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SERVICE TIPS AND GUIDELINES

OPTIMUM CAPABILITY: *Before You Start Cutting, You Should Consider Maximum Capability vs. Optimum Capability.* "Okay. This CobraSaw brochure says that the VH1014 has a 10" round capacity. Let's haul that 10" chunk of solid stainless over here and see if it'll cut it. " Which makes about as much sense as seeing if that fancy new Volvo station wagon will actually run 165 miles per hour. Let's talk about the terms "maximum capability" and "optimum capability."

For each blade size there is an optimum size of material that can be cut: a size that allows the saw to cut quickly and provide maximum blade life. This size is determined by the law of physics governing the relationship between the guide spacing and the beam stiffness of the blade. Anyone interested in the theoretical aspects will find them discussed in the section concerning "Beam Strength" further along. There's a formula for this, which includes things like blade deflection, modulus of elasticity, moment of inertia, load on blade, and spacing of guides. What it boils down to is that a one-inch blade is good for cutting material, say 4 to 5 inches wide. This is the "optimum capability". The optimum size range will give you the maximum blade life that you can expect from a particular size blade. When cutting in the optimum size range, operators with literally no skill and using poor quality blades will still achieve straight cuts. Working within the "optimum" performance range means that a lot of things can be substantially LESS than optimum and you will still receive high quality parts and high-speed production.

BEAM STRENGTH: To compute any "Beam Strength" difference simply cube the band width and determine the difference. In so doing you have to take into consideration the thickness change which is proportionate to the increase or decrease. Also you must consider the added pressure required to pull the wider chip due to a thicker blade.

Example: Compare a **Marvel NO8 Mark II** with a **1"** x .035 blade to **CobraSaw VH1820** with a **1¼"** x .042 blade:

1" :	1 x 1 x 1 :	100%
1¼":	5/4 x 5/4 x 5/4: 1.95 :	195%
Plus 0.007" added thickness:		20%
Total difference in beam strength:		215%

Same applies on other sizes using the ease formula.

½"	¾":	370%
¾"	1":	250%
1"	1¼":	215%
1¼"	1½":	184%

All of the above percentages are approximate and **D0 NOT** take into consideration the extra pressure required for added chip load.

So let's go back to our 10" saw and the plan to cut that chunk of solid stainless. The saw has a one-inch blade. You better find a real gnarly tooth blade to put on the saw. You'd also better have top quality, properly mixed coolant. You better have an operator who knows the difference between grinding and cutting. And, by the way, the saw needs to be in perfect running order. And you'd better bring your lunch, because this is going to take a while. The blade sets the limit as to the size of material that can be cut. These are the laws of physics, not the arbitrary rules of any manufacturer. The size and quality of the saw, of course, determines how well the blade is controlled, how much tension can be applied, and how well it is held in alignment as it cuts. So within the outside limits set by the blade dimensions, the design of the saw is extremely important. A high-quality one inch machine will easily out-perform a poor quality I¼" machine.

But even the best quality machine cannot cut efficiently if the blade is attempting to cut through a larger piece of material than the laws of physics permit. That is why different size saws are made. The optimum size gives you accurate parts, excellent blade life, and high production rates.

When your saw is being run in the "economic maximum" size range, you would expect to reduce the blade life and cutting speed by up to 50 percent. This may be a very sound operating range if not used too frequently. The "design maximum" is the absolute maximum size the saw will handle. A highly-skilled operator using high quality blades and operating under optimum conditions can expect these results: long cutting times and poor blade life. When driving one of those fancy new Volvo station wagons at 145 miles per hour you can expect the following results: long periods of time in jail and short life expectancy.

