TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS

LEVEL, DUMPY 2060-S18EDL
NSN 6675-01-071-5339

HEADQUARTERS, DEPARTMENT OF THE ARMY
17 NOVEMBER 1980

CHANGE

NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 10 October 1986

Operator's, Organizational, Direct Support,
and General Support Maintenance Manual
Including Repair Parts and Special Tools Lists

LEVEL, DUMPY 2060-S18EDL
NSN 6675-01-071-5339
TM 5-6675-271-14&P, 17 November 1980, is changed as follows:

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(2060-S18EDL).

TECHNICAL MANUAL)
TM 5-6675-271-14&P)

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 17 November 1980

**Operator's, Organizational, Direct Support,
And General Support Maintenance Manual
Including Repair Parts And Special Tools Lists
Level, Dumpy 2060-S1 8EDL
NSN 667501-071-5339**

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 & Aviation Materiel Readiness Command, ATTN: DRSTS-MTT, 4300 Goodfellow Boulevard, St. Louis, MO 63120. A reply will be furnished directly to you.

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CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE

- Type of Manual: Operator, Organizational, Direct Support, and General Support Maintenance with Repair Parts and Special Tools List.
- Model Number and Equipment Name: No. 2060-S18EDL 18-inch Engineer's Dumpy Level (figure 1-1).
- Purpose of Equipment: Used for land survey and leveling in construction projects.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

"EIRs" can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure; simply tell why the design is unfavorable or why a procedure is difficult. EIRs may be submitted on SF Form 368. Mail directly to U.S. Army Troop Support & Aviation Material Readiness Command, Attn: DRSTS-ME, 4300 Goodfellow Blvd., St. Louis, MO 63120 . A reply will be furnished to you.

1-4. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE

Refer to TM 750-244-3 which covers destruction of Army materiel to prevent enemy use.

1-5. ADMINISTRATIVE STORAGE

The dumpy level must be kept in its carrying case while it is not in use. The carrying case is the only authorized storage container for the dumpy level and it should be stored in a dry, clean area at all times. Specially designed supports within the carrying case support the level and prevent excessive movement during transport. A metal lens cap is provided to cover the objective lens. The cap should be in place at all times except when actually viewing through the telescope. A plastic cover is provided for covering the dumpy level when it is mounted on the tripod ready for later use.

1-5.1 HAND RECEIPT.

Hand receipts for Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) items are published in a Hand Receipt manual, TM 56675-271-14&P-HR. This manual is published to aid in property accountability and is available through: Commander, US Army Adjutant General Publication Center, ATTN: AGDL-OD, 1655 Woodson Road, St. Louis, MO 63114.

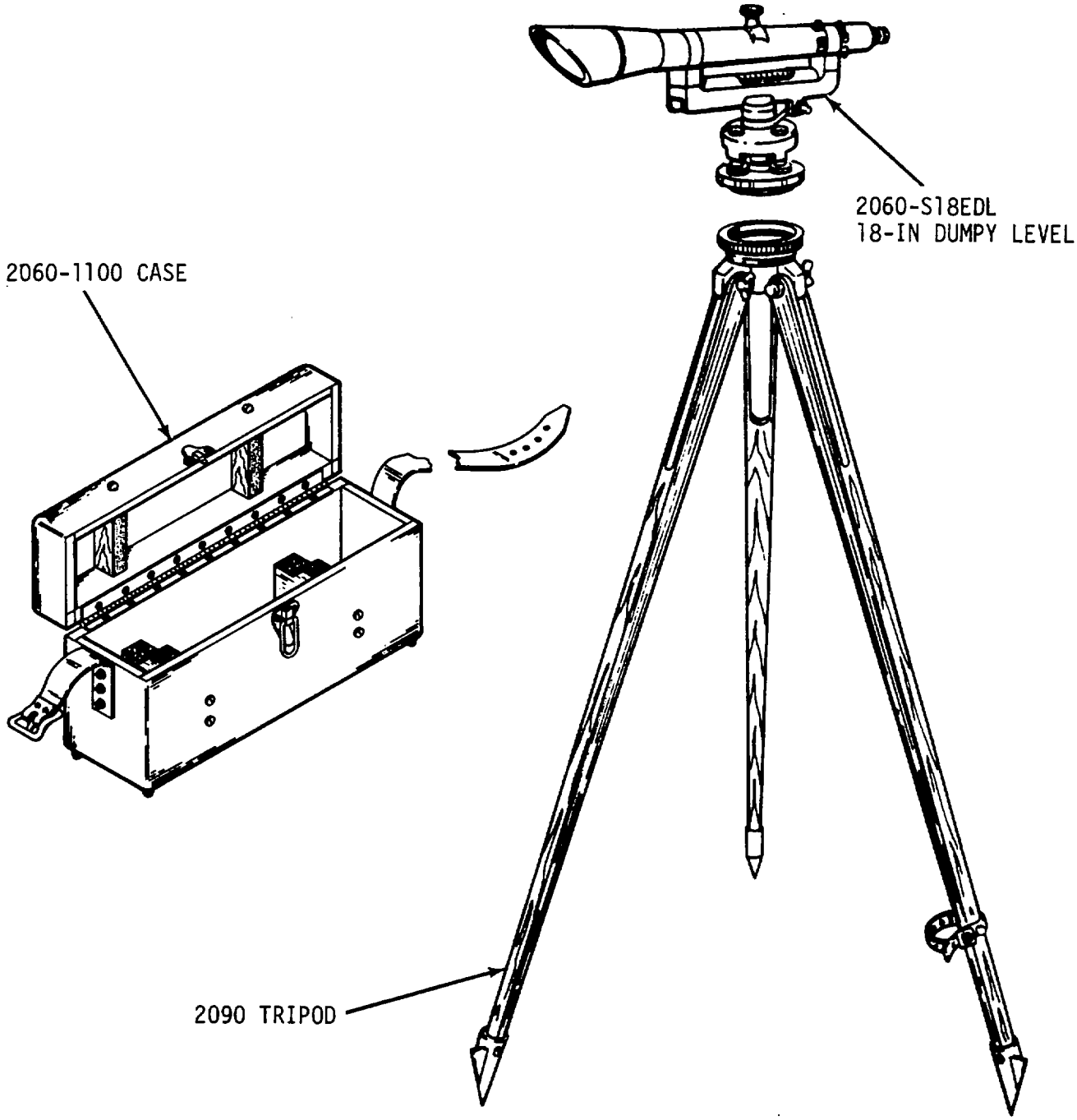


Figure 1-1. Dumpy Level, 2060-S18EDL

Section II. EQUIPMENT DESCRIPTION

1-6. PURPOSE OF DUMPY LEVEL

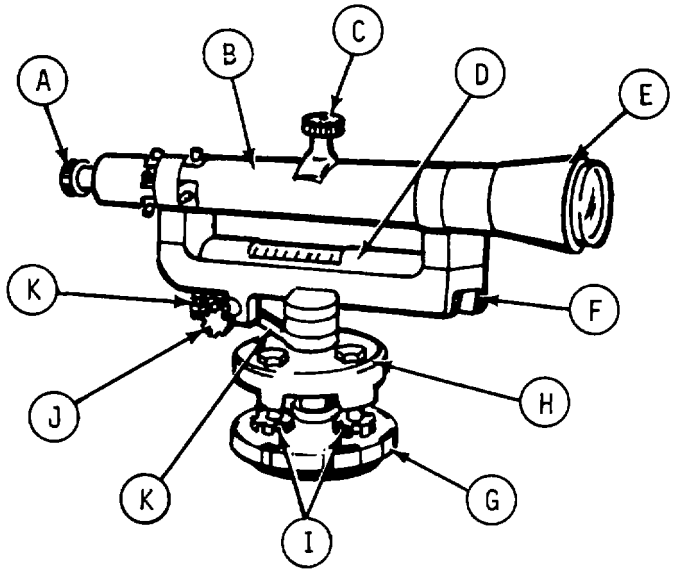
The dumpy level is used for land survey and leveling in various construction projects such as road building, and erection of bridges and dams.

Capabilities and Features:

- Achromatic lens system of telescope assembly is image erecting and 32power; lenses are coated.
- All telescope focusing components are internal except for the focusing knob. Cross hairs, centered in line-of-sight are focused at eyepiece.
- Field-of-view is one degree, four minutes; focusing range is nine feet to infinity.
- Baseplate of telescope assembly has 3. 5-inch x 8 female threads for attachment to tripod head.
    - Tripod has bronze head; legs are hardwood with cast steel shoes.
    - Major components:
    - Telescope assembly
    - Cross bar
    - Level housing with level vial
    - Leveling head
    - Baseplate
    - Tripod
    - Carrying case

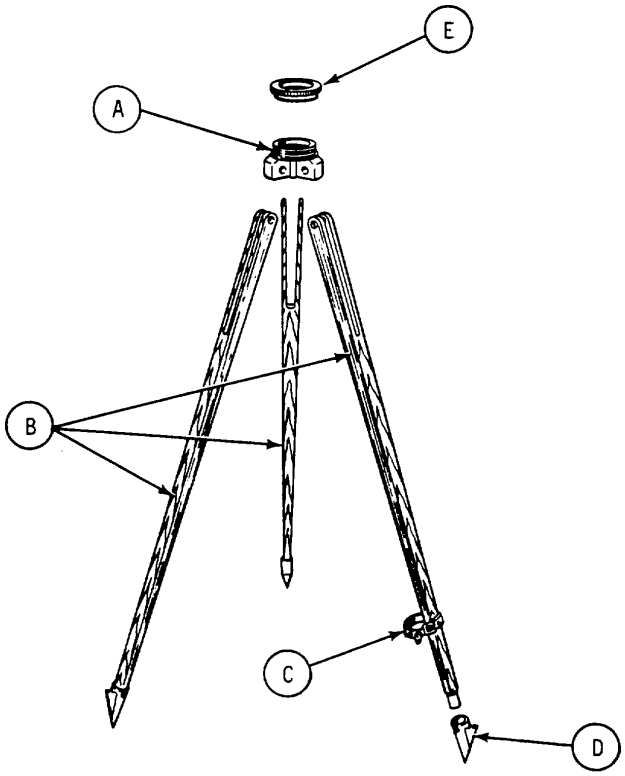
1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

Major components of the dumpy level are shown in figures 1-2 through 1-4. The nameplate attached to the cross bar of the level is shown in figure 1-5.



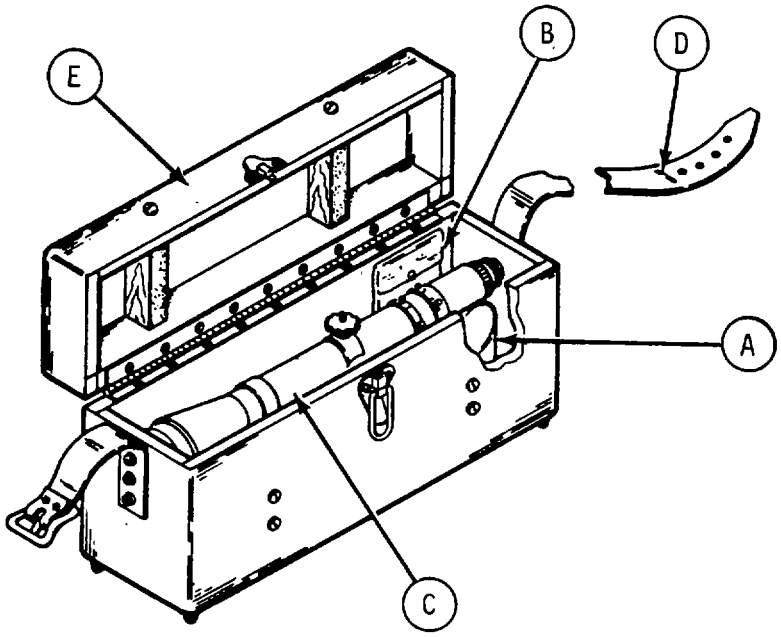
A	EYEPIECE	Lenses at eye end of telescope for viewing image of object.
B	TELESCOPE	Fixed and movable lenses within a tube for magnifying and viewing a distant object.
C	FOCUSING KNOB	Controls movement of movable lens for focusing distant object.
D	LEVEL HOUSING & LEVEL VIAL	Calibrated glass level vial with liquid and air bubble. Mounted in level housing, parallel to telescope line-of-sight, for leveling telescope.
E	OBJECTIVE LENS HEAD	Conical tube with objective lens, part of telescope lens system.
F	CROSS BAR	Heavy casting for holding telescope and level vial in parallel positions and for mounting on leveling head.
G	BASEPLATE	Connects dumpy level to tripod. Has female threads (3.5-inch diameter, 8 threads per inch).
H	LEVELING HEAD & . . .	
I	LEVELING SCREWS	Adjust level position of telescope line-of-sight.
J	TANGENT SCREW	Used for fine adjustment of telescope line-of-sight in azimuth.
K	CLAMP AND CLAMP SCREW	Used to lock telescope in azimuth position.

Figure 1-2. Dumpy Level, Location and Description of Major Components



A	HEAD	Has male threads (3.5-inch diameter, 8 threads per inch) to engage dumpy level baseplate threads.
B	LEGS	Connected to head by bolt, washers, and wing nut for easy folding or setup.
C	STRAP	Binds folded legs together for transportation of equipment.
D	SHOE	Pointed with stirrup, may be stepped on for firm emplacement during setup.
E	CAP	Connects to head to protect head threads when the level is not installed on the tripod.

Figure 1-3. Tripod, Location and Description of Major Components



A	SUNSHADE	D	CARRYING STRAP
B	ACCESORIES	E	CARRYING CASE
C	DUMPY LEVEL		

Figure 1-4. Carrying Case, Location and Description of Major Components

NSN 6675-01-071-5339
LEVEL, DUMPY, 2060-S18EDL
0 0
SEILER SER.NO.
CONT: DAAKOI-78-C-1451 US

NSN 6675-01-071-5339
LEVEL, DUMPY, 2060-S18EDL
0 0
SEILER SER.NO.
CONT: DAAKOI-78-C-1333 US

Figure 1-5. Dumpy Level Nameplates

1-8. EQUIPMENT DATA

Performance data for the dumpy level is provided below:

Manufacturer	Seiler Instrument & Manufacturing Co.	Metric Equivalent
Level, Model	No.	2060 - S18EDL
Telescope		
Length	18.25 inches	464 millimeters
Magnifying power	32 diameters	
Objective lens (diameter) 2 inches	51 millimeters	
Field-of-view	1 degree, 4 minutes	
Focal range	9 feet to infinity	2.74 meters to infinity
Lenses	coated	
Level housing, length	8 inches	203 millimeters
Level vial sensitivity	20 seconds of arc/2 millimeter division	
Baseplate (thread)	3.5 inches, 8 threads/inch (female)	88.9 millimeters
Weight	13 pounds	5.9 kilograms
Tripod, Model	No.	2090
Height	59 inches	1499 millimeters
Head (thread) 3.5 inches, 8 threads/inch	88.9 millimeters (male)	
Weight	13 pounds	5.9 kilograms
Case		
Length	20.50 inches	520 millimeters
Width	6 inches	152 millimeters
Height	9.75 inches	247 millimeters
Weight	10 pounds, 6 ounces	4.7 kilograms

Section III. PRINCIPLES OF OPERATION

1-9. GENERAL

The dumpy level has two functional groups: the telescope assembly and the base assembly. The tripod assembly supports the dumpy level. The carrying case is used to store and transport the dumpy level.

1-10. TELESCOPE ASSEMBLY

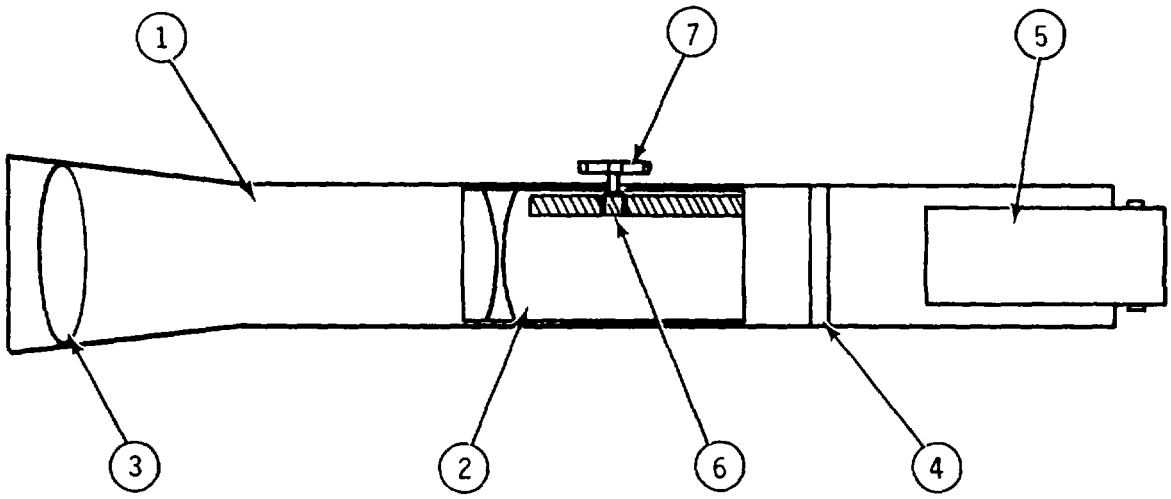
(Figure 1-6)

a. The telescope assembly magnifies an object far away, such as a leveling rod, and focuses it sharply. This lets the operator read a scale on the leveling rod against cross hairs in the telescope.

b. The telescope assembly consists of a telescope tube (1) with an internal draw tube (2) for focusing, an objective lens assembly (3), a diaphragm (4) with cross hairs, and an eyepiece assembly (5). The draw tube contains a lens and fits inside the telescope tube. A rack gear (6) in the draw tube engages a pinion gear which is turned by a focusing knob. Turning the focusing knob (7) moves the draw tube back and forth to focus the telescope on the leveling rod.

c. A knurled ring on the eyepiece assembly is turned to focus the eyepiece on the cross hair reticle. The eyepiece is focused so that the cross hairs are sharp against a blank background such as the sky.

