



Consulting Scientists - Safety Philosophy & Technology

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Auto-Deploying Vertical Band Saw Guard

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Fig. 1: Typical Meat-Cutting Vertical Band Saw

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Abstract

The origin of the band saw can be dated back to 1864. The safety of this 153 year old machine was first formalized in 1917 when the American Society of Mechanical Engineers first promulgated their safety standards for woodworking equipment. For the next 100 years, the safety of the vertical band saw has enjoyed a progress-free existence. Review of the ANSI standards indicate no significant change, in spite of the classical shortcomings that always subject workers to an unguarded saw blade during the band saw's idling, run-down, and stationary phases. During operation, most of the space between the table top and the upper guide rolls is filled with the workpiece. The portion of the blade above the guide rolls is required to be enclosed. This paper describes an invention that always guards the entire band saw blade unless cutting is called for. The guide rolls are constantly in contact with the table top until a foot control causes the guide roll to raise to a preset elevation exposing the band saw's "point-of-operation." A simple retrofit uses almost all of the original hardware and adds only a foot controlled "lifting/lowering" capability to the guide post or the attached blade guard. Examples of a retrofitted meat saw and a vertical wood/metal working band saw are explored.

Introduction

Vertical band saws may be dedicated to cutting meat, metal, wood, and plastics, whereas general purpose machines address multiple materials because of their variable speed and blade options. The primary features of all vertical band saws are almost identical, with variations that support their specialties. For example, sanitation standards usually require that meat saws have components of stainless steel that can be disassembled without the use of tools. They do not require tilting tables and welding/grinding accessories for their blades. Metal working band saws are typically low speed with band saw blades that use a large number of small teeth per inch that occasionally require continuous lubrication. Meat saw blades by contrast are much faster, have fewer teeth per inch, and use large aggressive contours that cut cows and humans with equal agility.

All of the standards, regulations, and references representing the safety of vertical band saws are harmonious in their requirements for the band saw guard, e.g., References 1 through 12.

A typical standard was promulgated in 1992 by the American National Standards Institute; ANSI Woodworking Machinery Safety Requirements, 5.4.1.1 Vertical Band Saw,

"5.4.1.1.3 Guarding of the saw blade

All portions of the saw blade, where possible, shall be enclosed or safeguarded except the working portion between the bottom of the upper guide and the top of the table. The guard providing protection in the guide post area above the upper guide shall guard the cutting edge of the saw blade on the front and open side of the machine.

E5.4.1.1.3 Guarding of the saw blade

Telescoping and Fixed-type guards between the upper wheel housing and the upper blade guide are used to satisfy the requirements of this clause. Because some band saws use a tilting table, a portion of the blade below the table may be impractical to fully guard but is considered relatively inaccessible, guarded by location."

Although there are no explicit safety regulations in OSHA for meat-cutting band saws, the safety of these machines is considered in other OSHA publications, e.g., Safeguarding Equipment and Protecting Employees from Amputations, OSHA 3170,02R 2007; pp.40-41, Exhibit 1.

Exhibit 1 Safeguarding and Other Controls for Meat-Cutting Band Saws

Primary safeguarding methods that you can use include the following:

1. Install a self-adjusting guard over the entire blade, except at the working portion, or point of operation of the blade. The guard must be adjustable to cover the unused portion of the blade above the meat during cutting operations.
2. Enclose the pulley mechanism and motor completely.

The following are some secondary safeguarding methods, work practices, and complementary equipment that may be used to supplement primary safeguarding or alone or in combination when primary safeguarding methods are not feasible:

3. Develop and implement safe work (operating) procedures for meat-cutting band saws to ensure that the guards are adequate and in place and that operators safely perform feeding methods.
4. Ensure that all operators receive adequate on-the-job training under the direct supervision of experienced operators until they can work safely on their own.
5. Use warning signs to alert employees of the hazard and safety instructions.
6. Install a brake on one or both wheels to prevent the saw blade from coasting after the machine is shut off.
7. Provide a pushing guard or fence to feed meat into the saw blade.
8. Instruct operators to use the pushing guard or fence to feed the saw, especially when cutting small pieces of meat.
9. Instruct operators to adjust the point of operation guard properly to fit the thickness of the meat.
10. Instruct operators to use only sharp meat-cutting blades and to tighten blades to the appropriate tension with the machine's tension control device.
11. Instruct operators not to wear gloves, jewelry, or loose-fitting clothing while operating a band saw and to secure long hair in a net or cap.
12. Prohibit operators from removing meat from the band saw while the saw blade is still moving.
13. Instruct operators to turn off and unplug band saws when not in use or when left unattended for any period of time.
14. Conduct periodic inspections of the saw operation to ensure compliance.
15. Perform servicing and maintenance under an energy control program in accordance with the CFR 1910.147, standard. You can avoid slicer lockout/tagout if the equipment is cord-and-plug connected equipment simply by having exclusive control over the attachment plug after you shut the band saw off and unplug it from the energy source.

Observe that item 1 in Exhibit 1 is similar to paragraph 5.4.1.1.3. Referring to item 11, it should be noted that gloves are allowed in other countries. Finally, items 12 and 13 are affected by the safety device proposed in this paper.

