Metal Shop Documentation

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[**Beverly Shears**](#_71zwhka0k3mt) **4**

[**Sheet Metal Brake**](#_rmbo99z76vs5) **5**

[Author:](#_76efw2aq1i2e) 5

[Name of Machine:](#_zcgvob8n64s3) 5

[Link to Manufacturer’s Manual:](#_uq1li9ljbxl9) 5

[3 Sentence Description (Explain Like I'm 5):](#_pl2fwsuz9nws) 5

[Physical Limitations:](#_cnojrkco49lo) 5

[Materials:](#_dq48it9yq1v8) 5

[PPE:](#_tm9pe9pwj2k9) 6

[E-Stops and Safety Procedures:](#_nchg37hxyppd) 6

[Project Ideas:](#_k3yqmacmuh7s) 6

[Startup Procedure:](#_7tm3e4nlnrcp) 6

[Operation of Equipment](#_3v6fi4ffy3pk) 7

[Recommended Cleanup:](#_1krlmuhjg1lo) 7

[Basic Troubleshooting:](#_6d04zpgiurrw) 7

[Advanced TroubleShooting:](#_2wdvt9q4fqle) 8

[References:](#_tu6x1wo7xeiu) 8

[**Rivet Gun**](#_da23tj2puzdh) **8**

[Author:](#_cqmhx1g4l9av) 8

[**Bench Grinder**](#_2423r216e4s6) **9**

[Author:](#_5i3ob7o7fmkp) 9

[Name of Machine:](#_mabp4isxluxs) 9

[Link to Manufacturer's Manual:](#_vzusgqtzyen2) 9

[3 Sentence Description (Explain Like I'm 5):](#_mp0gkblqnwkr) 9

[Materials:](#_pbcemh3jrd71) 9

[PPE:](#_37o17wkcdvzz) 9

[E-Stops and Safety Procedures:](#_vc6gettaq1x6) 10

[Project Ideas (with links to content):](#_m46bmcbqxe45) 10

[Startup Procedure:](#_pr1uin4kpcnc) 10

[Operation of Equipment:](#_uf1sxouhmj08) 10

[Recommended Clean-Up:](#_jpgtvl4eumwm) 11

[Basic Troubleshooting:](#_kxjridcq78z) 11

[Advanced Troubleshooting/Maintenance:](#_1gqau7xbeg3h) 11

[References:](#_7t792mmolauo) 11

[**Tin Snips**](#_x5kg0av99dk5) **12**

[Author:](#_3qaf5946md6s) 12

[Name of Machine](#_fqqclpltphup) 12

[3 Sentence Description](#_f433odfpqkcb) 12

[Materials](#_d0xh97ptgawz) 12

[PPE](#_nksn06ek76ei) 12

[Operation of Equipment](#_z922sah3pb1s) 13

[References](#_plv8bgt0ucq) 13

[**Nibbler**](#_ja2lzwlqearh) **13**

[Author:](#_eymbg3bl4bon) 13

[Name of Machine:](#_38eqwgtfbewm) 13

[Link to Manufacturer’s Manual:](#_bzc2uu178xu) 13

[3 Sentence Description (Explain Like I'm 5):](#_ta65sin7pptn) 14

[Physical Limitations:](#_helgndqh252j) 14

[Materials:](#_t0ifsxi98kp2) 14

[PPE:](#_pqu443669g5p) 14

[E-Stops and Safety Procedures:](#_v2f3wxmpcy8d) 14

[Project Ideas (with links to content):](#_3rbtzimp0jk) 15

[Startup Procedure:](#_i883015inyl) 15

[Operation of Equipment:](#_ccjzihs7ktkf) 15

[Recommended Clean-Up:](#_vwlx37lkx43b) 16

[Basic Troubleshooting:](#_y64scx5uehr) 16

[Advanced Troubleshooting/Maintenance:](#_ixhzne9lvjif) 16

[References:](#_661hkq61319r) 16

[**Spot Welder**](#_6vgxyanrfy4k) **17**

[Author:](#_gqtkmcc2t5r8) 17

[Name of Machine:](#_ua4y7ilokbuf) 17

[Manual:](#_hnyztuc66mtl) 17

[Description:](#_uutaid8gonau) 17

[Physical Limitations:](#_p5iv0tw3kwb3) 17

[Materials:](#_6su660fg5v3w) 17

[PPE:](#_fiev3eqmpvrd) 17

[E-Stops and Safety Procedures:](#_5y9noh5psjqb) 18

[Use Procedure:](#_gm9ynjpwdxte) 18

[Basic Troubleshooting:](#_1d7pj3h65liu) 18

[Advanced Troubleshooting:](#_ceb1tcz7kbj5) 18

[Resources:](#_g0u0b0z56rbx) 18

[**Vectrax Mill**](#_qxhcm8851i1z) **19**

[Author:](#_fkeuclrgfpit) 19

[Name of Machine:](#_iulujtg7du23) 19

[Link to Manufacturer’s Manual:](#_ihxkrnifyfq1) 19

[3 Sentence Description:](#_yu5au9wa6ht6) 19

[Physical Limitations:](#_ap81394mmjmn) 19

[Materials:](#_c54txif22s9q) 20

[PPE:](#_pjthpc4n80l6) 20

[E-Stops and Safety Procedures:](#_q8dwxr9frb8d) 20

[Startup Procedure:](#_frnharm95rzn) 20

[Operation:](#_hf76uvzbjns6) 20

