

TECHNICAL MANUAL

**TRANSPORTABILITY GUIDANCE
ARMORED COMBAT EARTHMOVER, M9
(NSN 2350-00-808-7100)**

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

This manual supersedes TM-2350-262-14, 28 March 1986.

TECHNICAL MANUAL

TRANSPORTABILITY GUIDANCE

ARMORED COMBAT EARTHMOVER, M9 (NSN 2350-00-808-7100)

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CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

a. This manual provides transportability guidance for logistical handling and movement of the M9 Armored Combat Earthmover (ACE). It contains information considered appropriate for safe transport of the item. Included are significant technical and physical characteristics with safety considerations required for worldwide movement by the various transportation modes. Where considered necessary, metric equivalents are given in parentheses following the dimension or other measurement.

b. This manual is intended for transportation officers and other personnel responsible for providing movement or transportation services.

1-2. Safety

Appropriate precautionary measures required during movement of the item are contained in chapter 3.

1-3. Definitions of Warnings, Cautions, and Notes

Throughout this manual, warnings, cautions, and notes emphasize important or critical guid-

ance. They are used for the following conditions:

a. *Warning.* Instructions, that if not followed, could result in injury to or death of personnel.

b. *Caution.* Instructions, that if not strictly observed, could result in damage to or destruction of equipment.

c. *Note.* An operating procedure or condition that must be emphasized.

1-4. Reporting of Publication Improvements

Users of this manual are encouraged to submit comments and recommended changes for its improvement. Comments and recommendations should be prepared on DA Form 2028 (Recommended Changes to DA Publications and Blank Forms) and forwarded to Director, Military Traffic Management Command Transportation Engineering Agency, ATTN: MTTE-TRV, 720 Thimble Shoals Blvd. PO Box 6276, Newport News, VA 23606-0276. Electrically transmitted messages should be addressed to DIR MTMCTEA FT EUSTIS//MTTE-TRV//.

CHAPTER 2

TRANSPORTABILITY DATA

Section 1. GENERAL

2-1. Scope

This chapter provides a general description and identification of the M9 ACE (fig 2-1), as well as tabulated transportability characteristics that are necessary in movement of the item.

2-2. Description

a. General. The M9 ACE tractor is a full-tracked (hard rubber), armored amphibious, multipurpose combat engineer vehicle capable of performing tilt and straight dozing, scraping, rough grading, and hauling. The tractor features a front-loaded scraper bowl (ballast compartment), hydraulically

operated apron, and positive-load ejector. Dozing and scraping are accomplished by raising and lowering the entire front of the vehicle by means of the hydropneumatic suspension system. This dozer/scrapper tractor is powered by a 295-horsepower diesel engine. The M9 ACE has six forward and two reverse gears and is operated only by the driver.

2-3. Transportability Drawings

Detailed side- and end-view transportability drawings of the M9 ACE, with dimensions and tiedown and lift provision load-rating capacities, are shown in figures 2-2 through 2-4.

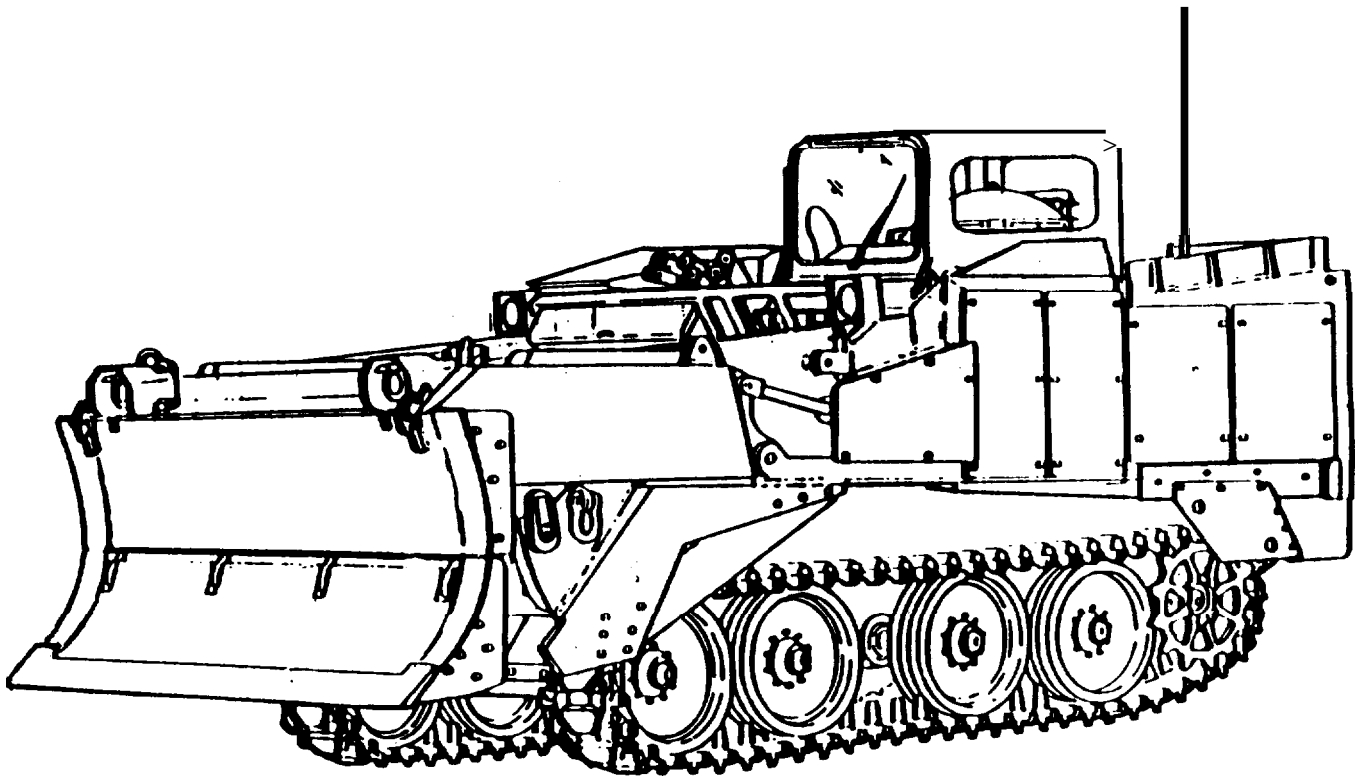


Figure 2-1. Armored Combat Earthmover, M9.

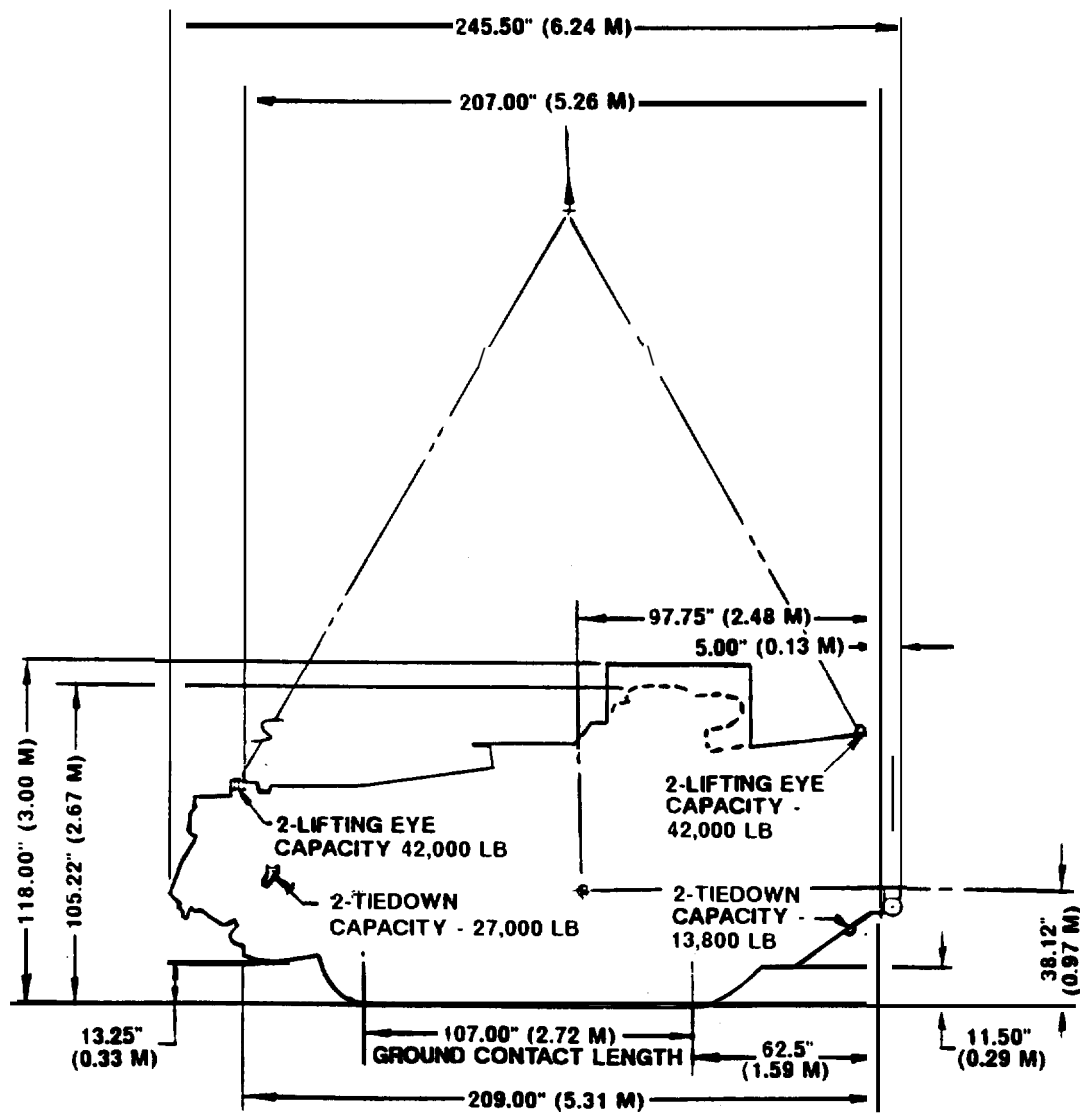
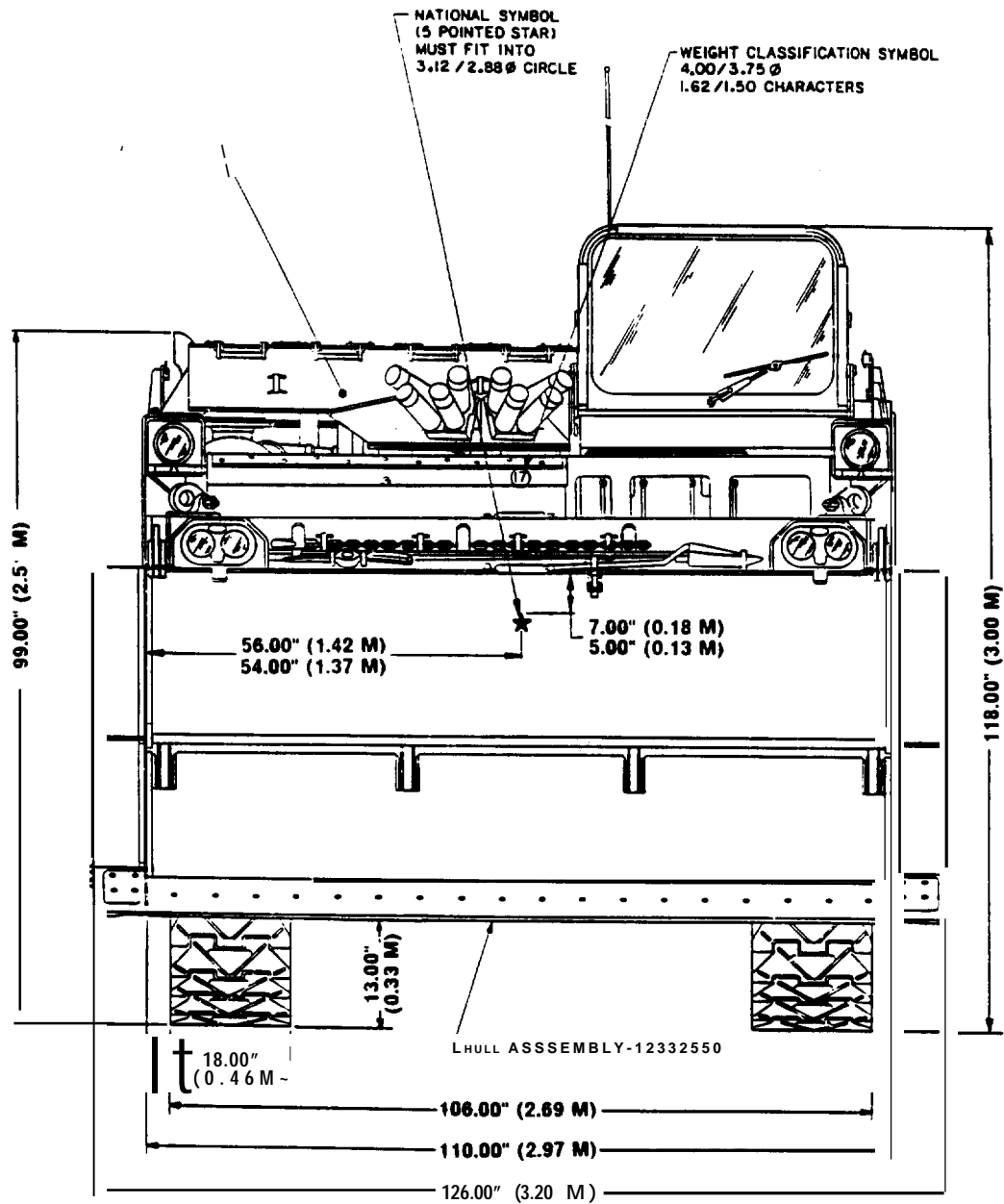


