

TECHNICAL MANUAL
CALIBRATION PROCEDURE
FOR
CALIPERS
GENERAL

This publication replaces T.O. 33K6-4-552-1 dated 30 October 2012.

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Published under Authority of the Secretary of the Air Force

30 JULY 2013

CALIPERS**GENERAL****1 CALIBRATION DESCRIPTION:***Table 1.*

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Length	Range: * Accuracy: *	Verified by comparison to Gage Blocks

* See applicable T.O. 33K-1-100-2 or Calibration Measurement Summary (CMS) using the AFCAV Viewer.

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1 GAGE BLOCK SET	Range: 0.010 to 4 in Accuracy: ± 20 μin from stated value	L.S. Starrett Co 36	
2.2 GAGE BLOCK SET	Range: 5 to 20 in Accuracy: ± 5 $\mu\text{in/in}$ from stated value	L.S. Starrett Co 8	
2.3 SURFACE PLATE	Range: 36 \times 72 in Accuracy: not to exceed 0.00035 in TIR over entire measurement area	Brown & Sharpe 701-157	
2.4 GAGE BLOCK ACCESSORY KIT	Range: N/A Accuracy: 12 μin TIR	L.S. Starrett Co SA25A	
2.5 PLUG GAGE	Range: Up to and including 1.0 in diameter Accuracy: Class Z	As Available	

3 PRELIMINARY OPERATIONS:

3.1 Review and become familiar with entire procedure before beginning Calibration Process.

NOTE

1 microinch (μin)	=	0.000001 inch
1 millimeter (mm)	=	0.03937 inch
1 inch	=	25.40 millimeters (mm)

- 3.2 Use only that portion of the procedure that applies to the TI being calibrated.
- 3.3 Bring TI into calibration area 4 hours prior to beginning calibration.
- 3.4 Clean and deburr all critical surfaces of the TI.
- 3.5 Loosen the TI sliding jaw thumb screw, and if applicable, the adjusting nut carrier thumb screw. Verify the TI sliding jaw can be moved smoothly along the full length of the beam.
- 3.6 For Electronic and Dial type TIs: Reset zero as necessary.
- 3.7 Unless otherwise noted, measurements can be accomplished anywhere on the TI measuring jaws.

4 CALIBRATION PROCESS:

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 MECHANICAL, ELECTRONIC AND DIAL TYPE CALIPER CALIBRATION:

NOTE

When wringing Gage Block sizes together to form desired lengths, the stack must soak for at least 1 hour for sizes over 8 inches. This soak time does not apply to sizes above 8 inches which do not require wringing. This soak time only applies to TIs with a 0.0001 inch resolution.

- 4.1.1 Select the necessary Gage Block sizes required to obtain TI indications at approximately 25, 50, 75 and 100% of full scale range to verify TI Outside Dimension linearity.
- 4.1.2 Select a Plug Gage (up to and including 1.0 inch diameter) to verify TI Outside Dimension measuring jaw parallelism.
- 4.1.3 For Dial Type TIs: In addition, select and wring if necessary, 4 individual Gage Block sizes required to obtain TI indications at approximately 10, 40, 70 and 90% of the TI Dial range to verify TI Dial linearity.

Example: For a TI Dial with 0.100 inch range select 0.110, 0.140, 0.170 and 0.190 inch Gage Blocks.

- 4.1.4 For TIs with fixed jaws, verify TI Outside Dimension measuring jaws parallelism by measuring the Plug Gage in contact near the front, center and back side of the TI measuring jaws.
 - 4.1.4.1 For TIs that have a jaw that can be slid to make it shorter or longer than the other jaw, slide the jaw to the longest position and verify TI Outside Dimension measuring jaws parallelism by measuring the Plug Gage in contact near the front, center and back side of the TI measuring jaws.
 - 4.1.4.2 Repeat step 4.1.4.1 with jaw slid to the mid position and the shortest position. An example of a TI with a slidable jaw is Starrett P/N 120J.

NOTE

In substitution of Plug Gage, Parallelism can be measured using the corner of one of the Gage Blocks selected in step 4.1.1.

- 4.1.5 For all three measurements, the TI must indicate the Plug Gage Diameter within the stated accuracy listed as per Table 1 directive for TI being calibrated.

4.1.6 For Dial Type TIs: In addition, measure the first selected Gage Block from step 4.1.3 to verify the dial linearity.

4.1.6.1 The TI must indicate the Gage Block size within the stated accuracy listed as per Table 1 directive for TI being calibrated. Refer to Figure 1.

