TECHNICAL MANUAL

TRANSPORTABILITY GUIDANCE

LAUNCHER, ROCKET, ARMORED-VEHICLE-MOUNTED: XM270

(NSN 1055-01-092-0596)

HEADQUARTERS, DEPARTMENT OF THE ARMY

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DEPARTMENT OF THE ARMY
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TRANSPORTABILITY GUIDANCE
LAUNCHER, ROCKET, ARMORED-VEHICLE-MOUNTED: XM270
(NSN 1055-01 -092-0596)
FOR
MULTIPLE-LAUNCH ROCKET SYSTEM
(MLRS)

LIST OF ILLUSTRATIONS

CHAPTER 1
INTRODUCTION

1-1. Purpose and Scope

This manual provides guidance for transporting the launcher, rocket, armored-vehicle-mounted, XM270 (referred to herein as the XM270). which is a major component of the multiple-launch rocket system. This manual also provides technical and physical characteristics, as well as safety considerations, for worldwide movement of the XM270 by the various modes of transportation.

1-2. Definitions of Warnings, Cautions, and Notes

Warnings, cautions, and notes emphasize important or critical guidance. They are used for the following conditions.

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

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

c. Note. A brief statement for use as necessary to emphasize a particular operating procedure, condition, and *so* forth.

1-3. Destruction of Material to Prevent Enemy Use

If the items being transported must be destroyed to prevent enemy use, they shall be destroyed in accordance with procedures contained in TM 750--2446.

1-4. Reporting of Recommendations and Comments

Users of the manual are invited to send comments and suggested improvements, on DA Form 2028 (Recommended Changes to DA Publications and Blank Forms), to Commander, Military Traffic Management Command Transportation Engineering Agency. ATTN: MTT-TRC, PO Box 6276, Newport News, VA 23606. Electrically transmitted comments should be sent to CDR MTMCTEA FT EUSTIS VA// MTT-TRC//.

CHAPTER 2
TRANSPORTABILITY DATA

Section I. GENERAL

2-1. Scope

This chapter provides a general description, photograph, drawings, and transportability characteristics of the XM270.

2-2. Description

The XM270 (fig 2-1) is a lightly armored, traversable rocket launcher, platform mounted on a full-tracked carrier vehicle. The vehicle, which has a three-person cab and an armor hull, is powered by a 500-horsepower diesel engine. The engine drives an automatic transmission. which includes differential steering and braking, through identical left and right final drives to the track-drive hub and sprocket assemblies. The suspension system has six road wheels per side. which are torsion-bar sprung and hydraulic dampened. Road wheel arms 1, 5, and 6 provide the suspension lockout system, which stabilizes the suspension during rocket launching operations. The XM270 suspension lockout system will operate with engine off.

2-3. Drawings

Drawings of the XM270 (figs 2-2 and 2-3) provide data for determining its movement by various transportation modes.

Section II. CHARACTERISTICS

2-4. Transportability Characteristics

These data apply to the item in its current configuration only and may change.

National stock number	1055 01 092 0596
Line item number	Z37726
Ground pressure:	
Unloaded (curb weight)	4.2 psi (28.95 kpa)
Loaded, combat	7.0 psi (48.3 kpa)
Track contact area	49.7 sq ft (4.61 sq m)
Pad contact area	8.0 sq ft (0.74 sq m)
Track type:	Steel, rubber-bushed, pin-link Shoes
Pad surface area	26.76 sq in. (19.68 sq mm)
Performance:	
Maximum speed	38 mph (61.2 km hr)
Maximum grade	60 percent
Maximum range at 25 mph	300 miles (483 km)
Fuel capacity	163 (usable) US gal. (617 liters)
Turning radius	pivot
Dimensions (operational):	
Length	275.3 In. (6.99 m)
Width	117.0 in. (2.97 m)
Height	102.9 in. (2.61 m)
Area	223.7 sq ft (20.78 sq m)
Cube	1,918 cu ft (54.33 cu m)
Weight;	
Shipping (less crew, ammo, and fuel)	42,750 lb (19 391 kg)
With combat load	53,000 lb (24 040 kg)
Bridge weight classifaction	21

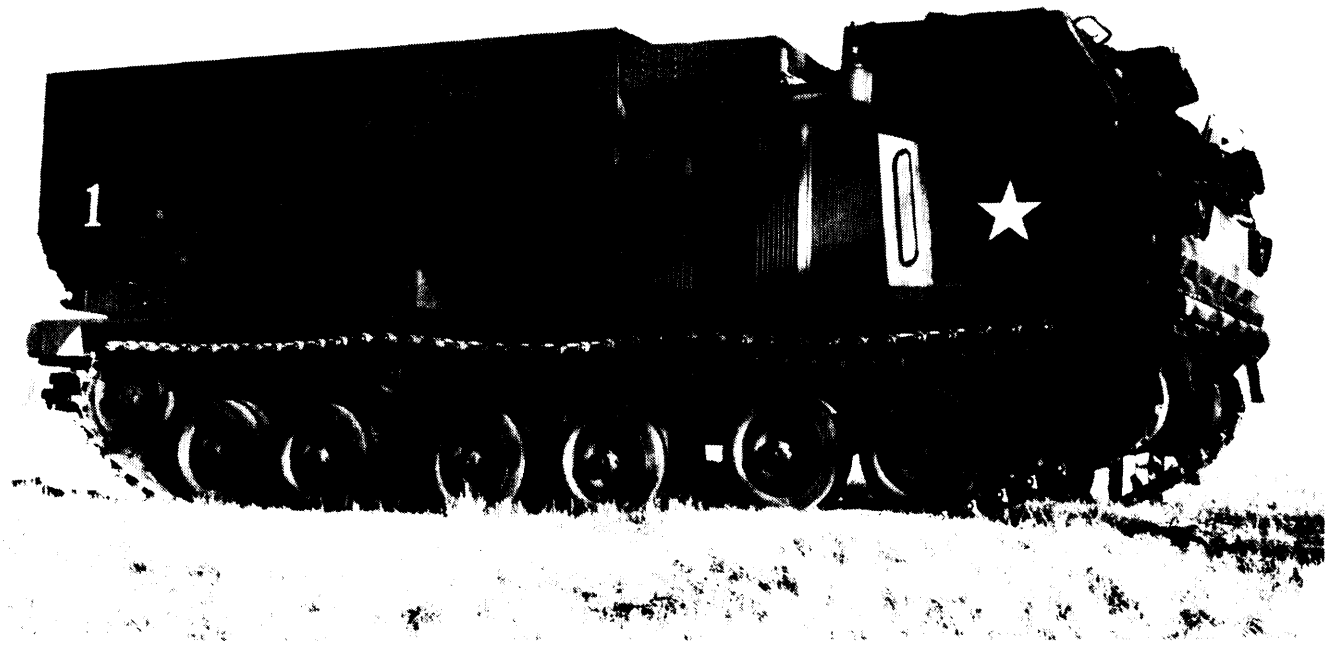

Figure 2-1. XM270 for MLRS missle system.

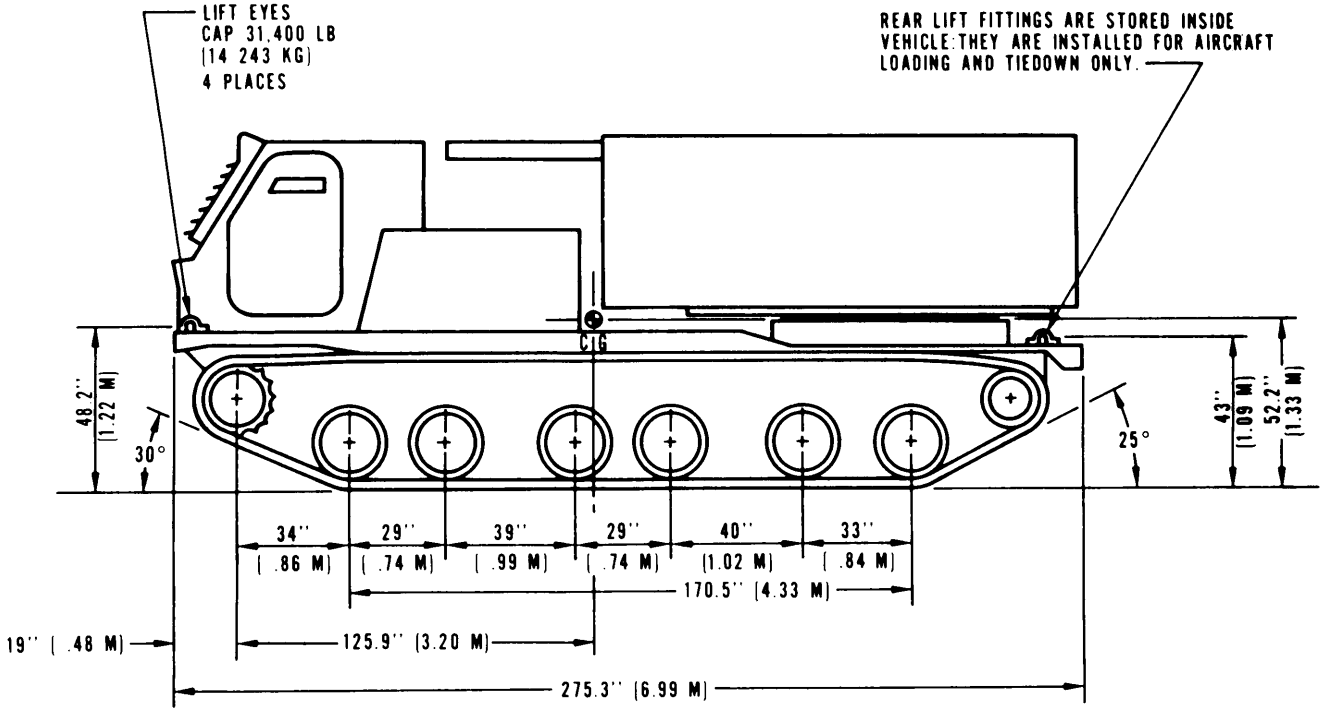

Figure 2-2. Left-side elevation, XM270.

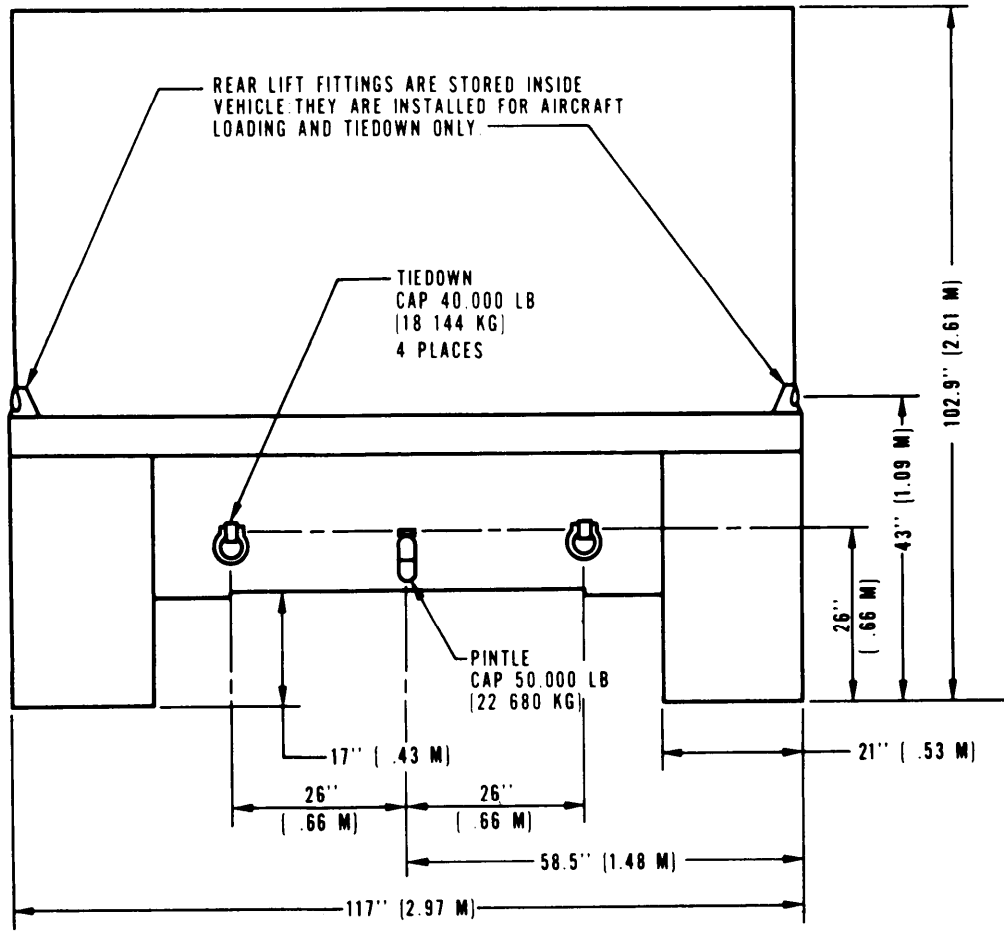

Figure 2-3. Rear-end elevation, XM270.

