TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT
SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL

TOPOGRAPHIC SUPPORT SYSTEM
SYNTHESIS SECTION
MODEL ADC-TSS-14
NSN: 6675-01-105-5763

THIS MANUAL SUPERSEDES TM 5-6675-325-14 DATED 30 JUNE 1983

HEADQUARTERS, DEPARTMENT OF THE ARMY

20 JUNE 1985

CHANGE

NO. 4

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

TOPOGRAPHIC SUPPORT SYSTEM
SYNTHESIS SECTION
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Operator's, Organizational, Direct Support and
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TOPOGRAPHIC SUPPORT SYSTEM SYNTHESIS SECTION
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Operator's, Organizational, Direct Support and
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TOPOGRAPHIC SUPPORT SYSTEM
SYNTHESIS SECTION
MODEL ADC-TSS-14
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Remove pages	Insert pages
i and ii	i and ii
1-13 and 1-14	1-13 and 1-14
1-53 and 1-54	1-53 and 1-54
1-61 through 1-64	1-61 through 1-64
1-71 and 1-72	1-71 and 1-72
1-99 and 1-100	1-99 and 1-100
2-25 and 2-26	2-25 and 2-26
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3-93 and 3-94	3-93 and 3-94
3-99 and 3-100	3-99 and 3-100
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5-143 through 5-150	5-143 through 5-150
8-11 and 8-12	8-11 and 8-12
8-15 and 8-16	8-15 and 8-16
B-5 through B-10	B-5 through B-10
C-1 and C-2	C-1 and C-2
C-5 and C-6	C-5 and C-6
D-1/D-2	D-1/D-2
E-1 through E-8	3-1 through E-8
---	E-9/E-10

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WARNING

HIGH VOLTAGE is used in this equipment. DEATH ON CONTACT or severe injury may result if personnel fail to observe safety precautions.

DO not be misled by the term LOW VOLTAGE. LOW voltage can cause serious injury or death.

Test procedures requiring the operator or maintenance personnel to investigate equipment or restore casualties with Interlocks disconnected or covers removed may result in DEATH ON CONTACT if personnel fail to observe safety precautions.

Voltages in switches and circuit breaker panels may result in DEATH ON CONTACT if personnel fail to observe safety precautions.

Failure to ground the section or equipment may result in DEATH ON CONTACT if personnel fail to observe safety procedures.

For Artificial Respiration refer to FM 21-11.

WARNING

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

WARNING

Attempting to move overweight or top-heavy equipment that is unsecured may result in SEVERE PERSONNEL INJURY. Always have sufficient personnel and equipment to accomplish the task.

TECHNICAL MANUAL

NO. 5-6675-325-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 20 June 1985

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

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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 63120-17!38. A reply will be furnished directly to you.

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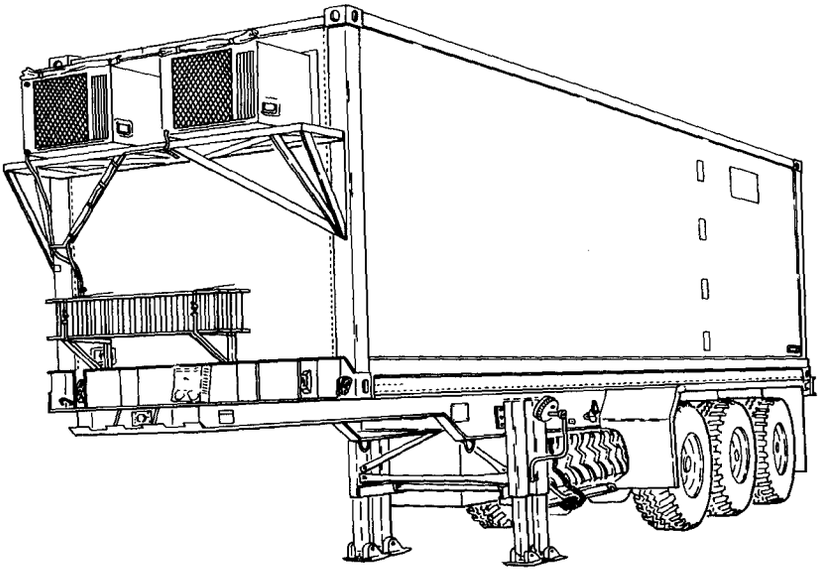


CHAPTER 1

SYNTHESIS SECTION

Section 1 INTRODUCTION

1-1. GENERAL INFORMATION.

1-1.1 Scope. This manual contains operating and maintenance instructions for the ADC-TSS-14, Synthesis Section, Topographic Support System (TSS). The purpose of the Synthesis Section is to provide graphic and textural terrain analysis. The chassis is covered in TM 5-2330-305-14, Operator, Organizational, Direct Support and General Support Maintenance Manual, Topographic Support System, Chassis, Semi-trailer, ISO Container Transporter. Repair parts and special tools are listed in TM 5-6675-325-24P, Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List, Synthesis Section, Topographic Support System. Lubrication instructions are contained in LO 5-6675-325-12, Lubrication Order, Synthesis Section, Topographic Support System. All authorized equipment, supplies, and their locations for transport are shown in Location and Description of Major Components of this manual.

1-1.2 Purpose of Equipment. To provide a transportable facility for graphic or textural analysis from factor overlays and other Topographic Support System data to meet military requirements.

1-1.3 Maintenance Forms and Records. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, The Army Maintenance Management System (TAMMS).

1-1.4 Reporting Equipment Improvements (EIR's). If the Synthesis Section needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you do not like about your equipment. Let us know why you do not like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: U.S. Army Troop Support Command, ATTN: AMSTR-QX, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. We will send you a reply.

1-1.5 Destruction of Material to Prevent Enemy Use For information on destruction of material to prevent enemy use, refer to TM 750-244-3, Procedures for Destruction of Equipment to Prevent Enemy Use.

1-1.6 Preparation for Storage or Shipment.

a. Perform your preparation for movement procedures..

b. For administrative storage of equipment, refer to TM 740-90-1.

c. The chapters of this manual describe special shipping instructions for major components located in the section.

d. In the event this equipment must be removed from the section for repair or replacement, contact your battalion for packing and shipping instructions.

1-2. EQUIPMENT DESCRIPTION.

1-2.1 Equipment Characteristics, Capabilities, and Features.

a. Air and sea transportable.

b. Transportable cross-country capability when mounted on trailer chassis.

c. Controlled internal environment.

1-2.2 Special Considerations.

a. Site must permit section to be leveled within ±2°, be well drained, and provide adequate overhead concealment. Wooded areas and other obstacles must not impede movement of transporters.

b. Dispersal of topographic sections is limited to the length of electric power transmission cable available for unit generators.

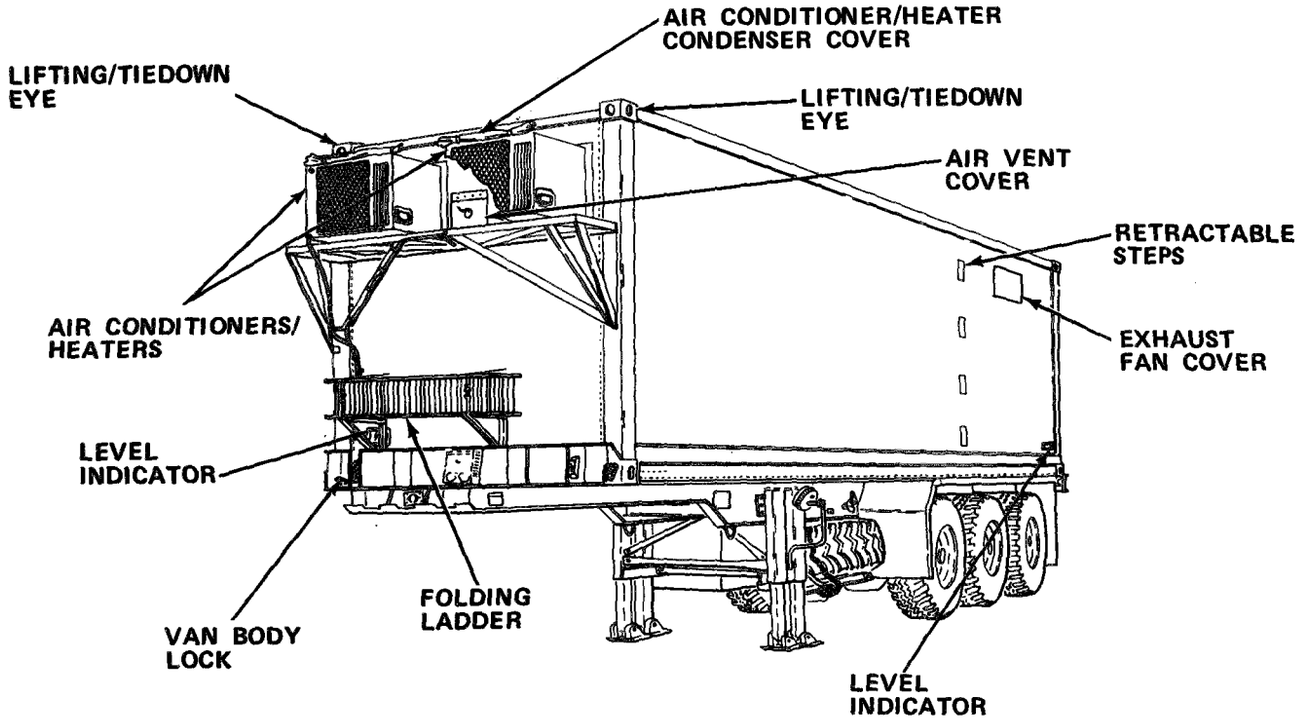
c. During site selection, avoid overhead power transmission lines to prevent danger from electric shock or electromagnetic interference.

d. Power is normally supplied by 60 kW generators. Commercial electric power should be used if it is compatible and available.

e. Cross-country capability of sections and transporters is limited. Relocation should be accomplished over hard-surfaced, all-weather roads whenever possible.

1-2.3 Location and Description of Major Components.

a. Roadside exterior.



VAN BODY LOCK. Locks van body to trailer chassis.

AIR CONDITIONERS/HEATERS. Two air conditioner/heater units for internal environmental control.

LIFTING/TIEDOWN EYES. Attachment point for lifting or tying down section.

AIR CONDITIONER/HEATER CONDENSER COVER. Covers air conditioner/heater condenser to prevent water/air entering air conditioner/heater unit when in transport or storage.

AIR VENT COVER. Covers air vent opening.

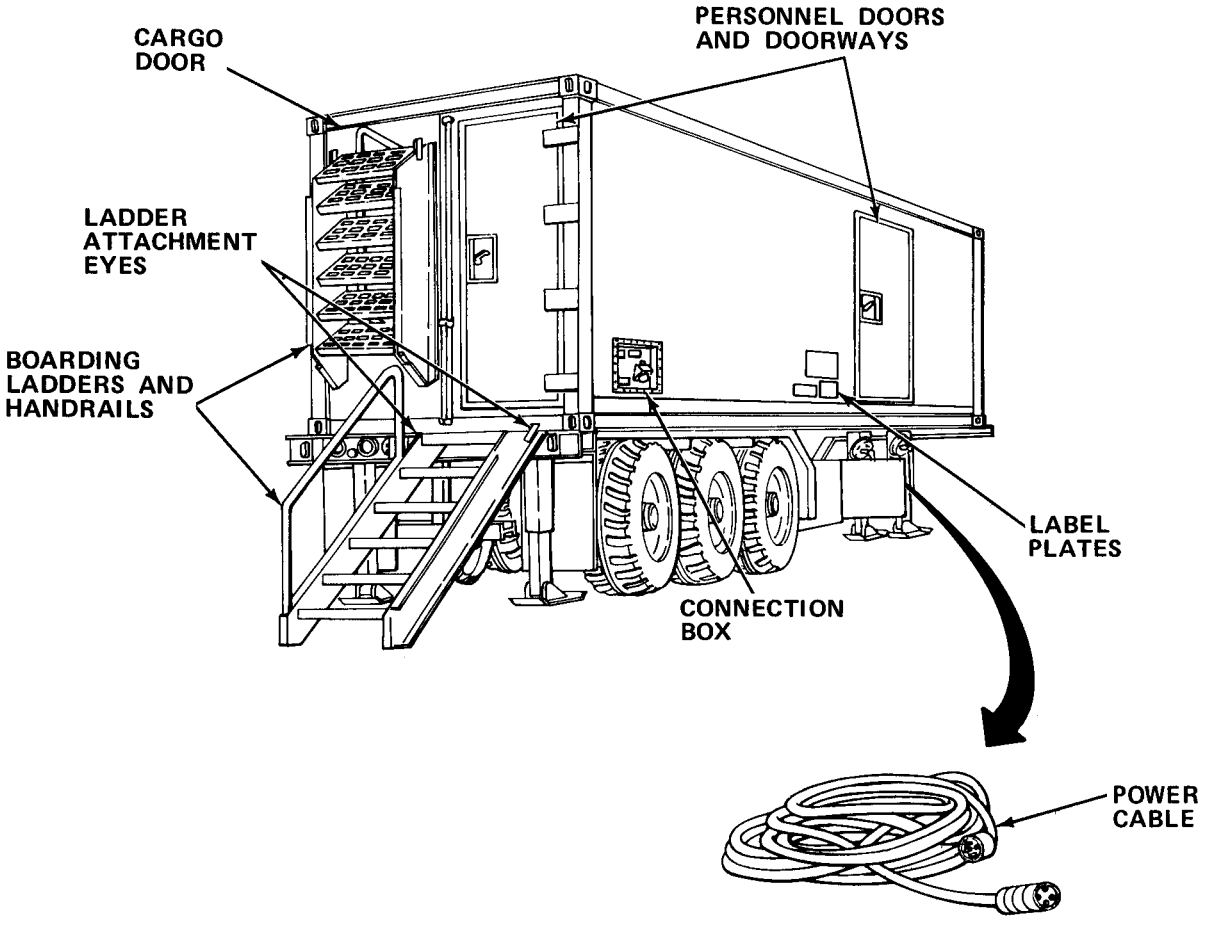
RETRACTABLE STEPS. Provide access to roof.

EXHAUST FAN COVER. Covers exhaust fan opening.

LEVEL INDICATORS. Indicate section inclination.

FOLDING LADDER. Allows access to air conditioners and top of van.

b. Curbside exterior.



CARGO DOOR. Access for equipment removal/installation.

PERSONNEL DOORS. Doors are 35.75 in. (90.8 cm) wide by 86 in. (218.4 cm) high.

PERSONNEL DOORWAYS. Doorways are 30.75 in. (78.1 cm) wide by 78.5 in. (199.4 cm) high.

LABEL PLATES. Provide weight/moment data.

POWER CABLE. Power cable is in 50 ft (15.2 m) sections. (Stored in trailer chassis storage box.)

CONNECTION BOX. Contains terminals for ground cable, power cables, and telephone lines.

LADDER ATTACHMENT EYES. Attachment points for boarding ladder.

BOARDING LADDERS AND HANDRAILS. Provide access to section.

c. Interior.

PERSONNEL DOOR. Weatherproof, fitted with blackout switch.

FIRST AID KIT. Limited first aid supplies.

CARGO DOOR. Access for equipment removal/installation.

EXHAUST FAN. Provides ventilation. Fitted with lightproof louvers and weatherproof cover.

MAGNIFIER LAMP. Provides illumination and magnification for light table work station.

BLACKOUT/DOME LIGHT. Red-lensed, white-lensed 12 V ac light actuated when blackout switch operates, or from external power.

DRAFTING, SCRIBING/TRACING TABLE. Illuminated tracing board. Turns over for drafting board.

FLUORESCENT CEILING LAMP. White, two-level (high/low) overhead light.

READER-PRINTER. Illuminates and magnifies microfiche. Provides magnified hard copy of microfiche card.

WALL STORAGE CABINET. Storage.

MANUAL TYPEWRITER. Wide carriage.

VERTICAL PROJECTOR. Rapid scale change drafting instrument for magnification or reductions.

EMERGENCY LIGHTS. Battery-powered lighting actuated by power failure.

AIRCONDITIONERS/HEATERS. Internal environmental control.

FILING CABINET. Storage.

OFFICE TABLE. Additional work space.

FIRE EXTINGUISHER. Dry-chemical fire extinguisher.

BLACKOUT SWITCH. Turns ceiling lights off when activated.

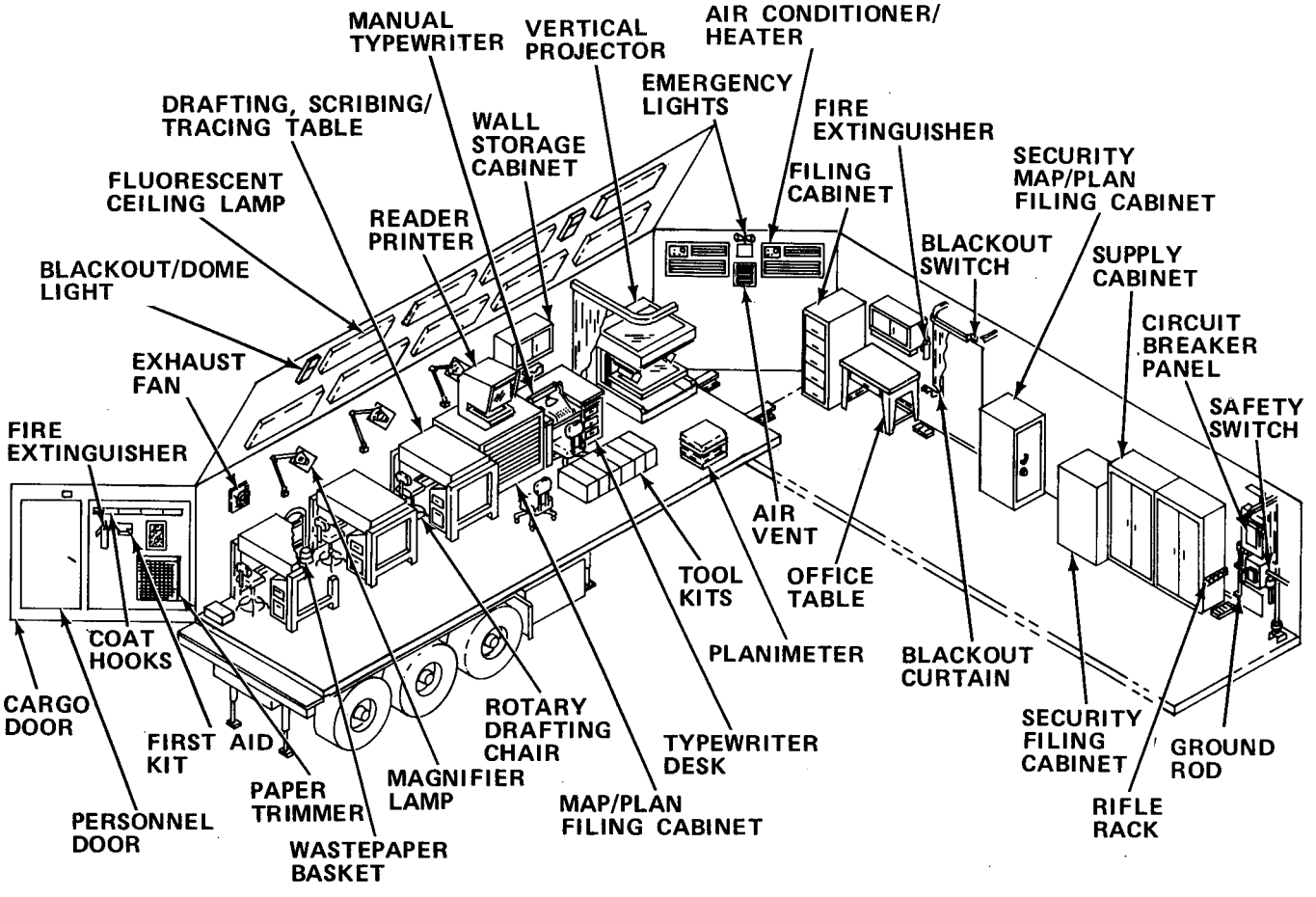
SECURITY MAP AND PLAN FILING CABINET. Security storage for maps/topographic products.

SUPPLY CABINET. Storage.

CIRCUIT BREAKER PANEL. Circuit breakers with phase test indicator.

SAFETY SWITCH. Main power safety disconnect switch.

GROUND ROD. Electrical ground for section.


MANUAL TYPEWRITER
VERTICAL PROJECTOR
AIR CONDITIONER/ HEATER
EMERGENCY LIGHTS
DRAFTING, SCRIBING/ TRACING TABLE
WALL STORAGE CABINET
FIRE EXTINGUISHER
SECURITY MAP/PLAN FILING CABINET
FILING CABINET
FLUORESCENT CEILING LAMP
READER PRINTER
BLACKOUT SWITCH
SUPPLY CABINET
BLACKOUT/DOME LIGHT
CIRCUIT BREAKER PANEL
EXHAUST FAN
SAFETY SWITCH
FIRE EXTINGUISHER
AIR VENT
TOOL KITS
OFFICE TABLE
COAT HOOKS
PLANIMETER
BLACKOUT CURTAIN
CARGO DOOR
ROTARY DRAFTING CHAIR
SECURITY FILING CABINET
FIRST AID KIT
TYPEWRITER DESK
GROUND ROD
MAGNIFIER LAMP
PAPER TRIMMER
MAP/PLAN FILING CABINET
RIFLE RACK
PERSONNEL DOOR
WASTEPAPER BASKET

RIFLE RACK. Weapon storage.

SECURITY FILING CABINET. Security storage.

BLACKOUT CURTAIN. Lightproof cover for personnel door.

AIR VENT. Permits filtered make-up air to enter section.

PLANIMETER. Storage for transport.

TOOL KITS.

TYPEWRITER DESK. Work station.

MAP AND PLAN FILING CABINET. Storage for maps/topographic products.

ROTARY DRAFTING CHAIR. Adjustable-height chair.

WASTEPAPER BASKET. Storage for transport.

PAPER TRIMMER. Trims sheet paper.

COAT HOOKS. Storage.

FIRE EXTINGUISHER. Dry-chemical fire extinguisher.

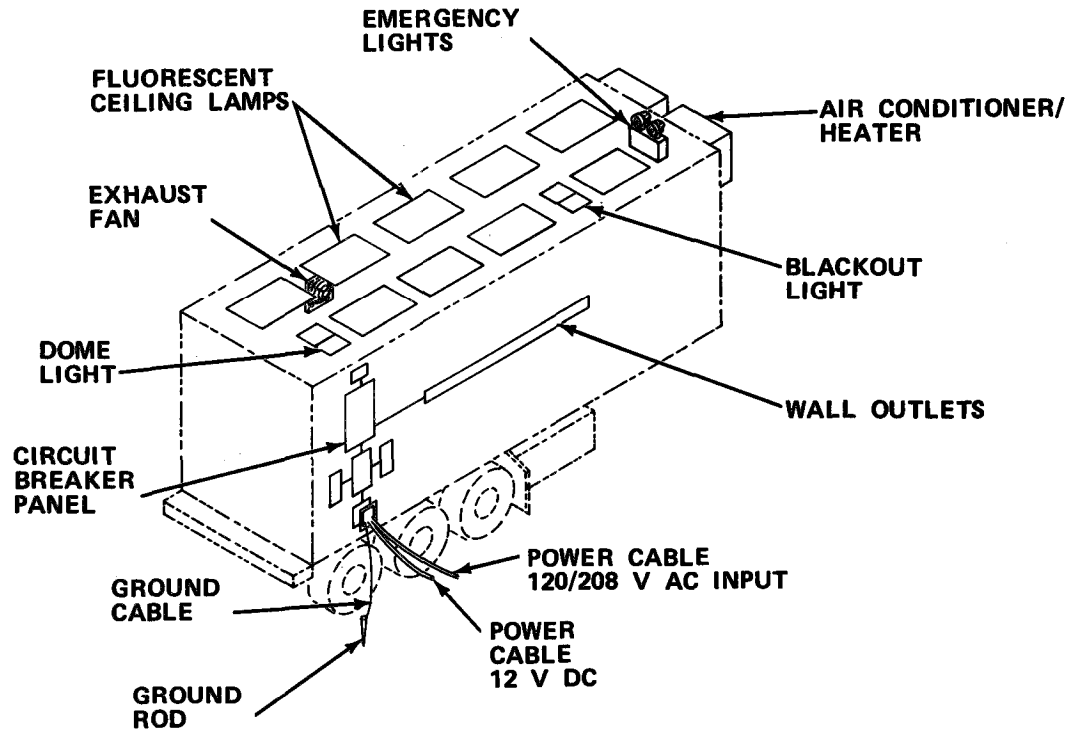
1-2.4 Equipment Data - ISO Container (Unmounted).

Dimensions	
Length	33.66 ft (10.26m)
Width	8ft (2.44m)
Height	8 ft (2.44 m)
Cubage	2154 ft^3 (61.0 m^3)
Connections	
Telephones	One telephone (three-post) connection
Power	13.6 kW. One 120/208 V, three-phase, four-wire connection and one 12 V dc connection
Ground	Ground lug
Air Conditioner/Heater (Two Units)	
Cooling	18.000 Btu/hr (5274 W) Each
Heating	14,300 Btu/hr (4190 W) (Max) Each
Power Requirements	208 V, 60 Hz, three-phase
Exhaust Fan	289 ft^3/min (8.18 m^3/min)
Air Vent	289 ft^3/min (8.18 m^3/min)
Weight	
Gross (Container and Chassis)	25,390 1bs (11,514.37 kg)
Tare (Container Only)	13,950 1bs (6326.33 kg)

1-3. TECHNICAL PRINCIPALS OF OPERATION.

1-3.1 General. The operation of major components located in the section are explained in the appropriate chapter for that equipment.

1-3.2 Electrical System.



GROUND ROD. Used to ground section.

GROUND CABLE . Used with ground rod.

CIRCUIT BREAKER PANEL . Contains voltage indicator, phase monitor, and circuit breakers.

DOME LIGHTS. White-lensed, 12 V dc lights powered from external source. Separately switched and fused.

EXHAUST FAN . Plug-in fan. Separately fused.

FLUORESCENT CEILING LAMPS. Two-level (high/low) overhead lights with blackout override switches.

EMERGENCY LIGHTS. Battery-powered. Activated by power loss.

AIR CONDITIONER/HEATER. Air conditioner and electrical heater powered by three-phase, 208 V, 30 amp current.

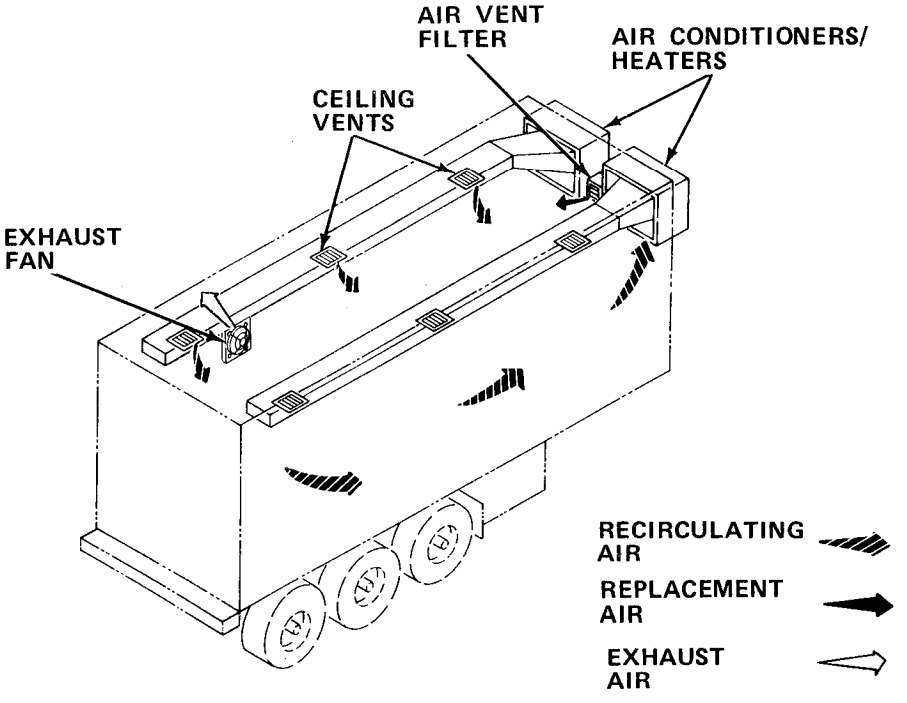
BLACKOUT LIGHTS. Red-lensed, 12 V ac lights actuated when blackout switch operates.

WALL OUTLETS. Provide grounded outlets for portable or plug-in equipment.

POWER CABLES. Power input (120/208 V ac and 12 V de).

1-3.3 Wiring Diagram. A foldout wiring diagram is provided at the end of this manual.

1-3.4 Ventilation System.



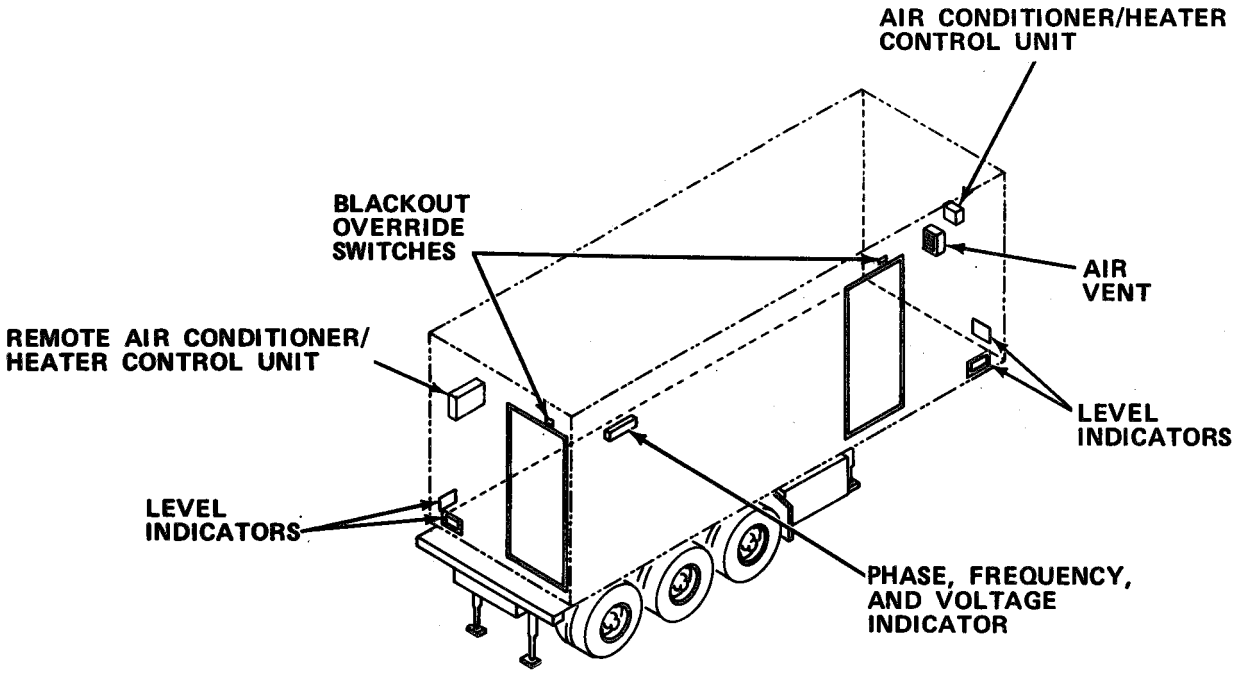
Exhaust fan exhausts air. Replacement air flows into the section through the air vent filter. Recirculating air is filtered as it enters the air conditioners/heaters. From the air conditioners/heaters, it flows through the ceiling vents and into the section.

NOTE

Detailed description of air conditioner/heater operation is contained in TM 5-4120-367-14, Operator, Organizational, Direct Support, and General Support Maintenance Manual, Air Conditioner, Horizontal, Compact, 18,000 Btu/hr Cooling, and TM 5-4120-367-24P, Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair) for Air Conditioner,' Horizontal, Compact, 18,000 Btu/hr (5274W).

Section II OPERATING INSTRUCTIONS

1-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Blackout Override Switches	Turn off illumination when doors are opened.
Air Vent	Permits make-up air to enter as required.
Air Conditioner/Heater Control Units	Permit selection of air conditioner or heater mode of operation and temperature.
Phase, Frequency, and Voltage Indicator	Monitors electrical power, phase, frequency, and voltage.
Level Indicators	Used to level section.

1-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

1-5.1 PMCS Procedures.

PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The "Equipment is Not Ready/Available If" column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Wire Brush	1 ea
6 in. Adjustable Wrench	1 ea
Flat Tip Screwdriver	1 ea
Vacuum Cleaner	1 ea
Cheesecloth (Item 8, Appendix E)	ar
General Purpose Detergent (Item 10, Appendix E)	ar
Paint (Items 16, 16A and 16B, Appendix E)	ar
Paint Brushes	ar

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY	
1		Inspect Exterior.	
	B/W	1. Inspect surfaces for punctures, cracks, or open seams that could permit moisture to enter wall.	Punctures, cracks, or open seams are present.
	B	2. Inspect four level indicators for damage and to be sure section is level.	Indicators are broken.

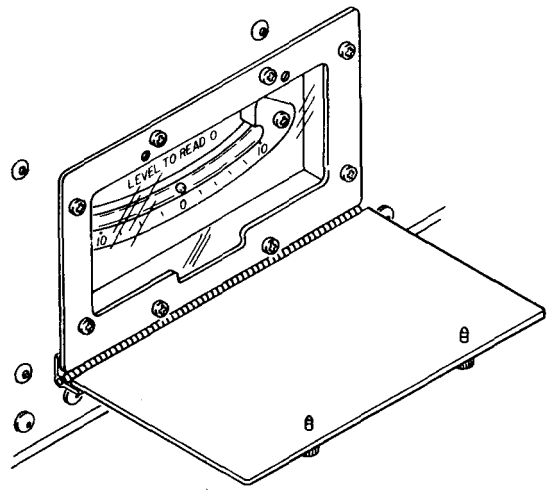


Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

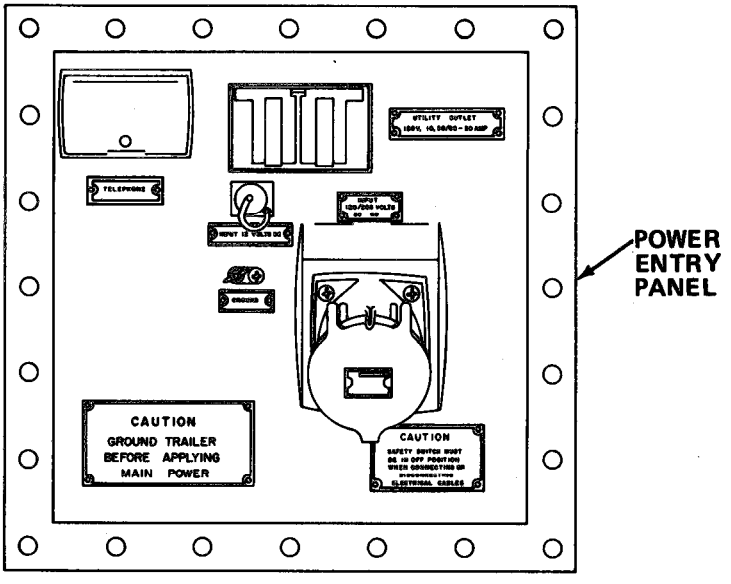
B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM No.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Reediness Reporting, Equipment Is Not Ready/ Available If:
1		**Inspect Exterior - Cont**	
		WARNING To prevent death or serious injury, do not handle or clean power cable or connectors when cable is connected to power source.	
	B	3. Inspect power cable assembly for dirt or damaged connectors. a. Wipe cable insulation with clean dry cloth to remove dirt. b. Clean corrosion from terminals.	Connector damaged.



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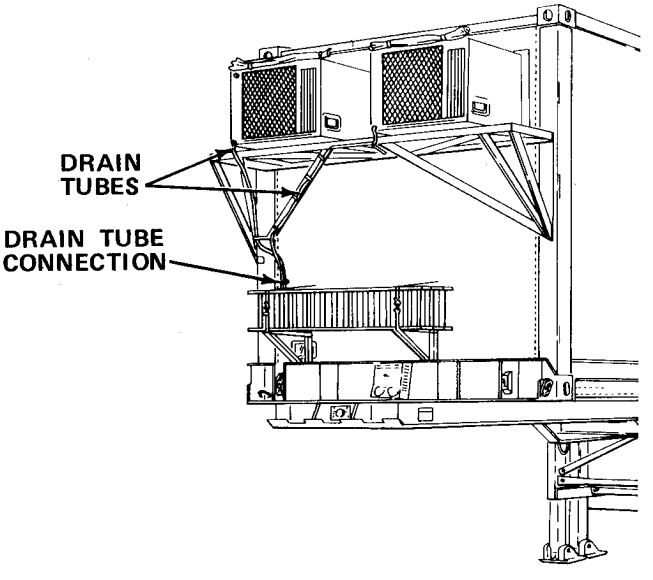
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cent	
1		Inspect Exterior - Cont	
	B/W	4. Inspect power entry panel for accumulated dirt, water, or corrosion. Clean power entry panel.	
	B/W	5. Inspect power entry panel to be sure any unused receptacles are covered.	Missing covers.
	B/W	6. Inspect air conditioner/heater drain tube to be sure tube is positioned as shown. Check for breaks and crimps in hose and check connections for damage or leakage.	



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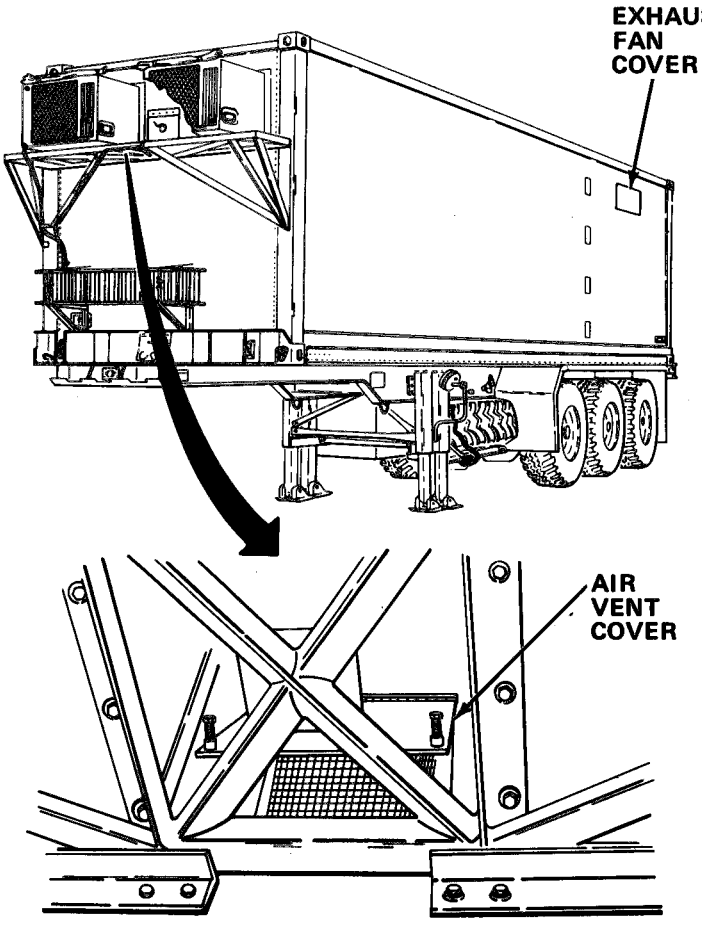
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cont	
1		Inspect Exterior - Cont	
			
	B/W	7. Inspect exhaust fan cover and air vent covers to be sure they are not blocked or clogged. Clean as required. Clean screen with vacuum cleaner as necessary.	
	B/W	8. Visually inspect ground connections to be sure ground cable is connected to terminal lug and ground rod. Clean if necessary.	Ground connections are broken or missing.

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment is Not Ready/ Available If:
		VAN BODY - Cent	
1		Inspect Exterior - Cont	
		WARNING Electrical shock hazard. Power cable must be deenergized before servicing entry panel connections. Death can result from failure to observe these safety precautions.	
		a. Turn power off to cable. Disconnect from power source.	
		b. Disconnect ground lug from ground rod.	
		c. Clean lug, cable end, and rod with wire brush.	
		d. Reconnect ground cable lug to rod.	
		e. Disconnect ground cable end from entry panel.	
		f. Clean terminal and cable end with wire brush.	
		g. Reconnect ground cable to entry panel.	
		h. Reconnect cable to power source. Turn power on.	
	B	9* Inspect boarding ladders for: a. Secure attachment of handrails. b. Steps not broken. c. Locking pins in place.	Steps are broken or will not lock in place.
	B/D/A	10. Inspect front and rear van body locks to be sure locks are fully engaged.	Lock disengaged.
	Q	11. Inspect gaskets on personnel doors for leaks or damage.	

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually Bi - Biennially | (Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cont	
1		Inspect Exterior - Cont	
	W	11.1 Inspect hinges for proper placement of hinge pins.	Missing hinge pins
	Q	12. Clean and paint blistered, pitted, or flaking areas and bare metal spots in accordance with instructions contained in TM 43-0139, Painting Instructions for Field Use.	
2		Inspect Interior.	
	B/D	1. Test emergency lights by pressing test button.	Emergency lights do not light.
	W	2. Inspect power cords and cables to be sure wires are not kinked, cut, or cracked.	Wires or cables are cracked or cut.
	W	3. Inspect plug connectors to be sure all plug connectors are tight and firmly seated. Tighten if necessary.	
	D	4. Inspect for burned out light bulbs and fluorescent lamps. Replace as required.	
	W	5. Inspect walls, ceiling, and floor for holes, open seams, or signs of seepage or leaks.	Leaks are present.
	D	6. Check storage cabinets for broken hinges, latches, and locks.	Hinge, latch, or lock is broken.
	B/M/A	7. Inspect fire extinguishers. Check that security seals are not broken.	Fire extinguisher is missing or seals are broken.

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

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D - During
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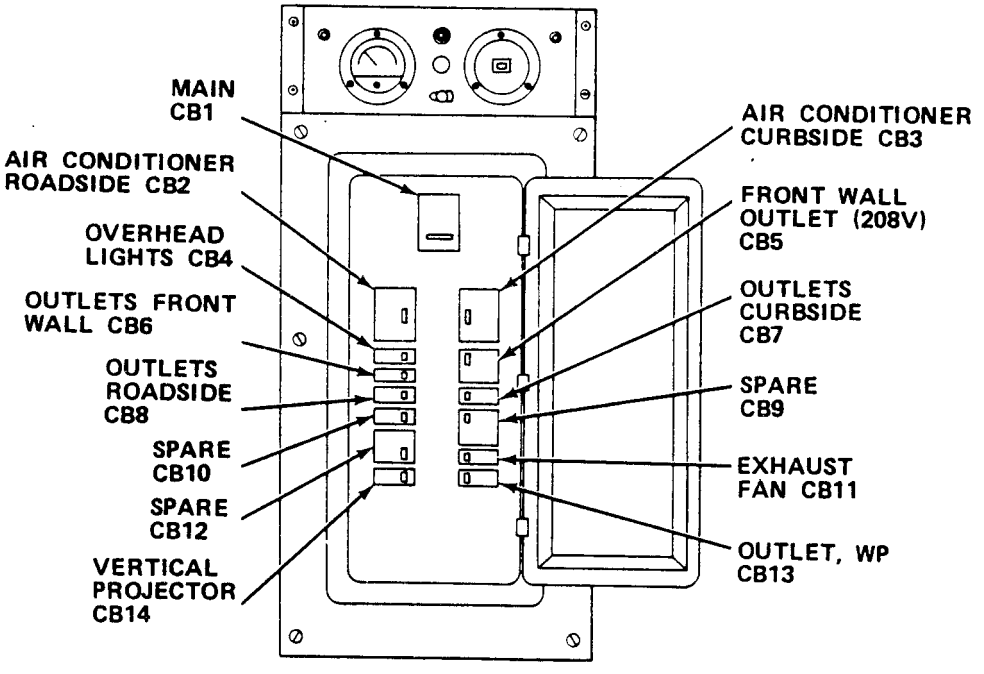
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cont	
2		Inspect Interior - Cont	
	Q	8. Inspect circuit breaker panel.	Circuit breaker is defective.

NOTE

Inspection is to be conducted on a not-to-interfere basis with work being conducted. Individual equipment will be inspected as directed by the appropriate chapter of this manual.



a. Set main circuit breaker to ON.

b. Set each circuit breaker to OFF, then ON.

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PIN: 039875-002

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B-Before D-During A-After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually BI - Biennially | (Numbed - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cent	
2		Inspect Interior - Cont	
	Q	9. Inspect light traps.	
		a. Turn on fluorescent 1 amps (high 1evel).	
		b. Close entrance doors. Have exhaust fan and air vent open. Inspect for light leakage through vents.	Light leaks are present.
		c. Turn on light switches and blackout override switches off.	
		d. Open door and make sure internal lights go off.	Blackout system is inoperable.
	A	10. Inspect/clean interior.	
		WARNING Death or serious injury may occur if wet or damp cloth is used to wipe or clean energized equipment, power cords, or cables.	
		CAUTION Do not sweep interior. Dislodged dirt or dust will ruin optical, electronic, and photographic equipment and supplies.	
		a. Wipe vertical and horizontal painted surfaces with cleaning cloth moistened with solution of general purpose detergent and fresh water until soil is removed from painted surfaces.	

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
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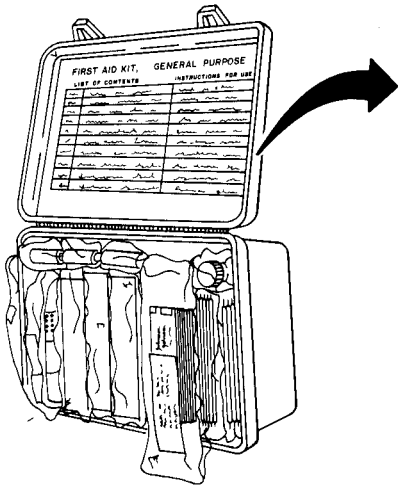
W - Weekly
M - Monthly
Q - Quarterly

AN . Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cont	
2		Inspect Interior - Cont	
		b. Dry vertical and horizontal painted surfaces with clean cloth.	
		c. Vacuum interior of section to remove dirt and waste. Pay particular attention to work stations.	
	S	11. Inspect first aid kit.	



FIRST AID KIT, GENERAL PURPOSE

LIST OF CONTENTS		INSTRUCTIONS FOR USE
3 ROLLS	ADHESIVE TAPE, SURGICAL, 1"X1½ YARDS	USE FOR MINOR CUTS AND CLOTHING REPAIR
16 EACH	BANDAGE, ADHESIVE, ¾"X3"	MINOR CUTS, AS REQUIRED
2 EACH	BANDAGE, GAUZE, COMPRESSED, CAMOUFLAGED, 3"X6 YARDS	CUT IN LENGTHS AS REQUIRED FOR BANDAGE INJURIES
1 EACH	BANDAGE, MUSLIN, COMPRESSED, CAMOUFLAGED, 37X37X62 INCH	USE FOR SLING
1 PKG	BLADE, SURGICAL PREPARATION RAZOR, STRAIGHT, SINGLE EDGE, 5s	SHAVING HAIR AND OPENING WOUNDS AS REQUIRED
1 PKG	COMPRESS AND BANDAGE, CAMOUFLAGED, 2"X2", 4s	FOR WOUNDS
3 EACH	DRESSING, FIRST AID, FIELD, 4X7 INCHES	FOR LARGE WOUNDS, EXCESSIVE BLEEDING
1 EACH	FIRST AID KIT, EYE DRESSING	FOR EYE WOUNDS, SEE INSTRUCTIONS
1 PKG	GAUZE, PETROLATUM, 3"X36", 3s	FOR BURNS, APPLY PAD OVER BURN
1 BTL	POVIDONE, IODINE SOLUTION, ½ OUNCE	AS DISINFECTANT AND CLEANSER OF CUTS AND WOUNDS, APPLY BEFORE BANDAGING
1 EACH	AMMONIA INHALANTS	CRUSH INHALANT BETWEEN FINGERS. HOLD A FEW INCHES FROM NOSE, HOLD CLOSER AS AMMONIA GETS WEAKER. WHEN TOO WEAK, USE FRESH INHALANT.
1 EACH	INSTRUCTION BOOKLET AND FIRST AID EXPLANATIONS	

a. Remove first aid kit from bracket.

b. Remove contents.

c. Inspect container for damage.

d. Inspect contents for damage. Then use checklist to inventory contents.

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
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w - weakly
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Q - Quarterly

AN - Annually
s - Semiannually
Bl - Biennially

(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED / PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cont	
2		Inspect Interior - Cont	
		e. Replace damaged or missing terns.	
		f. Repack kit.	
		g. Reinstall kit.	
	B/W	12. Inspect blackout curtains.	
		a. Inspect blackout curtains and valances for tears, missing hooks, or broken eyelets.	Curtains damaged.
		b. Inspect nylon hook and pile tape on curtain and wall for security of attachment.	
3	B	Inspect Air Conditioner/Heater. Refer to TM 5-4120-367-14 for preventive maintenance checks and services.	

Table 1-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
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W - Weekly
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Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		VAN BODY - Cont	
4	M	Service Power Cable. WARNING Electrical shock hazard. Power cable must be deenergized before servicing. Death or serious injury may occur from failure to observe this safety precaution. 1. Turn off safety switch. 2. Disconnect cable from power entry panel. 3. Wrap any cuts or abrasions in cable with electrical insulation tape. NOTE Check to be sure cable does not endanger personnel. 4. Reconnect power cable to entry panel.	

1-6. OPERATION UNDER USUAL CONDITIONS. Operation of the Synthesis Section consists of activation of power after the section has been located at the operation site and 12 V dc power disconnected.

1-6.1 Preparation for Use.

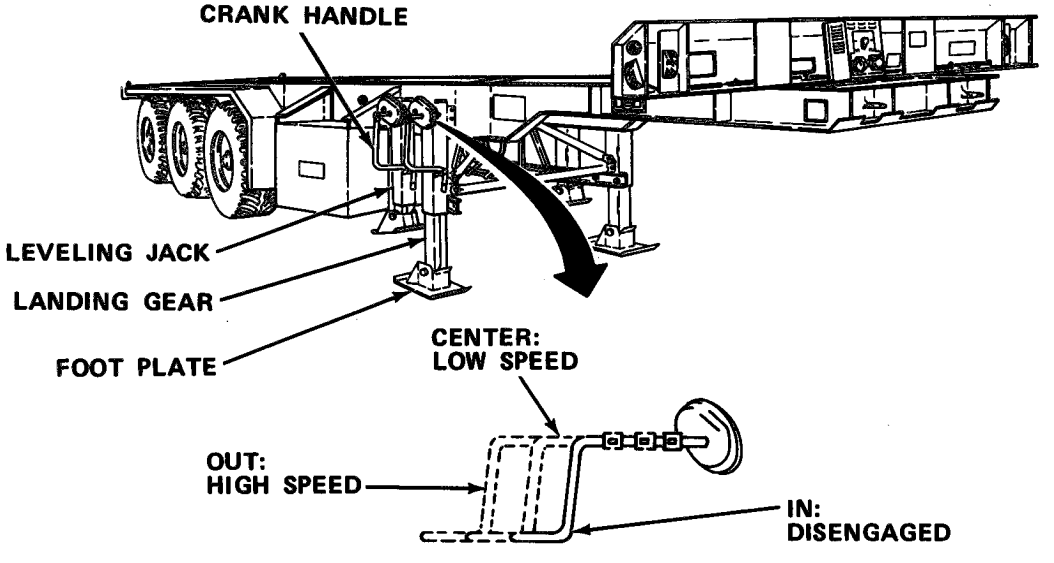
a. Procedures for leveling.

CAUTION

Trailer-mounted section must be on surface that is approximate y level to avoid unnecessary stress or twisting of chassis when section is leveled.

NOTE

- Snow or ice should be removed from under leveling foot plate before attempting to level section.
- Sand, soft ground, or mud requires that shoring or scrap material be placed under leveling foot plate to increase surface area and prevent sinking Into surface.
- Be sure that air suspension is deflated as indicated in TM 5-2330-305-14.



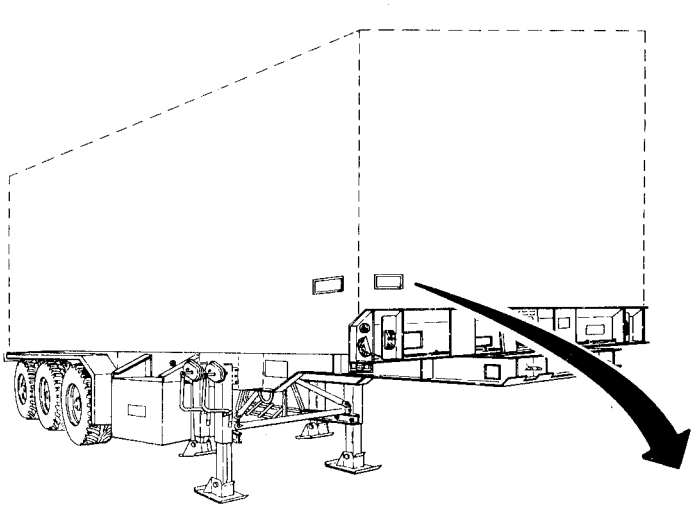
(1) Deflate air suspension in accordance with TM 5-2330-305-14.

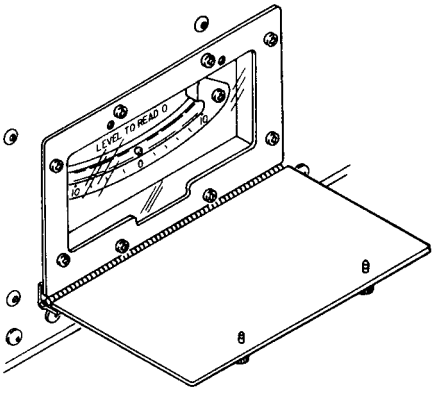
(2) Approximately level trailer chassis by raising or lowering landing gear.

(3) Move handle from secured location and swing out.

(4) Pull crank handle on each leveling jack all the way out and engage. There are two positions when handle is engaged. Fully out is high speed. Partially out is low speed.

(5) Lower each leveling jack by turning crank to right at high speed until foot plate just contacts ground.



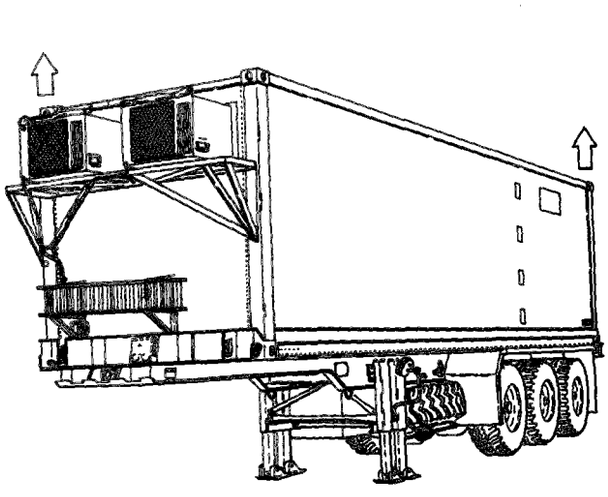


(6) Station personnel to have a clear view of level indicators at both front and rear of van body.

(7) Observe level indicators to determine which end and side must be raised.

CAUTION

Do not attempt tolevel section by lifting at diagonal corners, or frame will be twisted.



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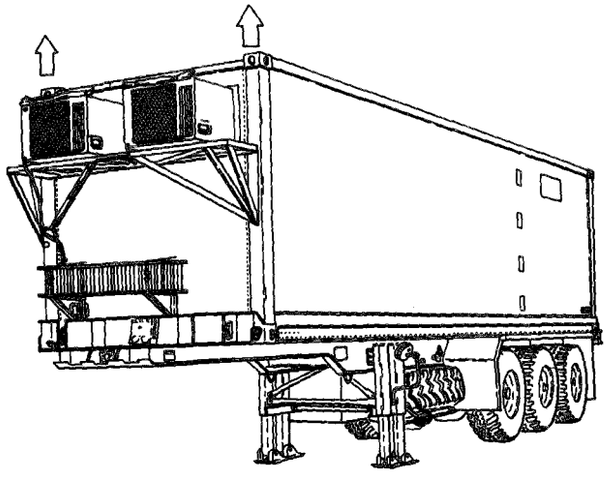
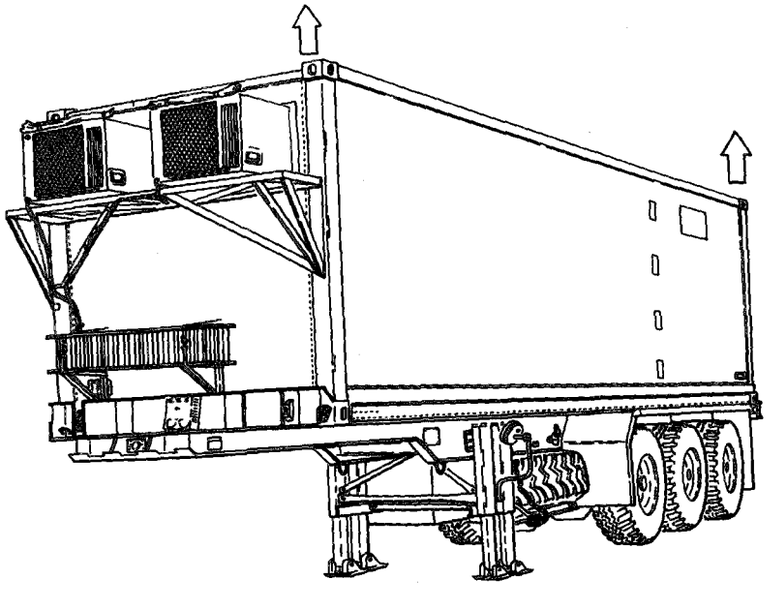
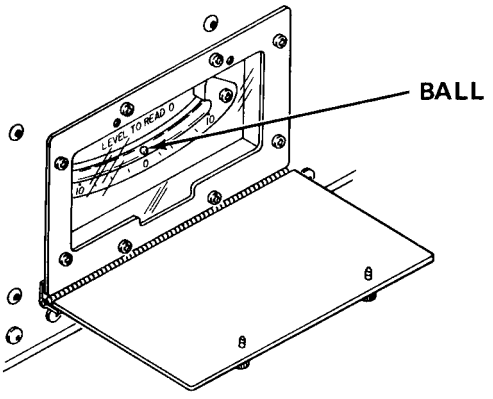


YES

(8) Raise low end by extending both leveling jacks at low end. Use low speed.



(9) Raise low side by extending both leveling jacks at low side.

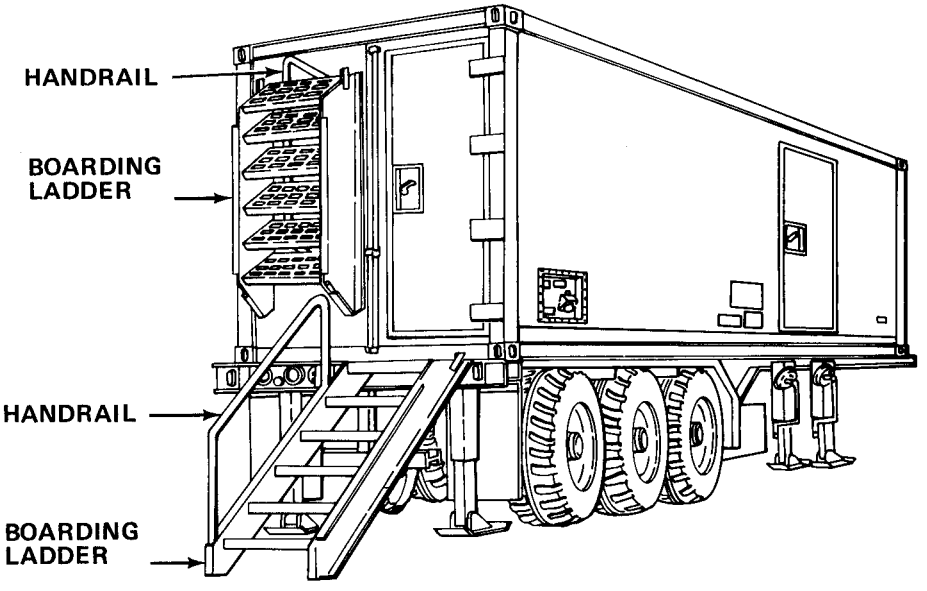


NOTE

Be sure ball is centered on all four level indicators ±2°.

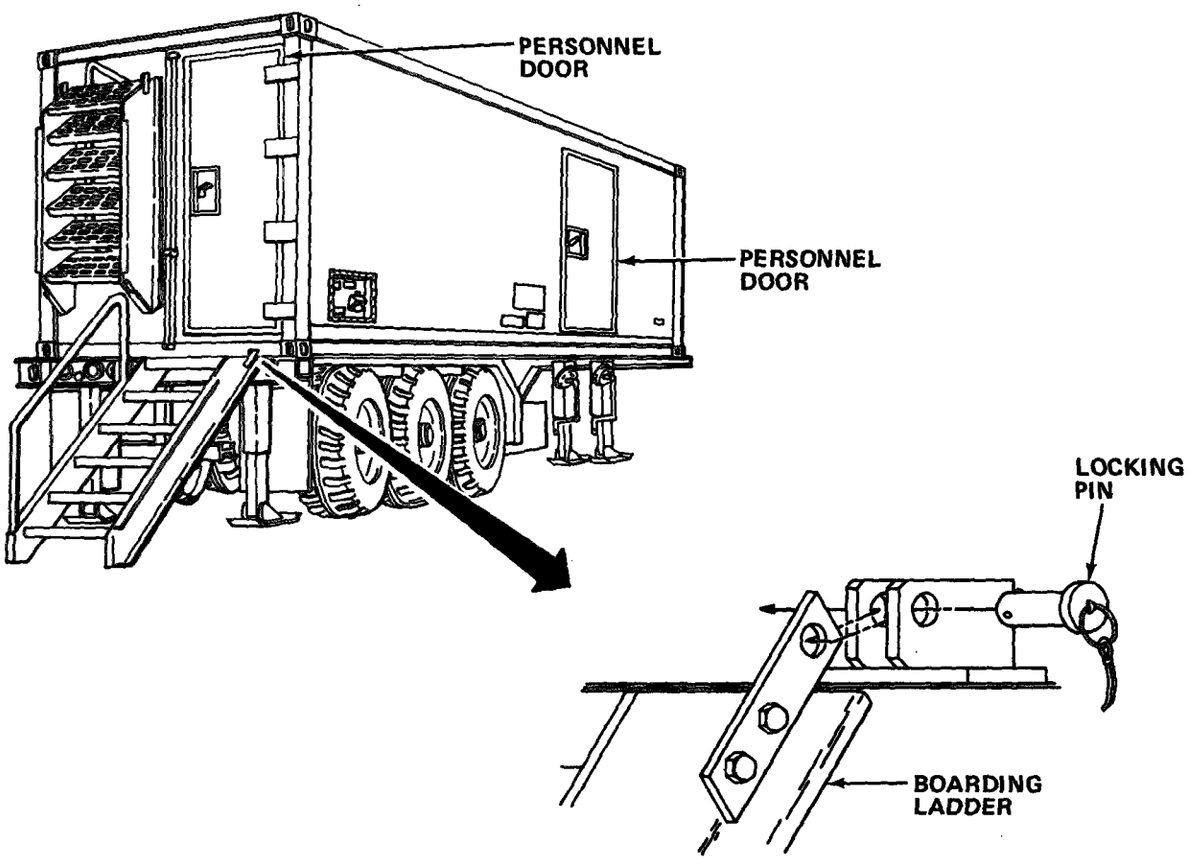
(10) Pull leveling crank handles away from trailer chassis, and lower crank handle to stowed position.

b. Procedures to activate section.

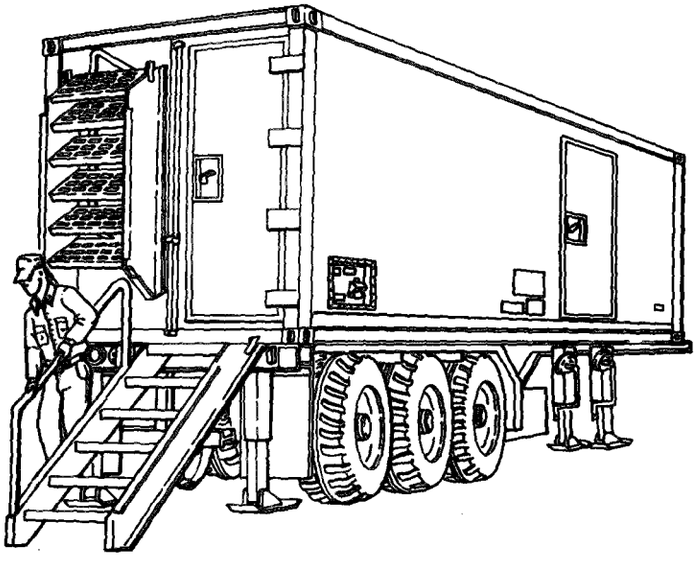


(1) Remove boarding ladders and handrails from rear of section.

(2) Remove handrails from ladders.



(3) Mount ladders at personnel doors and secure with locking pins.

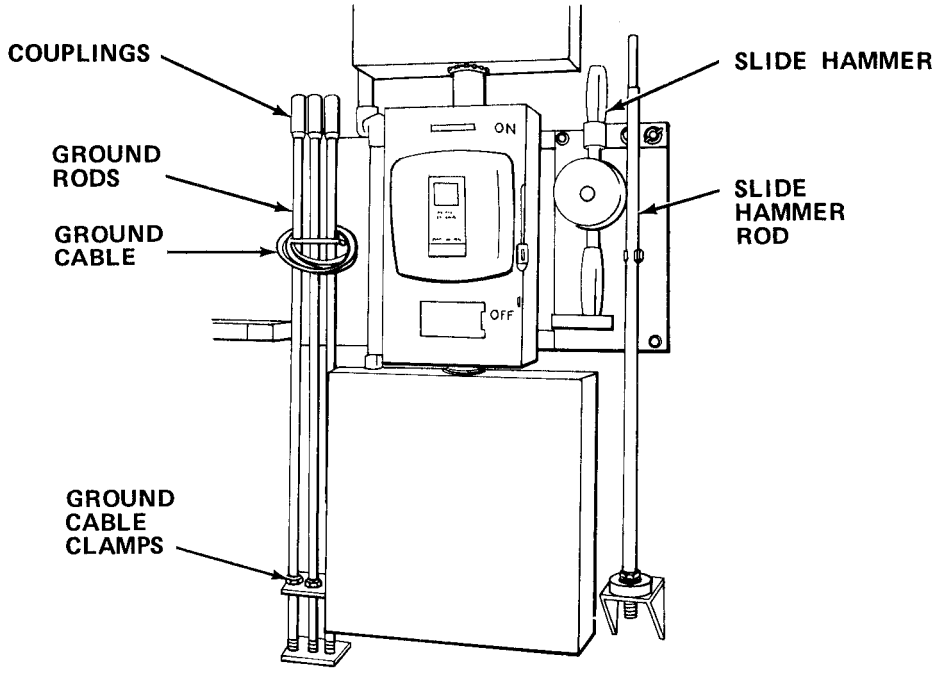


(4) Mount one handrail on each ladder.

(5) Enter section and be sure safety switch , main circuit breaker, and all equipment power supply switches are off.

WARNING

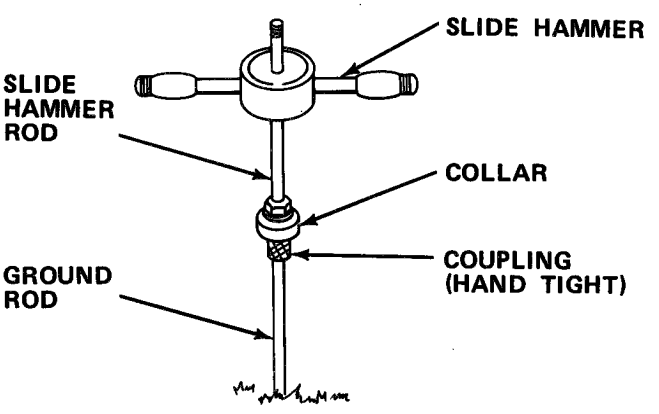
Death or serious injury may result from connecting power cable to section before grounding.



(6) Remove ground rod, slide hammer, and ground cable from the section.

NOTE

- Apply a thin film of grease to threaded ends of rods before driving into ground. This will permit easy disassembly upon removal from ground.
- Bottom ground rod must be numbered or identified so that it will always be the first rod driven into the ground.
- These instructions supplement TC 11-6, Grounding Techniques.



(7) Select an area as close to power entry panel as possible to install ground rod. Then assemble the first ground rod and coupling to the slide hammer rod .

CAUTION

Do not allow ground rod to rotate when removing the slide hammer rod. Rods must be kept screwed together to make a good electrical ground.

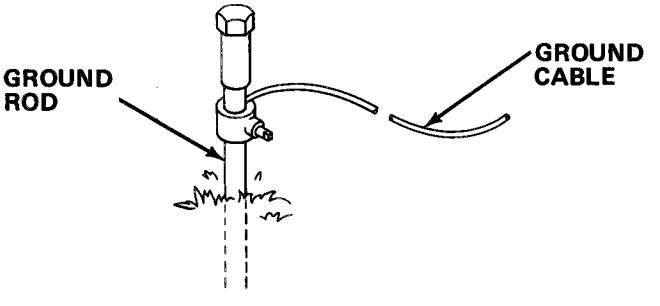
NOTE

Before driving ground rod be certain that rods meet inside coupling. Be sure collar is handtight against coupling.

(8) Place slide hammer on hammer rod end, and drive ground rod into ground. Remove slide hammer rod. Attach slide hammer rod to a new section of ground rod, and repeat procedure until only 12 in, (30.5 cm) of the third rod is above ground.

(9) Remove slide hammer and hammer rod, and place in section.

(10) Secure ground cable clamp and ground cable to ground rod.

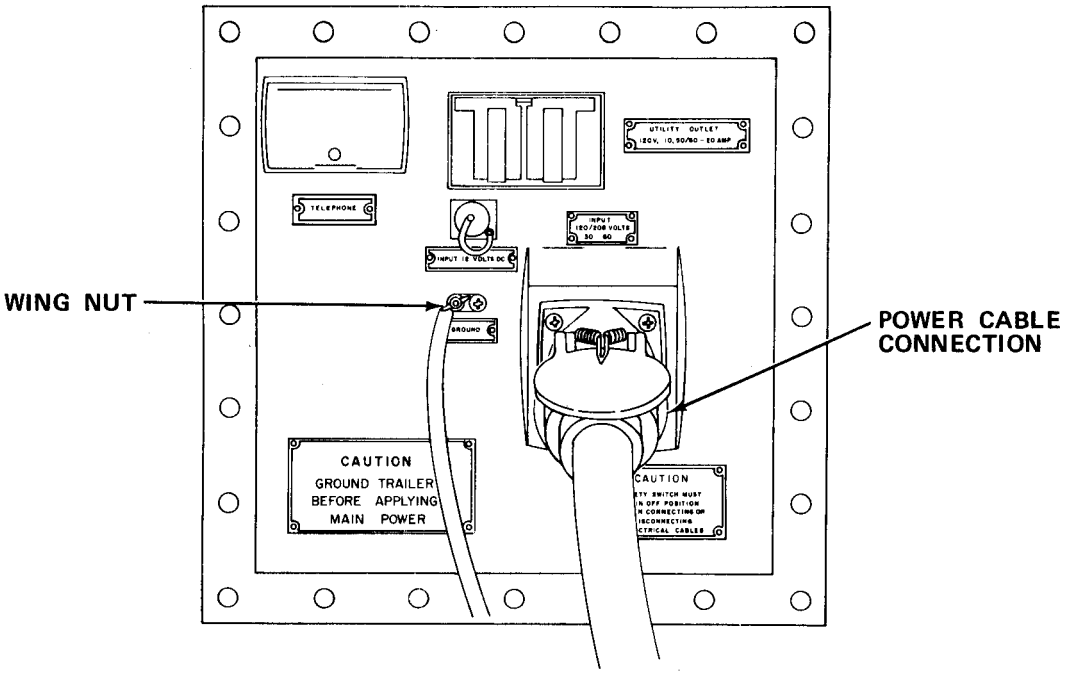


WARNING

To prevent death or serious injury, do not handle or clean power cable or connectors when cable is connected to power source.

NOTE

The section must be properly grounded before power is connected. If it is not possible to drive the three sections of ground rod fully into ground, the rods may each be driven into the wound separately and connected in series. If it is impossible to drive-a ground rod, a-suitable alternative ground must be found, such as a buried metal water pipe. Grounding Techniques for additional instructions.

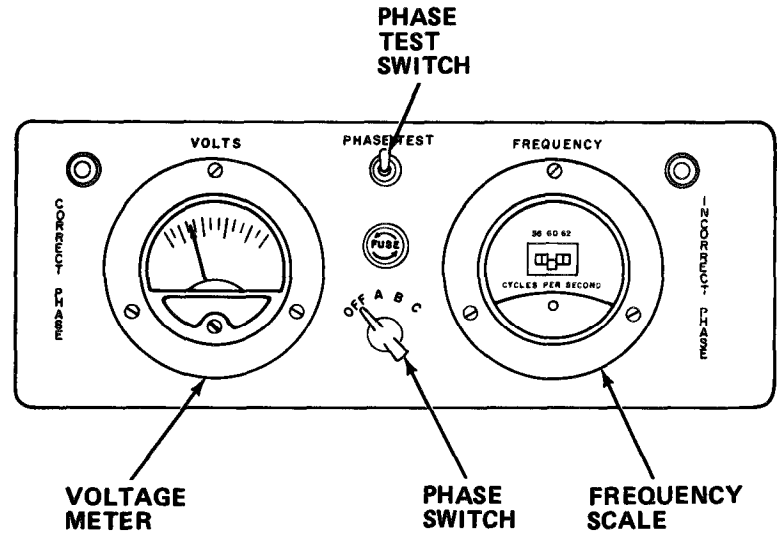


(11) Connect ground cable to ground lug with wing nut.

CAUTION

Be sure safety switch is off before connecting power cable to avoid equipment damage.

(12) Firmly connect the power cable to the power receptacle.



(13) Turn on safety switch.

CAUTION

Do not energize section if incorrect phase lamp lights. Damage to equipment may result.

(14) Check voltage and frequency as follows:

(a) Push phase test switch. Observe correct phase lamp lights.

(b) Turn phase switch to A.

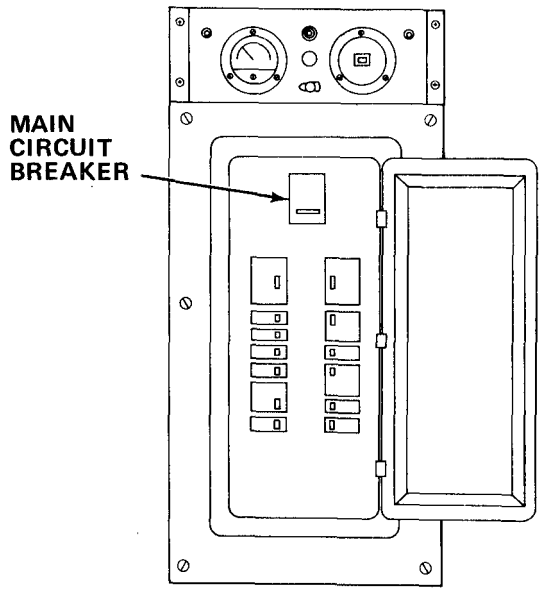
CAUTION

Voltage must be between 110 and 120, and frequency must be at 60 ±1 Hz on each leg before turning on main circuit breaker or damage to equipment may result.

(c) Read voltage on meter.

(d) Read frequency on seal e.

(e) Repeat for positions B and C on phase switch.



(15) Set main circuit breaker on.

NOTE

This step must be accomplished if section is placed n operation in darkness, fog, mist, or under blackout conditions;

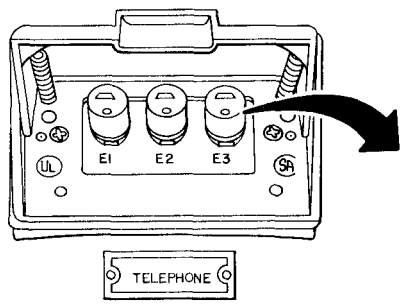
(16) Close blackout curtains, if required.

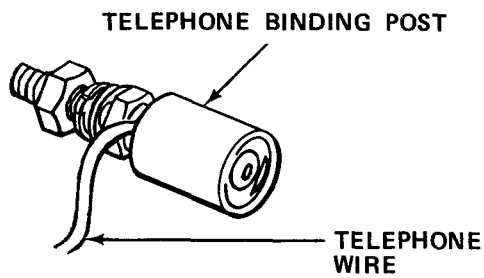
(17) Turn on circuit breakers in following order:

(a) Individual lighting.

(b) Curbside and roadside air conditioners/heaters.

(c) Curbside and roadside receptacles.





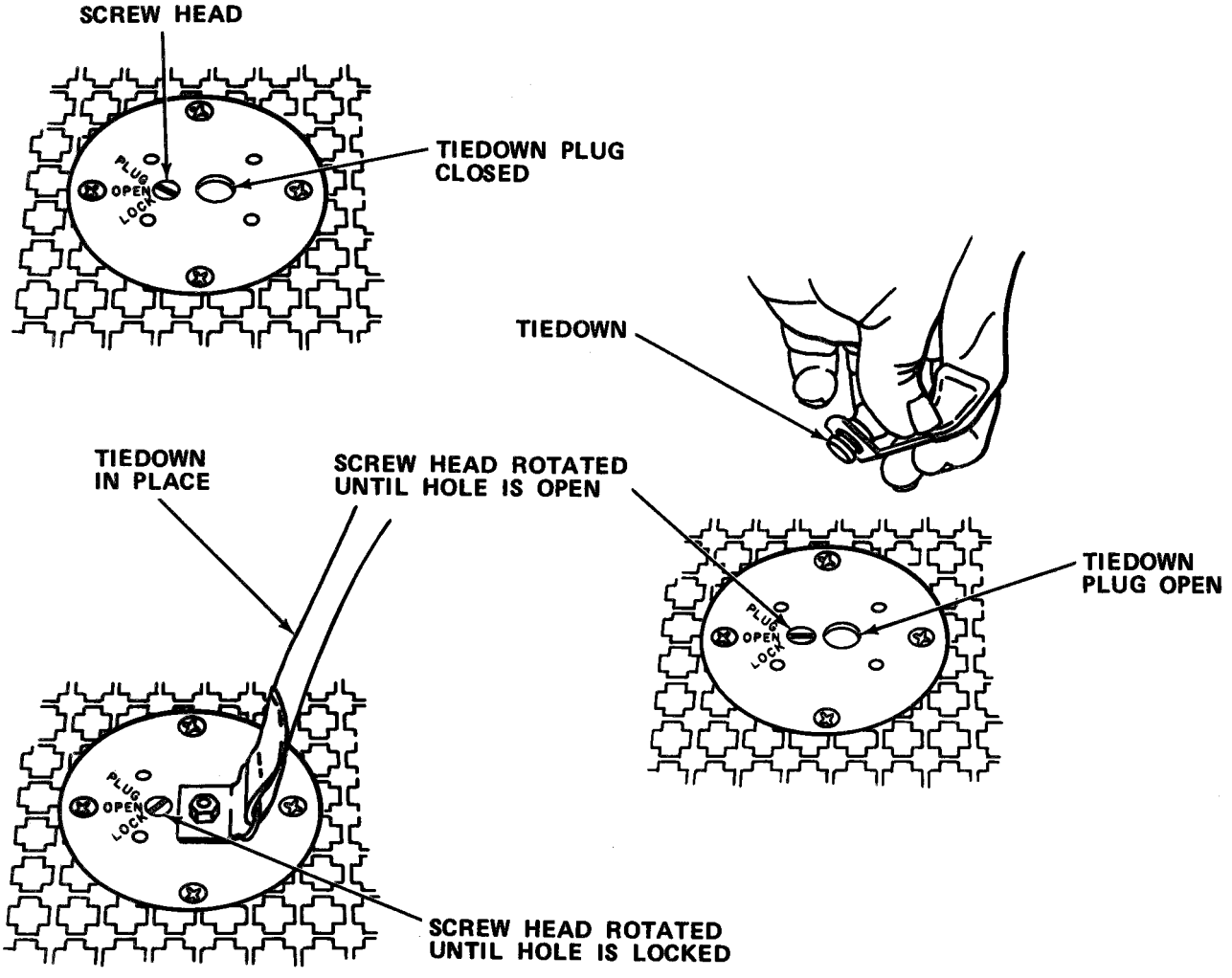
(18) Connect telephone lines to corresponding interior binding posts.

(19) Check blackout switches.

(20) Plug in emergency lighting and turn switch to READY.

1-6.2 Preparation for Movement.

a. Inventory equipment and supplies.



b. Install tiedowns in tiedown sockets.

c. Secure authorized equipment in proper containers or as specified by appropriate chapters.

d. Secure straps and remove slack from tiedowns.

WARNING

Death or serious injury may occur if power cable is disconnected while power is on.

e. Turn equipment switches off.

f. Turn main circuit breaker off.

g. Turn safety switch off.

h. Have power cable disconnected at power supply end. Then disconnect power cable from receptacle. Put cable in storage box on trailer chassis.

i. Turn emergency light switch off.

j. Disconnect telephone cables from power entry panel.

CAUTION

To prevent loss of rod or thread damage, do not allow ground rod to rotate and unscrew when removing the slide hammer rod.

k. Remove ground rod with slide hammer, and put ground rods, couplings, and slide hammer inside section. Clean threads on each ground rod before storing.

NOTE

Be certain exhaust fan and air vent doors are securely closed.

l. Reinspect section interior for loose equipment and close all vents.

m. Close section. Secure and lock all personnel doors and cargo door.

NOTE

Be sure air conditioner/heater covers are down and secured.

n. Remove handrails from boarding ladders.

o. Remove boarding ladders and insert handrails into back of ladders.

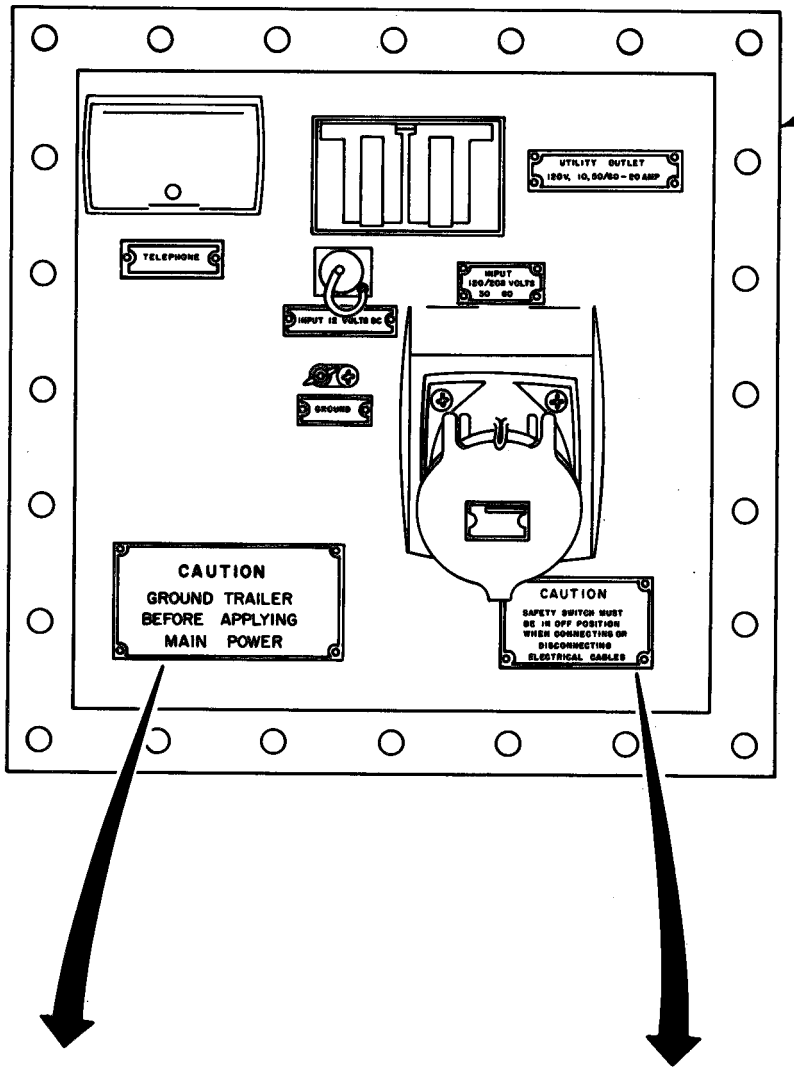
p. Secure ladders to back of section.

q. Fully extend landing gear.

r. Retract leveling jacks.

s. Visually inspect section exterior to be sure al equipment and covers are secured.

1-6.3 Operating Instuctions on Decals and Instruction Plates.

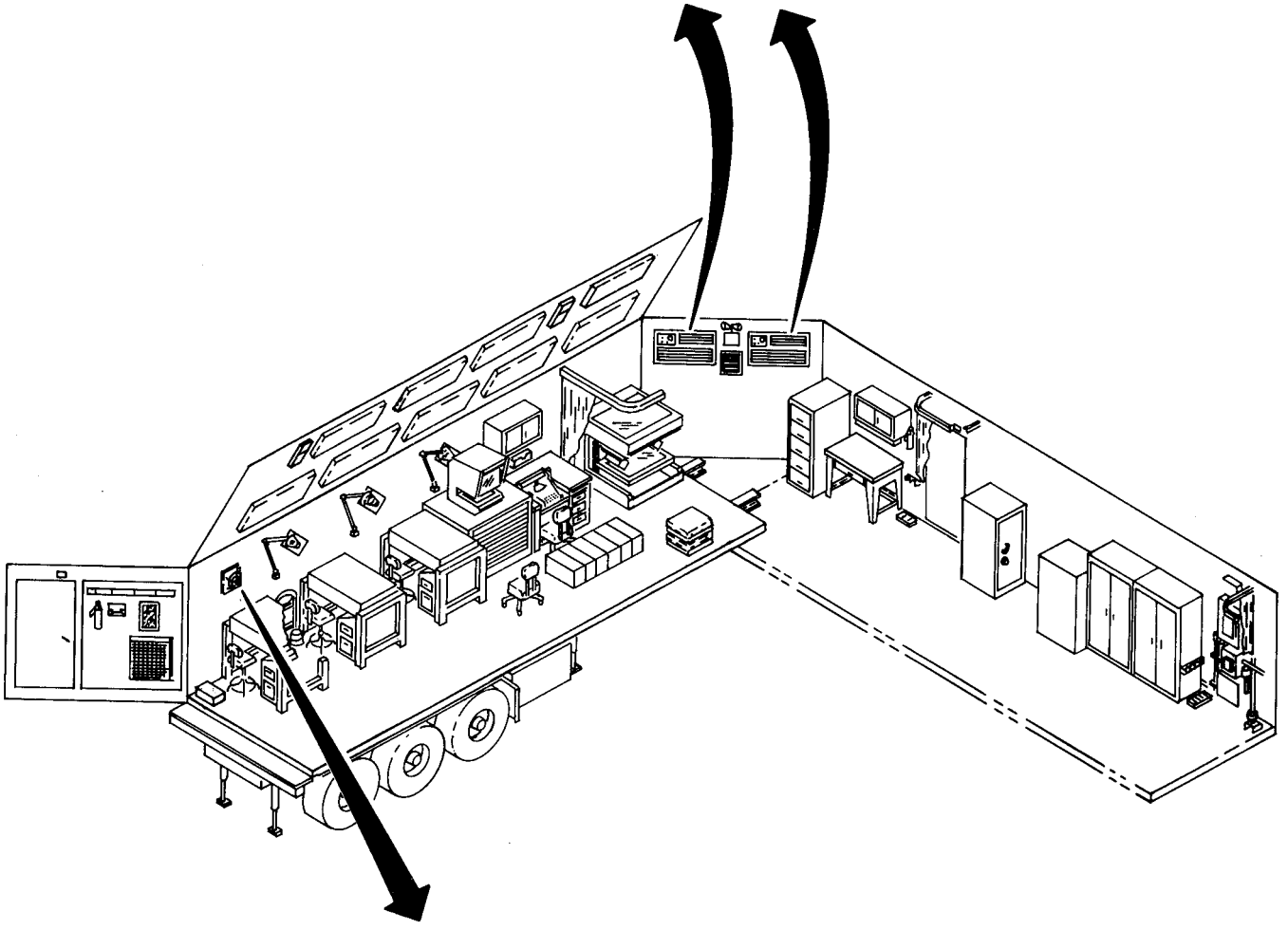


CAUTION
GROUND TRAILER BEFORE APPLYING MAIN POWER

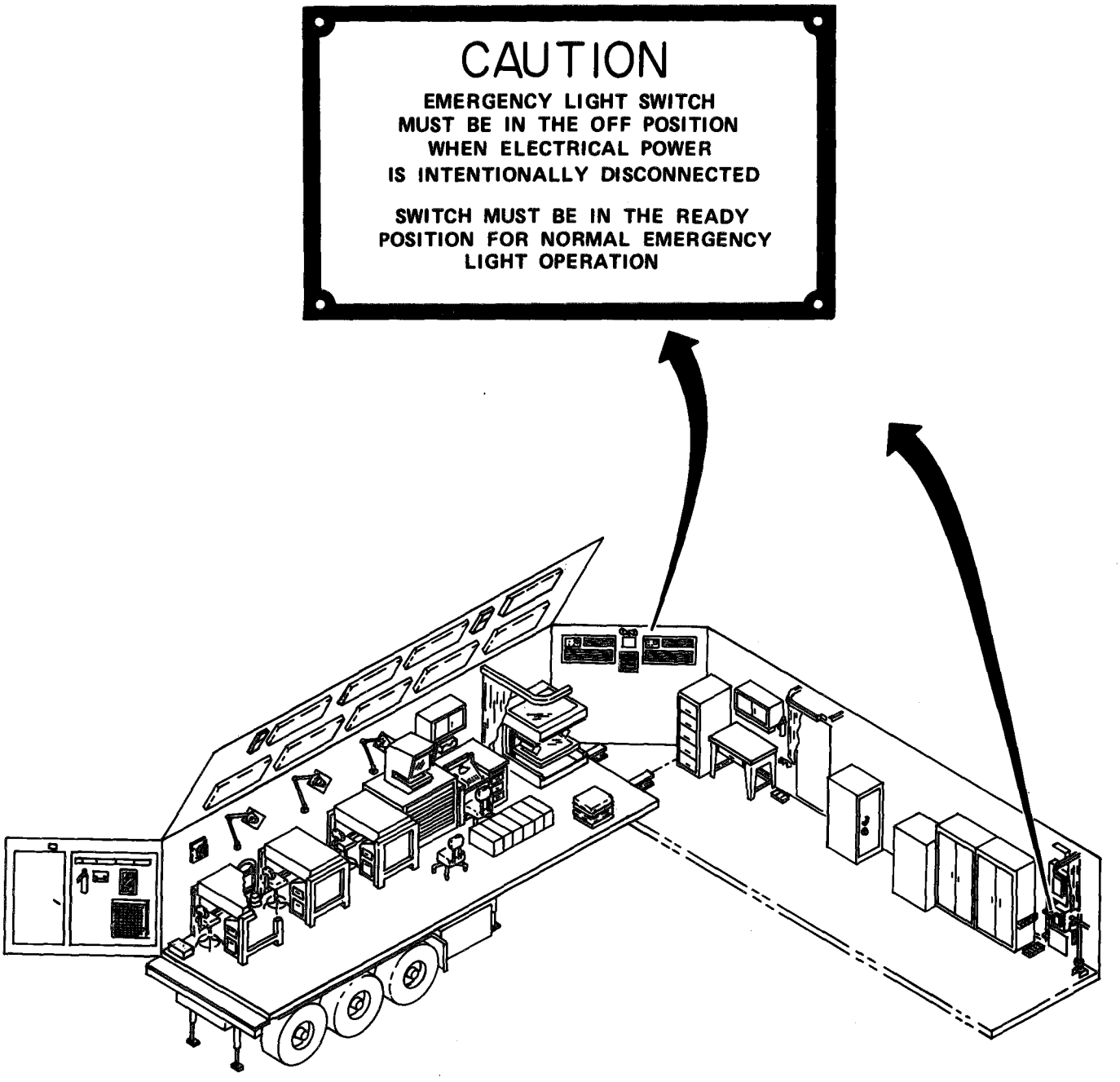
CAUTION
SAFETY SWITCH MUST BE IN OFF POSITION WHEN CONNECTING OR DISCONNECTING ELECTRICAL CABLES

CAUTION
FOR SAFE OPERATION
SEE TM FOR PROPER
INTERNAL AND EXTERNAL
GROUNDING

CAUTION TO START UNIT ON "COOL"
MODE AT 0°F AMBIENT
JUMPER LACO SWITCH (S-5)

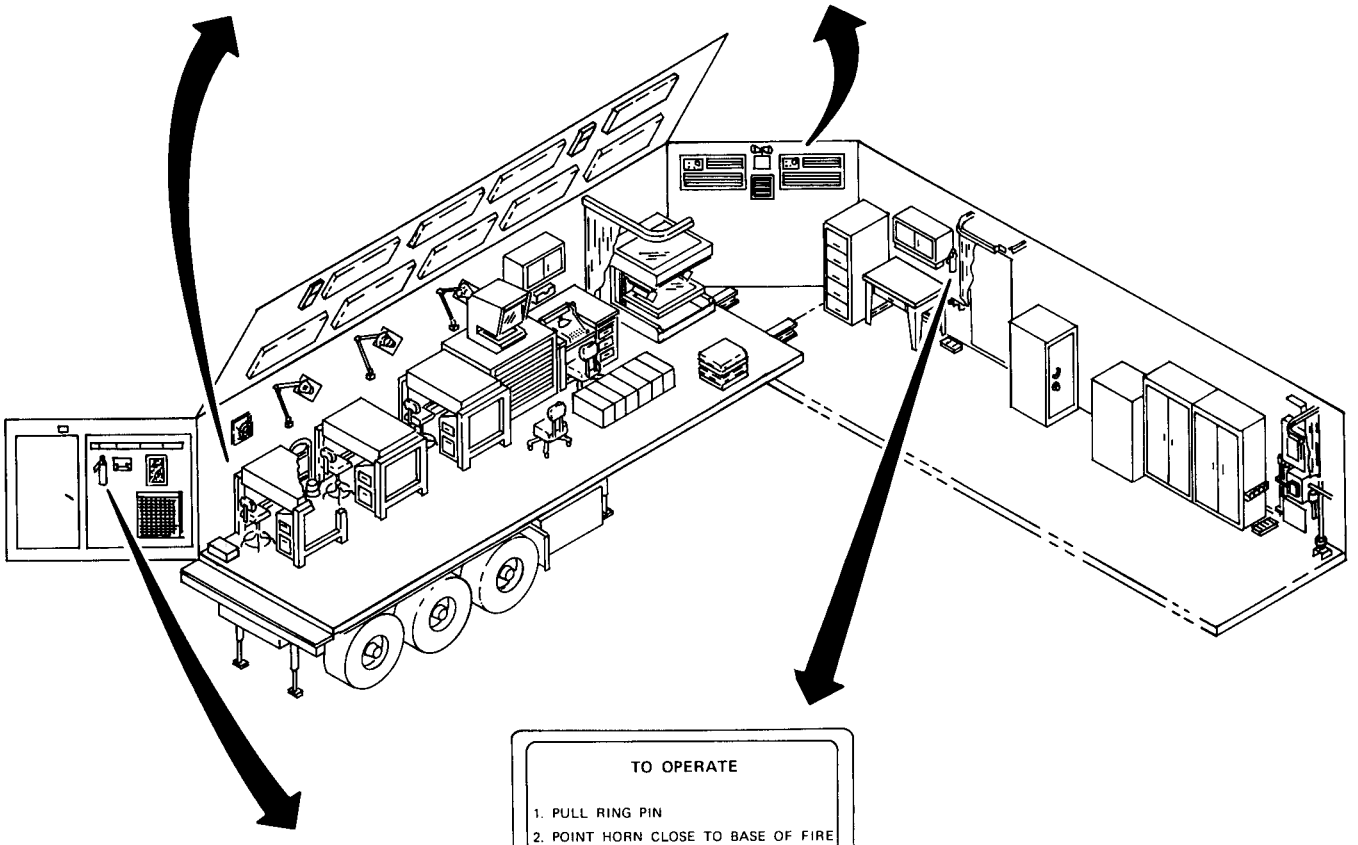


CAUTION
OPEN OUTSIDE VENT BEFORE
OPERATING FAN


CAUTION
EMERGENCY LIGHT SWITCH
MUST BE IN THE OFF POSITION
WHEN ELECTRICAL POWER
IS INTENTIONALLY DISCONNECTED
SWITCH MUST BE IN THE READY
POSITION FOR NORMAL EMERGENCY
LIGHT OPERATION

CAUTION

OPEN OUTSIDE FLAPS
PRIOR
TO OPERATING AIR COND



TO OPERATE

1. PULL RING PIN
2. POINT HORN CLOSE TO BASE OF FIRE
3. DEPRESS TRIGGER FOR DISCHARGE AND KEEP BASE OF FLAMES COVERED
4. AVOID BREATHING OF SMOKE
5. REMOVE VALVE AND HORN ASSEMBLY AND DISCARD USED CYLINDER

EXTINGUISHER, FIRE, CF_3BR, 2 3/4 LB

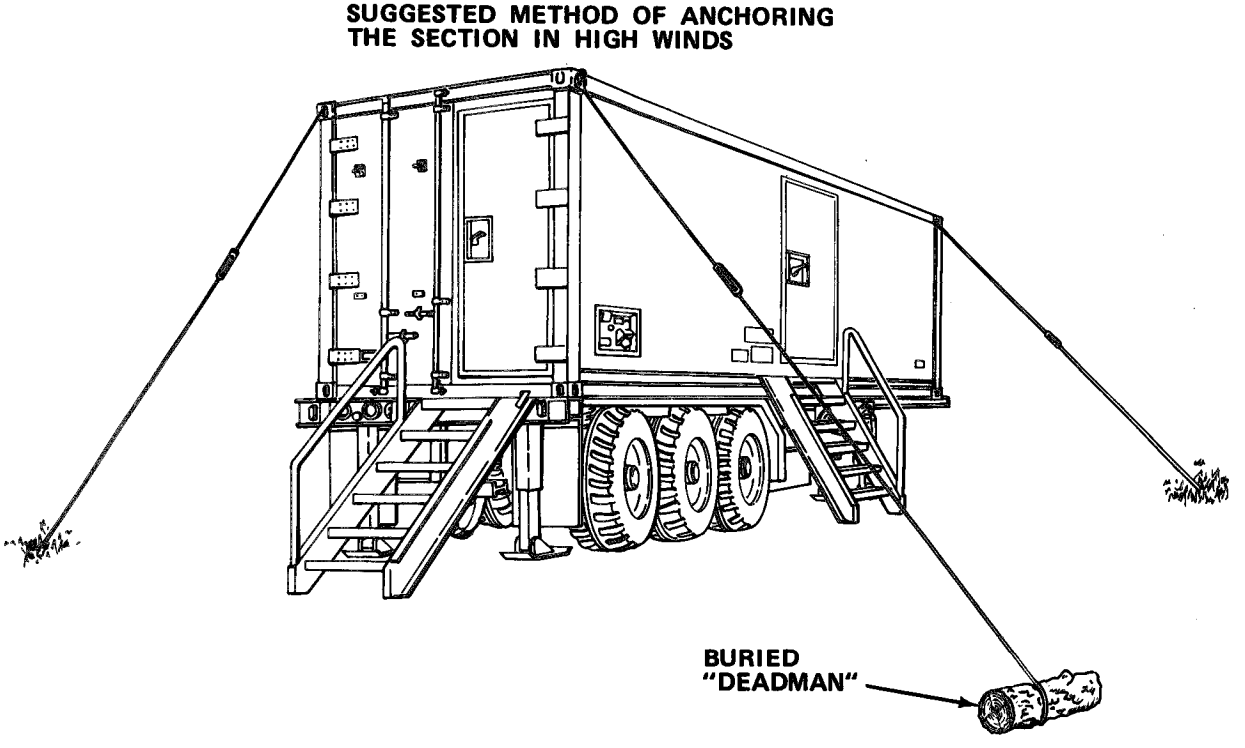
1-7. OPERATION UNDER UNUSUAL CONDITIONS.

NOTE

Damage to container permitting light leaks, water, or dirt entry must be temporarily repaired using available material on hand. Maintenance personnel will conduct permanent repairs; however, crew must maintain operational capability of section.

1-7.1 Operation in High Wind or Storm Conditions.

a. Relocate section if trees or structures present hazard.



b. Secure section corners at lifting eyes to deadmen or substantial objects.

c. Remove all loose objects from area.

1-7.2 Operation in Cold Weather.

a. The operation of the internal equipment is performed within environmentally controlled conditions; however, in extreme cold, the main power supply cable and ground cable will become hard, brittle, and difficult to handle. Be careful when connecting and disconnecting the cables so that kinks and unnecessary loops will not result in permanent damage.

b. Make certain that connections and cable receptacles on the outside of the section are free of frost, snow, and ice.

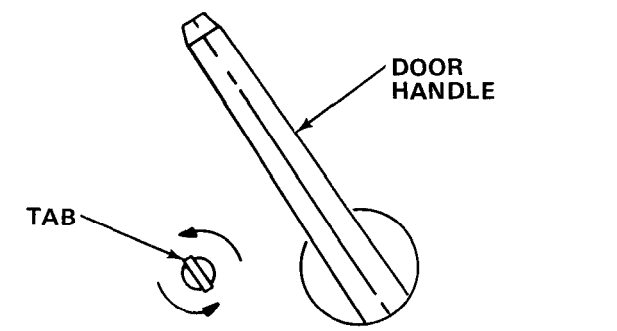
c. When section heaters are not operating or when the section is being transported, liquid consumable supplies may freeze, break their containers, then melt, and ruin equipment or documents. Store these items in an area to prevent equipment or document damage.

1-7.3 Operation in Extreme Heat. The operation of the internal equipment is performed within environmentally controlled conditions; however, during transportation or when air conditioning units are not operating, consumable supplies may suffer reduced shelf life, and internal components may have accelerated deterioration of gaskets, seals, or insulation.

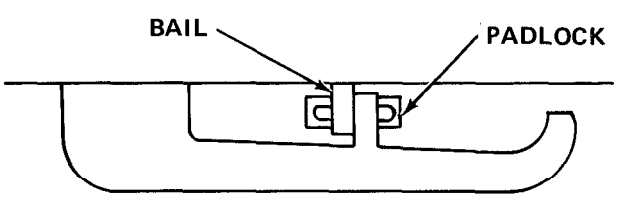
1-7.4 Operation in Tropical Conditions. Fungi, mildew, or mold will form on and in equipment, documents, and supplies if internal environmental control equipment is not operating and outside heat and humidity are allowed to enter the section.

1-7.5 Operation in Desert Conditions. Dust, grit, and sand will ruin supplies, equipment, and documents. Extreme care must be taken to prevent dust, grit, and sand from entering the section. Air filters will be chanqed whenever airflow is restricted, and cleaning of section interior must be conducted more frequently than specified by PMCS schedules.

1-7.6 Emergency Procedures. There are no specific emergency procedures for operation of the section.



INSIDE FRONT VIEW



OUTSIDE TOP VIEW

1-7.7 Emergency Means of Exit. In the event personnel are locked in the section. the tab may be turned to the left until the bail on the padlock falls free. The door handle is now free to turn.

Section III OPERATOR MAINTENANCE

1-8. LUBRICATION INSTRUCTIONS.

a. Lubrication instructions for the Synthesis Section are contained in LO 5-6675-325-12, Lubrication Order, Synthesis Section, Topographic Support System. The intervals and man-hours specified in the Lubrication Order are based on normal operations. During inactive periods, lubrication periods may be extended with adequate preservation.

b. Topographic equipment and all optical equipment require special care in lubrication. When a specified lubricant is called for, substitutions are not authorized. Minimum amounts of lubricant are to be used and all excess lubricant is to be Immediately removed. Spray lubricants must not be used In the vicinity of optical equipment unless optics are completely protected. No lubricant is to be applied unless a thorough cleaning is conducted first to remove dirt, dust, or abrasive material.

c. Be sure that you refer to the appropriate chapter before any equipment is stored after use, that the temperature has stabilized, and that lubrication required after use is accomplished.

1-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during operation or maintenance of the Synthesis Section, or its components. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all test or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 1-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. NO ELECTRICAL POWER TO SECTION.

WARNING

Death or serious injury may result. Do not perform any electrical maintenance or make electrical connections or disconnections at main power receptacle when power cable is energized.

Step 1. Observe voltage and frequency for phases A, B, and C. Read 115 ±5 V,60 ± 1 Hz.

(a) If voltage and frequency are correct, proceed to step 2.

(b) If voltage and frequency are incorrect, notify power supply supervisor.

CAUTION

Do not energize section if voltage or frequency is not correct. Damage to equipment may result.

Step 2. Press phase test switch on power panel for A, B, and C.

(a) If phases A, B, and C are correct, proceed to step 3.

(b) If incorrect phase lamp 1ights, notify power supply supervisor.

CAUTION

Do not energize section if incorrect phase lamp lights. Damage to equipment may result.

Step 3. Check safety switch position.

(a) If safety switch is on, proceed to step 4.

(b) If safety switch is off, turn on.

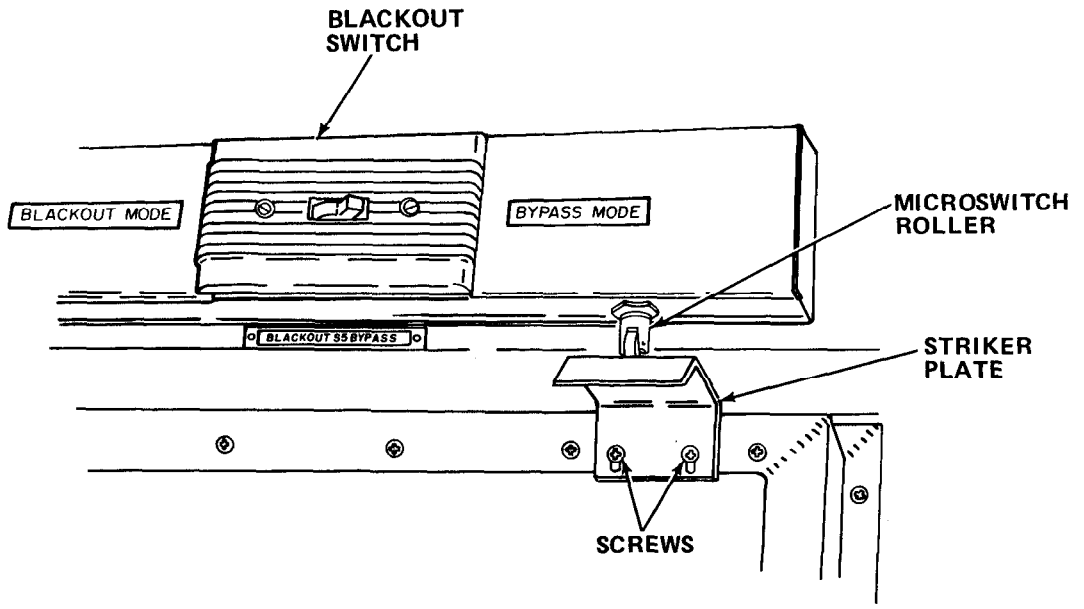
Table 1-2. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. NO ELECTRICAL POWER TO SECTION - Cont
Step 4. Check main circuit breaker position.
(a) If circuit breaker is ON, refer to direct/general support maintenance.
(b) If circuit breaker is OFF, turn ON.
(c) If circuit breaker trips repeatedly, notify power supply supervisor.
2. NO ELECTRICAL POWER TO EQUIPMENT.
Step 1. Check equipment power switch.
(a) If power switch is ON, proceed to step 2.
(b) If power switch is OFF, turn ON.
Step 2. Check power cord.
(a) If power cord is plugged in, proceed to step 3.
(b) If power cord is unplugged, plug in.
Step 3. Inspect circuit breaker panel for breakers in OFF position.
(a) If al 1 circuit breakers are ON, refer to direct/general support maintenance.
(b) If any circuit breakers are OFF, turn ON.

Table 1-2. TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

3. BLACKOUT SWITCH DOES NOT OPERATE .



Step 1. Check blackout switch position.

(a) If switch is on, proceed to step 2.

(b) If switch is off, reset switch to BLACKOUT.

Step 2. Check to see that striker plate contacts roller on microswitch.

(a) Loosen screws, and move plate up or down until microswitch operates.

(b) If blackout switch still fails to operate, refer to organizational maintenance.

1-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the Synthesis Section. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

1-10.1 Replace Fluorescent Lamp.

MOS: 810, Terrain Analyst

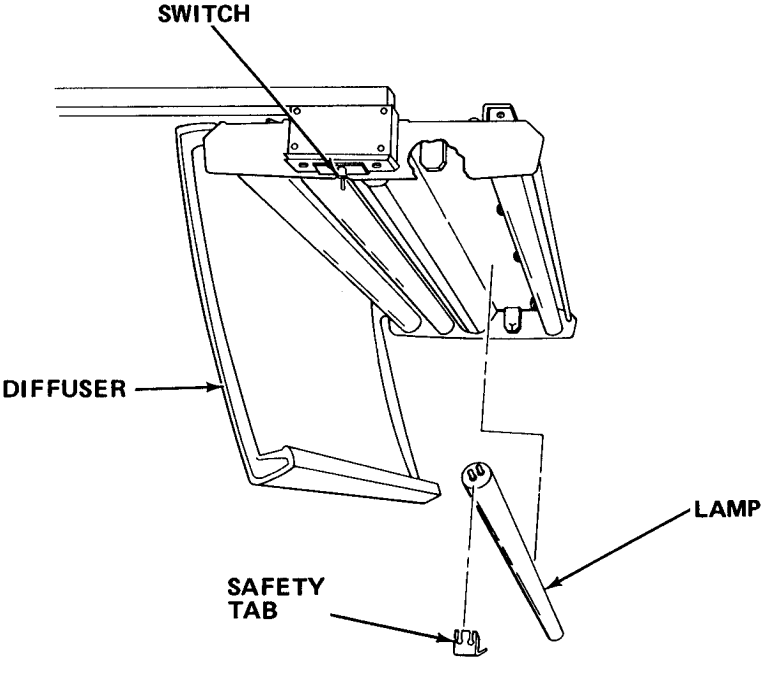
TOOLS: None

SUPPLIES: Fluorescent Lamp

WARNING

Death or serious injury may result if power is left on while servicing lamp.

a. Turn off switch.



b. Gently pull diffuser from light bracket, and place diffuser out of the way to prevent damage.

c. Remove safety tab from lamp socket.

d. Rotate defective lamp until prongs are free from slot and remove.

e. Insert new lamp prongs into slot and rotate 90 degrees.

f. Reinstall safety tab into lamp socket.

g. Reinstall diffuser.

h. Turn on switch.

1-10.2 Service Ventilation Ducts.

MS: 81Q, Terrain Analyst

TOOLS: Vacuum Cleaner
Flat Tip Screwdriver

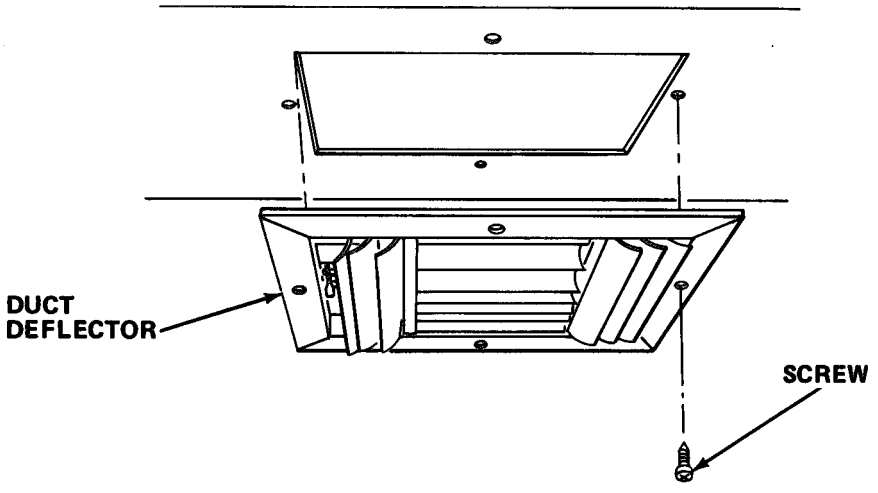
SUPPLIES: None

a. Cover equipment to prevent dust from entering equipment.

b. Close all doors and cabinets.

c. Remove any documents or other work that may be damaged by dirt/dust.

d. Turn off air conditioner/heater.



e. Remove four screws from each ventilation duct deflector.

f. Remove all duct deflectors,

g. Vacuum dirt or dust from deflector louvers.

h. Insert vacuum cleaner probe into ventilation duct at each deflector hole, and vacuum as far as probe will reach.

i. Reinstall deflectors and secure with four screws.

j. Turn on air conditioner/heater.

k. Vacuum any dislodged dirt or dust from interior of section.

l. Remove covers for operation.

1-10.3 Replace Blackout/Dome Light.

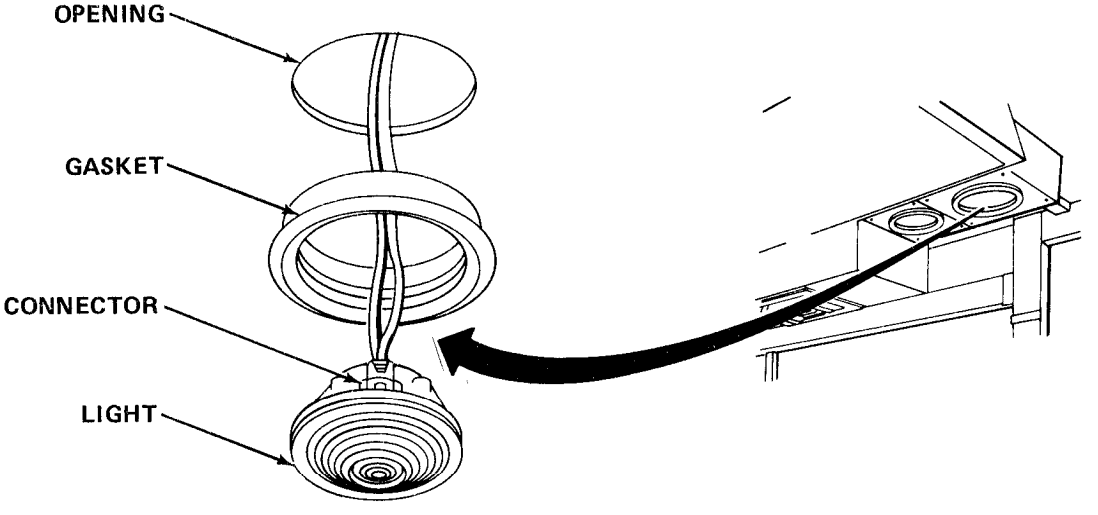
MOS : 81Q, Terrain Analyst

TOOLS: None

SUPPLIES: Light (12 V)
Silicone Spray (Item 26, Appendix E)

NOTE

Blackout light and dome light are sealed units. No bulb replacement is possible. Complete light must be replaced.



a. Push light and gasket up into opening.

b. Tilt and remove light and gasket from opening.

c. Disconnect defective light from connector.

d. Connect new light to connector.

e. Reinstall gasket in opening.

NOTE

The use of silicone spray on the gasket will help to position light.

f. Position light in gasket and push in.

Section IV ORGANIZATIONAL MAINTENANCE

1-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

1-12 REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

1-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

1-12.2 Special Tools : Test, Measurement. and Diagnostic Equipment; and Support Equipment. Special Tool s, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

1-12.3 Repair Parts. Repair parts for this equipment are 1 i steal in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering organizational maintenance for this equipment.

1-13. SERVICE UPON RECEIPT.

NOTE

The section may be received mounted on a chassis, or as a van body for mounting on an available transporter, or on site. Inspection of the chassis is covered in TM 5-2330-305-14. Inspection of the air conditioner/heater is covered in TM 5-4120-367-14.

1-13.1 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, Packing Improvement Report.

(1) Visual 1 y inspect the section exterior starting at the rear to cover rear, curbside, roadside, front, top, and bottom. Inspect for damage, tears, breaks, or corrosion.

(2) Enter section and inspect for broken equipment, tool boxes, chairs, or equipment loose and not secured.

(3) Close doors and vents to determine if light leaks exist.

(4) Inspect doors for damage, torn or rotted seals, and tightness of closure.

(5) Inspect interior for evidence of water damage, fungi, mildew, or corrosion.

(6) Report damage or discrepancies in accordance with AR 735-11 and AR 735-11-2.

b. Check the equipment against the packing list to see if shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

(1) Inventory section against Components of End Item and Basic Issue Items Lists (Appendix C).

(2) Inventory expendable supplies contained in section as shown in Appendix E.

(3) Conduct operational checks on equipment in accordance with the chapters in this manual when operators are available and power can be safely provided to the section.

c. Check to see whether the equipment has been modified.

1-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. PMCS are designed to keep the equipment in good working condition by peforming certain tests, inspections, and services. The intervals provide you, the organizational technician, with time schedules that determine when to perform specified tasks.

b. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording the results of PMCS.

c. Interval columns. This column determines the time period designated to perform your PMCS.

d. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

e. Preventive maintenance checks and services for the air conditioners/heaters are contained in TM 5-4120-367-14.

f. List of tools and materials required for PMCS is as follows:

Item	Quantity
Vacuum Cleaner	1 ea
6 in. Adjustable Wrench	1 ea
Cross Tip Screwdriver	1 ea
Flat Tip Screwdriver	1 ea
Spring Scale	1 ea
Padlock	1 ea
Flashlight	1 ea

Table 1-13. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

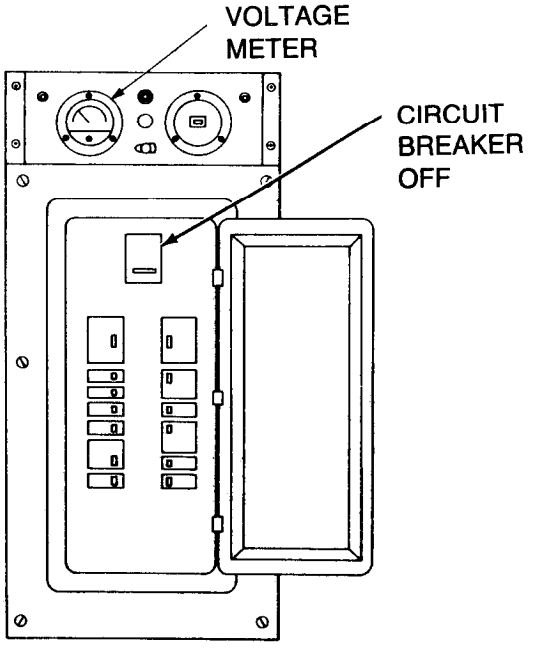
B - Before
D - During
A - After

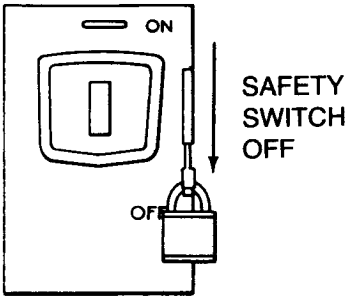
W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE
		VAN BODY
1	M	Service Air Conditioner/Heater. Refer to TM 5-4120-367-14 for preventive maintenance checks and services.
2	M	Service Lighting System.





WARNING

Do not open circuit breaker panel or service electrical connections, cables or switches until main power is off, and voltage meter confirms circuit is not energized. Death may result from failure to observe these safety precautions.

1. Turn off main circuit breaker. Turn off safety switch.

Table 1-3. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D-During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S -Semiannually Bl -Biennially | (Number)- Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED / PROCEDURE
		VAN BODY - Cont
2	M	Service Lighting System - Cont
		2. Padlock safety switch.
		3. Tighten al 1 loose screws, bolts, and clamps.
		4. Check which switches, switch plate outlets, receptacles, and posts require repair.
		5. Check for loose screws and nuts on ceiling, console lights, circuit breaker panels, and conduits.
		6. Remove padlock.
		7. Turn on main circuit breaker and safety switch.

Table 1-3. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

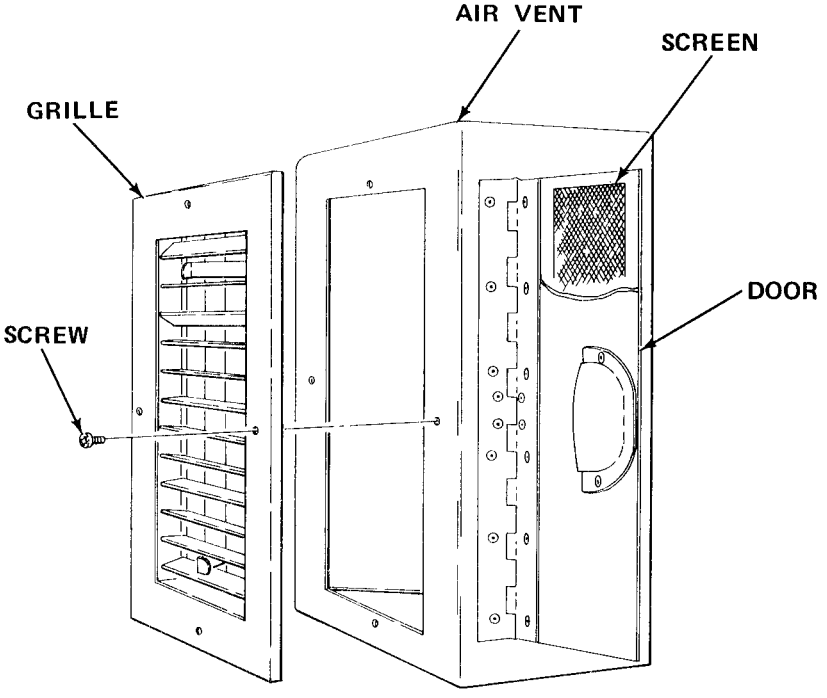
B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE
		VAN BODY - Cont
3	M	Service Air Vent.



1. Remove screws from front of grille.
2. Remove front grille.
3. Using vacuum cleaner, clean screens on side doors. Vacuum inside of air vent.
4. Reinstall grille and secure with screws.

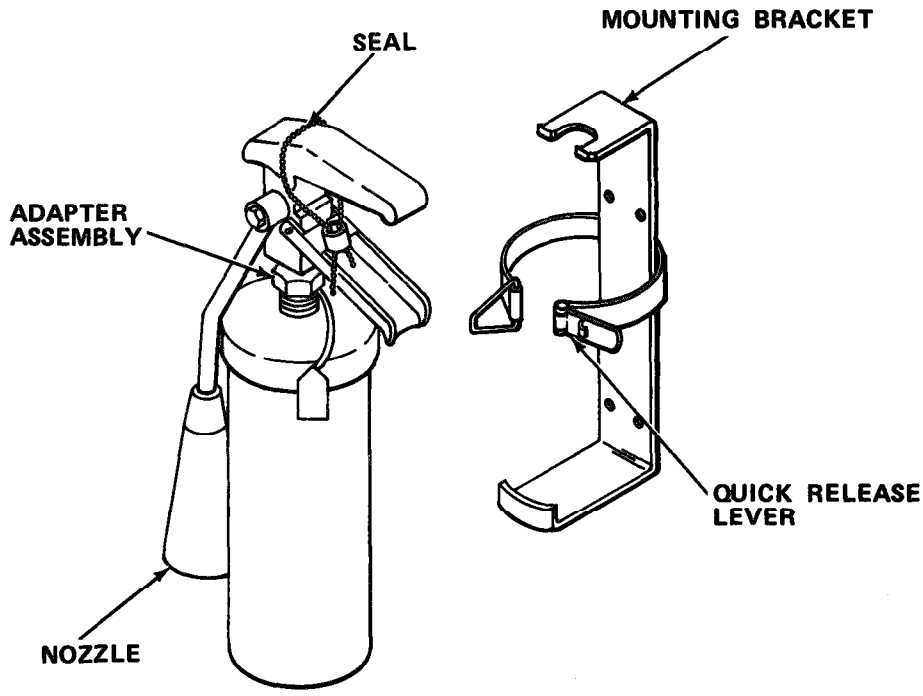
Table 1-3. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weakly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE
		VAN BODY - Cont
4	M	Inspect Fire Extinguisher.
		
