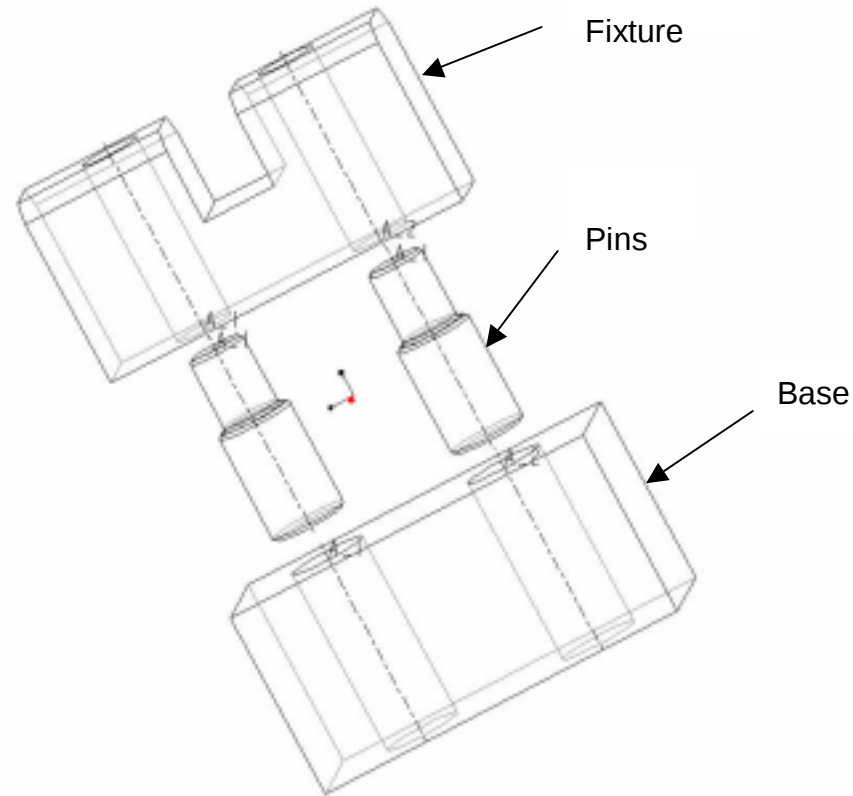


A tolerancing problem

The exploded assembly below illustrates a fixture that is to be accurately located on a mounting base with two precise pins.