2-5. Hazardous or Dangerous Characteristics

Unless shipped with ammunition under the provisions of Department of Transportation Special Permit No. 3498 (applicable to shipments during national emergency), the XM270 does not have any hazardous or dangerous characteristics.

NOTE

Those regulations and procedures normally associated with vehicles containing diesel fuel shall apply.

2-6. Sensitivity

The XM270, when restrained in accordance with this manual. can withstand shocks and vibrations associated with the various modes of transportation.

2-7. CONUS Freight Classification

CONUS freight classification and item number will be determined in accordance with chapter 211 of AR 55-355 and the freight classification guide system. Classification must be determined and provided on the bill of lading before the shipment is released to the carrier.

CHAPTER 3
SAFETY

3-1. General

a. All loose items in the XM270 shall be secured in accordance with applicable regulations.

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

c. While the vehicle is driven, its hatch cover must be secured in the fully open or fully closed position.

d. While vehicle engine is running. driver shall not leave his her station.

e. If track is thrown while vehicle is in operation, brakes shall not be applied unless absolutely necessary. Vehicle shall be allowed to coast to a stop.

f. Vehicle shall not be mounted or dismounted when XM270 is in motion.

g. Vehicle engine shall not be operated in an enclosed area without adequate ventilation.

3-2. Specific Safety Requirements

WARNING

Fire extinguishers shall be readily available during all aircraft and marine loading and unloading operations.

WARNING

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

WARNING

Vehicle shall not exceed three miles per hour inside aircraft, marine vessels, or on the loading ramps of rail or highway vehicles.

a. Travel Lock. Rocket pod latch assemblies shall be in the locked position for all modes of transportation. They extend beyond the side plane of the vehicle in the unlocked position and may cause physical damage. The travel lock handle shall be swung aft and the quick release pin shall be properly installed.

b. Air. The activity offering the vehicles for air transport shall inform the aircraft commander or designated representative:

(1) If ammunition or explosives are to be transported within the vehicle.

(2) Whether liquid containers (fuel or water) are empty or full.

(3) Of the type of fuel in cookstove stored in rear section of XM270 carrier frame.

(4) Vehicle fuel tanks shall not be more than three-fourths full.

c. Highway. Highway movement is subject to all safety laws, rules, and regulations applicable to commercial carriers. Overseas-area movements are governed by theater regulations.

d. Water.

(1) If ammunition or explosives are to be transported with the vehicle, the activity offering the vehicle for transport shall notify the carrier. in compliance with AR 55-228.

(2) Ammunition and vehicles shall be handled and stowed in accordance with provisions contained in Water Carrier Tariff No. 32 or reissues thereof.

(3) Fuel tanks shall not be more than one-fourth full. (See note, paragraph 6-2.)

(4) The type of fuel in cook stove stored in rear section of XM270 carrier frame shall be identified.

e. Rail.

(1) Railcar controls, levers, valves, or accessories shall no be manipulated.

(2) Personnel shall not walk backwards on railcar deck.

(3) Gloves should be worn for handling wire rope.

CHAPTER 4
AIR TRANSPORTABILITY GUIDANCE

4-1. Scope

This chapter provides guidance for transporting the XM270 by US Air Force aircraft. lt covers technical and physical characteristics and safety considerations and prescribes the materials and guidance required to prepare. load, tie down. and unload the XM270.

4-2. Maximum Use of Aircraft

The loads described in this section are not maximum loads. Total cargo loads and operating ranges are subject to variables such as weather, airfield conditions, individual aircraft characteristics, and distance. General guidance on total cargo loads and operating ranges are provided in TM 38-236/AFP 71-8. Additional cargo and or personnel within allowable load limits and restrictions. prescribed by pertinent safety regulations. may be transported.

4-3. Applicability

The XM270 is transportable by the C-141 and C-5A aircraft. Procedures in this manual and those prescribed by Air Force Technical Orders lC-141A-9 and IC-5A9 apply. The vehicle tiedown patterns are shown in figures 4-1 and 4-2. The tiedown devices required. the location of the tiedown points on the vehicle, the corresponding fittings to which the devices are secured, and the number and capacity of devices are shown in tables 4-1 and 4-2. The restraint factors (g loads) for crew and passenger safety in the event of a controlled emergency landing are identified in AR 70-47 and TO 1C-141A-9 and TO 1C-5A-9.

4-4. Safety

Safety precautions are contained in chapter 3.

4-5. Preparation, Materials, Loading, and Unloading

a. Preparation. Each vehicle or component shall be checked carefully to assure:

(1) That all loose items are properly secured with nylon cord or suitable substitute.

(2) That antennas are tied down or removed and hatches are in secured position.

(3) That all externally and internally stowed equipment is secure.

(4) That ammunition boxes and grenades are secure.

(5) That the driver's side window is secured open before the XM270 is backed into the C-141 aircraft, as driver cannot exit the vehicle with window closed.

(6) That the rear lift fittings are unbolted from inside the aft vehicle body and installed below the cage assembly at the rear of the vehicle.

WARNING

Launch Pod Containers (LP/C's) with or training rounds shall not be installed on the launcher for loading in the C-141 aircraft. They shall be palletized and loaded separately'.

WARNING

TM 38 250 (AFM 71-4) shall be consulted to assure comparability of additional cargo to be loaded with the XM270.

b. Materials. Plywood strips or lumber for rolling and parking shoring are required to protect the aircraft floor and ramps during loading, flight. and unloading.

c. Loading into C-141 Aircraft.

(1) The XM270 shall be backed into the aircraft to the position indicated in figure 4-1.

(2) The XM270 transmission range selector shall be placed in neutral and brakes shall be set.

(3) Tiedown shall be in accordance with the pattern shown in figure 4-1 and the data given in table 4-1.

d. Loading into C-5A Aircraft.

(1) The XM270 shall be backed into the aircraft to the position indicated in figure 4-2.

(2) The transmission range selector shall be placed in neutral and brakes shall be set.

(3) Tiedown shall be in accordance with the pattern shown in figure 4-2 and the data given in table 4-2.

e. *Unloading.*

(1) Procedures for unloading are the reverse of those for loading.

(2) The rear lift fittings shall be removed and stowed in the aft vehicle body after unloading.

4-6. Internal and External Transport by US Army Helicopters

The XM270 exceeds the size and weight for either internal or external transport by US Army helicopters.

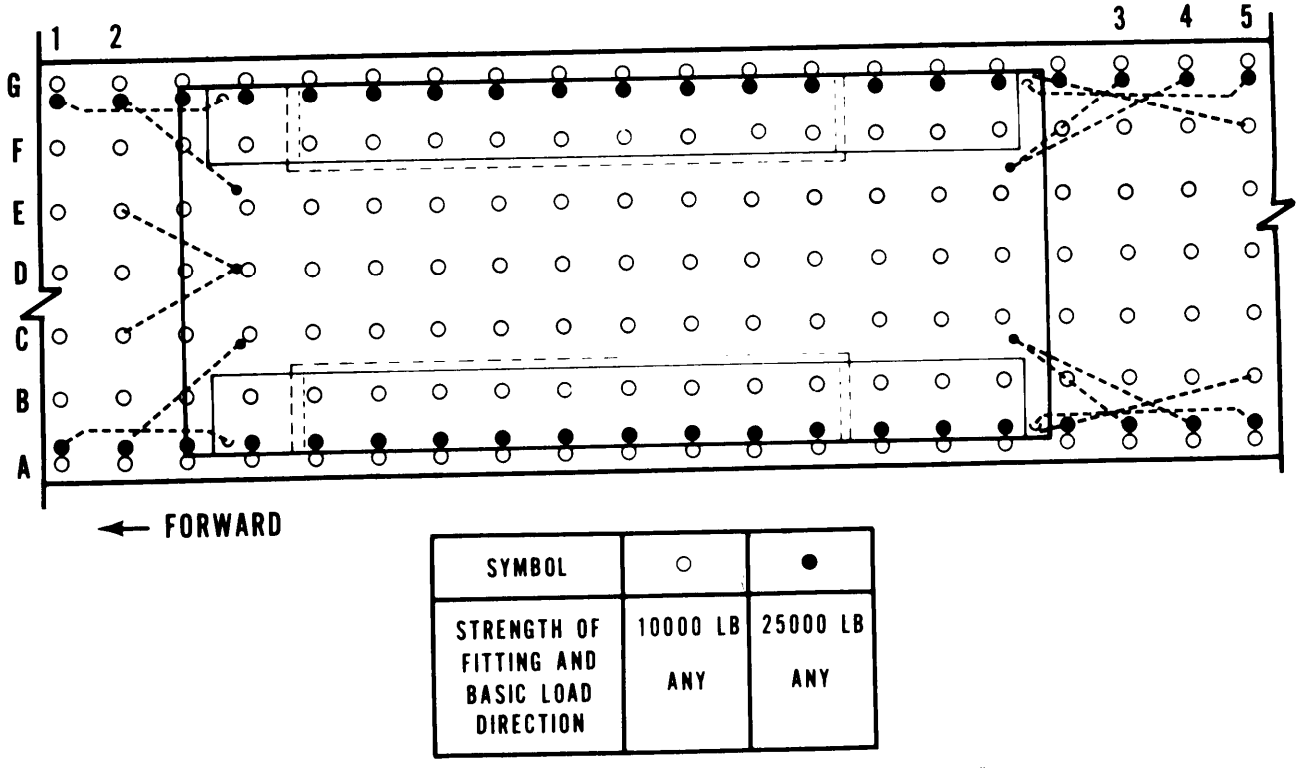

Figure 4-1. Tiedown diagram for XM270 in US Air Force C-141 aircraft.

