DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

ANALYZERS

ZM-3/U AND ZM-3A/U

This copy is a reprint which includes current pages from Changes 1 through 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY
MAY 1958

WARNING

EXTREMELY DANGEROUS VOLTAGES ARE PRESENT ON THE FRONT PANEL OF THIS EQUIPMENT. SERIOUS INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.

All operating adjustments of this equipment are made with the power on. During operation, voltages as high as 600 volts are present at the leakage terminals and the insulation resistance terminals (fig. 4) on the equipment front panel.

GPO 801-593-1

Changes in force: C 1, C 2, and C 3

CHANGE } No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 7 December 1973

Operator's and Organizational Maintenance Manual

ANALYZERS ZM-3/U AND ZM-3A/U

TM 11-5043-12, 27 May 1958, is changed as follows:

Page 3, paragraph 2. Delete paragraph 2 and substitute:

2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

Paragraph 2.1. Delete paragraph 2.1 and substitute:

2.1. Maintenance Forms and Records
Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

2.2. Reporting of Equipment Publication Improvements
The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications), and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-C Fort Monmouth, NJ 07703.

Page 24, appendix III. Delete appendix III.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

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

Distribution:
Active Army:
CNGB (1)
Dir of Trans (1)
COE (1)
TSG (1)
ACSC-E (2)
USAMB (10)
USAARENBD (2)
USASA (2)
TRADOC (2)
AMC (1)
MICOM (2)
TECOM (2)
ARADCOM (2)
ARADCOM Rgn (1)
OS Maj Comd (2)
USACDCEC (10)
USASTRATCOM (2)
HISA (ECOM) (18)
Armies (1)
USASESS (5)
Svc Colleges (1)
Ft Huachuca (5)

TAGO 3295A

WSMR (1)
Ft Carson (7)
USAERDAA (1)
USAERDAW (1)
Army Dep (1) except
LBAD (10)
SAAD (30)
TOAD (14)
ATAD (10)
Gen Dep (1)
Sig Sec Gen Dep (3)
Sig Dep (3)
Sig FLDMS (1)
Ft Richardson (ECOM Ofc) (2)
Units org under fol TOE:
(1 cy each)
11-158
29-134
29-136

NG: State AG (3).
USAR: None.
For explanation of abbreviations used, see AR 310-50.

GPO 807-103

Changes in force: C 1 and C 2

Operator's and Organizational Maintenance Manual

ANALYZERS ZM-3/U AND ZM-3A/U

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *20 July 1964*

TM 11-5043-12, 27 May 1958, is changed as follows:

Note. The parenthetical reference to previous changes (example: "page 1 of C 1") indicates that pertinent material was published in that change.

Page 3, paragraph 2.1 (page 1 of C 1). Delete subparagraph c and substitute:

c. Reporting of Equipment Manual Improvements. The direct reporting, by the individual user, of errors, omissions, and recommendation for improving this manual, is authorized and encouraged. DA Form 2028 (Recommended changes to DA publications) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-MR-MP-P, Fort Monmouth, N.J. 07703. One information copy will be furnished to the individual's immediate supervisor (officer, non-commissioned officer, supervisor, etc.).

Page 24, Appendix II. Delete and substitute:

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*This change, together with TM 11-6625-241-20P, 20 July 1964, supersedes TM 11-6625-241-12P, 18 September 1958.

APPENDIX II

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

1. General

a. This section assigns maintenance functions to be performed on components, assemblies, and subassemblies by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) Part or component. This column shows only the nomenclature or standard item name. Additional descriptive data are included only where clarification is necessary to identify the component. Components, assemblies, and subassemblies are listed in top-down order, that is, the assemblies which are part of a component are listed immediately below that component, and the subassemblies which are part of an assembly are listed immediately below that assembly. Each generation breakdown (components, assemblies, or subassemblies) is listed in disassembly order or alphabetical order.

(2) Maintenance function. This column indicates the various maintenance functions allocated to the echelons.

(a) Service. To clean, to preserve, and to replenish lubricants.

(b) Adjust. To regulate periodically to prevent malfunction.

(c) Inspect. To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(d) Test. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(e) Replace. To substitute serviceable 2 components, assemblies, or subassemblies, for unserviceable components, assemblies, or subassemblies.

(f) Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

(g) Align. To adjust two or more components of an electrical system so that their functions are properly synchronized.

(h) Calibrate. To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(i) Overhaul. To restore an item to completely serviceable condition as prescribed by serviceability standards. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

(j) Rebuild. To restore an item to a standard as near as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or

components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and/or specifications, and subsequent reassembly of the item.

(3) *1st, 2d, 3d, 4th, 5th echelons*. The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required*. This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool and maintenance equipment required to perform the maintenance function.

(5) *Remarks*. Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding column.

c. Columns in the allocation of tools for maintenance functions are as follows:

(1) *Tools required for maintenance functions*. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(3) *1st, 2d, 3d, 4th, 5th echelons*. The dagger (t) indicates the echelons normally allocated the facility.

(3) *Tool code*. This column lists the tool code assigned.

2. Maintenance by Using Organizations

When this equipment is used by signal services organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

SECTION II MAINTENANCE ALLOCATION CHART

PART OR COMPONENT	MAINTENANCE FUNCTION	1ST ECH	2ND ECH	3RD ECH	4TH ECH	5TH ECH	TOOLS REQUIRED	REMARKS
ANALYZERS ZM-3/U; ZM-3A/U	service	X						
	inspect	X						
	test		X				9, 3	Circuit Continuity-tubes etc.
	repair		X				9	Easily replaced items
					X		8	
	adjust				X		8	
	calibrate				X		1, 4 5, 6, 7	
	overhaul				X		1, 3, 4, 5, 6, 7	

SECTION III ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

PART OR COMPONENT	1ST ECH	2ND ECH	3RD ECH	4TH ECH	5TH ECH	TOOL CODE	REMARKS
ANALYZERS ZM-3/U; ZM-3A/U							
MULTIMETER TS-352			t	t	1		
TEST SET, ELECTRON TUBE TV-2				t	2		
TEST SET, ELECTRON TUBE TV-7			t		3		
METER TESTER TS-656			t	t	4		
METER TEST SET TS-682/GSM-1			t	t	5		
TEST SET, CAPACITANCE-IND-RES AN/URM-90			t	t	6		
CRYSTAL RECTIFIER TEST SET TS-268E			t	t	7		
TOOL EQUIPMENT TK-21/G			t	t	8		
TOOLS AND TEST EQUIPMENT ASSIGNED TO ORGANIZATIONAL REPAIRMAN BY VIRTUE OF HIS ASSIGNED MISSION		t				9	

APPENDIX III (added)

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix lists items supplied for initial operation and for running spares. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis of requisitioning

2. Columns

Columns are as follows:

a. Federal Stock Number. This column lists the 11-digit Federal stock number.

b. Designation by Model. The dagger (t indicates equipment in which the part is used.

c. Description. Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

d. Unit of Issue. The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances and issue purposes.

e. Expendability. Nonexpendable items are indicated by NX. Expendable items are not annotated.

f. Quantity Authorized. Under "Items Comprising an Operable Equipment, " the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spare Items" the quantities listed are those issued initially with the equipment as spart parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

3. Illustration

The "Item No." column lists the reference symbols used for identification of the items in the illustration or text of the manual.

SECTION II. FUNCTIONAL PARTS LIST

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL						DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
											FIGURE NO.	ITEM NO.
							ANALYZERS ZM-3/U; ZM-3A/U					
6625-229-1060							ANALYZERS ZM-3/U; ZM-3A/U: capacitance range 5 uuf to 10 uf;105v to 125v; 210v to 250v; 50 to 1600 cyc					
							NOTE: Model Column 1 refers to ZM-3/U; Model Column 2 refers to ZM-3A/U					
							ITEMS COMPRISING AN OPERABLE EQUIPMENT					
ORD thru AGC	†	†					TECHNICAL MANUAL TM 11-5043-12			2		
	†	†					ANALYZERS ZM-3/U; ZM-3A/U: (Basic Component)		NX	1		
							RUNNING SPARE ITEMS					
5960-503-4880	†	†					ELECTRON TUBE: MIL type 0A2WA			1		V5
5960-262-3763	†	†					ELECTRON TUBE: MIL type 0B2WA			1		V6,V7
5960-188-0883	†	†					ELECTRON TUBE: MIL type 6SL7WGT			1		V8
5960-557-6780	†	†					ELECTRON TUBE: MIL type 6C4WA			1		V2
5960-188-0880	†	†					ELECTRON TUBE: MIL type 6X4W			1		V4
5960-107-8160	†	†					ELECTRON TUBE: MIL type 12AU7			1		V1
5960-114-4868	†	†					ELECTRON TUBE: MIL type 807			1		V9
5960-264-2089	†	†					ELECTRON TUBE: MIL type 5749/6BA6W			1		V3
5920-474-6125	†	†					FUSE,CARTRIDGE: 2 amp, 250v; MIL type F02A250VAS			5		F1,F2
6240-132-5351	†	†					LAMP,INCANDESCENT: 115v, 6w, S-6 clear;1-3/4 in lg o/a; GE No. 6S6DC(115v)			1		R4,R38
6240-155-8706	†	†					LAMP,INCANDESCENT: 6-8v, 6.3 amp;T-3-1/4, 1-3/16 in lg o/a; GE No. 47			1		E1

By Order of the Secretary of the Army:

HAROLD K. JOHNSON
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

USASA (2)
CNGB (1)
CofT (1)
CofEngrs (1)
TSG (1)
CC-E (2)
CofSptS (1)
USACECDA (Ft Huachuca) (1)
USACECDA (Ft Monmouth) (1)
USAARMBD (2)
USAARTYBD (2)
USCONARC (2)
USAMC (2)
USAMICOM (2)
USAECOM (2)
USASMCOM (3)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (2)
OS Base Comd (2)
USASCC (2)
Armies (1)
USASCS (2)
11th Air Assault Div (3)
Svc Colleges (1)
GENDEP (0S) (1)
Sig Sec, GENDEP (4)
Sig Dep (OS) (6)
Lexington Army Dep (6)
Sacramento Army Dep (6)
Tobyhanna Army Dep (6)
Letterkenny Army Dep (5)
Ft Worth Army Dep (5)
Sharpe Army Dep (3)
Navajo Army Dep (5)
Charleston Army Dep (1)
Savanna Army Dep (5)
Ft Huachuca (1)
WSMR (1)
Sig Fld Maint Shops (1)
USA Elct R&D Lab (6)
USA Engr R&D Lab (2)
USA Cold Rgns RE Lab (2)
Chicago Proc Dist (1)
Oakland Army Tml (5)
1st USASA Fld Sta (1)
Units org under fol TOE:
11-587 (2)
11-592 (2)
11-597 (2)

NG: State AG (3) ; units-same as active Army except allowance is one (1) copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320-50.

892-771

TECHNICAL MANUAL
Operator's and Organizational Maintenance Manual
ANALYZERS
ZM-3/U AND ZM-3A/U

TM 11-5043-12
CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *19 July 1963*

TM 11-5043-12, 27 May 1958, is changed as follows:

Page 3. Make the following changes:

Delete paragraph 1f.

Delete paragraph 2 in its entirety and substitute:

2. Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to your equipment. DA Pam 310-4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc) and the latest changes to and revisions of each equipment publication.

After paragraph 2, add paragraph 2.1.

2.1. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71-4 (Air Force).

c. Comments on Manual. Forward all comments on this publication direct to: Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N.J. DA Form 1598 (Record of Comments on Publications), DA Form 2496 (Disposition Form), or letter may be used.

Page 16. Delete paragraphs 21 and 22 and substitute:

Section I. OPERATOR'S MAINTENANCE

21. Scope of Maintenance

The maintenance duties assigned to the operator of the analyzer are listed below together with a reference to the paragraphs covering the specific maintenance function. The duties assigned do not require tools or test equipment other than those issued with the analyzer.

a. Daily preventive maintenance checks and services (par. 22.2).
b. Weekly preventive maintenance checks and services (par. 22.3).
c. Cleaning (par. 22.4).
d. Troubleshooting (par. 23).
e. Repairs and adjustments:
(1) Replacement of fuses (par. 24b).
(2) Replacement of pilot lamp (par. 24c).
(3) Replacement of lamp R4 or R38 (par. 24d).
(4) Replacement of tubes (par. 24e).

22. Operator's Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 22.2 through 22.4 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (pars. 22.2 and 22.3) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat

serviceability, the charts indicate what to check, how to check, and what the normal conditions are; the references column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by the operator, higher echelon maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

22.1. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the analyzer are required daily. Paragraph 22.2 specifies the items to be checked and serviced. In addition to the routine daily checks and services, the equipment should be rechecked and serviced immediately before going on a mission and as soon after completion of the mission as possible.