Figure 2-2. Transportability drawing, left side view of the M9 ACE.

-WALKWAY COATING -12355335



FRONT ELEVATION

Figure 2-3. Transportability drawing, front view of the M9 ACE

ATTACHMENT	NO. OF PLACES	SWL (LBS)	KG
A	1	61,000	27 669.6
B	4	42,000	19 051.2
C	2	30,000	13 608.0
D	4	27,000	12 247.2
E	2	75,000	34 020.0
F	2	50,000	22 680.0
G	2	13,800	6 259.7
H	2	10,000	4 536.0
I	1	10,000	4 536.0
J	2	5,000	2 268.0
K	2	5,000	2 268.0
L	4	20,000	9 072.0
M	2	75,000	34 020.0

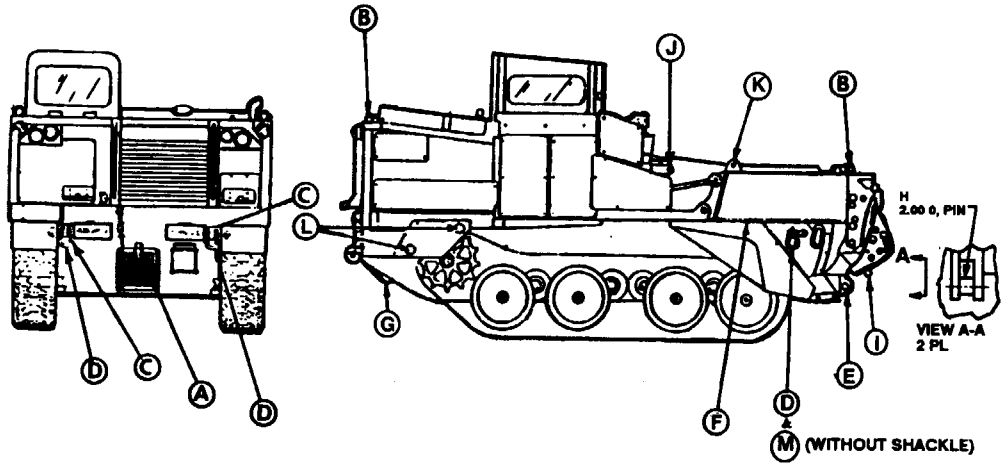


Figure 2-4. Tiedown drawing, rear and right side view of the M9 ACE.

Section II. CHARACTERISTICS AND RELATED DATA

2-4. General Transportability Characteristics

Data contained herein are applicable to the model number or national stock number (NSN) shown.

National stock number	2350-00-808-7100
Ground pressure	9.5 lb per in. (net)
Unloaded (curb weight).....	36,120 lb(16384 kg)
Loaded (combat).....	36,820 lb(16701 kg)
Track type.....	single pin
Size	18 in. (0.46m)
Pitch	6 in. (0.15m)
Grouser wear height	1/4 in. (amount allowable wear)
Military load classification (MLC):	
Empty.....	MLC 17
Loaded	MLC 30
Performance:	
Maximum speed (sixth gear)	30 mph (48 km/h)
Maximum speed (reverse).....	6 mph (10km/h)
Maximum grade	60 pct(with 18,000 lb in bowl)
Maximum range	230 mi (370 km)
Fuel tank capacity	134 gal (507 L)
Turning radius.....	23 ft per pivot
Angle of approach:	
Blade (folded)	32 degrees
Blade (down)	16 degrees
Angle of departure	21 degrees
Ground clearance (min).....	12-1/2 in.
Dimensions and shipping data:	
Length	
Operational	245.5 in. (624 cm)
Width	
Operational	126 in. (320 cm)
Reduced	110 in. (279 cm)
Height	
Operational	118 in. (300 cm)
Reduced	102.5 in. (260 cm)
Center of gravity:	
Above ground.....	32.12 in. (82 cm)
From rear pintle	97.5 in. (248 cm)

2-5. Unusual Characteristics

The vehicle has no unusual characteristics that would require that special attention be given to temperatures, atmospheric pressure, or humidity variations during its exposure to normal transportation environments.

2-6. Hazardous and Dangerous Characteristics

Unless the vehicle is shipped with ammunition, under the provisions of Department of Transporta-

tion special Permit No. 3498 (applicable to shipments in periods of actual national emergency), it will present no special hazardous or dangerous characteristics during exposure to normal transportation environments.

NOTE

Those regulations and/or transportation procedures normally associated with vehicles containing diesel fuel will apply.

CHAPTER 3

SAFETY

3-1. General

General safety considerations and precautions for movement are as follows:

a. Each vehicle must be checked to ensure that all loose items are secured in accordance with applicable regulations (operator's manual for M9 ACE, TM 5-2350-262-10).

b. The vehicle must be driven by qualified drivers only.

c. Drivers must not leave their station while the engine is running.

d. When the vehicle is in motion, it should not be mounted or dismounted.

e. Personnel must not ride "on" the vehicle.

f. Personnel must not smoke in or on the vehicle or within 50 feet of a refueling area.

g. The vehicle must be brought to a complete stop before it is driven into or out of a building.

h. Whenever the vehicle is being operated in reverse or within 20 feet of an obstruction, a ground guide must be used to direct the driver.

i. Personnel must stay clear of engine exhaust area during and immediately after engine operation. Contact with this area can cause severe burns.

j. The engine must not be operated in an enclosed area without adequate ventilation.

WARNING

The M13A1 air filter will not protect users against carbon monoxide.

3-2. Specific Safety Requirements

Pertinent safety requirements by individual mode can be found where applicable in the appropriate chapters.

CHAPTER 4

AIR TRANSPORTABILITY GUIDANCE

4-1. Scope

This chapter provides air transportability guidance for the movement of the M9 ACE vehicle. It covers technical and physical characteristics, as well as safety considerations, and prescribes the manpower, material, and time required to prepare, load, and tie down the vehicle on, or unload the vehicle from, U.S. Air Force aircraft.

4-2. Maximum Utilization of Aircraft

The loads described in this section are not maximum loads. General guidance on total cargo loads and on operating ranges is provided in TM 38-236/AFP 71-8. Additional cargo and/or personnel within allowable load limits and restrictions prescribed by pertinent safety regulations can be transported.

4-3. Applicability

a. *U.S. Air Force Aircraft.* The M9 ACE is transportable in C-130, C-141, and C-5 aircraft. Procedures in this manual and those prescribed in TO 1C-130A-9, TO 1C-141A-9, and TO 1C-5A-9 are applicable.

b. *Tiedown.* This vehicle is tied down in accordance with the applicable TO 1C-XXX-9, section IV. Figures 4-1 through 4-3 show the suggested tiedown patterns for the M9 ACE in the C-130, C-141, and C-5 aircraft, respectively. Tables 4-1 through 4-3 show the suggested tiedown patterns for the M9 ACE in the C-130, C-141, and C-5 aircraft, respectively. Tables 4-1 through 4-3 list the tiedown devices required, the locations of tiedown points, the corresponding fittings to which the devices are secured, the number and capacity of the devices, and the lumber shoring required for loading and/or securement.

(1) The rolling shoring requirements listed in tables 4-4 and 4-5 are to be applied in sequence from the top to the bottom of the table, with the first items for the ground, the second for the ramp, and so forth (see figs 4-4 and 4-5). For the C-5, rolling shoring may have to be leap-frogged, depending on the desired tiedown location.

(2) Parking/sleeper shoring is to be applied as shown in figures 4-6 and 4-7.

c. *Loadmaster Responsibilities.* The loadmaster will ensure that the vehicle is loaded and secured in accordance with the applicable TO 1C-XXX-9.

4-4. Safety

Besides the safety precautions contained in chapter 3, the following considerations should be noted:

a. The height of the M9 ACE must be reduced for transport in C-130 and C-141 aircraft.

b. Sleeper and parking shoring are required in all aircraft.

c. Relieve track tension until the track lies directly on top of road wheel four prior to loading aboard the aircraft.

d. Position suspension to the UNSPRUNG mode for loading/offloading and to the SPRUNG mode for flight.

e. The fuel load must be reduced to 25 percent, and the components must be repositioned in the bowl before loading operations.

f. Once the vehicle is loaded in the aircraft, relieve the hydraulic pressure to allow the vehicle to settle on the bump stops faster.

4-5. Preparation of Vehicle

a. *Personnel Requirement.* At least one heavy equipment operator, heavy equipment mechanic, and wrecker operator are required to prepare, load, unload, and place the M9 ACE in operation. Additional support personnel (MOS immaterial) with minimum familiarization of the equipment will reduce preparation time.

b. *Equipment and Materials.* The following equipment and materials are required for preparing and placing the M9 ACE in operation:

- (1) Tool kit, mechanic
- (2) Wrecker, 5-ton
- (3) Shoring (tables 4-4 and 4-5)
- (4) Socket set, heavy-duty, 3/4-inch drive
- (5) Handle, socket, 3/4-inch square drive, 20-1/2-inch length

c. *Preparation Times.* Time required for preparing, loading, offloading, and placing the M9 ACE in operation will vary depending on existing conditions and personnel available. Time and personnel allotted to each operation are for planning purposes.

