I-03

TOOLMAKER TRAINING

SKILL DEVELOPMENT GUIDE

Duty I: Jig Bore
I-03: Set Up Jig Bore
Issued 03/01/98

Task Preview

Set Up Jig Bore

This skill development guide provides information for setting up the more commonly used jig bore setup equipment: corner knee, clamp-to-table, round table / tilt table, sine bar, V-block, and taper pots. All setups begin with ensuring that the work surface and parts are free of dirt and debris.

You must be able to read a part print and possess knowledge of jig bore setup equipment to perform this task. If the jig bore and part are not set up properly, the part can be machined wrong, resulting in additional costs due to materials and labor. Improper setup can cause injury to personnel.

Work surfaces must be clean, equipment indicated as necessary, parts secured and the machine origin or reference point is set. Depending on the job, setups differ, even with the same setup tool. There are numerous tools, including TR tooling - special application setups. These special application tools are stamped with a “TR#” and is referenced on the print.

How your skills will be checked

The Skill Check will require you to set up a jig bore. 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

Upon receiving a process sheet for a job requiring a high degree of accuracy and a part that must be secured for jig bore work, set up the jig bore.

Task Standards

1. Work surfaces must be free of dirt, metal scraps, and other debris.

2. Setup must be indicated when measured with a dial indicator.

3. The machine origin must be set.

4. All safe practices must be demonstrated during the setup procedure.

What You Will Need

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

- ☐ 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.

- ☐ Jig bore machine with round and tilt table
- ☐ dial indicator (tenths)
- ☐ indicating chair
- ☐ shop towels
- ☐ gauge blocks
- ☐ corner knee
- ☐ V-block
- ☐ clamps
- ☐ sine bar
- ☐ taper pot
- ☐ hand tools
- ☐ gage roll

- ☐ sample piece part
- ☐ tool room prints (PX numbers)

Task Steps

Set Up Jig Bore

The setup procedure is detailed in the following order: Corner knee, Clamp-to-table, Sine bar on Round Table or Tilt Table, V-block, and Taper Pots.

Corner Knee

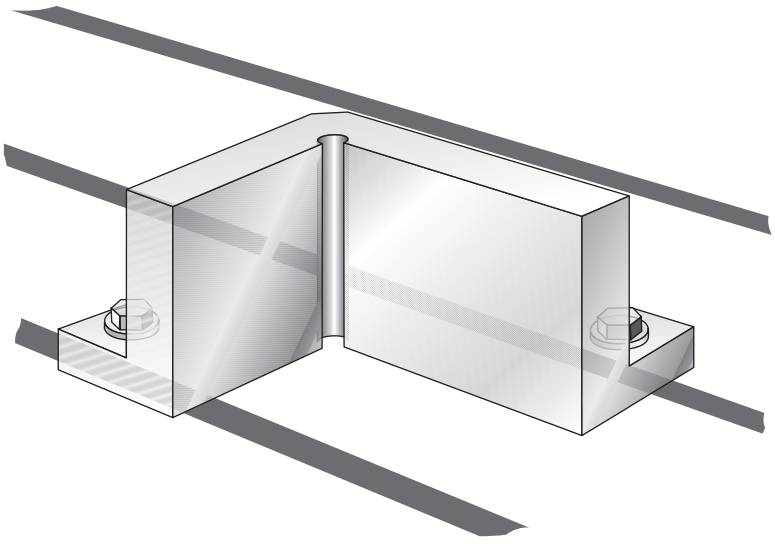
Warning: Safety First! Make sure the machine is placed in the neutral state before starting a setup procedure.

1. **Clean the work surface and corner knee with shop towels.**

   ☐ Make sure work surface and corner knee are free of debris.

