

HOW TO USE THE LATHE MACHINE

1. Turn on the machine
2. Turn on the digital board
3. Turn on the light
4. Turn on the coolant if necessary
5. Check the tightness of the Jaws

2. HOW TO TURN ON THE MACHINE (red lever)

1. Pull the lever out and up
2. Low to turn off until clicks
3. If you push the red lever too much you will start the reverse, lift up the red lever again to turn it off.
4. THE FOOT BRAKE IS FOR EMERGENCIES

3. CUTTING JAWS

1. Choose the right jaws that grip enough and that to make the hole not hit on the back.
2. Check if the jaws will not touch or hit when you close it into the piece
3. Put Part to check size, make sure that your machine TIR is close to 0, if it not go to 0, lose bolts and tight them one by one, repeat.
4. Find a suitable plate and tighten it up.
5. PUT PAINT IN THE JAWS
6. Touching face, and press Z
7. Touch inside OD, press X
8. Remove 10 press X
9. Turn on the machine, see if remove some paint and clean the jaws
10. Remove more if needed
11. Touch the Z face, remove 3mm
12. Cut face and look if the jaws are clean

4. SETTING THE PART OR ORDER

1. Check for order number
2. Check for number of pieces and material
3. Check for due date and priority
4. Check for sizes (OD, LTD, BORE)
5. Check for Instructions
6. Find Jaws
7. Find sword or insert and insert holder
8. Cut Jaws
9. Put plate when cutting jaws
10. Put paint
11. INDICATE PART
12. Cut Roughs
13. Measuring up to the extent indicated or leave 60 before making the grooves, bore, HUB, or part for welding.
14. If the piece was started by someone else check the measurements before start
(Never cuts without knowing exactly how much you are cutting)

5. T.I.R

The TIR is the maximum that you can change a piece when you rotate it, most of the time the paper will say how TIR can vary, in the first operation does not matter much, if you got 100 extra material for cutting and the TIR is 30, its okay, unless the part that has holes or cracks and may not be enough material for cleaning. Always leave as little as possible of TIR.

1. Check the TIR of the drum or chawks to the least possible, a drum that its not right will make you more cut in the jaws, or it will not allow you to make your tir right on your piece, because you can only move your drum 30thousand, if your piece is wrong 20 thousand, your bolts will be too tight and you will not be able to move them
2. Unscrew all bolts before placing the jaws and indicates the drum,
3. Clean and turn the piece so that the see the best side, set and tight it up as best u can, some 5 to 7 is ok.
4. Put the indicator and check the needle, look for the highest point

and there put the needle in 0 , if the needle is still moving forward, return it to 0. . Find the lowest point and tighten the screw closer to it, if the TIR is 40, tighten the screw until you reach 20 or slightly less, always half

5. Check out the needle, see if the piece got better, returns the highest point at 0, find the lowest point and tighten the screw halfway again.

7. If you crossed 0, loosen the screws and start again. if the piece is not going better, turn it to the other side. hit it with the hammer on the highest point, change it of position etc.

8. Never tighten your screws too much, or tight it up one when others are too tight, if you do it you will have problems when you try to release them.

9. If your first operation, and your TIR is higher than 100, hit with a hammer in the HIGHEST POINT until arrives within 100

10. If the piece is not touching the back well, and your TIR is fine, clean the face, clean a little piece OD and turns the other side, if don't do it the part will move when do you bore or may fall out of the jaws.

11. Leave your tir at 60, if you have more than 120 of material, 40 if your extra material is more than 80, 20 if you have more than 40 material but always leave as little as possible

12. If this is your second operation, cut your Jaws and indicates your piece as little as possible or at least indicated on the paper.

13. ALWAYS FIND THE LOWEST POINT AND THAT IS THE BOLT THAT YOU MUST TIGHTEN. The machine can not indicate more than 30 (thousands of an inch)

14. MAKE SURE THAT YOUR CUTTING TOOLS ARE NOT TOO CLOSE TO YOUR BODY, IF YOUR HAND SLIPS, YOU CAN CUT YOU BAD.

15. If ur piece is already started or is already premade, your TIR must be very close to 0 or close enough so u have enough material to cut ur OD, LTD or Bore.

16. Shims go on the highest side of the part if you need to use them

6. SETUP TO MAKE YOUR FIRST CUTS

1. Measure the piece, check that you have enough material in OD and LTD, Check how many pieces are in the order
2. Find the right jaws for the piece, that hold the piece right, that you will be able to measure with caliper and the taper gage will not touch the back of the jaws (if u are doing tapers)
3. Cut jaws if you need it, set part, check TIR, if its more that 100, hammer the highest side in, If less that 60, tight the bolts in Drum (make sure than you don't have sharp tools pointing towards you)
4. Make some cuts in OD and Face, if you have a gap in the back, flip the piece to the other side, check TIR, cut OD and face again. Leave some 50 o 100 on the OD to cut last.
5. Make the Prebore, use low speed and dont get it in too much, if the tip breaks remove the shards or flip the part around.
6. Make bore, MEASURE THE INCERT 3 TIMES to make sure that you have the right one, leave from 100 to 300 to cut with bar.
7. Check Tir, Reset if u have to, finish bore, cut face again and OD
17. NEVER FINISH THE OD FIRST, IN CASE THAT U HAVE TO MOVE YOUR PIECE FOR SOME REASON

7. CUT FACE (Z)

1. Set part, check Tightness of part and TIR
3. Check for the insert this good with edge and that is right and that the tower is tight enough.
4. Touch face, Press Z
6. Remove 20 USE HIGH-MEDIUM SPEED
7. You can touch the lowest point on the face, press 0 on the Z and cut that amount. (always under 100 on the face)
8. Measure up and see how much more you have to cut for cleaning or go to the length given on the order
9. Remove more if needed, never cut too much
10. Allow 60 extra if the piece is going to be taken to weld department or if you have to clean the other side
11. Speed 165-400 high-medium speed.

8. CUT OD (X) Overall Diameter

1. Measure the distance of the insert to the Jaws (on the back)
2. Press Z, Make sure that the insert will not touch the Jaws
3. Turn on the machine (red lever up)
4. Touch the part with the insert, press X. removes about 10, 20, or 50 to put 0 in X., Cut as needed
7. Leave 60 of extra material to cut the bore, grooves, Hubs or if the pieces is to be taken to weld department, (leave hub as less a possible according to the paper so it can it on the piece that is will be weld on)
8. Always reach your limits and then you can cut a little more if necessary, Speed 165- 312-400
9. Check measure with the OD mic and Caliper to see you are ok on your measurements. IN THE HUBS YOU HAVE TO LEAVE THE LOWEST MEASURE so the part will fit with the piece that will be welded on ..
11. Check radios, Chamfers, undercuts, and sharp edges.
12. Never change speed or insert your last cuts, if you do it you have to do a small cut for adjusting the insert again.
13. Go to ur hundreds and 50s, that means that if u have 1.976 on your od, and you need to go down to 1.260, cut some to clean the piece, if u have 1.946, cut 46 to come down to 1.900, or 146 to come down to 1.800, measure and start cutting hundreds, cut 3 sets of 100, measure until you get close to 1.300, then start cutting 20s, 10s or 5s until u get to measure, cut your sharp edges on the bore and the face when you get closer, it will make it easier to measure and it will protect you from cuts., do it when u still have some 30 of material, set ur cutting tools again, touch ur Z, make a small cut and measure, cut again.
13. Call your manager to check the measures and sign the paper when you finish.
14. Groves inside the bore always must be double, if the bore is .60, you must touch the inside of the bore and go inside .120, always double. Make sure that your tool is straigh and always go to the center of the tolerances

9. HOW TO MAKE THE BORE

1. Search for the Sword,quadrill insert and insert holder
2. Place Part and indicate
3. Measure insert to have the right size, always 100 or more undersized
4. Make Prebore
5. Put the drill and tight it up on the tower
6. Put wood and brake
7. Turn on machines on slow (65-124)
8. Check for size of the sword and measure with the caliper again
9. Turn by hand
10. Drills and swords can break if you too much pressure or over heat if they are very big, if breaks, remove bits, turn to other side. (Remove the trash with the air so that it does not jam inside the hole)
11. Use lower speeds using stainless steel (65) because if it overheats, it melts inside the hole and the metal becomes harder with heat, using a smaller sword or turn the piece around if this happens. If the insert or sword breaks, removes the chunks because those chunks can break the next insert.
12. Measure, cut more and leave 60 for making the grooves, bore, HUB, or if the piece will be taken to weld departament.
13. CUT ur sharp edges on OD and bore when u get closer, always leave around 100 under to cut with your boring bar last, because if your insert breaks, it will make nicks in the bore and you will not be able to clean it up. Use a rimmer if you can (only for parts that will be weld.

10. HOW TO FINISH THE BORE

1. Put bar, make sure that is centered in the hole.
2. Check that the insert is not broken or blunt
3. Check that the bar will not touch the edges of the bore.
4. Put the rod into the hole until you see it on the back, press Z
5. Move Jaws to see that not touching back
6. Turn on machine, touch inside face press X
7. Remove 10 or 20 and always remove half of what you have.
8. Measure with 3d digital Mic or ID mic
9. Remove more with appropriate cuts, if you have 100, removes 60, if you have 60 removes 30, if you have 30 removes 15 if you have 15 removes 7, if you are 7 removes 3, if you have 3, remove 1 or 0 (2 times to remove the pressure).
10. Make cuts 1 or 2 or less at the end
11. Use Sandpaper if necessary * ask supervisor for help, sandpaper and files are very dangerous to use, sandpaper can wrap around your arm or fingers, push them into the machine and break your fingers, file can hit the jaws and hit you specially if it has no wood handle.
12. Remove the sharp edges
13. Never pass the limits and if the part to be heated, cut or get milled or heated somehow, always reaches a little bit over half so they would not return if the hole shrinks.
14. If the piece is hot, cool it before finishing the hole because it will shrink when cools down.
15. Use plug to see if it goes thru, use sandpaper* or powertool if needed. (*be careful using sandpaper)
16. Never change the insert or change of speed in you are almost done because it can cut more, FOR EXAMPLE, if you have 10 to remove, and you change your speed or insert, it will cut around 3, you have to make a small cut of 1 or 2 to graduate the bar again.
17. BE CAREFUL WHEN FINISHING BORE
18. Speed 400, if the bore chatters, use new insert, bigger bar, raise your bar, change speed or sharper or bolder insert.

