

TECHNICAL MANUAL

TRANSPORTABILITY GUIDANCE
TRUCK, CARGO, 1-1/4-TON, 6X6, M561
(FSN 2320-873-5407)

HEADQUARTERS DEPARTMENT OF THE ARMY
OCTOBER 1973

TECHNICAL MANUAL

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WASHINGTON, D.C., 31 October 1973**TRANSPORTABILITY GUIDANCE
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CHAPTER 1 INTRODUCTION

1-1. Purpose and Scope

This manual provides transportability guidance for logistic handling and movement of the truck, cargo, 1 1/4-ton, 6x6, M561, also referred to as the Gama Goat. It provides transportation officers down to division level and other personnel engaged in or responsible for movement or providing transportation services with information considered appropriate to safe transport. Significant technical and physical characteristics as well as safety considerations required for worldwide movement by the various modes of transportation are included. When considered necessary, metric

equivalents are given in parentheses following the dimensions, weights, or other measurements.

1-2. Description

The M561 is a light-weight, dual-bodied (tractor and carrier), articulated, six-wheel vehicle of aluminum-unitized construction with selected compartments filled with polyurethane foam (fig. 1-1). It swims, using its wheels for propulsion. It is normally a cargo/personnel carrier but can be converted to an ambulance, M792. The vehicle bodies are equipped with lifting rings, body tiedown fittings, cargo tiedowns, tow

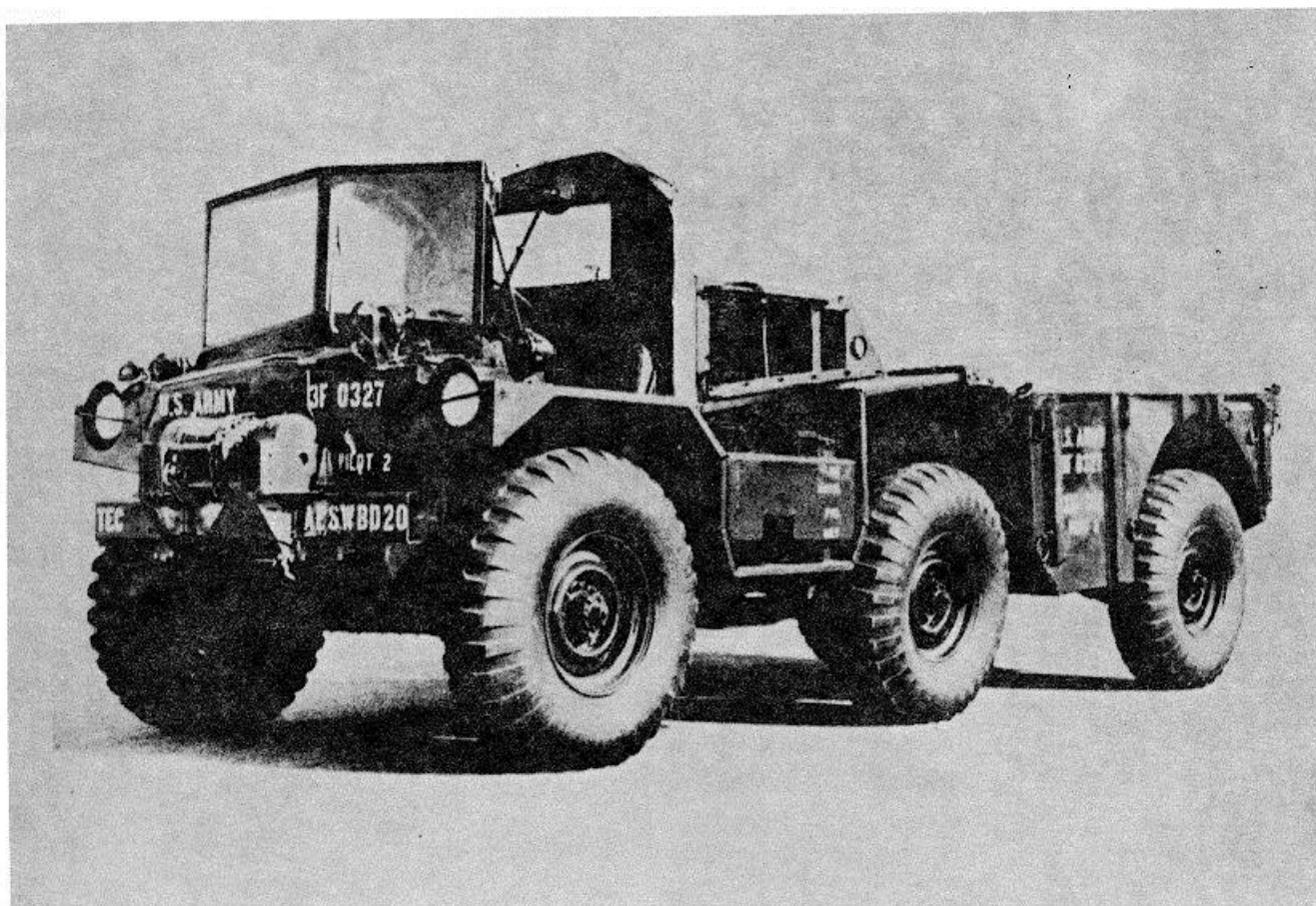


Figure 1-1. Truck, cargo, 1 1/4 ton, 6x6, M561.

ing shackles, and a towing pintle. The mechanically coordinated steering of the front and rear wheels provides a short turning radius and gives the operator full control of the vehicle. An 8,000pound-capacity winch kit, designed for mounting in the front of the tractor, where it is secured to the towing support brackets, is available.

1-3. Reporting of Recommendations and Comments

The reporting of errors, omissions, and recommendations for improving the manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded to Director, US Army Transportation Engineering Agency, Military Traffic Management and Terminal Service, ATTN: MTT-GDP, P.O. Box 6276, Newport News, Virginia 23606.

1-4. Safety

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

1-5. Definitions of Warnings, Cautions, and Notes

Throughout this manual, warnings, cautions, and notes emphasize important or critical guidance. They are used for the following conditions:

a. *Warning.* An operating procedure or practice that, if not correctly followed, could result in personal injury or loss of life.

b. *Caution.* An operating procedure or practice 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.

CHAPTER 2

TRANSPORTABILITY DATA

Section I. GENERAL

2-1. Scope

This chapter provides a drawing and data and characteristics of the M561 that are necessary for determining the loadability of the vehicle for movement by various transportation modes.

2-2. Dimensional Drawing

Figure 2-1 is a dimensional drawing of the M561.

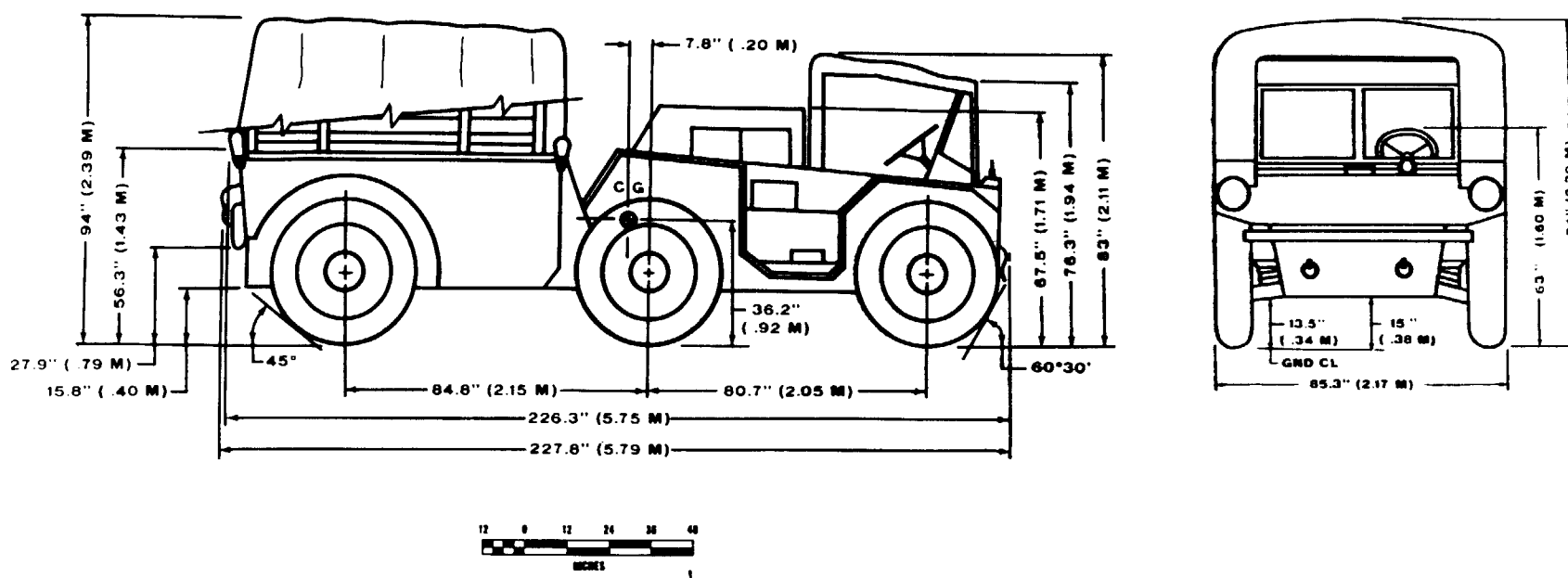


Figure 2-1. Side and end elevation of truck, cargo, M561.

Section II. CHARACTERISTICS AND RELATED DATA

2-3. General Transportability Characteristics

Data contained herein are applicable to vehicles having the model number and Federal Stock Number (FSN) shown. Vehicles having a different model number or FSN may have characteristics that will affect the loadability to an extent that the guidance shown in this manual will not apply. If weights or measurements are

critical factors for transportability purposes, each vehicle should be weighed and/or measured.

Truck, cargo, 1 1/4-ton, 6x6, M561.
Federal Stock Number: 2320-873-5407
Line item number: X39940
Type classification: Standard A

	<i>Without Winch</i>	<i>With Winch</i>
Measurements:		
Length, Operational	227.8 in. (5.79 m)	232.6 in. (5.91 m)
Length, Reduced*	226.3 in. (5.75 m)	231.1 in. (5.87 m)
Width**	85.3 in. (2.17 m)	85.3 in. (2.17 m)
Height, Operational	94.0 in. (2.39 m)	94.0 in. (2.39 m)
Height, Reduced***	67.5 in. (1.71 m)	67.5 in. (1.71 m)
Volume	1,057 cu ft (29.91 cu m)	1,084 cu ft (30.68 cu m)
Volume, Reduced***	754 cu ft (21.34 cu m)	770 cu ft (21.79 cu m)
Curb Weight:		
Front Axle	2,430 lb (1,103 kg)	3,030 lb (1,375 kg)
Center Axle	2,915 lb (1,322 kg)	2,785 lb (1,263 kg)
Rear Axle	1,665 lb (755 kg)	1,665 lb (755 kg)
Total	7,010 lb (3,180 kg)	7,480 lb (3,393 kg)
Weight Distribution With Payload and Crew:		
Front Axle	2,670 lb (1,211 kg)	3,340 lb (1,515 kg)
Center Axle	3,785 lb (1,717 kg)	3,560 lb (1,615 kg)
Rear Axle	3,455 lb (1,567 kg)	3,480 lb (1,579 kg)
Gross Weight	9,910 lb (4,495 kg)	10,380 lb (4,709 kg)
Payload and Crew	2,900 lb (1,315 kg)	2,900 lb (1,315 kg)
Towed Load Allowance	6,200 lb (2,812 kg)	6,200 lb (2,812 kg)
Center of Gravity (Based on Rated Payload)		
Above Ground	36.2 in. (0.92 m)	36.2 in. (0.92 m)
From Rear of Center Line		
Center Axle	7.8 in. (0.20 m)	2.5 in. (0.06 m)

*With pioneer tools removed from tailgate bracket.

**Over top of center wheels.

***With canopies, bows, and side racks removed, and windshield lowered.

Vehicle Classification: Unloaded (Curb Weight and Crew)		3
Loaded (Payload and Crew)		4
Turning Radius.....		29 ft (8.84 m)
Angle of Approach		60° 30'
Angle of Departure.....		45°
Tire Size		11.00 x 18 (0.28 x 0.46 m), 6-ply
Tire Pressure:		
Highway	22 psi (1.55 kg/sq cm)	
Cross-Country	18 psi (1.26 kg/sq cm)	
Snow	12 psi (0.84 kg/sq cm)	

NOTE

When shipping M561 there should be 32 pounds per square inch of air pressure in tires.

Maximum Speed: Land	55 mph (88 km/ph)
Water	2.5 mph (5 km/ph)

2-4. CONUS Freight Classification

Rail and motor freight classification descriptions and item numbers will be determined in accordance with chapter 211, AR 65-355 and the Freight Classification

Guide System. Proper classification and/or description of the vehicle must be determined and provided on the bill of lading before the shipment is released to the carrier.

CHAPTER 3 SAFETY

3-1. General

General safety considerations and precautions for lifting, moving, and securing the item are as follows:

- a. Do not leave vehicle unattached while engine is running.
- b. Do not smoke or allow open flames in area while performing service to fuel system.
- c. Exercise extreme care when removing radiator cap if temperature gauge reads above 180 degrees Fahrenheit.
- d. Check vehicle to insure that all loose items are secured.
- e. When backing the vehicle, insure that no personnel or obstructions are behind it.

f. Exercise extreme caution during towing operations of disabled vehicles. The towing shackles or pintle hook are to be used for all towing operations.

g. Do not allow any part of a pushing vehicle to make contact with the carrier tailgate. This could result in bending or damage to the tailgate causing it to leak in any subsequent swimming operation.

h. Do not walk under the vehicle when it is being lifted by crane or other means.

i. Insure that proper ventilation is provided when loading and unloading. Prolonged exposure to carbon monoxide fumes will produce adverse effects that may prove fatal.

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

Section I. GENERAL

4-1. Scope

This chapter provides air transportability guidance for movement of the M561. It covers significant technical and physical characteristics; safety considerations; and manpower, materials, and time required to prepare, load, tie down, and unload the vehicle on US Army and US Air Force aircraft.

4-2. Maximum Utilization of Aircraft

The loads described in this chapter are not maximum loads. Total cargo loads and operating ranges in nautical miles are identified in AR 70-39. Additional cargo and/or personnel within allowable load limits and restrictions prescribed by pertinent safety regulations (app) can be transported.

