

DEPARTMENT OF THE ARMY  
TECHNICAL MANUAL

DEPARTMENT OF THE AIR  
FORCE TECHNICAL ORDER

**TM 11-2413**

**TO 31M1-2TM-121**

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**HYDROGEN  
GENERATOR  
ML - 303 / TM AND  
HYDROGEN  
GENERATOR SET  
AN / TM Q - 3**

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This copy is a reprint which includes current  
pages from Changes 1,3 and 4.



CHANGE }  
No. 4 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, DC 5 November 1980

**HYDROGEN GENERATOR ML-303/TM AND  
HYDROGEN GENERATOR SET AN/TMQ-3  
(NSN 3655-00-408-4683)**

TM 11-2413/TO 31M1-2TM-121, 17 August 1956, is changed as follows:

The title is changed as shown above.

*Warning page.* Add the following under DON'T TAKE CHANCES:

Should any corroded, pitted, scarred, or broken ML-304A/TM or ML-305A/TM canister be found, perform the following:

- a. Extinguish any source of spark or flame.
- b. Fill a large bucket minimum 5 gallon container with water.
- c. Puncture the knockout holes in the canister.
- d. Put *one* canister at a time in the bucket in an open uncovered area away from all sources of spark, flame, or ventilation intakes.
- e. Allow 30-45 minutes for hydrogen generation. Remove canister from bucket and dispose of through normal channels *after* hydrogen cycle has stopped.

*Page 10, paragraph 9a.* Add the following after the paragraph heading:

**WARNING**

Should any corroded, pitted, scarred, or broken ML-304A/TM or ML-305A/TM canisters be found, follow all steps as shown on the warning page to render the canisters safe.

*Page 14*, paragraph 13a(6). Add the following after line 1:

**WARNING**

Should any corroded, pitted, scarred, or broken ML-304A/TM or ML-305A/TM canisters be found, follow all steps as shown on the warning page to render the canisters safe.

Delete Appendix D.

By Order of the Secretaries of the Army, the Navy, and the Air Force:

**E. C. MEYER**

*General, United States Army*

*Chief of Staff*

Official:

**J. C. PENNINGTON**

*Major General, United States Army*

*The Adjutant General*

**LEW ALLEN, JR., General USAF**

*Chief of Staff*

Official:

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Ft Gillem (10)

WSMR (1)

USAERDAA (1)

USAERDAW (1)

Army Dep (1) except

SAAD (30)

TOAD (14)

SHAD (2)

USA Dep (1)

Sig Sec Dep USA (1)

Units org under fol TOE:

29-207 (2)

29-610 (2)

29-134 (1)

29-136 (1)

NG: None

USAR: None

For explanation of abbreviations used, see AR 310-50.



CHANGE }  
No. 3 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C. 7 MAY 1968

HYDROGEN GENERATOR ML-303/TM AND HYDROGEN  
GENERATOR SET AN/TMQ-3 INCLUDING REPAIR PARTS  
AND SPECIAL TOOLS LIST

TM 11-2413, 17 August 1956, is changed as follows:

The title is changed as shown above.

Page 5, section I. (As changed by C 2, 27 Jan 66) Delete and substitute:

Section I. GENERAL

1. scope

a. This manual describes Hydrogen Generator ML303/TM and Hydrogen Generator Set AN/TMQ-3, and covers their installation, operation, maintenance and repair, and theory of operation. It also includes instructions for performing preventive maintenance and periodic maintenance services, including repair parts.

b. A list of pertinent publications applicable to the hydrogen generator and hydrogen generator set are included in appendix A.

c. A basic issue items list for the hydrogen generator set is contained in appendix B.

d. A maintenance allocation chart is contained in appendix C.

e. Organizational, DS, GS, and depot repair parts and special tools list is contained in appendix D.

f. Appendixes B, C, and D are current as of 30 January 1968.

2. Indexes of Publications

a. **DA Pam 310-4.** Refer to DA Pam 310-4 to determine whether there are new additions, changes, or additional publications pertaining to the equipment.

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\* This change supersedes C 2, 27 January 1966.

b. *DA Pam 310-7*. Refer to DA Pam 310-7 to determine whether there are modification work orders pertaining to the equipment.

### 3. 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 and Packaging and Handling Deficiencies*. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army), NAVSUP Publication 378 (Navy), AFR 71-4 (Air Force), and MCO P4610-5 (Marine Corps).

c. *Discrepancy in Shipment Report (DISREP) (SF361)*. Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38 (Army), NAVSUP Pub 459 (Navy), AFM 75-34 (Air Force), and MCO P4610.19 (Marine Corps).

d. *Report of Equipment Manual Improvements*. Report of errors, omissions, and recommendations for improving this publication by the individual is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL-ME-NMP-AD, Fort Monmouth, N. J., 07703.

Page 6, paragraph 5. (As changed by C 2, 27 Jan 66) Delete note below paragraph heading.

Page 28, appendix II. (As changed by C 2, 27 Jan 66) Delete and substitute:

## APPENDIX A REFERENCES

Following is a list of pertinent publications applicable to Hydrogen Generator ML-303/TM and Hydrogen Set AN/TMQ-3.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), and Lubrication Orders.
DA Pam 310-7	U. S. Index of Modification Work Orders.



- SB 11-573 Painting and Preservation Supplies Available for Field Use for Electronic Command Equipment.
- TB SIG 364 Field Instructions for Painting and Preserving Electronic Command Equipment.
- TM 9-213 Painting Instructions for Field Use.
- TM 11-6660-21&12 Organizational Maintenance Manual: Meteorological Station Manual AN/TMQ-4.
- TM 38-750 Army Equipment Record Procedures.
- Appendixes II, III, and IV. (As added by C2, 27 January 1966)  
Delete and substitute appendixes B, C, and D:

## APPENDIX B BASIC ISSUE ITEMS

### Section I. INTRODUCTION

#### B-1. Scope

This appendix lists items comprising an operable equipment and those required for installation, operation, or operator's maintenance for Hydrogen Generator Set AN/TMQ-3.

#### B-2. Explanation of Columns

The following is a list of explanations of columns in section II.

##### *a. Source, Maintenance, and Recoverability Codes (SMR) Column.*

- (1) *Source code (S).* The selection status and source for the item is first code indicated in this column. The source codes used and their explanations are—

<i>Code</i>	<i>Explanation</i>
<b>P</b>	<b>Applies to repair parts that are stocked in or supplied from GSA/DSA, or Army supply system, and authorized for use at indicated maintenance categories.</b>
<b>A</b>	<b>Applies to assemblies that are not procured or stocked as such but are made up of two or more units, each of which carries an individual stock number and description and is procured and stocked and can be assembled by units at indicated maintenance categories.</b>

- (2) *Maintenance code (M).* The lowest category of maintenance authorized to install the item is indicated by the second code in the column. The maintenance category codes and their explanations are—

Code	Explanation
C . . . . .	Operator/Crew
O . . . . .	Organizational Maintenance

(3) *Recoverability code (R)*. The recoverability code is the third code in the column. It indicates whether unserviceable items should be returned for recovery or salvage. Recoverability codes and their explanations are as follows:

*Note.* When no code is indicated in the recoverability column, the part will be considered expendable.

Code	Explanation
R-	Applies to repair parts and assemblies that are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
U-	Applies to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value reusable casings or castings.

*b. Federal Stock Number Column.* This column indicates the Federal stock number for the item.

*c. Description Column.* This column includes the Federal item name and any additional description of the item which may be required. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers. Usable on code column is not used.

*d. Unit of Issue Column.* The unit used as a basis of issue (e.g., ea, pr, ft, yd, etc.) is given in this column.

*e. Quantity Incorporated in Unit Pack Column.* Not used.

*f. Quantity Incorporated in Unit Column.* The total quantity of the item use in the equipment is given in this column.

*g. Quantity Furnished with Equipment Column.* This column lists the quantity of the item supplied for initial operation of the equipment and/or the quantities authorized to be kept on hand by the operator for maintenance of the equipment.

*h. Quantity Authorized Column.* Not used.

*i. Illustrations Column.*

(1) *Figure number (a).* The number of the illustration on which the item is shown is indicated in this column.

(2) *Item No. or reference designation (b).* Not used.

SECTION II. BASIC ISSUE ITEMS

(1) S&W CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  Reference Number & Mfr Code	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT UNIT	(7) QTY FURN WITH EQUIP	(8) QTY AUTH	(9) ILLUSTRATIONS	
								(a) FIG. NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
A O R	3655 40E-4662	HYDROGEN GENERATOR SET AH/TM-3: generates hydrogen for inflation of 700 or 350 gm balloons (This item is nonexpendable)  TECHNICAL MANUAL TM 11-2413  Requisition through pinpoint account number if assigned; otherwise through nearest Adjutant General facility  A quantity of one technical manual is packed with each equipment. Where a valid need exists, additional copies may be requisitioned and kept on hand	ea			1	1	4	
P-O	4730-40E-4671	ADAPTER, STRAIGHT, PIPE TO TUBE: steel cap; 3-7/8" lg o/a; SC-D-7431, Item 2; 81349	ea		4	2		2	
P-C	6660-40E-4559	CALCIUM HYDRIDE CHARGE ML 304A/TM: 3-3/4" dia x 2" h	ea		4	4		5	
P-C	6660-40E-4560	CALCIUM HYDRIDE CHARGE ML 305A/TM: 3 3/4" dia x 6 1/4" h	ea		4	4		5	
P-O-U	3655-40E-4569	CASE CY-219/TM-3: 12" h x 18" wd x 27" deep; approx 20 lbs (This item is nonexpendable)	ea		1	1		4	
P-O	5330-189-8897	GASKET: 1-3/4" od x 1-1/32" id x 1/16" thk; SC-D-7431-3; 81349	ea		4	2		4	
P O	4720-263-3306	HOSE: rubber; 1/2" id x 3/4" od, 12 ft lg, ZZ-T-831b, amend 2, Grade A, heavy wall; 96906	ft		12	12		4	
P-O-U	3655-40E-4669	HYDROGEN GENERATOR ML-303/TM: for calcium hydride charge; 5-1/8" dia x 15" h; MIL-H-11127; 96906 (This item is nonexpendable)	ea		4	2		2	
P-O-U	3655-40E-4699	MANIFOLD ML-344/TM-3: 10-9/16" square plate; 1/16" thk (This item is nonexpendable)	ea		1	1		7	
P-O-U	5110-322-6112	PUNCH, SADDLERS: SC-A-7433; 81349 (This item is nonexpendable)  NO ACCESSORIES, TOOLS, OR TEST EQUIPMENT ARE TO BE ISSUED WITH THIS EQUIPMENT  NO BASIC ISSUE ITEMS ARE MOUNTED IN OR ON THIS EQUIPMENT	ea		1	1		2	

# APPEDIX C

## MAINTENANCE ALLOCATION

### Section I INTRODUCTION

#### C-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature for Hydrogen Generator Set AN/TMQ-3. It authorizes categories of maintenance for specific functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

#### C-2. Explanation of Format for Maintenance Allocation Chart

*a. Group Number.* Not used.