11. CHECKING LENGTH OF THE PART (LTD)

1. Check for the piece from one side to the other
2. Face for cleaning, reach the indicated measure or leave enough to cut on the other side
3. Take measures on 3 sides, if the difference of the measure is more than 3 find the highest side and hit with a hammer to make it better.

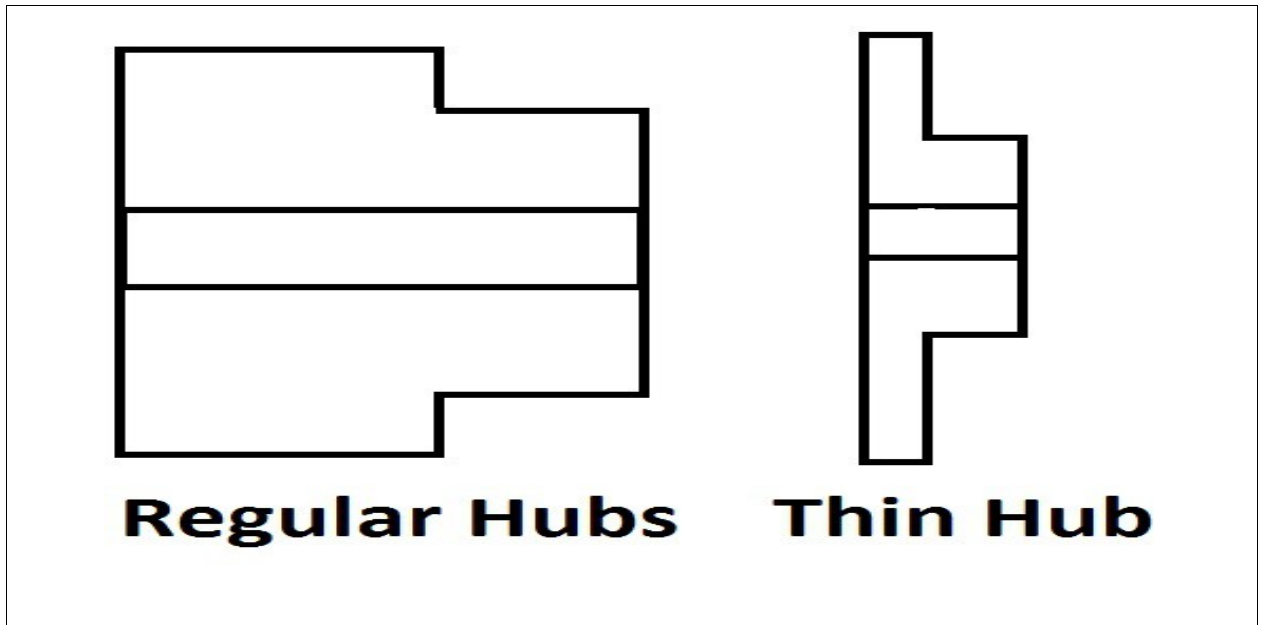
Loosen it and hit it more and tight it up again, check the TIR, and make a cut of 5. If this don't fix the piece, take it out and clean the jaws or cut it again if needed because you may have trash behind the piece, always do this when you have material not when you almost done. Make sure that your calipher is not hitting the back of the machine, find a smaller calipher or measure from the bore if needed.

This is very important for your piece otherwise it will have bad measures all around, remove the part from the machine and clean up the jaws until you have a good measure, clean the part with the buffer if you can to remove trash, weld and paint (Speed 165-400)

12. SPEED OF THE TOWER

1. You have to find a suitable speed so that the piece does not vibrate, shatter or make bad cut on the piece
2. Make sure the insert is for steel, copper, wood, plastic or iron and that is not broken or blunt
3. Make sure of the way that the tower will go, turn it on in the air to see which side runs You can increase or decrease the speed of the tower using the small H and L lever
4. NEVER PUT THE INSERT NEAR THE PART BEFORE STARTING THE MACHINE BECAUSE IT CAN HIT THE PIECE AND PULL THE PART OUT OF THE JAWS
6. Pay attention that the insert does not hit in Jaws.
7. Make sure that the bolts in the tower are properly tightened, put some greese and make sure that there is not trash underneath.

13. HUBS



Hubs are parts that have a big od and a small Od and the bore.

FIRST OPERATION

1. Put part, check TIR, if the part is more that a 100 TIR, hammer the highest side in.
2. Cut some material on face and OD, (if you have a lot of material), if the back of the piece has a gap where is not touching theback of the jaws, flip around, check tir again and cut the face and OD again
3. Do the pre-bore, and drill it leaving from 70 to 200 under to cut with the bar.
4. if you have more pieces, put another piece, cut some on face and OD and drill them also.
2. Reset the first piece, cut the face again and finish bore, OD, chamfler and sharp edges.

SECOND OPERATION

1. Check drum TIR, cut the jaws, set piece, set TIR almost to 0, (loosen up all bolts on the drum if you need it
2. Finish the LTD
3. Finish hub, cut sharp edges and check bore again because sometimes shrinks with the heat.
(Do OD, bore and face on first operation, Hub on second unless the part is too thin)

14. HOW TO CUT RADIOS AND CHAMFLERS

Radios are semi-circular edges inside the bore, on the hub or other parts of the piece, you have to use a radius tool that is DOUBLE the size that is asking on the paper

1. Check paper for size
2. Search for the right Radio tool, if ur radius is $\frac{1}{4}$, use double size ($\frac{1}{2}$), ALWAYS DOUBLE THE SIZE
3. if you have a $\frac{1}{8}$ radius, you can do it with a big triangle or diamond shaped cutting insert.
3. Look the measuring radio tools, usually are double of the size
4. Cut radios, check size
6. Always use slow speed
7. Put lifesaver if you can
8. Speed 44 - 55
9. Check if the measure is lateral or diagonal
10. Check for size and measures, dept (X) must be right but x must be double (example for an $\frac{1}{4}$ radius, you must use a $\frac{1}{2}$ tool .500, deep .250 from the face and deep .500 from the OD.

15. J-CHAMFER

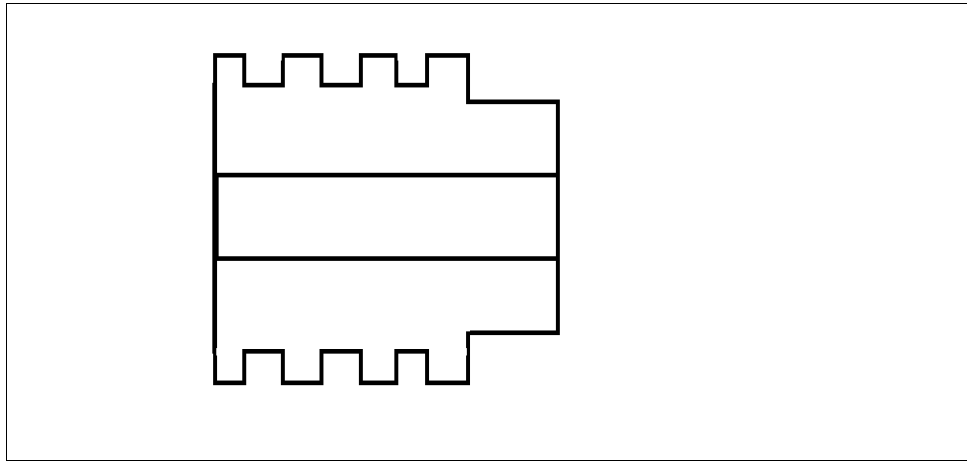
J- Chamfer are like radios, but inside, are used to weld an parts with others.

1. Find the right tool, they are round and black, if you have a J-chamfer of 500, look for an insert of 1000 and if you have a J-Chamfer $\frac{1}{4}$ (.250) seeks an insert 500, ALWAYS double,
2. Touch the face Z and press the O, Touch the OD and press the 0,
4. Turn on the machine and slowly enter the piece until you get to 0, then the other side to get to 0. touch the OD, going in has to be double, touch the face and going in has to be on measure. Check for size and measures, dept (X) must be right but x must be double (example for an $\frac{1}{4}$ radius, you must use a $\frac{1}{2}$ tool .500, deep .250 from the face and deep .500 from the OD.

(double on the OD, ID double, same measure on face)

5. Put Life saver and Ask your supervisor for help.

16. HOW TO DO GROOVES



Grooves can be on the OD, inside the bore or on the face of the part

1. Cut the face and OD, leaving 60 for the grooves in the OD, removes the sharp edges on the face.
2. Find the right insert, it's not too big for the groove but is long enough for the job.
3. Measure the OD of the part, write the measure on a paper
4. Look at the measure of the OD of the Groove which is on the order paper, write it down under your OD measurement.
5. Subtract the current OD against the OD of the groove. write the result in large letters.
6. Divide the result by 2.
7. Put your tool, touch the OD and put 0
8. Remove the insert, and in the air, enters the insert inward until it reaches the specified length, press 0 on X.
9. Touch the OD to see that you have the correct measure of what you're going to cut.
10. Make the size of the rows chain with a marker and put the insert in the middle of these marks.
11. Put the lifesaver and tighten it well.
11. Turn on the machine with speed 52, introduces the insert down to 20 in the X
12. If the machine becomes hard, remove the insert and cuts 10 in either side to remove the pressure.
13. Leave the last 20 to clean last.
14. Measure and cut more if necessary, cut by hand in your first cut

- and the machine in the last, (can increase your speed at this point)
15. Remove the sharp edges and measured with the Dept mic, caliper and OD MIC if possible.
 16. At the bottom, cut a little more to get to 0.
 17. Check out the TIR before finishing, if the face measures different in the 3 sides, you may need to clean the face again before finishing.
 18. Finish the first side, measures it and start the other side, measured with the caliper and dep mic.
 19. At the bottom, decrease your speed and cut the bottom, If you take away 10, dep mic will appear only 5, so you have to cut twice.

