

TECHNICAL MANUAL

**OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT,
AND GENERAL SUPPORT MAINTENANCE MANUAL
THEODOLITE, DIRECTIONAL; 1-SECOND GRADUATION,
5.91N. LONG TELESCOPE: DETACHABLE TRIBRACH
W/ACCESSORIES AND TRIPOD
(WILD HEERBRUGG MODEL T2-74DEG)
NSN 6675-00-334-5335**

**This copy is a reprint which includes current
pages from Changes 1 and 2.**

**HEADQUARTERS, DEPARTMENT OF THE ARMY
JULY 1975**

WARNING

Severe eye damage can result from performing observations against direct sunlight without utilizing the telescope black sunglass.

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 °F.-138 °F. (38 °C.-59 °C.).

CHANGE

No. 2

**HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 14 April 1988**

**Operator's, Organizational, Direct Support and
General Support Maintenance Manual**

**THEODOLITE, DIRECTIONAL; 1-SECOND GRADUATION,
5.9 IN. LONG TELESCOPE: DETACHABLE TRIBRACH
W/ACCESSORIES AND TRIPOD
(WILD HEERBRUGG MODEL T2-74DEG)
NSN 6675-00-334-5335**

TM 5-6675-306-14, 23 July 1975, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages

i and ii
4-15 and 4-16

Insert pages

i and ii
4-15 and 4-16

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Support and General Support Maintenance requirements for Theodolite, Directional, 1 sec Grad, 5.9-in Telescope (T2-74 Deg).

CHANGE

No. 1

**HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 5 October 1978**

**Operator's, Organizational, Direct Support and
General Support Maintenance Manual**

**THEODOLITE, DIRECTIONAL; 1-SECOND GRADUATION,
5.9 IN. LONG TELESCOPE: DETACHABLE TRIBRACH
W/ACCESSORIES AND TRIPOD
(WILD HEERBRUGG MODEL T2-74DEG)
NSN 6675-0-334-5635**

TM 5-6675-306-14, 25 July 1975, is changed as follows:

1. Remove old pages and insert new pages as indicated below.
2. New or changed material is indicated by a vertical bar in the margin of the page.
3. Added or revised illustrations are indicated by a vertical bar adjacent to the illustration identification number.

Remove Pages

i, ii
1-1, 1-2

2-17, 2-18
3-5, 3-6
B-1
C-1 thru C-5

Insert Pages

i, ii
1-1, 1-2

2-17, 2-18
3-5, 3-6
B-1 thru B-3
C-1
D-1 thru D-5
E-1

4. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:
]

Official:

J.C.PENNINGTON
Brigadier General, United States Army
The Adjutant General

BERNARD W.ROGERS
General, United States Army
Chief of Staff

Distribution:

To be distributed in accordance with DA Form 12-25A, Operator maintenance requirements for Surveying Equipment.

**Operator, Organizational, Direct Support and
 General Support Maintenance Manual**

**THEODOLITE, DIRECTIONAL; 1-SECOND GRADUATION,
 5.9 IN.LONG TELESCOPE: DETACHABLE TRIBRACH
 W/ACCESSORIES AND TRIPOD
 (WILD HEERBRUGG MODEL 12-74DEG)
 NSN 667500-334-65335**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

			Paragraph	Page
CHAPTER	1.	INTRODUCTION		
Section	I.	General	1-1-1-6	1-1
	II.	Description and data	1-7-1-9	1-1
CHAPTER	2.	OPERATING INSTRUCTIONS		
Section	I.	Service upon receipt of equipment	2-1-2-3	2-1
	II.	Movement to a new worksite	2-4, 2-5	2-20
	III.	Controls and instruments	2-6, 2-7	2-20
	IV.	Operation under usual conditions	2-8-2-10	2-25
	V.	Operation under unusual conditions	2-11-2-18	2-36
CHAPTER	3.	OPERATOR/CREW MAINTENANCE INSTRUCTIONS		
Section	I.	Basic issue items list and items troop installed or authorized	3-1	3-1
	II.	Lubrication instructions	3-2, 3-3	3-1
	III.	Preventive Maintenance Checks and Service	3-4, 3-5	3-4
	IV.	Troubleshooting	3-6	3-4
	V.	Maintenance of Lamp Fitting and Battery Box	3-7,3-8	3-6
CHAPTER	4.	ORGANIZATIONAL MAINTENANCE INSTRUCTION		
Section	I.	Service upon receipt of equipment	4-1	4-1
	II.	Movement to a new worksite.....	4-2	4-1
	III.	Repair parts, special tools and equipment	4-3-4-5	4-1
	IV.	Lubrication instructions	4-6	4-1
	V.	Preventive maintenance checks and services	4-7,4-8	4-2
	VI.	Troubleshooting	4-9	4-2
	VII.	Carrying case and haversack	4-10 - 4-12	4-3
	VIII.	Sunshade	4-13,4-14	4-7
	IX.	Tribrach assembly	4-16,4-16	4-7
	X.	Illumination mirrors	4 -17, 4-18	4-9
	XI.	Tripod assembly, plumb bob, and tripod wrench	4-19, 4-21	4-12
	XII.	Accessories	4-22-4-29	4-16
CHAPTER	5.	DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS		
Section	I.	Repair parts, special tools and equipment.....	5-1-- 5-3	5-1
	II.	Troubleshooting	5-4	5-3
	III.	Removal and installation of major components and auxiliaries	5-5 5-8	5-4
CHAPTER	6.	REPAIR OF TRIBRACH ASSEMBLY		
Section	I.	General	6-1	6-1
	II.	Tribrach assembly, components	6-2 - 6-4	6-1

		Paragraph	Page
CHAPTER	7. REPAIR OF BATTERY BOX, HANDLAMP AND CONNECTING CABLE, AND LAMP FITTINGS		
Section	I. General	7-1	7-1
	II. Battery box, handlamp and connecting cable, and lamp fittings	7-2-7-4	7-1
APPENDIX	A. REFERENCES		A-1
	B. COMPONENTS OF END ITEMS LIST		B-1
	C. ADDITIONAL AUTHORIZATION LIST		C-1
	D. MAINTENANCE ALLOCATION CHART		D-1
	E. EXPENDABLE SUPPLIES AND MATERIALS LIST		E-1
Index		I-1

LIST OF ILLUSTRATIONS

<i>Number</i>	<i>Title</i>	<i>Page</i>
1-1	Theodolite, front view	1-3
1-2	Theodolite, left side view	1-4
1-3	Theodolite, rear view	1-5
1-4	Theodolite, right side view.....	1-6
2-1	Theodolite carrying case, removal and installation	2-2
2-2	Carrying case base	2-3
2-3	Tripod assembly	2-5
2-4	Tripod accessory case, unpacked view	2-6
2-5	Accessory case	2-8
2-6	Battery box, unpacked view	2-10
2-7	Haversack	2-11
2-8	Tripod and plumb bob, removal and installation	2-13
2-9	Theodolite, removal and installation.....	2-14
2-10	Theodolite carrying case, removal and installation	2-15
2-11	Theodolite carrying case base, removal and installation.....	2-16
2-12	Illumination system, removal and installation	2-18
2-13	Theodolite diagonal eyepieces, removal and installation	2-19
2-14	Controls and instruments (sheet 1 of 4)	2-21
2-14	Controls and instruments (sheet 2 of 4)	2-22
2-14	Controls and instruments (sheet 3 of 4)	2-23
2-14	Controls and instruments (sheet 4 of 4)	2-24
2-15	Plate level, adjustment	2-26
2-16	Collimation, vertical and horizontal Slow-motion screws, adjustment	2-27
2-17	Horizontal circle drive knob, adjustment.....	2-28
2-18	Footscrews, adjustment	2-29
2-19	Horizontal collimation error, adjustment	2-30
2-20	Vertical collimation error, adjustment	2-31
2-21	Circular level, adjustment	2-32
2-22	Optical plummet, adjustment	2-33
2-23	Theodolite leveling	2-35
3-1	Lubrication chart (sheet 1 of 2)	3-2
3-1	Lubrication chart (sheet 2 of 2)	3-3
3-2	Lamp and battery, removal and installation	3-6
4-1	Carrying case hood, disassembly and reassembly	4-5
4-2	Carrying case base, disassembly and reassembly	4-6
4-3	Tribrach assembly, removal and installation	4-8
4-4	Illumination mirrors, removal and installation	4-10
4-5	Illumination mirrors, disassembly and reassembly.....	4-11
4-6	Tripod, disassembly and reassembly	4-13
4-7	Plumb bob, disassembly and reassembly.....	4-15
5-1	Tripod ,base wrench, fabrication	5-2
5-2	Base plate and footscrews, removal and installation.....	5-5
5-3	Footscrew assemblies, removal and installation	5-7
5-4	Locking plate, lock knob and circular level, removal, disassembly and installation	5-9
6-1	Base plate, disassembly and reassembly	6-1
6-2	Footscrew assembly, disassembly and reassembly	6-4
7-1	Battery box, disassembly and reassembly	7-2
7-2	Handlamp and connecting cable, disassembly and reassembly.....	7-4
7-3	Lamp fittings, disassembly and reassembly	7-6

CHAPTER 1 INTRODUCTION

Section I. GENERAL

1-1. Scope

a. These instructions are published for use by personnel to whom the Wild Heerbrugg Model T2-74DEG Theodolite is issued. Chapters 1 through 3 provide information on operation, preventive maintenance services, and organizational maintenance of equipment, accessories, components, and attachments. Chapter 4 provides information for direct and general support maintenance. Also included are descriptions of main units and their functions in relationship to other components.

b. Appendix A contains a list of publications applicable to this manual. Appendix B contains the list of basic issue items authorized the operator of this equipment. Appendix C contains the maintenance allocation chart. Organizational direct and general support maintenance repair parts and special tools are listed in TM 5-6675-306-24P.

c. Numbers in parentheses following nomenclature callouts on illustrations indicate quantity; numbers preceding nomenclature callouts indicate preferred maintenance sequence.

1-2. Maintenance Forms and Records

The maintenance forms and records you are required to use with the theodolite are DA Forms 2402 and 2801 (TM 38-750).

1-3. Reporting of Errors

DELETED

Section II. DESCRIPTION AND DATA

1-7. Description

a. The Wild Heerbrugg Model T.2-74DEG Theodolite (figs. 1-1 through 1-4) is a precision, directional-type surveying and traversing instrument. It has both vertical and horizontal

circle scales, calibrated in degrees and seconds for reading the value of angles. Such readings are observed through the microscope eyepiece (fig. 1-1). A micrometer assembly (fig. 1-4) is provided for the interpolation of angle value readings to

DELETED

1-4. Equipment Serviceability Criteria (ESC)

This equipment is not covered by an E.S.C.

1-5. Destruction of Army Material To Prevent Enemy Use

Methods of destruction should achieve such damage to equipment and repair parts that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or cannibalization.

a. Demolition of Theodolites.

(1) *Fire.* Use fire to destroy equipment when quantities of fuel and flammable materials are at hand. Proper concentration of equipment to be burned will produce a hotter, more destructive fire. Fires should be lit after mechanical destruction has been accomplished. Fires can be built to produce more heat or smoke. For destruction, heat is desired but smoke may be useful.

(2) *Mechanical destruction.* Using an axe, pick, mattock, sledge, or any other heavy implement, damage all vital elements.

b. For additional data on procedures for destruction of equipment to prevent enemy use, refer to TM 750-244-3.

1-6. Administrative Storage

Refer to TM 740-90-1 (Administrative Storage of Equipment) for information and instructions pertaining to administrative storage.

one second accuracy. A detachable tribrach (fig. 1-2) containing three foot screws, a circular level, and a starshaped base plate is mounted to the horizontal base. The base plate is provided with a threaded center to accommodate the tripod central fixing screw for securing the theodolite on the tripod head. Illumination of the vertical, horizontal, and micrometer circles during daylight operation is accomplished by adjusting the illumination mirrors (fig. 1-1). A battery-powered illumination system is provided for night or dark-day operations. Diagonal eyepieces for attachment to the telescope and microscope eyepieces for high-angle and astronomical observations are contained in the accessory case.

b. The following components and accessories make up a complete theodolite:

- (1) Theodolite
- (2) Carrying case
- (3) Tripod

(4) Tripod accessory case

- (a) Tripod wrench
- (b) Plumb bob

(5) Battery box (batteries troop installed, not supplied)

- (a) Handlamp
- (b) Connecting cable

(6) Haversack

(7) Accessory case

- (a) Instrument cover
- (b) Black sunglass
- (c) Lamp fittings (2)
- (d) Adjusting pins (2)
- (e) Screwdriver
- (f) Brush
- (g) Grease container
- (h) Chamois
- (i) Telescope diagonal eyepiece
- (j) Microscope diagonal eyepiece

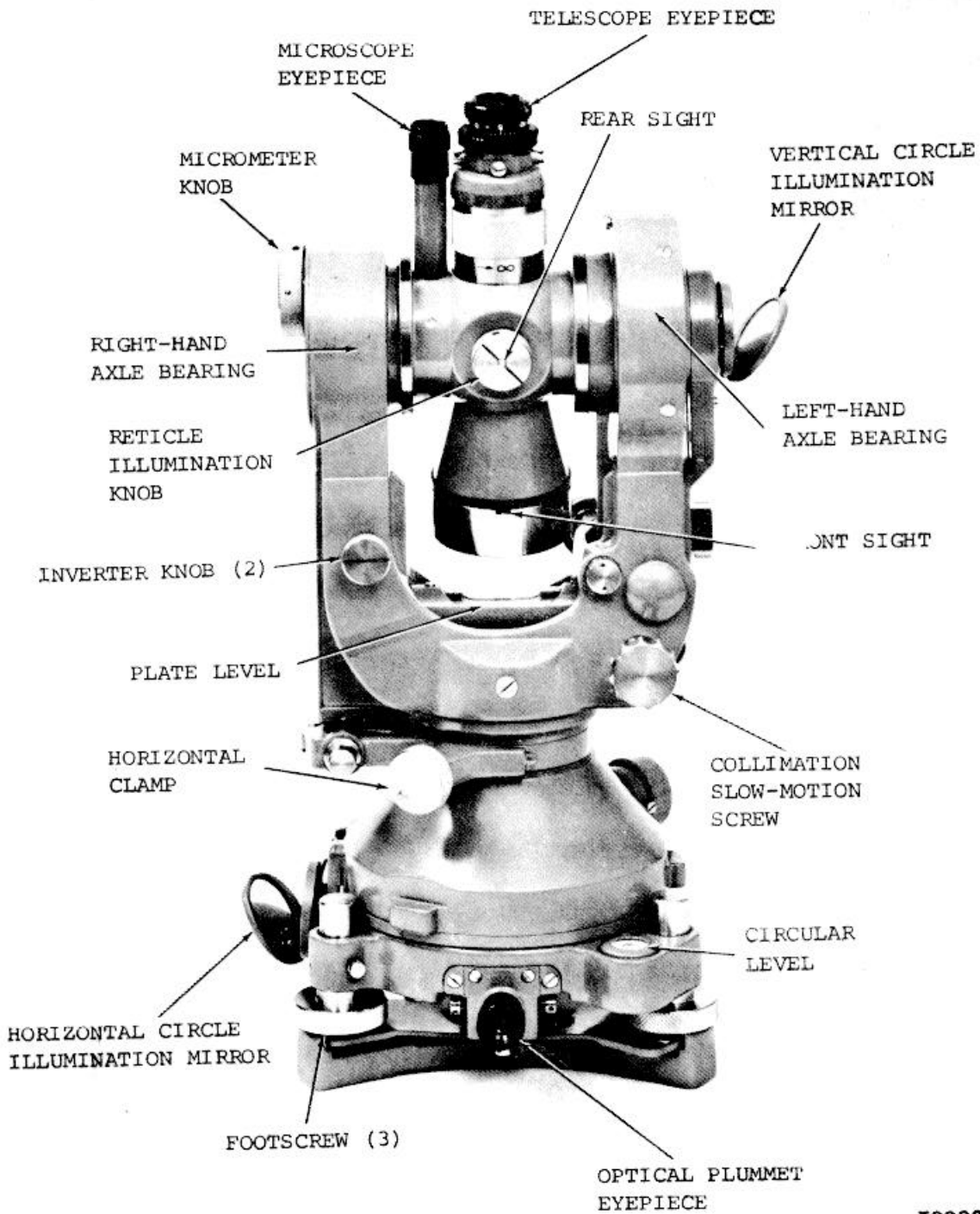
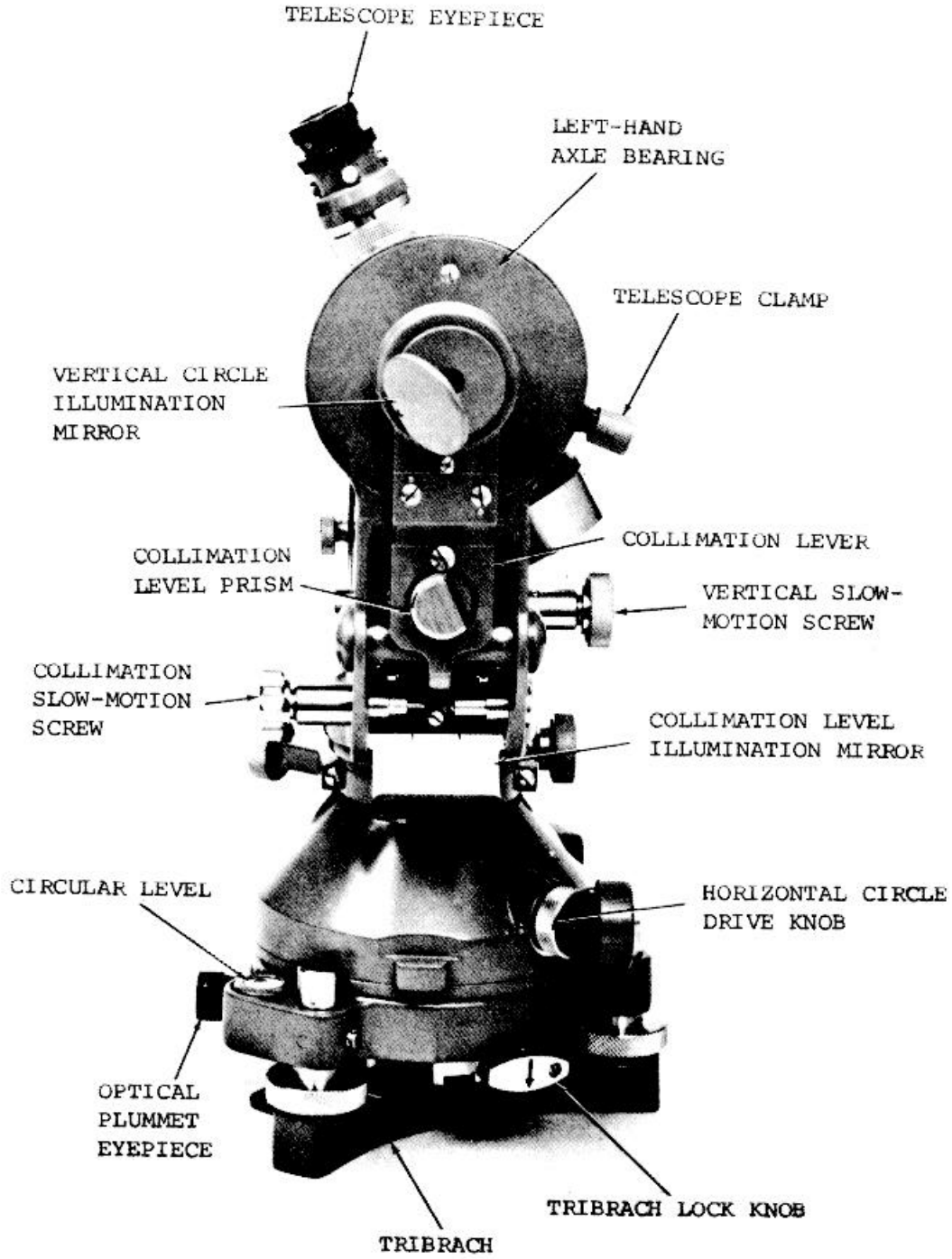
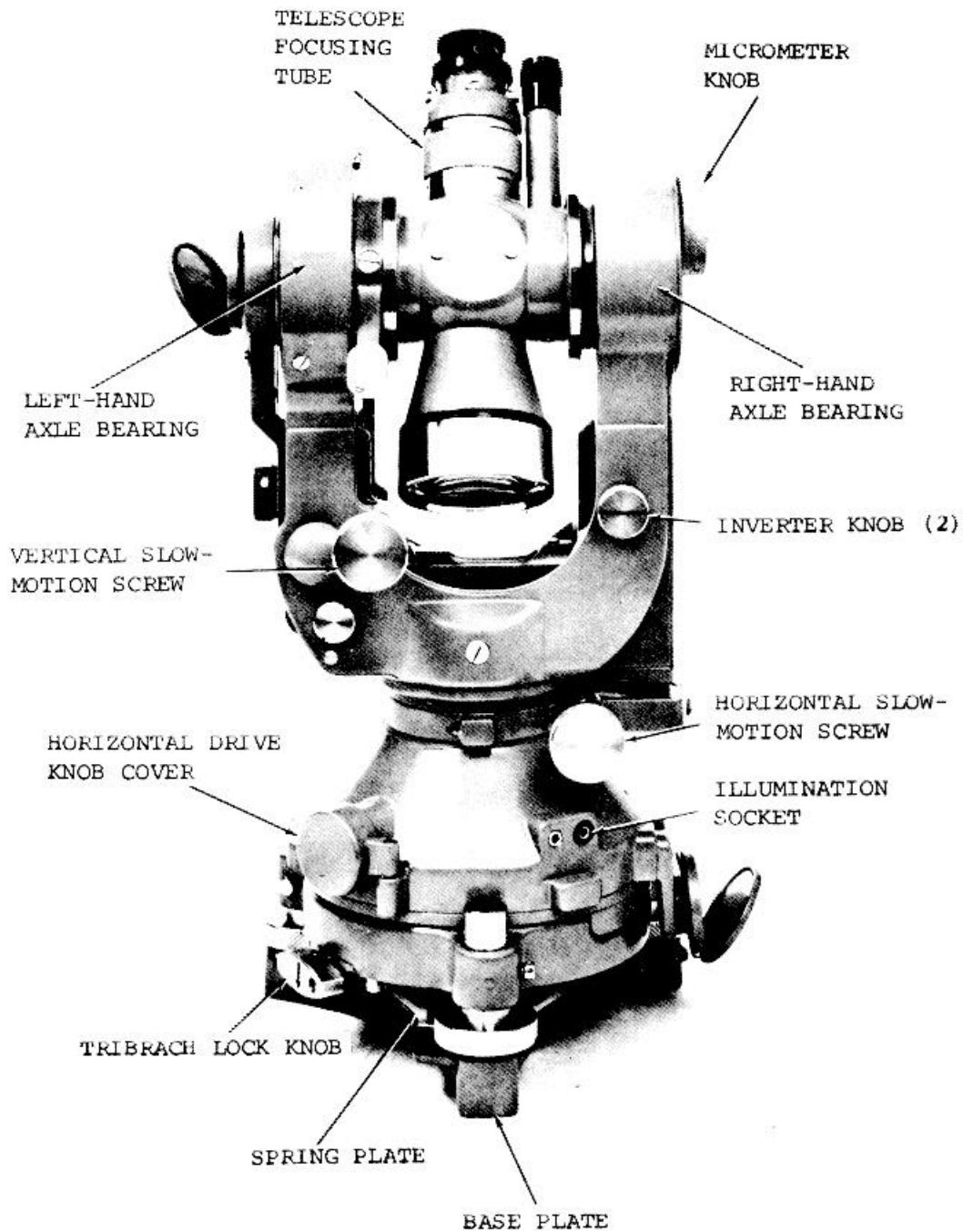


Figure 1-1. Theodolite, front view.



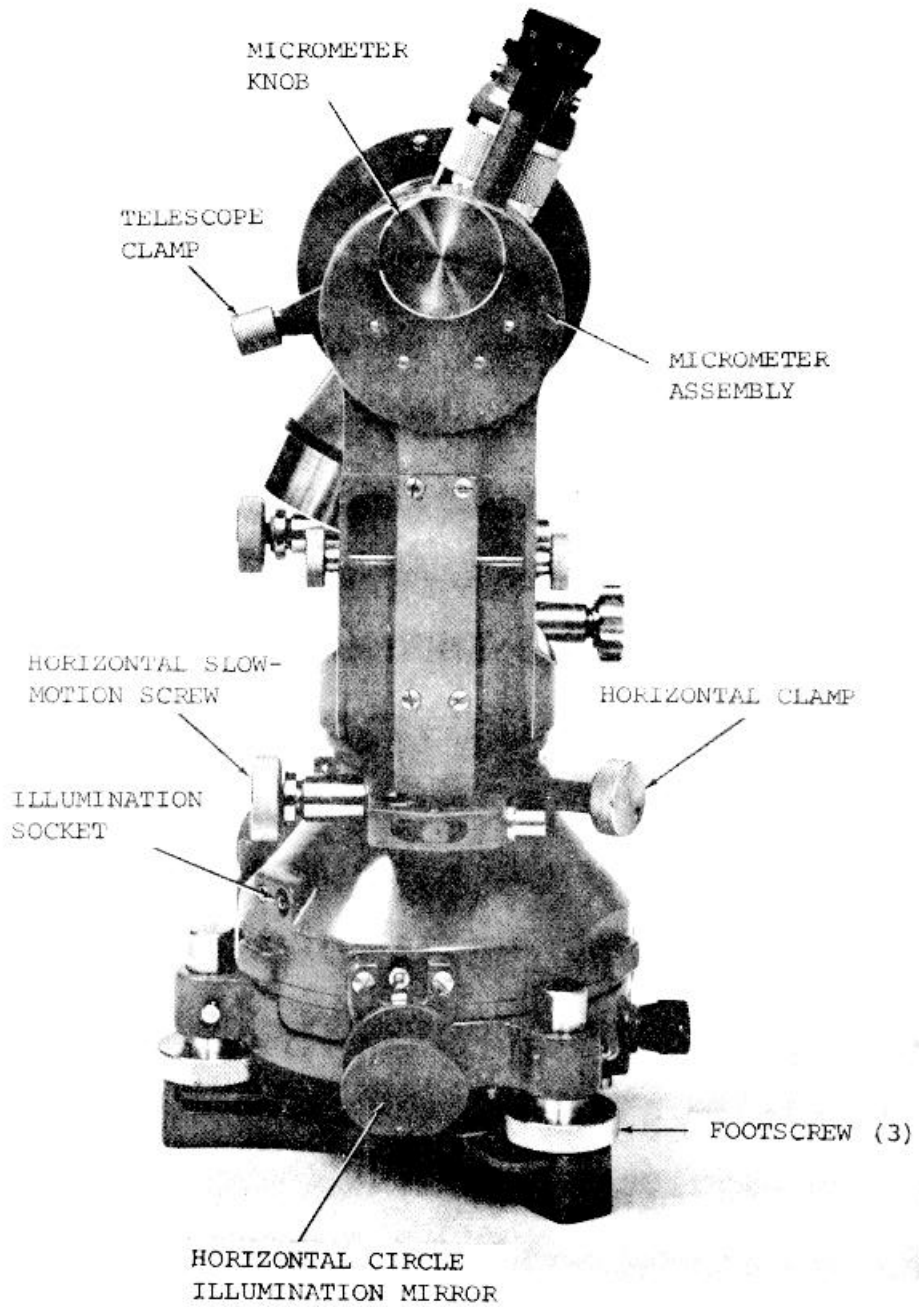
TS008777

Figure 1-2. Theodolite, left side view



TS006776

Figure 1-3. Theodolite, rearview.



TS006779

Figure 1-4. Theodolite, right side view.

1-8. Difference in Models

This manual covers only the Wild Heerbrugg Model T2-74DEG Theodolite. No known unit differences exist for the model covered by this manual.

1-9. Identification and Tabulated Data

a. Identification. The theodolite and carrying case have the following identification markings:

(1) Theodolite. The manufacturer's name, model, and serial number are engraved on the U-standard.

(2) Carrying case hood. The manufacturer's model and serial number are stenciled on the carrying case hood.

b. Tabulated Data.

(1) General.

Manufacturer	Wild Heerbrugg Ltd. Heerbrugg, Switzerland
Model	T2-74DEG
Telescope	28X (power)
Telescope length	5.9 in. (14,986 centimeters)
Shortest focusing distance	4.5 ft (1.3716 meters)
Longest aiming distance at	1,000 ft (304.8 meters)
which degree can be read	
Longest aiming distance at	465 ft (141.732 meters)
which second can be evaluated	
Normal range.....	6 to 12 miles (9.6558 to 19.3116 kilometers)

Diameter of field	29 ft at 1,000 ft (8.8392 m at 304.8 meters)
Accuracy of circle readings	1 second
Multiplication constant	100
Addition constant	0
Glass circles	360 degrees
Sensitivity of plate level	20 seconds per 2 mm (millimeter)
Sensitivity of collimation level	30 seconds per 2 mm (millimeter)
Graduation interval of	10 minutes
horizontal circle	
Graduation interval of	10 minutes
vertical circle	
Magnification of microscope.....	30 diameters, plus or minus 2 diameters
Lamp.....	2/2 v (volt), 3 amp (amperes), miniature screwbase
Battery.....	BA 30

(2) Dimensions and weights.

Tripod	
extended	63 in.(160.02 centimeters)
folded	38.5in.(97.79 centimeters)
weight	14.4 lb. (Pound (s))
Theodolite	12.3 lb.
Shipping case w/theodolite	35 lb.
Carrying case	4.8 lb.
Shipping crate w/tripod	82 lb.
battery box, accessory case, and field pack	

CHAPTER 2

OPERATING INSTRUCTIONS

CAUTION

If equipment fails to operate, refer to troubleshooting procedures in Chapter 3.

Section I. SERVICE UPON RECEIPT OF EQUIPMENT**2-1. Inspecting and Servicing The Equipment**

a. *General.* Perform the daily preventive maintenance services (para 3-5).

b. *Carrying Case.*

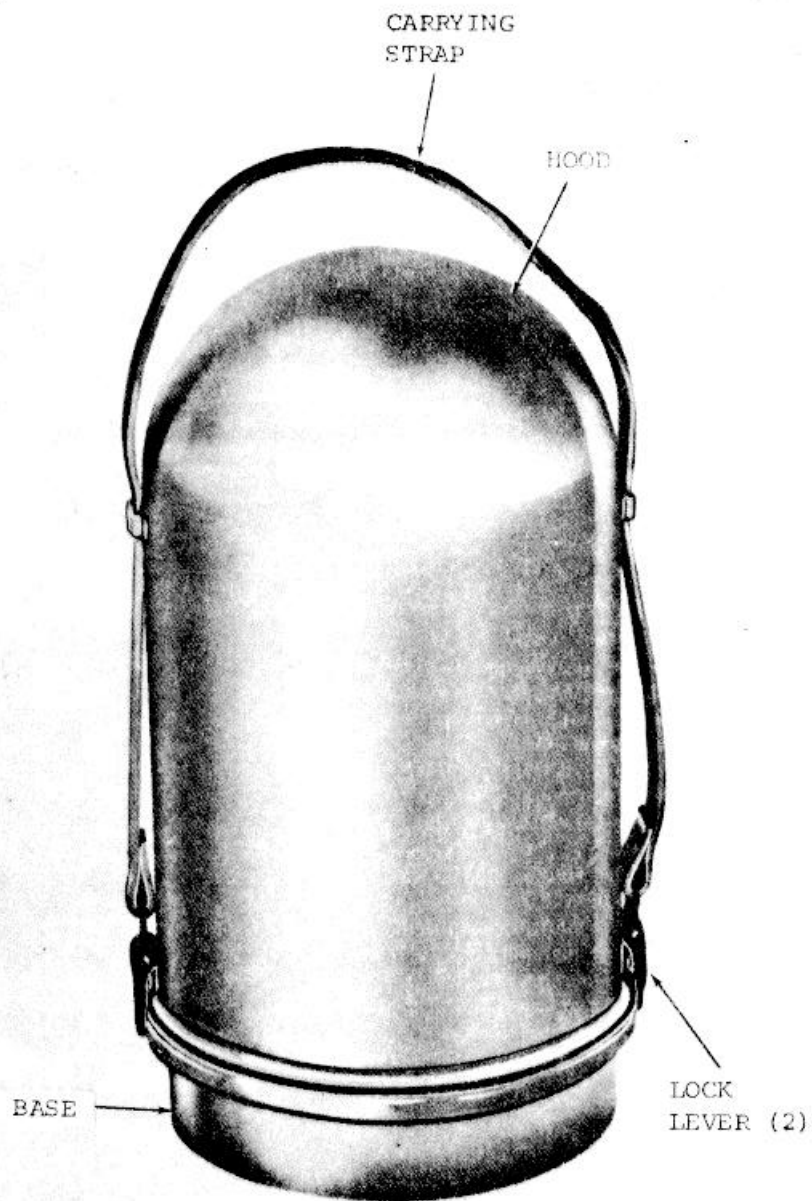
(1) Inspect the carrying case hood and base (fig. 2-1) for dents, cracks, and rust. Inspect clamps and carrying strap for defects.

