

DEPARTMENT OF THE ARMY TECHNICAL MANUAL **TM 11-6660-238-15**

DEPARTMENT OF THE AIR FORCE TECHNICAL MANUAL **TO 31-M1-2U-2**

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ORGANIZATIONAL, DS, GS, AND DEPOT  
MAINTENANCE MANUAL

**BALLOON INFLATION AND  
LAUNCHING DEVICE  
ML-594/U**

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

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*DEPARTMENTS OF THE ARMY AND THE AIR FORCE  
AUGUST 1966*



CHANGE }  
No. 2 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, DC, 20 August 1984

**Operator's, Organizational, Direct Support, General  
Support, and Depot Maintenance Manual  
BALLOON INFLATION AND LAUNCHING DEVICE ML-594/U  
(NSN 6660-00-999-2663)**

TM 11-6660-238-15/TO 31-M1-2U-2, 8 August 1966 is changed as follows.

1. Title of the manual is changed as shown above.
2. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar in front of the figure caption.
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4. File this change sheet in front of the publication.

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TECHNICAL MANUAL  
No. 11-6660-238-15  
TECHNICAL ORDER  
No. 31-M1-2U-2

DEPARTMENTS OF THE ARMY  
AND THE AIR FORCE

WASHINGTON, DC, 8 August 1966

**OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT  
AND DEPOT MAINTENANCE MANUAL  
BALLOON INFLATION AND LAUNCHING DEVICE ML-594/U  
(NSN 6660-00-999-2663)**

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**  
You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DR-SEL-ME-MP, Fort Monmouth, New Jersey 07703.  
In either case a reply will be furnished direct to you.

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# CHAPTER 1

## INTRODUCTION

### Section I. GENERAL

#### 1-1. Scope

a. This manual describes the Balloon Inflation and Launching Device ML-594/U (fig. 1-1) and includes complete installation, operation, and maintenance instructions at all levels of maintenance at which maintenance is authorized. It includes instructions for operation under usual and unusual conditions, cleaning and inspection of the equipment, and replacement of parts available to the operator.

b. The Components of End item List (COEI) and Basic Issue Items (BII) appear in appendix B.

c. The Maintenance Allocation Chart (MAC) appears in appendix C.

#### 1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

#### 1-3. Maintenance Forms, Records and Reports

a. *Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update.

b. *Report of Packaging and Handling Deficiencies.* Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73A/AFR 400-54/MCO 4430.3F.

c. *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

#### 1-3.1. Administrative Storage

Administrative storage of equipment issued to and

used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operation readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in chapter 6.

#### 1-3.2. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

#### 1-3.3. Reporting Equipment Improvement Recommendations (EIR)

If your Balloon Inflation and Launching Device needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. We'll send you a reply.

#### 1-3.4. Hand Receipt

This manual has a companion document with a TM number followed by -HR (which stands for Hand Receipt). The TM 11-6660-238-15-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEI, BII, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the US Army Adjutant General Publications Center, Baltimore, MD, in accordance with the procedures in Chapter 3, AR 310-2, and DA Pam 310-10-2.

### Section II. DESCRIPTION AND DATA

#### 1-4. Purpose and Use

a. *Purpose.* Balloon Inflation and Launching Device ML-594/U (fig. 1-1) is designed to secure and protect meteorological balloons during inflation and

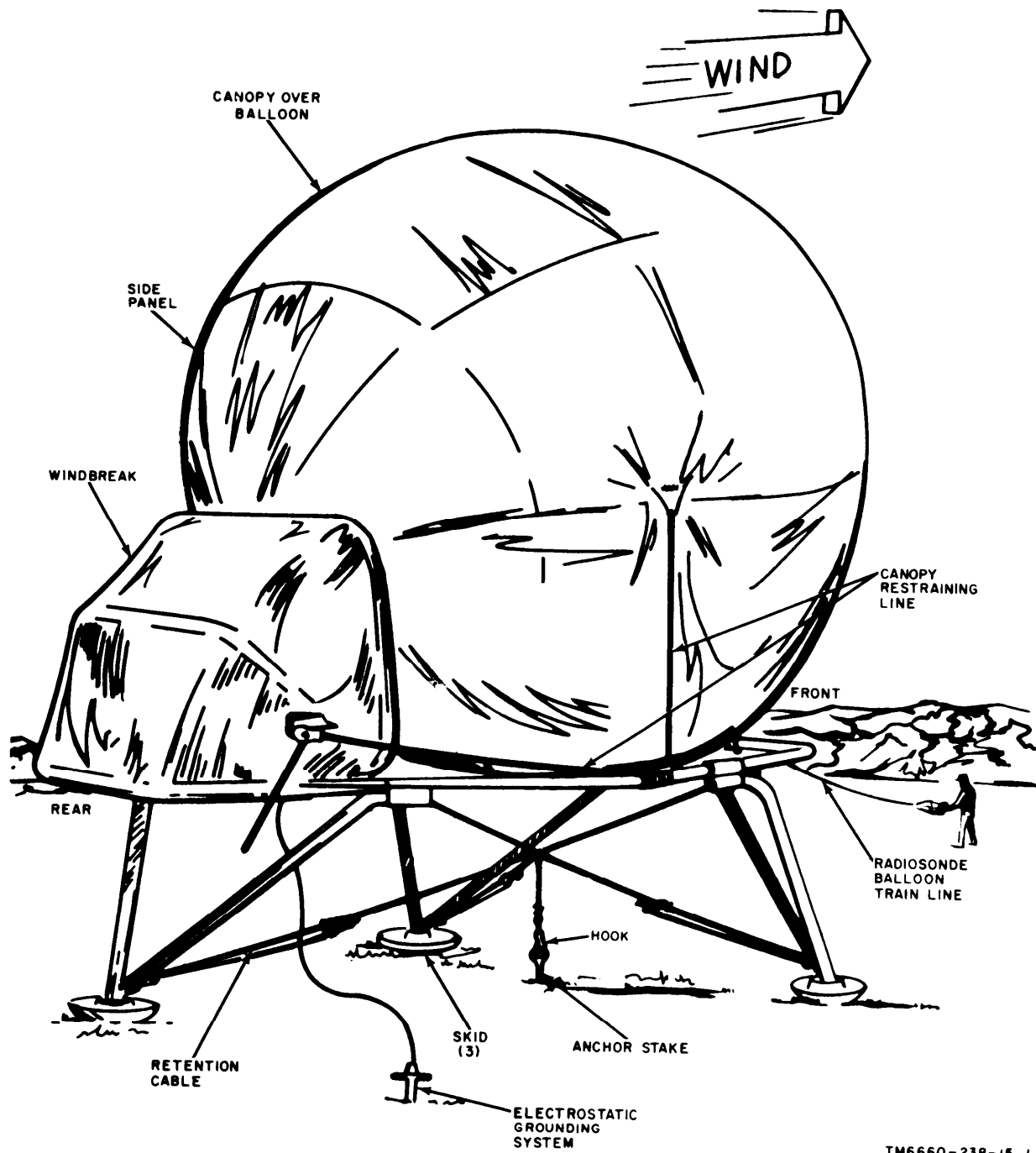
launching. Effective meteorological forecasting data from many levels of the earth's atmosphere is obtained with the help of meteorological balloons of various types and performance characteristics. The

meteorological balloons are fabricated of highly elastic compounds which are easily punctured; therefore, they are highly vulnerable to damage during inflation and launching operations, particularly when these operations are accomplished during extreme weather conditions such as strong winds, heavy rain, snow, ice, or other heavy precipitation.

*b. Use.* The MIL-594/U is a portable inflation shelter and launching platform designed for use in

the field in an inflation and launching system consisting of a gas cylinder supply, the Balloon Inflation and Launching Device ML-594/U, and a Hydrogen-Helium Volume Meter ML-605/U to accommodate and provide for successful inflation from ground elevation to 10,000 feet for balloon types ML-391, ML-518, ML-537, ML-541, and ML-566, which are currently in production, or other balloons of similar size and construction.





TM6660-238-15-1

Figure 1-1. Balloon Inflation and Launching Device ML-594/U.



**1-5. Technical Characteristics of Balloon Inflation launching Device ML-594/U**

Operating ranges:  
 Wind 0-50 mph/w rain or dust.  
 Temperature -40° to +140° F.  
 Ice cover on equipment surface 1/16" thickness maximum.  
 Altitude Sea level to 10,000 ft.  
 Used with balloon types ML-331, ML-518, ML-537, ML-541, ML-566, or other balloons of similar size and construction.

Weight:  
 With transit case 140.40 lb.  
 Without transit case 89.00 lb.  
 Dimensions:  
 Stored in transit case 6 13/16" high x 47 7/8" wide x 66 3/4" long.  
 Assembled 3 ft high x 6 ft wide x 11 ft long.  
 Weight assembled 80 lb.

**1-6. Components of ML-594/U**

(Fig. 1-2)

Component	Required No.	Height	Width	Depth	Length (in.)	Diameter	Weight (lb)
Anchor Stake	1				30	3/4	3.50
Bag, Sand	6		14		26		.50
Brace, Windbreak	1				41 3/4	3/4	200
Cable, Grounding	1				1.20		1.70
Cable, Retention	3				85	1/4	.50
Canopy (fig. 6-1)	1				156	120	10.30
Canopy, support	1		52		98		3.50
Case, Transit (fig. 6-1)	1	9 3/4	48		66 3/4		51.50
Hook	1						.25
Hose	1				180	1 1/2 odx 1 1/8 id	
Leg, center	2	30 1/2			37 1/2	2	1.85
Leg, Forward	2	30 1/2			55 1/2	2	2.30
Leg, Rear	2	30 3/4			60 3/4	2	2.50
Manual	1		8 1/2		11		.70
Running Spares	1 set						
Cable, Retention	1				85	3/16	.50
Skid	3	2				12	1.80
Stake, Grounding	1				14 1/2	5/8	1.00
Strap	2		1		24		.25
Tube, Support, Center (Boomerang Section)	2	4			49	2	5.30
Tube, Support, Forward (C Section, Forward)	1	4	45	61		2	6.80
Turning Bar	1				40	1	8.50
Windbreak, Assembly	1	9	45	61			22.70
Nozzle Assembly	1				9 1/2	1 1/2	.50
Radiosonde Holder	1	2 3/4	3 1/2		9 1/2		.25

**1-6.1. Items Comprising an Operable Equipment**

FSN	Qty	Nomenclature, part No., and mfr code	Fig. No.
		<b>NOTE</b> The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, or Government agency; etc.	
6660-993-2668		Balloon Inflation and Launching Device ML-594/U; (NX) consisting of:	1-1
4030-580-7833	1	Anchor: Hold-down grnd stake; A. B. Chance #SPO850	1-2
	6	Bag, Sand: 50 lb size; ES-C-205509.	1-2

FSN	Qty	Nomenclature, part No., and mfr code	Fig. No.
6660-947-1786	1	Cable Assembly: Grnding cable; 10 ft lg; #ES-C-205507, 80063.	1-2
6660-947-1760	2	Retention Assembly: Retention cable assy; #ES-C-205508, 80063 (1 of 2 included as a running spare).	1-2
4720-948-2718	15 ft	Hose: Inflation hose; 15 ft lg; Minor Rubber Co. 1 1/8 in od x 3/16 in thk wall.	1-2
6660-947-1704	1	Nozzle Assembly: #ES-C-204697, 80063	1-2
6660-947-1480	1	Brace Assembly: Supports windbreak; ES-B-205494	1-2
5120-947-1766	1	Crowbar: #ES-B-205516, 80063	1-2
6660-947-1830	1	Canopy Support: #ES-D-205499, 80063	1-2
5340-999-3910	1	Strap, Retaining: 24 in lg; #ES-C-205501, 80063	1-2
6660-947-1713	3	Skid Assembly: #ES-D-205489, 80063	1-2
6660-947-1770	1	frame Section: Front support: #ES-D-205481, 80063	
6660-947-1779	1	Frame Section: Center support; #ES-C-205483-1, 80063,	
6660-947-1758	1	Frame Section: Center support; #ES-C-205483-1, 80063.	
6660-947-1763	1	Leg, Frame: Fwd; #ES-F-205486-2, 80063	
6660-947-1753	1	Leg, Frame: Fwd, #ES-F-205486-1, 80063	
6660-947-1754	1	Leg, Frame: Cntr; #ES-F-205487-1, 80063	
6660-947-1755	1	Leg, Frame: Cntr; #ES-F-205487-2, 80063	1-2
6660-947-1756	1	Leg, Frame: Rear; #ES-F-205488-2, 80063	1-2
6660-947-1757	1	Leg, Frame: Rear; #ES-F-205488-1, 80063	1-2
6660-926-4418	1	Windbreak Assembly: C/o ES-D-205482, ES-D-205492, ES-D-205493, ES-F-205498.	
6660-947-1759	1	Ground Stake Assembly: #ES-C-205502, 80063	

**1-7. Substitution of Common Name for Nomenclature**

Common name	Name	Nomenclature
Device	1-1	Balloon Inflation and Launching Device ML-594/U.
Boomerang section	1-2	Tube, support, center (side member of main frame).
C-section, forward	1-2	Tube, support, forward (front end member of main frame).
C-section, rear	1-2	Tube, support, rear (part of windbreak assembly).
Side panel	2-11	Side opening in canopy
Trampoline	2-4	Canopy support netting assembled to main frame with legs attached.
Windbreak	1-2	Windbreak assembly
Netting	2-3	Canopy support
Main frame	2-2	Boomerang and C-sections assembled.

**1-8. Description of Balloon Inflation and Launching Device ML-594/U**

a. The assembled device, shown in operation in figure 1-1, consists of the canopy support (fig. 1-2) made of nylon netting attached to a four-section tubular metal frame. Three pairs of legs (fig. 1-2), clamped to the main frame, support it at 36 inches above the ground. To compensate for uneven terrain, a self-adjusting skid is fitted to each pair of legs. Another tubular framework assembly covered with fabric is raised at the rear of the main frame assembly to serve as a windbreak (fig. 1-1). An anchoring assembly made of polypropylene ropes (retention cables) attaches to the main frame at five points and to an anchor stake. This anchor system is used to maintain rigidity and stability. Sandbags are provided that many be filled with available material and attached to the skids to provide even greater sta-

bility in high winds. The balloon is sheltered from the weather by a thin, flexible, moisture-resistant bag-like canopy. The canopy has a snap-fastened side opening which extends its entire length, through which the balloon may be released when launchings are undertaken in adverse weather. The canopy is secured to the device as follows:

(1) The canopy is fastened to eyelets (fig. 2-6) in the windbreak frame by hooks which are sewed to straps on the canopy at the small end.