[Recommended Clean-Up:](#_eqvprmz46lrw) 20

[References:](#_sez91cfcnrsy) 20

[**Harrison M300 Lathe**](#_hpccce98kkcp) **21**

[Author:](#_ft96fl95r5xi) 21

[Name of Machine:](#_4efc3bcafvz1) 21

[Link to Manufacturer’s Manual:](#_7l0xwqnwry05) 21

[3 Sentence Description:](#_5f3xbakxfurm) 21

[Physical Limitations:](#_fa0zk41dsjxa) 21

[Materials:](#_9uj01meostj0) 21

[PPE:](#_ukko729jg6gk) 22

[E-Stops and Safety Procedures:](#_v66be2y1y4no) 22

[Startup Procedure:](#_9xvntzqobf2z) 22

[Operation:](#_q0ig2vywjhdj) 22

[Recommended Clean-Up:](#_s10p5d6jgdso) 22

[References:](#_kvf3jcjwj5l7) 22

[**DoAll Horizontal Bandsaw**](#_4n9hjpmf0bwp) **23**

[Author:](#_h5o8mqoikf3p) 23

[Name of Machine:](#_j9viqnl7oo2p) 23

[Link to Manufacturer’s Manual:](#_dfuxyofxp8ku) 23

[3 Sentence Description (Explain Like I'm 5):](#_3tyok2lxxf2p) 23

[Physical Limitations:](#_rpjmvtnrjyi) 23

[Materials:](#_e5zam6aiwbf3) 23

[PPE:](#_8qmchlhf9m9v) 24

[E-Stops and Safety Procedures:](#_hrtf6gev9xjs) 24

[Project Ideas (with links to content)](#_pgag07l4oybu) 24

[Startup Procedure:](#_lk474ke8ayqz) 24

[Operation of Equipment:](#_af7pge8tbaj4) 25

[Recommended Clean-Up:](#_riydj5pz5mb4) 25

[Basic Troubleshooting:](#_34j0fw1fjp2f) 26

[Advanced Troubleshooting/Maintenance:](#_8ixa5v1su80r) 26

[References:](#_pgkwqplebjge) 27

[**Angle Grinder**](#_b4xs12sk0dlv) **27**

[Author:](#_4ozahjviveal) 27

[Name of Machine:](#_s16otkrs7kcq) 27

[Link to Manufacturer’s Manual:](#_f5gbfrnvkik8) 27

[3 Sentence Description (Explain Like I'm 5):](#_tvr3kdqtu8n9) 28

[Materials:](#_rf2l9qptffv1) 28

[PPE:](#_226heyufi3fy) 28

[E-Stops and Safety Procedures:](#_ht10dgondwai) 28

[Project Ideas (with links to content):](#_n6x2x9fn59dl) 28

[Startup Procedure:](#_ob73vi9piuin) 29

[Operation of Equipment:](#_743bydwe9dim) 29

[Basic Troubleshooting:](#_1fob1jr658tb) 29

[Advanced Troubleshooting/Maintenance:](#_a0gs444ptvu) 29

[References:](#_qjp8n9ffsbuw) 29

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# Beverly Shears

Author: None

# Sheet Metal Brake

## Author:

Walker Poole

## Name of Machine:

Sheet Metal Brake (Baileigh BB-4816M)

## Link to Manufacturer’s Manual:

https://www.baileigh.com/media/uploads/manuals/BB-4816M\_6-2016.pdf

## 3 Sentence Description (Explain Like I'm 5):

The sheet metal brake is a device for bending sheet metal. It uses strong magnetic force to clamp the metal down, and long lever arms are rotated upwards to bend the metal to a desired angle. This tool is great for bending a piece of metal into a box.

## Physical Limitations:

* Not advised to attempt bending metal thicker than 1/16”
* Maximum width of bending: 4’
* Bend angles between 0-180 degrees
* Requires 220V inlet

## Materials:

* Sheet Metal. Works best with Aluminum or a mid grade steel

## PPE:

Safety glasses and closed-toed shoes are required in the metal room. Long pants are recommended in case the metal being bent breaks and creates sharp debris

## E-Stops and Safety Procedures:

There is a power switch as well as two buttons for turning the machine on and off respectively. If you want to stop using the machine, press the red off button on the front of the machine, then flip the red switch to the off position to fully power off the device. In terms of safety, make sure you fingers are not near the magnetic pieces during clamping, or the rotating joint during bending, as both present significant pinching hazards.