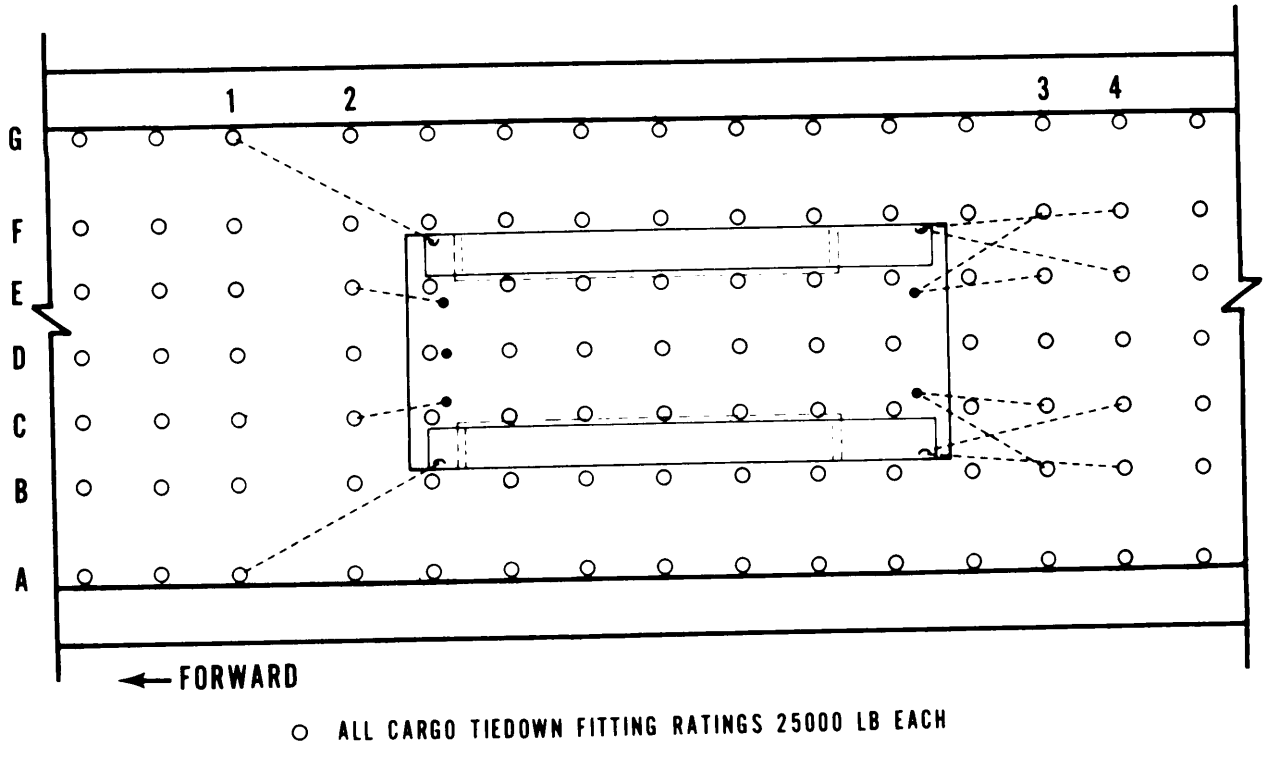

Figure 4-2. Tiedown diagram for xm270 in US Air Force C-5A aircraft.

Table 4-1. Tiedown Data for XM270 in US Air Force C-141 Aircraft

Tiedown fitting		Tiedown device		
desig-nation	capacity in 1.000 lb	type	capacity in 1,000 lb	Attach to item
G1	25	MB-2	25	Left rear lift provision
A1	25	MB-2	25	Right rear lift provision
G 2	25	MB-2	25	Left rear tiedown provision
A 2	25	MB-2	25	Right rear tiedown provision
E2	10	MB-1	10	Towing pintle
C 2	10	MB-1	10	Towing pintle
G 3	25	MB-2	25	Left front tiedown provision
A 3	25	MB-2	25	Right front tiedown protvision
G 4	25	MB-2	25	Left front tiedown provision
A 4	25	MB-2	25	Right front tiedown provision
G 5	25	MB-2	25	Left front lift provision
A 5	25	MB-2	25	Right front lift provision
B5	10	MB-1	10	Left front lift provision
F5	10	MB-1	10	Right front lift provision

Table 4-2. Tiedown Data for XM270 in US Air Force C-5A Aircraft

Tiedown fitting		Tiedown device		
desig-nation	capacity in 1,000 lb	type	capacitj in 1,000 lb	Attach to item
G1	25	MB-2	25	Left rear lift provision
A1	25	MB-2	25	Right rear lift provision
E2	25	MB-2	25	Left rear tiedown provision
C 2	25	MB-2	25	Right rear tiedown provision
F3	25	MB-2	25	Left front tiedown provision
B3	25	M B - 2	25	Right front tiedown provision
E3	25	M B - 2	25	Left front tiedown provision
C 3	25	MB-2	25	Right front tiedown provision
F 4	25	MB-2	25	Left front lift provision
B 4	25	MB-2	25	Right front lift provision
E4	25	MB-1	10	Left front lift provision
C 4	25	MB-1	10	Right Front lift provision

CHAPTER 5
HIGHWAY TRANSPORTABILITY GUIDANCE

5-1. Scope

This chapter provides guidance for transporting the XM270 over highways. It covers technical and physical characteristics and safety considerations and prescribes the materials required to prepare, load, tie down, and unload the XM270.

5-2. Applicability

a. The XM270 will be considered for road march under appropriate tactical situations only. It has a maximum operating range of 300 miles (483 km) and a maximum speed of 38 miles (61.2 km) per hour. Although its tracks are rubber padded, the XM270 shall not be moved over paved public highways without specific approval from the federal, state, and or local authorities prior to movement.

b. The XM270 loaded on semitrailers exceeds the width limitations in CONUS and oversea areas. Such movement over public highways in CONUS and oversea areas may be made only when other transport modes cannot be used. In such cases, it normally can be transported by military or commercial low-bed semitrailers of adequate capacity. Special permits are required in CONUS (AR 55-162), and special routing ma) be required overseas for outsize overweight shipments. Legal limitations of oversea areas are identified in "Limits of Motor Vehicle Sizes and Weights," *International Road Federation, 1023* Washington Building, Washington, DC 20005.

5-3. Safety

Safety precautions are contained in chapter 3.

5-4. Preparation, Materials, Loading, and Unloading

a. Preparation. Antennas shall be tied down or removed, armor protection for windows shall be closed. mirrors shall be folded, and loose gear shall be secured with nylon cord or suitable substitute.

b. Materials. Blocking and tiedown material (table 5-1) shall be provided by the shipping activity.

c. Loading.

(1) The XM270 may be placed in the tiedown position on a semitrailer by a crane of adequate capacity (22-ton minimum). It may be driven onto the semitrailer if a suitable ramp is available. When the XM270 is in tiedown position, its transmission range selector shall be placed in neutral position and wire tied to prevent movement, and its parking brakes shall be set.

(2) Materials application and tiedown diagram to adequately restrain the load against forces encountered at normal speeds and operating condition are shown in figures 5-1 and 5-2. Blocking and tiedown details are given in figure 5-3. A turning diagram for the truck-tractor-semitrailer combination is shown in figure 5-4. A bill of materials is shown in table 5-1, and guidance for their application is given in table 5-2.

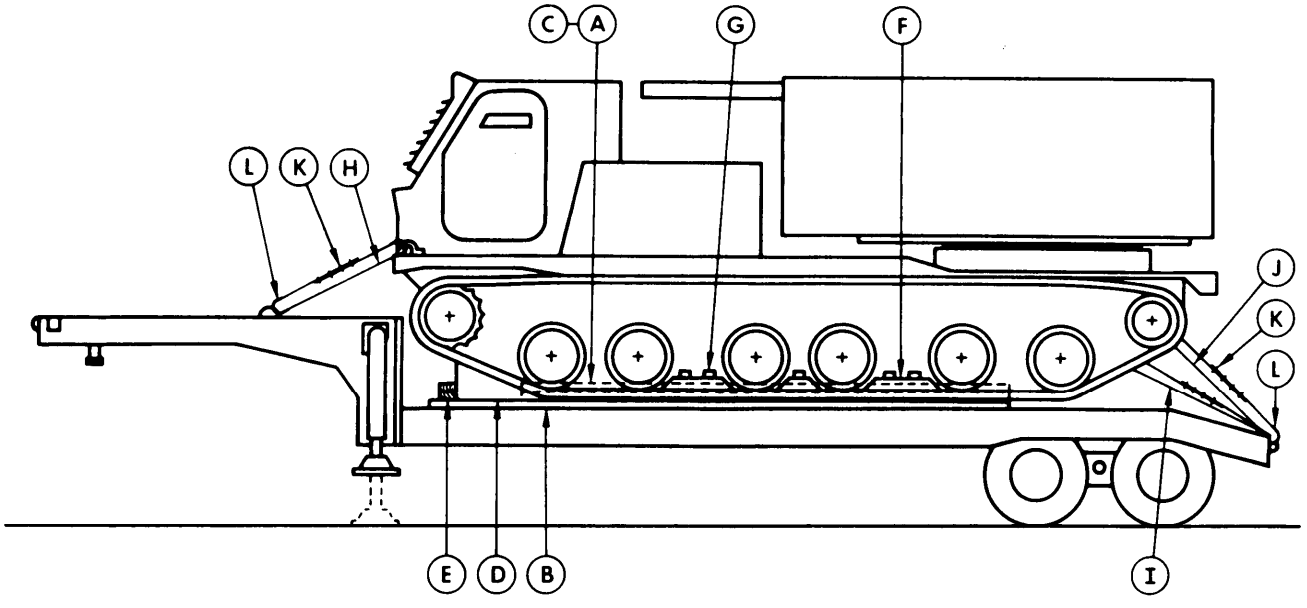

Figure 5-1. Tiedown diagram for XM270 on M 172A1 semitrailer (side view).

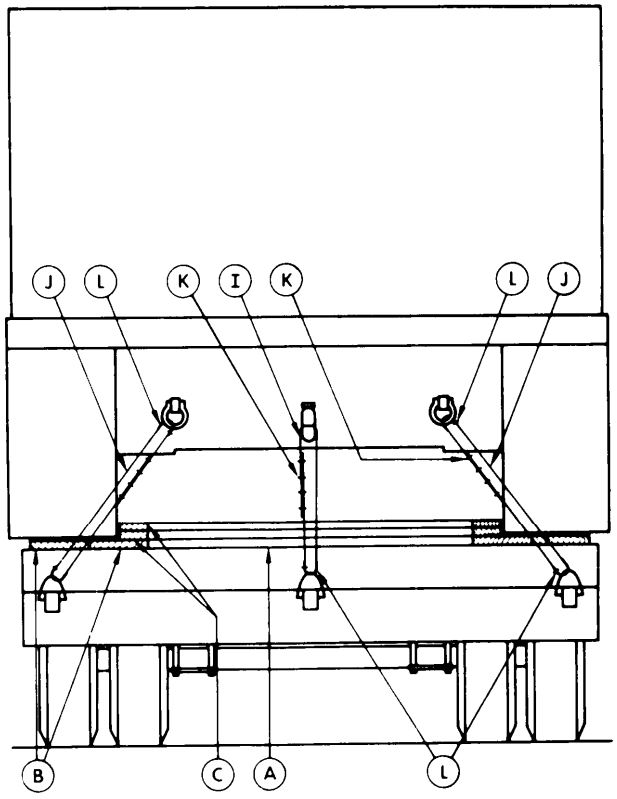

Figure 5-2. Tiedown diagram for XM270 on M172A1 semitrailer (end view).

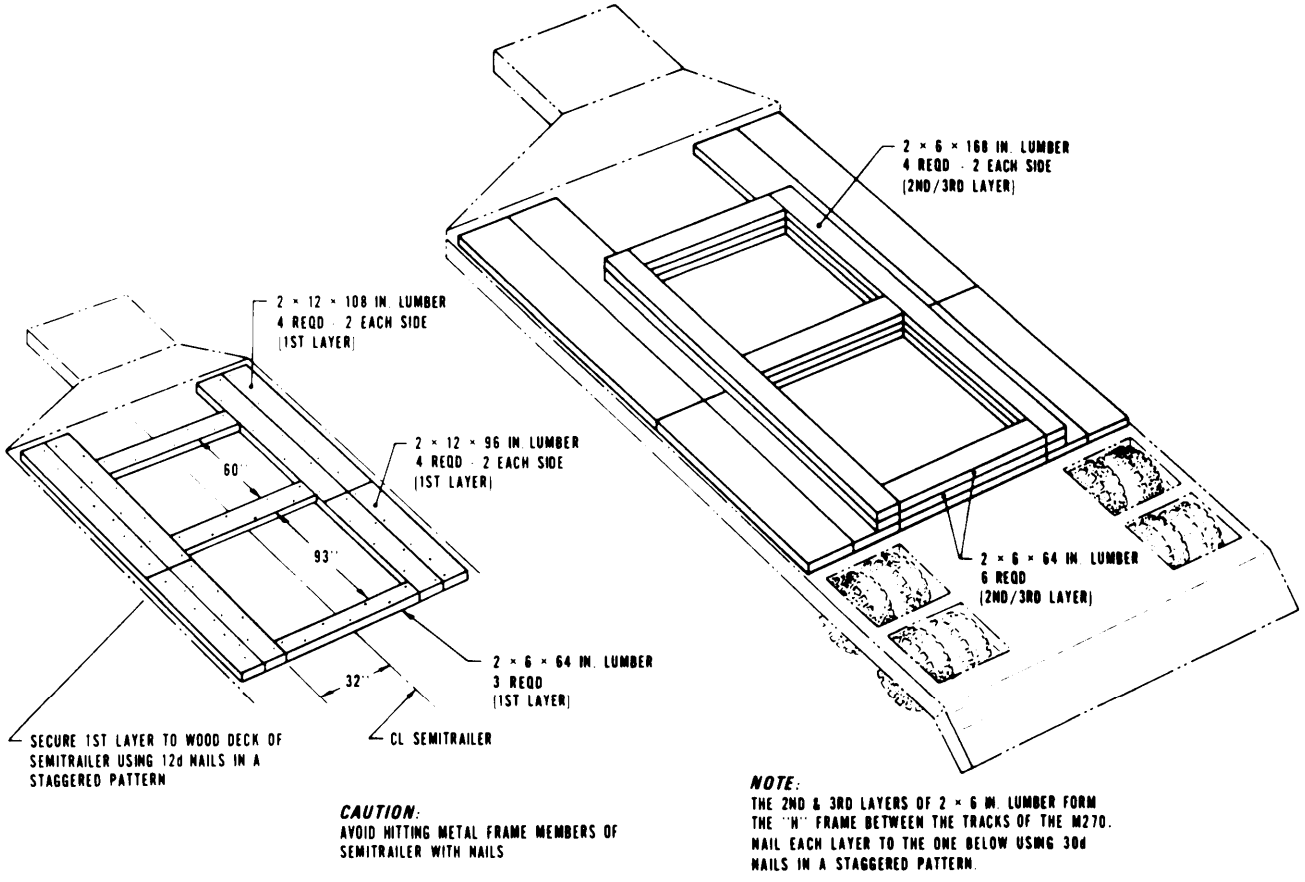

Figure 5-3. Placement of shoring on M172A1 semitrailer before loading XM270.

