








INTRODUCTION TO LATHE (SAFETY, PARTS & OPERATION)



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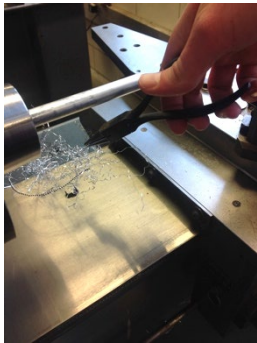
	CONTENT	VISUALS	TRAINER NOTES
1	SAFETY FIRST		
2	<p>WHO IS OSHA</p> <p>With the <u>Occupational Safety and Health Act of 1970</u>, Congress created the <u>Occupational Safety and Health Administration (OSHA)</u> to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance.</p> <p>ORGANIZATION</p> <p>OSHA is part of the <u>United States Department of Labor</u>. The administrator for OSHA is the Assistant Secretary of Labor for Occupational Safety and Health. OSHA's administrator answers to the <u>Secretary of Labor</u>, who is a member of the cabinet of the President of the United States.</p>		<p>Explain who OSHA is and its role in ensuring safe and healthful working conditions</p>
3	<p>KNOW YOUR RIGHTS</p> <p>Under federal law, you are entitled to a safe workplace. Your employer must provide a workplace free of known health and safety hazards. If you have concerns, you have the right to speak up about them without fear of retaliation. You also have the right to:</p> <ul style="list-style-type: none"> ● Be trained in a language you understand ● Work on machines that are safe ● Be provided required safety gear, such as gloves or a harness and lifeline for falls ● Be protected from toxic chemicals ● Request an OSHA inspection, and speak to the inspector ● Report an injury or illness, and get copies of your medical records ● See copies of the workplace injury and 		<p>Read the rights to the trainees and point them to the posters available around the workplace where they can refer to for more information. Extra resources can be found at https://www.osha.gov/workers/index.html</p>


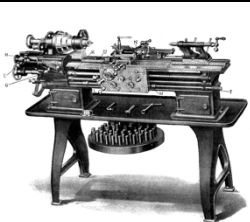
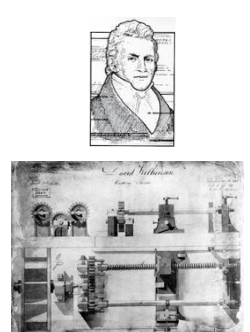

	<p>illness log</p> <ul style="list-style-type: none"> ● Review records of work-related injuries and illnesses ● Get copies of test results done to find hazards in the workplace 		
4	<p>INTRODUCTION TO LATHE (Machine Guarding)</p>		
5	<p>WHAT IS MACHINE GUARDING A means of shielding employees from moving or flying parts and preventing them from accidentally coming into contact with moving pieces of equipment</p>	 	
6	<p>MACHINE-RELATED INJURIES Possible machinery-related injuries include:</p> <ul style="list-style-type: none"> ● Crushed fingers or hands ● Amputations ● Burns ● Blindness <p>A good rule to remember is: Any machine part, function, or process which may cause injury must be safeguarded</p>		<p>Many accidents result from persons working on, or around, moving machinery. These accidents could have been prevented by the installation and proper maintenance of guarding. The goal of this training is to make the guarding of all equipment as easily understood as possible and re-inforce the safe working procedures that must always be in place around dangerous equipment.</p> <p>This list of accidents is as long as it is horrifying.</p> <p>Safeguards are essential for protecting workers from needless and preventable injuries. Where the operation of a machine can injure the operator or other workers, the hazard must be controlled or eliminated.</p>