*b. Component Assembly Nomenclature.* This column lists the item names of component units, assemblies, subassemblies, and modules on which maintenance is authorized.

*c. Maintenance Function.* This column indicates the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

<i>Code</i>	<i>Maintenance category</i>
C -----	Operator/Crew
O -----	Organizational Maintenance
F -----	Direct Support Maintenance
H -----	General Support Maintenance
D -----	Depot Maintenance

*d. Tools and Equipment.* The numbers appearing in this column refer to specific tools and equipment which are identified by these numbers in section III.

*e. Remarks.* Self-explanatory.

#### C-3. Explanation of Format for Tool and Test Equipment Requirements

The columns in the tool and test equipment requirements chart are as follows:

*a. Tools and Equipment.* The numbers in this column coincide with the numbers used in the tools and equipment column of the

MAC. The numbers indicate the applicable tool for the maintenance function.

*b. Maintenance Category.* The codes in this column indicate the maintenance category normally allocated the facility.

*c. Nomenclature.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

*d. Federal Stock Number.* This column lists the Federal stock number.

*e. Tool Number.* Not used.

SECTION II. MAINTENANCE ALLOCATION CHART

MAINTENANCE ALLOCATION CHART														
GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS										TOOLS AND EQUIPMENT	REMARKS	
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL			REBUILD
	HYDROGEN GENERATOR SET AM/TNR-3	C		C				C	C	C	D	D	1	
	HYDROGEN GENERATOR BODY ML-303/2M							C		D				
	MANIFOLD ML-344/TNR-3							C		D				

AGO 9955B

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOL AND TEST EQUIPMENT REQUIREMENTS				
TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	D	SHOP SUPPORT		

# APPENDIX D ORGANIZATIONAL, DS, GS, AND DEPOT REPAIR PARTS

## Section I. INTRODUCTION

### D-1. Scope

This appendix contains a list of repair parts required for the performance of organizational maintenance and a list covering the corresponding requirements for direct support, general support, and depot maintenance for Hydrogen Generator Set AN/TMQ-3.

*Note.* No special tools, test, and support equipment are required.

### D-2. General

The repair parts list is divided into the following sections:

*a. Repair Parts for Organizational Maintenance, Section II.* Repair parts authorized for organizational maintenance are included in this section.

*b. Repair Parts for Direct Support, General Support, and Depot Maintenance, Section III.* Repair parts authorized for direct support, general support and depot maintenance are included in this section.

*Note.* The index noted below is cross-referenced to index numbers. The index numbers appear in ascending sequence in column 1 of the repair parts list (para D-3a). The index number for the particular item will be the same for the item in all sections of this appendix.

*c. Federal Stock Number. Cross Reference to Index Number, Section IV.* This is a cross reference index of Federal stock numbers to index numbers.

### D-3. Explanation of Columns

An explanation of the columns is given below.

*a. Source, Maintenance, and Recoverability Codes (SMR) and Index Numbers Column.* The first line in this column lists the applicable SMR codes for the part. Listed in ascending order directly below the SMR codes is the index number assigned to the repair part.

- (1) *Source code (S).* The selection status and source for the listed item is noted here. Source codes and their explanations are as follows:



Code

Maintenance

P—Applies to repair parts that are stocked in or supplied from the GSA/DSA, or Army supply system, and authorized for use at indicated maintenance categories.

A—Applies to assemblies that are not procured or stocked as such but are made up of two or more units, each of which carries an individual stock number and description and is procured and stocked and can be assembled by units at indicated maintenance categories.

(2) *Maintenance code (M)*. The lowest category of maintenance authorized to install the listed item is noted here.

Code

Explanation

O ----- Organizational Maintenance

(3) *Recoverability code (R)*. The information in this column indicates whether unserviceable items should be returned for recovery or salvage. Recoverability codes and their explanations as follows:

*Note.* When no code is indicated in the recoverability column, the part will be considered expendable.

Code

Explanation

R—Applies to repair parts and assemblies which are economically repairable at DSU and GSU activities and normally are furnished by supply on an exchange basis.

U—Applies to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value reusable casings or castings.

*b. Federal Stock Number Column.* The Federal stock number for the item is listed in this column.

*c. Description Column.* This column includes the Federal item name and any additional description of the item required, the manufacturer's part number (reference number), and the applicable five-digit Federal Supply Code for Manufacturers (para D-5). Usable on code column is not used.

*d. Unit of Issue Column.* The unit used as a basis of issue (e.g., ea, pr, ft, yd, etc.) is indicated in this column.

*e. Quantity Incorporated in Unit Pack Column.* Not used.

*f. Quantity Incorporated in Unit Column.* The quantity of repair parts in an assembly is given in this column.

*g. Maintenance Allowances Column.*

(1) The maintenance allowance columns are divided into subcolumns. Indicated in each subcolumn opposite the item is the total quantity of items authorized for the number of equipments supported. Items authorized for

use as required, but not for initial stockage, are identified with an asterisk (\*) in the allowance column.

- (2) Subsequent changes to organizational allowances will be limited as follows: No change in the range of items is authorized. If additional items are considered necessary, recommendations should be forwarded to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL-ME-NMP-ES, Fort Monmouth, N. J., 07703, for exception or revision to the allowance list. Revisions to the range of items authorized will be made by the USA ECOM National Maintenance Point based upon engineering experience, demand data, or TAERS information.
- (3) The quantitative allowances for DS/GS categories of maintenance will represent initial stockage for a 30-day period for the number of equipments supported.

*h. One-Year Allowances Per 100 Equipments/Contingency Planning Purposes Column.* Opposite the item, the total quantity required for distribution and contingency planning purposes is indicated. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments for one year.

*i. Depot Maintenance Allowance Per 100 Equipments Column.* This column indicates the total quantity of each item authorized depot maintenance for 100 equipments.

*j. Illustrations Column.*

- (1) *Figure number (a).* The number of the illustration in which the item is shown is indicated in this column.
- (2) *Item No. or reference designation (b).* Not used.

#### **D-4. Location of Repair Parts**

*a.* This appendix contains one cross-reference index (sec IV), to be used to locate a repair part when the Federal Stock number is known. The first column in the cross-reference index is prepared in numerical sequence. The last column of the cross-reference index lists the index number assigned to the part.

*b.* Refer to the cross-reference index (para D-2c) and note the index number in the last column; then refer to the repair parts list to locate the index number which is listed in ascending order in column 1 of the repair parts list.

**D-5. Federal Supply Codes**

This paragraph lists the Federal supply code and the associated manufacturer's name.

<i>Code</i>	<i>Manufacturer</i>
81349. . . . .	Military Specifications
96906. . . . .	Military Standards

## SECTION II.

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION  Reference Number & Mfr Code	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT PACK	(6) QTY INC IN UNIT	(7) 15-DAY ORGANIZATIONAL MAINTENANCE ALW				(8) ILLUSTRATIONS	
						(a) 1-5	(b) 6-20	(c) 21-50	(d) 51-100	(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
A-O-R A001	3655-408-4683	HYDROGEN GENERATOR SET AN/TMQ-3: generates hydrogen for inflation of 700 or 350 gm balloons (This item is nonexpendable)								4	
P O A003	4730-408-4671	ADAPTER, STRAIGHT, PIPE TO TUBE: steel cap; 3-7/8" lg o/a; SC-D-7431, Item 2; 81349	ea		4	*	*	*	*	2	
P-O-U A006	3655-408-4569	CASE CY-219/TMQ-3: 12" h x 18" wd x 27" deep; approx 20 lbs; (This item is nonexpendable)	ea		1	*	*	*	*	4	
P O A007	5330-189-8897	GASKET: 1-3/4" od x 1-1/32" id x 1/16" thk; SC-D-7431-3; 81349	ea		4	*	*	*	*	4	
P-O A008	4720-263-3306	HOSE: rubber; 1/2" id x 3/4" od, 12 ft lg; ZZ-T-831b, amend 2, Grade A, heavy wall; 96906	ft		12	*	*	*	*	4	
P O U A009	3655-408-4669	HYDROGEN GENERATOR ML-303/TM: for calcium hydride charge; 5-1/8" dia x 15" h; MIL-H-11127; 96906 (This item is nonexpendable)	ea		4	*	*	*	*	2	
P-O-U A010	3655-408-4699	MANIFOLD ML-344/TMQ-3: 10-9/16" square plate; 1/16" thk (This item is nonexpendable)	ea		1	*	*	*	*	7	
P-O-U A011	5110-322-6112	PUNCH, SADDLERS: SC-A-7433; 81349 (This item is nonexpendable)	ea		1	*	*	*	*	2	