(2) Each side of the canopy is fitted with a restraining line (fig. 1-1) sewed to the canopy side. These lines lead down through eyelets on the main frame and back toward the windbreak frame where they are held by rope snubbers (fig. 2-6). This arrangement permits the operator to gradually ease the tension developed as the canopy swells with the inflating balloon.

(3) Balloon canopy tiedown straps (fig. 2-4) attached to the canopy support (netting) are available to hold down the slack ends of the canopy during inflation. As inflation progresses, the balloon tiedown straps are lengthened to accommodate increased canopy size. Both tiedown straps are unbuckled prior to launch.

(4) For small balloons, a strap (fig. 2-6) is provided to shorten the canopy. When needed,

this strap is pulled over the canopy and fastened to D rings on netting straps that fasten to eyelets A and D shown in figure 2-2.

*b.* The opening in the downwind end (front) of the canopy is fitted with 11 small loops and 1 master loop for closing the canopy (fig. 2-10). The meteorological balloon is placed in the canopy as indicated in figure 2-9 with the neck of the balloon protruding from the opening in the downwind end of the canopy. The master loop is then threaded through each of the small rings of the canopy (fig. 2-10), so that it in turn forms a loop around the neck of the balloon, and placed over the lift dot fastener stud and secured with the release and the safety straps as shown in figure 2-10. This arrangement reduces the size of the opening in the canopy, retaining the balloon, allows access to the balloon neck for attachment of the inflation nozzle, and permits rapid opening of the canopy for launching the balloon.

*c.* To prevent premature opening of the canopy, the master loop is held with a safety strap and release strap (fig. 2-10), each fitted with a lift dot fastener and both snapped onto a common lift dot fastener stud and a third strap. The balloon train line is attached to the release strap either by



the use of the release ring as shown in the figure 2-9 (if the release ring is supplied) or a 4-inch loop is tied in the train line and the release strap is placed through the train line loop. The balloon train line is then taken downwind and attached to the radiosonde. The launch is triggered by a tug on the balloon train line which causes the release strap to disengage from the lift dot fastener stud; this action frees the master loop, allows the canopy loop to unthread, opens the canopy, and launches the balloon with its payload.

*d.* All components of Balloon Inflation and Launching Device ML-594/U are packed in one transit case (figs. 6-1, 6-2). The case is fabricated from a double thickness of cotton duck which is fire, water, weather, and mildew resistant. Nylon-rope carrying handles are provided at each end of the case so that two men may move the case to the erection site. A zipper extends around the sides of the transit case. The flap covering the equipment packed in the bottom half of the case contains holddown points for storage of the front and rear legs, as well as pockets for storing a manual, running spares, a nozzle assembly, hook, retention cables, and canopy shortening strap. The flap is opened by unbuckling the nine straps and folding the flap over the side of the case (fig. 6-2) to which it is attached. All the remaining equipment is exposed (fig. 6-1) when the flap is opened. Except for the holddown points for the legs, the location of holding down points for individual components are easily identified by inspection. The location of the holddown points for the legs are marked with symbols corresponding to the coded tabs attached to the legs. The tabs are coded by geometric designs such as squares, octagons, triangles, etc.

### 1-9. Additional Equipment Required

The following equipment is not supplied with Balloon Inflation and Launching Device ML-594/U but is required when used in the system described in paragraph 1-8.

*a. Shovel.* High wind conditions may require

that Balloon Inflation and Launching Device ML-594/U be anchored by attachment of the six sandbags supplied to the skids. The shovel to fill the bags may be obtained from personnel field equipment or from equipment supplied with the transporting vehicle.

*b. Mallet.* An electrical grounding strike is provided with the device. A mallet or other expedient tool may be required to embed the stake if terrain is hard.

*c. Release Ring.* A ring or a loop tied in the balloon train and attached to the balloon payload, is used to release the canopy master loop release strap (fig. 2-10). One is required for each balloon inflation and release. If a release ring is not available, a 4-inch-in-diameter loop is tied in the balloon train line. This loop is used in place of the release ring.

### 1-10. System Application of Balloon Inflation and Launching Device

The balloon inflation and launching system (fig. 1-7, TM 11-6660-245-15) consists of a helium or hydrogen gas supply (cylinder or generator), Hydrogen Regulator ML-193, Coupling ML-49, Hose ML-81; Hydrogen-Helium Volume Meter ML-605/U, Balloon Inflation and Launching Device ML-594/U, and meteorological balloons.

*a. Helium or Hydrogen Cylinder.* A source of inflation gas for balloons. The helium or hydrogen is stored in cylinders under pressure.

*b. Hydrogen Regulator ML-193.* Provides a gage inclination that will show gage pressure as gas leaves cylinder. This pressure reading indicates condition of cylinder valve or pressure remaining in cylinder.

*c. Coupling ML-49.* Provides a connection between Hydrogen Regulator ML-193 and Hose ML-81.

*d. Hose ML-81.* Carries the gas to ML-605/U.

*e. Hydrogen-Helium Volume Meter ML-605/U.* Measure, indicates, and records the volume of gas in cubic feet delivered to a particular balloon.

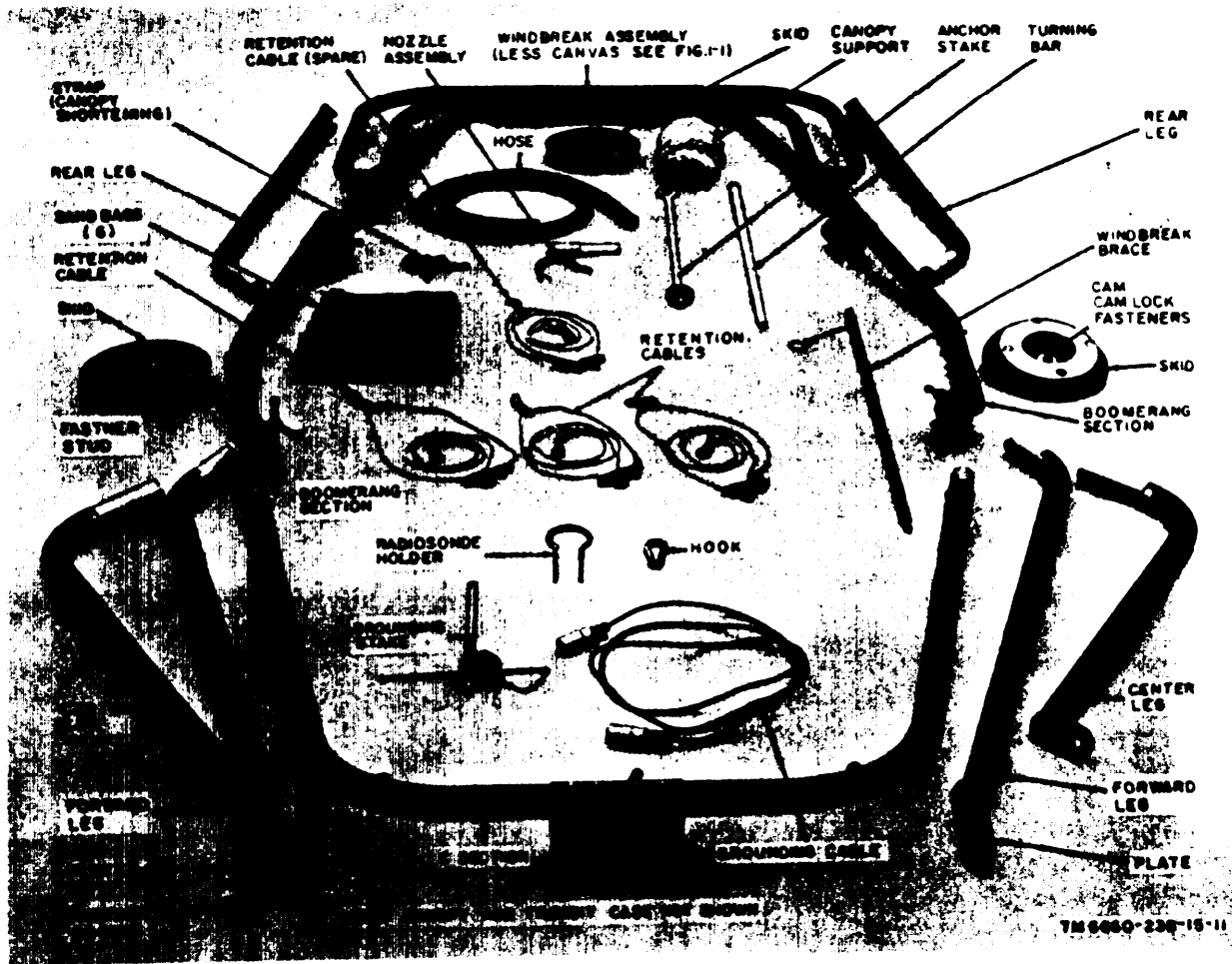


Figure 1-2. Components of ML-594/U.



## CHAPTER 2

### INSTALLATION AND OPERATING INSTRUCTIONS

---

#### Section I. SERVICE UPON RECEIPT OF EQUIPMENT

##### 2-1. Unpacking

*a. Packaging Data.* When packaged for shipment, the components of Balloon Inflation and Launching Device ML-594/U are placed in a moisture-vaporproof carton and are packed in a wooden box. An exploded view of a typical component packaged for export is shown in figure 2-1.

*b. Packaging Data.* Balloon Inflation and Launching Device ML-594/U when packed for shipment is 69 inches long by 50 inches wide by 9 inches high. Its volume is 17.9 cubic feet and it weighs 150 pounds.

*c. Removing Contents.* Perform all the procedures given below when unpacking equipment packaged in wooden boxes. When unpacking equipment in cartons, omit the procedure given in (1), (2), and (3) below.

(1) Place the wooden packing case that contains the device as near the operating position as possible.

(2) Cut and fold back the metal straps.

(3) Remove the nails with a nailpuller. Remove the wooden cover from the wooden packing case and expose the moisture-vaporproof barrier.

#### **CAUTION**

**Do not attempt to pry off the wooden cover; damage to the equipment might result.**

(4) Slit the moisture-vaporproof barrier and expose the outer corrugated carton.

(5) Open the outer corrugated carton and expose the second moisture-vaporproof barrier,

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

(7) Open the inner corrugated carton and remove the contents.

##### 2-2. Checking Unpacked Equipment

*a.* Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (para 1-3) .

*b.* See that the equipment is complete as listed on the packing slip. Report all discrepancies on DD Form 6 (para 1-3).

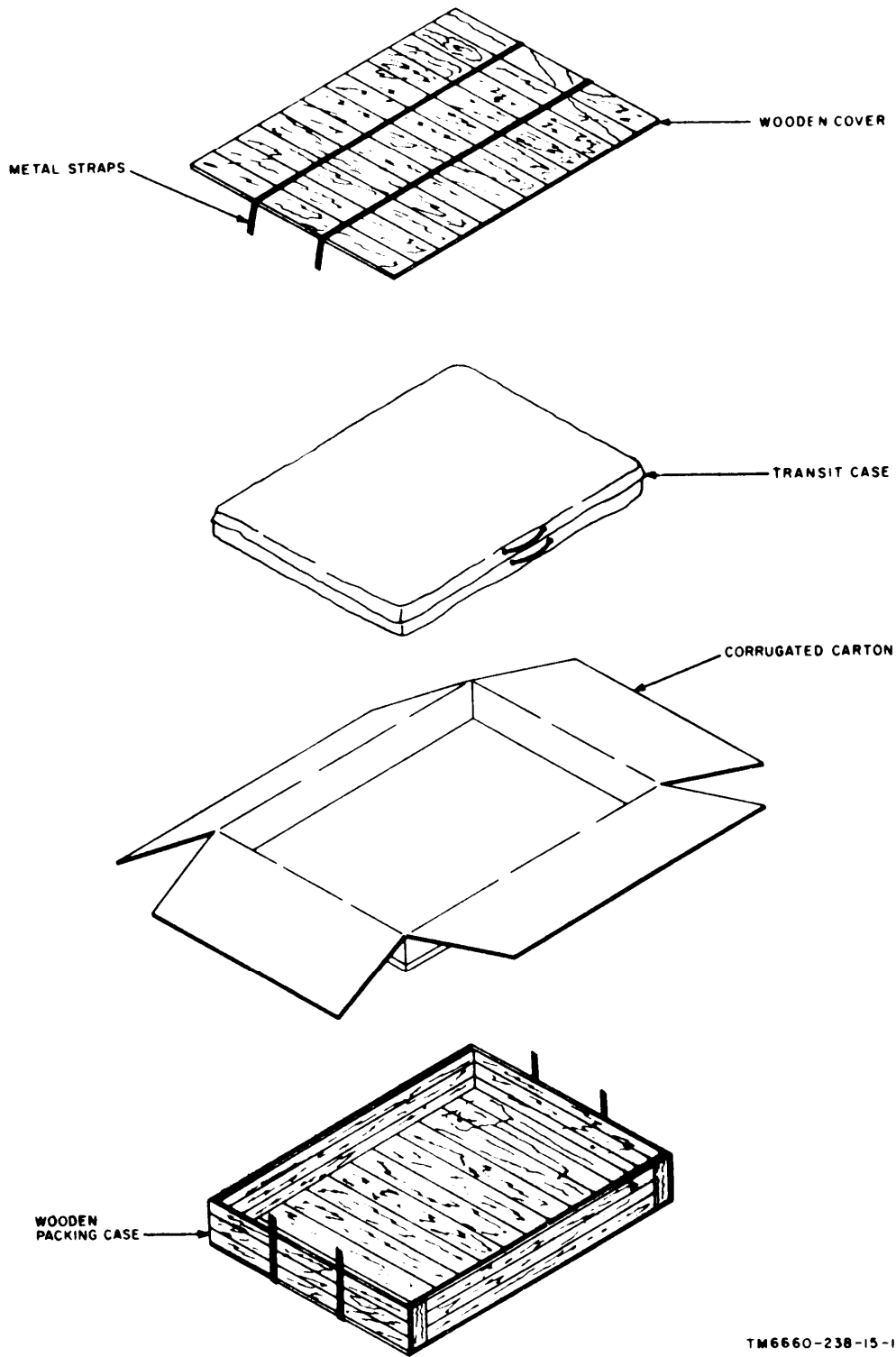
#### **NOTE**

Shortage of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

*c.* If the equipment has been used or reconditioned, see whether it has been changed by a modification work order (MWO). If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see whether the MWO number (if any) and appropriate notations concerning the modification have been entered in the equipment manual.

#### **NOTE**

Current MWO's applicable to the equipment are listed in DA Pam 310-4.



