

## G-07: Set Up Machine

### SAFETY FIRST

- Follow all Caterpillar facility safety standards when performing this task.
- Hoist may be required to move the part or the holding device, depending upon part requirements.
- Hydraulic lever must be used to control release of heavy equipment on the boring mill table, which is a sensitive measuring device.

### EQUIPMENT

- rigging/lifting equipment
- indicators (1/10000 - .0001)
- Jo blocks (gage blocks)
- micrometers (inside/outside/depth)
- vernier calipers
- tape measure
- hole gages
- gage pins

### RESOURCES

- manufacturer's manuals
- print
- process sheet

### Set Up Machine

#### 1. Determine the part and machine needs.

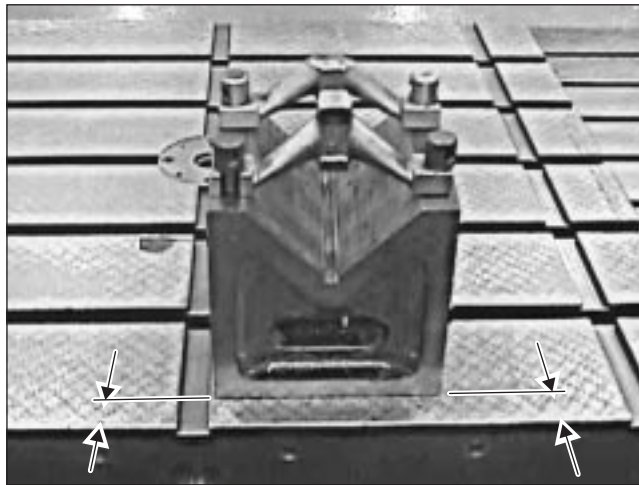
- Read the process sheet and print.
- Determine the part requirements.

#### 2. Measure and mark the part as needed.

- Scribe the part, if needed, according to the print specifications.



3. **Stone and clean all surfaces.**
  - Verify that the surfaces are smooth.
  - Use a clean shop towel to clean all debris from the surfaces.
4. **Always verify the relation of the holding devices to the machine.**



#### **Holding Device Square with the Table**

5. **Use any required lifting/rigging to position the holding devices on the bore mill table.**
  - Be careful not to bang the device on the boring mill table or you will damage the surface and/or offset the scales.



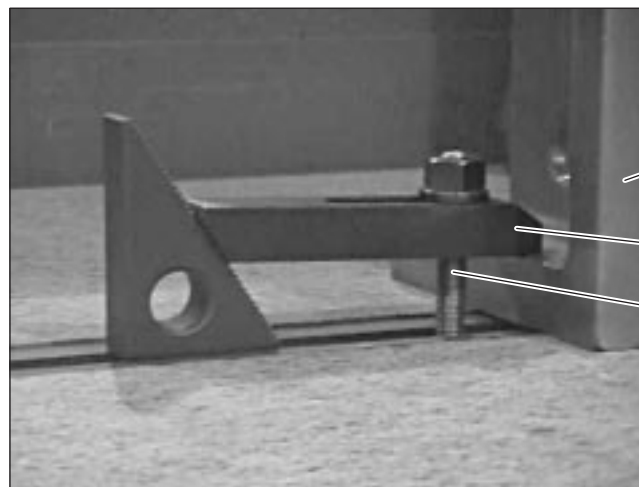
#### **Holding Device Eased to the Table**

## Clamp Part

**Note:** Clamping a part may be performed with or without additional holding devices. These steps are intended to provide a general framework for clamping a part, and may include clamping with different types of clamps.



1. Position clamps so they are not in the cutting path.
2. Position the stud in the center of the clamp, or closer to the piece to be milled.
3. Angle the clamp toward the piece to be milled.
4. Tighten the nut on the stud until the part will not move when milled.



