

**TECHNICAL MANUAL
TRANSPORTABILITY GUIDANCE
ROLAND MISSILE SYSTEM
GUIDED MISSILE, INTERCEPT-AERIAL (LESS CARRIER),
ROLAND FIRE UNITS
(NSN 1425-01-146-9213 W/O NBC and
NSN 1425-01-144-9802
W/NBC, AN/GSG- 1 1(XO-1)(V)(2))
CARRIER, AIR DEFENSE (W/MODULE LOADER MECHANISM)
MISSILE SYSTEM
XM1058 TRUCK TRANSPORTER
(NSN 1450-01-134-9359, XM1058 (LIN C10788))
SHOP EQUIPMENT, GUIDED MISSILE SYSTEM
(NSN 4935-01-072-2890, GSM-272 (LIN S17188))
GUIDED MISSILE, AERIAL, XMIM-115
(NSN 1410-01-148-6372 through 1410-01-148-6378
and ROLF NSN 1410-01-148-6379
through 1410-01-148-6385 (LIN G95546))
SHELTER CARRIER, TRUCK, CARGO, 2-1/2-TON, M35A2, W/W
(NSN 2320-00-077-1617, X40146-12)**

**HEADQUARTERS, DEPARTMENT OF THE ARMY
16 SEPTEMBER 1985**

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, Military Traffic Management Command-Trans. Eng. Agency, ATTN: MTT-TRC, P.O. Box 6276, Newport News, VA 23606-0276.

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CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

a. This manual provides transportability guidance for logistical handling and movement of the ROLAND all-weather short-range air defense missile system. It contains information considered appropriate for safe transport of the system. Also included are significant technical and physical characteristics, as well as safety considerations, required for worldwide movement by various transportation modes. Where considered necessary, metric equivalents are given in parentheses following the dimension or other measurement.

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

1-2. Safety

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

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

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

- a. *Warning.* Instructions that, if not followed could result in injury to or death of personnel.
- b. *Caution.* Instructions that, if not strictly observed, could result in damage to or destruction of equipment.
- c. *Note.* A brief statement for use as necessary to emphasize a particular operating procedure or condition.

1-4. Reporting of Recommendations and Comments

Individual users of this manual are encouraged to report errors and omissions and to make recommendations for improving it. Reports should be prepared on DA Form 2028 (Recommended Changes to DA Publications and Blank Forms) and forwarded to Commander, Military Traffic Management Command Transportation Engineering Agency, ATTN: MTT-TRC, PO Box 6276, Newport News, Virginia 23606-0276. Electrically transmitted messages should be addressed to CDR MTMCTEA FT EUSTIS VA II/MTT-TRCII/. A reply will be furnished by this command.

CHAPTER 2
TRANSPORTABILITY DATA
SECTION I. GENERAL

2-1. Scope

This chapter provides a general description and identification photographs of the ROLAND missile system components, as well as tabulated transportability characteristics, that are necessary in movement of the system.

2-2. Description

a. General. The ROLAND missile system has two major components: the XM1058 truck transporter (a modified 5-ton truck) and the guided-missile intercept aerial fire unit. The ROLAND missile system in its normal transport configuration is shown in figure 2-1. The fire unit has a fully traversable turret with missile launching tubes and acquisition antennae, as shown in figures 2-2 and 2-3. The complete fire unit is pallet mounted and can be removed from the XM1058 truck transporter to the ground surface or loaded onto the truck transporter from the ground, as shown in figure 2-4, without any crane or gantry.

b. Support Equipment. Support equipment for the ROLAND missile system consists of an organizational maintenance test set (OMTS) stored and transported in two S280 shelters. Each shelter can be transported on a 2-1/2-ton cargo truck as shown in figure 2-5.

c. ROLAND Missile Rounds. The ROLAND missile rounds are contained in a launch tube and placed in a wooden overpack primarily for air transportation, long-term storage, and logistical handling, as shown in figure 2-6.

2-3. Transportability Drawings

Detailed transportability drawings, side and end views, of the ROLAND missile system components and support shelters, with dimensions and load-rating capacities of the tiedown and lift provisions, are shown in figures 2-6 through 2-15.

Section II. CHARACTERISTIC AND RELATED DATA**2-4. General Transportability Characteristics**

Data contained herein are applicable to model number or national stock number (NSN) shown. Changes in model number of NSN may affect the load-ability of the item as related to the guidance shown in this manual.

a. ROLAND Missile System Fire Unit.

Without NBC

National stock number

1425-01-146-9213

Line item number

G95795

With NBC

National stock number

1425-01-144-9802

Line item number

Z32049

Model number

AN/GSG-11(X0-1X-2)

Type classification

LP

Dimensions and shipping data:

Length, operational

208.0 in. (5.28 m)

Width, operational

113 in. (2.87 m)

Height, operational

155.4 in. (3.95 m)

With antenna folded

102.0 in. (2.59 m)

Area, operational

153.4 ft² (14.25 m²)

With antenna folded

153.4 ft² (14.25 m²)

Cube, operational

1986.5 ft³ (56.22 m³)

With antenna folded

1219.5 ft³ (34.51 m³)

Center of gravity:

Above ground

53.3 in. (1.35 m)

From forward edge of pallet

103.7 in. (2.63 in)



Figure 2-1. ROLAND missile system fire unit mounted on XM1058 truck transporter.

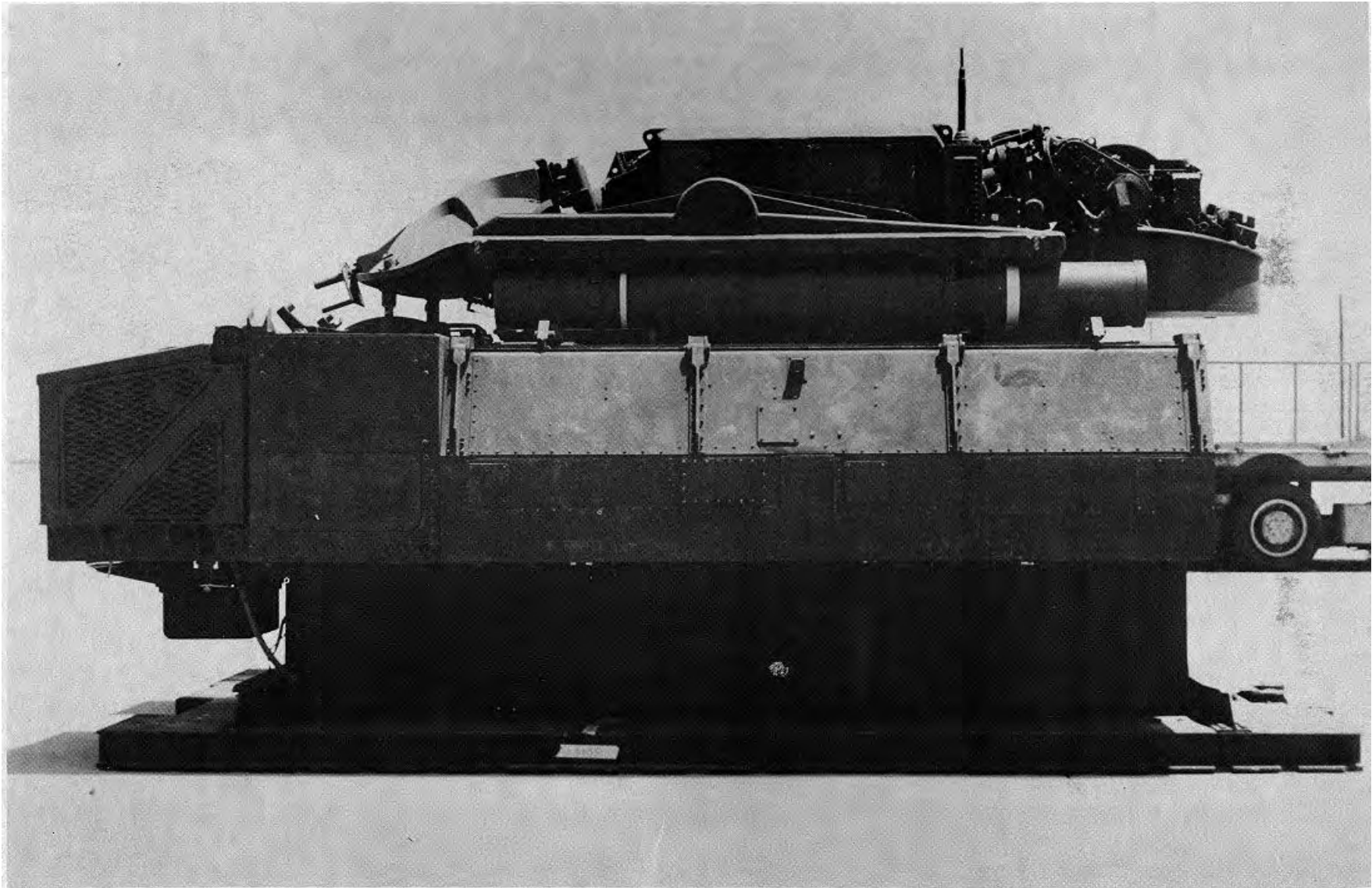


Figure 2-2. ROLAND missile system fire unit in its shipping configuration.

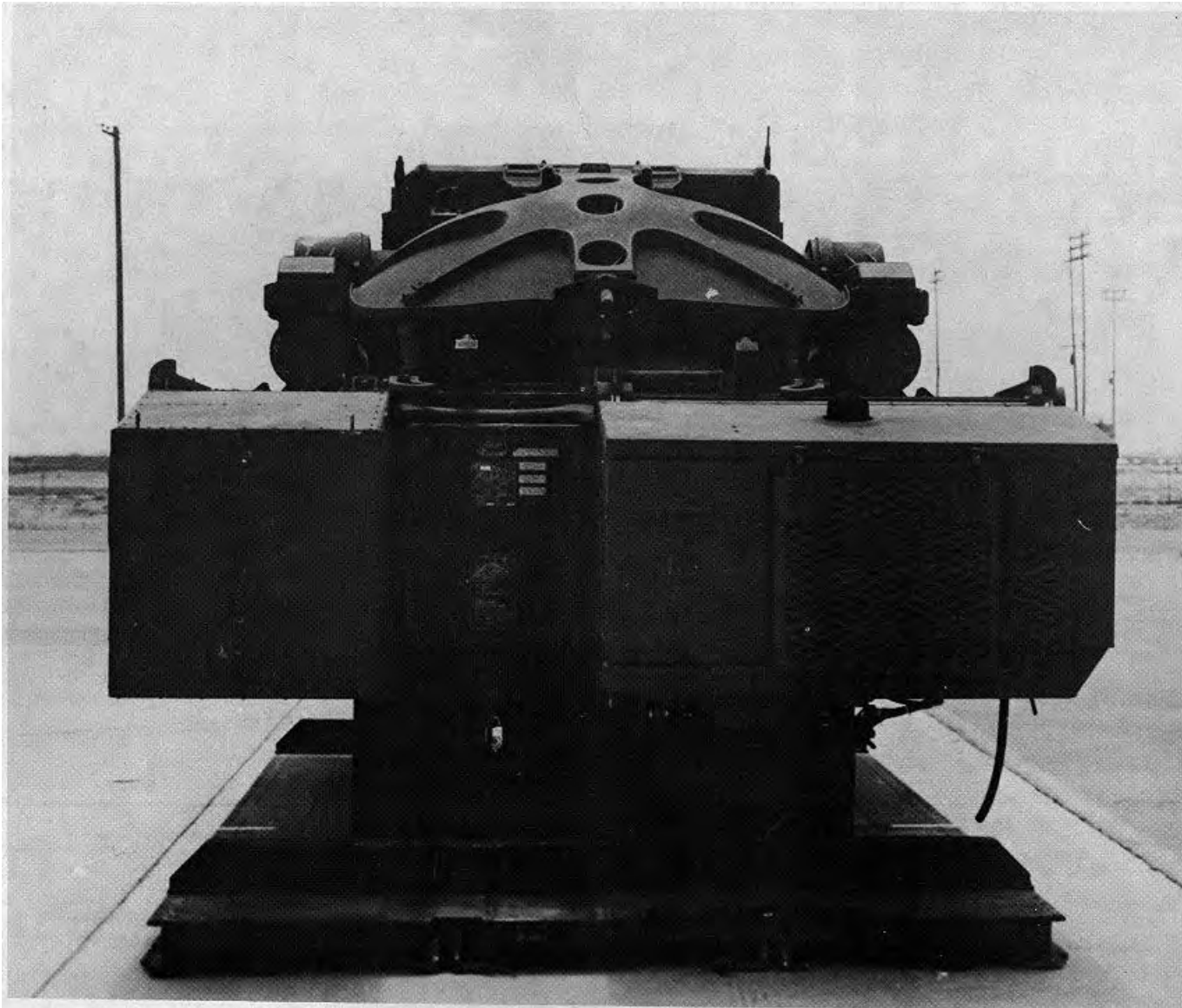


Figure 2-3. ROLAND missile system fire unit, rear view, in its shipping configuration.



Figure 2-4. ROLAND missile system fire unit in its operational configuration.

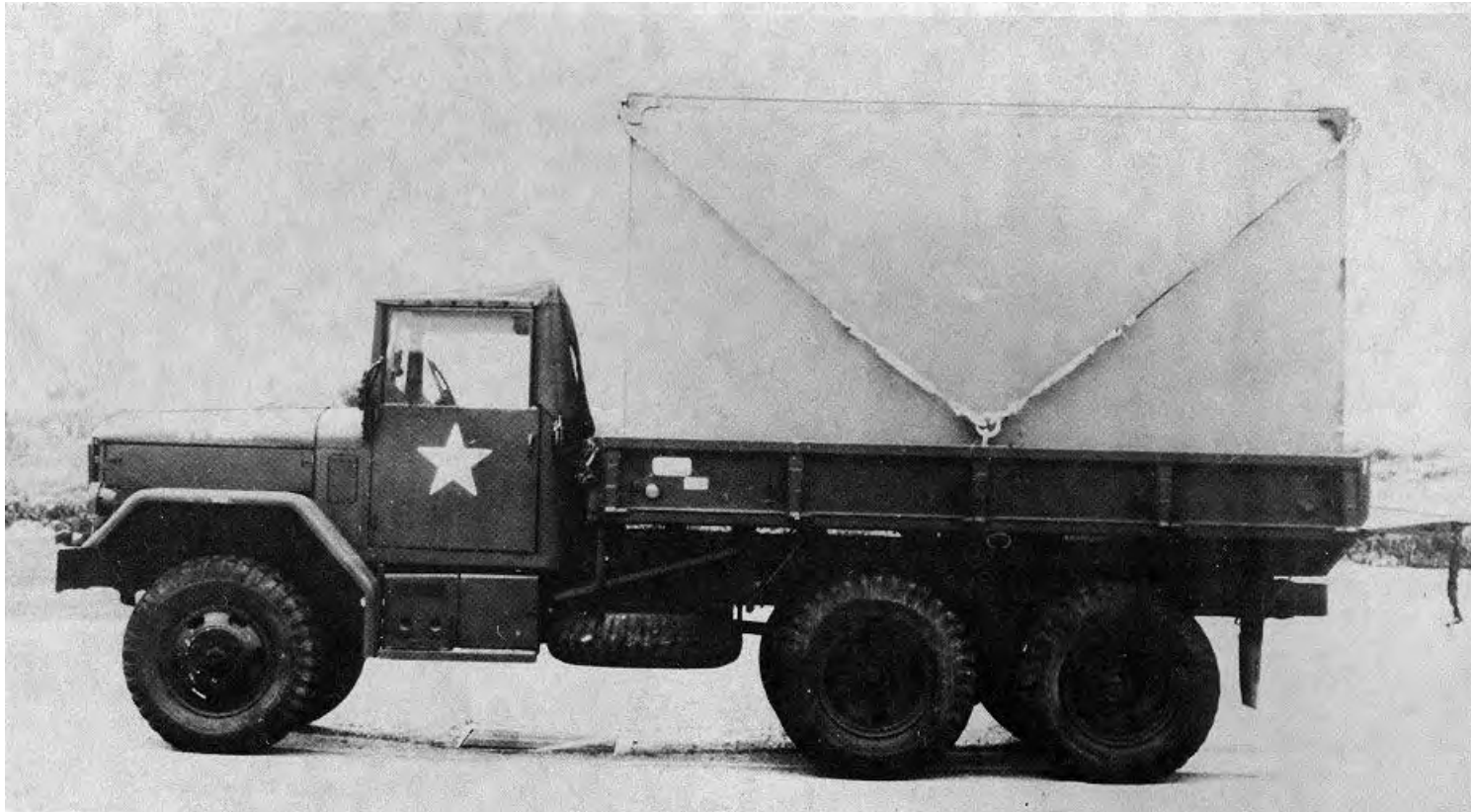


Figure 2-5. OMTS shelter mounted on 2-1/2-ton cargo truck.

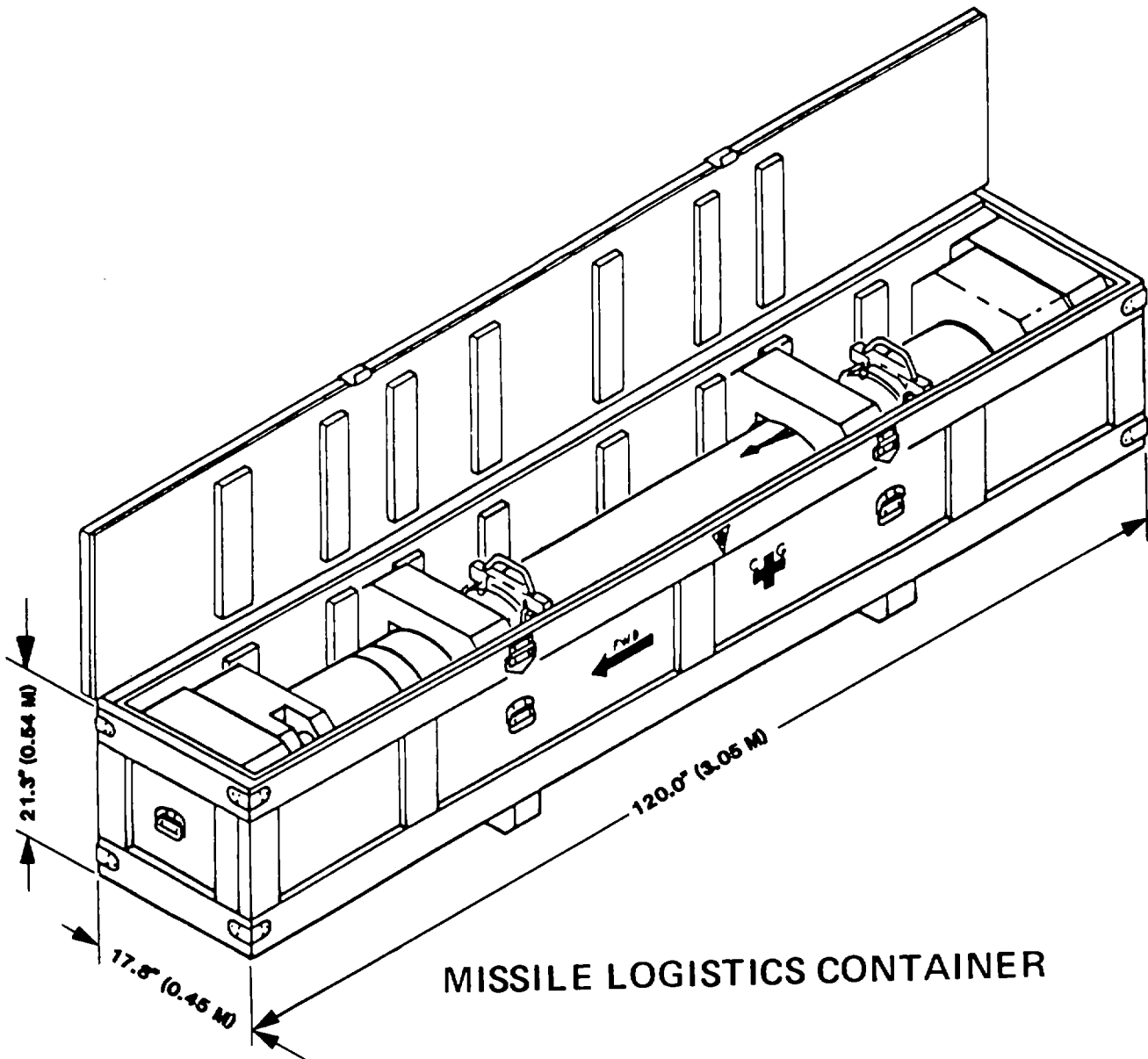


Figure 2-6. ROLAND missile rounds in a launch tube inside a wooden shipping crate.

2-4. General Transportability Characteristics Continued

From left side face rear end

Weights:

Fire unit	19,631 lb (8905 kg)
Pallet	1,835 lb (832 kg)
Empty	21,466 lb (9737 kg)
With missile	24,313 lb (11 028 kg)
Aircraft loading-basic	22,050 lb (10 001 kg)
Aircraft loading-w/missile	24,068 lb (10 917 kg)
Combat	24,781 lb (11 241 kg)

b. ROLAND Missile System Fire Unit Mounted on XM1058 Truck Transporter.

National stock number	none assigned
Line item number	none assigned
Type classification	none assigned

WEIGHT	UNLOADED	LOADED
PAYLOAD	—	24,313 LBS 11,028 KG
FRONT AXLE	10,481 LBS 4754 KG	12,480 LBS 566 KG
INTER AXLE	7317 LBS 3319 KG	18,474 LBS 8380 KG
REAR AXLE	7317 LBS 3319 KG	18,474 LBS 8380 KG
TOTALS	25,115 LBS 11,392 KG	49,428 LBS 22,420 KG

NOTE ALL WEIGHTS ARE LESS CREW

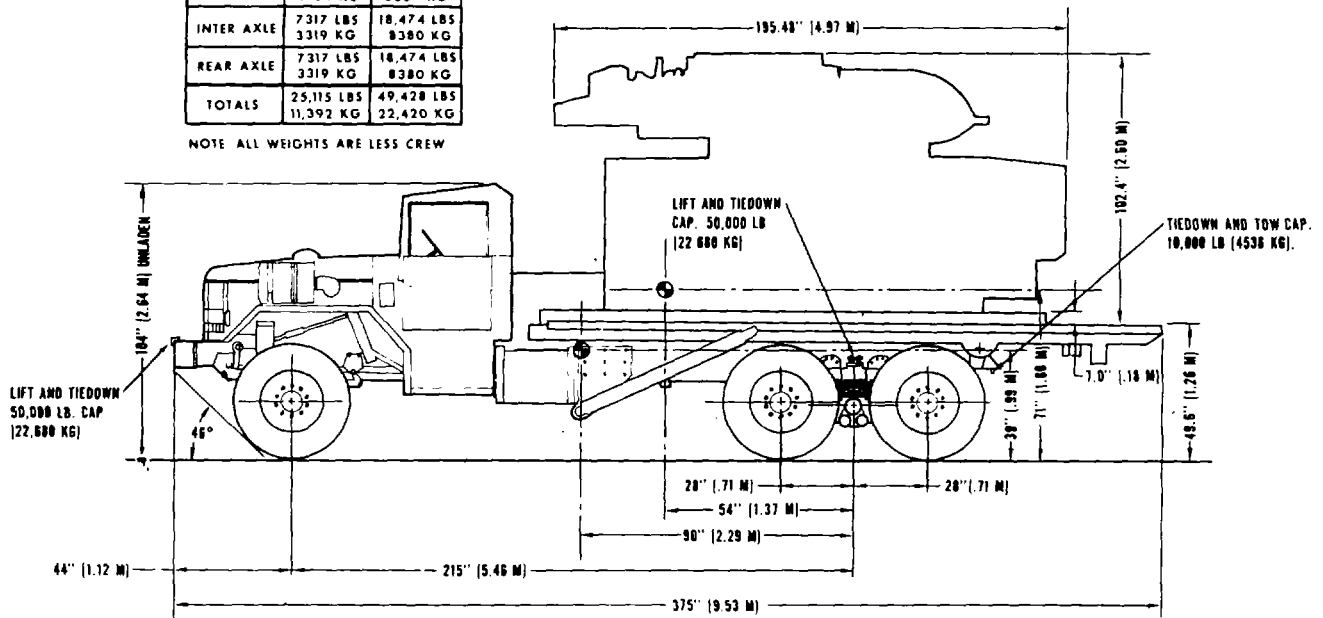


Figure 2-7. Transportability drawing, left-side view, ROLAND missile system fire unit mounted on XM1058 truck transporter.

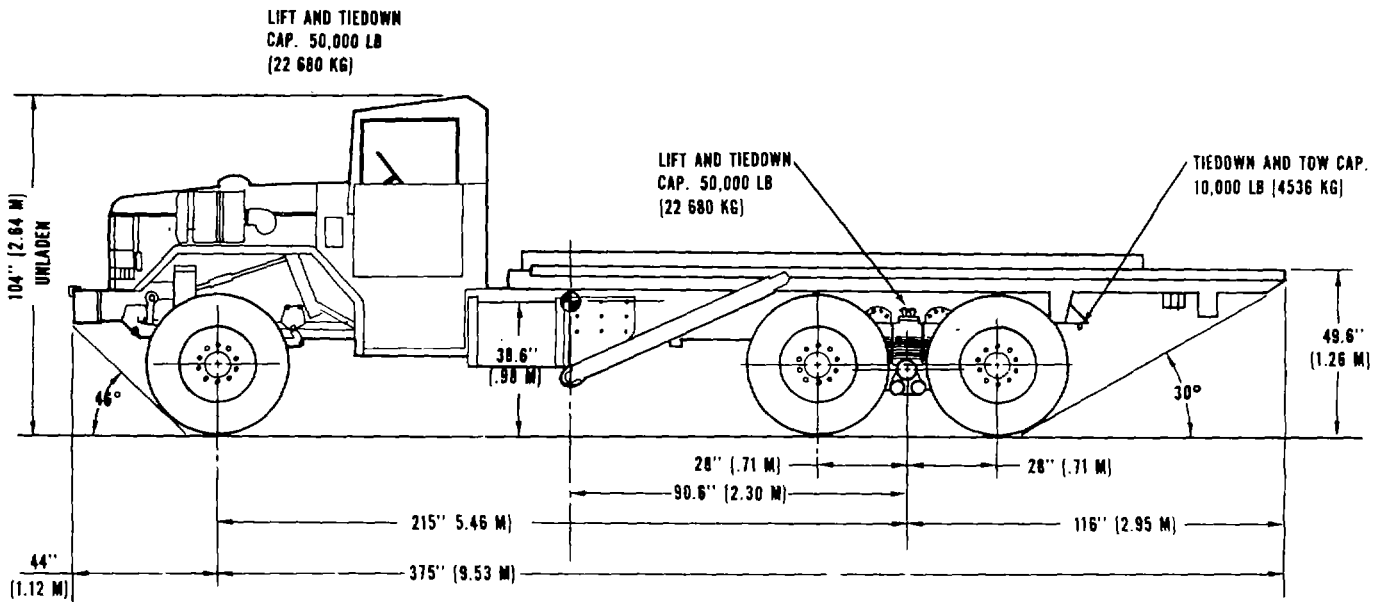


Figure 2-8. Transportability drawing, left-side view, XMI 058 truck transporter.