TM6660-238-15-12

Figure 2-1. Balloon inflation and Launching Device ML-594/U. Packaging and packing diagram.

## Section II. PREOPERATIONAL INSTRUCTIONS

### 2-3. Siting

The ideal site for erecting and operating Balloon Inflation and Launching Device ML-594/U is the center of a large plateau, with no natural or artificial objects within 200 yards and no obstructions at any distance that may intercept the balloon. Ideal conditions seldom exist, however, and the selection of an operating site may often be a compromise. Several major considerations for siting the device are given below:

- a. The horizon, from the device, should be unobstructed (at least in the direction toward which the balloon and transmitter are to be carried by prevailing winds).
- b. The prevailing winds at both surface and high levels should be considered.
- c. The launching device should be installed on a level and firm site.
- d. Nearby structures and elevated terrain that may intercept the balloon should be avoided.

### 2-4. Installation Instructions

- a. Place the transit case on the ground; observe the marking THIS SIDE UP.
- b. Unsnap the five fasteners (fig. 6-2) that secure the transit case zippered weather flap.

**Caution: Do not attempt to unfold the transit case with the zipper partially open; the zipper will become damaged.**

- c. Completely open the transit case zipper that extends around the three sides of the case.
- d. Unfold the transit case (fig. 6-1).
- e. Unpack and place the components on the ground as shown in figure 2-2. (Leave the canopy and netting in the transit case.)
- f. Assemble the main frame in the inverted position. The two C-sections and the *boomerang* sections slip together at the clamps identified as joints 1, 2, 3, and 4 shown in figure 2-2. Coded tabs on the clamps of the *boomerang* sections are matched to corresponding tabs on the C-sections.
- g. Observe the geometric shape of the coded tabs on the legs. Insert tile legs into clamps at joints 1, 2, 3, 4, and 5 in such a manner that the shape of coded tabs on the legs matches the shape of the tabs on the clamps. Do not tighten clamps at this time.

h. Install the three skids, one at the end of each pair of legs. Only one leg of each pair has a cam-lock fastener socket (fig. 1-2). Place the fastener stud of a skid through the leg plate without the socket first, then into the fastener socket of the other leg and lock in place by rotating the skid cam-lock fastener stud one-quarter turn clockwise.

i. Tighten clamps at joints 2, 3, 1, 4, and 5 in that order to prevent binding.

j. Attach one retention cable between eyelets at points G and H shown in figure 2-3, one cable between I and J, and one cable to point K. The hook at the free end of the cable from point K may be attached at point F, the intersection of the cables from points G and H, and I and J, or to the eye of the anchor stake (fig. 1-1) if it is installed by the use of the hook provided. Tighten the retention cable by pulling the single strand end that feeds into the snubber (fig. 2-5). Secure the cable by placing the snubber hook over the strand that feeds through the snubber.

k. If strong winds prevail and terrain conditions permit, install the anchor stake (fig. 1-1) by twisting the stake into the ground; use the turning bar (fig. 1-2).

l. Use one man at each end to lift and invert the device as shown in figure 2-3 until it is resting on the skids.

m. Position the device so that the windbreak is upwind as shown in figure 1-1.

n. Remove the netting (fig. 6-1) from the transit case and fasten the four netting strap hooks to the eyelets at points A, B, C, and D as shown in figure 2-2 so the netting is positioned as shown in figure 2-4.

o. The side flaps of the netting are brought over and around the main frame to joints 1, 2, 3, and 4, and buckled underneath the frame to the flap on the opposite side with the straps on the end of each flap.

p. The flap at the front end of the canopy support is placed over joint 5 and fastened to the fastener stud near the bottom of the joint; use the fastener socket at the end of the flap.

q. When the anchor stake is used attach the free end of the retention cable from point K to the eye of the anchor stake; use the hook provided (fig. 1-1).

r. Tighten the three retention cables by the use of the rope snubbers that are part of the cable assemblies; pull the single strand end (fig. 2-5) and feed into the snubber. Secure the cable by placing the snubber hook over the strand that feeds through the snubber.

s. To buckle the canopy tiedown straps (fig. 2-4), insert the strap up through the middle slot in the strap buckles, over the bar between the slots, and down through the bottom slot. Pull all the netting straps until the netting is just taut. If the straps do not remain taut, the strap has been incorrectly buckled.

t. In extremely windy conditions or when terrain does not allow the installation of the ground stake, fill the sandbags (fig. 1-2) provided in the transit case with any available material, and lay the sandbags on the skid. Tie the bags to the holes provided in the skids.

**Warning: Position the grounding stake and grounding cable where they will not be tripped over or kicked loose during launch operation. Make sure that the grounding cable is attached securely to the grounding stake and windbreak frame assembly. An ungrounded device may explode.**

u. Install the electrical grounding stake (fig. 1-2). The ground stake is fitted with a T-handle to aid in the installation of the stake in loose soil. When soil conditions require the use of a mallet to set the stake, place the protective cap that is chained to the T-handle over the grounding connector at the top of the stake to prevent damaging it when the stake is driven into the ground. Connect the electrical cable between the grounding stake and the connector on the C-frame member of the windbreak (fig. 1-1).

v. Remove the windbreak brace (fig. 1-2) from the transit case.

w. Stand at the rear of the device (fig. 1-1).

x. Hold the windbreak brace in one hand and, with the other hand, raise the windbreak assembly to the position shown in figure 2-6.

y. Hold the windbreak assembly in the raised position rind, with the other hand, reach through the upper flap opening (fig. 2-7) and engage the plug end of the windbreak support brace into the hole (fig. 2-6) provided under the windbreak in the center of the windbreak assembly top support tubing.

z. Continue to support the windbreak assembly by holding it up with a hand on the windbreak brace.

aa. Reach through the lower flap opening (fig. 2-7) with the other hand and grasp the windbreak support brace.

ab. Support the windbreak assembly by holding the windbreak support brace through the lower flap opening and, with the other hand, reach underneath the device and fit the clevis end (fig. 2-8) on the lug provided in the center of the windbreak assembly C-section.

ac. Insert the wire hook (part of the windbreak support brace) through the holes to secure the windbreak in the raised position.

## 2-5. Standby Preparation

Between balloon launches, perform the procedures given in *a* through *d* below.

a. Remove the canopy from the device.

b. Visually check the canopy and make sure that the rope snubbers are adequately covered by the flaps on the windbreak assembly. This check is especially important during periods when ice or blowing dust could foul the snubbers.

c. Fold the canopy and place it in the transit case to prevent unnecessary exposure of the canopy to moisture, ice, and blowing dust or foreign objects. Keep the inside surface of the canopy dry.

d. Before starting the balloon inflation and launching procedures, make a final check to determine that the device is properly oriented with respect to wind direction. The windbreak should be located upwind (fig. 1-1).

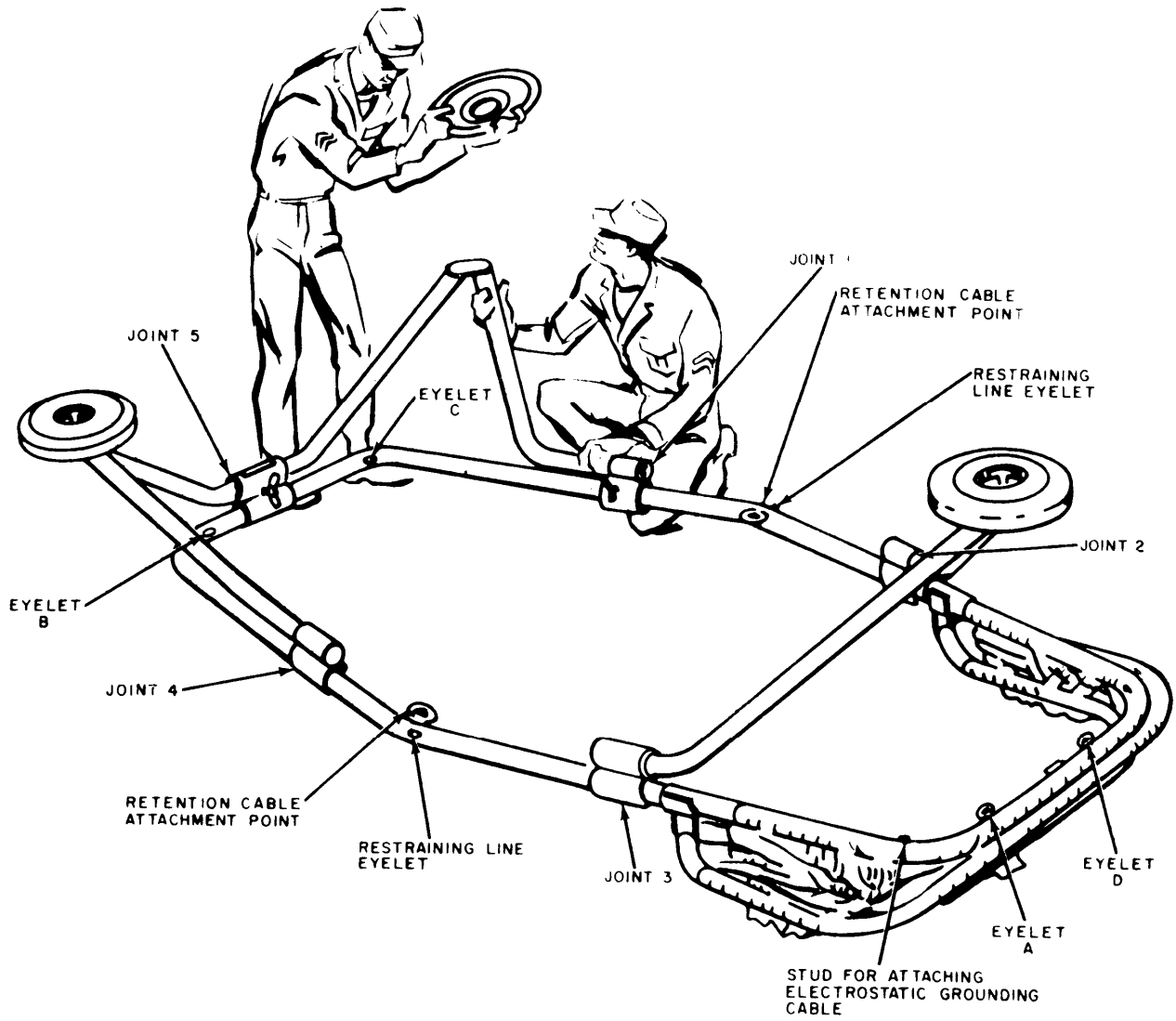


Figure 2-2. Assembly in inverted position.

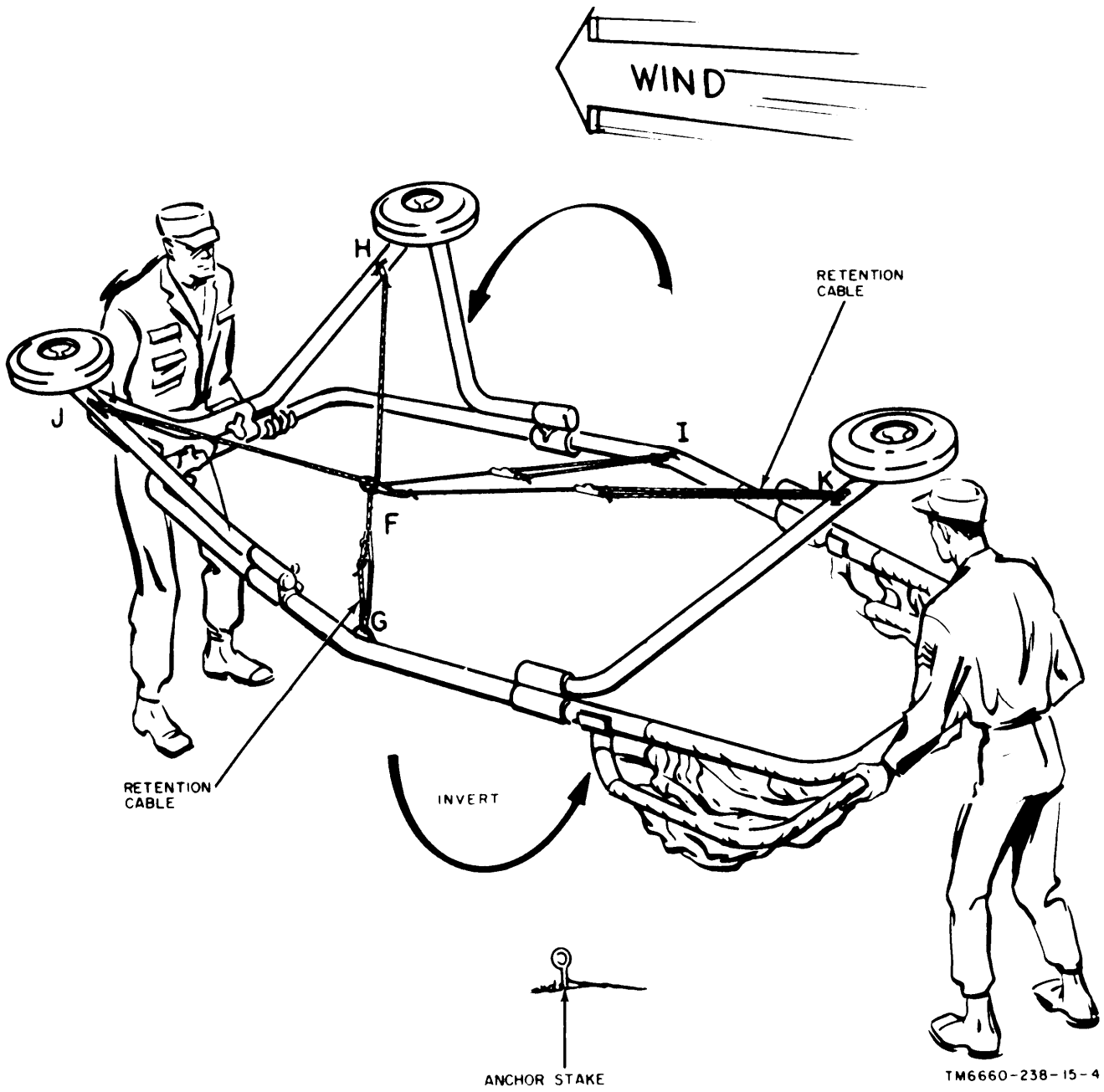
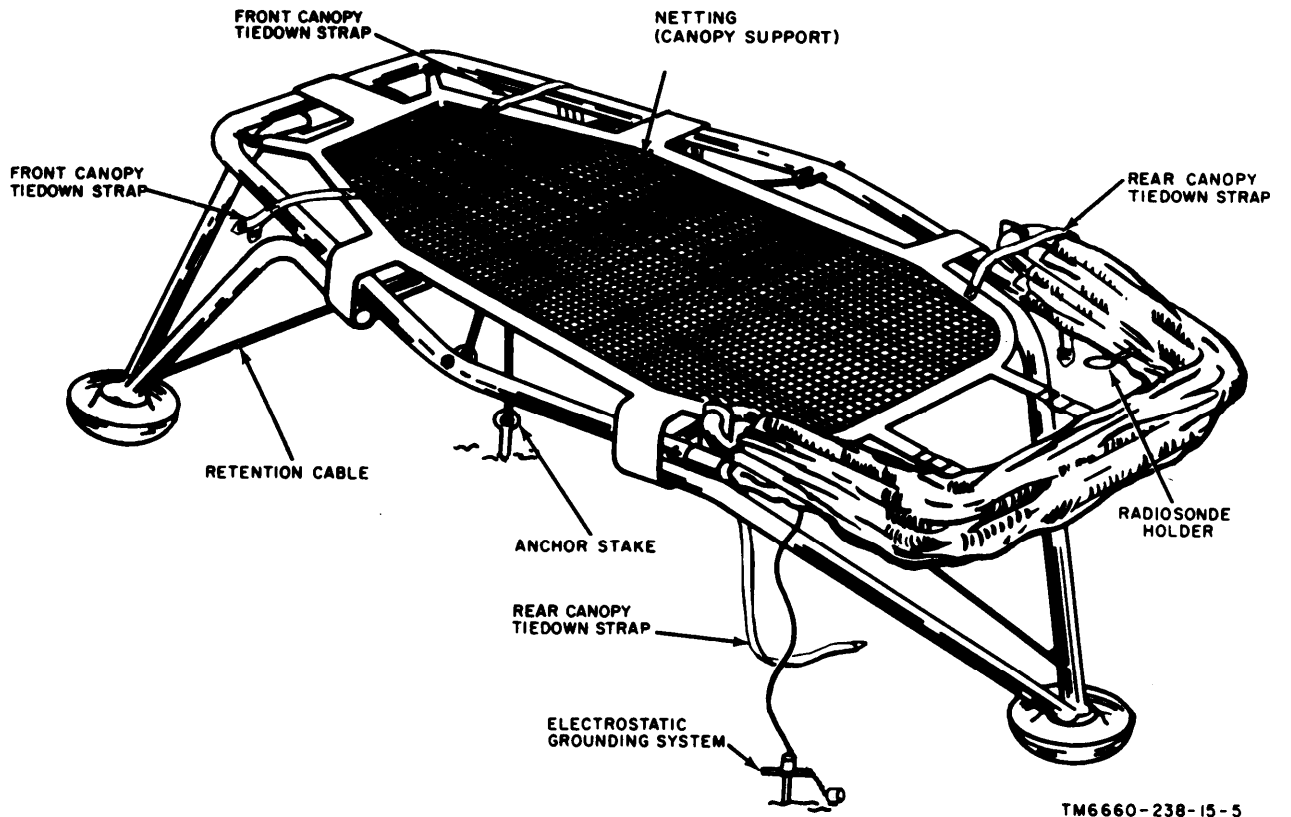


