

TECHNICAL MANUAL

TRANSPORT GUIDANCE

M113 FAMILY OF VEHICLES

(M113A2, M113A3, M106A2, M125A2, M548A1,
M577A2, M667, M730A2, M741A1, M901A1, M981,
M1015A1, M1059, M1064, AND M1068)

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TRANSPORT GUIDANCE M113 Family of Vehicles

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*This manual supersedes TM 55-2350-224-14, dated 1 April 1980.

CHAPTER 1 INTRODUCTION

Section I. GENERAL

1-1. Purpose and Scope

This manual is for transportation officers and other personnel responsible for safe transport of the M113 Family of Vehicles (FOV). It provides transportability guidance for safe shipping and receiving of the M113 FOV. It includes significant technical and physical characteristics of the vehicles as well as safety requirements for worldwide movement by various modes of transportation. Where appropriate, this manual provides metric equivalents in parentheses next to US customary units of measure.

1-2. Related Publications

Additional information on transport procedures can be found in the following:

MTMCTEA Pamphlet 55-19, *Tiedown Handbook for Rail Movements*.

MTMCTEA Pamphlet 55-20, *Tiedown Handbook for Highway Movements*.

MTMCTEA Pamphlet 56-1, *Surface Transportation, Marine Terminal Lifting Guidance*.

MTMCTEA Pamphlet 70-1, *Transportability for Better Strategic Mobility*.

FM 10-567/TO 13C7-16-171, *Airdrop of Supplies and Equipment Rigging Tracked Personnel—Cargo Carriers*.

FM 55-65, *Strategic Deployment by Surface Transportation*.

TM 38-250/AFR 71-4, *Preparation of Hazardous Materials for Military Air Shipment*.

USAREUR Reg 55-8, *Loading and Securing Military Wheeled and Tracked Vehicles on European Railcars*.

AR 55-162, *Permits for Oversize, Overweight, or Other Special Military Movements on Public Highways in the United States*.

AR 55-228, *Transportation by Water of Explosives and Hazardous Cargo*.

1-3. User Comments

Send comments and recommendations for improving this manual on a DA Form 2028 (Recom-

mended Changes to DA Publications and Blank Forms) or a marked copy of a page or pages of the manual to Director, MTMC Transportation Engineering Agency, ATTN: MTTE-TR, 720 Thimble Shoals Blvd, Suite 130, Newport News, VA 23606-2574.

1-4. Definitions

The following definitions are used throughout this manual:

a. Breaking Strength (BS). The stress at which a part (wire rope) actually fails.

b. CONUS. Continental United States.

c. Curb Weight (CW). Total weight of operable carrier, including fuel, all system fluids, and on-vehicle basic issue items (BII). CW does not include crew weight.

d. FISTV. Fire Support Team Vehicle.

e. Gross Vehicle Weight (GVW). CW plus maximum payload.

f. Total Load Restraint (TLR). The TLR given for highway, rail, and marine modes includes allowances for shipping directions and typical tie-down angles. For example, the highway TLR is 1.5 times GVW: 1.5 x 20,000 pounds = 30,000 pounds.

g. TOW. Tube-Launched, Optically Tracked, Wire-Guided Missile.

1-5. Warnings, Cautions, and Notes

Throughout this manual the following special messages emphasize important or critical information:

WARNINGS

Instructions that must be followed to prevent serious injury to, or death of, personnel.

CAUTION

Instructions that must be followed to prevent damage to, or destruction of, equipment.

NOTE

An operating procedure that should receive special attention.

Section II. SAFETY

1-6. General

To ensure safe operation and movement, operators should follow the precautions and safety considerations given below. Specific safety instructions are

given throughout the manual as warnings, cautions, and notes.

a. When the ramp door latch on any of the carriers (except the M113A3, M548, M548A1,

M667, M730A2, M901, M901A1, M981, M1015A1, and M1064) is not functioning properly, use the procedure given in appendix E.

b. Check each carrier to ensure all loose items are appropriately secured per instructions in the respective operator's manuals.

c. All carriers must be driven only by qualified drivers.

d. When a carrier is being driven, the driver's hatch cover must be secured in the fully open or fully closed position.

e. If a track is thrown while the carrier is in operation, do not apply brakes unless absolutely necessary. Instead, let the carrier coast to a stop.

f. Do not mount or dismount a carrier when it is in motion.

g. The driver must bring the carrier to a complete stop before entering or leaving a building.

h. Anytime carriers are operated in reverse, or within 20 feet of a building or other carrier, a "ground guide" must direct driver movement.

i. Do not operate the engine in an enclosed area without adequate ventilation.

j. High voltage in the M19 periscope can cause serious injury. Always connect the power cable to the periscope before turning the master power switch and the infrared (IR) power switch to ON. Never disconnect the power cable from the periscope until the image on the screen disappears completely.

Section III. EQUIPMENT DESCRIPTION

1-7. General

a. The M113 FOV are fully tracked, self-propelled carriers, and are either thick skinned (armored) or thin skinned (unarmored). The armored variants are derived from the M113A2 or M113A3, and the unarmored are derived from the M548. The M667 guided missile carrier is a special exception. It is thin skinned, but is not based on the M548.

b. All of the variants are powered by a diesel engine and are supported by a torsion-bar suspension. Various product improvements on some variants have resulted in transmission, suspension, armor, and power upgrades. The carriers vary in height and weight, but unless otherwise noted, are considered the same for transportability purposes.

c. The following paragraphs contain the specific administrative and technical data that affect transportability for each of the individual carriers. Each subsection contains a vehicle picture and the relating transportability characteristics and data necessary for safe movement. For transportability purposes, the pictures of the newest versions (A1, A2, and A3) are representative of the older versions.

1-7-1. M106, M106A1, and M106A2 (figs 1-1 and 1-2). This carrier is designed to transport the 107-mm (4.2-inch) M30 mortar and crew. The M30 is mounted on a turntable in the personnel compartment and is fired to the rear with the mortar hatch open. The mortar may be dismounted and fired from the ground by using the M24A1 mortar mount that is stored on the carrier. The M106 was converted to the M106A1, which was then converted to the M106A2. The M106A2

is capable of Low Altitude Parachute Extraction System (LAPES) operations.

1-7-1. M106, M106A1, and M106A2 (figs 1-1 and 1-2). This carrier is designed to transport the 107-mm (4.2-inch) M30 mortar and crew. The M30 is mounted on a turntable in the personnel compartment and is fired to the rear with the mortar hatch open. The mortar may be dismounted and fired from the ground by using the M24A1 mortar mount that is stored on the carrier. The M106 was converted to the M106A1, which was then converted to the M106A2. The M106A2 is capable of Low Altitude Parachute Extraction System (LAPES) operations.

1-7-2. M113, M113A1, M113A2, and M113A3 Armored Personnel Carrier (figs 1-3 and 1-4). This is a combat troop transporter that provides protected transportation for cargo or troops. Almost all M113's and M113A1's have been converted to M113A2's or M113A3's. The M113, M113A1, M113A2, and M113A3 are capable of LAPES operations and low velocity air drop (LVAD).

1-7-3. M125A1 and M125A2 Armored Self-Propelled 81-mm Mortar (figs 1-5 and 1-6). This carrier is designed to transport the 81-mm mortar and crew. The M125A2 is a product improvement of the M125A1.

1-7-4. M548 and M548A1 Cargo Carrier (figs 1-7 and 1-8). This is a full-tracked, unarmored, forward area transport vehicle that provides transportation for ammunition and general cargo. The M548A1 is a product improvement of the M548.

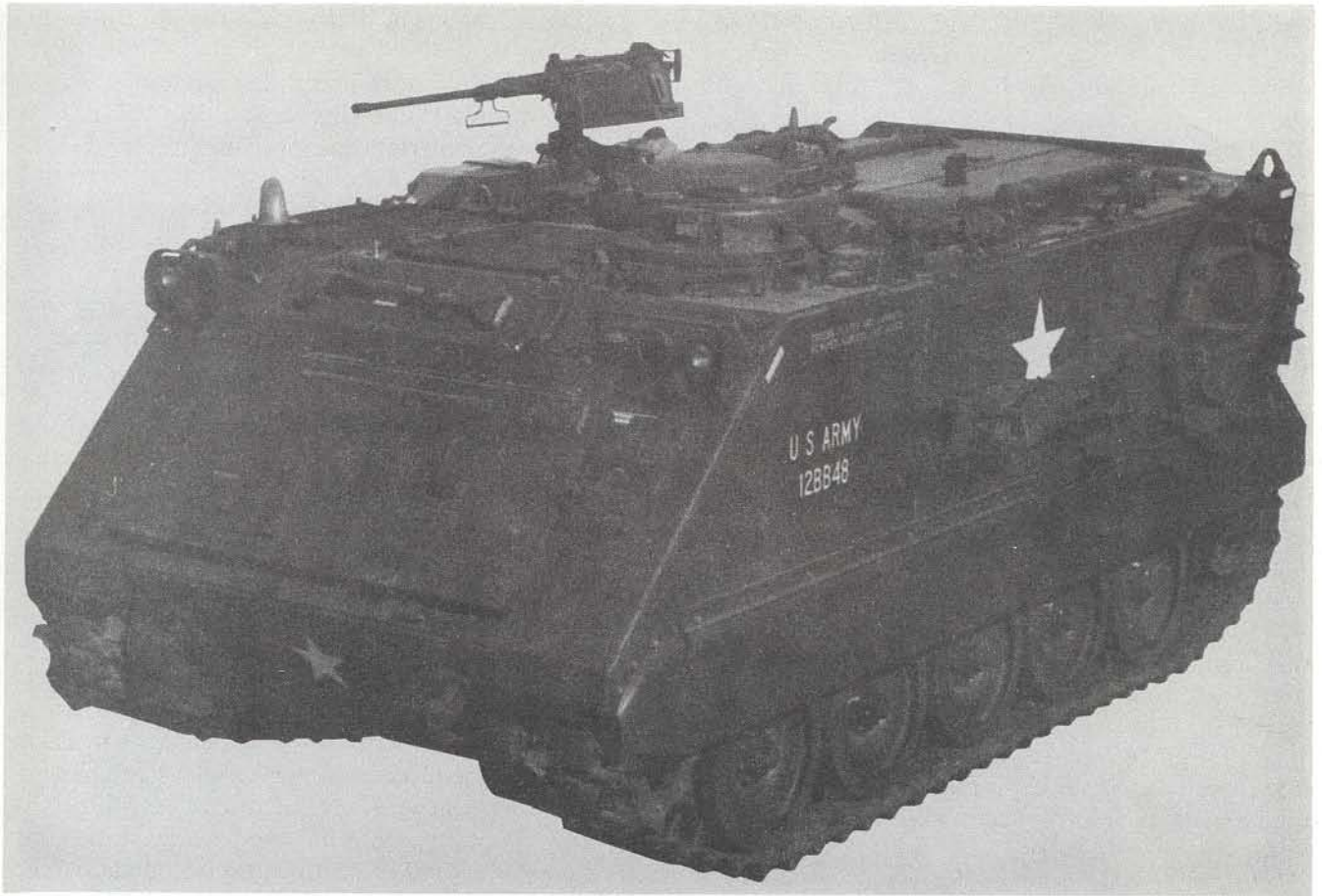


Figure 1-1. M106A2 107-mm Mortar Carrier.

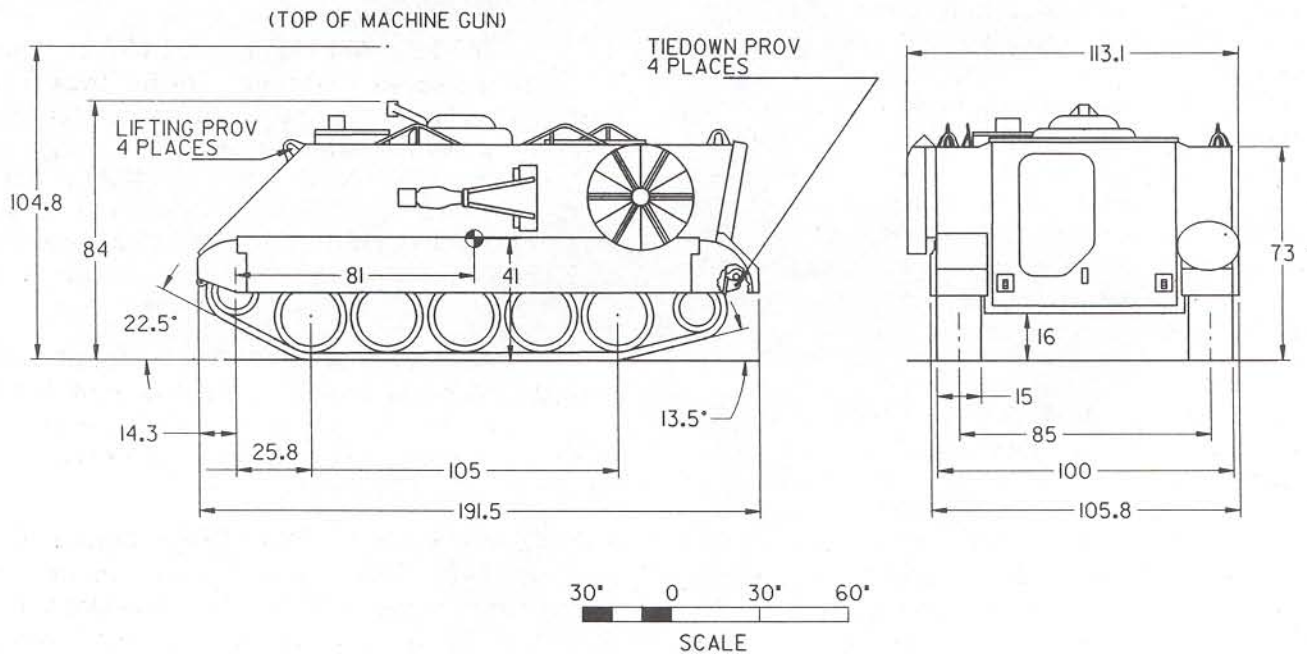


Figure 1-2. M106A2 107-mm Mortar Carrier. All dimensions are in inches.



Figure 1-3. M113A2 Armored Personnel Carrier.

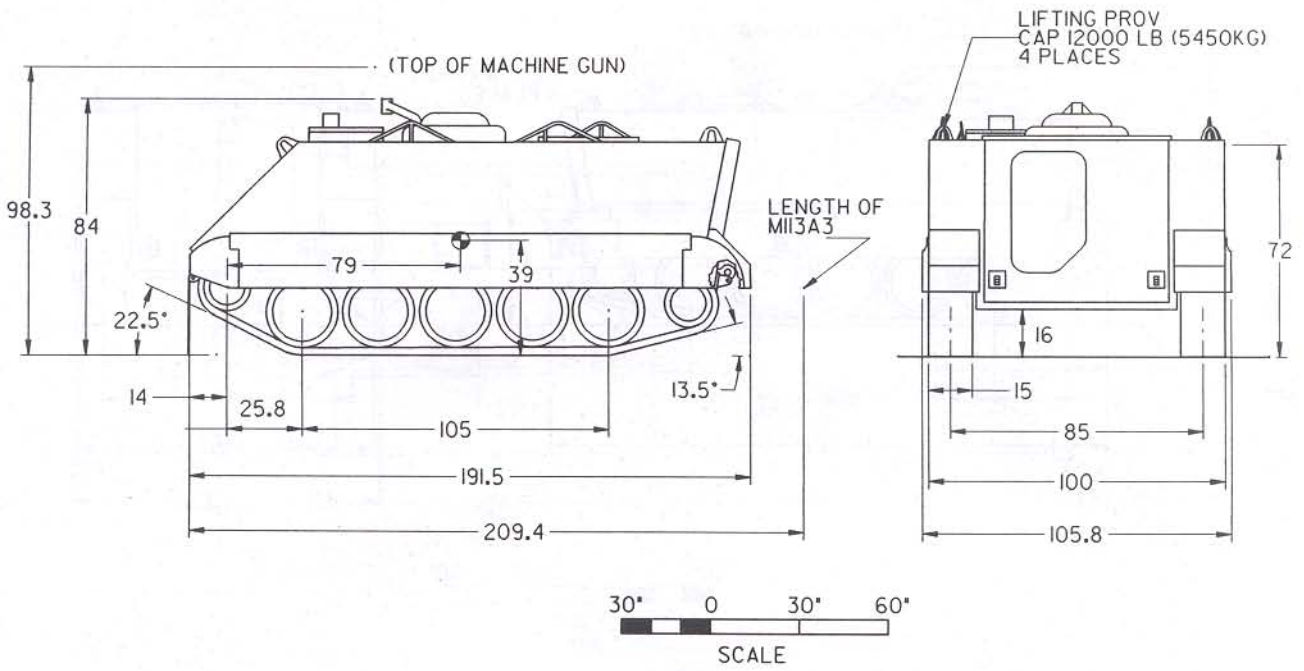


Figure 1-4. M113A3 and M113A2 (M113A3 has external fuel tanks as indicated in drawing). All dimensions are in inches.

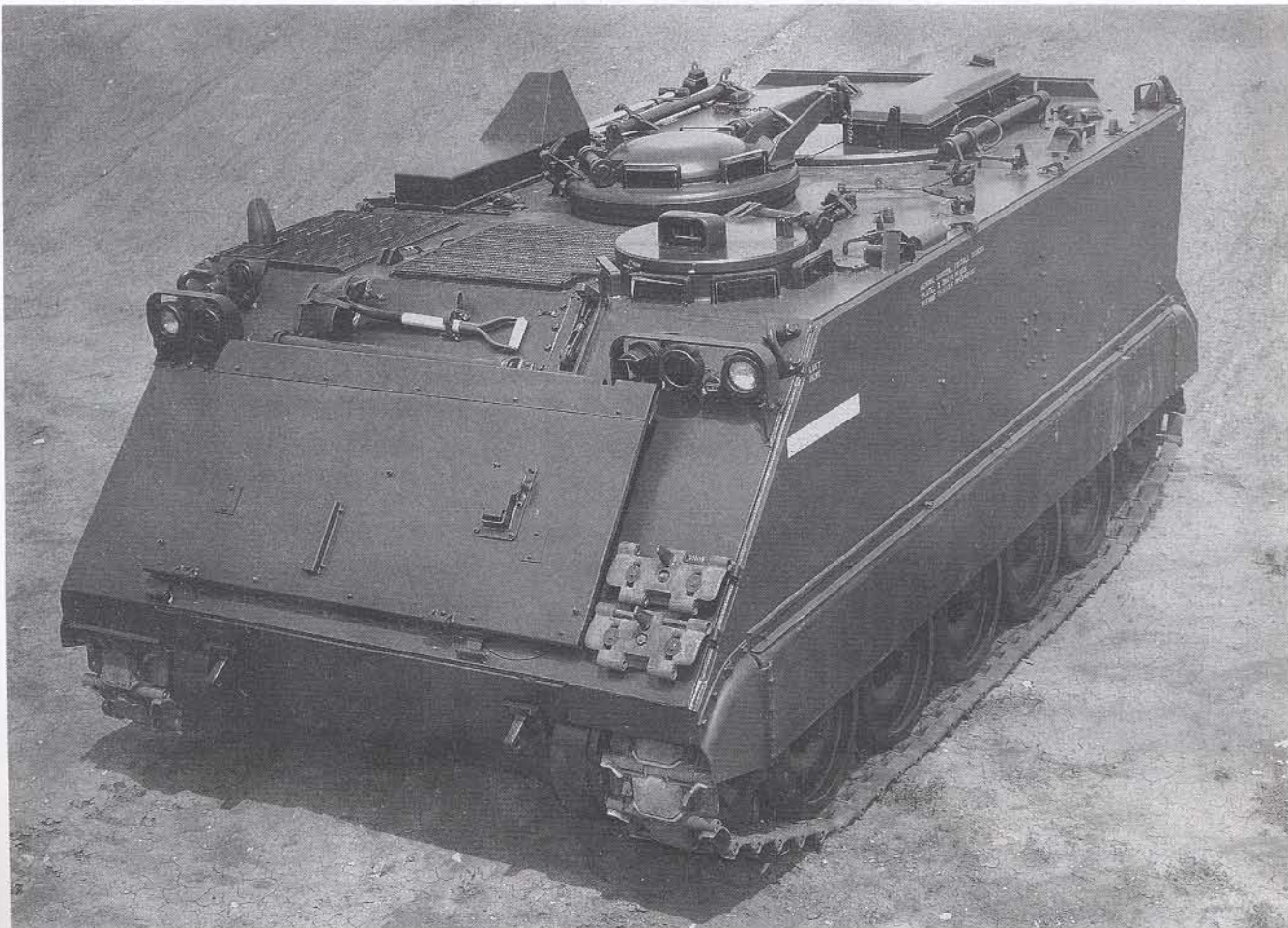


Figure 1-5. Armored Self-Propelled 81-mm Mortar.

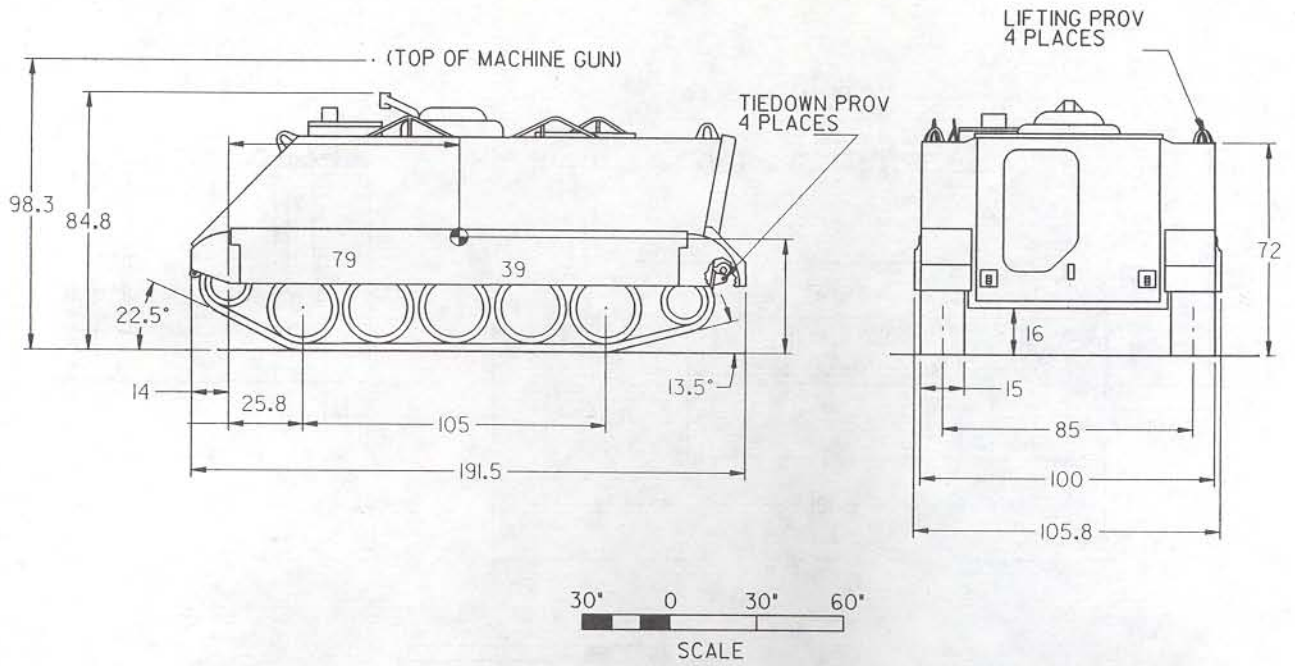


Figure 1-6. M125A2 81-mm Mortar Carrier. All dimensions are in inches.