Because meat-cutting band saws are especially dangerous, two studies are cited to characterize their accident propensity:

1. National Institute for Occupational Safety and Health: "Occupational Injuries in the Meatpacking Industry, United States, 1978 - 1981," Pezaro, Leffingwell, and Mahaffey [Ref 13],

"For the years 1977-1981, the meatpacking industry (Standard Industrial Classification [SIC] 2011) had the third highest injury rate among all U.S. manufacturing industries. Data from the annual survey of the Bureau of Labor Statistics (BLS) indicate that the meatpacking industry, which employed an average of 161,700 workers during that period, had an average incidence rate for all injuries of 31.4/100 workers. This contrasts with an average of 12.2 injuries/100 workers in all manufacturing industries. In the same period, the average rate for lost workday cases in the meatpacking industry was 15.0/100 workers employed. This was also one of the highest among manufacturing industries, where the mean rate for lost workday cases was 5.2/100 workers."

"Ten specific occupations accounted for 83% of the injuries in the meatpacking industry, with meatcutters, laborers, material handlers, and miscellaneous operators accounting for 70%. The most frequently injured workers were meatcutters (40.8%) and laborers (20.3%)."

"The largest proportion of injuries involved knives and saws, meat products, and containers (Table 2). Knives and saws were associated with 22.6% of all injuries and meat products with 11.7%. Knives and saws caused 52% of the injuries to meatcutters and 22% to laborers."

2. California Department of Industrial Relations: "Work Injuries in the Meat Products Industry California, July 1969 - June 1970," Margaret R. O'Grady, Chief [Ref 14],

"In each of the past five years, meat packing and processing in California ranked as the State's most hazardous industry in terms of the number of lost-time injuries per 1,000 employees. The work injury rate in the industry has consistently remained more than four times the average for all manufacturing plants taken as a group."

Disabling injuries per 1,000 workers

<u>Year</u>	<u>All manufacturing</u>	<u>Meat products</u>
1966	36.3	149.0
1967	35.5	170.1
1968	36.3	152.6
1969	38.8	159.8
1970 ^a	38.2	160.3

^aRates for 1970 are preliminary and subject to revision

· "Accidents in which cutting department workers were caught in or between objects typically involved moving parts of machinery. The largest number of workers caught their hands or fingers in band saws while cutting up meat containing bones. Still other workers were caught in skinning machines and bone cutters."

· "DISABLING WORK INJURIES IN THE MEAT PRODUCTS INDUSTRY BY AGENCY INVOLVED, CALIFORNIA, JULY 1969-JUNE 1970

<u>Agency</u>	<u>Number of Injuries</u>	<u>Percent</u>
<u>Machines</u>	<u>176</u>	<u>6.5</u>
Meat saw	43	
Stuffer	20	
Meat slicer	18	
Wrapping machine	13	
Meat press	9	
Grinder	8	
Skinning machine	6	
Meat chopper	3	
Cutter	2	
Carton sealer	2	
Other or type not reported	52"	

OSHA assembled a series of accident scenarios associated with various types of band saws. The following subset of these accidents are associated with vertical band saws that were idling or running down at the time of the accidents. The proposed invention eliminates these mishaps:

- “1. At approximately 8:45 a.m. on March 25, 2010, Employee #1, a meat cutter, was assigned to cut meat pork butts. Employee #1 turned to her right to get pork butts from a container. When Employee #1 turned back to the left to place the pork butt on the sliding table to cut the meat, her left finger struck the saw blade. Employee #1 immediately shut off the meat band saw when she saw blood on her pinky finger and called coworkers for assistance. The paramedics were called, and Employee #1 was taken to High Desert Community Hospital and then transferred to Antelope Valley Hospital. Employee #1 was diagnosed with a severe laceration and fracture to the left pinky finger. Employer #1 was in the Hospital for two days. The bandsaw was guarded and appropriately adjusted to the cut of the meat. Employee #1 was employed by Stater Brothers, retail supermarket company, in San Bernardino, CA. Stater Brothers reported the accident on March 25.
2. On July 31, 2010, Employee #1 was working at a supermarket cutting pork ribs on a band saw (120/208 Volts AC). He adjusted the sliding guard to the height of meat being cut, his right hand slipped, and his thumb contacted the moving blade of band saw. Approximately 1 in. of the top portion of his thumb was amputated and was surgically reattached later at the hospital. Employee #1 was hospitalized for approximately two days. The band saw was inspected during inspection with management officials and found to be working alright and no safety violations were observed directly relating to this accident. However, a few other non-accident-related violations were observed for which the employer was cited.
3. At approximately 12:30 p.m. on September 10, 2010, Employee #1, a Meat Manager with Liborio Markets, was using a meat band saw (Hobart Corporation, Model Number 6801, Serial Number 27-1175-708, equipped with a bone-in blade) to cut frozen turkey drumsticks. When a customer called him, he turned off the saw with his right hand by pressing the control buttons on the machine. He removed his left hand from the meat and his left thumb contacted the flat side of the blade, which was still in motion. Employee #1 was hospitalized at California Hospital Medical Center for an avulsion type of injury to his left thumb, with nearly complete amputation. The saw guard was not properly adjusted and pusher plates were not used.
4. On February 15, 2011, an employee worked in the meat department was slicing meat into chunks about 1.5-in. in size. The Hobart band saw had a guard to cover the unused portion of the blade. That guard was not adjusted by the employee and the exposed portion of the blade was 11.5-in.
5. At 12:00 p.m. on May 17, 2012, Employee #1 was cutting chicken leg quarters using a vertical band meat saw. Employee #1 blacked out and fell over onto the bandsaws tabletop. The safety guard on the bandsaw was raised where approximately 9 inches of the blade was exposed. Employee #1's head and shoulders were on the saw table pressing against the moving saw blade. The blade cut through Employee #1's shoulder blade and continued on into his neck. Employee #1 was killed from his injuries.
6. At approximately 6:00 p.m. on August 10, 2013, an employee, a meat clerk was operating a meat-cutting band saw, Hobart Model Number 6801, Serial Number 31-1448-782, to thinly slice pork butt, 2-in. by 0.25-in. The employee was slicing the frozen meat when he tried to adjust the back guard, which controls the thickness of the cut. The employee turned off the band saw but did not lower the guard all the way to prevent inadvertent contact with the blade as it was still in motion. As the employee reached with his right hand to adjust the back guard, his left hand was on the sliding table. The sliding table moved toward the band saw blade creating two circumferential lacerations of the 4th and 5th fingers on the left-hand ultimately resulting in an amputation of the 4th finger. The employee was not hospitalized.
7. On February 15, 2011, Employee #1, a shipping processor, was cutting a 0.33-inch sheet of cardboard that was 5-ft by 10-ft, in half, using a DoAll Model 25 3620 band saw, Serial Number 264-92391. After cutting the cardboard in half, he turned off the machine and reached for one of the halves of the cardboard that appeared to be falling. As he did so, his left index finger contacted the saw blade that was still coasting to a stop. He sustained a severe laceration and fractured his finger. Employee #1 was hospitalized for surgical treatment of the finger and was released the next afternoon.
8. At 12:15 p.m. on October 24, 2012, Employee #1 was working as a machine operator for T & R Lumber, Inc. He was a fulltime, hourly employee. T & R Lumber, Inc. was a company that manufactured and distributed wooden nursery products, trellises, and stakes. Employee #1 was using a Model Number BBR-O Baker Products band resaw, with employer Identification Number 5B. He was feeding 1-inch by 6-inch (25-millimeter by 150-millimeter) pieces of wood that were cut and fed to the other end of the resaw. A coworker was on the receiving end of the machine, but he did not see the accident. Another coworker, who was the supervisor, was outside when the incident occurred. The resaw's exhaust was designed to collect sawdust, and it began to get clogged with sawdust. Employee #1 put his