22.2. Daily Preventive Maintenance Checks and Services Chart

Sequence	Item	Procedure	References
1	Completeness	Check to see that the equipment is complete	TM 11-6625-241-12P.
2	Cleanliness	Remove dirt and moisture from the surfaces, connectors, cables and meter and dial windows.	Paragraph 22.4.
3	Meter	Inspect the meter for broken or cracked glass.	
4	Fuses	Check the fuses to see that they are properly seated and that they are not burned out. Replace if necessary.	Paragraph 24b.
5	Lamp	Inspect the pilot lamp for proper seating. Check to see if the lamp filament is open. Replace if necessary.	Paragraph 24c.
6	Knobs and switches	While operating the equipment, observe that the mechanical action of each knob and switch is smooth and free from binding.	
7	Meter pointer	Check the meter pointer for erratic movement while operating the equipment.	
8	Operation	During operation, be alert for any unusual performance or condition.	Paragraph 23.

22.3. Weekly Preventive Maintenance Checks and Services Chart

Sequence	Item	Procedure	References
1	Power cable	Inspect power cable for breaks, deterioration, and loose connectors.	
2	Exterior items	Inspect for looseness of accessible items such as clamps, hinges, panel hardware, and terminals. Tighten if necessary.	
3	Exterior surfaces	Inspect exposed metal surfaces for rust, fungus, and corrosion.	

22.4. Cleaning

Inspect the exterior of the analyzer. The exterior surfaces should be c(lean and free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean soft cloth.

Warning: Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. Do not use near a flame.

b. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with cleaning compound.

c. Remove dust or dirt from plugs and jacks with a brush.

Caution: Do not press on the meter face (glass) when cleaning; the meter may be damaged.

d. Clean the front panels, meters, and control knobs; use a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water; mild soap may be used for more effective cleaning.

Section II. ORGANIZATIONAL MAINTENANCE

22.5. Organizational Preventive Maintenance

a. Organizational preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all echelons concerned with the equipment and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of the analyzer at the second echelon level are made at monthly intervals unless otherwise directed by the commanding officer.

b. Maintenance forms and records to be used and maintained on this equipment ale specified in TM 38-750.

22.6. Monthly Maintenance

Perform the maintenance functions indicated in the monthly preventive maintenance checks and services chart (par. 22.7) once each month. A month is defined as approximately 30 calendar days of 8-hour-per-day operation. If the equipment is operated 16 hours a day, the monthly preventive maintenance checks and services should be performed at 15-day intervals. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions. Equipment maintained in a standby (ready for immediate operation) condition must have monthly preventive maintenance checks and services performed on it. Equipment in limited storage (requires service before operation) does not require monthly preventive maintenance.

22.7. Monthly Preventive Maintenance Checks and Services Chart

Sequence	Item	Procedure	References
1	Completeness	See that the equipment is complete (TM 11-6625-241-12P).	
2	Installation	See that the equipment is properly installed (pars. 11a and b).	
3	Cleanliness	See that the equipment is clean (par. 22.4).	
4	Preservation	Check all surfaces for evidence of fungus. Remove rust and corrosion and spot-paint bare spots.	Paragraph 22.8.
5	Publications	See that all publications are complete, serviceable, and current	DA Pam 310-4.
6	Modifications	Check DA Pam 310-4 to determine if new applicable MWO's have been published. All URGENT MWO's must be applied immediately. All ROUTINE MWO's must be scheduled.	DA Pam 310-4.
7	Pluckout items	Inspect clamps and seating of pluckout items. Check for wrong, bent, or broken parts.	Figures 9 and 10.
8	Resistors and capacitors	Inspect resistors for cracks and blistering and capacitors for broken or cracked insulation.	
9	Rotary switches	Inspect rotary switches for broken wires and insulators.	
10	Screw-type terminals	Check to see that all screw-type terminals area secure. Tighten as necessary (fig. 4).	
11	Meter	Inspect the meter for broken or cracked glass.	
12	Fuses	Check the fuses to see that they are properly seated and that they are in operating condition. Replace if necessary.	Paragraph 24b.
13	Lamps	Inspect the pilot lamp (fig. 4) and filter lamp R38 or R4 (fig. 10) for open filaments. Replace if necessary.	Paragraphs 24c and d.
14	Knobs and switches	While making the operating checks, observe that the mechanical action of each knob and switch is smooth and free from binding.	
15	Meter pointer	Check the meter pointer for erratic movement when operating the equipment.	
16	Operating check	Refer to paragraph 23.	
17	Spare parts	Check all spare parts for general condition and method of storage. There should be no evidence of overstock, and all shortages must be on valid requisitions.	TM 11-6625-241-12P.

22.8. Cleaning and Touchup Painting Instructions

Clean rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect if from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 9-213.

Page 17. Delete figure 7.

Page 18. Delete figure 8.

Page 23, appendix I. Add the following:

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 9-213	Painting Instructions for Field Use.
TM 11-6625-241-12P	Operator's and Organizational Maintenance Repair Parts and Special Tools Lists for Analyzers ZM-3/U and ZM-3A/U.
TM 38-750	The Army Equipment Record System and Procedures.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DASA (6)	USA Trans Tml Comd (1)	11-156
USASA (2)	Army Tml (1)	11-157
CNGB (1)	POE (1)	11-158
Cof Engrs (1)	USAOSA (1)	11-165
TSG (1)	AMS (1)	11-167
CSigO (7)	WRAMC (1)	11-500 (AA-AC, RM-RU)
CofT (1)	AFIP (1)	11-555
C/Spt Svcs (1)	Army Pic Cen (2)	11-557
USA CD Agcy (1)	USA Mbl Spt Cen (1)	11-587
USCONARC (5)	USA Elct Mat Agcy (12)	11-592
USAMC (5)	Chicago Proc Dist (1)	11-597
ARADCOM (2)	USARCARIB Sig Agcy (1)	11-608
ARADCOM Rgn (2)	Sig Fld Maint Shop (3)	17
OS Maj Comd (3)	USA Corps (3)	29-1
OS Base Comd (2)	Units organized under following	29-21
LOGCOMD (2)	TOE's:	29-25
USAECOM (5)	Two copies each unit:	29-26
USAMICOM (3)	5-600	29-27
USASCC (4)	5-605	29-35
MDW (1)	7	29-36
Armies (2)	7-52	29-37
Corps (2)	7-100	29-56
USATC AD (2)	9-47	32-56
USATC Engr (2)	9-87	32-67
USATC Inf (2)	9-227	37
USATC Armor (2)	9-377	37-100
Instl (2) except	9-500 (AA-AC)	44-435
Ft Monmouth (63)	11-5	44-437
Svc College (2)	11-6	44-445
Br Svc Sch (2)	11-7	44-446
GENDEP (OS) (2)	11-15	44-447
Sig Dep (OS) (12)	11-16	44-448
Sig Sec, GENDEP (OS) (5)	11-36	44-535
Army Dep (2) except	11-38	44-536
Ft Worth (8)	11-55	44-537
Lexington (12)	11-56	44-544
Sacramento (28)	11-57	44-545
Tobyhanna (12)	11-68	44-546
Frankford Arsenal (5)	11-96	44-547
USA Elct RD Actv, White Sands	11-97	44-548
(13)	11-98	57
USA Elct RD Actv, Ft Huachuca	11-117	57-100
(2)	11-155	

NG: State AG (3); units-same as active Army except allowance is one copy each unit.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

TECHNICAL MANUAL

No. 11-5043-12

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *27 May 1958*.

ANALYZERS ZM-3/U AND ZM-3A/U
OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

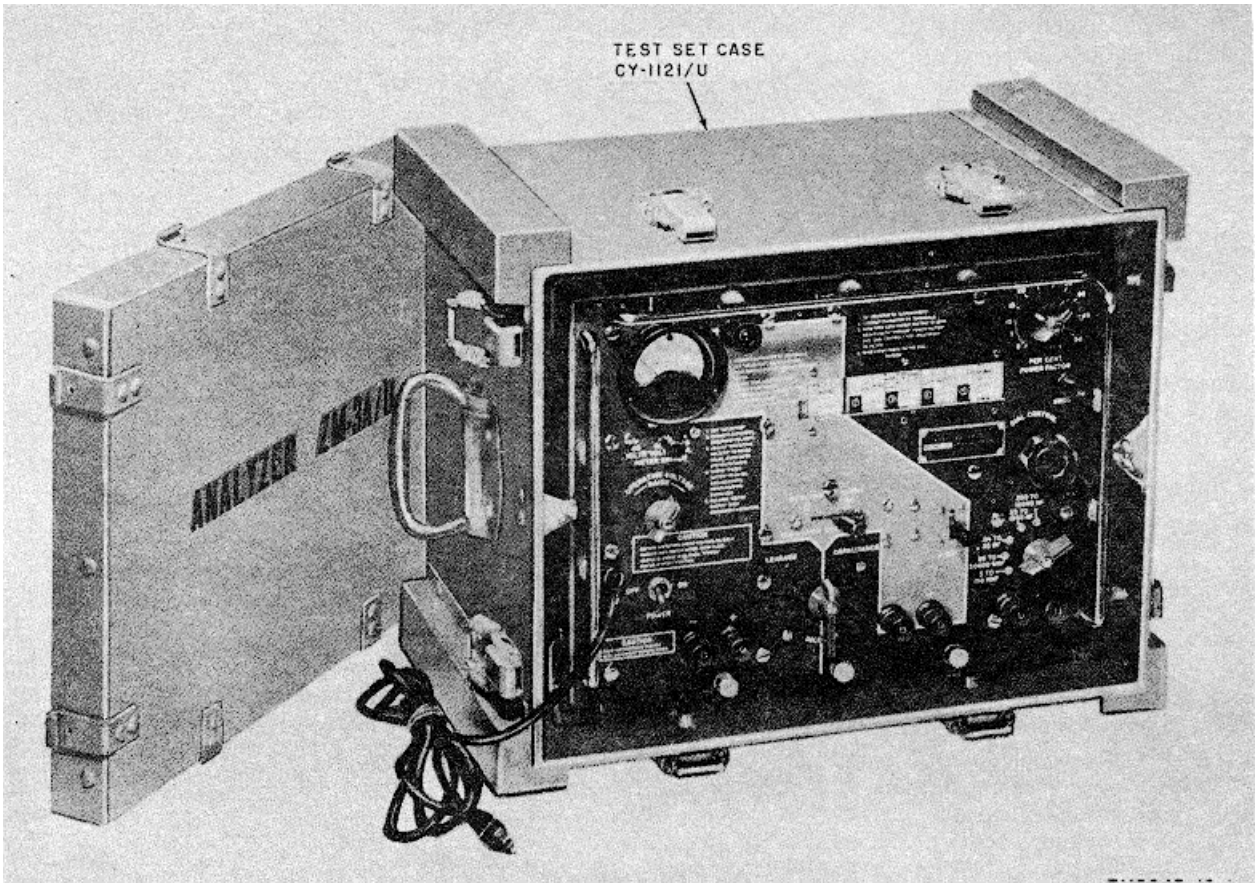


Figure 1. Analyzer ZM-3A/U, less running spares.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual covers operation and organizational maintenance (first and second echelon) of Analyzers ZM-3/U and ZM-3A/U.

b. The complete technical manual includes one other publication: TM 11-5043-35, Analyzers ZM-3/U and ZM-3A/U, Field and Depot Maintenance.

c. This manual contains 2 appendixes. See SM SIG 7 & 8 ZM-3/U for maintenance parts information.

d. Official nomenclature followed by (*) is used to indicate all models of the equipment covered in this manual. Analyzer ZM-3(*)/U represents Analyzers ZM-3/U and ZM-3A/U.

e. Throughout this manual, the major component (fig. 4) of Analyzer ZM-3(*)/U is referred to as analyzer. Test Set Case CY-1121/U (fig. 1) is referred to as case.

f. Forward any comments concerning omissions and discrepancies in this manual on DA Form 2028 direct to Commanding Officer, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N.J., ATTN: SIGFM/ESM.

2. Forms and Records

a. Unsatisfactory Equipment Reports. Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, U.S. Army Signal Equipment Support Agency, Fort Monmouth, N.J., as prescribed in AR 700-38.

b. Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58.

c. Preventive Maintenance Form. Prepare DA Form 11-266 (figs. 7 and 8), (Maintenance Check List for Signal Equipment) (Test Equipment) in accordance with instruction on the form.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Purpose. The analyzer is used to determine characteristics of capacitors from 5 μμf (micro-microfarad) to 10, 000 μf (microfarad).

b. Use. The analyzer is used to measure leakage current of electrolytic capacitors, insulation resistance of all types of capacitors except electrolytic capacitors, capacitance of all types of capacitors, and the power factor of capacitors larger than .04 μf. The analyzer may also be used to check insulation resistance and capacitance of cables.