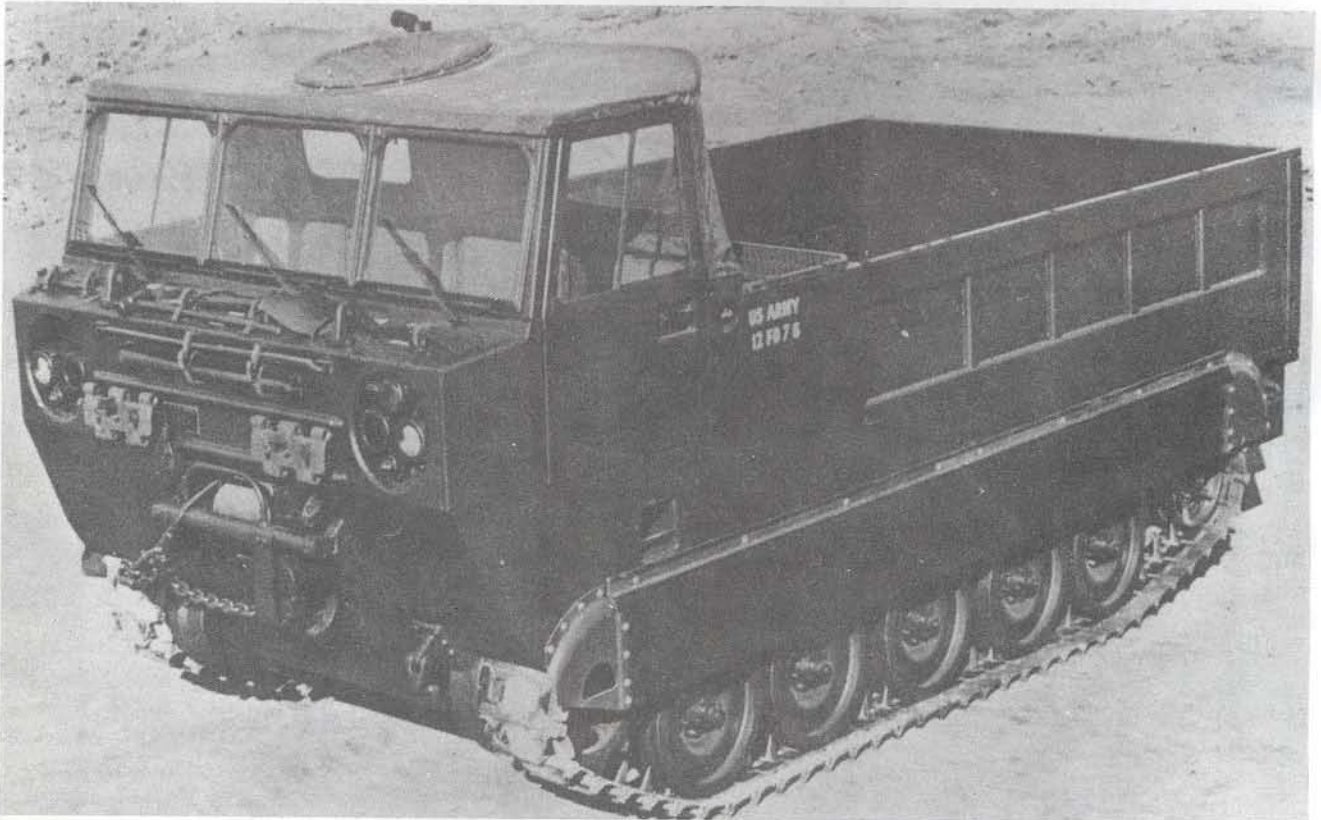


Figure 1-7. M548 Cargo Carrier.

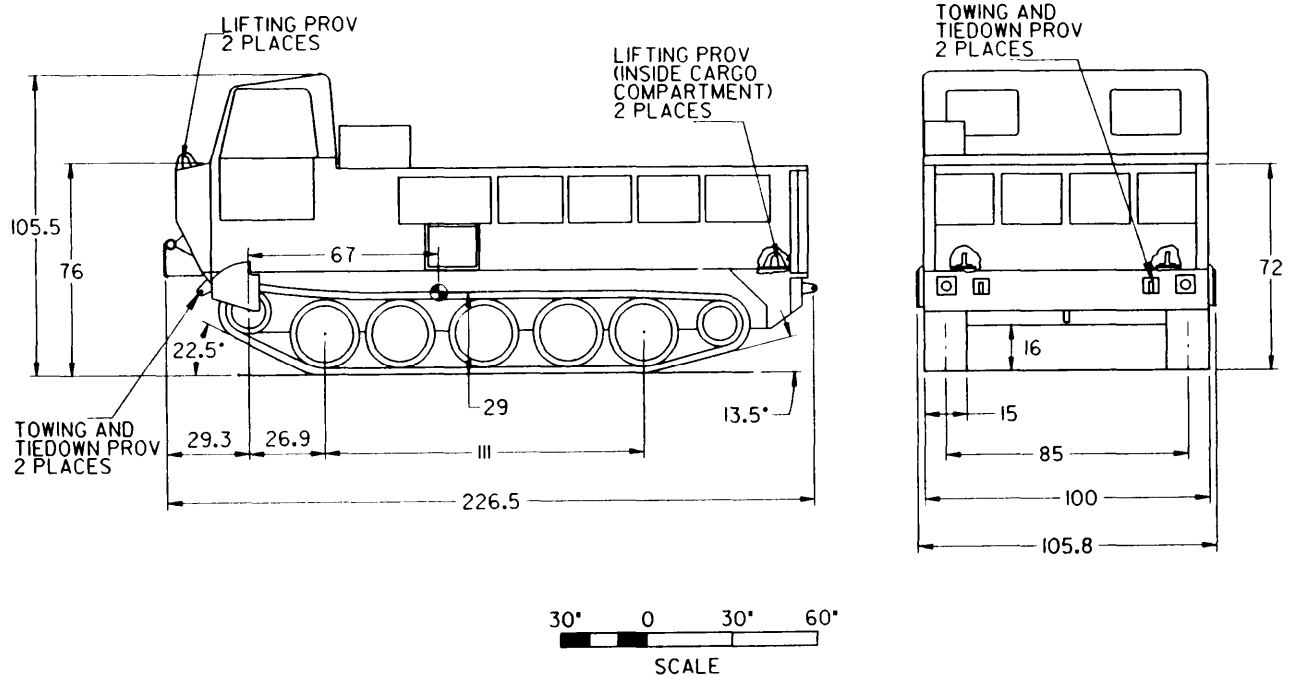


Figure 1-8. M548A1 Cargo Carrier. All dimensions are in inches.

1-7-5. M577, M577A1, and M577A2 Carrier Command Post (figs 1-9 and 1-10). This is a lightweight carrier used as an operational staff office and command post. A tent extension attaches to the rear of the carrier and doubles the available work area. The M577A2 is a product improvement of the M577A1.

1-7-6. M667 Missile Equipment Carrier (figs 1-11 and 1-12). This is a lightweight, unarmored carrier used to transport weapons systems such as Lance. The M667 is capable of LAPES operations and LVAD.

1-7-7. M730A2 Guided Missile Equipment Carrier (figs 1-13 and 1-14). The M730A2 transports the M54A5 Chaparral Aerial Intercept Guided Missile Subsystem. The unarmored carrier provides nuclear, biological, and chemical warfare protection for a crew of four.

1-7-8. M741A1 Vulcan Air Defense System (figs 1-15 and 1-16). The M741A1 is a product improved version of the M741 Vulcan Air Defense System. It transports the M163 Vulcan air defense weapon.

1-7-9. M901 and M901A1 Improved TOW Vehicle (figs 1-17 and 1-18). The M901A1 is a TOW weapon station mounted on a modified M113A2. The armored carrier provides protection for both the weapon and the crew. The launcher

platform is attached to an M27 coupola. The elevating mechanism positions the launcher platform into its stow, reload, and firing positions. The M901A1 is a product improvement program (PIP) version of the M901.

1-7-10. M981 FISTV (refer to figs 1-17 and 1-18). The weapon station contains the Ground/Vehicle Laser Locator Designator, which is used for target designation. The armored carrier provides protection for both the weapon and the crew. The turret is designed to look like the M901A1.

1-7-11. M1015A1 Electronic Warfare (EW) Shelter Carrier (figs 1-19 and 1-20). This vehicle provides a carrier for EW Systems.

1-7-12. M1059 Carrier, Smoke Generator (figs 1-21 and 1-22). The armored carrier provides protection for the smoke-generating equipment and crew. The M1059 can generate smoke continuously for 1 hour. The XM1011, Large Area Mobile Projected Smoke System (LAMPSS) Carrier, will partially replace the M1059. Unless otherwise instructed, follow the transport guidance for the M1059.

1-7-13. M1064 Carrier, 120-mm Mortar (figs 1-23 and 1-24). The M1064 is a modification of the M106A2 carrier. It has external fuel tanks and is modified internally to carry the 120-mm mortar.

1-7-14. M1068 Carrier, Armored Command Post, Full Tracked, Standardized Integrated Command Post System (SICPS) (figs 1-25 and 1-26). The M1068 is a modification of the M577A2. It carries the new Army Tactical Command and Control System (ATCCS). The rear tiedown provisions are located on the underside of the M1068, instead of on the rear door.

1-8. Technical Data

Table 1-1 gives characteristics and data for the M113 FOV.

1-9. Reduced Configuration

It may be necessary to transport some of the carriers in their reduced configurations. The reduced configurations for the M901A1 and the M981 are indicated by dotted lines in the line drawings on the previous pages. Specific instructions for reducing the overall dimensions and the weight of various carriers are given in the following chapters.

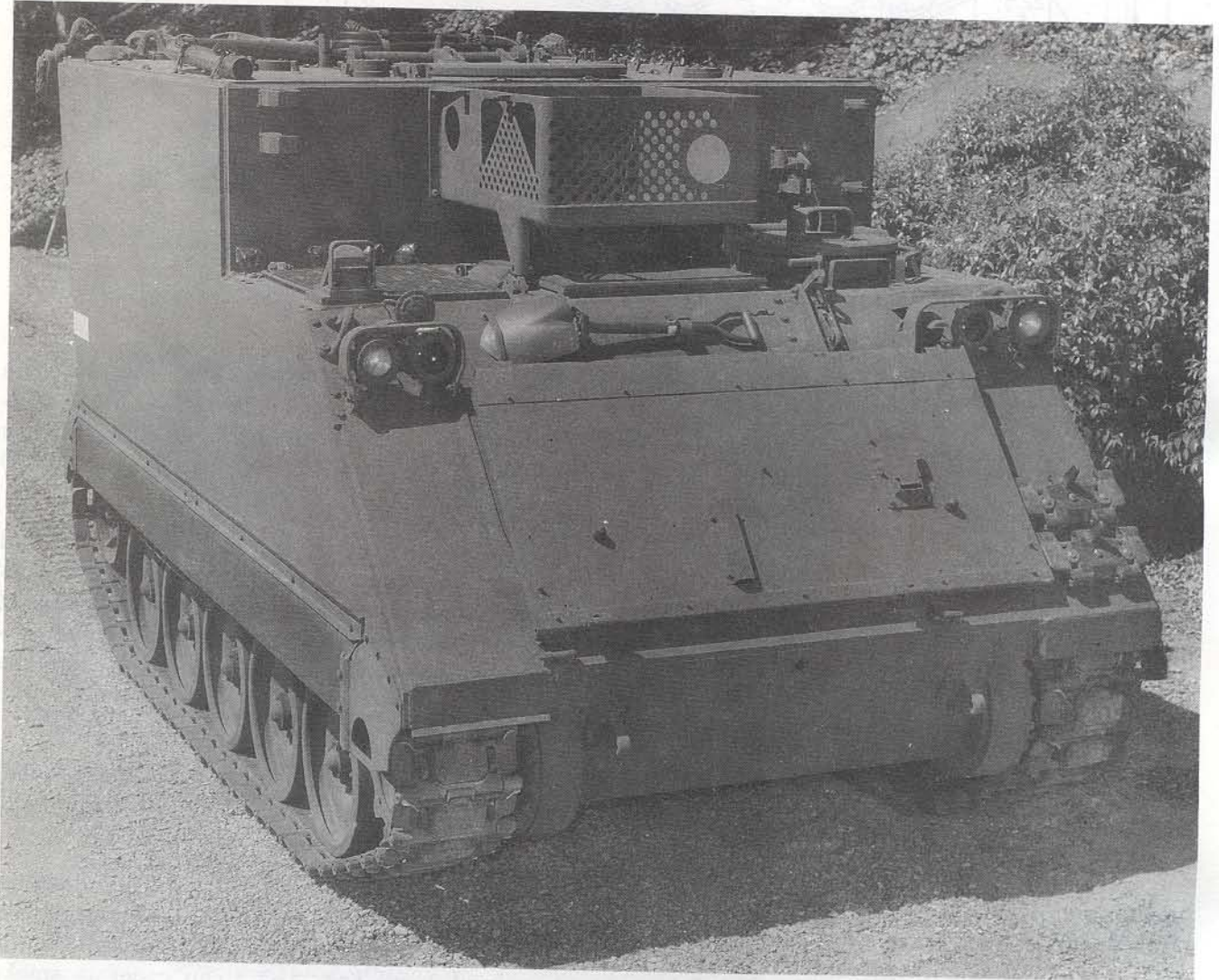


Figure 1-9. M577A2 Carrier Command Post.

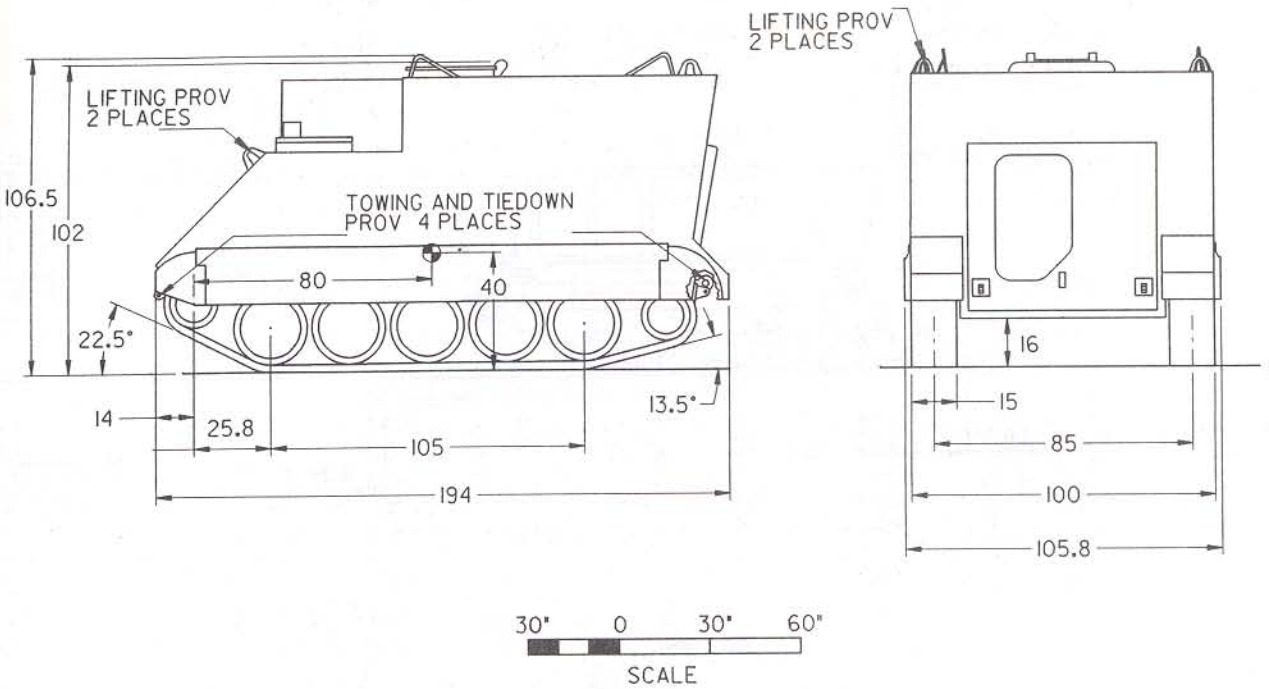


Figure 1-10. M577A2 Armored Command Post. All dimensions are in inches.

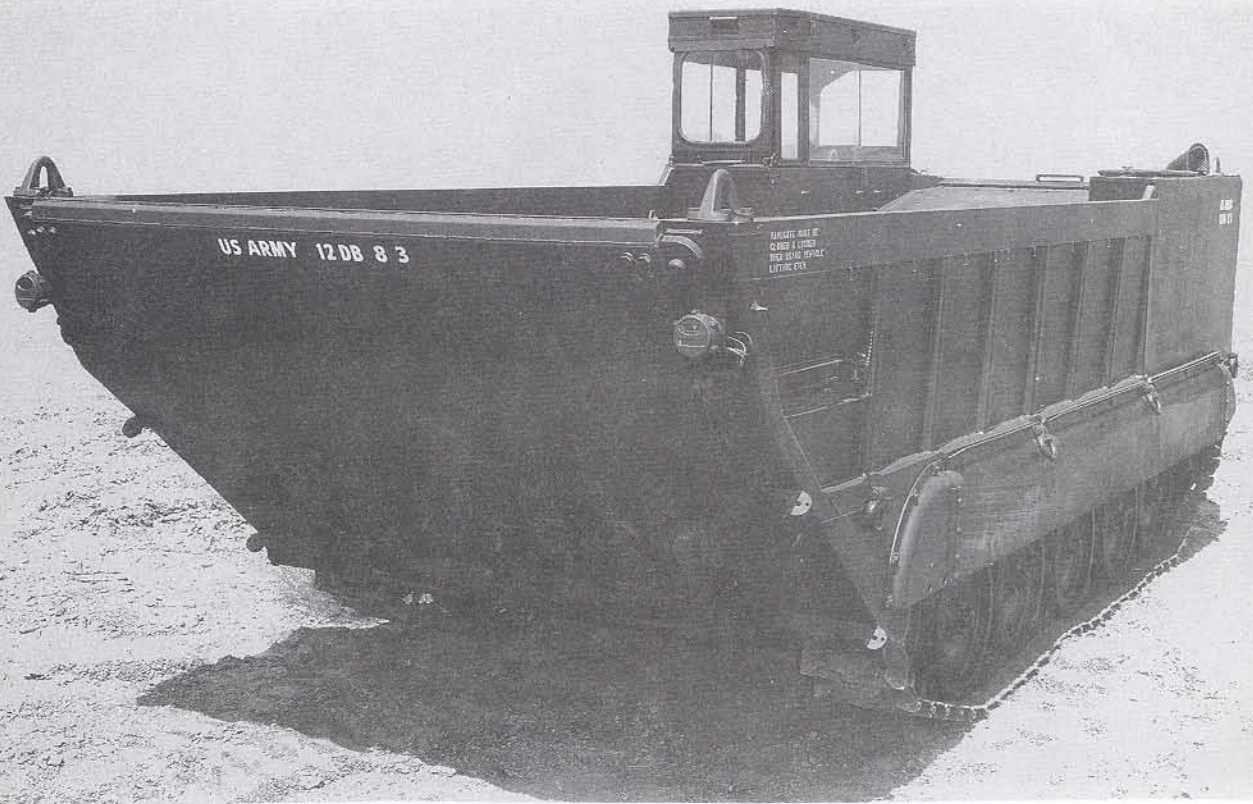


Figure 1-11. M667 Missile Equipment Carrier.

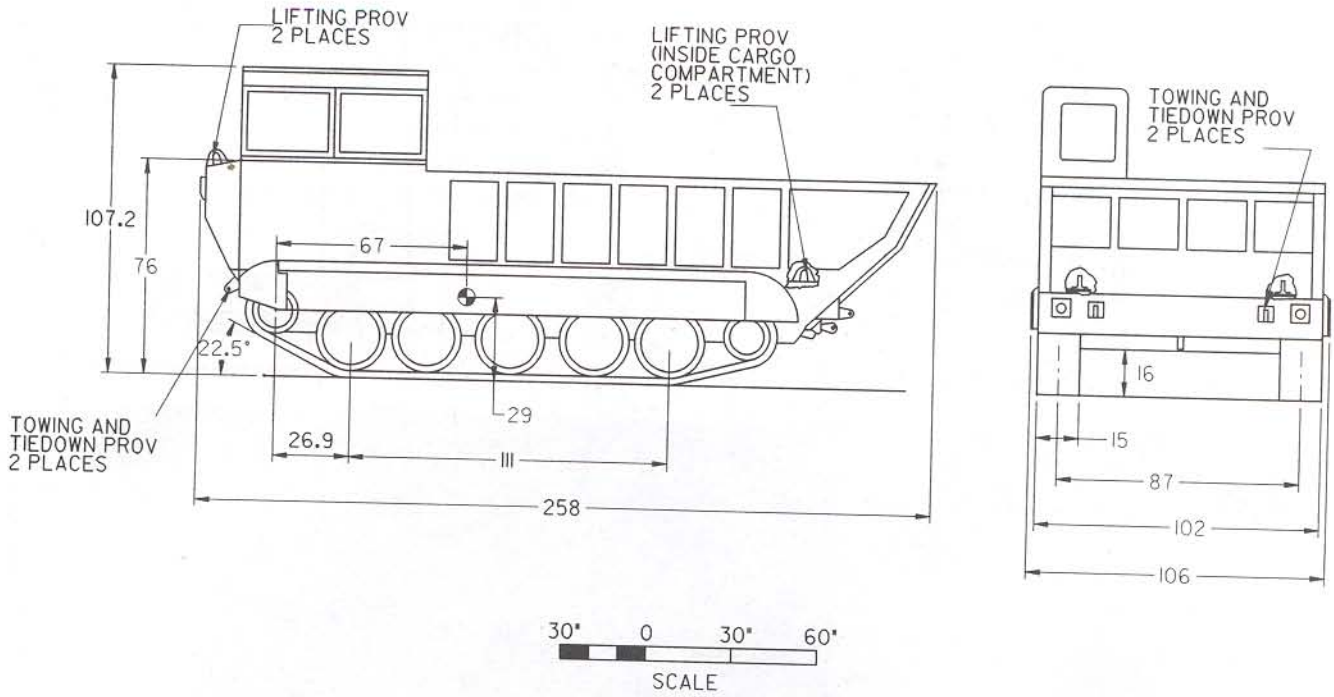


Figure 1-12. M667 Cargo Carrier. All dimensions are in inches.



Figure 1-13. M730A2 Guided Missile Equipment Carrier.