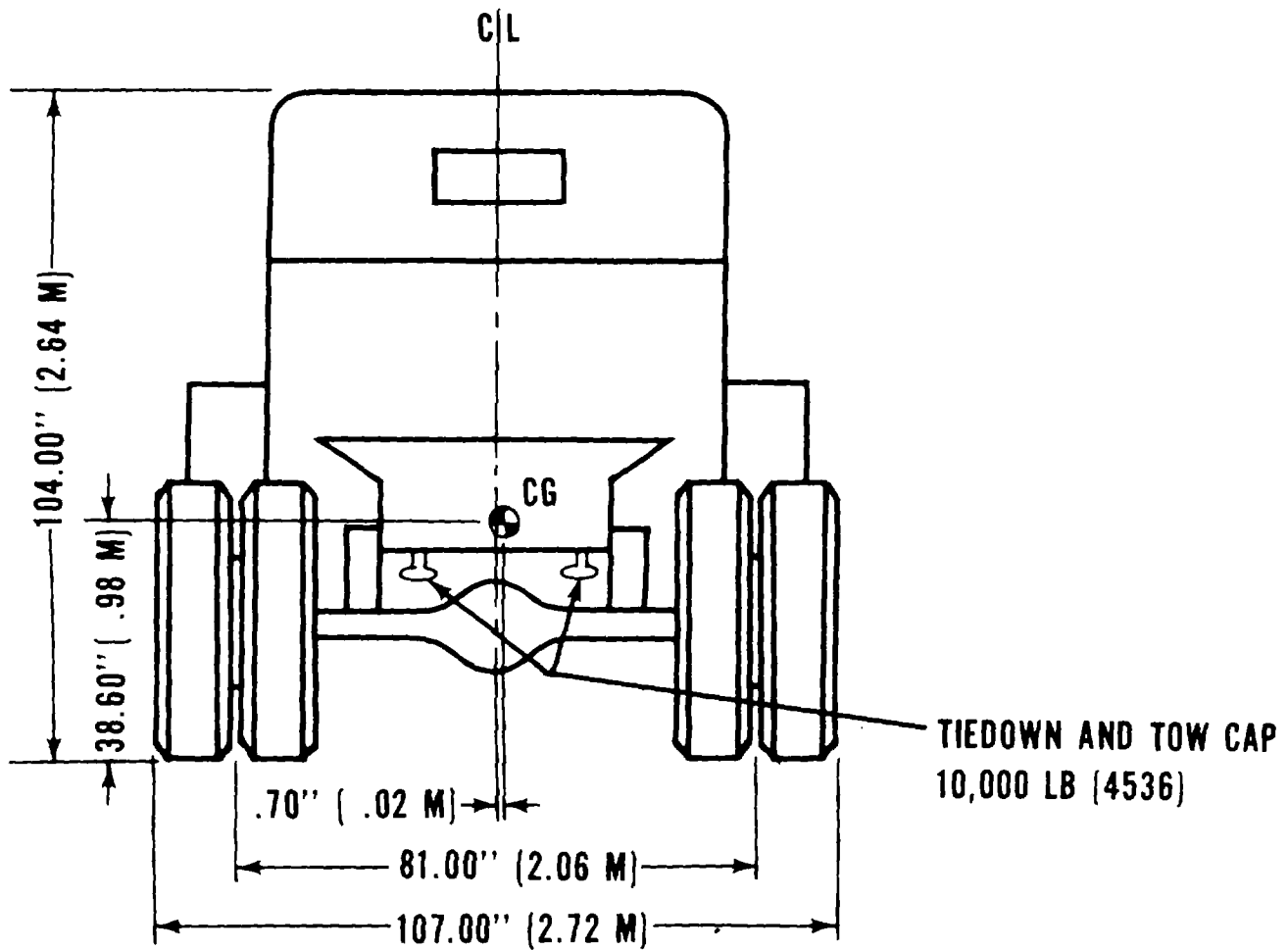


Figure 2-9. Transportability drawing, rear view, XM1058 truck transporter.

2-4. General Transportability Characteristics Continued

Performance:

Maximum speed	50 mph (80 km per hr)
Maximum range	220 miles (352 km)
Fuel type	cetane, type II
Fuel tank capacity	55 (usable) US gallons (208.2 liters)

Turning radius

L or R 47 ft 8 in. (1.21 m)

Angle of approach

460

Angle of departure

300

Ground clearance:

Fuel tank

21.0 in. (0.53 m)

Spring shackle

10.75 in. (0.27 m)

Tire size

11.00 x 20 G on 8.5-in. (0.22 m) wheels

Dimensions and shipping data:

Length, operational

375.0 in. (9.53 m)

Width, operational

107.0 in. (2.72 m)

Height, operational

152.0 in. (3.86 m)

With antenna folded

152.0 in. (3.86 m)

- * CG W/O PAYLOAD
- ** CG W PAYLOAD

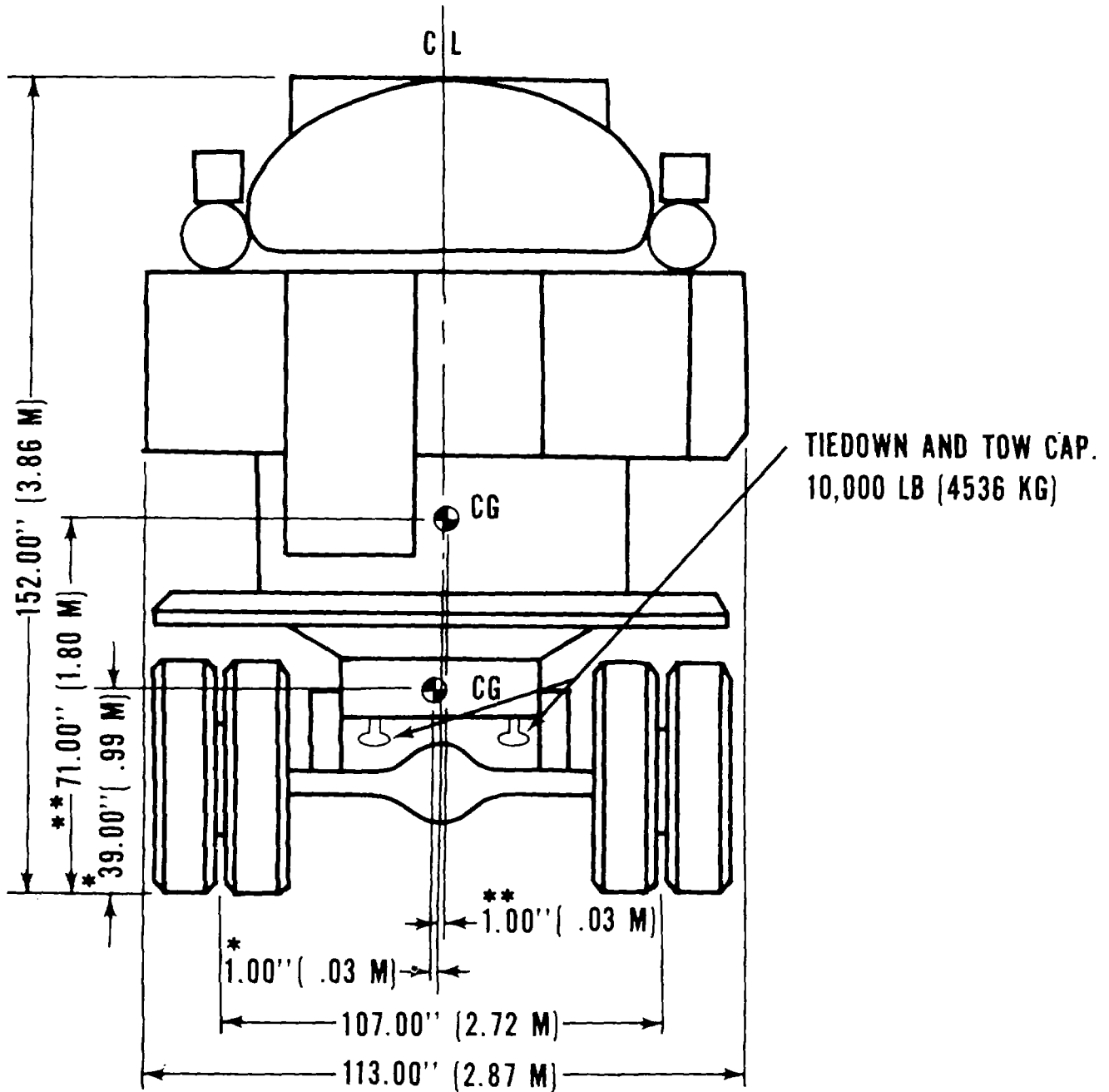


Figure 2- 10. Transportability drawing, rear view, ROLAND missile system fire unit mounted on XM1058 truck transporter,

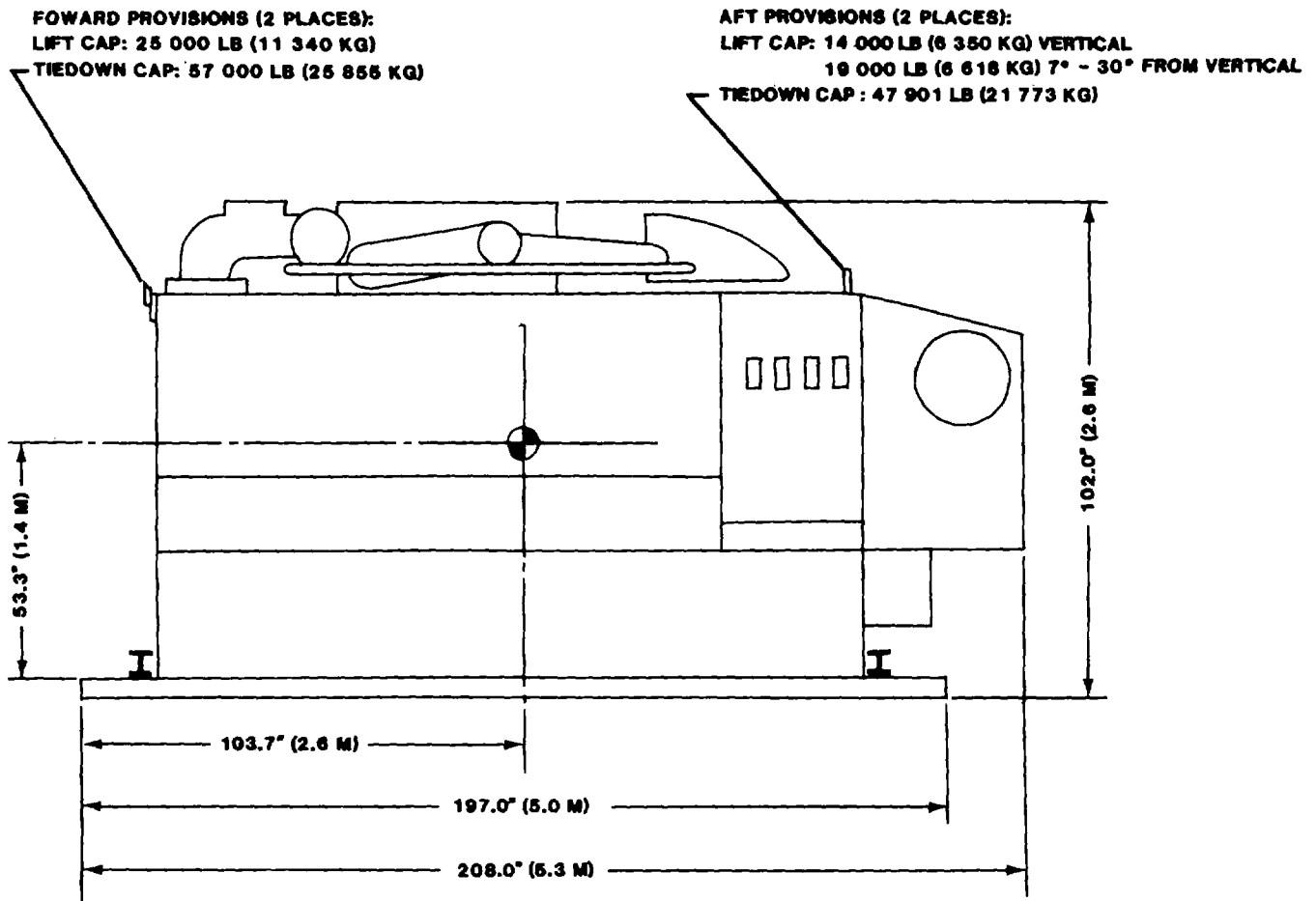


Figure 2-11. Transportability drawing, left-side view, ROLAND system fire unit, pallet mounted.

2-4. General Transportability Characteristics Continued

Weights:

Shipping (less crew, missiles, and fuel)	46,581 lb (21 129 kg)
With combat load (missiles and fuel)	49,428 lb (22 420 kg)

c. ROLAND Missile System XM1058 Truck Transporter.

National stock number	1450-01-134-9359
Line item number	C10783

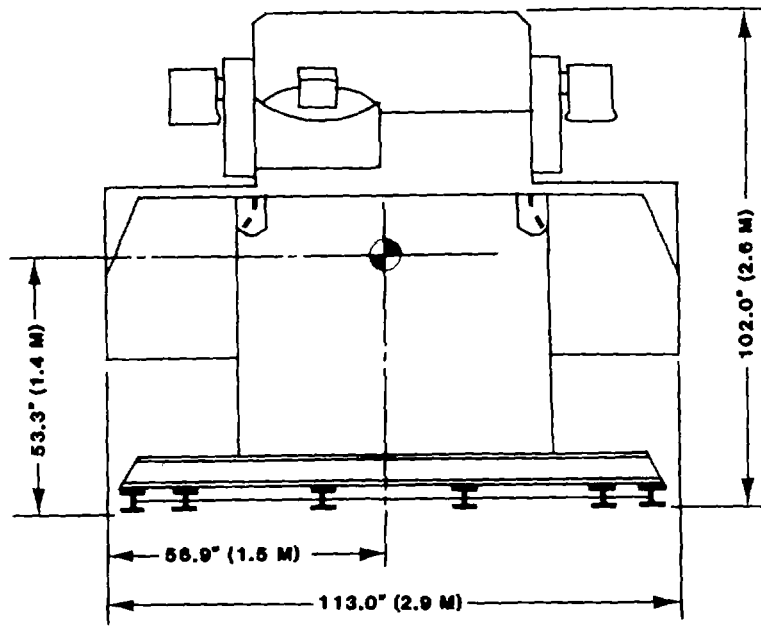
*Dimensions and shipping data:

Reduced for shipment	
Length	375.0 in. (9.53 m)
Width	107.0 in. (2.72 m)
Height	104.0 in. (2.64 m)
Weight	25,115 lb (11 392 kg)

*All other data is the same as paragraph 2-4b.

d. ROLAND Missile System OMTS in Shelter Mounted on 2-1/2-Ton Truck.

National stock number	
Line item number	
Dimensions and shipping data:	
Reduced for shipment	
Length	264.8 in. (6.73 m)
Width	95.4 in. (2.43 m)



FRONT VIEW

Figure 2-12. Transportability drawing, front view, ROLAND missile system fire unit, pallet mounted.

MAXIMUM LOADS

LIFT CAP 11000 LB (4959 KG) ANY DIRECTION

TIEDOWN CAP 10000 LB (4536 KG) ANY DIRECTION

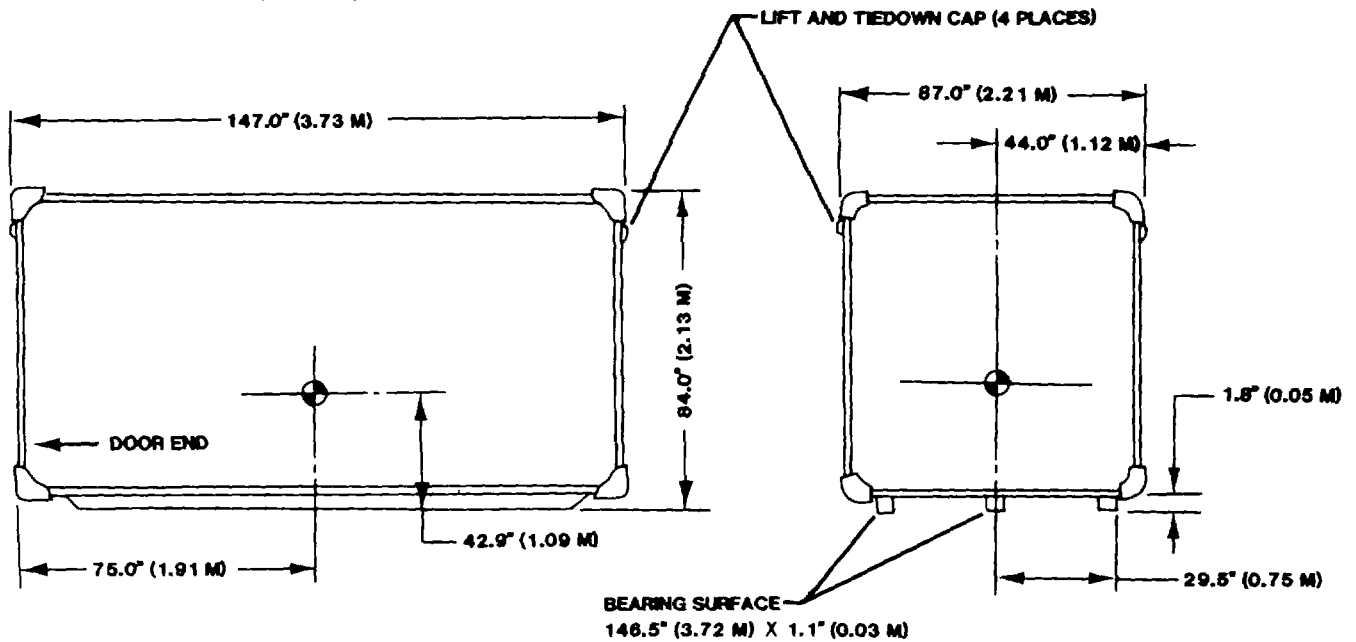


Figure 2-13. Transportability drawing, left-side view, unmounted OMTS shelter.

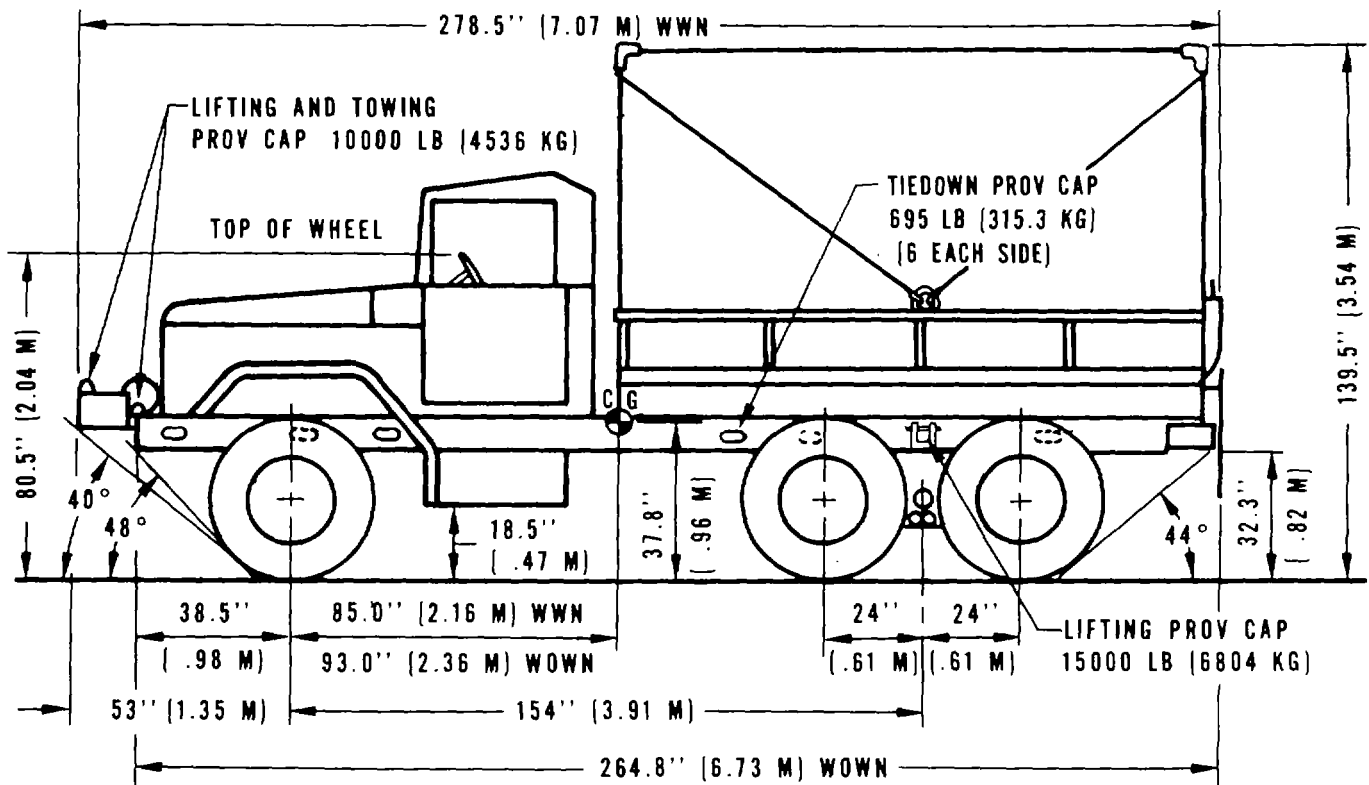


Figure 2-14. Transportability drawing, left-side view, OMTS shelter mounted on 2-1/2-ton cargo truck.

2-4. General Transportability Characteristics Continued

Height with OMTS shelter	135.9 in. (3.45 m)
Reduced for shipment without shelter	80.8 in. (2.05 m)
Weight with OMTS-Set #1	16,818 lb (7629 kg)
-Set #2	17,318 lb (7855 kg)
Without OMTS	13,180 lb (5978 kg)

e. ROLAND Missile System OMTS Mounted in S-280 Shelter

National stock number	4935-01-072-2890
Line item number	S17188

Dimensions and shipping data:

Length	147.0 in. (3.73 m)
Width	87.0 in. (2.21 m)
Height	84.0 in. (2.13 m)
Weight-Set #1	2,950 lb (1338 kg)
-Set #2	3,450 lb (1565 kg)

f. ROLAND Missile Round in a Launch Tube Inside Wooden Shipping Crate.

National stock number	1410-01-148-6372 through 6378 (ROLF 1410-01-148-6379 through 6385) Z32232
Line item number	

Dimensions and shipping data:

Length	120 in. (3.05 m)
Width	17.8 in. (0.45 m)
Height	21.3 in. (0.54 m)
Weight	337 lb (152.9 kg)

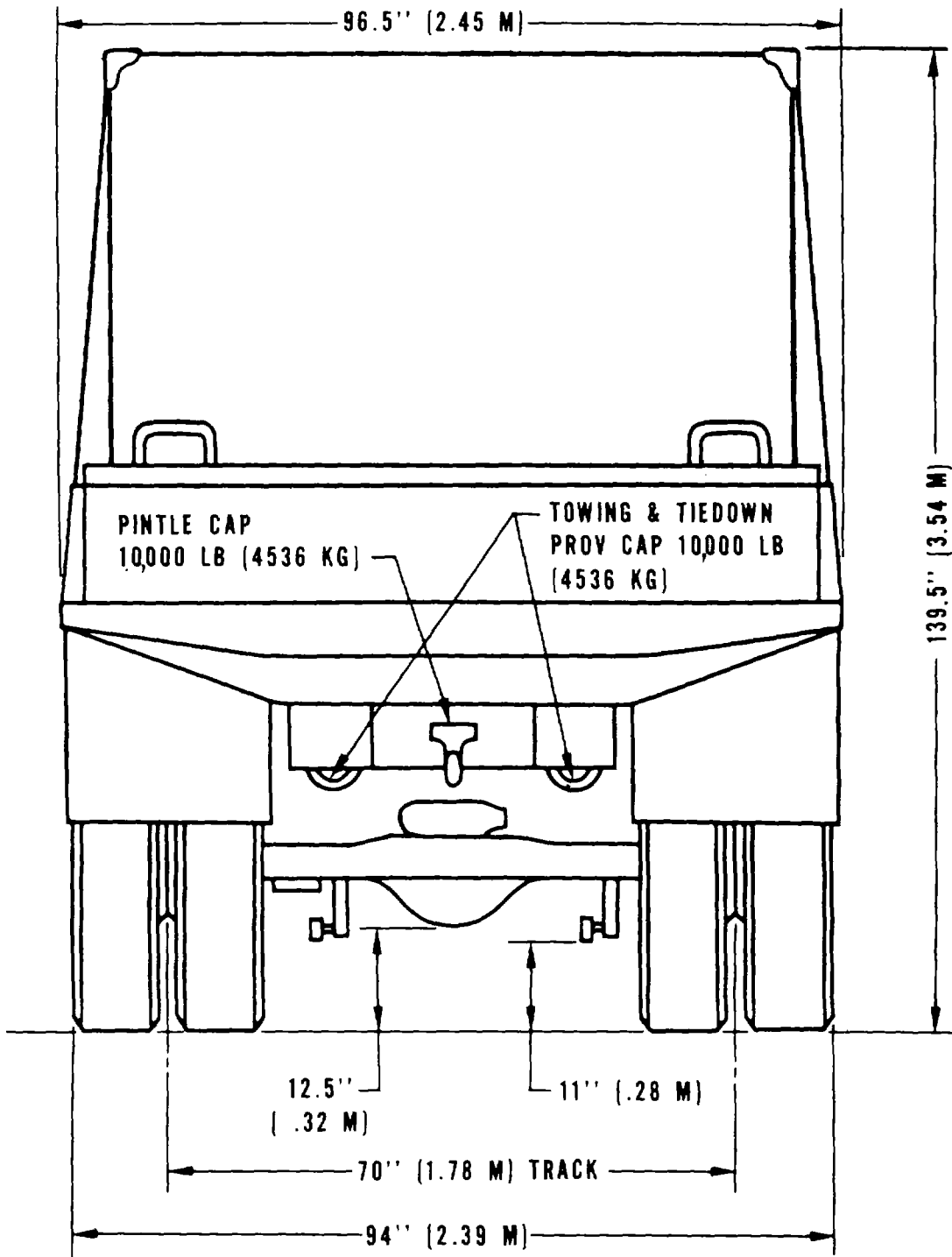


Figure 2-15. Transportability drawing, rear-end view, OMTS shelter mounted on 2-1/2-ton cargo truck.