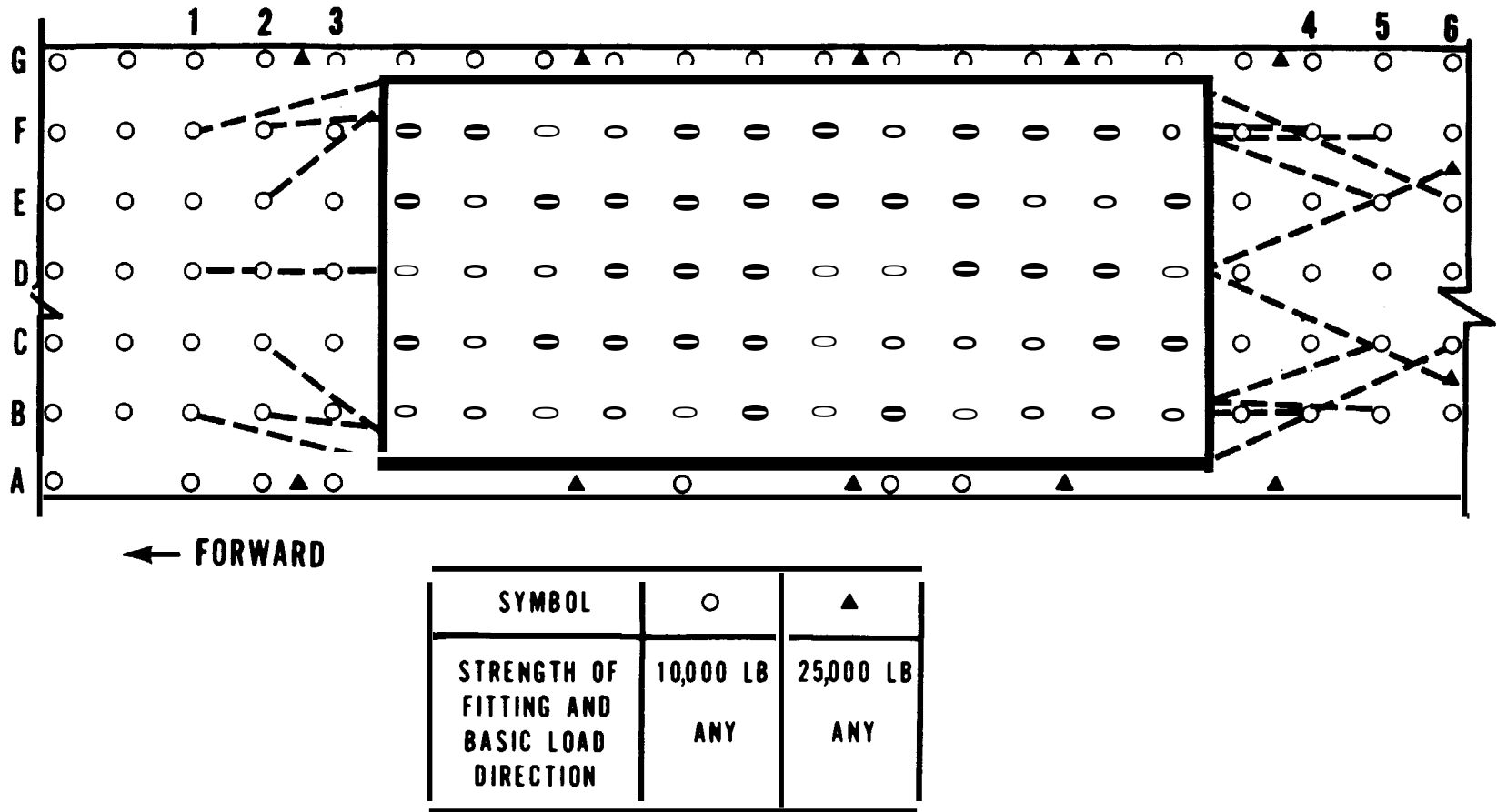
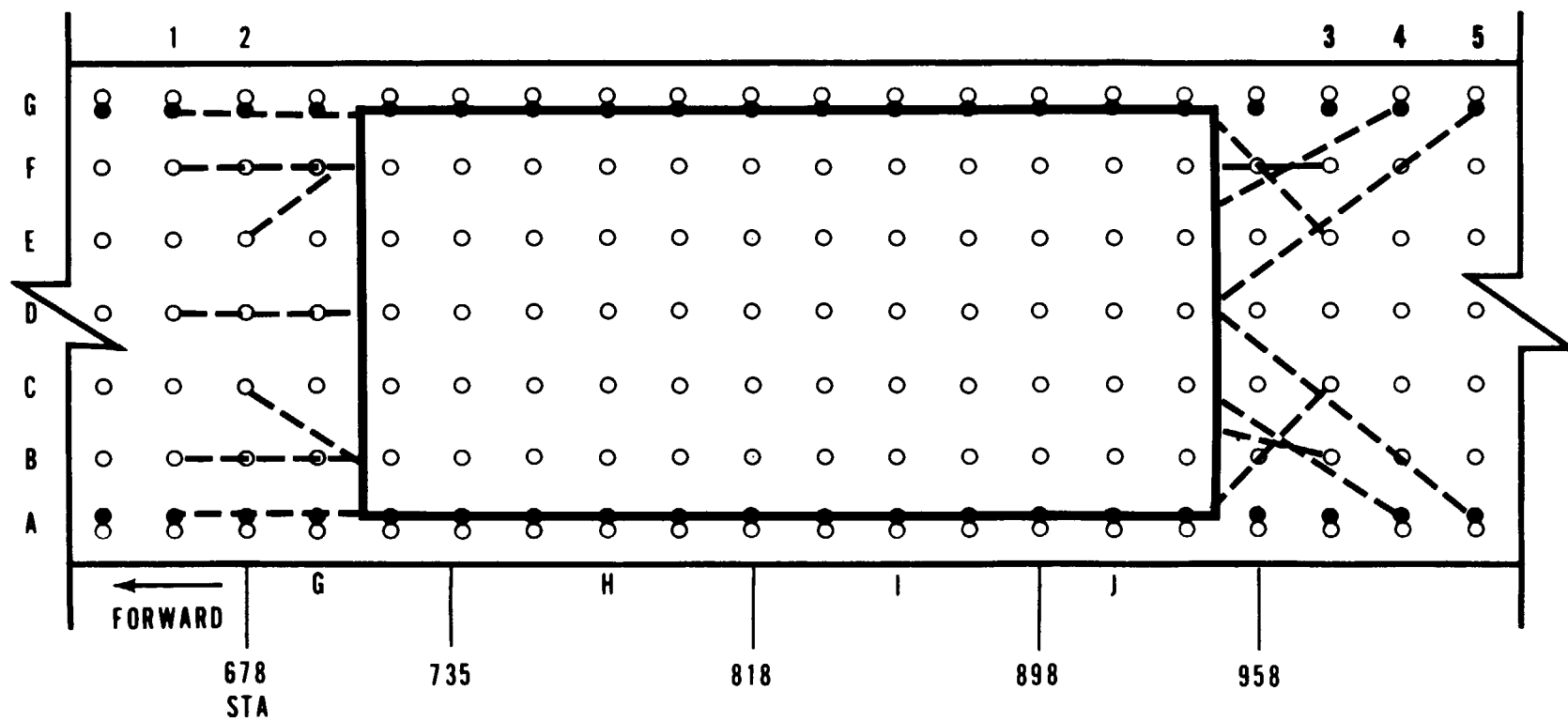
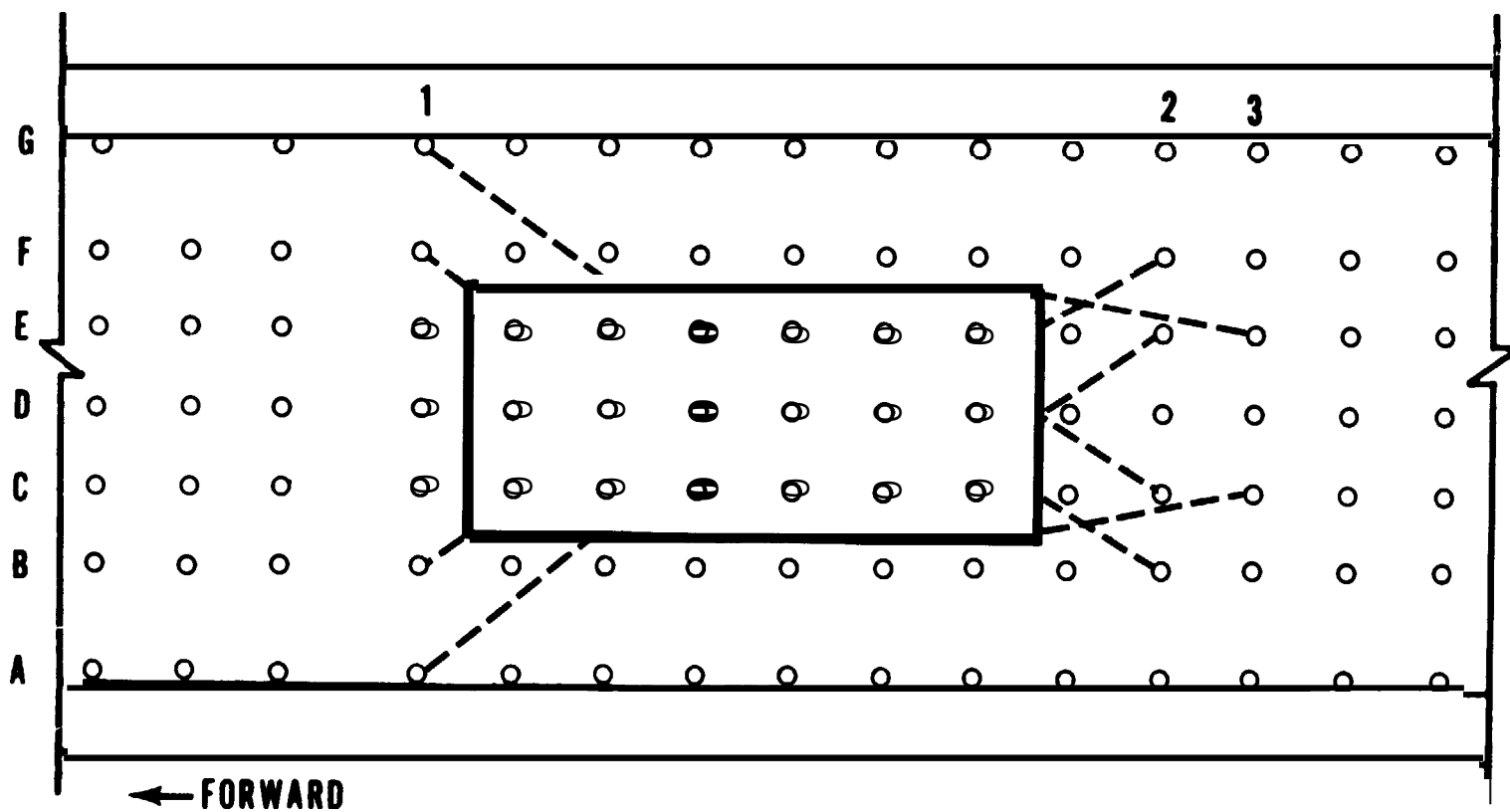


Figure 4-1. Tiedown diagram for the M9 ACE in C-130 aircraft.



SYMBOL	○	●
STRENGTH OF FITTING AND BASIC LOAD DIRECTION	10,000-LB ANY	25,000-LB ANY

Figure 4-2. Tiedown diagram for the M9 ACE in C-141 aircraft.



○ ALL CARGO TIEDOWN FITTING RATINGS 2,5000 LB EACH

Figure 4-3. Tiedown diagram for the M9 ACE in C-5 aircraft.

Table 4-1. Tiedown Data M9 ACE in C130 Aircraft

<u>Tiedown Fitting</u>		<u>Tiedown Device</u>		
Designation	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	Attach to item
B1	10	MB-1	10	Left front lift provision.
D1	10	MB-1	10	Center front tiedown provision.
F1	10	MB-1	10	Right front lift provision.
B2	10	MB-1	10	Left front tiedown provision.
C2	10	MB-1	10	Left front tiedown provision.
E2	10	MB-1	10	Right front tiedown provision.
F2	10	MB-1	10	Right front tiedown provision.
B4	10	MB-1	10	Left rear lower tiedown provision.
F4	10	MB-1	10	Right rear lower tiedown provision.
B5	10	MB-1	10	Left rear upper tiedown provision.
C5	10	MB-1	10	Left rear upper tiedown provision.
E5	10	MB-1	10	Right rear upper tiedown provision.
F5	10	MB-1	10	Right rear upper tiedown provision.
B6	25	MB-2	25	Rear pintle.
C6	10	MB-1	10	Left rear upper lift provision.
E6	10	MB-1	10	Right rear upper lift provision.
F6	25	MB-2	25	Rear pintle.