		1. Remove from mounting bracket. Check free movement of bracket.
		2. Inspect nozzle and adapter assembly for damage.
		3. Inspect seal. Check that it is not broken.
	S	4. Weigh cylinder. Replace if gross weight has decreased by 6 oz (170 g) or more.

1-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.

a. Organizational troubleshooting procedures cover the most common malfunctions that may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/inspection and corrective action. If a malfunction is not listed or is not corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the facing schematic or the foldout located at the end of this manual for further fault analysis.

d. If any component of the Synthesis Section does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power troubleshooting procedures for dead receptacle (Table 1-4).

Table 1-4. ORGANIZATIONAL TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WARNING

Electrical shock hazard. Be sure power is off when checking continuity at troubleshooting points. Death or serious injury could result from failure to do so.

1. FLUORESCENT CEILING LAMP IS INOPERATIVE.

Step 1. Check for continuity of fluorescent lamp switch.

(a) If continuity exists, proceed to step 2.

(b) If continuity does not exist, replace switch (paragraph 1-16.3).

Table 1-4. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1. FLUORESCENT CEILING LAMP IS INOPERATIVE - Cont	
Step 2. Check for continuity of lamp ballast.	(a) If continuity exists, proceed to step 3. (b) If continuity does not exist, replace lamp ballast (paragraph 1-16.1).
Step 3. Check for shorts in RF filter.	Replace RF filter (paragraph 1-16.2).
2. EXHAUST FAN IS INOPERATIVE.	
Check on/off switch for continuity.	(a) If continuity exists, replace fan (paragraph 1-16.9). (b) If continuity does not exist, replace switch (paragraph 1-16.4).
3. EMERGENCY LIGHTS ARE INOPERATIVE.	
Press in test indicator.	If lamps do not light, replace emergency light assembly (paragraph 1-16.11).

Table 1-4. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
4. NO POWER TO EQUIPMENT. Step 1. Check circuit breaker **ON/OFF** position.	(a) If circuit breaker is ON, proceed to step 2. (b) If circuit breaker is OFF, turn ON. (c) If circuit breaker trips repeatedly, notify power supply supervisor.
Step 2. Check circuit breaker input for 120 V ac.	(a) If input voltage is present, proceed to step 3. (b) If input voltage is not present, refer to direct/general support maintenance for repair or replacement of defective wiring.
Step 3. Check circuit breaker output for 120 V ac.	(a) If output voltage is present, proceed to step 4. (b) If output voltage is not present, refer to direct/general support maintenance for circuit breaker replacement (paragraph 1-20.5).
Step 4. Remove receptacle and check for 120 V ac input.	(a) If present, replace receptacle (paragraph 1-16.6). (b) If not present, refer to direct/general support maintenance for repair or replacement of defective wiring.

1-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance fuctions for the Synthesis Section. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

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1-16.1 Replace Fluorescent Lamp Ballast.

MOS: 83FJ6, Reproduction Equipment Repairer
or
416, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
1/4 in. Wrench
1/4 in. Drive Socket Set
Scribe

SUPPLIES: Lamp Ballast
Wire Ties

WARNING

Death or serious injury may occur unless overhead light circuit breaker and main circuit breaker are turned off before working on light fixture.

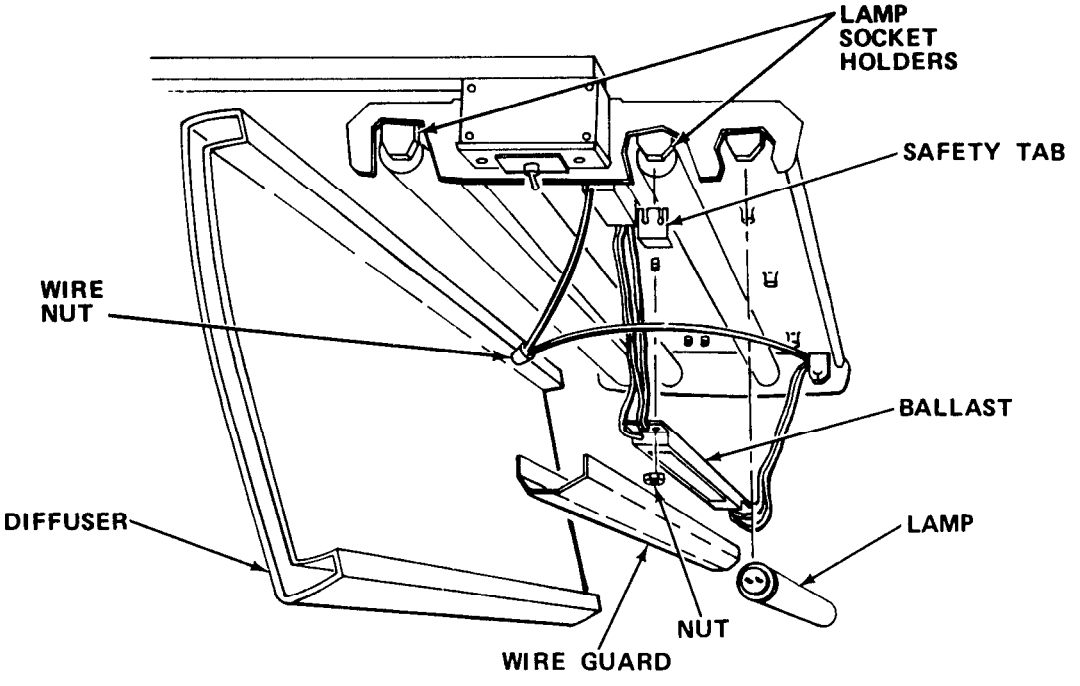
a. Turn off overhead light circuit breaker and main circuit breaker.

b. Remove diffuser from light fixture.

c. Remove safety tabs and lamps. Place in diffuser.

d. Squeeze light wiring guard and remove.

e. Remove wire ties as required.



f. Tag wires from ballast for reference.

g. Disconnect ballast wire from wire nut connection.

h. Pry out lamp socket holder with flat tip screwdriver.

i. Using scribe, depress wire clips and disconnect ballast wiring.

j. Remove nut and defective ballast.

k. Install new ballast and connect wires to corresponding lamp socket holders.

1. Secure with nut.

m. Reconnect ballast wire to wire nut connection.

n. Remove tags.

o. Install new wire ties.

NOTE

Be sure wires are free of kinks and do not interfere with placement of wire guard.

p. Reinstall wire guard.

q. Reinstall lamp and safety tabs.

r. Reinstall diffuser.

s. Turn on overhead light circuit breaker and main circuit breaker.

1-16.2 Replace Radio Frequency (RF) Filter.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41 B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
1/4 in. Wrench
1/4 in. Drive Socket Set

SUPPLIES: RF Filter
Wire Ties

WARNING

Death or serious injury may occur unless overhead light switch is turned OFF before working on light fixture.

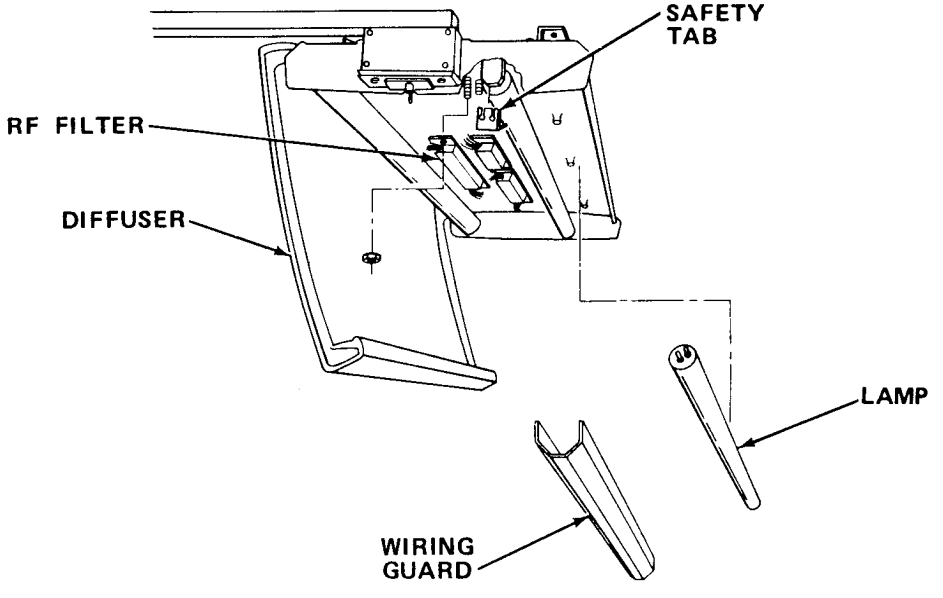
a. Turn off overhead light switch.

b. Remove diffuser from light fixture.

c. Remove safety tabs and lamps. Place in diffuser.

d. Squeeze light wiring guard and remove.

e. Remove wire ties as required.



f. Tag wires to filter.

g. Remove wire nuts and disconnect filter wires.

h. Remove nuts and defective filter.

i. Install new filter. Secure with nuts.

j. Reconnect filter wires" and secure with wire nuts.

k. Remove tags.

l. Install new wire ties.

NOTE

Be sure wires are free of kinks and do not interfere with placement of wire guard.

m. Reinstall wire guard.

n. Reinstall lamps and safety tabs.

o. Reinstall diffuser.

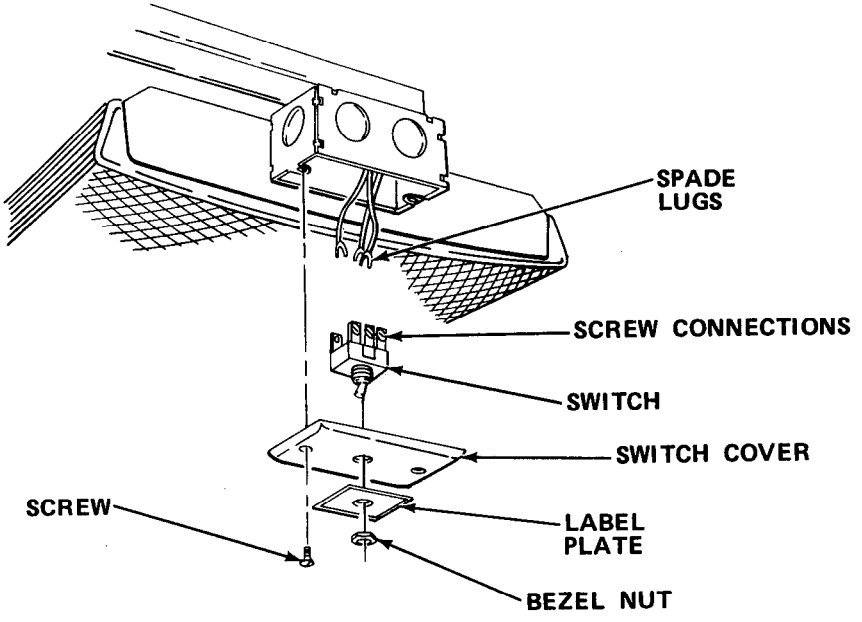
p. Turn on light switch.

1-16.3 Replace Fluorescent Lamp Switch.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS : Flat Tip Screwdriver
Needle Nose Pliers
Flashlight

SUPPLIES: Switch Assembly



WARNING

Death or serious injury may occur if lighting circuit breaker is not turned off before working on lamp assembly.

NOTE

Alternate lighting is required to perform this task.

a. Turn off circuit breaker.

b. Remove bezel nut.

c. Note notch on label plate and remove label plate.

d. Loosen screws.

NOTE

Note position of cover and reinstall as noted.

e. Remove cover plate.

f. Tag and disconnect wires from defective switch.

g. Install new switch and connect wires.

h. Insert switch through cover plate and label plate.

NOTE

Be sure label plate is in same direction as when removed. Secure with bezel nut.

i. Aline cover plate with holes and secure with screws.

j. Turn on circuit breaker.

1-16.4 Replace On/Off Switch.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

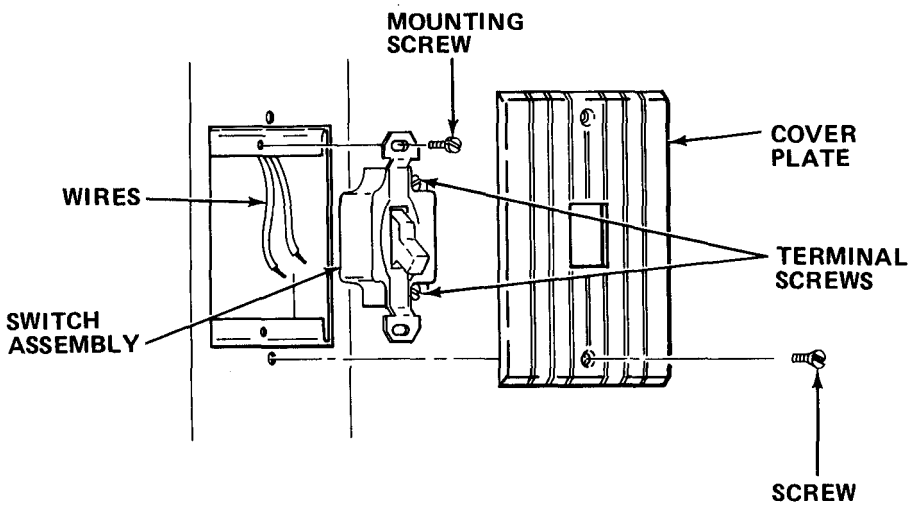
TOOLS : Flat Tip Screwdriver

SUPPLIES: Switch

WARNING

Death or serious injury may occur if switch circuit breaker is not turned off before working on switch.

a. Turn off appropriate circuit breaker.



b. Remove screws.

c. Remove cover plate.

d. Remove mounting screws.

e. Pull switch assembly from wire guide to gain access to wires.

f. Loosen terminal screws; then disconnect wires.

g. Install new switch.

h. Reconnect wires.

i. Guide switch into wire guide, alining holes.

NOTE

Be sure wires are not kinked or strained.

j. Reinstall mounting screws.

k. Reinstall cover plate and secure with screws.

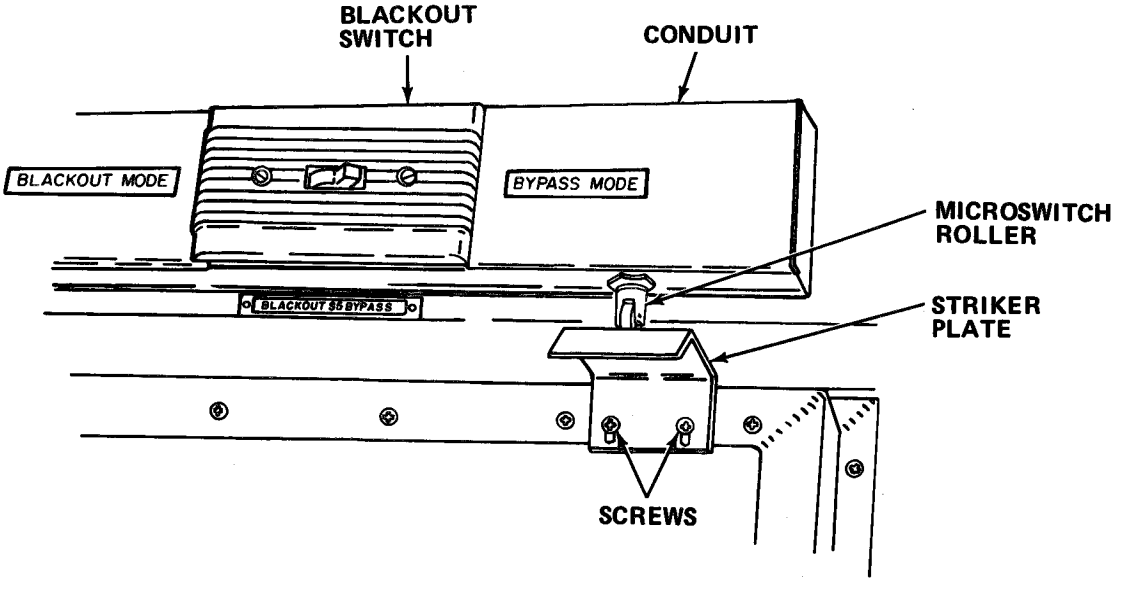
1. Turn on switch circuit breaker.

1-16.5 Replace Blackout/Dome Light Microswitch.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
6 in. Adjustable Wrench

SUPPLIES: Microswitch



WARNING

Death or serious injury may occur from electrical shock unless power is off before servicing.

a. Turn off blackout/dome light circuit breaker.

b. Remove conduit cover.

c. Remove nut and pull out switch to expose wiring.

d. Disconnect wires from defective switch.

e. Connect wires to new switch.

f. Install switch and secure with nut.

g. Adjust striker plate until plate contacts rollers.

h. Reinstall conduit cover.

i. Turn on circuit breaker.

1-16.6 Replace Receptacle.

MOS : 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

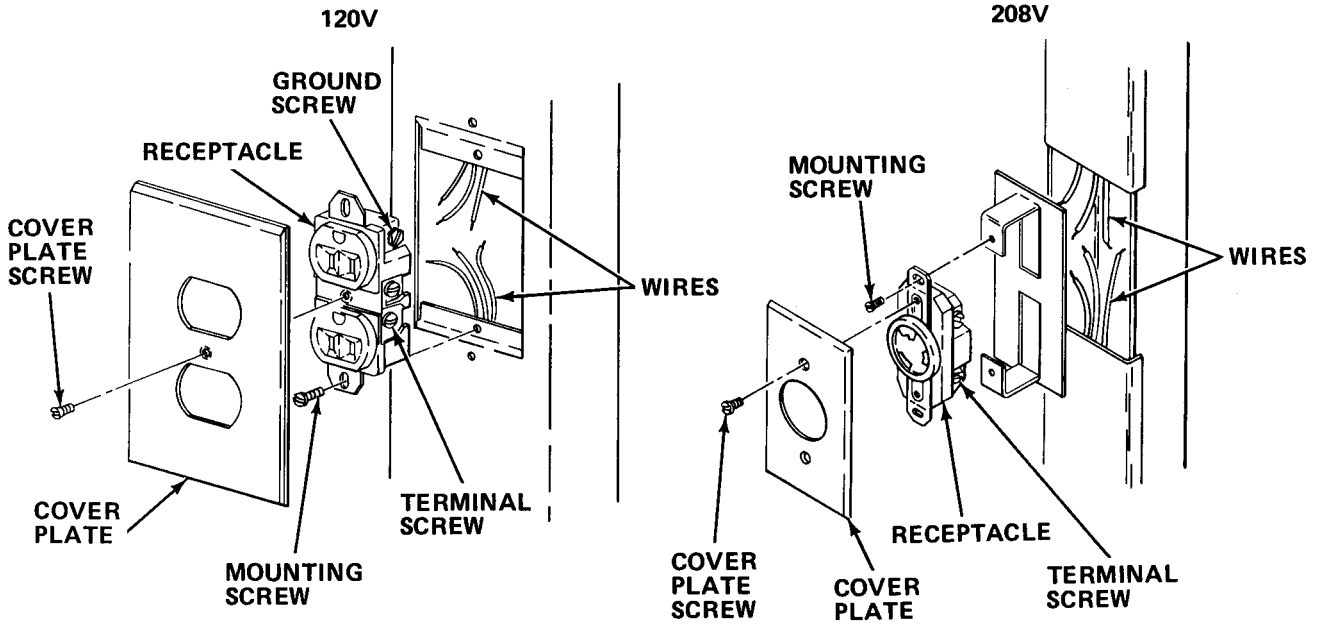
TOOLS: Flat Tip Screwdriver

SUPPLIES: Receptacle

WARNING

Death or serious injury may occur if receptacle circuit breaker is not turned off before working on receptacle.

a. Turn off receptacle circuit breaker.



b. Remove cover plate screws.

c. Remove cover plate.

d. Remove mounting screws.

e. Withdraw receptacle to gain access to wires.

f. Loosen terminal screws and ground screw. Then disconnect wires.

g. Reconnect wires. Connect green (ground) wire first.

h. Install new receptacle.

i. Guide receptacle into wire guide.

NOTE

Be sure wires are not kinked or strained.

j. Secure receptacle with screws.

k. Reinstall cover plate. Secure with screws.

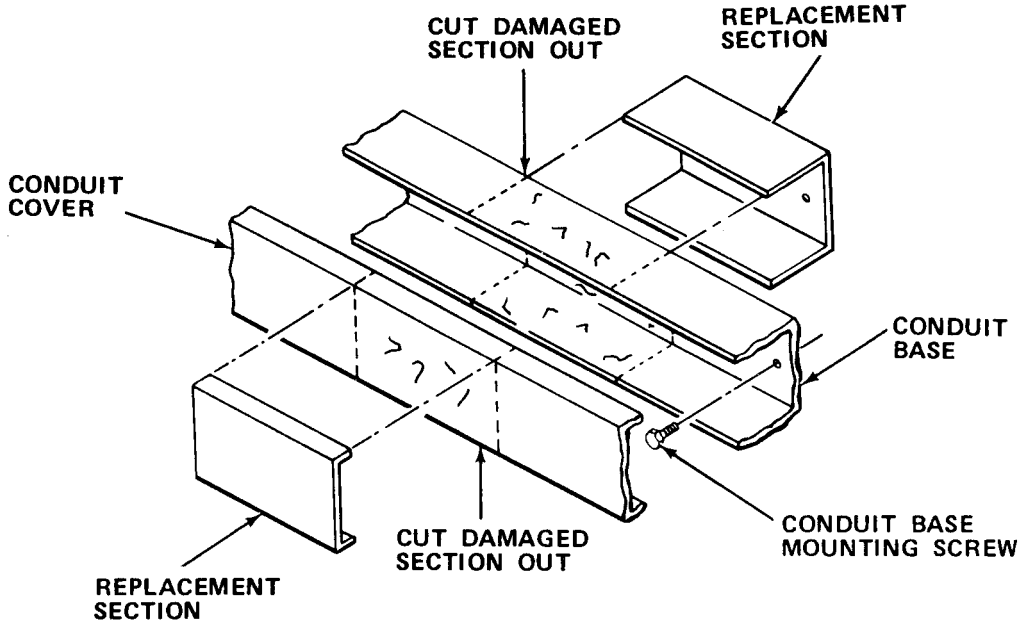
1. Turn on receptacle circuit breaker.

1-16.1 Replace Wire Molding.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41 B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
Hacksaw
Flashlight
Paint Brush
Multimeter
Drill and Bits
File
Machinist Rule

SUPPLIES: Paint (Item 17, Appendix E)
Cheesecloth (Item 8, Appendix E)
Conduit Base
Conduit Cover
Padlock



WARNING

Death or serious injury may occur from failure to turn off and padlock safety switch before repairing molding.

NOTE

Alternate lighting is required to perform this task.

a. Turn off and padlock safety switch.

b. Remove conduit cover.

c. Inspect wires for damage.

NOTE

Refer to direct support maintenance for wiring repair if necessary.

d. Loosen wiring and carefully pull it from the entire base section.

e. Remove screws and base from wall.

f. Mark and measure damaged area on molding. Record measurement.

g. Cut damaged area from molding.

h. Cut section from new molding to the length recorded in step f.

i. Using damaged area as a template, mark mounting holes on new piece.

j. With a number 25 drill bit, drill holes in new molding.

k. With file, remove all burred edges.

1. Paint base section as required.

m. Reinstall conduit base on wall with screws.

n. Carefully place wiring back in conduit base.

o. Reinstall cover on base.

P. Test wiring for continuity between power wires and conduit. If there is continuity, determine and correct grounding fault.

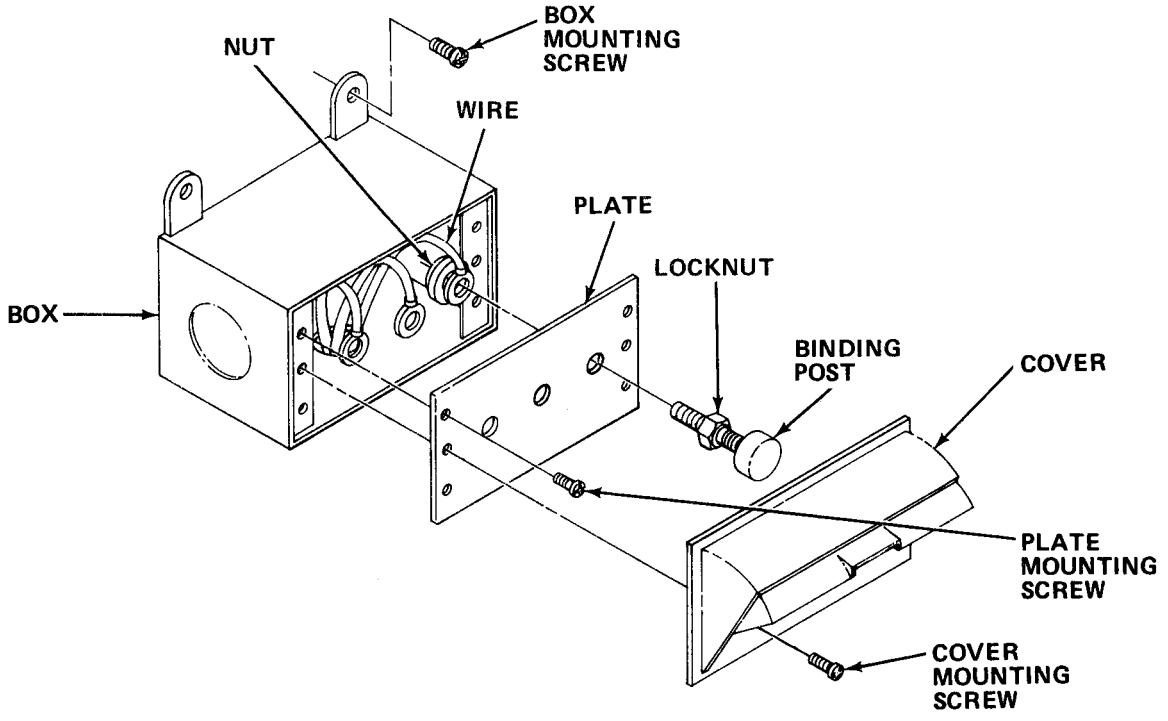
q. Test wiring with power on.

1-16.8 Repair Telephone Binding Post Assembly.

MOS: 83FJ6, Reproduction Equipment Repairer
or
416, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screwdriver
1/2 in. Combination Wrench

SUPPLIES: Binding Post Box
Binding Posts



a. Remove cover mounting screws. Remove cover.

b. Remove plate mounting screws to gain access to back of plate.

c. Tag wires for identification.

d. Remove nuts and wires from binding posts.

e. If required, remove box mounting screws and replace box.

f. Replace any defective binding posts. Secure wires to new posts and remove tags.

g. Reinstall box assembly and plate, and secure plate with screws.

h. Secure cover with screws.

1-16.9 Replace Exhaust Fan.

M0S: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

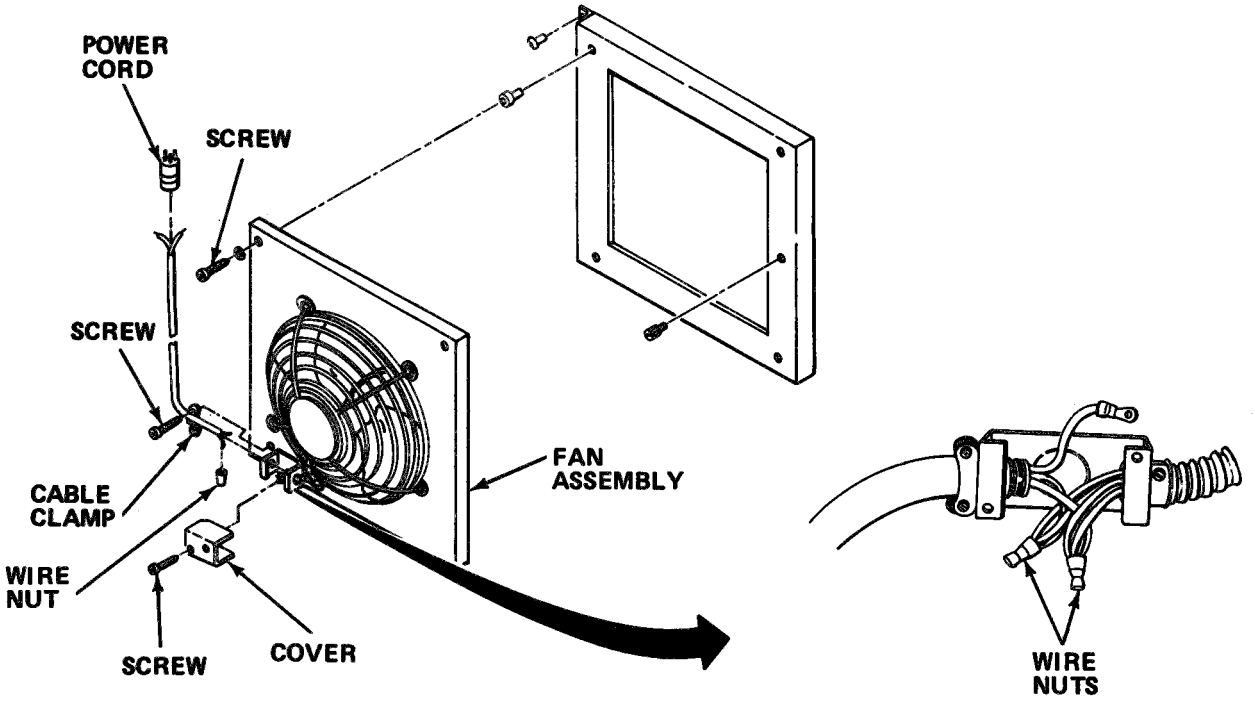
TOOLS: Flat Tip Screwdriver
Cross Tip Screwdriver
Wire Cutters

SUPPLIES: Fan Assembly
Wire Nuts
Power Cord

WARNING

Death or serious injury may occur if power is left on. Turn fan switch off and unplug power cord before working on exhaust fan.

a. Unplug power cord.



b. Remove screws and place fan assemblly on work surface.

c. Loosen screws on cable clamp.

d. Remove screws and cover.

e. Tag wires and cut **wire nuts from wires.**

f. Remove power cord from defective fan assembly.

g. Install new fan.

h. Install new power cord.

i. Connect wires with wire nuts and remove tags.

j. Tighten cable clamp screws.

k. Reinstall cover. Secure with screws.

1. Reinstall fan assembly. Secure with screws.

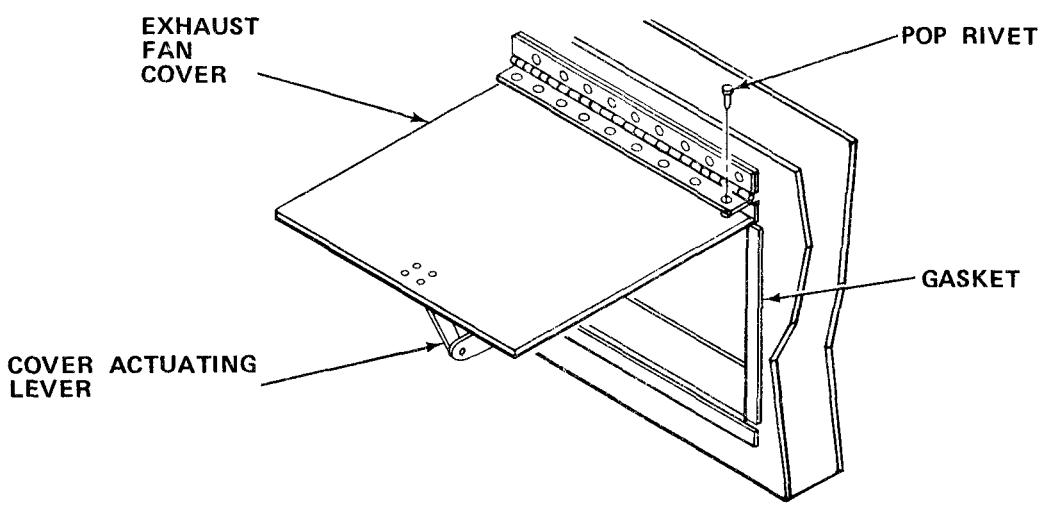
m. Plug in power cord.

1-16.10 Replace Exhaust Fan Cover.

MOS : 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Drill and Bits
Pop Rivet Gun
Scraper

SUPPLIES: Pop Rivets
Exhaust Fan Cover-
Gasket
Solvent P-D-680 (Item 24, Appendix E)
Adhesive (Item 2, Appendix E)
Cheesecloth (Item 8, Appendix E)
Impermeable Gloves
Goggles



a. Drill pop rivets from hinged cover to remove vent cover.

b. Remove defective cover and transfer mounting hardware to new cover.

WARNING

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

c. Scrape gasket off section and clean area with solvent P-D-680.

d. Secure new gasket to section with adhesive.

e. Aline cover and pop rivet to hinge.

f. Test cover for tightness of closure.

1-16.11 Replace Emergency Light Assembly.

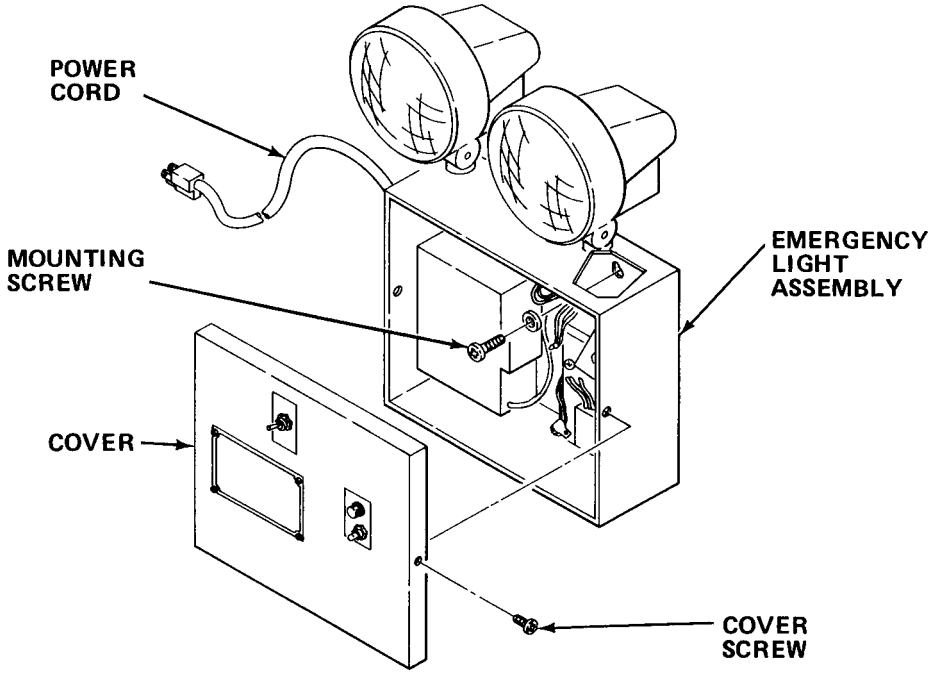
MOS : 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screwdriver
Flat Tip Screwdriver

SUPPLIES: Emergency Light Assembly

WARNING

Death or serious injury may occur if power cord is not unplugged before servicing light.



a. Unplug power cord.

b. Remove cover screws. Move cover out of way.

c. Remove mounting screws.

d. Remove emergency light assembly.

e. Install new emergency light assembly. Secure with screws.

f. Secure cover with screws.

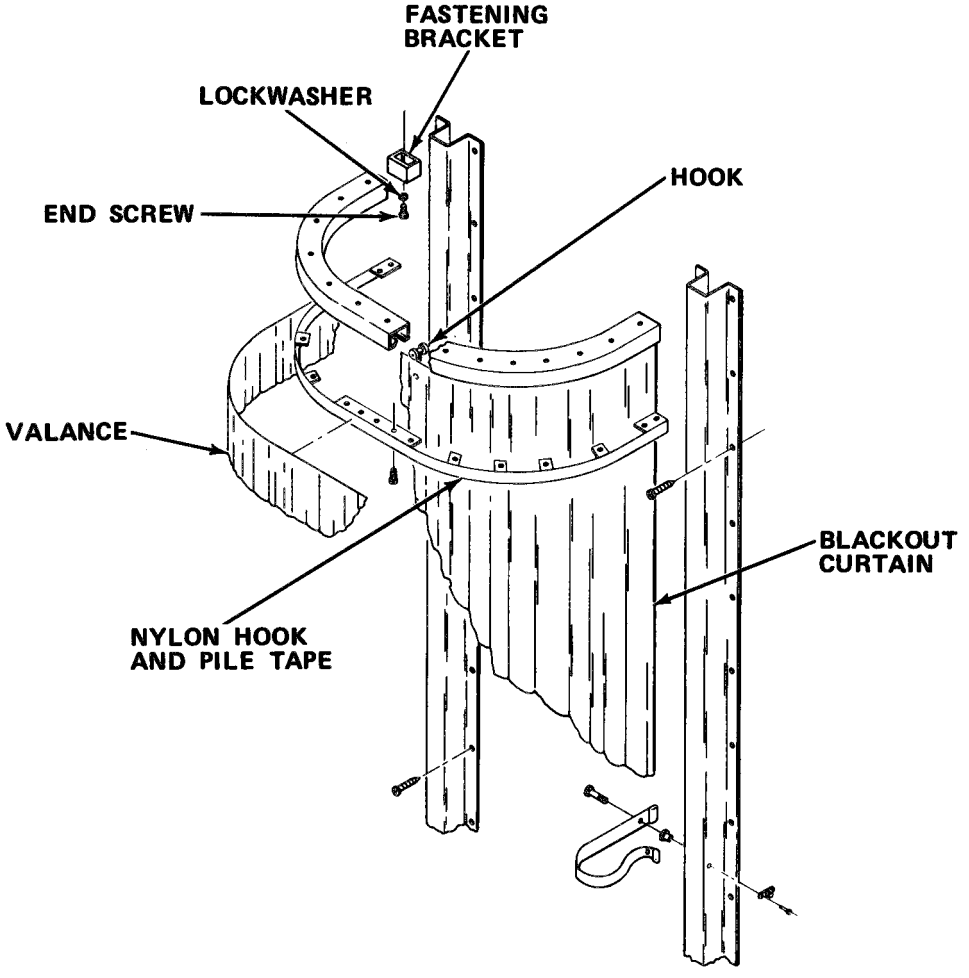
g. Plug in power cord.

1-16.12 Repair Blackout Curtain.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screw driver

SUPPLIES: Hooks
Valance
Curtain
Nylon Hook and Pile Tape
Adhesive (Item 2, Appendix E)



a. Remove curtain from hooks.

b. Pull curtain and valance from nylon hook and pile tape.

c* Remove end screw, lockwasher, and fastening bracket from ceiling.

d. Replace damaged hooks.

e. Reinstall fastening bracket with hooks. Fasten with end screw and lockwasher.

f. Glue loose nylon hook and pile tape to wall or bracket. Replace tape if worn out.

g. Hook curtain to bracket.

h. Attach valance.

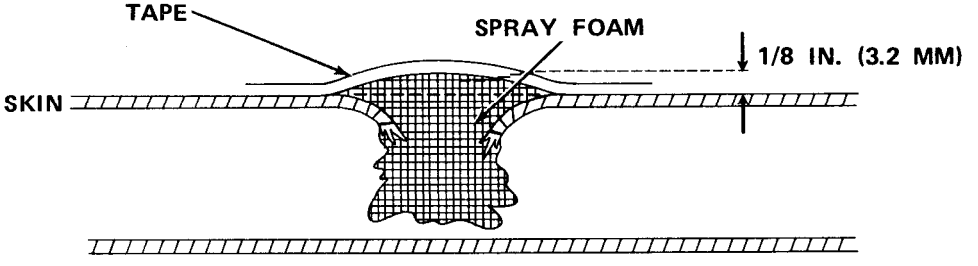
i. Check curtain for free movement.

1-16.13 Repair Van Body Skin (Temporary).

MOS : 52C, Utilities Equipment Repairer

TOOLS: Pliers
Ball Peen Hammer
Scissors or Utility Knife

SUPPLIES: Cloth Duct Sealing Tape (Item 28, Appendix E)
Silicone Sealant (Item 22, Appendix E)
Sprayfoam (Item 27, Appendix E)
Cheesecloth (Item 8, Appendix E)



a. Bend broken edges of punctured skin inward into puncture hole. Do not attempt to remove fragments of skin by bending or pulling outward. Bend skin inward only enough to put broken edges below surface of unbroken skin.

b. Remove any loose fragments of foam which are not now held in place by bent broken skin. Removing small pieces of foam or dust is more important than removing chunks.

c. Using cloth slightly dampened with water, wipe area around puncture to remove any dirt or mud and wipe dry.

d. Inject sprayfoam into puncture. Mound sprayfoam to about 1/8 in. (3.2 mm) above surface of unbroken skin. Apply bead of sealant about 1/4 in. (6.4 mm) wide over all cuts in skin leading out from puncture. Do not smooth out sealant.

e. Plan how puncture is to be covered with tape before applying any tape. Length and width of tape, number of tape strips, overlapping, and how tape is applied will affect sealing capability of repair. Each piece of tape should extend about 1-1/2 in. (3.81 cm) beyond sealant it will cover. If this will require more than one strip of tape, tape should overlap about 1/2 in (12.7 mm). If three or more strips of tape are required, center strip should be applied first.

f. Holding tape taut, apply it perpendicular to panel skin. Do not apply with rolling motion either end-to-end or center-to-ends. Do not rub each strip in place individually. Apply all strips lightly with proper overlap and rub into place.

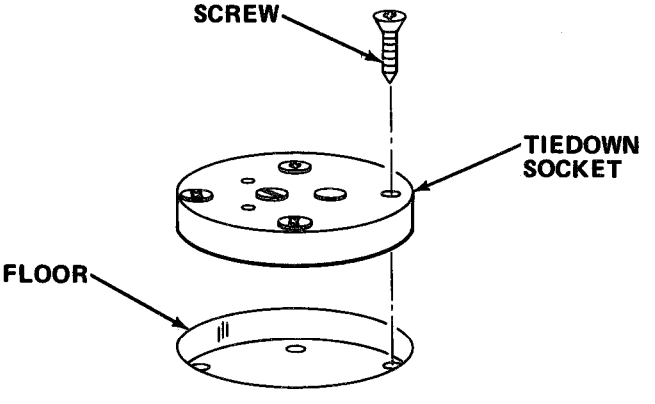
g. If necessary, damaged tape can be replaced; however, it should be removed with careful peeling motion to avoid damage to sealant. If sealant also peels back, new sealant should be applied. Complete removal of old sealant is not necessary. Permanent repair by direct support, or higher category of maintenance, should be made as soon as possible.

1-16.14 Replace Tiedown Socket.

M0S: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screwdriver
Flat Tip Screwdriver

SUPPLIES: Tiedown Socket



a. Remove screws from tiedown socket.

b. Pry defective socket from floor.

c. Install new tiedown socket. Rotate new tiedown socket enough to avoid installing screws in old screw holes.

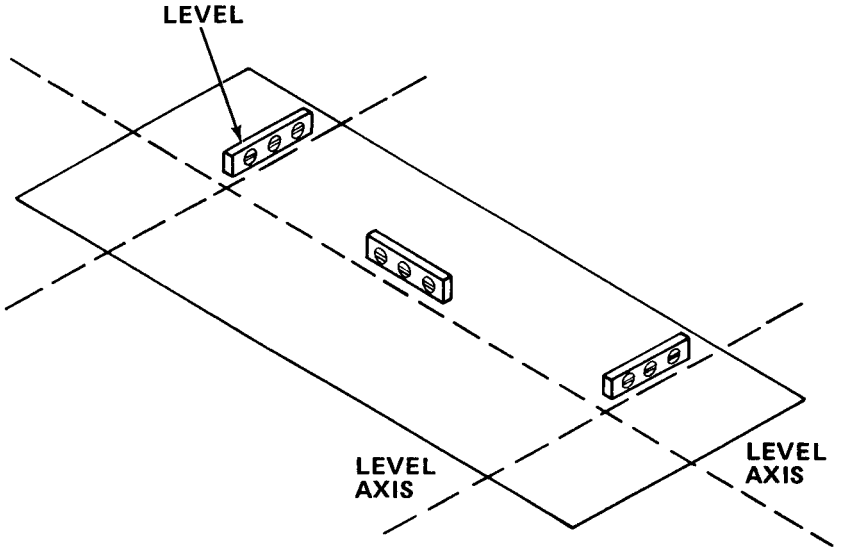
d. Reinstall screws.

1-16.15 Repair Level Indicator.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

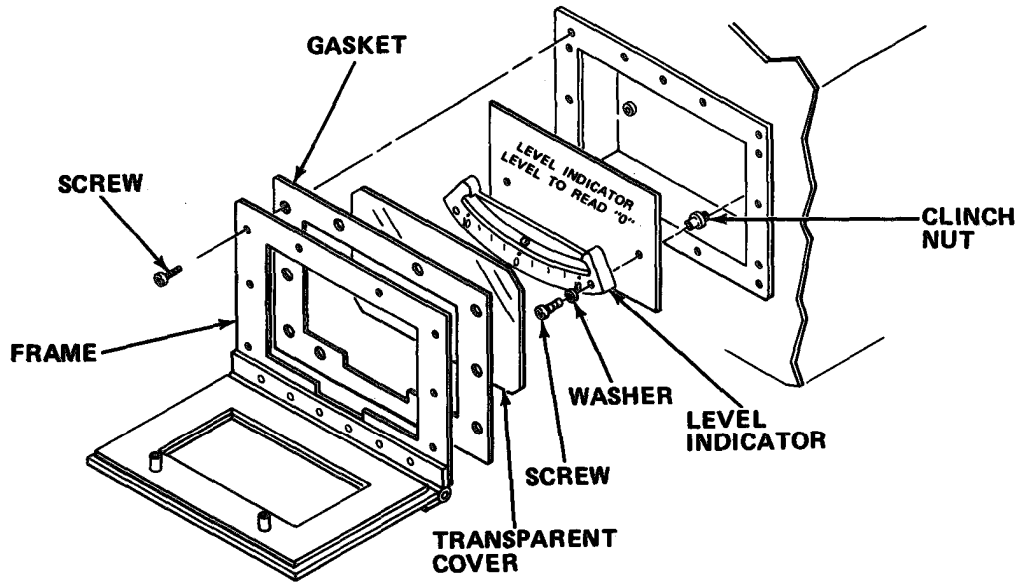
TOOLS: Carpenter's Level
Cross Tip Screwdriver
Knife, TL-29

SUPPLIES: Level Indicator
Gasket



a. Level section using level indicators. Then confirm section is level by using carpenter's level on floor inside section.

b. Adjust section leveling jacks until section is level as indicated by carpenter's level at front-rear and left-right at each end as shown in illustration.



c. Loosen knurled screws and move cover away from level assembly.

d. Remove screws and washers to release frame and gasket.

e. Remove transparent cover.

f. Remove screws and washers to remove level indicator.

g. Replace level assembly and secure with screws and washers.

h. Reinstall transparent cover.

i. Install new gasket.

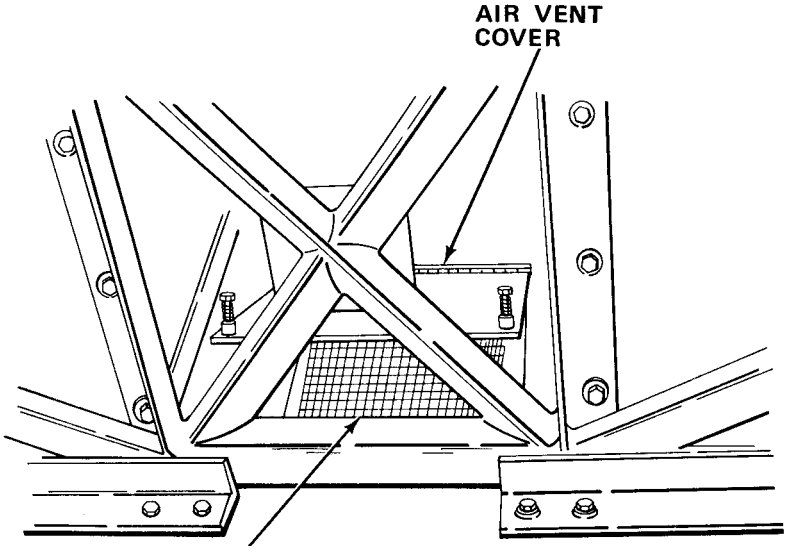
j. Reinstall frame and secure with screws and washers.

1-16.16 Replace Air Vent Screen.

MOS : 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screwdriver
Scissors

SUPPLIES: Rubber Adhesive (Item 2, Appendix E)
Nylon Screen (Item 21, Appendix E)



a. Raise access cover and remove screws holding screen frame to section.

b. Remove screen and frame.

c. Clean all old screen material and adhesive from frame.

d. Cut new screen material to size and attach to frame with adhesive.

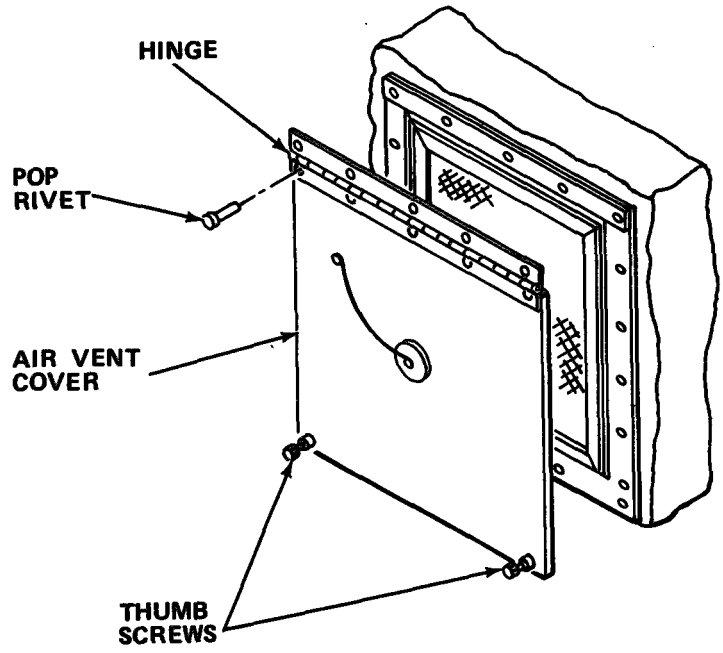
e. Reinstall frame to section and secure with screws. Lower cover.

1-16.17 Replace Air Vent Cover.

M0S: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Drill and Bits
Pop Rivet Gun

SUPPLIES: Vent Cover
Pop Rivets



a. Loosen thumbscrews.

b. Drill pop rivets from hinge. Remove air vent cover.

c. Aline holes and pop rivet new air vent cover to section.

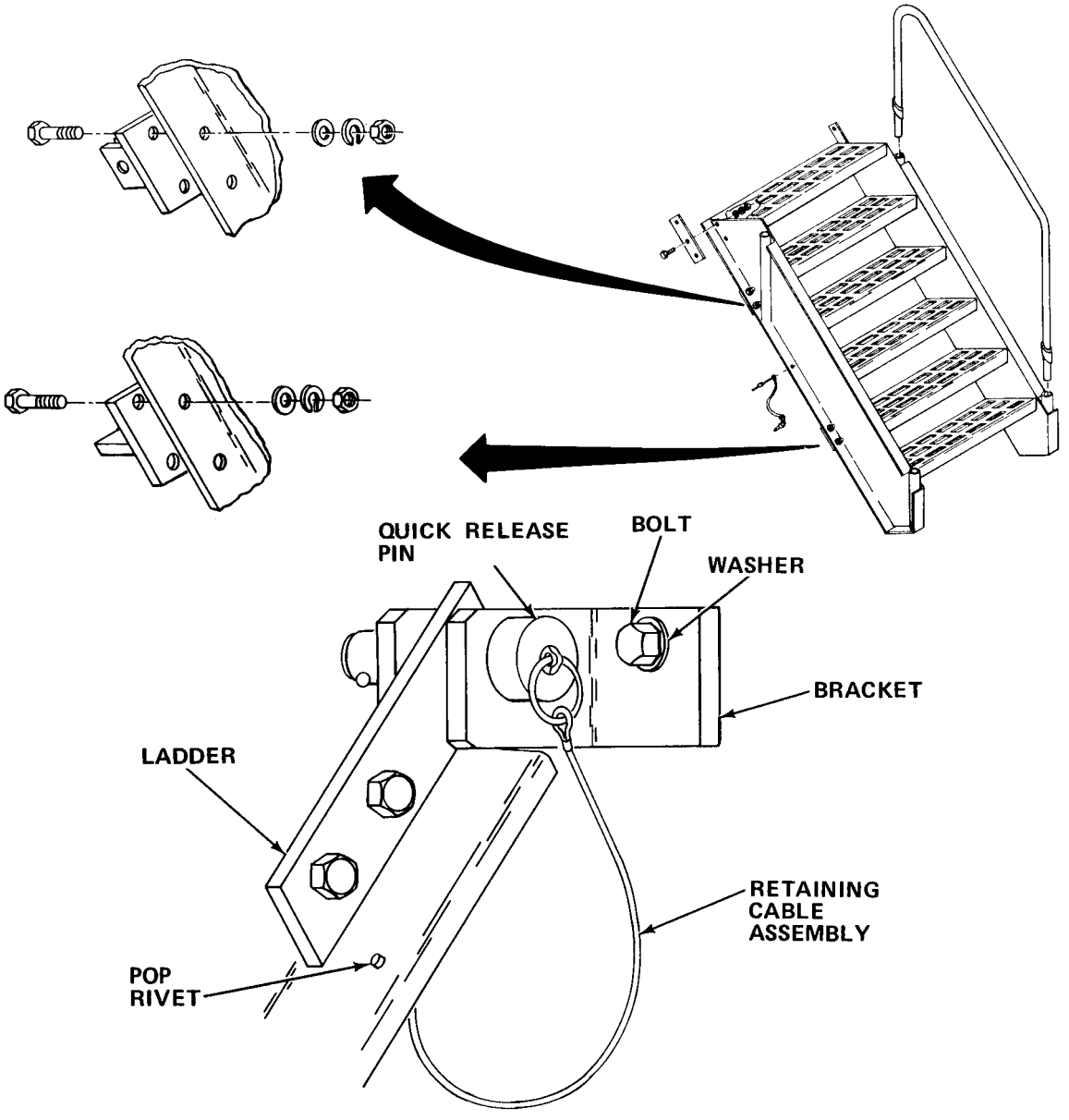
d. Tighten thumbscrews.

1-16.18 Repair Personnel Ladder.

MOS: 83FJ6, Reproduction Equipment Repairer
or
41B, Topographic Instrument Repair Specialist

TOOLS: Drill and Bits
Pop Rivet Gun
9/16 in. Combination Wrench
8 in. Adjustable Wrench

SUPPLIES: Cable Assembly
Quick Release Pins
Pop Rivets
Mounting Brackets



a. Remove ladder from mounting bracket.

b. Remove bolts, washers, and nuts securing damaged mounting brackets to ladder.

c. Remove damaged cable assembly from ladder by drilling out rivet.

d. Reinstall or install new mounting brackets. Secure with bolts, washers, and nuts.

e. Rivet new cable assembly to ladder.

NOTE

Be sure ladder mounting brackets fit section on rear door and under personnel doors.

f. Reinstall ladder on mounting bracket.

1-17. PREPARATION FOR STORAGE OR SHIPMENT.

a. Van body may be stored or shipped either mounted on trailer chassis or unmounted. Preparation of trailer chassis is covered in TM 5-2330-305-14 and should be referred to when trailer-mounted section is prepared for storage and shipment. TM 5-4120-367-14 must be reviewed for instructions covering air conditioner/heater.

b. Remove consumable supplies that have limited shelf life or broken seals. Replace missing items and be sure that all remaining consumable supplies are at authorized levels. Be sure all major components are operational.

c. Remove all unauthorized or personal equipment from section.

d. Move all classified material or sensitive data to proper storage. Complete all accountability and/or transfer of documents.

e. Refer to Preparation for Movement (paragraph 1-6.2) and follow applicable steps and any additional steps directed by area authorities.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

1-18. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

1-18.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

1-18.2 Special Tools: Test, Measurement, and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and-in Appendix B of this manual.

1-18.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering direct/general support maintenance for this equipment.

1-18.4 Electrical System. Direct/general support level of maintenance for the repair of the section's electrical system will consist of electrical wiring repair using standard electrical wiring repair procedures.

1-19. DIRECT/GENERAL SUPPORT TROUBLESHOOTING PROCEDURES.

a. Direct/general support troubleshooting procedures cover the most common malfunctions that may be repaired at the direct/general support level. Repair or adjustment requiring-specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used at lower levels should be conducted in addition to the direct/general support troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/inspection and corrective action. If a malfunction is not listed or corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the facing schematic or the foldout located at the end of this manual for further fault analysis.

Table 1-5. DIRECT/GENERAL SUPPORT TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. PERSONNEL/CARGO DOORS DO NOT CLOSE COMPLETELY.

   Step 1. Check that latch rollers rotate freely.

   Replace latches (paragraph 1-20.2).

   Step 2. Check to see if latch rods are bent.

   Replace latch rods (paragraph 1-20.2).

   Step 3. Check to see if door gasket is torn or broken.

   Replace door gasket (paragraph 1-20.3).

2. PERSONNEL/CARGO DOORS DO NOT LATCH PROPERLY.

   Check door latch for missing or damaged components.

   Replace door latch (paragraph 1-20.2).

3. AIR OR WATER ENTERS SECTION AROUND DOOR.

   Check to see if door gasket is worn or broken.

   Replace door gasket (paragraph 1-20.3).

4. RECEPTACLES DO NOT OPERATE BUT CIRCUIT BREAKERS ARE ON.

WARNING

Turn off main circuit breaker before inspecting or servicing circuit breakers or receptacles. Failure to do so may result in death or serious injury.

Step 1. Check to see if power cable is firmly connected to power entry panel.

Connect power cable.

Table 1-5. DIRECT/GENERAL SUPPORT TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
4. RECEPTACLES DO NOT OPERATE BUT CIRCUIT BREAKERS ARE ON - Cent	
Step 2. Check to see if voltage meter and frequency scale and INCORRECT PHASE or CORRECT PHASE lamp indicate necessary power.	Notify your supervisor for service of power supply at source.
5. CIRCUIT BREAKERS TRIP CONTINUALLY.	
	WARNING Turn off and padlock safety switch before inspecting or servicing circuit breakers or receptacles. Failure to do so may result in death or serious injury.
Step 1. Check to see if receptacles are overloaded.	Reconnect equipment to different receptacles.
Step 2. Check to see if receptacles are damaged.	Replace receptacles (paragraph 1-16.6).

1-20. MAINTENANCE PROCEDURES.

a. This section contains instructions covering direct/general support maintenance fuctions for the Synthesis Section. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

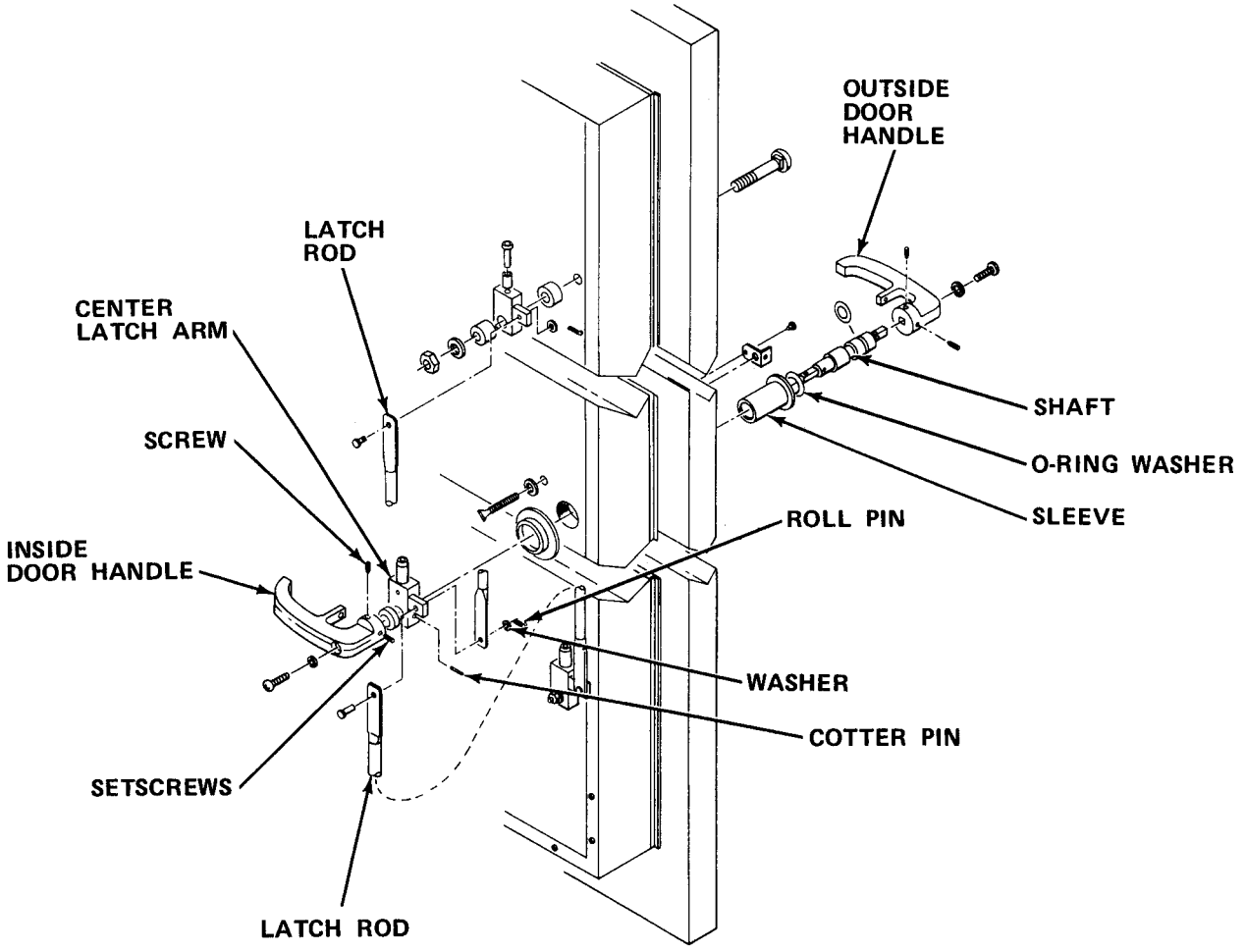
INDEX

1-20.1 Repair Personnel Door Handle.

MOS: 63W, Wheel Vehicle Repairer

TOOLS: Cross Tip Screwdriver
Needle Nose Pliers
15/16 in. Combination Wrench
Hammer
Center Punch
1/8 in. Hex Head Key Wrench

SUPPLIES: O-Ring Washer
Sleeve
Roll Pin
Personnel Door Handle
Cheesecloth (Item 8, Appendix E)
Oil, Lubricating, General Purpose (Item 14, Appendix E)
Hand Oiler
Cotter Pin



a. Loosen screw and socket head setscrews. Remove defective inside door handle.

b. Remove cotter pin and pins from center latch arm assembly.

c. Move latch rods out of way.

d. Punch roll pin from center latch arm assembly and pull latch arm assembly from shaft.

e. Withdraw latch and defective door handle.

f. Inspect all components for wear.

g. Replace worn O-ring washer and sleeve.

h. Replace other worn components as needed.

i. Reinstall shaft and new door handle.

j. Aline center latch arm assembly on shaft. Secure with new roll pin.

k. Aline latch rods. Attach to latch arms with pins, washers, and new cotter pin.

l. Reinstall new inside door handle.

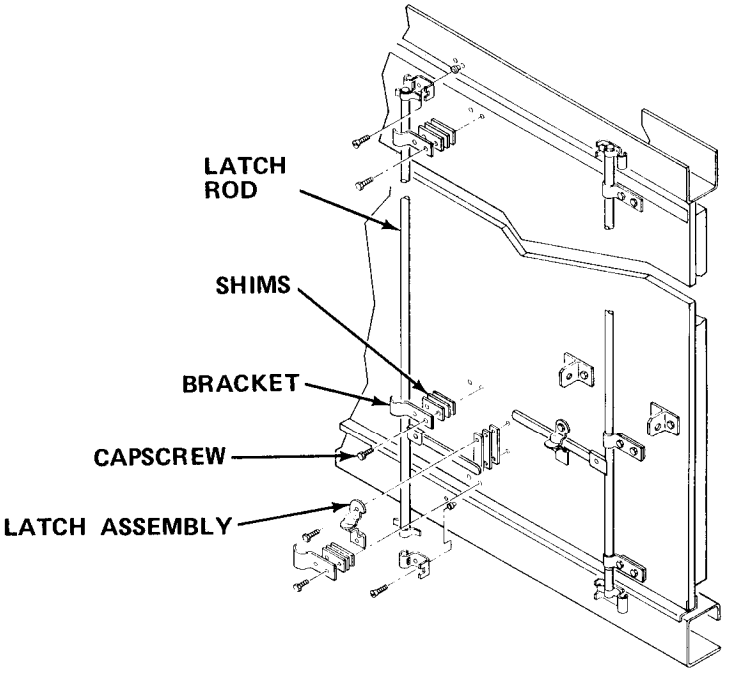
m. Lightly oil all moving parts. Wipe up surplus oil.

1-20.2 Replace Cargo Door Latch Assembly.

MOS: 63W, Wheel Vehicle Repairer

TOOLS: 9/16 in. Combination Wrench

SUPPLIES: Cargo Door Latch Assembly



b. Remove capscrews and washers from brackets. Remove brackets and shims.

c. Remove defective latch assembly and latch rod.

d. Install new latch assembly and latch rod.

e. Reinstall shims, brackets, washers, and capscrews.

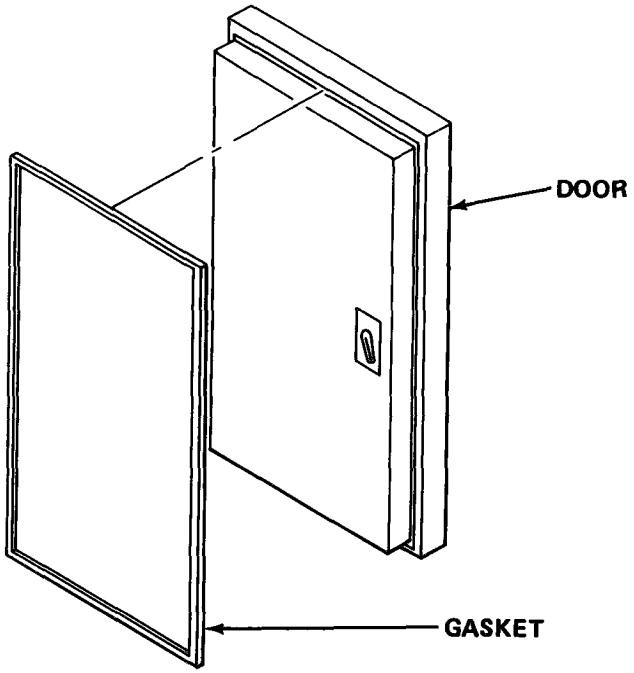
f. Check movement of latch rod and latch assembly. Lock latch.

1-20.3 Replace Personnel/Cargo Door Gasket.

MOS: 63W, Wheel Vehicle Repairer

TOOLS: Knife

SUPPLIES: Vinyl Gasket
Adhesive (Item 2, Appendix E)
Solvent P-D-680 (Item 24, Appendix E)
Impermeable Gloves
Goggles



a. Open door completely and secure in open position.

WARNING

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

b. Remove defective gasket by prying gasket from door. Scrape traces of gasket and adhesive from door. Wash with solvent P-D-680.

c. Coat gasket area on door with adhesive.

d. Firmly press new gasket onto door.

e. Wipe excess adhesive from gasket.

f. Close door and wipe excess adhesive from door and frame.

g. Allow adhesive to dry before using door.

1-20.4 Replace Personnel/Cargo Doors.

MOS: 63W, Wheel Vehicle Repairer

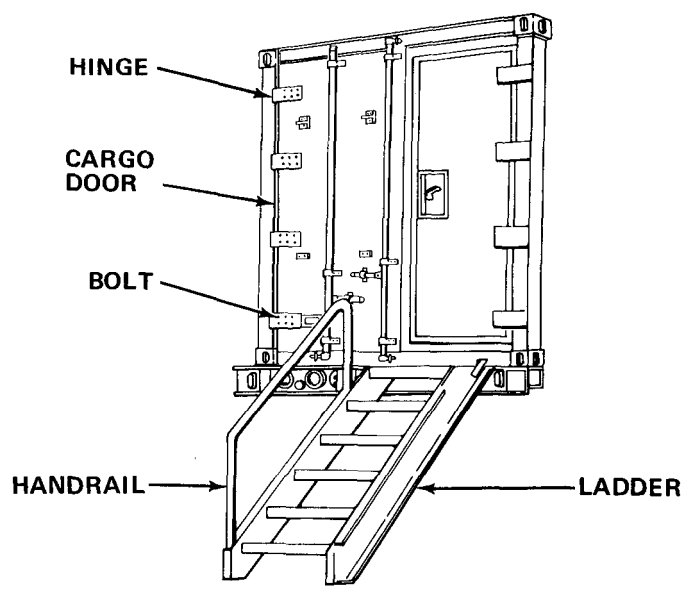
PERSONNEL: Two persons are required to perform this procedure.

TOOLS: Pop Rivet Gun
Electric Drill and Bits
Hoist
3/4 in. Combination Wrench
Paint Brush

SUPPLIES: Personnel/Cargo Door
Pop Rivets
Vinyl Gasket
Paint (Item 16, Appendix E)
Paint (Item 17, Appendix E)
Adhesive (Item 2, Appendix E)
Cheesecloth (Item 8, Appendix E)

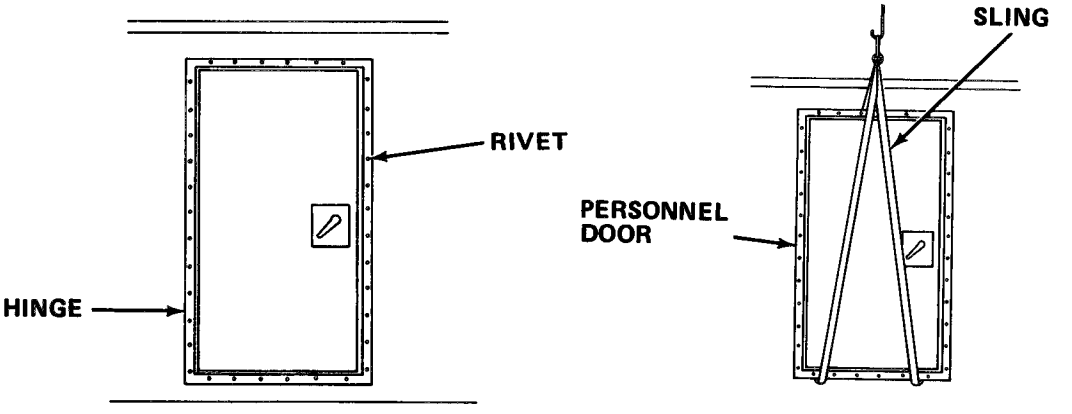
WARNING

To prevent personal injury or equipment damage, do not attempt to remove doors unless suitable lifting equipment and hoist are available.



a. Remove handrails and ladders if rear cargo door is to be replaced.

b. Unlock and open door to be replaced.



c. Place sling around door and put a slight strain on hoist to remove weight from hinges.

d. Remove bolts from hinges on rear personnel door. On side personnel door, drill out pop rivets from hinge. Remove hinges from door.

e. Remove damaged door using hoist.

f. Install new door using hoist.

g. Reinstall hinges on rear personnel door. Secure with bolts. Reinstall hinges on side personnel door. Secure with pop rivets.

h. Remove sling from door.

i. Install new gaskets on door after it is mounted (paragraph 1-20.3).

j. Repaint as needed.

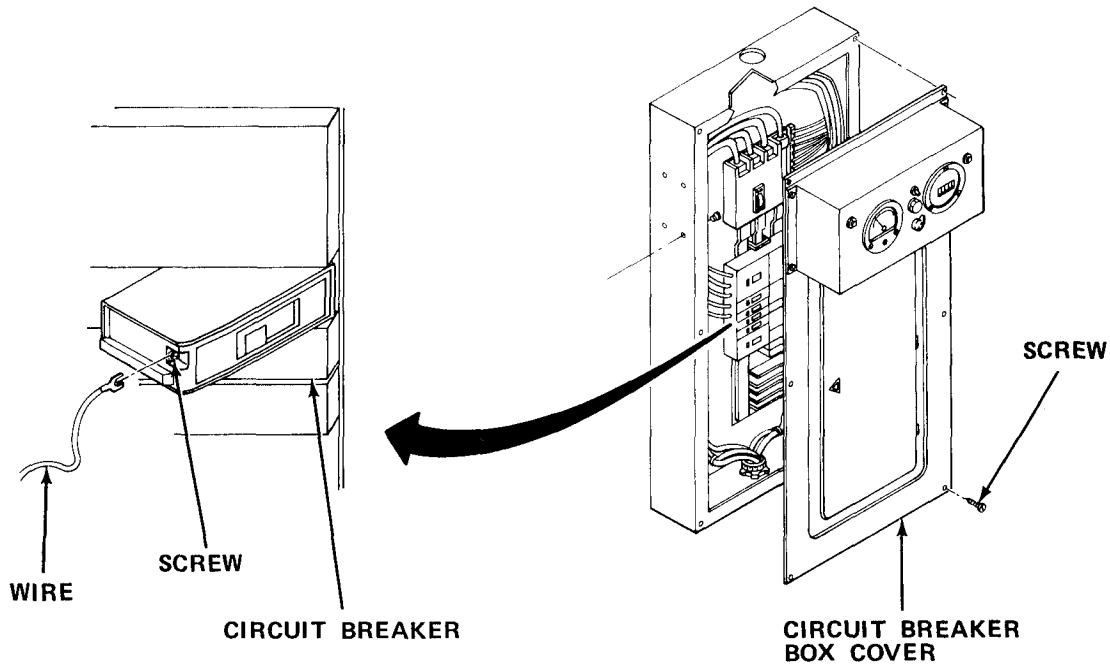
k. Close and lock door.

1-20.5 Replace Circuit Breaker.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: Flat Tip Screwdriver
Multimeter

SUPPLIES: Circuit Breaker



WARNING

Turn off and padlock safety switch. Turn off individual circuit breakers before inspecting or servicing circuit breakers. Failure to do so may result in death or serious injury.

a. Turn off and padlock safety switch. Turn off individual circuit breakers.

b. Remove circuit breaker box cover.

c. Use multimeter to make sure voltage is not present.

d. Remove defective circuit breaker by pushing and snapping out of place.

e. Tag and remove wires from defective circuit breaker.

f. Pull circuit breaker from panel.

g. Reconnect wires to new circuit breaker. Secure wires with screws.

h. Install new circuit breaker by pushing and snapping into place.

i. Reinstall circuit breaker box cover.

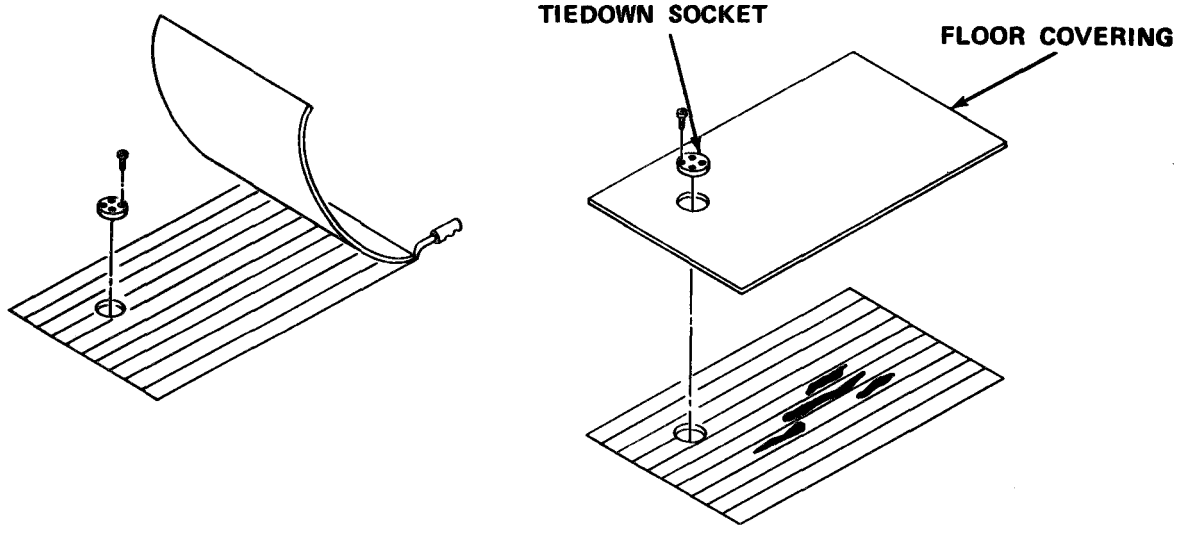
J. Remove padlock, turn on safety switch and individual circuit breakers,

1-20.6 Repair Floor Covering.

MOS: 52C, Utilities Equipment Repairer

TOOLS: Utility Knife
Cross Tip Screwdriver
Scraper
Straightedge

SUPPLIES: Vinyl Floor Covering
Epoxy Resin (Item 20, Appendix E)
Floor Patch (Item 11, Appendix E)
Cheesecloth (Item 8, Appendix E)
Adhesive (Item 3, Appendix E)



a. Cut a rectangular area from damaged floor covering.

b. Remove tiedown socket. Remove damaged floor covering.

c. Cut new floor covering to fit. Apply adhesive to floor. Press down new floor covering.

d. Reinstall tiedown socket.

1-20.7 Repair Van Body Skin (Permanent).

MOS: 63W, Wheel Vehicle Repairer

TOOLS: Pop Rivet Gun
Electric Drill and Bits
Paint Brush

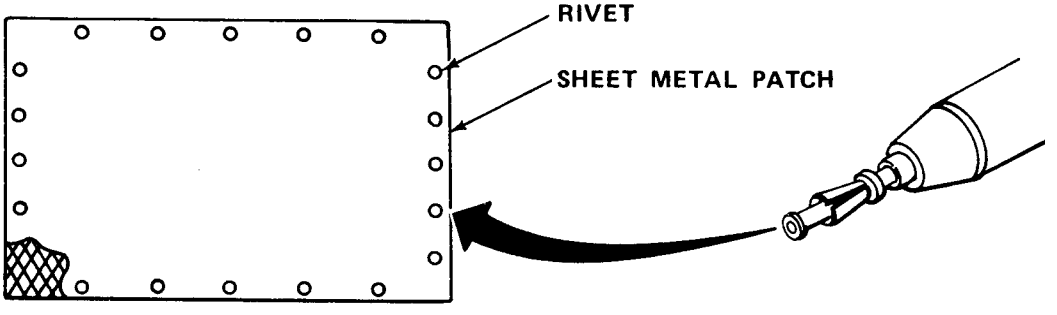
SUPPLIES: Pop Rivets
Sprayfoam (Item 27, Appendix E)
Silicone Sealant (Item 22, Appendix E)
Sheet Metal
Paint (Items 16, 16A and 16B, Appendix E)
Cheesecloth (Item 8, Appendix E)

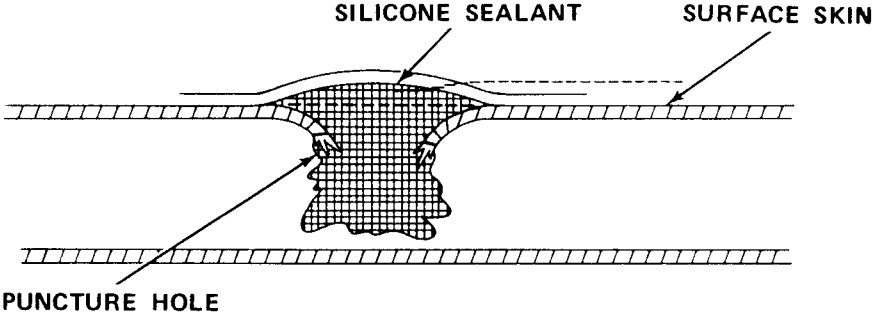
a. Bend broken edges of skin inward into puncture hole. Do not attempt to remove fragments of skin by bending or pulling out.

b. Remove any loose fragments of foam.

c. Use cloth dampened with water to clean area around puncture. Wipe dry.

d. Inject sprayfoam into puncture. Fill to 1/8 in. (3.2 mm) above surface of unbroken skin. Apply sealant to cracks leading to puncture.





e. Prepare sheet metal patch large enough to cover damaged area with overlap

f. Place patch over damaged area and mark all around edges of patch.

g. Drill holes 1 in. (25.4 mm) apart.

h. Apply sealant to edges of patch.

i. Apply patch to van body.

j. Install pop rivets beginning at center of each side. Rivets should be placed 1 in. (25.4 mm) apart.

k. Paint as needed.

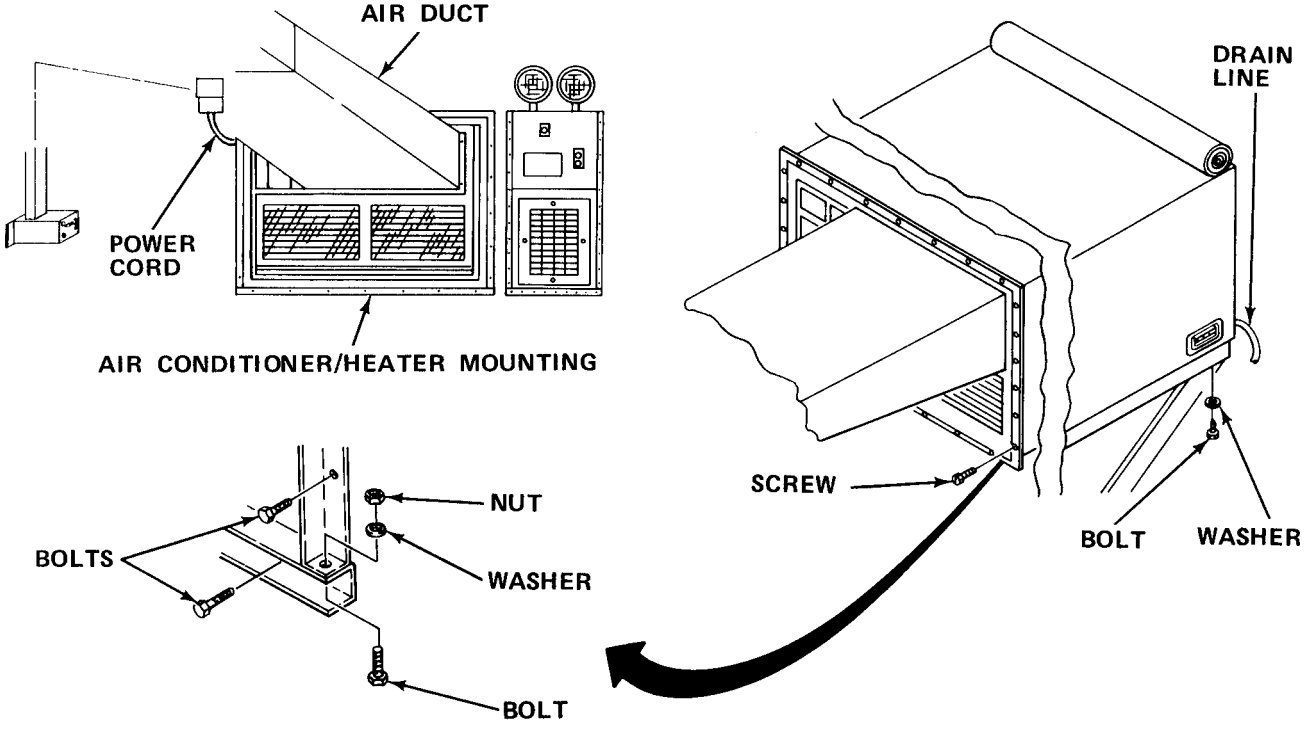
1-20.8 Replace Air Conditioner/Heater.

MOS: 63W, Wheel Vehicle Repairer

PERSONNEL: Two persons are required to perform this procedure.

TOOLS: Cross Tip Screwdriver
Lifting Equipment
8 in. Adjustable Wrench
7/16 in. Combination Wrench

SUPPLIES: Air Conditioner/Heater
Solvent P-D-680 (Item 24, Appendix E)
Gasket
Silicone Sealant (Item 22, Appendix E)
Adhesive (Item 2, Appendix E)



WARNING

- Use hoist or proper lifting equipment to replace air conditioner/heater. Failure to do so may result in death or serious injury.
- Turn off air conditioner/heater circuit breaker and unplug power cord. Failure to do so may result in death or serious injury.

a. Turn off air conditioner/heater circuit breaker. Unplug or disconnect power cord as appropriate.

b. Remove screws holding air duct to air conditioner/heater.

c. Remove nut, washer, and screw from each corner of air conditioner/heater mounting. Remove screws securing mounting to section wall.

d. Disconnect drain line from air conditioner/heater.

e. Attach sling to lifting handles. Raise hoist enough to remove slack from sling.

f. Remove mounting bolts and washers.

g. Slide out air conditioner until other lifting handles are free. Attach sling to handles.

h. Raise defective air conditioner/heater with hoist until unit is free from brackets and section.

i. Place air conditioner/heater on flat-bed truck or pallet.

WARNING

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

j. Clean sealant from opening using dry cleaning solvent P-D-680.

k. Remove damaged gasket and replace with new gasket.

l. Raise air conditioner/heater until it rests on air conditioner/heater brackets.

m. Remove two sling hooks as unit is eased into hole until grille touches duct.

n. Remove remaining sling.

o. Reinstall washers and mounting bolts.

p. Reconnect drain lines.

q. Reinstall screws securing air conditioner/heater mounting to section wall. Reinstall screw, washer, and nut to each corner of mounting.

r. Reinstall screws securing air duct to air conditioner/heater.

s. Reconnect or plug in power cord. Turn on air conditioner/heater circuit breaker.

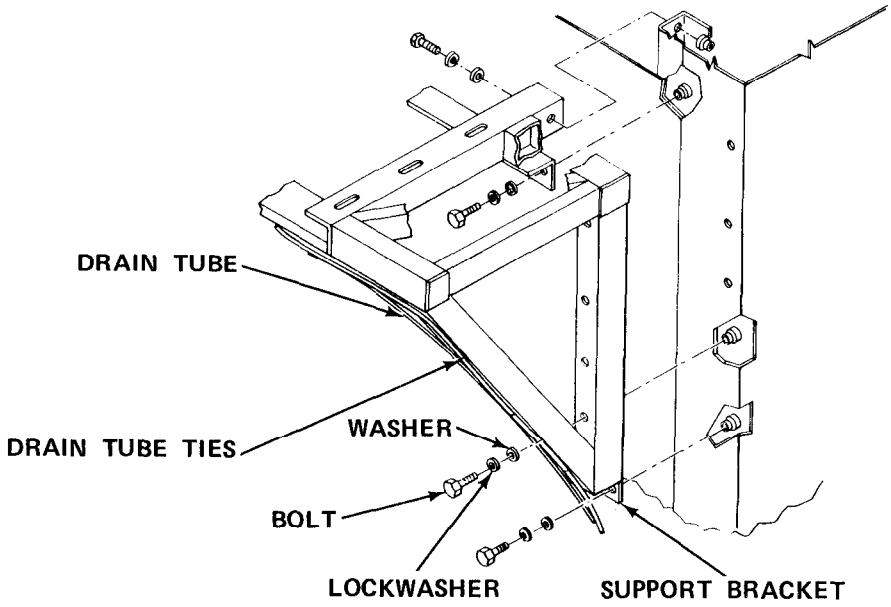
1-20.9 Replace Air Conditioner Support Bracket.

MOS: 63W, Wheel Vehicle Repairer

PERSONNEL: Two persons are required to perform this procedure.

TOOLS: 9/16 in. Combination Wrench
Lifting Equipment
Knife, TL-29

SUPPLIES: Air Conditioner Support Bracket
Drain Tube Ties



WARNING

Serious injury to personnel or damage to equipment may occur unless two or more personnel are used to remove and replace air conditioner/heater because of weight and balance of air conditioner/heater.

a. Remove air conditioner/heater (paragraph 1-20.8).

b. Cut drain tube ties, and remove drain tube from support bracket.

c. Remove bolts, lockwashers, and washers securing support bracket.

d. Remove defective support bracket.

e. Install new support bracket. Secure to section with bolts, lockwashers, and washers.

f. Reinstall drain tube on support bracket, and secure with new ties.

g. Reinstall air conditioner/heater (paragraph 1-20.8).

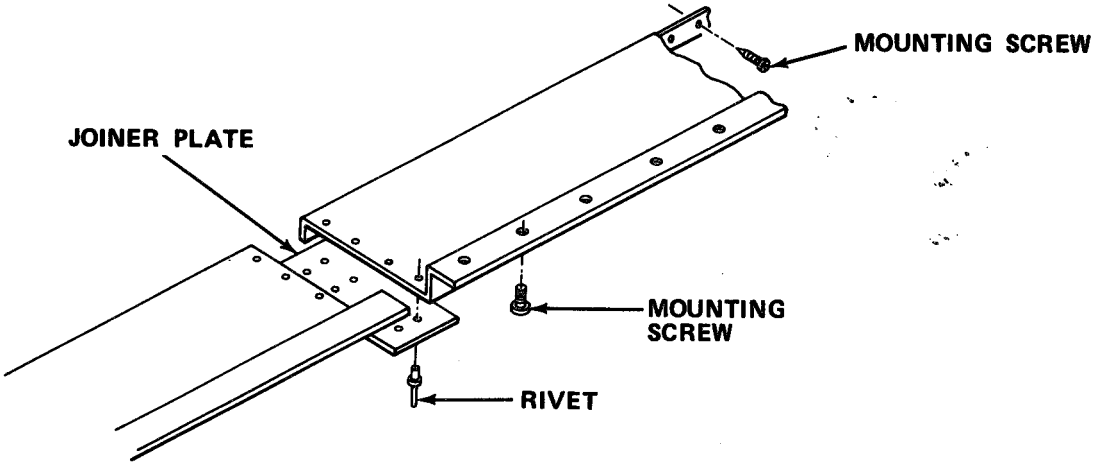
1-20.10 Replace Ventilation Duct.

MOS: 52C, Utilities Equipment Repairer

TOOLS: Hacksaw
Electric Drill and Bits
Ball Peen Hammer
Pop Rivet Gun
Paint Brush
Cross Tip Screwdriver

SUPPLIES: Silicone Sealant (Item 22, Appendix E)
Wood Block
Pop Rivets
Paint (Item 17, Appendix E)
Cheesecloth (Item 8, Appendix E)
Salvaged Ventilation Duct

a. Turn off air conditioner/heater so air will not blow through duct.



b. Drill rivets from damaged section of duct. Remove joiner plates.

c. Remove mounting screws to remove damaged sections of duct.

d. Straighten remaining sections of duct at edges using hammer and wood block.

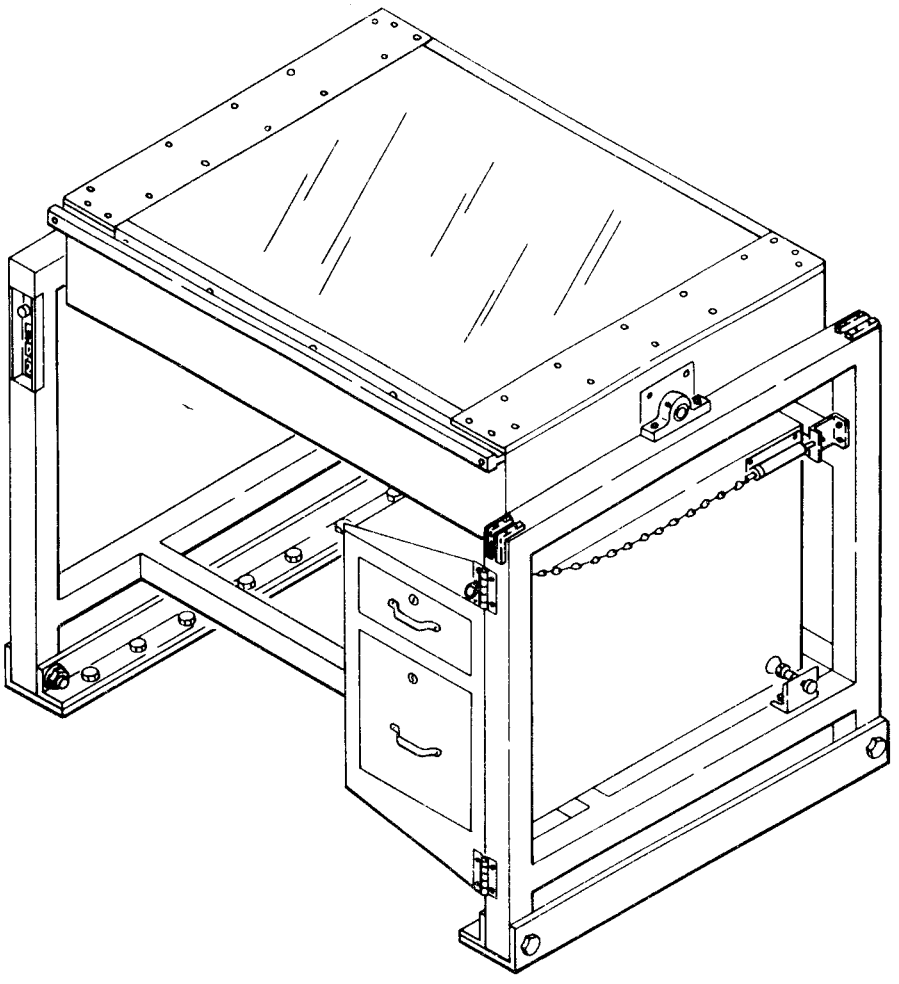
e. Place sealant on mounting edges.

f. Install new duct section cut from salvaged duct. Secure to section with screws.

g. Reinstall joiner plates. Install rivets to secure.

h. Paint as necessary.

i. Turn on air conditioner/heater.



CHAPTER 2

DRAFTING, SCRIBING/TRACING TABLE

Section I INTRODUCTION

2-1. GENERAL INFORMATION.

2-1.1 Scope.

a. Model Number and Equipment Name. Model 99-9933 Drafting, Scribing/Tracing Table.

b. Purpose of Equipment. To provide user with drafting, scribing, or tracing table in compact unit.

2-2. EQUIPMENT DESCRIPTION.

2-2.1 Equipment Characteristics, Capabilities, and Features.

a. Rapid work surface selection.

b. Auxiliary electrical outlets.

c. Two drawer storage.

d. Tilting work surface (0, 5, and 10 degrees).

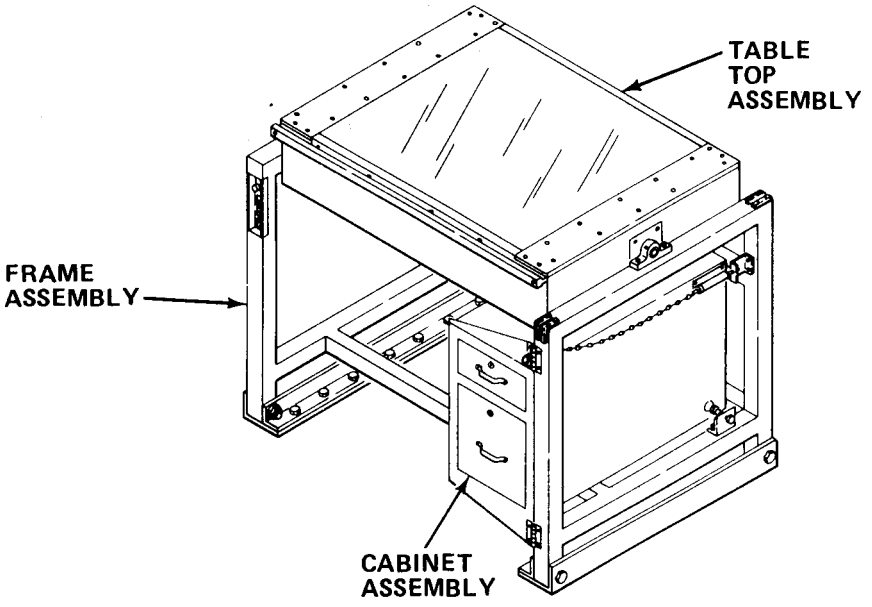
e. Easy access to all controls.

f. Diffused light source.

g. Drawing guard on front edge of drafting, scribing/tracing table.

h. Sturdy steel base.

2-2.2 Location and Description of Major Components.



FRAME ASSEMBLY . Supports table top assembly, drawer assembly, control panel, safety stops, and tilt lock.

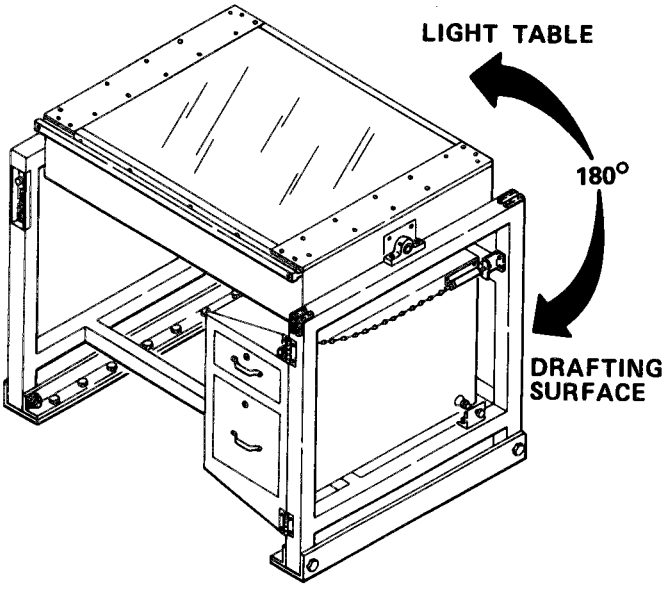
TABLE TOP ASSEMBLY. Consists of drafting board, light board, diffused lighting, and drawing guard.

CABINET ASSEMBLY. Consists of two drawers and drawer lock module.

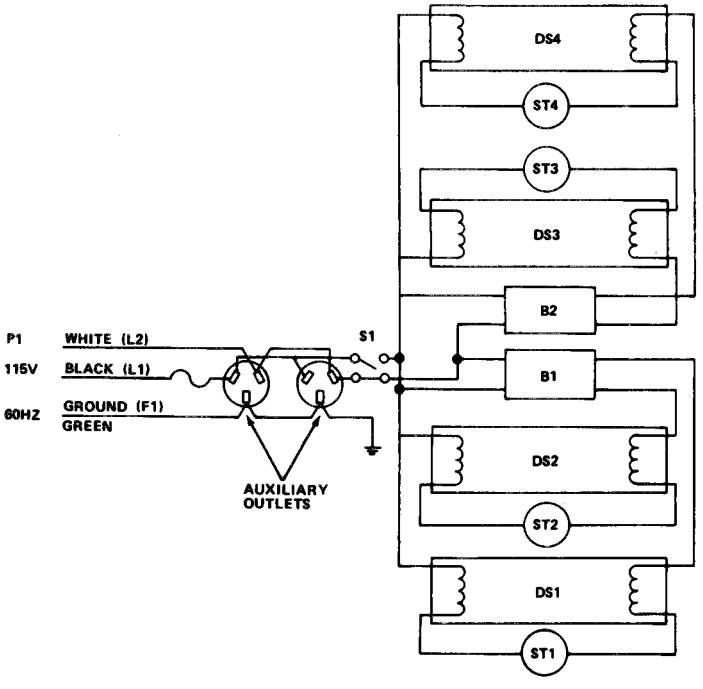
2-2.3 Equipment Data.

Power Requirements	115 V, 60 Hz, single-phase
Drafting Surface	42 in. X 31 in. (106.7 cm X 78.7 cm)
Light Table Surface	30 in. X 30 in. (76.2 cm X 76.2 cm)
Dimensions	
Width	47 in. (119.4 cm)
Depth	34 in. (86.4 cm)
Height (Table Flat)	42 in. (106.7 cm)

2-3. TECHNICAL PRINCIPLES OF OPERATION.



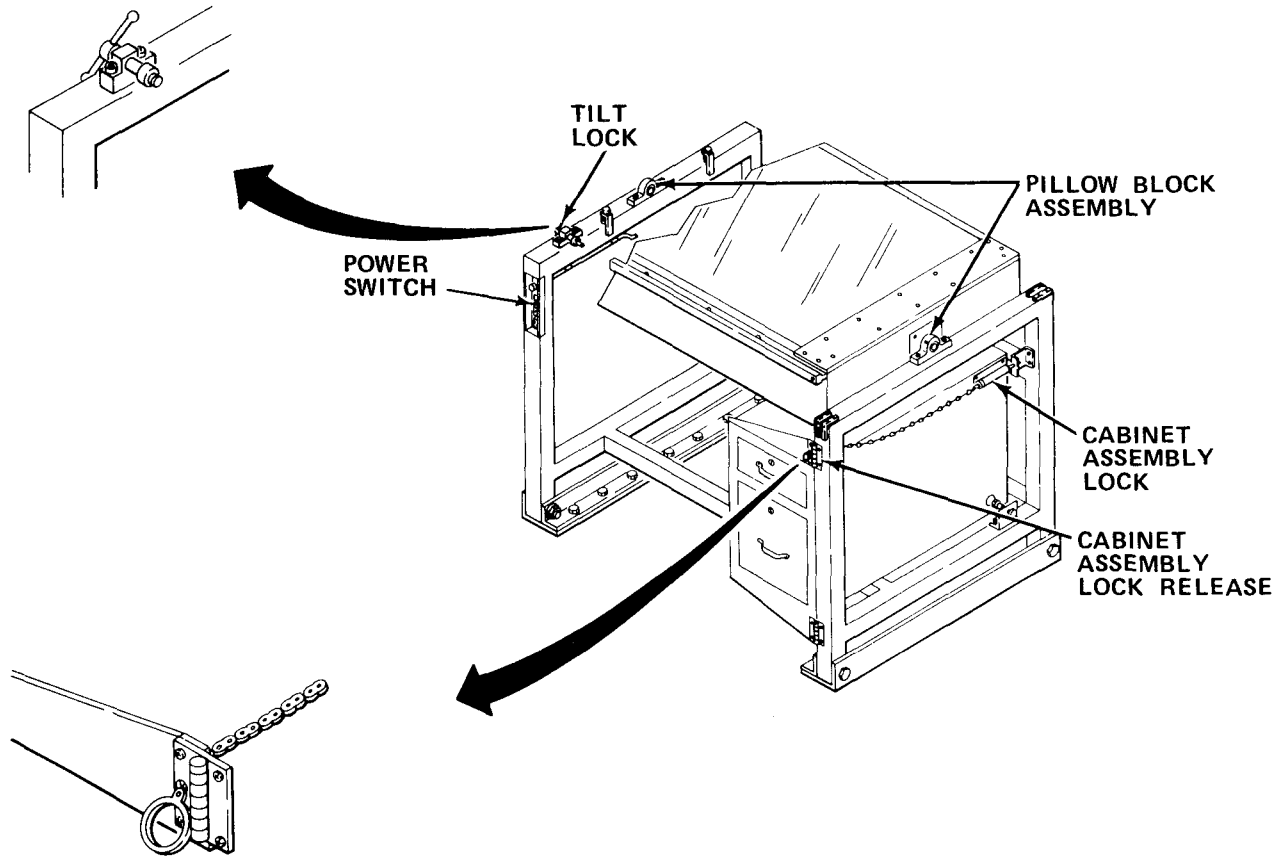
2-3.1 General. The movable top permits selection of drafting surface or light table. Has safety stops so that table top will turn only 180 degrees to prevent damage to electrical wiring. For drafting surface, rotate top away from operator. For light table, rotate top toward operator.



2-3.2 Electrical System. Provides power to the light table and two auxiliary outlets. The auxiliary outlets are located on the control panel. When plug **P1** is connected, 120 V ac is applied to auxiliary outlets even if power switch S1 is off.

Section II OPERATING INSTRUCTIONS

2-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Tilt Lock	Used to change angle of work surface or to change work surface. Loosen tilt lock to change work surface. Tighten to secure in position.
Pillow Block Assembly	Houses the bearing which allows easy rotation of the work surface.

Control or Indicator	Function
Cabinet Assembly Lock and Cabinet Assembly Lock Release	Located at upper cabinet assembly hinge on right front table leg. To open cabinet assembly, pull cabinet assembly lock release and swing assembly out, so it is not under table.
Power Switch	Provides power to light table lamps only.

2-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

2-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The "Equipment is Not Ready/Available If" column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not. operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Liquid Detergent (Item 7, Appendix E)	ar
Cheesecloth (Item 5, Appendix E)	ar

Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W - Weekly
M - Monthly
Cl - Quarterly

AN - Annually
s - Semiannually
Bl - Biennially

(Number) - Hundreds of Hours

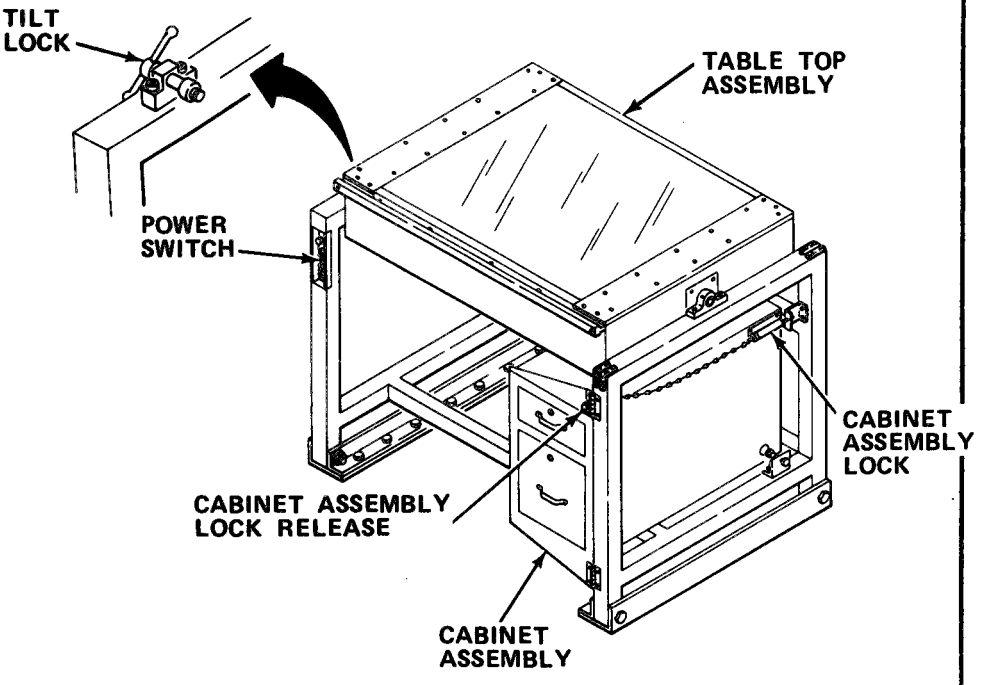
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		DRAFTING, SCRIBING/TRACING TABLE	
1	B/A	Inspect.	
		1. Glass table surface.	Glass cracked or broken.
			
		2. Turn power switch OFF.	

Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

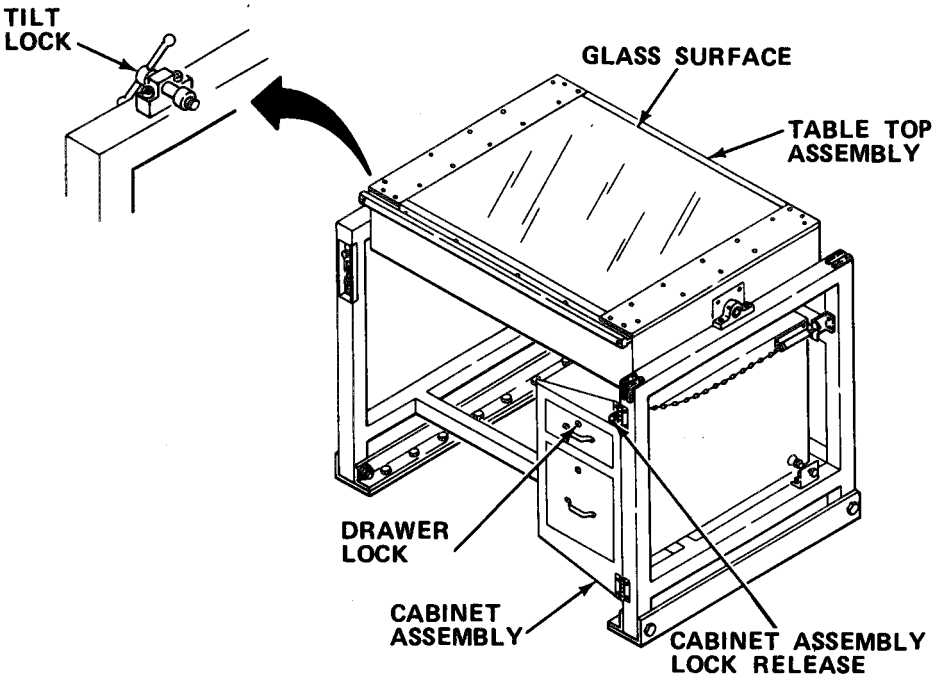
(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		DRAFTING, SCRIBING/TRACING TABLE - Cont	
1	B/A	Inspect - Cont	
		3. Pull cabinet assembly lock release ring and swing out cabinet assembly.	
		4. Loosen tilt lock until it clears table top assembly.	Tilt lock is damaged.
		5. Rotate table top 180°.	Table top does not rotate.
		6. Tighten tilt lock to secure table top assembly in position.	Table top will not lock in position.
		7. Inspect wooden table top.	Table top has gouges, dents, or cuts.
		8. Rotate table top 180° and tighten tilt lock.	
		9. Return cabinet assembly to its normal position under table.	
		10. Press firmly on cabinet assembly front until cabinet assembly lock clicks.	
		11. Turn power switch ON. Be sure all table lights are on. Check surface for cracks or breaks.	Table lights do not illuminate. Glass is broken. Power switch is broken.
		12. Turn power switch OFF.	

Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before, D - During, A - After | W - Weakly, M - Monthly, Q - Quarterly | AN - Annually, S - Semiannually, BI - Biennially | (Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		DRAFTING, SCRIBING/TRACING TABLE - Cont	
2	B	**Service.**	



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

1. Unplug power cord.
2. Pull cabinet assembly lock release ring and swing out cabinet assembly.
3. Loosen tilt lock until it clears table top assembly.

Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before W - Weekly AN - Annually (Number) . Hundreds of Hours
D - During M - Monthly s - Semiannually
A - After Q - Quarterly BI - Biennially

ITEM NO.	IN-TERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		DRAFTING, SCRIBING/TRACING TABLE - Cont	
2	B	Service - Cont	
		4. Rotate table top assembly until glass surface is on top.	Table top does not rotate.
		5. Tighten tilt lock to secure table top assembly in position.	
		CAUTION Do not use abrasive cleaner on glass surface. Do not use running water or excessive water on cloth. Use moist cloth. Abrasive cleaner will scratch glass surface. Excessive water can cause equipment damage.	
		6. Wipe glass surface with cheesecloth moistened in mild solution of detergent and water.	
		7. Wipe glass surface with dry cheesecloth to remove streaks and smears.	
		8. Swing cabinet assembly to its normal position under table.	
		9. Plug in power cord.	

2-6. OPERATION UNDER USUAL CONDITIONS.

2-6.1 Assembly and Preparation for Use.

a. Clean work surface.

b. Plug power cord into electrical receptacle.

c. Turn power switch on for light table use.

2-6.2 Operating Procedures.

a. Changing Work Surface.

CAUTION

Safety stops have been included to prevent overtravel of table top and damage to electrical wiring. If drafting surface is in top position, swing front edge of table top down to change work surface. If light table is in top position, swing front edge up to change work surface. Table cannot be rotated until cabinet assembly is swung out.

(1) Pull cabinet assembly lock release ring and swing out cabinet assembly.

(2) Loosen tilt lock until it clears table top assembly.

(3) Tighten tilt lock to secure table top assembly in position.

(4) Return cabinet assembly to its normal position under table top assembly.

(5) Press firmly on cabinet assembly front until cabinet assembly lock clicks.

2-6.3 Preparation for Movement.

a. Turn off power.

b. Unplug power cord. Coil power cord and tape to table.

c. Rotate table top assembly, if necessary, to be sure glass surface faces upward.

d. Tighten tilt lock to secure table top assembly.

e. Press firmly on cabinet assembly front until cabinet assembly lock clicks.

f. Check cabinet drawers for open containers and loose items. Seal containers and secure all loose items.

g. Lock cabinet drawers.

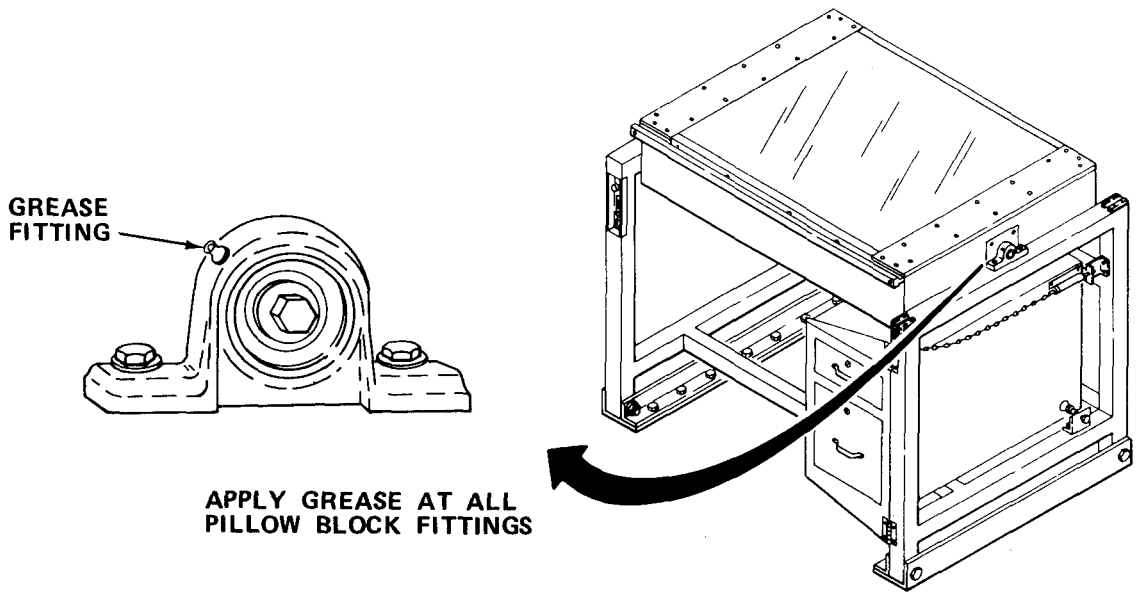
2-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

2-8. LUBRICATION INSTRUCTIONS.

NOTE

These lubrication instructions are mandatory.



2-8.1 Pillow Block Fittings. Apply ball and roller bearing grease (Item 9, Appendix E) to both pillow blocks annually.

a. Apply grease sparingly using grease gun.

b. Wipe grease fittings clean after application.

2-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during operation or maintenance of the drafting, scribing/tracing table, or its components. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all test or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 2-2. TROUBLESHOOTING.

MALFUCTION TEST OR INSPECTION CORRECTIVE ACTION
1. LAWS DO NOT LIGHT
Step 1. Check that power switch is ON.
(a) If power switch is ON, proceed to step 2.
(b) Turn on power switch.
Step 2. Check that power cord is plugged in.
(a) If power cord is plugged in, proceed to step 3.
(b) Plug in power cord.
Step 3. Visually check fuse for broken filament.
(a) Replace fuse (paragraphs 2-10.1)
(b) If filament is not broken, refer to organizational maintenance.
2. TABLE DOES NOT LOCK.
Check for loose tilt lock.
(a) If loose, tighten.
(b) If tight, refer to organizational maintenance.

2-10. MAINTENANCE PROCEDURES.

This section contains instructions covering operator/crew maintenance funtions for the drafting, scribing/tracing table. Personnel required are listed only if the task requires more than one.

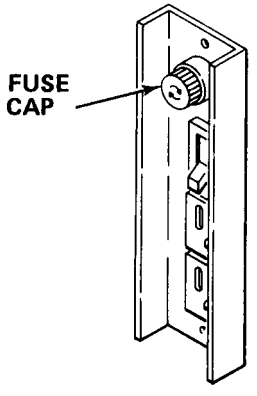
b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

2-10.1 Replace Fuse.

MOS: 81C, Cartographer

SUPPLIES: Fuse



a. Turn power switch OFF.

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

b. Unplug power cord.

c. Push in on cap and turn left.

d. Remove defective fuse.

e. Install new fuse, push in, and turn right.

f. Plug in power cord.

Section IV ORGANIZATIONAL MAINTENANCE

2-11. LUBRICATION INSTRUCTIONS.

2-11.1 Pillow Block Fittings. After replacement, apply ball and roller bearing grease to pillow blocks (paragraph 2-8.1).

2-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

2-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

2-12.2 Special Tools: Test, Measurement, and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

2-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering organizational maintenance for this equipment.

2-13. SERVICE UPON RECEIPT. The drafting, scribing/tracing table may be received mounted in the section or in a shipping crate.

2-13.1 Checking Unpacked Equipment.

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

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

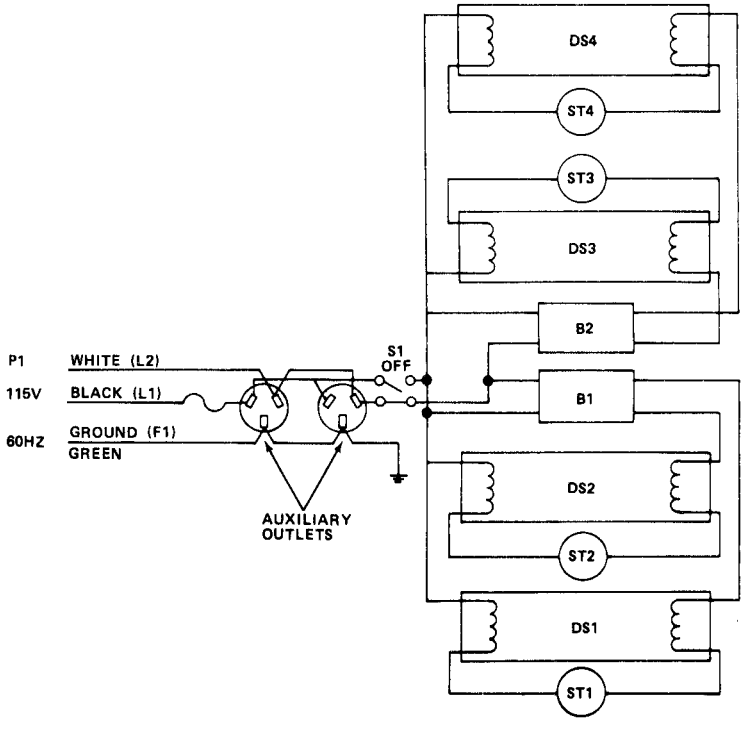
2-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

2-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.

a. Organizational troubleshooting procedures cover the most common malfunctions that may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/inspection and corrective action. If a malfunction is not listed-or corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the following schematic or foldout located at the end of this manual for further fault analysis.



d. If the drafting, scribing/tracing table does not power-up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment trouble-shooting. Perform no-power procedures for dead receptacle (Table 1-4).

Table 2-3. ORGANIZATIONAL TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. LAMPS DO NOT LIGHT.	Step 1. Check continuity of power switch.	(a) If continuity exists, proceed to step 2. (b) If no continuity exists, replace power switch (paragraph 2-16.1).
	Step 2. Check continuity of power cord.	(a) If no continuity exists, replace power cord (paragraph 2-16.2). (b) If continuity exists, replace tube starter (paragraph 2-16.5). (c) If lamps still do not light, replace ballast (paragraph 2-16.4).
2. POWER RECEPTACLES DO NOT WORK.	Step 1. Check continuity of power cord.	(a) If continuity exists, proceed to step 2. (b) If no continuity exists, replace power cord (paragraph 2-16.2).
	Step 2. Check continuity of receptacle.	Repair receptacle (paragraph 2-16.3).
3. TABLE DOES NOT LOCK.	Step 1. Check for loose tilt lock.	(a) If tight, proceed to step 2. (b) Tighten tilt lock.

Table 2-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
3. TABLE DOES NOT LOCK - Cont
Step 2. Check for defective tilt lock.
(a) If good, proceed to step 3.
(b) If defective, replace (paragraph 2-16.6).
Step 3. Check for loose tilt locking block.
(a) If tight, proceed to step 4.
(b) If loose, tighten.
Step 4. Check for defective tilt locking block.
(a) If good, proceed to step 5.
(b) If defective, replace (paragraph 2-16.6).
Step 5. Check for defective tilt lock plate.
If defective, replace (paragraph 2-16.6).

2-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance functions for the drafting, scribing/tracing table. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

2-16.1 Replace Power Switch.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 5/64 in. Hex Head Key Wrench

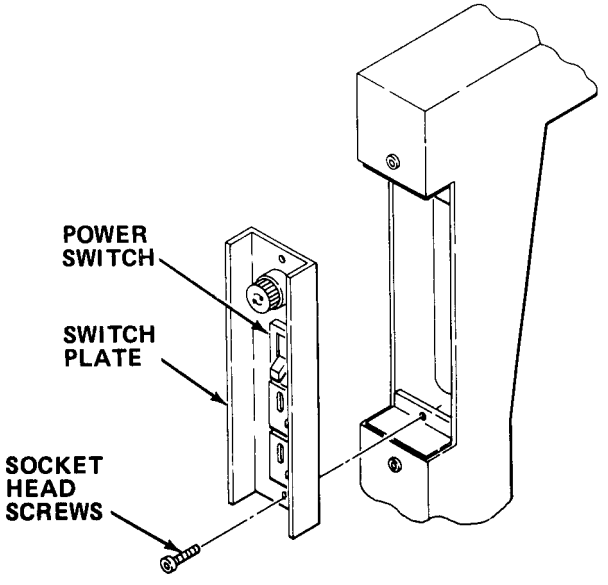
SUPPLIES: Power Switch

WARNING

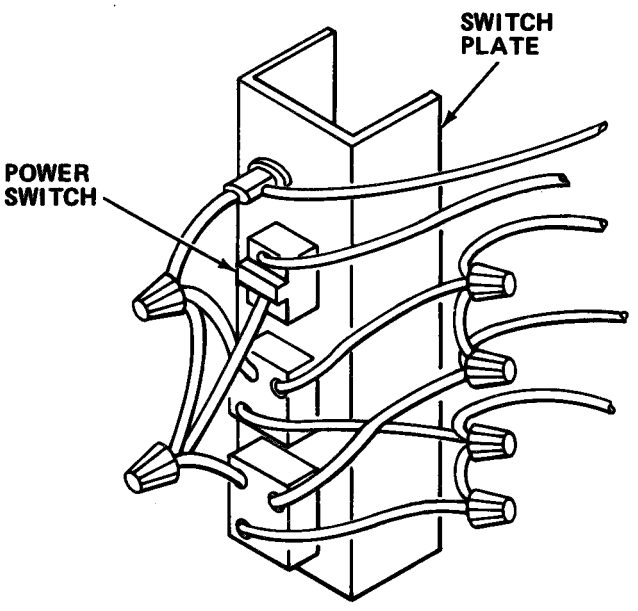
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power switch OFF.

b. Unplug power cord.



c. Remove socket head screws and pull switch plate out.



d. Tag and disconnect wires from power switch.

e. Remove defective power switch from front of switch plate.

f. Install new power switch.

g. Reconnect wires to power switch and remove tags.

h. Reinstall switch plate and secure with socket head screws.

i. Plug in power cord.