The eyepiece focus need not be changed so long as the same eye uses it.



1. TELESCOPE TUBE
2 DRAW TUBE
3 OBJECTIVE LENS
4 DIAPHRAGM WITH CROSS HAIRS
5 EYEPIECE ASSEMBLY
6 RACK AND PINION GEARS
7 FOCUSING KNOB

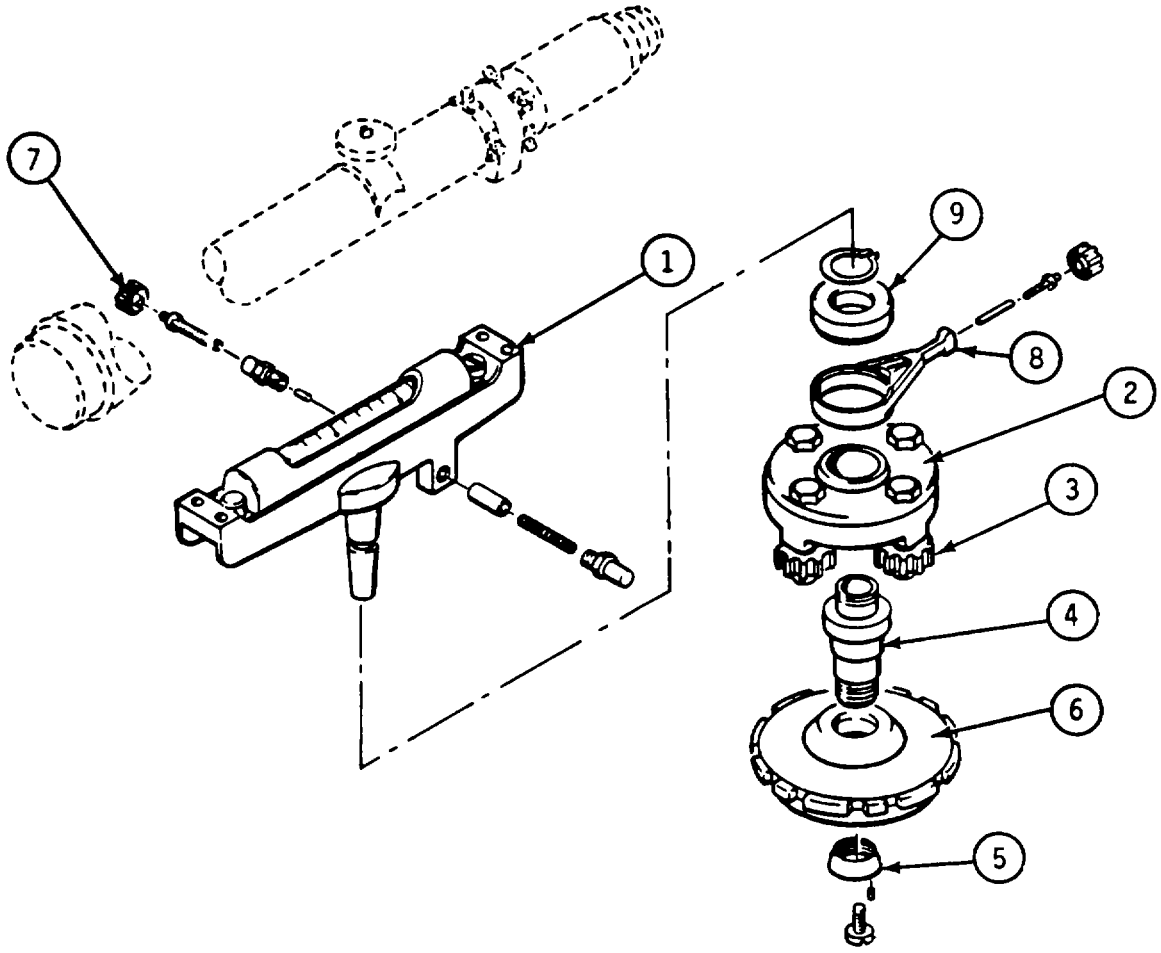
Figure 1-6. Telescope Optical Diagram

1-11. BASE ASSEMBLY (Figure 1-7)

a. The base assembly supports the telescope assembly and contains level indicating and adjusting components. These let the operator adjust the telescope line-of-sight in relation to the horizontal plane.

b. The base assembly consists of a cross bar with level vial (1), leveling head (2), four leveling screw assemblies (3), center housing (4) with ball nut (5), and a baseplate (6). The cross bar has a vertical center shaft which mounts in the leveling head and center housing. All of these parts rotate around a common vertical axis. Fine adjustments in the horizontal plane are made by a tangent screw (7). A clamp assembly (8) and clamp locating ring (9) hold the cross bar in a fixed position when all adjustments have been made.

c. The four leveling screw assemblies (3) are evenly spaced around the leveling head (2) for precise control of tilt. Threads in the bottom of the baseplate (6) connect the whole assembly to the tripod.

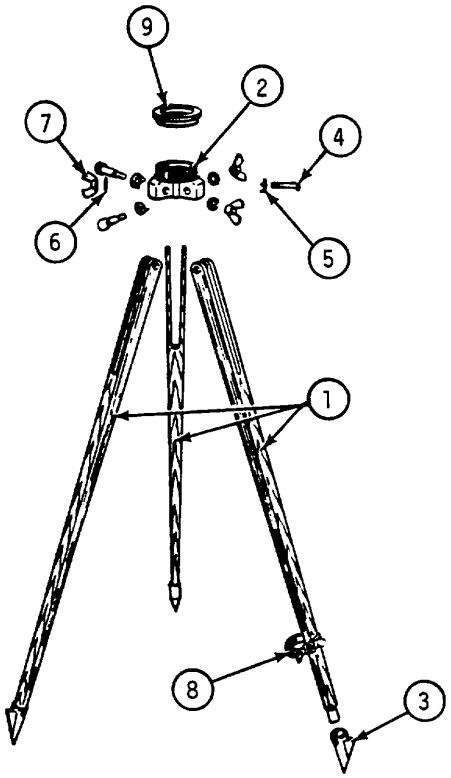


1	CROSS BAR WITH LEVEL VIAL	6	BASEPLATE
2	LEVELING HEAD	7	TANGET SCREW
3	LEVELING SCREW ASSEMBLY	8	CLAMP ASSEMBLY
4	CENTER HOUSING	9	CLAMP LOCATING RING

Figure 1-7. Base Assembly

1-12. TRIPOD ASSEMBLY (Figure 1-8)

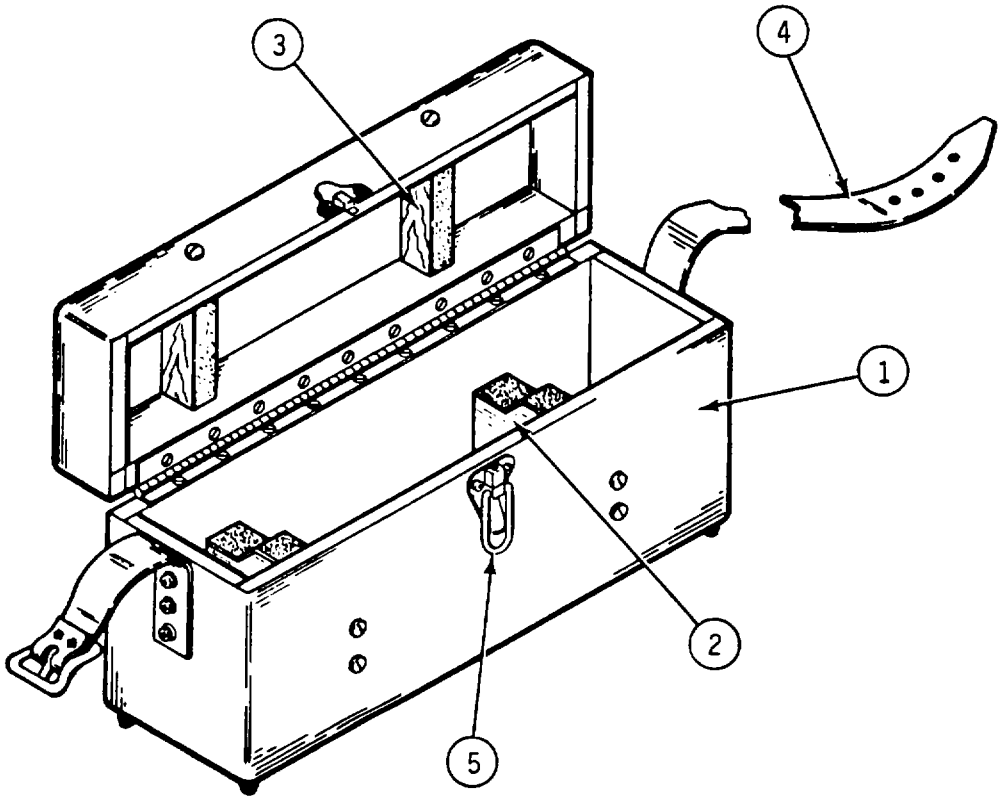
The dumpy level is installed on a tripod assembly for use. The tripod assembly consists of three legs (1) and a head (2). The head has three evenly spaced short spokes for mounting the legs. Male threads at the top of the head, screw into the baseplate of the level. The leg is forked to straddle a spoke and is attached to it with a bolt (4), torque washer (5), lockwasher (6), and wing nut (7). The tripod is set up by spreading the legs; the wing nuts are then firmly tightened. When the tripod is not set up the legs are closed together and held by a strap (8) attached to one leg. The head threads are protected by a cap (8) when the level is not installed on the tripod.



1	**LEGS**	**6**	**LOCKWASHER**
2	**HEAD**	**7**	**WING NUT**
3	**SHOE**	**8**	**STRAP**
4	**BOLT**	**9**	**CAP**
5	**TROQUE WASHER**		

Figure 1-8. Tripod Assembly

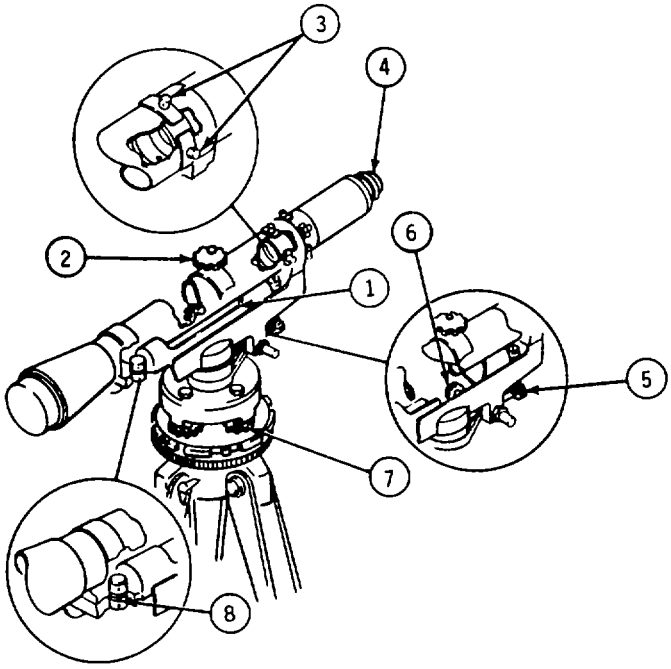
1-13. CARRYING CASE (Figure 1-9)
The dumpy level is carried and stored in a carrying case. The carrying case consists of a box (1) with a hinged cover. Support blocks (2) are built in the box to bear the weight of the instrument. Hold-down blocks (3) are built in the cover to keep the instrument on the support blocks during transport. Felt covering on interior contact surfaces protects the instrument. A two-piece carrying strap (4) is attached to the carrying case. The carrying case can be locked closed by a latch (5).



1 BOX
2 SUPPORT BLOCK
3 HOLDDOWN BLOCK
4 CARRYING STRAP
5 LATCH

Figure 1-9. Carrying Case

CHAPTER 2
OPERATING INSTRUCTIONS



ITEM	CONTROL OR INDICATOR	FUNCTION
1	LEVEL VIAL	INDICATES THAT TELESCOPE IS LEVEL WHEN BUBBLE IS CENTERED ON SCALE.
2	FOCUSING KNOB	ROTATE TO SHARPEN FOCUS OF OBJECT IMAGE AS VIEWED THROUGH EYEPIECE.
3	DIAPHRAGM ADJUSTMENT SCREWS	LOOSEN AND THEN TIGHTEN TO ADJUST POSITION OF VERTICAL AND HORIZONTAL CROSS HAIRS. USE ONLY WHEN REQUIRED BY TEST.
4	EYEPIECE	VIEW CROSS HAIRS AND OBJECT IMAGE. ROTATE TO SHARPEN FOCUS OF CROSS HAIRS.
5	CLAMP SCREW	LOOSEN TO CHANGE AZIMUTH DIRECTION OF TELESCOPE, TIGHTEN TO LOCK TELESCOPE IN AZIMUTH POSITION.
6	TANGENT SCREW	ROTATE FOR FINE ADJUSTMENT OF TELESCOPE IN AZIMUTH.
7	LEVELING SCREWS	ROTATE TWO OPPOSITE SCREWS AT THE SAME TIME AND IN OPPOSITE DIRECTIONS TO LEVEL TELESCOPE (AS INDICATED BY LEVEL VIAL).
8	LEVEL VIAL ADJUSTMENT SCREW	ROTATE TO ADJUST HORIZONTAL POSITION OF LEVEL VIAL. USE ONLY WHEN REQUIRED BY TEST.

Figure 2-1. Controls and Indicators

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2-1. CONTROLS AND INDICATORS
Controls and indicators for the dumpy level are described and shown in figure 2-1. The tripod does not have controls and indicators.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. GENERAL Preventive maintenance checks and services (PMCS) are required to ensure proper operation and serviceability of the equipment. The dumpy level is a precision optical instrument; always keep it clean and handle it carefully. It must not be handled carelessly or abused in any way. PMCS consists only of proper storage while the level is not in use and close attention to cleanliness before, during, and after use.

2-3. STORAGE WHILE NOT IN USE
The level must be kept in its carrying case while it is not in use. The carrying case is the only authorized storage container for the level and it should be stored in a dry, clean area at all times. Specially designed supports within the carrying case support the level and prevent excessive movement during transport. A metal lens cap is provided to cover the objective lens. The cap should be in place at all times except when actually viewing through the telescope. A plastic cover is provided for covering the level when it is mounted on the tripod ready for later use.

2-4. CLEANING
The presence of dirt or moisture can reduce the effectiveness of the level. Dirt or moisture on the objective or eyepiece lens will obscure the view and make sharp focusing difficult. Remove dust from the lenses with a soft, dry dust brush.

Section III. OPERATION UNDER USUAL CONDITIONS

2-5. PREPARATION FOR USE

Select a clear, level area within sight of two or more places to be measured. Set up the tripod and dumpy level (see figure 2-2).

a. Stand the tripod on level ground while spreading the legs equally and wide enough apart to prevent tipping over.

b. Step firmly on the stirrup of each shoe to secure the tripod. Hand tighten the wing nuts.

c. Remove protection cap from tripod head.

d. Remove the dumpy level from its carrying case.

e. Relieve tension of all leveling screws from the baseplate.

CAUTION

Thread the level baseplate carefully onto the tripod head threads. Do not use force. The parts should screw together easily when clean and correctly lined up.

f. Screw the level baseplate onto the tripod head.

CAUTION

Do not use tools to tighten the level baseplate on the tripod head.

g. Tighten the level baseplate on the tripod head by hand.

h. Tighten the four leveling screws to a uniform firmness (not excessively tight).

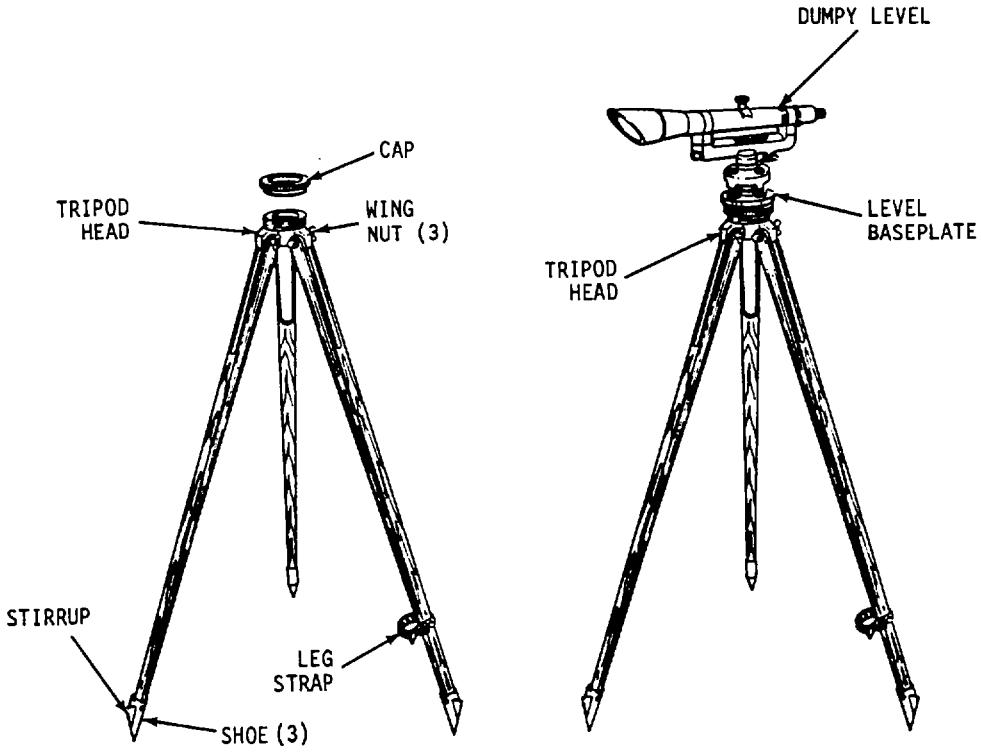


Figure 2-2. Setting Up Tripod and Dumpy Level

2-6. INITIAL TESTS AND ADJUSTMENTS OF TELESCOPE AND LEVEL VIAL

a. If possible, do the tests on a cloudy day.

b. Always perform the tests in the order given.

c. If a test indicates the same error when repeated three times, do the adjustments.

d. After an adjustment is done, repeat the test at once.

e. After all required adjustments are done, perform all the tests in the order given to ensure that no adjustments have been disturbed.