hand over the exhaust, the moving blade pulled his gloved hand into the blade, resulting in the amputation of the middle and index fingers on his right hand. There were no witnesses to the incident. The cause of the accident was the lack of a guard on the blade resaw's blade. The employer reported the accident to the West Covina District office at 1:28 pm on October 24, 2012.

9. At about 2:45 p.m. on March 1, 2017, an employee turned on a band saw while he was looking away and he sliced his finger. The medical facility could not close up the wound, and the finger to the knuckle was removed.
10. On March 29, 2013, Employee #1 was locked out the Single Log Mill band saw and walked into the point of operation. The saw blades were still turning as it was winding down. As he stepped past the number 1 band saw, his left hand made contact with the saw blade. Employee #1's arm was lacerated and his fingers were amputated. Employee #1 was transported to an area hospital, where he was treated and remained hospitalized.

11. At approximately 10:45 a.m. on February 1, 2013, an employee was assisting a band saw operator by offloading corrugated materials, being cut to size, off the band saw table. The employee reached onto the band saw table to retrieve a piece of the material that had been cut, and came into contact with the spinning saw blade, sustaining a deep laceration, and partial amputation of the left thumb. Emergency services were contacted, and the employee was transported to U.C. Davis Medical Center and then transferred to California Pacific Medical Center for treatment. The employee underwent reconstructive surgery to repair the thumb and was hospitalized overnight."

Once again, observe that the eleven scenarios contain no accidents during normal meat cutting. The various blade contacts are eliminated by having the blade completely guarded using our invention.



Fig. 2: Retrofit Meat Saw With Foot Pedal Released—Workpiece height plus clearance = A; Clamp setting = A; Guard touches table top



Fig. 3: Retrofit Meat Saw with Depressed Foot Pedal—Pneumatic cylinder exposes blade height = A

Meat Cutting Vertical Band Saw Retrofit

A. Original Meat Saw

The original design of the Hobart Model 6614 meat saw shown in Fig. 1 uses a one-piece prismatic blade guard with an angle section; one leg is outboard and the other is in front of the blade teeth. The bottom of the blade guard is rigidly attached to a guide post with a manual lifting knob that allows the height of the guide post/blade guard to be “friction set” at a desired blade exposure. Within the confines of the guide post and blade guard, a blade guide (upper) is located that supports and stabilizes the band saw blade. There is a lower blade guide just below the table top.

B. Retrofit Meat Saw

A retrofit meat saw is depicted in Fig. 2 with the entire “point-of-operation” portion of the band saw blade enclosed. The following components have been retrofitted:

1. Retrofit Guide Post - The original guide post has been perforated with 1/4-inch diameter holes drilled on one-inch centers. The holes are not as important as the one-inch delineation which could be etched into the guide post.
2. Retrofit Clamp - The fabricated clamp illustrated in Fig. 2 may be held in place on the guide post using the

holes for an interference fit. Between holes, the clamp is secured by friction. The distance between the top of the clamp and the bottom of the guide post friction support defines the selected blade exposure (see Figs. 2 and 3).