Example

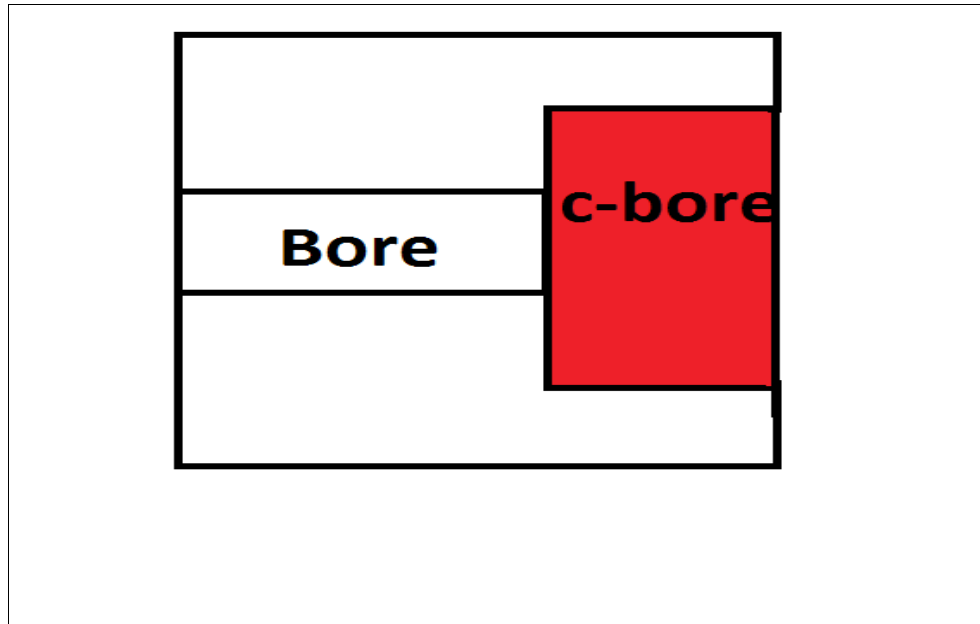
OD in job,	5.000	
Current OD	5.060	(60 extra)
OD of the groove	3000	

subtract	2,000	(this you have to cut the groove tool)
divide this by 2	1000	(measure for the the Dept Mic)

20. Always leave less than half of your tolerance because if don't do it, your measurements are not going OK on the other groove or length of piece
21. If your have a tolerance of 30 on the OD of the groove, cut 15 in your OD (X) it will show 7 in your dept mic,
22. Measure with your dept mic, and OD Mic if possible.
23. Finish your grooves, finish the bore and OD also
24. ALWAYS SLOW DOWN AND PAY ATTENTION

Bores inside the bore must be cut DOUBLE the size that is asking on the paper, if the bore is 3/32 (.93) you must touch the face inside the bore and go slowly .183 to make your bore properly.
 If your bore must be .500 inside the bore, and the bore is .125 wide you must add those 2 measures, touch the face with your groove insert and go inside .625

17. COUNTERBORE



Counterbores are bores in the workpiece that are larger than the original bore, Use a medium or large bar to do them.

1. Finish the piece (bore and face) but not the OD
2. Paint with a marker the size of the counterbore (Use the smallest size)
3. Touch the face, press Z,
4. Put the bar in the bore, reaching more or less to the extent indicated the depth of the counterbore. example, if the depth is .500. Introduce the bar .440 (leaving 60 to cut last) press X
5. Make some cuts, measure an cuts more until nearly reach the measures, clean the face, measured with the dept mic and cut more if needed. Finish the counterbore as you do with a bore.
6. Call your supervisor to check the piece.

18. TAPER BORE

Taper bore are bores that are enlarged on one side, and small on the other side, if they bring you a piece that already have a taperbore, always find the smaller and larger side of the bore.

1. Place the piece and indicate the OD and face.
2. Clean the TaperBore bar, tighten the screws.
3. See if the bar is well graded, Check 3 times to remove the slack.
4. In an inch (Z), X must move as indicated in this table.

1/2	.0416
3/4	.0625
1 1/4	.10416
8 °	.13986
1 1 /5	.125

Multiply this measures by the dept of your dep mic to find out how much do have left to cut. MULTIPLY THIS BY 12 TO have your real size of ur taper $.13986 \times 12 = 1.678 / \text{FT}$ and viceversa, 1.500 divided by 12 equals 0.125 , that is the taper by foot that has to show on the digital screen.

5. If the bar is well graded, put the bar and insert 2 inches outside your piece, mark this point on the big wheel because this is the point where you always have to start
6. Put paint in the hole to see if it will cut the bar
7. Make a cut, look if you cut inside the bore and mark with a marker in the small wheel.
8. Remove the small Slack 3 times by turning the wheel forward, and returning back, removes 5 and mark on the wheel
9. Turn on the machine, let it cut and see if you are making any progress.
10. Keep cutting and measuring, using the taper plug indicated.
11. If you can fit the plug of the taper inside the hole, measured with the mic dept and divides the result by the numbers of the table above, and the result is what you need to cut
12. Do small cuts and continues to measure until the plug fits right but not pass over.

13. The taper gages with numbers like 1615 are 8 degrees taper gages, taper gages with letters like E are 3 / 4 s.

14. the tip of the Insert must be 2 15/16 from the base of the tower, you can take as much as 100 on high-medium speed as many times, as long as the tip don't break or start bending forward and making bad cuts. It must be properly alligned, the bar not too far out, properly tight and with the right insert so it does not shatter.

15. The taper goes on the side that has 3 holes or the holes without a thread for the pins, unless the paper says otherwise.

16. If you take the slack on the wrong way, it will cut straigh and ruin your taper.

FOR TAPERS INSIDE THE BORE, move your big wheel forward 3 times, (Z)push 0 on boths Z AND X , move the (X) bar towards your 4 times, go back and stop BEFORE 0, push 0 on the (X) again and let the machine go

FOR TAPERS ON THE OD, Do the same, but take the slack against you, if the numbers do not start moving the same, you are taking the slack the wrong way.

17. if the taper gage wiggles around, you are doing something wrong, make a lot of cuts on 0 or change your insert or bar.

18. DO not trust your last measurements specially when you have around 10 thousands to go, start cutting from 1, or 3 thousands or less and measure each time. Be extremally careful so u dont pass your measurements.

19. If you have more pieces to cut, do not cut the sharp edges or move your settings, put a new part, check Tir on the teeths, put your incert on (Z) 0 and move your (X) to minus 700, put 0, start making some cuts or around .100 or .050, write each cut on a paper, check with the gage sometimes, make some cuts on 0 to take out the preasure of the bar, and check with the gage until you make it fit again, cut sharp edges on all pieces last and use the dinofile to cut the sharp edges on the threads of the holes.

19. HOW TO CUT BRASS AND STEEL BARS

Steel and brass bars need to be cut to certain OD

Check the size of ur bar on the front page of your work order, where is the operations list, not the back page.

1. Remove the jaws. put the bar up until they leave only about 15 inches inside, set the piece
3. Drill a hole with the drill Center
4. Set the piece 40 inches out, put the lifesaver and tight the piece up.
5. Check the TIR on both ends. if you have 20 for your TIR and have 60 extra material, it will be okay, but always try to have as little as possible.
6. Find the insert suitable for bronze, and check speed because sometimes the piece vibrate and cut more.
7. There are some inserts that when used properly does not vibrate much. Usually the smallest and sharpest ones, make some cuts, measure both sides if one is more that 3thousand difference, you will have to move the Lifesaver tower towards you if the lifesaver part is higher than the side close to the jaws and viceversa if the saw side is higher that the lifesaver side
8. Cut speed to 312-400 with the tool tower on high speed
9. Cut the OD to measure, according to the paper
10. If the part is 2500 and you get 10 or so, you can use those 10 to taper, can have side and the other side 2,509 2,501 (8 taper) and is OK.
11. Make sure that both brakes are properly secured on the tower, put the brakes on the tower as well.
12. Make a cut of 20 or 30, measure the piece on a clean side always, touch the clean side with the insert to start another cut
13. CHECK THAT THE TAPER BAR IS PROPERLY ALIGNED TO THE MIDDLE, BECAUSE IF NOT IT WILL HIT THE MACHINE AND CAUSE TROUBLES, CHECK ALSO THE BREAK BAR ON THE DRILL TOWER BECAUSE IF ITS TOO LOW IT WILL BLOCK THE MOVING TOWER
14. Recommended speed 312- 400 A - STOP - F

15. Check if the machine will hit anything when moving, specially the tighten bar on the center tower and that the electric cables will not stretch too much.

16. If your tool is cutting more on one side that the other, move your lifesaver tower closer to the cutting tool or farther away when u still have material, the tower can move up to 200 to each side, and leave when you have around 3-4 thousand from the front and back, you can sand down the rest, be careful when using sandpaper, do not wrap it around your hands and always ask for a supervisor to be present when using sandpaper.

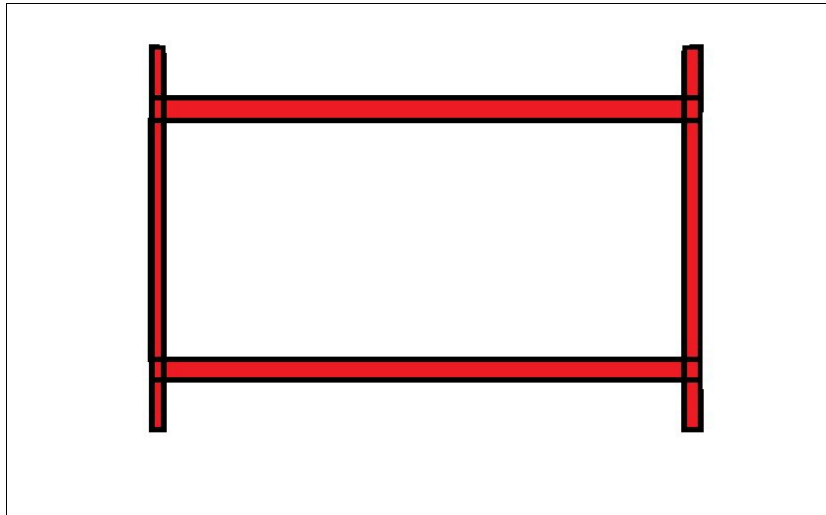
20. BRASS BUSHINGS

Brash bushings are parts that go into the bore of other pieces, usually they don't give you a lot of tolerances for this, usually is only .003thousand of an inch on the OD and bore.

If they only send you a reference on the OD (example 3.500 or 3 ½) you must leave around .003 more on the OD.