4-3. Applicability

a. The M561 can be transported without sectionalization by US Air Force C-130, C-141, and C-5 aircraft.

b. The M561 is too large and/or heavy for external or internal movement by US Army fixed wing aircraft; however, when sectionalized, it can be transported externally and internally by US Army CH-47 and CH-54 helicopters.

c. The data contained herein on external transport of the M561 by the CH-47 helicopter are also applicable to the CH-54 helicopter.

4-4. Aircraft Commander Responsibilities

The aircraft commander or his representative is responsible for insuring that the load is secured in accordance with restraint criteria outlined in the applicable aircraft T.O. IC-XXXX-9.

4-5. Safety

In addition to the safety precautions contained in chapter 3, the following should be noted:

a. The vehicle fuel tanks must not be more than three-fourths full.

b. Each vehicle must be checked carefully to insure that all loose items are properly secured.

Nylon cord of 550-pound capacity can be used to secure loose items.

c. Fire extinguishers must be readily available during all loading and unloading operations.

d. Proper ventilation must be provided when loading and unloading. Prolonged exposure to carbon monoxide fumes may be fatal.

e. Vehicles must not exceed speed of 3 miles per hour inside airplane or helicopter or on the loading ramps.

f. The required number of tiedowns plus their capacity must be checked and the criteria for gravity forces adhered to.

4-6. Preparation of Vehicle

a. Internal or External Helicopter Loading. The vehicle must be reduced to its minimum configuration.

(1) Remove frame assembly and canopy from tractor and stow on the engine cover.

(2) Remove windshield assembly and stow in stowage compartment in engine cover.

(3) Remove canopy and bows from carrier and stow in carrier.

b. Internal Loading in US Air Force Aircraft. Remove lockout truss if installed and stow in vehicle before loading into aircraft.

Section II. TRANSPORT BY US ARMY AIRCRAFT

WARNING

The high noise level of helicopter turbine engines can cause permanent damage to the ear.

Personnel working in the vicinity will wear earplugs and avoid entering engine noise-danger area. External cargo

hookup personnel will wear goggles and protective headgear (hard hat/steel helmet) or flight helmet.

WARNING

Always assume that a charge of static electricity is present on the helicopter. Use of some type of discharge apparatus (fig 4-1, TM 55-450-19) to ground the hook and discharge electricity is necessary to prevent shock when the hook is touched. After discharge of electricity, the hook is grasped quickly and firmly and held, if possible, until the hookup is completed. If contact with the hook is lost after initial grounded again before it is touched. Do not use the M561 as X ground contact. After air delivery and before handling, again ground the load to discharge any accumulated /retained static electricity.

CAUTION

Caution should be exercised in transporting external cargo, as flight may be affected by size, weight, and shape of the cargo load. The recommended airspeed with each load is between 70 and 80 knots depending on the weight of the load. Higher speeds cause load instability.

NOTE

The lockout truss when installed between the tractor and carrier immobilizes the tractor and carrier by preventing movement in any direction thereby insuring protection to the articulation system when the vehicle is being lifted at the lifting points.

NOTE

The hookup team must stand on the M561 to grasp the helicopter cargo hook and place the 10-inch sling on the hook. Positive control and coordination are required to accomplish hookup and to insure that the pilot allows time for the hookup team to clear the M561 before lift-off.

4-7. External Load Descriptions on CH-47 Helicopter

The M561 loads are rigged for external transport with and without the lockout truss kit installed 4-2 between the tractor and carrier. Descriptions of the loads and slings used are as follows:

- a. Load 1-External Air Transport of the M561 Without Lockout Truss Kit, Using 15,000-PoundCapacity Multileg (Chainleg) Sling Set.
- b. Load 2-External Air Transport of the M561 With Lockout Truss Kit, Using 15,000-PoundCapacity Multileg (Chainleg) Sling Set.
- c. Load 3-External Air Transport of the M561 Without Lockout Truss Kit, Using Aerial Delivery Cargo Equipment.
- d. Load 4-External Air Transport of the M561 With Lockout Truss Kit, Using Aerial Delivery Cargo Equipment.
- e. Load 5-External Air Transport of the M561 Without Lockout Truss Kit, Using Universal Cargo Sling Set.
- f. Load 6-External Air Transport of the M561 With Lockout Truss Kit, Using Universal Cargo Sling Set.
- g. Load 7-Internal Air Transport of the M561 Without Lockout Truss Kit in US Army CH-47 Helicopter.
- h. Load 8-Internal Air Transport of the M561 Without Lockout Truss Kit in US Army CH-54 Helicopter Pod.

4-8. Load 1-External Air Transport of the M561 Without Lockout Truss Kit, Using 15,000-Pound-Capacity Multileg (Chainleg) Sling Set (Fig 4-1)

- a. Materials.
 - (1) Two-inch pressure-sensitive tape (FSN 8135-558-5016), as required.
 - (2) One 15,000-pound-capacity multileg (chainleg) sling set (FSN 1670-902-3080).
 - (3) 550-pound-capacity nylon cord, natural, type-III (FSN 4020-240-2146), as required.
- b. Personnel.
 - (1) Two men can rig the load in 20 minutes.
 - (2) Two men can derig the load in 10 minutes.
- c. Rigging procedures.
 - (1) Attach one chain to each of the lifting points of the vehicle and hook link number 5 (counted from webbing) in the grab link.
 - (2) Cluster and tape sling legs (breakaway technique) to prevent fouling during lift-off.

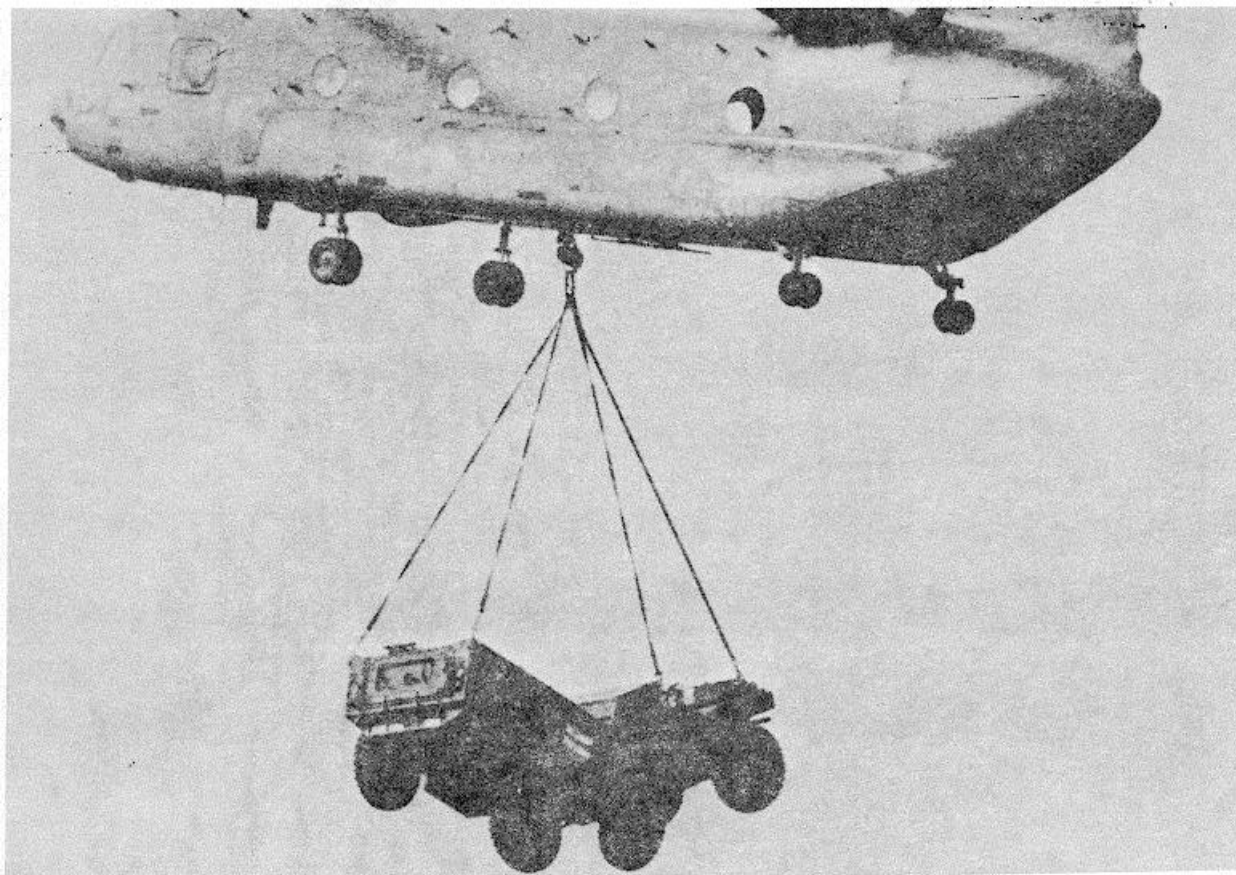


Figure 4-1. Load 1-external air transport of the M561 without lockout truss kit, using 15,000-pound-capacity multileg (chainleg) sling set.

4-9. Load 2-External Air Transport of the M561 With Lockout Truss Kit, Using 15,000-Pound-Capacity Multileg (Chainleg) Sling Set (Fig 4-2)

NOTE

Load 2 (fig. 4-2) is rigged the same way as load 1.

4-10. Load 3-External Air Transport of the M561 Without Lockout Truss Kit, Using Aerial Delivery Cargo Equipment (Fig 4-3)

a. Materials.

- (1) Two-inch pressure-sensitive tape (FSN 8135-558-5016), as required.
- (2) 550-pound-capacity nylon cord, natural, Type-III (FSN 4020-240-2146), as required.
- (3) Four 12-foot, 3-loop aerial delivery cargo slings (FSN 1670-823-5041).

(4) One 3-foot, 3-loop aerial delivery cargo sling (FSN 1670-753-3788).

(5) One Type-IV link assembly (FSN 1670783-5988).

b. Personnel.

- (1) Two men can rig the load in 20 minutes.
- (2) Two men can derig the load in 10 minutes.

c. Rigging Procedures.

- (1) Attach one 12-foot sling to each of the lifting points of the vehicle by using a choker hitch.
- (2) Twist all sling legs one turn per 3 feet of sling, and attach the free ends of each 12-foot sling to the 3-foot sling.
- (3) Connect the free ends of the 3-foot sling with a Type-IV link to form a ring for attachment to the helicopter hook.
- (4) Cluster and tape sling legs (breakaway technique) to prevent fouling during lift-off.

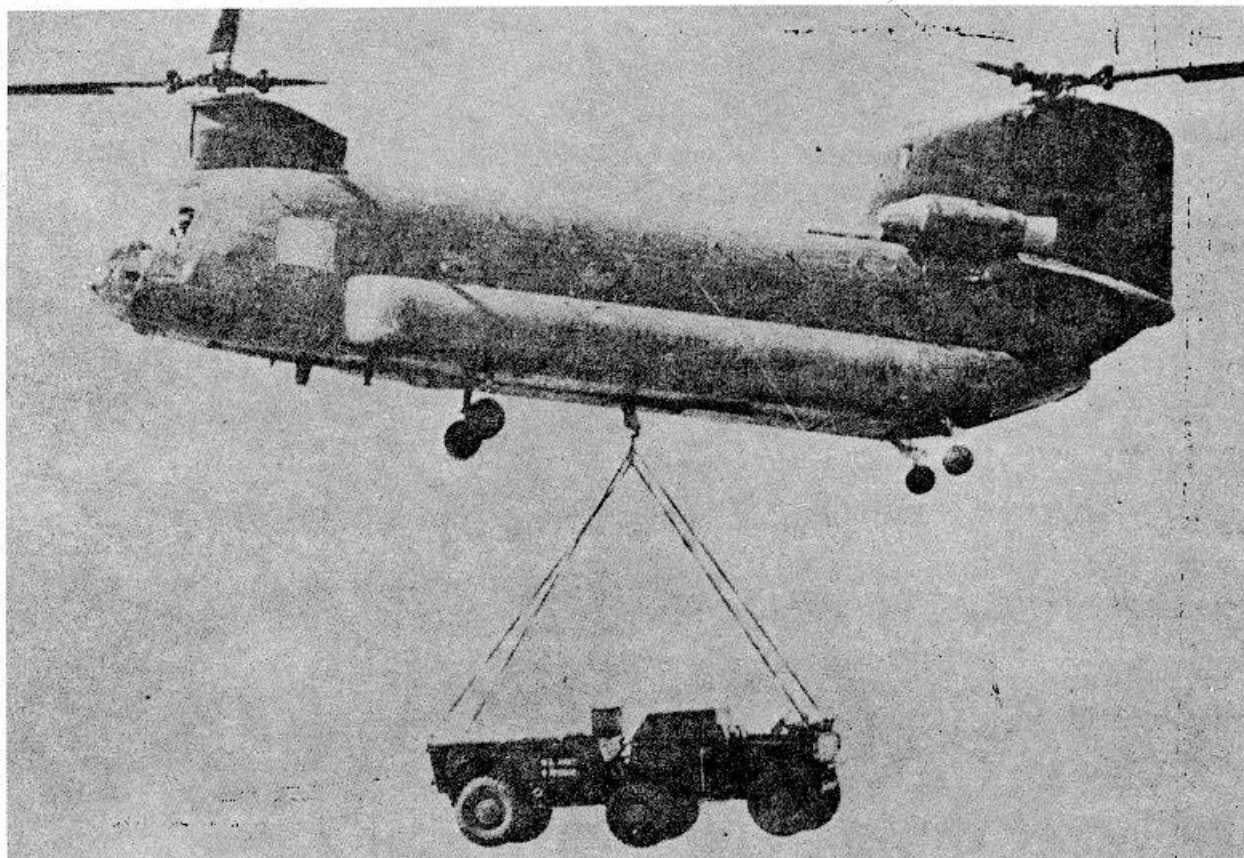


Figure 4-2. Load 2-external air transport of the M561 with lockout truss kit, using 15,000-pound-capacity multileg (chainleg) sling set.

4-11. Load 4-External Air Transport of the M561 With Lockout Truss Kit, Using Aerial Delivery Cargo Equipment (Fig 4-4)

NOTE

Load 4 (fig 4-4) is rigged the same way as load 3 except that four 16-foot, 3-loop aerial delivery cargo slings are used in lieu of the 12-foot slings.