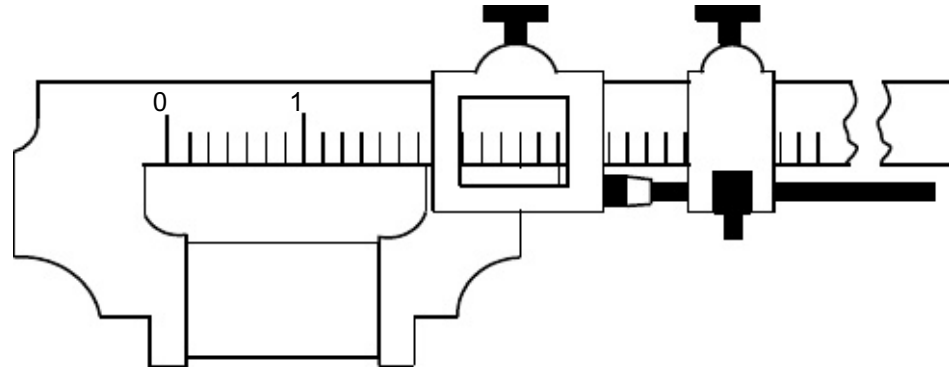


Figure 1.

4.1.6.2 Repeat steps 4.1.6 and 4.1.6.1 using the remaining Gage Blocks selected in step 4.1.3.

4.1.7 Measure the first selected Gage Block from step 4.1.1 to verify TI Outside Dimension linearity. Refer to Figure 1.

4.1.8 The TI Outside Dimension must indicate the Gage Block size within the stated accuracy listed as per Table 1 directive for TI being calibrated.

4.1.9 Repeat steps 4.1.7 and 4.1.8 using the remaining Gage Blocks selected in step 4.1.1.

4.1.10 If TI has an Outside Dimension metric scale, proceed to step 4.1.11 or 4.1.12 as applicable. If not, proceed to step 4.1.13. If metric scale is not calibrated, annotate and attach a Limited Certification Label stating: Metric scale not certified.

4.1.11 For Mechanical TIs that have Outside Dimension metric scales: Calibrate the metric scale using either inch or metric Gage Blocks following steps 4.1.7 through 4.1.9. The TI must indicate the Gage Block size within the stated accuracy listed per Table 1 directive for the TI being calibrated for both inch and metric indications.

4.1.12 For Electronic TIs that have Outside Dimension metric scales: Gage onto one of the Gage Blocks selected in step 4.1.1 and note inch indication. Change the electronic display to metric and note indication. The TI must indicate the Gage Block size within the stated accuracy listed per Table 1 directive for TI being calibrated for both inch and metric indications.

4.1.13 If the TI has the capability to measure Inside Dimensions, proceed to step 4.1.14. If not, proceed to step 4.1.16. If Inside Dimension jaws are not calibrated, annotate and attach a Limited Certification Label stating: Inside Dimension jaws not certified.

4.1.14 If the TI has a separate scale for inside measurements, select and wring caliper jaws (supplied as an accessory to the Gage Block Set) to the necessary Gage Block sizes required to obtain TI indications at approximately 25, 50, 75 and 100% of FS range to verify TI Inside Dimension linearity. If the TI uses the same scale for inside and outside measurements, wring caliper jaws to one of the Gage Blocks selected in step 4.1.1 to verify Inside Dimension linearity.

4.1.14.1 Nibs: If the TI Jaws have nibs and the TI uses the same scale for inside and outside measurements, the nib thickness must be added to the inside measurements. Consult AFCAV to determine nib thickness. If the nib thickness is not identified in AFCAV, consult manufacturer technical data to determine the nib thickness. If the nib thickness cannot be obtained from the manufacturer, measure nib thickness using a measuring device with a minimum accuracy of ± 0.0001 inch and identify measured nib thickness on appropriate Certification Label.

4.1.15 Measure the Inside Dimension of the Gage Block selected in step 4.1.14. The TI must indicate the Gage Block size within the stated accuracy listed per Table 1 directive for the TI being calibrated. Refer to Figure 2.

