

TECHNICAL MANUAL

TRANSPORTABILITY GUIDANCE
LAND COMBAT SUPPORT SYSTEM [LCSS]

TEST STATION, GUIDED MISSILE SYSTEM: AN/TSM-93
[FSN 4935-930-7250]

SHOP EQUIPMENT, GUIDED MISSILE SYSTEM: AN/TSM-94
[FSN 4935-930-7251]

GENERATOR SET, DIESEL, ENGINE: 45KW, 400-CYCLE,
[FSN 6115-475-6573], MOUNTED ON M200A1 TRAILER

TRUCK, CARGO, 5-TON, 6x6, M55A2
[FSN 2320-055-9259]

TECHNICAL MANUAL

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CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

a. This manual provides transportability guidance for logistic handling and movement of the major end items comprising the Land Combat Support System (LCSS).

b. The intent of this manual is to provide transportation officers down to division level and other personnel engaged in or responsible for movement or providing transportation services with information considered appropriate to insure safe transport of the system items. Significant technical and physical characteristics as well as safety considerations required for worldwide movement by the various modes of transportation are included. For the purpose of transportability guidance, the test station and shop equipment are similar except for weight. Where differences occur, each model is listed separately in paragraph 2-5. Where considered necessary, metric equivalents are given in parentheses following the dimension or other measurement.

1-2. Reporting of Recommendations and Comments

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

1-3. Safety

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

1-4. Definitions of Notes, Cautions, and Warnings

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

a. Note. Guidance which is essential to be highlighted.

b. Caution. Guidance which if not strictly observed will result in damage to or destruction of equipment.

c. Warning. Guidance which if not correctly followed will result in personnel injury or loss of life.

1-5. Destruction of Materiel to Prevent Enemy Use

In the event the items being transported must be destroyed to prevent enemy use, refer to the following technical manuals:

a. TM 9-4935-552-14/1, for the test station.

b. TM 9-4935-554-14, for the shop equipment.

c. TM 9-2320-211-10, for the cargo truck, M55A2.

d. TM 5-6115-274-12, for the generator set.

CHAPTER 2

TRANSPORTABILITY DATA

Section I. GENERAL

2-1. Scope

This chapter provides a general description of the items, identification photographs, side- and end-elevation transportability drawings, and transportability characteristics and data which are necessary for movement of the items.

2-2. Descriptions

a. The test station is a modified S141/G equipment shelter containing electronic equipment for testing guided missile systems (fig 2-1).

b. The shop equipment is a modified S141/G

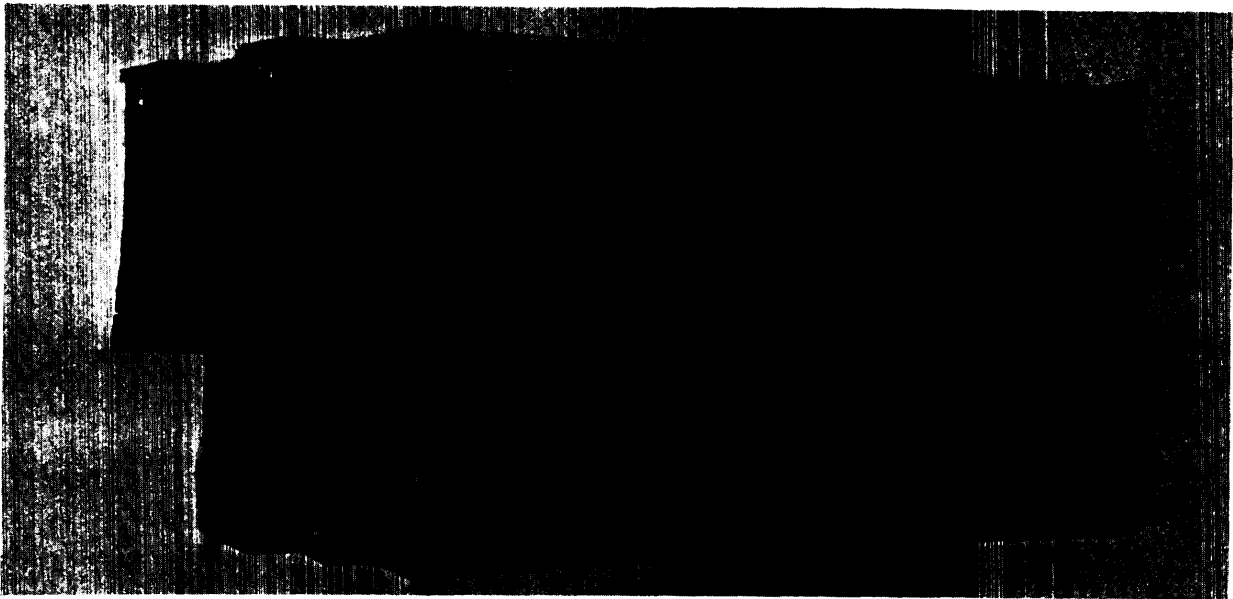


Figure 2-1. Side view of test station, guided missile system, AN/TSM-93.

equipment shelter containing necessary tools and equipment for repairing guided missile systems.

c. The 45-kilowatt generator mounted on the M200A1 trailer furnishes the power for the test station and shop equipment (fig 2-2).

d. The M55A2 5-ton cargo truck is used for

tactical movement of the test station, shop equipment, and trailer-mounted generator (fig 2-3).

2-3. Transportability Drawings

Detailed side- and end-elevation transportability drawings of the items, with dimensions, are shown in figures 2-4 through 2-9.

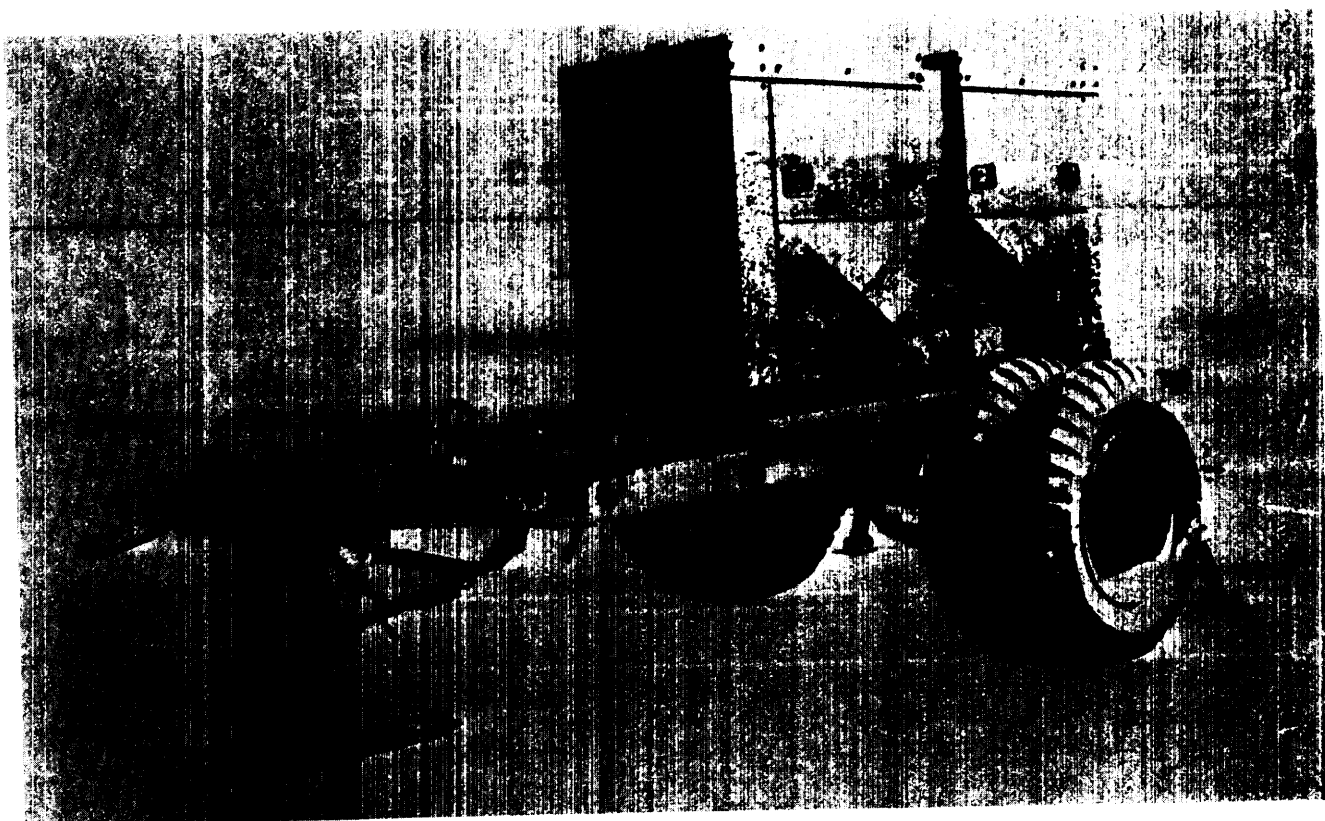


Figure 2-2. Side view of generator set, diesel engine, 45KW, 400-cycle, mounted on M200A1 trailer.

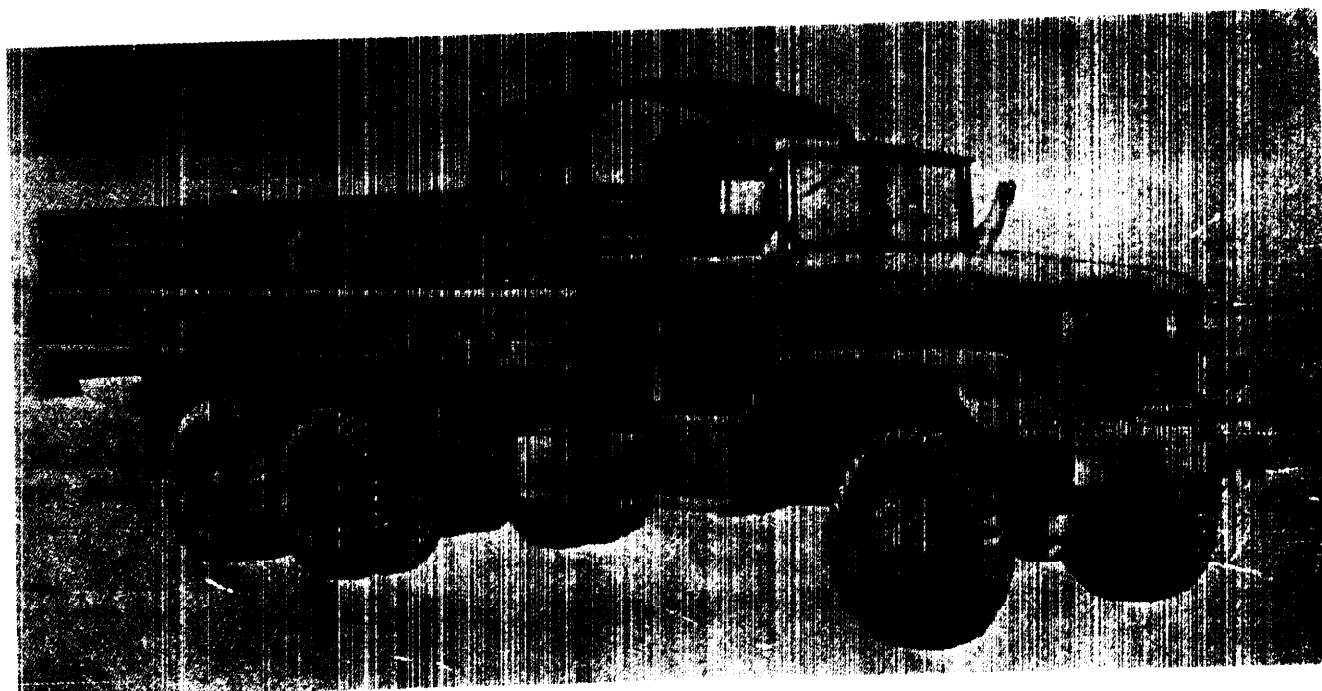


Figure 2-3. Side view of truck, cargo, 5-ton, 6x6, M55A2.

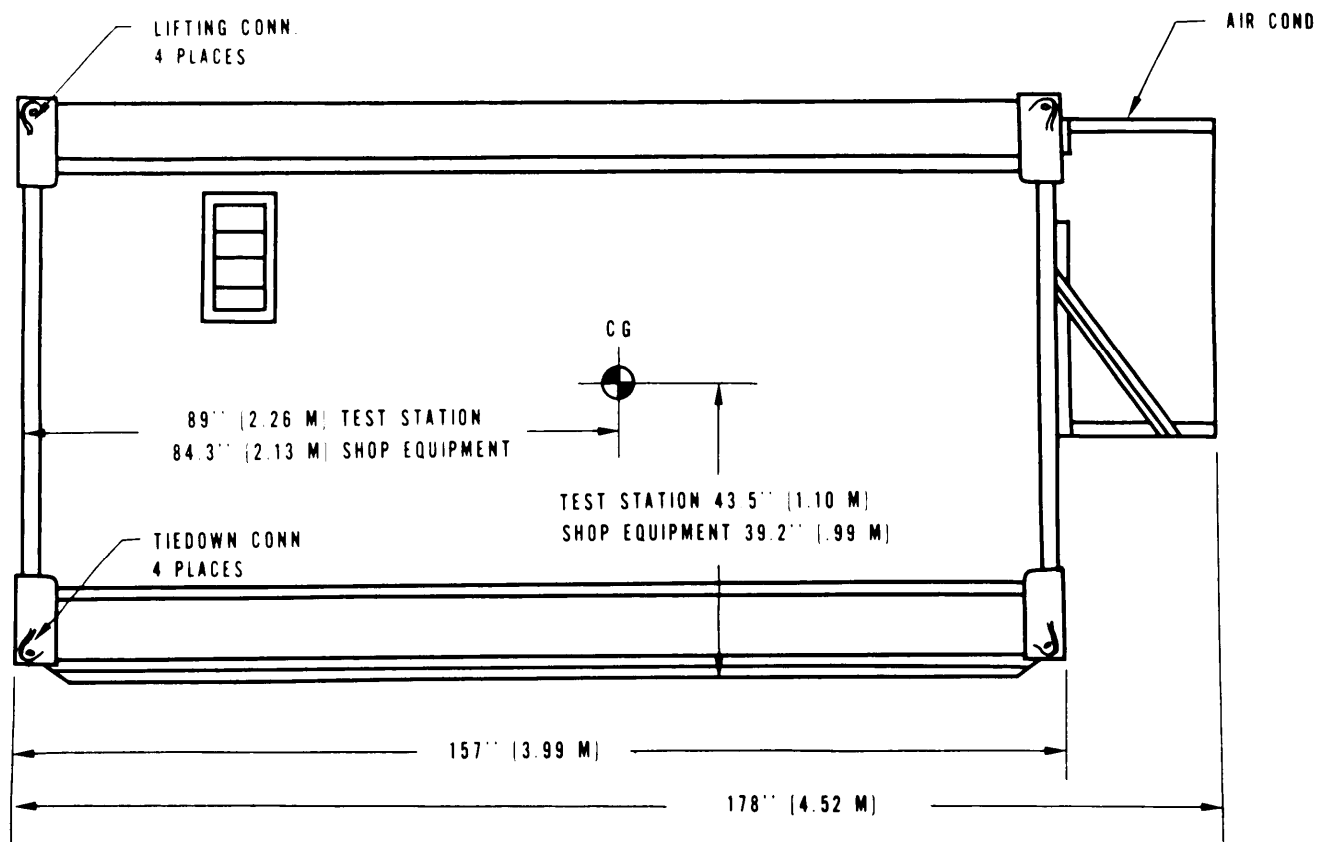


Figure 2-4. Side elevation of test station, guided missile system, AN/TSM-93.

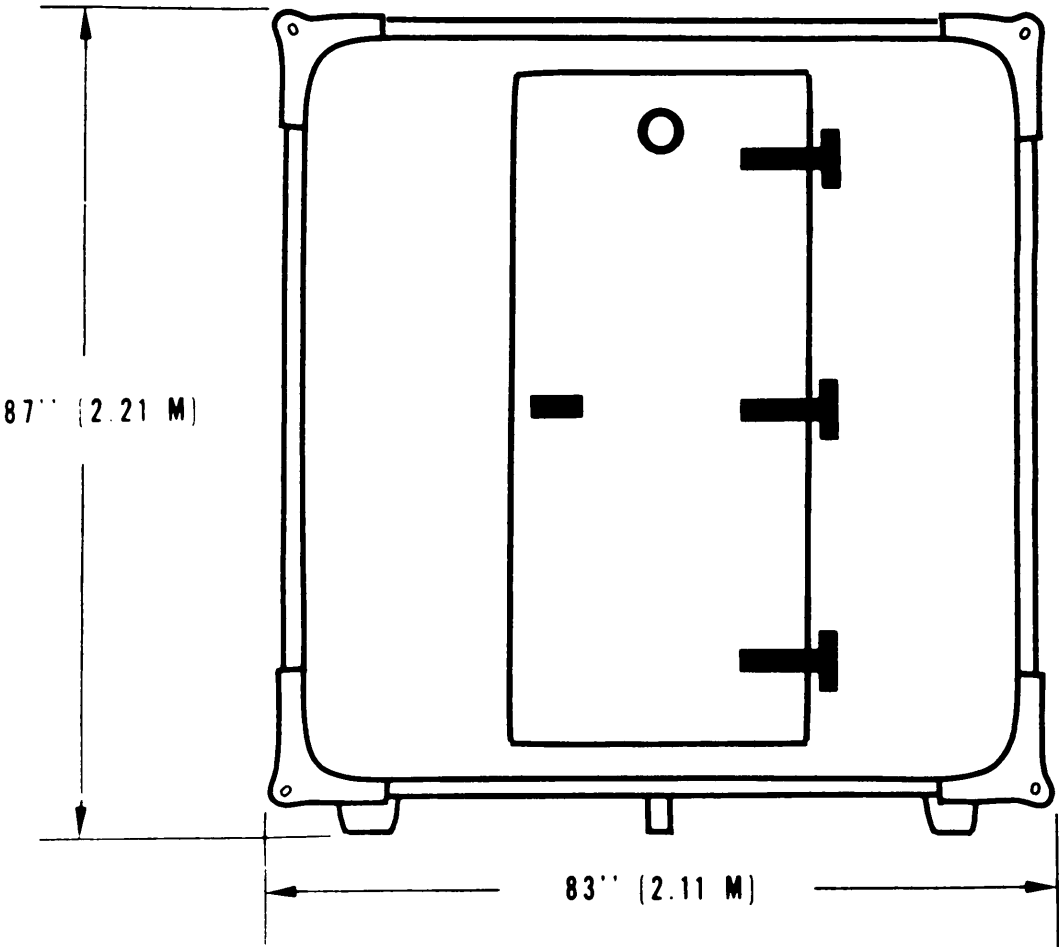


Figure 2-5. Rear elevation of test station, guided missile system, AN/TSM-93.

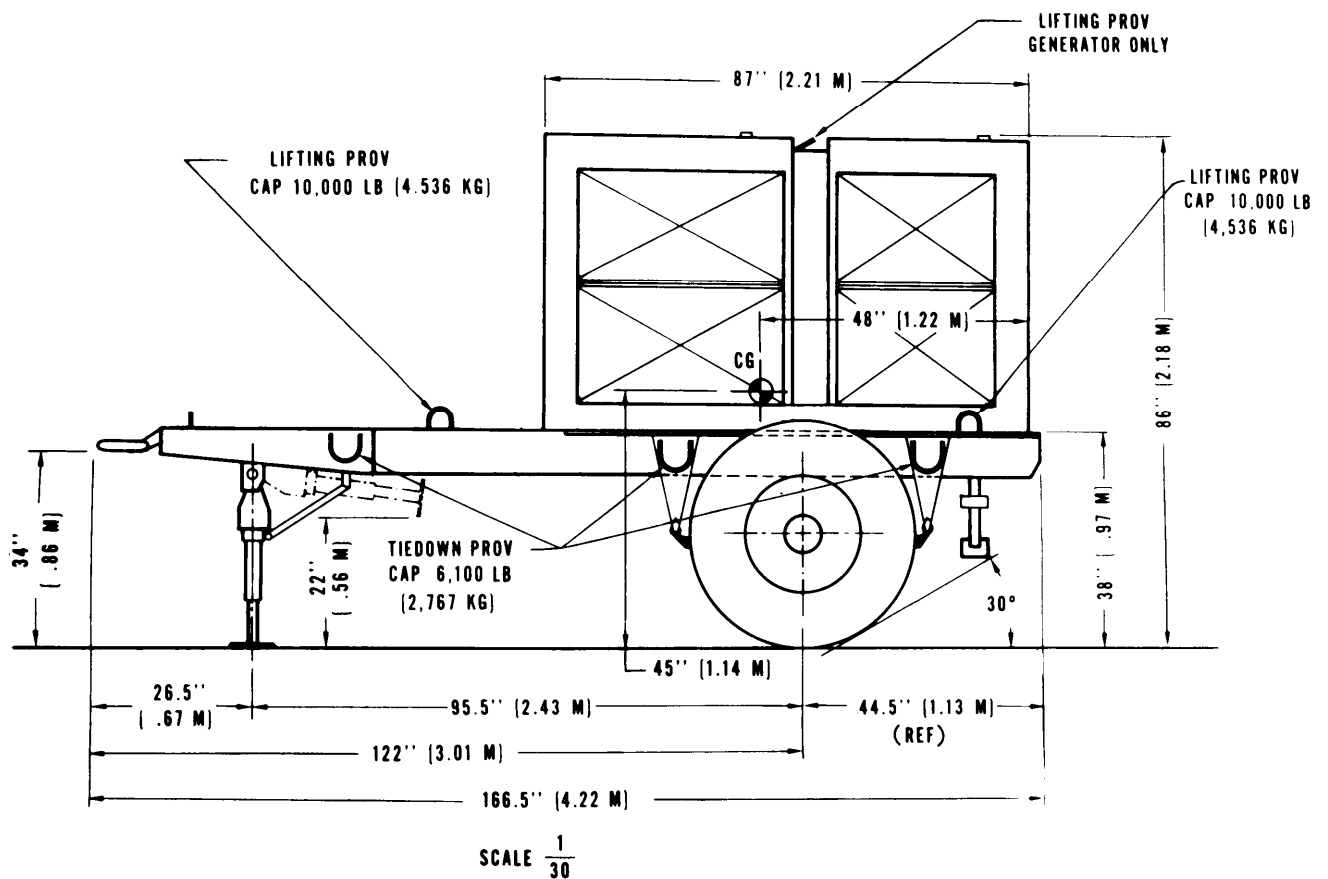


Figure 2-6. Side elevation of generator set, diesel engine, 45KW, 400-cycle, mounted on M200A1 trailer.