2. **Prepare the corner knee for squaring.**

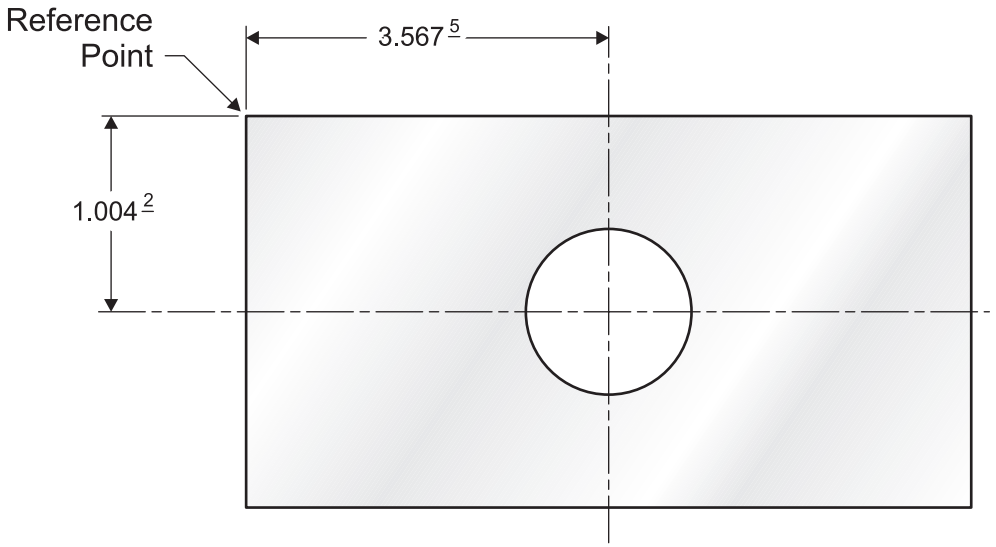
   ☐ Snug the corner knee fasteners, hand-tight. See the figure below.



3. Square corner knee.

- ☐ Position the knee on the machine table.
- ☐ Position the dial probe against one of the inside adjacent faces of the knee.
- ☐ Move the appropriate axis to sweep dial probe across the knee face. Observe the indicator dial for movement as you sweep the face. If needle movement is observed, lightly tap the opposite corner to adjust for square. Repeat the adjustment process until no needle movement (± .000) is observed on the dial face.
- ☐ Secure the fasteners wrench-tight, and sweep the face again to ensure it is square. If it is not square, loosen the fasteners and readjust as necessary.

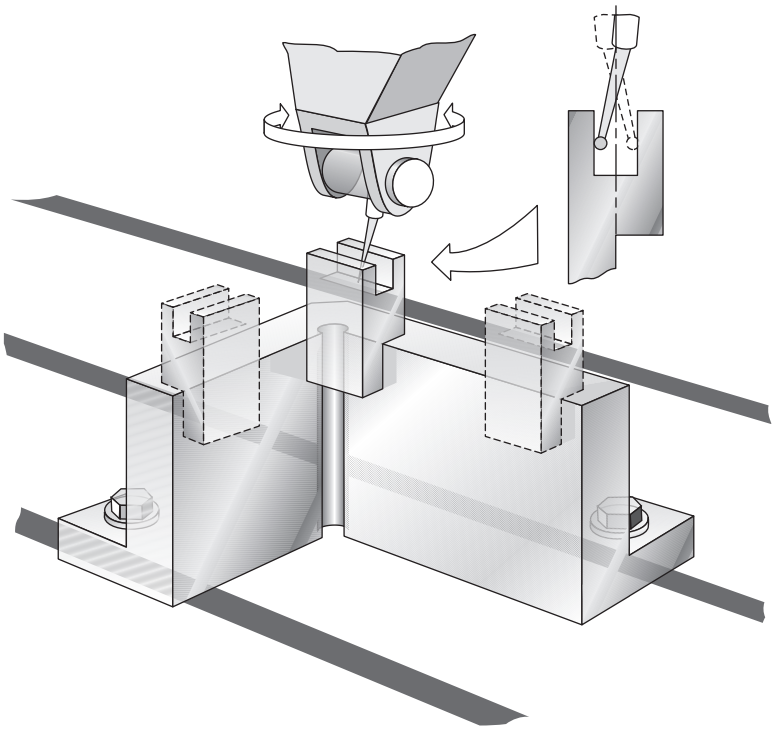
Note: Depending on the type of jig bore machine, an origin may not always be set at X, 0 and Y, 0. A reference point, or origin point, is the location on the setup from which the measurements are taken.