3. Retrofit Knobs - Figure 4 illustrates two knobs on the front of the guide post friction support that have been substituted for the original hole plugs and hidden set screws. They are loosened to eliminate the original counterweight effect.
4. Retrofit Pneumatic Cylinder - A two-way pneumatic cylinder with a 1.25 inch I.D. is mounted directly above the blade guard shown in Fig. 3. A mounting bracket was constructed.
5. Retrofit Quick Disconnect Clevis - An Easy Adapt Clevis Rod End joins the cylinder rod to the top of the blade guard so the guard may be quickly removed without tools for cleaning (Fig. 6). The sheet metal on the bottom of the upper pulley cover required trimming to accommodate the clevis.
6. Retrofit Foot Valve - The yellow foot valve illustrated in Fig. 2 causes the guide post/blade guard to raise or lower respectively when the pedal is depressed or released. In its lowered position, the blade guard fully encloses the blade.



Fig. 4: Retrofit Controls: Push Stop/Pull Start, Two Friction Knobs, Clamp

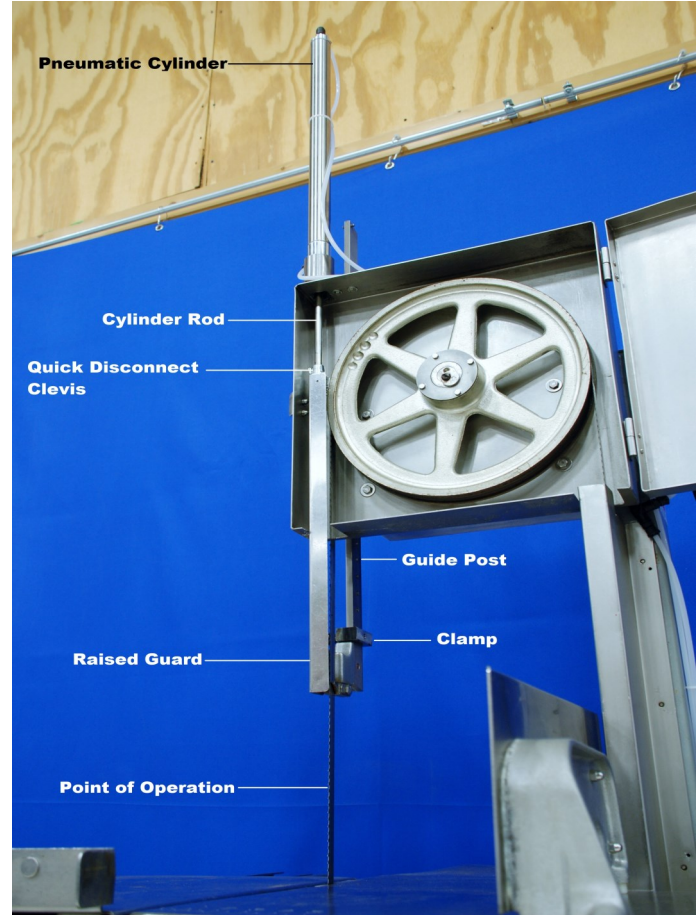


Fig. 5: The Linkage: Cylinder, Cylinder Rod, Quick Disconnect Clevis, L-Shaped Guard, Guide Post, Clamp, Blade



Fig. 6: Quick Disconnect Clevis



Fig. 7: Mode Selector Switch

7. Retrofit Selector Switch - Figures 3 and 7 reveal a mode selector switch mounted on top of the band saw column. Two of three operating modes are delineated with this control.

C. Auto-Guard Mode

The following steps are associated with band saw operation in the auto-guard mode:

- Step 1. Connect the foot valve to an air line with a minimum pressure of 25 psi.
- Step 2. Use a low clamping force on the guide post (loosen front knobs).
- Step 3. Set the mode selector switch to “Air Only” [See Fig. 7].
- Step 4. Preset the clamp elevation to provide the smallest usable blade exposure or “point-of-operation.”
- Step 5. The saw motor switch may be on or off (Pull to Start, Push to Stop).
- Step 6. Step on foot valve pedal to raise the guard and expose the “point-of- operation;” see Fig.3.
- Step 7. Release the foot valve pedal to enclose the band saw blade entirely “when finished with a cut” or “between cuts;” see Fig. 2.

By automatically returning the blade guard to its lowered position, when the meat saw is not in use the stationary or operating band saw blade is isolated from contact. There may be reasons for exposing a stationary blade, e.g., cleaning the blade neighborhood, or aligning a workpiece. A full stroke of the band saw guard was measured at 15.5 inches. The retrofit did not compromise the original maximum “point-of-operation.” Timing test results are displayed in Table 1.

Table 1 Timing Test Results (Low Guide Post Friction)

<u>Physical Property</u>	<u>Total Elapsed Time</u>
Motor Start Up	1.5 sec
Motor Shut Down	13.85 sec
40 psi: Full Rising Guard	1.95 sec
40 psi: Full Closing Guard	1.19 sec
25 psi: Full Rising Guard	2.72 sec
25 psi: Full Closing Guard	1.43 sec

Observe that without a brake the blade run-down is quite long, 13.85 sec. At 40 psi it takes approximately one second to enclose the fully exposed blade; this is a quick response time. Because the internal diameter of the pneumatic cylinder is 1.25 inches, the downward compression force on the guide post/blade guard assembly cannot exceed 49.09 lb. at 40 psi or 30.68 lb. at 25 psi.

