

## Shop Safety Procedure

	Equipment/Task Name:	METAL ROLLER
	Equipment/Task Hazard Class:	5 – POWERED ROLLER 2 – MANUAL ROLLER <a href="http://ehs.yale.edu/forms-tools/tool-classification-matrix">http://ehs.yale.edu/forms-tools/tool-classification-matrix</a>
	Shop Name:	
	Shop Hazard Class:	

### Purpose

Metal rollers are used to form rounded sections out of flat metal stock and sheet metal. The final forms can take the shape of hoops, cylinders and cones or combinations of any of these forms. Metal rollers range in size from small bench-mounted manual crank models to large motorized units. The design of metal rollers typically consists of a set of three steel rollers that are arranged with the long rolling axes parallel and the rolling centers of the three forming a triangle (See Diagrams/Illustrations). Often the operator can adjust the spacing between the rollers to engage the workpiece and adjust the amount of radius forming that takes place on each pass. Adjustments to the parallelism of the rollers can be changed to form cone shapes. The manual units perform the same types of operations as the motorized units, on lighter smaller workpieces, but their operation is controlled by the user which greatly reduces the risk of serious injury. For the purpose of this Procedure, the term “roller” will be used to refer to manual and powered metal rollers unless specifically stated.

### Hazards

As with all shop tools there are many potential hazards associated with the use of a roller. Powered rollers are Class 5 tools while manual rollers are Class 2 tools (<http://ehs.yale.edu/forms-tools/tool-classification-matrix>). There are a number of particular hazards associated with the operation and use of rollers (See attached diagram).

#### Pinch Points

- In-running nip points are inherently part of the metal roller design to grab the workpiece. Since the nip point cannot be guarded, operators must be aware of the hazards, maintain a safe distance, and maintain focus on the work during operation. On manual machines the nip opening is small (typically less than ¼”) and the infeed is completely controlled by the actions of the operator and can be instantly stopped at any sign of trouble. This is not the case for powered rollers. When using powered rollers, operators must plan for specific tasks and have workpieces positioned on rollers or fixed tables that allow control of the feed of the workpiece into the nip while keeping the operator (and any helpers/bystanders) a safe distance from the rolls and workpiece as it starts to feed into the machine. Required safeguards for powered rollers include trip wires one both sides of the machine to serve as an emergency stop and momentary controls (such as covered foot switches) to stop the roller on release.
- Powered rollers are for professional and experienced shop users. Students are not permitted to use powered rollers.

## Hazards (cont'd)

### Moving Workpiece

- As the workpiece is roll formed it is in a continuously changing shape and orientation. The operator must stay back from the edges/end of the workpiece as it creates a large hazard zone around the roll former. As the workpiece completes one “revolution” thru the roll former the operator must be careful that the extending end of the workpiece does not get caught on any equipment parts.
- The workpiece can be ejected from the roll former at the end of a cycle. Workpieces can become disengaged and rotate or be flung across the room as they are formed and removed from the rolls.
- Materials have a “memory” of their prior shape and have a tendency to partially return to that shape. Consequently, operators must be cautious of the potential spring-like behavior of the workpiece when removing it from the roller.

### Sharp Edges and Corners

Due to the nature of the metal workpiece which may include sharp edges, corners, and burrs, there is a potential for cuts, lacerations, and puncture wounds.

## Limitations

- Capacities of rollers are limited by the physical geometry and length of the rollers and the input power of the hand crank or motor drive.
- On manual units the devices will typically be self-limiting as only a certain length of material can physically be fed into the piece of equipment. Material limitations and restrictions should be posted near the tool.
- Motorized units must have published material limits so as to not overload the motor or rollers and cause physical injury to operator or machine.
- The minimum radius that can be formed is slightly larger than the radius of the main roller. Continuous loops of materials need to be able to be removed from the roller assembly and there is usually provision for one end of the roller assembly to be opened so that the workpiece can be slid off the machine.
- Rollers are designed to form flat metal stock and sheet metal only.

## Required Personal Protective Equipment

- Refer to the Shop Safety Postings and instructions provided by the Shop Supervisor.
- 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:

- Understand the uses, limitation, and hazards of roller.
- Be able to dress appropriately and don correct personal protective equipment.
- Know how to inspect the roller and ensure all components function properly for the selected option.
- Know how to adjust all components for the selected operations.

### Required Training (cont'd)

- Be capable of effectively and safely performing the forming operation, including setup, rolling sample pieces, and final forming of expected materials and shapes.
- Show proper body position for stable and safe operation of the roller.
- Advanced users may be trained to be able to setup and form cone shaped workpieces in addition to hoop and cylinder shapes.