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) S&C CODE	(2) FPMN NUMBER	(3) DESCRIPTION  REFERENCE NUMBER & MFR. CODE	(4) USABLE ON CODE	(5) UNIT OF ISSUE	(6) QTY INC IN UNIT PACK	(7) 30-DAY DS MAINT ALLOWANCE			(8) 30-DAY GS MAINT ALLOWANCE			(9) 1 YR ALW PER EQUIP CENTGY	(10) 1 YR DEPOT MAINT PER 100 EQUIP	(11) ILLUSTRATIONS	
						(a)	(b)	(c)	(a)	(b)	(c)			(a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
						1-20	21-50	51-100	1-20	21-50	51-100				
A O R AO01	3695-400-4609	GENERATOR SET AM/TMG-3: generates hydrogen for inflation of 700 or 350 ps balloons (This item is nonexpansible)												4	
P O AO03	4730-400-4671	ADAPTER, SWAJUNT, PIPE TO TUBE: steel cap: 3-7/8" lg e/a; SC-B-7431, Item 2; 61349		ea	4	*	*	2	*	*	2	10	4	2	
P O U AO06	3695-400-4569	CAGE CT-219/TMG 3: 12" h x 18" wd 37" deep; approx 20 lbs: (This item is nonexpansible)		ea	1	*	*	*	*	*	*	4	1	4	
P O AO07	5330-109-1897	CONNECT: 1-3/4" od x 1-1/32" id x 1/20" thk; SC-B-7431-3; 61349		ea	4	*	*	2	*	*	2	10	4	4	
P O AO01	4700-263-3306	WHEEL: rubber; 1/2" id x 3/4" od, 12 ft lg; 22-T-031b, model 2, Grade A, heavy wall; 96906		ft	12	*	*	12	*	*	12	60	24	4	
P-O-U AO09	3695-400-4669	GENERATOR ML-301/TM: for calcium hydride charge; 5-1/8" dia x 15" h; MIL-N-11127; 96906 (This item is nonexpansible)		ea	4	*	*	2	*	*	2	10	4	2	
P O U AO10	3695-400-4699	WHEELS ML-344/TMG-3: 10-9/16" square plate; 1/16" thk (This item is nonexpansible)		ea	1	*	*	*	*	*	*	4	1	7	
P O U AO11	3810-302-6112	WHEEL, SANDLERS: SC-A-7433; 61349 (This item is nonexpansible)		ea	1	*	*	*	*	*	*	4	1	2	

**SECTION IV. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE  
TO INDEX NUMBER (CONTINUED)**

FEDERAL STOCK NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.	FEDERAL STOCK NUMBER	INDEX NO.
3655-408-4569	A006				
3655-408-4669	A009				
3655-408-4683	A001				
3655-408-4699	A010				
4720-263-3306	A008				
4730-408-4671	A003				
5110-322-6112	A011				
5330-169-8897	A007				

By Order of the Secretary of the Army:

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

Official:

**KENNETH G. WICKHAM,**  
*Major General, United States Army,*  
*The Adjutant General.*

Distribution:

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CofEngrs (1)	WSMR (5)
TSG (1)	Army Dep (2) except
CofSptS (1)	LBAD (14)
USAARENBD (2)	SAAD (30)
USAARTYBD (5)	TOAD (14)
USCDC Agcy (1)	LEAD (7)
USAMC (5)	SHAD (3)
USCONARC (5)	NAAD (5)
ARADCOM (5)	SVAD (5)
ARADCOM Rgn (2)	CHAD (3)
OS Maj Comd (4)	ATAD (10)
USARHAW (5)	GENDEPS (2)
USARYIS (5)	Sig Sec Gen Deps (5)
LOGCOMD (2)	Sig Dep (12)
USAMICOM (4)	Sig FLDMS (2)
USASTRATCOM (4)	AMS (1)
USAESC (70)	USAERDAA (2)
MDW (1)	USAERDAW (13)
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USAIS (2)	6-200 7
USAES (2)	6-201 7-100
USATC Armor (2)	6-300 11-57
USATC Inf (2)	6-385 11-97
USASTC (2)	6-386 11-98
WRAMC (1)	6-525 11-117
Army Pic Cen (2)	6-526 11-127
USACDCEC (10)	6-565 11-155
Instl (2) except	6-575 11-157

11-158	17-100
11-500 (AA-AC)	37
11-587	37-100
11-592	39-51
11-597	57
17	67

NG: None

USAR: None

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



TECHNICAL MANUAL  
HYDROGEN GENERATOR ML-303/TM  
AND  
HYDROGEN GENERATOR SET AN/TMQ-3

TM 11-2413

CHANGE No. 1



HEADQUARTERS,  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 2 October 1963

TM 11-2413, 17 August 1956, is changed as follows:

Page 5. Delete section I and substitute:

Section I. GENERAL

1. Scope

a. This manual describes Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3, and covers their installation, operation, maintenance and repair, and theory of operation. It also includes instructions for performing preventive and periodic maintenance services.

b. The operator and organizational repair parts and special tools list and maintenance allocation chart for Hydrogen Generator Set AN/TMQ-3 are contained in TM 11-3655-200-12P.

c. The field and depot maintenance repair parts and special tools list for Hydrogen Generator Set AN/TMQ-3 is contained in TM 11-3655-200-35P.

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 the equipment. DA Pam 310-4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders 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.

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. Reporting of Equipment Manual Improvements.* The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA technical manual parts lists or supply manual 7, 8, or 9) 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 Officer, U. S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N.J., 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

*Page 21.* Delete chapter 3 and substitute:

## CHAPTER 3

### ORGANIZATIONAL MAINTENANCE

#### **17. Scope of Maintenance**

The maintenance duties assigned are listed below together with a reference to the paragraphs covering the specific maintenance function. The duties assigned include instructions for performing preventive maintenance checks and services.

*a.* Preventive maintenance (par. 19).

*b.* Daily preventive maintenance checks and services (par. 20.1).

*c.* Cleaning (par. 20.2).

*d.* Gasket replacement (par. 20.3).

*e.* Monthly preventive maintenance checks and services (par. 20.5).

*f.* Touchup painting (par. 20.6).

#### **18. Tools and Materials Required**

The tools and materials required for maintenance are listed below.

*a. Tools.*

(1) Knife TL-29 (or equivalent).

(2) .Brush (2-inch).

*b. Materials.*

(1) Cleaning Compound (Federal stock No. 7930-395-9542).

(2) Cleaning cloth.

(3) Fine sandpaper.

(4) Length of stiff wire (approximately size: No. 18, about 6 in. long).

## 19. 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 20.1 through 20.6 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 chart (pars. 20.1 and 20.5) outline functions to be performed at specific intervals. These checks and services are to maintain Army 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 chart indicates what to check, how to check, and what the normal conditions are. The *References* column lists the paragraph that contains additional information. If the defect cannot be remedied at first or second echelon, higher echelon maintenance is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

## 20 Preventive Maintenance Checks and Services Periods

*a.* Preventive maintenance checks and services of the equipment are required on a daily and monthly basis.

*b.* Paragraph 20.1 specifies checks and services that must be accomplished daily or under the following special conditions:

(1) When the equipment is initially received.

(2) When the equipment is returned after being removed for any reason.

(3) At least once each week if the equipment is maintained in standby condition.

20.1 Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Case .....	Inspect outside and inside of case (fig. 4) for cleanliness, rust and corrosion, and clean as required.	Par. 20.2.
2	Generator body ....	<p>a. Inspect outside and inside of generator body (fig. 2) to make sure it is clean and free of chemical deposits.</p> <p>b. Inspect condition of interrupted threads located at bottom of generator body (fig. 3). They should be undamaged and without rust or corrosion.</p>	Par. 20.2.
3-W a	Gaskets .....	Inspect seating and condition of gaskets in screwcap of outlet tubes (fig. 2). Gaskets should be clean and not deteriorating.	Par. 20.3.
4	Outlet tube .....	Unscrew outlet tube (fig. 2) from generator body and check to see that outlet tube is unobstructed and that the screwcap contains a gasket.	Par. 20.2.
5	Manifold .....	<p>Visually inspect and check manifold (fig. 4) for following:</p> <p>a. Cleanliness, rust, and corrosion.</p> <p>b. Security of attachment of hydrogen generators to manifold.</p> <p>c. Security of attachment of each 6-inch hose to its respective outlet tube and to larger center metal tubing and condition of hoses.</p>	Par. 20.2.
6	Balloon nozzle ....	Inspect balloon nozzle to see that it is clean, free of rust and corrosion, and that there are no obstructions in its outlet or inlet end.	Paras. 9b and 20.2.
7	Container .....	Inspect inside of water containers for cleanliness. They should be free of chemical deposits.	Par. 9c.

## 20.1 Daily Preventive Maintenance Checks and Services Chart -(Continued)

	Item	Procedure	References
	Operation.....	During normal use of equipment, be alert for any unusual operating condition. Observe that there are no leaks around manifold hose connections and that nozzle valve does not stick.	Pars. 14 and 15.

**\*To be accomplished weekly instead of daily.**

### 20.2. Cleaning

Inspect the components of the equipment for rust and chemical deposits (encrustations). The surfaces should be clean and free of rust or corrosion.

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

a. Remove grease and oil, fungus, and ground-in dirt from the case (fig. 4). To clean surfaces of grease and oil, use cleaning compound. To remove dirt, use a damp (with water) cleaning cloth.

b. Remove rust, corrosion, or chemical deposits from component surfaces with sandpaper.

c. Rinse the components of the equipment with water immediately after use and dry with a clean cloth.

d. Remove obstructions of dirt or chemical deposits from nozzle inlets and outlets, outlet tubes, manifold, and hose by running a short length of stiff wire through the openings and washing with water.

### 20.3. Gasket Replacement

(fig. 2)

Gaskets must be replaced when they become damaged or deteriorated. Replace gasket as follows:

a. Unscrew the outlet tube from the generator body.

b. Remove the gasket from the screwcap end of the outlet tube.

c. Place the new gasket in the screwcap end of the outlet tube.

d. Screw the outlet tube on the generator body.

## 20.4 Monthly Maintenance

Perform the maintenance functions indicated in the monthly preventive maintenance checks and services chart (par. 20.5) 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.