(2) Inspect the gasket in the carrying case base (fig. 2-2).

(3) Inspect the carrying case desiccant for discoloration.

NOTE

Desiccant should be blue in color. Pink desiccant indicates moisture saturation and must be dehydrated or replaced.

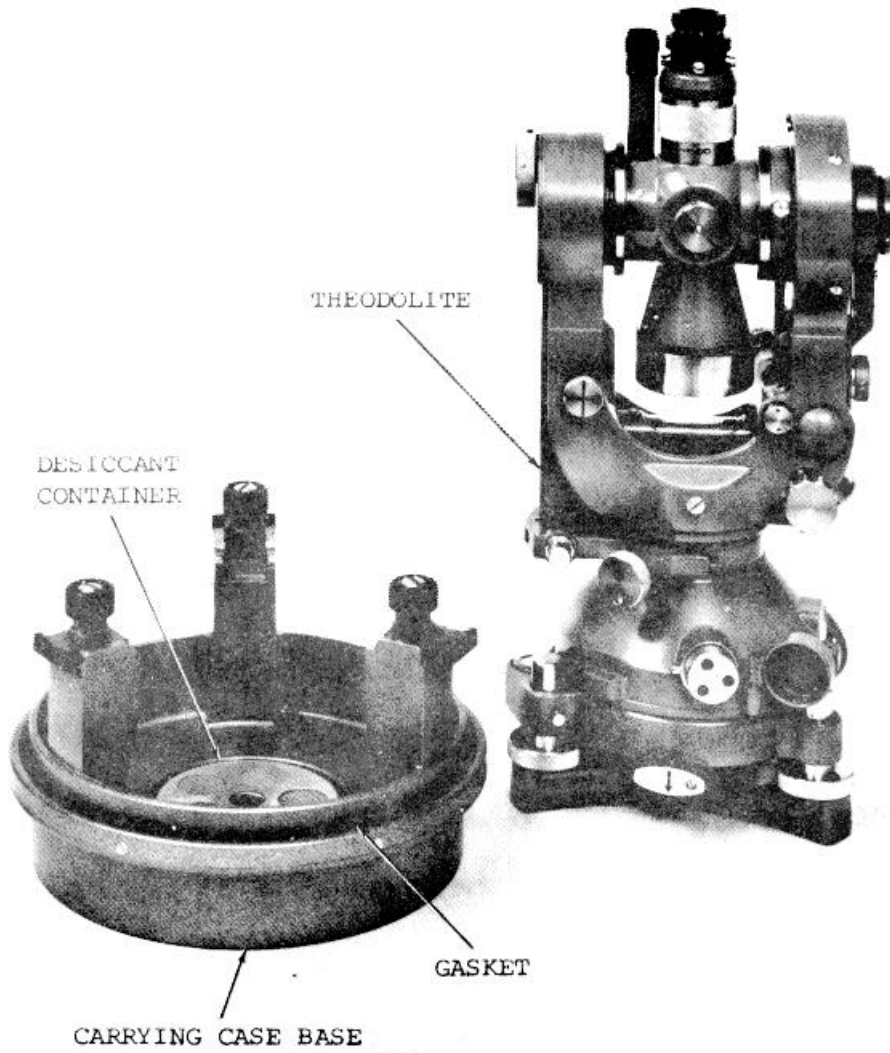


STEP 1. GRASP CARRYING STRAP JUST ABOVE
LOCK LEVERS AND PULL OUTWARD
TO RELEASE CLAMPS.

STEP 2. LIFT THE HOOD FROM THE BASE.

TS008780

Figure 2-1. Theodolite carrying case, removal and installation.



TS008781

Figure 2-2. Carrying case base.

c. Theodolite.

(1) Visually inspect the theodolite for broken or missing parts, cracked or scratched lens and mirrors, loose or missing hardware, and other indications of damage.

(2) Rotate the three leveling footscrews (fig. 1-1) and inspect for rough travel and instability.

(3) Inspect the telescope and horizontal clamps (fig. 1-4) for improper operation.

(4) Inspect the horizontal slow-motion screw, vertical slow-motion screw (fig. -3), and collimation slow-motion screw (fig.1-2) for improper operation.

(5) Inspect the reticle illumination knob (fig.

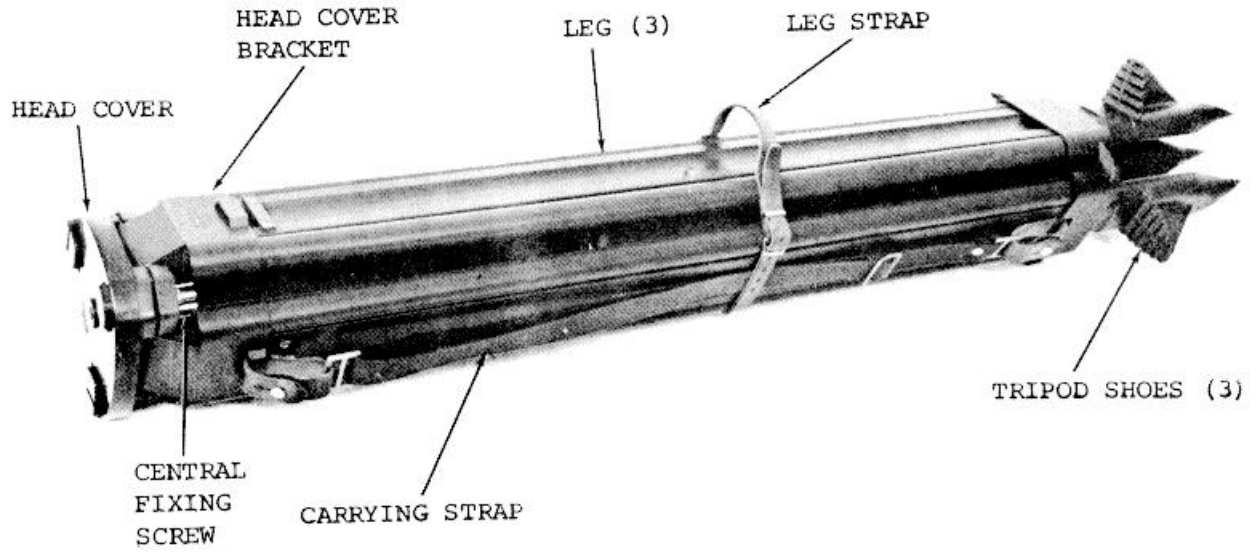
1-1), micrometer knob, and inverter knobs for smooth operation throughout their full travel.

(6) Inspect the telescope focusing tube (fig. 1-3), telescope eyepiece (fig. 1-1), and microscope eyepiece for smooth operation throughout their full travel.

d. Tripod Assembly.

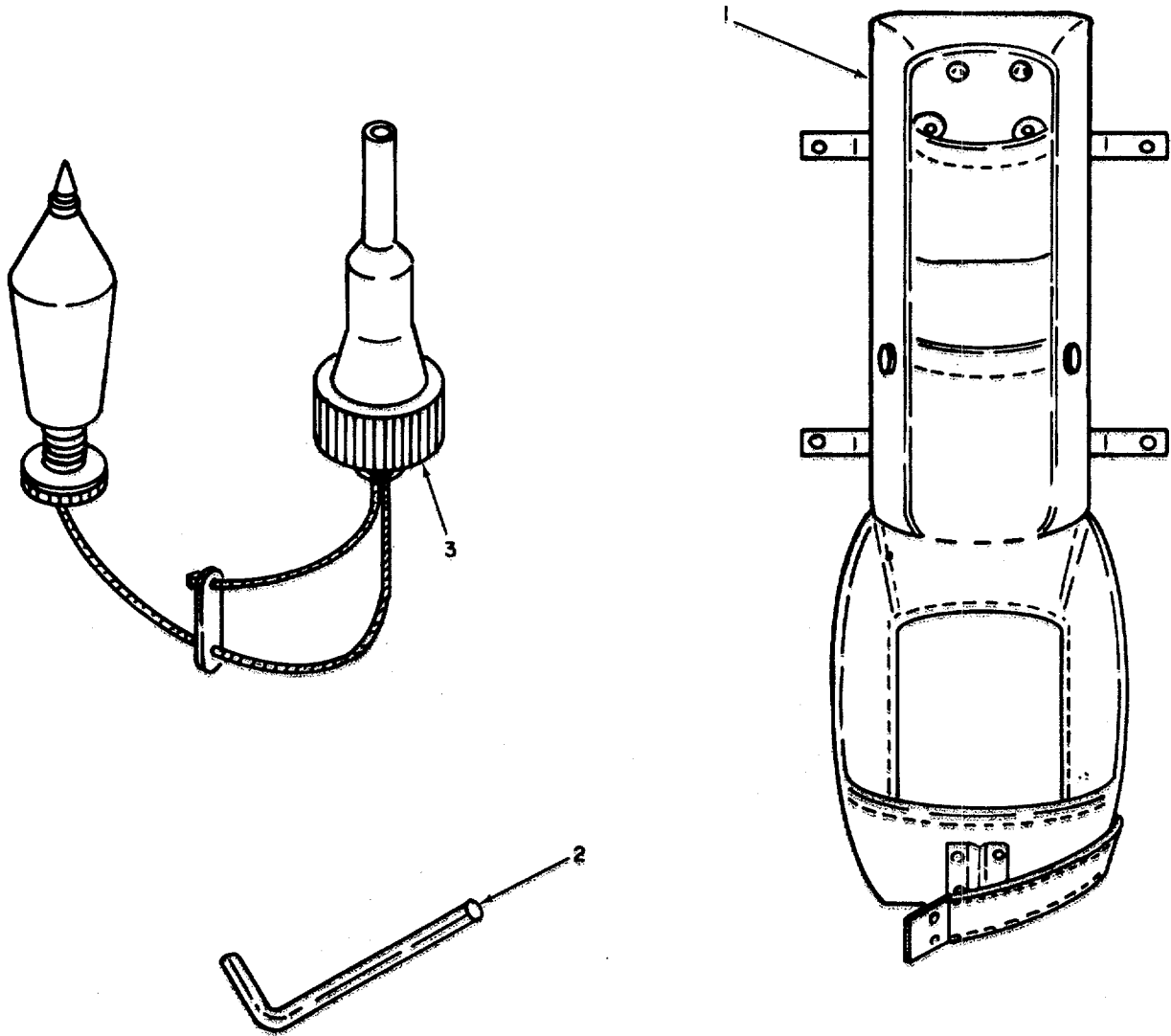
(1) Refer to figure 2-3 and inspect the tripod assembly for damaged or missing parts and loose or missing hardware.

(2) Refer to figure 2-4 and inspect the tripod accessory case for damage. See that the plumb bob assembly and tripod wrench are contained in the case and are in serviceable condition.



TS008782

Figure 2-3. Tripod assembly.



TS008783

Figure 2-4. Tripod accessory case, unpacked view.

KEY to fig. 2-4:

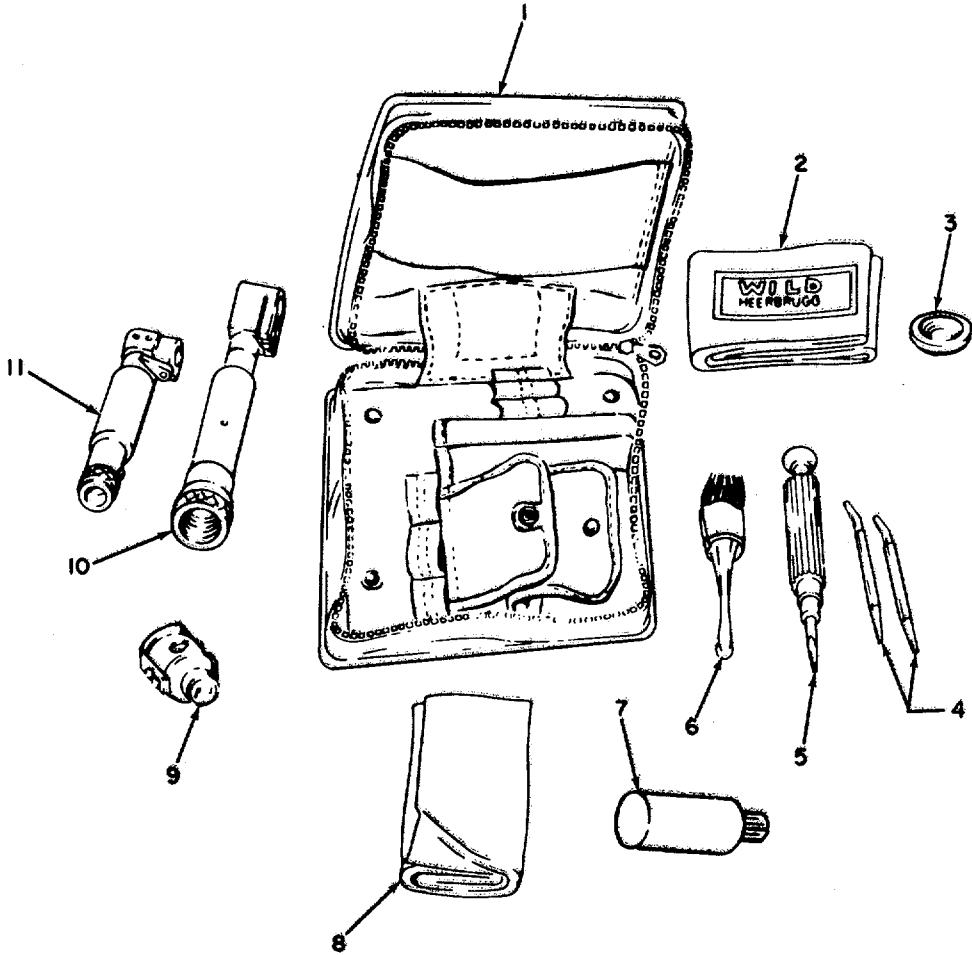
1. Tripod accessory case
2. Tripod wrench
3. Plumb bob

e. Accessory Case.

(1) Inspect the accessory case for damage and defective zipper and snaps. Make certain that the case contains the components shown by figure 2-5.

(2) Inspect the telescope and microscope diagonal eyepieces and the telescope sunglass filter for scratches, cracks, and defective mounting.

(3) Inspect the lamp fittings for broken glass and corroded or defective contacts.



TS000784

Figure 2-5. Accessory case, unpacked view.
2-8

KEY to fig. 2-5:

1. Accessory case
2. Instrument cover
3. Black sunglass
4. Adjusting pin (2)
5. Screwdriver
6. Brush
7. Grease container
8. Chamois
9. Lamp fitting (2)
10. Telescope diagonal eyepiece
11. Microscope diagonal eyepiece

f. Battery Box.

(1) Inspect the battery box (fig. 2-6) for damage, rust, and defective clamps and carrying

handle. Make certain the box contains all the components shown in figure 2-6.

(2) Turn the rheostat knob through its full travel. The movement should be smooth and free of binding.

(3) Inspect all electrical contacts for loose connections and corrosion.

(4) Inspect the handlamp for broken casing, defective switch, insecure or damaged plug, and frayed insulation.

(5) Inspect the connecting cable for insecure or damaged plugs and frayed or cracked insulation.

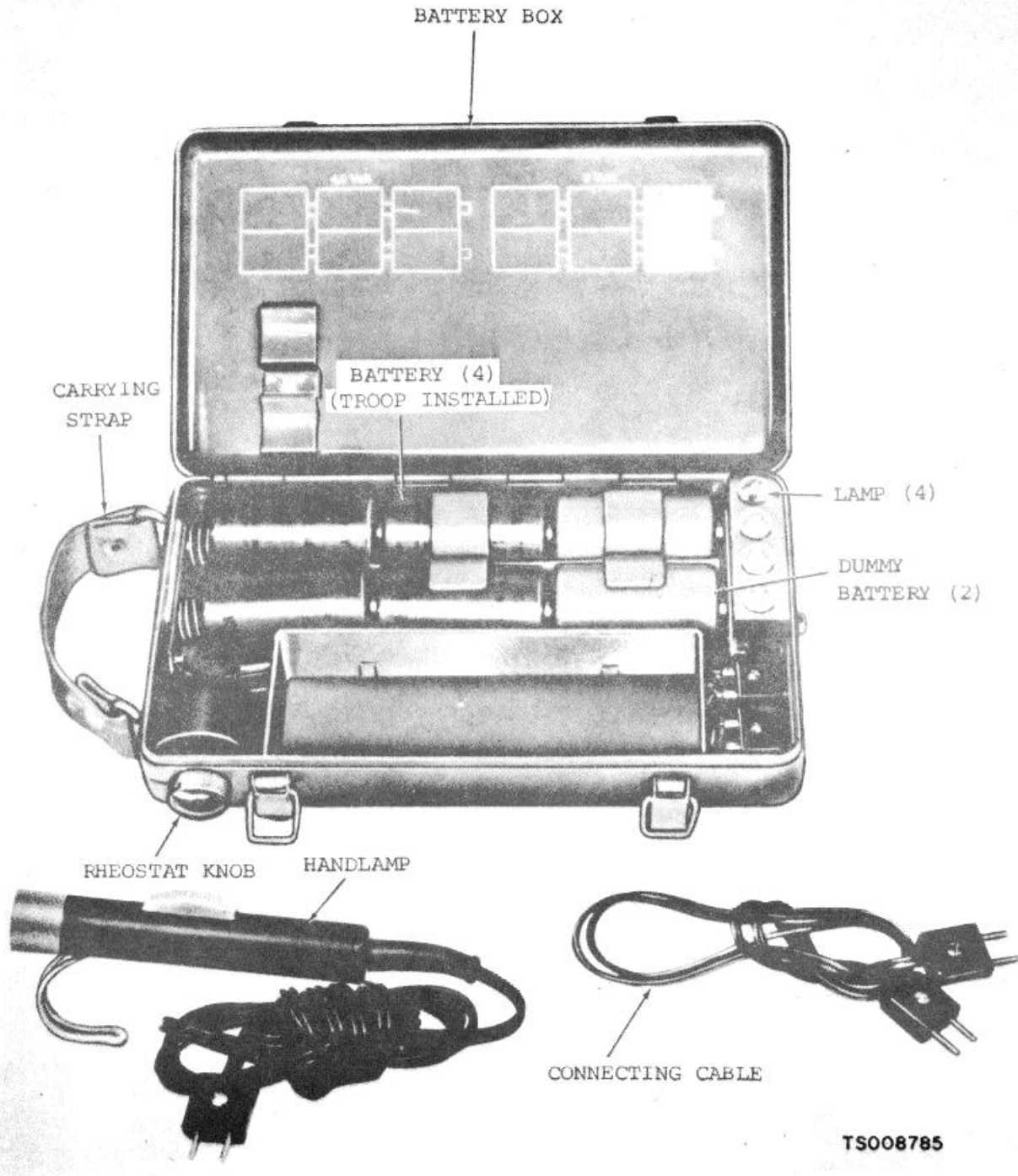


Figure 2-6. Battery box, unpacked view.

g. Haversack. Inspect the haversack (fig. 2-7) for damaged straps, insecure or defective buckles, torn padding, and tears or cuts.

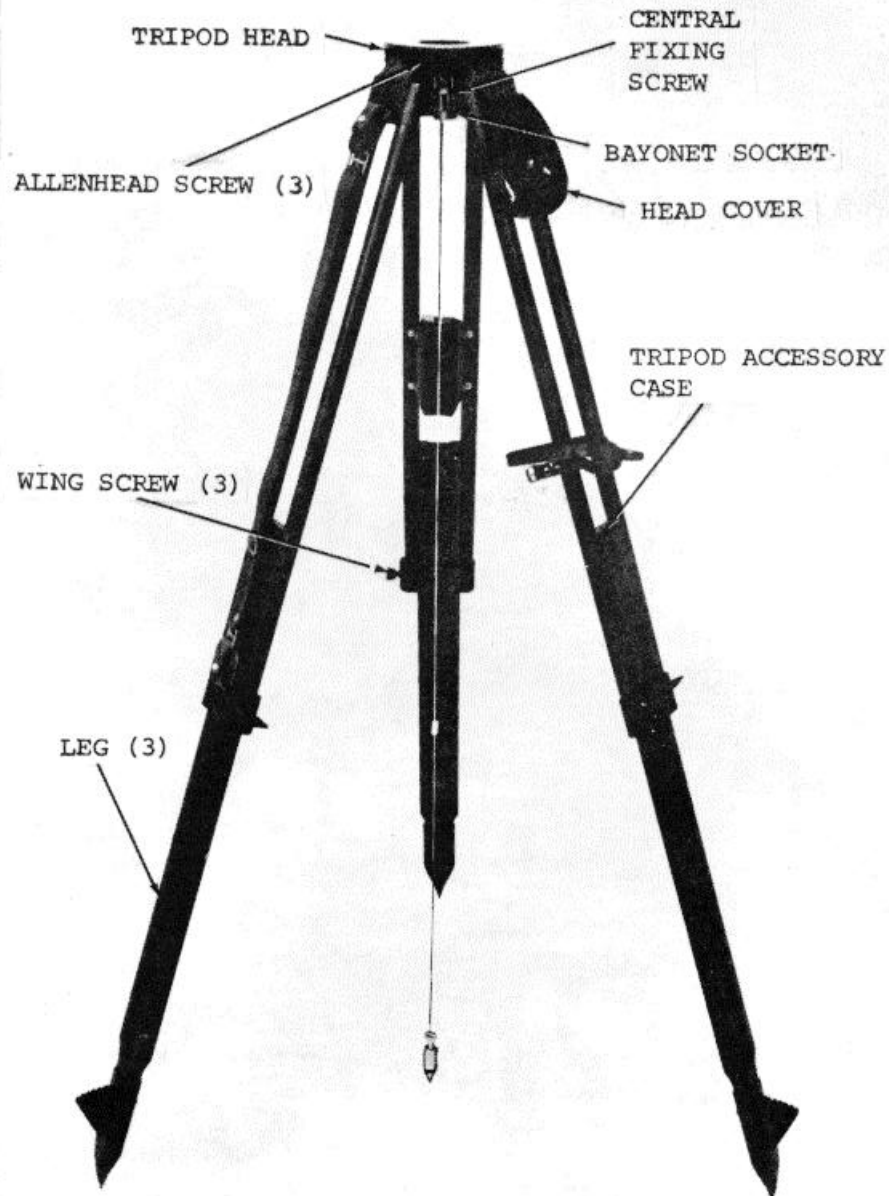


TS008786

Figure 2-7. Haversack. 2-11
2-11

2-2. Installation

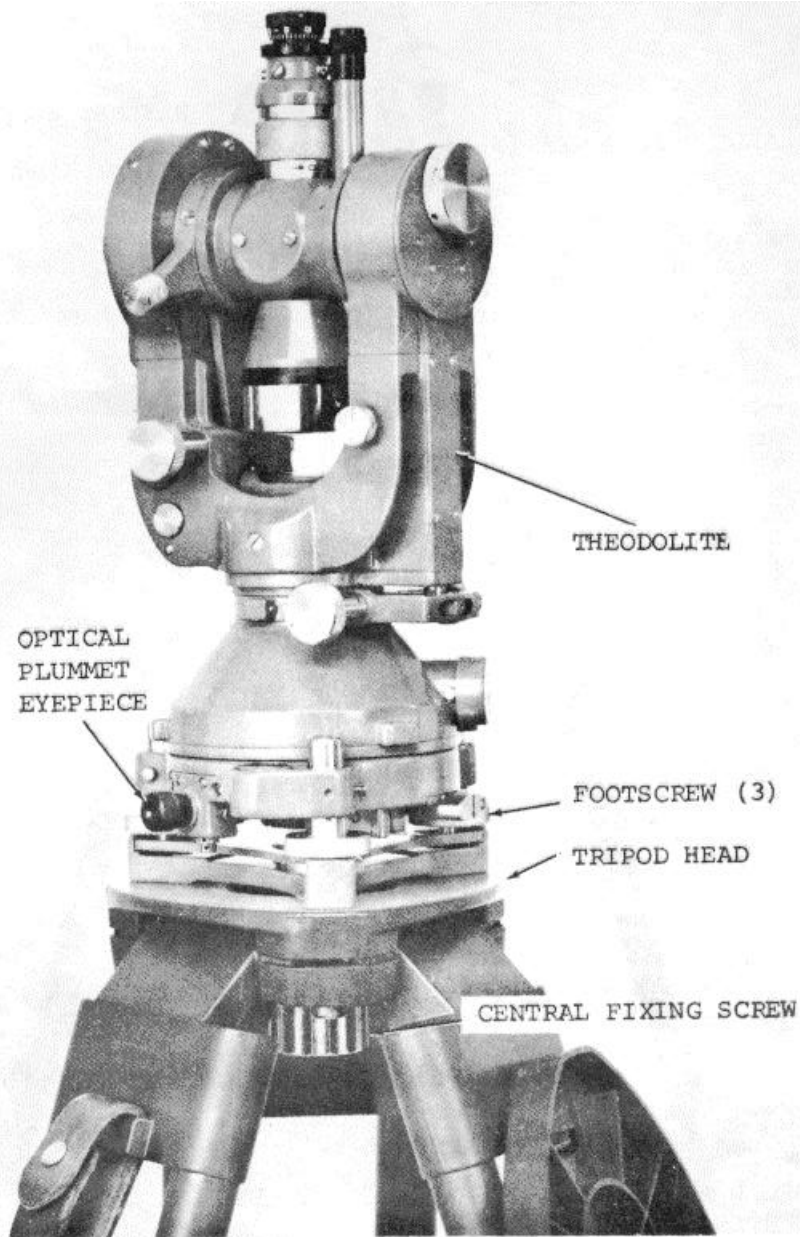
- a. *Tripod.* Refer to figure 2-8 and set up the tripod.
- b. *Theodolite.*
 - (1) Refer to figure 2-10 and remove theodolite carrying case from shipping case.
 - (2) Refer to figure 2-1 and remove carrying case hood from base.
 - (3) Refer to figure 2-11 and remove the theodolite from the carrying case.
 - (4) Refer to figure 2-9 and install the theodolite on the tripod.



- STEP 1. UNFOLD AND EXTEND LEGS TO DESIRED LENGTH. TIGHTEN THREE WING SCREWS.
- STEP 2. TIGHTEN ALLENHEAD SCREWS.
- STEP 3. REMOVE HEAD COVER. STOW ON LEGHOLDER.
- STEP 4. REMOVE PLUMB BOB FROM TRIPOD ACCESSORY CASE. INSERT BAYONET SOCKET INTO CENTRAL FIXING SCREW. SECURE BY TURNING CLOCKWISE 1/4 TURN.
- STEP 5. POSITION TRIPOD SO THAT PLUMB BOB IS 1/2-INCH FROM STATION POINT.
- STEP 6. SET LEGS FIRMLY IN GROUND WITH FOOT PRESSURE.

TS008787

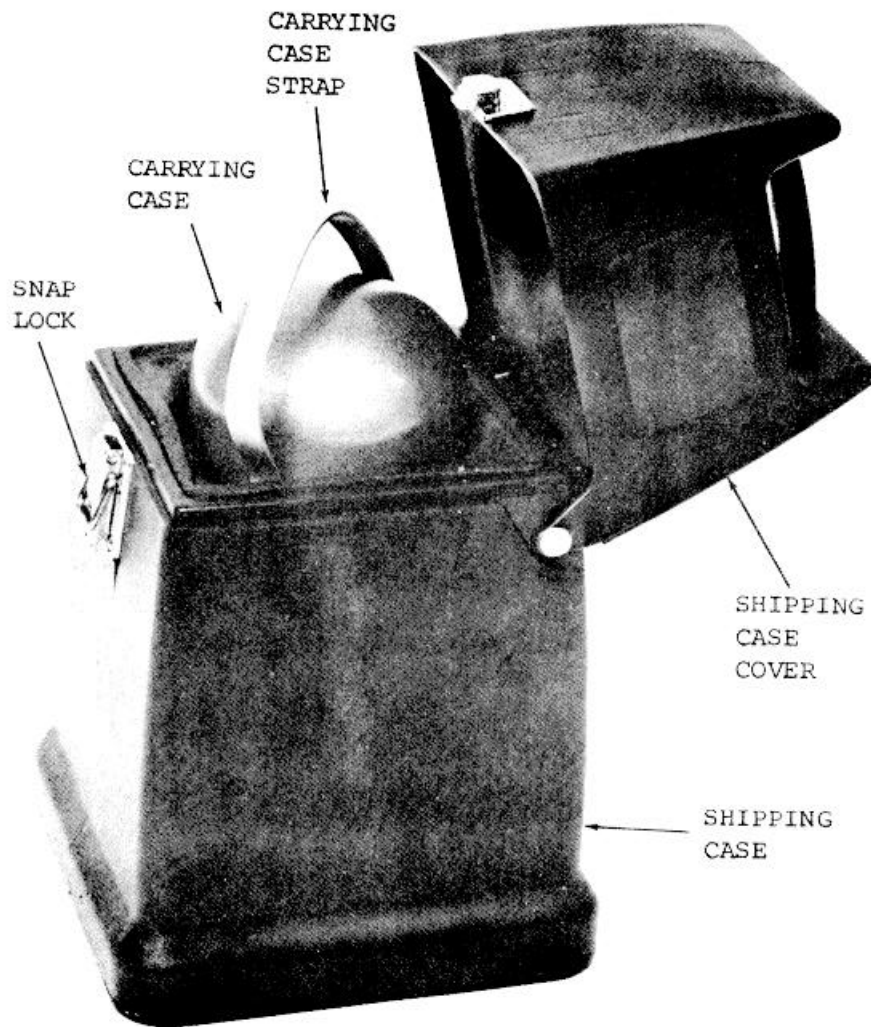
Figure 2-8. Tripod and plumb bob, removal and installation.



- STEP 1. POSITION THEODOLITE ON TRIPOD HEAD AND SECURE LOOSELY WITH CENTRAL FIXING SCREW.
- STEP 2. CENTER CIRCULAR LEVEL BUBBLE USING FOOTSCREWS.
- STEP 3. SIGHT THROUGH OPTICAL PLUMMET EYEPIECE AND ADJUST EYEPIECE UNTIL THE CIRCULAR MARKS ARE CLEARLY VISIBLE.
- STEP 4. CAREFULLY MOVE THEODOLITE ON TRIPOD HEAD UNTIL THE STATION POINT IS CENTERED ON THE EYEPIECE CIRCULAR MARKS.
- STEP 5. TIGHTEN CENTRAL FIXING SCREW.