			<p>National Emphasis Program on Amputations*. CPL 03-00-019, (August 13, 2015). Describes policies and procedures for implementing a National Emphasis Program (NEP) to identify and to reduce workplace machinery and equipment hazards which are causing or likely to cause amputations.</p> <p>Resource:</p> <p>https://www.osha.gov/dte/outreach/construction_generalindustry/gi_outreach_tp.html</p> <p>https://safetyresourcesblog.com/2014/08/16/osha-quickcards-download-here-all-free-englishspanishother/</p>
7	<p>MACHINERY ACCIDENTS Examples of how machine accidents can occur: Hazardous conditions Missing or loose machine guards Human actions Reaching-in to “clear” equipment Unauthorized persons doing maintenance or using the machines</p>		
8	<p>BASIC MACHINERY PARTS AND HAZARDS Three fundamental machine areas:</p> <ul style="list-style-type: none"> ● Point of operation ● Power transmission device ● Other moving parts – Operating controls such as mechanical or electric power control 		<p>“All machines consist of three fundamental areas: the <u>point of operation</u>, the <u>power transmission device</u>, and the <u>operating controls</u>. Despite all machines having the same basic components, their safeguarding needs widely</p>


			<p>differ due to varying physical characteristics and operator involvement” (OSHA 2007).</p> <p>OSHA Machine Guarding eTool - https://www.osha.gov/SLTC/etools/machineguarding/intro.html</p>
9	<p>HAZARD TYPES (4 slides)</p> <ul style="list-style-type: none"> ● Point of Operation ● Nip Points and Rotating Parts ● Flying Chips 		<p>These hazards exist on the Lathe and they need to be guarded.</p> <p>Explain that the Point of Operation is where the work is being done on the machine. In this case it is where the cutting tool contacts the work material.</p>
10	<p>POTENTIAL HAZARDS</p>		<p>The primary hazards of lathes are contact with rotating parts and contact at the point of operation. An operator can be pulled into the lathe from working too close, or wearing gloves, loose clothing, loose hair, or jewelry. Trapping spaces are also created between the cutting tool, its mounting, and the workpiece or chuck. Projected parts or material such as chuck keys, unsecured workpieces, flying chips and coolant also strike or present hazards to the operator.</p>
11	<p>PREVENTING INJURIES AND AMPUTATIONS</p>		<p>Any user needs to have taken the in person Lathe</p>



	<ul style="list-style-type: none"> ● Do not remove any guards, or other devices. ● Always use the flip down clear guard to protect against flying chips or work pieces. ● Make sure that that spindle nose cover is on the machine when a chuck is not in use. This protects operators from point of operation contact. ● Make sure to always put the collet closer guard down before starting the lathe. This protects the users from rotational hazards. ● Do not operate the lathe unless you are trained and authorized to operate the machine ● Move the carriage back to a safe distance when loading or unloading parts and measuring the work. ● If performing service and maintenance activities follow lock out tag out procedures 		<p>Introduction session to use the machine.</p> <p>If the Emergency Stop switch is engaged, pull it out to reset it.</p> <p>If a measurement needs to be made or a tool needs to be changed turn the spindle off.</p> <p>Do not reach in while the cutting tool is rotating.</p> <p>If the lathe is malfunctioning or something isn't working right let one of the shop staff know.</p>
12	<p>SAFETY PRECAUTIONS I</p> <ul style="list-style-type: none"> ● Be sure the work and holding device are firmly attached ● Turn spindle by hand using the hand wheel, with lathe turned OFF, to be sure there is no danger of striking any part of the lathe 	 <p>Replace picture with one that has the spindle nose cover on it</p>	<p>Anyone operating the lathe must make sure that their work piece and holding devices are securely mounted to the machine.</p> <p>It is a good idea to manually rotate the spindle of the lathe to make sure that the work piece or holding device does not strike anything on the lathe, especially for large work pieces.</p>
13	<p>SAFETY PRECAUTIONS II</p> <ul style="list-style-type: none"> ● Keep machine clear of tools. Tools must not be placed on the ways of the lathe ● Stop lathe before making any measurements, adjustments, or cleaning ● Support all work solidly. Do not permit small diameter work to project too far from chuck (not 		<p>Do not leave tools on the ways of apron of the machine the can get struck by the work piece or holding device.</p> <p>Never reach in towards the Point of Operation while the spindle is turning.</p>