The same considerations must be made for the feed system. Many factors affect the band sawing operation, for example, if a very skilled operator were to control the machine, he might, even under ideal conditions, vary from the "Optimum Capability" closer to the "Design Maximum". Generally, you will want to select the saw and feed that will be the most productive for your application. Design maximum is defined as the largest size which the feed system is designed to support, and is as large as will fit into the saw. However, since large bars are frequently not straight and cause concentration of weight at one point, this is not a practical size for frequent use. Economic Maximum is defined as the largest size that the machine will handle easily. The Optimum is the size material that can be fed easily without regard to surface condition or straightness. As an analogy, if you have a half-ton truck at its Design Maximum, it can carry 4000 pounds or more. At its Economic Maximum it may carry 2000 pounds, and at its Optimum Capacity it will carry 1000 pounds. Overloaded vehicles, like saws, start hard and stop poorly.

Factors Affecting Blade Performance: The following factors should be taken into account when suggesting blade tooth pitches and tooth configurations:

- ***Tough material*** can tear the teeth out of the blade because the load on each tooth can exceed the shear strength of the tooth. A controlled feed rate and a raker set blade will help. Hard material will require heavy feed pressure per tooth for penetration. A coarse tooth blade will give better teeth performance. For fragile materials such as cast iron, a fine tooth blade works best.

- ***Work hardening material*** requires a very heavy feed pressure to prevent the blade from riding on top of the material and dulling the teeth. Again, a coarse hook tooth works the best.

- ***Abrasive material*** will appear to cut easily, but will dull the blade quickly. A blade that is too dull to cut tough material like stainless steel may cut mild steel satisfactorily. Proper cutting fluid for the material being cut will substantially increase blade life. Incorrect cutting fluid often results in crooked cuts or damaged blades.

- ***Blade Sharpness:*** It comes as no surprise that a dull blade will cause problems. But it is also true that a very sharp blade can be a source of difficulty - namely vibration.

- ***Vibration:*** Vibration occurs as follows: when a very sharp point enters the material, it immediately begins to dig itself into the material. At some point, it gets in too deep and "bounces" up. The next tooth does the same thing and the result, of course, is vibration. Excessive vibration will greatly reduce blade life and will also cause excessive wear on other parts of the saw. As the blade begins to dull just slightly, the points of the teeth stop digging in and the vibration stops. Now the teeth must be pushed into the material by the saw, permitting proper cutting pressure to be applied.

- **Blade Vibration:** A blade tooth causes blade vibration as it enters the material. A force is required to make the tooth penetrate the material. The resisting force causes the blade to rise up slightly at the time of contact. The raising and lowering of the blade causes vibration and if the vibration is allowed to build up, it will affect the blade fatigue life. This might cause the blade to break.
  To eliminate blade vibration and noise during a demo;

  - Increase the blade tension and/or the blade feed rate.
  - Change the blade speed.
  - Use a different tooth form.
  - Spacing the guides farther apart will allow the blade to vibrate freely in the cut without this vibration being transferred to the sawing machine.

  Blades with variable tooth spacing may be very helpful in eliminating vibration in some applications. Thus, the vibration will appear to stop, but will actually continue and blade control is reduced with this wider spacing.

- **Coolant:** *The Number One Factor Affecting Performance is Coolant!* One of the most common complaints from band saw owners is the in-famous "breaking blades" problem.

  Here's a Top Ten List of why blades break:

  - Number 10: Coolant.
  - Number 9: Really bad coolant.
  - Number 8: No coolant to speak of.
  - Number 7: Right coolant mixed wrong.
  - Number 6:Wrong coolant mixed right.
  - Number 5: Old coolant.
  - Number 4: Good coolant mixed too thin.
  - Number 3: Poor quality coolant.
  - Number 2: Poor quality coolant mixer! wrong.

  - And the Number 1 reason why blades break is: See Number 10.

  Really! We know that coolant quality has a direct effect on blade life. Simply by using high quality, properly mixed coolant saw owners can extend blade life substantially. Too many saws are operating with coolant designed (and mixed) for other machines. While a particular kind of coolant may work miracles in a turning center, it could be disastrous when used in a band saw.

  The role of "coolant" in this application is largely just that, to keep the tool and the material cool.