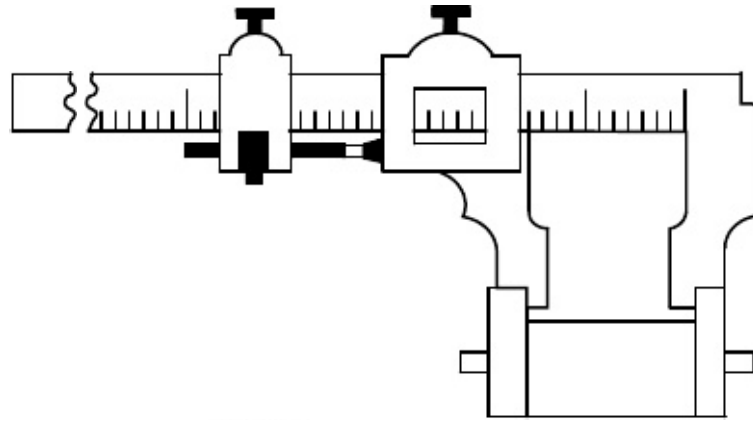


Figure 2.

4.1.16 If TI is capable of measuring Depth, proceed to step 4.1.17 or 4.1.18. If not, proceed to step 4.1.21. If the Depth measuring rod is not calibrated, annotate and attach a Limited Certification Label stating: Depth measuring capability is not certified.

4.1.17 For Electronic and Dial Type TIs: Press the rod flush to the end of the TI bar using either a Surface Plate or Triangular Base (supplied as an accessory to the Gage Block Set) and reset zero.

4.1.18 For Mechanical TIs: TI does not need to be zeroed.

4.1.19 Refer to Figure 3 and gage on one of the Gage Blocks selected in step 4.1.1.

4.1.20 The TI must indicate the size of the Gage Block within the stated accuracy listed per Table 1 directive for the TI being calibrated.

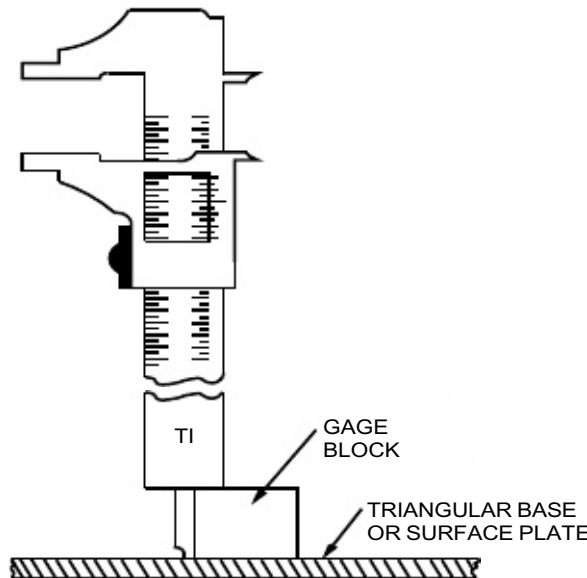


Figure 3.

4.1.21 If the TI has the capability to measure Step Dimensions, proceed to step 4.1.22 or 4.1.23. If not, proceed to step 4.1.26. If Step Dimension capability is not calibrated, annotate and attach a Limited Certification Label stating: Step Dimension capability not certified.

4.1.22 For Electronic and Dial Type TIs: With the TI fully closed, reset to zero.

4.1.23 For Mechanical TIs: TI does not need to be zeroed.

4.1.24 Refer to Figure 4 and gage on a 1.0 inch Gage Block. The 1.0 inch Gage Block can be substituted with one of the Gage Blocks from step 4.1.1.

4.1.25 The TI must indicate the size of the Gage Block within the stated accuracy listed per Table 1 directive for the TI being calibrated.