2-16.2 Replace Power Cord.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: Flat Tip Screwdriver
Soldering Iron
5/64 in. Hex Head Key Wrench

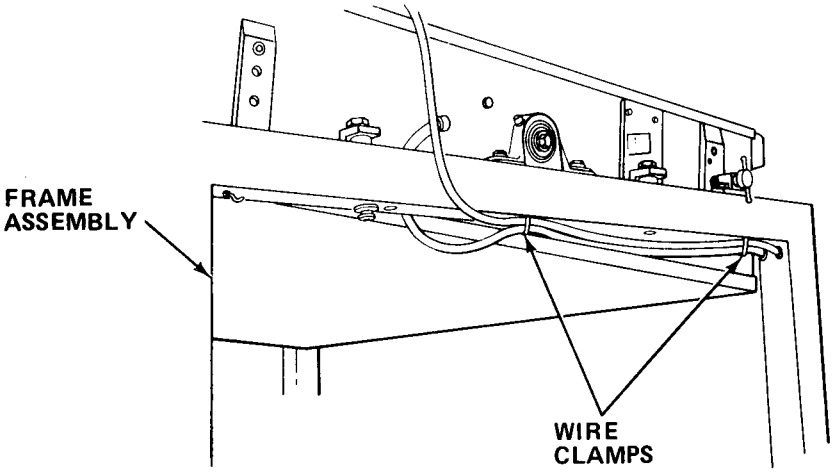
SUPPLIES: Power Cord
Solder (Item 17, Appendix E)

WARNING

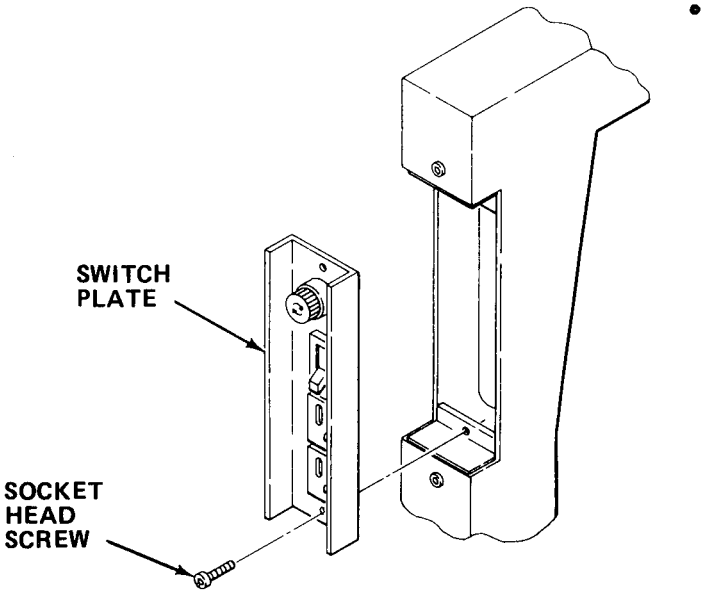
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power switch OFF.

b. Unplug power cord.

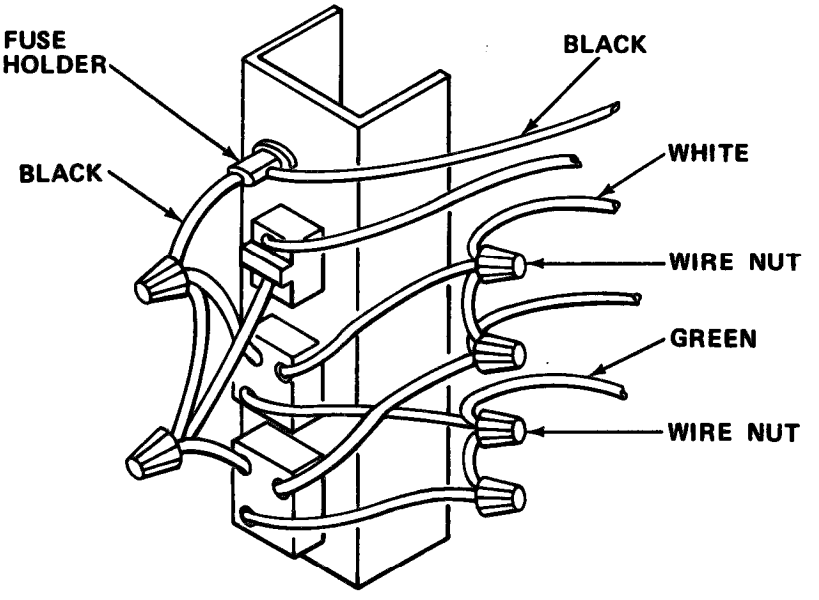


c. Remove wire clamps located on frame assembly.



d. Remove socket head screws and pull switch plate out.

e. Tag wire connections for proper reconnection of wires.



f. Desolder black power cord lead from fuse holder.

g. Disconnect white lead and green ground at wire nuts.

h. Remove power cord.

i. Insert new power cord through hole in back of leg.

j. Reconnect white lead and green ground; tighten wire nuts.

k. Solder black lead to fuse holder.

l. Reinstall wire clamps.

m. Reinstall switch plate and secure with socket head screws.

n. Plug in power cord.

2-16.3 Replace Receptacle.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS : Flat Tip Screwdriver
5/64 in. Hex Head Key Wrench

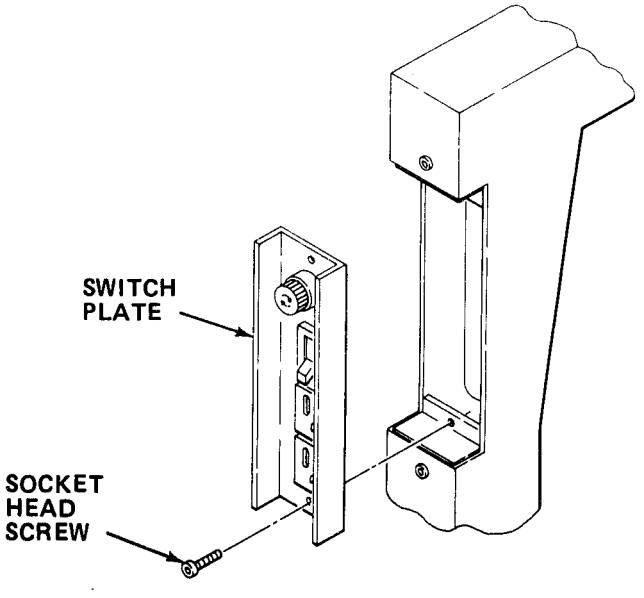
SUPPLIES: Receptacle

WARNING

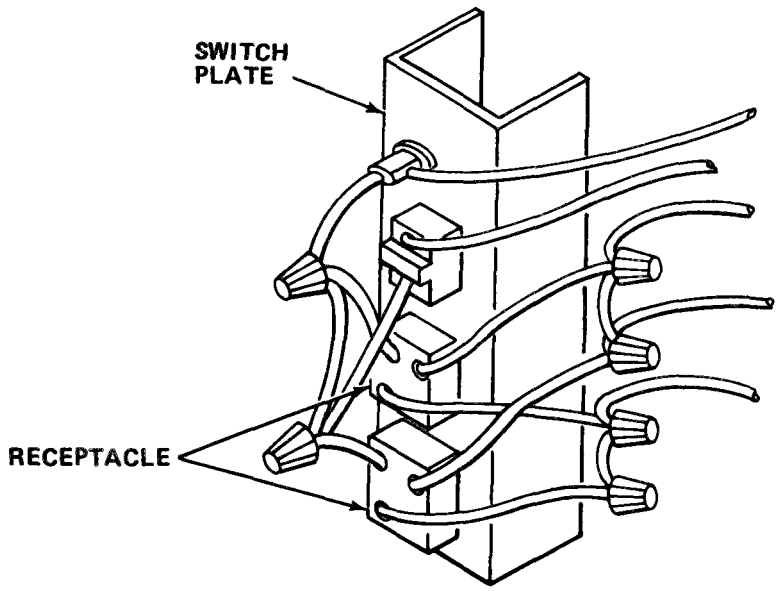
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power switch OFF.

b. Unplug power cord.



c. Remove socket head screws and pull switch plate out.



d. Tag and disconnect wires from defective receptacle.

e. Remove defective receptacle from switch assembly.

f. Install new receptacle and reconnect wires.

g. Reinstall switch plate and secure with socket head screws.

h. Plug in power cord.

2-16.4 Replace Lamp Ballast.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 3/32 in. Hex Head Key Wrench
1/8 in. Hex Head Key Wrench
1/4 in. Wrench
3/8 in. Socket, 1/4 in. Drive
1/4 in. Drive Ratchet

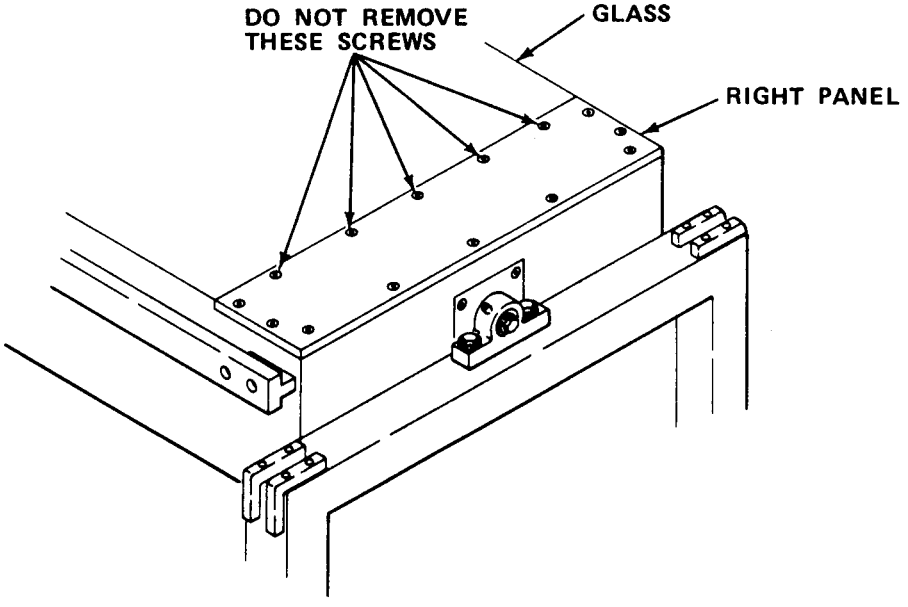
SUPPLIES Lamp Ballast

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing

a. Turn power switch OFF.

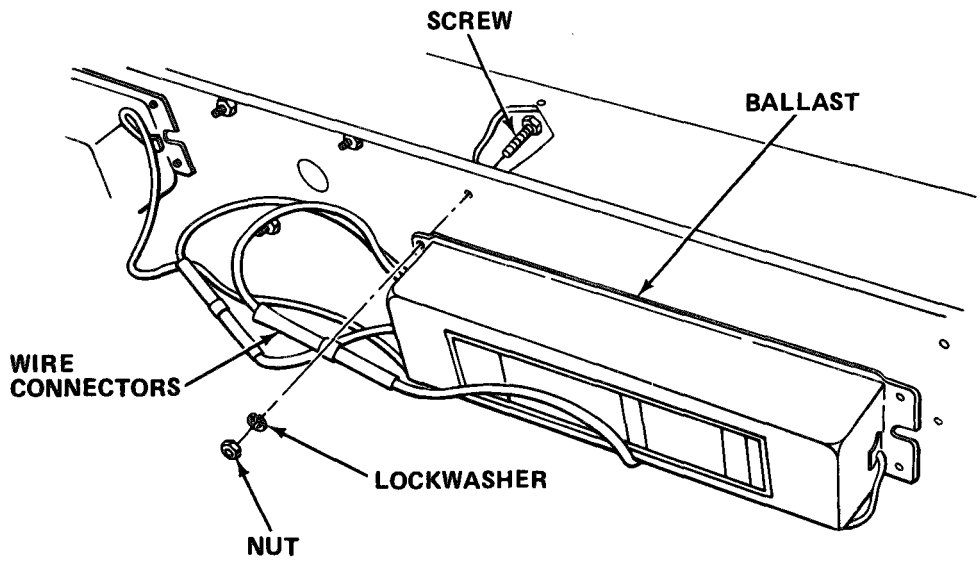
b. Unplug power cord.



CAUTION

Removal of five socket head screws located closest to glass surface may result in damage to equipment.

c. Remove nine socket head screws and right panel, but do not remove five socket head screws indicated in CAUTION and illustration.



d. Remove socket head screws, lockwashers, and nuts that secure ballast.

e. Lift ballast out of table to gain access to wire connectors.

f. Tag and disconnect all wires.

g. Install new ballast.

NOTE

Be sure wires are not kinked.

h. Reconnect all wires.

i. Secure ballast with nuts, lockwashers, and socket head screws.

j. Reinstall right panel and secure with socket head screws.

k. Plug in power cord.

2-16.5 Replace Fluorescent Lamp/Starter.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 3/32 in. Hex Head Key Wrench
Flat Tip Screwdriver.

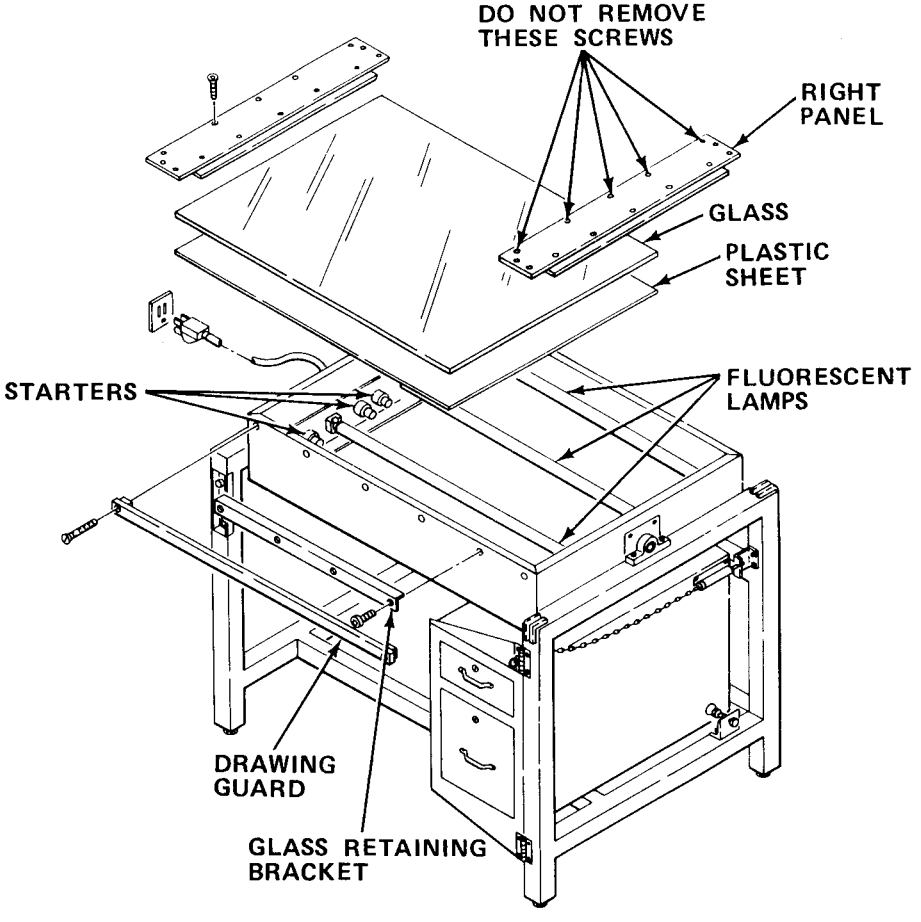
SUPPLIES: Fluorescent Lamp/Starter

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Place light surface up. Turn on power switch and note defective lamp.

b. Turn off power switch and unplug power cord.



CAUTION

Removal of five socket. head screws located closest to glass surface may result. in equipment damage.

c. Remove nine socket head screws and right panel, but do not remove five socket head screws indicated in CAUTION and illustration.

d. Remove socket head screws and drawing guard.

e. Remove socket head screws and glass retaining bracket.

f. Carefully slide glass and plastic sheet from retaining glass bracket and left panel.

g. Remove defective lamp/starter.

h. Install new lamp/starter.

i. Reinstall plastic sheet and glass.

j. Reinstall right panel and secure with socket head screws.

k. Reinstall glass retaining bracket and secure with socket head screws.

l. Reinstall drawing guard and secure with socket head screws.

m. Plug in power cord.

2-16.6 Repair Tilt Lock.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: Flat Tip Screwdriver
7/1 6 in. Combination Wrench
9 mm Wrench
3/32 in. Hex Head Key Wrench
3/1 6 in. Hex Head Key Wrench
5/32 in. Hex Head Key Wrench

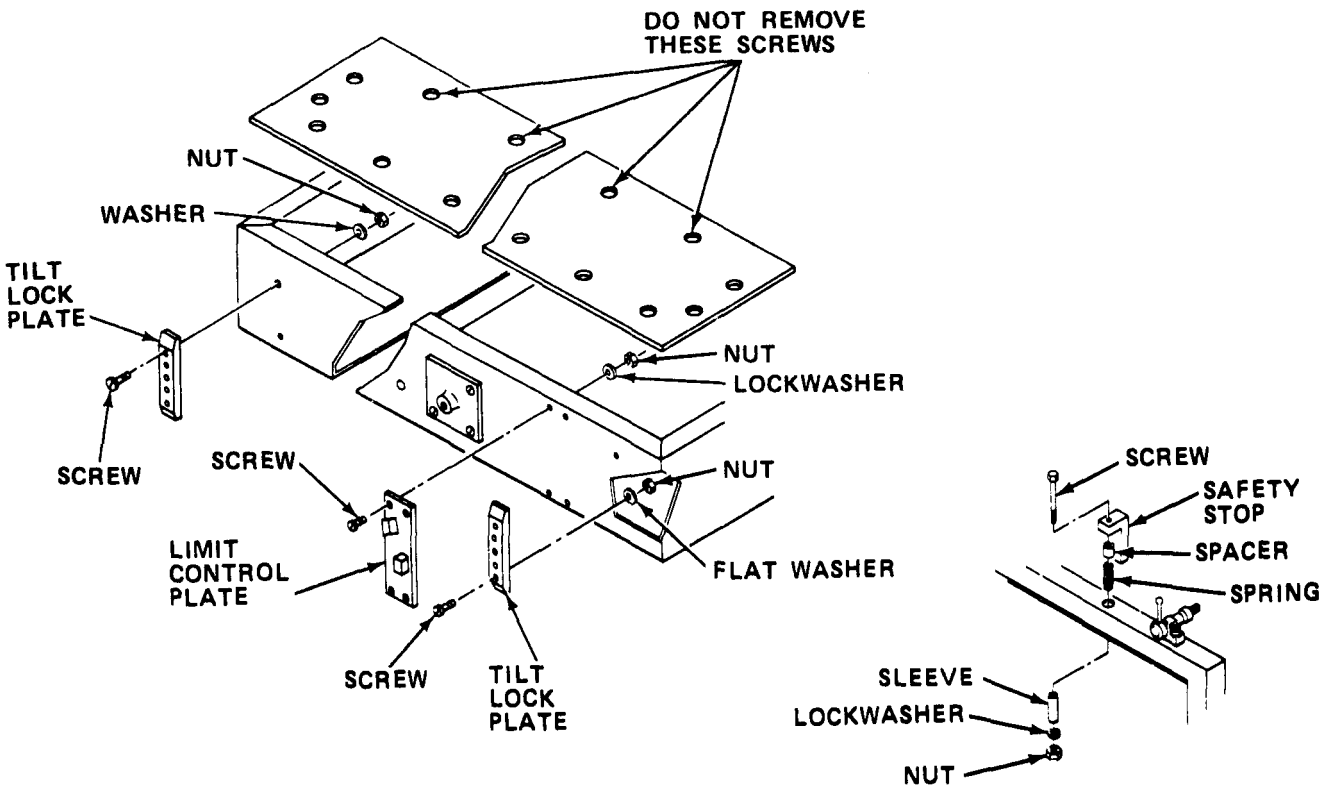
SUPPLIES: Tilt Lock Plate
Limit Control Plate
Safety Stop

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power switch OFF.

b. Unplug power cord.



CAUTION

Removal of five socket head screws located closest to glass surface may result in damage to equipment.

c. Remove nine socket head screws and left panel, but do not remove five socket head screws indicated in CAUTION and illustration.

d. Pull cabinet assembly lock release and swing cabinet assembly out so that it is not under-table.

NOTE

Tilt lock plates are not interchangeable and must be replaced in same positions.

e. Remove upper screws, nuts, and washers from defective tilt lock plate.

f. Tilt table top as necessary and remove defective tilt lock plate by removing lower screws, nuts, and washers.

g. Install new tilt lock plate and secure with washers, nuts, and screws.

h. Check position of tilt lock plate and readjust if required.

i. Remove defective limit control plate by removing screws, washers, and nuts.

j. Install new limit. control plate. Secure with nuts, washers, and screws.

k. Reinstall left panel and secure with nine socket head screws.

NOTE

Use care in disassembly of safety stop to prevent spring from falling inside frame.

1. Remove defective safety stop by removing nut, lockwasher, sleeve, spring, spacer, and screw.

m. Install new safety stop. Secure with screw, spacer, spring, sleeve, lockwasher, and nut.

n. Swing cabinet assembly to its normal position under table.

o. Plug in power cord.

2-16.7 Replace Pillow Block Assembly.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/8 in. Hex Head Key Wrench.
9/16 in. Combination Wrench
1/2 in. Combination Wrench
Grease Gun

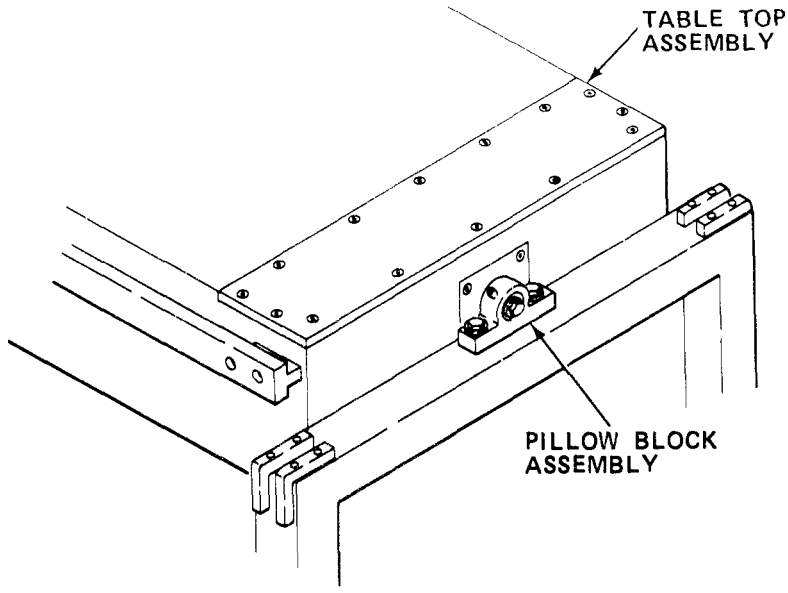
SUPPLIES: Pillow Block Assembly
GAA Grease (Item 9, Appendix E)

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power switch OFF.

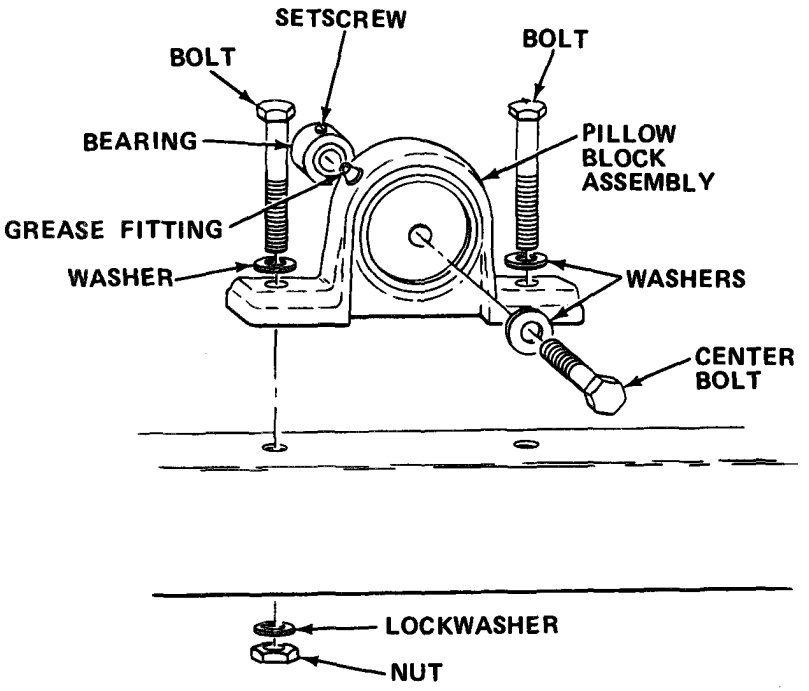
b. Unplug power cord.



CAUTION

Table top assembly must be supported with drafting surface down to prevent table top from falling, causing equipment damage.

c. Support table top assembly.



e. Remove center bolt and washer.

f. Remove bolts, washers, lockwashers, and nuts; remove defective pillow block assembly.

g. Install new pillow block assembly and secure with nuts, lockwashers, washers, and bolts.

h. Grease bearing (Paragraph 2-11.1).

i. Reinstall washer and center bolt.

j. Tighten socket head setscrew.

k. Remove table top assembly supports.

2-16.8 Remove/Install Drafting, Scribing/Tracing Table.

MOS: 83FJ6, Reproduction Equipment Repairer

PERSONNEL: Two persons are required to perfom this procedure.

TOOLS : 1/2 in. Combination Wrench

SUPPLIES: Drafting, Scribing/Tracing Table

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

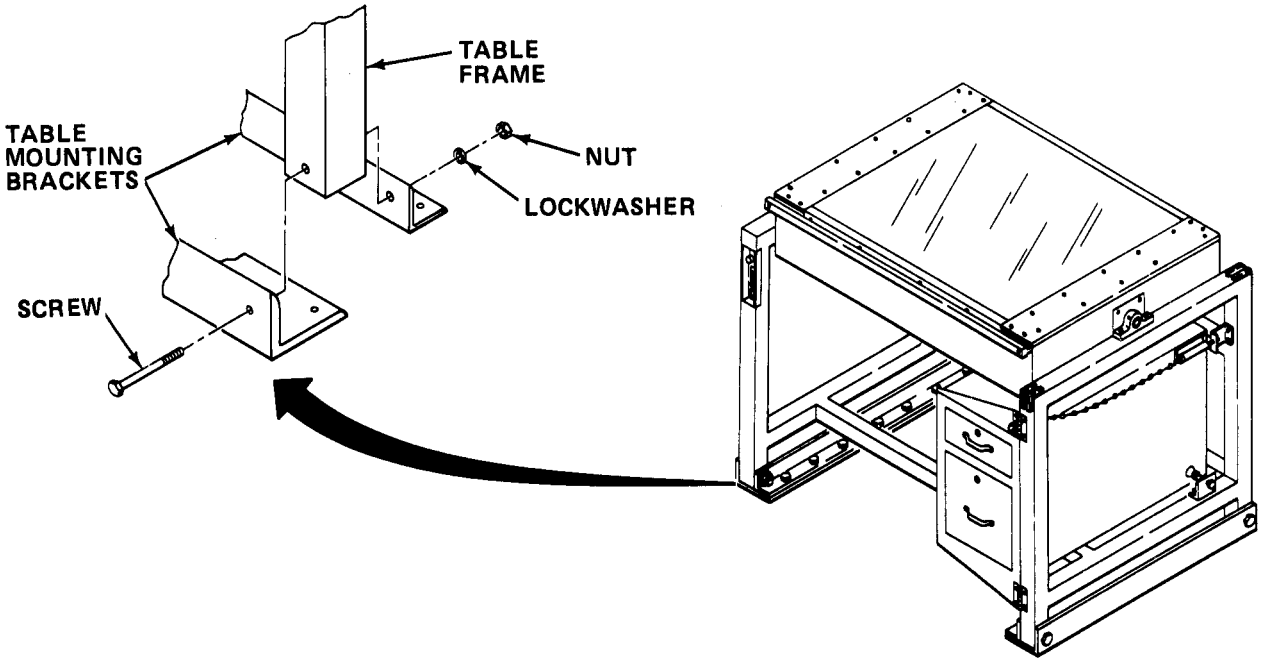
a. Unplug power cord.

b. Remove socket head screws, lockwashers, and nuts from table mounting brackets.

WARNING

To prevent personal injury, two persons are required to move the drafting, scribing/tracing table.

c. Carefully pull table away from wall until it clears table mounting brackets.



d. Remove defective table from section.

e. Position new drafting, scribing/tracing table in front of table mounting bracket.

f. Slide table between table mounting brackets until holes in table frame are alined with table mounting bracket holes.

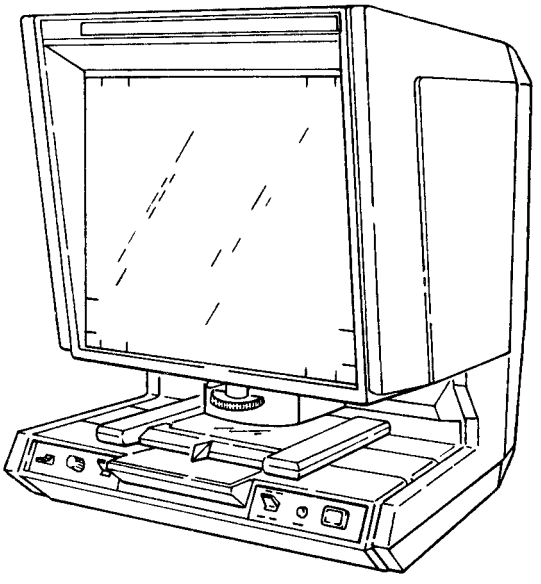
g. Reinstall socket head screws, lock washers, and nuts into table mounting brackets.

h. Plug in power cord.

2-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.



CHAPTER 3

MICROFICHE READER-PRINTER

Section I INTRODUCTION

3-1. GENERAL INFORMATION.

3-1.1 Scope.

a. Model Number and Equipment Name. Model 800 Microfiche Reader-Printer.

b. Purpose of Equipment. To provide direct magnified viewing and permanent prints of selected microfiche frames.

3-2. EQUIPMENT DESCRIPTION.

3-2.1 Equipment characteristics, Capabilities, and Features.

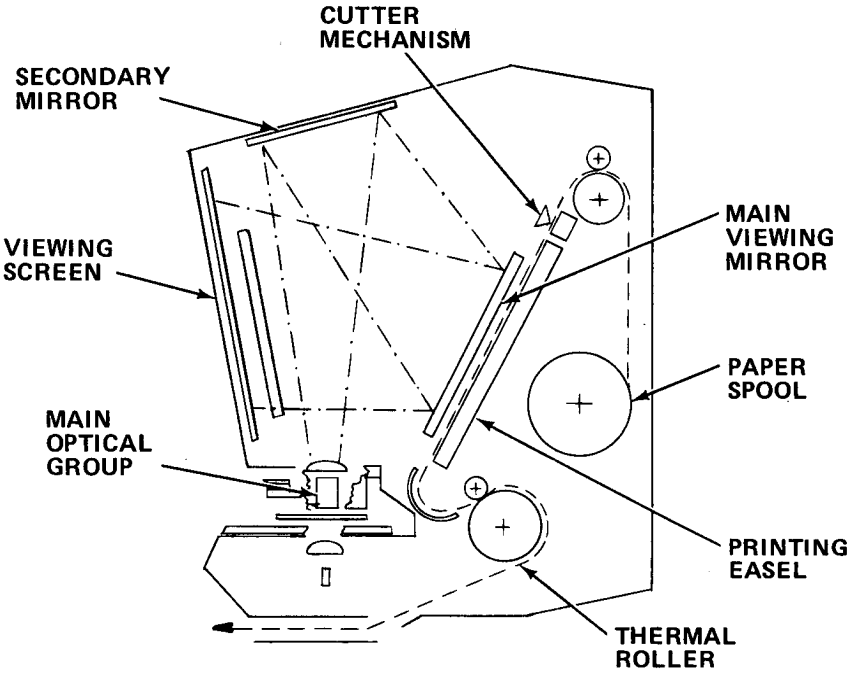
a. Standby feature keeps reader-printer ready for immediate use after initial warm-up.

b. Index grid permits rapid microfiche frame location.

c. View and print capability allows fast reproduction of viewed frame.

d. Variable contrast control of correct reproduction density.

3-2.2 Location and Description of Major Components.



SECONDARY MIRROR. Directs image from main optical group onto main viewing mirror.

CUTTER MECHANISM. Cuts paper to selected length.

MAIN VIEWING MIRROR. Directs image onto viewing screen.

PAPER SPOOL. Holds stock of thermographic paper.

PRINTING EASEL. Supports printing paper in correct plane for receiving image.

THERMAL ROLLER. Develops image on paper by heating.

MAIN OPTICAL GROUP. Magnifies and projects microfiche frame image for viewing or printing.

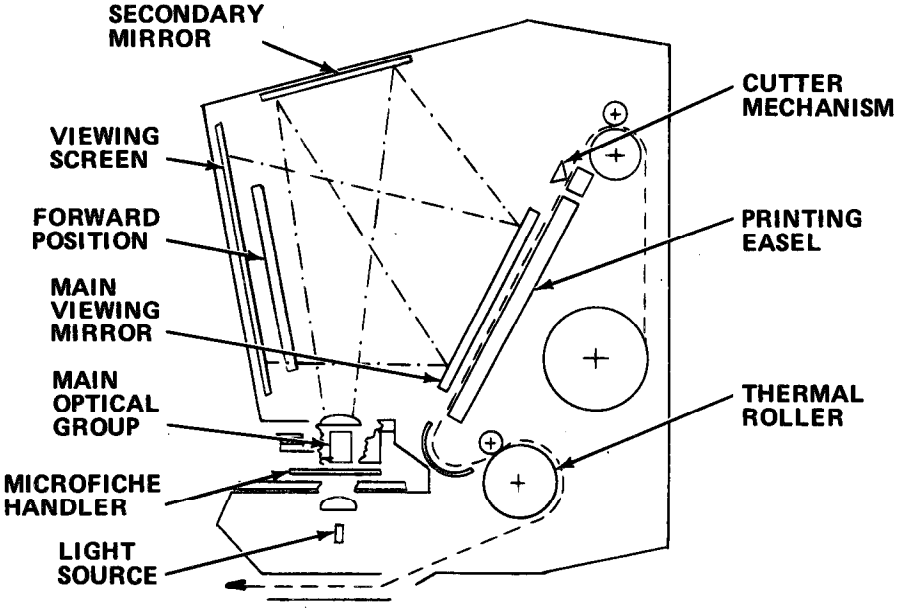
VIEWING SCREEN. Presents image to operator.

3-2.3 Equipment Data.

Power Requirements	105-130 V, 60 Hz, 10 amps
Illumination	150 w
Overall Viewing Area	11 in. X 11 in. (27.9 cm X 27.9 cm)
Microfiche Reduction Ratio	24X with 22X lens 48X with 36X lens

Magnification Ratio	Screen 26.4X; Print 22X with 22X lens Screen 42.7X; Print 36X with 36X lens
Print Size	Long prints, **11** in. longX 8.5 in. wide (27.9 cm long X 21.5 cm wide) Short prints, 8.5 in. long X 8.5 in. wide (21.5 cm long X 21.5 cm wide)
Overall Dimensions	20 in. X 26 in. X 26.5 in. (50.8 cm X 66.0 cm X 67.3 cm)
Weight	105 lbs (47.6 kg)

3-3. TECHNICAL PRINCIPLES OF OPERATION.

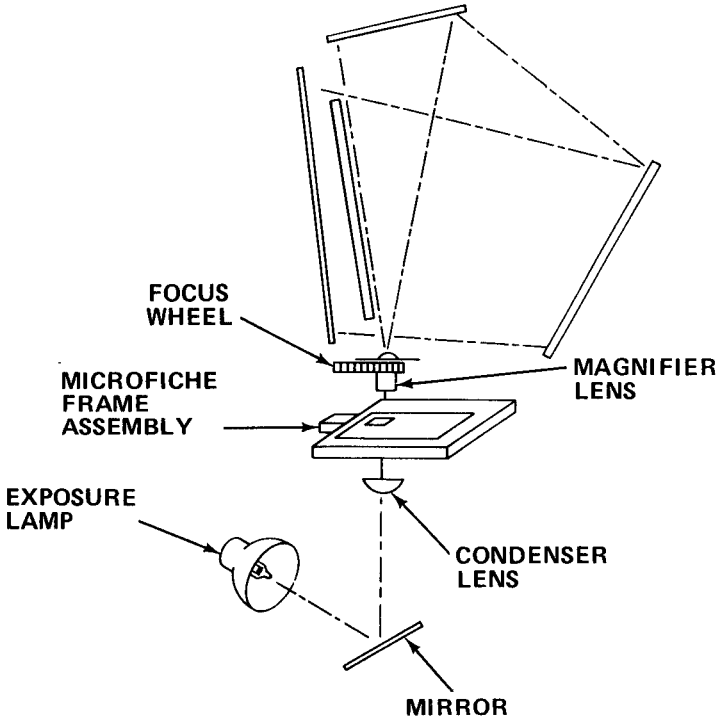


3-3.1 General. Operator places microfiche to be viewed into the microfiche handler, and selected frame is illuminated by the built-in light source. The image is passed through the main optical group, and via the secondary mirror, onto the main viewing mirror. The image is then directed onto the viewing screen. Permanent copies are made by momentarily pushing the PRINT switch which activates the print mechanism. The main viewing mirror is moved to its forward position, and the image falls onto the printing paper in location on the printing easel. The paper is cut to desired length by the cutter mechanism, and the copy is developed by passing it around the thermal roller.

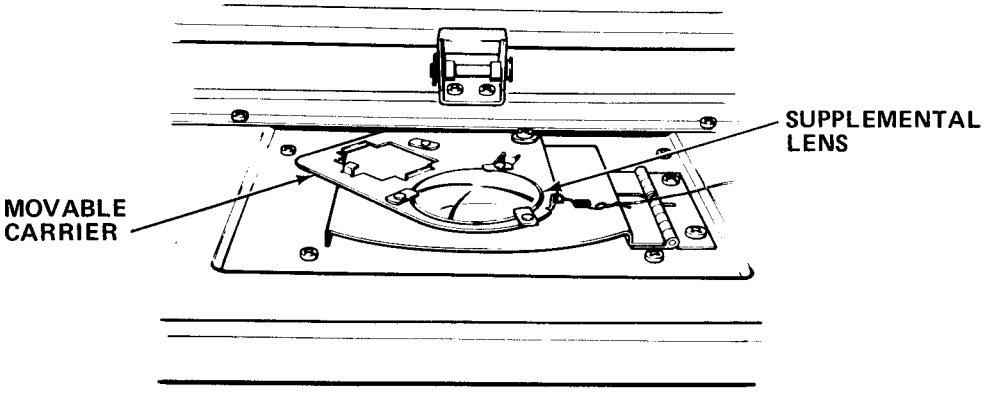
3-3.2 Detailed. The reader-printer is composed of three subsystems.

a. Optical and mirror subsystem. Magnifies and projects selected microfiche frame for either viewing or printing.

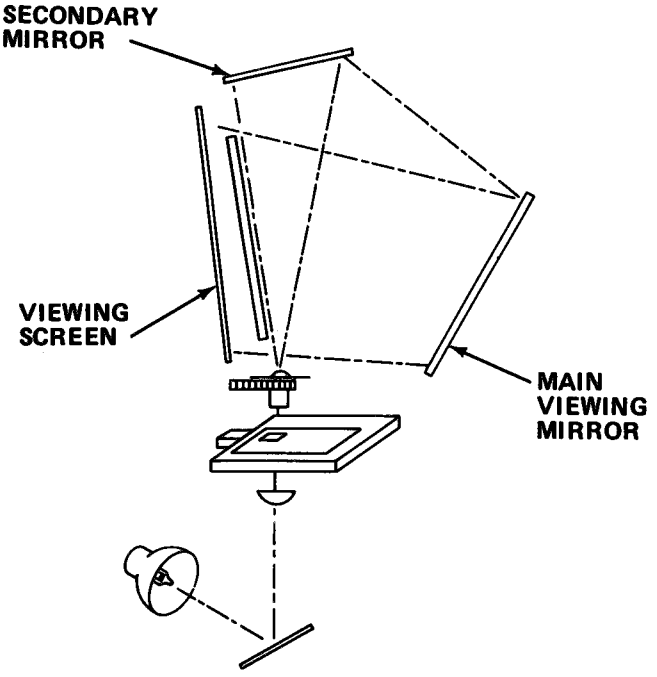
(1) Viewing:



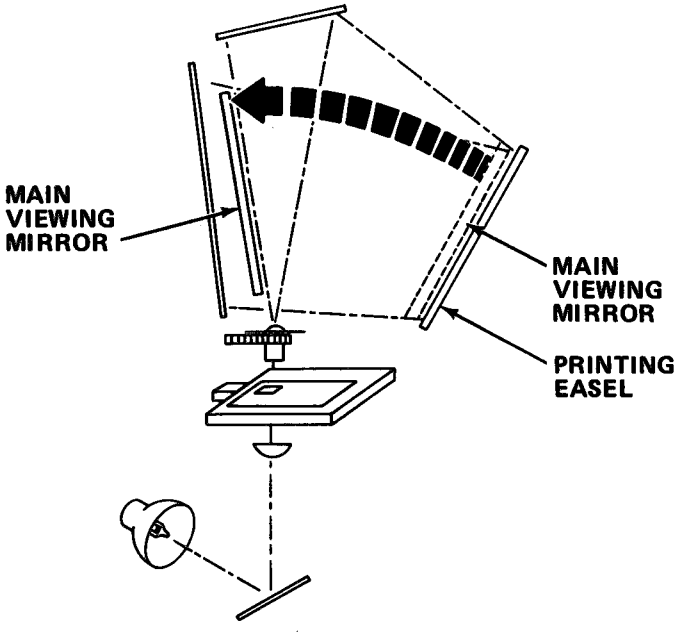
(a) The exposure lamp is a 150 W light by a 45-degree mirror. The beam passes through the condenser lens, which intensifies the light before it reaches the microfiche frame. The microfiche is carried in the microfiche frame assembly which is movable to allow selection of any single frame within the microfiche. The image then passes through the magnifier lens where it is focused by the focus wheel.



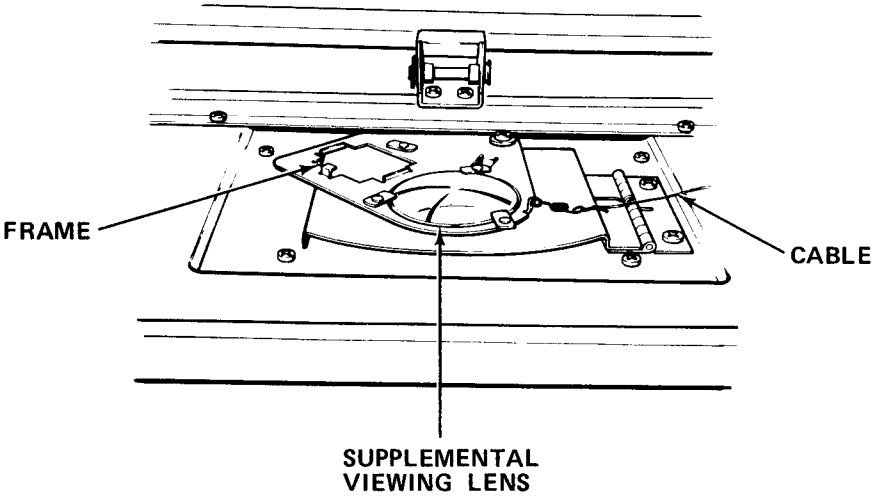
(b) After being focused, the image is passed through a supplemental lens which is mounted in a movable carrier. The supplemental lens adjusts the image for viewing and is of fixed focus.



(c) The processed viewing image then passes to the secondary mirror and is directed onto the main viewing mirror. In "home" position, the main viewing mirror is at the correct angle to project the image onto the viewing screen.

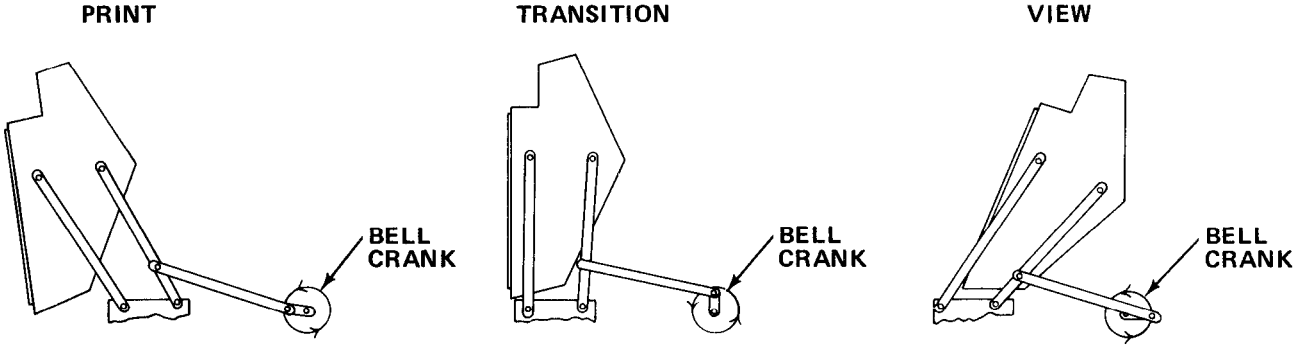


(a) In print mode, the main viewing mirror swings forward, allowing the image to fall onto the printing paper which is in position on the printing easel. The main optical group remains the same for viewing with the following exception:



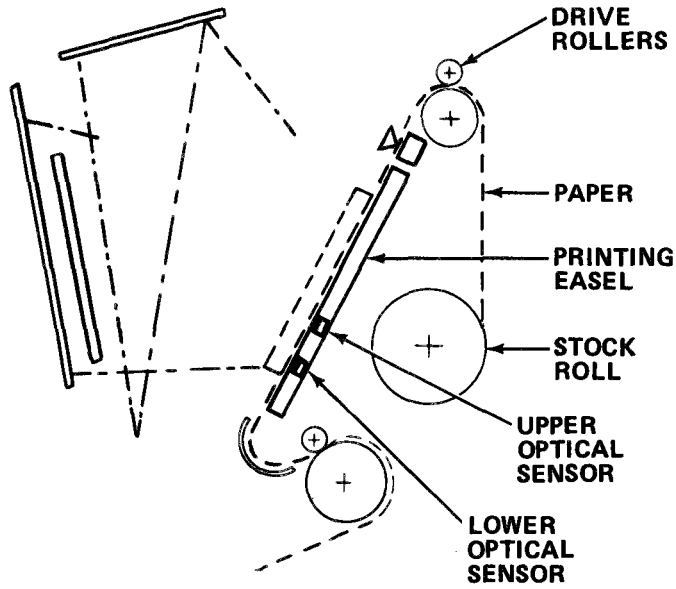
(b) The supplemental viewing lens is swung out of the optical path by a cable which is coupled to the main viewing mirror mechanism. The open frame moves across and forms a border around the microfiche frame to be printed.

b. The mirror movement and printing subsystem. Directs magnified image onto either viewing screen or printing paper. Cuts, develops,and delivers completed print.

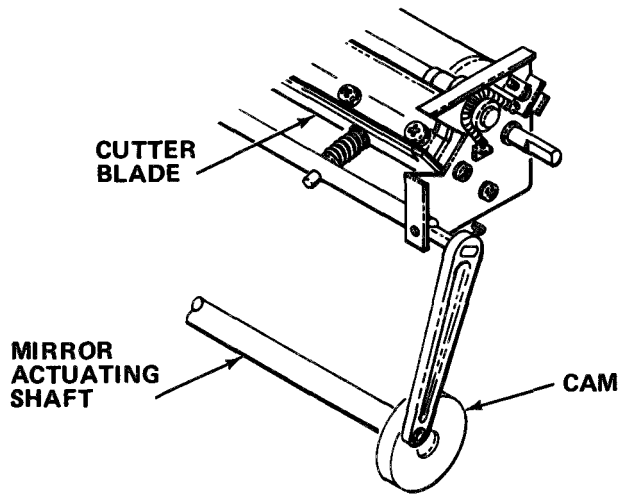


MIRROR MOVEMENT AND PRINTING SUBSYSTEM

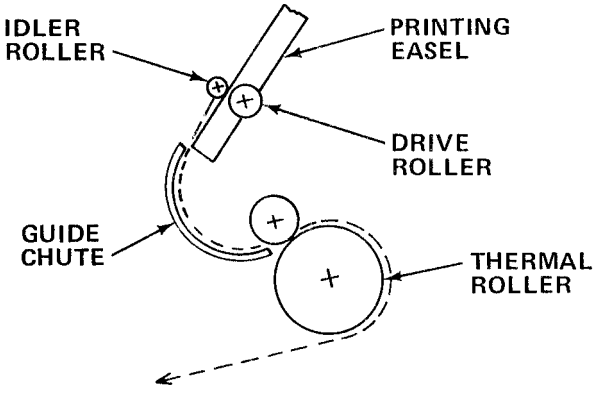
(1) The mirror movement and printing subsystem is actuated by pressing PRINT switch. A timing sequence controls mirror-movement, printing-paper feeding, print length cutting, switching of exposure lamp, and operation of developing roller In position 1, the main viewing mirror assembly is in the "home" position, where the mirror face directs the image onto the viewing screen. When the PRINT switch is pressed, the main viewing mirror assembly moves forward as the link bell crank rotates, and motion is transmitted to the pivot arm assembly by the offset arm. The whole assembly passes through position 2 and stops at position 3. In this position, the microfiche image falls onto the printing paper. Further rotation of the bell crank returns the main viewing mirror assembly to "home" and view position.



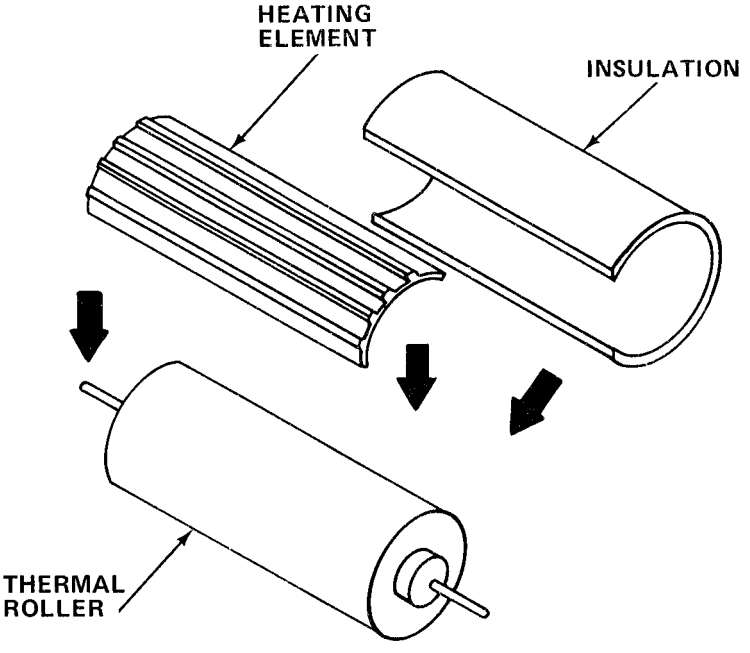
(2) As the main viewing mirror assembly moves from "home" to the full forward position, the paper drive actuates. The drive rollers pull paper from the stock . roll and feed it down into exposure position on the printing easel. With the print length switch in the SHORT PRINT position, the paper drive stops when paper reaches the upper optical sensor, and lower optical sensor with the print length switch in the LONG PRINT position. When main viewing mirror assembly reaches the full forward position, the mirror drive motor stops and the exposure lamp switches on to project microfiche image onto printing paper. The printing process complete, the mirror drive motor starts as the exposure lamp switches off, and the main viewing mirror assembly swings back toward the "home" position. In the "home" position, the exposure lamp is on.



(3) The cutter blade is actuated by a cam driven off the end of the mirror actuating shaft. The blade operates as the main viewing mirror assembly reaches the "home" position. This action cuts the paper at the length previously set by the optical sensor.



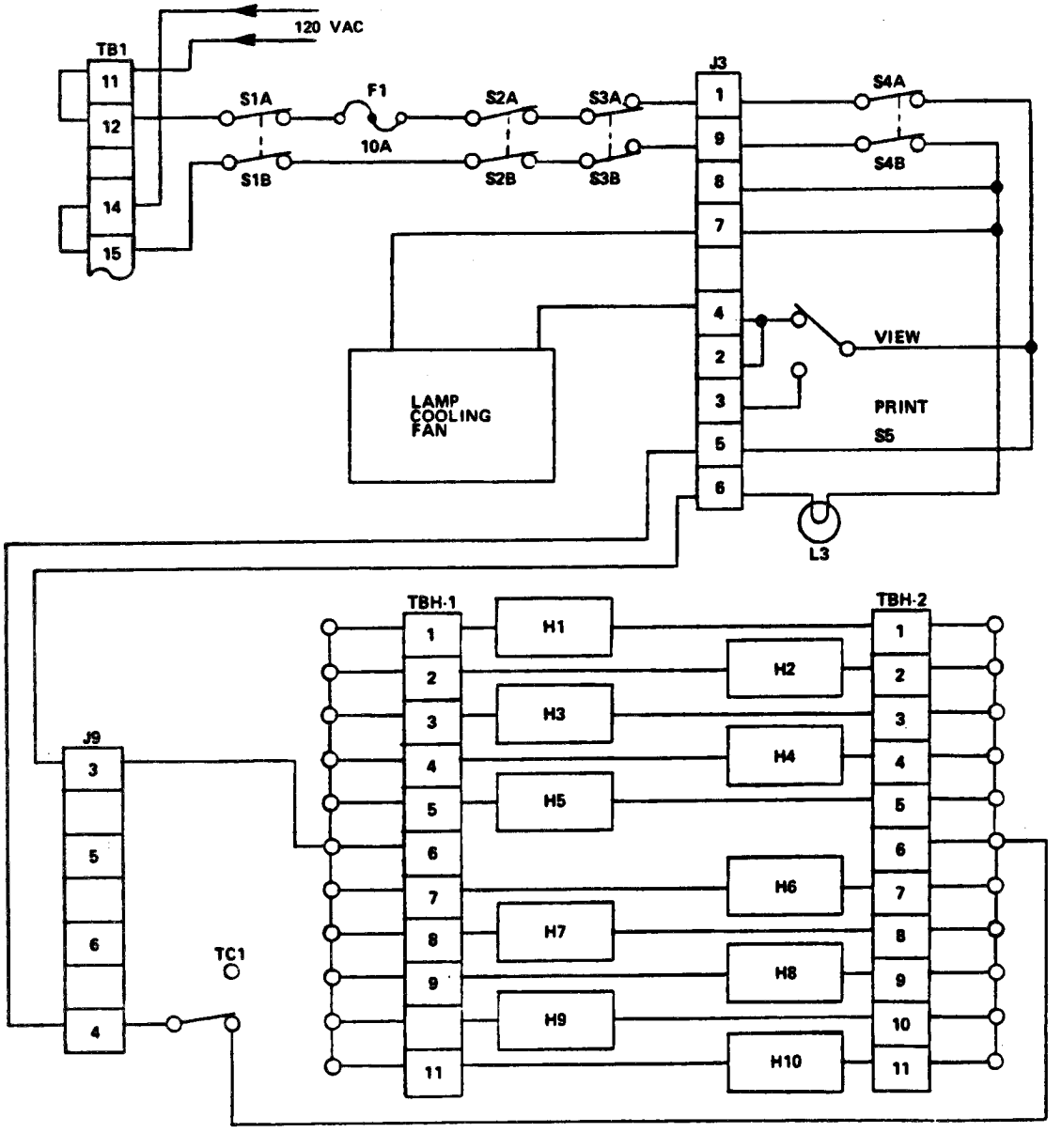
(4) With the main viewing mirror in the "home" position, the idler roller is positioned over paper on the printing easel. The paper is then driven downward as the paper drive roller rotates and the paper leaves the printing easel, entering the developer roller assembly, via a guide chute, to the thermal roller.



(5) The thermal roller is wrapped with heating elements and covered with insulation. In operation, it is kept at a temperature of 277°F (136°C) and develops print as it passes around the thermal roller. The completed print exits the reader-printer via a slot and guide in the base.

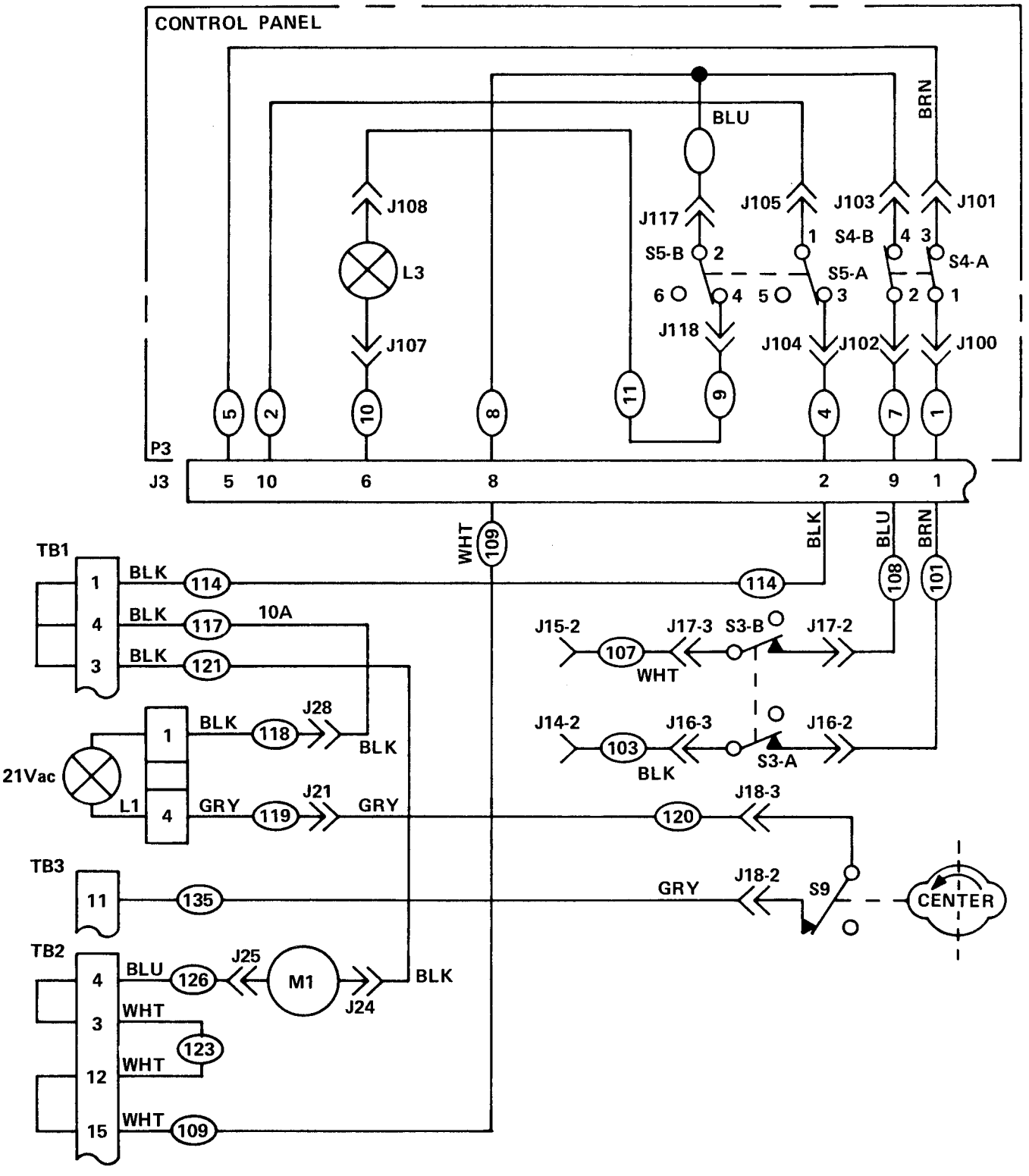
c. Electrical subsystem. Powers mirror drive motor, paper drive motor, heaters and drive motor, cooling fan, and exposure lamp. Provides sequence timing for view and print cycles.

(1) The reader-printer has 120 V ac power applied through left door interlock switch S1, main 10 amp fuse F1, rear cover S2, and right door S3 interlock. All power is removed from the reader-printer when any of the interlocked doors are open. A counter (CNT1) is used to maintain the number of copies made. The counter increases the count when the mirror motor is energized.

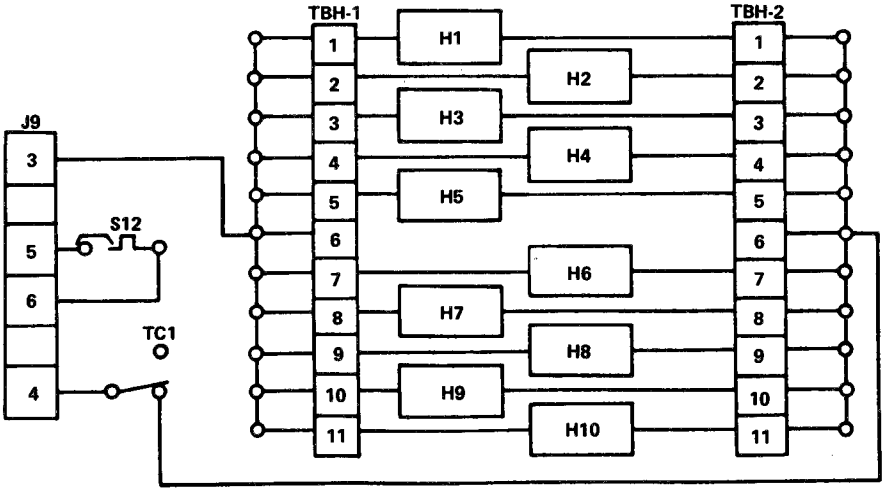


HEATER ASSEMBLY

(2) With VIEW/STANDBY switch S5 in VIEW position and ON/OFF switch S4 in ON position, line power is applied to heaters H1 thru H10 of developer unit and the lamp cooling fan.



(3) Exposure lamp L1 receives power from the secondary side of the power transformer via switch S9. Developer motor Ml receives 120 V ac also from the secondary side of the power transformer.



HEATER DEVELOPER ASSEMBLY

(4) During three to four minute warm-up cycle, two switches in the heater developer assembly remain closed: Temperature control thermostat TC1 remains closed to apply line voltage to the heaters until the temperature reaches 277°F (136° C). Temperature sensing switch S12 remains closed until temperature reaches 260° F (127° C). This stops movement of the main viewing mirror assembly and start of a print cycle before the heater developer assembly reaches the correct temperature.

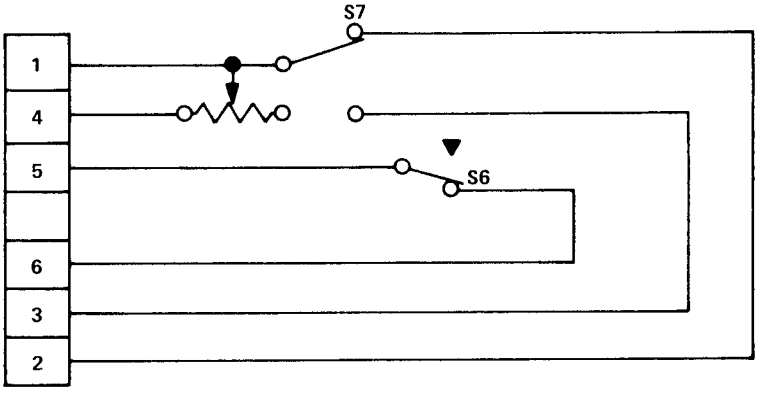
(5) The logic board is the control center for the reader-printer and determines that all conditions are met before allowing a print cycle to begin. This board also checks that the heater developer assembly is at the correct temperature, controls the mirror and paper drive motors, times the exposure lamp, and senses the paper length selected. Before the PRINT switch can start a print cycle, the logic board must receive a high signal from the following components:

(a) Temperature sensing switch S12.

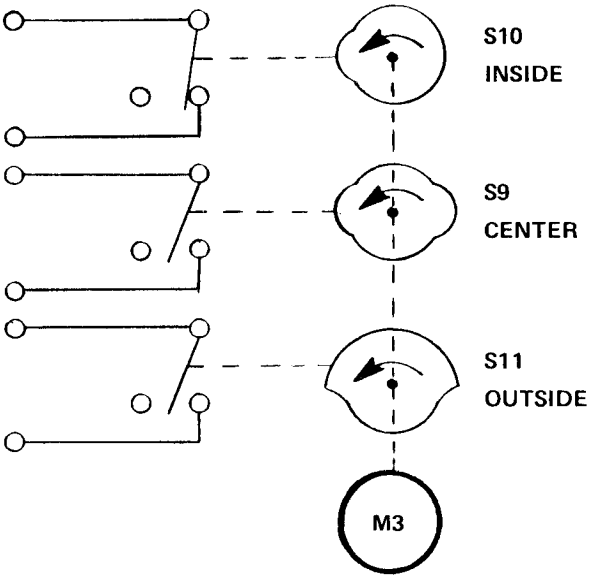
(b) Optical sensors 0S1 and 0S2. With no paper blocking light from the light-emitting diode (LED) to optical sensors, they produce a high signal at TP5 on the logic board.

(c) The main viewing mirror inside cam. This cam holds contacts of mirror home switch S1O open, and this gives a high signal at TP7 on the logic board.

(d) The main viewing mirror outside cam. This cam holds contacts of mirror forward switch S11 open, and this gives a high signal at TP9 on the logic board.



(6) When PRINT switch S6 is depressed, contacts are opened producing a high signal at TP6 on the logic board. The logic board now has high indications at TP5, 6, 7, and 9. These are all conditions required to initiate the print cycle. The mirror motor logic circuit applies start signal from integrated circuit U29 to transistor V4. This fires triac V2 which energizes mirror motor M3.



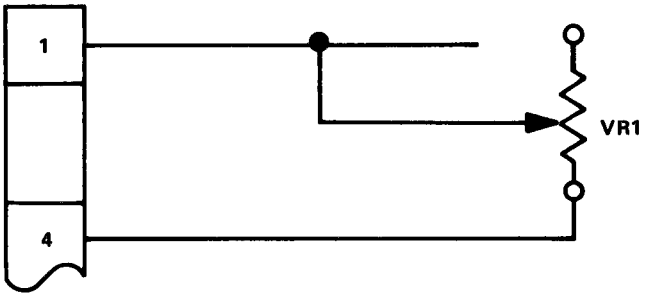
(7) When the mirror motor is energized, the main viewing mirror assembly begins to move forward from the "home" position. The cam, which is driven by the mirror motor, starts to rotate counterclockwise, operating switches S9, 10, and 11. The contacts of mirror forward switch S11 remain open, and this tells the logic board via TP9 to keep the mirror motor running. The contacts of mirror home switch S10 close. This puts TP7 low. The contacts of exposure lamp switch S9 open to remove voltage from one side of exposure lamp L1. The paper drive begins when the main viewing mirror starts to move forward and away from the mirror's "home" position. Before the paper drive motor can start, the logic board needs to see the correct signals from:

(a) Optical sensors 0S1 and 0S2. With no paper blocking light from the light-emitting diode (LED) to the optical sensors, they produce a high signal at TP5.

(b) Outside cam S11. With the mirror away from the “home” position, this switch is held open, producing a high signal at TP9.

(c) Inside cam S1O. With the mirror away from the ‘home” position, this switch is closed, producing a low signal at TP7. The logic board now has a high signal at TP5 and TP9 with a low signal at TP7. These are indications required to initiate a paper drive cycle. The paper drive logic now applies a start signal from integrated circuit U21O to transistor V3. This fires triac V1, which energizes paper drive motor M2. As main viewing mirror approaches the mirror’s forward position, the paper is driven down the printing easel to the expose position. As either optical sensor 0S1 or 0S2, depending on position of print length switch, detects leading edge of paper, it puts TP5 low. With TP5 low, the paper drive logic turns off paper drive triac V1 and stops the paper drive motor.

(8) The main viewing mirror stops at the mirror’s forward position. Contacts of mirror forward switch S11 close, putting TP9 low. This turns off mirror motor triac V2, which stops mirror motor M3. The contacts of exposure lamp switch S9 close and apply voltage to exposure lamp. The main viewing mirror remains in the forward position, and exposure lamp exposes paper on the printing easel.

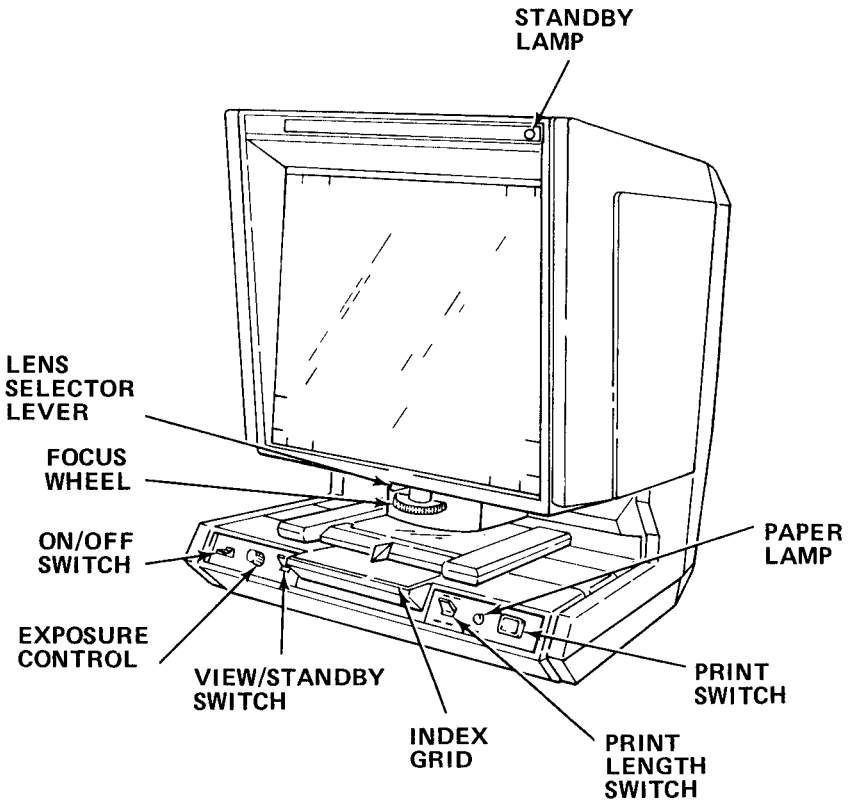


(9) The exposure control VR1 setting adjusts the timing circuit composed of V5 and U25 on the logic board. The timing circuit determines the period of time that the main viewing mirror assembly remains in the forward position and therefore, how long exposure lamp switch S9 remains closed. At the end of the exposure cycle, the timing circuit overrides low on TP9 and starts mirror motor M3.

(10) The main viewing mirror moves away from the forward position back toward the “home” position. Contacts of exposure lamp switch S9 open, and exposure lamp goes out. As the main viewing mirror approaches the “home” position, linkage of the mirror actuates the paper cutter, the upper nip rollers contact the paper, and the drive rollers drive the paper down the printing easel. When the paper is moved down the printing easel, it clears optical sensors 0S1 and 0S2, and TP5 goes high. With the main viewing mirror in the “home” position, mirror home switch S1O opens and TP7 goes high. Mirror forward switch S11 opens and TP9 goes high. Exposure lamp switch S9 closes and exposure lamp comes on. The reader-printer is now ready to begin another print cycle.

Section II OPERATING INSTRUCTIONS

3-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Standby Lamp	When 1 it, indicates that power is applied to Reader-Printer and that VIEW/STANDBY switch is in STANDBY position.
PAPER Lamp	When ON/OFF switch is first placed in ON position, PAPER lamp comes on to indicate reader-printer is in warm-up cycle. If PAPER lamp comes on again after initial warm-up, it indicates that unit is either out of paper or that paper is stalled on printing easel.

Control or Indicator	Function
PRINT Switch	Press and hold momentarily to make print. Switch is defeated when paper lamp is on or when VIEW/STANDBY switch is in STANDBY position.
Print Length Switch	SHORT PRINT position produces 8.5 in. (21.6 cm) long prints. LONG PRINT position produces 11 in. (27.9 cm) long prints.
Index Grid	Allows rapid location of individual microfiche frame.
VIEW/STANDBY Switch	In VIEW position, allows viewing of microfiche frame immediately and, after initial warm-up cycle, permits printing of that frame. In STANDBY position, supplies power to print heaters and standby lamp. This allows immediate printing when switch is placed in VIEW position.
EXPOSURE Control	Adjusts contrast of print to match density of microfiche frame.
ON/OFF Switch	Applies power to reader-printer.
Focus Wheel	Adjusts lens to sharpen image on viewing screen or print.
Lens Selector Lever	Selects viewing lens when in full left or right position. Allows removal of lens when in center position.

3-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

3-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic-service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The "Equipment is Not Ready/Available If" column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Cheesecloth (Item 8, Appendix E)	ar
Anderol Lubricant 495 (Item 5, Appendix E)	ar
Liquid Detergent (Item 10, Appendix E)	ar
Lens Tissue (Item 30, Appendix E)	ar
Lens Cleaner (Item 7, Appendix E)	ar
Dusting Brush	1 ea

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
s - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		MICROFICHE READER-PRINTER	
1	M	Inspect.	
		1. Unplug power cord.	
		2. Inspect power cord for cuts, breaks, broken plug, and other signs of damage.	Power cord has cuts, breaks, or broken plug.
		3. Inspect exterior of reader-printer for dents, scratches, broken glass, and missing parts.	
		4. Inspect control panel for loose or damaged components.	Control panel has loose or damaged components.
		5. Inspect lens and mirrors for breaks, scratches, and broken or missing parts.	Lens is cracked, scratched, or broken.
		6. Plug in power cord.	Viewing screen or secondary mirror broken.

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A- After | W - Weekly M - Monthly Q - Quarterly | AN - Annually s - Semiannually BI - Biennially | (Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED / PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		MICROFICHE READER-PRINTER - Cont	
2	B	Clean. 1. Unplug power cord. 2. Clean exterior of reader-printer using cheesecloth moistened with mild detergent and warm water. 3. Brush off loose dust from viewing screen. CAUTION Exercise great care when removing or handling viewing screen. Damage to viewing screen can result. 4. Remove viewing screen by pushing screen up and lifting out lower edge. Place viewing screen in safe place.	Viewing screen scored or broken.

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

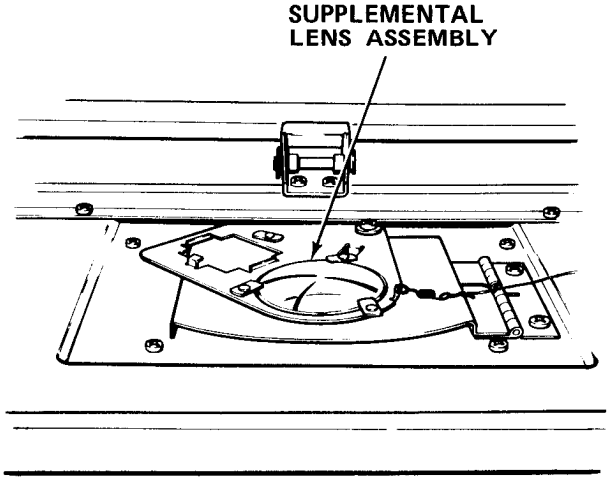
B - Before
D - During
A - After

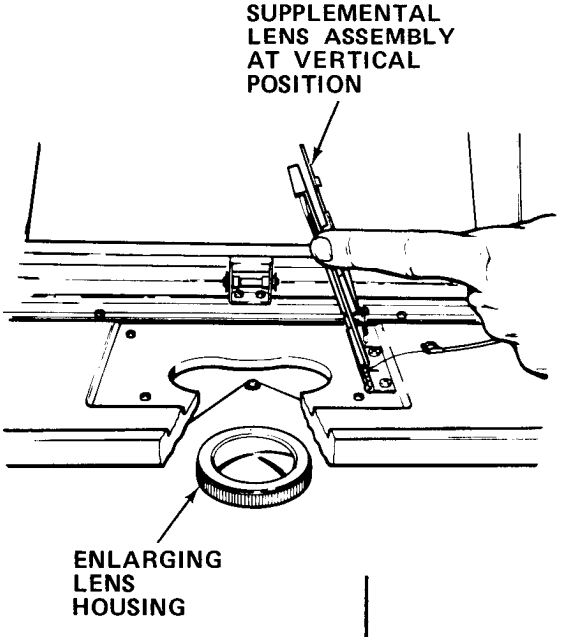
W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		MICROFICHE READER-PRINTER - Cont	
2	B	Clean - Cont	





NOTE

Note position of enlarging lens. Replace in same position.

	5. Lift supplemental lens assembly to vertical position. With other hand, move enlarging lens selector lever to center position, and remove enlarging lens assembly from yoke of enlarging lens housing.	Supplemental lens assembly cracked or broken.
	6. Carefully lower supplemental lens to original position.	
	7. Clean enlarging lens with lens cleaner and lens tissue.	
	8. Lift supplemental lens assembly to vertical position. Clean underside of lens with lens cleaner and lens tissue.	

Table 3-1. OPERATOR PEVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before, D - During, A - After | w - weekly, M - Monthly, Q - Quarterly | AN . Annually, S - Semiannually, BI - Biennially | (Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED / PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		MICROFICHE READER-PRINTER - Cont	
2	B	Clean-Cont 9. Hold supplemental lens assembly vertical and, with other hand, insert enlarging lens through opening into yoke of lens housing. Make sure keys of assembly seat correctly with slots of yoke. 10. Carefully lower supplemental lens assembly to original position. 11. Clean upper surface of supplemental 1 ens assembly with lens cleaner and lens tissue. 12. Carefully wipe surface of top secondary mirror with lens tissue moistened with lens cleaner. 13. Carefully wipe surface of main viewing mirror with lens tissue moistened with lens cleaner. 14. Reinstall viewing screen. First insert upper edge of viewing screen into upper part of hood. Then swing lower part of viewing screen inward until it falls into lower slot. 15. Move enlarging lens selector lever to full right or full left position to place lens into optical path. 16. Open left-hand lower panel.	Enlarging lens selector will not move.

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN . Annually S - Semiannually Bl - Biennially | (Number) - Hundreds of Hours

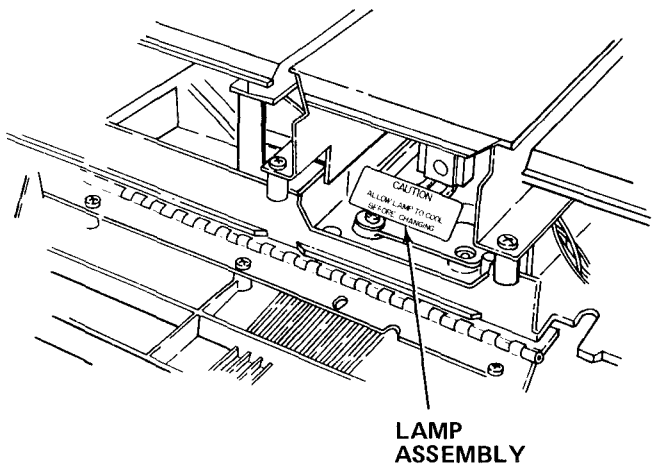
ITEM NO.	IN-TER VA 1	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		MICROFICHE READER-PRINTER - Cont	
2	B	Clean - Cont	
			
		17. Grasp handle of 1 amp assembly and pull unit out until it stops.	
		18. Carefully wipe surface of 45-degree mirror with lens tissue moistened with lens cleaner.	Mirror broken or cracked.
		19. Push lamp assembly firmly into reader-printer to engage connector at rear.	
		20. Close left-hand door.	
		21. Pull microfiche handler out to full extent.	
		22. Carefully clean upper and lower microfiche glass with cheesecloth.	Upper and lower microfiche glass scratched.
		23. Push microfiche handler back into position.	
		24. Plug in power cord.	

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

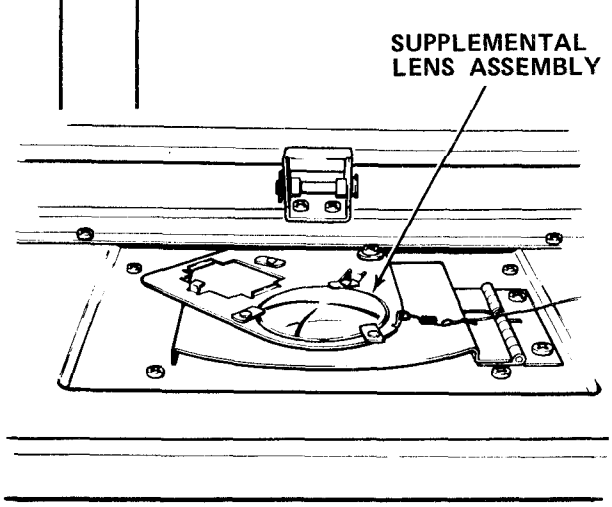
B - Before, D - During, A - After; w - Weekly, M - Monthly, Q - Quarterly; AN - Annually, s - Semiannually, BI - Biennially; (Number) - Hundreds of Hours

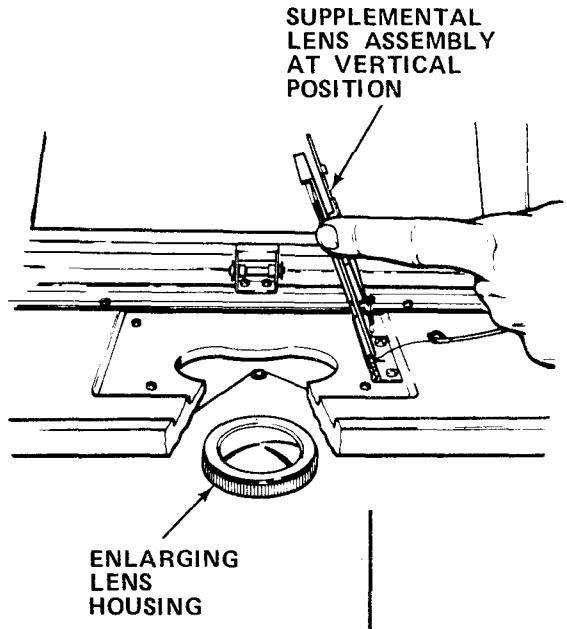
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED / PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		MICROFICHE READER-PRINTER - Cont	
3	B	Clean Lens Sleeve Threads.	
		1. Unplug power cord.	
		CAUTION Exercise great care when removing or handling viewing screen. Damage to viewing screen can result.	
		NOTE Left and right on reader-minter are taken when viewed-from front.	
		2. Remove viewing screen by pushing upward and lifting out lower edge. Place viewing screen in safe place.	Viewing screen cracked.

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN . Annually S - Semiannually Bl - Biennially | (Numbed - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		MICROFICHE READER-PRINTER - Cont	
3	B	Clean Lens Sleeve Threads - Cont	





		3. Lift supplemental lens assembly to vertical position. With other hand, move enlarging lens selector lever to central position, and remove enlarging lens assembly from yoke of enlarging lens housing.	Supplemental lens assembly cracked. Enlarging lens cracked.
		4. Lower supplemental lens to original position.	

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES . Cont

B - Before
D - During
A - After

W - Weakly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

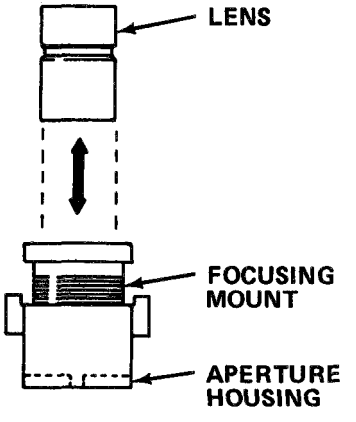
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available if:
		MICROFICHE READER-PRINTER - Cent	
3	B	Clean Len Sleeve Threads - Cont	
			
		5. Remove lens from focusing mount and aperture housing.	
		6. Clean threads of focusing mount and aperture housing.	Threads dirty and/or damaged.
		7. Replace focusing mount into aperture housing.	
		8. Replace lens into focusing mount.	
		9. Lift supplemental lens to vertical position and, with other hand, place enlarging lens assembly into yoke of enlarging lens housing.	
		10. Lower supplemental lens into position.	

Table 3-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cent

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

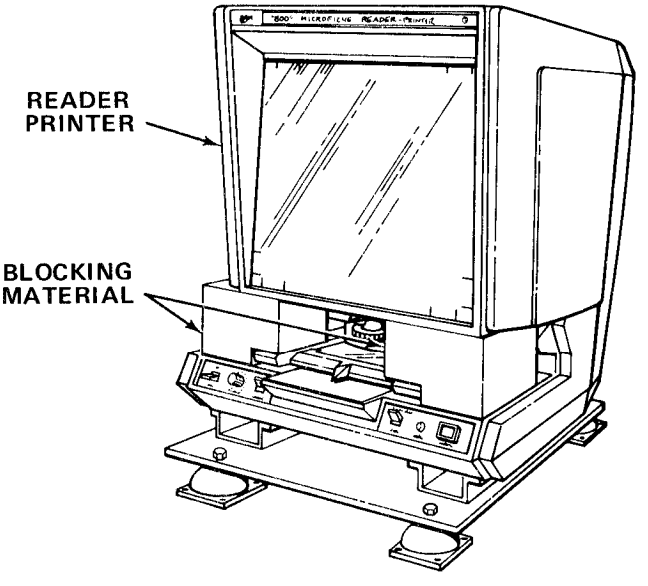
AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Reediness Reporting, Equipment is Not Ready/ Available If:
		MICROFICHE READER-PRINTER - Cont	
3	B	Clean Lens Sleeve Threads - Cont 11. Lift viewing screen into hood. Secure by lifting upward and pushing bottom edge of screen inward. Then lower viewing screen. 12. Place lens selector lever to full left or full right position. 13. Plug in power cord.	

3-6. OPERATION UNDER USUAL CONDITIONS.

3-6.1 Assembly and Preparation For Use.

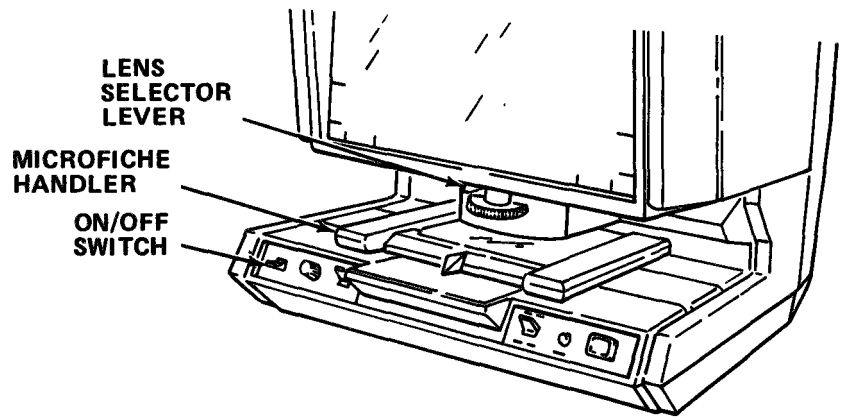


a. Remove blocking and packing material.

b. Perform your before (B) PMCS.

c. Plug in reader-printer power cord to permit equipment to warm up.

3-6.2 Operating Procedures.

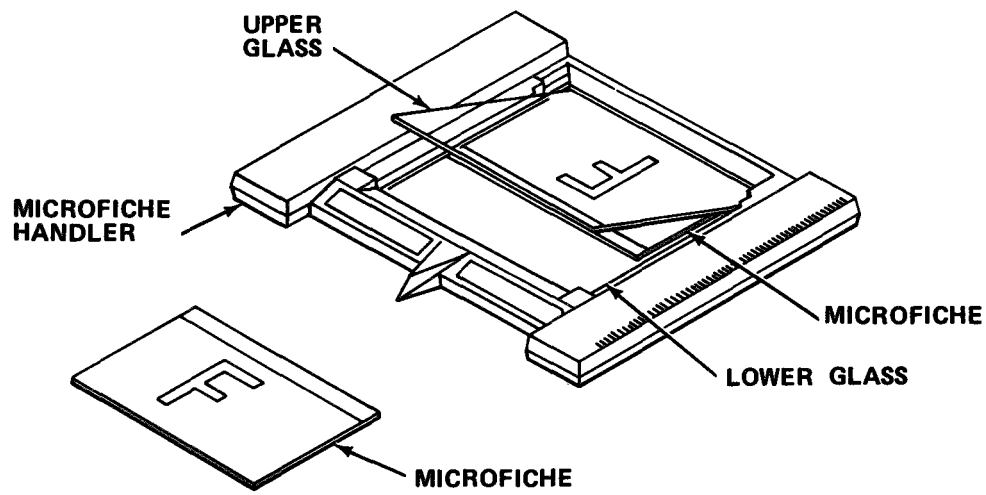


a. Viewing.

(1) Plug in power cord and turn on ON/OFF switch.

(2) Move lens selector lever to full left or full right position.

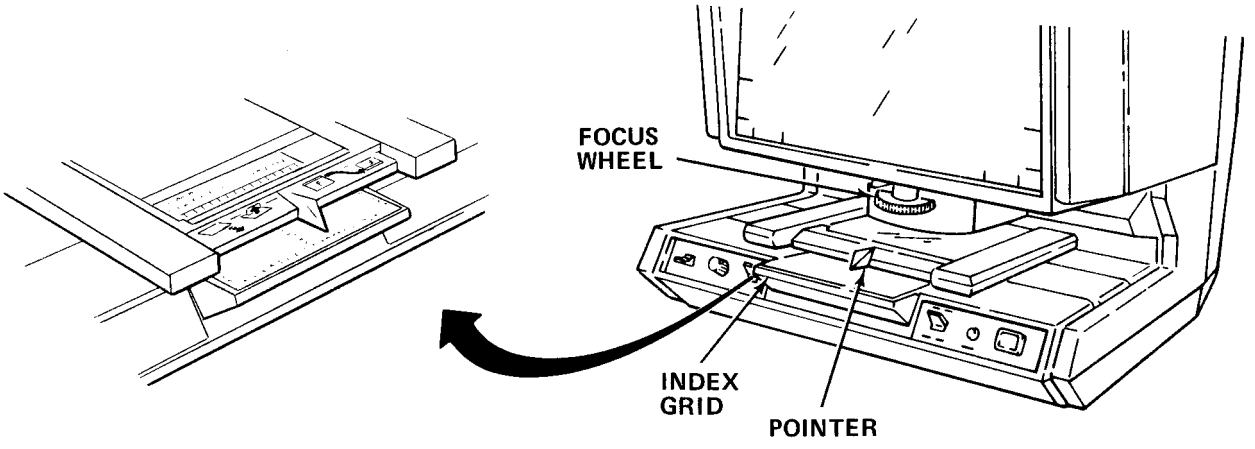
(3) Pull microfiche handler toward you until upper glass opens.



(4) Place selected microfiche between upper and lower glass of microfiche handler. Slide microfiche back against rear stop and against right stop.

(5) Push microfiche handler in until upper glass closes.

(6) Move lens selector lever to either full right or full left, and leave in position-which gives most satisfactory image of microfiche on viewing screen.



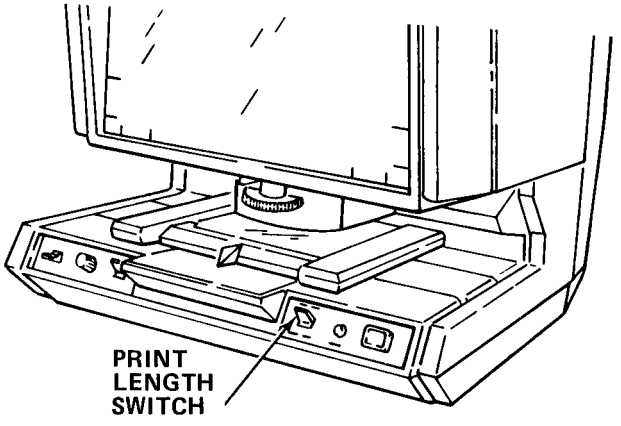
(7) Check that index grid is in position under pointer of microfiche handler. (The grid is movable.)

(8) Center image on viewing screen by moving microfiche handler pointer. Using focus wheel, adjust for sharp image of microfiche frame on viewing screen.

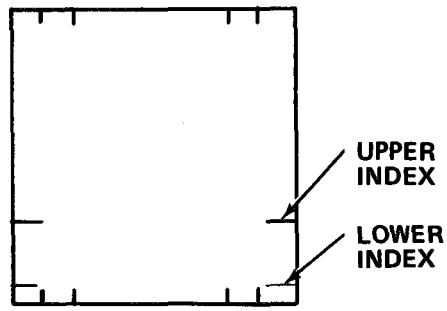
(9) Reposition index grid until pointer of microfiche handler points to same grid coordinate as shown on viewing screen.

(10) Select required individual microfiche frame by moving microfiche handler pointer to frame coordinate on index grid. Focus image on viewing screen until it is sharp.

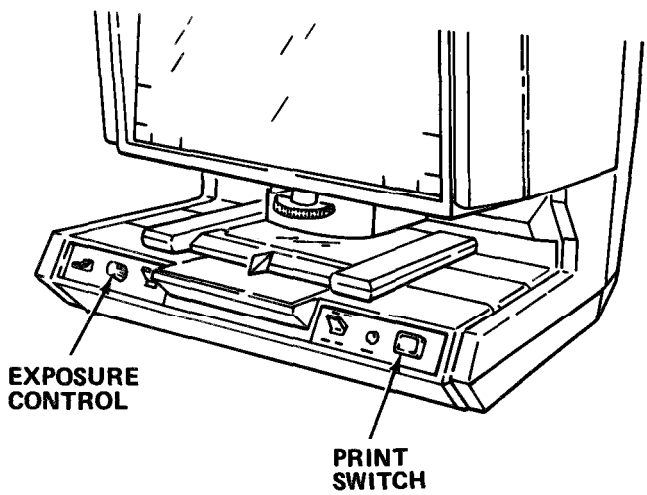
b. Making print.



(1) Before making print, use viewing screen to determine required position of print length switch.



(2) Line up top edge of image with top of viewing screen by moving microfiche handler pointer. If bottom edge of image is above upper index, place print length switch In SHORT PRINT position. If bottom edge of image is between upper and lower indexes, place print length switch in LONG PRINT position.



(3) Set EXPOSURE control to 3.5.

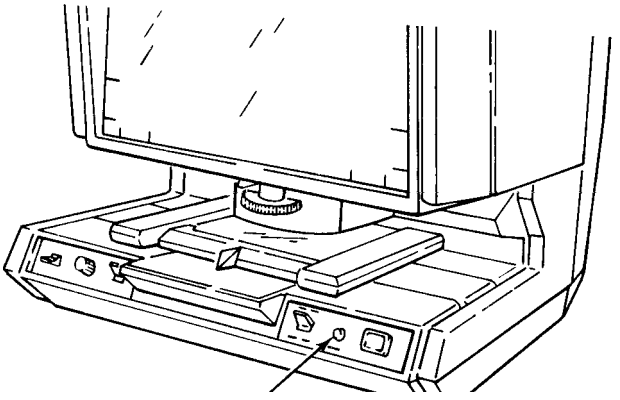
(4) To make print of image shown on viewing screen, press and hold PRINT switch momentarily.

CAUTION

Allow last print to completely exit before placing VIEW/STANDBY switch into STANDBY position or paper jams may occur.

(5) Observe finished print for satisfactory reproduction. If lighter or darker print is required, adjust EXPOSURE control. Lower settings produce lighter prints; higher settings produce darker prints.

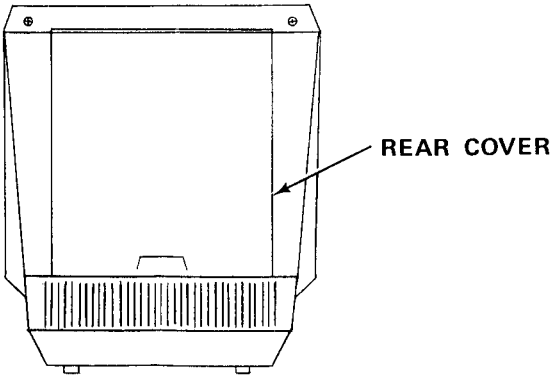
c. Loading new roll of paper.



(1) PAPER 1 amp will illuminate when paper roll is empty.

WARNING

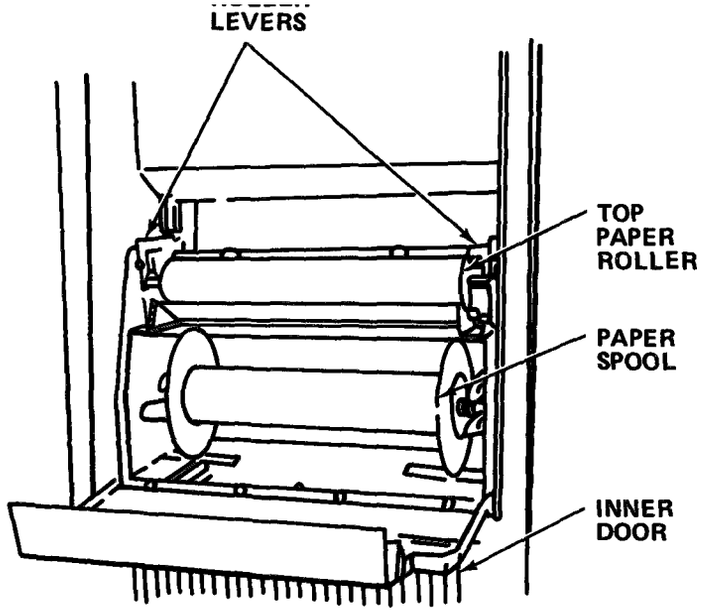
Before opening rear of side doors of reader-printer, place ON/OFF switch in OFF position and remove power cord from outlet. Death or serious personal injury may occur.



(2) Remove rear cover by lifting upward.

NOTE

Copy paper is light sensitive. Do not open inner door other than to replace paper or clear paper jam.

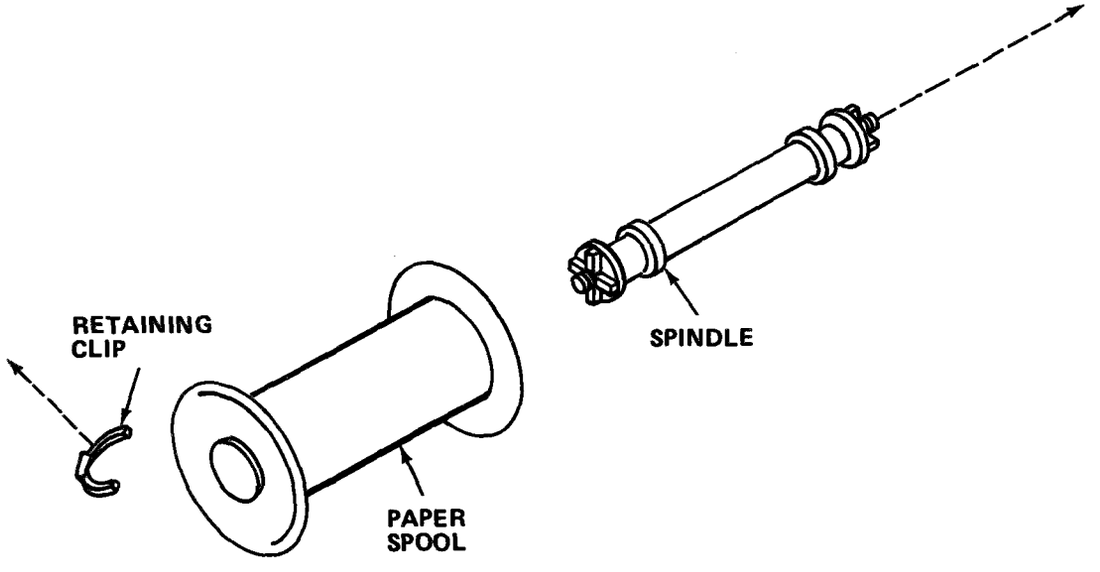


(3) Open inner door by pulling out and down from top.

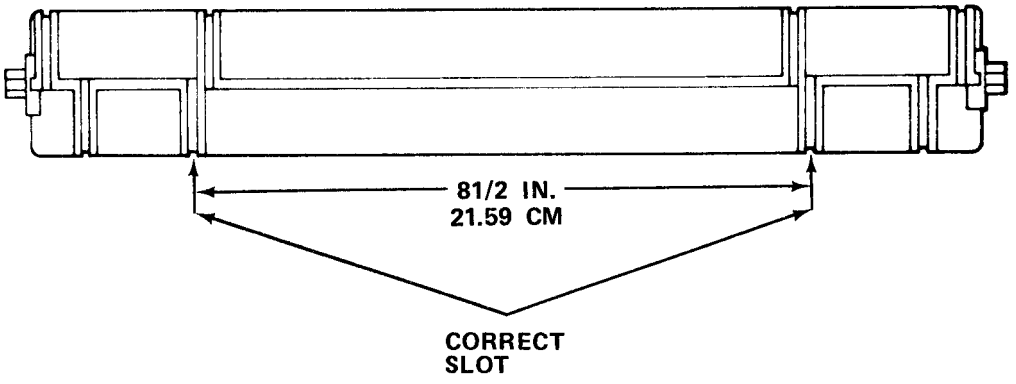
(4) Raise top paper roller by pushing up on paper roller levers.

(5) Remove empty paper spool from stock roll compartment by sliding it to rear of reader-printer.

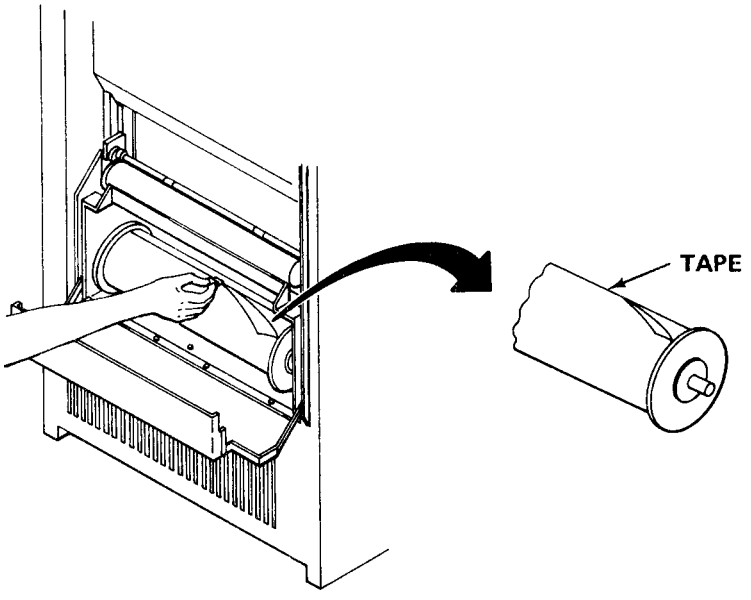
(6) Remove any paper remnants from paper rollers.



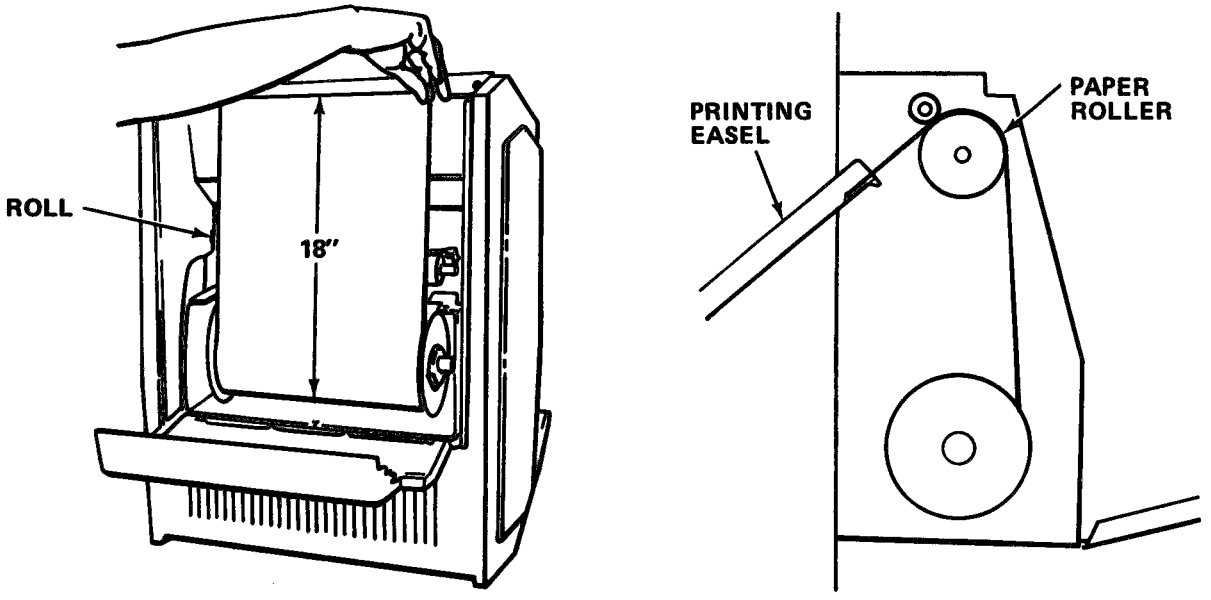
(7) Pull off one retaining clip and remove spindle from empty paper spool.



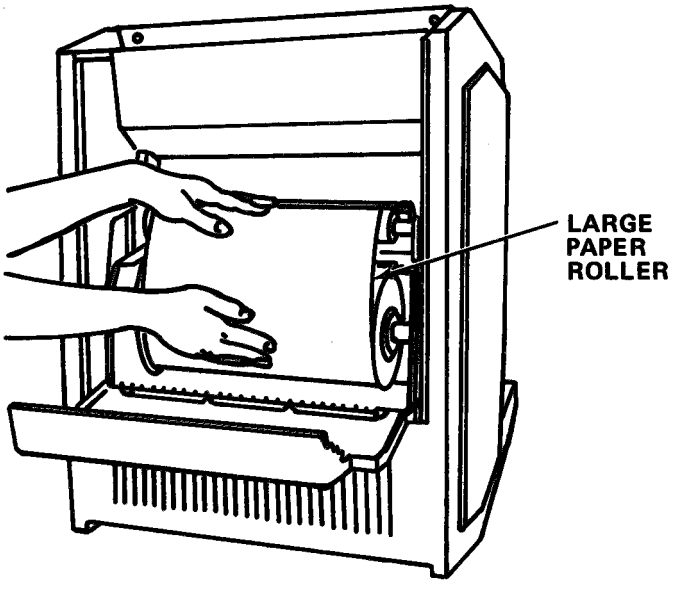
(8) Slide new roll of paper onto spindle and reinstall retaining clip. Use correct slot for width of paper.



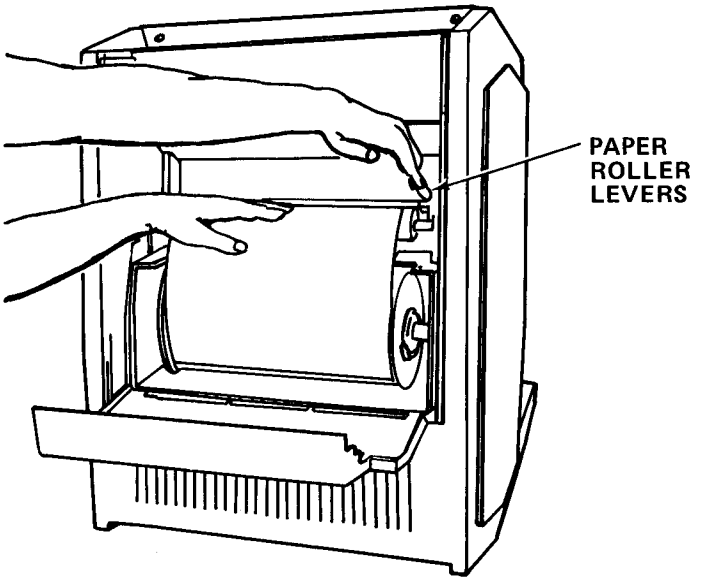
(9) Install paper roll into reader-printer only as shown. To avoid tearing leader, lift tape from roll only as shown.



(10) Pull 18 in. (45.7 cm) of leader from roll. Point leader down and insert it between paper rollers at same angle as printing easel.



(11) With leader resting on printing easel, press leader onto large paper roller with one hand. Then wind leader back onto paper roll with other hand. Allow approximately 1 in. (25.4 mm) of leader to rest on printing easel.



(12) Keep light pressure on leader to keep it centered on roller, and lower two paper roller levers.

(13) Close and secure inner and outer doors

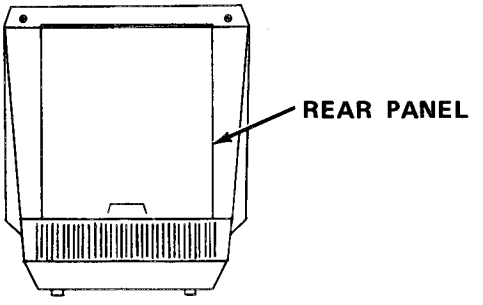
(14) Rotate exposure control fully left and set print length switch to LONG PRINT position.

(15) Reconnect power cord to outlet and place ON/OFF switch to ON position.

(16) Run five prints to clear leader from reader-printer. When leader-to-paper splice appears, reset EXPOSURE control and print length switch to their normal positions.

NOTE

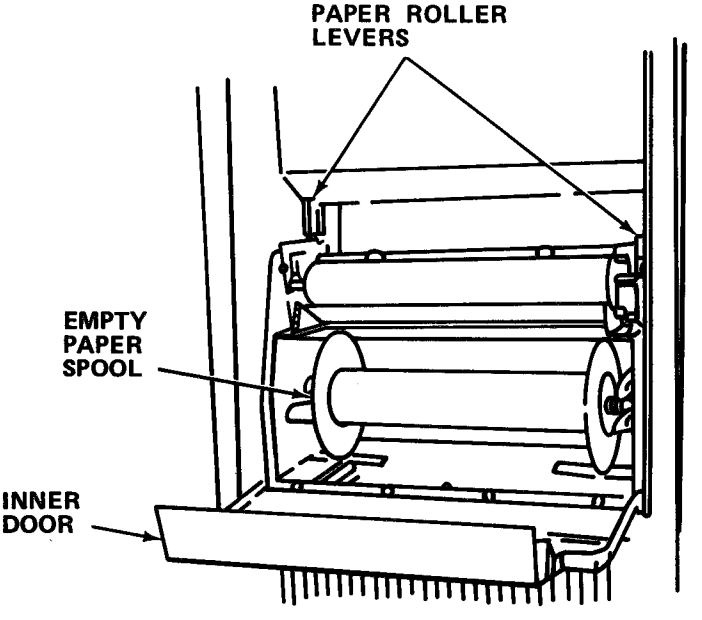
If inner rear door of reader-printer is opened before stock paper is exhausted, set EXPOSURE control fully left and print length switch to LONG PRINT position. Run five prints to clear exposed print paper prior to recommencing printing.



WARNING

Before opening rear panel of reader-printer, place ON/OFF switch to OFF and remove power cord from outlet. Serious injury or death may occur.

(1) Remove rear panel by lifting upward.

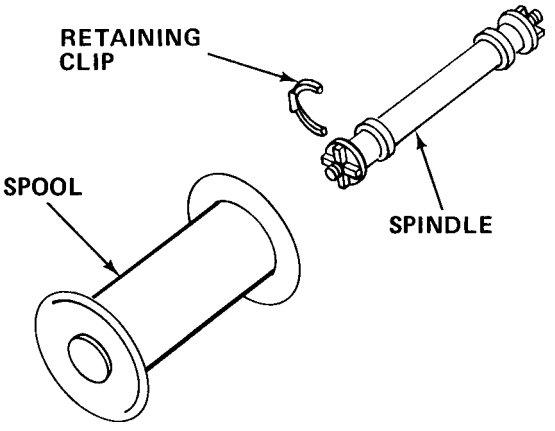


(2) Open inner door.

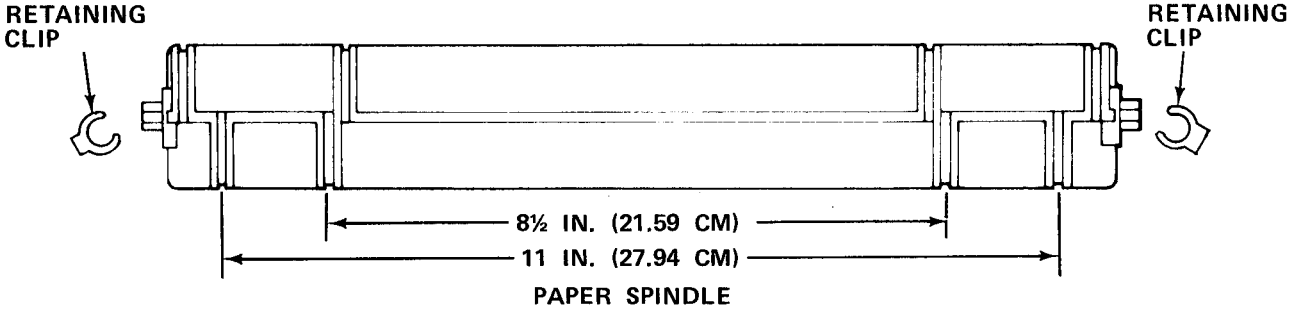
(3) Raise top paper roller by pushing up paper roller levers.

(4) Remove empty paper spool from stock roll compartment by sliding it to rear of reader-printer.

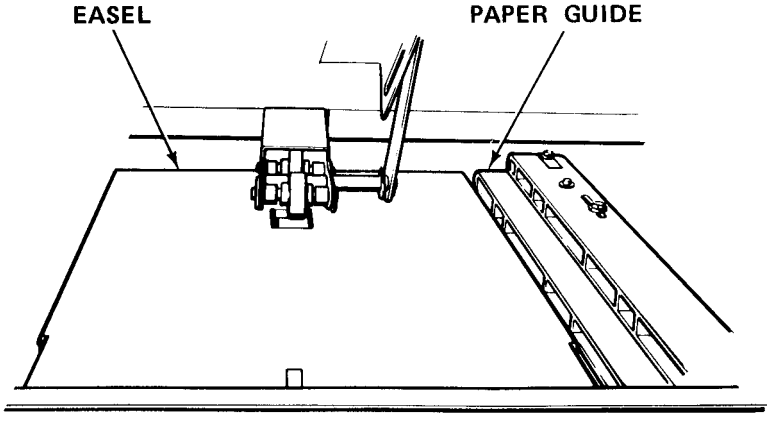
(5) Remove paper from paper rollers.



(6) Pull off one retaining clip and remove spindle from empty paper spool.



(7) Remove and reposition both retaining clips on stock roll spindle.



(8) Reach into easel area and pull paper guide toward you.

(9) Slide paper guide out to change from narrow to wide, or slide paper guide in to change from wide to narrow.

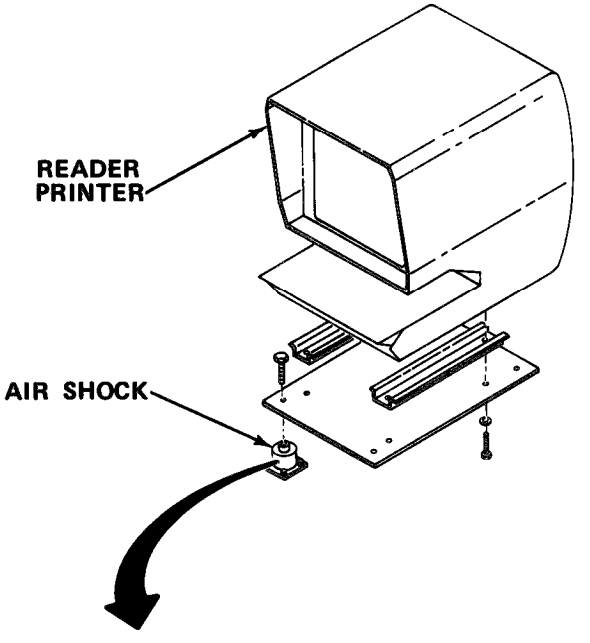
(10) Be sure that both top and bottom of paper guide are securely in place.

(11) Refer to paragraph 3-6.2 c, step (8) to complete loading of copy paper.

3-6.3 Operating Instructions on Decals and Instruction Plates.

THERMAL PROCESS
TURN THIS MACHINE OFF
AFTER NORMAL WORKING HOURS

CAUTION
ALLOW LAMP TO COOL
BEFORE CHANGING



LOAD MUST BE PLACED ATOP MOUNT BEFORE INFLATING.
MAXIMUM INFLATION PRESSURES MUST NOT BE EXCEEDED.
MOUNT MUST BE DEFLATED BEFORE REMOVAL OF LOAD.

BARRY STABL-LEVL SLM-24
LOAD RATING: 75 TO 300 LBS.
MAX. INFLATION 70 P.S.I.

EQUIPMENT LOAD ON MOUNT MUST BE WITHIN LOAD RATING.
EQUIPMENT MOUNTING SURFACE MUST BE, OR ADAPTED TO BE FLAT
AND OF SIZE TO COVER ENTIRE OUTSIDE DIAMETER OF MOUNT.

3-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

3-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication at this level of maintenance.

3-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during operation or maintenance of the microfiche reader-printer, or its components. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all test or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 3-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. READER-PRINTER IS INOPERATIVE.
Step 1. Check that power cord is plugged in.
(a) If power cord is plugged in, proceed to step 2.
(b) Plug in power cord.
Step 2. Examine power cord for damaged wire or broken plug.
(a) If power cord is not faulty, proceed to step 3.
(b) If power cord is faulty, notify organizational maintenance.

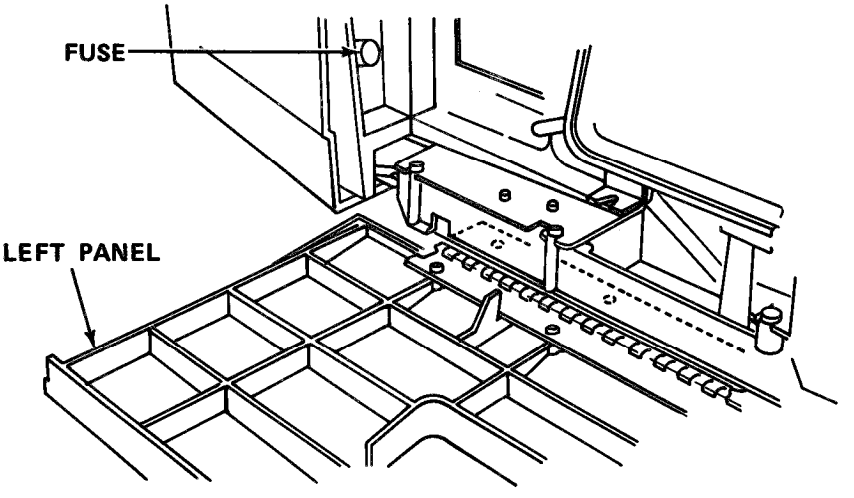
Table 3-2. TROUBLESHOOTING - Cent

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

1. READER-PRINTER IS INOPERATIVE - Cont



Step 3. Visually check fuse for broken filament.

(a) If fuse is defective, replace fuse.

(b) If reader-printer still does not operate, notify organizational maintenance.

2. VIEWING SCREEN DOES NOT LIGHT.

Step 1. Check that VIEW/STANDBY switch is in VIEW position.

(a) If properly positioned, proceed to step 2.

(b) Place in VIEW position.

Step 2. Check that lamp assembly is properly seated.

(a) If properly seated, proceed to step 3.

(b) Seat lamp assembly by pushing in firmly against stop.

Table 3-2. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
2. VIEWING SCREEN DOES NOT LIGHT - Cont
Step 3. Inspect exposure lamp for burned filament.
Replace exposure lamp.
3. PAPER LAMP ILLUMINATES DURING PRINT CYCLE.
Check paper supply.
Replace paper roll.
4. **POOR RESOLUTION.**
Check that lens assembly is properly installed.
Install assembly correctly.

3-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the microfiche reader-printer. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

3-10.1 Replace Exposure Lamp

MOS: 810, Terrain Analyst

SUPPLIES: Lamp (120 V ac, 150 W) DDL

WARNING

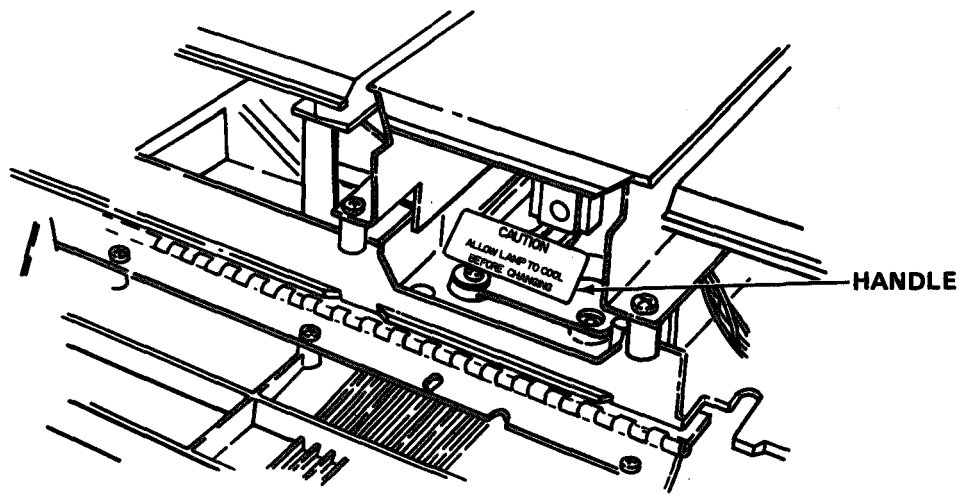
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

NOTE

Left and right on reader-printer are taken when viewed from front.

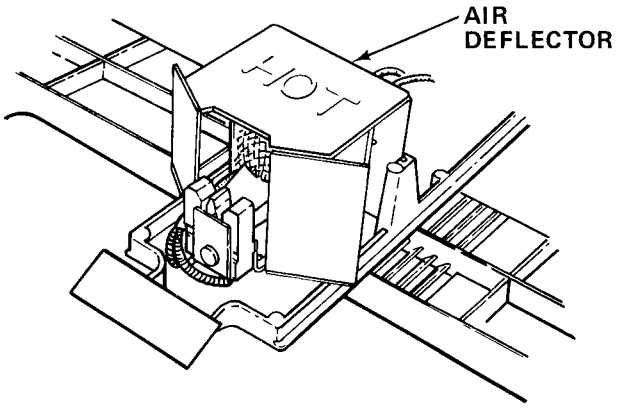
b. Open left-hand door.



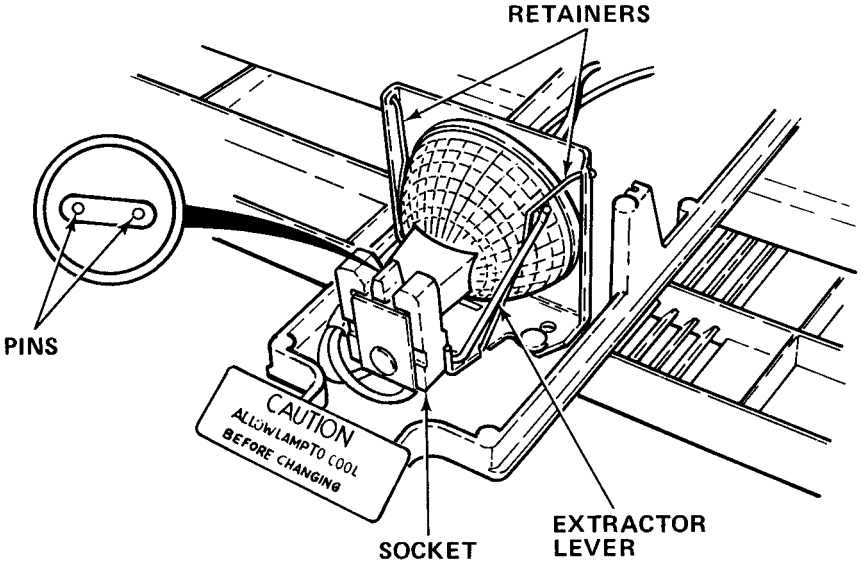
WARNING

If exposure lamp has recently failed, it may be hot enough to cause severe burn. Allow minimum of five minutes for lamp assembly to cool before attempting to change lamp.

c. Grasp handle of lamp assembly and pull out until it stops.



d. Remove air deflector by pulling upward out of retaining slots.



e. Pull extractor lever back.

f. Remove exposure lamp by lifting upward.