Figure 2-3. Inverting main frame to upright position.



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Figure 2-4. Installation of netting



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*Figure 2-5. Rope snubber.*



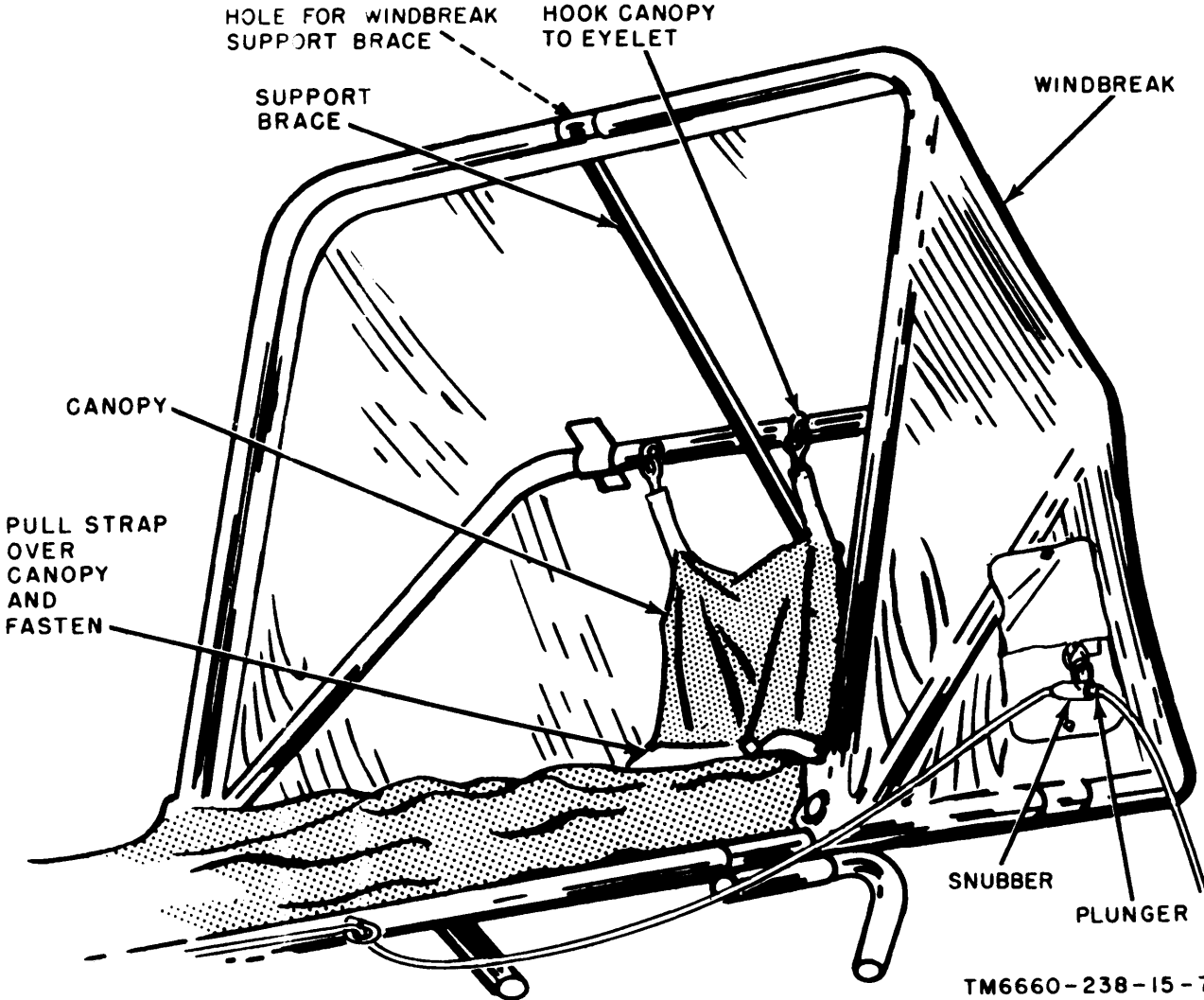
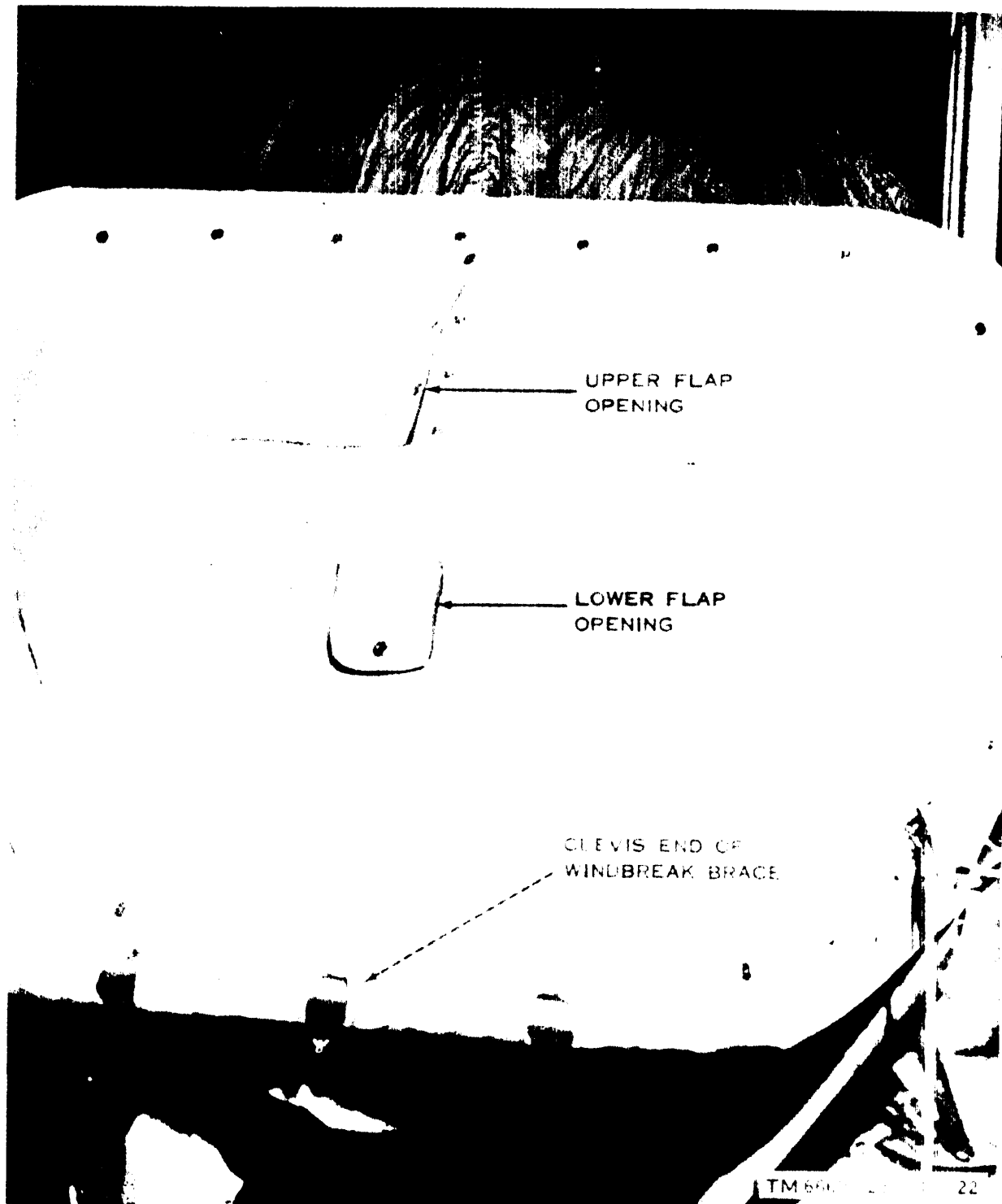


Figure 2-6. Shortening canopy.



*Figure 2-7. Flap openings in windbreak.*

4a

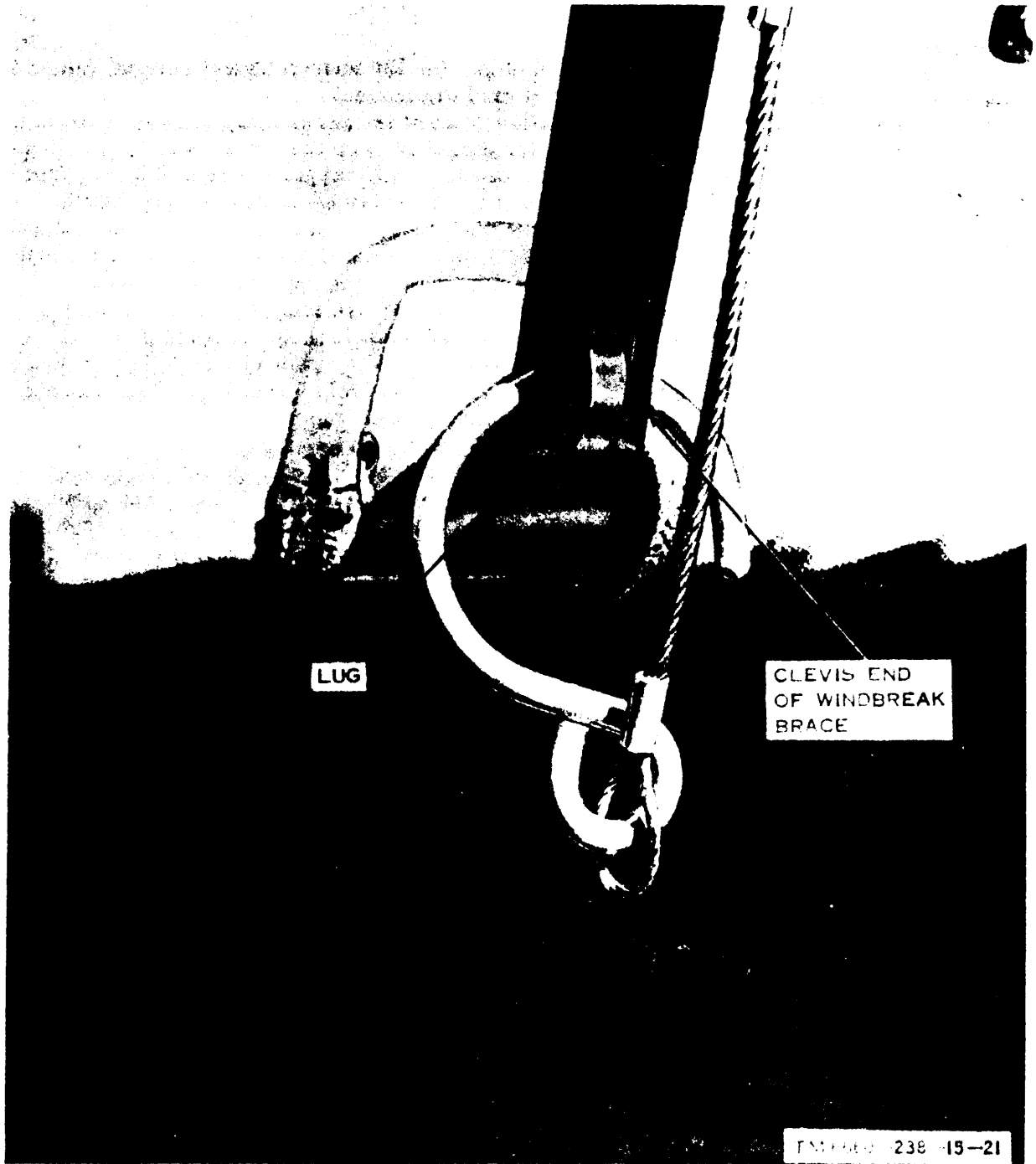


Figure 2-8. Windbreak brace, clevis end installed.