2-7. INITIAL ADJUSTMENT OF LEVEL VIAL AND TELESCOPE

a. Level Vial Test

CAUTION
Do not over tighten clamp screw.

(1) Loosen clamp screw (5, figure 2-1) and turn telescope so that cross bar is positioned over two opposite leveling screws (figure 2-3). Tighten clamp screw.

(2) Noting location of bubble in level vial (figure 2-4), center bubble in level vial by turning both leveling screws (figure 2-5) at the same time in opposite directions. Turn the screw held by the left hand so that your thumb moves in the direction that you want the bubble to move; at the same time, turn the screw held by the right hand in the opposite direction. Turn the screws at the same rate in order to retain tension.

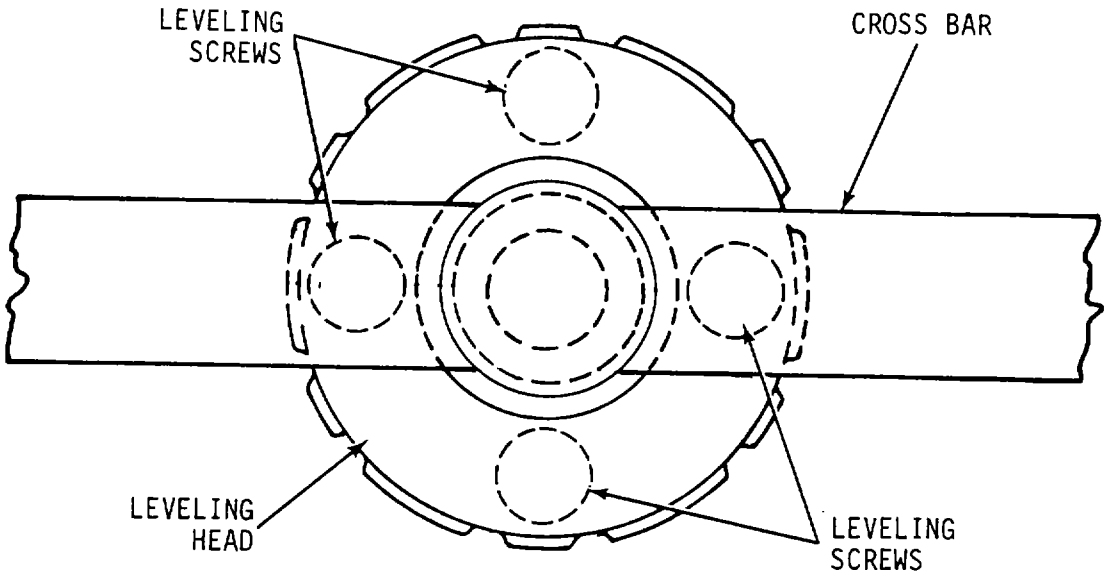


Figure 2-3. Leveling Screws and Cross Bar

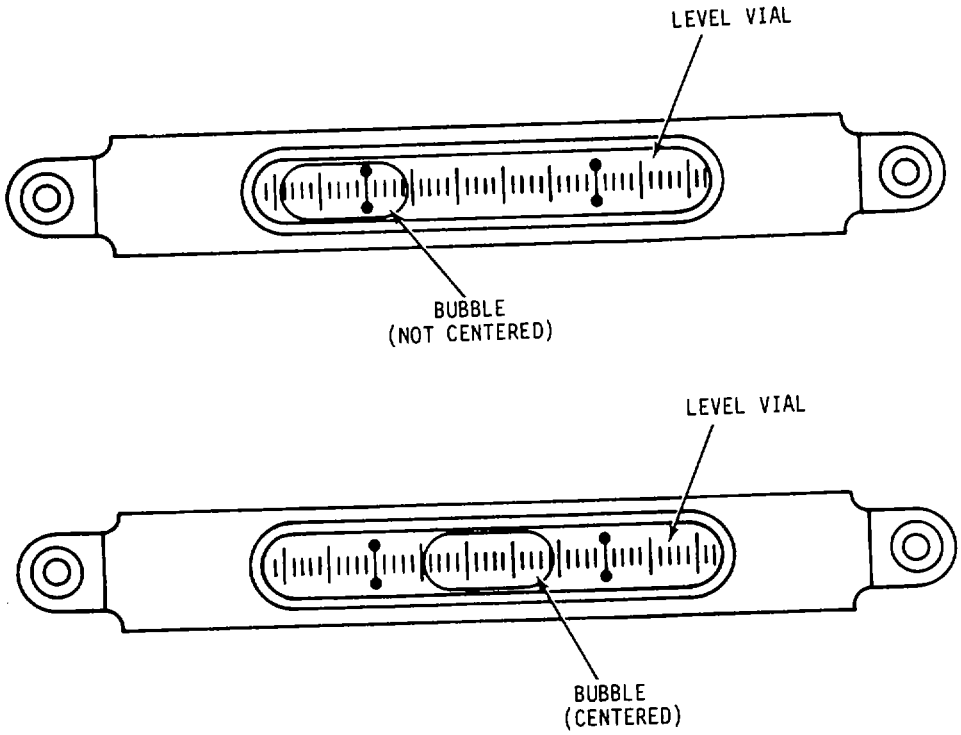
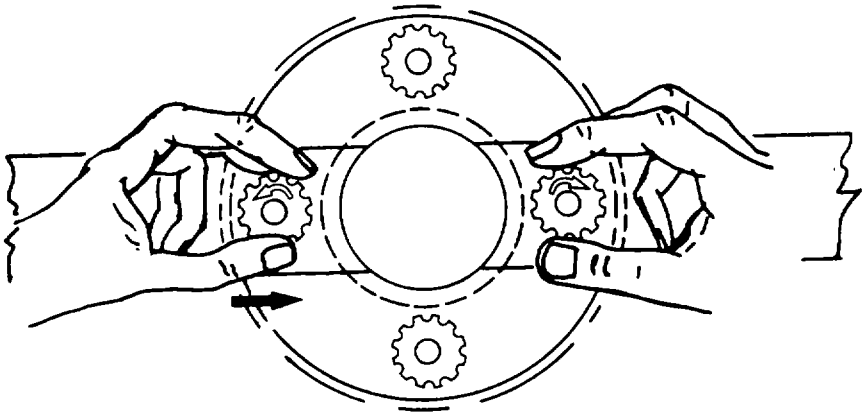


Figure 2-4. Location of Level Vial Bubble



NOTE: TO LEVEL THE BUBBLE SHOWN IN FIGURE 2-4, TURN THE LEFT LEVELING SCREW CCW AND TURN THE RIGHT SCREW CW. THE BUBBLE WILL ALWAYS FOLLOW THE LEFT THUMB.

Figure 2-5. Turning Leveling Screws for Leveling

CAUTION
Do not over tighten clamp screw.

(3) Loosen clamp screw and turn the telescope 90 degrees until cross bar is over the other two opposite leveling screws. Tighten clamp screw.

(4) Center bubble in level vial by repeating step (2), above.

CAUTION
Do not over tighten clamp screw.

(5) Loosen clamp screw and rotate telescope through 360 degrees, stopping at various positions. Tighten clamp screw. Bubble should be centered in level vial at every position. If bubble fails to center, proceed to level via adjustment procedure, paragraph b, below.

b. Level Vial Adjustment. If bubble fails to center during the test in paragraph a, above, proceed as follows:

CAUTION
Do not over tighten clamp screw.

(1) Loosen clamp screw and turn telescope so that cross bar is positioned over two opposite leveling screws (figure 2-3). Tighten clamp screw.

(2) Center bubble, using opposite leveling screws.

CAUTION
Do not over tighten clamp screw.

(3) Loosen clamp screw and turn telescope 180 degrees. Tighten clamp screw.

(4) Note position of bubble; bring bubble halfway toward center by turning both leveling screws at the same time in opposite directions (see figure 2-5).

(5) Using pin wrench, turn level vial adjusting screw (8, figure 2-1) to position bubble exactly on center.

(6) Check adjustment by repeating steps (1) through (5) of level vial test in paragraph a, above.

c. Horizontal Cross Hair Test (1) Rotate eyepiece (4, figure 2-1) to focus the cross hairs.

(2) Aim the telescope so that the horizontal cross hair falls across a well defined point. Rotate focusing knob (2, figure 2-1) to focus on the point.

(3) Turn the telescope slightly left and right with the tangent screw (6, figure 2-1). The horizontal cross hair should remain on the point.

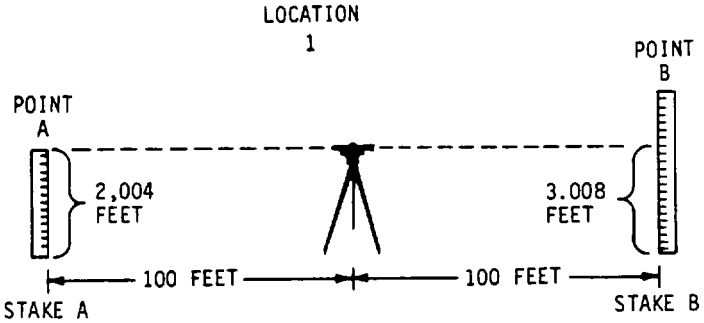
(4) If the cross hair does not remain on the point, adjust per paragraph d, below.

d. Horizontal Cross Hair Adjustment (1) Slightly loosen two adjacent diaphragm adjustment screws (3, figure 2-1).

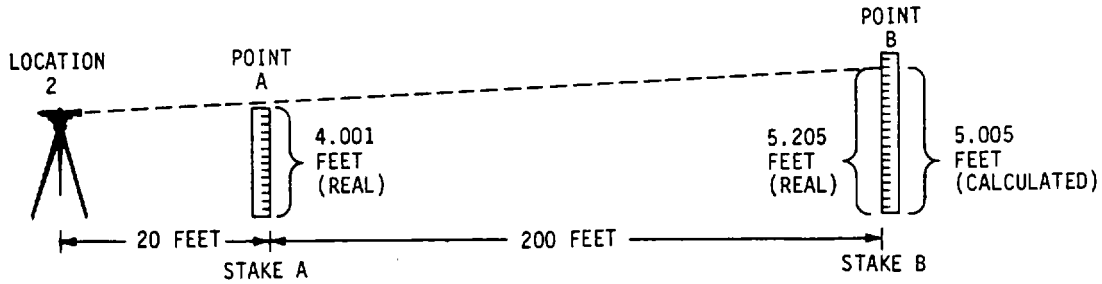
(2) Lightly tap the sides of each adjustment screw until the horizontal cross hair is in its correct position.

(3) After proper adjustment is obtained, tighten the two adjustment screws.

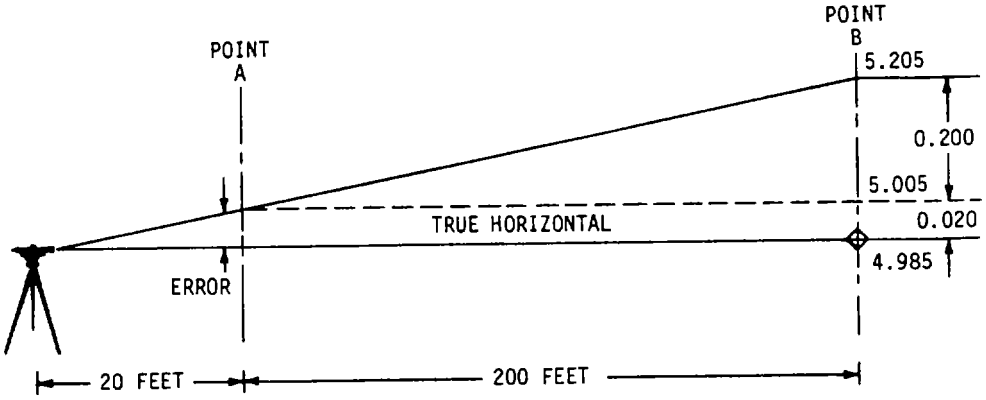
(4) Check adjustment by repeating the horizontal cross hair test in paragraph c, above.



READING AT POINT B IS 3.008 - 2.004 = 1.004 FEET HIGHER THAN POINT A



CALCULATED READING AT POINT B IS POINT A READING (4.001) PLUS 1.004 (FROM Step 1) = 5.005 feet



READING IS 5.205 LINE OF SIGHT SLOPES UPWARD AT A RATE OF 5.205-5.005 = 0.200 FEET IN 200 FEET.

IN THE 20 FEET BETWEEN LOCATION 2 AND POINT A THE ERROR INTRODUCED BY THE SLOPE IS 20/200 = 1/10 X 0.200 = 0.020 FEET.

A SCALE READING OF 5.005-0.020 = 4.985 AT POINT B WILL BE LEVEL WITH THE INSTRUMENT.

STEP 3

NOTE

IF THE LINE OF SIGHT STRIKES BELOW THE COMPUTED READING INSTEAD OF ABOVE IT, THE ERRORS MUST BE ADDED TO THE LEVELLING ROD READING INSTEAD OF BEING SUBTRACTED FROM IT.

Figure 2-6. Horizontal Line-of-Sight Test (Peg Test)

e. Line-of- Sight Test

(1) Refer to step 1 of figure 2-6 and set up tripod and dumpy level (2-5). Level telescope (2-7a). Set up two leveling rods approximately 200 feet apart, with the telescope exactly halfway between the two leveling rods (figure 2-6).

(2) Sight on and record a reading on each leveling rod. Make certain that level bubble is centered for each reading. Referring to step 1, figure 2-6, note that the difference between the two recorded readings will be the true distance in elevation between the leveling rods.

(3) Move the telescope to a position beyond one of the leveling rods. This distance should be a convenient decimal fraction (such as 1/10) of the distance between the leveling rods. Refer to step 2, figure 2-6.

(4) Set up level and level the telescope again and take a new reading on each leveling rod. Record the two readings and refer to step 3, figure 2-6 for an example of how to compute line-of-sight error.

(5) Proceed to paragraph f, below, if level requires line-of-sight adjustment.

f. Line-of-Sight Adjustment

(1) Referring to step 2, figure 2-6, set up tripod and dumpy level (paragraph 2-5) and level telescope (paragraph a, above). Sight telescope on point B leveling rod and focus telescope.

(2) Loosen one of the side diaphragm adjustment screws (3, figure 2-1) then move the upper and low diaphragm adjustment screws in small increments until the horizontal cross hair is on target (4. 985 feet on leveling rod at point B in the example).

(3) Tighten the side adjusting screw.

2-8. OPERATING PROCEDURES

a. In order to measure differences in elevation between two or more points, the operator must first select a clear, level area within sight of the two or more points to be measured.

b. Set up the tripod and dumpy level as described in paragraph 2-5.

c. Level the telescope as described in paragraph 2-7a.

d. Place leveling rod vertically at first point to be measured (point A, figure 2-7).

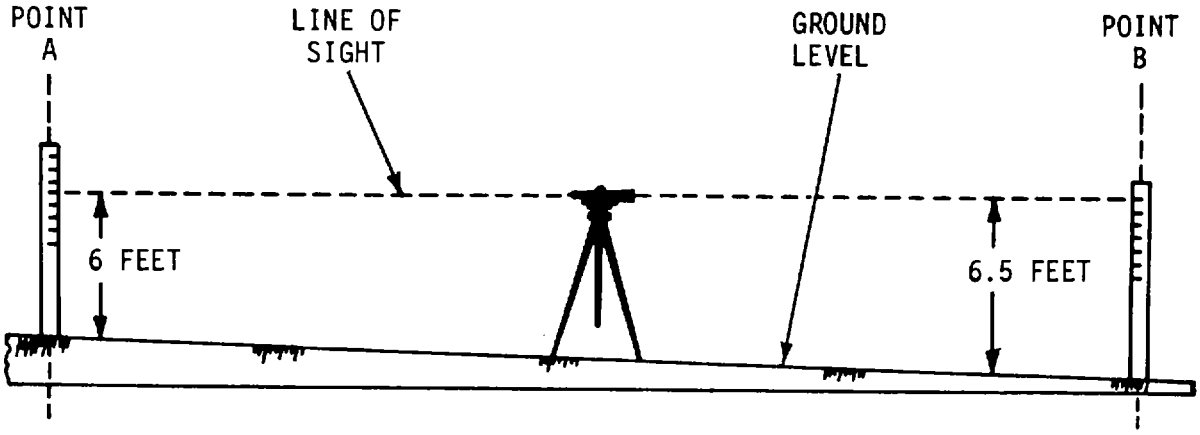


Figure 2-7. Measuring Elevation

CAUTION
Do not over tighten clamp screw.

e. Loosen clamp screw (5, figure 2-1) and rotate telescope until you can see the leveling rod. Tighten clamp screw by hand; do not over tighten.

f. Rotate eyepiece (4) until cross hairs are in sharp focus.

g. Rotate focusing knob (2) until leveling rod is in sharp focus.

h. Rotate tangent screw (6) until leveling rod is lined up with vertical cross hair (figure 2-8).