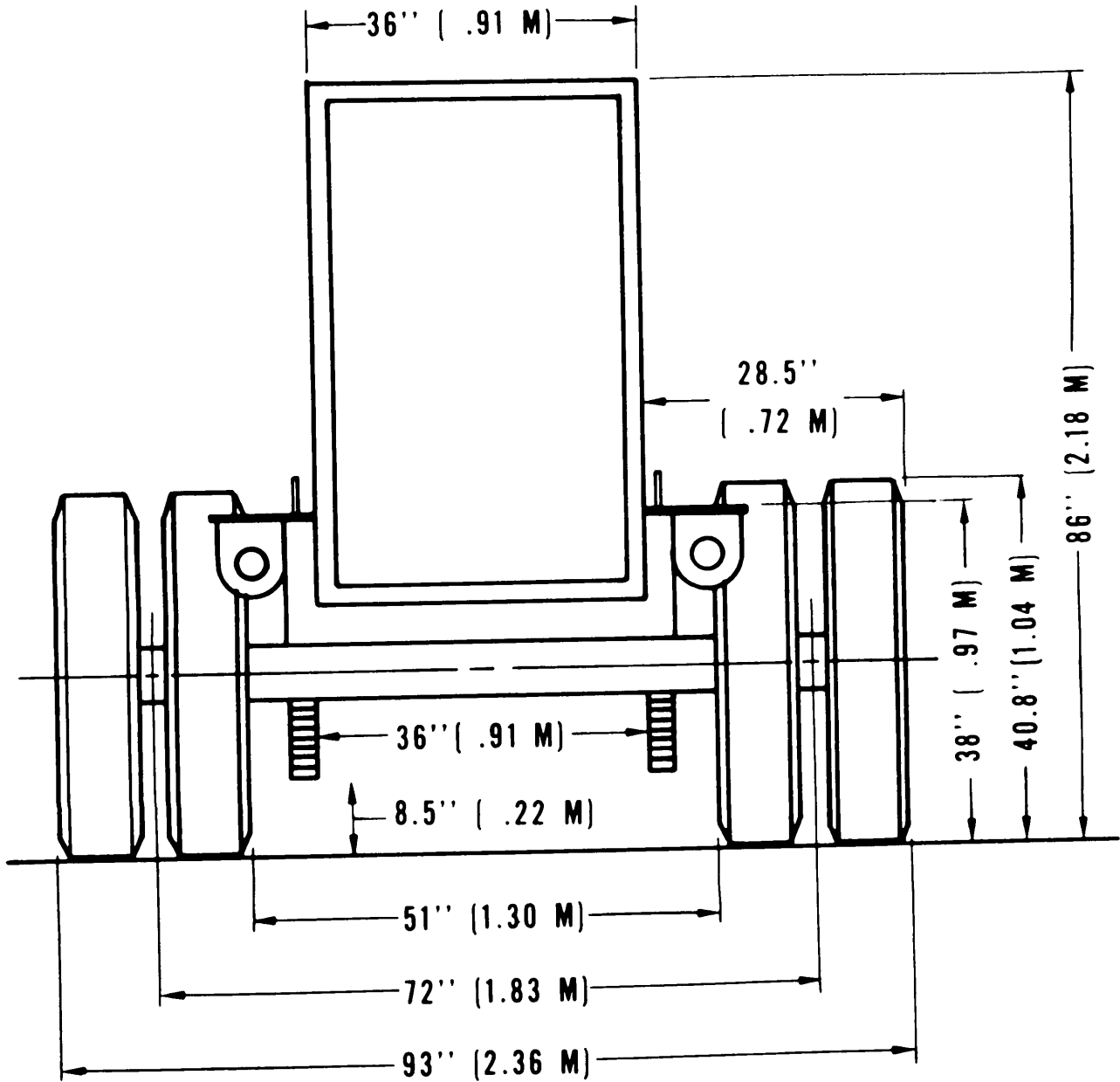


Figure 2-7. Rear elevation of generator set, diesel engine, 45KW, 400-cycle, mounted on M200A1 trailer.

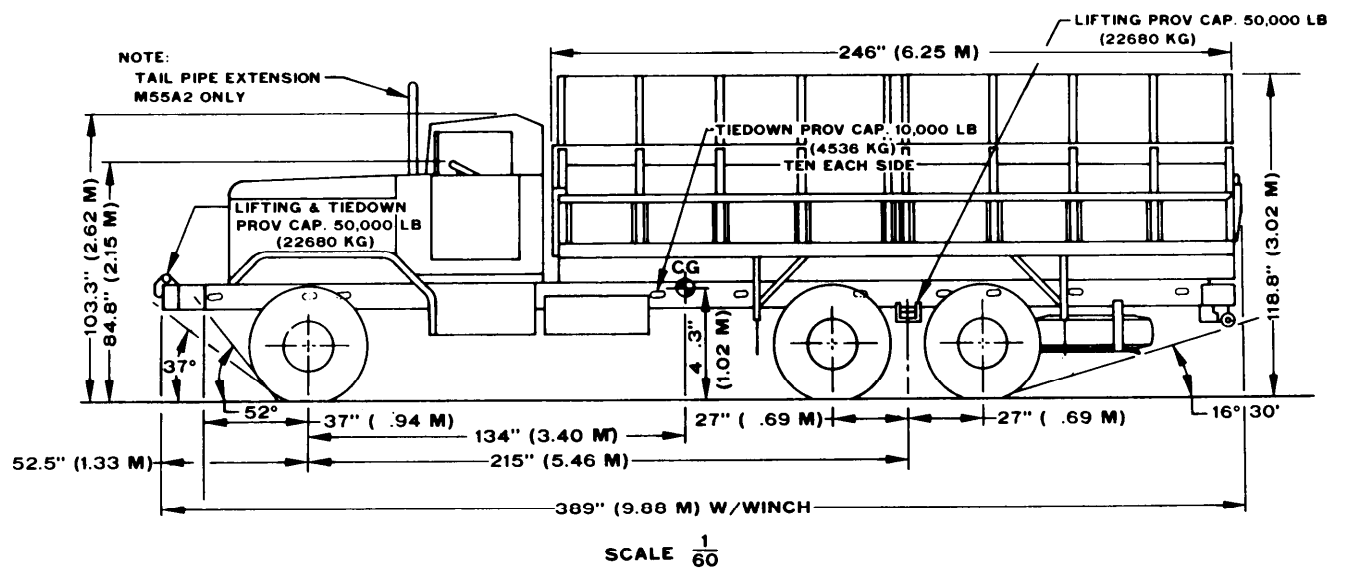


Figure 2-8. Side elevation of truck, cargo, 5-ton, 6x6, M55A2.

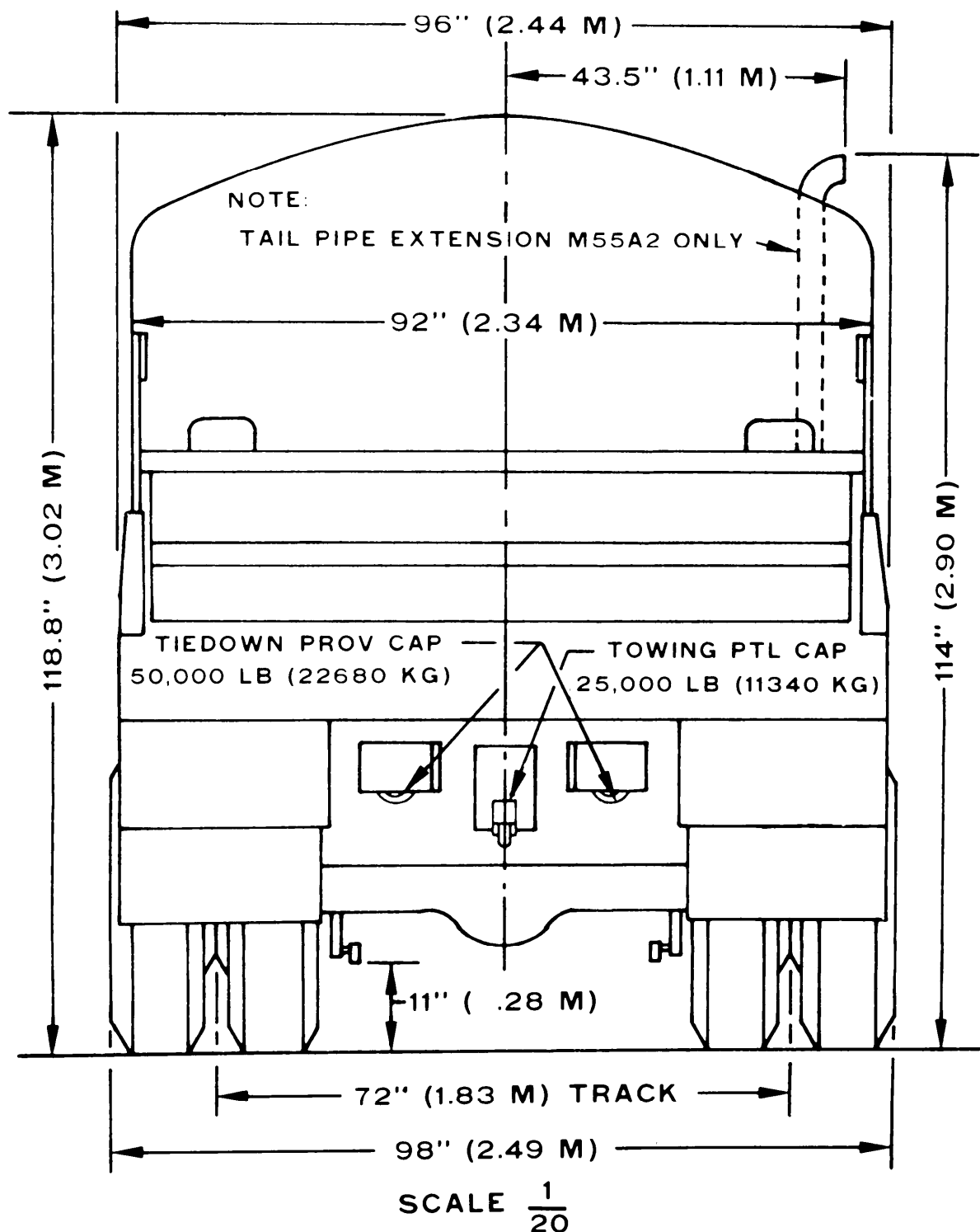


Figure 2-9. Rear elevation of truck, cargo, 5-ton,
6X6, M55A2.

Section II. CHARACTERISTICS AND RELATED DATA OF ITEMS

2-4. Transportability Characteristics

Data contained herein are applicable to model number or Federal Stock Number (FSN) shown.

Changes in model number or FSN may affect the loadability of the item as related to the guidance shown in this manual.

2-5. General*a. Test Station, AN/TSM-93.*

Federal Stock Number _ _ _ _ _ 4935-930-7250

Operational and shipping configuration

Measurements:

Length	178.0 in. (4.52 m)
Width	83.0 in. (2.11 m)
Height	87.0 in. (2.21 m)
Volume	744.0 cu ft (21.1 cu m)
Weight	6,620 lb (3,003 kg)

Center of gravity:

Longitudinal, from front	89.0 in. (2.26 m)
Vertical, from ground	43.5 in. (1.10 m)

b. Shop Equipment, AN/TSM-94.

Federal Stock Number _ _ _ _ _ 4935-930-7251

Operational and shipping configuration

Measurements:

Length	178.0 in. (4.52 m)
Width	83.0 in. (2.11 m)
Height	87.0 in. (2.21 m)
Volume	744.0 cu ft (21.1 cu m)
Weight	5,420 lb (2,456 kg)

Center of gravity:

Longitudinal, from front	84.3 in. (2.13 m)
Vertical, from ground	39.2 in. (0.99 m)

c. Generator on M200A1 Trailer.

Federal Stock Number _ _ _ _ _ 611-475-6573

Operational and shipping configurations

Measurements:

Length	166.5 in. (4.22 m)
Width	93.0 in. (2.36 m)
Height	86.0 in. (2.18 m)
Volume	772 cu ft (21.8 cu m)
Weight	7,100 lb (3,218 kg)

Center of gravity:

Longitudinal, from rear	48.0 in. (1.22 m)
Vertical, from ground	45.0 in. (1.14 m)

Soils trafficability data:

Item at curb weight	VCI 58
------------------------	--------

Vehicle classification:

Cross-country	5
Highway	5

d. M55A2 Cargo Truck.

Federal Stock Number _ _ _ _ _ 2320-055-9259

Operational and shipping configuration

Measurements:

Length	389.0 in. (9.88 m)
Width	98.0 in. (2.49 m)
Height, operational	118.8 in. (3.02 m)
Height, reduced for shipping	84.8 in. (2.15 m)
Volume, operational	2,620.7 cu ft (74.7 cu m)
Volume, reduced for shipping	1,870 cu ft (52.93 cu m)
Weight	24,250 lb (10,990 kg)

Center of gravity:

Longitudinal, C/L front axle	134.0 in. (3.40 m)
Vertical, above ground	40.3 in. (1.02 m)

Soils trafficability data:

Item at curb weight plus personnel	VCI 57
Item with cross- country pay- load plus personnel	VCI 67

Vehicle classification:

Empty	10
Cross-country	16
Highway	21

Vehicle classification with M200A trailer:

Cross-country	15
Highway	15

Note. Whenever weight and/or measurement are critical factors for transportability purposes, each item should be weighed and measured.

2-6. Sectionalization

a. The M55A2 cargo truck can be sectionalized by removing the tarpaulin, bows, cab top, and the vertical exhaust pipe extension, thereby reducing the height.

b. The test station, shop equipment, and generator mounted on trailer cannot be sectionalized.

2-7. CONUS Freight Classification

The determination of appropriate rail and motor freight classification descriptions and proper classification item numbers is the responsibility of the Installation Transportation Officer issuing the bill of lading for shipment of the item(s).

2-8. Hazardous and Dangerous**Characteristics**

The items will not present any special hazardous

or dangerous characteristics during their exposure to normal transportation environments.

2-9. Sensitivity

The items are so designed that when restrained

in accordance with the guidance contained in this manual they are able to withstand the shocks and vibrations associated with current transportation methods.

CHAPTER 3

SAFETY

3-1. General

General safety considerations and precautions for movement of the items, as applicable, are as follows:

- a.* Do not leave vehicle unattended while engine is running.
- b.* Do not smoke or allow open flames in area while performing service to fuel system.
- c.* Exercise extreme care when removing radiator cap if temperature gage reads above 180 degrees Fahrenheit.
- d.* Insure adequate ventilation while engine is running; carbon monoxide poisoning can be deadly.
- e.* Check each vehicle to insure that all loose items are tied down.

f. When backing the vehicle, insure that no personnel or obstructions are behind it.

g. Exercise extreme caution during towing operations of disabled vehicles.

h. Do not walk under any item when it is being lifted for any purpose.

Warning. Fire extinguishers must be readily available during all loading and off-loading operations.

Warning. Proper ventilation must be provided when loading and off-loading. Prolonged exposure to carbon monoxide fumes will produce adverse effects that may prove fatal.

3-2. Specific Safety Requirements

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

CHAPTER 4

AIR TRANSPORTABILITY GUIDANCE

Section I. GENERAL

4-1. Scope

This chapter provides air transportability guidance for movement of the Land Combat Support System. It covers significant technical and physical characteristics and prescribes the manpower, materials, and time required to prepare, load, and off-load the items.

4-2. Maximum Utilization of Aircraft

Additional cargo, including nuclear weapons, and/or personnel within allowable load limits and restrictions prescribed by pertinent safety regulations (app) can be transported.

Section II. TRANSPORT BY US ARMY AIRCRAFT

4-3. Fixed Wing Aircraft

All the items are too large and/or heavy for internal or external transport by US Army aircraft.

mounted generator can be transported externally by the CH-47 and CH-54 helicopters; however, the items have not been test-lifted. When tests have been accomplished, the procedures will be published in a revision to this manual.

4-4. Helicopters

The test station, shop equipment, and trailer-

Section III. TRANSPORT BY US AIR FORCE AIRCRAFT

4-5. Applicability

a. The Land Combat Support System can be transported by the following US Air Force aircraft: C-130 series C-141, and C-5.

b. The loads as shown in subsequent figures are not maximum loads but do designate a typical tiedown pattern for each item. Additional cargo and/or personnel within allowable load limits and restrictions prescribed by pertinent safety regulations (app) can be transported.

c. The airplane commander must insure that the number and type of tiedown devices are as prescribed in this manual and that the tiedown devices are secured to tiedown fittings of at least the same strength and in the same locations relative to those shown in the tiedown diagrams.

Caution. Aircraft floors and ramps must be protected by 2- by 12-inch running shoring when loading or unloading the test station or shop equipment. Pieces of plywood and 2- by 12- by 16-inch lumber are required under wheels of truck and trailer and under lunette of trailer. After loading, running shoring is secured in airplane and used for unloading.

Note. Remove dual rail system from airplane floors as required.

d. The items can be transported without major sectionalization.

e. The items are tied down in accordance with the inclosed figures and tables. Figures show the item tiedown pattern; and the tables list the type and capacity of the tiedown devices required, the location of the tiedown points on the item, and the corresponding row of fittings to which the devices are secured. Refer to AR 70-39 for specified minimum restraint factors (g-load) required in the event of a controlled emergency landing.

4-6. Loading of the Land Combat Support System

a. Test Station or Shop Equipment on 463L Pallet System. The primary method for loading the test station or shop equipment shelter in C-130, C-141, and C-5 aircraft is by using the 463L pallet system. When the item is adequately restrained on the 463L pallet it can be loaded by using the K loader or a loading dock (fig 4-1 and table 4-1).

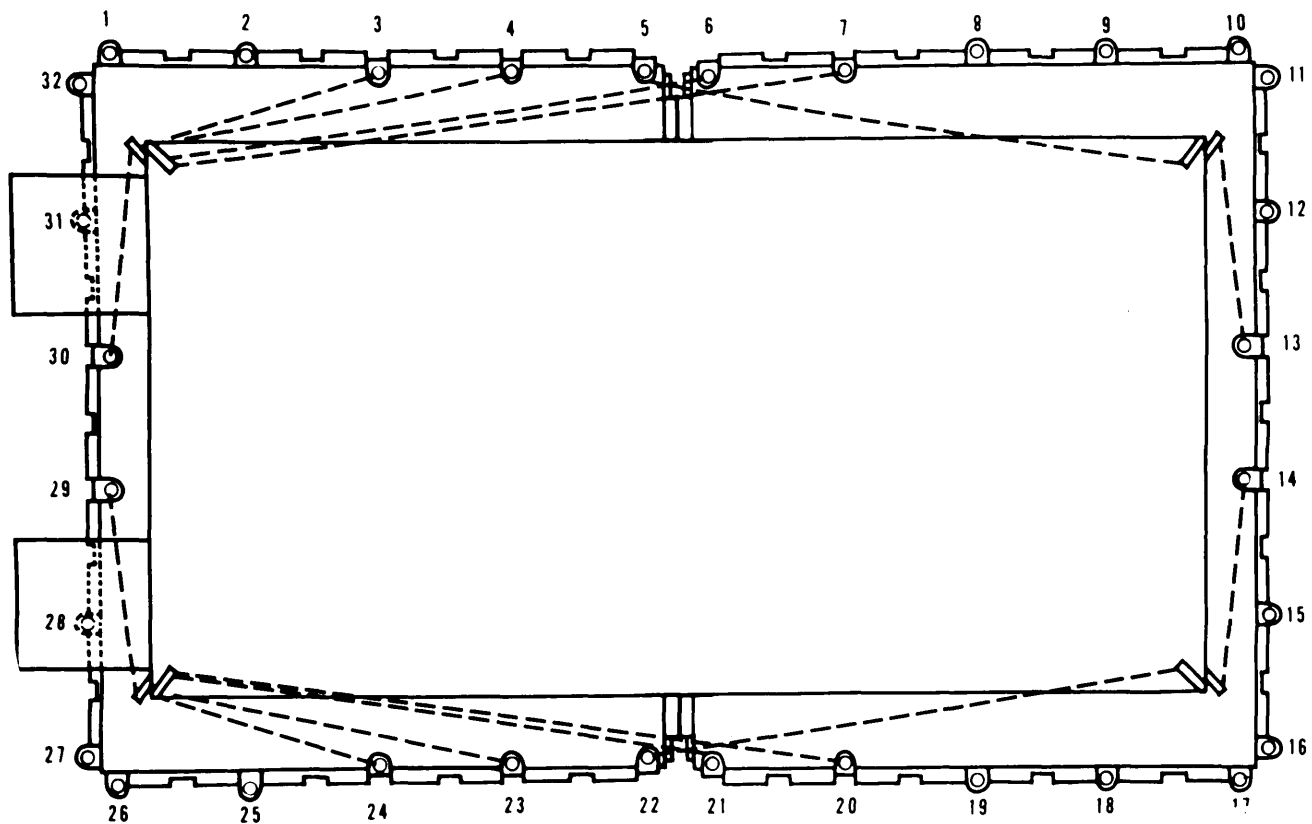


Figure 4-1. Test station or shop equipment secured to two interlocking 463L pallets (HCU-6/E).

Table 4-1. Tiedown Data for Securing Test Station or Shop Equipment Onto Two Interlocking HCU-6/E Pallets.

