

TECHNICAL MANUAL

TRANSPORTABILITY GUIDANCE

TRACTOR, FULL-TRACKED, LOW-SPEED

DIESEL-ENGINE-DRIVEN, MEDIUM DRAWBAR PULL,

CATERPILLAR MODEL D7G

W/WINCH (NSN 2410-01-223-7261)

W/RIPPER (NSN 2410-01-223-0350)

CATERPILLAR MODEL D7F

W/WINCH, WO/ROPS (NSN 2410-00-177-7284)

W/WINCH AND ROPS (NSN 2410-00-185-9792)

W/RIPPER, WO/ROPS (NSN 2410-00-177-7283)

W/RIPPER AND ROPS (NSN 2410-00-185-9794)

CATERPILLAR MODEL D7E

W/WINCH, WO/ROPS (NSN 2410-00-782-1130)

W/WINCH AND ROPS (NSN 2410-01-050-9628)

W/RIPPER, WO/ROPS (NSN 2410-00-926-3697)

W/RIPPER AND ROPS (NSN 2410-01-050-9629)

Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY

5 OCTOBER 1990

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w/Ripper (NSN 2410-01-223-0350)**

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w/Winch, wo/ROPS (NSN 2410-00-177-7284)
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w/Ripper, wo/ROPS (NSN 2410-00-177-7283)
w/Ripper and ROPS (NSN 2410-00-185-9794)**

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CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

This manual provides transportability guidance for logistical handling and movement of the Caterpillar D7E, D7F, and D7G crawler tractors. It contains information appropriate for safely transporting the tractor. It also includes significant physical characteristics as well as safety considerations required for worldwide movement by the various transportation modes. Where considered necessary, metric equivalents appear in parentheses following the dimensions or other measurements. This manual is for transportation officers and other personnel responsible for movement or for providing transportation services.

1-2. Safety

Chapter 3 contains appropriate precautionary measures required during movement of the tractor.

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

1-4. Reporting of Recommendations and Comments

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

CHAPTER 2

TRANSPORTABILITY DATA

Section I. GENERAL

2-1. Scope

This chapter provides a general description and identification photographs of the D7 tractors as well as transportability data necessary in moving the tractors.

2-2. Description

The D7 tractor is a commercial, track-type tractor modified for the US Army. It is diesel-engine-driven, has a rollover protection system (ROPS) canopy, and has a straight blade. It also has either a rear-mounted towing winch or a ripper. However, the ripper and winch are not interchangeable. The ripper can be mounted only on D7 tractors equipped with ripper mounting devices; the winch can be mounted only on D7 tractors equipped for a winch. Figures 2-

1 and 2-2 show the D7G with ripper and the D7G with winch, respectively. The D7E and D7F model tractors are similar in appearance to the D7G.

2-3. Transportability Drawings

Figures 2-3 through 2-6 are detailed side- and end-elevation transportability drawings of the D7G with ripper and the D7G with winch. These drawings show dimensions and lifting and tiedown provision locations with load rating capacities. The D7E and F models have similar features except the weights and dimensions vary as shown in table 2-1. Also, the D7E and F models have one extra tiedown provision on the track roller frame. The provision is located between the other two multipurpose provisions on each side.

Section II. CHARACTERISTICS AND RELATED DATA

2-4. General Transportability Characteristics

The data in this manual apply to the model number or national stock number (NSN) shown. Changes in model number or NSN may affect the loadability of the item as related to the guidance in this manual. Dimensions and weights are given for both operational and reduced configurations. The reduced D7 configuration consists of removing the ROPS, exhaust stack, precleaner, blade, and winch or ripper. Figures 2-7 through 2-11 show the removable items.

2-5. Unusual Characteristics

This tractor has no unusual characteristics that would

require special attention be given to temperature, atmospheric pressure, or humidity variations during exposure to normal transportation environments.

2-6. Hazardous and Dangerous Characteristics

The D7 crawler tractors will not present any special hazardous characteristics during exposure to normal transportation environments.

NOTE

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

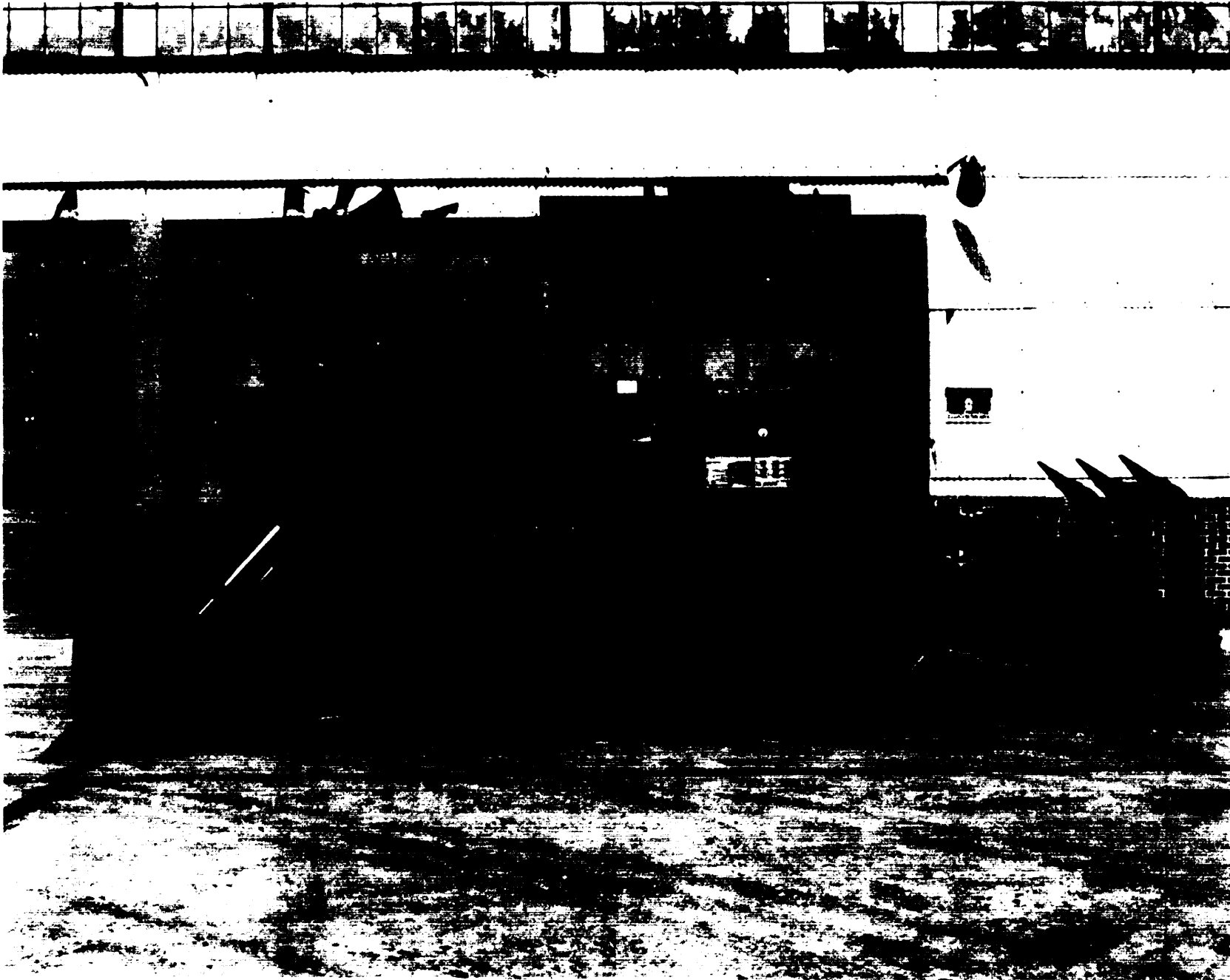


Figure 2-1. D7G crawler tractor with ripper.

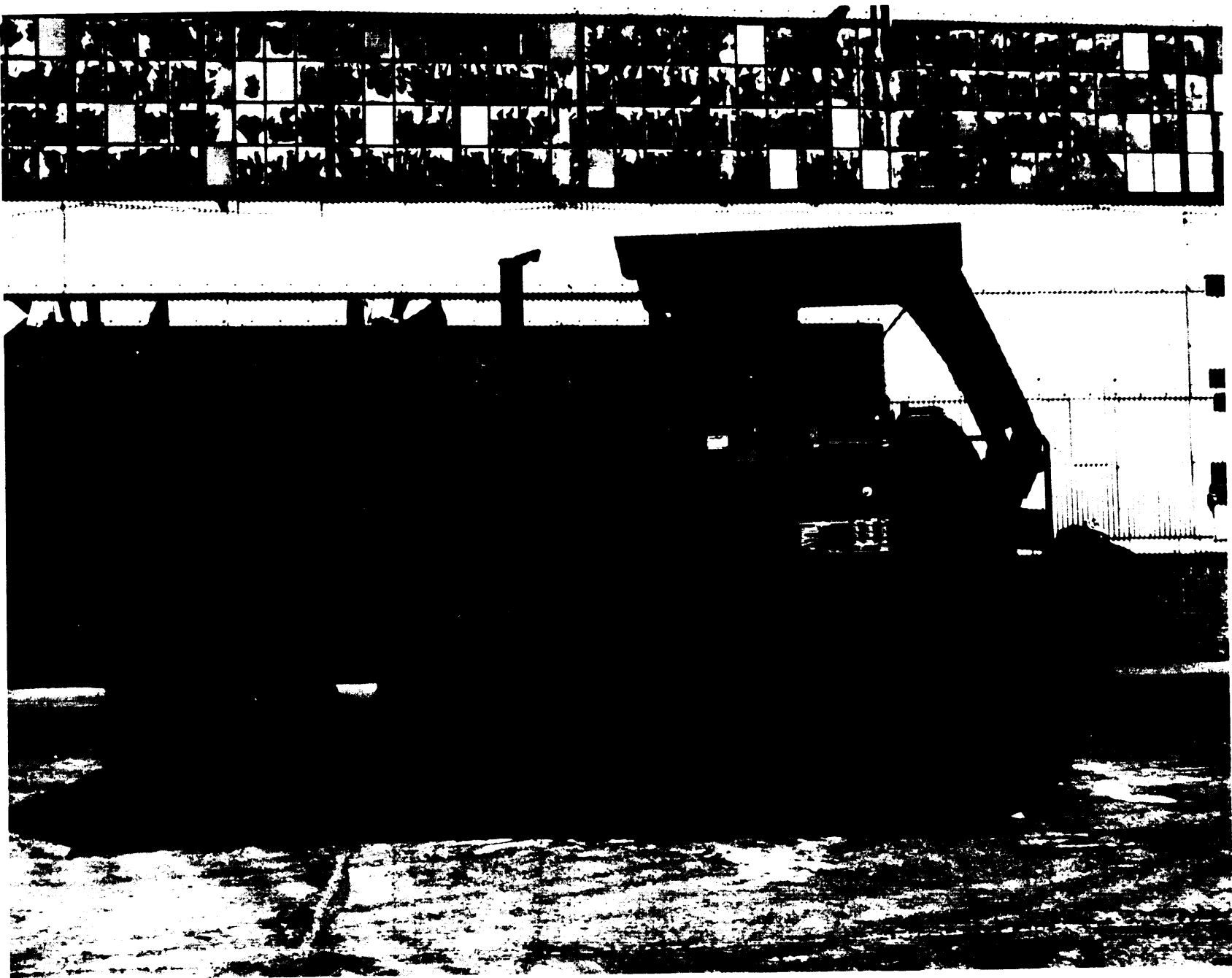
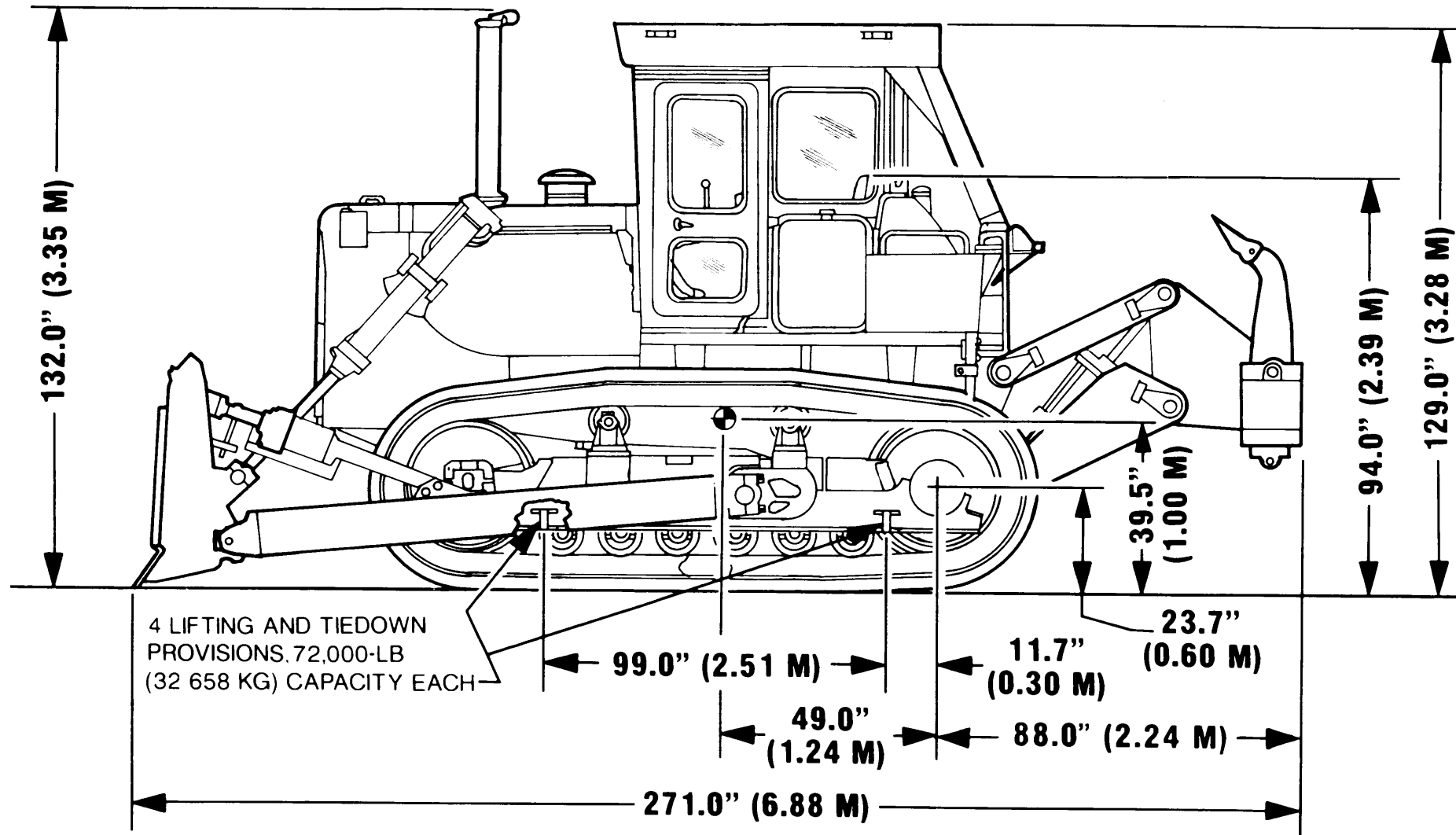


Figure 2-2. D7G crawler tractor with winch.



RIPPER MACHINE
 OPERATING WEIGHT
 W/CAB 53,330 LB (24 190 KG)
 W/CANOPY 52,450 LB (23 791 KG)

Figure 2-3. Side view of D7G crawler tractor with ripper.