NOTE

Each sling-leg segment of this cargo sling consists of two 8-foot slings placed one upon the other.

a. Sling-leg 1. Basket-hitch a pair of 8-foot slings (1A) to the right front lifting point of the M561. Basket-hitch three pairs of 8-foot slings (1B, C, and D) successively from 1A.

b. Sling-leg 2. Basket-hitch a pair of 8-foot slings (2A) to the left front lifting point of the M561. Basket-hitch three pairs of 8-foot slings (2B, C, and D) successively from 2A.

c. Sling-leg 3. Basket-hitch a pair of 8-foot slings (3A) to the right rear lifting point of the M561. Basket-hitch three pairs of 8-foot slings (3B, C, and D) successively from 3A.

d. Sling-leg 4. Basket-hitch a pair of 8-foot slings (4A) to the left rear lifting point of the M561. Basket-hitch three pairs of 8-foot slings (4B, C, and D) successively from 4A.

e. Combine the free ends of sling legs 3 and 4 to form a single loop, and reverse-choker-hitch this loop to the 10-inch sling. Then attach legs 1 and 2 to the 10-inch sling in the same manner.

f. To prevent fouling of slings before hookup, wrap three turns of tape around each basket-hitch joint, top and bottom.

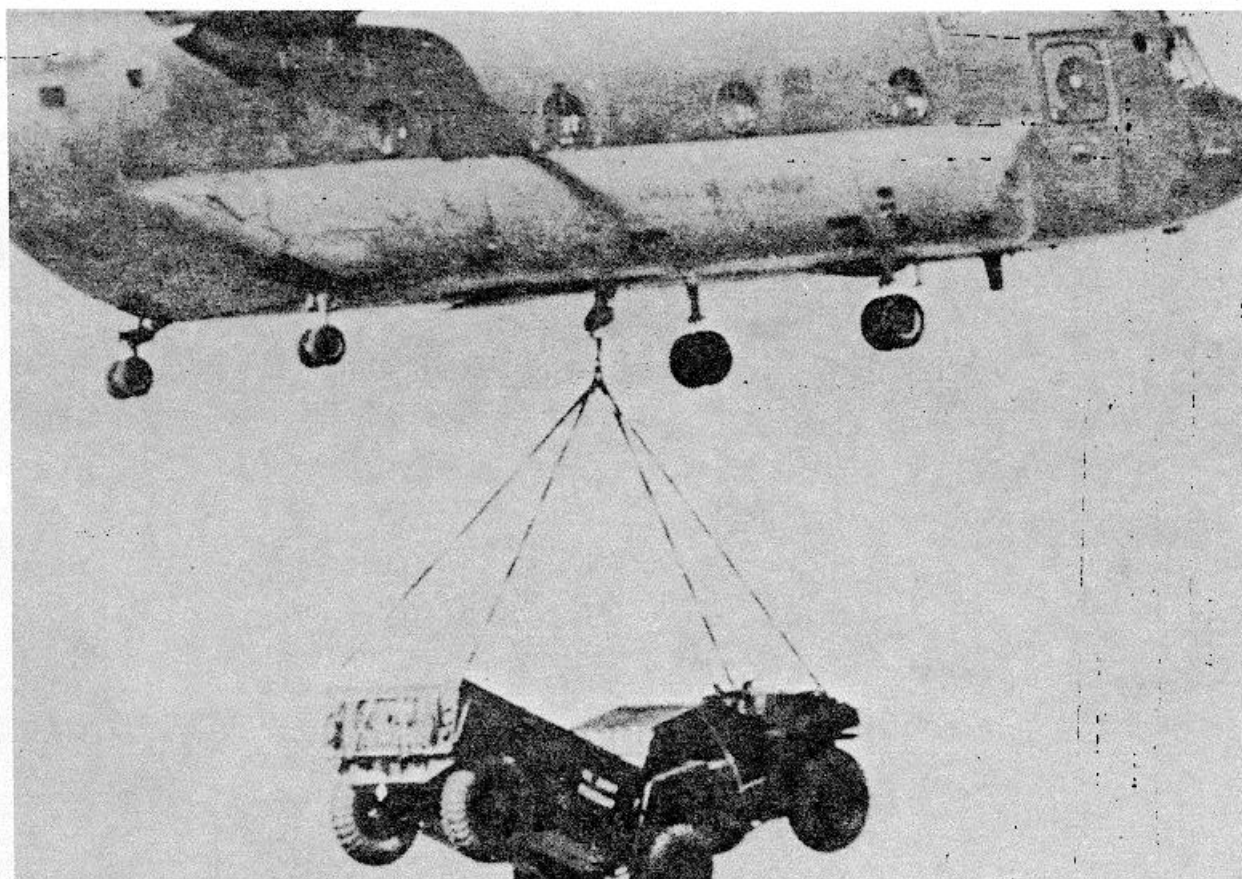


Figure 4-3. Load S-external air transport of the M561 without lockout truss kit, using aerial delivery cargo equipment.

4-12. Load 5-External Air Transport of the M561 Without Lockout Truss Kit, Using Universal Cargo Sling Set (Fig 4-6)

a. Materials.

- (1) Two-inch pressure-sensitive tape (FSN 8135-558-5016), as required.
- (2) 550-pound-capacity nylon cord, natural, Type-III (FSN 4020-240-2146), as required.
- (3) One 10-inch 10,000-pound-capacity universal cargo sling (FSN 3940-675-5001).
- (4) Thirty-two 8-foot universal cargo slings (FSN 3940-675-5003).

b. Personnel.

- (1) Two men can rig the load in 20 minutes.
- (2) Two men can derig the load in 10 minutes.

c. Rigging Procedures. The load is rigged using figure 4-5 as a guide.

4-13. Load 6-External Air Transport of the M561 With Lockout Truss Kit, Using Universal Cargo Sling Set (Fig 4-7)

NOTE

Load 6 (fig 4-7) is rigged the same way as load 5 (para 4-12).

4-14. Load 7-Internal Air Transport of the M561 Without Lockout Truss Kit in US Army CH-47 Helicopter (Fig 4-8)

a. Materials.

- (1) Parking shoring, two each-2, x 12-inch x 20-foot lumber.
- (2) 14 CGU-1/B tiedown devices (FSN 1670-725-1437).

b. Personnel.

- (1) Two men can accomplish loading and tiedown in 25 minutes.
- (2) Two men can unload the vehicle in 10 minutes.

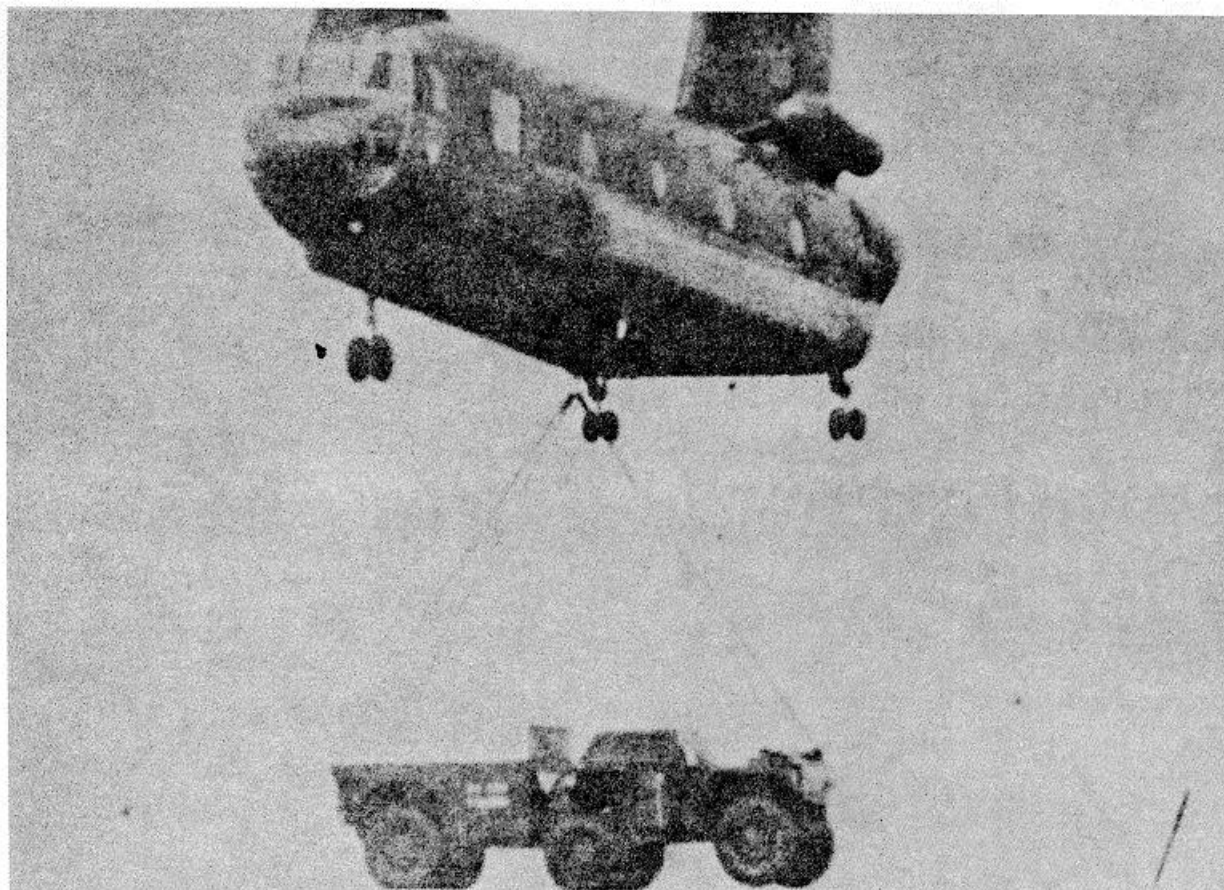


Figure 4-4. Load 4-external air transport of the M561 with lockout truss kit, using aerial delivery cargo equipment.

c. Loading Procedures.

(1) Place the parking shoring on each side of the cargo compartment to match the wheel width of the vehicle.

(2) Back the vehicle into the helicopter and onto the parking shoring to the location indicated in figure 4-8.

(3) Set brakes, place vehicle in gear, and tie down as indicated in figure 4-8 and table 4-1.

CAUTION

Side clearance is limited (vehicle width is 85.3 inches). Allowable lateral clearance of 5 inches is exceeded. A waiver must be obtained for loading M561 in CH-47 helicopter.

Table 4-1. Load 7-Tiedown Data for M561 in CH-47 Helicopter (Fig 4-8)

Tiedown fitting No.	Capacity of fitting in 1,000 lb	Type device	Attach to item
B1/D2	5	CGU-1/B	Right side, upper suspension arm
D1/B2	5	CGU-1/B	Left side, upper suspension arm
A1	5	CGU-1/B	Left rear tiedown clevis
E1	5	CGU-1/B	Right rear tiedown clevis
B3/D4	5	CGU-1/B	Right side through tractor jack pad
D3/B4	5	CGU-1/B	Left side through tractor jack pad
B6	5	CGU-1/B	Left front carrier tiedown ring
D5	5	CGU-1/B	Right front carrier tiedown ring
B7/D6	5	CGU-1/B	Right side, through tractor jack pad on A frame
D7/B6	5	CGU-1/B	Left side, through tractor jack pad on A frame

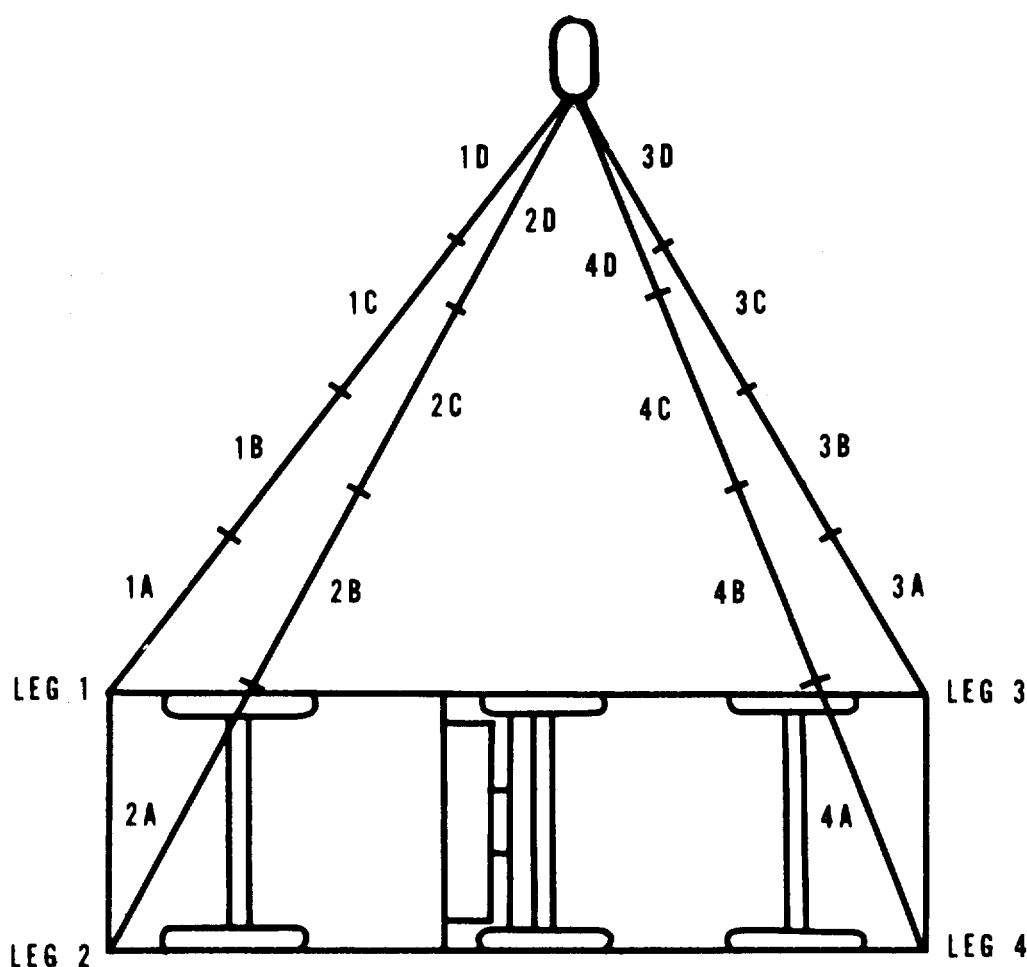


Figure 4-5. Diagram of the M561 rigged with universal cargo sling set.