TS008788

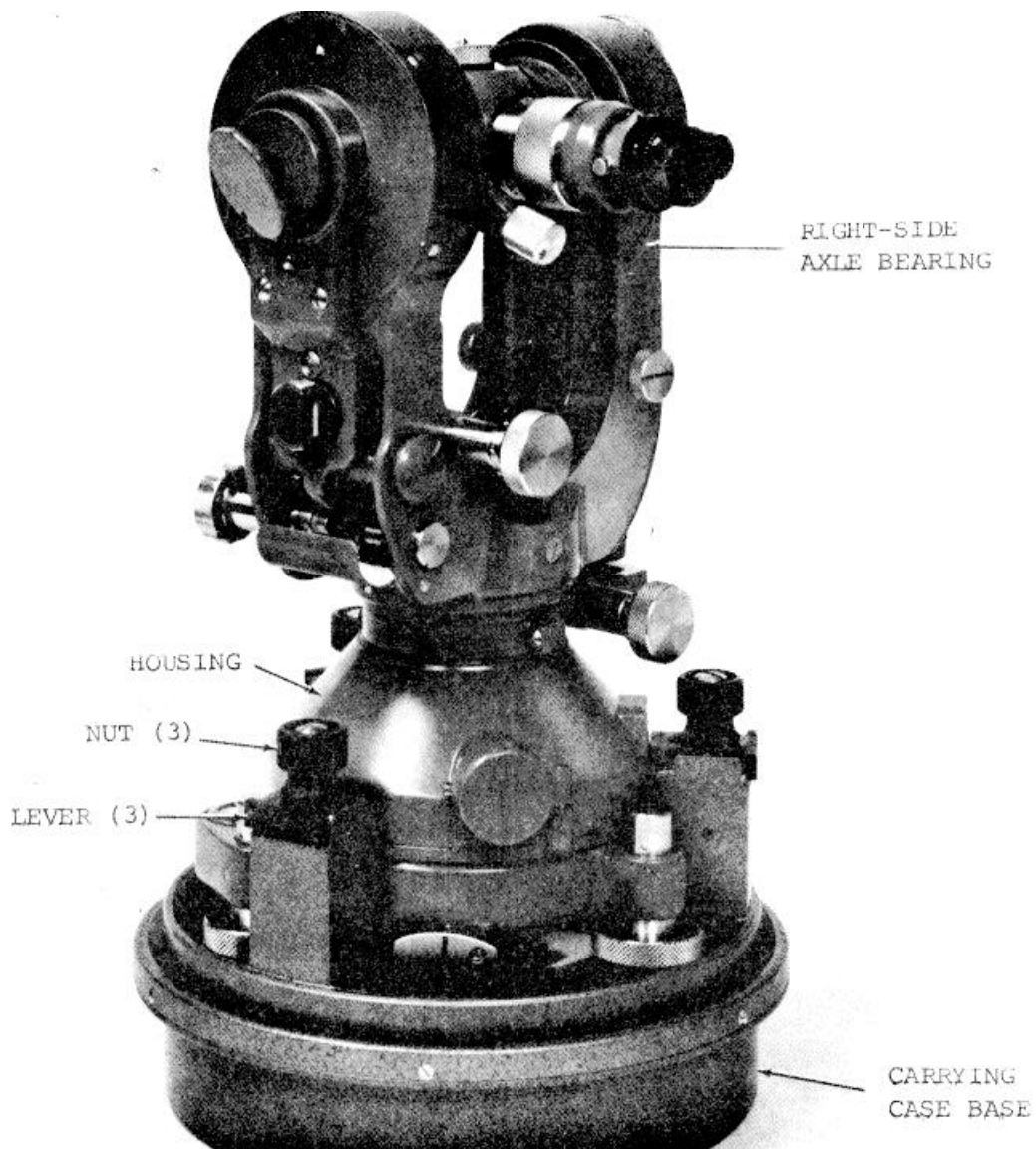
Figure 2-9. Theodolite, removal and installation.



NOTE: GRASP CARRYING CASE STRAP WITH BOTH HANDS AND REMOVE THEODOLITE IN ITS CARRYING CASE, FROM THE SHIPPING CASE.

TSOO8789

Figure 2-10. Theodolite carrying case, removal and installation.



- STEP 1. LOOSEN THE THREE NUTS AND PULL LEVERS AWAY FROM CARRYING CASE BASE.
- STEP 2. GRASP THE RIGHT SIDE AXLE BEARING WITH ONE HAND AND PLACE THE OTHER HAND BELOW THE HOUSING. LIFT THE THEODOLITE FROM THE CARRYING CASE BASE.
- STEP 3. PLACE THE THEODOLITE ON A FIRM, LEVEL SURFACE.

Figure 2-11. Theodolite carrying case base, removal and installation.

2-3. Equipment Conversion

a. General. During night or dark-day operation, the reading circles are illuminated by installing the illumination system, which is contained in the battery box and the accessory case. For high-angle and celestial observations, the diagonal eyepieces and black sunglass contained in the accessory case are installed on the telescope and microscope eyepieces.

b. Night or Dark-Day Operations. Refer to figure 2-12 and install the illumination system.

c. High Angle Observations.

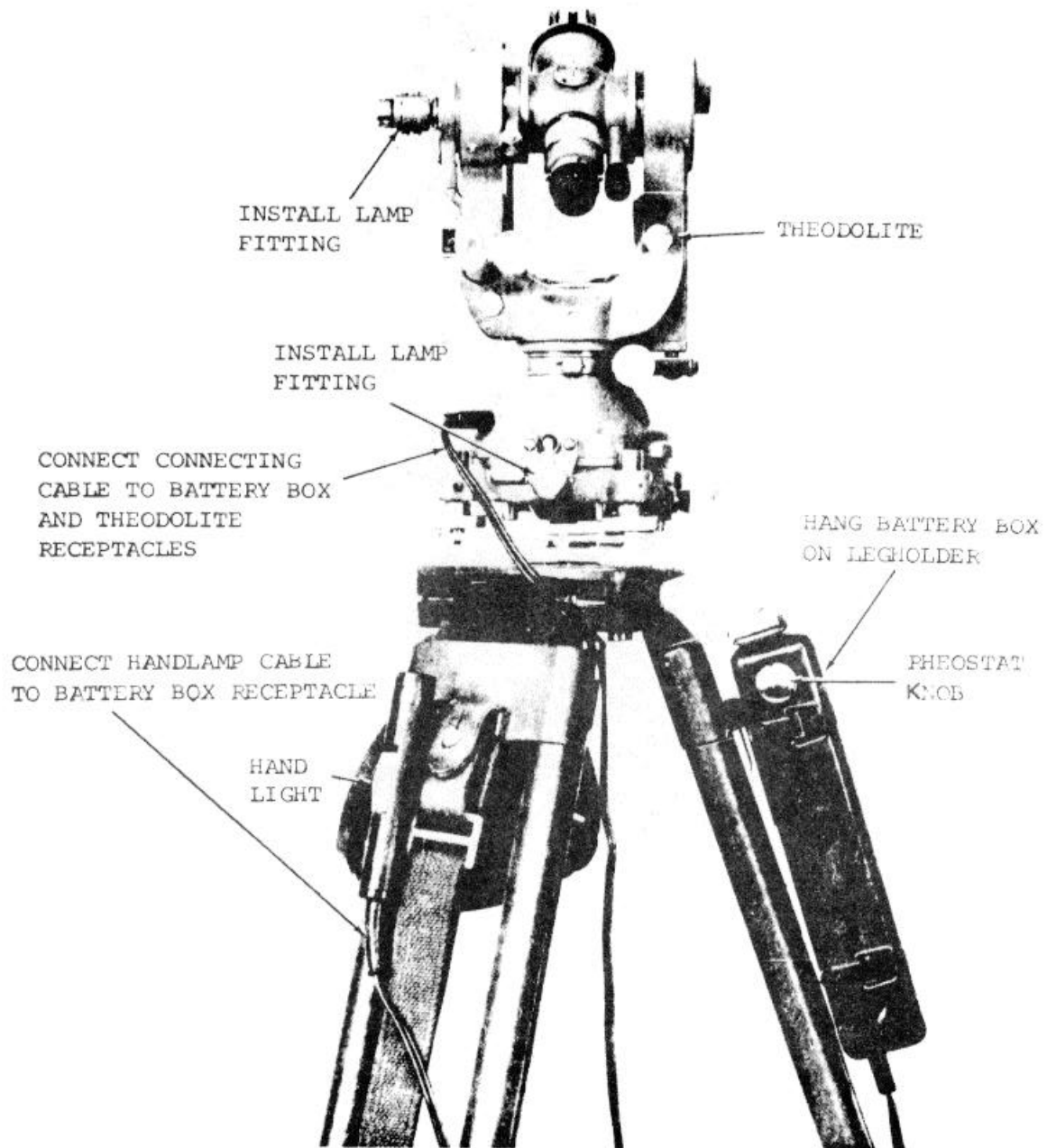
(1) Remove the telescope and microscope eyepieces (para 4-24).

(2) Remove the telescope and microscope eyepieces from the accessory case (fig. 2-5).

(3) Refer to figure 2-13 and install the diagonal eyepieces.

WARNING

Severe eye damage can result from performing observations against direct sunlight without utilizing the black sunglass (para 4-25).



NOTE: IF THE CONNECTING CABLE FROM THE BATTERY BOX TO THE THEODOLITE IS CONNECTED TO THE RECEPTACLE NEAREST THE CORNER OF THE BATTERY BOX, THE BRILLIANCE OF ILLUMINATION WITHIN THE THEODOLITE CAN BE CONTROLLED BY TURNING THE RHEOSTAT KNOB ON THE BATTERY BOX.

TS008791

Figure 2-12. Illumination system, removal and installation.

Change 1 2-18

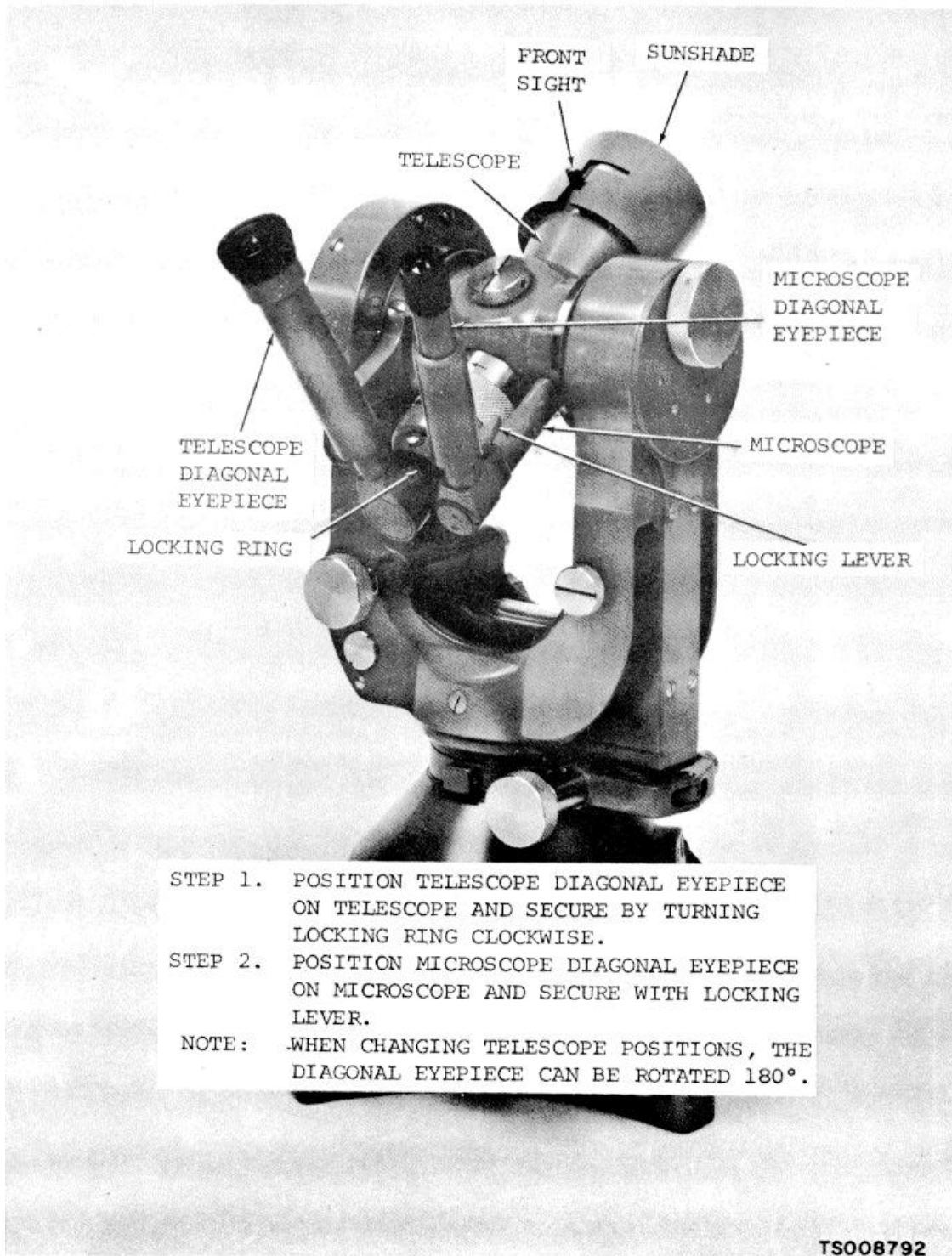


Figure 2-13. Theodolite diagonal eyepieces, removal and installation.

Section II. MOVEMENT TO A NEW WORKSITE

2-4. Dismantling for Movement

a. Short distances. For short distances in cleared, level areas, the operator may carry the instrument mounted on the tripod. If the instrument is carried while mounted on the tripod, the operator should not carry it in any position other than upright.

CAUTION

Exercise care when moving the theodolite mounted on tripod. Handle the instrument carefully. Never subject it to bumps, jars, or shocks. Never leave the instrument unattended for long periods of time unless it is returned to the carrying case. Never carry the instrument over the shoulder.

b. Long Distances.

(1) When the theodolite must be moved for long distances or over rough terrain, the instrument should be transported in the carrying case (fig. 2-1).

(2) Handle the carrying case carefully to avoid sudden jolts, continued vibration, or other shocks that might damage the delicate parts of the instrument.

(3) Do not drop the carrying case into a vehicle or on the ground during transportation.

NOTE

If the carrying case is accidentally dropped, the instrument should be thoroughly inspected for damage.

(4) If the theodolite is to be carried long distances by manpower, the haversack (fig. 2-7) should be utilized.

2-5. Reinstallation after Movement

Refer to paragraph 2-2 for reinstallation after movement.

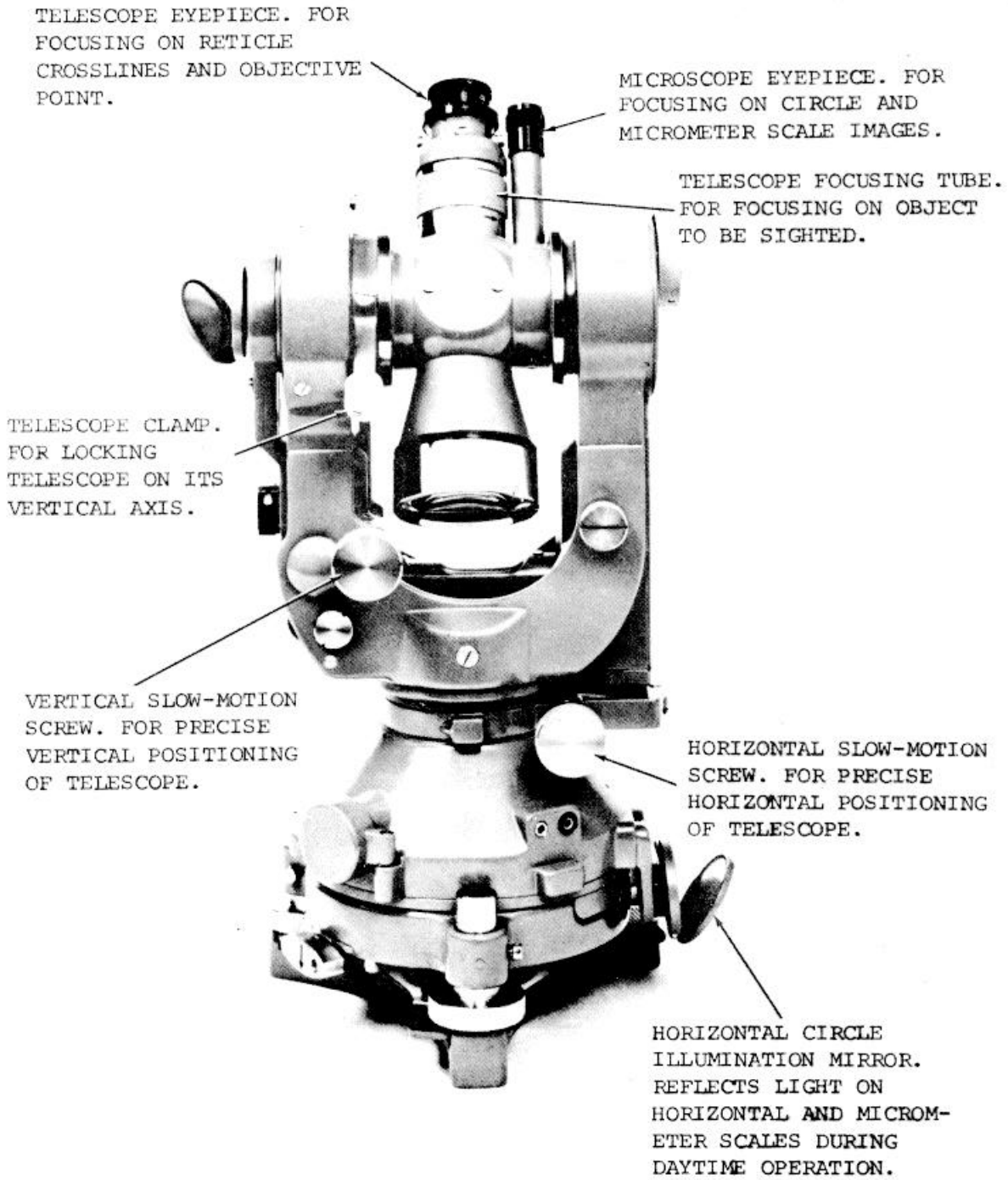
Section III. CONTROL AND INSTRUMENTS

2-6. General

This section describes the various controls and instruments and provides the operator/crew sufficient information to insure proper operation of the theodolite.

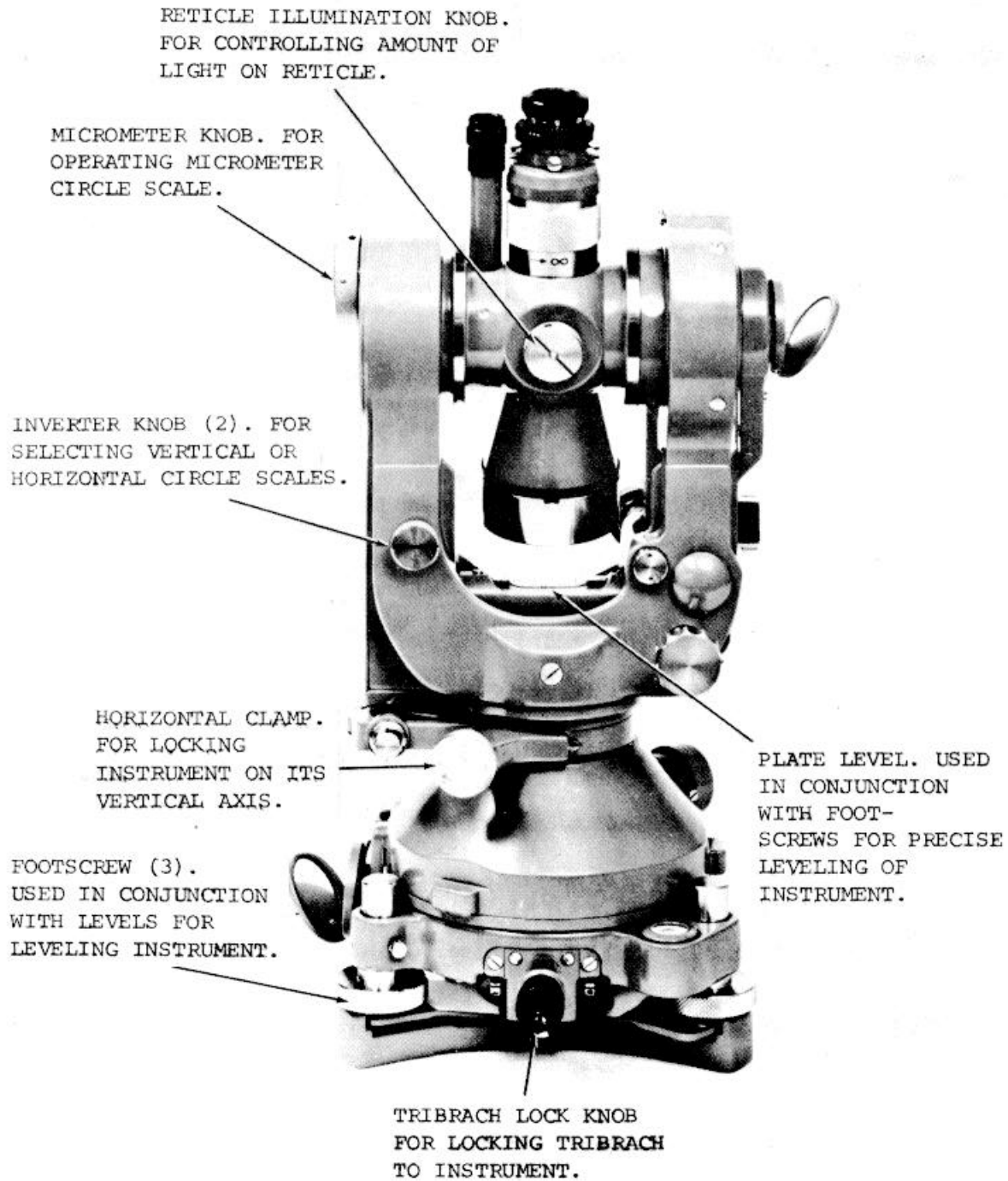
2-7. Controls and Instruments

The purpose of controls and instruments with an example reading are provided in figure 2-14, sheets 1 through 4.



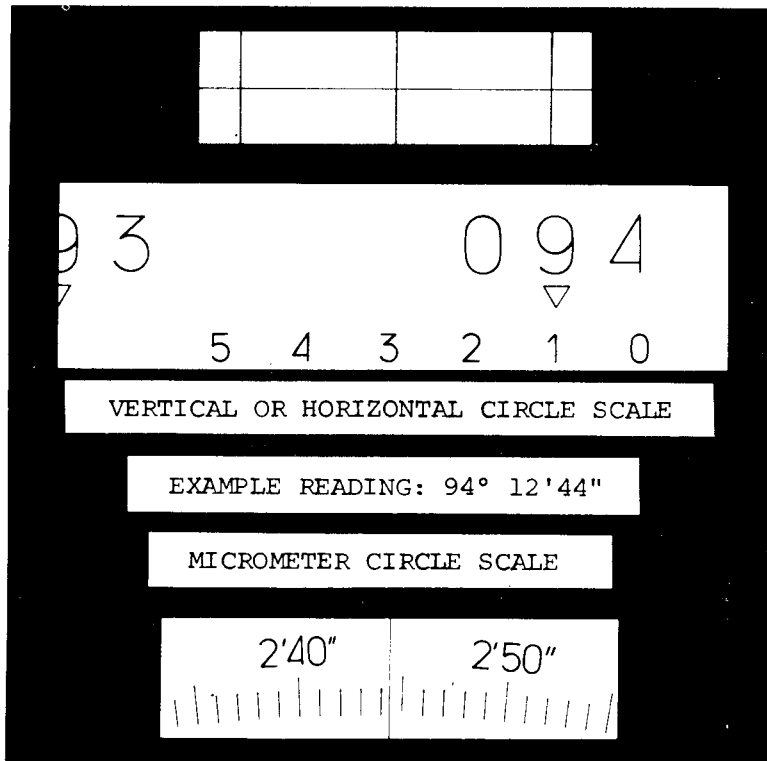
TS008793

Figure 2-14. Controls and instruments (Sheet 1 of 4).



TS008794

Figure 2-14. Controls and instruments (Sheet 2 of 4).



TS008796

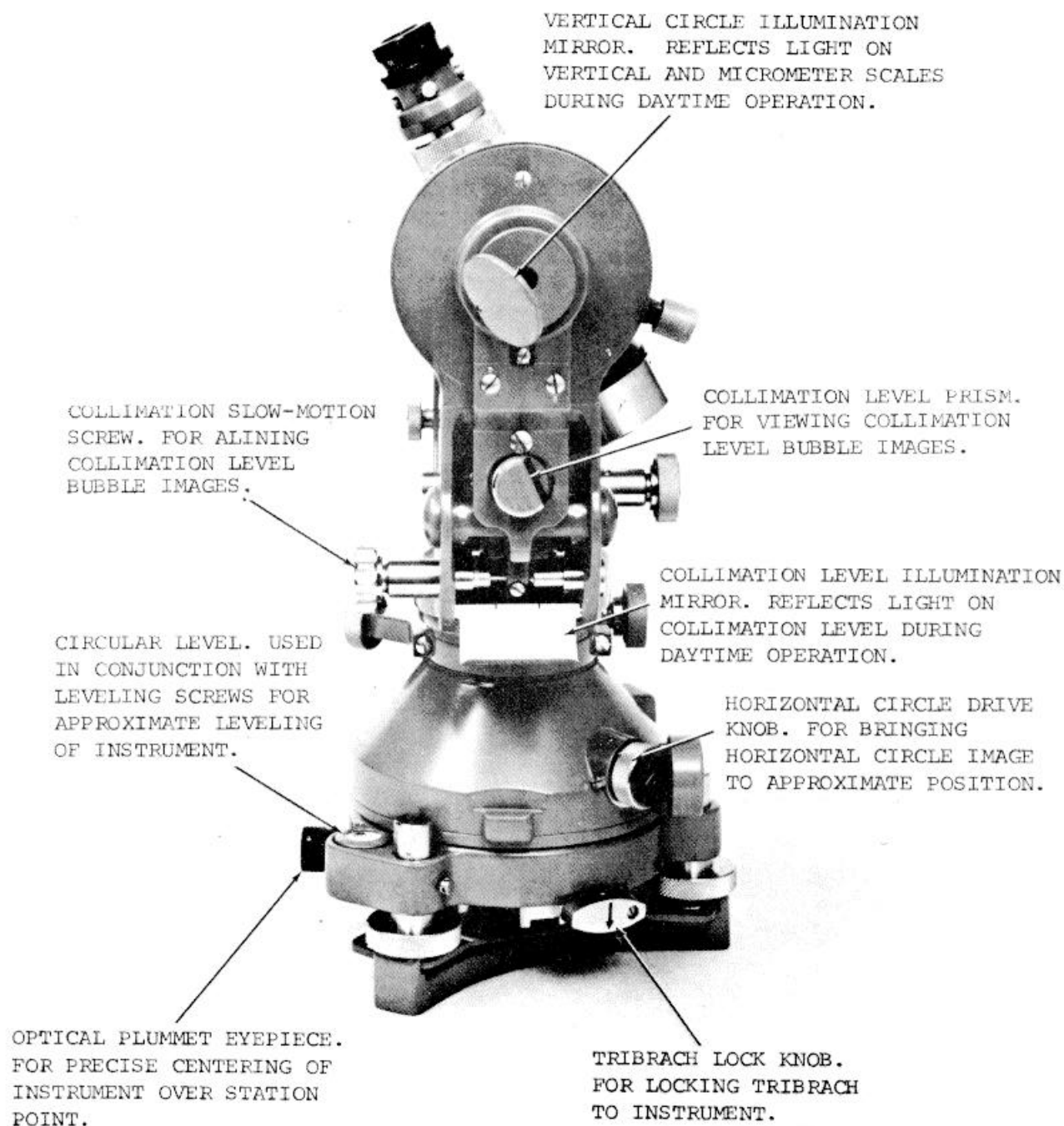
VERTICAL OR HORIZONTAL CIRCLE SCALE

- 1 CALIBRATED IN THREE-DIGIT INTERVALS TOTALING 360 DEGREES.
- 2 DISTANCE BETWEEN SINGLE-DIGIT INTERVALS REPRESENTS TEN MINUTES
- 3 USED TO MEASURE ANGLES IN DEGREES TO NEAREST 10 MINUTES

MICROMETER CIRCLE SCALE

- 1 CALIBRATED IN NUMBERED AND UNNUMBERED LINES FROM 0'0" to 9'59".
- 2 DISTANCE BETWEEN NUMBERED LINES REPRESENTS 10 SECONDS. DISTANCE BETWEEN UNNUMBERED LINES REPRESENTS ONE SECOND.
- 3 USED TO MEASURE MINUTES AND SECONDS ON BOTH VERTICAL AND HORIZONTAL SCALES.

Figure 2-14. Controls and instruments (Sheet 3 of 4).



TS008795

Figure 2-14. Controls and instruments (Sheet 4 of 4).

Section IV. OPERATION UNDER USUAL CONDITIONS

2-8. General

a. The instructions in this section are published for the information and guidance of personnel responsible for operation of the theodolite.

b. The operator must know how to PERFORM every operation of which the theodolite is capable. This section gives instructions on handling and preparation for operation of the theodolite, basic motions, adjustments, and on coordinating the basic motions to perform the specific tasks for which the equipment is designed. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual job.

2-9. Preparation for Operation

a. General. This paragraph describes all preventive maintenance checks and services and all instrument adjustments necessary to prepare the theodolite for operation. Instrument adjustments bring the theodolite into proper operating condition with respect to the interrelationship of its parts and are not normally made in the field.

b. Preventive Maintenance Checks and Services. Perform the daily preventive maintenance checks and services (para 3-5).

c. Plate Level. Refer to figure 2-15 and adjust the plate level.

d. Collimation Slow-Motion Screw. Refer to figure 2-16 and adjust the collimation slow-motion screw.

e. Vertical Slow-Motion Screw. Refer to figure 2-16 and adjust the vertical slow-motion screw.

f. Horizontal Slow-Motion Screw. Refer to figure 2-16 and adjust the horizontal slow-motion screw.

g. Horizontal Circle Drive Knob. Refer to figure 2-17 and adjust the horizontal circle drive knob.

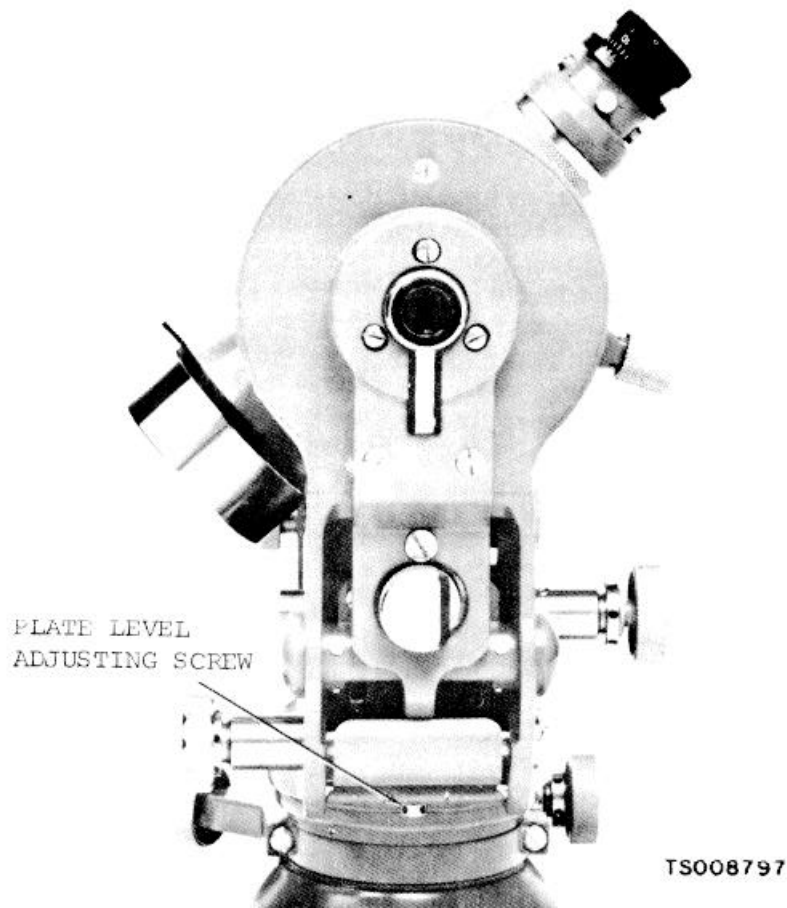
h. Footscrews. Refer to figure 2-18 and adjust the footscrews.

i. Horizontal Collimation Error Adjustment. Refer to figure 2-19 and adjust the theodolite horizontal collimation error.

j. Vertical Collimation Error Adjustment. Refer to figure 2-20 and adjust the theodolite vertical collimation error.