## Section III. OPERATING INSTRUCTIONS

**Warnings:**

1. If hydrogen is to be used as the inflation gas for the meteorological balloon, follow the precautions outlined on the inside of the front cover of this manual.

2. If a balloon should rupture during inflation, some of the gas escaping from the balloon will become trapped inside the canopy. The operator should press on the canopy with his hands until all the gas is forced out of the openings in the canopy. All trapped gas should be removed before the side panel is opened or the master loop or safety or release straps are unfastened.

**2-6. Balloon Inflation**

a. Lay the canopy on the trampoline (canopy support) with the side panel up and the small diameter opening of the canopy under the windbreak (fig. 2-6).

b. Fasten the end of the canopy to the center windbreak support by engaging the two hooks on the straps of the small end of the canopy to the two eyelets on the center support of the windbreak frame.

c. When inflating smaller balloons, shorten the canopy (fig. 2-6) by placing a small shortening strap (fig. 1-2), provided among assembly components, over the canopy and engaging the hooks on the strap ends to eyelets A and D as shown in figure 2-2.

d. If inflating a single balloon type such as the ML-537, use the procedure in *e* below when placing the balloon in the canopy. If inflating a double balloon type such as the ML-541, use the procedure in *f*, *g*, and *h* below when placing the balloon in the canopy.

e. Place the balloon in the canopy (fig. 2-9) through the side panel with the neck protruding through the open end of the canopy. Make sure there are no twists in the balloon. Proceed to *i* below:

*f*. Place the balloon in the canopy (fig. 2-9) through the side panel so that the inflation nozzle, the one without the train line, faces the open end of the canopy.

*g*. Position the balloon in the canopy so that the tail assembly of the balloon folds beneath the balloon.

**Caution: Make sure to leave approximately 5 feet of slack in the train line under the balloon; otherwise, the line will cut into the balloon during inflation.**

*h*. Run the train line under the balloon, along the neck, and through the opening in the end of

the canopy. Make sure to leave approximately 5 feet of slack in the train line under the balloon to allow for the inflation of the balloon.

*i*. Install the release ring if provided on the release strap as shown in figure 2-10. If the release ring is not available, tie a 4-inch-in-diameter loop in the train line and place the release strap through this loop.

*j*. If the release ring has been provided, loop the balloon train line through the release ring.

*k*. Gather the polyethylene rings on the open end of the canopy together mound the neck of the balloon by threading the master loop through each ring (fig. 2-10).

*l*. Place the master loop over the stud and snap the release strap lift dot fastener all the way down on the stud. Press the safety strap lift dot fastener on the same stud until it engages the notch on the stud.

*m*. Insert the inflation nozzle (fig. 2-9) through the gathered end of the canopy and into the neck of the balloon.

*n*. Secure the neck of the balloon to the nozzle with the wire clip (fig. 2-10).

*o*. Attach the nozzle to the master loop. Use the hook (figs. 2-9, 2-10) of the second step.

*p*. Cover the nozzle and balloon neck protruding from the canopy with the rain flap on the canopy (fig. 2-9).

*q*. Close the side panel of the canopy. Make sure that the balloon is free of twists and clear of the canopy snap fasteners.

*r*. Secure the canopy and the balloon to the canopy support (netting). Use the front and rear balloon tiedown straps (fig. 2-9).

*s*. Insert the canopy restraining lines (attached at each side of the canopy) through the restraining line eyelets (fig. 2-2) on each boomerang section and through the rope snubbers (fig. 2-6) anchored under the flaps on each side of the windbreak.

*Note.* The restraining line attached near the side panel (fig. 2-11) of the canopy should be installed on the left side of the device (as viewed from the rear) and threaded through the snubber so that it maintains tension on the line (fig. 2-5). This condition keeps the side panel of the canopy in a relatively fixed position just above the main frame assembly to allow the operator to reach the side panel fastening snap, at any time during inflation.

*t.* Inflate the balloon slowly and follow *u* through *y* during inflation.

*u.* As the balloon bubble begins to form, open the side panel (fig. 2-12). Unsnap as many fasteners from the side panel fastening strap as necessary to visually check to see that the balloon has not become twisted or damaged; then close the side panel.

*v.* As the balloon inflation progresses continue to adjust the length of the front and rear balloon tiedown straps (fig. 2-9) to accommodate the increasing size of the canopy by slipping the strap through the buckles.

*w.* Regulate the tension on the canopy restraining line (fig. 1-1) on the right side of the device only enough to keep the balloon firmly against the netting by operating the rope snubber, (fig. 2-6) plunger to release tile tension.

*x.* Prior to complete balloon inflation, unbuckle and remove the front and rear tiedown straps (fig. 2-9).

*y.* When the desired volume for meteorological balloons equipped with a self-seal ball unit has been reached, shut off the gas source, remove the wire clip (fig. 2-10) and withdraw the inflation nozzle (fig. 2-9). Secure the nozzle to any convenient attaching point on the frame of the device. Use the hook to avoid dropping the nozzle on the ground. When the desired volume for meteorological balloons not equipped with the self-sealing unit has been reached, perform the procedure given in paragraph 2-7.

## 2-7. Tie Seal Procedure for Balloon

Tie off the non-self-sealing balloon in the manner indicated in *a* through *h* below:

*a.* Cut a 2-foot length of the balloon train line.

*b.* Double the 2-foot length and place it around the balloon neck above the inflation nozzle.

*c.* Tie a square knot tightly around the balloon neck.

*d.* Separate the single ends of the line, wrap them around the balloon neck, pull tight, and tie a second square knot.

*e.* Remove the wire clip (fig. 2-10) and the nozzle (fig. 2-9). Secure the nozzle to any convenient attaching point on the frame of the device. Use the hook (fig. 2-10) to avoid dropping the nozzle on the ground.

*f.* Fold the neck of the balloon at its midpoint so that it falls over the last square knot tied.

*g.* Tie the train line over the double neck of the balloon. Tie it securely with a square knot.

*h.* Wrap the train line around the neck a second time and tie with a second square knot.

## 2-8. Launching Under Usual Conditions

One operator is used to perform a launching. After the balloon is inflated and sealed (paras 2-6 and 2-7), follow the procedure given in *a* through *d* below to launch the balloon under normal conditions.

*a.* Remove the safety strap (fig. 2-10) from the lift dot fastener stud manually and position the release strap fastener in the groove on the stud to insure that the proper release action will occur.

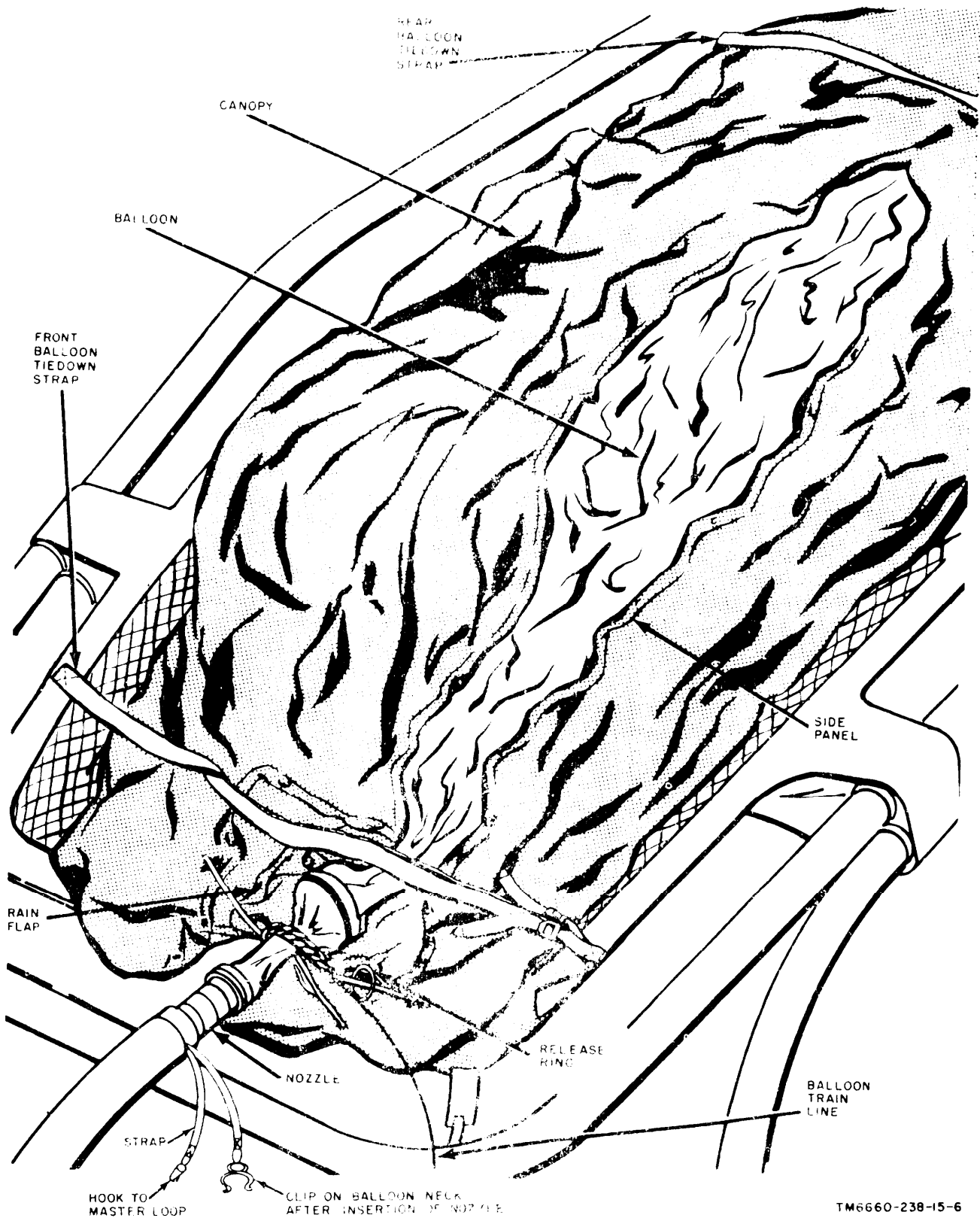
*b.* When ready to release, carry the radiosonde unit and parachute assembly downwind from the device. The front of the device should be pointed downwind.

*c.* After making sure that all personnel are at least 50 feet from the launcher, have one man launch the balloon as follows:

(1) Pull on the radiosonde end of the balloon train.

(2) Pull the balloon train line firmly in the direction of the balloon flight and allow the release ring of the 4-inch loop in the train line to disengage the release strap from the dot fastener. This action frees the master loop and allows the end of the canopy to open.

*d.* When the balloon has risen to an altitude where the balloon train line supports the payload clear of the ground, release the payload and the launch has been completed.



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Figure 2-9. Insertion of balloon into canopy.