4. Technical Characteristics

Leakage voltage range	0- to 600-volt dc.
Leakage current range	0 to 50 ma dc.
Insulation resistance range	1.1 to 100 meg.
	110 to 10, 000 meg.
Capacitance range	5 to 100 μμf.
	80 to 50, 000 μμf.
	.04 to 30 μf.
	25 to 1, 000 μf.
	250 to 10, 000 μf.
Power factor range	0 to 50 percent.
Accuracy:	
Leakage test voltage and leakage current measurements.	3 percent of full-scale meter deflection.
Insulation resistance	20 percent.
Capacitance:	
5 μμf to 100 μμf	3μμf.
100 μμf to 100 μf	5 percent.
100 μf to 1, 000 μf	10 percent.
1, 000 μf to 10, 000 μf	20 percent.
Power factor	10 percent.
Number of tubes	9.
Power source:	
Analyzer ZM-3/U	105 to 125 or 210 to 250 volt ac, 50 to 1, 600 cps (cycles per second).
Analyzer ZM-3A/U	105 to 125 or 210 to 250 volt ac, 50 to 1, 000 cps.

5. Table of Components

a. Components (fig. 1).The components of Analyzer ZM-3(*)/U are listed in the table below.

Quantity	Item	Height (in.)	Depth (in.)	Width (in.)	Unit weight (lb.)
1	Analyzer (for ZM-3/U)	10 3/8	8 5/8	13 7/8	34 3/4
	or				
	Analyzer (for ZM-3A/U)	10 1/4	9 1/4	13 1/2	27 1/4
1	Test Set Case CY-1121/U (for ZM-3/U)	14 3/8	12 1/2	17 5/8	15 1/4
	or				
	Test Set Case CY-1121/U (for ZM-3A/U)	13 7/8	11 1/2	17 1/2	18 3/4
1 set	Running spares (b below)				

b. Running Spares (fig. 2)

Quantity	Item	Quantity	Item
5	Fuses, 2-ampere	1	Electron tube, 807
1	Electron tube, OA2	1	Electron tube, 5749/6BA6W
1	Electron tube, OB2		
1	Electron tube, 6C4W	1	Incandescent lamp, #47
1	Electron tube, 6SL7WGT	1	Incandescent lamp: 110 v, 6w (ZM-3/U)
1	Electron tube, 6X4W		
1	Electron tube, 12AU7		115 v, 6w (ZM-3A/U)

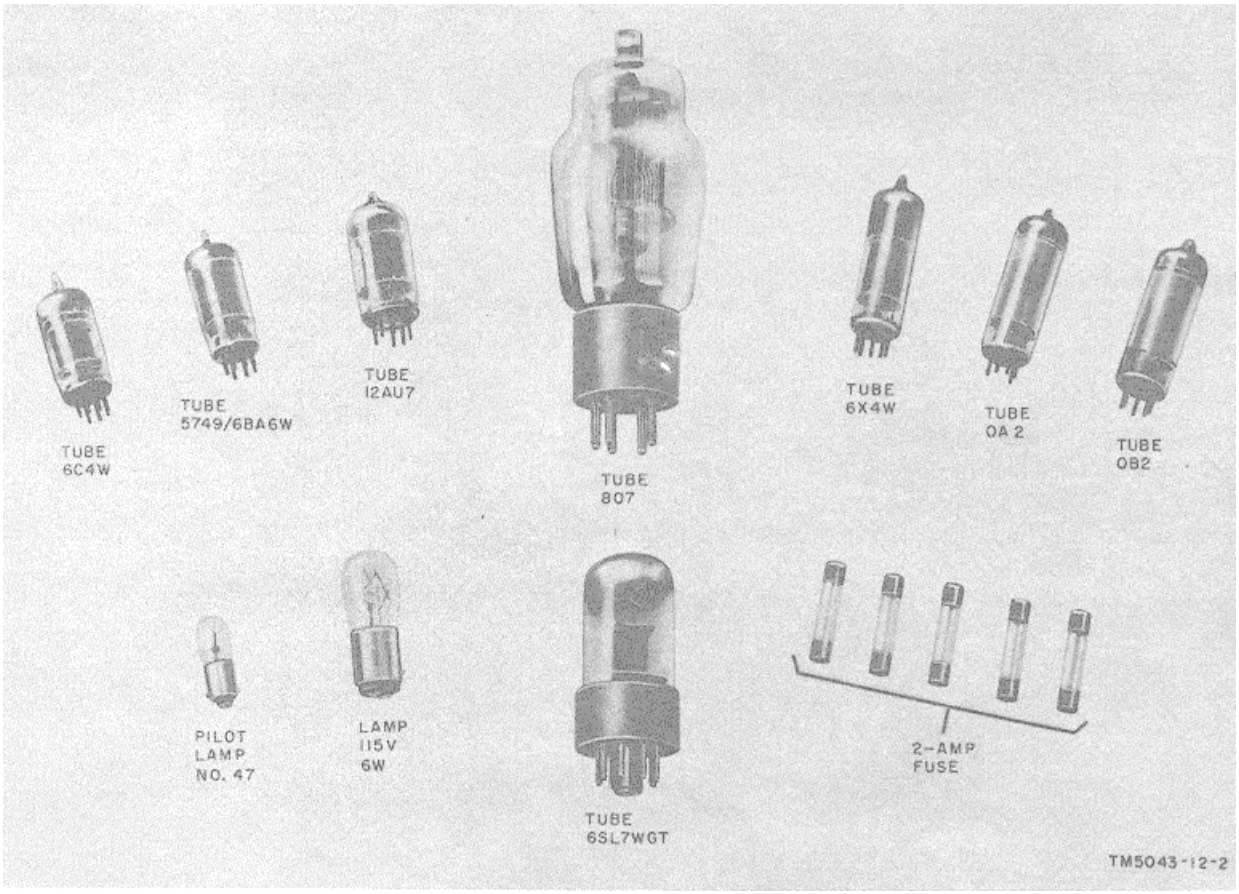


Figure 2. Running spares.

6. Description

(fig. 1)

The analyzer is a self-contained instrument which is housed in a dust cover. In transit, the analyzer is installed in a shock-mounted case. All operating controls (except the change-over switch) and terminals are located on the front panel. The change-over switch is located behind a plate on the rear of the dust cover. The operating controls and terminals are located in three colored sections on the front panel as follows:

a. Maroon. Controls and terminals for leakage current measurements.

b. Gray. Controls and terminals for insulation resistance measurements.

c. Green. Controls and terminals for capacitance measurements.

CHAPTER 2

SERVICE UPON RECEIPT OF EQUIPMENT

7. Unpacking

(fig. 3)

a. Packaging Data. Analyzer ZM-3(*)/U is packed for shipment in a wooden packing case. The dimensions of the packed equipment are 22 by 17 by 14 inches; the weight is 60 pounds, and the volume is 3 cubic feet.

b. Unpacking.

(1) Cut and fold back the metal straps.

(2) Remove the nails from the wooden cover with a nail puller. Do not attempt to pry off the wooden cover; prying may damage the equipment. Remove the wooden cover and expose the moistureproof barrier.

(3) Slit the moistureproof barrier and expose the outer corrugated carton.

(4) Open the outer corrugated carton by cutting the gummed tape and expose the moisture-vaporproof barrier.

(5) Slit the moisture-vaporproof barrier and expose the inner corrugated carton.

(6) Open the inner corrugated carton by cutting the gummed tape and remove the contents.

(7) Remove the cover from the case and remove the running spares from inside the case.

8. Checking Unpacked Equipment

a. Inspect the equipment for any loss or damage that might have occurred during shipment. If the equipment has been damaged or is incomplete, refer to paragraph 2.

b. Check the equipment against the packing list. When no packing list accompanies the equipment, use the table of components (par. 5) as a general check to indicate the equipment which probably was packed.

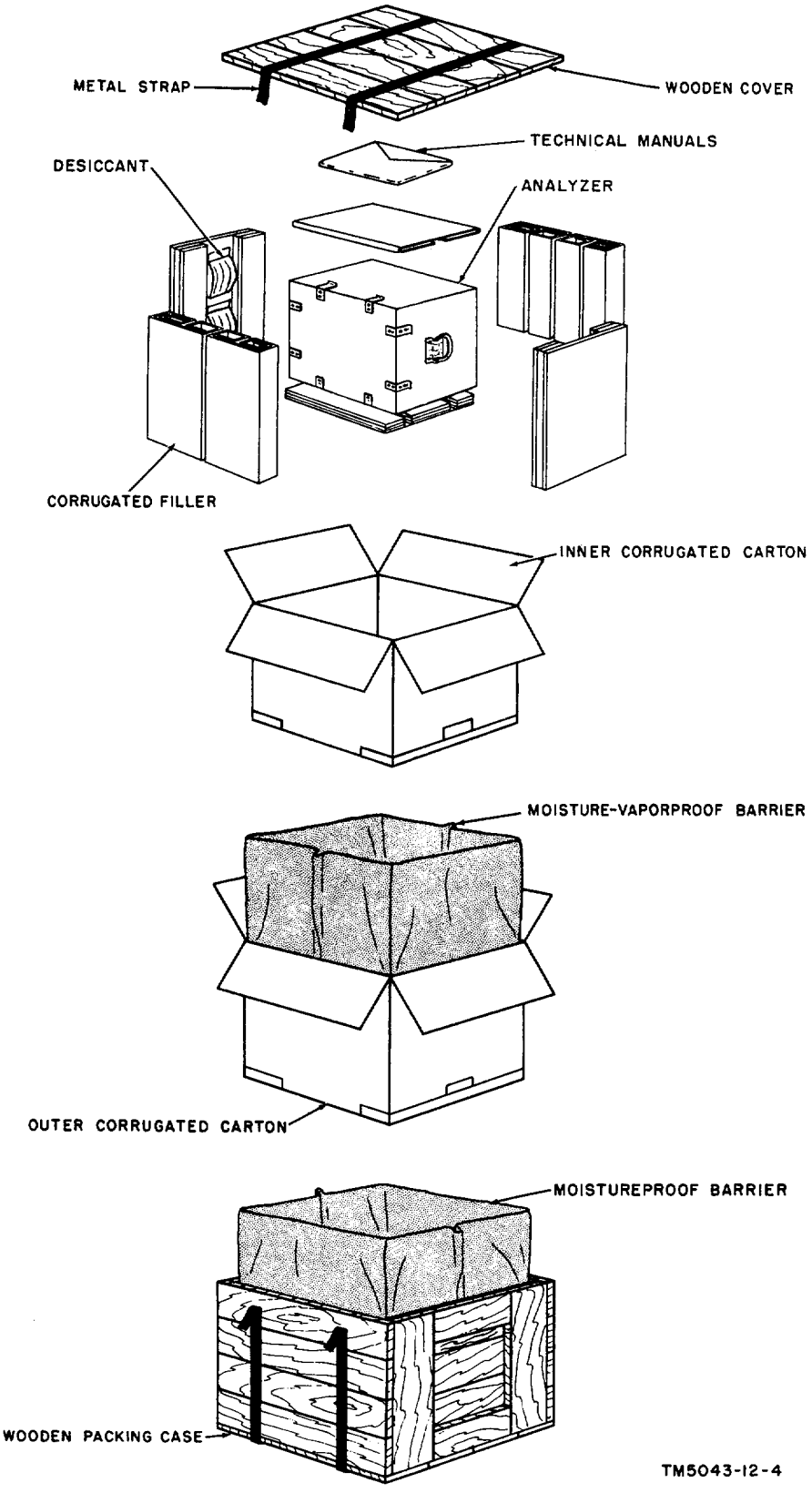


Figure 3. Packaging diagram.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. OPERATION UNDER USUAL CONDITIONS

9. Controls and Indicators

(fig. 4)

The operating controls and indicators and their functions are listed in the table below.

Control or indicator	Function
Changeover switch (behind rear plate).	Toggle switch, single-pole double-throw-Permits operation on 110- or 220-volt ac.
POWER switch-	Toggle switch, double-pole, double-throw-In ON position, applies power to analyzer; in OFF position, applies power to internal heater.
SELECTOR switch.	Three-position rotary switch-
	Position — *Function*
	LEAKAGE — Connects meter circuit and leakage terminals to high-voltage rectifier to measure leakage current of electrolytic capacitors.
	INSULATION RESISTANCE — Connects insulation resistance bridge to meter circuit to measure insulation resistance of capacitors.
	CAPITANCE — Connects capacitance bridge to meter circuit to measure capacitance.
Pilot lamp	Indicator lamp assembly-Indicates POWER switch is in ON position.
METER SWITCH	Three-position spring return, lever switch-
	Position — *Function*
	600 VOLTS (normal position) — Connects meter and meter multiplier to high-voltage rectifier to measure leakage test voltage.
	60 VOLTS (spring return) — Connects meter and meter multiplier to high-voltage rectifier to measure leakage test voltage.
	50 MA. (spring return) — Connects meter to leakage terminals to measure leakage current of electrolytic capacitors.
Meter	Dc voltmeter and dc milliammeter. Indicates leakage test voltage, leakage current of electrolytic capacitors, and balance of insulation resistance bridge or capacitance bridge.
OPERATING VOLTAGE control.	Variable resistor-Controls leakage test voltage.
DIAL CONTROL	Drum and scale assembly-Operates drum and scale assembly which is connected to variable resistor used to balance insulation resistance bridge or capacitance bridge on scales 3, 4, and 5; connected to variable capa citor used to balance capacitance bridge on scale 2. Value of insulation resistance or capacitance is indicated on scale.