Part Reference Point

4. Position the chair on the corner knee.

- ☐ Position the indicator probe on the chair inside face. Indicate both sides.



Indicator Positioned on Chair Face

- ☐ Sweep the faces of the chair by turning the indicator and moving the appropriate axis, observing the indicator dial during movement.
- ☐ Adjust the measuring system to zero when the center-line of the chair is obtained.

Clamp-to-Table

1. Clean the work surface and parts with a shop towel.

- ☐ Make sure the work surface and the parts are free of debris.

2. Set up the clamps.

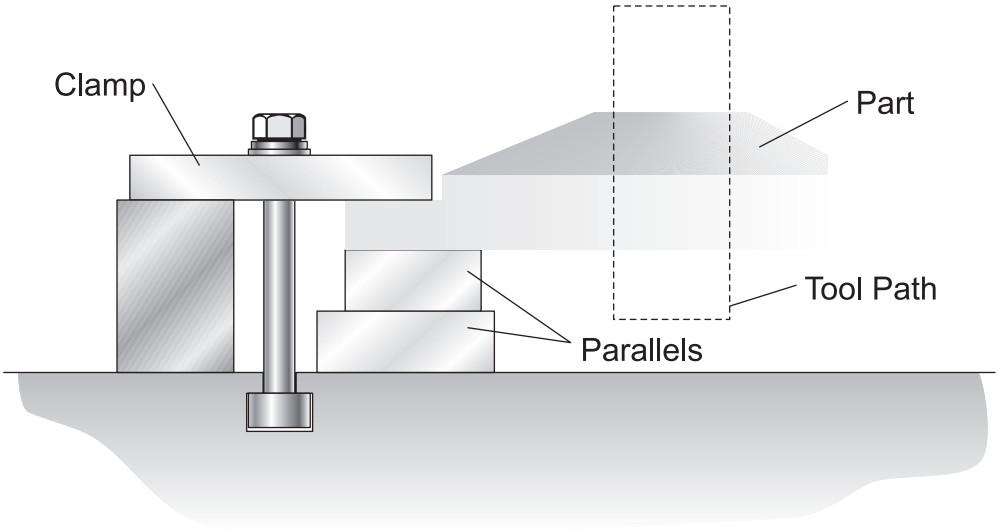
- ☐ The surface of the piece part should be slightly lower than the height of the clamping blocks.

3. Position the parallels.

- ☐ Position of the parallels is determined by the size and shape of the part. The parallels must be positioned so that the parallels do not obstruct the path of the tool.
- ☐ Parallels must be clean and free of burrs.

4. Clamp the part to the table.

- ☐ When possible, position the clamp over the parallels. Securing the part over the parallels can reduce the amount of pressure on a part. If a part is secured tightly in an area where there is no support, bending may result.
- ☐ A part could be damaged if it is not clamped securely or if the clamp is over-tightened.



Part Clamped to the Table

Set Up the Tilt Table and Check the Angle Using a Sine Bar

1. Clean the work surface and tilt table surface.

- ☐ Make sure the work surface and tilt table are free of debris.

2. Set the parallels in keyways for a rough lineup.

- ☐ Snug the clamps.

3. Set the tilt table to 90°.

4. Indicate the table face square.

- ☐ Position the dial indicator probe against the table face.
- ☐ Move the appropriate axis to sweep the dial across the table face observing the dial indicator for movement.
- ☐ Tap the table *lightly* on the opposite corner of the indicator to reposition the table if any needle movement is observed, then sweep the surface again. Repeat this process until no movement is observed on the dial.
- ☐ Tighten the clamps wrench-tight.