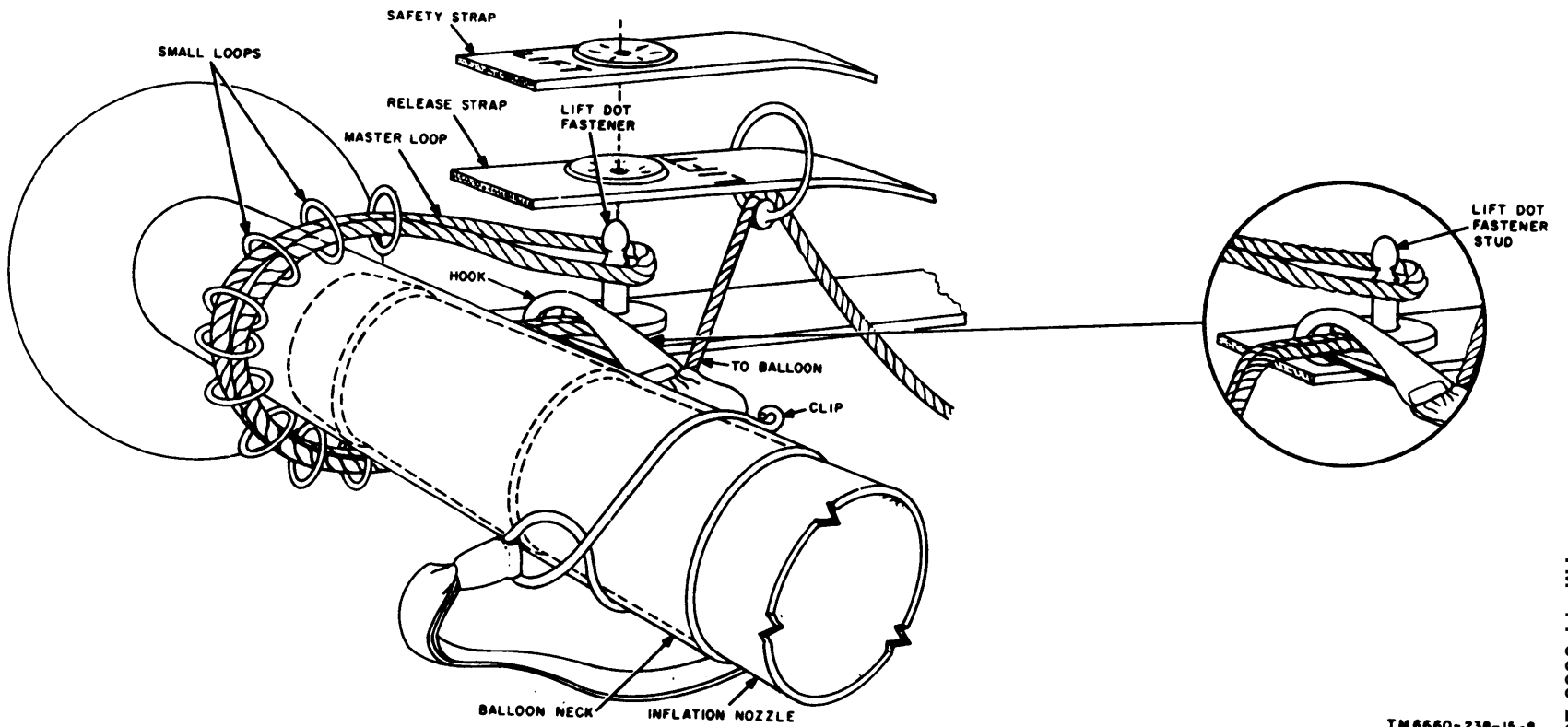
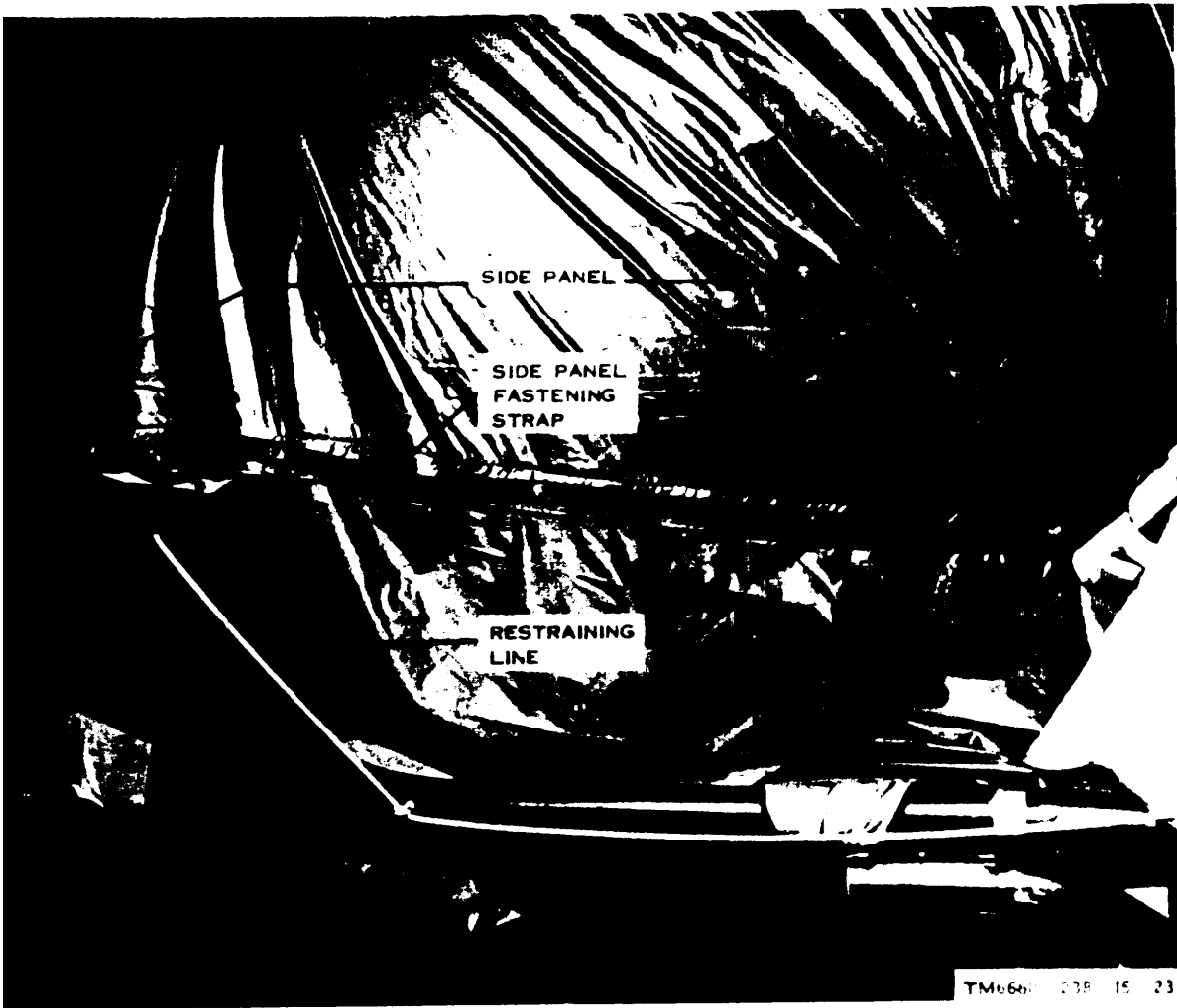


Figure 2-10. Closing downwind end of canopy.

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*Figure 2-11. Left side of canopy with balloon inflated.*



6A

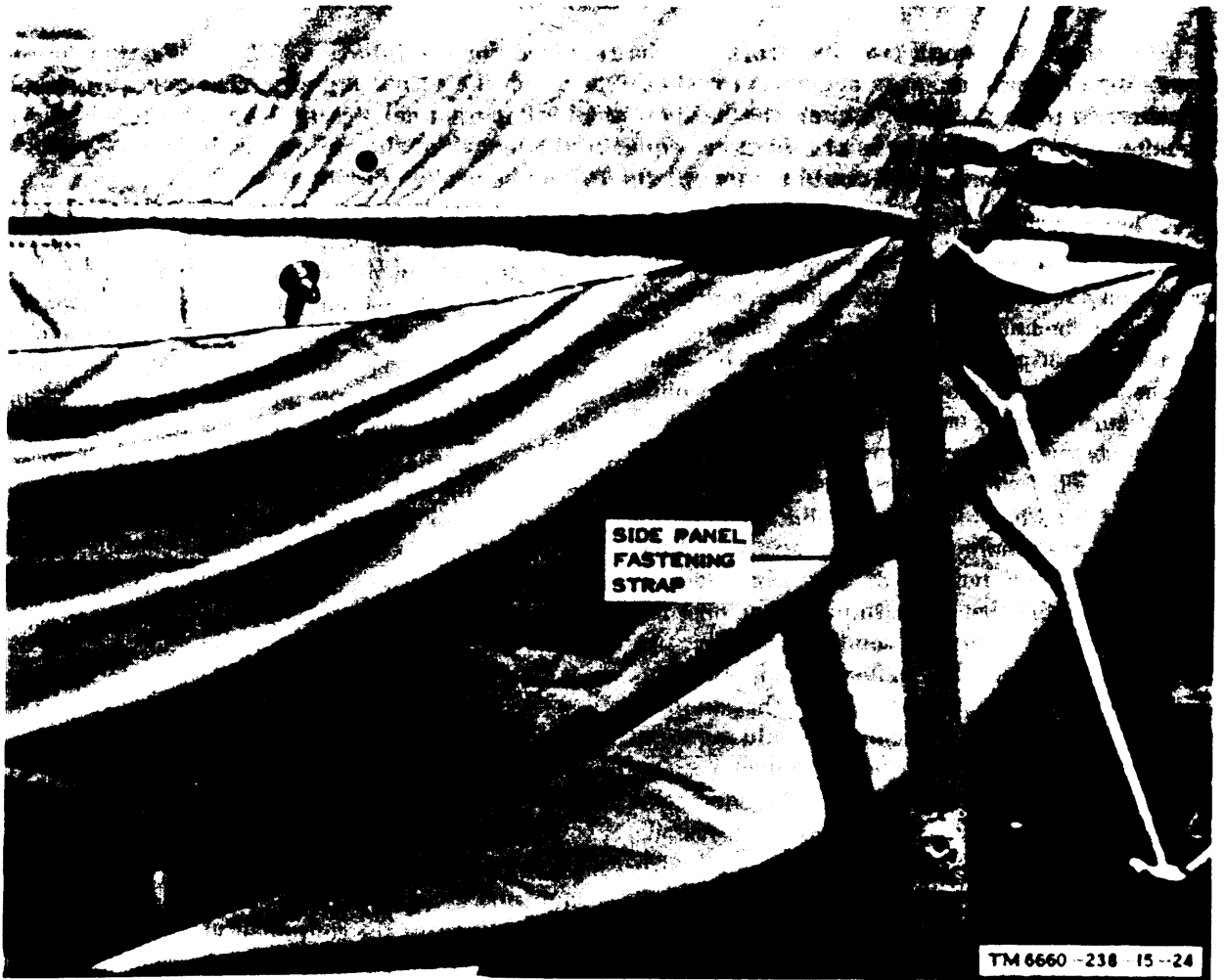


Figure 2-12. Side panel of canopy opened partly.

## Section IV. OPERATION UNDER UNUSUAL CONDITIONS

**Warning:** Although two operators may be required for the inflation and preparation for the launching of a balloon, only one operator should perform the actual launch. The operator should be careful not to actually launch the balloon until all personnel are at least 50 feet from the launcher and the operator is at a distance equal to the length of the balloon train line. Hydrogen gas is highly explosive and could explode if the balloon is broken during launch.

## 2-9. Special Operating Instructions

When adverse weather conditions exist, two operators may be required for the inflation and preparation for the launching of a balloon but only one operator should perform the actual launch. During the preparation for launch and under condition of high wind, a rapid and timely control of the balloon tiedown straps and restraining line is required. The two operators must work together when handling the pair of restraining lines and the front and rear balloon tiedown straps. When launching during periods of low wind velocity (less than 5 miles per hour (mph)), one operator should partially open the canopy carefully. Be careful to prevent the balloon from escaping. (See warning notice above.) After the canopy is partially opened, all personnel should move at least 50 feet from launcher before launch. Paragraph 2-10 contains instructions for operation in arctic climates, paragraph 2-11 contains instructions for operation in tropical climates, and paragraph 2-12 contains instructions for operation in desert climates.

## 2-10. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the operation of the launching device. In below-freezing temperatures, the weight of the ice that may form on the canopy may prevent normal release. The procedure given in *a* through *d* below should be used in freezing temperatures:

- a.* Before inflation of the balloon, check the canopy for ice.
- b.* If the canopy is covered with ice, shake the canopy to free it of ice. Shake the canopy support to free it of any ice.
- c.* If the launch is performed at the completion of inflation, launch the balloon in the usual manner (para 2-8).
- d.* If the launch is delayed, check the canopy covering the inflated balloon for ice. If the canopy is free of ice, launch the balloon in the usual

manner (para 2-8). If the canopy covering the inflated balloon is covered with ice, follow the procedure given in (1) through (4) below.

- (1) Have one man extend the train line and hold the radiosonde ready for launch.
- (2) Have the second man open the side panel of the canopy just far enough to almost allow the balloon to escape. Be careful in this operation that the balloon is not allowed to escape from the canopy while a man is close to the balloon. (See warning not ice above.)
- (3) As soon as the canopy is opened, the second man must move at least 50 feet away from the launcher.
- (4) The man at the end of the train line then launches the balloon in the usual manner (para 2-8).

## 2-11. Operation in Tropical Climates

Moisture conditions are more acute in tropical, swampy areas. The high relative humidity causes moisture condensation on the equipment when the temperature of the equipment drops below that of the surrounding air. Adequate ventilation will minimize this condition. Dry the equipment thoroughly before operating it. If moisture forms between the balloon and the canopy, which may occur during rain, high humidity, or extremely hot temperatures, the canopy may cling to the balloon and prevent a normal release. Use the procedure given in *a* through *d* below if high moisture conditions prevent a normal launch:

- a.* Have one man extend the train line and hold the radiosonde ready for launch.
- b.* Have a second man open the side panel of the canopy just far enough to almost allow the balloon to escape. Be careful in this operation that the balloon is not allowed to escape from the canopy while a man is close to the balloon.
- c.* As soon as the canopy is opened (*b* above), the second man must move at least 50 feet away from the launcher.

*d.* The man at the end of the train line launches the balloon in the usual manner (para 2-8).

**2-12. Operation in Desert Climates**

Remove the dust and sand out of the canopy and off the canopy support before use. Grit and

sand will damage the balloons and in time will damage the launcher. Before use, shake all of the sand and grit out of the canopy. If possible, protect the launcher, when not in use, from the direct rays of the sun.



## CHAPTER 3

### OPERATOR MAINTENANCE INSTRUCTIONS

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#### 3-1. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Balloon Inflation and Launching Device ML-594/U are listed below, together with the reference to the paragraph covering the specific maintenance function.

- a. Daily preventive maintenance checks and services (paras 3-4 and 3-5).
- b. Monthly preventive maintenance checks and services (paras 3-4 and 3-5).
- c. Cleaning (para 3-6).
- d. Repair or replacement (para 3-7).

#### 3-2. Tools and Equipment Required for Maintenance

- a. *Tools.* No tools are required to perform operator's maintenance.
- b. *Materials.*
  - (1) Clean cloths.
  - (2) Emery cloth.
  - (3) Cleaning compound (FSN 7930-395-9542).

#### 3-3. 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 3-4 through 3-7 cover routine systematic care and cleaning essential to the proper upkeep and operation of the equipment.

b. *Preventive Maintenance Checks and Services.* The preventive maintenance checks and services

chart (para 3-5) outlines functions to be performed at specific intervals. For equipments operated separately, these checks and services are necessary 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 illustration, paragraph, or manual that contains detailed repair or replacement procedures. If the defect cannot be remedied by the operator a higher category of 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 33-750.

#### 3-4. Preventive Maintenance Checks and Services Periods

a. Preventive maintenance checks and services of Balloon Inflation and Launching Device ML-594/U are required on a daily and monthly basis.

b. Paragraph 3-5 specifies checks and services that must be accomplished daily and under special conditions as listed below.

- (1) When the equipment is initially installed.
- (2) When the equipment is reinstalled after removal for any reason.
- (3) Before the equipment is repacked in its transit container.
- (4) At least once each month if the equipment is maintained in a standby condition.

3-5. Daily Preventive Maintenance Checks and Services Chart

Se- quence No.	Item to be inspected	Procedure	Reference
1	Completeness.....	See that equipment is complete.....	Para 1-6.
2	Cleanliness.....	Clean all components of equipment.....	Para 3-6.
3	Metal surfaces.....	Check main frame parts, skids, grounding material, and other metal parts for corrosion or other deterioration.	Para 3-6.
4	Nonmetal surfaces.....	Check netting, ropes, canvas areas of the canopy, and windbreak for fungus, fraying, and tears. Replace and repair as necessary.	TM 10-269. Para 3-7.
5	Installation.....	Check to see that the main frame, windbreak assembly, legs, and skids fit and operate properly, are not bent out of shape, and can be secured for proper operation. Correct as necessary.	Para 3-7.
6	Hardware.....	Check to see that the netting hooks, hardware used to secure the ropes, snap fasteners, and other hardware are present, secure, and in good condition.	Fig. 1-2.

3-6. Cleaning

Under normal (dry) weather conditions, all components, after use or before repacking, can be conveniently cleaned and inspected in the field. For adverse (wet) weather conditions, cleaning and inspection will be performed under shelter. Remove dust, dirt, moisture, grease, fungus, and any other foreign matter from all surfaces including joints, clamps, hooks, and points where two or more pieces are connected as indicated in *a* and *b* below.

*a.* Remove dust and loose dirt from metal surfaces with a clean soft cloth.

**Caution:** Allow surfaces to dry before cleaning.

*b.* Remove dust and loose dirt from nonmetal surfaces with a clean soft brush.