	over 3X the work's diameter) without support		Work pieces that need to extend more than 3 X the diameter need to be supported so that the piece will not have the chance to whip around while the work is being performed.
14	<p>SAFETY PRECAUTIONS III</p> <ul style="list-style-type: none"> ● If work must be repositioned or removed from the lathe. Move cutting tool clear of work to prevent any accidental injuries ● You should always be aware of direction of travel and speed of carriage before you engage automatic feed 		<p>Users always need to make sure that they move cutting tools and attachments out of the way before moving their work pieces so that they remove the risk of accidental cuts or injury.</p> <p>When using the power feed on the machine users must always know which way the machine will travel so that injury or machine crashes do not occur.</p>
15	<p>SAFETY PRECAUTIONS IV</p> <ul style="list-style-type: none"> ● Chips are sharp. Do not attempt to remove them with your hand when they become “stringy” and build up on tool post or work piece. Stop machine and remove them with pliers 	 <p>Replace picture with one that has the spindle nose cover on it.</p>	<p>Lathe chips may not seem dangerous, but they are sharp and can cause cuts. Chips can also be hot so do not attempt to catch the chips while cutting. Do not allow chips to run through hands or fingers while the machine is running. Serious injury can result. Long stringy chips are also dangerous. If these occur shut off the power feed and the spindle and remove them with pliers.</p>
16	<p>SAFETY PRECAUTIONS V</p> <ul style="list-style-type: none"> ● Stop lathe immediately if any odd noise or vibration develops. If you cannot locate source of the trouble, get help from instructor. Under no circumstance should the 		<p>If the lathe starts making odd noises or vibrating stop the machine and let one of the shop staff members know.</p>




	<p>lathe be operated until the problem has been corrected</p> <ul style="list-style-type: none"> ● Remove sharp edges and burrs from work before removing it from the lathe 		<p>Sharp edges and burrs can cause cuts always be sure to remove them.</p>
17	<p>PROTECT YOURSELF WITH PPE</p> <ul style="list-style-type: none"> ● Always wear safety glasses ● Always wear closed toe shoes that protect the top of your foot ● Do not wear any rings or dangling jewelry ● Long hair needs to be tied up or put into a bun 		<p>Personal Protective Equipment may be a bit uncomfortable or bulky, but needs to be worn to protect the user.</p>
18	<p>INTRODUCTION TO LATHE</p>		
19	<p>ORIGIN David Wilkinson was a U.S. mechanical engineer who invented a lathe for cutting screw threads, which was extremely important in the development of the machine tool industry in the early 19th century.</p>		
20	<p>In 1794, Wilkinson designed a screw-cutting lathe with a slide rest on which he obtained a patent in 1798. It is not known how many of these lathes Wilkinson produced in his own plant, but in 1848 a Senate Committee found that there were more than 200 such lathes in use in government workshops alone.</p>		
21	<p>WHAT IT DOES The lathe is a machine tool used principally for shaping pieces of metal (and sometimes wood or other materials) by causing the workpiece to be held and rotated by the lathe while a tool bit is advanced into the work causing the cutting action.</p>		<p>The basic lathe that was designed to cut cylindrical metal stock has been developed further to produce screw threads, tapered work, drilled holes, knurled surfaces, and crankshafts.</p>

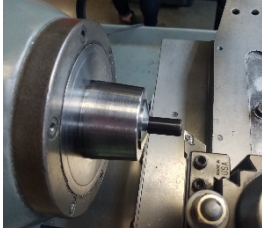
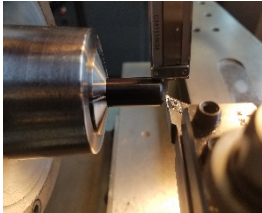
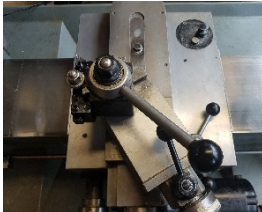