Cutting Edge of Part

Clamp

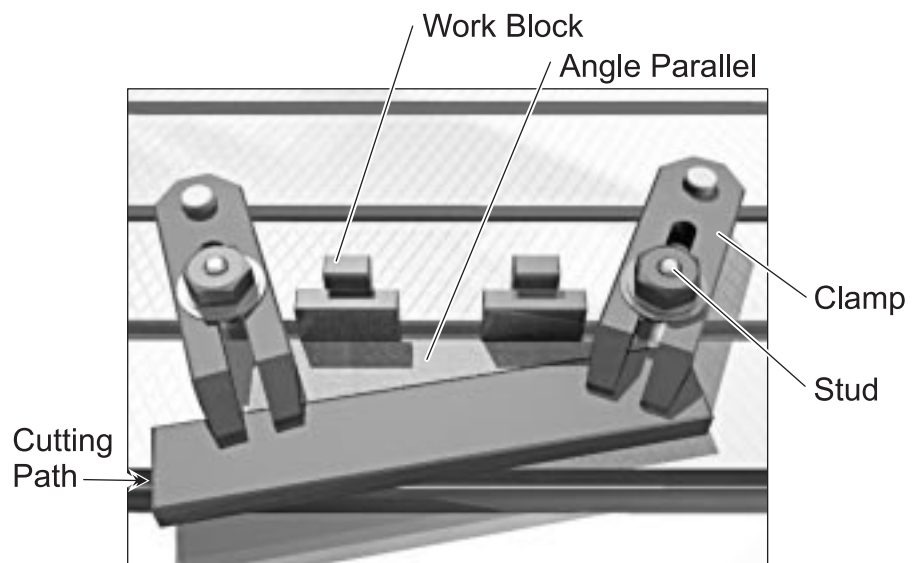
Stud

**Properly Clamped Part**

## Set Up Angle Parallel

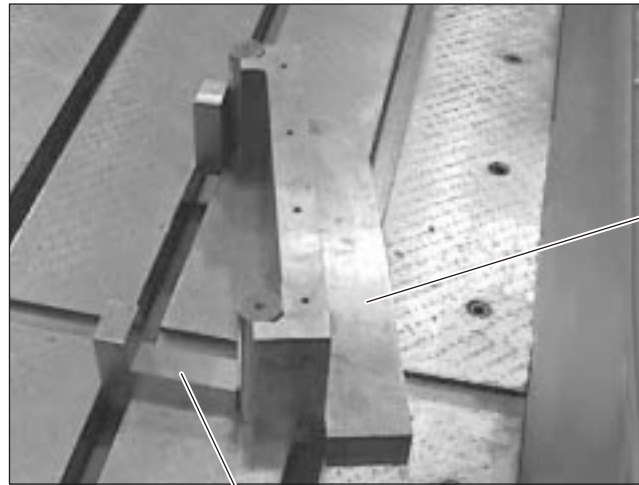
**Note:** Angle parallels are used when a less accurate angle is required on a standard angle (10, 15, 20 degree).

1. **Determine the required angle parallel according to the part requirements.**
2. **Position work blocks, as needed, to support the angle parallel and part.**
3. **Install the work blocks in position.**
  - Knock the blocks into the groove with a soft hammer until square against the surface.
4. **Use two sets of work blocks, or more according to part needs, to provide a surface you can mill with one pass.**
5. **Clamp the part to the table or the knee.**
  - Position the clamps so they are not on the cutting surface.



## Set Up a Part with a Sine Bar

**Note:** Use a sine bar when an accurate, less common angle is required.



Jo (gage) Blocks

- 1. Calculate the sine of the angle(s) specified on the print.**
- 2. Use Jo (gage) blocks to set the angle on the sine bar according to your calculations.**
  - Sweat the Jo blocks together, combining them until they equal your calculation.
- 3. Position working blocks for the sine bar.**
  - Set the working blocks in place so the work is accessible for cutting.
  - Knock the blocks in place with a soft hammer.
- 4. Position the Jo blocks on the work blocks to set the angle on the sine bar.**
- 5. Clamp the part as necessary.**

