*TB 9-5210-204-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MICROMETER CALIPER, TYPE I, CLASS 1 STYLE A, B, C, AND D, AND TYPE 1, CLASS 2 STYLE A, B, AND C (GGG-C-105) AND (GGG-C-105b)

Headquarters, Department of the Army, Washington, DC
25 June 2008

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-5210-204-35, 7 June 1985, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Micrometer Caliper, Type I, Class 1, Style A, B, C, and D, and Type I, Class 2, Style A, B, and C (GGG-C-105) and (GGG-C-105b). The manufacturer's manual and federal specification were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Type I: Caliper, micrometer, outside:

Class 1: Enameled I-beam or tubular frame:
Style A: Solid anvil
Style B: Interchangeable anvil
Style C: Tubing, ball anvil
Style D: Tubing, upright anvil

Class 2: Finished frame:
Style A: Solid anvil
Style B: Paper gage
Style C: Tubing, ball anvil

Calibration procedures for thread gage micrometers are not included in this bulletin.

b. Time and Technique. The time required for this calibration is approximately 1 hour, using the physical technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Length measurement	Range: 0 to 36 in. or 0 to 300 mm Accuracy: Refer to tables 5 and 6 for tolerances
Parallelism	Range: 0 to 5 in. or 0 to 125 mm Accuracy: Refer to table 4 for tolerances

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-286, AN/GSM-287 or AN/GSM-705. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in **4** above, and are not listed in this calibration procedure. The following peculiar accessories are also required for this calibration: Ball Micrometer Tester, Van Keuren Co, (7916272); Vise, (39B148).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
GAGE BLOCK (8 PIECE SET)	Range: 5.000 to 20.000 in. Accuracy: Grade 3	(7915946)
GAGE BLOCK (81 PIECE SET)	Range: .0050 to 4 in. Accuracy: Grade 3	(7901961)

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in tables 2.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturers' manuals for this TI.

d. Unless otherwise specified all controls and control settings refer to the TI.

7. Equipment Setup

a. Remove TI from protective case.

b. Visually inspect TI for any damage that will affect the accuracy of measurement.

c. Rotate thimble several times along full length of thread range to determine if roughness, binding, or irregularities occur. If necessary, disassemble thimble and spindle from barrel and check for foreign matter or lack of lubricant.

d. If necessary, clean thimble and spindle and apply a small quantity of instrument oil.

NOTE

Perform parallelism check only if visual inspection reveals damage that would prevent the anvil and spindle surfaces from remaining parallel to each other throughout one revolution of the spindle.

8. Parallelism

a. Performance Check

NOTE

Parallelism measurements are not required for ball-anvil tubing or other types of micrometers that do not have a flat anvil and flat spindle opposed and parallel to one another.

NOTE

If TI basic length is too great to permit direct contact with both sides of ball micrometer tester, proceed to (7) below.

(1) If contact is possible, perform parallelism tests for TIs with a 0 to 1 inch range as listed in (2) through (6) below.

(2) Position ball micrometer tester small ball (0.1875 in.) between the TI, anvil and spindle measuring faces at point A as shown in figure 1.

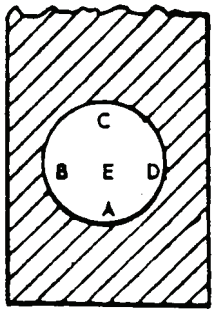

Figure 1. Parallelism test points.

(3) Adjust micrometer ratchet as necessary to obtain a measurement of the ball diameter. Note indication to the nearest 0.0001 inch.

NOTE

If TI has a 0.001 inch readout micrometer, read to the nearest one-half minor division. If TI has a 0.0001 inch vernier, read direct.

(4) Repeat (2) and (3) above for points B, C, D, and E.

(5) Reset micrometer to increase the anvil to spindle dimension by $^1/_{16}$ inch. Replace ball micrometer tester small ball with large ball (0.250 in.) and repeat (2) through (4) above.

(6) For 0.001 inch readout micrometers, verify that the five readings have a maximum difference of one-half of a minor division for each ball. Use tolerances in table 4 for 0.0001 inch readout micrometers.