Table 4-2. Tiedown Data M9 ACE in C-141 Aircraft

<u>Tiedown Fitting</u>		<u>Tiedown Device</u>		
Designation	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	Attach to item
A1	25	MB-2	25	Left front lift provision.
B1	10	MB-1	10	Left front lift provision.
D1	10	MB-1	10	Center front tiedown provision.
F1	10	MB-1	10	Right front lift provision.
G1	25	MB-2	25	Right front tiedown provision.
E2	10	MB-1	10	Right front lift provision.
B3	10	MB-1	10	Left rear lower tiedown provision.
C3	10	MB-1	10	Left rear upper lift provision.
E3	10	MB-1	10	Right rear upper tiedown provision.
F3	10	MB-1	10	Right rear lower tiedown provision.
A4	25	MB-2	25	Left rear upper tiedown provision.
G4	25	MB-2	25	Right rear upper tiedown provision.
A5	25	MB-2	25	Rear pintle.
G5	25	MB-2	25	Rear pintle.

Table 4-3. Tiedown Data for M9 ACE in C-5 Aircraft

<u>Tiedown Fitting</u>		<u>Tiedown Device</u>		Attach to item
Designation	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	
A1	25	MB-2	25	Left front side tiedown provision.
B1	25	MB-2	25	Left front tiedown provision.
F1	25	MB-2	25	Right front tiedown provision.
G1	25	MB-2	25	Right front side tiedown provision.
B2	25	MB-2	25	Left rear upper tiedown provision.
C2	25	MB-2	25	Rear pintle.
E2	25	MB-2	25	Rear pintle.
F2	25	MB-2	25	Right rear upper tiedown provision.
C3	25	MB-2	25	Left rear upper lift provision.
E3	10	MB-2	10	Right rear upper lift provision.

Table 4-4. Bill of Materials for Shoring the M9 ACE in C-130 Aircraft

Item	Description	Approximate Quantity
Rolling Shoring	Lumber, 2- x 12- x 96-inch	8 each
	Lumber, 2- x 12- x 66-inch	12 each
	Lumber, 2- x 12- x 120-inch	12 each
	Lumber, 2- x 12- x 96-inch	12 each
	Lumber, 2- x 12- x 102-inch	12 each
	Lumber, 2- x 12- x 133-inch	12 each
Sleeper Shoring	Lumber, 1- x 6- x 96-inch	2 each

Table 4-5. Bill of Materials for Shoring the M9 ACE in C-141 and C-5 Aircraft

Item	Description	Approximate Quantity
Rolling Shoring	Lumber, 2- x 12- x 96-inch	8 each
	Lumber, 2- x 12- x 66-inch	12 each
	Lumber, 2- x 12- x 120-inch	12 each
	Lumber, 2- x 12- x 96-inch	12 each
	Lumber, 2- x 12- x 102-inch	12 each
	Lumber, 2- x 12- x 133-inch	12 each
Sleeper Shoring	Lumber, 1- x 6- x 96-inch	12 each

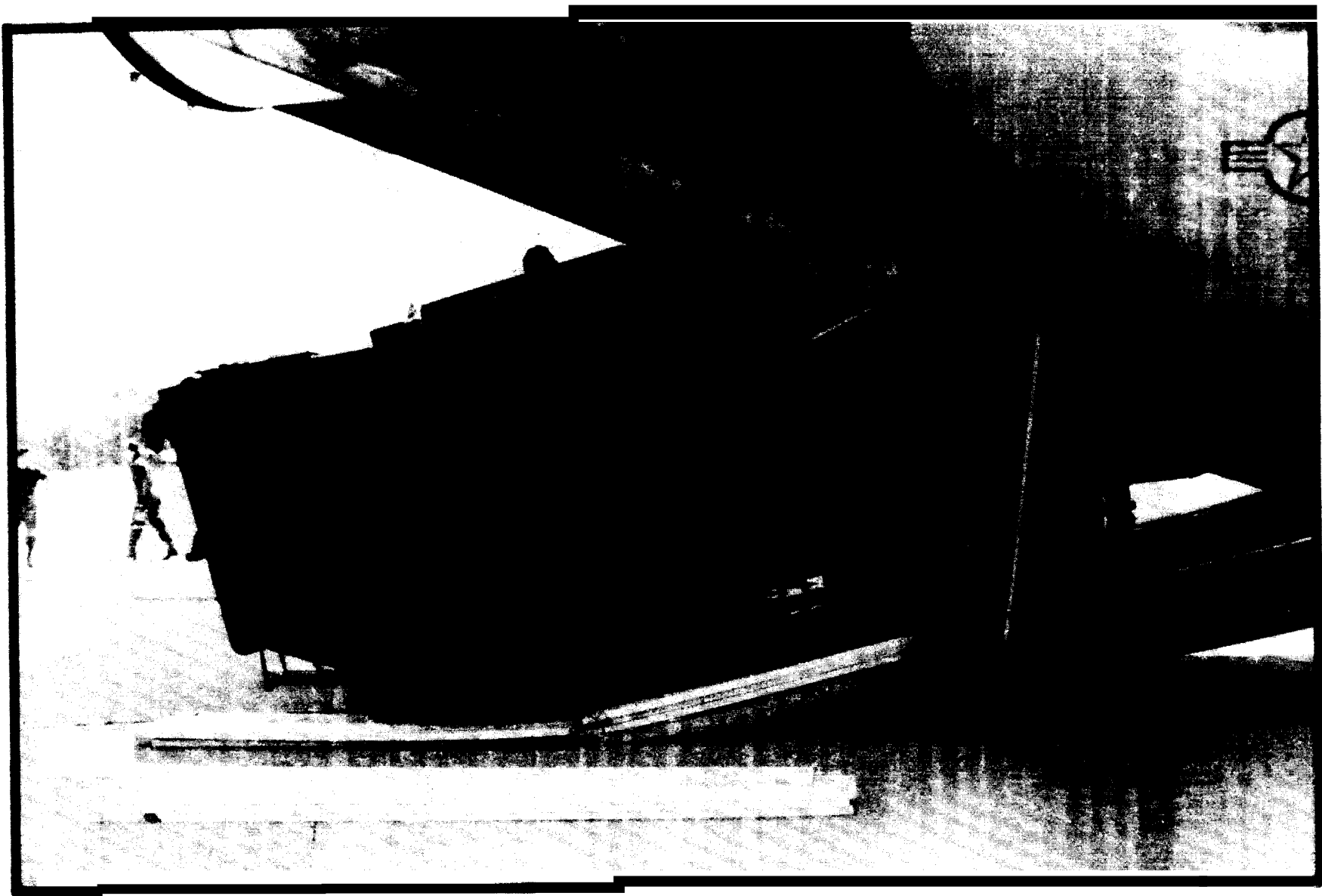


Figure 4-4. The M9 ACE entering C-130 on rolling shoring.



Figure 4-5. The M9 ACE entering C-141 on rolling shoring.

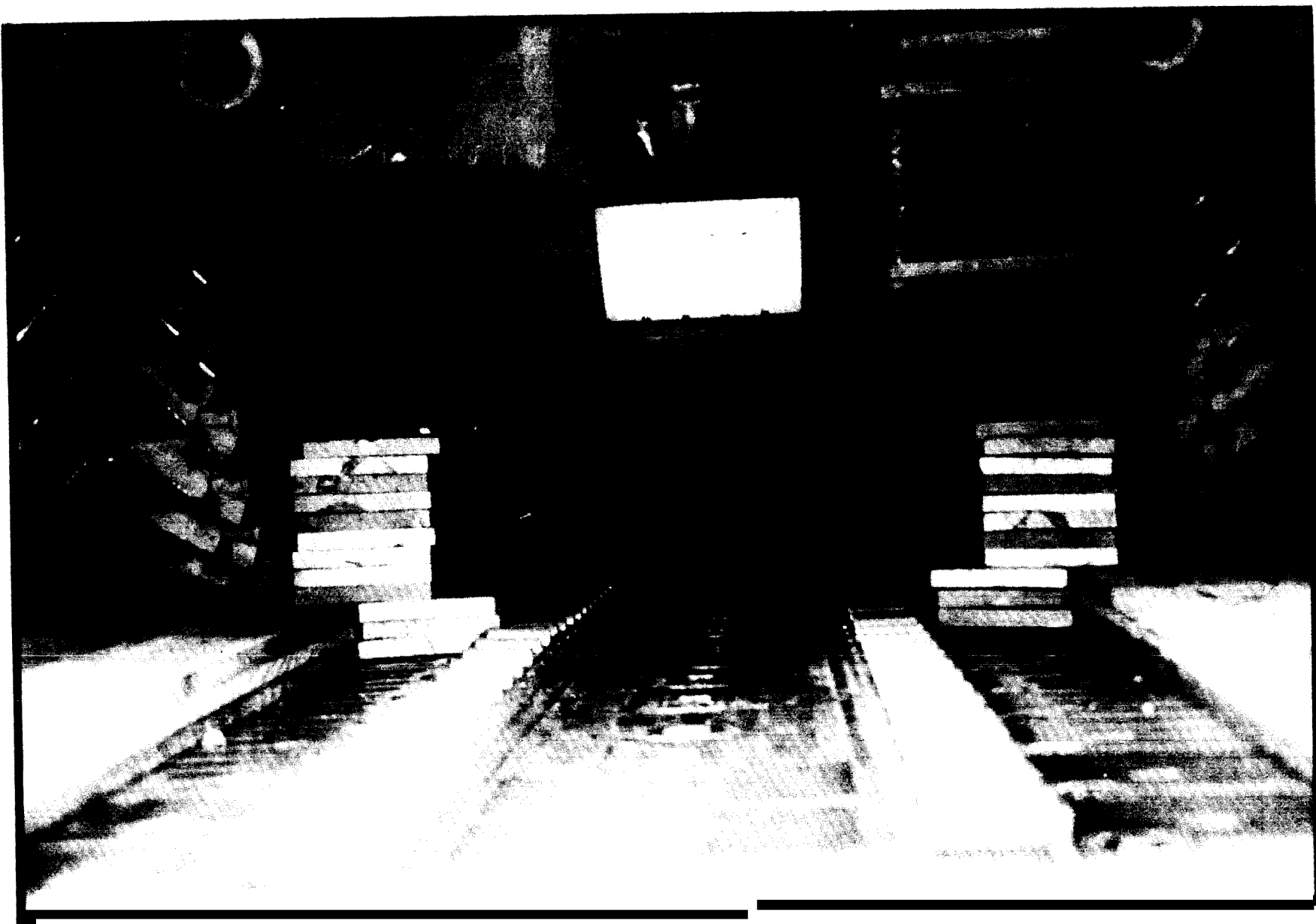


Figure 4-6. The M9 ACE in C-130 on sleeper shoring.

