

**TECHNICAL MANUAL**

**TRANSPORTABILITY GUIDANCE**

**GRADER, ROAD, MOTORIZED, DIESEL-ENGINE-DRIVEN (DED)**

**HEAVY, COMMERCIAL CONSTRUCTION EQUIPMENT (CCE)**

**MODEL 130G MIL**

**NSN 3805-01-150-4795**

**MODEL 130G TYPE I (NONSECTIONALIZED)**

**NSN 3805-01-126-7894**

**MODEL 130G TYPE II (SECTIONALIZED)**

**NSN 3805-01-126-7895**

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**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**8 JULY 1986**

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## CHAPTER 1

### INTRODUCTION

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#### 1-1. Purpose and Scope

a. This manual provides transportability guidance for logistical handling and movement of the grader, road, motorized, diesel-engine-driven (DED) in the following configurations.

(1) Grader, road, motorized, DED, heavy, commercial construction equipment (CCE).

(2) Grader, road, motorized, DED, nonsectionalized, Type I.

(3) Grader, road, motorized, DED, sectionalized, Type II.

b. This manual contains information considered appropriate for safe transport of these items. Included are significant technical and physical characteristics with safety considerations required for worldwide movement by the various transportation modes. Where considered necessary, metric equivalents are given in parentheses following the dimension or other measurement.

c. This manual is intended for transportation officers and other personnel responsible for providing transportation services.

#### 1-2. Safety

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

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

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

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

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

c. *Note.* A brief statement for use as necessary to emphasize a particular operating procedure or condition.

#### 1-4. Reporting of Recommendations and Comments

Individual users of this manual are encouraged to recommend changes and submit comments for its improvement. Comments should be prepared on DA Form 2028 (Recommended Changes to DA Publications and Blank Forms) and forwarded to Commander, Military Traffic Management Command Transportation Engineering Agency, ATTN: MTT-TRC, PO Box 6276, Newport News, VA 23606-0276. Electrically transmitted messages should be addressed to CDR MTMC TEA FT EUSTIS VA//IMTT-TRC//. A reply will be furnished by this command.

CHAPTER 2

TRANSPORTABILITY DATA

Section I. GENERAL

2-1. Scope

This chapter provides a general description and identification photographs of the three configurations of the Caterpillar model 130G graders. Transportability characteristics of the grader are also provided.

2-2. Description

a. The Caterpillar model 130G graders are diesel engine-driven, four-wheel-drive, with six pneumatic tires and front-wheel, articulated-frame steering. Each grader is equipped with a blade and scarifier.

b. The model 130G MIL grader (fig 2-1) is the standard production Caterpillar. This grader is equipped with a sound-suppressed cab that meets OSHA standards. The letters MIL, which are given after the model number on the data plate, indicates that the cab or roll-over-protection system (ROPS) is removable and that tiedowns, lift points, and forward positioned hydraulic-lift cylinder auxiliary trunions are added for transportability purposes.

c. The model 130G Type I grader (fig 2-2) is modified for nonsectionalized requirements. This grader has an open ROPS and eight 20,000-pound tiedowns on each side for rigging on a 24-foot pallet for the low altitude parachute extraction system (LAPES). Although the Type I grader cannot be sectionalized for external sling loading, it has four lift eyes.

d. The model 130G Type II (sectionalized) grader (fig 2-3) has the same modifications as the Type I grader. Also, the Type II grader can be sectionalized into two halves for airmobile operations. Each half can be externally lifted by the CH-47 or larger helicopter. After both halves have been lifted, the rear half can be driven for a short distance from a ground position to rejoin the front half.

2-3. Transportability Drawings

Detailed transportability elevations of the model 130G grader with dimensions and tiedown and lift provisions are shown in figures 2-4 through 2-8.

Section II. CHARACTERISTICS AND RELATED DATA

2-4. General Transportability Characteristics

These data are applicable to model number or national stock number (NSN) shown. Changes in model or NSN may affect the loadability of the item related to guidance shown in this manual.

a. Grader, Road, DED, Heavy, CCE, Model 130G MIL

Line item number .....	G-74783
National stock number .....	3805-01-150-4795
Performance:	
Maximum speed .....	24.5 mph (40.8 km/h)
Fuel tank capacity .....	75 gal (284 liters)
Turning radius .....	24 ft (7.32 m)
Ground clearance.....	13.8 in. (0.35 m)
Dimensions and weight:	
Weight, operational .....	31,300 lb (14 197.44 kg)
Front axle, operational .....	9,680 lb (4 390.75 kg)
Rear tandem axle, operational .....	21,620 lb (9 806.62 kg)
Weight, reduced .....	29,450 lb (13 358.23 kg)
Front axle, reduced .....	9,470 lb (4 295.50 kg)
Rear tandem axle, reduced .....	19,980 lb (9 062.73 kg)
Length, operational.....	327 in. (8.31 m)
Length, reduced .....	327 in. (8.31 m)
Width, operational .....	95.5 in. (2.43 m)
Width, reduced .....	95.5 in. (2.43 m)
Height, operational .....	127 in. (3.23 m)

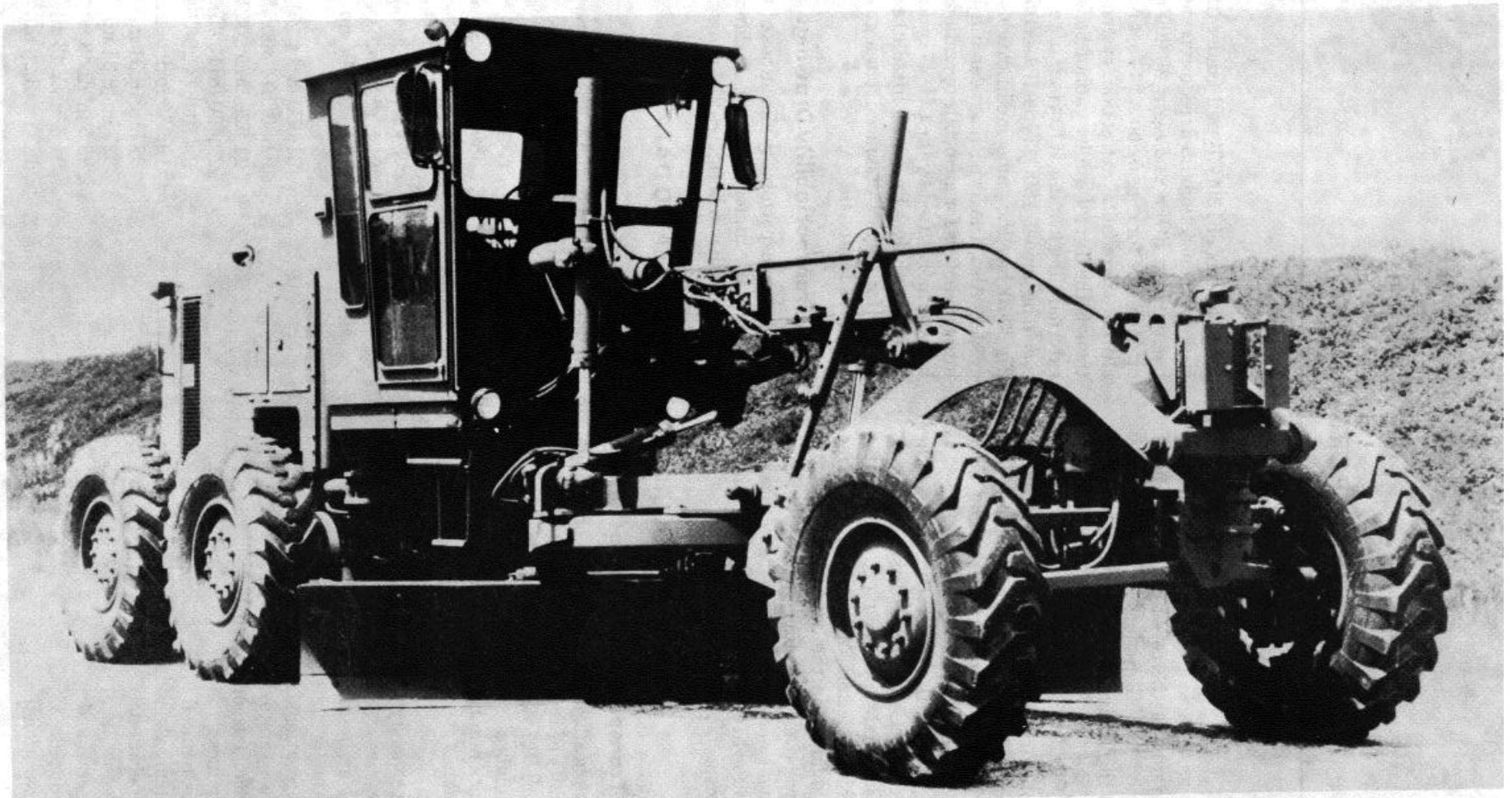


Figure 2-1. Model 130G MIL grader.