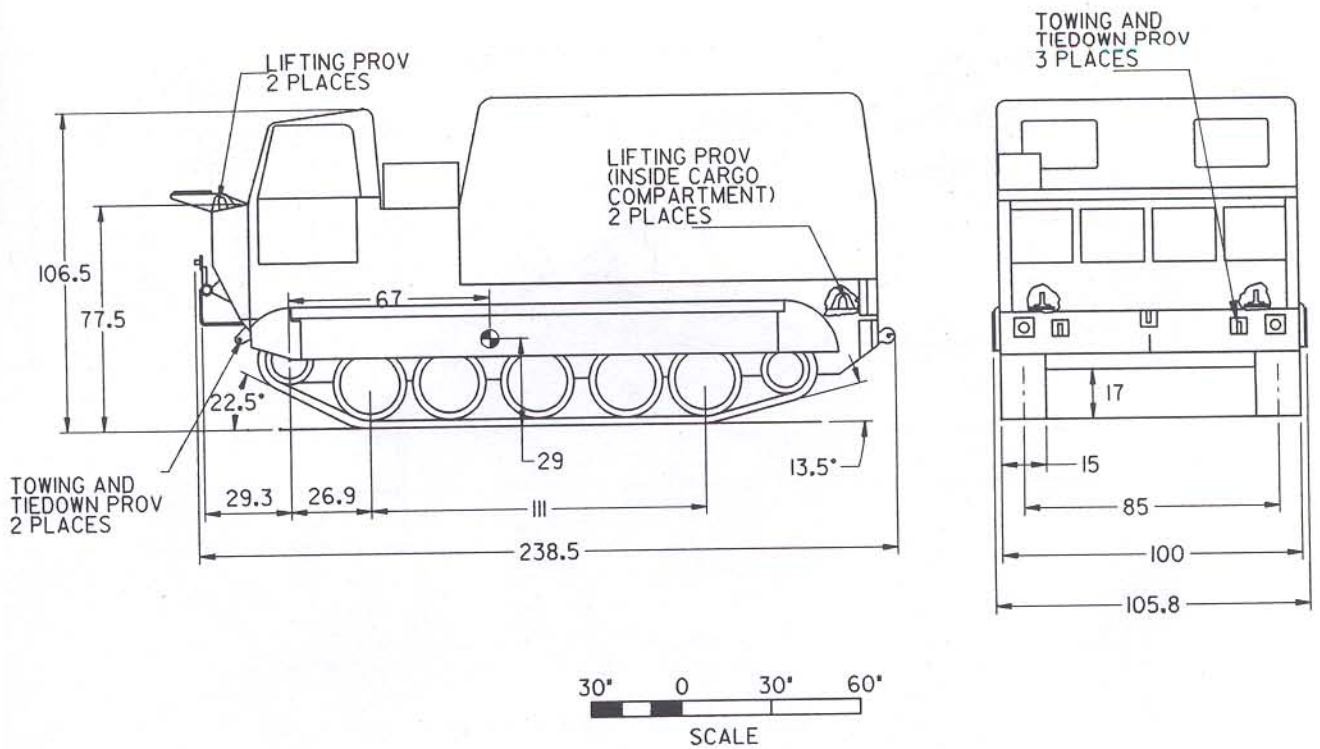


Figure 1-14. M730A2 Guided Missile Equipment Carrier. All dimensions are in inches.



Figure 1-15. M741A1 Vulcan Air Defense System.

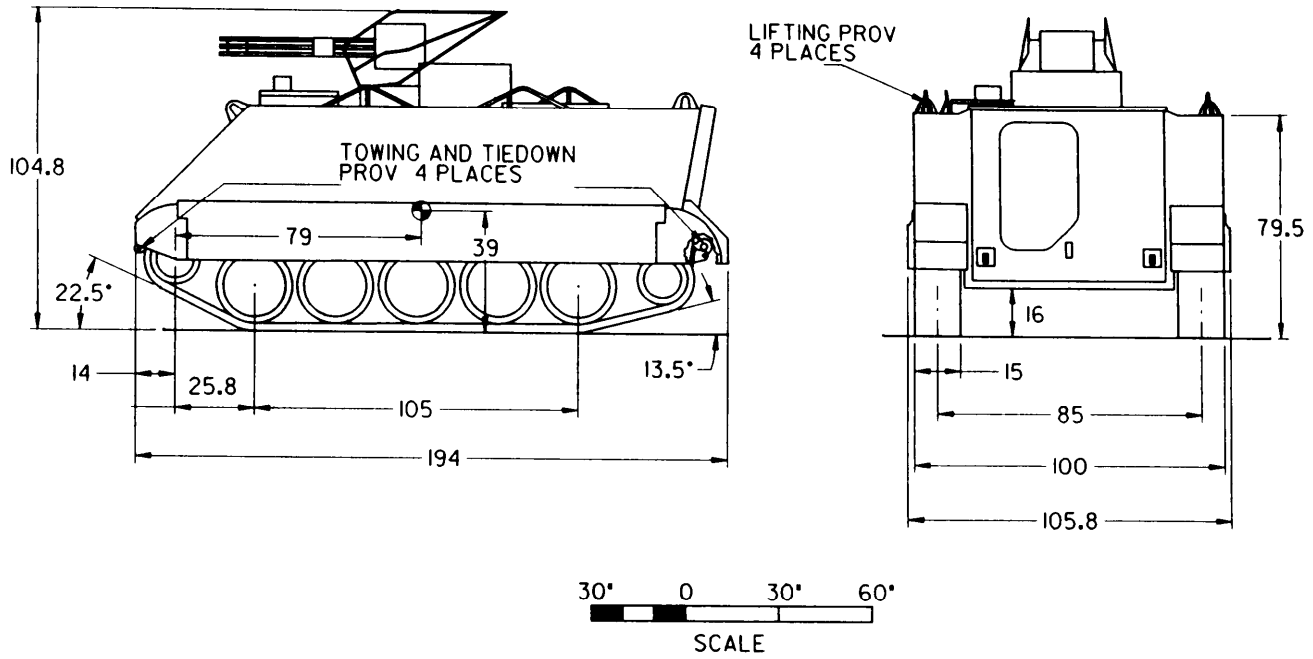


Figure 1-16. M741A1 Vulcan Air Defense Vehicle. All dimensions are in inches.



Figure 1-17. M901A1 Improved Tow Vehicle.

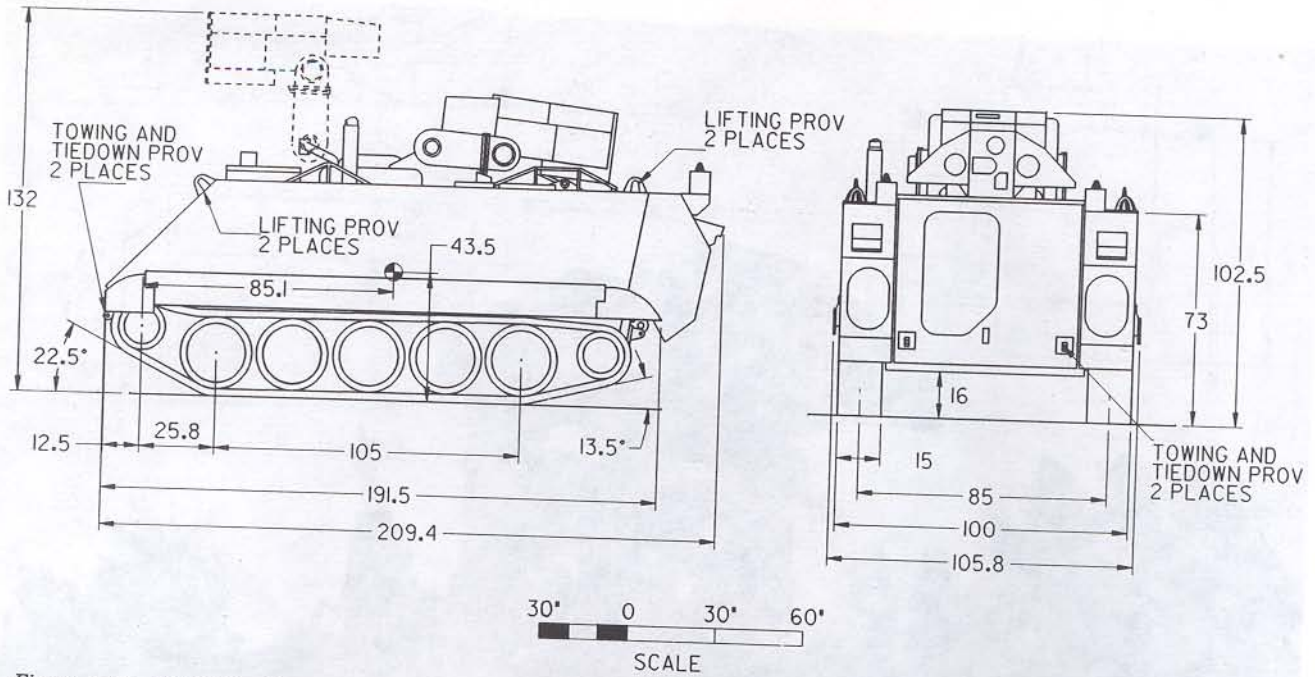


Figure 1-18. M981 Fire Support Team Vehicle (FISTV). The dotted lines show the erect position. The M901A1 Improved Tow Vehicle (ITV) is identical in appearance, except the M901A1 does not have external fuel tanks. The M901A1 is 191.5 inches long. All dimensions are in inches.



Figure 1-19. M1015A1 Electronic Warfare Shelter Carrier.

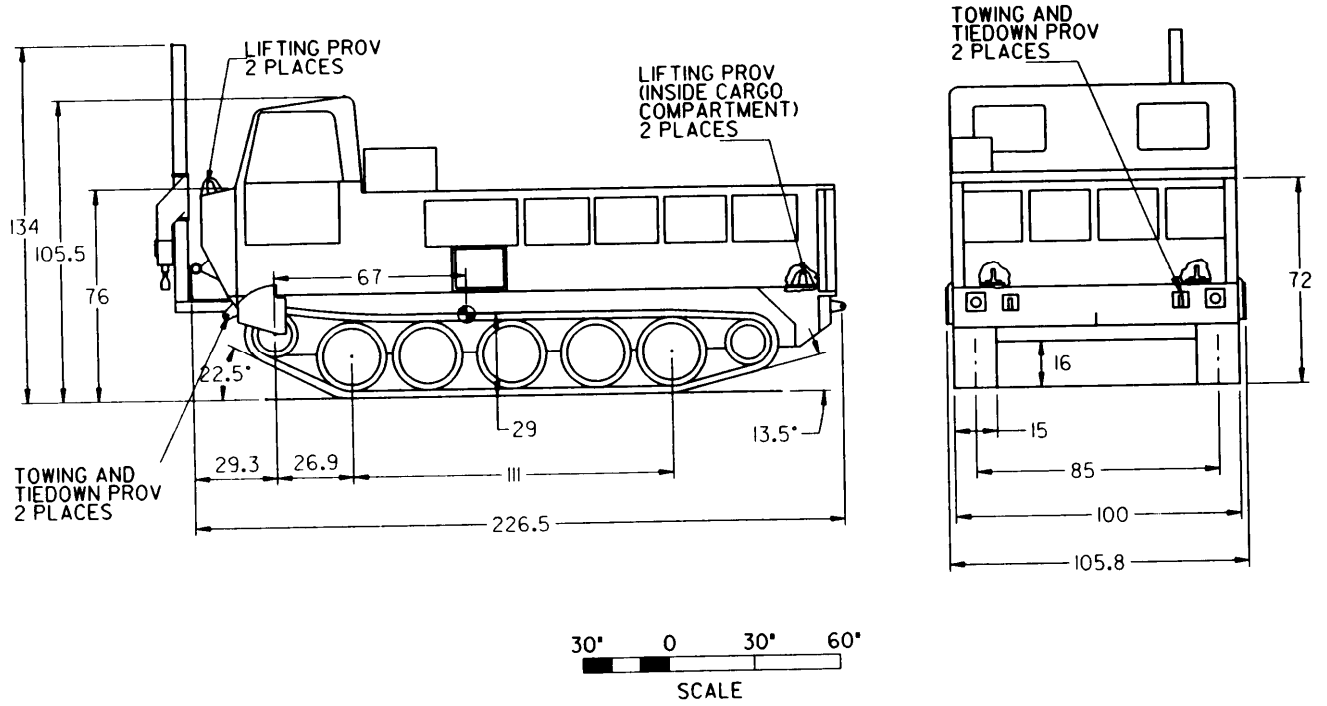


Figure 1-20. M1015A1 Electronic Warfare Carrier. All dimensions are in inches.

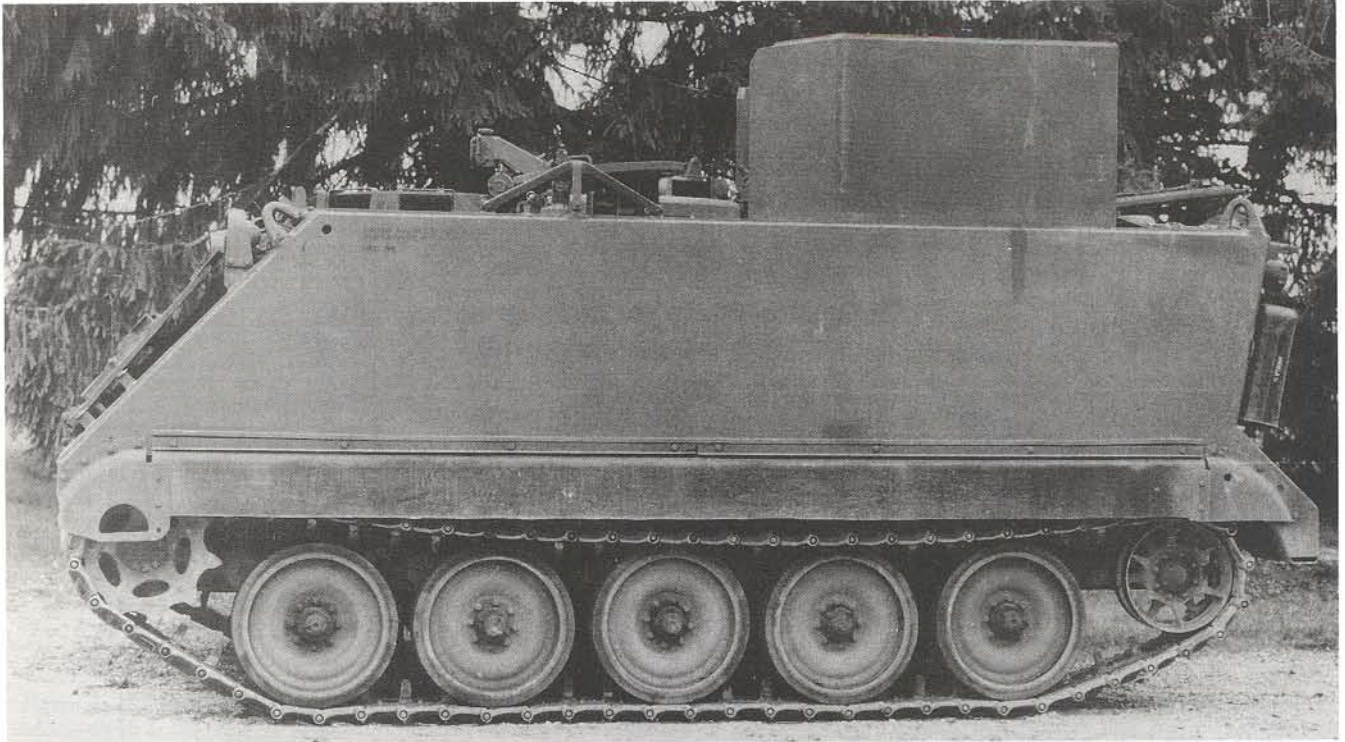


Figure 1-21. M1059 Carrier, Smoke Generator.

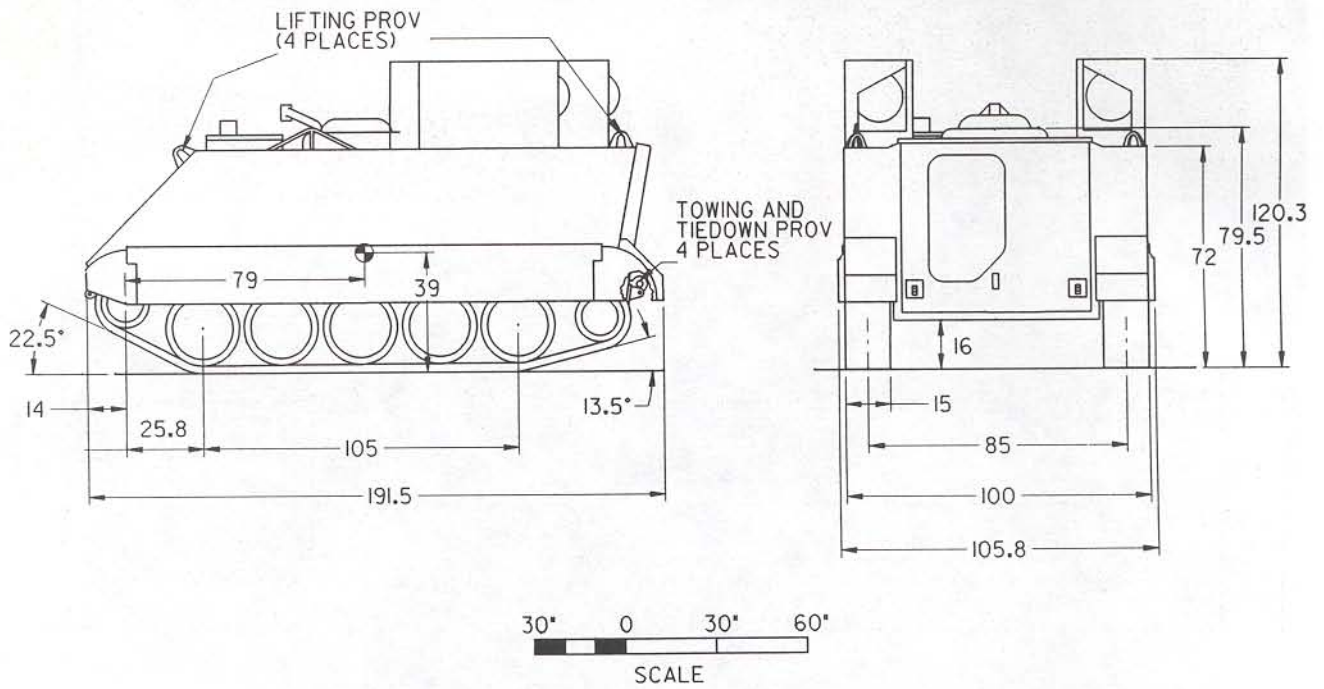


Figure 1-22. M1059 Carrier, Smoke Generator. All dimensions are in inches.

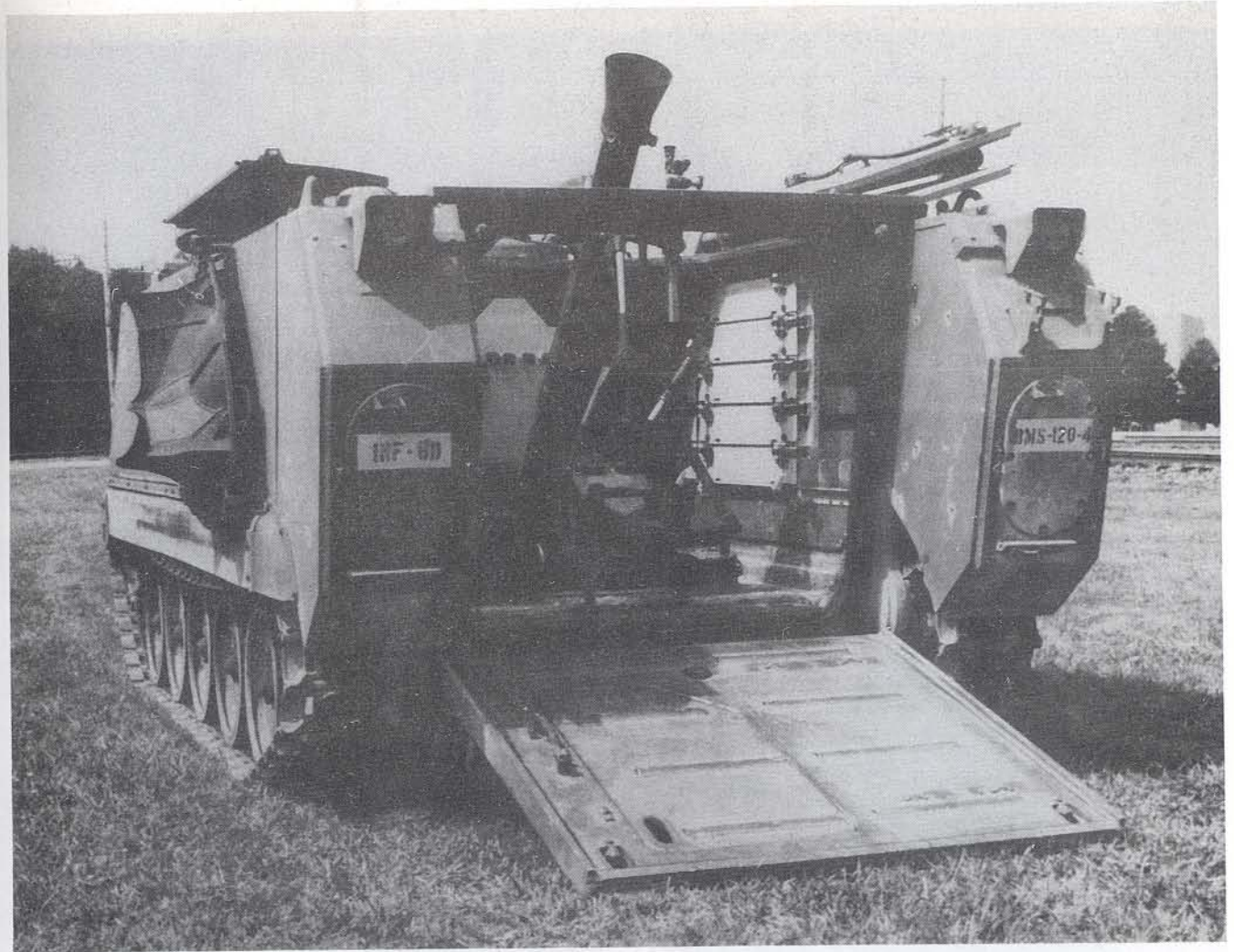


Figure 1-23. M1064 Carrier, 120-mm Mortar.

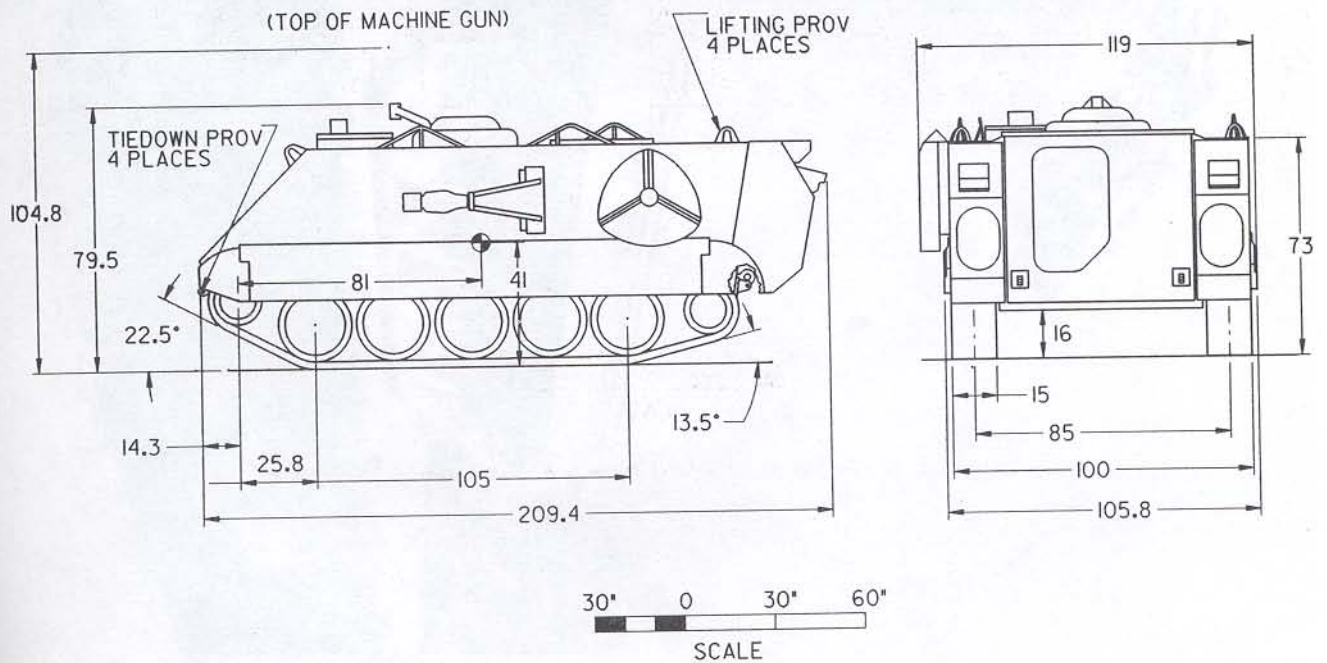


Figure 1-24. M1064 Mortar Carrier. All dimensions are in inches.