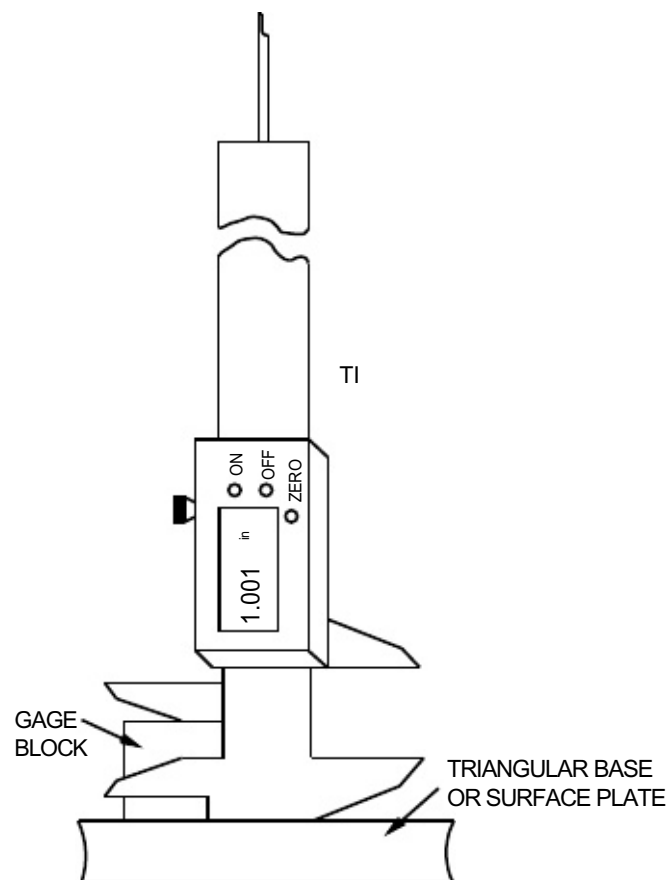


Figure 4

4.1.26 Proceed to step 4.2.10.

4.2 TYPE II TI, GEAR TOOTH VERNIER CALIBRATION: (Refer to Figures 5 and 6)

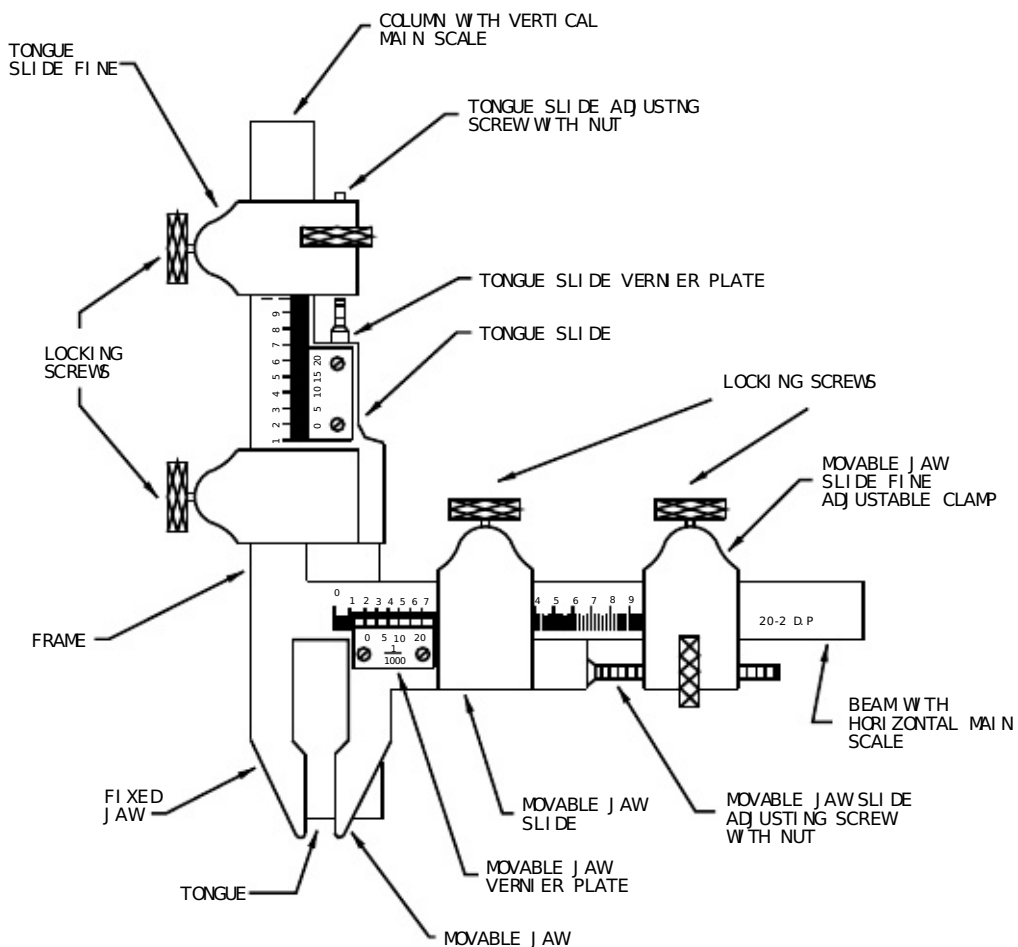


Figure 5.

