

Shop Safety Procedure



Equipment/Task Name:	METAL TURNING LATHE
Equipment/Task Hazard Class:	5 http://ehs.yale.edu/forms-tools/tool-classification-matrix
Shop Name:	
Shop Hazard Class:	

Purpose

Metal turning lathes are used to precision machine circular (round) features on metal, plastic, and composite work pieces. With the appropriate tooling and fixtures, metal turning lathes can also produce concentric features internal or external to the surface of the work piece, including concentric precision diameters, tapers, threads, and chamfers.

Hazards

As with all shop tools, there are many potential hazards associated with the use of a metal turning lathe. Small bench-top and mini-lathes are Class 3 or 4 tools, while self-standing industrial sized machines are Class 5 tools (<http://ehs.yale.edu/forms-tools/tool-classification-matrix>). There are a number of particular hazards associated with the operation and use of metal lathes.

Rotating components:

- Rotating components are found on the:
 - Chuck, other holding fixtures, and the turning work piece
 - Drive and transmission shafts
 - Feed shafts, cranks, and knobs
 - Headstock
- Rotating components can result in accidental entanglement or worse with body parts, hair, loose jewelry, or clothing.
- Rotating components operating at excessive revolutions per minute create an extreme danger. In emergencies and when the emergency stop is activated, the machine will take much longer to stop. Limit spindle rotation to 1000 RPM or slower whenever possible

Pinch points / in-running nip points:

- Pinch points and in-running nip points can be found between the:
 - Cutting tool and work piece
 - Carriage and stationary lathe parts
 - Carriage and rotating lathe parts or the work piece
 - Feed cranks and stationary lathe parts
- Pinch points and in-running nip points can cause bruising, crushing, and even amputation hazards, and can also offer additional entanglement hazards to clothing and other loose hanging materials.

Hazards (cont'd)

Cut and laceration hazards:

- Sharp edges and pieces are frequently generated during tooling and cutting, creating risks of cuts and lacerations. These include handling of:
 - Cutting tools and drill bits
 - Machined/ cut edges on work pieces
 - Chips and cutoffs from work pieces
 - Rotating/ moving long spiral “chips”
 - Improper storage of unused cutting tool and materials

Flying objects:

- Lathe cutting creates the potential for objects to be thrown from the work piece at high velocity, with a high risk of injury. Flying object hazards can be generated from:
 - Improperly secured work piece
 - Improperly secured cutting tools
 - Failure to remove the chuck key from the chuck before starting the lathe
 - Cutting debris and chips
 - Collision between the cross-slide carriage / tooling and fixed objects or the workpiece.

Burn hazards:

- Cutting metals and other materials at high speed on a lathe, even with cutting fluids or coolants, produces significant amounts of friction and heat. Components that may become very hot include:
 - Cutting chips- be aware that some metal chips can themselves be fire hazards – consult the Safety Data Sheet for exotic or reactive metals, and review in advance with shop manager, instructor, or Yale EHS (<http://ehs.yale.edu/forms-tools/chemwatch-msds>)
 - Tooling/ bits/ tool holders
 - Work pieces and cutoffs

Limitations

Users should check with the shop manager, instructor, or supervisor before machining unusual or exotic materials such as composites, titanium, magnesium, or beryllium, as these materials may also create serious fire or inhalation hazards.

Required Personal Protective Equipment

- Refer to the Shop Safety Postings and instructions provided by the Shop Supervisor.
- Safety glasses
- Shop specific required PPE:

Required Training

- Applicable Shop Rules
 - **Student Shop Rules** (<http://ehs.yale.edu/forms-tools/shop-rules-student-accessible-shops>)
 - **Professional Shop Rules** (<http://ehs.yale.edu/forms-tools/guidelines-professional-shops>)
- For Class 2 through 5 Student Shops, review and signing of the **Yale University Shop/Tool Use Safety Agreement** (<http://ehs.yale.edu/forms-tools/shoptool-use-safety-agreement>).
- Shop Supervisors or Instructors must evaluate the tool user based on successful demonstration of the Training Competencies listed below as applicable.

Training Competencies:

- Identify the uses, limitation, and hazards of the metal turning lathe, including locations and use of all controls and machine E-stop methods.
- Demonstrate use of appropriate clothing, work boots and correct personal protective equipment.

Required Training (cont'd)

- Demonstrate how to inspect the lathe and setup for selected operation, with power shut-off.
- Properly demonstrate lathe preparation and start-up process.
- Demonstrate proper placement of work pieces and secure as needed.
- Demonstrate safe turning operation, including using adequate lubrication and appropriate spindle speed and feed for work piece material, cutting bit selected and secure work holding methods
- Be able to correctly observe lathe operations and know when intervention is required and perform appropriate interventions including knowledge of emergency stopping procedure.
- Demonstrate how to properly set spindle speeds

Shop specific training requirements:

Authorized Tool Users

Shop Supervisor, Shop Monitors and those authorized by shop supervision to operate the tool.