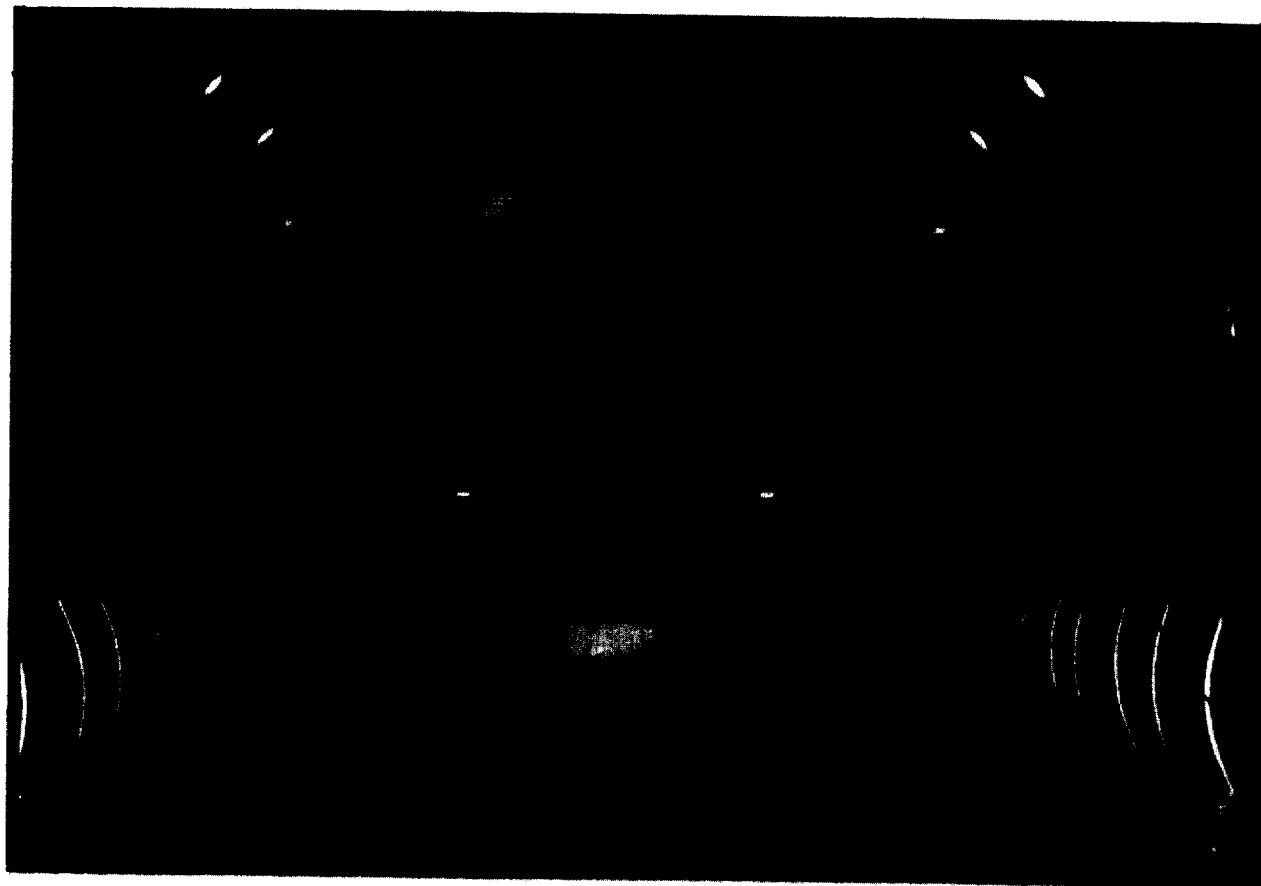


Figure 4-7. The M9 ACE in C-141 on sleeper shoring.

Type Aircraft	Preparation* (Personnel/Minutes)	Loading (Personnel/Minutes)	Offloading (Personnel/Minutes)	Operation (Personnel/Minutes)
C-130 and C-141	2/120	6/60**	6/10	6/100
C-5	2/30	2/40**	2/10	2/30

*Preparation time does not include fabrication of shoring.

**This time may vary, depending on how long it takes the vehicle to settle on sleeper shoring.

d. Preparation.

(1) Preparation required for the M9 ACE is the same for C-130 and C-141 aircraft.

(2) The following steps cover preparation of the M9 ACE for C-130, C-141, and C-5 transport:

(a) Inspect the M9 ACE for leaks, damage, and operation; repair as required.

(b) Fabricate shoring.

(c) Check fuel level. Drain (TM 5-2350-262-20) as necessary to reduce fuel level to 25 percent for C-130 and C-141 aircraft or 75 percent for C-5 aircraft.

(d) Fold dozer blade (TM 5-2350-262-10). Ensure the lower apron is installed (TM 5-2350-262-10).

(e) Remove the antenna and antenna base (TM 11-5820-401-1).

(f) Place the SPRUNG/UNSPRUNG control lever in UNSPRUNG for loading/offloading. Reduce the track tension (TM 5-2350-262-10) until the track lies directly on top of road wheel four, relieve the hydraulic pressure (TM 5-2350-262-10), and place the SPRUNG/UNSPRUNG control lever in SPRUNG for flight.

(3) The following steps cover preparation of the M9 ACE for C-130 or C-141 transport. Refer to TM 5-2350-262-10 for location of major components.

(a) Place eight cargo tiedown assemblies (FSN 1670-00-937-0271) in the vehicle bowl and interlace D-ring to D-ring.

(b) Remove vehicle's rear door and place it in the vehicle bowl.

(c) Place a piece of pad, energy dissipating, honeycomb, in the bottom of the vehicle bowl. If this is not available, other suitable cushioning material may be used.

WARNING

Driver's hatch assembly weighs 900 lb (408 kg). Do not put hands or feet under driver's hatch assembly while removing or installing hatch. Severe injury may result.

(d) Remove the driver's hatch assembly (TM 5-2350-262-20). Place it and the mounting hardware, with latch forward, in the center of the bowl. Tape over the eight vision blocks.

(e) Remove the apron and dozer blade extensions (TM 5-2350-262-20). Tape mounting hardware into the holes in the apron and dozer extensions. Place the apron and dozer extensions in the bowl, forward of each of the track fender wells.

(f) Secure the bowl load with tiedown lashings.

4-6. Internal and External Transport by U.S. Army Aircraft

The M9 ACE exceeds the size and weight limitations for either internal or external transport by U.S. Army fixed-wing aircraft or helicopters.

CHAPTER 5

HIGHWAY TRANSPORTABILITY GUIDANCE

Section I. GENERAL

5-1. Scope

This chapter provides highway transportability guidance for the movement of the M9 ACE vehicle. It covers technical and physical characteristics and safety considerations and prescribes the material and guidance required to prepare, load, tie down, and unload the vehicle.

5-2. Safety

Besides the safety precautions contained in chapter 3, movement is subject to all safety laws, rules, and regulations applicable to commercial carriers. Overseas, such movements are governed by the theater regulations.

CAUTION

Vehicle must not exceed 3 miles per hour (mph) during loading or unloading.

5-3. General

The M9 ACE is considered self-deliverable only under appropriate tactical situations. The M9 ACE vehicle has a maximum operating range of 230 miles (370 km) and a maximum speed of 30 mph (48 km per hour). Even with rubber tracks, the M9 ACE must have a special permit for its movement over public highways.

Section II. TRANSPORT BY SEMITRAILER

5-4. Transport of the M9 ACE by Semitrailer

When loaded on a semitrailer, the M9 ACE can be transported over highways; however, movement over public highways in CONUS and overseas should be made only when other transport modes cannot be used. Normally, highway shipments are made with the vehicle loaded on a military or commercial low-bed semitrailer of adequate capacity. In CONUS and overseas, a special permit is required because the vehicle, when loaded on a semitrailer, exceeds the length, width, and weight limitations. The M9 ACE must be reduced to its lowest shipment configuration before shipment.

5-5. Transport of the M9 ACE on the M870 Semitrailer Towed by the M920 Truck Tractor

a. General. The combined length of the tractor and semitrailer exceeds the generally accepted CONUS and overseas unrestricted length of 55 feet. The width and weight of the vehicle and semitrailer combination exceed the legal limits for CONUS and overseas. The legal limits for CONUS are established by the American Association of State Highway and Transportation Officials. The legal limits for overseas are given in the *Limits of Motor Vehicle Sizes and Weights*, published by International and Road Federation, Geneva, Switzerland.

b. MTMC Assistance. Assistance in obtaining approvals for highway movement of the loaded transport system can be obtained from Director, Military Traffic Management Command, Transportation Engineering Agency, ATTN: MTTE-SA, 720 Thimble Shoals Blvd. PO Box 6276, Newport News, VA 23606-0276, when highway movement can be certified as essential for national defense and no other mode can be used.

c. Materials. The bill of materials for blocking and tiedown of the M9 ACE on the M870 semitrailer is shown in table 5-1.

d. Loading.

(1) The vehicle may be driven onto the semitrailer if a ramp is available or backed onto the semitrailer if the gooseneck of the semitrailer is extended. However, should physical facilities and/or equipment preclude these loading methods, the vehicle may be lifted onto the semitrailer by a crane of sufficient capacity. Lifting procedures and precautions are provided in paragraph 6-4b. The handbrake must be set and the transmission placed in park.

CAUTION

Since the track width is 106 inches and the trailer width is 96 inches, about 5 inches of the treads will project beyond the sides of the trailer. Care must be taken to ensure an equal amount of tread overhang occurs on both sides.

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- (2) The H-frame shoring should be installed between the tracks, as shown in figure 5-1.
- (3) The vehicle should be parked, with the brake set, as shown in figure 5-2. The dozer blade should be lowered to the floor of the trailer.
- (4) The M870 semitrailer gooseneck must be

- raised to the travel position by using the truck-tractor winch cable, and the semitrailer must be connected to the M920 truck tractor.
- (5) Data for the application of material required to restrain the vehicle are provided in table 5-2.

Table 5-1. Bill of Materials for Blocking and Tiedown of the M9 ACE on the M870 Semitrailer

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight grain, free from material defects; Fed Spec MM-L-751H: 2- x 4-inch	65 linear feet
Wire rope*	6 x 19, IWRC: improved plow steel; preformed regular-lay; table X, Fed Spec R-W-410: 5/8-inch	90 feet
Clamps*	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal; MIL-STD 16842 5/8-inch	24
Thimbles	Standard, open-type: 5/8-inch	8
Nails	Common, steel; flathead, bright or cement-coated; para 3.6.11.2 Fed Spec FF-N-105B: 12D (3-1/4-inch)	100

*Suitable capacity chains and load binders may be substituted for 5/8-inch wire rope and clamps.

Table 5-2. Application of Material for Tiedown of the M9 ACE on the M870 Semitrailer (Fig 5-2)

Item	No. Required	Application
A	2	Side blocking, 2- x 4- x 120-inch lumber (doubled). Pre-position. Nail first piece to trailer floor with one 12d nail every 8 inches. Nail second piece to first in a like manner.
B	2	Lateral bracing, 2- x 4-inch x length-cut-to-fit lumber (doubled). Pre-position. Nail first piece to trailer floor with one 12d nail every 8 inches. Nail second piece to first in a like manner.
C, D,E,F	8	Thimble, open-type, 5/8-inch. Place one on each M9 ACE tiedown (front and back) and on each semitrailer outside tiedown ring to be used.
C,D,E,F	4	Wire rope, 5/8-inch. Attach, in a complete loop, through thimbles on the vehicle tiedown and through the thimbles on the semitrailer outside tiedown rings on the same side.
	24	Clamp, 5/8-inch. secure the ends of the wire rope with four clamps each. Secure the thimbles with one clamp each.

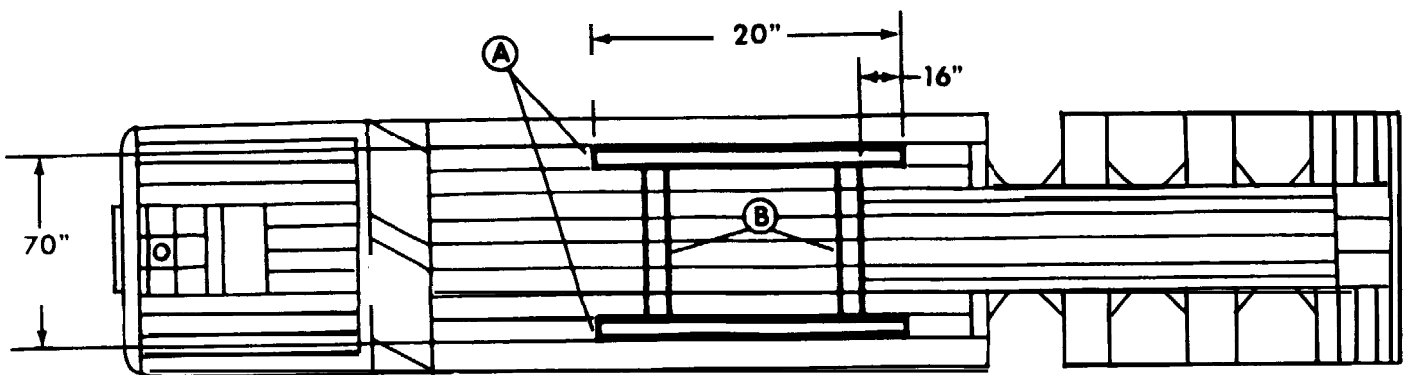


Figure 5-1. Blocking diagram of the semitrailer, M870.