1 . Set up your piece, check the TIR and cut some on the OD and face, flip the piece over if you have extra material. Tight it up a lot, cut extra material leaving .100 in od and Bore , loose up the piece, cut the sharp edges with a 45 and finish the bore, (make sure that the piece is not too tight) finish bore and Od make sure that it does not have taper in the bore and OD, sand down the rest to get it to size

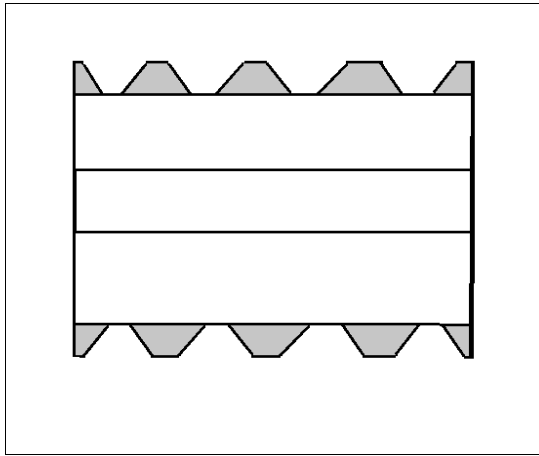
21. SHARK SPOOLS



Shark spools are pieces of brass that looks like a spool,

1. Put your piece, indicate as best as you can,, cut the face and the some on the OD, flip the piece around, make sure that you can do the whole part in one cutting if possible, you can hold it with as little as 200, the life saver will help you out. Cut some on more on the OD, face and bore, cutting on the bore is important because a bad bore will make the lifesaver go on a wrong side and mess up the TIR, make a clamfler on the bore with a 30 degree tool.
2. Put a lifesaver that fits on the hole, Do not use a plate and a smaller lifesaver, the piece falls and the TIR gets messed up
3. Rest the measure of the OD to the measure of the groove, that is the dept that you have to cut, make a groove, leave from 100 to 30 extra material, measure with an OD, if your measurements are OK, cut all the material you can, leaving some extra, even on the face to finish. Make a cut to smooth the OD of the groove then finish the piece.
4. Finish the groove, Bore, OD on that side. Make sure that the piece is not too tight or the bore will be bad.
5. Take out the part, cut jaws and finish the other side.

22. V SHAPED GROOVES

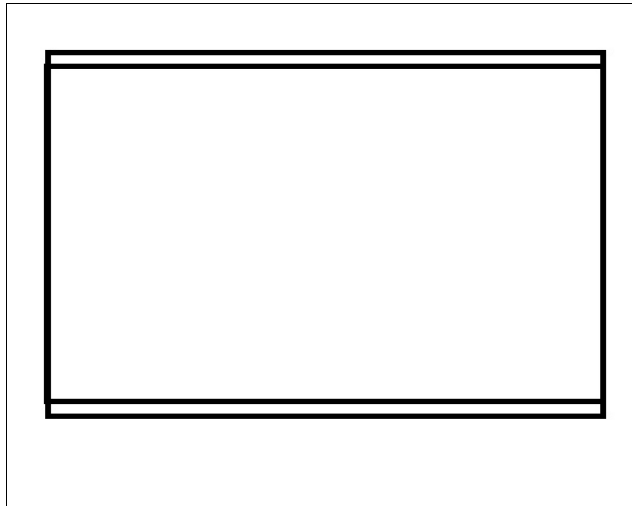


V shaped grooves are grooves that look like a lot of V grooves, they hard to make if the material is hard, but easy if the material is cast iron

1. Put the piece, check tir, Make bore (not too big), cut face and OD, cut the bore with a boring bar, make 30 degree chamfler on the bore and put lifesaver.
2. To start the grooves, make sure that the OD is right in the middle of the od tolerances, Do the same steps as you do with regular grooves, leave some extra on the face to cut last.
3. Make sure you know the minimum dept, the distance from the face to the first groove and the measure with the wires
4. do groves first with thin grooving tools
5. Measure the distance

Check tir on all sides before finishing the v shaped grooves

23. BRASS BUSHINGS



Brass bussings go inside another piece, usually they only give you .003 thousand or less on the bore and OD.

To start cut your jaws, set up your piece, tight it pu a lot, measure how much do u have to cut in OD and bore, if you have a lot of material try to clean up some material on the face, Od bore, leaving around .100 on OD and Bore, cut a 45 on the sharp edges and flip around, cut the rest of the raw material and loose the piece up to start the small cuts.

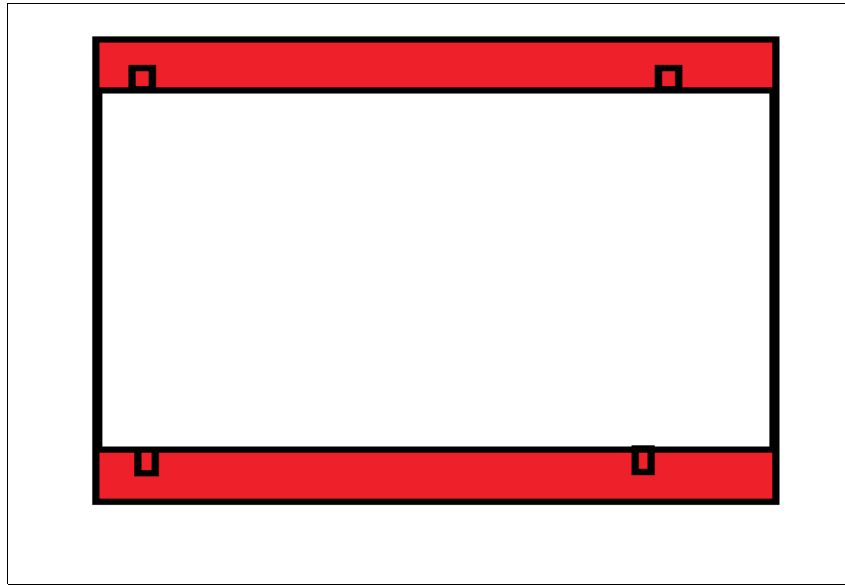
If you dont have material a lot of material, set the piece, check the tir, make sure that the piece is not too tight and start making small cuts to clean up the od, leave around .060 if you have enough material and start making the bore, make sure that you dont have taper on the bore and OD, put them to measure and sand down the rest.

DO not cut to close to the jaws if the piece is too tight, the od and bore gets bad and have low and high points and you wont be able to fix it.

If the piece shakes try to find a sharper insert, a bigger boring bar or use a lower speed.

---- > See grease grooves

24. GREASING GROOVES



*Greasing
groove

grooves are
inside the

bore of a brass bushing, it usually have 2 of them.

*Finish the bore, OD and face and cut the sharp edges. MAKE SURE THAT YOUR PART IS VERY TIGHT BEFORE MAKING THE GROOVE.

*Find out what kind of tool do u need to make the groove usually the groove width is a reference. (.125)

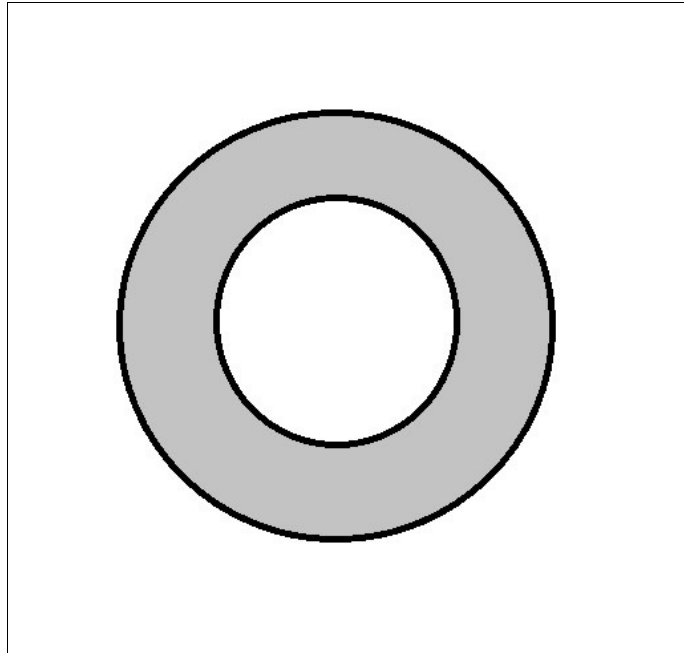
*find out the distance of the groove to the face, example (.250) or (.500) add this measure to the width of the groove (.250) = .625

*touch the face of the part, go in the required amount, (face to the bore + width of the bore) put 0, touch the inside of the bore, put 0 and go deep the reference times 2. example $.062 \times 2 = .160$

*Flip to the other side and finish the part, face, OD, bore and groove.

25. FLANGES

.315 LTD, 9.313 on OD and 6.670 on bore 20 degrees chamfler

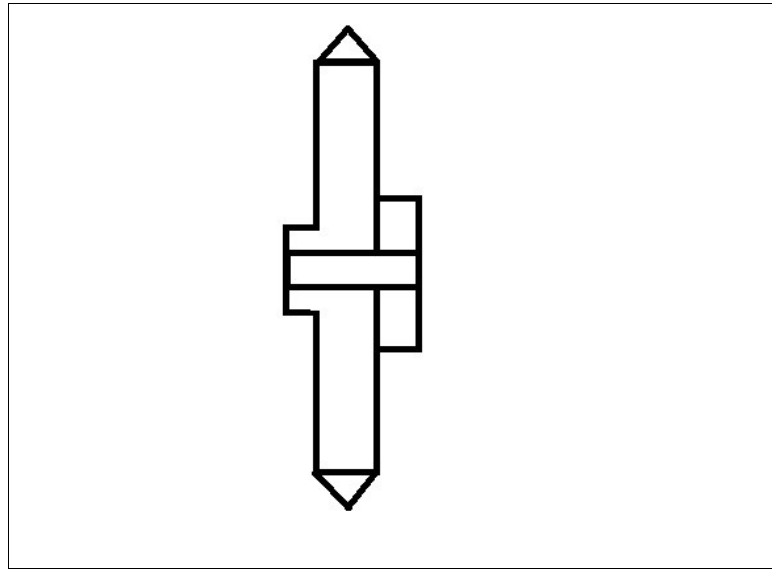


Flanges are ring shaped parts that go on the side of other parts to hold belts in place , they are thin, usually .095 - .360 and require the bore to have less that .005 tolerance and should not be egged, when they are too thin they are very difficult to make.

if the part is around .600, set up your piece, cut the OD, leave .060 and cut the face and with a marker, make a circle around the bore required, make a groove on the face around the bore required, it must be deeper that the LTD of the finished piece (.315) or more, usually you can cut around 1 inch deep, usually all measures are a reference so its not problem. finish cutting the OD and bore and chamfler, PUT A LIFESAVER and cut the LTD with a grooving tool leaving around .030 extra to cut with a low profile tool on the other side,to get it to size, cut the face again, do the chamfler,anc cut more pieces if requiered.