22	MAJOR COMPONENTS OF THE LATHE		
23	<p>IMPORTANT PARTS</p> <p>Digital Readout Description</p> <p>On/Off Speed Control Description</p> <p>Tool Post Description</p> <p>Compound Description</p> <p>Tail Stock Description</p> <p>Power Feed Control Description</p> <p>Collet Storage Cabinet Description</p> <p>Power Feed Levers Description</p> <p>Carriage Handwheel Description</p> <p>Threading Handle</p> <p>High</p> <p>Low Description</p> <p>Spindle Forward Reverse Description</p> <p>Head Stock Description</p> <p>Spindle Description</p> <p>Bed Description</p> <p>Threading Lever Description</p>		<p>Show respective parts to trainees. Refer to larger picture at the end of the training packet.</p>
24	INTRODUCTION TO LATHE (Safe Machine Operations)		




<p>25</p>	<p>SAFE MACHINE OPERATIONS 1</p> <p>Squaring Aloris tool post to spindle face</p>		<p>Some lathe operations require the lathe tool to be perpendicular to the centerline of the spindle. To accomplish this have the trainees</p> <ul style="list-style-type: none"> Loosen the nut on top of the Aloris tool post Remove spindle nose cover. Bring the carriage forward until the Aloris tool post lightly contacts the spindle face. Make sure that the Aloris tool post completely contacts the spindle face. Tighten the nut on top of the Aloris tool post. Replace spindle nose cover.
<p>26</p>	<p>SAFE MACHINE OPERATIONS 2</p> <p>Selecting and preparing to load a 5C collet</p>		<p>The collets for the lathe are graduated in 1/64" increments. Measure the work piece you will working on and select the collet size that will best fit the work piece.</p> <p>Explain that the keyway that is on the threaded end of the collet is going to have to line up with the key of the machine.</p> <p>The keyway that is inside the spindle nose lines up with the keyway that is on the outside of the spindle nose and can be used as reference when lining the collet keyway up with the spindle keyway.</p>

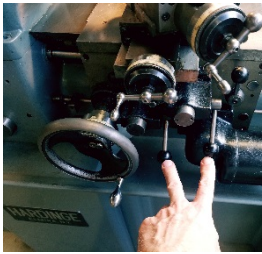
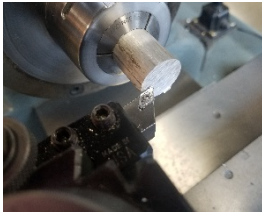

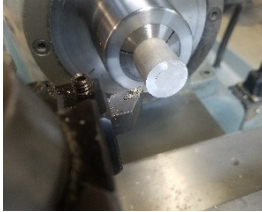
27	<p>SAFE MACHINE OPERATIONS 3</p> <p>Inserting the 5C lathe collet into spindle</p>	 <p>Take a picture of only the lathe spindle with the spindle nose cover on it.</p>	<p>Lift the Collet closer guard that is at the left hand side of the machine.</p> <p>Show the trainees how to turn the brake off so that the spindle can be rotated by hand.</p> <p>Turn spindle hand wheel at the back of the Head Stock by hand until its keyway is at the 12 o'clock position. The external keyway and internal key of the spindle are in the same orientation.</p>
28	<p>SAFE MACHINE OPERATIONS 4</p> <p>Threading the draw tube onto the collet end</p>		<p>Push collet closer lever yolk all the way to the right.</p> <p>Insert the collet into the spindle nose with the keyway facing up.</p> <p>Place right hand over collet and exert light pressure onto face of collet and turn shell guard clockwise to start threading collet into draw tube.</p>
29	<p>SAFE MACHINE OPERATIONS 5</p> <p>Adjusting collet to workpiece size</p>		<p>The collet will need to be adjusted so that it has a preload and will clamp onto the work piece. To do this push the collet closer lever to the left and turn the collet shell guard until you feel slight resistance on the shell guard. This will indicate that the collet has made contact with the work piece.</p> <p>Stop turning the shell guard when you feel the resistance.</p>