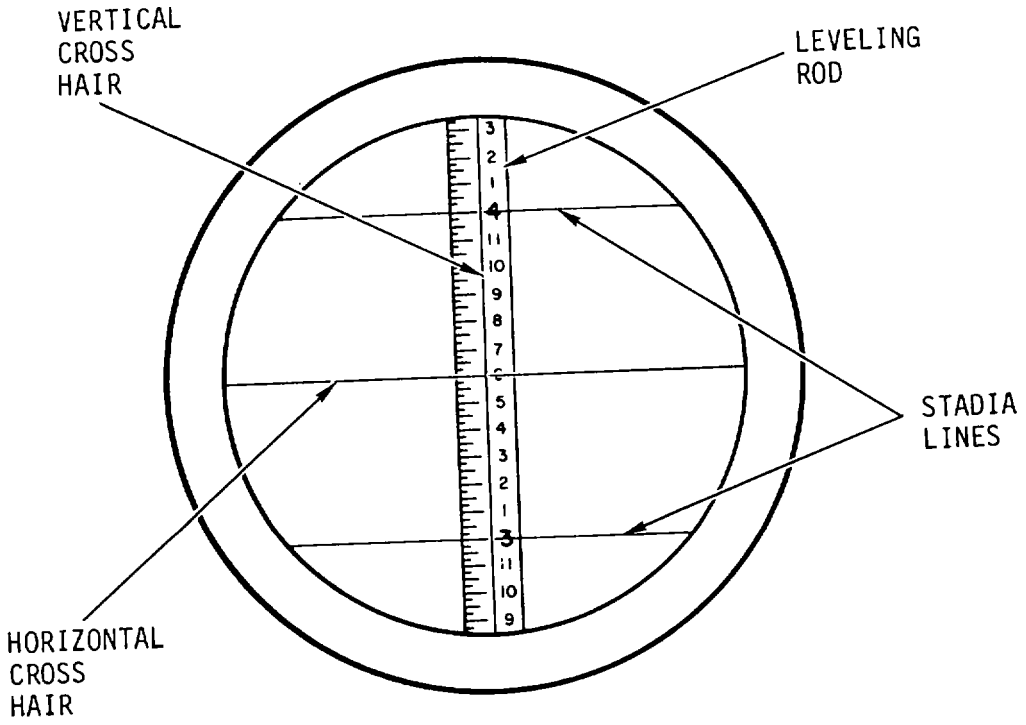


Figure 2-8. View Through Telescope

i. Read vertical measurement shown by horizontal cross hair and leveling rod scale.

j. Place leveling rod vertically at next point to be measured (point B. figure 2-7).

k. Do steps e through i.

l. Record vertical measurement shown by horizontal cross hair and leveling rod scale.

m. Measure elevation of additional points as described in steps j through l.

n. Calculate difference in elevation using measurements recorded in steps i and l.

EXAMPLE:

If measurement at point A is 6 feet and at point B it is 6. 5 feet, the difference is + 0. 5 foot. Ground level at point B is + 0. 5 foot lower than point A.

o. Calculate differences in ground level between additional points as shown in step n.

2-9. PREPARATION FOR MOVEMENT

a. Movement Over Short Distances. For short distances in cleared, level areas, the operator may carry the dumpy level mounted on the tripod. While the instrument is 2-in mounted on the tripod, it should only be carried in the upright position.

CAUTION

Use extreme care when moving the dumpy level mounted on tripod. Handle instrument carefully. Never subject it to bumps, jars, or shocks. Never leave the dumpy level unattended for long periods of time unless it is returned to the packing box. Never carry the instrument over the shoulder.

NOTE

Whenever the dumpy level is to be removed from tripod, relieve tension of the leveling screws.

b. Movement Over Long Distances. When the dumpy level must be transported over a long distance or over rough terrain, it must be transported in its carrying case (figure 1-4).

2-10. REINSTALLATION AFTER REMOVAL

Refer to paragraphs 2-5 and 2-7a for reinstallation after movement.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-11. OPERATION IN EXTREME COLD (BELOW 0°F)

The dumpy level may be used in extreme cold with no adverse effect on its capabilities. Its use is limited only by the endurance of the operating personnel and conditions affecting visibility.

CAUTION

Avoid subjecting the instrument to sudden changes in temperature. Extreme temperature changes may cause internal stresses affecting accuracy and optical components may become fogged. Keep dumpy level in carrying case to allow gradual change to ambient temperature.

2-12. OPERATION IN EXTREME HEAT

If the dumpy level is operated in extreme heat and under the direct rays of the sun, internal stresses and distortion may occur which would result in poor sightings. If possible, the dumpy level should be protected from the sun by a surveyor' field umbrella or other suitable means. Taking sightings during early morning or late evening will help to minimize error magnitude. Also, shorter sightings will decrease the amount of sighting error. If the instrument is kept in a cool storage area, it should be removed from storage in sufficient time before use to allow the temperature of the instrument to approach that of the outside air.

2-13. OPERATION IN DUST OR SANDY AREAS

Special precautions must be observed when the dumpy level is used In a dusty or sandy environment, as dust and sand are highly abrasive. If foreign matter adheres to mating surfaces, the mechanisms may bind. The instrument should be kept as clean as possible. Use extreme care to avoid scratching the optical surfaces while cleaning. Protect the level from blowing dust and sand. Always place a protective cover over the instrument when it is not in use.

2-14. OPERATION UNDER RAINY OR HUMID CONDITIONS

In spite of its enclosed construction, the dumpy level is not waterproof. In humid areas, a drop in temperature may cause condensation to fog the lenses. Internal fogging can usually be removed by placing the instrument in a warm, dry environment. External condensation may be removed using a chamois. During rainfall, protect the instrument with a surveyor's field umbrella; and between periods of use, while it is set up on the tripod, cover the instrument with a waterproof hood. If the instrument is wet, do not keep it in the carrying case any longer than necessary. As soon as possible, remove the instrument and do not return it to the carrying case until it is completely dry.

2-15. OPERATION IN SALT WATER AREAS

Salt is highly corrosive to metal. If using the dumpy level in salt water areas, wipe it frequently with a chamois. If salt water contacts the instrument, the exterior should be thoroughly cleaned. As soon as possible, return the instrument to Direct Support and General Support Maintenance.

CHAPTER 3
ORGANIZATIONAL MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

3-2. SPECIAL TOOLS, FADE, AND SUPPORT EQUIPMENT

No special tools or equipments are required by Operator or Organizational maintenance personnel for maintenance of the dumpy level.

3-3. SPARES AND REPAIR PARTS

Spares and repair parts are listed and illustrated in Appendix C of this manual.

Section II. SERVICE UPON RECEIPT

3-4. GENERAL

This section provides the information required at the Organizational maintenance level to ensure that the equipment is adequately inspected, serviced, and operationally tested before normal use.

3-5. SERVICE UPON RECEIPT OF MATERIEL

Service upon receipt procedures are covered in the following Checklist.

LOCATION	ITEM	ACTION	REMARKS
1. Carrying case	Components	a. Inspect for loose or broken bottom and corner; Dints, interior blocks and protective lining, hinge, closure clamps, and carrying strap. Also, inspect wood for breaks and varnished surfaces for damage. b. Reject carrying case if damage prevents its normal use.	

LOCATION	ITEM	ACTION	REMARKS
2. Dumpy Level	Base assembly	a. Inspect head and base plate for cracks and mounting threads for damage, leveling screws for damaged threads or knob. Also, inspect level vial for secure attachment and good condition. b. Reject dumpy level if any base component is cracked or broken, any part is missing, threads are damaged, clamp screw cannot function, or if level vial is broken.	
	Telescope assembly	a. Inspect telescope body and objective lens head for dents, cross bar for cracks, and the focusing knob and eyepiece ring for smooth operation through their complete range. View through telescope. Inspect for sharp image throughout focusing range and for condition of cross hairs. b. Reject dumpy level if body is bent or dent in body obstructs focusing. Reject if cross hairs are missing or in poor condition.	
3. Tripod	Head and legs	a. Inspect head for cracks, mounting threads for damage, legs for cracks or other damage, and shoes for breaks and tight attachment. b. Reject tripod if head has cracks, threads are damaged, legs are excessively worn at upper end or have cracks, or if shoe is missing or broken.	

3-6. CHECKING UNPACKED EQUIPMENT

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Report.

b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of TM 38-750.

Section III. OPERATIONAL CHECKS

3-7. OPERATIONAL CHECKS

Operational checks, consisting of instrument leveling and focusing checks, are shown in table 3-1. Perform the procedures weekly when the instrument is in regular use. When the instrument is not used regularly, perform the procedures before each use.

Table 3-1. Instrument Leveling and Focusing Checks.

Step	Operation Normal indication Corrective procedure
1	Level the telescope. Use the level vial as a guide; center the bubble by turning the leveling screws. See figures 2-1 through 2-5. Lubricate leveling screws with light application of machine oil if screws are hard to rotate. Apply machine oil to ball nut and base plate. Check the condition of level vial. Vial should have no cracks; bubble length should not exceed 1.8 inches (46 mm); vial should be firmly attached to level housing.
2	Focus cross hairs. Rotate eyepiece to obtain sharp image of cross hairs while looking through telescope. See figures 2-1 and 2-8. Check rotation for smooth operation with no binding or loose play. Binding indicates damage; loose play indicates excessive wear.
3	Focus on a distant object. Rotate focusing knob to obtain sharp image while looking at image of object in telescope. See figures 2-1 and 2-8. Check focusing gears (pinion and rack) for smooth operation with no binding or loose play. Slight resistance to rotation is normal. Excessive resistance indicates defective gears, faulty pinion gear shaft, or distorted telescope tube. Loose play indicates excessive wear.

Section IV. PREVENTIVE MAINTENANCE

3-8. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Table 3-2 presents recommended checks and services arranged in a logical sequence. These service items should be performed at the indicated time interval. When the instrument is not used daily, it is not necessary to perform the daily scheduled procedures. Instead, perform daily scheduled procedures before each use of the instrument.

Table 3-2. Organizational Preventive Maintenance Checks and Services

D - Daily
W - Weekly
M - Monthly

Item No.	Interval D	W	M	Item To Be Inspected	Procedures	Equipment is Not Ready/Available If:
1	●			Telescope	Inspect telescope assembly for missing, broken, or loose parts; inspect lenses for cracks or scratches.	Focusing knob, clamp screw, tangent screw, clamp, or a leveling screw is missing; eyepiece is missing; lens is cracked.
2	●			Base assembly	Inspect leveling head for cracks.	Leveling head or cross bar is cracked or level vial missing.
3	●			Diaphragm assembly	Look through the eyepiece and Inspect the cross hairs horizontal and vertical placement.	Any portion of a cross hair is missing or broken.
4	●			Pinion gear assembly	Inspect the pinion gear assembly by operating the focusing knob; inspect for smooth operation with no binding and no play.	Operation is not smooth or is excessively tight or loose.
5	●			Eyepiece assembly	Inspect eyepiece assembly by rotating the large knurled ring; inspect for smooth operation with no binding and no play.	Operation is not smooth or is excessively tight or loose.

Table 3-2. Organizational Preventive Maintenance Checks and Services (Continued)

D - Daily
W - Weekly
M - Monthly

Item No.	Interval D	Interval W	Interval M	Item To Be Inspected	Procedures	Equipment is Not Ready/Available if:
6	•			Level vial assembly	Inspect the level vial for cracks or loose attachment; inspect for presence of liquid.	Level vial is broken or loose in its housing.
7			•	Accessories	Inspect carrying case for plastic cover, sunshade, and objective lens dust cap.	
8		•		Carrying case	Inspect carrying case for loose or broken joints, hinge, closure clamp, and carrying strap.	
9		•		Tripod	Inspect legs for cracks or excessive wear at upper end; inspect legs for broken, missing, or loose shoes; inspect head for cracks and mounting threads for damage.	Legs are cracked or too worn at top to be tightened; a shoe is missing; head is broken or cracked.

Section V. TROUBLESHOOTING

3-9. GENERAL

Troubleshooting of the dumpy level by Organizational maintenance personnel is limited to inspection of the telescope (including eyepiece and focusing assemblies), leveling screw assemblies, base plate and ball nut assembly, and the tripod. Only repair and replacement of the level vial assembly is authorized to be accomplished by Organizational maintenance personnel. The troubleshooting procedures in table 3-3 provide malfunction, test or inspection, and corrective action information common to the level vial assembly only. Any malfunction which are observed and are beyond the repair scope of Organizational maintenance personnel shall be reported to Direct Support maintenance.

Table 3-3. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. LEVEL WILL NOT SEAT PROPERLY ON TRIPOD.
Step 1. Check to see if tripod and baseplate threads improperly started. Restart tripod plate (paragraph 2-5).
Step 2. Check to see if tripod head defective. Have Direct Support maintenance personnel replace tripod head.
2. LEVEL WILL NOT STAY ON LINE.
Step 1. Check to see if instrument out of level. Level instrument (paragraph 2-7a)
Step 2. Check to see if level vial bubble out of adjustment. Adjust level vial bubble (paragraph 2-7b).

Section VI. MAINTENANCE PROCEDURES

3-10. GENERAL

Maintenance procedures in this section are limited to installation, removal, cleaning, and inspection of the level vial assembly. All maintenance procedures can be performed by one maintenance technician.

3-11. LEVEL VIAL MAINTENANCE INSTRUCTIONS (Figure 3-1)

This task covers:

a. Removal
b. Cleaning
c. Inspection
d. Installation

Accessories

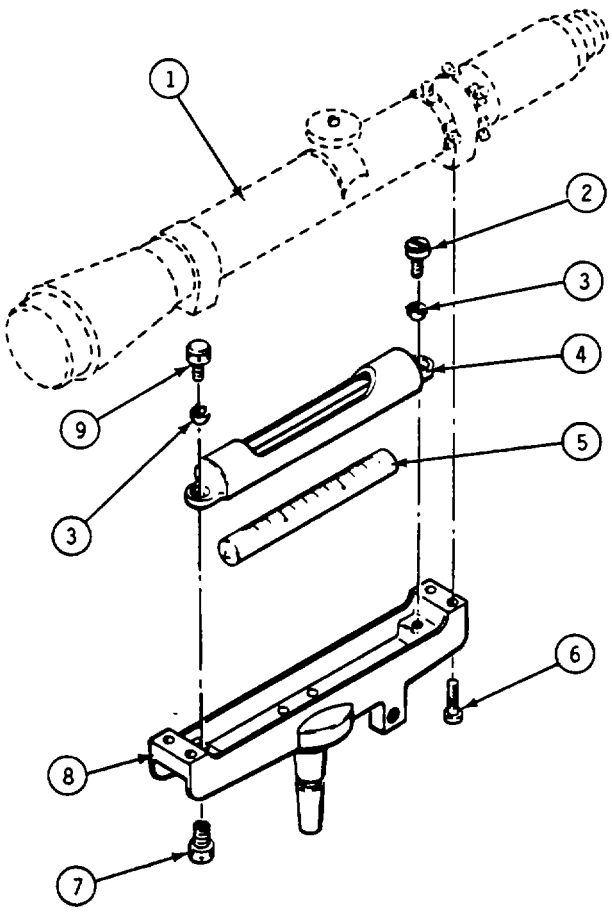
Pin wrenches

Materials/Parts

Level vial
Plaster of paris (item 8, App F)

Troubleshooting References

Paragraph 3-9



1 TELESCOPE
2 SCREW
3 HALF BALL WASHER
4 LEVEL HOUSING
5 LEVEL VIAL
6 SCREW
7 ADJUSTING SCREW
8 CROSS BAR
9 SCREW

Figure 3-1. Level Vial Maintenance

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
Level vial (5)	4 screws (6)	Remove	Lift telescope (1) from cross bar (8).
	2 screws (2) and (9) 2 half ball washers (3)	Remove	Use pin wrench to remove screw (9); use pin wrench to hold adjusting screw (7); lift level housing (4) and level vial (5) from cross bar (8).
	Plaster of paris	Remove	Remove plaster of paris from end of level housing (4) for access to level vial (5); remove level vial from housing.
CLEANING			
Level housing (4)	Plaster of paris	Clean	Scrape clean, wash in soapy water, dry.
Level vial (5)		Clean	Use dry cloth to clean new level vial.
INSTALLATION			
	NOTE Use masking tape to hold level vial temporarily in place.		
Level vial (5)	Level vial (5)	Install	Install level vial (5) in level housing (4) with graduations in housing window.
	Plaster of paris	Install	Mix plaster of paris to creamy consistency; pour mixture over end of level vial (5) in level housing (4) until vial is covered.

LOCATION	ITEM	ACTION	REMARKS
	NOTE Allow plaster of paris to harden for at least one hour.		
Level housing (4)	Level housing (4)	Install	Place level housing (4) in cross bar (8).
	2 half ball washers (3)	Install	Place rounded surface toward level housing (4).
	2 screws (2) and (9)	Install	Screw (9) threads into adjusting screw (7); use pin wrench to install screw (9); use pin wrench to hold adjusting screw (7).

CHAPTER 4
DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

No special tools or equipment are required by Direct Support and General Support personnel for maintenance of the level.

4-3. SPARES AND REPAIR PARTS

Spares and repair parts are listed and illustrated in Appendix C of this manual.

Section II. TROUBLESHOOTING

4-4. GENERAL

Troubleshooting procedures in table 4-1 section provide Direct Support Maintenance personnel with tabular information for diagnosing and correcting unsatisfactory operation or failure of the eyepiece, ball nut assembly, clamp assembly, and tripod. Following each malfunction are tests or inspections and corrective actions required to correct the malfunction.

Table 4-1. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. LEVEL WILL NOT SEAT PROPERLY ON TRIPOD HEAD.

Step 1. Check to see if baseplate assembly defective.

Repair or replace baseplate assembly (paragraph 4-7).

Step 2. Check to see if tripod head defective.

Replace tripod head (paragraph 4-9).

2. LEVEL WILL NOT STAY ON LINE.

Step 1. Check to see if baseplate assembly is loose or defective.

Repair or replace baseplate assembly (paragraph 4-7).

Step 2. Check to see if ball nut is defective or loose.

Tighten or replace ball nut assembly (paragraph 4-7).

3. LEVELING SCREWS TOO TIGHT OR TOO LOOSE.

Check to see if ball nut assembly is defective or loose.

Tighten or replace ball nut assembly (paragraph 4-7).