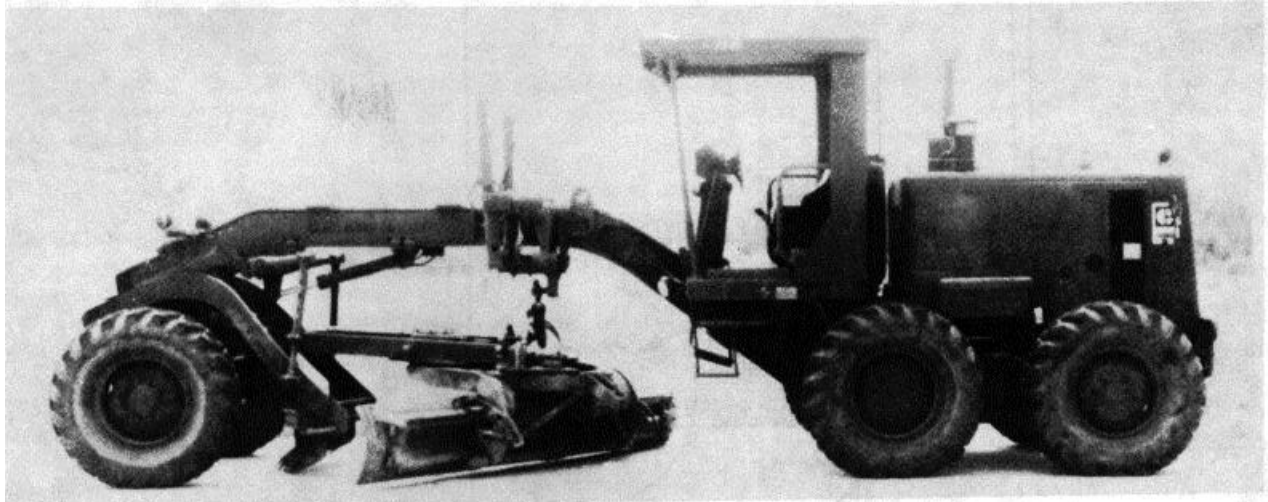


Figure 2-2. Model 130 G Type I (nonsectionalized) grader.

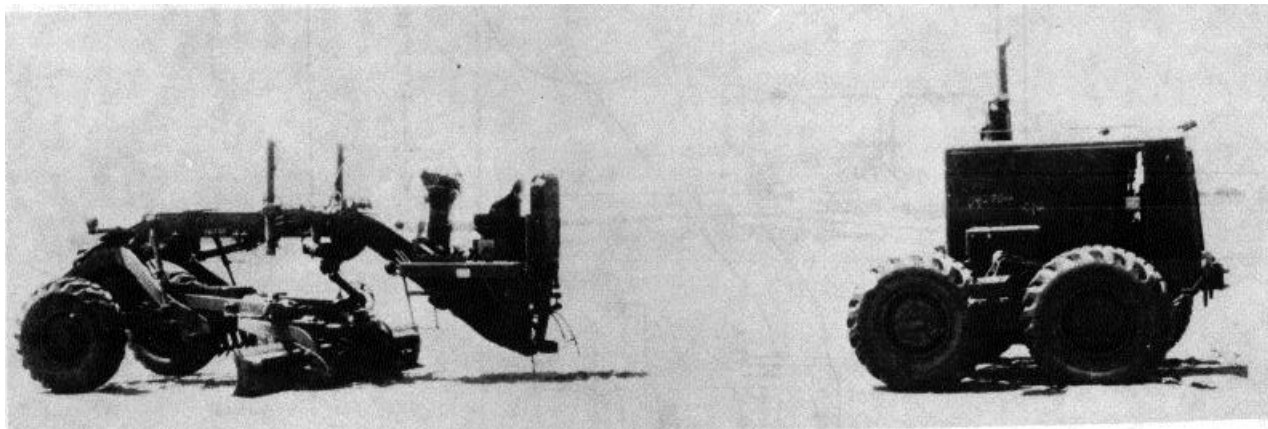


Figure 2-3. Model 130G Type II (sectionalized) grader.

Height, reduced .....	91 in. (2.31 m)
Area, operational .....	217 ft <sup>2</sup> (20.16 m <sup>2</sup> )
Area, reduced .....	217 ft <sup>2</sup> (20.16 m <sup>2</sup> )
Cube, operational .....	2,272 ft <sup>3</sup> (64.34 m <sup>3</sup> )
Cube, reduced .....	1,628 ft <sup>3</sup> (46.10 m <sup>3</sup> )
Center of gravity:	
Forward of rear tandem center .....	76.7 in. (1.95 m)
Above ground .....	41 in. (1.04 m)
Tire size .....	13.00 x 24 10PR traction type
Ground contact area, each tire:	
Front .....	138.3 in. <sup>2</sup> (0.09 m <sup>2</sup> )
Rear .....	154.4 in. <sup>2</sup> (0.10 m <sup>2</sup> )
Ground pressure, tires .....	35 psi (all)
Military load classification (MLC) .....	MLC 14
b. <i>Grader, Road, DED, Heavy, CCE, Model 130G Type I (Nonsectionalized)</i>	
Line item number .....	J-74920
National stock number .....	3805-01-126-7894

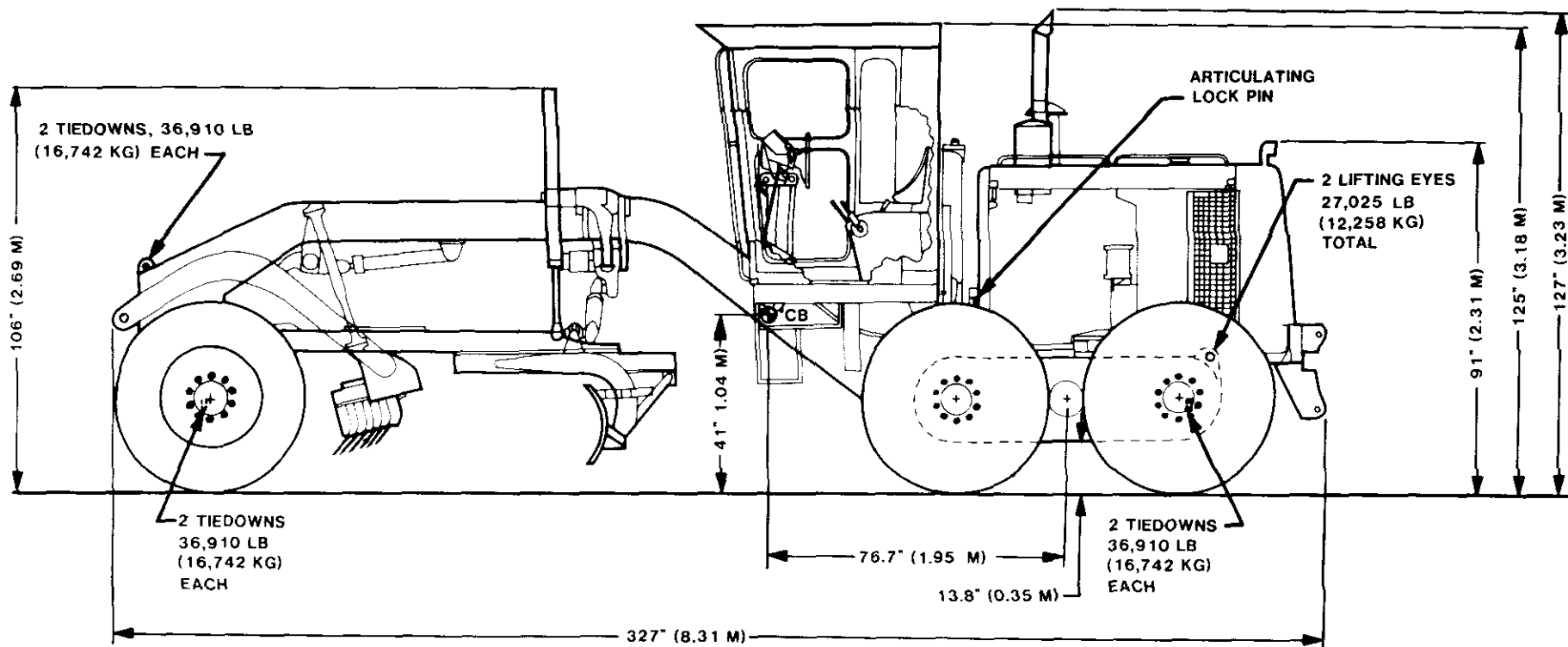


Figure 2-4. Left-side view of model 130G MIL grader.