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.
- Understand and follow manufacturer operating procedures.
- Inspect the tool for damage prior to use.
- Verify all guards are in place and adjusted properly.
- Do not bypass any safety devices.
- For powered rollers, know the location of the trip cable(s) and emergency stops. Verify functionality prior to each operation.
- For powered rollers, never lean against any part of the machine when it is running. Make others aware you are operating the machine if they are in the same area.
- Clean the tool after use.
- Report any malfunction or damage to the Shop Supervisor after tagging the tool "Out of Service, do not use".
- Always keep fingers, hands, and helpers/bystanders away from the rollers.
- Never where clothes when with rollers that are powered or have powered feed components.
- Never exceed the capacity of the tool.
- Make sure all material is free of debris before sending it through the rollers.
- Never attempt to roll multiple workpieces at a time.

Shop specific rules:

### Proper Setup and Use

#### Prior to Use

- Become familiar with the adjustments, controls and settings for the roller. Specifically:
  - For powered rollers all controls, trip wires, and emergency stops;
  - The adjustments for material thickness;
  - The adjustments for the forming roll position to controls amount of forming; and
  - How the forming roll is engaged.
- Verify that the workpiece is safe and appropriate for use on the particular roller.
- Measure the workpiece thickness.
- Ensure that there will be adequate support of the material to engage it into the rolls while the operator maintains a safe position from the moving rollers and advancing workpiece.
- Prepare for roll forming by verifying again that any loose clothing or jewelry has been removed or secured, and hair (including beards) is tied back.
- Don personal protective equipment.

#### At the Roll Former

- Inspect the roller for damage and hazards.
- Place any necessary supports and align workpiece with infeed rolls.
- Adjust roll position for material thickness of workpiece such that it is a snug fit between the infeed rollers.

### Proper Setup and Use (cont'd)

- Using a sample narrow strip of the same material and thickness as the final workpiece feed it into the rolls to ensure the proper infeed roll setting. Try this at several positions that will span the width of the final workpiece to ensure that the rolls are parallel. For powered rollers, this step is to be done with the tool securely turned off.
- Once the infeed rolls are set, continue to manually feed the sample workpiece into the rolls until it engages the forming roll in the engaged position.
- Continue to feed and adjust the forming roll (usually using hand crank) to determine the appropriate displacement setting for the desired final radius of the workpiece. This step may require several attempts and samples until the settings are correct for the desired final outcome.

#### Rolling Process

- For powered rollers, verify all helpers/bystanders are at a safe distance and turn the tool on.
- Insert supported final workpiece into infeed rollers.
- Ensure that the workpiece is aligned and equally engaged along its length.
- Carefully feed the workpiece through the roller while staying away from the moving edges of the workpiece and maintaining a safe distance away from the infeed rollers.
- Adjust rollers as needed to obtain correct final radius.
- For manual rollers the operator may not be able to hand feed a wide workpiece and obtain the same desired radius as produced on the sample narrow strip material. If this is the case the operator must back off the forming roll displacement and create the final roll formed shape in several passes of with incremental increases in displacement.
- The user must work with the supervisor to determine the proper technique for obtaining the desired formed shape. In the case of forming circles, it may be better to roll  $\frac{1}{2}$  of the circumference at a time so that the operator does not have to re-feed the workpiece into the nip as it completes a full circle when multiple passes are required.

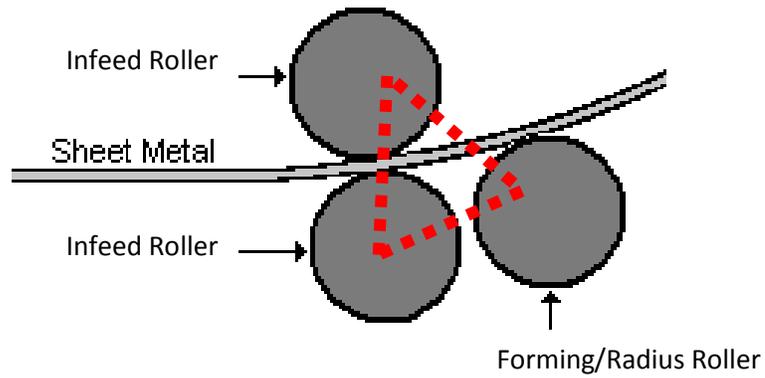
#### Completion

- For powered rollers, turn off the tool.
- When the workpiece has reached the final formed shape it must be removed from the roller.
  - If the final shape is less than a complete circle then the forming roll may be released and the part rolled out of the machine.
  - If the final shape is a complete circle then in addition to releasing the forming roll the bearing support must be removed to allow the workpiece to slide off the rolls. Follow manufacturer's instructions and the Shop Supervisor's guidance for specific procedures.

#### Shop specific procedures:

## Diagrams/Illustrations

### Basic Roller Configuration



### Example Powered Roller



FORMING ROLL ADJUSTMENT

INFEED ROLL ADJUSTMENT

TRIP WIRE

FOOT SWITCH

Creation/Revision Dates:

*Suggestions, questions, or comments? Please contact your shop supervisor or EHS.*