## Project Ideas:

* Create a box out of metal
  + Here is a video explaining the method <https://www.youtube.com/watch?v=Ytczt75-tqw>
  + Feel free to use the waterjet to cut the metal as opposed to the bandsaw for a more precise shape
* Create a hexagon base to a table
  + Step by step documentation is here <https://gordsgarage.wordpress.com/tag/bending-brake/>
  + Try thinking of other shapes you can bend with the same method

## Startup Procedure:

* Make sure the machine is plugged in. Turn on the power by flipping the red rocker on the front of the machine to the on position.
* Ensure that the brake surface is free of any unwanted metallic bits or contaminants that you wouldn’t want clamped/magnetized. They can safely be put on the mat behind the brake

## Operation of Equipment

* Once the machine is turned on, use whatever magnetic clamps would fit the use of your part to secure the metal (options shown below), trying to maximize the amount of area that is clamped down under the bar. The slits in the large clamping bar create relief points at various lengths in the case that you are bending a box, so that the side walls can rotate freely without hitting the clamp bar itself
* To engage the magnet before bending, either use the foot pedal connected to the brake, or push the green on button on the front of the machine. This will give a small amount of clamping force to keep the metal in place
* Now, rotate the bending arms to bend the metal to the desired angle. When you begin to rotate the arm, a small switch will trigger that will activate the full clamping force of the magnet. Continue pulling up on the handles until the desired bend angle is made (the angle should be indicated by a gage on the arm of the brake). It is recommended to bend a few degrees past the desired angle to accommodate for springback of the metal (this is expanded upon in the tool manual)
* Lower the arm, and hold the red off button (see above) for a few seconds to release the magnetic clamp.

## Recommended Cleanup:

* Turn off the power rocker on the front of the machine
* Remove your part from the clamping environment
* Slide the foot pedal underneath the machine to prevent tripping hazard
* Replace any clamping bar back to the padded platform behind the brake

## Basic Troubleshooting:

Magnet doesn’t Engage

* Check to make sure the machine is plugged in
* Check to make sure the power rocker is turned on
* Make sure the pedal is correctly plugged into the back of the brake

Magnet is Weak

* Try to add as much area of clamping as possible by using a larger clamp bar or adding multiple clamp bars. Make sure you are holding down the foot pedal before lifting the bending lever

## Advanced TroubleShooting:

Magnets Seem to Release

* The microswitch that controls this is likely messed up. Consult a PI or contact the Metal Master

## References:

Magnetic Box and Pan Brake: Operator's Manual. (2016, September). Retrieved from

https://www.baileigh.com/media/uploads/manuals/BB-4816M\_6-2016.pdf

NYC CNC. (2008, September). Sheet Metal Box & Pan Brake Tutorial. Retrieved from

https://www.youtube.com/watch?v=Ytczt75-tqw

GordsGarage. (2011). Putting a hex on it. Retrieved from

https://gordsgarage.wordpress.com/tag/bending-brake/

# Rivet Gun

## Author:

None

# Bench Grinder

## Author:

Miles Chan

## Name of Machine:

Bench Grinder (PCXB515BG)

Image Source: Lowe’s

## Link to Manufacturer's Manual:

http://pdf.lowes.com/useandcareguides/000999515004\_use.pdf

## 3 Sentence Description (Explain Like I'm 5):

The bench grinder uses spinning grinder wheels to remove material from a variety of metals. It is useful for sharpening tools, removing rust, deburring parts, and polishing jobs. It is better for finer sharpening and finishing operations than for removing large amounts of material at a time.

## Materials:

* Metal - steel, iron, other ferrous metals
* No Aluminum, Brass, Copper, Wood, Plastics, or other Nonmetallic Materials
  + These materials clog the wheel

## PPE:

* Do Not Wear Gloves. Gloves are a snagging hazard, and can get caught in the spinning wheel.
* Safety glasses and close toed shoes are required in the metal room.
* Long pants are strongly encouraged to protect from any sparks or small metal bits, which can be byproducts of grinding operations.

## E-Stops and Safety Procedures:

* The bench grinder will stop if the “Off” switch is flicked or the power cord is unplugged.
* The bench grinder includes eye guards and spark guards to redirect sparks and debris.
* The bench grinder includes wheel guards which cover most of the spinning wheel to minimize catching hazard.
* Do not grind for extended periods of time, as the material will become hot.

## Project Ideas (with links to content):

Sharpening chisels

* <https://youtu.be/GB-Pa73Snp4>
* 60 to 80 grit wheels are recommended for sharpening jobs
* Safety Notice: Always be careful when working with sharp objects.