2-5. Unusual Characteristics.

The ROLAND missile system components do not have any unusual characteristics requiring that special attention be given to temperature, atmospheric pressure, or humidity variations during their exposure to normal transportation environments. The ROLAND missile system contains classified hardware. Instructions for declassification of the system prior to shipment will be provided by the unit commander.

2-6. Hazardous and Dangerous Characteristics

The ROLAND missile system components will not present any special hazardous or dangerous characteristics during their exposure to normal transportation environments.

NOTE

The ROLAND missile rounds are classified as rocket ammunition with explosive projectile, class A, explosives.

NOTE

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

2-7. Sensitivity

The ROLAND missile system is designed so that, when restrained according to guidance contained in this manual, it can withstand the shock and vibration associated with current transportation methods.

CHAPTER 3**SAFETY**

3-1. General

General safety considerations and precautions for handling and movement of the ROLAND missile system are as follows:

- a. The XM1058 truck transporter must not be left unattended while the engine is running.
- b. When the XM1058 truck transporter is being backed, not personnel or obstructions are allowed behind it.
- c. Extreme caution must be exercised when towing disabled XM1058 truck transporters.
- d. When the fire unit or XM1058 truck transporter is being lifted, for any purpose, no one is permitted to walk under it.

WARNING

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

WARNING

Proper ventilation must be provided during loading and unloading operations if the XM1058 truck transporter engine is running. Prolonged exposure to carbon monoxide fumes may be fatal.

3-2. Specific Safety Requirements

Pertinent safety requirements by individual modes can be found, where applicable, in the appropriate chapter.

**CHAPTER 4
AIR TRANSPORTABILITY GUIDANCE**

4-1. Scope

This chapter provides air transportability guidance for the movement of the ROLAND missile system. It covers technical and physical characteristics, as well as safety considerations, and prescribes the material required to prepare, load, and tie down system equipment on, or offload from, US Air Force cargo aircraft.

4-2. Maximum Utilization of Aircraft

The loads described in this chapter are not maximum loads. General guidance on total cargo loads and operating ranges is provided in TM 38-2361AFP 71-8. Additional cargo and/or personnel, within allowable load limits and restrictions prescribed by pertinent safety regulations, can be transported.

4-3. Applicability

a. *US Air Force Aircraft.* The ROLAND missile system is transportable in US Air Force C-130, C-141B, and C-5A aircraft. Procedures in this manual and those prescribed by section VI, TO 1C-XX-9, are applicable.

b. *Tiedown Devices.* The ROLAND missile system components are tied down in accordance with the minimum acceptable restraint factors (g loads) identified in TO 1C-XX-9. The ROLAND XM1058 truck transporter and M35 truck will be tied down in accordance with TO 1C-XX-9 and the figures and tables shown in this chapter. Suggested tiedown patterns for the XM1058 truck transporter are shown in figures 4-1 through 4-3 for C-130, C-141B, and C-5A aircraft, respectively. Suggested tiedown patterns for the M35 trucks are shown in figures 4-4 through 4-6. Tables 4-1 through 4-6 list the tiedown devices required, the location of tiedown points, the corresponding fittings to which the devices are secured, the number and capacity of devices, and the lumber shoring required for loading and securement. The OMTS shelters, when removed from their carrier vehicles because of C-130 and C-141B height restrictions, will be secured on coupled aircraft pallets. Figure 4-7 illustrates typical shelter-mounted items secured to coupled pallets, and table 4-7 lists tiedown data. The ROLAND missile system fire unit is mounted on a special pallet that is compatible with the aircraft pallet system. For C-5 aircraft loading, the fire unit must be loaded on two HCU-6/E pallets, 2-1/2 inches off center toward the inboard side. Therefore, the palletized fire unit and the OMTS shelters will be locked into appropriate pallet positions on C-130 and C-141 aircraft.

**Table 4-1. Tiedown Data for XMI058 Truck Transporter in USAF
C-130 Aircraft (Fig 4-1)**

<u>Tiedown Fitting</u>		<u>Tiedown Device</u>		
Designation	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	Attach to Item
AI	10	MB1	10	Tiedown fitting, right rear.
C1	10	MB1	10	Tiedown fitting, left rear.
EI	10	MB1	10	Tiedown fitting, right rear.
G1	10	MB1	10	Tiedown fitting, left rear.
A2	10	MB1	10	Axle, right rear.
G2	10	MB1	10	Axle, left rear.
A3	25	MB2	25	Axle, right intermediate.
G3	25	MB2	25	Axle, left intermediate.
A4	25	MB2	25	Bumper/tiedown fitting, right front.
G4	25	MB2	25	Bumper tie down fitting, left front.
C5	10	MB1	10	Bumper/tiedown fitting, right front.
D5	10	MB1	10	Bumper/tiedown fitting, left front.

**Table 4-2. Tiedown Data for XMI058 Truck Transporter in USAF
C-141B Aircraft (Fig 4-2)**

<u>Tiedown Fitting</u>		<u>Tiedown Device</u>		
Designation	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	Attach to Item
AI	25	MB2	25	Tiedown fitting, right rear.
C1	10	MB1	10	Tiedown fitting, left rear.
EI	10	MB1	10	Tiedown fitting, right rear.
G 1	25	MB2	25	Tiedown fitting, left rear.
A2	25	MB2	25	Axle, right intermediate.
G2	25	MB2	25	Axle, left intermediate.
A3	25	MB2	25	Bumper/tiedown fitting, right front.
C3	10	MB1	10	Bumper/tiedown fitting, left front.
E3	10	MB1	10	Bumper/tiedown fitting, right front.
G3	25	MB2	25	Bumper/tiedown fitting, left front.

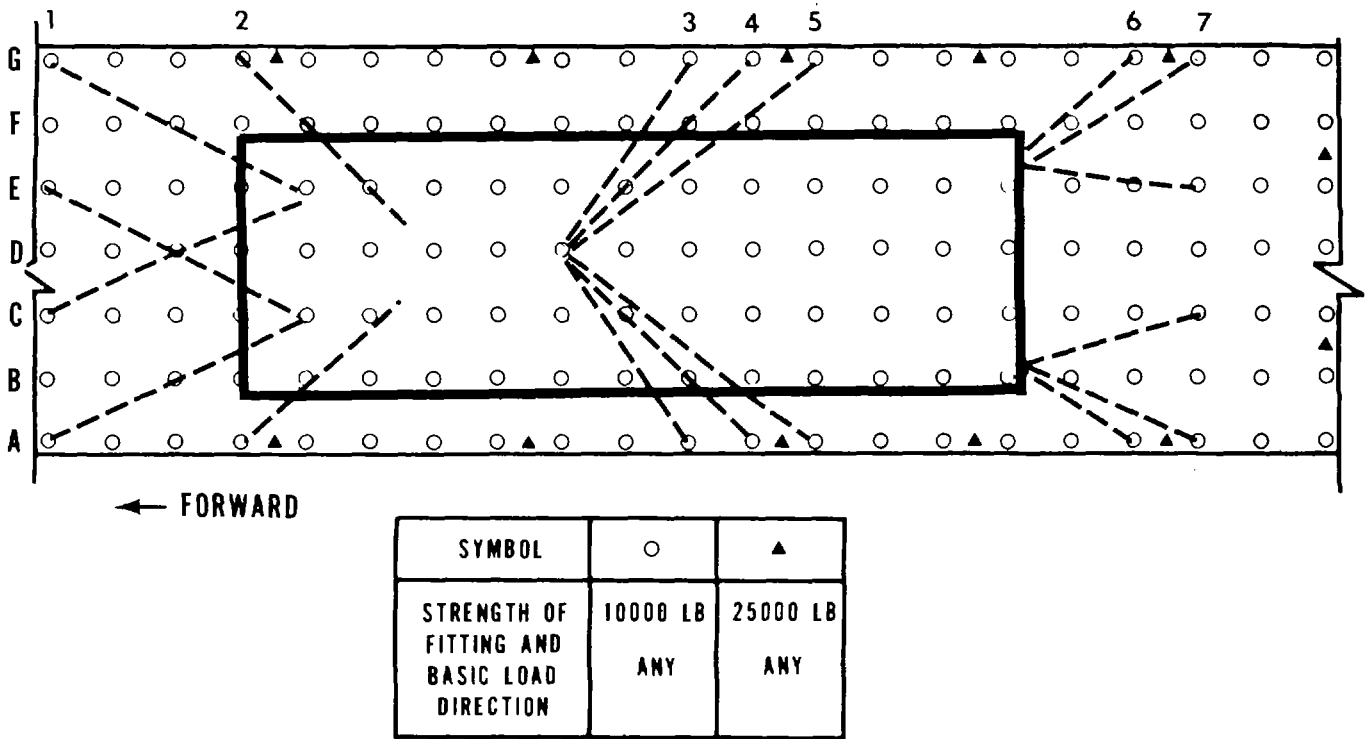


Figure 4-1. Typical tiedown diagram for XM1058 truck transporter in USAF C- 130 aircraft.

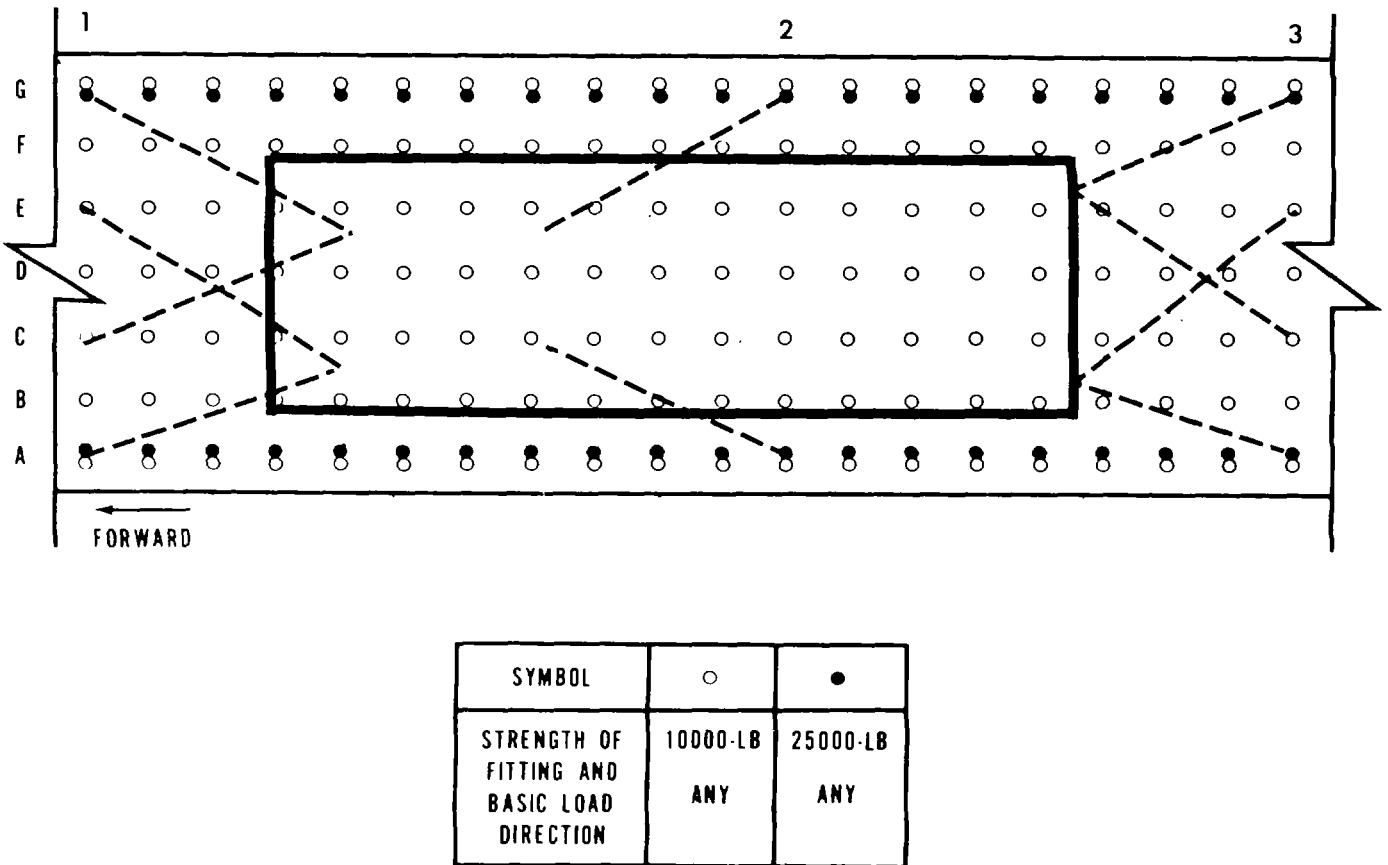


Figure 4-2. Typical tiedown diagram for XMI 058 truck transporter in USAF C- 141 B aircraft.

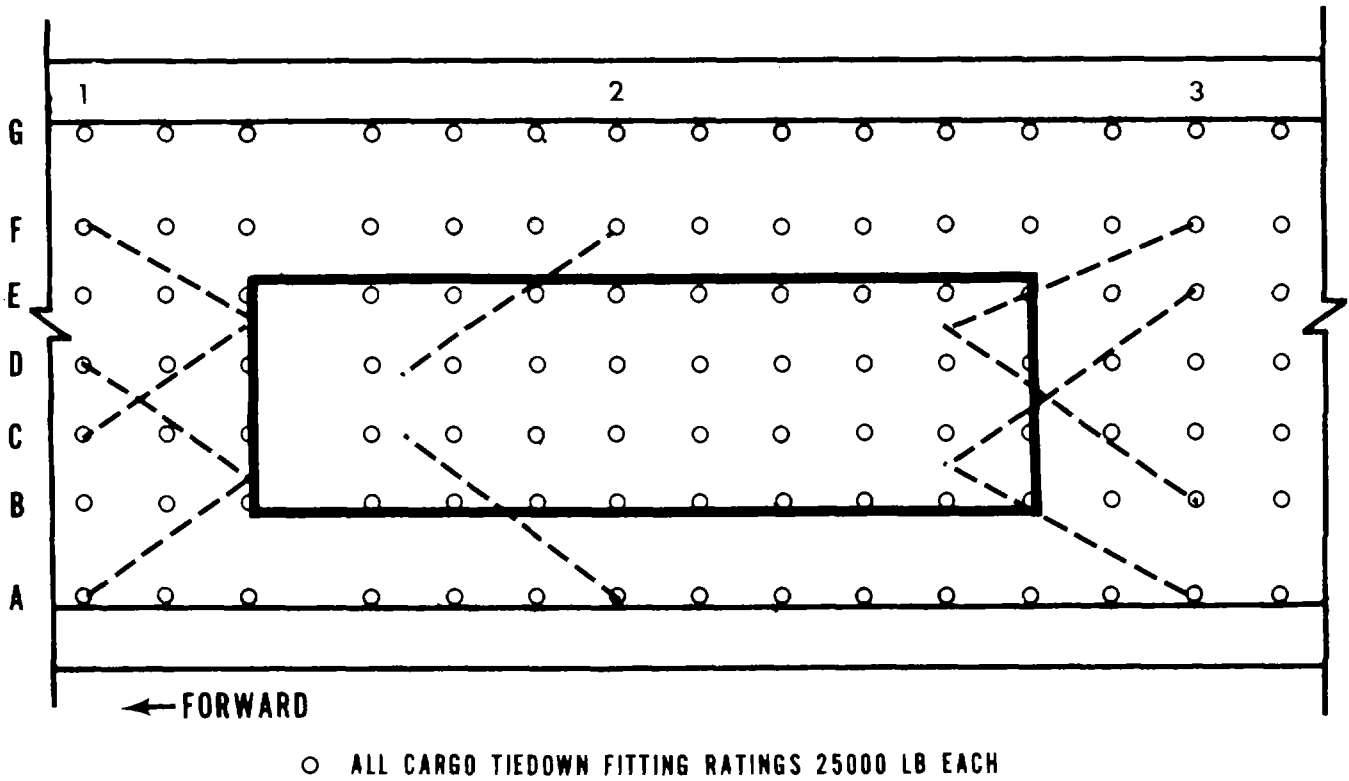


Figure 4-3. Typical tiedown diagram for XM1058 truck in USAFC--5A aircraft.

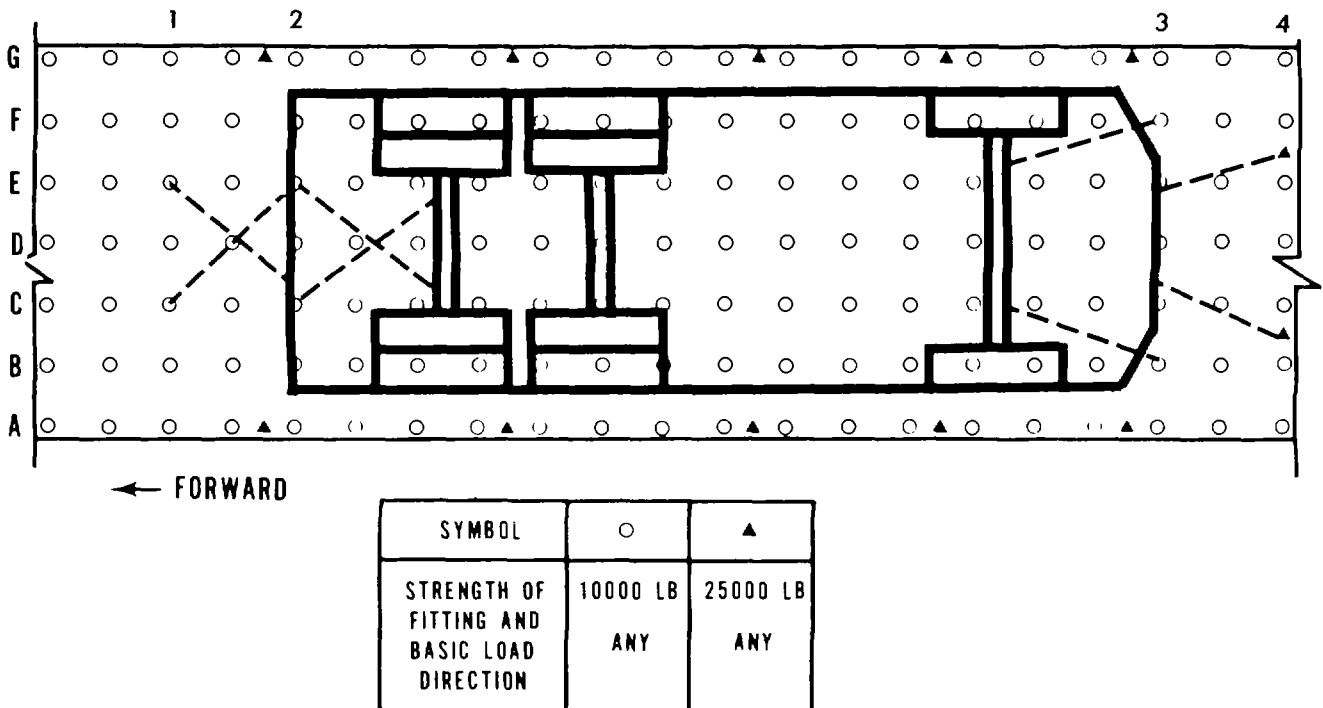


Figure 4-4. Typical tiedown diagram for M35 truck in USAFC-130 aircraft.

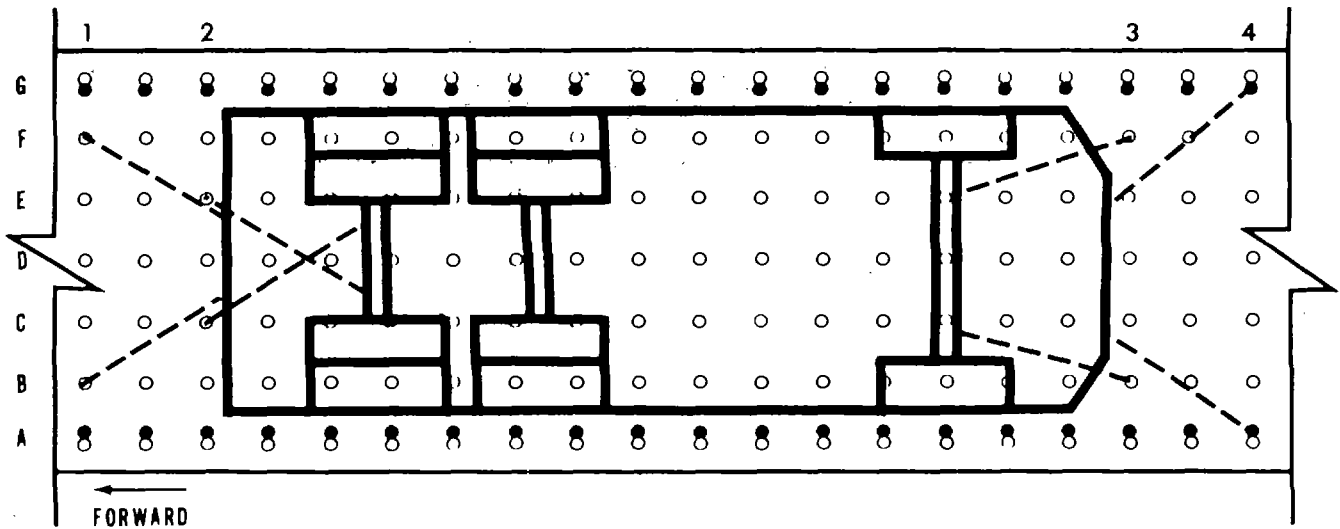


Figure 4-5. Typical tiedown diagram for M35 truck in USAF C- 141B aircraft.

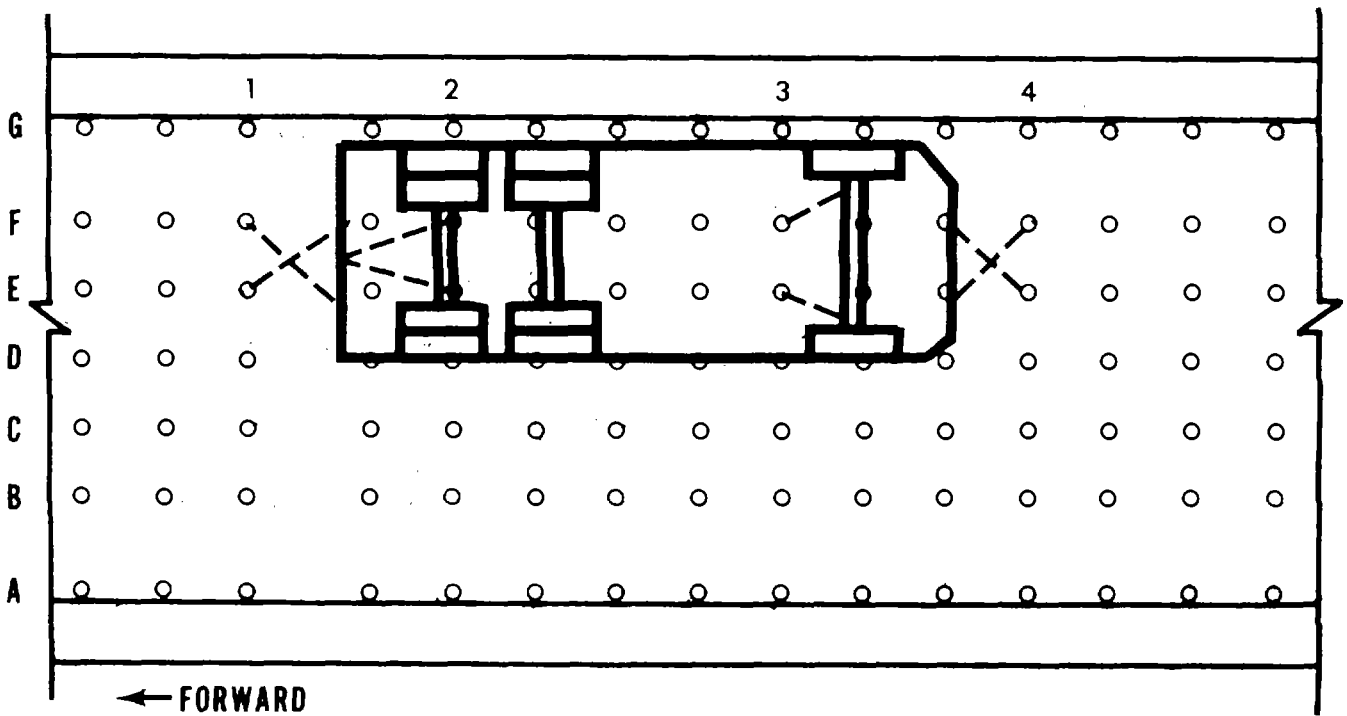


Figure 4-6. Typical tiedown diagram for M35 truck in USAF C-5A aircraft.