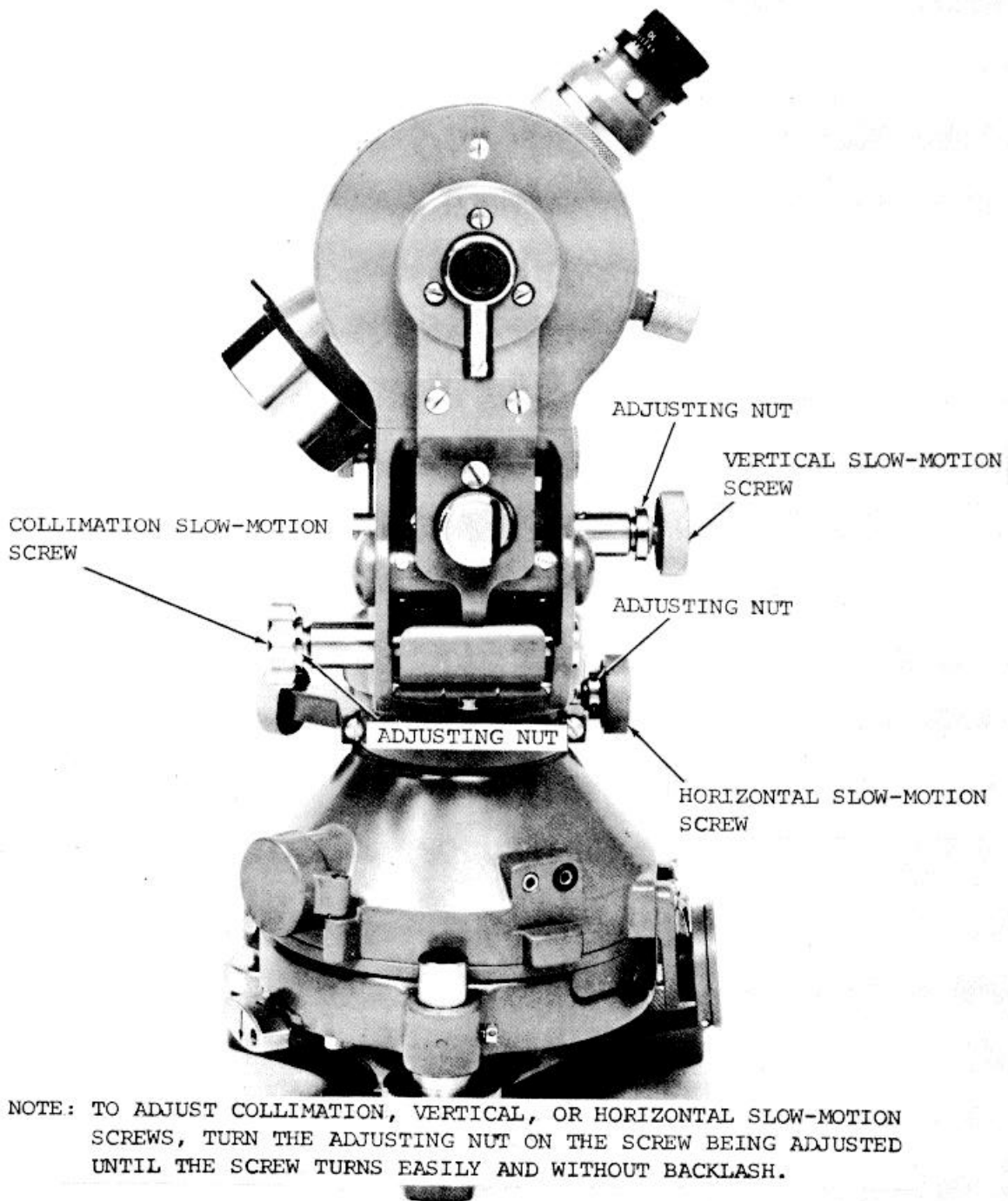
k. Circular Level. Refer to figure 2-21 and adjust the circular level.

l. Optic Plummet. Refer to figure 2-22 and adjust the optical plummet.



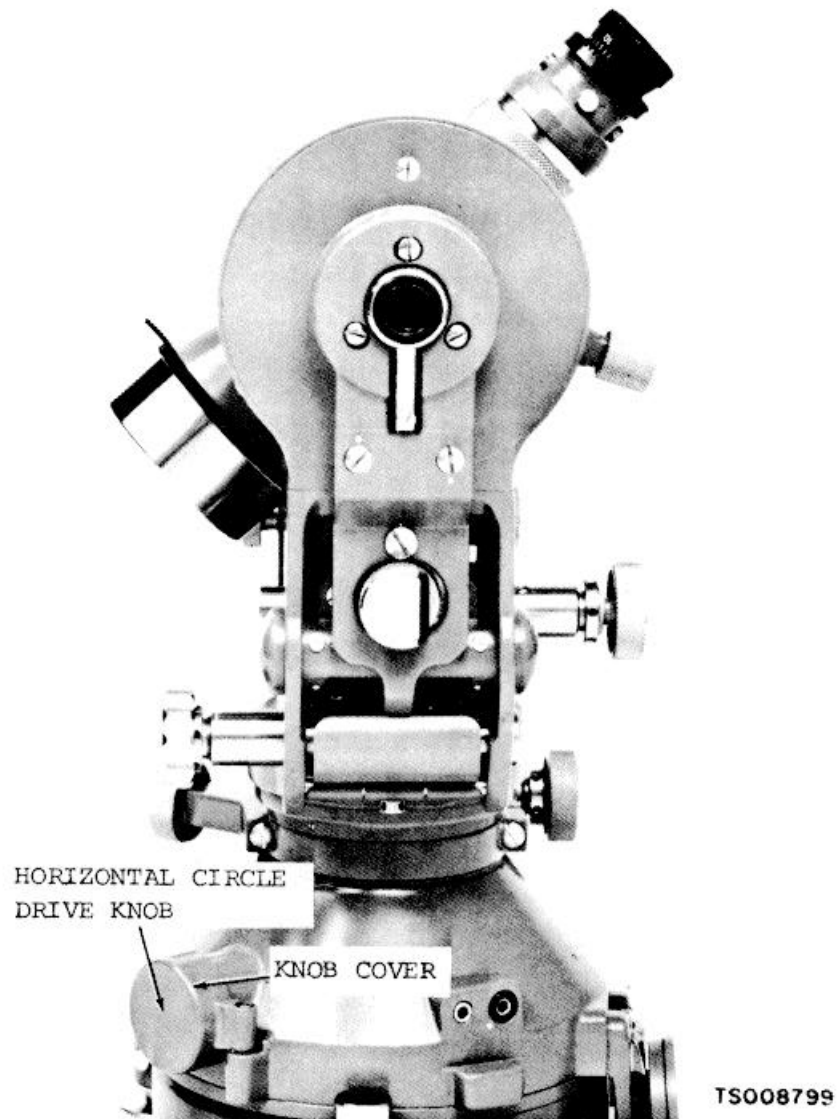
- STEP 1. BRING PLATE LEVEL BUBBLE TO AS NEAR CENTER AS POSSIBLE.
- STEP 2. WITH THE THEODOLITE IN THIS POSITION, CORRECT ONE-HALF OF THE BUBBLE ERROR BY TURNING THE FOOTSCREW.
- STEP 3. USING THE ADJUSTING PIN (FIG. 2-5), TURN THE PLATE LEVEL ADJUSTING SCREW TO CORRECT THE OTHER HALF OF THE ERROR.
- STEP 4. REPEAT THE ABOVE STEPS UNTIL THE BUBBLE REMAINS CENTERED REGARDLESS OF THE POSITION TO WHICH THE THEODOLITE IS TRAVERSED.

Figure 2-15. Plate level adjustment.



TS008798

Figure 2-16. Collimation, vertical and horizontal slow-motion screws, adjustment.



- STEP 1. OPEN THE KNOB COVER.
- STEP 2. TURN THE DRIVE KNOB UNTIL THE THREE SCREWS CAN BE SEEN THROUGH THE HOLES IN THE KNOB.
- STEP 3. LOOSEN THE THREE SCREWS JUST ENOUGH TO MOVE THE -KNOB MOVE THE KNOB UP OR DOWN UNTIL IT TURNS SMOOTHLY WITHOUT WHIPLASH.
- STEP 4. TIGHTEN THE THREE SCREWS AND CLOSE THE KNOB COVER.

Figure 2-17. Horizontal circle drive knob, adjustment.

NOTE: THE FOOTSCREWS MUST TURN SMOOTHLY AND WITHOUT BACKLASH. ADJUST PRESSURE BY TURNING ADJUSTING SCREWS.

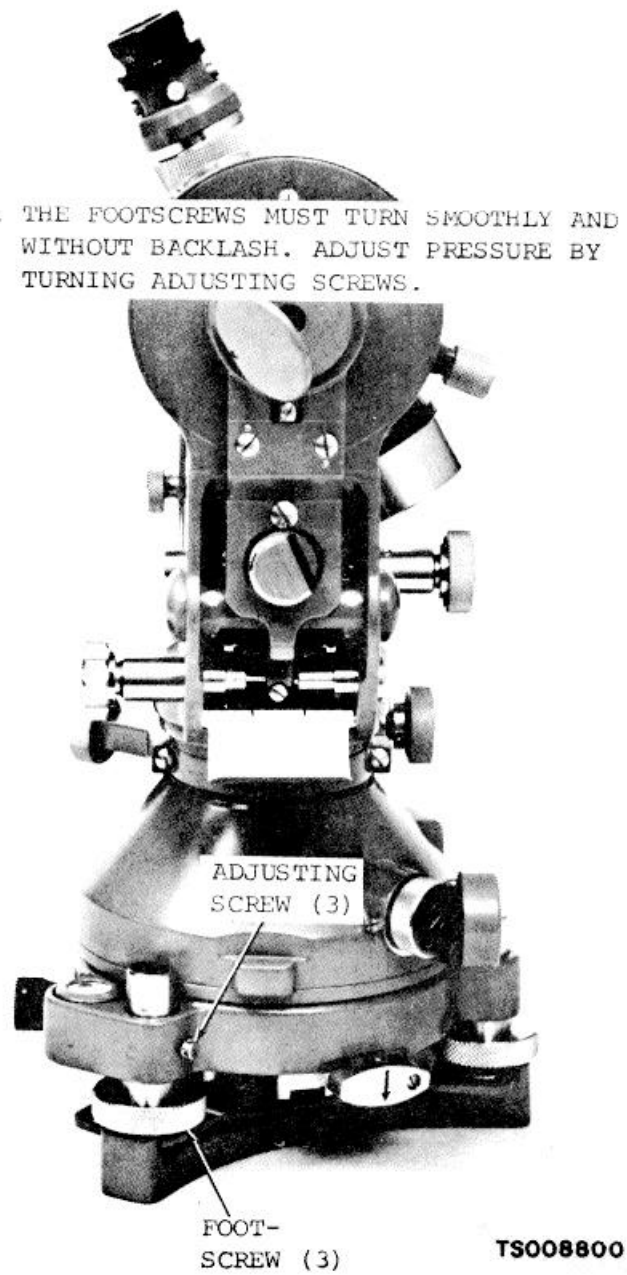
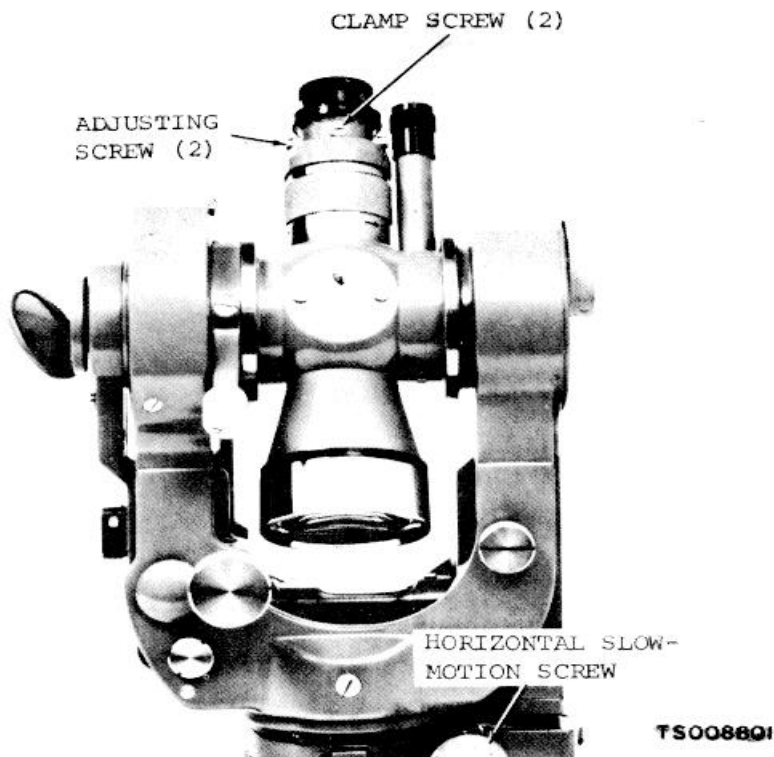
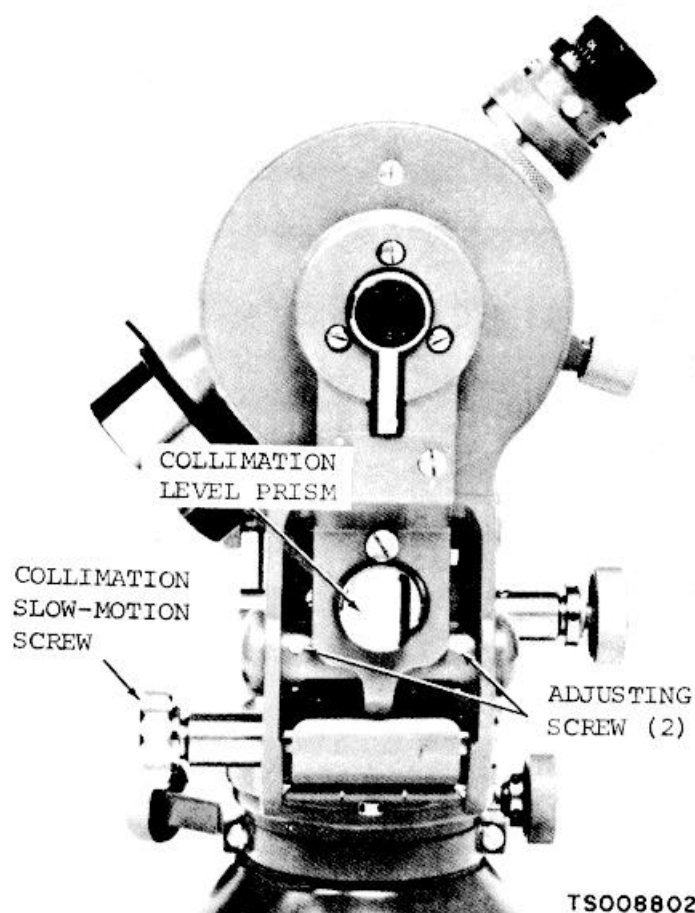


Figure 2-18. Footscrews, adjustment.



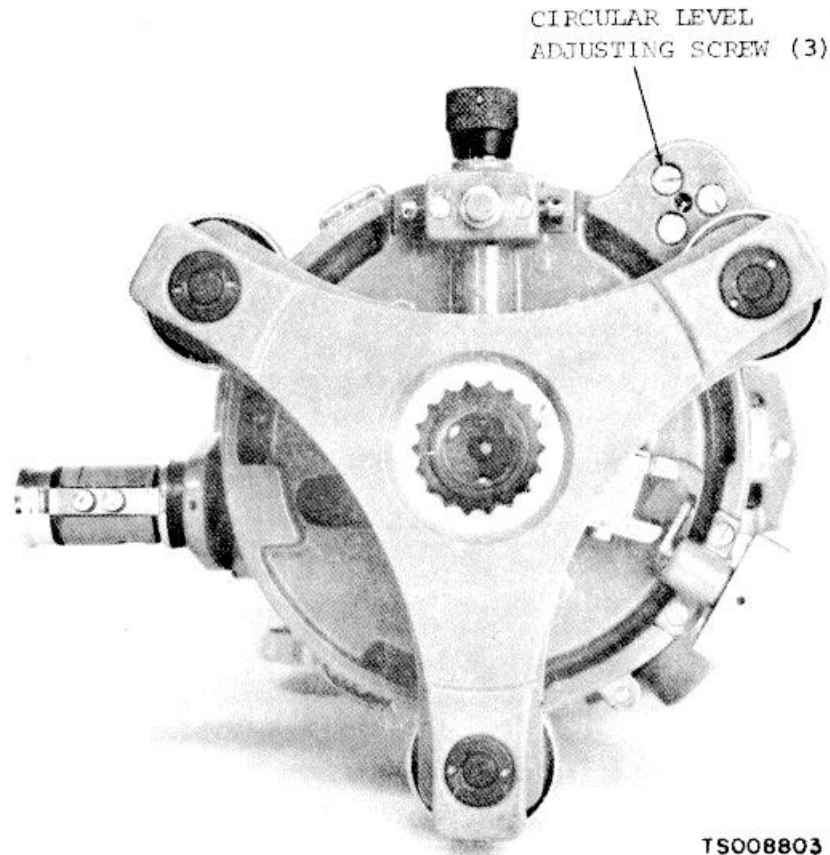
- STEP 1. SET UP THE THEODOLITE (PAR. 2-2).
- STEP 2. SIGHT A WELL DEFINED OBJECT WITH THE VERTICAL CROSSLINE. MAKE THE COINCIDENCE OF THE GRADUATION LINES AND RECORD THE SCALE READINGS.
- STEP 3. REVERSE THE TELESCOPE POSITION AND SIGHT THE OBJECT. MAKE THE COINCIDENCE OF THE GRADUATION LINES AND RECORD THE SCALE READINGS.
- STEP 4. THE DIFFERENCE BETWEEN THE TWO READINGS, REDUCED BY 180 DEGREES IS TWICE THE COLLIMATION ERROR.
- STEP 5. SET THE MICROMETER SCALE AT ONE-HALF THE FIGURE COMPUTED BY STEP 4. MAKE THE COINCIDENCE OF THE GRADUATION LINES BY TURNING THE HORIZONTAL SLOW-MOTION SCREW.
- STEP 6. WITH THE TELESCOPE IN THIS POSITION, CENTER THE VERTICAL CROSSLINE ON THE OBJECT AS FOLLOWS:
- A. TO MOVE THE CROSSLINE TO THE RIGHT, LOOSEN LEFT ADJUSTING SCREW AND TIGHTEN RIGHT ADJUSTING SCREW BY AN EQUAL DEGREE.
 - B. TO MOVE CROSSLINE TO THE LEFT, LOOSEN RIGHT ADJUSTING SCREW AND TIGHTEN LEFT ADJUSTING SCREW BY AN EQUAL DEGREE.

Figure 2-19. Horizontal collimation error, adjustment.



- STEP 1. REFER TO FIGURE 2-19 AND CORRECT HORIZONTAL COLLIMATION IF NECESSARY.
- STEP 2. SIGHT A WELL DEFINED OBJECT WITH THE HORIZONTAL CROSSLINE. COINCIDE THE COLLIMATION LEVEL BUBBLE BY TURNING THE COLLIMATION; SLOW--MOTION SCREW. MAKE THE COINCIDENCE OF THE GRADUATION LINES AND RECORD THE SCALE READINGS.
- STEP 3. REVERSE THE TELESCOPE POSITION, SIGHT THE OBJECT. COINCIDE THE COLLIMATION LEVEL BUBBLE. MAKE THE COINCIDENCE OF THE GRADUATION LINES AND RECORD THE SCALE READINGS.
- STEP 4. THE TOTAL OF THE -10 READINGS, REDUCED BY 360 DEGREES IS TWICE THE COLLIMATION ERROR.. COMPUTE THE ZENITH DISTANCE AND SET THE MICROMETER SCALP, AT THE CORRECT READING.
- STEP 5. MAKE THE COINCIDENCE OF THE GRADUATION LINES.
- STEP 6. COINCIDE THE COLLIMATION LEVEL BUBBLE BY LOOSENING ONE ADJUSTING SCREW AND TIGHTENING THE OTHER ADJUSTING SCREW BY AN EQUAL DEGREE.

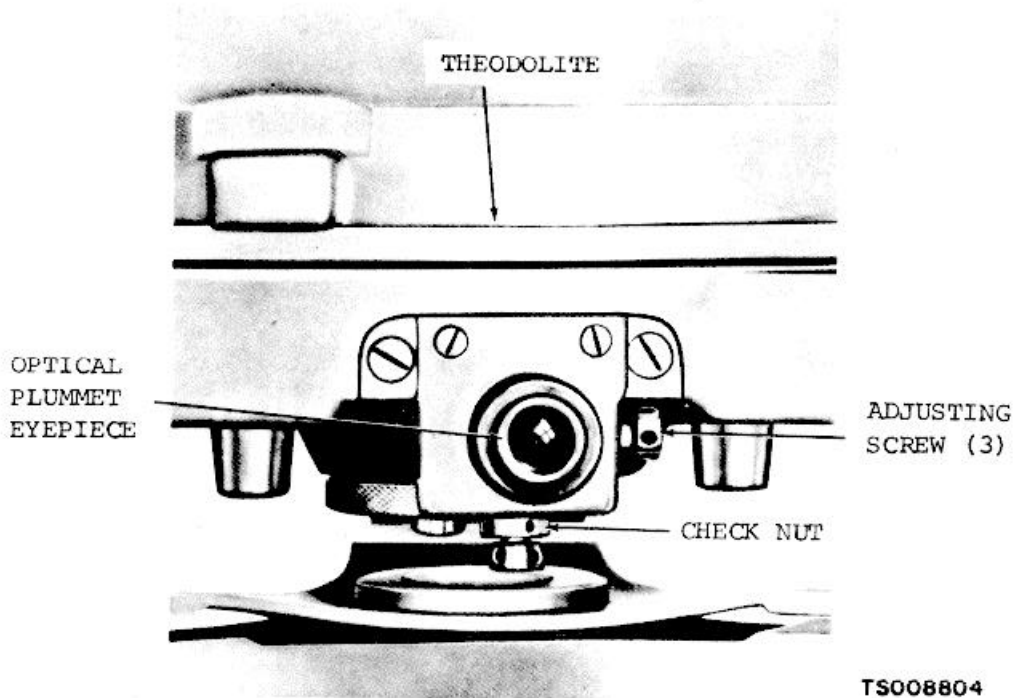
Figure 2-20. Vertical collimation error, adjustment.



TS008803

- STEP 1. REFER TO PARAGRAPH 2-10 AND LEVEL THE THEODOLITE.
- STEP 2. IF THE CIRCULAR LEVEL IS NOT CENTERED IN THE VIAL, THE CIRCULAR LEVEL IS OUT OF ADJUSTMENT. TIGHTEN OR LOOSEN THE THREE ADJUSTING SCREWS TO BRING THE LEVEL BUBBLE TO CENTER.
- STEP 2. NONE OF THE THREE ADJUSTING SCREWS SHOULD BE TIGHTENED ALL THE WAY. THEY SHOULD FLOAT ON THE ADJUSTING SPRINGS.

Figure 2-21. Circular level, adjustment.



TS008804

- STEP 1. REFER TO PARAGRAPH 2-2 AND SET UP THE THEODOLITE.
- STEP 2. OBSERVE STATION POINT THROUGH OPTICAL PLUMMET EYEPIECE. IF STATION POINT IS NOT CENTERED IN THE EYEPIECE CIRCULAR MARKS, USE ADJUSTING PIN (FIG. 2-5) TO TURN THE TWO HORIZONTAL ADJUSTING SCREWS FOR LATERAL ALIGNMENT. FOR VERTICAL ALIGNMENT, LOOSEN CHECK NUT AND TURN VERTICAL ADJUSTING SCREW.
- STEP 3. WHEN THE STATION POINT IS CENTERED IN THE EYEPIECE CIRCULAR MARKS, TIGHTEN THE CHECK NUT.

Figure 2-22. Optical plummet, adjustment.

2-10. Operation of Theodolite

- a. Set up the theodolite on the tripod (para 2-2).
- b. If necessary, install the illumination system (para 2-3)

NOTE

To operate the illumination system, turn the rheostat knob until desired brilliance is obtained. Place the hand light switch in the ON position.

- c. Install the diagonal eyepieces as necessary (para 2-3).
- d. Install the telescope eyepiece black sunglass as necessary (para 4-24).
- e. Perform the daily preventive maintenance services (para 3-5).
- f. Refer to figure 2-23 and level the theodolite.

WARNING

Severe eye damage can result from performing observations against direct sunlight without utilizing the telescope black sunglass.

g. Focus the telescope as follows: (1) Direct the telescope toward a uniformly light background. Adjust the telescope eyepiece (fig. 1-1) until the crosslines are sharp and black.

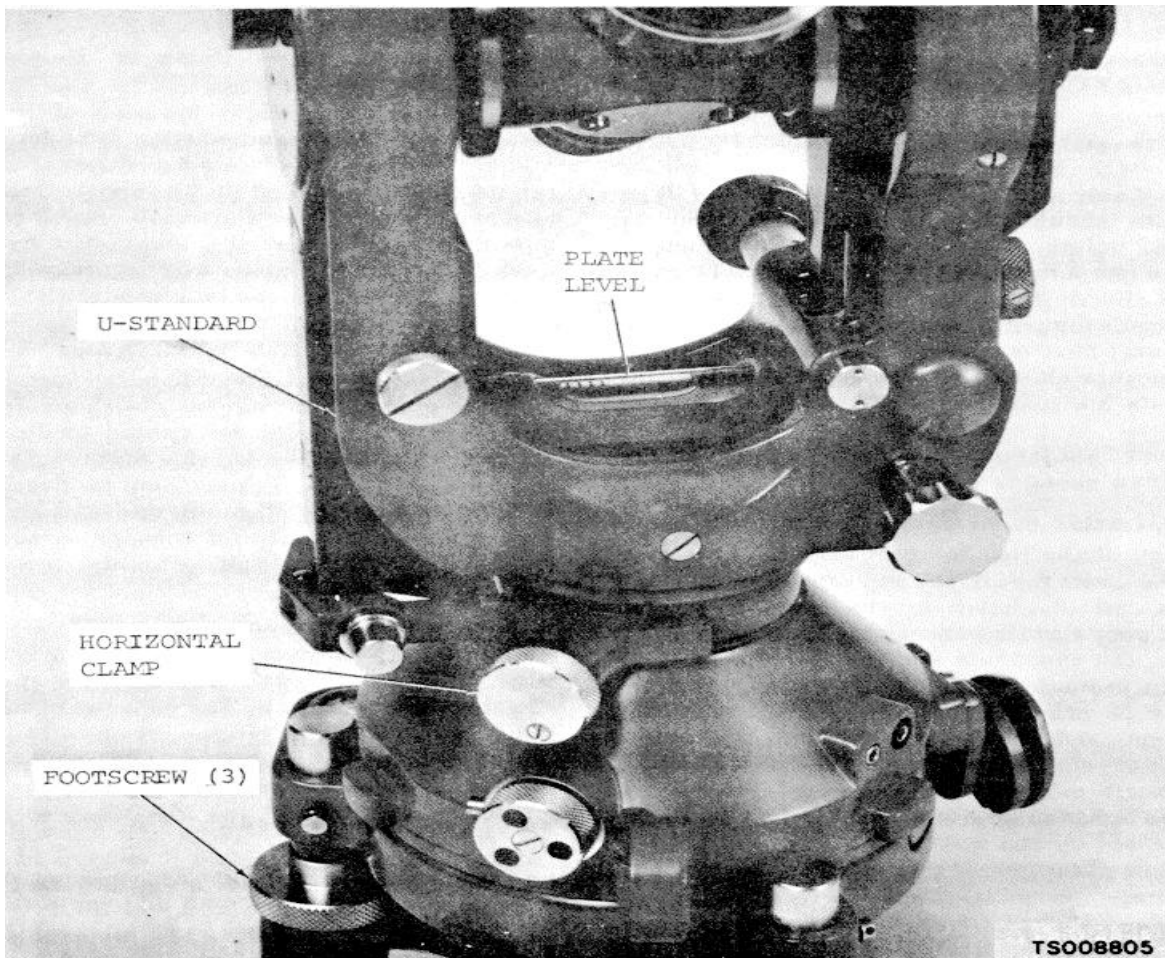
NOTE

Observe the setting on the eyepiece (fig 1-1) This setting will remain constant for the same observer but will vary for other observers.

(2) Adjust the telescope focusing tube (fig. 1-

3) to bring into view a clear image of the object being sighted.

h. The horizontal and vertical circle reading scales are both observed through the microscope eyepiece (fig. 1-1). When the line of the inverter knob is in a horizontal position, the horizontal circle image appears in the upper window (fig. 2-14). When the inverter knob is turned with the line in the vertical position, the vertical circle image appears in the upper window. Simultaneously with either of the circle images, the image of the micrometer scale is always visible in the lower window (fig. 2-14).



- STEP 1. UNLOCK THE HORIZONTAL CLAMP. ROTATE THE U-STANDARD UNTIL THE PLATE LEVEL IS PARALLEL TO A LINE JOINING ANY TWO FOOTSCREWS. LOCK THE CLAMP.
- STEP 2. TURN THE TWO FOOTSCREWS THAT ARE PARALLEL WITH THE PLATE LEVEL SIMULTANEOUSLY, BUT IN OPPOSITE DIRECTIONS UNTIL THE LEVEL BUBBLE IS CENTERED.
- STEP 3. UNLOCK THE HORIZONTAL CLAMP. ROTATE THE U-STANDARD 90° AND LOCK THE CLAMP. TURN THE THIRD FOOTSCREW UNTIL THE LEVEL BUBBLE IS CENTERED.
- STEP 4. UNLOCK THE HORIZONTAL CLAMP. ROTATE THE U-STANDARD 180° AND LOCK THE CLAMP. TURN THE SAME FOOTSCREW AS IN STEP 3 AND REMOVE ONE HALF OF ANY BUBBLE DISPLACEMENT THAT MAY EXIST.
- NOTE: IF AFTER STEP 4 THE PLATE BUBBLE IS MORE THAN TWO DIVISIONS FROM CENTRALITY, THE CORRECTION IS MADE BY MEANS OF THE PLATE LEVEL ADJUSTING SCREW. REFER TO PARAGRAPH 2-9.

Figure 2-23. Theodolite leveling.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

2-11. Operation in Extreme Cold (Below 0°F.) (-18°C.)

With proper precautions and servicing, the theodolite can be used in extreme cold. Its use is limited only by the endurance of operating personnel and conditions affecting visibility. The theodolite should be kept out-of-doors or in unheated buildings for short periods of nonuse. Extreme temperature changes will induce internal stresses affecting accuracy and lenses, and prisms may become fogged. Theodolites to be used under conditions of extreme cold should be cleaned, and all lubricants should be removed before the instruments are used.

CAUTION

Avoid subjecting the theodolite to sudden changes in temperature.

2-12. Operation in Extreme Heat

Operation of the theodolite in extreme heat and under the direct rays of the sun can cause internal stresses and distortion in the instrument and produce poor sightings because of heat waves. If possible, the theodolite and the instrument man should be protected from the direct sunlight by an umbrella or other suitable means. Under these conditions, shorter sightings will decrease the amount of sighting errors. Taking sightings during early morning and late evening will also minimize error magnitude. The use of suitable dark glasses by the instrument man will reduce eyestrain and fatigue. If the theodolite is kept in a cool storage place, it should be removed from storage in sufficient time before use to allow the temperature of the metal to approach that of the outside air.

2-13. Operation in Dusty or Sandy Areas

Special care must be given instruments which are being used in dusty or sandy areas, since both dust and sand are highly abrasive. If dust and sand are allowed to remain on threaded or sliding surfaces, moving parts of the theodolite will soon bind and the instrument will become inaccurate or inoperable. The theodolite should be brushed frequently and carefully wiped clean. Be extremely careful not to scratch lens and prism surfaces during cleaning operations. Always protect the instrument from blowing dust and sand. Place a protective cover over the theodolite when it is not in use.

2-14. Operation under Rainy or Humid Conditions

In humid areas, a slight lowering of the temperature will cause condensation of moisture and fogging of lenses and prisms. Internal fogging can usually be removed by placing the theodolite in a warm, dry place. Corrosion caused by high humidity can be partially eliminated by using warm, dry storage areas and desiccants. After use, dry the instrument thoroughly with a soft, lint-free cloth.

2-15. Operation in Salt Water Areas

When operating the theodolite in salt water areas, wipe the instrument frequently with a soft, clean cloth. If the theodolite is exposed to direct salt spray, it should be cleaned thoroughly and should be returned to an instrument shop for overhauling as soon as possible. Cleaning intervals should be shortened considerably for theodolites subjected to salt air exposure. Salt is highly corrosive to metal.

2-16. Operation in Snow

Visibility is sharply reduced while snow is falling. When taking sightings after a snowfall, the use of suitable dark glasses by the instrument man will reduce eyestrain and fatigue. If snow conditions are accompanied by extreme cold (below 0° F.) (-18°C.), refer to paragraph 2-11.

2-17. Operation in Mud

Mud is highly abrasive and if allowed to remain on threaded or sliding surfaces, moving parts of the theodolite will soon bind and the instrument will become inaccurate or inoperable. The theodolite should be carefully wiped clean. Be extremely careful not to scratch lens and prism surfaces during cleaning operations. Place a protective cover over the theodolite when not in use. When the tripod is set up on muddy ground, leveling is extremely important and should be checked frequently. Anchor tripod legs firmly to avoid slippage which will cause incorrect readings.

