

L-08

TOOLMAKER TRAINING

SKILL DEVELOPMENT GUIDE

Duty L: External Grinder
L-08: Set Up External Grinder

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Task Preview

Set Up External Grinder

A toolmaker must set up an external grinding machine before grinding the surfaces of a workpiece (part). Setup involves mounting the part in the grinding machine for the type of grinding that will be done. The Toolmaker mounts the part so that it is:

- centered
- supported
- turned reliably by the headstock spindle without excessive friction or wear
- and oriented so that the grinding machine can grind it to the print-specified dimensions

The grinding machine operator must be careful. If this task is performed incorrectly or incompletely, the part and/or the grinding machine may be damaged. The grinding machine also can be dangerous; caution is essential to avoid physical injury.

How your skills will be checked

The Skill Check will require you to set up a part in an external grinder. All tools, materials, and resources will be available. The Evaluator will verify that your demonstration meets the skill objective by observing or measuring each task standard. You must demonstrate safe work practices during the Skill Check. Contact your Evaluator when you are ready for the Skill Check.



Skill Objective

Given an external grinder, a workpiece (part) to be ground, and appropriate accessories (work centers, arbors, drive dogs, etc.), set up the external grinder.

Task Standards

1. The part must be mounted so that it can be ground to the specified dimensions without damage to the part or the grinder.
2. All safety requirements must be demonstrated.

What You Will Need

This section contains the safety information, tools, and resources you will need before setting up the external grinder.



- Follow all Caterpillar facility safety standards when performing this task.
- Be aware of rotating equipment and pinch points.



- external grinder
- part (workpiece to be ground)
- fixtures and/or tooling to adapt the part to the external grinder
- dial indicator
- copper/brass knocker
- lubricating grease
- shop towels
- tools to tighten drive dogs



- part dimensional print
- process sheet
- external grinder documentation



Task Steps

Between Centers

1. **Inspect the part center recesses and polish them, if necessary, as described in the procedures for polishing center.**
2. **Set up a work center in the headstock spindle and in the tailstock.**
 - Clean the work centers before installing them.
 - Select work centers large enough to fit without bottoming in the center recesses of the part.
 - Be sure the work center selected for the tailstock will not be touched by the grinding wheel.
3. **Pull back the handle on the tailstock to retract the work center.**
4. **Loosen and slide the headstock and tailstock so the work center points are far enough apart to accept the part, and equidistant from the middle of the grinder table.**

Note: Wipe ways cleans and apply way oil every time you move the tailstock.

5. **Install a drive dog on the headstock end of the part.**
6. **Lubricate the center recess in both ends of the part.**

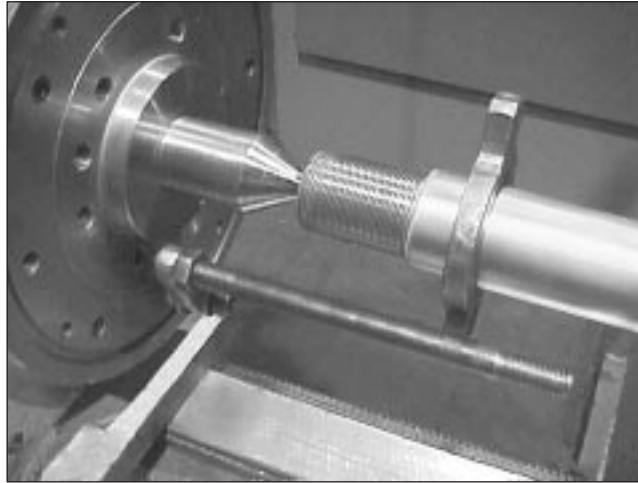
7. **Install the part between centers, as shown below.**



Part Held Between Centers

- Use the tailstock handle to extend the tailstock center, to mate with the part.
- Adjust the tailstock position, if necessary, to ensure that spring pressure between the part and the work centers is no more than required to hold the part in place as it is ground.
- Parts that must withstand heavy grinding will need more spring pressure. Alternatively, use the tailstock handwheel to position the tailstock work center.
- Parts with a large diameter recess for the tailstock work center may need less pressure to limit friction and damage to the part recess or the work center.
- Turn piece between center by hand to ensure there is not too much tension.

8. **Install a bolt in the spindle to transfer rotation to the drive dog, as shown below.**



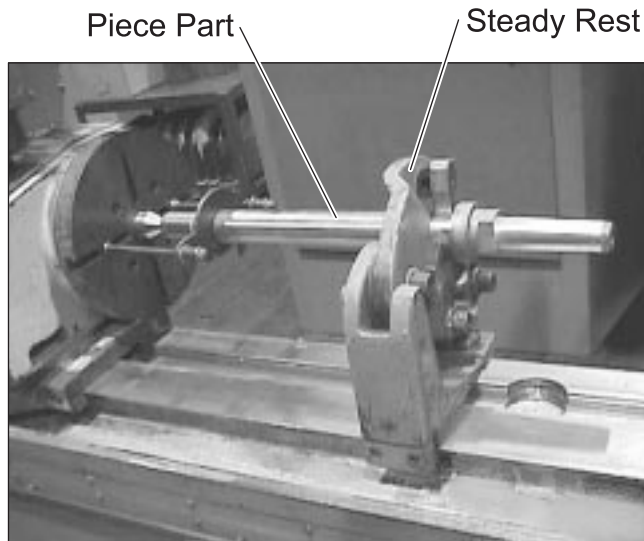
Driving a Part Mounted Between Centers

9. **If the part has a finished OD, check it for concentricity with dial indicator.**
10. **If the part will deflect under its own weight or grinding wheel pressure, use a steady rest as described below.**