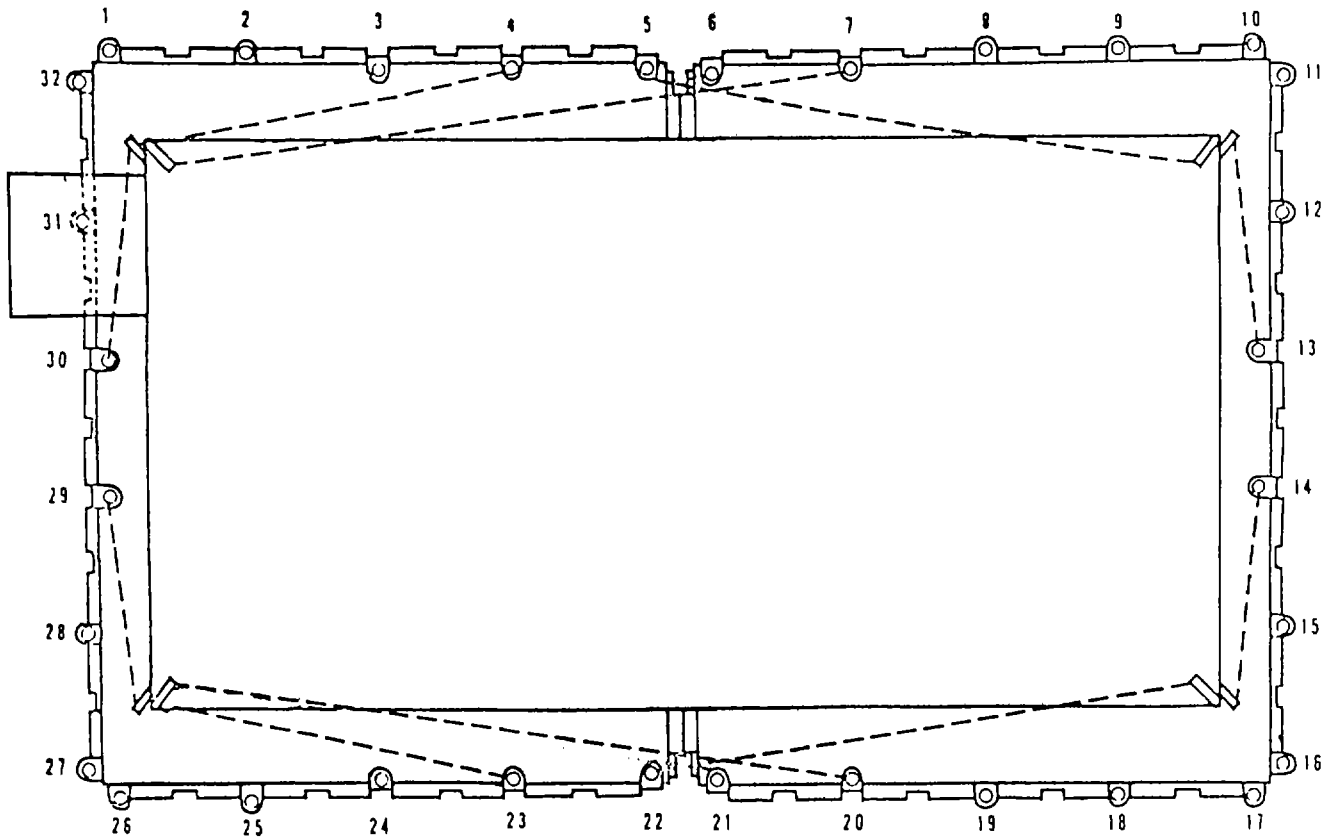


Figure 4-7. Typical shelter-mounted items secured to two interlocked 463L pallets (HUC-6/E).

Table 4-3. Tiedown Data for XM1058 Truck Transporter in USAF C-5A Aircraft (Fig 4-3)

Designation	Tiedown Fitting Capacity		Tiedown Device Capacity		Attach to Item
	in	1,000 lb	Type	in	
A1	25		MB-2	25	Bumper/tiedown fitting, left front.
C1	25		MB-2	25	Bumper/tiedown fitting, right front.
D1	25		MB-2	25	Bumper/tiedown fitting, left front.
F1	25		MB-2	25	Bumper/tiedown fitting, right front.
A2	25		MB-2	25	Axle, left front.
F2	25		MB-2	25	Axle, right front.
A3	25		MB-2	25	Tiedown fitting, left rear.
B3	25		MB-2	25	Tiedown fitting, right rear.
E3	25		MB-2	25	Tiedown fitting, left rear.
F3	25		MB-2	25	Tiedown fitting, right rear.

Table 4-4. Tiedown Data for M35 Truck in C-130 Aircraft (Fig 4-4)

Designation	Tiedown Fitting Capacity		Tiedown Device Capacity		Attach to Item
	in	1,000 lb	Type	in	
C1	10		MB-1	10	Bumperette, left side.
E1	10		MB-1	10	Bumperette, right side.
C2	10		MB-1	10	Rear axle, left side.
E2	10		MB-1	10	Rear axle, right side.
B3	10		MB-1	10	Front axle, right side.
F3	10		MB-1	10	Front axle, left side.
C4	25		MB-2	25	Bumper frame, right side.
E4	25		MB-2	25	Bumper frame, left side.

Table 4-5. Tiedown Data for M35 Truck in C-141B Aircraft (Fig 4-5)

Designation	Fitting Capacity	Tiedown Device Type	Fitting Capacity	Attach to Item
	in 1,000 lb		in 1,000 lb	
C1	10	MB-1	10	Bumperette, left side.
E1	10	MB-1	10	Bumperette, right side.
C2	10	MB-1	10	Rear axle, left side.
E2	10	MB-1	10	Rear axle, right side.
B3	10	MB-1	10	Front axle, right side.
F3	10	MB-1	10	Front axle, left side.
A4	25	MB-2	25	Bumper frame, right side.
G4	25	MB-2	25	Bumper frame, left side.

Table 4-6. Tiedown Data for M35 Truck in C-5A Aircraft (Fig 4-6)

Designation	Fitting Capacity	Tiedown Device Type	Fitting Capacity	Attach to Item
	in 1,000 lb		in 1,000 lb	
E11	25	MB-2	25	Bumper frame, right side.
F11	25	MB-2	25	Bumper frame, left side.
E2	25	MB-2	25	Pintle.
F2	25	MB-2	25	Pintle.
E3	25	MB-2	25	Front axle, right side.
F3	25	MB-2	25	Front axle, left side.
E4	25	MB-2	25	Bumper frame, left side.
F4	25	MB-2	25	Bumper frame, right side.

Table 4-7. Tiedown Data for Typical Shelter-Mounted Items Secured to Two Interlocked 463L Pallets (HUC-6/E) (Fig 4-7)

Designation	Fitting Capacity	Tiedown Device Type	Fitting Capacity	Attach to Item
	in 1,000 lb		in 1,000 lb	
29	7.5	MB-1	10	Tiedown, left bottom.
30	7.5	MB-1	10	Tiedown, right bottom.
23	7.5	MB-1	10	Tiedown, left bottom.
4	7.5	MB-1	10	Tiedown, right bottom.
22	7.5	MB-1	10	Tiedown, aft left top.
5	7.5	MB-1	10	Tiedown, aft right top.
20*	7.5	MB-1	10	Tiedown, forward left top.
7'	7.5	MB-1	10	Tiedown, forward right top.
14	7.5	MB-1	10	Tiedown, aft left bottom.
13	7.5	MB-1	10	Tiedown, aft right bottom.

*Not required for C-5 aircraft.

c. Aircraft Commander Responsibilities. The aircraft commander, or designated representative, will ensure that the loaded equipment is secured in accordance with restraint criteria outlined in TO 1C-XX-9.

4-4. Safety

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

a. The activity offering the equipment for air transport must notify the pilot in command or designated representative, when ammunition or explosives are to be transported and ensure that all hazardous materials

have prepared for shipment in accordance with TM 38-250.

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

c. Vehicles must be tied down in accordance with procedures prescribed by TO 1C-130-9, TO 1C-141B-9, or TO 1C-5A-9, as appropriate.

d. Each vehicle or component must be checked carefully to ensure that all loose items are properly secured.

WARNING

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

WARNING

Proper ventilation must be provided during loading and unloading operations if the XM1058 truck transporter engine is running. Prolonged exposure to carbon monoxide fumes may be fatal.

CAUTION

Do not allow the vehicle speed to exceed 3 miles per hour inside the aircraft or on the loading ramps.

4-5. Preparation of Equipment.

a. Turret traverse and launch-elevating mechanism must be in the travel position, locked, and wire-tied to prevent rotation.

b. Antennae must be tied down or removed; cupola must be placed in the closed position; and loose gear must be secured with nylon cord or a suitable substitute.

c. Mirrors from the XM1058 truck transporter must be removed and secured in the carrier.

d. The infra lens (IR) must be covered.

e. The fire unit battery must be completely protected and secured so that leakage of acid cannot occur (TM 38-250/NAVSUP PUB505(REV)/MCO P4030.19D/DSAM4145.3, 22 March 1976).

f. TM 38-250 (AFR 71-4) must be consulted to ensure compatibility of any additional cargo being considered for loading with the ROLAND missile system.

g. All externally and internally stowed equipment must be secured.

h. The vehicle transmission must be placed in neutral, and the brakes must be set.

i. The vehicle fuel tanks must not be more than three-fourths full (TM 38-250 (AFR 71-4)).

j. Ten ROLAND missile rounds are permitted on board the aircraft (certificate of equivalency (COE) AY-84-191).

k. When the XM1058 truck transporter, instead of a TAC loader, is used to load the fire unit aboard the C-141B, ramp pedestal shoring (20 inches in length by 11 inches in width by 28 inches in height, minimum) is required. This shoring must be placed under the aft end of the ramp to prevent the aircraft ramp from descending more than 51 inches from the ground.

l. When the shelters, with the OMTS, are removed from their transport vehicles, the shelters must be palletized on coupled aircraft pallets. Transport vehicles will be reduced to the minimum shipping configuration.

4-6. Transport of ROLAND Missile System by US Air Force Aircraft

a. *C130 Aircraft.* ROLAND missile system components are air transportable in a configuration not to exceed 104 inches in height for the XM1058 truck transporter or 102.4 inches in height for the fire unit. A 25K or 40K TAC loader is required for loading/unloading. The C-130 is limited to one major component per aircraft since the axleload of the XM1058 truck transporter must be positioned in the high strength area (center wing, fuselage stations 337 to 682) for flight. Because of height restrictions, the shelters, with the OMTS, must be removed from the transporting vehicles and secured on coupled aircraft pallets. The OMTS carrier vehicles will be loaded in their reduced configuration.

b. *C-141B Aircraft.* The two ROLAND fire units and the XM1058 truck transporter are approved for C-141B airlift. However, the fire units must be removed from the carrier (XM1058 truck transporter) and loaded separately because of height restrictions. Direct loading of the fire units from the XM1058 truck transporter onto the C-141B aircraft ramps, without the use of a TAC loader, is an approved method of loading/unloading. The fire unit/pallet on the aircraft ramp or TAC loader must be positioned within 4 feet of the end of the aircraft ramp or TAC loader so that the pallet hook and the XM1058 truck transporter retrieving cable can be properly mated. Both components (fire unit and XM1058 truck transporter) may be TM 55-1425-289-14

airlifted on the same C-141B aircraft because only the forward axle of the XM1058 is required in the center wing section (fuselage stations 678 to 998) for flight. The XM1058 truck transporter, as a separate entity, can be driven onto the aircraft when shipped with the fire unit. Because of height restrictions, the S-280 shelters, with the OMTS, must be removed from the transporting vehicles and secured on coupled aircraft pallets. The carrier vehicles (2-1/2-ton trucks) for the OMTS will be loaded in their reduced configuration.

c. *C-5A Aircraft.* ROLAND missile system components are transportable in C-5A aircraft. Because of weight and tiedown restrictions, the ROLAND fire unit and the XM1058 truck transporter must be transported as separate units. The procedures prescribed in chapter IV, TO 1C-5A-9, are applicable for tiedown of this equipment. The shelter, with the OMTS, may be loaded as a single unit when transported on a 2-1/2-ton truck.

(1) The loadmaster will coordinate with the ROLAND missile system crew on leveling an alignment of the XM1058 truck transporter during loading/unloading, in accordance with the applicable TO 1C-XX-9. The XM1058 truck transporter will be positioned in accordance with the applicable TO 1C-XX-9. The ROLAND fire unit should always be located forward in the aircraft.

(2) Startup of the ROLAND fire unit and the air conditioning unit on board the aircraft is permissible as noted in the appropriate TO 1C-XX-9.

4-7. Internal and External Transport by US Army Aircraft

The ROLAND missile system fire unit is within the external lift capability of the CH-47D helicopter for short-range missions under ideal flight conditions. The XM1058 truck transporter also is within the external lift capability of the CH-47D helicopter. However, external helicopter lift operations for the XM1058 truck transporter are impractical because the range of the CH-47D helicopter/SM1058 truck transporter combination is extremely limited, even under ideal flight conditions.

CHAPTER 5

HIGHWAY TRANSPORTABILITY GUIDANCE

Section I. GENERAL

5-1. Scope

This chapter provides highway transportability guidance for movement of the ROLAND missile system. It covers technical and physical characteristics, as well as safety considerations, and prescribes the materials and guidance required to prepare, load, tie down, and unload the ROLAND fire unit and the XM1058 truck transporter.

5-2. Safety

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

CAUTION

Do not allow the XM1058 truck transporter to exceed 3 miles per hour during loading or unloading of semitrailers.

5-3. General

The ROLAND missile system is a fully integrated fire control and missile launching system mounted on a pallet for highway, rail, air, and marine transportability. The ROLAND fire unit is mounted on a modified XM1058 truck transporter for mobility. However, the fire unit can be easily dismantled from the wheeled carrier for shipment by all modes. The supporting S280 shelters with the OMTS, are transported on 2 1/2-ton trucks that do not exceed legal limitations.

Section II. MOVEMENT ON SYSTEM CHASSIS**5-4. General**

In CONUS, the XM1058 truck transporter/ROLAND fire unit combination exceeds the legal width in all states, the legal gross weight in 22 states, the legal tandem axleload in 42 states, and the legal height in 1 state (West Virginia). Permits (AR 55-162) or a "certification of essentially to national defense" (AR 55-80) are required in CONUS. Special routing and permits are also required overseas. The XM1058 truck transporter without the fire unit exceeds legal width limitations in CONUS and, thus, permits are required for highway movement.

5-5. MTMC Assistance

Assistance in obtaining approvals for highway movement of the loaded transport system can be obtained from the Commander, Military Traffic Management Command, ATTN: MT-SA, 5611 Columbia Pike, Falls Church, Virginia 22041-5050, when highway movement can be certified as essential for national defense and no other transportation mode can be used.

Section III. TRANSPORT BY SEMITRAILER**5-6. Transport of ROLAND Missile System by Semitrailer**

When loaded on Semitrailers, the ROLAND missile system components can be transported over highways. Normally, highway movements are made with the system components loaded on military or commercial trailers of adequate capacity and size. Both in CONUS and overseas, permits will be required because width of the transported items will exceed highway limitations. In addition, based on the tractor-trailer combination used for transport, other size and weight limitations may be exceeded.

5-7. Preparation for Transport

Preparation of the ROLAND missile system for transport includes the following procedures:

a. Turret traverse and launch-elevating mechanism must be in the travel position, locked, and wire-tied to prevent rotation.

b. Antennae must be tied down or removed, cupola must be in closed position; and loose gear must be secured with nylon cord or suitable substitute.

5-8. Loading on Semitrailers

a. *XM1058 Truck Transporter.* The truck transporter can be loaded on a 25-ton, or larger, semitrailer. A tiedown diagram compatible with standard loading practices that will offer adequate restraint is provided

in figure 5-1. The bill of materials for blocking and tiedown of the XM1058 truck transporter is shown in table 5-1. Data on the application of these materials are provided in table 5-2.

b. *Fire Unit.* The palletized fire unit can be loaded on a 12-ton, or larger, semitrailer as shown in figures 5-2 and 5-3. A bill of materials for blocking and tiedown of the truck transporter is shown in table 5-3, and data on the application of these materials, table 5-4.

Table 5-1. Bill of Materials for Blocking and Tiedown of XM1058 Truck Transporter on Semitrailer

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable; straight-grain, free from material defects; Fed Spec MM-L-751:	
	2- x 2-inch	6 linear ft
	2- x 4-inch	66 linear ft
	2- x 6-inch	22 linear ft
	2- x 8-inch	48 linear ft
Nails	Common, steel, flathead, bright or cement-coated, Fed Spec FF N-105:	
	12d	172
	20d	68
Wire Rope	6 x 19, IWRC; plain steel; pre formed, regular-lay; Fed Spec RR W-410: 1/2-inch	55 ft
Clips	U-bolt, Crosby heavy-duty, or equal; Fed Spec FF-C-450, Type I, Class 1: 1/2-inch	20 ft
Thimbles	Commercial grade; standard, 1/2 inch	4
Anti-chafing material	Neutral barrier material; water proof or burlap; MIL-B-121, or equal	as required

Table 5-2. Application of Materials for Blocking and Tiedown of XM1058 Truck Transporter on Semitrailer

Item	No. Required	Application
1	8	Chock blocks. Locate beveled end of the block against the wheel. Nail the first piece to the trailer floor with five 12d nails. Nail each additional piece with four 20d nails.
2	2	Rubbing Strip, 2- x 6- x 36-inch. Position on the edge of the chock block, and nail to the lower piece (item 3) with five 12d nails.
3	2	Side blocks, 2- x 4- x 36-inch (tripled). Nail the first piece to the trailer floor with five 12d nails. Nail each additional piece in a like manner.
4	2	Rubbing strip, 2-inch x 6-inch + 8-foot 0-inch. Nail to the lower piece (item 5) with one 12d nail spaced every 8 inches.
5	2	Side blocks, 2-inch x 4-inch x 8-foot 0-inch (tripled). Nail the first piece to the trailer floor with one 12d nail spaced every 8 inches. Nail each additional piece in a like manner
6	2	Wire rope, 1/2-inch-diameter, 11.5-ton. In stall cable to the approximate angle shown

Table 5-2. Continued

Item	No. Required	Application
6 (cont)		in figure to form a complete loop around the lading rear mainframe member and to pass through the trailer tiedown facility. <i>Caution:</i> Do not tie cable to lading lofting devices. <i>Note:</i> Cable of a larger size may be used when specified cable is not available.
7	10	Clips, 1/2-inch-diameter. Four per cable and one per thimble. See item 10.
8	2	Wire rope. 1/2-inch-diameter, 11.5-ton. In stall cable to the approximate angle shown in figure to form a complete loop around the lading rear mainframe member and to pass through the trailer tiedown facility. <i>Caution:</i> Do not tie to lading lifting devices. <i>Note:</i> Cable of a larger size may be used when specified cable is not available.
9	10	Clips, 1/2-inch-diameter; four per cable and one per thimble. See item 10.
10	4	Thimbles, standard, 1/2-inch; one per trailer tiedown facility. Secure to wire rope with one clip per thimble. <i>Note:</i> A standard thimble as specified can be secured to a cable with a 1/2-inch clip. However, if desired, or if the 1/2-inch thimble being used is of a type that cannot be secured to a cable with a 1/2 inch clip, a 5/8-inch clip may be used. <i>Note</i> that an "open pattern" thimble is recommended.
11		Waterproof paper or burlap of sufficient size to position under and extend 2 inches above rubbing strips (items 2 and 4).

Table 5-3. Bill of Materials for Blocking and Tiedown of ROLAND Fire Unit on Semitrailer

Item	Description	Approximate Quantity
Chain	General service S-leg, high-tensile, 1/2-inch, 10-foot length, with two grabhooks; 16,000-lb safe working load.	4
Load binder	Type I, plain, 18-1/2-inch; operating lever, with two grabhooks designed for 1/4- to 1/2-inch chain; 16,000-lb safe working load. Fed Spec GGG-B-325A; NSN 3990-00-171-9774	4

Table 5-4. Application of Materials for Blocking and Tiedown of ROLAND Fire Unit on Semitrailer

Item	No. Required	Application
NA	2	Chains. Secure a chain to each front tiedown ring. Crisscross the chains, and attach the ends of the chains to the trailer.
NA	2	Load binders. Tighten the front chains with the load binders.
NA	2	Chains. At the aft end of the fire unit, attach one end of each chain to the trailer. Pass the chain over the top of the fire unit and in back of the lofting fittings, and attach the chains to the trailer.
NA	2	Load binders. Tighten the aft chains with the load binders.

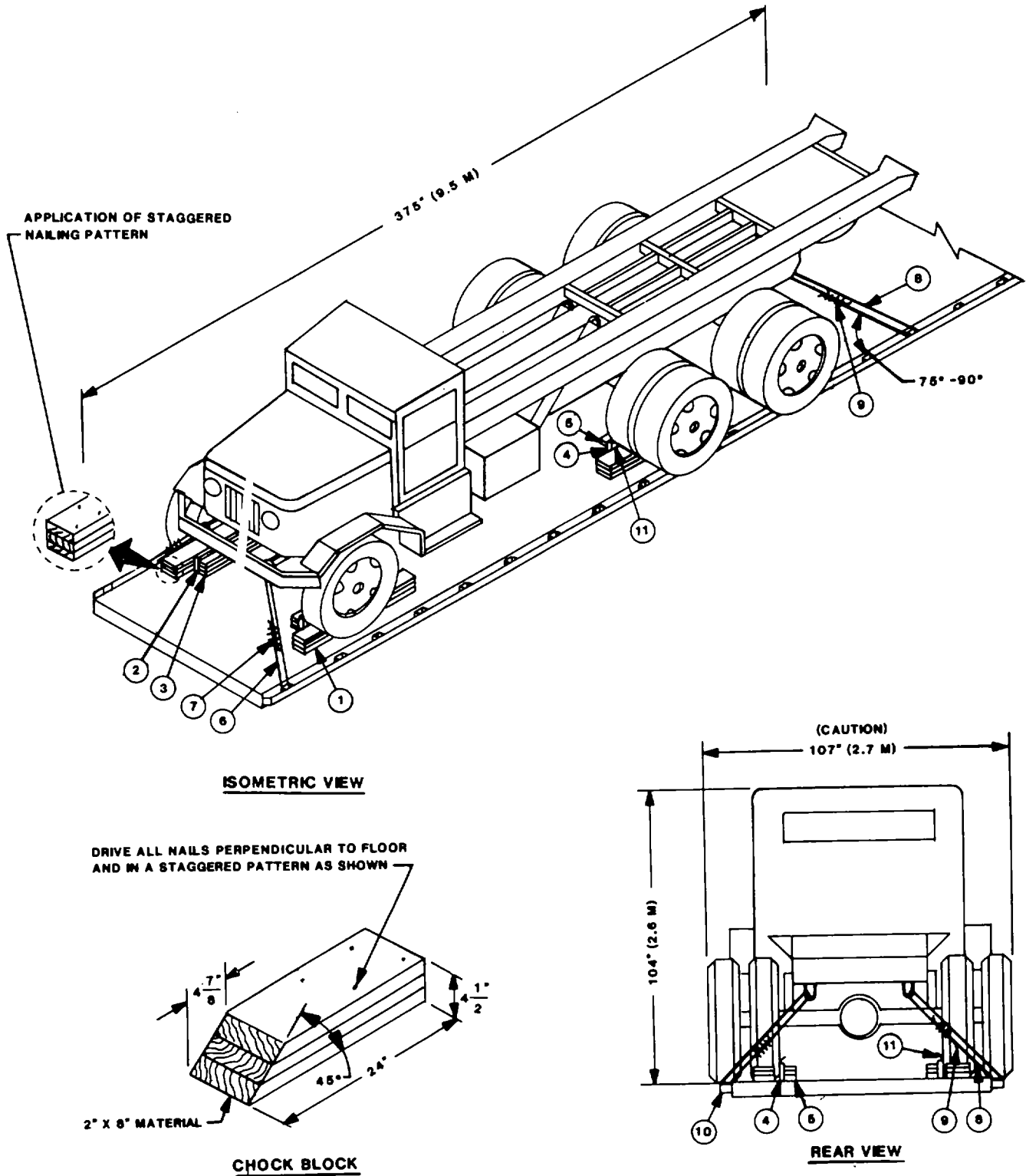


Figure 5-1. Blocking and tiedown of XM1058 truck transporter on 25-ton, or larger, semitrailer.



Figure 5-2. Fire unit transported on flatbed semitrailer.

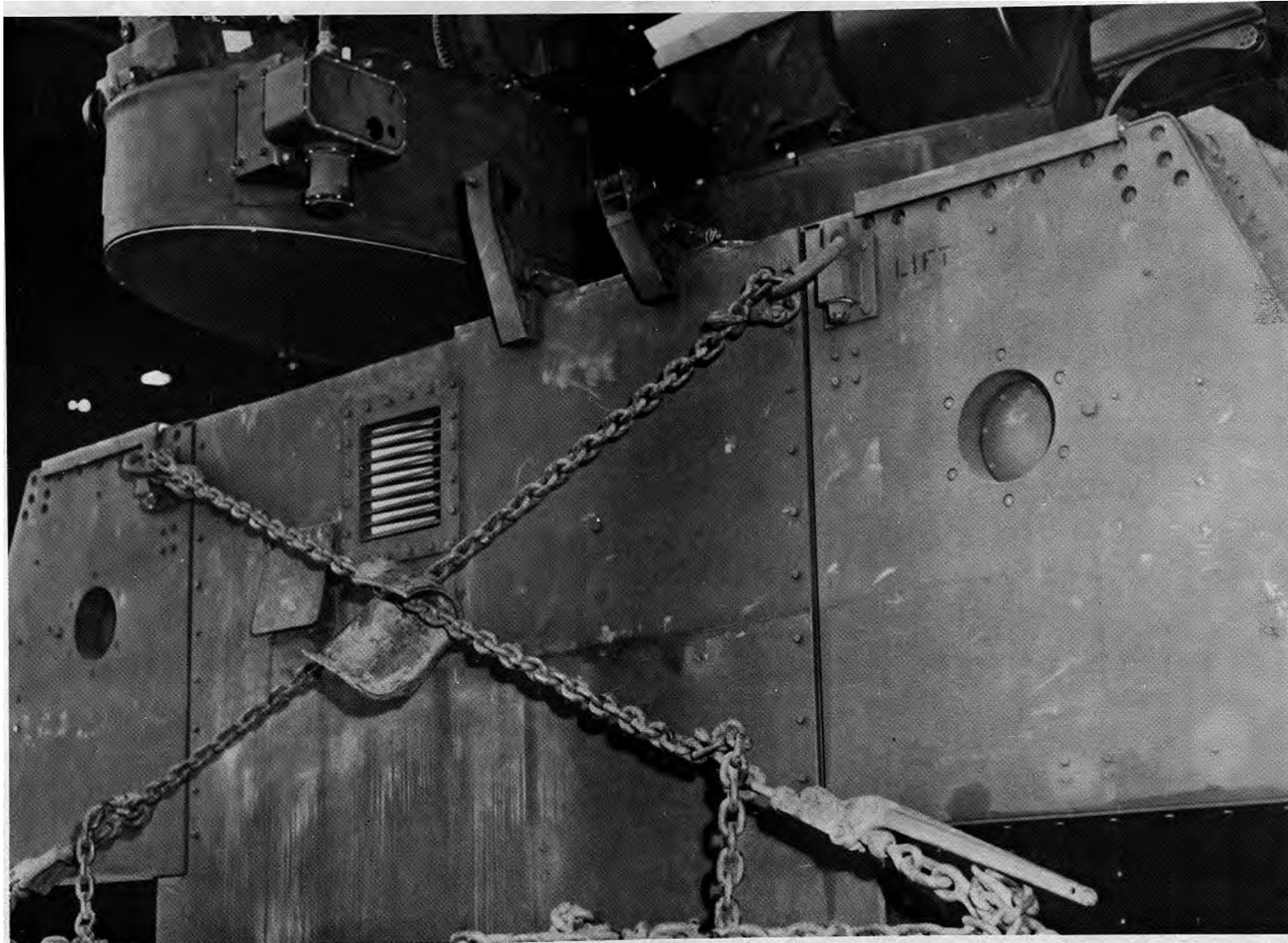


Figure 5-3. Fire unit tied down on flatbed semitrailer.

c. *M35 Truck*. When OMTS shelters cannot be transported over the highway on M35 trucks, because of distance involved or other considerations, shipment may be made with either commercial or military flatbed trailers or cargo trucks of adequate size and capacity. For unrestricted height clearance, the shelter is removed from the cargo truck and loaded separately. The cargo truck height must be reduced so that, when it is combined with the semitrailer loading-surface height, the unrestricted height limit is not exceeded. Figures 5-4 through 5-6 provide blocking and tiedown details for the ROLAND missile system components. Tables 5-5 and 5-6 provide bills of materials, and tables 5-7 and 5-8, data on the application of these materials.