**Warning:** Prolonged breathing of cleaning compound is dangerous; make sure that adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame. Avoid contact with the skin; wash off any that spills on your hands.

*c.* Remove grease, fungus, and ground-in dirt from all metal surfaces; use a cloth dampened (not wet) with cleaning compound. Wipe with a clean dry cloth.

*d.* Spot clean nonmetal surfaces with soap and water; allow to dry thoroughly before packing.

*e.* To remove rust and corrosion from metal surfaces, sand them lightly with a fine emery cloth. Brush two thin coats of paint on the bare metal to protect from further corrosion. Refer to applicable cleaning and refinishing practices specified in TB SIG 364.

3-7. Repair or Replacement

*a.* Replace worn retention cables with cables of the same size and type only; tying pieces of cable together is not advisable because of high tensile forces which develop during use in strong winds.

*b.* Replace the grounding stake whenever inspection reveals damage that would render it unserviceable.

*c.* Repair or replacement of any other part or assembly which inspection indicates has been damaged to the extent that repair will be required before it can be considered serviceable, will be accomplished at organizational maintenance or as indicated in the maintenance allocation chart appendix III.

*d. Lubrication.* The device will not require lubrication.

## CHAPTER 4

### ORGANIZATIONAL MAINTENANCE

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#### Section I. PREVENTIVE MAINTENANCE

##### 4-1. Scope

*a.* This section contains instructions for organizational maintenance, preventive maintenance, periodic maintenance services, and the repair functions to be accomplished by the organizational repairman. This section supplements those instructions that appear in chapter 3. Section II of the chapter explains the function of the equipment. Operating instructions are included in chapter 2.

*b.* Organizational maintenance of the Balloon Inflation and Launching Device ML-594/U includes the following:

- (1) Organizational monthly maintenance (para 4-4).
- (2) Organizational preventive maintenance (para 4-6).
- (3) Replacement of the canopy (para 4-7).
- (4) Replacement of the canopy support (para 4-7).

##### 4-2. Tools, Materials, and Test Equipment Required

No tools or test equipment are required. Refer to paragraph 3-2b for materials.

##### 4-3. Organizational Preventive Maintenance Instructions

Preventive maintenance, which is the responsibility of all categories of maintenance concerned with the equipment, includes the inspection, repair and replacement of parts, subassemblies, and units that inspection indicates would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of Balloon Inflation and Launching Device ML-594/U at the organizational level are made at monthly intervals when the equipment is on standby unless otherwise directed by the commanding officer.

##### 4-4. Organizational Monthly Maintenance

Equipment, maintained in a standby (ready for immediate operation) condition must have

monthly preventive maintenance checks and service performed on it. A month is defined as 30 calendar days. Equipment in limited storage does not require monthly preventive maintenance.

##### 4-5. Organizational Monthly Preventive Maintenance Checks and Service Charts

The monthly maintenance required at the organizational maintenance category is the same as that indicated in the daily preventive maintenance checks and service chart (para 3-5).

##### 4-6. Lubrication

No lubrication is required.

##### 4-7. Repair or Replacement

*a.* Small tears in the canopy will not affect normal operation. The canopy should be replaced if a tear is large enough to allow excessive amounts of rain to enter the canopy or if the position of the hole directly exposes the balloon surface to abrasion.

*b.* Holes or rips in the canvas transit case or windbreak will be patched in a manner similar to that used in repairing tents (TM 10-269).

*c.* Small bends in the frame may be straightened. Any frame member seriously bent should be replaced since attempts to straighten would result in a great loss of strength.

*d.* Replace the canopy support whenever inspection indicates that the part is worn or damaged to an extent that repair would be required before it could be considered serviceable.

*e.* Replace the canopy whenever inspection reveals damage or wear that would render it unserviceable.

*f.* Repair of the canopy or the canopy support will be accomplished at depot maintenance. For Air Force units repair of the canopy will be accomplished at Organizational/Field.

## Section II. FUNCTIONING OF EQUIPMENT

### 4-8. General Functioning

Balloon Inflation and Launching Device ML-594/U is a portable device designed primarily to facilitate meteorological balloon launchings under adverse field conditions. The equipment design provides a portable launching platform that is adaptable to a variety of terrain conditions and affords protective shelter for the balloon and some portions of the inflation equipment. Design features and composition of the material reduces the explosion hazard related to the use of hydrogen gas.

### 4-9. Functions of Design

*a. Wind Stability.* When large meteorological balloons are inflated under conditions of high wind velocity, large forces are applied to the device which tend to lift and drag it downwind. For example, a 50-mph wind will apply about 100 pounds of force when a balloon containing 300 cubic feet of gas is secured to the device. This drag force may be overcome by anchoring the device to a stake or by placing weighted bags on the skids of the device. When surface winds are expected to exceed 25 miles per hour, each skid should be weighted down with two filled bags weighing approximately 50 pounds each. When the surface winds are less than 5 miles per hour, the device is stable and may be used without anchoring.

*b. Terrain Adaption.* Field conditions do not always permit sufficient time to locate a flat or level site for the equipment installation. To compensate for terrain irregularities at the launching

site, the three legs on the device have flexible mounted skids which will readily adapt to uneven terrain. Where the soil is loose or rocky, sandbags are provided which may be filled and placed on each of the three skids to provide additional stability.

*c. Portability.* The device can be disassembled to facilitate packing and transportation. It is stored and transported in a fabric transit case that can be carried by two men. The device can be transported by air without further preparation. All parts for the complete assembly of the device are supplied in a single package. The equipment is sufficiently rugged to withstand the normal rigors of field service and cross-country transport in a  $\frac{3}{4}$ -ton, 4 x 4 cargo truck.

*d. Hydrogen Safety.* Because this device may be used to inflate balloons with hydrogen, features have been incorporated in the device to prevent a spark-producing discharge of static electricity. For example, cotton has been used for many fabric parts because of the favorable antistatic properties of this material. Synthetic fabrics which come in contact with the balloon during inflation and launching operations are antistatic treated and tested to insure that their antistatic properties are at least as good as those of cotton. An electrical grounding cable supplied with the device provides grounding for the aluminum frame members. Under extremely dry operating conditions keeping the ground around the launching device damp will help to maintain a good electrical ground. For further safety procedures, refer to the warning notices on the inside of the front cover.



## CHAPTER 5

### DEPOT MAINTENANCE

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#### 5-1. Scope of Depot Maintenance

*a.* This chapter contains instructions for depot maintenance of Balloon Inflation and Launching Device ML-594/U. It includes instructions for repairing specified maintenance parts. The instructions covering the replacement and repair of maintenance parts to be accomplished by the depot repairman supplement those instructions appearing in the chapters 3 and 4 of this manual. Operating instructions are included in chapter 2.

*b.* Depot maintenance of Balloon Inflation and Launching Device ML-594/U includes the following:

- (1) Repair of the canopy.
- (2) Repair of the canopy support.

#### 5-2. Tools, Materials, and Test Equipment Required

*a. Tools.* No tools or test equipment is required.

*b. Materials.* Refer to paragraph 3-2b for materials.

#### 5-3. Repairs

The repairs given in *a* through *g* below will be

made according to the procedures used in repairing tents (TM 104269).

*a.* Worn restraining ropes on the canopy assembly will be replaced by sewing new ones to the flaps provided on the canopy.

*b.* Worn straps, loops, or broken rings on the canopy assembly will be replaced by sewing new ones into the canopy envelope or to the appropriate strap provided on the canopy assembly.

*c.* Replace any worn, broken, or missing fasteners on the canopy in the conventional manner.

*d.* Patch small holes in the canopy by sewing patches of the same material to the outside surface.

*e.* Replace the canopy if holes or rips are large enough to expose the balloon surface to abrasion and cannot be patched or sewed without distorting the shape of the canopy envelope.

*f.* Replace worn, broken, or missing fasteners on the canopy support assembly in the same manner as described in paragraph 4-7.

*g.* Replace the canopy support when it is determined that damage or wear requires such extensive repairs that replacement would be more economical.



## CHAPTER 6

# SHIPMENT AND LIMITED STORAGE

### 6-1. Disassembly Instructions

*a.* Unfasten the canopy (fig. 2-6) by removing the canopy shortening strap.

*b.* Unthread the canopy restraining lines from the snubber and from the restraining line eyelet (fig. 2-2).

*c.* Loosen the front and rear balloon tiedown straps (fig. 2-4).

*d.* Unhook the canopy from the windbreak (fig. 2-6) and slide the canopy from beneath the tiedown straps.

*e.* Fold the canopy as instructed in (1) through (6) below.

- (1) Lay the canopy so that the side panel forms an edge and fasten all the snap fasteners on the side panel.
- (2) Coil all the ropes and straps and place them in the transit case (fig. 6-1).
- (3) Fold the side panel edge to the center of the canopy then fold the opposite edge to the center.
- (4) Fold the width in half two more times so that the canopy is laid out full length and the width is approximately 20 inches.
- (5) Begin at the rear of the canopy (fig. 2-4) and roll the canopy toward the forward end.
- (6) Place the rolled canopy nearby to be placed in the transit case (fig. 6-1).

*f.* Release and remove the support brace from the windbreak frame assembly (fig. 2-6).

*g.* Collapse the windbreak frame assembly.

*h.* Unhook the retention cable from the anchor stake (fig. 1-1).

*i.* Remove the hook from the anchor stake.

*j.* Remove the anchor stake; use the turning bar.

*k.* Disconnect the grounding cable from the ground assembly.

*l.* Remove the electrostatic ground stake.

*m.* Untie and empty the sandbags.

*n.* Remove the netting, coil all straps, and fold the netting into a rectangular bundle approximately 24 by 12 inches wide. Place the bundle in a clean sandbag for storage in the transit case.

*o.* With one man at each end of the frame, lift and invert device (fig. 2-2). Place the inverted device on the ground so that it rests on the main frame.

*p.* Disconnect the snaphooks and remove the retention cable assemblies.

*q.* Remove the skids (fig. 1-2) by rotating the skid

cam lock fasteners counterclockwise and withdrawing skids.

*r.* Loosen the clamps at joints 1 through 5 (fig. 2-2) and withdraw the legs and C-sections from the joints.

*s.* Lay the components on the ground as shown in figure 1-2, in preparation for packing into the transit case.

### 6-2. Packing Instructions

Preventive maintenance procedures (paras 3-4 through 3-6) should be performed before the equipment is repacked in its transit case for any extended time. When inspection and cleaning of components has been completed, each piece will be placed in its appropriate place in the transit case (fig. 6-1) and on the transit case flap (fig. 6-2) as follows:

*a.* Place the windbreak assembly (fig. 6-1), hose, and anchor stake (fig. 6-2) into the lower half of transit case and strap them down with the four straps provided.

*b.* Place the canopy, canopy support, and sandbags in the center of the lower portion of the transit case and strap them down with the two straps provided.

*c.* Place the boomerang section in the lower portion of the transit case as shown in figure 6-1 and strap down each section with flaps provided. Observe that the markings on the transit case correspond with the coded tabs on the boomerang section clamps.

*d.* Place the grounding cable and stake in the pocket provided between the canopy and the windbreak assembly on the lower half of transit case.

*e.* Insert ends of the C-section in the tabular pockets at the corners of the transit case nearest the center of the case. Observe that markings on the case correspond to the coded tabs on the ends of the C-section. Strap the flap over the clamp at the center of the C-section.

*f.* Place the skids in the upper portion of the transit tape along the center and strap them down with the flaps provided.

*g.* Place the center legs into the tubular sleeves in the center of the top portion of the transit case. Observe that the markings on the case correspond to the coded tabs on the legs. Position the legs as shown in figure 6-2. Snap the two webbing straps over each of the legs.

h. Cover the packed transit case (upper and lower portions) with the transit case flap, but do not secure the nine straps around the edges at this time.

i. Slip the upper end of each of the forward and rear legs into the sleeves on the flap. Observe that the markings on the case and the coded tabs on the legs correspond (fig. 6-2).

j. Slip the windbreak brace into the long pocket between the rear legs and the snap flap.

k. Slide the turning bar into the pocket near the forward legs and snap the flap.

l. Fold back the portion of the flap covering the lower portion of the transit case and locate the two

large pockets on the flap (fig. 6-1).

m. Place the technical manual in one pocket.

n. Place the four retention cables (fig. 1-2), canopy shortening strap, nozzle, hook, and radiosonde holder in the other pocket and snap the pocket flap on both pockets.

o. Unfold the flap on the cover of the transit case (fig. 6-2) and secure the flap to the transit case with nine straps.

p. Fold the transit case top (end with flap sewed on) over the bottom, pull the zipper closed around the three sides of the transit case, and close the weather flap with the five snaps.