  Let's look at it in another way. In a lathe you have a fairly large tool removing fairly small amounts of material from the work piece. In effect, the tool is larger than the chip. The tool and the work piece are directly exposed to flood coolant. The chips that are being removed are not as big as the tool. And the instant the chip is removed it is flushed away from the cutting action. The role of "coolant" in this application is largely just that - to keep the tool and the material cool.

  In band saw cutting, the tool is very small. Only the very tip of the tooth does much work. The rest of the tooth is designed simply to hold the tip in place. The chip remains curled up in the blade during the cut. The chip being removed is larger than the tooth itself. After the chip is removed from the work piece we still have the problem of getting the chip out of the cut and off the saw blade. So we have a very small tool doing very heavy work. The tooth has to work BURIED in the work piece away from much benefit of flood coolant. The role of "coolant" in band saw cutting is as much lubrication as it is cooling. Note that not all cutting fluids are suitable for all materials.

Cutting fluid also prevents chip welding to either the blade or the parent material by chemical and/or thermal interface. When chips weld to the blade, the tooth form is changed resulting in cut deviation or lack of penetration. If the chips weld to the parent material, the usual result is a stripped blade.

Cutting fluid lubricates the blade and, more importantly, the chips as they pass up into the gullets of the blade. Cutting fluid tends to cool the blade and the material being cut by absorbing heat. Heat is always generated because "work" has occurred from the cutting action as well as from friction. Note that when wide material is being cut, the blade gets much hotter than when narrow material is cut. This happens even when both materials are cut at the same rate in square inches per minute. Cutting fluid is so important it cannot be over stressed. A good quality cutting fluid in a band saw is one of the most important factors in straight cutting.

If cutting fluid is unable to cool the blade teeth, They will soften and become dull. If the cutting fluid is distributed to only one side of the blade, the opposite side will become dull. This will cause the blade to cut toward the side that has the most cutting fluid and the cut will be crooked.

If we compare sawing to milling, we immediately see that in sawing there is much less room for the chip. The chip must lodge in a small place between the teeth and be carried smoothly out of the cut. In selecting a cutting fluid, pick one which is of high quality. Without proper cutting fluid one of two things will happen. First, the chip may become welded to the tooth. This will change the form of the tooth, which, in turn, will change the amount of force required for the blade to cut. The result is an unbalanced blade that will produce a crooked cut.

The second possibility is that the chip will wedge in the cut. Since the chip is work hardened and harder than the stock from which it came, the blade will cut into the stock beside the chip. Again, the result is a crooked cut and a dull blade.

In selecting a cutting fluid, pick one that is of high quality. Avoid thinly mixed soluble oils. Some of the new synthetic oils are highly satisfactory in difficult operations.

A general rule of thumb for cutting fluid mixture is a ratio of 5 parts water to 1 part cutting fluid. Consult with the manufacturer for specific mixture ratios.

If optimum cutting and blade life are the desired result, before selecting a cutting fluid and mixture for your saws, ask yourself the question, "Would I tap this material with this fluid?"

- **BLADE WELDS:** *Poor Quality Blades and Poor Quality Welds Make Big Difference in Performance.* There are many factors that contribute to decreased blade life. We will concentrate on poor quality blades and high quality blades with poor welds.

  Bargain basement bandsaw blades can save you hundreds of dollars, as long as you don't put them on your saw. Some cheap blades may turn out to work fine, but the problem is finding cheap blades that are consistently good. You might get a batch of cheap blades that are good but the next batch might not be worth a darn.
  Many manufacturers spend money to develop high quality, consistent and long lasting blades. Which blades to buy? Get the blade that works best for you. Try several manufacturers and several kinds of blades. Once you find a blade that works best for you, stick with it!

  Sometimes even the best blades just won't cut it because they fail too soon. If the blades consistently break in the weld you've got bad welds. Suppose you bought a set of tires for your eighteen wheeler and sixteen of them went flat in a week. Would you sell the truck? No, you would find tires that wouldn't go flat.