2-18. Operation at High Altitudes

No special procedures are required to operate the theodolite at high altitudes.

CHAPTER 3

OPERATOR/ CREW MAINTENANCE INSTRUCTIONS

Section I. BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST

3-1. Basic Issue Items and Items Troop Installed or Authorized

Tools, equipment and repair parts issued with troop

installed or authorized for the theodolite are listed in the basic issue items list and items troop installed or authorized list, Appendix B.

Section II. LUBRICATION INSTRUCTIONS

3-2. General

a. This section contains a lubrication chart and instructions which are supplemental to, and not specifically covered in the lubrication chart. Refer to figure 3-1 for the lubrication chart.

b. All moving parts of the theodolite, both smooth and threaded surfaces, are fitted within extremely fine tolerances. For this reason, most parts of the theodolite are cleaned prior to lubrication. Any attempt to lubricate the theodolite without first cleaning it, may result in damage to the instrument. Only those lubricants approved for use on the theodolite will be used. No lubrication will be performed in the field unless specifically called for.

3-3. Detailed Lubrication Information

a. Care of Lubricants. Special care should be taken to see that all surveying instrument lubricants are kept absolutely free from contamination by any foreign substance. Containers must be stored in a clean, dry

place and wiped free of dirt or dust before they are opened. All lids or bottle tops must be airtight.

b. Lubricants. No lubricants other than those approved for use on the theodolite will be stocked. Approved lubricants are noncorrosive and highly refined and must be free from all paint removing ingredients. The following lubricants are approved for use on this theodolite:

(1) OCW; oil, clock and watch.

(2) DM; grease, aircraft and instrument.

c. *Lubrication Procedure.* Cleaning and lubrication services, which require partial or complete disassembly of the instrument, must be performed in the dust-free atmosphere of an instrument repair shop and only by qualified personnel. Disassembling the instrument under other conditions, especially where dust might filter into recesses, will do more harm than good. Since the lubricants must be applied sparingly, never use a container with a spout, such as an oil can, to apply oil on parts or into assemblies.

LUBRICATION CHART

THEODOLITE, DIRECTIONAL; 1-SECOND GRADATION, 5.9 IN. LONG TELESCOPE: DETACHABLE TRIBRACH WITH ACCESSORIES AND TRIPOD (WILD-HEERBRUGG MODEL T2-74 DEG) NSN 6675-00-334-5335

Reference: FEDERAL SUPPLY CATALOG C9100-IL

Intervals are based on normal hours of operations. Reduce to compensate for abnormal operations and severe conditions. During inactive periods, sufficient lubrication must be performed for adequate preservation.

Clean parts with SOLVENT, dry-cleaning, Type II (SD-2). Dry before lubricating.

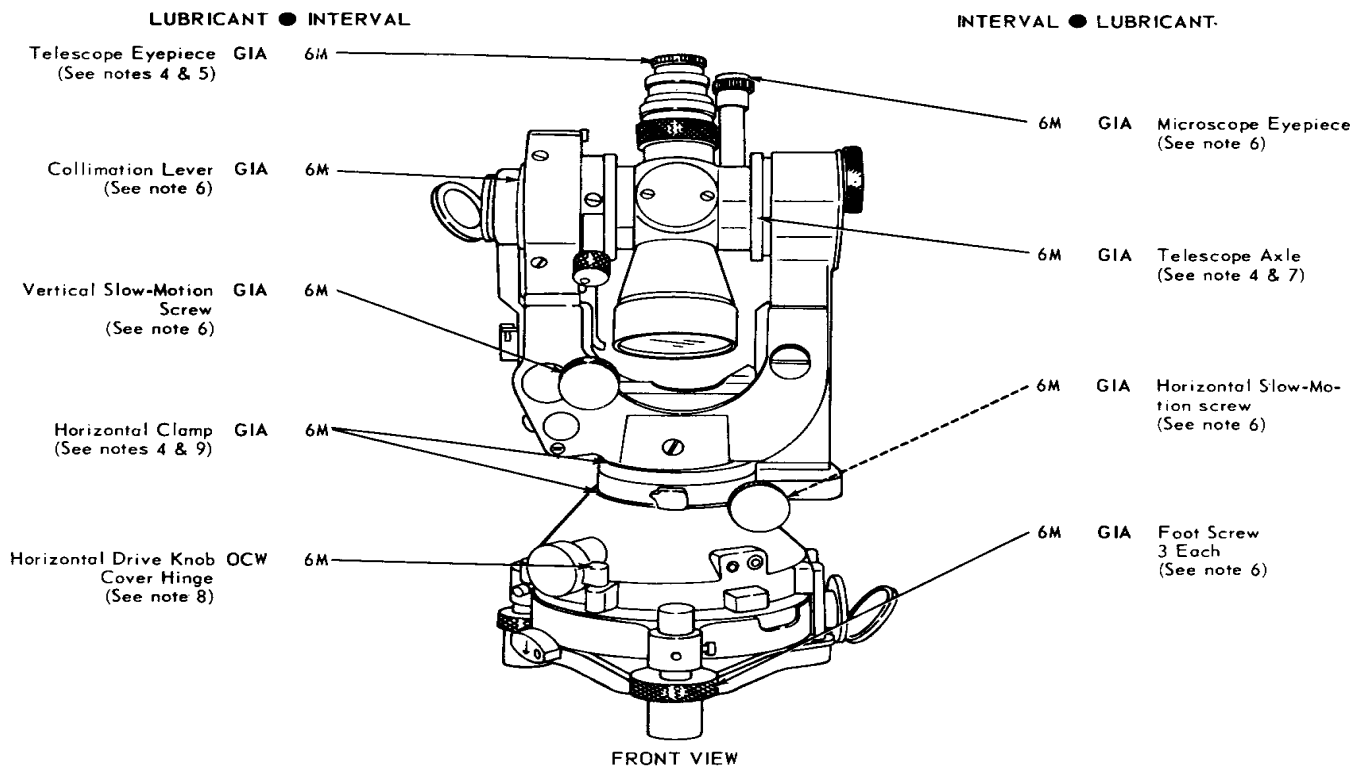
Lubricate points indicated by dotted arrow shafts on both sides of equipment.

*The time specified is the time required to perform all services at the particular interval.

* TOTAL MAN-HR	
INTERVAL	MAN-HR
6M	1.0

FOLD

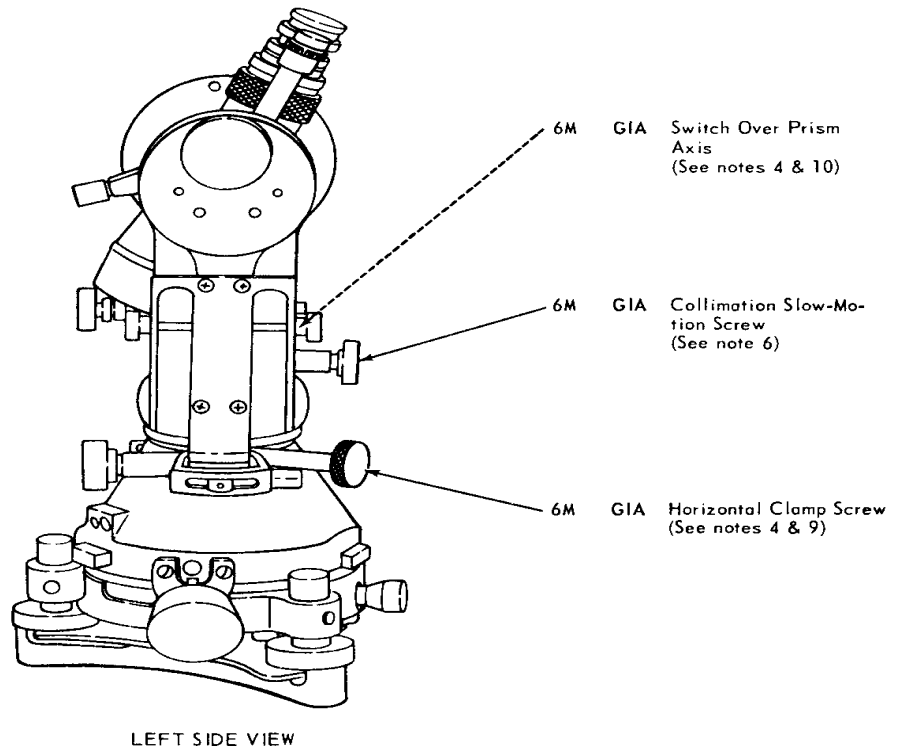
FOLD



TS 008806

Figure 3-1. Lubrication Chart-Sheet 1 of 2).

INTERVAL ● LUBRICANT



FOLD

FOLD

-KEY-

LUBRICANTS	CAPACITY	EXPECTED TEMPERATURES			INTERVALS
		Above +32°F Above 0°C	+40°F to -10°F +5°C to -23°C	0°F to -65°F -18°C to -50°C	
GIA-GREASE, Aircraft & Instrument		ALL TEMPERATURES			6M-6 Months
OCW-LUBRICATING OIL, Watch					

NOTES:

1. Before lubricating, clean all surfaces with cleaning solvent. Dry before lubricating.
2. Under adverse climate conditions, e. g. rainy and humid or dry and dusty, lubrication at 2-month intervals is required.
3. Lubrication which requires partial disassembly of the instrument must be performed in the dust-free atmosphere of an instrument repair shop and only by qualified personnel. Disassembling the instrument under other conditions, especially where dust might filter into recesses, will do more harm than good.
4. Use OCW instead of GIA when disassembly is not possible, e. g., in the field.
5. Place 1 drop of OCW at the top of the crack between the collimation lever (Fig. 1-2) and the left-hand axle bearing. Work oil into the crack by alternately pushing and releasing the lower part of the collimation lever against the spring of the collimation slow-motion screw.
6. Apply a light film of GIA to all threads.
7. Clean the area between the right-hand axle bearing (Fig. 1-1), telescope clamp (Fig. 1-2) and telescope axle. Apply one drop of OCW at the top of each crack. Turn telescope 180 and apply one drop of oil in same cracks. Rotate telescope and simultaneously press down and release the telescope clamp to work oil into the telescope axle. When the axle is thoroughly lubricated, wipe off excess oil with clean lint-free cloth.
8. Apply 1 drop of OCW to hinge pin or horizontal drive cover (Fig. 1-2). Carefully work the cover forward, backward, up and down to distribute oil over the working surfaces. Wipe off excess oil with a clean lint-free cloth.
9. Carefully tip theodolite at an angle and apply one drop of OCW in the cracks where the horizontal clamp (Fig. 1-1) meets the base housing and the u-standard. Wipe off excess oil with a clean lint-free cloth.
10. Apply one drop of OCW to switchover prism axis where axis rides in holes of the u-standard. Rotate inverter knobs (Fig. 1-4) between vertical and horizontal circle reading positions until switchover prism axis is thoroughly lubricated. Wipe off excess oil with clean lint-free cloth.
11. The following is a list of lubricants with the Military Symbols and applicable Specification numbers.
 GIA MIL-G-23827 OCW MIL-L-3918

TS 008807

Figure 3-1. Lubrication Chart (Sheet 2 of 2).

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-4. General

To insure that the theodolite is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in paragraph 3-5. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit shall be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if

operation were continued. All deficiencies and shortcomings will be recorded, together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-5. Preventive Maintenance Checks and Services

This paragraph contains a tabulated listing of operator's periodic (daily) preventive maintenance checks and services. The sequence numbers are listed consecutively and indicate the minimum requirements for daily (D) and weekly (W) preventive maintenance, respectively. Refer to table 3-1 for the preventive maintenance checks and services.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services

D-Daily Time required: 0.5			W-Weekly Time required: 0.1
Interval and Sequence No		ITEM TO BE INSPECTED PROCEDURE	WORK TIME (M/H)
D	W		
1		HAVERSACK Clean dirty haversack	0.1
2		ACCESSORY CASE Clean accessory case Check for missing components	0.1
3		TRIPOD ACCESSORY CASE Check for missing components	0.1
4		BATTERY BOX Replace defective batteries or missing spare lamps Check handlamp for proper operation	0 1
1		TRIPOD Clean dirty tripod	0.1
5		CARRYING CASE Check dessicant for proper color	0.1

Section IV. TROUBLESHOOTING

3-6. Scope

a. This section contains troubleshooting or malfunction information and tests for locating and correcting most of the troubles which may develop in the theodolite. Each malfunction or trouble symptom for an individual component, unit, or system is followed by a list of tests or inspections necessary for you to determine probable causes and suggested corrective actions for you to remedy the malfunction.

b. This manual cannot list all possible malfunctions that may occur or all tests, or inspections, and corrective actions. If a malfunction is not listed or is not corrected

by listed corrective actions, you should notify higher level maintenance.

c. Table 3-2 lists the common malfunctions that you may find during the operation or maintenance of the theodolite or its components.

You should perform the tests, inspections and corrective actions in the order listed.

NOTE

If you have a malfunction which is not listed in this table. notify the next higher level of maintenance.

Table 3-2. Troubleshooting

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
THEODOLITE		
1. THEODOLITE WILL NOT SEAT PROPERLY ON TRIPOD HEAD	Step 1. Check alignment of the central fixing screw. Restart central fixing screw (fig. 2-9). Step 2. Inspect tribrach assembly for defects. Replace a defective tribrach assembly (fig. 1-2).	
2. THEODOLITE WILL NOT STAY ON LINE	Step 1. Check theodolite for level. Level theodolite: (1) Position theodolite on tripod head and secure with central fixing (r (fig. 2-9). (2) Center circular level bubble using footscrews (fig. 2-9). Step 2. Plate level or collimation level out of adjustment. a. Adjust plate level (fig. 2-15). b. Adjust collimation level (fig. 2-16).	
3. LIGHTS ON VERTICAL AND HORIZONTAL CIRCLES UNEQUAL OR ABSENT	Step 1. Illumination lamp defective. Replace lamp (fig. 3-2). Step 2. Batteries defective. Replace batteries (fig. 3-2).	
4. HORIZONTAL CIRCLE HARD TO MOVE	Circle drive knob out of adjustment. Adjust knob (fig. 2-17).	
5. FOOTSCREWS TOO TIGHT OR LOOSE	Footscrews out of adjustment. Adjust footscrews (fig. 2-18).	

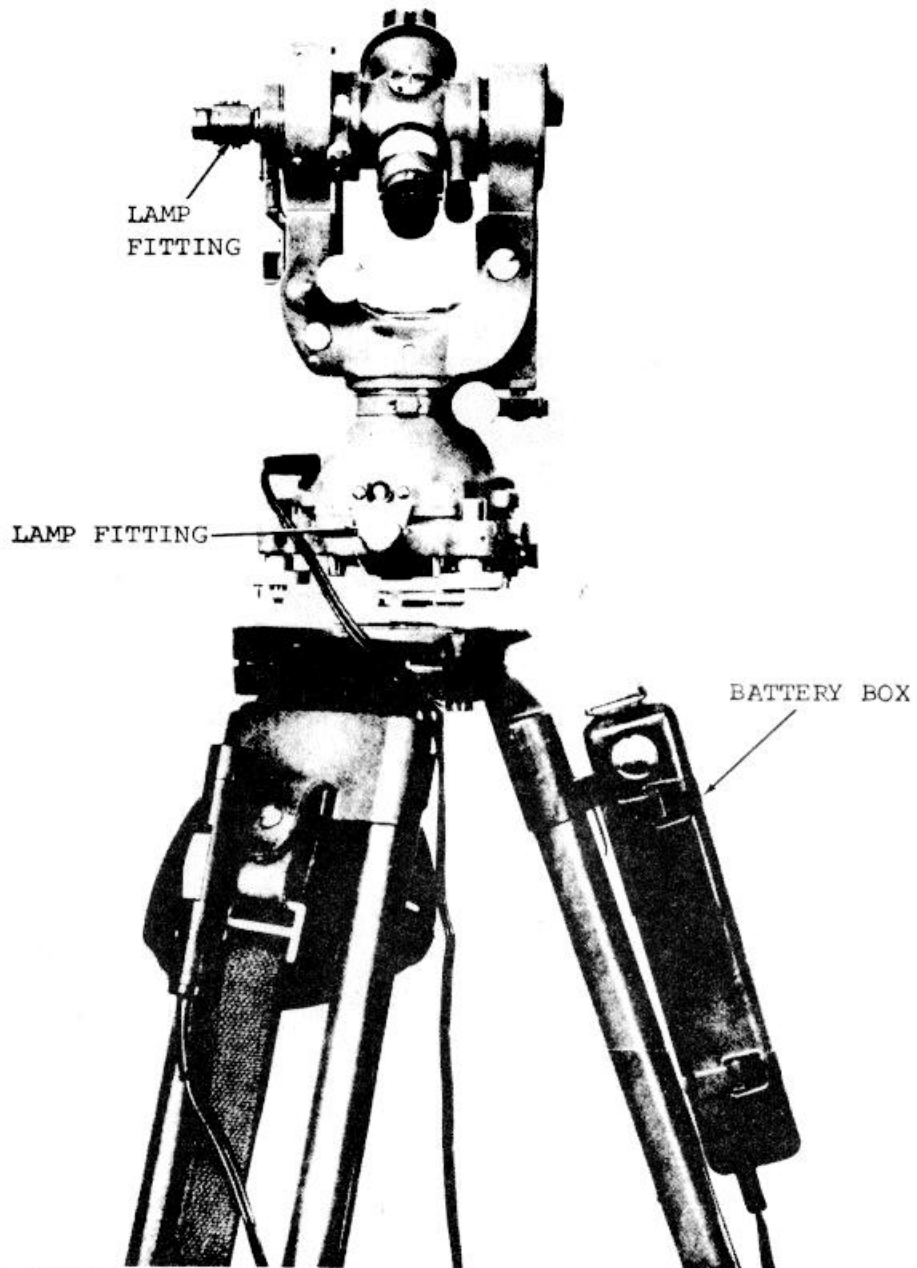
Section V. MAINTENANCE OF LAMP FITTING AND BATTERY BOX

3-7. Lamp Replacement

Refer to figure 3-2 and replace the lamps.

3-8. Battery Replacement

Refer to figure 3-2 and replace the batteries.



NOTE: REMOVE LAMP FITTING FROM THEODOLITE BY PULLING WITH A TWISTING MOTION. REMOVE LAMP FROM LIGHT HOUSING. OPEN BATTERY BOX COVER AND REMOVE BATTERIES.

TS008809

Figure 3-2. Lamp and battery, removal and installation.

Change 1 3-6

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

4-1. Service Upon Receipt of Equipment

Refer to paragraph 2-1 for instructions pertaining to service upon receipt of equipment.

Section II. MOVEMENT TO A NEW WORKSITE

4-2. Movement to a New Worksite

Refer to paragraphs 2-4 and 2-5 for instructions pertaining to movement to a new worksite.

Section III. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

4-3. Tools and Equipment

Tools, equipment, and repair parts issued with troop installed, or authorized for the theodolite are listed in the basic issue items list and items troop installed or authorized list, Appendix B.

References and illustrations indicating the use of these tools are listed in the table. The five-digit number preceding the stock number is the Federal Supply Code Number for the manufacturer of the tool(s). No special equipment is required by organizational maintenance personnel for performing maintenance on the theodolite.

4-4. Special Tools and Equipment

The special tools required to perform organizational maintenance on the theodolite are listed in table 4-1.

Table 4-1. Special Tools

Item	NSN or Part No.	Reference		Use
		Figure	Paragraph	
Pin, adjusting Wrench, tripod	(89905)* 6675-00-353-4103 (89905)* 5120-00-378-9520	2-5 2-4	2-9 2-2	Adjust theodolite adjusting screws. Tripod leg adjustment, removal, and installation .

4-5. Maintenance Repair Parts Repair parts and are listed and equipment. illustrated in the repair parts

and special tools list, TM 5-6675-306-24P, covering organizational maintenance for this equipment.

Section IV. LUBRICATION INSTRUCTIONS

4-6. Lubrication Instructions

Refer to paragraphs 3-2 and 3-3 for lubrication instructions.

Section V. PREVENTIVE MAINTENANCE

4-7. General

To insure that the theodolite is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in paragraph 4-8. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit shall be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded,

together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

4-8. Preventive Maintenance Checks and Services

This paragraph contains a tabulated listing of organizational periodic preventive maintenance checks and services. The item numbers are listed consecutively and indicate the sequence of minimum requirements. A quarterly interval is equal to 3 calendar months, or 250 hours of operation, whichever occurs first. Refer to table 4- 2 for the preventive maintenance checks and services.

Table 4-2. Organizational Preventive Maintenance Checks and Services

Q - Quarterly

Total man-hours required: 0.9

Sequence number	ITEMS TO BE INSPECTED PROCEDURE	Work	time (M/H)
1	HAVERSACK Clean dirty haversack. Replace defective haversack.		0.1
2	ACCESSORY CASE Replace missing or defective components		0.1
3	TRIPOD ACCESSORY CASE Replace missing or defective components.		0.1
4	BATTERY BOX Replace defective batteries. Replace missing spare lamps. Replace defective handlamp.		0.1
5	TRIPOD Repair or replace defective tripod.		0.2
6	CARRYING CASE Replace discolored dessicant. Replace defective carrying case.		
7	THEODOLITE Clean dirty lenses, mirrors and level vials. Check eyepieces adjusting and clamping . knobs of movement for freedom.		0.2

Section VI. TROUBLESHOOTING

4-9. Scope

a. This section contains troubleshooting or malfunction information and tests for locating and correcting most of the troubles which may develop in the theodolite. Each malfunction or trouble symptom for an individual component, unit, or system is followed by a list of tests or inspections necessary for you to determine probable causes and suggested corrective actions for you to remedy the malfunction.

b. This manual cannot list all possible malfunctions that may occur or all tests or inspections, and corrective actions. If a malfunction is not listed, or is not corrected

by listed corrective actions, you should notify higher level maintenance.

c. Table 4-3 lists the common malfunctions that you may find during the operation or maintenance of the theodolite or its components. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

If you have a malfunction which is not listed in this table, notify the next higher level of maintenance.

Table 4-3. Troubleshooting

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
THEODOLITE		
1. THEODOLITE WILL NOT SEAT PROPERLY ON TRIPOD HEAD		
Step 1.	Check alignment of the central fixing screw.	Restart central fixing screw (fig. 2-9).
Step 2.	Inspect tribrach assembly for defects.	Replace a defective tribrach assembly (fig. 1-2).
Step 3.	Tripod head defective.	Replace a defective head (fig. 4-6).
2. THEODOLITE WILL NOT STAY ON LINE		
Step 1.	Check theodolite for level.	Level theodolite. (1) Position theodolite on tripod head and secure with central fixing screw (fig. 2-9). (2) Center circular level bubble using footscrews (fig. 2-9).
Step 2.	Plate level or collimation level out of adjustment.	a. Adjust plate level (fig. 2-15). b. Adjust collimation level (fig. 2-16).
3. LIGHTS ON VERTICAL AND HORIZONTAL CIRCLES UNEQUAL OR ABSENT		
Step 1.	Illumination lamp defective.	Replace lamp (fig. 3-2).
Step 2.	Batteries defective.	Replace batteries (fig. 3-2).
Step 3.	Horizontal or vertical circle illuminating mirror defective.	Replace mirror-(fig. 4-4).
4. TRIPOD LEG WILL NOT LOCK IN POSITION		
	Leg clamping screws loose,	Tighten or replace screws (fig. 2-8).
5. HORIZONTAL CIRCLE HARD TO MOVE		
	Circle drive knob out of adjustment.	Adjust knob (fig. 2-17).
6. FOOTSCREWS TOO TIGHT OR LOOSE		
	Footscrews out of adjustment.	Adjust footscrews (fig. 2-18).
7. TELESCOPE TURNS TOO HARD OR TOO EASILY		
	Telescope clamp not properly adjusted.	Adjust clamp (fig. 2-14).

Section VII. CARRYING CASE AND HAVERSACK

4-10. General

The carrying case for theodolite is composed of the metal hood and base. The carrying case provides a convenient means of carrying the theodolite in the field and serves as a dustproof and moistureproof container for the instrument when it is in storage. The base has a recess in the bottom which houses the desiccant container. The haversack is used to carry the theodolite when the use of the carrying case is impractical.

4-11. Carrying Case

- a. Hood.
 - (1) Removal. Remove the hood (para 2-2).
 - (2) Disassembly. Refer to figure 4-1 and disassemble the hood.
 - (3) Cleaning, inspection, and repair.

WARNING

Dry cleaning solvent, P-D-680, used

to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 ° F.-138 ° F. (38 ° C.-59 ° C.)

- (a) Clean all metal parts with an approved cleaning solvent and dry thoroughly.
- (b) Clean the carrying strap with saddle soap.
- (c) Inspect the strap for cracks, breaks, and cuts. Inspect for worn mounting holes and deterioration due to age. Inspect for enlarged mounting holes.
- (d) Inspect the lock pins for burrs and wear. Inspect the locking levers and lever springs for burrs, bends, and crack. Inspect the hood for (dents, cracks, and holes. Inspect the bottom rim for out-of-round.

(f) Remove all burrs from the lock pins, locking levers, and lever springs. Straighten dents. Remove all traces of rust and repaint where necessary.

(g) Straighten dents or bends in the hood. Seal all cuts or holes in the hood. Repaint where necessary.

(h) Replace all defective parts that cannot be repaired.

(4) Reassembly. Refer to figure 4-1 and reassemble the hood.

(5) Installation. Install the hood (fig. 2-1).

b. Base.

(1) Removal. Remove the base (fig. 2-11i).

(2) Disassembly. Refer to figure 4-2 and disassemble the base.

(3) Cleaning, inspection, and repair.

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° F.-138° F. (38°C.-59°C.)

(a) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Brush threaded surfaces free of any foreign matter. Wipe the rubber gasket clean with a soft cloth.

(b) Inspect all threaded surfaces for worn

or damaged threads. Inspect the lever nuts, levers, and washers for burrs and worn surfaces.

(c) Inspect the base for cracks and a broken casting. Inspect the collar of base for bends, breaks, and out-of-round.

(d) Inspect the rubber gasket for damage or hardening because of age or excessive heat.

(e) Remove all burrs from the base, levers, lever nuts, and collar of base. Straighten bends in the collar of base and washers. Replace all defective parts.

(f) Inspect the sections of the desiccant container for bends, breaks, and damaged threads

(g) Inspect the desiccant for color. Serviceable desiccant is blue in color. Pink desiccant indicates moisture saturation, and the desiccant must be dehydrated or replaced.

(h) Replace the desiccant or container as necessary.

(4) Reassembly. Refer to figure 4-2 and reassemble the base.

(5) Installation. Refer to fig. 2-2. Install the theodolite on the carrying case base.

KEY to fig. 4-1:

- | | |
|------------------|--------------------|
| 1. Leather strap | 4. Lock spring (2) |
| 2. Metal hood | 5. Lock lever (2) |
| 3. Lock pin (4) | 6. Rivet (4) |

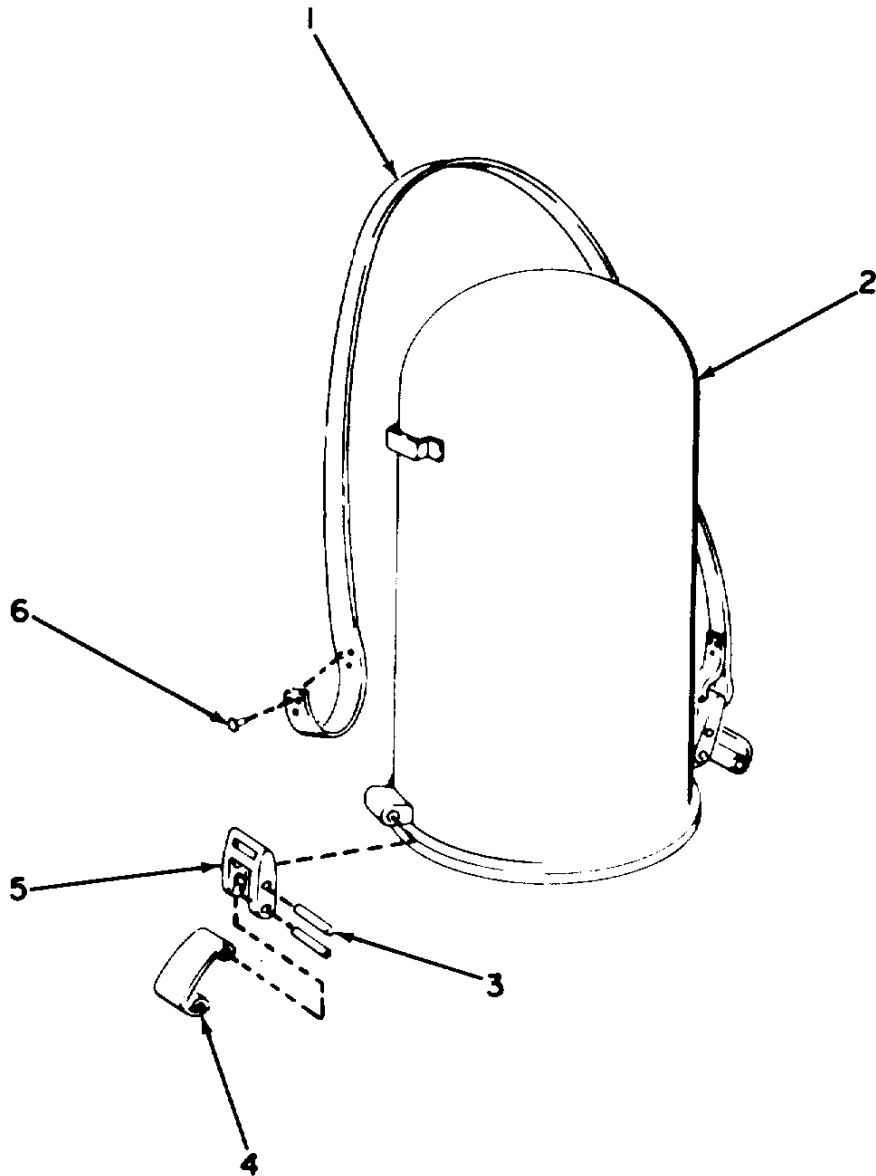


Figure 4-1. Carrying case hood, disassembly and reassembly.

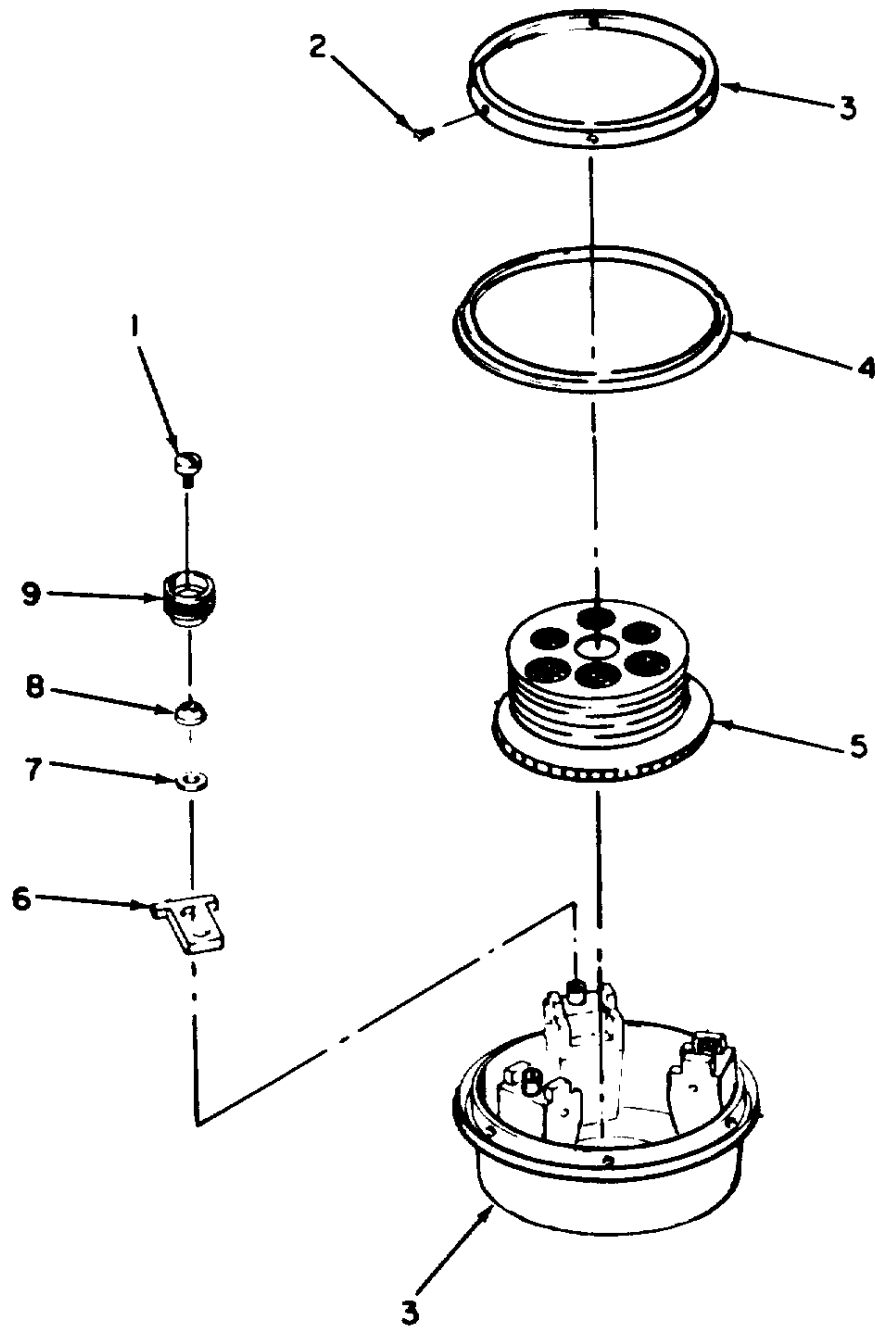


Figure 4-2. Carrying case base, disassembly and reassembly.