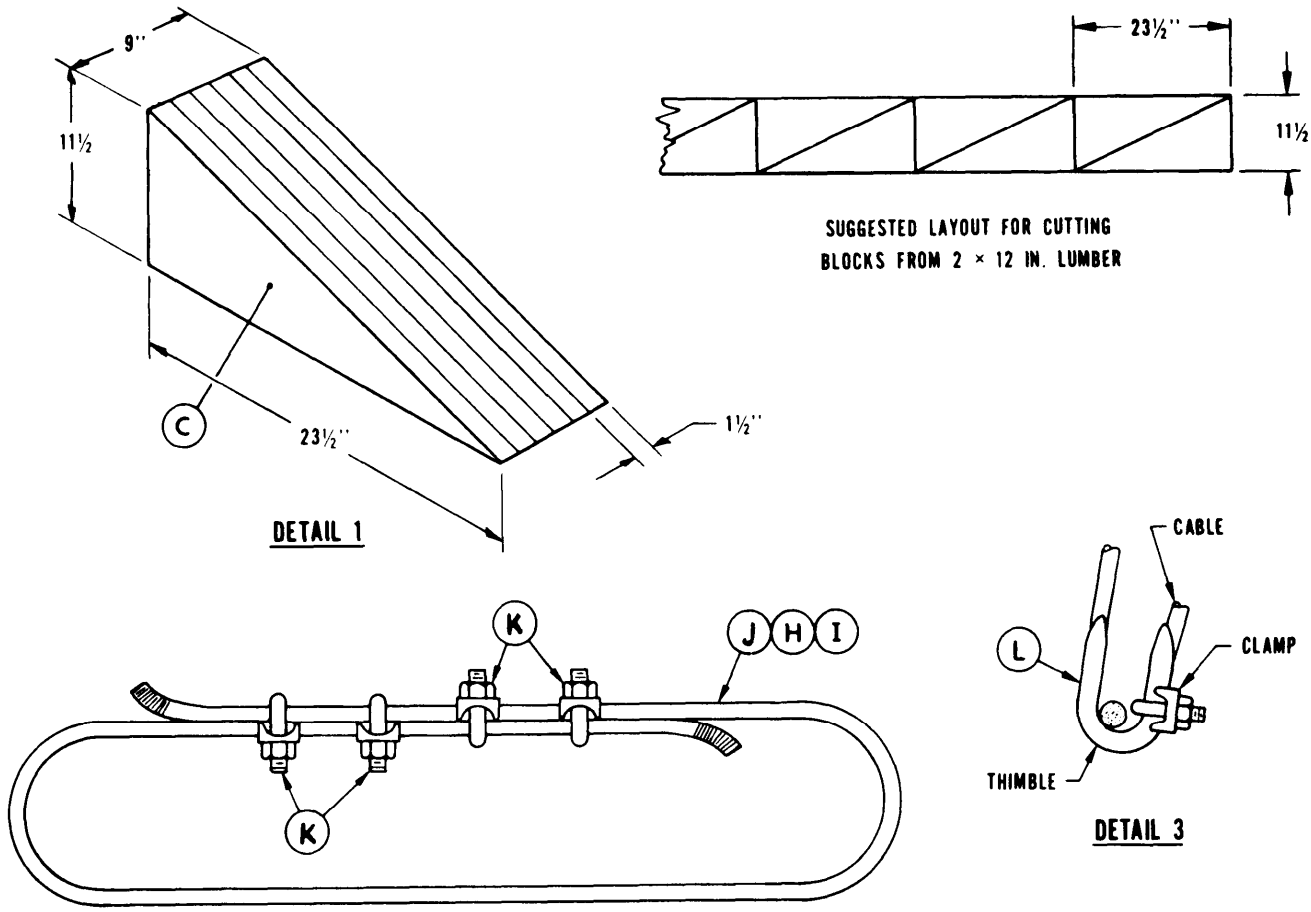

Figure 5-4. Blocking and tiedown detail diagram.

Table 5-1. Bill of Materials for Blocking and Tiedown of XM270 on M172A1 Semitrailer (figs 5-1 through 5-4)

Item	Description	Approximate quantity
Lumber	Douglas fir or comparable. straight-grain. free from material de defects, Fed Spec MM 1. 751H:	
	1- x 4-inch	15 linear ft
	2- x 4-inch	4 linear ft
	2- x 6-inch	120 linear ft
	2- x 12-inch	68 linear ft
	6- x 6-inch	32 linear ft
Nails	Common. steel, flathead. bright or cement-coated. type II. style 10. Fed Spec FF N 1058:	
	12d	95
	2od	20
	3od	130
Wire rope*	6 x 19. IWRC; improved plow steel: preformed. regular-lay. table X. Fed Spec RR W 410C:	
	1/2-inch	90 ft
Clamps*	Wire rope. U-bolt clips, saddled. single-grip. steel. Crosby heavy-duty, or equal, Fed Spec FF-N-1058:	
	1/2-inch	20
	3/8-inch	9
Thimble*	Standard. open type:	
	1/2-inch	9

*Chains and load binders may be substituted.

Table 5-2 Application of Material for Blocking and Tiedown of XM270 on M172A1 Semitrailer (figs 5-1 and 5-2

Item	No. required	Application
A	3	*Brace (fig 5-3).* Each layer consists of three pieces Of 2- x 6- x 64-inch lumber. Place the first piece across semitrailer, even with the forward edge of the wheel well, with one end 32 inches from the center line of the trailer. Nail to trailer with 12d nails spaced approximately 8 inches apart, in staggered pattern. **CAUTION** Do not attempt to nail in the trailer's metal frame. Place the second brace parallel to and 93 inches from the first brace, and nail with 12d nails. Place the third brace parallel to and 60 Inches from the second brace, and nail with 12d nails. Repeat tor next two layers, nailing the second and third layers with 30d nails.
B	2	*Riser (fig 5-3).* Each consists of tour pieces of 2- x 12-inch lumber. Place one piece of 96-inch lumber even with the aft edge of Item A next to the wheel well. Insure that item B contacts approximately half of the end of the middle Item A. Press Item B firmly against both items A and nail with 12d naills In a staggered pattern Butt one piece of 108-inch lumber to the end of the 96-inch lumber. Press item B firmly against both items A and nail with 12d nails In a staggered pattern. Place two like pieces (one 96-inch and one 108-inch) alongside the first pieces, and nail with 12d nails through the inboard 4 inches. (The outboard part of the second pieces of item B cover the outside metal frame of the trailer.) Repeat the above for the opposite side of the trailer.
C	2	*Upper board layers for 'H' frame.* Each consists of two pieces of 2- x 6- x 168-inch lumber. Place one piece against item A and on top of item B for second layer, as in figure 5-3, and nail with 30d nails in a staggered pattern. Repeat for third layer. Repeat above for opposite side.
D	2	*Block (detail 1, fig 5-4).* Each consists of six pieces of 2- x 12- x 23-1/2-inch lumber cut as shown in detail 1. Nail pieces together with four 12d nails in each piece. Place the block on item B, with the heel 17 inches trom the trailer gooseneck and 5 inches from side of trailer. Toenail blocks in place with three 20d nails in each side. Nails should be driven 6 inches from each end and one in the middle of each side, starting the nail near a 60-degree angle, 1-1/2 inches from the bottom.
E	2	*End cleat.* Each consists of two pieces of 2- x 4- x 12-inch lumber. Press one piece firmly against the heel of item D, and nail with four 20d nails. Nail the second piece to the first with three 30d nails. Lift or drive the XM270 onto the semitrailer unit it rests firmly against the blocks, item D, and set the brakes.
F	6	*Road wheel blocks.* Each consists of two pieces of 6- x 6-inch lumber cut to fit between road wheels 2-3, 3-4, and 4-5. Place on block on the outside part of the track and one block on the inside part of the track.
G	10	*Tie cleat.* Use two pieces of 1- x 4- X 14-inch lumber across the top of each set of F blocks between road wheels 2-3 and 4-5. Use one piece across the top of blocks between road wheels 3-4. Nail each cleat with two 12d nails in each block.
H *	2	*Wire rope.* Each consists of one piece of 1/2-inch wire rope, length as required. Form a complete loop between the lift fitting on the XM270 to the tiedown provision on top of the gooseneck of the semitrailer. Wire rope ends should overlap a minimum of 24 inches. Place one thimble, item L, at the lift fitting and one at the tiedown provision. Repeat for opposite side.
I*	1	*Wire rope.* One piece of 1/2-inch wire rope, length as required. Form a complete loop, with 24-inch overlap, between towing pintle and the center tiedown provlsion at the rear of the semitrailer. Place one thimble, item L, at the tiedown provision (not required for pintle).
J *	2	*Wire rope.* Each consists of one piece of 1/2-inch wire rope, length as required. Form a complete loop, with 24-inch overlap, between the aft tiedown fitting on the XM270 and the outside tiedown provision on the rear of the semitrailer. Place one thimble, item L, at the aft tiedown fitting and one at the tiedown provisions. Repeat for opposite side.

Table 5-2. Application of Materials for Blocking and Tiedown XM270 on M172A1 Semitrailer (figs 5-1 and 5-2)-Continued

Item	No. required	Application
K *	29	*Clamps (twenty 1/2-inch and nine 5/8-inch).* Place four 1/2-inch clamps on each wire rope at the overlap area and space 3-1/2 inches apart, with a minimum of 6 inches from each end of wire rope (detail 2, fig 5-4). Tension wire rope and tighten clamps to 35-40 foot-pounds torque. Use one 5/8-inch clamp to secure each thimble, item L, to wire rope at both lift fittings and both tiedown fittings on the XM270 and one at each tiedown provision on semitrailer (detail 3, fig 5-4).
L *	9	***Thimbes.*** Place one thimble on wire rope at each lift and tiedown fitting on the XM270 and one at each tiedown provision on the semitrailer.

*Chains and loadbinders may be substituted for items H, I, J, K, and L.

CHAPTER 6
MARINE AND TERMINAL TRANSPORTABILITY GUIDANCE

6-1. Scope

This chapter provides guidance for transporting the XM270 by marine mode. It covers technical and physical characteristics and safety considerations and prescribes the materials and guidance required to prepare, load, tie down and unload the XM270.