CAUTION

Do not touch inside of reflector or bulb assembly with bare hands. Fingerprints on either area can cause premature failure of exposure lamp or significant decrease in lamp performance.

g. Remove new exposure lamp from packaging, handling only by outside of reflector.

h. Position pins horizontally.

i. Position bell of reflector into retainers, and press down until pins seat firmly in socket.

j. Reinstall air deflector.

k. Push in lamp assembly firmly to engage connector at rear.

l. Close left side door.

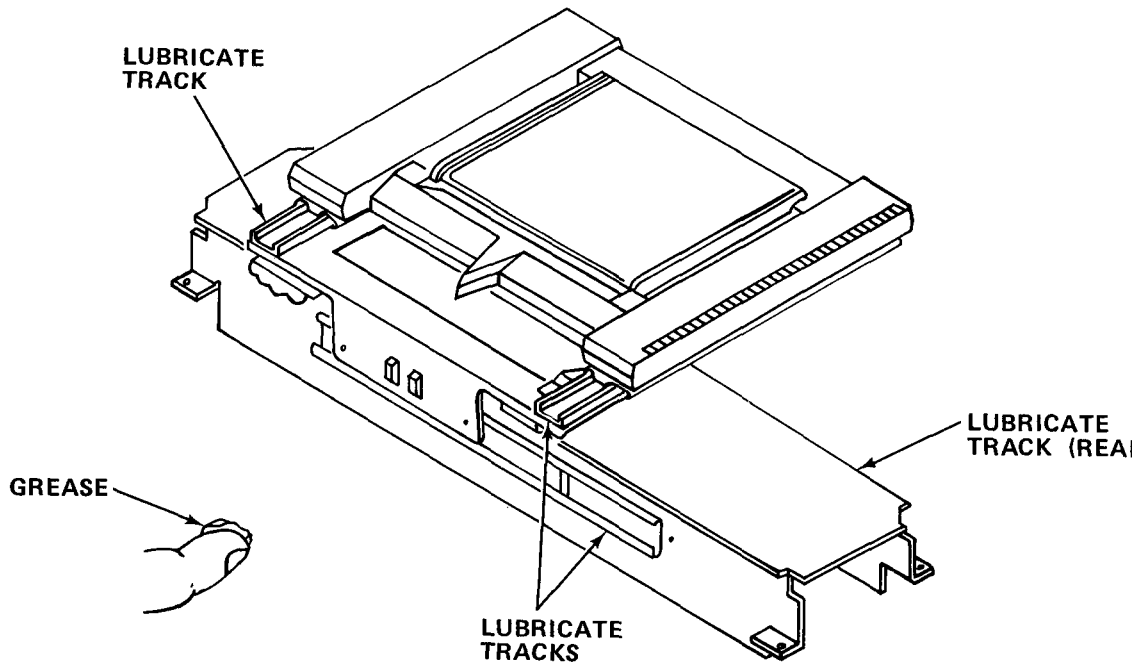
m. Plug in power cord.

Section IV ORGANIZATIONAL MAINTENANCE

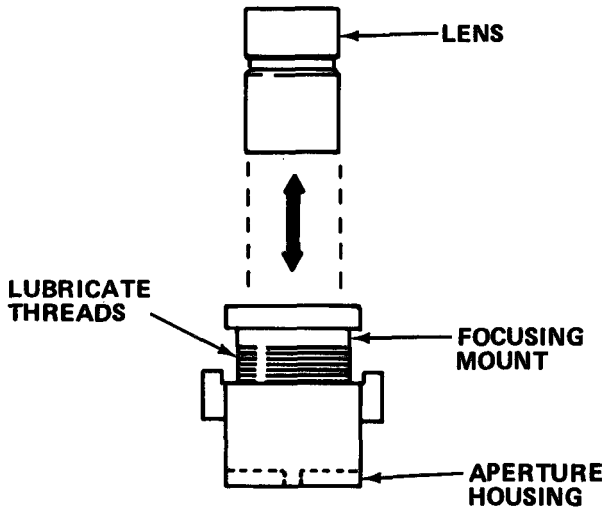
3-11. LUBRICATION INSTRUCTIONS.

NOTE

These lubrication instructions are mandatory.



3-11.1 Microfiche Handler. Apply thin film of silicone grease (Item 13, Appendix E) to four tracks qarterly (refer to paragraph 3-16.3 for disassembly procedures).



3-11.2 Focusing Mount and Aperture Housing. Lightly coat threads of focusing mount and aperture housing with Anderol Lubricant 495 (Item 5, Appendix E) quarterly.

3-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT(TMDE);AND SUPPORT EQUIPMENT.

3-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

3-12.2 Special Tools: Test, Measurement, and Diagnostic Equipment: and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

3-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering organizational maintenance for this equipment.

3-13. SERVICE UPON RECEIPT.

3-13.1 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, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

3-14. ORGANIZATIONAL PREVENTIVE **MAINTENANCE CHECKS AND SERVICES.** There are no organizational PMCS procedures assigned for this equipment.

3-15. **ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.**

a. Organizational troubleshooting procedures cover the most common malfunctions that may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/ inspection and corrective action. If a malfunction is not listed or corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the facing schematic or the foldout located at the end of this manual for further fault analysis.

d. If the microfiche reader-printer does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedures for dead receptacle (Table 1-4).

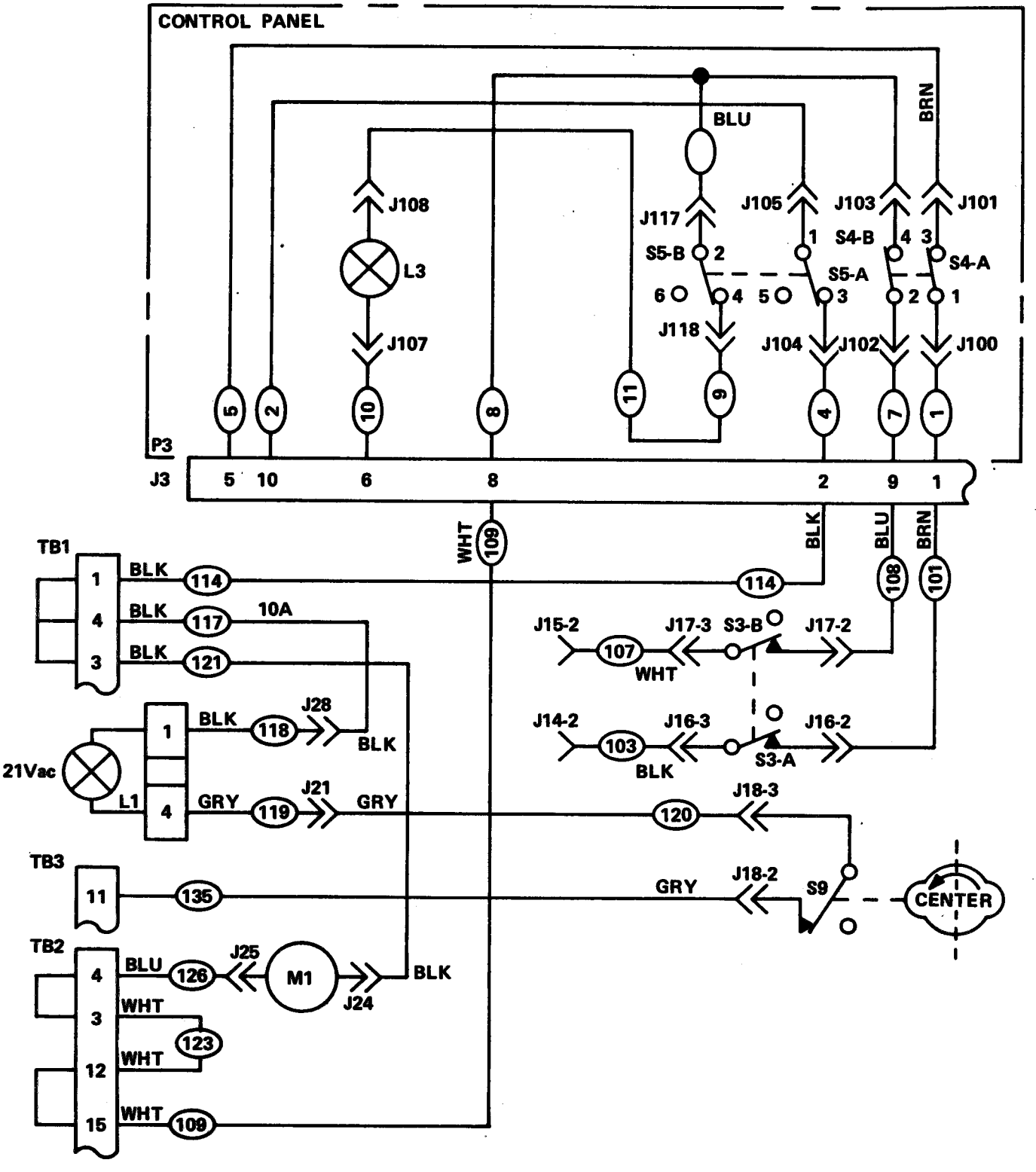

CONTROL PANEL
BLU
BRN
J108
L3
J107
J117
J105
J103
J101
S5-B
S4-B
S4-A
S5-A
J118
J104
J102
J100
P3
J3
WHT
109
BLK
BLU
BRN
108
101
TB1
BLK
114
10A
117
121
J15-2
J17-3
S3-B
J17-2
107
WHT
J28
118
21Vac
L1
GRY
119
J21
J14-2
J16-3
J16-2
103
S3-A
J18-3
120
TB3
11
135
J18-2
S9
CENTER
TB2
BLU
126
J25
M1
J24
12
123
15

Table 3-3. ORGANIZATIONAL TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1. READER-PRINTER IS INOPERATIVE.	
Step 1. Examine all interlocks for correct operation.	(a) If interlocks operate correctly, proceed to step 2. (b) Adjust interlocks (paragraph 3-16.2).
Step 2. Inspect for loose or defective power transformer and ac plug connections.	(a) If connections are tight, proceed to step 3. (b) Tighten connections.
Step 3. Test ON/OFF switch for continuity.	(a) If continuity is present, proceed to step 4. (b) If no continuity is present, replace ON/OFF switch (paragraph 3-16.3).
Step 4. Test power transformer for 120 V ac input/output.	Replace defective transformer (paragraph 3-16.6).
2. VIEWING SCREEN DOES NOT LIGHT.	
Test VIEW/STANDBY switch for continuity.	Replace switch if no continuity is present (paragraph 3-16.3).

Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
3. PRINT SWITCH DOES NOT ACTIVATE PRINT.	
Step 1. Test for defective print length switch as follows:	
(a) Select SHORT PRINT on print length switch.	
(b) Press PRINT switch.	
(c) If print is not produced, select **LONG PRINT** on print length switch.	
(d) Press PRINT switch.	
(e) If PRINT is produced in only one position of print length switch, replace print length switch (paragraph 3-16.3).	
(f) If reader-printer will not print in either switch position, proceed to step 2.	
Step 2. Test alinement of optical sensors on printing easel.	
(a) If in proper alinement, proceed to step 3.	
(b) Adjust optical sensors (paragraph 3-16.4).	
Step 3. Test optical sensors for blocked or faulty operation.	
(a) If optical sensors operate properly, proceed to step 4.	
(b) Replace optical sensors (paragraph 3-16.5).	
Step 4. Test PRINT switch for continuity.	
(a) If continuity does not exist replace PRINT switch (paragraph 3-16.3).	
(b) If continuity exists, refer to direct/general support maintenance.	

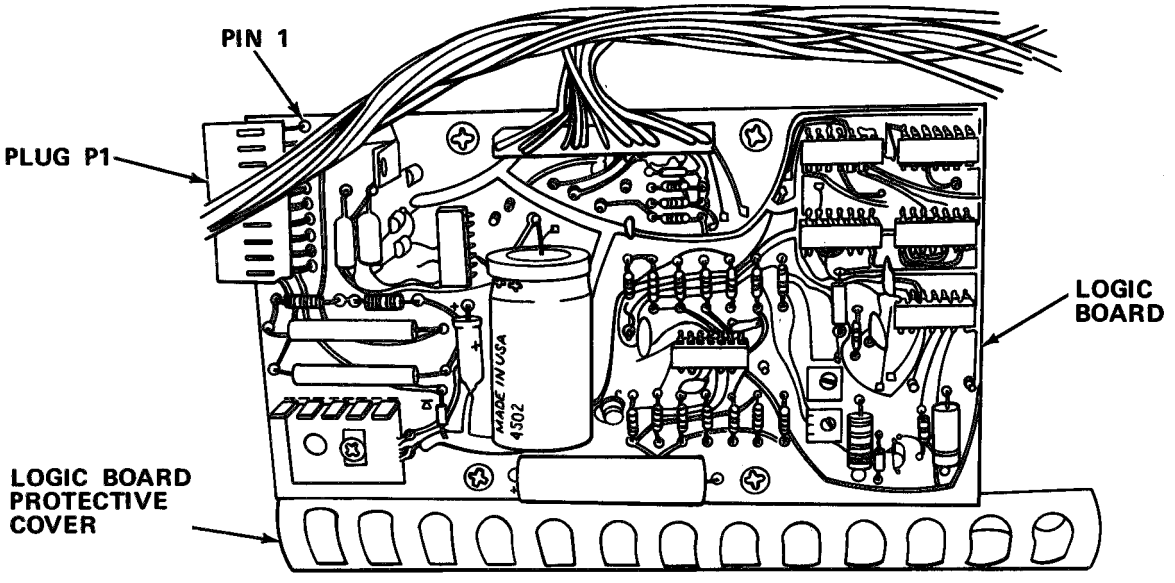
Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
4. LIGHT BAR ACROSS TOP OF VIEWING SCREEN. Check adjustment of secondary mirror. Adjust secondary mirror (paragraph 3-16.7).
5. PARTIAL OR NO PAPER DRIVE. Step 1. Inspect that drive rollers are correctly engaged. (a) If drive rollers are engaged, proceed to step 2. (b) If drive rollers are not engaged, engage rollers. Step 2. Remove paper drive roller, and check for slippage of plastic end caps. (a) If no play is present, proceed to step 3. (b) If caps show signs of slippage, reglue caps to roller. Step 3. Check for proper light shield alinement at top roller. (a) If light shield is properly alined, proceed to step 4. (b) If light shield presses on top roller when reloading door is closed, adjust light shield by bending away from loading door. Step 4. Test rollers for freedom of rotation. (a) If rollers are free, proceed to step 5. (b) If rollers are not free, lubricate roller shaft bearing with general purpose lubricating oil (Item 14, Appendix E).

Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

5. PARTIAL OR NO PAPER DRIVE - Cont



REAR OF READER PRINTER

step 5. Open rear panel and remove logic board protective cover. Using multimeter set to read 0-200 V ac, measure between **P1** pins 1 and 4 on logic board. Place reader-printer into operation. Voltage between pins 1 and 4 must drop from 115 V ac to 0 volts ac during paper drive cycle.

(a) **If** voltage drops to 0, proceed to step 6.

(b) If voltage does not drop to 0 volts ac, refer to direct support maintenance.

Step 6. Open rear panel of reader-printer. Disconnect paper drive motor from its supply. Using multimeter, check for 10 ohms resistance across motor windings.

If motor windings show open or short circuit, replace motor (paragraph 3-16.15).

Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

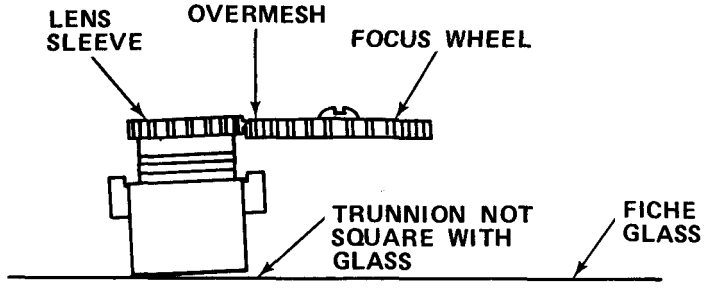
6. PAPER ERROR LIGHT COMES ON DURING PRINT CYCLE.

Step 1. Check position of optical sensors on paper guide rails. Paper must touch sensors during operation.

(a) If paper does not touch sensors, adjust optical sensors (paragraph 3-16.4).

(b) Refer to direct/general support troubleshooting.

7. FOCUS WHEEL IS DIFFICULT TO ADJUST.



Step 1. Check for binding between focus wheel and focus wheel bearing.

(a) If no binding is noted, proceed to step 2.

(b) If binding is noticeable, lubricate bearing with general purpose lubricating oil (Item 14, Appendix E).

Step 2. Check operation of lens sleeve in trunnion.

(a) If no binding is noted, proceed to step 3.

Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

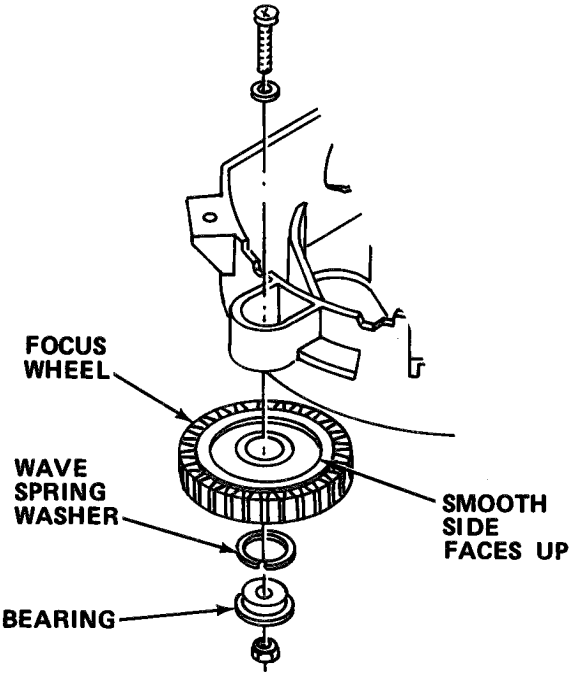
7. FOCUS WHEEL IS DIFFICULT TO ADJUST - Cont

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Wear solvent impermeable gloves and eye/face protective equipment when using solvent. Do not use near open flame or excessive heat. Flashpoint of solvent is 100°F to 138° F (38° C to 59° C).

(b) If binding is evident, clean lens sleeve threads with solvent P-D-680 (Item 24, Appendix E).

Step 3. Check installation of focus-wheel.



Smooth side of focus wheel must face upward. If it does not, remove focus wheel and refit correctly.

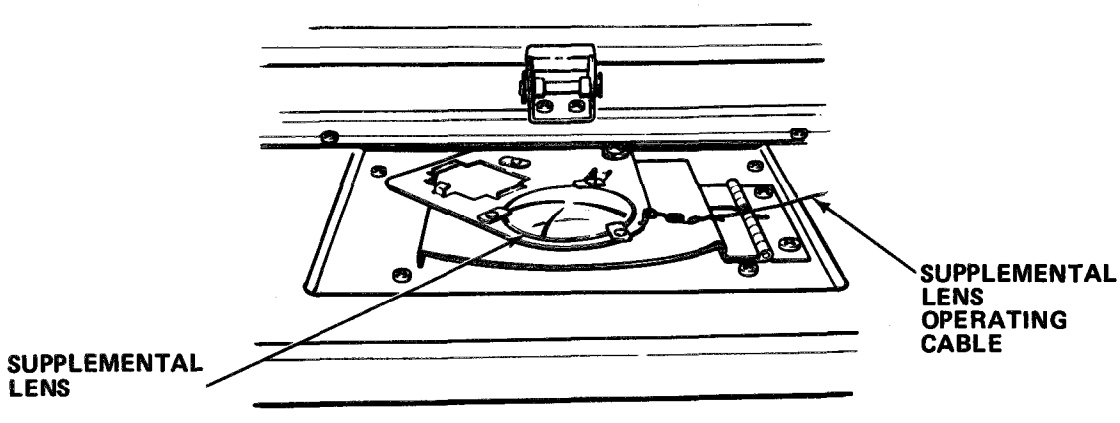
Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
8. POOR FOCUS.	
Step 1. Check that lens sleeve is not unscrewed higher than focus wheel.	
(a) If lens sleeve has correct height, proceed to step 2.	
(b) If lens sleeve height is incorrect, remove lens from reader-printer and screw lens sleeve further into trunnion.	
Step 2. Check that lens is not installed upside down. Legend, LENS MADE IN JAPAN, should face downward.	
(a) If lens is installed correctly, proceed to step 3.	
(b) If lens is not installed correctly, install lens in correct position.	
Step 3. Check meshing of focus wheel with lens sleeve.	
(a) Trunnion should sit squarely on upper microfiche glass.	
(b) If trunnion is not square, check for burrs on trunnion base, trunnion ears, or yoke in which trunnion rests.	
(c) Check that microfiche handler is correctly locked.	
(d) Lock correctly.	

Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

9. POOR PRINT FOCUS. SCREEN IMAGE IS CLEAR.



Step 1. Check supplemental lens. Lens should move out of light path during print cycle.

(a) If supplemental 1 ens operates correctly, proceed to step 2.

(b) Adjust supplemental lens operating cable (paragraph 3-16.11).

Step 2. Feel reader-printer during print operation for excessive vibration. Vibration should be minimal during mirror movement.

Adjust mirror drive chain tension, and check all fastenings in drive system (paragraph 3-16.13).

10. PAPER TRACKS TO ONE SIDE AND JAMS IN READER-PRINTER.

Inspect for proper paper drive roller adjustment.

Adjust paper drive rollers (paragraph 3-16.8).

Table 3-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
11. PAPER DRIVE MOTOR LOADS DOWN AND RESULTS IN SLOW PAPER DRIVE. Inspect for proper paper drive roller adjustment. Adjust paper drive rollers (paragraph 3-16.8).
12. PAPER SLIPS ON ROLLERS AND PRODUCES FALSE PAPER LAMP INDICATION. Inspect for proper paper drive roller adjustment. Adjust paper drive rollers (paragraph 3-16.8).

3-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance function for the microfiche reader-printer. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

3-16.1 Check Transformer Connections.

MOS: 35E, Special Electronic Devices Repairer

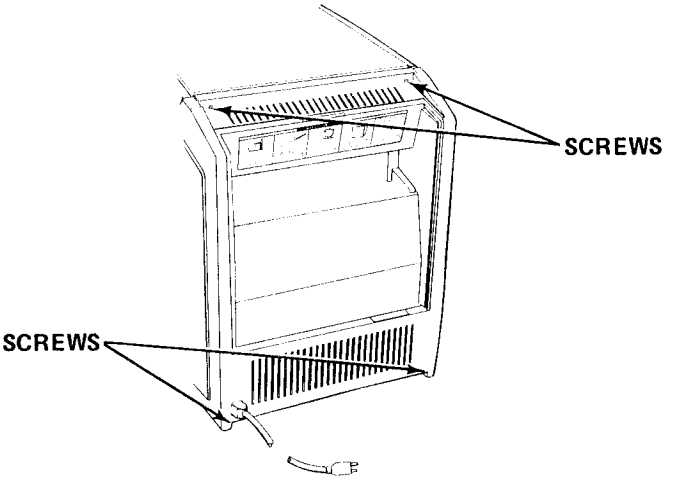
TOOLS : Cross Tip Screwdriver

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

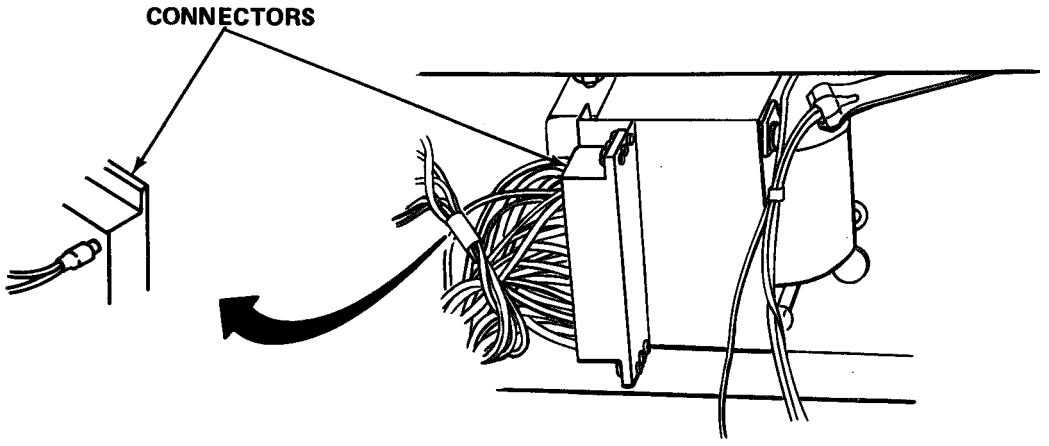
b. Remove paper loading door by lifting up and back.



CAUTION

Wiring is attached to rear panel. Carefully pull panel from frame and disconnect interlock before removing panel.

c. Remove screws and rear panel.



d. Locate power transformer at lower rear. Check all screw connectors for security. Tighten as required.

e. Replace rear panel. Refit and tighten screws.

f. Replace paper loading door.

g. Plug in power cord.

3-16.2 Adjust Interlocks

MOS: 35E, Special Electronic Devices Repairer

TOOLS: Cross Tip Screwdriver

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

b. Open left and right side doors.

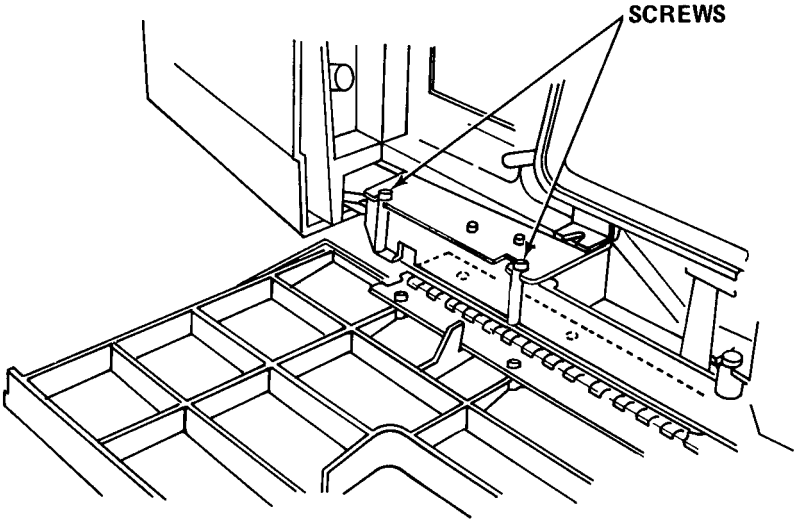
c. Loosen two screws holding interlock switch.

d. Move switch in or out until door actuates switch completely.

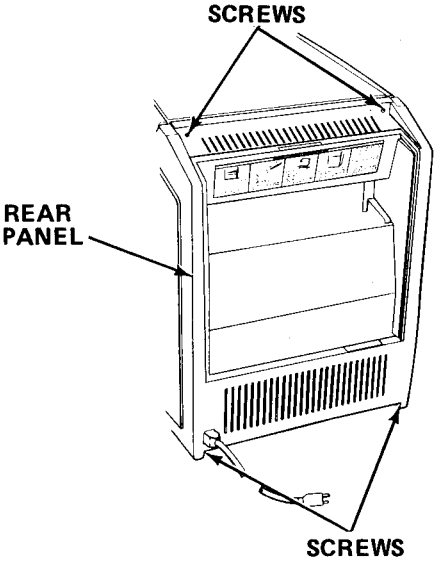
e. Tighten mounting screws.

f. Repeat task on opposite side of reader-printer.

g. Close both side doors.



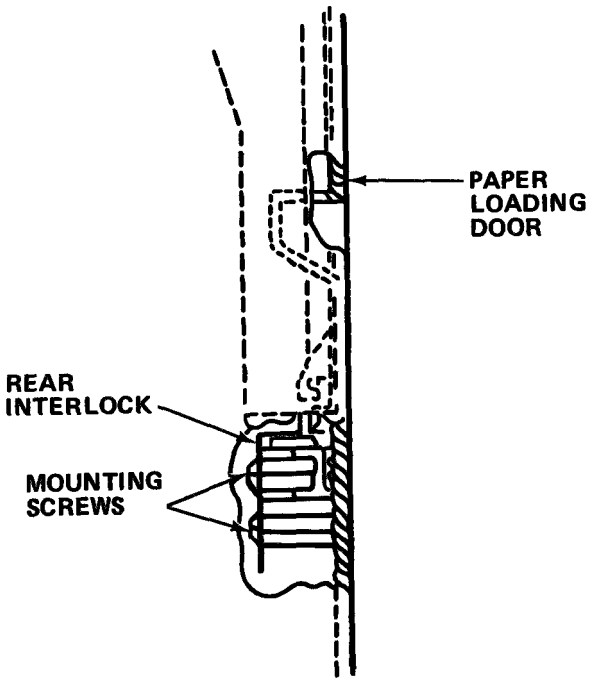
h. Remove paper loading door.



CAUTION

Wiring is attached to rear panel. Carefully pull panel from frame and disconnect interlock before removing panel.

i. Remove four screws and rear panel.



j. Locate rear interlock. Loosen mounting screws.

k. Move switch until paper loading door actuates switch. Tighten mounting screws.

l. Replace paper loading door and rear panel.

m. Plug in power cord.

3-16.3 Replace Switch(es).

MOS: 35E, Special Electronic Devices Repairer

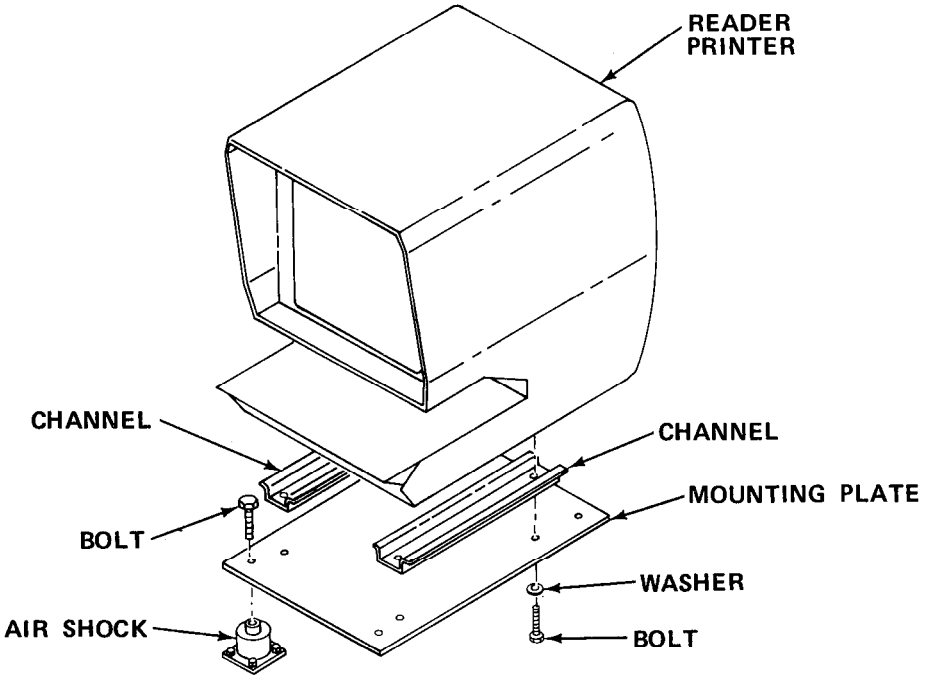
TOOLS: Cross Tip Screwdriver
3/4 in. Combination Wrench
7/16 in. Combination Wrench
9/16 in. Combination Wrench

SUPPLIES: VIEW/STANDBY Switch
ON/OFF Switch
PRINT Switch
Print Length Switch

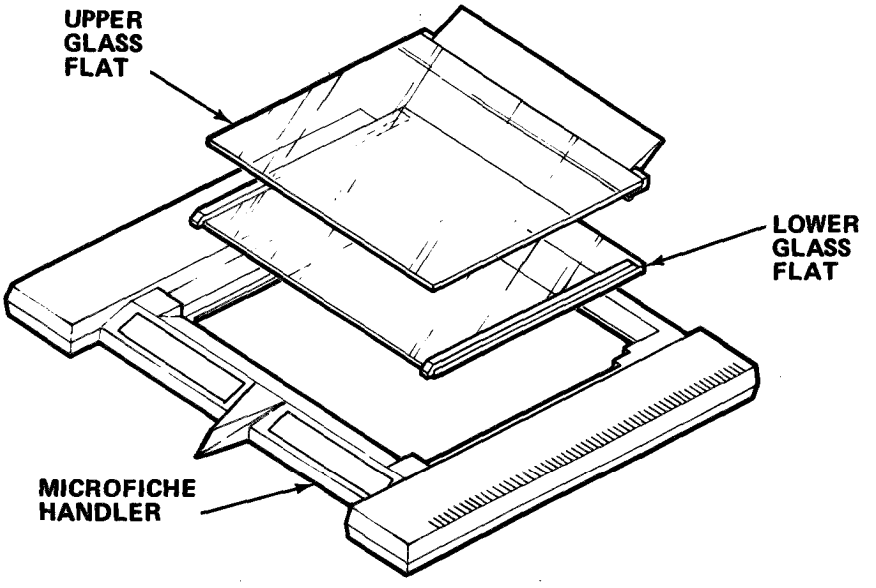
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.



b. Remove reader-printer from mounting plate.



c. Pull microfiche handler out until upper glass flat opens.

d. Lift up front of upper glass flat, and slide it forward out of microfiche handler.

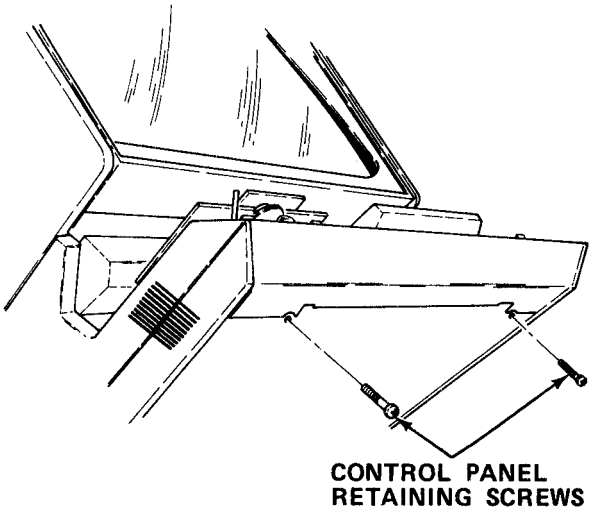
e. Push lower glass flat to rear slightly. Then lift up front edge of glass. Pull forward out of microfiche handler.

f. Push microfiche handler back into reader-printer until it reaches stop .

CAUTION

Provide protection and support for reader-printer when placing in positions other than vertical. Failure to provide support and protection can result in damage to reader-printer.

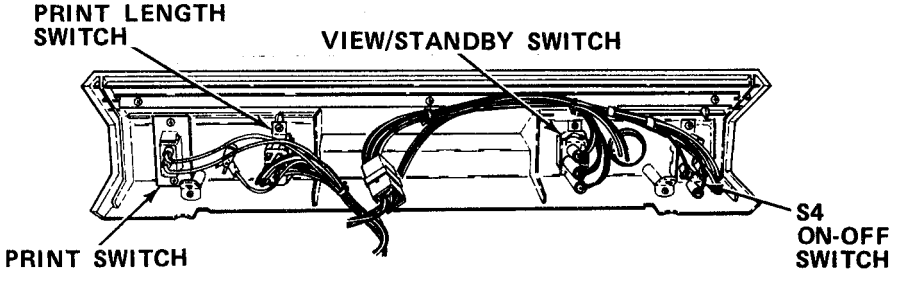
g. Lay reader-printer on rear.



h. Remove screws retaining control panel.

i. Open left and right panels.

j. Tilt reader-printer forward and remove control panel to gain access to cable harness.



k. Locate switch, tag and disconnect wiring.

1. Remove cables from connectors at rear of switch.

m. Remove screws retaining switch and remove switch.

n. Install new switch and secure with screws.

o. Reconnect cables.

p. Reinstall control panel and secure with screws.

q. Place reader-printer in upright position.

r. Pull microfiche handler fully forward.

s. Place lower microfiche glass back edge into rear of microfiche handler with front edge tilted up. Push in and, at same time, lower front edge.

t. Place rear edge of upper microfiche glass into rear of holder with front edge tilted up. Lower front edge.

u. Close left and right panels.

v. Push microfiche handler into reader-printer, observing that upper microfiche glass closes as handler moves in.

w. Reinstall reader-printer on stand and secure with mounting hardware.

x. Plug in power cord.

3-16.4 Adjust Optical Sensors.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Offset Cross Tip Screwdriver
Rule (12 in.) .

a. Plug power cord into outlet.

b. Allow reader-printer to complete warm-up cycle.

c. Place print length switch in SHORT PRINT position.

d. Push PRINT switch.

e. Measure resultant paper length and note measurement.

f. Place print length switch in LONG PRINT position.

g* Push PRINT switch.

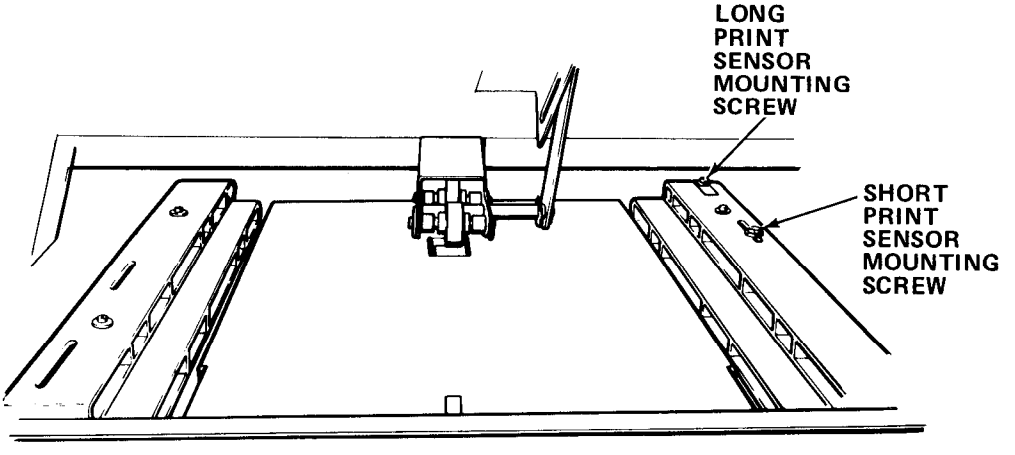
h. Measure resultant paper length and note measurement.

i. Remove power cord from outlet.

j. Compare print length measurements with specification (Table 3-4).

Table 3-4. PRINT LENGTH SPECIFICATIONS

Switch Position	Specification	Adjustable Range
SHORT PRINT	8.5 ± .12 in. (21.59 cm ± 3 mm)	8.37 in. (21.25 cm) to 8.62 in. (21.89 cm)
LONG PRINT	11 ± .12 in. (27.94 cm ± 3 mm)	10.87 in. (27.60 cm) to 11.12 in. (28.24 cm)



k. Open rear paper loading door by lifting up and out. Then look down over top roller at printing easel.

l. Locate short print sensor mounting screw and loosen.

m. If print was too short, move sensor away from you to increase length. Tighten screw.

n. If print was too long, move sensor toward you to shorten length. Tighten screw.

o. Locate long print sensor mounting screw and loosen.

p. If print was too short, move sensor away from you to increase length. Tighten screw.

q. If print was too long, move sensor toward you to shorten length. Tighten screw.

r. Close rear paper loading door.

s. Plug in power cord.

t. Allow reader-printer to complete warm-up cycle.

u. Push PRINT switch, in both long and short print modes. Check resultant prints for correct length.

v. Repeat adjustment if required.

w. Place reader-printer in service.

3-16.5 Replace Optical Sensor(s).

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Offset Cross Tip Screwdriver
Yellow Grease Pencil
Jeweler's Screwdriver

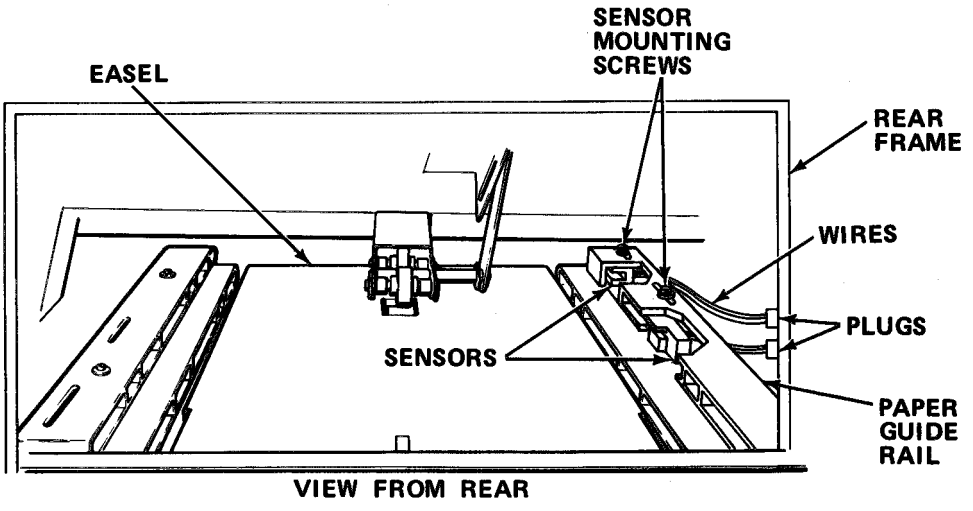
SUPPLIES: Paper Sensor(s)

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

b. Remove rear paper loading door by lifting up and out.



c. View over top roller down easel line. Locate sensor mounting screws.

NOTE

Mark position of sensor on paper guide with yellow grease pencil before removal. Be sure sensor is parallel to paper guide.

d. Mark position of sensor on paper guide rail. Then remove screw.

e. Disconnect sensor leads and remove sensor.

f. Fit new sensor between guide rails. Reconnect sensor leads.

g. Aline new sensor with grease pencil mark parallel to paper guide rail.

h. Be sure that paper guide rail is against paper.

i. Reinstall and tighten screw.

j. Reinstall rear paper loading door.

3-16.6 Replace Transformer Assembly.

MOS: 35E, Special Electronic Devices Repairer

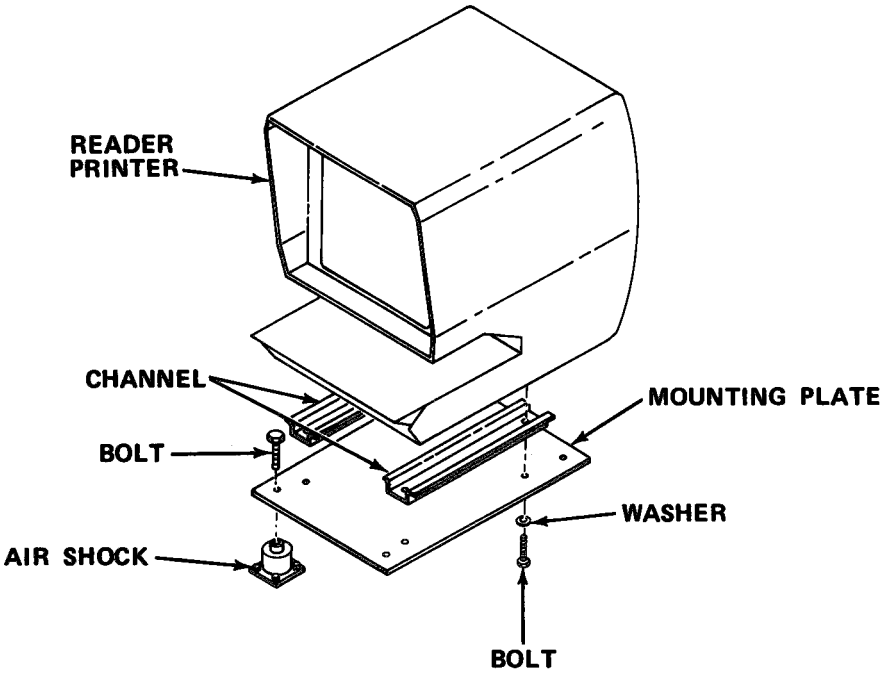
TOOLS: Cross Tip Screwdriver
3/4 in. combination Wrench
7/16 in. Combination Wrench
9/16 in. Combination Wrench
3/8 in. Combination Wrench
Screw Starter

SUPPLIES: Transformer Assembly

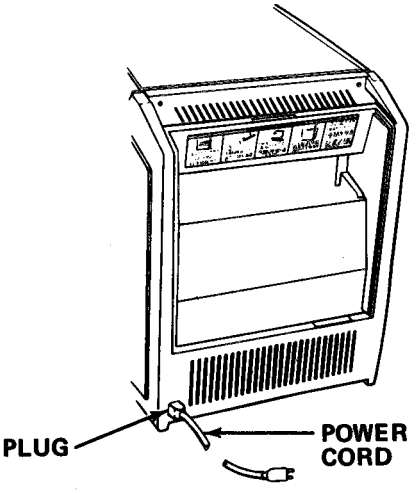
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

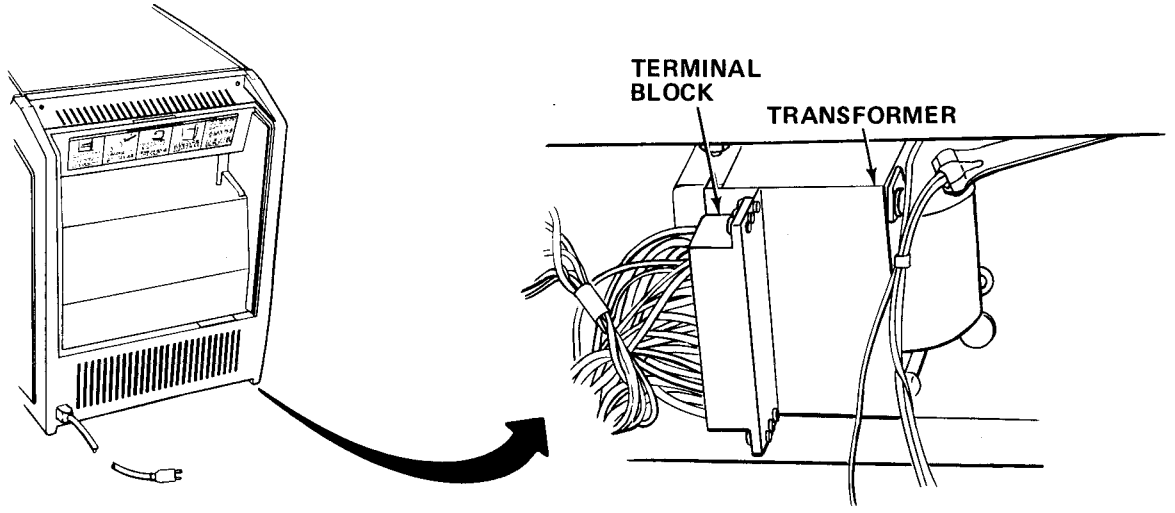


b. Remove reader-printer from mounting plate.



c. Remove power cord from rear of reader-printer.

d. Remove four screws and rear panel.



e. Remove defective transformer, terminal block, and associated wiring as a unit.

f. Tag and disconnect wires from terminal block to defective transformer. Connect new transformer to terminal block.

g. Install new transformer, terminal block and associated wiring as a unit.

h. Reinstall rear panel.

i. Reconnect power cord to rear of reader-printer.

j. Reinstall reader-printer on mounting plate.

k. Plug in power cord.

3-16.7 Adjust Secondary Mirror.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
Alinement Aperture

SUPPLIES: Secondary Mirror Adjustment Template
Painter's Masking Tape (Item 29, Appendix E)

WARNING

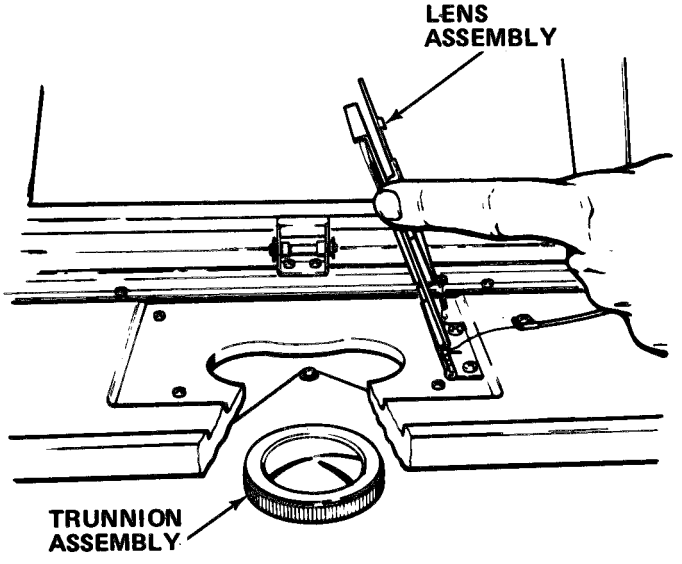
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

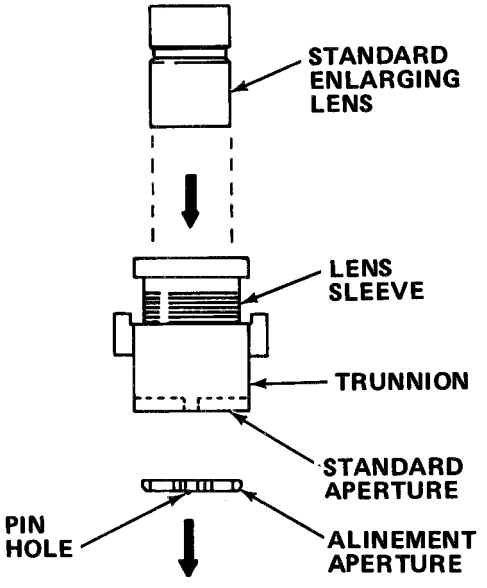
CAUTION

Exercise great care when removing or handling viewing screen. Damage to viewing screen can result.

b. Remove viewing screen by pushing gently upward until bottom edge can be pulled outward.



c. Lift up supplemental lens assembly and, with other hand, remove lens sleeve and trunnion assembly from reader-printer.



d. Remove standard aperture from location in base of trunnion.

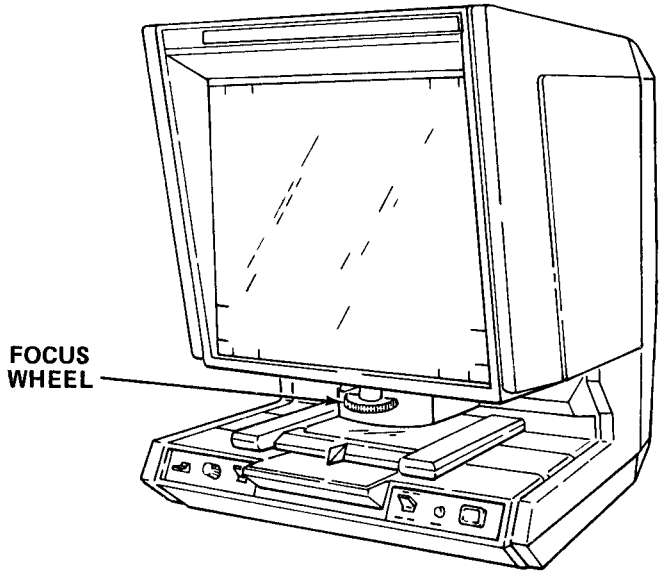
e. Install alinement aperture upside down, as compared with standard aperture. Pin hole faces downward.

f. Standard enlarging lens remains in position in lens sleeve.

g. Reinstall lens sleeve and trunnion assembly into Reader-Printer, and reinstall viewing screen.

h. Plug in power cord.

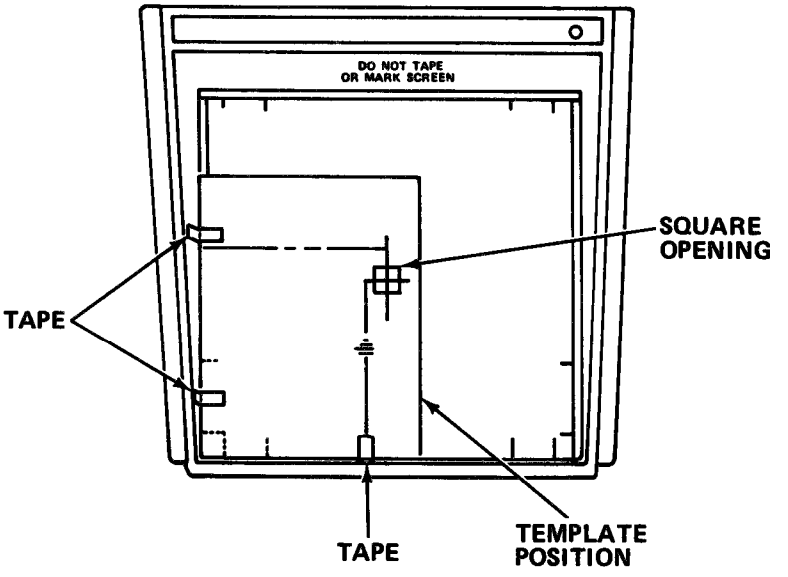
i. Switch reader-printer ON.



j. Adjust focus wheel until sharply defined spot of light is visible on viewing screen.

CAUTION

Tape or pencil marks will permanently damage viewing screen. When attaching secondary mirror adjustment template, tape only to hood.

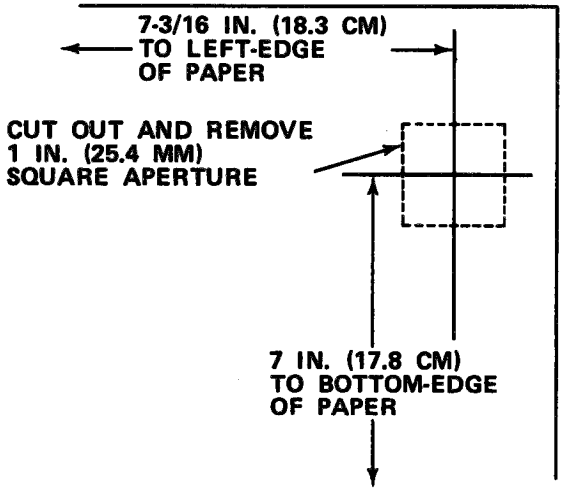


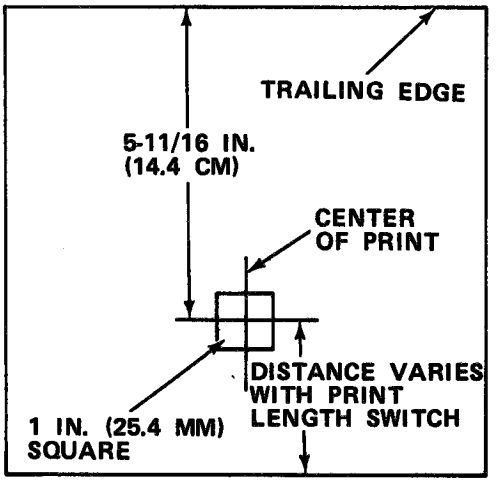
k. Place secondary mirror adjustment template in position on viewing screen. Use adhesive tape to attach template to hood frame only as shown.

l. Check viewing screen. Spot of light should appear within square opening of template.

m. Construct template of cardboard.

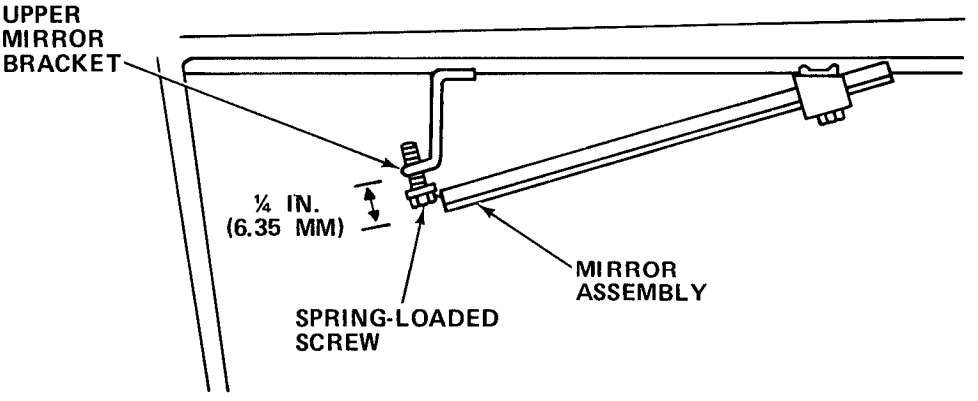
ADJUSTMENT TEMPLATE DIMENSIONS





n. Hake print. Light spot should be within 1 in. (25.4 mm) square centered on width of paper and 5.68 in. (14.4 cm) from trailing edge.

o. Remove viewing screen.



p. Check that front surface of mirror assembly is .25 in. (6.35 mm) from bottom of front upper mirror bracket. Adjust spring-loaded screw as required.

If spot of light does not fall within 1 in. (25.4 mm) square, adjust two rear mirror screws 1/4 turn.

r. Replace viewing screen.

s. Observe position of light spot and make further mirror adjustments as required.

t. Make print to be sure of correct adjustment.

u. Remove viewing screen.

v. Lift up supplemental lens assembly and, with other hand, remove lens sleeve and trunnion assembly from reader-printer.

w. Remove alinement aperture and replace with standard aperture.

x. Lift up supplemental lens assembly and replace lens sleeve and trunnion assembly.

y. Reinstall viewing screen.

z. Place microfiche in position in microfiche handler.

aa. Make print and check that all data shown on viewing screen appears on print.

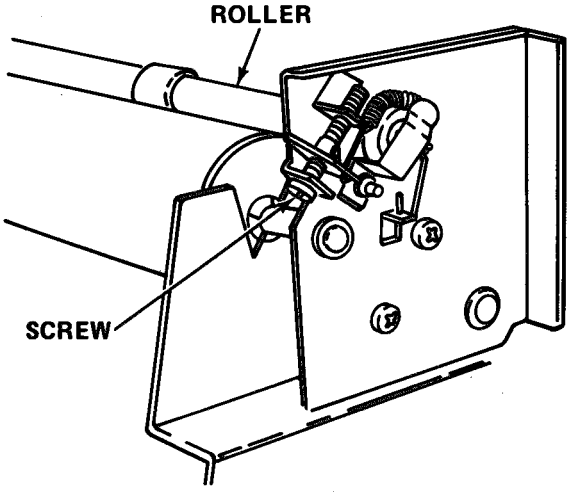
3-16.8 Adjust Paper Drive Rollers.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screwdriver

a. Unplug power cord.

b. Remove rear paper loading door.



c. If paper rollers slip, adjust tension screws on both ends of roller one full turn to the right.

d. Plug power cord into outlet.

e. Depress rear interlock switch and push PRINT switch to observe that paper is correctly driven by rollers. Readjust if required.

f. If paper tracks to right side of rollers, turn left adjusting screw one full turn to the right to increase tension.

g. Push PRINT switch and observe that paper is correctly driven by rollers. Readjust if required.

h. If paper tracks to left side of rollers, turn right adjusting screw one full turn to the right to increase tension.

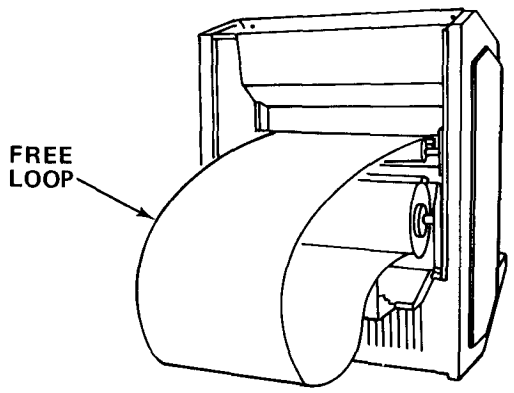
i. Push PRINT switch and observe that paper is correctly driven by rollers. Readjust if required.

NOTE

Over-tension of rollers will slow motor down and possibly wrinkle paper edge even though paper remains centered on rollers.

j. Adjust both screws one full turn to the left to reduce tension.

k. Push PRINT switch and observe that paper is driven correctly by rollers. Readjust if required.



l. Pull enough paper, approximately 24 in. (61 cm), from stock roll to produce free loop. Avoid kinks or wrinkles in paper.

m. Cycle reader-printer through five long prints. Observe paper for even tracking and disregard any side-to-side movement of less than .12 in. (3mm). Reader-printer should produce five long prints without mistracking. Readjust if required.

n. Reinstall rear paper loading door.

o. Run five long prints to clear exposed paper from reader-priter.

3-16.9 Adjust Bed Cutter.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screwdriver

WARNING

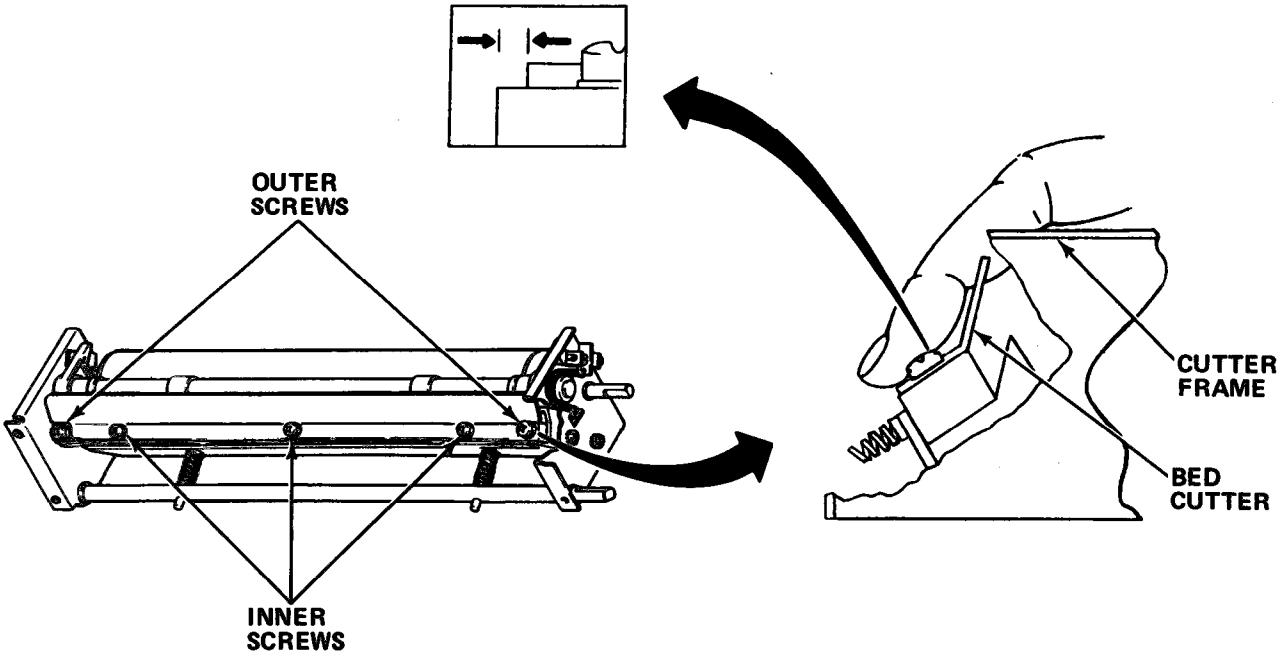
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing

a. Unplug power cord.

b. Remove rear paper loading door.

NOTE

Left and right on bed cutter adjustment are viewed from rear of reader-printer.



c. Reach into reader-printer over top of rollers, and use your finger to feel approximate distance that bed cutter overlaps cutter frame. Check left side first. Bed cutter should slightly overlap. Check right side. This should be greater than left side. Precise measurements are 0.005 in. (0.127 mm) for left and 0.015 in. (0.381 mm) for right. You will not be able to determine bed cutter overlap to this order of accuracy. Approximate measurements are adequate.

CAUTION

Too high adjustment of bed cutter will cause premature failure of cutter assembly.

d. Loosen two outer screws and then three inner screws.

e. Move bed cutter slightly to obtain approximate settings noted in step c. Tighten two outer screws.

f. Tighten three inner screws.

g. Reinstall rear paper loading door.

h. Plug in power cord.

i. Make several prints to check operation of cutter. Readjust as required.

3-16.10 Adjust Mirror Linkage.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Cross Tip Screwdriver

WARNING

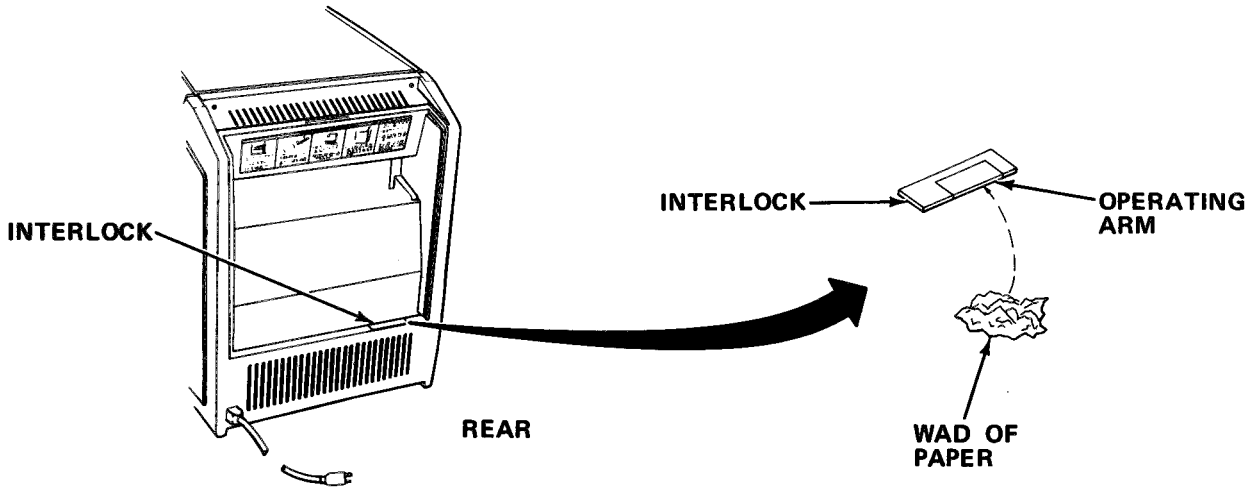
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

NOTE

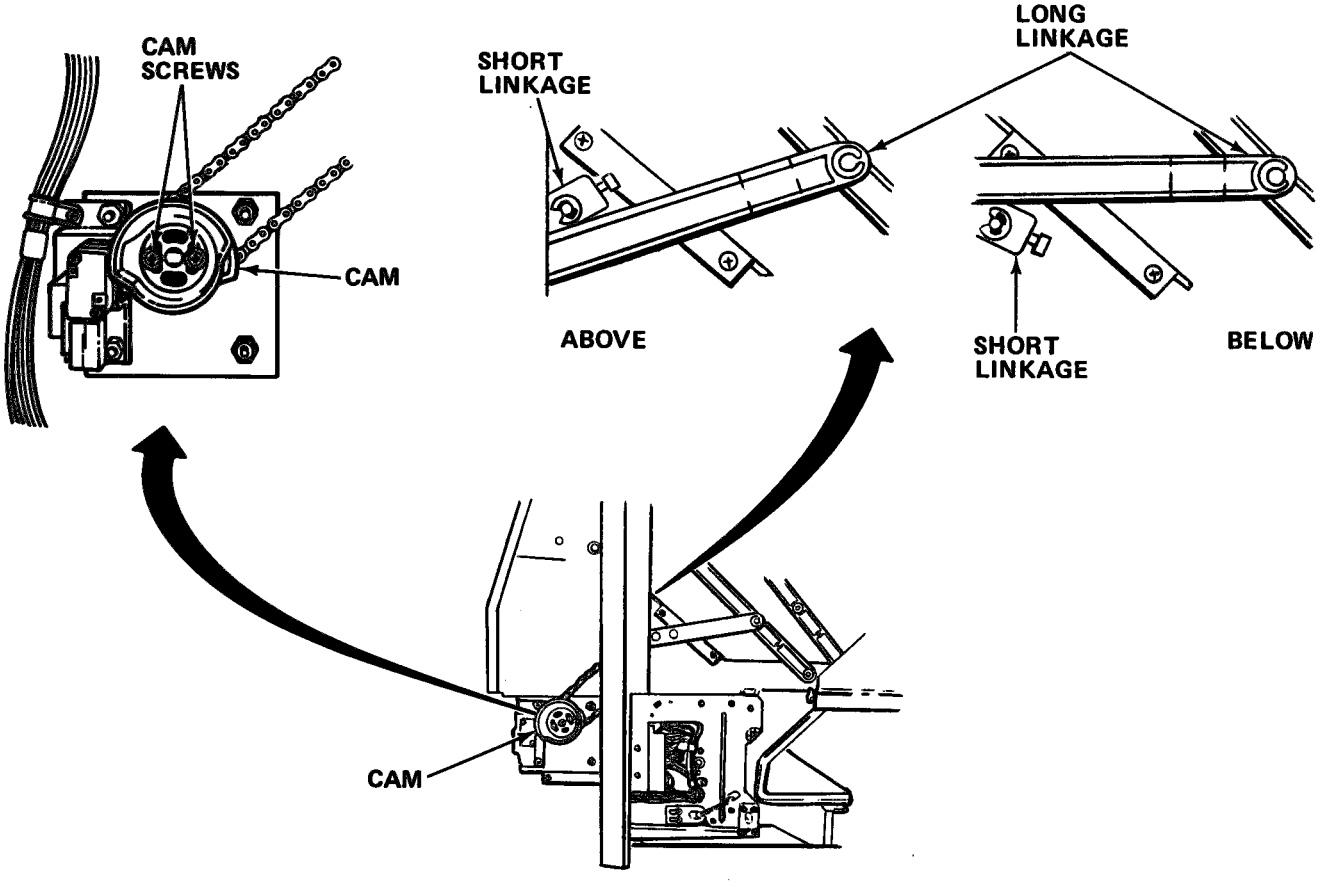
Left and right on reader-printer are taken when viewed from front.

b. Remove rear panel.



c. Disable rear door interlock by depressing operating arm. Place wad of paper into slot to keep arm depressed.

d. Plug in power cord.



e. Cycle reader-printer several times and check relationship of mirror linkage.

f. With main viewing mirror in full home position, check position of mirror linkage. Loosen both cam screws. If short linkage is above long linkage, turn cam to the left one-quarter turn.

g. If short linkage is below long linkage, turn cam to the right one-quarter turn.

h. Tighten both cam screws.

i. Cycle reader-printer two or three times to check relationship of short and long arms. Repeat adjustments as required.

j. Unplug power cord.

k. Remove wad of paper from interlock.

l. Reinstall rear panel.

m . Plug in power cord.

3-16.11 Adjust Supplemental Lens Operating Cable.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS : Flat Tip Screwdriver
Cross Tip Screwdriver

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

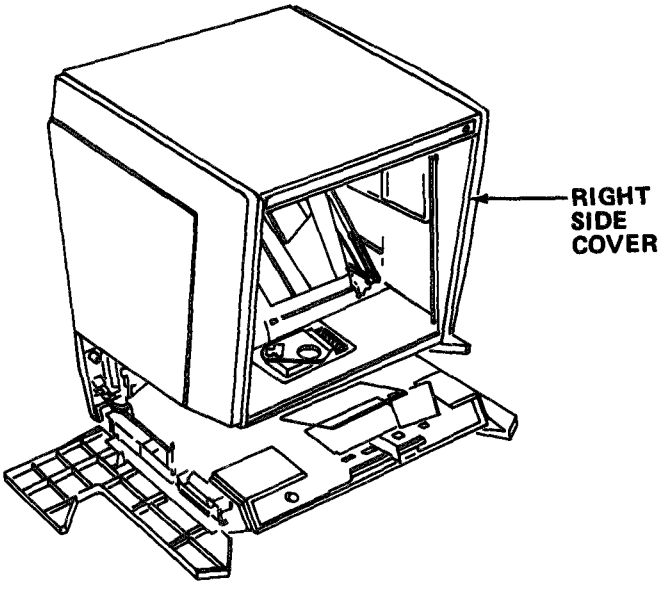
CAUTION

Exercise great care when removing or handling viewing screen. Damage to viewing screen may result.

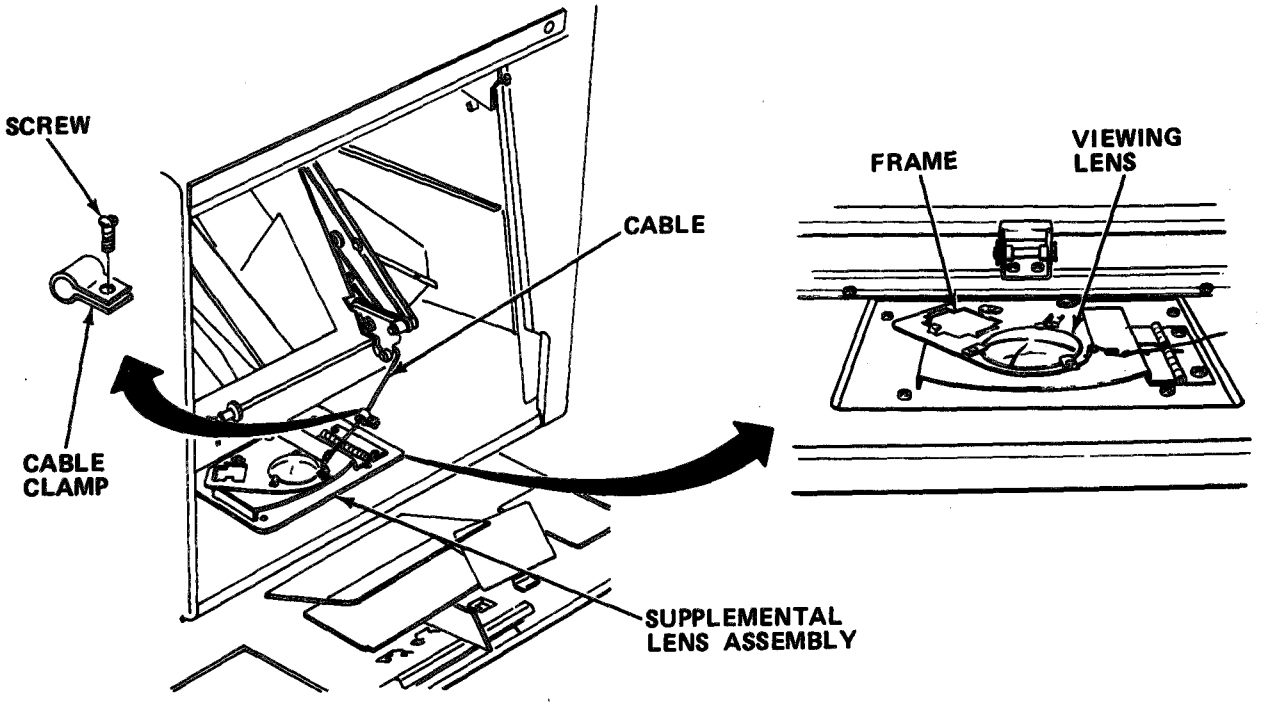
NOTE

Left and right on reader-printer are taken as viewed from front.

b. Remove viewing screen by pushing upward and lifting out lower edge. Place viewing screen in safe place.



c. Remove right side cover.



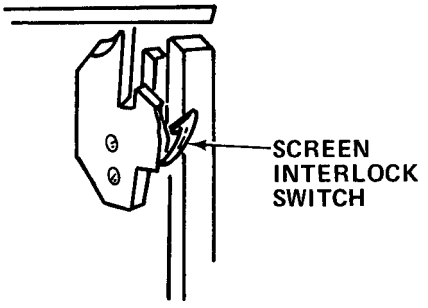
d. Loosen cable clamp.

e. Remove all slack e between the clamp and supplemental lens assembly.

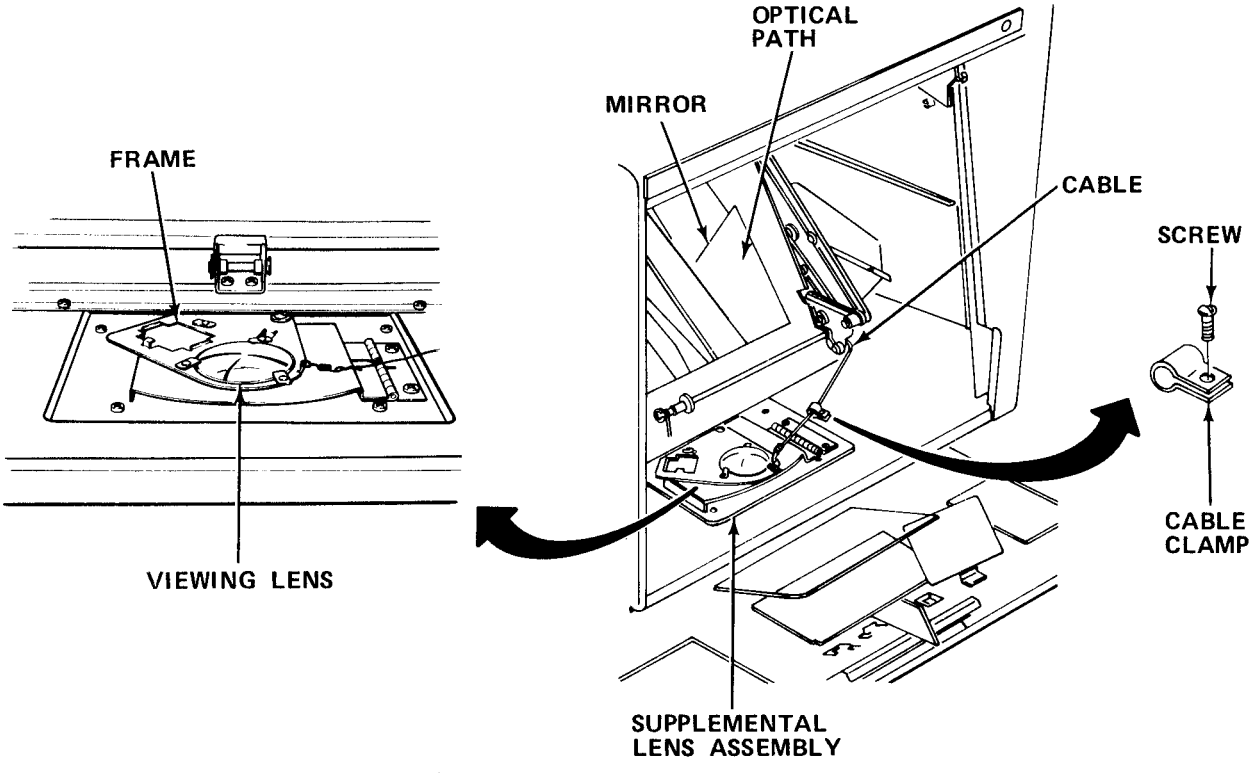
f. Tighten cable clamp.

g. Plug in power cord and place ON/OFF switch to ON.

h. Place VIEW/STANDBY switch to VIEW.



i. Depress screen interlock switch.



j. Press PRINT switch.

k. As the mirror moves forward, the frame on the supplemental lens assembly should move into the optical path.

l. As the mirror moves back the viewing lens on the supplemental lens assembly should move into the optical path.

m. Readjust by performing steps d through 1.

n. Place ON/OFF switch OFF.

o. Remove finger from screen interlock switch.

p. Unplug power cord.

q. Reinstall right side cover.

r. Reinstall viewing screen. First insert upper edge of viewing screen into upper part of hood. Then swing lower part of viewing screen inward until it falls into lower slot.

s. Plug in power cord.

3-16.12 Adjust Cam Switch Actuator.

MOS: 41B, Topographic Instrument Repair Specialist

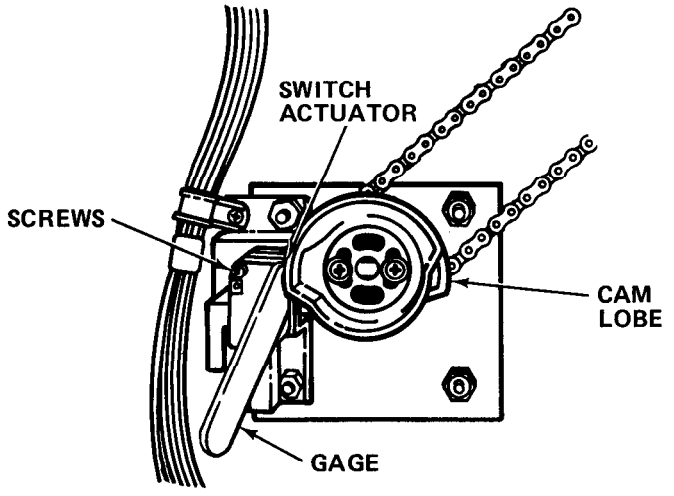
TOOLS: Cross Tip Screwdriver
Thickness Gage

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

b. Remove rear panel.



c. Loosen switch mounting screws.

NOTE

Place feeler gage horizontally between cam lobes and switch actuators so that it is between lobe and actuator on all three switches at same time.

d. Place 0.007 in. (0.178 mm) thickness gage between switch actuators and cam lobes.

e. Adjust switch location so that all three actuators bottom out.

f. Tighten mounting screws.

g. Reinstall rear panel.

h. Plug in power cord.

3-16.13 Adjust Mirror Drive Chain Tension.

MOS: 41B, Topographic Instrument Repair Specialist

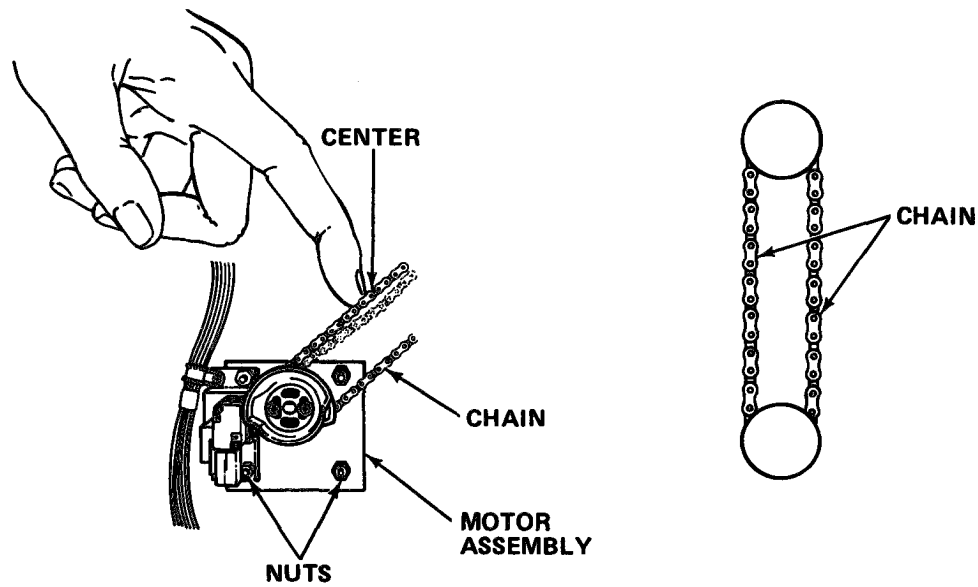
TOOLS: Socket Wrench Set, 1/4 in. Drive
Cross Tip Screwdriver

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

b. Remove rear panel.



c. Loosen motor drive nuts.

d. Move motor assembly until chain deflects .25 in. (6.35 mm) under finger pressure on center.

e. Be sure tension is equal on both sides of chain.

f. Tighten motor mount nuts.

g. Plug in power cord.

h. Disable rear interlock.

i. Run reader-printer through two cycles, observing operation of mirror drive chain. Readjust tension if required.

j. Remove disabling device from rear interlock.

k. Reinstall rear panel.

3-16.14 Adjust Timing Belts.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS : Socket Wrench Set, 1/4 in. Drive

WARNING

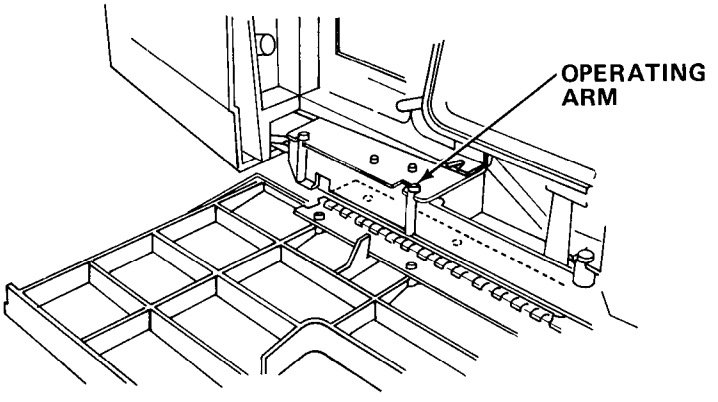
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

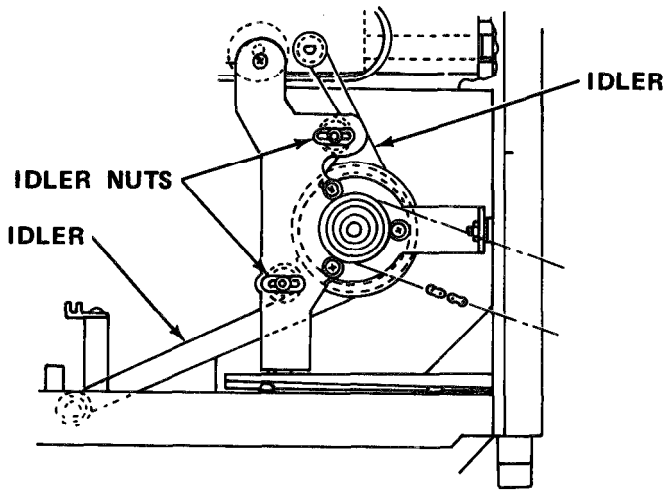
NOTE

Left and right on reader-printer are taken when viewed from front.

b. Open lower right side panel.



c. Disable door interlock by depressing operating arm.



d. Loosen idler nuts.

e. Adjust idlers until timing belt deflection is .18 in. (4.76 mm) at point opposite idler. Tighten idler nuts.

f. Plug in power cord. Switch reader-printer ON.

g. Cycle reader-printer. Check that paper moves smoothly off printing easel and through exit slot. Readjust if required.

h. Switch reader-printer OFF. Unplug power cord.

i. Remove disabling device from interlock.

j. Close lower right side panel.

k. Plug in power cord.

3-16.15 Replace Drive Motor(s).

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Socket Head Key Wrench Set
1/4 in. Combination Wrench
3/8 in. Combination Wrench

SUPPLIES: Mirror Drive Motor
Developer Drive Motor
Paper Drive Motor

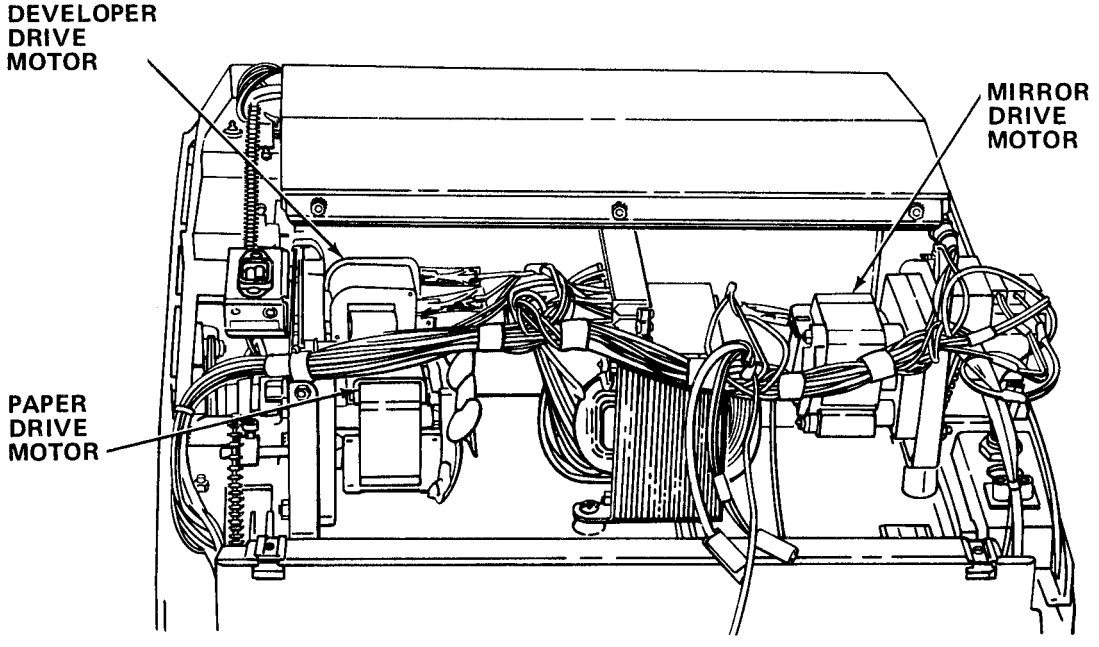
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

b. Remove reader-printer from mounts.

c. Remove rear panel.



d. Tag and disconnect electrical wiring to motor(s).

e. Loosen setscrew on chain drive sprocket(s).

f. Remove drive motor mounting hardware.

g. Remove and replace motor(s). Be sure that chain and sprocket mesh.

h. Assemble and tighten mounting hardware.

i. Adjust sprocket(s) and tighten setscrew.

j. Reconnect electrical wiring.

k. Reinstall rear panel.

l. Plug in and test operation.

m. Unplug power cord. Reinstall on mounts.

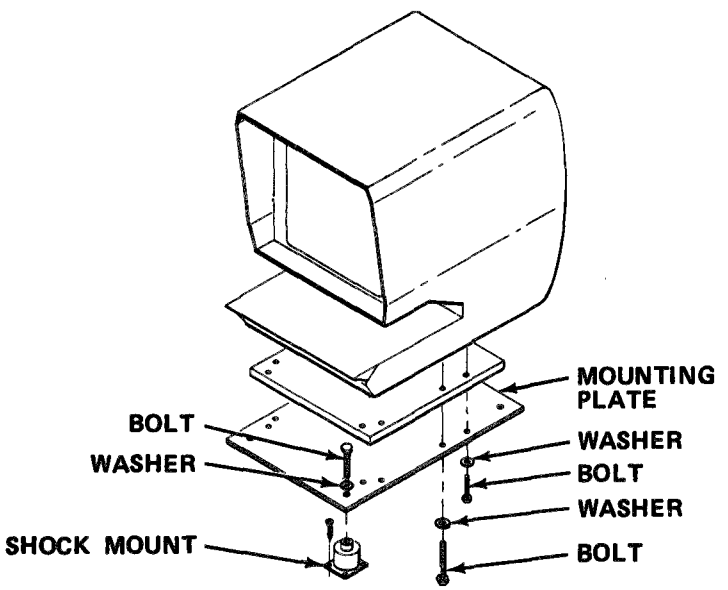
3-16.16 Remove/Install Microfiche Reader-Printer

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 7/16 in. Socket with 1/2 in. Drive
9/16 in. Socket with 1/2 in. Drive
3/4 in. Combination Wrench
1/2 in. Drive Ratchet

SUPPLIES: Microfiche Reader-Printer

a. Unplug microfiche reader-printer; coil and tape cord.



b. Deflate shock mounts.

c. Remove bolts and washers to shock mountings.

d. Lift reader-printer for access to underside; then remove bolts and washers holding mounting plate to defective reader-printer.

e. Install new reader-printer on mounting plate and secure with bolts and washers.

f. Secure mounting plate to shock mounts.

g. Inflate shock mounts.

h . Plug in power cord.

3-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

3-18. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

3-18.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organizati on and Equipment (MTOE) applicable to your unit.

3-18.2 Special Tools: Test, Measurement, and Diagnostic Equipment: and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

3-18.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering direct/general support maintenance for this equipment.

3-19. DIRECT/GENERAL SUPPORT TROUBLESHOOTING PROCEDURES.

a. Direct/general support troubleshooting procedures cover the most common malfunctions that may be repaired at the direct/general support level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used at lower levels should be conducted in addition to direct/general support troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/ inspection and corrective action. If a malfunction is not listed or is not corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the facing schematic or the foldout located at the end of this manual for further fault analysis.

d. If the microfiche reader-printer does not power up when turned on, verify that 120 V ac is present at the" receptacle. If voltage is not preseent, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedures for dead receptacle (Table 1-4).

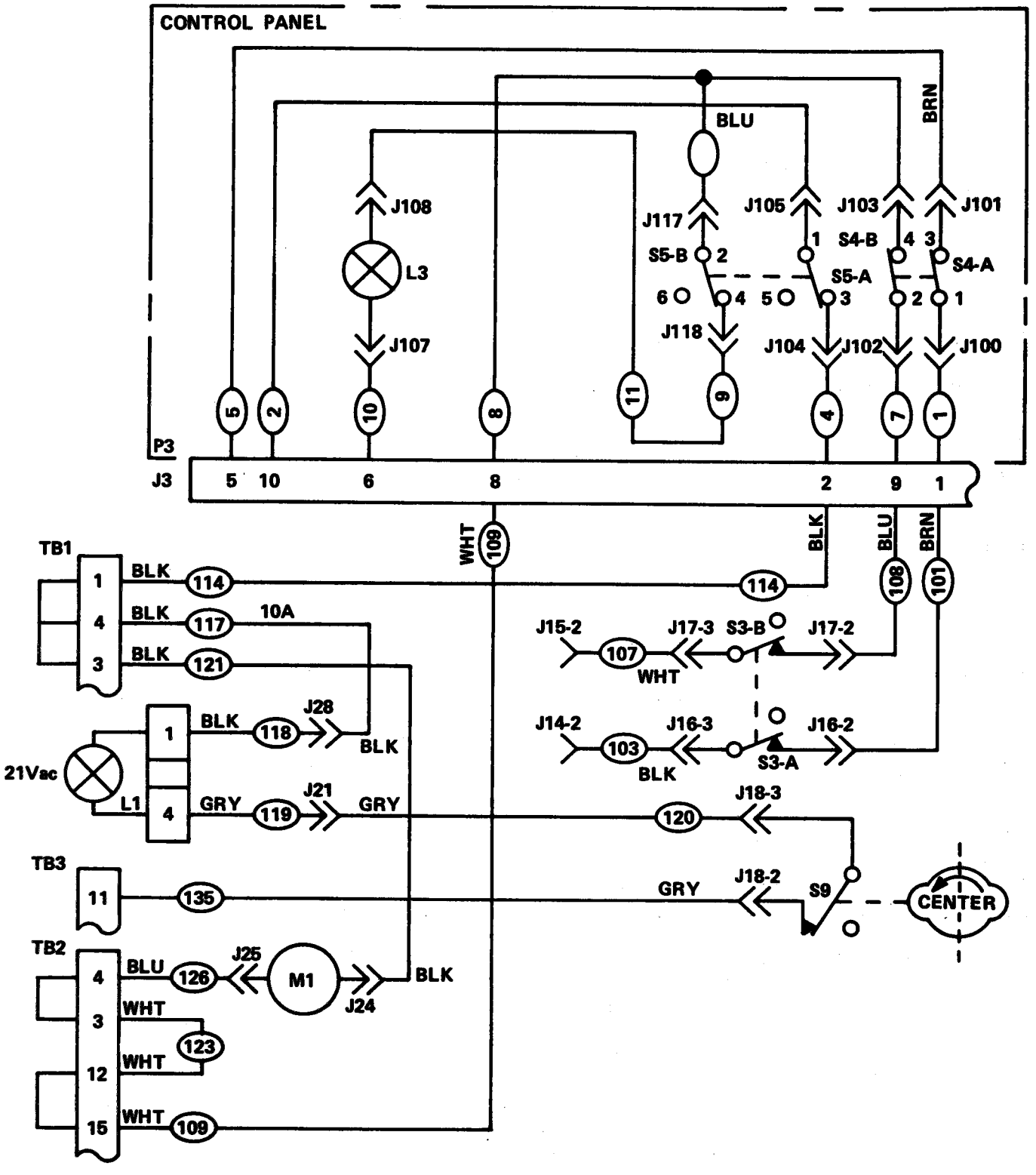
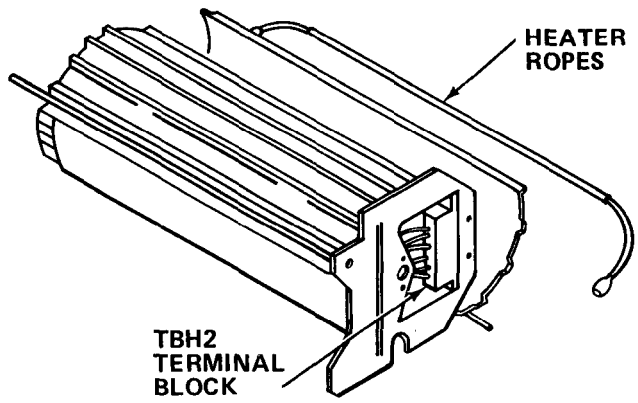

CONTROL PANEL
BLU
BRN
J108
L3
J107
J117
J105
J103
J101
S5-B
S4-B
S4-A
S5-A
J118
J104
J102
J100
P3
J3
5 10 6 8 2 9 1
WHT 109
BLK
BLU
BRN
114
108
101
TB1
1
4
3
BLK 114
BLK 117
10A
BLK 121
J15-2
J17-3
S3-B
J17-2
107
WHT
J14-2
J16-3
J16-2
103
BLK
S3-A
21Vac
L1
BLK 118
J28
BLK
GRY 119
J21
GRY
J18-3
120
TB3
11
135
GRY
J18-2
S9
CENTER
TB2
4
3
12
15
BLU 126
J25
M1
J24
BLK
WHT
123
WHT
WHT 109

Table 3-4. DIRECT/GENERAL SUPPORT TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. LONG WARM-UP CYCLE.	Step 1. Check for burned-out heater.	(a) Remove wire from pin 6 of terminal block TBH2. (b) Remove PC board assembly and place out of way. (c) Using multimeter, measure resistance between pin 1 of TBH1 and pin 1 of TBH2 and then resistance between pin 7 of TBH1 and pin 7 of TBH2.



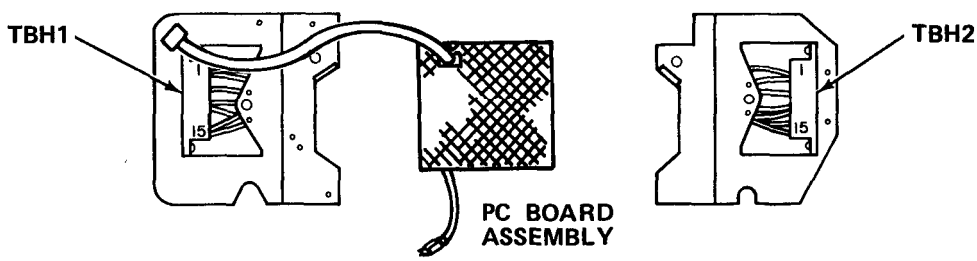


Table 3-4. DIRECT/GENERAL SUPPORT TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

1. LONG WARM-LIP CYCLE - Cont

(d) Normal resistance for one-half of heater circuit is 40 ohms. If either half of heater circuit is high (greater than 50 ohms), one ore more of heaters in that half of heater circuit is open.

(1) If resistance is correct, proceed to step 2.

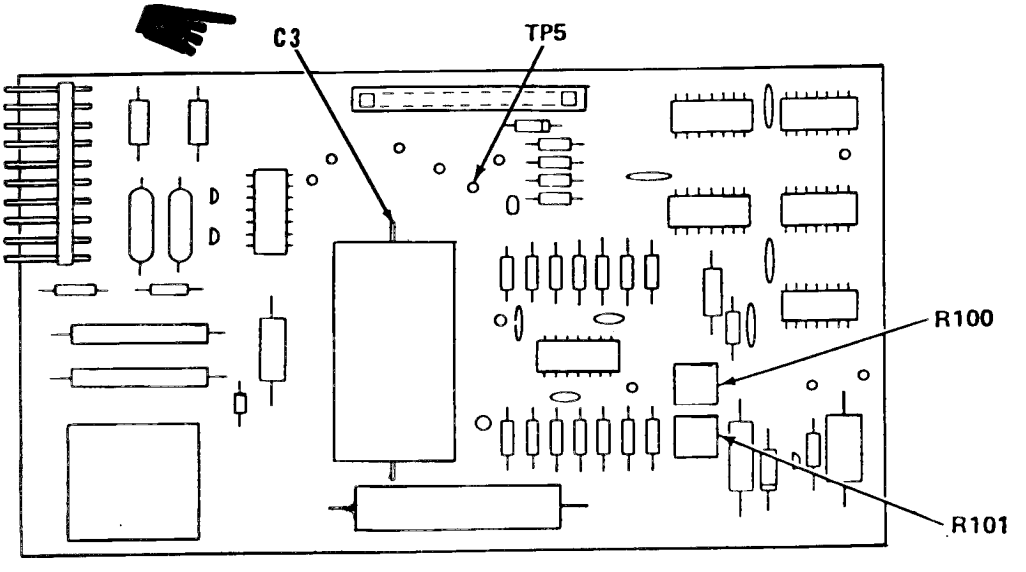
(2) If resistance is incorrect, replace heater ropes (paragraph 3-20.5).

Step 2. Check thermal roller temperature.

Adjust temperature if incorrect (paragraph 3-20.2).

2. PAPER ERROR LIGHT COMES ON DURING PRINT CYCLE.

Step 1. Adjust potentiometers.



(a) Unplug power cord and remove rear panel of reader-printer.

(b) Open logic board protective cover.

Table 3-4. DIRECT/GENERAL SUPPORT TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

2. PAPER ERROR LIGHT COMES ON DURING PRINT CYCLE - Cont

(c) Set multimeter to read 0-5 V dc.

(d) Attach positive lead to TP5 on logic board.

(e) Attach negative lead to top end of capacitor C3.

CAUTION

Between dc return of logic and chassis of reader-printer, 105 V ac exists. Never use chassis as common when making dc measurements on logic board. Erroneous readings will result and damage equipment.

(f) Plug in power cord.

(g) Switch reader-printer ON.

(h) Place print length switch into LONG PRINT position.

(i) Rotate long print potentiometer RI 00 to obtain maximum voltage reading. This must be +3.75 V dc or greater.

(j) Adjust R100 to read +2.50 to +2.75 V dc.

(k) Place print length switch into SHORT PRINT position.

(1) Rotate short print potentiometer RI 01 to obtain maximium voltage reading. This must be +3.75 V dc or greater.

(m) Adjust R101 to read +2.50 to +2.75 V dc.

If either long or short print potentiometers cannot be adjusted to produce minimum of +3.75 V dc, replace appropriate sensor.

Step 2. Check temperature of thermal roller.

(a) If temperature is correct, proceed to step 3.

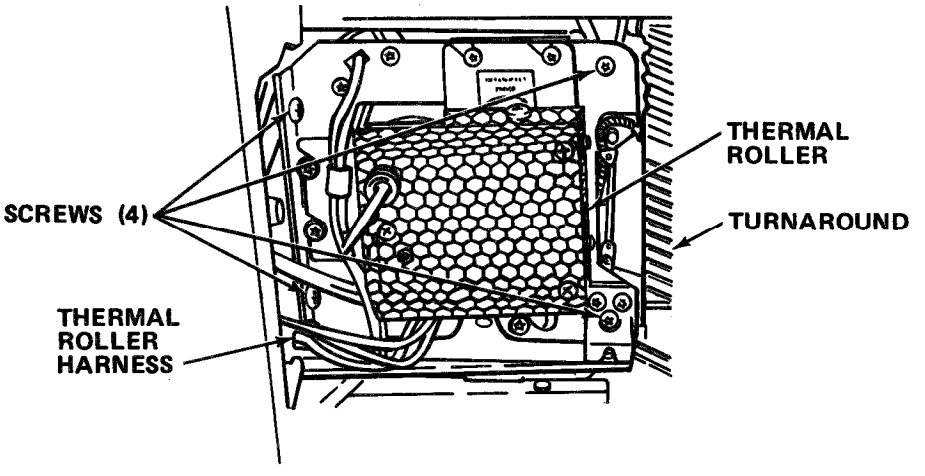
(b) Adjust if necessary (paragraph 3-20.2).

Table 3-4. DIRECT/GENERAL SUPPORT TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION

2. PAPER ERROR LIGHT COMES ON DURING PRINT CYCLE - Cont

Step 3. Check temperature-sensing switch.



(a) Open left side door. Pull turnaround out of reader-printer.

(b) Remove screws which attach thermal roller.

(c) Disconnect thermal roller harness.

(d) Slide thermal roller out of reader-printer.

(e) Remove insulation blanket.

(f) Using multimeter set on ohms range, check temperature-sensing switch mounted next to adjustable temperature control thermostat. Use soldering iron to heat base of switch. If switch closes, switch is operating correctly. Use pyrometer to verify temperature. Switch should be open at temperatures below 260°F (127°C) and closed above this temperature.

Replace temperature-sensing switch.

Step 4. If all above steps fail to correct problem, replace logic board (paragraph 3-20.1).

3-20. MAINTENANCE PROCEDURES.

a. This section contains instructions covering direct/general support maintenance fuctions for the microfiche reader-printer. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

3-20.1 Replace Logic Board.

MOS: 35E, Special Electronic Devices Repairer

TOOLS : Cross Tip Screwdriver

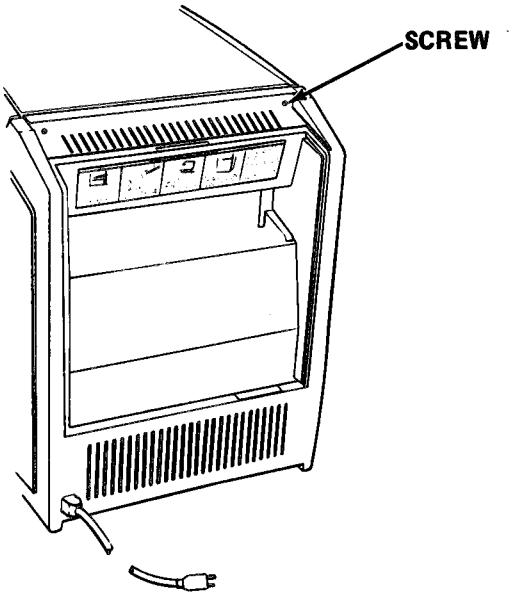
SUPPLIES: Logic board

WARNING

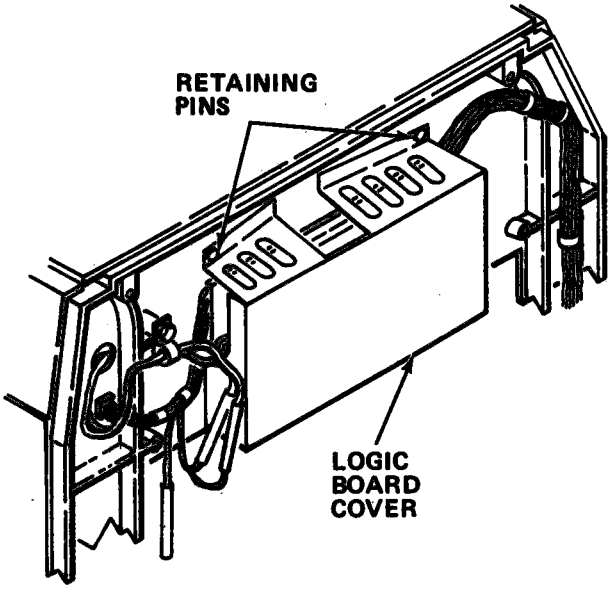
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

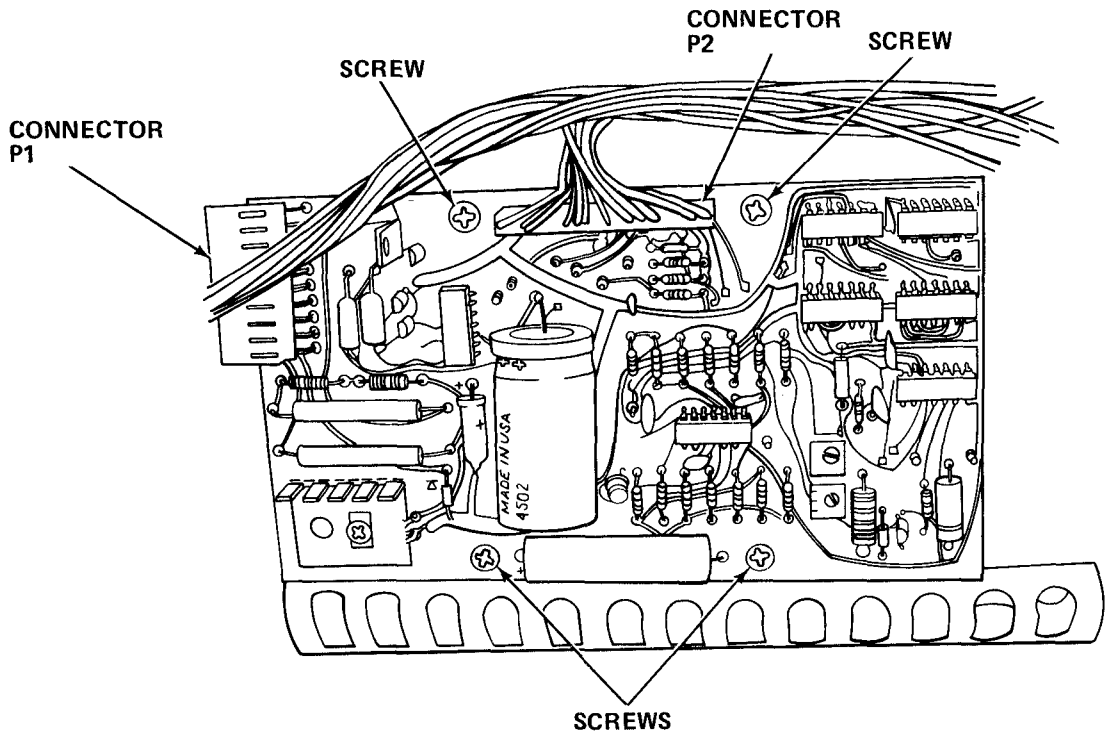
b. Remove rear paper loading door by lifting up and out.



c. Remove screws and rear panel.



d. Pull out nylon retaining pins from logic board cover. Hinge cover downward.



e. Unplug connector P2 by pulling straight out.

f. Unplug connector **P1** by pulling to left.

g. Remove screws and defective board.

h. Install new board and secure with screws.

i. Reconnect **P1** and P2 connectors.

j. Reinstall logic board cover.

k. Reinstall rear panel and secure with screws.

1. Reinstall rear paper loading door.

m. Plug in power cord.

3-20.2 Adjust Thermal Roller Temperature.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: Flat Tip Screwdriver
Pyrometer

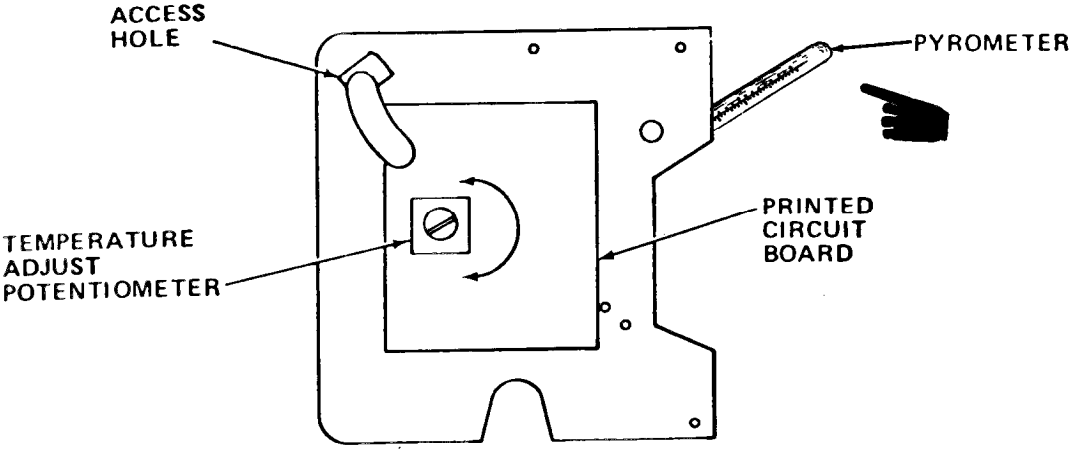
a. Plug in power cord.

b. Switch reader-printer ON and allow minimum of 10 minutes for temperatures to stabilize before making adjustments.

c. Slide microfiche handler fully right.

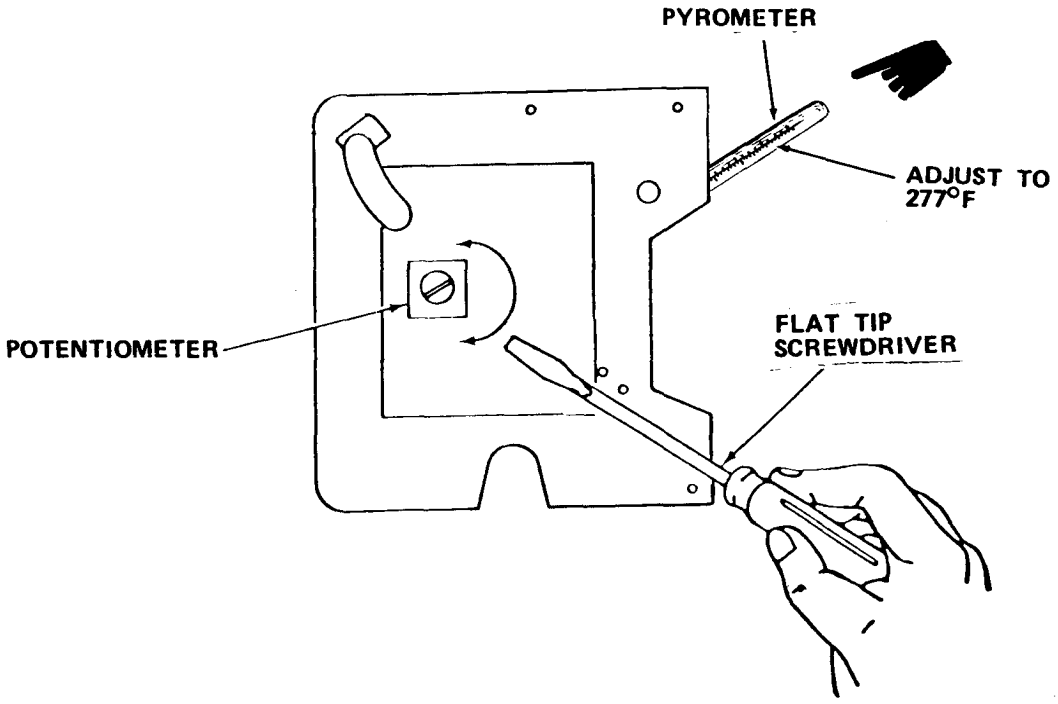
d. Open left side panel.

e. Pull turnaround out of reader-printer.



Place pyrometer underneath developer insulation pad. Leave in position for 1 minute.

Check temperature.



h. If temperature is below 277° ±3°F (136° ± 2°C), adjust potentiometer unitl desired temperature is obtained.

i. Remove pyrometer.

j. Replace turnaround into reader-printer.

k. Close left side panel.

1. Replace microfiche handler to normal work position.

3-20.3 Replace Temperature Control Thermostat.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: No. 3 Cross Tip Screwdriver

SUPPLIES Temperature Thermostat

WARNING

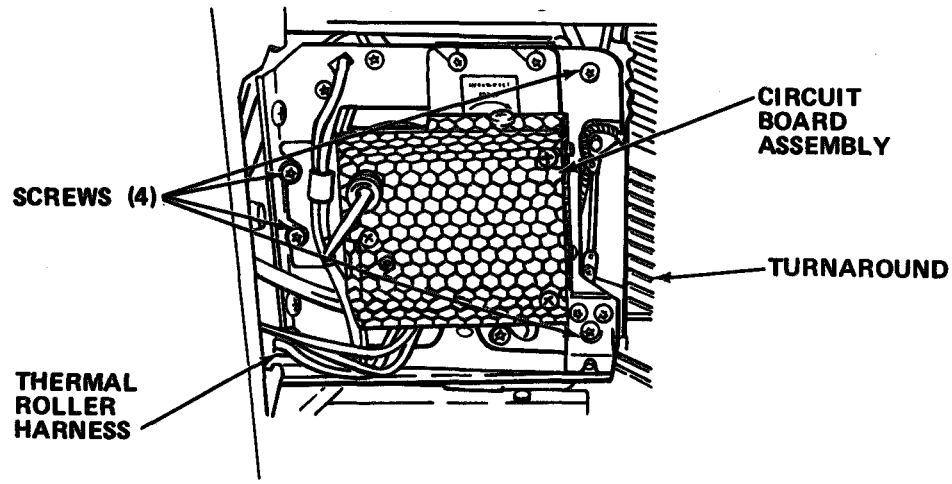
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord

NOTE

Left and right on reader-printer are taken when viewed from front.

b. open lower left side panel.



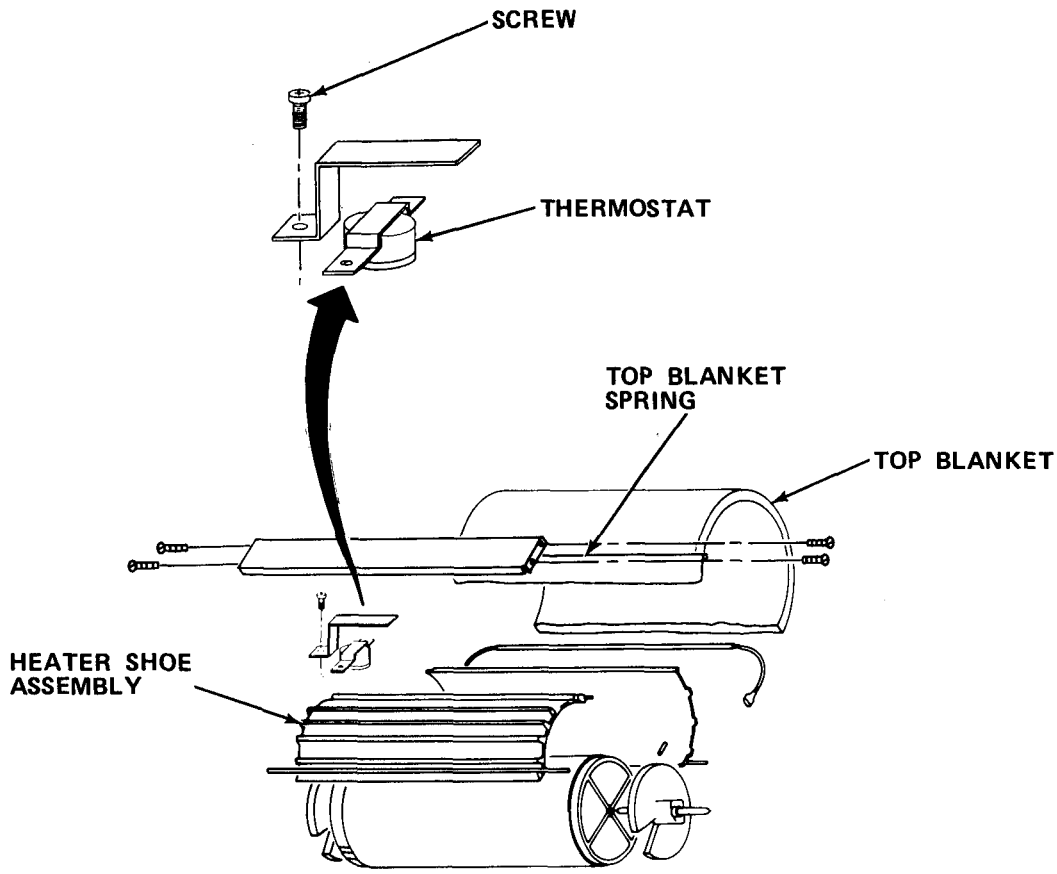
c. Remove turnaround.

d. Disconnect thermal roller harness from circuit board assembly.

e. Remove screws and slide thermal roller out.

f. Remove top blanket spring and top blanket from thermal roller assembly.

g. Tag and disconnect wires from temperature control thermostat.



h. Remove screw and lift out defective thermostat.

i. Install new thermostat and secure with screw.

j. Reconnect wiring to thermostat.

k. Reinstall top blanket spring and top blanket.

1. Reinstall thermal roller assembly into reader-printer.

m. Reconnect thermal roller harness.

n. Reinstall turnaround in reader-printer.

o. Close lower left side panel.

p. Plug in power cord.

3-20.4 Replace Temperature-Sensing Probe,

MOS: 35E, Special Electronic Devices Repairer

TOOLS: No. 3 Cross Tip Screwdriver
1/4 in. Combination Wrench

SUPPLIES: Temperature-Sensing Probe

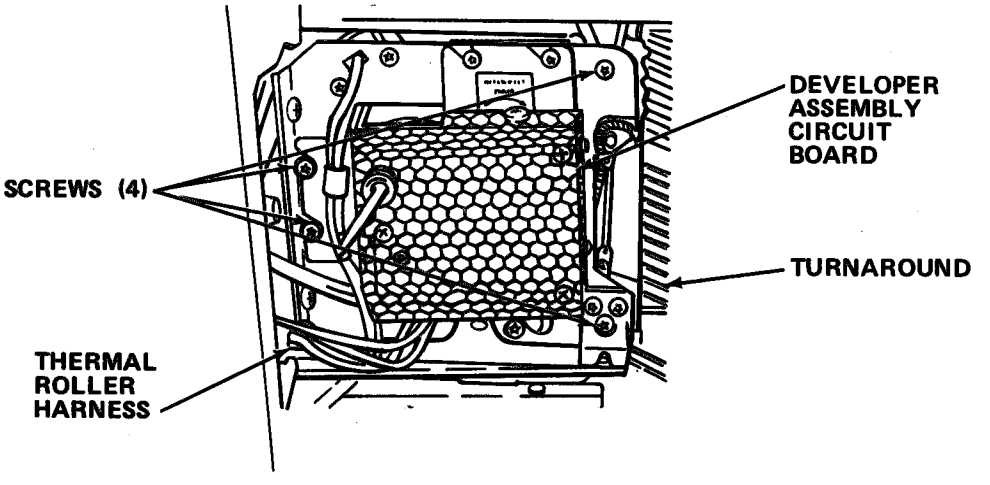
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing,

a. Unplug power cord.

NOTE

Left and right on reader-printer are taken when viewed from front.