Grinding primary bevels on plane blades

* <https://youtu.be/HIux8MRmu6E>

Another chisel sharpening example

* https://youtu.be/LKJoFmVUArk

## Startup Procedure:

1. Lift eye shield so it does not contact tool rest or grinding wheel
2. Flick power switch to “On” position

## Operation of Equipment:

1. Push material against appropriate grinding wheel.
   1. Use vise grips or other appropriate clamping for small parts
   2. A lower grit number (30) is more coarse than a higher grit number (80), which is finer. Use a lower grit, more coarse wheel to remove material more quickly. Use a higher grit wheel for a finer finish.
2. Keep all movements gentle and smooth. Remember the spin direction of the grinder.
3. Pause periodically to prevent the material from heating too much.

## Recommended Clean-Up:

1. Flick power switch to “Off” position
2. Sweep up or vacuum metal dust which collects behind and around the grinder.
3. Lower eye shields

## Basic Troubleshooting:

Bench Grinder won’t Start

* If problem persists, contact metal room master as there may be a more serious issue.

Repositioning the Tool Rests

* Loosen these knobs, adjust the tool rests, and retighten
* More details on p. 12 of the manual

## Advanced Troubleshooting/Maintenance:

Material Buildup

* The wheel can be cleaned using a dressing brush, refer to manual p. 18

Wheel Replacement

* Refer to manual p. 15-16

## References:

Lowe’s. (n.d.). PORTER-CABLE 6-in Bench Grinder with Built-in Light. Retrieved on July 8, 2018 from https://www.lowes.com/pd/PORTER-CABLE-6-in-Bench-Grinder-with-Built-in-Light/1000180381?cm\_mmc=SCE\_PLA-\_-ToolsAndHardware-\_-BenchtopTools-\_-1000180381:PORTER-CABLE&CAWELAID=&kpid=1000180381&CAGPSPN=pla&store\_code=1875&k\_clickID=8569598c-54fc-470c-8d11-9ab52788ba91&gclid=Cj0KCQjwpvzZBRCbARIsACe8vyKGXVC409Y-0OFT4gW3sDLfS2qDnPSr3ru4KcgfBviX2cR62kzjFYAaArlYEALw\_wcB

# Tin Snips

## Author:

Alex

## Name of Machine

Tin Snips

Picture of Tool in Space

In storage, figure 1 is a generic picture of Stanley tin snips from Lowe’s

Figure 1 - Tin Snips

## 3 Sentence Description

Tin snips are small, handheld shears used to cut through sheet metal.

## Materials

Can cut up to 18-gauge cold-rolled steel or 22-gauge stainless steel

Other types of metals of similar hardness, such as aluminum, tin, copper, etc.

Thin metal bars and dowels

## PPE

Eye protection and close-toed shoes are required in the metal room, where the tin snips are located. It is also recommended to wear protective gloves, as the snips produce sharp edges and corners when used.

## Operation of Equipment

It is recommended to mark the intended cut on the sheet metal before using the snips. Once this is done, simply treat the snips like a pair of scissors to cut through the sheet metal. For advanced techniques, such as cutting holes inside of the material, this video acts as a good tutorial: https://www.youtube.com/watch?v=OeOZdHXRvv0

## References

Lowe's. (2018). Stanley FATMAX 2-in 60CrV Snips. Retrieved from Lowe's: https://www.lowes.com/pd/Stanley-FATMAX-2-in-60CrV-Snips/50211923

# Nibbler

## Author:

Miles

## Name of Machine:

14 Gauge Nibbler

Image Source: HomeDepot

## Link to Manufacturer’s Manual:

(https://servicenet.dewalt.com/documents/English/Instruction%20Manual/N193853,DW898.pdf#\_ga=2.62981740.2103683119.1530930539-1059182948.1530930539)

## 3 Sentence Description (Explain Like I'm 5):

The nibbler is a hand held, corded tool which cuts up to 0.075 in. thick sheet metal without distortion. The user holds the nibbler by its yellow handle and presses the paddle to activate the reciprocating punch and die which cut the sheet metal. The nibbler is great for creating complex, curved contours with sharp radius turns by guiding the nibbler carefully and skillfully along the desired cut path.

## Physical Limitations:

1. Cuts up to 14 gauge (~0.075 in. thick based on mild steel) sheet metal
2. Cut width is at least 7/32 in., corresponding to the punch diameter
3. Starting hole diameter is at least ⅝ in.

## Materials:

Metal (<= 0.075 in. thick)

* Mild Steel
* Aluminum
* Brass
* Others

Materials should not contain harmful chemicals, such as lead or arsenic.

## PPE:

Safety Glasses, gloves, and closed toed shoes are required when using the nibbler. Gloves are needed to protect the user while handling sheet metal with potentially sharp edges. Long pants are strongly recommended. A mask is suggested if a large amount of dust is created, due to the specific material being cut or prolonged cutting duration.

## E-Stops and Safety Procedures:

If the paddle is released at any time, the nibbler will stop cutting. In addition, if the cord is unplugged, the nibbler has no stored energy capacity and will not continue cutting.