Tiedown fitting No.	Capacity of fitting in 1,000 lb	Type device	Attach to item
B8/D9	5	CGU-1/B	Around right front tractor suspension arm
B9/D8	5	CGU-1/B	Around left front tractor suspension arm
B10	5	CGU-1/B	Left front tiedown clevis
D10	5	CGU-1/B	Right front tiedown clevis

4-15. Load 8-Internal Air Transport of the M561 Without Lockout Truss Kit in US Army CH-54 Helicopter Pod (Fig 4-9)

a. Materials.

(1) Parking shoring, two each-2x 12-inch x 20-foot lumber.

(2) 14 CGU-1/B tiedown devices (FSN 1670-725-1437).

b. Personnel.

(1) Two men can accomplish loading and tiedown in 25 minutes.

(2) Two men can unload the vehicle in 10 minutes.

c. Loading Procedures.

(1) Place the parking shoring on each side of the cargo compartment to match the wheel width of the vehicle.

(2) Back the vehicle into the pod and onto the parking shoring to the location indicated in figure 4-9.

(3) Set brakes, place vehicle in gear, and tie down as indicated in figure 4-9 and table 4-2.

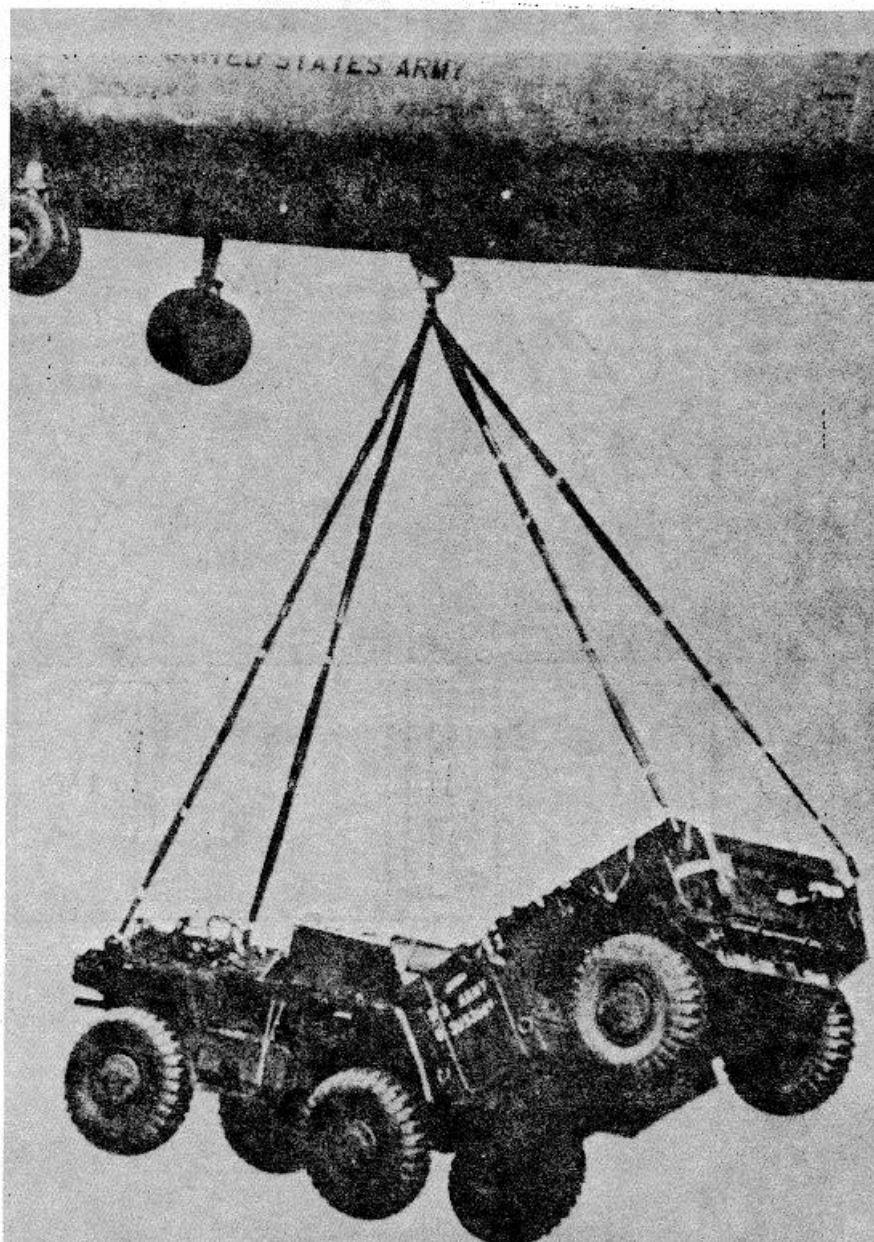


Figure 4-6. Load 5-external air transport of the M561 without lockout truss kit, using universal cargo sling set.

Table 4-2. Load 8-Tiedown Data for M561 in CH-54 Helicopter Pod (Fig 4-9)

Tiedown fitting No.	Capacity of fitting in 1,000 lb	Type device	Attach to item
B1/D2	5	CGU-1/B	Right side, over upper suspension arm
E1/C2	5	CGU-1/B	Left side over upper suspension arm
C1	5	CGU-1/B	Left side rear tiedown clevis
D1	5	CGU-1/B	Right side rear tiedown clevis
C3/D4	5	CGU-1/B	Right side through tractor jack pad on A frame
D3/C4	5	CGU-1/B	Left side through tractor jack pad on A frame
B5	5	CGU-1/B	Left front carrier tiedown ring
E5	5	CGU-1/B	Right front carrier tiedown ring
C6/E7	5	CGU-1/B	Left side through tractor jack
D6/B7	5	CGU-1/B	Right side through tractor jack

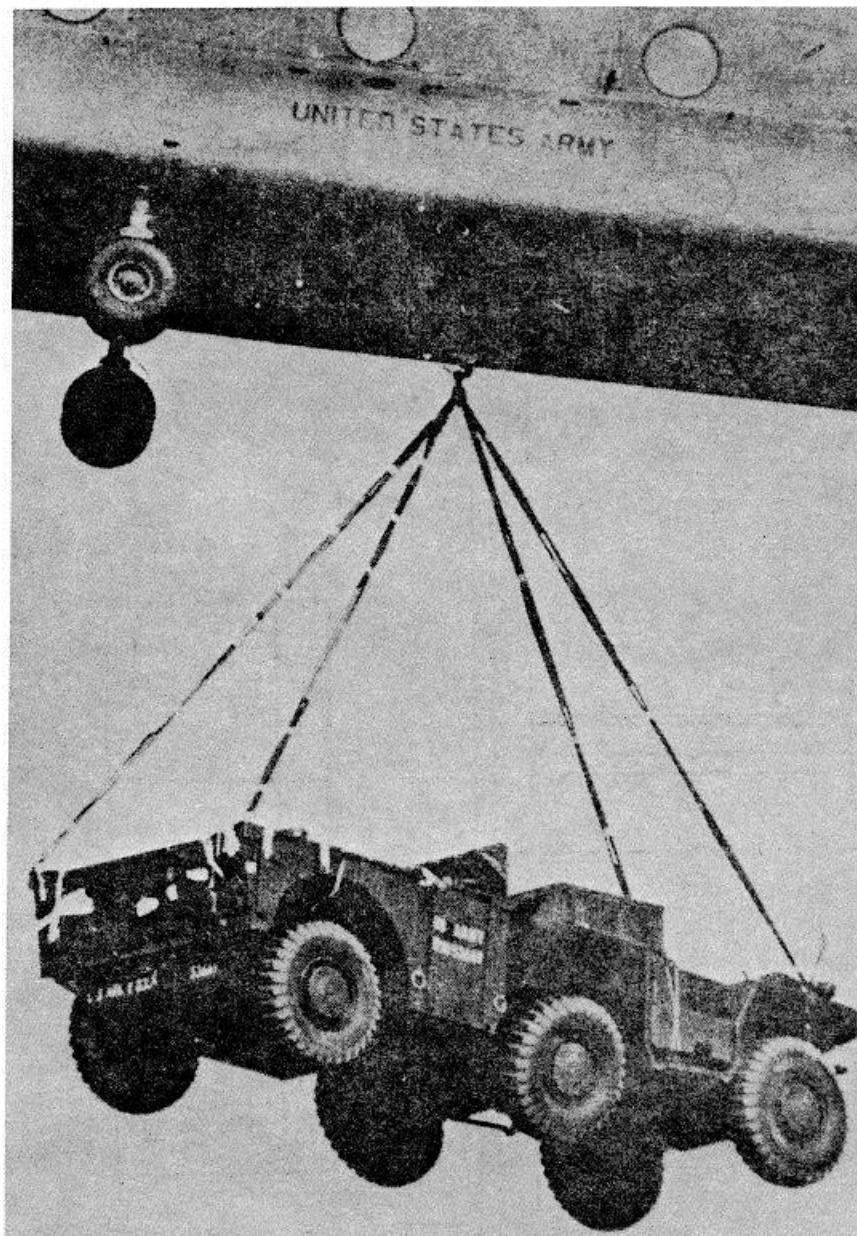
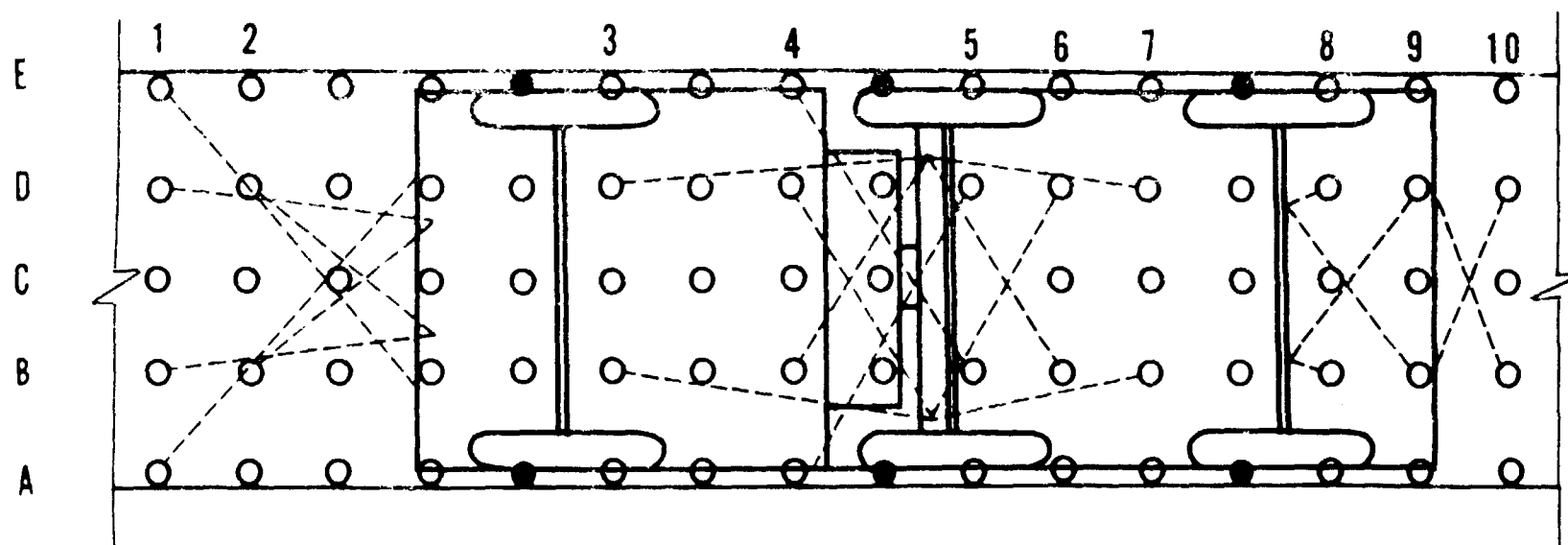


Figure 4-7. Load 6-external air transport of the M561 with lockout truss kit, using universal cargo sling set.

Tiedown fitting No.	Capacity of fitting in 1,000 lb	Type device	Attach to item
B8/C9	5	CGU-1/B	Around right front tractor suspension arm
E8/D9	5	CGU-1/B	Around left front tractor suspension arm
B9	5	CGU-1/B	Left front tiedown clevis
E9	5	CGU-1/B	Right front tiedown clevis



SYMBOL	○	●
STRENGTH OF FITTING AND BASIC LOAD DIRECTION	5,000-LB	10,000-LB
	ANY	ANY

Figure 4-8. Load 7-internal air transport of the M561 without lockout truss kit in US Army CH-47 helicopter.

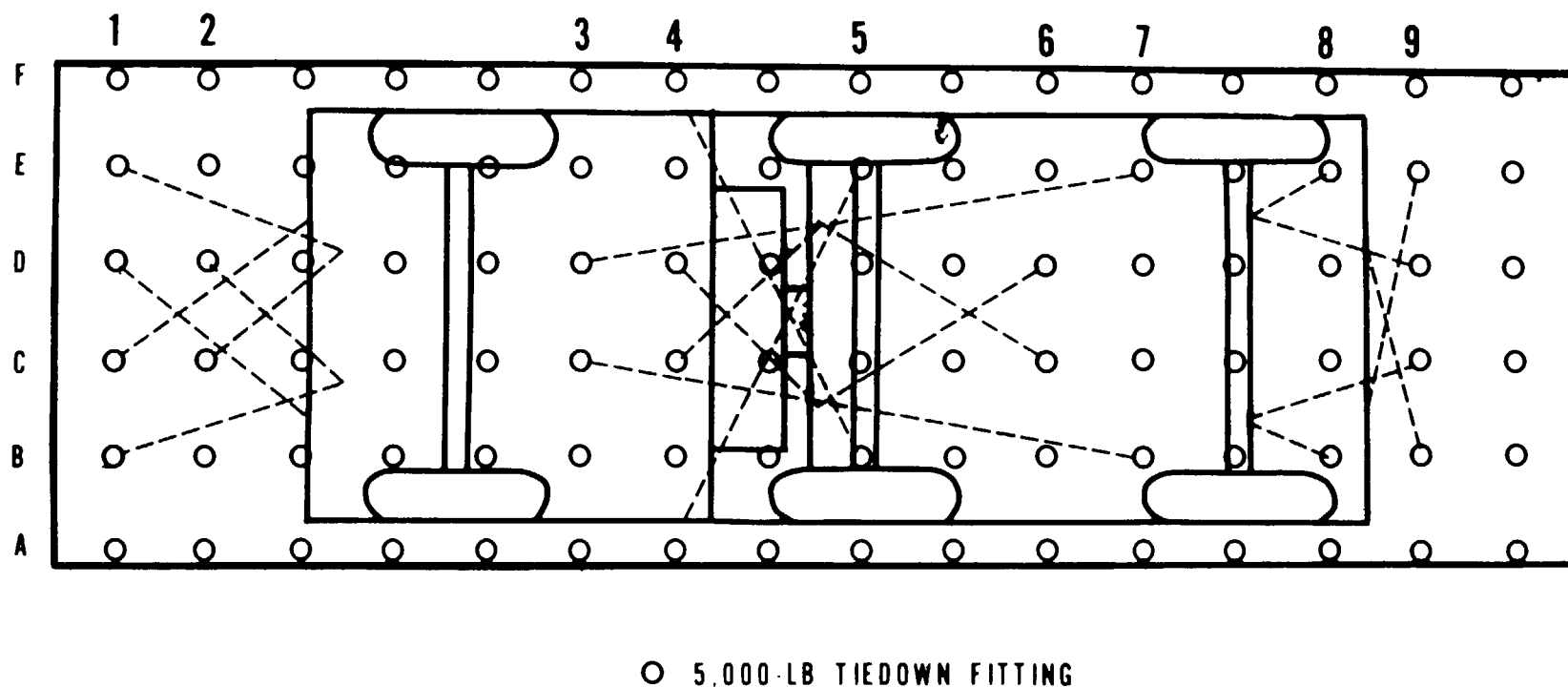


Figure 4-9. Load 8-internal air transport of the M561 without lockout truss kit in US Army CH-54 helicopter pod.