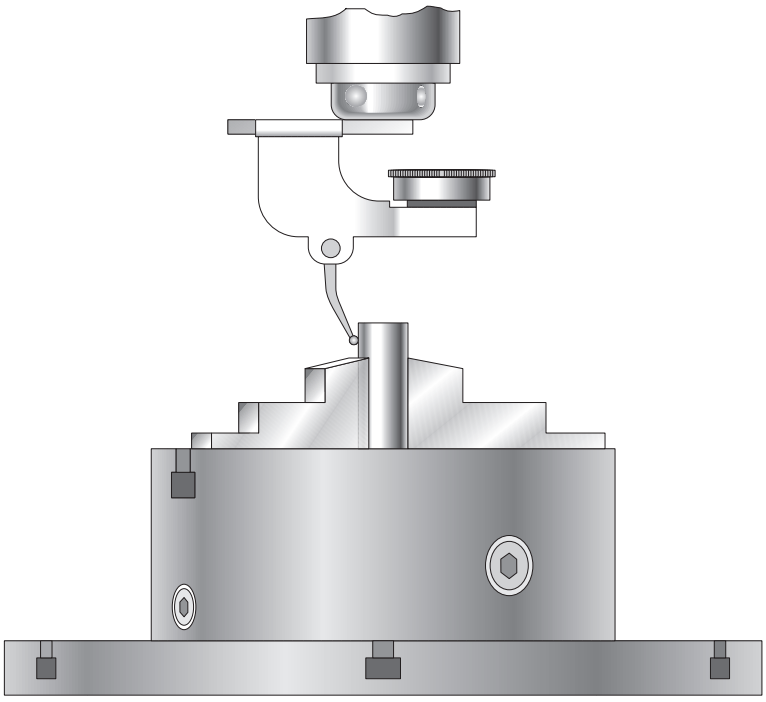
5. Verify table square.

- ☐ Sweep the indicator across the table face again to verify that the table did not shift during clamping.

6. Return the tilt table to 0° tilt.

7. Establish the origin (center-line of the round table).

- ☐ Indicate the center-line of the round table at 0° tilt.



Round Table Indicated at a 0° Tilt

8. **Position the work piece on the table.**

9. **Set the tilt angle per the job requirements.**

   - ☐ The sine bar is an adjustable angle parallel used to set up an angle or to check an angle. A sine bar can be implemented in a variety of setups but on a tilt table it is used to set up an angle or to check an angle in degrees, minutes and seconds.

10. **Square the sine bar on the tilt table.**

    - ☐ Use gauge blocks and light clamping techniques.

11. **Indicate the face of the sine bar.**

12. **Adjust the tilt, as necessary, until the increment readout indicates the required angle.**

V-Block

V-blocks are most commonly used for securing round stock.