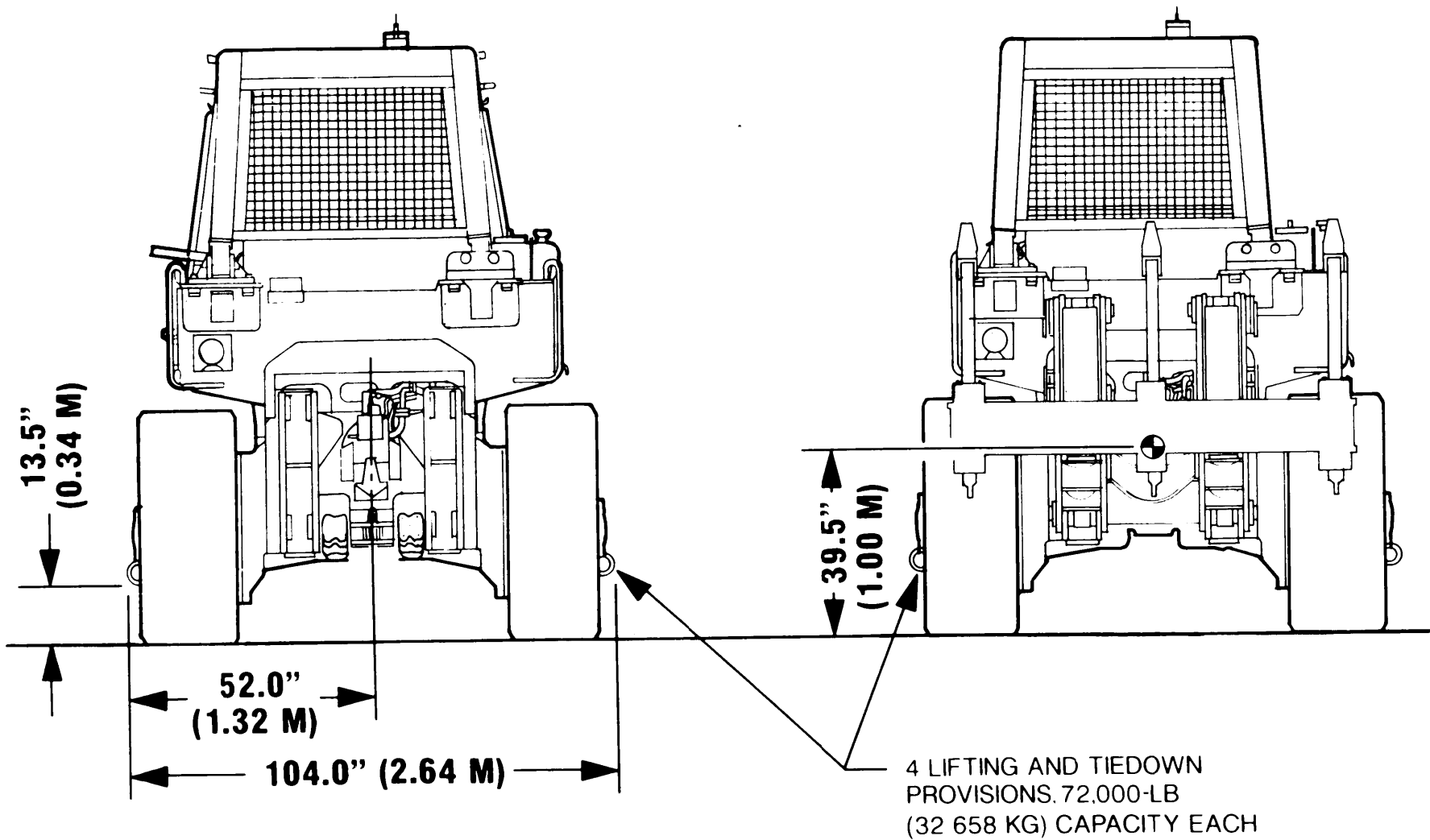


Figure 2-4. Rear view of D7G crawler tractor with ripper.

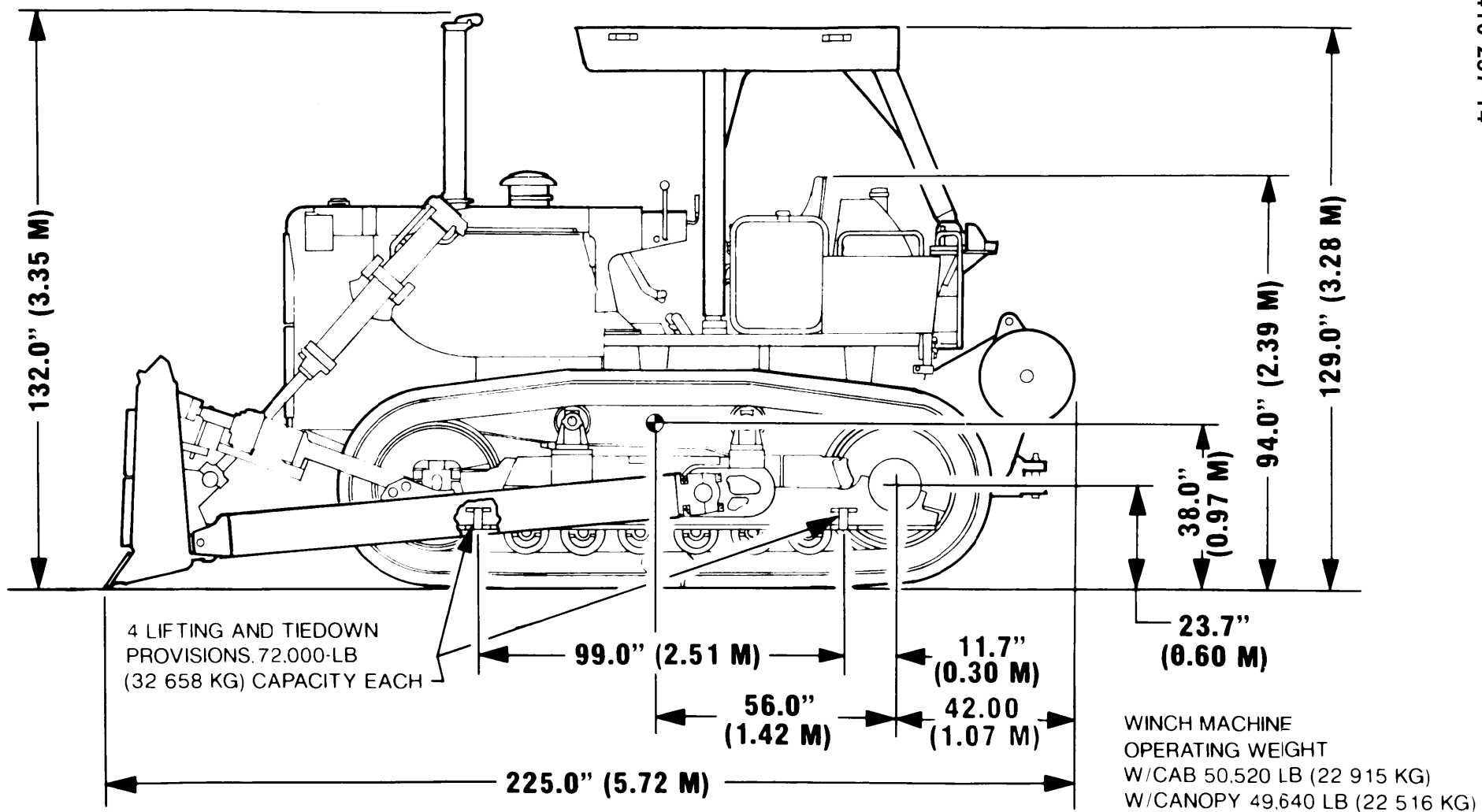


Figure 2-5. Side view of D7G crawler tractor with winch.

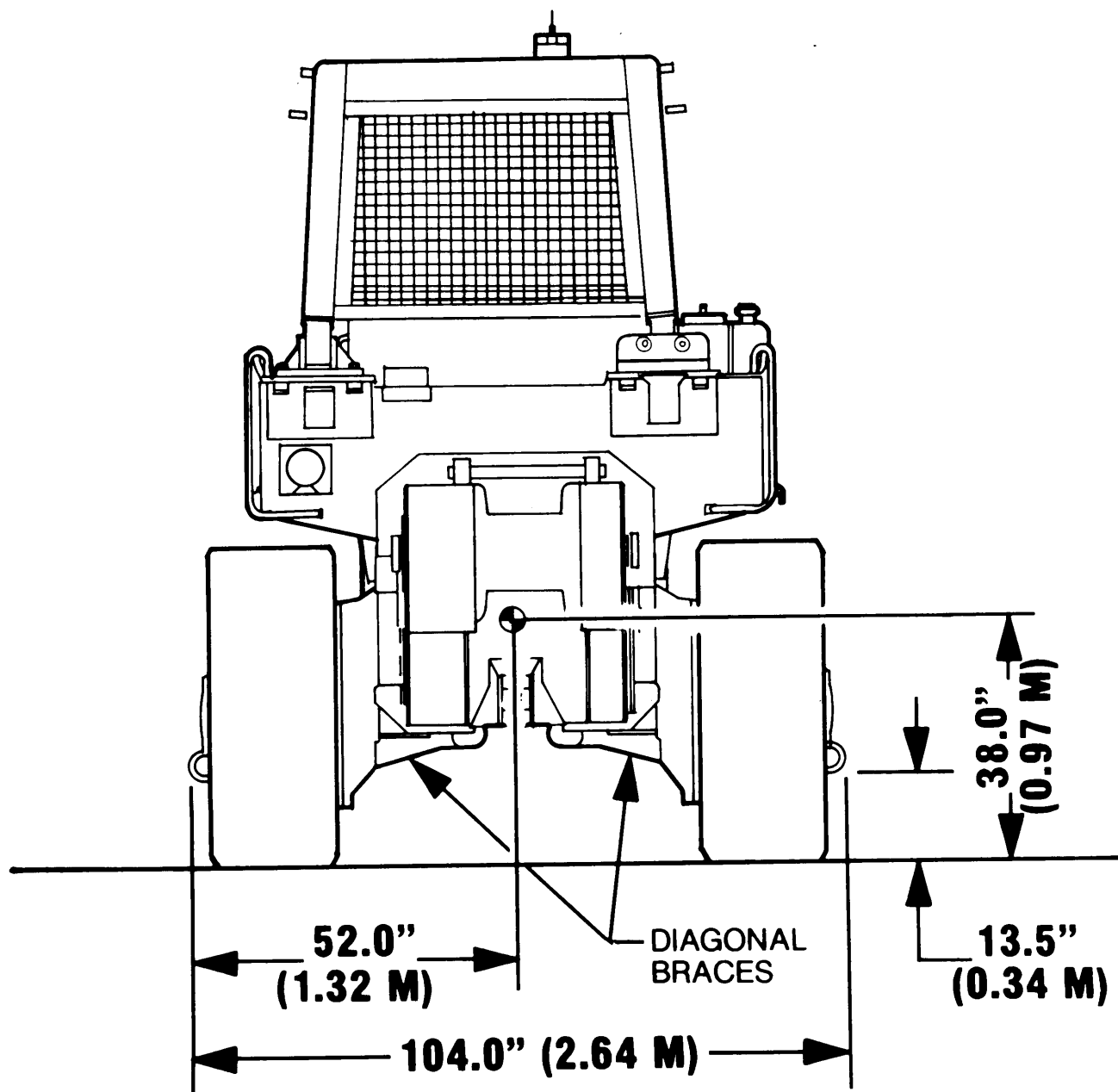


Figure 2-6. Rear view of D7G crawler tractor with winch.

Table 2-1. D7 Weight and Dimensional Characteristics and Related Data.

OPERATIONAL = D7G, D7F WITH ROPS CANOPY **D7E W/O ROPS**

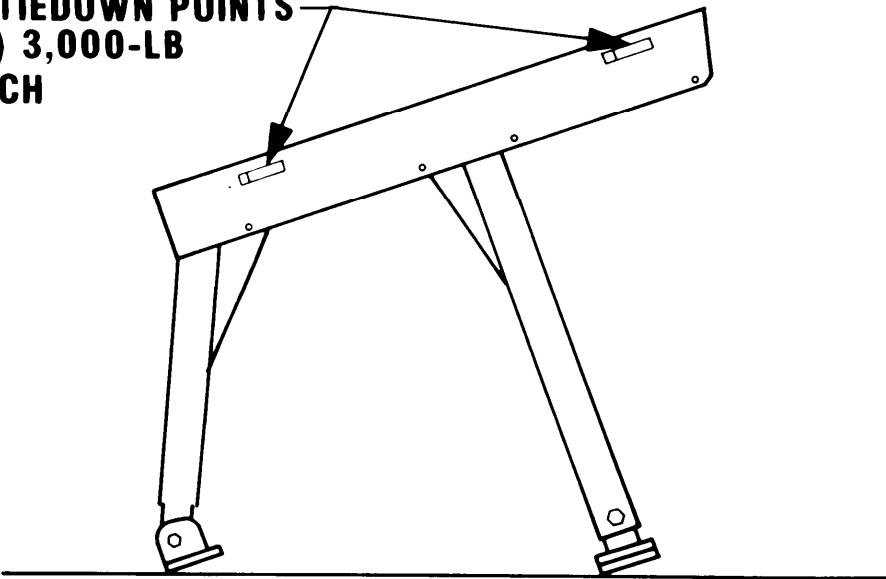
TM 55-2410-237-14

	D7G		D7F		D7E	
	w/Winch	w/Ripper	w/Winch	w/Ripper	w/o ROPS w/Winch	w/o ROPS w/Ripper
National Stock Number W/ROPS	2410-01-223-7261	2410-01-223-0350	2410-00-177-7284 2410-00-185-9792	2410-00-177-7283 2410-00-185-9794	2410-00-782-1130 2410-01-050-9628	2410-00-926-3697 2410-01-050-9629
Line Item Number	W76816	W83529	W76816	W83529	W76816	W83529
Dimensions & Shipping Data						
Length: Operational	225.0 ln (5.72 m)	271.0 ln (6.88 m)	232.0 ln (5.89 m)	287.0 ln (7.29 m)	230.0 ln (5.84 m)	284.0 ln (7.21 m)
Reduced	173.4 ln (4.40 m)	173.4 ln (4.40 m)	172.1 ln (4.37 m)	172.1 ln (4.37 m)	174.1 ln (4.42 m)	174.1 ln (4.42 m)
Width: Operational	144.0 ln (3.66 m)	144.0 ln (3.66 m)	133.0 ln (3.38 m)	133.0 ln (3.38 m)	133.0 ln (3.38 m)	133.0 ln (3.38 m)
Reduced	104.0 ln (2.64 m)	104.0 ln (2.64 m)	104.0 ln (2.64 m)	104.0 ln (2.64 m)	104.0 ln (2.64 m)	104.0 ln (2.64 m)
*Height: Operational	132.0 ln (3.35 m)	132.0 ln (3.35 m)	131.0 ln (3.33 m)	131.0 ln (3.33 m)	120.0 ln (3.05 m)	120.0 ln (3.05 m)
Reduced	94.0 ln (2.39 m)	94.0 ln (2.39 m)	93.0 ln (2.36 m)	93.0 ln (2.36 m)	98.7 ln (2.51 m)	98.7 ln (2.51 m)
Weight: Operational	49,640 lb (22,537 kg)	52,450 lb (23,812 kg)	49,770 lb (22,623 kg)	55,415 lb (25,189 kg)	49,290 lb (22,404 kg)	53,090 lb (24,131 kg)
Reduced	37,256 lb (16,914 kg)	38,196 lb (17,341 kg)	37,474 lb (17,034 kg)	39,552 lb (17,978 kg)	38,845 lb (17,657 kg)	39,078 lb (17,763 kg)
Ground Pressure:						
Operational	254.1 psi (1753 kPa)	268.5 psi (1853 kPa)	229.9 psi (1584 kPa)	256.0 psi (1764 kPa)	227.7 psi (1569 kPa)	245.2 lb (1689 kPa)
Reduced	190.7 psi (1316 kPa)	195.5 psi (1349 kPa)	173.1 psi (1193 kPa)	182.7 psi (1259 kPa)	179.4 psi (1236 kPa)	180.5 lb (1244 kPa)
Ground Contact Area (Grouser Tips Only)	195.4 sq ln (.126 sq m)	195.4 sq ln (.126 sq m)	216.5 sq ln (.14 sq m)	216.5 psi (.14 sq m)	216.5 psi (.14 sq m)	216.5 psi (.14 sq m)
Track Type	Metal Grousers	Metal Grousers	Metal Grousers	Metal Grousers	Metal Grousers	Metal Grousers
Width	20.0 ln (0.51 m)	20.0 ln (0.51 m)	22.0 ln (0.56 m)	22.0 ln (0.56 m)	22.0 ln (0.56 m)	22.0 ln (0.56 m)

Table 2-1. Continued.