Cut your jaws and cut the other side of the face using a low profile tool, medium speed on the machine and high speed on the tool tower.

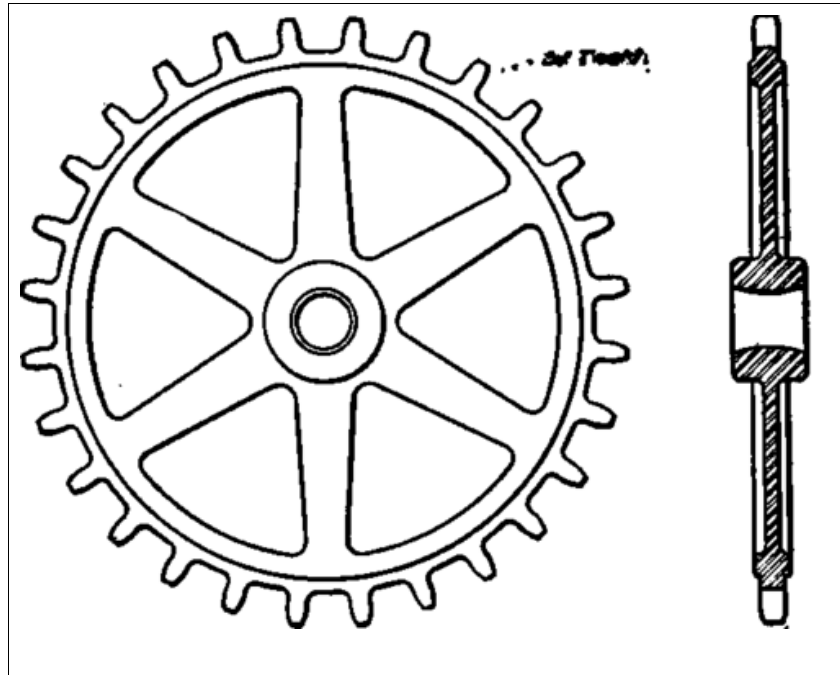
26. FOOD SERVICE SPROCKETS



Food service sprockets are stainless steel sprockets that must not have any holes on the face, OD or weld, if they have any holes, they must be reweld.

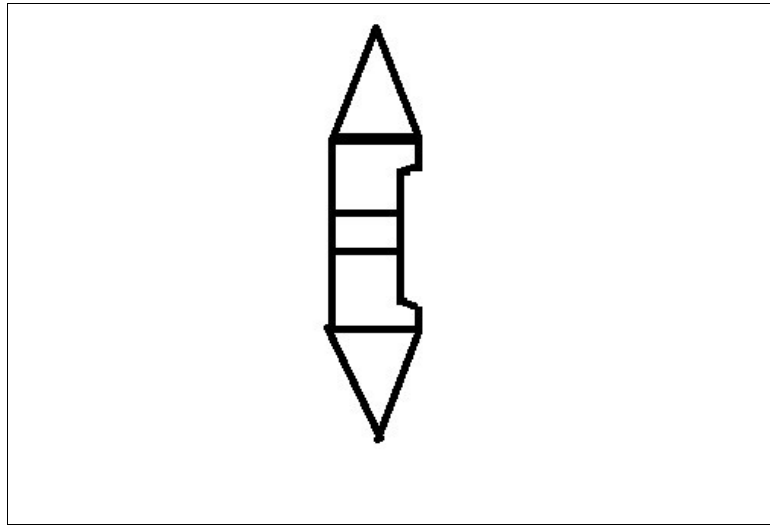
1. The TIR must be perfect on all sides, and set your tool tower at a 45 degree angle, facing you and to your left, remove the handle on the tool tower, so it does not touch the jaws, and put a low profile tool facing out 3 inches or more.

27. WHEELS



Wheels are pre-made cast iron parts, that need to be machine completed, find out if you can hold the piece by the hub or OD or with an arbor, put the part and cut some material, flip it around to have a better grip and check the Tir on all sides, including the inside of the Od and the face inside the wheel, cut all parts to size and if you have .700 on the inside of the face, cut some divide the measures by to to make the piece

28. ANGLES



Angles are parts that look like spaceships, there are many ways of doing this part, but the easiest way is doing the OD, bore, HUB and do the first angle, (the one with the LTD measures) .

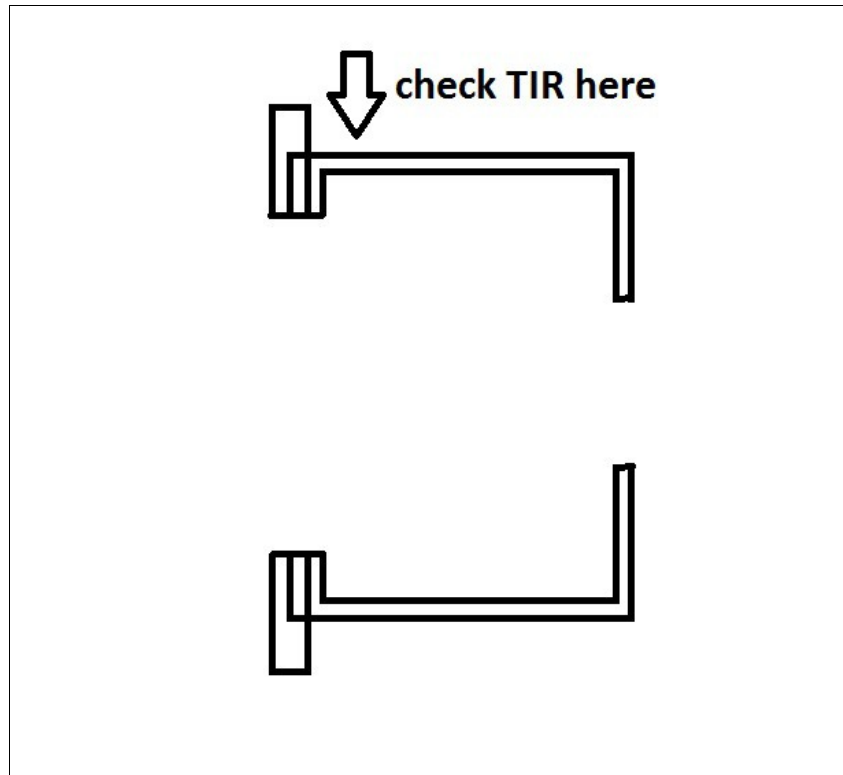
Finish the OD, leaving it all the way to the top, bore and Hub and face. Find out if your angle is measured from the face or the part or the face of the hub and rest all the measures to find out how much do u have to cut.

rest the lenght of the hub minus the total lenght of the angle,
example $1.800 - 1.500 - .004 = .296 + .004$.296 is the MINIMUM that you have to cut, the .004 is your tolerances, you must not go over the .004 measure or your part will be scrapped.

Some angles are measured right and others backwards, usually the first angle is backwards, this is because the engeeners measure the angles from the center of the bore to the outside, (radial angles) and you have to measure the angle from the OD down. example, if your angle is 71.34 rest this from 90 and is $71.34 - 90 = 18.66$ that is the angle that you have to cut, if your angle is 75, rest it from $90 = 15$, this is your angle measured from the face of the part.

Find the proctor, find the angle that you have to make, make some cuts and call your supervisor to double check if you have the right angle before going any further.

29. DRUM HUBS

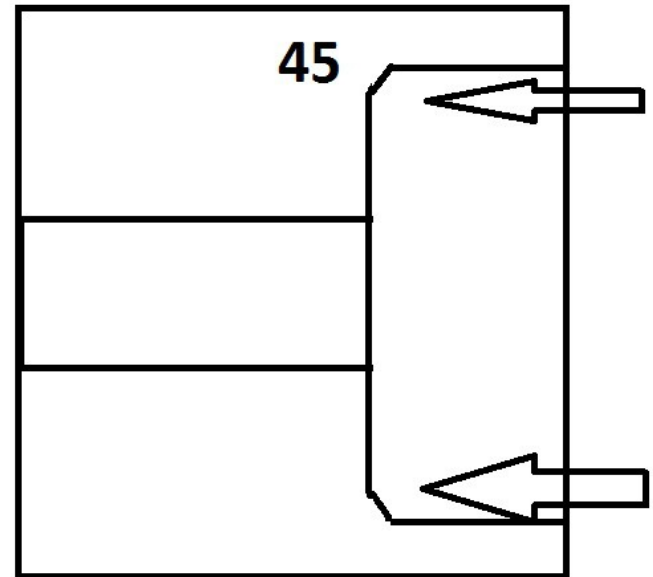


Drum

Hubs are parts that look like a drum with a hole in front, a bigger hole in the back and teeth all around, you must clean the jaws, and put the piece holding it by the teeth, DO NOT CHECK THE TIR on the drum, it does not matter, TIR must be checked on the teeth clean some of the OD on the drum, make sure that you go to size, clean some on the face by the teeth if you can, clean the face, finish the first bore, cut the sharp edges and flip to the other side, you may have to get the right parallelism, around .003 all faces and concentricity from the bore to the OD of the drum

30. 45 INSIDE A COUNTERBORE

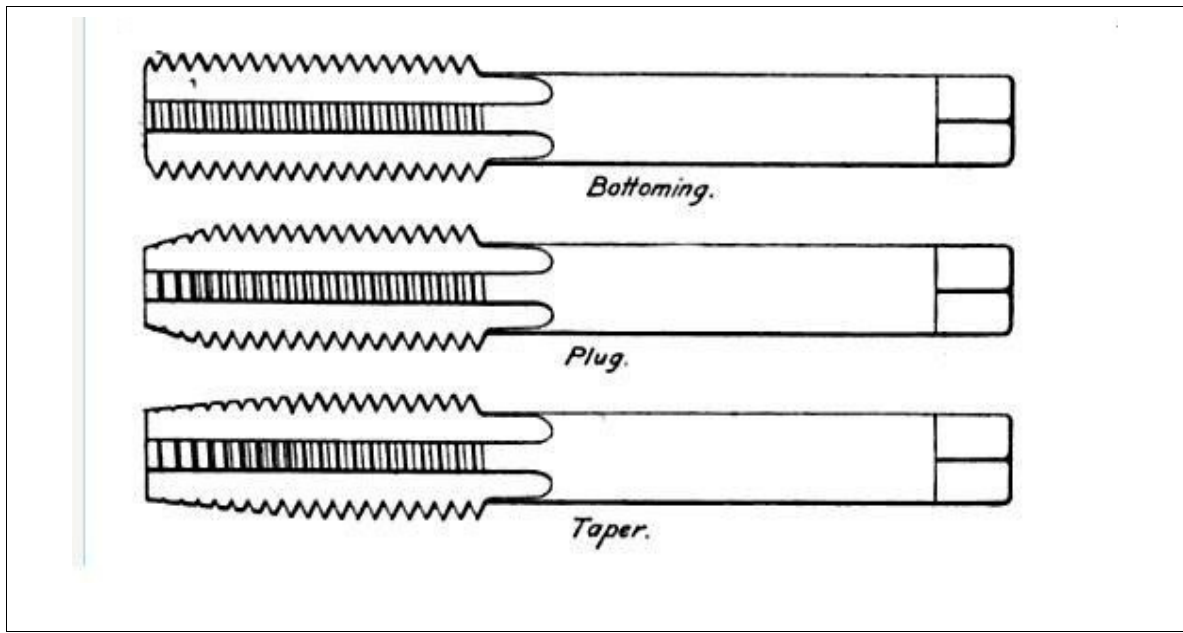
leave .060 if the 45 is
1/16
on the dept and .
125 on the bore
to make a 45
on the counterbore



31. UO-STL

UO-STL have a 3/4 taper on the OD, it has a gage line and you have to measure from the face of the chainrow to the end of the taper, using a gage.