### 20.5 Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Completeness .....	Check to see that all components and running spares are on hand.	TM 11-3655-200-12P.
2	Case .....	Visually inspect and check (fig. 6) for following: a. Loose or detached handles, fasteners, hinges, or other missing hardware. b. Security of attachment of manifold support inside case. c. Condition of paint .....	a. None. b. None. c. Par. 20.6.
3	Manifold .....	Dismantle hydrogen generators (generator bodies and four 6-inch hoses from manifold (fig. 7)) and check for following: a. Cleanliness of outlet tubes. b. Condition of gaskets. Replace gaskets if required. c. Interior cleanliness of 6-inch hoses. d. Condition of 6-inch hoses. Replace with new hosing if required.	a. Par. 20.2. b. Par. 20.3. c. Par. 20.2. d. None.
4	Hose ML-81 .....	Inspect 10-foot hose (fig. 4) for breaks, cracks, and general deterioration.	
5	Punch .....	Check to see that punch handle is not broken and that it is	

**20.5 Monthly Preventive Maintenance Checks and Services  
Chart - ( Continued )**

Sequence No.	Item	Procedure	References
6-Q*	Publications .....	securely attached to punch (fig. 4). a. Check to see that all pertinent publications are on hand, complete, and current. Requisition pertinent publications not on hand. b. Check DA Pam 310-4 to determine whether all changes pertinent to the equipment are on hand.	a. Appx and DA Pam 310-4. b. DA Pam 310-4.
7-Q*	Modifications .....	Check DA Pam 310-4 to determine whether new applicable MWO's have been published. All urgent MWO's must be applied immediately. All NORMAL MWO's must be scheduled.	TM 38-750 and DA Pam 310-4.

\* To be accomplished quarterly instead of monthly.

**20.6. Touchup Painting**

Remove rust and corrosion from the metal surfaces by lightly sanding them with fine sandpaper. Sand down nicks, burrs, and splinters from wooden surfaces before applying paint. Brush two thin coats of paint on surfaces to be protected. Refer to the applicable cleaning and refinishing practices specified in TM 9-213 for more details.

*Page 28.* Add appendix after chapter 6.

**APPENDIX  
REFERENCES**

Following is a list of pertinent publications applicable to Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3:

DA Pam 310-4

Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.

TM 9-213

Painting Instruction for Field Use.

TM 11-2405	Meteorological Balloons and Inflation and Launching Accessories.
TM 11-3655-200-12P	Operator and Organizational Repair Parts and Special Tools List and Maintenance Allocation Chart: Hydrogen Generator Set AN/TMQ-3.
TM 11-3655-200-35P	Field and Depot Maintenance Repair Parts and Special Tools List: Hydrogen Generator Set AN/TMQ-3.
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.*

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ARADCOM Rgn (2)  
OS Maj Comd (3)  
OS Base Comd (2)  
LOGCOMD (2)  
USAECOM (5)  
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Corps (2)  
USA Corps (3)  
USATC AD (2)  
USATC Engr (2)  
USATC Inf (2)  
USATC Armor (2)  
USATC (5)  
Instl (2) except  
    Ft Monmouth (65)  
Svc Colleges (2)  
Br Svc Sch (2)  
GENDEP (OS) (2)  
Sig Sec, GENDEP (5)  
Sig Dep (OS) (12)  
Army Dep (2) except  
    Ft Worth (8)

Lexington (12)  
Sacramento (28)  
Tobyhanna (12)  
USA Trans Tml Comd (1)  
Army Tml (1)  
POE (1)  
USAOSA (1)  
AMS (1)  
WRAMC (1)  
AFIP (1)  
Army Pic Cen (2)  
USA Elct RD Actv, White Sands (13)  
USA Elct RD Actv, FtF Huachuca (2)  
USA Mbl Spt Cen (1)  
USA Elct Mat Agcy (12)  
Chicago Proc Dist (1)  
USARCARIB Sig Agcy (1)  
Sig Fld Maint Shops (3)  
Units org under fol TOE:  
11-7 (2)  
11-16 (2)  
11-57 (2)  
11-97 (2)  
11-98 (2)  
11-117 (2)  
11-155 (2)  
11-157 (2)  
11-500 (AA-AE) (4)  
11-557 (2)  
11-587 (2)  
11-592 (2)  
11-597 (2)

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

**USAR:** None.

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

TECHNICAL MANUAL } DEPARTMENTS OF THE ARMY AND  
No. 11-2413 } THE AIR FORCE  
TECHNICAL ORDER }  
No. 31M1-2TM-121 } WASHINGTON 25, D. C., 17 August 1956

## HYDROGEN GENERATOR ML-303/TM AND HYDROGEN GENERATOR SET AN/TMQ-3

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**\*This manual supersedes TM 11-2413, 3 April 1945, including C 1, 29 November 1945; C 2, 12 July 1946; and C 3, 14 April 1954.**

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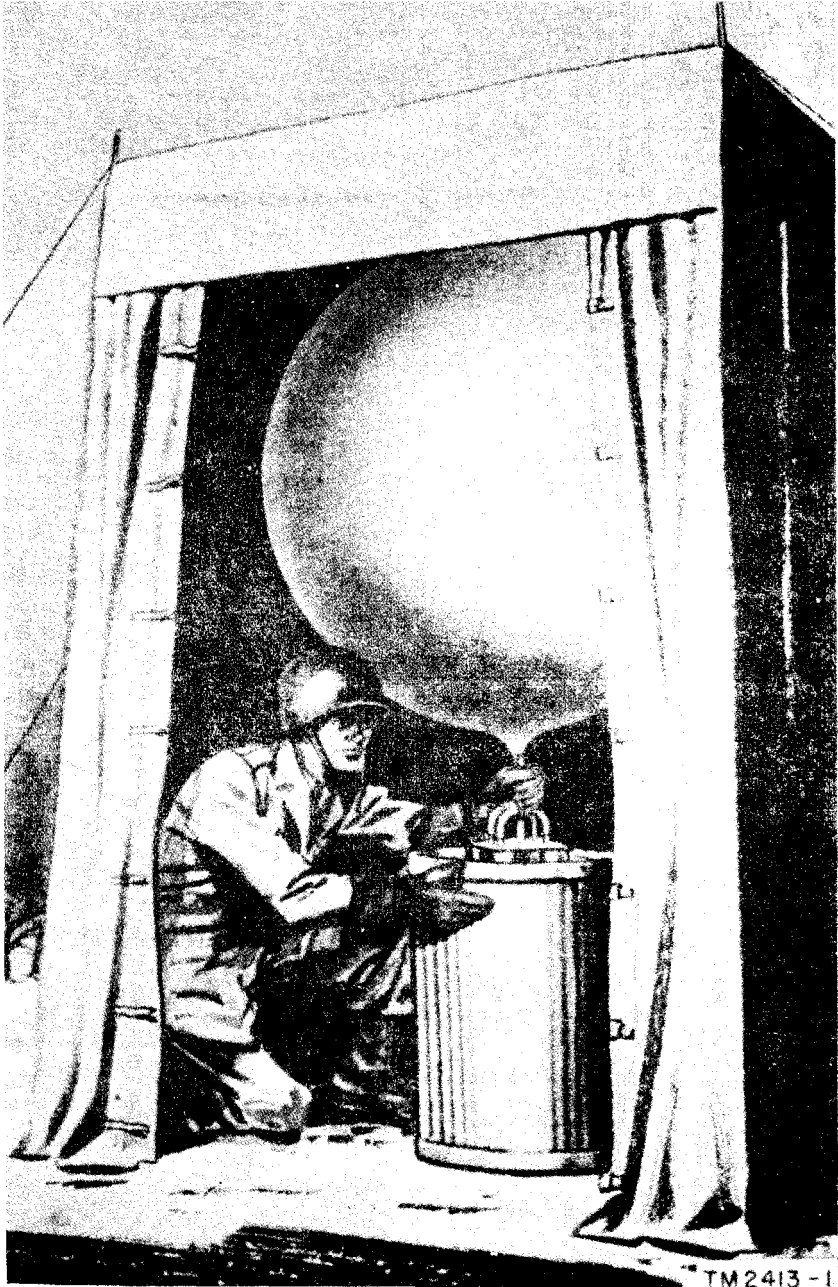
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*Figure 1. Hydrogen Generator Set AN/TMQ-3 in operation.*

# CHAPTER 1

## INTRODUCTION

---

### Section I. GENERAL

#### 1. Scope

a. This manual provides instructions for the installation, operation, and maintenance of Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3.

b. Forward comments on this publication directly to: Commanding Officer, The Signal Corps Publications Agency, Fort Monmouth, New Jersey.

#### 2. Forms and Records

a. *Unsatisfactory Equipment Reports.*

(1) Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding General, Signal Corps Engineering Laboratories, Fort Monmouth, New Jersey, as prescribed in AR 700-38.

(2) Fill out and forward DD Form 535 (Unsatisfactory Report) to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in AF TO 00-35D-54.

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) ; Navy Shipping Guide, Article 1850-4 (Navy) ; and AFR 71-4 (Air Force).

### Section II. DESCRIPTION AND DATA

#### 3. Purpose and Use

Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3 are used in the inflation of meteorological balloons. The equipment is transportable and is intended for use in the field.

#### 4. Technical Characteristics

a. *Hydrogen Generator ML-303/TM.*

Calcium hydride charge used	Hydrogen generating capacity (cu ft)	Time required (minutes)
ML-304A/TM-----	6	4 1/2
ML-305A/TM-----	24	15

*b. Hydrogen Generator Set AN/TMQ-3,*

- (1) *Generating capacity.* When using four calcium hydride charges ML-305A/TM, Hydrogen Generator Set AN/TMQ-3 will produce 96 cubic feet of hydrogen in 15 to 25 minutes.
- (2) *Generating cycle.* The time required for generating gas, changing water, and preparing new charges is from 30 to 40 minutes.

**5. Components**

**Note.** The lists of components in this paragraph are for information only. See SIG 7 and 8 AN/TMQ-3 and SIG 7 and 8 ML-303/TM for information pertaining to the requisitioning of spare parts.