KEY to fig. 4-2:

- | | |
|------------------------|----------------------|
| 1. Screw (31) | 6. Lever J3) |
| 2. Screw (61) | 7. Washer (3) |
| 3. Base | 8. Spring washer 13) |
| 4. Rubber gasket | 9. Nut (3) |
| 5. Desiccant container | |

4-12. Haversack

a. *General.* The haversack (fig. 2-7) is used for carrying the theodolite when it is impractical to carry the unit using the carrying case. The

theodolite in its carrying case is strapped in the haversack, which in turn, is carried on the operator's back.

b. *Cleaning and Inspection.*

(1) Brush the haversack free of dust and dirt. Clean the straps with saddle soap.

(2) Inspect the haversack for damage and defects that would render it unserviceable. Repair or replace a defective haversack.

Section VIII. SUNSHADE

4-13. General

The sunshade is push-fit on the telescope objective. It is held in place by spring action exerted by the sunshade body. The sunshade is used to reduce glare of sunlight shining into the objective. When not in use it is mounted on the objective so that the slotted portion fits over the front sight, and then twisted slightly to lock it in place.

4-14. Sunshade

a. *Removal.* Carefully pull the sunshade from the telescope objective (fig. 2-13). If in stored position, twist sunshade up with front sight, then pull sunshade from telescope objective.

b. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D-680, used to

clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 F.-138 ° F. (38 a C.-59 0C.)

(1) Clean the sunshade with a clean cloth dampened with an approved cleaning solvent.

(2) Inspect the sunshade for bent or cracked parts.

(3) Replace defective sunshade.

c. *Installation.* Gently push the sunshade over the telescope objective so that edge of sunshade is against front sight (fig. 2-13). To store, align slot in sunshade with front sight; push sunshade over telescope objective and twist slightly to lock in place.

Section IX. TRIBACH ASSEMBLY

4-15. General

The tribach assembly consists of the locking plate, footscrew, optical plumbing device, mounting flange, and base plate assemblies. Together they enable the operator to quickly and accurately secure the theodolite to, and remove it from, the prelevelled base which remains attached to the tripod head. By using it the operator can shift the instrument back and forth between established stations, as when closing a traverse, without having to level or realign the theodolite each time it is moved.

4-16. Tribach Assembly

a. *Removal.* Refer to figure 4-3 and remove the tribach assembly.

b. *Cleaning and Inspection.*

WARNING

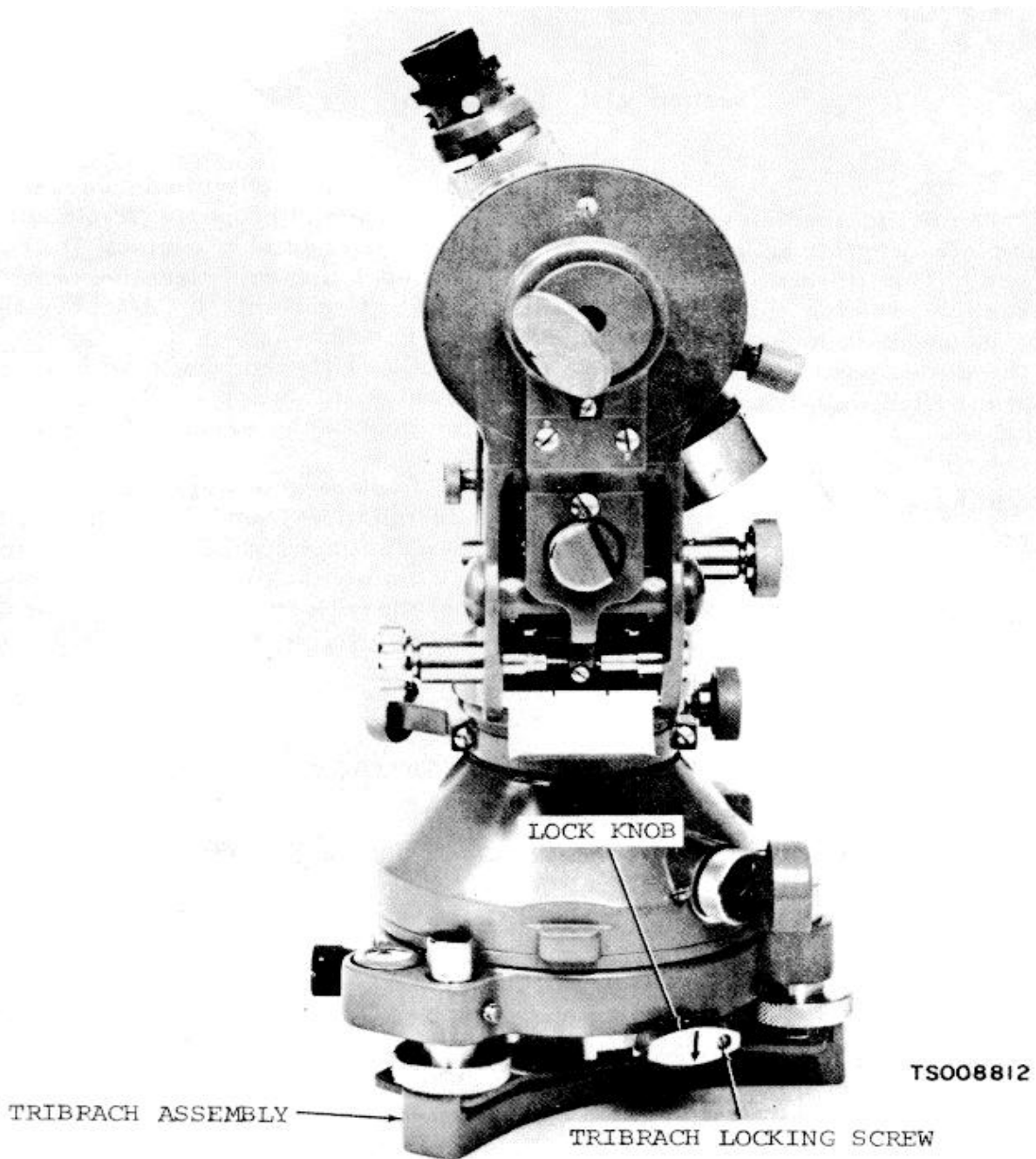
Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to

personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 ° F.-138 0 F. (38 0 C.-59 C.)

(1) Brush all dirt, dust, and foreign matter from the tribach components. Wipe all surfaces clean with a soft, lint-free cloth moistened with an approved cleaning solvent. Thoroughly clean all bearing surfaces on which the tapered locking wedges ride.

(2) Inspect the tribach, base plate, and spring plate for cracks, and breaks. Inspect the three footscrews for improper operation. They should turn smoothly and evenly, yet require a moderate amount of force exerted by thumb and forefinger to turn without backlash. Lubricate bearing surfaces sparingly before reassembling the tribach assembly to the theodolite.

- (3) Replace a defective tribrach assembly.
- c. *Installation.* Refer to figure 4-3 and install the tribrach assembly.



- STEP 1. LOOSEN THE LOCKING SCREW AND ROTATE THE TRIBRACH LOCK KNOB COUNTERCLOCKWISE.
- STEP 2. LIFT THE THEODOLITE FROM THE TRIBRACH ASSEMBLY.

Figure 4-3. Tribrach assembly, removal and installation.

Section X. ILLUMINATION MIRRORS

4-17. General

Two identical rotatable illumination mirrors (fig. 1-1) are used to reflect available natural light through the illuminating prisms within the theodolite and onto the reading circles. At night and on dark days the illumination mirrors are not used.

4-18. Illumination Mirrors

a. *Removal.* Refer to figure 4-4 and remove the illumination mirrors.

b. *Disassembly.* Refer to figure 4-5 and disassemble the illumination mirrors.

c. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat.

Flash point of solvent is 100 0 F.-138 °
F. (380 C.-59 a C.)

(1) Clean the metal parts with a soft cloth moistened with an approved cleaning solvent. Clean the mirror with a camel's hair brush if dusty, and with the chamois if foggy.

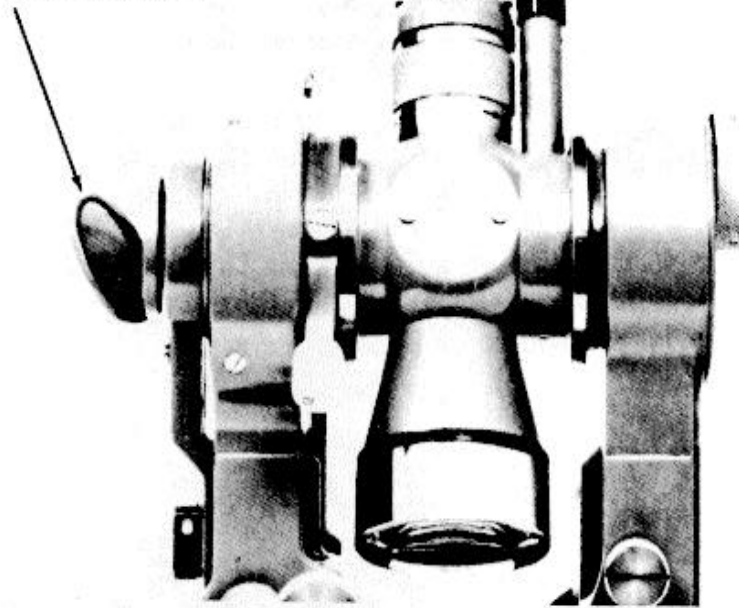
(2) Inspect the hinge action for stiff or loose movement. It should remain in the position where placed. Inspect the push-fit mirror mounting for close fit, distortion, and other damage. Oil the hinge sparingly if needed and wipe off all excess oil. Inspect for a lost, cracked, or broken mirror.

(3) Replace a defective illumination mirror.

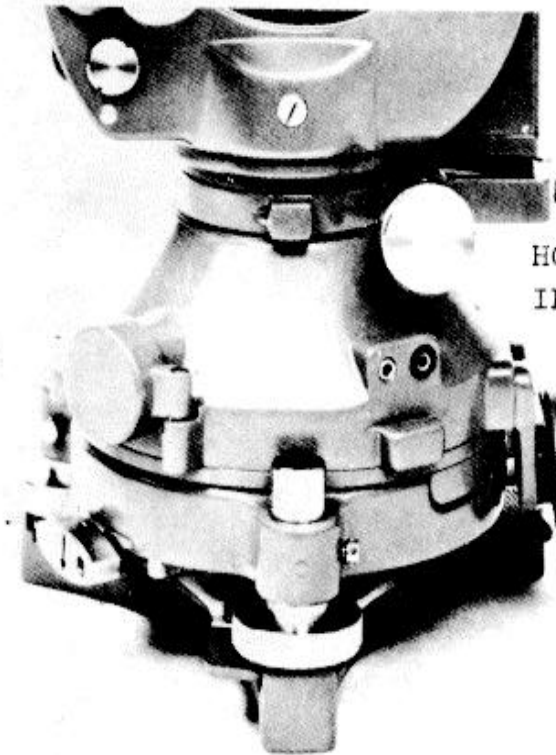
d. *Reassembly.* Refer to figure 4-5 and reassemble the illumination mirrors.

e. *Installation.* Refer to figure 4-4 and install the illumination mirrors.

VERTICAL CIRCLE
ILLUMINATION MIRROR



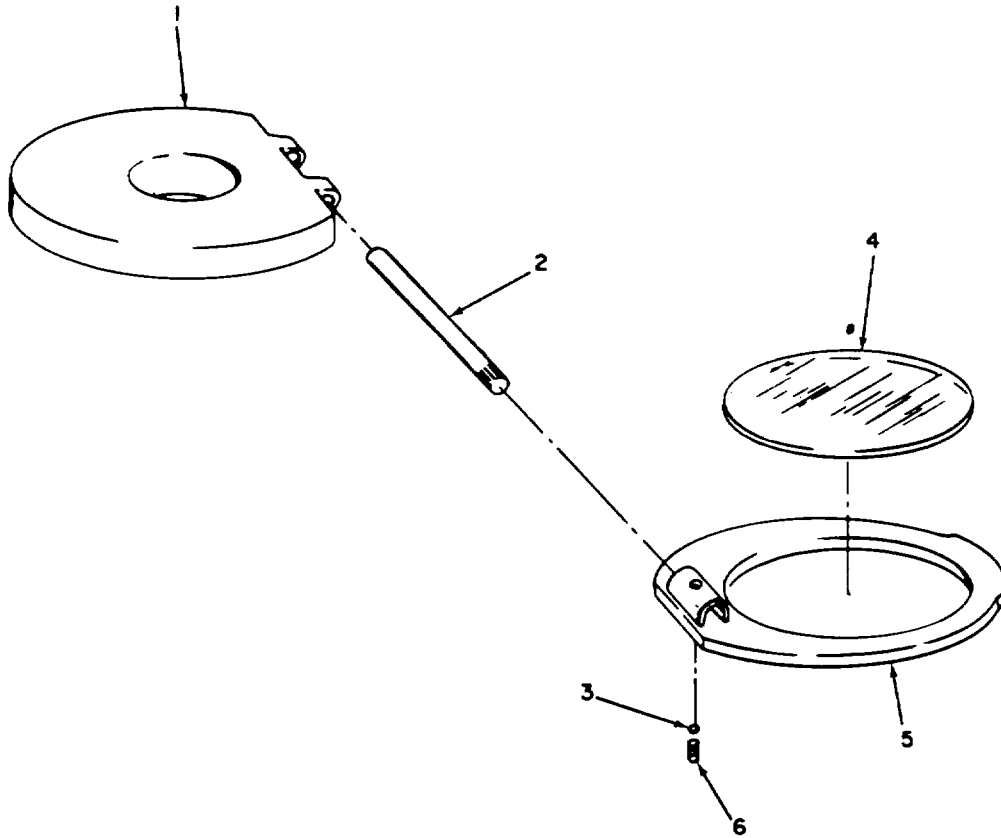
NOTE: REMOVE ILLUMINATION MIRRORS BY PULLING OUTWARD WITH A TWISTING MOTION.



HORIZONTAL CIRCLE
ILLUMINATION MIRROR

TS008813

Figure 4-4. Illumination mirrors, removal and installation.



1. Mirror sleeve 2. Mirror axis 3. Pin 4. Mirror 5. Mirror mount 6. Setscrew

Figure 4-5. Illumination mirrors, disassembly and reassembly.

Section XI. TRIPOD ASSEMBLY, PLUMB BOB, AND TRIPOD WRENCH

4-19. General

The tripod assembly is of the extension leg type which consists of the tripod head, tripod leg assemblies, and the cover plate. When the theodolite is being used for surveying work and other precision measuring, it is mounted on the tripod head. The plumb bob and tripod wrench are kept in the tripod accessory case mounted on one of the tripod legs. When installed on the tripod, the plumb bob makes it possible to center the instrument exactly over the station point. The tripod wrench is used to tighten or loosen the clamping screws under the tripod head to hold the tripod legs in position.

4-20. Tripod Assembly

a. *Disassembly.* Refer to figure 4-6 and disassemble the tripod assembly.

b. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 ° F.-138 ° F. (38 ° C.-59 ° C.)

(1) Clean all parts with an approved cleaning solvent and dry thoroughly. Clean the wooden parts with a soft cloth moistened with water and dry thoroughly. Clean the strap with saddle soap.

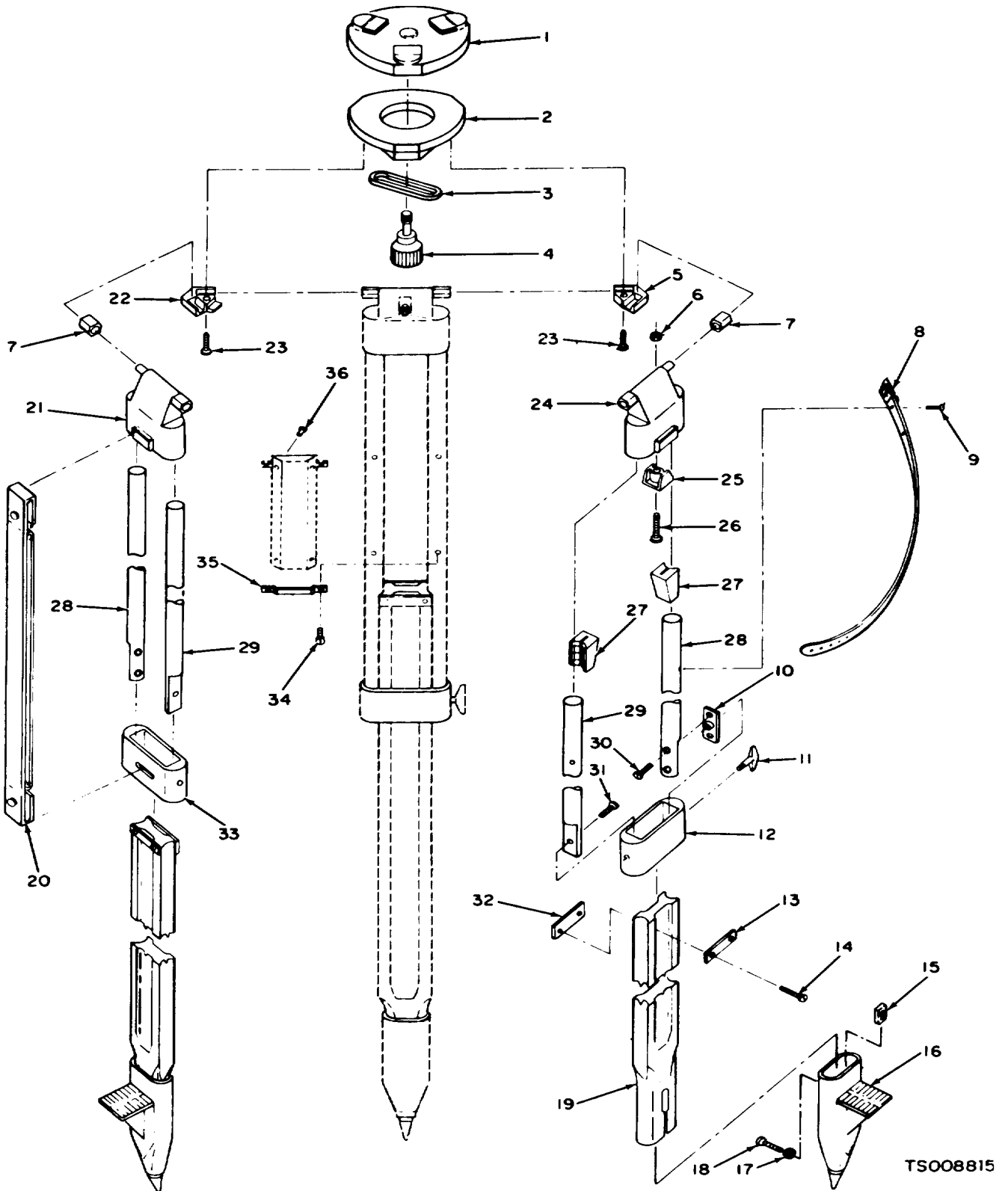
(2) Inspect the tripod leg housings and cover for burrs, cracks, and wear. Inspect the head and cover for burrs, scratches, cracks, and breaks. Inspect the bridge for bends, burrs, wear, and damage. Inspect the clamps, shoes, and battery box bracket for cracks, breaks, and wear.

(3) Inspect the strap for cuts, wear, and damaged seams. Inspect the wooden legs for cracks, splits, wear, and warping.

(4) Remove all burrs and scratches. Straighten dents and bends. Surfaces normally painted shall be painted in accordance with MIL- T-704, Type B. The instrument contact surface of the tripod head and the threaded portion of the instrument fastener shall not be painted.

(5) Replace all defective parts that cannot be repaired.

c. *Reassembly.* Refer to figure 4-6 and reassemble the tripod assembly.



TSO08815

Figure 4-6. Tripod, disassembly and reassembly.

KEY to fig. 4-6:

- | | |
|------------------------------|----------------------|
| 1. Plastic tripod head cover | 19. Wooden leg (3) |
| 2. Tripod head plate | 20. Carrying strap |
| 3. Washer | 21. Legholder |
| 4. Central fixing screw | 22. Clamp jaw |
| 5. Clamp jaw (2) | 23. Screw (3) |
| 6. Nut (3) | 24. Legholder (2) |
| 7. Bearing (6) | 25. Wedge (3) |
| 8. Leather strap | 26. Screw (3) |
| 9. Screw | 27. Bracket (6) |
| 10. Plate clamp (3) | 28. Wooden dowel (3) |
| 11. Wing screw (3) | 29. Wooden leg (3) |
| 12. Clamp band (2) | 30. Screw (6) |
| 13. Stop plate (3) | 31. Screw (31) |
| 14. Screw (6) | 32. Stop plate (3) |
| 15. Nut (31) | 33. Clamp band |
| 16. Shoe (3) | 34. Screw (4) |
| 17. Washer (3) | 35. Bracket (2) |
| 18. Screw (3) | 36. Rivet (4) |

4-21. Plumb Bob and Tripod Wrench

a. Plumb Bob.

(1) *Disassembly.* Refer to figure 4-7 and disassemble the plumb bob.

(2) *Cleaning, inspection, and repair.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 °F. -138° F. (38 0 C.-59 0 C.)

(a) Clean all metal parts with an approved cleaning solvent and dry thoroughly.

(b) Inspect the bayonet socket, ring, slide, and plumb bob for signs of wear, cracks, or breaks. Inspect the lugs on the bayonet socket for burrs. Inspect the cord for wear.

(c) Remove all burrs and replace damaged or defective parts. Use new cord when re- assembling the plumb bob.

(3) *Reassembly.* Refer to figure 4-7 and reassemble the plumb bob.

b. Tripod Wrench.

(1) *Removal.* Remove the tripod wrench from the tripod accessory case (fig. 2-4).

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 0 F.-138° F. (38l C. -590C.)

(2) *Cleaning, inspection and repair.* Clean the wrench with an approved cleaning solvent and dry thoroughly. Inspect the wrench for wear, burrs, cracks, or breaks. Remove minor burrs from the wrench. Check to see whether the wrench engages the bolts on the tripod head in a satisfactory manner. Replace a damaged or defective tripod wrench. Stow the wrench in the tripod accessory case.

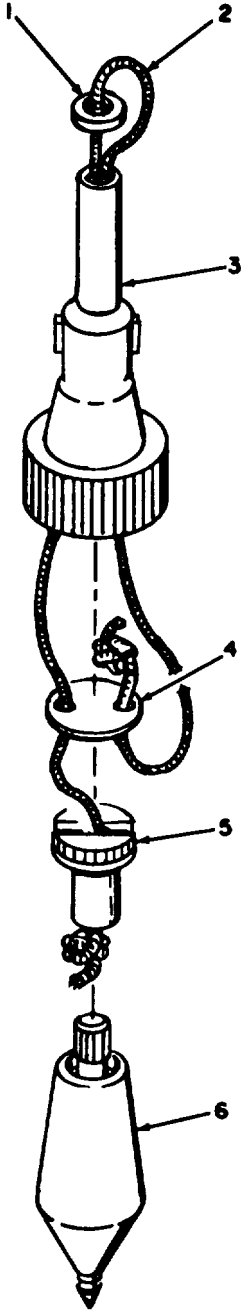


Figure 4-7. Plumb bob, disassembly and reassembly.

KEY to fig. 4-7:

- | | |
|-------------------|-------------------|
| 1 Ring | 4. Adjuster slide |
| 2 String | 5. Nut |
| 3. Bayonet socket | 6. Plumb bob |

Section XII. ACCESSORIES

4-22. General

The accessories consist of a plastic cover to protect the theodolite when not in use; a black sunglass which protects against eye damage when performing observations against direct sunlight; two lamp fittings used to install the illumination system; two adjusting pins and a screwdriver used to adjust the horizontal axis, vertical reading assembly, and vertical collimation level; a soft brush and chamois used to clean the theodolite; a grease container used to store approved lubricant; and diagonal microscope and telescope eyepieces used for high angle observations. When not in use all accessories are stored in the accessory case.

4-23. Adjusting Pins and Screwdriver

- a. *Removal.* Remove the adjusting pins and screwdriver from the accessory case (fig. 2-5i).
- b. *Cleaning, inspection and repair.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° F.-138 F. (380 C.-590 C.)

- (1) Clean adjusting pins and screwdriver with an approved solvent and dry thoroughly.
- (2) Inspect adjusting pins and screwdriver for bends, nicks, scratches, burrs, and damage.
- (3) Remove all burrs and scratches; straighten dents and bends.
- (4) Replace defective adjusting pin or screwdriver.
- c. *Installation.* Install adjusting pins and screwdriver in accessory case (fig. 2-5).

4-24. Black Sunglass

- a. *General.* The black sunglass is push-fit on the telescope eyepiece (fig. 2-5).
- b. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 ° F.-138 ° F. (380 C.- 59 ° C.)

- (1) Clean the metal part of the black sunglass using clean cloth dampened with an approved cleaning solvent.
- (2) Clean the lens with a soft brush, lens tissue or an approved cleaning solvent.
- (3) Inspect the eyepiece for bent or cracked metal parts.
- (4) Replace a defective black sunglass.

4-25. Diagonal Telescope and Diagonal Microscope Eyepieces

- a. *Removal.* Refer to figure 2-13 and remove the diagonal eyepieces.
- b. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 1000 F.-138 ° F. (380 C.-59 0 C.)

- (1) Clean all parts except the lenses with a clean cloth dampened with an approved cleaning solvent.
- (2) Clean the lenses with a soft brush, lens tissue, or an approved cleaning solvent.
- (3) Inspect the lenses for chips, cracks and fungus etching. Inspect the metal parts for bends, breaks, and worn or damaged threads.
- (4) Replace defective diagonal eyepieces.
- c. *Installation.* Refer to figure 2-13 and install the diagonal eyepieces.

4-26. Dust Brush, Chamois, and Plastic Cover

- a. *General.* The dust brush and chamois are used to clean the theodolite. The plastic cover is used to protect the theodolite.
- b. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 1000 F.-138' F. (380C.-590C.)

- (1) Clean the dust brush with an approved solvent.

(2) Clean plastic cover with a clean cloth dampened with an approved solvent.

(3) Inspect dust brush for loose, frayed, or broken bristles.

(4) Inspect plastic cover for cracks and rips.

(5) Inspect chamois for rips and frays.

(6) Replace defective dust brush, plastic cover or chamois.

4-27. Grease Container

a. *General.* The grease container is used to store approved lubricant.

b. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° F-138°F.(38°C.-59°C.)

(1) Clean grease container with a clean cloth dampened with an approved solvent.

(2) Inspect grease container for cracks, chips, and wear.

(3) Replace defective grease container.

4.28. Lamp Fittings

a. *Removal.* Refer to figure 3-2 and remove the lamp fittings.

b. *Cleaning and Inspection.*

WARNING

Dry cleaning solvent, P-D680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° F.-138° F. (38 ° C.-59 ° C.)

(1) Clean lamp fittings with cloth dampened with an approved solvent.

(2) Inspect lamp fittings for worn or damaged threads, bent or broken metal parts, chips or cracks.

(3) Replace defective lamp fittings.

c. *Installation.* Refer to figure 3-2 and install the lamp fittings.

4-29. Accessory Case

a. *General.* The accessory case is used to stow all accessories when not in use (fig. 2-5).

b. *Cleaning and Inspection.*

(1) Brush the accessory case free of dust and dirt.

(2) Inspect the accessory case for rips, torn straps, and damage defects that would render it unserviceable.

(3) Replace defective accessory case.

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT

Section I.

MAINTENANCE INSTRUCTIONS

5-1. Tools and Equipment

Tools, equipment, and repair parts issued with troop installed, or authorized for the theodolite are listed in the basic issue items list and items troop installed or authorized list, Appendix B.

general support maintenance on the theodolite are listed in table 5-1. References and illustrations indicating the use of these tools are listed in the table. No special equipment is required by organizational maintenance personnel for performing maintenance on the theodolite.

5-2. Special Tools and Equipment

The special tools required to perform direct support and

Table 5-1. Special Tools

Item	NSN or Reference No	Reference		Use	Fig * *
		Figure	Paragraph		
Pin, adjusting	(89905)* 6675-00-353-4103	2-5	2-9	Adjusting theodolite adjusting screws.	
Wrench, tripod	(89905)* 5120-00-378-9520	2-4	2.2	Tripod leg adjustment, removal, and installation.	
Wrench, Tripod	(89905)* None		6-2	To remove and install base plate nut and lock nut.	5-1

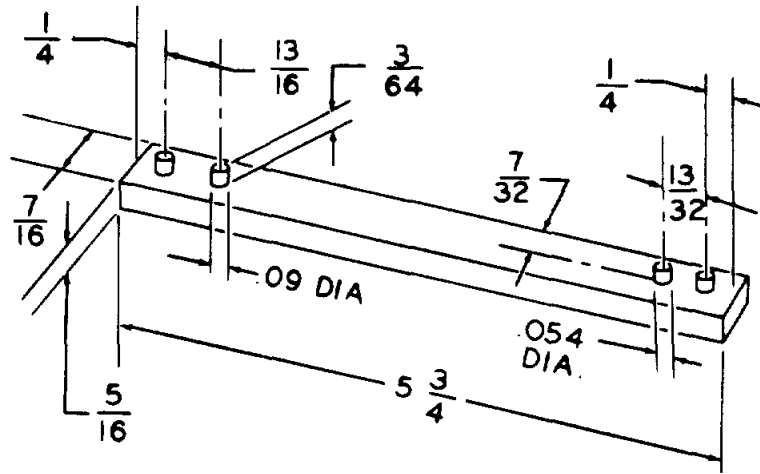
* Federal supply code for manufacturer

* * Fabrication drawings in this manual

5-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list, TM 5-6675-306-

24P, covering direct support and general support maintenance of this equipment.



TRIPOD BASE WRENCH

BODY - STEEL
PINS - STEEL

TSO08817

Figure 5-1. Tripod base wrench, fabrication.

Section II. TROUBLESHOOTING

5-4. Scope

a. This section contains troubleshooting or malfunction information and tests for locating and correcting most of the troubles which may develop in the theodolite. Each malfunction or trouble symptom for an individual component, unit, or system is followed by a list of tests or inspections necessary for you to determine probable causes and suggested corrective actions for you to remedy the malfunction.

b. This manual cannot list all possible malfunctions that may occur or all tests or inspections, and corrective

actions. If a malfunction is not listed, or is not corrected by listed corrective actions, you should notify higher level maintenance.

c. Table 5-2 lists the common malfunctions that you may find during the operation or maintenance of the theodolite or its components. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

If you have a malfunction which is not listed in this table, notify the next higher level of maintenance.