32. TAPS



Taps are usually only drilled, using a provided drill and tapped, no need to get the bore to size.

Look on the chart for the right drill and tap number, check the page for the TAP TYPE also.

Drill the piece, do a chamfer on the bore and ask for help to do the Tap.

Use oil and take the tap out once in a while to clean out the trash and avoiding the tap from breaking, if that happens your part will be ruined.

Use a low speed, use a lifesaver and tap holder,

Make sure that the taps have the right size and numbers and letters. make sure that you will not force the tab too much, have a lot of trash because they break easily.

make sure that the bar is all the way straight and the tabs go straight into the bore.

The measure of the tab grooves are not measured from the beginning of the tab but rather from where the threads are bigger, use the proper tab gage to measure the tab.

33. SNAPS RINGS/ GROOVE INSIDE OD



Snap rings are rings that go inside a bore to hold a bearing in place the counterbore is usually very close, usually 1-7 tenths of a thousand of an inch, and the snap ring groove is very close around .010 and the distance from the face of the counterbore to the groove is also very close.

DO NOT CUT A BIG 45 ON THE edge of the bore because it will be very difficult to measure,

if the dept of the groove is a reference

example $1/16$ (.062) in which case you must touch the face and go in double (.120)

if the dept of a groove is a number, example (1.853 to 1.862)

rest the size of the C-Bore example $(1.749 - 1.853 = .104)$ is the minimum, this is the dept that you have to go, DO NOT DOUBLE THIS SIZE, use slow speed and water, the grooving tool can break or push back the tool, measure with a special grooving measuring extensions and caliper, holding the tool straight up to measure, Do not remove your grooving tool until you know that you have the right groove dept without going over it.

34. SETTING UP FOR THREADS



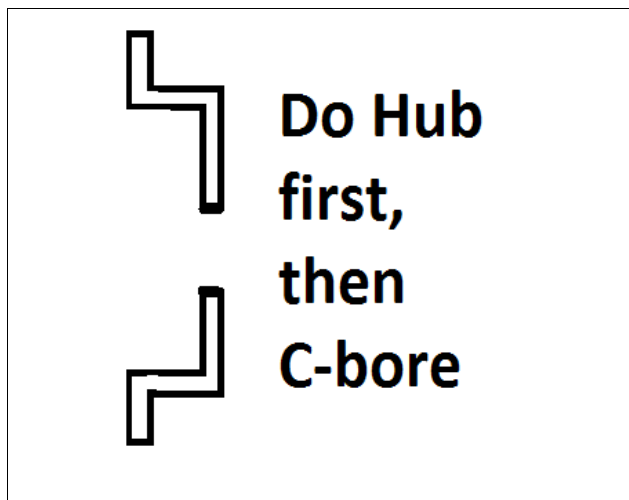
- *When setting up for threads make sure that the bore is finished
Cut a big chamfler on the bore before starting
- *You must find the right gage, find out if the threads are even (2 - 4) or uneven (1 - 3).
- *Make sure that you have the right cutting tip (30°) and that the tool is straight.
- *Use the right measuring tool to check that, (general 777) to measure from the face of the part to the center of the tool.
- *Find a good bar and leave only one inch extra from the dept of the c bore so the bar does not shake when making the grooves.
- *Set up your machine, set up your gears inside and engage the blue knob, it has 2-4 1-3 on the top and spins when engaged, (make sure that you release it after you are done)
- *Put the black handle underneath in neutral before starting.
- *Set up your speeds, you can change that anytime if the part shakes.
- * Set up the Z on the back, touching the face inside the counterbore and your X close to the bore, put paint to see the lines that you make.
- * The DC level must be backwards

35. HOW TO RUN THE THREADS

1. You may be able to run a test piece to make sure that your setting are ok.
2. Set up your speed on low (65-25)
3. Make sure that the tip is the right one and is properly secured
4. Make sure that your tip is straight, use a tool to measure it
5. If your threads are even, you must start your level when it gets from 2 or 4, if they are uneven you must start at 1- 3. always start at the same set of number.
5. Make sure that your tools and part are properly tight and your tire is OK,
7. Start your machine, take out the slack, stop your level at the right number, (even or Uneven) Using the BLACK HANDLE leave a reasonable distance from the tip to the face, so you can stop the level if you miss your number
8. Keep your hand at the handle to stop it when it reach 0 on the Z.
9. take some more if it does not cut more, do not take more than .005 if it is already cutting, make sure that you have the right threads, use the gage to measure them (the tool looks like a swiss knife) you can never trust the machine.
10. Do not stop your machine when your tool is cutting, you must run the bar backwards before stopping the black level or the machine, if not you will damage your threads.
11. Make more cuts of .005, always start at your number and stop on Z-0
12. and even if you run on 0 again, it will cut more, so be very careful, Check the gage after each cut to see if it fits
13. Do not stop the machine with the emergency level, take out your bar and cutting tool first.
14. Do not mistake the black handle with the silver handle.
15. Mark when the threads start on your gage so you can measure better.
16. Take your bar backwards (X) after each cut
17. If you miss your number, let it twist around and get the next number.

18. always keep your hand in the handle so u can stop it if necessary, remember to take out the bar first
19. If you put a mark on the gage starts getting in, you will be able to see how much you are advancing in after each cut.
20. Make a smaller cut (.001 -.003) even if you run on 0 or minus it will still cut so be carefull and run some negative numbers.
21. Put oil on your last cuts to make a smooth finish

36. V RING SEAL



V ring seals are parts that have a C-bore on the other side of the Hub.

1. Finish the OD
2. Do the Hub and Bore
3. Cut jaws and finish the LTD and C-bore from the other side, holding your part by the Hub.

37. CAST IRON SPROCKETS

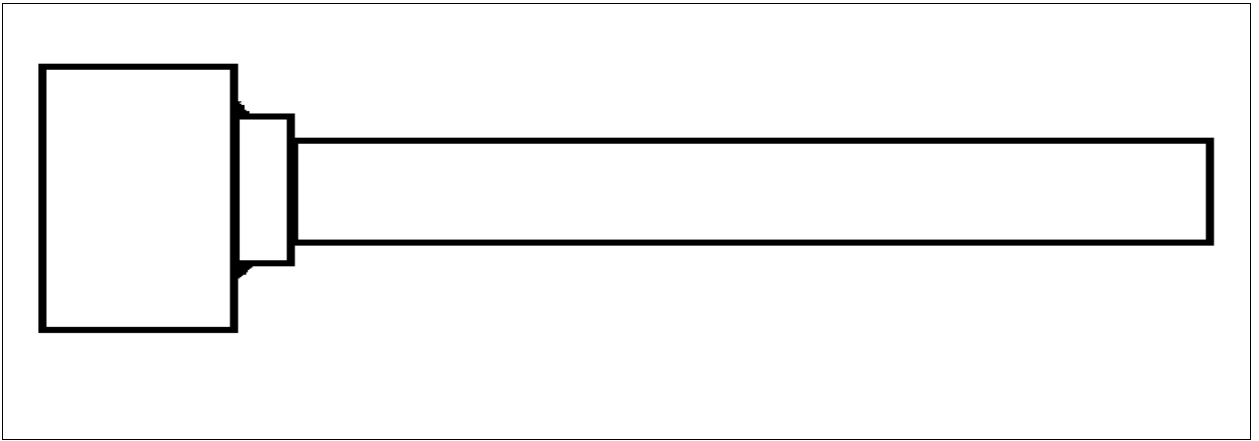


When making on cast iron use

the part a lot, use a face grooving bar and use water and push the tool with your hands, hitting the big wheel with hand to make smalls cuts and avoid the insert from shaking and doing damage on your part