Control or indicator	Function
Megohm range switch	Two-position lever switch-Selects correct value of resistance for use in insulation resistance bridge; in MEGOHMS X1 position, indication on scale 1 is read directly; in MEGOHMS X100 position, indication on scale 1 must be multiplied by 100
KEY	Two-position, spring return, lever switch - When depressed, connects meter circuit to insulation resistance bridge when SELECTOR switch is in INSULATION RESISTANCE position. KEY is spring loaded to return to normal position when released.
Capacitance range switch	Five-position rotary switch-Selects correct value of resistance for use in capacitance bridge; indication on scale is read directly except on 250 TO 10000 MF range where indication on scale must be multiplied by 10.
PER CENT POWER FACTOR control	Variable resistor - Used with DIAL CONTROL to balance capacitance bridge when measuring capacitors larger than .04 µf; when capacitance bridge is balanced, power factor of capacitor being checked is read from PER CENT POWER FACTOR control scale.

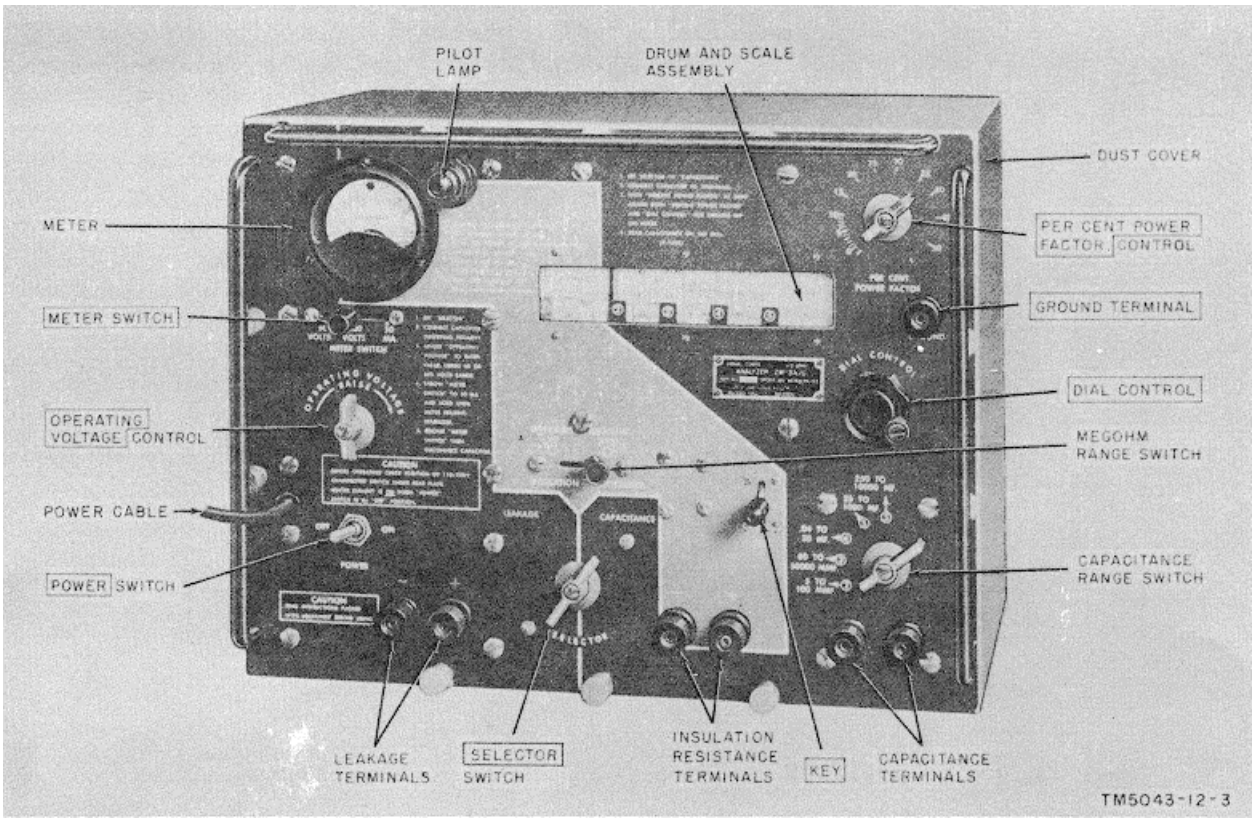


Figure 4. Analyzer, operating controls and indicators.

10. Interpreting Scale

(figs. 4 and 5)

a. General. The chart below gives the scale marker and the range covered by that scale marker for each position of the megohm range switch or the capacitance range switch.

Scale marker	Megohm range switch	Capacitance range switch	Scale range
1	MEGOHMS X1	Not used	1.1 to 100
	MEGOHMS X100	Not used	1.1 to 100
2	Not used	5 TO 100 MMF	0 to 110
3	Not used	80 TO 50000 MMF	80 to 50,000
4	Not used	.04 TO 30 MF	.04 to 30
	Not used	25 TO 1000 MF	20 to 1,200
5	Not used	250 to 10000 MF	20 to 1,200 (multiply by 10)

b. Insulation Resistance Readings.

(1) Read the value of insulation resistance behind the hairline in the column indicated by scale marker 1.

Example: The value behind the hairline in the column indicated by scale marker 1 is approximately 1.21.

(2) Multiply the value read ((1) above) by 1 or 100 as determined by the position of the megohm range switch.

Examples:

1. With the megohm range switch in MEGOHMS X1 position, the value read is multiplied by 1; 1.21X1=1.21 megohms.

2. With the megohm range switch in MEGOHMS X100 position, the value read is multiplied by 100; 1.21 X 100=121 megohms.

c. Capacitance Readings.

(1) Read the value of capacitance behind the hairline in the column indicated by one of the green scale markers. The position of the capacitance range switch (*a* above) indicates which scale marker to use.

Example: The value behind the hairline in the column indicated by scale marker 5 is approximately 24.

(2) All capacitance values are read directly from the scale, except for the highest capacitance range (250 TO 10,000 MF), where the value read must be multiplied by 10.

Examples:

1. When the capacitance range switch is set to the 25 To 1000 MF position, the value behind the hairline ((1) above) indicates 24 μf.

2. When the capacitance range switch is set to the 250 TO 10,000 MF position, the value behind the hairline ((1) above) is multiplied by 10; 24X10 = 240 μf.

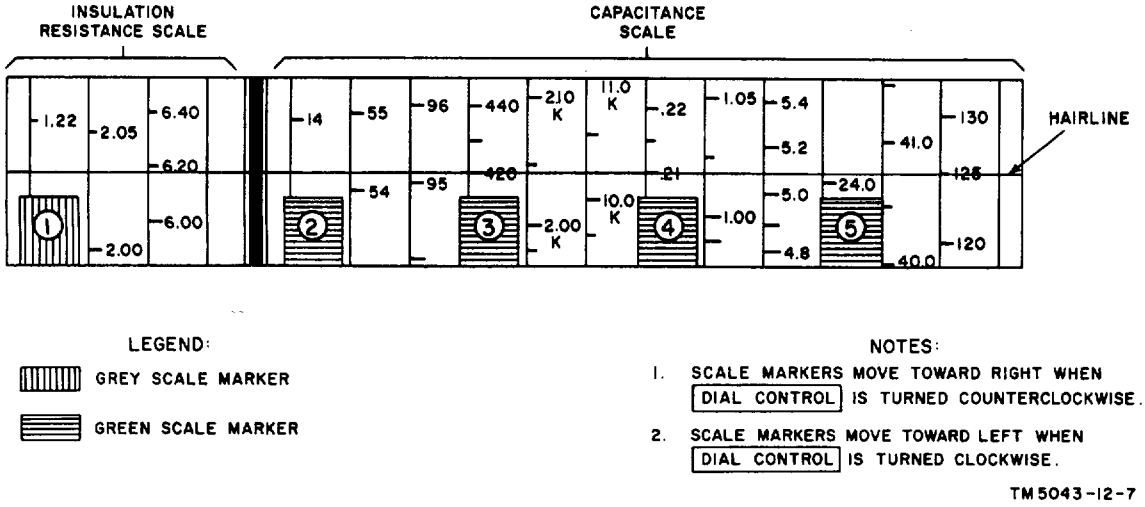


Figure 5. Drum and scale assembly, scale markers and portion of scale.

11. Starting Procedure

(fig. 4)

a. Check the position of the changeover switch (not shown) to be sure that is is set properly for the available power source.

b. Connect the power cable to the power source (par. 4).

c. Operate the POWER switch to the ON position. Allow the analyzer to warm up for 2 minutes before proceeding.

12. Leakage Current Measurements

(fig. 4)

To measure the leakage current of electrolytic capacitors, proceed as follows:

a. Perform the starting procedures (par. 11).

b. Set the SELECTOR switch to the LEAKAGE position.

c. Locate the working voltage on the capacitor to be tested.

d. Adjust the OPERATING VOLTAGE control until the meter indicates the correct working voltage (*c* above). If the voltage is less than 60 volts, use the 60 VOLTS position of the METER SWITCH.

e. Observing polarity, connect the capacitor to the leakage terminals.

f. Hold the METER SWITCH in the 50 MA. position.

(1) If the meter needle goes off scale, release the METER SWITCH. The capacitor is shorted.

(2) A leakage current indication of 5 milliamperes (ma) or less indicates that the capacitor is acceptable. Discard capacitors that have a leakage current higher than 5 ma.

Warning: Do not touch the capacitor leads or the leakage terminals; up to 600 volts direct current (dc) is applied to the leakage terminals when the METER SWITCH is in the 50 MA. position.

g. Release the METER SWITCH.

h. Turn the OPERATING VOLTAGE control counterclockwise to its stop.

i. Remove the capacitor from the leakage terminals.

13. Insulation Resistance Measurements

a. Insulation Resistance Values. The minimum insulation resistance values are given in (1) through (4) below. Discard capacitors which have insulation resistance values lower than the values given.

(1) Fixed ceramic and air dielectric types. The insulation resistance of fixed compensating and high K ceramic capacitors and air dielectric capacitors should be higher than 1,000 megohms.

(2) Variable ceramic and mica capacitors. The insulation resistance of variable ceramic and mica capacitors should be higher than 3,000 megohms.

(3) Paper capacitors (oil impregnated).

(a) The insulation resistance of oil impregnated paper capacitors should equal or exceed the values indicated in the chart below. The characteristic letter is the third letter from the right in the type designation on the capacitor.

Characteristic letter	Insulation resistance (meg x μf)			
	20° C.	25° C.	40° C.	85° C.
A ----------	2,840	2,000	700	20
B ----------	2,130	1,500	525	15
D ----------	710	500	175	5
E ----------	2,840	2,000	700	20
F ----------	2,130	1,500	525	15
K ----------	5,680	4,000	1,400	10(125° C.)

Note. Normal room temperature is approximately 25° C.

(b) The insulation resistance given in the chart ((a) above) is the product of the insulation resistance in megohms and the capacitance in μf. To determine the minimum acceptable insulation resistance of a given capacitor, proceed as follows: 1. Take the insulation resistance value from the chart at the temperature of the capacitor.