Table 4. Parallelism Tolerance for Outside Micrometer Calipers

Test instrument					
Size		Range		Tolerance	
Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
1	25	0 to 1	0 to 25	0.00010	0.0024
2	50	1 to 2	25 to 50	0.00020	0.0050
3	75	2 to 3	50 to 75	0.00030	0.008
4	100	3 to 4	75 to 100	0.0004	0.010
5	125	4 to 5	100 to 125	0.0004	0.010

(7) If TI basic length is 1 to 5 inches, perform (8) through (15) below:

(8) Place vise on a flat level surface.

(9) Place TI in vise so TI is at a 90 degree angle from work surface and spindle is parallel to rubber jaws of vise (fig. 2).

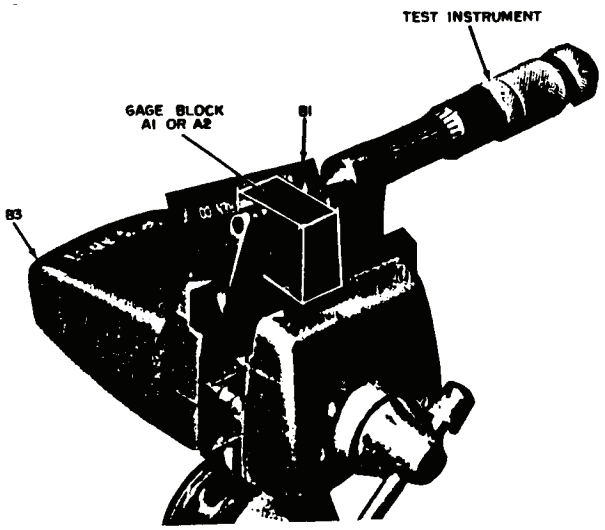

Figure 2. Parallelism test - equipment setup.

NOTE

For larger frame micrometers, it may be necessary to stack several gage blocks vertically on rubber jaws of vise to perform steps (10) through (15).

NOTE

Vise should have rubber covered jaws to protect TI. Vise should be adjusted to hold TI firmly, but not so tight that it will distort TI frame.

(10) Rest appropriate size gage block on rubber jaws of vise so that gage block is flat on anvil face of TI (fig. 2).

(11) Place ball micrometer tester small ball (0.1875 in.) between gage block top gaging surface and TI spindle face at point A as shown in figure 1.

(12) Adjust ratchet and micrometer as necessary to obtain a measurement of the ball diameter. Note indication to the nearest 0.0001 inch (by estimation).

NOTE

If TI has a 0.001 inch readout micrometer, read to nearest one-half minor division. If TI has a 0.0001 inch vernier, read direct.

(13) Repeat (11) and (12) above for points B, C, D, and E, figure 1.

(14) Reset micrometer to increase anvil to spindle dimension by 1/16th inch. Replace ball micrometer tester small ball with large ball (0.250 in.) and repeat (11) through (13) above.

(15) For 0.001 inch readout micrometer, verify that the five readings have a maximum difference of one-half of a minor division for each ball. Use tolerances in table 4 for 0.0001 inch readout micrometers.

b. Adjustments. No adjustments can be made.

9. Zero Check

a. Performance Check

(1) For 0 to 1 inch range micrometer caliper, rotate thimble until surface of spindle and anvil face make gentle contact. If indication on barrel is not zero, perform **b** below.

(2) For micrometer caliper greater than 0 to 1 inch in range, use appropriate gage block from gage block set that will leave a measuring range of 1 inch. Rotate thimble until spindle face contacts gage block. If indication on barrel is not zero, perform **b** below.

b. Adjustments

(1) Rotate thimble until measuring face of anvil and spindle come together, or make contact with appropriate gage block.

(2) Adjustment procedures vary with manufacturer. Adjust in accordance with manufacturer's manual (R).

10. Length Measurement for Micrometers Without Adjustable Mandrels and Checking Standards

a. Performance Check

NOTE

To calibrate a TI graduated in the metric system, it will be necessary to convert the metric reading to applicable length in inches. Formula is: 1 millimeter = 0.03937 inch, or 1 inch = 25.4 millimeters.

