I-11: Drill Compound Angle Hole

SAFETY FIRST

- ☐ Follow all Caterpillar facility safety standards when performing this task.

EQUIPMENT

- ☐ rotating tilt table
- ☐ taper pot (or other appropriate holding fixture)
- ☐ dogs, blocks, studs, tee-nuts
- ☐ dial indicator
- ☐ bluing
- ☐ gage blocks
- ☐ scriber
- ☐ wiggler
- ☐ pilot start drill
- ☐ drill (for finished hole size)
- ☐ tooling ball (px 7617813)

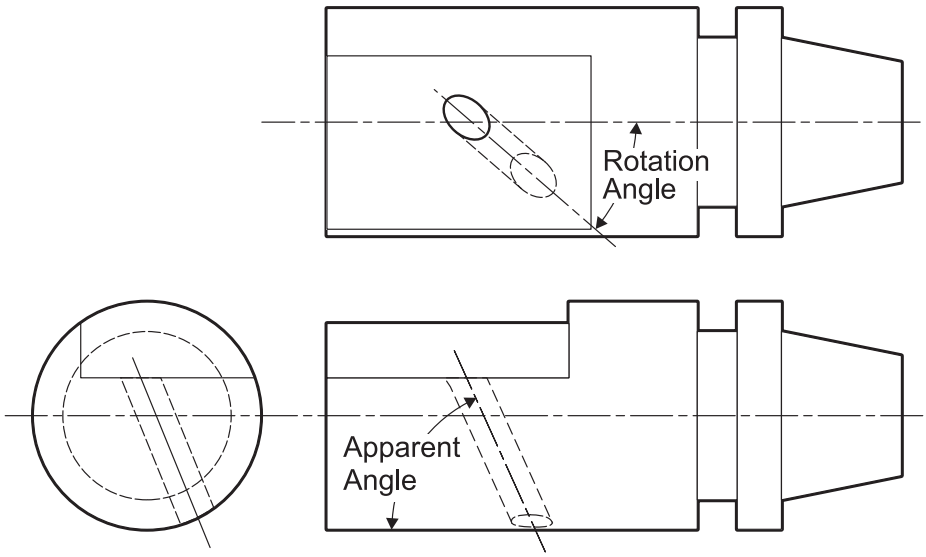
RESOURCES

- ☐ part print

Drill Compound Angle Hole

1. Consult the part print.

- ☐ Identify the compound angle hole.
- ☐ Find the specified angle of the compound angle hole in two views, usually front and top. See the example below.



Sample Part Print with Specified Angles for a Compound Angle Hole

- ☐ Identify the surface, plane, or centerline from which each angle is measured.

2. Plan the best mounting arrangement for the part so the hole to be drilled is parallel to the vertical jig bore machine spindle.

- ☐ Determine how to mount the part so that one of the angles specified in the print can be the rotation angle of the rotating tilt table.
- ☐ When possible, mount the part to minimize the necessary tilt angle on the rotating tilt table and resulting side thrust on the clamps.

3. Calculate the tilt angle.

- ☐ Use the following formula: Cos x Tan(1) = Tan(2)

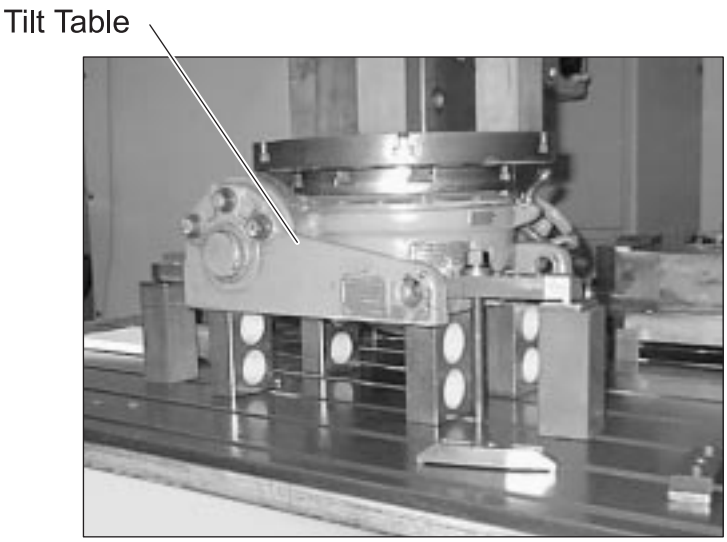
  Cos = rotation angle (second angle)
  (1) Tan = tangent of first angle (apparent tilt angle)
  (2) Tan = tangent of actual tilt angle