D. Auto-Guard Plus Electric Motor Control Mode

In addition to fully enclosing the band saw blade when an operator leaves the band saw, there may be reasons for also terminating powered operation. For example, protection against blade fracture, sound abatement, energy conservation, and conformance with general workplace rules.

A retrofit pressure activated electric switch was incorporated into the control system to

- Turn on the saw motor whenever the foot valve pedal is depressed
- and
- Shut off the saw motor whenever the foot valve pedal is released.

The mode selector switch was labeled “Air Only” for the independent operation of the guard; it was labeled “Air + Electric” for the simultaneous operation of guard deployment and saw motor control (Fig. 7). During the long rundown of the band saw blade (14 sec.), the blade is completely enclosed. Our exemplar meat saw was not equipped with a brake. A brake can stop a blade in a fraction of a second.

E. Original Operating Mode

In the face of maintenance breakdowns in the new safety systems (e.g. air compressor failure), the entire retrofit menagerie of devices may easily be bypassed. The following four steps restore the original operating protocol:

Step 1. Disconnect the air supply.

Step 2. Place the mode selector switch to “Air Only.”

Step 3. In accordance with the original operating instructions (Hobart, Slide Bar Adjustment, Form 34527 Rev. B, August 2011), counter balance the guide post/blade guard using the two retrofit handles on the front of guide post friction support, Fig. 4, together with the two set screws on the side.

Step 4. Tuck the footswitch underneath the meat saw frame out of harm’s way.

The complete conversion back to the original operating mode takes five seconds.

Once again, the guard elevation is hand-set using the original lifting knob; it will stay in position because of the original friction counterbalance mechanism. It should be

noted that Step 3 can be ignored by setting the blade guard elevation manually and using either of the two retrofit knobs to tighten the internal friction clamps to stabilize the guard. This provides the improved safety found in wood or metal working band saws, where impact with the guard cannot change its elevation.



Fig. 8: Rockwell 20” Metal-Wood Vertical Band Saw

Metal-Wood Vertical Band Saw—Retrofit

A. Original Metal-Wood Band Saw

The Rockwell 20" Metal-Wood Variable Speed Band Saw shown in Fig. 8 was retrofitted with a pneumatic/electric guard system. The band saw, Model No. 28-345, was manufactured in 1980 and provided a speed range from 4500 to 50 ft/min. This general purpose machine accommodates a large variety of band saw blades that are protected with a telescoping blade guard.

B. Retrofit Metal-Wood Band Saw

Once again, a proposed foot controlled safety system raises and lowers the blade guard. This was accomplished with the following retrofit components:

1. Retrofit Pneumatic Cylinder - In contrast to the meat saw, a pneumatic cylinder was attached to the guide post



Fig. 9: Two-Way Pneumatic Cylinder

instead of the telescoping guard. Because the guide post and the blade guard are rigidly fastened at their lower ends, lifting the guide post raises the guard. Figure 9 depicts the two-way cylinder.

2. Retrofit Clamp - To control the elevation of the guard, a clamp was fabricated to grip the guide post as illustrated in Fig. 10. The vertical travel of the guide post is limited when the clamp contacts the bottom of the guide post bracket as depicted in Fig. 11.
3. Retrofit Cylinder Rod/Guide Post Fastener - Figure 12 illustrates the lifting linkage used to elevate the solid square guide post. An extension rod is screwed into the top of the guide post, which in turn is screwed into a fastener that joins it to the cylinder rod. The entire guide post bracket is shown in contact with the retrofit clamp.
4. Retrofit Foot Switch - Figure 8 portrays an orange electric foot switch that controls the raising (depress pedal) and lowering (release pedal) of the blade guard.
5. Retrofit Solenoid Valve -To control the pneumatic cylinder, the foot switch sends an electric signal to a solenoid valve that appropriately directs air to the cylinder. Because the meat saw's guard control system was entirely pneumatic it did not use a solenoid valve; only the foot valve was required to control the cylinder. The solenoid valve, which is shown in Fig. 13, has the capability of adjusting the air flow. This is an unnecessary feature for a production machine.