Section III. TRANSPORT BY US AIR FORCE AIRCRAFT

4-16. Internal Load Descriptions on C-130 and C-141 US Air Force Aircraft

The M561 is loaded without the lockout truss installed between tractor and carrier. Description of loads in the C-130 and C-141 US Air Force aircraft are given in the following paragraphs.

4-17. Load 9-M561 in US Air Force C-130 Airplane (Fig 4-10)

- a. *Materials.* 18 MB-1 tiedown devices.
- b. *Personnel.* Two men can load and tie down the vehicle in 25 minutes and unload it in 15 minutes.
- c. *Loading Procedures.*
 - (1) Back the M561 into the airplane.
 - (2) Place vehicle in gear and set brakes.
 - (3) Tie down as indicated in figure 4-10 and table 4-3.

NOTE

General cargo loads depicted in this manual for US Air Force C-130 and C-141 aircraft are restrained to the minimum of 8g's forward restraint that is required when passengers or nuclear weapons cargo are carried forward of the general cargo. The 8g's forward restraint may be reduced to a minimum of 3g's forward restraint for general cargo when passengers or nuclear weapons are not carried forward of the general cargo.

When passengers or nuclear weapons cargo are carried forward of general cargo, the HBU-9/A(VAN ZELM) barrier net or equivalent net on aircraft so equipped shall be positioned in front of the general cargo to achieve a minimum of 8g's forward restraint.

Table 4-3. Load 9-Tiedown Data for M561 in US Air Force C-130 Airplane (Fig 4-10)

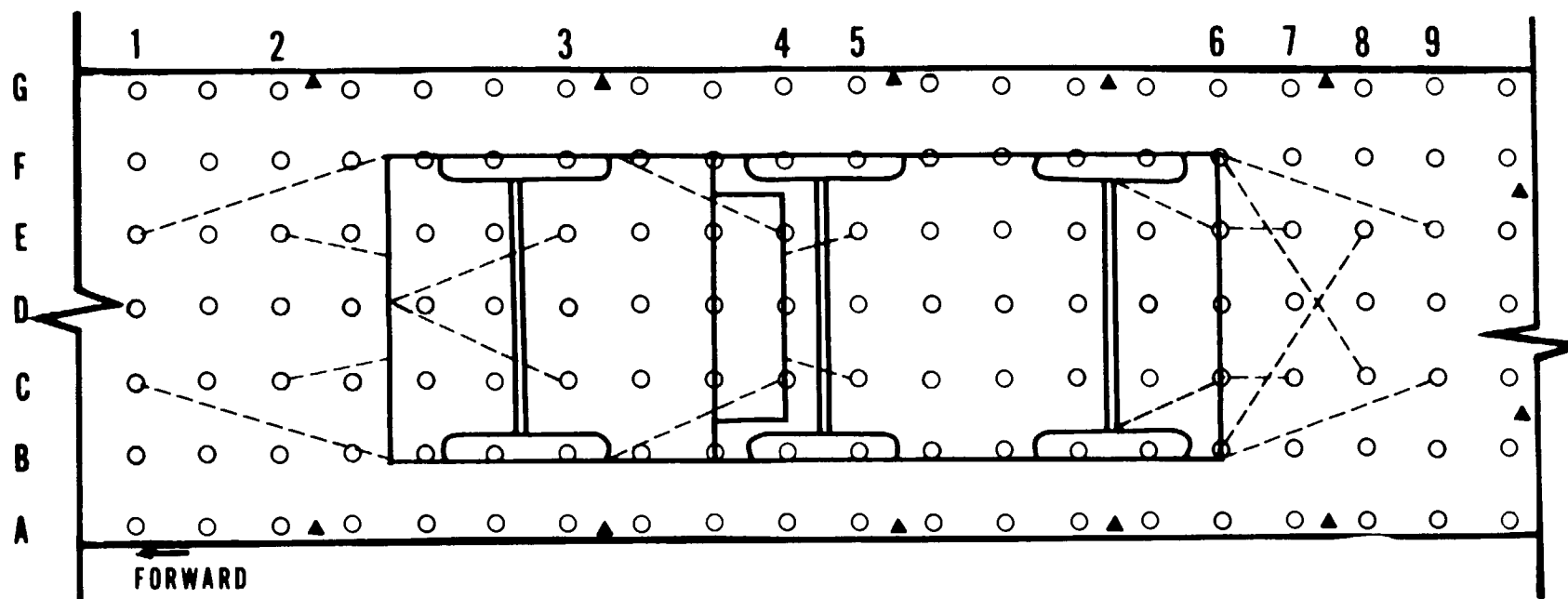
Tiedown fitting		Tiedown device		Attach to item
designation	capacity in 1,000 lb	type	capacity in 1,000 lb	
C1	10	MB-1	10	Right rear lift ring
E1	10	MB-1	10	Left rear lift ring
C2	10	MB-1	10	Right rear tiedown point
E2	10	MB-1	10	Left rear tiedown point
C3*	10	MB-1	10	Towing pintle
E3*	10	MB-1	10	Towing pintle
C4	10	MB-1	10	Under carrier to right side tiedown point
E4	10	MB-1	10	Under carrier to left side tiedown point
C5'	10	MB-1	10	Right tractor jack point
E5*	10	MB-1	10	Left tractor jack point
C6*	10	MB-1	10	Tractor right front arm and axle
E6*	10	MB-1	10	Tractor left front arm and axle
C7	10	MB-1	10	Right towing ring
E7	10	MB-1	10	Left towing ring
C8*	10	MB-1	10	Left lift ring
E8*	10	MB-1	10	Right lift ring
C9	10	MB-1	10	Right lift ring
E9	10	MB-1	10	Left lift ring

*Not required with adequate restraint barrier installed forward of load.

4-18. Load 10-M561 in US Air Force C-141 Airplane (Fig 4-11)

- a. *Materials.* Six MB-1 and four MB-2 devices.
- b. *Personnel.* Two men can load and tie down the vehicle in 25 minutes and unload it in 15 minutes.
- c. *Loading Procedures.*

- (1) Back the M561 into the airplane.
- (2) Place the vehicle in gear and set brakes.
- (3) Tie down as indicated in figure 4-11 and table 4-4.



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

Figure 4-10. Load 9-M561 in US Air Force C-130 airplane.

Table 4-4. Load 10-Tiedown Data for M561 in US Air Force C-141 Airplane (Fig 4-11)

Tiedown fitting		Tiedown device		Attach to item
designation row and No.	capacity in 1,000 lb	type	capacity in 1,000 lb	
A1	25	MB-2	25	Right rear towing shackle
G1	25	MB-2	25	Left rear towing shackle
A2	10	MB-1	10	Right rear carrier tiedown ring
G2	10	MB-1	10	Left rear carrier tiedown ring
A3*	10	MB-1	10	Right forward carrier tiedown ring
G3*	10	MB-1	10	Left forward carrier tiedown ring
C4	10	MB-1	10	Right lifting ring
E4	10	MB-1	10	Left lifting ring
A4*	25	MB-2	25	Right front shackle
G4*	25	MB-2	25	Left front shackle

*Not required with adequate restraint barrier installed forward of load.

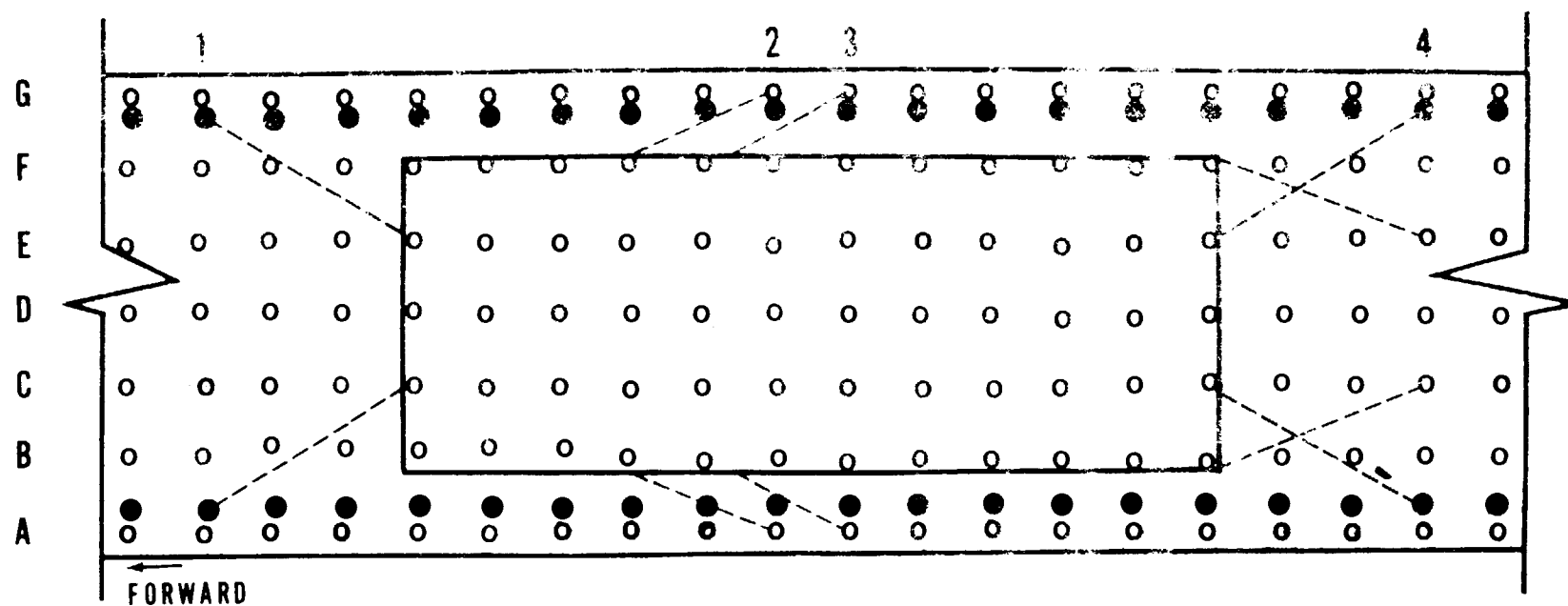
4-19. Load 11-M561 in US Air Force C-5 Airplane (Fig 4-12)

- a. Materials. 10 MB-2 devices.
- b. Personnel. Two men can load and tie down the vehicle in 20 minutes and unload it in 10 minutes.
- c. Loading Procedures.

- (1) Drive or back the M561 into the airplane.
- (2) Place the vehicle in gear and set brakes.
- (3) Tie down as indicated in figure 4-12 and table 4-5.

Table 4-5. Load 11-Tiedown Data for M561 in US Air Force C-5 Airplane (Fig 4-12)

Tiedown fitting		Tiedown device		Attach to item
designation row and No.	capacity in 1,000 lb	type	capacity in 1,000 lb	
D1	25	MB-2	25	Right rear lifting ring
G1	25	MB-2	25	Left rear lifting ring
F1	25	MB-2	25	Pintle
D2	25	MB-2	25	Right rear carrier tiedown ring
G2	25	MB-2	25	Left rear carrier tiedown ring
D3	25	MB-2	25	Right front carrier tiedown ring
G3	25	MB-2	25	Left front carrier tiedown ring
D4	25	MB-2	25	Right front lifting ring
G4	25	MB-2	25	Left front lifting ring
F4	25	MB-2	25	Front shackles



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

Figure 4-11. Load 10-M561 in US Air Force C-141 airplane.