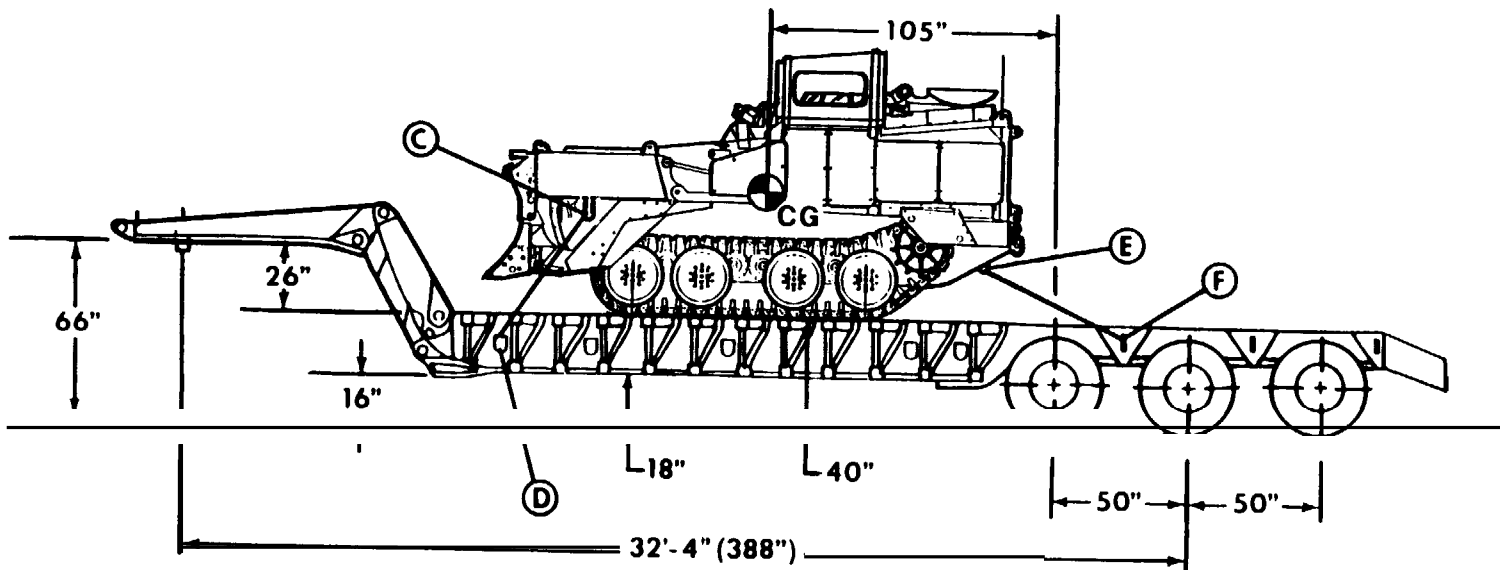


Figure 5-2. Tiedown diagram of the M9 ACE on the semitrailer, M870.

CHAPTER 6

MARINE AND TERMINAL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

6-1. Scope

This chapter provides marine and terminal transportability guidance for movement of the M9 ACE. It covers technical and physical characteristics, as well as safety considerations, and prescribes the materials and guidance required to prepare, load, tie down, and unload the vehicle.

6-2. Safety

Besides the safety precautions contained in chapter 3, the following areas apply:

- a. All vessel equipment and gear should be inspected before use.
- b. All stevedore slings and other items used in loading and unloading operations should be checked for their condition and capacity.
- c. All other precautionary measures and safety regulations peculiar to the loading/unloading site or terminal will be observed.
- d. Vehicle fuel tanks must be drained and bat-

tery terminals disconnected.

- e. Vehicle transmissions must be placed in the neutral position and handbrakes must be set.

NOTE

When the M9 ACE is loaded on vessels that are adequately ventilated by power blowers, such as those commonly found on the roll-on/roll-off (RORO) ships, fuel tanks need not be drained.

6-3. Water Shipment

The M9 ACE can be transported by a great variety of inland waterway cargo carriers, lighters, and barges and by all seagoing cargo vessels.

NOTE

The methods described in this chapter for lifting and securing the M9 ACE are suggested procedures. Other methods of handling and stowage may be used to accomplish safe delivery without damage.

Section II. LOADING AND SECURING

6-4. General Rules for Stowing

a. *General.* Whenever possible, vehicles should receive the protection of below-deck stowage. In general, good stowage of vehicles means having them placed fore and aft as close together as practical, with minimum spacing (about 4 to 6 inches) between outer vehicles and the sweat-boards. Breakable parts or auxiliary equipment of the vehicles should be adequately protected and secured for shipment. If not shipped on the vehicle, spare parts and on-equipment material should be properly identified as to location or disposition during shipment. Vehicles in the ship's hold should be blocked in front, in rear, and on both sides of the wheels so that the vehicles cannot move. Individual vehicle blocks should be braced to bulkheads, stanchions, and other vehicle blocks. In addition, all vehicles should be lashed with wire rope or chains to nearby padeyes, bulkheads, or stanchions.

b. *Lifting.* Correct lifting points on the vehicle are the lifting eye provisions atop each of the four extreme corners of the hull's superstructure as shown in figure 6-1.

c. *Loading.* A check must be made to ensure the hatch girder clearance of the specified vessel is at least 107 inches (272 cm) for the unreduced M9 ACE or 98 inches (249 cm) for the reduced M9 ACE (cupola and exhaust stack removed). The vehicle can be loaded over the beach or from piers onto landing craft, beach discharge and amphibious lighters, landing ship tanks (LST), and landing ship docks (LSD), under its own power or by crane of adequate capacity. The vehicle can also be loaded under its own power onto the deck of barges from pierside when tidal conditions are favorable and ramps are available. The vehicle can be loaded onto seagoing vessels by shoreside or floating cranes of adequate capacity. Jumbo booms and heavy-lift ship's gear may be used to load the vehicle onto vessels. Also, the vehicle can be driven or towed onto RORO vessels. Since the M9 ACE is amphibious, it can, under favorable conditions, swim aboard, or debark from, offshore LST and LSD. However, extreme caution is necessary during amphibious operations because loss of free-board may occur from excessive waves or while turning on the water.

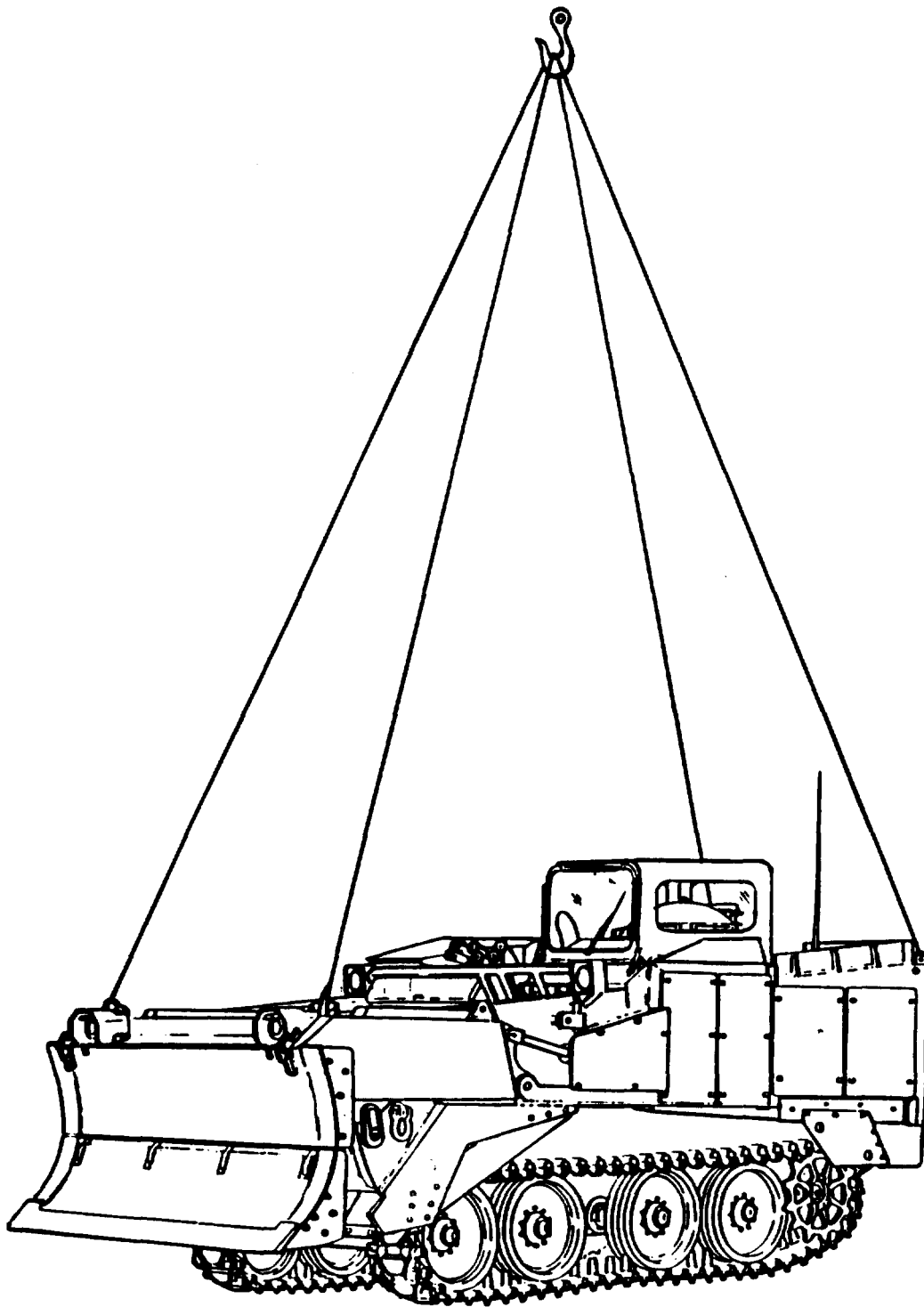


Figure 6-1. Lifting diagram for the M9 ACE.

NOTE

The parking brake must be set and the transmission placed in neutral.