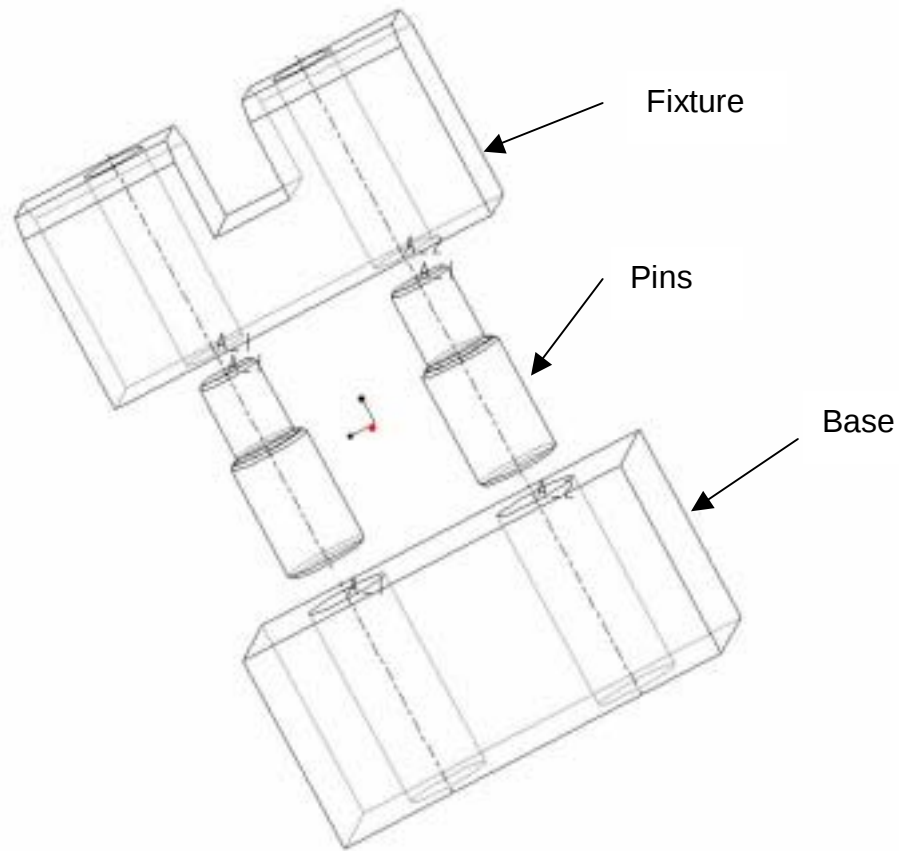
Basic specification

- The larger portion of each pin is nominally 20 mm in diameter.
- The smaller portion is nominally 15 mm in diameter.
- The nominal pin spacing is 50 mm.
- The pins are to be press fit into the base.
- The pins are then to allow a fit equivalent to a sliding or locational clearance fit when the fixture is assembled onto the base.

Fit specifications

- Specify the tolerance on the two pin diameters (use the ISO "hole basis" method), the holes in the base and the fixture, and the 50 mm hole spacing on each part.
- Use conventional bilateral tolerances for the hole spacing (not GDT).
- Remember, extreme tolerances are expensive, so try to spread your tolerance allowances among all your parts.

Selecting Tolerances



Pins into base

- Press 20 mm pins into base
- Use ISO Press Fit
- For 20 mm nominal use H7 on hole, p6 on pin
- Hole 20.000 to 20.021
- Pin 20.022 to 20.035

Pins into fixture

- Some clearance between pins and fixture is required
- Use locational clearance or sliding fit (H7, h6, or H7,g6)
- For 15 mm nominal, H7, h6 gives minimum of zero clearance (maximum pin and minimum hole), would require perfect hole spacing!
- Use H7, g6 or hole is 15.000 to 15.018 and pin is 14.983 to 14.994
- Minimum clearance is 0.006 mm

Tolerance on hole spacing

- 0.006 mm minimum clearance for each hole
- Total possible difference in spacing is 0.012 mm
- Thus the holes in both the base and the fixture should be nominally spaced 50 mm with a tolerance of ± 0.006 mm

What is the worse case angular “play” in the assembly

- Each pin in the fixture can have a worse case “play” of $15.018 - 14.983 = 0.035$ mm
- Since the radius (50 mm) times the angular “play” in radians could equal 0.070 mm, the angular play is 0.0014 radians or 0.080 degrees.

Would GDT produce more
usable parts?

No

- The only limitation on fit is hole spacing.
- A circular region of acceptance has no value in this case

How can the design be improved?

Improvements

- Increase hole spacing to reduce angular “play”
- Use constant diameter pins to produce less expensive design (see following)
- Use adhesive bonding of at least one pin in base to produce less expensive solution (will not provide interchangeability)

Constant diameter pins

- Use 16 mm pins (ISO preferred size)
- Use “shaft basis” for tolerances
- Press fit into base - hole P7, pin h6 so hole is 15.971 to 15.989 and pin is 15.989 to 16.000
- Use sliding fit between pins and fixture – hole G7, pin h6, so hole is 16.006 to 16.024, pin is 15.989 to 16.000 as before
- Minimum clearance is 0.006 mm implying same tolerance on hole spacings

Adhesive bonding

- Example - Loctite 603 can easily bond a pin into a hole with a clearance of up to 0.1 mm
- Make holes in base oversize
- Use tight “locational clearance fit” between pins and fixture (minimum clearance of 0.000 mm)
- Bond pins into base on initial assembly
- Lose interchangeability, but can be replaced by heating and cleaning.

Exporting Pro E models

- Pro E can output models in JPG format (easily imported in to Microsoft applications)
- Note – to set up with black on white

#VIEW

#DISPLAY SETTINGS

#SYSTEM COLORS

In dialog box pull down SCHEME and select Black on White then OK ('default' to restore)

Other formats

- VRML for web browsers
- IGES and DXF for other drafting and solid modeling programs