6-2. Applicability

The XM270 can be transported by a variety of inland-waterway cargo carriers and lighters and by all seagoing vessels. Whenever possible, the XM270 vehicles should receive the protection of below-deck stowage. Good stowage of vehicles means placing them fore and aft as close together as practical, with minimum spacing between outer vehicles and the sweat boards; protecting breakable parts; placing armor protection for windows; stowing spare parts usually within or near the vehicles; stowing vehicles in neutral with brakes on; disconnecting battery terminals; draining fuel; and securing vehicles by adequate blocking and lashing. Securing includes: blocking tracks on all four sides so that the vehicle cannot move in any direction; bracing individual vehicle blocks to bulkheads, stanchions, and other vehicle blocks; and lashing vehicle with wire rope or chain.

NOTE

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

NOTE

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

6-3. Safety

Safety precautions are contained in chapter 3.

6-4. Preparation, Materials, Loading, and Unloading

a. Preparation. The XM270 shall be loaded on vessels in its minimum reduced height configuration. It can be loaded onto landing craft, beach discharge and amphibious lighters, and landing ships under its own power or by crane of adequate capacity (22-ton minimum). It can also be loaded under its own power onto the decks of barges from a pier when tidal conditions are suitable and ramps are available. lt 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 XM270 onto vessels. It can be loaded onto roll-on/roll-off vessels under its own power or can be towed. See figure 6-1 for typical lifting diagram. Vehicle tracks should be equipped with rubber pads. Vessel deck surfaces should be dry and free of grease or debris.

b. Materials. Materials required for the specific vessel being loaded are identified in the following paragraphs.

c. Loading.

(1) Cargo vessel. Typical blocking and tiedown details for securing the XM270 on general-cargo vessels are shown in figure 6-2. Materials and their application are listed in tables 6-1 and 6-2.

(2) *Special design.* All seatrain trailer vessels, roll-on/roll-off vessels, landing ships, and attach-cargo vessels are equipped with patented lashing gear and pre-positioned fittings in the deck. By proper application of patented lashing gear (as shown in fig 6-3), blocking and bracing is not required. Vehicle tracks should be equipped with rubber pads.

(3) *Barges and lighters.* When the XM270 is to be moved by barge or similar lighterage to or from vessels secured to piers or a sheltered anchorage, blocking and chocking material is required. If the XM270 is to be moved extended distances or through rough waters, tiedowns must also be used.

(4) *Landing ships, landing craft, and amphibious vehicles.* When the XM270 is to be moved extended distances or through rough waters, blocking and tiedowns must be used. Most vessels are equipped with turnbuckles with a sheep's-foot on one end that fits into a deck cloverleaf; where not provided, a suitable substitute may be used.

(5) *Lighter Aboard Ship (LASH).*

(a) Armored tracked vehicles may arrive at the processing area with hatches padlocked shut to prevent pilferage. Since these vehicles cannot maneuver under their own power, their tracks are not braked and transmissions are set in the neutral position to permit towing in the loading area. Contrary to normal stowage of tracked vehicles on cargo vessels, the idler wheel chocks, when positioned by crane in their final stow location, should be in place. Shoring usually is not used beneath the trends of tracked vehicles with rubber pads. Friction forces between the pads and the deck are sufficient to make it unnecessary.

(b) Floating barges noticeably tilt when heavy items are placed aboard them. Tracked vehicles should be loaded by placing one at one end and the next at the other end. This process should be repeated until all are

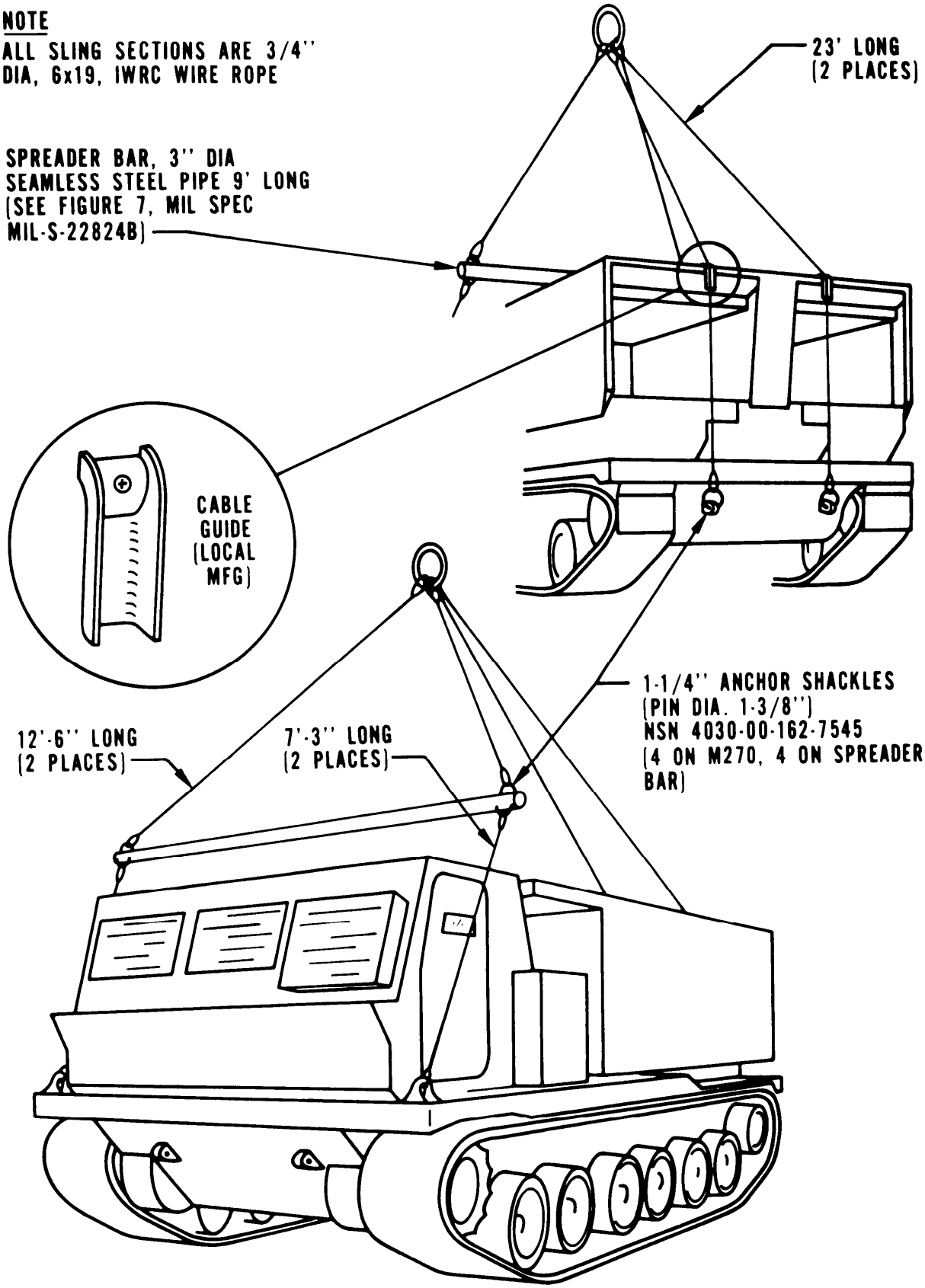

Figure 6-1.Lifting diagram for XM270 by use of six-legged sling and spreader bar.

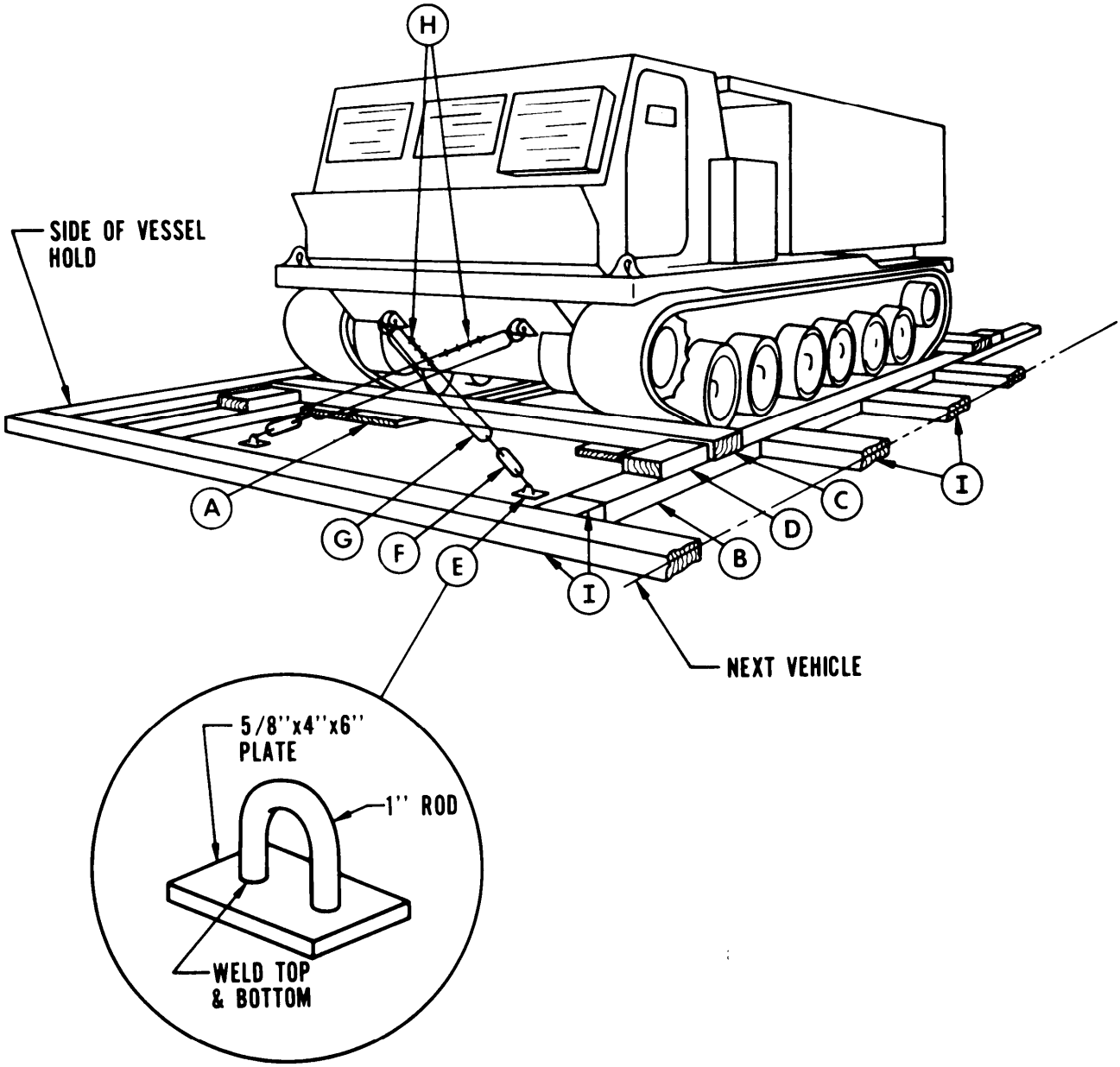

Figure 6-2. Typical blocking and tiedown of XM270 in hold of general-cargo vessel.

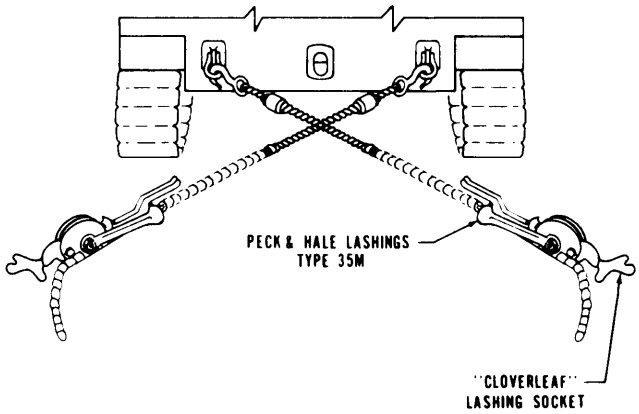

Figure 6-3. Rear view of XM270 tied down on RORO ship showing typical securement with patented lashing.

loaded. If center of balance cannot be centered in the barge, vehicles should be loaded side by side facing opposite directions.