## Project Ideas (with links to content):

1. Yard Art - Sun
   1. https://youtu.be/OpxAc7T4\_LE?t=1m7s
   2. Safety Notice: This user does not clamp his metal piece, and it is strongly recommended that you clamp material securely, to minimize risk. It is possible to obtain complicated contours while clamping your material securely. However, this user was sure to wear gloves which allow him to safely grip the metal, and he is well protected with safety glasses, long pants, and closed toed shoes.
2. Cutting a Straight Line
   1. https://youtu.be/2UI\_ZEY1xuI
   2. This user shows an example of good clamping procedure, and the use of a straight edge to achieve a straight cut with the handheld nibbler tool.
3. Cutting lines in corrugated metal and rectangular access holes in pipe
   1. https://youtu.be/zyNSLL-NLuU?t=32s

## Startup Procedure:

1. Plug the nibbler into power outlet or extension cord connected to power outlet.
2. Lubricate the nibbler cutting head (punch and die) by applying cutting oil with brush

## Operation of Equipment:

1. Secure the material to be cut, using C-clamps, table top clamps, weights, or other means. The material should not be free to move by hand.
2. It may be helpful to mark your cut profile with a sharpie.
3. Ensure that the nibbler can reach all extents of the desired cut profile.
4. Apply cutting oil to the material along the cut profile.
5. If the cut profile starts inside the material rather than at the outer perimeter of the material, you must drill a hole at least ⅝ in. in diameter at the cutting path start, to accept the nibbler.
6. If the cut profile ends inside the material rather than at the outer perimeter of the material, you should consider drilling a hole at least ⅝ in. in diameter at the cutting path end, so the nibbler can be removed more easily. However, this is not strictly necessary, as it is often possible to stop the nibbler and back it out of the cut carefully.
7. Position the nibbler at the desired cut start point and press the paddle to start the reciprocating punch.
8. Guide the nibbler along the desired cut contour towards the cutting end point.
9. If the cut is more than 30 ft. long, remember to pause and re-oil the cutting head as detailed in the start up procedure.
10. Release the paddle at the end point.
11. Remove the nibbler from the material.

## Recommended Clean-Up:

1. Recover and secure finished part
2. Unplug the nibbler
3. Wrap up the cord in an organized manner.
4. Stow the nibbler in the correct drawer.
5. Cut off sharp or thin, elongated metal shards from remaining material using the nibbler or shears as appropriate.
6. Use either a dustpan and brush or vacuum to clean up small metal debris and dust.
7. Use a dustpan and brush to collect large metal waste (> 0.5” in any dimension) and dispose in trash can.
8. Stow the dustpan, brush, and/or vacuum.
9. Remove the waste material from the room, or discard with other scrap material.

## Basic Troubleshooting:

If the nibbler is having difficulty cutting the material, verify the thickness of the material. Unplug the nibbler and check that no material is caught inside the cutting head. If the problem remains unresolved, contact a metal room master.

## Advanced Troubleshooting/Maintenance:

The nibbler may have difficulty cutting if the punch is worn out or is not adjusted for proper engagement with the die. If either of these are true, follow the instructions detailed in the user manual for sharpening the punch and adjusting the engagement length. If these instructions do not resolve the issue, the die may need to be replaced, and the manual also details this procedure.

## References:

Dewalt. (n.d.). 14 Gauge Nibbler. Retrieved July 7, 2018 from https://www.dewalt.com/products/power-tools/polishers-shears-and-nibblers/14-gauge-nibbler/dw898?pageNum=2

Home Depot. (n.d.). 6.5 Amp 14-Gauge Nibbler. Retrieved July 7, 2018 from https://www.homedepot.com/p/DEWALT-6-5-Amp-14-Gauge-Nibbler-DW898/203164108

# Spot Welder

## Author:

Ritesh

## Name of Machine:

Miller MSW-41 110 Spot Welder

## Manual:

https://www.millerwelds.com/files/owners-manuals/O716H\_MIL.pdf

## Description:

A spot welder is used to quickly fuse, or weld, two thin sheets of metal together by passing a large electrical current between two electrodes. The sheets get welded at the spot where the electrodes contact them on either side.

## Physical Limitations:

The spot welder can weld metal up to ⅛” (3.2mm) in total thickness (Miller).

## Materials:

Don’t weld galvanized metals or metals with zinc since this creates toxic fumes.

## PPE:

Safety goggles and gloves must be worn to prevent harm to eyes or hands from sparks and hot metal.

## E-Stops and Safety Procedures:

Unplug the spot welder when not in use.

Never hold the sheet metal with bare hands, wear gloves and use tongs or vice grips since the metal will get very hot.

