BD-03b: Align Components (Mechanical)

SAFETY FIRST

- ☐ Follow all Caterpillar facility safety standards when performing this task.
- ☐ All power sources to the power must be locked out.
- ☐ The driver and driven equipment must be set to a zero mechanical state with all pressure relieved.

EQUIPMENT

- ☐ two shafts (requiring alignment)
- ☐ two dial indicators with mounting accessories
- ☐ paper and pencil
- ☐ straight edge

RESOURCES

- ☐ Vibralign Book

Align Components (Mechanical)

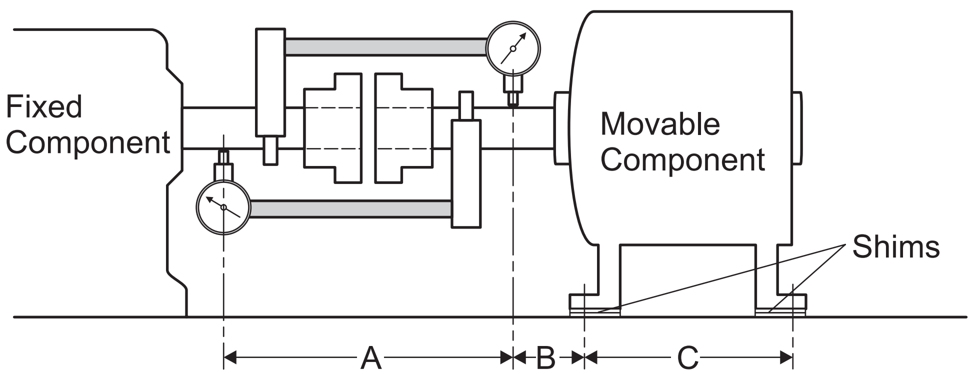
Note: The following "reverse rim" procedure uses two dial indicators, one mounted on each shaft and reading the other shaft. Both shafts must be able to turn. All measurements are radial (perpendicular to the shafts). No coupling halves are necessary, although they can be in place.

1. Shift and shim the moveable component.

- ☐ Align the shafts as closely as possible with a straight edge.

2. Set up the dial indicators.

- ☐ Attach one dial indicator to the shaft of the component (usually the driver) that you intend to shim (vertically) and / or shift (horizontally) to correct misalignment.
- ☐ Attach the other dial indicator to the shaft of the fixed component. See the figure below.



Dial Indicators on Fixed and Movable Shafts

- ☐ The distance (shown above as A) between the plungers of the dial indicators should be as wide as possible for accurate readings.
- ☐ The distance between each dial indicator and its attachment point on the shaft should be as small as possible to minimize sag and deflection.
- ☐ The center line of the dial indicator plunger must intersect, and be perpendicular to, the centerline of the shaft on which it is mounted.

3. Measure and record the distances parallel to the shafts.

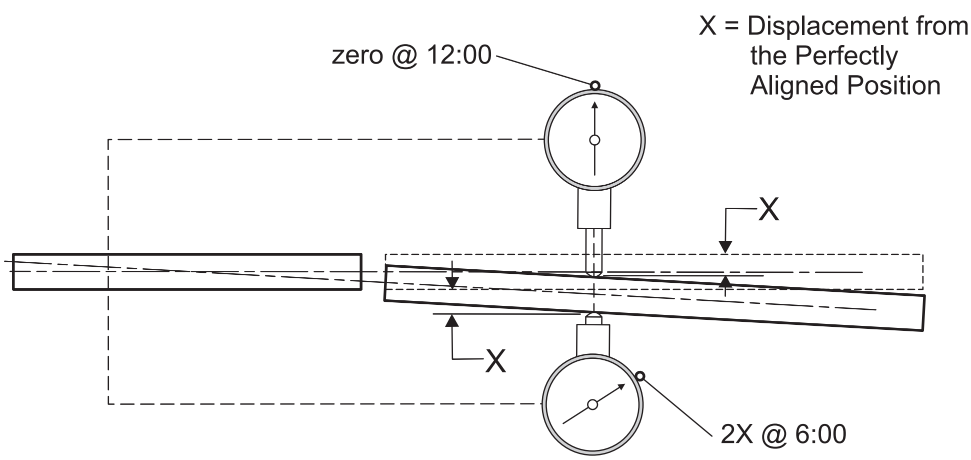
- ☐ (A) between the dial indicator plungers. ______ inches (mm)
- ☐ (C) between the mounting feet of the movable component. ______ inches (mm)
- ☐ (B) between the front mounting feet on the movable component and the nearer dial indicator plunger. ______ inches (mm)