(c) The XM270 may be adequately blocked and braced with 6- x 8-inch timbers. lf the load orientation permits, blocking maybe installed as a separator between the vehicle track and the barge bulkhead. Blocking usually is installed in front of and in rear of the tracks, and the bracing part is force-fitted to the bulkhead. Loading, blocking, and bracing begin from the outer areas of the barge toward the center, which is loaded last. A single separator timber is installed against the tracks of the vehicle, and the next vehicle loaded is placed firmly against the timber. The vehicles shall be secured with wire rope and turn buckles as shown in figure 6-4. The void area remaining in the center of the barge after the final vehicle has been loaded shall be filled (fig 6-5) by cut and force-fitted blocking.

Table 6-1. Bill of Material.Y, for Blocking and Tiedown of the XM270 in Hold of 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-751:	
	4- x 6-inch	4 linear ft
	2.- x 10-inch	72 linear ft
	6- x 8-inch	120 linear ft
Nails	Common, steel, flathead, bright or cement-coated; table X1-b, Fed Spec FF-N-105: 20d	20
	40d	116
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; table X, Fed Spec RR-W-410: 1/2-inch	40 ft
Clamps	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal; MIL-STD-16842: 1/2-inch	16
Pad eyes	Local manufacture from 1-Inch steel rod and 4- x 6- x 5/8-inch steel plate. Bore l-inch holes through plate and weld U-shaped 1-inch rod ends top and bottom of plate	4
Turnbuckles	T- x 18-inch with jaw and jaw endfittlngs	4

Table 6-2. Application of Materials for Blocking and Tiedown of XM270 in Hold of General-Cargo Vessel (fig 6-2)

Item	No. required	Application
A	4	Lumber, 2- x 10- x 216-inch. Pre-position on floor of vessel hold under vehicle treads; two pieces required under each tread, (Not used if tracks have rubber pads.)
B	2	*Side blocking.* Each consisls of one piece of 6- x 18-inch x length-to-suit lumber. Locate against outside of vehicle treads; one piece on each side of vehicle.
C	2	*End blocking.* Each consists of one piece of 6- x 8-inch x length-to-suit lumber. Locate on top of item B against vehicle treads (front and rear). Toenail to item B with four 40d nails at each end.
D	4	*Backup cleats, 4- x 6- x 12-inch lumber.* Locate on top of Item B against item C. Toenail to item B with four 40d nails.
E	4	*Pad eye.* Four required on floor of vessel.
F	4	*Turnbuckle, 1- x 18-inch.* Attach one jaw to wire rope, item G, and other jaw to pad eye, item E. Tighten turnbuckles evenly.
G	4	*Wire rope, 1/2-inch, in a complete loop.* Secure with clamps (item H). Attach to front and rear shackles and to the turnbuckles.
H	16	*Clamp. 1/2 inch.* Secure to item G in complete loop.
l	as required	*Bracing, 6- x 8-inch x Ienglh-to-suit lumber.* Brace as required against vehicle blocking, side of vessel, or adjacent cargo blocking to immobilize vehicle and blocking. Secure each end to adjacent bracing or blocking by toenailing with 40d nails.

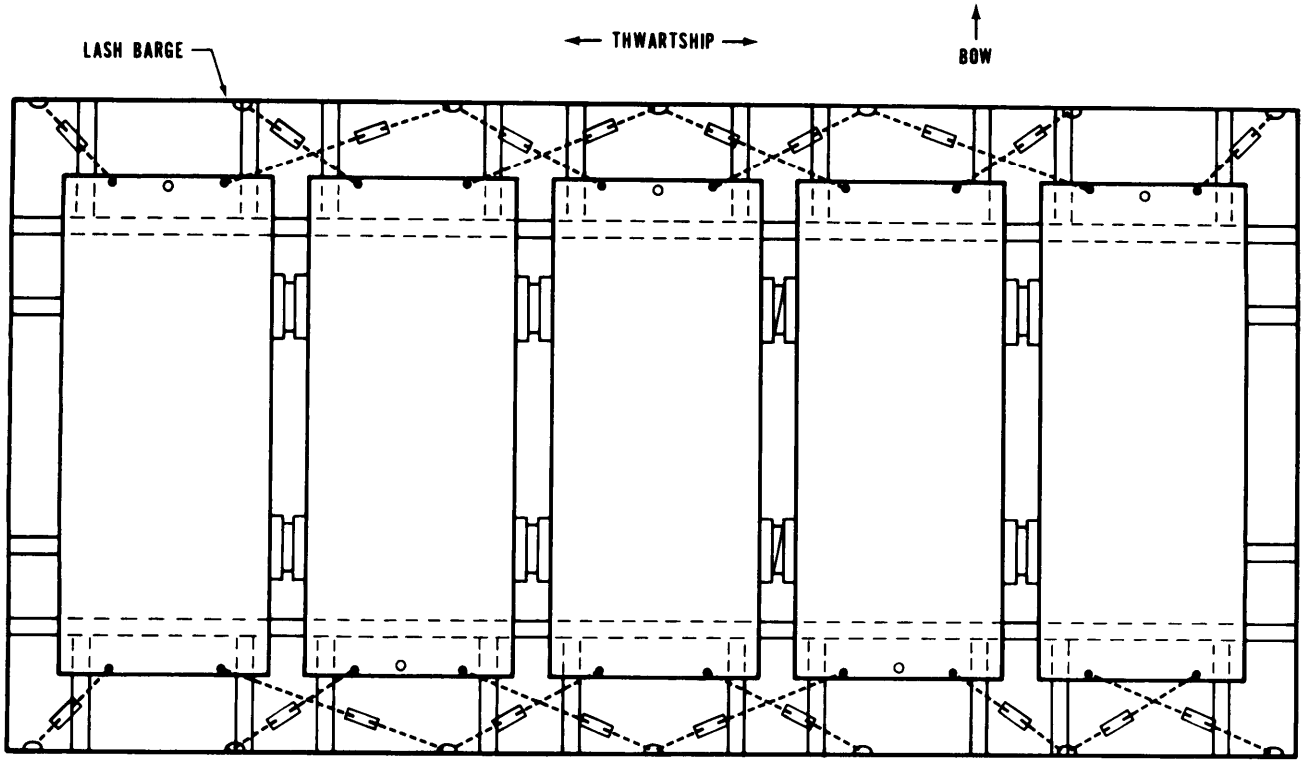

Figure 6-4. Typical loading of five XM270s on a LASH (59.9 ft by 29.5 ft), by use of wire rope, cable clips, and turnbuckles, with blocking between vehicles and between vehicles and hull.

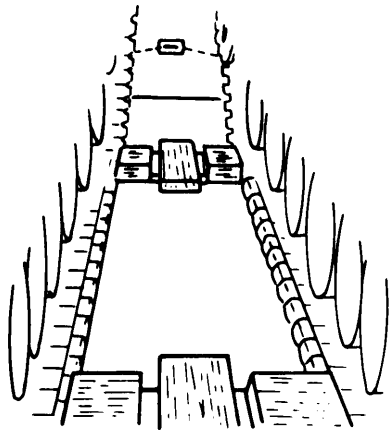

Figure 6-5. Filling center void or XM270-to-hull void area.

CHAPTER 7
RAIL TRANSPORTABILITY GUIDANCE

7-1. Scope

This chapter provides guidance for transporting the XM270 by rail. It covers technical and physical characteristics and safety considerations and prescribes the materials and guidance required to prepare, load, tie down, and unload the XM270.

7-2. Applicability

The guidance for transporting the XM270 by railway is based on a flatcar width of 10 feet and on other special-purpose railcars of adequate capacity. Consideration is given to single and multiple movements on the types of flatcars normally used for movement of this vehicle without sectionalization or major disassembly. Additional cargo, as approved by the activity offering the items for transport, may be transported with the vehicles.

7-3. Safety

Safety precautions are contained in chapter 3.

7-4. Preparation, Materials, Loading, and Unloading— CONUS Railways

a. Preparation. Antennas must be tied down or removed, armor protection for windows closed, mirrors folded, and loose gear secured with nylon cord or suitable substitute. If the XM270 is to be driven on the railcar, the window protection shall be left open until after loading.

b. Materials. Materials for loading the vehicle onto flatcars are provided in the respective figures and tables for the type of flatcar used. Special-purpose railcar-tiedown equipment is identified for the type of car discussed.

c. *Loading,* The XM270 may be placed in the tiedown position on a railcar by a crane of adequate capacity (22-ton minimum). Also, it may be driven or towed onto the railcar if a suitable ramp or bridge is available.

(1) *General-purpose flatcar.* The load illustrated in figures 7-1 and 7-2 is based on a flatcar width of 10 feet. Detailed instructions for blocking and tiedown are shown in figure 7-3. A bill of materials is provided in table 7–1 and application of those materials for securing the XM270 on general-purpose flatcars is presented in table 7-2.

NOTE

A staggered nailing pattern should be used when lumber or laminated lumber is nailed to the floor of a railcar. The nailing pattern for an upper piece of lumber should be adjusted, as required, so that a nail for that piece will not be driven into or against a nail in the lower piece of lumber.

Table 7-1. Bill of Materials for Blocking and Tiedown of XM270 on General-Purpose Flatcar figs 7-1, 7-2, and 7-3)

Item	Description	Approximate quantity
Lumber	Douglas-fir or comparable, straight-grain, free from material defects, Fed Spec MM-L-751:	
	2- x 4-inch	30 linear ft
	2- x 6-inch	80 linear ft
	2- x 12-inch	36 linear ft
	6- x 6-inch	40 linear ft
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay, table X, Fed Spec RR-W-410: 5/8-inch	200 ft
Clamps	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal; MIL-STD 16842: 5/8-inch	32
	3/4inch	14
Thimbles	Standard, open-type: 5/8-inch	14
Nails	Common, steel; flathead; bright or cement-coated; table XI-b, Fed Spec FF-N-105: 16d	80
	20d	296
	30d	160

Table 7-2. Application of Materials for Loading and Securing XM270 General-Purpose Flatcars (figs 7-1, 7-2, and 7-3)

Item	No. required	Application
A	-	*Brake-wheel clearance.* Minimum clearance required is 6 inches above, in back of, and on both sides of, and 4 inches underneath wheel.
B	3	*Brace (item B, detail 1, fig 7-3).* Each layer consists of three pieces of 2- x 6- x 64-inch lumber. Locate the first piece across deck of flatcar, with one end 32 inches from center line of flatcar and nail with 20d nails. Place the second piece parallel to, and 78 inches from. the first piece and nail with 20d nails. Place the third piece parallel to, and 79 inches from, the second piece and nail with 20d nails. Repeat for second layer and nail the top Iayer with 30d nails.
C	2	*Brace (item C, detail 1, fIg 7-3).* Each layer consists of two pieces of 2- x 6- x 168-inch lumber. Place one piece firmly against the ends of items B and nail with 20d nails. Place the second piece on top of the first and nail with 30d nails. Repeat for the opposite side.
D	2	*Chock block (detail 2, fig 7-3).* Fabricate from 2- x 12-inch lumber. Laminate pieces using four 16d nails in each piece. Place firmly against center part of the forward ends of the tracks and toenail each side with three 20d nails.
E	2	*Chock block (detal 3, fig 7-3).* Fabricate from 2- x 12-inch lumber. Laminate pieces using four 16d nails in each piece. Place firmly against center part of the aft ends of the tracks and toenail each side with three 20d nails.
F	4	*End cleats.* Each consists of two pieces of 2- x 12- x 12-inch lumber. Place one against each item D and E. Secure the lower piece to floor with four 20d nails and the top piece to the one below with four 30d nails.
G	8	*Side cleats.* Each consists of one piece of 2- x 4- x 18-inch lumber. Place one on each side of items D and E, Secure to the floor with four 20d nails.
H	2	*Wire rope, 5/8 inch.* Attach one complete loop through the towing pintle and stake pocket. Place a thimble between wire rope and bottom edge of stake pocket. Tension wire rope and apply four cable clamps, item M. Apply one cable clamp, item N, to each thimblem, item L (detail 4. fig 7 3).
1	2	*Wire rope 5/8 inch.* Attach one complete loop through stake pocket and tiedown shackle, Place a thimble, item L, between wire rope and shackle and between wire rope and bottom of stake pocket. Tension wire rope and apply four cable clamps, item M.
J	2	*Wire rope 5/8 inch.* Attach one complete loop through stake pocket and tiedown shackle; complete as in item I.
K	2	*Wire rope 5/8-inch.* Attach one complete loop through stake pocket and tiedown shackle; complete as in item I.
L	8	*Thimble 5/8-inch.* Place under wire rope at a sharp radius or square edge to protect rope.
M	32	*Clamp 5/8-inch.* Secure the ends of the wire rope with four clamps each. Place clamps a minimum of 4 inches apart and from ends of wire rope (detail 5, fig 7-3).
N	12	*Clamp 3/4-inch.* Secure each thimble, Item L, in place with one clamp (detail 4, fig 7-3).
O	6	*Road wheel chocking.* Each consists of two pieces of 6- x 6-inch x length-to-suit lumber, cut to fit between road wheels 2-3, 3-4, and 4-5 (detail 6, fig 7-3). Place one piece between inside wheels and one piece between outside wheels of each set 2-3, 3-4, and 4-5 of both tracks.
P	10	*Tie cleat, 2- x 4-inch x length-to-suit lumber.* Locate on top of Item O (inside and outside) and secure with four 20d nails.