## Use Procedure:

1. Plug in the spot welder’s power cord into the wall outlet
2. Hold the two sheet metals to be welded with tongs or vice grips
3. Separate the two electrodes by lifting the upper electrode
4. Position the metal stack onto the lower electrode at the desired location of welding
5. Lower the upper electrode onto the metal stack.
6. Press the handle at the back to hold the metal stack in place, and press the foot pedal to begin the flow of current and the welding process.
7. Once a small area around the electrodes turns bright orange in color, disengage the foot pedal to stop the flow of current
8. Lift the top electrode and remove the welded piece.
9. Unplug the spot welder once finished using.

## Basic Troubleshooting:

This article from the Miller website covers basic spot welding tips:

https://www.millerwelds.com/resources/welding-resources/spot-welding-tips

Additionally, refer to the Resistance Spot Welding Handbook on the right of the page.

## Advanced Troubleshooting:

After sufficient use, the electrodes may become dirty, causing weld performance to be poor. Electrodes should be cleaned occasionally using a tip dresser (Miller).

## Resources:

Manuals & Parts. (n.d.). Retrieved July 8, 2018, from https://www.millerwelds.com/support/manuals-and-parts

Miller Spot Welders. (n.d.). Retrieved July 8, 2018, from https://www.millerwelds.com/equipment/welders/spot-welders/msw-and-lmsw-air-cooled-m11100#!/?product-options-title=msw-41-110-900371

Spot Welding Tips - MillerWelds. (n.d.). Retrieved July 8, 2018, from https://www.millerwelds.com/resources/welding-resources/spot-welding-tips

# Vectrax Mill

## Author:

Constantine

## Name of Machine:

Vectrax Mill

## Link to Manufacturer’s Manual:

Cannot Find Manual

## 3 Sentence Description:

The Vectrax Mill is a Knee Type Vertical Mill. It has a 2 axis digital readout meaning that the x and y directions can be either manually or electronically jogged. This kind of mill is useful for machining metal parts with cuts ranging from holes, pockets, or chamfers.

## Physical Limitations:

* Table Size: 10x54 in
* X Travel: 31.75 in
* Y Travel: 16.2 in
* Knee Travel: 19 in
* Ram Travel: 18 in
* Quill Travel: 5 in
* Quill Diameter 3-3/4 in

## Materials:

The Vectrax Mill can cut a range of metals from aluminum to steel. When steel is being cut, make sure to use lubricant to prevent work hardening the workpiece or damaging the bits.

## PPE:

Safety glasses and closed toe shoes should be worn at all times when operating the mill. If the workpiece becomes hot while machining, gloves should be worn if the workpiece needs to be held.

## E-Stops and Safety Procedures:

## Startup Procedure:

## Operation:

## Recommended Clean-Up:

Clean off mill with compressed air and clear the work area from metal shavings. Sweep or vacuum metal shavings and throw them away. If grease is used, wipe off with shop towels.

## References:

VECTRAX. (n.d.). Retrieved from https://www.mscdirect.com/products/vectrax?rdrct=Vectrax

# Harrison M300 Lathe

## Author:

Constantine

## Name of Machine:

Harrison M300 Lathe

## Link to Manufacturer’s Manual:

http://harrisonlathe.com/m300%20description%20page.pdf

## 3 Sentence Description:

The Harrison M300 Lathe is a precision conventional lathe typically used for machining symmetrical parts about its axis of rotation. Typically cylindrical pieces are turned on the lathe to create specific diameter cylinders, centered holes, and chamfering cylinders. Combined with an electronic readout, accurate and precise parts can be turned on this lathe.

## Physical Limitations:

* Swing Over Bed: 13 in
* Maximum Piece Length: 40 in
* Spindle Bore: 1-9/16 in
* Speeds: 40-2500 rpm
* Feeds: .001 - .08 in/rev
* Threads: 2-56 TPI

## Materials:

Due to being a metalworking lathe, the Harrison M300 can turn basically any material. Since it is located in the metal room, wood should not be used on the lathe and should rather be used in the wood room lathe. Some example materials are as follows:

Metal:

* Brass
* Aluminum
* Copper
* Steel

Any plastics can be cut.

## PPE:

Safety glasses and closed toe shoes are required in the metal room and must be worn while operating the lathe. Also, hair and loose clothing should be tied back to prevent them from being caught in the lathe. Do not wear gloves as they can easily become caught in the machine and pull in hands.

## E-Stops and Safety Procedures:

## Startup Procedure:

## Operation:

## Recommended Clean-Up:

## References:

Harrison. (n.d.). Harrison M300 [PDF]. http://harrisonlathe.com/m300 description page.pdf

Mini Lathe Introduction. (n.d.). Retrieved from http://www.mini-lathe.com/Mini\_lathe/Introduction/introduction.htm

# DoAll Horizontal Bandsaw

## Author:

Miles

## Name of Machine:

DoAll Horizontal Bandsaw C-916M

Image Source: machinesused.com

## Link to Manufacturer’s Manual:

(ftp://ftp.doall.nl/td%20inst%20man/General%20Purpose/C-916S%20\_529.pdf)

Note: This manual is for the version of the DoAll C-916S, which includes a swivel feature. The Invention Studio uses a DoAll C-916M, which does not include a swivel feature. The rest of the manual is accurate, and is the closest available reference for this machine.