4. Measure the vertical misalignment.

- ☐ Position one dial indicator above the shafts (12:00) and the other below the shafts (6:00).
- ☐ Zero both dials.
- ☐ Rotate both shafts half a turn and read the dials.

5. Calculate the slope of the misalignment angle between the shafts in the vertical plane.

- ☐ The following figure shows how the dial indicator reads twice the distance between the two shaft centerlines at the indicator plunger.



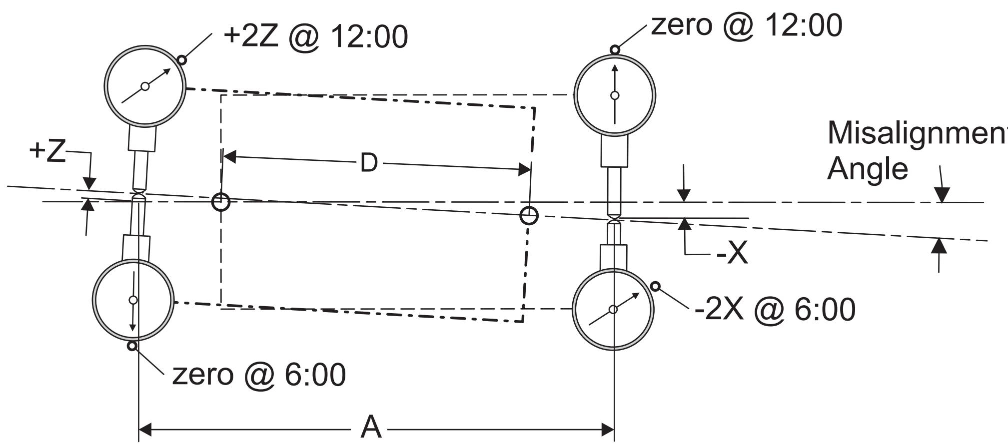
Single Reading = Twice Distance Between Shaft Centerlines

- ☐ Subtract half of both readings, being careful to observe signs.
- ☐ Divide the result by the distance (A), for the slope of the angle. Distance A is shown in step 2.
- ☐ The result will probably be a small decimal, such as 0.003” / 4.50”= 0.00067” or 0.12 mm / 152mm = 0.00079mm.

6. Calculate the distance to the point where the shaft centerlines intersect in the vertical plane.

Note: The shaft centerlines probably will not actually intersect at any point in space. However, when looking horizontally at the vertical plane, they will appear to unless the shafts are exactly parallel. In this case, both dial readings will be the same, the slope will be zero, and the shim thickness at front and back feet of the moveable component will be half the dial readings.

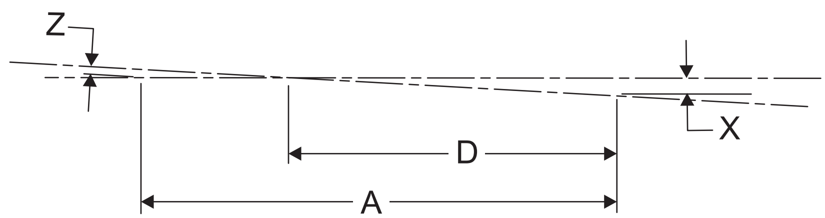
- ☐ Divide one half the smaller dial reading by the slope calculated in step 4 for the distance (D) in the following graphic.



$$\text{Tangent of Misalignment Angle} = \frac{Z - (-X)}{A} = \frac{Z + X}{A}$$

Vertical Plane Intersection Point Between the Indicators

- ☐ Note that if one dial indicator reading is positive (+) and the other is negative (-), the intersection point will be between the dial indicators, as shown above. If both readings are positive or negative, the intersection point will be beyond the smaller reading, as shown below.