Tiedown fitting		Tiedown device		Attach to item
designation number	capacity in 1,000-lb	type (s)	capacity in 1,000-lb	
29	7.5	MB-1 or C-2	10	Left bottom tiedown
30	7.5	MB-1 or C-2	10	Right bottom tiedown
24	7.5	MB-1 or C-2	10	Left bottom tiedown
3	7.5	MB-1 or C-2	10	Right bottom tiedown
23	7.5	MB-1 or C-2	10	Left bottom tiedown
4	7.5	MB-1 or C-2	10	Right bottom tiedown
22	7.5	MB-1 or C-2	10	Aft left top tiedown
5	7.5	MB-1 or C-2	10	Aft right top tiedown
21	7.5	MB-1 or C-2	10	Forward left top tiedown
6	7.5	MB-1 or C-2	10	Forward right top tiedown
20*	7.5	MB-1 or C-2	10	Forward left top tiedown
7*	7.5	MB-1 or C-2	10	Forward right top tiedown
14	7.5	MB-1 or C-2	10	Aft left bottom tiedown
13	7.5	MB-1 or C-2	10	Aft right bottom tiedown

*Not required for the C-5 airplane.

b. Test Station or Shop Equipment on Lumber Shoring With or Without Roller System Installed.

(1) *Material.*

(a) Crane, 5-ton wrecker, or skatewheel conveyors.

(b) Three 10,000-pound chains.

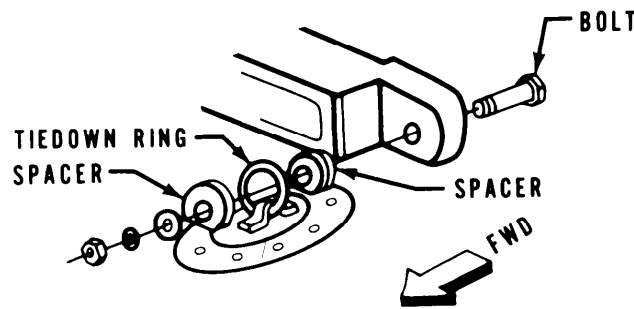
(c) 2- by 12-inch lumber, running shoring.

(2) *Loading.*

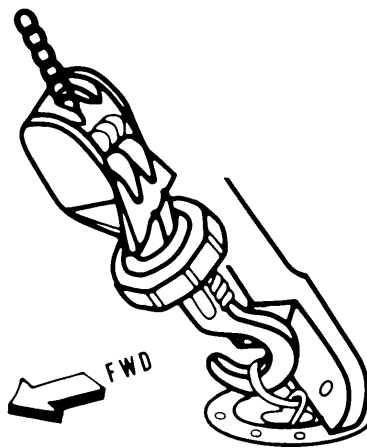
(a) Position three rows of running shoring (matching skids of item) from at least 2 feet beyond edge of ramp into airplane to tiedown location of item.

(b) Position item on running shoring by using crane, wrecker, or skatewheel conveyors.

(c) Form bridle with three 10,000-pound chains, and by means of winch and snatch block



Detail A



Detail B

NOTE: Disconnect attaching hardware from roller support arm (Detail A) and tiedown ring, and install hook end (Detail B) of tiedown device.

Figure 4-2. Details for installing tiedown hooks for forward restraint in all aircraft utilizing 463L system.

double line configuration (fig 4-15, T.O. 1C-130A-9), winch item into aircraft to tiedown location. Lubricate shoring if required and use organic wheeled pry-bar as necessary to maintain alignment of item.

(d) Remove excess shoring, and stow as directed by airplane commander.

(e) For aircraft with roller system installed, disconnect roller support arms as indicated in aircraft T.O. 1C-XXX-9 for forward restraint attachment to tiedown rings, and attach tiedown

hooks as shown in figure 4-2. Stow removed hardware in airplane compartment provided for tiedown devices.

(f) Tie down as shown in figures 4-3 and 4-4 and in tables 4-2 and 4-3.

(g) Four men can load and tie down the items in approximately 1 hour.

(3) *Off-loading.* Reverse procedures, using 5-ton cargo truck to tow item from airplane. Four men can unload in approximately 30 minutes.

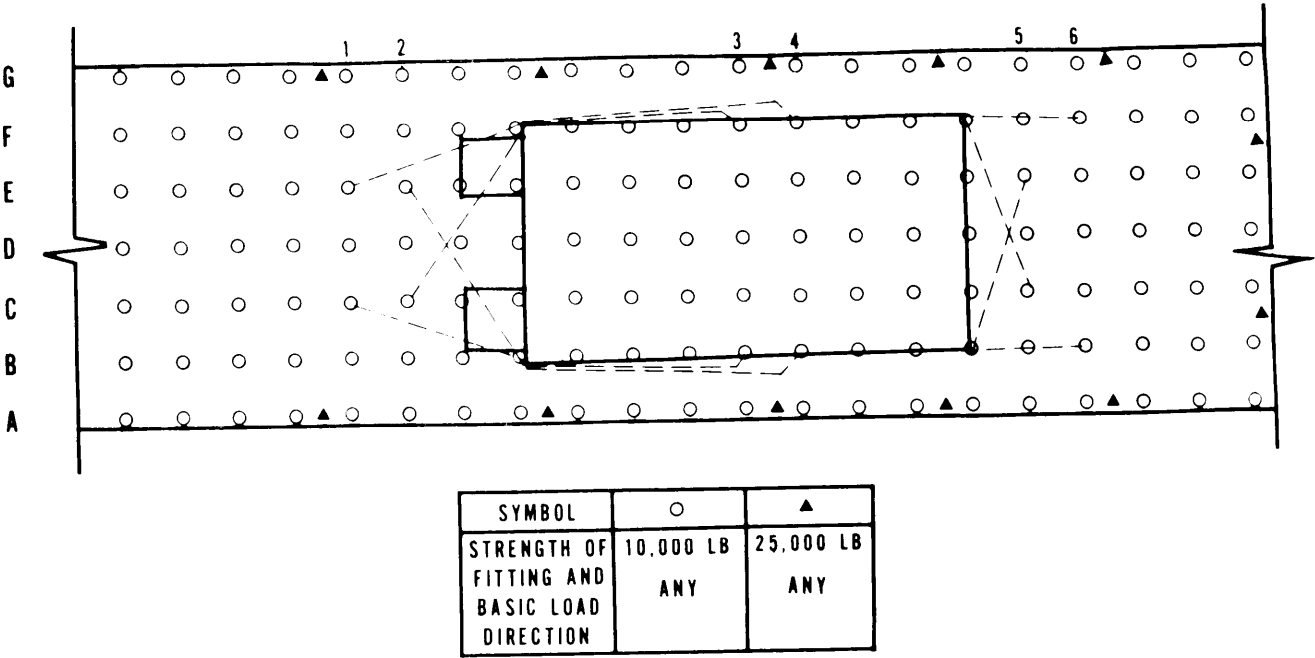


Figure 4-3. Typical loading of test station or shop equipment in C-130 or C-141 airplane with or without roller system installed.

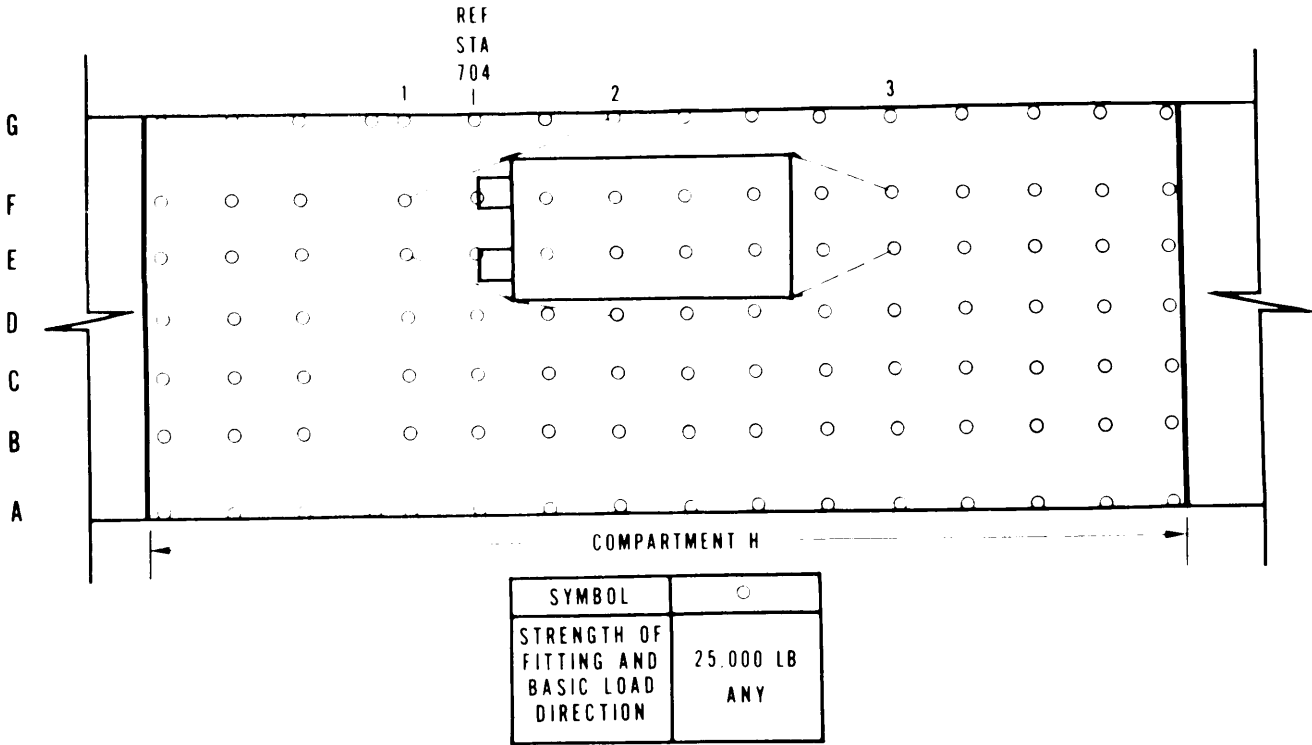


Figure 4-4. Typical loading of test station or shop equipment in C-5 airplane with or without roller system installed.

Table 4-2. Tiedown Data for Securing Teat Station or Shop Equipment in C-130 or C-141 Airplanes With or Without Roller System Installed

Tiedown fitting		Tiedown device		Attach to item
designation row	capacity in 1,000 lb	type (s)	capacity in 1,000 lb	
C1*	10	MB-1 or C-2	10	Right rear top tiedown
E1*	10	MB-1 or C-2	10	Left rear top tiedown
C2	10	MB-1 or C-2	10	Left rear bottom tiedown
E2	10	MB-1 or C-2	10	Right rear bottom tiedown
B3*	10	MB-1 or C-2	10	Right rear top tiedown
F3*	10	MB-1 or C-2	10	Left rear top tiedown
B4*	10	MB-1 or C-2	10	Right rear top tiedown
F4*	10	MB-1 or C-2	10	Left rear top tiedown
C5	10	MB-1 or C-2	10	Left front bottom tiedown
E5	10	MB-1 or C-2	10	Right front bottom tiedown
B6	10	MB-1 or C-2	10	Right front top tiedown
F6	10	MB-1 or C-2	10	Left front top tiedown

* Use barrier material between tiedown chain and item.

Table 4-3. Tiedown Data for Securing Test Station or Shop Equipment in C-5 Airplane With or Without Roller System Installed

Tiedown fitting		Tiedown device		Attach to item
designation row	capacity in 1,000 lb	type(s)	Capacity in 1,000 lb	
E1	10	C-2 or MB-1	10	Right rear top tiedown
F1	10	C-2 or MB-1	10	Left rear top tiedown
D2	10	C-2 or MB-1	10	Right rear top tiedown
G2	10	C-2 or MB-1	10	Left rear top tiedown
E3	10	C-2 or MB-1	10	Right front top tiedown
F3	10	C-2 or MB-1	10	Left front top tiedown

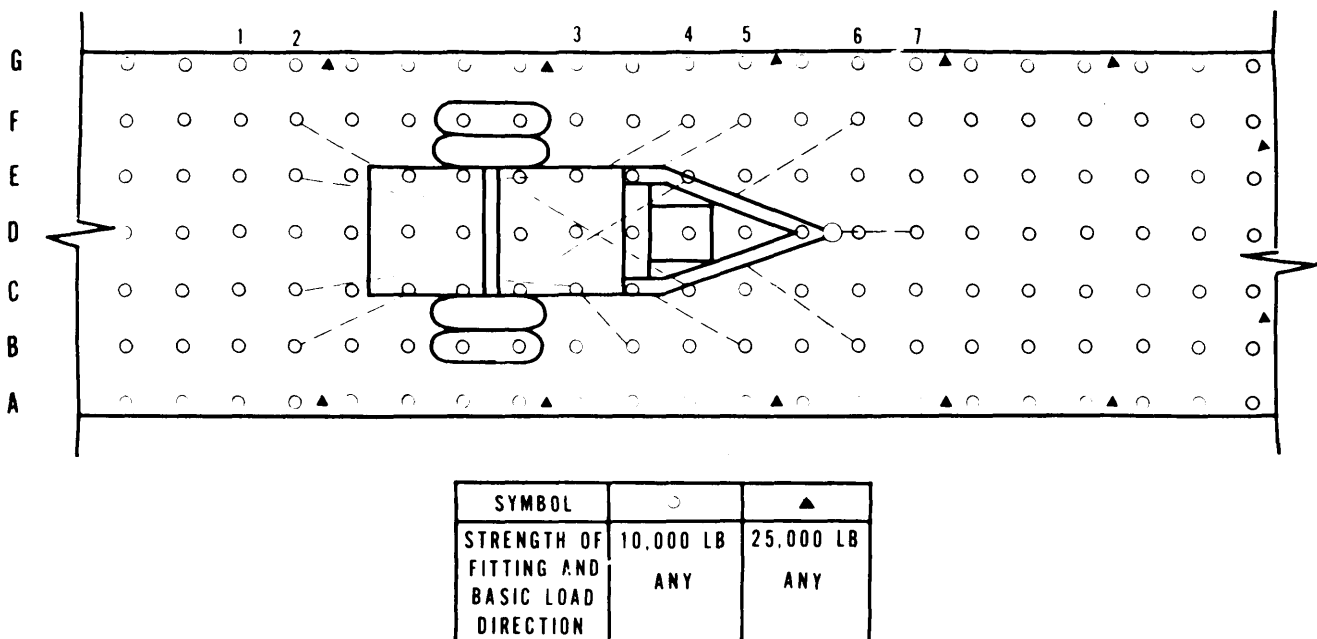


Figure 4-5. Tiedown diagram for trailer-mounted generator in C-130 or C-141 airplane.

Table 4-4. Tiedown Data for Trailer-Mounted Generator in C-130 or C-141 Airplane

Tiedown fitting		Tiedown device		Attach to item
designation row	capacity in 1,000-lb	type(s)	capacity in 1,000-lb	
B2*	10	MB-1 or C-2	10	Right rear tiedown connection
F2*	10	MB-1 or C-2	10	Left rear tiedown connection
C2	10	MB-1 or C-2	10	Spring shackle right rear
E2	10	MB-1 or C-2	10	Spring shackle left rear
C3	10	MB-1 or C-2	10	Around axle right
E3	10	MB-1 or C-2	10	Around axle left
B4	10	MB-1 or C-2	10	Right center tiedown connection
F4	10	MB-1 or C-2	10	Left center tiedown connection
B5	10	MB-1 or C-2	10	Around frame right front
F5	10	MB-1 or C-2	10	Around frame left front
C4	10	MB-1 or C-2	10	Spring shackle left front
E4	10	MB-1 or C-2	10	Spring shackle right front
B6	10	MB-1 or C-2	10	Right front tiedown connection
F6	10	MB-1 or C-2	10	Left front tiedown connection
D7	10	MB-1 or C-2	10	Lunette

*Change to designations C1 and E1 if roller system is installed in C-130.

c. Trailer-Mounted Generator.

(1) *Material.* Pieces of 1- by 12- by 16-inch plywood and 2- by 12- by 16-inch lumber to provide bearing surface (shoring) under trailer wheels and lunette, and 2- by 12-inch lumber for running shoring.

(2) *Loading in C-130 and C-141 airplanes.*

(a) For C-130 airplane with rail system installed, use doubled running shoring inboard of rail arms from ground end of ramp to tiedown position. Position one piece of 2- by 12- by 16-inch lumber and one piece of 1- by 12- by 16-inch plywood between rail arms at tiedown location beneath wheels and lunette of the trailer.

(b) For C-130 with rail system removed or C-141 airplane with the rail system stowed, use 2- by 12-inch single running shoring.

(c) Using a tractor, truck, or the airplane

winch, back trailer into the airplane. Insure trailer wheels are on pre-positioned shoring and trailer brakes are set.

(d) Place 2- by 12-inch shoring beneath lunette of the trailer at the tiedown location.

(e) Tie down as shown in figure 4-5 and table 4-4.

(f) Four men can load and tie down the item in approximately 20 minutes.

(g) Reverse procedure for unloading. Four men can release tiedowns and unload item in approximately 20 minutes.

(3) *Loading in C-5 airplane.* The trailer-mounted generator may be loaded and off-loaded in the C-5 airplane with the rail system stowed by using 2- by 12-inch single running shoring; however, a different tiedown pattern (fig 4-6) and table 4-5 are required.

Table 4-5. Tiedown Data for Trailer-Mounted Generator in C-5 Airplane

Tiedown fitting		Tiedown device		Attach to item
designation row	capacity in 1,000-lb	type (s)	capacity in 1,000-lb	
D1	25	MB-1 or C-2	10	Around frame right rear
G1	25	MB-1 or C-2	10	Around frame left rear
E2	25	MB-1 or C-2	10	Around axle right
F2	25	MB-1 or C-2	10	Around axle left
E3	25	MB-1 or C-2	10	Around frame left front
F3	25	MB-1 or C-2	10	Around frame right front

d. 5-Ton Cargo Truck, M55A2.

(1) *Preparation.*

(a) Remove tarpaulin, bows, cab top, and vertical exhaust pipe extension, and secure in truck.

(b) Lower windshield.

(c) Insure fuel tank is not more than three-fourths full.

(2) *Material.* Use pieces of 1- by 12- by 16-inch plywood and 2- by 12- by 16-inch lumber to provide bearing surface (shoring) under wheels of the truck, and 2- by 12-inch lumber for running shoring.

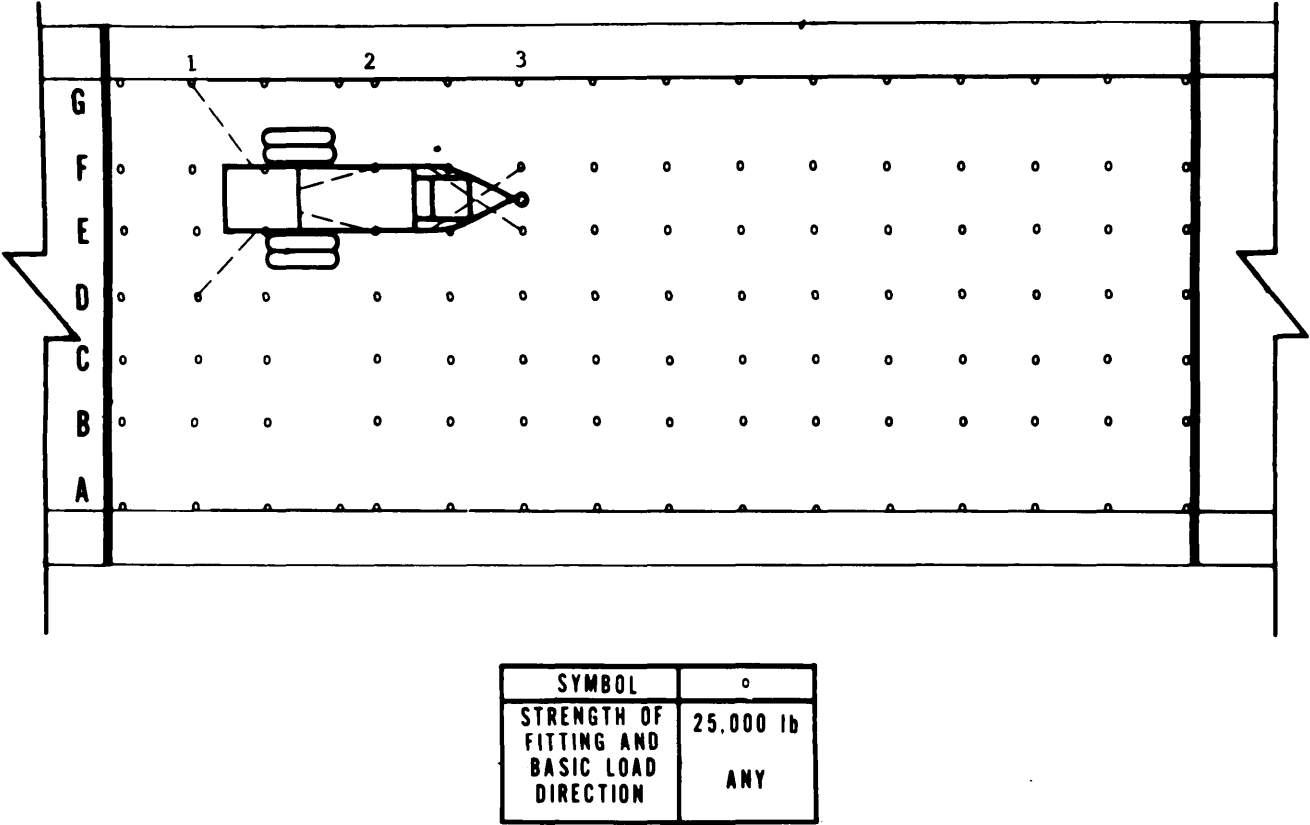


Figure 4-6. Tiedown diagram for trailer-mounted generator in C-5 airplane.