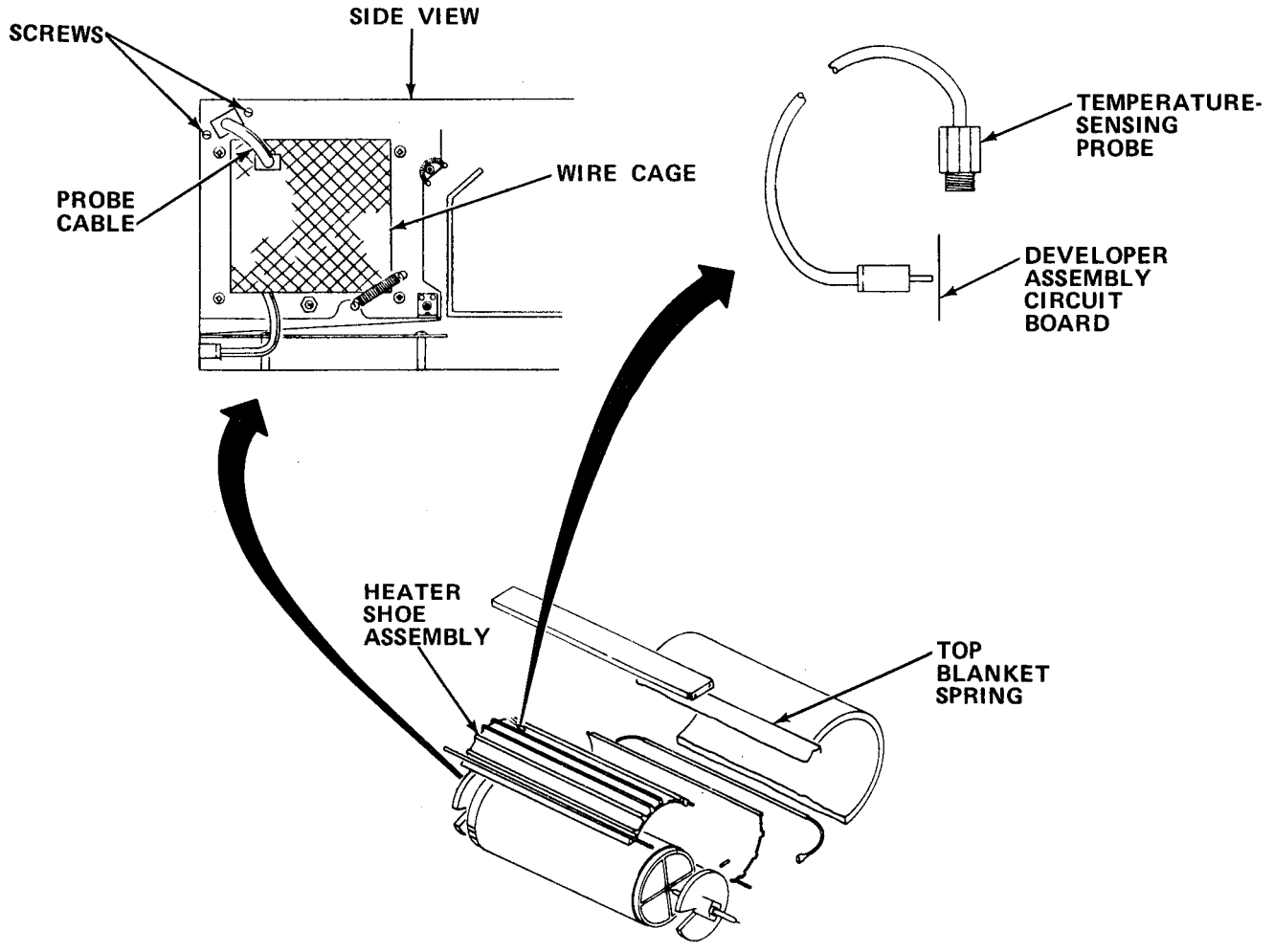


c. Pull turnaround out of reader-printer and place in safe location.

d. Disconnect thermal board harness.

e. Remove screws and slide thermal roller out of reader-printer.

f. Disconnect probe from developer assembly circuit board and thermal roller assembly.



g. Unscrew defective temperature-sensing probe.

CAUTION

Be careful while tightening probe nut. Probe is fragile.

h. Install new temperature-sensing probe and connect wiring at circuit board assembly.

i. Slide thermal roller into place and secure with screws.

j. Reconnect thermal roller harness.

k. Reinstall turnaround in reader-printer.

l. Close lower left side panel.

m. Plug in power cord.

3-20.5 Replace Heater Ropes.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: No. 2 Cross Tip Screwdriver
No. 3 Cross Tip Screwdriver
Flat Tip Screwdriver with 2 in. shaft x 1/8 in. blade

SUPPLIES: Heater Ropes

WARNING

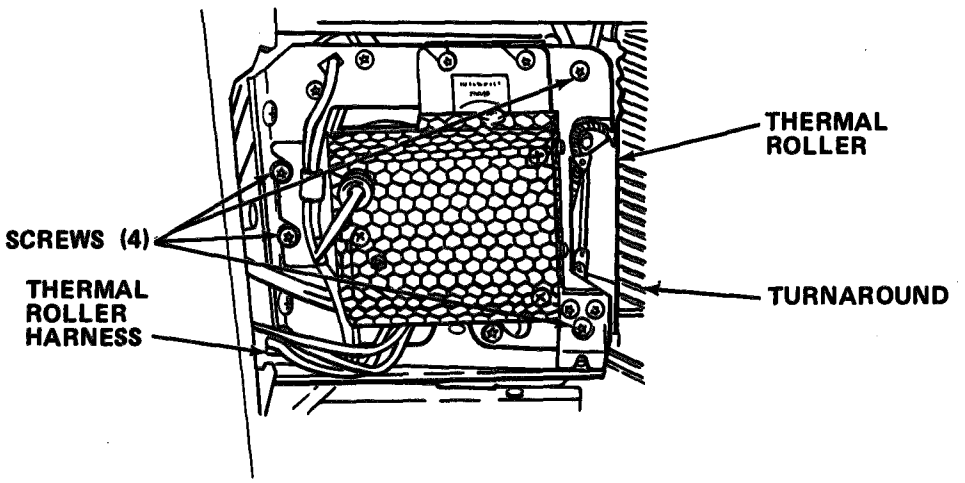
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

NOTE

Left and right on reader-printer are taken when viewed from front.

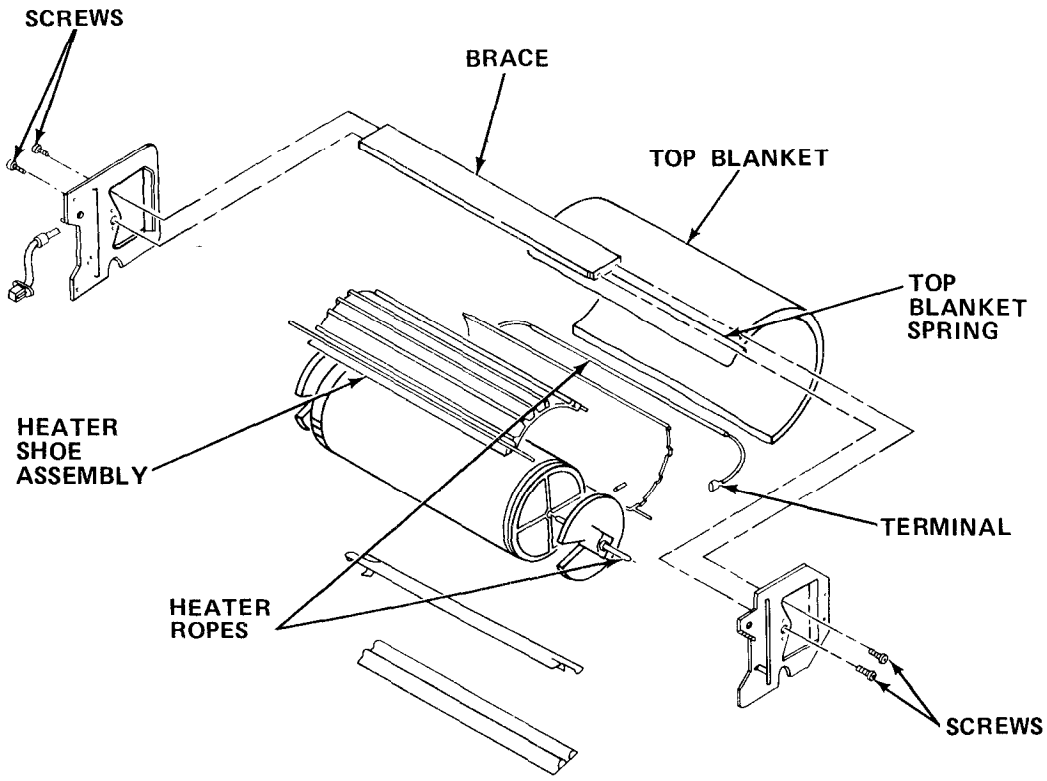
b. Open left side panel.



c. Pull turnaround out of reader-printer and place in safe location.

d. Disconnect thermal roller harness.

e. Remove screws and slide thermal roller assembly out.



f. Remove screws and top thermal roller brace.

g. Remove screws and circuit board assembly,

h. Remove top blanket springs and top blanket from heater shoe assembly.

i. Pull defective heater ropes from end terminals.

j. Install new heater ropes.

k. Push new heater ropes into end terminals and seat with small screwdriver.

l. Reinstall top blanket and secure with top blanket springs.

m. Reinstall top thermal roller brace and four screws.

n. Reinstall circuit board assembly.

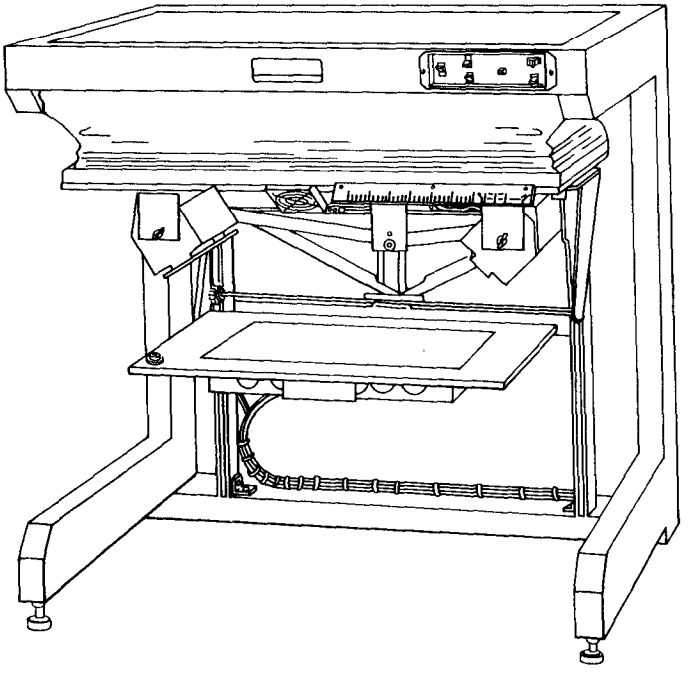
o. Slide in thermal roller and secure with screws.

p. Reconnect thermal roller harness.

q. Reinstall turnaround.

r. Close left side panel.

s. Plug in power cord.



CHAPTER 4

VERTICAL REFLECTING PROJECTOR

Section I INTRODUCTION

4-1. GENERAL INFORMATION.

4-1.1 Scope.

a. Model Number and Equipment Name. Model RP-T-4B Vertical Reflecting Projector.

b. Purpose of Equipment. To provide rapid scale change drafting of opaque or transparent copy.

4-2. EQUIPMENT DESCRIPTION.

4-2.1 Equipment Characteristics, Capabilities, and Features.

a. Capable of 4X reduction and 4X enlargement.

b. Provides back light for translucent copy and front light for opaque copy.

c. Provides±10 degree rectification of copy tilt.

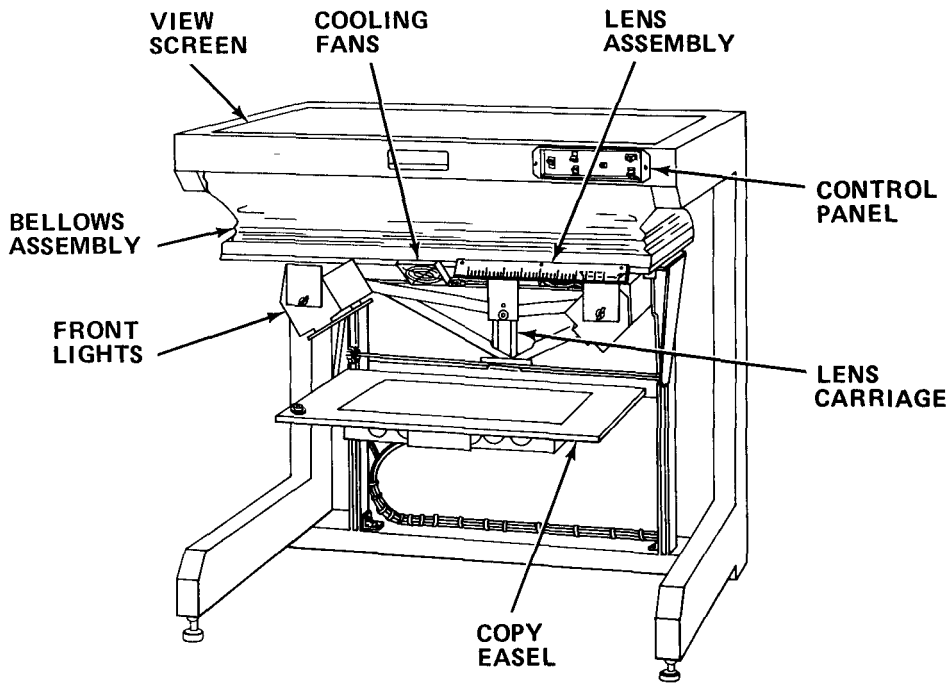
d. Autofocusing.

e. Cooling fans keep copy cool.

f. Electrically controlled enlargement and reduction.

g. Integral control panel controls all functions.

4-2.2 Location and Description of Major Components.



FRONT LIGHTS . Provide illumination to front of copy easel board.

BELLOWS ASSEMBLY. Isolates view screen from light of copy easel.

VIEW SCREEN. Provides flat surface for tracing projected image of copy.

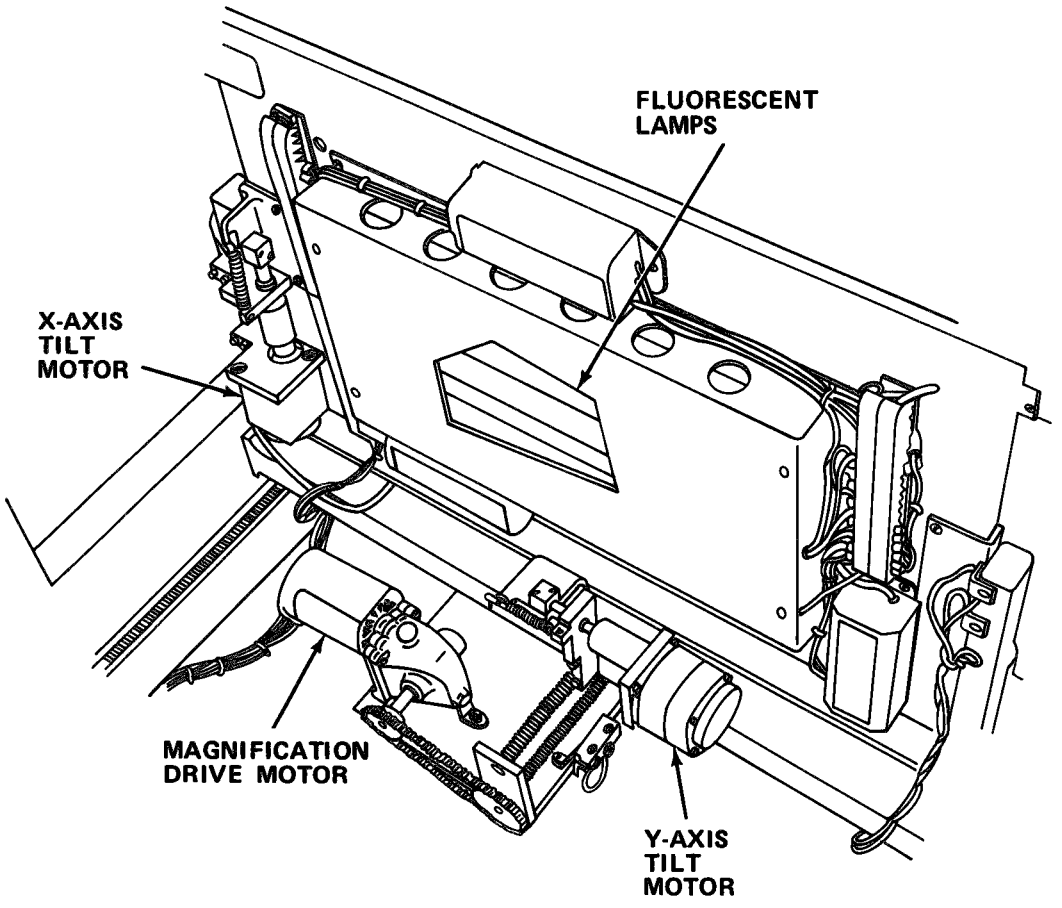
LENS ASSEMBLY. Collects copy image and projects it onto view screen.

COOLING FANS. Provide airflow to cool copy easel board and copy material.

CONTROL PANEL. Contains operator's controls for projector.

LENS CARRIAGE. Retains lens and maintains correct focal length.

COPY EASEL BOARD. Provides flat surface for projection copy.



FLUORESCENT LAMPS. Provide back light for transparent copy.

Y-AXIS TILT MOTOR. Provides rectification of image by tilting copy easel board front-rear.

MAGNIFICATION DRIVE MOTOR. Moves lens assembly to enlarge or reduce image.

X-AXIS TILT MOTOR. Provides rectification of image by tilting copy easel board right-left.

4-2.3 Equipment Data.

Dimensions	
Width	42 in. (106.7 cm)
Depth	31.62 in. (80.3 cm)
Height	42 in. (106.7 cm)
View Screen Area	23.37 in. X37.37 in. (59.4 cm X 94.9 cm)

Copy Easel Area	27.5 in. X 18 in. (69.9 cm X45.7 cm)
Back Lighted Area	10.25 in. X 18.25 in. (26.0 cm X 46.4 cm)
Reduction or Magnification	
Range	4X reduction to 4X enlargement
Lens	F/4.5, 6 in. (15.2 cm) focal length, wide angle design
Distortion Correction	Approximately 10 degree tilt of copy easel, any direction
Illumination	
Top Lights	Tungsten-iodine
Back Lights	Fluorescent
Voltage	115 V, 60-cycle, single-phase
Current	10.0 amps
Peak Power	1.23 kW
Nominal Power	1.05 kW
Fuse	10.0 amps
Operating Temperature Range	32°F (O°C) to 131°F (55°C)

4-3. TECHNICAL PRINCIPLES OF OPERATION. The purpose of the projector is to provide rapid scale change drafting of opaque or transparent copy. It consists of:

Enlargement/Reduction System

Rectification System

Lighting System

Electrical System

4-3.1 Enlargement/Reduction System. Varies the copy image size and maintains focus of lens. It consists of:

Lens Assembly

Lens Carriage

Magnification Drive Motor

a. Lens assembly. Collects, focuses, and projects the copy image onto the view screen.

b. Lens carriage. Contains the lens assembly. Through vertical movement, the lens carriage varies the projected image size while maintaining the focus.

c. Magnification drive motor. Applies rotary motion to two vertical screws. Two idler nuts on the screws convert the rotary motion to vertical linear motion. The nuts are connected to levers that move the lens carriage and copy easel up or down.

4-3.2 Rectification System. Corrects oblique copy image up to 10 degrees from

Copy Easel

X-Axis Tilt Motor

Y-Axis Tilt Motor

a. Copy easel. Provides a support surface for copy material. The easel will pivot in X-direction (right-left) or Y-direction (front-rear).

b. X-Axis tilt motor. Is located under the copy easel and provides power to tilt copy easel along its X-axis (right-left). A control panel switch controls the motor, and two microswitches limit the pivot angle to ±1O degrees.

c. Y-Axis tilt motor. Is located under the copy easel and provides power to tilt copy easel along its Y-axis (front-rear). A control panel switch controls the motor, and two microswitches limit the pivot angle to ±1O degrees.

4-3.3 Lighting System. Provides illumination for the copy material on the copy easel. It consists of:

Front Lights

Back Lights

a. Front lights. Provide surface illumination for opaque copy material. They are located above the copy easel.

b. Back lights. Provide illumination to the rear of translucent or transparent copy material. They are located under the copy easel.

4-3.4 Electrical System. Provides power and control for the various systems of the projector. It consists of:

Drive Motor Circuit

X-Axis Motor Circuit

Y-Axis Motor Circuit

Front Light Circuit

Back Light Circuit

a. Drive motor circuit. Controls the operation of the magnification drive motor through the control panel switch. Two microswitches limit the travel of the magnification drive.

b. X-Axis motor circuit. Controls the operation of the X-axis rectification drive through the control panel switch. Two microswitches limit the copy easel to 10 degrees of tilt right or left.

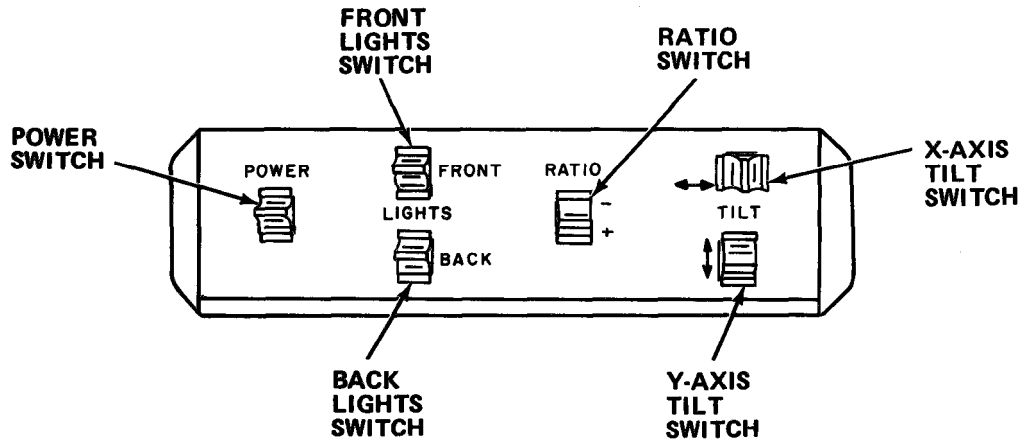
c. Y-Axis motor circuit. Controls the operation of the Y-axis rectification drive through the control panel switch. Two microswitches limit the copy easel to 10 degrees of tilt front or rear.

d. Front light circuit. Controls the operation of the tungsten-iodine front lights. A switch mounted on the control panel controls power to the lights.

e. Back light circuit. Controls the operation of the six fluorescent back light lamps through a switch on the control panel. Three ballasts regulate the current to the lamps.

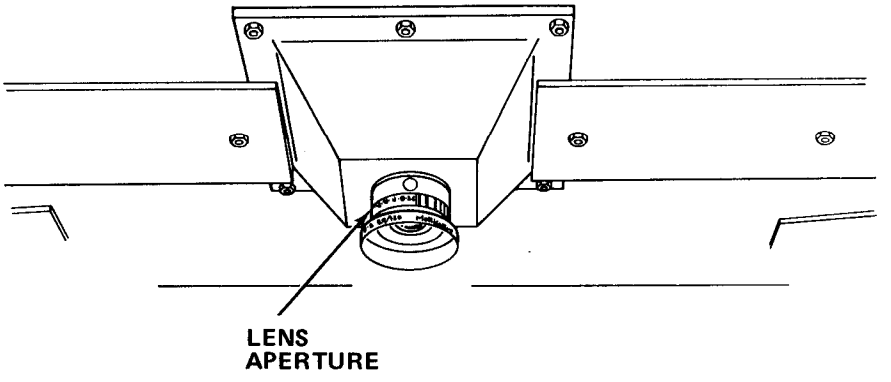
Section II OPERATING INSTRUCTIONS

4-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
POWER Switch	Provides power control of systems of projector. ON: Press up. OFF : Press down.
FRONT LIGHTS Switch	Provides power to tungsten-iodine front lights. **ON:** Press up. OFF: Press down.
RATIO Switch	Provides power and directional control of magnification drive motor. REDUCE (-): Press up. ENLARGE (+): Press down.
X-Axis TILT Switch	Provides power and control of X-axis tilt motor. RIGHT TILT: Press toward right. LEFT TILT: Press toward left.

Control or Indicator	Function
Y-Axis TILT Switch	Provides power and control of Y-axis tilt motor. FRONT TILT: Press down. REAR TILT: Press up.
BACK LIGHTS Switch	Provides power to fluorescent back lights. **ON:** Press up. OFF: Press down.



Lens Aperture	Controls intensity of projected image. INCREASE INTENSITY: Rotate left. DECREASE INTENSITY: Rotate right.

4-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

4-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If” column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to peform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Glass Cleaner (Item 6, Appendix E)	ar
Cheesecloth (Item 8, Appendix E)	ar
Lens Cleaner (Item 7, Appendix E)	ar
Lens Tissue (Item 30, Appendix E)	ar

Table 4-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN . Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Reediness Reporting, Equipment Is Not Ready/ Available If:
		VERTICAL REFLECTING PROJECTOR	
1	B	Inspect Projector.	
		1. Check for loose or missing nuts or screws. Tighten or replace.	
		2. Check for loose connections or damaged wiring.	Wiring is damaged
		3. Plug power cord in, set POWER switch to on, and check lights for proper illumination.	Power switch or power cord is defective.
		4. Check lens for dust cap. Remove cap, if present, and clean lens with lens cleaner and tissue.	
		5. With power on, press RATIO switch. Check for proper linkage movement.	Switch is defective.
		6. Press TILT switches and check for proper easel tilting.	Switch is defective.
		7. With POWER and FRONT LIGHTS switches on, check for operation of cooling fans.	Fans are defective.
		8. Check glass view screen for cracks, chips, or scratches.	View screen is cracked, chipped or scratched.
		9. Clean glass view screen with glass cleaner and cheesecloth.	

4-6. OPERATION UNDER USUAL CONDITIONS.

4-6.1 Assembly and Preparation For Use.

a. Remove copy easel strap, cushions, and two securing straps.

b. Remove wing nuts, plexiglas shield, and lamp retaining bar.

c. Reinstall plexiglas shield and wing nuts.

d. Remove view screen holddowns and store.

4-6.2 Operating Procedures.

a. Plug in power cord and set POWER switch to ON.

b. Remove inside and outside lens covers.

c. Place original copy to be traced on copy easel.

d. Place two weight bars on edge of copy to retain position.

e. Turn on front lights for opaque copy or back lights for translucent or transparent copy.

f. Place translucent tracing paper on view screen.

g. To observe projected image, move RATIO switch to achieve proper image scale.

h. If image rectification is needed, move X-axis or Y-axis TILT switch in proper direction.

4-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

4-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

4-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during operation or maintenance of the vertical reflecting projector, or its components. You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all test or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 4-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. FRONT LIGHTS WILL NOT LIGHT WHEN ACTIVATED.
Step 1. Check for unplugged power cord.
(a) If plugged in, proceed to step 2.
(b) Plug in power cord.
Step 2. Check fuse.
(a) If fuse is not defective, proceed to step 3.
(b) Replace defective fuse (10 amp).
(1) Push in cap and turn left.
(2) Remove defective fuse.
(3) Install new fuse.
(4) Push in cap and turn right.
Step 3. Check for defective front lightbulb.
(a) Replace defective front lightbulb (paragraph 4-10.2).
(b) Refer to organizational maintenance.
2. BACK LIGHTS WILL NOT LIGHT WHEN ACTIVATED.
Step 1. Check for unplugged power cord.
(a) If power cord is plugged in, proceed to step 2.
(b) Plug in power cord.
Step 2. Check fuse.
(a) Replace defective fuse (malfunction 1).
(b) Refer to organizational maintenance.

Table 4-2. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
3. BACK LIGHTS LIGHT, BUT ONE OR MORE FLUORESCENT LAMPS DO NOT LIGHT. Check for defective fluorescent lamps.	(a) Replace defective lamps. (b) If one or more fluorescent lamps still do not 1ight, refer to organizational maintenance.
4. INVERTER ASSEMBLY WILL NOT REDUCE OR ENLARGE IMAGE. Step 1. Check for unplugged power cord.	(a) If plugged in, proceed to step 2. (b) Plug in power cord.
Step 2. Check fuse.	(a) Replace defective fuse (real function 1). (b) Refer to organizational maintenance.
5. COPY EASEL WILL NOT TILT TO RECTIFY IMAGE. Step 1. Check for unplugged power cord.	(a) If plugged in, proceed to step 2. (b) Plug in power cord.
Step 2. Check fuse.	(a) Replace defective fuse (malfunction 1). (b) Refer to organizational maintenance.

4-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the vertical reflecting projector. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

4-10.1 Replace Back Lights.

MOS: 81Q, Terrain Analyst

SUPPLIES: Fluorescent Lamp

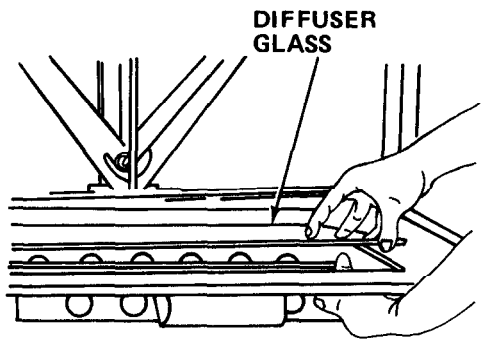
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

CAUTION

Remove glass with care to avoid breakage.



b. Remove diffuser glass from copy easel by inserting finger in vent hole and gently lifting upward.

c. Twist defective fluorescent lamp 90 degrees and remove by lifting up.

d. Install new fluorescent lamp into slotted holder and twist 90 degrees.

e. Reinstall diffuser glass into copy easel, dull surface down.

f. Plug in power cord.

4-10.2 Replace Front Lights.

M0S: 81Q, Terrain Analyst

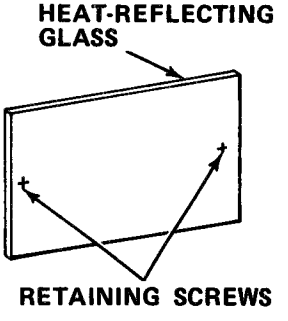
TOOLS: Flat Tip Screwdriver

SUPPLIES: Lightbulb
Cheesecloth (Item 8, Appendix E)

WARNING

- Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.
- Front lights become extremely hot during use. Wait until light assembly cools before replacement is effected.

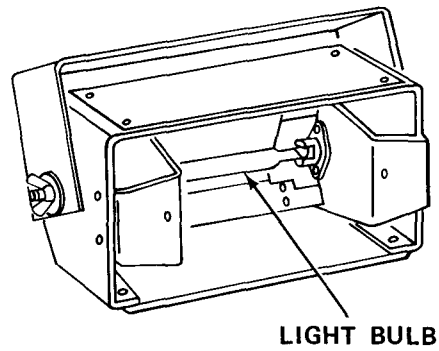
a. Unplug power cord.



b. Remove two screws retaining heat-reflecting glass and remove glass.

CAUTION

Do not handle lightbulb with bare hands or fingers. Skin oils will cause deterioration of lightbulb envelope. If lightbulb is accidentally touched, it must be cleaned with water and soft cloth and thoroughly dried.



c. Grasp lightbulb firmly, press horizontally against spring-loaded sockets and remove.

d. Grasp new lightbulb with clean rag or gloved hands, and install into sockets.

e. Reinstall heat-reflecting glass and secure with retaining screws.

f. Plug in power cord.

Section IV ORGANIZATIONAL MAINTENANCE

4-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

4-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT(TMDE); AND SUPPORT EQUIPMENT.

4-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-12.2 Special Tools: Test, Measurement, and Diagnostic Equipment: and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

4-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering organizational maintenance for this equipment.

4-13. SERVICE UPON RECEIPT.

4-13.1 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, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

4-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS assigned for this equipment.

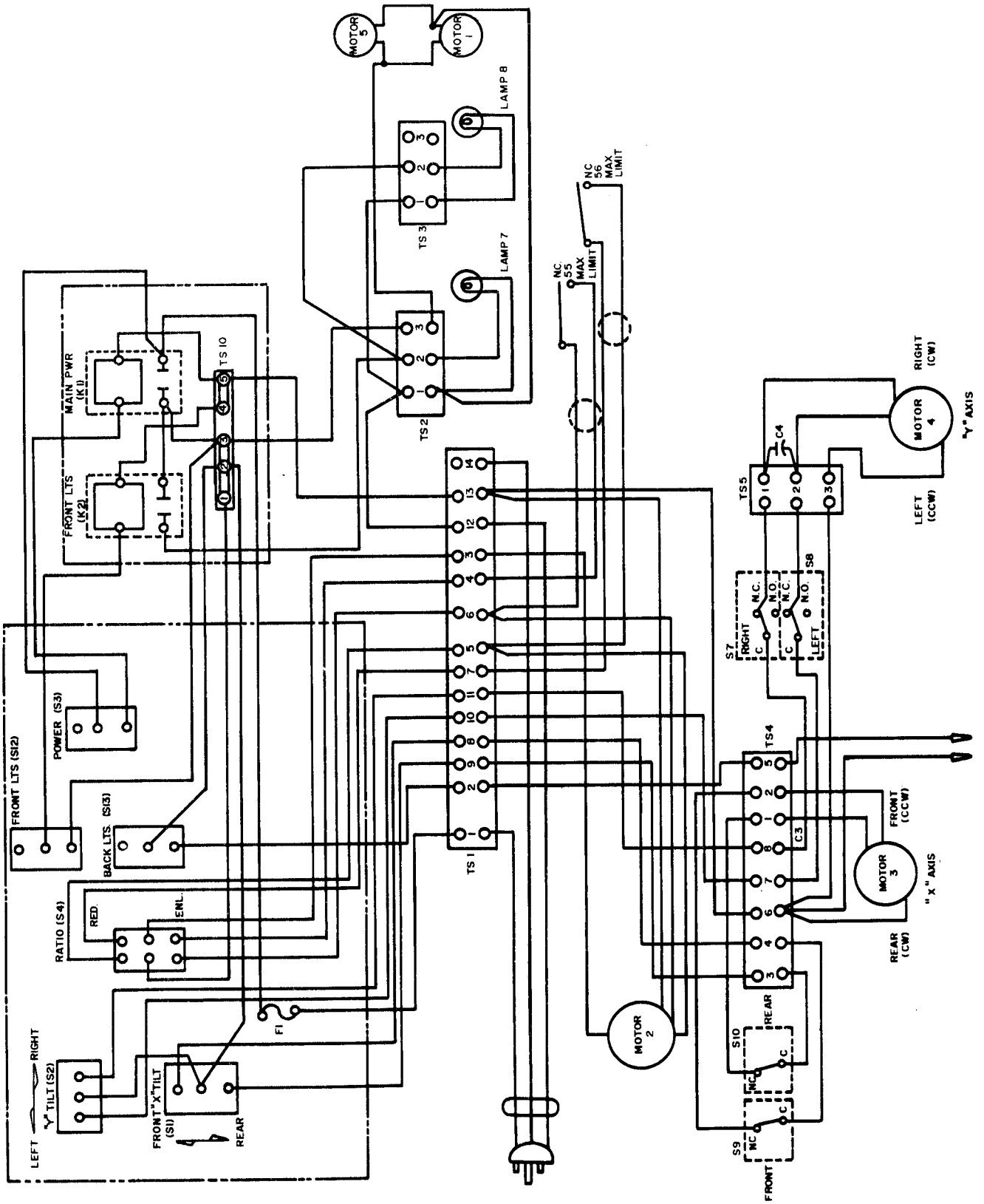
4-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.

a. Organizational troubleshooting procedures cover the most common malfunctions the may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/ inspection and corrective action. If a malfunction is not listed or corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the following schematics or the foldout located at the end of this manual for further fault analysis.

d. If the vertical reflecting projector does not power up when turned up, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedures for dead receptacle (Table 1-4).


MOTOR 5
MOTOR 1
LAMP 8
LAMP 7
TS 3
TS2
TS 10
MAIN PWR (K1)
FRONT LTS (K2)
NC 55 MAX LIMIT
NC 56 MAX LIMIT
TS 1
TS4
TS5
C4
C3
RIGHT (CW)
MOTOR 4
"Y" AXIS
LEFT (CCW)
S7
S8
RIGHT
LEFT
N.C.
N.O.
C
FRONT (CCW)
MOTOR 3
"X" AXIS
REAR (CW)
MOTOR 2
S10
REAR
S9
FRONT
FRONT LTS (SI2)
POWER (S3)
BACK LTS (SI3)
RATIO (S4)
RED
ENL
F1
LEFT
RIGHT
"Y" TILT (S2)
FRONT "X" TILT (SI)
REAR

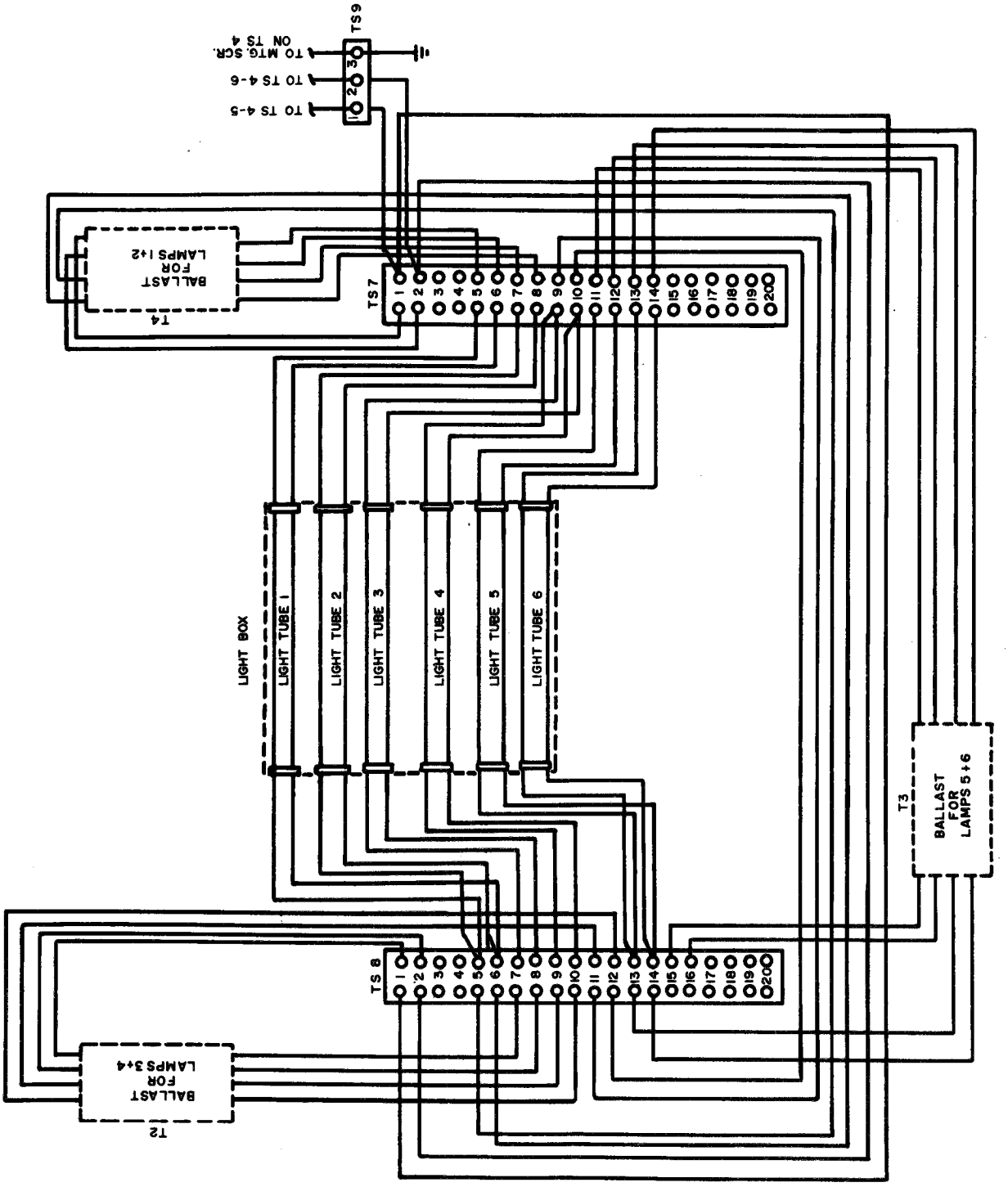

TS9
TO MTG. SCR. ON TS 4
TO TS 4-6
TO TS 4-5
1 2 3
BALLAST FOR LAMPS 1+2
T4
TS7
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
LIGHT BOX
LIGHT TUBE 1
LIGHT TUBE 2
LIGHT TUBE 3
LIGHT TUBE 4
LIGHT TUBE 5
LIGHT TUBE 6
T3
BALLAST FOR LAMPS 5+6
TS 8
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
BALLAST FOR LAMPS 3+4
T2

Table 4-3. ORGANIZATIONAL TROUBLESHOOTING

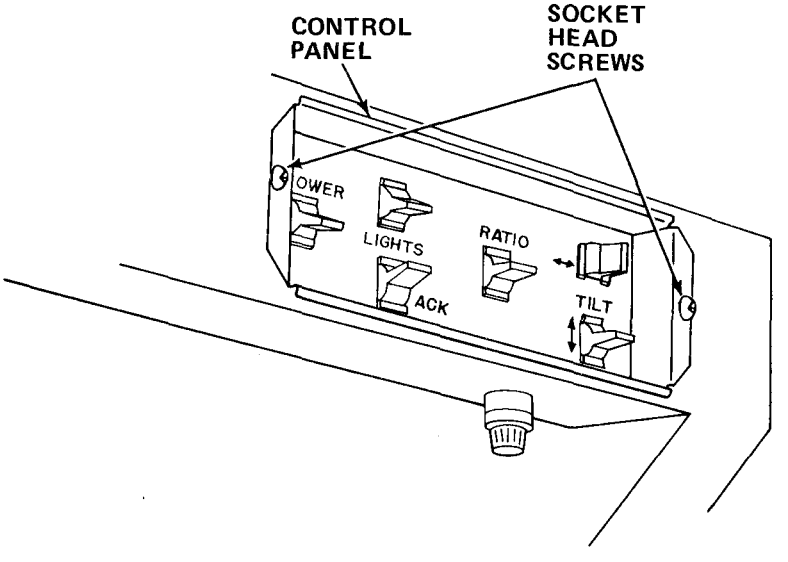
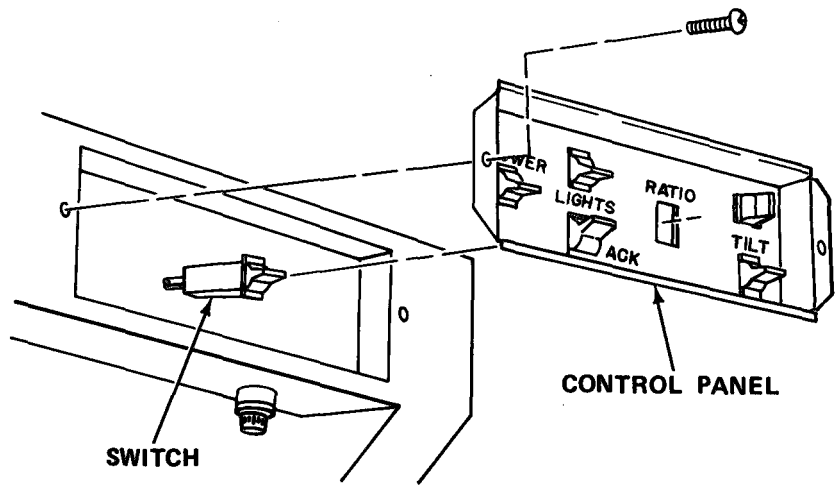
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. FRONT LIGHTS WILL NOT LIGHT WHEN ACTIVATED. Check FRONT LIGHTS switch for continuity with multimeter. **WARNING** Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing. (a) Unplug power cord.      (b) Remove socket head screws and control panel .

Table 4-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. FRONT LIGHTS WILL NOT LIGHT WHEN ACTIVATED - Cont



(c) Connect multi meter probes to wire terminals on rear of FRONT LIGHTS switch.

(d) Set FRONT LIGHTS switch to on and check that it has continuity.

(e) Set FRONT LIGHTS switch to off and check that it has no continuity.

Replace FRONT LIGHTS switch if defective (paragraph 4-16.2).

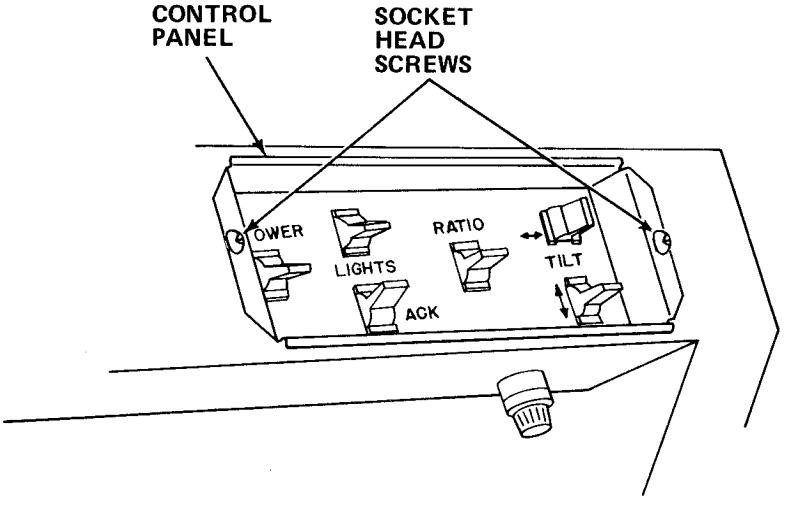
Table 4-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
2. BACK LIGHTS WILL NOT LIGHT WHEN ACTIVATED.	Check BACK LIGHTS switch for continuity with multimeter.	

WARNING

Death or serious injury may occur from electrical shock unless power cord

(a) Unplug power cord.



(b) Remove socket head screws and control panel .

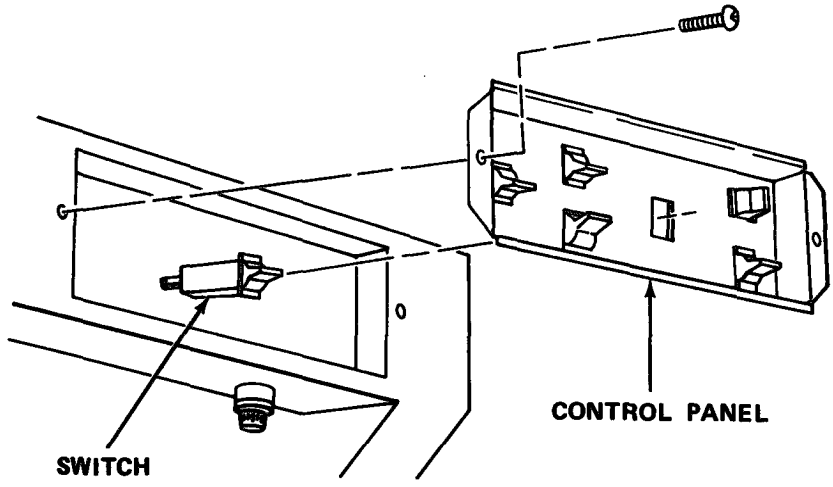
Table 4-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

2. BACK LIGHTS WILL NOT LIGHT WHEN ACTIVATED - Cont



(c) Set BACK LIGHTS switch to on and check that it has continuity.

(d) Set BACK LIGHTS switch to off and check that it has no continuity.

Replace BACK LIGHTS switch if defective (paragraph 4-16.2).

3. BACK LIGHTS LIGHT, BUT ONE OR MORE FLUORESCENT LAMPS DO NOT LIGHT.

Check for defective ballast.

Replace defective ballast (paragraph 4-16.4).

Table 4-3. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
4. INVERTER ASSEMBLY WILL NOT REDUCE OR ENLARGE IMAGE.
Step 1. Check for defective RATIO switch.
(a) If switch is not defective, proceed to step 2.
(b) Replace defective RATIO switch (paragraph 4-16.2).
Step 2. Check for defective magnification drive motor.
Replace defective magnification drive motor (paragraph 4-16.6).
5. COPY EASEL WILL NOT TILT TO RECTIFY IMAGE.
Step 1. Check for defective drive chain.
(a) If chain is not defective, proceed to step 2.
(b) Replace drive chain (paragraph 4-16.7).
Step 2. Check for defective rectifying tilt motor.
(a) If tilt motor is not defective, proceed to step 3.
(b) Replace defective rectifying tilt motor (paragraph 4-16.5).
Step 3. Check for defective tilt switch.
Replace defective tilt switch (paragraph 4-16.2).

4-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance functions for the vertical reflecting projector. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

4-16.1 Replace Cooling Fan.

MOS: 41B, Topographic Instrument Repair Specialist

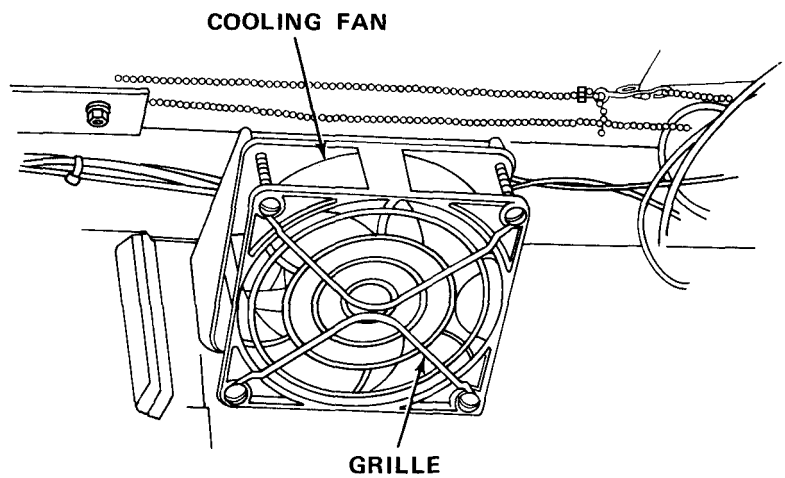
TOOLS: Flat Tip Screwdriver

SUPPLIES: Cooling Fan
Wire Ties

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.



b. Remove screws and terminal block cover. Tag and disconnect wires from motor.

c. Cut wire ties.

d. Remove retaining screws, and defective cooling fan and grille.

e. Install new cooling fan and reinstall grille. Secure with retaining screws.

f. Reconnect wires. Secure with retaining screws and reinstall terminal block cover.

g. Install wire ties.

h. Plug in power cord.

4-16.2 Replace Switch (es).

MOS: 41B, Topographic Instrument Repair Specialist

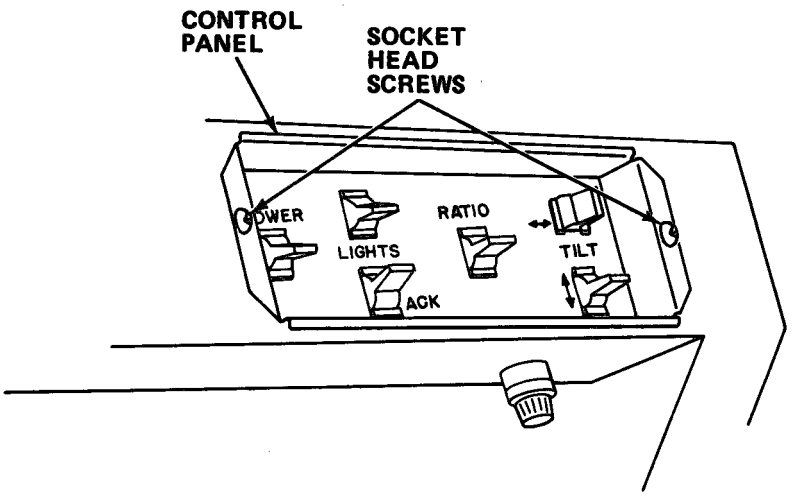
TOOLS: 3/32 in. Hex Head Key Wrench
Soldering Iron

SUPPLIES: Switch
Solder (Item 23, Appendix E)
Wire Ties

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

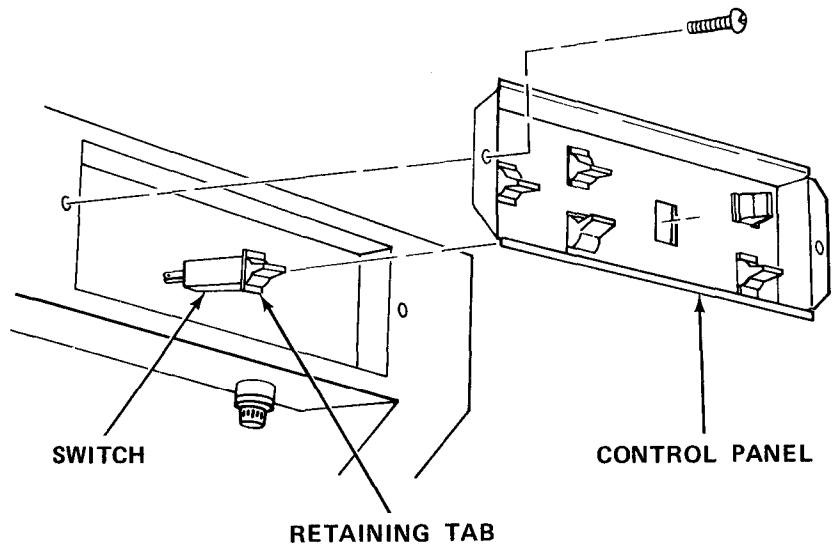
a. Unplug power cord.



b. Remove socket head screws and control panel.

NOTE

Tag all electrical connections before removing to be sure of proper reassembly.



c. Remove retaining screws. Tag and desolder wiring.

d. Press retaining tabs together and remove defective switch in front of control panel.

e. Press retaining tabs together and install new switch in front of control panel.

f. Solder wiring in proper order.

g. Reinstall control panel to projector, and secure with socket head screws.

h. Plug in power cord.

4-16.3 Replace Rectifying Limit Switch(es).

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
5/16 in. Combination Wrench

SUPPLIES: Limit Switch(es)

a. Turn POWER switch on. Position copy easel as follows:

(1) Raise copy easel to top position for Y-axis switch replacement.

(2) Lower copy easel for X-axis switch replacement.

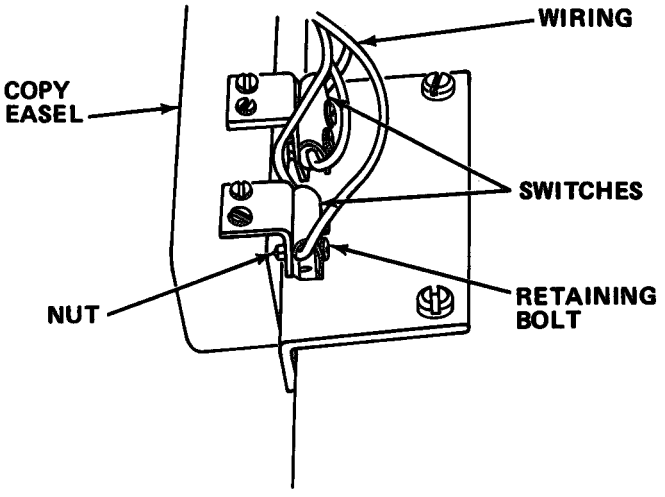
WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

b. Turn off power switch and unplug power cord.

NOTE

Tag all electrical connections before removing to be sure of proper reassembly.



c. Remove screws retaining electrical wiring to limit switch. Tag and remove wires.

d. Remove bolts, nuts, and washers retaining limit switch to copy easel.

e. Remove defective limit switch from copy easel.

f. Install new limit switch on copy easel.

g. Reinstall washers, nuts, and bolts retaining limit switch to copy easel and tighten bolts securely.

h. Reconnect electrical wiring in proper order to limit switch.

i. Reinstall screws retaining wiring to limit switch and tighten screws securely.

j. Plug in power cord.

4-16.4 Replace Ballast.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS : Flat Tip Screwdriver

SUPPLIES: Ballast

WARNING

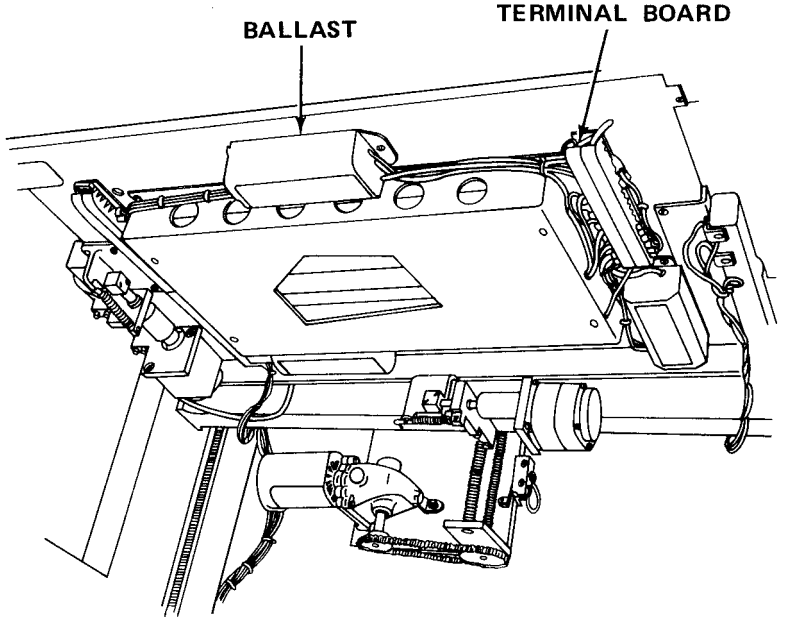
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

NOTE

Tag all electrical connections before removing to be sure of proper reassembly.

b. Remove screws and cover from terminal board. Tag and disconnect wiring.



c. Remove screws retaining ballast to copy easel and remove defective ballast.

d. Install new ballast to copy easel and retain with screws.

e. Reconnect electrical wiring to terminal block in proper positions and retain with screws.

f. Reinstall cover to terminal board.

g. Plug in power cord.

4-16.5 Replace Rectifying Tilt Motor.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver
.050 in. Hex Head Key Wrench
5/32 in. Hex Head Key Wrench

SUPPLIES: Tilt Motor

WARNING

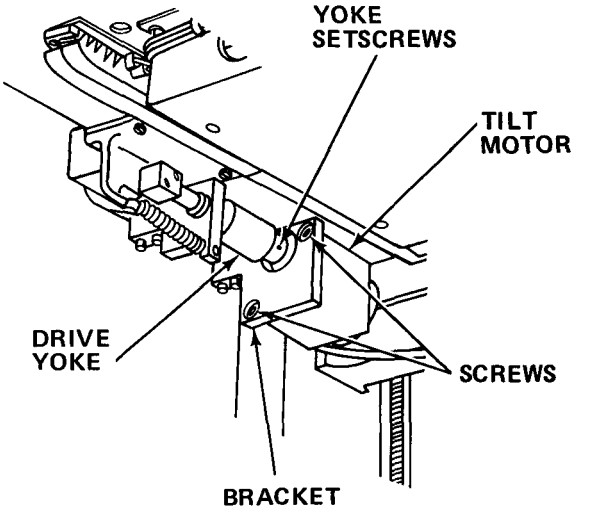
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

NOTE

Tag all electrical connections before removing to be sure of proper reassembly.

b. Remove terminal board cover. Remove retaining screws and motor wiring harness.



c. Loosen setscrews retaining drive yoke to motor shaft.

d. Remove screws and nuts retaining tilt motor to bracket, and remove defective motor.

e. Aline motor shaft to drive yoke. Install new tilt motor to bracket, and secure with screws and nuts.

f. Tighten drive yoke setscrews.

g. Reconnect wiring in proper order to terminal board. Secure with screws and reinstall cover.

h. Plug in power cord.

4-16.6 Replace Magnification Drive Motor.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: 7/16 in. Combination Wrench

SUPPLIES: Drive Motor

WARNING

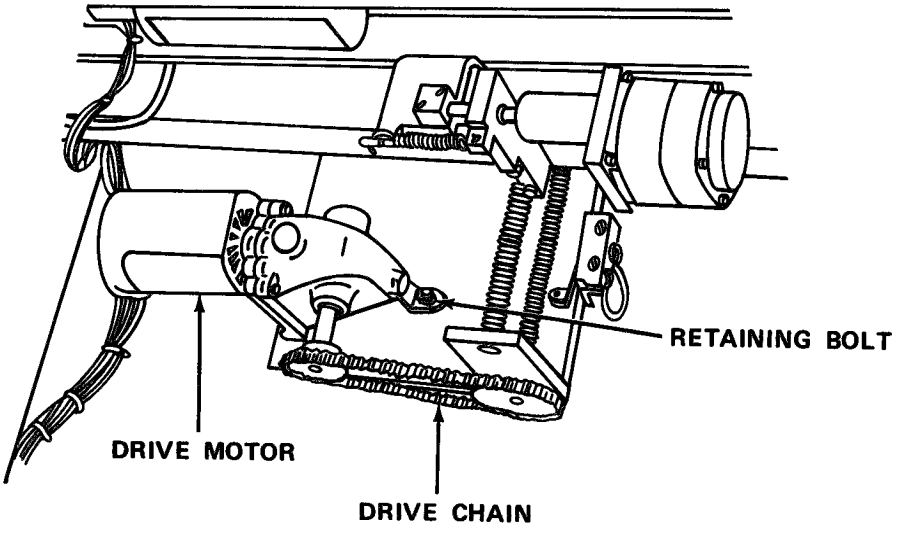
Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.

NOTE

Tag all electrical connections before removing to be sure of proper reassembly.

b. Remove terminal screws and terminal board cover. Tag and disconnect wiring.



c. Loosen retaining bolts and slide drive motor to right to loosen drive chain.

d. Remove drive chain.

e. Remove retaining bolts, nuts, and washers.

f. Remove defective magnification drive motor from bracket.

g. Install new magnification drive motor to bracket.

h. Reinstall, but do not tighten, retaining washers, nuts, and bolts.

i. Reinstall drive chain to sprockets.

NOTE

Chain deflection should be 1/8 - 3/16 in. (3.0 - 4.5 mm).

j. Slide magnification drive motor to left to tighten chain. Tighten retaining bolts.

k. Reconnect wiring in proper order to terminal board. Secure with terminal screws and reinstall cover.

l. Plug in power cord.

4-16.7 Replace Drive Chain.

MOS: 41B, Topographic Instrument Repair Specialist

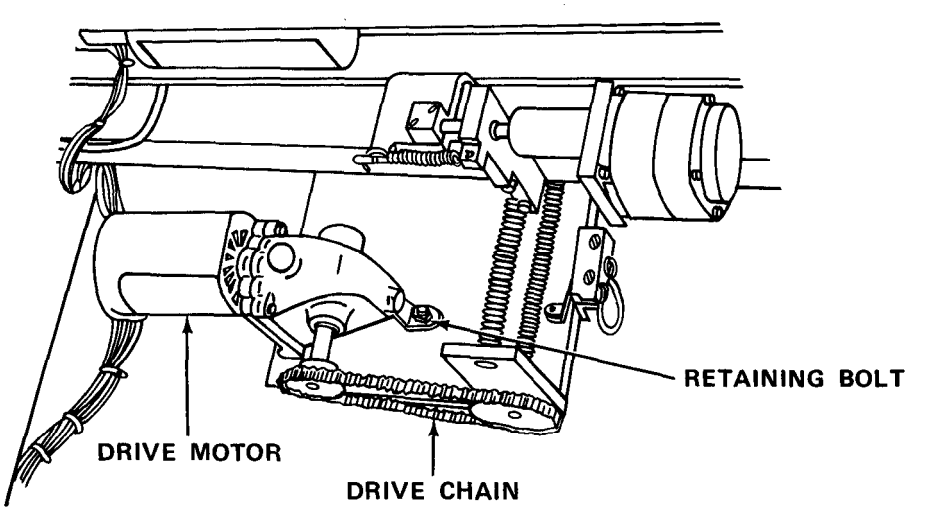
TOOLS: 7/16 in. Combination Wrench

SUPPLIES: Drive Chain

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Unplug power cord.



b. Loosen retaining bolts and slide magnification drive motor to right to loosen drive chain.

c. Remove drive chain from sprockets.

d. Install new drive chain on sprockets.

NOTE

Chain deflection should be 1/8 -3/16 in. (3.0 - 4.5 mm).

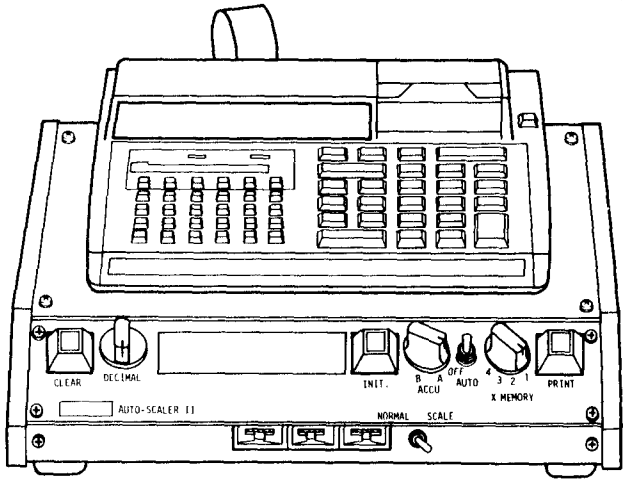
e. Slide magnification drive motor to left to tighten drive chain. Tighten retaining bolts securely.

f. Plug in power cord.

4-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.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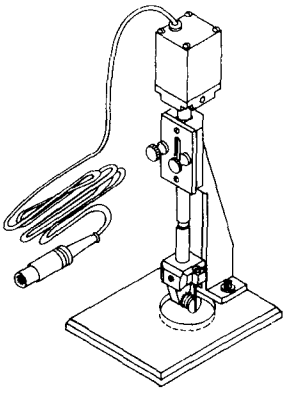
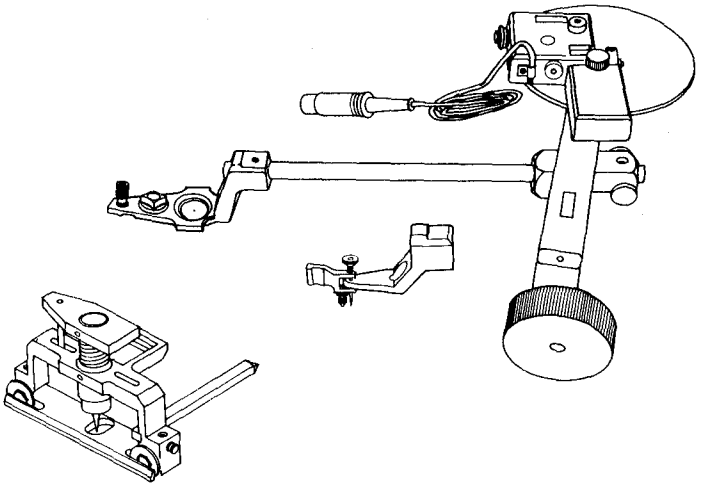
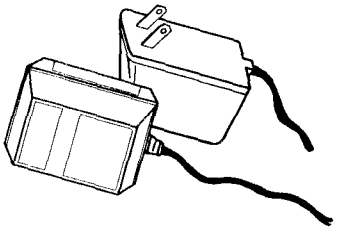
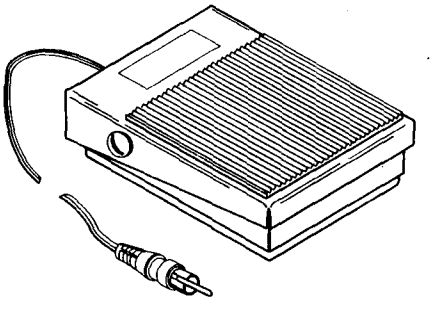
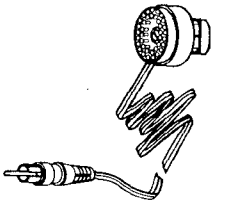
4 3 2 1
X MEMORY
PRINT
AUTO-SCALER II
NORMAL SCALE











CHAPTER 5

QUANTITY PROCESSING SYSTEM (QPS)

Section I INTRODUCTION

5-1. GENERAL INFORMATION.

5-1.1 Scope.

a. Model Number and Equipment Name. Model L2501 Quantity Processing System (QPS).

b. Purpose of Equipment. To provide electronic estimation, in proper units and scale, of area, perimeter, distance, and volume of geographic-shapes found on maps, drawings and aerial photographs.

5-1.2 Reference Information. Numerical values shown on the Calibration Records Sheet, which is supplied with your QPS, must be used to successfully operate the equipment.

5-1.3 Glossary.

Constant	Factor used to convert electronic measurement counts of the planimeter or linear measuring probe, to desired unit of measurement.
Contour	Closed loop on contour map. Indicates height by interval.
Contour Interval	Difference in elevation of two consecutive contour lines.
Contour Method	Estimates volume of fill or cut from its contours.
cut	Excavation or depression-like formation.
Daylighted Contour	Point or edge where cut becomes fill or fill becomes cut .
Fill	Embankment or hilly formation.

Planimeter	Instrument that provides data used to estimate area of geometric shape by tracing its boundary line.
QPS	Quantity Processing System
R_L or R_2	Alinement reading of linear measuring probe representing total number of pulse counts emitted by probe, per unit of length.
R_T or R_1	Alinement reading of planimeter representing total number of pulse counts derived by measuring area described by a test rule.
Scale Ratio	Ratio between given distance on map or drawing to corresponding distance on ground.
Slope	Natural or artificial incline or slant of ground.
Subroutine	Distinct routine or program. Part of larger routine or program that will perform its own distinct functions when used.
Test Rule	Device used to aline planimeter and obtain a constant factor.
μ	Resolution factor for linear measuring probe or planimeter at specified tracer arm length. Represents smallest area or length measuring instrument can measure. Measuring instrument emits single pulse count for each unit.

5-2. EQUIPMENT DESCRIPTION.

5-2.1 Equipment Characteristics, Capabilities, and Features. Provides electronic estimation, in scale, of area, perimeter, distance, and volume of geometric shapes on maps, drawings, aerial photographs etc. The equipment has the following capabilities and features.

a. Calculator provides for data storage and manipulation.

b. Automatically estimates distance, area, or volume as measuring instrument is moved.

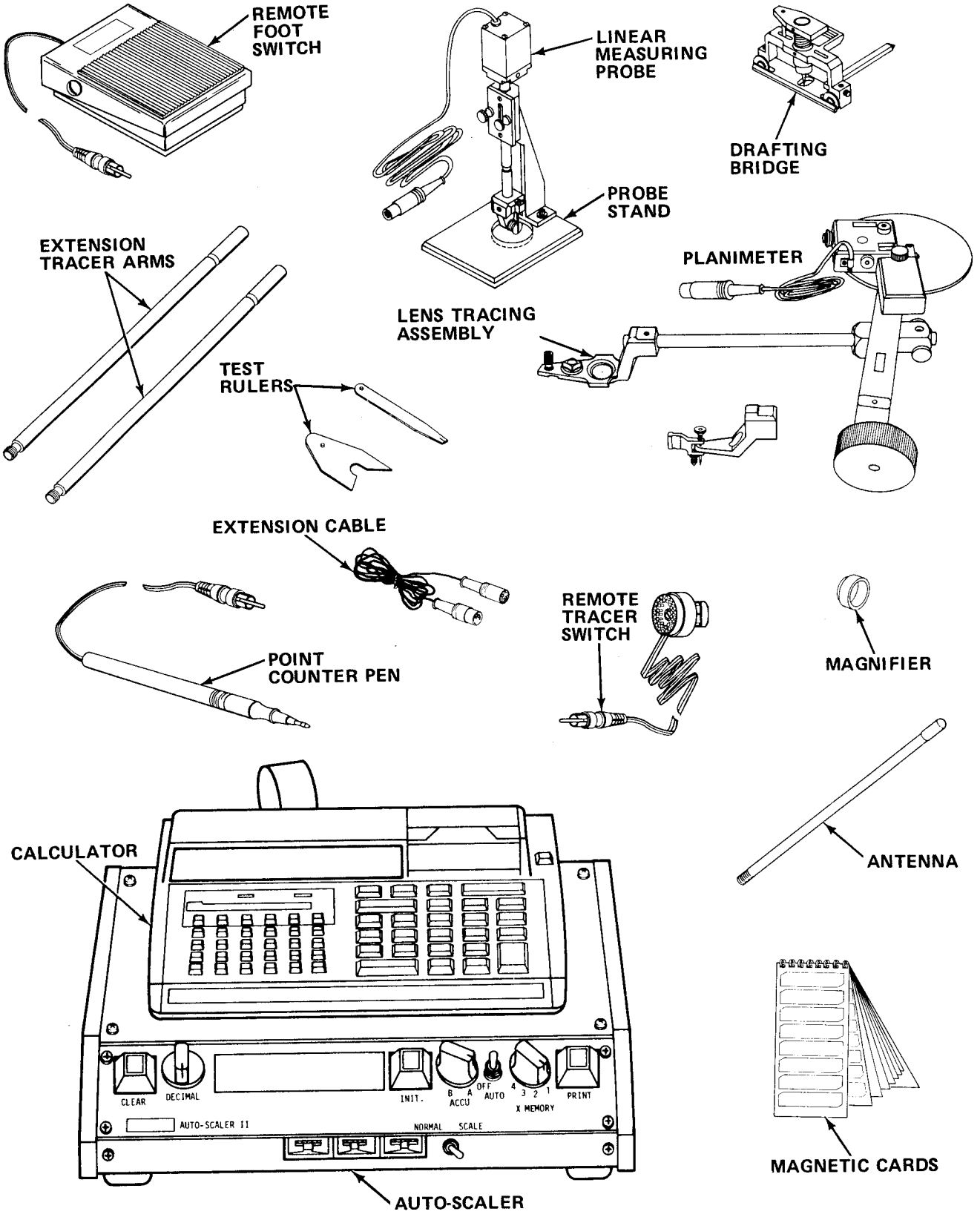
c. Displays results of measurement in proper scale and units.

d. Prints measurement automatically or on command.

e. Planimeter provides for measurement of surface area and volume.

f. Linear measuring probe provides for measurement of distances.

5-2.2 Location and Description of Major Components.



REMOTE FOOT SWITCH. Enables operator to remotely control four auto-scaler functions: Print, Clear, Actuate, or Initiate.

LINEAR MEASURING PROBE. Hand held or stand held measuring instrument. Measures distance.

PROBE STAND. Metal stand that holds linear measuring probe to secure its fixed position during measurements.

DRAFTING BRIDGE. Provides mount for planimeter encoder for use during measurements or detailed layout work.

PLANIMETER. Wheel mounted measuring instrument. Measures surface area and volume,

LENS TRACING ASSEMBLY. Assembly mounted on end of planimeter tracer arm. Traces lines by centering with a small dot printed on center of lens.

NEEDLE TRACING ASSEMBLY. Assembly mounted on end of planimeter tracer arm. Used to provide polar compensation in tracing measurements.

REMOTE TRACER SWITCH. Mounted on planimeter or drafting bridge. Enables operator to remotely control four auto-scaler functions: Print, Clear, Actuate, or Initialize. Provides remote operation of auto-scaler command switches.

MAGNIFIER. Placed over lens of lens tracing assembly to improve visibility of fine lines.

ANTENNA. Holds signal cables out of way of planimeter.

PREPROGRAMMED CARDS. Magnetic cards containing instructions to calculate, store, print, and display measurement input.

MAGNETIC CARDS. Blank cards used for recording original programs.

AUTO-SCALER. Counts pulses from measuring instruments. Displays count. Interfaces with calculator.

CALCULATOR. Calculates measurements according to program data. Displays results of measurements. Prints measurement results.

POINT COUNTER PEN. Pen that contains transducer. Pen emits one pulse for each stroke (count) made during count measurement.

EXTENSION CABLE. Used with planimeter to extend its reach.

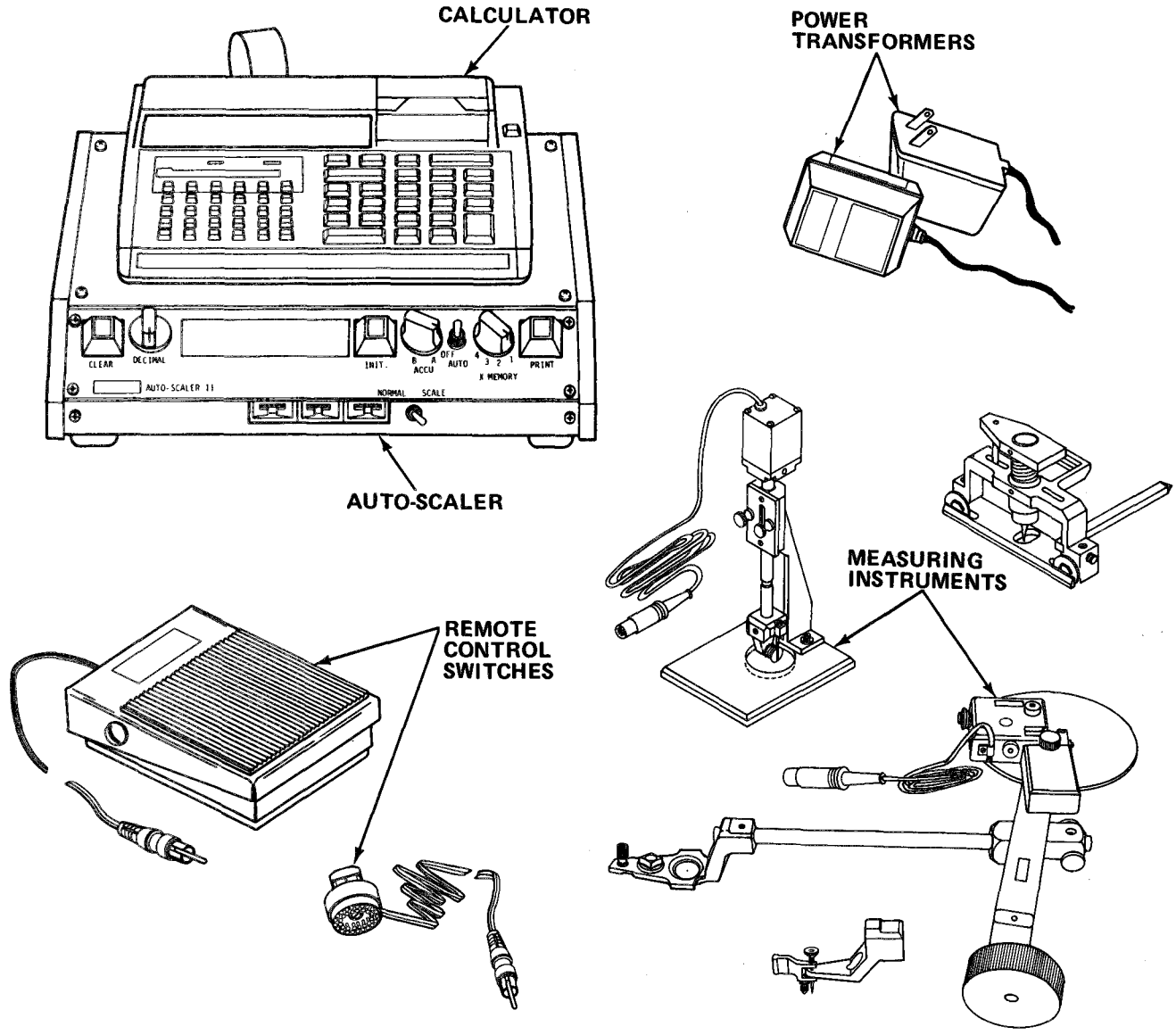
TEST RULES. Metal plates of specific lengths. Used for alinement and testing of planimeter.

EXTENSION TRACER ARMS. Extend reach of planimeter tracing assembly.

5-2.3 Equipment Data.

Quantity Processing System	
Total Weight	25 1bs (11.4 kg)
Power Requirements	
Calculator	110 V, 60 Hz
Auto-Scaler	110 V, 60 Hz
Linear Measuring Probe	
Weight	0.25 lb (0.11 kg)
Smallest measurable length	0.0014 in. (0.0356 mm)
Planimeter	
Weight	12 lbs (5.4 kg)
Maximum reach of tracer arm	45 in. (114.3 cm)
Smallest measurable length	0.002 in. (0.051 mm)
Smallest measurable area	0.0017 in2 (.011 cm^2)
Calculator	
Weight	2.5 lbs (1.14 kg)
Number of memory register	26
Program length	224 steps max
Operating time with battery	3 to 6 hours max
Battery Charge Time	6 hours (calculator off) 17 hours (calculator on)

5-3. TECHNICAL PRINCIPLES OF OPERATION. The QPS consists of five major components which interface with each other. The calculator and auto-scaler can be used independently from the system. When used as a total system, the QPS can provide advanced measurement capabilities. The five major components of the QPS are the measuring instruments, auto-scaler, calculator, remote control switches and power transformers.



5-3.1 Measuring Instruments. Provide an approximate measurement of a line or area by translating the movement of measuring instruments during tracing into electronic pulses. Measurement pulses (counts) are emitted as long as the measuring instrument is moving. The pulses (counts) are sent to the auto-scaler. There are four measuring instruments: planimeter, linear measuring probe, point counter pen and drafting bridge.

a. Planimeter. Used to trace the perimeter or boundary line of a plane figure. Pulses emitted during tracing are sent to the auto-scaler and counted. The count is then used in calculating the estimated area or volume measurement of the figure.

b. Linear measuring probe. Used to measure the length (distance) of curved or straight lines. The linear measuring probe emits pulses per unit of length measured. The pulses are sent to the auto-scaler and counted. The count is then used in calculating the estimated length or distance of line measured.

c. Point counter pen. Used to count items of a similar type found on a map, blueprint, plan, etc. Each time the point counter pen is stroked in counting, the transducer in the pen emits a signal pulse which is sent to the auto-scaler for totaling.

d. Drafting bridge. A layout instrument and mount for the encoder of the planimeter. When the encoder is moved from the planimeter and mounted on the drafting bridge, it can be used for linear measurement and detailed layout work.

5-3.3 Auto-Scaler. Processes pulses emitted by measuring instruments. The,pulses are input into the rear of the auto-scaler through the applicable input jack (El, E2, or POINT COUNT). There are two modes of entry to the auto-scaler, NORMAL and SCALE. This is determined by the NORMAL/SCALE switch. When switch is on NORMAL, pulses bypass the scaler circuit and are applied to the decade up/down counter. When the switch is on SCALE, pulses are first input into the scaler circuit before counting. The auto-scaler has five functional components: scaler, decade up/down counter, LED display, calculator interface circuit, and command switches.

a. Scaler. Enables operator to perform a scale reduction of the pulse count. When activated by NORMAL/SCALE switch, the scaler uses a correction constant to divide input pulses. The correction constant is input by setting dials. Pulses are then sent to the decade up/down counter.

b. Decade up/down counter. Counts pul ses received from the measuring instruments or scaler circuit. It counts up or down, depending on the direction that the measuring instrument is moved. The pulse count is continuously output to the calculator interface circuit and scaler LED display.

c. LED display. Displays current total of the decade up/down counter. The decimal place for the display is controlled by the DECIMAL switch.

d. Calculator interface circut. Converts the pulse count into data compatible with the calculator and then transmits it through a ribbon cable to the calculator. Converts and transmits signals from the command switches. When switch is on AUTO, data is automatically and continuously transmitted to the calculator. When switch is on MAN, data is transmitted only when the PRINT command is received from the PRINT X command switch on the calculator.

e. Command switches. Control the operating modes of the auto-scaler, data transmission, and remote operation of the calculator. There are six command switches: CLEAR, PRINT, INIT, X MEMORY, MAN/AUTO, and ACCU.

(1) CLEAR. Command is sent to clear LED display on calculator and LED display and decade up/down counter on auto-scaler.

(2) PRINT. Command sent to signal calculator to implement instructions of subroutine E, stored in memory, which prints the pulse count data. PRINT also initiates transmission of that data for printing when auto-scaler is in MAN.

(3) INIT. Command sent to signal calculator to implement subroutine D, which resets memory data registers for the next set of data.

(4) X MEMORY. Has four settings: 1, 2, 3, and 4. Tells the calculator which primary register memory location (1, 2, 3, or 4), and its contents, is to be used in calculations.

(5) MAN/AUTO. Determines the mode of data transmission for the auto-sealer.

(6) B/ACCU/A/OFF. Controls the operating status of the decade up/down counter. There are four possible settings: OFF, A, ACCU, and B. OFF turns the auto-scaler OFF. A enables the decade up/down counter to increment the count, B enables it to decrement the count, and ACCU freezes the decade up/down counter at its current total.

5-3.4 Calculator. Performs manipulations and calculations on pulse count data, prints results and intermediate steps in the proper units on command, and stores data and programs. There are six functional parts: memory, logic circuitry, keyboard, LED display, magnetic card reader, and printer.

a. Memory. Stores pulse count data, constants, results of calculations, and subroutines containing programmed instructions (for using pulse count data and constants). In order to use the QPS, the programs with instructions for performing calculations are entered into the calculator memory. The memory is divided into three parts: automatic memory stack, storage registers, and program memory.

b. Automatic memory stack. Has four available locations (X, Y, Z, and T) which are used by the operator and the calculator in performing calculations. The logic circuitry uses the automatic memory stack in performance of its instructions and to store intermediate results of calculations.

c. Storage registers. Used to store special numbers such as pulse counts and constants. Each register can hold one constant number or command. Primary register R^1 is directly connected to the calculator interface circuitry in the auto-scaler. Contents of storage registers are affected only by the keyboard or program command. The INIT signal begins a program which commands the calculator to clear the storage registers. The storage registers are divided into two parts: 16 primary registers and 9 secondary registers. The primary registers contain data and constants that need to be readily available and accessible for use. The MEMORY 1, 2, 3, or 4 signal is a release command for the contents of the corresponding primary register, R^1, R^2, R^3, or R^4. The remaining 12 primary registers are only used when operating programs. The secondary registers contain data that Is not immediately needed. They are only accessible through the use of the special command key P≷S.

d. Program memory. Stores the instructions of a complete program or subroutine. Programs and subroutines are entered into the memory either manually, keyed in from the keyboard, or from a preprogrammed magnetic card. The programs are recalled by command each time new information must be processed. A subroutine automatically processes data and implements recorded instructions.

e. Logic circuitry. Performs all calculations, commands, and data and signal transfers. The logic circuitry is the interface for all external inputs, including auto-scaler signals, and directs all operations of the calculator.

f. Keyboard. Gives operator direct access and control of the calculator operation. Pressing a key results in the corresponding command or signal being sent to the logic circuitry and memory. The keyboard has two modes: PRGM (program) and RUN. In PRGM, all keystroke signals are entered into the memory and sent to the logic circuitry which identifies the location on the keyboard of the function, letter, or number the keystroke signal represents. In RUN, all keyboard signals are sent to the logic circuitry for implementation or transfer.

g. LED display. Displays last entry mode into calculator or contents of any memory register when commanded. Also provides all the visual indications of error conditions that may exist and the key code of each step of a program when being entered or run.

h. Magnetic card reader. Used to store programs and subroutines on magnetic cards. Reads and loads contents of preprogrammed cards into calculator memory.

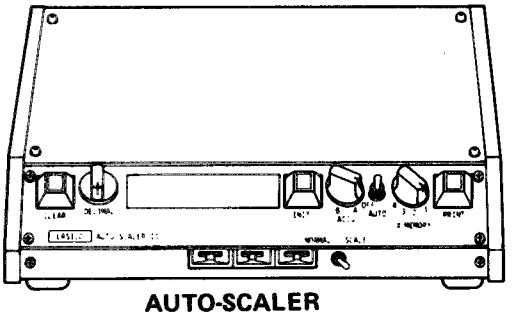
i. Printer. Provides hard copy of any data, calculation results, or program steps.

5-3.5 Remote Control Switches. The planimeter pushbutton remote tracer switch and foot switch enable the operator to remotely activate two of four possible signals: CLEAR, PRINT, INIT, or ACCU. The signals that the switches control depend on which input jacks the switches are plugged into.

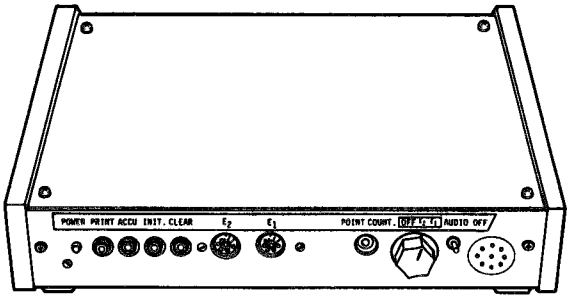
5-3.6 Power Transformers. Converts ac power to dc power on the auto-scaler. The calculator uses ac power.

Section II OPERATING INSTRUCTIONS

5-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



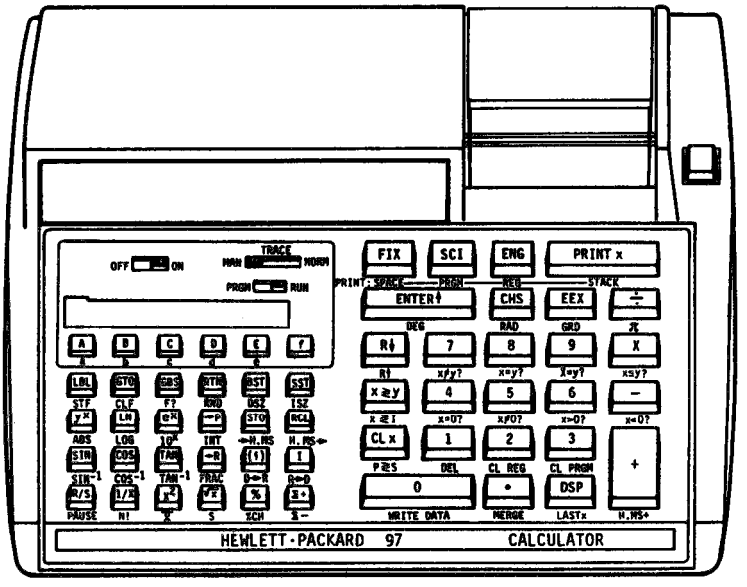
AUTO-SCALER



Key	Control or Indicator	Function
	CLEAR button	Clears all displays and memories.
	DECIMAL switch	Selects position of decimal point in auto-scaler display.
	LED indicator light	Indicates when pulse count is positive.
	LED display	Displays current pulse count total.
	SCALE dials	Inputs three most significant figures of constant into scaler.
	NORMAL/SCALE	In NORMAL, pulse count is not scaled.
		In SCALE, activates internal scaling circuit.
	INIT button	Sends initialize command signal to calculator.

Key	Control or Indicator	Function
	B/ACCU/A/OFF	Controls pulse counter: A: Count up B: Count down ACCU: Freeze count OFF: Turns auto-scaler off.
	MAN/AUTO switch	Controls pulse count sent to calculator. MAN count is sent when PRINT is activated. AUTO count is sent automatically.
	X MEMORY switch	Selects memory register 1, 2, 3, or 4 to be used in calculator.
	PRINT switch	Sends print command to calculator and auto-scaler.
	POWER supply jack	Input for power transformer plug.
	PRINT input jack	Input for remote tracer switch or foot switch plug, used to activate print command.
	ACCU input jack	Input for foot switch or remote tracer switch plug used to activate actuate command.
	INIT input jack	Input for foot switch plug used to activate initialize command.
	CLEAR input jack	Input for foot switch plug used to activate clear command.
	E_2 encoder socket	Input for linear measuring probe.
	E_1 encoder socket	Input for planimeter.
	POINT COUNT input jack	Input for point counter pen.

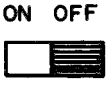
Key	Control or Indicator	Function
	0FF/E_2/E_1 switch	Selects input from linear measuring probe, planimeter, or turns on input.
	AUDIO/TOFF switch	Used to turn audio alarm on or off.
	Audio alarm	Emits audible tone each time pulse (stroke count) is received from point counter pen.



CALCULATOR

NOTE

Numbers, letters, symbols, and words that are on top of the calculator keys will be boxed throughout the text.

	LED Display	Displays numbers or message.
	Paper Advance Button	Advances printer paper.
	OFF/ON Switch	Turns calculator on or off.

Key	Control or Indicator	Function
MAN TRACE NORM	MAN/TRACE/NORM switch	Selects operating mode for printer. MAN : Print only when commanded. TRACE : Prints intermediate and final calculations as they are performed. NORM : Prints entry-by-entry records of entries and commands.
PRGM RUN	PRGM/RUN switch	Selects operating mode of calculator. RUN : Operates normally. PRGM : Used to manually enter program.
f	Function prefix key	Shifts next keystroke to activate function written beneath a key.
ENTER↑ **DEG**	Enter/Degrees key	ENTER : Value in X-register is stored in Y-register. DEG : Instructs calculator that units for all angles and trig calculations will be in degrees.
PRINT X	Print X/Stack key	PRINT X : Value of display is printed.
PRINT:STACK	Print/Stack	STACK : Used to print contents of entire automatic memory stack.

Key	Control or Indicator	Function
[FIX] **PRINT:SPACE**	FIX/SPACE key	[FIX] : Fixes decimal point of LED display to one position. SPACE : Instructs printer to advance paper one line.
[ENG] **PRINT:REG**	Engineering Notation/ Register key	[ENG] : Instructs LED display to display all numbers in engineering notation. PRINT:REG : Instructs printer to print contents of all primary storage registers.
[CHS] **RAD**	Change Sign/Radians key	[CHS] : Change sign of number or exponent in X-register (LED display). RAD : Instructs calculator that units for all angles and trig calculations will be in radians.
[EEX] **GRD**	Exponents/grads key	[EEX] : Numbers keyed in after pressing EEX are to be displayed as exponents of 10. GRD : Instructs calculator that units for all angles and trig calculations will be in grads.
[÷]	Divide arithmetic/ π key	[÷] : Divides number in Y-register by number in X-register.
π		π : Enters value of pi into X-register.

Key	Control or Indicator	Function
[x] X≤Y?	Multiply arithmetic/X≤Y? key	[x]: Multiplies number in Y-register by number in X-register. X≤Y? : Used in program. Compares numbers in X- and Y-memories. If X is less than or equal to Y, next step in program is performed. If X is not less than or equal to Y, test is negative and calculator skips next step in program.
[-] X<0?	Subtract arithmetic/X<0? key	[-] : Subtracts number in X-memory from number in Y-memory. X<0? : Used in programs to compare number in X-register to 0. If X is less than 0, calculator performs next program step. If X is not less than 0, calculator skips next program step.
[+] H.MS+	Add arithmetic/Hours, Minutes, Seconds key	[+] : Adds number in X-register to number in Y-register. H.MS+ : Adds hours, minutes, and seconds, or degrees, minutes and seconds in the Y-register to those displayed in the X-register.
[R↓] R↑	R↓/R↑ roll stack key	[R↓]: Instructs calculator to roll down contents of automatic memory stack (X, Y, Z, and T) into X-register. Each time new number is displayed, old one moves to top of stack. First value moved is in Y-register.

Key	Control or Indicator	Function
		R↓: Instructs calculater to roll up contents of automatic memory stack (X, Y, Z, and T) into X-register, starting with number in T-register.
[X≷Y] **X≷I**	**X≷Y/X≷I** manipulation key	[X≷Y] **:** Interchanges numbers in X- and Y-memory registers. **X≷I :** Interchanges numbers in X- and I-memory registers.
[CL X] **P≷S**	Clear/**X/P≷S** key	[CL X] **:** Clears contents of X-memory register (LED display) to zero. **P≷S :** Interchanges contents of primary memory registers with contents of secondary memory registers.
[0] **WRITE DATA**	0/Write Data key	[0] **:** Enters number 0 into X-memory register (LED display). WRITE DATA : If a magnetic card is passed through the card reader immediately after this operation, the contents of the storage registers are recorded on the card.
[·] **MERGE**	Decimal Point/Merge key	[·] **:** Enters decimal point in desired position in X-memory (LED display) register. MERGE : Merges, rather than overwrites, data on program from magnetic card with data or program in calculator.

Key	Control or Indicator	Function
1 **DEL**	1/Delete key	1 : Enters number 1 into desired position in X register (LED display). DEL : Deletes current instructions from program memory. All subsequent instructions moved up one step.
2 **CL REG**	2/Clear register key	2 : Enters number 2 into desired position in X-register (LED display). CL REG : Clears contents of all primary memory registers.
3 **CL PRGM**	3/Clear program key	3 : Enters number 3 into desired position in X-register (LED display). CL PRGM : (In PRGM) Clears calculator's program memory down to all R/S (Run/Stop) instructions, and clears all flags. Sends calculator to step 000 and instructs it to operate in FIX 2 and DEG mode.
6 **X = 0?**	6/X = 0? key	6 : Enters number 6 into desired position in X-register (LED display). X= 0? : Used in program. Compares number in X-memory register to 0. If X is greater than 0, calculator executes next program step. If X is 0 or less than 0, calculator skips next program step and executes the following step.

Key	Control or Indicator	Function
7 **X≠Y?**	**7/X≠Y?** key	7 : Enters number 7 into desired position in X-register (LED display). **X≠Y? :** If X is not equal to Y, calculator skips one step before continuing program.
8 **X=Y?**	8/X=Y? key	8 : Enters number 8 into desired position in X-register (LED display). **X=Y? :** If X equals Y calculator will execute next instruction in program.
4 **X=0?**	4/X=0? key	4 : Enters number 4 into desired position in X-register (LED display). **X=0? :** Compares number in X-register to 0. If X equals 0, calculator executes next program step. If X is not 0, calculator skips next step and executes the following step.
5 **X≠0?**	**5/X≠0?** key	5 : Enters number 5 into desired position in X-register (LED display). **X≠0? :** Compares number in X-register to o. If X is not 0, calculator executes next program step. If X is 0, calculator skips next step and executes the following step.

Key	Control or Indicator	Function
[9] **X=Y?**	9/X=Y? Key	[9] : Enters number 9 into desired position in X-register (LED display). **X=y?** : Compares number in X-register to Y-register. If X is equal to Y, calculator executes next program step. If not, it skips the next step and executes the following step.
[A] **a** [B] **b** [C] **c** [D] **d** [E] **e**	A/a through E/e **NOTE** Small letter labels a through e are called with [f] prefix key.	Used to assign user-defined labels. With calculator in PRGM, pressing [LBL] and label key or [LBL], [f], and label key assigns that label to routine or subroutine within a program. In RUN, calculator searches program memory for that label. Calculator begins execution of program memory at that point. [GTO] or [GSB] followed by label key or [f], label key: Calculator stops execution, searches memory for designated label, and begins execution there.

Key	Control or Indicator	Function
LBL **STF**	Label/Set Flag key	LBL : In PRGM, enters label designation A /a through E /e or 0 through 9 into program step. In RUN, calculator searches program memory for designated label and begins execution there. STF : Followed by flag designation 0, 1, 2, or 3, sets designated flag.
GTO **CLF**	Go to/Clear flag key	GTO : When calculator is in PRGM, GTO followed by o and three digit step number sets calculator to three digit step number of program memory. No instructions are executed. When calculator is in RUN, GTO followed by . and three-digit step number sets calculator to three-digit step number of program memory. No instructions are executed. In RUN, followed by label designator q /a through E/e or 0 through 9 , sends calculator to first designated label in memory. CLF : Followed by flag designation 0, 1, 2, or 3, clears designated flag.

Key	Control or Indicator	Function
[RCL] **H.MS**	Recall/Hours, Minutes, Seconds key	[RCL] : Followed by address of memory register, places value of that register into X-register (LED display). H.MS : Converts hours, minutes, seconds, or degrees, minutes, seconds displayed in X-register to decimal hours or degrees.
[SIN] **SIN^{-1}**	Sin/Arc $Sine^{-1}$ trig key	[SIN] : Computes sine of number in X-register. **SIN^{-1}** : Computes arc sine of number in X-register.
[COS] **COS^{-1}**	Cosine/Arc Cosine trig key	[COS] : Computes cosine of number in X-register. COS^{-1}: Computes arc cosine of number in X-register.
[(i)] **D R**	Register /D R key	[(i)] : Subracts 1 from contents of storage register specified by value in I. Skips one step if value is then 0. D R: Converts degrees displayed in X-register to radians.
[RTN] **RND**	Return/round key	[RTN] : Followed by 000, returns calculator to step 000 of program memory. When encountered as step in program or subroutine, returns calculator to first step of that program or subroutine.

Key	Control or Indicator	Function
		RND : Rounds mantissa of 10-digit number in X-register to that of actual value seen in display.
[BST] DSZ	Back Step/Decrement and Skip if 0 key	[BST] : In PRGM, moves calculator back one step in program memory to previous input. In RUN, stops program and moves calculator back one program step in memory. Original X-register contents return when key is released. **DSZ : Followed by [I] , subtracts 1 from contents of [I] .**
[STO] →H.MS	Store/Hours, Minutes, Seconds key	[STO] : **Followed by address key ([0] through [9] or [A] through [E]),** stores displayed number in corresponding primary memory register: R_0 through R_9, R_A through R_E, I. →H.MS : Converts decimal hours or degrees in X-register to hours, minutes, seconds or degrees, minutes and seconds.
[I] R→D	I-Register/R→D key	[I] : Recalls number in I-register into X-register. R→D : Converts radians in X-register to degrees.

Key	Control or Indicator	Function
[R/S] **PAUSE**	Run/Stop/Pause key	[R/S] : In RUN, begins program execution. If program is already running, pressing [R/S] stops program. If encountered in program as program step, program stops at that point. PAUSE : Momentarily stops running program and transfers control to keyboard for 1 sec.
[SCI] **PRINT:PRGM**	Scientific notation/ Print Program key	[SCI] : Selects scientific notation display. PRINT:PRGM : Prints program.
[GSB] **F?**	Go to subroutine/flag key	[GSB] : Causes calculator to begin executing instructions. F? : Is flag true? When followed by designator, it tests flag. Clears flags after testing.
[SST] **ISZ**	Single step/increment	[SST] : Moves calculator forward one step in program memory. ISZ : Increments value in I register.
[R] **FRAC**	Polar magnitude/fraction	[R] : Converts polar magnitude X and angle Y in X- and Y-resisters to rectangular X-and Y coordinates. FRAC : Leaves only fractional portion of number in X-register.

Key	Control or Indicator	Function
[y^x] ABS	Exponent/absolute value	[y^x] :Raises number in Y-register to power of number of X-register. ABS : Gives absolute power of number in X-register.
[LN] LOG	Natural logarithm	[LN] : Computes natural logarithm of number in X-register. LOG : Computes common logarithm of number in X-register.
[e^x]	Antilogarithm/common	[e^x] : Natural antilogarithm. Raises e to power of number in X-register.
10^X		10^x : Common antilogarithm. Raises 10 to power of number in X-register.
[→P] INT	Polar, rectangular/ conversion, integer	[→P] : Converts X and Y rectangular coordinates placed in X- and Y-registers to polar magnitude and angle . INT : Leaves only integer part of number in X-register.
[TAN] TAN^{-1}	Tangent/arc tangent	[TAN] : Computes tangent of value in X-register. TAN-l : Computes arc tangent of number in X-register.
[1/X] N!	Reciprocal/factorial	[1/X] : Computes reciprocal of number in X-register. N! : Computes factorial of number in X-register.

Key	Control or Indicator	Function
[x²]	Square/average	[x²]: Computes square of number in X-reqister.
X		$\bar{X}$: Computes mean (average) of X and Y values.
[√x]	Square root/standard deviation	[√x]: Computes square root of number in X-register.
S		S: Computes sample standard deviations of X and Y values.
[Σ+]	Accumulate/subtract	[Σ+] : Accumulates numbers from X- and Y-registers into secondary storage registers.
Σ-		[Σ-] : Subtracts X and Y values from storage registers.
[DSP]	Display/recall	[DSP] : Followed by number key, selects number of displayed digits.
LAST X		LAST X: Recalls number displayed before previous operation back into X-register.
[%]	Percent/change	[%] : Computes X% of Y.
		%CH: Computes percent of change from number in Y-register to number in X-register.

5-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. 'Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

5-5.1 PMCS Procedures.

a. PMCS are desiqned to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The "Equipment is Not Ready/Available If" column is used for -identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to peform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary missions

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Brush	1 ea
Cheesecloth (Item 8, Appendix E)	ar
Isopropyl Alcohol (Item 4, Appendix E)	ar
Cotton Swabs (Item 9, Appendix E)	ar

Table 5-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A- After

W - Weekly
M - Monthly
Q- Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM No.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER)	
1	B	Inspect Planimeter.	
		1. Check wheels, lens tracing assembly, axle, and paper disk for dirt, cracks, and breaks. Clean with soft brush. Replace paper disk as needed (paragraph 5-10.4).	Components are dirty or broken.
		2. Check planimeter drive gears for dirt or breaks. Check for jammed or loose drive gears.	Drive gears are damaged:
		3. Check teflon guide washer underneath tracing lens for cracks, dirt, or looseness. Clean with soft brush. Replace teflon guide washer as needed (pararaph 5-10.2).	Teflon guide washer is dirty or cracked.

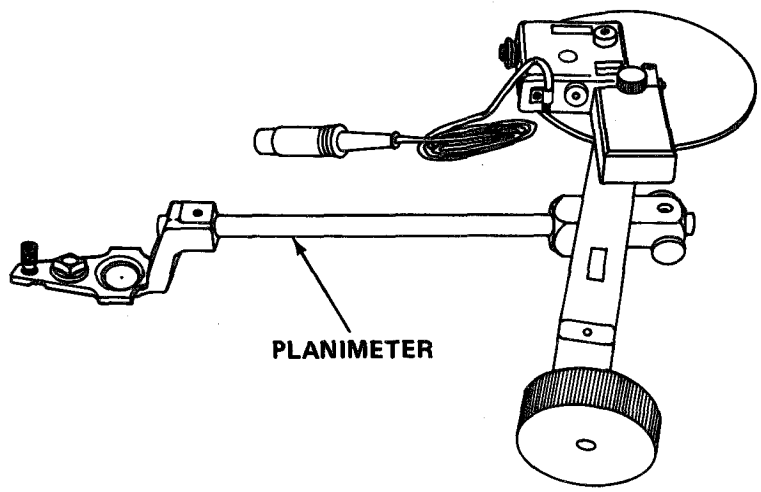


Table 5-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN . Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

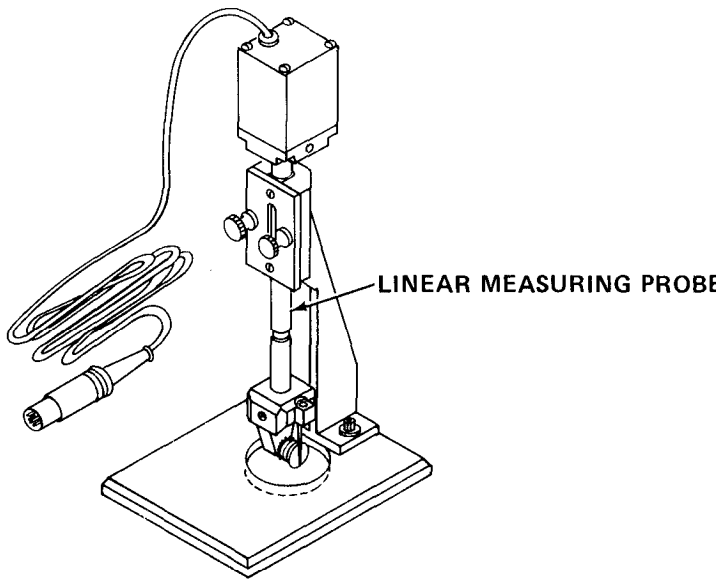
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
2	B	Inspect Linear Measuring Probe.	
			
		1. Check case, stand, guiding wheel, and gears for cracks, breaks, or dirt. Clean wi th soft brush.	Linear measuring probe is damaged.
		2. Clean base of measuring probe with soft brush.	
		3. Remove dirt from linear measuring probe gears with soft brush.	Linear measuring probe is dirty.

Table 5-1. OEPRATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

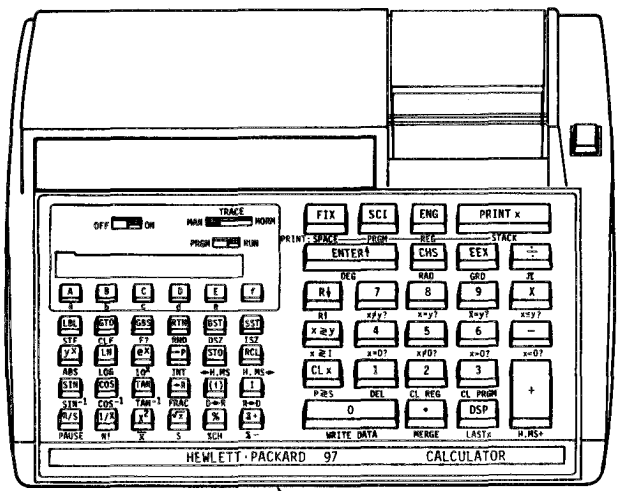
B - Before
O - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
s - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM No.	INTERVAL	ITEM TO BE INSPECTED / PROCEDURE	For Reediness Reporting, Equipment Is Not Reedy/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cent	
3	B	Inspect Calculator.	



CALCULATOR

1. Inspect keyboard, battery pack, display, and casing for cracks or breaks. Replace calculator as needed.	Calculator is damaged.
CAUTION Do not allow alcohol to touch any part of the calculator. Damage to calculator could result.	
2. Inspect calculator battery pack contacts. Clean with cotton swabs moistened with alcohol.	Battery pack contacts are dirty.

Table 5-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before D - During A - After | W - Weekly M - Monthly Q - Quarterly | AN - Annually S - Semiannually B I - Biennially | (Number) - Hundreds of Hours

ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
3	B	Inspect Calculator - Cont	
		3. Inspect ribbon cable and power jacks for cracks or breaks.	Ribbon cable or power jacks are damaged.
		4. Wipe dirt and dust from calculator with soft cloth.	
		CAUTION Use head cleaning card only as a result of continued use of preprogrammed card. Head cleaning card is abrasive. Damage to calculator reader could result.	
		5. Clean magnetic card reader heads with head cleaning card.	
3	M	1. Wipe magnetic cards with soft cloth moistened with alcohol.	

Table 5-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before, D - During, A - After | w - weekly, M - Monthly, Q - Quarterly | AN - Annually, S - Semiannually, Bl - Biennially | (Number) - Hundreds of Hours

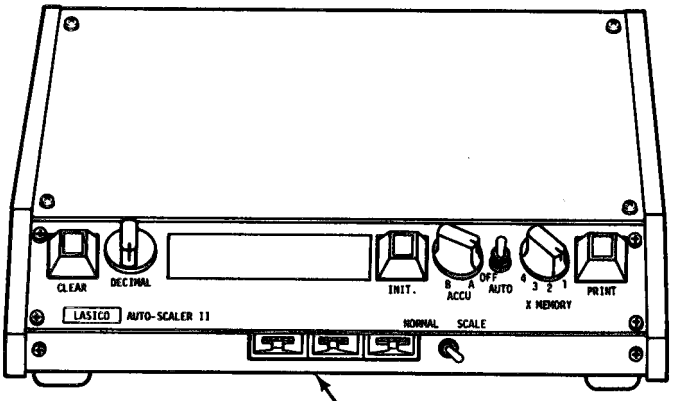
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED / PROCEDURE	For Reediness Reporting, Equipment Is Not Ready/ Available If:
	—	QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
4	B	Inspect Auto-Sealer.	
		 AUTO-SCALER	
		1. Inspect front panel, back panel, and casing for dirt, cracks, or breaks. Clean with soft brush.	Auto-scaler is damaged.
		2. Inspect power jacks on back of auto-scaler for breaks or loose fittings.	Power jacks are broken or loose.

Table 5-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

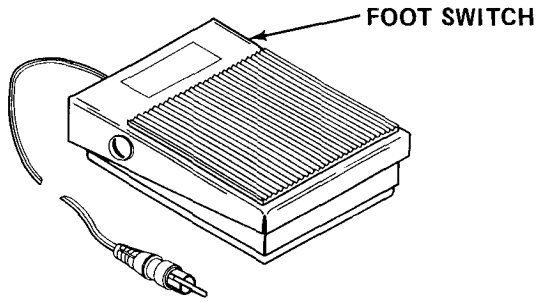
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
5	B	Inspect Foot Switch.	
			
		1. Inspect foot switch for cracks or breaks.	Foot switch is damaged.
		2. Inspect foot switch cord for frays or breaks.	Foot switch cord is damaged.

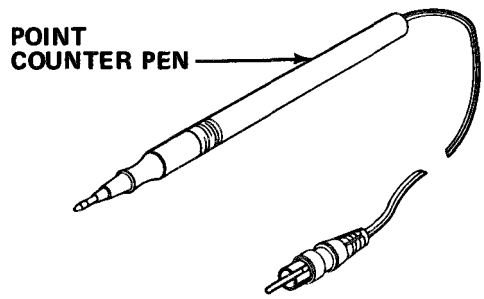
Table 5-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

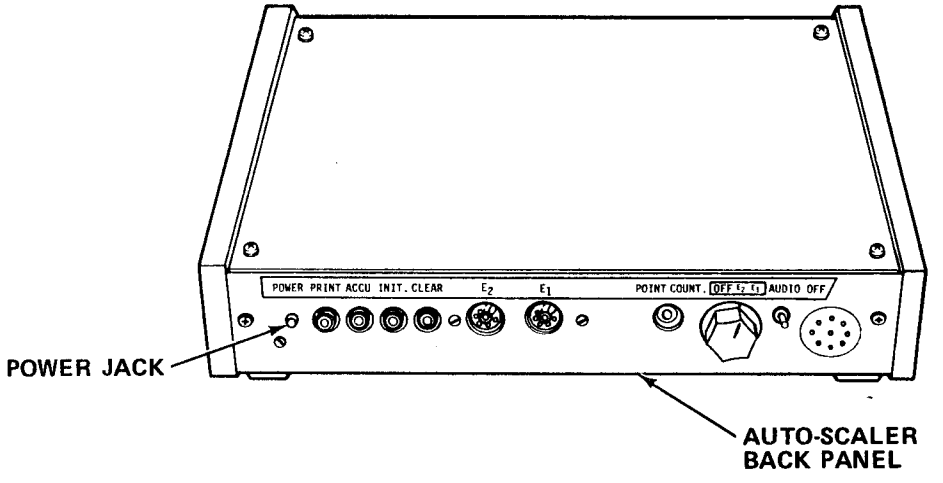
ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		QUANTITY PROCESSING SYSTEM (PLANIMETER) - Cont	
6	B	Inspect Point Counter Pen.	
			
		1. Inspect pen for cracks or breaks.	Point counter pen is damaged.
		2. Inspect point counter pen cord for breaks or frays.	Point counter pen cord is damaged.

5-6. OPERATION UNDER USUAL CONDITIONS.

5-6.1 Assembly and Preparation for Use.

a. Remove auto-scaler from case. Set on table near drawing, map, or photograph to be measured.

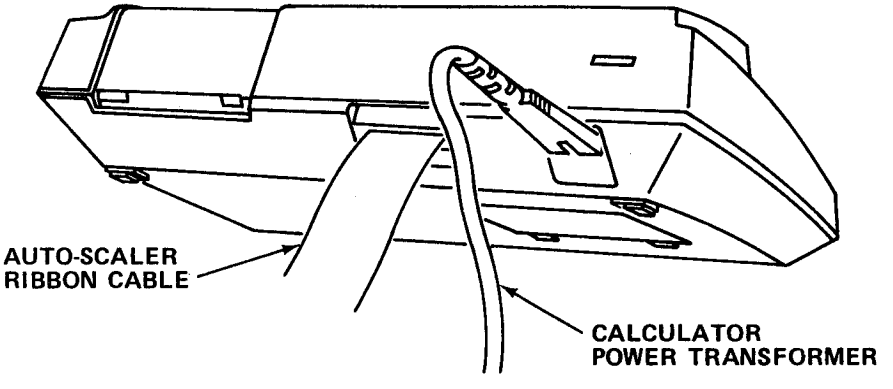
b. Remove calculator from case. Place on top of auto-scaler with keyboard facing front of auto-scaler.



CAUTION

Do not plug power transformer into power supply rated over 125 V ac. Permanent damage to auto-scaler may occur.

c. Plug auto-scaler power transformer plug into power supply jack on auto-scaler back panel.



CAUTION

Arrows on calculator and ribbon cable must aline. Damage to calculator may occur if cable is plugged in backward.

d. Plug auto-scaler ribbon cable into cable jack in back of calculator.

CAUTION

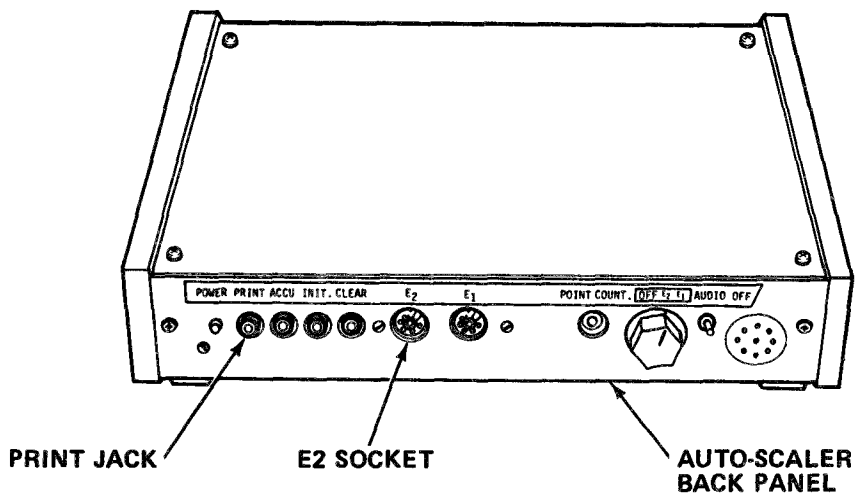
Do not plug power transformer into power supply rated over 125 V ac. Permanent damage to calculator may occur.

e. Plug calculator power transformer into power jack on calculator back panel.

CAUTION

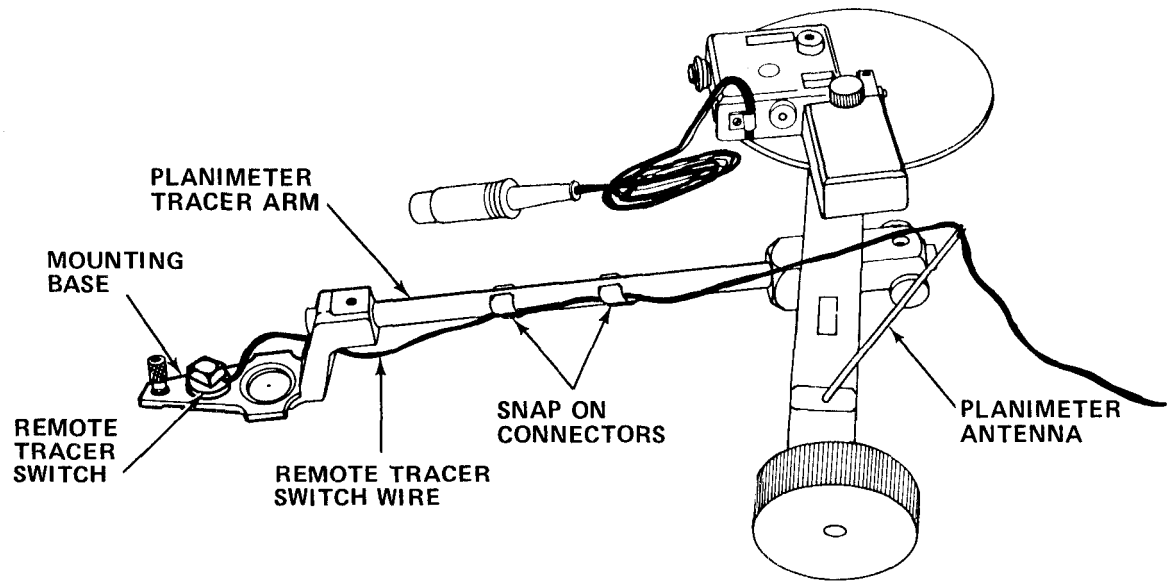
Always carry planimeter by top. Damage to planimeter or misalinement may occur.

f. Carefully remove planimeter from case. Place planimeter on table near auto-scaler.



g. Plug planimeter into E_2 encoder socket on auto-scaler back panel.

h . Remove remote tracer switch from case. Plug into PRINT input jack on auto-scaler back panel.

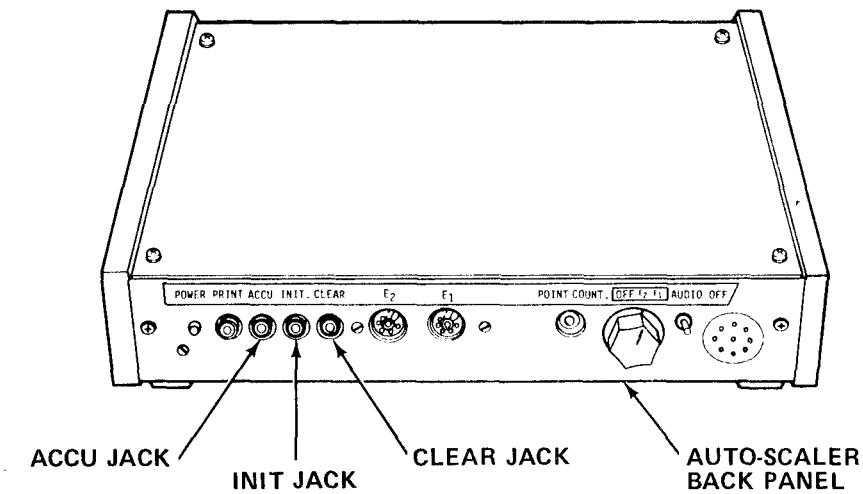


i. Mount remote tracer switch on mount ing base at end of planimeter tracer arm by pressing against mounting base.

j. Remove planimeter antenna from case Screw into hole on top of planimeter body.

k. Attach remote tracer switch wires to tracer arm with snap-on connectors.

1. Remove cap from antenna and guide remote tracer switch wires through slotted end of antenna. Replace cap.



m. Remove foot switch from carrying case. Plug into CLEAR, INIT, or ACCU input jack on auto-scaler back panel.

n. If using point counter pen, remove from case. Plug into POINT COUNT jack on auto-scaler back panel.

o. If using linear measuring probe, remove from case. Plug into E_1 encoder socket on auto-scaler back panel.

p. Plug both power transformers into 120 V ac outlets.

5-6.2 Operating Procedures. The QPS provides for estimation of distance, area, perimeter and volume of geographic shapes found on maps, drawings, and aerial photographs. It is precisely set and alined at the factory. Factory determined values, necessary for accurate calculations and estimations, are different for each QPS. The formulas and values on the Calibration Records Sheet, provided with the equipment, must be used in order to obtain correct results from measurements.

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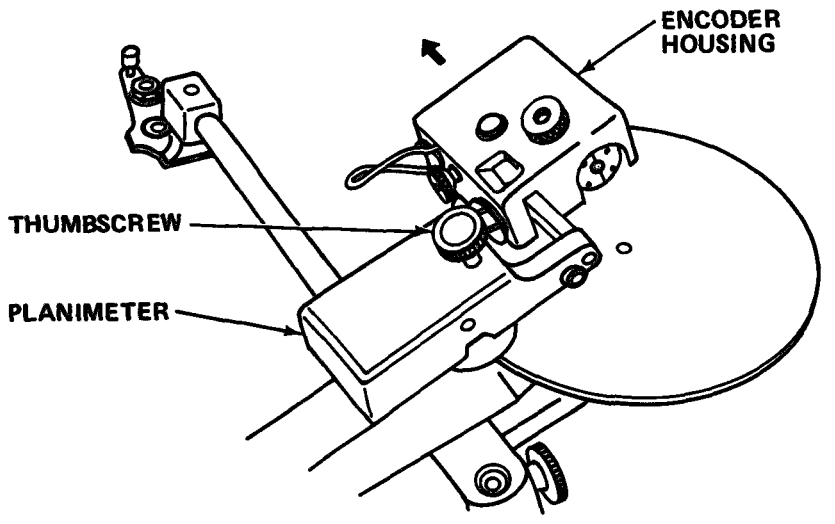
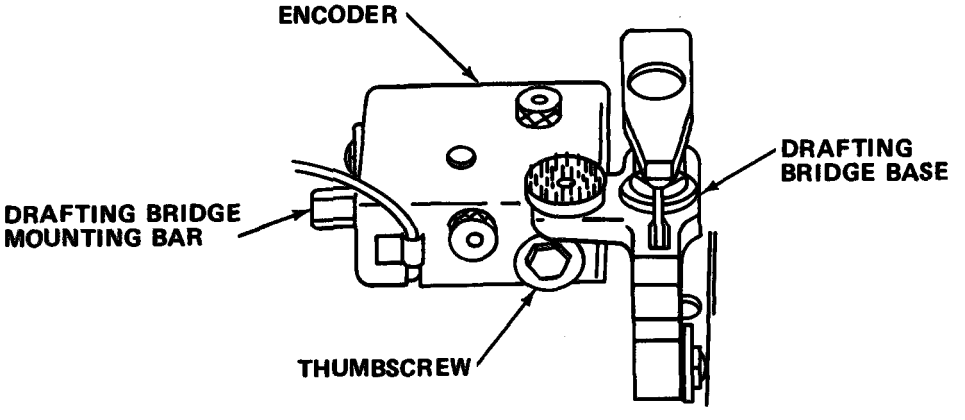
a. Mounting drafting bridge assembly.



(1) Loosen thumbscrew holding encoder housing on planimeter.

(2) Grasp encoder housing and slide off mounting bar.