Table 5-2. Troubleshooting

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
THEODOLITE		
1. THEODOLITE WILL NOT SEAT PROPERLY ON TRIPOD HEAD	Step 1. Check alignment of the central fixing screw.	Restart central fixing screw (fig. 2-9).
	Step 2. Inspect tribrach assembly for defects.	Replace a defective tribrach assembly (fig. 1-2).
	Step 3. Tripod head defective.	Replace a defective head (fig. 4-6).
	Step 4. Base plate defective.	Repair or replace base plate (fig. 6-1).
2. THEODOLITE WILL NOT STAY ON LINE	Step 1. Check theodolite for level.	Level theodolite. (1) Position theodolite on tripod head and secure with central fixing screw (fig. 2-9). (2) Center circular level bubble using footscrews.
	Step 2. Plate level or collimation level out of adjustment.	a. Adjust plate level (fig. 2-15). b. Adjust collimation level (fig. 2-16).
3. LIGHTS ON VERTICAL AND HORIZONTAL CIRCLES UNEQUAL OR ABSENT	Step 1. Illumination lamp defective.	Replace lamp (fig. 3-2).
	Step 2. Batteries defective.	Replace batteries (fig. 3-2).
	Step 3. Horizontal or vertical circle illuminating mirror defective.	Replace mirror (fig. 4-4).
4. TRIPOD LEG WILL NOT LOCK IN POSITION	Leg clamping screws loose.	Tighten or replace screws (fig. 4-6).
5. HORIZONTAL CIRCLE HARD TO MOVE	Circle drive knob out of adjustment.	Adjust knob (fig. 2-17).
6. FOOTSCREWS TOO TIGHT OR LOOSE	Footscrews out of adjustment.	Adjust footscrews (fig. 2-18).
7. TELESCOPE TURNS TOO HARD OR TOO EASILY	Telescope clamp not properly adjusted.	Adjust clamp (fig. 2-14).
8. CIRCULAR LEVEL BUBBLE DOES NOT STAY IN CENTER	Step 1. Circular level out of adjustment.	Adjust circular level (fig. 2-21).
	Step 2. Circular level defective.	Replace circular level (fig. 5-4).

Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND AUXILIARIES

5-5. Tribrach Assembly

a. *Removal.* Refer to figure 4-3 and remove the tribrach assembly.

b. *Installation.* Refer to figure 4-3 and install the tribrach assembly.

5-6. Base Plate and Footscrews

a. *Removal.* Refer to figure 5-2 and remove the base plate with the three footscrews attached from the base casting.

b. *Installation.* Refer to figure 5-2 and install the base plate and footscrew.

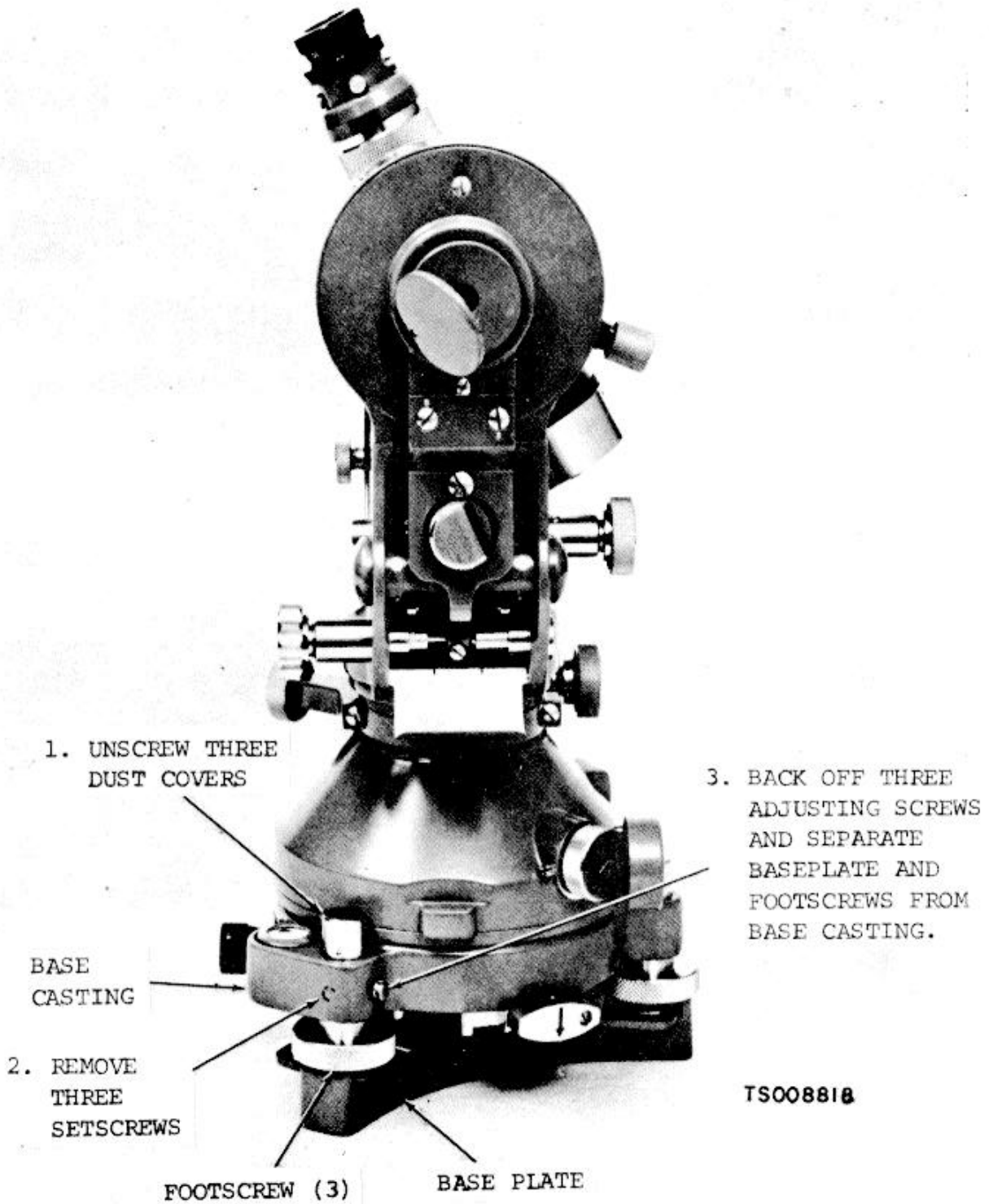


Figure 5-2. Base plate and footscrews, removal and installation.

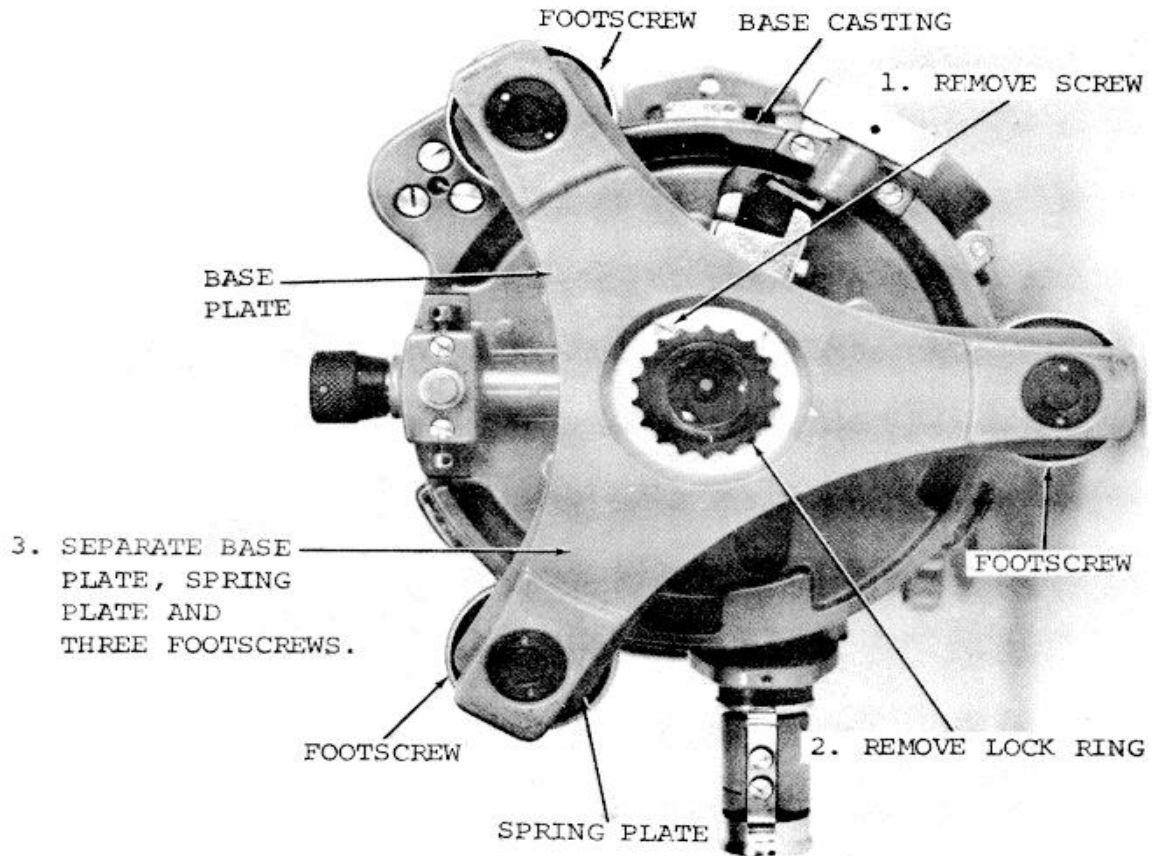
5-7. Footscrew Assembly

a. Removal.

- (1) Refer to figure 5-2 and remove the base plate.
- (2) Refer to figure 5-3 and remove the three footscrew assemblies.

b. Installation.

- (1) Refer to figure 5-3 and install the three footscrew assemblies.
- (2) Refer to figure 5-2 and install the base plate.



TS008819

Figure 5-3. Footscrew assemblies, removal and installation.

5-8. Locking Plate, Lock Knob and Circular Level

a. Removal.

(1) Refer to figure 5-2 and remove the base plate and footscrews.

(2) Refer to figure 5-4 and remove the locking plate, lock knob and circular level.

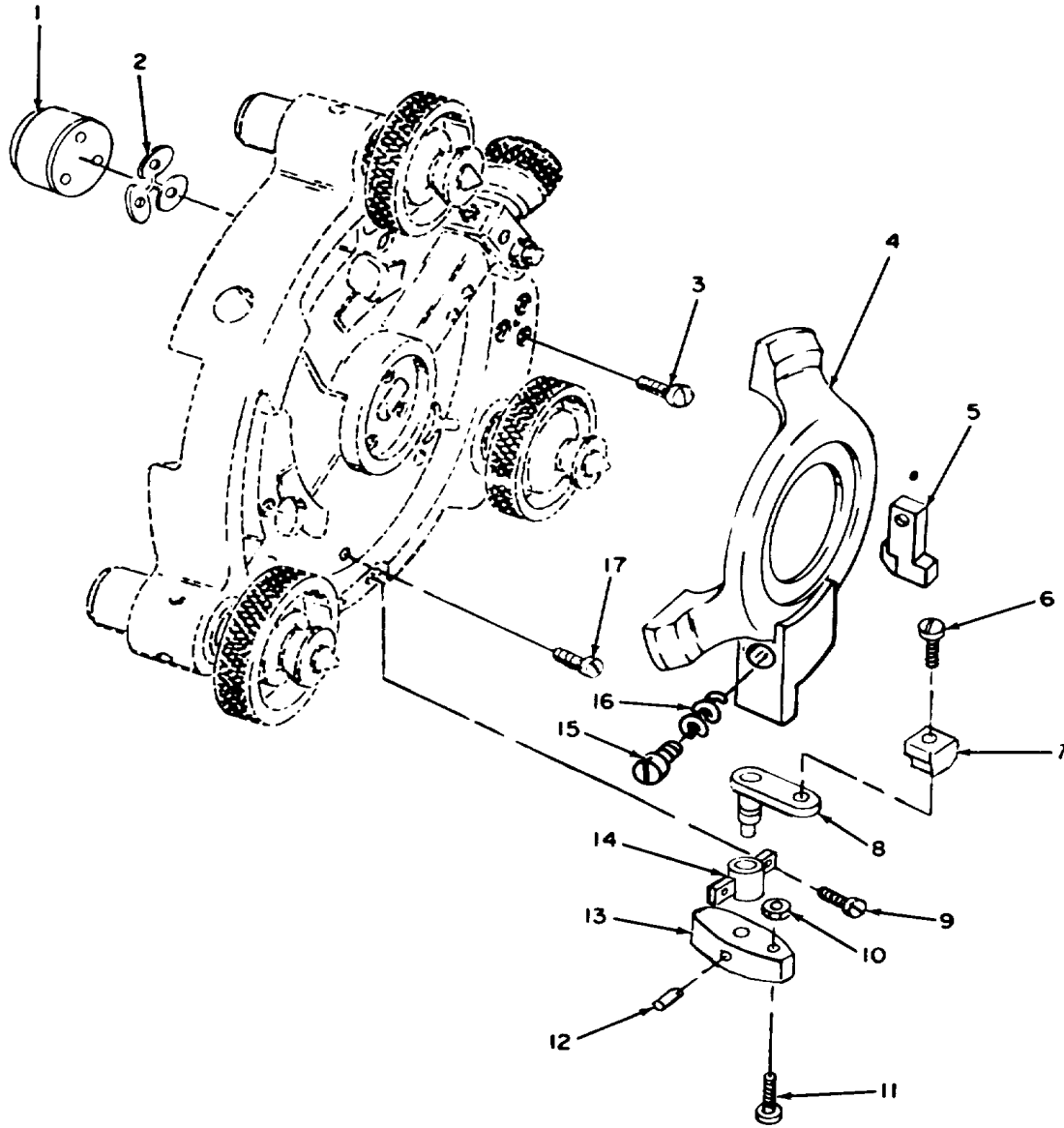
b. Installation.

(1) Refer to figure 5-4 and install the locking plate, lock knob and circular level.

(2) Refer to figure 5-2 and install the base plate and footscrews.

KEY to figure 5-4:

- | | |
|--|-------------------|
| 1. Circular level vial | 10. Nut |
| 2. Spring washer | 11. Machine screw |
| 3. Machine screw (3) | 12. Pin |
| 4. Lock plate | 13. Lock knob |
| 5. Stop | 14. Bearing |
| 6. Machine screw | 15. Machine screw |
| 7. Clamp chuck | 16. Spring |
| 8. Locking lever | 17. Machine screw |
| 9. Lock knob assembly mounting screw (2) | |



TS008820

Figure 5-4. Locking plate, lock knob and circular level, removal disassembly and installation.

5-9. Accessories

a. Removal. Remove all accessories from accessory case (fig. 2-5).

b. Installation. Store all accessories in accessory case (fig. 2-5).

5-10. Black Sunglass

a. Removal. Remove black sunglass from accessory case (fig. 2-5). If installed, carefully pull black sunglass from telescope eyepiece or telescope diagonal eyepiece.

b. Installation. Store black sunglass in accessory case; install by pushing black sunglass over telescope eyepiece or telescope diagonal eyepiece.

5-11. Lamp Fittings

a. Removal. Refer to figure 3-2 and remove the lamp fittings.

b. Installation. Refer to figure 3-2 and install the lamp fittings.

5-12. Diagonal Telescope and Diagonal Microscope Eyepieces

a. Removal. Refer to figure 2-13 and remove the diagonal eyepieces.

b. Installation. Refer to figure 2-13 and install the diagonal eyepieces.

5-13. Illumination Mirrors

a. Removal. Refer to figure 4-4 and remove the illumination mirrors.

b. Installation. Refer to figure 4-4 and install the illumination mirrors.

5-14. Sunshade

a. Removal. Carefully pull the sunshade from the telescope objective (fig. 2-13). If in stored position, twist sunshade so that slot in sunshade is aligned with front sight; then pull sunshade from telescope objective.

b. Gently push sunshade over telescope objective so that edge of sunshade is against front sight (fig. 2-13). To store, align slot in sunshade with front sight; then push sunshade over telescope objective and twist slightly to lock in place.

5-15. Handlamp and Connecting Cable

a. Removal. Remove handlamp and connecting cable from battery box.

b. Installation. Store handlamp and connecting cable in battery box.

CHAPTER 6

REPAIR OF TRIBRACH ASSEMBLY

Section I. GENERAL

6-1. Description

The tribrach assembly consists of the base plate, locking plate, footscrews, circular level, optical plummet, and lock knob. The tribrach assembly forms a leveling base between the theodolite and the tripod head. The base plate provides a means

for securing the theodolite to the tripod, with the utilization of the tripod central fixing screw. Leveling is accomplished by means of the foot-screws. Precise location of the theodolite over the station point is verified by sighting through the optical plummet.

Section II. TRIBRACH ASSEMBLY COMPONENTS

6-2. Base Plate

(2) Refer to figure 5-2 and remove the base plate.

a. General. The base plate is used to secure the theodolite to the tripod by means of the tripod central fixing screw.

c. Disassembly. Refer to figure 6-1 and disassemble the base plate.

b. Removal.

(1) Refer to figure 4-3 and remove the tribrach assembly.

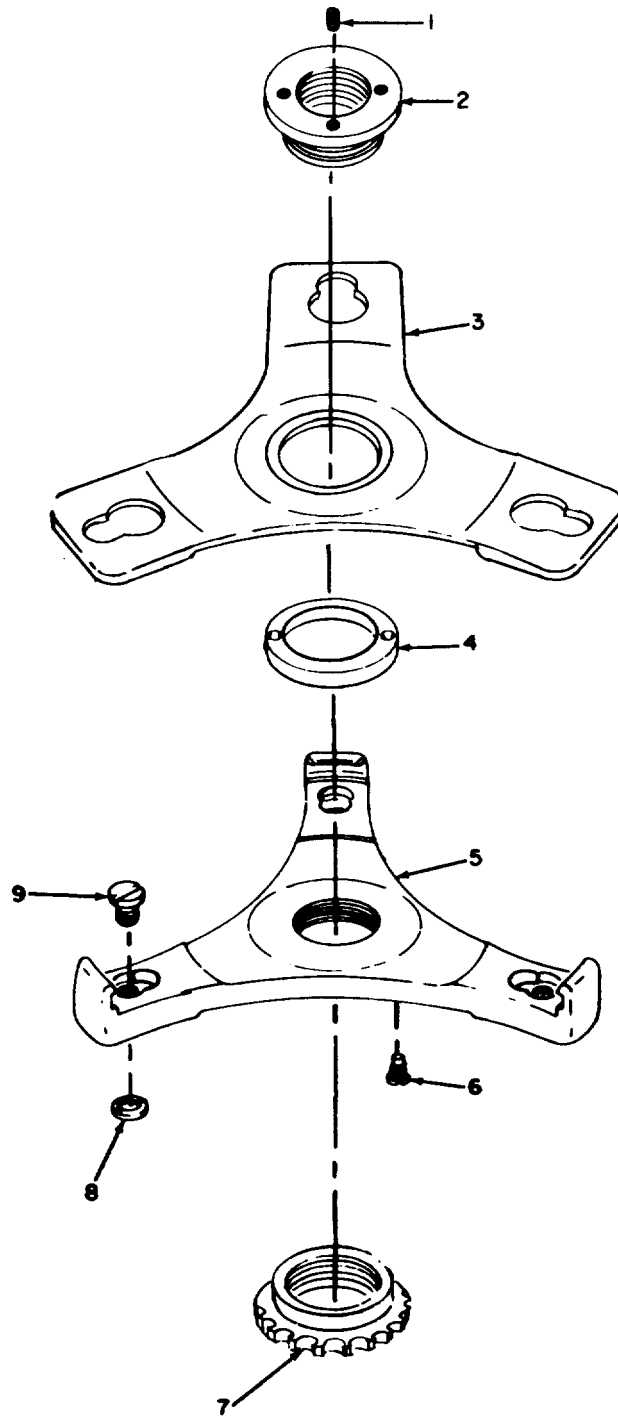


Figure 6-1. Base plate, disassembly and reassembly.

NOTE

Tripod base wrench (fig. 5-1) required to remove and install center nut (2) and lock nut (6).

KEY to fig. 6-1:

- | | |
|-----------------|--------------|
| 1. Setscrew | 6. Screw |
| 2. Center nut | 7. Lock ring |
| 3. Spring plate | 8. Lock nut |
| 4. Lock nut | 9. Pad |
| 5. Base plate | |

d. *Cleaning, inspection, and repair.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 1000 F.-138 0 F. (38 0 C.-59 ° C.)

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the base plate and the spring plate for dents, cracks, breaks, and burrs. Inspect all threaded parts and hardware for worn or damaged threads.

(3) Remove all burrs and dents.

(4) Replace all defective parts that cannot be repaired.

e. Reassembly. Refer to figure 6-1 and reassemble the base plate.

f. Installation.

(1) Refer to figure 5-2 and install the base plate.

(2) Refer to figure 4-3 and install the tribrach assembly.

6-3. Footscrews

a. General Three footscrews are used to level the theodolite.

b. Removal.

(1) Refer to figure 4-3 and remove the tribrach assembly.

(2) Refer to figure 5-2 and remove the base plate.

(3) Refer to figure 5-3 and remove the footscrews.

c. Disassembly. Refer to figure 6-2 and disassemble the footscrews.

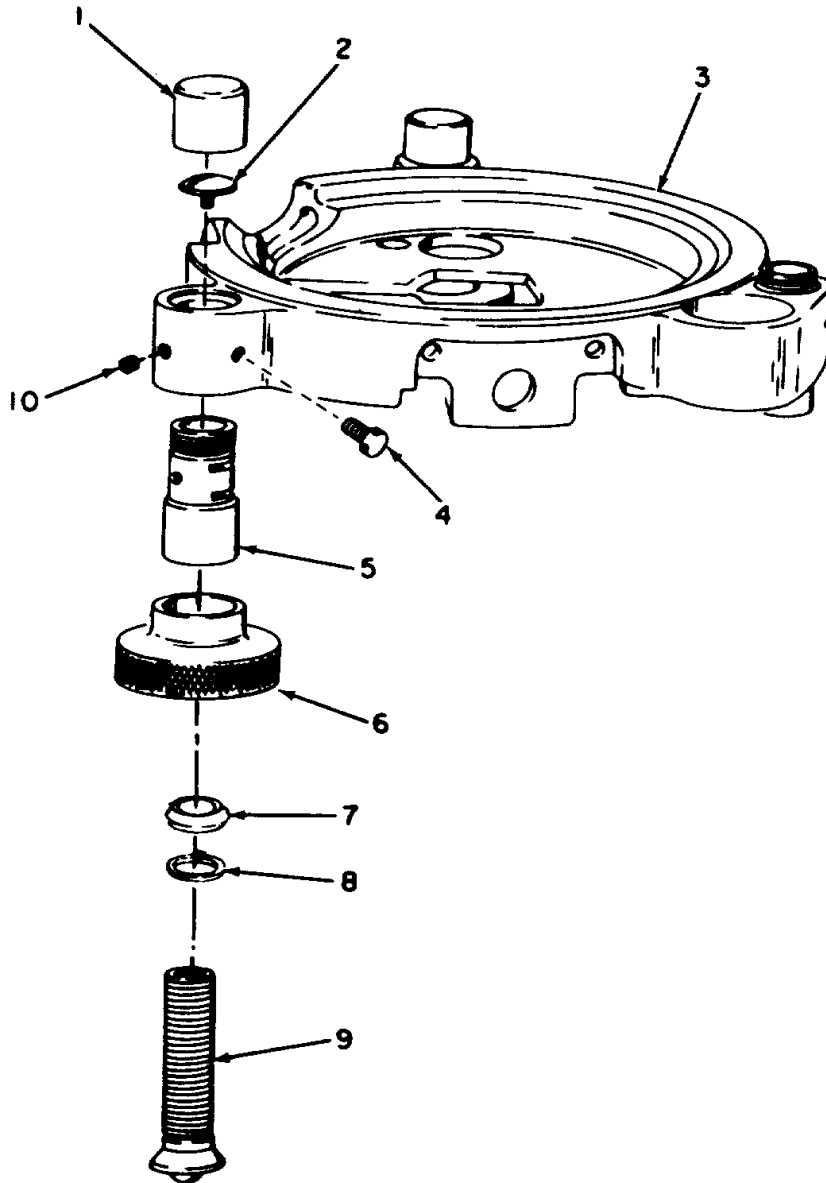


Figure 6-2. F9tscfw assembly, disassembly and reassembly.

CAUTION

Stop screw (2) has a left-hand thread.

KEY to fig. 6-2

- | | |
|-------------------------------------|----------------------|
| 1. Dust cover (3) | 6. Milled knob (3) |
| 2. Stop screw 13) | 7. Washer (3) |
| 3. Base casting 11) | 8. Washer (3) |
| 4. Adjusting screw (3) | 9. Machine screw 131 |
| 5. Adjustable nut (3) | 10. Setscrew 13) |
| d. Cleaning, inspection and repair. | |

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 ° F.-138 ° F. (38 0 C.-59 0 C.)

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the spindles for bends. Inspect all threaded parts for worn or damaged threads.

(3) Replace all defective parts that cannot be repaired.

e Reassembly. Refer to figure 6-2 and reassemble the footscrews.

f *Installation.*

(1) Refer to figure 5-3 and install the footscrews.

(2) Refer to figure 5-2 and install the base plate.

(3) Refer to figure 4-3 and install the tribrach assembly.

6-4. Locking Plate, Lock Knob and Circular Level

a. *General.* The locking plate is used to secure the theodolite to the tribrach assembly. The lock knob is used to release the theodolite from the tribrach. The circular level is used to level the theodolite.

b. *Removal.*

(1) Refer to figure 5-2 and remove the base plate and footscrews.

(2) Refer to figure 5-4 and remove the locking plate, lock knob, and circular level (para 5-8).

c. *Disassembly.* Refer to figure 5-4 and disassemble the lock knob and locking plate.

d. *Cleaning, inspection and repair.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent* is 100 0 F.-138 ° F. (38°C.-59°C.-59°C.)

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Wipe the level vial with lens tissue or a lens cloth.

(2) Inspect the level vial for cracks, scratches, and broken vial tip. Inspect the locking plate, stop plate and lever for bends, burrs, and cracks. Inspect the springs for cracks. Inspect all threaded parts for worn or defective threads.

(3) Remove all burrs and straighten bends.

(4) Replace all defective parts that cannot be repaired.

e *Reassembly.* Refer to figure 5-4 and reassemble the locking plate and lock knob.

f. *Installation.*

(1) Refer to figure 5-4 and install the circular level, locking plate, and lock knob.

(2) Refer to figure 5-2 and install the base plate.

CHAPTER 7

REPAIR OF BATTERY BOX, HANDLAMP AND CONNECTING CABLE, AND LAMP FITTINGS

Section I. GENERAL

7-1. Description

The illumination system consists of two lamp fittings and a battery box, with a rheostat to control the intensity of light illuminating the horizontal, vertical, and micrometer

circles. A handlamp with a connecting cable that plugs into the battery box is also provided for general external lighting purposes.

Section II. BATTERY BOX, HANDLAMP AND CONNECTING CABLE AND LAMP FITTINGS

7-2. Battery Box

a. *General.* The battery box stores the batteries which provide power for the illumination system. A rheostat on the battery box controls illumination brightness.

b. *Disassembly.* Refer to figure 7-1 and disassemble the battery box.

c. *Cleaning, inspection, and repair.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 ° F.- 138 ° F. (38 ° C.-59 ° C.)

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Wipe all corrosion from terminals and contacts. Wipe dirt and other foreign

matter from cables, lamp trunk, springs, washers, and rheostat.

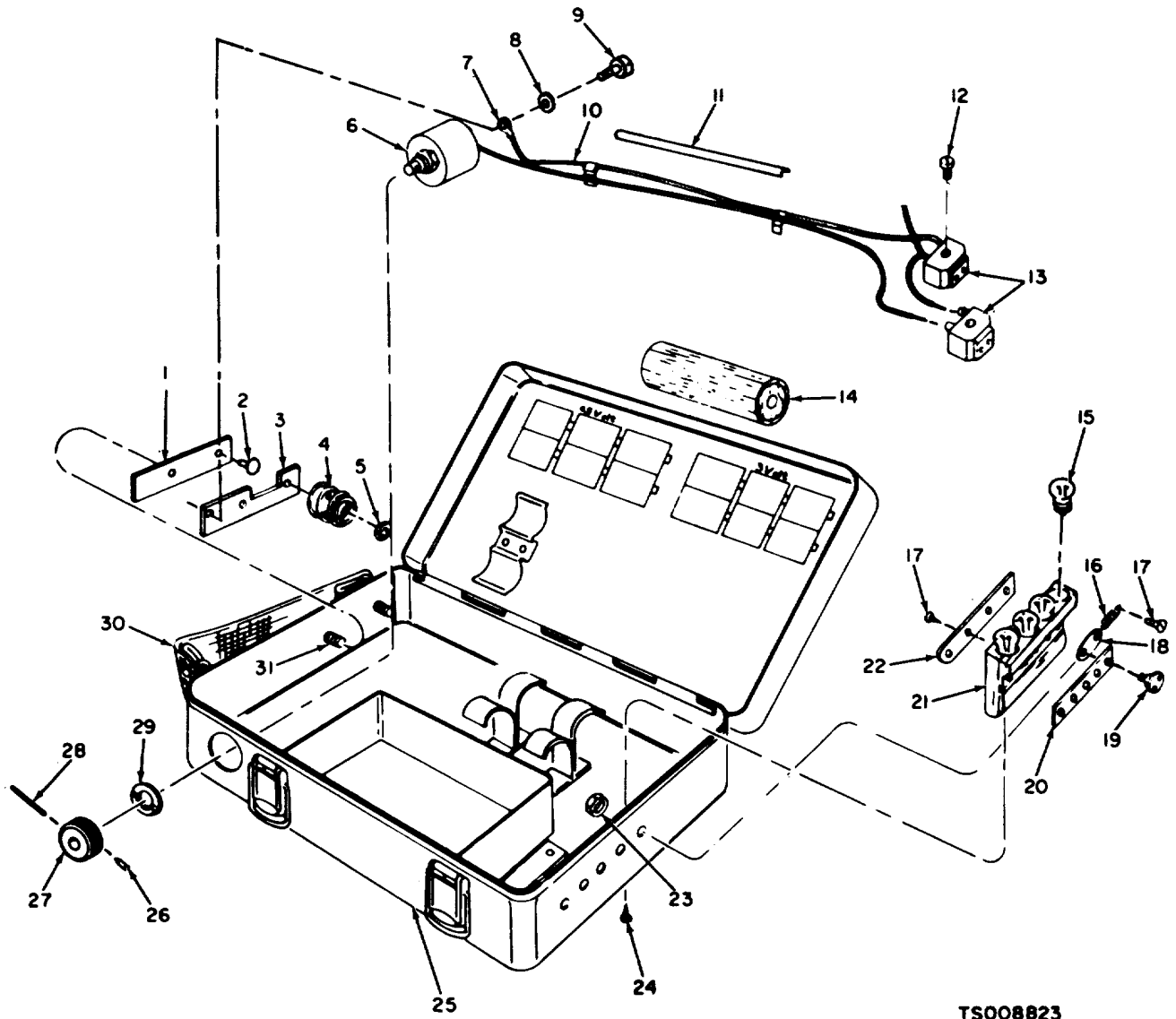
(2) Inspect the cables and contacts for cracked, swollen, or damaged insulation, broken wires, and defective terminals. Inspect the springs for bends, breaks, and fatigue.

(3) Inspect the lamp trunk for cracks and other damage. Inspect the rheostat for improper operation and other damage. Inspect the sockets for cracks and wear. Inspect the springs for bends, breaks, and fatigue. Inspect the contacts and slide lever for wear, burrs, and bends.

(4) Inspect the battery box for dents, cracks, and defective mounting bracket, clamps, and carrying strap.

(5) Remove all burrs and straighten dents. Replace all defective parts that cannot be repaired.

d Reassembly. Refer to figure 7-1 and reassemble the battery box.



TS008823

Figure 7-1. Battery box, disassembly and reassembly.

KEY to fig. 7-1:	16. Cover plate spring
1. Insulation plate	17. Wood screw (3)
2. Rivet (2)	18. Contact
3. Contact plate	19. Cover plate knob
4. Contact spring (2)	20. Cover plate
5. Nut (2)	21. Wood block
6. Rheostat	22. Contact plate
7. Cable clip	23. Nut
8. Spring	24. Wood screw (3)
9. Machine screw	25. Battery case
10. Electric cable	26. Setscrew
11. Insulation tube	27. Rheostat knob
12. Screw (2)	28. Pin
13. Electric plug (2)	29. Washer
14. Dummy battery (2)	30. Carrying strap
15. Bulb, 2.5V (4)	31. Screw 121

7-3. Handlamp and Connecting Cable

a. *General.* The handlamp is used for general external lighting purposes. The connecting cable is used to provide power from the battery box to the handlamp. When not in use the handlamp and connecting cable are stored in the battery box.

b. *Disassembly.* Refer to figure 7-2 and disassemble the handlamp and connecting cable.

c. *Cleaning, inspection, and repair.*

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 10° F.-138° F. (38° C.-59° C.)