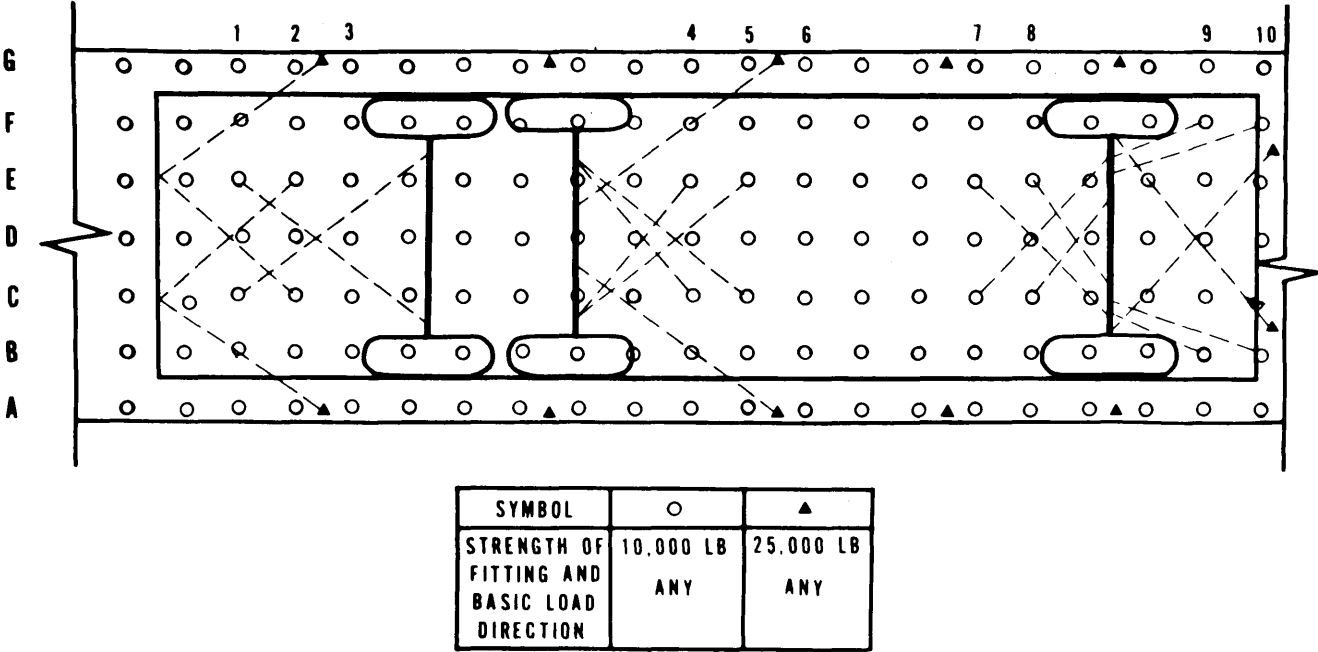
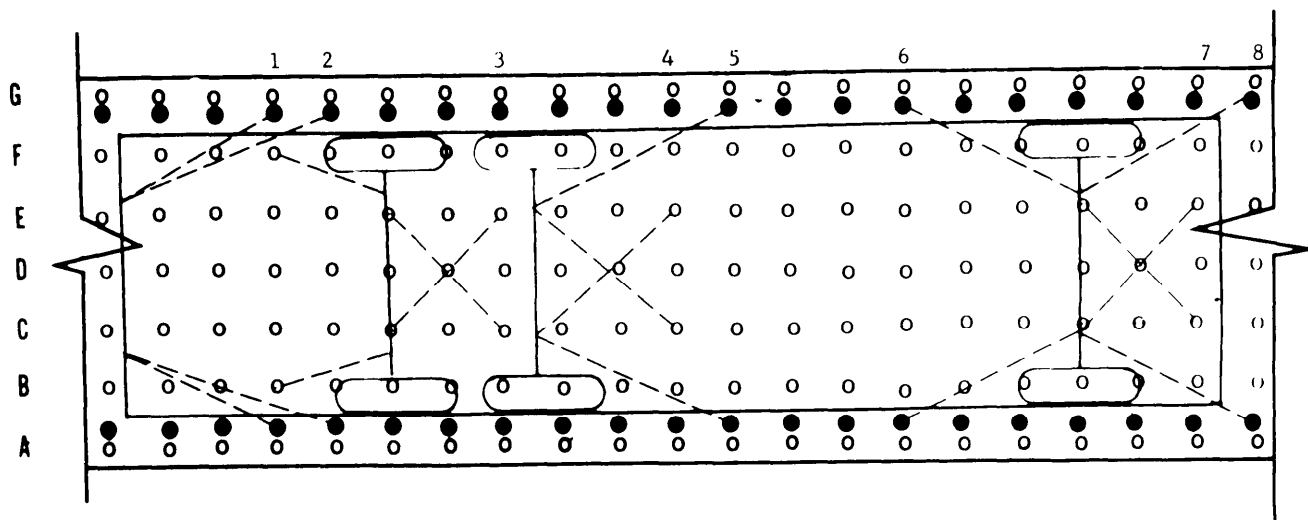


Figure 4-7. Tiedown diagram for cargo truck in C-130 airplane.



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

Figure 4-8. Tiedown diagram for cargo truck in C-141 airplane.

Table 4-6. Tiedown Data for Cargo Truck in C-130 Airplane

Tiedown fitting		Tiedown device		Attach to item
designation	capacity in 1,000-lb	type(s)	capacity in 1,000-lb	
A2*	25	MB-2 or D-1	25	Right rear tiedown connection
G2*	25	MB-2 or D-1	25	Left rear tiedown connection
C2	10	MB-1 or C-2	10	Left rear tiedown connection
E2	10	MB-1 or C-2	10	Right rear tiedown connection
C1	10	MB-1 or C-2	10	Around rear axle left
E1	10	MB-1 or C-2	10	Around rear axle right
A5*	25	MB-2 or D-1	25	Around intermediate axle right
G5*	25	MB-2 or D-1	25	Around intermediate axle left
C4	10	MB-1 or C-2	10	Around intermediate axle left
E4	10	MB-1 or C-2	10	Around intermediate axle right
C5	10	MB-1 or C-2	10	Around intermediate axle left
E5	10	MB-1 or C-2	10	Around intermediate axle right
C7	10	MB-1 or C-2	10	Around front axle left
E7	10	MB-1 or C-2	10	Around front axle right
C8	10	MB-1 or C-2	10	Spring shackle left
E8	10	MB-1 or C-2	10	Spring shackle right
B9	10	MB-1 or C-2	10	Spring shackle right
F9	10	MB-1 or C-2	10	Spring shackle left
B10	10	MB-1 or C-2	10	Around front axle right
F10	10	MB-1 or C-2	10	Around front axle left
B10	25	MB-2 or D-1	25	Around front axle left
F10	25	MB-2 or D-1	25	Around front axle right

* If roller system is installed in C-130, change tiedowns in rows A and G, using 10,000-lb devices, as follows:

from A2 to B2, B3, C3
from G2 to F2, F3, E3
from A5 to B4, B5, B6
from G5 to F4, F5, F6.

(3) Loading in C-130 and C-141 airplanes.

(a) For C-130 airplanes with rail system

installed, position doubled running shoring in-board of rail arms from ground end of ramp to

Table 4-7. Tiedown Data for Cargo Truck in C-141 Airplane

Tiedown fitting		Tiedown device		Attach to item
designation row	capacity in 1,000-lb	type (s)	capacity in 1,000-lb	
A1	25	MB-2	25	Right rear tiedown connection
G1	25	MB-2	25	Left rear tiedown connection
A2	25	MB-2	25	Right rear tiedown connection
G2	25	MB-2	25	Left rear tiedown connection
B1	10	MB-1	10	Around rear axle right
F1	10	MB-1	10	Around rear axle left
C3	10	MB-1	10	Around rear axle left
E3	10	MB-1	10	Around rear axle right
A5	25	MB-2	25	Around intermediate axle right
G5	25	MB-2	25	Around intermediate axle left
C4	10	MB-1	10	Around intermediate axle left
E4	10	MB-1	10	Around intermediate axle right
A6	25	MB-2	25	Around front axle right
G6	25	MB-2	25	Around front axle left
A8	25	MB-2	25	Around front axle right
G8	25	MB-2	25	Around front axle left
C7	10	MB-1	10	Around front axle left
E7	10	MB-1	10	Around front axle right

Table 4-8. Tiedown Data for Cargo Truck in C-5 Airplane

Tiedown fitting		Tiedown device		Attach to item
designation row	capacity in 1,000-lb	type(s)	capacity in 1,000-lb	
D1	25	MB-2 or D-1	25	Right rear tiedown connection
G1	25	MB-2 or D-1	25	Left rear tiedown connection
E1	25	MB-2 or D-1	25	Left rear tiedown connection
F1	25	MB-2 or D-1	25	Right rear tiedown connection
E2	25	MB-2 or D-1	25	Around intermediate axle left
F2	25	MB-2 or D-1	25	Around intermediate axle right
E3	25	MB-2 or D-1	25	Around front axle left
F3	25	MB-2 or D-1	25	Around front axle right
E4	25	MB-2 or D-1	25	Around front axle left
F4	25	MB-2 or D-1	25	Around front axle right
D5	25	MB-2 or D-1	25	Right front tiedown connection
G5	25	MB-2 or D-1	25	Left front tiedown connection

tiedown position. Position one piece of 2- by 12- by 16-inch lumber and one piece of 1- by 12- by 16-inch plywood between rail arms at tiedown location beneath the wheels of the truck.

(b) For C-130 with rail system removed or the C-141 with the rail system stowed, use 2- by 12-inch single running shoring and parking shoring under the wheels of the truck at the tiedown location.

(c) Back truck into airplane, and insure all wheels are resting on pre-positioned shoring; set brakes and place in gear.

(d) Tie down as shown in figure 4-7 and table 4-6 and figure 4-8 and table 4-7.

(e) Four men can prepare, load, and tie

down the truck in approximately 60 minutes.

(f) Reverse procedures for unloading. Four men can release tiedowns and unload the truck in approximately 20 minutes.

Caution. Do not allow vehicle to exceed 3 miles per hour inside airplane or on the loading ramp, and insure that vehicle's fuel tanks are not more than three-fourths full.

(4) *Loading in C-5 airplane.* The cargo truck, M55A2, may be loaded and off-loaded in the C-5 airplane with the rail system stowed by using 2- by 12-inch single running shoring; however, a different tiedown pattern (fig 4-9) and table 4-8 are required.

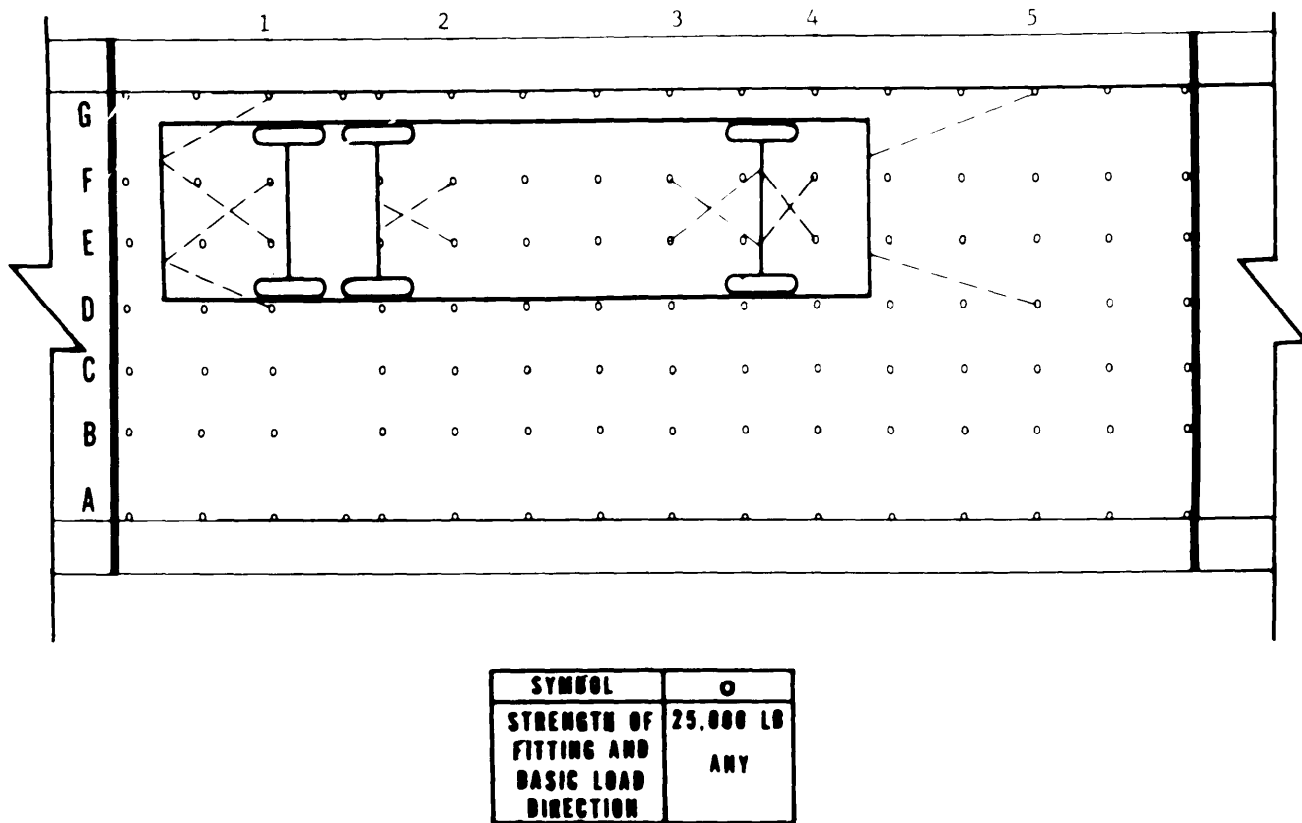


Figure 4-9. Tiedown diagram for cargo truck in C-5 airplane.

CHAPTER 5

HIGHWAY TRANSPORTABILITY GUIDANCE

5-1. General

This chapter provides transportability guidance for movement of the Land Combat Support System by highway. It covers significant technical and physical characteristics and prescribes the materials and guidance required to prepare, load, and tie down the items. The M55A2 cargo truck can be moved under its own power either empty or carrying the test station or shop equipment and towing the trailer-mounted generator. For logistic movement, the preferred method of shipment by highway is with the items loaded on flatbed semitrailers. The M55A2 truck exceeds CONUS legal width limitations by 2 inches, and highway permits may be required either for movement under its own power or when loaded on semitrailers. These restrictions also apply to highway movement overseas.

5-2. Off-Road Operations, Soils Trafficability Data

A vehicle cone index (VCI) is a number which tests have proved can be related to the characteristics of a particular vehicle (para 2-5c and d). This number, when used in connection with the rating cone index (of the soil), can forecast the ability of that vehicle to cross fine-grained soil. The rating index is obtained by use of the cone penetrometer and its associated equipment. See TM 5-330, chapter for use of the equipment in the and for interpretation of index numbers.

5-3. Movement by Semitrailer

The items can be transported over highway by semitrailers of adequate capacity and size. The combined length of the tractor and semitrailer required to effect/movement will not exceed the highway limitations for movement in CONUS and the recommended highway limitations in overseas areas. No height restrictions exist either when the M55A2 cargo truck is shipped in a reduced configuration or for the other items in the system.

5-4. Preparation of Items

No preparation is required for the test station, shop equipment, or trailer-mounted generator. The cargo truck is reduced by removing the exhaust pipe vertical extension, canvas top, bows, and cab and by lowering the windshield and door windows. All removed items should be secured within the vehicle body.

5-5. Loading of Test Station or Shop Equipment on Semitrailer

See figure 5-1 sheet 1 of 3 and sheet 3 of 3 for blocking and tiedown diagrams and sheet 2 of 3 for bill of material and general notes.

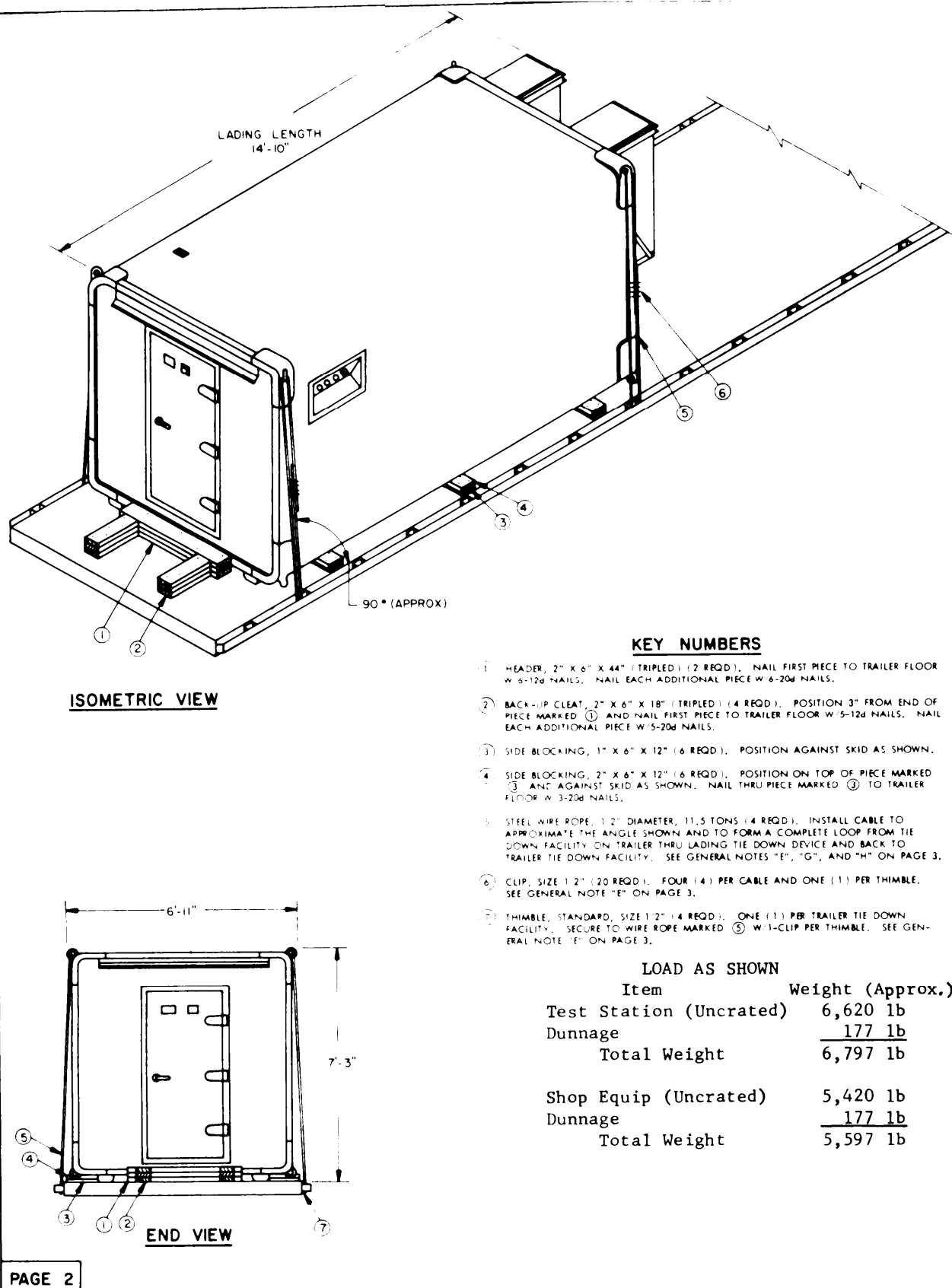
Note. Wherever page 3 is referred to under Key Numbers in figure 5-1 sheet 1 of 3 and sheet 3 of 3, refer to applicable item under General Notes on sheet 2 of 3.

5-6. Loading of Trailer-Mounted Generator on Semitrailer

Table 5-1 is the bill of material for blocking and restraining the item on the semitrailer. Figure 5-2, a blocking and tiedown diagram compatible with standing loading practices, provides for adequate restraint against the forces encountered during movements at normal speeds. Figure 5-3 presents blocking details. Table 5-2 presents application of materials for loading and securing item on the semitrailer.

5-7. Loading of 5-Ton Cargo Truck by Semitrailer

Table 5-3 is the bill of material for blocking and tiedown of the item on the semitrailer. Figure 5-4, a blocking and tiedown diagram compatible with standard loading practices, provides for adequate restraint against the forces encountered during movements at normal speeds. Refer to figure 5-3 for blocking details. Figure 5-5 shows methods for applying and twisting number 8 gage black annealed wire. Table 5-4 presents application of materials for loading and securing vehicle on semitrailer.



PAGE 2

Figure 5-1, Sheet 1 of 3. Blocking and tiedown diagram for uncrated test station or shop equipment loaded on semitrailer.