NOTE

Figure 5-1 and tables 5-1 and 5-2 were extracted from US Army Materiel Command drawings.

Table 5-5. Bill of Materials for Blocking and Tiedown of M35 Truck on 12-Ton, or Larger, Semitrailer (Figs 5-4 and 5-5)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable; straight-grain, free from material defects; Fed Spec: MM-L-751H: 2- x 4-inch	24 linear ft
	2- x 6-inch	12 linear ft
	6- x 8-inch	16 linear ft
Nails	Common, steel; flathead; bright or cement-coated; table X1-b; Fed Spec: FF-N-105a: 20d	48
	30d	52
	40d	16
Cushioning material	Waterproof paper, burlap, or suitable material	as required
Chains	Type 1, grade C, Class 2; welded-steel, 1/4- to 1/2-inch width x 10-foot length; 6,000-lb safe working load; welded-steel, high-test chain; Fed Spec RR-C-271; with two grabhooks equal to or better than the strength of the chain; grabhooks are not required if wire rope and clamps are used.	8
Load binders	Double-hook, heavy-duty, eccentric takeup, with chain grabhooks for 1/4- to 1/2-inch chain; 16,000-lb safe working load; grabhooks are not required if wire rope and clamps are used.	8
*Wire rope	6 x19, IWRC; improved plow steel, preformed, regular-lay; table X, Fed Spec RR-W-410: 1/2-inch	64 ft

Table 5-5. Continued

Item	Description	Approximate Quantity
*Clamps	Wire rope, U-bolt clips, saddled, single-grip, steel; Crosby heavy-duty, or equal; MIL-STD-16842: 1/2-inch	32

*Wire rope and clamps may be substituted for chains and load binders.

Table 5-6. Bill of Materials for Blocking and Tiedown of S-280 Shelter, With OMTS, on Semitrailer (Fig 5-6)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable; straight-grain, free from material defects; Fed Spec: MM-L-751H: 4- x 4-inch	22 linear ft
	2- x 4-inch	44 linear ft
Nails	Common, steel; flathead; bright or cement-coated; Fed Spec FF-N-1058: 20d	40
	30d	40
	60d	44
Wire rope	6 x 19, IWRC; improved plow steel, preformed, regular-lay; Fed Spec RR-W-410C: 3/8-inch	122 ft
Clamps	Wire rope, U-bolt clips, saddled, single-grip; steel; Crosby heavy-duty, or equal; Fed Spec FF-C-450D: 3/8-inch	32
Thimbles	Standard, open-type: 3/8-inch	16
Cushioning material	Waterproof paper, burlap, or other suitable material	as required

Table 5-7. Application of Materials for Blocking and Tiedown of M35 Truck on 12-Ton, or Larger, Semitrailer (Figs 5-4 and 5-5)

Item	No. Required	Application
A	8	Chock blocks. Locate the 330 portion against the front of the front and intermediate wheels and against the rear of the front and rear wheels. Toenail the heel of the block (near the bottom edge) to the semitrailer floor with one 20d nail. Also, drive two 40d nails into the heel of the block, perpendicular to the semitrailer floor. Toenail each side of the block to the semitrailer floor with two 30d nails on each side.
B	as required	Protective material, such as waterproof paper or burlap, should be located under the bottom edge of the 2- x 4- x 36-inch piece and between the tire and the 2- x 6- x 36-inch piece, to extend 2 inches above blocking.
C	4	Side blocking. Each to consist of one piece of 2- x 6- x 36-inch lumber and two pieces of 2- x 4- x 36-inch lumber. Nail the 2- x 6- x 36-inch piece to the edge of the lower 2- x 4- x 36-inch piece with five 20d nails. Place the 2- x 6- x 36-inch piece against the tire,

Table 5-7. Continued

Item	No. Required	Application
C (cont)		and nail to the semitrailer floor through the
		2- x 4- x 36-inch piece with five 20d nails in a staggered pattern. Nail the other 2- x 4- x 36-inch piece to the one below in a like manner with five 30d nails.
D	4	Chains, load-lashing. Attach to the front and rear tiedown provisions on the vehicles and semitrailer as indicated. Substitute, if desired, 112- or 5/8-inch IWRC wire rope in a complete loop, and secure with four cable clips spaced about 4 inches apart.
E	4	Load binders. Secure grabhooks to chains, and take up slack with eccentric takeup. Grabhooks are not required if wire rope and cable clips are used.

Table 5-8. Application of Materials for Blocking and Tiedown of an S280 Shelter, with OMTS, on Semitrailer (Fig 5-6)

Item	No. Required	Application
A	2	End blocks. Each to consist of one piece of 4- x 4- x 48-inch lumber. Center and place each piece against the end of the shelter, and nail to the floor with eight 60d nails. Nail the lower 2- x 4- x 48-inch piece to the 4- x 4- x 48-inch piece with eight 30d nails. Nail the upper 2- x 4- x 48-inch piece to the lower piece with eight 20d nails. If the trailer or truck is equipped with a headboard, the forward end block should be placed prior to loading the shelter on the trailer or truck.

Table 5-8. Continued

Item	No. Required	Application
B	4	Side blocks. Each to consist of one piece of 4- x 4- x 36-inch lumber and two pieces of 2- x 4- x 36-inch lumber. Place the 4- x 4- x 36-inch piece on the floor and against the shelter about 18 inches in from the end of the shelter. Nail to the floor with six 60d nails. Nail the lower 2- x 4- x 36-inch piece to the 4- x 4- x 36-inch piece with six 30d nails. Nail the upper 2- x 4- x 36-inch piece to the lower 2- x 4- x 36-inch piece with six 30d nails.
C	8	Tiedowns. Each to consist of one piece of wire rope, 3/8-inch, 6 x 19, IWRC, length as required. Form a complete loop between the tiedown provision and the appropriate trailer stake pocket at a maximum angle of 45°. Wire-rope ends should overlap approximately 24 inches.
D	48	Clamps. Place four on each item E at the overlapped area. Space clamps 3-1/2 inches apart, with a minimum of 6 inches from the ends of the wire rope. Place one clamp on each thimble, item G, to secure the thimble to the wire rope at the trailer stake pockets and at the equipment tiedown provisions.
E	16	Thimbles. Locate one under the wire rope at each place where the wire rope passes through the equipment tiedown provisions and over the edge of the trailer stake pockets. Secure each thimble to the wire rope with one 3/8-inch clamp.

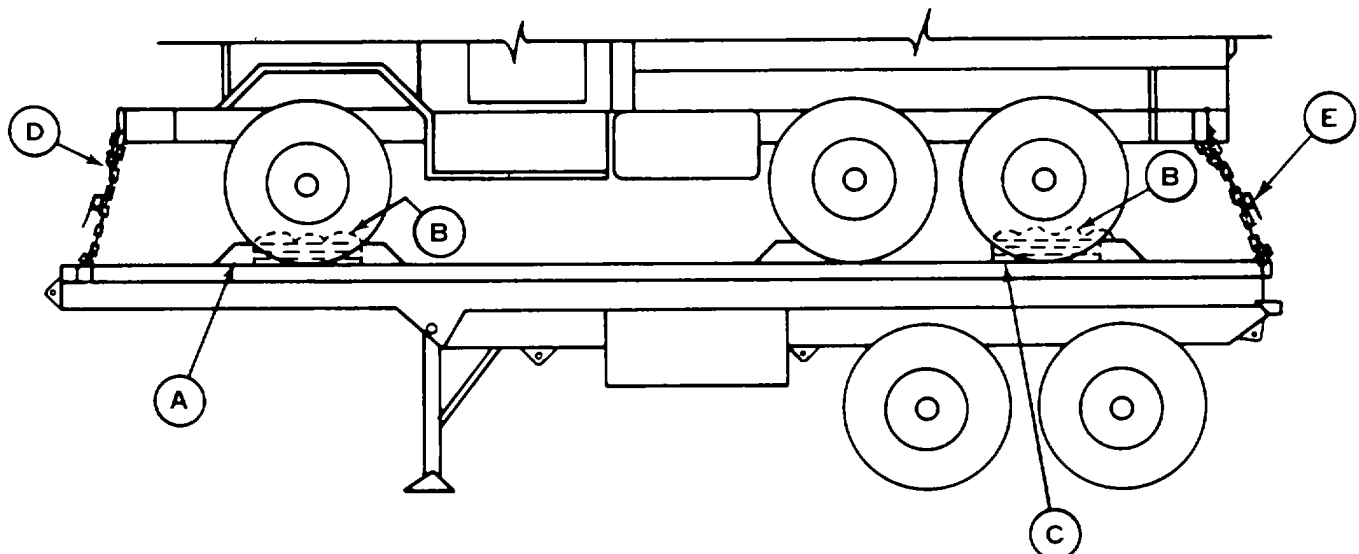


Figure 5-4. Blocking and tiedown of M35 truck on 12-ton, or larger, semitrailer.

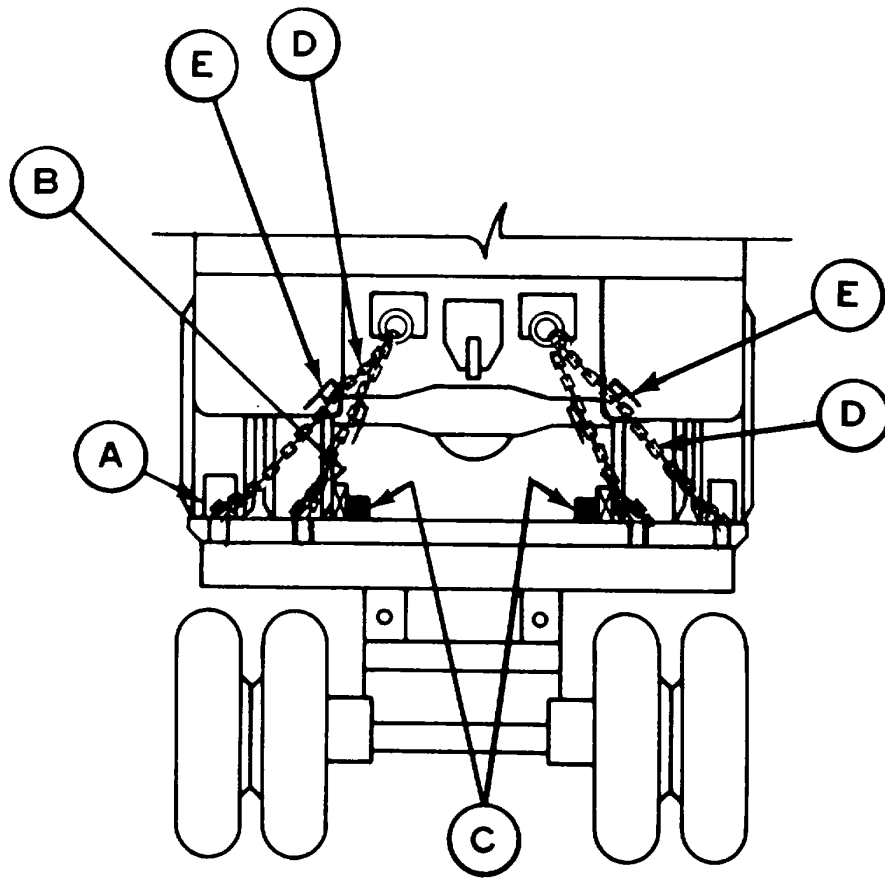


Figure 5-5. Rear view of M35 truck tied down on 12. ton, or larger, semitrailer.

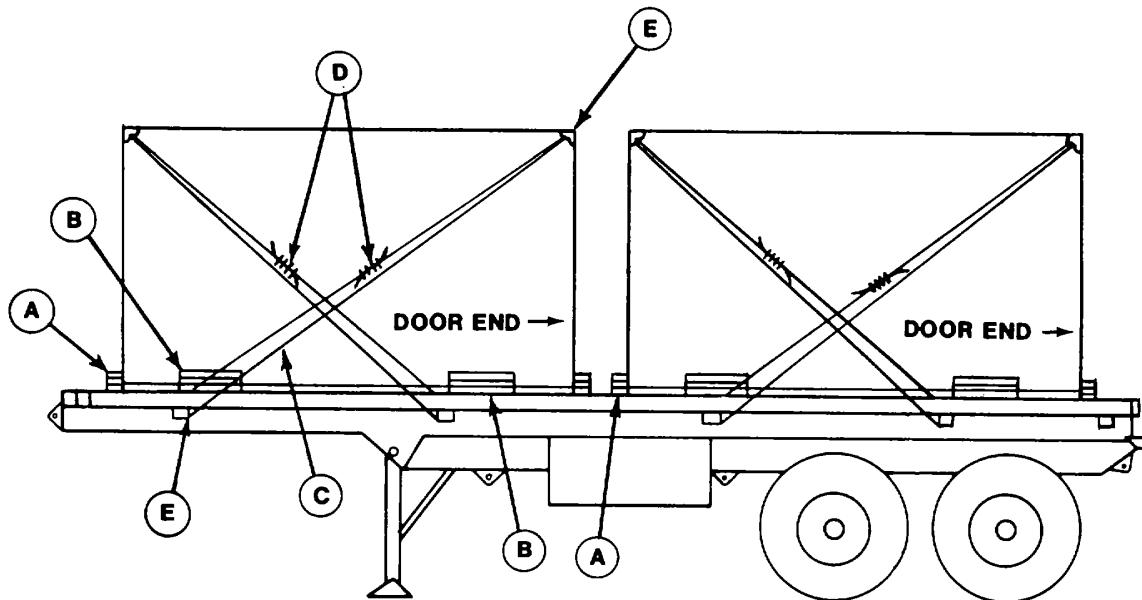


Figure 5-6. S-280 shelter, with OMTS, loaded on semitrailer.

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 ROLAND missile system. It covers technical and physical characteristics, as well as safety considerations, and prescribes the materials and guidance required to prepare, load, tie down, and unload the system equipment.

6-2. Safety

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

a. If ammunition or explosives are to be transported with the ROLAND missile system, the activity offering the cargo for transport will notify the carrier in compliance with paragraph 2-7, AR 55-228.

b. Ammunition, explosives, and vehicles will be handled and stowed in accordance with provisions contained Water Carrier Tariff No. 31 and Title 46/Title 49, Code of Federal Regulations.

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

d. Vehicle fuel tanks must not be more than one fourth full.

6-3. Water Shipment

The ROLAND missile system can be transported by a great variety of inland-waterway cargo carriers and lighters and by all seagoing cargo vessels.

NOTE

In this chapter, the methods described for lifting and securing vehicles are recommended procedures. Other methods of handling and stowing may be used provided they will ensure safe delivery without damage.

Section II. LOADING AND SECURING

6-4. General Rules for Stowing

a. *General.* Whenever possible, ROLAND missile system components should receive the protection of below-deck stowage. In general, good stowage of vehicles means vehicles are placed fore and aft as close together as practicable with minimum spacing between outer vehicles and the sweatboard. Breakable parts are protected, and spare parts are located within or near the vehicles. Vehicles are stowed in neutral with brakes set, battery terminals disconnected, and fuel drained, and secured with adequate blocking and lashing. Securing includes blocking of wheels on all four sides so that the vehicles cannot move in any direction; bracing of individual vehicle blocks to bulkheads, stanchions, and other vehicle blocks; and lashing of vehicle with wire rope or chain.

NOTE

Department of Transportation exemption (DOT-E-7280) authorizes DOD to ship vehicles with fuel tanks three-quarters full when vehicles are loaded on vessels that are adequately ventilated by power blowers, such as the roll-on/roll-off vessels.

b. *Loading.* Vehicles are always loaded onto vessels in their minimum configuration; that is, reduced height, width, and length and with or without cargo. The vehicles can be driven or lifted by crane of adequate capacity onto landing craft, beach discharge and

amphibious lighters, and landing ship tanks. They can also be driven onto the decks or barges from a pier when tidal conditions are suitable and ramps are available. The vehicles and the fire unit can be lifted by shoreside or floating cranes of adequate capacity onto seagoing vessels. Jumbo booms and heavy-lift ship's gear may be used in loading vehicles and other cargo onto vessels. The vehicles can be driven or towed onto roll-on/roll-off vessels. The ROLAND fire unit and the XM1058 truck transporter may be loaded as a single unit or as separate items, based on the type of vessel and the stowage location available. The M35 truck transporting an OMTS shelter may be loaded as a single unit or as separate items. Typical lifting diagrams for ROLAND missile system components are shown in figures 6-1 through 6-4.

c. *Tiedown.* Typical blocking and tiedown details for ROLAND missile system components are shown in figures 6-5 through 6-8. Materials and their application are listed in tables 6-1 through 6-6.

NOTE

Figure 6-5 was extracted from US Army Materiel Command drawings. Reference to page numbers in the notes within this figure refer to the number listed in the lower left-hand corner of the figure.

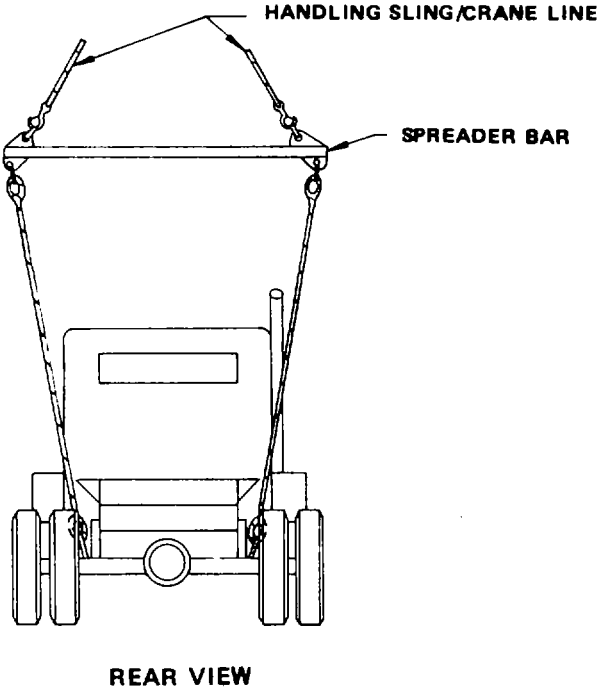
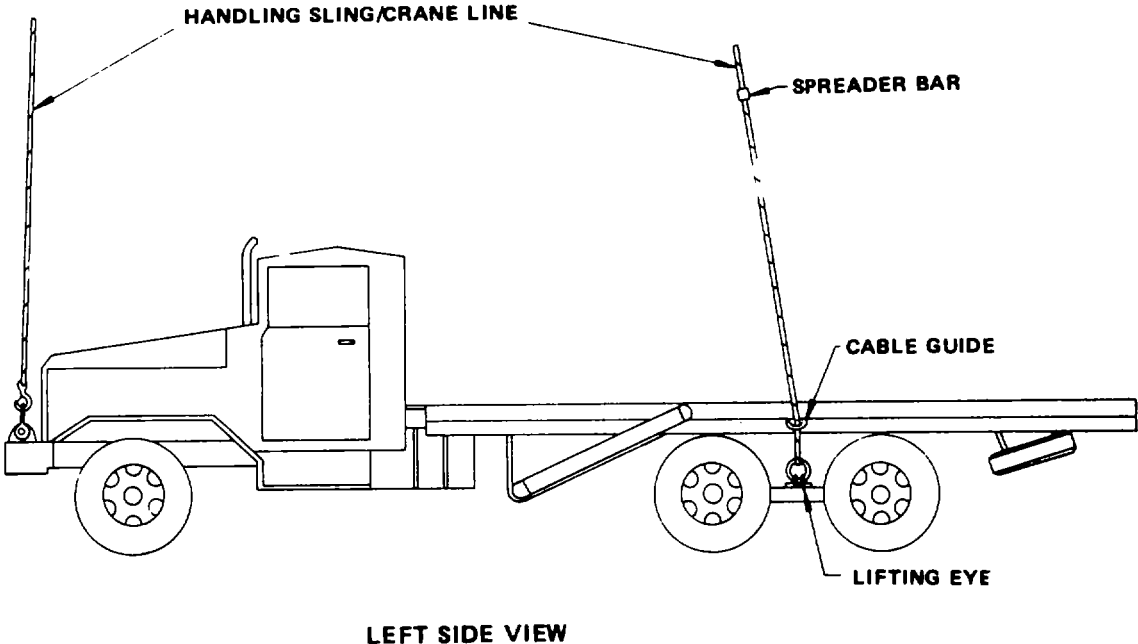


Figure 6-1. Lifting diagram for XM1058 truck transporter.

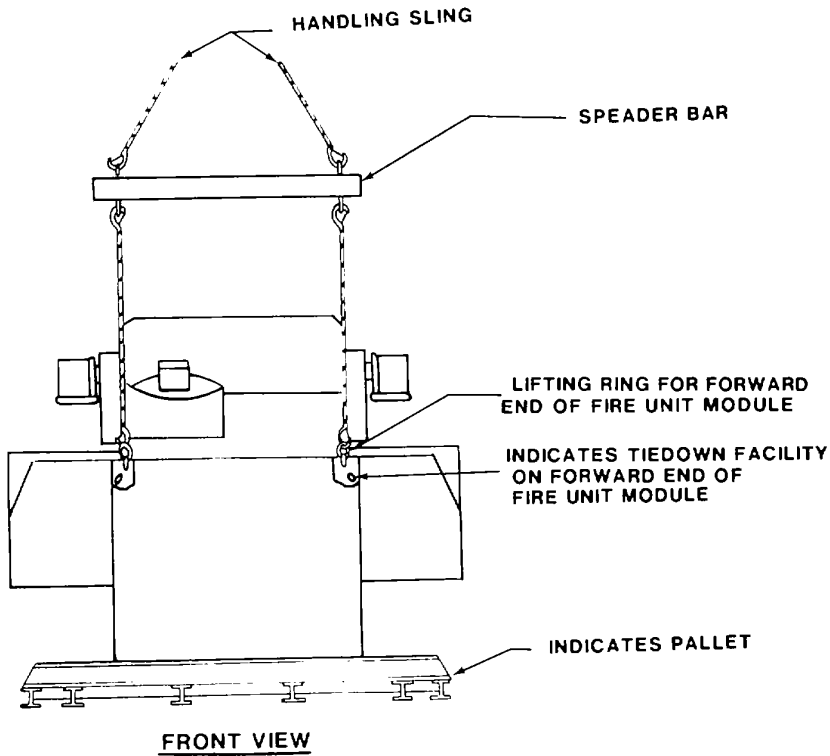
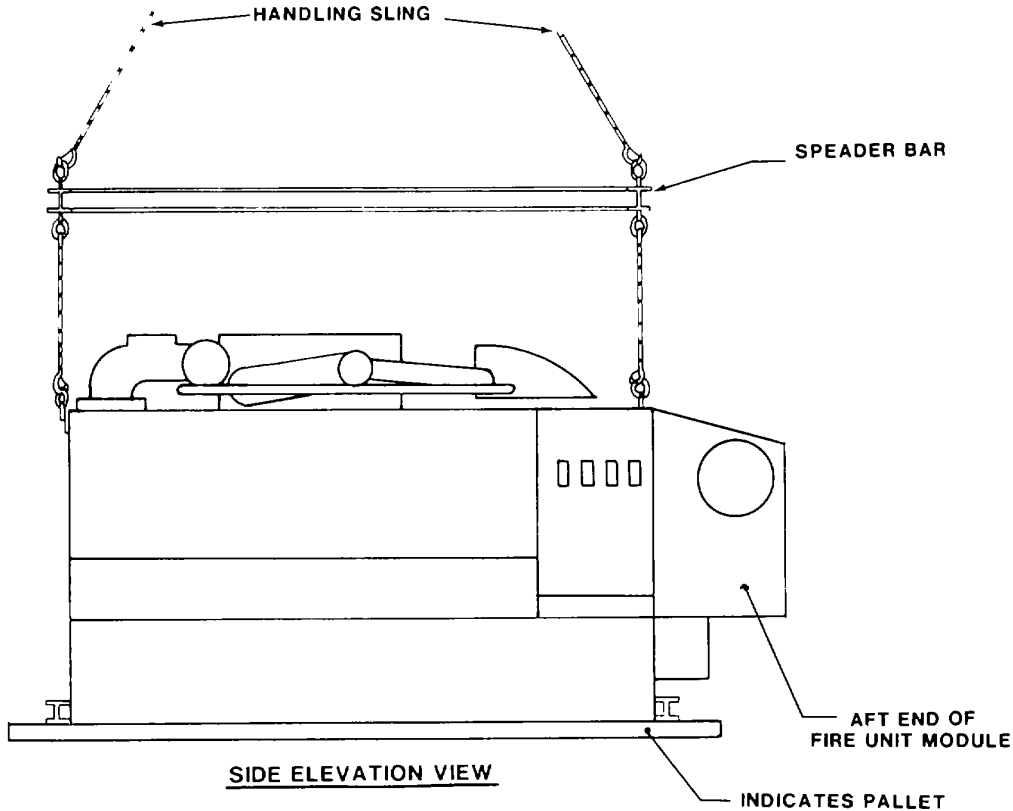


Figure 6-2. Lifting diagram for ROLAND fire unit.