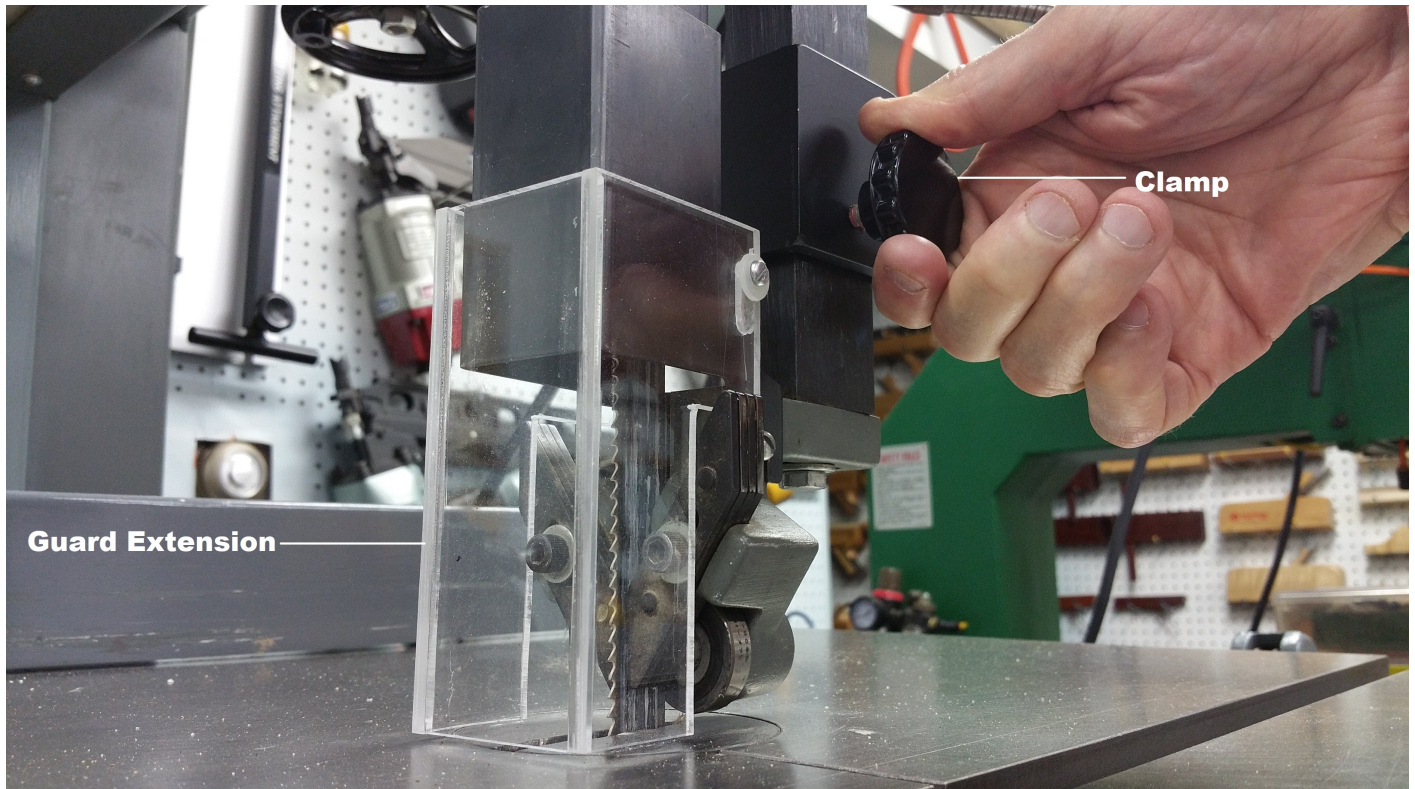


Fig. 10: Retrofit Clamp on Guide Post; Retrofit Transparent Guard Extension

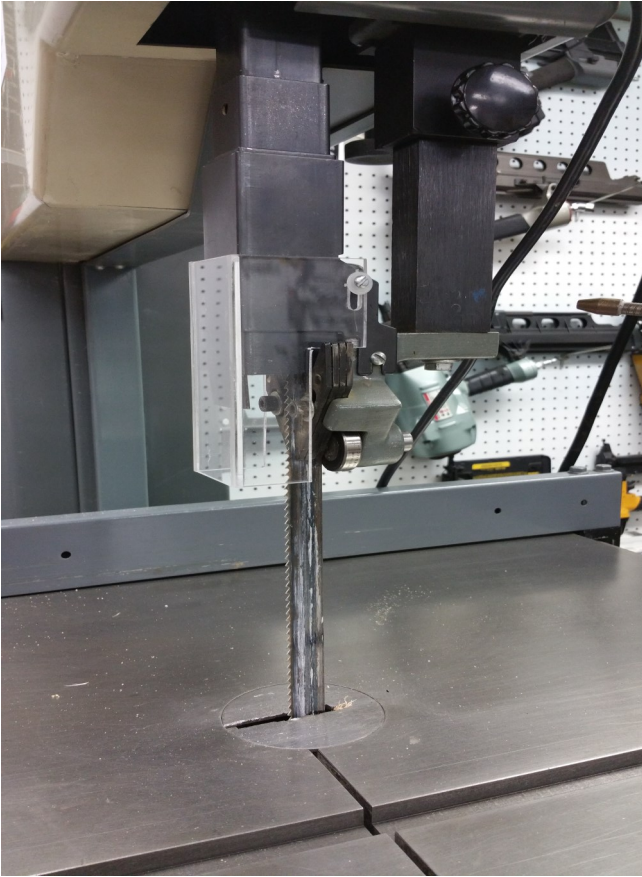


Fig. 11: Contact Between the Clamp and the Bottom of the Guide Post Support Bracket