	D7G		D7F		D7E	
	w/Winch	w/Ripper	w/Winch	w/Ripper	w/o ROPS w/Winch	w/o ROPS w/Ripper
Performance						
Maximum Speed (Forward)	6.2 mph (9.98 kph)	6.2 mph (9.98 kph)	6.0 mph (9.66 kph)	6.0 mph (9.66 kph)	6.0 mph (9.66 kph)	6.0 mph (9.66 kph)
Maximum Speed (Reverse)	7.4 mph (11.91 kph)	7.4 mph (11.91 kph)	6.6 mph (10.63 kph)	6.6 mph (10.63 kph)	7.0 mph (11.27 kph)	7.0 mph (11.27 kph)
Maximum Grade	60% (30.97 deg)	60% (30.97 deg)	60% (30.97 deg)	60% (30.97 deg)	60% (30.97 deg)	60% (30.97 deg)
Maximum Side Slope	35% (19.28 deg)	35% (19.28 deg)	35% (19.28 deg)	35% (19.28 deg)	35% (19.28 deg)	35% (19.28 deg)
 Fuel Tank Capacity	115 gal (436 L)	115 gal (436 L)	115 gal (436 L)	115 gal (436 L)	115 gal (436 L)	115 gal (436 L)
Fuel Type	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Minimum Ground Clearance (From Grouser Tip)	16.5 in (0.42 m)	16.5 in (0.42 m)	16.1 in (0.41 m)	16.1 in (0.41 m)	16.8 in (0.43 m)	16.8 in (0.43 m)
Width Between Tracks	58.0 in (1.47 m)	58.0 in (1.47 m)	56.0 in (1.42 m)	56.0 in (1.42 m)	56.0 in (1.42 m)	56.0 in (1.42 m)
Cube: Operational	2475 cu ft (69.30 cu m)	2981 cu ft (83.47 cu m)	2339 cu ft (66.29 cu m)	2894 cu ft (82.05 cu m)	2124 cu ft (60.15 cu m)	2623 cu ft (74.28 cu m)
Reduced	981 cu ft (27.48 cu m)	981 cu ft (27.48 cu m)	963 cu ft (27.23 cu m)	963 cu ft (27.23 cu m)	1034 cu ft (29.28 cu m)	1034 cu ft (29.28 cu m)
Center of Gravity:						
Above Ground	38.0 in (0.97 m)	39.5 in (1.00 m)	36.1 in (0.92 m)	36.0 in (0.91 m)	33.0 in (0.84 m)	33.0 in (0.84 m)
Forward from Center of Rear Drive Sprocket	56.0 in (1.42 m)	49.0 in (1.24 m)	59.7 in (1.52 m)	48.7 in (1.24 m)	60.8 in (1.54 m)	56.8 in (1.44 m)
Military Load Classification w/ROPS	C26	C29	C24	C34	C27	C27
Component and Weights Removed for C130 Trans.	As Required	As Required	As Required	As Required	As Required	As Required
Components and Weights Removed for Rail Transport	As Required	As Required	As Required	As Required	As Required	As Required
Components and Weights Removed for Highway Trans.	As Required By	Transporter	As Required By	Transporter	As Required By	Transporter

**LIFTING AND TIEDOWN POINTS
(2 EACH SIDE) 3,000-LB
CAPACITY EACH**

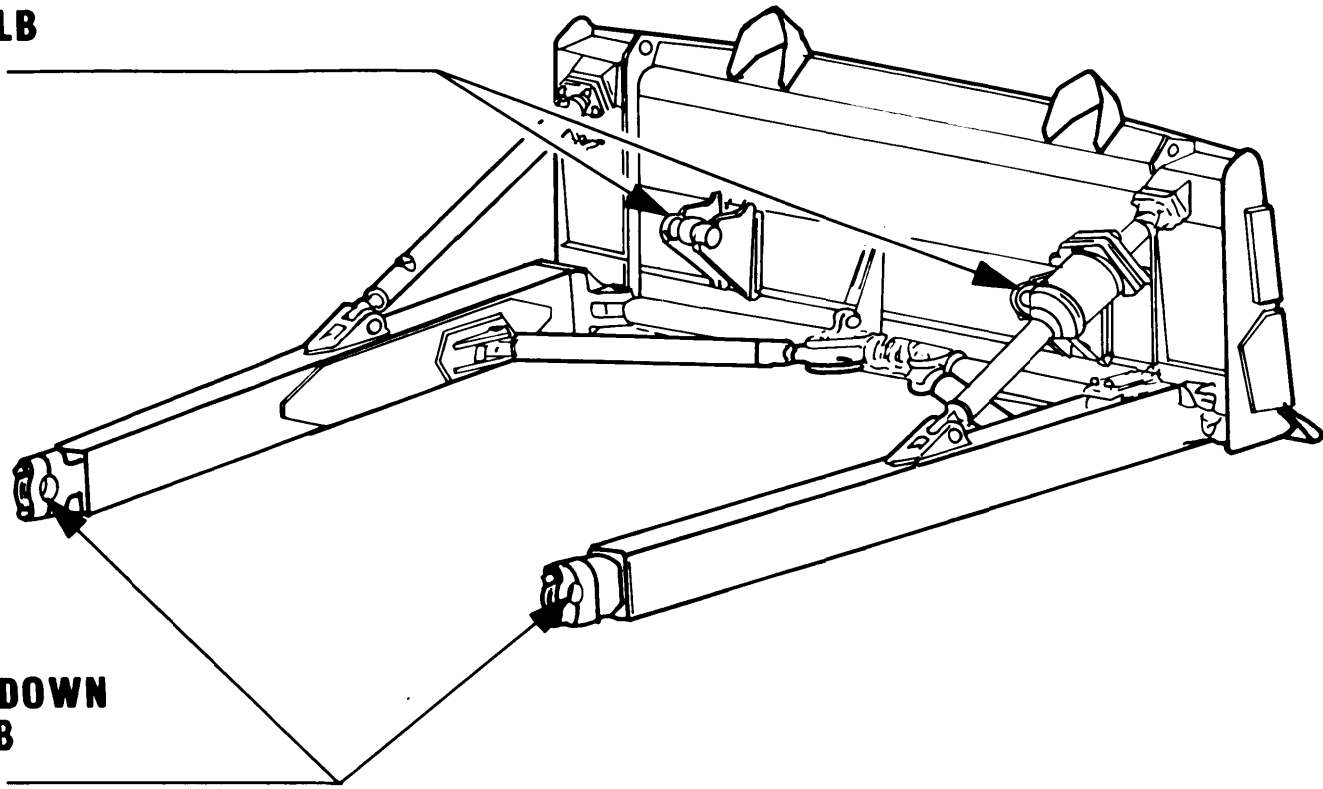


ROPS/FOPS PROTECTIVE CANOPY-DIMENSIONS			
D7G ONLY		D7F ONLY	
WEIGHT	1,740 LB	WEIGHT	1,850 LB
LENGTH	71.50 IN.	LENGTH	79.38 IN.
WIDTH	82.50 IN.	WIDTH	82.50 IN. ACROSS ROPS MTG BRACKETS
HEIGHT	78.00 IN.	HEIGHT	69.50 IN.

DISASSEMBLY TIME - 9 MIN.
REASSEMBLY TIME - 16 MIN.
(2 PERSONS, STANDARD SHOP TOOLS)

Figure 2-7. D7 crawler tractor ROPS/FOPS Protective Canopy.

**LIFTING AND TIEDOWN
POINTS 10,500-LB
CAPACITY EACH**



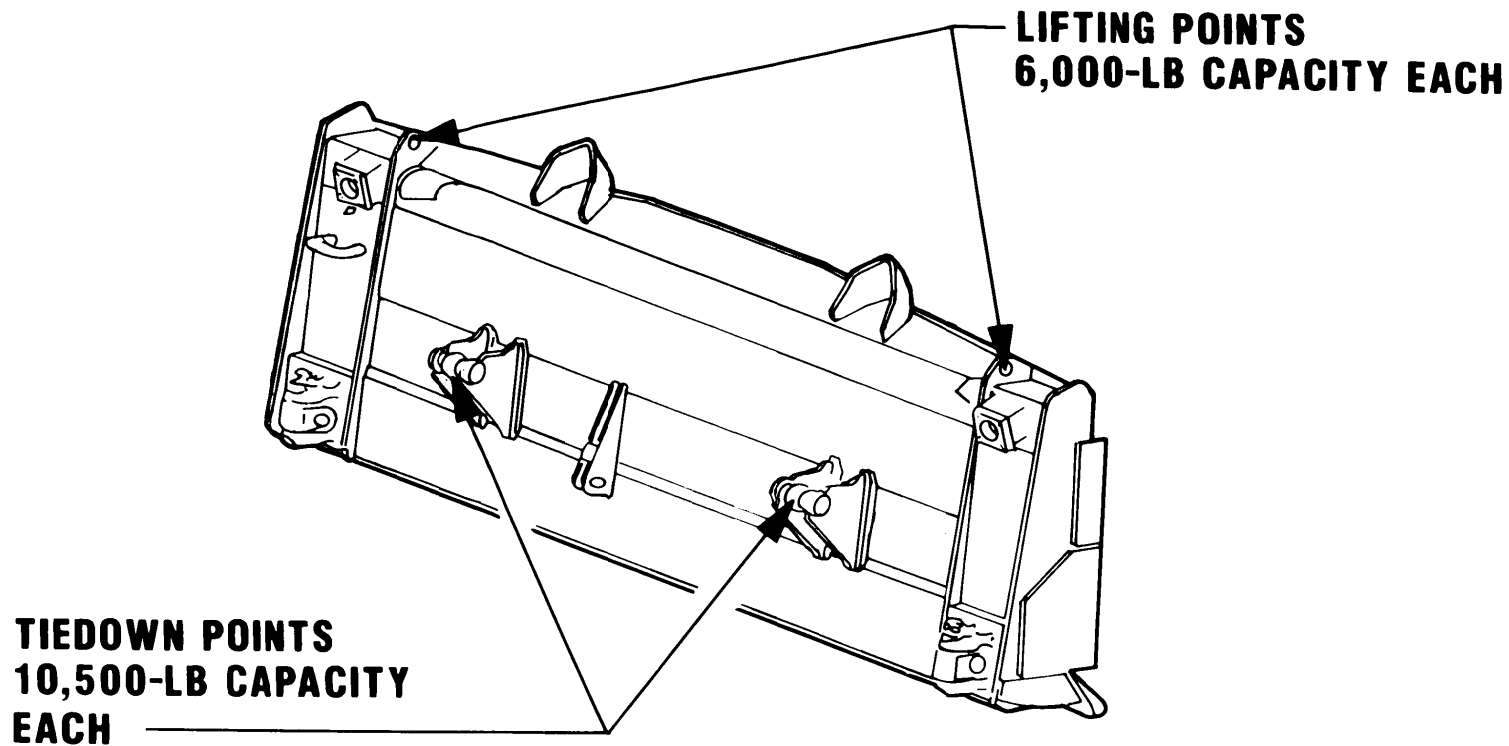
**LIFTING AND TIEDOWN
POINTS 9,500-LB
CAPACITY EACH**

DISASSEMBLY TIME - 33 MIN.
REASSEMBLY TIME - 36 MIN.
(2 PERSONS, STANDARD SHOP TOOLS)

BULLDOZER BLADE - DIMENSIONS			
D7G ONLY		D7E AND F ONLY	
WEIGHT	6,266 LB	WEIGHT	6,617 LB
LENGTH	146.00 IN.	LENGTH	149.84 IN.
WIDTH	144.00 IN.	WIDTH	133.38 IN.
HEIGHT	53.12 IN.	HEIGHT	47.32 IN.

D7G - END BITS MAY BE TURNED UP TO REDUCE WIDTH TO 134.00 IN.

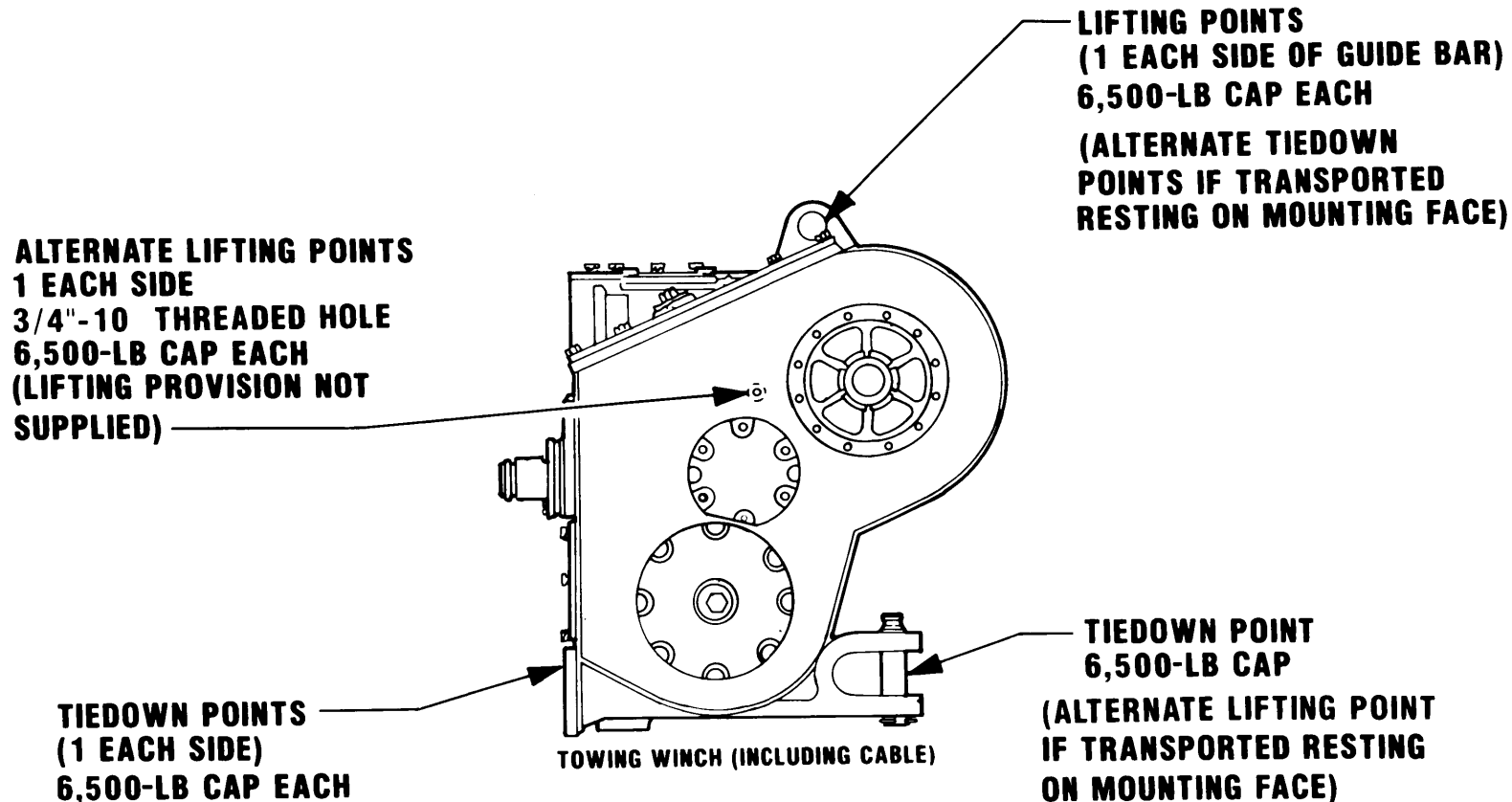
Figure 2-8. D7 bulldozer blade-hydraulically operated-including blade, push arms, braces, and tilt cylinder.



BULLDOZER BLADE	
DIMENSIONS	
WEIGHT	3.582 LB
LENGTH	144.00 IN.
WIDTH	25.63 IN.
HEIGHT	53.13 IN.

NOTE: REFER TO PUSH ARM, BRACES, TILT CYLINDERS
FIGURES FOR DISASSEMBLY AND REASSEMBLY TIME.

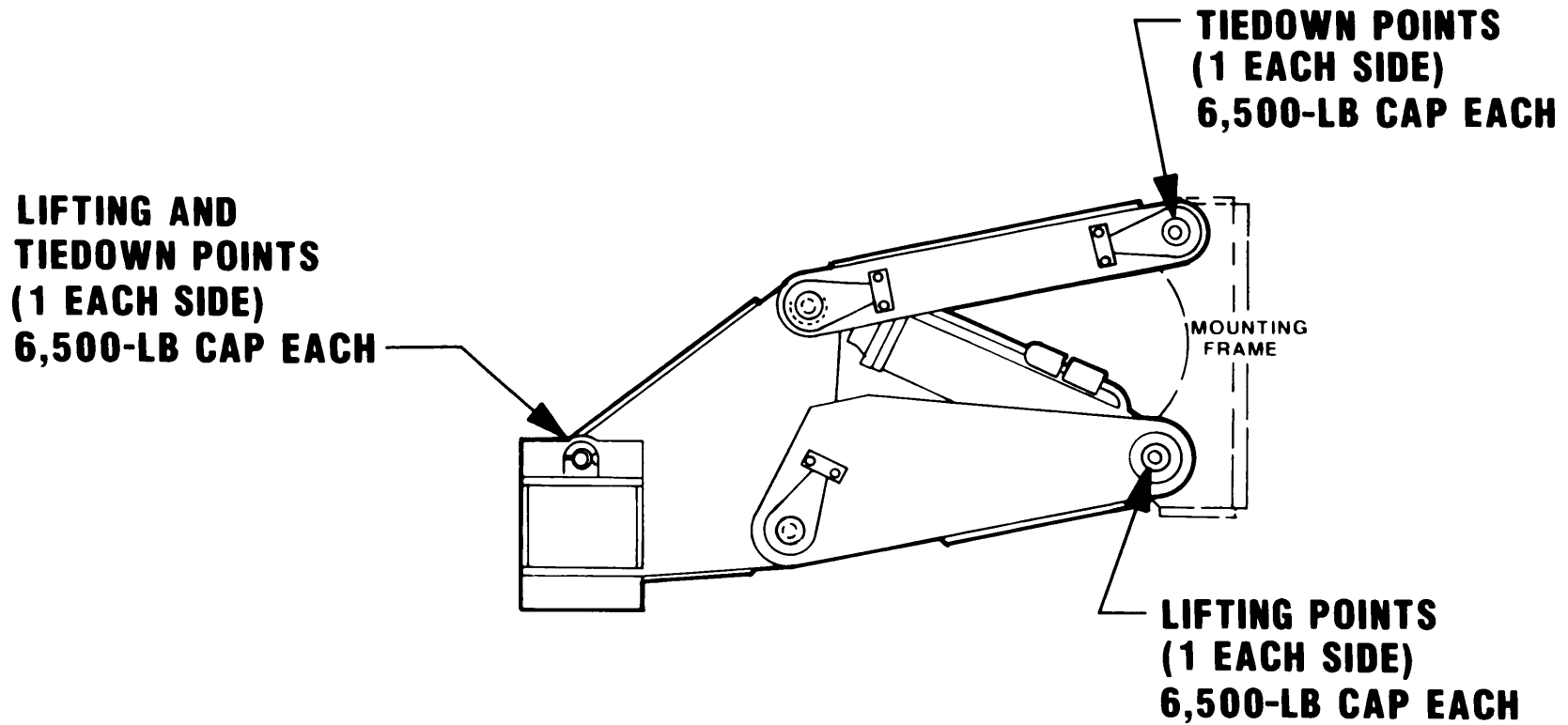
Figure 2-9. D7 bulldozer blade.