*a. Hydrogen Generator ML-303/TM.*

Component	Required			Weight (lb)	
	No.	Dimensions (in)			
		Height	Diameter	Length	
Generator body_____	1	15 1/2	5 1/8		1.5
Outlet tube_____	1	3 7/8	1 3/4	-----	
Gasket_____	1	-----	1 3/4	-----	
Punch_____	1	-----	1 5/8	3 1/4	
Spare parts (par. 8a)_____					



*b. Hydrogen Generator Set AN/TMQ-3.*

Component	Required No.	Dimensions (in)					Weight (lb)	Volume (cu ft)
		Height	Width	Depth	Length	Diameter		
Hydrogen Generator ML-303/TM (less punch and spare parts).	4	19				5½	1.6	2.3
Manifold ML-344/TMQ-3	1	11	11	11			2.3	
Hose ML-81	4				6	½ (inside diameter)		
Case CY-219/TMQ-3	1	18	27	12			32	3.5
Punch	1				3¼	1½		
Spare parts (par. 8b)								

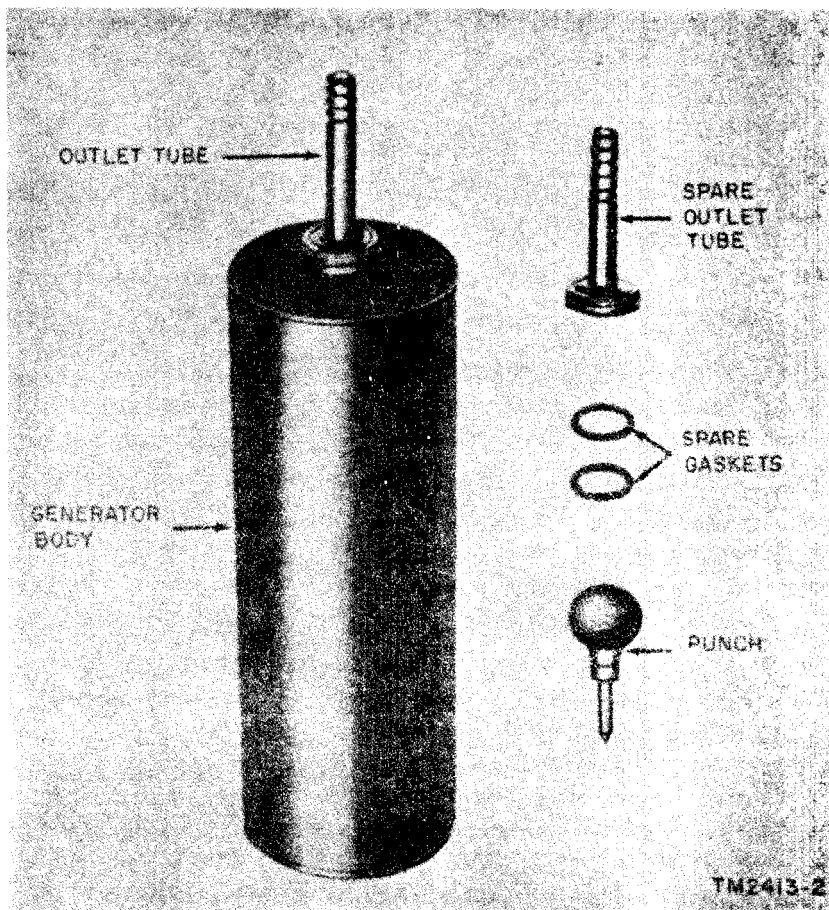


Figure 2. Hydrogen Generator ML-303/TM.

## 6. Description of Hydrogen Generator ML-303/TM

Hydrogen Generator ML-303/TM is shown in figure 2. The generator body is a cylindrical steel can. The outlet tube has a screw cap for attaching it to the generator body, and a corrugated stem to which Hose ML-81 may be attached. The bottom of the can (fig. 3) is recessed and has a protruding center with interrupter threads for attaching the chemical charge. The bottom of the can also has a number of holes to allow water to enter the generator body.

## 7. Description of Hydrogen Generator Set AN/TMQ-3

Hydrogen Generator Set AN/TMQ-3 is shown in figure 4. The manifold consists of a steel tube welded to a square sheet iron

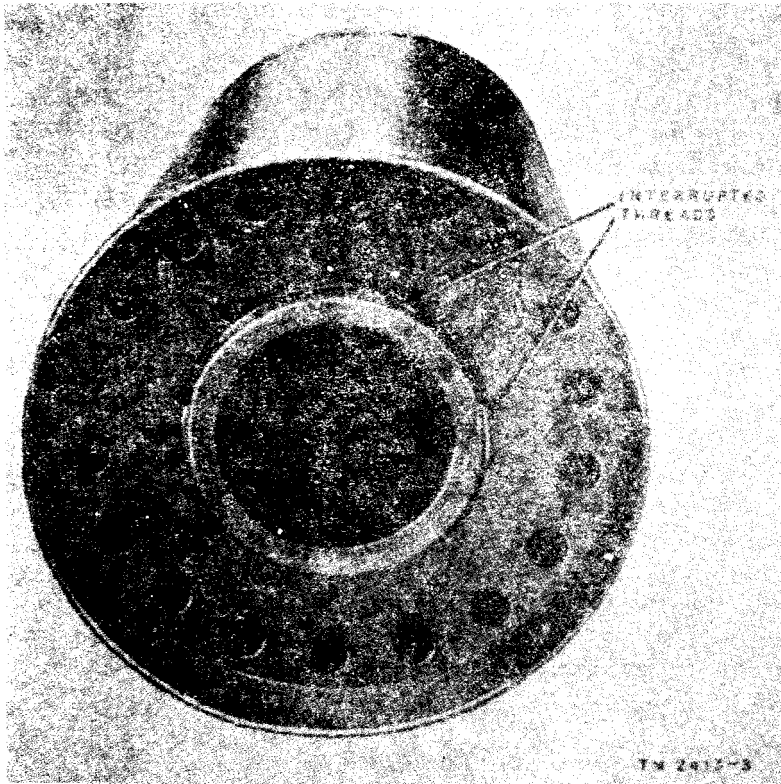


Figure 3. Generator body, bottom view.

plate. The plate has four holes for mounting the hydrogen generators, Short branch tubes connect Hoses ML-81 from each generator to the manifold. Case CY-219/TMQ-3 is fitted to hold the various components.

## 8. Spare Parts

a. *Hydrogen Generator ML-303/TM.* Hydrogen Generators ML-303/TM purchased on Order No. 19946-Phila-55 include one spare outlet tube and two spare gaskets. Equipment purchased on previous orders is not provided with spare parts.

b. *Hydrogen Generator Set AN/TMQ-3.* Hydrogen Generator Sets AN/TMQ-3 purchased on Order No. 21207-Phila-55 include the spare parts listed in the table below. Sets purchased on previous orders include the same spare parts except that the number of gaskets provided is six, and Hose ML-81 is provided in a 5-foot length.

Spare parts	Quantity
Hydrogen Generator ML-303/TM (less punch and spare parts)_	2
Punch_	1
G a s k e t s _	8
Hose ML-81 (10-foot length)_	1

### 9. Additional Equipment Required

The equipment discussed in *a* through *d* below is required for operation of Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3.

*a. Calcium Hydride Charge ML-804A/TM and ML-305A/TM (fig. 5).*

- (1) Calcium Hydride Charge ML-304A/TM is an airtight metal can containing approximately 6 ounces of 90-percent pure calcium hydride. The can is 3  $\frac{3}{4}$  inches in diameter, and 2 inches high. The top of the can is recessed and is provided with interrupted threads for attaching the charge to the bottom of the generator body. On the top of the can there are a number of knockouts that can be removed to allow water to enter the can. The charge

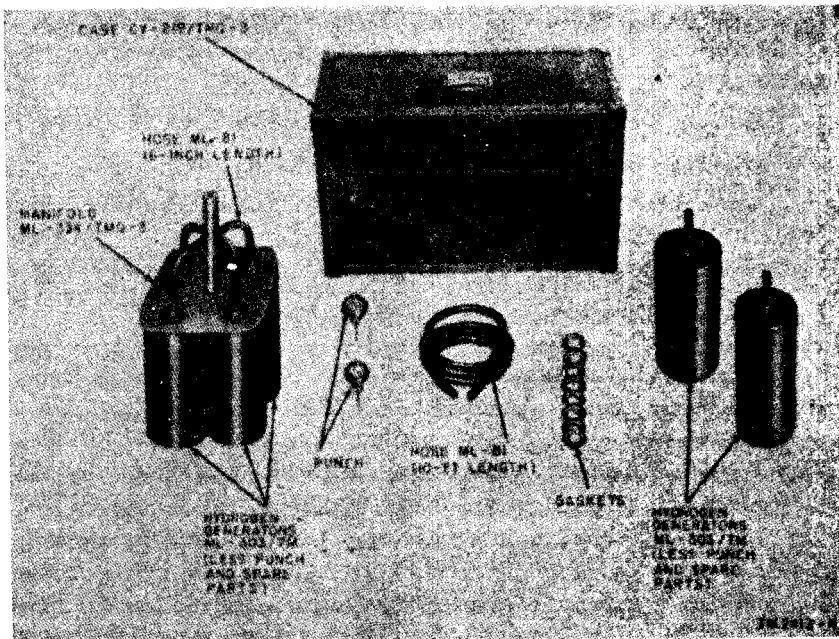


Figure 4. Hydrogen Generator Set AN/TMQ-3.