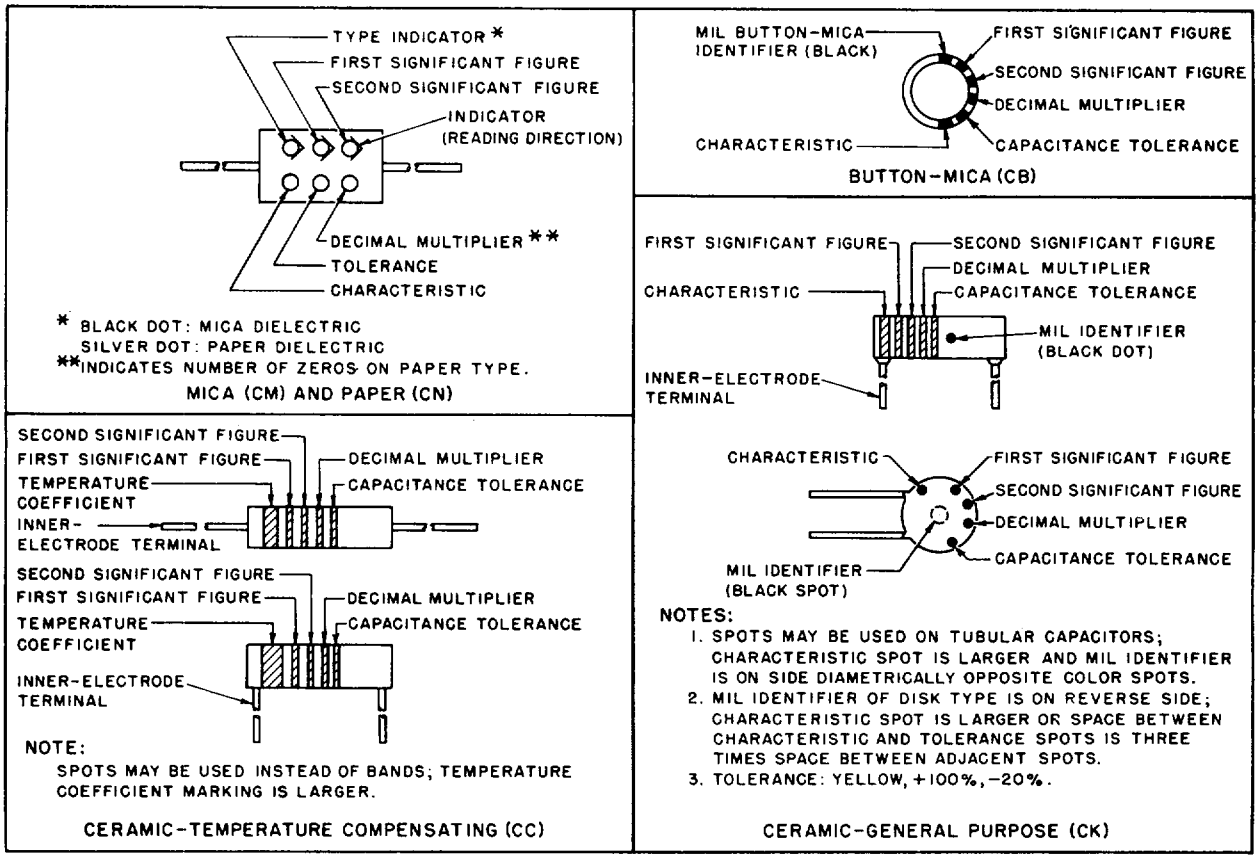
2. Divide this figure by the capacitance value in μf.

3. The result is the minimum value of insulation resistance in megohms.

Example: A 4-μf capacitor (characteristic letter K) at 25° C. has an insulation resistance of 4,000; therefore, 4,000 divided by 4 equals 1,000 megohms.

(4) Paper capacitors (wax impregnated). The insulation resistance of wax impregnated

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

Figure 6. MIL-STD capacitor color-code marking.

paper capacitors should be measured only at temperatures between -10° and +55° C. They should be within the limits specified for characteristic letter B ((3) (a) above).

b. Procedure (fig. 4).

(1) Perform the starting procedures (par. 11).

(2) Set the SELECTOR switch to the INSULATION RESISTANCE position. The meter will indicate 10 ma.

(3) If the insulation resistance of ceramic, air, or mica capacitors is to be measured, place the megohm range switch on the MEGOHMS X100 position; for paper capacitors, set the megohm range switch to MEGOHMS X1 for readings between 1.1 and 100 megohms and to MEGOHMS X100 for readings between 110 and 10,000 megohms.

(4) When testing ceramic or air dielectric capacitors, adjust the DIAL CONTROL for a reading of 10 on scale 1 (par. 10*b*); for mica capacitors, adjust the DIAL CONTROL for a scale reading of 30. When testing paper capacitors, adjust the DIAL CONTROL until the scale reading times the number (1 or 100) indicated by the position of the megohm range switch equals the resistance value (*a*(3) and (4) above).

(5) Connect the capacitor to the insulation resistance terminals. Allow 2 minutes for the capacitor to charge before proceeding.

Warning: Do not touch the insulation resistance terminals or the leads of the capacitor when connecting the capacitor; 105 volts dc is applied to the insulation resistance terminals.

(6) Depress the KEY and watch the meter. If the needle deflects to the right, the capacitor is acceptable.

Caution: If the meter needle goes off scale to the left, release the KEY. The capacitor is shorted. The meter may be damaged if the KEY is held in the closed position too long.

(7) Adjust the DIAL CONTROL until the meter indicates 10 ma.

(8) Read the insulation resistance behind the harline in the column indicated by the position of scale marker 1 (par. 10*b*).

(9) Release the KEY.

(10) Remove the capacitor from the insulation resistance terminals.

Warning: Discharge the capacitor by shorting the capacitor leads after the leads have been removed from the insulation resistance terminals. While testing, the capacitor is charged to 105 volts dc.

14. Capacitance Measurements

a. Tolerances. There are six types of capacitors, each having a different tolerance. Tolerances for each type are as follows:

(1) Temperature compensating ceramic types and mica types. The capacitance of fixed and variable temperature compensating ceramic and fixed mica capacitors should be within the limits indicated by the letter in the type designation or by the color code at any temperature between -40° and +55° C.

(2) High K and special purpose ceramic types. The capacitance should be within the limits marked on the capacitor at any temperature between -40° and +55° C.

Note. The high K ceramic capacitors are very unstable. Difficulty in balancing the bridge does not necessarily indicate a defective capacitor.

(3) Paper capacitors (oil-impregnated). The capacitance of oil-impregnated paper capacitors should be within the limits indicated by the letter in the type designation or within ± 20 percent when the tolerance is not indicated at any temperature between 0° and +55°C. Oil-impregnated paper capacitors measured between -40° and 0° C. would not show an open or short circuit. The measurement of capacitance at these low temperatures is not significant.

(4) Paper capacitors (wax-impregnated). The capacitance of wax-impregnated paper capacitors should be within the limits indicated by the letter in the type designation or within ± 20 percent when the tolerance is not indicated; measurements should be made at temperatures between -10° and +55°C.

(5) Electrolytic capacitors. The capacitance of electrolytic capacitors should be not less than 90 percent nor more than 150 percent of the rated value at temperatures between +25° and +55° C.

(6) Air dielectric capacitors. Tuning and trimmer capacitors should have maximum and minimum capacitances within the limits required by their application.

b. Procedure (fig. 4).

(1) Perform the starting procedures (par. 11).

(2) Set the SELECTOR switch to the CAPACITANCE position.

(3) Set the capacitance range switch to the range which includes the approximate value of the capacitor to be measured.

(4) Set the DIAL CONTROL so that the approximate value of the capacitor to be measured is indicated behind the hairline (par. 10*c*).

(5) Connect the capacitor to the capacitance terminals. The meter indication will probably be off scale to the right.

(6) Adjust the DIAL CONTROL for a minimum indication on the meter. For capacitors larger than 4 μf, adjust both the DIAL CONTROL and the PERCENT POWER FACTOR control for a minimum indication on the mater.

(a) If the minimum meter indication occurs more than 10 percent below the lower capacitor tolerance the capacitor is open.

(b) If a minimum meter indication can not be obtained, the capacitor is shorted.

(c) If the meter indication is not steady, the capacitor is probably intermittent. Tapping the case or striking it lightly against a table will sometimes show up an intermittent capacitor.

(7) Read the capacitance value on the proper scale (par. 10*c*) as indicated by the position of the capacitance range switch.

(8) The power factor of capacitors larger than 4 of will be indicated by the position of the PERCENT POWER FACTOR control.

Note. For electrolytic capacitors rated under 100 volts, 50 percent is the maximum power factor acceptable: for electrolytic capacitors rated at 100 volts or higher, 15 percent is the maximum power factor acceptable.

(9) Remove the capacitor from the capacitance terminals.

15. Dielectric Strength Tests

a. Requirements.

(1) Fixed and variable temperature compensated ceramic capacitors should withstand 600 volts dc for 1 minute with no current indicated on the meter.

(2) High K ceramic capacitors should withstand 300 volts dc for 1 minute with no current indicated on the meter.

b. Procedure (fig. 4).

(1) Perform the starting procedures (par. 11).

(2) Set the SELECTOR switch to the LEAKAGE position.

(3) Adjust the OPERATING VOLTAGE control until the meter indicates 600 volts or 300 volts as required (*a* above).

(4) Connect the capacitor to the leakage terminals.

(5) Hold the METER SWITCH in the 50 MA. position for 1 minute.

Warning: Do not touch the capacitor leads or the leakage terminals; up to 600 volts dc is applied to the leakage terminals when the METER SWITCH is in the 50 MA. position.

(a) If the needle goes off scale, release the METER SWITCH; the capacitor is shorted.

(b) If no current is indicated, the capacitor is acceptable.

(6) Release the METER SWITCH.

(7) Turn the OPERATING VOLTAGE control counterclockwise to its stop.

(8) Remove the capacitor from the leakage terminals.

16. Insulation Resistance and Capacitance of Cables

a. To measure the insulation resistance of cables, follow the procedures in paragraph 13.

b. To measure the capacitance of cables, follow the procedures in paragraph 14.

17. Stopping Procedure

(fig. 4)

a. To return the analyzer to a standby condition, set the POWER switch to the OFF position.

b. To shut down the analyzer completely, set the POWER switch to the OFF position, and remove the power cable from the power source.

Section II. OPERATION UNDER UNUSUAL CONDITIONS

18. Operation at Low Temperatures

Low temperatures affect the efficient operation of the analyzer. Instructions and precautions for operation under these conditions are as follows:

a. Keep the equipment warm and dry. A built-in heater resistor keeps the analyzer warm, thereby minimizing moisture condensation. The heater resistor is on when the POWER switch is in the OFF position. Always keep the power cable connected to the power source and the POWER switch in the OFF position when the equipment is not being used. This will also eliminate excessively long warm-up periods when the equipment is not used frequently.

b. If equipment has been exposed to the cold and is brought into a warm room, moisture will gather on the equipment until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

19. Operation in Tropical Climates

Moisture conditions are more acute in tropical, swampy areas. The high relative humidity causes moisture on the equipment. Adequate ventilation will minimize this condition. Dry the equipment thoroughly before operating it. Keep the power cable connected to the power source and the POWER switch in the OFF position. The built-in heater resistor will help keep the analyzer dry.

20. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures as for tropical climates (par. 19) to insure proper operation of the equipment. A common condition in desert areas is high temperature during the day and a large drop in temperature during the night. This leads to condensation of moisture.

b. Provide means for keeping dust and sand from entering the moving parts of the equipment. Grit, resulting from the mixture of lubricant and sand, will damage the equipment. Clean and lubricate the equipment more often; cover the equipment when not in use. If possible, protect the equipment from the direct rays of the sun.

CHAPTER 4

MAINTENANCE INSTRUCTIONS

21. General

The procedures outlined in this chapter are to be performed by the operator and organizational maintenance personnel. Organizational maintenance of the analyzer is limited to preventive maintenance. No special tools or test equipment is required.

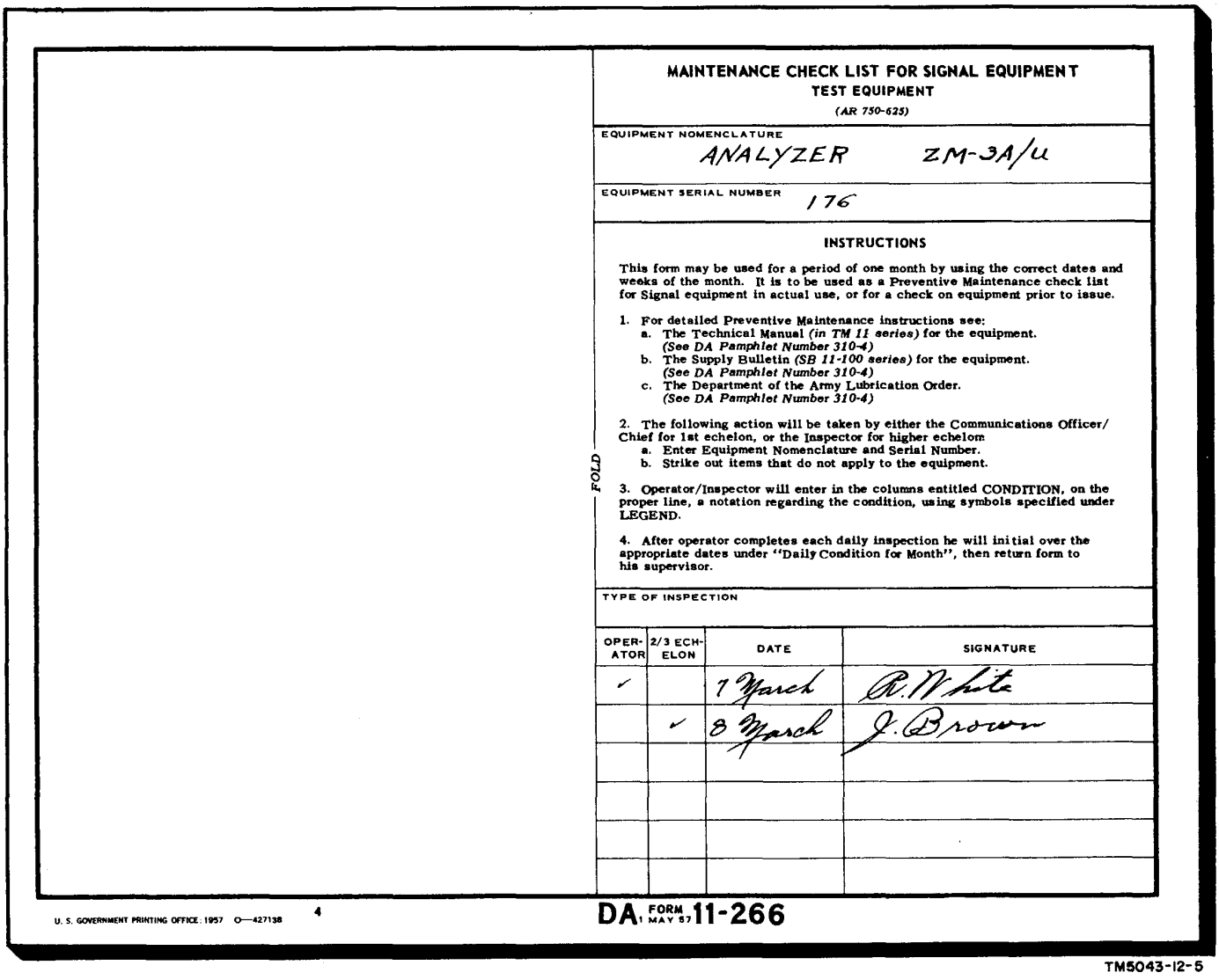
22. Preventive Maintenance

(figs. 7 and 8)

DA Form 11-266 is a preventive maintenance checklist to be used by the operator and organizational maintenance personnel. Items not applicable to the equipment are lined out on the form. References in the ITEM block are to paragraphs that contain additional maintenance information pertinent to the particular item. Instructions for use of the form appear on page 1 of the form.