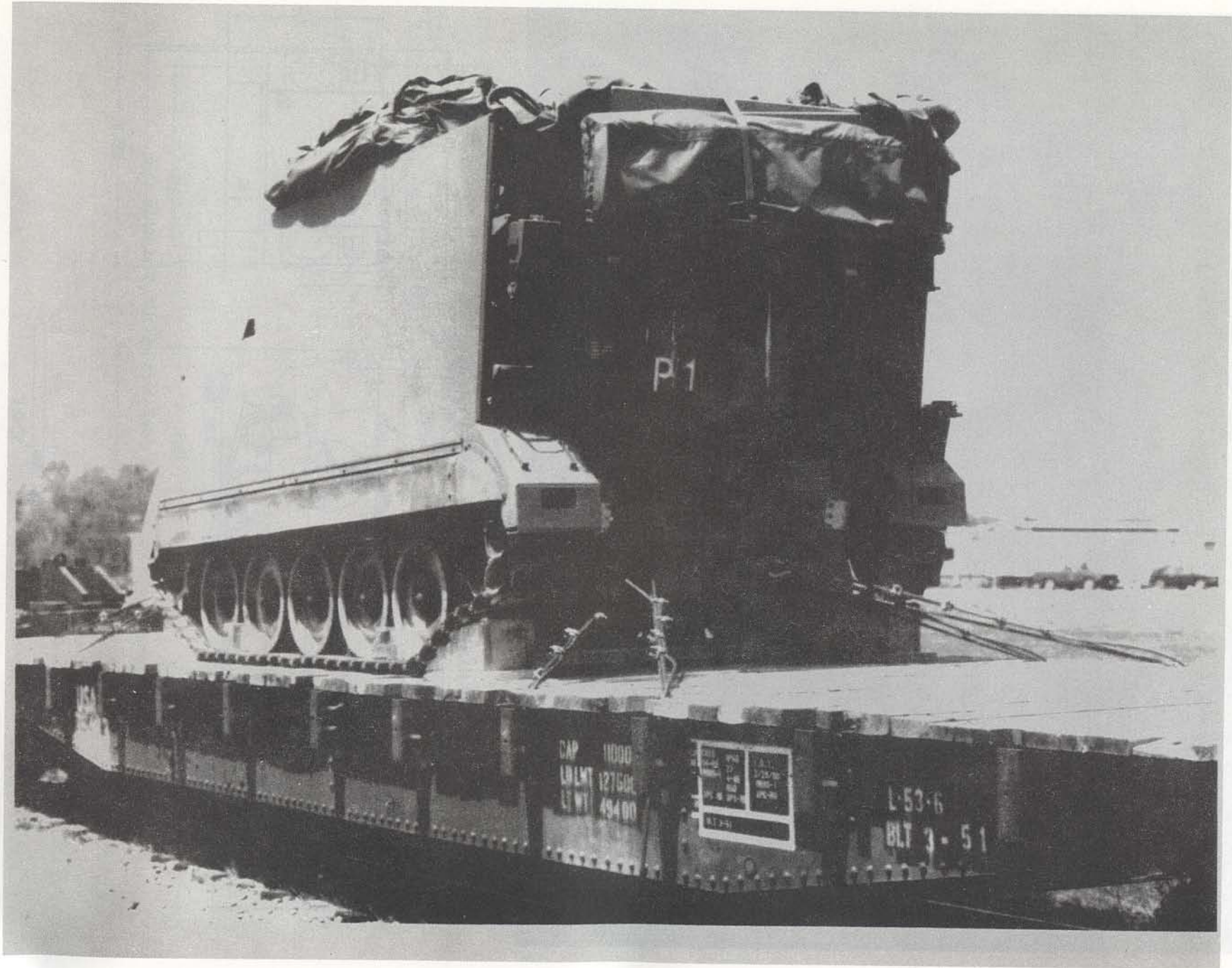


Figure 1-25. M1063 SICPS Tracked Command Post.

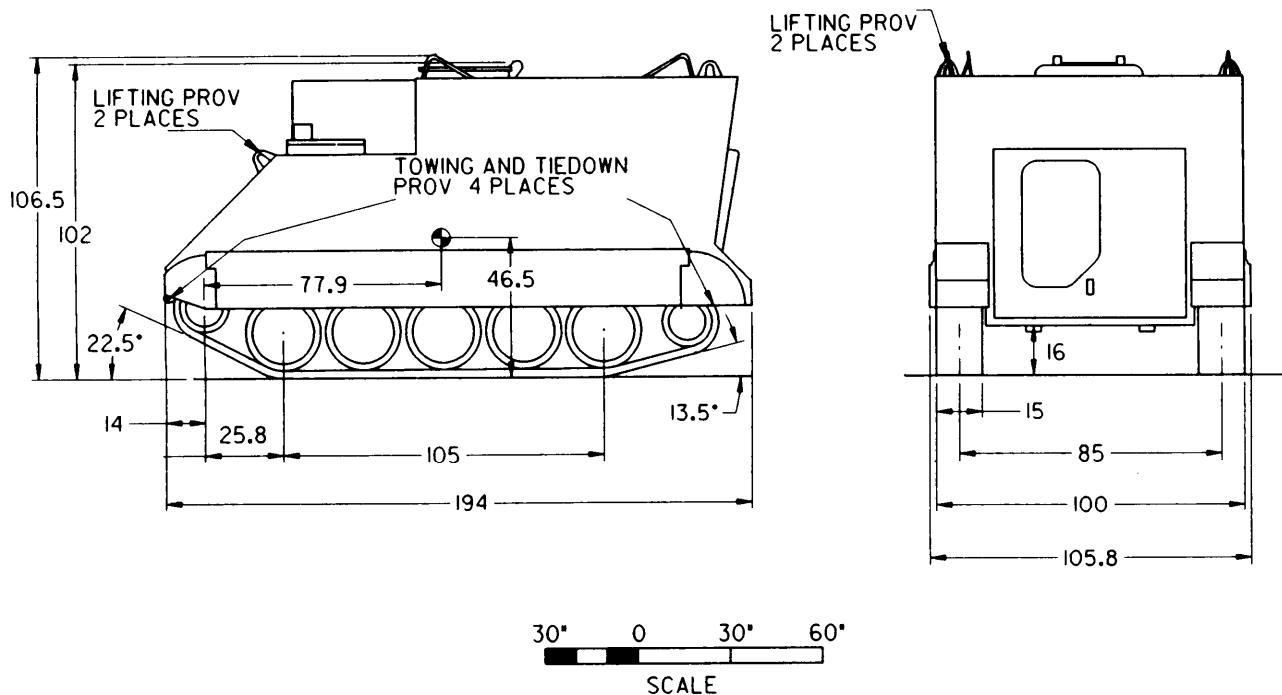


Figure 1-26. M1068 SICPS Tracked Command Post. All dimensions are in inches.

Table 1-1. Characteristics of the M113 FOV

Nomenclature	TOE LIN	NSN	Curb Weight lb (kg)	Combat Weight lb (kg)	Ground Pressure (psi)		Foot Print in. x in.	MLC		
					curb	combat		curb	combat	
Carrier, Personnel	M113	D12087	2350-00-629-1294	18,940 (8591)	22,140(10043)	6.01	7.03	105 x 15	10	12
	M113A1	D12087	2335-00-968-6321	21,400 (9707)	24,600(11159)	6.79	7.81	105 x 15	11	13
	M113A2	D12087	2350-01-068-4077'	21,866 (9918)	24,986(11334)	6.95	7.94	105 x 15	11	13
	M113A3	D12087	2335-01-219-7577	24,960(11322)	27,180(12329)	7.92	8.63	105 x 15	13	14
Carrier, Mortar, 107-mm	M106	D10741	2350-00-860-2350	19,000 (8618)	20,402 (9254)	6.03	6.48	105 x 15	10	11
	M106A1	D10741	2350-00-076-9002	24,854(11274)	26,446(11996)	7.89	8.39	105 x 15	13	14
	M106A2	D10741	2350-01-069-6931	25,044(11360)	26,876(12191)	8.08	8.53	105 x 15	12	14
Carrier, Mortar, 81-mm Carrier, Cargo	M125A1	D10726	2350-00-071-0732	23,243(10543)	24,826(11261)	7.38	7.90	105 x 15	13	13
	M125A2	D10726	2350-01-068-4087	23,424(10625)	25,256(11456)	7.68	8.14	105 x 15	13	13
	M548	D11049	2350-00-078-4545	16,744 (7609)	28,000(12701)	5.32	8.89	111 x 15	9	15
	M548A1	D11049	2350-01-096-9356	16,390 (7435)	28,400(12882)	4.87	8.47	111 x 15	9	15
Carrier, Command Post	M577	D11538	2350-00-856-6624	21,700 (9843)	23,143(10488)	6.89	7.35	105 x 15	11	12
	M577A1	D11538	2350-00-056-6808	23,950(10864)	25,383(11514)	7.60	8.06	105 x 15	13	13
	M577A2	D11538	2350-01-068-4089	24,142(10951)	25,813(11709)	7.76	8.14	105 x 15	13	13
Carrier, Guided Missile Equipment Support	M667	L76750	1450-00-879-3380	22,811(10350)	25,807(11709)	6.85	7.75	111 x 15	8	13
	M730A2	D11668	1450-00-930-8749	16,350 (7435)	30,176(13688)	4.41	8.80	111 x 15	8	15
Carrier, Weapon Station	M741A1	J96694	2350-01-099-8929	26,523(12034)	27,478(12490)	8.42	8.72	105 x 15	14	14
Carrier, ITV	M901	E56896	2350-01-045-1123	23,500(12211)	7.46	8.55	105 x 15	13	14
	M901A1	E56896	2350-01-103-5641	22,579(10242)	26,000(11798)	7.17	8.25	105 x 15	12	13
Carrier, FISTV	M981	C12155	2350-01-085-3792	26,200(11884)	27,900(12665)	8.32	8.86	105 x 15	14	14
Carrier, Electronic Warfare	M1015A1	C10858	2350-01-136-8745	17,390 (7888)	26,785(12150)	5.22	8.04	111 x 15	9	14
Carrier, Smoke Generator	M1059	C12815	2350-01-203-0188	21,238 (9634)	24,553(11137)	6.74	7.79	105 x 15	11	13
Carrier, 120-mm Mortar	M1064	C10990	2350-01-338-3116	25,810(11704)	27,635(12535)	8.19	8.77	105 x 15	13	14
Carrier, Command Post	M1068	Z20415	NA	23,950(10861)	25,813(11709)	7.66	8.19	105 x 15	NA	NA

CHAPTER 2 HIGHWAY TRANSPORT

Section I. GENERAL

2-1. General

The M113 FOV are highway transportable, using standard Army semitrailers. The semitrailers must be of adequate capacity. All of the variants in the M113 FOV require highway permits for oversized cargo. Permit requirements will vary depending on local regulations and conditions, but in general the shipper must:

a. Submit DD Form 1266 (Request for Special Hauling Permit) to the installation transportation officer (ITO) 2 weeks before the Planned movement.

b. Be aware that travel may be restricted to daylight hours on normal workdays.

c. Be prepared to use wide-load signs, amber lights, and escorts.

d. Determine if blanket permits are available for specific prime movers, such as a heavy-equipment transporter.

e. AR 55-162 gives additional guidance on permits in CONUS. MTMCTEA Pamphlet 55-20, *Tiedown Handbook for Highway Movements*, provides additional information on tying down military equipment. Copies of this publication can be obtained by contacting:

Director
Military Traffic Management Command
Transportation Engineering Agency
ATTN: MTTE-TR
720 Thimble Shoals Boulevard, Suite 130
Newport News, VA 23606-2574

2-2. Self-Delivery

The FOV are considered self-deliverable only under appropriate tactical situations. The carriers' tracks are equipped with rubber pads. However, movement over paved public roads is not made without specific approval from State highway officials, as outlined in FM 55-65.

Section II. MOTOR VEHICLE TRANSPORT

2-3. Prime Mover Selection

a. The M113 FOV can be transported over highways by a variety of semitrailers. When selecting a transporter, consider the proposed route and local availability of wide-load permits. Total load restraint is a minimum of 1.5 times the GVW of the carrier.

b. Table 2-1 is a comparison of possible military semitrailers for transporting the M113 FOV.

c. Table 2-2 gives specific truck tractor-semitrailer-carrier combinations that do not exceed the capabilities of the truck tractors or semitrailers.

2-4. Preparation

To prepare the M113 FOV carriers for highway transport:

a. Empty fuel tank to one-fourth of its capacity.

b. Remove all trash and mud from the tracks.

c. Check for fluid leaks, and repair defects.

d. Secure the battery.

e. Inspect engine, brakes, and tiedowns, to ensure they are in good mechanical condition.

f. Remove all BII from outside the carrier, and restrain them inside the carrier.

Table 2-1. Evaluation of Semitrailers

Semi-trailers	Load rating (tons)	Comments
M1000 HET	70	Large. Can transport one or two carriers.
M747 HET	60	Large. Can transport only one carrier.
M870 Low Bed	40	Can transport one carrier.
M872 Flat Bed	34	Can transport one or two carriers.
M172A1 Low Bed	25	Recommended, 115 in. wide.
M871 Flat Bed	22.5	Second choice (semitrailer is 96 in. wide, 2-in. overhang on each side).
M127A2C Stake	12	Limited usefulness. Deck height is 57 in.
M345 Flat Bed	10	Trailer too small.

Table 2-2. Number of Carriers Allowed on Various Truck Tractor/Semitrailer Combinations (a),(b)

Nomenclature		M1070 M1000	M915A1 M871	M915A1 M872A1(c)	M915A1 M127A2C(d)	M916 M870	M916 M172A1	M920 M870	M920 M172A1
Carrier,	M113A1	2	1	2	1	1	1	1	1
personnel	M113A2	2	1	2	1	1	1	1	1
	M113A3	1	1	1	1	1	1	1	1
Carrier,	M106A1	2	1	2	1	1	1	1	1
mortar, 107-mm	M106A2	2	1	2	1	1	1	1	1
Carrier,	M125A1	2	1	2	1	1	1	1	1
mortar, 81-mm	M125A2	2	1	2	1	1	1	1	1
Carrier, cargo	M548	1	1	1	1	1	1	1	1
	M548A1	1	1	1	1	1	1	1	1
Carrier,	M577A1	1	1	2	1 (e)	1	1	1	1
command post	M577A2	1	1	2	1 (e)	1	1	1	1
Carrier, guided missile equipment support	M667	1	1	1	1	1	1	1	1
	M730A2	1	1	1	1	1	1	1	1
Carrier, weapon station		1	1	1	1	1	1	1	1
	M741A1	1	1	1	1	1	1	1	1
Carrier, ITV	M901A1	2	1	2	1 (e)	1	1	1	1 (e)
Carrier, FISTV	M981	1	1	1	1 (e)	1	1	1	1
Carrier, electronic warfare	M1015A1	1	1	1	1	1	1	1	1
Carrier, smoke generator	M1059	2	1	2	1	1	1	1	1
Carrier, mortar, 120-mm	M1064	1	1	1	1	1	1	1	1
Carrier, command post	M1068	1	1	2	1 (e)	1	1	1	1

Notes:

(a) All carriers are in the combat configuration.

(b) Carriers will overhang on both sides of all semitrailers except the M172A1 and the M1000.

(c) Each carrier must weigh less than 27,000 pounds when transporting two carriers on the M872A1.

(d) The 127A2C is the least preferred semitrailer.

(e) Height restrictions in NATO countries.

*****WARNING*****

Only the driver of the carrier is allowed on the trailer bed during loading operations.

*****WARNING*****

Do not load on side or lateral slopes exceeding 10 percent or with a tractor-to-trailer offset angle greater than 50. Avoid loading on a severe downgrade, to prevent the payload from rolling forward on the trailer.

****CAUTION****

The M901A1 and M981 launcher must be in the low stow position for transport. (See app D or TM 9-2350-259 or TM 9-2350-266 series for low stow procedures.)

2-5. Loading and Tiedown Procedures

****CAUTION****

The rear ramp of the M577-series carriers rear ramp requires special preparation to prevent it from falling during transport. See appendix E for instructions.

a. Place the carrier in the tiedown position on a semitrailer by using a crane of adequate capacity (15-ton minimum), or drive the carrier onto a semitrailer if a suitable ramp is available.

b. Position the carrier on the semitrailer, using the trailer's cargo data plate as guidance. If no cargo data plate is present, position the carrier so that its weight is evenly distributed over the tractor and trailer axles.

c. Set the parking brakes.

d. Put the transmission in neutral. For the M113A3 and M730A2, put the transmission in the steer lock (SL) position.

e. On some semitrailers the carriers will have 1 to 2 inches of overhang on both sides. Position the carrier so that the overhang is equal on both sides.

f. Install chain and load binders. Specific sizes and types of chain and cable assemblies are specified in table 2-3 and figures 2-1 and 2-2. Figures

2-3, 2-4, and 2-5 and table 2-4 provide detailed instructions for restraining the carriers against forces encountered at normal speeds and operating conditions. The transporter can use other chain and cable assemblies of adequate strength and size.

NOTE

The M1068 carrier only requires two shackle assemblies. The rear tiedown provisions do not need shackles.

Table 2-3. Bill of Materials for Transport by Semitrailer

Item	Quantity	Description
Shackle assembly	4	Shackle, NSN 4030-00-279-4475. Bolt, NSN 5305-01-006-2072. Washer (2), NSN 5310-00-809-8541. Nut (2), NSN 5310-00-891-3428. (Part number 19207-12381884, MIL-S-24214, grade B, type I, class 3 safety anchor shackle with a special bolt that has a 0.99 (+0.00, -0.06) in. diameter, with a minimum breaking load of 122,000 pounds and a minimum proof load of 61,000 pounds).
<i>Chain assembly, option 1a, for loading one carrier on the M870 and the M871</i>		
Chain	4	NSN 4010-00-443-4845, 3/8 in. x 14 1/2 ft, grade 70, 6,600-pound safe working load.
Load binders	4	NSN 3990-01-213-1746, 3/8 in.-1/2 in., type 4 latching, 9,200-pound safe working load.
<i>Chain assembly, option 1b, for loading one carrier on the M172A1 and the M127A2C</i>		
Chain	6	NSN 4010-00-803-8858, 3/8 in. x 10 ft, grade 80, 8,250-pound safe working load.
Load binders	6	NSN 3990-01-213-1746, 3/8 in.-1/2 in., type 4 latching, 9,200-pound safe working load.
<i>Chain assembly option 2, for loading two carriers on the M872 series</i>		
Chain	12	NSN 4010-00-803-8858, 3/8 in. x 10 ft, grade 80, 8,250-pound safe working load.
Load binders	12	NSN 3990-01-213-1746, 3/8 in.-1/2 in., type 4 latching, 9,200-pound safe working load.
<i>Chain assembly, option 3, for loading two carriers on the M1000 series</i>		
Chain	4	1/2 in. x 10 ft, high strength alloy steel chains, 12,500-pound safe working load (BII with M1000).
	4	NSN 4010-00-803-8858, 3/8 in. x 10 ft, grade, 80, 8,250-pound safe working load.
Load Binders	4	Adequate strength, 1/2 in., latching (BII with M1000)
	4	NSN 3990-01-213-1746, 3/8 in.-1/2 in., type 4 latching, 9,200-pound safe working load.
<i>When chain not available, option 4</i>		
Wire Rope	80 ft	NSN 4010-00-272-8848, 1/2-in. diameter, 6 x 19 IWRC (independent wire rope core) improved plow steel, regular lay, table X, Federal Specification RR-W-410, <i>Wire Rope and Strand</i> , nominal BS of 23,000 pounds.
Cable clamps		NSN 4030-00-243-4440 (1/2 in.),
1/2 in.	16	NSN 4030-00-243-4441 (5/8 in.), type I, single-saddled, wire-rope clamp. (Crosby heavy-duty or one that will meet or exceed Federal Specification FF-C-450.)
5/8 in.	8	Torque capacity equals 65 ft-lb (1/2 in.) or 95 ft-lb (5/8-in.).
Thimbles	8	NSN 4030-00-282-2512, 1/2 in, type III, heavy split oval construction (open pattern), Federal Specification FF-T-276.
Come-along or cable tightener	1	Adequate strength cable tensioning device.

NOTE

a. Load binders are generally marked with an ultimate breaking strength rating. Depending on manufacturer, breaking strength is about three times the safe working load.

b. Chain is generally rated by proof test load or about two times the safe working load. Appendix C includes a table titled "Method of Identification for Inch-Size Chain."