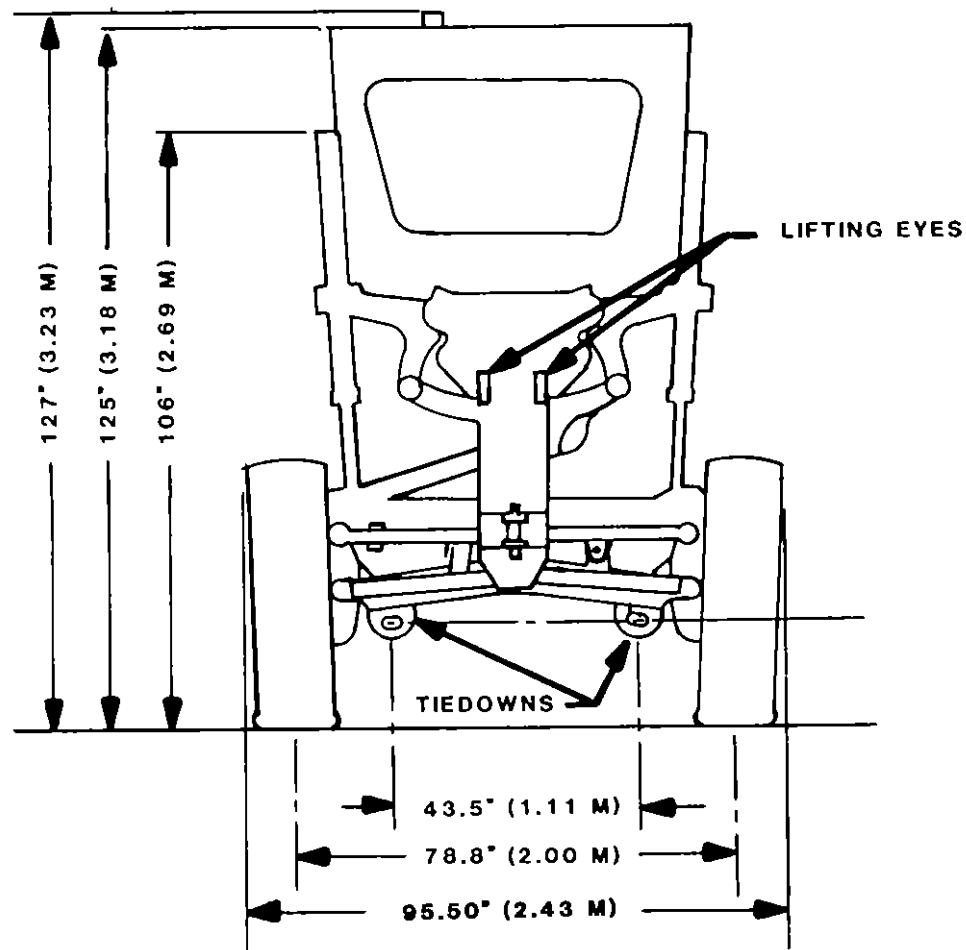


Figure 2-5. Front view of model 130 G MIL grader.

Performance:

Maximum speed .....	24.5 mph (40.8 km/h)
Fuel tank capacity .....	75 gal (284 liters)
Turning radius .....	24 ft (7.32 m)
Ground clearance.....	13.8 in. (0.35 m)

Dimensions and weight:

Weight, operational .....	31,540 lb (14 306.23 kg)
Front axle, operational .....	10,230 lb (4 640.23 kg)
Rear tandem axle, operational .....	21,310 lb (9 666.00 kg)
Weight, reduced for air transport .....	29,918 lb (13 570.51 kg)
Front axle, reduced .....	9,650 lb (4 377.14 kg)
Rear tandem axle, reduced .....	20,268 lb (9 193.36 kg)
Weight, reduced for airdrop .....	30,300 lb (13 743.78 kg)
Length, operational.....	331 in. (8.41 m)
Length, reduced .....	331 in. (8.41 m)
Width, operational .....	95.5 in. (2.43 m)
Width, reduced .....	95.5 in. (2.43 m)
Height, operational .....	127 in. (3.23 m)
Height, reduced .....	91 in. (2.31 m)
Area, operational .....	220 ft <sup>2</sup> (20.44 m <sup>2</sup> )
Area, reduced .....	220 ft <sup>2</sup> (20.44 m <sup>2</sup> )
Cube, operational .....	2,296 ft <sup>3</sup> (64.98 m <sup>3</sup> )
Cube, reduced .....	1,645 ft <sup>3</sup> (46.55 m <sup>3</sup> )

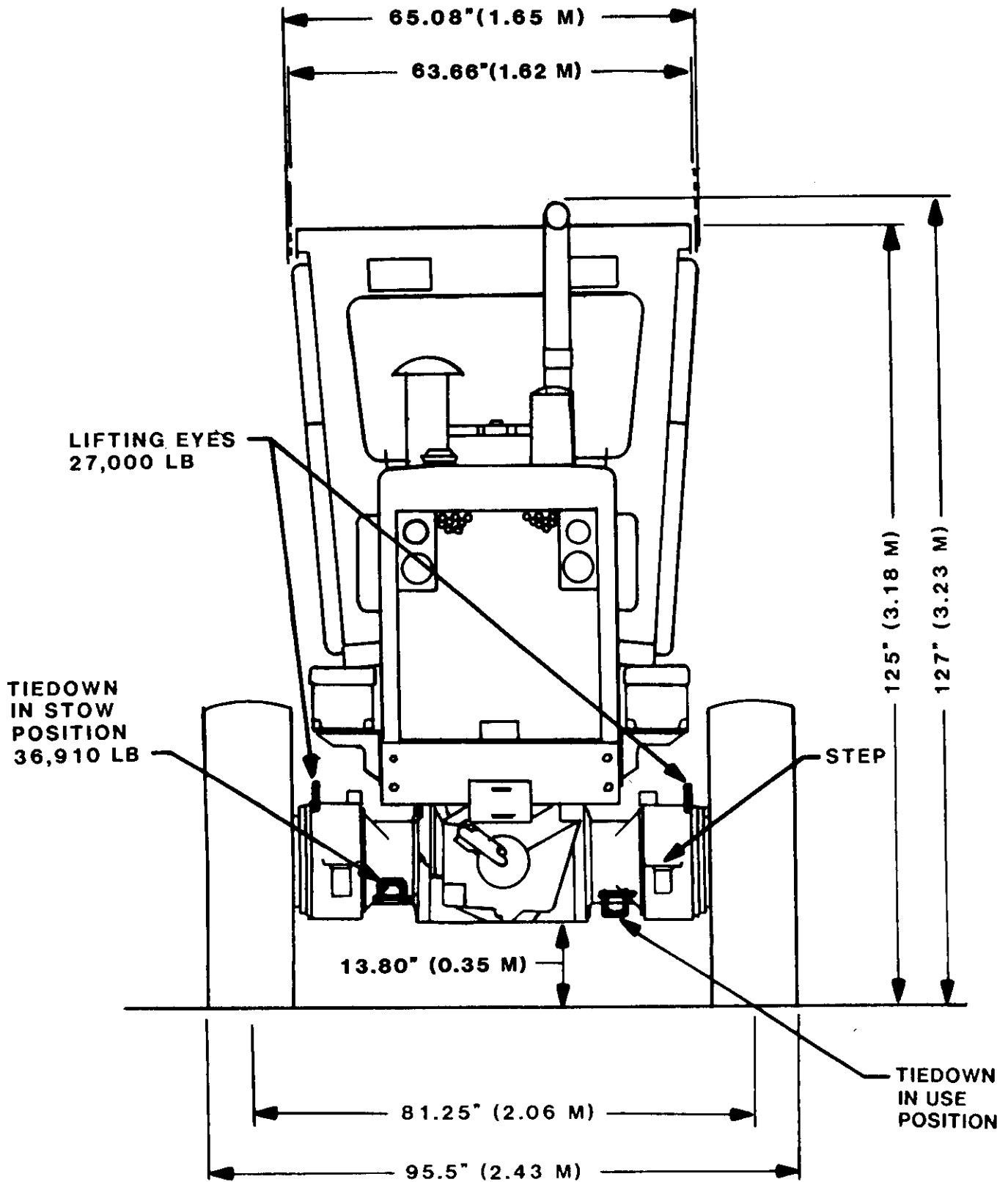


Figure 2-6. Rear view of model 130G MIL grader.

