

I-02: Machine Hole

SAFETY FIRST

- Follow all Caterpillar facility safety standards when performing this task.
- Be aware of axis motions, rotating equipment, and unexpected machine movement.
- Machine spindle must be placed in neutral during the setup procedure.
- There are a variety of plastics and materials requiring a respirator or knowledge of chemical hazards.

EQUIPMENT

- jig bore
- stock
- dial indicator (tenths)
- shop towels
- setup equipment
- center drill
- tap
- boring bars and reamers
- gaging and measuring equipment

RESOURCES

- print with holes specified
- piece parts
- process sheet

Machine Holes

WARNING: Make sure the machine is placed in the neutral state before starting a setup procedure. Sudden machine movement can cause personal injury.

1. **Set up the part.**
2. **Clamp the part.**



3. Determine hole locations.

- This is substeps or knowledge components.

4. Plan the machining of the hole(s).

- Plan which tools you will use to remove the material and how much material you will remove with each tool.

Note: Below is an example of a plan for machining a hole with a diameter of $.5000 \pm .001$. Notice the decreasing amount of material removed as you approach the final dimension of the hole.

Example plan for machining hole:

drill hole to	.421"
rough ream hole to	.471"
ream to	.480"
1st pass with bore bar	.490"
2nd pass with bore bar	.496"
3rd pass with bore bar	.498"
4th pass with bore bar	.500"

- The hole sizes and locations determine the sequence you will follow when drilling holes. When machining holes that intersect, care must be given as to which hole is machined first.

CAUTION: Place the machine in neutral before performing the next step.

5. Mount the center drill.

- Select the appropriately sized center drill for the hole shown on the process sheet. The size you select is based on the size of the hole.
- Spot the hole. Be aware of the depth requirements.

6. Drill the rough hole.

- Check the print for hole size and tolerance.
- Select the feed and speed rates based on the type of stock you are machining.
- Determine if the hole should be drilled dry or with a lubricant. Whether the hole is drilled dry or with coolant is determined by the type of material and the drill size.
- Drill the hole as required.



7. Tap the hole.

- Verify that the hole has been drilled to the proper size.
- Select the correct size tap to tap the hole. The print will specify a thread size (for example: 1/2-13).
- Load the spring-loaded center tap.
- Start the tap into the hole. Holes are often tapped by hand or using other equipment, such as a radial drill.

8. Bore the hole.

Note: After a rough hole has been drilled, boring bars are used to remove material when a close tolerance is specified.

- Set a hole depth. If you are boring or drilling multiple holes of the same depth, setting the boring depth can ensure consistent depth cutting.
- Select the boring bar based on the type of hole. The print will designate the type of hole. If a part has two or more dowel holes, bore, rather than ream, the hole. Boring allows close control over the amount of material removed from the part.
- Mount the boring bar wrench-tight.
- Set feeds and speeds.
- Bore to the desired depth.

9. Ream the hole.

- Select the reaming tool based on the hole specifications.
- Mount the reaming tool wrench-tight.
- Set feeds and speeds.
- Ream the hole. Allow 1/64" for finishing in holes up to 1/2". Allow 1/32" for finishing in holes over 1/2".

10. Inspect the piece.

- Check the part dimensions against the print dimensions.
- Rework the hole if it is not machined to specifications.

11. Return the machine to neutral mode of operation.