TOWING WINCH - DIMENSIONS			
D7F AND D7E		D7G	
WEIGHT	3.080 LB	WEIGHT	3.600 LB
LENGTH	38.375 IN.	LENGTH	38.375 IN.
WIDTH	44.875 IN.	WIDTH	44.875 IN.
HEIGHT	43.125 IN.	HEIGHT	43.125 IN.

DISASSEMBLY TIME - 33 MIN.
 REASSEMBLY TIME - 53 MIN.
 (2 PERSONS, STANDARD SHOP TOOLS)

Figure 2-10. D7 towing winch.



CARRIER BEAM ASSEMBLY - RIPPER DIMENSIONS			
D7E AND D7F ONLY		D7G ONLY	
WEIGHT	5.579 LB	WEIGHT	4.540 LB
LENGTH	108.65 IN.	LENGTH	74.90 IN.
WIDTH	87.00 IN.	WIDTH	87.00 IN.
HEIGHT	38.75 IN.	HEIGHT	38.75 IN.

DISASSEMBLY TIME - 1 HOUR, 3 MINUTES
 REASSEMBLY TIME - 1 HOUR, 25 MINUTES
 (2 PERSONS, STANDARD SHOP TOOLS)

Figure 2-11. D7 carrier beam assembly-ripper including carrier beam, linkage, and hydraulic cylinders.

CHAPTER 3

SAFETY

3-1. General

General safety considerations and precautions for movement are as follows:

- a.* Ensure all loose items are properly secured on each tractor.
- b.* When backing a tractor, ensure no personnel or obstacles are in danger of being hurt or damaged by the tractor.
- c.* Providing protection on all transporter decks to prevent the tractor grousers from damaging the floor during loading/unloading operations.
- d.* Be careful when loading/unloading the tractor onto a transporter via a metal ramp that is slippery due to dampness or mud.

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 vehicle engine is in use. Prolonged inhalation of carbon monoxide fumes will produce adverse affects that could prove fatal.

3-2. Specific Safety Requirements

Pertinent safety requirements by individual mode are in the appropriate chapters of this manual.

CHAPTER 4

AIR TRANSPORTABILITY GUIDANCE

4-1. Scope

This chapter provides air transportability guidance for moving the Caterpillar D7 crawler tractors. It covers significant safety considerations and prescribes the materials required to prepare, load, and tie down the tractor on, or unload the tractor from, US Air Force aircraft.

4-2. Maximum Utilization of Aircraft

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

4-3. Applicability

The D7 tractors are transportable in C-130, C-141, and C-5 aircraft. Procedures in this manual and those prescribed in TO 1C-130A-9, TO 1C-141A-9, and TO 1C-5A-9 apply.

4-4. Safety

In addition to the safety precautions in chapter 3, note the following instructions:

- a. The activity offering the equipment for air transport must notify the aircraft commander, or designated representative, when hazardous materials are to be transported. It must also state whether these materials have been prepared for shipment according to TM 38-250/AFR 71-4.
- b. Ensure the tractor fuel tank is no more than one-half full.
- c. Tie down the tractor according to procedures in TO 1C-XXX-9.
- d. Check each tractor carefully to ensure that all loose items are properly stowed and secured.
- e. Transport the tractor aboard C-130 and C-141 aircraft in the reduced configuration (remove blade, ripper or winch, ROPS, and exhaust stack).
- f. Use rolling and parking shoring aboard all aircraft.
- g. Park the tractor between fuselage stations 337 and 682 on C-130 aircraft.
- h. Straight-in load the tractor aboard C-141 aircraft.
- i. Adequately restrain the tractor and all accompanying loads. The tractor restraint system must withstand loadings of 3g forward, 2g vertically up, 4.5g vertically down, and 1.5g aft and lateral.

WARNING

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

WARNING

Proper ventilation must be provided during loading and unloading operations. Prolonged exposure to carbon monoxide fumes could be fatal.

WARNING

On C-130 aircraft, the width of the tractor may not allow for a proper safety aisle for passengers, in which case passengers would be limited to mission essential personnel only.

CAUTION

The tractor must not exceed 3 mph inside the aircraft or on the loading ramp.

CAUTION

The clearance between the dual rails on the C-130 is critical and will require careful maneuvering or building the shoring above the rails.

4-5. Preparation of the Vehicle

- a. Inspect the D7 tractor for leaks, damage, and operation; repair as required.
- b. Fabricate and place shoring.
- c. Reduce crawler (required for C-130 and C-141 transport) by removing blade, ripper or winch, ROPS, and exhaust stack.
- d. Palletize removed items.

NOTE

The tractor must be loaded onto a semi-trailer or similar transporter for straight-in loading aboard C-141 aircraft.

NOTE

The tractor ripper shanks should be turned upward when transporting the operational tractor aboard C-5 aircraft.

4-6. Transport by US Air Force Aircraft

This tractor is tied down according to the applicable TO 1C-XXX-9, section IV. Figure 4-1 shows the suggested tiedown pattern for the D7G in the C-130 aircraft. The suggested tiedown pattern for the D7E and F tractors is similar to the D7G except that the transporter should use the additional center tiedown provisions located on the track roller frames in between the other two multipurpose provisions. This additional tiedown is required to adequately restrain the D7E and F tractors for air transport because the D7E and F tractors are heavier than the D7G. For C-141 and C-5 transport, fewer tiedown devices are

required because 25,000-pound (25K) aircraft fittings and tiedown devices are available. Table 4-1 lists the tiedown devices required, the locations of tiedown points, the corresponding fittings to which the devices are secured, and the number and capacity of

the devices. Shoring may have to be leapfrogged depending on the desired tiedown location. The rolling and parking shoring requirements below are to be supplied by the shipper.

Table 4-1. Tiedown Data for the D7 Crawler Tractor in US Air Force C-130 Aircraft (Fig 4-1).

Tiedown Fitting		Tiedown Device		
Designation	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	Attach to Item
G6	10	MB-1	10	Left front tiedown provision.
F7	10	MB-1	10	Tow hook.
G7	10	MB-1	10	Left front tiedown provision.
G9	10	MB-1	10	Left front track support.
G10*	10	MB-1	10	Left middle tiedown provision.
G11	10	MB-1	10	Left front tiedown provision.
G11	10	MB-1	10	Left rear tiedown provision.
G12	10	MB-1	10	Left front tiedown provision.
G12	10	MB-1	10	Left rear tiedown provision.
G13*	10	MB-1	10	Left middle tiedown provision.
G14	10	MB-1	10	Left rear track support.
G16	10	MB-1	10	Left rear tiedown provision.
G17	10	MB-1	10	Left rear tiedown provision.
F16	10	MB-1	10	Right rear diagonal brace.
F18	10	MB-1	10	Left rear diagonal brace.
E17	10	MB-1	10	Right rear diagonal brace.
C17	10	MB-1	10	Left rear diagonal brace.
B18	10	MB-1	10	Right rear diagonal brace.
B16	10	MB-1	10	Left rear diagonal brace.
A17	10	MB-1	10	Right rear tiedown provision.
A16	10	MB-1	10	Right rear tiedown provision.
A14	10	MB-1	10	Right rear track support.
A13*	10	MB-1	10	Right middle tiedown provision.
A12	10	MB-1	10	Right rear tiedown provision.
A12	10	MB-1	10	Right front tiedown provision.
A11	10	MB-1	10	Right rear tiedown provision.
A11	10	MB-1	10	Right front tiedown provision.
A10*	10	MB-1	10	Right middle tiedown provision.
A9	10	MB-1	10	Right front track support.
A7	10	MB-1	10	Right front tiedown provision.
A6	10	MB-1	10	Right front tiedown provision.
B7	10	MB-1	10	Tow hook.

*Applies to D7E and F tiedown only.

a. Materials for Shoring the D7 Cruder Tractor in the C-130 Aircraft.

(1) *Rolling Shoring.*

(a) Lumber, 2- by 12- by 96-inch, 16 pieces.

(b) Lumber, 2- by 12- by 84-inch, four pieces.

(c) Lumber, 2- by 12- by 72-inch, four pieces.

(2) *Parking Shoring.* Lumber, 2- by 12- by 96-inch, eight pieces. Some of the rolling shoring can be used also for parking shoring.

b. Materials for Shoring the D7 Crawler tractor in the C-141 Aircraft.

(1) *Rolling Shoring.*

(a) Lumber, 2- by 12- by 96-inch, 16 pieces.

(b) Lumber, 2- by 12- by 132-inch, four pieces.

(2) *Parking Shoring.* Lumber, 2- by 12- by 96-inch, eight pieces. Some of the rolling shoring can be used also for parking shoring.

c. Materials for Shoring the D7 Crawler Tractor in the C-5 Aircraft.

(1) *Rolling Shoring.*

(a) Lumber, 2- by 12- by 96-inch, 20 pieces.

(b) Lumber, 2- by 12- by 84-inch, four pieces.

(c) Lumber, 2- by 12- by 30-inch, four pieces.

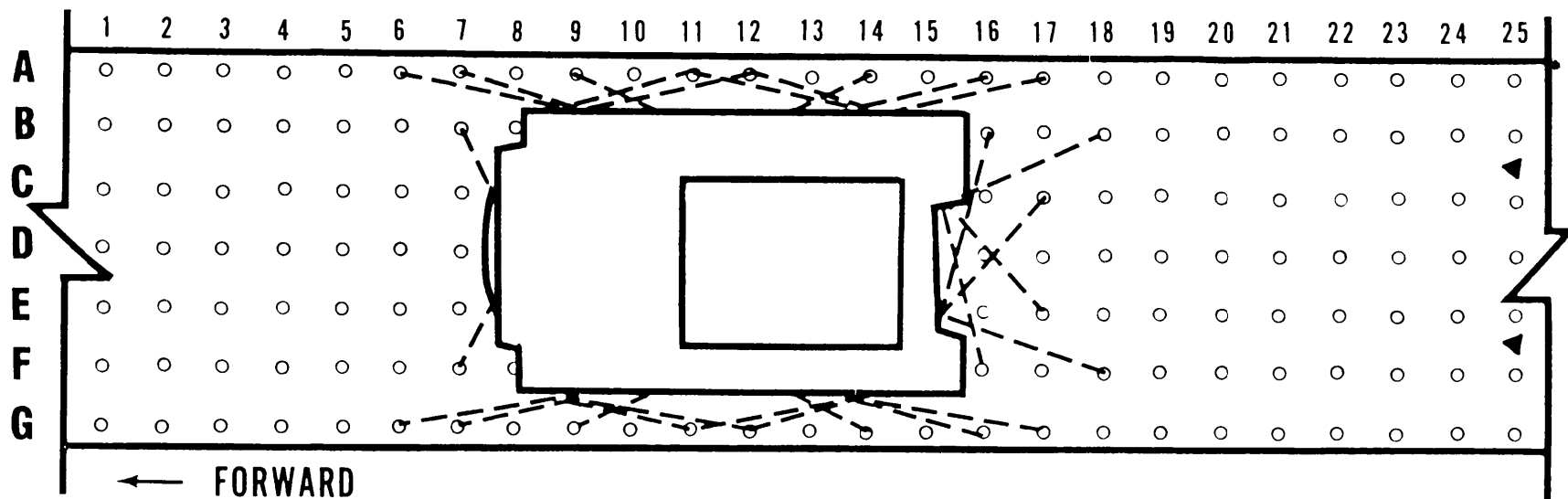
The 84-inch lumber is used along with eight pieces of the 96-inch lumber to provide rolling shoring on the forward ramp of the C-5. The 30-inch lumber is used with 12 pieces of the 96-inch lumber to provide rolling shoring on the aft ramp of the C-5.

(2) *Parking Shoring.* Lumber, 2- by 12- by 96-inch, eight pieces. Some of the rolling shoring can be used also for parking shoring.

d. Loadmaster Responsibilities. The loadmaster will ensure that the vehicle is loaded and secured according to the applicable TO 1C-XXX-9.

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

The D7 crawler tractors exceed the size and weight limitations for either internal or external transport by US Army helicopters.



LEGEND: C-130 AIRCRAFT

- 10,000 - POUND - CAPACITY TIEDOWN FITTING
- ▲ 25,000 - POUND - CAPACITY TIEDOWN FITTING

NOTE:

TIEDOWN FITTINGS ARE LOCATED IN ROWS A THROUGH G AND COLUMNS 1 THROUGH 30. FIVE OF THESE ARE LOCATED ON THE RAMP. THIS IS A TYPICAL TIEDOWN PROCEDURE, AND ONLY COLUMNS 1 THROUGH 24 ARE SHOWN. ITEM BEING SHIPPED CAN BE TIED DOWN AT ANY LOCATION [1-30] APPROVED BY THE LOADMASTER.

CHAPTER 5

HIGHWAY TRANSPORTABILITY GUIDANCE

Section I. GENERAL

5-1. Scope

This chapter provides highway transportability guidance for moving the D7 crawler tractors. It covers significant physical characteristics and safety considerations. It also prescribes the materials and guidance required to prepare, load, and tie down the D7 tractor on the M870 and M172A1 semitrailers.

5-2. Safety

In addition to the safety precautions in chapter 3,

movement within CONUS is subject to all safety laws, rules, and regulations that apply to commercial carriers. In overseas areas, movements are governed by the theater and local regulations.

CAUTION

Do not allow the D7 tractor to exceed 3 miles per hour during loading and unloading operations.

Section II. SELF-PROPELLED MOVEMENT

5-3. General

The D7 tractor is self-deliverable only under appropriate tactical situations. Movement over paved pub-

lic highways will not be made without approval from state highway or local government authorities.

Section III. TRANSPORT BY TRACTOR/SEMITRAILER

5-4. General.

This section covers the D7 tractors transported by the M916/M870 and M123A1C/M172A1 truck-tractor/semitrailer combinations. The D7 tractors must be in the reduced configuration for highway transport on these combinations. The exhaust stack and pre-cleaner can be stored and secured on the tractor. The blade, pusher arms, ROPS, and winch or carrier beam and ripper must be transported on a separate truck-tractor semitrailer combination and can be positioned as shown in figure 5-1 for the D7G. Movement over paved public highways will not be made without specific approval as outlined in AR 55-162.

5-5. Transport of the D7 Tractors on the M916/M870 and M123A1C/M172A1 Truck-Tractor/Semitrailer Combinations

a. Restrictions. Restrictions for D7 tractor transport on the M916/M870 and M123A1C/M172A1 combinations are major. Both legal and permit limits are exceeded for CONUS transport. Width, single-axle load, and most combination gross vehicle weights exceed legal limits, but are within permit limits for both combinations. Some additional restrictions will be encountered when transporting the D7 by the M916/M870 because of the length of this combination. However, these restrictions are also within permit limits. Some permit limits, however will be exceeded for the high tandem-axle loadings and combination

gross vehicle weights. Of the two transporters, the M123A1C/M172A1 combination will encounter the most restrictions when hauling the D7. In general, overseas highway transport is more restrictive than CONUS highway transport. Legal limits for overseas are identified in "Limits of Motor Vehicle Sizes and Weights," International Road Federation, Geneva, Switzerland.

b. Materials for Blocking and Tiedown. Adequate tiedown chains and binders for securing the D7 crawler tractors are basic issue items (BII). Table 5-1 gives the bill of materials for blocking and tiedown of the D7 tractor on the M870 semitrailer. Table 5-2 provides data concerning application of materials for tiedown on the M870. Blocking and tiedown diagrams compatible with standard loading practices are provided in figures 5-2 and 5-3. These procedures will offer adequate restraint against forces encountered during movement at normal speeds and operating conditions.