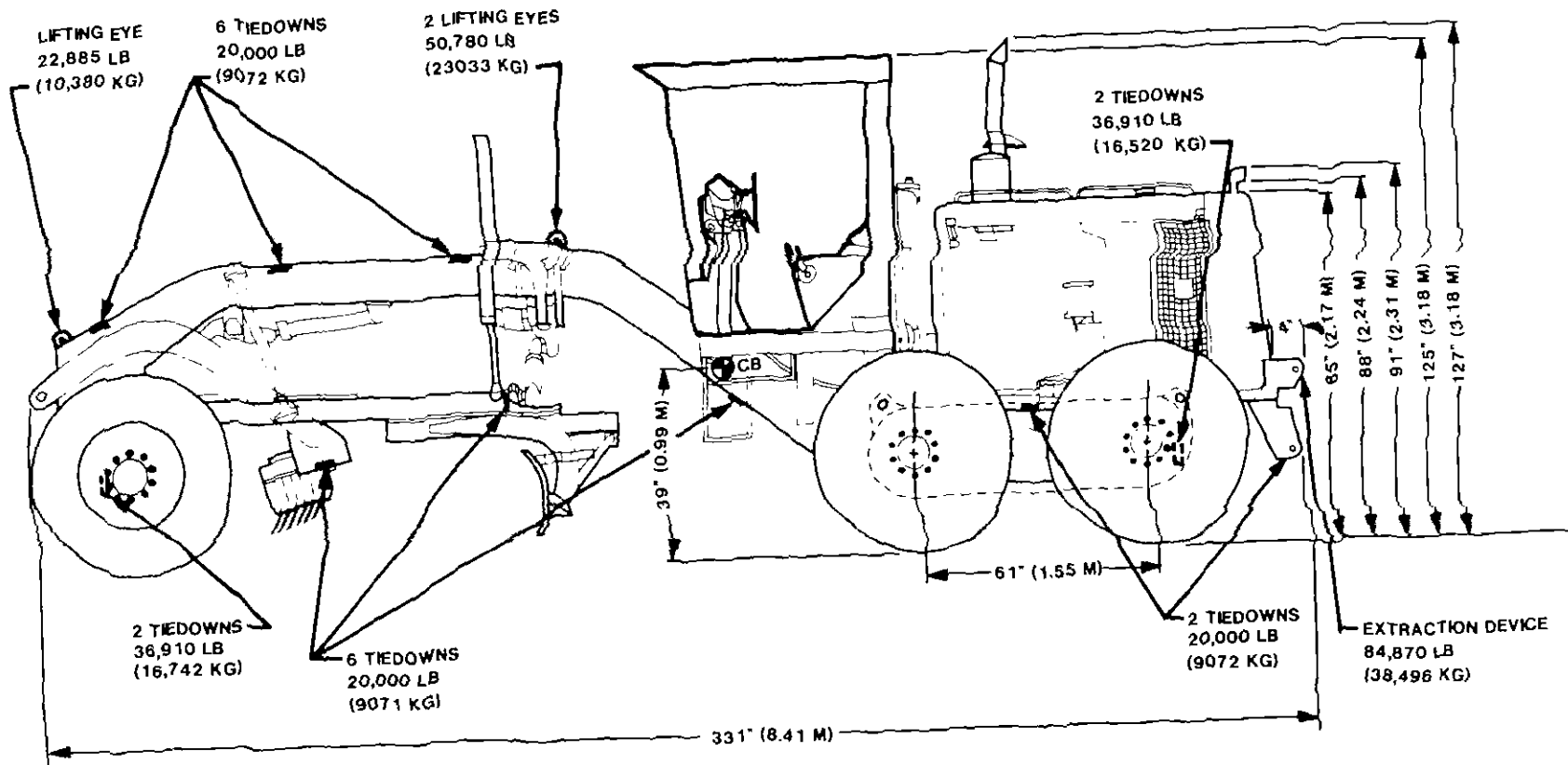


Figure 2-7. Left-side view of model 130G Types I and II graders.

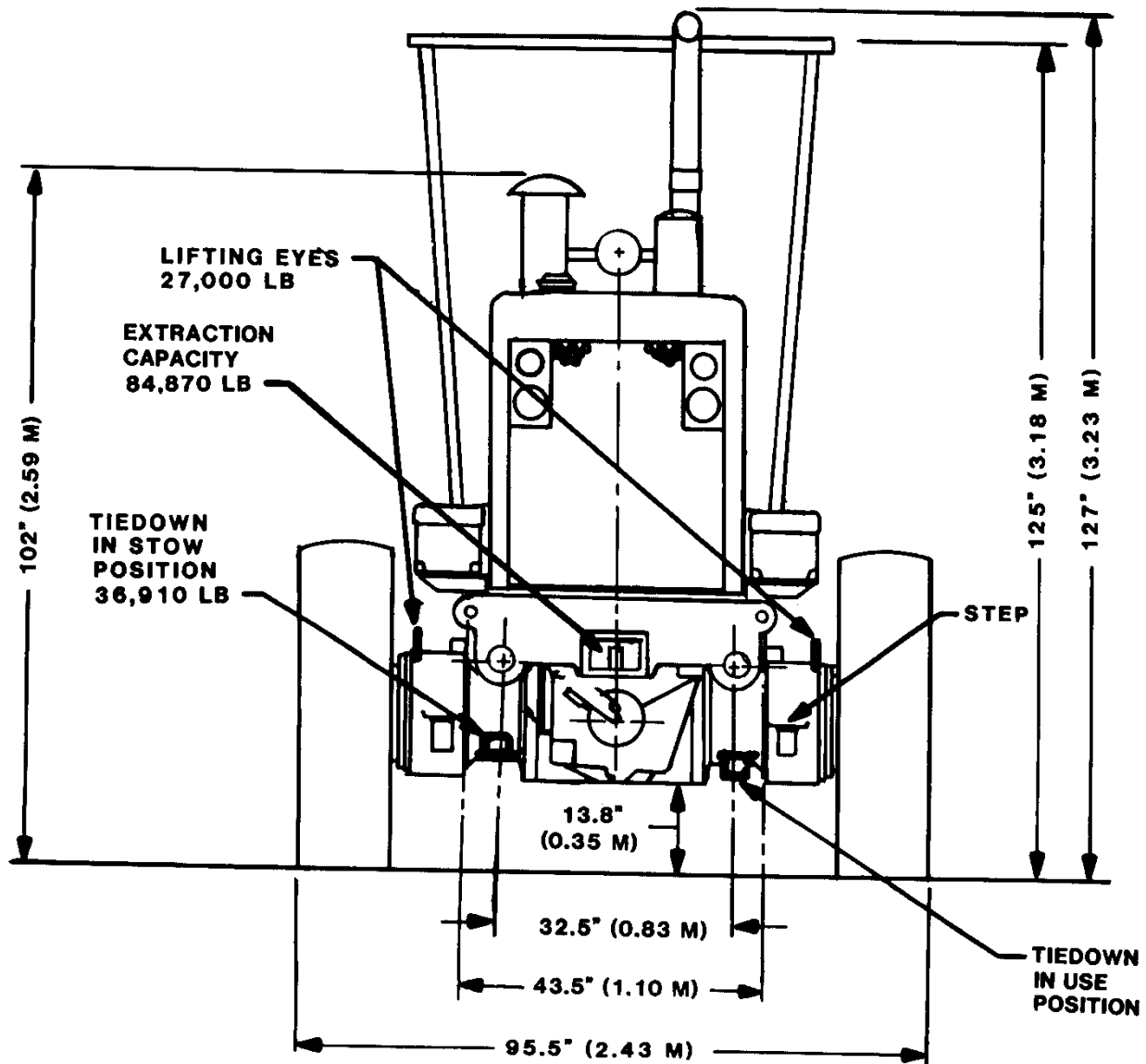


Figure 2-8. Rear view of model 130G Types I and II graders.

Center of gravity:	
Forward of rear tandem center .....	73.8 in. (1.88 m)
Above ground .....	39 in. (0.99 m)
Tire size .....	13.00 x 24 10PR traction type
Ground contact area each tire:	
Front .....	138.3 in. <sup>2</sup> (0.09 m <sup>2</sup> )
Rear .....	154.4 in. <sup>2</sup> (0.10 m <sup>2</sup> )
Ground pressure, tires .....	35 psi (all)
Military load classification (MLC) .....	MLC 14
c. Grader, Road, DED, Heavy, CCE, Model 130G Type II(Sectionalized)	
Line item number .....	J-74886
National stock number .....	3805-01-126-7895
Performance:	
Maximum speed .....	24.5 mph (40.8 km/h)

Fuel tank capacity .....	75 gal (284 liters)
Turning radius .....	24 ft. (7.32 m)
Ground clearance .....	13.8 in. (0.35 m)
Dimensions and weight:	
Weight, operational .....	31,870 lb (14 455.91 kg)
Front axle, operational .....	10,270 lb (4 658.37 kg)
Rear tandem axle, operational .....	21,600 lb (9 797.54 kg)
Weight, reduced for air transport .....	30,240 lb (13 716.63 kg)
Front axle, reduced .....	10,380 lb (4 708.26 kg)
Rear tandem axle, reduced .....	20,450 lb (9 275 kg)
Weight, reduced for airdrop .....	30,470 lb (13 820.89 kg)
Weight, sectionalized:	
Front section .....	15,980 lb (7 248.37 kg)
Rear section .....	14,460 lb (6 558.91 kg)
Length, operational .....	331 in. (8.41 m)
Length, reduced .....	331 in. (8.41 m)
Width, operational .....	95.5 in. (2.43 m)
Width, reduced .....	95.5 in. (2.43 m)
Height, operational .....	127 in. (3.23 m)
Height, reduced .....	91 in. (2.31 m)
Area, operational .....	220 ft <sup>2</sup> (20.44 m <sup>2</sup> )
Area, reduced .....	220 ft <sup>2</sup> (20.44 m <sup>2</sup> )
Cube, operational .....	2.296 ft <sup>3</sup> (64.98 m <sup>3</sup> )
Cube, reduced .....	1,645 ft <sup>3</sup> (46.55 m <sup>3</sup> )
Center of gravity:	
Forward of rear tandem center .....	76.0 in. (1.93 m)
Above ground .....	39.8 in. (1.01 m)
Ground contact area, each tire:	
Front .....	138.3 in. <sup>2</sup> (0.090 m <sup>2</sup> )
Rear .....	154.4 in. <sup>2</sup> (0.10 m <sup>2</sup> )
Ground pressure, tires .....	35 psi (all)
Tire size .....	13.00 x 24 10PR traction type
Military Load Classification (MLC) .....	MLC 14

2-5. Unusual Characteristics

The vehicle has no unusual characteristics that would require special attention be given to temperature, atmospheric pressure, or humidity variations during its exposure to normal transportation environments.

characteristics that would hinder its operation in normal transportation environments.