4. Lay out the hole position on the part.

- ☐ Use bluing, gage blocks, and a scribe to scribe cross lines.
- ☐ For more accurate location, use a tooling ball installed in a work hole.

5. Mount the rotating tilt table on the jig bore machine table.

- ☐ Tilt the table at least 45 degrees, and indicate the face of the tilt table from side to side.
- ☐ If necessary, adjust the rotating tilt table position on the jig bore machine table, to align the tilt axis parallel to the Y axis of the jig bore machine.
- ☐ Tighten the clamps holding the rotating tilt table to the jig bore machine table. See the figure below.



Rotating Tilt Table Mounted on Table of Jig Bore Machine

- ☐ Return the rotating tilt table to a tilt angle of 0 degrees.

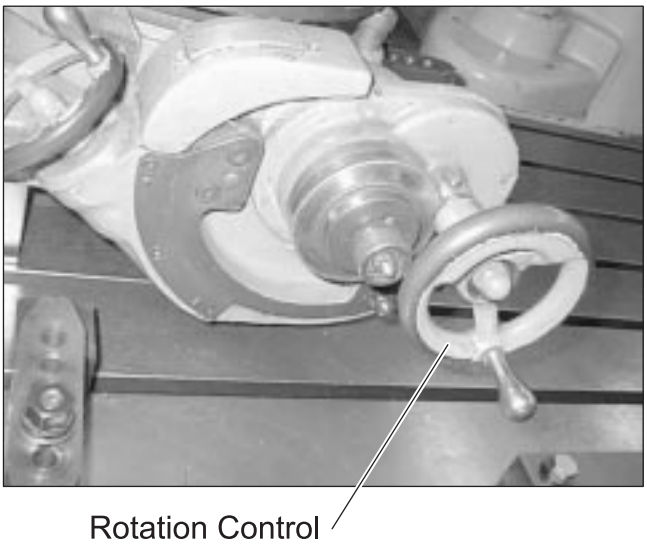
6. Mount a holding fixture, such as a tool taper pot, on the rotating tilt table.

- ☐ Indicate from side to side along a flat surface of the holding fixture that should be parallel to the Y axis of the jig bore machine.
- ☐ If necessary, rotate the rotating tilt table to align the holding fixture surface parallel to the Y axis.

- ☐ Tighten the clamps securing the holding fixture to the rotating tilt table.

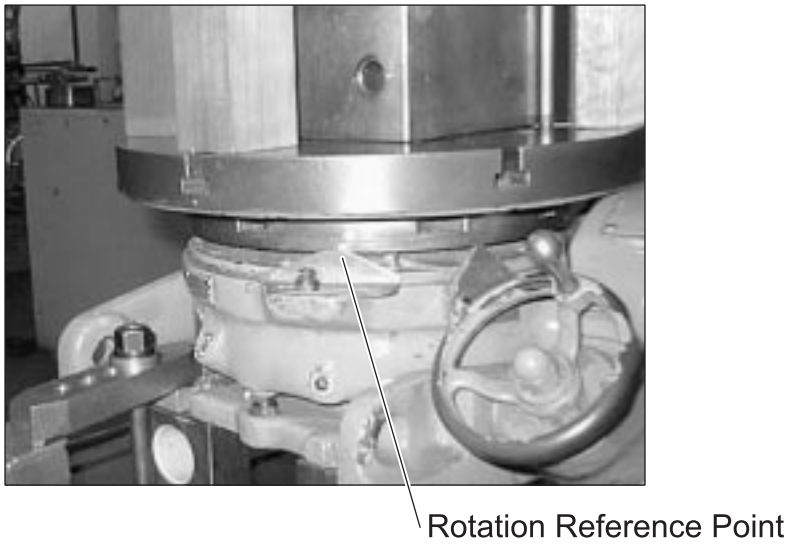
7. Zero the rotating tilt table.