NOTE

The tiedown procedure for the D7E, F, and G is similar except that the shipper must use the middle tiedown provision on the D7E and F, as shown in figure 5-2, as an additional tiedown point. The center tiedown provision is not available on the D7G; however, additional tiedown is not required on this model. The D7E and F models require the additional tiedown because they are heavier than the D7G.

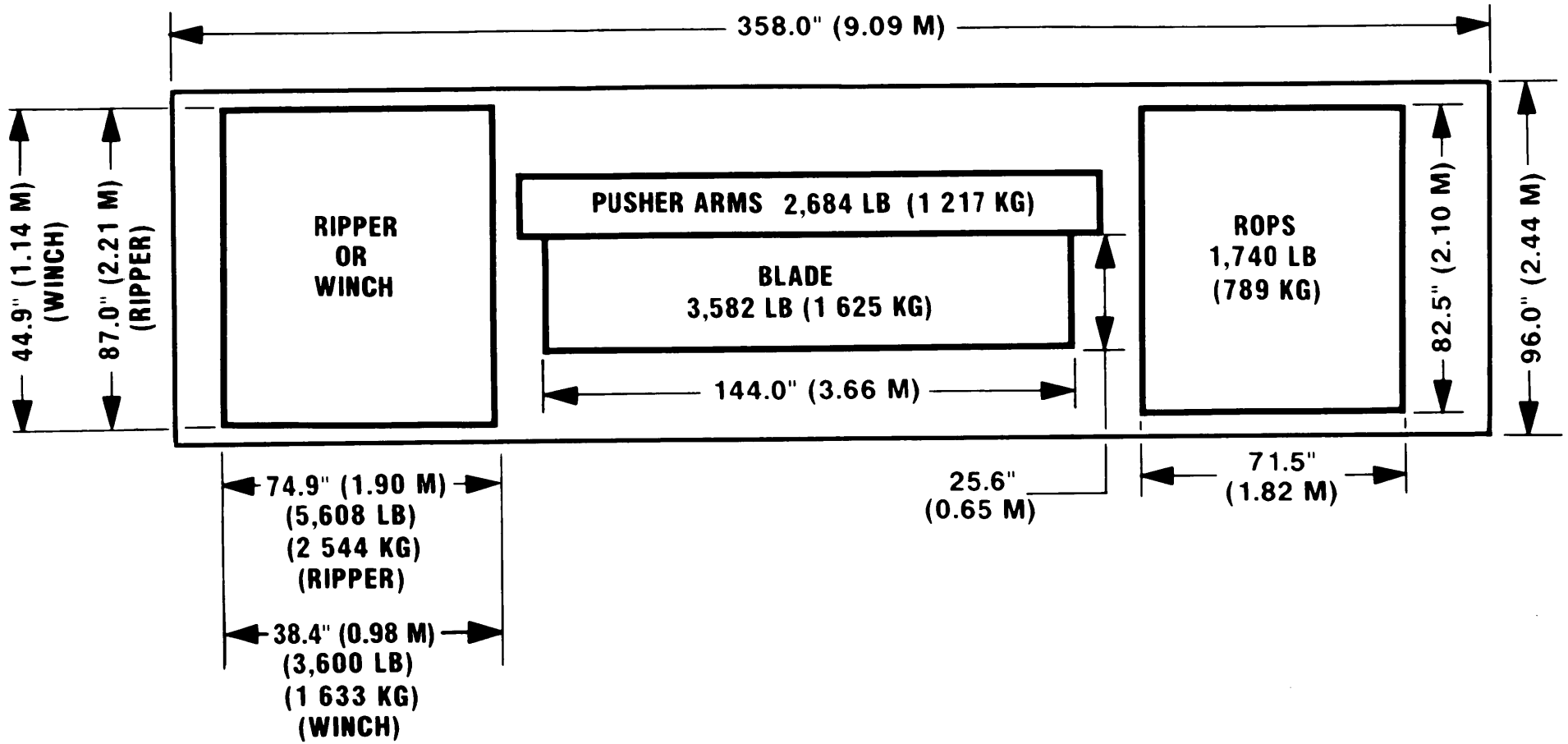
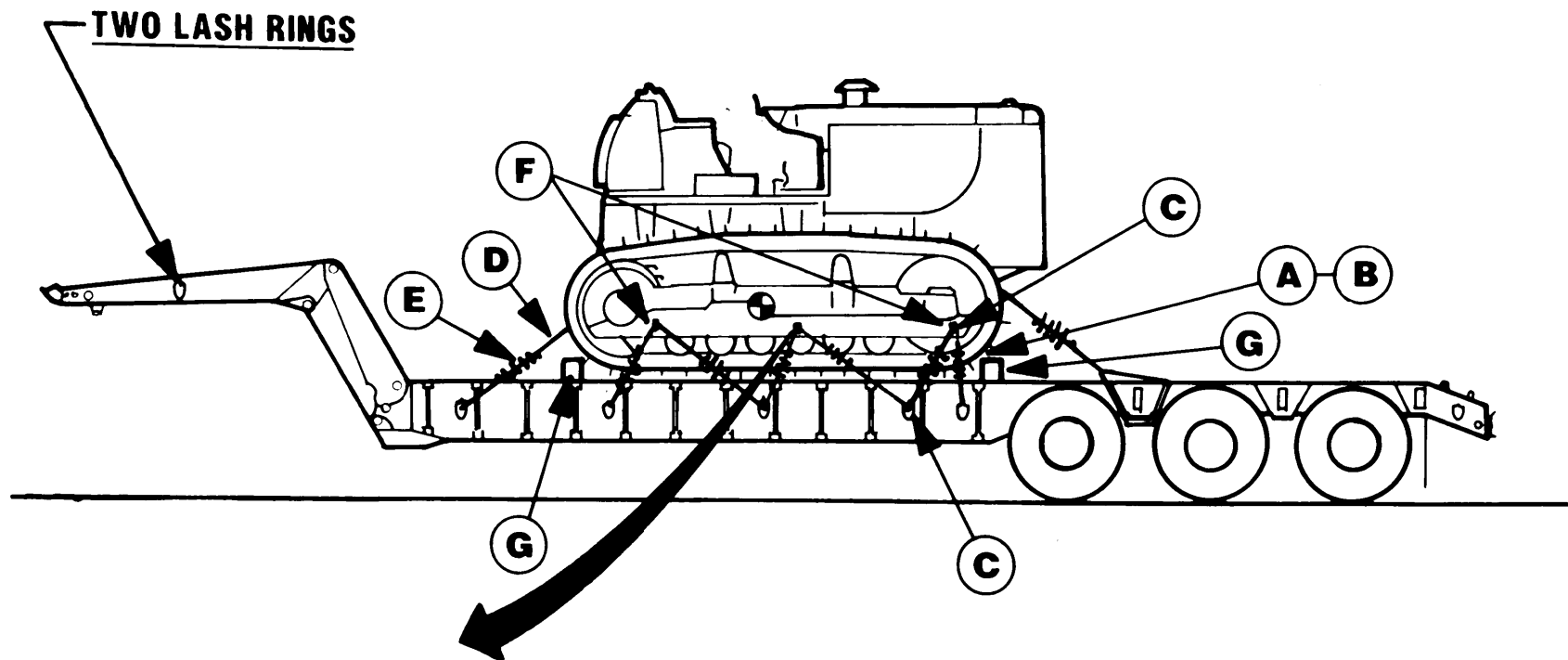


Figure 5-1. D7G removed components secured to a separate semitrailer.

D7E OR F



NOTE:
THIS PROVISION IS NOT AVAILABLE AND THEREFORE
NOT USED WHEN TYING DOWN THE D7G ON THE M870.

Figure 5-2. D7E and F tiedown diagram for the M870 semitrailer (table 5-3 and figure 5-3).

Table 5-1. Bill of Materials for Blocking and Tiedown of the D7 Crawler Tractor (Reduced) on the M870 Semitrailer (Figs 5-2 and 5-3)

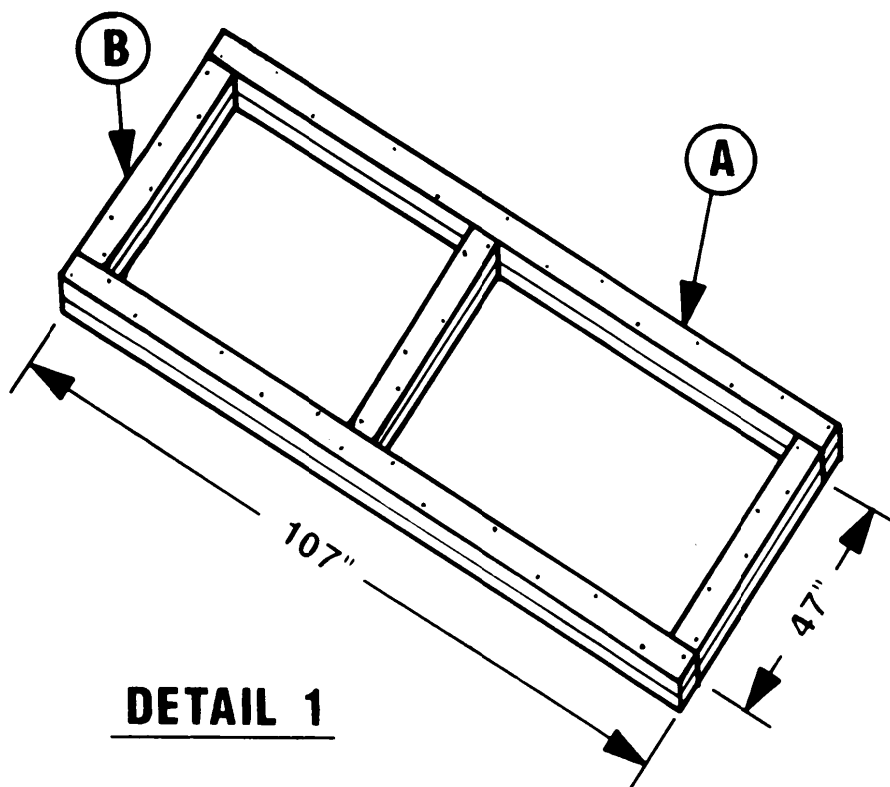
Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects; Fed Spec MM-L-751: 2- by 6-inch 4- by 4-inch	52 linear feet 20 linear feet
Nails	Common, steel, flathead; bright or cement-coated; Fed Spec FF-N-105: 20d 30d	34 30
Wire rope	6 × 19, IWRC; improved plow steel; preformed, regular-lay; Fed Spec RR-W-410: ½-inch	160 feet (D7G) 192 feet (D7E&F)
Clamps	Wire rope, U-bolt clips, saddled, single-grip steel, Crosby heavy-duty, or equal; Fed Spec FF-450; type 1, class 1: ½-inch ¾-inch	48 (D7G) 64 (D7E&F) 20 (D7G) 28 (D7E&F)
Thimbles	Standard, open-type; ½-inch, type II, Fed Spec FF-T-276	18 (D7G) 26 (D7E&F)
Chain*	Type I, class 1; welded, steel, alloy, ½-inch, 11,400-pound safe working load; Fed Spec RR-C-271; with two grabhooks equal to or better than the strength of the chain.	12 (D7G) 16 (D7E&F)
Loadbinders*	Type I, plain, 18-½-inch operating lever, with two grabhooks designed for ¼-inch to ½-inch chain, 8-ton capacity; Fed Spec GGG-B-325A, NSN 3990-00-274-6746	12 (D7G) 16 (D7E&F)

*Chains and loadbinders may be substituted for ½-inch wire rope and clamps.

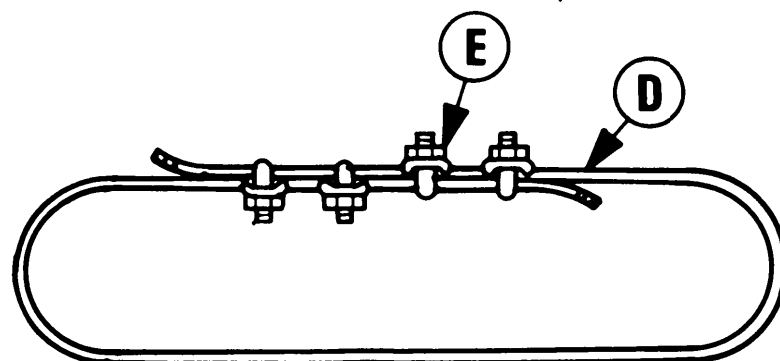
Table 5-2. Application of Materials for Blocking and Tiedown of the D7 Crawler Tractors on the M870 Semitrailer (Figs 5-2 and 5-3)

Item	No. Required	Application
A	2	Side blocking, 2- by 6- by 107-inch lumber (doubled). Pre-position each side to match inside width of tractor. Nail first piece to semitrailer floor with one 20d nail every 8 inches. Nail second piece to first in a like manner using 30d nails (detail 1, fig 5-3).
B	2	Lateral bracing, 2- by 6-inch × length-cut-to-fit lumber (doubled). Nail first piece to semitrailer floor so item B will contact inboard side of item A with one 20d nail every 8 inches. Nail second piece to first in a like manner using 30d nails (detail 1, fig 5-3).
C	20 (D7G) 28 (D7E&F)	Thimble, open-type, ½-inch. Place two on each D7 tractor tiedown provision (eight total). Place one on each semitrailer outside tiedown ring to be used (10 total). No thimbles are required on the tractor pintle hook or tow hook.
*D	12 (D7G) 16 (D7E&F)	Wire rope. Each consists of ½-inch wire rope, length as required. Form complete loops (detail 2, fig 5-3) between tractor diagonal braces (see fig 2-6) and M870 left and right front tiedown rings aft of semi-trailer goose-neck (see fig 5-2). Form complete loops between right rear tiedown provision on tractor and two nearest M870 tiedown rings on same side. Place thimbles between wire rope and tiedown provision on tractor. Place thimble between wire rope and M870 tiedown rings. Attach wire ropes to remaining tiedown provisions and tie down in same manner as above. Form complete loops between tractor tow hook and M870 frame between first and second axles of tridum on both sides. Wrap wire rope around M870 frame for tiedown. Tension all tiedowns evenly.
CAUTION		
Tension tiedowns evenly. Do not exceed 400 pounds of tension on any single tiedown.		
Wire rope ends should overlap at least 24 inches. Secure with four ½-inch clamps (item E).		
*E	48 (D7G) 64 (D7E&F)	Clamps, ½-inch (detail 2, fig 5-3). Place four clamps on each wire rope loop at the overlap area. Space the four clamps 2-½ inches apart, with at least 6 inches from the free end of the wire rope. Tension wire rope and tighten clamps to approximately 65-foot-pound torque.
*F	20 (D7G) 28 (D7E&F)	Clamps, ¾-inch (detail 3, fig 5-3). Secure each ½-inch thimble with one clamp.
G	2	Outrigger plank securement, 4- by 4- by 120-inch lumber. Place one piece in front of and behind tracks on D7 tractor and toe-nail with two 20d nails on each board.

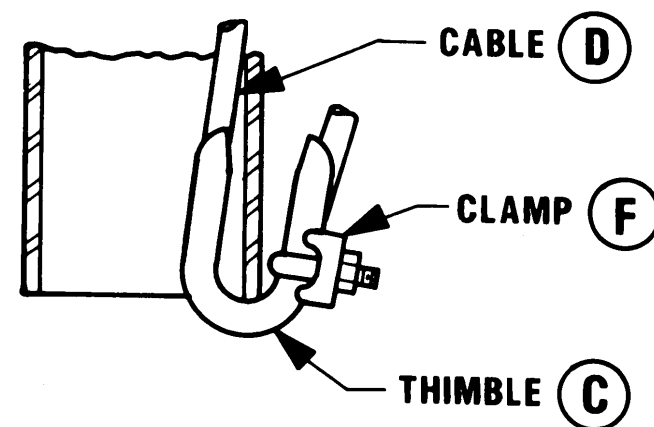
*Suitable capacity of chains and loadbinders may be substituted for ½-inch wire rope and clamps.



DETAIL 1



DETAIL 2



DETAIL 3

Figure 5-3. Blocking and tiedown details (tables 5-2 and 5-4, figures 5-2 and 5-4).