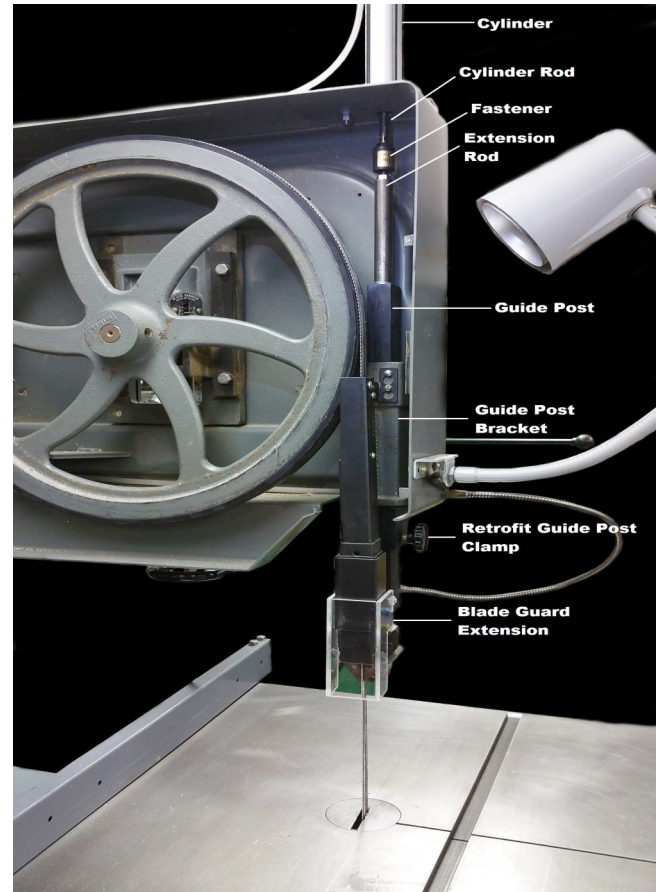


Fig. 12: The Linkage: Cylinder, Cylinder Rod, Fastener, Extension Rod, Guide Post, Guide Post Bracket, and Retrofit Clamp

6. Retrofit Guard Extension -The original guard extension was opaque. The retrofit transparent blade guard extension depicted in Fig. 10 improved the ability to cut along a scribed line on the workpiece.

C. Retrofit Mode

Figure 14 illustrates the fully guarded band saw blade when the foot switch pedal is not depressed. When the operator steps on the pedal as depicted in Fig. 15, the guard is raised to an elevation defined by the clamp position. This exposes the “point-of-operation” so a workpiece can be cut. Walking away from the band saw leaves the blade fully protected when the machine is either stationary or in motion.



Fig. 13: Solenoid Valve



Fig. 14: Fully Guarded Band Saw Blade, Pedal is not Depressed



Fig. 15: Exposed Band Saw Blade for Cutting

D. Original Operating Mode

For any purpose including maintenance, it may become desirable to bypass the retrofit devices. The circumvention can be accomplished in two steps in less than 15 seconds,

Step 1: Disconnect the air supply to the band saw.

Step 2: Lower the retrofit clamp.

Step 3: Move the foot switch out of harm's way.

Having recaptured the original control system, use only the original guide post clamp to set the blade exposure, Fig. 16.

Commentary—General: Vertical Band Saws

- A. Retrofitting any vertical band saw is completely straight forward.
- B. Retrofit vertical band saws use all the original major components. The retrofit components are primarily the pneumatic cylinder, foot valve, small clamp, and tubing.
- C. Raising and lowering the guide post/blade guard can be accomplished with physical devices that are mechanical, electrical, pneumatic, magnetic, and hydraulic. All manner of gravity devices, springs, solenoids, treadle linkages, and electrical paraphernalia may be summoned into service.

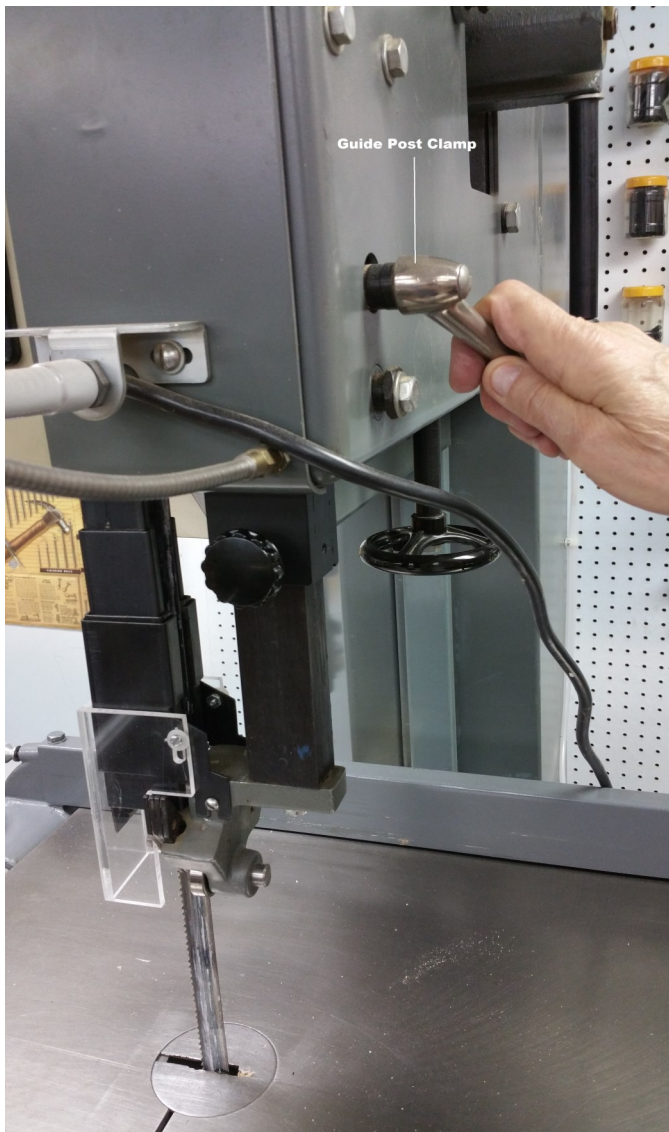


Fig. 16: Original Guide Post Clamp

- D. Because the guide post and the blade guard are rigidly connected, the pneumatic lift cylinder can be affixed to either component.
- E. Additional operational training for the retrofit band saw is de minimis. After the foot valve pedal is depressed, the original and retrofit band saws operate identically. If one forgets to depress the pedal, the saw blade remains safely enclosed and cutting cannot proceed.
- F. The guide post may be marked to reveal the exact elevation of the guard. When the guide post and blade guard are fully lowered to the table top, the distance between the top of the clamp and the bottom of the guide post support or guide post bracket is exactly the same as the point-of-operation or fully exposed band saw blade, see Figs. 2 and 3. The guide post should be scribed on one-inch centers or delineated with drill holes such as shown in Figure 3.