NOTE

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

2-6. Hazardous and Dangerous Characteristics

This vehicle has no explosive devices or hazardous

## CHAPTER 3

### SAFETY

---

#### 3-1. General

General safety considerations and precautions for movement are as follows:

- a. Each vehicle must be checked to ensure that all loose items are appropriately secured.
- b. The vehicle must be driven by qualified drivers only.
- c. Drivers must not leave their station while the engine is running.
- d. When the vehicle is in motion, it must not be mounted or dismounted.
- e. Personnel must not ride "on" the vehicle.
- f. Personnel must not smoke when operating or refueling the vehicle.
- g. The exhaust stack must be cooled before it is removed for shipment.
- h. The blade must be in the full up position before the vehicle is loaded.

i. The scarifier must be in the stow position before the vehicle is loaded.

j. Ground guides must be used when the vehicle is being loaded.

k. The articulating pin and wheel lockpin must be in place before loading.

l. The engine must not be operated in an enclosed area without adequate ventilation to provide sufficient air for engine combustion, as well as dissipation of exhaust gases.

m. Personnel must stay clear of the exhaust area during and immediately after engine operation. Contact with these areas can cause severe burns.

#### 3-2. Specific Safety Requirements

Safety requirements by individual model can be found in the drivers' manuals

CHAPTER 4

AIR TRANSPORTABILITY GUIDANCE

**4-1. Scope**

This chapter provides air transportability guidance for movement of the grader, road, motorized, DED, heavy, CCE. It covers technical and physical characteristics, as well as safety considerations, and prescribes the manpower, materials, and time required to prepare, load, and tie down the vehicle on, or unload the vehicle from, US Air Force cargo aircraft.

**4-2. Maximum Utilization of Aircraft**

The loads described in this section are not maximum loads. Additional cargo and/or personnel within allowable load limits and restrictions prescribed by pertinent safety regulations can be transported.

**4-3. Applicability**

a. *US Air Force Aircraft.* The CCE grader is transportable in the C-130, C-141, and C-6 aircraft. Procedures in this manual and those prescribed in the Air Force loading instructions, technical orders (TO) IC-xxx-9 series, are applicable to each aircraft.

b. *Tiedown.* The graders are tied down in accordance with the applicable TO [C-xxx-9, section IV. Suggested tiedown patterns are shown in figures 4-1 through 4-3. Tables 4-1 through 4-4 show the tiedown devices required, the location of the tiedown

points on the vehicle, the corresponding fittings to which the devices are secured, the number and capacity of devices, and the wood shoring required for loading and securing the vehicle on C-130, C-141, and C-5 aircraft. The minimum acceptable restraint factors (g loads) are identified in the applicable TO 1C-xxx-9's.

c. *Loadmaster Responsibilities.* The load master will ensure that the vehicle is loaded and secured in accordance with in the applicable TO 1C-xxx-9.

**4-4. Safety**

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

a. The vehicle fuel tanks must not be more than one quarter full.

b. The vehicle must be tied down in accordance with this manual and the applicable TO 1C-xxx-9 for each particular aircraft.

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

d. Ground guides must be used when the vehicle is loaded in or unloaded off the aircraft.

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

**Table 4-1. Tiedown data for the Model 1 30G Type I or II Grader in US Air Force C-130 Aircraft (Fig. 4-1)**

Tiedown Fitting		Tiedown Device		Attach to Item
Descrip- tion	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	
B1	10	MB1	10	Right extraction plate tiedown.
C1	10	MB1	10	Extraction/towing attachment.
E1	10	MB1	10	Extraction/towing attachment.
F1	10	MB1	10	Left extraction plate tiedown.
C2	10	MB1	10	Right rear axle tiedown.
E2	10	MB1	10	Left rear axle tiedown.
B3	10	MB1	10	Right lifting device.
F3	10	MB1	10	Left lifting device.
B4	10	MB1	10	Right side tiedown.
F4	10	MB1	10	Left side tiedown.
B5	10	MB1	10	Right circle tiedown.
F5	10	MB1	10	Left circle tiedown.
B6	10	MB1	10	Right front tiedown.
F6	10	MB1	10	Left front tiedown.
C7	10	MB1	10	Right front tiedown.
E7	10	MB1	10	Left front tiedown.
C8	25	MB2	25	Right front tiedown.
E8	25	MB2	25	Left front tiedown.

**Table 4-2. Tiedown Data for the Model 130G Type I or II Grader in US Air Force C-141 Aircraft (Fig. 4-2)**

Tiedown Fitting		Tiedown Device		
Description	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	Attach to Item
A1	25	MB2	25	Right extraction plate tiedown
G1	25	MB2	25	Left extraction plate tiedown.
C2	10	MB1	10	Right rear axle tiedown.
E2	10	MB1	10	Left rear axle tiedown.
A3	20	MB2	25	Right side tiedown.
G3	20	MB2	25	Left side tiedown.
A4	20	MB2	25	Right circle tiedown.
G4	20	MB2	25	Left circle tiedown.
C5	36	MB1	10	Right front tiedown.
E5	36	MB1	10	Left front tiedown.
A6	36	MB2	25	Right front tiedown.
G6	36	MB2	25	Left front tiedown.

**Table 4-3. Tiedown Data for the Model 130G Type I or II Grader in US Air Force C-5 Aircraft (Fig. 4-3)**

Tiedown Fitting		Tiedown Device		
Description	Capacity in 1,000 lb	Type	Capacity in 1,000 lb	Attach to Item
E1	25	MB2	25	Left extraction plate tiedown.
G1	25	MB2	25	Right extra(tion plate tiedown
E2	36	MB2	25	Left rear tiedown.
F2	36	MB2	25	Right rear tiedown.
D3	20	MB2	25	left circle tiedown
G3	20	MB2	25	Right circle tiedown.
E4	36	MB2	25	Left front tiedown.
F4	36	MB2	25	Right front tiedown.
E5	25	MB2	25	Left front lifting eye.
F5	25	MB2	25	Right front lifting eye.

f. The vehicle must not exceed 3 miles per hour on or near the loading ramps.

**CAUTION**

Vehicle scraper blade must be in the full up position before the vehicle is loaded in the aircraft,

**WARNING**

Proper ventilation must be provided during loading or unloading. Prolonged exposure to carbon monoxide fumes may be fatal.

**4-5. Preparation of Vehicle**

*a. Special Considerations*

- (1) All three grader heights must be reduced for internal air transport (IAT) in the C-130 and C-141 aircraft.
- (2) If suspension brackets are mounted on the forward bolster of the Types I and II graders, they must be removed for IAT in the C141 aircraft but not for IAT in the C130 and C-5 aircraft.
- (3) Fuel load must be reduced to 25 percent and the engine side panels must be removed to meet (141 aircraft axle-load limitations.
- (4) Sleeper and parking shoring are required in

all aircraft. Figure 4-4 shows the shoring requirements, and table 4-4 shows the dimensions of each item.

*b. Personnel Requirements.* The following personnel are the minimum required to load and offload the grader and prepare it for operation:

- (1) One motor grader operator.
- (2) One heavy equipment mechanic.
- (3) One wrecker operator.

*c. Equipment and Materials Requirements.*

- (1) Wrecker, 5-ton.
- (2) Socket set, heavy-duty, 3/4-inch drive.
- (3) Torque wrench, 1,000-pound-capacity.
- (4) Plywood, nine sheets, each 3/4-inch x 4x 8foot. (Two-inch-thick lumber can be used in lieu of plywood.) Wood stud, one, 2x 4-inch x 4-foot.