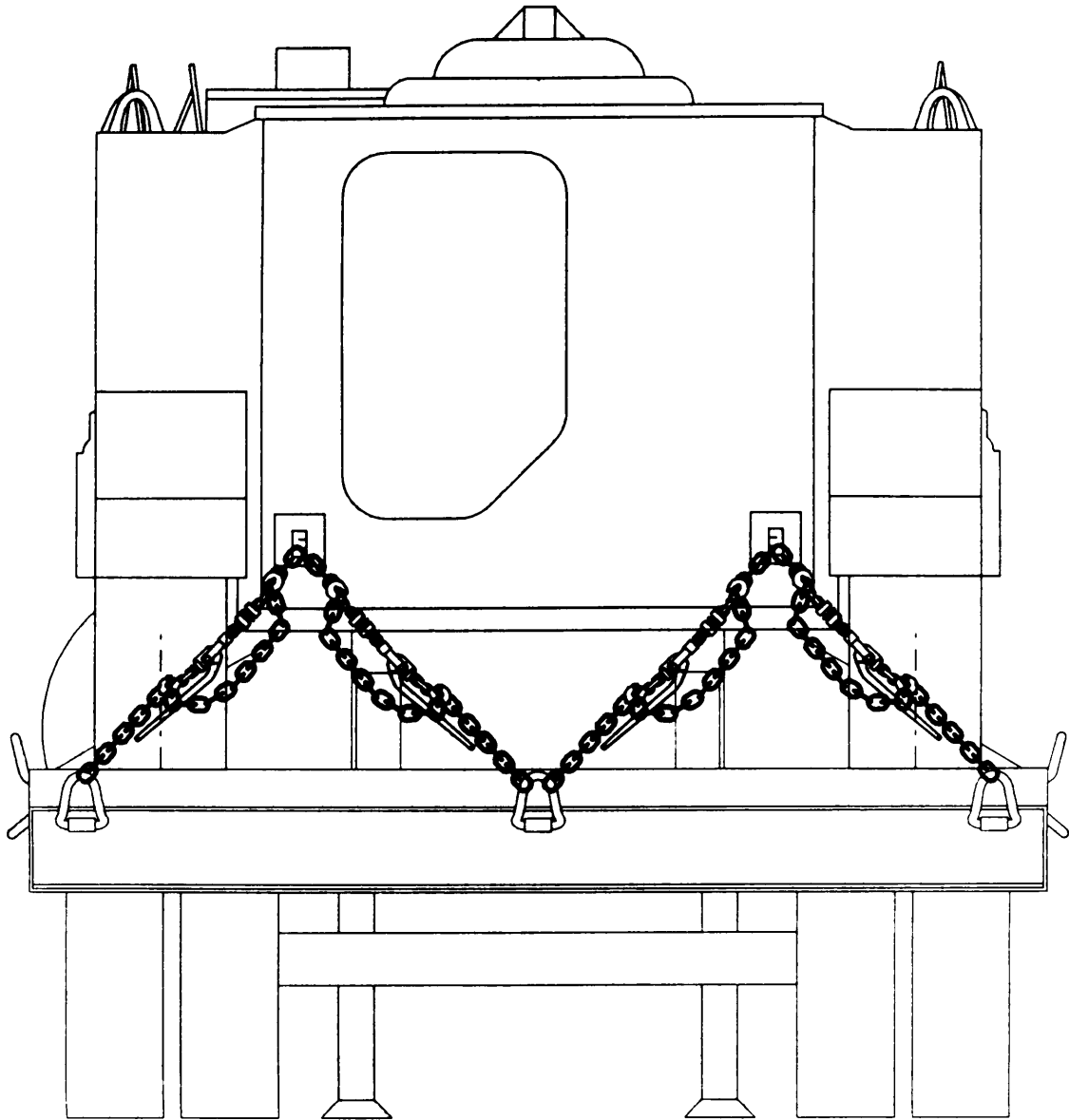


Figure 2-1. Detail of a chain tiedown pattern. (Table 2-3, chain assembly, option 1b)

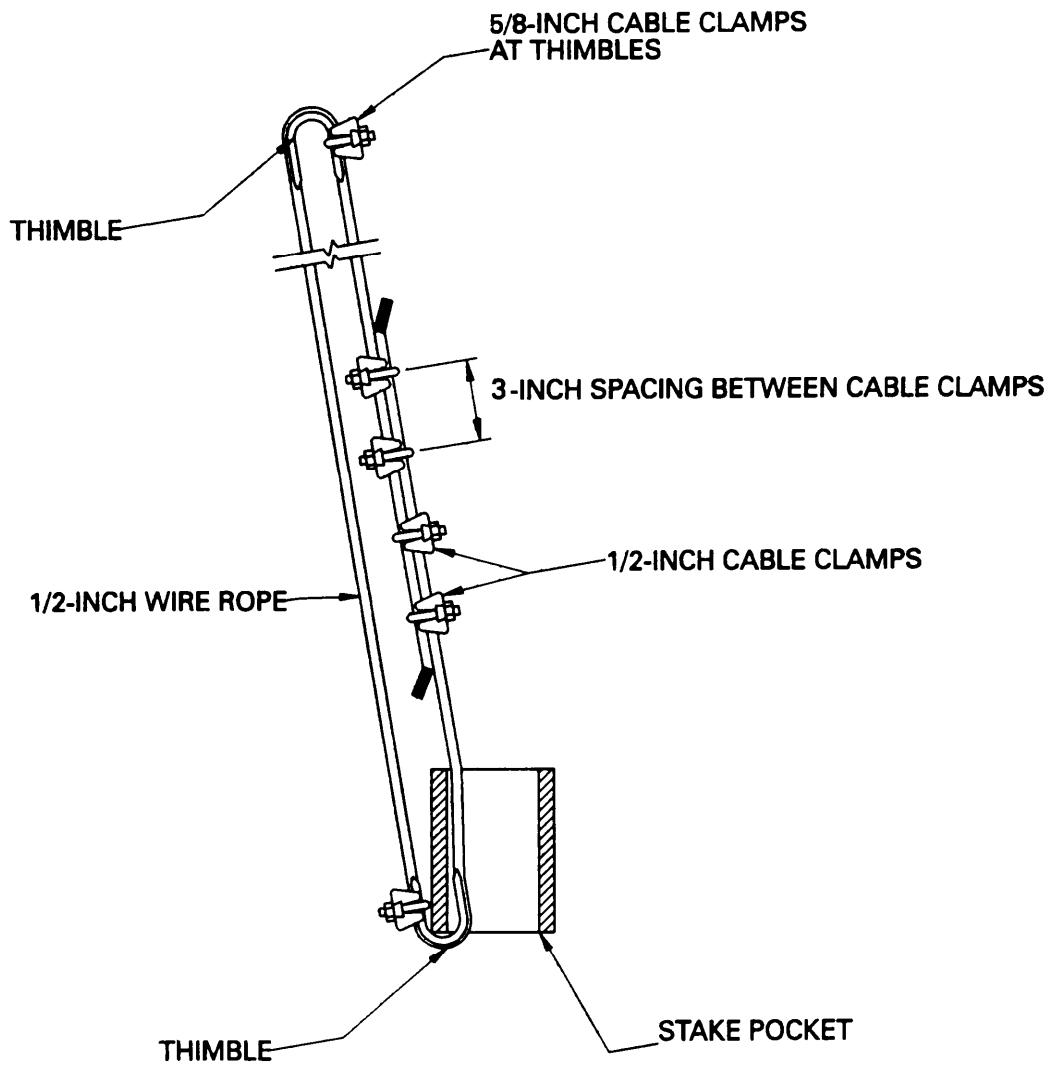


Figure 2-2. Detail of a cable assembly for highway transport. (Table 2-3, option 4)

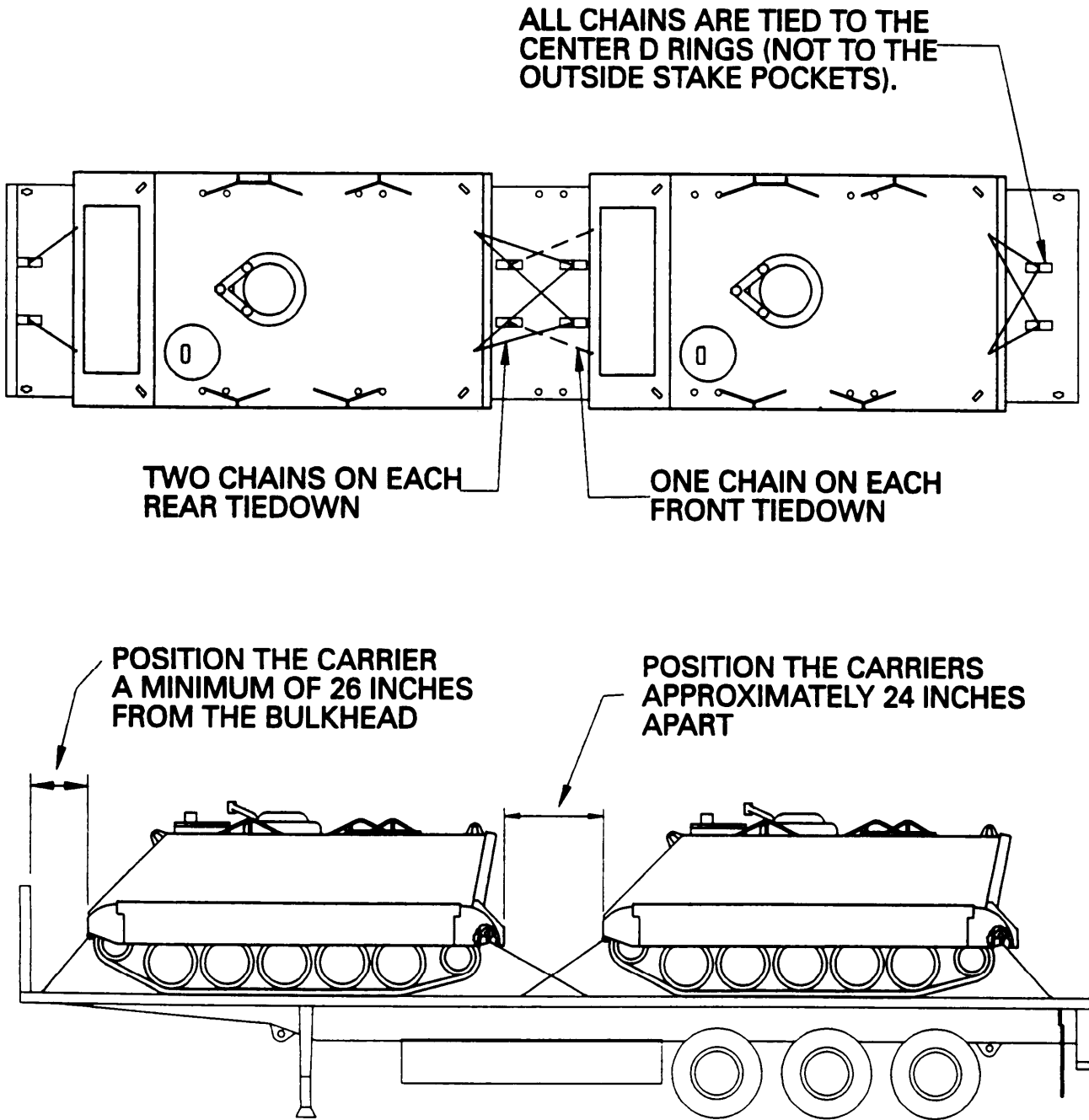
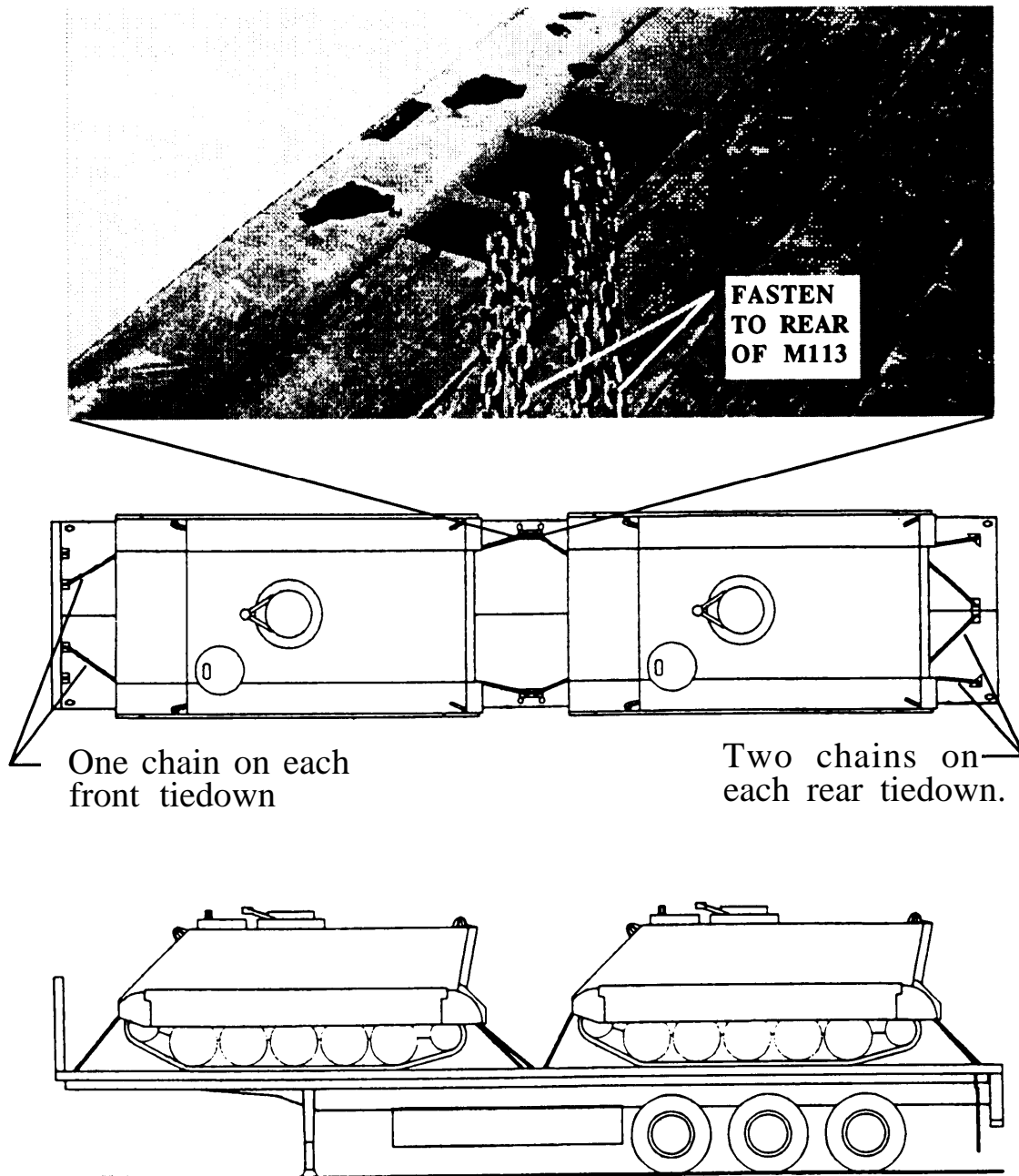


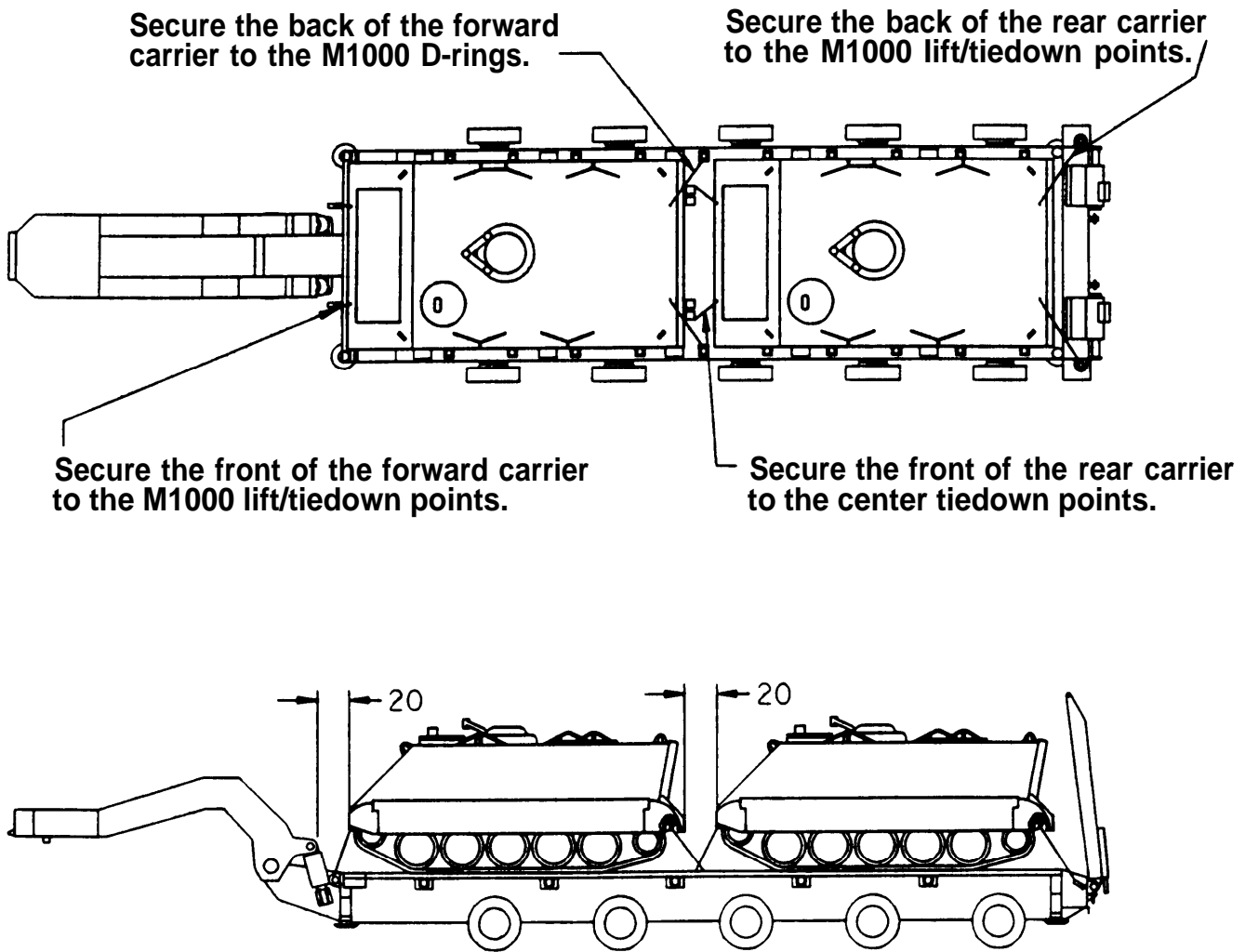
Figure 2-3a. Two M113 variants secured to an M872A2 semitrailer. Only applicable for the M113A1, M113A1, M106A1, M106A2, M125A1, M125A2, M577A1, M577A2, M901A1, M1059, and the M1068. All dimensions are in inches. (Table 2-3, option 2)



NOTE: All chains are attached to the cargo tiedown rings (not to the outside stake pockets).

FIGURE 2-3b. Two M113 variants secured to an M872A3. Only applicable for the M113A1, M113A2, M106A1, M106A2, M125A1, M125A2, M577A1, M577A2, M901A1, M1059, and the M1068. All dimensions are in inches. (TABLE 2-3)

Figure 2-3b. Two M113 variants secured to an M872A3. Only applicable for the M113A1, M113A2, M106A1, M106A2, M125A1, M125A2, M577A1, M577A2, M901A1, M1059, and the M1068. All dimensions are in inches. (Table 2-3)



NOTE: Use four M1000 BII 50,000 pound capacity, 1/2-inch chains to secure the rear of each M113 carrier.

Figure 2-4. Two carriers secured to the M1000 semitrailer. Only applicable for the M113A1, M113A2, M106A1, M106A2, M125A1, M125A2, M901A1 and the M1059. All dimensions are in inches. (Table 2-3, option 3)

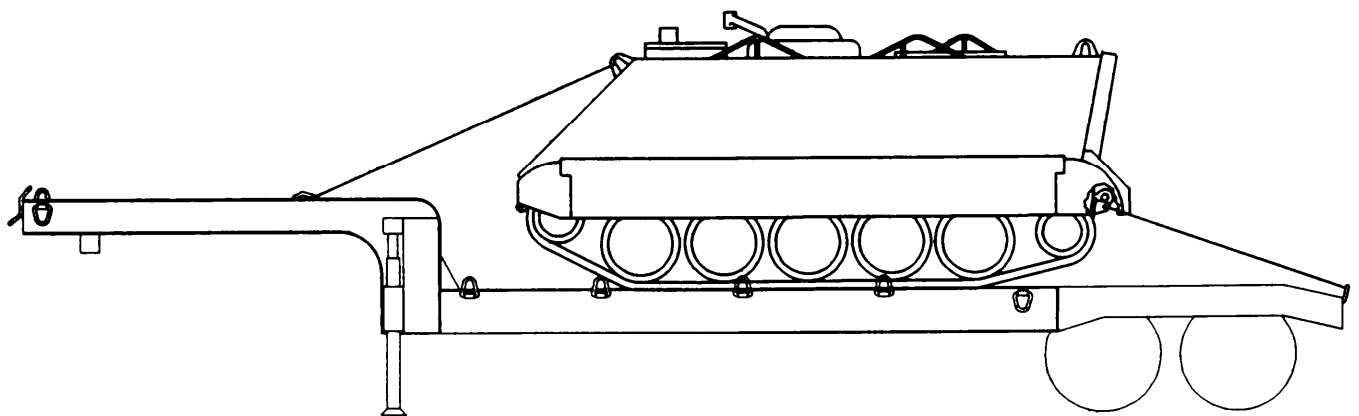
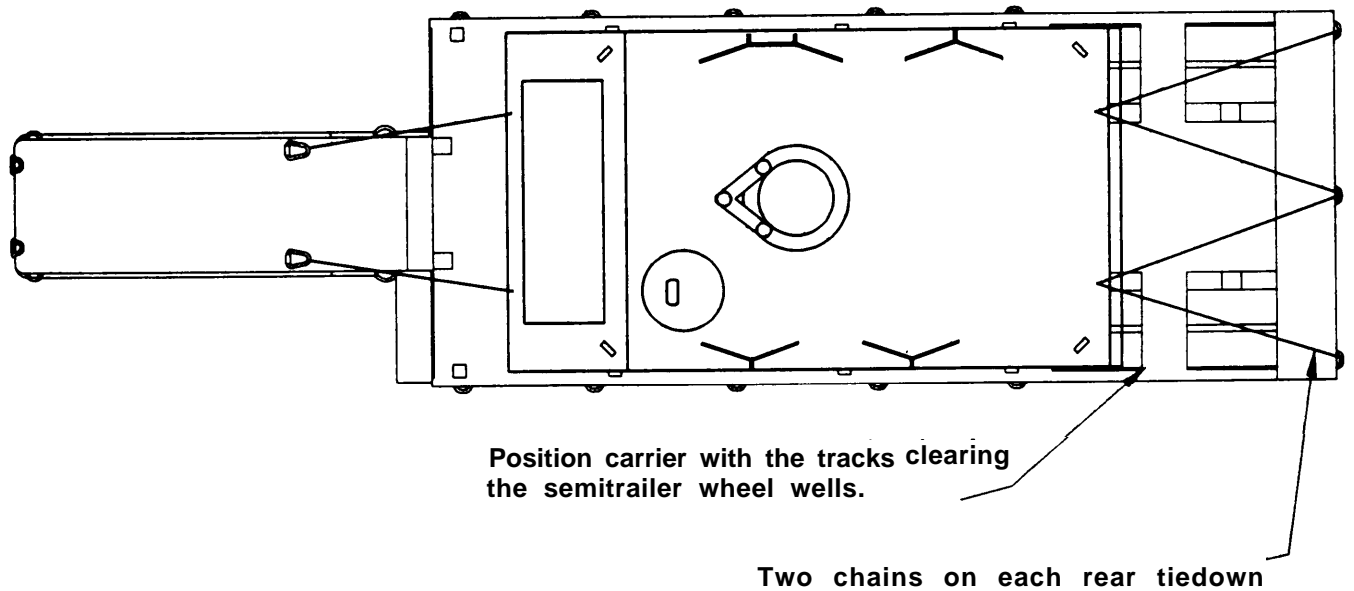


Figure 2-5. Tiedown of a carrier on the M172A1 semitrailer. (Table 2-3, option 1b)

Table 2-4. Tiedown Procedures for Securing a Typical Carrier on a Semitrailer

Item	Procedure
Chains/Load Binders (4 to 8 required)	Properly rated chains and load binders are preferred for tiedown. Install at indicated locations, as shown in figures 2-1, 2-3, 2-4, and 2-5.
	<i>Use the Following Procedure When Chains Are Not Available</i>
Wire Rope Loops (4 or 6 required)	Each tiedown is made from one piece of 1/2-in. wire rope. Cut length as required. (Need a maximum of 20 ft per tiedown.) For a complete loop between carrier tiedown provision and appropriate trailer stake pocket. The angle between the cables and trailer deck (as viewed from the side) should be as close to 45° as possible. The wire rope ends must overlap at least 24 in. Tension the wire rope by using two cable grippers and a 3-ton chain hoist or come-along.
Cable Clamps	Space clamps 3 in. apart. Use 1/2-in. cable clamps, and torque nuts alternately to a minimum of 65 R-lb.
Thimbles	Use thimbles to protect cable at sharp bends. Attach to cable with 5/8-in. cable clamp.

NOTE

One-half-inch cable clamp nuts must be torqued to at least 65 ft-lb, to develop full

cable loop breaking strength of 36,800 pounds. To get the correct torque, apply torque alternately to both nuts.

CHAPTER 3 RAIL TRANSPORT GUIDANCE

Section I. GENERAL

3-1. General

The M113 FOV, when at a maximum width of 105.8 inches, are transportable on most flatcars without restriction and sectionalization or major disassembly. The railcar may have a wood or steel deck and standard or cushioned-draft couplers. It must have suitable tiedown points, such as stake pockets or chain-tiedown anchor channels. MTMC-TEA Pamphlet 55-19, *Tiedown Handbook for Rail Movements*, provides additional information on tying down military equipment on railcars. Copies of this publication can be obtained by contacting:

Director
Military Traffic Management Command
Transportation Engineering Agency

ATTN: MTTE-TR
720 Thimble Shoals Boulevard, Suite 130
Newport News, VA 23606-2574

****CAUTION****

Use railcar and ground guides during loading.

****CAUTION****

Do not allow carrier to exceed 3 miles per hour (mph) (walking speed) during loading or unloading operations.

NOTE

Only qualified equipment drivers/operators should move a carrier.