- ☐ Set the rotation vernier control to zero. See the figure below.



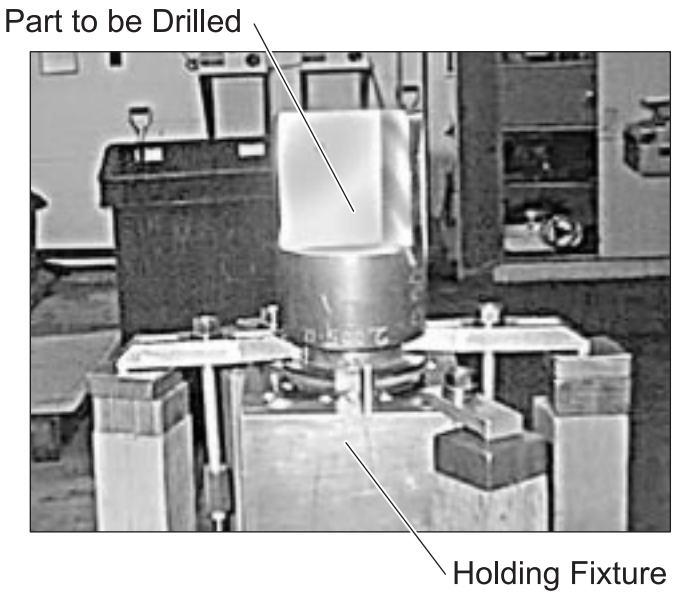
Rotating Tilt Table Rotation Control

- ☐ Set the reference pointer to zero. See the figure below.



Rotation Reference Point

8. Install the part in the holding fixture, as shown below.



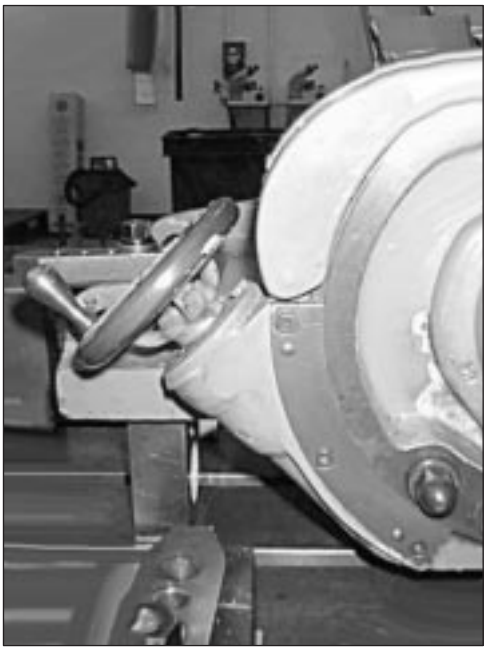
Part in Holding Fixture

- ☐ If possible, index the part in the holding fixture.
- ☐ Indicate from side to side along a flat surface of the part that should be parallel to the Y axis of the jig bore machine.
- ☐ If necessary, adjust the part position to align the part surface parallel to the Y axis.
- ☐ Tighten the clamps securing the part in the holding fixture.

9. Turn the rotating tilt table to the rotation angle identified in step 2. See the figure below.

Part Rotated the Rotation Angle

10. Slant the tilt table for the rotation angle. Use the control shown below.



Tilt Control and Scale

- ☐ Set the angle equal to 90 degrees minus the angle calculated in step 3.
- ☐ Use the vernier scale to set minutes.

11. Move the part under the jig bore machine spindle axis.

- ☐ Use a wiggler in the spindle chuck to center the cross lines directly under the axis, as shown below.

Using a Wiggler to Align the Hole Cross Lines

- ☐ Indicate a tooling ball for more accuracy to align a hole.

Tooling Ball

12. Install a pilot drill in the chuck, and drill a pilot hole, as shown below.

Using a Pilot Drill

13. Install a drill in the chuck, and drill the finished hole.

14. Clean up the work area.

15. Document the work history.