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly.

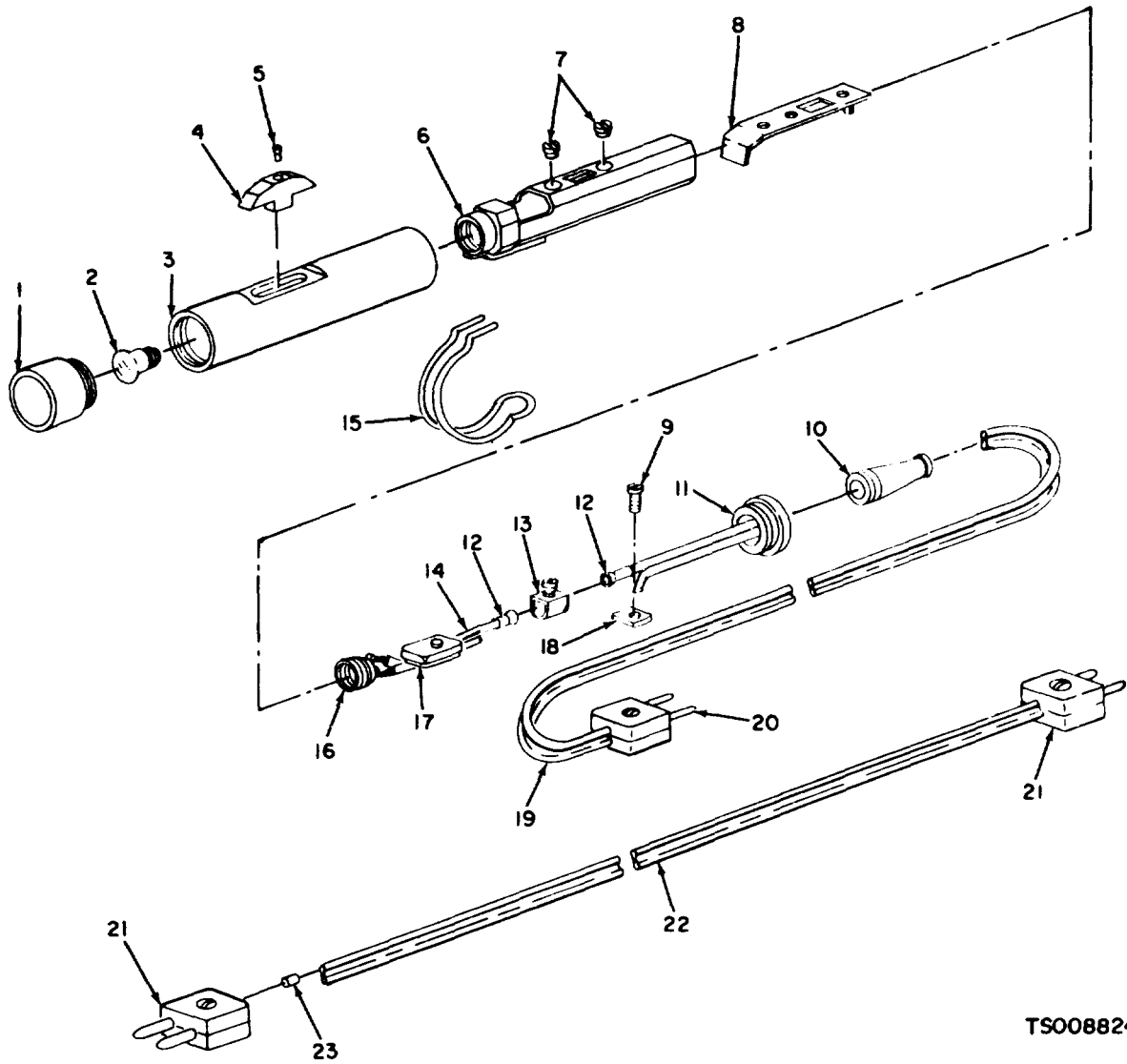
(2) Inspect the lamps for defects. Inspect all electrical contacts for breaks, wear, and corrosion.

(3) Inspect insulation for cracks, wear, and damage. Inspect the electrical cable for breaks and frayed insulation. Inspect the cable connectors for breaks and defective terminals.

(4) Inspect the housing and body for dents, rust, burrs, and other defects.

(5) Remove all burrs and straighten dents. Replace all defective parts that cannot be repaired.

d. *Reassembly.* Refer to figure 7-2 and reassemble the handlamp and connecting cable.



TSO08824

Figure 7-2. Handlamp and connecting cable, disassembly and reassembly.

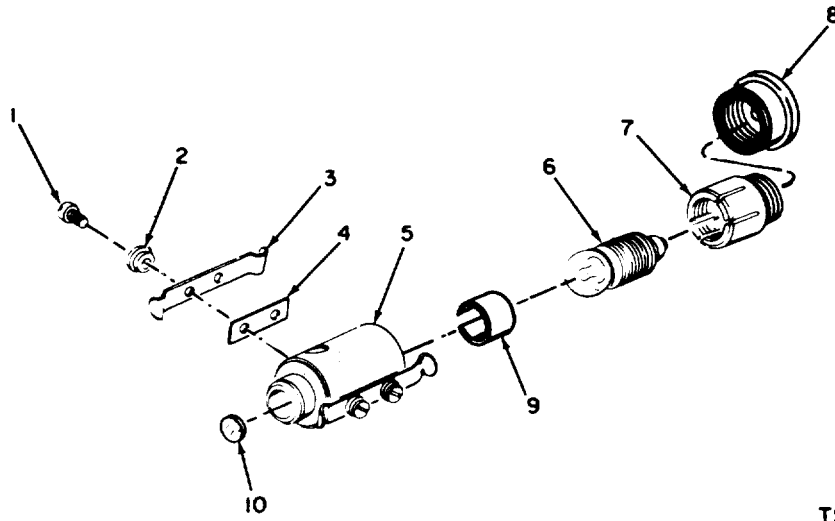
KEY to fig. 7-2:

- | | |
|----------------------|-------------------------|
| 1. Sleeve | 13. Wedge |
| 2. Bulb, 2.5V | 14. Copper wire |
| 3. Lamp housing | 15. Hook |
| 4. Switch slide | 16. Lampholder |
| 5. Screw | 17. Slide switch |
| 6. Insulation | 18. Plate |
| 7. Screw (21 | 19. Electric cable |
| 8. Contact spring | 20. Electric plug |
| 9. Screw | 21. Electric plug |
| 10. Rubber sleeve | 22. Electric cable |
| 11. End cover | 23. Insulating tube (4) |
| 12. Cable sleeve (4) | |

7-4. Lamp Fittings

a. General. The lamp fittings supply light for the vertical, horizontal, and micrometer circles. When not in use, the lamp fittings are stowed in the accessory case.

b. Disassembly. Refer to figure 7-3 and disassemble the lamp fittings.



TS008825

Figure 7-3. Lamp fittings, disassembly and reassembly.

KEY to fig. 7-3:

- | | |
|---------------------------|-----------------|
| 1. Screw (4) | 6. Bulb |
| 2. Insulation bushing (4) | 7. Lamp socket |
| 3. Contact spring (2) | 8. Housing |
| 4. Insulation plate (2) | 9. Cover plate |
| 5. Lamp housing | 10. Groundglass |

c *Cleaning, inspection, and repair.*

WARNING

Dry cleaning solvent, P-D680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° F-138°F.(38°C.-59°C.)

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Clean the groundglass with lens tissue or a lens cloth.

(2) Inspect the groundglass for cracks, chips, scratches, and etching. Inspect the lamp for defects. Inspect the contact springs for bends, wear, and fatigue. Inspect the insulators for wear and damage.

(3) Replace all defective parts that cannot be repaired.

d Reassembly. Refer to figure 7-3 and reassemble the lamp fittings.

APPENDIX A

REFERENCES

- A-1. Lubrication**
C910OIL Fuels, Lubricants, Oils, and Waxes
- A-2. Painting**
TM 9-213 Painting Instructions for Field Use
- A-3. Maintenance**
FM 29-2 Organizational Maintenance Management
TB 750-97-66 Maintenance Expenditure Limits for FSC Group 66
TM 38-750 The Army Maintenance Management System
TM 5-6675-306-24P Organizational, Direct Support and General Support Maintenance
Repair Parts and Special Tools List (Including Depot Maintenance
Repair Parts and Special Tools) 'Theodolite, Survey, Directional 1
Second Graduation; Wild Heerbrugg Model T2-74 Deg.
- A-4. Shipment and Storage**
TM 740-90-1 Administrative Storage of Equipment
- A-5. Demolition**
TM 750-244-3 Destruction of Equipment to Prevent Enemy Use

**APPENDIX B
COMPONENTS OF END ITEMS LIST**

B-1. Scope.

This appendix lists Integral Components of and Basic Issue Items (BII) for the directional theodolite to help you inventory items required for safe and efficient operation.

B-2. General.

The components of end item list are divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the directional theodolite and must accompany it whenever it is transferred or turned in. These illustrations will help you identify these items.

b Section II. Basic Issue Items. These are minimum essential items required to place the directional theodolite in operation, to operate it and to perform emergency repairs. Although shipped separately packed, they must accompany the directional theodolite during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII based on Table(s) of Organization and Equipment (TOE/Modification Table of Organization and Equipment (MTOE) authorization of the end item.

B-3. Explanation of Columns.

a. Illustration. This column is divided as follows:

(1) Figure Number. Indicates the figure number of the illustration on which the item is shown (if applicable).

(2) Item Number. The number used to identify item called out in the illustration.

b. National Stock Number (NSN). Indicates the national stock number assigned to the end item which will be used for requisitioning.

c. Part Number (P/N). Indicates the primary number used by the manufacturer which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards and inspection requirements to identify an item or range of items.

d. Description. Indicates the federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on the adjacent area.

f. Usable on Code. "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in this list are:

CODE	NOT APPLICABLE
------	----------------

g. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during inventory. Under the received column, list the quantity you actually receive on your major item. The date columns are for use when you inventory the major item at a later date, such as for shipment to another site.

Section II INTEGRAL COMPONENTS OF END ITEM

(1) ILLUSTRATION (A) FIGURE NO.		(2) (B) ITEM NO.	(3) NATIONAL STOCK NUMBER	(4) PART NO. & FSCM	(5) DESCRIPTION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCVD DATE DATE DATE		
4-3			6675-00-065-8527	314519 (89905)	Tribrach Assembly		1			
2-13			6675-00-979-8744	311850 (89905)	Sunshade		1			
2-14			6675-00-014-3516	360473 (89905)	Illumin- ation Mirror Assembly		2			
2-1					Case Assy Carrying consisting of:					
2-1			6675-00-037-0253	316055 (89905)	Hood Assy		1			
2-1			6675-00-963-6365	158656-74 (89905)	Base Assy		1			
2-2			6675-00-127-2857	316083 (89905)	Desiccant Container		1			
2-1			06675-00-036-5616 (89905)	316110	Case Shipping		1			
2-5					Case Acces- sory contain- ing the following:					
2-5	1		6675-00-980-0118 (89905)	134253	Case Acces- sory		1			
2-5	2		6675-00-014-3518 (89905)	311846	Cover,		1			
2-5	3		6675-00-378-9401 (89905)	284836	Instrument Sunglass, black		1			
2-5	9		6675-00-014-3519 (89905)	316106	Lamp Fittings		2			
2-5	10		6675-00-378-9497 (89905)	323133	Eyepiece, Telescope diagonal		1			
2-5	11		6675-00-378-9498	323134 (89905)	Eyepiece, Micro- scope diagonal		1			
2-6				Not Applicable	Battery Box Assy contain- ing the following:					
2-6			6675-00-997-4340	310443 (89905)	Box Assy		1			
2-6			6135-00-937-4118	310432 (89905)	Battery, Dummy		2			
2-6			6675-00-997-4341	246416 (89905)	Cable, Connecting		1			
2-6			6675-00-714-1375	268034 (89905)	Light, Hand		1			
2-7			6675-00-023-5052	202573 (89905)	Haversack		1			
2-8					Tripod Assy Extension Leg, consist- ing of:		1			
2-8			6675-00-641-3572	GST20-1 (89905)	Tripod Assy		1			
2-8			6675-00-378-9525	319062 (89905)	Cover, Tripod		1			
2-8			6675-00-036-	319164 (89905)	Tripod Accessory Case		1			
2-4	2		5120-00-011-8393	166494 (89905)	Wrench, Tripod		1			
2-4	3		5210-00-869-3744	319010 (89905)	Plumb Bob Assy w/adjuster		1			

Section II INTEGRAL COMPONENTS OF END ITEM

(1) ILLUSTRATION (A) FIGURE NO.		(B) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) PART NO. & FSCM	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCVD DATE DATE DATE		
					TM 5-6675- 00-306-14 Operator, Organization- al Direct Support, General Support Maintenance Manual						
2-5	6		7920-00-378- 9524	109335 (89905)	Brush, Dust	1					
2-5	8		8330-00-965- 1722	166684 (89905)	Chamois	1					
2-5	7		6675-00-446- 1762	167226 (89905)	Container, Lubricant	1					
2-6			6675-00-859- 5936	166370 (89905)	Lamps	4					
2-5	4		6675-00-353- 4103	109334 (89905)	Pin, Adjusting	2					
2-5	5		5120-00-446- 2860	166786 (89905)	Screw- driver, Jewelers	1					

Change 1 B-3/(B-4 blank)

**APPENDIX C
ADDITIONAL AUTHORIZATION LIST**

Section I. INTRODUCTION

C-1. Scope.

This appendix lists additional items you are authorized for the support of directional theodolite.

C-2. General.

This list identifies items that do not have to accompany the directional theodolite and that do not have to be

turned in with it. These items are authorized to you by CTA, MTOE, TDA or JTA.

C-3. Explanation of Listing.

National stock number, descriptions and quantities are provided to help you identify and request the additional items you require to support this equipment.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) PART NUMBER & FSCM	DESCRIPTION	USABLE ON CODE	(3) U/M	(4) QTY AUTH
6135-00-120-1020	BA30 (81349)	Battery, Dry, 1.5 Volts		EA	8

Change 1 C-1/(C-2 blank)

APPENDIX D

MAINTENANCE ALLOCATION CHART

D-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from Section II.

D-2. Explanation of Columns in Section II

a. Column (1), Group Number. Column 1 list group numbers to identify related components, assemblies, sub-assemblies, and modules and their next higher assembly. The applicable groups are listed in the MAC in disassembly sequence beginning with the first group removed.

b. Column (2), Component/Assembly. This column contains the noun names of components, assemblies, sub-assemblies and modules for which maintenance is authorized.

c. Column (3), Maintenance Functions. This column lists the functions to be performed on the item listed in Column 2. The maintenance functions are defined as follows:

(1) *Inspect*. To determine serviceability of an item by comparing its physical, mechanical, or electrical characteristics with established standards through examination.

(2) *Test*. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

(3) *Service*. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

(4) *Adjust*. To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

(5) *Align*. To adjust specified variable elements of an item to bring about optimum desired performance.

(6) *Calibrate*. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. Consists of comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared,

(7) *Install*. The act of employing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning equipment or system.

(8) *Replace*. The act of substituting a serviceable like type part, sub-assembly, or module (component or assembly) for an unserviceable counterpart.

(9) *Repair*. The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, sub-assembly, module (component or assembly), end item, or system.

(10) *Overhaul*. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e. DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to a like new condition .

(11) *Rebuild*. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements

(hours/miles, etc.) considered in classifying Army equipments/components.

d. *Column (4x), Maintenance Category.* This column is made up of sub-columns for each category of maintenance. Work time figures are listed in these sub-columns for the lowest level of maintenance authorized to perform the function listed in Column (3). These figures indicate the average active time required to perform the maintenance function at the indicated category of maintenance under typical field operating conditions.

e. *Column (5), Tools, and Equipment.* This column is provided for referencing by code, the common tool sets (not individual tools) special tools, test and support equipment required to perform the designated function.

D-3. Explanation of Columns in Section III

a. *Column (1), Reference Code.* This column

consists of an arabic number listed in sequence from Column (5) of Section II. The number references the common tool sets, special tools and test equipment requirements.

b. *Column (2), Maintenance Category.* This column shows the lowest category of maintenance authorized to use the special tools or test equipment.

c. *Column (3), Nomenclature.* This column lists the name or identification of the common tool sets, special tools, or test equipment.

d. *Column (4), National/Nato Stock No. (NSN).* This column is provided for the NSN of common tools sets, special tools and test equipment listed in the nomenclature column.

e. *Column (5), Tool Number.* This column lists the manufacturer's code and part number of tools and test equipment.

Section II. MAINTENANCE ALLOCATION CHART

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance category					(5) Tools and equipment
			C	O	F	H	D	
01	Shipping Case, Haversack, Carrying Case and Base Shipping Case	Inspect		0.2				
		Replace		0.1				
		Repair		2.0				
	Haversack	Inspect		0.1				
		Service	0.2					
		Replace		0.1				
	Metal Carrying Case	Replace		0.2				
		Repair		0.5				
		Inspect		0.1				
	Base	Replace		0.1				
Repair			0.1					
Inspect			1.0					
Repair								
02	Tribrach Assy Base Plate	Inspect		0.1				
		Replace		0.4				
		Repair		0.5				
	Foot Screw Assy	Overhaul		1.5				
		Inspect		0.1				
		Service		0.2				
	Locking Plate	Replace		0.5				
		Inspect		0.1				
		Replace		0.2				
		Repair		0.3				
Optical Plummet Eyepiece and Objective and Mounting Flange	Inspect		0.1					
	Service	0.2						
	Align				0.3			
	Adjust	0.2					1	
	Replace				2.0			
	Repair				2.6			

* Subcolumns are as follows: COOPERATOR / CREW; OORGANIZATIONAL;
F-DIRECTSUPPORT; HENERAL SUPPORT; DDEPOT

** INDICATES WT/ MY REQUIRED

Section II. MAINTENANCE ALLOCATION CHART

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance category					(5) Tools and equipment
			C	O	F	H	D	
03	Base and Axle Base Cover	Inspect		0.1				
		Replace				1.0		
	Base Housing, Illumination Flange and contact Ring	Repair					2.0	
		Inspect					0.2	
04	Horizontal Circle Drive	Replace				0.8		
		Repair				1.0		
	Horizontal Clamp Vertical Axle and Horizontal Circle Objectives	Inspect		0.1			0.1	
		Align					0.5	
05	U-Standard Assy U-Standard	Replace				0.9		
		Repair				1.0		
	Plate Level	Inspect	0.2				1.0	1 2
		Align					0.5	
06	Connecting Flange	Replace				1.0		
		Repair				0.5		
	Telescope Axis, Vertical Clamp, Reticule Illumination Assy, Vertical Circle Objectives and Vertical Collimation Level	Inspect		0.1			0.4	
		Adjust					3.5	
07	Telescope Axis	Repair				4.5		
		Inspect				0.5		
	Vertical Clamp	Adjust	0.2				0.5	1
		Replace					0.4	
08	Reticule Illumination	Repair				0.1		
		Inspect				0.5		
	Collimation Assy	Align	0.2				0.2	1,2
		Adjust					0.1	
09	Vertical Circle Objectives	Repair				0.2		
		Inspect				0.3		
	Vertical Collimation Level	Align					0.6	1
		Replace					0.8	2
10	Adjusting Prism and Optical Micrometer	Repair				0.2		
		Inspect				0.4		
	Optical Micrometer	Adjust	0.1				0.5	2
		Replace	0.2				0.3	

* SUBCOLUMNS ARE AS FOLLOWS:
F-DIRECT SUPPORT;

C-OPERATOR / CREW;
H-GENRALSUPPORT;

O-ORGANIZATIONAL;
D-DEPOT

* INDICATE WT / MH REQUIRED

Section II. MAINTENANCE ALLOCATION CHART

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance category					(5) Tools and equipment
			C	O	F	H	D	
07	Telescope Objective and Telescope Eyepiece Tube	Inspect					0.2	
	Telescope Objective	Adjust	0.2				1.0	
	Telescope Eyepiece Tube	Repair					1.0	
		Inspect					0.1	
08	Reading Microscope	Replace					0.5	2
		Repair					0.5	
	Horizontal Microscope	Inspect		0.1			1.5	
		Align					2.5	
09	Horizontal, Vertical and Collimation Slow Motion Screws	Replace					1.8	
		Repair					2.5	
	Horizontal Slow Motion Screw	Inspect		0.1			0.2	
		Service		0.1			0.3	
	Vertical Slow Motion Screw	Repair					0.2	
		Inspect		0.1			0.3	
	Collimation Slow Motion Screw	Service	0.1				0.2	
		Replace					0.3	
	Collimation Slow Motion Screw	Repair					0.2	3
		Inspect	0.1	0.1			0.3	
10	Handlamp, Connecting Cable and Battery Box	Service					0.2	
		Replace					0.3	
	Handlamp and Connecting Cable	Repair					0.2	
		Inspect		0.1			0.1	
	Battery Box	Replace			0.2			
		Inspect		0.2				
	Accessory Case, Filled	Test			0.2			
		Replace			0.1			
11	Accessory Case	Repair			0.4			
		Inspect		0.1				
	Accessory Case	Service		0.1				
		Replace		0.1				
	Lamp Fitting	Inspect		0.1				
		Replace		0.1				
	Diagonal Telescope Eyepiece	Repair			0.4			
		Inspect		0.1				
	Diagonal Telescope Eyepiece	Replace		0.1			0.5	
		Repair					1.0	
	Diagonal Microscope Eyepiece	Overhaul					0.5	
		Inspect		0.1			1.0	
	Diagonal Microscope Eyepiece	Replace		0.1				
		Repair		0.5				
12	Tripod	Overhaul		1.0				
		Inspect	0.2					
	Tripod	Service	0.2					
		Replace		0.1				
	Tripod	Repair		2.0				
		Repair						

* SUBCOLUMNS ARE AS FOLLOWS:
F-DIRECT SUPPORT;

C-OPERATOR / CREW;
H-GENRALSUPPORT;

O-ORGANIZATIONAL;
D-DEPOT

* INDICATE WT / MH REQUIRED

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1)	(2)	(3)	(4)	(5)
Reference code	Maintenance category	Nomenclature number (NSN)	National stock	Tool number
1	C, O, D	Pin, Adjusting	6675-00-353-4103	109334(89905)
2	C, O, D	Screwdriver, Jewelers	5120-00-961-2761	166786(89905)
3	C, O, F	Wrench Tripod	166494(89905)	

Change 1 D-5

APPENDIX E
EXPENDABLE SUPPLIES AND MATERIALS LIST
Section I. INTRODUCTION

E-1. Scope.

This appendix lists Expendable Supplies and Materials you will need to operate and maintain the directional theodolite. These items are authorized to you by CTA50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. Explanation of columns.

a. Column 1 - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material.

b. Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item.

c. Column 3 - National Stock Number. This is the

National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parenthesis, if applicable.

e. Column 5 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., each (ea), inch (in), pair (pr), etc.). If the unit or measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1)	(2)	(3)	(4)	(5)
ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
1	0	6810-00-223-2739	Acetone Technical 1 pt can, Fed Spec MMM-A-185	PT
2	0	6850-00-664-5683	Cleaning solvent Fed Spec PD-680	QT
3	C	7920-00-401-8034	Cloth, lint free, non-abrasive, general purpose, Part No 1001	BX
4	C	6850-00-680-2233	Desiccant, activated 1.5 lb	LB
5	0	9150-00-985-7244	Grease, Instrument and Aircraft (GIA) MIL-G-23827	TU
6	C	6640-00-597-6745	Paper, lens tissue (4 in X 6 in) 50 sheets	PX
7	0	9150-00-2526382	Lubricating Oil, watchmaking	TB
8	0	5720-01-018-5908	Orange Sticks 13218E3063 (97403)	PK

Change 1 E-1/(E-2 blank)

INDEX

Paragraph A	Page	Paragraph E	Page
Accessory case	4-29	4-17	
Adjusting pins and screwdriver	4-23	4-16	
Adjustments	2-9	2-25	
Circular level	2-9	2-25	
Collimation level	2-9	2-25	
"Collimation slow-motion screw	2-9	2-25	
Horizontal circle drive knob	2-9	2-25	
Horizontal slow-motion screw .	2-9	2-25	
Leveling screws	2-9	2-25	
Optical plumbing device	2-9	2-25	
Plate level '	2-9	2-25	
Vertical collimation error	2-9	2-25	
Vertical slow-motion screw	2-9	2-25	
Administrative storage	1-6	1-1	
B			
Base plate	5-6,6-2	5:4 ,6.1	
Basic issue items and items troop installed or authorized	3-1	3-1	
Battery box.....	7-2	7-1	
Battery replacement.....	3-8	3-5	
Black sunglass	4-24	4-16	
Box, battery	7-2	7-1	
C			
Cable, handlamp and connecting	7-3	7-1	
Carrying case.....	4-11	4-3	
Case, accessory.....	4-29	4-17	
Case, carrying.....	4-11	4-3	
Checks, preventive maintenance ..	3-5,4-8	3-4,4-2	
Chamois.....	4-26	4-16	
Circular level.....	5-8,6-45.8,6-5		
Adjustment.....	2-9	2-25	
Collimation level adjustment	2-9	2-25	
Collimation slow-motion screw adjustment	2-9	2-25	
Connecting cable and handlamp ...	7.73	7-1	
Container, grease	4-27	4-16	
Controls and instruments	2-7	2-20	
Conversion, equipment	2-3	2-17	
Cover, plastic.....	4-26	4-16	
D			
Data (see tabulated data)			
Description 1-7	1-1		
Destruction of Army material to prevent enemy use.....	1-5	1-1	
Detailed lubrication information	3-3	3-1	
Diagonal eyepieces.....	4-25	4-16	
Difference in models	1-8	1-7	
Direct support and general support maintenance repair parts.....	5-3	5-1	
Dismantling for movement	2-4	2-20	
Dust brush, chamois and plastic cover	4-26	4-16	
Dusty or sandy areas, operation in	2213	2-36	
Equipment:			
and tools	4-3,5-1	4-1,5-1	
and special tools	5-2	5-1	
Conversion.....	2-3	2-17	
Dismantling for movement	2-4	2-20	
Inspecting and servicing.....	2-1	2-1	
Installation.....	2-2	2-12,	
Reinstallation after movement...	2-5	2-20	
Serviceability criteria (ESC)	1-4	1-1	
Servicing, and preventive maintenance checks.....	3-5,4-8	3-4,4-2	
Service upon receipt	4-1	4-1	
Starting	2-9	2-25	
Errors, reporting of	1-3	1-1	
Extreme cold, operation in	2-11	2-36	
Extreme heat, operation in	2-12	2-36	
Eyepieces:			
Black sunglass	4-24	4-16	
Diagonal.....	4-25	4-16	
F			
Fittings, lamp	4-28,7-4	4-17,7-5	
Footscrews.....	5.56,5-7,6-3	5-4,5-6,6-3	
Forms, maintenance and records ..	1-2	1-1	
G			
General lubrication information .	3-3	3-1	
Grease container.....	4-27	4-17	
H			
Handlamp and connecting cable ...	7-3	7-3	
Haversack.....	4-12	4-7	
Horizontal circle drive adjustment .	2-9	2-25	
Horizontal slow-motion screw adjustment	2-9	2-25	
Humid or rainy conditions, operation under	2-14	2-36	
I			
Identification and tatulated data.....	1-9	1-7	
Illumination Mirrors.....	4-18	4-9	
Inspecting and servicing the equipment	2.1	2-1	
Installation.....	2-2	2-12	
Instruments and controls	2-7	2-20	
Items, basic issue and troop installed or authorized	3.1	3-1	
K			
Knob, lock	5-8	5-8	
L			
Lamp fittings	4-28,7-4	4-17,7-5	
Lamp replacement	3-7	3-5	
Level, circular	5--8,6-4	5-8,6-5	
Lock knob	5-8	5-8	
Locking plate.....	5-8,6-4	5-8,6-5	

Paragraph	Page
L-Continued	
Lubrication:	
Detailed information	3-3 3-1
General information	3-2 3-1
Instructions	1-2 1-1
M	
Maintenance forms and records	1-2 1-1
Maintenance repair parts.....	4-5,5-3 4-1,5-1
Maintenance services:	
General	3-4,4-7 3-4,4-2
Preventive	3-5,4-8 3-4,4-2
Microscope and telescope diagonal.....	4-25 4-16
Mirrors, illumination	4-18 4-9
Models, difference in	1-8 1-7
Movement:	
Dismantling for	2-4 2-20
Reinstallation after	2-5 2-20
To a new worksite	4-2 4-1
O	
Operation:	
Adjustments	2-9 2-25
At high altitudes	2-18 2-36
General	2-8 2-25
In dusty or sandy areas	2-13 2-36
In extreme cold	2-11 2-36
In extreme heat	2-12 2-36
In mud	2-17 2-36
In salt water areas	2-15 2-36
In snow	2-16 2-36
of theodolite	2-10 2-33
Under rainy or humid conditions	2-14 2-36
Operator's maintenance:	
Battery replacement	3-8 3-5
Lamp replacement	3-7 3-5
Organizational maintenance repair parts	4-5 4-1
P	
Pins, adjusting	4-23 4-16
Plastic cover	4-26 4-16
Plate level adjustment	2-9 2-25
Plate, base.....	5-6,6-2 5-4,6-1
Plate, locking	5-8 5-8
Plumb bob and tripod wrench.....	4-21 4-14
Preventive maintenance checks and services	3-5,4-8 3-4,4-2
R	
Rainy or humid conditions, operation under.....	2-14 2-36
Records, and maintenance forms.....	1-2 1-1
Reinstallation after movement .	2-5 2-20

Paragraph	Page
R-Continued	
Repair parts, maintenance	4-5,5-3 4-1,5-1
Reporting of errors	1-3 1-1
S	
Salt water areas, operation in.....	2-15 2-36
Sandy or dusty areas, operation in	2-13 2-36
Scope	1-1 1-1
Screwdriver.....	4-23 4-16
Screws:	
Collimation slow-motion	2-9 2-25
Foot	2-9,5-6, 2-25,5-4, 6-3 6-3
Horizontal slow-motion	2-9 2-25
Vertical slow-motion	2-9 2-25
Servicing, and inspecting of equipment	2-1 2-1
Service upon receipt of equipment	4-1 4-1
Slow-motion screws:	
Collimation	2-9 2-25
Horizontal	2-9 2-25
Vertical	2-9 2-25
Special tools and equipment	4.4 ,5-2 4-1,5-1
Starting	2-9 2-25
Sunshade	4-14 4-7
Sunglass, black	4-24 4-1(
T	
Tabulated data	1-9 1-7
Telescope and microscope diagonal eyepieces.....	4-25 4-16
Tools:	
and Equipment.....	4.3,5-1 4-1,5-1
Special, and equipment.....	4-4,5-2 4-1,5-1
Tribrach assembly	4-16 4-7
Base plate.....	5-6,6-2 5-4,6-1
Circular level.....	5-8,6-4 5-8,6-5
Description.....	6-1 6-1
Footscrews	5-6,5-7,6-3 5-4,5-6,6-3
General	4-15 4-7
Installation	5-5 5-4
Lock plate, lock knob and circular level	6-4 6-5
Removal	5-5 5-4
Tripod:	
Assembly	4-20 4-12
Wrench and plumb bob	4-21 4-14
Troubleshooting	3-6,4-9,5-4 3-4,4-2,5-3
V	
Vertical slow-motion screw adjustment .	2-9 2-25
W	
Wrench, tripod .	4-21 4-14

By Order of the Secretary of the Army:

Official:
VERNE L. BOWERS
*Major General, United States Army,
The Adjutant General.*

FRED C. WEYAND
*General, United States Army,
Chief of Staff.*

Distribution:

To be distributed in accordance with DA Form 12-25A, (qty rqr block no. 173). Operator maintenance requirements for Surveying Equipment.

*U.S. GOVERNMENT PRINTING OFFICE. 1990 - 261-888/22695

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?



THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT. FOLD IT AND DROP IT IN THE MAIL.

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

PUBLICATION DATE

PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PAGE NO.

PARA-GRAPH

FIGURE NO.

TABLE NO.

TEAR ALONG PERFORATED LINE

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