30	<p>SAFE MACHINE OPERATIONS 6</p> <p>Setting collet clamping pressure</p>		<p>Push collet closer lever yolk to the right and remove workpiece. Add clamping preload to collet by releasing adjusting finger that is on shell guard and turn shell guard clockwise counting 5 or 6 spaces on adjusting nut, then re-engage adjusting finger.</p> <p>Tell the trainees not to rest their other hand on the collet closer yolk while engaging it. They may risk pinching their finger.</p>
31	<p>SAFE MACHINE OPERATIONS 7</p> <p>Clamping the workpiece in the collet</p>	 <p>Replace this picture with one that has the spindle nose cover on it.</p>	<p>Reinsert workpiece into collet and give collet closer lever yolk a firm push to the left. The Collet Closer Yolk should give an audible click that will indicate that workpiece is clamped.</p> <p>Engage collet closer yolk with a stiff arm to reduce risk of over-exerting your shoulder</p> <p>Flip Collet Closer Guard down.</p> <p>Replace the spindle Nose Guard onto the spindle face.</p>
32	<p>SAFE MACHINE OPERATIONS 8</p> <p>Selecting a lathe tool</p>		<p>General purpose tool is for cutting steel, stainless steel, and cast iron. It is recognized by the gold color of the insert.</p>

			<p>This tool is for cutting aluminum, wood, titanium, and plastic. It can be recognized by its sharp edges and shiny appearance.</p> <p>Do not run fingers or hand over cutting edge of tool or risk getting cut.</p>
33	<p>SAFE MACHINE OPERATIONS 9</p> <p>Loading the lathe tool onto the Aloris tool post.</p>		<p>Tell the trainees that they need to make sure that the spindle is not turning when loading the tool. This could constitute a point of operation contact or in line nip point.</p> <p>Push the Aloris Tool Post handle forward to release the cam lock.</p> <p>Grip the lathe tool holder and insert it on top of the dovetail of the Aloris tool post.</p> <p>Pull tool post handle back towards the operator until resistance is felt. This will indicate that the tool post clamp has engaged onto the tool holder.</p>
34	<p>SAFE MACHINE OPERATIONS 10</p> <p>Calculating workpiece radius</p>	 <p>Replace picture with one that has the spindle nose</p>	<p>Use a caliper to measure the workpiece diameter and divide by 2 to calculate the radius.</p> <p>Set the caliper to the radius of the workpiece.</p>

		<p>cover on it.</p>	
	<p>SAFE MACHINE OPERATIONS 11</p> <p>Setting the lathe tool on center</p>	  <p>Replace these pictures with pictures that have spindle nose covers on them.</p> 	<p>Using Carriage Feed and Cross Slide Feed handles bring the lathe tool as close as you can to the face of the part and as near to the center of the workpiece as possible without touching it.</p> <p>Push the tool post handle forward to unlock the lathe tool holder.</p> <p>Set dial caliper on top of workpiece and adjust the height of the tool using the height adjusting nut and lock nut. The edge of the lathe tool should just contact the bottom of the dial caliper.</p> <p>Pull the tool post handle back to you to lock the mounted tool in place.</p>
<p>35</p>	<p>SAFE MACHINE OPERATIONS 12</p> <p>Turning lathe on and adjusting speed</p> <p>Note: Make sure that the floor is dry to eliminate risk of electrocution.</p> <p>Make sure that the Clear chip guard is flipped down and that the collet closer guard is down.</p> <p>The Emergency Stop button is used to shut the machine down if something goes wrong.</p>	 <p>Get a side picture that shows power disconnect</p> <p>Insert picture depicting the emergency stop button.</p>	<p>The disconnect on the machine is the switch that disconnects the power form the main supply.</p> <p>The start / stop buttons are used to activate and deactivate the lathe's motor.</p> <p>The Emergency stop switch is located on the front panel of the lathe. It is used in case there is an emergency and the machine needs to be shut off quickly.</p>