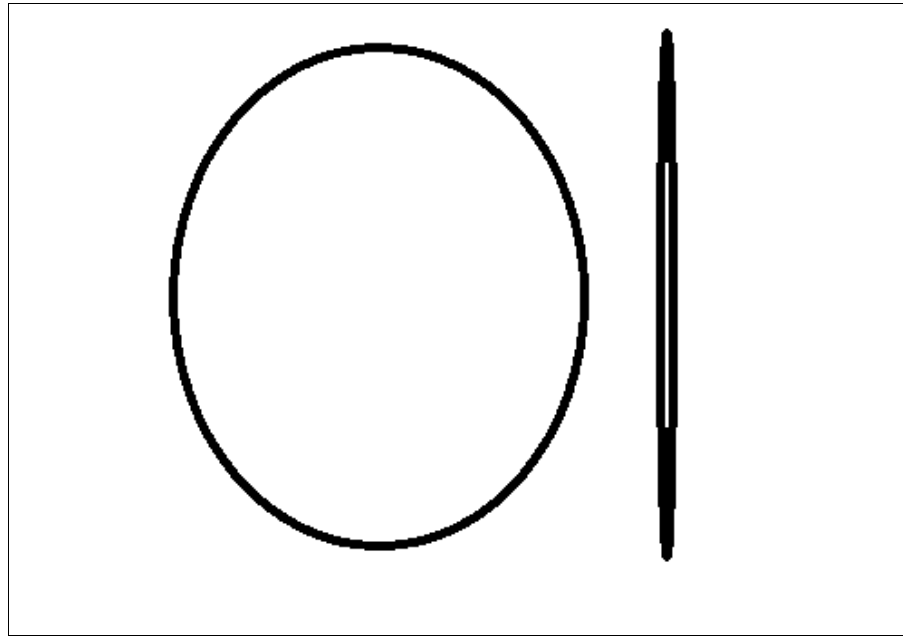
face counterbores low speed, tight

38. SF/S212 22 1/2 (Long axels)



1. Get a steady rest part (looks like ring with 3 pistons)
2. Cut some material on the face
3. Drill a small hole on the face, put lifesaver
4. take out the steady rest
5. Make a long cut on the OD, all the way to the end
6. Measure the front and back if that does not match, move you lifesaver tower to one side or the other, as needed make another cut and measure again, **BOTH SIDES MUST MATCH** otherwise your part will give you wrong measures on all sides
7. when you match both numbers, front and back take out the part, cut jaws, put steady rest, flip around your part, cut face, make hole and make another long cut to see if your numbers still match, if that happens you can start making your steps. if not, move your lifesaver until you get a good number. if you don't do this you will have to sand down the OD if you get a taper, all of this does not matter a lot even the holes may not be straight but it will save you a lot of work when you are making those steps.
8. Cut as much material as you can to make the piece lighter and put the steady rest for extra safety, do the first part close to the jaws, move your steady rest, do not tight it up and finish the rest of the part.
9. Cut all ODs to size, sometime they just leave .001 tolerances, sand down as needed, finish all ODs before doing anything else or your part will move and will be really hard to reset it.

39. 35A100 Big thin plates



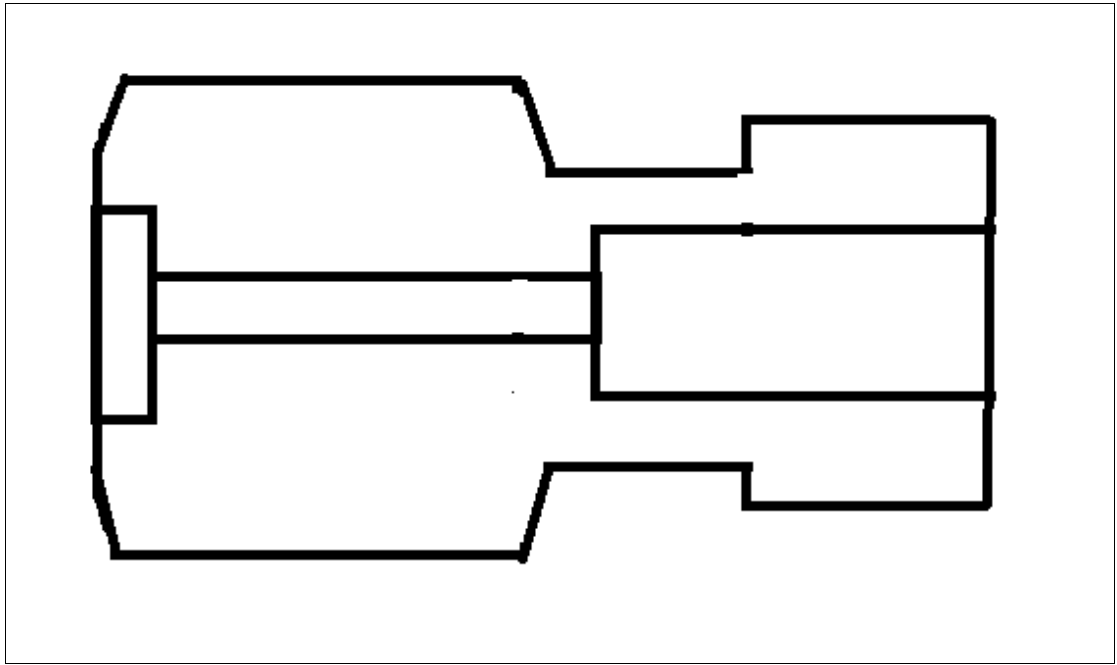
(.150 thickness)

1. Set up and do the OD first on 022L (C20) using low speed, a sharp tool and cutting only around .050 each time, put a plate on both sides of the part to strength.
2. make sure that the face is not running more that .050 on the face but it does not matter much
3. Cut only .050 each time and put a lot of presure on the part to avoid shaking or grinding on each plate.
4. Get to size on the OD, cut the sharp edges and move to another machine to do the Chamfler and Bore

40. SANDPAPER

The use of Sandpaper is banned to use in the company without supervision by a qualified person. ASK SUPERVISOR FOR HELP OR YOU CAN GET FIRED, do not wrap the sanding paper on your hands or it can suck you into the machine, if the bore is too small, do not put your fingers inside the hole with sandpaper, use a log, pliers or any other small tool, NO NOT USE GLOVES

41. MTO GEAR WORM



1th Operation

1. Cut some material on OD
2. Drill bore to size (drill+rim) slowly
3. Drill first Cb close to size
4. Finish first CB
5. Finish OD
6. Put Lifesaver
7. Finish groove
8. Finish 15 degree angles

2 th operation

1. Cut Jaws
2. Put part and check Tir
3. Drill a small bore close to c-bore sizes
4. Finish LTD
5. Finish second OD
6. Finish 45 degree
7. Drill second CB
8. Finish second C-bore

42. HOW TO CHANGE THE CHAWKS

Sometimes you will need to change the chawks to bore the driving hubs or square bars



1. take out the jaws
2. TURN OFF MACHINE
3. Close up the chawks
4. Find the tools to lose up the chawks (square .560 bar)
5. Find square bar to lose up new jaws (.500 square bar or socket extension)
6. Find out the special hook to lift up the chawks
7. lose up all the chawks lock except one.
8. Put the special hook and hoist
9. lose up the last chawlk lock, lift it up a little
10. Hit it with a hammer to lose it up and take it out
11. Clean up the drums and all parts very good before putting the new chawks,
12. Mark the holes where the pins will be inserted
13. Put the drums and push it with the boring tower and a wood log to tight it up
14. Tight only the locks that have a pin inside, the others will only turn and will not lock
15. Make sure that everything is correctly tight.
16. Test machine on slow speed
17. Change back chawks when you finish.

43. WHEN CLEANING OUT THE JAWS

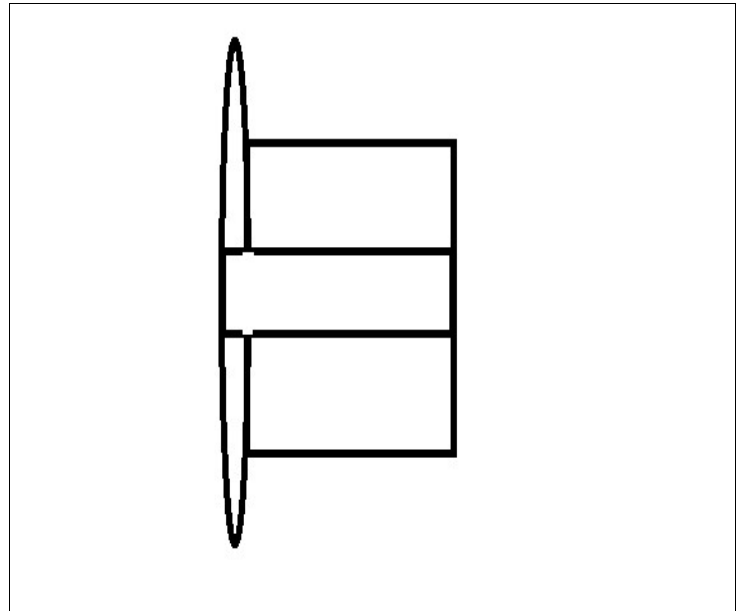
Sometimes trash goes on the back of the jaws, and accumulate on the sides, specially after you run brass or cast iron, making difficult to close or open the jaws,

you must remove the jaws and clean them up once in awhile and put some oil inside, the third one goes out first, then second, then first and to put them back 1 goes first, then second, then third.

put some oil or greese inside, close the lid of the machine, put some rags underneath and start the machine to get rid of the excess oil.

44. DRIVING HUBS

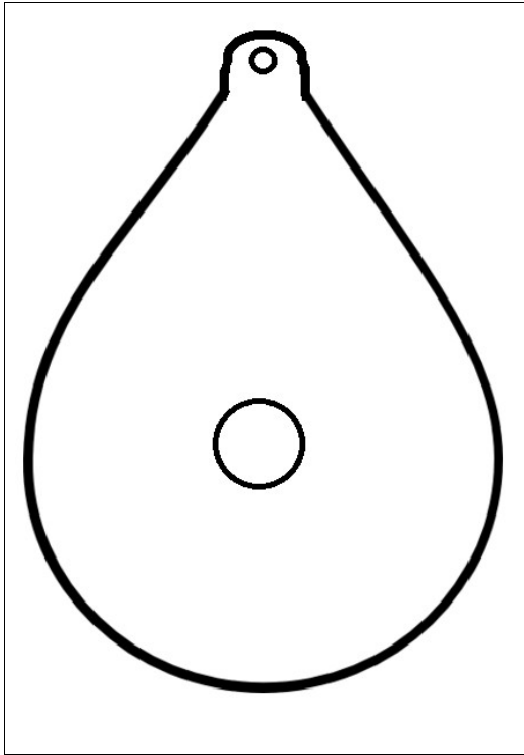
Driving Hubs are parts that have an elongated plate and a hub with a hole in the middle. the measures must be right all around, the dept from the face of hub to the face of plate and thickness of plate.