1. **Clean the work surface, V-block, and gage roll.**

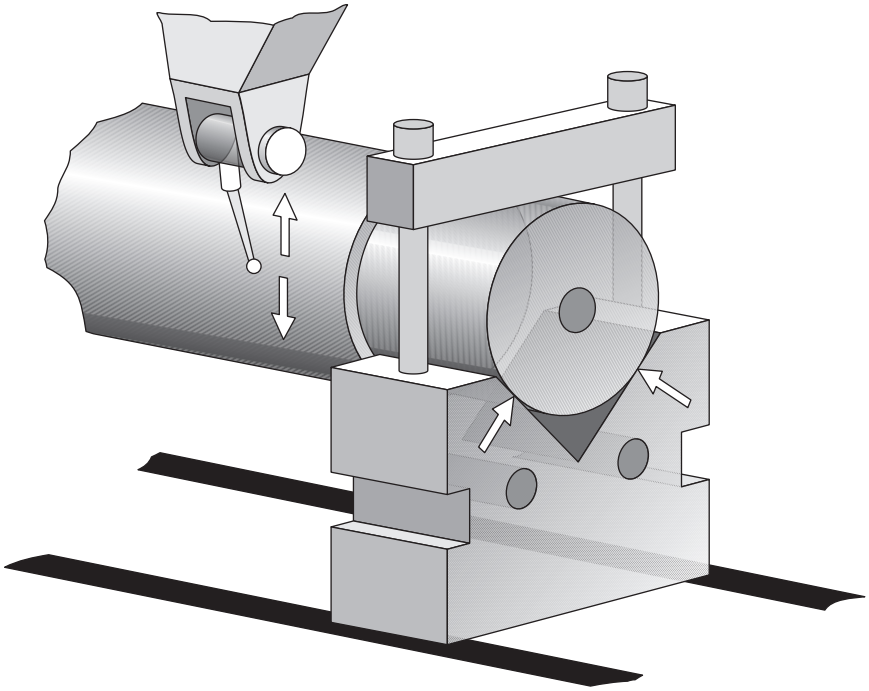
   - ☐ Make sure the work surface and V-block are free of debris.
   - ☐ Deburr the part, as necessary.

2. Set the v-block on table face (horizontal position) without the piece part.

- ☐ Snug into position hand-tight.
- ☐ Position the indicator probe on the inside faces of the V-block.

4. Indicate the center-line of the V-block.

- ☐ Indicate the center-line at the approximate location where the part will mate with the block. See the figure below.



V-Block in the Horizontal Position

- ☐ All V-blocks are not designed symmetrically; therefore, you must verify the center-line. Sweep both sides to find the high spot.
- ☐ Whether you need to indicate the center-line of the piece part or the V-block depends on the part.

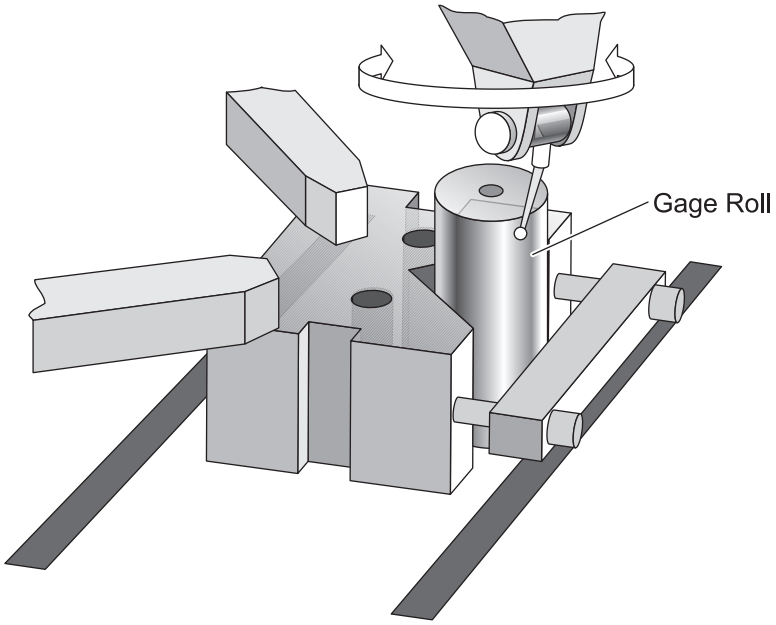
5. Set the V-block on the table face (vertical position).

- ☐ Snug into position hand-tight.

6. **Indicate the V-block square.**

7. **Indicate center-line of V-block.**

   ☐ Sweep around the outside parameter of the gage roll or sweep inside the center-line of gage roll. See the figure below.



V-Block in Vertical Position

8. **Set machine origin or reference point.**

Taper Pots

Taper pots are used for locating boring bars. The boring bars mount inside taper pots. Taper pots are usually clamped on a tilt or round table. Taper pots are used for both routine and unique applications.