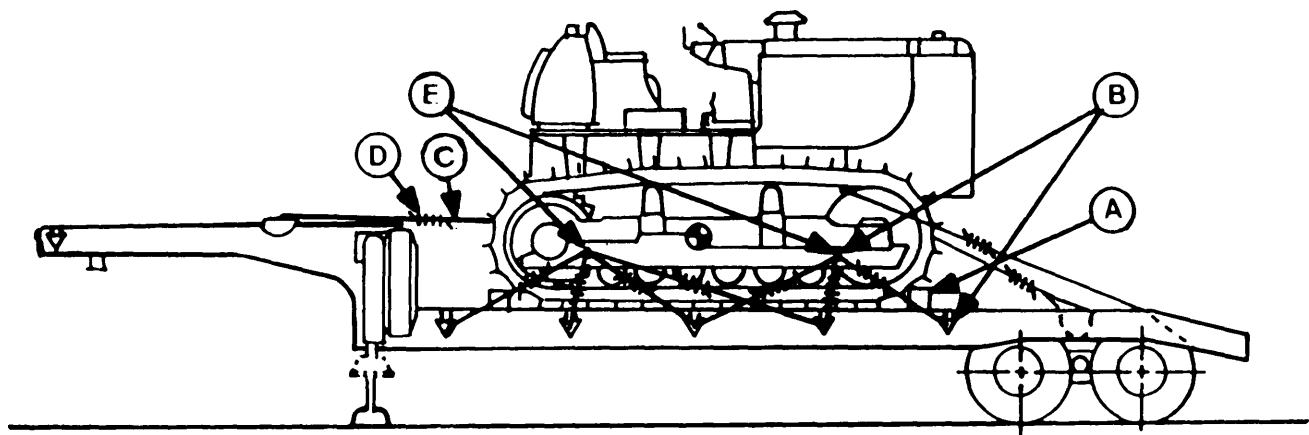


Figure 5-4. D7 tiedown diagram for the M172A1 semitrailer (table 5-4 and figure 5-3).

Table 5-3 gives the bill of materials for blocking and tiedown of the D7 tractor on the M172A1 semitrailer. Table 5-4 provides the data concerning application of materials for tiedown on the M172A1. Figure 5-4, and details 2 and 3 of figure 5-3, provide tiedown diagrams compatible with standard loading practices that will offer adequate restraint during movement at normal speeds and operating conditions.

c. Loading.

WARNING

At no time during loading operations should

personnel, other than the guide and the driver of the tractor, be on the semitrailer bed.

WARNING

Loading should not be conducted with the semitrailer sideways on a slope that exceeds 10 percent or with a tractor-to-semi-trailer offset angle greater than 5°. Loading also should not be conducted on a severe down-grade, because the tractor driver may not be able to safely control movement of the tractor.

Table 5-3. Bill of Materials for Blocking and Tiedown of the D7 Crawler Tractor (Reduced) on the M172A1 Semitrailer (Figs 5-3 and 5-4)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects; Fed Spec MM-L-751: 4- by 4-inch	8 linear feet
Nails	Common, steel, flathead; bright or cement coated; Fed Spec FF-N-105: 30d	20
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; Fed Spec RR-W-410: ½-inch	250 linear feet
Clamps	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal; Fed Spec FF-450; type 1, class 1: ½-inch 5/8-inch	80 30
Chain*	Type I, class 1; welded, steel alloy, ½-inch, 11,400-pound safe working load; Fed Spec RR-C-271; with two grabhooks equal to or better than the strength of the chain	20
Loadbinders*	Type 1, plain, 18-½-inch operating lever, with two grabhooks designed for ¼-inch to ½-inch chain, 8-ton capacity; Fed Spec GGG-B-325A, NSN 3990-00-274-6746	18
Thimbles	Standard, open-type; ½-inch, type II, Fed Spec FF-T-276	26

*Chains and loadbinders may be substituted for ½-inch wire rope and clamps.

Table 5-4. Application of Materials for Blocking and Tiedown of the D7 Crawler Tractor on the M172A1 Semitrailer (Figs 5-3 and 5-4)

Item	No. Required	Application
A	4	Track blocking, 4- by 4- by 24-inch lumber. Place one piece in front of and behind tracks on D7 tractor and toenail with 5 30d nails on each block.
B	26	Thimble, open-type, ½-inch. Place four on each rear tiedown provision, and three on each front provision (see figs 2-3 and 2-4). Place one thimble on each semitrailer outside tiedown ring to be used.
*C	20	Wire rope. Each consists of ½-inch wire rope, length as required. Form complete loops (detail 2, fig 5-3) between tractor diagonal braces (see fig 2-6) and M172A1 left and right tiedown rings on top of semitrailer goose-neck (see fig 5-4). Place thimble between wire rope and M172A1 tiedown rings. From complete loops between right rear tie-down provision on tractor and four nearest M172A1 tiedown rings on same side along semitrailer bed. Place thimbles between wire rope and tiedown provision on tractor. Place thimbles between wire rope and M172A1 tiedown rings. Attach wire ropes to remaining tiedown provisions and tie down in same manner as above. Form complete loops between tractor tow hook and M172A1 frame between first and second axles of tandem on both sides. Wrap wire rope around M172A1 frame for tiedown. Place cushioning material between wire rope around M172A1 frame if desired. Form complete loops between D7 tracks behind forward drive sprocket and rear frame on each side of M172A1. Use cushioning material as necessary between wire rope and tracks or M172A1 frame. Wrap wire rope around M172A1 frame and D7 tracks for tie-down. Tension all tiedowns evenly. CAUTION Tension tiedowns evenly. Do not exceed 400 pounds of tension on any single tiedown. Wire rope ends should overlap at least 24 inches. Secure with four ½ 5/8-inch clamps (item D).
*D	80	Clamps, ½-inch (detail 2, fig 5-3). Place four clamps on each wire rope loop at the overlap area. Space the four clamps 2-½ inches apart, with at least 6 inches from the free end of the wire rope. Tension wire rope and tighten clamps to approximately 65-foot-pound torque.
*E	30	Clamps, 5/8-inch (detail 3, fig 5-3). Secure each ½-inch thimble with one clamp.

*Suitable capacity of chains and loadbinders may be substituted for ½-inch wire rope and clamps.

(1) *M870 Loading.* Position curbing assembly (detail 1, fig 5-3) on the semitrailer bed so that it will be close to the inside edge of both tracks when the tractor is aboard the trailer. Drive or lift the D7 tractor onto semitrailer to the position where the tractor center of gravity is about 127 inches aft of the goose-neck lower hinge pin. Place the transmission control in neutral, and set the parking brakes.

(2) *M172A1 Loading.* Place the M172A1 loading ramps into position to load the D7 onto the semitrailer bed. Back or lift the D7 tractor onto semitrailer to the position where the tractor center of gravity is about 91 inches aft of the M172A1 spare tire. Place the transmission control in neutral, and set the parking brakes.

CHAPTER 6

MARINE AND TERMINAL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

6-1. Scope

This chapter provides marine and terminal transportability guidance for moving the D7 crawler tractor. It covers significant safety considerations and prescribes the materials and guidance required to prepare, load, tie down, and unload the vehicle.

6-2. Safety

In addition to the safety precautions in chapter 3, the following precautions apply:

- a. Inspect all slings, lifting rings, shackles, and other items used in loading and discharging operations for their condition and adequate capacity.
- b. Handle and stow vehicles according to provisions in Title 46/49, *Code of Federal Regulations*.
- c. Ensure fire extinguishers are available during all loading and discharging operations.
- d. Drain tractor fuel tanks and disconnect battery terminals.
- e. Inspect all lifting provisions, including lifting eyes and shackles, to ensure they are not damaged.

f. Caution personnel not to walk under items being lifted.

g. Ensure all lifts have at least two tag lines attached to control the swing of the lift while suspended.

NOTE

When the D7 tractor is loaded on vessels that are adequately ventilated by power blowers, such as the roll-on/roll-off (RORO) ships, fuel tanks need not be drained.

6-3. Water Shipment

The D7 tractor is transportable by a great variety of inland-waterway cargo carriers, lighters, and barges and by all seagoing cargo vessels.

NOTE

The methods described in this chapter for lifting and securing the D7 tractor are suggested procedures. Other methods of handling and stowage may be used to accomplish safe delivery without damage.

Section II. LOADING AND SECURING

6-4. General Rules for Stowing

a. *General.* When possible, stow the D7 tractor below deck for protection. In general, good stowage means placing vehicles fore and aft as close together as practical, with minimum spacing (about 4 to 6 inches) between outer vehicles and the sweatboards. Also, protect breakable parts and stow spare parts in or near the parent item. Set the brakes and place the transmission control in neutral.

NOTE

The ripper shanks should be turned upward for marine transport.

Secure the D7 tractors with blocks in front, in rear, and on both sides of the tracks to adequately restrain the vehicles. Brace individual tractor blocks to bulkheads, stanchions, and other vehicle blocks. Lash all vehicles with wire rope or chains to nearby padeyes, bulkheads, or stanchions.

b. *Lifting.* The correct lifting points on the D7 tractor are on the front and rear of the track roller frames. Figure 6-1 shows a typical lifting diagram.

c. *Loading.* Load the D7 tractor on vessels in the operational configuration when possible to avoid

time-consuming and costly disassembly. Make sure the hatch girder clearance of the specified vessel is greater than 134 inches (3.40 m) for the operational tractor. With the ROPS and exhaust stack removal, the D7F and G tractors require a hatch girder clearance greater than 96 inches (2.44 m). The D7E tractor requires a hatch girder clearance of 101 inches (2.57 m). The D7 can be driven, or lifted by cranes of adequate capacity, aboard landing craft beach discharge lighters, heavy amphibious lighters, and landing ships. It also can be driven or towed aboard RORO vessels, or onto the decks of barges from a pier, when tidal conditions are suitable and ramps are available. The D7 can be loaded onto seagoing vessels by shoreside or floating cranes of adequate capacity or by heavy-lift ship's gear. The D7 tractor cannot be transported on the LARC-V or LARC-XV lighterage vessels. Transport by the LACV-30 can be made possible by reducing the D7 tractor weight to no more than 45,000 pounds. This involves removing at least two of the D7 major components such as the blade, ROPS, ripper, or winch. Figure 6-2 shows typical blocking and tiedown details. Bill of and application of materials for blocking and tiedown are given in tables 6-1 and 6-2.

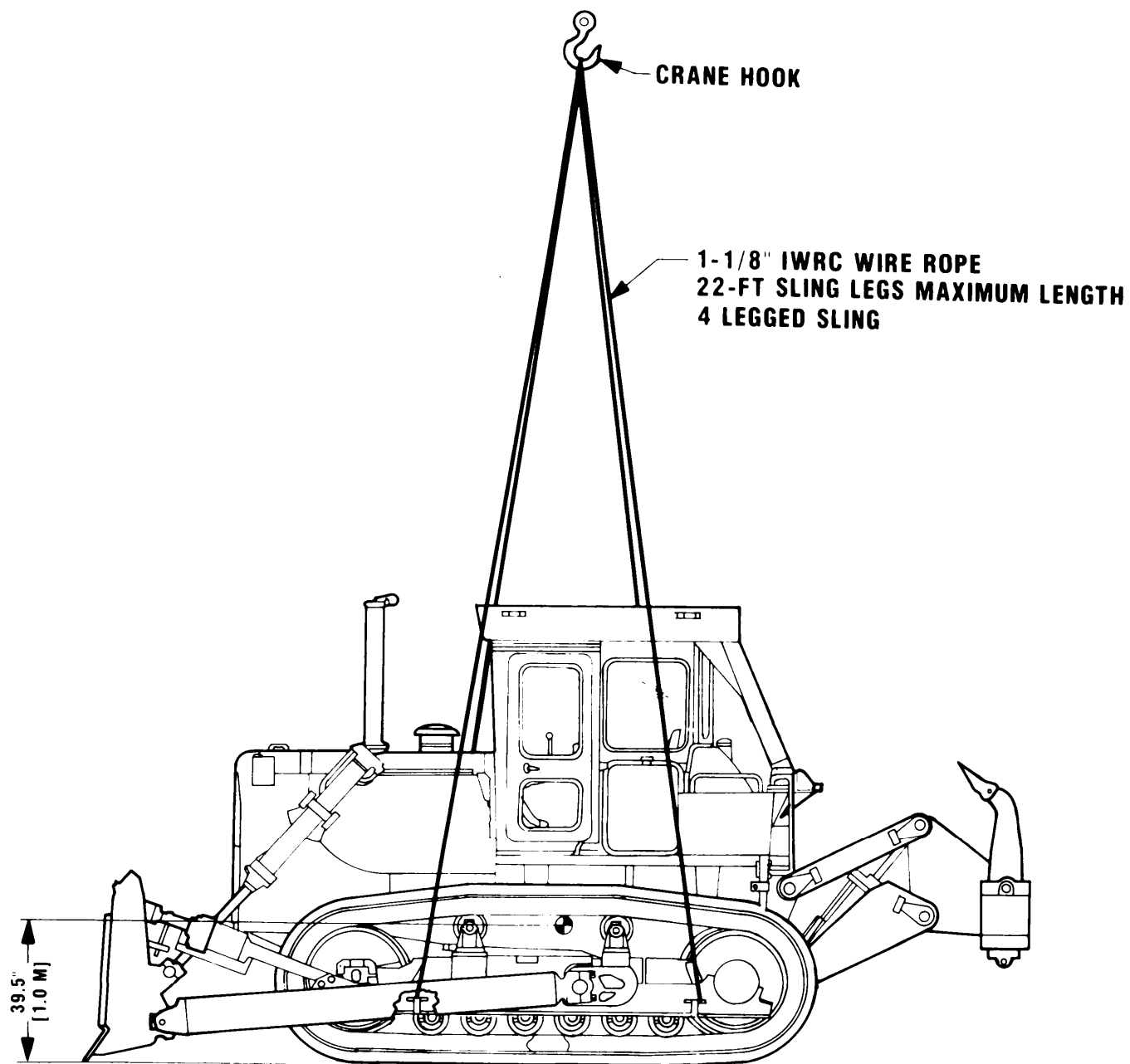


Figure 6-1. D7 lifting diagram (side view).

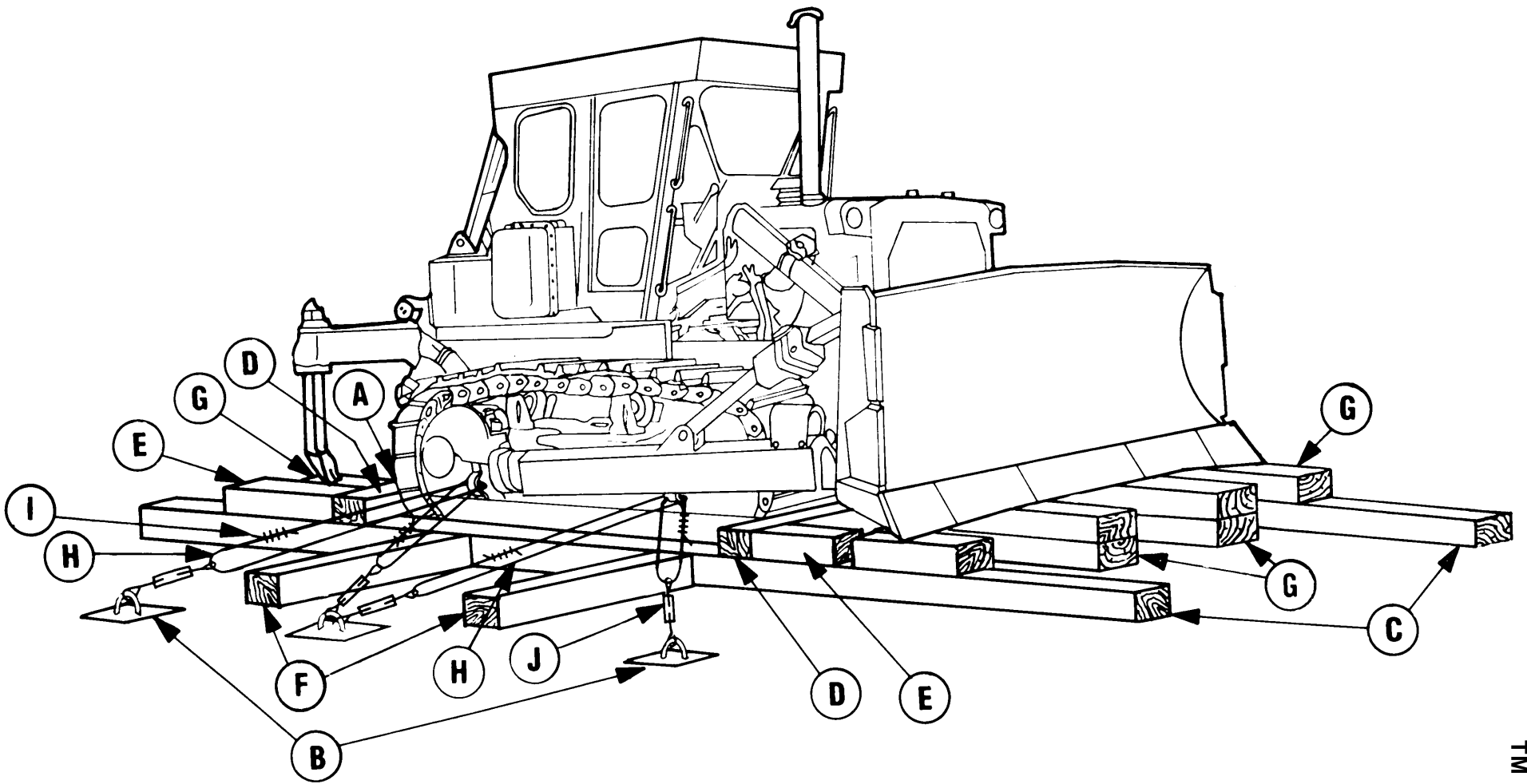


Figure 6-2. D7 crawler tractor tiedown scheme aboard general cargo vessels (table 6-2).