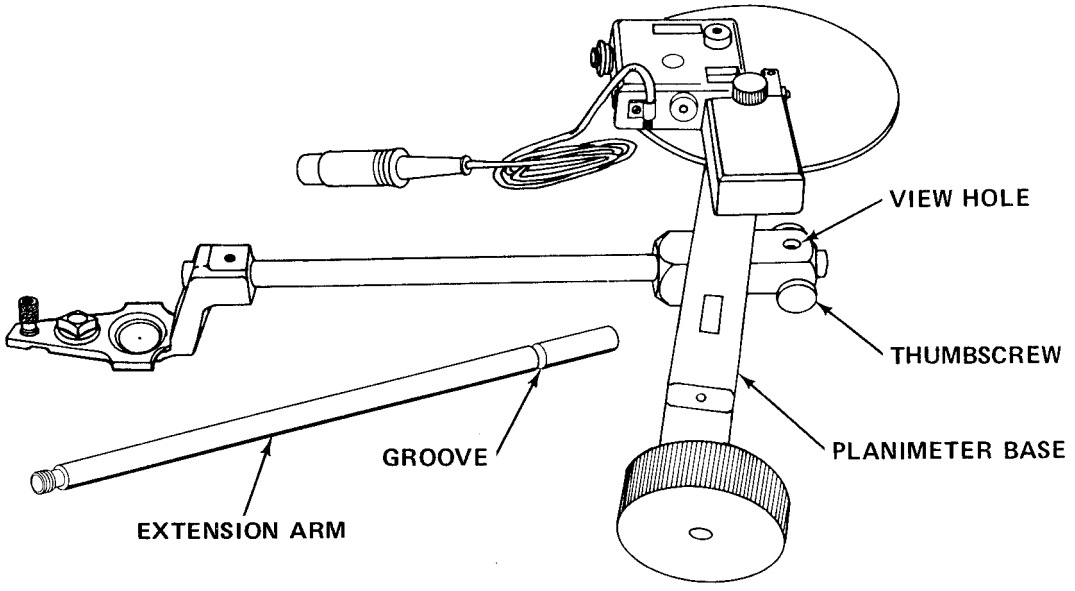
(3) Slide encoder onto drafting bridge mounting bar until it fits snugly against drafting bridge base.

(4) Tighten thumbscrew to secure.

(5) Remove remote tracer switch from end of planimeter.

(6) Mount remote tracer switch on mounting base of drafting bridge.

b. Mount tracer arm extension assembly.



(1) Remove desired lengths of tracer arm extension from case.

CAUTION

Do not release hold on planimeter when tracer arm is removed. Planimeter will turn on its side. Damage to planimeter disk may occur.

(2) Loosen two thumbscrews at back of tracer arm.

(3) Hold tracer arm with one hand. With other hand, slide tracer arm out of planimeter base.

(4) While still holding planimeter, slide one end of extension arm into tracer arm slot on planimeter base. Move extension arm until groove in end lines up with view hole in tracer arm slot.

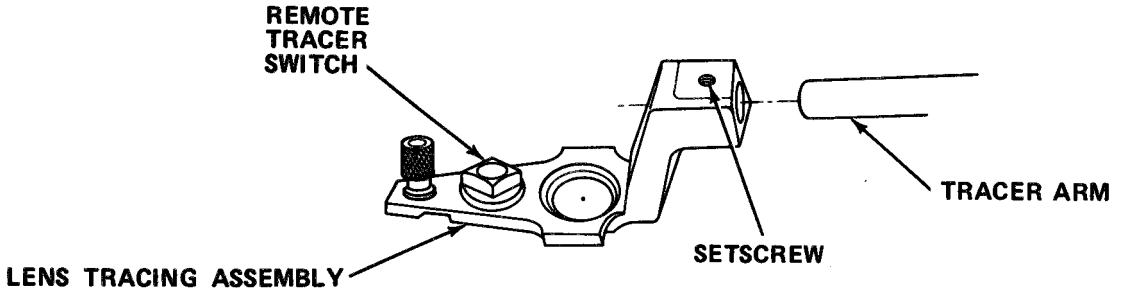
NOTE

Different tracer arm lengths with same tracer arm can be obtained by loosening two thumbscrews and sliding tracer arm in and out of its slot. Tracer arm lengths should be premarked short, medium, or long. If any other tracer arm length is desired, planimeter must be realined.

(5) Tighten two thumbscrews to secure tracer arm extension. Be sure lens tracing assembly is flat on table surface.

(6) Readjust encoder and remote tracer switch wires through antenna.

c. Mounting needle tracing assembly.

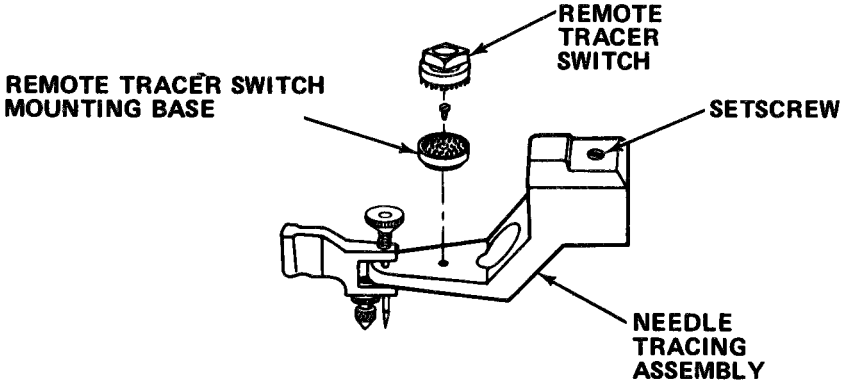


(1) Remove remote tracer switch from lens tracing assembly.

CAUTION

Hold tracer arm while removing lens tracing assembly. Planimeter will turn on its side. Damage to planimeter disk may occur.

(2) Loosen setscrew. Slide lens tracer assembly

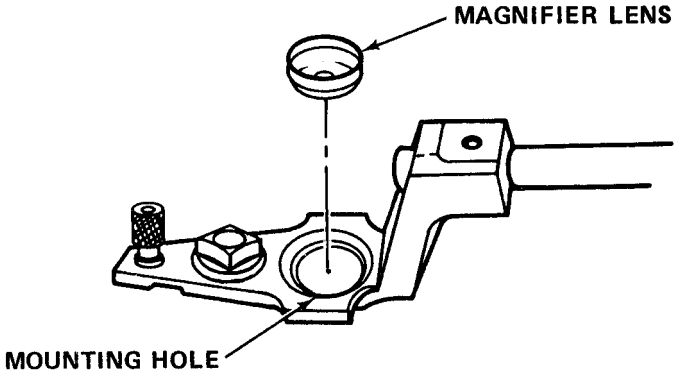


(3) Slide needle tracing assembly onto tracer arm. Tighten setscrew to secure.

(4) Screw remote tracer switch mounting base into needle tracing assembly. Snap remote tracer switch into needle tracing assembly.

d. Mounting magnifier in lens tracing assembly.

(1) Remove magnifier lens from carrying case.



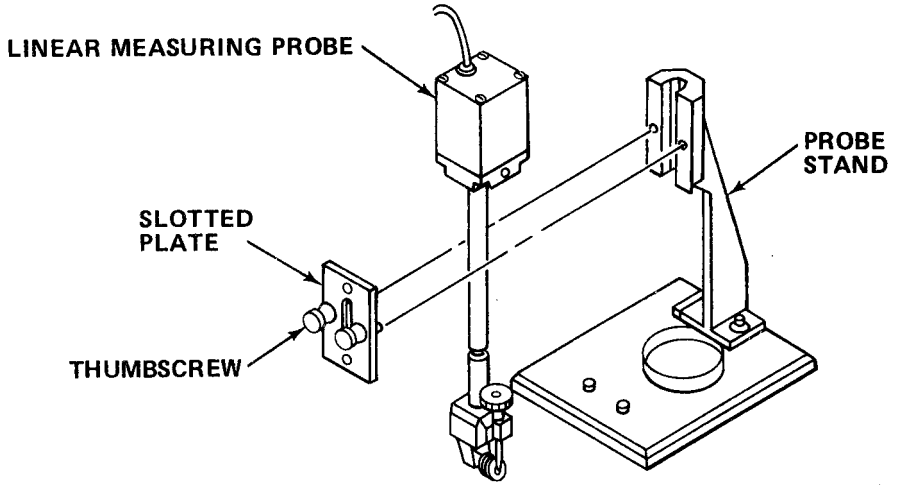
Do not touch optical surface with bare fingers. Viewing will be impaired.

(2) Holding lens by edges, drop into mounting hole.

(3) Press lens into place with finger wrapped in tissue.

e. Mounting linear measuring probe in stand.

(1) Remove linear measuring probe and probe stand from case.



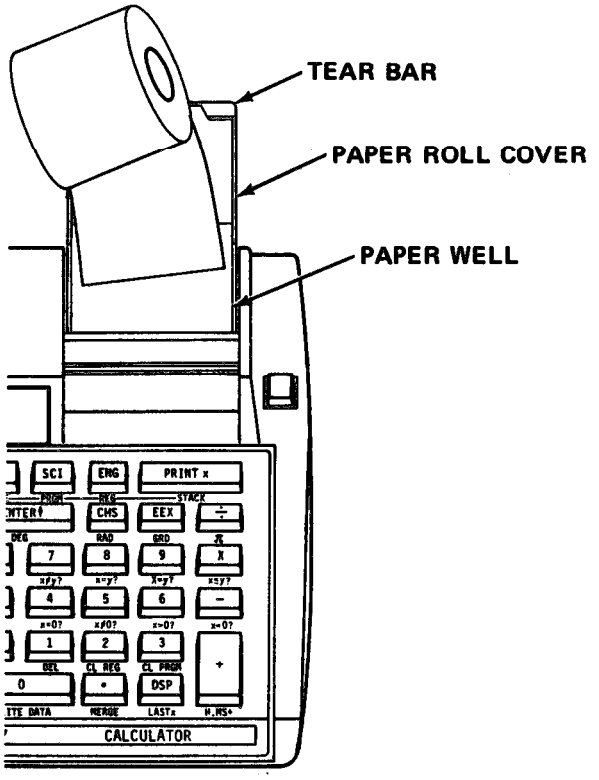
(2) Remove two thumbscrews on front of probe stand that hold slotted plate. Remove slotted plate.

(3) **Place** linear measuring probe into recess under slotted plate.

(4) Set 1 i near measuring probe so that alinement stud is in center of recess and facing front.

(5) Reinstall slotted plate. Secure with two thumbscrews.

f. Installing paper in calculator.



(1) Open paper roll cover. Remove empty core from paper well.

(2) Remove first two inches of paper from new roll before installing.

(3) Fold and crease leading edge of paper.

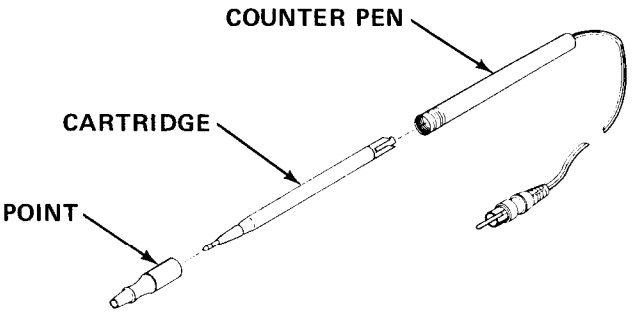
(4) Insert leading edge of paper into slot at bottom of paper well.

(5) Turn calculator OFF/ON switch to ON.

(6) Press paper advance button until leading edge of paper becomes visible beneath tear bar.

(7) Place roll of paper in paper well. Close paper roll cover.

g. Installing blank cartridge in point counter pen.



CAUTION

Cartridge is spring-loaded. Do not let spring fall out. Pen will not work without spring.

(1) Grasp point counter pen at both ends. Unscrew two halves of pen.

(2) Remove ink cartridge.

(3) Insert blank cartridge.

(4) Screw two halves of pen back together.

h. Loading magnetic cards.

(1) Turn calculator ON/OFF switch to ON.

(2) Turn MAN/TRACE/NORM switch to MAN.

(3) Turn PRGRM/RUN switch to RUN.

CAUTION

- Hold magnetic cards by the edge. Be sure hands are clean. Grease, oil, or other materials can damage magnetic cards.
- Do not continue to hold card after it is grasped by feed mechanism. Damage to magnetic card or calculator may occur.

(4) Insert magnetic card into reader. If calculator displays ERROR, press any key to clear.

(5) Pass side one of magnetic card through reader again.

(6) If calculator displays Crd, reverse card and load side two.

(7) Print out program to obtain record of program from magnetic card.

(a) Press [RTN] and [f] keys.

(b) Press PRINT:PRGM key.

NOTE

- Printout should have three columns. The first column is program step number, the second column is keystrokes entered, and the third column shows key codes for the key stroke entries.
- To stop printout at any point, press [R/S] key.
- To start over at beginning of program, press [RTN] key.

i. Manual program loading. Programs are loaded as a series of keystrokes. The calculator will display two groups of numbers during the course of programming. The three digit display to the left is the program step number. The digits to the right are key code numbers identifying keys pressed by row and column. Keystrokes that make up the program are stored in the program memory of the calculator. The program memory has a storage capacity of 224 steps.

(1) Turn calculator OFF/ON switch to ON.

(2) Turn MAN/TRACE/NORM switch to MAN.

(3) Turn PRGM/RUN switch to PRGM.

(4) Press [f] and CL PRGM keys.

NOTE

Pressing [f] and CL PRGM clears calculator memory of any previous programs.

(5) Determine and write down natural sequence of keystrokes that are required to perform functions in program.

(6) Assign program an identifying label by pressing [LBL] key followed by one of the following keys: [A] through [D] , a through e, or [0] through [9].

NOTE

Two different programs cannot be given the same label on same magnetic card at same time in calculator memory.

(7) Key in keystrokes of program determined in step c.

NOTE

Except for the following seven functions, all functions can be recorded, **f CL PRGM, BST , SST , f , DEL, GTO , . , and f PRINT:PRGM** are used to load, edit and modify programs.

(8) Print out program to verify.

(a) Press RTN .

(b) Press f and PRINT:PRGM keys.

j. Printing out programs. All programs should be printed out. The printout can verify the program, and provide a copy of the program should the magnetic card get damaged or lost. The printout can be used to record a verified program onto a magnetic card.

(1) Load contents of magnetic card into calculator memory.

(a) Turn calculator ON/OFF switch to ON.

(b) Turn MAN/TRACE/NORM switch to MAN.

(c) Turn PRGM/RUN switch to RUN.

CAUTION

- Hold magnetic card by the edge. Be sure hands are clean. Grease, oil, or other materials can damage magnetic card.
- Do not continue to hold card after it is grasped by feed mechanism. Damage to magnetic card or calculator may occur.

(d) Insert magnetic card into reader. If calculator displays error, press any key to clear.

(e) If calculator displays CRD, reverse card and load side two.

(2) To obtain printout of program now loaded into calculator memory:

(a) Press RTN key.

(b) Press f and PRINT:PRGM keys.

(c) To stop printout at any time, press R/S key.

(d) To return to beginning of program, press RTN key.

(3) To obtain printout of manually loaded program follow above steps after keying last keystroke.

(4) Use printout to verify program, and load magnetic card.

k. Recording program on magnetic card.

(1) Manually enter desired program into calculator memory (paragraph 5-6.2i).

(2) Obtain printout to verify program.

(a) Press [RTN] key.

(b) Press [f] and PRINT:PRGM key.

NOTE

If printout does not verify program, repeat steps (1) and (2).

(3) Set PRGM/RUN switch to PRGM. If display does not show 000 or 001, press [BST] key.

(4) Select unclipped and unmarked magnetic card from packet of cards.

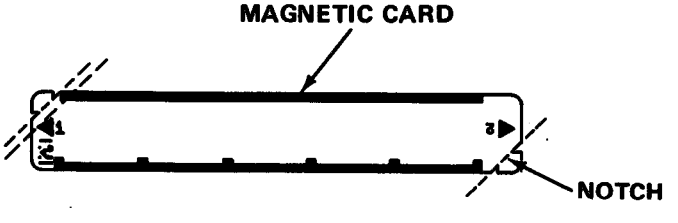
CAUTION

- Hold magnetic card by the edge. Be sure hands are clean. Grease, oil, and other materials can damage magnetic card.
- Do not continue to hold card after it is grapsed by feed mechanism. Damage to magnetic card may occur.

(5) Load side one of magnetic card through reader. If display indicates ERROR, press any key to clear.

(6) Pass side one through reader again. If calculator displays Crd, reverse card and load side two.

(7) Print out program to verify.



(8) Mark magnetic card to identify program.

(9) To protect contents of magnetic card from being erased, cut corners of card along notches.

l. Alinement of planimeter with lens tracing assembly. Alinement of the planimeter provides information needed to make area and volume measurements. Using the testing procedure provides values needed to check alinement with factory determined values and provides a constant in determining additional measurements and calculations. Test measurement is made with the test rule. Measurement with the test rule traces a circle with a two inch radius. The area of that circle has a factory determined area AT , found on the Calibration Records Sheet provided with the equipment.

(1) Assemble QPS using the planimeter with lens tracing assembly.

(2) Activate QPS:

(a) Plug foot switch into CLEAR input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E_1, encoder socket on back panel auto-scaler.

(d) Plug power transformer cable into power supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto scaler to E_1.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to AUTO.

(1) Set auto-scaler X-memory switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

(3) Remove Y-shaped test rule from carrying case.

(4) Tape piece of paper to table.

(5) Draw a horizontal line 12 inches long.

(6) Place planimeter on paper so it straddles line drawn.

(7) Hold tracer arm in place and turn wheels on planimeter so that wheel axle forms 90 degree angle with tracer arm.

(8) Press point of Y-shaped test rule into paper on horizontal line.

(9) Place lens tracing assembly so that recessed end of Y-shaped test rule rests against edge of lens.

(10) Press edge of lens so that it rides against inside edges of test rule recess.

(11) Clear auto-scaler by pressing and releasing foot switch.

NOTE

If planimeter is allowed to slip, area measured will not be actual area of test rule, and results will be inaccurate.

(12) Keep lens firmly pressed against test rule. Slowly trace 360 degree circle by moving lens around center of test rule. Stop when you return to starting point.

(13) Repeat steps 9 through 12 four times. Reposition test rule at different point on line after three measurements.

(14) Average the pulse counts shown on the LED display after test measurement to obtain R_T value.

NOTE

- If QPS is being initially alined with premarked tracer arm lengths compare average R_T value to R_T value found on calibration Record Sheet provided with equipment.
- Move lens tracer in 1/4 inch increment to bring "R_T value" within R_T value found on Calibration Record Sheet provided with equipment.
- If average R_T value is not within ±0.2% of factory determined R_T value, - the planimeter may be defective. Repeat alinement procedure. Notify direct/general support maintenance for service or replacement.
- If using preprogrammed cards, manual calculation of C_A calibration constant) is not necessary.

(15) For manual calibration of CA:

Press [SCI] key to perform the following equation.

$$C_A = \frac{(S_{HOR} \times S_{VERT})}{R_T} \times A_T$$

S_{HOR} = Horizontal scale of shape to be measured

S_{VERT} = Vertical scale of shape to be measured

A_T = Area of test rule

R_T = Average pulse count reading

S_{HOR} and S_{VERT} are usually provided with map

A_T is premarked value on top of test rule

R_T can be found on Calibration Records Sheet or from average measurements made with test rule

(16) Note value of actual area measured by test rule, which is premarked on top of test rule.

(17) Use test rule area and the scale ratio of shape to be measured to determine CA (calibration constant). CA is needed to perform various measurements.

m. Alinement of planimeter with needle tracing assembly.

(1) Alinement of the planimeter with the needle tracing assembly follows the same procedure as alinement of the planimeter with the lens tracing assembly (paragraph 5-6.21).

(2) The test measurement checks the alinement of the planimeter with the initial use of the needle tracing assembly.

(3) The needle on the needle tracing assembly fits into the hole on the long test rule to make test measurements.

(4) The average R_T reading obtained by following the steps for the lens tracing assembly should be within ±0.2% of the R_T value given on Calibration Records Worksheet provided with equipment.

(5) The same formula is used to determine the calibration constant, CA.

n. Alinement of linear measuring probe. Provides information needed to make linear measurements. Using the testing procedure provides values needed to check alinement with factory determined values and provides a constant to use in determining additional measurements and calculations.

(1) Assemble QPS with the linear measuring probe.

(2) Activate QPS:

(a) Plug foot switch into CLEAR input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug 1 i near measuring probe into El, encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to AUTO.

(1) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: 1 , STO , 1 and ENTER↑ .

(3) Tape piece of paper to table.

(4) Draw line exactly 10 inches long.

(5) Label ends of line A and B.

NOTE

Foot switch must remain depressed until ready to begin measurement, so that movement and handling of linear measuring probe will not increment counter.

(6) Press CLEAR button on auto-scaler.

(7) Depress foot switch to initiate ACCU and freeze count at zero.

(8) Place linear measuring probe and stand so that pricking pin is at beginning mark of line.

(9) Release foot switch.

(10) Grasp probe body and roll linear measuring probe along length of line. Stop when needle is precisely at end of line.

(11) Press foot switch.

(12) Divide digital readout on LED display by 10 to determine alined pulse count reading, R_L.

(13) Record this number.

(14) Repeat steps 6 through 13 four times.

(15) Average the five pulse count results obtained from the LED display after each test measurement to obtain R_L value.

NOTE

If average R_L value is not within ±0.2% of factory determined R_L value, the linear measuring probe may be defective. Repeat alinement procedure. Notify direct/general support maintenance for service or-replacement.

(16) Compare average R_L value to R_L value found on Calibration Records Sheet provided with equipment.

NOTE

If using preprogrammed card, Program III, manual calculation of CL is not necessary.

(17) Use scale of map, plan, or blueprint being measured to determine CL (calibration constant). CL is needed to perform various measurements.

(18) Use the following equation to determine CL.

$$C_L = S/R_L$$

S = Scale, in desired units for measurements.

R_L can be found on Calibration Records Sheet or from average of test measurements.

0. Measuring areas with planimeter.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E, encoder socket on back panel of auto-scaler.

(d] Plug power transformer cable into power supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(9) Plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(i) Set AUDI0/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(1) Set auto-scaler X MEMORY to 1.

(m) Set Calculator OFF/ON to ON.

(n) Set Calculator MAN/TRACE/NORM switch to NORM.

(o) Set PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] and [ENTER↑] .

CAUTION

Hold magnetic cards by **edge. Be sure hands are clean. Grease, oil, or** other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6. 2h), Program 1, into calculator.

(4) Tape map or drawing to be measured to table.

(5) Select correct tracer arm length.

NOTE

Tracer arm should be shortest one possible that will allow entire shape to be measured without moving planimeter.

(6) Aline planimeter with tracer arm length selected (paragraph 5-6.2n).

(7) Record R_T value. This value to be used in step 14.

NOTE

Factory determined RT value is provided on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(8) Place planimeter near shape to be measured so that length of tracer arm lies along imaginary line through center of shape.

(9) Set wheels so that their axles form 90 degree angle with tracer arm.

(10) Make practice trace to be sure tracer arm will cover area in one operation.

(11) Select starting point for measurement on shape where imaginary line crosses boundary of shape.

(12) Mark point.

(13) Set dot in lens tracing assembly over starting point.

(14) Enter into calculator horizontal and vertical scales of shape and R_T values.

(a) Key in horizontal scale; press [ENTER↑]

(b) Key in vertical; press [ENTER↑]

(c) Key in R_T value; press •l .

(d) For results in square feet or square feet and acres, press [f] and [d].

NOTE

- If R_T value is not entered, all results from calculator will be zero.
- When results are printed, the first area given will be in square feet, the second in acres.

(15) Clear auto-scaler by pressing CLEAR button.

(16) Trace boundary line of shape using dot in 1 ens tracing assembly. Stop when you reach starting point.

(17) Press remote tracer switch to activate actuate function and freeze count.

(18) Press foot switch to activate PRINT command. Calculator will print area of shape in square feet or square feet and acres.

(19) To measure several shapes, keep foot switch and remote tracer switch depressed.

(20) Reposition planimeter to next shape and repeat steps **11,** and 15 through 18.

(21) To change functions or change scale of next shape to remeasured, press ❑ and repeat steps (14) through (18).

P. Pleasuring areas to be added and/or subtracted.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into power supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

(3) Set up planimeter for area measurement (paragraph 5-6.20).

(4) To add areas being measured, in square feet or square feet and acres, press [C] .

(5) Reposition planimeter near next shape to be measured. Keep remote tracer switch depressed.

(6) Clear auto-scaler by pressing CLEAR button.

(7) Trace boundary line of shape using dot on lens tracing assembly. Stop when you reach starting point.

(8) Press foot switch to activate print command.

NOTE

Calculator will print data on area just measured. It prints area of single shape in square feet first followed by area in square feet and acres. Current total areas are printed in same order. '

(9) If area is to be subtracted instead of added, press [f] and **c** for Actuate routine. Repeat measurement procedure.

q. Measuring surface area of slope.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(9) Plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto-sealer to E_2.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-sealer MAN/AUTO switch to MAN.

(1) Set auto-sealer X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

(3) Set up planimeter for area measurement (paragraph 5-6.20).

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(4) Load preprogrammed card (paragraph 5-6.2h), Program I, into calculator.

(5) Tape map or drawing to remeasured to table.

(6) If needed, aline planimeter with tracer arm length selected (paragraph 5-6.20). Record R_T value.

NOTE

Factory determined RT value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(7) Position planimeter near shape to remeasured so that tracer arm lies along imaginary line through center of shape.

(8) Set wheels so that their axles form 90 degree angle with tracer arm.

(9) Enter into calculator horizontal and vertical scales of shape and R_T value.

(a) Key in horizontal scale; press [ENTER↑] .

(b) Key in vertical scale; press [ENTER↑] .

(c) Key in R_T value; press [B] .

(d) Press [f] and [d] to obtain results in square feet or acres.

NOTE

Slope ratio should be given. Slope ratio can be determined by using the given horizontal scale and vertical scale.

$$\frac{\text{horizontal scale}}{\text{vertical scale}} \quad \text{invert to} \quad \frac{\text{vertical scale}}{\text{horizontal scale}} = \text{scale ratio}$$

Example: $\frac{\text{horizontal scale}}{\text{vertical scale}} = \frac{10}{50} = 1/5$ invert to 5/1 or 5:1 scale ratio

(e) Key in ratio slope; press f and B.

(9) Press CLEAR button to clear auto-scaler.

(10) Trace boundary of shape using dot in lens tracing assembly. Stop when you reach the starting point.

(11) Press foot switch to activate PRINT command and freeze count.

NOTE

Calculator will print area of shape. Horizontal area in square feet will be printed first followed by the true surface area in square feet.

(12) Keeping foot switch depressed, reposition planimeter near next shape to be measured.

(13) Repeat steps (9) through (11).

r. Measuring slopes to be added and/or subtracted. This procedure follows measuring surface area of slope (paragraph 5-6.2q) steps 1 through 9. After completing steps (1) through (9), follow the steps provided below to add or subtract from slope measurement obtained.

(1) If slope to be measured will be added, press C.

(2) If slope to be measured will be subtracted, press f and c.

(3) Press CLEAR button to clear auto-scaler.

(4) Trace boundary of shape using dot in lens tracing assembly. Stop when you reach starting point.

(5) Depress foot switch to activate PRINT command and freeze count.

NOTE

Calculator will print horizontal and true slope surface area of shape last measured, followed by totals (added or subtracted) of horizontal and true slope surface areas.

(6) Keeping foot switch depressed, reposition planimeter near shape to be measured.

(7) Make next measurement.

(8) If change is made in planimeter function or if new scales or slope ratios **are used, press D to initiate measurement.** Beg in measurement procedures.

s. Measuring areas without the calculator.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder OFF/E_2/E_1 switch on back of auto-scaler to E,.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(j) Set auto-scaler MAN/AUTO switch to MAN.

(k) Set auto-scalerXMEMORY switch to 1.

(1) Set calculator OFF/ON switch to OFF.

(3) Tape map or drawing to be measured to table.

(4) Select correct tracer arm length.

(5) If needed, aline planimeter for tracer arm length selected (paragraph 5-6.21). Record T_T value.

NOTE

Factory determined R_T value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(6) Manually calculate alinement, C_A, using the following equation.

$C_A = Sc^2 \times u$

C_A = Alinement constant

Sc^2 = Scale ratio squared (given on map being measured or determined by equation in paragraph 5-6.2q).

u = Value of one planimeter unit (factory determined value provided on Calibration Records Sheet provided with equipment.

(7) Enter three most significant digits of alinement constant, C_A, into auto-scaler using scaler dials.

(a) Set first most significant digit on left hand dial.

(b) Set second most significant digit on middle dial.

(c) Set third most significant digit on right hand dial.

Example: If C_A is 10.571, left hand dial should read 1, middle dial should read 0, and right hand dial should read 5.

(8) Set decimal selector according to value of first significant digit of alinement constant.

NOTE

- Decimal selector sets decimal place for auto-scaler LED display.
- If constant is one or greater, set decimal selector to 0.
- If constant is less than one, set decimal selector according to place value of first significant digit.

(9) Place planimeter near shape to remeasured so that length of tracer arm lies along imaginary line through center of shape.

(10) Set wheels so that their axles form 90 degree angle.

(11) Make practice trace to be sure tracer arm will cover area.

(12) Select starting point for measurement, and mark.

(13) Set dot of lens tracing assembly over starting point.

(14) Press CLEAR button to clear auto-sealer.

(15) Trace boundary line of shape using dot in 1 ens tracing assembly. Stop when you return to starting point.

(16) Multiply numbers shown in auto-scaler LED display to obtain area of shape in square feet.

NOTE

- If first significant digit of C_A is in ones column (one place to left of decimal point), multiply auto-scaler LED display by 10.
- If first significant digit is in tens column, multiply auto-scaler LED display by 100.
- If first significant digit is three or more places to left of decimal point, increase multiplication factor by 10 for each position it lies further to left.

t. Measuring lengths with linear measuring probe to be added and/or subtracted.

(1) Assemble QPS with linear measuring probe.

(2) Activate QPS:

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) Plug linear measuring probe into El, encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into wall outlet.

(g) Set encoder OFF/E_2E_1 switch on back panel of auto-scaler to El.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(j) Set auto-scaler MAN/AUTO switch to MAN.

(k) Set auto-scaler X MEMORY switch to 1.

(1) Set calculator OFF/ON switch to ON.

(m) Set calculator MAN/TRACE/NORM switch to NORM.

(n) Set calculator PRGM/RUN switch to RUN.

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6. 2h), Program 1, into calculator.

(4) Tape drawing or map to remeasured to table.

(5) If needed, aline 1 i near measuring probe (paragraph 5-6.2.1).

(6) Record R_L value.

NOTE

Factory determined R_L value is given on Calibration Record Sheet provided with equipment. Alinement is performed as a check.

(7) Key in scale of map or drawing to measured.

(8) Press [f] and a to call up (from memory) lengths routine for feet. Press ❑ and d if printout in feet and inches is desired.

NOTE

Linear measuring probe stand is used to facilitate measurement using a straightedge.

(9) If needed, mount linear measuring probe in stand.

(10) Press CLEAR button to clear auto-scaler.

(11) Press foot switch. Do not release until ready to begin measurement.

(12) Position linear measuring probe so that pricking pin is at beginning of length to be measured. Release foot switch.

(13) Make measurement by tracing length of line with linear measuring probe.

(14) Press foot switch to initiate PRINT command and freeze count.

(15) To make another measurement, repeat steps (11) through (14).

(16) If additional lengths are to be added, press f and c to initiate ACCU and addition subroutine.

(17) If additional lengths are to be subtracted, press f and e for ACCU and subtraction subroutine.

(18) To change scale or function with new measurement, press D to initiate calculator memory.

u. Layout work with linear measuring probe.

(1) Assemble QPS with linear measuring probe.

(2) Activate QPS.

(a) Plug foot switch into PRINT input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into ACCU input jack on back panel of auto-scaler.

(c) plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(l) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6.2h), Program 1, into calculator.

(4) Tape drawing or map to be measured and paper for layout to table.

(5) If needed, aline 1 i near measuring probe (paragraph 5-6.2n). Record R_L value.

NOTE

Factory determined R_L value is given on Calibration Record sheets provided with equipment. Alinement is performed as a check.

(6) Key in scale of map or drawing on which measurements will be made.

NOTE

If layout is to be drawn to a different scale than original map or drawing, key in scale for layout.

(7) Press [f] and a.

(8) Press [f] and d for printout in feet and inches.

(9) Press CLEAR button to clear auto-scaler.

(10) Press foot switch. Do not release until ready to begin measurement.

(11) Position linear measuring probe so that pricking pin is at beginning of length to be measured.

(12) Release foot switch.

(13) Make measurement by tracing length of line with linear measuring probe.

(14) Depress, then release foot switch to initiate print command.

(15) Position linear measuring probe on layout sheet at beginning of line just measured.

(16)’ Press pricking pin.

(17) Press CLEAR button to clear auto-sealer.

(18) Using a straightedge as a guide, move linear measuring probe until auto-scaler LED display shows count total identical to previously measured line.

(19) When LED display shows the same count, stop 1 i near measuring probe.

(20) Press pricking pin.

NOTE

Pricking pin marks identify beginning and end of lines being laid out.

(21) For each new line, repeat steps (7) through (20).

(22) To change scale or function, press D to initiate calculator memory.

v. Linear measuring probe measurements without the calculator.

(1) Assemble the QPS with the linear measuring probe.

(2) Activate the QPS:

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(h) Set AUDIO/OFF switch on back panel of auto-sealer to AUDIO.

(i) Set auto-sealer B/ACCU/A/OFF switch to A.

(j) Set auto-sealer MAN/AUTO switch to MAN.

(k) Set auto-sealer X MEMORY switch to 1.

(1) Set calculator OFF/ON switch to OFF.

(m) Set auto-sealer NORMAL/SCALE switch to seal e.

(3) Tape map or drawing to be measured to table.

(4) Calculate linear scale constant, CL, using the following equation.

$$C_L = Sc/R_L$$

CL = Linear scale constant

Sc = Scale of drawing or map

RL = Alinement constant (found on Calibration Records Sheet provided with equipment)

(5) Enter three most significant digits of 1 i near scale constant, C_L, into auto-scaler using scaler dials.

(a) Set first most significant digit on left hand dial.

(b) Set second most significant digit on middle dial.

(c) Set third most significant digit on right hand dial.

Example: If C_L is 10.571, left hand dial should read 1, middle dial should read 0, and right hand dial should read 5.

(6) Set decimal selector according to value of first significant digit of linear scale constant CL.

NOTE

- Decimal selector switch sets decimal place for auto-scaler LED display.
- If constant is one or greater, set decimal selector to O.
- If constant is less than one, set decimal selector according to place of first significant digit.

(7) Place linear measuring probe on line to be measured so that pricking pin is at starting point.

(8) Press CLEAR button to clear auto-scaler.

(9) Make measurement by tracing length of line with linear measuring probe.

(10) Press foot switch to activate ACCU and freeze count.

(11) Multiply number shown in auto-scaler LED display to obtain length of line in feet.

NOTE

- If first significant digit of C_L is in ones column (one place to left of decimal point), multiply auto-scaler LED display to 10.
- If first significant digit is in tens column, multiply auto-scaler LED display by 100.
- If first significant digit is three or more places to left of decimal point, increase multiplication factor by 10 for each position it lies further to the left.

w. Point counts with point counter pen and constants.

(1) Assemble QPS with point counter pen.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into wall outlet.

(f) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to OFF.

(g) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(h) Set auto-scaler B/ACCU/A/OFF switch to A.

(i) Set auto-scaler MAN/AUTO switch to MAN.

(j) Set auto-scaler X MEMORY switch to 1.

(k) Set calculator OFF/ON switch to ON.

(l) Set calculator MAN/TRACE/NORM switch to NORM.

(m) Set calculator PRGM/RUN switch to RUN.

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed card (paragraph 5-6.2h), Program I, into calculator.

(4) Tape drawing or map to be measured to table.

(5) When multiplying counts by one constant, key in constant press [ENTER↑] and [A] .

(6) Press CLEAR button to clear auto-scaler.

(7) Using point counter pen, make point count.

(8) Press PRINT to obtain results of count.

(9) To make point count with two to four constants, follow steps (1) through (4).

(10) When multiplying counts by two to four constants, key in each constant followed by [ENTER↑] .

(11) After last constant has been keyed in, press [ENTER↑] , [f] , and e.

(12) Press CLEAR button to clear auto-scaler.

(13) Using point counter pen, make point count.

(14) Press PRINT to obtain results of count.

(15) Change X MEMORY switch to 2.

(16) Press CLEAR button to clear auto scaler.

(17) Using point counter pen, make poi nt count.

(18) Press PRINT to obtain results of count.

(19) Repeat steps (13) through (18) if there is another constant being used.

x. Standard volume run using contour method.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug transformer power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(j) Set auto-scaler MAN/AUTO switch to MAN.

(k) Set auto-scaler X MEMORY switch to 1.

(1) Set calculator OFF/ON switch to ON.

(m) Set calculator MAN/TRACE/NORM switch to NORM.

(n) Set calculator PRGM/RUN switch to RUN.

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6.2h), Program II, in calculator.

(4) Tape map or drawing to remeasured to table.

(5) Select correct tracer arm length.

NOTE

The tracer arm length should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) If needed, aline planimeter with tracer arm length selected (paragraph 5-6.21).

(7) Record R_T value.

NOTE

Factory determined R_T value is given on Calibration Record Sheet provided with equipment. Alinement is performed as a check.

(8) Key in horizontal and vertical scales of contour map or photo and R_T value.

(a) Key in horizontal scale, press ENTER↑ .

(b) Key in vertical scale, press ENTER↑ .

(c) Key in R_T value, press ENTER↑ .

(9) Key in section interval of contours to remeasured, and press ENTER↑

(10) Press ❑ to call up subroutine A.

(11) Determine if object of contour is cut (excavation) or fill (embankment).

(a) If contour is fill, press B .

(b) If contour is cut, press f and b.

(12) Press INIT button to clear calculator.

(13) Key in value for elevation of first contour to be measured.

(14) Press c.

(15) Place planimeter at starting point of boundary line for measuring contour loop .

(16) Make practice trace to make sure tracer arm will cover area in one operation.

(17) Press CLEAR button to clear auto-scaler.

(18) Trace boundary line of contour loop with dot in lens tracing assembly. Stop when you reach starting point.

(19) Press and hold down remote tracer switch to activate PRINT command.

NOTE

- Calculator will print the following information after the first measurement.
- ***Elevation
  ***Section of contour loop
- Additional measurements will provide values for intermediate volume and total volume.
- 0.00 Intermediate volume in cubic yards
  0.00 Total volume in cubic yards

(20) Move to next contour loop.

(21) Release remote tracer switch.

(22) Repeat steps (18) and (19) until desired volume is determined.

(23) To change contour interval when next loop to be measured is at a different interval, key in new interval. **Press f and a.**

(24) **If** last elevation is not even contour interval, key in value for last elevation. **Press f and c.** Repeat steps (18) through (23).

(25) To start a new run, press b or f and b to initiate memory. Repeat steps (12) through (18).

y. Merging volume runs.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into PRINT input jack on back panel of auto-scaler.

(c) Plug planimeter into E_1 encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER supply jack on back panel of auto-scaler.

(e) Plug transformer power cable into wall outlet.

(f) Plug power cord into back of calculator.

(9) Plug power cord into wall outlet.

(h) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(i) Set AUDIO/OFF switch on back panel of auto-sealer to AUDIO.

(J) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-sealer MAN/AUTO switch to AUTO.

(1) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6.2h), Program II, into calculator.

(4) Tape map or drawing to remeasured to table.

(5) Select correct tracer arm length.

NOTE

The tracer arm length should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) If needed, aline planimeter with tracer arm selected (paragraph 5-6.21),

(7) Record R_T value.

NOTE

Factory determined RT value is given on Calibration Record Sheet provided with equipment. Alinement is performed as a check.

(8) Key in horizontal and vertical scales of contour map or photo and R_T value.

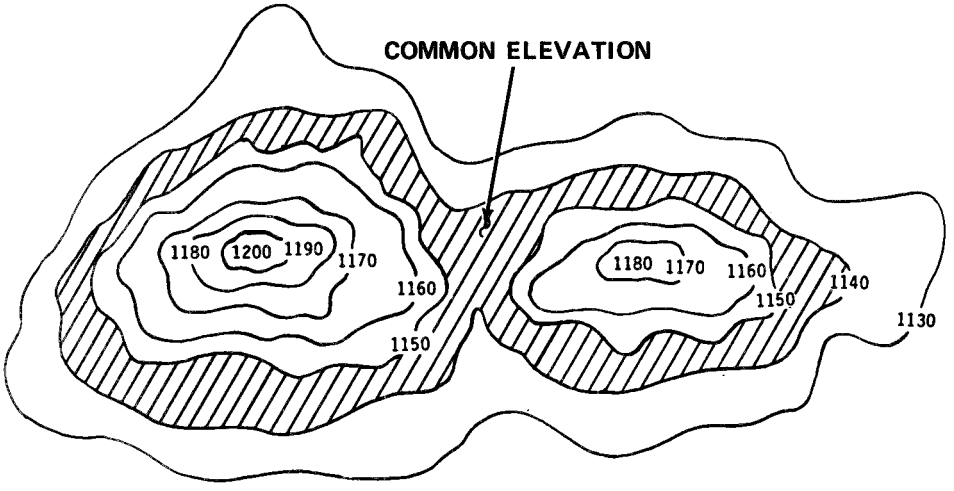
(a) Key in horizontal scale, press [ENTER↑] .

(b) Key in vertical scale, press [ENTER↑] .

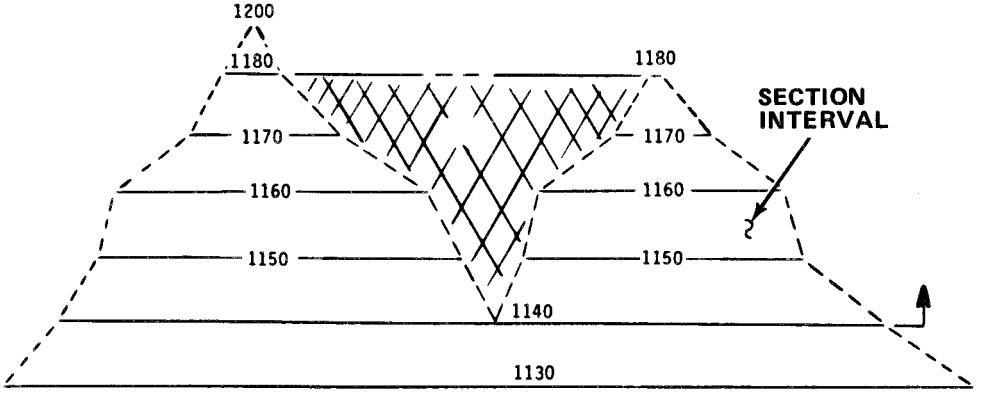
(c) Key in R_T value, press [ENTER↑] .

NOTE

In contour map example of twin peak mountain, area is elevation where volumes merge into common base. Volume of left peak above merge point will be measured first.



NORMAL VIEW



SIDE VIEW

(9) Key in section elevation interval of contours to be measured. Press [A]

(10) If contour is a fill, press [B] . If contour is a cut, press [f] and b.

(11) Place planimeter at starting point of boundary line for measuring first contour.

(12) Press INIT. key to clear calculator.

(13) Make practice trace to make sure tracer arm will cover area in one operation.

(14) Press CLEAR button to clear auto-scaler.

(15) Key in starting elevation and press [C] .

(16) Trace boundary line of contour loop with dot in lens tracing asembly. Stop when you reach starting point.

(17) Press and hold down remote tracer switch to activate PRINT command.

NOTE

- Calculator will print the following information after the first measurement.
- *** Elevation
- Additional measurements will provide values for intermediate volume and total volume.
- 0.00 Area of contour loop
  0.00 Intermediate volume in cubic yards
  0.00 Total volume in cubic yards

(18) Press and hold down foot switch.

(19) Reposition planimeter to make measurement of next contour loop.

(20) Release foot switch.

(21) Repeat steps (17) through (21) for each consecutive loop measured before merge.

(22) To change contour interval when next loop to be measured is at a different interval, key in new interval, press [f] and a.

(23) Repeat steps (18) through (24) for each of the independent volumes, until all independent volumes have been measured.

(24) Reposition planimeter for measuring merge volume, and repeat steps (18) through (24).

(25) To measure next object, press [D] , and repeat steps (8) through (24).

z. Diverging volume runs.

(1) Use merging volume runs (paragraph 5-6.2y) to begin procedure for diverging volume runs. Follow steps (1) through (16).

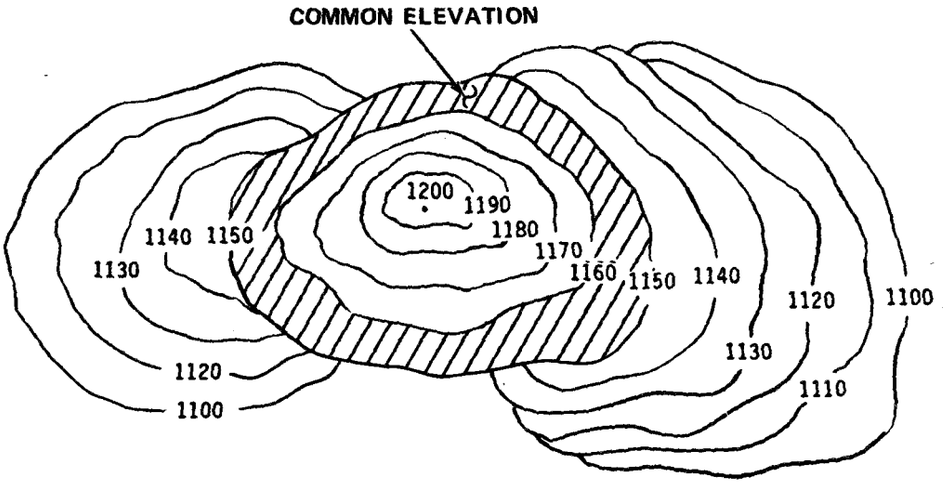
(2) Trace boundary lines of contour. Stop when you reach starting point.

(3) Move up or down contours until you reach last contour before split (diverging volume).

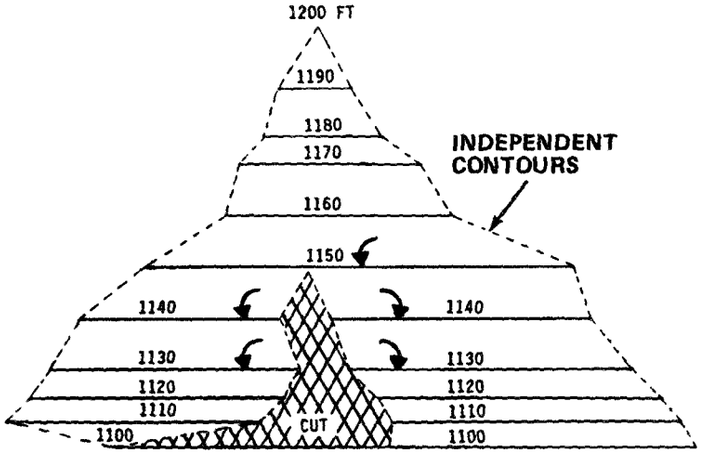
(4) Position planimeter to measure first contour adjacent to diverging cut.

(5) Trace boundary of first contour.

(6) Press and hold down foot switch to reposition planimeter over adjacent contour area.



NORMAL VIEW



SIDE VIEW

NOTE

- In contour map, example of diverging-cut ridge, area is elevation where features of object diverge into two volumes.
- Contours adjacent to diverging cut represent independent portions of total volume of object. Each contour must be measured at each elevation interval. Total counts must be entered before PRINT command to prevent negative volume of cut being added to total.

(7) Release foot switch.

(8) Press remote tracer switch to activate print command.

(9) Key in elevation of first adjacent contour. Press [f] and c.

(10) Retrace first loop of short (smaller) side.

(11) Repeat steps (4) through (8) until last contour of short (smaller) side has been traced and printed.

(12) Reposition tracer arm to first adjacent contour on larger (higher) side.

(13) Press [f] and c. Enter [0] , [STO] , and [0].

(14) Trace contour.

(15) Press remote tracer switch to activate PRINT command.

(16) Repeat steps (4) through (8) until last contour of larger (higher) side has been traced and printed.

NOTE

- Calculator will print the following information after the first measurement.
- *** Elevation
- Additional measurements will provide values for area of contour, intermediate volume, and total volume.
- 0.00 Area of contour
  0.00 Intermediate volume
  0.00 Total volume so far

(17) To measure new object, press [D] to initiate memory. Repeat steps (4) through (9).

aa. Vertical cross sections.

(1) Assemble QPS with planimeter.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug remote tracer switch into PRINT input jack on back panel of auto-scaler.

(c) Plug planimeter into E, encoder socket on back panel of auto-scaler.

(d) Plug power transformer cable into POWER jack on back of auto-scaler.

(e) Plug power transformer cable into wall outlet.

(f) Plug power cord into back of calculator.

(g) Plug power cord into wall outlet.

(h) Set encoder OFF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(i) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(j) Set auto-scaler B/ACCU/A/OFF switch to A.

(k) Set auto-scaler MAN/AUTO switch to MAN.

(1) Set auto-scaler X MEMORY switch to 1.

(m) Set calculator OFF/ON switch to ON.

(n) Set calculator MAN/TRACE/NORM switch to NORM.

(o) Set calculator PRGM/RUN switch to RUN.

(p) Press following keys: [1] , [STO] , [1] and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6.2h), Program II, into calculator.

(4) Tape map or drawing to be measured to table.

(5) Select correct tracer arm length.

NOTE

Tracer arm length should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) If needed, aline planimeter with tracer arm length selected (paragraph 5-6.21).

NOTE

Factory determined R_T value is given on Calibration Records sheet provided with equipment. Alinement is performed as a check.

(7) Key in horizontal scale and vertical scale of contour map or photo and R_T value.

(a) Key in horizontal scale; press [ENTER↑] .

(b) Key in vertical scale; press [ENTER↑] .

(c) Key in R_T value; press [ENTER↑] .

(8) Key in section interval of contours to be measured; press [A].

(9) Determine if object contour described is cut (excavation) or fill (embankment).

(10) If object is fill, press [B] . If object is cut, press [f] and b.

(11) Press INIT to clear calculator.

(12) Key in value for elevation of first station point to be measured.

NOTE

If contour is cut, first station point elevation should be largest. If contour is fill, first station point elevation should be smallest.

(13) Press [C] .

(14) Place planimeter at starting point on boundary line of contour loop.

(15) Press CLEAR button to clear auto-scaler.

(16) Trace boundary line of contour loop with dot in lens tracing assembly. Stop when you reach starting point.

NOTE

When running vertical sections, odd stations (elevations) may occur. Odd stations may be keyed in by the following steps.

- **Key in next station (elevation).**
- **Press [f] and c.**
- **Trace section.**

(17) Press and hold down remote tracer switch to activate PRINT command.

(18) Move to next contour loop.

(19) Release remote tracer switch.

(20) Repeat steps (15) through (18) for each consecutive loop until desired volume is determined.

NOTE

- Calculator will print the following information after the first measurement.
- *** First station
  *** Section area
- Additional measurements will provide values for intermediate volume and total volume.
- 0.00 Intermediate volume in cubic yards
  0.00 Total volume in cubic yards

(21) To start new run, press [D] , and repeat steps (12) through (20).

ab. Volume erase procedure.

(1) If error in tracing was made and caught before initiating PRINT command.

(a) Reposition planimeter at starting point.

(b) **Press CLEAR button to clear auto-scaler.**

(c) Retrace boundary of contour.

(2) If error is caught after initiating PRINT command:

(a) Reposition planimeter at starting point.

(b) Press CLEAR, [f] , and e.

(c) Retrace boundary of contour.

(3) If volume run is completed before error is caught, repeat entire volume run up to error. Elevation after incorrect section does not have to be rerun.

(a) Rerun volume starting from elevation section immediately above incorrect section down to error. **Press [f] and d to initiate reload of volume run.**

(b) Key in area of each section, read from previous printout that follows incorrect section. **Press [ENTER↑] and [E] .**

ac. Out-of-phase adjustments.

NOTE

Out-of-phase adjustment is used when there is constant section interval, but sections are not even elevations.

(1) Determine phase differential.

NOTE

Program II automatically locates next even elevation from first section entered. Determine what this number is, and subtract it from desired second elevation. Result is phase differential.

Example: Running vertical sections at 100-ft intervals

```
  525  = Desired second elevation
- 600  = Next even 100-ft elevation
  -75 = Phase differential
```

Example: Running contours at 10-ft intervals

```
  1215  = Desired second elevation
- 1210 = Next even 10-ft elevation
    +5  = Phase differential
```

(2) Key in phase differential.

(3) Press [f] and [P ≷ S.].

(4) Press [STO] and 0.

(5) Press [f] [P ≷ S.].

ad. Linear measurements on aerial photographs of unknown scale or magnification. To make linear measurements of aerial photographs, there must be a known length of an object. This known factor is used to compute constants needed for measurements.

(1) Assemble QPS with measuring probe.

(2) Activate QPS.

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug linear measuring probe into E_1 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER jack on back of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_1.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to AUTO.

(j) Set auto-scaler MAN/AUTO switch to AUTO.

(k) Set auto-scaler X MEMORY switch to 1.

(1) Set calculator OFF/ON switch to ON.

(m] Set calculator MAN/TRACE/NORM switch to MAN.

(n) Set calculator PRGM/RUN switch to **RUN.**

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6.2.10), Program IV, into calculator.

(4) Tape photograph to be measured to table.

(5) If needed, aline linear measuring probe (paragraph 5-6.2.16). Record R_L value.

NOTE

Factory determined R_L value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(6) Press CLEAR button to clear auto-scaler.

(7) Determine length constant, C_L (multiplier), using the following formula:

$$CL = \frac{D}{R}$$

C_L = Length of constant

D = Length of known object

R = Counts generated by measuring length of known object

Example: On aerial photograph of unknown scale or magnification where a telephone line is visible, use the known distance between two telephone poles, 105 feet, for D in formula.

(1) With linear measuring probe, measure the known distance (between two telephone poles) to obtain R.

(2) The value shown on the auto-scaler LED display (5692) can be used for R in the formula

(3) Compute $C_L = \frac{D}{R}$ or $C_L = \frac{105}{5692}$

(4) Result is 0.02. Press [DSP] and [6] to display six decimal places, 0.018447 = C_L.

(5) Press [PRINT X] to activate PRINT command.

(8) Key in C_L value (computed with known length of object in photograph being measured). Press [STO] , [1] , and [ENTER↑] .

(9) Press foot switch. Do not release until ready to begin measurement.

(10) Position linear measuring probe so that pricking pin is at beginning of length to be measured. Release foot switch.

(11) Make measurement by tracing length of line with linear measuring probe.

(12) Press [PRINT X] to activate PRINT command and freeze count.

ae. Area measurements on aerial photographs of unknown scale or magnification. To make area measurements of aerial photographs, there must be a known length of an object. This known factor must be used to compute constants needed for measurements.

(1) Assemble QPS with planimeter.

(2) Activate QPS:

(a) Plug foot switch into ACCU input jack on back panel of auto-scaler.

(b) Plug planimeter into E_2 encoder socket on back panel of auto-scaler.

(c) Plug power transformer cable into POWER supply jack back panel of auto-scaler.

(d) Plug power transformer cable into wall outlet.

(e) Plug power cord into back of calculator.

(f) Plug power cord into wall outlet.

(g) Set encoder 0FF/E_2/E_1 switch on back panel of auto-scaler to E_2.

(h) Set AUDIO/OFF switch on back panel of auto-scaler to AUDIO.

(i) Set auto-scaler B/ACCU/A/OFF switch to A.

(j) Set auto-scaler MAN/AUTO switch to AUTO.

(k) Set auto-scaler X MEMORY switch to 1.

(l) Set calculator OFF/ON switch to ON.

(m) Set calculator MAN/TRACE/NORM switch to MAN.

(n) Set calculator PRGM/RUN switch to RUN.

(o) Press following keys: [1] , [STO] , [1] , and [ENTER↑] .

CAUTION

Hold magnetic cards by edge. Be sure hands are clean. Grease, oil, or other materials may damage magnetic cards.

(3) Load preprogrammed magnetic card (paragraph 5-6.2 h), Program IV, into calculator.

(4) Tape photograph to be measured to table.

(5) Select correct tracer arm length.

NOTE

Tracer arm length should be shortest one possible that will allow entire shape to be measured without moving the planimeter.

(6) Aline planimeter with tracer arm length selected (paragraph 5-6.2 k). Record R_T value.

NOTE

Factory determined R_T value is given on Calibration Records Sheet provided with equipment. Alinement is performed as a check.

(7) Place planimeter near shape to be measured so that length of tracer arm lies along imaginary line through center of shape. Set wheels so that axles form 90 degree angle with tracer arm.

(8) Make practice trace to be sure tracer arm will cover area in one operation.

(9) Determine area constant, C (multiplier), using the following formula:

$$C = \frac{S_c 2 \times A_T}{R_T}$$

C = Area of constant

A_T = Area of test rule (given on Calibration Records Sheet provided with equipment)

R_T = Encoder count for each revolution (given on Calibration Records Sheet provided with equipment)

S_c = Scale ratio

(a) Determine S_c by using the following formula:

$S_c = CL \times R_L$

S_c = Scale ratio

C_L = Length constant (paragraph 5-6.2.32)

R_L = Counts per inch (given on Calibration Records Sheet provided with equipment)

(b) Example: Use given R_L value (724) on Calibration Records Sheet and C_L value (0.018447) obtained from linear measurements on aerial photographs (paragraph 5-6.2.ad).

$S_c = 0.018447 \times 724 = 13.355628$

$S_c 2 = 178.372799$

(c) Use values provided on Calibration Records Sheet for A_T and R_T. For this example, the value for R_T is 2157 and A_T is 12.54. The formula can now be computed on the calculator.

$$C = \frac{178.372799 \times 12.54}{2157} = \frac{2236.794903}{2157} = 1.036993$$

(d) Press [PRINT X] to activate PRINT command.

(10) Key in C value (computed with known length of object in photograph being measured). **Press [STO] , [2] , and [ENTER↑] .**

(11) Set auto-scaler X MEMORY switch to 2.

(12) Trace boundary line of shape using lens tracing assembly. Stop when you reach starting point.

(13) Press [PRINT X] to activate PRINT command and freeze count.

NOTE

Following are tables providing information found on preprogrammed magnetic cards. The tables can be used to verify programs or to program the calculator if preprogrammed cards are damaged or lost.

Table 5-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAMS I,II, III, AND IV)

Label Key	Routine	Function and Usage Notes
	PROGRAM I	
[A]	Point Counts	Used to total point counts and multiply total by constant. Must be reinitiated if different count is to be used.
a	Lengths	Used to measure lengths with linear measuring probe or planimeter. Must be reinitiated if scales are changed.
[B]	Areas	Computes area of measurement. Prints area in square feet. Must be reinitiated if tracer arm length is changed.
b	Slope Area	Computes area of slope. Must be reinitiated if new slope ratios or scales are to be used.
[C]	**ACCU +**	Addition routine for adding slopes or areas.

Table 5-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAMS 1, II, III, AND IV) - Cont

Label Key	Routine	Function and Usage Notes
	PROGRAM I - Cont	
C	ACCU -	Subtraction routine for subtracting slopes or areas.
D	Initiate	Places zero in memory registers so they can be used for new input.
d	Inches/Acres	Converts computed area measurement into units of acres.
E	Print	Master print routine. Contains subroutines for printing results and data of other label routines in inches, square feet, or acres.
e	Memory Load	Loads constants 4, 3, 2, and 1 into memory stack.
	PROGRAM II	
A	Load Data	Used to enter horizontal and vertical scales of item to be measured and alinement data.
a	New Interval	Used to change or enter contour interval. Next even contour interval elevation for new interval is automatically determined.
B	Fill Routine	Sets system up for measurement and calculculation. of fill.
b	Cut Routine	Sets system up for measurement and calculation of cut.

Table 5-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAMS I, II, III, AND IV) - Cont

Label Key	Routine	Function and Usage Notes
	PROGRAM II - Cont	
C	First Section	Automatically determines next even-valued section elevation from one being measured.
c	Next Section	Used anytime manual loading of next elevation is required. Used to run sections not on even elevation intervals.
D	Initiate	Stores zeros in memory registers so they can be used for new input.
d	Reload Stack	Used to rerun volume run where an incorrect section was entered; Resets memory stack for input of areas of sections that follow erroneous section on tape.
E	Print	Master print routine contains subroutines for printing results and data of other label routines.
e	Erase	Erases results and data for last (volume) contour trace made so incorrect intervals can be eliminated before volume run is completed. Calculator will reprint all data groups for previous section and ready itself for next measurement. Can only be used to erase one step at time.

Table 5-2. PRERECORDED PROGRAM SUBROUTINES (PROGRAMS I, II, Ill, AND IV) - Cont

Label Key	Routine	Function and Usage Notes
	PROGRAM III	
E	Print	Prints new value of X.
A B C D a, b, c, d	Load Register	Loads multiple constants or factors stored in registers 2-9 into register 1. Pressing corresponding label key loads new constant or factor into that register.
	PROGRAM IV	
A	Enter 1	Loads number 1 into memory.
B	Constant/Ratio	Computes constants CL and S_c for aerial photographs.
C	C_L	Loads value of CL into memory.
E	Print	Prints results of calculations.

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV)

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program I - Points, Areas, and Lengths			
001	LBL A	001	21 11	POINT COUNTS routine
002	STO A	002	35 11	Storage for constant
003	f SPACE	003	16-11	Space printer
004	1	004	01	
005	STO 1	005	3501	Constant
006	CLX	006	-51	
007	STO I	007	3546	Print indicator, I
008	RTN	008	24	Return to 001
009	LBL f a	009	21 16 11	LENGTHS routine
010	STO A	010	35 11	Scale (of map)
011	7	011	07	
012	2	012	02	Register
013	4	013	04	
014	f SPACE	014	16-11	Space printer
015	÷	015	-24	Register
016	STO 1	016	35 01	Constant
017	1	017	01	Input
018	STO I	018	35 46	Print indicator, I
019	RCL A	019	36 11	
020	f SPACE	020	16-11	Space printer
021	RTN	021	24	Return to 000
022	LBL B	022	21 12	AREAS routine
023	1	023	01	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I,II,III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont		
024	2	02	
025	.	-62	A_T, Area of test rule
026	5	05	
027	5	05	
028	X≷Y	-41	
029	R↓	-31	Roll down stack 1
030	X	-35	Multiply S_2 X A_T
031	X	-35	
032	X Y	-41	
033	÷	-24	Divide by R_T
034	STO 1	35 01	Store constant
035	1	01	Input
036	CHS	-22	Change sign
037	STO 1	35 46	Print indicator, 1
038	CL X	-51	Clear X
039	f SPACE	16-11	Space printer
040	RTN	24	Return to 000
041	LBL f b	21 16 12	SLOPE AREA routine
042	STO 8	35 08	Slope factor
043	RCL I	36 46	
044	f X 0?	16-45	Conditional area test
045	GTO 7	22 07	Go to slope calculation
046	RTN	24	Return to 000 (Test Failed)

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont			
047	[LBL] [7]	047	21 07	Slope area calculation
048	[R↓]	048	-31	Adjust memory stack
049	[1]	049	01	Input
050	[PRINT X]	050	-14	Print display
051	[f] SPACE	051	16 11	Space printer
052	[X≷Y]	052	-41	
053	[÷]	053	-24	
054	[f] TAN^{-1}	054	16 43	Arc tangent
055	[COS]	055	42	Slope cosine run)
056	[STO] [7]	056	35 07	Slope storage
057	[RTN]	057	24	Return to 000
058	[LBL] [C]	058	21 13	Actuate + Routine
059	[1]	059	01	Input
060	[STO] [6]	060	35 06	Storage indicator
061	[f] SPACE	061	16-11	Space printer
062	[RTN]	062	24	Return to 000
063	[LBL] [f]	063	21 16 13	Actuate - Routine
064	[1]	064	01	Input
065	[CHS]	065	-22	Change sign
066	[STO] [6]	066	35 06	Store indicator
067	[f] SPACE	067	16-11	Space printer
068	[RTN]	068	24	Return to 000
069	[LBL] [D]	069	21 14	Initiate routine

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code	Display	Meaning or Purpose
		Program I - Points, Areas, and Lengths - Cont		
070	0	070	00	Input 0
071	STO 0	071	35 00	Zero register 0
072	STO 2	072	35 02	Zero register 2
073	STO 3	073	35 03	Zero register 3
074	STO 4	074	35 04	Zero register 4
075	STO 5	075	35 05	Zero register 5
076	STO 6	076	35 06	Zero register 6
077	STO 7	077	35 07	Zero register 7
078	STO 8	078	35 08	Zero register 8
079	STO 9	079	35 09	Zero register 9
080	f SPACE	080	16-11	Space printer
081	RTN	081	24	Return to 000
082	LBL f d	082	21 16 14	INCHES/ACRES routine
083	1	083	01	Input
084	STO 9	084	35 09	Zero register nine
085	RCL I	085	36 46	
086	f X>0?	086	16-44	Test for length or area
087	GTO 5	087	22 05	To calculate inches
088	RCL 1	088	36 01	
089	4	089	04	
090	3	090	03	
091	5	091	05	Constant
092	6	092	06	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
		Program I - Points, Areas, and Lengths - Cont		
093	0	093	00	
094	÷	094	-24	Divide
095	f SPACE	095	16-11	Space printer
096	STO 2	096	35 02	
097	RTN	097	24	Return to 000
098	LBL E	098	21 15	PRINT routine
099	STO 0	099	35 00	
100	RCL I	100	3646	
101	f X=0?	101	16-43	Test for points
102	STO 0	102	22 00	If Yes
103	RCL 8	103	36 08	If No
104	f X≠0?	104	16-42	Test for slope
105	GTO 4	105	22 04	If Yes, routine 4
106	RCL 9	106	36 09	If No
107	f X>0?	107	16-44	Test for inches/acres
108	GTO 2	108	22 02	If Yes, routine 2
109	GTO I	109	22 01	If No, routine 1
110	RTN	110	24	Return to 000
111	LBL I	111	21 01	Print areas or length routine
112	RCL 0	112	3600	
113	PRINT X	113	-14	Print display
114	RCL 6	114	36 06	
115	f X≠0?	115	16-42	Test for actuate

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont			
116	GTO 8	116	22 08	If Yes, routine 8
117	f SPACE	117	16-11	If No
118	R↓	118	-31	Adjust memory stack
119	RTN	119	24	Return to 000
120	LBL 8	120	21 08	PRINT actuate routine
121	X	121	-35	Input X
122	RCL 3	122	36 03	
123	+	123	-55	Add
124	STO 3	124	35 03	
125	PRINT X	125	-14	Print total
126	f SPACE	126	16-11	Space printer
127	RTN	127	24	Return to 000
128	LBL 2	128	21 02	Print inches/acres routine
129	RCL 0	129	36 00	
130	PRINT X	130	-14	Print display
131	RCL 1	131	36 01	
132		132	-24	
133	RCL 2	133	36 02	
134	X	134	-35	
135	PRINT X	135	-14	Print inches/acres
136	STO 5	136	35 05	
137	RCL 6	137	36 06	
138	f X≠0?	138	16-42	Test for actuate

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont			
139	GTO 9	139	22 09	If yes, routine 9
140	f SPACE	140	16-11	If no
141	R↓	141	-31	Adjust memory to X
142	RTN	142	24	Return to 000
143	LBL 9	143	21 09	Print inches/acres Actuate routine
144	RCL 0	144	36 00	
145	RCL 6	145	3606	
146	X	146	-35	
147	RCL 3	147	3603	
148	+	148	-55	Add
149	STO 3	149	35 03	
150	PRINT X	150	-14	Print display
151	RCL 5	151	36 05	
152	RCL 6	152	3606	
153	X	153	-35	Input
154	RCL 4	154	36 04	
155	+	155	-55	Add
156	STO 4	156	35 04	
157	PRINT X	157	-14	Print
158	f SPACE	158	16-11	Space printer
159	f SPACE	159	16-11	Space printer
160	RTN	160	24	Return to 000
161	LBL 0	161	21 00	Print points routine

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, Ill, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I - Points, Areas, and Lengths - Cont		
162	RCL 0	162 36 00	
163	RCL A	163 36 11	
164	PRINT X	164 -14	
165	X	165 -35	Input
166	PRINT X	166 -14	
167	f SPACE	167 16-11	
168	RTN	168 24	Return to 000
169	LBL 4	169 21 04	Print slope routine
170	RCL 0	170 36 00	
171	PRINT X	171 -14	Print
172	RCL 7	172 36 07	
173	÷	173 -24	Divide
174	PRINT X	174 -14	Print
175	STO 5	175 35 05	
176	f SPACE	176 16-11	Space printer
177	RCL 6	177 36 06	
178	X≠0?	178 16-42	Test for ACCU
179	GTO 9	179 22 09	If Yes, routine 9
180	R↓	180 -31	If No, move stack
181	RTN	181 24	Return to 000
182	LBL 5	182 21 05	Inches routine
183	RCL 1	183 36 01	
184	RCL A	184 36 11	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - **Cont**

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
		Program I - Points, Areas, and Lengths - Cont		
185	÷	185	-24	Divide
186	STO 2	186	35 02	
187	f SPACE	187	16-11	Space printer
188	RTN	188	24	Return to 000
189	LBL f e	189	21 16 15	Memory load routine
190	STO 4	190	35 04	
191	R↓	191	-31	Move memory stack
192	STO 3	192	35 03	
193	R↓	193	-31	Move memory stack
194	STO 2	194	35 02	
195	R↓	195	-31	Advance memory stack
196	STO I	196	35 01	
197	I	197	01	
198	STO I	198	35 46	
199	f SPACE	199	16-11	Space printer
200	R/S	200	51	Run/Stop, end of program
		Program II - Volumes by Contour		
001	LBL A	001	21 11	Load data routine
002	STO E	002	35 15	
003	f R↓	003	16-31	Roll up stack
004	STO A	004	35 11	Horizontal scale entry
005	f R↑	005	16-31	Roll up stack
006	STO B	006	35 12	Vertical scale entry

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
007	R↓	007 -31	Roll down stack
008	1	008 01	
009	2	009 02	
010	.	010 -62	Actual area of test rule
011	5	011 05	
012	5	012 05	
013	STO C	013 35 13	Test area
014	f R↑	014 16-31	Roll up stack
015	STO D	015 35 14	
016	f R↑	016 16-31	Roll up stack
017	CL X	017 -51	Clear display
018	f SPACE	018 16-11	
019	RTN	019 24	Return to 000
020	LBL B	020 21 12	Fill routine
021	1	021 01	
022	LBL 4	022 21 04	Cut/Fill indication
023	STO I	023 35 46	Entry
024	f SPACE	024 16-11	
025	RTN	025 24	Return to 000
026	LBL C	026 21 13	First section routine
027	STO 9	027 35 09	
028	f SPACE	028 16-11	
029	RCL 5	029 36 05	

Table **5-3.** PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

	Keystroke Entry	Key Code	Display	Meaning or Purpose
		Program II - Volumes by Contour - Cont		
030	RCL 6	030	3606	
031	f P≷S	031	16-51	
032	STO 6	032	35 06	
033	R↓	033	-31	Roll down stack
034	STO 5	034	3605	
035	f P≷S	035	16-51	
036	0	036	00	
037	STO 0	037	3500	
038	RTN	038	24	Return to 000
039	LBL D	039	21 14	Initiate routine
040	RCL A	040	36 11	Indicator
041	RCL B	041	36 12	
042	X	042	-35	Multiply
043	RCL C	043	36 13	
044	X	044	-35	Multiply
045	RCL D	045	36 14	
046	÷	046	-24	Divide
047	STO 1	047	35 01	0 Stored
048	0	048	00	
049	STO 5	049	35 05	Store 0's
050	STO 6	050	35 06	Store 0's
051	STO 7	051	35 07	Store 0's
052	STO 8	052	3508	Store 0's

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
		Program 11 - Volumes by Contour - Cont		
053	STO 9	053	35 09	Store O's
054	f P≷S	054	16-51	
055	STO 0	055	35 00	Store O's
056	STO 1	056	35 01	Store O's
057	STO 2	057	35 02	
058	STO 3	058	35 03	
059	STO 4	059	35 04	
060	STO 5	060	35 05	
061	STO 6	061	35 06	
062	f P≷S	062	16-51	
063	f SPACE	063	16-11	
064	f CLF 0	064	16 22 00	Clear flag O
065	RTN	065	24	Return to 000
066	LBL E	066	21 15	Print routine
067	RCL 6	067	36 06	
068	f P≷S	068	16-51	Current area next to last area
069	STO 2	069	35 02	
070	f P≷S	070	16-51	
071	X≷Y	071	-41	
072	STO 6	072	35 06	Store new area in current area
073	RCL 7	073	36 07	
074	f P≷S	074	16-51	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
075	STO 3	3503	Store current intermediate volume in last intermediate volume
076	f P≷S	16-51	
077	RCL 9	36 09	
078	PRINT X	-14	Print next elevation
079	RCL 6	3606	
080	PRINT X	-14	Print new area
081	f P≷S	081 16-51	
082	RCL 2	082 3602	
083	+	083 -55	Add
084	f P≷S	084 16-51	
085	RCL 0	085 36 00	Section/Volume calculation
086	X	086 -35	Multiply
087	5	087 05	
088	4	088 04	Constant
089	÷	089 -24	Divide
090	RCL 9	090 36 09	
091	RCL 5	091 36 05	
092	−	092 -45	Subtract
093	X	093 -35	Multiply
094	STO 7	094 3507	
095	PRINT X	095 -14	Print intermediate volume
096	RCL 8	096 3608	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
097	f P≷S	097 16-51	
098	STO 4	098 35 04	
099	f P≷S	099 16-51	
100	+	100 -55	Add
101	STO 8	101 35-08	Store total volume
102	PRINT X	102 -14	Print total volume
103	RCL 9	103 36 09	
104	f P≷S	104 16-51	
105	RCL 5	105 36 05	
106	f P≷S	106 16-51	
107	−	107 -45	Subtract
108	f X≠0?	108 16-42	Twin peak test
109	GTO 0	109 22 00	If yes
110	RCL 6	110 36 06	If no
111	f P≷S	111 16-51	
112	RCL 6	112 36 06	
113	f P≷S	113 16-51	
114	+	114 -55	Add
115	STO 6	115 35 06	
116	LBL 0	116 21 00	Twin peak routine
117	RCL 9	117 36 09	
118	f F? 0	118 16 23 00	Test flag 0
119	GTO 2	119 22 02	If yes

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code	Display	Meaning or Purpose
	Program II- Volumes by Contour - Cont			
120	RCL E	120	36 15	If no
121	÷	121	-24	Divide
122	f FRAC	122	16 44	
123	f X=0?	123	16-43	Test for 000
124	GTO 1	124	22 01	If yes
125	RCL I	125	36 46	If odd elevations
126	1	126	01	
127	−	127	-45	Subtract
128	2	128	02	
129	÷	129	-24	Divide
130	CHS	130	-22	Change sign
131	RCL 9	131	36 09	
132	RCL E	132	36 15	
133	÷	133	-24	Divide
134	+	134	-55	Add
135	f INT	135	1634	Truncate to integer
136	RCL E	136	36 15	
137	X	137	-35	
138	GTO 2	137	22 02	To twin peak routine
139	LBL 1	139	21 01	Even elevation routine
140	RCL 9	140	36 09	
141	LBL 2	141	21 02	Twin peak routine
142	RCL 1	142	36 46	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program I I - Volumes by Contour - Cont		
143	RCL E	143 36 15	
144	X	144 -35	Multiply
145	+	145 -55	Add
146	f F? 0	146 16 23 00	Test flag 0
147	GTO 8	147 22 08	If yes
148	f P≷S	148 16-51	If no
149	RCL 0	149 36 00	
150	f P≷S	150 16-51	
151	+	151 -55	Add
152	LBL 8	152 21 08	In twin peak routine
153	RCL 9	153 36 90	
154	RCL 5	154 36 05	
155	f P≷S	155 16-51	
156	STO 1	156 35 01	
157	f P≷S	157 16-51	
158	R↓	158 -31	Roll down stack
159	STO 5	159 35 05	
160	R↓	160 -31	
161	STO 9	161 35 09	
162	1	162 01	
163	STO 0	163 35 00	
164	RCL 8	164 36 08	
165	f P≷	165 16-51	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program II - Volumes by Contour - Cont			
166	RCL 0	166	36 00	
167	f X=0?	167	16-42	Test for twin peak
168	f STF 0	168	16 21 00	Set flag to 0
169	f P≷S	169	16-51	
170	RCL 8	170	36 08	
171	f SPACE	171	16-11	Space printer
172	RTN	172	24	Return to 000
173	LBL f a	173	21 16 11	New interval routine
174	STO E	174	35 15	
175	f SPACE	175	16-11	Space printer
176	RCL 5	176	36 05	
177	STO 9	177	35 09	Store last elevation
178	f P≷S	178	16-51	In current elevation
179	RCL 1	179	36 01	
180	f P≷S	180	16-51	
181	STO 5	181	35'05	
182	GTO 0	182	22 00	To first section routine
183	LBL f b	183	21 16 12	Cut routine
184	1	184	01	
185	CHS	185	-22	Change sign
186	GTO 4	186	22 04	
187	LBL f c	187	21 16 13	Next section routine
188	STO 9	188	35 09	

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program II - Volumes by Contour - Cont		
189	f SPACE	16-11	Space printer
190	RTN	24	Return to 000
191	LBL f d	21 16 14	Reload stack routine
192	GSB 5	23 05	To subroutine 5, data load
193	f R↑	16 31	
194	RCL E	36 15	
195	RCL I	3646	Set up for next elevation
196	X	-35	Multiply
197	+	-55	Add
198	STO 9	35 09	
199	RCL 8	36 08	
200	f SPACE	16-11	
201	RTN	24	Return to 000
202	LBL f e	21 16 15	Erase routine
203	RCL 5	36 05	
204	STO 9	35 09	
205	f P≷S	16-51	Backs up data
206	RCL 1	36 01	Group 1 section
207	RCL 2	36 02	
208	RCL 3	36 03	
209	RCL 4	36 04	
210	f P≷S	16-51	
211	f STACK	16-14	Print stack

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display		Meaning or Purpose
	Program II - Volumes by Contour - Cont			
212	LBL 5	212	21 05	Loader routine
213	STO 8	213	3508	
214	R↓	214	-31	Roll down stack
215	STO 7	215	3507	Loads stack into memory
216	R↓	216	-31	Roll down stack
217	STO 6	217	3506	
218	R↓	218	-31	Roll down stack
219	STO 5	219	35 05	
220	R↓	220	-31	Roll down stack
221	RTN	221	24	Return to 000
222	R/S	222	51	Run/Stop, end of program
	Program III - Multiple Scale or Alinement Factors			
001	LBL E	001	21 15	Print X routine
002	PRINT X	002	-14	
003	RTN	003	24	Return to 000
004	LBL A	004	21 11	Loads register 2
005	RCL 2	005	3602	
006	STO 1	006	35 01	Loads register 2 into 1
007	RTN	007	24	Return to 000
008	LBL B	008	21 12	Loads register 3
009	RCL 3	009	3603	
010	STO 1	010	35 01	Loads register 3 into 1
011	RTN	011	24	Return to 000

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program III - Multiple Scale or Alinement Factors - Cont		
012	LBL C	012 21 13	Loads register 4
013	RCL 4	013 36 04	
014	STO 1	014 35 01	Load register 4 into 1
015	RTN	015 24	Return to 000
016	LBL D	016 21 14	Loads register 5
017	RCL 5	017 36 05	
018	STO 1	018 35 01	Loads register 5 into 1
019	RTN	019 24	Return to 000
020	LBL f a	020 21 16 11	Loads register 6
021	RCL 6	021 36 06	
022	STO 1	022 35 01	Loads register 6 into 1
023	RTN	023 24	Return to 000
024	LBL f b	024 21 16 12	Loads register 7
025	RCL 7	025 36 07	
026	STO 1	026 35 01	Load register 7 into 1
027	RTN	027 24	Return to 000
028	LBL f c	028 21 16 13	Loads register 8
029	RCL 8	029 36 08	
030	STO 1	030 35 01	Load register 8 into 1
031	RTN	031 24	Return to 000
032	LBL f d	032 21 16 14	Loads register 9
033	RCL 9	033 36 09	
034	STO 1	034 35 01	Load register 9 into 1

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program III - Multiple Scale or Alinement Factors - Cont		
035	RTN	035 24	Return to 000
036	R/S	036 51	Run/Stop, end of program
	Program IV - Linear Measuring Probe Program for Aerial Photos		
001	LBL A	001 21 11	Enter 1 routine
002	1	002 01	
003	STO 1	003 35 01	Enter 1 into memory
004	RTN	004 24	Return to 000
005	LBL B	005 21 12	Constant/Ratio routine
006	ENTER↑	006 -21	
007	RCL I	007 36 01	
008	X	008 -35	Multiply
009	1/X	009 52	Reciprocal of X
010	RCL 8	010 36 08	
011	X	011 -35	Multiply
012	PRINT X	012 -14	Print X
013	STO 3	013 35 03	
014	7	014 07	
015	2	015 02	Constant
016	4	016 04	
017	X	017 -35	
018	PRINT X	018 -14	
019	f SPACE	019 16-11	Space printer
020	RTN	020 24	Return to 000

Table 5-3. PREPROGRAMMED KEYSTROKE ENTRIES (PROGRAMS I, II, III, AND IV) - Cont

Step	Keystroke Entry	Key Code Display	Meaning or Purpose
	Program III - Multiple Scale or Alinement Factors - Cont		
021	LBL C	021 21 13	CL routine
022	RCL 3	022 36 03	
023	STO 1	023 35 01	Enter CL in memory
024	RTN	024 24	Return to 000
025	LBL E	025 21 15	Print routine
026	PRINT X	026 -14	
027	RTN	027 24	Return to 000
028	R/S	028 51	Run/Stop, end of program

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES

Step	Keyboard Entry	Purpose
001	*LBLO	Clear registers subroutine.
002	CL REG	
003	P S	
004	CL REG	
005	RTN	
006	*LBLa	Function test subroutine.
007	RND	
008	RCLI	
009	X≠Y?	
010	R/S	
011	*LBL2	

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
012	DSZI	DSZI and RCLI subroutine.
013	*LBL5	
014	RCLI	
015	RTN	RCL and STOP if called.
016	*LBLc	
017	RCLI	
018	RCLI	Verify registers and sum in
019	X≠Y?	R_0 subroutine.
020	R/S	
021	STO 0	
022	DSZI	
023	GTOC	
024	3	
025	EEX	
026	2	
027	RCLO	
028	X≠Y?	Test R_0.
029	R/S	
030	RTN	
031	*LBLe	Decrement x subroutine.
032	1	
033	-	
034	RTN	

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
	NOTE	
	These first 34 instruction steps are standard for any program run. They are used to set registers and flags for the following program.	
035	*LBLA	Start and pause after first subroutine execution.
036	5	
037	7	
038	GBSO	
039	P SE	
040	GBSe	Decrement x.
041	ENT	
042	R	Stack (X, Y, Z, T) test.
043	X Y	
044	R	
045	R	
046	X Y	
047	R	
048	**X≠0?**	
049	**X≠Y?**	
050	RTN	
051	GBSe	Decrement x.
052	X Y?	
053	RTN	
054	GBSe	X-to-Y comparisons.

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
055	**X=Y?**	
056	RTN	
057	GBSe	
058	X Y?	
059	GT01	
060	RTN	
061	*LBL1	Decrement x.
062	GBSe	
063	ST0I	I-register test.
064	RCLI	
065	X Y	
066	**X≠Y?**	X-to-O comparisons.
067	RTN	
068	GBS2	
069	**X≠0?**	
070	GT03	
071	RTN	
072	*LBL3	
073	GBS2	
074	X=0?	
075	RTN	
076	GBS2	
077	X 0?	
078	RTN	

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
079	GBS 2	
080	X 0?	
081	GT04	
082	RTN	
083	*LBL 4	Check set status on flags.
084	DSZI	
085	F?2	
086	GT05	
087	DSZI	
088	F?1	
089	GTO 5	
090	DSZI	
091	F?3	
092	GTO 6	
093	GTO 5	
094	*LBL 6	
095	DSZI	
096	F?0	
097	GTO 7	
098	GTO 5	
099	*LBL7	Check complement of set status on flags.
100	STF 2	
101	STF 1	

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
102	CFO	
103	DSZI	
104	F?3	
105	GTO 5	
106	DSZI	
107	F?O	
108	GTO 5	
109	DSZI	
110	F?2	
111	GTO 8	
112	GT0 5	
113	*LBL 8	
114	DSZI	
115	F?1	
116	GT0 9	
117	GTO 5	
118	*LBL 9	Check F2 for test clearing.
119	DSZI	
120	F?2	
121	GT0 5	
122	GBS 2	Test DEG, SIN, SIN^{-1}.
123	DSP 7	
124	DEG	
125	SIN	

Table 5-4. PREPROGRAMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
126	SIN^{-1}	
127	GBSa	
128	C0s	Test COS, COS^{-1}.
129	COS^{-1}	
130	GBSa	
131	TAN	Test TAN, TAN-l.
132	TAN^{-1}	
133	GBSa	
134	P	Test P, R.
135	R	
136	GBSa	
137	SIN	Test H. MS, H. MS
138	H.MS	
139	H.MS	
140	SIN^{-1}	
141	GBSa	
142	LOG	Test LOG, 10^x.
143	lo^x	
144	GBSa	
145	LN	Test LN, e^x.
146	e^x	
147	GBSa	
148	X	Test X, X^2.
149	X^2	

Table 5-4. PREPROGRAM ED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
150	GBSa	
151	ENT	Test y^x, LASTx, 1/x.
152	Y^x	
153	LAST X	
154	1/X	
155	Y^x	
156	GBSa	
157	ENT	**Test +, -**
158	+	
159	LAST X	
160		
161	GBSa	
162	ENT	**Test x, .**
163	x	
164	LAST X	
165		
166	GBSa	
167	x	**Test** FRAC, INT.
168	FRAC	
169	LAST X	
170	INT	
171	+	
172	X^2	
173	GBSa	**Test D R, R D.**

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
174	D R	
175	R D	
176	GBSa	
177	EEX	Test **EEX, %.**
178	2	
179	X Y	
180	%	
181	GBSa	
182	DSP1	Test registers 24 and 0.
183	*LBLb	
184	RCLI	
185	ST0I	(Sensitivity of lower-order registers to higher-order register changes.)
186	DSZ1	
187	GTOb	
188	2	
189	4	
190	X I	
191	GBS	
192	GBS0	
193	*LBLd	
194	DSZI	
195	RCLI	
196	ABS	

Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

Step	Keyboard Entry	Purpose
197	ST0I	
198	2	
199	4	
200	X≠Y?	
201	GTOd	
202	ST0I	
203	GBSc	
204	9	Generate “PASS” display.
205	EEX	
206	8	-8-888888888-88
207	7	
208	1/X	
209	8	
210	CHS	
211	x	
212	STF O	
213	CLF 1	Reset status for possible second pass.
214	STF 3	
215	RAD	
216	DSP3	Test display formatting and printing.
217	ENG	
218	PRINT X	
219	SCI	

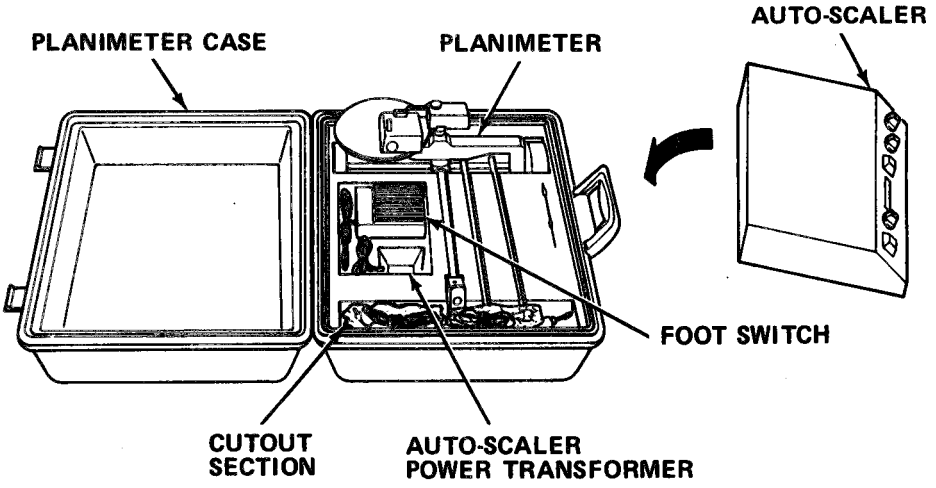
Table 5-4. PREPROGRAMMED DIAGNOSTIC ENTRIES - Cont

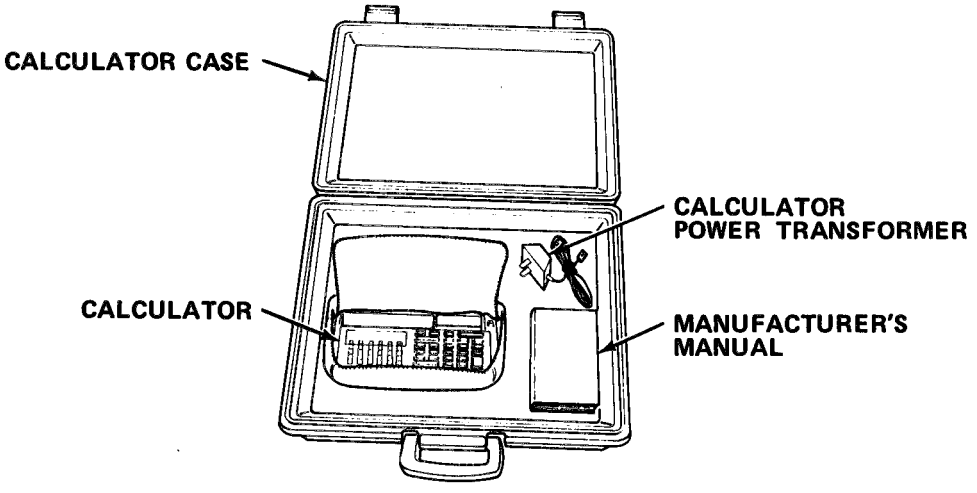
Step	Keyboard Entry	Purpose
220	**PRINT X**	
221	**DSPI**	
222	**FIX**	
223	**PRINT X**	
224	**R/S**	End of test.

5-6.3 Preparation for Movement.

a. Disconnect all cables and switches from equipment.

b. Cover components with their respective plastic covers.





c. Place foot switch and auto-scaler power transformer into planimeter case.

d. Place planimeter tracer arm extensions into cutout section of planimeter case.

e. Place planimeter with needle tracing assembly sideways into case.

f. Place remote tracer switch, point counter pen, linear measuring probe, and drafting bridge into cutout section of planimeter case.

g.. Place auto-scaler in planimeter case.

h. Place calculator in small case.

i. Place calculator in case, calculator power transformer, magnetic card pack, and manufacturer's manual in large calculator case.

j. Close and secure both cases.

5-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

5-8. LUBRICATION INSTURCTIONS.

NOTE

These lubrication instructions are mandatory.

Apply one drop of watch oil (Item 15, Appendix E) to drive gears of linear measuring probe quarterly.

5-9. TROUBLESHOOTING PROCEDURES.

5-9.1 The table lists the common malfunctions which you may find during the operation or maintenance of the QPS. You should perform the test/inspections and corrective actions in the order listed.

5-9.2 This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 5-5. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. AUTO-SCALER DOES NOT OPERATE.
Step 1. Check to see if power transformer is plugged into wall outlet and auto-scaler back panel.
(a) **If** power transformer is plugged in, proceed to step 2.
(b) Plug in power transformer.
Step 2. Check position of circuit breaker in power panel.
(a) **If** circuit breaker is on, refer to organizational maintenance.
(b) Turn on circuit. breaker.
2. CALCULATOR DOES NOT OPERATE.
step 1. Check to see if power transformer is plugged into wall outlet and back of calculator.
(a) If power transformer is plugged in, proceed to step 2.
(b) Plug in power transformer.
Step 2. Check position of circuit breaker at power panel.
(a) **If** circuit breaker is turned on, refer to organizational maintenance and proceed to step 3.
(b) Turn on circuit breaker.
Step 3. Check to see if calculator will energize with good battery pack.
(a) **If** calculator energizes, replace power transformer.
(b) **If** calculator does not energize, replace calculator.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
3. AUTO-SCALER AND CALCULATOR DISPLAY ALL ZEROS.
Step 1. With scale dials set to 000, check setting of NORMAL/SCALE switch. (a) If NORMAL/SCALE switch is on NORMAL, proceed to step 2. (b) Set NORMAL/SCALE switch to NORMAL.
Step 2. Check to see if switches on auto-scaler front panel are set correctly for specific measuring procedure. (a) If switches are set correctly, proceed to step 3. (b) Set auto-scaler switches for measuring procedure being performed.
Step 3. Check to see if remote tracer switch is stuck. (a) If remote tracer switch functions properly, proceed to step **4 .** (b) Free remote tracer switch.
Step 4. Check to see if auto-scaler 0FF/E_2/E_1 switch is set correctly for specific measuring procedure. (a) If 0FF/E_2/E_1 switch is set correctly, proceed to step 5. (b) Set 0FF/E_2/E_1 switch correctly.
Step 5. Check alinement procedure with linear measuring probe (paragraph 5 - 6 . 2 n) . Perform alinement procedure with linear measuring probe (paragraph 5-6.2n).
4. AUTO-SCALER DISPLAYS ALL ZEROS. CALCULATOR DISPLAYS CORRECT COUNT.
Check to see if auto-scaler switches are set correctly for specific measuring procedures. Set switches correctly.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
5. AUTO-SCALER DISPLAYS CORRECT COUNT. CALCULATOR DISPLAYS ALL ZEROS.	
Step 1. Check to see if ribbon cable in back of calculator is correctly connected.	(a) If ribbon cable is connected properly, proceed to step 2. (b) Insert ribbon cables correctly.
Step 2. Check to see if [1] , [STO] , [1] , and [ENTER↑] have been keyed into calculator memory.	(a) If correct entries have been keyed in, proceed to step 3. (b) Key into calculator [1] , [STO] , [1] , and [ENTER↑] .
Step 3. Check to see if auto-scaler MAN/AUTO switch, X MEMORY switch, and INIT button are set correctly for specific measuring procedure.	(a) If switches are set correctly, proceed to step 4. (b) Set switches correctly.
Step 4. Run calculator diagnostic program on preprogrammed magnetic card.	Replace calculator.
6. AUTO-SCALER IS ERRATIC. CALCULATOR DISPLAYS CORRECT COUNT.	
Perform checks in malfunction 5.	
7. CALCULATOR DISPLAYS CORRECT COUNT BUT DOES NOT RESPOND TO AUTO-SCALER SWITCHES.	
Step 1. Check to see if ribbon cable in back of calculator is correctly connected.	(a) If ribbon cable connection is correct, proceed to step 2. (b) Insert ribbon cable correctly.
Step 2. Run calculator diagnostic program on preprogrammed magnetic card.	Replace calculator.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION / TEST OR INSPECTION / CORRECTIVE ACTION
8. CALCULATOR AND AUTO-SCALER DISPLAYS ARE ERRATIC .
Step 1. Check to see if encoder cable is correctly inserted into auto-scaler back panel.
(a) If encoder cable is correctly inserted, proceed to step 2.
(b) Insert encoder cable correctly.
Step 2. Check to see if encoder mounting screws are loose or missing.
(a) If no screws are loose or missing, proceed to step 3.
(b) Notify direct support maintenance for tightening or replacing of screws.
Step 3. Check to see if planimeter drive gears are slipping or jamming.
(a) If gears are operating correctly, proceed to step 4.
(b) Tighten or loosen setscrew on wheel axle to adjust drive gears.
Step 4. Check to see if compression spring is operating.
(a) If compression spring is operating properly, proceed to step 5.
(b) Replace compression spring (paragraph 5-10.3).
Step 5. Check to see if encoder measuring wheel is in contact with planimeter disk.
Proceed to step 6.
Step 6. Check for any obstruction under the planimeter disk.
(a) If there is no obstruction present, proceed to step 7.
(b) Remove obstruction, press encoder housing in place.
Step 7. Check to see if there are enough paper disks in planimeter.
If necessary, add another disk to planimeter (paragraph 5-10.4).

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
9. AUTO-SCALER DISPLAYS CORRECT COUNT. CALCULATOR DISPLAY IS ERRATIC. Perform checks in malfunction 8.
10. POINT COUNTER PEN DOES NOT INCREMENT COUNT CORRECTLY. Step 1. Check to see if point of point counter pen is jammed. (a) If point is free, proceed to step 2. (b) Free point. (c) Replace cartridge. (d) Replace point counter pen. Step 2. Check to see if point counter pen will operate with new cartridge. (a) Replace cartridge. (b) Replace point counter pen. step 3. Check to see if auto-scaler LED display shows erratic counting while moving point counter pen. Replace point counter pen.
11. BOTH DISPLAYS APPEAR NORMAL. ALINEMENT RESULTS ARE INCORRECT OR INCONSISTENT. Step 1. Check to see if planimeter tracer arm has slipped or moved. (a) If planimeter tracer arm is in the proper position, proceed to step 2 (b) Set tracer arm to proper length. step 2. Check to see if planimeter wheels are clean. (a) If planimeter wheels are cl can, proceed to step 3. (b) Clean wheels using a soft brush.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
11. BOTH DISPLAYS APPEAR NORMAL. ALINEMENT RESULTS ARE INCORRECT OR INCONSISTENT - Cont		
	Step 3. Check to see if teflon guide washer beneath the lens tracing assembly is clean and in contact with surface.	
		(a) If teflon guide washer is clean and positioned correctly, proceed to step 4.
		(b) Clean teflon guide washer with soft clean cloth.
		(c) Replace teflon guide washer (paragraph 5-10.2).
	Step 4. Check to see if paper disk on planimeter is clean.	
		(a) If paper disk is clean, proceed to step 5.
		(b) Replace paper disk (paragraph 5-10.4).
	Step 5. Check to see if auto-scaler NORMAL/SCALE switch is set to NORMAL.	
		(a) If switch is correctly set, proceed to step 6.
		(b) Set NORMAL/SCALE switch to NORMAL.
	Step 6. With 90° triangle, check to see if axis of tracing assembly is at 90° angle to surface being measured.	
		(a) If axis is at proper angle, proceed to step 7.
		(b) Adjust axis of tracing assembly until it is at 90° angle with surface being measured.
	Step 7. With 90° triangle, check to see if axis of tracer arm and axis of wheel axle are at 90° angle.	
		(a) If axis is correct, proceed to step 8.
		(b) Adjust tracer arm assembly until it is at 90° angle with axis of wheel axle.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
11. BOTH DISPLAYS APPEAR NORMAL . ALINEMENT RESULTS ARE INCORRECT OR INCONSISTENT - Cont	
step 8. Check to see if encoder measuring wheel Is clean.	(a) If encoder measuring wheel is clean, proceed to step 9. (b) Clean encoder measuring wheel with soft brush.
Step 9. Check to see if encoder is alined.	Notify direct support maintenance for encoder alinement and replacement.
12. AUTO-SCALER AND CALCULATOR DISPLAYS DO NOT AGREE BY TWO OR MORE COUNTS.	
Check to see if ribbon cable in back of calculator is correctly connected.	Insert ribbon cable correctly.
13. CALCULATOR WILL NOT ACCEPT MAGNETIC CARD.	
Step 1. Check to see if magnetic card is being fed into reader backward or upside down.	(a) If card is being inserted correctly, proceed to step 2. (b) Feed magnetic card correctly.
Step 2. Check to make sure calculator is correctly keyed to accept card.	(a) If calculator has been correctly keyed, proceed to step 3. (b) Set keys correctly.
step 3. Check to see if head-cleaning card will be accepted into magnetic card reader.	(a) If head-cleaning card will be accepted, proceed to step 4. (b) Run head-cleaning card through magnetic card reader.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
13. CALCULATOR WILL NOT ACCEPT MAGNETIC CARD - Cont	Step 4. Check to see if magnetic card is dirty,	(a) If magnetic card is clean, proceed to step 5. (b) Clean magnetic card with cloth moistened with alcohol (Table 5-1).
	Step 5. Check to see if battery pack contacts are clean and straight.	(a) If contacts are clean and straight, proceed to step 6. (b) Clean battery pack contacts with cotton swab moistened with alcohol (Table 5-1). (c) Straighten battery pack contacts by pressing down with finger. (d) Replace battery pack (paragraph 5-10.1).
	Step 6. Run calculator diagnostic program on preprogrammed magnetic card.	Replace calculator.
14. CALCULATOR PRINTER WILL NOT ADVANCE.	Step 1. Check to see if paper roll is jammed.	(a) If paper roll is free, proceed to step 2. (b) Free paper roll.
	Step 2. Check to see if battery pack is defective.	(a) If battery pack is good, proceed to step 3. (b) Replace battery pack (paragraph 5-10.1).
	Step 3. Check to see if calculator display is active.	(a) If display is active, proceed to step 4. (b) Replace calculator.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

14. CALCULATOR PRINTER WILL NOT ADVANCE - Cont

Step 4. Check to see if calculator PRGM/RUN switch is set to RUN.

(a) If PRGM/RUN is set properly, proceed to step 5.

(b) Set switch to RUN.

Step 5. Run calculator diagnostic program on preprogrammed magnetic card. Replace calculator.

15. CALCULATOR PRINTER ADVANCES, BUT NOTHING PRINTS WHEN PRINT X IS ACTIVATED.

Step 1. Check to see if paper roll is jammed.

(a) If paper roll is free, proceed to step 2.

(b) Free paper roll.

Step 2. Perform checks in malfunction 14.

16. AUTO-SCALER LED DISPLAY DOES NOT OPERATE OR SHOWS INCORRECT COUNT.

step 1. Check to see if power source has 10 v dc to 15 V dc output.

(a) If output is correct, proceed to step 2.

(b) Change power source.

Step 2. Check to see if voltage on regulator on main logic PC board is 8 V dc .

(a) If voltage is correct, proceed to step 3.

(b) Notify direct support maintenance for replacement of main logic PC board.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
16. AUTO-SCALER LED DISPLAY DOES NOT OPERATE OR SHOWS INCORRECT COUNT - Cont	
Step 3. Check to see if there is power at power source but not on main logic PC board.	(a) If power is present, proceed to step 4. (b) Notify direct support maintenance for replacement of main logic PC board and front display PC board.
Step 4. Check to see if auto-scaler LED display shows numbers but does not count.	(a) If display operates properly, proceed to step 5. (b) Notify direct support maintenance for replacement of main logic PC board and front display PC board.
Step 5. Check to see if auto-scaler LED display shows count only increasing or only decreasing.	(a) If count is correct, proceed to step 6. (b) Notify direct support maintenance for replacement of main logic PC board and front display PC board.
Step 6. Check to see if auto-scaler LED display shows erratic counts or skips counts.	(a) If count is correct, proceed to step 7. (b) Notify direct support maintenance for replacement of main logic PC board and front display PC board.
Step 7. Check to see if auto-scaler LED display does not show even or odd digits.	(a) If display is correct, proceed to step 8. (b) Notify direct support maintenance for replacement of main logic PC board.

Table 5-5. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
16. AUTO-SCALER LED DISPLAY DOES NOT OPERATE OR SHOWS INCORRECT COUNT - Cont	
Step 8. Check to see if auto-scaler LED display shows inaccurate counts.	
	(a) If display is correct, proceed to step 9.
	(b) Notify direct support maintenance for replacement of main logic PC board.
step 9. Check to see if calculator LED shows incorrect readings.	
	(a) If calculator LED display is correct, proceed to step 10.
	(b) Notify direct support maintenance for replacement of main logic PC board.
Step 10. Check to see if calculator LED display will clear.	
	(a) If step clears, proceed to step 11.
	(b) Notify direct support maintenance for replacement of main logic PC board.
Step 11. Check to see if auto-scaler NORMAL/SCALE switch and scale dials are operating correctly.	
	(a) Notify direct support maintenance for replacement of sealer PC board
	(b) Replace auto-scaler.
	NOTE
If above procedures do not correct malfunction, notify direct support maintenance for replacement of all auto-scaler PC boards in the following order:	
(1) Replace main logic PC board.	
(2) Replace front display PC board.	
(3) Replace sealer PC board.	
(4) Replace rear input PC board.	

5-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the quantity processing system. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

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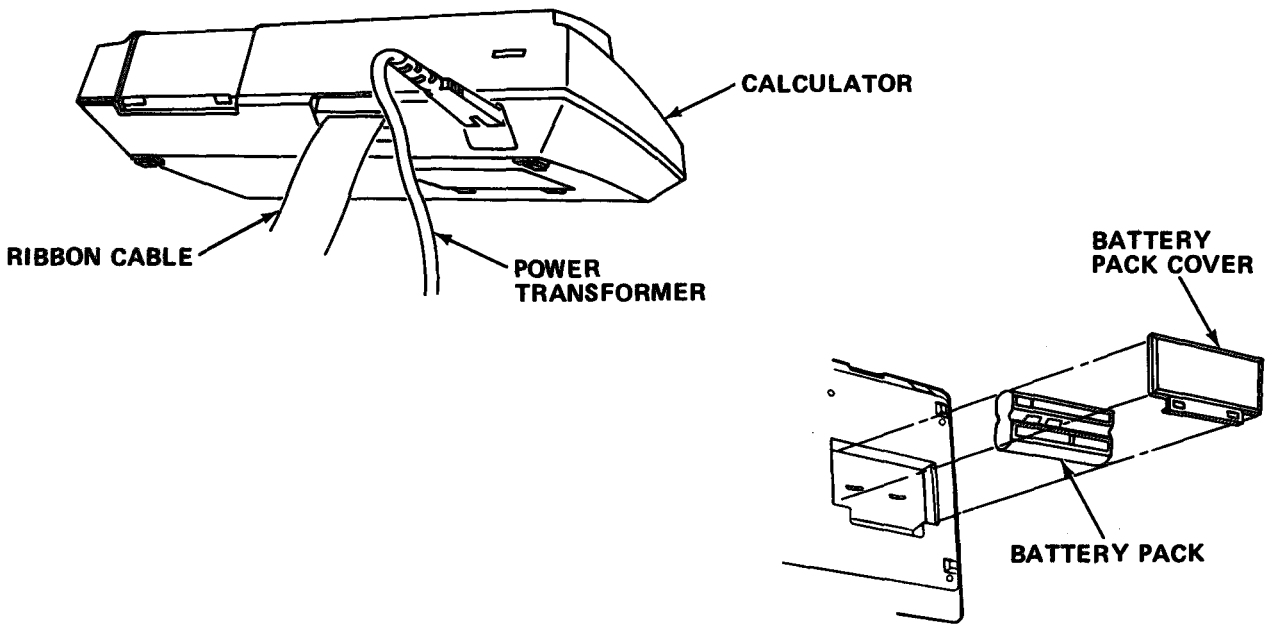
5-10.1 Replace Battery Pack.

MOS: 81Q, Terrain Analyst

SUPPLIES: Battery Pack



a. Turn calculator OFF/ON switch to OFF. Disconnect power transformer from wall outlet.

b. Remove ribbon cable.

c. Turn calculator over. Slide battery cover latches open.

d. Remove defective battery pack.

e. Install new battery pack so contacts face calculator and line up with connectors.

f. Replace cover. Slide cover latches over to secure.

CAUTION

Arrows on ribbon cable and calculator must aline. Damage to calculator can result if cable is plugged in backwards.

g. Turn calculator over. Replace ribbon cable.

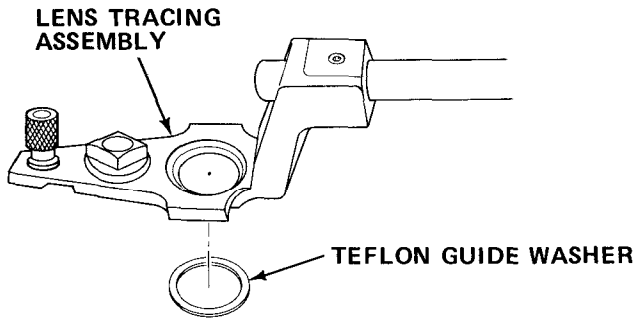
h. Reconnect power transformer to wall outlet. Turn calculator on.

5-10.2 Replace Teflon Guide Washer.

MOS: 81Q, Terrain Analyst

TOOLS: 3/16 in. Flat Tip Screwdriver
Steel Knife
3/32 in. Hex Head Key Wrench

SUPPLIES: Teflon Guide Washer
General Purpose Glue (Item 3, Appendix E)
Technical Acetone (Item 1, Appendix E)
Cheesecloth (Item 8, Appendix E)



CAUTION

Hold tracer arm with one hand before removing lens tracing assembly. Tracer arm will fall and damage planimeter.

a. Remove lens tracing assembly from planimeter tracer arm by loosening setscrew on top. Slide lens tracing assembly off tracer arm.

b. Turn lens tracing assembly over. Pry up teflon guide washer.

c. Scrape off glue and pieces of washer from base of lens tracing assembly.

d. Apply small amount of general purpose glue to bottom of new teflon guide washer.

e. Press new teflon guide washer into place. Remove excess glue with technical acetone and soft cloth.

f. Check to be sure teflon washer guide is level and is flat on surface.

g. Slide lens tracing assembly on tracer arm. Secure by tightening setscrew on top.

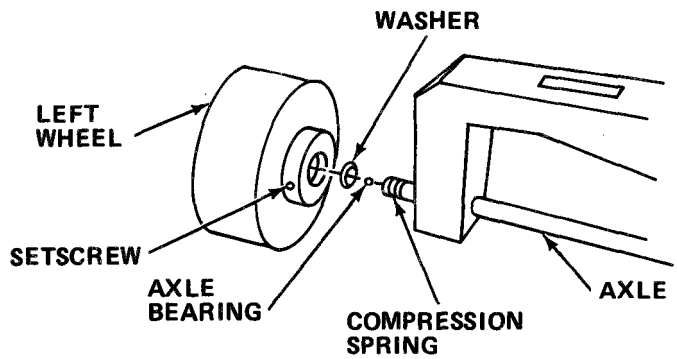
5-10.3 Replace Compression Spring.

MOS: 81Q Terrain Analyst

TOOLS: 5/64 in. Hex Head Key Wrench

SUPPLIES: Compression Spring

a. Remove wires from antenna and tracer arm assembly.



b. Facing the back of the planimeter, loosen three setscrews holding left wheel on axle.

c. Slide left wheel and washer off end of axle.

d. Slide axle bearing off.

e. Pull defective compression spring from end of axle.

f. Install new compression spring on end of axle.

g. Reinstall axle bearing.

h. Reinstall washer and left wheel on end of axle.

i. Evenly tighten setscrews.

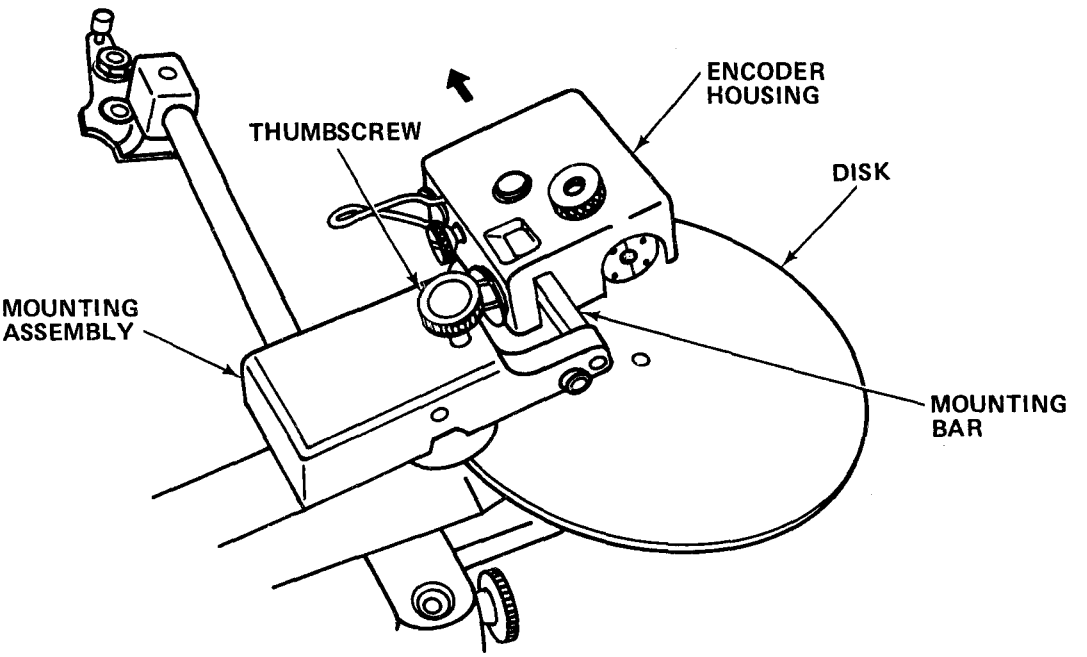
j. Reinstall wires on tracer arm assembly and antenna.

5-10.4 Replace Paper Disk.

MOS: 81Q, Terrain Analyst

TOOLS: Knife

SUPPLIES: Paper Disk
General Purpose Glue (Item 3, Appendix E)
Alcohol (Item 4, Appendix E)
Brush



a. Loosen thumbscrew on side of encoder housing. Slide encoder housing off mounting bar.

b. Turn thumbscrew to move mounting assembly away from paper disk.

c. Pry up old paper disks with knife and remove.

d. Remove any remaining glue with alcohol and a brush.

e. Spread three or four drops of general purpose glue along edge of paper disk.

f. Reinstall new disk on planimeter surface. Press down firmly.

g. Trim excess paper from edges with knife. Remove any excess glue from edges.

h. Slide encoder housing onto mounting bar. Tighten thumbscrew.

Section IV ORGANIZATIONAL MAINTENANCE

5-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication at the organizational level.

5-12 REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT. These items are not required at this level of maintenance.

5-13. SERVICE UPON RECEIPT.

5-13.1 Checking Unpacked Equipment.

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

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

5-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

5-15. ORGANIZATIONAL TROUBLESHOOTING. There are no organizational troubleshooting procedures assigned for this equipment.

5-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

5-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

5-18. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

5-18.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

5-18.2 Special Tools; Test. Measurement, and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

5-18.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering direct/general support maintenance for this equipment.

5-19. DIRECT/GENERAL SUPPORT TROUBLESHOOTING.

There are no direct/general support troubleshooting procedures assigned for this equipment.

5-20. DIRECT/GENERAL SUPPORT MAINTENANCE PROCEDURES.

a. This section contains instructions covering direct/general support maintenance functions for the quantity processing system. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

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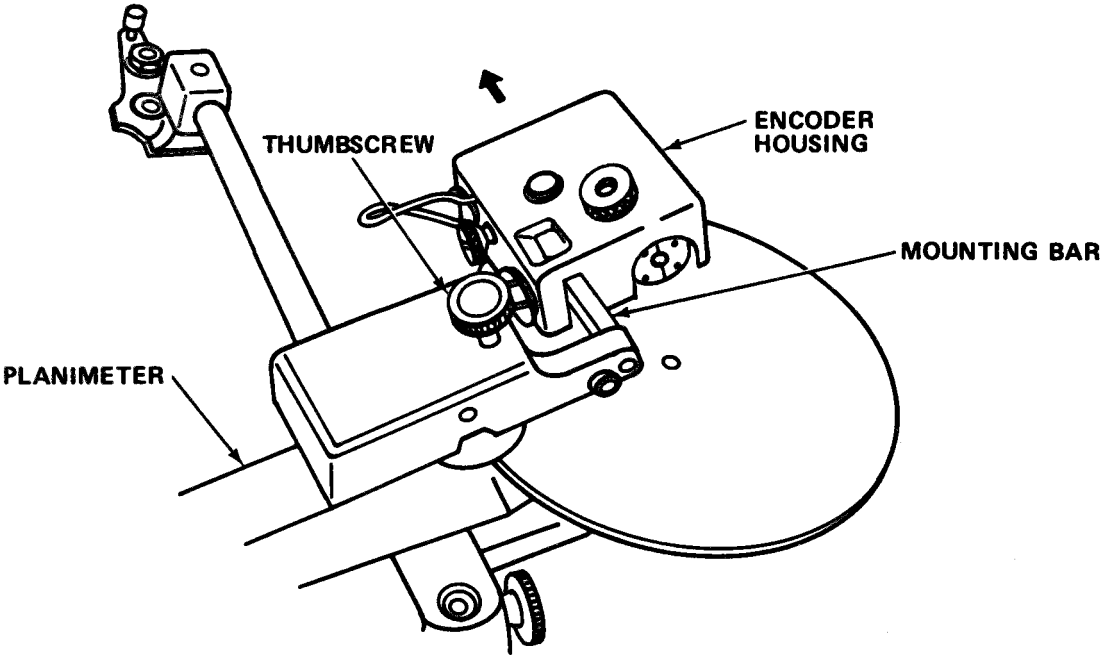
5-20.1 Replace Planimeter Encoder.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 5/64 in. Hex Head Key Wrench
No. 2 Jeweler's Screwdriver
3/16 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver

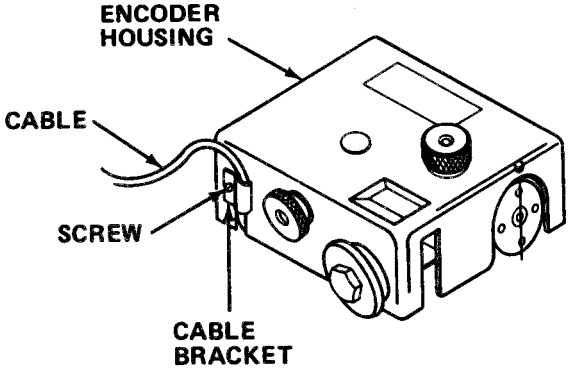
SUPPLIES: Encoder

SUPPLIES: Encoder

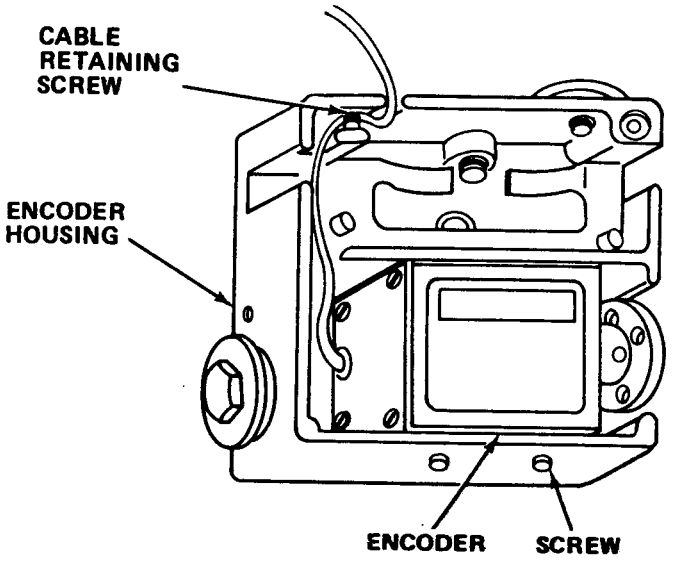


a. Loosen thumbscrew holding encoder housing on planimeter.

b. Grasp encoder housing and slide off mounting bar.



c. Remove screw holding cable bracket to encoder housing. Remove cable bracket and cable.



d. Remove cable retaining screw.

e. Mark exact position of encoder on inside walls of encoder housing.

f. Remove two hex head screws on side of housing.

g. Remove defective encoder from housing.

h. Install new encoder in housing.

i. Make sure the new encoder is parallel with the bottom of the housing and placed exactly between the marks made on the housing.

j. Reinstall two hex head screws on side of encoder housing.

k. Insert cable in housing. Reinstall cable retaining screw.

l. Reinstall cable bracket. Secure with screw.

m. Slide encoder housing onto mounting bar of planimeter.

n. Tighten thumbscrew holding encoder housing on planimeter.

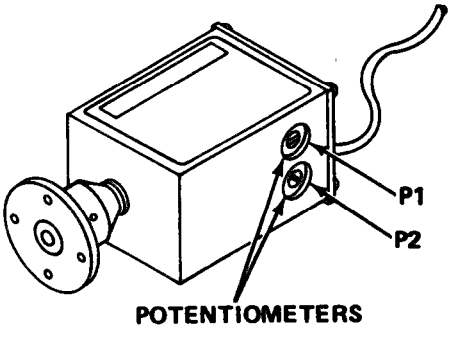
5-20.2 Aline Planimeter Encoder.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
1/8 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver
No. 2 Jeweler's Screwdriver
5/64 in. Hex Head Key Wrench
Multimeter

SUPPLIES: Spar Varnish (Item 25, Appendix E)
Dip-Clip (14 pin)

a. Remove planimeter encoder from housing (paragraph 5-20.1)



b. With technical acetone, remove resin covering from adjustment potentiometers, P1 and P2.

c. Remove four screws and washers from top of auto-scaler. Life off top.

d. Plug encoder into E_1 encoder socket on back of auto-scaler.

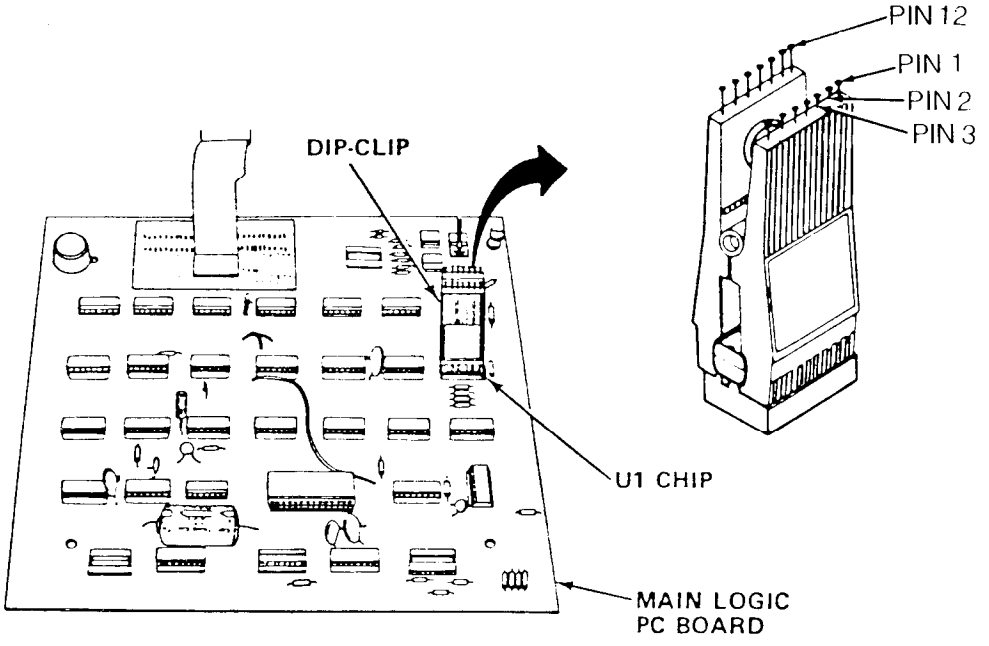
e. Turn OFF/E_2E_1 switch on back panel of auto-scaler to E_1.

CAUTION

Plug transformer power cable into auto-scaler before connecting it to wall outlet. Failure to do so could result in damage to auto-scaler.

f. Plug transformer power cable into POWER supply jack on back panel of auto-scaler.

g. Plug transformer power cable into wall outlet.



CAUTION

Make sure B/ACCU/A/OFF switch is set to off before attaching dip-clip to U1 chip. Failure to do so could result in damage to auto-scaler.

h. Attach dip-clip to U1 chip on main logic PC board.

i. Attach positive lead from multimeter to pin 3 on U1 chip. Attach negative lead to pin 12.

j. Turn auto-scaler B/ACCU/A/OFF switch to A.

k. Roll encoder wheel along work surface, and while it is turning, read voltage on multimeter

NOTE

Divide voltage reading by two to obtain encoder alinement voltage, which should be 6 ± 0.3.