Type II, Class 1, Style A TIs, Gear Tooth Vernier, 20-2 Diametrical Pitch

- 4.2.1 Select the appropriate size Gage Blocks to check the TI at approximately 20, 40, 60 and 80% of full scale for the vertical main scale and horizontal main scale.
- 4.2.2 Place the smallest Gage Block size on the Surface Plate with the bottom gaging surface of the Gage Block making contact with the Surface Plate.
- 4.2.3 Place TI tongue in a vertical position on the top gaging surface of the Gage Block and with the locking screws on vertical scale loose, make an estimated setting. Tighten lock screw on the fine adjustment clamp (Style B) or tongue slide fine clamp (Style A). With the knurled nut on the adjusting screw, make adjustment until the fixed and moveable TI measuring jaws make contact with the Surface Plate and the tongue slide makes firm contact with the top gaging surface of the Gage Block.
- 4.2.4 The TI must indicate the Gage Block size within the stated accuracy listed per Table 1 directive for the TI being calibrated.

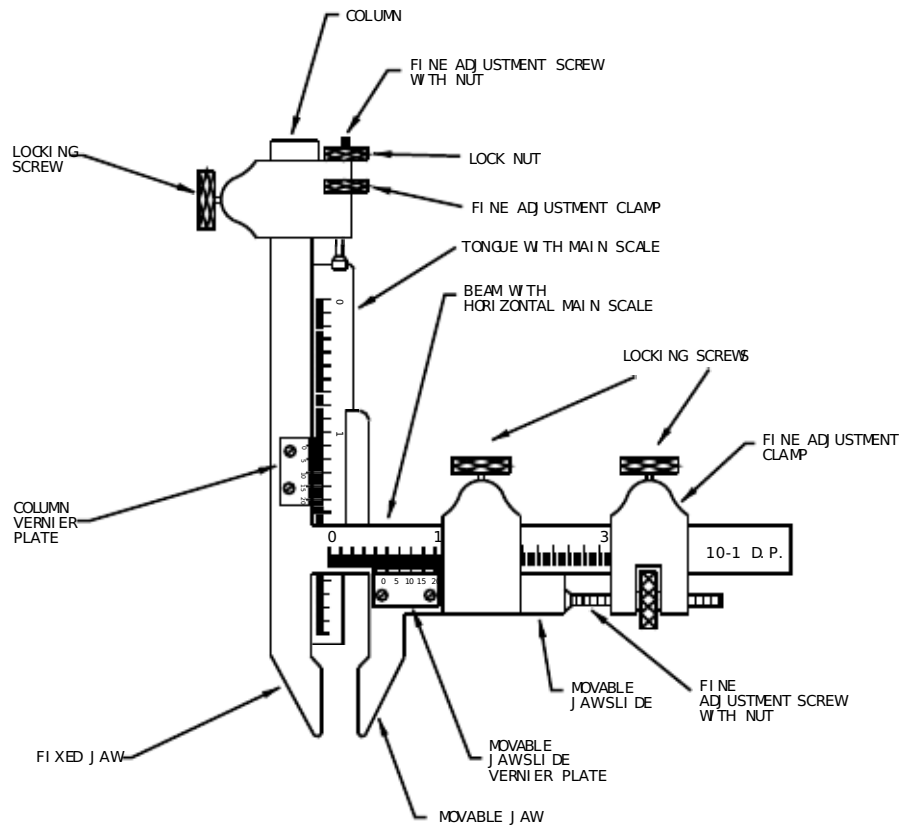


Figure 6.

Type II, Class 1, Style B TIs, Gear Tooth Vernier, 10-1 Diametrical Pitch

4.2.5 The TI horizontal main scale is checked by placing the Gage Block on a side in such a manner that both gaging surfaces are exposed.

4.2.6 Place the TI in a vertical position over the Gage Block with the moveable and fixed TI measuring jaws extending down over the gaging surface of the Gage Block.

4.2.7 Make a rough setting by holding the fixed TI measuring jaw against one gaging surface of the Gage Block and moving the moveable TI measuring jaw until contact is almost made. Tighten locking screw on the fine adjustment clamp.

4.2.8 Make final adjustment with knurled nut by bringing TI measuring jaws into contact with the Gage Block gaging surfaces. The TI must indicate the Gage Block size within the stated accuracy listed per Table 1 directive for the TI being calibrated.

4.2.9 Repeat steps 4.2.2 through 4.2.8 for the remaining Gage Block sizes.

4.2.10 Calibration complete. Secure all equipment.

4.2.11 Annotate and attach the appropriate Certification Label per steps 4.1.10, 4.1.13, 4.1.14.1, 4.1.16 and/or 4.1.21 as applicable.

CALIBRATION PERFORMANCE TABLE

Not Required