## 3 Sentence Description (Explain Like I'm 5):

The DoAll Horizontal Bandsaw makes it easy to cut thick and wide pieces of metal. Most machine motion is automated and easily controlled using an accessible control panel. The DoAll is an excellent choice for cutting metal stock to size, especially pieces which would be more difficult with smaller machines such as the metal bandsaw or sawzall.

## Physical Limitations:

* Rectangular stock up to 9 in. high and 16 in. wide (describing a rectangular profile parallel to cutting plane)
* Round stock up to 10.75 in. diameter
* Vise bed capacity is 1800 lb, distributed evenly

## Materials:

* Metal, including steel, aluminum, and others.
* Plastics, such as delrin and ABS

## PPE:

Safety Glasses and close toed shoes are required. Long pants strongly recommended. Gloves may be desirable for handling material, but should be taken off when operating the machine as they may be a catching hazard.

## E-Stops and Safety Procedures:

The bandsaw will stop running if the “Band Stop” button is pressed at any time. If the “Head Up” button is pressed at any time, the bandsaw head will be lifted away from the material to its maximum height immediately.

## Project Ideas (with links to content)

* Cutting bar stock
  + https://youtu.be/4IKqAr0XliM?t=1m2s
* Cutting steel square extrusion
  + https://youtu.be/SZKUzIcWynU?t=7s
* Cutting large round tube stock
  + https://youtu.be/g8EgFT6WiPg?t=5m14s

## Startup Procedure:

Image Source: DoAll Manual

1. Ensure that DoAll power cord is plugged in.
2. Pull the vise knob to “Open” position
3. Verify that the head feed knob is turned to the “Hold” position
4. Turn the feed force dial clockwise to its minimum setting
5. Set the coolant selector to “Band On”
6. Press the “Head Up” button

## Operation of Equipment:

Clamping Material

Image Source: DoAll Manual

1. Open the vise so the material can be placed on the vise bed. This can be done by lifting the pawl arm off the rack, so the vise jaw can move freely.
2. Place the material on the vise bed.
3. Move the vise jaw until it is close to the material edge, and engage the pawl arm and rack.
4. Push the vise knob to “Clamp” position.
5. Verify that the material is securely clamped.

Cutting Material

1. If coolant is desired during the cut, ensure the coolant selector is set to “Band On”. While it is possible and sometimes desirable to cut without coolant, this will wear down the saw band quicker. Use coolant during cuts whenever possible.
2. Press the “Band Start” button.
3. Turn the head feed knob to “Feed”
4. Turn the feed force dial slightly counterclockwise, until the head starts to move downwards. Be careful not to move the head too quickly, so make small adjustments to the feed force dial.
5. The head will move downwards, eventually engaging the saw band with the material.
6. When the saw has reached its lowest point, the saw band will automatically stop moving.

If you want to stop the operation at any other point, press the “Band Stop” button.

After Cutting Material

1. Ensure the saw is stopped using the “Band Stop” button if necessary.
2. Turn the feed force dial clockwise to its minimum position.
3. Turn the head feed knob to “Hold” position.
4. Press the “Head Up” button to raise the head.
5. Pull the vise knob to “Open” position.
6. Remove the cut piece and remaining material.

## Recommended Clean-Up:

1. Remove the cut piece and remaining material from the vise table.
2. Use a shop vacuum or dustpan and brush to clean up the machine and surrounding area.
3. Turn the coolant knob to the “Off” position.
4. Put the head down by turning the head feed knob to the “Feed” position and turning the feed force dial counterclockwise slightly until the head starts to move downwards.
5. When the head has moved downwards as far as it will go, turn the head feed knob to the “Hold” position and decrease the feed force.
6. Now, the machine head is down, the work area is clean, and the machine is ready for its next user.

## Basic Troubleshooting:

* Bandsaw travel is not correct - the head does not lower enough to cut through material, or lowers too far and cuts into the vise table
  + Contact a metal room master - the stop needs to be adjusted.
* Bandsaw is not cutting material effectively
  + Contact a metal room master - the saw band speed may need to be changed, or the saw band may need to be changed. Make sure to identify the material and thickness to be attempted.
* Coolant not flowing during operation
  + Try setting the coolant knob to the “on” position instead of the “band on” position
  + Contact a metal room master - it may be necessary to refill the cooling tank.