  While good manufacturing can create a high quality, consistent band saw blade, the next step is getting the blade to fit your machine. You may have the best blades in the world , but if they aren't welded right, you have problems.

Many suppliers weld blades in-house so they can eliminate the trouble of warehousing dozens of different blade lengths, sizes, thicknesses, tooth configurations, etc...

With the advent of much larger bandsaws in the last 5 years, some blade suppliers are still coming to terms with the welding requirements of 1-1/2", 2", 2- 5/8" and 3" blades. A 2" blade that is not welded properly is much less forgiving than a 3/4" that is not properly welded.

Here's how to tell if you having a problem with bad welds. If ten blades break and eight of them break in the weld, it's a bad weld. Might be a fine blade but a poor weld.

If the blade breaks within the first 5-10 hours, you might want to inspect the blade.

Are the teeth spaced correctly at the weld?
Is the finish grind smooth and even?
Is the grind cut too deep or not deep enough?
Does the blade show that it has been annealed unevenly?
Can you see cracks in the weld?
Is the back of the band smooth at the weld point or does the blade go "tick, tick, tick" as it goes around the saw? Is the gullet at the weld joint smooth, or is there a notch where a crack can begin?

A visual inspection may not detect all the flaws that are possible in a poorly welded blade, but obvious defects can be felt.

- **MAINTENANCE:** *Good Maintenance Habits Equals Optimum Performance!* Routine maintenance of your customer's bandsaw is vital to his production schedule.

  Suggest that he clean the machine off at the end of each shift.

  That means;

  - The control panel is wiped clean.
  - All scrap and drops are removed to recycling bins.
  - All chips are flushed into the chip pan.

  The truth is that a band saw is really tough to get clean once its been neglected for a month or so. The chips congeal in the coolant and create nearly solid blocks of steel that collect moisture, corrode, and cause havoc with switch settings, foul up the smooth operation of sliding parts and goof up everything that is possible to goof up. Chips get everywhere and an accumulation of chips can cause a disaster in down time and loss of productivity. Flush chips out at the end of every shift. Machines that are kept clean, have fewer problems. If they do have a problem, it is easier to get to the parts requiring and keep everything running smoothly. So the bottom line is: getting your saw clean might be a real hassle but keeping it clean is easy. Just flush it down every day so that the chips and debris can't accumulate in all the wrong places.

  Here's another tip that could save your customer Big Bucks: if he has to schedule "paid" service from one of our saw technicians, you should ask him to make sure that the saw is clean BEFORE the service technician gets there. Otherwise, he's liable to clean the machine himself (for about a bazillion dollars an hour) before he even gets down to fixing whatever is wrong with the machine. It is very likely your customer will discover that whatever is wrong with the saw is simply due to poor housekeeping and he will get a service bill that could have been avoided if he'd simply maintained the saw.

  The guides hold the blade in alignment for proper cutting. The blade slides between sets of precision ground bearings. Routine maintenance is much cheaper than buying a new set of guides. Guide maintenance is simple. Every time you change the blade, or at least once a

week, clean out all the chips that will accumulate there. The chips have a tendency to build up and cause all sorts of cutting problems. Make sure the roller guides on the caps are able to turn.
Guides that are packed with chips can cause the following problems:

- Poor blade life due to misaligned guides.
- Crooked cuts due to misaligned guides.
- Crooked cuts and poor blade life due to plugged coolant passages.
- Poor bearing guide life due to all of the above.

Do your customer a favor and ask him to keep the guides clean.

Once a month all of the bearing surfaces should get attention. A couple of drops of oil or grease in the pivot bearings will keep them in fine shape. Guide rails and ways should be cleaned and lubricated monthly to prevent rusting and galling of metal-to-metal surfaces. Wheel bearings should be greased monthly. The grease helps keep coolant out of the bearings. A couple or five pumps with a hand held grease gun once a month will do wonders for bearing life.