Tool Safety Rules

- Observe and follow all Yale Professional or Student Shop Rules as posted.
- Report any safety concerns to the shop supervisor immediately.
- Understand and follow manufacturer operating procedures. (Are they provided?)
- Inspect the cutting tool for damage prior to use.
- Verify all guards are in place and adjusted properly.
- Do not bypass any safety devices.
- Always stay at the machine while it is running.
- Clean the machine completely after use.
- Report any malfunction or damage to the Shop Supervisor after tagging the machine tool "Out of Service, do not use".
- Maintain exclusive control of the machine. Don't allow anyone else to touch the machine while in operation.
- Do not make measurements of the stock while the machine is rotating.
- Do not allow large quantities of chips to accumulate around the work piece or machine table. After stopping the machine, use a chip brush pliers to remove all excess chips from the mill table and stock. Never use your hands
- Work pieces, stock, cutting tools and accessories must be secure before operation.
- Use appropriate speeds and feeds for the type and size of cutter being used and the material being machined.
- Make sure the cutting tool is clear of the work piece before starting the machine.
- Obtain help or use lifting aids when placing or removing awkward or heavy work pieces.

Shop specific rules:

Proper Setup and Use

Prior to approaching the lathe you should have:

- Verified that the work piece is appropriate for use in the lathe.
- Ensure that the work piece is held in the chuck by a minimum of 1". If the setup requires less material to be held, the use of the live center in the tail stock is mandatory.
- Prepared a drawing, plan, or worksheet as a guide to the work.
- Identified the operations that are intended for this work piece.
- Identified the appropriate settings for the material and intended operations, including proper rotational speeds and cutter feed rates.
- Prepared for tool use by verifying again that any loose clothing or jewelry has been removed or secured, and hair (including beards) tied back and away. Gloves should never be worn when working on a lathe.
- Donned personal protective equipment (safety glasses).

Proper Setup and Use (cont'd)

At the lathe:

- Verify locations of all controls to be used in machining operation
- Preset work piece rotational speed and feeds, as appropriate
- Ensure power is off and that the carriage and tool post are located safely out of the way prior to clamping the work piece in the lathe chuck
- Securely clamp the work piece in lathe chuck and **remove the chuck key**. Rotate chuck by hand to ensure that the work piece is centered in the chuck with minimum run out (wobble)
- Position the cutting tool in the tool post and ensure that the fixturing will allow desired the machining of the work piece without carriage interference.
- Replace the chuck guard and tooling / carriage guard and ensure that they will not interfere with the machine, work piece rotation, or tool motions.
- Only install the cutting tool while the power is off and all motion has stopped
- For new users: Do not turn power on until shop supervisor inspects machine setup and tooling
- When first energized, ensure the chuck and tooling feeds are set in the proper direction and speed.
- Immediately shut down the lathe if the cutting tool or work piece vibrates or makes unusual noises or there is large buildup of cutting chips
- Shut down the lathe prior to measuring a part
- Move the carriage away from the work piece prior to measuring or inspecting

Completion:

- Do not touch any rotating parts. Shut lathe off and await complete stop to rest before removing work piece, tooling, or starting to clean-up.
- Clear bed and machine of all debris and scraps.
- Police area around lathe and remove any materials that do not belong there.
- Return tooling to proper storage area.
- Clear carriage away from the chuck area.
- Be sure to note any issues or problems with the laser and notify shop supervisor.
- Clean and sweep the floor surrounding the machine of any chips, tools or materials.

Shop specific procedures:

**Diagrams / Illustrations
(See Following Pages)**

Part No.	Name	Part No.	Name
1	Power Disconnect	16	Longitudinal Traverse Handwheel
2	Emergency Stop	17	Cross Traverse Handle
3	Spindle Brake Pedal	18	Top Slide Traverse Handle
4	Spindle Control Lever	19	Feed Access Selector
5	Chuck Guard	20	Feed Engagement Knob
6	Workpiece Guard	21	Carriage Lock
7	Gearcase Interlock	22	Threadcutting Engagement

8	Spindle Speed Selector	23	Tailstock
9	Spindle Speed Selector	24	Tailstock Quill Traverse Handwheel
10	Feed Selector Dial	25	Quill Lock
11	Feed Speed Selector- Range ABC	26	Tailstock Clamp
12	Feed Speed Selector- Range RST	27	Tailstock Set-Over Screw
13	Feed Speed Selector- Range WXY	28	Tailstock Quill
14	Feed Direction Selector	29	Tailstock Chuck
15	Oil Coolant Pump		