Table 7-3. Application of Chain Tiedown for Securing XM270 onto Flatcars Equipped with Cushioned Rub-Rails (Fig 7-4)

Item	No. required	Application
A	-	Brake--wheel clearance. Minimum clearance required is 6 inches above, in back of, and on both side of, and 4 inches underneath wheel (fig 7-4).
B	8 ea unit	Device. Use the Brandon silngle-chain tiedown device 1/2-inch diameter Excel-Ioy chain or similar, proof-tested to 27,500 lbs. Attach chain to the shackle on the vehlcle and to the car rub-rail (detail 1, fig 7-4). Items C and D may be substituted for Item B.
c	4 ea unit	Chain with turnbuckle. Attach chain and turnbuckle to the shackle on the vehicle and to the car rub-rail (detail 2, fig 7-4). All four on one end of the vehicle.
D	4 ea unit	Chain. Attach chain to the shackle on the vehicle and to the rub-rail (detail 3, fig 7-4). All Four on one end of the vehicle.

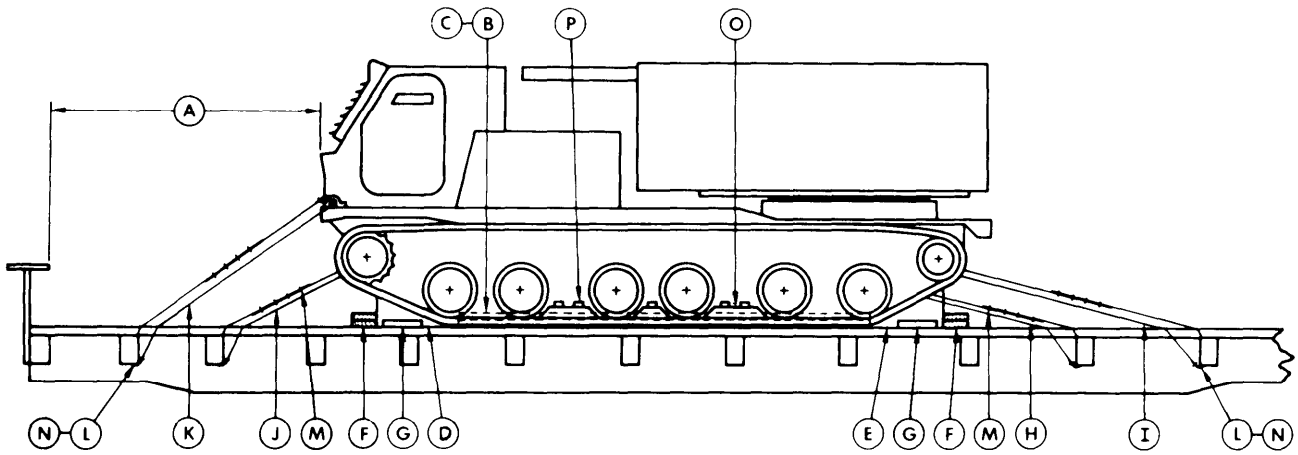

Figure 7-1. Blocking and tiedown diagram of XM270 on CONUS general purpose flatcar (side view).

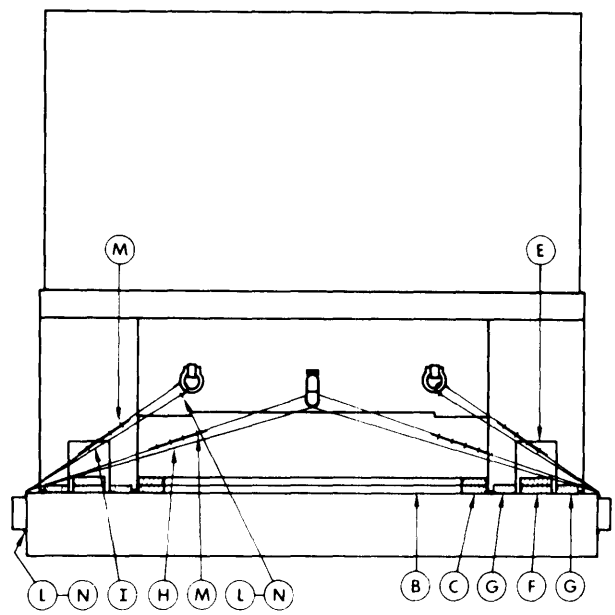

Figure 7-2. Blocking and tiedown diagram of XM270 on CONUS general-purpose flatcar (end view).

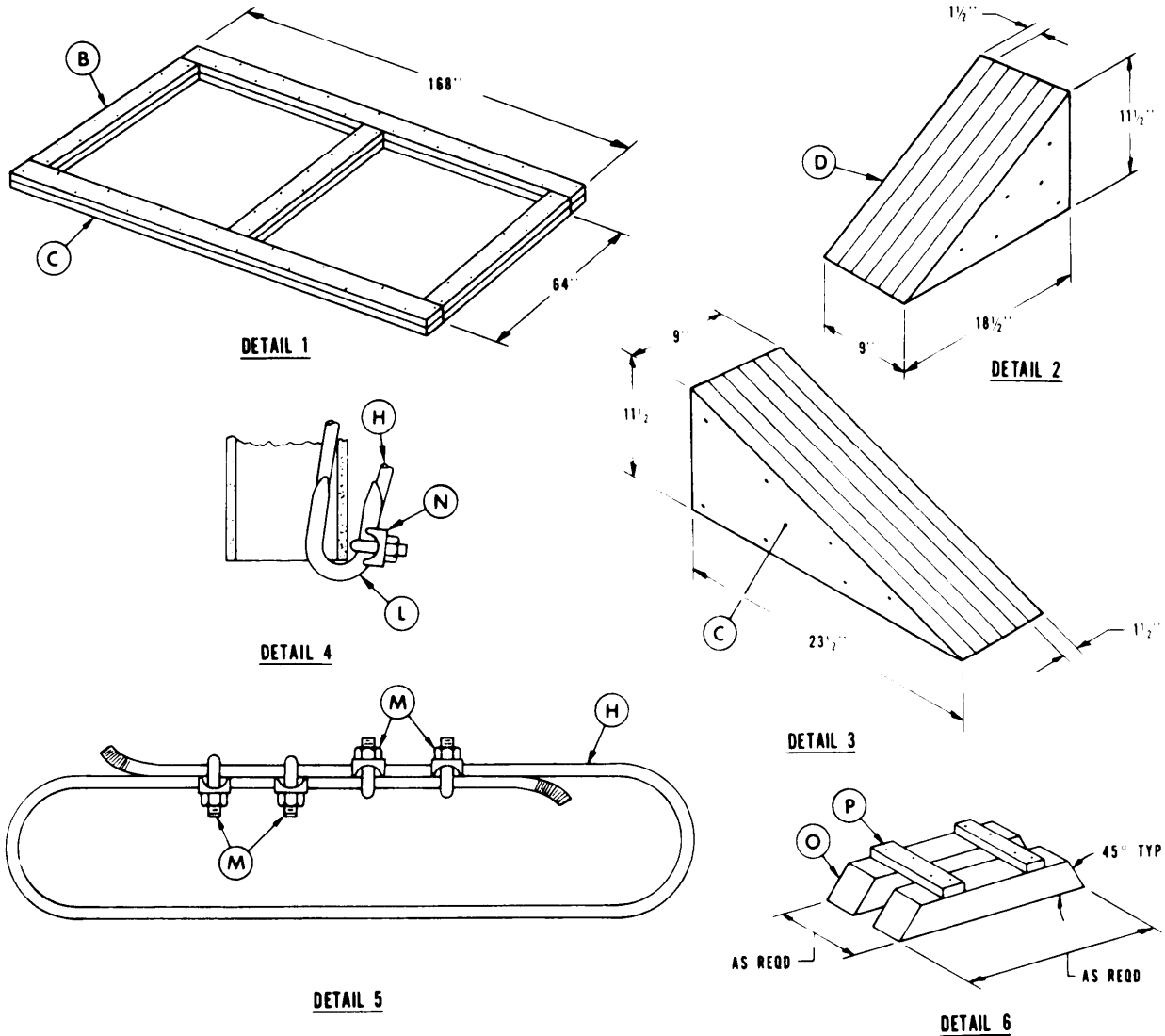

Figure 7-3. Blocking and tiedown detail diagram

(2) *Special-purpose flatcars.* Special-purpose G85 and G89 cushioned rub-rail or similar types of flatcars are suitable for transporting XM270s. The flatcar shown in figure 7-4 is equipped with special heavy-duty tiedown devices and two cushioned rub-rails running the length of the car on each side of the center sill. Materials and their application for securing vehicles on cushioned rub-rail flatcars are presented in table 7-3. Brakes shall not be set and blocking shall not be used.

(3) Conventional chain tiedown cars (without the center rub-rail). Conventional chain-tiedown cars usually are equipped with four parallel channels that run the full length of the car deck: two channels are near the center line of the car, about 30 inches apart, and the other two channels run along the outer edges of the car deck. These channels are recessed so that the top is flush with the deck surface, and each channel contains numerous (usually 8 to 12) chain anchors, each of which has an attached 10- or 12-foot chain. The chain anchors can be moved along the channels and locked in place where needed, At the free end of each chain is a hook, which is passed through the tiedown shackle of the vehicle, is pulled handtight, and is hooked back onto the chain. Tension is then applied to the chain either by tightening a Turnbuckle built into the chain or by turning a ratchet or screw jack in the anchor block. A 3/4-inch square-drive, Heavy-duty ratchet or hinge-handle is needed to tighten the chain at the anchor blocks. Where 1/2-inch chain (proof-tested to 27,000 pounds) is provided, four pairs of chain tiedowns (eight chains total) are sufficient to secure a XM270 on the railcar. Both front and rear tiedowns should be applied at approximately a 45-degree angle. Chains trom the inner channels shall be crossed. Chains from the outer channels shall not be crossed. Hooks shall be wire tied to the chains.

GENERAL INSTRUCTIONS

Loading rules 1A, 3, 4, 5, 7, 9, 14, 15, 19, and 19A, section I of the *Rules Governing the Loading of Commodities on Open-Top Cars and Trailers,* published by the Association of American Railroads, provide applicable guidelines and shall be followed.