(1) Select and use appropriate gage block from gage block set to check TI at full range in accordance with table 5.

Table 5. Micrometer Caliper Tolerances

Size (in.)	Range (in.)	Maximum error (in.)
0 to 4	0 to 1	0.0002
	1 to 2	0.0002
	2 to 3	0.0002
	3 to 4	0.0002
2 to 6	2 to 3	0.0002
	3 to 4	0.0002
	4 to 5	0.0002
	5 to 6	0.0002
6 to 9	6 to 7	0.0003
	7 to 8	0.0003
	8 to 9	0.0003
6 to 12	6 to 7	0.0003
	7 to 8	0.0003
	8 to 9	0.0003
	9 to 10	0.0003
	10 to 11	0.0003
	11 to 12	0.0003
9 to 12	9 to 10	0.0003
	10 to 11	0.0003
	11 to 12	0.0003
12 to 16	12 to 13	0.0004
	13 to 14	0.0004
	14 to 15	0.0004
	15 to 16	0.0004
12 to 18	12 to 13	0.0004
	13 to 14	0.0004
	14 to 15	0.0004
	15 to 16	0.0004
	16 to 17	0.0004
	17 to 18	0.0004

Table 5. Micrometer Caliper Tolerances - Continued

Size (in.)	Range (in.)	Maximum error (in.)
16 to 20	16 to 17	0.0004
	17 to 18	0.0004
	18 to 19	0.0005
	19 to 20	0.0005
18 to 24	18 to 19	0.0005
	19 to 20	0.0005
	20 to 21	0.0005
	21 to 22	0.0005
	22 to 23	0.0005
	23 to 24	0.0005
18 to 24	20 to 21	0.0005
	21 to 22	0.0005
	22 to 23	0.0005
	23 to 24	0.0005
24 to 30	24 to 25	0.0006
	25 to 26	0.0006
	26 to 27	0.0006
	27 to 28	0.0006
	28 to 29	0.0006
	29 to 30	0.0006
30 to 36	30 to 31	0.0007
	31 to 32	0.0007
	32 to 33	0.0007
	33 to 34	0.0007
	34 to 35	0.0007
	35 to 36	0.0007

(2) If any error is indicated, either high or low, select appropriate gage blocks to obtain either a + (plus) or - (minus) tolerance from nominal dimension. TI should read nominal dimension or an error in opposite direction.

(3) If TI continues to read an error in original direction after changing dimensional tolerance, TI must be rejected. Example: If a 0 to 1 inch TI indicates a dimension less than 1 inch, wring a 0.1002-inch block to a 0.900 inch block. TI must indicate 1 inch or more. If indication is less than 1 inch after using 0.1002 inch and 0.900 inch combination, TI is out of tolerance.

b. Adjustments. No adjustments can be made.

11. Length Measurement for Micrometer Calipers With Adjustable Mandrels and Checking Standards

a. Performance Check

(1) Select appropriate gage blocks from gage blocks set to verify range of TI length standards.

(2) Assemble gage blocks. Be certain that blocks are firmly wrung together prior to applying tie rods. Each stack of blocks must have an inside caliper jaw at each end, which serves as an end stop. See figure 3 below.

(3) Set up length standard between end stops.

(4) After obtaining a satisfactory fix on end stops, total length of gage block stack should not exceed the tolerance listed in table 6 below.

(5) Repeat (1) through (4) above for each length standard supplied with TI.

(6) Select longest adjustable mandrel supplied with TI and insert into TI frame socket. Tighten knurled screw thumb tight.

(7) Select shortest length of checking standard supplied with TI and place it between surface of anvil and spindle face.

(8) Rotate thimble until surface of spindle and anvil face make gentle contact. TI will indicate within limits specified in table 6 below.