1. Turn auto-scaler B/ACCU/A/OFF switch to OFF.

m. Disconnect positive lead from pin 3 and attach to pin 1. Leave negative lead on pin 12.

n. Turn auto-scaler B/ACCU/A/OFF switch to A.

o. While encoder wheel is turning, adjust P1 by turning screw slowly to obtain encoder alinement voltage (6 ± 0.3 V dc).

p. Turn auto-sealer B/ACCU/A/OFF switch to OFF.

q. Disconnect positive lead from pin 1 and attach to pin 2. Leave negative lead on pin 12.

r. Turn auto-scaler B/ACCU/A/OFF switch to A.

s. While encoder wheel is turning, adjust P2 by turning screw slowly to obtain encoder alignment voltage (6 ± 0.3 V dc).

t. Turn auto-scaler B/ACCU/A/OFF switch to OFF.

u. After encoder alinement is obtained, coat adjustment pots, PI and P2 with spar varnish.

v. Disconnect and remove multimeter lead from dip-clip and dip-clip from chip.

w. Reinstall encoder in housing (paragraph 5-20.1).

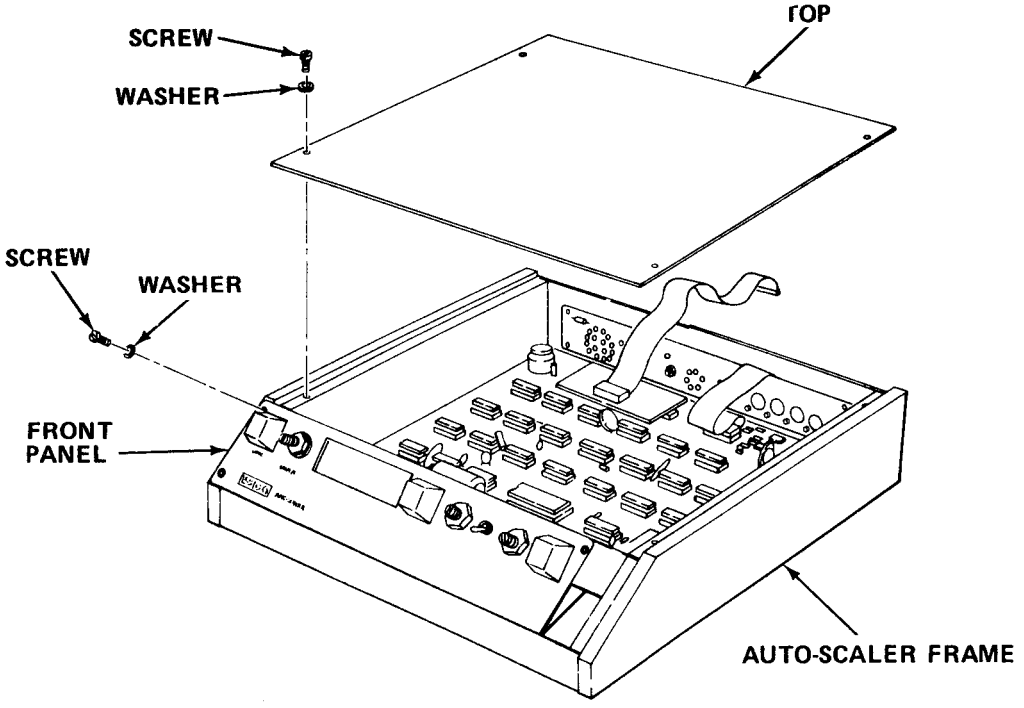
x. Reinstall top on auto-scaler. Secure with four washers and screws.

5-20.3 Replace Main Logic PC Board.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver
Needle Nose Pliers

SUPPLIES: Main Logic PC Board

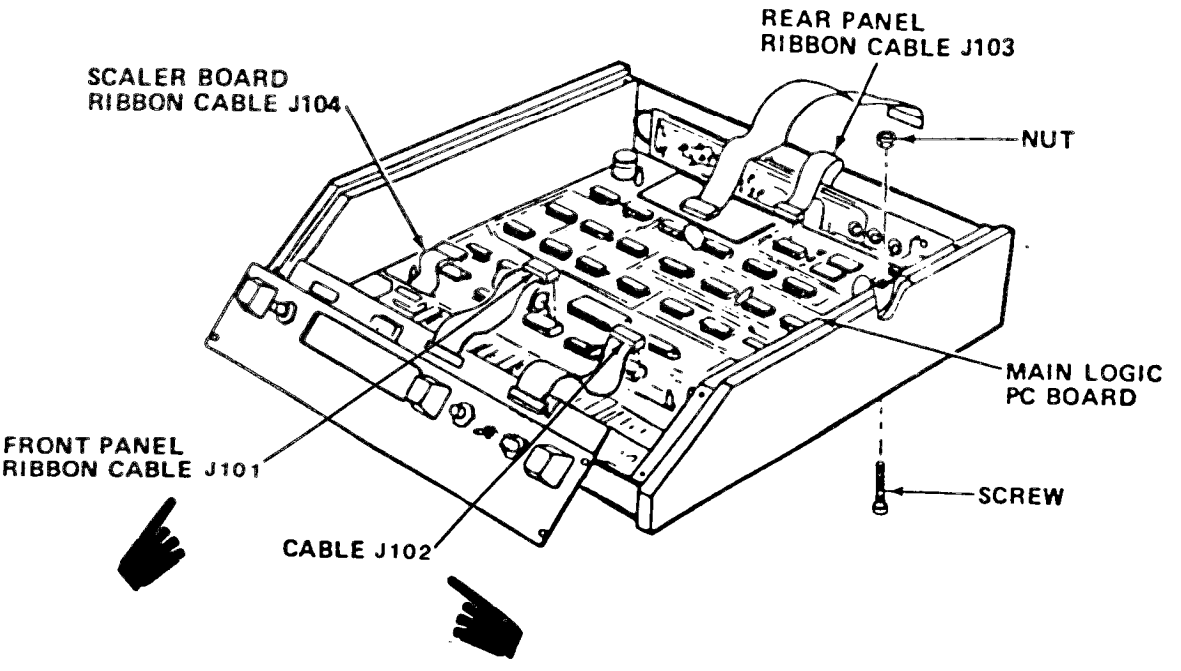


a. Remove four screws and washers from top of auto-scaler. Lift off top.

CAUTION

Front panel is connected to frame of auto-scaler by two ribbon cables. Do not pull front panel more than a few inches from frame. Damage to circuit boards can result.

b. Remove four screws on front panel of auto-scaler. Pull front panel free from auto-scaler frame.



c. Disconnect front panel ribbon cables J101 and J102 from main logic PC board.

d. Disconnect scaler board ribbon cable J104 and rear panel ribbon cable J103 from main logic PC board.

e. Remove screw and nut from upper right corner of main logic PC board.

f. Pinch plastic retainer to free main logic PC board from auto-scaler base.

g. Remove defective main logic PC board. Remove plastic retainers from board.

h. Install plastic retainers in auto-scaler base.

i. Press new main logic PC board onto plastic retainers in auto-scaler base.

j. Reinstall screw and nut on upper right corner of main logic PC board.

k. Reconnect rear panel ribbon cable J103 and scaler board ribbon cable J104 to main logic PC board.

l. Reconnect front panel ribbon cables J101 and J102 to main logic PC board.

m. Reinstall front panel on auto-scaler frame. Secure with four screws.

n. Reinstall top on auto-scaler. Secure with four washers and screws.

5-20.4 Replace Front Display PC Board.

MOS : 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
1/2 in. Box End Wrench
No. 2 Cross Tip Screwdriver

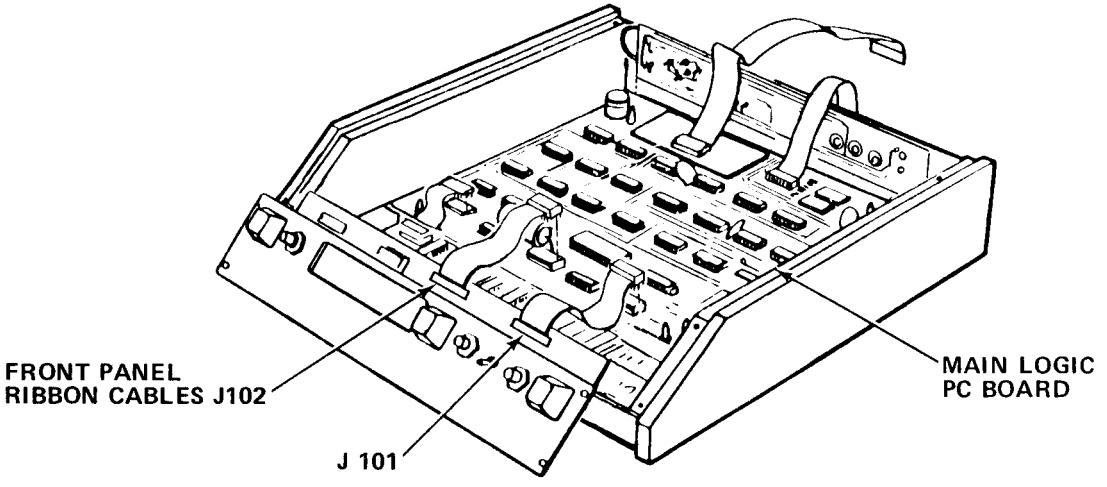
SUPPLIES: Front Display PC Board

a. Remove four screws and washers from top of auto-scaler. Lift off top,

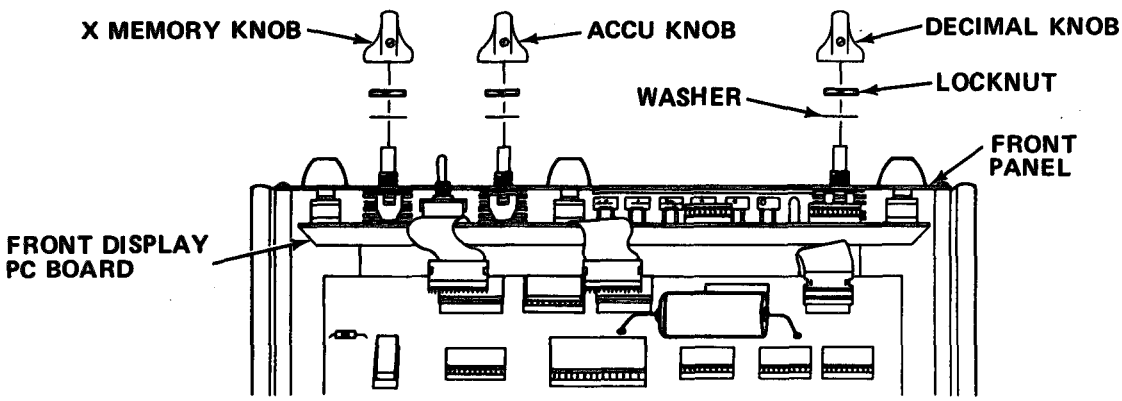
CAUTION

Front panel is connected to frame of auto-scaler by two ribbon cables. Do not pull front panel more than a few inches from frame. Damage to circuit boards can result.

b. Remove four screws on front panel of auto-scaler. Pull front panel free from auto-scaler frame.



c. Disconnect front panel ribbon cables J101 and J102 from main logic PC board.



d. Loosen setscrews holding DECIMAL, ACCU, and X MEMORY switch knobs to front panel. Remove knobs.

e. Remove three locknuts and washers from front panel. Lift off front panel. Remove defective front display PC board.

f. Place front panel on new front display PC board. Reinstall three washers and locknuts to front panel.

g. Reinstall DECIMAL, ACCU, and X MEMORY knobs on front panel. Tighten setscrews to secure.

h. Reconnect front panel ribbon cables J101 and J102 to main logic PC board.

i. Reinstall front panel on auto-scaler frame. Secure with four screws.

j. Reinstall top on auto-scaler. Secure with four washers and screws.

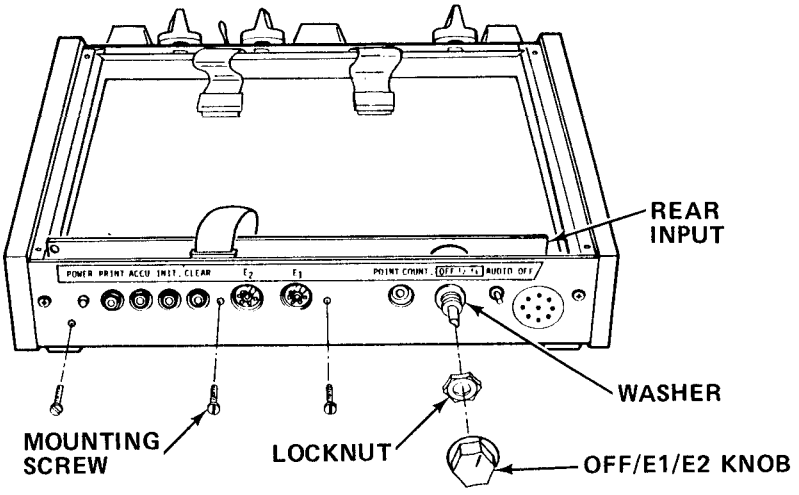
5-20.5 Replace Rear Input PC Board.

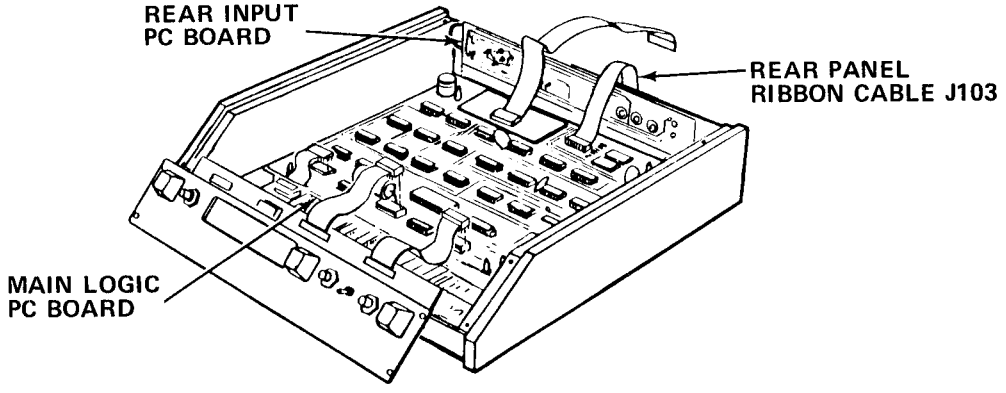
MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
No. 2 Cross Tip Screwdriver

SUPPLIES: Rear Input PC Board

a. Remove four screws and washers from top of auto-scaler. Lift off top.





b. Disconnect rear panel ribbon cable J103 from main logic PC board.

c. Loosen OFF/E2/E1 knob locknut. Remove 0FF/E_2/E_1 knob, locknut, and washer from back panel.

d. Remove three rear input PC board mounting screws and nuts from back panel. Remove defective rear input PC board.

e. Secure new rear input PC board on back panel with three nuts and screws.

f. Reinstall OFF/E_2/E_1 washer, locknut, and knob on back panel. Tighten locknut.

g. Reconnect rear panel ribbon cable J103 to main logic PC board.

h. Reinstall top on auto-scaler. Secure with four washers and screws.

5-20.6 Replace Scaler PC Board.

MOS: 35E, Special Electronic Devices Repairer

TOOLS: 3/16 in. Flat Tip Screwdriver
No. 2. Cross Tip Screwdriver
Needle Nose Pliers

SUPPLIES: Scaler PC Board

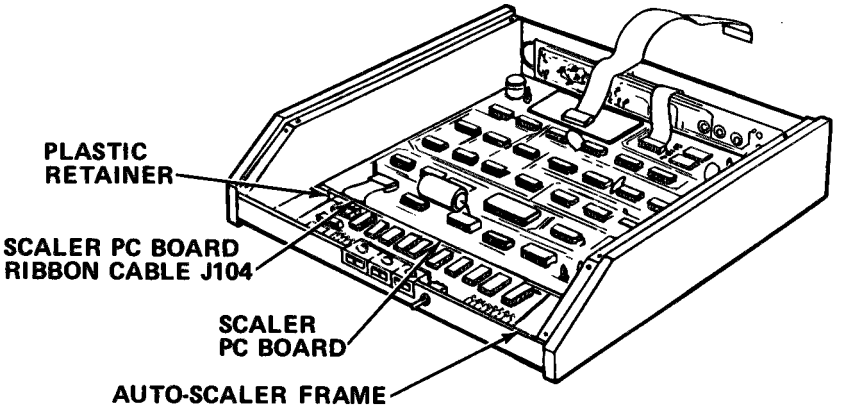
a. Remove four screws and washers from top of auto-scaler. Lift off top.

CAUTION

Front panel is connected to frame of auto-scaler by two ribbon cables. Do not pull front panel more than a few inches from frame. Damage to circuit boards can result.

b. Remove four screws on front panel of auto-scaler. Pull front panel free from auto-scaler frame.

c. Disconnect front panel ribbon cables J101 and J102 from main logic PC board. Set front panel to one side.



d. Disconnect scaler board ribon cable J104 from scaler PC board.

e. Pinch plastic retainers, and gently pry scaler PC board free from auto-scaler frame. Lift out scaler PC board.

f. Install new scaler PC board by snapping onto plastic retainers.

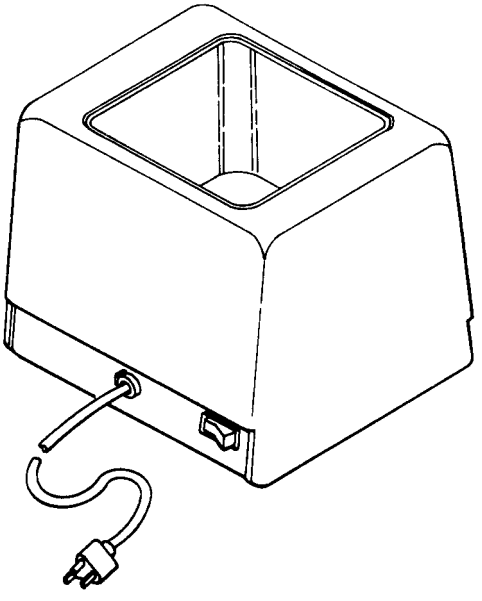
g. Reconnect scaler board ribbon cable J104 to scaler PC board.

h. Place front panel on auto-scaler frame.

i. Reconnect front panel ribbon cables **J101** and J102 to main logic PC board.

j. Secure front panel to auto-scaler frame with four screws.

k. Reinstall top on auto-scaler. Secure with four washers and screws.



CHAPTER 6

ULTRASONIC CLEANER

Section I INTRODUCTION

6-1. GENERAL INFORMATION.

6-1.1 Scope.

a. Model Number and Equipment Name. Model 3069USC3 Ultrasonic Cleaner.

b. Purpose of Equipment. To clean drafting/drawing pens.

6-2. EQUIPMENT DESCRIPTION.

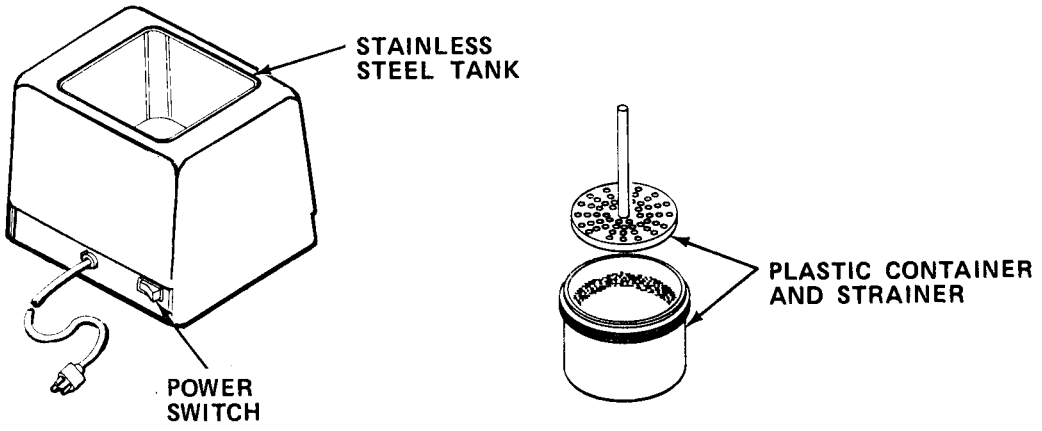
6-2.1 Equipment Characteristics, Capabilities and Features.

a. Cl cans without disassembly.

b. Removes dried ink.

c. Portable.

6-2.2 Location and Description of Major Components.



STAINLESS STEEL TANK. Holds water.

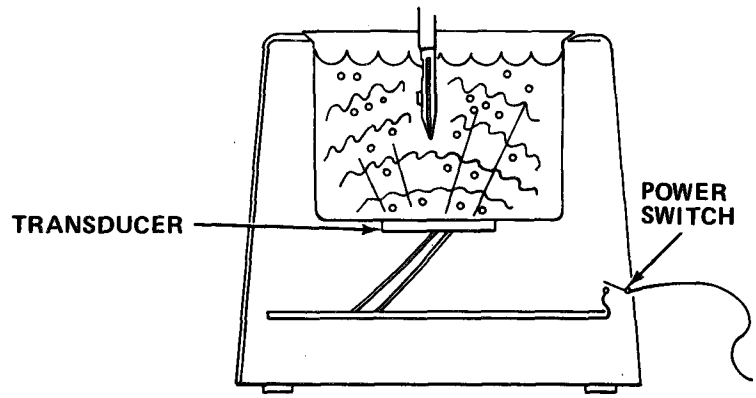
PLASTIC CONTAINER AND STRAINER. Holds small parts in solution for cleaning.

POWER SWITCH. Turns machine ON or OFF.

6-2.3 Equipment Data.

Weight	5.51 lbs (2.5 kg)
Power Requirements	115 V, 60 Hz, 60 W

6-3. TECHNICAL PRINCIPLES OF OPERATION.

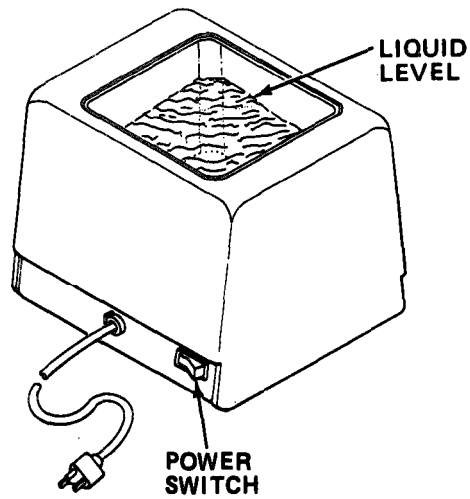


POWER SWITCH. When turned ON, provides power to the transducer.

TRANSDUCER. Generates ultrahigh frequency sound waves.

Section II OPERATING INSTRUCTIONS

6-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.



Control or Indicator	Function
Liquid Level	Level of liquid in stainless steel tank must be 1/3 full .
Power Switch	Turns power on or off.

6-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

6-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic-service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The “Equipment is Not Ready/Available If" column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your “TM Number” Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Item	Quantity
Cheesecloth (Item 5, Appendix E)	ar

Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W -Wweekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ULTRASONIC CLEANER	
1	B	Inspect Cleaner.	

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

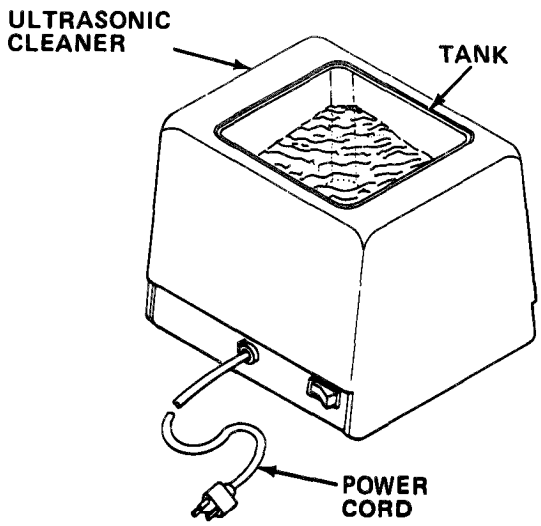


Table 6-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cent

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

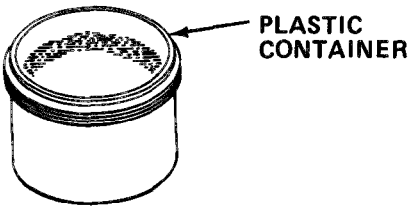
AN - Annually
S - Semiannually
BI - Biennially

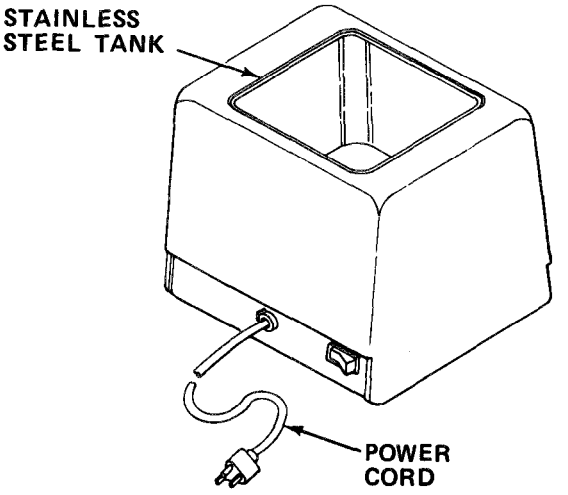
(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		ULTRASONIC CLEANER - Cont	
1	B	Inspect Cleaner - Cont	
		1. Check power cord for kinks, frays, or burns. If power cord is defective, notify organizational maintenance.	Power cord is damaged.
		2. Check tank for dirt or chemical residue. Clean tank by wiping with cheesecloth moistened with water.	
		3. Check for agitation of water surface.	Water surface is not agitating.

6-6. OPERATION UNDER USUAL CONDITIONS.

6-6.1 Operating Procedure





Fill stainless steel tank 1/3 full with fresh, clean water. Fill plastic container with water to within 1/2 in. (12.7 mm) of top.

b. Add .135 oz (4 ml) of cleaning solution to plastic container.

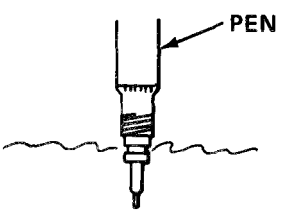
c. Plug in power cord to 120 V, 60 Hz grounded outlet.

d. Turn power on. Be sure water surface in stainless steel tank is agitating.

WARNING

Do not place fingers in stainless steel tank when ultrasonic cleaner is operating. Cleaning solution may be driven through skin or ultrasonic waves may cause injury to body tissue.

e. Prepare cleaning solution by operating ultrasonic cleaner for one minute before cleaning pen tips.



CAUTION

Do not immerse pen beyond cap threads. Damage to pen may result.

f. Dip pen about 3/4 in. (19 mm) in cleaning solution.

g. Lift pen from cleaning solution. Keeping point downward, shake solution from pen onto cheesecloth (Item 5, Appendix E).

h. Wipe pen.

i. Draw pen over scrap paper until ink flows freely and shows uniform color.

j. Turn power off. Unplug power cord.

k. Dispose of cleaning solution when dirty.

CAUTION

Avoid getting water into body of ultrasonic cleaner. Damage to circuit board can result.

l. Carefully rinse stainless steel tank.

m. Wipe stainless steel tank dry with cheesecloth (Item 5, Appendix E).

6-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

6-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

6-9. TROUBLESHOOTING PROCEDURES. There are no operator troubleshooting procedures assigned for this equipment.

6-10. MAINTENANCE PROCEDURES. Operator maintenance is limited to performance of regular preventive maintenance checks and services and replenishment of cleaning solution.

Section IV ORGANIZATIONAL MAINTENANCE

6-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

6-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

6-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of (organization and Equipment (MTOE) applicable to your unit.

6-12.2 Special Tools; Test, Measurement, and Diagnostic Equipment and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

6-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering organizational maintenance for this equipment.

6-13. SERVICE UPON RECEIPT.

6-13.1 Checking Unpacked Equipment.

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

b. Check the equipment against the packing list to see if the shipment is complete. Report all-discrepancies in accordance with the instructions of DA Pam 7 3 8 - 7 5 0 .

c. Check to see whether the equipment has been modified.

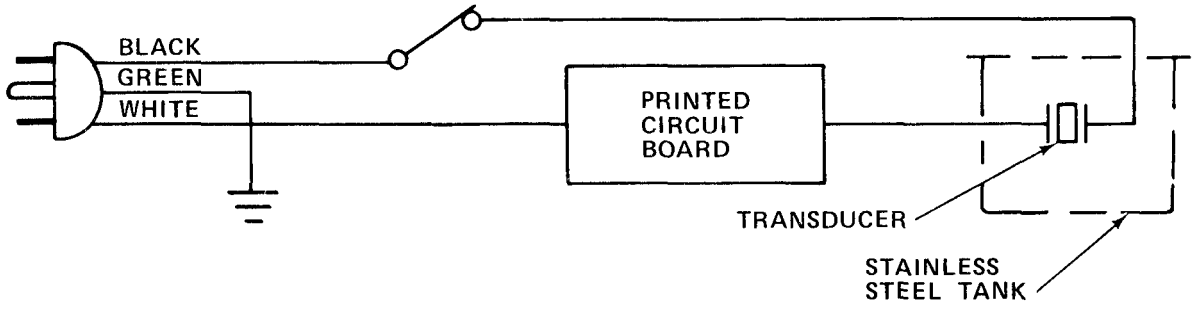
6-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

6-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES.

a. Organizational troubleshooting procedures cover the most common malfunctions that may be repaired at the organizational level. Repair or adjustment requiring specialized equipment is not authorized unless such equipment is available. Troubleshooting procedures used by the operator should be conducted in addition to the organizational troubleshooting procedures.

b. This manual cannot list all the possible malfunctions or every possible test/ inspection and corrective action. If a malfunction is not listed or corrected by a listed corrective action, notify your supervisor.

c. For unidentified malfunctions, use the following schematic or the foldout located at the end of this manual for further fault analysis.



d. If the ultrasonic cleaner does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle with power available and proceed with equipment troubleshooting. Perform no-power procedure for dead receptacle (Table 1-4).

Table 6-2. ORGANIZATIONAL TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. NO CLEANING ACTION, WATER AGITATES. Check cleaning action using fresh cleaning solution. (a) If test was satisfactory, instruct operator to change cleaning solution when dirty. (b) If test was not satisfactory, replace circuit board (paragraph 6-16.3).
2. NO WATER AGITATION. Step 1. Using multimeter, check for continuity of power cord. (a) If continuity exists, proceed to step 2. (b) If continuity does not exist, replace power cord (paragraph 6-16.1).

Table 6-2. ORGANIZATIONAL TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
2. NO WATER AGITATION - Cont	
Step 2. Check continuity of power switch.	
(a) If continuity does not exist, replace power switch (paragraph 6-16.2).	
(b) If continuity does exist, replace circuit board (paragraph 6-16.3).	

6-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance functions for the ultrasonic cleaner. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

6-16.1 Replace Power Cord.

MOS: 41B, Topographic Instrument Repair Specialist

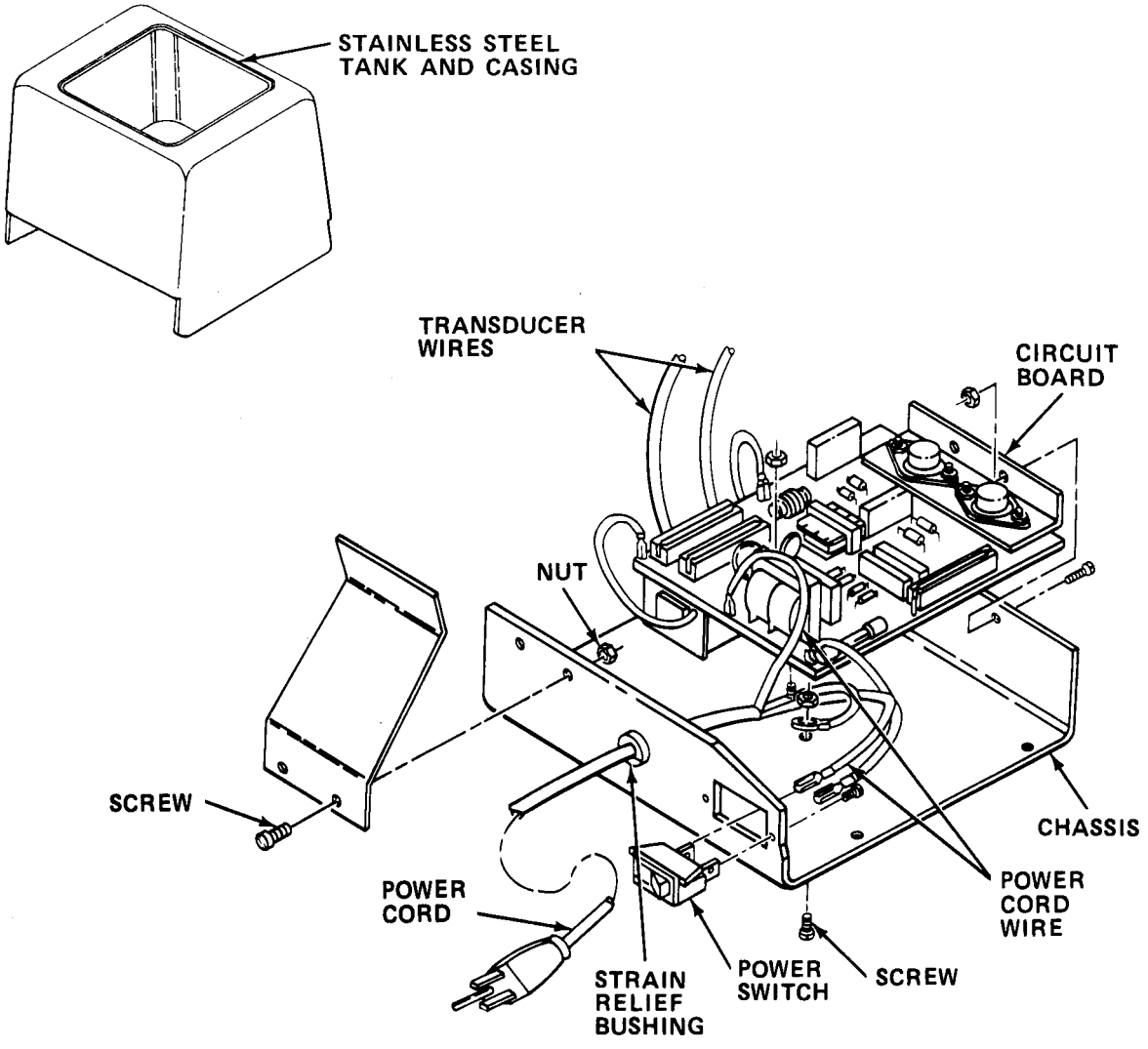
TOOLS: Flat Tip Screwdriver

SUPPLIES: Power Cord
Wire Clips

WARNING

Death or serious injury may occur if power cord is not unplugged before servicing.

a. Turn power off. Unplug power cord.



b. Remove screws and washers holding stainless steel tank and casing to chassis.

c. Lift stainless steel tank and casing free. Set aside.

NOTE

Do not disconnect wires to transducer.

d. Remove three screws, one nut, and one washer holding circuit board to chassis.

e. Disconnect power cord wire from power switch, chassis ground, and circuit board.

f. Loosen strain relief bushing from chassis and remove defective power cord.

g. Install strain relief bushing on new power cord. Insert terminal ends of cord into chassis.

h. Fit strain relief bushing into chassis.

i. Reconnect power cord wire to circuit board, chassis, and power switch.

j. Reinstall circuit board into chassis and secure with one washer, one nut, and three screws.

k. Reinstall stainless steel tank and casing. Secure with screws and washers.

l. Fill stainless steel tank 1/3 full with water.

m . Plug in power cord and turn power on. Check that water surface agitates.

6-16.2 Replace Power Switch.

MOS: 41B, Topographic Instrument Repair Specialist

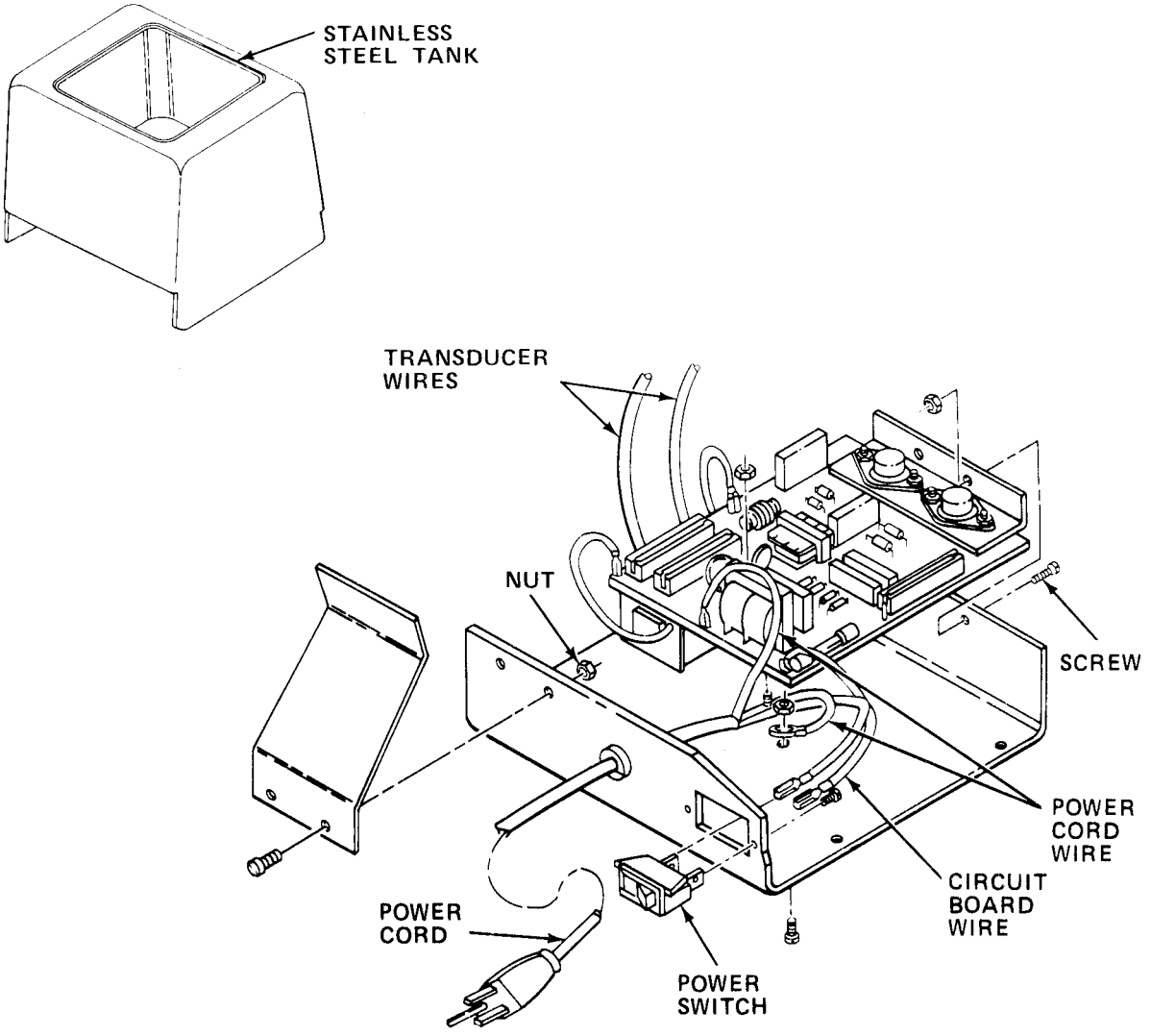
TOOLS: Flat Tip Screwdriver

SUPPLIES: Switch

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power off and unplug power cord.



b. Remove screws and washers holding stainless steel tank and casing to chassis.

c. Lift stainless steel tank and casing free. Set aside.

NOTE

Do not disconnect wires to transducer.

d. Tag and disconnect power cord wire from power switch.

e. Press sides of defective power switch and remove from chassis.

f. Install new power switch in chassis. Push power switch until tabs lock into hole.

g. Reconnect power cord wires to power switch.

h. Reinstall stainless steel tank and casing. Secure with screws and washers.

i. Fill stainless steel tank 1/3 full with water.

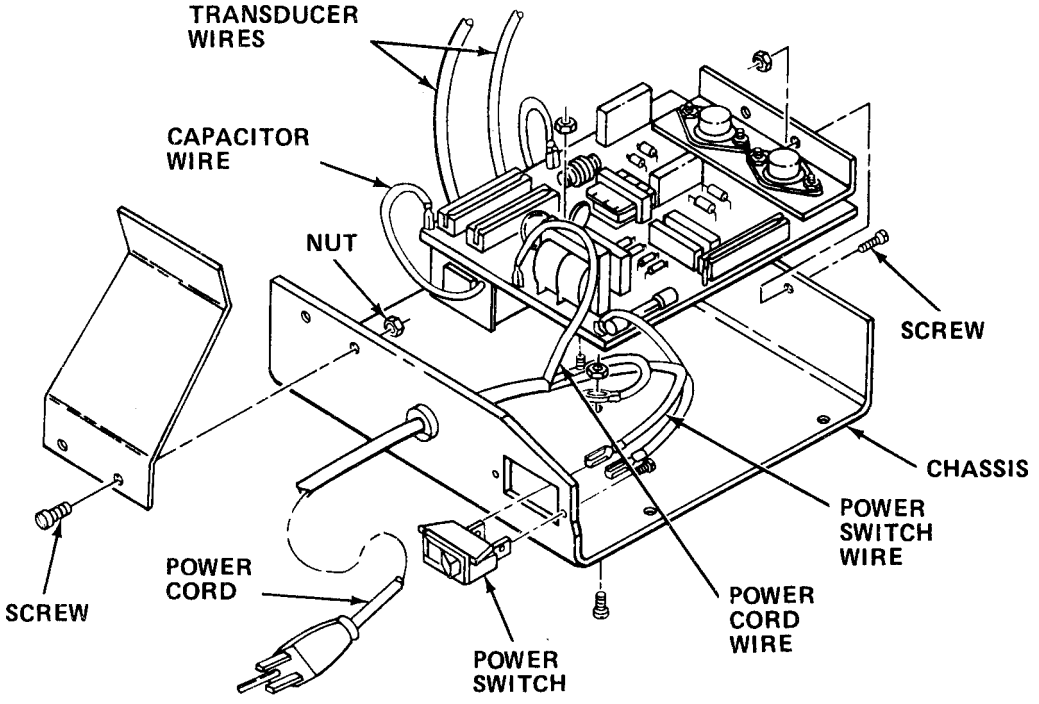
j. Plug in power cord and turn power on. Check that water surface agitates.

6-16.3 Replace Circuit Board.

MOS: 41B, Topographic Instrument Repair Specialist

TOOLS: Flat Tip Screwdriver

SUPPLIES: Circuit Board



WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

a. Turn power off and unplug power cord.

b. Remove screws and washers holding stainless steel tank and casing to chassis.

c. Lift stainless steel tank and casing free. Set aside.

NOTE

Do not disconnect wires to transducer.

d. Remove three screws, one nut, and one washer holding circuit board to chassis.

e. Tag and disconnect power cord wires and power switch wires from circuit board.

f. Disconnect capacitor wires from ci rcuit board.

g. Tag and disconnect two transducer wires from circuit board.

h. Remove defective circuit board.

i. Install new circuit board.

j. Reconnect two transducer wires to circuit board.

k. Reconnect capacitor wires to circuit board.

1. Reconnect power switch wires and power cord wires to circuit board.

m. Reinstall one washer, one nut, and three screws holding circuit board to chassis.

n. Reinstall stainless steel tank and casing. Secure with screws and washers.

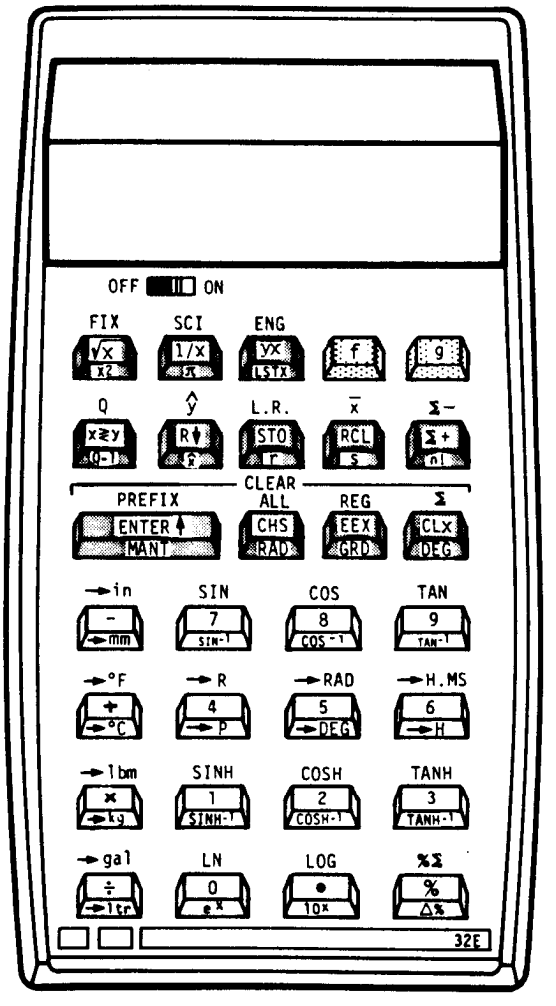
o. Fill stainless steel tank 1/3 full with water.

p. Plug in power cord and turn power on. Check that water surface agitates.

6-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.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CLEAR
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→R
→RAD
→H.MS
→lbm
SINH
COSH
TANH
→gal
LN
LOG
32E

CHAPTER 7

POCKET CALCULATOR

Section I INTRODUCTION

7-1. GENERAL INFORMATION.

7-1.1 Scope.

a. Model Number and Equipment Name. Model HP-32E Pocket Calculator.

b. Purpose of Equipment. To perform mathematical calculations.

7-2. EQUIPMENT DESCRIPTION.

7-2.1 Equipment Characteristics, Capabilities, and Features. Performs mathematical calculations with the following capabilities and features.

a. Rechargeable battery pack.

b. AC operation.

c. Trigonometric functions.

d. Ten-digit display.

e. Automatic memory stack.

f. Fifteen storage registers.

g. Scientific notation.

h. Logarithmic functions.

i. Square root.

j. Fixed-point display.

k. Engineering display.

l. Automatic overflow and underflow.

m. Error display.

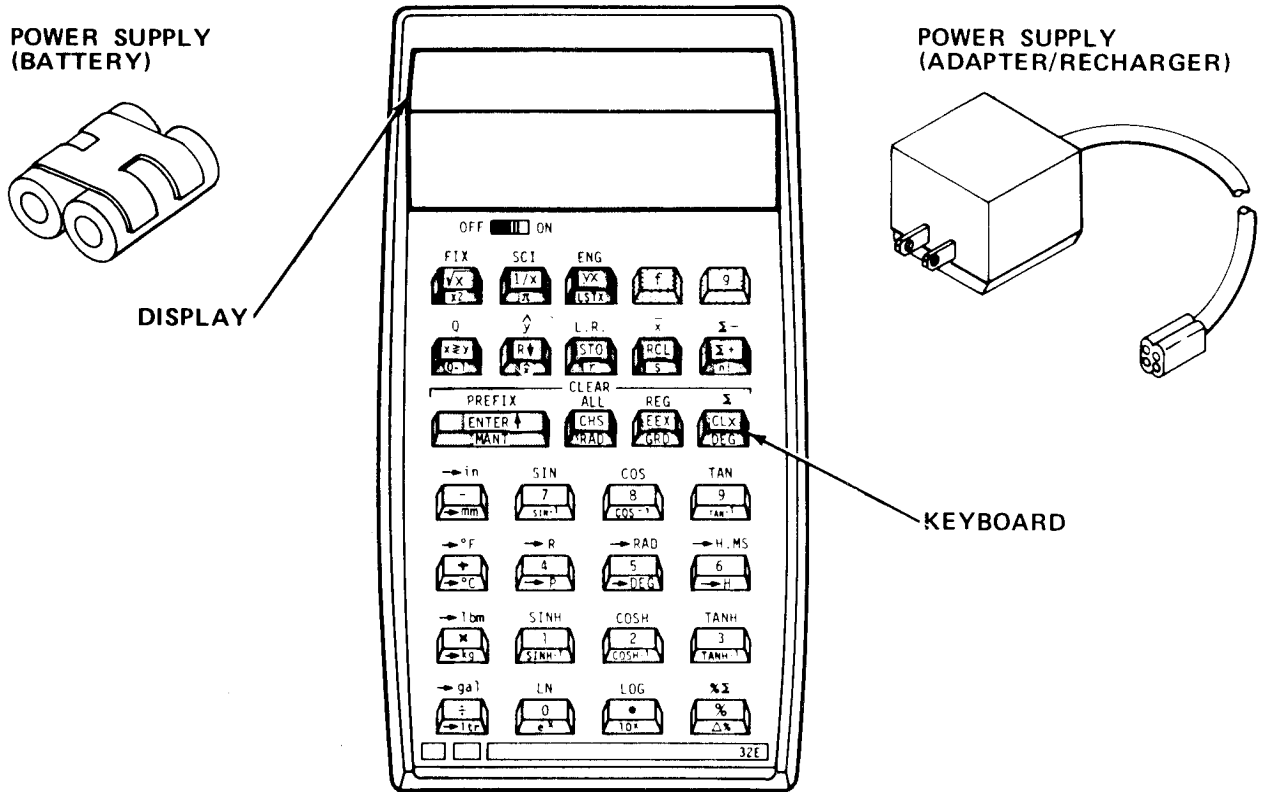
n. Key-selected metric conversions.

o. Self-Check.

7-2.2 Equipment Data.

Power Requirements	120 V, 60 Hz
Battery Pack:	
Recharge Time	9 hrs, maximum (calculator off)
	17 hrs, minimum (calculator on)
Operating Time	3 hrs, maximum

7-3. TECHNICAL PRINCIPLES OF OPERATION. The purpose of the HP-32E Calculator is to assist its user in the performance of complex or simple mathematics equations and consists of the following functional parts:



POWER SUPPLY. Power is provided to the calculator from either the battery pack or ac adapter/recharger. The battery pack consists of two rechargeable nickel cadmium batteries which give the calculator full portability. The adapter/recharger also provides power to the calculator when plugged into a power outlet. When battery pack is in need of recharging, raised decimal is turned on at the far left of the display. When raised decimal is displayed, there are 1 to 25 minutes of operating time left.

KEYBOARD. The keyboard is used to select functions and input numbers into the calculator. All keys, except q and q keys, perform three functions.

One function is indicated by the symbol on the flat surface of the key, a second by the symbol on the slanted key face, and a third by the symbol written above the key on the calculator case. Function printed on the flat face of the key is selected by pressing the key. Function printed above the key is selected by first pressing **prefix key [f] and then the function key.** The function printed on the slanted face **of the key is selected by first pressing prefix key [g] and then the function key.**

DISPLAY. The display is the X-register of the automatic memory stack and provides a visual readout of latest numeric entry, operation result, or error messages.

MEMORY. Memory is divided into two parts; storage registers and automatic memory stack.

a. Storage registers. Storage registers are used to set aside numbers for recall in later calculations. **Numbers are stored by first pressing [STO] followed by a number [0] thru [8] or a decimal point and a number [0] thru [5]. The number in** displayed X-register is then copied into the selected register. Recalling a number **is accomplished by first pressing [RCL] followed by a number [0] thru [8] or a decimal point and a number [0] thru [5].** The number that is in the selected register will be copied into the displayed X-register without any change to contents of that register. Storage registers R. through R. are used for accumulation of statistical data. Turning calculator o f will clear (place zeros in) all storage registers.

b. Automatic memory stack. The automatic memory stack is used to store intermediate results during calculations. The stack consists of four registers designated, Y, Z and T. The contents of X-register are constantly shown on the calculator display. Numbers are manually entered into the memory stack by pressing [ENTER↑]. During chain calculations (long equations), intermediate answers are automatically entered in the memory stack. Each new entry into the stack is first entered in the X-register and, with each additional entry, the stack rolls up one and the contents that were in the T-register before roll-up, are lost. The contents **of the stack can be viewed by pressing** [RCL] key four times. The contents of T-register are not lost because the stack forms a continuous loop, i.e., the contents of T-register are shifted to the Z-register; Z-register to Y-register; Y-register to X-register; and X-register to T-register. With intermediate answers stored in the stack, operations can be performed with these numbers by pressing the key of the desired operation.

Example: To calculate (3 x 5) + 2, press:

[3] (3 enters X-register.)

[ENTER↑] (3 is copied to Y-register.)

[5] (5 is entered in X-register; 3 stays in Y-register.)

[×] (5 is multiplied by 3; result, 15, is placed in X-register; Y-register becomes 0.)

[2] (15 moves to Y-register; 2 enters X-register.)

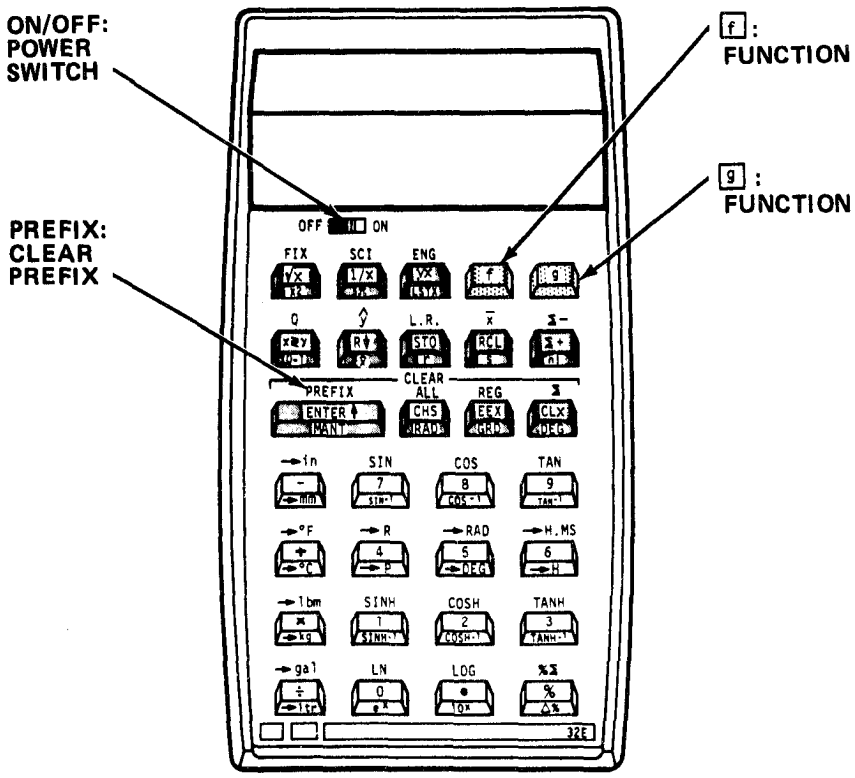
[+] (2 is added to 15; result, 17, is placed in X-register; Y-register becomes 0.)

Section II OPERATING INSTRUCTIONS

7-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.

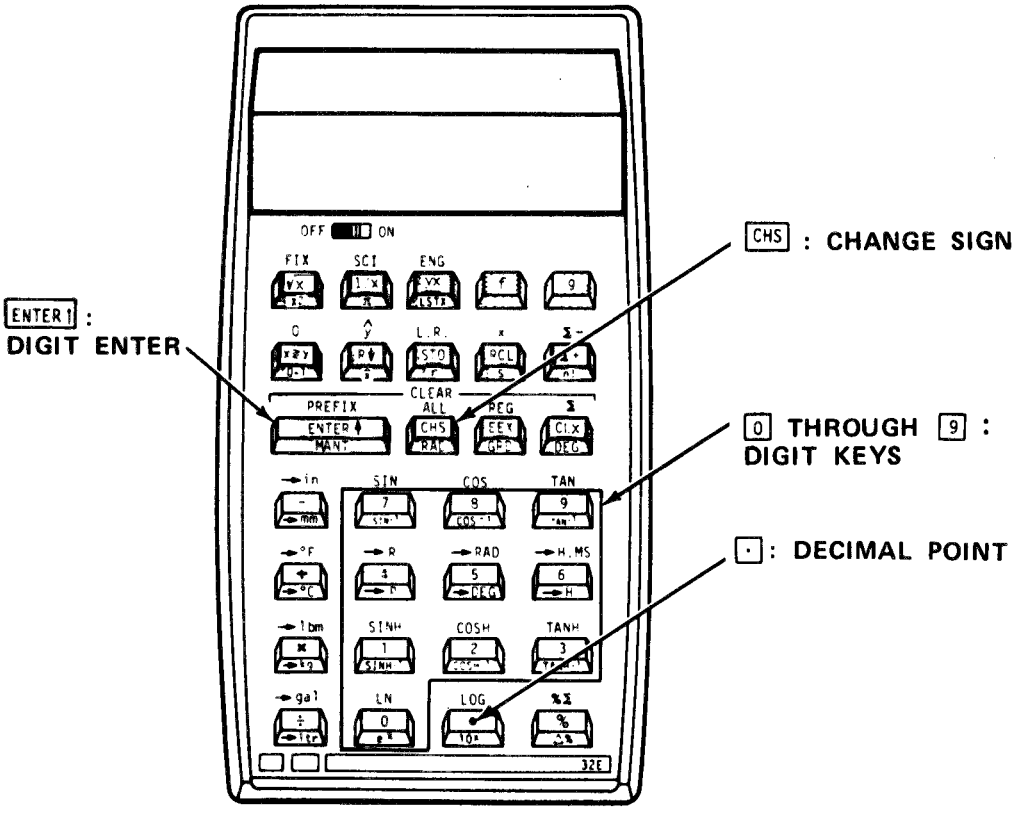
NOTE

Symbols on flat surface and slanted surface of keys are boxed. Symbols over keys are not boxed.



Key		Control or Indicator	Function
OFF	**ON**	Power Switch	Turns power on or off.
f		Function	Pressed before another key, it selects function printed above key.
g		**Function**	Pressed before another key, it selects function printed on slanted fjace of key.

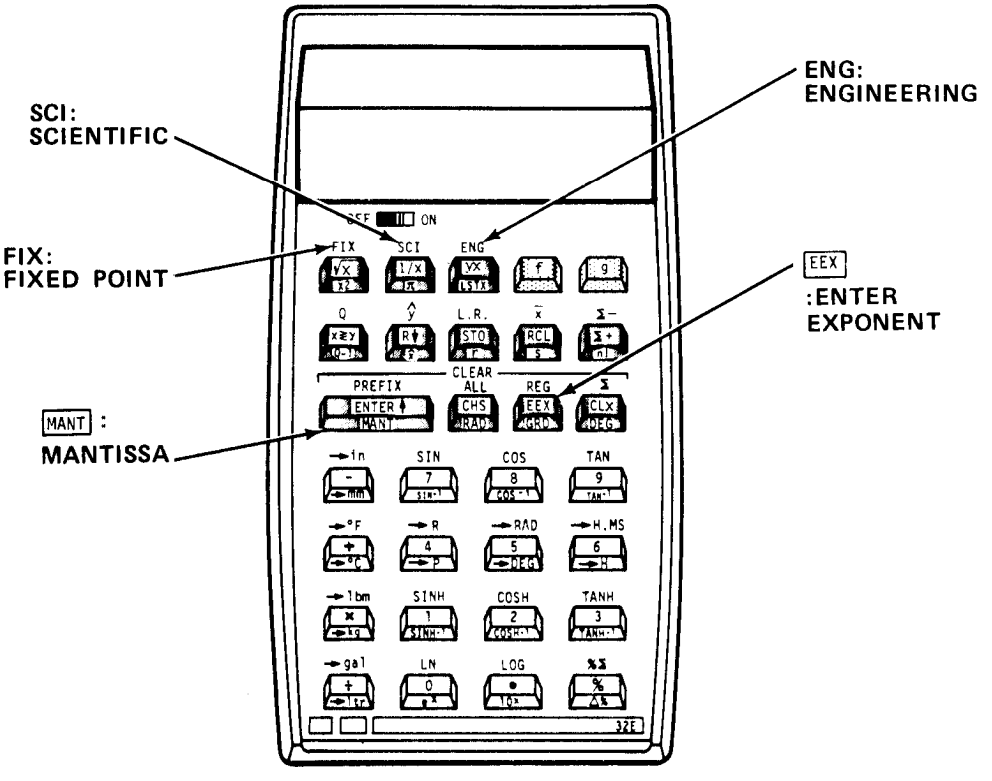
Key	Control or Indicator	Function
[PREFIX]	Clear Prefix	Cancels the following key strokes or sequence of key strokes when pressed after each one: [f], [g], [STO], [RCL], [STO] [·], [RCL] [·], [STO] [+], [STO] [-], [STO] [x], [STO] [÷], [STO] [+] [·], [STO] [-] [·], [STO] [x] [·], [STO] [÷] [·], FIX, SCI, ENG.



Digit Entry

[0] thru [9]	Digit Keys	Enters digits.
[·]	Decimal Point	Enters decimal point.

Key	Control or Indicator	Function
[ENTER↑]	Digit ENTER	Enters copy of number displayed in X-register into Y-register of automatic memory stack. Pressing key also causes contents of Y-register to be shifted to Z-register and Z-register to the T-register. Contents of T-register are lost.
[CHS]	Change Sign	Changes sign of mantissa or exponent in display (X-register).

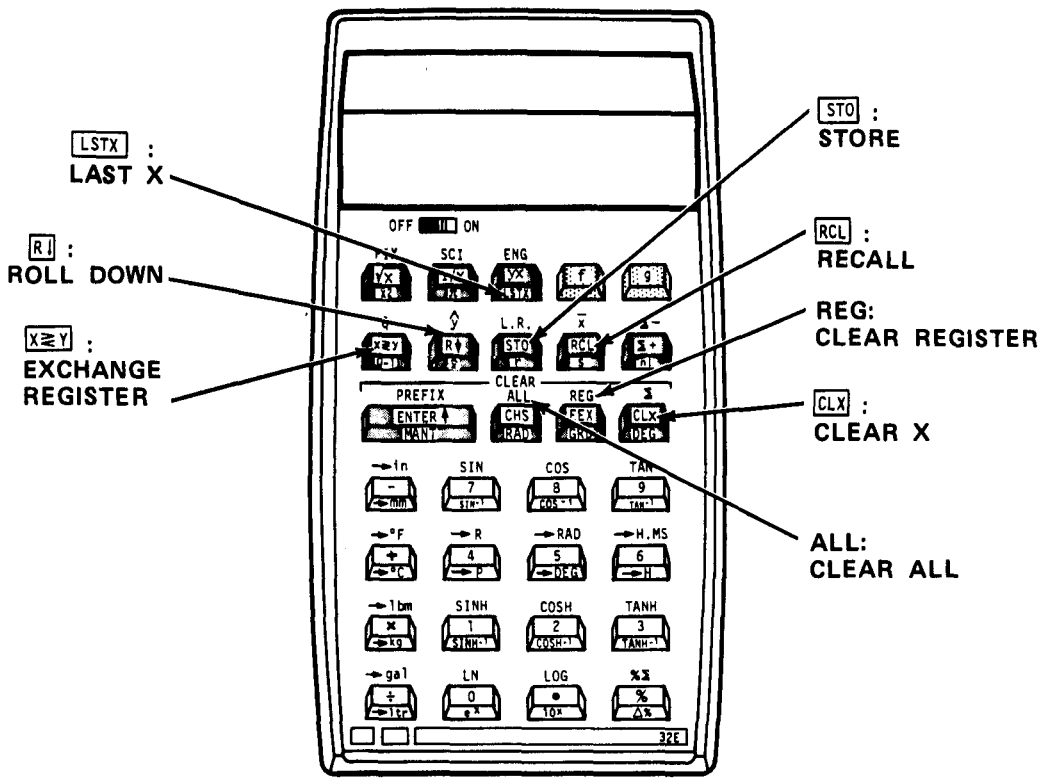


Display Control

[EEX]	Enter Exponent	After pressing, next numbers keyed in are exponents of 10.

Key	Control or Indicator	Function
FIX	Fixed Point	Followed by digit key, selects fixed point notation display. Digit entry designates number of digits to be displayed to the right of decimal point.
SCI	Scientific	Followed by the number key that specifies the number of decimal places the display will be rounded to.
ENG	Engineering	Followed by digit key, selects engineering notation display. Digit key specifies number of digits to be displayed to right of decimal point.
MANT	Mantissa	Temporarily displays all 10 digits of mantissa of number in X-register.

Key	Control or Indicator	Function

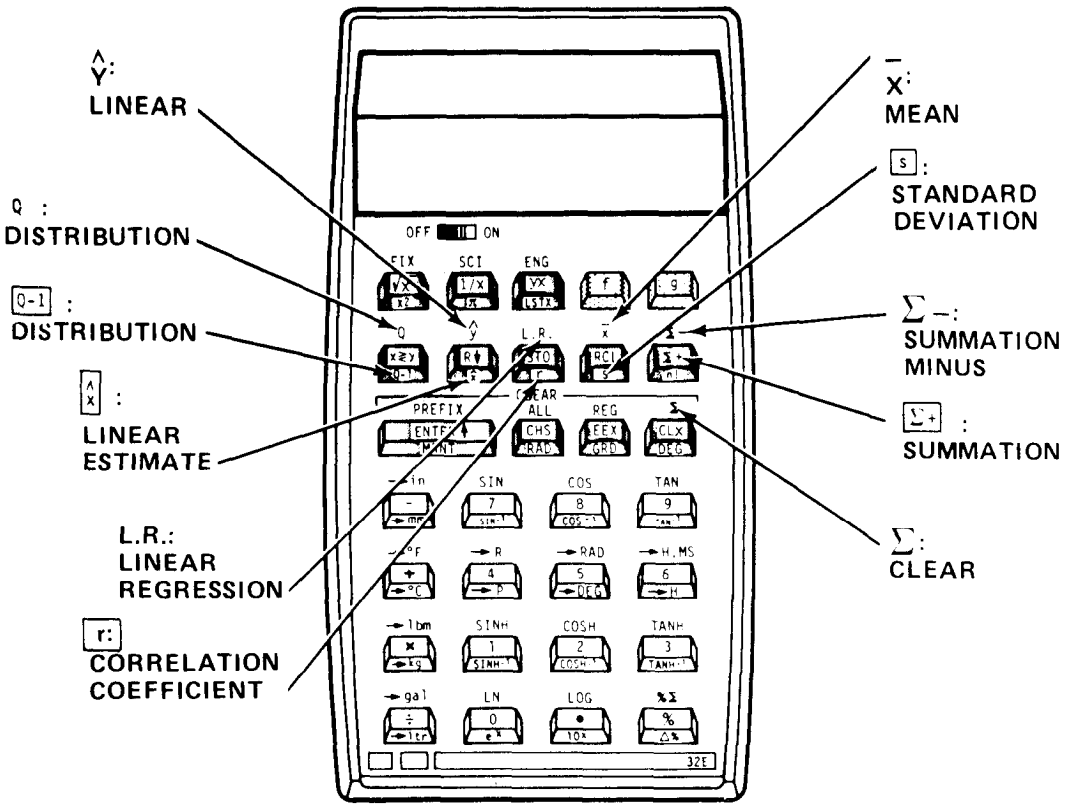


Number Manipulation

X≷Y	Exchange Register	Interchanges contents of X and Y-registers.
R↓	Roll Down	Rolls down contents of automatic memory stack for viewing in X-register without loss of data. When pressed, contents of X-register is shifted to T-register, T-register shifts to Z-register, Z-register shifts to Y-register, and Y-register advances to X-register for viewing.
CLX	CLEAR X	Clears contents of displayed X-register.

Key	Control or Indicator	Function
ALL	CLEAR ALL	Clears contents of memory stack and all storage registers.
STO	Store	**Followed by digit key 0 through 8 or by a decimal point and a key 0 through 5 , stores** displayed number in that specified location. Also used to perform storage register arithmetic.
RCL	Recall	Followed by digit key **0 thru 8 or by a decimal point and a digit key 0 thru 5, recalls value** from specified storage register into the dis- displayed X-register.
REG	CLEAR Register	Clears contents of storage registers RO through R8. Contents of registers R.O thru R.5 are unaffected.
LSTX	LAST X	Recalls number displayed before previous operation back into displayed X-register.

Key	Control or Indicator	Function

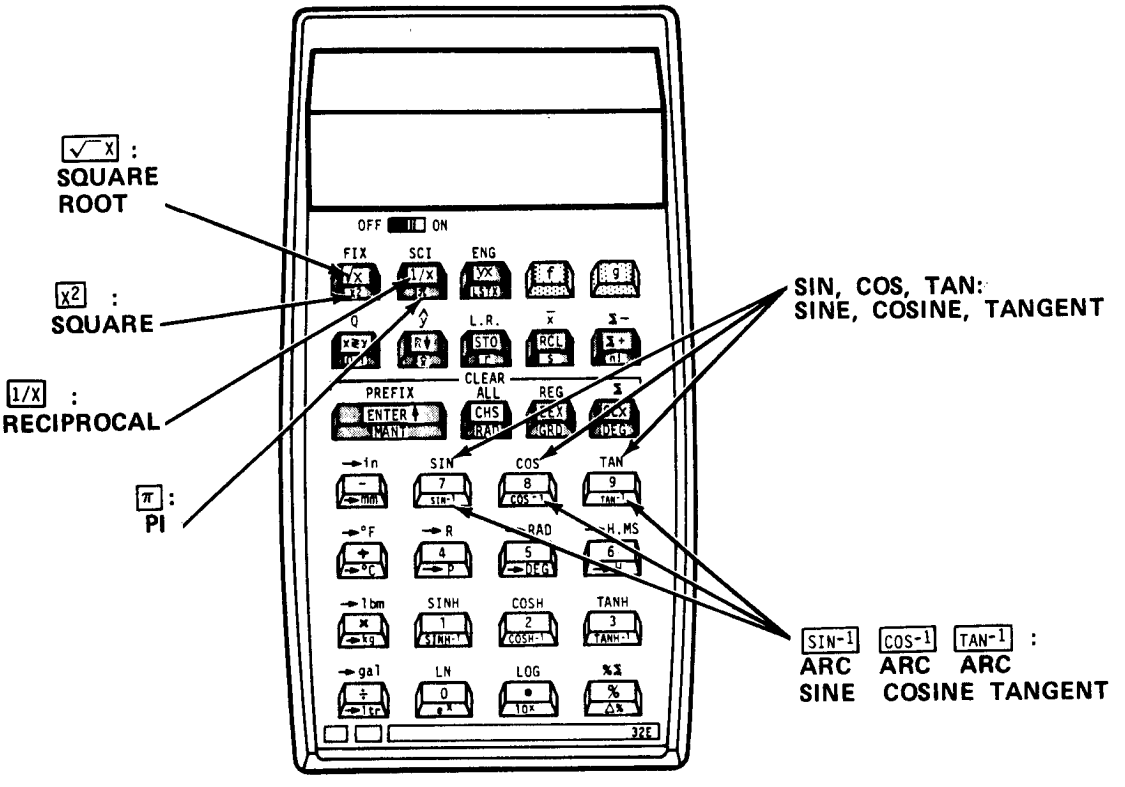


Statistical

Q		Computes area under standard normal distribu - tion curve to left of X.
Q-1		Computes X, given area under standard normal distribution curve to left of X.
$\hat{Y}$	Linear Estimate	Computes estimated value of Y for a given value of X.
$\hat{X}$	Linear Estimate	Computes estimated value of X for a given value of Y.

Key	Control or Indicator	Function
L.R.	Linear Regression	Computes Y-intercept and slope for linear function approximated by X and Y values accumulated using [Σ+] . Value of slope is placed in Y-register.
[r]	Correlation Coefficient	Computes goodness of fit between X and Y values accumulated using [Σ+] and linear function which they approximate.
$\bar{X}$	MEAN	Computes mean (average) of X and Y values accumulated using [Σ+] .
[s]	Standard Deviation	Computes standard deviations of X and Y values accumulated using [Σ+] .
[Σ+]	Summation	Accumulates statistical data in storage registers R.0 thru R.5 using numbers in X- and Y-registers.
Σ-	Summation Minus	Subtracts from statistical data in storage registers R.0 thru R.5 using numbers in X- and Y-registers.
	CLEAR	Clears statistical storage registers R.0 thru R.5.

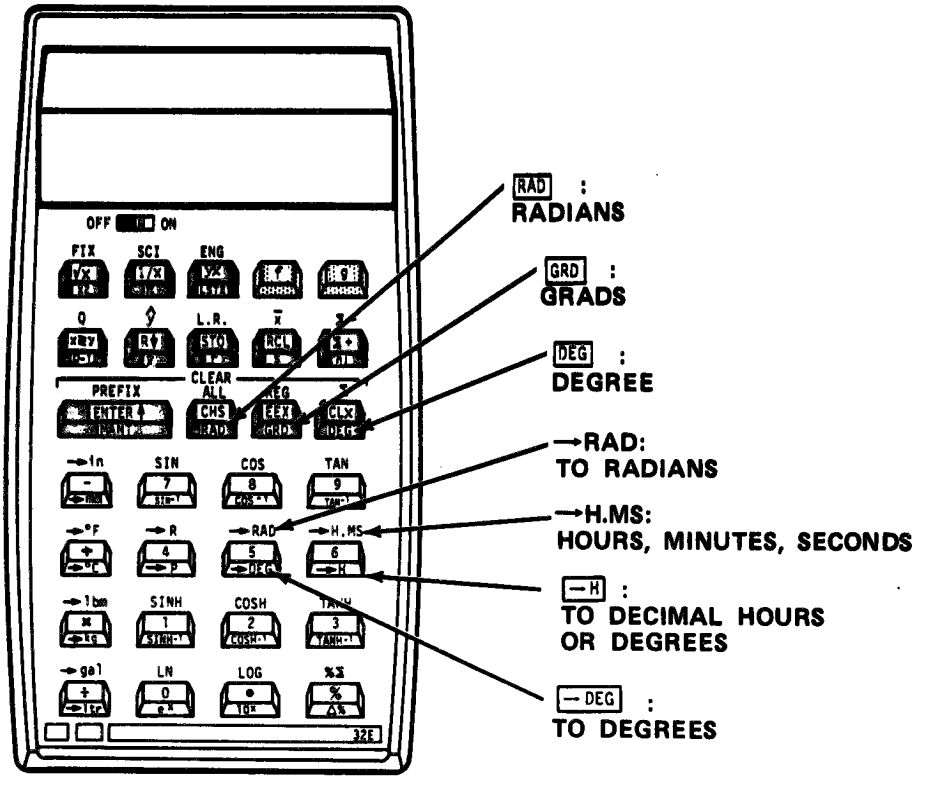
Key	Control or Indicator	Function



Mathematical

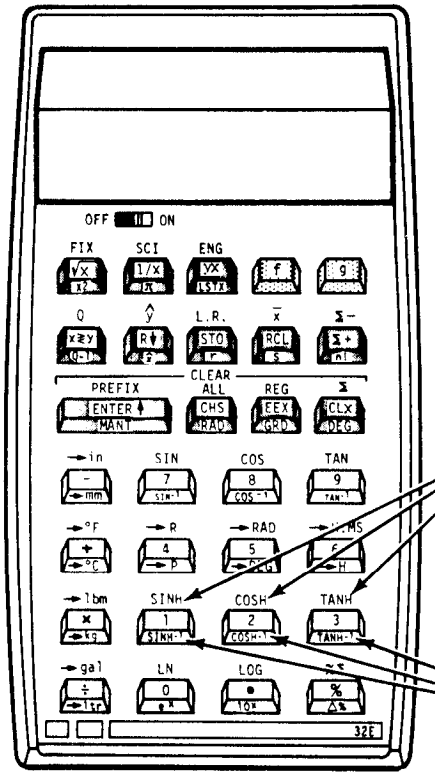
√x	Square Root	Computes square root of number in displayed X-register.
x²	Square	Computes square of number in displayed X-register.
1/x	Reciprocal	Computes reciprocal of number in displayed X-register.
π	pi	Places value of pi (3.141592654) into X-register.
SIN, COS, TAN	Sine, Cosine, Tangent	Computes sine, cosine, or tangent of number in displayed X-register.

Key	Control or Indicator	Function
SIN⁻¹ , COS⁻¹ , TAN⁻¹	Arc Sine, Arc Cosine, Arc Tangent	Computes arc sine, arc cosine, or arc tangent of number in displayed X-register.



RAD	Radians	Sets radians mode for al 1 trigonometric functions.
GRD	Grads	Sets grads mode for al 1 trigonometric functions.
DEG	Degree	Sets decimal degrees mode for all trigonometric functions.
→RAD	To Radians	Converts decimal degrees to radians.
— DEG	To Degrees	Converts radians to decimal degrees.

Key	Control or Indicator	Function
→H.MS	Hours. Minutes Seconds	Converts decimal hours or degrees to hours, minutes, seconds or degrees, minutes, seconds.
[→H]	To Decimal Hours or Degrees	Converts hours, minutes, seconds, or degrees, minutes, seconds to decimal hours or degrees.

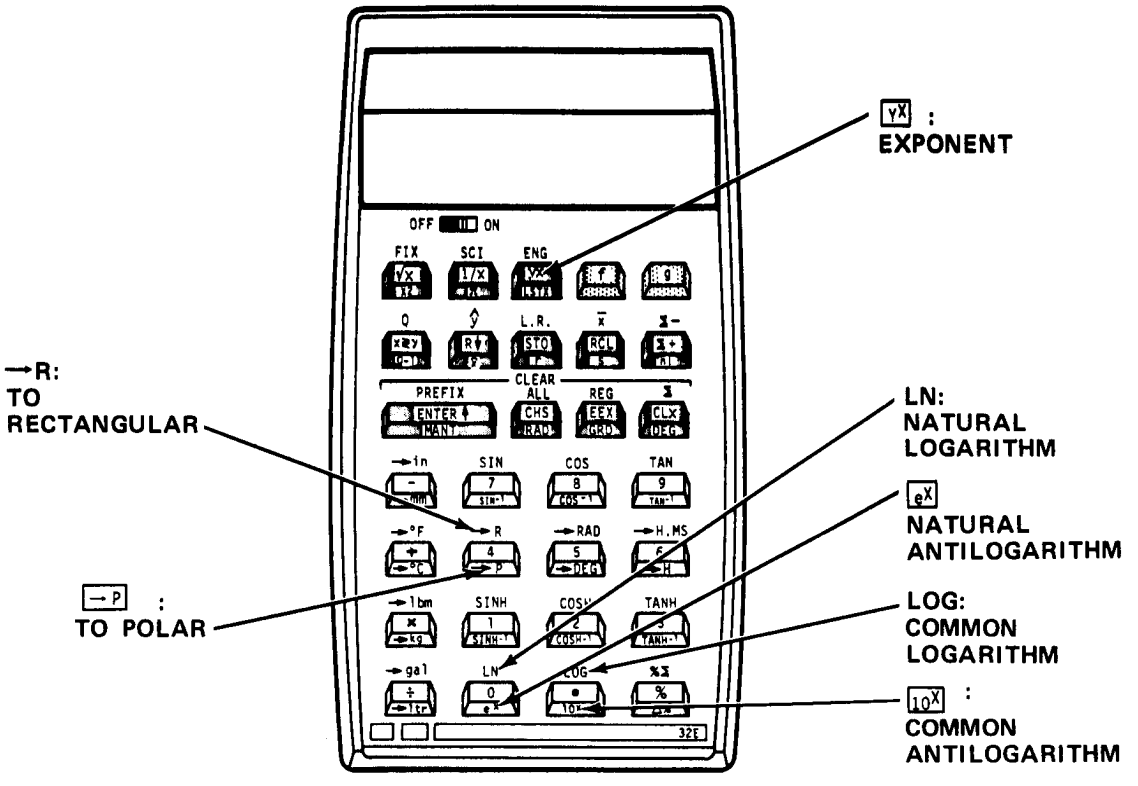


SINH, COSH, TANH:
HYPERBOLIC SINE,
COSINE, AND TANGENT

[SINH-1] [COSH-1] [TANH-1]
INVERSE HYPERBOLIC SINE,
COSINE, TANGENT

Key	Control or Indicator	Function
	Hyperbolic	
SINH, COSH, TANH	Hyperbolic Sine, Cosine, and Tangent	Computes hyperbolic sine, hyperbolic cosine, or hyperbolic tangent of number in displayed X-register.
SINH-1 , COSH-1 TANH-1	Inverse Hyperbolic Sine, Cosine, Tangent	Computes inverse hyperbolic sine, inverse hyperbolic cosine, or inverse hyperbolic tangent of number in displayed X-register.

Key	Control or Indicator	Function

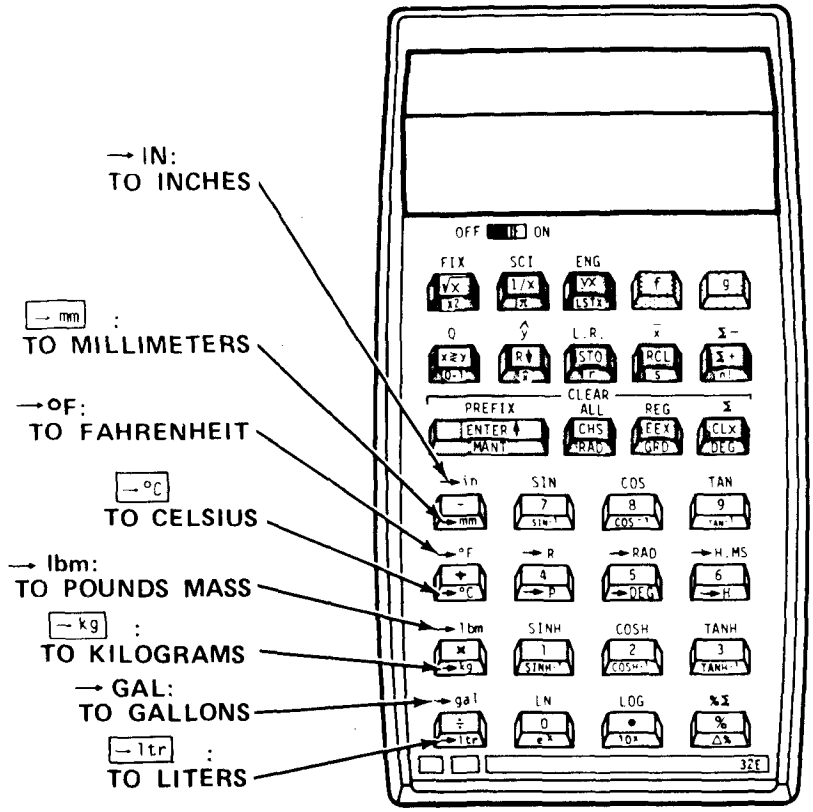


Logarithmic and Exponential

YX	Exponent	Raises number in Y-register to power of number in displayed X-register.
LN	Natural Logarithm	Computes natural logarithm (base e) of number in displayed X-register.
eX	Natural Antilogarithm	Raises e to power of number in displayed X-register.
LOG	Common Logarithm	Computes common logarithm (base 10) of number in displayed X-register.

Key	Control or Indicator	Function
10^X	Common Antilogarithm	Raises 10 to power of number in displayed X-register.
→P	To Polar	Converts rectangular (X,Y or coordinates in X- and Y - registers into polar (R, 0) coordinates. Angle 0 stored in Y-register.
→R	To Rectangular	Converts polar (R, 0) coordinates in X- and Y-registers into rectangular (X, Y) coordinates.

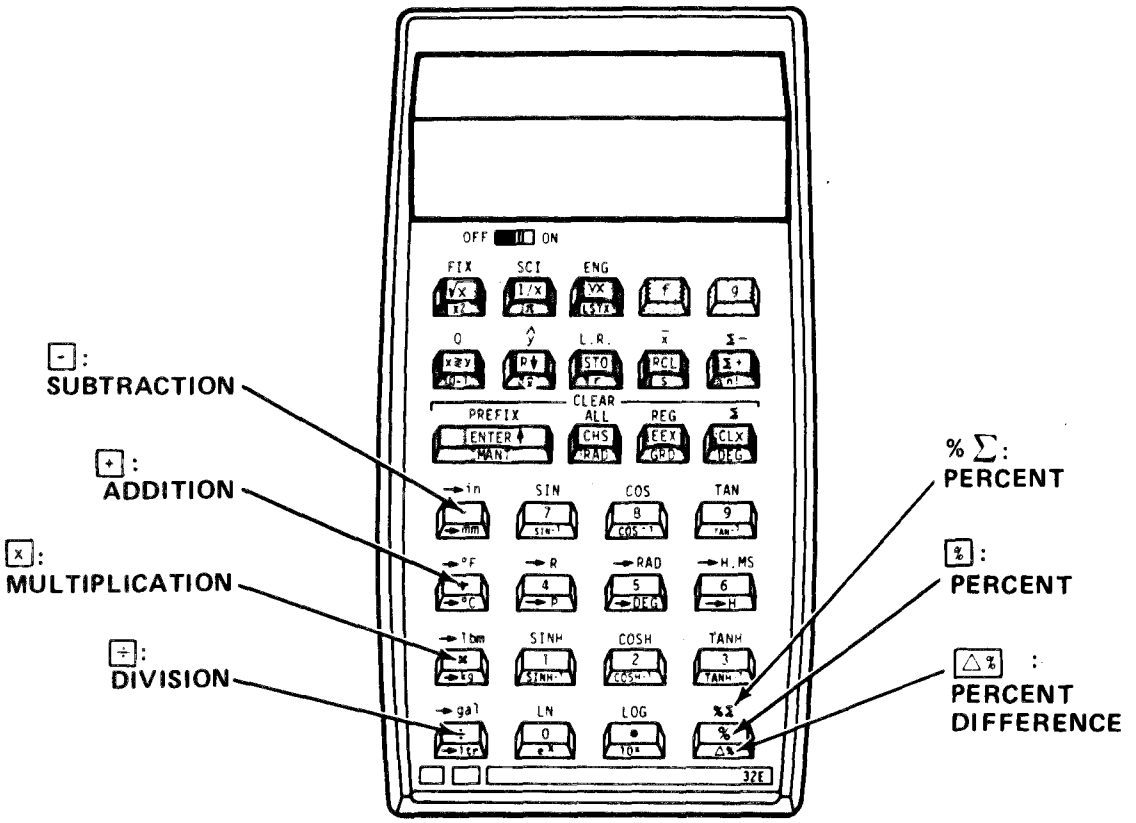
Key	Control or Indicator	Function



Metric Conversions

→in	To Inches	Converts millimeters to inches.
→mm	To Millimeters	Converts inches to millimeters.
→°F	To Fahrenheit	Converts degrees Celsius to degrees Fahrenheit.
→°C	To Celsius	Converts degrees Fahrenheit to degrees Celsius.
→ lbm	To Pounds Mass	Converts kilograms to pounds mass.
→kg	To Kilograms	Converts pounds mass to kilograms.

Key	Control or Indicator	Function
→gal	To Gallons	Converts liters to gallons (U.S.).
[→ltr]	To Liters	Converts gallons (U.S.) to liters.



Percentage

[%]		Computes X-percent of Y.
[△%]		Computes percent difference between number in Y-register and number in X-register.
%Σ	Percent	Computes percent that X is of the number (ΣX) in storage register R_1.

Arithmetic Functions

[+]	Addition	Arithmetic functions
[-]	Subtraction	
[x]	Multiplication	
[÷]	Division	

7-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

7-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by performing periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The "Equipment is Not Ready/Available If" column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to perform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows.

Item	Quantity
Cheesecloth (Item 5, Appendix E)	ar

Table 7-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

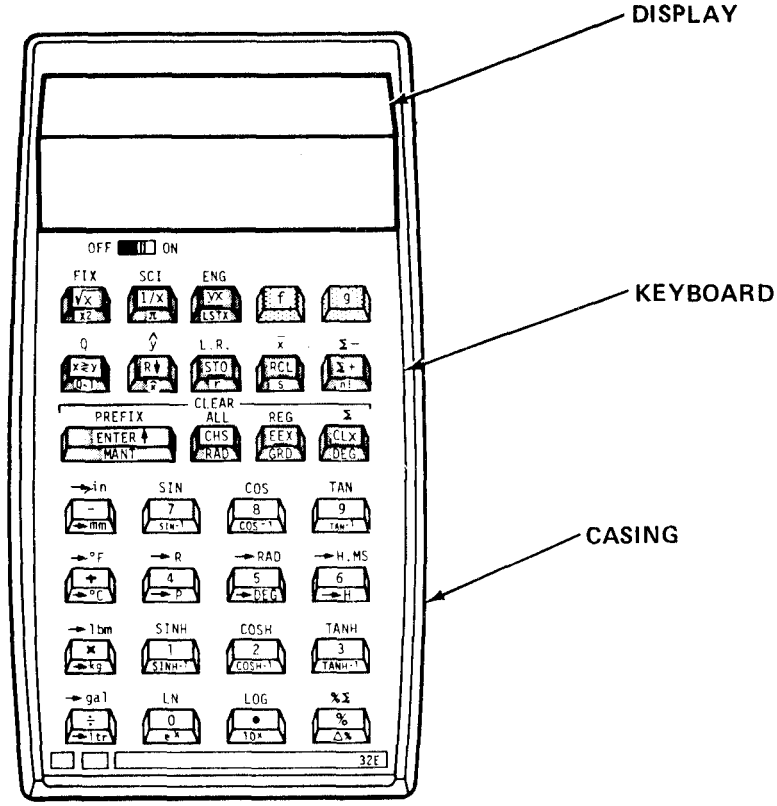
ITEM NO.	INTERVAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		POCKET CALCULATOR	
1	B	INSPECT.	
			
		1. Check keyboard, display, and casing for cracks or breaks. Replace calculator if casing or display is cracked or broken.	Calculator keyboard, display, or casing is damaged.

Table 7-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cont

B - Before W - Weekly AN - Annually (Number) - Hundreds of Hours
D - During M - Monthly S - Semiannually
A After Q - Quarterly Bl - Biennially

ITEM NO.	IN-TER. VAL	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		POCKET CALCULATOR - Cont	
1	B	INSPECT - Cont	
		2. **Connect ac adapter/recharger to calculator and plug in. Turn calculator on. Press [STO] and [ENTER↑] . Display should indicate -8, 8, 8, 8, 8, 8, 8, 8, 8, 8.**	Display does not show - 8, 8, 8, 8, 8, 8, 8, 8, 8, 8.
		3* With battery pack in calculator, check operation to be sure calculator turns on. Remove battery pack and check for clean contacts. Wipe clean. Reinstall battery pack.	Battery pack is defective.
		4. Check power cord for kinks, frays or burns.	Power cord is damaged.

7-6 OPERATION UNDER USUAL CONDITIONS.

7-6.1 Operating Procedure.

a. Selecting a function.

NOTE

Most keys on the keyboard perform three functions. One function is indicated by symbol on top of key, second is above key, and third is on slanted face of key.

(1) To select a function printed on the key, press the key.

(2) To select a function printed above the key, press key [f], then function key.

Example: To use LOG in calculation, enter number, [f] then LOG.

(3) To select a function printed on slanted face of key, press [g] then function-key.

Example: To use [x²] in calculations, enter number, [g] then [x²] .

b. Keying in numbers.

(1) Press keys corresponding to digits and decimal point in the order that they appear, reading from left to right.

(2) If needed, press [CHS] to make number negative.

c. One-number functions.

(1) Key in number on which operation is to be performed.

(2) Select desired function. Press key.

Example: To calculate square root of 5, press [5] and [√x].

Answer is 2.2361.

d. Two-number functions.

(1) Key in first number.

(2) Press [ENTER↑] to separate first number from second number.

(3) Key in second number.

(4) Select desired function. Press key.

Example: To calculate 5 percent of 35, press [3], [5], [ENTER↑], [5], and [%].

Answer is 1.75.

e. Exponent key [y^x].

NOTE

Exponent key is two-number function.

(1) Key in number for Y. Press [CHS] if it is negative.

(2) Press [ENTER↑] to send number to Y register in automatic memory stack.

(3) Key in number for X (exponent for Y).

(4) Press [y^x] key.

Example: To calculate 5^3, press [5], [ENTER↑], [3], and [y^x].

Answer is 125.

f. Chain calculations.

NOTE

Calculator uses reverse polar notation (RPN) logic for chain calculations.

(1) If equation has parenthetical expressions, key in numbers and perform function in first parenthesis. Key in first number, press [ENTER↑] key in second number, and press function key for that operation.

(2) Key in numbers and perform function in second parenthesis. Key in first number, press [ENTER↑] , key in second number, then press function key for that operation.

(3) Press function key for operation indicated between parentheses.

Example: To calculate (3 x 4) x (5 + 6), press

[3], [ENTER↑] , [4], and [x]
[5], [ENTER↑] , [6], and [+]
[x]; answer is 132.

g. Operations with powers of 10.

(1) Key in number being multiplied by power of 10. Press [CHS] if number is negative.

(2) Press [EEX] .

(3) Key in exponent (power) of 10. Press [CHS] if exponent is negative.

(4) Press [ENTER↑] , and key in exponent.

(5) Press [x] .

Example: To multiply 15.6×10^{12} by 25 press

[1], [5], [.], [6], [EEX], and [12]
[ENTER] , [25] , and [x]; answer is 3.9000×10^{14}.

h. Storage (memory) register arithmetic.

NOTE

This procedure performs two-number arithmetic functions on number stored in storage register. The displayed X-register is the second number.

(1) Press [STO] .

(2) Press appropriate function key [+] , [-] , [x] , or [÷] .

(3) Press [0] through [8] or, [.] [0] through [.] [5], indicating on which register function will be performed.

Example: Pressing [STO] , [x] , and [1] multiplies value of (displayed) X-register by contents of storage (memory) register 1. The answer is placed into storage (memory) register 1.

NOTE

Value of X-register will not be changed.

i. Clearing storage (memory) register.

(1) To clear single storage (memory) register, press [0] , [STO] , and location of register to be cleared.

Example: To clear register 2, press [0] , [STO] , and [2] .

(2) To clear registers 0 through 8, press [f] and **REG**. To clear registers 0 through 5, press [f] and [.] [.] to clear all registers (including the automatic memory stack) press [f] and **ALL**.

j. Trigonometric functions.

(1) Enter or calculate value of X, number on which trigonometric function is to be performed.

(2) Press [g] key.

(3) Press [DEG] , [RAD] , or [GRD] to select measurement for answer (degrees, radians, or grads).

(4) Press [f] key.

(5) Press needed function (SIN, COS, TAN) key.

Example: To calculate sine 35 , press
[3] , [5] , [g] , [DEG] , [f] , and SIN . Answer is 0.5736.

k. Polar/rectangular coordinate conversion.

(1) Convert from rectangular (X, Y) to polar coordinates.

NOTE

Value for Y is always keyed in first.

(a) Key in value of Y.

(b) Press [ENTER↑] .

(c) Key in value of X.

(d) Press [g] then key in [DEG] , [RAD] , or [GRD] to select measurement for answer (degrees, radians, or grads).

(e) Press [g] and [→P] to get R (magnitude). Press [x≷y] to get angle in radians.

Example: To convert rectangular coordinates 4, 3 to polar with angle in radians, press

[3] , [ENTER↑] , and [4]
[g] and [RAD]
[g] and [→P] ; ; answer is 5.
[x≷y] , answer is .64.

(2) Convert from polar to rectangular coordinates.

(a) Key in angle in radians.

(b) Press [ENTER↑] .

(c) Key in value of R (magnitude).

(d) Press [g] then key in [DEG] , [RAD] , or [GRD] to select measurement of angle (degrees, radians, or grads).

(e) Press [g] , R to get X. Press [x≷y] to get Y.

Example: To convert polar coordinates 5 and .64 to rectangular, press

[.] , [6] , [4] , [ENTER↑] , and [5]
[g] and [RAD]
[g] and [→R] : answer is 4.01.
[x≷y] : answer is 2.986.

1. Statistical functions.

(1) Accumulations.

(a) Pressing [Σ+] key computes sums and products of the values in the X- and Y-registers. Results are automatically accumulated in storage registers R through R . Before starting to calculate accumulations with a new set of x and y values, clear registers by pressing FJ REG.

Key y value into X-register.

Press [ENTER↑] to raise y value into Y-register.

Key x value into X-register.

Press [Σ+]

b. If statistical problem involves only one variable (x), clear storage registers R.0 through R.5 and Y-register. Press [g] [Σ] and [ENTER↑].

Key number into X-register.

Press [Σ+].

NOTE

Unlike storage register arithmetic, the accumulation operation allows overflows (i.e., number whose magnitudes are greater than $9.99999999 \times 10^{99}$) in storage registers R.0 through R.5 without indicating Error 1 in the display.

c. To use any of the accumulations, recall contents of desired storage register into dispalyed X-register by pressing [RCL] [.] followed by the number of the register. If this is done immediately after pressing [Σ+] or [Σ-], the accumulation recalled is written over the number of data pair entries (n) in the display. To use both Σx and and Σy press [RCL] [Σ+]. This simultaneously copies Σx from R.1 into displayed X-register and copies from R.3 into Y-register. If this is done immediately after pressing [Σ+], [Σ-], [CLX], or [ENTER↑], the number in the Y-register is first lifted in o the Z-register. Otherwise, the numbers in the X- and Y-registers are first lifted into Z- and T- registers, respectively.

Example: To find Σx, Σx^2, Σy, Σy^2, and Σxy for the paired values of x and y listed below, press

y	7	5	9
x	5	3	8

Keystrokes	Display	
[f] CLEAR Σ	0.0000	Clear statistical storage registers. (Display shown assumes no results remain from previous calculations.)
[7] [ENTER↑]	7.0000	
[5] [Σ+]	1.0000	First pair is accumulated: n=1
[5] [ENTER↑]	5.0000	
[3] [Σ+]	2.0000	Second pair is accumulated: n=2
[9] [ENTER↑]	9.0000	
[8] [Σ+]	3.0000	Third pair is accumulated: n=3

Keystrokes	Display	
RCL . 1	16.0000	Sum of x values from register R.1
RCL . 2	98.0000	Sum of squares of x values from register R.2
RCL . 3	21.0000	Sum of y values from register
RCL . 4	155.0000	Sum of squares of y values from register R.4
RCL . 5	122.0000	Sum of products of x and y values from register R.5
RCL . 0	3 e 0000	Number of entries (n=3) from register R.O

(2) Deleting and correcting data.

(a) If an incorrect value is keyed in and Σ+ has not yet been pressed, press CLX and key in correct value.

(b) To change one of the values, or if after pressing Σ+ one of the values was erroneous, correct the accumulations by using Σ- (summation minus) key as follows:

Key incorrect data pair into X- and Y-registers. LSTX can be used to return a single incorrect data value to displayed X-register.

Press f Σ- to delete incorrect data.

Key in correct values for x and y. If one value of an (x, y) data pair is incorrect, both values must be deleted and reentered.
Press R/S .

Example: If last data pair (8, 9) in previous example should have been (8, 6), correct the accumulation as follows, press

Keystrokes	Display	
9 ENTER↑	9.0000	Incorrect y value is entered again.
8	8.	Correct x value is entered again.
f Σ-	2.0000	Number of entries (n) is now two.

Keystrokes	Display	
q lEml	6.0000	Correct y value is entered.
8	8.	x value is entered again.
Σ+	3.0000	Number of entries is again three.

(3) Mean. Pressing $\hat{x}$ computes the arithmetic mean (average) of x and y values accumulated in registers R.1 and R.3 respectively.

Pressing q $\hat{x}$ causes the following operations to be performed.

The contents of the stack registers are lifted just as they are when pressing RCL .

The mean of the x values ($\hat{x}$) is calculated using data accumulated in registers R_1 ($\sum x$) and R.0 (n). The resulting value for x appears in displayed X-register.

The mean of y values ($\hat{y}$) is calculated using data accumulated in registers R.3 ($\sum y$) and R.O (n).

The resulting value for y is available in Y-register of stack.

Example: Below is a chart of daily high and low temperatures for a winter week. To find average high and low temperatures for week selected, press

	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
High	6	11	14	12	5	-2	-9
Low	-22	-17	-15	-9	-24	-29	-35

Keystrokes	Display	
q m n	0.0000	Statistical registers cleared. (Display shown assumes no results remain from previous calculations.)
6 ENTER↑ 22	22.	
CHS Σ+	1.0000	Number of data pairs (n) is now 1.
11 ENTER↑ 17	17.	
CHS Σ+	2.0000	Number of data pairs (n) is now 2.
14 ENTER↑ 15	15.	

Keystrokes	Display	
CHS Σ+	3.0000	
12 ENTER↑ 9	9.	
CHS Σ+	4.0000	
5 ENTER↑ 24	24.	
CHS Σ+	5.0000	
2 CHS ENTER↑	-2.0000	
29 CHS Σ+	6.0000	
9 CHS ENTER↑	-9.0000	
35 CHS Σ+	7.0000	Number of data pairs (n) is now 7.
f $\bar{x}$	-21.5714	Average low temperature.
x≷y	5.2857	Average high temperature.

(4) Standard deviation.

(a) Pressing s computes the standard deviation (a measure of dispersion around the mean) of' accumulated data.

(b) When g s is pressed:

The contents of stack registers are lifted just as they are when pressing RCL Σ+ .

The standard deviation of x values (s_x) is calculated using data accumulated in registers R.2 (2), R.1 (Σ), and R.O (n). The result appears in displayed X-register.

The standard deviation of y values (s.,) is calculated using data accumulated in registers R.4 (y2), R.3 (y), and R.0 (n). The result appears in Y-register.

Example: To determine the standard devi ation of the following test scores: 79, 94, 68, 86, 82, 78, 83, and 89, press

Keystrokes	Display	
f CLEAR ALL	0.0000	Clear statistical registers and Y-register for new, one-variable problem.

Keystrokes	Display	
79 Σ+	1.0000	First score is entered. Since this problem involves only one variable, y-value does not have to be entered into Y-register using the ENTER↑ key.
94 Σ+	2.0000	Display shows number of scores entered so far.
68 Σ+	3.0000	
86 Σ+	4.0000	
82 ❑	5.0000	
78 Σ+	6.0000	
83 Σ+	7.0000	
89 Σ+	8.0000	Last score in sample.
g s	7.8365	Standard deviation of test scores.

(5) Linear regression. Linear regression is a statistical method for finding a straight line that best fits a set of data points, thus providing a relationship between two variables.

(a) To use the linear regression function, first key in a series of data points using the Σ+ key. Then press f L.R.

(b) When f L.R. if pressed:

The contents of the stack registers are lifted just as they are when you press RCL Σ+ .

The slope (A) of the least squares line of the data is available in the Y-register of the stack.

The y-intercept (B) of the least squares line of the data appears in the displayed X-register of the stack.

(c) To use value for A or bring it into displayed X-register, simply shift stack contents with the x≤y key.

Example: An oil company wishes to know the slope and y-intercept of a least squares line for the consumption of motor fuel in the United States against time since 1945. It knows the data given in the table.

Motor Fuel Demand (Millions of Barrels)	696	994	1330	1512	1750	2162	2243	2382	2484
Year	1945	1950	1955	1960	1965	1970	1971	1972	1973

Solution: Key the data into the calculator using the Σ+ key, key, then press f L.R.

Keystrokes	Display	
❑ CLEAR Σ+	0.0000	Clear statistical storage registers. (Display shown assumes no results remain from previous calculations).
696 ENTER↑	696.0000	
1945 Σ+	1.0000	
994 ENTER↑	994.0000	
1950 Σ+	2.0000	
1330 ENTER↑	1,330.0000	
1955 Σ+	3.0000	
1512 ENTER↑	1,512.0000	
1960 Σ+	4.0000	
1750 ENTER↑	1,750.0000	
1965 Σ+	5.0000	
2162 ENTER↑	2,162.0000	
1970 Σ+	6.0000	
2243 ENTER↑	2,243.0000	
1971 Σ+	7.0000	
2382 ENTER↑	2,382.0000	
1972 Σ+	8.0000	
2484 ENTER↑	2,484.0000	
1973 Σ+	9.0000	All data pairs have been **keyed** in.

Keystrokes	Display	
[f] L.R.	-118,290.6295	The y-intercept of the line.
[x≷y]	61.1612	Slope of the line.

(6) Linear estimation. With data accumulated in registers R.O through R.5 a predicted value for y (denoted y) can be calculated by keying in a new value for x and pressing [f] ŷ . A predicted value for x (denoted x) can be calculated by keying in a new value for y and pressing [g] [x̂] .

Example: With data intact from previous example in registers R.O through R.5 to predict demand for motor fuel for the years 1980 and 2000, key in new x values and press [f] ŷ . To determine the year that the demand for motor fuel is expected to pass 3,500 million barrels, key in 3,500 (new value for y) and press [g] [x̂] .

Keystroke	Display	
1980 [f] ŷ	2,808.6264	Predicted demand in millions of barrels for the year 1980.
2000 [f] ŷ	4,031.8512	Predicted demand in millions of barrels for the year 2000.
35 [g] [x̂]	1,991.3041	The demand is expected to pass 3,500 million barrels during 1992.

(7) Correlation coefficient. Both linear regression and linear estimation presume that the relationship between x and y data values can be approximated, to some degree, by a linear function (a straight line). [r] (correlation coefficient) can be used to determine how closely the data "fits" a straight line. The correlation coefficient can range from r = + 1 to r = - 1. At r = + 1, data falls exactly onto a straight line with positive slope. While at r = -1, data falls exactly onto a straight line with negative slope. At r = 0, data cannot be approximated by a straight line.

Example: To calculate the correlation coefficient for previous example press:

Keystrokes	Display	
[g] [r]	0.9931	The data very closely approximates a straight line.

7-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section Ill OPERATOR MAINTENANCE

7-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

7-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during the operation or maintenance of the pocket calculator or its components. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 7-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
1. CALCULATOR DISPLAY IS BLANK.	
Step 1. Plug in ac adapter/recharger. Turn calculator on.	
(a) If display of zeros comes on, proceed to step 2.	
(b) If display is blank, replace adapter/recharger.	
(c) If problem remains, replace calculator.	
Step 2. Check for raised decimal point at far left corner of display. Indicates low power condition.	
(a) If indicator is on, proceed to step 3.	
(b) If indicator is off, recharge battery pack.	
Step 3. Check to see if contacts are dirty.	
(a) Clean contacts on inside of calculator and battery pack with cotton swab (Item 6, Appendix E) moistened with alcohol (Item 3, Appendix E).	
(b) Replace battery pack. Open battery pack door. Remove defective battery pack. Install new battery pack. Reinstall battery pack door.	

Table 7-2. TROUBLESHOOTING - Cont

MALFUNCTION TEST OR INSPECTION	CORRECTIVE ACTION
2. CALCULATIONS OR DISPLAY ERRATIC.	
Step 1. Check for raised decimal point at far left corner of display. Indicates low power condition.	
	(a) Recharge battery pack.
	(b) Replace battery pack.
	(c) Replace calculator.
Step 2. Press [STO] and [ENTER↑] to see if display shows -8,8,8,8,8,8,8,8, not ERROR 9.	
If ERROR 9 is displayed, replace calculator.	

NOTE

For error conditions refer to operator's instructions for the HP-32E provided with equipment.

7-10. MAINTENANCE PROCEDURES. There are no operator maintenance procedures assigned for this equipment.

Section IV ORGANIZATIONAL MAINTENANCE

7-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

7-12. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT. These items are not required at the organizational level of maintenance.

7-13. SERVICE UPON RECEIPT.

7-13.1 Checking Unpacked Equipment.

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

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

7-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

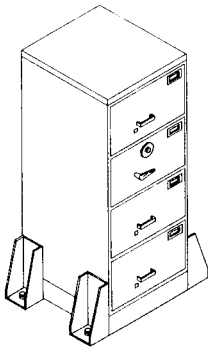
7-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. There are no organizational troubleshooting procedures assigned for this equipment.

7-16. MAINTENANCE PROCEDURES. There are no organizational maintenance procedures assigned for this equipment.

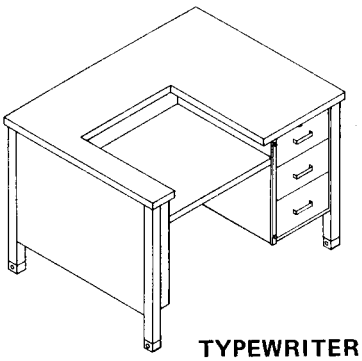
7-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.



SECURITY FILING CABINET



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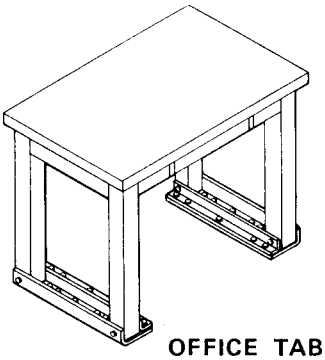
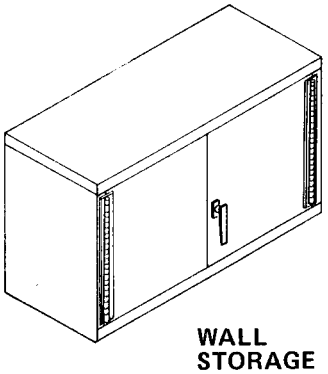
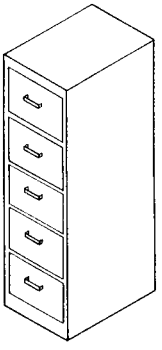


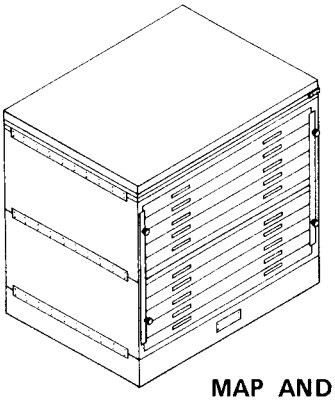
OFFICE TABLE



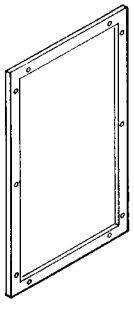
WALL STORAGE CABINET



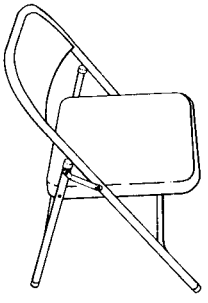
FILING CABINET



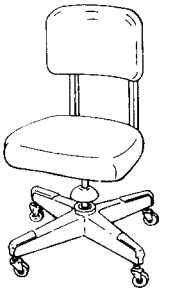
MAP AND PLAN FILING CABINET



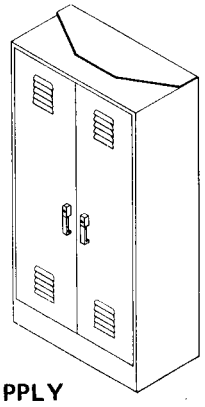
CORKBOARD



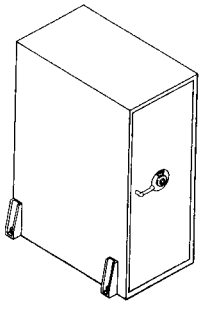
FOLDING CHAIR



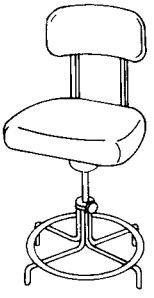
ROTARY DESK CHAIR



SUPPLY CABINET



MAP AND PLAN SECURITY CABINET



ROTARY DRAFTING CHAIR

CHAPTER 8

FURNITURE AND CABINETS

Section I INTRODUCTION

8-1. GENERAL INFORMATION.

8-1.1 Scope. This chapter contains the description of all furniture and cabinets contained in this section.

8-2. EQUIPMENT DESCRIPTION.

a. Typewriter desk. Provides a typing area and general working space for clerical personnel. The typewriter mounts- to-a section of the desk top which can be flipped over to convert to a flat work area. There are three drawers and a pull-out writing table. The three drawers can be secured by a locking bar. Dimensions:

Width	45 in. (114.3 cm)
Depth	34 in. (86.4 cm)
Height	30.5 in. (77.5 cm)

b. Supply cabinet. Used for storage of miscellaneous large, bulky items. There are six shelves within the cabinet. It has two doors secured by a handle-type latch with a built-in lock. Dimensions:

Width	36 in. (91.4 cm)
Depth	18 in. (45.7 cm)
Height	64.5 in. (163.8 cm)

C. Wall storage cabinet. Used for miscellaneous storage. There are two shelves. The two doors are held shut by a handle-type latch. Dimensions:

Width	30 in. (76.2 cm)
Depth	12 in. (30.5 cm)
Height	18 in. (45.7 cm)

d. Security filing cabinet. Used for security storage of classified documents. It has four drawers locked by a latch and combination lock located on the second drawer. Dimensions:

Width	20.75 in. (52.7 cm)
Depth	28 in. (71.1 cm)
Height	52 in. (132.1 cm)

e. Map and plan security cabinet. Used for the security storage of maps, plans and charts of various sizes. These items are hung from racks in the cabinet. The door is secured by a bolt work latch with an integral combination lock. Dimensions:

Width	22 in. (55.9 cm)
Depth	39 in. (99.1 cm)
Height	51.38 in. (130.5 cm)

f. Filing cabinet. Provided for storage and filing of legal sized documents. There are five drawers with a built-in lock. Dimensions:

Width	18 in. (45.7 cm)
Depth	26.5 in. (67.3 cm)
Height	57.5 in. (146.1 cm)

g. Map and plan filing cabinet. Used for flat, horizontal storage of maps, blueprints, charts and plans of various sizes. The eight drawers are held shut by two locking bars located on either side of the front of the cabinet. Dimensions:

Width	40.75 in. (103.5 cm)
Depth	28.62 in. (72.7 cm)
Height	41.68 in. (105.9 cm)

h. Office table. Provides additional work space. Table has one pull out drawer. Dimensions:

Width	36 in. (91.4 cm)
Depth	24 in. (61.0 cm)
Height	30.5 in. (77.5 cm)

i. Rotary desk chair. Provides seating for personnel working at desk. It has a 3-3/4-in. (9.5 cm) seat height adjustment, ball bearing casters, tilt movement tension adjustment and adjustable back height. Dimensions:

Width	20 in. (50.8 cm)
Depth	21 in. (53.3 cm)
Height	32 in. (81.3 cm)

j. Rotary drafting chair. Provides seating for drafting personnel. It has adjustable seat height and back position. Dimensions:

Width	17.12 in. (43.4 cm)
Depth	17.12 in. (43.4 cm)
Height	42 in. (106.7 cm), Max 36 in. (91.4 cm), Min

k. Folding chair. Provided for general seating. Folds flat for storage. Dimensions:

Width	18 in. (45.7 cm)
Depth	20 in. (50.8 cm)
Height	32 in. (81.3 cm)

l. Corkboard. Wall mounted. Dimensions:

Width	18 in. (45.7 cm)
Height	30 in. (76.2 cm)

8-3. TECHNICAL PRINCIPLES OF OPERATION. There are no specific principles of operation for this equipment.

Section II OPERATING INSTRUCTIONS

8-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS. This equipment has no operator's controls or indicators.

8-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no operator PMCS procedures assigned for this equipment.

8-6. OPERATION UNDER USUAL CONDITIONS.

8-6.1 Preparation for Movement. Ensure that portable equipment is properly secured with tiedowns provided.

8-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

8-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication,

8-9. TROUBLESHOOTING PROCEDURES. There are no operator troubleshooting procedures assigned for this equipment.

8-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the furniture and cabinets. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

8-10.1 Inspect Furniture and Cabinets. Inspect furniture and cabinets for structural damage, rust, and proper operation of all latches, hinges, and adjustment mechanisms.

Section IV ORGANIZATIONAL MAINTENANCE

8-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

8-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

8-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

8-12.2 Special Tools: Test. Measurement. and Diagnostic Equipment: and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

8-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering organizational maintenance for this equipment.

8-13. SERVICE UPON RECEIPT.

8-13.1 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, Packing Improvement Report.

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

8-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

8-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. There are no organizational troubleshooting procedures assigned for this equipment.

8-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance fuctions for the furniture and cabinets. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

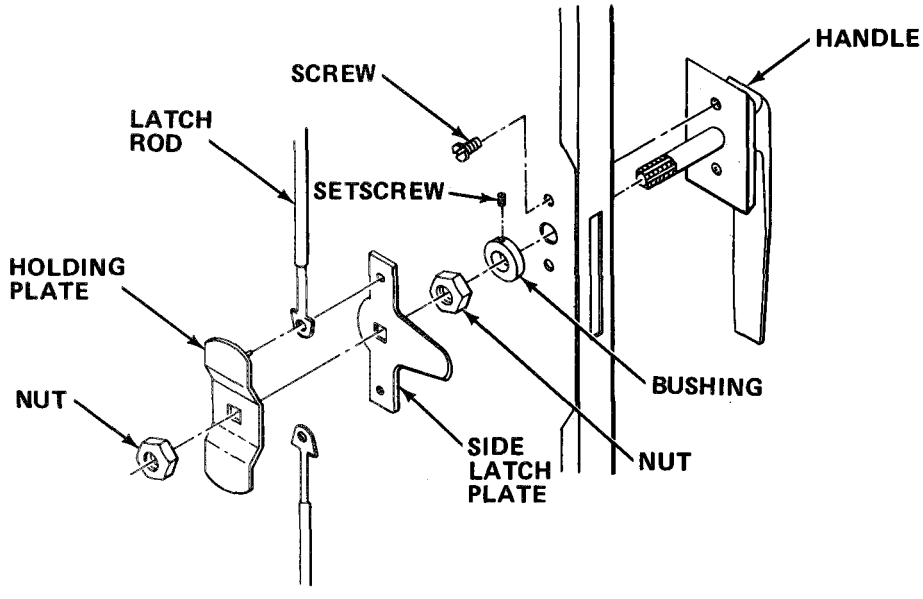
INDEX

8-16.1 Replace Door Latch (Wall Storage Cabinet).

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 9/16 in. Combination Wrench
Flat Tip Screwdriver

SUPPLIES: Handle Type Latch



a. Remove holding plate retaining nut.

b. Remove holding plate and latch rods.

c. Remove side latch plate.

d. Remove handle retaining nut.

e. Loosen setscrew and remove bushing from handle shaft.

f. Remove handle retaining screws and remove handle.

g. Install new handle and secure with screws.

h. Reinstall bushing on handle shaft and tighten setscrew.

i. Reinstall handle retaining nut.

j. Install side latch plate.

k. Reinstall latch rod holding plates and latch rods.

1. Reinstall holding plate retaining nut.

8-16.2 Replace Door Hinge (Piano Hinge).

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/4 in. Electric Drill
5/32 in. Drill Bit
Pop Rivet Gun

SUPPLIES: Storage Cabinet Hinge
5/32 in. Pop Rivets
8-32 x 1/2 in. Screws (4 required)
8-32 Nuts (4 required)

a. Drill out rivets holding hinge to cabinet and remove hinge.

b. Install new hinge and temporarily secure with four screws and nuts.

c. Close and latch cabinet door and install pop rivets.

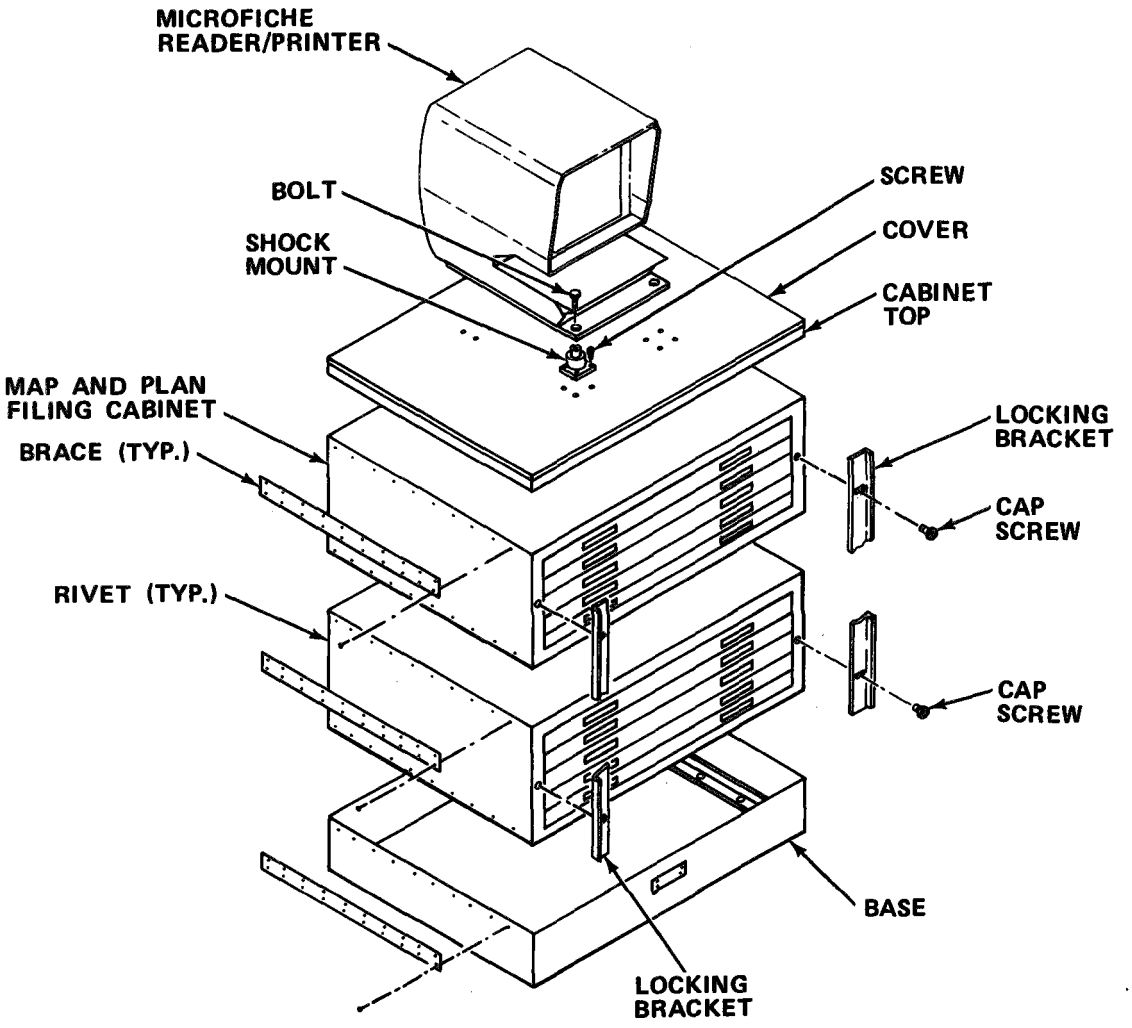
d. Remove temporarily installed screws and nuts, and install pop rivets.

8-16.3 Remove/Install Map and Plan Filing Cabinet.

MOS : 83FJ6, Reproduction Equipment Repairer

TOOLS : Flat Tip Screwdriver
Pop Rivet Gun
Drill and Bits

SUPPLIES: Map and Plan Filing Cabinet
Pop Rivets



a. Remove microfiche reader-printer (paragraph 3-16.16).

b. Drill rivets from braces and remove braces.

c. Remove map and plan filing cabinet top.

d. Remove knurled screws from locking bracket on each side of front. Then remove locking bracket.

e. Lift top and bottom sections free from base.

f. Unscrew base from floor. Retain screws for reuse.

g. Install new base, and both top and bottom sections of map and plan filing cabinet. Reinstall cabinet top.

h. Screw base to floor through inside mounting brackets.

i. Rivet bottom section to base through braces.

j. Rivet top section to bottom section through braces.

k. Rivet top to top section.

1. Reinstall locking brackets and secure with nuts and bolts.

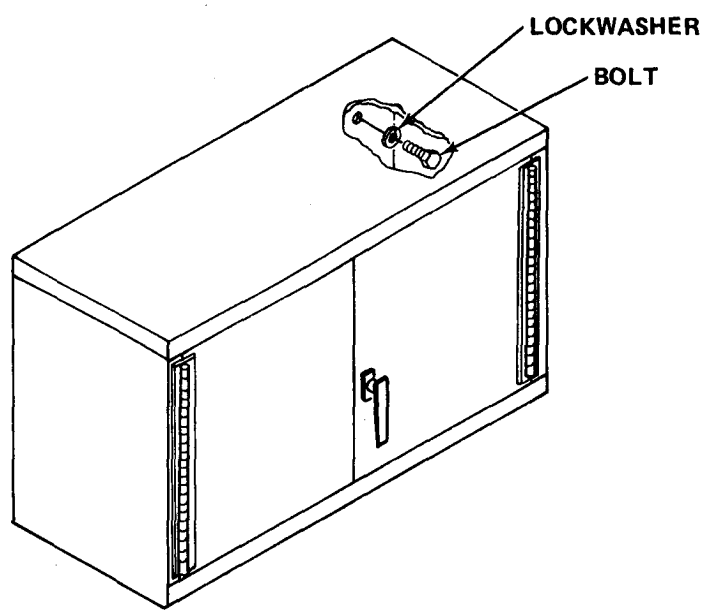
m. Reinstall microfiche reader-printer (paragraph 3-16.16).