			<p>Demonstrate the emergency stop switch</p> <p>The spindle forward and reverse switch is used to set the spindle rotation to forward or reverse.</p>
36	<p>SAFE MACHINE OPERATIONS 13</p> <p>Speed control, low-speed and high speed handle, and Emergency stop switch.</p> <p>Note: This lever turns the spindle on. Keep your hands away from workpiece or near back of head stock while spindle is running</p>	 	<p>The Low-speed and high-speed handle is used to select whether the low speed ranges or high speed ranges are going to be used. The spindle is off when the handle is at the 12 o'clock position. Pushing the handle to the left engages low speed and pushing the handle to the right engages high speed</p> <p>Turn the lathe on in low gear and demonstrate how to switch to high gear</p> <p>The speed control knob allows the operator to increase or decrease the speed of the lathe</p> <p>Demonstrate how to adjust the spindle speed using the speed control knob</p>
37	<p>Power feed unit, carriage feed (Z axis) and cross slide feed (X axis)</p> <p>The best finishes and tolerances are achieved by using the power feed which moves the tool at a constant feed rate across the workpiece</p> <p>Note: Do not put fingers or body parts in between moving parts while power feed is on they could get crushed. Insert a crushed finger symbol</p>		<p>The power feed controls are on the right side of the machine.</p> <p>The right / left switch relates to the direction that the engaged axis will travel.</p> <p>The feed rate rheostat can be adjusted from 0 (no feed) to 100 (very fast)</p>

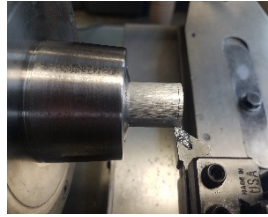
			<p>feed).</p> <p>The power feed for either the longitudinal or the cross slide feed is engaged by the power feed levers next to the carriage handwheel (longitudinal) and cross slide feed handles. The power feed will only work if the spindle is turning.</p> <p>Demonstrate how to switch from left to right feed.</p> <p>Demonstrate how to adjust the power feed rate.</p> <p>Demonstrate engaging the longitudinal feed.</p> <p>Demonstrate engaging the cross slide feed.</p>
38	<p>Facing (cross feed)</p> <p>This operation is used to create a smooth flat surface on the end of the part.</p> <p>Safety Notes: Put Chip Shield down before turning spindle on.</p> <p>Do not put fingers or hands anywhere near the rotating material or cutting tool. Insert a broken fingers symbol and cut symbol</p> <p>Do not grab the chips as they are coming off the workpiece. Insert a cut finger symbol.</p> <p>Do not have the workpiece protruding more than 3 times the diameter from the collet</p>	  	<p>Bring lathe tool within approximately $\frac{1}{8}$" of the face of the workpiece and adjust it on the cross slide so that it is approximately halfway between the outside diameter (OD) and the center of the part.</p> <p>Turn on the spindle in low and select the speed at which the workpiece needs to spin.</p> <p>Slowly bring the lathe tool towards the face until you see some chips just coming off the face.</p> <p>Slowly turn the cross slide handle counterclockwise until the lathe tool clears the OD of the part.</p>

		<p>Replace pictures with pictures that have the sPindle Nose Guard on them.</p>  	<p>Turn off the spindle.</p> <p>Visually check the face of the workpiece to see about how much material may need to come off the face for it to clean up.</p> <p>Set the graduated collar on the Carriage Handwheel to 0.</p> <p>Adjust the Carriage to the left by .030 and turn the spindle on low.</p> <p>Make sure that the power feed switch is set to the "right" direction and engage the cross slide power feed lever.</p> <p>Allow the lathe tool to progress to the center of the workpiece then disengage the cross slide power feed lever.</p> <p>Turn off spindle and inspect face after spindle comes to a complete stop.</p> <p>Repeat the steps in #38 until face has completely cleaned up.</p>
39	<p>Traverse cutting</p> <p>This operation is used to reduce the diameter of the workpiece</p> <p>Safety Notes: Put Chip Shield down before turning spindle on.</p> <p>Do not put fingers or hands anywhere near the rotating</p>		<p>Make sure that the lathe tool is clear of the outside diameter of the workpiece by approximately $\frac{1}{8}$". Turn the Carriage Handwheel counter clockwise until the lathe tool is over the workpiece.</p> <p>Turn the spindle on in low gear</p>

material or cutting tool. Insert a broken fingers symbol and cut symbol

Do not grab the chips as they are coming off the workpiece. Insert a cut finger symbol.