Steady Rest

1. **Assemble the steady rest to the grinder table.**

2. Loosen the bolt to open the top jaw of the steady rest and, if possible, install the part between centers, as described above in Between Centers as shown below.



Part Held in Steady Rest

3. Adjust the steady rest lateral position, so that the bearing blocks contact a finished OD on the part as close as possible to the surface to be ground, as shown below.



Steady Rest Adjusted to Part

4. **Adjust the steady rest bearing blocks so the part will rotate on the grinder axis.**
5. **Lubricate the surfaces of the part that contact the steady rest bearing blocks.**

Tapered Arbor

1. **Select a tapered arbor with the nominal OD equal to the part ID.**
2. **Clean the tapered arbor and the part ID.**
3. **Slide the part onto the smaller end of the tapered arbor and wedge it tightly in place.**
4. **Clean and lubricate the tapered arbor center recesses.**
5. **Install the tapered arbor and part between centers as described above in Between Centers.**
6. **If the part has a finished OD, check it for concentricity.**
7. **Strike the small end of the tapered arbor on a brass knock block to remove the part from the tapered arbor after grinding.**

Nut Arbor

1. **Select a suitable nut arbor for the length and ID of the part.**
2. **Select arbor cones that will hold each end of the part on the nut arbor.**

3. **Assemble one cone, the part, the second cone, spacers (if necessary), and the nut on the nut arbor, as shown below.**



Part Installed on Nut Arbor

4. **Clean and lubricate the nut arbor center recesses.**
5. **Install the nut arbor and part between centers as described above in Between Centers.**
6. **If the part has a finished OD, check it for concentricity.**



Concept Check

Set Up External Grinder

Answer the following questions to check your understanding of setting up an external grinder. Circle the correct answer in each question. Then compare your responses with the answers on the next page. Some of the questions may have more than one correct answer. If you have difficulty answering a question, review the Skill Development Guide or ask your Trainer for assistance.

1. Spring pressure on a part mounted between centers must be:
 - a. as heavy as possible.
 - b. released after the part is in place.
 - c. no more than necessary to hold the part.
 - d. higher on short parts.
2. The purpose of a drive dog is to:
 - a. couple the part to the rotation of the tailstock center.
 - b. maintain spring pressure on the work centers.
 - c. index the part to the grinding wheel.
 - d. turn the part with the headstock spindle.
3. The steady rest should be positioned so that the bearing blocks contact the part:
 - a. on a finished OD close to where the part will be ground.
 - b. as close to the tailstock end of the part as possible.
 - c. just beyond the headstock face plate.
 - d. on the face to be ground.

4. A tapered arbor holds the part:
 - a. at the precise angle of the taper to be ground.
 - b. with a cone in each side.
 - c. by wedge action.
 - d. by expanding inside it.
5. When mounting a part between centers:
 - a. make sure both work centers are free to turn.
 - b. lubricate both center recesses of the part.
 - c. always polish the centers first.
 - d. a steady rest cannot be used.

Answers: (1. c 2. d 3. a 4. c 5. b)

Next Step

If you are ready to demonstrate the task now, ask your Evaluator or Trainer to schedule the Skill Check. However, if you need to practice some of the steps first, continue to the next section.



Practice

The following practice will help prepare you for the Skill Check. Ask your Trainer to set up the practice for you. After you complete a practice, ask your Trainer to check your work.

Practice 1:

Install a long part between centers, and support it with a steady rest.

Tools and equipment for Practice 1:

- External grinder
- Part, of sufficient length, with a center recess at both ends and a finished OD near the middle
- Work centers and steady rest

Practice Objective 1:

The part must rotate smoothly and securely on the headstock-tailstock centerline, without radial or axial movement.

Practice 2:

Install a part on a tapered arbor or a nut arbor.

Tools and equipment for Practice 2:

- Tapered arbor or nut arbor
- Part with suitable ID to work on a tapered arbor or nut arbor
- Work centers

Practice Objective 2:

The part must be securely held on the tapered arbor and must rotate without radial or axial runout on the headstock-tailstock centerline.

Practice 3:

Turn the piece between center by hand to ensure there is not too much tension.

Tools and equipment for Practice 3:

- Tailstock
- Work centers

Practice Objective 3:

The piece must turn without binding or too much tension.

Next Step

Continue to practice until you are ready for the Skill Check. When you are ready to demonstrate the task, ask your Evaluator or Trainer to schedule the Skill Check.