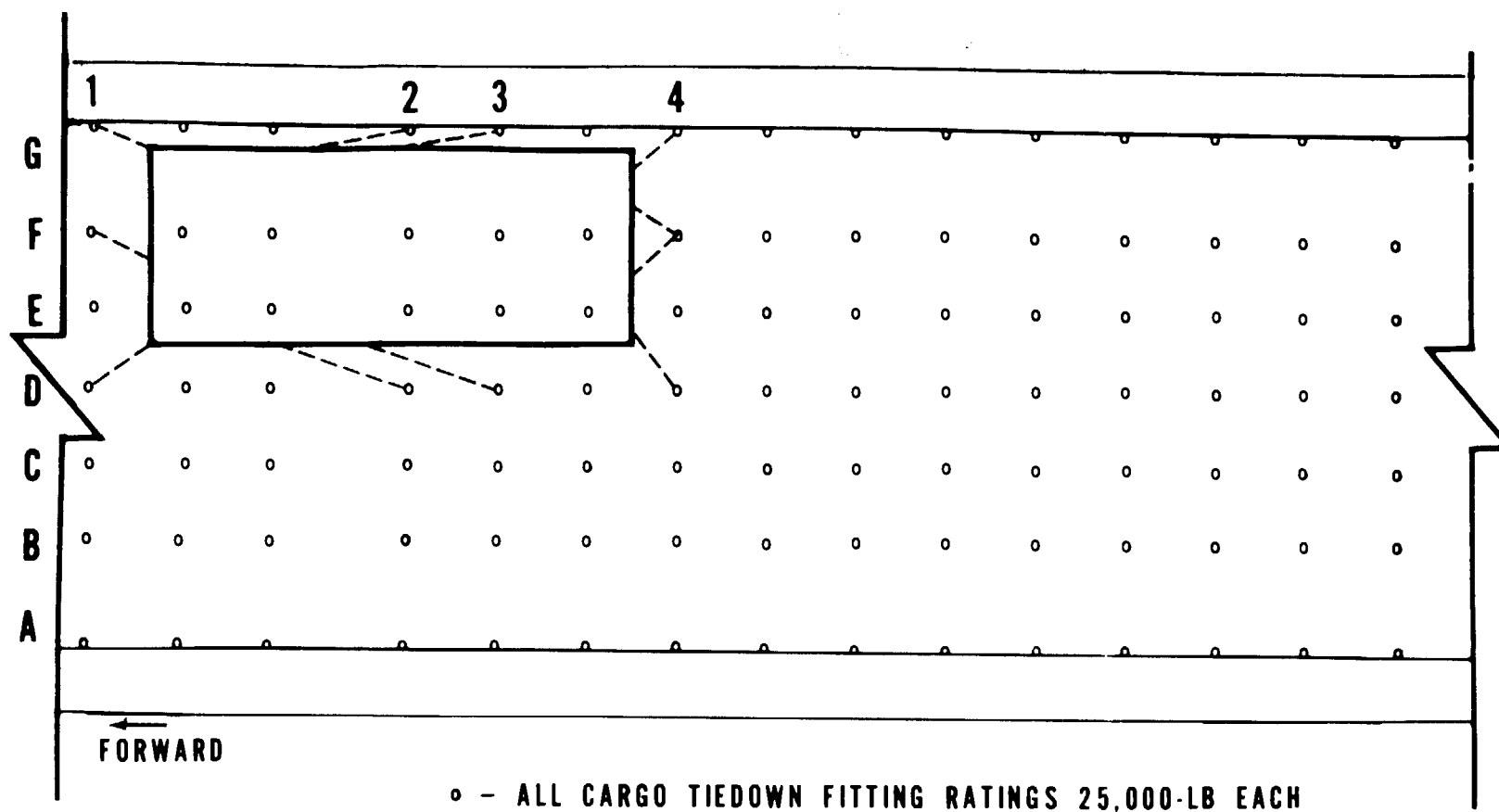


Figure 4-12. Load 11-M561 in US Air Force C-5 airplane.

CHAPTER 5

HIGHWAY AND OFF-ROAD TRANSPORTABILITY GUIDANCE

5-1. General

This chapter provides highway and off-road transportability guidance for the M561. It covers significant technical and physical characteristics and prescribes the materials and guidance required to prepare, load, and unload the vehicle. The M561 can move over public highways in CONUS and in overseas areas without restrictions. Figure 5-1 is the tracking diagram for the M561.

5-2. Off-Road Operation

The articulated joint coupling tractor and carrier permits tractor and carrier to roll and pitch independently to keep all wheels on the ground and provide maximum traction. The vehicle is equipped with a two-speed transfer case, a four-speed transmission, and is selective for either two or six-wheel drive. The above features give this vehicle excellent cross-country mobility.

5-3. Preparation of M561

No special preparation of the item is required, either for movements under its own power or for transport by semitrailer. However, all loose items should be secured within the vehicle.

5-4. Movement by Semitrailer

The M561 can be transported over highway by semitrailers of adequate capacity and size. Figure 5-2 illustrates a method for securing the M561 on a semitrailer by the use of four tiedown chains equipped with an appropriate tensioning device.

5-5. Loading on Semitrailer

a. The M561 can be loaded onto a semitrailer by a crane of adequate capacity by the use of four wire-slings attached to its four lifting rings and the crane hook (fig 6-1).

b. After vehicle has been loaded on semitrailer, place vehicle gear shift levers (transmission and transfer) in neutral position and apply vehicle hand parking brake.

c. For conventional method of securing the M561 on semitrailer using wooden blocks, chocks, and wire tiedowns, see figure 7-1 and tables 7-1 and 7-2.

d. For conventional chain tiedown with a minimum proof-test of 8,700 pounds and appropriate tensioning device, see figure 5-2.

(1) Apply tiedowns parallel to each other at one end of the vehicle and from the vehicle tiedown points to the semitrailer tiedown facilities. The angle of the tiedown must be as close to 45 degrees as possible.

(2) Hand tension the tiedown chains as tight as possible and attach grab hook to an appropriate link of the chains.

(3) Apply tiedowns parallel to each other at the opposite end of the vehicle and from the vehicle tiedown points to the semitrailer tiedown facilities.

(4) Final tensioning of the tiedown chains will be accomplished by utilizing an appropriate tensioning device.

(5) After all chains have been tensioned, they will be hit sharply with a hammer to relieve any binding and retensioned if necessary.

(6) Grabhooks will be secured with wire through the chain openings to prevent the hooks from disengaging from links to which they are attached.

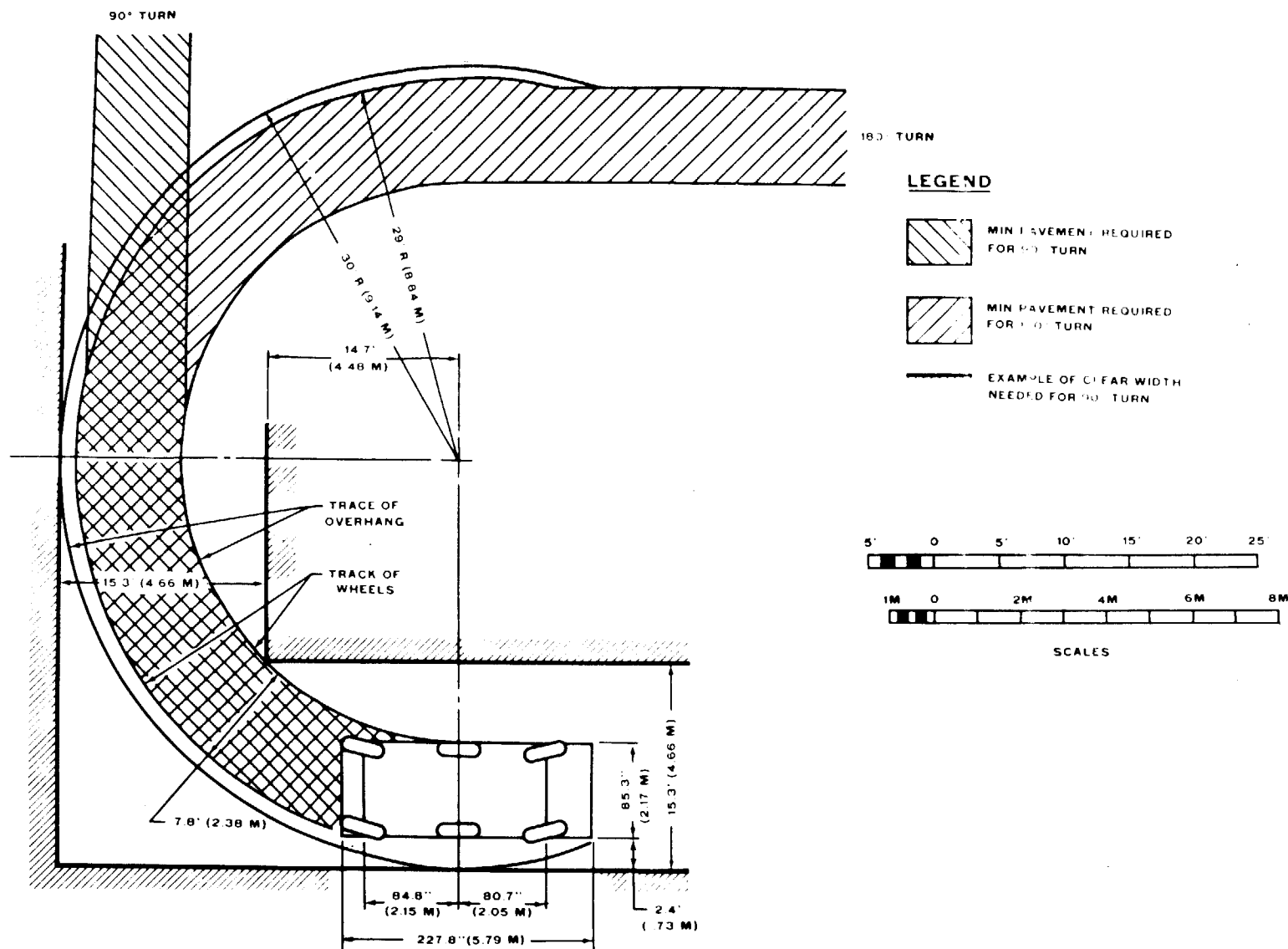


Figure 5-1. Tracking diagram for M561.

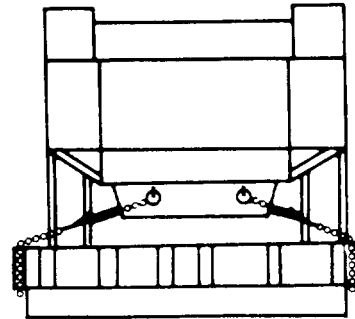
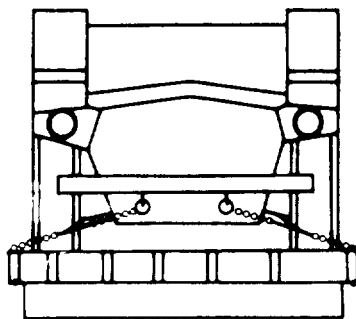
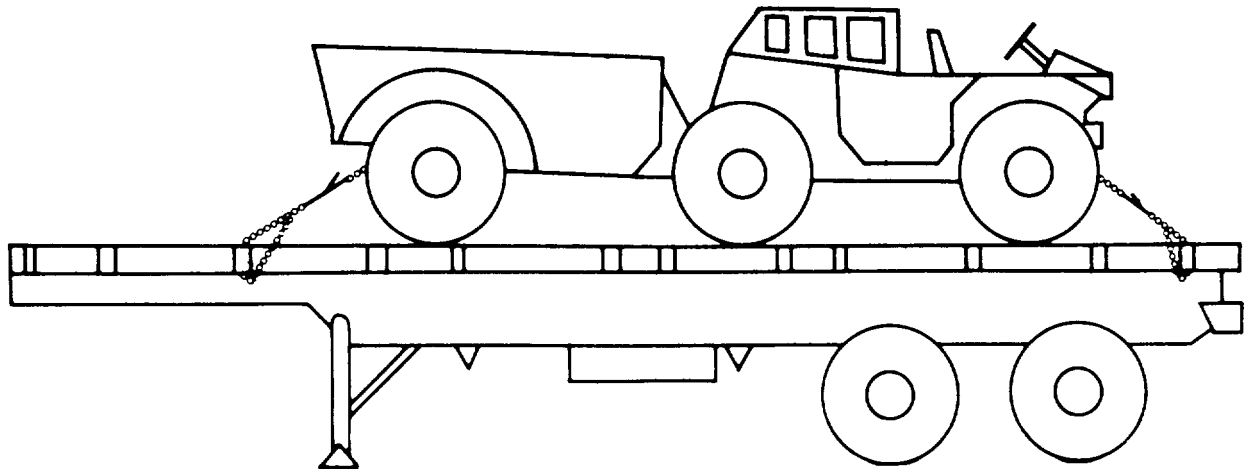


Figure 5-2. Tiedown diagram for M561 on semitrailer.

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 M561. It covers significant technical and physical characteristics and prescribes the materials and guidance to prepare, load, stow, and secure the vehicle. The methods described for lifting and securing the M561 are suggested procedures. Other methods of handling and stowage may be used providing they will insure delivery without damage to the vehicle.

6-2. Safety

In addition to the safety precautions contained in

chapter 3, the following areas should be noted as applicable:

a. In the event ammunition or explosives are to be transported with the vehicle, the ammunition or explosives and the vehicle will be handled and stowed in accordance with provisions contained in Water Carrier Tariff No 24 or reissues thereof.

b. Prior to lifting M561 with cargo slings, insure the lockout truss kit is installed between the tractor and carrier bodies to prevent damage to the articulated joint assembly.

Section II. LOADING AND SECURING

6-3. General Rules for Stowing the M561 on General Cargo Vessels

a. *Stowage.* Whenever possible, the M561 should receive the protection of below-deck stowage. In general, good stowage of vehicles means placing them fore and aft as close together as practical, with minimum spacing between outer vehicles and the sweatboards; protecting breakable parts and noting the disposition of spare parts and tools, usually within or near the vehicle; stowing vehicles in neutral with brakes on, battery terminals disconnected and fuel drained, and securing the vehicles) by adequate blocking and lashing. Securing includes blocking the vehicle on all four sides so that it cannot move in any direction; bracing individual vehicle blocking to bulkheads, stanchions, or other vehicle blocking; and lashing the vehicle with wire rope or chain.

NOTE

1. When vehicles are loaded on vessels that are adequately ventilated by power blowers, such as the roll-on/roll-off vessels, fuel need not be drained from fuel tanks.

2. The M561 should be lifted by using the lift provisions at the rear of the carrier and front of the tractor. with lockout trusses installed between the tractor and carrier.

b. *Loading.* Vehicles should always be loaded on vessels in their minimum configuration; that is, reduced height, with or without cargo. The M561 can be loaded under its own power or by crane of adequate capacity onto landing craft, beach discharge lighters, amphibious lighters, and landing ship tanks. It can also be loaded under its own power onto the deck of barges from piers when the tidal conditions are suitable and ramps are available. The vehicle can be loaded onto seagoing vessels by shoreside cranes; floating cranes; or by the ship's own gear, providing the level of preservation protection will permit; and onto roll-on/roll-off vessels under its own power or by being towed. Figure 6-1 shows a typical lifting diagram for the M561, figure 6-2 shows typical blocking and tiedown details, and tables 6-1 and 6-2 list necessary materials and their application for the blocking and tiedown of the M561.