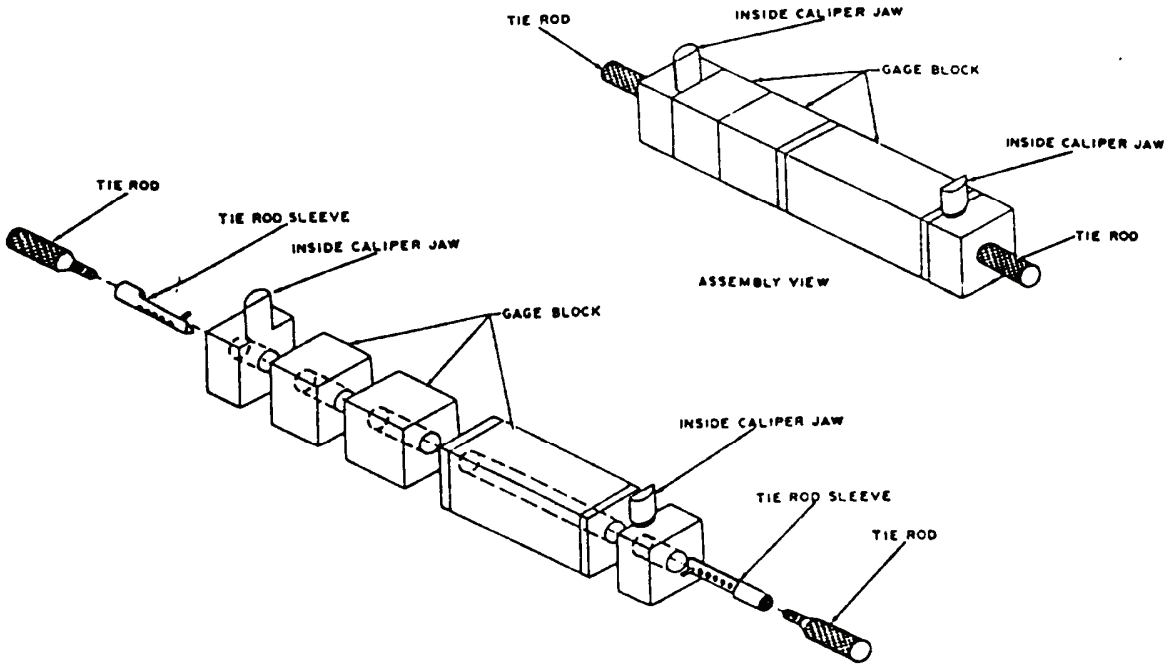

Figure 3. Gage blocks - equipment setup.

Table 6. Micrometer Standards Accuracy Check

Size of length standard (in.)	Tolerance of gage block stack between end stops (in.)	
	Min	Max
1.00000	0.9999	1.0001
2.00000	1.9999	2.0001
3.00000	2.9999	3.0001
4.00000	3.9999	4.0001
5.00000	4.9998	5.0002
6.00000	5.9998	6.0002
7.00000	6.9998	7.0002
8.00000	7.9998	8.0002

Table 6. Micrometer Standards Accuracy Check - Continued

Size of length standard (in.)	Tolerance of gage block stack between end stops (in.)	
	Min	Max
9.00000	8.9998	9.0002
10.00000	9.9998	10.0002
11.00000	10.9998	11.0002
12.00000	11.9997	12.0003
13.00000	12.9997	13.0003
14.00000	13.9997	14.0003
15.00000	14.9997	15.0003
16.00000	15.9997	16.0003
17.00000	16.9997	17.0003
18.00000	17.9997	18.0003
19.00000	18.9997	19.0003
20.00000	19.9997	20.0003
21.00000	20.9997	21.0003
22.00000	21.9997	22.0003
23.00000	22.9997	23.0003
24.00000	23.9997	24.0003
25.00000	24.9996	25.0004
26.00000	25.9996	26.0004
27.00000	26.9996	27.0004
28.00000	27.9996	28.0004
29.00000	28.9996	29.0004
30.00000	29.9996	30.0004
31.00000	30.9996	31.0004
32.00000	31.9996	32.0004
33.00000	32.9996	33.0004
34.00000	33.9996	34.0004
35.00000	34.9996	35.0004
36.00000	35.9996	36.0004

b. Adjustments. Make adjustments as outlined in manufacturer's manual (R).

12. Final Procedure

a. Deenergize and disconnect all equipment and reinstall protective cover on TI.

b. Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0812105

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342811, requirements for calibration procedure TB 9-5210-204-24.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.