23. Operational Checklist

a. General. The operational checklist (b below) provides a procedure for systematically checking equipment performance. All corrective measures that the operator or second-echelon repairman can perform are given in the corrective measures column. If the corrective measures indicated do not restore normal equipment performance, repair is required by higher echelon maintenance personnel. Note on the repair tag how the equipment performed and the corrective measures that were taken.



MAINTENANCE CHECK LIST FOR SIGNAL EQUIPMENT
TEST EQUIPMENT
(AR 750-625)

EQUIPMENT NOMENCLATURE: ANALYZER ZM-3A/U

EQUIPMENT SERIAL NUMBER: 176

INSTRUCTIONS

This form may be used for a period of one month by using the correct dates and weeks of the month. It is to be used as a Preventive Maintenance check list for Signal equipment in actual use, or for a check on equipment prior to issue.

1. For detailed Preventive Maintenance instructions see:
   a. The Technical Manual *(in TM 11 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   b. The Supply Bulletin *(SB 11-100 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   c. The Department of the Army Lubrication Order. *(See DA Pamphlet Number 310-4)*

2. The following action will be taken by either the Communications Officer/ Chief for 1st echelon, or the Inspector for higher echelon
   a. Enter Equipment Nomenclature and Serial Number.
   b. Strike out items that do not apply to the equipment.

3. Operator/Inspector will enter in the columns entitled CONDITION, on the proper line, a notation regarding the condition, using symbols specified under LEGEND.

4. After operator completes each daily inspection he will initial over the appropriate dates under "Daily Condition for Month", then return form to his supervisor.

FOLD

TYPE OF INSPECTION

OPER-ATOR	2/3 ECH-ELON	DATE	SIGNATURE
✓		1 March	R. White
	✓	8 March	J. Brown

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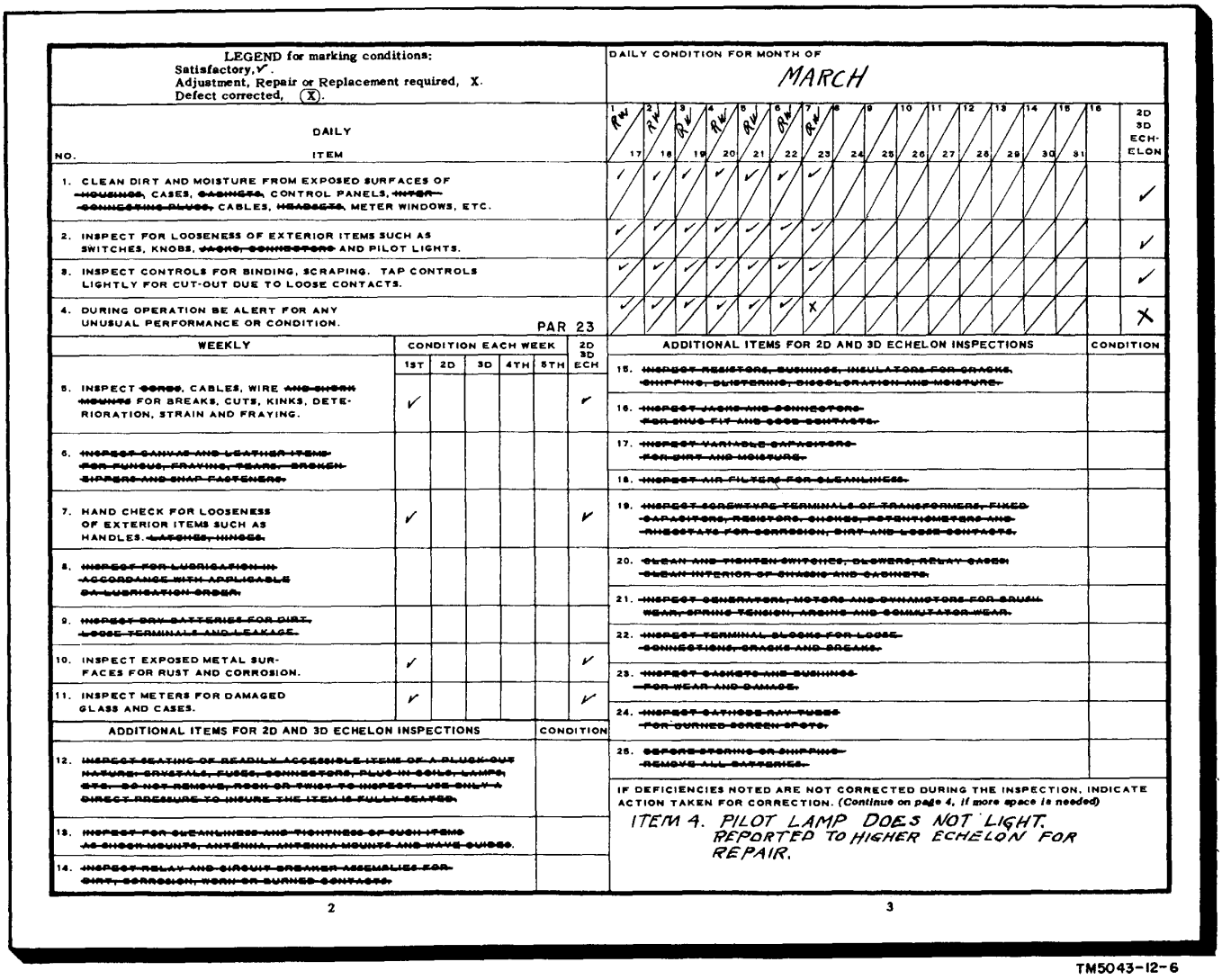
DA FORM 1 MAY 57 11-266

TM5043-12-5

Figure 7. DA Form 11-266, pages 1 and 4.



LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF MARCH

NO.	DAILY ITEM	1 RW 17	2 RW 18	3 RW 19	4 RW 20	5 RW 21	6 RW 22	7 RW 23	8 24	9 25	10 26	11 27	12 28	13 29	14 30	15 31	16	2D 3D ECHELON
1.	CLEAN DIRT AND MOISTURE FROM EXPOSED SURFACES OF ~~HOUSINGS~~, CASES, ~~CABINETS~~, CONTROL PANELS, ~~INTER-CONNECTING PLUGS~~, CABLES, ~~HEADSETS~~, METER WINDOWS, ETC.	✓	✓	✓	✓	✓	✓	✓										✓
2.	INSPECT FOR LOOSENESS OF EXTERIOR ITEMS SUCH AS SWITCHES, KNOBS, ~~JACKS, CONNECTORS~~ AND PILOT LIGHTS.	✓	✓	✓	✓	✓	✓	✓										✓
3.	INSPECT CONTROLS FOR BINDING, SCRAPING. TAP CONTROLS LIGHTLY FOR CUT-OUT DUE TO LOOSE CONTACTS.	✓	✓	✓	✓	✓	✓	✓										✓
4.	DURING OPERATION BE ALERT FOR ANY UNUSUAL PERFORMANCE OR CONDITION. PAR 23	✓	✓	✓	✓	✓	✓	X										X

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D 3D ECH
5. INSPECT ~~CORDS~~, CABLES, WIRE ~~AND SHOCK MOUNTS~~ FOR BREAKS, CUTS, KINKS, DETERIORATION, STRAIN AND FRAYING.	✓					✓
6. ~~INSPECT CANVAS AND LEATHER ITEMS FOR FUNGUS, FRAYING, TEARS, BROKEN ZIPPERS AND SNAP FASTENERS.~~						
7. HAND CHECK FOR LOOSENESS OF EXTERIOR ITEMS SUCH AS HANDLES. ~~LATCHES, HINGES.~~	✓					✓
8. ~~INSPECT FOR LUBRICATION IN ACCORDANCE WITH APPLICABLE SB LUBRICATION ORDER.~~						
9. ~~INSPECT DRY BATTERIES FOR DIRT, LOOSE TERMINALS AND LEAKAGE.~~						
10. INSPECT EXPOSED METAL SURFACES FOR RUST AND CORROSION.	✓					✓
11. INSPECT METERS FOR DAMAGED GLASS AND CASES.	✓					✓

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
12. ~~INSPECT SEATING OF READILY ACCESSIBLE ITEMS OF A PLUG-OUT NATURE; CRYSTALS, FUSES, CONNECTORS, PLUG-IN COILS, LAMPS, ETC. DO NOT REMOVE, ROCK OR TWIST TO INSPECT. USE ONLY A DIRECT PRESSURE TO INSURE THE ITEM IS FULLY SEATED.~~	
13. ~~INSPECT FOR CLEANLINESS AND TIGHTNESS OF SHOCK ITEMS AS SHOCK MOUNTS, ANTENNA, ANTENNA MOUNTS AND WAVE GUIDES.~~	
14. ~~INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR DIRT, CORROSION, WORN OR BURNED CONTACTS.~~	

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
15. ~~INSPECT RESISTORS, BUSHINGS, INSULATORS FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE.~~	
16. ~~INSPECT JACKS AND CONNECTORS FOR SNUG FIT AND GOOD CONTACTS.~~	
17. ~~INSPECT VARIABLE CAPACITORS FOR DIRT AND MOISTURE.~~	
18. ~~INSPECT AIR FILTERS FOR CLEANLINESS.~~	
19. ~~INSPECT SOLDERING TERMINALS OF TRANSFORMERS, FIXED CAPACITORS, RESISTORS, BUSHINGS, POTENTIOMETERS AND RHEOSTATS FOR CORROSION, DIRT AND LOOSE CONTACTS.~~	
20. ~~CLEAN AND TIGHTEN SWITCHES, BLOWERS, RELAY CASES. CLEAN INTERIOR OF CHASSIS AND CABINETS.~~	
21. ~~INSPECT GENERATORS, MOTORS AND DYNAMOTORS FOR BRUSH WEAR, SPRING TENSION, ARCING AND COMMUTATOR WEAR.~~	
22. ~~INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.~~	
23. ~~INSPECT GASKETS AND BUSHINGS FOR WEAR AND DAMAGE.~~	
24. ~~INSPECT CATHODE RAY TUBES FOR BURNED SCREEN SPOTS.~~	
25. ~~BEFORE STORING OR SHIPPING REMOVE ALL BATTERIES.~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. *(Continue on page 4, if more space is needed)*

ITEM 4. PILOT LAMP DOES NOT LIGHT. REPORTED TO HIGHER ECHELON FOR REPAIR.