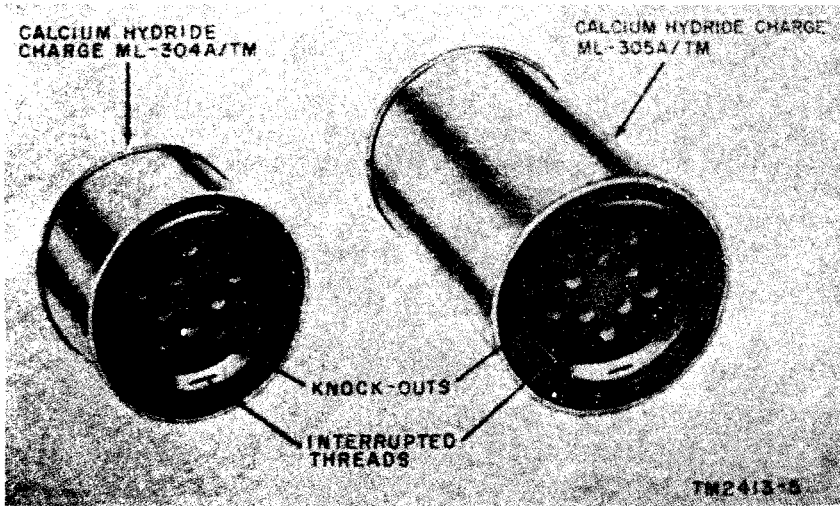


Figure 5. Calcium Hydride Charges ML-304A/TM and ML-305A/TM.

will produce approximately 6 cubic feet of hydrogen for inflation of a 30-gram balloon.

- (2) Calcium Hydride Charge ML-305A/TM is the same as Calcium Hydride Charge ML-304A/TM ((1) above) except that it contains approximately 1 ½ pounds of 90-percent pure calcium hydride, is 6 ¾ inches high, and produces approximately 24 cubic feet of hydrogen for inflation of a 100-gram balloon.

*b. Balloon Nozzle ML-373/GM.* Balloon Nozzle ML-373/GM is required for inflation of small balloons. Refer to TM 11-2405, Meteorological Balloons, for information regarding this nozzle.

*c. Water Containers.* Water containers, preferably of metal, are required as indicated below:

- (1) A container having the minimum dimensions of 25 inches in height and 10 inches in diameter is required when Hydrogen Generator ML-303/TM is used.
- (2) A container having the minimum dimensions of 25 inches in height and 20 inches in diameter is required when Hydrogen Generator Set AN/TMQ-3 is used.

*d. Hose ML-81.* When only Hydrogen Generator ML-303/TM is available, a 5- to 10-foot length of Hose ML-81 is required as additional equipment because no inflation hose is included with the generator.

## CHAPTER 2

### INSTALLATION AND OPERATION

---

#### Section I. INSTALLATION

#### 10. Unpacking Equipment

##### a. Packaging Data.

- (1) *Hydrogen Generator ML-303/TM*. All components are packed in a water-resistant fiberboard box with flexible, corrugated fiberboard to prevent movement. The fiberboard box is then sealed and inclosed in a nailed wooden shipping box. For export shipment, the shipping box is banded with steel strapping.

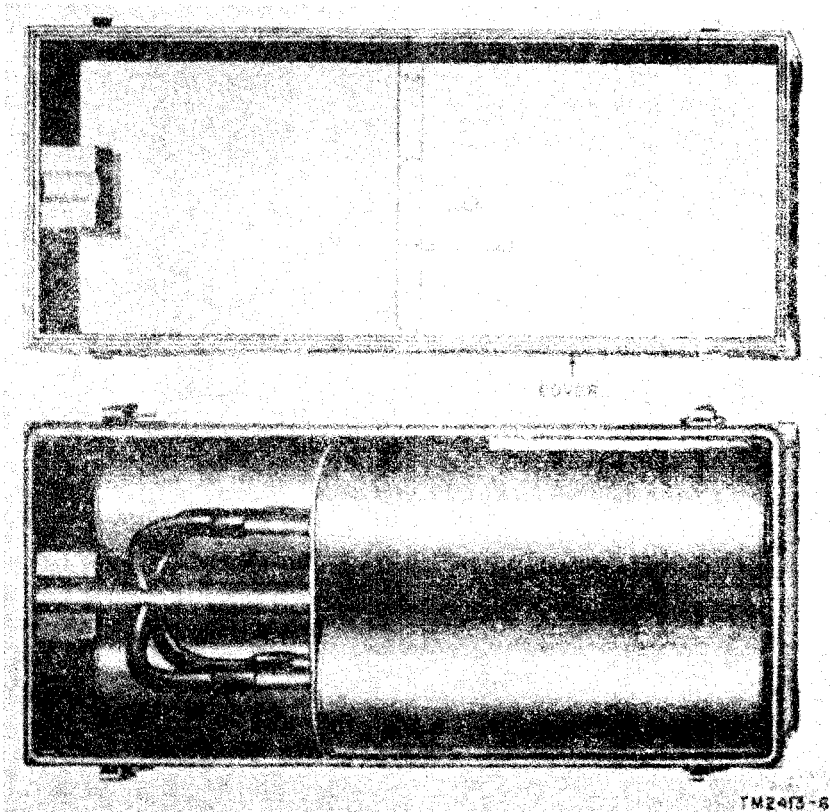


Figure 6. Hydrogen Generator Set AN/TMQ-3 in Case CY-219/TMQ-3 with cover of case removed

(2) *Hydrogen Generator Set AN/TMQ-3.* The components are placed in their compartments in Case CY-219/TMQ-3 (fig. 6) and the case is closed and secured with its latches. The case is placed in a water-resistant fiberboard box, which is then sealed. The sealed fiberboard box is then inclosed in a nailed wooden shipping box. For export shipment, the shipping box is banded with steel strapping.

(3) *Dimensions, volume, and weight of packed equipment.*

Equipment	Height (in)	Width (in)	Depth (in)	Volume (cu ft)	Weight
Hydrogen Generator ML-303/TM.	20	6	6	.4	3
Hydrogen Generator Set AN/TMQ-3.	20	30	15	5.0	45

*b. Removing Contents.* Cut and remove the steel strapping if the equipment is packed for export shipment. Carefully open the wooden shipping box and the fiberboard box. Do not push unpacking tools through the boxes, because the equipment may be damaged. Remove the equipment from the fiberboard box. In the case of Hydrogen Generator Set AN/TMQ-3, open the case and remove the contents.

## 11. Checking Equipment Before Use

*a. Checking Hydrogen Generator ML-303/TM.* Check all components against the packing slip.

*b. Checking Hydrogen Generator Set AN/TMQ-3.*

- (1) Check Manifold ML-344/TMQ-3 for cracks or breaks.
- (2) Check the 6-inch lengths of Hose ML-81 for cracks or breaks. and for proper attachment to the manifold and outlet tubes.
- (3) Unscrew the generator bodies from the outlet tubes; check the outlet tube gaskets; check the generator bodies for cracks or breaks; replace the generator bodies. Be sure that the outlet tubes fit tightly on the necks of the generator bodies and that the outlet tubes are not clamped against the manifold plate.
- (4) Check for the presence and good condition of the accessories (par. 5b) and spare parts (par. 8b).

## 12. Siting

Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3 should be installed as near as possible to the site where

the balloons are to be released. The installation should also be located near a water supply and in an area having good drainage for the disposal of water and waste chemicals.

13. Preparation for Use

a. **Hydrogen Generator ML-303/TM.**

- (1) Obtain a container (par. 9c(1)).
- (2) Fill the container with fresh water to a depth of 22 inches. If fresh water is not available, salt water may be used. The water should be as cool as possible; the temperature of the water must not be over 85° F.
- (3) Be sure that the gasket is in place inside the screw cap, and that the outlet tube is screwed tightly on the threaded neck of the generator body.
- (4) Attach the balloon to be inflated to the injector on Balloon Nozzle ML-373/GM. Open the valve on the nozzle, roll up the balloon to expel the air, and close the valve.
- (5) Attach one end of the long length of Hose ML-81 to the outlet tube on the generator body.
- (6) Select the proper calcium hydride charge (par. 9a).
- (7) Follow the procedure given below to open the knockouts on the top of the calcium hydride charge can.

*Note.* Never punch out the knockouts on the charge can until the charge is to be used because the calcium hydride will begin to deteriorate when air enters the can.

- (a) Shake the charge can gently to settle the calcium hydride so that there will be no lumps against the top of the can that may interfere with the removal of the knockouts.

*Caution:* There may be some pressure within the charge can. Unless precautions are taken before removing the first knockout, this pressure may blow calcium hydride dust into your face and may injure your eyes. Carefully follow the procedures given in (b) and (c) below.

- (b) Wrap a piece of paper or a cloth around the punch so that the top of the charge can will be completely covered when the first knockout is removed.
- (c) Place the point of the punch on one of the knockouts, hold the paper or cloth against the top of the charge can, and force the punch through the knockout.
- (d) Remove the paper or cloth and punch out the remaining knockouts.



- (e) Be sure that the knockouts are punched out completely, and that the calcium hydride lumps do not block the openings. If necessary, shake the can to settle the calcium hydride enough to clear the openings.
- (8) Attach the calcium hydride charge can to the bottom of the generator body by engaging the interrupted threads (figs. 3 and 5) and then rotating the charge can a short turn.