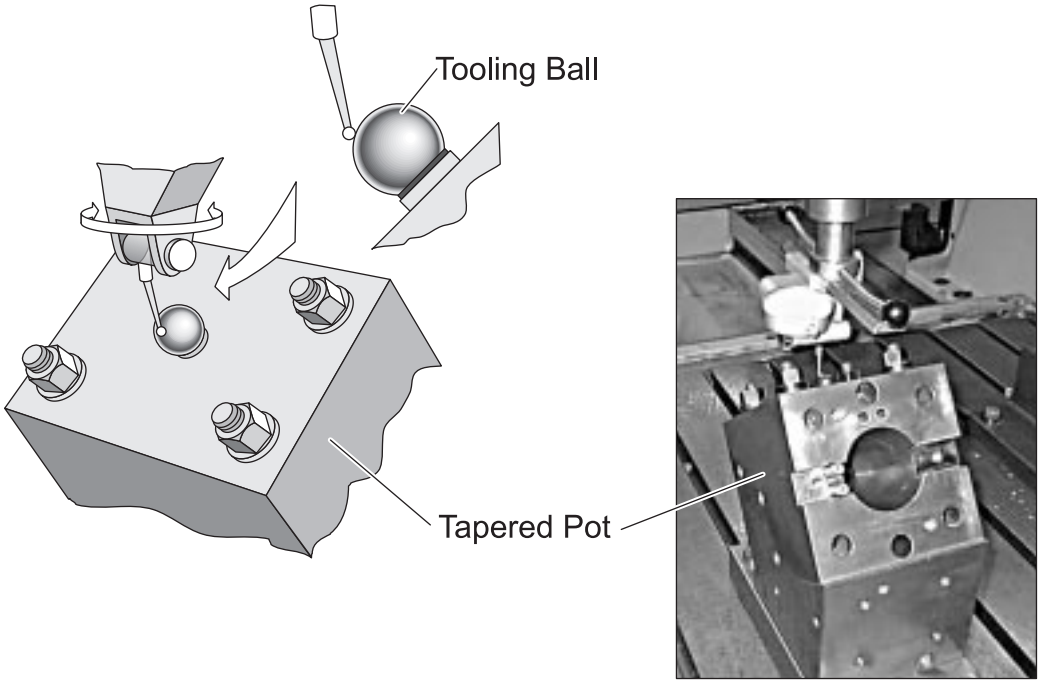
1. **Clean the work surface and taper pot.**

   ☐ Make sure the work surface and taper pot are free of debris.

2. Snug the taper pot to the table surface.

3. Indicate the pot in.

☐ Position the indicator on the taper pot, as shown below.



Indicating a Taper Pot

☐ Move appropriate axis until no movement is indicated on the dial face.

4. Set the machine origin.

Concept Check

Set Up Jig Bore

Answer the following questions to check your understanding of setting up a jig bore. Circle the correct answer in each question. Then compare your responses with the answers at the bottom of this 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. More commonly used jig bore setup equipment include:

    a. corner knee.

    b. round table / tilt table.

    c. V-block.

    d. pry bar.

2. All setups begin with ensuring that the work surface and parts are:

    a. oiled.

    b. square.

    c. free of dirt and debris.

    d. indicated.

3. Depending on the type of jig bore machine, an origin may not always be set at:

    a. X, 0 and Y, 0.

    b. X, 0 and Z, 0.

    c. horizontal.

    d. vertical.

Answers: (1. a, b, c 2. c 3. a)

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

Use available prints which require the following setup devices:

corner knee, clamp-to-table, parallels, tilt table, round table, V-blocks, sine bar, taper pots

Tools and equipment for the practice:

jig bore equipped with round and tilt tables, corner knee, parallels, V-blocks, sine bar, clamps, taper pots, prints, parts, dial indicator

Practice Objective

Set up the equipment, including indicating equipment and set the machine origin or reference point. All safe practices must be demonstrated during the setup.

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.