Change the oil filter every hundred hours of use or when contaminated. This helps keep the oil clean which in turn keeps the hydraulic valves motors and cylinders in top condition.

- **TROUBLE SHOOTING:** The most important part of any saw service representative's job is trouble shooting. A good methodical approach to the problem will usually result in a solution mutually pleasing to all concerned.

  The following is one such approach that seems to work very well:

  Get all the facts about the problem at hand as quickly as possible.

  - Determine if anything has changed since, or at the time the problem started: operator, machine application, speed, feed, coolant, material, blade spec. machine moved, repaired, or damaged: severe change of temperature, etc.
  - Check out any changes.
  - Check out complete operation. (Can't be much of a problem if you are not allowed to check over the situation personally!)
  - Check machine for proper condition and settings.
  - Check blades for alignment and welds.

  Once you have determined the problem, and then the cause, convince the customer, that what you found was the cause of his problem, rather than defective material supplied. Keep in mind that approximately 99% of all complaints received by CobraFab Industries Inc. are not the fault of our saws, but rather one or more of the items listed above.

SAW MACHINE FEED SYSTEMS: Customers will ask you what type of feed system the CobraSaw uses, this handy guide will explain the differences between the CobraSaw "TYPE B" system and competitive saws.

Feed systems differ in how they control feed force and the traverse rate:

- *FEED FORCE* is the force applied against a saw blade to make it penetrate the work piece.
- *TRAVERSE RATE* is the rate at which a saw machine allows the saw blade to travel without cutting resistance.

TYPE A:
FEED FORCE is the sole control, TRAVERSE RATE is either preset or not under operator control. This type is represented by a DOALL C-1216 and the FEED FORCE is controlled by a servo valve.

AFFECT ON APPLICATION:
Because the TRAVERSE RATE is preset, tooth selection can be critical when cutting interrupted or widely varying cross sections. A finer than normal pitch should be selected to avoid strippage when cutting structurals or tubing.

TYPE B:
FEED FORCE is the primary control, TRAVERSE RATE is controllable but the traverse valve is not accurate enough by itself. FEED FORCE is controlled either by a relief valve or a servo valve. TRAVERSE RATE is generally controlled by a flow control valve. This type is represented by HE&M 1200, Marvel I5a, Marvel 81a, **CobraSaw VH1820** and Peerless 1400.

AFFECT ON APPLICATION:
This type of system allows the most flexibility in tooth selection, however when cutting interrupted cross sections, the adjustment of the TRAVERSE RATE to avoid cutting too fast through thin sections is important to get good blade life. To maintain constant cutting rates with this system changes in feed force must be made on tougher grades of metals as the blade wears. Saws with a type B control are very efficient when cutting structurals or tubing.

TYPE C:
TRAVERSE RATE is the sole control, FEED FORCE is not under operator control and is usually very high. A very accurate flow control valve is the only means of controlling the cutting action. This type is represented by a Kasto PBA 460 AU.

AFFECT ON APPLICATION:
Machines with a type C control force the saw blade to cut at TRAVERSE RATES set by the operator, as the cutting rates increase so does the cutting resistance. When a saw blade cannot keep up with the TRAVERSE RATE damage can occur. Generally a coarser than normal pitch is recommended on type C machines. Type C machines are more efficient cutting solids than cutting structurals or tubing.

TYPE D:
TRAVERSE RATE is the primary control, however the FEED FORCE can be limited or reduced. TRAVERSE RATE is controlled by a very accurate flow control valve and FEED FORCE can be controlled through either a relief valve or servo valve. This type is represented by a Wells 1270 or Amada HA400.

AFFECT ON APPLICATION:
As with TYPE C machines, a coarser than normal pitch can increase cutting performance, however type D is not as critical because adjustments can be made to the FEED FORCE. This feed system can be adjusted to cut most types and shapes of metal.

Note. FEED FORCE can be produced by the weight of the saw head (Gravity Feed) or produced by applying hydraulic or pneumatic pressure to a cylinder to push the saw head down or forward (Positive Feed).