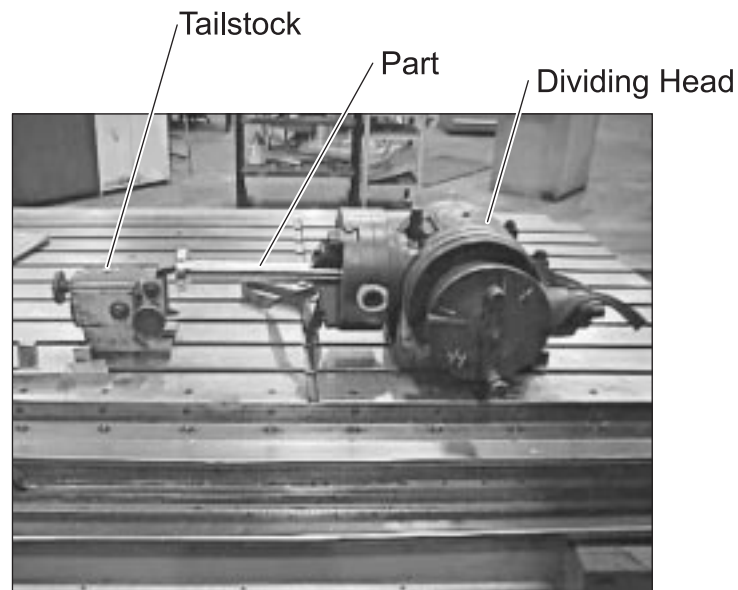
## Set Up a Part in a Vise

**Note:** Use a vise when face milling allows you to cut the entire face. Depending upon the type of vise you are using, you can cut certain types of angles.

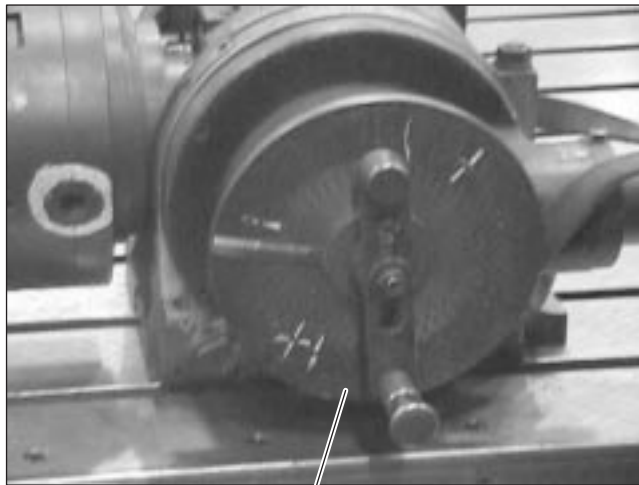
1. Bolt the vise into position.
2. Select parallels to position the part in the vise.
3. Hold the part against the parallels while carefully tightening the vise just enough to hold the part in place.
4. Softly tap the part against the parallels until they are flush against the back of the vise.
5. Tighten the vise until the machine cannot move the part.

## Set Up a Part in the Dividing Head

**Note:** Use a dividing head when round stock must be machined and rotated.



1. **Clamp the dividing head into position according to the part requirements.**
2. **Fix the part into the dividing head.**
3. **Clamp the tail stock into position in relation to the part.**
4. **Set the zero on the angle setting wheel.**