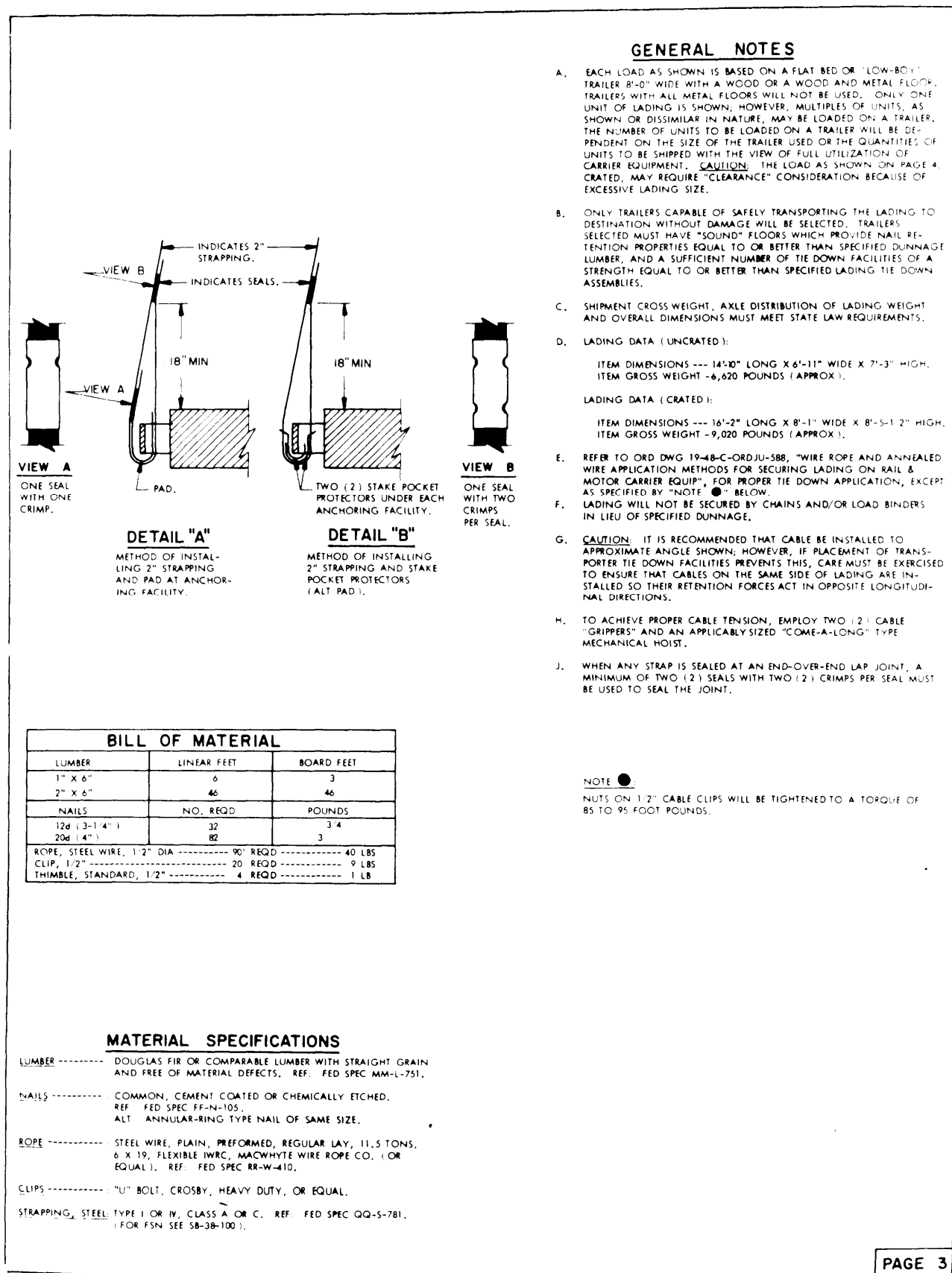
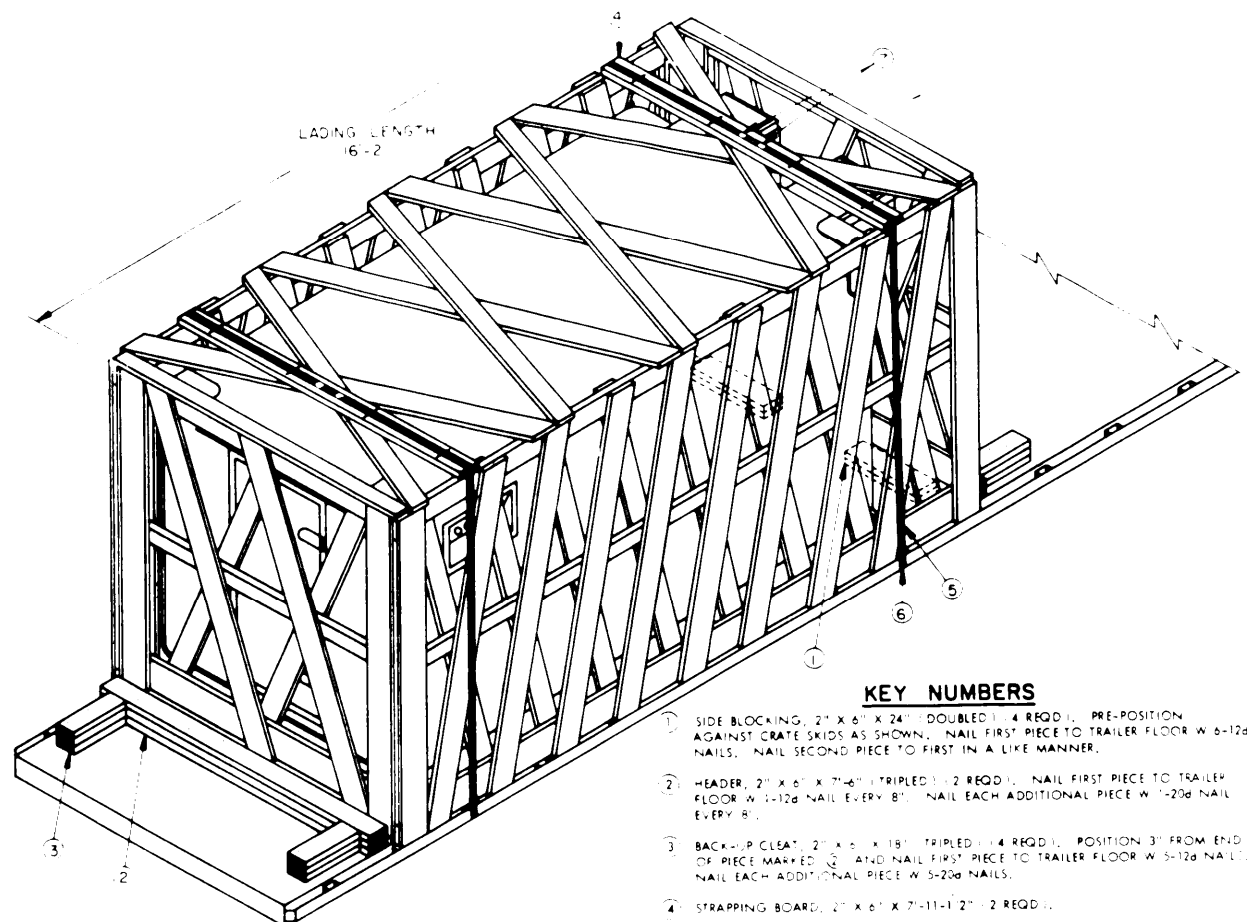


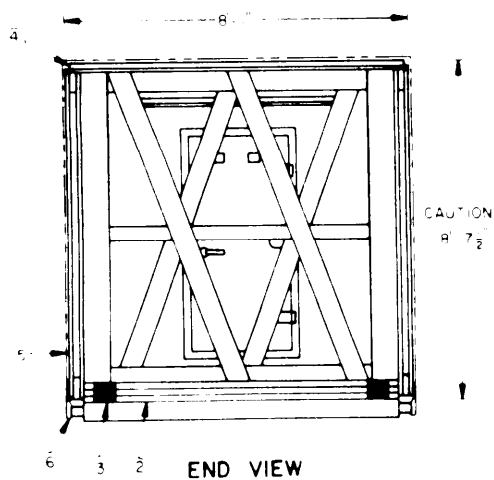
Figure 5-1, Sheet 2 of 3. Bill of material and general notes for uncrated test station or shop equipment loaded on semitrailer.



ISOMETRIC VIEW

KEY NUMBERS

- 1 SIDE BLOCKING, 2" X 6" X 24" DOUBLED, 4 REQ'D., PRE-POSITION AGAINST CRATE SKIDS AS SHOWN. NAIL FIRST PIECE TO TRAILER FLOOR W 6-12d NAILS. NAIL SECOND PIECE TO FIRST IN A LIKE MANNER.
- 2 HEADER, 2" X 6" X 7'-4" (TRIPLED), 2 REQ'D., NAIL FIRST PIECE TO TRAILER FLOOR W 6-12d NAIL EVERY 8". NAIL EACH ADDITIONAL PIECE W 6-12d NAIL EVERY 8".
- 3 BACK-UP CLEAT, 2" X 6" X 18" (TRIPLED), 4 REQ'D., POSITION 3" FROM END OF PIECE MARKED (2) AND NAIL FIRST PIECE TO TRAILER FLOOR W 6-12d NAIL. NAIL EACH ADDITIONAL PIECE W 6-12d NAILS.
- 4 STRAPPING BOARD, 2" X 6" X 7'-11" (2) 2 REQ'D.
- 5 STEEL STRAPPING, 2" X .050" X 33'-0" (2 REQ'D., STAPLE TO PIECE MARKED (4) W 4 STAPLES
- 6 PAD, 2" X .050" STRAP 18" LONG, 4 REQ'D., POSITION UNDER AND SEAL TO PIECE MARKED (3). SEE DETAIL A ON PAGE 3. ALT. STAKE POCKET PROTECTOR, UNLESS DET. NO. 1 OR EQUAL, 8 REQ'D., TWO (2) USED UNDER EACH TIE DOWN FACILITY WITH PIECE MARKED (3). SEE DETAIL B ON PAGE 3.
- 7 SEAL FOR 2" STRAPPING, 12 REQ'D., SEE GENERAL NOTE 12 ON PAGE 3.



END VIEW

BILL OF MATERIAL		
NUMBER	LINEAR FEET	BOARD FEET
2" X 6"	96	25
NAIL	NO. REQ'D.	POUNDS
12d 3-1/4"	90	14.1
20d 4"	14	3
STEEL STRAPPING, 2" X .050" 2 REQ'D. 24 LB.		
SEAL FOR 2" STRAPPING 12 REQ'D. 3 LB.		
STAPLE FOR 2" STRAPPING 4 REQ'D. 1 LB.		

LOAD AS SHOWN

Item	Weight (Approx.)
Test Station (Crated)	9,020 lb
Dunnage	270 lb
Total Weight	9,290 lb
Shop Equip (Crated)	7,820 lb
Dunnage	270 lb
Total Weight	8,090 lb

Figure 5-1, Sheet 3 of 3. Blocking and tiedown diagram and bill of material for crated test station or shop equipment loaded on semitrailer.

Table 5-1. Bill of Material for Blocking and Restraining Trailer-Mounted Generator on Semitrailer (Fig 5-2 and 5-3)

Item	Description	Approximate quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects, Fed Spec MM-L-751c: 2 x 4 in. 2 x 6 in. 2 x 8 in. 6 x 8 in.	12 linear ft 6 linear ft 16 linear ft 8 linear ft
Nails	Common, steel; flathead; bright or cement coated; table XI-b, Fed Spec FF-N-105a; size: 12d 20d 30d 40d	10 27 32 20
Wire rope	6 x 19; IWRC; improved plow steel; preformed, regular-lay; table X, Fed Spec RR-W-410a: 3/8-in.	60 ft
Clamps	Wire-rope, "U"-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal, Fed Spec FF-C-450c: 3/8-in.	24
Thimbles	Standard, open-type: 3/8-in.	8
Cushioning material	Waterproof paper, or suitable material	as required

Table 5-2. Application of Materials for Loading and Securing Trailer-Mounted Generator on Semitrailer (Fig 5-2 and 5-3)

Item	No. required	Application
A	1	Forward blocking detail. Item to consist of six pieces of 2- x 8- x 28-in lumber and two pieces of 2- x 8- x 11½-in. lumber angle-cut to 7 7/8-in. as shown in fig 5-2, detail item A. Center first of six pieces crosswise on semitrailer as shown, and nail to floor with six 30d nails. Nail three of the six pieces to the one below each in a like manner. Place remaining two pieces on edge, and nail the first to the assembled four pieces with six 20d nails. Nail the second piece to the first in a like manner. Center trailer drawbar frame on forward blocking detail with retractable landing leg housing against blocking. Nail one piece of 2- x 8- x 11½- x 7 7/8-in. blocking on each side of drawbar frame with four 30d nails as shown.
B	4	Chock block (sketch 1, fig 5-3). Locate 45°-portion of block against front and rear of each inside wheel. Nail heel of block to semitrailer floor with three 40d nails driven vertically, and toenail that portion of the block under the tire with two 40d nails before items C and D are applied.
C	as required	Suitable protective material, such as burlap or waterproof paper (sketch 2, detail A, fig 5-3). Locate bottom portion under item D, the top portion to extend 2 in. above item D.
D	2	Side blocking. Each to consist of one piece of 2- x 6- x 36-in. lumber and two pieces of 2- x 4- x 36-in. lumber (sketch 2, detail A, fig 5-3). Nail one edge of the 2- x 6- x 36-in. piece to the bottom 2- x 4- x 36-in. piece with five 12d nails. Then place, with item C, against the inside tire, and nail to semitrailer floor through 2- x 4- x 36-in. piece with five 20d nails. Nail the second piece of 2- x 4- x 36-in. to the one below in the same manner.
E	4	3/8-in., 6 x 19 steel cable, independent wire rope core. Cable to form a complete loop from semitrailer tiedown pockets through tiedown positions on trailer as shown. Apply one item F at each pocket and trailer tiedown position, and tighten cable to cause slight vehicle body depression. Secure each complete loop of cable with four items G (sketch 3, fig 5-3).
F	8	3/8-in. standard thimbles (sketch 4, fig 5-3). Use at semitrailer pockets and trailer tiedown positions to protect cable. Secure each to cable with one item G to prevent dislodgement.
G	24	3/8-in. cable clips, "U"-bolt type, Crosby heavy-duty, or equal. Apply as shown in items E and F. Torque to 60 to 90 ft-lb. A wrench with a 15-in.-long handle may be used in place of a torque wrench.

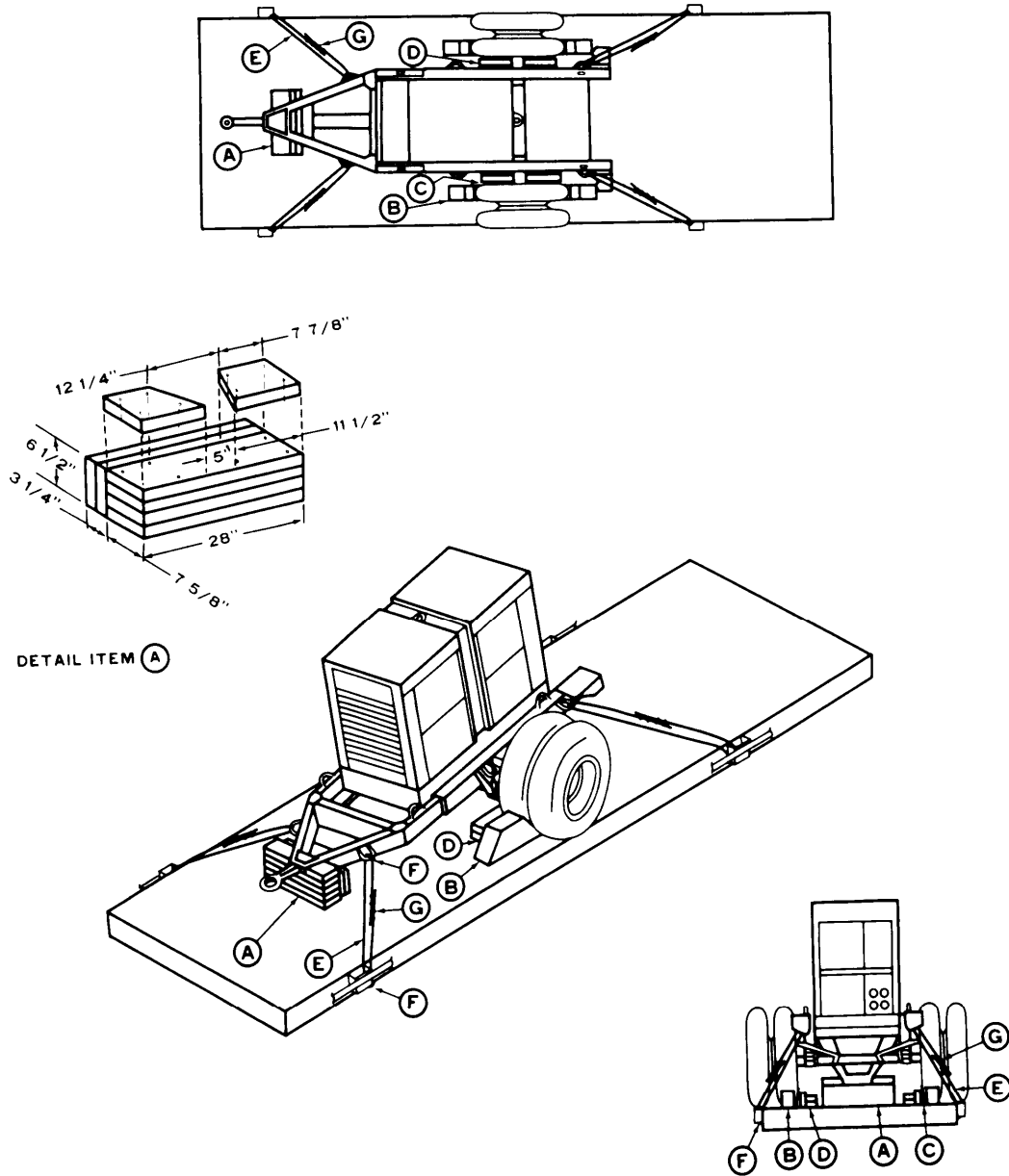


Figure 5-2. Blocking and tiedown diagram for trailer-mounted generator loaded on semitrailer.

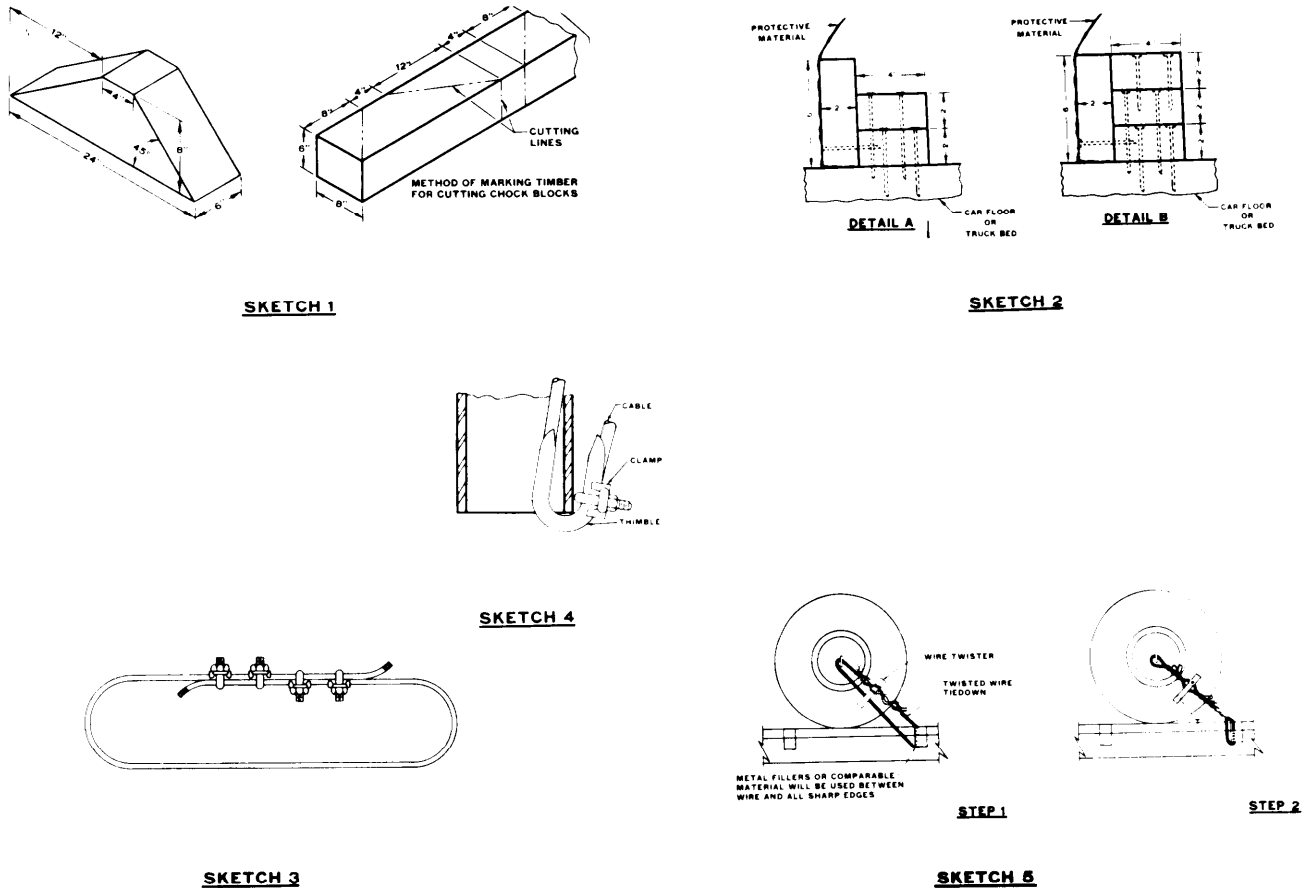


Figure 5-3. Blocking and tiedown detail diagram.

Table 5-3. Bill of Material for Blocking and Tiedown of 5-Ton Cargo Truck on Semitrailer (Fig 5-4 and 5-5)

Item	Description	Approximate quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects, Fed Spec MM-L-751c: 2 x 4 in. 2 x 6 in. 6 x 8 in.	54 linear ft 18 linear ft 24 linear ft
Nails	Common, steel; flathead, bright or cement coated; table XI-b, Fed Spec FF-N-105a; size: 12d 20d 40d	30 72 60
Wire	No. 8 gage black annealed, Fed Spec QQ-W-461f	200 ft*
Wire rope	6 X 19, IWRC; improved plow steel; preformed, regular-lay; table X, Fed Spec RR-W-410a: 1/2-in.	60 ft**
Clamps	Wire-rope, "U"-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal, Fed Spec FF-C-450c: 1/2-in.	20***
Thimbles	Standard, open-type: 1/2-in.	4
Cushioning material	Waterproof paper, or suitable material	as required

* Not required if 1/2-in. wire rope is used for item D (table 5-4).

**Not required if No. 8 gage wire is used for item D (table 5-4).

***Only four required if No. 8 gage wire is used for item D (table 5-4).

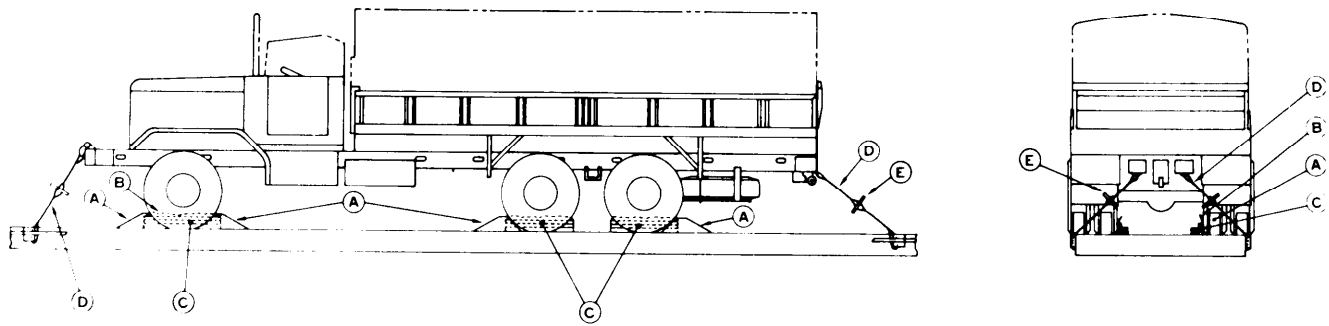


Figure 5-4. Blocking and tiedown diagram for 5-ton cargo truck on semitrailer.