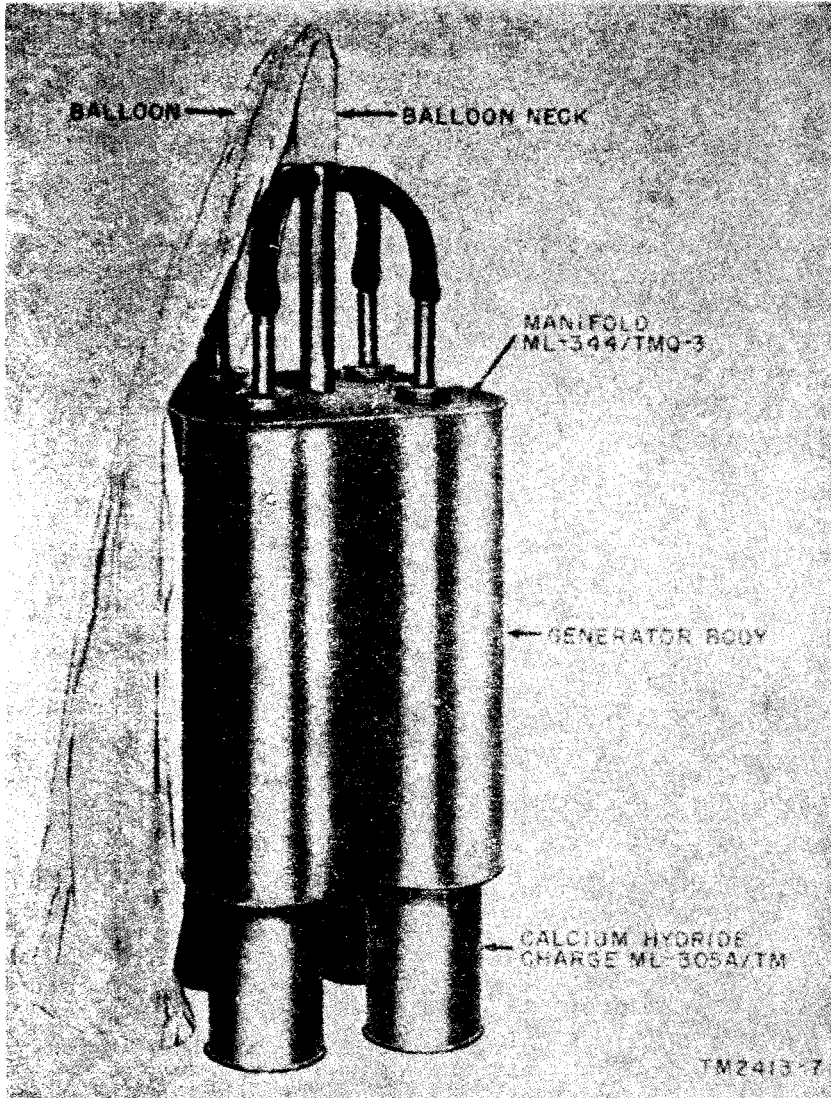


Figure 7. Hydrogen Generator Set AN/TMQ-3 prepared for use.

*b. Hydrogen Generator Set AN/TMQ-3.*

- (1) Obtain a container (par. 9c(2)).
- (2) Follow the procedure given in *a* (2) above.
- (3) Select the proper calcium hydride charges (par. 4) necessary to generate the number of cubic feet of hydrogen required. The amount of hydrogen required depends on the type and use of the balloon to be inflated as described in TM 11-2405.
- (4) Follow the procedure given in *a* (7) above for each calcium hydride charge being used.
- (5) Follow the procedure given in *a* (8) above for each generator being used.

*Note.* The four generators must remain assembled on the manifold during operation even though less than four calcium hydride charges are used. The water that enters the unused generator will prevent the escape of hydrogen from the unused manifold tube.

- (6) Pull the neck of the balloon to be inflated over the outlet on Manifold ML-344/TMQ-3 (fig. 7). Tie the balloon securely on the outlet with twine if the neck fits loosely.

## Section II. OPERATION

### 14. Precautions

*a.* Hydrogen is a flammable gas and can be highly explosive when mixed with air. Never smoke near a hydrogen generator when it is in operation, and keep all flames and sources of sparks away from the hydrogen generating area.

*b.* Never remove the hydrogen generator from the water until the generation of hydrogen has stopped. If a balloon breaks during inflation, or if for any other reason inflation must be interrupted, keep the generator in the water until the calcium hydride is completely exhausted. Removing the generator from the water while in operation will produce excessive heat and may cause dangerous chemical reaction.

*c.* Ground the equipment as explained in TM 11-2405.

*d.* When operating Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3, all outer clothing and the gloves (*e* below) worn by the operator should be of a material that will not produce static electricity, because a static charge may produce a spark which will ignite the hydrogen gas. If other types of clothing must be worn, the operator should wear a grounding device as explained in TM 11-2405.

*e.* When operating Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3, wear gloves to protect the hands,

because the outlet tube or manifold may become hot if a blow-back condition (par. 15a (2)) occurs.

f. When using Balloon Nozzle ML-373/GM, be sure that there is no obstruction in the nozzle. If there is any interference with the passing of the hydrogen into the balloon, a blow-back condition (par. 15a (2)) may occur.

g. Be sure there is no constriction in the balloon neck while the balloon is being inflated.

## 15. Operation Under Usual Conditions

### a. *Hydrogen Generator ML-303/TM.*

- (1) Grasp the outlet tube of the generator and immerse the generator body rapidly in the water so that the top rim of the generator body is 2 inches above the surface of the water (fig. 8) ; hold it in this position throughout the generating process, except as indicated in (2) below, to prevent water from being blown through the outlet tube. A slight vibration should be noticed, indicating that hydrogen is being generated.
- (2) In some cases hydrogen may escape from the bottom of the generator; this condition is called a blow back.
  - (a) When a blow back occurs, lower the generator so that the top rim of the generator is below the surface of the water.
  - (b) As soon as the blow back stops, raise the generator to the position described in (1) above.
- (3) Allow the hydrogen to pass through the generator body, outlet tube, and Hose ML-81 for about 3 seconds to remove all air from inside these parts; when all air has been removed, open the valve on Balloon Nozzle ML-373/GM to which the balloon is attached, and attach the end of the hose to the balloon nozzle.
- (4) Move the generator 2 or 3 inches up and down in the water to agitate the water in contact with the chemical charge. This supplies fresher, cooler water to the chemical, thereby keeping the hydrogen cooler and stimulating the chemical action.
  - (a) If the hydrogen is being generated too fast, decrease the speed of agitation.
  - (b) If the hydrogen is being generated too slowly, increase the speed of agitation.
- (5) If the calcium hydride charge is defective and does not produce the hydrogen properly, remove the charge can under water and discard it in water. Prepare and install a new charge as described in paragraph 13a(6) through

(8), and repeat the procedure described in (1) through (4) above.

**Caution:** When removing the charge can, do not allow metal parts to strike each other. This may cause sparks. Be careful when handling the defective charge can. It may be very hot. Deposit the defective charge can in water quickly. When exposed to the air the charge may get extremely hot and the chemical may erupt.

- (6) When the vibration stops and it is certain that the chemical action has been completed, hold the equipment in its operating position for 5 to 10 minutes to allow the water and sediment to drain from the balloon.
- (7) When all of the water and sediment have drained from the balloon, close the valve on Balloon Nozzle ML-373/GM and detach Hose ML-81 from the nozzle.
- (8) Weigh off and tie the balloon securely as described in TM 11-2405.



*Figure 8. Hydrogen Generator ML-303/TM in operation.*

- (9) Remove the generator from the water and rinse the inside of the generator body with water to remove the waste chemical products. These waste products are not injurious to the skin or clothing.
- (10) After 10 to 12 generations using Calcium Hydride Charge ML-304A/TM, or 5 to 7 generations using Calcium Hydride Charge ML-305A/TM, change the water in the container to remove the waste chemical products which retard the chemical action.

*b. Hydrogen Generator Set AN/TMQ-3.*

- (1) Grasp the outlet tube of Manifold ML-344/TMQ-3 and immerse the generator in the water so that the top rims of the generator bodies are 2 inches above the surface of the water (fig. 1) ; hold it in this position throughout the generating process, to prevent water from being blown through the outlet tube. A vibration should be noticed indicating that hydrogen is being generated.
- (2) Be sure that the neck of the balloon is not twisted or pinched. Any interference with the passage of the hydrogen through the neck of the balloon will cause the hydrogen to escape from the bottom of the generator.
- (3) Follow the procedure in *a(4)* and (6) above.
- (4) When all the water and sediment have drained from the balloon, twist and hold its neck to prevent the escape of hydrogen, remove the balloon from the manifold, and tie it off as described in TM 11-2405. If it is desired to weigh off the balloon, attach the neck of the balloon to Nozzle ML-196 immediately after removing it from the manifold, and weigh off as described in TM 11-2405.
- (5) Remove the generator from the water and rinse the inside of the generator bodies, the manifold, and the four short lengths of hose, using water to remove the waste chemical products. These waste products are not injurious to the skin or clothing.
- (6) Change the water in the container after each generation of hydrogen to remove waste chemical products, which retard the chemical action.

## 16. Operation Under Unusual Conditions

*a. Operation of Hydrogen Generator ML-303/TM in Extreme Cold.* When operating Hydrogen Generator ML-303/TM in extreme cold, the water vapor in the generated hydrogen will freeze and form snow as it passes through Hose ML-81 if the regular length of hose is used. This snow will accumulate in the balloon nozzle and block the passage of hydrogen. To prevent this condi-

tion, cut off approximately 6 inches from Hose ML-81 and use this short length of hose instead of the regular length.

*b. Operation When Water is Difficult to Obtain.*

- (1) When the water is to be changed (par. 15a(10) and b(6)) allow it to stand for about 2 hours while using a second container of water for operation.
- (2) When the waste chemicals in the first container have settled, pour the clear water into a temporary container, clean the first container, and replace the water.

*c. Operation Without Water Container.* When a water container is not available, or when it is expedient, Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 may be operated in a stream, brook, or other suitable body of water.

# CHAPTER 3

## ORGANIZATIONAL MAINTENANCE

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### Section I. OPERATOR'S MAINTENANCE

#### 17. General

Operator's maintenance of Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3 consists of inspecting and cleaning the equipment and replacing minor parts. A supply of water, clean cloths, a knife, and a narrow wooden stick for cleaning the small holes in the generator parts are required.

#### 18. Performing Operator's Maintenance

The operator will perform the following maintenance monthly:

*a. Hydrogen Generator ML-303/TM.*

- (1) Remove the outlet tube and gasket from the generator body.
- (2) Inspect all interior and exterior parts of the generator for chemical deposits and dirt. Remove any deposits and dirt found. Rinse all parts of the generator with water, and wipe the equipment dry.
- (3) Replace the gasket and screw the outlet tube tightly on the generator body.

*b. Hydrogen Generator Set AN/TMQ-3.*

- (1) Remove the four short lengths of Hose ML-81 from the manifold and from the outlet tubes. Remove the four outlet tubes and the four gaskets from the generator bodies, and remove the generator bodies from the manifold.
- (2) Inspect all interior and exterior parts of the generator for chemical deposits and dirt. Remove any deposits and dirt found. Rinse all parts of the generator with water, and wipe the equipment dry.
- (3) Replace the generator bodies, gaskets, outlet tubes, and hoses on the manifold. Be sure that the outlet tubes fit tightly on the necks of the generator bodies and that the outlet tubes are not clamped against the manifold plate.
- (4) If any of the short lengths of hose are unserviceable, cut a 6-inch length from the long length of Hose ML-81 supplied with the equipment, to replace the unserviceable hose.