Section II. RAIL LOADING

3-2. Railcar Selection

A variety of railcars can transport the M113 FOV. Table 3-1 gives an evaluation of railcars readily available in the U.S.

Table 3-1. Evaluation of Railcars

Railcars	Features	Comments
DODX, 140-ton	68 ft long, 10.5 ft wide, steel deck, cushioned-draft gear*, 1/2-in. chain-tiedown.	Not recommended. Designed and intended for heavier tracked vehicles.
DODX, 100-ton	Wood deck, 54 ft long, 10.5 ft wide, standard-draft gear**, no chain-tiedown.	Suitable, chains required, but not supplied with railcar.
HTTX	Wood deck, 60 ft long, 10.2 ft wide, 73 tons, cushioned-draft gear, 1/2-in. chain-tiedown.	Suitable.
OTTX	Wood deck, 60 ft long, 10.5 ft wide, 72 tons, cushioned-draft gear, 3/8-in. chain-tiedown.	Suitable.
ITTX	Steel deck, 89 ft long, 8.5 ft wide, 70 tons, cushioned-draft gear, 3/8-in. chain tiedown.	Suitable.
TTDX	Steel deck, 89 ft long, 8.5 ft wide, 74 tons, cushioned-draft gear, 1/2-in. chain tiedown.	Suitable.
MTTX	Wood deck, 60 ft long, 10.5 ft wide, 74 tons, cushioned-draft gear.	Suitable, 1/2-in. chains and blocking required.
General-purpose flatcar	Wood-deck, standard-draft gear* *.	Suitable, 1/2-in. chains and blocking required.

*Couplers are hydraulically "cushioned."

**Couplers have stiff mechanical snubbers only.

3-3. Preparation

3-3-1. Preparations for Rail Movement:

- a. Empty fuel tank to one-quarter full.
- b. Remove trash and mud from the carrier's tracks.
- c. Check for fluid leaks, and repair any defects.

- d. Secure the battery.
- e. Make sure the engine, brakes, and tiedowns are in good mechanical condition.
- f. Remove all BII from outside the carrier, and restrain them inside the carrier.
- g. Secure all equipment inside the carrier, to prevent damage.

3-3-2. Specific Carrier Instructions:

a. *M548A1 Cargo Carrier.* Remove cargo body canvas and bows, and restrain them inside the cargo compartment.

b. *M106/106A1 Mortar Carriers.* Remove base-plate and bridge assembly from the outside stowage positions, and restrain them inside the carrier.

c. *M113A3 and M730A2 Carriers.* Put the transmission in the SL position.

d. *M1068 Carrier.* Requires only two shackle assemblies. The rear tiedown provisions do not need shackles.

3-4. Loading Procedures

a. *Materials.* The shipper must supply materials for shipping and tiedown on the railcar when chain-tiedown cars are unavailable. Table 3-2 lists

the necessary materials. It gives four different options for tiedown materials.

****CAUTION****

The rear ramp of the M577-series carriers requires special preparation to prevent it from falling during transport. See appendix E for instructions.

NOTE

The M730A2 guided missile equipment carrier has three tiedowns on the rear. Therefore, it needs two more cables and/or chains than specified in table 3-2.

NOTE

For use in rail transport, load binders must be marked with the safe working load.

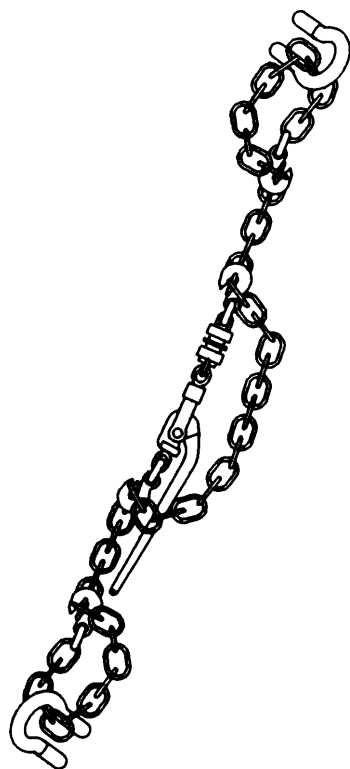
Table 3-2. Bill of Materials for Transport by Railcar

Item	Quantity	Description
Shackle assembly	4	Shackle, NSN 4030-00-279-4475. Bolt, NSN 5305-01-006-2072. washer (2), NSN 5310-00-809-8541. Nut (2), NSN 5310-00-891-3428. (See "Highway" section, table 2-3, for more details.)
<i>Chain assembly, option 1 (fig 3-1), for carriers weighing 25,000 to 30,000 pounds</i>		
Chain	8	NSN 4010-00-443-4845, 3/8 in. x 14 1/2 ft, grade 70, 6,600-pound safe working load.
Load binders	8	NSN 3990-01-213-1746, 3/8 in.-1/2 in., type 4 latching, 9,200-pound safe working load.
<i>Chain assembly, option 2 (fig 3-1), for carriers weighing 15,000 to 25,000 pounds</i>		
Chain	8	NSN 4010-00-803-8858, 3/8 in. x 10 ft, grade 80, 8,250-pound safe working load.
Load binders	4	NSN 3990-01-213-1746, 3/8 in.-1/2 in., type 4 latching, 9,200-pound safe working load.
<i>When Chain Not Available</i>		
<i>Option 3, for carriers weighing 15,000 to 25,000 pounds</i>		
Wire rope	64ft	NSN 4010-00-763-9361, 5/8-in. diameter, 6 x 19 IWRC improved plow steel, regular lay, table X, Federal Specification RR-W-410, nominal BS of 35,800 pounds.
Cable clamps 5/8 in.	24	NSN 4030-00-243-4441, 5/8 in., type I, single-saddled, wire rope clamp (Crosby heavy-duty or one that will meet or exceed Federal Specification FF-C450), class 1. Torque capacity equals 95 ft-lb.
Thimbles	8	NSN 4030-00431-6058, 5/8-in., type III, heavy split oval construction (open pattern), Federal Specification FF-T-276.
Come-along or cable tightener	1	Adequate strength cable tensioning device.
<i>Option 4, for carriers weighing 25,000 to 30,000 pounds</i>		
Wire rope	128 ft	NSN 4010-00-272-8848, 1/2-in. diameter, 6 x 19 IWRC, improved plow steel, regular lay, table X, Federal Specification RR-W-410, nominal BS of 23,000 pounds.
Cable clamps, 1/2 in.	32	NSN 4030-00-243-4440 (1/2 in.),
5/8 in.	16	NSN 4030-00-243-4441 (5/8 in.), type I, single-saddled, wire-rope clamp (Crosby heavy-duty or one that will meet or exceed Federal Specification FF-C-45). Torque nuts to 65 ft-lb for 1/2 in. or 95 ft-lb for 5/8 in.
Thimbles	16	NSN 4030-00-282-2512, 1/2-in., type III, heavy split oval construction (open pattern); Federal Specification FF-T-276.

Table 3-2. Continued

Item	Quantity	Description
Come-along or cable tightener	1	Adequate strength cable tensioning device.
Blocking Materials		
Lumber (nominal sizes)		Douglas fir, or comparable straight grain, free from material defects, Federal Specification MM-L-75.
2- x 4-in.	40 linear ft	
2- x 6-in.	12 linear ft	
2- x 8-in.	12 linear ft	
2- x 12-in.	12 linear ft	
Nails		Common, steel, flathead; bright or cement-coated, type II, style 10, Federal Specification FF-N-105.
12d	120	
30d	80	
40d	10	

**Option 1: 1 chain,
1 loadbinder**



**Option 2: 2 chains,
1 loadbinder**

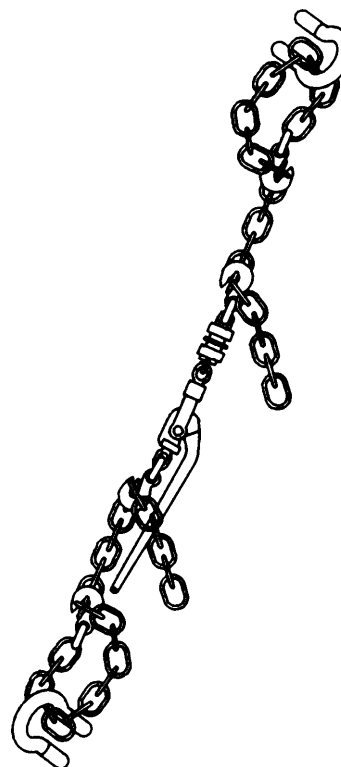


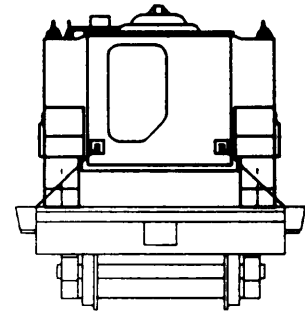
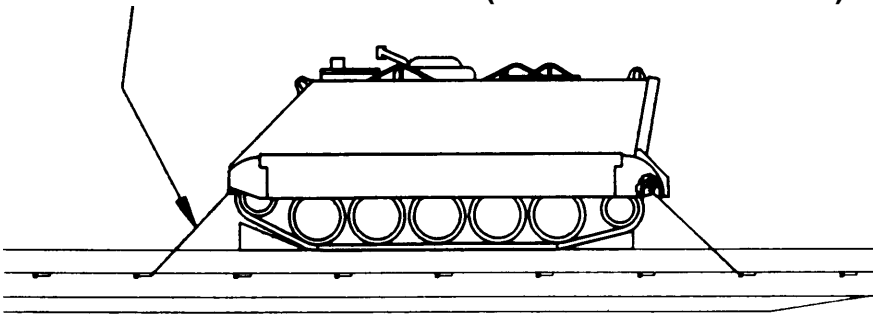
Figure 3-1. Detail of rail chain tiedown patterns. (Table 3-2, chain assembly, option 1 and 2)

b. *Loading.* Place the carriers in the tiedown position on the railcar, using a crane of adequate capacity (see para 4-5 for lifting guidance), or drive the carriers onto the railcar if a suitable ramp is available. Position the carrier so that sufficient railcar tiedown points are available. Carriers must face in the same direction, with a minimum space of 10 inches between them and 6 inches between the brake wheel and the front of

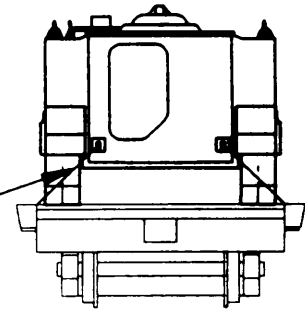
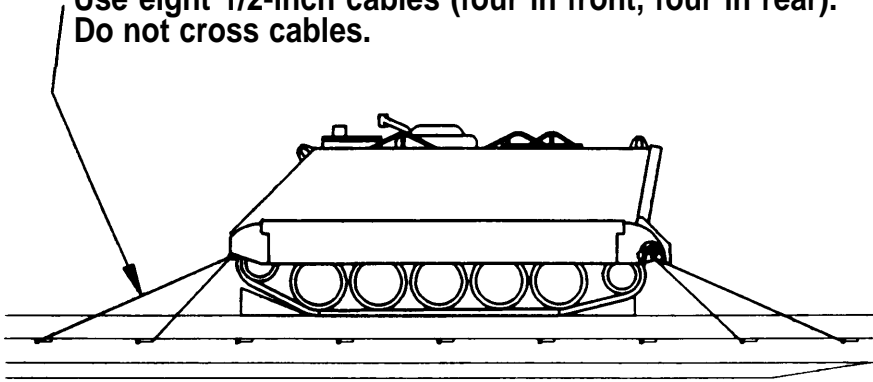
the carrier. Do not set handbrakes on the carriers. Place gearshift levers in neutral. Total load restraint (para 1-4) is three times the carrier GVW per AAR, Section 1, *General Rules Governing the Loading of Commodities On Open Top Cars.*

c. *Tiedowns and Blocking.* Figures 3-2, 3-3, and 3-4 and table 3-3 provide instructions for restraining the carriers against forces encountered in normal rail operations.

**Carriers weighing 15,000 to 25,000 pounds.
Use four 5/8-inch cables (two in front two in rear).**



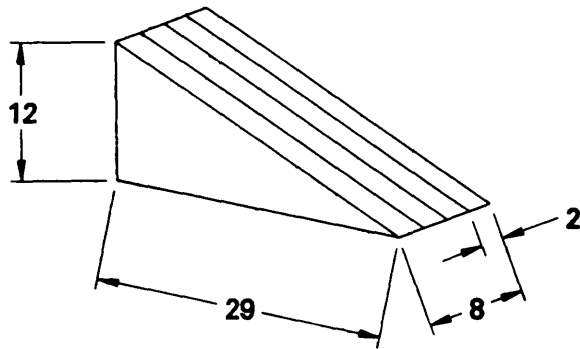
**Carriers weighing 25,000 to 30,000 pounds.
Use eight 1/2-inch cables (four in front, four in rear).
Do not cross cables.**



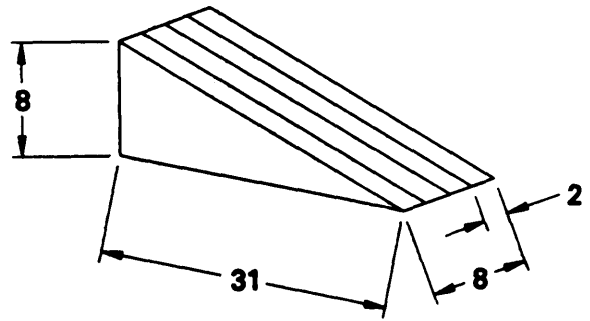
**Use two 1/2-inch cables
at each tiedown.**

Figure 3-2. Blocking and tiedown of carriers on railcar.

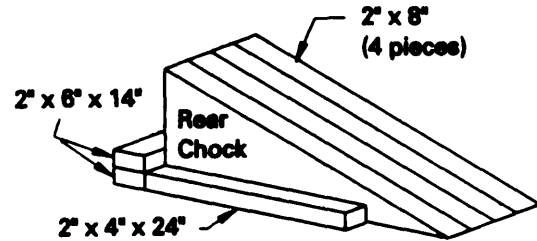
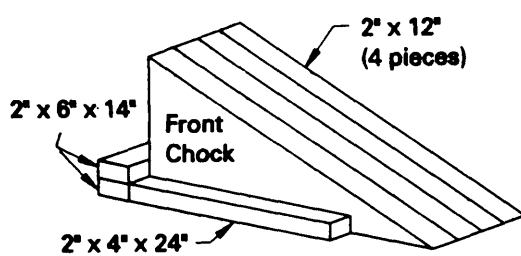
Blocking for Front of Carrier



Blocking for Rear of Carrier

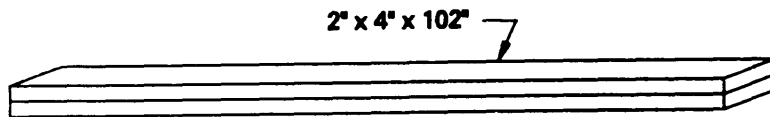


Nail the two inside pieces with three 12-D nails through each opposite side. Nail the outside pieces to inside places with four 12-D nails on each side. Place each block against the correct track and toe-tail the heel of the block with two 30-D nails. Toe nail each side of the block with two 40-D nails.



Center the 2" x 6" x 14" lumber crosswise against heel of front and rear chocks and nail to car floor with four 20-D nails. Nail top piece to bottom piece in a like manner. Locate one 2" x 4" x 24" lumber on each side of the front and rear chocks and nail to car floor with four 20-D nails.

Side Blocking Assembly



Place longitudinally against the outside of each track and nail to car floor with 20-D nails spaced approximately 8 inches. Nail top piece to lower piece in like manner.

Figure 3-3. Railcar blocking details. All dimensions are in inches.

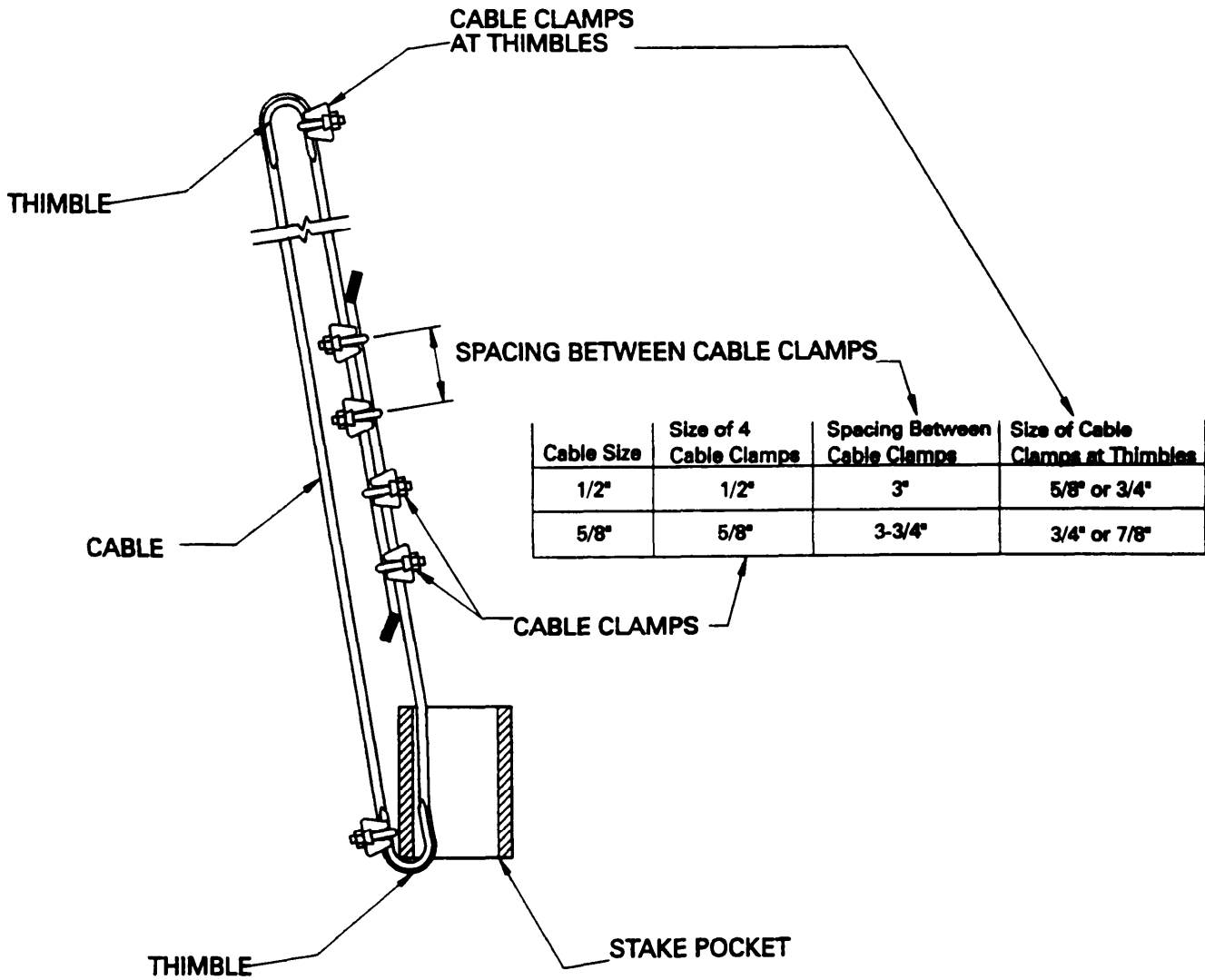


Figure 3-4. Detail of a cable assembly for rail transport. (Table 3-2 and table 3-3)

Table 3-3. Tiedown Procedures for Securing Carriers on Flatcars (fig 3-1)

Item	Procedure
Chain tiedowns	Install at indicated locations. The number of chains used will depend on chain size/strength. Use eight chains, NSN 4010-00-803-8858, two for each load binder, or eight chains, NSN 4010-00-443-4845, one for each load binder.
NOTE	
When chain-tiedown-equipped railcars are not available, wire rope and wood blocking must be used.	
Wire rope loops	Each tiedown is made from one piece of wire rope. Four 5/8-in. ropes are required for carriers weighing 15,000 to 25,000 pounds, one at each tiedown. Eight 1/2-in. ropes are required for carriers weighing 25,000 to 30,000 pounds, two at each tiedown, using a same-side tiedown pattern. Length as required (12 to 16 feet). Form a complete loop between carrier tiedown provision and railcar stake pocket. The angle between the cables and railcar deck (as viewed from the side) should be as close to 45° as possible. The wire rope ends must overlap at least 24 inches. Tension the wire rope by using two cable grippers and a (3-ton) come-along or cable tightener.
Cable clamps	For 1/2-in. wire rope, space 1/2-in. cable clamps 3 in. apart. Alternately torque nuts a minimum of 65 ft-lb. For 5/8-in. wire rope, space 5/8-in. cable clamps 3 3/4 in. apart. Alternately torque nuts to a minimum of 95 ft-lb.
Thimbles	Use thimbles to protect cable at sharp bends. Attach to cable with cable clamps (5/8-in. clamps on 1/2-in. thimbles and 5/8-in. clamps on 5/8-in. thimbles).
Blocking	Position and nail blocking to railcar as shown in figure 3-2.

NOTE

To develop full cable loop working strength, cable clamp nuts must be torqued to at least: 65 ft-lb on 1/2-in. clamp nuts. 95 ft-lb on 5/8-in. clamp nuts.

NOTE

To ensure proper torque, apply torque in stages to both nuts alternately.

NOTE

Use a staggered nailing pattern when lumber or laminated lumber is nailed to the floor of a railcar. Adjust the nail pattern so that a nail going through a piece of lumber on the top of the stack is not driven into or against a nail in a lower piece of lumber.

CHAPTER 4 MARINE TRANSPORT

Section I. GENERAL

4-1. General

The M113 FOV are marine transportable aboard most general purpose or roll-on/roll-off (RORO) ships. The ships must have suitable tiedown points, such as "D" rings or chain lashing anchors. MTMCTEA Pamphlet 56-1, *Marine Terminal Lifting Guidance*, provides additional information on lifting military equipment. Copies of this publication can be obtained by contacting:

Director
Military Traffic Management Command
Transportation Engineering Agency
ATTN: MTTE-TR
720 Thimble Shoals Boulevard, Suite 130
Newport News, VA 23606-2574

CAUTION

Wear ear protection (plugs) at all times when working in RORO ship holds.

NOTE

Check the entire vehicle to ensure that all loose items are properly secured.

NOTE

Do not allow carrier to exceed 3 mph

(walking speed) during loading or unloading operations.

NOTE

Have fire extinguishers readily available during ship loading and unloading operations.

4-2. Safety

Besides the general safety notes in paragraph 1-6 and the "Cautions," "Warnings," and "Notes" in this section, the following safety considerations and precautions apply for marine transport:

a. The activity offering the vehicles for transport will notify the carrier if ammunition or explosives are transported with the item. Compliance with AR 55-228, paragraph 2-7, is mandatory.

b. When the external MOGAS cans on the M1059 have fuel or fumes in them, drain and purge the tank to one-quarter full.

c. Ammunition and vehicles will be handled and stowed according to the Code of Federal Regulations, Title 49, Transportation, subparts 176.76 and 176.905. The same regulations are also contained in Water Carrier Tariff No. 32 or the current issue of this tariff.

d. Inspect vessel equipment and gear before using it.

Section II. SHIPLOADING

4-3. Preparation

Fill or empty fuel tank to one-quarter full for RORO operations.

CAUTION

The rear ramp of the M577-series carriers requires special preparation to prevent it from falling during transport. See appendix E for instructions.

NOTE

Because of limited cargo-hold ventilation, most general cargo ships will require that

the fuel tank be no more than one-quarter full.

4-4. Loading Procedures

a. Materials. When a chain-lashing-equipped ship is unavailable, the shipper must supply materials for tiedown. Total load restraint (para 1-4) is equal to 1.2 times the weight of the vehicle. Table 4-1 is a listing of materials required for marine transport.