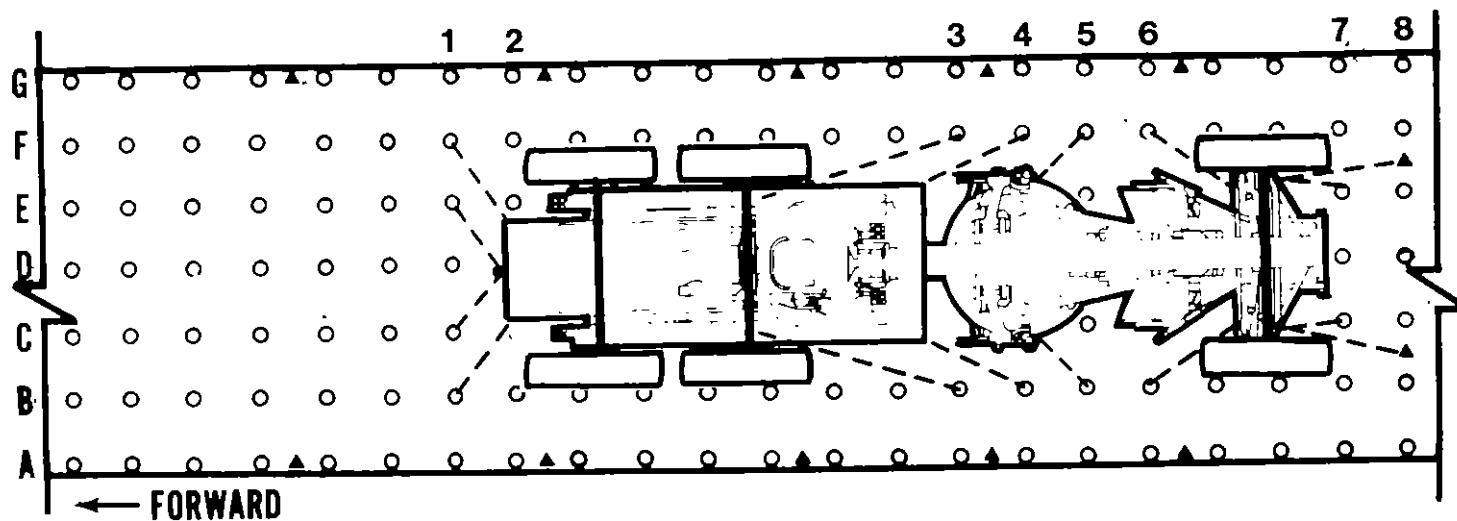
*d. Preparation Times.* Times required for preparing, loading, and offloading the grader and for placing it in operation are shown in table 4-5.

**NOTE**

Times in table 4-5 do not include fabrication of parking and sleeper shoring.

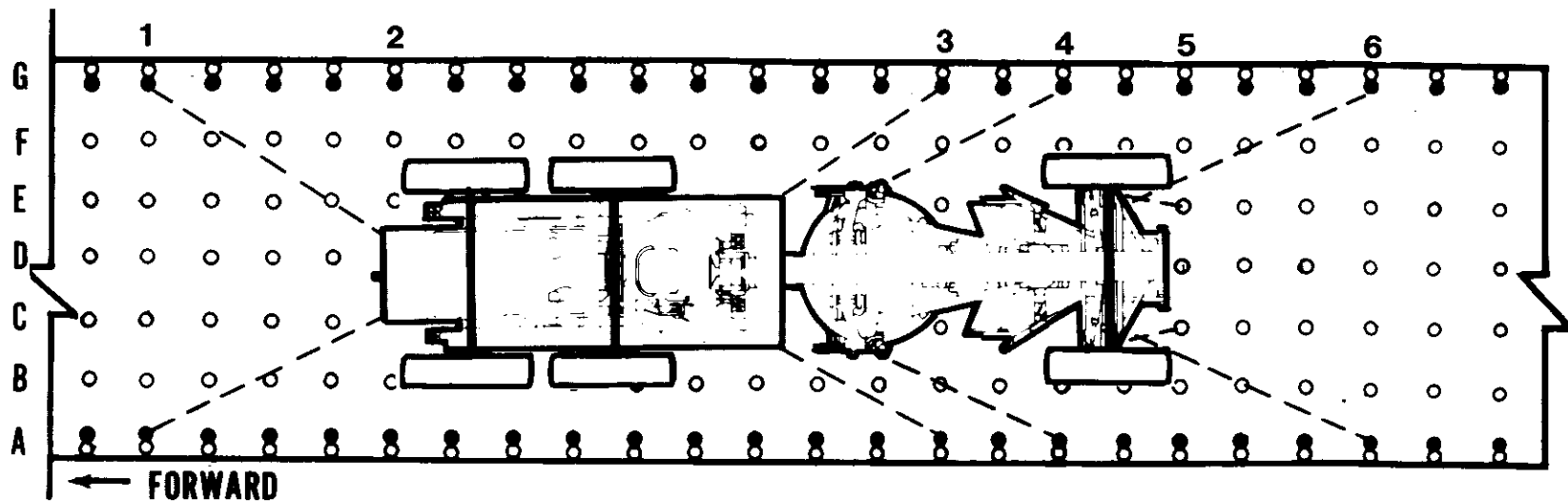
- e. Preparation. The extent of preparation required for IAT of the grader varies in accordance with the type of aircraft to be used. The following preparation





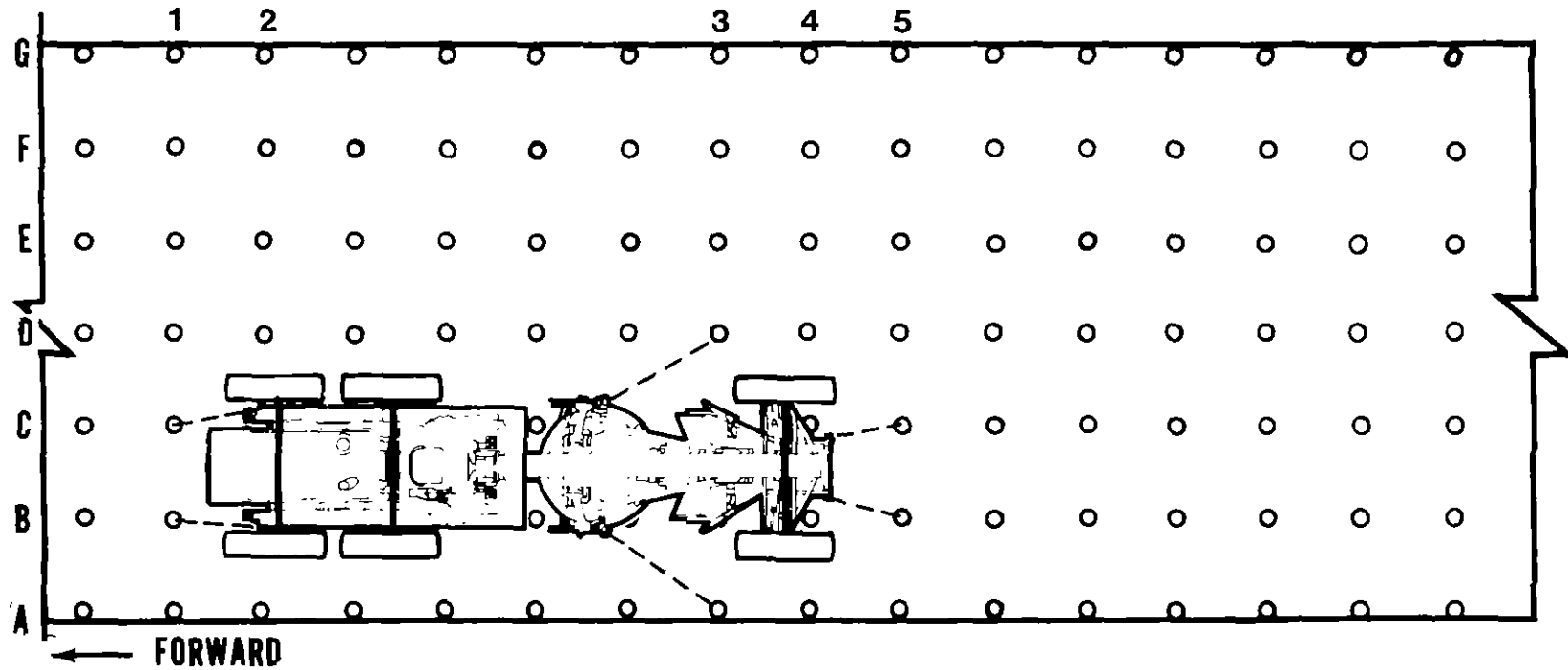
SYMBOL	○	▲
STRENGTH OF FITTING AND BASIC LOAD DIRECTION	10000 LB ANY	25000 LB ANY

Figure 4-1. Typical tiedown diagram for model 130G Type I or II grader in a C-130 aircraft.



SYMBOL	○	●
STRENGTH OF FITTING AND BASIC LOAD DIRECTION	10000 LB ANY	25000 LB ANY

Figure 4-2. Typical tiedown diagram for model 130G Type I or II grader in a C-141 aircraft.



● ALL CARGO TIEDOWN FITTING RATINGS 25000 LB EACH

Figure 4-3. Typical tiedown diagram for model 130G Type I or II grader in a C-5 aircraft.