2 3

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Figure 8. DA Form 11-266, pages 2 and 3.

b. Check list

Item	Action	Normal indication	Corrective measures
1	Check position of changeover switch to be sure that it is set for proper input voltage.		
2	Connect power cable to power source.		
3	Operate POWER switch to ON. Allow 2 minutes for warm up before proceeding.	Pilot lamp lights	Replace pilot lamp E1 (par. 24*c*) Replace fuse F1 or F2 (par. 24*b*) Check connection of power cable
4	Turn OPERATING VOLTAGE control to its extreme counterclockwise position.		
5	Operate SELECTOR switch to LEAKAGE position.		
6	Hold METER SWITCH in 60 VOLTS position	Meter indicates from 4 to 10 volts	Replace lamp R38 (par. 24*d*) Replace tube V9 (par. 24e)
7	Release meter switch	METER SWITCH returns to 600 VOLTS position.	Higher-echelon repair required
8	Turn OPERATING VOLTAGE control clockwise	Meter reading increases as control is rotated. Adjust to 600 volts.	Higher-echelon repair required
9	Hold METER SWITCH in 50 MA. position.	Meter indicates 0	Higher-echelon repair required
10	Release METER SWITCH	Meter SWITCH returns to 600 VOLTS position and meter indicates 600 volts.	Higher-echelon repair required
11	Turn OPERATING VOLTAGE control counterclockwise to its stop.	Meter reading decreases as control is rotated.	Higher-echelon repair required
12	Operate SELECTOR switch to INSULATION RESISTANCE positions.	Meter indicates 10 ma	Replace tube V4, V5, V6, or V8 (par. 24e).
13	Turn DIAL CONTROL, counterclockwise to its stop.		
14	Operate megohm range switch to MEGOHMS X1 position and depress KEY.	Meter indication remains constant	Higher-echelon repair required
15	Release KEY	KEY returns to normal position	Higher-echelon repair required
16	Operate megohm range switch to MEGOHMS X100 position and depress KEY.	Meter indication remains constant	Higher-echelon repair required
17	Release KEY	KEY returns to normal position	Higher-echelon repair required
18	Operate capacitance range switch to 5 TO 100 MMF position.		
19	Operate SELECTOR switch to CAPACITANCE position.	Meter indication is off scale to right.	Replace lamp R4 (par. 24*d*) Replace tube V1, V2, or V3 (par 24*e*).
20	Turn DIAL CONTROL clockwise until scale marker 2 indicates 0.	Meter indicates minimum (minimum indication should be below midscale).	Higher-echelon repair required
21	Operate capacitance range switch through its remaining positions.	Meter indication is off scale to the right.	Higher-echelon repair required
22	Operate POWER switch to OFF and remove power cable from power source.	Pilot lamp goes out	Higher-echelon repair required

24. Repairs

(figs. 9 and 10)

a. General.

(1) Turn the POWER switch to the OFF position and remove the power cable from the power source.

(2) Remove the analyzer from the case.

(3) Loosen the knurled screws that secure the dust cover to the analyzer and remove the dust cover.

b. Replacement of Fuses.

(1) Press in on the fuse cap and turn it counterclockwise to unlock.

(2) Remove the fuse cap with the defective fuse from the fuse holder.

(3) Remove the defective fuse from the fuse cap and replace it with a new one.

(4) Replace the fuse cap with the new fuse in the fuse holder; press and turn the fuse cap clockwise to lock.

c. Replacement of Pilot Lamp.

(1) Unscrew the indicator jewel from the pilot lamp assembly

(2) Press in on the lamp and turn it counterclockwise to unlock.

(3) Remove the defective lamp and replace it with a new one. Push the lamp in and turn it clockwise to lock.

(4) Screw the indicator jewel into the pilot lamp assembly.

d. Replacement of Lamp R4 or R38.

(1) Press in on lamp R4 or R38 and turn it counterclockwise to unlock.

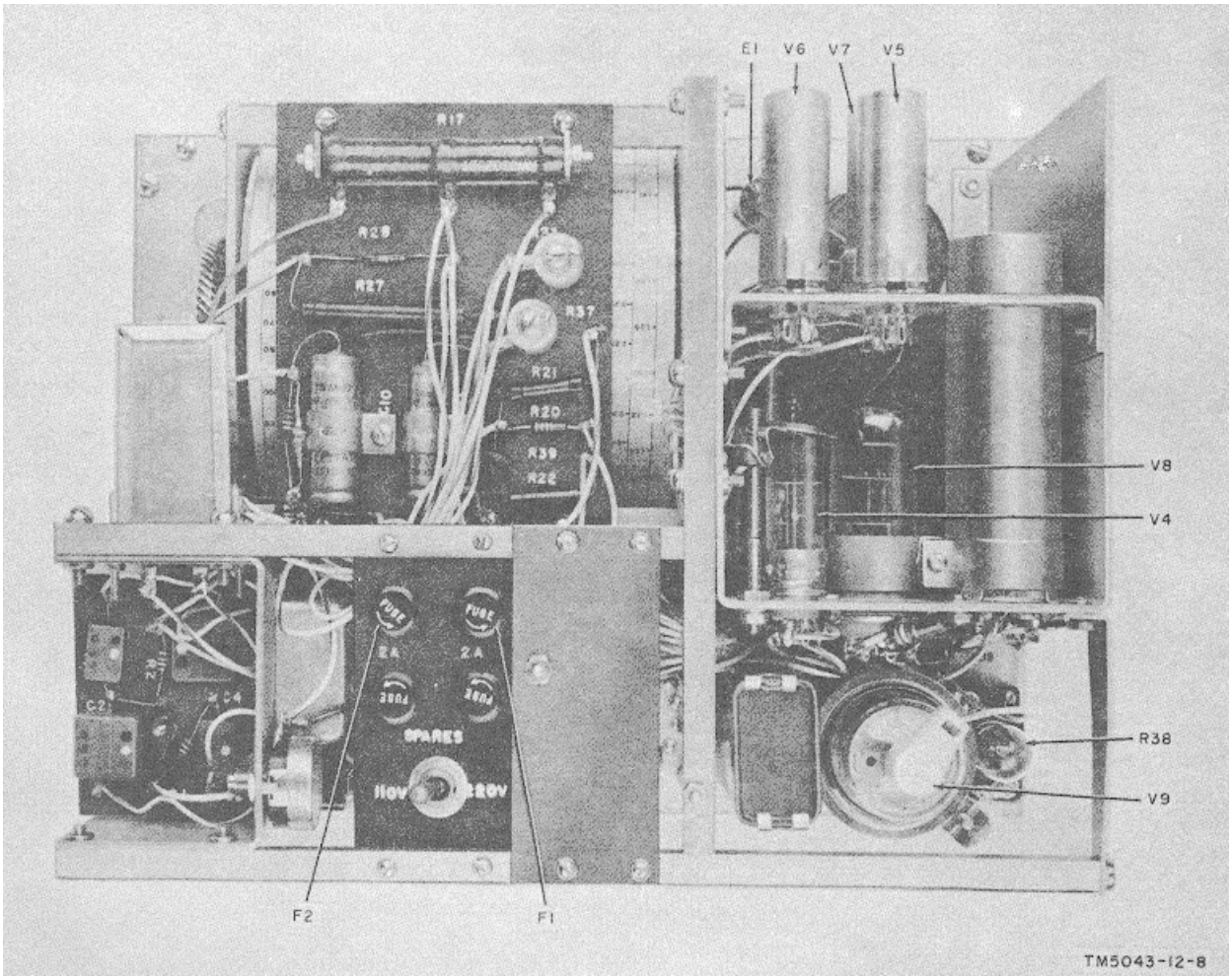

Figure 9. Analyzer, rear view, location of tubes, fuses, and lamps.

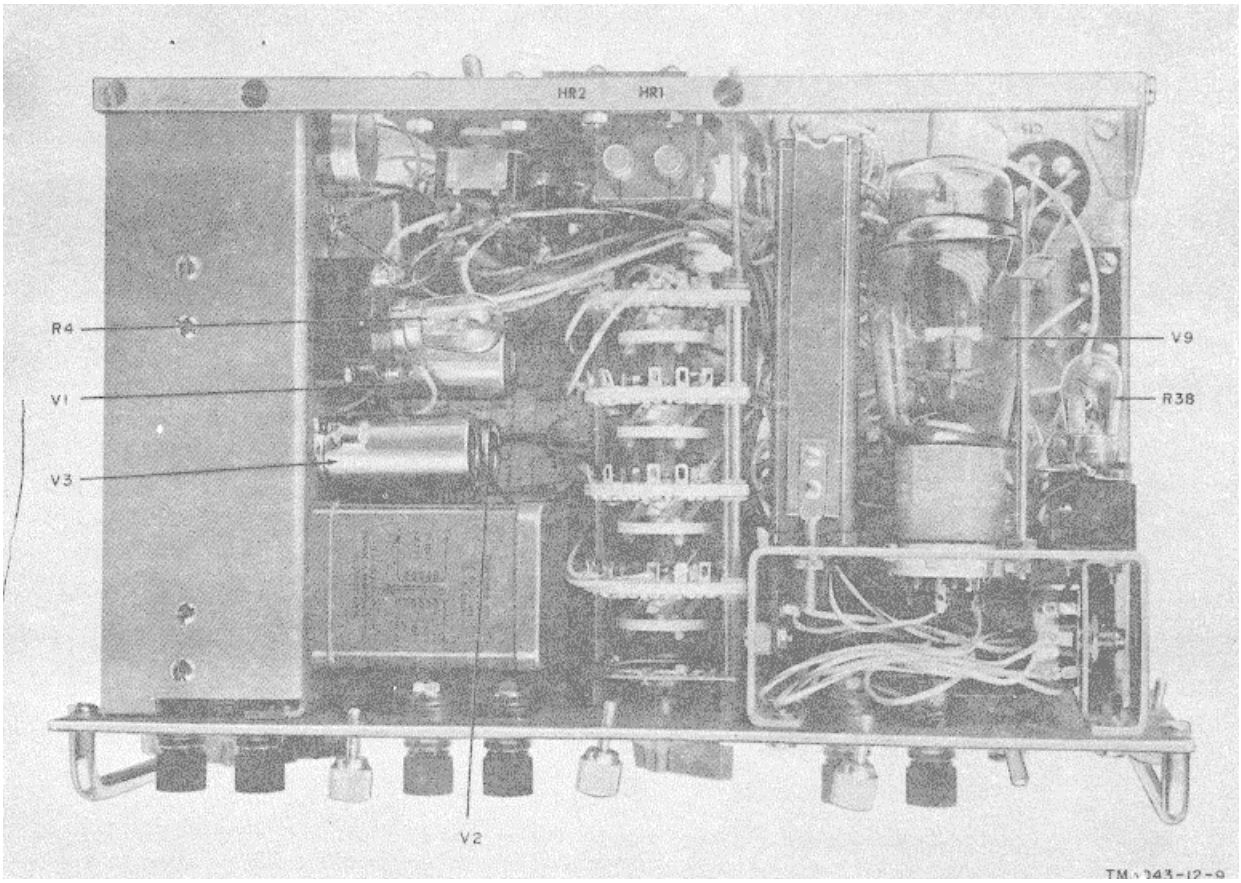

Figure 10. Analyzer, bottom view, location of tubes and lamps.

(2) Remove the defective lamp and replace it with a new one. Push the lamp in and turn it clockwise to lock.

e. Replacement of Tubes. Replace a suspected tube with a new tube. If the equipment remains inoperative, remove the new tube and replace it with the original tube. Repeat this procedure with each suspected tube until the defective tube is located.

Caution: Do not rock or rotate a tube when removing it from the tube socket; pull it straight out.

25. Preferred-Type Tubes

The chart below lists the preferred-type tube for each nonpreferred-type tube. Do not replace a preferred type with a nonpreferred type.

Nonpreferred-type tube	Preferred-type tube	Where used
6BA6	5749/6BA6	Capacitance bridge amplifier V3.
6C4	6C4W	Amplifier V1
6SL7	6SL7WGT	Dc amplifier V8
6X4	6X4W	Low voltage rectifier V4

CHAPTER 5

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

26. Disassembly of Equipment

To disassemble the analyzer, proceed as follows:

a. Disconnect the power cable from the power source. Coil the power cable and tie it with twine.

b. Place the analyzer in the case.

c. Secure the cover to the case.

27. Repackaging for Shipment or Limited Storage

a. If the original packing materials are on hand, use them and reverse the unpacking procedures given in paragraph 8.

b. The prime requirement is to pack the equipment so as to prevent damage during transit or limited storage. Package the equipment securely and use sufficient wadding to minimize the effects of severe jolting. Make sure the equipment is protected from rain and snow.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

28. Authority for Demolition

Demolition of the equipment will be accomplished only upon the order of the commander. The destruction procedures outlined in paragraph 29 will be used to prevent further use of the equipment.

29. Methods of Destruction

Any or all of the methods of destruction given below may be used. The time available is the major factor in determining destruction methods.

a. Smash. Smash control knobs, meter, switches, control panel, case, vacuum tubes, tube sockets, transformers, terminal boards, fuses, and the drum and scale assembly; use sledges, axes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut the power cable and internal wiring; use handaxes, axes, or machetes.

c. Burn. Burn instruction manuals and wiring; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

Warning: Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.

d. Explode. If explosives are necessary, use firearms, grenades, or TNT.

e. Dispose. Bury or scatter the destroyed parts or throw them into nearby waterways.

APPENDIX I

REFERENCES

Following is a list of capacitor specifications:

MIL-C-5A	Capacitors, Fixed, Mica-Dielectric
MILC-20B	Capacitors, Fixed, Ceramic-Dielectric (Temperature Compensating)
MIL-C-25A	Capacitors, Fixed, Paper-Dielectric, Direct-Current (Hermetically Sealed in Metallic Cases)
MILC-62A	Capacitors, Fixed, Electrolytic (DC, Aluminum, Dry Electrolytic, Polarized)
MIL-C-81A	Capacitors, Variable, Ceramic-Dielectric.
MIL-C-91A	Capacitors, Fixed, Paper-Dielectric (Nonmetallic Cases).
MILC-3965	Capacitors, Fixed, Electrolytic (Tantalum).
MILC-11015A	Capacitors, Fixed, Ceramic-Dielectric (General Purpose).
JAN-C-92	Capacitors, Air-Dielectric, Variable (Trimmer Capacitors).