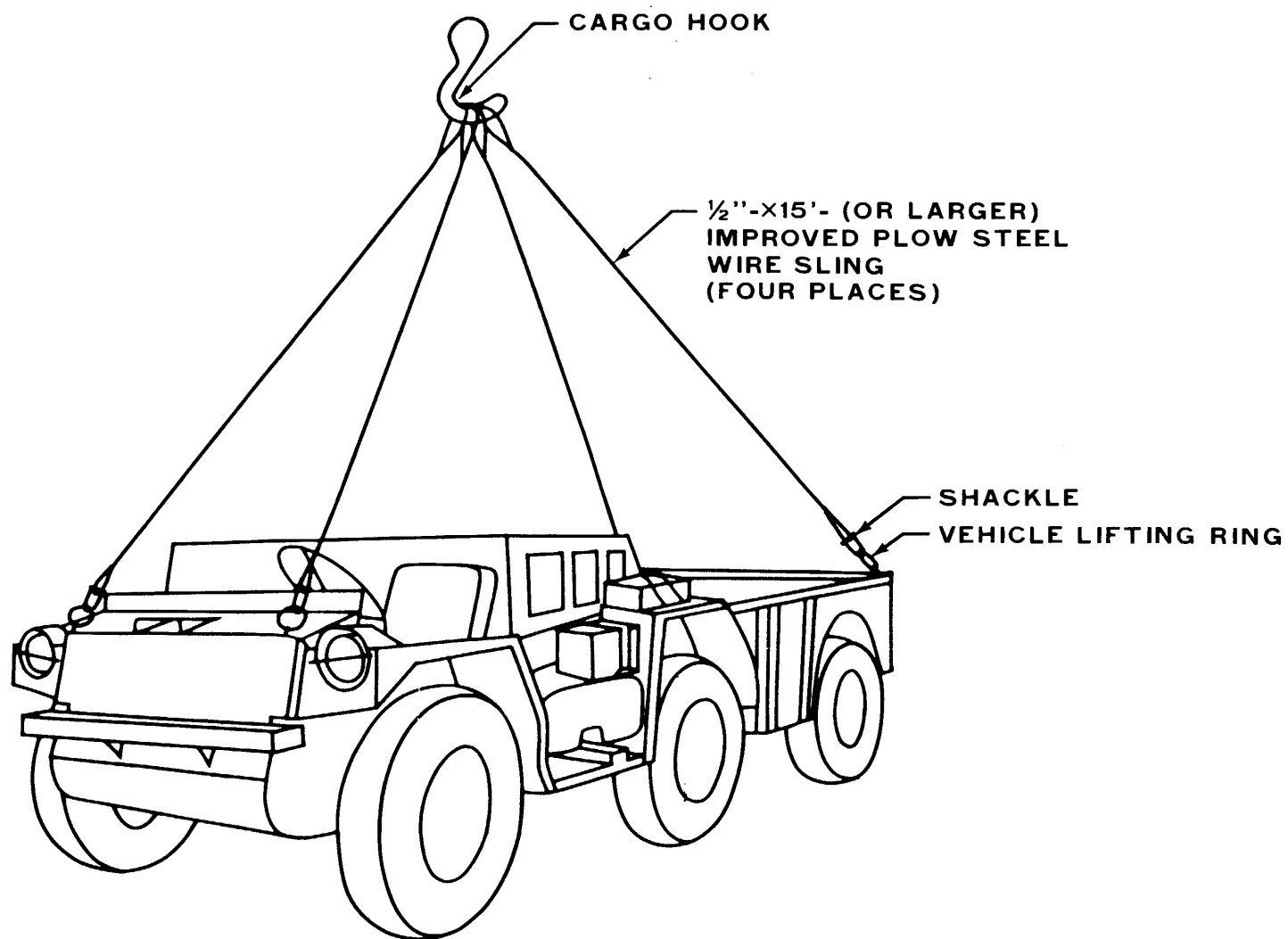


Figure 6-1. Lifting M561 with wire slings.

Table 6-1. Bill of Materials for Blocking and Tiedown of M561 in General Cargo Vessel (Fig 6-2)

Item	Description	Approximate quantity
Lumber	Douglas-fir, or comparable, straight grain, free from material defects; Fed Spec MM-L-751c: 2- x 4-in. 4- x 4-in.	40 linear ft 60 linear ft
Nails	Common, steel; flathead; bright or cement-coated; table X1-b, Fed Spec FF-N-105a: 12d 30d	72 120
Wire rope	6 x 19, IWRC; improved plow steel; preformed regular-lay; table X, Fed Spec RR-W410a: ½-in.	40 ft
Clamps	Wire-rope, "U"-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal, Fed Spec FF-C-450d: ½-in.	16

Item	No. required	Application
		blocking to immobilize vehicle and blocking. Secure each end to adjacent bracing or blocking detail by toenailing with two 30d nails on each side.
E	4	Padeye, four required on deck of vessel.
F	4	Wire rope, ½-in., in a complete loop. Secure by four clips (item G). Attach to front and rear shackles on vehicle and padeyes on vessel deck.
G	16	Clamps, ½-in., wire-rope, "U"-bolt clips. Used to secure item F in complete loop.

Table 6-2. Application of Materials for Blocking and Tie-down of M561 in Hold of General Cargo Vessel (Fig 6-2)

Item	No. required	Application
A	2	Side blocking, 4- x 4- x 240-in. lumber. Locate one piece against wheels on each side of vehicle.
B	4	End blocking, 2- x 4- x 96-in. lumber. Locate at front and rear of front and rear tires. Nail to item A with three 12d nails.
C	8	Backup cleat, 2- x 4- x 12-in. lumber. Locate on top of item A against item B. Nail to item A with six 12d nails.
D	as required	Bracing, 4- x 4-in. x length-to-suit. Brace as required against vehicle blocking, side of vessel, or against cargo

6-4. Special Design Vessels

Roll-on/roll-off vessels, landing ships, and attack cargo vessels are all equipped with patented lashing gear and pre-positioned fittings in the deck. The use of such equipment is adequate, and the vehicles will not require blocking and bracing.

6-5. Barges and Lighters

In moving the M561 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 moving extended distances or through rough waters, tiedowns must be used.

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

When moving the vehicle 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. Where such equipment is not provided, a suitable substitute may be used.

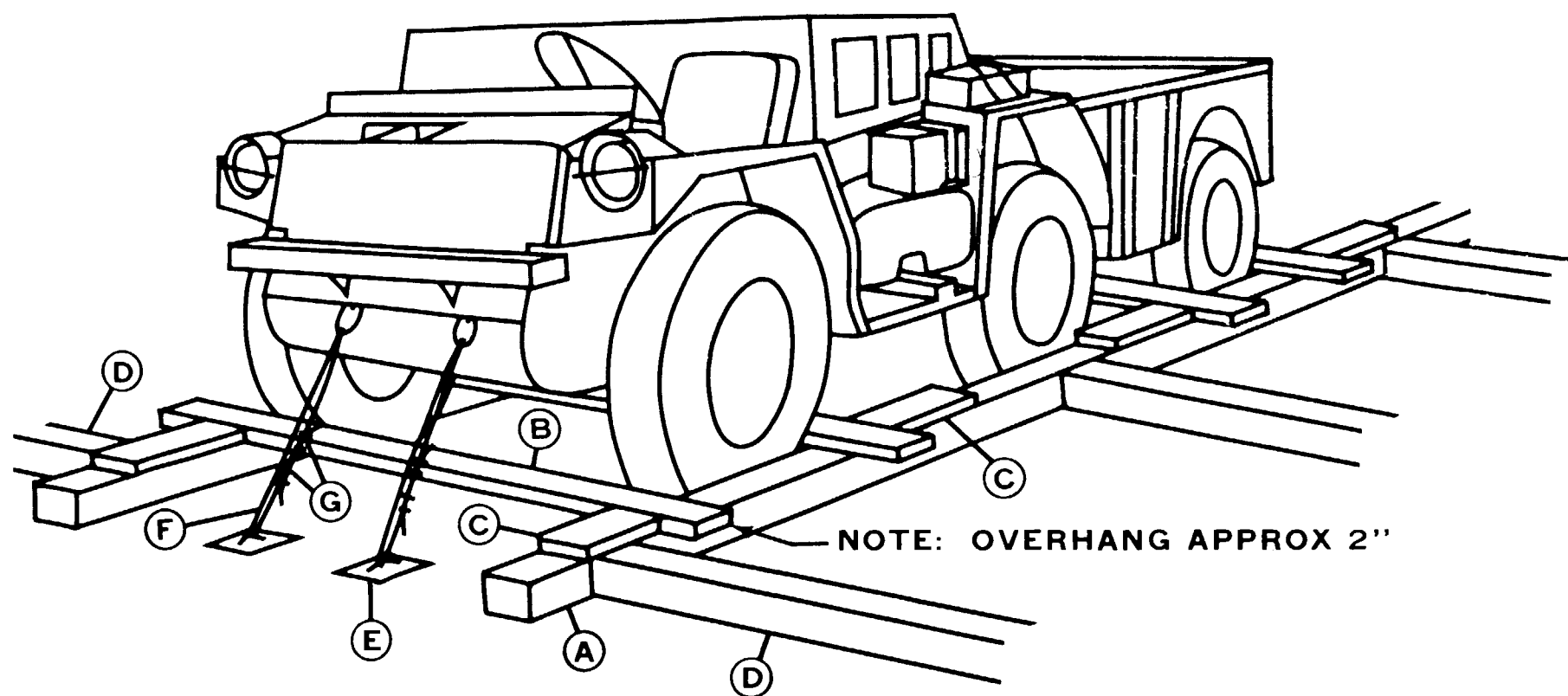


Figure 6-2. Blocking and tiedown of M561 in general cargo vessel.

CHAPTER 7 RAIL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

7-1. Scope

This chapter provides rail transportability guidance for movement of the M561. It covers significant technical and physical characteristics and safety considerations

and prescribes materials and guidance to prepare, load, tie down, and unload the vehicle.

7-2. Maximum Utilization of Railcars

Additional cargo, as approved by the activity offering the vehicle for transport, may be transported with the M561.

Section II. TRANSPORT ON CONUS RAILWAYS

7-3. General

The M561, when loaded on suitable railcars, can be transported on CONUS railways without sectionalization or major disassembly. It can be transported within the Association of American Railroads' Outline Diagram of Single Loads, Without End Overhang, on Open Top Cars as shown in both the *Railway Line Clearance Publication and the Official Railway Equipment Register*. Flatcars having a width of 9 feet are required to transport the M561. Two vehicles can be loaded on railcars that are 48 feet or longer. The M561 can be transported on suitable special-purpose bilevel cars.

7-4. Preparation of the M561

The degree of preparation of the vehicle prior to being transported by railcar is dependent upon the operational commitment.

7-5. Loading M561 on General-Purpose Flatcars

a. The vehicle may be placed in the tiedown position on the railcar by a crane or may be driven or towed (without lockout truss) provided a suitable ramp or bridge is available.

b. After loading and placement of vehicle at the tiedown position, the handbrake on vehicle must be set and the gearshift lever for the transmission must be placed and wire-tied in its neutral position.

c. Figure 7-1 shows the M561 blocked and tied on a general-purpose flatcar. Table 7-1 is the bill of materials and table 7-2 is the application of these materials for the blocking and tiedown of one M561 on a general-purpose flatcar.

NOTE

A staggered nailing pattern will be used when blocking and bracing lumber is nailed to the floor of the railcar. In addition, the nailing pattern for an upper piece of laminated lumber "will be adjusted as required so that a nail for that piece will not be driven through, onto, or right beside a nail in the lumber piece of lumber.

Table 7-1. Bill of Materials for Blocking and Tiedown of M561 on General-Purpose Flatcar (Fig 7-1).

Item	Description	Approximate quantity
Lumber	Douglas-fir, or comparable, straight grain, free from material defects Fed Spec MM-L-751c: 2- x 2-in. 2- x 4-in. 2- x 6-in. 6- x 8-in.	8 linear ft 20 linear ft 10 linear ft 12 linear ft

Item	Description	Approximate quantity
Nails	Common, steel; flathead; bright or cement-coated; table X1-b, Fed Spec FF-N-105a: 12d	20
	20d	20
	30d	20
	40d	50
Wire	No. 8 gage, black annealed, Fed Spec QQ-W-46lf	160*
Wire rope	6 x 19, IWRC; improved plow steel; preformed regular-lay; table X, Fed Spec RR-W-410a: 3/8-in.	50**
Clamps	Wire-rope, "U"-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal, Fed Spec FF-C-50d: 3/8-in.	16**
Thimbles	Standard, open-type: 3/8-in.	4**
Cushioning material	Waterproof paper, or suitable material	as required

* Not required if 3/8 in. wire rope is used for item E (fig 7-1).

** Not required if No. 8 gauge wire is used for item E (fig 7-1).

Table 7-2. Application of Materials for Blocking and Tiedown of M561 on General-Purpose Flatcar (Fig 7-1)

Item	No. required	Application
A	—	Brake wheel clearance. Minimum clearance required is 6 in. above, in back of, and on both sides of and 4 in. underneath wheel.
B	8	Chock block (detail 1, fig 7-1), 6- x 8- x 24-in. lumber. Locate 45° portion of block against front and rear of front and rear wheels. Nail heel of block to car floor with three 40d nails, and toenail each side of block to car floor with two 40d nails.
C	1 ea item D	Suitable material, such as waterproof paper or burlap. Locate bottom portion under item D, the top portion to extend 2 in. above item D.
D	4	Blocks, each to consist of one piece of 2- x 6- x 30-in. lumber and two pieces of 2- x 4- x 30-in. lumber (detail 2, fig 7-1). Nail one edge of 2- x 6- x 30-in. piece to bottom 2- x 4- x 30-in. piece with five 12d nails. Then place against tire, and nail to car floor through 2- x 4- x 30-in. piece with five 20d nails. Nail the other 2- x 4- x 30-in. piece to the one below with five 30d nails. Be sure protective material as outlined in item C, above, is placed as specified.
E	4	No. 8 gage, black annealed wire, eight strands. Attach to the shackles at each end of vehicle and to stake pockets on the same side of car. The angle formed by the wire tiedown and the car floor must not exceed 45°. Metal fillers sufficient to provide a suitable

Item	No. required	Application
		radius must be used to protect the wire at stake pockets and applied so as to prevent dislodgment. Substitute, if desired, 3/8-in. wire rope in a complete loop, and secure with three 3/8-in. wire-rope clamps. Thimble must be used at stake pocket to protect the rope and must be secured to the wire rope with one 3/8-in. clamp.
F	4	Wire twisters. Twist taut with 2- x 2- x 24-in. lumber or suitable rod or bolt, and secure to preclude unwinding.

GENERAL INSTRUCTIONS

1. Loading rules 3, 5, 9, 14, 15, 19-A, and 19-B, appearing in section I of the 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.
2. Lumber widths and thicknesses are nominal.
3. When two vehicles are loaded on a car, they must be evenly spaced along the length of the car and centered laterally.