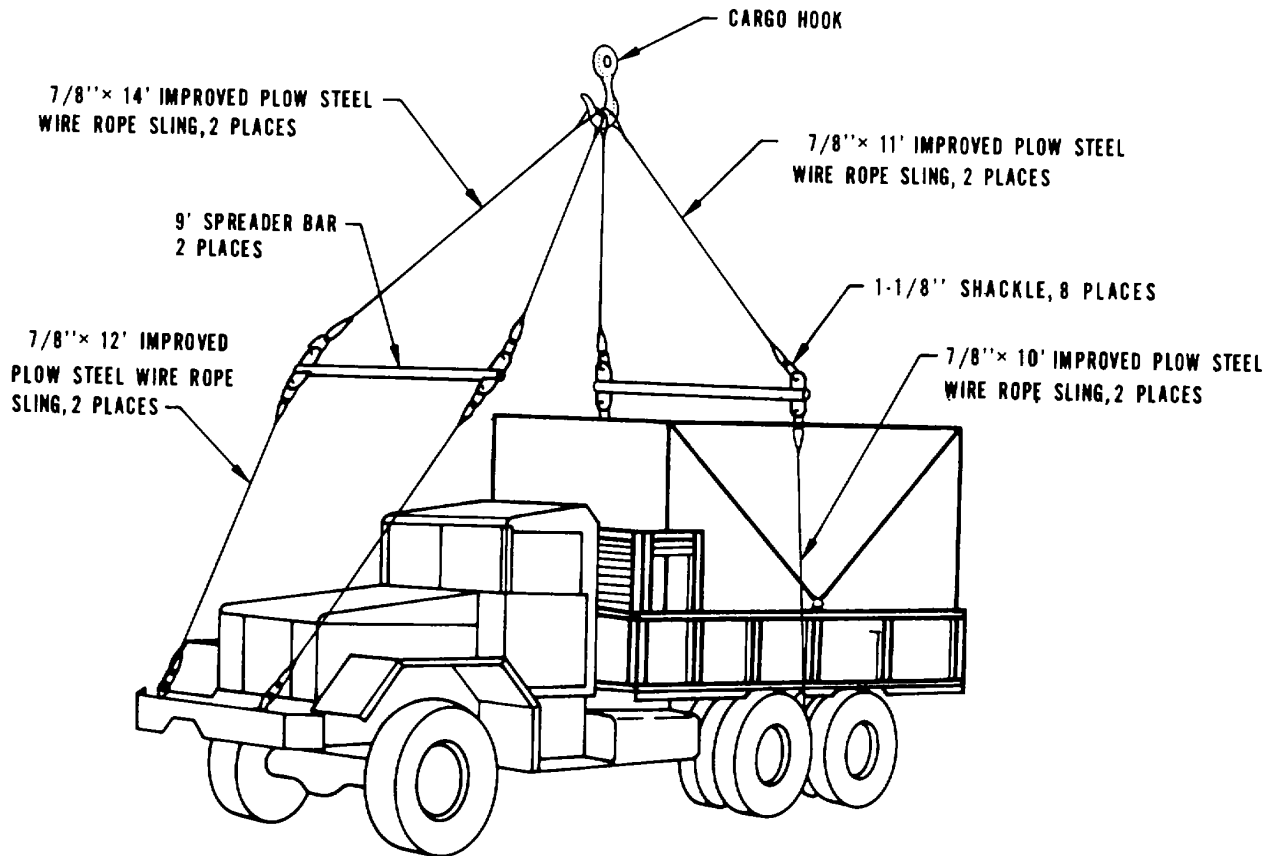


Figure 6-3. Lifting diagram for M35 truck with OMTS shelter.

d. *Special Design.* Seatrain trailer 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. With proper application of lashing gear, blocking and bracing will not be required.

6-5. Barges and Lighters

When the ROLAND missile system is moved by barge or similar lighterage to or from vessels secured to piers or a sheltered anchorage, blocking and chocking material will be required. When the vehicle is moved for extended distances or through rough waters, tiedowns must also be used.

Table 6-1. Bill of Materials for Blocking and Tiedown of ROLAND Fire Unit in Hold of General Cargo Vessel(Fig 6-6)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable; straight-grain, free from material defects; Fed Spec MM-L-751: 4- x 6-inch	60 linear ft
Nails	Common, steel; flathead; bright or cement-coated; Fed Spec FF-N-105: 60d	55
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; Fed Spec RR-W-410: 5/8-inch	70 ft
Clamps	Wire rope, U-bolt clips, saddled, single-grip; Steel; Crosby heavy-duty, or equal; MIL-STD-16842: 5/8-inch	16
Turn-buckles	314- x 18-inch	4
Padeyes	Local manufacturer; 1-inch steel rod and 4- x 6-5/8-inch steel plate. Bore 1-inch holes through the plate, and weld U-shaped 1-inch rod ends to the top and bottom of the plate.	4

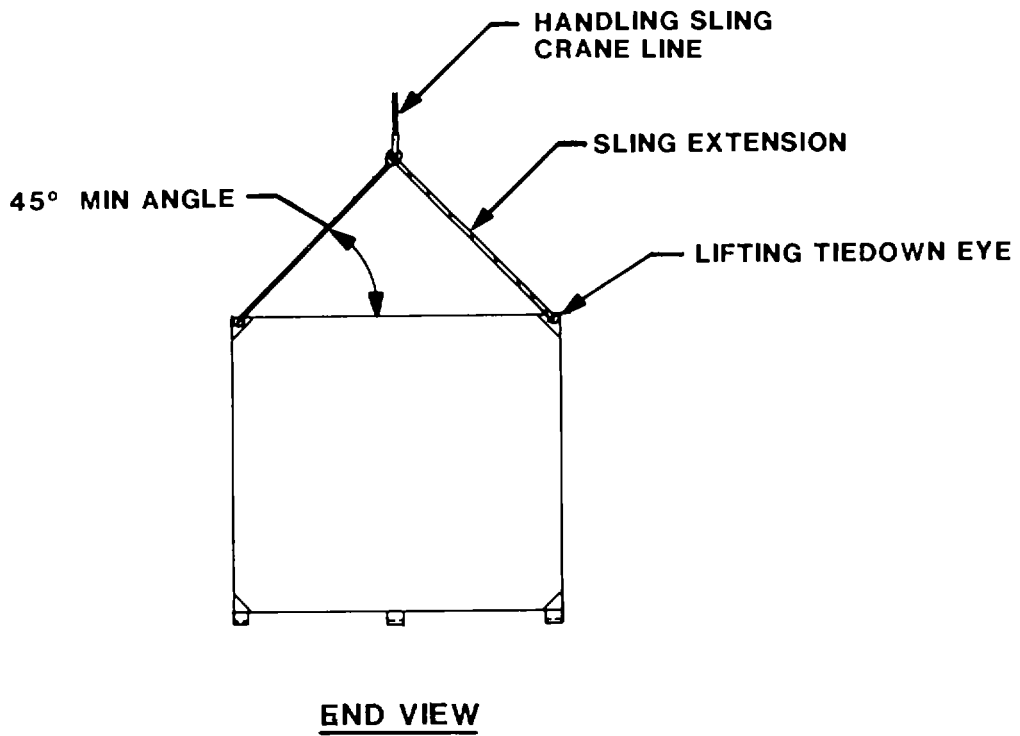
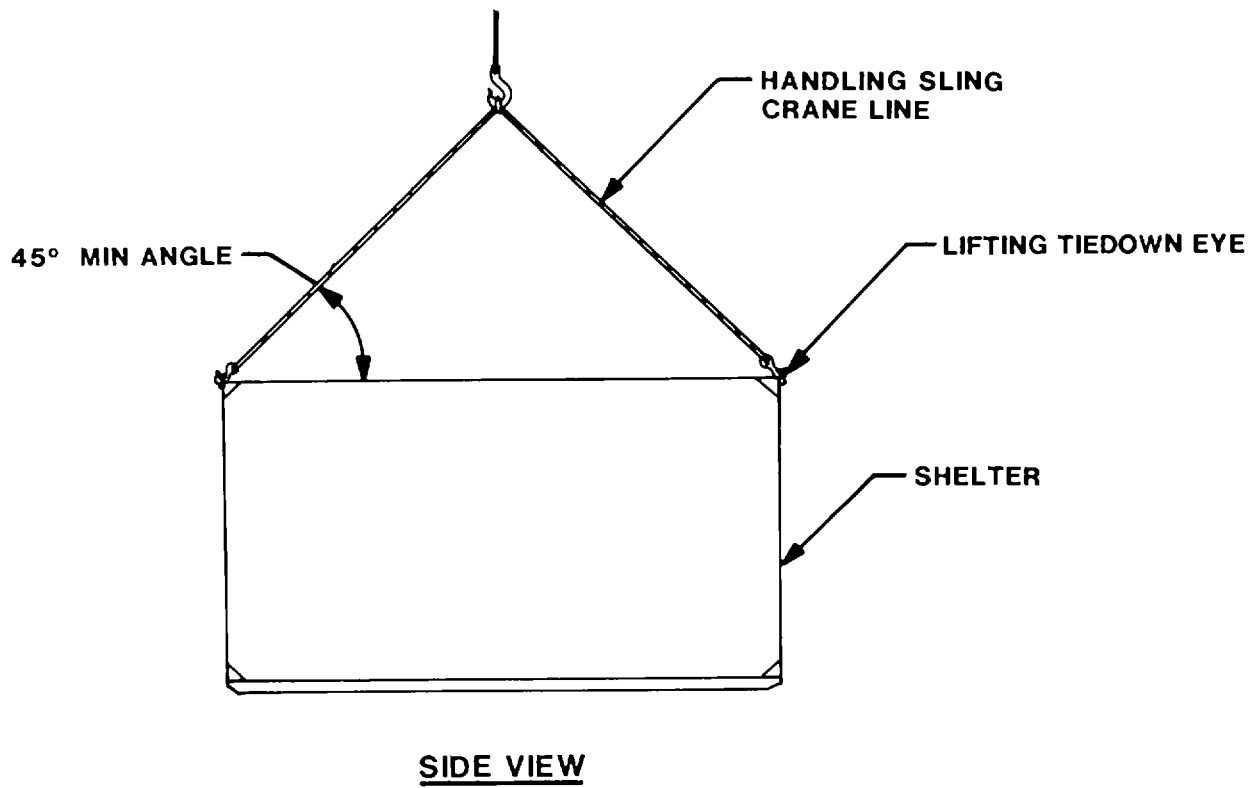


Figure 6-4. Lifting diagram for OMTS shelter only.

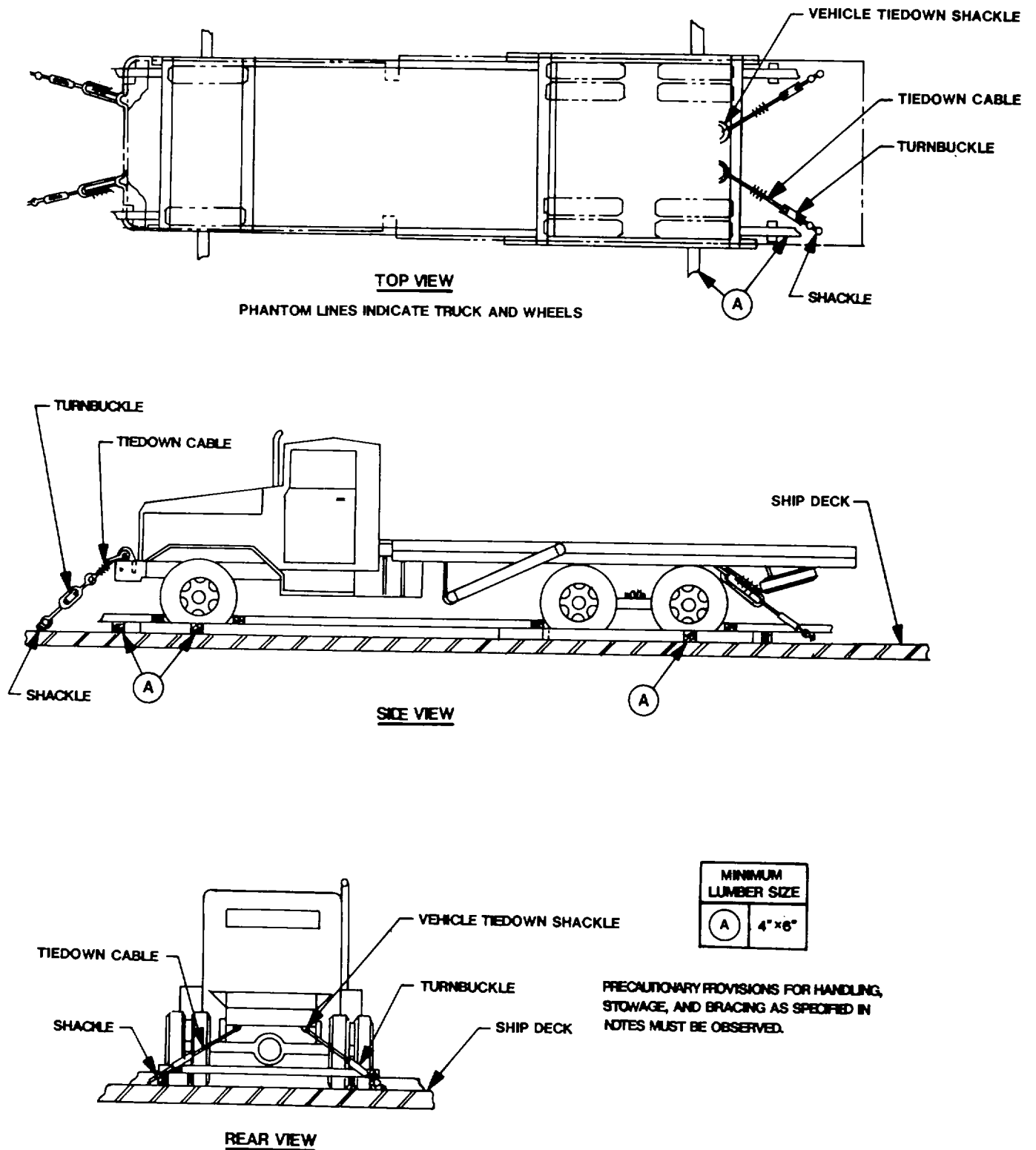


Figure 6-5. Blocking and tiedown of XM1058 truck transporter in general cargo vessel.

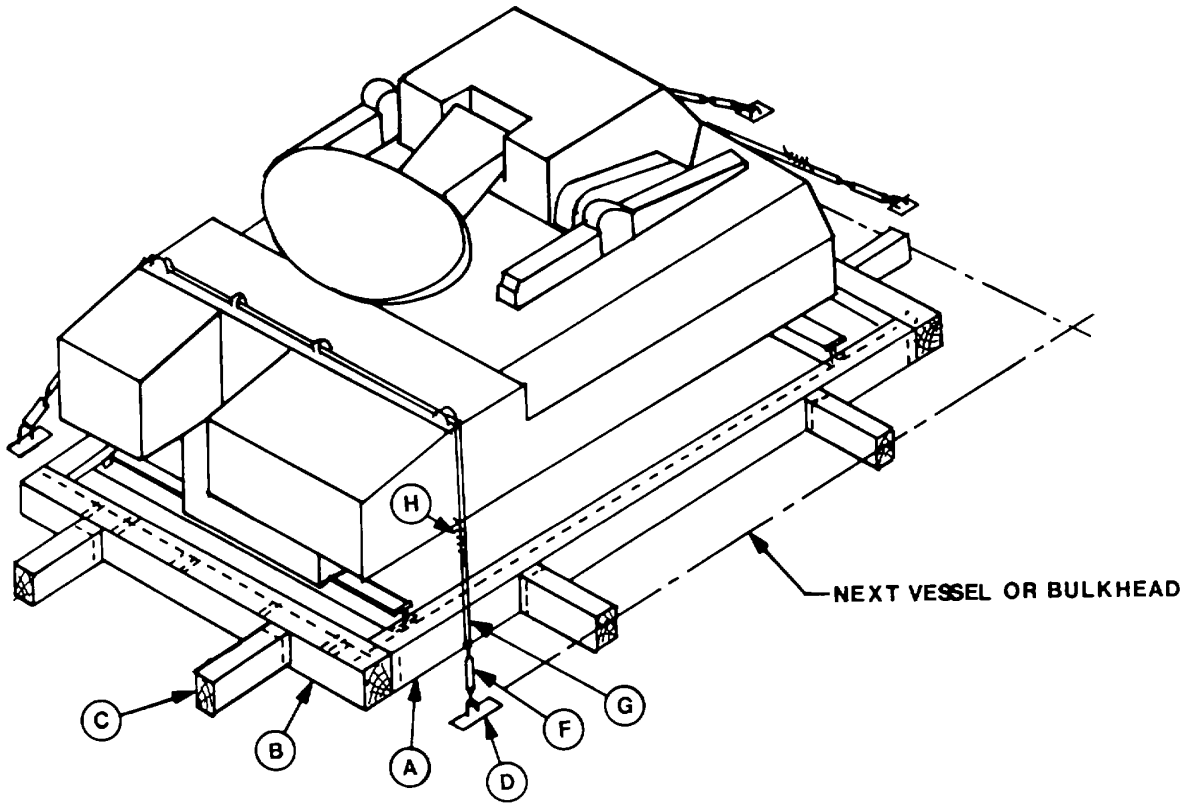


Figure 6-6. Blocking and tiedown of ROLAND fire unit in general cargo vessel.

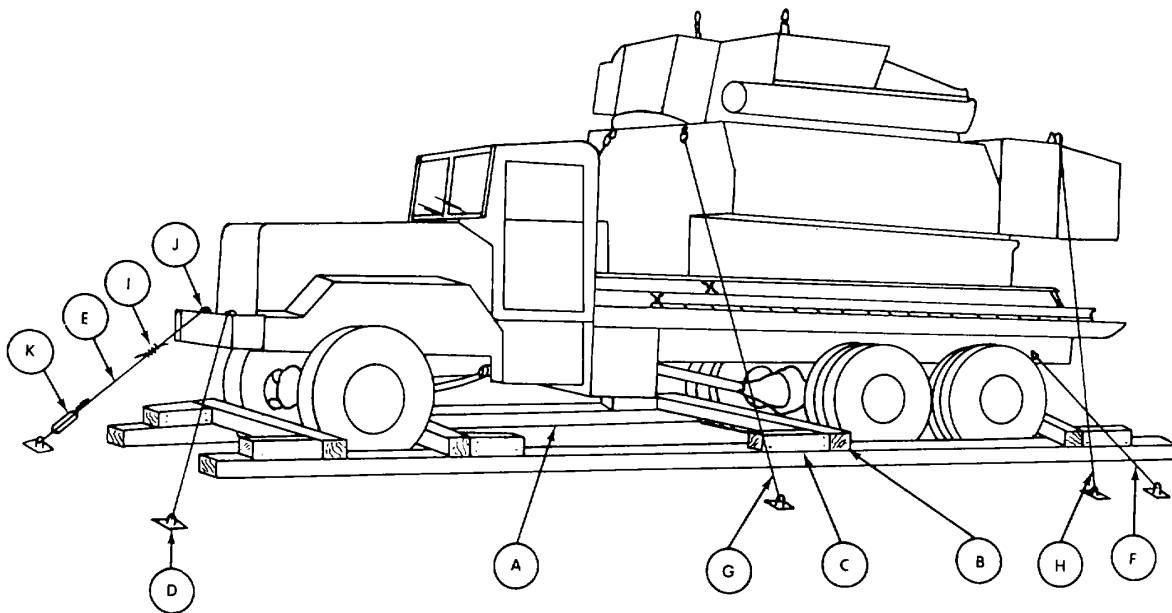


Figure 6-7. Blocking and tiedown of XM1058 truck transporter with fire unit in general cargo vessel.

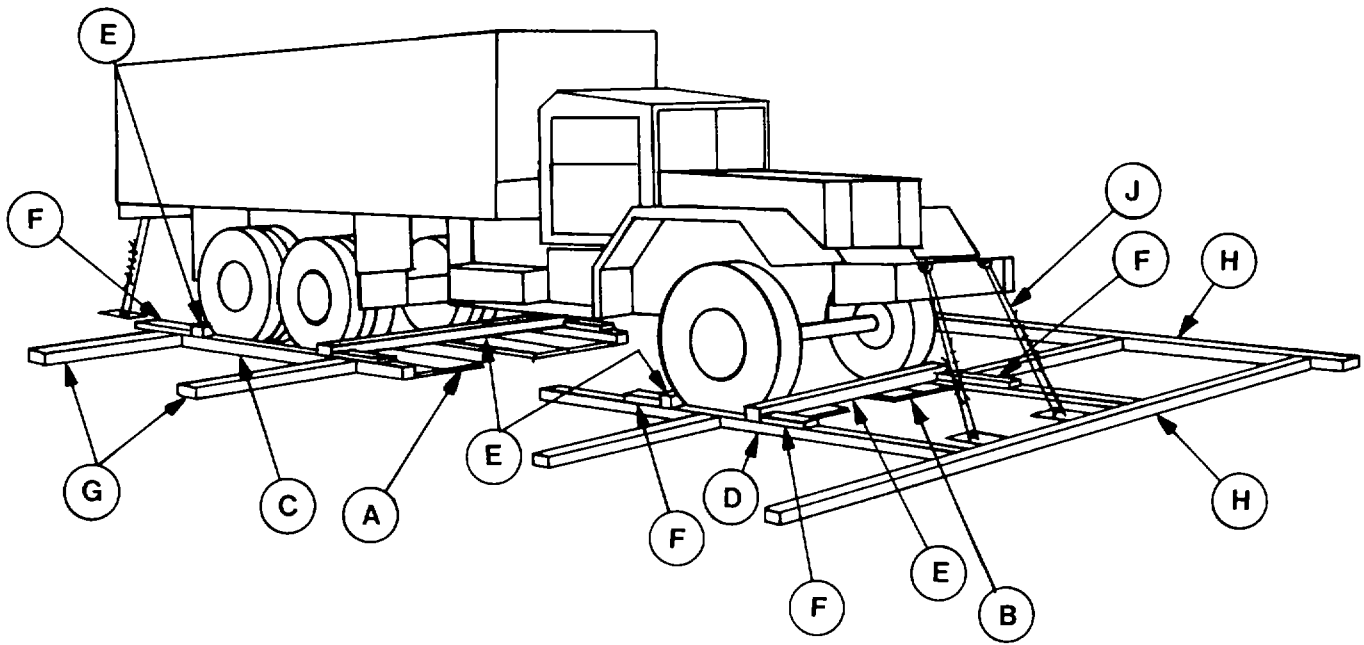


Figure 6-8. Blocking and tiedown of M35 truck, with OMTS shelter, in general cargo vessel.

Table 6-2. Bill of Materials for Blocking and Tiedown of ROLAND Fire Unit in Hold of General Cargo Vessel (Fig. 6-6)

Item	No. Required	Application
A	2	Side blocks, lumber, 4-inch x 6-inch x length-to-suit. Locate against the fire unit pallet, one piece on each side of the fire unit.
B	2	End blocks. Each consists of one piece of 4-inch x 6-inch x length-to-suit lumber. Locate on top of side blocking and pallet edge. Toenail to side blocking with four 60d nails at each end.
C	as required	Bracing, lumber 4-inch x 6-inch x length-to-suit. Brace as required against fire unit blocking, on the side of the vessel or adjacent to cargo blocking, to immobilize equipment. Toenail each end to adjacent bracing with four 60d nails.
D	4	Padeyes. Required on the floor of the vessel if proper D-rings or deck tiedown fittings are not available.
E	2	Wire rope, 5/8-inch, formed into a complete loop. Secure with clamps (item H below). Attach to the front tiedown ring on each side of the fire unit.
F	4	Turnbuckles, 3/4- x 18-inch. Apply between wire rope and padeyes. Tighten to even tension between all turnbuckles.
G	2	Wire rope, 5/8-inch; form the first cable into a complete loop between the rear right-hand golf club clevis, routed through cable guides at the top corner, and the left-hand padeye; form the second cable into a loop between the left-hand golf club clevis, routed through cable guides at the top corner, and the right-hand padeye. Secure each with four clamps (item H below).
H	16	Clamps, 5/8-inch. Secure to items E and G above.

Table 6-3. Bill of Materials for Blocking and Tiedown of XM1 058 Truck Transporter with Fire Unit in Hold of General Cargo Vessel (Fig 6- 7)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable; straight-grain, free from material defects; Fed Spec MM-L-751: 4- x 6-inch	120 linear ft
Nails	Common steel; flathead; bright or cement-coated; Fed Spec FF-N-105: 60d	110
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; Fed Spec RR-W-410: 5/8-inch	150 ft
Clamps	Wire rope, U-bolt clips, saddled, single-grip; steel; Crosby heavy-duty, or equal; MIL-STD-16842: 5/8-inch	32
Thimbles	Standard, open-type: 5/8-inch	14
Turnbuckles	3/4- x 18-inch	8
Padeyes	Local manufacturer; 1-inch steel rod and 4- x 6- x 5/8-inch steel plate. Bore 1-inch holes through the plate, and weld U-shaped 1-inch rod ends to the top and bottom of the plate.	8

Table 6-4. Application of Materials for Blocking and Tiedown of XM1058 Truck with Fire Unit in Hold of General Cargo Vessel (Fig 6-7).

Item	No. Required	Application
A	as required	Side blocks, lumber, 4- x 6-inch x length-to-suit. Locate against vehicle treads, one piece on each side of vehicle.

Table 6-4. Continued

Item	No. Required	Application
B	4	Blocks, lumber, 4- x 6- x 120-inch. Locate one in front of the front and intermediate wheels and in back of the front and rear wheels. Toenail each end to the side blocking with two 60d nails.
C	8	Cleats, lumber, 4- x 6- x 18-inch. Locate against blocks as indicated in figure 6-7, and secure each cleat to side blocking with ten 60d nails.
D	8	Padeyes. Required on the floor of the vessel if proper D-rings or deck tiedown fittings are not available.
E	2	Wire rope, 5-8-inch, formed into a complete loop around the tiedown ring. Secure with clamps (item I below).
F	2	Wire rope, 5/8-inch, formed into a complete loop. Secure with clamps (item I below).
G	2	Wire rope, 5/8-inch, formed into a complete loop. Secure with clamps (items I below). Attach to the front tiedown ring on the fire unit, on each side of the vehicle.
H	2	Wire rope, 5/8-inch; form the first cable into a complete loop between the rear right-hand golf club clevis, routed through cable guides at the top corner, and the left-hand padeye; form the second cable into a complete loop between the left-hand golf club clevis, routed through cable guides at the top corner, and the right-hand padeye. Secure each with four clamps (item I below).
I	28	Clamps, 5/8-inch. Secure to items E through H.
J	16	Place one thimble at each tiedown provision and turnbuckle.
K	8	Turnbuckles, 3/4- x 18-inch. Apply turnbuckles between wire rope and padeyes. Tighten to even tension between all turnbuckles.