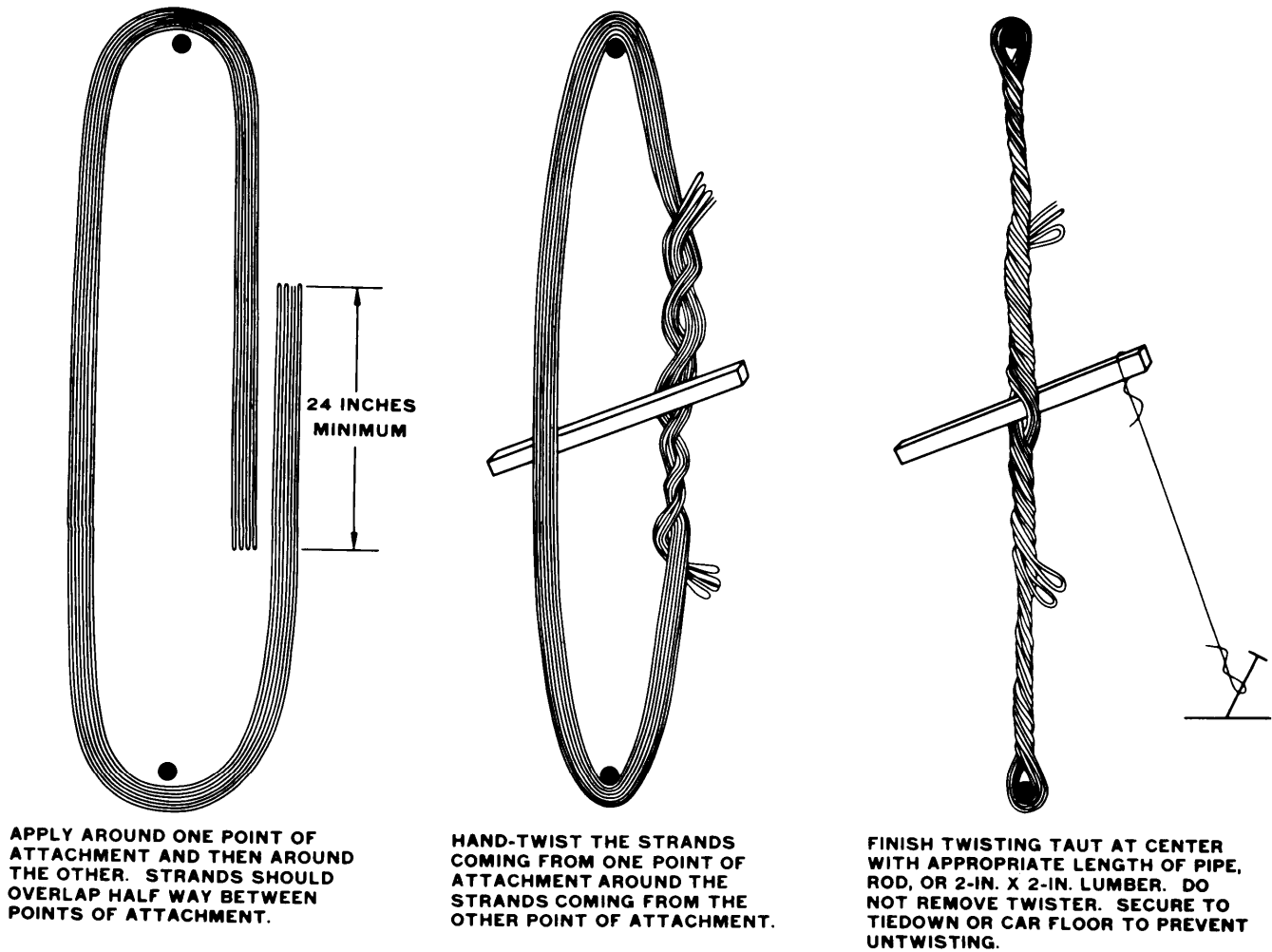


Figure 5-5. Method for applying and twisting multistrand no. 8 gage black annealed wire.

Table 5-4. Application of Materials for Blocking and Tiedown of 5-Ton Cargo Truck on Semitrailer (Fig 5-4 and 5-5)

Item	No. required	Application
A	12	Chock block (sketch 1, fig 5-3). Locate 45°-portion of block against front and rear of front wheels, in front of all intermediate wheels, and in back of all rear wheels. Nail heel of block to semitrailer floor with three 40d nails driven vertically, and toenail that portion of the block under the tire to semitrailer floor with two 40d nails before items B and C are applied.
B	as required	Suitable protective material, such as burlap or waterproof paper (sketch 2, detail B, fig 5-3). Locate bottom portion under item C, the top portion to extend 2 in. above item C.
C	6	Side blocking. Each to consist of one piece of 2- x 6- x 36-in. lumber and three pieces of 2- x 4- x 36-in. lumber (sketch 2, detail B, fig 5-3). Nail one edge of the 2- x 6- x 36-in. piece to the bottom 2- x 4- x 36-in. piece with five 12d nails. Then place, with item B, against the inside tire, and nail to semitrailer floor through the 2- x 4- x 36-in. piece with four 20d nails. Nail the other two 2- x 4- x 36-in. pieces to the one below in the same manner.
D	4	Eight strands, no. 8 gage black annealed wire. Attach to front and rear tiedown positions on the 5-ton cargo truck and thence to tiedown points on trailer as indicated (fig 5-4). Twist wire taut with rod, bolt, or suitable length of 2- x 2-in lumber, and secure to prevent unwinding (fig 5-5). Substitute, if desired, ½-in.-dia. IWRC wire rope in complete loop, and secure with four cable clips spaced approximately 3 in. apart. Apply protective thimble at stake pocket, and secure each to wire rope or no. 8 gage wire with one cable clip (sketch 4, fig 5-3).
E	4	Wire twisters (fig 5-5). Use 2- x 2-in. X length-to-suit lumber (metal rod or bolt may be used in lieu of lumber). Leave twister in place, and secure to prevent unwinding.

CHAPTER 6

MARINE AND TERMINAL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

61. Scope

This chapter provides marine and terminal transportability guidance for movement of the Land Combat Support System. It covers significant technical and physical characteristics and prescribes the materials and guidance required to

prepare, load, stow, and secure the items.

6-2. Water Shipment

The items can be transported by a great variety of inland-waterway cargo carriers and lighters and by all sea going cargo vessels.

Section II. LOADING, STOWING, AND SECURING ITEMS

6-3. General

The methods described in this chapter for lifting and securing items are suggested procedures.

Other methods of handling and stowage may be used providing they will insure safe delivery without damage to the items.

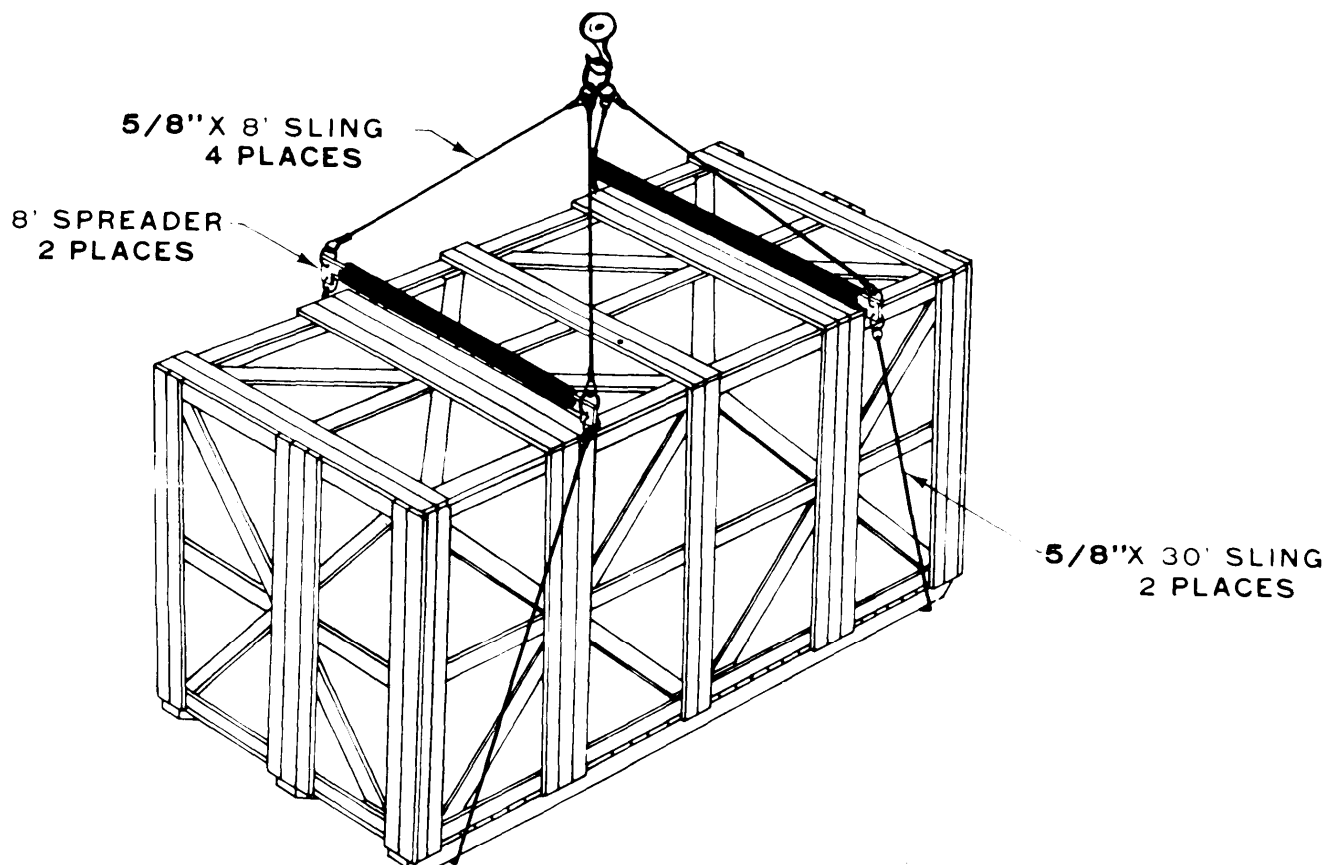


Figure 6-1. Lifting diagram for the test station or shop equipment using wire-rope slings with spreader bar.

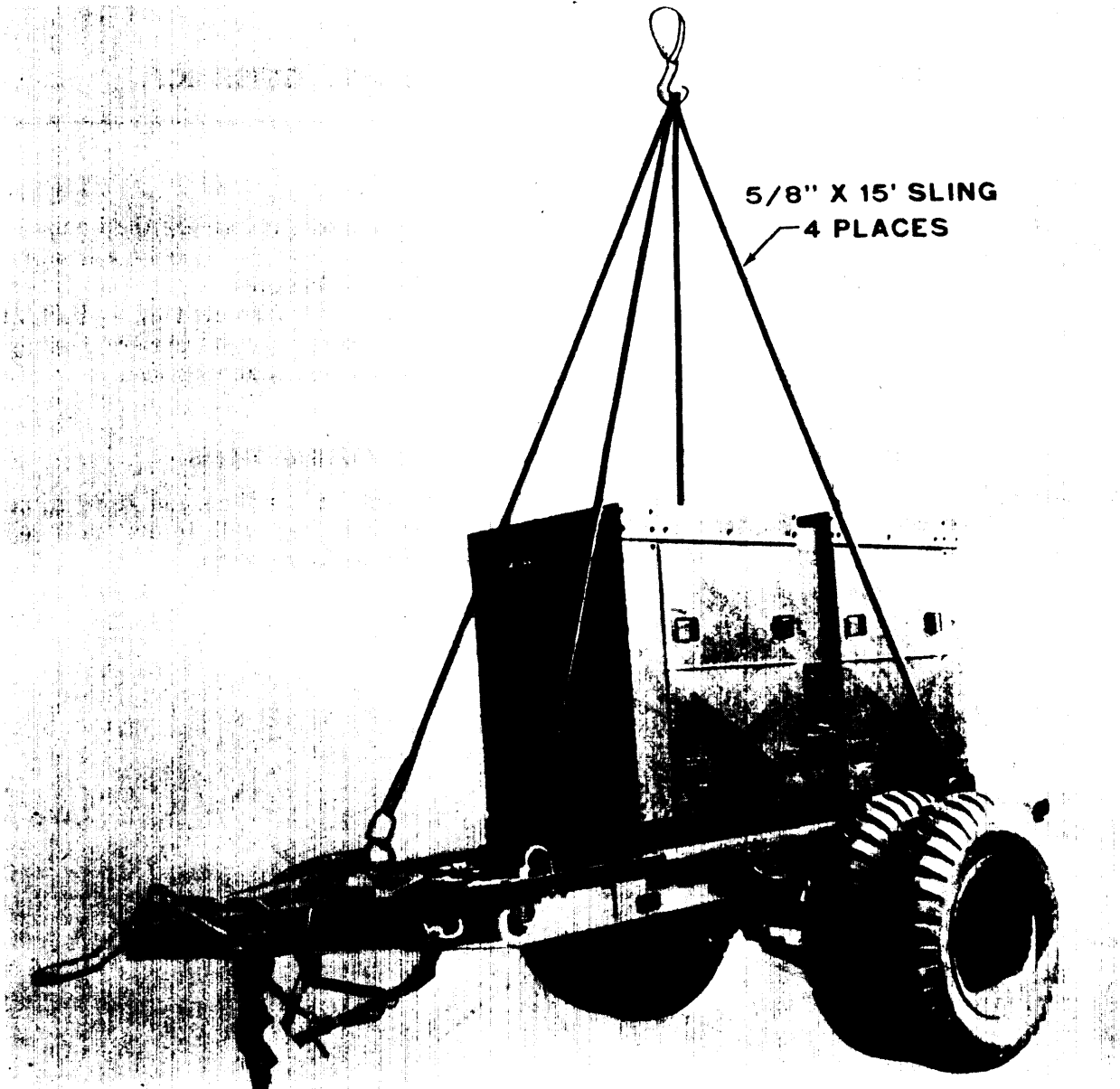


Figure 6-2. Lifting diagram for trailer-mounted generator using wire-rope slings.

6-4. Transport of LCSS by Cargo Vessels

a. Loading.

- (1) All the items can be loaded by ships' gear or shore cranes of adequate capacity.
- (2) The 5-ton cargo truck can be loaded under its own power onto landing craft, landing ships, beach discharge lighters, and barges.
- (3) Figures 6-1 through 6-3 present the lifting diagram for the items being loaded.

b. Stowage and Securing. All items should be stowed below deck and properly secured.

- (1) The test station or shop equipment should be stowed tightly against bulkhead or sweatboards at side of vessel. Use lashing, bracing, blocking, tomming, and shoring as required to prevent movement.
- (2) The 5-ton cargo truck should be stowed 4 to 6 inches from bulkhead or sweatboards, in

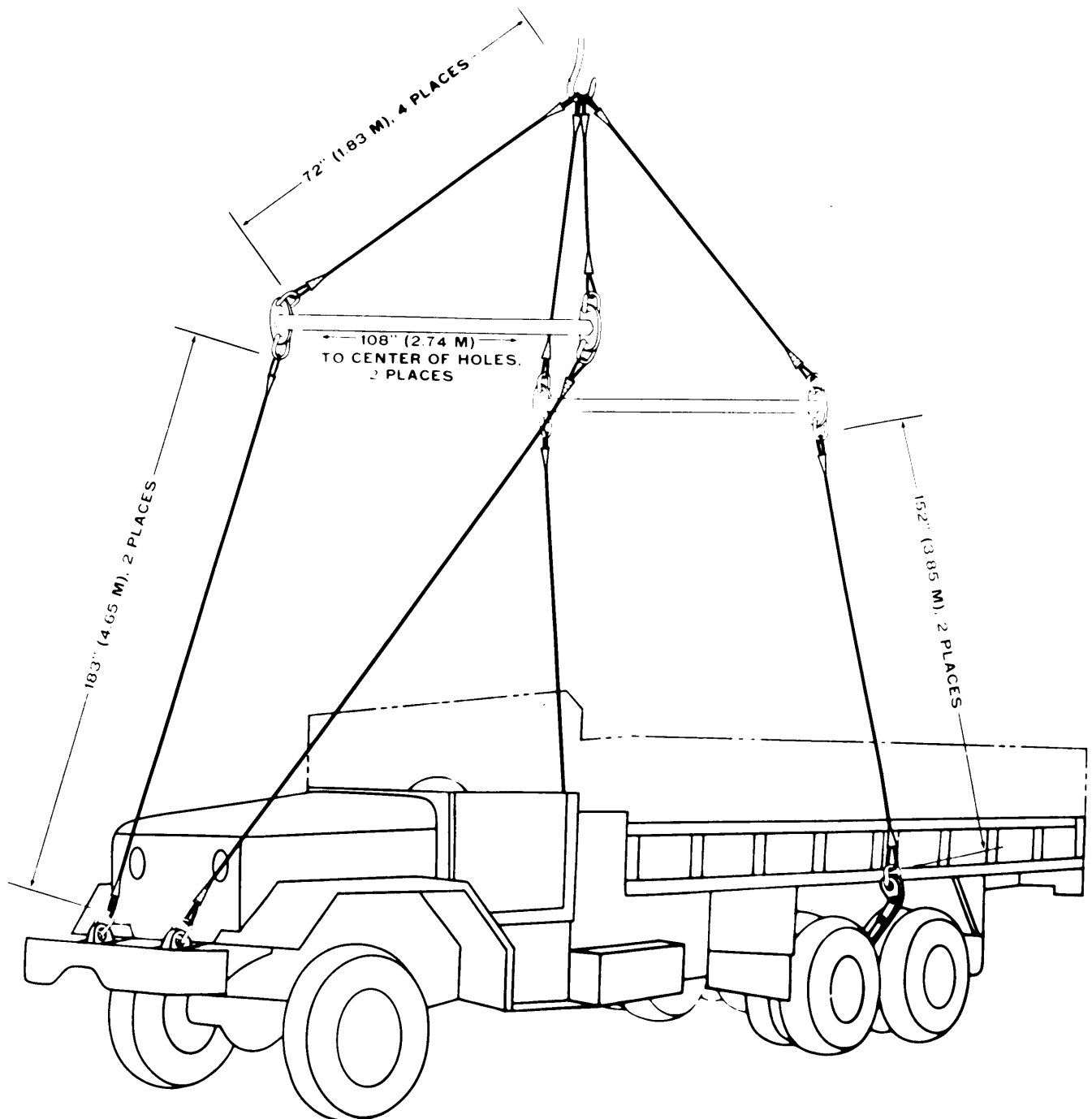


Figure 6-3. Lifting diagram for the 5-ton cargo truck using wire-rope slings with spreader bar.

neutral gear with brakes on and wire-tied, with battery terminals disconnected, and with gasoline drained. Secure by blocking wheels front and rear and on both sides; lash with wire rope or chains to bulkhead or stanchions.

Note. When truck is loaded on vessels which are adequately ventilated by power blowers, such as on roll-on or roll-off vessels, gasoline need not be drained.

(3) The trailer-mounted generator is stowed and secured in similar manner as the cargo truck.

CHAPTER 7

RAIL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

7-1. Scope

This chapter provides rail transportability guidance for movement of the Land Combat Support System. It covers significant technical and physical characteristics and prescribes the materials and guidance required to prepare, load, and tie

down the items.

7-2. Maximum Utilization of Railcars

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

Section II. TRANSPORT ON CONUS RAILWAYS

7-3. General

The transportability guidance contained in this section is applicable when the items are transported on CONUS railways. Consideration is given to single and multiple movements on the types of railcars normally used for the movement of these items. All items when loaded on suitable railcars can be transported without sectionalization/or major disassembly within the Association of American Railroads Outline Diagram for Single Loads, Without End Overhand, on Open Top Cars as shown in both in *Railway Line Clearance Publication* and the *Official Railway Equipment Register*.

7-4. Preparation of Items

No preparation is required for the test station, shop equipment, or generator on trailer. ton cargo truck is reduced by removing haust pipe vertical extension, canvas top, bows, and cab by lowering the windshield and door windows. All removed items should be secured within the vehicle body.

7-5. Loading

a. The times may be placed in the tiedown position on the railcar by a crane, or the cargo truck may be driven or towed provided a suitable ramp or bridge is available.

b. After loading and placement of the item at the tiedown position, handbrakes on truck *must* be set. Gearshift levers for automatic or conventional transmissions must be placed and wire-tied in neutral position.

c. Loads as shown are based on flatcars 9 feet 2 inches wide (platform). Cars with wider platforms may also be used.

7-6. Transport on General-Purpose Flatcars

The number of units to be loaded on a car will be dependent on the size of the car used, the quantities or assortment of units to be shipped with view of full utilization of carrier equipment. Special-purpose railcars equipped with chain tie-owns generally provide greater economies in loading costs and transportation charges; they should be used whenever appropriate and available from the rail carriers (para 7-10).

Note. A staggered nailing pattern will be used when lumber is nailed to the floor of the railcar, or when laminating lumber. Additionally, the nailing pattern for an upper piece of laminated lumber will be adjusted a required so that a nail for that piece will not be driven through, onto, or right beside a nail in the lower piece of lumber.

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

7-7. Transport of Test Station or Shop Equipment on General-Purpose Flatcars

Refer to figure 7-1, sheet 1 of 3 and sheet 3 of 3 for blocking and tiedown diagram and sheet 2 of 3 for bill of material and general notes.

Note. Wherever page 3 is referred to under Key Numbers in figure 7-1 sheet 1 of 3 and sheet 3 of 3, refer to applicable item under General Notes on sheet 2 of 3.