1. find a arbor that fits the hole of the driving hub
2. cut jaws, put arbor and check TIR on face and bar
3. put part, do not check TIR. Find a washer that is a little smalled that the hole that you are going to make.
4. make sure your piece is properly tighten.
5. Cut some material in OD, face and face of plate, finish it
6. take it out, take out the harbor, put some jaws to hold it by hub and cut jaws
7. put piece and cut some material on the face of plate, if allowed, to leave equal thickness on all sides
8. finish bore and cut sharp edges

45. How to do Driving Hubs plates

Driving hubs plates are plates that will be welded on a big hub



1. Put square jaws
2. Check bore size on paper
3. Check measure from bottom of part to center of bore, on paper mark it with chalk
4. TURN OFF MACHINE WHEN TIGHTENING BOLTS OR TAKING OUT PART
5. Put part, check that is centered on the base jaw
6. Make sure that bottom and top bolt are tight
7. Check Tir on Face and that the part is all the way to the back
8. Tight the bolts of the sides, side to side, tight the high side first (mark highest and lowest)
9. Tight the base and high side, then tight all four sides.
10. Make sure that all bolts are tight mark 2 of them to see which ones you will loose later
11. Use speed 312, Make sure that your insert wont hit the back
12. Make some cuts, measure the part from side to side they must match less that 40 thousand, if not do the tir again, tight the highest to move it sideways, make some more cuts and measure again
13. Check check TIR on face again because it may move.
14. Check concentricity again before finishing bore.
15. Cut sharp edges and make 45 on one side.

46. Things that need to be on each machine

1. Hammer
2. Air blower
3. Cheater pipe
4. Chawlk losing tool
5. 5/8 allen
6. 3/8 allen
7. 12mm allen
8. 10 mm allen
9. 1 inch boring bar
10. .750 boring bar
11. 1.500 boring bar
12. big allen wrench base
13. small allen wrench base
14. tool base
15. decimal chart
16. Millimeter Chart
17. 17.Taper chart

Personal things that you need

1. Calipher
2. Report papers
3. pen
4. markers
- 5.
- 6.
- 7.
- 8.
- 9
- 10.
- 11.
- 12.

47. INDIRECT LABOR REPORTING CODES MID

0010	Clean -up
0015	Machine Down
0020	Material Handling
0025	Re-setup
0030	Rework - No Operation # General Rework
0035	Safety Meeting
0040	Either Being Trained or Training Another Operator
0045	Wait 2nd Machine Setup
0050	Waiting on part/Material
0055	Waiting for Program
0060	Waiting for Program Correction
0065	Waiting for Setup
0070	Waiting for Work
0075	General Maintenance
0080	Orientation
0085	Admin Meeting
0090	1DR Work
0095	SS Hone
0100	QC Check / Inspection
0110	Waiting on Print
0115	Writing Program
0120	Make Tooling

48. WHAT NOT TO DO

1. NEVER LEAVE THE MACHINE ALONE WHEN IT IS RUNNING

2. Never turn the machine on if you have the insert very close, it can hit the piece, and pull the piece out of the jaws and break it.
3. Always put the brake on the tower when using the drill, because if you put the machine pulls the drill inward and break it.
4. Always check 2 or 3 times the size of the bore, and drill insert
5. Always look at what you're doing, if the machine is doing something weird turn it off
6. Always make small cuts and measures it until you have confidence measure and can cut more
7. Always check your measures 2 times and measured with the OD mic and caliper to make sure your measurements are OK, do the same with dep mic and caliper.
8. If you use a drill, make sure to pu the brake on the tower, otherwise the machine will suck it up and break it, insert and insert holders don't do that
9. Put your foot on the emergency brake if you need to turn off the machine immediately. Put it in neutral when you have to measure and prevent accidents.
10. If the sword or the drill breaks, turn off the machine and take out the bits out because those bits can break your next sword, insert or drill, sometimes have to flip the piece to the other side.
11. Slow down before you finish making the hole because vibrations can break the drill
12. Change the blades, drill bits inserts or damaged inserts because they can break inside, overheat the part or damage the workpiece or the machine.
13. Make sure that Chawks, the part, the tower, and inserts are properly secured before cutting the piece
14. Make sure the piece is well indicated before cutting.
15. You can turn the machine with the incert in the air to see where it is running.

16. If any error, call your supervisor immediately
17. Have patience at work and will learn
18. Always take care tools, not the breaks them, you put in the hard surfaces or drop them.
19. Always call your supervisor at the end of your first piece.
20. Always pay attention to your machine and not around you, the machine can break the insert, drill, or cut more.
21. If someone leaves a piece in the machine, the check the jaws, the tower and the part are tight and indicated.
21. At the end of the day, if you'll leave a piece in the machine, make sure it is tight enough so as not to cause an accident.
22. When trying a new speed turn the machine on to see if it ok.
23. Always wear gloves when changing the jaws, or when you put a large piece or when handling trash
24. Never change the speed or insert in your last cut, because they can cut more, for example, if you cut three thousandths, and put another speed, you're going to cut 5 or more . You have to make a small cut for adjusting the insert again.
25. Sometimes, the sword of the tower has pressure, and cuts of more, so it is a good idea to let the machine make a cut to 0 or 1 when you have like 10 thousandths, to see how much it cuts, also is a good idea to take away the Slack to the graduated wheel.

26. ALWAYS TIGHTEN BOLTS ON BOLTED PARTS (SPLIT GEARS), and make sure you are properly aligned.

27. Always fill your paperwork before cleaning the end of the day, and return the digital mics and tools before cleaning.

28. While always grab the ID MICS properly when checking the size of the bores because you can fall into the water, never hit them or drop them.

29. Never put water in the insert or the workpiece if too hot, the insert can be break by the temperature change, always put water before they overheat the piece . If the piece is too hot or you are almost finishing, slow down and put water to cool the part,

especially in stainless steel and bronze, otherwise the bore will shrink when cools down.

30. Always remove the trash of the bores because if you don't do it, the part will overheat and break the insert or drill

31. If you change insert, make a small cut for adjusting the insert and remove the pressure.

32. Put life-saver if you can to prevent the piece from falling, if it falls, press the foot brake immediately.

33. Always do chamfers, grooves and radios in a slow speed.

34. Always put water in your piece if you cut a lot so not overheat, turn off the pump if not you are using it, clean the pump with air if it becomes clogged. Cool down your piece before finishing.

35. Never run inside the shop or on company property.

36. If you're going to be late, call your supervisor

(_____)

37. Never put parts of your body near the machine when it is turned on.

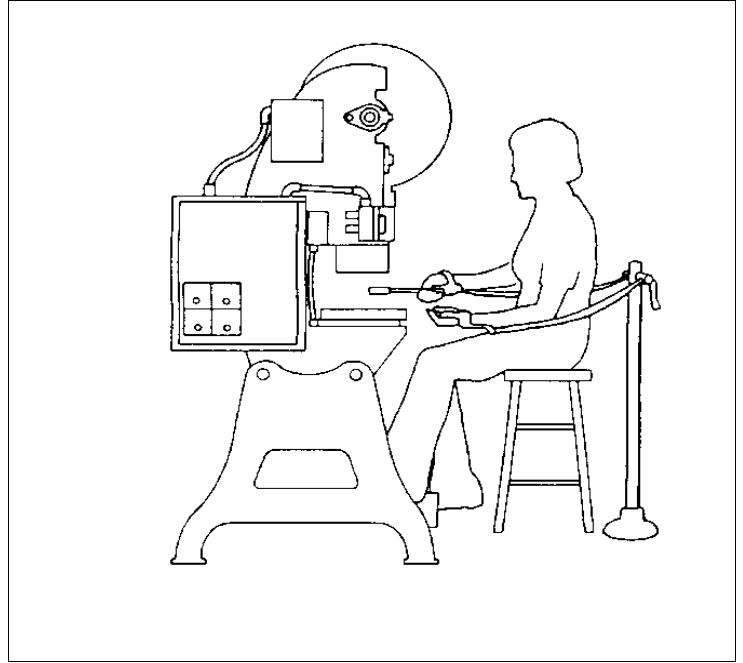
38. Do not hit the drilling tower against the tools tower, you will damage the X bar underneath.

39. Do not tight the bolts too much on the Taper bar.

40. Be very careful when using sanding paper, **ASK SUPERVISOR FOR HELP OR U CAN GET FIRED**, do not wrap the sanding paper on your hands or it can suck you into the machine, if the bore is too small, do not put your fingers inside the hole with sandpaper, use a log, pliers or any other small tool, **NO NOT USE GLOVES**

49. Dangers of the Lathe Machine

Any machine with moving parts has a lot of dangers, body parts can get caught in the machine if started accidentally, you can trip and fall into the machine if you have any material, cables, hoses, trash close to the machine or work area, clean up any spills and watch out for any other tripping hazard.



*Get a good hold of the wheel and other tools before moving them because your hand can slip and bump your head against the chawks, it can be deadly if the machine is moving.

*Lower your shield before starting the machine, this will avoid rubber parts to get caught in the moving machine and and rip parts of metal, break jaws or other accidents that may cause flying parts or metal going up against you.

*lose clothes, watches, jewelry, long hair or other things can cause your body to get caught in the machine and suck you into it. This is one of the leading causes of deadly accidents in the machine. Work on lower speeds when possible, specially when using file or deburner tools. Remove the tool tower about 2 feet away from the jaws when using a file, deburner or taking measures, enclosed places can be a cause of accident.

* Turn off your machine when:

1. Setting or taking out parts
2. You are doing general cleaning in your area, under or inside the machine
3. When you are changing parts on the machine, gears, chawks, or setting up big pieces or jaws.
4. When somebody else is helping you changing parts, cleaning or setting up big pieces.
5. When hoisting or setting up big pieces, to avoid accidentally starting up your machine with your legs, feet or the hoisted part.
6. When cleaning or getting stuffs from behind the machine.

You may turn off your machine or putting in neutral when.

1. Doing some light cleaning on the machine, when putting up jaws or setting up tools
2. When getting out trash, parts, shims or other tools that may have fallen under the machine. Do not get them when the machine is moving, this may cause your arms or body to get caught in the moving parts of the machine. Use a broom or other long tool to move things far from the machine.

Put your machine in neutral when you or somebody else is taking measures or doing anything that causes your hand or body to be close to the chawks or other moving parts of the machine.

Do not start the machine when somebody else is close to it.

50. Floor mats



Floor mats are wooden frames that are used in the floor close to the machine for safety, to avoid slippery floors or to provide a dry, soft surface for workers, make sure that the gaps between the boards are not too wide because they may become a tripping hazard, if somebody falls into a moving machine it can be deadly.

Watch out for loose, broken or missing floorboards, nails, uneven surfaces, gaps or holes close to the machine that also can become a tripping hazard, watch out for trash, cables, hoses or slippery surfaces and others tripping hazards in the work area.

Look out for electrical cables that may come in contact with water and become an electrocution hazards.

Do not go into enclosed, confined spaces without proper training.

Always think on safety when working and avoid accidents and incidents.