4. EYEPIECE HARD TO MOVE.

Check to see if eyepiece assembly is dirty or defective.

Clean, repair, or replace eyepiece assembly (paragraph 4-6).

5. LEVEL WILL NOT STAY ON AZIMUTH POSITION

Check to see if telescope can be rotated when clamp screw is hand tightened.

Clean, repair, or replace clamp assembly (Paragraph 4-8).

Section III. MAINTENANCE PROCEDURES

4-5. GENERAL

Maintenance procedures in this section 'include installation, removal, cleaning, and inspection of the eyepiece, ball nut, clamp, and tripod assemblies. All maintenance procedures can be performed by one maintenance technician.

4-6. EYEPIECE ASSEMBLY MAINTENANCE INSTRUCTIONS (Figure 4-1)

This task covers:

a. Removal
b. Cleaning
c. Inspection
d. Installation

Initial Setup

Applicable Configuration

All

Accessories

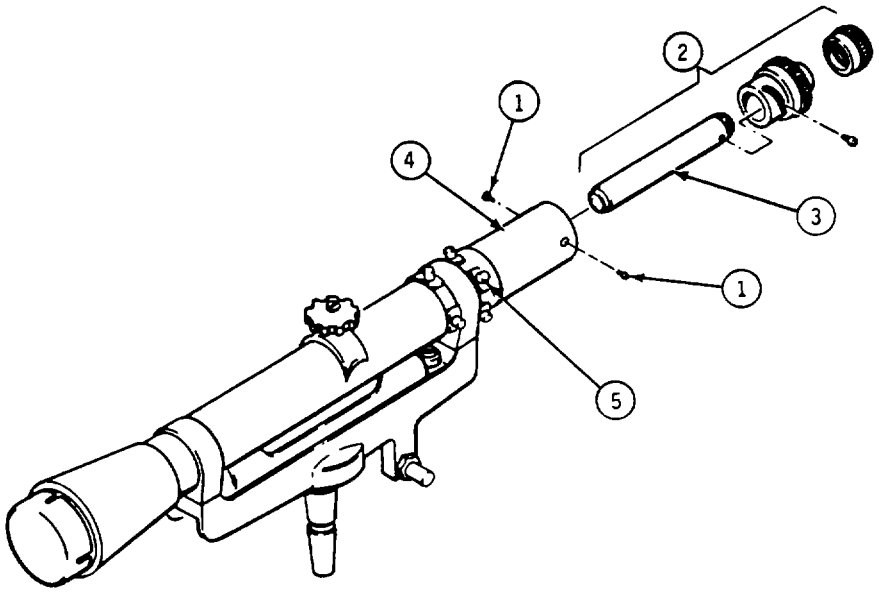
Camel hair dust brush
Jeweler's screwdriver

Materials/Parts:

Eyepiece assembly
Light grease

Troubleshooting References:

Paragraph 4-4



1 SCREW
2 EYEPIECE ASSEMBLY
3 BARREL
4 TELESCOPE
5 EYEPIECE GUIDE SCREW

Figure 4-1. Eyepiece Assembly Maintenance

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
Eyepiece assembly (2)	2 screws (1)	Remove	—
	Eyepiece assembly (2)	Remove	Inspect spiral slot and spiral screw; discard if there is excessive wear or binding. Inspect lenses for looseness, scratches, or cracks.
CLEANING			
	Eyepiece assembly (2)	Remove dust from lenses with soft, dry brush; remove grease film from barrel (3).	Remove dust from lenses with brush; clean lenses with soft cloth moistened with water and ammonia; apply light film of grease to barrel surface.
INSTALLATION			
Eyepiece assembly (2)	Eyepiece assembly (2)	Install	—
	2 screws (1)	Install	—

4-7. BALL NUT MAINTENANCE INSTRUCTIONS (Figure 4-2)

This task covers:

a. Removal
b. Cleaning
c. Inspection
d. Installation

Initial Setup

Applicable Configuration:

All

Accessories:

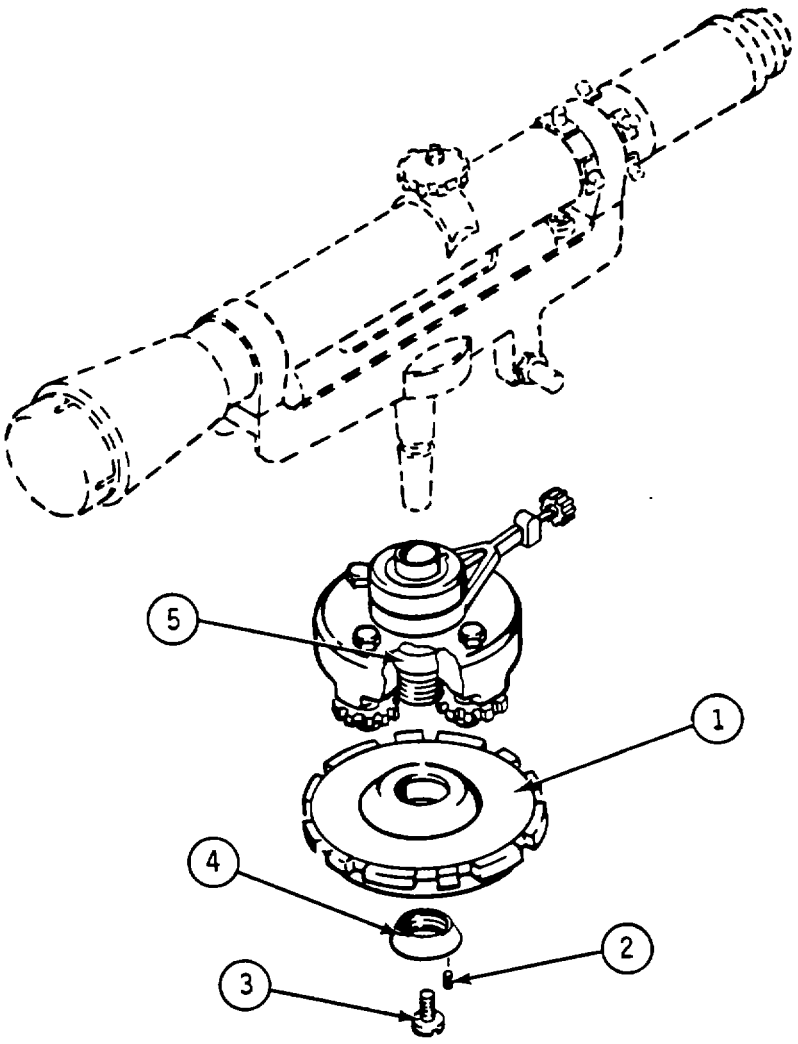
Spanner wrench
Hex socket head wrench 1-16 inch

Materials/Parts:

Ball nut
Light grease (item 4, App F)

Troubleshooting References:

Paragraph 4-4



1 BASEPLATE
2 RETAINING SCREW
3 BOTTOMING SCREW
4 BALL NUT
5 CENTER HOUSING

Figure 4-2. Ball Nut Maintenance

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
Ball nut (4)	Retaining screw (2)	Remove	—
	Ball nut (4)	Remove	Use spanner wrench to remove ball nut (4); support baseplate (1) when ball nut (4) is removed; inspect seat for ball nut in baseplate for excessive wear; inspect center housing (5) for excessively worn threads.
CLEANING			
	Baseplate (1)	Remove grease film on ball nut (4) seat	—
INSTALLATION			
	Baseplate (1)	Install	Apply light film of grease to ball nut (4) seat.
	Ball nut (4)	Install	Use spanner wrench to install ball nut (4); tighten ball nut then back off to align hole for retaining screw (2).
	Retaining screw (2)	Install	—

4-8. CLAMP ASSEMBLY MAINTENANCE INSTRUCTIONS (Figure 4-3)

This task covers:

a. Removal
b. Cleaning
c. Inspection
d. Installation

Initial Setup

Applicable Configuration

All

Accessories:

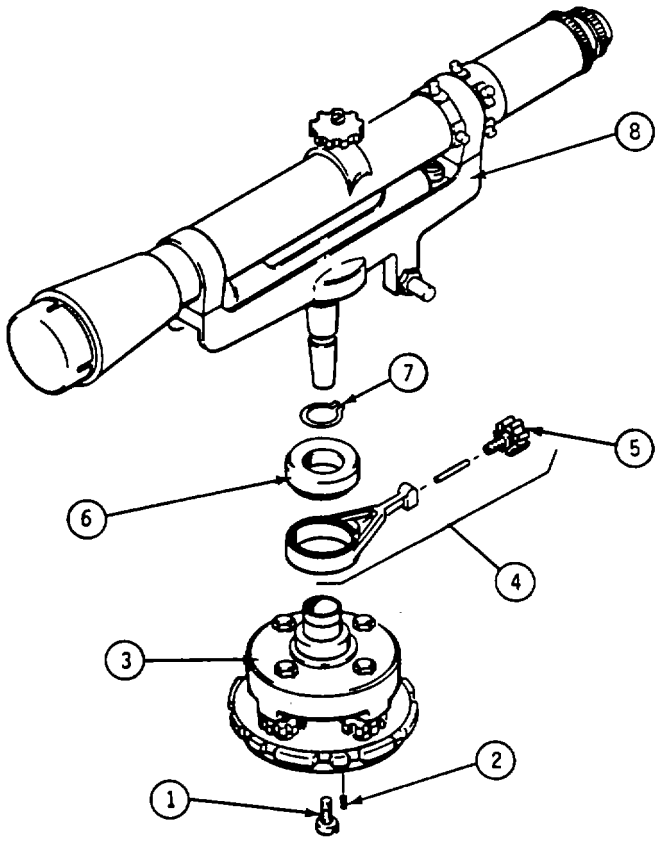
Spanner wrench
Retaining ring pliers
1/16 inch hex socket wrench
1/2 inch open-end wrench
Screwdriver

Materials/Parts:

Clamp assembly

Troubleshooting References:

Paragraph 4-4



1 BOTTOMING SCREW
2 RETAINING SCREW
3 BASEPLATE AND LEVELING SCREW ASSEMBLY
4 CLAMP ASSEMBLY
5 CLAMP SCREW
6 CLAMP LOCATING RING
7 RETAINING RING
8 TELESCOPE AND CROSS BAR ASSEMBLY

Figure 4-3. Clamp Assembly Maintenance

LOCATION	ITEM	ACTION	REMARKS
REMOVAL			
Telescope and cross bar assembly (8)	Retaining screw (2)	Remove	
	Bottoming screw (1)	Remove	Remove telescope and cross bar assembly (8) from baseplate and leveling screw assembly (3)
Clamp assembly (4) and clamp locating ring (6)	Retaining ring (7)	Remove	Use retaining ring pliers to remove retaining ring (7)
	Clamp locating ring (6)	Remove	
	Clamp assembly (4)	Remove	Loosen clamp screw (5) to remove clamp assembly (4)
CLEANING AND INSPECTION	Clamp assembly (4) and clamp locating ring (6)	Wipe with clean dry lintless cloth	Inspect clamp assembly and clamp locating ring (6) for excessive wear, worn screw threads, or cracks
INSTALLATION			
Clamp assembly (4)	Clamp assembly (4)	Install	Install clamp assembly (4) in position on baseplate and leveling screw assembly (3); tighten clamp screw (5).
	Clamp locating ring (6)	Install	Install clamp locating ring (6) over center shaft on top of clamp assembly (4).
	Retaining ring (7)	Install	Secure clamp assembly (4) and clamp locating ring (6) in position on center shaft of baseplate and leveling screw assembly (3).
Telescope and cross bar assembly (8)	Bottoming screw (1)	Install	Install telescope and cross bar assembly (8) in position on baseplate and leveling screw assembly (3); replace and tighten bottoming screw (1)
	Retaining screw (2)	Install	

4-9. TRIPOD ASSEMBLY MAINTENANCE INSTRUCTIONS (Figure 4-4)

This task covers:

- Disassembly
- Cleaning
- Inspection
- Repair
- Reassembly

Initial Setup

Accessories:

Screwdriver

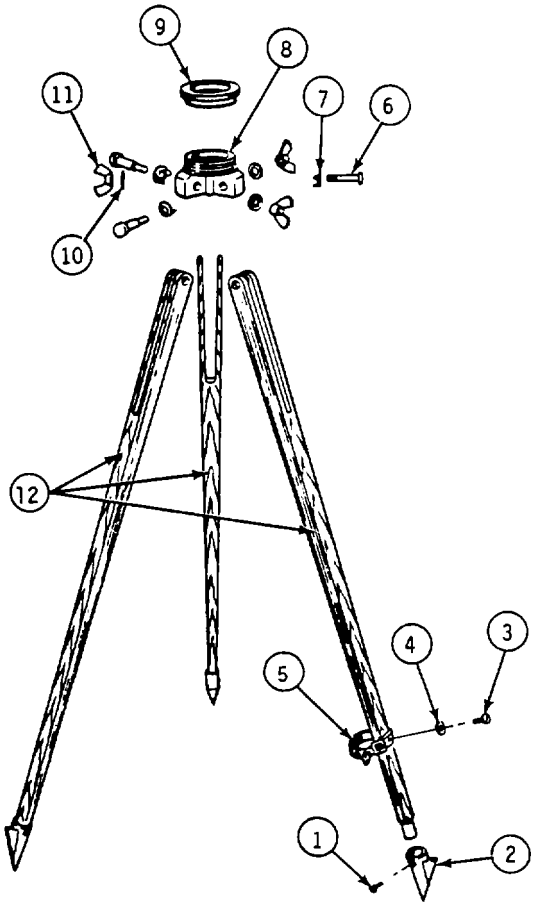
Materials/Parts:

Tripod

Leg
Cap
Head
Shoes

Troubleshooting References:

Paragraph 4-4



1 SCREW
2 SHOE
3 SCREW
4 WASHER
5 STRAP
6 MOUNTING BOLT
7 TORQUE WASHER
8 HEAD
9 CAP
10 LOCKWASHER
11 WING NUT
12 LEG

Figure 4-4. Tripod Assembly Maintenance

LOCATION	ITEM	ACTION	REMARKS
DISASSEMBLY			
Shoes (2)	Screws (1)	Remove	
	Shoes (2)	Remove	
Strap (5)	Screw (3)	Remove	
	Washer (4)	Remove	
	Strap (5)	Remove	
Legs (12)	Mounting bolts (6)	Remove	
	Torque washers (7)	Remove	
	Lockwashers (10)	Remove	
	Wing nuts (11)	Remove	
	Legs (12)	Remove	
	Head (8)	Remove	
	Cap (9)	Remove	
CLEANING AND INSPECTION			
	Cap (9) and head (8)	Remove dust and oil film from all threaded surfaces	Inspect for excessive wear on threaded surfaces
	Strap (5)		Inspect strap for cuts, wear, and damaged seams.
	Legs (12)	Remove all burrs and minor scratches.	

LOCATION	ITEM	ACTION	REMARKS
REPAIR			
	Legs (12), Cap (9), head (8) and shoes (2)	Paint wooden legs (12) if protective coating is worn or damaged; paint any surface that shows bare metal.	Replace any part that cannot be repaired.
REASSEMBLY			
Head (8)	Cap (9)	Install	
Legs (12)	Head (8)	Install	Assemble legs (12) in position on head (8).
	Mounting bolts (6) and torque washers (7)	Install	
	Lockwashers (10)	Install	
	Wing nuts (11)	Install	
Shoes (2)	Shoes (2)	Install	Make certain that cleated sections of shoes (2) are facing outward.
	Screws (1)	Install	

APPENDIX A
REFERENCES

A-1. LUBRICATION

C9100IL

Fuels, Lubricants, Oils, and Waxes

A-2. PAINTING

TM 9-213

Painting Instructions for Field Use

A-3. MAINTENANCE

TB ENG 301

Identification, Inspection, and Classification of Surveying Instruments - Level, Surveying, Dumpy Style Federal Class 6675

TM 38-750

Army Equipment Record Procedures

TM 5-6675-271-14&P

Operator, Organizational, Direct Support and General Support Maintenance Manual (including Repair Parts and Special Tools List): Level, Dumpy 2060-S18EDL, NSN 6675-01-071-5339

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. GENERAL

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

b. The Maintenance Allocation Chart (MAC) in Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. -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 Special Tools and Test Equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions or explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS

Inspect	To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.
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.
Service	Operations required periodically to keep an item in proper operating condition; i.e., to clean (decontaminate), preserve, drain, paint, or replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.
Adjust	To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.
Align	To adjust specified variable elements of an item to bring about optimum or desired performance.
Calibrate	To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons 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.

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

Replace — The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

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, subassembly, module (component or assembly), and item, or system.

Overhaul — That maintenance effort (services/actions) 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 like new condition.

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.

B-3. COLUMN ENTRIES USED IN THE MAC

Column 1, Group Number	Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.
Column 2, Component/Assembly	Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.
Column 3, Maintenance Functions	Column 3 lists the functions to be performed on the item listed in column2. (For detailed explanation of these functions, see B.2.)

Column 4 Maintenance Level	Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn (s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform the maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work time figures will be shown for each level. The number of man-hours specified by the work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows: C - Operator or crew O - Organizational maintenance F - Direct Support maintenance H - General Support maintenance D - Depot maintenance
Column 5, Tools and Equipment	Column 5 specifies, by code, those common tool sets (not individual tools) and Special Tools, Test, and Support Equipment required to perform the designated function.
Column 6, Remarks	This column shall contain a letter code in alphabetical order which shall be keyed to the remarks contained in Section IV.

B-4. COLUMN ENTRIES USED IN TOOL AND TEST EQUIPMENT REQUIREMENTS

Column 1, Tool or Test Equipment Reference Code	The tool and test equipment reference code correlates with a maintenance function on the identified end item or component.
Column 2, Maintenance Level	The lowest level of maintenance authorized to use the tool or test equipment.
Column 3, Nomenclature	Name or identification of the tool or test equipment.

Column 4, National/NATO Stock Number	The National or NATO stock number of the tool or test equipment.
Column 5, Tool Number	The manufacturer's part number.

