

*TB 9-5210-202-40

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR OPTICAL FLATS (SET OF FOUR) (7902794)

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

Distribution Statement A: Approved for public release; distribution is unlimited.

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.

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*This bulletin supersedes TB 9-5210-202-50, dated 9 April 1976.

**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Optical Flats (Set of Four) 7902794. The manufacturer's manual and MIL-0-26901 (USAF) were used as the prime data source in compiling these instructions. The optical flats (set of four) will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. None.

b. Time and Technique. The time required for this calibration is approximately 2 hours, using the physical technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required by 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. When adjustments are in tables the (R) follows the designated adjustment. 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
Flatness	Accuracy: ± 0.000001 in.

**SECTION II
EQUIPMENT REQUIREMENTS**

4. Equipment Required. This equipment is issued with the Secondary Reference Standards Set, NSN 4931-00-621-7878. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in paragraph 4 above, and are not listed in this calibration procedure. The following peculiar accessory is also required for this calibration: Monochromatic Light, Helium glass tube 11.6 μ m. wavelength, Van Keurin, Model C-2 wavelength (7902779).

SECTION III PRELIMINARY OPERATIONS

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 paragraph 5.

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

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

7. Equipment Setup

a. Remove TI from protective cover.

b. Clean all TI surfaces with alcohol and wipe dry with a lint-free cloth.

NOTE

It is very important that surfaces be free from lint, dust, or grease.

c. Inspect TI for chips and scratches. If edges of TI are chipped enough to make handling hazardous, or if surfaces are scratched enough to produce erroneous readings, the TI should be rejected.

d. Allow TI (10 minutes per inch of diameter) to stabilize to room temperature.

NOTE

Make sure each TI can be identified from the others. As an aid in identification, a temporary designation of A, B, C, or D may be placed on the edge of each flat until this calibration is completed.

**SECTION IV
CALIBRATION PROCESS**

8. Flatness

a. Performance Check

- (1) Place one TI on another and place on base of monochromatic light (fig. 1).

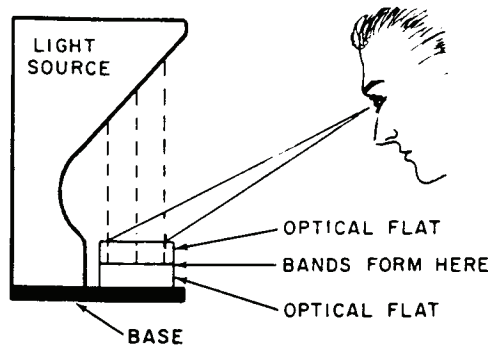


Figure 1. Monochromatic light - equipment setup.

NOTE

A black cloth or paper placed under bottom TI will make the band more distinctly readable.

- (2) Locate thread as shown in figure 2 and pull taut. Read and record deviation from straight line of fringes under monochromatic light.

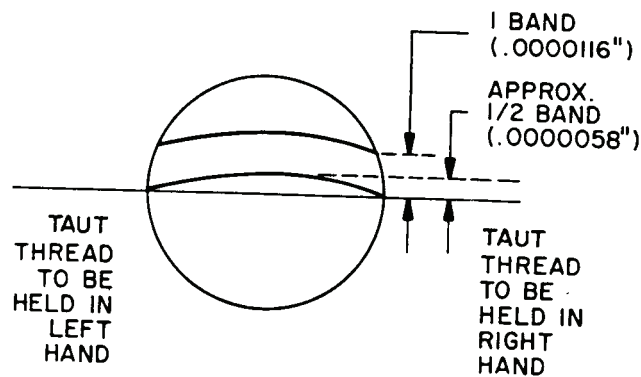


Figure 2. Distortion measurement.

NOTE

Bands should be viewed as near a vertical position as possible. Use monochromatic light only when required.

- (3) Rotate the TI (both flats) approximately 90 degrees and repeat (2) above.

(4) Repeat (2) and (3) above using sequence and TI combinations as listed in table 3 of example A. Both surfaces of each TI must be checked.

EXAMPLE A:

NOTE

Each distortion fringe is multiplied by 11.6 microinches-wavelength of the monochromatic light.

Table 3. Distortion (Example)

Sequence	Distortion (fringes)	Distortion (micro inches)
B on A	$A + B = 1/10$	1.16
C on A	$A + C = 1/4$	2.90
D on A	$A + D = 1/5$	2.32
C on B	$B + C = 1/10$	1.16
D on B	$D + B = 1/10$	1.16
D on C	$C + D = 1/5$	2.32

NOTE

Place each surface of each TI upon the same surface (top or bottom) of each of the other TIs.

NOTE

If the fringes bow around the contact point, convexity is indicated (+) and the fringe distortion has a positive sign. If the fringes bow away from the contact point, concavity is indicated (-) and the fringe distortion has a negative sign.

NOTE

The contact point is determined by downward pressure on the flat at a point directly above one of the edges running parallel to the interference bands. If bands remain the same distance apart, that edge forms the line of contact. If the bands tend to decrease in number, the opposite edge forms the line of contact.

(5) Determine deviation of TI (each flat) by arranging distortion values from table 3 (Example A) in an equation, such as Example B, and solve algebraically. The maximum deviation should not exceed 0.000003 (approx. $1/4$ of one band) inch.

EXAMPLE B:

$$\begin{array}{r} A + B = 1.16 \\ -B - C = -1.16 \\ \hline A - C = 0 \end{array}$$

$$\begin{array}{r} A + C = 2.90 \\ \underline{A - C = 0.00} \\ 2A = 2.90 \\ A = C \quad A = 1.45 \end{array}$$

$$\begin{array}{r} A = C \\ C = 1.45 \end{array}$$

$$A + B = 1.16$$

$$\begin{array}{r} C = D = 2.32 \\ B = 1.16 - A \\ B = 1.16 - 1.45 \\ B = -0.29 \end{array}$$

$$\begin{array}{r} D = 2.32 - C \\ D = 2.32 - 1.45 \\ D = 0.870 \end{array}$$

b. Adjustments. Replace TI (each flat) which deviates more than 0.000003 inch (approx. $\frac{1}{4}$ of one band).

9. Final Procedure

- a. Replace TI in its protective cover.
- b. Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

Official:

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

Handwritten signature of Joyce E. Morrow in cursive script.

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

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Distribution:

To be distributed in accordance with STD IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-5210-202-40.

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.