APPENDIX II

MAINTENANCE ALLOCATION CHART

1. General

The maintenance allocation portion of this manual assigns maintenance functions and repair operations to be performed by the lowest appropriate maintenance echelon.

2. Explanation of columns

a. Part or Component. Only the nomenclature or standard item name is used in this column. Additional descriptive data are included only where clarification is necessary to identify the part. Components and parts comprising a major end item are listed alphabetically. Assemblies and subassemblies are in alphabetical sequence with their components listed alphabetically immediately below the assembly listing.

b. Related Operation. This column indicates the various maintenance functions allocated to the echelon capable of performing the operation.

(1) Service. To clean, to preserve, and to replenish fuel and lubricants.

(2) Adjust. To regulate periodically to prevent malfunction.

(3) Inspect. To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(4) Test. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(5) Replace. To substitute serviceable assemblies, subassemblies, and parts for unserviceable components.

(6) Repair. To restore to a serviceable condition by replacing unserviceable parts or by any other action required utilizing tools, equipment and skills available, to include welding, grinding, riveting, straightening, adjusting, etc.

(7) Aline. To adjust two or more components of an electrical system so that their functions are properly synchronized.

(8) Calibrate. To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(9) Rebuild. To restore to a condition comparable to new by disassembling the item to determine the condition of each of its component parts and reassembling it using serviceable, rebuilt, or new assemblies, subassemblies, and parts.

c. Echelon Allocated the Maintenance Operation. The symbol X placed in the appropriate column indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked "X" are authorized to perform the indicated operation.

d. Repair Facilities Code. Code numbers are assigned to each individual tool equipment, test equipment and maintenance equipment referenced under facilities required for maintenance operations. The grouping of codes in the repair facilities code column of the maintenance allocation chart indicates the tool, test and maintenance equipment required to perform the maintenance operation.

e. Remarks. Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding columns.

f. Facilities Required For Maintenance Operations. Tools, test and maintenance equipment required to perform the maintenance functions are listed in this column and coded in the repair facilities code column. The plus sign indicates the echelons allocated the facility.

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)
PART OR COMPONENT	RELATED OPERATION	1ST ECH	2ND ECH	3RD ECH	4TH ECH	5TH ECH	REPAIR FACILITIES CODE	REMARKS
ANALYZER ZM-3/U; ZM-3A/U								
	calibrate					X	1,2,4,5,6,7,8	
	adjust				X		1,3,5,6,7,8	
	service			X			8 or 9 or 10	
	rebuild				X		8	
	inspect			X				
ALUMINUM ALLOY BAR: (structural bars to support components)	replace				X		8	Fabricate if required
ARRESTER, ELECTRICAL	replace				X		8	
	test				X		1	
BALL, BEARING: (positions drum assembly gear)	replace				X		8	Obtain from salvage if required
	service				X		8	
	inspect			X				
BLOCK: (supports drum assembly shaft)	replace				X		8	Fabricate if required
BRACKET: (supports and mounts chassis components)	replace				X		8	Fabricate if required
BUSHING: (AC line cord and drum assembly)	replace				X		8	Fabricate if required
	service				X		8	
	inspect			X				
BUTTON, PLUG: (dust cover)	replace				X		8	Fabricate it required
CABLE, POWER, ELECTRICAL: (cable assembly)	replace			X			8 or 9 or 10	
	inspect			X				
CABLE ASSMIBLY, POWER, ELECTRICAL: (AC line cord)	repair			X			8 or 9 or 10	Fabricate when required. Cable and connector available as maintenance parts
	replace			X			8 or 9 or 10	
	inspect			X				
CAP, ELECTRICAL: (fuseholder)	replace		X					
	inspect		X					
CAPACITOR	replace				X		6,8	
	inspect			X				
	test				X		6,8	
CASE, TEST SET: (carrying case)	repair		X				8 or 9 or 10	Spring catches only
	replace				X		8	Fabricate if required
CHASSIS, ELECTRICAL EQUIPMENT	replace					X	8	Fabricate if required
CLIP, ELICTRICAL: (Electron Tube V9)	replace			X			8 or 9 or 10	
	inspect			X				
CONNECTOR, PLUG: (cable assembly)	replace		X				8 or 9 or 10	
	inspect		X					
ZM-3/U; ZM-3A/U								

(1) PART OR COMPONENT	RELATED OPERATION	(2) 1ST ECH	(3) 2ND ECH	(4) 3RD ECH	(5) 4TH ECH	(6) 5TH ECH	(7) REPAIR FACILITIES CODE	(8) REMARKS
ZU-3/U; 21-3A/U (continued)								
DIAL, SCALE: (drum assembly)	replace				X		8	
	inspect			X				
	service				X		8	
DRUM, FACSIMILE	replace				X		8	
DUST COVER: (test set)	replace				X		8	Obtain from salvage if required
ELECTRON TUBE	replace	X						
	test				X		3	
	test					X	2	
	inspect			X				
FUSE, CARTRIDGE	replace	X						
	inspect	X						
FUSEHOLDER	replace			X			8 or 9 or 10	
	inspect			X				
GEAR: (drum assembly)	replace				X		8	
	inspect			X				
	service				X		8	
GROMMET, RUBBER	replace			X			8	Available in Maintenance Equipment ME-9
HANDLE, BOW	replace				X		8	Fabricate if required
HEATING ELEMENT, ELECTRICAL	replace			X			8 or 9 or 10	
	inspect			X				
HUB: (gear alignment)	replace				X		8	Fabricate if required
	inspect			X				
INSULATOR, PLATE: (fuse mounting)	replace				X		8	Fabricate if required
	inspect			X				
KNOB: (except knob for Switch 56)	replace		X				8 or 9 or 10	
KNOB: (Switch 56)	replace				X		8	Fabricate if required
LAMP, INCANDESCENT:	replace	X						
	test				X		1	
	inspect	X						
LAMPHOLDER	replace			X			8 or 9 or 10	
	inspect			X				
LENS, INDICATOR LIGHT	replace		X					
LIGHT, INDICATOR	replace			X			8 or 9 or 10	
	inspect			X				
MASK, DIAL	replace				X		8	Fabricate if required
	inspect				X			
MOUNTING: (heating elements)	replace				X		8	Fabricate if required
	inspect				X			

ZM-3/U; ZM-3A/U

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)
PART OR COMPONENT	**RELATED OPERATION**	**1ST ECH**	**2ND ECH**	**3RD ECH**	**4TH ECH**	**5TH ECH**	**REPAIR FACILITIES CODE**	**REMARKS**
ZM-3/U; ZM-3A/U (continued)								
MULTIMETER, REPLACEMENT	replace				X		8	
	repair				X		5,8	
	inspect				X		8	
NUT: (common hardware)	replace			X			8 or 9 or 10	Available in Hardware Kit MK-41/U and Maintenance Equipment ME-9
PANEL, INDICATOR: (front control panel)	replace					X	8	Fabricate if required
PIN: (drum assembly)	replace				X		8	Fabricate if required
PLATE	replace				X		8	Fabricate if required
POST, BINDING	replace			X			8 or 9 or 10	
	inspect			X				
PULLEY: (drum assembly)	replace					X	8	Fabricate if required
RESISTOR	replace				X		8	
	test				X		1	
	inspect			X				
RETAINER, ELECTRON TUBE	replace		X					
RING, RETAINING: (drum assembly)	replace				X		8	Fabricate if required
RIVET, TUBULAR	replace				X		8	Substitute available in Hardware Kit MK-41/U
SCREW: (common hardware)	replace			X			8 or 9 or 10	Available in Hardware Kit MK-41/U and Maintenance Equipment ME-9
SEMI-CONDUCTOR DEVICE, D10ODE	replace				X		8	
	test				X		7	
SLISCREW	replace			X			8 or 9 or 10	Fabricate if required
SHIELD, ELECTRON TUBE	replace		X					
SOCKET, ELECTRON TUBE	replace				X		8	
	inspect				X			
SPACER, SLEEVE: (panel assembly)	replace				X		8	Fabricate if required
SPIDER: (drum dial)	replace				X		8	Fabricate if required
SPRING, HELICAL, EXTENSION: (drum assembly)	replace				X		8	

(1) PART OR COMPONENT	RELATED OPERATION	(2) 1ST ECH	(3) 2ND ECH	(4) 3RD ECH	(5) 4TH ECH	(6) 5TH ECH	(7) REPAIR FACILITIES CODE	(8) REMARKS
ZM-3/U; ZM-3A/U (continued)								
STEEL BAR, CORROSION RESISTANT, COLD FINISHED: (drum assembly)	replace				X		8	Fabricate if required
STUD, PLAIN: (resistor mounting)	replace				X		8	Fabricate if required
STUD, THREADED	replace				X		8	Fabricate if required
SWITCH: (except Switch S7)	replace				X		8	
	inspect				X			
	test				X		1	
SWITCH, TOGGLE: S7	replace			X			8 or 9 or 10	
TERMINAL, LUG: (wire connections)	replace				X		8	Available in Maintenance Equipment ME-9
TERMINAL BOARD	replace				X		8	Fabricate if required. Plastic sheet and terminals available in Maintenance Equipment ME-9
	inspect				X			
TEST SET SUB-ASSEIBLY: (dial drum assembly)	replace				X		8	
	service				X		8	
THUMBSCREW: (dust cover)	replace		X					
TRANSFORMER	replace				X		8	
	test				X		1	
	inspect			X				
WASHER: (plastic)	replace				X		8	Fabricate if required
WASHER: (steel, common hardware)	replace			X			8 or 9 or 10	Available in Hardware Kit MK-41/U and Maintenance Equipment ME-9

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FACILITIES REQIRED FOR MAINTENANCE OPERATIONS	1ST ECH	2ND ECH	3RD ECH	4TH ECH	5TH ECH	REPAIR FACIL-ITIES CODE	REMARKS
ZM-3/U; ZM-3A/U (continued)							
MULTIMETER AN/URM-105 ( )				t	t	1	
TEST SET ELECTRON TUBE TV-2( )/U					t	2	
TEST SET ELECTRON TUBE TV-7( )/U				t		3	
METER TESTER TS-656( )/U				t		4	
METER TEST EQUIPMENT AN/GSM-1 ( )				t	t	5	
TEST SET, CAPACITANCE-INDUCTANCE-RESISTANCE AN/URM-90( )				t	t	6	
CRYSTAL RECTIFIER TEST SET TS-268E/U				t	t	7	
TOOL EQUIPUENT TK-21/G		t	t	t	t	8	Depending on the various repairman operators, tool equipments 8 or 9 or 10 will be available at 2nd echelon. 2nd echelon level of maintenance is performed at 3rd echelon. Lowest using organization is a 3rd echelon organization.
TOOL EQUIPIENT TE-113		t	t			9	
TOOL EQUIPMENT TE-49		t	t			10	

[AG 413.44 (22 Apr 58)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

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USA Abn & Elct Bd (1)
USA Avn Bd (1)
USA Armor Bd Test Sec (1)
USA Air Def Bd Test Sec (1)
USA Arctic Test Bd (1)
USCONARC (5)
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OS Maj Comd (5)
Log Comd (5)
MDW (1)
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Div (2)
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Svc Colleges (2)
Br Svc Sch (5) except USASCS (25)
Gen Depots (2) except Atlanta Gen Depot (none)
Sig Sec, Gen Depots (10)
Sig Depots (17)
Fld Comd, AFSWP (5)
USA Sp Warfare Cen (5)
Engr Maint Cen (1)
Army Pictorial Cen (2)
Madigan AH (5)
WRAMC (1)
Brooke AH (5)
AFIP (1)
AMS (1)
Ports of Emb (OS) (2)
Trans Terminal Comd (2)
Army Terminals (2)
OS Sup Agcy (2)
USA Sig Pub Agey (8)
USA Sig Comm Engr Agey (1)
USA Comm Agcy (2)
TASSA (13)
Mid-Western Rgn Ofc (1)
USA Sig Eqp Spt Agey (2)
USA White Sands Sig Agey (13)
Yuma Test Sta (2)
Aberdeen PG (5)
USA Elect PG (1)
Picatinny Arsenal (5)
Frankford Arsenal (5)
Sig Fld Maint Shops (3)
Sig Lab (5)
Mil Dist (1)
Sectors, US Army Corps (Res) (1)
US Army Corps (Res) (1)
JBUSMC (2)
Units organized under following TOE's:
9-500 (AA-AC) (2)
11-7 (2)
11-15 (2)
11-16 (2)
11-26 (2)
11-57 (2)
11-127 (2)
11-128 (2)
11-500 (AA-AE) (2)
11-537 (2)
11-557 (2)
11-587 (2)
11-592 (2)
11-597 (2)
20-300 (2)

NG: State AG (6); units-same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

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