B-5. EXPLANATION OF COLUMNS IN SECTION IV

Reference Code	The code scheme recorded in column 6, Section II.
Remarks	This column lists information pertinent to the maintenance function being performed as indicated on the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART FOR LEVEL, SURVEY, SEILER INSTRUMENT COMPANY

(1) Group Number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance level					(5) Tools and equipment	(6) Remarks
			C	O	F	H	D		
01	Accessories	Inspect	0.2						
		Replace		0.2					
02	Case, Carrying	Service		0.2					A
		Replace		0.1					
		Repair		1.0					
03	Tripod Assembly	Inspect		0.2					
		Service		0.3					A
		Repair			1.0			6	
04	Level Surveying								
0401	Telescope and Level Assembly	Inspect		0.3					
		Service		0.5					A,C
		Repair					**		
		Overhaul					**		
	Head Leveling	Inspect		0.1					
		Replace					**		
		Repair					**		
	Leveling Screw Assembly	Inspect		0.1					
		Service			0.2				A
		Replace					**		
	Diaphragm Assembly	Inspect		0.2					
		Adjust	0.2					4	B
		Replace					**		
	Ball nut	Inspect			0.1				
		Replace			0.2			7,8	
	Clamp Assembly	Inspect			0.1				
		Adjust			0.2			7,8,9	C
		Replace			0.3				
	Pinion Assembly	Inspect		0.1					
		Repair					**		
	Eyepiece Assembly	Inspect		0.2					
		Repair					**		
		Replace			0.3			5,6	
	Objective Lens	Inspect			0.3				
		Repair							
		Replace					**		
	Level Vial Assembly	Inspect		0.2					
		Adjust	0.2					2,3	B
		Replace		0.3					
		Repair		0.3					

** Depot:Time will be in DMWR

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR LEVEL, SURVEY, SEILER INSTRUMENT COMPANY

(1) REFERENCE CODE	(2) MAINTENANCE CATEGORY	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER (NSN)	(5) TOOL NUMBER
1	C	Brush, Dust		
2	C	Pin Wrench, Straight		
3	C	Pin Wrench, Bent		
4	C	Screwdriver, 1/8 inch wide blade		
5	F	Screwdriver, Jeweler's 0.080-inch wide tip		
6	C	Screwdriver, Flat Tip, 3/16-inch		
7	D	Wrench, Socket Head 1/16 inch key		
8	F,D	Wrench, Spanner		
9	F	Pliers, Retaining Ring		

Section IV. REMARKS

REFERENCE CODE	REMARKS
A	Service consists of cleaning and lubricating.
B	Included in operational procedures.
C	Adjustment consists only of loosening or tightening the tangent tension screw.

APPENDIX C
REPAIR PARTS AND SPECIAL TOOLS LIST

Section I. INTRODUCTION

C-1. SCOPE.

This manual lists spares and repair parts; special tools; and other special support equipment required for performance of organizational, direct support, and general support maintenance of the Engineer's Dumpy Level Model 2060-S18EDL. It authorizes the requisitioning and issue of spares and repair parts as indicated by the source and maintenance codes.

C-2. GENERAL.

This Repair Parts and Special Tools List is divided into the following sections:

a. Section II. Repair Parts List. A list of spares and repair parts authorized for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in numeric sequence, with the parts in each group listed in figure and item number sequence.

b. Section III. Special Tools List.

c. Section IV. National Stock Number and Part Number Index. A list, in National item identification number (NIIN) sequence, of all National stock numbers (NSN) appearing in the listings, followed by a list in alphameric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance.

C-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.

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

b. Source, Maintenance and Recoverability (SMR) Codes.

(1) Source Code. Source codes indicate the manner of acquiring support items for maintenance, repair, or overhaul of end items. Source codes are entered in the first and second positions of the Uniform SMR Code format as follows:

Code	Definition
PA	- Item procured and stocked for anticipated or known usage.
PB	- Item procured and stocked for insurance purpose because essentially dictates that a minimum quantity be available in the supply system.
PC	- Item procured and stocked and which otherwise would be coded PA except that it is deteriorative in nature.
PD	- Support item, excluding support equipment, procured for initial issue or outfitting and stocked only for subsequent or additional initial issues or

Code	Definition
	outfittings. Not subject to automatic replenishment.
PE	Support equipment procured and stocked for initial issue or outfitting to specified maintenance repair activities.
PF	Support equipment which will not be stocked but which will be centrally procured on demand.
PG	Item procured and stocked to provide for sustained support for the life of the equipment. It is applied to an item peculiar to the equipment which, because of probable discontinuance or shutdown of production facilities, would prove uneconomical to reproduce at a later time.
KD	An item of a depot overhaul/ repair kit and not purchased separately. Depot kit defined as a kit that provides items required at the time of overhaul or repair.
KF	An item of a maintenance kit and not purchased separately. Maintenance kit defined as a kit that provides an item that can be replaced at organizational or intermediate levels of maintenance.
KB	Item included in both a depot overhaul/repair kit and a maintenance kit.
MO	Item to be manufactured or fabricated at organizational level.
MF	Item to be manufactured or fabricated at the direct support maintenance level.
MH	Item to be manufactured or fabricated at the general support maintenance level.
MD	Item to be manufactured or fabricated at the depot maintenance level.
AO	Item to be assembled at organizational level.
AF	Item to be assembled at direct support maintenance level.
AH	Item to be assembled at general support maintenance level.
AD	Item to be assembled at depot maintenance level.
XA	Item is not procured or stocked because the requirements for the item will result in the replacement of the next higher assembly.
XB	Item is not procured or stocked. If not available through salvage, requisition.
XC	Installation drawing, diagram, instruction sheet, field service drawing, that is identified by manufacturer's part number.
XD	A support item that is not stocked. When required, item will be procured through normal supply channels.

NOTE: Cannibalization or salvage may be used as a source of supply for any items coded above except those coded XA.

(2) Maintenance Code. Maintenance codes are assigned to indicate the levels of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the Uniform SMR Code format as follows:

(a) The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace, and use the support item. The maintenance code entered in the third

position will indicate one of the following levels of maintenance:

Code	Application/Explanation
C	- Crew or operator maintenance performed within organizational maintenance.
O	- Support item is removed, replaced, used at the organizational level.
F	- Support item is removed, replaced, used at the direct support level.
H	- Support item is removed, replaced, used at the general support level.
D	- Support items that are removed, replaced, used at depot, mobile depot, or specialized repair activity only.

(b) The maintenance code entered in the fourth position indicates whether the item is to be repaired and identifies the lowest maintenance level with the capability to perform complete repair (i.e., all authorized maintenance functions). This position will contain one of the following maintenance codes.

Code	Application/Explanation
O	- The lowest maintenance level capable of complete repair of the support item is the organizational level.
F	- The lowest maintenance level capable of complete repair of the support item is the direct support level.
H	- The lowest maintenance level capable of complete repair of the support item is the general support level.
D	- The lowest maintenance level capable of complete repair of the support item is the depot level.
L	- Repair restricted to (enter applicable designated specialized repair activity), Specialized Repair Activity.
Z	- Nonreparable. No repair is authorized.
B	- No repair is authorized. The item may be reconditioned by adjusting, lubricating, etc., at the user level. No parts or special tools are procured for the maintenance of this item.

(3) Recoverability Code. Recoverability codes are assigned to support items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the Uniform SMR Code format as follows:

Recoverability Codes	Definition
Z	- Nonreparable item. When unserviceable, condemn and dispose at the level indicate in position 3.
O	- Reparable item. When uneconomically reparable, condemn and dispose at organizational level.
F	- Reparable item. When uneconomically reparable, condemn and dispose at the direct support level.
H	- Reparable item. When uneconomically reparable, condemn and dispose at the general support level.
D	- Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal not authorized below depot level.
L	- Reparable item. Repair, condemnation, and disposal not authorized below depot/

Recoverability Codes	Definition
	- specialized repair activity level.
A	- Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar values, critical material or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. National Stock Number. Indicates the National stock number assigned to the item and which will be used for requisitioning.

d. Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), 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.

NOTE: When a stock numbered item is requisitioned, the item received may have a different part number than the part being replaced.

e. Federal Supply Code for Manufactured (FSCM). The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

f. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

g. Unit of Measure (U/M). Indicates the standard of the basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr, etc). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

h. Quantity Incorporated in Unit. Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a
quantity indicates that no specific quantity is applicable, (e.g., shims, spacers, etc).

C-4. SPECIAL INFORMATION

No special information is required for this equipment.

C-5. HOW TO LOCATE REPAIR PARTS

a. When National Stock Number or Part Number is Unknown:

(1) First. Using the table of contents, determine the functional group within which the item belongs. This is necessary since illustrations are prepared for functional groups and listings are divided into the same groups.

(2) Second. Find the illustration covering the functional group to which the item belongs.

(3) Third. Identify the item on the illustration and note the Illustration figure and item number of the item.

(4) Fourth. Using the Repair Parts Listing, find the figure and item number noted on the illustration.

b. When National Stock Number or Part Number is Known:

(1) First. Using the Index of National Stock Numbers and Part Numbers,

find the pertinent National stock number or part number. This index is in NIIN sequence followed by a list of part numbers in alphameric sequence, cross-referenced to the illustration figure number and item number.

(2) Second. After finding the figure and item number, locate the figure and item number in the repair parts list.

C-6. ABBREVIATIONS

All abbreviations used in this Repair Parts and Special Tools List are in accordance with MIL-STD-12.

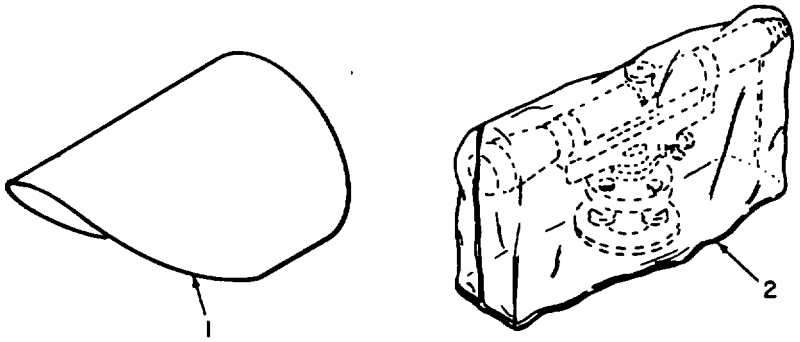


Figure C-1. Accessory Items

(1) Illustration		(2)	(3)	(4)	(5)	(6) Description	(7)	(8)
(a) Fig No.	(b) Item No.	SMR Code	National Stock Number	Part Number	FSCM	*Usable On Code*	U/M	Qty Inc. In Unit
						GROUP 01 - ACCESSORY ITEMS		
C-1	1	PA0OZ	6675-01-084-0963	2060-1221	11934	SUNSHADE.....	EA	1
C-1	2	PAOZZ		2060-1224	11 934	COVER, INSTRUMENT.....	EA	1

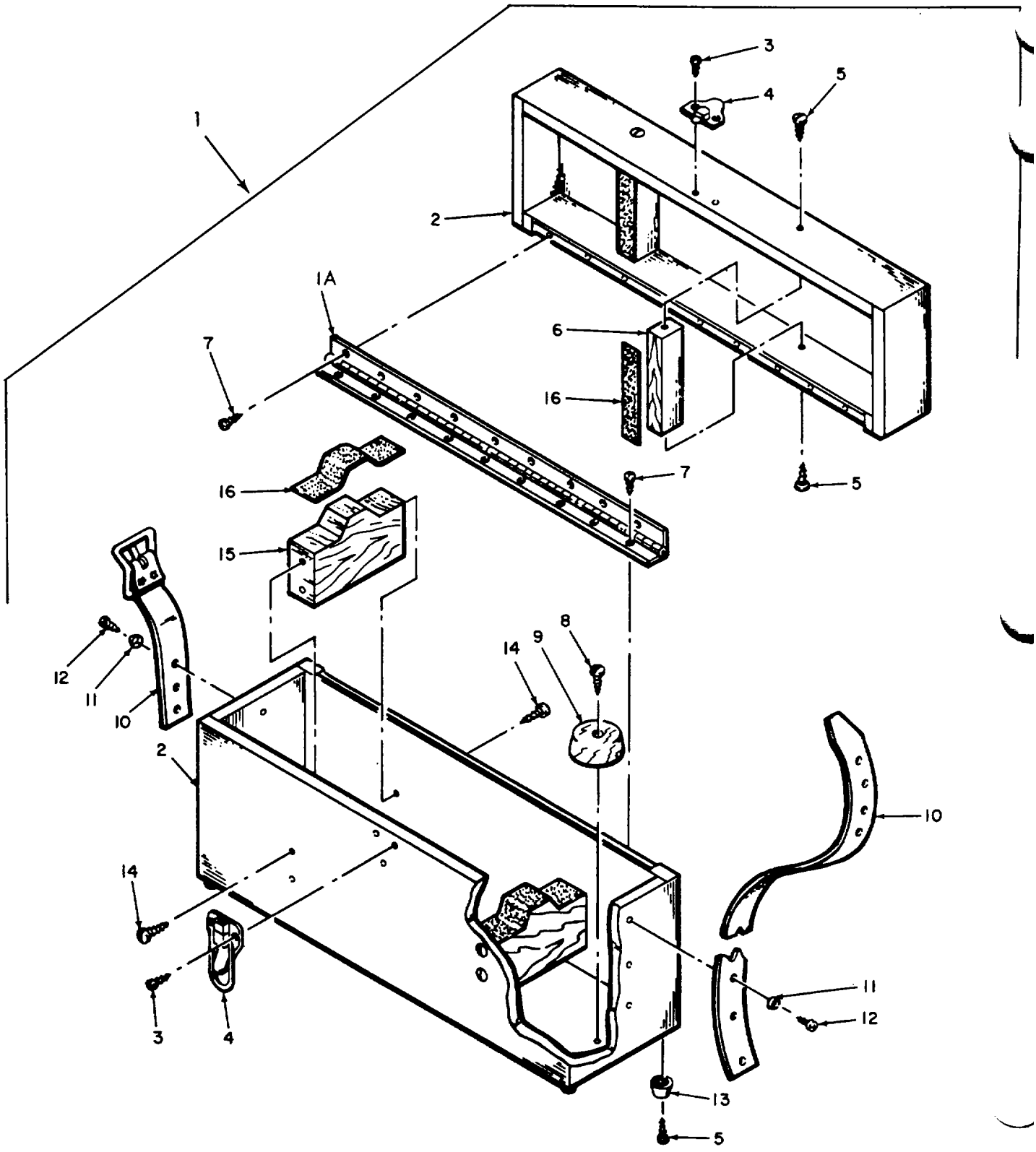


Figure C-2. Carrying Case

(1) Illustration (a) Fig No.	(1) Illustration (b) Item No.	(2) SMR Code	(3) National Stock Number	(4) Part Number	(5) FSCM	(6) Description *Usable On Code*	(7) U/M	(8) Qty Inc. In Unit
						GROUP 02-CARRYING CASE		
C-2	1	XBOZZ		2060-11I00	1134	CASSXCARRIIA	EA	1
C-2	1A	XBOZZ		2060-1137	11934	RINGS	EA	1
2	2	XBOZZ		2060-1103	11934	BOX ASSEMBLY	EA	1
C-2	3	PAOZZ	5305-01-090-7129	2060-1024	11934	SCREW,WOO	EA	5
C-2	4	PAOZZ		2060-1121	11934	CATCI	EA	1
C-.2	5	PAOZZ		2060-1052	11934	SCREW WOOD	EA	4
C-2	6	XSOSI		2060-1149	11934	SUPPORT,LID	EA	2
C-2	7	PAOZZ	5305-01-090-7129	2060-1024	11934	SCREW,WOOD	EA	18
C-2	6	PAOZZ		2060-1052	11934	S8CR WSIC	EA	1
C-2	9	XBOZZ		2060-1164	11934	BLOCK,SUNSHADE	EA	1
C-2	10	XBOZZ		2060-1112	11934	STRAP ARD BUCKLE	EA	1
C-2	11	PAOZZ	5310-01-084-1916	2060-1049	11934	WASHER, FINISHING	EA	6
C-2	12	PAOZZ	5305-01-090-1510	2060-1048	11934	SCREW WOOD	EA	6
C-2	13	PAOZS	5340-01-090-2069	2060-1143	11934	BUMPER, RUBBER	EA	4
C-2	14	PAOZZ		2060-1052	11934	SCREW, WOOD	EA	8
C-2	15	XBOZZ		2060-1188	11934	BOPPOAT,IZDE-S109	EA	2
C-2	16	KXOZZ		2040-1155	11934	PAD, LID	EA	2