NOTE

The M1068 carrier only requires two shackle assemblies. The rear tiedown provisions do not need shackles.

Table 4-1. Bill of Materials for Transport by Ship

Item	Quantity	Description
Shackle Assembly	4	Shackle, NSN 4030-00-279-4475. Bolt, NSN 5305-01-006-2072. Washer (2), NSN 5310-00-809-8541. Nut (2), NSN 5310-00-891-3428, (See "Highway" section, table 2-3, for more details.)
<i>Chain lashing assembly, option 1</i>		
Chain	8	NSN 4010-00-803-8858, 3/8 in. x 10 ft, grade 80, 8,250-pound safe working load.
Load Binders	8	NSN 3990-01-213-1746, type 4 latching, 9,200-pound safe working load.
<i>When chain lashing not available, option 2</i>		
wire Rope	About 60 ft	NSN 4010-00-272-8848, 1/2-in., improved plow steel, 6 x 19 IWRC or wire-strand core, nominal BS of 23,000 pounds; Federal Specification RR-W-410.
Cable clamps (clips)		Type I, single-saddle wire-rope, NSN 4030-00-243-4440 (1/2-in.), NSN 4030-00-243-4441, (5/8-in.) (Crosby heavy-duty or meet or exceed Federal Specification FF-C-450 requirements).
1/2 in.	16	
5/8 in.	8	
Thimbles		NSN 4030-00-282-2512, type III, heavy split oval construction (open pattern), Federal Specification FF-T-276.
1/2 in.	8	
Chain hoist or come-along	1	Adequate strength cable tensioning device.

b. Loading. Place the carrier in the position indicated by the stow plan so sufficient tiedown points are available. Set the parking brakes and place the transmission in neutral. Disconnect the battery once the carrier is positioned aboard ship.

For the M113A and M730A2, put the transmission in SL position.

c. Tiedowns. Table 4-2 provides instructions for restraining the carriers against forces encountered in normal marine operations.

Table 4-2. Tiedown Procedures for Securing a Carrier in the Hold of a General Cargo Ship

Item	Procedure
Chain tiedowns	Install at indicated locations. The number of chains used will depend on chain sizdstrength. Use eight chains, NSN 4010-00-803-8858, two for each load binder. Cross two cables on the front and rear of the carrier.
wire rope loops (4 required)	Each tiedown is made from one piece of 1/2-in. wire rope. Length as required. Form a complete lmp between carrier and ship tiedown provisions, The angle between the cables and deck (as viewed horn the side) should be as close to 45° as possible. Cross cables on the fkont and rear of the carrier. The wire rope ends must overlap at least 24 inches. Tension the wire rope by using two cable grippers and a 3-ton chain hoist or come-along.
Cable clamps	Space clamps 3 3/4 in. apart as shown. Use 1/2-in. cable clamps and alternately torque nuts to a minimum of 65 ft-lb.
Thimbles	Use thimbles to protect cable at sharp bends. Attach to cable with %-in. cable clamp and torque cable clamps to a minimum of 95 ft-lb.

NOTE

The methods described in this chapter for lifting and securing vehicles are recommended procedures. Other methods of handling and stowage may be used, provided they ensure safe delivery without damage.

NOTE

To develop full cable loop working strength, 1/2-in. cable clamp nuts must be torqued to at least 65 ft-lb. To ensure proper torque, apply torque in stages to both nuts alternately.

4-5. Lifting Operations

Shiploading will often require lifting the carriers into position aboard ship. Shipside and shoreside cranes are usually rated in long tons (LTON), 2,240 pounds, and/or metric tons (t), 1000 kilograms. To lift a carrier, a crane and sling-set capacity of at least 13 t (12.8 LTON or 28,660 pounds) is needed.

*****WARNING*****

Crane lifting operations are inherently dangerous. Do not stand under overhead loads.

Most M113 lifting provisions are near the top surfaces of the carriers, one provision on each

corner. Figures 4-1 and 4-2 show typical lifting configurations of different M113's.

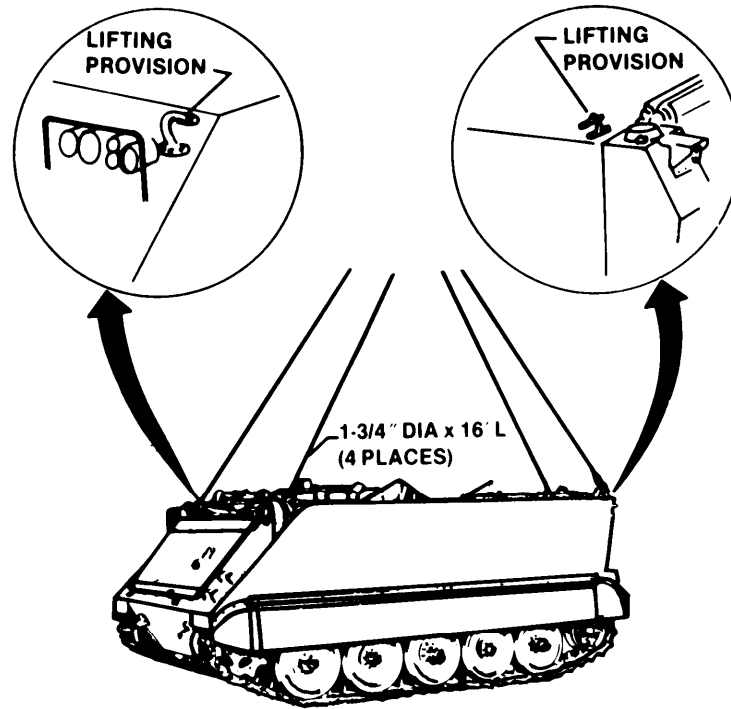


Figure 4-1. Crane lifting of M113A2 carrier.

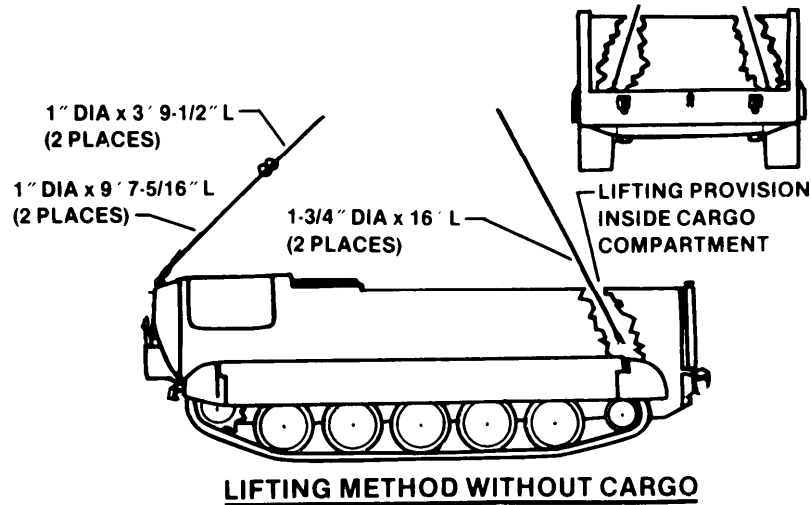
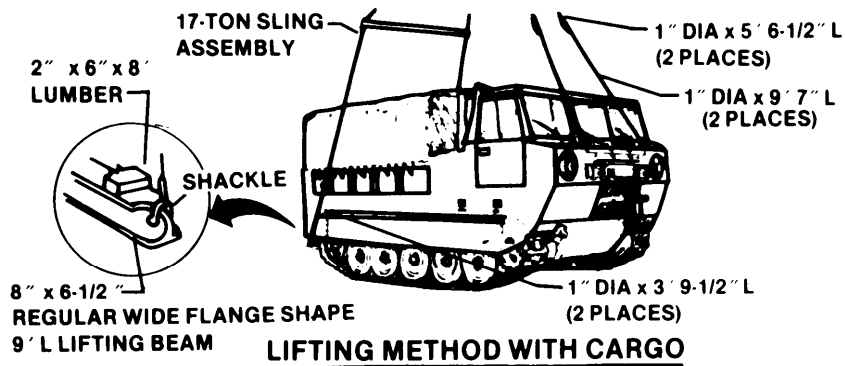


Figure 4-2. Crane lifting of M548, 548A1, M1015, M1015A1 carriers.

CHAPTER 5 AIR TRANSPORT

Section I. GENERAL

5-1. General

The carriers are air transportable aboard C-130, C-141, and C-5 aircraft. The shipping unit must ensure that the carriers are properly prepared for air transport before reaching the marshaling area. The shipping unit will assist the aircraft loadmaster/crew in loading and tying down the carriers. The loadmaster-prepared load plan for the actual aircraft mission will have determined loading limitations, tiedown patterns, and troop seating availability.

NOTE

Only the M106A1, M113, M113A1, and M667 are capable of LAPES operations.

NOTE

Only the M113, M113A1, and M667 are capable of LVAD.

5-2. Safety

Besides the general safety notes in paragraph 1-6 and the "Caution," "Warnings," and "Notes" in

this section, the following safety considerations and precautions apply for air transport:

- a. Personnel must wear ear protection (plugs) at all times while working on the flightline.
- b. Fire extinguishers must be readily available during aircraft loading and unloading operations.
- c. The vehicle maximum speed within 25 feet of any aircraft is 5 mph. On loading ramps or inside the aircraft, the vehicle should not exceed 3 mph.
- d. Personnel must not refuel or otherwise service the carriers within 50 feet of an aircraft.
- e. The fuel tanks of the flamethrower weapon system mounted in the M132 and M132A1 must be emptied and purged as indicated in paragraph 4-2b.

5-3. Dangerous Materials

Shippers must provide written notification before shipping dangerous or hazardous materials aboard military or DOD contract aircraft. Details are covered in TM 38-250/AFR 71-4, *Preparation of Hazardous Materials for Military Air Shipment*, and CFR 49.

Section II. TRANSPORT BY CARGO AIRCRAFT

5-4. USAF Cargo Aircraft

The carriers are certified for airlift aboard C-130, C-141, and C-5 aircraft. Total load restraint is three times the carrier weight in the forward direction (relative to the aircraft) and 1 1/2 times its weight in the aft and lateral directions. Vertical load restraint is equal to two times the carrier weight.

The carriers are air transportable aboard C-17 aircraft. When the C-17 is operational, the USAF will certify the carriers for air transport aboard the aircraft.

For preliminary planning purposes only, table 5-1 gives maximum payload dimensions and weight characteristics. In addition, walking and tiedown space must also be allowed for.

Table 5-1. Aircraft Cargo Dimensional and Maximum Weight Limits

Aircraft	Height (in.)	Width (in.)	Length (in.)	Weight (lb)
C-130	102	107	480	44,800
C-141	103	111	1,090	68,600
C-5	156	216	1,454	291,000
C-17	142	204	812	172,200

5-5. U.S. Army Aircraft

The carriers exceed size and weight limitations for transport by U.S. Army fixed-wing aircraft. The carrier also exceed size limitations for internal transport and weight limitations for external lift by U.S. Army rotary-wing aircraft.

acteristics of all aircraft in the CRAF.

5-6. Civil Reserve Air Fleet (CRAF)

The carrier exceeds the height and/or width char-

5-7. Preparation

5-7-1. General Preparations:

- a. Empty fuel tank to three-quarters full.
- b. Secure all loose items inside the carrier.
- c. Remove all trash and mud from the carrier's tracks.
- d. Check for fluid leaks and repair defects.

e. Secure the battery.

f. Inspect engine, brakes, and tiedowns, to ensure they are in good mechanical condition.

g. Mark shipping weight and center of balance location on both sides of the carrier.

5-7-2. Specific Carrier Preparations for Airlift:

a. M106, M106A1, and M106A2. Secure the base plate for the 107-mm mortar inside the carrier.

b. M548 and M548A1. Secure the bows and canvas inside the carrier.

c. M577, M577A1, and M577A2. Remove the antenna extensions and guards to reduce the carrier to its lowest configuration. Rear ramp requires special preparation to prevent it from falling during transport. See appendix E for instructions.

d. M901, M901A1, and M981. Reduce the height of the carrier for transport on the C-130 and C-141 aircraft by removing the armored sight cover from the top of the TOW launcher or targeting head. The wide field of view (WFOV) sight must also be removed (by a qualified fire-control technician). Appendix D contains detailed procedures for converting from the high stow to the low stow position.

e. M1068. Remove the antenna extensions and guards, auxiliary power unit, and tent light set mounts to reduce the carrier to its lowest configuration.

5-7-3. Loading Instructions

a. Metal parts of the carrier tracks must not make contact with the aircraft loading ramp or cargo compartment floor. Prolonged operation of vehicles causes the rubber track pads to chip, crack, and wear, thus eliminating the rubber pad protection and allowing the steel track shoes to impact the surface. Therefore, the use of shoring is always required when loading and offloading the carriers. Use 2- by 12-inch lumber to provide two rows of shoring 24 inches wide and spaced to match the carrier tracks. The loaded height of the carriers may be reduced slightly by use of 3/4-inch or 1/2-inch plywood shoring instead of 2- by 12-inch lumber. Lay the shoring from the ground end of the aircraft ramp extension into the cargo compartment, so that when the carrier is in the tiedown position, the tracks are on the shoring. Shoring is provided by the transported unit or by the shipping activity.

b. Place the transmission in neutral and set the parking brake, after the carrier has been positioned aboard the aircraft.

c. Restraint factors (g loads) for minimum acceptable conditions (specified for crew and passenger safety in the event of a controlled emergency landing) are specified in the applicable aircraft Technical Orders (TO 1C-5A-9, TO 1C-130A-9, and TO 1C-141A-9).

d. For the M113A3 and M730A2, put the transmission in SL position.

APPENDIX A CONVERSION TABLES

A-1. Common Metric Abbreviations

m = meter
dm = decimeter
cm = centimeter
mm = millimeter

kg = kilogram
km = kilometer
t = metric ton

A-2. Linear Measure

1 mi = 1609.35 m
1 yd = 0.9144 m
1 ft = 0.3048 m
1 in. = 0.0254 m
1 m = 10 dm = 100 cm = 1000 mm

1 km = 0.6214 mi
1 m = 1.0936 yd
1 m = 3.2808 ft
1 m = 39.3700 in.

A-3. Surface Measure

1 sq yd = 0.8361 sq m
1 sq ft = 0.0929 sq m
1 sq in. = 0.00065 sq m

1 sq m = 1.196 sq yd
1 sq m = 10.764 sq ft
1 sq m = 1,550 sq in.

A-4. Cubic Measure

1 cu yd = 0.76455 cu m
1 cu ft = 0.02831 cu m
1 cu in. = 0.000016 cu m

1 cu m = 1.31 cu yd
1 cu m = 35.30 cu ft
1 cu m = 61,023 cu in.

A-5. Weight

1 Ton = 1 STON = 907.185 kg = 2,000 lb
1 LTON = 2,240 lb = 1.0605t = 1016.05 kg
1 kg = 2.2046 lb
1 lb = 0.45359 kg

1 t = 2,204.62 lb
1 t = 1000 kg = 1 Tonne

A-6. The following simplified conversion factors are accurate to within 2 percent for quick computations:

- a. Inches to centimeters—Multiply in. by 10 and divide by 4.
- b. Yards to meters—Multiply yd by 9 and divide by 10.
- c. Miles to kilometers—Multiply mi by 8 and divide by 5.
- d. Pounds to kilograms—Multiply lb by 5 and divide by 11.

A-7. The following conversions are provided for guidance when procuring lumber, wire rope, or wire in areas that use the metric system. Lumber sizes are rounded off to the nearest 1/2 cm.

a. Lumber.

2-in x 4-in x desired length = 5-cm x 10-cm x desired length
1-in x 6-in x desired length = 2.5-cm x 15-cm x desired length
6-in x 8-in x desired length = 15-cm x 20-cm x desired length
1-in x 12-in x desired length = 2.5-cm x 30-cm x desired length

(length normally expressed in ft or m)

b. Wire Rope. Round off to next higher whole mm of available wire rope sizes.

3/8-in. dia = 9.5-mm dia
1/2-in. dia = 12.7-mm dia
5/8-in. dia = 15.8-mm dia
3/4-in. dia = 19.0-mm dia
7/8-in. dia = 22.2-mm dia
1-in. dia = 25.4-mm dia
1 1/4-in. dia = 31.7-mm dia
1 1/2-in. dia = 38.1-mm dia

c. *Wire*. No. 8 gauge annealed (11/64-in. dia) = 4.37-mm dia. Round off to the next higher whole mm of available wire rope sizes.

APPENDIX B REFERENCES

B-1. Army Regulations (AR)

55-29	Military Convoy Operations in CONUS
55-80	Highways for National Defense
55-162	Permits for Oversize, Overweight, or Other Special Military Movements on Public Highways in the United States
55-355	Defense Traffic Management Regulation
70-44	DOD Engineering for Transportability
70-47	Engineering for Transportability
746-1	Packaging of Army Material for Shipment and Storage

B-2. Field Manuals (FM)

5-34	Engineer Field Data
5-36	Route Reconnaissance and Classification
55-15	Transportation Reference Data
55-17	Terminal Operations Coordinator's Handbook

B-3. Supply Bulletins (SB)

700-20	Army Adopted/Other Items Selected for Authorization/List of Reportable Items
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B-4. Technical Bulletins (TB)

55-46-1	Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outside/Overweight Equipment
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B-5. Technical Manuals (TM)

38-236 (AFP 71-8)	Preparation of Freight for Air Shipment
38-250 (AFR 71-4)	Packaging and Materials Handling Preparation of Hazardous Materials for Military Air Shipment
55-500	Marine Equipment Characteristics and Data
55-2200-001-12	Transportability Guidance: Application of Blocking, Bracing, and Tiedown Materials for Rail Transport

B-6. Air Force Manuals

TO IC-5A-9	Loading Instructions, USAF Series C-5 Aircraft
TO IC-130E-9	Loading Instructions, USAF Series C-130 Aircraft
TO IC-141B-9	Loading Instructions, USAF Series C-141 Aircraft

B-7. Other publications

a. Code of Federal Regulation, Title 49—Transportation Parts, 107–179 and Title 46—Shipping, Part 146

Available from: Superintendent of Documents
US Government Printing Offices
Washington, DC 20402

b. Association of American Railroads, *Rules of Governing the Loading of Commodities on Open-Top Cars and Trailers*

Section No. 1—General Rules

Section No. 6—Rules Governing the Loading of Department of Defense Material on Open-Top Cars

c. TM 55–3930–660-14

Available from: Association of American Railroads
50F Street, NW
Washington, DC 20001-1564

d. 4th Transportation Command Pamphlet 55-2, *Tiedown Guide of Rail Movement*

Available from: Commander
1st Transportation Movement Control Agency
ATTN: AEUTR-MCA-TA
APO New York 09451-4000

APPENDIX C
METHODS OF IDENTIFICATION FOR INCH-SIZE CHAIN

Manufacturer	Grade 30	Grade 43	Grade 70	Grade 80	Steel Alloy	Special Alloy
Acco	G3	G4	G7	A8A		
Boltmaster-Taylor	BTPC or PC	THT	BT7	TAC		TAC
Campbell	C3JCP or P	C4fCH	C7	CA/C3 (+000)		CA/C8
Columbus McKinnon	CM/PC or G30	CM/HT or G43	CM/SG7 or G70	CM/HA or HA800		
Crosby	CG/PC/3	CG/C/4	CG/C/7	CG/A/8		
Laclede	13	N4 or L4	N7 or L7	G8 or L8		
Maclean Fogg						-A-, P, PA or P3
Peerless		PC	PH	P7	P8	
Portec						-A-, H, HA800 or BE
Teledyne McKay		4MK/MKH	MK7	MK8		
Turner & Seymour		T3	T4	T7		

Note: (Taken from AAR 1989 update.)

APPENDIX D

REQUIREMENTS FOR CONVERTING THE M981 , M901 , M901A1 (ITV) LAUNCHER FROM STANDARD TO TRANSPORT CONFIGURATION AND BACK TO STANDARD

NOTE

This appendix is extracted from the M901 (ITV) system specification. Everywhere the M901 is cited, the information applies to the M901A1 and M981. If an M901 vehicle is already in the transport (or "low stow") configuration, follow the procedure in paragraph 6 to reduce the vehicle height for transport in C-130 or C-141 aircraft. However, if the M901 is in the standard operational (or "high stow") configuration, perform all the steps in this appendix through paragraph 7. See TM 9-2350-259 or TM 9-2350-266 series for reference.

To reduce the M901 vehicle overall height for transport, proceed as follows: Place launcher in erect position. Bleed system down in accordance with paragraph 1. Remove stowage brackets in accordance with paragraph 2, and proceed through paragraph 8.

D-1. Hydraulic Pressure Bleed-Down Procedure:

- a. Apply power to turret in the normal manner, to place launcher in erect position at 1800 azimuth (facing rear).
- b. Set EMER PWR switch to UP POSITION.
- c. Move hand controller up and down in elevation until launcher ceases motion.
- d. Set TURRET POWER switch to OFF, and then set EMER PWR switch to OFF.
- e. Ensure that ERECTION LOCKS are engaged. If not, repeat steps a through d to ensure erection locks remain engaged.
- f. Support front of launcher, using two C-clamps (NSN 5120-00-203-6431) and two 2x4 lumber bracing, as shown in figure D-1.

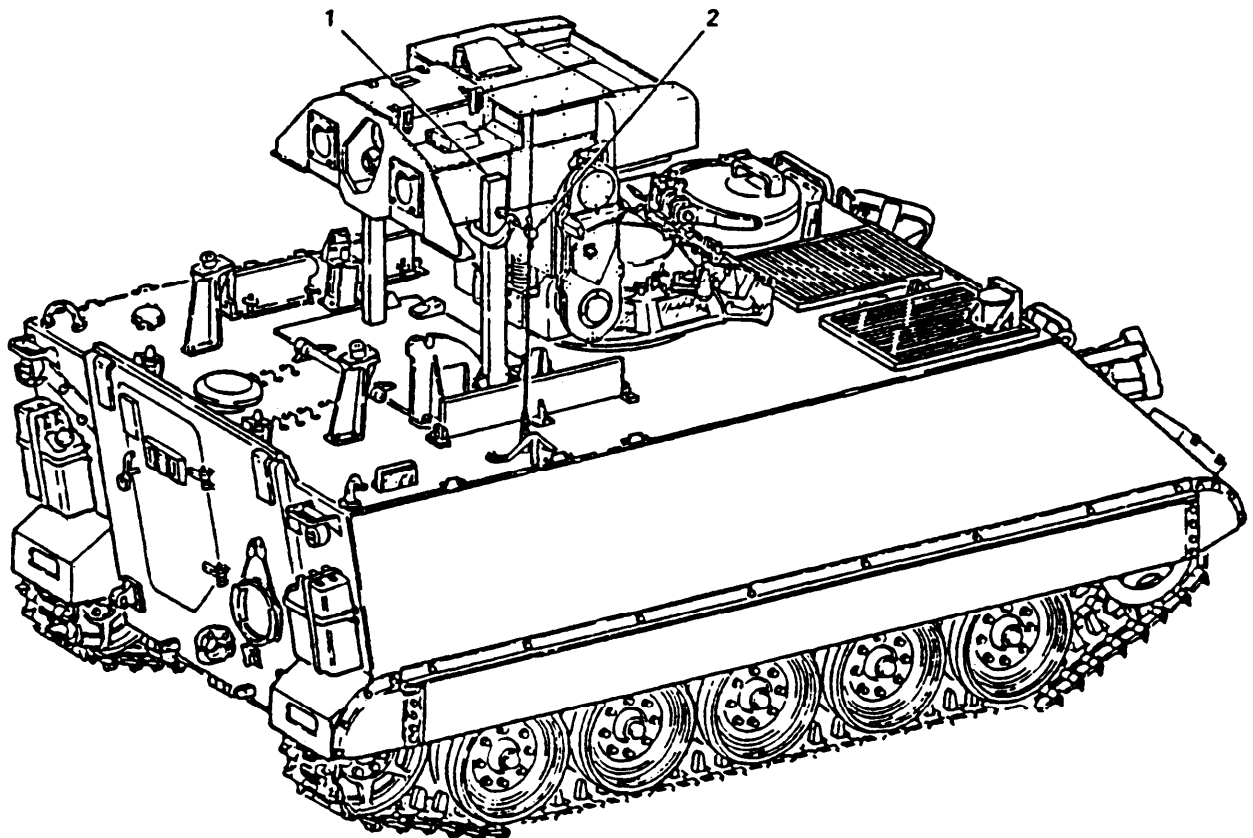


Figure D-1. M901 hydraulic pressure bleed-down

D-2. Removal of Stowage Brackets:

To get launcher down to lowest level possible, remove stowage brackets in accordance with figure D-2 and paragraph 5.