Table 6-1. Bill of Materials for Blocking and Tiedown of the D7 Crawler Tractor in General Cargo Vessels (Fig 6-2)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects; Fed Spec MM-L-751: 4- by 6-inch	4 linear feet
	2- by 12-inch	60 linear feet
	6- by 8-inch	74 linear feet*
Lumber	Oak or comparable hardwood, straight-grain, free from material defects; Fed Spec MM-L-751: 6- by 8-inch	36 linear feet
Nails	Common, steel, flathead; bright or cement-coated; Fed Spec FF-N-105:	
	16d	10
	40d	132
Wire rope	6 × 19, IWRC; improved plow steel; preformed, regular-lay; Fed Spec RR-W-410: ¾-inch	96 feet
Clamps	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal; Fed Spec FF-C-450: ¾-inch	32
Turnbuckles	1- by 18-inch with jaw and jaw-end fittings	8
Padeyes	Local manufacturer, from 1-inch steel rod and 4- by 6- by ¾-inch steel plate. Bore 1-inch holes through plate and weld U-shaped 1-inch rod ends on top and bottom of plate.	6

*Does not include lumber for item F, table 6-2.

Table 6-2. Application of Materials for Blocking and Tiedown of the D7 Crawler Tractor in General Cargo Vessels (Fig 6-2)

Item	No. Required	Application
A	4	Lumber, 2- by 12- by 180-inch. Pre-position lumber on vessel floor under vehicle tracks. Two side-by-side rows are required under each track.
B	4	Padeyes. Weld padeyes to the deck of vessel if D-rings or deck tiedown fittings are unavailable.
C	2	Side blocks. Each consists of two pieces of 6- by 8- by 126-inch lumber. Place two pieces end to end centered against outside of tracks.
D	2	End blocks. Each consists of one piece of 6- by 8- by 120-inch lumber. Place on top of item C and against tracks as shown in figure 6-2. Toenail to item C with four 40d nails at each end of each item D.
E	4	Backup cleats. Each consists of 4- by 6- by 12-inch lumber. Place on top of item C against the joint of each item D. Nail to item C with four 40d nails each.
F	as required	Bracing. Each consists of 6- by 8-inch by length-cut-to-fit lumber. Brace as required against adjacent vehicle cargo, side of vessel, or bulkhead, as appropriate. (Materials for this requirement are not in table 6-1).
G	12	Hardwood blocks. Place 6- by 8- by 36-inch hardwood blocks, doubled, under blade and each ripper shank. Toenail blocks together using eight 40d nails. Place remaining two blocks under blade on top of item C and nail using eight 40d nails.
H	8	Wire rope, ¾-inch. Form a complete loop. Secure with clamps (item I). Attach to front and rear tiedown provisions as shown in figure 6-2.
I	32	Clamps, ¾-inch. Install four clamps on each item H with 4-inch spacing between clamps.
J	8	Turnbuckles, 1- × 18-inch. Attach on jaw to wire rope (item H) and one jaw to padeye (item B) or deck fitting. Tighten all turnbuckles evenly.

CHAPTER 7

RAIL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

7-1. Scope

This chapter provides rail transportability guidance for moving of the Caterpillar D7 crawler tractor. It covers physical characteristics and safety considerations. It also prescribes the materials and guidance required to prepare, load, and tie down the D7 tran-

tor on open-top flatcars.

7-2. Maximum Utilization of Railcars

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

Section II. TRANSPORT ON CONUS RAILWAYS

7-3. General

The transportability guidance in this section applies to transport of the tractor on CONUS railways. It includes both single and multiple movements for the types of flatcars normally used in moving this tractor.

7-4. Preparation

Load the D7 tractor on the flatcar in the operational configuration, when possible, to avoid time-consuming and costly disassembly. However, the D7 may require disassembly along some rail lines where restrictions such as tunnels or bridges occur. When transporting the D7 tractor with minimum restrictions in CONUS on a standard 50-inch-high flatcar, remove the tractor dozer blade to reduce the width. Remove the exhaust stack to reduce the height. The exhaust stack can be transported on the tractor if it is securely stowed. Also, turn the ripper shanks upward to prevent railcar damage.

7-5. Loading the D7 Crawler Tractor on General-Purpose Flatcars

a. The tractor may be placed in the tiedown position on the flatcar by a crane, or it may be driven or towed if a suitable ramp or bridge is available. When loading the vehicle by crane, follow the procedures and precautions in paragraphs 6-2 and 6-4b.

b. Figure 7-1 shows typical loading diagrams of the tractor on a general-purpose flatcar with a minimum width of 10 feet 4 inches. The type of blocking and tiedown shown is compatible with standard loading practices and provides adequate restraint against the forces encountered during movements at normal speeds. Figure 7-2 shows the D7 blocking and tiedown details.

CAUTION

Do not allow the tractor to exceed 3 miles

per hour during loading and unloading operations.

NOTE

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

NOTE

For the D7E and F models, the middle tiedown provision, located on each side of the track roller frame between the multipurpose (lifting and tiedown) provisions, can be used if additional tiedown is desired.

c. Table 7-1 is the bill of materials for blocking and tiedown of the D7 tractor on a CONUS general-purpose flatcar. Table 7-2 provides information for the application of materials required to restrain the vehicle.

NOTE

Refer to figures 5-2 and 5-4 for other tiedown points that can be used for transporting the reduced D7 tractor.

7-6. Loading the D7 Crawler Tractor on Wooden-Deck Chain-Tiedown Flatcars

a. The tractor can be loaded on the wooden-deck chain-tiedown flatcars by the procedures in 7-5a.

b. Figure 7-3 shows a typical loading diagram of the D7 tractor on a wooden-deck chain-tiedown flatcar with a minimum width of 10 feet 4 inches.

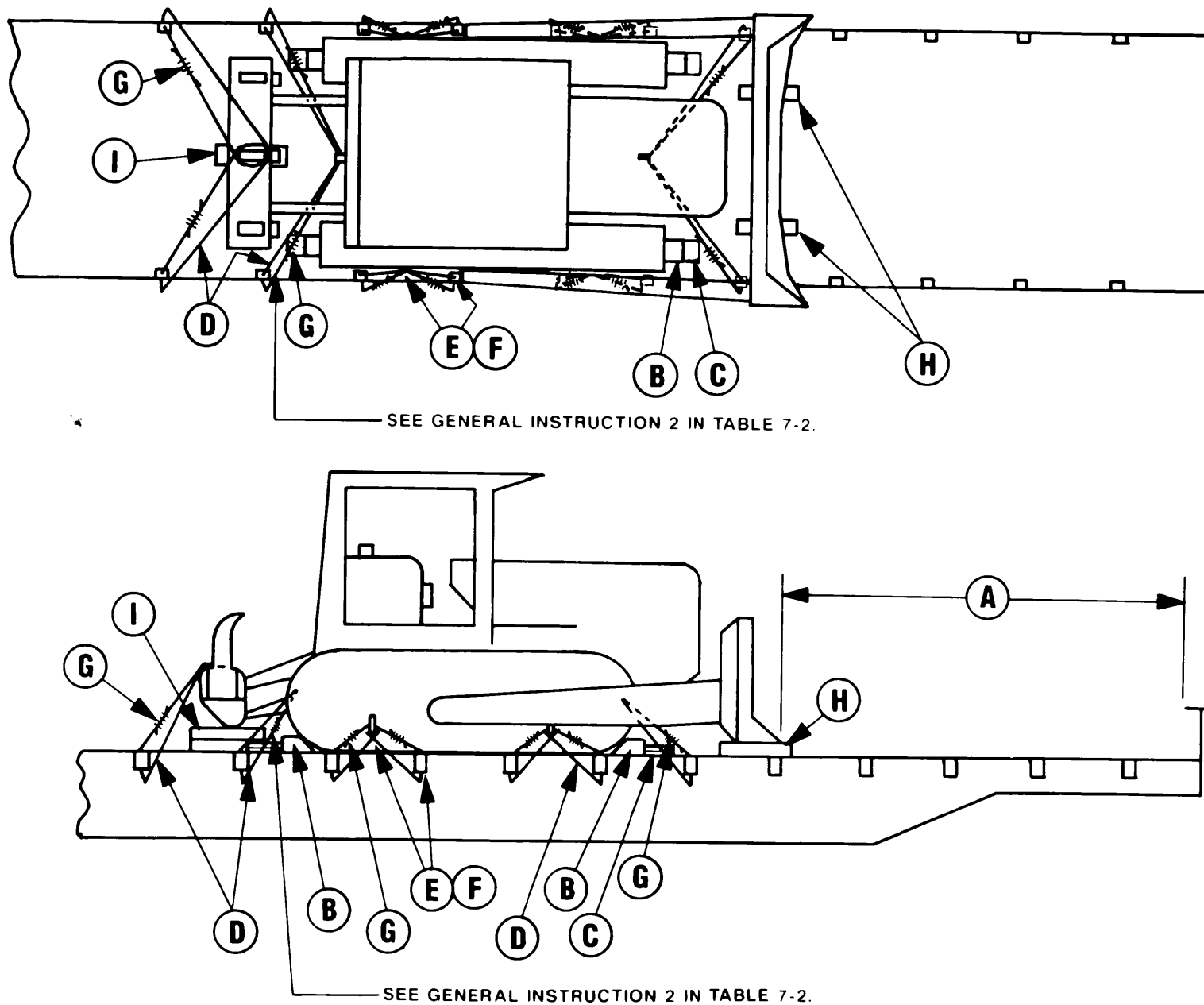
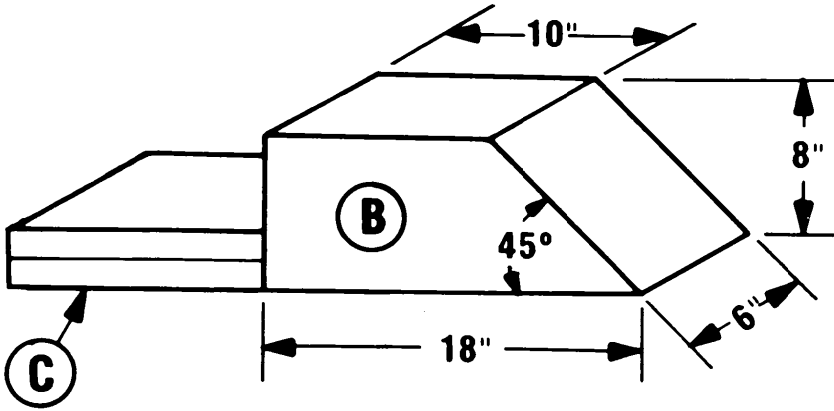
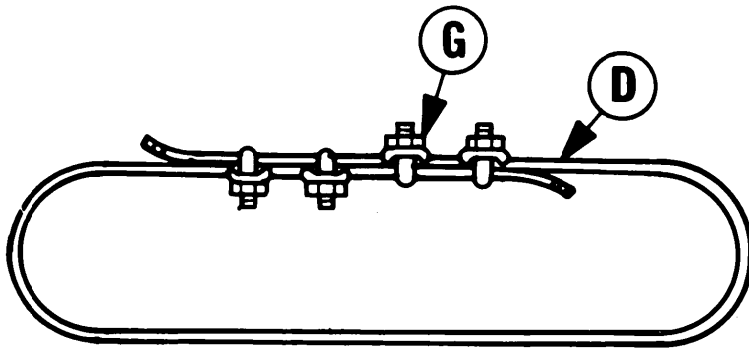


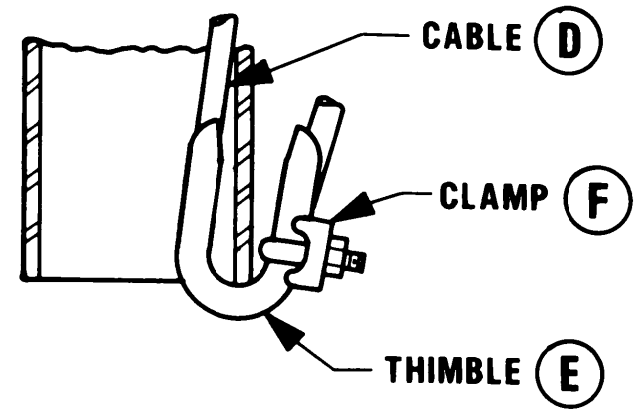
Figure 7-1. D7 crawler tractor loaded on a CONT'S general-purpose flatcar (table 7-2 and figure 7-2).



DETAIL 1



DETAIL 3



DETAIL 2

Figure 7-2. Blocking and tiedown details (table 7-2 and figure 7-1)

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Table 7-1. Bill of Materials for Blocking and Tiedown of the D7 Crawler Tractor on a CONUS General-Purpose Flatcar (Figs 7-1 and 7-2)

Item	Description	Approximate Quantity
Lumber	Oak or comparable hardwood, straight-grain, free from material defects; type II, Fed Spec MM-L-736: 4- by 8-inch	10 linear feet
Lumber	Douglas-fir, or comparable, straight-grain, free from material defects; Fed Spec MM-L-751: 2- by 6-inch	12 linear feet
	6- by 8-inch	8 linear feet
Nails	Common, steel, flathead; bright or cement-coated; Fed Spec FF-N-105: 30d	34
Wire rope	6 x 19, IWRC; improved plow steel; preformed, regular-lay; Fed Spec RR-W-410: 5/8-inch	142 feet
Clamps	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal; Fed Spec FF-C-450: 5/8-inch	48
	3/4-inch	20
Thimbles	Standard, open-type: 5/8-inch	20

Table 7-2. Application of Materials for Blocking and Tiedown of the D7 Crawler Tractor on a CONUS General-Purpose Flatcar (Figs 7-1 and 7-2)

Item	No. Required	Application
A		Brake-wheel clearance. Minimum clearance required is 6 inches above, in back of, and on both sides of and 4 inches underneath wheel; 12 inches from end of railcar to load, which extends from center of brake wheel to side of railcar; and 6 feet above railcar floor.
B	4	Track chocks. Each consists of 6- by 8- by 18-inch block cut as shown in detail 1, figure 7-2. Place one chock firmly against the center of each track at the forward and rear ends of the tractor. Place chock with the 45° cut angle edge toward the track. Toenail each chock with four 30d nails.
C	4	Backup cleats. Use two pieces of 2- by 6- by 18-inch lumber for each track chock. Place against each track chock, item B. Nail bottom piece with three 30d nails in staggered pattern and nail top piece with three 30d nails in like manner.
D	12	Wire rope, 5/8-inch, 6 x 19, IWRC. Form wire rope in a complete loop. Apply from left and right tiedowns, forward towing hook, and around the center ripper shank on top of the tool block on the track-type tractor to stake pockets. Wire tie hook and pin to retain wire rope, if necessary. Overlap wire rope at least 24 inches (details 2 and 3, fig 7-2). See general instruction 2.
E	20	Thimbles. Place thimbles at the side tiedowns and the bottom of each stake pocket.

F	20	Clamps. Fasten thimbles to wire rope with 3/4-inch cable clips to prevent dislodgement.
G	48	Clamps. Fasten each wire rope tiedown with four 5/8-inch wire rope clips spaced about 3-1/2 to 4 inches apart. Torque 5/8-inch clips to 90-foot-pounds.
H	2	Lumber, oak, 4- by 8- by 30-inch. Raise blade and place one piece of lumber lengthwise, about 36 inches from each end of blade. Drill and toenail each piece of lumber to railcar floor with four 30d nails. Lower blade on top of blocking and lock hydraulic cylinders into position.
I	2	Lumber, oak, 4- by 8- by 30-inch. Raise rear ripper for placing the two pieces of lumber stacked one on another in the center of the ripper. Place a 30-inch piece lengthwise on railcar. Drill and toenail first piece of lumber to the railcar floor with four 30d nails. Then drill and toenail second piece on top of first with four 30d nails. Lower ripper on top of blocking.