## Section II. REPAIRMAN'S MAINTENANCE

### 19. General

Repairman's maintenance of Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3 consists of removing rust and corrosion from the equipment and retouching the equipment with paint where the finish has been damaged. The only maintenance equipment required is fine sandpaper and appropriate pointing materials.

### 20. Performing Repairman's Maintenance

*a.* Disassemble the equipment as described in paragraph *18a(1)* or *b(1)*.

*b.* Inspect all metal parts of the equipment and remove any rust, corrosion, or dirt found. Use fine sandpaper for the removal of rust or corrosion.

*c.* Retouch any places on the equipment with paint where the finish has been damaged. Refer to TM 9-2851, Painting Instructions for Field Use, for the procedure to be used when painting metal surfaces.

*d.* Reassemble the equipment as described in paragraph *18a(3)* or *b(3)*.



## CHAPTER 4

### THEORY

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#### 21. Generator Action

*a. Hydrogen Generator ML-303/TM* (fig. 9). When the generator is placed in the water, the water enters the generator through the holes in the bottom of the generator body and rises to the same level as the outside water. The water also enters the calcium hydride charge can through the knockout holes in the top of the can and reacts with the calcium hydride to form hydrogen gas. The hydrogen gas escapes through the holes in the top of the charge can and rises through the water to the top of the generator body. The gas then passes through the holes in the baffle plate, through the outlet tube, Hose ML-81, Balloon Nozzle ML-373/GM, and into the balloon. The outlet tube provides a narrow passage for the gas and therefore a pressure is created in the top of the generator body which forces the water inside the generator body down below the level of the outside water. The baffle plate prevents the passage of excessive water and waste chemicals from being carried through the outlet tube and into the balloon.

*b. Hydrogen Generator Set AN/TMQ-3.* The theory of Hydrogen Generator Set AN/TMQ-3 is the same as the theory described in a above except that when the hydrogen gas leaves the outlet tubes on the generator bodies, it passes through the short lengths of hose, through the outlet tube on Manifold ML-344/TM, and into the balloon.

#### 22. Chemical Action

*a.* When the water comes into contact with the calcium hydride, a chemical reaction takes place which produces hydrogen gas and calcium hydroxide. The hydrogen passes through the generator and into the balloon as explained in paragraph 21. The calcium hydroxide is released in the water, causing the water to become cloudy. Some of the calcium hydroxide collects on the inner and outer surfaces of the generator, and the rest slowly settles at the bottom of the water container.

*b.* During the chemical reaction, a great amount of heat is produced in the calcium hydride charge can. Some of the heat is released in the water, and some is passed through the generator and causes the outlet tube to become hot.

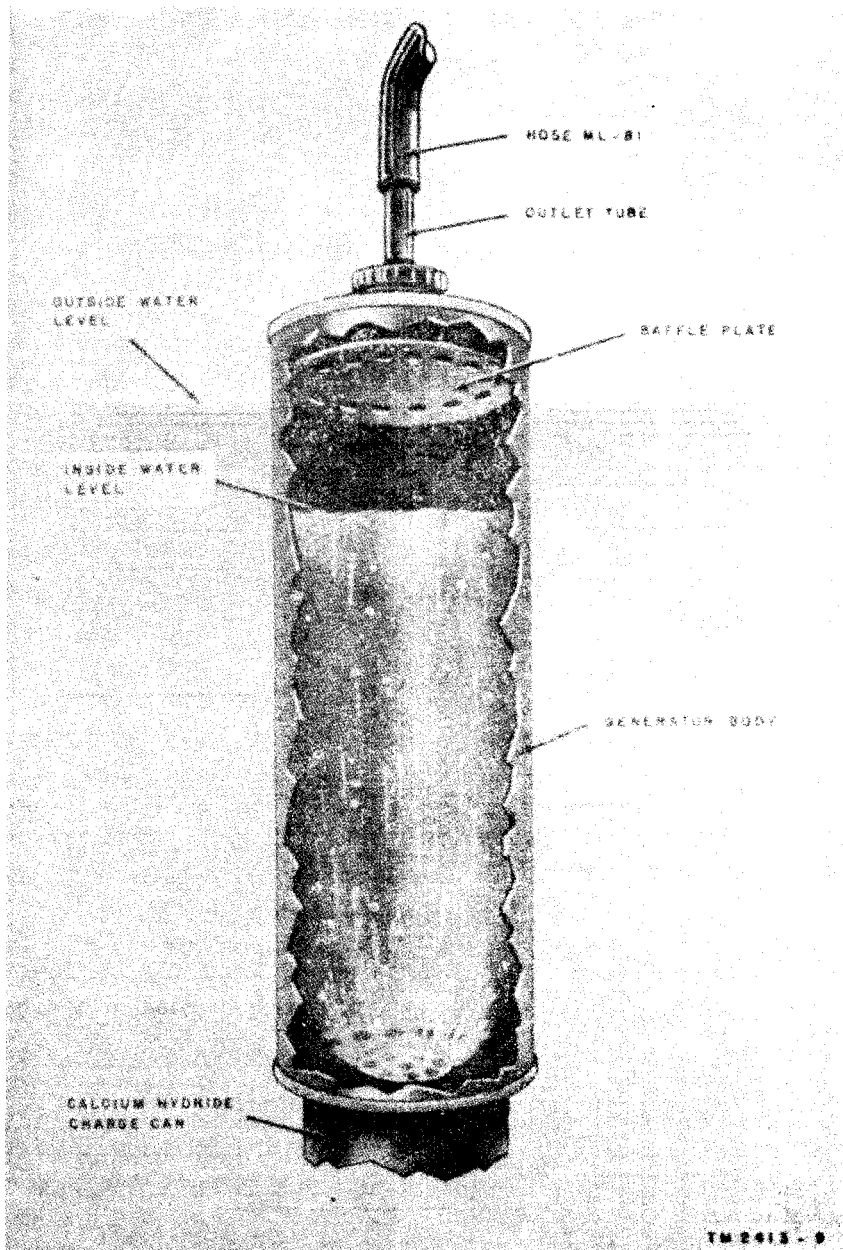


Figure 9. Generator action.

c. When the generator is removed from the water, the calcium hydroxide which collected on the various surfaces (*a* above) reacts with the carbon dioxide in the air to form calcium carbonate which is very hard. If the equipment is not cleaned before the various surfaces dry, the calcium carbonate will stick to the surfaces, clog the small openings, and become difficult to remove.

## CHAPTER 5

### FIELD MAINTENANCE

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#### **23. Troubleshooting Hydrogen Generator ML-303/TM**

- a.* Be sure the outlet tube and gasket are firmly in place on the generator body.
- b.* Plug the top of the outlet tube to prevent the escape of air.
- c.* Immerse the generator body and outlet tube vertically in water with the outlet tube upward.
- d.* Any leaks in the equipment will be indicated by a stream of air bubbles rising from the location of the leak.

#### **24. Troubleshooting Hydrogen Generator Set AN/TMQ-3**

- a.* Be sure the generator is properly assembled (par. 18*b* (3)).
- b.* Plug the top of the outlet tube on Manifold ML-344/TMQ-3 to prevent the escape of air.
- c.* Immerse the assembly vertically in water with the outlet tube of the manifold upward.
- d.* Leaks will be indicated as in paragraph 23*d*.

#### **25. Repairs, General**

- a.* Refer to paragraphs 18 and 20 for minor maintenance procedures and disassembly and reassembly instructions.
- b.* If any part of the equipment is damaged beyond repair, replace the damaged part with a new one.

#### **26. Repairing Leaks**

- a.* Repair small holes with solder. Repair large holes by soldering a piece of sheet metal over the hole.
- b.* If a leak is caused by a defective gasket, replace the gasket with a new one.

#### **27. Visual Inspection**

Visually inspect the equipment for evidence of damage and improper assembly. Check all outlet tubes for gaskets and for secure attachment to the generator bodies.

#### **28. Leakage Test**

When the equipment has been repaired, repainted, and reassembled, repeat the procedure in paragraph 23 or 24.

# CHAPTER 6

## SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

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### Section I. SHIPMENT AND LIMITED STORAGE

#### 29. General

When Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 is to be shipped or placed in limited storage, pack the equipment so that it will not be damaged by severe jolting or adverse weather conditions. Use a packing case strong enough to protect the equipment according to the type of transportation or storage to be used.

#### 30. Repacking

Pack Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 in accordance with the packaging data in paragraph 10a. Use the original packing material if available or use similar material. Further repacking information is usually available at supply depots.

### Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

#### 31. General

Demolition of Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 will be accomplished only upon order of the proper authority. The demolition procedures in paragraph 32 will be used to prevent the enemy from using or salvaging the equipment or any of its parts.

#### 32. Methods of Destruction

Use any or all of the following methods to destroy Hydrogen Generator ML-303/TM, Hydrogen Generator Set AN/TMQ-3, and the additional equipment:

*a. Smash.* Smash the generator bodies, outlet tubes, manifold, case, punches, water container, and balloon nozzle; use sledges, axes, or other heavy tools.

*b. Cut.* Cut the hoses and gaskets; use axes, knives, machetes, or shears.

*c. Burn.* Burn the hoses, gaskets, case, punches, and technical manuals; use oil, kerosene, or gasoline.

**Warning:** Gasoline vaporizes rapidly and may explode when lighted, causing injury or death to near-by personnel. When setting fire to gasoline-soaked material, stand away from the material and throw a lighted torch into it.

*d. Dispose.* Bury the destroyed parts in trenches, foxholes, or other holes, or throw the destroyed parts into streams, rivers, or lakes. Open the calcium hydride charge cans and dispose of them in water in an open area.

**BY ORDER OF THE SECRETARIES OF THE ARMY AND THE  
AIR FORCE:**

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US Army Tng Cen (2)	

NG: State AG (6) ; units-same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviation used, see SR 320-50-1.