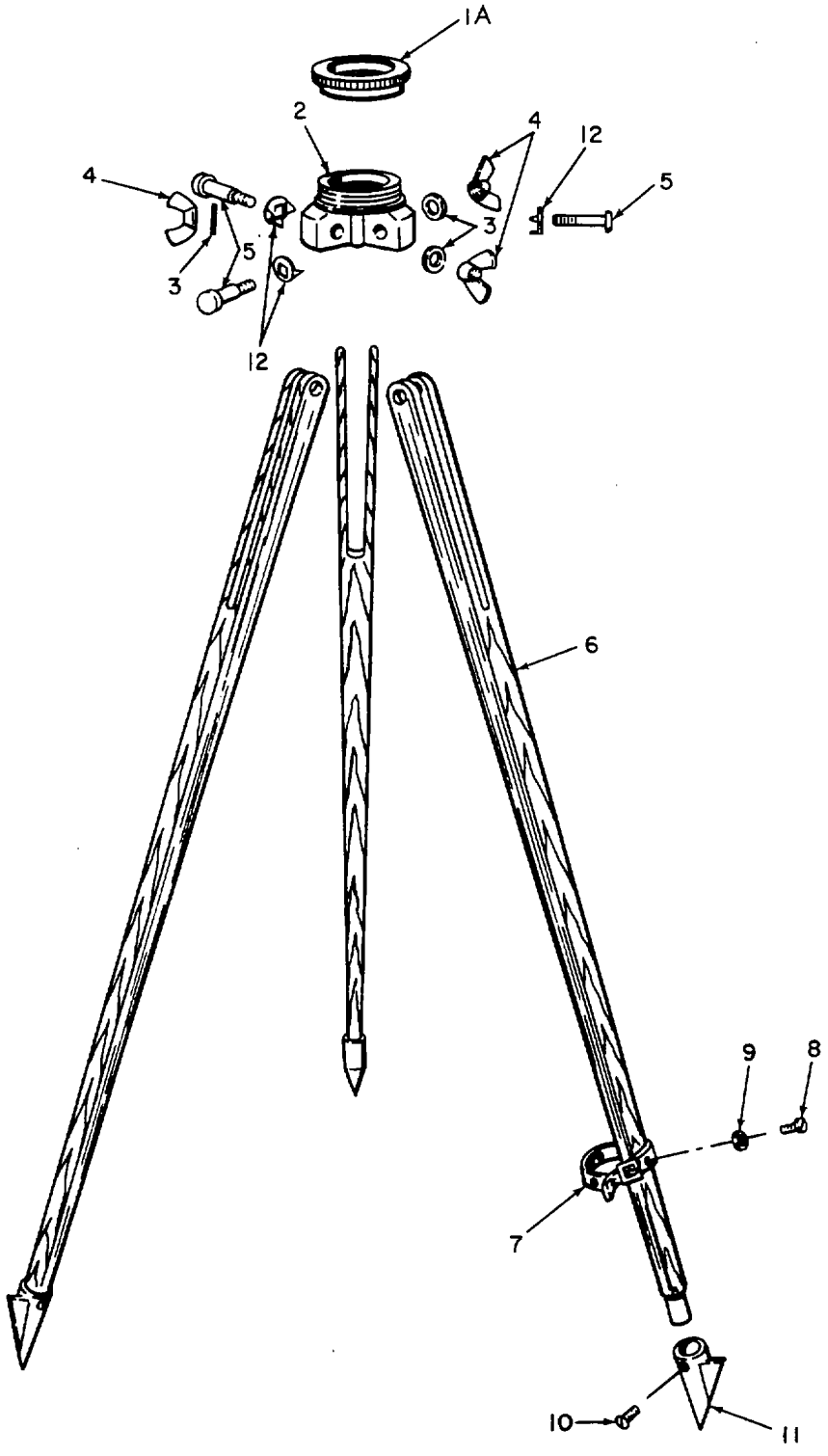


Figure C-3. Tripod Assembly

(1) Illustration (a) Fig No.	(1) Illustration (b) Item No.	(2) SMR Code	(3) National Stock Number	(4) Part Number	(5) FSCM	(6) Description *Usable On Code*	(7) U/M	(8) Qty Inc. In Unit
						GROUP 03 - TRIPOD ASSEMBLY		
C-'	1	XBOFZ		2090	11934	TRIPOD ASSEMBLY	EA	1
C-3	1A	XBOFZ		2090-906	11934	CAP,TRIPOD	EA	1
C-3	2	XBFZZ		2090-903	11934	HEAD,TRIPOD	EA	1
C-3	3	PAFZZ		2090-915	11934	WASHER,TRIPOD HEAD	EA	3
C-3	4	PAFZZ	5310-01-090-1541	2090-912	11934	WINGNUT,TRIPOD HEAD	EA	3
C-3	5	PAFZZ	5305-01-083-9559	2090-909	11934	BOLT,TRIPOD B&AD	EA	3
C-3	6	XBFZZ		2090-928	11934	LEG,FIXED	EA	3
C-3	7	XBFZZ		2090-12	11934	STRAP ASSY,LEG	EA	1
C-3	8	PAFZZ	5305-01-090-1510	2060-1048	11934	SCREW,WOOD	EA	1
C-3	9	PAPER	5310-01-084-1916	2060-1049	11934	WASNBR,FXIBRNO	EA	1
C-3	10	PAFZZ	5305-01-090-1510	2060-1048	11934	CRAB,WOOD	EA	9
C-3-	11	XBFZZ		2090-972	11934	SHOE	EA	3
C-3	12	XBFZZ		2090-910	11934	WASHER, TORQUE	EA	3

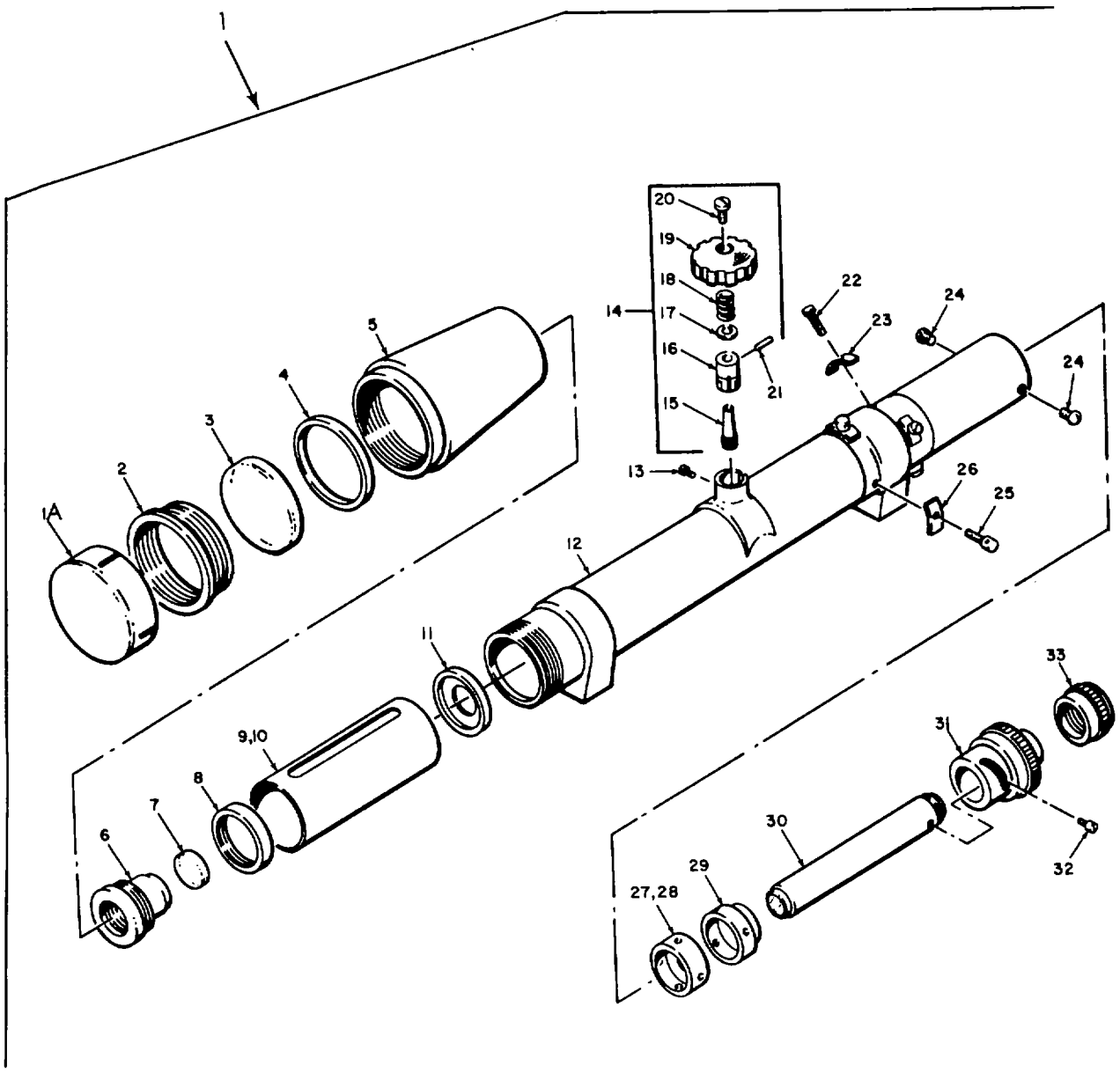


Figure C-4. Surveying Level, (Sheet 1 of 2)

(1) Illustration (a) Fig No.	(1) Illustration (b) Item No.	(2) SMR Code	(3) National Stock Number	(4) Part Number	(5) FSCM	(6) Description *Usable On Code*	(7) U/M	(8) Qty Inc. In Unit
						GROUP 04 - SURVEYING LEVEL		
C-4	1	XBDDD		S18EDL	11934	LEVEL,SURVEYING	EA	1
C-4	1A	XBOZZ		2060-554	11934	CAP.LENS	EA	1
C-4	2	XSDDD		2060-590	11934	HOUNTING,LZENS	EA	1
C-4	3	XSDDD		2060-593	11934	LENS	EA	1
C-4	4	XBDDD		2060-596	11934	RINO,RETAIHINO	EA	1
C-4	5	XBDDD		2060-599	11934	HEAD,OBJECTIVE	EA	1
C-4	6	XBDZZ		2060-707	11934	NEG NOUNT	EA	1
C-4	7	X5DZZ		2060-710	11934	NEG LENS	EA	1
C-4	8	XDZZ		2060-704	11934	NEG ADAPTER RING	EA	1
C-4	9	XSDZZ		2060-696	11934	DRAW TUBE	EA	1
C-4	10	XBDZZ		2060-701	11934	DRAW TUBE RACK	EA	1
C-4	11	XBDZZ		2060-713	11934	DRAW TUBE LIGHT	EA	1
C-4	12	XB0ZZ		2060-605	11934	TUBE, TELESCOPE	EA	1
C-4	13	XBDZZ		2060-677	11934	SCREW,RETAINING	EA	1
C-4	14	XBDZZ		2060-659	11934	PINION ASSEMBLY	EA	1
C-4	15	XBDZZ		2060-686	11934	SHAFT, PINION	EA	1
C-4	16	X.DZZ		2060-680	11934	HOUSING,PINION	EA	1
C-4	17	XBDZZ		2060-671	11934	WASHER, PINION	EA	1
C-4	18	XZDZZ		2060-674	11934	SPRING, PINION	EA	1
C-4	19	XBDZZ		2060-662	11934	HEAD,PINION	EA	1
C-4	20	XBDZZ		2060-665	11934	SCREW,PINION HEAD	EA	1
C-4	21	XBDZZ		2060-683	11934	PIN,LOCKING	EA	1
C-4	22	XBDZZ		2060-740	11934	SCREW.MACHINE	EA	4
C-4	23	XBDZZ		2060-725	11934	WASHER,SPECIAL	EA	4
C-4	24	XBPZZ		2060-749	1193	SCREW,MACHINE	EA	2
C-4	25	XSDZZ		2060-722	119	SCREW,CROSS HAIR	EA	4
C-4	26	XSDZZ		2060-725	11934	WASHER,SPECIAL	EA	4
C-4	27	XADZZ		2060-737	11934	CROSS HAIR	EA	1
C-4	28	XBDZZ		2060-731	11934	CROSS HAIR DIA	EA	1
C-4	29	XBDZZ		2060-743	11934	GUIDE,EYEPIECE	EA	1
C-4	30	XBFZZ		2060-772	11934	EYEPIECE ASSEMBLY	EA	1
C-4	31	XBFZZ		2060-746	1193	ADAPTER,ZYEPIECZ	EA	1
C-4	32	XBFZZ		2060-752	1193	SPIRAL SCREW,EYEPIB	EA	1
C-4	33	XBFZZ		2060-B14	1193	CAP,EYEPICE	EA	1
C-4	34	XBOZZ		2060-210	1193	SCREW,LOCKING	EA	1
C-4	35	XBOZZ		2060-225	1193	WASHER,HALF-SALL	EA	1
C-4	36	XBOZZ		2060-212	1193	VIAL HROUSIN	EA	1
C-4	37	XB0ZZ		2060-223	1193	SCRW,RETAINIWG	EA	1
C-4	36	XBOZZ		2060-222	11931	WASHER,BALL	EA	1
C-4	39	PAOZZ	6675-01-088-5766	2060-209	11934	VIAL,LEVEL	EA	1
C-4	40	XBDZZ		2060-206	11934	CROSSBAR	EA	1
C-4	41	PADZZ	5305-01-083-6437	2060-237	11934	SCREN,MACHINIE	EA	4

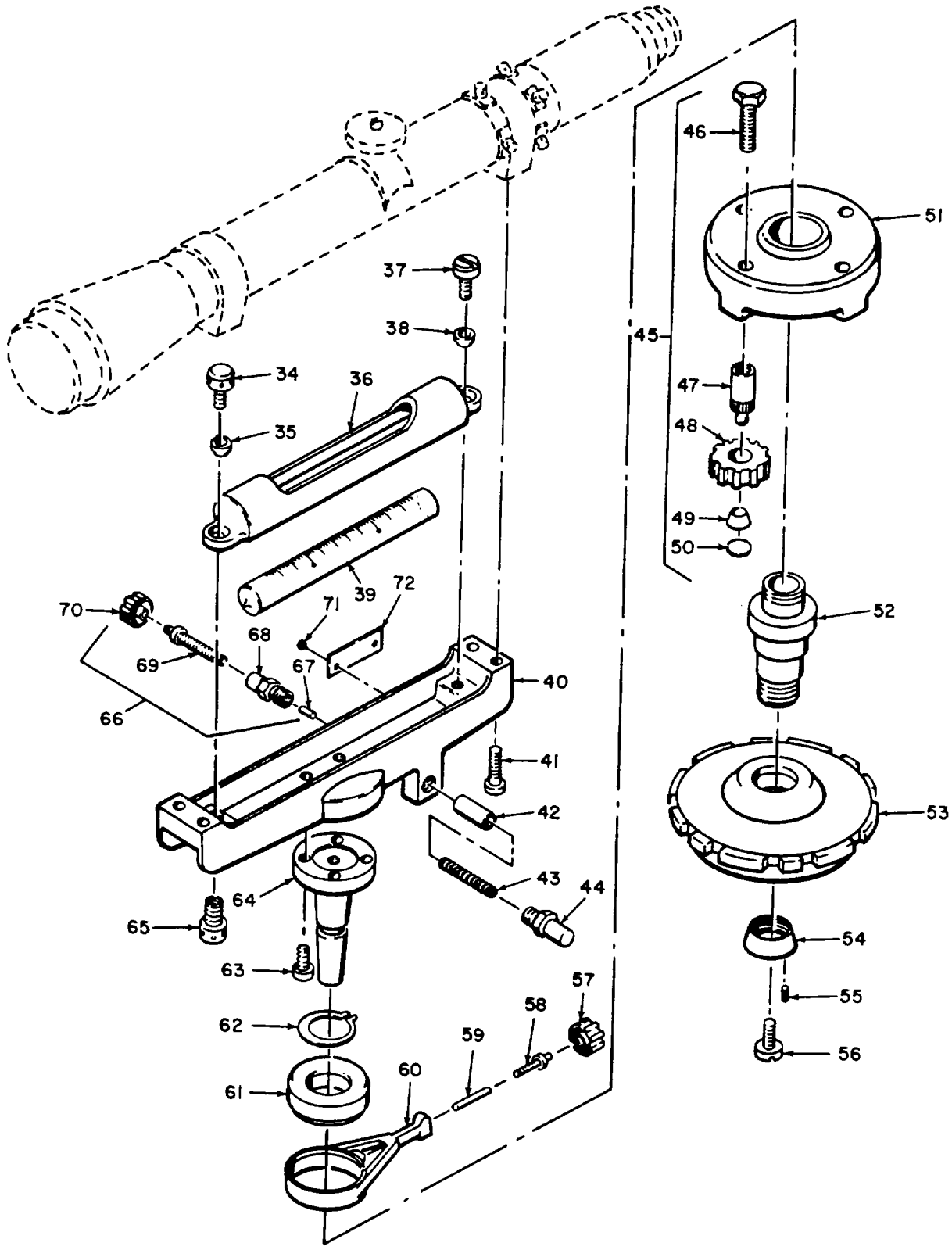


Figure C-4. Surveying Level (Sheet 2of 2)

(1) Illustration (a) Fig No.	(1) Illustration (b) Item No.	(2) SMR Code	(3) National Stock Number	(4) Part Number	(5) FSCM	(6) Description *Usable On Code*	(7) U/M	(8) Qty Inc. In Unit
C-4	42	XBFZZ		2060-520	11934	SLIDE BOX TANGENT	EA	1
C-4	43	XBFZZ		2060-523	11934	SPRING SLIDE BOX	EA	1
C-4	44	XBFZZ		2060-515	11934	HOUSING.SLIDE BOX	EA	1
C-4	45	XBDZZ		2060-19	11934	SCRBE ASSY,LZVELIHG	EA	4
C-4	46	XBDZZ		2060-28	11934	SCRW,.LZVBLING	EA	4
C-4	47	XBDZZ		2060-22	11934	BUSHING,LEVELING	EA	4
C-4	48	XBDZ		2060-34	11934	SCREW HEADS,LZVEL	EA	4
C-4	49	XBDZZ		2060-37	11934	SROB,LEVELING,SCREW	EA	4
C-4	50	XBDZZ		2060-40	11934	PELT PAD,LEVELING	EA	4
C-4	51	XBFZZ		2060-15	11934	HEAD,LEVELING	EA	1
C-4	52	XBFZZ		2060-17N	11934	CENTER HOUSING	EA	1
C-4	53	XBRZZ		2060-4	11934	HASEPLATE,BOTTOM	EA	1
C-4	54	XBFZZ		2060-10	11934	BALL NUT	EA	1
C-4	55	XBFZZ		2060-13	11934	SCREW,BALL NUT	EA	1
C-4	56	XBFZZ		2060-139	11934	SCREW,RETAINING	EA	1
C-4	57	XBFZZ		2060-55	11934	KNOB,PLASTIC	EA	1
C-4	58	XBFZZ		2060-52	11934	SCREW,CLAMP LOWER	EA	1
C-4	59	XBFZZ		2060-47	11934	CLAMP ROD,LOWER	EA	1
C-4	60	XBFZZ		2060-48	11934	CLAMP,LOWZR	EA	1
C-4	61	PAFZZ		2060-82	11934	RING, RETAINING	EA	1
C-4	62	XBRZZ		2060-59	11934	RING,RETAINING	EA	1
C-4	63	PAPZZ	5305-01-084-4654	2060-136	11934	SCREW,MACHINE	EA	4
C-4	64	XBFZZ		2060-133	11934	CENTER	EA	1
C-4	65	XBOZZ		2060-221	11934	SCREW,ADJUSTING	EA	1
C-4	66	XBFZZ		2060-513	11934	RORIZ TANGENT ASSY	EA	1
C-4	67	XBFZZ		2060-516	11934	HOUSING,SCREW	EA	1
C-4	68	XRFZZ		2060-517	11934	SCREW,HOUSING	EA	1
C-4	69	XRFZZ		2060-518	11934	SHANX,TANGENT SCREW	EA	1
C-4	70	XBFZZ		2060-55	11934	XNOB,PLASTIC	EA	1
C-4	71	PADZZ	5315-01-084-4821	2060-528	11934	PIN,RETAINING	EA	2
C-4	72	XBDZZ		2060-527	11934	NAMZPLATE	EA	1

