slots are machine into the work table for your use with fixturing or other accessories. The dimensions of these T-slots are furnished to the right.



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