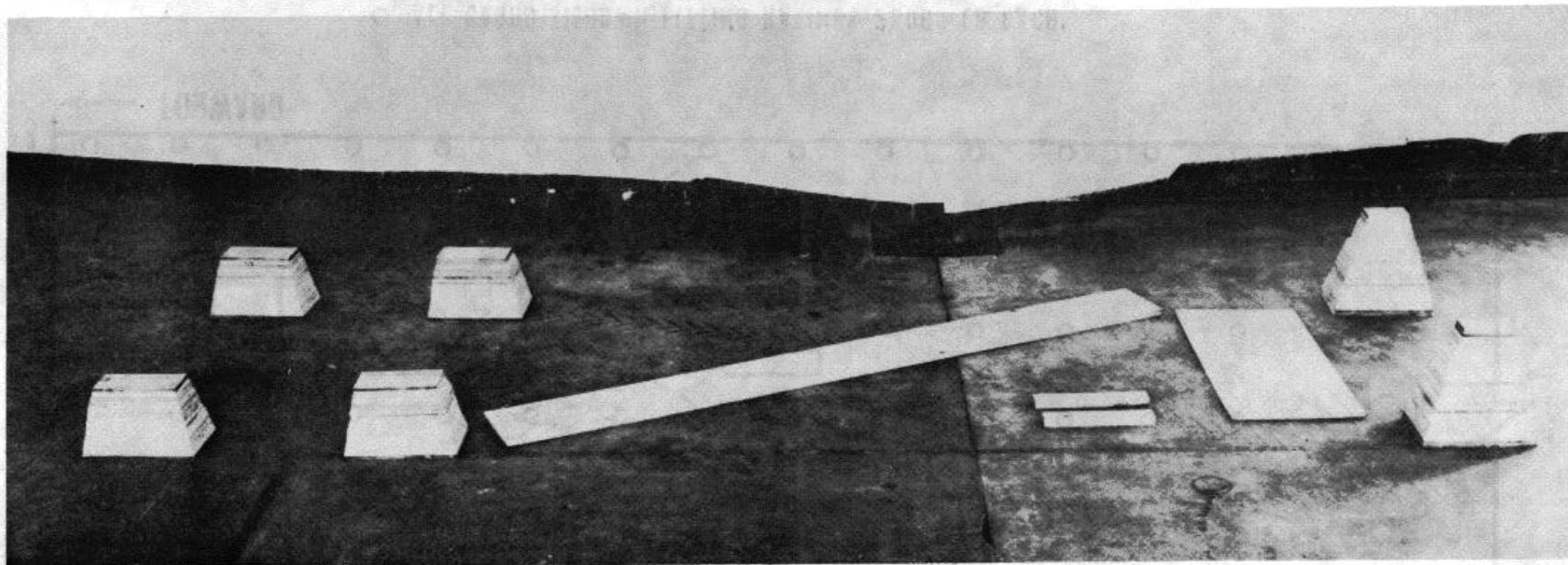


Figure 4-4. Shoring requirements for loading the model 130G grader in Air Force cargo aircraft

Table 4-4. Requirements for Shoring, and Lift Cylinder Restrictor Blocks for Loading, the Model 130G Grader (Reduced) in Air Force Aircraft

Item	Requirements
Sleeper shoring, rear tandem axle	Four stacks: each has a base 14 x 30 inches, top 8 x 16 inches, and height 13.5 inches.
Sleeper shoring, front axle	Two stacks: each has a base 14 x 30 inches, top 5 x 8 inches, and height 21.75 inches. NOTE: The top 7.5 inches of each stack must not exceed 5 inches in width.
Parking shoring, blade	One piece, 1.5 x 12 x 142 inches, fabricated from 3/4-inch plywood.
Parking shoring, scarifier	One piece, 3/4 x 25 x 56 inches, fabricated from 3/4-inch plywood.
Restrictor blocks, lift cylinder rod travel (two)	One, 2 x 4 x 20.5 inches, for left lift cylinder. One, 2 x 4 x 21.5 inches, for right lift cylinder. NOTE: It is best to cut restrictor blocks to length onsite since grader lift cylinder rod travel may differ slightly.

steps pertain to the aircraft indicated.

(1) All Fabricate sleeper and parking shoring and restrictor blocks (lift cylinder rod travel) in accordance with table 4-4.

(2) All Inspect the grader for leaks, damage, and operation. Repair as necessary.

(3) All Inflate all tires to 35 psi.

(4) All Raise the scarifier, and remove and stow the teeth in the top of the block assembly (upside down).

(5) All Position the center shift (wheel lean) lockpin in the center position.

(6) All Place the antipivot pin, located on the left side of the frame below and aft of the operator's platform, in the lock position.

(7) C130/C-5-Adjust the fuel level to 25 percent.

(8) C141 Adjust the fuel level to 25 percent.

(9) C130/C-141-Remove the roll-over-protection system (ROPS) from Types I and II graders and the cab from the MIL grader. Store bolts and spacers in drawbar toolbox.

**NOTE**

**ROPS must be palletized because of weight (1,030 lb).**

(10) C-130/C-141-Remove air cleaner, exhaust pipe, and muffler. Stow and secure these items behind the operator's seat.

(11) C-130/C-141-Ground the blade, and reposition the cylinder rods from the ball studs to the air transport ball studs located forward on each side of the

drawbar.

(12) C-130/C-141-Install the lift cylinder restrictor blocks. Tape the 20.5-inch-long block to the left rod and the 21.5-inch-long block to the right rod.

**NOTE**

**To ensure proper fit, it will be best to cut these blocks to the exact length needed just before installation.**

**CAUTION**

**Rod restrictor blocks are required to prevent damage to the air hose fitting on the center shift. Do not lift blade unless blocks are installed.**

(13) C-130/C-141-Raise the blade until the restrictor blocks are seated between the shoulder of the rod cap and the bottom of the lift cylinder. Rotate the blade clockwise and center it inside the intermediate and front tires.

(14) C-5-Raise the blade 14 inches above the ground, rotate it clockwise, and center it inside the intermediate and front tires.

(15) All-Raise the scarifier until the teeth are 2 inches below the drawbar.

(16) C-141-Remove the engine compartment side panels.

**NOTE**

**If the panels have not been modified, battery cables and brake system air hoses, which pass through the panels, must be disconnected.**

Table 4-5. Times Required for Preparing, Loading, and Offloading the Model 130G Grader and Placing it in Operation

Type of Aircraft	Preparation Personnel Minutes	Loading Personnel Minutes	Offloading Personnel Minutes	Operation Personnel Minutes	Remarks
C-130	4150	4/25	4/10	4160	
C-141	4170	4/25	4/10	4/90	Reduce to 60 minutes if engine side panels are modified (only on Types I and II graders.)
C-5	2/20	4/20	4/10	2/10	

NOTE:

1. Preparation times do not include fabrication of parking and sleeper shoring
2. Times will vary in accordance with existing conditions.

**CAUTION**

**Battery cables are hot until both batteries have been disconnected.**

- (a) Disconnect battery cables and pass them through the panel holes to the inside.
- (b) Drain the air tanks, disconnect the brake system air hoses, and remove the nipples.
- (c) Loosen clamps located in the center of each panel.
- (d) Remove the door latch on the left panel.
- (e) Remove the panel mounting bolts and end spacers.
- (f) Remove the panels.

**CAUTION**

**Panel weight (111 and 125 pounds) and location requires extreme care to preclude damage or personal injury during removal.**

**NOTE**

**Panels may be stowed on the floor of the aircraft or palletized.**

- (g) Stow small, loose components in the drawbar toolbox.
- (h) Reconnect battery cables and air hoses for loading/offloading operations.
- (i) Figure 4-5 shows the model 130G grader prepared for transport in C-130/C-141 aircraft.

**4-6. Transport of Model 130G Grader in US Air Force Aircraft**

*a. Materials.* Sleeper, parking shoring, and restrictor blocks, as shown in figure 4-4, should be prepared before actual loading of the model 130G grader. Palletized items should be loaded, secured, and weighed before loading time.

*b. Loading.*

- (1) Actual loading instructions, such as use of auxiliary ramps and station location of items in the aircraft, will be in accordance with the applicable TO 1C-xxx-9 and the Air Force loadmaster.
- (2) All externally and internally stowed equipment must be secured.
- (3) The vehicle transmission must be placed in neutral and brakes must be set.

*c. Time Required.* The time and personnel required to prepare, load, and unload the item and to place it back into operation are depicted in table 4-5.

**4-7. Internal Transport by US Army Aircraft**

The model 130G grader exceeds the size and weight limitations for internal transport by US Army fixed-wing aircraft or helicopters.

**4-8. External Transport by US Army Helicopters**

*a. General.* The model 130G Type II (sectionalized) grader can be externally lifted by the CH-

47 and CH-54 helicopters. Trained heavy-equipment drivers or repairmen are required to sectionalize the grader, rig it for remote maneuvering, and reassemble it after the lift. The procedure for sectionalizing the grader can be found in the applicable operator's manual.