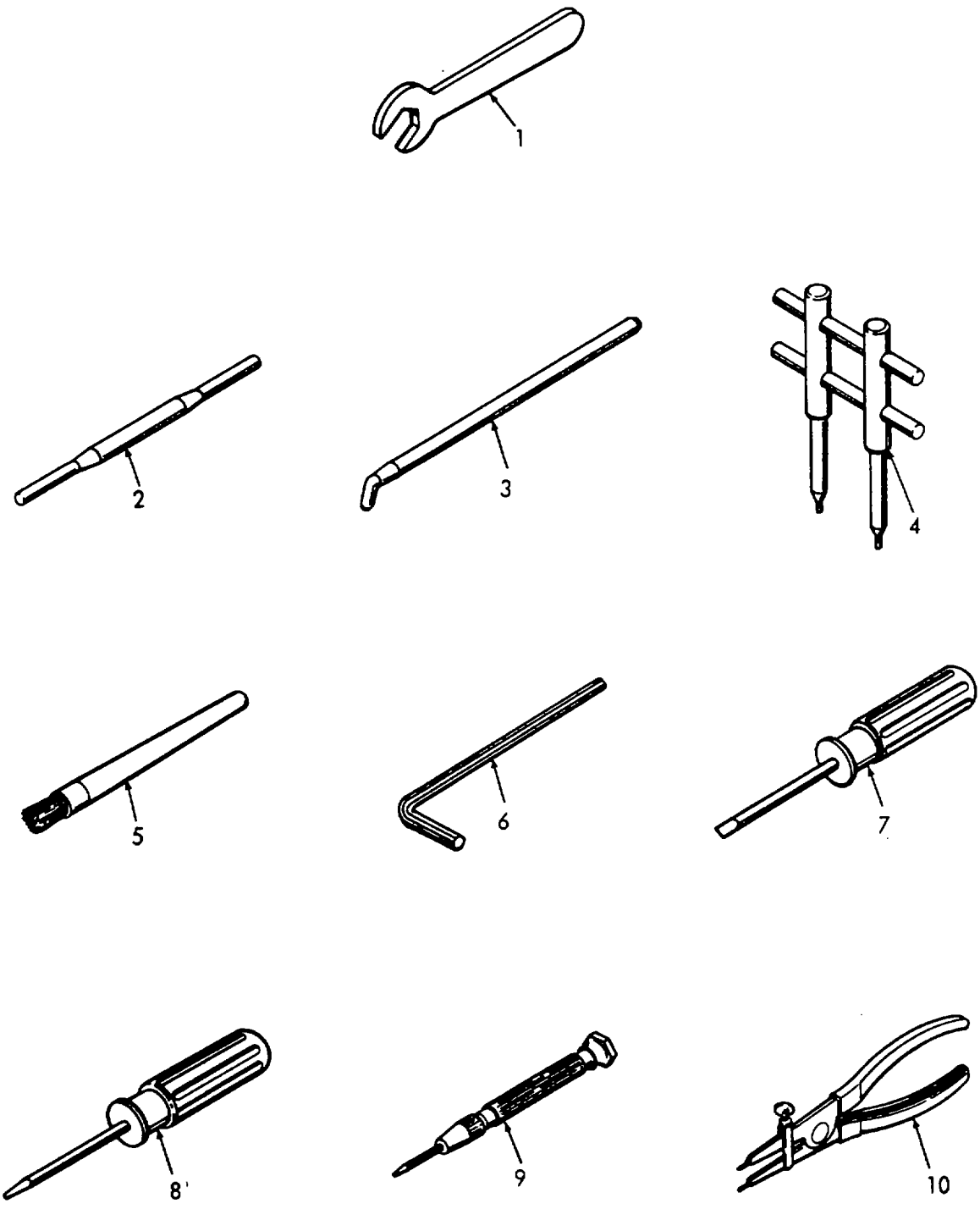


Figure C-5. Special Tools

(1) Illustration (a) Fig No.	(1) Illustration (b) Item No.	(2) SMR Code	(3) National Stock Number	(4) Part Number	(5) FSCM	(6) Description *Usable On Code*	(7) U/M	(8) Qty Inc. In Unit
						GROUP O5 -SPECIAL TOOLS		
C-5	1	PAOZZ		2090-1051	11934	WRENCH,1/2	EA	1
C-5	2	PAOZZ	6675-01-084-0973	A1306-1	11934	PIN ADJUSTING, SURVE	EA	1
C-5	3	PAOZZ	6675-01-084-0974	A1306-2	11934	PIN, ADJUSTING, SURVE	EA	1
C-5	4	PAOOZ	5120-01-092-3274	A1308	11934	WRENCH, SPANNER	EA	1
C-5	5	PAOZZ	7920-01-016-0457	A1310-1	11934	BRUSH, DUST	EA	1
C-5	6	PAOZZ		11310-2	11934	WRENCH, HEX 1/16	EA	1
C-S	7	PA0ZZ		GGG-S-121E	81348	SCREWDRIVER, 3/16	EA	1
C-5	8	PAOZZ		GGG-S-121E	81348	SCREWDRIVER	EA	1
C-5	9	PAOZZ		A1313-3	11934	SCREWDRIVER	EA	1
C-5	10	PAOZZ		A1315	11934	PLIER, TRUARC	EA	1

STOCK NUMBER	FIGURE NO.	ITEM NO.
5305-01-083-6437	C-4	41
5305-01-083-9559	C-3	5
6675-01-084-0963	C-1	1
6675-01-084-0973	C-5	2
6675-01-084-0974	C-5	3
5310-01-084-1916	C-2	11
5310-01-084-1916	C-3	9
5305-01-084-4654	C-4	63
5315-01-084-4821	C-4	71
7920-01-086-0457	C-5	5
6675-01-089-5766	C-4	39
5305-01-090-1510	C-2	12
5305-01-090-1510	C-3	8
5305-01-090-1510	C-3	10
5310-01-090-1541	C-3	4
5340-01-090-2069	C-2	13
5305-01-090-7129	C-2	3
5305-01-090-7129	C-2	7
5120-01-092-3274	C-5	4

PART NUMBER	FSCM	FIG. NO.	ITEM NO
A1306-1	11934	C-S	2
A1306-2	11934	C-5	3
A1308	11934	C-5	4
A1310-2	11934	C-5	6
A1312-3	11934	C-5	9
A1315	11934	C-5	10
GGG-S-121E	81348	C-5	7
GGG-S-121E	81348	C-5	8
2060-SIEDL	11934	C-4	1
2060-10	11934	C-4	54
2060-1024	11934	C-2	3
2060-1024	11934	C-2	7
2060-1048	11934	C-2	12
2060-1048	11934	C-3	8
2060-1048	11934	C-3	10
2069-1049	11934	C-2	11
2060-1049	11934	C-3	9
2060-1051	11934	C-5	1
2060-1052	11934	C-2	5
2060-1052	11934	C-2	8
2060-1052	11934	C-2	14
2060-1100	11934	C-2	1
2060-1103	11934	C-2	2
2060-1112	11934	C-2	10
2060-1121	11934	C-2	4
2060-1137	11934	C-2	1A
2060-1143	11934	C-2	13
2060-1149	11934	C-2	6
2060-1155	11934	C-2	16
2060-1164	11934	C-2	9
2060-1188	11934	C-2	15
2060-1221	11934	C-1	1
2060-1224	11934	C-1	1
2060-13	11934	C-4	55
2060-133	11934	C-4	64
2060-136	11934	C-4	63
2060-139	11934	C-4	56
2060-15	11934	C-4	51
2060-17M	11934	C-4	52
2060-19	11934	C-4	45
2060-206	11934	C-4	40
2060-209	11934	C-4	39
2060-210	11934	C-4	34
2060-212	11934	C-4	36
2060-22	11934	C-4	47
2060-221	11934	C-4	65
2060-222	11934	C-4	38
2060-223	11934	C-4	37
2060-225	11934	C-4	35
2060-237	11934	C-4	41
2060-28	11934	C-4	46
2060-34	11934	C-4	48
2060-37	11934	C-4	49
2060-4	11934	C-4	53
2060-40	11934	C-4	50
2060-47	11934	C-4	59
2060-48	11934	C-4	60
2060-513	11934	C-4	66
2060-515	11934	C-4	44
2060-516	11934	C-4	67
2060-517	11934	C-4	68
2060-518	11934	C-4	69
2060-52	11934	C-4	58
2060-520	11934	C-4	42
2060-523	11934	C-4	43
2060-527	11934	C-4	72
2060-528	11934	C-4	71
2060-55	11934	C-4	57
2060-55	11934	C-4	70
2060-554	11934	C-4	1A
2060-59	11934	C-4	62
2060-590	11934	C-4	2
2060-593	11934	C-4	3
2060-596	11934	C-4	4
2060-599	11934	C-4	5
2060-605	11934	C-4	12
2060-659	11934	C-4	14
2060-662	11934	C-4	19
2060-665	11934	C-4	20
2060-671	11934	C-4	17
2060-674	11934	C-4	18
2060-677	11934	C-4	13
2060-680	11934	C-4	16
2060-683	11934	C-4	21
2060-686	11934	C-4	15
2060-698	11934	C-4	9
2060-701	11934	C-4	10
2060-704	11934	C-4	8
2060-707	11934	C-4	6
2060-710	11934	C-4	7
2060-713	11934	C-4	11
2060-722	11934	C-4	25
2060-725	11934	C-4	23
2060-725	11934	C-4	26
2060-731	11934	C-4	28
2060-737	11934	C-4	27
2060-740	11934	C-4	22
2060-743	11934	C-4	29
2060-746	11934	C-4	31
2060-749	11934	C-4	24
2060-752	11934	C-4	32
2060-772	11934	C-4	30
2060-814	11934	C-4	33
2060-82	11934	C-4	61
2090	11934	C-3	1
2090-12	11934	C-3	7
2090-903	11934	C-3	2
2090-906	11934	C-3	1A
2090-909	11934	C-3	5
2090-910	11934	C-3	12
2090-912	11934	C-3	4
2090-915	11934	C-3	3
2090-928	11934	C-3	6
2090-972	11934	C-3	11

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APPENDIX D
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists components of end item and basic issue items for the dumpy level to help you inventory items required for safe and efficient operation.

D-2. GENERAL

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the dumpy level in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged BII must be with the dumpy level during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

D-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listings:

a. Column (1) - Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

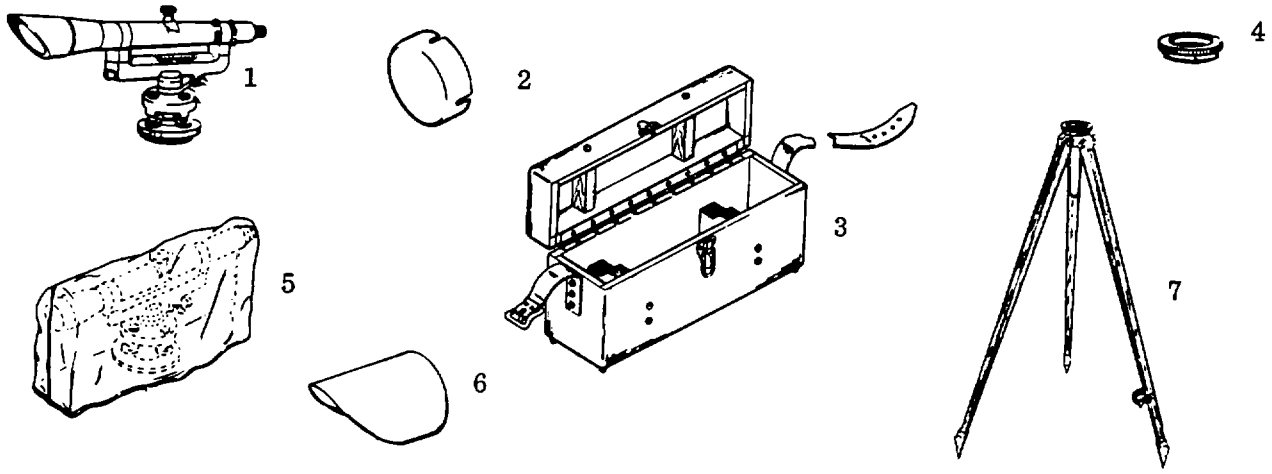
b. Column (2) - National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the National item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. Column (4) - Unit of Measure (U/M) Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

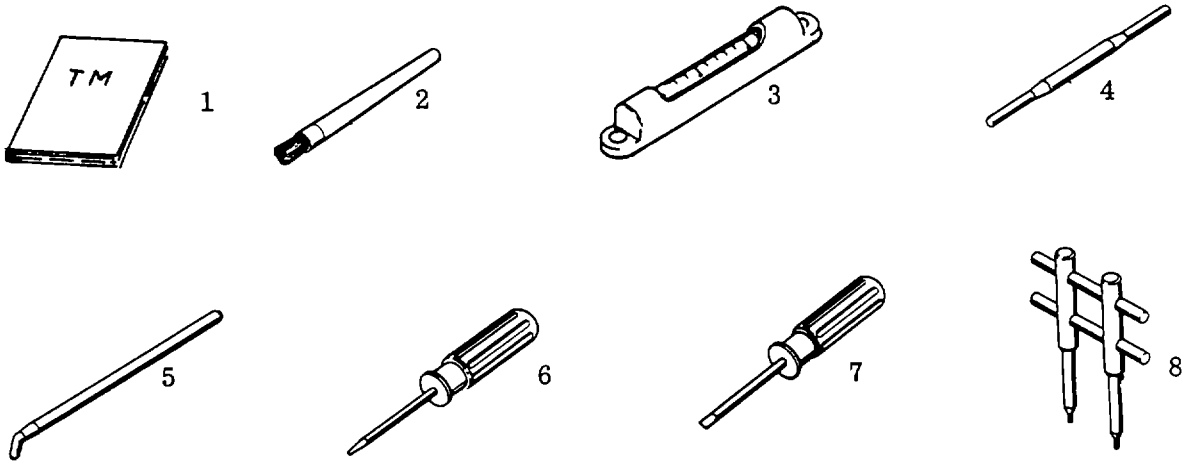
e. Column (5) - Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM



(1) Illus No.	(2) National Stock No.	(3) Description Usable FSCM and Part No. on Code	(4) U/M	(5) Qty rqr
1		Level, Surveying (11934) 2060	ea.	1
2		Cap, Lens (11934) 2060-554	ea.	1
3		Carrying Case (11934) 2060-1100	ea.	1
4		Cap, Tripod (11934) 2090-906	ea.	1
5		Cover, Instrument (11934) 2060-1224	ea.	1
6		Sunshade (11934) 2060-1221	ea.	
7		Tripod Assembly (11934) 2090	ea	1

Section III. BASIC ISSUE ITEMS



(1) Illus No.	(2) National Stock No.	(3) Description Usable FSCM and Part No. on Code	(4) U/M	(5) Qty rqr
1		TM 5-6675-271-14&P Operator, Organizational, Direct Support and General Support Maintenance Manual	ea.	1
2		Brush, Dust	ea.	1
3		Level Vial Assembly	ea	1
4		Pin Wrench, Straight	ea.	1
5		Pin Wrench, Bent	ea.	1
6		Screwdriver, 1/8 inch wide blade	ea.	1
7		Screwdriver, Flat Tip, 3/16 inch	ea.	1
8		Wrench, Spanner	ea.	1

APPENDIX E
ADDITIONAL AUTHORIZATION LIST

Not Applicable

APPENDIX F
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

F-1. SCOPE

This appendix lists expendable supplies and materials you will need to operate and maintain the dumpy level. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

F-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 (e.g., "Use cleaning compound, item 5, App. D").

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

(enter as applicable)

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

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 Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

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., ea, in, pr). If the unit of 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) ITEM NUMBER	(2) LEVEL	(3) NATIONA L STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C, O	6810-00-223-2739	Acetone, Technical 1 pt. can, Fed Spec NMM-A-185	PT
2	C, O	6850-00-664-5683	Cleaning Solvent, Fed Spec PD-680	QT
3	C, 0	7920-00-401-8034	Cloth, lint free, non-abrasive, General Purpose, Part No. 1001	BX
4	C, 0	9150-00-576-4262	Grease, Instrument and Aircraft (GIA), MIL-G-23827	TU
5	C, O	6640-00-597-6745	Paper, Lens Tissue (4 in. x 6 in.), 50 sheets	PK
6	C, 0	9150-00-252-6382	Lubricating Oil, Watchmaking	BT
7	C, 0	5120-01-018-5908	Orange Stick, 13218E3063 (97403) PK	
8	0		Plaster of Paris, 5 pounds	BX

ALPHABETICAL INDEX

ALPHABETICAL INDEX (Continued)

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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