## Advanced Troubleshooting/Maintenance:

* A detailed maintenance guide is provided in the DoAll Manual on pages 16-18.
* A detailed troubleshooting guide is provided in the DoAll Manual p. 19-21.
* While common advanced troubleshooting/maintenance tasks are listed here, please check the detailed sections of the manual for additional information.
* If the bandsaw travel is not correct (the head does not lower enough to cut through material, or lowers too far and cuts into the vise table):
  + Look at the “Counterbalance Spring” section on DoAll Manual page 18, which details how to adjust a collar which determines the stop position.
* If the bandsaw is not cutting material effectively:
  + Verify that the band is clean.
  + Check the job selector chart on the right side of the machine, which provides information about saw band choice and speeds for different types of material and thicknesses.
  + If the saw band is not appropriate or it is damaged, refer to the following DoAll Manual sections to remove the old band, install a new one, and tension the saw band.
    - Saw Band Removal (p. 9)
    - Saw Band Installation (p. 9)
    - Band Tension Handwheel (p. 10)
  + If the speed is not appropriate, turn the band speed adjusting handwheel clockwise to increase the band speed and counterclockwise to decrease it, only while the band saw is running.
* If the coolant reservoir needs to be replenished, consult the instructions on p.11-12 of the DoAll Manual.

## References:

DoAll. (1998). C-916 Series. General Purpose Fixed & Swivel Head Cut-Off Saws. Retrieved on July 7, 2018 from http://www.sterlingmachinery.com/media/brochures1/file/doall-c-916-series-general-purpose-fixed-&-swivel-head-cut--off-saws-brochure.pdf

# Angle Grinder

## Author:

Miles

## Name of Machine:

Angle Grinder

Image Source: Amazon

## Link to Manufacturer’s Manual:

(https://servicenet.dewalt.com/documents/English/Instruction%20Manual/N234379,D28114.pdf#\_ga=2.100078296.753484348.1531085241-1059182948.1530930539)

## 3 Sentence Description (Explain Like I'm 5):

The angle grinder is a handheld power tool which is used for grinding and polishing. It is powered from a standard wall outlet. It can use grinding wheels, brush wheels, or buffing wheel attachments.

## Materials:

* Metal - steel, iron, other nonferrous metals
* When using grinding wheel:
  + No Aluminum, Brass, Copper, Wood, Plastics, or other Nonmetallic Materials

## PPE:

* Safety Glasses, close-toed shoes, and hearing protection are required.
* Gloves are strongly suggested
  + Caution: Keep gloves away from moving parts of angle grinder
* Workshop apron for stopping small abrasive or workpiece particles is also suggested

## E-Stops and Safety Procedures:

* Releasing the paddle stops the tool
* Unplugging the tool power cord from the wall will stop the tool as well
* Be sure to cut such that sparks and debris fly away from users and other people (see example videos)

## Project Ideas (with links to content):

* Polishing Metal
  + https://youtu.be/X8i7Ga1UqEE?t=10m2s
  + Note usage of gloves and proper material clamping
* Cutting metal pipe
  + https://youtu.be/puGg\_UzpVo4?t=1m59s
  + Note usage of gloves, hand placement on grips, proper material clamping
* Cutting steel L channel
  + https://youtu.be/E20kwSJqjdQ?t=4s
  + Note usage of gloves, hand placement on grips, proper material clamping, and usage of protective apron, mask, and glasses

## Startup Procedure:

1. Plug angle grinder power cord into wall
2. Hold angle grinder firmly using provided yellow and black handles

Image Source: Zoro

## Operation of Equipment:

1. Ensure that material sparks will not fly towards user or other people in vicinity
2. Secure material for grinding using clamps or other means as appropriate
3. Position angle grinder near material for grinding or polishing
4. Press paddle to turn on angle grinder
5. Press wheel against material
6. Do not press too hard, as this may overstrain the tool motor
7. When job is complete, move wheel away from material and turn off angle grinder by releasing the paddle

## Basic Troubleshooting:

* Wheels should be replaced as needed, either due to wear or for a specific job. To do this, refer to the instructions on p. 14-19 of the manual
  + Depressed Center Grinding Wheels and Sanding Flap Disks (p. 14)
  + Mounting and Using Wire Brushes and Wire Wheels (p. 17)
  + Mounting and Using Cutting (Type 1) Wheels (p. 18)

## Advanced Troubleshooting/Maintenance:

* At least once a week, blow dirt and dust out of air vents with compressed air
  + Wear safety glasses while doing this

## References:

Amazon. (n.d.). DEWALT D28114 4-1/2-Inch/5-Inch High-Performance Angle Grinder. Retrieved on July 8, 2018 from https://www.amazon.com/DEWALT-D28114-2-Inch-High-Performance-Grinder/dp/B000HI0ZZA

DeWalt. (n.d.). 4-1/2" (115 mm) / 5" (127 mm) High Performance Paddle Switch Grinder. Retrieved on July 8, 2018 from https://www.dewalt.com/en-us/products/power-tools/control-products/412-115-mm--5-127-mm-high-performance-paddle-switch-grinder/d28114

Zoro. (n.d.) Dewalt Angle Grinder, 4-1/2 in., Paddle Switch. Retrieved on July 8, 2018 from https://www.zoro.com/dewalt-angle-grinder-4-12-in-paddle-switch-dwe402/i/G8577441/