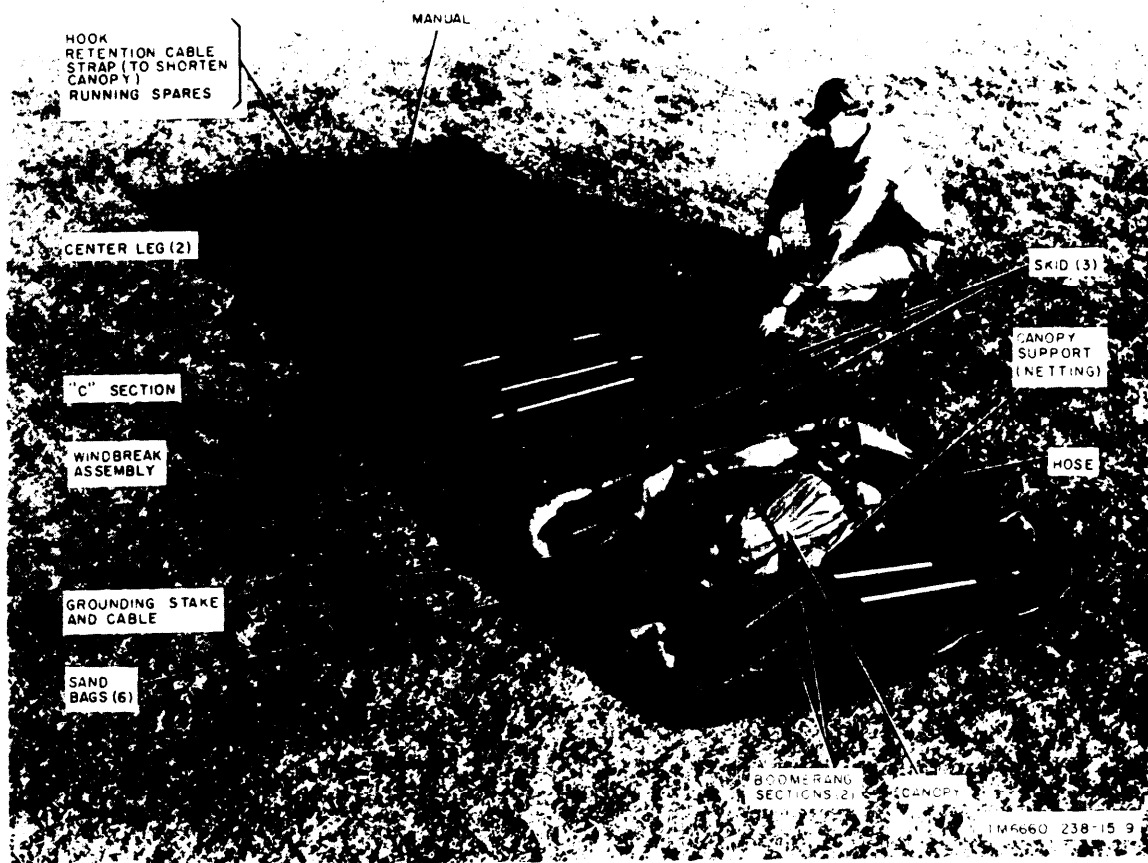
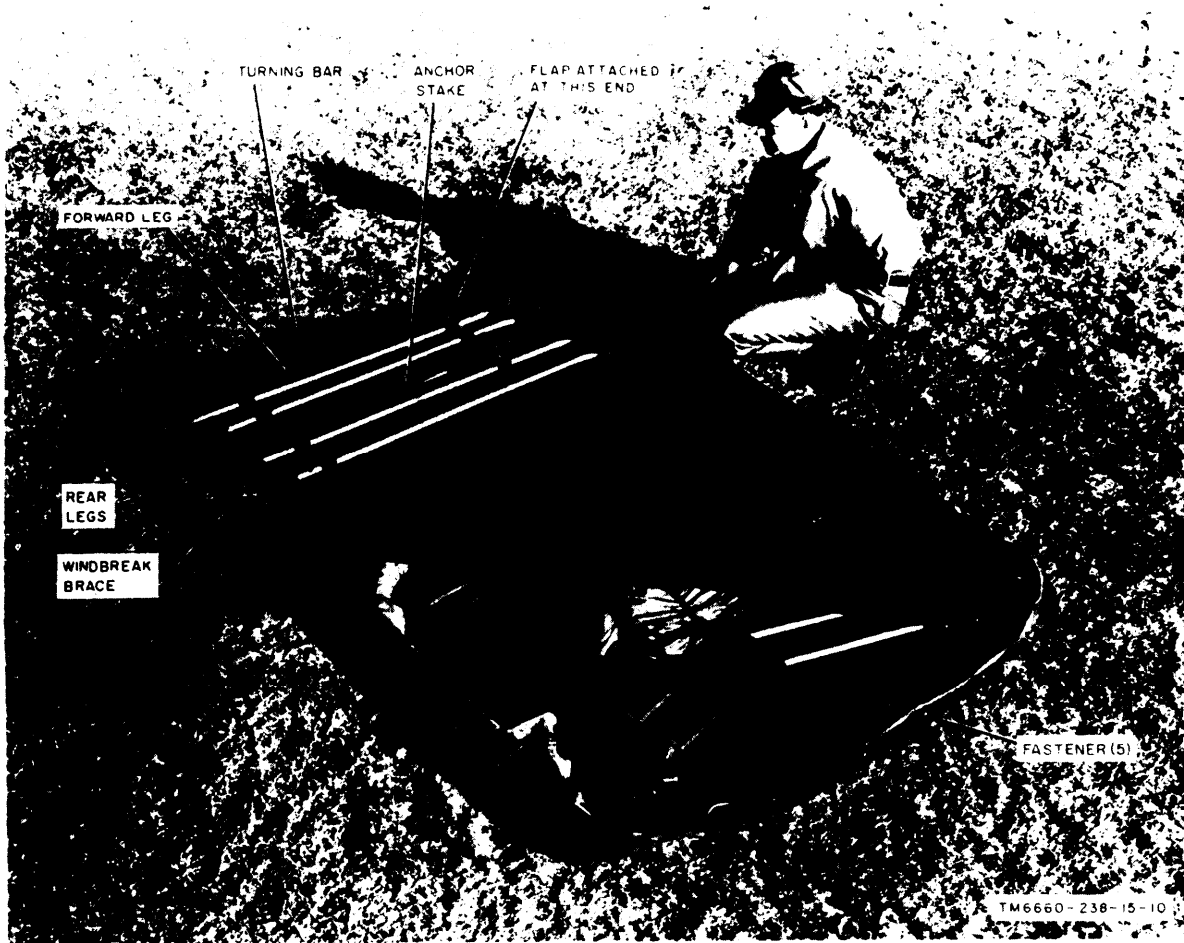


Figure 6-1. Position of Components in Transit Case.



*Figure 6-2. Position of Components in Transit Case Flap.*

Section II, paragraphs 6-3 and 6-4 deleted.



## APPENDIX A

### REFERENCES

Following is a list of applicable references which are available to maintenance personnel of Balloon Inflation and Launching Device ML-594/U.

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 310-10-2	Standard Army Publications System Users Guide.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
TM 11-2413	Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3 (NSN 3655-00-408-4683).
TM 11-6660-238-15-HR	Hand Receipt Covering Contents of Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) for Balloon Inflation and Launching Device ML-594/U (NSN 6660-00-999-2663).
TM 11-6660-245-15	Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual, Meter, Volume, Hydrogen-Helium ML-605/U (NSN 6660-00-999-2661).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).





# APPENDIX B

## COMPONENTS OF END ITEM LIST

---

### Section I. INTRODUCTION

#### B-1. Scope

This appendix lists integral components of and basic issue items for the ML-594/U to help you inventory items required for safe and efficient operation.

#### B-2. General

This Components of End Item List is divided into the following sections:

*a. Section II. Integral Components of the End Item.* These items, when assembled, comprise the ML-594/U and must accompany it whenever it is transferred or turned in. The illustrations will help you identify these items.

*b. Section III. Basic Issue Items.* These are the minimum essential items required to place the ML-594/U in operation, to operate it, and to perform emergency repairs. Although shipped separately packed they must accompany the ML-594/U during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII, based on TOE/MTOE authorization of the end item.

#### B-3. Explanation of Columns

*a. Illustration.* This column is divided as follows:

- (1) *Figure number.* Indicates the figure number of the illustration on which the item is shown.
- (2) *Item number.* The number used to identify

item called out in the illustration.

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

*c. Part Number.* Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. Following the part number, the Federal Supply Code for Manufacturers (FSCM) is shown in parentheses.

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

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

*f. Usable on Code.* Not applicable.

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

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

(Next printed page is B-2)

SECTION II INTEGRAL COMPONENTS OF END ITEM

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION  PART NUMBER (FSCM)	(4) LOCATION	(5) USABLE ON CODE	(6) QTY REQD	(7) QUANTITY	
(A) FIG NO.	(B) ITEM NO.						RCVD	DATE
1-1		6660-00-999-2663	BALLOON INFLATION AND LAUNCHING DEVICE ML-594/U CONSISTING OF:			1		
1-2		4030-00-580-7833	ANCHOR, HOLD DOWN GROUND STAKE			1		
1-2		6660-00-947-1786	CABLE ASSEMBLY; GROUNDING CABLE, 10 FEET LONG			1		
1-2		6660-00-947-1760	RETENTION CABLE ASSEMBLY			2		
1-2		4720-00-948-2718	HOSE; INFLATION HOSE, 15 FEET LONG			1		
1-2		6660-00-947-1704	NOZZLE ASSEMBLY			1		
1-2		6660-00-947-1480	BRACE ASSEMBLY			1		
1-2		5120-00-947-1766	CROW BAR			1		
1-2		6660-00-947-1830	CANOPY SUPPORT			1		
1-2		5340-00-999-3910	STRAP, RETAINING, 24 INCHES LONG			1		
1-2		6660-00-947-1713	SKID ASSEMBLY			3		
		6660-00-947-1770	FRAME SECTION, FRONT SUPPORT			1		
		6660-00-947-1779	FRAME SECTION, CENTER SUPPORT			1		
		6660-00-947-1758	FRAME SECTION, CENTER SUPPORT			1		
1-2		6660-00-947-1763	LEG FRAME, FORWARD			1		
1-2		6660-00-947-1753	LEG FRAME, FORWARD			1		
1-2		6660-00-947-1754	LEG FRAME, CENTER			1		
1-2		6660-00-947-1755	LEG FRAME, CENTER			1		
1-2		6660-00-947-1756	LEG FRAME, REAR			1		
1-2		6660-00-947-1757	LEG FRAME, REAR			1		
1-1		6660-00-926-4418	WINDBREAK ASSEMBLY			1		
1-2		6660-00-947-1759	GROUND STAKE ASSEMBLY			1		

SECTION III BASIC ISSUE ITEMS

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION  PART NUMBER (FSCM)	(4) LOCATION	(5) USABLE ON CODE	(6) QTY REQU	(7) QUANTITY	
(A) FIG NO.	(B) ITEM NO.						RCVD	DATE
2-9		6660-00-947-1829	CANOPY			1		
6-1		6660-00-999-3914	CASE, TRANSIT, CANVAS			1		



# APPENDIX C

## MAINTENANCE ALLOCATION

---

### Section I. INTRODUCTION

#### C-1. General

This appendix provides a summary of the maintenance operations for ML-594/U. It authorizes categories of maintenance for specific maintenance 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. Maintenance Function.

Maintenance functions will be limited to and defined as follows:

*a. Inspect.* To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

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

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

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

*e. Align.* To adjust specified variable elements of an item to bring about optimum or desired performance.

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

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

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

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

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

*k. Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/components.

#### C-3. Column Entries.

*a. Column 1, Group Number.* Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

*b. Column 2, Component/Assembly.* Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

*c. Column 3, Maintenance Functions.* Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

*d. Column 4, Maintenance Category.* Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or

complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of task-hours specified by the "work-time" figure represents the average time required to restore an item (assembly, sub-assembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

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

*e. Column 5, Tools and Equipment.* Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

*f. Column 6, Remarks.* Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

#### **C-4. Tool and Test Equipment Requirements (Sect. III).**

*a. Tool or Test Equipment Reference Code.* 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 or equipment for the maintenance functions.

*b. Maintenance Category.* The codes in this column indicate the maintenance category allocated the tool or test equipment.

*c. Nomenclature.* This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

*d. National/NATO Stock Number.* This column lists the National/NATO stock number of the specific tool or test equipment.

*e. Tool Number.* This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

#### **C-5. Remarks (Sect. IV).**

*a. Reference Code.* This code refers to the appropriate item in section II, column 6.

*b. Remarks.* This column provides the required explanatory information necessary to clarify items appearing in section II.

(Next printed page is C-3)

SECTION II MAINTENANCE ALLOCATION CHART  
FOR

BALLOON INFLATION AND LAUNCHING DEVICE ML-594/U

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS	
			C	O	F	H	D			
00	BALLOON INFLATION AND LAUNCHING DEVICE ML-594/U	INSPECT SERVICE REPAIR REPAIR OVERHAUL	0.3 0.5	0.5				1.0 8.0	1,2 1,2 1,2	A B C
	SUPPORT ASSEMBLIES									D
	SKID ASSEMBLIES									D
01	NOZZLE ASSEMBLY	REPLACE REPAIR		0.3 0.5					1,2	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS  
FOR

BALLOON INFLATION AND LAUNCHING DEVICE ML-594/U

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL NATO STOCK NUMBER	TOOL NUMBER
1	0	SCREWDRIVER	5120-00-640-5428	
2	0	WRENCH, OPEN END	5120-00-278-2421	



SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	PREVENTIVE MAINTENANCE, CLEAN.
B	REPLACE ALL PARTS.
C	WINDBREAKER ASSEMBLY, GROUND CABLE ASSEMBLY, CANOPY ASSEMBLY, CANOPY SUPPORT ASSEMBLY, CASE ASSEMBLY. FINAL DISPOSITION AT DEPOT.
D	MAINTAINED AS PART OF GROUP NUMBER 00.



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

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Major General, United States Army,  
The Adjutant General.

**HAROLD K. JOHNSON,**  
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Chief of Staff.

Distribution:

*Active Army:*

USASA (2)  
CNGB (1)  
OCC-E (7)  
Dir of Trans (1)  
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TSG (1)  
CofSpts (1)  
USACDCEA (1)  
USACDCCBRA (1)  
USACDCCEA (1)  
USACDCCEA  
Ft Huachuca (1)  
USACDCOA (1)  
ASACDCQMA (1)  
USACDCTA (1)  
USACDCADA (1)  
USACDCARMA (1)  
USACDCAVNA (1)  
USACDCARTYA (1)  
USACDCSWA (1)  
USAMC (5)  
USCONARC (5)  
ARADCOM (5)  
ARADCOM Rgn (2)  
OS Maj Comd (4)  
LOGCOMD (2)  
USAMICOM (4)  
USASCC (4)  
MDW (1)  
Armies (2) except  
EUSA (10)

Corps (2)  
USAC (3)  
Svc Colleges (2)  
Br Svc Sch (2) except  
USASCS (20)  
USAAMS (10)  
USAADS (10)  
USATC AD (2)  
USATC Armor (2)  
USATC Engr (2)  
USATC Inf (2)  
USASTC (2)  
WRAMC (1)  
Army Pic Cen (2)  
USACDCEC (10)  
Instl (2) except  
Ft Carson (19)  
Ft Gordon (10)  
Ft Huachuca (10)  
Ft Hancock (4)  
Ft Monmouth (70)  
Ft Knox (12)  
WSMR (5)  
JPG (5)  
APG (5)  
Army Dep (2) except  
LBAD (14)  
SAAD (30)  
TOAD (14)  
ATAD (10)  
LEAD (7)

GENDEPS (2)  
Sig Sec, GENDEP (5)  
Sig Dep (12)  
Sig Fld Maint Shops (2)  
AMS (1)  
USAERDAA (2)  
USAERDAW (13)  
USACRREL (2)  
Units organized under following  
TOE's (2 copies each):  
each):

6-100	7-100
6-101	11-7
6-185	11-57
6-186	11-96
6-200	11-117
6-201	11-157
6-300	11-158
6-302	11-500
6-885	(AA-AC)
6-386	11-587
6-525	11-592
6-565	11-597
6-575	17-100
6-576	29-134
6-700	37
6-701	37-100
6-715	39-51
6-716	47
7	57

*NG:* State AG (3).

*USAR:* None.

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