7-6. Transport of M561 on Special-Purpose Flatcars

Special-purpose bi-level cushioned cars equipped with chain tiedown devices provide economies in loading costs and often a savings in transportation charges, provided full utilization of the loadable space is made. When such cars are available from the rail carriers and full utilization can be made, they should be used. For loading information see figure 7-2 and table 7-3.

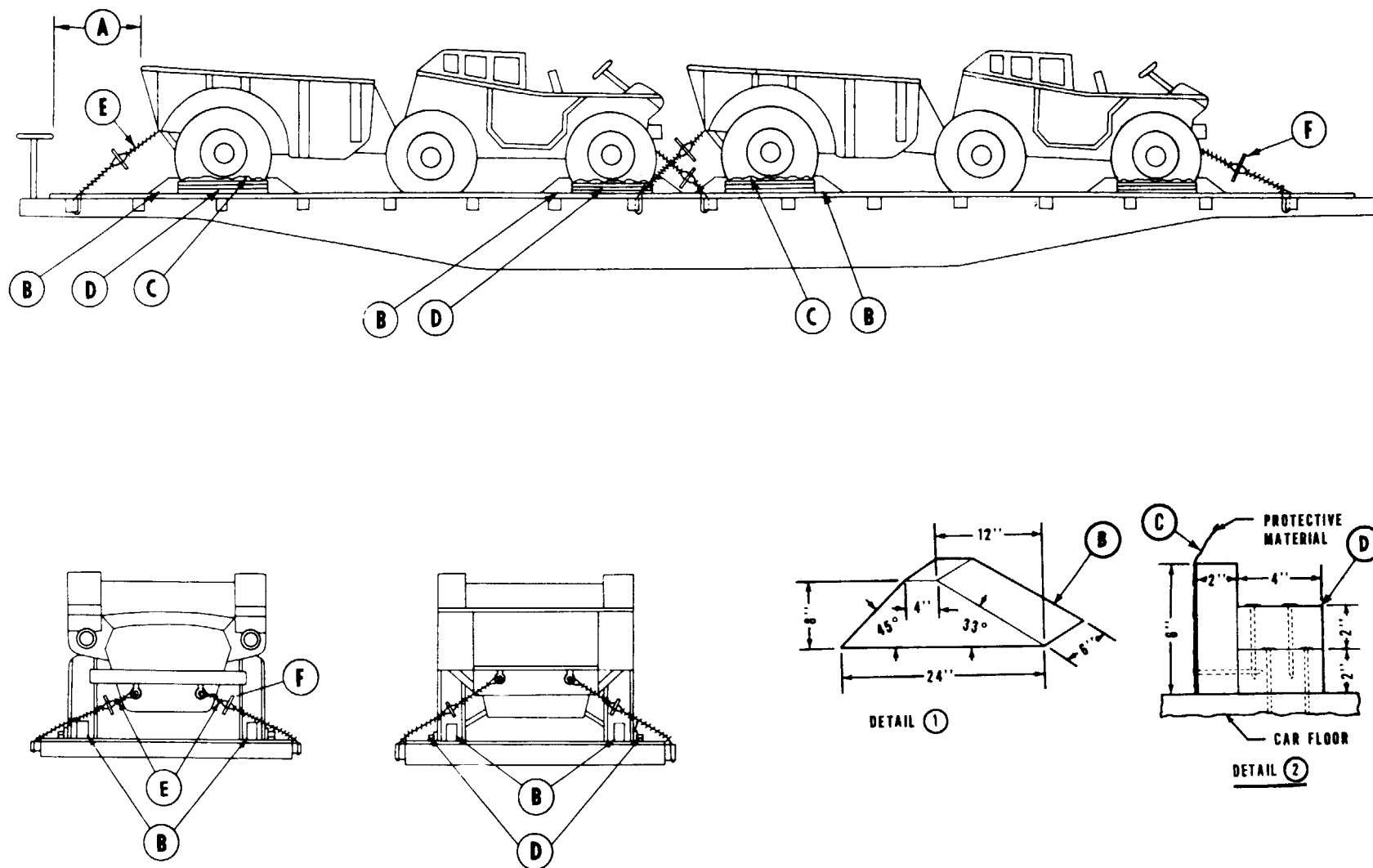


Figure 7-1. M561 blocked and tied down on general-purpose flatcar.

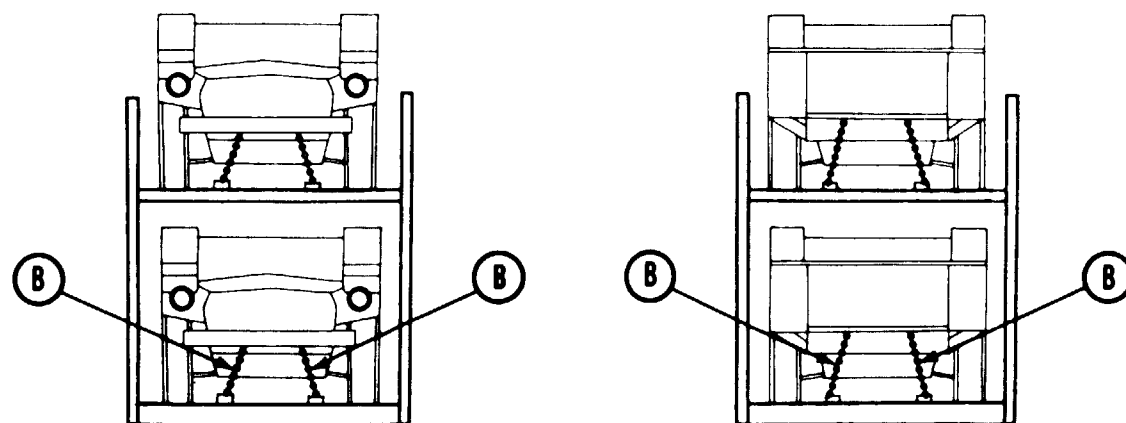
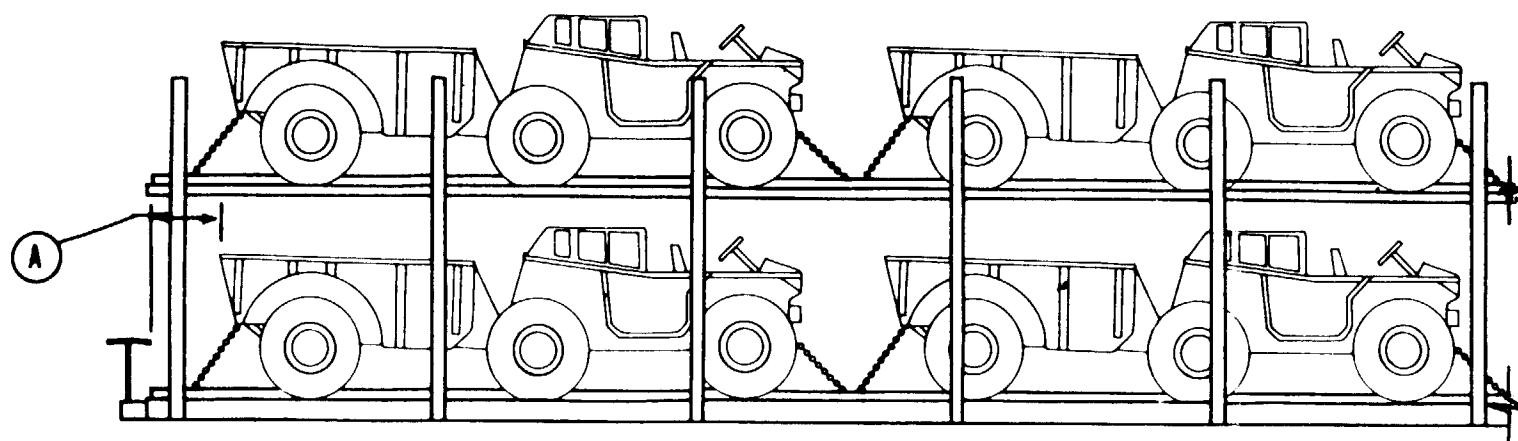


Figure 7-2. M561 tiedown on special-purpose bi-level cushioned car.

NOTE

Bi-level cars with standard friction type draft gear cannot be used. Use only bi-level cars with end of car cushioning.

Table 7-3. Application of Chain Tiedown for Securing M561 on Special-Purpose Bi-Level Cushioned Car (Fig 7-2)

Item	No. Required	Application
A	4 ea unit	Brake wheel clearance. Minimum clearance required is 6 in. above, in back of, and on both sides of 4 in. underneath wheel.
B		Chain tiedown device. 5/16-in.-diameter alloy, steel chain, proof-tested at a minimum of 8,500 lb or 3/4-in.-diameter high test chain, proof-tester at a minimum of 8,500 lb. Pass one chain tiedown through each of the vehicle tiedown shackles, front and rear. Attach hooks into an appropriately located link on each chain. Hand tension each chain as tight as possible. Further tensioning should be accomplished by utilizing the tensioning device supplied with the car.

GENERAL INSTRUCTIONS

1. Shippers should specify cars equipped with tiedown devices in the quantities and with chain strengths specified in Item "B".
2. Trucks must face in the same direction and be uniformly spaced along the length of the railcar to allow sufficient space between the trucks and at each end of the railcar for proper securement.
3. Tiedown chains must be free from twisted or kinked links prior to their application to the vehicle.
4. Tension each chain until a slight depression is noted in the vehicle suspension system. After chains have been tensioned they should be hit sharply with a hammer to relieve any binding. Retention chains if required.
5. All open hooks must be secured with wire over the openings to prevent the hook from becoming disengaged from the chain to which it is secured.

Section III. TRANSPORT ON FOREIGN RAILWAYS**7-7. General**

The M561, when loaded on a suitable railcar, can be transported without restrictions within European countries complying with the International Loading Gauge (formerly Berne International); the majority of the countries in the Middle East; and South America, Australia, India, and Pakistan.

7-8. Transport on US Army Foreign-Service Flatcars

a. General. The M561 can be transported on a number of US Army-owned foreign-service flatcars. These flatcars are used exclusively for the transport of US military materiel. Table 7-4 represents a few of the US Army-owned flatcars available in Europe that are suitable for transportation of the M561.

b. Materials. The materials required for blocking and tiedown of the M561 on US Army foreign service flatcars are essentially the same as those used for transporting the vehicles within CONUS. For general guidance, refer to figure 7-1 and tables 7-1 and 7-2.

Table 7-4. Characteristics of US Army-Owned Flatcars Available in Europe for Transporting M561

Flatcar designation	Capacity	Length	Width	Platform height*
FF	50-ton (45.36 MT)	40-ft. 9-in. (12.42 m)	8-ft. 7 1/8-in. (2.62 m)	4-ft. 1 1/8-in. (1.25 m)
SSY	55-ton (49.90 MT)	31-ft. 2-in. (9.50 m)	10-ft. 4-in. (3.15 m)	4-ft. 2 3/4-in. (1.29 m)
SSYS	66-ton (59.88 MT)	31-ft. 2-in. (9.50 m)	10-ft. 4-in. (3.15 m)	4-ft. 2 3/4-in. (1.29 m)
SSYM	88-ton (79.83 MT)	39-ft. 1/2-in. (11.90 m)	10-ft. 4-in. (3.15 m)	4-ft. 3 1/2-in. (1.31 m)
FFLM	90-ton (81.65 MT)	46-ft. 8-in. (14.42 m)	10-ft. 3-in. (3.12 m)	4-ft. 2 3/4-in. (1.29 m)

*Above top of rail.

55-15r20-227-10	Operator's Manual US Army Model CH-47B and CH-47C Helicopter.
55-1520-217-10/1 and 10/2	Operator's Manual, Army Model CH-54A and CH-54B Helicopters.

6. Other Publications and Source of Procurement

Association of American Railroads Rules Governing the Loading Commodities on Open Top Cars.

Section No. 1-General Rules

Section No. 6-Rules Governing the Loading of Department of Defense Material

Mr. R. C. Reber, Secretary

Mechanical Division

Association of American Railroads

1920 L Street, N W.

Washington, D.C. 20036

7. Other

Water Carrier No. 24-Regulations Governing the Transportation of Explosives or Other Dangerous Articles or Substances, and Combustible Liquids on Board Vessels.

APPENDIX

REFERENCES

1. Field Manuals (FM)

- 1-100 Army Aviation Utilization.
- 5-36 Route Reconnaissance and Classification.
- 55-15 Transportation Reference Data.

2. Supply Bulletins (SB)

- 700-20 Army Adopted and Other Items of Materials Selected for Authorization.

3. Air Force Manuals

- T.O. 1-1B-40 Handbook of Weight and Balance Data.
- T.O. 1C-5A-9 Cargo Loading Manual for USAF Series C-5 Airplane.
- T.O. 1C-130-9 Cargo Loading Manual USAF Series C-130 Airplane.
- T.O. 1C-141A-9 Cargo Loading Manual for USAF Series C-141 Airplane.

NOTE

Air Force Technical Orders that have not been integrated into the Department of the Army publications system may be requisitioned through The Adjutant General Office in accordance with AR 310-71.

4. Army Regulations (AR)

- 55-29 Military Convoy Operations in CONUS.
- 55-355 Military Traffic Management Regulation.
- 70-39 Criteria for Air Transport and Airdrop of Material.
- 95-16 Weight and Balance-Army Aircraft.
- 385-40 Accident Reporting and Records.

5. Technical Manuals (TM)

- 5-330 Planning and Design of Roads, Airbases and Heliports in Theater of Operations.
- 5-725 Rigging.
- 9-2320-242-10 Operator's Manual for Truck, Cargo: 11/4-ton, 6X6, M561.
- 55-405-9 Weight and Balance.
- 55-450-10/1 Air Transport of Supplies and Equipment Standard Loads in US Air Force C-130E Aircraft.
- 55-450-11 Air Transport of Supplies and Equipment: Helicopter External Loads Rigged with Air Delivery Equipment.
- 55-450-15 Air Movement of Troops and Equipment (Nontactical).
- 55-450-19 Helicopter External Lift Rigging Material, Techniques and Procedures.
- 55-500 Marine Equipment Characteristics and Data.
- 55-513 Military Stevedoring.
- 57-210 Air Movement of Troops and Equipment.
- 55-1520-209-10 Operator's Manual US Army Model CH-47A Helicopter.

By Order of the Secretary of the Army:

Official:

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

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

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 decagram = 10 grams = .35 ounce
 1 hectogram = 10 decagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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