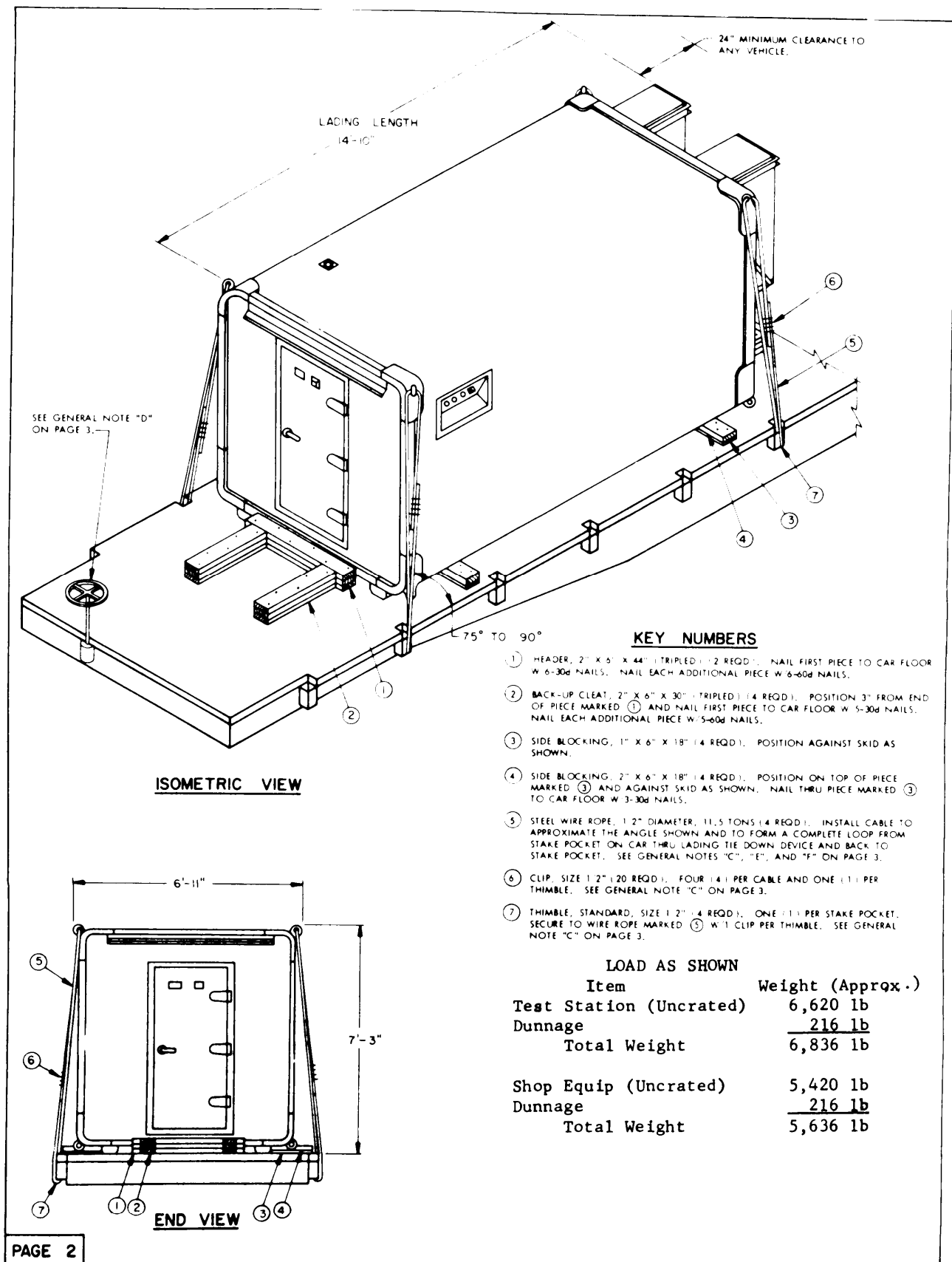
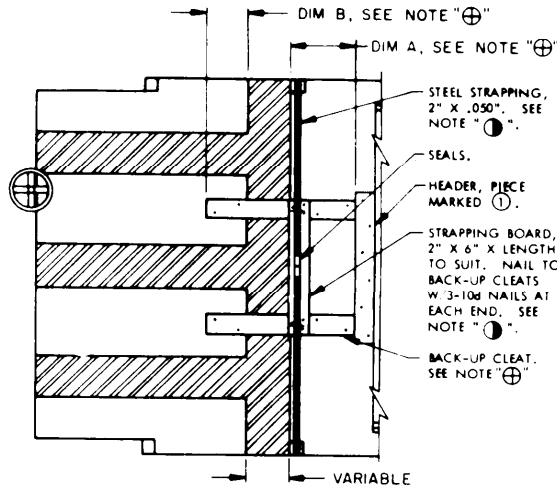


Figure 7-1, Sheet 1 of 3. Blocking and tiedown diagram for test station or shop equipment loaded on general-purpose flatcar.



END BLOCKING FOR CARS WITH EXPOSED STEEL BOLSTERS

(SEE GENERAL NOTE "G" ON THIS PAGE)

NOTE 'A'

OPTIONAL STRAP HOLD DOWN FOR END BLOCKING, FOR CARS WITH OR WITHOUT EXPOSED STEEL BOLSTERS.

NOTE 'B'

WHEN LOADING CARS WITH EXPOSED STEEL BOLSTERS, TOTAL OF DIMENSION "A" AND DIMENSION "B" (MIN 12") MUST EQUAL THE LENGTH OF BACK-UP CLEATS (PIECES MARKED 'C') TO PROVIDE FOR PROPER NAILING TO THE CAR FLOOR. SEE PIECE MARKED 'C' FOR PROPER NAILING.

BILL OF MATERIAL		
LUMBER	LINEAR FEET	BOARD FEET
1" X 6"	6	3
2" X 6"	58	58
NAILS	NO. REQD	POUNDS
30d (4-1/2")	44	2-1/4
60d (6")	64	6-1/2
ROPE, STEEL WIRE, 1/2" DIA	100' REQD	44 LBS
CLIP, 1/2"	20 REQD	9 LBS
THIMBLE, STANDARD, 1/2"	4 REQD	1 LB

MATERIAL SPECIFICATIONS

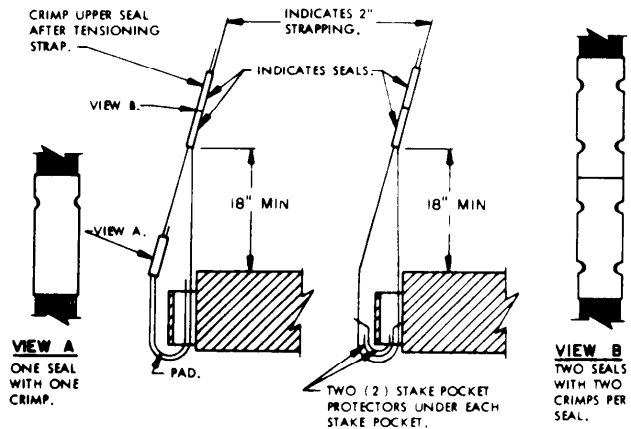
- LUMBER** ----- : DOUGLAS FIR OR COMPARABLE LUMBER WITH STRAIGHT GRAIN AND FREE OF MATERIAL DEFECTS. REF: FED SPEC MM-L-751.
- NAILS** ----- : COMMON, CEMENT COATED OR CHEMICALLY ETCHED. REF: FED SPEC FF-N-185. ALT: ANNULAR-RING TYPE NAIL OF SAME SIZE.
- ROPE** ----- : STEEL WIRE, PLAIN, PREFORMED, REGULAR LAY, 11.5 TONS, 6 X 19, FLEXIBLE IWRC, MACWHYTE WIRE ROPE CO. OR EQUAL. REF: FED SPEC RR-W-410.
- CLIPS** ----- : "U" BOLT, CROSBY, HEAVY DUTY.
- STRAPPING, STEEL** : TYPE I OR IV, CLASS A OR C. REF: FED SPEC QQ-5-781. (FOR FSN SEE 58-38-100).

GENERAL NOTES

- A. THE LOAD AS SHOWN ON PAGE 2 IS BASED ON A FLAT CAR 8'-6" WIDE (PLATFORM) AND THE LOAD AS SHOWN ON PAGE 4 IS BASED ON A FLAT CAR 9'-2" WIDE (PLATFORM). WIDER CARS CAN BE USED. ONLY ONE UNIT OF LADING IS SHOWN, HOWEVER, MULTIPLES OF UNITS, AS SHOWN OR DISSIMILAR IN NATURE, MAY BE LOADED ON A CAR. THE NUMBER OF UNITS TO BE LOADED ON A CAR WILL BE DEPENDENT ON THE SIZE OF THE CAR USED OR THE QUANTITIES OF UNITS TO BE SHIPPED WITH THE VIEW OF FULL UTILIZATION OF CARRIER EQUIPMENT.
- B. LADING DATA (UNCRATED)
- ITEM DIMENSIONS ---- 14'-10" LONG X 6'-11" WIDE X 7'-3" HIGH.
ITEM GROSS WEIGHT -- 6,620 POUNDS (APPROX).
- LADING DATA (CRATED)
- ITEM DIMENSIONS ---- 16'-2" LONG X 8'-11" WIDE X 8'-5 1/2" HIGH.
ITEM GROSS WEIGHT -- 9,020 POUNDS (APPROX).
- C. REFER TO ORD DWG 19-48-C-ORDJU-588, "WIRE ROPE AND ANNEALED WIRE APPLICATION METHODS FOR SECURING LADING ON RAIL & MOTOR CARRIER EQUIP", FOR PROPER TIE DOWN APPLICATION, EXCEPT AS SPECIFIED BY "NOTE 'D'" BELOW.
- D. REFER TO ASSOCIATION OF AMERICAN RAILROADS MANUAL "GENERAL RULES GOVERNING THE LOADING OF COMMODITIES ON OPEN TOP CARS". FOR APPLICABLE LOADING RULES: PREFACE, 1-A, 2, 3, 4, 5, 9, 14, AND 15.
- E. TO ACHIEVE PROPER CABLE TENSION, EMPLOY TWO (2) CABLE "GRIPPERS" AND AN APPLICABLY SIZED "COME-A-LONG" TYPE MECHANICAL HOIST.
- F. **CAUTION:** IT IS RECOMMENDED THAT CABLE BE INSTALLED TO APPROXIMATE ANGLE SHOWN; HOWEVER, IF PLACEMENT OF CAR STAKE POCKETS PREVENTS THIS, CARE MUST BE EXERCISED TO ENSURE THAT CABLES ON THE SAME SIDE OF LADING ARE INSTALLED SO THEIR RETENTION FORCES ACT IN OPPOSITE LONGITUDINAL DIRECTIONS --- CONTACT OF CABLE WITH EDGE OF LADING IS PROHIBITED.
- G. ONLY CARS WITH "SOUND" FLOORS WILL BE USED. CARS WITH STEEL FLOOR ENDS AND/OR EXPOSED STEEL BOLSTERS WHICH INTERFERE WITH PROPER POSITIONING OR NAILING OF THE DUNNAGE WILL NOT BE USED. SEE "END BLOCKING FOR CARS WITH EXPOSED STEEL BOLSTERS" DETAIL ON THIS PAGE.
- H. WHEN ANY STRAP IS SEALED AT AN END-OVER-END LAP JOINT, OR AS SHOWN IN DETAILS "A" AND "B" BELOW, A MINIMUM OF TWO (2) SEALS WITH TWO (2) CRIMPS PER SEAL MUST BE USED.

NOTE 'C'

NUTS ON 1/2" CABLE CLIPS WILL BE TIGHTENED TO A TORQUE OF 85 TO 95 FOOT POUNDS.



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).

Figure 7-1, sheet 2 of 3. Bill of material and general notes for test station or shop equipment loaded on general-purpose flatcar.

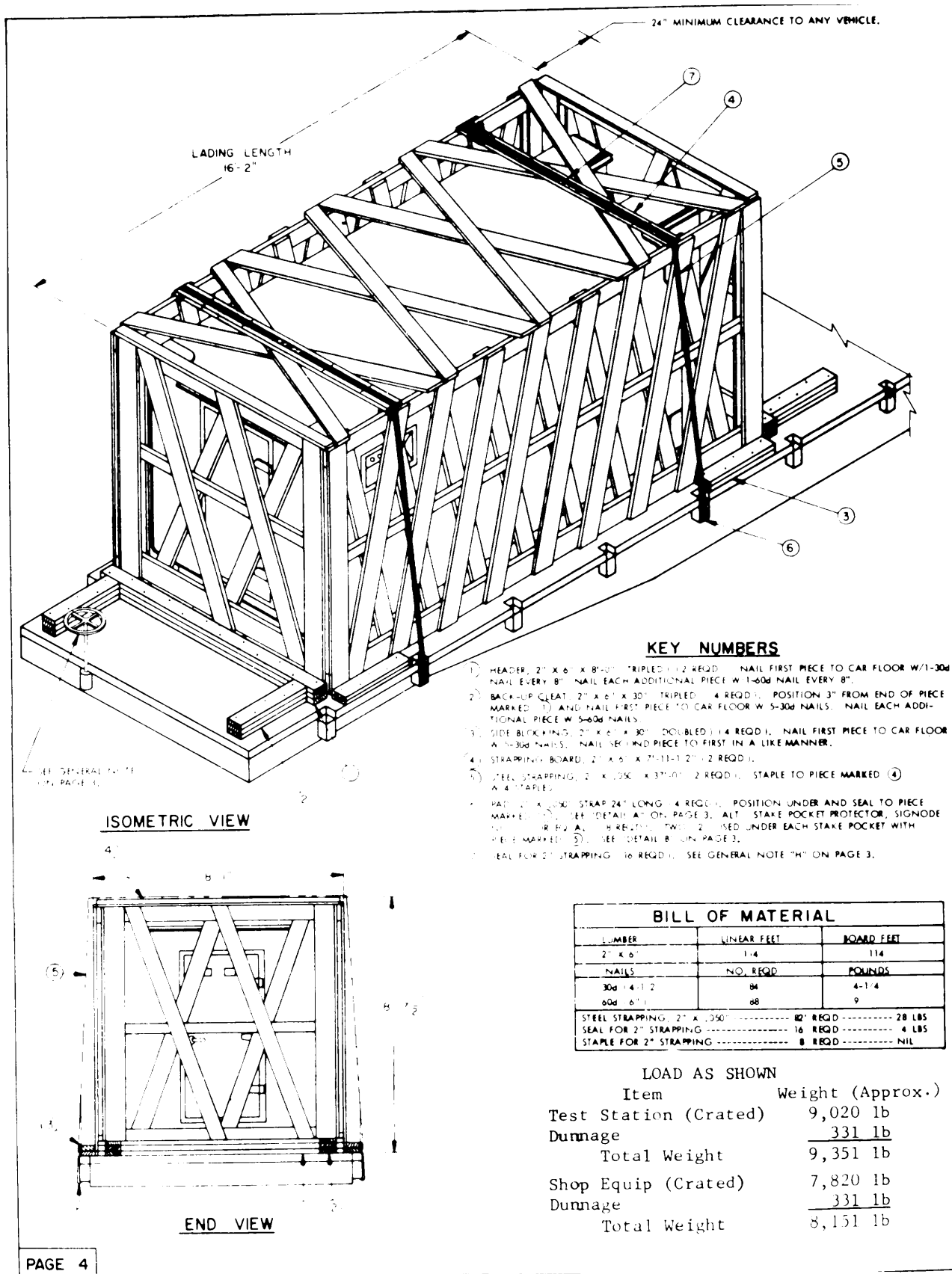


Figure 7-1, Sheet 3 of 3. Blocking and tiedown diagram and bill of material for crated test station or shop equipment loaded on general-purpose flatcar.

7-8. Transport of Trailer-Mounted Generator on General-Purpose Flatcars

Table 7-1 is the bill of material for blocking and tiedown of the item on the flatcar. Figure 7-2, a blocking and tiedown diagram compatible with standard loading practices, provides for adequate

restraint against the forces encountered during movements at normal speeds. Refer to figure 5-3 for blocking details. Table 7-2 presents application of materials for loading and securing item on flatcar. Refer to figure 5-5 for methods for applying and twisting no. 8 gage black annealed wire.

Table 7-1. Bill of Material for Blocking and Tiedown of Trailer-Mounted Generator on Flatcar (Fig 7-2)

Item	Description	Approximate quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects, Fed Spec MM-L-751a: 2 x 4 in. 2 x 6 in. 2 x 8 in. 6 x 8 in.	12 linear ft 6 linear ft 16 linear ft 8 linear ft
Nails	Common, steel; flathead; bright or cemented coated; table XI-b, Fed Spec FF-N-15a; size: 12d 20d 30d 40d	10 27 32 20
Wire	No. 8 gage black annealed, Fed Spec QQ-W-461f	115 ft
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; table X, Fed Spec RR-W-410a: 3/8-in.	60 ft
Clamps	Wire-rope, "U"-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal, Fed Spec FF-C-450c: 3/8-in.	24
Thimbles	Standard, open-type: 3/8-in.	8
Cushioning material	Waterproof paper, or suitable material	as required

Table 7-2. Application of Materials for Loading and Securing Trailer-Mounted Generator on Flatcar (Fig 7-2)

Item	No. required	Application
A		Brake wheel clearance. Minimum clearance required is 6 in. above, in back of, and on both sides of and 4 in. underneath wheel.
B	1	Forward blocking detail. Item to consist of six pieces of 2- x 8- 28-in. lumber and two pieces of 2- x 8- x 11½-in. lumber angle-cut to 7 7/8-in. as shown in fig 7-2, detail item B. Center first of six pieces crosswise on car as shown, and nail to car floor with six 30d nails. Nail three of the six pieces to the one below each in a like manner. Place remaining two pieces on edge, and nail the first to the assembled four pieces with six 20d nails. Nail the second piece to the first in a like manner. Center trailer drawbar frame on forward blocking detail with retractable landing leg housing against blocking. Nail one piece of 2- x 8- x 11 ½- x 7 7/8-in. blocking on each side of drawbar frame with four 30d nails as shown.
C	4	Chock block (sketch 1, fig 5-3). Locate 45°-portion of block against front and rear of each outside wheel. Nail heel of block to car floor with three 40d nails driven vertically, and toenail that portion of the block under the tire with two 40d nails before items D and E are applied.
D	as required	Suitable protective material, such as burlap or waterproof paper (sketch 2, detail A, fig 5-3). Locate bottom portion under item E, the top portion to extend 2 in. above item E.
E	2	Side blocking. Each to consist of one piece of 2- x 6- x 36-in. lumber and two pieces of 2- x 4- x 36-in. lumber (sketch 2, detail A, fig 5-3). Nail one edge of the 2- x 6- x 36-in. piece to the bottom 2- x 4- x 36-in. piece with five 12d nails. Then place, with item D, against the outside tire, and nail to car floor through the 2- x 4- x 36-in. piece with five 20d nails. Nail the second piece of 2- x 4- x 36-in. to the one below in the same manner.
F	4	Six strands, no. 8 gage black annealed wire (fig 5-5). Pass through the holes in the wheels and through the car stake pockets so that they form an "X" across the face of the wheel. Place item G between the wire and the lower edge of stake pocket. Twist wire taut with a suitable length of pipe, rod, or 2- x 2-in. lumber (item H). Leave twister in place, and secure to prevent unwinding.
G	4	Metal fillers sufficient to provide a suitable radius. Use as stake pockets to protect wire.

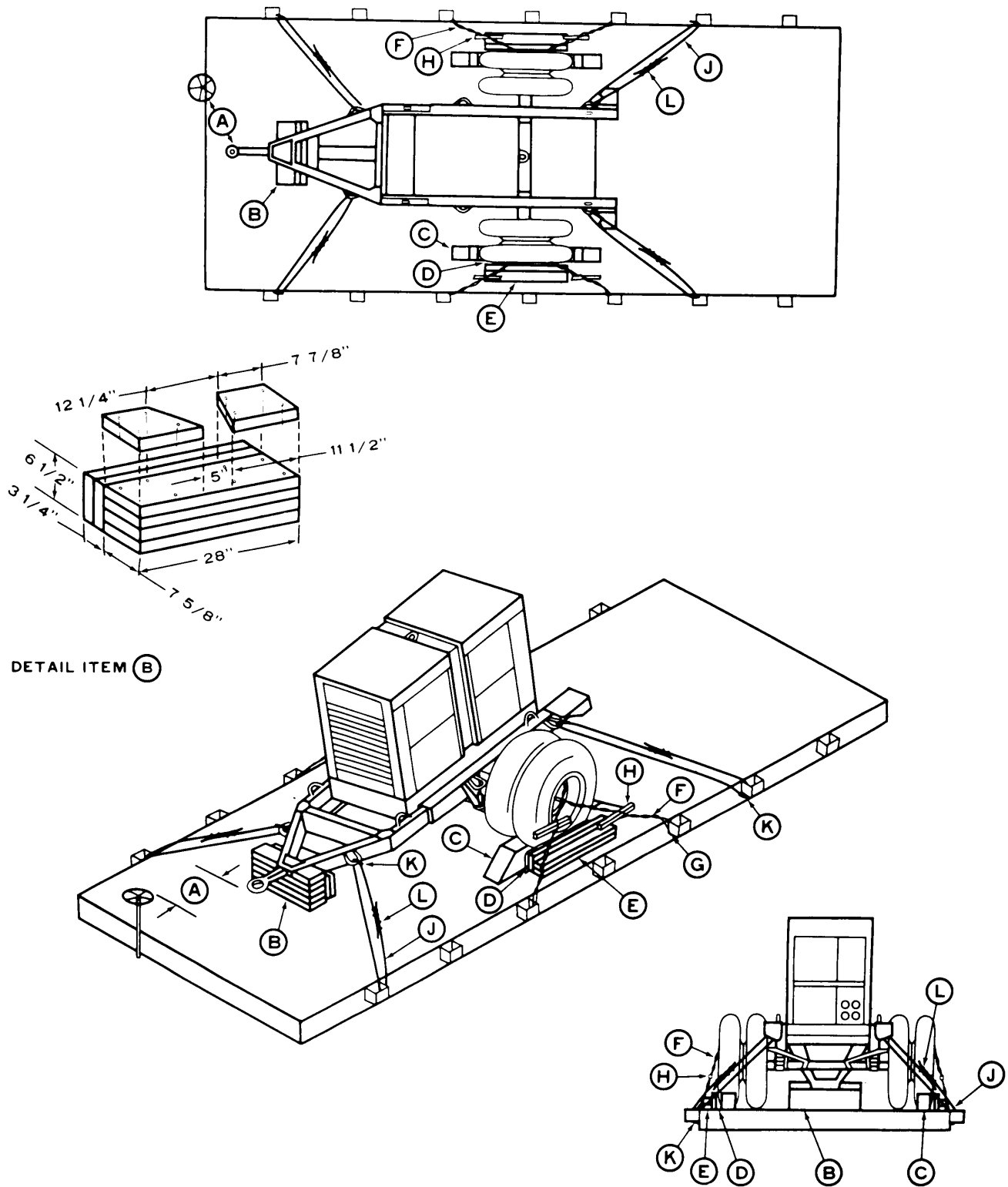


Figure 7-2. Blocking and tiedown diagram for trailer-mounted generator on flatcar.