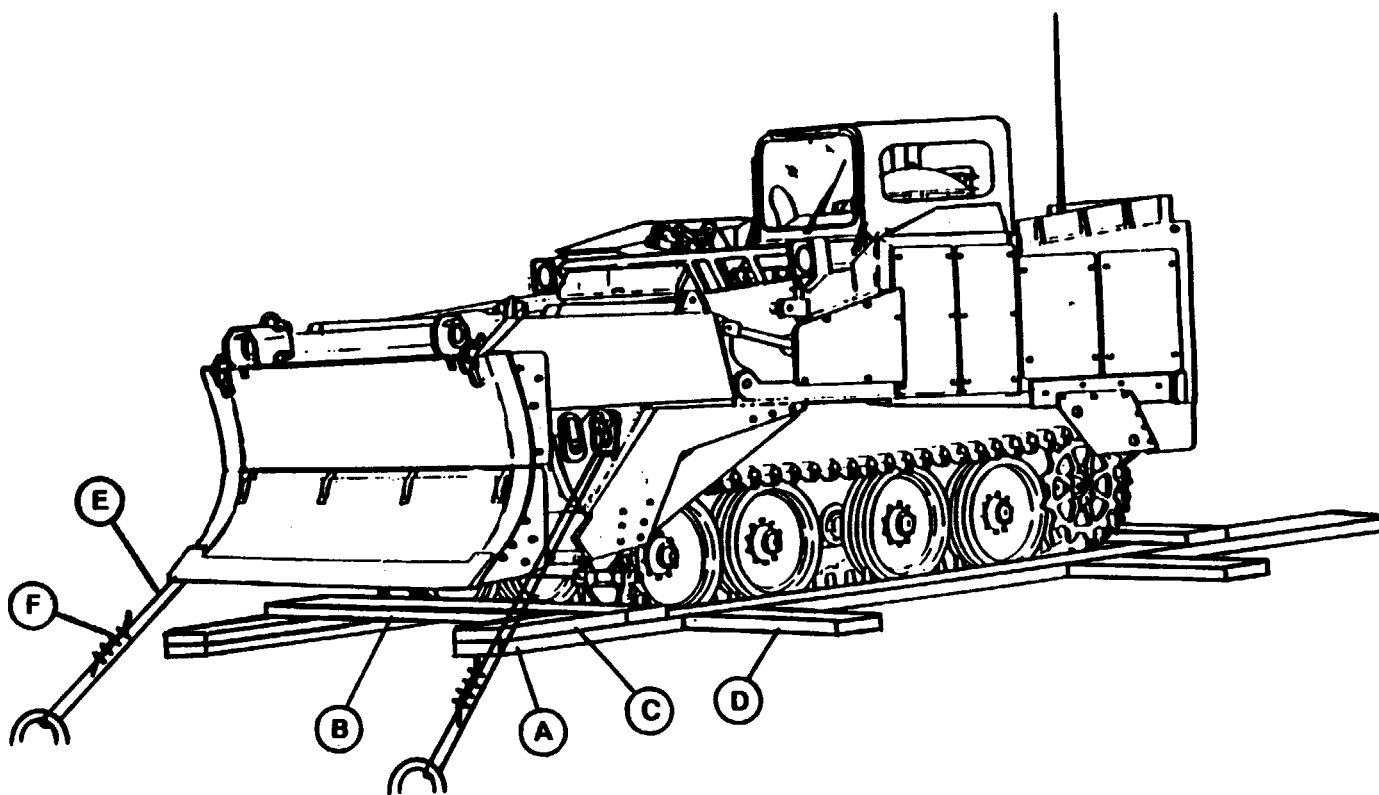
d. *Materials.*

(1) The bill of materials for blocking and tiedown of the M9 ACE in the hold of a general cargo vessel is provided in table 6-1. Required

amounts will vary as to type of vessel configuration and location aboard the vessel.

(2) Typical blocking and tiedown details of an M9 ACE in the hold of a general cargo vessel are shown in figure 6-2.

(3) Table 6-2 provides data concerning the application of materials required to restrain the vehicle.



NOTE: BLOCKING AND BRACING, A-D, IS NOT REQUIRED WHEN THE SHIP IS EQUIPPED WITH ADEQUATE DECK TIEDOWN FITTINGS.

Figure 6-2. Typical blocking and tiedown of the M9 ACE in a general cargo vessel.

Table 6-1. Bill of Materials for Blocking and Tiedown of an M9 ACE in the Hold of a General Cargo Vessel

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight grain, free from material defects; Fed Spec MM-L-751H: 4- x 6-inch	65 linear feet
Nails	Common, steel; flathead, bright or cement-coated; para 3.6.11.2, Fed Spec FF-N-105B: 20D 60d	60 40
Wire rope	Type I, general purpose; class 2, 6 x 19, improved plow steel, wire strand care or IWRC: Fed Spec RR-W-410: 5/8-inch	100 feet
Clamps	Wire rope, U-bolt clips, saddled, single-grip, forged steel, Crosby heavy-duty, or equal; Fed Spec FF-C-450D: 5/8-inch	16

Table 6-2. Application of Materials for Blocking and Tiedown of an M9 ACE in the Hold of a General Cargo Vessel (Fig 6-2)

Item	No. Required	Application
A	2	<i>Side blocking.</i> Each consists of one piece of 4- x 6-inch x length-cut-to-fit lumber. Place one piece on each side of vehicle against vehicle treads.
B	2	<i>End Mocking.</i> Each consists of one piece of 4- x 6-inch x length-cut-to-fit lumber. Place on top of item A, against vehicle treads. Toenail to item A.
C	4	Backup cleats, 4- x 6- x 12-inch lumber. Place on top of item A, against item B. Toenail to item A.
D	4	Cleats, 4 x 6- x 24-inch lumber. Place against item A and secure to side blocking with ten 20d nails.
E	4	Wire rope, 5/8-inch. Run each cable, in a complete loop, through vehicle tiedown shackle and deck padeye. Ensure sufficient overlap for clamps.
F	16	Clamps, 5/8-inch. Place four clamps over each cable loop overlap area and space 3-1/2 inches apart with a minimum of 6 inches from ends of cable.

e. Special Design. Seatrain trailer vessels, RORO vessels, landing ships, and attack cargo vessels are equipped with patented lashing gear and pre-positioned fittings in the deck. This on-board restraint equipment is considered adequate for the M9 ACE, and no further blocking or bracing is required.

6-5. Barges and Lighters

When the M9 ACE is moved by barge or similar lighterage to or from vessels secured to piers or at a sheltered anchorage, blocking and chocking materials will be required. When the M9 ACE is

moved for extended distances or through rough waters, tiedown restraints must also be used.

6-6. Landing Ships, Landing Craft, and Amphibious Vehicles

When the vehicle is moved for extended distances or through rough waters, blocking and tiedowns must be used. In most cases, the vessels are equipped with turnbuckles with a sheep's foot on one end that fits into a deck cloverleaf. If these materials are not provided, a suitable substitute may be used.

CHAPTER 7

RAIL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

7-1. Scope

This chapter provides rail transportability guidance for movement of the M9 ACE. It covers technical and physical characteristics and safety concerns and prescribes the materials and guidance required to prepare, load, tie down, and unload the vehicle.

7-2. Maximum Utilization of Railcars

Additional cargo, as approved by the activity offering the items for transport, may be transported with the vehicle. The minimum width of the railcar should be 10 feet 4 inches.

Section II. TRANSPORT ON CONUS RAILWAYS

7-3. General

The transportability guidance contained in this section is applicable when the vehicle is transported on CONUS railways. Consideration is given to single and multiple movements of this vehicle by the types of flatcars normally used. The vehicle, when loaded on a suitable flatcar, can be transported without sectionalization or major disassembly.

10 feet 4 inches are shown in figures 7-1 through 7-3. The type of blocking and tiedown depicted is compatible with standard loading practices and provides adequate restraint against the forces encountered during movements at normal speeds.

c. Table 7-1 is the bill of materials for blocking and tiedown of an M9 ACE. Table 7-2 provides data for the application of materials required to restrain the vehicle.

7-4. Preparation for Loading

The dozer blade side extensions must be removed to reduce the width of the vehicle. The operator's enclosure and engine exhaust stacks must be removed to reduce the height.

NOTE

The parking brake must be set and the transmission placed in neutral.

7-5. Loading of the M9 ACE on General-Purpose Flatcars

a. A crane may place the vehicle in the tiedown position on the railcar, approximately centered, or the vehicle may be driven or towed aboard if a suitable ramp or bridge is available. When the vehicle is loaded by crane, the procedures and precautions outlined in paragraph 6-4b will be observed. Once the vehicle is loaded on the railcar, but before it is tied down, relieve the hydraulic pressure to allow the vehicle to settle.

b. Typical loading diagrams of an M9 ACE on a general-purpose flatcar with a minimum width of

General Instructions

Loading rules 1, 2, 3, 4, 5, 9, 10, 11, 14, 15, 19, and 19A, appearing in section 1 of the *General Rules Governing the Loading of Commodities on Open-Top Cars*, published by the Association of American Railroads, provide applicable guidelines and are mandatory in application.

7-6. Transport of the M9 ACE on 54-foot DODX Flatcars

a. The procedures in paragraphs 7-4 and 7-5 apply.

b. When two vehicles are transported on a 54-foot DODX flatcar, the vehicles should be spaced to permit the correct blocking and bracing of each vehicle. (figs 7-1 through 7-3 and tables 7-1 and 7-2).

Section III. TRANSPORT ON FOREIGN RAILWAYS

7-7. General

The transportability guidance contained in this section is applicable when the M9 ACE is transported on foreign railways. Consideration is given to single and multiple movements of this vehicle

by the types of flatcars normally used. When loaded on a proper flatcar in reduced configuration (para 7-4), the vehicle is suitable for generally unrestricted rail movement throughout Europe and also in all countries worldwide that use standard- or wide-gauge track. The vehicle is

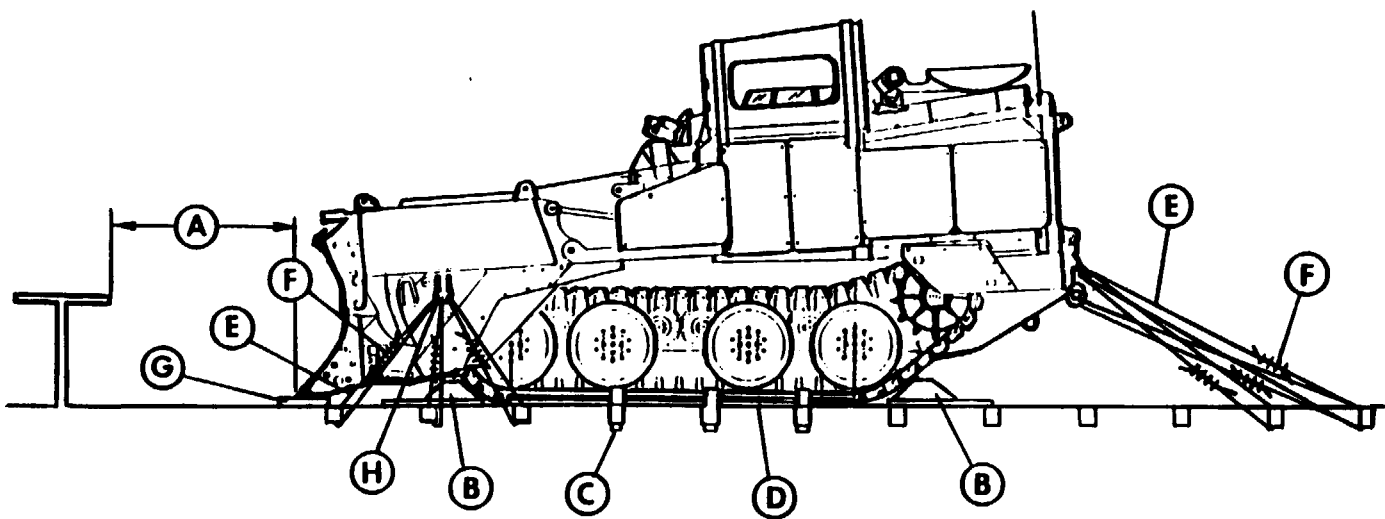


Figure 7-1. Side view of the M9 ACE, loaded and restrained on general-purpose flatcar.