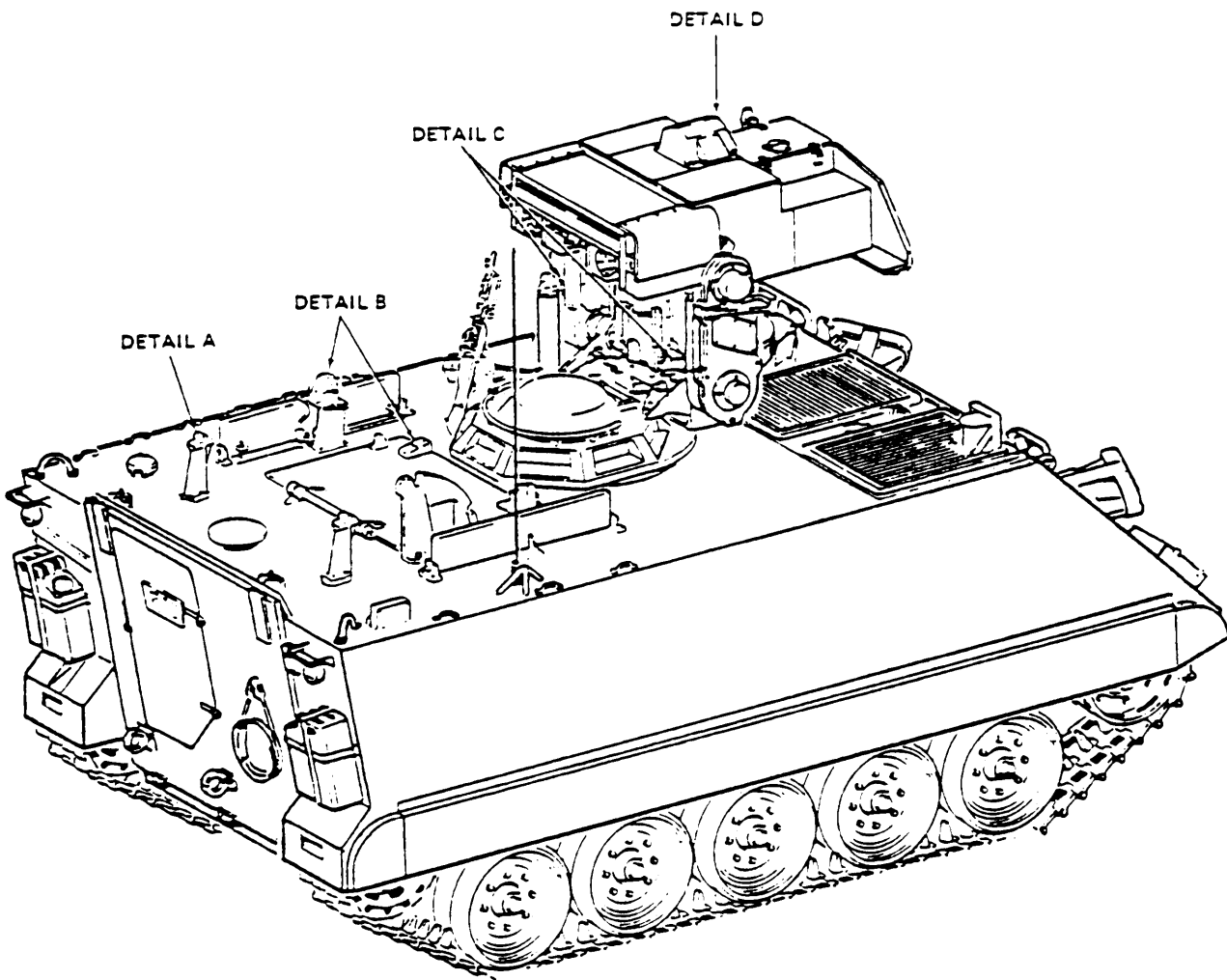


Figure D-2. M901 vehicle conversion (transport) (Sheet 1 of 3)

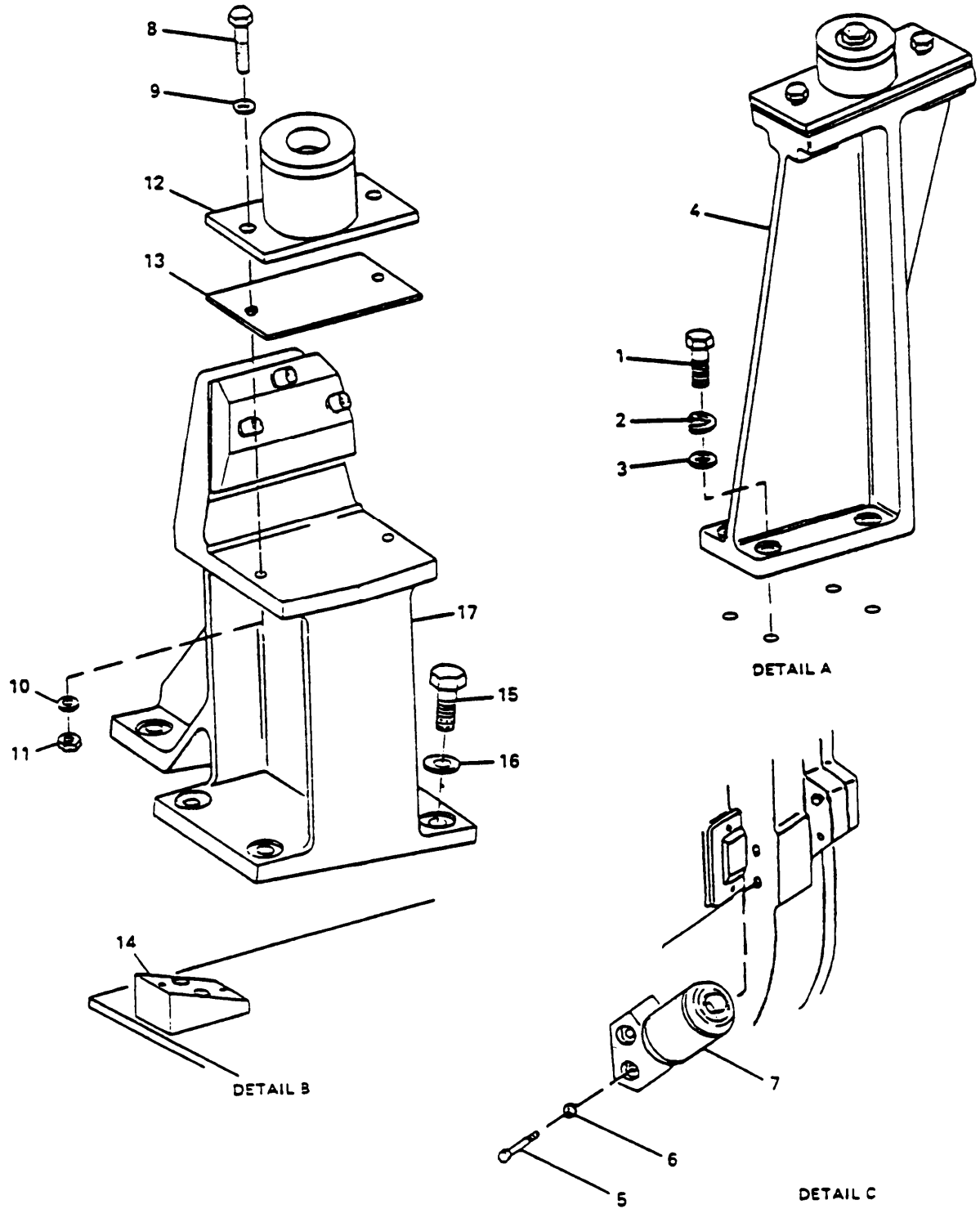
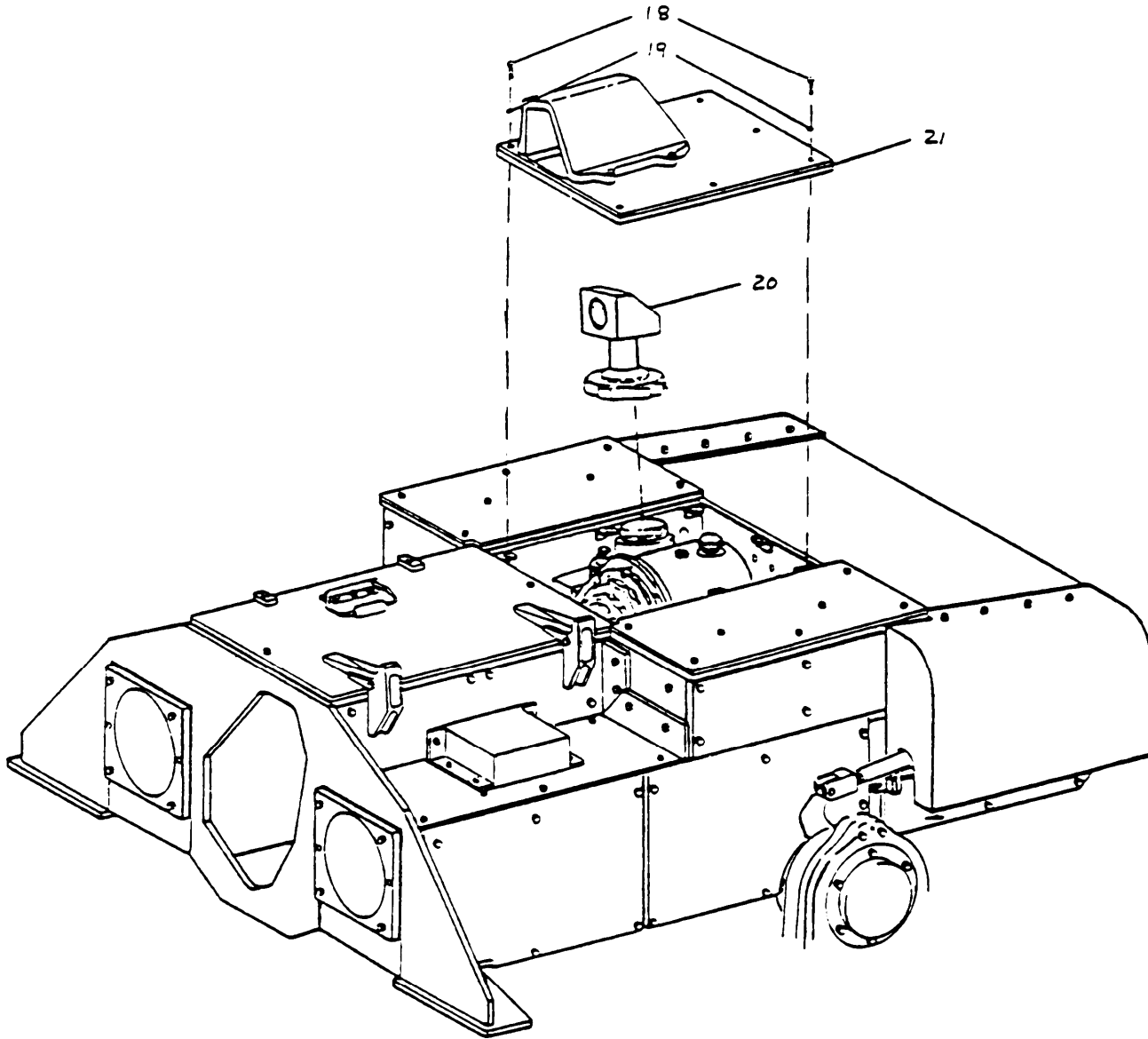


Figure D-2. M901 vehicle conversion (transport) (Sheet 2 of 3)



DETAIL D

Figure D-2. M901 vehicle conversion (transport) (Sheet 3 of 3)

D-3. Legend for Figure D-2:

- 1. Bolt (4)
- 2. Washer (4)
- 3. Lockwasher (4)
- 4. Launcher Stow Support
- 5. Bolt (2)
- 6. Washer (2)
- 7. Stow Position Shop
- 8. Bolt (2)
- 9. Washer (2)
- 10. Washer (2)
- 11. Nuts (2)
- 12. Bumper

13. Shim
14. Transport Pad
15. Bolt (6)
16. Washer (6)
17. Erection Arm Bumper Bracket
18. Bolt (7)
19. Washer (7)
20. WFOV Telescope
21. ITA Cover

D-4. Figures

- a.* Figure D2, M901 Vehicle Conversion (Transport) (Sheet 1 of 3)
- b.* Figure D-2, M901 Vehicle Conversion (Transport) (Sheet 2 of 3)
- c.* Figure D-2, M901 Vehicle Conversion (Transport) (Sheet 3 of 3)

D-5. Bracket Removal Procedure

- a.* Remove 4 bolts (1), 4 washers (3), 4 lockwashers (2) and launcher stow support (4). Repeat for other side.
- b.* From rear of erection arm, remove bolts (5), 2 washers (6), and stow position stop (7). Repeat for other side.
- c.* Remove 2 bolts (8), 2 washers (9), 2 nuts (11), 2 washers (1), bumper (12) and shim (13). Repeat for other side.
- d.* Apply corrosion preventive compound (MIL-C-16173, Grade I), to 2 bolts (8).
- e.* Install to transport pad (14) on loading hatch: shim (13), bumper (12), 2 washers (9), and 2 bolts (8). Repeat for other side.
- f.* Lower side armor and remove 6 bolts (15), 6 washers (16), and erection arm bumper bracket (17). Repeat for other side.
- g.* Retain all removed hardware, packed in a suitable fiberboard box, identify, and securely stow within vehicle.

D-6. Removal of Image Transfer Assembly (ITA) Cover and Wide Field-of-View (WFOV) Telescope (See fig. D-2, sheet 3)

- a.* Remove 7 bolts (18), 7 washers (19), and ITA cover (21).
- b.* Loosen split ring retainer from top of large ring, unscrew large ring on base of WFOV telescope (20), and remove telescope. Cover telescope opening with sheet plastic and tape. Wrap telescope with lens paper and tape. Wrap lens with Kimpak cushioning material and tape. Place lens in fiberboard container and tape. Label container as to contents and securely stow within vehicle.
- c.* Retain all removed items with M901 vehicle.

D-7. Launcher Crane Down Procedure

To lower launcher proceed as follows:

- a.* Apply system power, remove 2 x 4 lumber bracing and C-Clamps, and then place launcher to - 8.5 degrees as indicated by elevation pointer.
- b.* Set MODE SELECT switch to STOW.

WARNING

Do not touch ERECTION DRIVE switch. To do so would cause the launcher to stow. Severe injury or death may result to personnel in the launcher's path.

- c.* Remove cap (1) from erection arm. (See fig. D-3)
- d.* Install handbrank (2) and turn handcrank clockwise to crank launcher down to deck.

WARNING

All personnel should stand clear of handcrank. Handcrank may occasionally jump abruptly.

- e.* Remove handcrank, install cap, and turn off system power.
- f.* Reduce the height of the radio antenna by removing it. Wrap antenna in cushioning material (Kimpak) and place antenna in fiberboard container. Store and secure container within vehicle.

D-8. Transport to Standard Configuration Conversion Procedure To place the M901 vehicle into standard configuration from transport configuration, refer to figure D-2, and proceed as follows:

a. Set TURRET POWER switch to ON and MODE switch to ERECT. Use ERECTION DRIVE switch to erect launcher.

b. Bleed down hydraulic system pressure, and support launcher in accordance with paragraph 1.

c. Install WFOV telescope (20), ITV cover (21), 7 washers (19), and 7 bolts (18). (See fig. D-2). Adjust WFOV telescope (20) as follows; Without disturbing the ITA diopter ring, select the ITA WFOV channel (3X position on the sight select switch) for a clear, sharp image of the WFOV circular reticle. Lock-wire in place the focusing rings for the WFOV telescope, the optical sight, and the night-sight channel objective lens.

NOTE

Be sure to put split ring retainers back into position.

d. Apply corrosion preventive compound (MIL-C-16173, Grade I) to 6 bolts (15).

e. Install stow bracket (17), 6 washers (16), and 6 bolts (15). Repeat for other side. (See fig. D-2). Torque bolts (15) to 50-55 foot-pounds.

f. Remove 2 bolts (8), 2 washers (9), bumper (12), and shim (13) from low-stow cushion base (14) on cargo hatch. (See fig. D-2). Repeat for other bumper.

g. Apply corrosion preventive compound (MIL-C-16173, Grade 1) to 2 bolts (5).

h. Install shim (13), bumper (12), 2 washers (9), 2 bolts (8), 2 washers (10), and 2 nuts (11) to high-stow bracket (17). Repeat for other bumper.

i. Apply corrosion preventive compound (MIL-C-16173, Grade I) to 2 bolts (5).

j. Install stow position stop (7), 2 washers (6), and 2 bolts (5) to rear of erection arm. Repeat for other stow position stop. Torque bolts (5) to 8 to 9 foot-pounds.

k. Apply corrosion preventive compound (MIL-C-16173, Grade I) to 4 bolts (1).

l. Install launcher support (4), 4 washers (3), 4 lockwashers (2), and 4 bolts (1). Repeat for other launcher support. Torque bolts (1) to 25-30 foot-pounds.

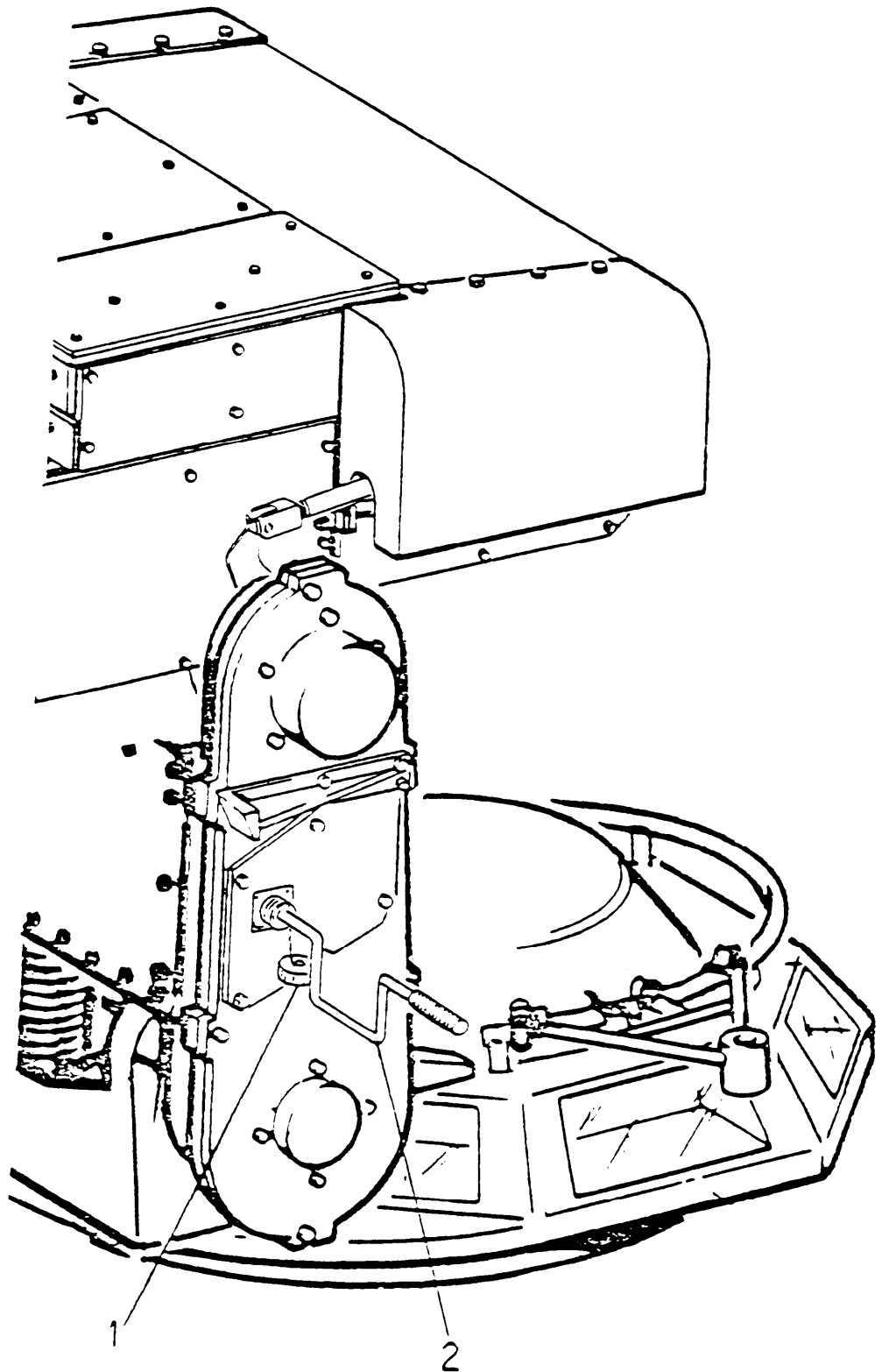


Figure D-3. Installation of Handcrank

APPENDIX E

DETAILED PROCEDURES FOR SECURING THE M577/A1/A2 REAR RAMP DOOR

E-1. Follow these procedures until new rear tiedown provisions are installed on the underside of the carrier:

- a. Before shipping M577's, put the canvas and poles that are normally stored on the outside rear of the carrier inside the carrier.
- b. Make sure the latch mechanism that holds the ramp closed is fully engaged. Units may have to use a crow bar or some other tool to force the latch down.
- c. Tighten the lock nut above the latch.
- d. Drive a wedge (wooden or scrap metal) into the area above the latch, to ensure the latch stays down.

E-2. As an added safety precaution during tiedown and shipment, MTMCCTEA recommends units follow the procedures given in steps 1 through 3 below. This requires two, approximately 160-inch long, 1/2-inch IWRC cables and sixteen 5/8-inch cable clamps (per vehicle). The word "deck" in paragraphs 1-3 below refers to a railcar, airplane, trailer, or ship deck.

- a. Before securing the carriers run a 1/2-inch IWRC cable (minimum diameter) horn the left rear tiedown provision to the right rear lifting provision and another from the right rear tiedown provision to the left rear lifting provision. Secure these two cables, leaving slack in the cables. They will form an "X" on the rear of the carrier. (This will keep the ramp horn falling on someone who is connecting the chains from the deck to the carrier.)

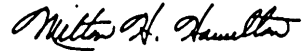
- b. Connect the tiedown chains/cables from the deck to the tiedown provisions. (Do not leave slack in the chains.)

- c. Tighten the two cables on the carrier to remove the slack. This allows the tiedown shackles to hang in the correct orientation (an angle less than 60° from the horizontal).

By Order of the Secretary of the Army:

Official:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff



MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army

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THE METRIC SYSTEM AND EQUIVALENTS

WEIGHT MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 lb.
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

$5/9(^{\circ}\text{F} - 32) = ^{\circ}\text{C}$
 212° Fahrenheit is equivalent to 100° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 $9/5^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
its	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
ometers per Liter	Miles per Gallon	2.354
ometers per Hour	Miles per Hour	0.621



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