Dividing Head  
Angle Setting Wheel

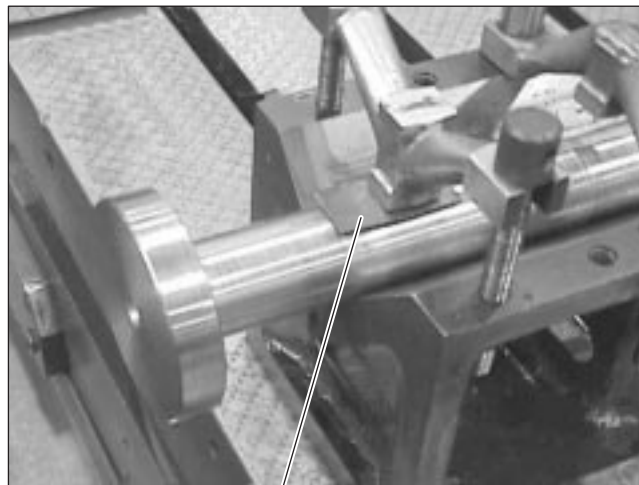
- Lift the pin to allow the angle setting wheel to rotate.
  - Count the revolutions required to turn the dividing head one full revolution with the angle setter.
  - Divide 360 degrees by that number to get the specific angle/degrees.
5. **Select a hole circle for pin engagement.**

**Note: Refer to the machinery handbook for additional angle setting instructions.**

## Set Up a Part in V-Blocks

**Note:** V-blocks are used for round stock.

1. **Select the V-block according to the part requirements and material size.**
2. **Clamp the V-block to the table so the part can be milled according to print specifications.**
3. **Clamp the part into the v-block.**
  - Use soft copper, where necessary, to keep the clamp from scarring the finished surfaces.



Soft Copper for Protection

- Slowly tighten the clamp.
4. **Tighten the V-block clamps so the part is square and secure.**
  5. **Locate the center line according to the Toolmaker procedures.**



## Set Up a Part on a Knee

**Note:** A knee is used when a vertical setup is used on the boring mill, and may use any of the holding devices listed in the steps to secure a part.

1. Move the pair of knees into place on the boring mill table.



Knees Vary in Size

2. Attach the knees to the table.
3. Position and clamp the part, as needed.

## Set Up a Part in a Taper Pot

1. Position the taper pot as needed, according to the print.
2. Secure the taper pot to the boring mill table.
  - Secure with mounting bolts or as required according to the type of taper pot.
3. Locate the piece into the taper pot.

4. **Secure the part in the taper pot, as needed.**



5. **Locate the center line of the taper pot according to the Toolmaker procedures.**

### **Set Up a Part on an Index Table**

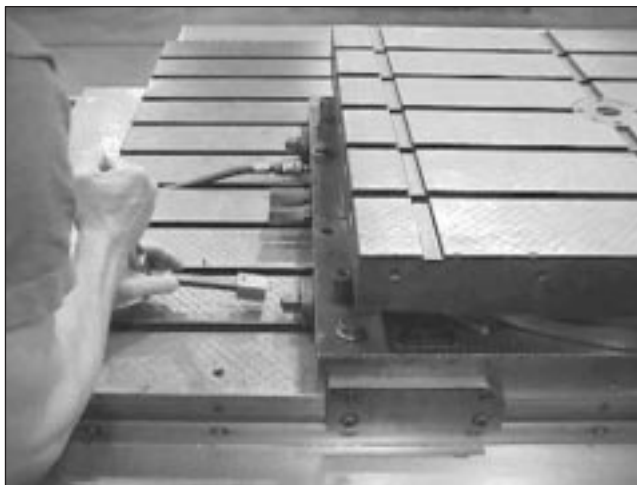
**Note: The Index Table is used for a line bore, when multiple operations must be performed, and limits clamping and unclamping.**

1. **Position the index table on the boring mill table according to part needs as shown on the print.**
  - Fit the keys of the index table base to the key slots of the boring mill table.
2. **Verify the index table key slots are square with the key slots of the machine table.**

- Be sure to verify by the slots and not the face of the table. The index table face may have been accidentally milled.



- 3. Setup the index table according to the part requirements on the print.**
  - Attach an air hose to the index table, to allow index adjustment.
  - Change the angle according to the needs on the print.
- 4. Secure the index table to the machine table.**
  - Secure the clamps as shown in the figure below.



- 5. Attach the part and any other required holding devices to the index table as required in the print.**