- G. Imprinting a scale on the gauge plate shown in Figure 1 enables the operator to measure the height of the work product and set the retrofit clamp accordingly. For example, if the height of the work piece is measured at 3-1/2 inches the retrofit clamp would be set at 3-1/2 plus 1/4 inch below the guide post support when the guide post is sitting on the table top.
- H. The blade guard elevation may be adjusted and set whenever the foot valve is released. It is no longer necessary to wait until the machine is motionless because the blade is covered.
- I. The retrofit band saw eliminates the need to manually lift and lower the blade guard and it's attached guide post. Only the small clamp is manually manipulated and set; the pneumatic cylinder does all the "heavy lifting."
- J. The disadvantages of long rundown times on unpowered saws are eliminated by the retrofit band saw design. It is a reasonably foreseeable misuse that some operators will clean the table or adjust the guard height while the machine is running down.
- K. The retrofit band saws have blade guards which "fail to safety". Pneumatic failure will be followed by a deployment of the blade guards, safely shielding the blade and alerting the operator to a problem.

Commentary—Meat Saws

- A. Disassembling the retrofit meat saw for cleaning is almost identical to the original saw. Disengaging the quick disconnect clevis takes three seconds.
- B. All hardware that was added to the meat saw conformed to the NSF Sanitation Standards, including the pneumatic cylinder which was equipped with a cylinder rod wiper. Note that the cylinder rod is located in a splash zone because of its proximity to the saw blade.
- C. It is possible to add an electric on and off control capability to the pneumatic foot control. This would cause a guard to open up and the motor to be turned on each time the foot pedal is depressed. Further, releasing the foot pedal causes the guard to deploy and the electric motor to be shut off. We have included this capability in our retrofit meat saw, which incorporates a selector switch to distinguish between an air only operation and an air plus electric operation.

It may not be desirable to turn an electric motor on and off frequently.

Accidental depression of the foot control in the air plus electric mode will result in both the removal of the guard and the start up of the saw blade. Because a workman may be suddenly exposed to a hazard, it may be desirable to substitute a guarded foot switch. [Ref. 15-17]

- D. Pushing the Hobart electric on/off switch will terminate powered operation in any operational mode.

- E. Either retrofit knob on the guide post friction support will stabilize the guard elevation in the face of exterior trauma or any wedging effect arising from contact with the meat product. Most metal or woodworking band saws provide this capability; Hobart does not.
- F. Compressed air supporting the food processing industries in North America must be contaminant-free to ensure the protection of food products. Three types of food-industry compressed air systems are presented in Ref. 18 by Air Technology Group Hitachi America.
- G. The cost of retrofitting a meat saw are modest compared to the original cost of the saw. For the Hobart Model 6614 the retrofit hardware components cost,

Pneumatic Cylinder	\$79.00
Foot Valve	\$65.00
Mode Selector Switch	\$74.00
Two Hand Knobs	\$30.00
Easy Adapt Clevis Rod Ends	\$10.00
Plastic Tubing	<u>\$ 6.00</u>
Total	\$264.00

The one-off cost of drilling out the guide post, mounting the pneumatic cylinder, fabricating the clamp, and rewiring the control circuit was estimated at \$100.00. The total retrofit cost, \$364.00, can be compared to the cost of a new meat saw, \$12,935 (MSRP) (2.8 %).

- H. The concept of an auto-deploying vertical meat saw guard has been used for years in Australia. They retrofitted their blade guard mechanism in 2012 with a “pneumatically operated guard that requires foot pedal activation to allow access to the saw.”
- I. The Hobart Meat Saw, Model 6614, is characterized in three documents:
- Hobart Specifications, F39920-6614, Ref. 19
 - Hobart Instructions, ML-134096, Ref. 20
 - Hobart Catalog of Replacement Parts, ML-134050, Ref. 21

Commentary—Wood/Metal Vertical Saws

- A. The Rockwell Instruction Manual for the No. 28-345 Band Saw has a Part No. 426-05-651-5002, Ref. 22.
- B. For the Rockwell Band Saw No. 28-345 the retrofit hardware components costs,

1-1/8” Bore Cylinder 8” Stroke	\$122.00
Foot Switch	\$175.00
Rod Alignment Coupler	\$ 30.00
2-1/2”x1/4” Flat Stock	\$ 20.00

5 feet of 1/8” Tubing	\$ 3.00
5 feet Corrugated Sleeving	\$ 13.00
Flow Control	\$153.00
Round Fluted Rim Knob	\$ 3.00
Solenoid Valve	\$131.00
Coils	<u>\$ 55.00</u>
Total	\$705.00

- C. The operation of the retrofitted vertical band saws may be viewed on Youtube; <https://www.youtube.com/watch?v=xuk918ysz8w>.

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