Table 6-5. Bill of Materials for Blocking and Tiedown of M35 Truck, with OMTS Shelter, in General Cargo Vessel (Fig 6-8)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable: Straight-grain, free from material defects; Fed Spec MM-L-751H: 2- x 4-inch 2- x 12-inch 4- x 6-inch	8 linear ft 44 linear ft 62 linear ft
Nails	Common steel; flathead; bright or cement-coated; Fed Spec FF-N-105B: 12d 30d 60d	32 as required 16
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; Fed Spec RR-W-410C: 5/8-inch	80 ft
Clamps	Wire rope, U-bolt clips, saddled, single-grip; steel, Crosby heavy-duty, or equal; Fed Spec FF-C-450D: 5/8-inch	16

Table 6-6. Application of Materials for Blocking and Tiedown of M35 Truck, with OMTS Shelter, in General Cargo Vessel (Fig 6-8)

Item	No. Required	Application
A	4	Lumber, 2- x 12- x 96-inch. Pre-position on vessel deck so that two pieces are under the left rear wheels and two pieces are under the right rear wheels parallel to the long axis of the truck.
B	4	Lumber, 2- x 12- x 36-inch. Pre-position on vessel deck so that two pieces are under each front wheel parallel to the long axis of the truck.
C	2	Side blocks. Each to consist of 4- x 6- x 108-inch lumber. Center one piece against the outside of the left and right rear wheels.
D	2	Side blocks. Each to consist of 4- x 6- x 48-inch lumber. Center one piece against the outside of each front wheel.
E	4	End blocks. inch lumber. Locate one piece forward of the front and intermediate wheels and behind the front and rear wheels. Toenail each end of the side block with two 60d nails.
F	8	Backup cleats. Each to consist of one piece of 2- x 4- x 12-inch lumber. Locate one on top of items C and D against the joint of each item E. Nail to items C and D with four 12d nails per block.
★G	as required	Bracing, lumber, 4-inch x 6-inch x random length, cut-to-fit. Place the ends against the side blocking and blocking of other cargo, or the side of the ship or other ship's structure. Nail with 30d nails where appropriate.
★H	as required	Blocks. 4-inch x 6-inch x random length, cut-to-fit. Place blocks around the truck and against other blocking, on the side of the ship or other ship's structure as appropriate, to assist in holding the bracing in place.
J	4	Wire rope, approximately 20 feet each. Form a complete loop through the truck tiedown provision and appropriate deck padeye or D-ring. Pull the wire rope taut and secure it with clamps (item K).
K	16	Clamps. Use four clamps to secure each item
J.		Details for placement of clamps are provided in figure 5-3 or 7-4.

★Material for these items are not included in table 6-1.

6-6. Landing Ships, Landing Craft, and Amphibious Vehicles When the ROLAND missile system is moved for extended distances or through rough waters, blocking and tiedowns must be used. In most cases, the vessels are equipped with turnbuckles with a sheep's foot on one end that fits into a deck cloverleaf; where not provided, a suitable substitute may be used.

6-7. Lighter Aboard Ship (LASH)

a. General. When transporting the ROLAND missile system by LASH-type ships, securement with blocking and tiedowns is required. Barge stability is

noticeably affected by the placement of heavy-lift items; therefore, ROLAND missile system equipment should be loaded in manner to counterbalance variations in the locations of centers of gravity from true center.

b. Shoring. Shoring is not generally used beneath vehicles equipped with rubber tires. Frictional forces between the tires and the deck are sufficient to make it unnecessary. However, deck surfaces should be dry and free of grease or debris.

CHAPTER 7

RAIL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

7-1. Scope

This chapter provides rail transportability guidance for movement of the ROLAND missile system. It covers technical and physical characteristics, as well as safety considerations, and prescribes the materials and guidance required to prepare, load, tie down, and unload the vehicles.

7-2. Maximum Utilization of Railcars

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

Section II. TRANSPORT ON CONUS RAILWAYS

7-3. General

The transportability guidance contained in this section is applicable when the ROLAND missile system is transported on CONUS railways. The ROLAND fire unit and the XM1058 truck transporter must be transported as separate components. The ROLAND missile system does not exceed width limits for unrestricted movement in its reduced configuration.

transported over various routes on different equipment, including rail equipment, and with different restraint procedures as identified in paragraphs 7-5 through 7-8.

b. *Rail Shipment Only.* Rear-door structural support must be installed prior to rail shipment. A diagram of a rear entry door opening is shown in figure 7-1.

c. *Whip Antennae.* The whip antennae must be folded and secured to avoid damage. Procedures for folding and securing the antennae are contained in TM 9-1425-625-10.

7-4. Preparation for Loading

a. *ROLAND Missile System.* Preparation of the ROLAND missile system will vary among loads to be

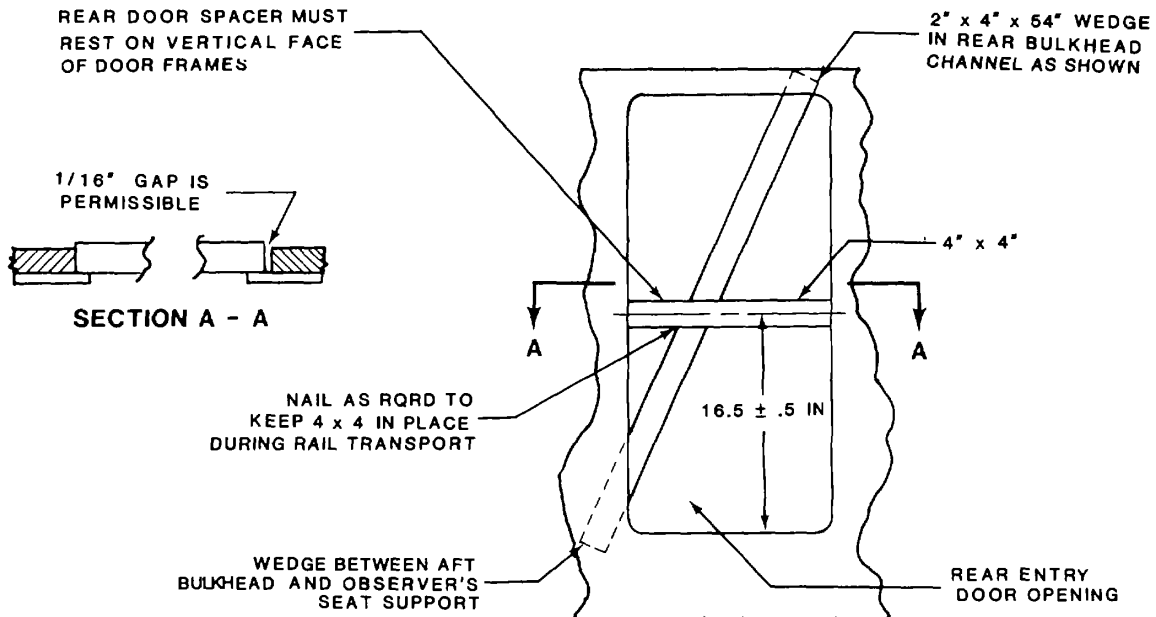


Figure 7-1. Diagram of rear entry door opening.

7-5. Loading of ROLAND Missile System on General Purpose Flatcar

a. The ROLAND missile system may be placed in the tiedown position on the flatcar by crane or it may be driven onto the flatcar, provided a suitable ramp or bridge is available.

b. General notes and material specifications are listed in table 7-1. Also shown in this table is the application of materials for loading and securing the ROLAND fire unit. Figures 7-2 (isometric view) and 7-3 (front view) show blocking and tiedown for the ROLAND fire unit on a general purpose flatcar.

c. Figures 7-4 and 7-5 illustrate the details for securing the ROLAND fire unit.

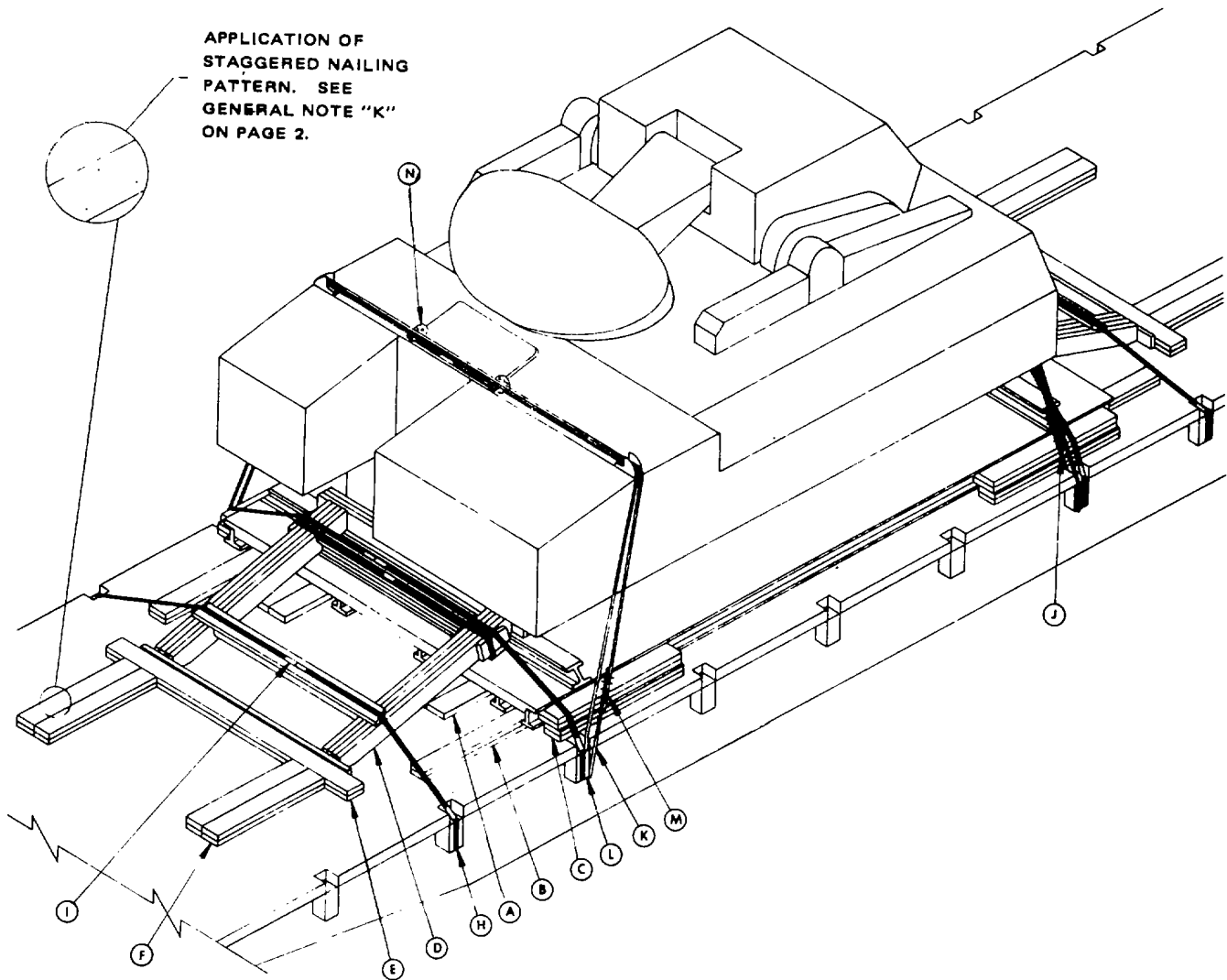


Figure 7-2. Blocking and tiedown for ROLAND fire unit on general purpose flatcar (isometric view).

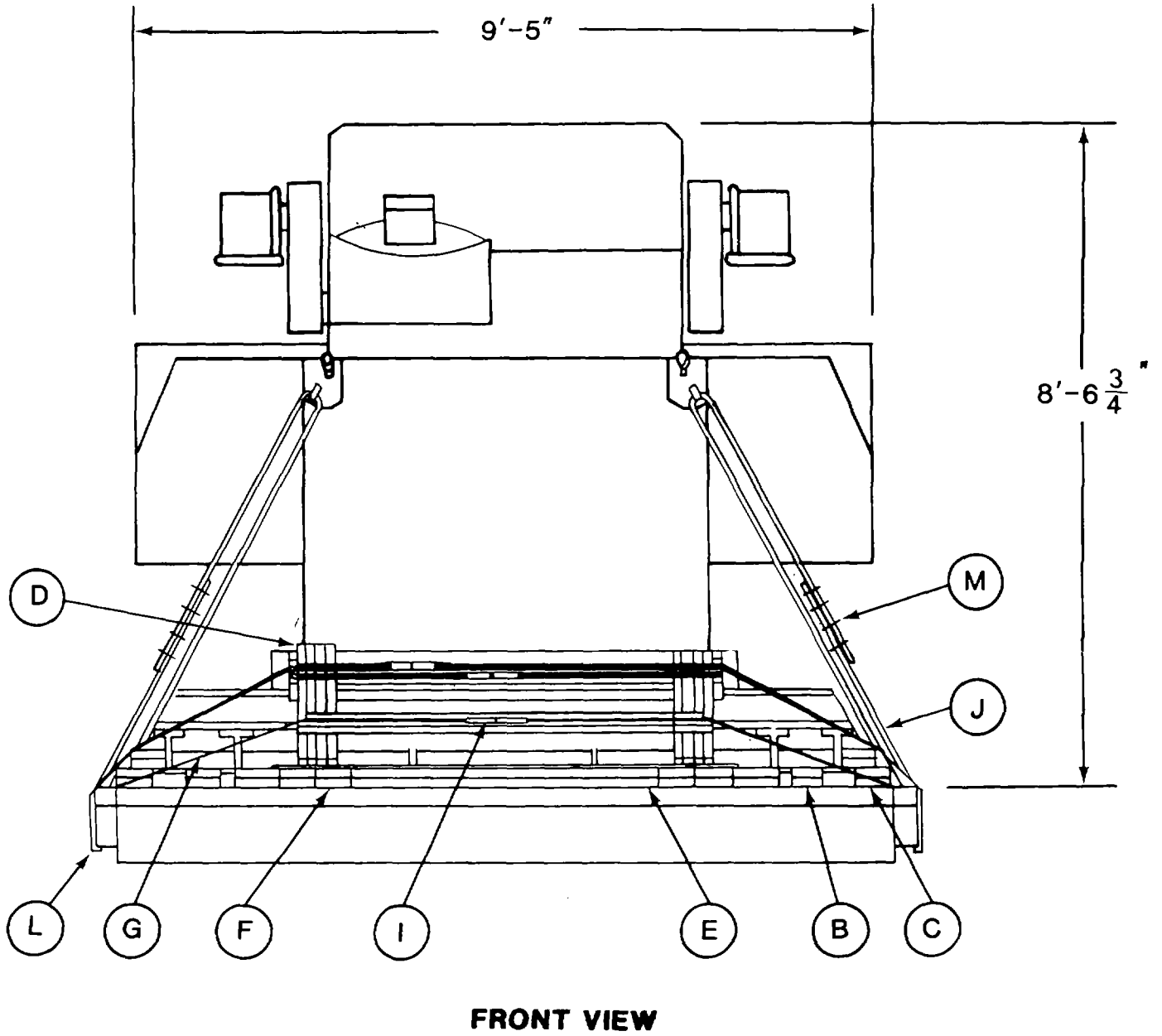


Figure 7-3. Blocking and tiedown for ROLAND fire unit on general purpose flatcar(front view).

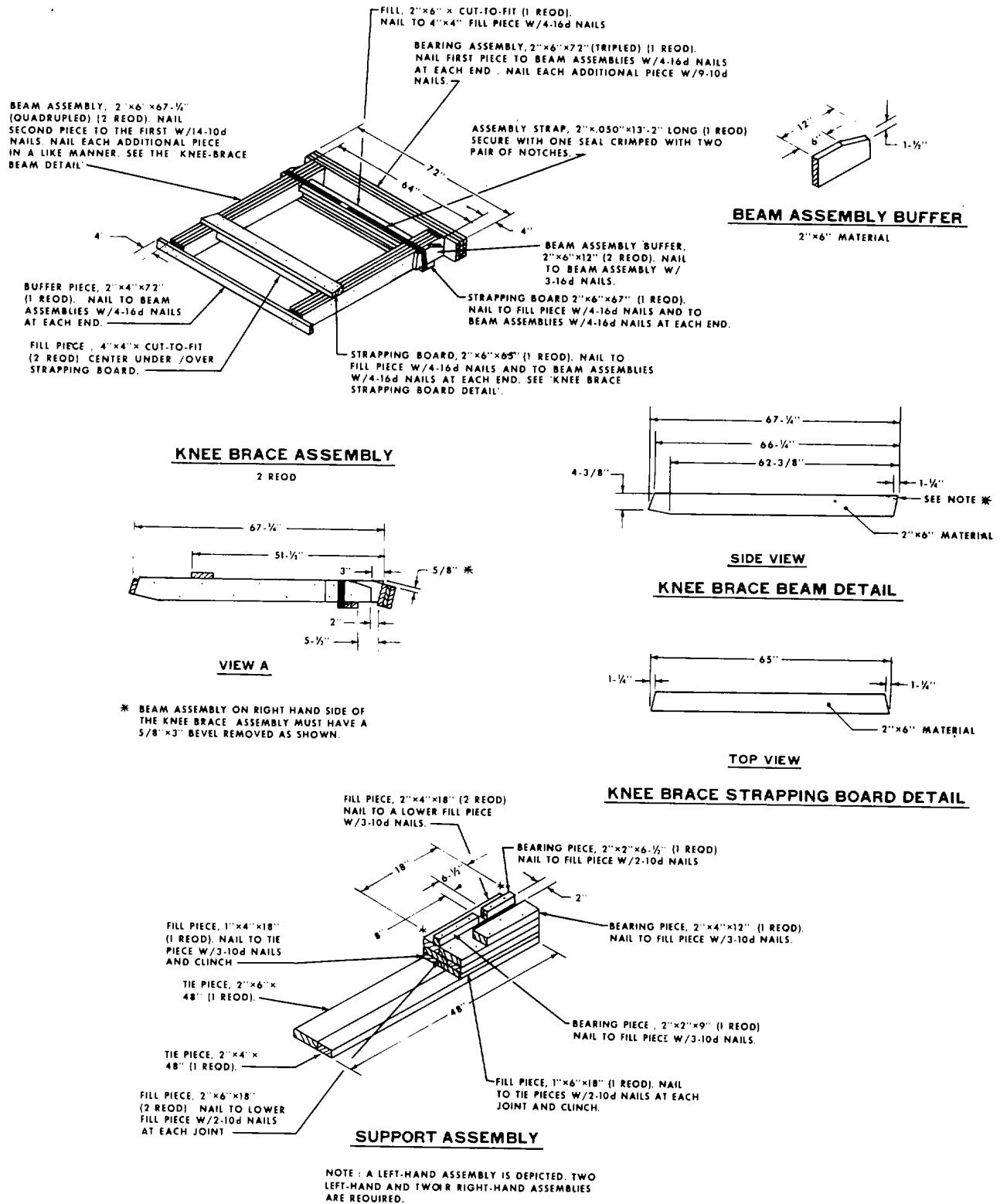
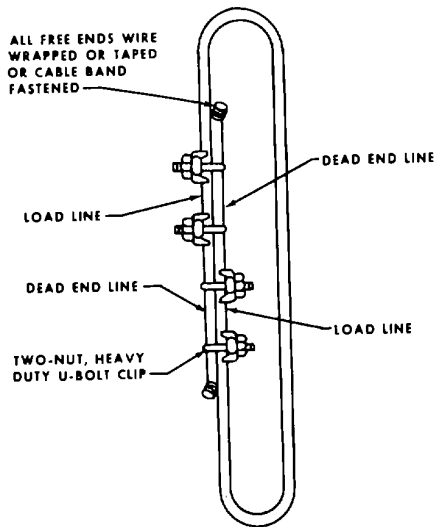
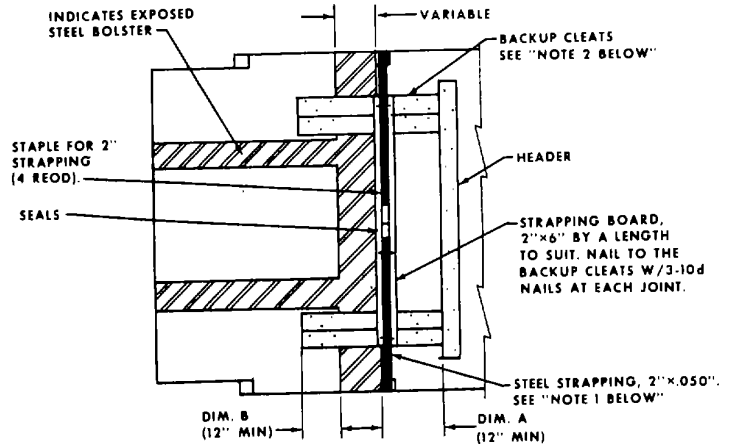


Figure 7-4. Blocking and bracing details for securing ROLAND fire unit.



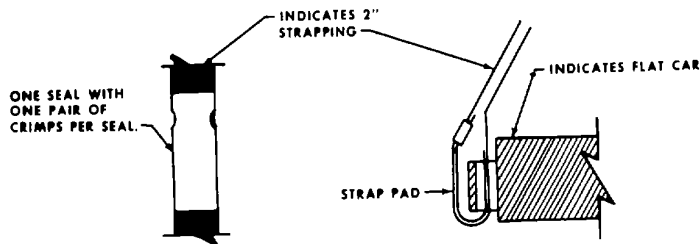
CABLE JOINT

PROPER TIGHTENING OF THE WIRE ROPE CLIP NUTS CAN BE ACCOMPLISHED BY UTILIZING A PROPER SIZED TORQUE WRENCH. AFTER THE NUTS HAVE BEEN INITIALLY TIGHTENED, THE "U" SIDE OF EACH CUP CLIP MUST BE STRUCK SEVERAL TIMES WITH A HAMMER TO INSURE PROPER SEATING INTO THE DEAD END LINE. FINAL TORQUE WILL BE ACQUIRED BY REPEATEDLY AND ALTERNATELY TIGHTENING EACH CLIP NUT.



TYPICAL END BLOCKING FOR CARS WITH EXPOSED STEEL BOLSTERS (TOP VIEW)

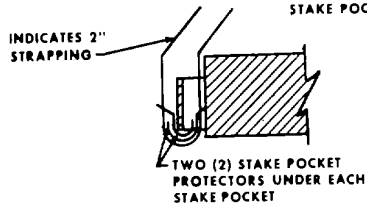
- NOTES: 1. THE OPTIONAL STRAP HOLD DOWN FOR END BLOCKING IS FOR CARS WITH OR WITHOUT EXPOSED STEEL BOLSTERS POCKET
2. WHEN LOADING CARS WITH EXPOSED STEEL BOLSTERS, THE TOTAL OF DIMENSION "A" AND DIMENSION "B" (MIN 12") MUST EQUAL THE LENGTH OF THE BACK-UP CLEATS TO PROVIDE FOR PROPER NAILING TO THE CAR FLOOR.



VIEW A

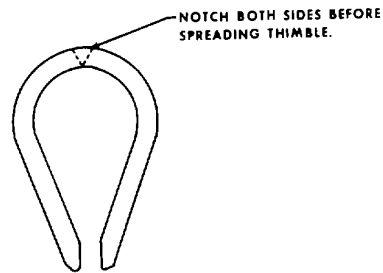
DETAIL A

METHOD OF INSTALLING 2" STRAPPING AND PAD AT STAKE POCKET

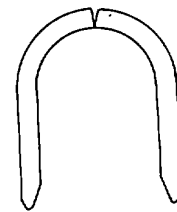


DETAIL B

METHOD OF INSTALLING 2" STRAPPING AND STAKE POCKET PROTECTORS (ALT PAD)



STANDARD 1/2" THIMBLE



THIMBLE AFTER SPREADING

DETAIL C

Figure 7-5. Details of parts for securing ROLAND fire unit.

Table 7-1. Application of Materials for Loading and Securing ROLAND Fire Unit (Figs 7-2, 7-3, 7-4, and 7-5)

Item	No. Required	Application
A	4	Support assembly. See the "support assembly detail in figure 7-4. Nail the assembly to the car floor with four 16d nails.
B	4	Pallet beam stiffeners, 2- x 6- x 48-inch (doubled). Position so that it is approximately 2 inches from contacting the lateral stiffener on the underside of the pallet. Nail the first piece to the car floor with seven 20d nails. Nail the second piece to the first with seven 50d nails.
C	8 each	Side blocks, 2- x 6- x 42-inch and 2- x 8- x 42-inch. Position the first 2- x 6-inch piece next to the pallet, and nail to the car floor with eleven 20d nails. Position the second 2- x 6-inch piece on top of the first piece (against pallet beam web), and nail the eleven 20d nails. Nail the second 2- x 8-inch piece to the first in a like manner.
D	2	Knee brace assembly. See the "knee brace assembly" detail in figure 7-4. Position as shown, on top of the pallet transverse beam, centered on the fire-unit module hull.
E	2	Headers, 2-inch x 6-inch x 7-ft 0-inch (doubled). Nail the first piece to the car floor with sixteen 20d nails. Nail the second piece to the first with sixteen 50d nails.
F	8	Backup cleats, 2- x 6- x 36-inch (doubled). Position two cleats side by side to align with piece marked D, as shown in figure. Nail the first piece to the car floor with nine 20d nails. Nail the second piece to the first with nine 50d nails.
G	4	Dunnage holddown straps, 2-inch x .050-inch by length-to-suit. Install to form a complete loop over the knee brace assembly. Thread through the stake pocket from inside to outside on each side of the car and bring both ends up above the knee brace assembly, where they can be tensioned and sealed with two seals. Secure to the knee brace assembly with the two 20d nails driven partially into the assembly and bent over the strap at each end of the assembly.
H	8	Pads, steel, strapping, 2-inch x .050-inch long. Position pad under stake pocket, and seal to holddown strap marked G (fig 7-5, detail A). For alternate stake pocket protector (16 required), use two pads under each stake pocket with a holddown strap (see fig 7-5, detail A).
I	16	Seals, 2-inch strapping, four per strap. Double-crimp each seal except those used to secure the pads marked H.
J	2	Wire rope, steel, 112-inch-diameter, 11.5-ton. Form a complete loop through a car stake pocket and around the tiedown facility at the forward end of the lading.
K	1	Wire rope, steel, 112-inch dia, 11.5-ton. Form a complete loop through the car stake pockets and the aft end of the cable facilities as shown in figure 7-5.

Table 7-1. Continued

Item	No. Required	Application
L	6	Thimble, standard, 1/2-inch. Use one each for the car stake pocket and the forward end tiedown facility. Secure to cables marked J and K with one clip per thimble. Note: A standard thimble as specified can be secured to a cable with a 1 1/2-inch clip. However, if desired, or if the 1/2-inch thimble being used is of a type that cannot be secured to a cable with a 1 1/2-inch clip, a 5/8-inch clip may be used. Alternate: No. 14 gauge wire may be used.
M	18	Clip, wire rope, 1/2-inch. Use four per cable joint of pieces marked J and K and one per thimble.
N	as required	Waterproof paper or burlap. Position paper or burlap between cable and lading at points of contact. Tape or wire tie to prevent displacement.

7-6. Loading of XM1058 Truck transporter on General Purpose Flatcar

a. The vehicle may be placed in the tiedown position on the flatcar by crane. It may be driven or towed into position if a suitable ramp or bridge is available. The application of materials for loading and securing the XM1058 truck transporter is shown in table 7-2. Figure 7-5 shows an isometric view of the truck transporter, and figure 7-6 shows a rear view of the truck transporter.

b. When the vehicle is loaded and tied down, the handbrakes must be set. The transmission gearshift must be in neutral.

c. Fire Unit slinging and railcar loading details are shown in figures 6-2 and 7-8, respectively. Blocking details for lading are presented in figure 7-9.