Item	No. required	Application
H	4	Wire twister (fig 5-5). Suitable length of pipe, rod, or 2- x 2-in. lumber. After twisting, secure twister to car floor or vehicle with one strand of no. 8 gage wire.
J	4	
K	8	3/8-in., 6 x 19 steel cable, independent wire rope core. Cable to form a complete loop from stake pockets on car through tiedown positions on vehicle as shown. Apply one item K at each stake pocket and vehicle tiedown position, and tighten cable to cause slight vehicle body depression. Secure each complete loop of cable with four items L.
L	24 ea vehicle	3/8-in. standard thimbles (sketch 4, fig 5-3). Use at stake pockets and trailer tie-down position to protect wire or cable. Secure cable or wire with one item L to prevent dislodgement.
		3/8-in. cable clips, "U"-bolt type, Crosby heavy-duty, or equal. Apply as shown in items J and K. Torque to 60 to 90 ft-lb. A wrench with a 15-in. -long handle may be used in place of a torque wrench.

7-9. Transport of 5-Ton Cargo Truck on General-Purpose Flatcars

Table 7-3 is the bill of material for blocking and tiedown of the item on the flatcar. Figure 7-3, a blocking and tiedown diagram compatible with standard loading practices, provides for adequate restraint against the forces encountered during

movements at normal speeds. Refer to figure 5-3 for blocking details. Table 7-4 presents application of materials for loading and securing item on flatcar. Refer to figure 5-5 for methods for applying and twisting no. 8 gage black annealed wire.

Table 7-3. Bill of Material for Blocking and Tiedown of 5-Ton Cargo Truck on General-Purpose Flatcar (Fig 7-9)

Item	Description	Approximate quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects, Fed Spec MM-L751c: 2 x 4 in.	54 linear ft
	2 x 6 in.	18 linear ft
	6 x 8 in.	24 linear ft
Nails	Common, steel; flathead; bright or cement coated; table XI-b, Fed Spec FF-N-105a; size: 12d	30
	20d	72
	40d	60
Wire	No. 8 gage black annealed, Fed Spec QQ-W-461f	300 ft
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; table X, Fed Spec RR-W-410a: 1/2-in.	72 ft
Clamps	Wire-rope, "U"-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal, Fed Spec FF-C-450c: 1/2-in.	28
Thimbles	Standard, open-type: 1/2-in.	12
Cushioning material	Waterproof paper, or suitable material	as required

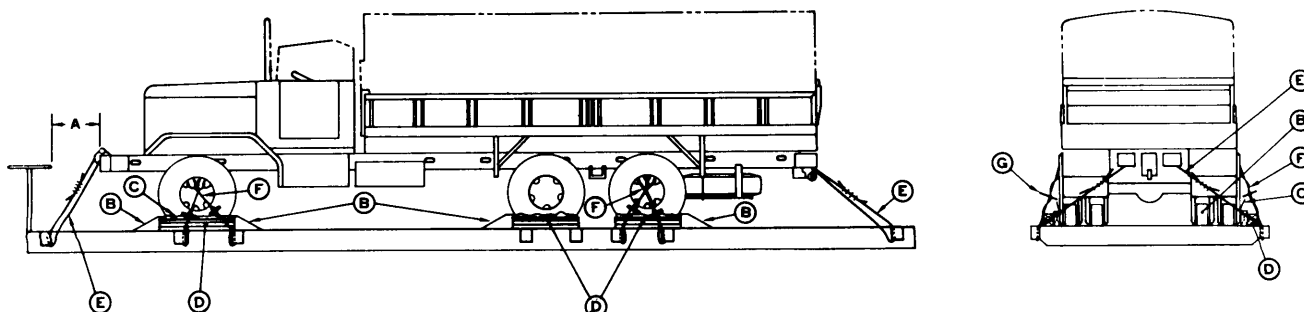


Figure 7-3. Blocking and tiedown diagram for 5-ton cargo truck on general-purpose flatcar.

Table 7-4. Application of Materials for Loading and Blocking 5-Ton Cargo Truck on General-Purpose Flatcar (Fig. 7-3)

Item	No. required	Application
A		Brake-wheel clearance. Minimum clearance required is 6 in. above, in back of, and on both sides of and 4 in. underneath wheel.
B	12	Chock block (sketch 1, fig 5-3). Locate 45° portion of block against front and rear of front wheels, in front of all intermediate wheels, and in back of all rear wheels. Nail heel of block to car floor with three 40d nails driven vertically, and toenail that portion of the block under the tire to car floor with two 40d nails before items C and D are applied.
C	as required	Suitable protective material, such as burlap or waterproof paper (sketch 2, fig 5-3). Locate bottom portion under item D, the top portion to extend 2 in. above item D.
D	6	Side blocking. Each to consist of one piece of 2- x 6- x 36-in. lumber and three pieces of 2- x 4- x 36-in. lumber (sketch 2, detail B, fig 5-3). Nail one edge of the 2- x 6- x 36-in. piece to the bottom 2- x 4- x 36-in. piece with five 12d nails. Then place, with item C, against the outside tire, and nail to the car floor through the 2- x 4- x 36-in. piece with four 20d nails. Nail the other two 2- x 4- x 36-in. pieces to the one below in a like manner.
E		Wire rope, ½-in., in a complete loop, and secured with four cable clips spaced approximately 3 in. apart. Attach to front and rear tiedown positions on 5-ton cargo truck and thence to tiedown points on car as indicated (fig 7-3). Apply protective thimble at stake pockets and secure each to wire rope with one cable clip (sketch 4, fig 5-3).
F	8	Six strands of no. 8 black annealed wire. Pass through holes in the front and rear wheels and through car stake pockets (fig 7-3). Apply protective thimble at stake pocket, and secure each to wire with one cable clip (sketch 4, fig 5-3).
G	8	Wire twisters (fig 5-5). Use 2- x 2-in. x length-to-suit lumber (metal rod or bolt may be used in lieu of lumber). Leave twister in place, and secure to prevent unwinding.

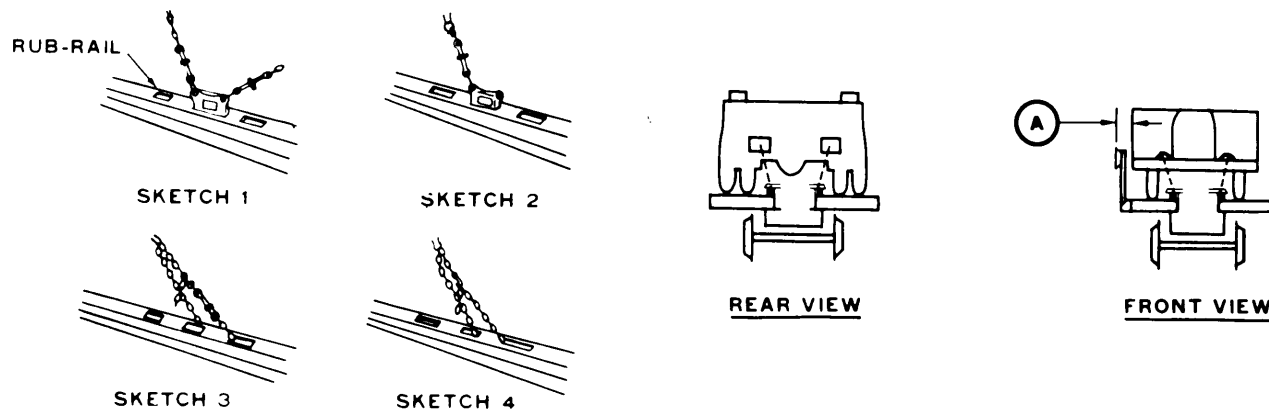
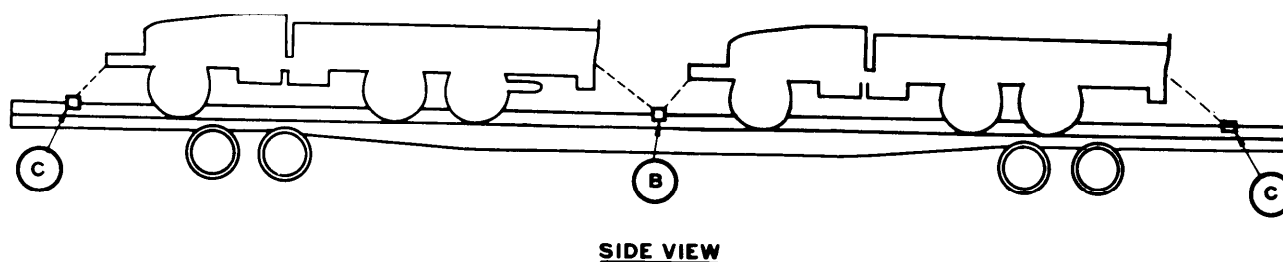


Figure 7-4. Tiedown diagram for 5-ton cargo truck on CONUS G-85 or G-89 cushioned rub-rail flatcar.

7-10. Transport of 5-Ton Cargo Truck on Special-Purpose Flatcars

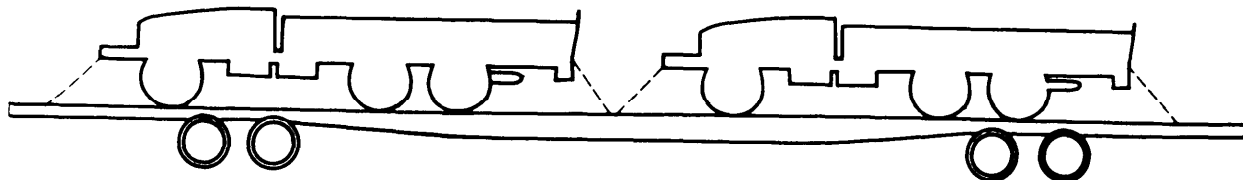
Special-purpose flatcars equipped with chain tie-downs provide economies in loading costs and often a savings in transportation charges, provided full utilization of the loadable space is made.

When such cars are available from the rail carriers and full utilization can be made, they should be used. For detailed information of loading on each type of car see figure 74 and table 7-5 and figure 7-5 and table 7-6.

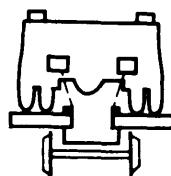
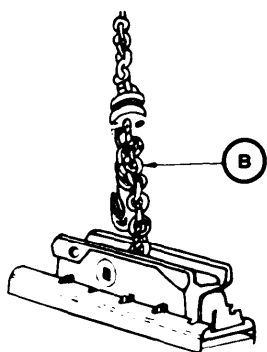
Table 7-5. Application of Materials for Tiedown of 5-Ton Cargo Truck on CONUS G-85 and G-89 Cushioned Rub-Rail Flatcar (Fig 7-4)

Item	No. required	Application
A	as required	Brake-wheel clearance. Maximum clearance required is 6 in. above, in back of, and on both sides of and 4 in. underneath wheel.
B		Brandon double chain tiedown device with ½-in.-dia. Excelloy chain, or similar, proof-tested to 27,500 lb. Locate between the vehicles as shown in figure 7-5. Attach one chain through the front tiedown shackle of one vehicle, and attach the other chain through the tiedown shackle located at the rear of the other vehicle. Substitute, if desired, ½-in.-dia chain with grab hook and turnbuckle equipped with a safety-lock device, proof-tested at a minimum of 22,500 lb. Attach one end of the chain to the rub-rail of the car by hopping the chain through the slots in the rub-rail. Attach the other end of the chain to the vehicles in the same manner as described above (see general instructions).
C	4	<p>Brandon single tiedown device with ½-in.-dia. Excelloy chain, or similar, proof-tested to 27,500 lb. Locate as shown. Attach one chain through the front tiedown shackle on the vehicle facing one end of the car and through the tiedown shackle located at the rear of the vehicle facing the opposite end of the car. Substitute, if desired, ½-in.-dia chain with grab hook and turnbuckle equipped with a safety-lock device, proof-tested at a minimum of 22,500 lb. Attach one end of the chain through the slots in the rub-rail and the other end of the chain to the vehicles in the same manner as described above (see general instructions).</p> <p style="text-align: center;">General Instructions</p> <p>1. Shippers should specify cars equipped with tiedown devices in the quantity required for items B and C. See sketches 1 and 2 of figure 7-4 when ordering specialized freight equipment. In the event that conventional chain tiedowns are supplied in lieu of devices specified, two of the four tiedowns required for each vehicle must have an adjustable turnbuckle equipped with a safety-lock device located in the chain for tensioning purposes (sketch 3 of figure 7-4). The chains must be applied in the following manner:</p> <p style="padding-left: 20px;">a. Attach the two chain tiedowns without the turnbuckle (sketch 4 of figure 7-4) to one end of the vehicle and to the car tiedown facility. Pull as tightly as possible by hand, and attach the hook to the appropriate link of the chain.</p> <p style="padding-left: 20px;">b. Attach the two chains with the adjustable turnbuckles to the opposite end of the vehicle and to the car tiedown facility. All four chain tiedowns should then be made taut by tightening the turnbuckles.</p> <p style="text-align: center;">NOTE</p> <p>Load binders are not to be used in lieu of turnbuckles to tension tiedown chains.</p> <p>2. Vehicles must face in the same direction and be uniformly spaced along the length of the car to allow sufficient space at each end of the car and between the vehicles for securement. Apply tiedowns parallel to each other at the same end of the vehicle and down from the vehicle point of attachment to the tiedown facility. The angle of the tiedown should be as close to 45° as possible.</p> <p>3. Hand brakes on vehicles <i>must not</i> be set when vehicles are shipped on G-85 and G-89 cushioned rub-rail flatcars.</p> <p>4. Gearshift levers for automatic or conventional transmissions must be wire-tied in the neutral position.</p> <p>5. Open hooks must be secured with wire over the opening to prevent the hook from becoming disengaged from the chain link to which it is secured.</p> <p>6. Turnbuckles used to tighten chains must be wired or locked to prevent them from turning during transit unless the turnbuckles are equipped with self-locking devices.</p> <p>7. When conventional chains are tensioned, care should be taken to avoid tensioning to such an extent that the rub-rail may start to rise. Brandon, or similar, tiedown devices, when attached to the vehicle tiedown shackles, should not be tensioned beyond the point where the springs of the vehicle start to compress. After chains are tightened, they should be struck with a hammer or bar to eliminate any possible</p>

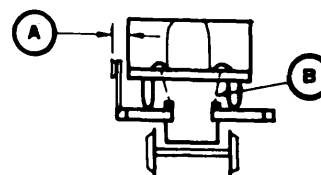
Item	No. required	Application
		<p>misalignment of links. Further tightening may be required to take up any slack that develops due to link alignment.</p> <p>8. Brandon tiedown devices are not to be attached to the slots in the cushioned rub-rail adjacent to the position of the recessed trailer hitches. This is to preclude the flange edge of the device, which rests over the inner side of the car's center sill, from coming in contact with any portion of the trailer hitch when in recessed position and thereby restricting the action of the cushioned rub-rail. When placement of vehicles on cars determines that securement points to the car would fall in this area, conventional chain tiedowns (with or without turnbuckles) attached through the rub-rail slots will be used instead of Brandon devices.</p> <p>9. Method of loading as shown is applicable to vehicles weighing up to 25,000 lb. Two vehicles can be loaded on an 85-foot or longer cushioned rub-rail equipped, or similar, railroad car with center sill tiedown positions running the entire length of the car.</p>



SIDE VIEW



REAR VIEW



FRONT VIEW

Figure 7-5. Tiedown diagram for 5-ton cargo truck on CONUS, ATTX, ITTX, HTTX, TTDX, or similar-type flatcars equipped with center tiedown rails running entire length of car.

Table 7-6. Application of Materials for Tiedown of 5-Ton Cargo Truck on CONUS ATTX, ITTX, HTTX, TTDX, or Similar-Type Flatcar Equipped With Center Tiedown Rails Running Entire Length of Car (Fig 7-5)

Item	No. required	Application
A	4 ea. unit	Brake wheel clearance. Minimum clearance required is 6 in. above, in back of, and on both sides of and 4 in. underneath wheel.
B		Steel chain, ½-in. dia, alloy, proof-tested at a minimum of 27,500 lb. General Instructions 1. Shippers should specify cars equipped with tiedown devices in the quantity shown in item B when ordering specialized railway equipment. When carrier furnishes cars that do not have built-in chains and tensioning devices, chains and turnbuckles of appropriate size and strength will be used in lieu thereof for securement of vehicles. Load binders are not to be used in lieu of turnbuckles to tension tiedown chains. 2. Vehicles must face in the same direction and be uniformly spaced along the length of the car to allow sufficient space at each end of the car and between the vehicles for securement. Apply tiedowns parallel to each other at the same end of the vehicle tiedown point to the car tiedown facility. The angle of the tiedown must be as close to 45° as possible. 3. Hand brakes <i>must</i> be set on all vehicles. 4. Gearshift levers on vehicles equipped with automatic or standard transmission must be wire-tied in the neutral position. 5. Open hooks must be secured with wire over the opening to prevent the hook from becoming disengaged from chain link to which it is secured. 6. Turnbuckles used to tighten chains must be wired to prevent them from turning during transit, unless the turnbuckles are equipped with self-locking devices.

Section III. TRANSPORT ON FOREIGN RAILWAYS

7-11. General

The transportability guidance contained in this section is applicable when the items are transported on foreign railways. Consideration is given to single and multiple vehicle movements on the types of railcars normally used for the movement of these types of items. The items, when loaded on a suitable railcar, can be transported in their reduced height configuration without restrictions within European countries complying with the International Loading Gauge (formerly Berne International), the majority of the countries in the Middle East and South America, Australia, India, and Pakistan. In the Middle East and South America, the clearances vary by country, and each country will require a separate check. In Australia, India, and Pakistan, wide- or broad-gauge railways provide adequate clearances. Be-

cause of the various designation systems used by different countries, foreign railcars are not easily classified. In addition, clearances vary, in many cases, from one country to the next and within one country; consequently, evaluation of transportability capability must be made on an individual basis.

7-12. Transport on US Army Foreign-Service Flatcars

a. General. The items can be transported on a number of US Army-owned foreign-service flatcars. These flatcars are exclusively for the transport of US military material. Table 7-5 represents a few of the flatcars available in Europe which are suitable for transportation of the LCSS.

Table 7-5. Characteristics of European Flatcars Available for Transporting Items

Flatcar Designation	Capacity	Length	Width	Platform Height*
FF	50-ton (45.36 MTon)	40-ft. 9-in. (12.42 m)	8-ft. 7 1/8-in. (2.62 m)	4-ft. 1 1/8-in. (1.25 m)
SSY	55-ton (49.90 MTon)	31-ft. 2-in. (9.50 m)	10-ft. 4-in. (3.15 m)	4-ft. 2 3/4-in. (1.29 m)
SSYS	66-ton (59.88 MTon)	31-ft. 2-in. (9.50 m)	10-ft. 4-in. (3.15 m)	4-ft. 2 3/4-in. (1.29 m)
SSYM	88-ton (79.83 MTon)	39-ft. ½-in. (11.90 m)	10-ft. 4-in. (3.15 m)	4-ft. 3 ½-in. (1.31 m)
FFLM	90-ton (81.65 MTon)	46-ft. 8-in. (14.42 m)	10-ft. 3-in. (3.12 m)	4-ft. 2 3/4-in. (1.29 m)

*Above top of rail.

b. Materials. The materials required for blocking and tiedown of the items on US Army foreign

service flatcars are essentially the same as those used for transporting the items within CONUS.

APPENDIX

REFERENCES

1. Army Field Manuals (FM)

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

2. Army Regulations (AR)

AR 70-39	Criteria for Air Transport and Airdrop of Material
AR 385-40	Accident Reporting and Records
AR 746-1	Color, Marking, and Preparation of Equipment for Shipment

3. Army Supply Bulletins (SB)

SB 700-20	Army Adopted Items of Materiel
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4. Army Technical Manuals (TM)

TM 5-6115-274-12	Organizational Maintenance Manual Generator Set, Diesel Engine, 45KW, 120/208, 240/416V, 3 phase, 400 cycle; Skid Mounted (Stewart & Stevenson Model 52300) FSN 6115-475-6573
TM 9-2320-211-10	Operator's Manual for 5-Ton, 6x6, Truck Chassis: M39, M40, M40C, M61, M61A2, M63, M63A2, M63C, M139, M139D, M139F; Truck Cargo: M41, M54, M54A1, M54A2, M55, M55A2; Truck Tractor: Wrecker: M246; Truck, Van, Expansible, M291A2, M291A2C; Truck, Wrecker, Medium, M62, M543, M543A2 (T.O. 36A-1-1131) changes 2-5-7-8
TM 9-1425-550-10	Operator's Manual: Index of Units Under Test, Tested and Repaired by LCSS (Land Combat Support System)
TM 94935-552-14/1	Operator, Organizational, DS and GS Maintenance Manual: Description for Guided Missile System Test Station AN/TSM-93 (XO-1) (Land Combat Support System)
TM 9-4935-554-14	Operator, Organizational, DS and GS Maintenance Manual: Guided Missile System Shop Equipment AN/TSM-94 (XO-1) (Land Combat Support System)
TM 55-405-9	Weight and Balance
TM 55-450-10/1	Air Transport of Supplies and Equipment Standard Loads in US Air Force C-130 Airplane
AFM 76-3	
TM 55-450-15	Air Movement of Troops and Equipment (Administrative)
TM 55-500	Marine Equipment Characteristics and Data
TM 55-513	Military Stevedoring
TM 55-2320-211-10-2	Transportability Guidance, Truck, Cargo, 5-Ton, 6x6, M55 and M55A2
TM 57-210	Air Movement of Troops and Equipment

5. Air Force Manuals

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

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

6. Other Publications and Source of Procurement

Association of American Railroads Rules Governing the Loading of Commodities on Open Top Cars
Section No. 1—General Rules

Section No. 6 - Rules Governing the Loading of Department of Defense Material
Mr. E. T. Zasadil, Secretary
The Association of American Railroads
59 East Van Buren Street
Chicago, Illinois 60605

By Order of the Secretary of the Army:

Official:

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*Major General, United States Army,
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