Do not have the workpiece protruding more than 3 times the diameter from the collet



Replace picture with one that has spindle nose guard on it.



Slowly turn the cross slide handle until the tip of the lathe tool lightly touches the outside diameter of the workpiece.

Turn the spindle off

Set the cross slide dial to 0

Turn the cross slide handle counterclockwise by at least .050 to pull it away from the surface of the workpiece


Turn the carriage handwheel clockwise until the lathe tool clears the face of the workpiece by about $\frac{1}{8}$ " to the right

Turn the cross slide handle clockwise until you reach 0 then carefully turn the cross slide handle to the amount you wish to remove from the diameter (OD) of the workpiece.

Make sure that the power feed direction switch is set to "left" then turn the lathe on in low speed

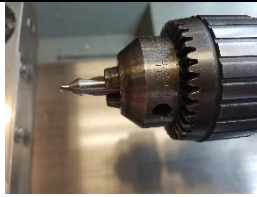
Engage the carriage power feed lever. Note: If chips do not break, intermittently disengage and re-engage the carriage power feed lever to break the chips.

Disengage the carriage feed lever when the desired length of cut is

			<p>reached.</p> <p>Turn the cross slide handle counterclockwise to disengage the lathe tool from the workpiece and turn the carriage handwheel clockwise to clear the lathe tool from the workpiece.</p> <p>Turn off spindle</p> <p>Repeat the steps in #39 until desired size is reached.</p>
40	<p>Drilling</p> <p>Safety Notes: Put Chip Shield down before turning spindle on.</p> <p>Do not put fingers or hands anywhere near the rotating material or cutting tool. Insert a broken fingers symbol and cut symbol</p> <p>Do not grab the chips as they are coming off the workpiece. Insert a cut finger symbol.</p> <p>Take caution not to get the heel</p>		<p>Select a drill chuck with a tapered shank that fit into the tailstock quill.1.17.1 Turn the tailstock handwheel clockwise until the quill is extended out ½". Reference the graduations on the quill.</p> <p>Make sure that the drill chuck taper and the tailstock quill taper are clean and free of oil.</p> <p>Take the drill chuck and run it into the female taper of the tailstock. It should lock in the taper at this point</p> <p>Select a center drill. A center drill is used to accurately locate a hole prior to drilling</p> <p>Insert the center drill into the drill chuck so that the point remains protruding from the drill chuck jaws. Turn the drill chuck body</p>

of your hand too close to the chuck key chuck interface because they could get pinched. Insert a pinch point picture.

Do not reach in front of the center drill you can get cut by the sharp point



clockwise with the other hand until the jaws engage the center drill body.

Take the chuck key and insert it in one of the 3 holes around the perimeter of the chuck. Firmly grab the chuck key and turn it clockwise until the chuck is tightened

Locate the tailstock cam lock on the far side of the tailstock and push it down this will unlock the tailstock from the bed of the lathe

1.17.8 Slide the tail stock forward until the drill point is approximately $\frac{1}{4}$ " away from the face of the workpiece and lock the tailstock cam lock by pulling it up.

Make sure that the tailstock quill lock is loosened by turning it counter clockwise

Turn lathe spindle on in low speed

Slowly turn the tailstock handwheel clockwise until your drill reaches the desired depth. Then turn the tailstock handwheel counterclockwise until the drill is completely out of the workpiece.

Repeat operations in step #40 for subsequent drilling operations

41 MORE IMPORTANT SAFETY PRECAUTIONS.