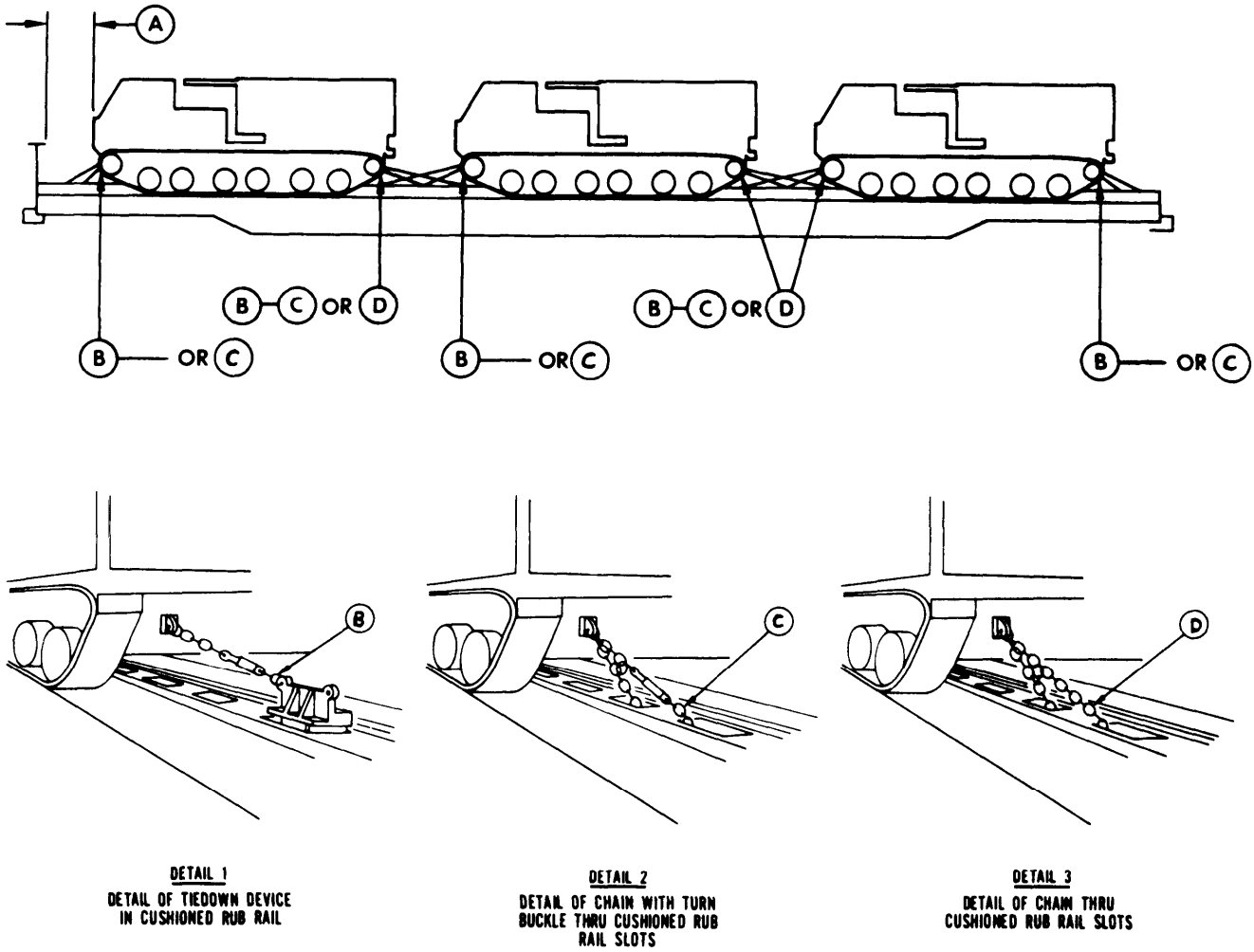

Figure 7-4. Tiedown diagram of XM270s on cushiuoned rub-rail or similar types of flatcars.

GENERAL INSTRUCTIONS

1. Shippers should specify cars equipped with tiedown devices in the quantity shown in item B above when ordering specialized railroad equipment. If conventional chain tiedowns are provided in lieu of the tiedown devices specified in item B above, they must conform to the requirements of items C and D and must be applied as follows:

a. Attach the four chain tiedowns (detail 3, fig 7-4), item D, to one end of the XM270 and to the car tiedown facility. Pull as tight as possible by hand, and attach chain hook to an appropriate link and wire tie.

b. Attach the four chains with turnbuckles, item C (detail 2, fig 7-4) to the opposite end of the XM270 and to the car rub-rail. All four chain tiedown turnbuckles shall be evenly tightened to apply tension to tiedowns on both ends of the XM270. Turnbuckles shall be wire tied or locked to prevent them from turning during transit unless the turn buckles are equipped with self-locking devices.

NOTE

Loadbinders are not to be used in lieu of turnbuckles to tension tiedown chains.

2. XM270s shall be faced in the same direction and be uniformly spaced along the length of the car to allow sufficient space at each end of car and between the vehicles for tiedown, Tiedowns shall be applied parallel to each other at the same end of the vehicle and down from the vehicle point of attachment to the car rub-rail, The angle of the tiedown chain must not be greater than 45 degrees.

3. XM270s weighing up to 44,000 Ibs each, in the quantities of three, can be loaded on 85-ft or longer, cushioned rub-rail equipped cars or similar railroad flatcars with center tiedown positions running the entire length of the car.

4. General rules 4, 5, 7, and 19a, section I of the *Rules Governing the Loading of Commodities on Open Top Cars and Trailers,* published by the Association of American Railroads, provide applicable guidelines and shall be followed.

7-5. Preparation, Materials, Loading, and Unloading— Foreign Railways

The guidance contained in this section shall apply when transporting the XM270 on foreign railways. Consideration is given to single and multiple movements on the types of railcars normally used for the transport of this type of equipment. Because of the various designation systems used by different countries, foreign railcars are difficult to classify. Clearances vary between countries and within a country. Consequently, evaluation of transport capability must be made on an individual basis. The XM270, with the launcher-loader module installed, exceeds unrestricted limits within European countries complying with the passe-partout international (PPI) guage railways; this also applies to most countries in the Middle East and South America, as well as Australia, India, and Pakistan. Because of the height of the XM270, special clearance will be required from local railway authorities. In the Middle East and South America the clearances vary, and each country will require a separate check. In Australia, India, and Pakistan, wide-or broad-guage railways provide greater clearances and fewer restrictions. The preparation, materials, loading, and unloading required for blocking and tiedown of the vehicles onto foreign-service flatcars are essentially the same as those used in CONUS. Dimensions, load capacity, and other data for several flatcars available in Europe, as well as detailed guidance for securing vehicles onto these cars, are contained in the 4th Transportation Command Pamphlet 55-2, *Tiedown Guide for Rail Movement.*

APPENDIX A
CONVERSION TABLES

1. *Common Metric Abbreviation.*

m	= meter	kg	= kilogram
dm	= decimeter	km	= kilometer
cm	= centimeter	t	= metric ton

2. *Linear Measure.*

1 mi	= *1,609.35* m	1 km	= 0.6214 mi
1 yd	= 0.9144 m	1 m	= 1,0936 yd
1 ft	= *0.3048* m	1 m	= 3,2808 ft
1 in	= *0.0254* m	1 m	= 39.3700 in

3. *Surface Measure.*

1 sq yd	= 0.8361 sq m	1 sq m	= 1.196 sq yd
1 sq ft	= 0.0929 sq m	1 sq m	= 10,764 sq ft
1 sq in	= 0.00065 sq m	l sq m	= 1,550 sq in

4. *Cubic Measure.*

1 cu yd	= 0.7655 cu m	1 cu m	= 1.31 cu yd
I cu ft	= 0.02831 cu m	1 cu m	= 35.30 cu ft
I cu in	= 0.000016 cu m	1 cu m	= 61,023 cu in

5. *Weight.*

1 STON	= *907.185* kg	1 kg	= 2.2046 lb
1 lb	= *0.45359* kg	1 t	= 1,000 kg
		1 t	= 2,204.62 lb

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

a. Inches to centimeters-Multiply in. by 10 and divide by 4.

b. Yards to meters-Multiply yd by 9 and divide by *10*.

c. Miles to kilometers-Multiply mi by 8 and divide by 5.

d. Pounds to kiograms-Multiply lb by *5* and divide by 11.

Paragraph 7-37, FM 55-15, and paragraph 2-15, TM 55-450-15, contain additional detailed conversion factors.

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

a. Lumber.

2-in. x 4-in. x desired length = 5-cm x 10-cm x desired length

l-in. x 6-in. x desired length = 2.5-cm x 15-cm x desired length

6-in. x 8-in. x desired length = 15-cm x 20-cm x desired length

l-in. x 12-in x desired length = 2.5-cm x 30-cm x desired length (length normally expressed in ft or m)

b. Wire rope.

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

Round off to next higher whole mm of available wire-rope sizes.

c. Wire. No. 8 gauge annealed (11 64-in. dia) = 4.37-mm dia. Round off as in *b* above.

APPENDIX B
REFERENCES

1. Army Regulations (AR)

55-29	Military Convoy Operation in CONUS.
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.
70-47	Engineering for Transportability.
385-40	Accident Reporting and Records.
746-1	Packaging of Army Materiel for Shipment and Storage.

2. Army Field Manuals (FM)

5-36	Route Reconnaissance and Classification.
55-9	Unit Air Movement Plan.
55-13	Air Transport of Supplies and Equipment: Standard Loads in Air Force C-5 Aircraft.
55-15	Transportation Reference Data.
55-17	Terminal Operations Coordinator's Handbook.

3. Army Supply Bulletins (SB)

700-20	Army Adopted/Other Items Selected for Authorization/List of Reportable Items.

4. Army Technical Bulletins (TB)

55-45 (AFP 76-19)	Certification of Military Equipment for Transport in MAC/CRAF Aircraft.
55-46-1	Standard Characteristics (Dimensions, Weight, and Cube) for Transportation of Military Vehicles and Other Outsize/Overweight Equipment.

5. Army Technical Manuals (TM)

5-725	Rigging.
38-236 (AFP 71-8)	Preparation of Freight for Air Shipment.
38-250 (AFP 71-4)	Packaging and Materials Handling: Preparation of Hazardous Materials for Military Air Shipment.
55-450-10/1	Air Transport of Supplies and Equipment: Standard Loads in US Air Force C-130 Aircraft.
55-450-10/2	Air Transport of Supplies and Equipment: Standard Loads in US Air Force C-141 Aircraft.
55-500	Marine Equipment Characteristics and Data.
750-244-6	Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use (US Army Tank-Automotive Command).

6. Air Force Manuals

TO 1-1B-40	Handbook of Weight and Balance Data.
TO IC-5 A-9	Loading Instructions, USAF Series C-5 Aircraft.
TO 1C-130A-9	Loading Instructions, USAF Series C-30 Aircraft.
TO 1C-141 A-9	Loading Instructions, USAF Series C-141 Aircraft.

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's Office in accordance with AR 310-71.

7. Other Publications and Sources of Procurement

a. Rail and Highway Shipment

(1) *Code of Federal Regulations*, Title 49–Transportation, Parts 170-179

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

(2) 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 Materiel on Open-Top Cars.
Available from: Secretary, Mechanical Division
Association of American Railroads
ATTN: J.H. Bean
59 E. Van Buren Street
Chicago, IL 60605

(3) R. M. Graziano's Tariff No. 32 (or reissues thereof) *Hazardous Materials Regulation of the Department of Transportation, Including Specifications for Shipping Containers*
Available from: R. M. Graziano, Agent
1920 L Street NW
Washington, DC 20036

(4) American Trucking Association, Inc., Agent Publication ICC ATA III-A/FMC F1-17 (or reissues thereof) *Department of Transportation Regulations Governing Transportation of Hazardous Materials by Motor, Rail and Water, Including Specifcations for Shipping Containers*
Available from: James C. Harkins, Issuing Officer
1616 P. Street NW
Washington, DC 20036

(5) International Road Federation *Limits of Motor Vehicle Sizes and Weights*
Available from: International Road Federation
1023 Washington Building
Washington, DC 20005

b. Water Shipment

(1) Code of Federal Regulations
Title 46—Shipping, Part 146
Available from: Superintendent of Documents
US Government Printing Office
Washington DC 20402

(2) Agent R. M. Graziano's Water Carrier Tariff No. 32 (or reissues thereof)
Regulations Governing the Transportation or Storage of Explosives or Other Dangerous Articles or Substances, and Combustible Liquids Onboard Vessels
Available from: R. M. Graziano, Agent
1920 L Street NW
Washington, DC 20036

8. Department of Transportation

Special Permit No. 3498
USCG 108 Rules and Regulations for Military Explosives and Hazardous Munitions

9. Military Specification

MIL-S-22824B Sling, Multiple Leg, Vehicle (Shipboard Loading).

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By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

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