8-16.4 Remove/Install Wall Storage Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/2 in. Drive Ratchet
2 in. Socket Extension, 1/2 in. Drive
1/2 in. Socket, 1/2 in. Drive

SUPPLIES: Wall Storage Cabinet



a. Remove fluorescent light fixture from underneath cabinet if applicable.

b. Remove bolts and lockwashers which secure defective cabinet to wall.

c. Remove defective cabinet.

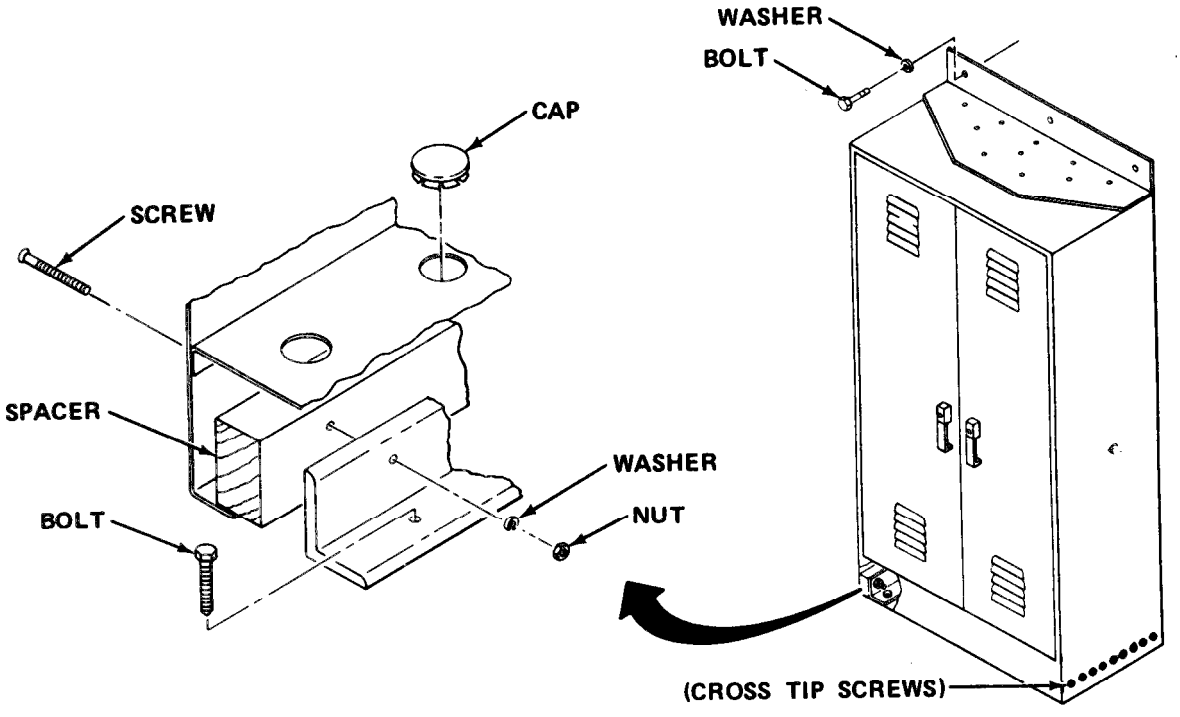
d. Install new cabinet and secure to wall with lockwashers and bolts.

8-16.5 Remove/Install Supply Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/4 in. Drive Socket Set
6 in. Extension, 1/4 in. Drive
11/32 in. Combination Wrench
Flat Tip Screwdriver
Cross Tip Screwdriver

SUPPLIES: Supply Cabinet



a. Remove bolts and washers holding cabinet to wall.

b. Remove caps and lag bolts holding mounting bracket to floor and remove cabinet.

c. Remove screws, lockwashers, and nuts and remove mounting brackets and spacers from cabinet. Retain mounting brackets and spacers for use on new cabinet.

d. Position spacers and mounting brackets on new cabinet, and install but do not tighten nuts, lockwashers, and screws.

e. Place new cabinet in position, and install but do not tighten lag bolts.

f. Secure cabinet to wall with flat washers, lockwashers, and bolts.

g. Tighten the bracket retaining bolts and nuts.

h. Tighten the bolts holding the mounting brackets to the floor, and install the caps.

8-16.6 Remove/Install Map and Plan Security Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

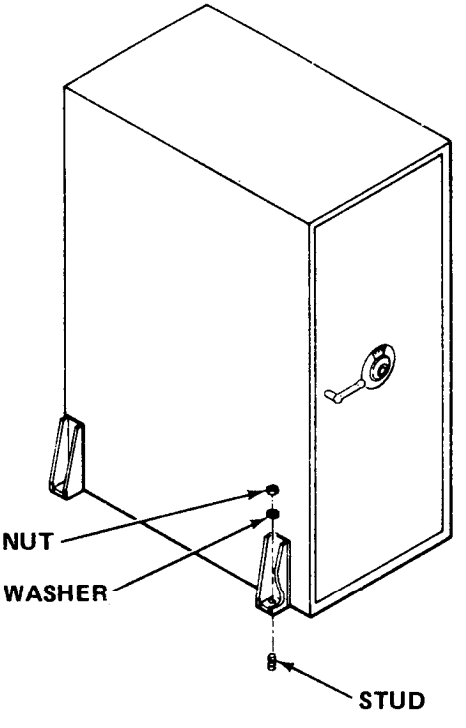
PERSONNEL: Two persons are required to perform this procedure.

TOOLS: 1/2 in. Drive Ratchet
11/8 in. Socket, 1/2 in. Drive
3 in. Extension

SUPPLIES: Map and Plan Security Cabinet

a. Open map and plan security cabinet and remove materials to secure storage.

b. Tape lock combination to outside of cabinet.



c. Remove nut and washer from floor mounting studs.

d. Raise cabinet onto skids and move to cargo door.

WARNING

Severe personal injury may occur when loading the cabinet to or from section due to cabinet's weight. Use special care and use only approved lifting equipment.

e. Remove cabinet from section.

f. Bring cabinet into section.

g. Locate cabinet over studs and reinstall nuts and washers.

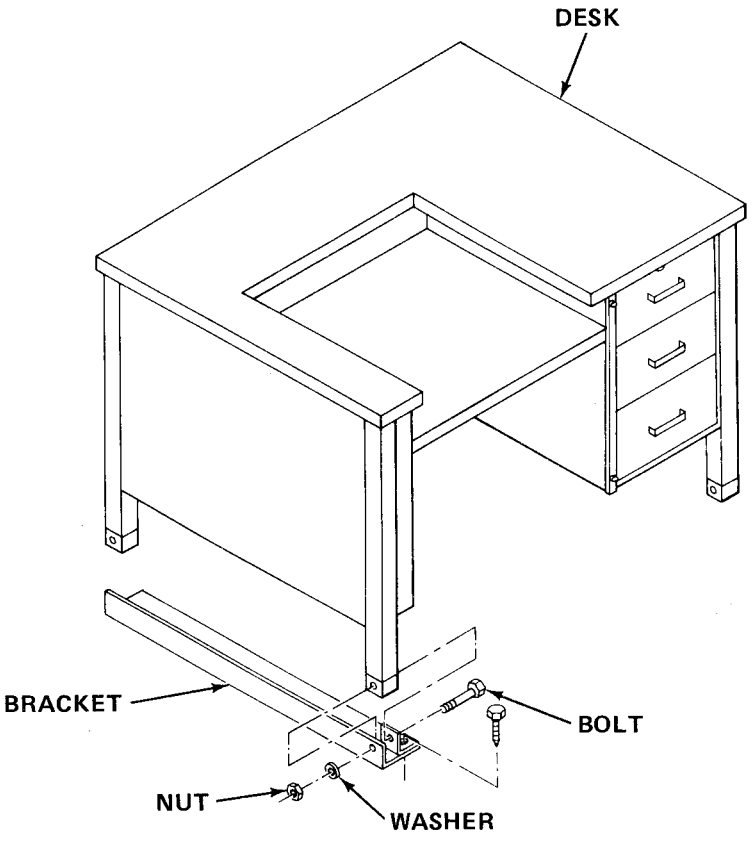
h. Have lock combination changed on cabinet before replacing material in cabinet.

8-16.7 Remove/Install Typewriter Desk.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: 1/4 in. Drive Ratchet
1/2 in. Socket, 1/4 in. Drive
3 in. Extension, 1/4 in. Drive

SUPPLIES: Typewriter Desk



a. Remove typewriter.

b. Remove typewriter desk mounting bolts, washers, and nuts.

c. Remove desk.

d. Position new desk and line up holes with mounting bracket.

e. Secure with bolts, washers, and nuts.

8-16.8 Remove/Install Security Filing Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

PERSONNEL: Two persons are required to perform this procedure,

TOOLS: 1/2 in. Drive Ratchet
1 1/8 in. Socket, 1/2 in. Drive
3 in. Extension

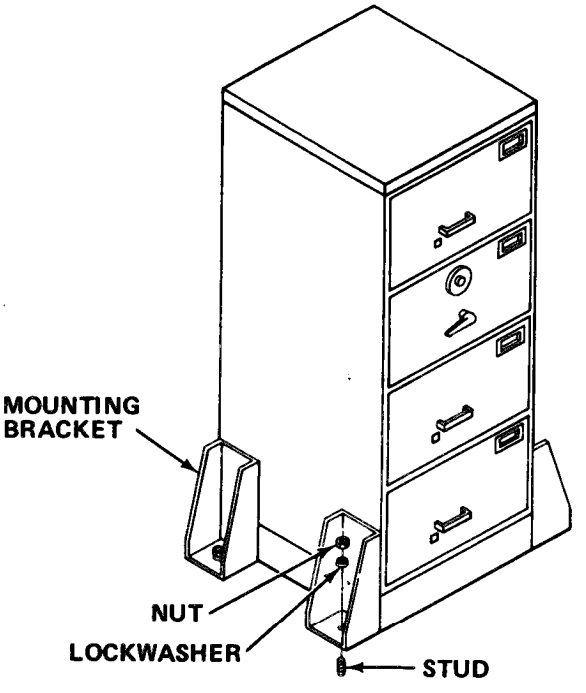
SUPPLIES: Security Filing Cabinet

a. Open cabinet.

b. Remove contents and temporarily store in secure area.

c. Tape lock combination to outside of cabinet.

d. Remove nuts and washers.



WARNING

Serious injury may occur if security filing cabinet is removed or replaced in the section without using adequate lifting equipment.

e. Move cabinet to door.

f. Remove cabinet from section.

g. Position new cabinet over studs and reinstall washers and nuts.

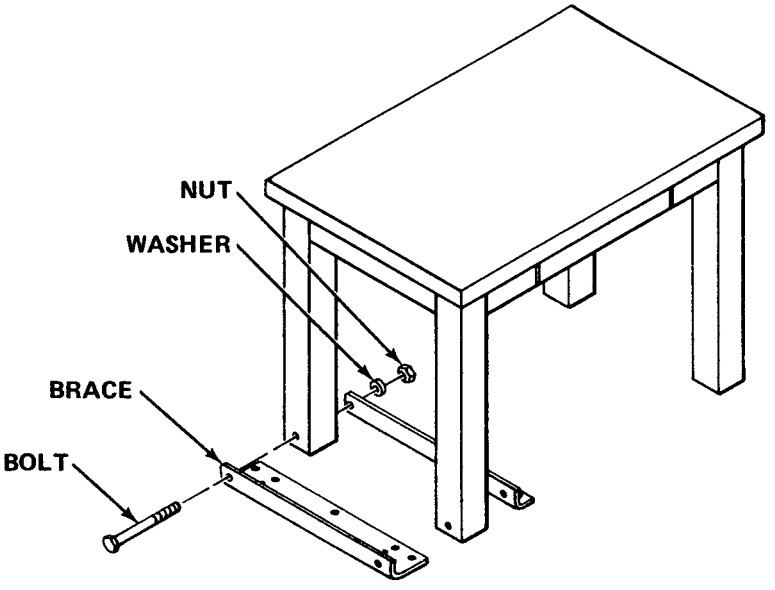
h. Have combination lock changed to new combination before storing material in security filing cabinet.

8-16.9 Remove/Install Office Table.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS : 1/2 in. Socket, 1/2 in. Drive
1/2 in. Ratchet
3 in. Extension

SUPPLIES: Office Table



a. Remove mounting bolts, washers, and nuts.

b. Remove table.

c. Replace table, line up holes with bracket.

d. Secure with bolts, washers, and nuts.

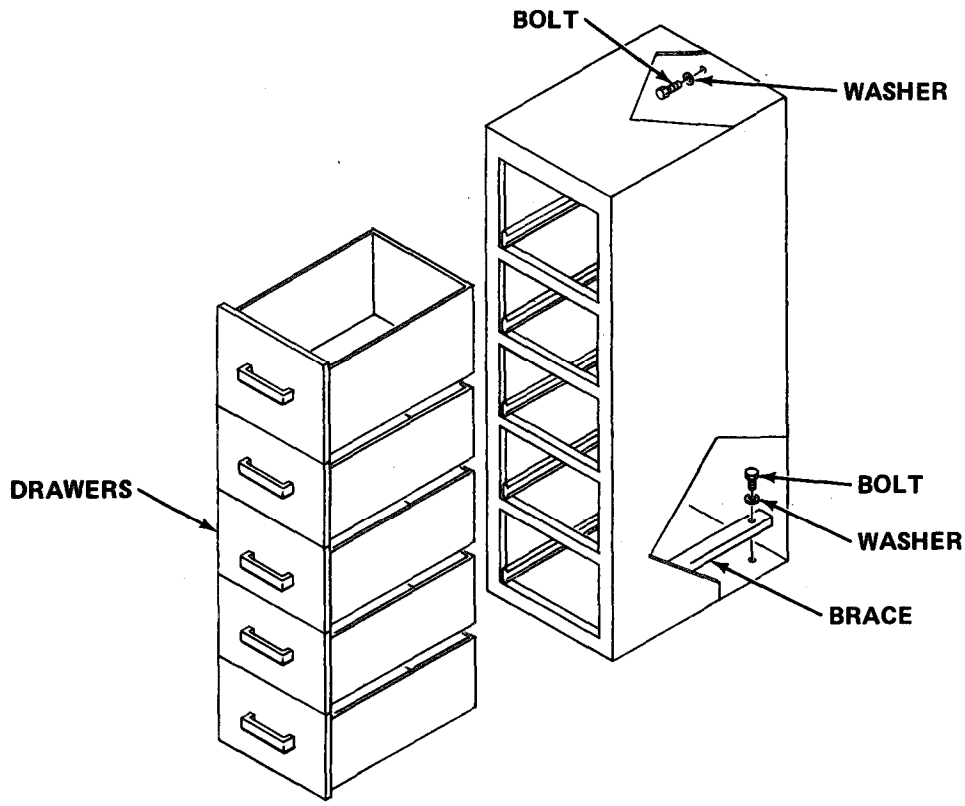
8-16.10 Remove/Install Filing Cabinet.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: Flat Tip Screwdriver
1/2 in. Socket, 1/2 in. Drive
1/2 in. Drive Ratchet

SUPPLIES: Filing Cabinet

a. Remove drawers from cabinet.



NOTE

Mounting of cabinets vary from section to section.

b. Remove upper mounting bolts and washers.

c. Remove lower mounting bolt, washer, and brace.

d. Remove filing cabinet.

e. Reinstall drawers.

f. Remove drawers from new cabinet.

g. Line up new cabinet inside section over mounting holes.

h. Secure cabinet with upper bolts and washers, and lower brace, bolts, and washers.

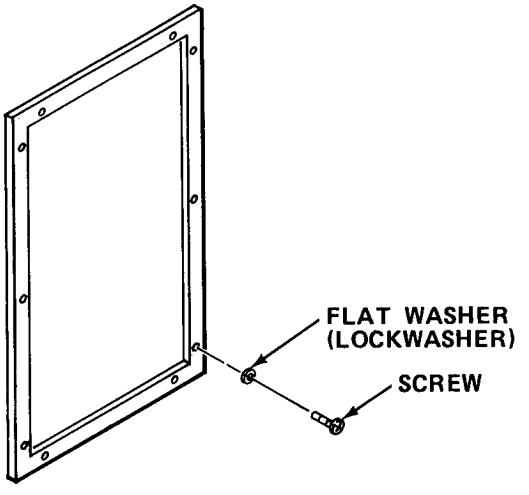
i. Reinstall drawers.

8-16.11 Remove/Install Corkboard.

MOS: 83FJ6, Reproduction Equipment Repairer

TOOLS: Cross Tip Screwdriver

SUPPLIES: Corkboard



a. Remove attaching hardware securing defective corkboard to wall.

b. Remove defective corkboard.

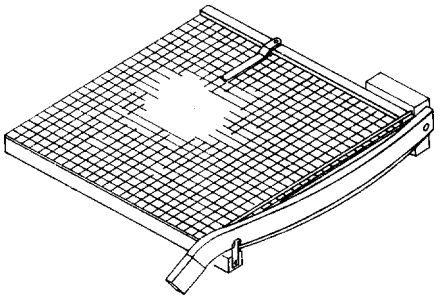
c. Position new corkboard and aline mounting holes.

d. Secure new corkboard to wall with attaching hardware.

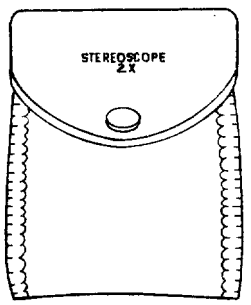
8-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

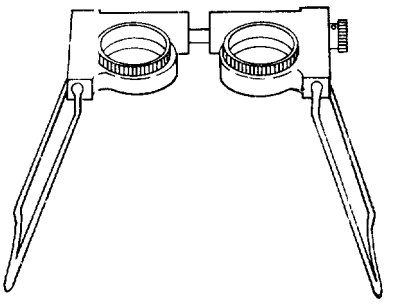
Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.

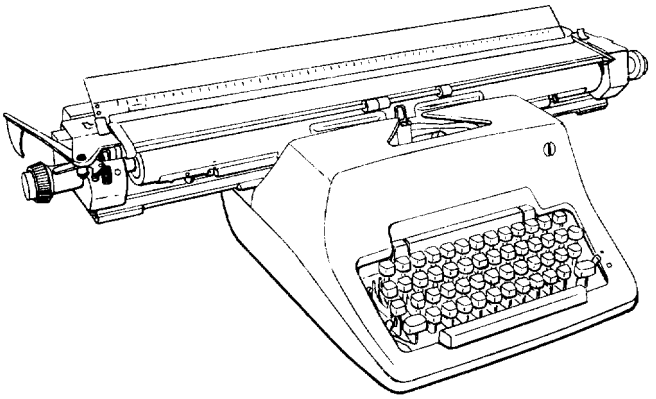


PAPER TRIMMER

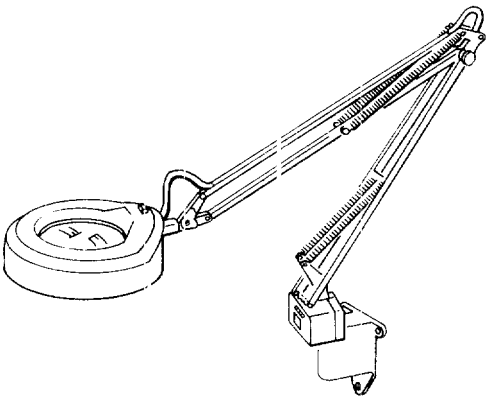




POCKET STEREOSCOPE



MANUAL TYPEWRITER



MAGNIFIER LAMP

CHAPTER 9

SUPPORT ITEMS

Section I INTRODUCTION

9-1. GENERAL INFORMATION.

9-1.1 Scope. This chapter covers the support items contained in this section. The support items consist of the following equipment:

a. Model LFM1BX5 Magnifier Lamp.

b. Model FED-99-T-678 Paper Trimmer.

c. Type 1 Pocket 2X Stereoscope.

d. Model SG3B Manual Typewriter.

9-2. EQUIPMENT DESCRIPTION.

9-2.1 Equipment Characteristics, Capabilities, and Features.

a. Magnifier lamp. Adjustable for accurate positioning to provide illuminated magnification of precision work. Provision for both wall and bench mounting.

b. Paper trimmer. Cuts paper up to 24 in. wide.

c. Pocket stereoscope. Optically matches and gives operator an apparent single image of two maps or photographs.

d. Manual typewriter. Refer to operator's manual supplied with the typewriter for characteristics, capabilities, and features.

9-2.2 Equipment Data.

a. Magnifier lamp. Replaceable 120 V ac lamp and diffuser.

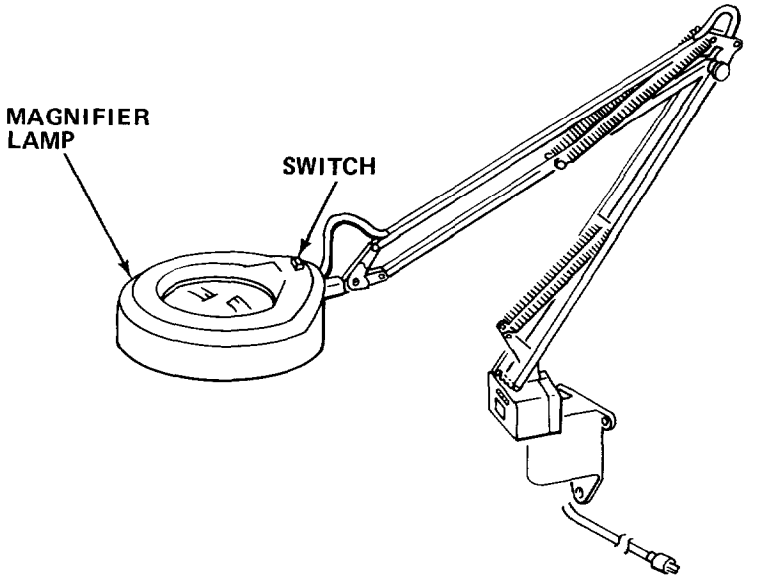
b. Manual typewriter. Refer to operator's manual supplied with the typewriter for equipment data.

9-3. TECHNICAL PRINCIPLES OF OPERATION. Principles of operation are combined with operator's controls and indicators.

Section II OPERATING INSTRUCTIONS

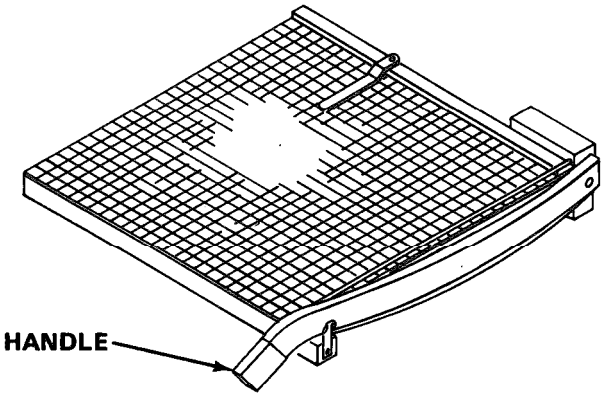
9-4. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS.

9-4.1 Magnifier Lamp.



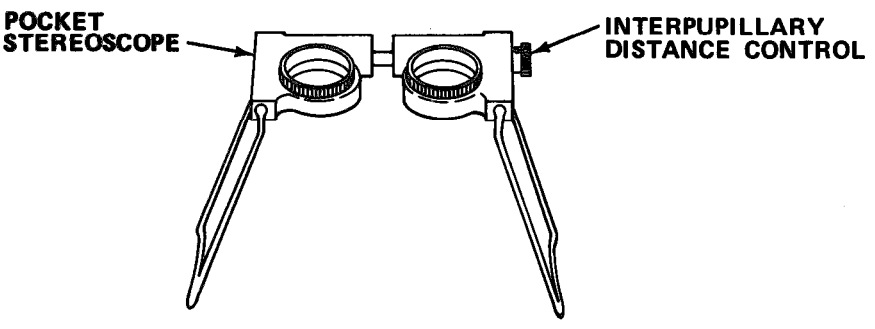
Control or Indicator	Function
Switch	Turns lamp on/off.

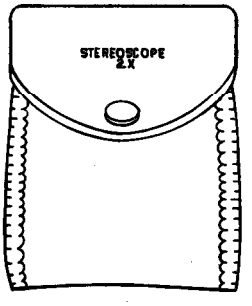
9-4.2 Paper Trimmer.



Control or Indicator	Function
Handle	Operates cutter.

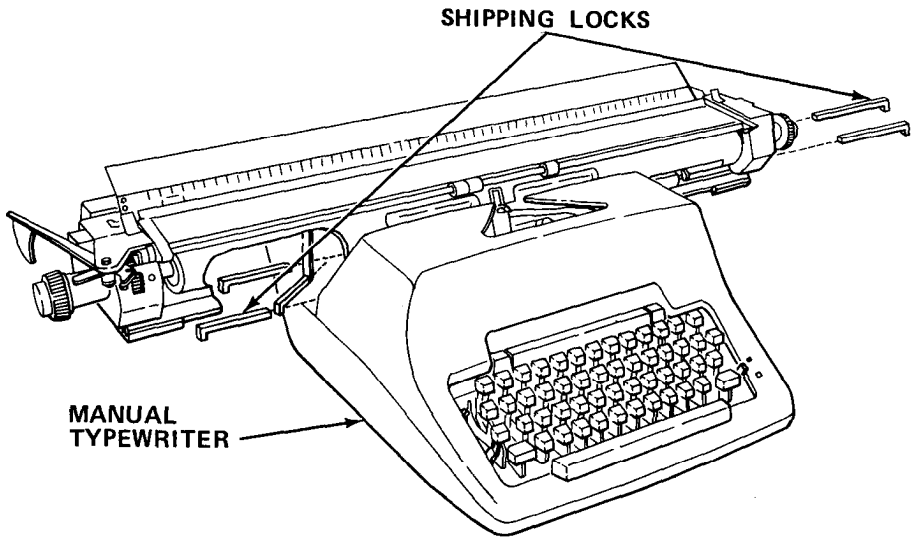
9-4.3 Pocket Stereoscope.





Control or Indicator	Function
Interpupillary Distance Control	Adjusts interpupillary distance of lenses to match that of viewer.

9-4.4 Manual Typewriter. Refer to the operator's manual supplied with the typewriter for the controls and indicators not shown.



Control or Indicator	Function
Shipping Lock	Locks carriage when typewriter is being transported.

9-5. **OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.**

a. Before You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

b. While You Operate. Always keep in mind the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails To Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

9-5.1 PMCS Procedures.

a. PMCS are designed to keep the equipment in good working condition by peforming periodic service tasks.

b. Service intervals provide you, the operator, with time schedules that determine when to perform specified service tasks.

c. The "Equipment is Not Ready/Available If" column is used for identification of conditions that-make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

d. If your equipment fails to operate after PMCS is performed, immediately report this condition to your supervisor.

e. Perform weekly as well as before operation if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.

f. Item number column. Item numbers are assigned in chronological ascending sequence regardless of interval designation. These numbers are used for your "TM Number" Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.

g. Interval columns. This column determines the time period designated to peform your PMCS.

h. Item to be inspected and procedures column. This column lists functional groups and their respective assemblies and subassemblies as shown in the Maintenance Allocation Chart (Appendix B). The appropriate check or service procedure follows the specific item to be inspected.

i. Equipment is not ready/available if: column. This column indicates the reason or cause why your equipment is not ready/available to perform its primary mission.

j. List of tools and materials required for PMCS is as follows:

Equipment	Items	Quantity
Magnifier Lamp	Liquid Lens Cleaner (Item 7, Appendix E)	ar
	Cheesecloth (Item 8, Appendix E)	ar
Pocket Stereoscope	Lens Tissue (Item 30, Appendix E)	ar
Manual Typewriter	Typewriter Ribbon	1 ea

Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can safely be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B - Before
D - During
A - After

W - Weekly
M - Monthly
Q . Quarterly

AN - Annually
s - Semiannually
BI - Biennially

(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VA L	ITEM TO BE INSPECTED PROCEDURE	For Readiness Reporting, Equipment Is Not Ready/ Available If:
		SUPPORT ITEMS	
1	B	Magnifier Lamp.	
		1. Inspect lens for cracks, breaks, or dirt. Clean as required.	Lens is cracked or broken.
		2. Inspect arms and base for cracks or breaks.	Arms or base is cracked or broken.
2	B	Service Magnifier Lamp.	
		1. Turn off magnifier lamp.	
		2. Apply small amount of liquid lens cleaner to lens and wipe clean with cheesecloth.	
		3. Turn on magnifier lamp.	
3	B	Paper Trimmer. Inspect paper trimmer for structural damage and proper operation of blade.	Blade will not operate.
4	B	Clean Pocket Stereoscope.	
		1. Inspect lenses for dust, dirt, cracks, or breaks.	Lenses are cracked or broken.
		2. Clean lenses with tissue paper.	
		3. Inspect housing and legs for cracks or breaks.	

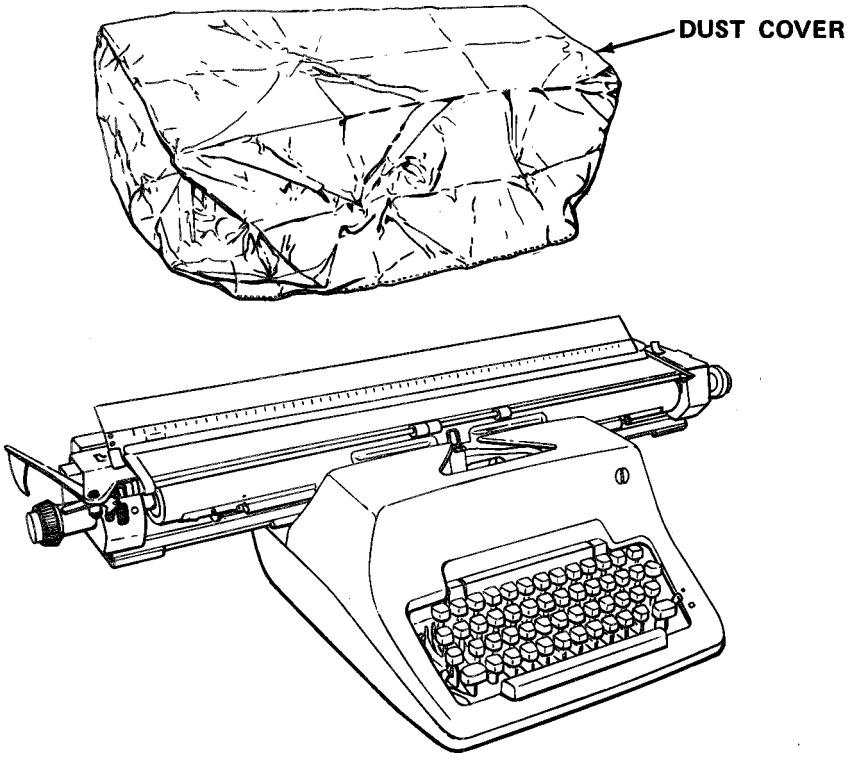
Table 9-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Cent

B - Before
D - During
A - After

w - weekly
M - Monthly
Q - Quarterly

AN - Annually
S - Semiannually
Bl - Biennially

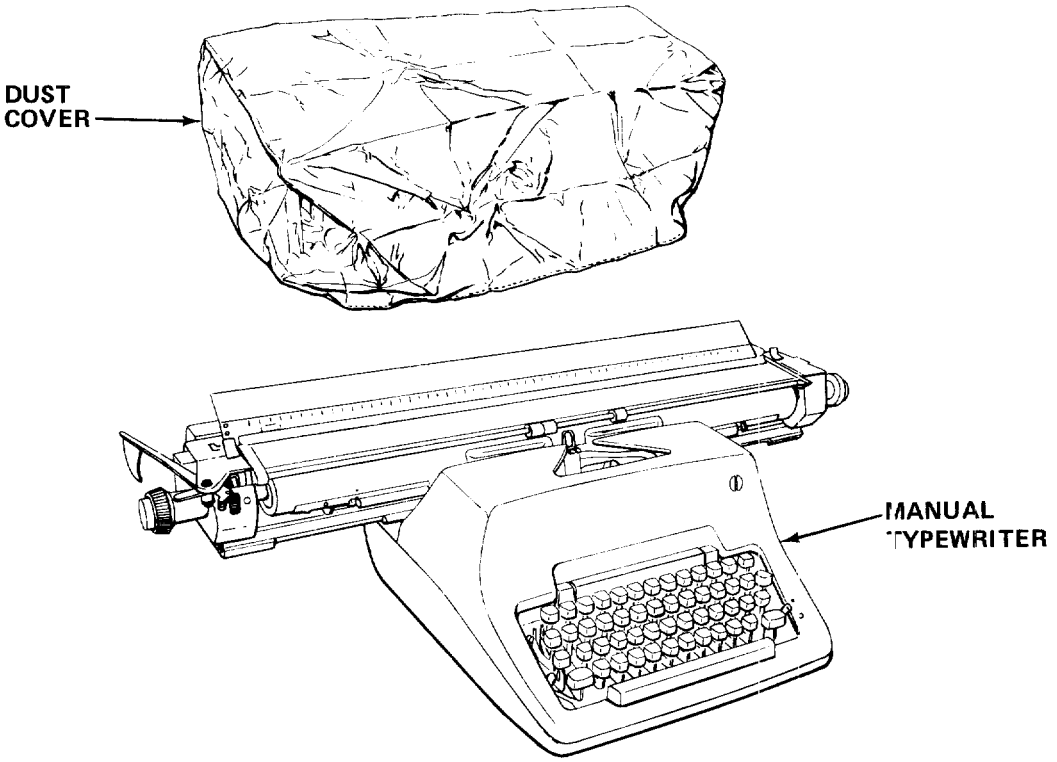
(Number) - Hundreds of Hours

ITEM NO.	IN-TER-VAL	ITEM TO BE INSPECTED PROCEDURE	For Reediness Reporting, Equipment Is Not Reedy/ Available If:
		SUPPORT ITEMS - Cent	
5	W	Manual Typewriter.	
			
		1. Remove dust cover. 2. Check that typewriter is mounted securely. 3. Check that typewriter ribbon is installed. 4. Replace dust cover.	Ribbon is missing.
6	S	Replace Typewriter Ribbon on Manual Typewriter. Refer to your operator's manual for replacement of ribbon.	

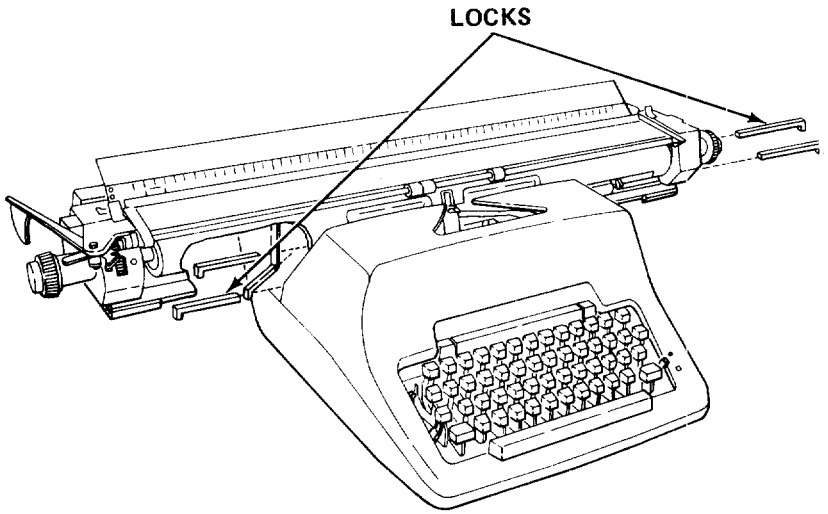
9-6. OPERATION UNDER USUAL CONDITIONS.

9-6.1 Assembly and Preparation for Use.

9-6.1.1 Manual Typewriter.



a. Remove dust cover.



b. Remove locks.

9-6.2 Operating Procedures.

a. Magnifier lamp.

(1) Move magnifier lamp from mounting bracket.

(2) Plug in power cord.

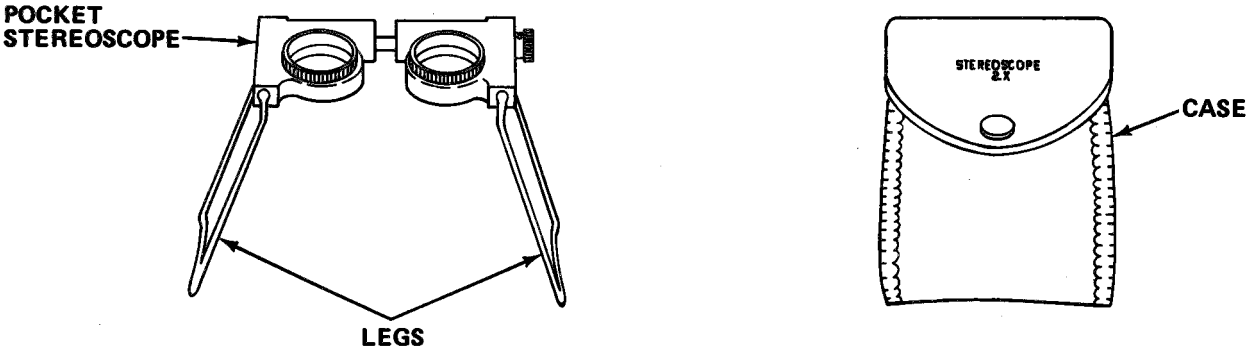
(3) Turn on fluorescent lamp.

(4) Position magnifier lamp over object.

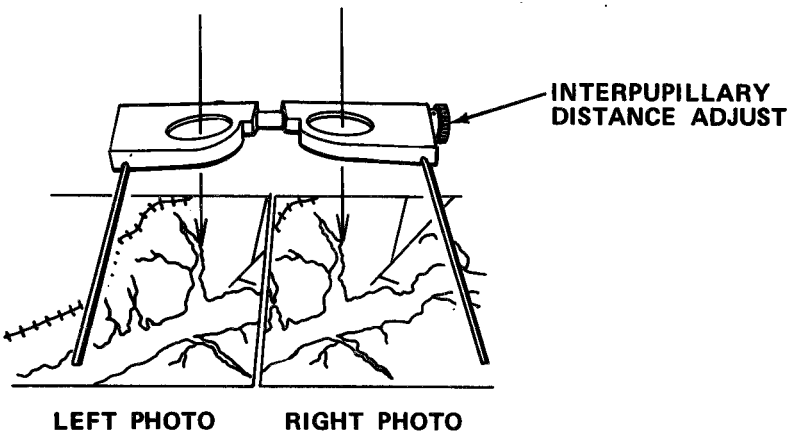
(5) Examine object through lens.

b. Pocket stereoscope.

(1) Position photographs in preparation for viewing in stereo.



(2) Remove pocket stereoscope from case and unfold legs.



(3) Set pocket stereoscope on photograph so that left lens is over left photograph and right lens is over right photograph.

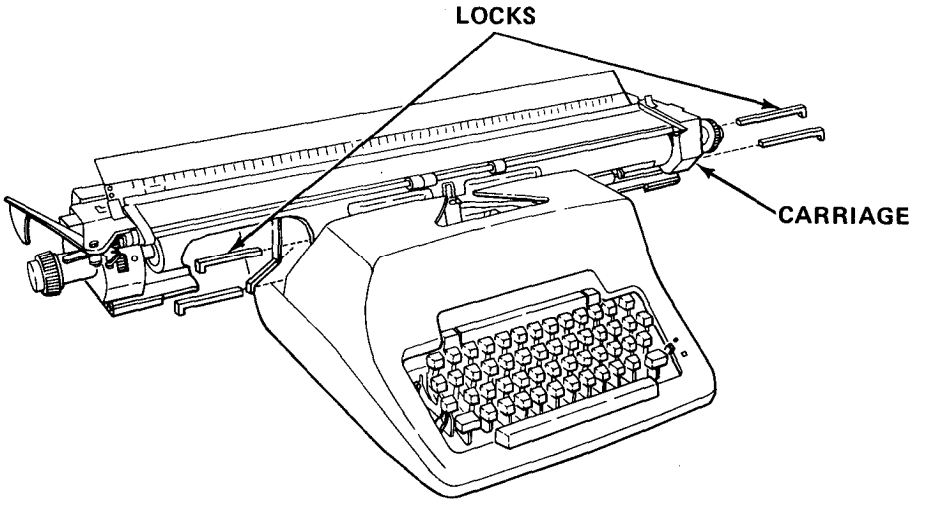
(4) Adjust interpupillary distance between lenses until it matches that of viewer.

(5) Locate detail to be viewed on left photograph and center left lens over it.

(6) 'Move right photograph until the same detail is centered under right lens. When viewed simultaneously, two details should merge into one. Adjust photographs until this effect is achieved.

9-6.3 Preparation For Movement.

9-6.3.1 Manual Typewriter.



a. Install locks on carriage.

b. Replace dust cover.

9-7. OPERATION UNDER UNUSUAL CONDITIONS. This equipment is designed for operation only in a controlled environment.

Section III OPERATOR MAINTENANCE

9-8. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

9-9. TROUBLESHOOTING PROCEDURES.

a. The table lists the common malfunctions which you may find during the operation or maintenance of the magnifier lamp, or its components. YOU should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all test or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 9-2. TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. FLUORESCENT LAMP WILL NOT WORK. Be sure that magnifier lamp assembly is plugged into active power outlet. Press switch OFF, then ON. (a) If lamp still does not come on, replace 1 amp (paragraph 9-10.1). (b) If new lamp does not light, refer to organizational maintenance.

9-10. MAINTENANCE PROCEDURES.

a. This section contains instructions covering operator maintenance functions for the support items. Personnel are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

9-10.1 Replace Lamp in Magnifier Lamp Assembly

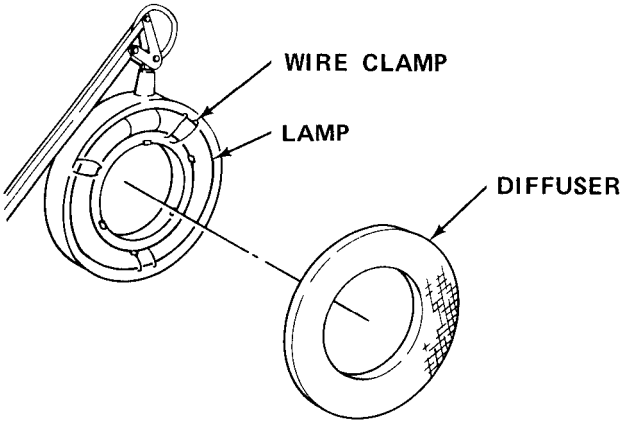
MOS: 81Q, Terrain Analyst

SUPPLIES: Fluorescent Lamp (22 W)

WARNING

Death or serious injury may occur from electrical shock unless power cord is unplugged before servicing.

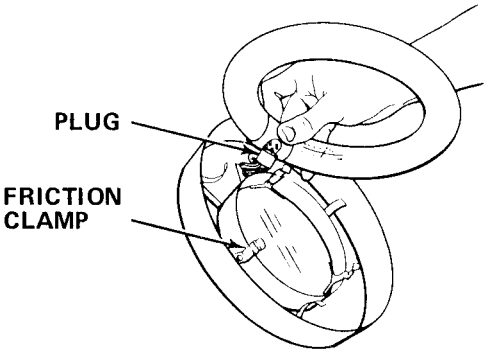
a. Unplug magnifier lamp and remove diffuser.



NOTE

On some magnifier lamp models, lamp is held in place with friction clamps.

b. Release wire clamps, pull out lamp, and disconnect plug from lamp.



c. Connect plug to new lamp and retain lamp with wire clamps.

d. Reinstall diffuser.

Section IV ORGANIZATIONAL MAINTENANCE

9-11. LUBRICATION INSTRUCTIONS. This equipment does not require lubrication.

9-12. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

9-12.1 Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

9-12.2 Special Tools: Test. Measurement, and Diagnostic Equipment; and Support Equipment. Special Tools, TMDE, and Support Equipment is listed in the applicable repair parts and special tools list and in Appendix B of this manual.

9-12.3 Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-6675-325-24P covering organizational maintenance for this equipment.

9-13. **SERVICE UPON RECEIPT.**

9-13.1 Checking Unpacked Equipment.

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

b. Check the equipment against the packing list to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified,

9-14. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES. There are no organizational PMCS procedures assigned for this equipment.

9-15. ORGANIZATIONAL TROUBLESHOOTING PROCEDURES. If the magnifier lamp does not power up when turned on, verify that 120 V ac is present at the receptacle. If voltage is not present, plug equipment into receptacle withpower available and proceed with equipment troubleshooting. Perform no-power procedure for dead receptacle (Table 1-4). If voltage is present, replace magnifier lamp assembly (paragraph 9-16.1).

9-16. MAINTENANCE PROCEDURES.

a. This section contains instructions covering organizational maintenance fuctions for the support items. Personnel required are listed only if the task requires more than one.

b. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

INDEX

9-16.1 Replace Magnifier Lamp Assembly.

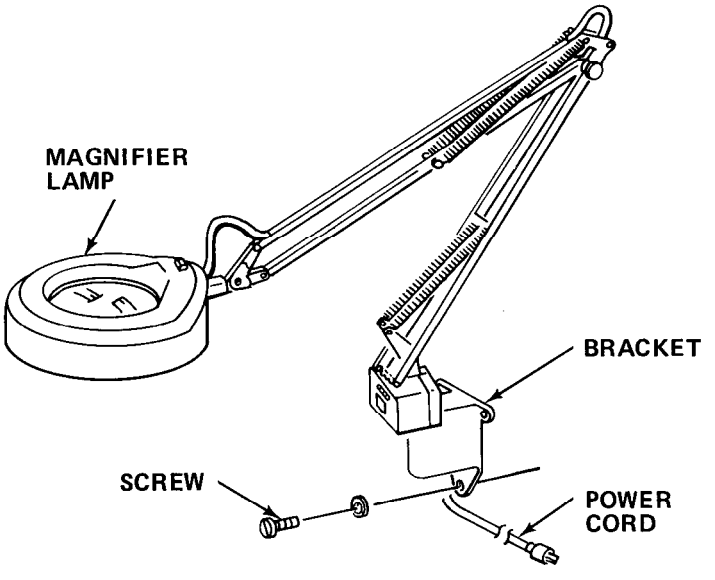
MOS : 81Q, Terrain Analyst

TOOLS: Flat Tip Screwdriver

SUPPLIES: Magnifier Lamp Assembly

WARNING

Death or serious injury may occur from electrical shock if power cord is not unplugged before servicing.



a. Unplug power cord and remove magnifier lamp assembly from bracket.

b. Remove screws to release bracket from wall.

c. Install new bracket and secure with screws.

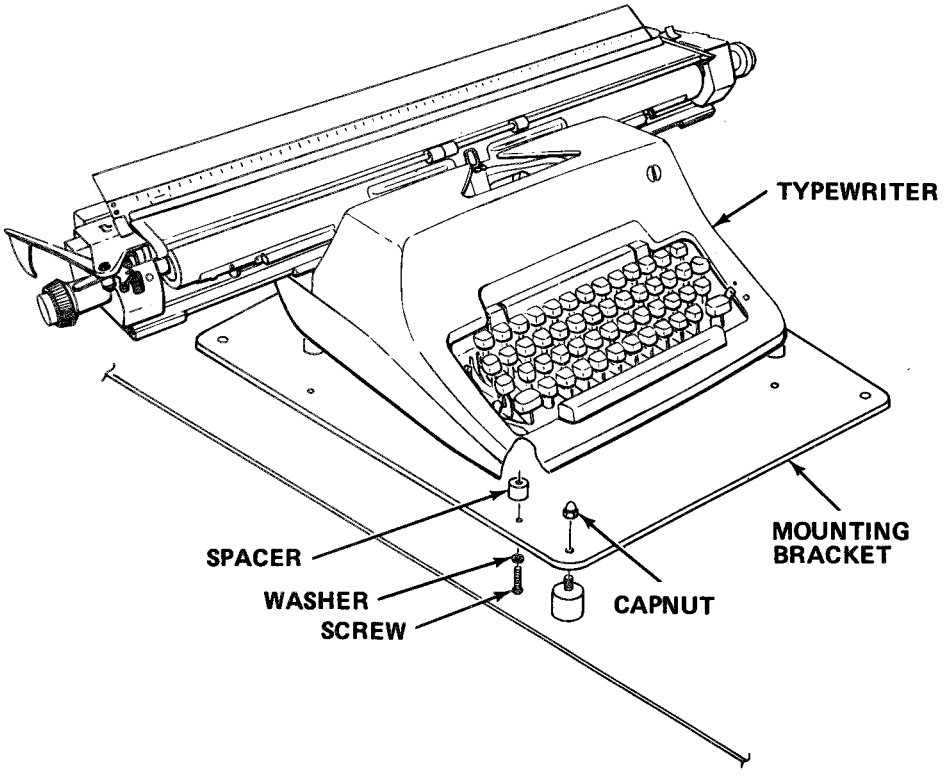
d. Install new magnifier lamp assembly on bracket and plug in power cord.

9-16.2 Remove/Install Manual Typewriter.

MOS: 81Q, Terrain Analyst

TOOLS : Flat Tip Screwdriver
8 in. Adjustable Wrench

SUPPLIES: Typewriter



a. Remove capnuts from mounting bracket.

b. Remove typewriter and mounting bracket.

c. Remove screws, washers, and spacers securing typewriter to mounting bracket.

d. Remove defective typewriter.

e. Secure new typewriter to mounting bracket with spacers, washers, and screws.

f. Install new typewriter and bracket.

g. Secure mounting bracket with capnuts.

9-17. PREPARATION FOR STORAGE OR SHIPMENT. Contact your battalion for packing and shipping instructions.

Section V DIRECT/GENERAL SUPPORT MAINTENANCE

There are no direct/general support maintenance procedures assigned for this equipment.

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals and miscellaneous publications referenced in this manual.

A-2. FORMS.

Recommended Changes to Publications and Blank Forms . . . . . DA Form 2028

Recommended Changes to Equipment Technical Publications . . . . . DA Form 2028-2

Equipment Inspection and Maintenance Worksheet . . . . . DA Form 2404

The Army Maintenance Management System (TAMMS). . . . . DA Pam 738-750

Quality Deficiency Report . . . .SF 368

A-3. FIELD MANUALS.

Camouflage. FM5-20

Nuclear, Biological and Chemical (NBC)
Defense (Reprinted w/Basic Incl Cl) FM21-40

Basic Cold Weather Manual FM31-70

Northern Operations FM31-71

Metal Body Repair and Related Operations FM43-2

First Aid for Soldiers. FM21-11

A-4. TECHNICAL MANUALS.

Administrative Storage of Equipment . . . . . TM 740-90-1

Chemical, Biological and Radiological (CBR)
Decontamination . . . . . TM 3-220

Operator, Organizational, Direct Support and General
Support Maintenance Manual: Air Conditioner, Horizontal,
Compact, 208-Volt, 3-Phase, 18,000 Btu Cooling, 12,000
Btu Heating. . . . . .TM 5-4120-367-14

Operator, Organizational, Direct Support and General Support Maintenance Manual for Chassis, Semi-Trailer, Container Transporter (ADCOR) . . . . . TM 5-2330-305-14

Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Air Conditioner/Heater . . . . . TM 5-4120-367-24P

Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Chassis, Semi-Trailer, Container Transporter (ADCOR) . . . . . TM 5-2330-305-24P

Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (RPSTL) (Including Depot Maintenance Repair Parts and Special Tools) for Synthesis Section . . . . . TM 5-6675-325-24P

Painting Instructions for Field Use . . . . . TM 43-0139

Procedure for the Destruction of Equipment to Prevent Enemy Use..... . . . . TM 750-244-3

Use and Care of Hand Tools and Measuring Tools . . . . . TM 9-243

A-5. MISCELLANEOUS PUBLICATIONS.

Lubrication Order: Topographic Support System, Synthesis Section, Model ADC-TSS-14 . . . . . LO 5-6675-325-12

Lubrication Order: Topographic Support System, Chassis, Semi-Trailer, Container Transporter (ADCOR) . . . . . LO 5-2330-305-12

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 categories.

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 application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

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

B-2. MAINTENANCE FUNCTIONS. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or-exact position, or by setting-the operating characteristics to specified parameters.

e. Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. 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 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.

g. Remove/ Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services[1], including fault location/-troubleshooting[2], removal/installation, and disassembly/assembly[3] procedures, and maintenance actions[4] to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item or system.

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

k. 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 equipment/components.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the next higher assembly. End item group number shall be "00."

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2.)

---

[1]Services - Inspect, test, service, adjust, aline, calibrate and/or replace.

[2]Fault locate/troubleshoot - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

[3]Disassemble/assemble - Encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration.

[4]Actions - Welding, grinding, riveting, straightening, facing, remachining and/or resurfacing.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance categories, appropriate work time figures will be shown for each category. 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 operation conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurante/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 categories are as follows:

C . . . . Operator or Crew

O . . . . Organizational Maintenance

F . . . . Direct Support Maintenance

H . . . . General Support Maintenance

L . . . . Specialized Repair Activity [5]

D . . . . Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetical order, which shall be keyed to the remarks contained in Section IV.

[5] This maintenance category is not included in Section II, column (4) of the Maintenance Allocation Chart. To identify functions to this category of maintenance, enter a work time figure in the "H" column of Section II, column (4), and use an associated reference code in the Remarks column (6). Key the code to Section IV, Remarks, and explain the SRA complete repair application there. The explanatory remark(s) shall reference the specific Repair Parts and Special Tools List (RPSTL) TM which contains additional SRA criteria and the authorized spare/repair parts.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Reference Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II MAINTENANCE ALLOCATION CHART

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D **	(5) Tools and Eqpt	(6) Remarks
00	SYNTHESIS SECTION	Overhaul							
01	VAN BODY	Inspect	0.8						
	(SO CONTAINER)	Service	0.9	0.5				10,12,13, 16	D
		Repair		1.0	1.5	2.0		1,3,6,17	
	FLOURESCENT LIGHT ASSY	Repair	0.1	0.7				1	
	BLACKOUT/DOME LIGHT ASSY	Repair	0.2						
	EXHAUST FAN ASSEMBLY	Repair		0.5				1	
	AIR CONDITIONER/ HEATER ASSY	Replace				2.0		1	C
	ELECTRICAL ASSEMBLY	Inspect		0.5					
		Repair		0.9	1.0			1,3	
	TELEPHONE BINDING POST ASSY	Repair		0.7				1	
	EMERGENCY LIGHT ASSY	Replace		0.3				1	
	TIEDOWN **SOCKET ASSY**	Replace		0.3				6	
	LEVEL INDICATOR ASSY	Repair		0.6				2,3	
	BLACKOUT CURTAIN ASSY	Repair		1.0				6	
	PERSONNEL LADDER ASSY	Repair		0.8				6,17	D
	PERSONNEL/CARGO DOOR ASSY	Replace			1.5			6	
		Repair			2.0			6	

**Depot will determine work time.

Section II MAINTENANCE ALLOCATION CHART-Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	0	F	H	D	(5) Tools and Eqpt	(6) Remarks
02	DRAFTING, SCRIBING TRACING TABLE	Inspect	0.2						
		Service	0.4					14	D
		Remove/ Install		1.0				1	
	ELECTRICAL SYSTEM	Repair	0.2	0.6				1	
	TABLE TOP TILT LOCKING ASSEMBLY	Repair		0.7				1	
	PILLOW BLOCK ASSEMBLY	Replace		0.5				1	
03	MICROFICHE READER-PRINTER	Inspect	2.30						
		Service	3.40					9	
		Adjust		0.80	0.50			1,7,15,20	D
		Replace		1.20				1,3,5	
		Repair	0.25	1,30	2.00			1,3,5	
04	VERTICAL REFLECTING PROJECTOR	Inspect	0.25						
		Service	0.25						
		Replace		0.50					
		Repair		1.50				1,4	D
	BLOWER ASSEMBLY	Remove/ Install		0.25				1	
	ELECTRICAL ASSY	Repair	0 . 7					12	
	RECTIFYING TILT MOTOR ASSEMBLY	Replace		0.33				1	
	MAGNIFICATION DRIVE MOTOR ASSY	Replace		0.33				1	
	DRIVE CHAIN ASSEMBLY	Replace		0.17				1	

Section II MAINTENANCE ALLOCATION CHART – Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
05	QUANTITY PROCESSING SYSTEM (PLANIMETER)	Inspect Service Repair	0.17 0.25 0.50					9	
	PLANIMETER ASSEMBLY	Inspect Aline Repair	0.2 0.5 0.7						
	LINEAR MEASURING PROBE ENCODER ASSEMBLY	Inspect Service Aline	0.1 0.1 0.3		0.5 0.8			5,21 5,12,18,19	D
	AUTO-SCALER ASSEMBLY	Inspect	0.2						
	MAIN LOGIC PC BOARD	Replace			0.30			5	A
	FRONT DISPLAY PC BOARD	Replace			0.50			4,5	A
	REAR INPUT PC BOARD	Replace			0.50			5	A
	SCALER PC BOARD	Replace			0.50			5	A
06	ULTRASONIC CLEANER	Inspect Repair	0.2	0.7				1	
	CIRCUIT BOARD	Replace		0.6				1	B
07	POCKET CALCULATOR	Inspect Repair	0.3 0.2						
08	FURNITURE AND CABINETS	Inspect Replace Remove/ Install	0.33	2.50 3.00				1,20 1,3	D

Section II MAINTENANCE ALLOCATION CHART — Cont

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Cat. C	O	F	H	D	(5) Tools and Eqpt	(6) Remarks
09	SUPPORT	Inspect Service Replace	0.33 0.33	 0.25				 1	

Section III TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference code	(2) Maintenance Category	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
1	O	Shop Kit, Automotive Maint & **Repair Common #1 Plus** Metric Option	4910-00-754-0654	
2	O	Took Kit, Carpenters Eng Squad	5180-00-293-2875	
3	O	Tool Kit, General Mechanic's Automotive Plus Metric Option	5180-00-177-7033	
4	O, F, H	Tool Kit, Electronic Equipment	5180-00-605-0079	
5	F,H	Tool Kit, Electronic Equipment	5180.00-61 0-8177	
6	O,F,H	Tool Kit, Light Machine Repair	5180-00-596-1540	
7	O	Alinement Aperture		(94862) 78-8015-5521-6
8	C	Blower, Watchmakers	5120-00-254-4612	
9	C	Brush, Lens	5920-00-205-0565	
10	C	Brush, Wire	7920-00-291-5815	
11	C	Screwdriver, Cross Tip No. 2	5120-00-234-8913	
12	C	Screwdriver, Flat Tip	5120-00-234-8910	
13	C	Wrench Adjustable	5120-00-264-3795	
14	C	Grease, Gun	1930-00-965-0288	
15	O	Rule, Steel, Mach, 12“	5210-00-273-1964	
16	O	Spring Scale	)670-00-238-9777	

Section III TOOL AND TEST EQUIPMENT REQUIREMENTS — Cent

(1) Reference Code	(2) Maintenance Category	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
17	O,F,H	Rivet Gun	5120-00-017-2849	
18	C	Knife, TL-29	5110-00-240-5943	
19	C	Keyset, Socket Head Screw	5120-00-935-4641	
20	F,H	Pyrometer		(39428) 4094K11
21	F,H	Multimeter		(28480) 3435A

Section IV REMARKS

Reference Code	Remarks
A	Printed circuit boards will be repaired at the general support maintenance level to the maximum extent possible as required by AR750-1.
B	Direct support maintenance will provide printed circuit board diagnosis and fault isolation which can be readily accomplished with assigned tools and test, measurement, and diagnostic equipment (TDME).
C	See TM 5-4120-367-14 for maintenance procedures.
D	Maintenance personnel and TSS Section 7 maintenance van (which carries the required tools) are authorized by HHC TOE 05336 H600.

APPENDIX C

COMPONENTS OF END ITEMS AND BASIC ISSUE ITEMS LISTS

Section I INTRODUCTION

C-1 . SCOPE.

This appendix lists components of end item and basic issue items for the Synthesis Section to help you inventory items required for safe and efficient operation:

C-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. 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 II: Basic issue Items. These are the minimum essential items required to place the Synthesis Section in operation, to operate it, and to perform emergency repairs. BII must be with the Synthesis Section 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.

C-3. EXPLANATION OF COLUMNS.

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

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

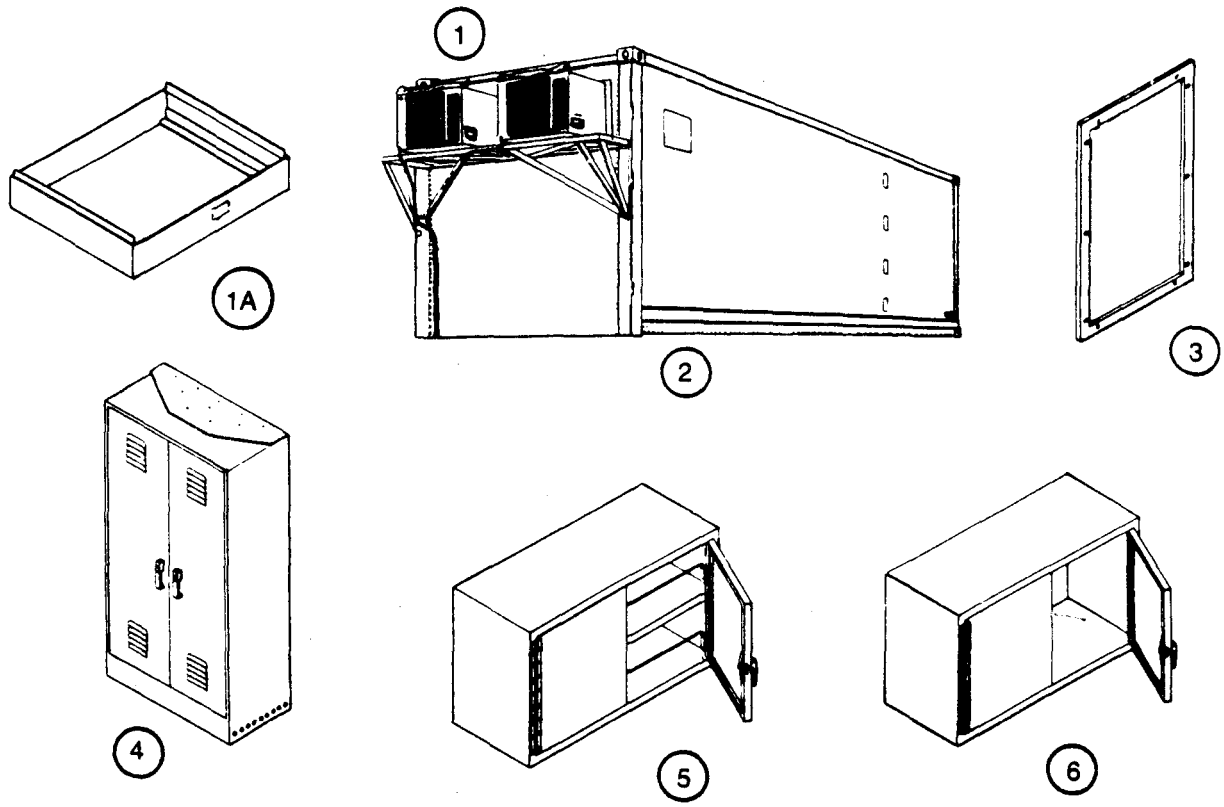
b. Column (2): *National Stock Number.* Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

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).

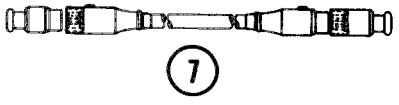
e. Column (5): *Quantity Required (Qty Rqr).* Indicates t he quantity of the item authorized to be used with/on the equipment.

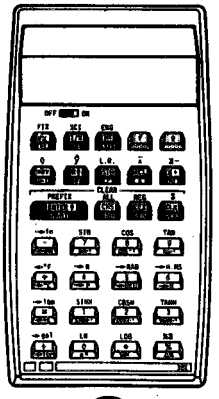
Section II COMPONENTS OF END ITEM

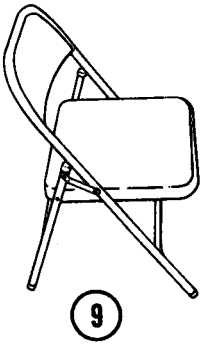


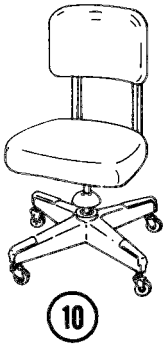
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
1	4120-00-974-7206	AIR CONDITIONER: (81 349) MIL-A-52767	ea	2
1A		BASE, FILING CABINET: (8891 5) S4634	ea	1
2	6675-01-221-6011	VAN ASSEMBLY: MODIFIED (97403) 13225E3039	ea	1
3	7195-00-105-7941	BULLETIN BOARD, CORK: (8D190) T5-2303	ea	1
4	7125-00-764-5744	CABINET, STORAGE, SUPPLY: (78252) AA-C-1770, type I class 1, size 2	ea	2
5	7125-00-286-5259	CABINET, STORAGE, WALL: (78252) MIL-C-40060/1 type I	ea	1
6		CABINET, STORAGE, TECH MANUAL: (97403) 13225E4648	ea	1

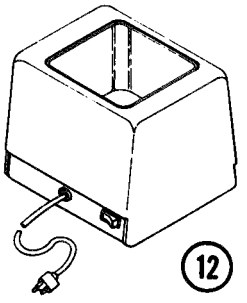
Section II COMPONENTS OF END ITEM - Cont





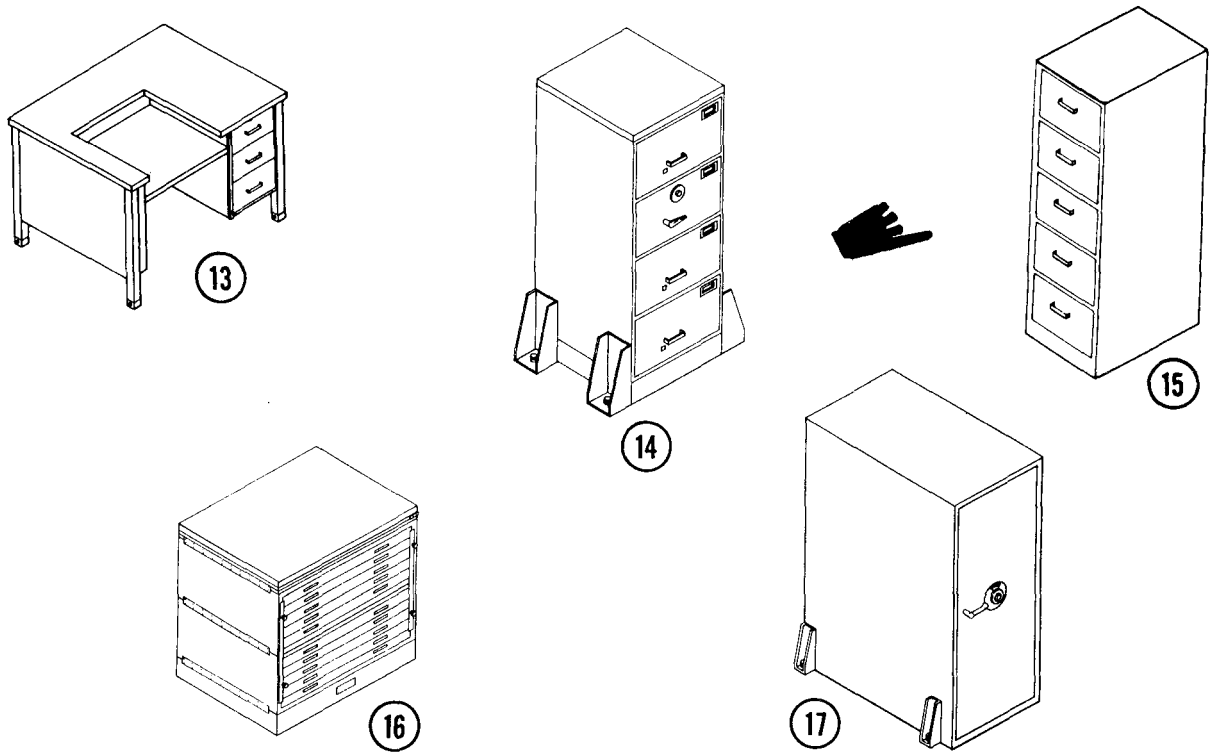






(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
7	6150-00-134-0847	CABLE ASSEMBLY, POWER ELECTRICAL: (90129) RC1736-5, except 50.5 ft lg	ea	3
8	7420-01-139-7441	CALCULATING MACHINE: (51174) HP-32E	ea	1
9	7105-00-269-8463	CHAIR, FOLDING: (80063) SCD539471	ea	1
10	7110-00-273-8791	CHAIR, ROTARY: (8D190) UC-S-17	ea	2
11	7110-00-281-4472	CHAIR, ROTARY: (8D190) UC-D42-L	ea	3
12	4940-01-118-1890	CLEANER, ULTRASONIC: (79819) 3069 USC 3	ea	1

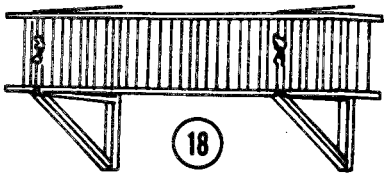
Section II COMPONENTS OF END ITEM - Cont

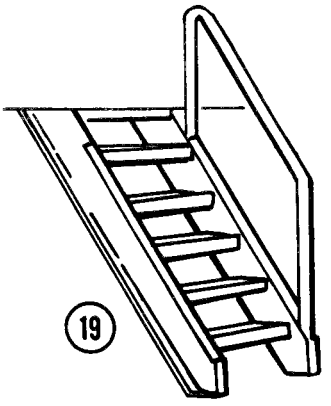


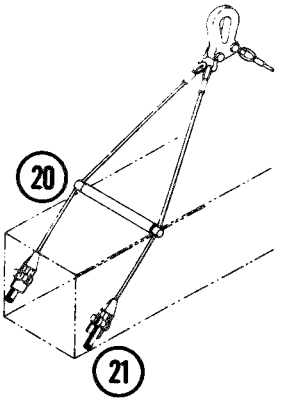
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
13	7110-00-143-0844	DESK, TYPEWRITER: (37296) AA-D-191, type II, class 2	ea	1
14	7110-00-920-9320	FILING CABINET, SECURITY: (54427) AA-F-358, class 6, size 3, 28 in. d, 52 in. h, 20.813 in. w	ea	1
15	7110-00-286-3796	FILING CABINET, 5 DRAWER: (81348) AA-F-359, type IV, size 1 28 in. d, 57.5 in h, 18 in. w	ea	1
16		FILING ASSEMBLY: Map/plan (97403) 13225E3138	ea	2
17	7110-00-068-7736	FILING CABINET, MAP AND PLAN SECURITY: (41729) 7110-00-068-7736HC, w/CTH-405905 or 489-103 and PHR 405904 or 489-103	ea	1

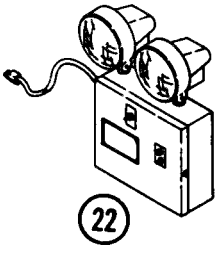
 ☆U.S. GOVERNMENT PRINTING OFFICE: 1990 754-124/20026

Section II COMPONENTS OF END ITEM



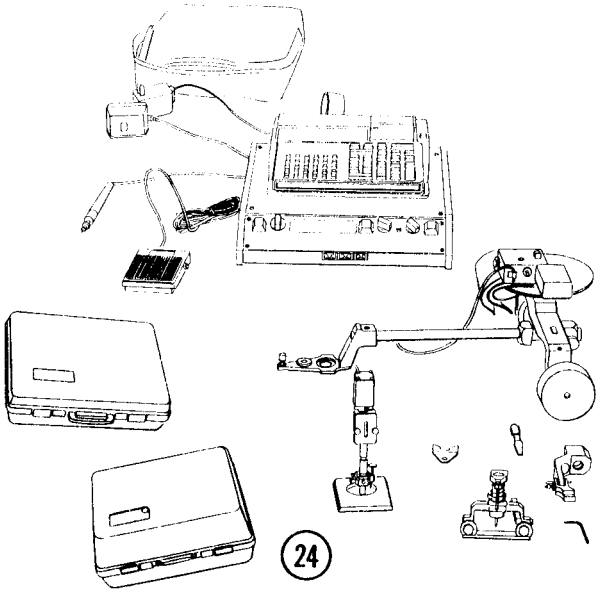


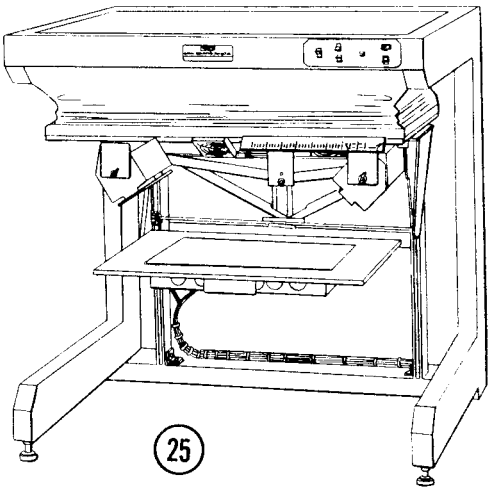


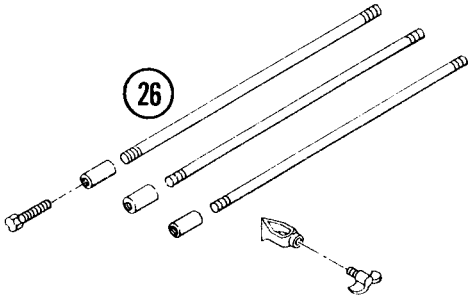


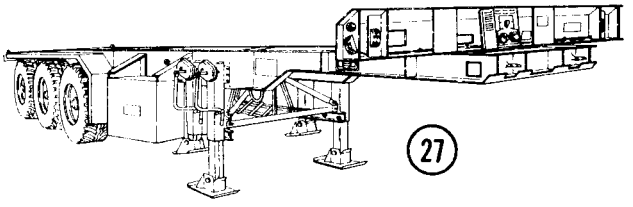
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
18	5440-01-152-7751	LADDER, EXTENSION - FOLDING: (39428) 8028T16	a	1
19	2540-01-133-9726	LADDER, VEHICLE BOARDING: (97403) 13225E3074	a	2
20		LIFTING AND TIEDOWN DEVICE, TRANSPORTABLE SHELTER: Left hand (52555) 1390-4	a	2
21		LIFTING AND TIEDOWN DEVICE, TRANSPORTABLE SHELTER: Right hand (52555) 1390-3	a	2
22		LIGHT, EMERGENCY: (97403) 13225E3396	a	1
23	Deleted			

Section II COMPONENTS OF END ITEM - Cont



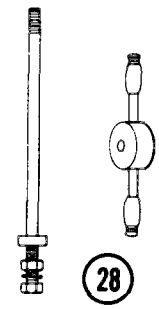


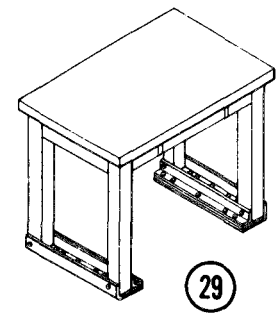


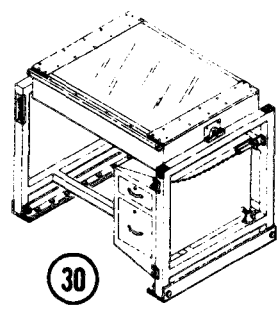


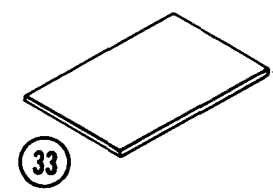
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
24	6675-01-155-6592	PLANIMETER, LARGE GRAPHIC QUANTITY PROCESSOR: (36970) L2501, w/HP-97	ea	1
25	6675-00-891-6219	PROJECTOR, VERTICAL REFLECTING, PHOTOGRAMMETRIC : (33363) 72-0402, Model RP-T-4B	ea	1
26	**5975-00-878-3791**	ROD, GROUND: (82370) A104	ea	1
27	2330-01-076-4797	SEMITRAILER, FLATBED: (97403) TL/MIL-B-13207, par. 3.11, Fig. 12, tables III and IV	ea	1

Section II COMPONENTS OF END ITEM - Cont



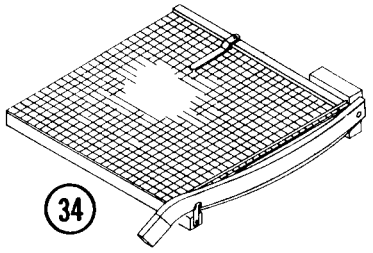


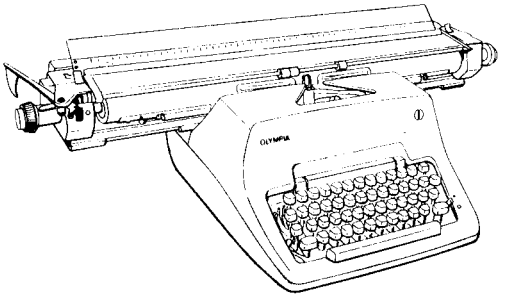


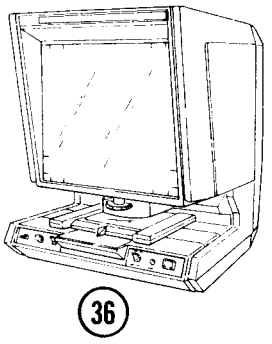


(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
28	5120-01-013-1676	SLIDE HAMMER, GROUND ROD EMPLACEMENT: (45225) P74-144	ea	1
29	7110-00-143-0820	TABLE, OFFICE: (37296) AA-T-91, class B, size 3	ea	1
30	6675-01-203-1049	TABLE, SCRIBING, TRACING, DRAFTING: (33363) 99-9933	ea	3
31	Deleted			
32	Deleted			
33		TOP, FILING CABINET: (88915) T3445	ea	1

Section II **COMPONENTS OF END ITEM** - Cont

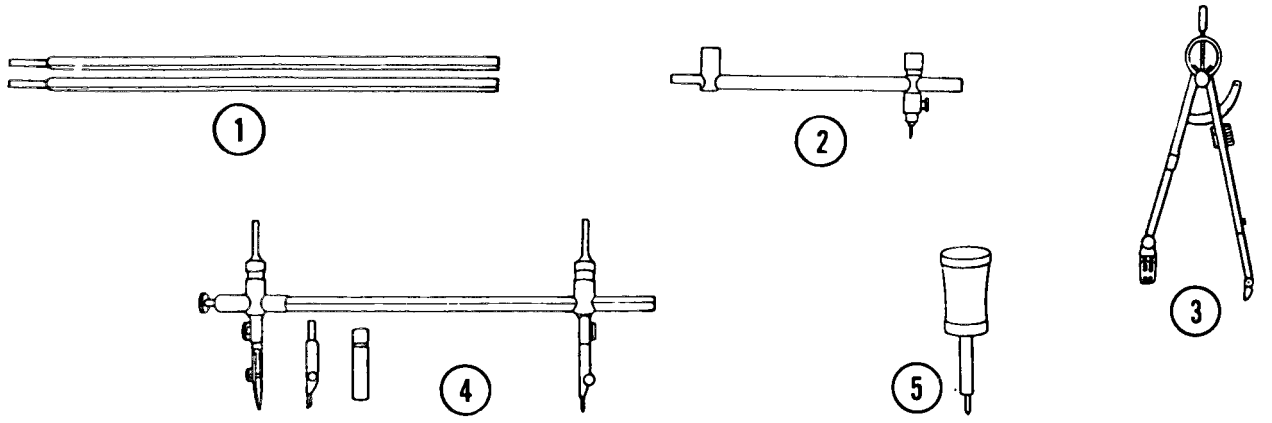






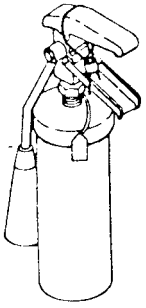
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	
34	7520-00-224-7621	TRIMMER, PAPER, DROP KNIFE: (81348) GG-T-678-TYPE-1, CLASS 5	ea	
35	7430-00-663-9102	TYPEWRITER: (61632) S27	ea	
36	6730-01-174-8122	VIEWER-PRINTER, PROJECTION, PHOTOGRAPHIC: (94862) 800 Reader-Printer, 22X Lens Kit, index card 24 x 6	ea	

Section III BASIC ISSUE ITEMS



(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
		ALINEMENT APERTURE: (94862) 78-8015-5521-6	ea	1
1	6675-01-114-7226	BAR, EXTENSION, BEAM COMPASS: (33363) 55-1818	ea	2
2		BEAM, ATTACHMENT, DRAFTING COMPASS: (79819) 3175BN	ea	2
	5120-00-254-4612	BLOWER, WATCHMAKERS: (64959) R8950	ea	1
		BOARD, CALIBRATION: (36970) 20188	ea	1
	7920-00-291-5812	BRUSH, DUSTING, DRAFTSMAN'S: (79819) Q6-38NB-010	ea	4
	7920-00-205-0565	BRUSH, DUSTING, LENS AND PHOTOGRAPHIC NEGATIVE: (17866) R698	ea	2
	7920-00-291-5$315	BRUSH, WIRE, SCRATCH: (39428) 7187T2	ea	1
3	6675-00-459-8935	COMPASS, DRAFTING BEAM: (79819) 3175N	ea	2
4	6675-00-904-1947	COMPASS, DRAFTING BEAM: (33363) 55-1806	ea	2
5	6675-01-071-8912	COMPASS, DRAFTING LEAD ATTACHMENT: (79819) 3175LA	ea	2
		COVER, WORKING SURFACE, BOARD DRAFTING: (33363) 99-9970	ea	5
	6675-00-250-2508	CURVE, DRAFTING, IRREGULAR: french type (79819) 8255-A	ea	4

Section III BASIC ISSUE ITEMS — Cent



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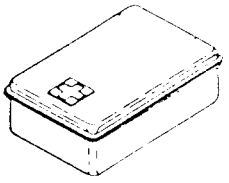

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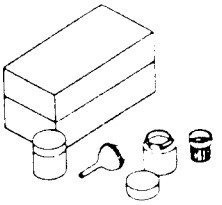
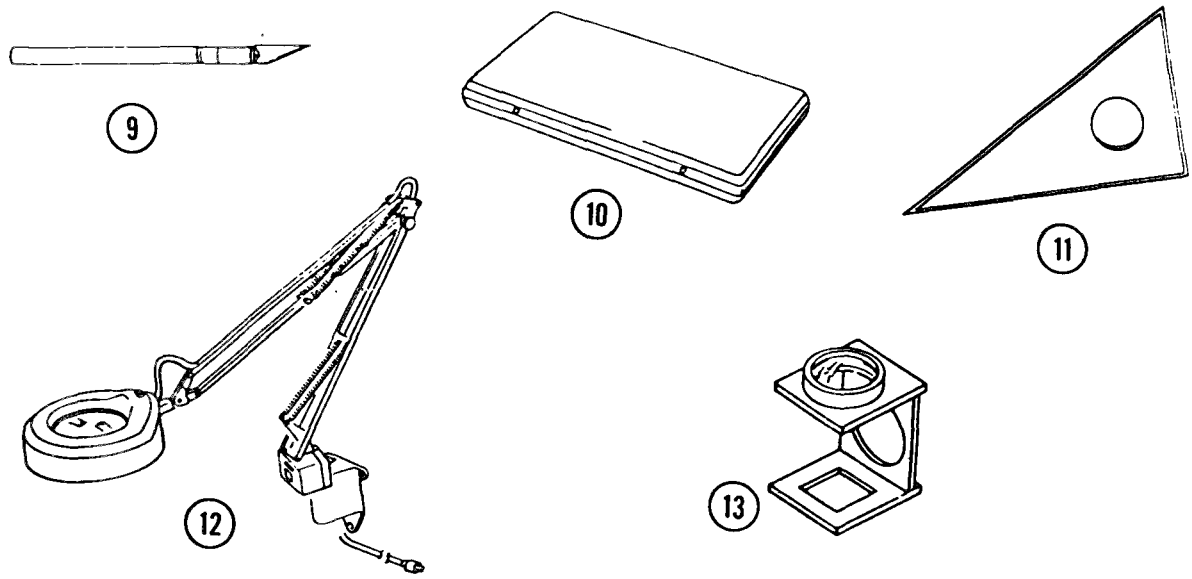


8

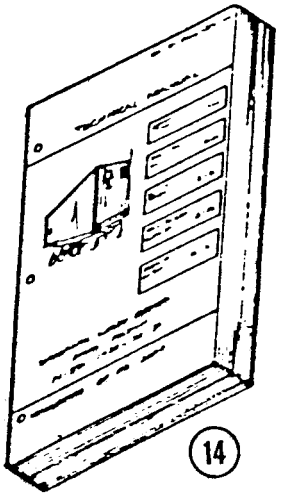
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
	6675-00-250-2509	CURVE, DRAFTING, IRREGULAR: ship type (1 7866) 2217-107	ea	4
	6675-00-641-3512	DIVIDERS, DRAFTING, PLAIN: (33363) 55-1764	ea	4
	66775-00-240-2049	DIVIDERS, DRAFTING, PROPORTIONAL: (33363) 55-1860	ea	2
	6675-01-599-8880	DIVIDERS, EQUAL SPACING: (39428) 1995D11, 6 in.	ea	1
	6675-01-599-8879	DIVIDERS, EQUAL SPACING: (39428) 1995D12, 12 in.	ea	1
6	5210-00-555-8837	EXTINGUISHER, FIRE, MONOBROMOTRI-FLUOROMETHANE: (33525) T2	ea	2
7	6545-00-922-1200	FIRST AID KIT, GENERAL PURPOSE: (89875) SC C-6545-IL vol 2	ea	1
	4940-00-965-0288	GUN GREASE: (77335) 550	ea	1
	5120-00-935-4641	KEY SET, SOCKET HEAD SCREW: (81 348) GGG-K-275 CL1 TY1	se	1
8	7510-00-927-8685	KIT, PEN CLEANING: (33363) 61-3115	kt	3

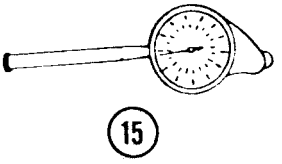
Section III BASIC ISSUE ITEMS — Cont

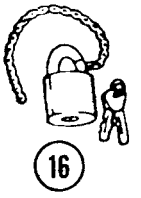


(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
	5110-00-240-5943	KNIFE (81 348) TL-29	ea	1
9	5110-00-595-8400	KNIFE, CRAFTSMAN'S: (99941) 3001	ea	4
	7520-01-008-7640	LEAD REPOINTER, PENCIL: (79819) 992WB	ea	4
10	6675-00-551-0785	LETTERING SET: (33363) 3245-14	ea	1
11	6675-00-190-5854	LINE GUIDE, LETTERING, NONADJUSTABLE: (1 7866) 2030B6	ea	6
12	6650-00-255-8268	MAGNIFIER: lamp type (15607) KFM1BX5	ea	3
13	6650-00-255-8268	MAGNIFIER: linen tester (79819) Q8-9518	ea	4

Section III BASIC ISSUE ITEMS — Cont

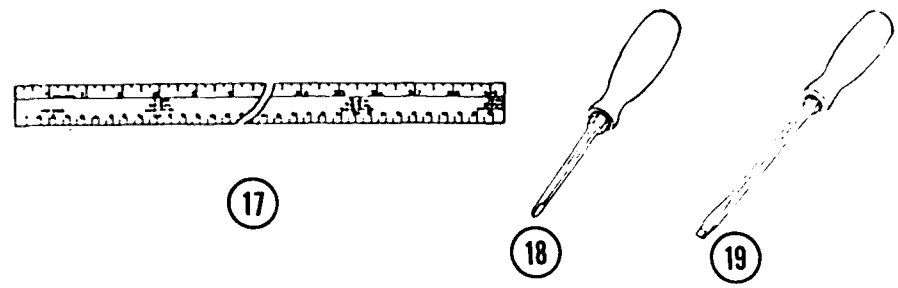






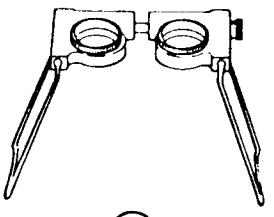
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
14		MANUALS, TECHNICAL		
		LO 5-6675-325-12, LUBRICATION ORDER, TSS SYNTHESIS SECTION	ea	1
		TM 5-6675-324-14, OPERATOR'S ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT TSS SYNTHESIS SECTION	ea	1
		TM 5-6675-325-24P, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST FOR TSS SYNTHESIS SECTION	ea	1
15	6675-00-222-2542	MEASURER, MAP: (33363) 62-0300	ea	2
16	5340-00-682-1505	PADLOCK SET: (77765) MS21313-52	se	1
	6675-00-222-2535	PROTRACTOR, SEMICIRCULAR: (23366) P478	ea	4
		PUMP, INFLATING, MANUAL: (53800) 6 A 49454	ea	1

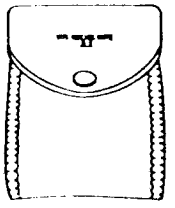
Section III BASIC ISSUE ITEMS — Cont



(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
17	5210-00-273-1965	RULE, STEEL, MACHINIST'S: (81349) MILR20387 TYPE1 CL1	ea	1
	6675-00-641-5727	SCALE, DRAFTING: (33363) 56-3280	ea	4
	6675-00-283-0035	SCALE, PLOTTING: (17866) GG-S-161/8, type VIII, shape 2, composition A, grade 1, size B, scale graduation 1, numbering A, style A	ea	4
	6675-00-283-0027	SCALE, PLOTTING: (23366) 28/YD, 10 in.	ea	4
	6675-00-283-0037	SCALE, PLOTTING: (23366) 28/MR, 12 in.	ea	4
18	5120-00-234-8913	SCREWDRIVER, CROSS TIP: size 2 (81348) GGG-S-121	ea	1
19	5120-00-234-8910	SCREWDRIVER, FLAT TIP: (78525) 1006	ea	1
	7510-00-224-7242	SHIELD, ERASING: (79819) 03-605	dz	1

Section III BASIC ISSUE ITEMS - Cont

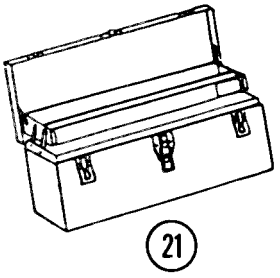


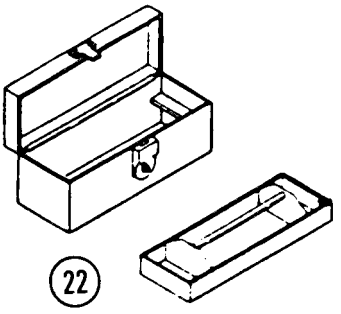


20

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
20	6675-00-641-3561	STEREOSCOPE, LENS, AERIAL PHOTOGRAPH, INTERPRETATION: (7D560) 51034, Abrams Model SV-1	ea	6
		STRAIGHTEDGE: (33363) 56-4150	ea	2
		STRAP ASSEMBLY, BUCKLE-END: 6.0 in. (82820) 1844-104	ea	9
		STRAP ASSEMBLY, BUCKLE-END: 8.0 in. (82820) 1844-101	ea	2
		STRAP ASSEMBLY, BUCKLE-END: 15.0 in. (82820) 1844-105	ea	1
		STRAP ASSEMBLY, TIP-END: 8.0 in. (82820) 1845-107	ea	7
		STRAP ASSEMBLY, TIP-END: 23.0 in. (82820) 1845-103	ea	1
		STRAP ASSEMBLY, TIP-END: 40.0 in. (82820) 1845-101	ea	2
		STRAP ASSEMBLY, WEBBING: 30.00 in. (98313) 13225E3695-8	ea	1
		STRAP ASSEMBLY, WEBBING: 35.00 in. (9831 3) 13225E3695-2	ea	6

Section Ill BASIC ISSUE ITEMS — Cont

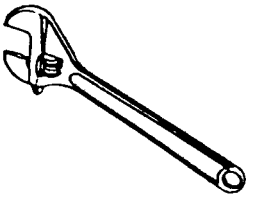




(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
		STRAP ASSEMBLY, WEBBING: 55.00 in. (98313) 13225E3695-6	ea	5
		STRAP ASSEMBLY, WEBBING: 72.C0 in. (98313) 13225E3695-1	ea	2
		STRAP ASSEMBLY, WEBBING: 94.00 in. (98313) 13225E3695-10	ea	2
		STRAP ASSEMBLY, WEBBING: 29.00 in. (98313) 13225E3695-13	ea	2
		STRAP ASSEMBLY, WEBBING: 65.00 in. (82820) 2058-102	ea	1
	6675-00-253-5501	TEMPLATE, DRAFTING: (79819) 831040	ea	4
21	5140-00-331-5496	TOOL BOX, PORTABLE: 1 fixed hinged tray (75206) CS 19	ea	6
22	5140-00-315-2747	TOOL BOX, PORTABLE: 1 removable tray (75206) CS 16	ea	1
		TRACER, NEEDLE: (36970) 1260 NK	ea	1
	6675-00-190-5863	TRIANGLE, DRAFTING: 245 degs (33363) 57-0292 size 10	ea	4

Section III BASIC ISSUE ITEMS — Cont

23



24

(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
	6675-00-190-5867	TRIANGLE, DRAFTING: 130 deg, 160 deg (33363) 57-0220 size 10	ea	4
	6675-00-183-6487	T-SQUARE: (81 562) 8068E	ea	2
23	5120-00-224-7271	VISE, PIN: (1 8037) PVDE	ea	2
24	5120-00-264-3795	WRENCH, ADJUSTABLE: (80244) GGG-W-631 TY1 CL1	ea	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I INTRODUCTION

D-1. SCOPE.

This appendix lists additional items you are authorized for the support of the Synthesis Section.

D-2. GENERAL.

This list identifies items that do not have to accompany the Synthesis Section and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA or JTA.

D-3. EXPLANATION OF LISTING.

National stock numbers, descriptions and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i,e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

Section II ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number	(2) Description FSCM and Part Number	(3) U/M	(4) Qty Rqr
	TOE AUTHORIZED ITEMS		
6675-02-641-3610	Drafting Equipment Set, Battalion: Charts, Sketches, and Overlays	ea	1
6675-00-202-8542	Interpretation Kit, Photographic	ea	1
5805-00-543-0012	Telephone Set: TA-312/PT	ea	1

APPENDIX E

EXPENDABLE/DURABLE 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 Synthesis Section. This listing is for information purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except Medical, Class V, Repair Parts and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable 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 (e.g., “Use cleaning compound, Item 5, Appendix E.").

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

C - Operator/Crew

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

e. Column (5) - *Unit of Measure ((J/M).* Indicates the measure used in performing the actual maintenance function. This measure is expressed by two-character alphabetical abbreviations (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/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	C	6810-00-223-2739	Acetone, Technical	pt
2	O	8040-00-174-2610	Adhesive, Rubber	cn
3	F	8040-00-152-0063	Adhesive, Waterproof	cn
4	C	6810-00-205-6786	Alcohol, Denatured	qt
5	C		Anderol Lubricant 495	tu
	C	7520-00-935-7136	Ball Point Pen (7981 9) VER-HR-84, black	dz
	C	7520-00-281-5911	Basket, Wastepaper (8D190) H10-34	ea
	C	7510-00-616-7471	Binder and Filler, Loose Leaf (65957) UU-B-356, grade C, 5 x 3 in. sh.	ea
	C	5110-00-359-6478	Blade, Craftsman Knife: Beveled (99941) 11	pg
	C	5110-00-542-2043	Blade, Craftsman Knife: Curved (99941) 10	pg
	C	5110-00-542-2044	Blade, Craftsman Knife: Square (99941) 17	pg
	C	5110-00-765-4144	Blade, Craftsman Knife: Stencil (99941) 16	pg
	C	8125-01-088-3553	Bottle, Adhesive Dispenser (8771 9) 500 plastic	ea
	C	7510-00-223-6706	Chalk, Marking: white (8541 9) 1402, white	gr
	C	7510-00-223-6702	Chalk, Marking: blue (70362) SS-C-266, grade A composition 3, blue	gr
	C	7510-00-223-6705	Chalk, Marking: red (8541 9) **SS-C-266,** grade A composition 3, red	gr

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	c	**7510-00-223-6707**	Chalk, Marking: yellow (79819) T2-1401	gr
	c	**8330-00-965-1722**	Chamois Leather, Sheepskin (39428) 7358T11	ea
	c	**6850-01-007-8073**	Cleaning Concentrate (7981 9) 3068	bt
6	c	**7930-00-664-6910**	Cleaner, Glass	co
7	**c**	**6850-00-592-3283**	Cleaner, Lens	bk
	c	**7510-00-161-4291**	Clip, Paper (7981 9) P2-72620	bx
8	**c**	**8305-00-222-2423**	Cloth, Cheesecloth	yd
	c	**8320-00-299-8625**	Cotton, Nonsterile (90878) JJJ-C-561, grade B 1 lb. roll	pg
9	**c**	**6515-00-303-8250**	Cotton Swabs	bg
10	**c**	**7930-00-530-8067**	Detergent, General Purpose	gl
	c	**7520-00-285-1772**	Dispenser, Pressure Sensitive Adhesive Tape (79819) C-22	ea
	c	**7530-00-268-3994**	Envelope, Wallet (87263) 1355E	bx
	c	**7510-01-099-3953**	Eraser (79819) 292-F	bt
	c	**7510-01-035-1317**	Eraser Kit (79819) 290-K	kt
	c	**7510-01-034-1278**	Eraser, Film (79819) 9600 (PT20)	bx
	c	**7510-00-634-5034**	Eraser, Rubber (D8230) 7099B	dz

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
11	F	5610-00-618-0258	Floor Patch	gl
12	O	9150-00-190-0904	Grease, GAA	lb
13	O	9150-00-616-9212	Grease, Silicone	bt
	C	7510-01-028-2877	Ink, Drawing (7981 9) 3080-F1	bt
	C	7510-01-070-8947	Ink, Drawing (7981 9) 3084-F	bt
	C	7510-01-039-5075	Ink, Drawing: Carmine Red (7981 9) 3080-F, CR	bt
	C	7510-01-035-8133	Ink, Drawing: Blue (7981 9) 3080-F1, Blue	bt
	C	7510-01-035-8131	Ink, Drawing: Brown (7981 9) 3080-F1, Brown	bt
	C	7510-01-035-8132	Ink, Drawing: Green (79819) 3080-F1, Green	bt
	C	7510-0” -036-3726	Ink, Drawing: Orange (7981 9) 3080-F1, Orange	bt
	C	7510-0” -080-1481	Ink, Drawing: Red (7981 9) 3080-F1, Red	bt
	C	7510-01-036-3725	Ink, Drawing: Violet (7981 9) 3080-F1, Violet	bt
	C	7510-01-035-8130	Ink, Drawing: Yellow (7981 9) 3080-F1, Yellow	bt
	C	7510-00-281-2143	Lead, Pencil, Graphite: HB (7981 9) 2200-HB	bx
	C	7510-00-285-5865	Lead, Pencil, Graphite: F (7981 9) 2200-F	pg
	C	7510-00-285-5866	Lead, Pencil, Graphite: H (7981 9) 2200-H	pg

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	c	7510-00-285-5863	Lead, Pencil, Graphite: 2H (79819) 2200-2H	pg
	c	7510-00-272-9820	Lead, Pencil, Graphite: 3H (7981 9) 2200-3H	pg
	c	7510-00-285-5884	Lead, Pencil, Graphite: 4H (79819) 2200-4H	pg
	c	7510-00-285-5862	Lead, Pencil, Graphite: HB (8D190) U2-F370-HB	pg
	c	7510-00-285-5847	Lead, Pencil, Graphite: 2H (8D190) U2-F350-2H	pg
14	F	9150-00-273-2389	011, Lubricating, General Purpose	cn
15	c	9150-00-252-6382	Oil, Lubricating, Watch	bt
	c	7530-00-285-3083	Pad, Writing Paper (8D190)M9-21-112	pg
16	o	8010-01-131-6254	Paint, Black	kt
16A	0	8010-01-160-6745	Paint, Brown	kt
165	0	8010-01-162-5578	Paint, Green	kt
17	0	8010-00-298-3859	Paint, Light Green, INT.	gl
18	c	5350-00-619-9166	Paper, Abrasive	pk
	c	7530-00=871 -8310	Paper, Drawing (33363) 15-2155, size 24 x 30 in.	pg
	c	6750-01-042-0336	Paper, Dry Silver (76381) 78-6529-5107-1	ct

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	c		Paper, Graph (33363) 48-5094,50 yds x 22 in. w	ro
	c		Paper, Graph (33363) 48-6002, 50 yds lg, 12 in. w	ro
	c	6640-00-559-1384	Paper, Lens (97942) M42215AJ	pg
19	c	7920-00-982-1203	Paper Towels	bk
	c	7530-01-006-4496	Paper, Tracing (33363) 10-9155, 24 x 30 in.	pg
	c	75 0-00-286-6985	Paperweight (33363) 58-0810	ea
	c	75 0-00-233-2027	Pencil: blue (79819) 1344, blue	dz
	c	7510-00-264-4610	Pencil: green (79819) 1800-16, green	dz
	c	7510-00-233-2021	Pencil: red (79819) 1800-39, red	dz
	c	75 0-00-264-4608	Pencil: yellow (79819) 1800-5, yellow	dz
	c	75 0-00-240-1526	Pencil: black (79819) 1555, black	dz
	c	7510-00-436-5210	Pencil: blue (79819) 1555, blue	dz
	c	7510-00-275-7212	Pencil: green (7981 9) 1555, green	dz
	c	7510-00-174-3205	Pencil: red (7981 9) 1555, red	dz

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST- Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	c	7510-00-264-4612	Pencil, Grease, Yellow (81348) SS-P-183-TYPE 1	dz
	c	7520-00-161-5664	Pencil Mechanical: automatic (8D190) VCS-P400	ea
	c	7520-01-083-6734	Pencil Mechanical: non automatic (7981 9) 5611	ea
	c	7510-01-030-7427	Pen Point Assortment and Penholder (7981 9)3165-JDCS9	se
	c	6675-01-107-9678	Pen Points: 0.13 mm, pink (79819) 72DJ, 0.13 mm	ea
	c	6675-01-098-1219	Pen Points: 0.18 mm, lavender (79819) 72DJ, 0.18 mm	ea
	c	6675-01-098-1220	Pen Points: 0.25 mm, beige (79819) 72DJ, 0.25 mm	ea
	c	6675-01-107-9679	Pen Points: 0.35 mm, grey (79819) 72DJ, 0.35 mm	ea
	c	6675-01-098-1221	Pen Points: 0.50 mm, red (79819) 72DJ, 0.50 mm	ea
	c	6675-01-099-3440	Pen Points: 0.70 mm, light blue (79819) 72DJ, 0.70 mm	ea
	c	6675-01-098-0308	Pen Points: 1.00 mm, orange (7981 9) 72DJ, 1.00 mm	ea
	c	6675-01-098-1222	Pen Points: 1.40 mm, cordovan brown (7981 9) 72DJ, 1.40 mm	ea
	c	6675-01-097-4516	Pen Points: 2.00 mm, cerise red (79819) 72DJ, 2.00 mm	ea
	c	7510-00-174-7343	Pin, Straight (8D190) P3-780C	bx

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST - Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C		Plastic Sheet (33363) 44-1037,24 in w, 30 in. lg	pg
	C		Plastic Sheet (33363) 44-1057,24 in. w, 30 in. lg.	pg
	C		Plastic Sheet Tracing (33363) 19-1253, 30.0 in. x 24.0 in.	pg
	O	8010-01-193-0520	Primer	kt
	C	7510-00-543-6792	Refill, Ball Point Pen (79819) VER-4	dz
20	F	8010-01-030-7254	Resin, Epoxy	kt
	c	7510-00-926-9146	Ribbon, Typewriter (6P460) 451-8183	ea
	C	7510-00-243-3435	Rubber Band (7981 9) N1 -8366-64	bx
21	O		Screen, Nylon (39428) 1017A31	ro
22	0	8040-00-851-0211	Sealant, Silicone	tu
	C	5110-00-161-6912	Shears, Straight Trimmers (901 37) 509-S9	ea
23	O	3439-00-273-3722	Solder, Rosin Core	s
24	0	6850-00-274-5421	Solvent, P-D-680	cn
25	0	8010-00-160-5851	Spar Varnish	qt
26	C	6850-00-880-1013	Spray, Silicone	cn
27	O		Sprayfoam Sealant (39428) 7627T1	cn

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST — Cont

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
	C	7520-00-281-5895	Stapler, Paper Fastening, Office: (8D190) X8-27, grey	ea
	C	5345-00-265-3126	Stone, Sharpening: (10670) 3501-3517	ea
28	O	5640-00-103-2254	Tape, Cloth, Duct Sealing, 2 in.	ro
29	C	7510-00-283-0612	Tape, Painter's Masking	ro
	C	7530-01-061-2301	Tape, Paper, Computing Machine (28480) 82045A	bx
	C	7510-00-550-7126	Tape, Pressure Sensitive Adhesive (99742) P45	ro
	C	7510-00-234-7960	Tape, Pressure Sensitive Adhesive (76381) 600	ro
	C	7510-00-551-9824	Tape, Pressure Sensitive Adhesive (76381) 810	ro
	C	7510-00-198-5831	Tape, Pressure Sensitive Adhesive (76381) 230	ro
	C	7510-00-634-1549	Tape, Pressure Sensitive Adhesive (76381) 666, 1.0 in.	ro
	C	7510-00-272-6887	Thumbtack (79819) V6-54	hd
30	C	6640-00-597-6745	Tissue, Lens cleaning	bk
	C	7920-00-823-9772	Towel, Paper (951 35) DW61 -1000-22	mx
	C	4020-00-241-8892	Twine, Fibrous (75678) T-R-650, type III	lb

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GLOSSARY

ABBREVIATION/TERM	DEFINITION
Constant	Factor used to convert electronic measurement counts of rolling disk planimeter or linear probe to desired physical unit, such as feet, inches, yards, etc.
Contour	Closed loop on contour map, plan, drawing, etc. Also called isorhythm.
Contour Interval	Difference in elevation of two consecutive contour lines. Note: Sometimes referred to as section interval.
Contour Method	Estimates volume of fill or cut via its contours.
Cut	Excavation- or depression-like formation.
Daylighted (Contour)	Point or edge where cut becomes fill or vice versa.
Fill	Embankment or hilly formation.
Micro ()	Resolution factor (or planimeter unit) for linear measuring probe or for rolling disk planimeter at specified tracer arm length. Represents smallest area or length measuring instrument can measure. Measuring instrument emits single pulse count for each unit.
Pad	One contour.
Planimeter	Instrument that provides data used to estimate area of geometric shape by tracing its boundary line.
Program Flag	(Calculator) Memory device, set either true or false, to install decision capabilities into a program.
QPS	Quantity Processing System.
R_L (or R_2)	Calibration reading of linear measuring probe representing total number of pulse counts emitted by probe per unit of length (inches or centimeters).

GLOSSARY - Cont

ABBREVIATION/TERM	DEFINITION
R_T(or R_1)	Calibration reading of rolling disk planimeter representing total number of pulse counts derived by measuring area described by a test rule.
Scale Ratio	Ratio between given distance on map or drawing to corresponding distance on ground.
Slope	Natural or artificial incline or slant of ground.
Subroutine	Distinct routine/program, part of larger routine/program, that will perform its own distinct manipulations of data when called up.
Toe	Lowest point, in terms of elevation, of embankment.

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Chief of Staff

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The Adjutant General

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TM 5-6675-325-14	20 June 1985	Topographic Support System, Synthesis Section

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 Cylenders. The engine on my set only has 4 Cylenders. Change the manual to show 4 Cylenders.
B1		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE: John Doe
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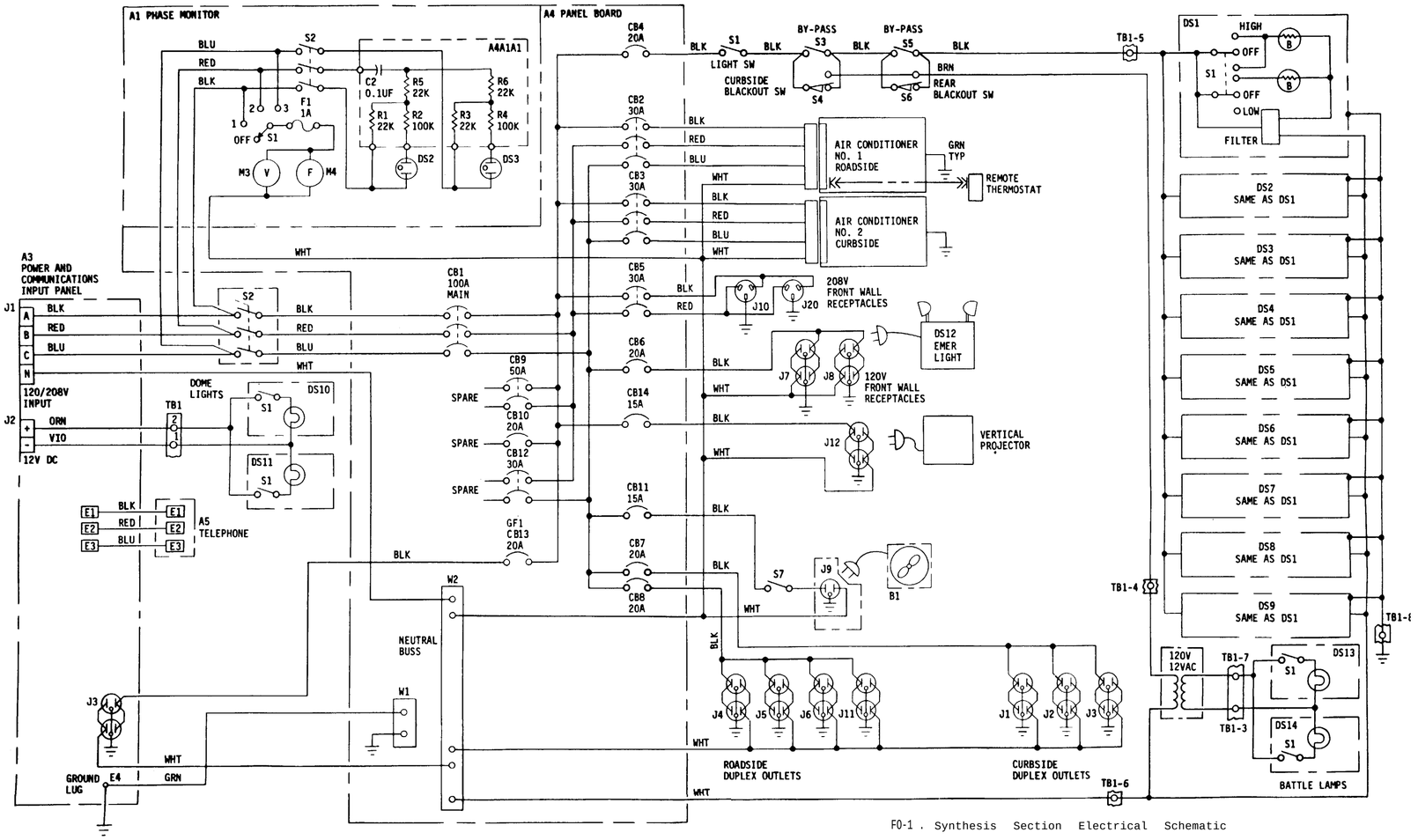
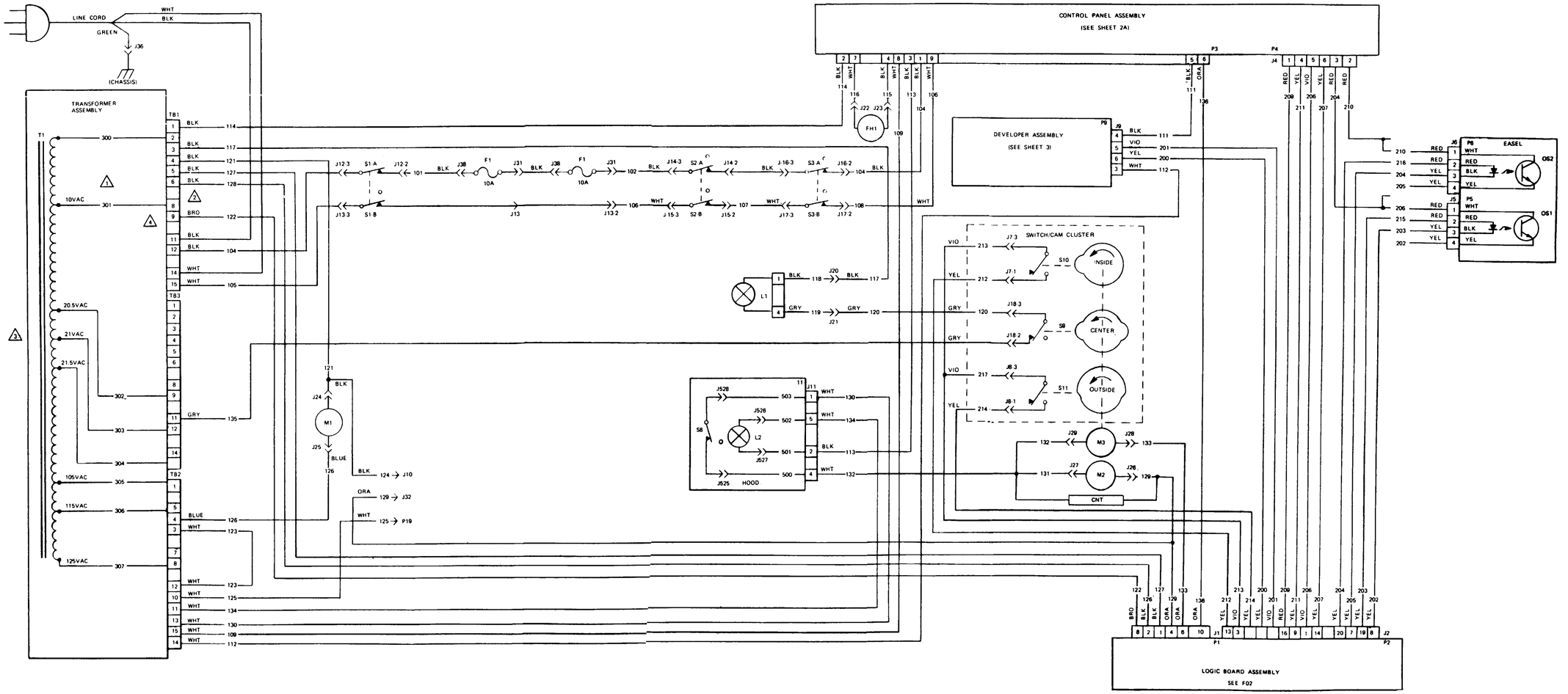


FO-1 . Synthesis Section Electrical Schematic

REFERENCE DESIGNATION	DESCRIPTION
F1	Fuse, Line
FH1	Fan Lamp
H1 thru H10	Heater, Rope (Sh. 3)
L1	Lamp, Exposure
L2	Lamp, Standby (Sh. 2B)
L3	Lamp, Paper (Sh. 2B)
M1	Motor, Developer
M2	Motor, Paper
M3	Motor, Mirror
OS1	Sensor, Short Paper
OS2	Sensor, Long Paper
S1	Switch, Left Door Interlock
S2	Switch, Rear Cover Interlock
S3	Switch, Right Door Interlock
S4	Switch, On/Off (Sh. 2B)
S5	Switch, View/Standby (Sh. 2B)
S6	Switch, Print (Sh. 2B)
S7	Switch, Print Length (Sh. 2B)
S8	Switch, Screen Interlock
S9	Switch, Exposure Lamp
S10	Switch, Mirror Home
S11	Switch, Mirror Forward
S12	Switch, Temperature Sensing (Sh. 3)
T1	Transformer, Power
TB1 thru TB6	Terminal Blocks, Transformer
TBH1, TBH2	Terminal Blocks, Developer (Sh. 3)
TC1	Thermostat, Temperature Control (Sh. 3)
VR1	Potentiometer, Exposure (Sh. 2B)

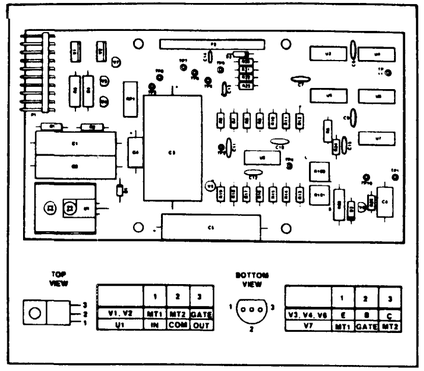
NOTES

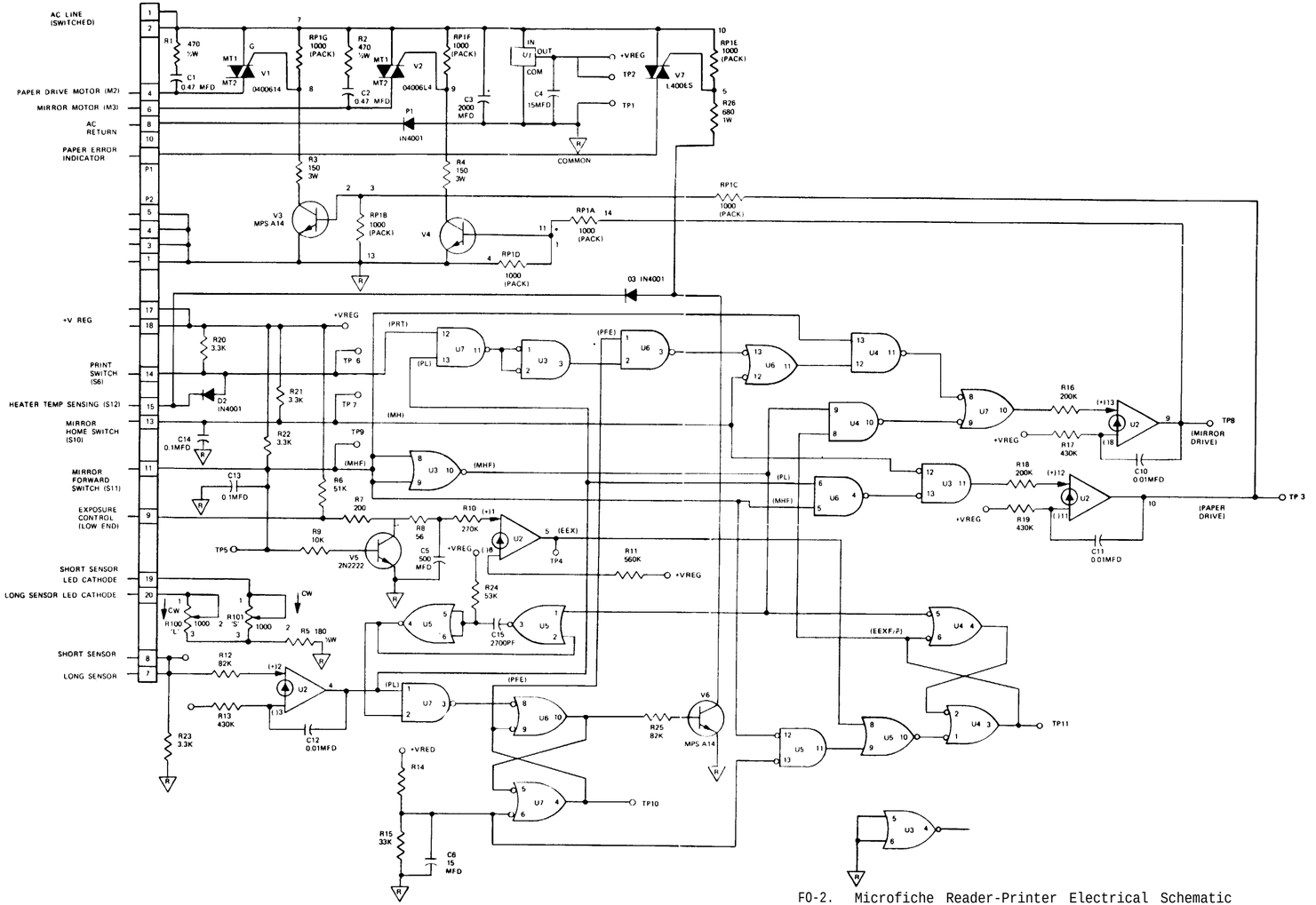
1. THE TRANSFORMER VOLTAGES SHOWN ARE WITH 115 VAC BETWEEN TRANSFORMER WIRES 300 AND 307.
2. THE DARK, UNNUMBERED POSITIONS ON TB1 THROUGH TB5 INDICATE A POLARIZING KEY AT THAT LOCATION.
3. 21 VAC LAMP VOLTAGES BETWEEN TB4-4 AND TB3-2.
4. 10 VAC LOGIC BOARD VOLTAGE BETWEEN TB3-8 AND TB3-2.
5. SCHEMATIC SHOWS MACHINE WARMED-UP, READY TO PRINT, WITH S5 IN THE VIEW POSITION.



FO-2. Microfiche Reader-Printer Electrical Schematic (Sheet 1 of 2)

REFERENCE DESIGNATION	DESCRIPTION
C1, C2	Capacitor, 0.47UF, 200 VDCW Sprague 416P47492)
C3	Capacitor, 2000UF + 80, 20%, 25 VDCW (Sprague 43D202G025JK1)
C4, C6	Capacitor, Aluminum, 15UF, 10%, +75%, 12 VDCW (Sprague 30D156G012BA5)
C5	Capacitor, Aluminum, 500UF ± 10%, 25 VDCW (Sprague 6300105)
C7 thru C12	Capacitor, Ceramic, 0.01UF, 20%, +80%, 100 VDCW (Sprague C0238101F1032)
C13, C14	Capacitor, 0.1UF + 80%, 20%, 50 VDCW (Sprague 1CZ5U104B050C4)
C15	Capacitor, Ceramic 2700PF ± 20%, 1000 VDCW (Sprague C0238102F272M)
D1, D2, D3	Diode (IN4001)
P1	Connector, 10 Pin (Molex 09-88-2101)
P2	Connector, 20 Pin (Molex 22-11-2201)
R1, R2	Resistor, Carbon, 470 Ohms ± 10%, 1/2W
R3, R4	Resistor, Wirewound, 150 Ohms ± 5%, 3W (Ohmite 223S150R0J)
R5	Resistor, Carbon, 180 Ohm ± 5%, 1/2W
R6	Resistor, Carbon, 51K ± 5%, 1/4W
R7	Resistor, Carbon, 200 Ohms ± 5%, 1/4W
R8	Resistor, Carbon, 56 Ohms ± 5%, 1/4W
R9	Resistor, Carbon, 10K ± 5%, 1/4W
R10	Resistor, Carbon, 270K, ± 5%, 1/4W
R11	Resistor, Carbon, 560K ± 5%, 1/4W
R12, R25	Resistor, Carbon, 82K ± 5%, 1/4W
R13, R17, R19	Resistor, Carbon, 430K ± 5%, 1/4W
R14,R20,R21,R22,R23	Resistor, Carbon, 33K ± 5%, 1/4W
R15, R24	Resistor, Carbon, 33K ± 5%, 1/4W
R16, R18	Resistor, Carbon, 200K ± 5%, 1/4W
R26	Resistor, Carbon, 680 Ohms ± 10%, 1W
R100, R101	Potentiometer, 1K (Bourns 3386P 1 102)
RP1	Resistor, Network, 1K (Pyrofilm PD14M)
TP1 thru TP11	Terminal, Test Point (Useco 2520B-4)
U1	Integrated Circuit (Fairchild 78M05UC)
U2	Integrated Circuit (LM3900)
U3, U5	Integrated Circuit (RCA CD4001AE)
U4, U6, U7	Integrated Circuit (RCA CD4011AE)
V1, V2	Triac, (04006L4)
V3, V4, V6	Transistor, (MPS-A14)
V5	Transistor (2N2222)
V7	Triac, (L400E5)





FO-2. Microfiche Reader-Printer Electrical Schematic (Sheet 2 of 2)

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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 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 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 centiliter = 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. feat
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. millimeter = .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	1.608	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	squme meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.580	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	29,673	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