GENERAL

1. Brakes must be tightly set and secured.
2. Tractors without ripper must have the rear left and right tiedowns attached to the rear towing pin. Maintain similar angles on tiedowns as shown on drawing.
3. General Loading Rules 1, 2, 4, 5, 7, 9, 14, 15, 19, 19A, and 19B appearing in section 1 of the *Rules Governing the Loading of Commodities on Open-Top Cars*, published by the Association of American Railroads, provide guidelines that are mandatory in application.

c. Wooden-deck chain-tiedown flatcars, usually are equipped with four parallel channels that run the full length of the flatcar deck. Two channels are about 30 inches apart, and two other channels run along the outer edges of the car, or just inboard of the tread-way loading area of the car. These channels are recessed so that the top is flush with the deck surface. Each channel contains numerous (usually 8 to 12) chain anchors, each with an attached 10- to 12-foot chain. The chain anchors can be moved along- the channel and locked in place where needed. At the free end of the chain, pass a hook through the tiedown shackle on the vehicle being loaded and pull the chain hand-tight. Then hook it back onto itself or directly to the shackle. Apply tension to the chain by tightening a turnbuckle built into the chain assembly or by turning a ratchet or screwjack in the anchor block. Use an open-end wrench to tighten the turnbuckles. Use a 3/4-inch square-drive, heavy-duty socket wrench to tighten the ratchet at the anchor blocks. Wire-tie open hooks to prevent them from becoming disconnected during over-the-road forces encountered en route. Table 7-3 gives the application of materials for tiedown of the D7 tractor on wooden-deck chain-tiedown flatcars.

CAUTION

Vehicles loaded on conventional wooden-

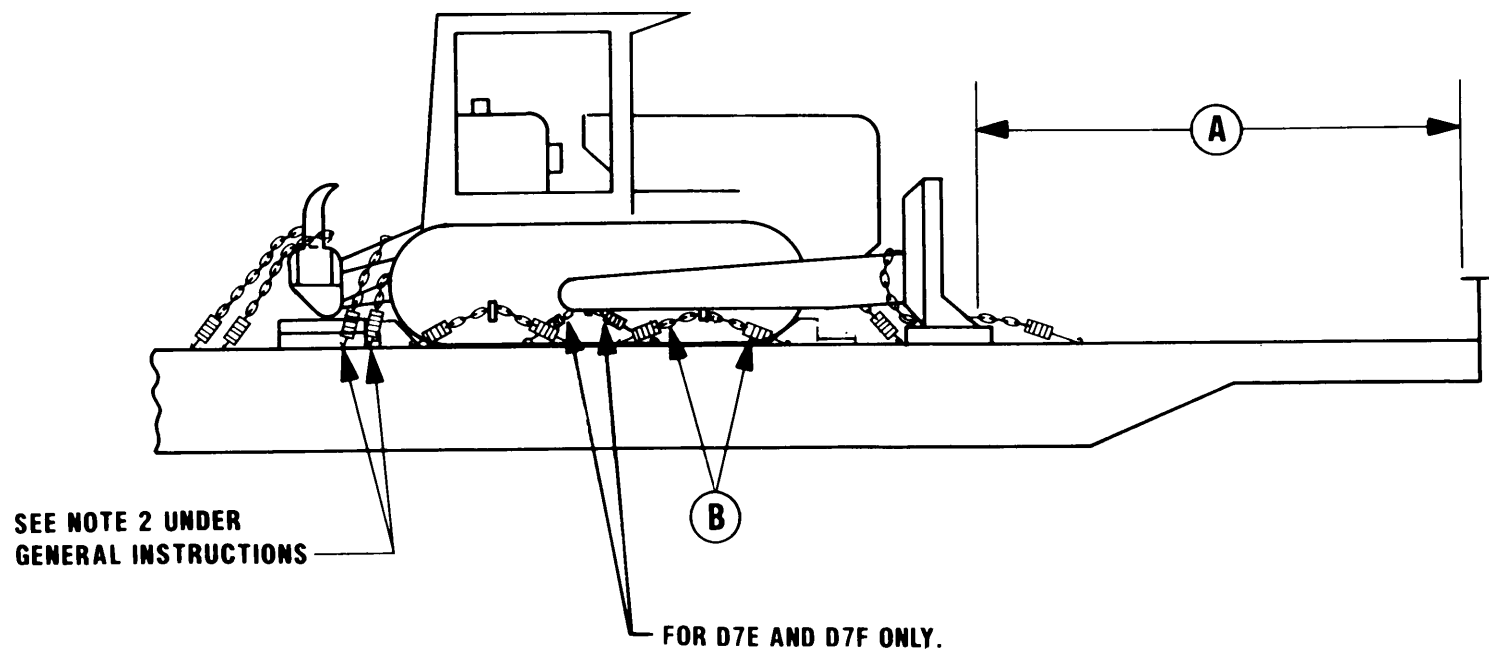
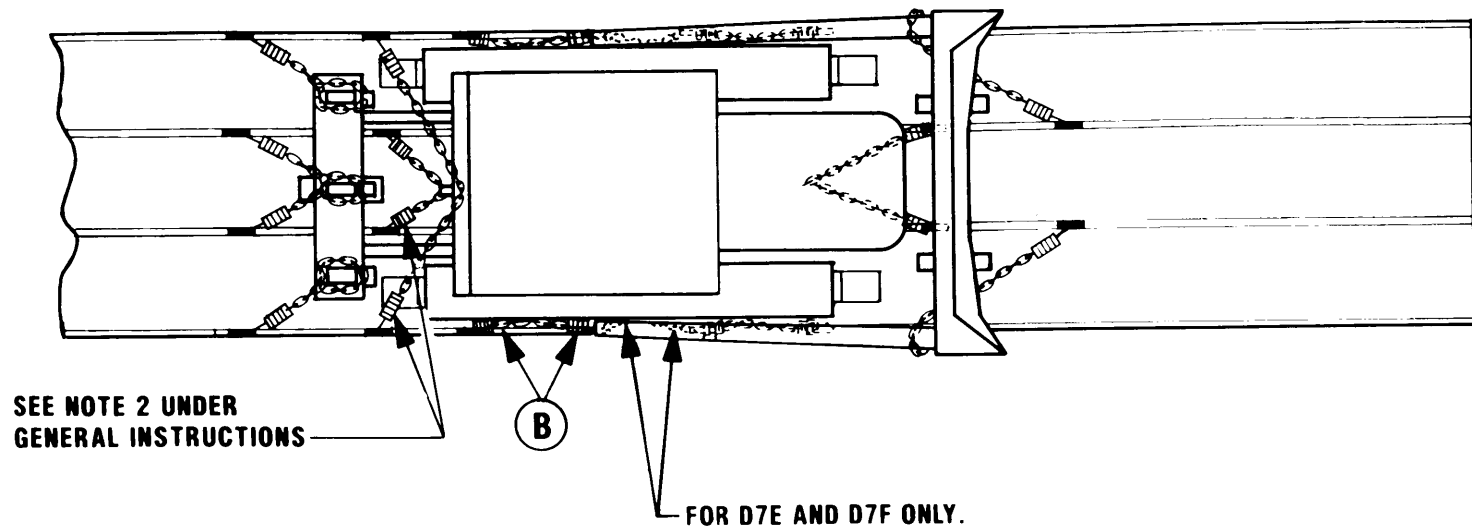


Figure 7-3. D7 crawler tractor loaded on a wooden-deck chain-tiedown flatcar (table 7-3).

deck chain-tiedown flatcars are placed in the tiedown position with the gearshift placed in neutral and the parking brakes set.

Table 7-3. Application of Materials for Blocking and Tiedown of the D7 Crawler Tractor on a Wooden-Deck Chain-Tiedown Flatcar (Fig 7-3)

Item	No. Required	Application
A		Brake-wheel clearance. Minimum clearance required is 6 inches above, in back of, and on both sides of and 4 inches underneath wheel; 12 inches from end of railcar to load, which extends from center of brake wheel to side of railcar; and 6 feet above railcar floor.
B	20 (D7G) 24 (D7E&F)	Tiedown chains (furnished with railcar), ½-inch diameter alloy steel chain, extra-strength, proof-tested to at least 27,500 pounds. Attach one to each tiedown

Item	No. Required	Application
		provision on each side of tractor to anchor positions as shown in figure 7-3. Tighten all chains evenly until 1/8-inch space remains between metal rings of the compression unit of the chain tiedown assembly. The angle of the tiedown chain must be as close to 45° as possible.

GENERAL INSTRUCTIONS

- 1. Tractors without ripper must have the rear left and right tiedowns attached to the rear towing pin and tiedown provision on winch. Maintain similar angles on tiedowns as shown on drawing.
- 2. Loading rules 4, 5, 7, 11, 15(g), 19, 19A, 19B, and 19C in section 1 of the *Rules Governing the Loading of Commodities on Open-Top Cars and Trailers*, published by the Association of American Railroads, provides guidelines that are mandatory in application.

Section III. TRANSPORT ON FOREIGN RAILWAYS

7-7. General

The transportability guidance in this section applies to transport of the D7 tractor on foreign railways. It includes both single and multiple vehicle movements for the types of flatcars normally used for moving this type of equipment. When loaded on a suitable flatcar, the D7 tractor, in reduced configuration (para 7-4), can be transported for generally unrestricted rail movement throughout Europe. Some rail line clearances will require removal of the tractor ROPS, dozer blade, and exhaust stack to meet height requirements. Flatcars with a capacity of more than 20 metric tons must be used for transporting the D7 tractor with ripper. The ripper must be removed to reduce the tractor weight if flatcars with a suitable weight-carrying capacity are not available.

7-8. Transport on Foreign-Service Flatcars

- a. *General.* The D7 tractor is transportable on foreign-service flatcars of adequate size and capacity. Within Europe are many railcars that have a suitable size and capacity for transporting the D7. A list of them can be found in the European Railway Equipment Register.
- b. *Materials.* The materials required for blocking and tiedown of the tractor on foreign-service flatcars are essentially the same as those used for transporting the vehicle within CONUS. The 4th Transportation Command Pamphlet 55-2, *Tiedown Guide for Rail Movements*, provides detailed guidance. Further assistance can be obtained from the 1st Transportation Movement Control Agency, Oberussel Germany.

APPENDIX A

CONVERSION TABLES

A-1. Common Metric Abbreviations

m = meter
dm = decimeter
cm = centimeter
mm = millimeter

kg = kilogram
km = kilometer
t = metric tons

A-2. Linear Measure

1 mi = 1,609.35 m
1 yd = 0.9144 m
1 ft = 0.3048 m
1 in. = 0.0254 m
1 m = 10 dm = 100 cm = 1000 mm

1 km x 0.6214 mi
1 m = 1.0936 yd
1 m = 3.2808 ft
1 m = 39.3700 in.

A-3. Surface Measure

1 yd² = 0.8361 m²
1 ft² = 0.0929 m²
1 in.² = 0.00065 m²

1 m² = 1.196 yd²
1 m² = 10.764 ft²
1 m² = 1,550 in.²

A-4. Cubic Measure

1 yd³ = 0.76455 m³
1 ft³ = 0.02831 m³
1 in.³ = 0.000016 m³

1 m³ = 1.31 yd³
1 m³ = 35.30 ft³
1 m³ = 61,023 in.³

A-5. Weight

1 STON = 907.185 kg
1 lb = 0.45359
1 kg = 2.2046 lb

1 t = 1000 kg
1 t = 2,204.62 lb

A-6. Simplified Conversion Factors

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

- a. *Inches to centimeters.* Multiply in. by 10 and divide by 4.
- b. *Yards to meters.* Multiply yd by 9 and divide by 10.
- c. *Miles to kilometers.* Multiply mi by 8 and divide by 5.
- d. *Pounds to kilograms.* Multiply lb by 5 and divide by 11.

Paragraph 7-37, FM 55-15 contains additional detailed conversion factors.

A-7. Conversions for Lumber, Wire Rope, and Wire

The following conversions are provided for guidance when procuring lumber, wire rope, or wire in areas that use the metric system. Lumber sizes are rounded off to nearest ½ cm.

a. Lumber.

- (1) 2-in. by 4-in. by desired length = 5-cm by 10-cm by desired length.
- (2) 1-in. by 6-in. by desired length = 2.5-cm by 15-cm by desired length.
- (3) 6-in. by 8-in. by desired length = 15-cm by 20-cm by desired length.
- (4) 1-in. by 12-in. by desired length = 2.5-cm by 30-cm by desired length (length normally expressed in ft or m).

b. Wire rope.

- (1) 3/8-in. dia = 9.5-mm dia.
- (2) ½-in. dia = 12.7-mm dia.
- (3) 5/8-in. dia = 15.8-mm dia.
- (4) ¾-in. dia = 19.0-mm dia.
- (5) 7/8-in. dia = 22.2-mm dia.

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- (6) 1-in. dia = 25.4-mm dia.
- (7) 1- $\frac{1}{4}$ -in. dia = 31.7-mm dia.
- (8) 1- $\frac{1}{2}$ -in. dia = 38.1-mm dia.

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

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

APPENDIX B

REFERENCES

B-1. Army Regulations (AR)

55-29	Military Convoy Operations in CONUS
55-80	Highways for National Defense
55-162	Permits for Oversize, Overweight, or Other Special Military Movements on Public Highways in the United States
55-228	Transportation by Water of Explosives and Hazardous Cargo
55-355	Defense Traffic Management Regulation
70-44	DOD Engineering for Transportability
70-47	Engineering for Transportability
385-40	Accident Reporting and Records
746-1	Packaging of Army Materiel for Shipment and Storage

B-2. Field Manuals (FM)

55-9	Unit Air Movement Planning
55-15	Transportation Reference Data
55-17	Terminal Operations Coordinator's Handbook

B-3. Supply Bulletins (SB)

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

55-46-1	Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outsize/Overweight Equipment
---------	--

B-5. Technical Manuals

5-2410-124-12	Operator and Organizational Maintenance Manual Tractor, Full Track, Low. Speed; Diesel Engine Driven; Medium Drawbar Pull, Oscillating Track 78-inch gage Caterpillar Model D7E NSN 2410-00-782-1130 w/winch NSN 2410-00-926-3697 w/ripper
5-2410-233-10	Operator's Manual, Tractor, Full Tracked; Low Speed; DED; Medium Drawbar Pull; Oscillating Track, 78 in. gage (Caterpillar Model D7F) with ripper; FSN 2410-177-7284
38-236 (AFP 71-8)	Preparation of Freight for Air Shipment
38-250 (AFR 71-4)	Packaging and Materials Handling; Preparation of Hazardous Materials for Military Air Shipment
55-500	Marine Equipment Characteristics and Data
55-2200-001-12	Application of Blocking, Bracing, and Tiedown Materials for Rail Transport

B-6. Technical Orders (TO)

1-1B-40	Handbook of Weight and Balance Data
1C-5A-9	Loading Instructions, USAF Series C-5A Airplane
1C-130-9	Loading Instructions, USAF Series C-130 Airplane
1C-141B-9	Loading Instructions, USAF Series C-141B Airplane

B-7. Other publications and Source of Procurement

- a. *Code of Federal Regulations*, Title 46 - Shipping, Part 146 and Title 49 - Transportation, Parts 170-179
Available from: Superintendent of Documents
US Government Printing Office
Washington, DC 20402

- b. Section No. 1, General Rules Governing the Loading of Commodities on Open Top Cars*
Section No. 6, Rules Governing the Loading of Department of Defense Material on Open Top Cars
Available from: Association of American Railroads
50 F. Street NW
Washington, DC 20001
- c. Legal Maximum Dimensions and Weight of Motor Vehicles Compared with AASHTO Standards*
Available from: American Association of State Highway
and Transportation Officials
341 National Press Building
Washington, DC 20004
- d. 4th Transportation Command Pamphlet 55-2, Tiedown Guide for Rail Movements*
Available from: 1st Transportation Movement Control Agency
ATTN: AEUTR-MCA-TA
APO New York 09451-4000

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THE METRIC SYSTEM AND EQUIVALENTS

LENGTH MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 lb.
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

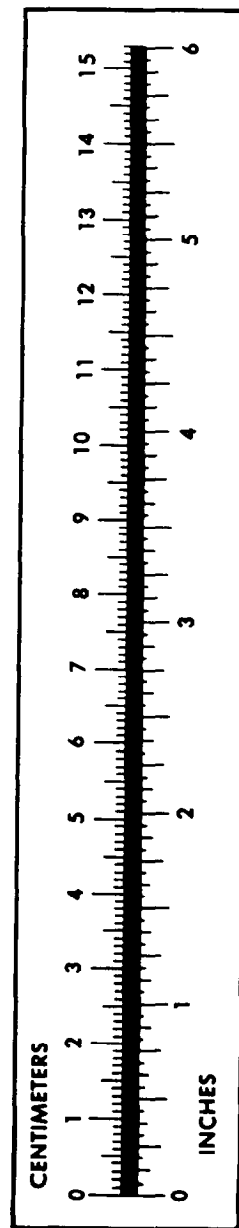
TEMPERATURE

$5/9(^{\circ}\text{F} - 32) = ^{\circ}\text{C}$
 212° Fahrenheit is equivalent to 100° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 $9/5^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Quarts	Liters	0.473
Gallons	Liters	0.946
Ounces	Liters	3.785
Pounds	Grams	28.349
Short Tons	Kilograms	0.454
Pound-Feet	Metric Tons	0.907
Pounds per Square Inch	Newton-Meters	1.356
Miles per Gallon	Kilopascals	6.895
Miles per Hour	Kilometers per Liter	0.425
	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Grams	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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