Table 7-2. Application of Materials for Loading and Securing XM1058 Truck Transporter (Figs 7-5 Through 7-6)

Item	No. Required	Application
A	8	Wheel blocks. Place the 450 end of block against a wheel. Nail through heel of block with three 40d and two 60d nails. Toenail each side to car floor with two 40d nails.
B	2	Rubbing strips, 2-inch x 6-inch x 7-foot 6-inch. Position on edge of wheel block, and nail to lower piece marked C with one 12d nail every 8 inches.
C	2	Side blocks, 2-inch x 4-inch x 7-foot 6-inch (tripled). Nail the first piece to the car floor with one 30d nail every 8 inches. Nail each additional piece in a like manner.
D	2	Rubbing strips, 2- x- x 36-inch. Position on edge of side block, and nail to lower piece marked E with five 12d nails.
E	2	Side blocks, 2- x 6- x 36-inch (tripled). Nail the first piece to the car floor with five 30d nails. Nail each additional piece in a like manner.

Table 7-2. Continued

Item	No. Required	Application
F	8	Wire rope, steel, 1/2-inch-dia, 11.5-ton. Install cable angularly and form a complete loop from the car stake pocket to the point of attachment on the lading and back to the stake pocket; at front of lading, extend one cable through the lading lifting device, around the main frame member, and back through the lifting device; extend the other cable under the bumper and around the truck main frame member. Caution: Do not tie cable to lading lifting devices or bumperettes. Note: Cable of a larger size may be used when specified cable is not available.
G	44	Clips, wire rope, size 1/2-inch. Use four per cable joint of piece marked F and one per thimble. Note: A standard thimble as specified can be secured to a cable with a 1/2-inch clip. However, if desired, or if the 1/2-inch thimble being used is of a type that cannot

Table 7-2. Continued

Item	No. Required	Application
H	12	Thimbles, standard 1/2-inch. Use one per stake pocket and one per tiedown device at the rear of the truck. Secure to cables marked F with one clip per thimble. Note that an "open pattern" thimble is recommended.
I	as required	Waterproof paper. Paper must be of sufficient size to position under and extend 2 inches above items marked B and D.

CAUTION
Do not allow vehicle to exceed 3 miles per hour during loading or unloading.

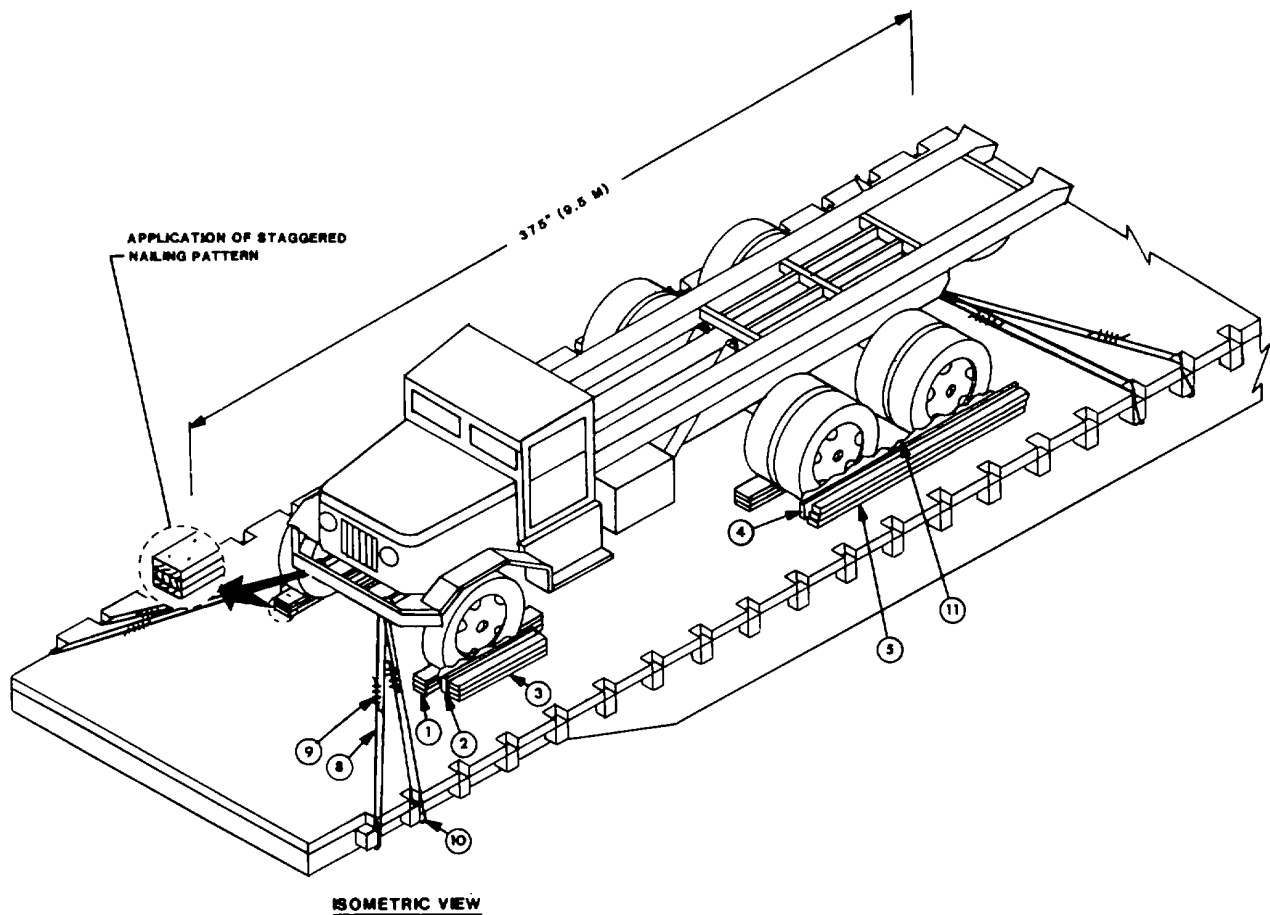


Figure 7-6. Isometric view of XM1058 truck transporter.

Section III. TRANSPORT ON FOREIGN RAILWAYS

7-7. General

Transportability guidance in this section is applicable when the ROLAND fire unit and the XM1058 truck are transported on foreign railways. Consideration is given to single and multiple vehicle movements for flatcars normally used in the movement of this type of vehicle. When loaded on a suitable flatcar, the ROLAND fire unit and the XM1058 truck can be transported, with restrictions, within European countries complying with the passe-partout international (PPI) gauge railways. This also applies to the majority of countries in the Middle East, South America, Australia, India, and Pakistan. In the Middle East and South America, the clearances vary by country, and each country requires a

separate check. In Australia, India, and Pakistan, wide or broad-gauge railways provide greater clearances and few restrictions. Because of the various designations and clearances used by different countries, evaluation of transport capability must be made on an individual basis.

7-8. Transport on Foreign Service Flatcars

a. General. The ROLAND fire unit and the XM1058 truck can be transported on some foreign service flatcars. Flatcars representative of those available in Europe that are suitable for transporting the

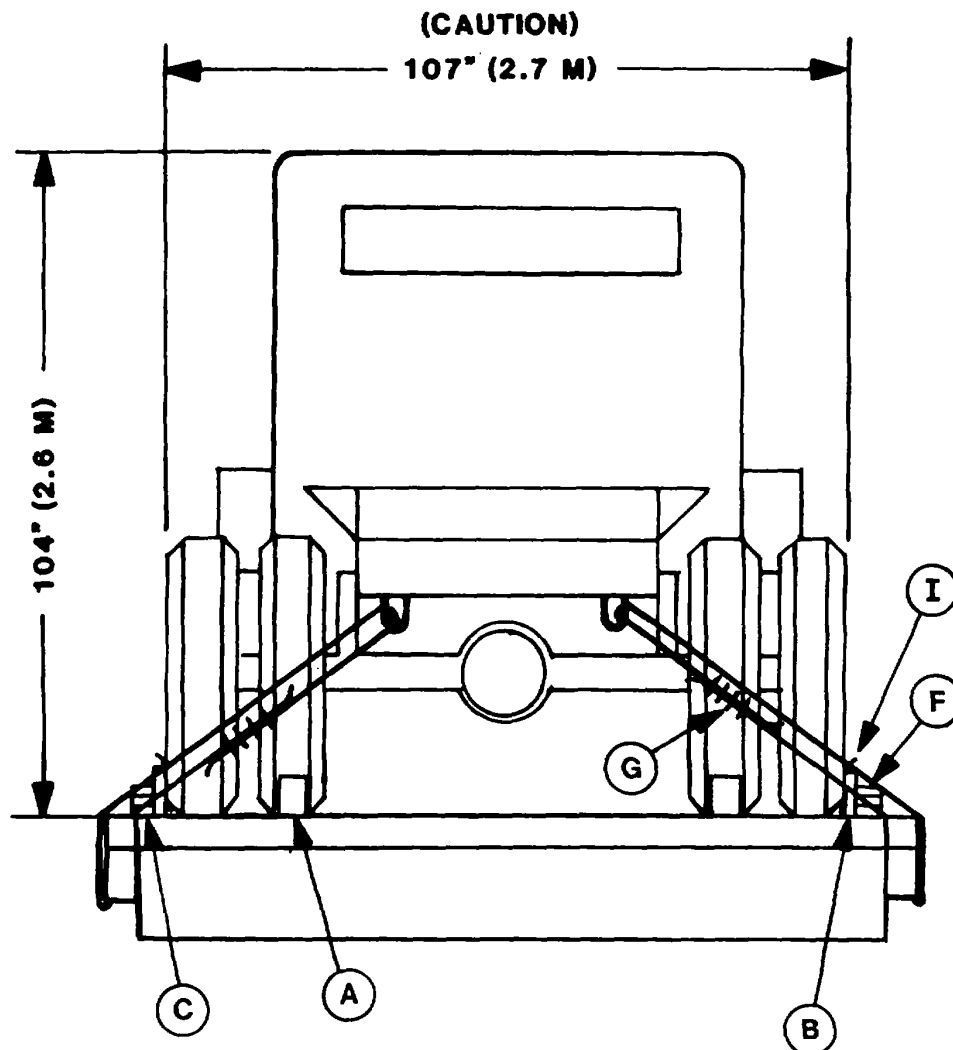


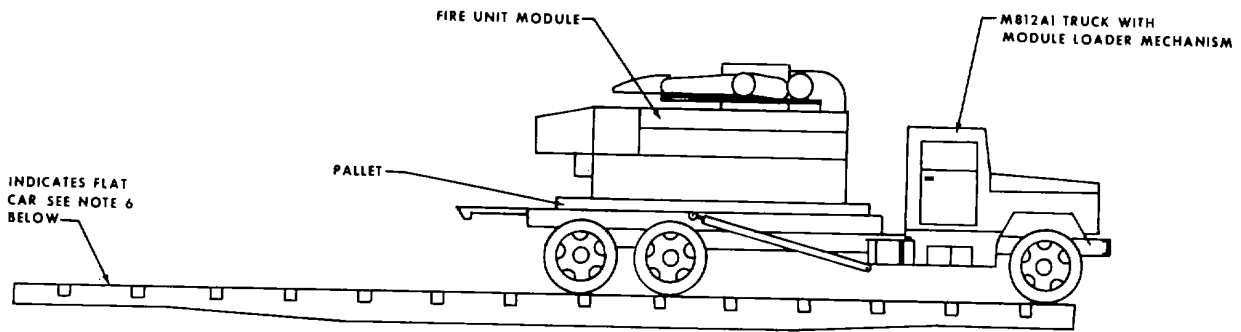
Figure 7-7. Rear view of XM1058 truck transporter.

ROLAND fire unit and the XM1058 truck are described below:

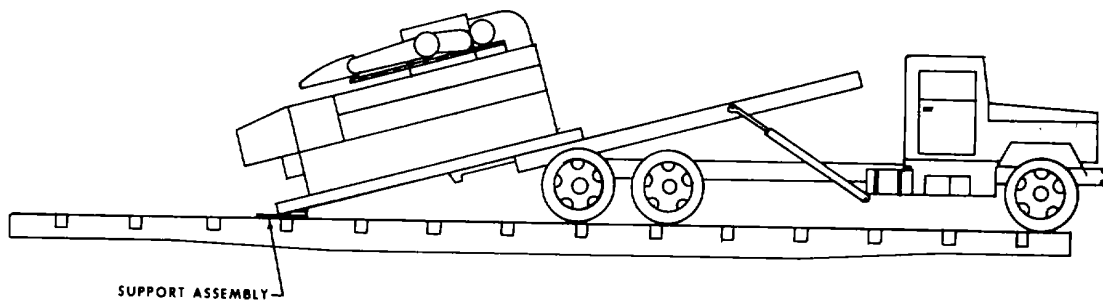
Flatcar Designation	Capacity	Length	Width	Platform Height
RLMMP 700	57.3-ton (52.00 MT)	31-ft 2-in. (7.50 m)	10-ft 4-in. (3.15 m)	4-ft 2-3/4-in. (1.29 m)
SAMMS 710	71.63-ton (65.00 MT)	49-ft 3-in. (15.01 m)	10-ft 2-in. (3.10 m)	4-ft 2-3/4-in. (1.29 m)

b. Materials. The materials required for blocking and tiedown of the ROLAND fire unit and the XM1058 truck on foreign service flatcars are essentially the same as those used for transporting the ROLAND fire unit and

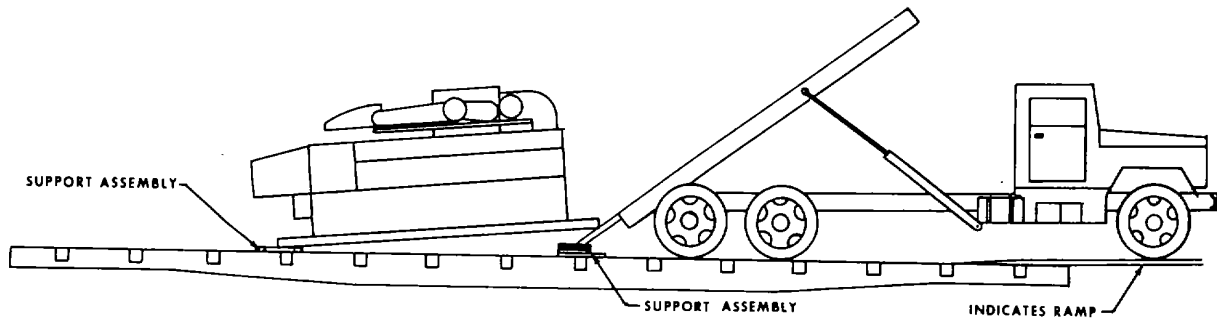
the XM1058 truck within CONUS. Detailed guidance is contained in the 4th Transportation Command Pamphlet 55-2, Tiedown Guide for Rail Movements.



STEP 1



STEP 2



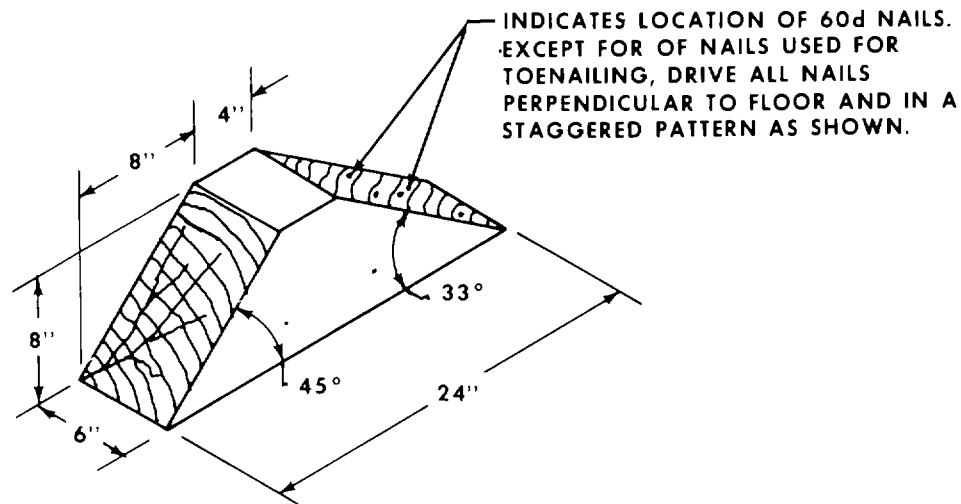
STEP 3

RAILCAR
LOADING GUIDANCE:

1. THE M82 M812A1 TRUCK WITH THE PALLET AND FIRE UNIT MODULE MUST BE POSITIONED ON THE FLAT CAR SO THAT WHEN OFF LOADED FROM THE TRUCK TO THE DECK OF THE RAIL CAR THEY ARE LONGITUDINALLY CENTERED OVER FIVE (5) STAKE POCKETS, WHICH HAVE A 42" CENTER-TO-CENTER SPACING. THE UNIT MUST ALSO BE CENTERED LATERALLY ON THE CAR DECK.
2. AS THE PALLET AND FIRE UNIT ARE BEING PLACED ON THE FLAT CAR, TWO SUPPORT ASSEMBLIES, PIECE MARKED A, MUST BE POSITIONED UNDER THE AFT END OF THE PALLET. THE SUPPORT ASSEMBLIES ARE DESIGNED SO THAT THE 3-1/2" SPACE BETWEEN THE 2" x 2" 2"x2" BEARING PIECES IS CENTERED UNDER THE SMALL DIAMETER CENTER BOLT OF THE PALLET CONE FITTING AND THE 2"x4" BEARING PIECE IS LOCATED TOWARDS THE OUTER EDGE OF THE PALLET. CAUTION MUST BE USED WHEN POSITIONING SUPPORT ASSEMBLIES FOR THE SAFETY OF PERSONNEL INVOLVED.
3. AS THE FORWARD END OF THE PALLET IS LOWERED ONTO THE CAR DECK, THE TWO REMAINING SUPPORT ASSEMBLIES MUST BE PLACED UNDER THE FORWARD END OF THE PALLET. AGAIN, CARE MUST BE EXERCISED IN POSITIONING THE ASSEMBLIES TO ASSURE PROPER PLACEMENT OF THE BEARING PIECES IN RELATION TO THE CONE FITTING BOLTS. CAUTION: EXTREME CARE MUST BE EXERCISED TO INSURE PERSONNEL SAFETY DURING SUPPORT ASSEMBLY POSITIONING.
4. AFTER THE PALLET AND FIRE UNIT MODULE ARE IN POSITION, THE TRUCK SHALL BE MOVED OFF OF THE RAIL CAR AND THE REMAINING DUNNAGE SHALL BE INSTALLED ACCORDING TO THE PROCEDURES.
5. IF DESIRED, THE PALLET AND FIRE UNIT MODULE MAY BE LOADED ONTO A FLAT CAR BY THE USE OF A CRANE OR A SIMILAR PIECE OF MATERIALS HANDLING EQUIPMENT. CARE MUST BE USED TO INSURE THAT THE RADAR MECHANISMS OR OTHER PARTS OF THE FIRE UNIT MODULE ARE NOT DAMAGED WHILE LIFTING. NOTICE: FORKLIFT TRUCKS SHALL NOT BE USED TO HANDLE THE FIRE UNIT MODULE, PALLET MOUNTED.
6. THE LOAD AS SHOWN IS BASED ON A FLAT CAR 10'-6" WIDE (PLATFORM). WIDER CARS CAN BE USED. CARS BEING USED MUST HAVE STAKE POCKETS THAT ARE SPACED ON 42" CENTERS. ONLY ONE UNIT OF LADING IS SHOWN; HOWEVER, MULTIPLES OF UNITS, AS SHOWN OR DISSIMILAR IN NATURE, MAY BE LOADED ON A CAR IF SPACE PERMITS. THE NUMBER OF UNITS TO BE LOADED ON A CAR WILL BE DEPENDENT ON SIZE OF THE CAR USED OR THE QUANTITIES OF UNITS TO BE SHIPPED WITH THE VIEW OF FULL UTILIZATION OF CARRIER EQUIPMENT.

RAILCAR LOADING GUIDANCE

Figure 7-8. Railcar loading details.



WHEEL BLOCK

SPECIAL PROVISIONS

LADING MAY BE SECURED ON A CUSHIONED FMS TYPE FLAT CAR WITH CHAIN TIEDOWN ASSEMBLIES IN LIEU OF USING THE DEPICTED GENERAL SERVICE FM TYPE CAR AND THE SPECIFIED TIEDOWN MATERIAL, PROVIDING THE FOLLOWING CONDITIONS ARE MET.

1. ONE (1) MOVABLE ANCHOR HAVING A 1/2-INCH ALLOY CHAIN ASSEMBLY TIEDOWN MARKED F OR AT EACH CORNER OF THE LADING, TWO (2) MOVABLE ANCHORS HAVING A 3/8-INCH ALLOY CHAIN ASSEMBLY TIEDOWN DEVICE MUST BE SUBSTITUTED FOR THE TWO WIRE ROPE CABLE TIEDOWN MARKED F AT THAT LOCATION. CHAINS WILL BE ATTACHED TO THE LADING AT THE SAME LOCATIONS SHOWN FOR THE WIRE ROPE. THE ANCHOR DEVICES OF A MATCHING PAIR OF CHAINS TIEDOWNS AT THE SAME END OF THE TRUCK SHOULD BE TIEDOWN ATTACHED TO A MATED PAIR OF INBOARD OR OUTBOARD TIEDOWN CHANNELS OF THE CAR FLOOR. ANCHOR DEVICES SHOULD BE LOCATED SO THAT THE MATCHING PAIR OF CHAIN TIEDOWNS ARE AS PARALLEL TO EACH OTHER AS POSSIBLE AND SO THAT THE VERTICAL ANGLE BETWEEN THE CAR FLOOR AND A CHAIN DOES NOT EXCEED 45°.
2. BEFORE AND DURING INSTALL, THE ANCHOR DEVICES SHALL BE INSPECTED FOR BENT HOOKS, STRETCH, GOUGES, BENT LINKS, AND EXCESSIVE WEAR IN THE CHAIN AND FOR DAMAGED LOAD BINDERS OR WINCHES, OR ANY OTHER NOTICEABLE DEFECTS. ANY DEFICIENCY SHALL BE CAUSE FOR NOT USING AN ANCHOR AND CHAIN ASSEMBLY.
3. CHAINS MUST NOT BE TWISTED DURING INSTALLATION. CHAINS ARE TO BE STRUCK WITH A HAMMER OR BAR AFTER TIGHTENING TO ELIMINATE ANY POSSIBLE MISALIGNMENT OF LINKS. FURTHER TIGHTENING MAY BE REQUIRED TO TAKE UP ANY SLACK THAT DEVELOPS DUE TO LINK ALIGNMENT.
4. TURNBUCLES OR OTHER TENSIONING DEVICES NOT EQUIPPED WITH SELF-LOCKING DEVICES MUST BE WIRED OR PINNED TO PREVENT THEM FROM TURNING OR LOOSENING DURING TRANSIT.
5. OPEN HOOKS MUST BE SE SECURED WIRE AS REQUIRED TO PREVENT THE HOOK FROM BECOMING DISENGAGED FROM THE CHAIN LINK TO WHICH IT IS ATTACHED.
6. ANTI-CHAFING MATERIAL MUST BE PLACED AND SECURED BETWEEN THE CHAINS AND THE LADING AT ALL POINTS OF CONTACT, EXCEPT AT DEFINITIVE TIEDOWN POINTS.

Figure 7-9. Blocking details.

APPENDIX

REFERENCES

-
1. **Army Regulations (AR)**
 - 55-29 Military Convoy Operations in CONUS
 - 55-80 Highways for National Defense
 - 55-162 Permit for Oversize, Overweight, or Other Special Military Movements on Public Highways in the Contiguous States and the District of Columbia of the United States
 - 55-228 Transportation by Water of Explosives and Hazardous Cargo
 - 55-355 Military Traffic Management Regulation
 - 70-44 DOD Engineering for Transportability
 - 70-47 Engineering for Transportability
 - 355-40 Accident Report and Records
 - 746-1 Color, Marking, and Preparation of Equipment for Shipment
 2. **Army Field Manuals (FM)**
 - 55-9 Unit Air Movement Planning
 - 55-15 Transportation Reference Data
 - 55-17 Terminal Operations Specialists Handbook
 3. **Army Supply Bulletins (SB)**
 - 700-20 Army Adopted Items of Materiel
 4. **Army Technical Bulletins (TB)**
 - 55-46-1 Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Equipment
 5. **Technical Manuals (TM)**
 - 9-1425-625-10 Operators Manual
 - 9-1425-625-20-1 Organizational Maintenance Manual: Fire Unit Trouble Shooting
 - 9-1425-625-20-2 Organizational Maintenance Manual: Radar, IFF, E-O, C and C Subsystems
 - 9-1425-625-20-3 Organizational Maintenance Manual: Electrical and Mechanical Subsystems
 - 9-1425-625-20-4 Fire Unit Hydraulic Subsystems
 - 9-1425-625-12-P Module Loader Mechanism
 - 38-250 (AFR 71-4) Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft
 - 55-405-9 Weight and Balance
 - 55-500 Marine Equipment Characteristics and Data
 - 55-2200-001-12 Transportability Guidance Application of Blocking, Bracing, and Tiedown Materials for Rail Transportation
 6. **Air Force Technical Orders**
 - 1-1B-40 Handbook of Weight and Balance Data
 - 1 C-5A-9 Loading Instructions, USAF Series C-5A Airplane

7. Other Publications and Source of Procurement

a. *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: R. C. Reber, Secretary

The Association of American Railroads

1920 L Street, NW

Washington, DC 20036

b. *Rail Carriers Tariff No. 25 or reissues thereof-Hazardous Materials Regulations of the Department of Transportation, Including Specifications for Shipping Containers.*

Available from: R. M. Graziano, Agent

American Railroad Building

1920 L Street, NW

Washington, DC 20036

c. *Water Carrier Tariff No. 24 or reissues thereof-Regulations Governing the Transportation or Storage of Explosives or Other Dangerous Articles or Substances, and Combustible Liquids On Board Vessels.*

Available from: R. M. Graziano, Agent

American Railroad Building

1920 L Street, NW

Washington, DC 20036

d. *Water Shipment, Code of Federal Regulation, Title 46-Shipping, Part 146; Title 49-Carriage by Vessel, Part 176.*

Available from: Superintendent of Documents

US Government Printing Office

Washington, DC 20402

e. *Motor Carriers Explosives and Dangerous Articles Tariff No. 14 or reissues thereof-Department of Transportation Hazardous Materials by Motor, Rail, and Water, Including Specifications for Shipping Containers.*

Available from: Richard H. Hinchcliff, Issuing Officer

1616 P Street, NW

Washington, DC 20036

8. Department of Transportation

Special Permit No. 3498

USCG 108 Rules and Regulations for Military Explosives and Hazardous Munitions

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:


DONALD J. DELANDRO

Brigadier General, United States Army

The Adjutant General

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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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