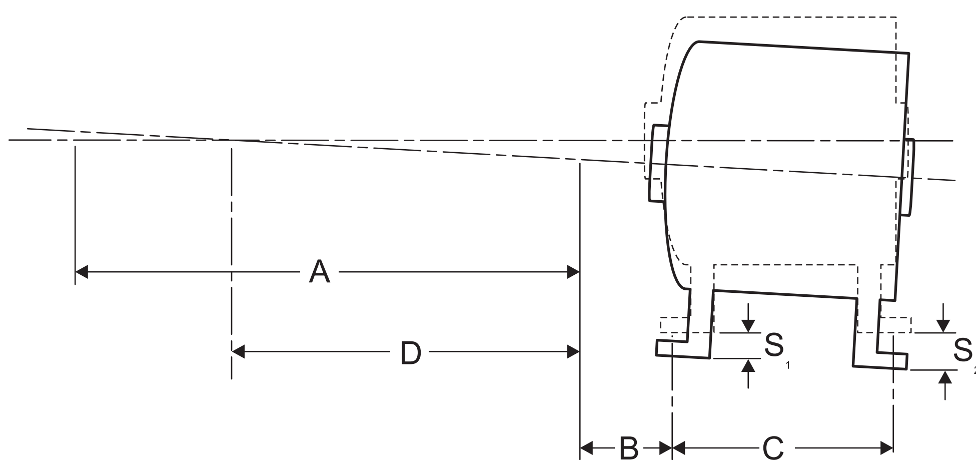


$$D = \frac{X}{\text{Tangent of Misalignment Angle}}$$

Vertical Plane Intersection Point Beyond Dial Indicators

7. Calculate the distance from the intersection point to the feet on the moveable component.

- ☐ Sketch the location of the intersection point with respect to the dial indicators and the feet of the moveable component. An example is shown below.



Distance from Intersection Point to Feet

- ☐ Be sure to add or subtract distance according to whether it is measured to the left or to the right.

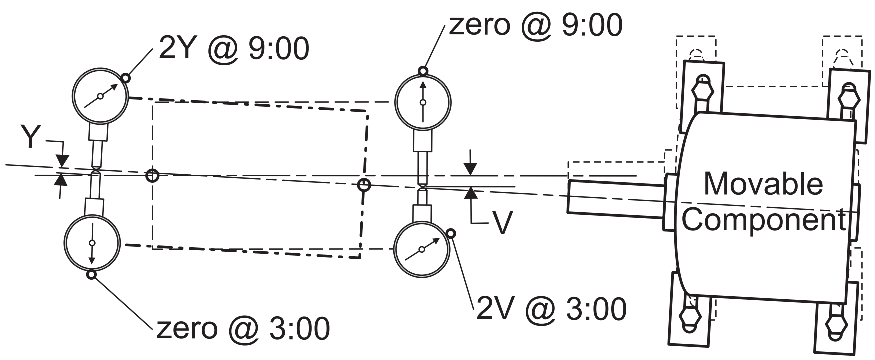
8. **Calculate the shim thicknesses needed to eliminate misalignment in the vertical plane.**

- ☐ For the shim thickness to use at the front feet, multiply the distance from the intersection point to the front feet by the slope of the misalignment angle.
- ☐ For the shim thickness to use at the back feet, multiply the distance from the intersection point to the back feet by the slope of the misalignment angle.

9. **Insert the shim thicknesses and verify that misalignment in the vertical plane is zero, or within some specified tolerance.**

10. **Measure misalignment in the horizontal plane.**

- ☐ Set one dial indicator at 3:00 and the other at 9:00, as shown below.



- ☐ Zero both dial indicators.
- ☐ Rotate both shafts half a turn to reverse the positions of the dial indicators.
- ☐ Note the dial readings.

11. **Correct misalignment in the horizontal plane.**

- ☐ Tap the movable component horizontally to halve the dial readings.
- ☐ Zero both dials.
- ☐ Rotate both shafts half a turn.
- ☐ Note the readings, which should be close to zero.
- ☐ Repeat the procedure as necessary to bring misalignment in the horizontal plane within specified tolerances.

12. **Tighten the bolts holding the moveable component, and recheck alignment in the vertical and horizontal planes. Correct as necessary.**