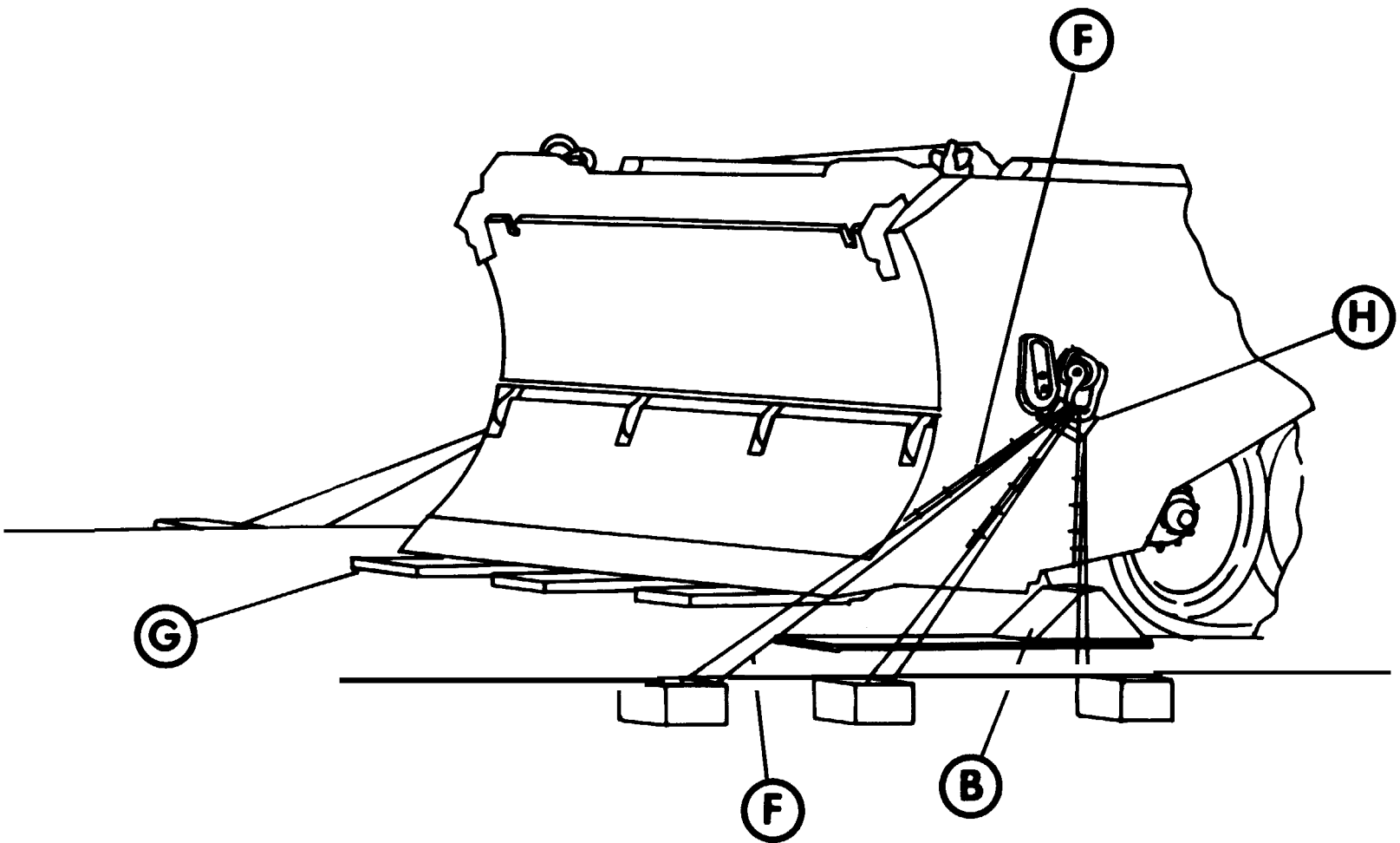


Figure 7-2. Front view of the M9 ACE blocking and restraints on general-purpose flatcar.

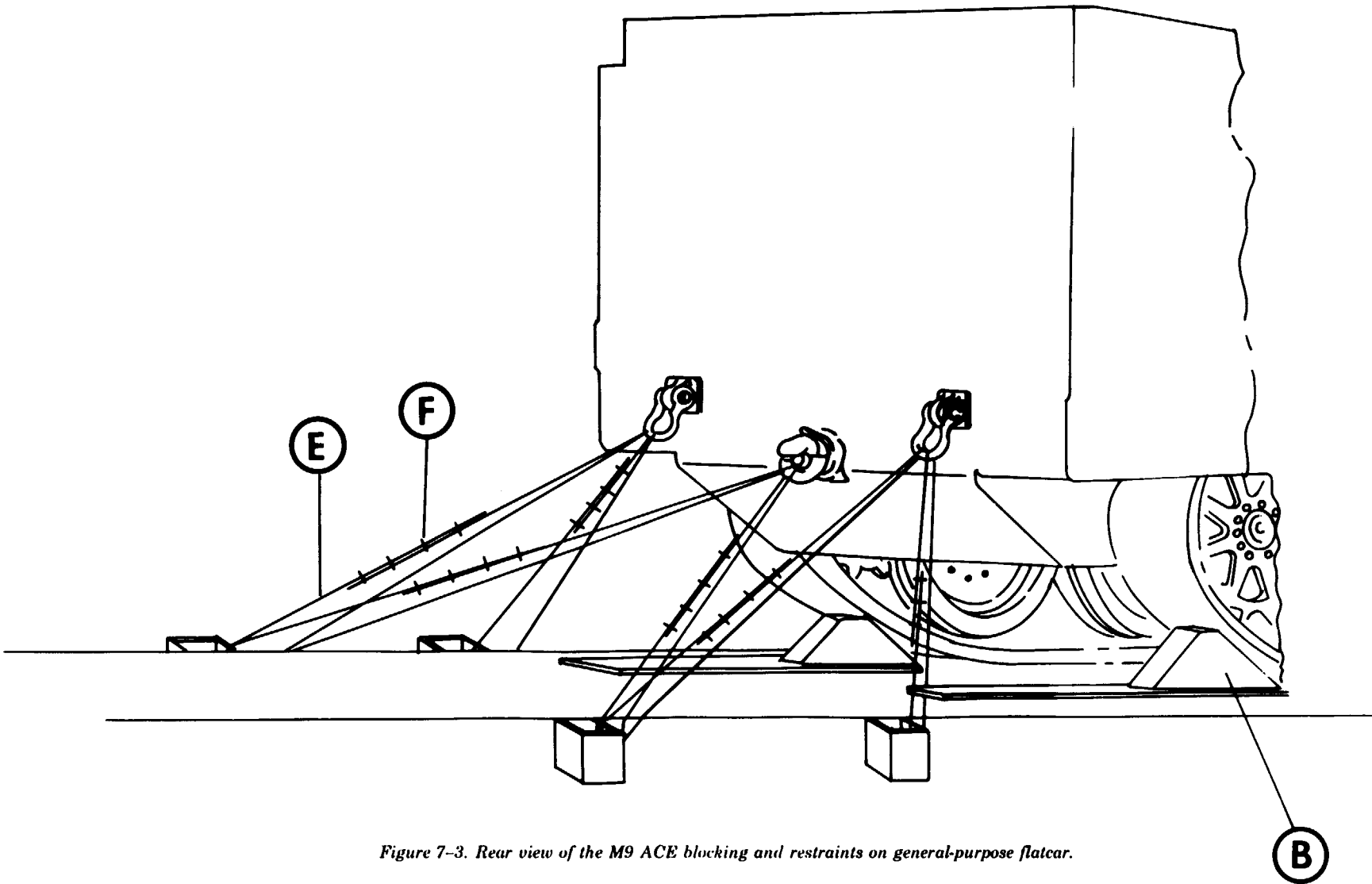


Figure 7-3. Rear view of the M9 ACE blocking and restraints on general-purpose flatcar.

Table 7-1. Bill of Materials for Blocking and Tiedown of an M9 ACE on a General-Purpose Flatcar

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight grain, free from material defects; Fed Spec MM-L-751H: 2-inch x width-to-suit 2- x 8-inch 3- x 4-inch 4- x 6-inch 6- x 8- x 24-inch Side stakes, 18 inches long, sized to fit	40 linear feet 16 linear feet 26 linear inch 10 linear feet 4 blocks 6 stakes
Nails	Common, steel; flathead, bright or cement-coated; para 3.6.11.2, Fed Spec FF-N-105B: 20d 30d	82 20
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; table X, Fed Spec RR-W-410: 5/8 inch	90 feet
clamps	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty or equal; MIL-STD-16842: 5/8-inch	48
Thimbles	Standard, open-type: 5/8-inch	2

Table 7-2. Application of Materials for Blocking and Tiedown of an M9 ACE on a General-Purpose Flatcar

Item	No. Required	Application
A		<i>Brake-wheel clearance.</i> Minimum clearance required is 6 inches above, in back of, on both sides of, and 4 inches underneath wheel.
B	4	<i>Chock blocks.</i> Each to consist of 6- x 8- x 24-inch block cut 45 degrees on one end and 35 degrees on the other end. Nail each block to a 2- x 8- x 47-inch piece of lumber with eight 20d nails so that two blocks will have the 35 degree end forward, and two blocks will have the 45 degree end forward. Place the 45 degree end under the front treads and the 35 degree end under the rear treads. Nail to car floor with eight 20d nails.
C	3 each side of vehicle	Side stakes, 18 inches long, sized to fit stake pocket. Extend clamps 2 inches below stake pocket and 8 inches above car floor. Locate in the stake packets nearest the center of the vehicle.
D	1 each side of vehicle	<i>Side blocks.</i> Each to consist of two pieces of 2-inch x width-to-suit x 10-foot lumber. Locate against crawler treads, centered along ground contact length. Secure both pieces to floor with ten 30d nails.
E	12	<i>Wire rope, 5/8-inch.</i> In a complete loop, apply from pintle through front and rear shackles to side stake pockets as, indicated in figures 7-1 through 7-3. Place thimbles at the bottom of each stake pocket and through each shackle. Overlap wire rope at least 24 inches.
F	48	<i>Clamps, 5/8-inch.</i> Fasten each wire rope with four clamps spaced about 3-1/2 to 4 inches apart.
G	3	Cribbing, 4- x 6- x 37-inch, solid block of lumber. Place under dozer blade. Nail each block to car floor with six 20d nails.
H	2	Spacer, 3- x 4- x 13-inch solid block of lumber. Place under forward shackles to prevent cables from passing over sharp edges of metal pad that protrudes from vehicle,

within the limits for width and height of the passe-partout international (PPI) gauge railways. Transport of the vehicle on narrow-gauge foreign rail lines may result in restricted movement since the vehicle exceeds the clearance envelopes of these lines. Therefore, special routing may result in those countries serviced by narrow-gauge rail lines.

7-8. Transport on Foreign-Service Flatcars

a. General. The vehicle can be transported on

some foreign-service flatcars. Flatcars representative of those in Europe that are available and suitable for transporting the vehicle are described in table 7-3.

b. Materials. The materials required for blocking and tiedown of the vehicle on foreign-service flatcars are essentially the same as those used for transporting the vehicle within CONUS. Detailed guidance is contained in the 4th Transportation Command Pamphlet 55-2, *Tiedown Guide for Rail Movements*.

Table 7-3. Characteristics of European Flatcar Availale for Transporting Vehicles

Flatcar Designation	Capacity	Length	Width	Platform Height
RLMMP 700	57.3 ton (52.00 MT)	31 feet 2 inches (9.50 m)	10 feet 4 inches (3.15 m)	4 feet 2-3/4 inches (1.29 m)
SAMMS 710	71.63 ton (65.00 MT)	49 feet 3 inches (15.01 m)	10 feet 2 inches (3.10 m)	4 feet 2-3/4 inches (1.29 m)

APPENDIX A

REFERENCES

A-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
55-228	Transportation by Water of Explosives and Hazardous Cargo
55-355	Military Traffic Management Regulation
70-44	DOD Engineering for Transportability
385-40	Accident Reports and Records
746-1	Packaging of Army Materiel for Shipment and Storage

A-2. Field Manuals (FM)

5-34	Engineer Field Data
5-36	Route Reconnaissance and Classification
55-9	Unit Air Movement
55-13	Transportation Reference Data
55-17	Terminal Operations Coordinator's Handbook

A-3. Supply Bulletin (SB)

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

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

5-2350-262-10	Operator's Manual, Armored Combat Earthmover, M9
38-250 (AFR 71-4)	Packaging and Materials Handling: Preparation of Dangerous Materials for Transportation by Military Air Shipment
55-500	Marine Equipment Characteristics and Data
55-2200-001-12	Transportability Guidance for Application of Blocking, Bracing, and Tiedown Materials for Rail Transport
5-2350-262-20	M9 ACE Unit Maintenance Manual
11-5820-401-10-1	Antenna Manual

A-6. Technical Orders (TO) (Air Force)

1-1B-40	Handbooks of Weight and Balance Data
1C-130A-9	Loading Instructions, USAF Series C-130 Aircraft

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1C-141B-9 Loading Instructions, USAF Series C-141 Aircraft

1C-5A-9 Loading Instructions, USAF Series C-5 Aircraft

A-7. Other Publications and Source of Procurement

- a. *Code of Federal Regulations*, Title 49- Transportation, Parts 170–179. Available from:
Superintendent of Documents
US Government Printing Office
Washington, DC 20402

b. Association of American Railroads *Rules 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

Available from: Association of American Railroads

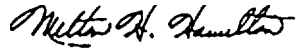
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