*b. Load Description.* The model 130G Type II (sectionalized) grader is reduced as described in paragraph 4-5 except the air cleaner, muffler, and exhaust stack are not stored behind the seat. Trained personnel will sectionalize the grader as described in the operator's manual. Figures 4-6 and 4-7 show the front and rear sections of the grader after they are rigged. For flight planning purposes, the weight of each section after it is rigged and ready for lift is as follows:

- (1) Front section ..... 15,980 pounds (7248.41 kg)
- (2) Rear section ..... 14,460 pounds (6558.95 kg)

**CAUTION**

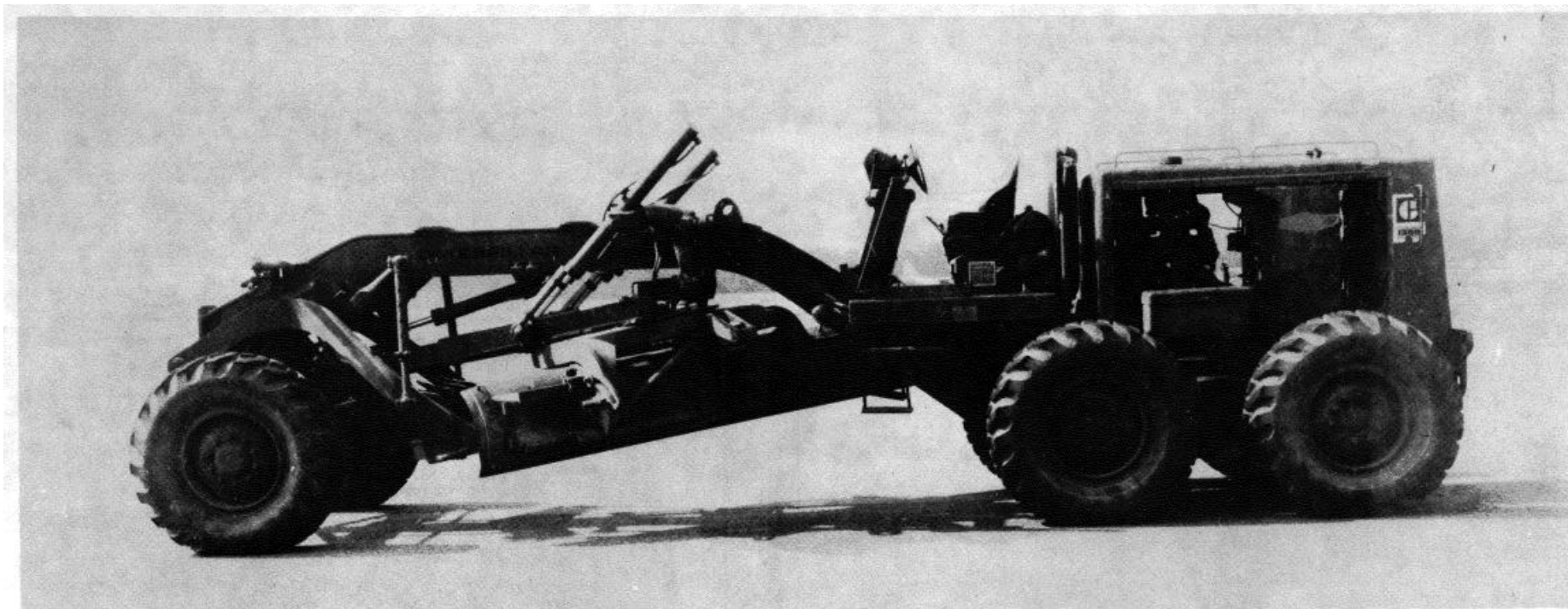
**Rigging and sling hookup personnel must be trained. Strict communication and coordination with aviation personnel are necessary for this operation. Qualified aviation or path-finder personnel should be utilized.**

*c. Personnel and Materials Required.* Two men are required to rig each load. A total of 40 minutes (20 minutes for each section) is required. Following is a list of materials required for rigging.

- (1) Two slings, helicopter, cargo-carrying, external four-leg, 25,000-pound-capacity (NSN 1670-01-027-2900).
- (2) Tape, adhesive, 2-inch-wide (NSN 7510-00-027-2900).
- (3) Cord, nylon, type III, 500-pound breaking strength (BS) (NSN 8305-00082-5752).
- (4) Webbing, cotton, 80-pound, natural, 1/4-inch (NSN 8305-00-268-2411).
- (5) Padding, material (cellulose) (NSN 8135-00-664-6958).
- (6) Cargo tie assembly (lashing, D-ring, load binder) (NSN 1670-00-937-0271).
- (7) Plastic bags.
- (8) Two wooden posts, 4-x 4-x 48-inch.

*d. Front Section Preparation for Single-Hook Lift.*

- (1) Secure each section of front axle to front tiedown points using the cargo tie assembly.
- (2) Loosen front headlight bar and rotate 180°, and retighten padlights with wadding and tape.
- (3) Pad and tape worklights on forward edge of operator's platform.
- (4) Secure steering wheel on both sides to horizontal control bar with nylon cord.
- (5) Secure seat with nylon cord.



**Figure 4-5. Model 130G Types I and II grader prepared for shipment in Air Force cargo aircraft.**

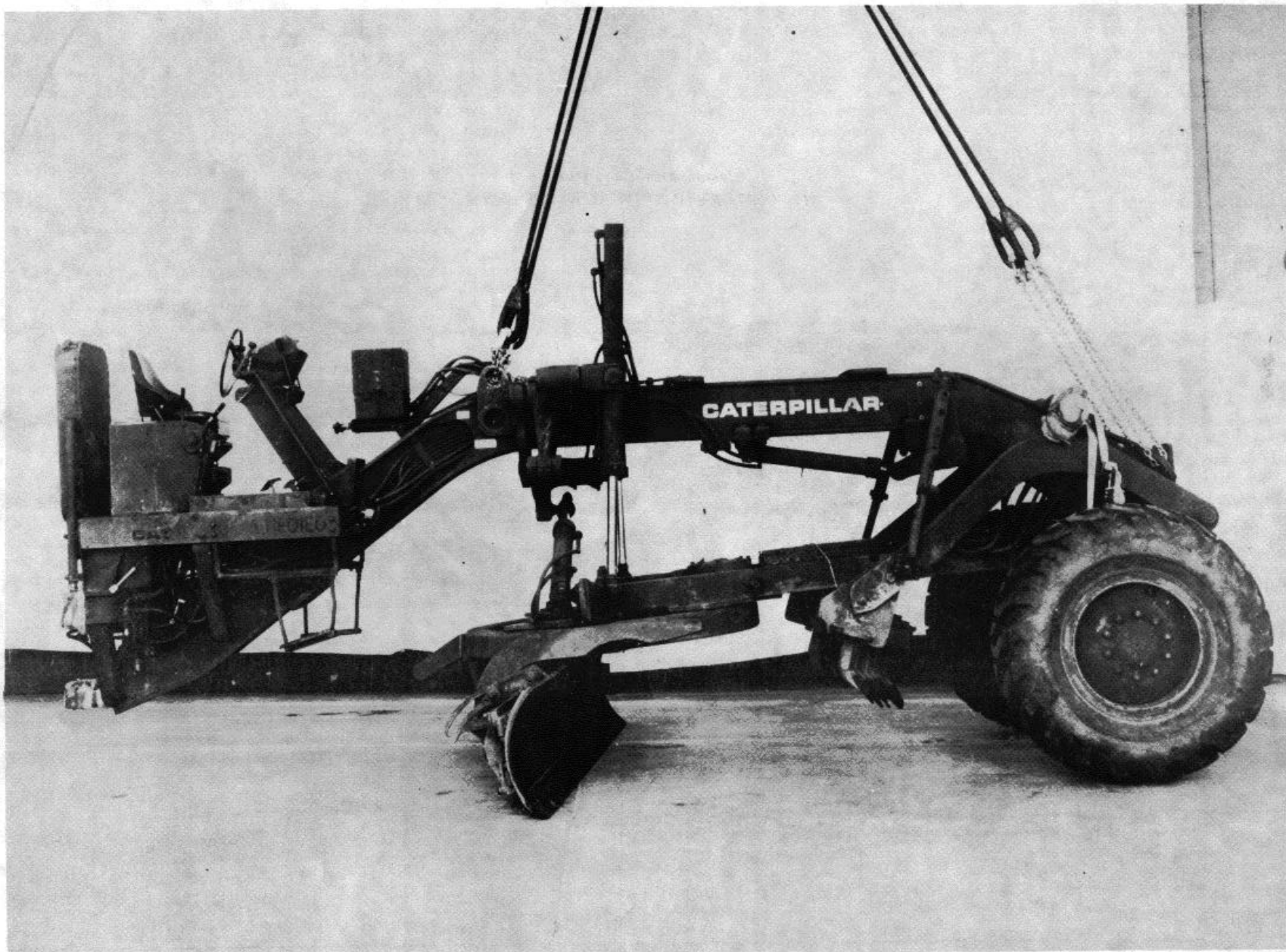
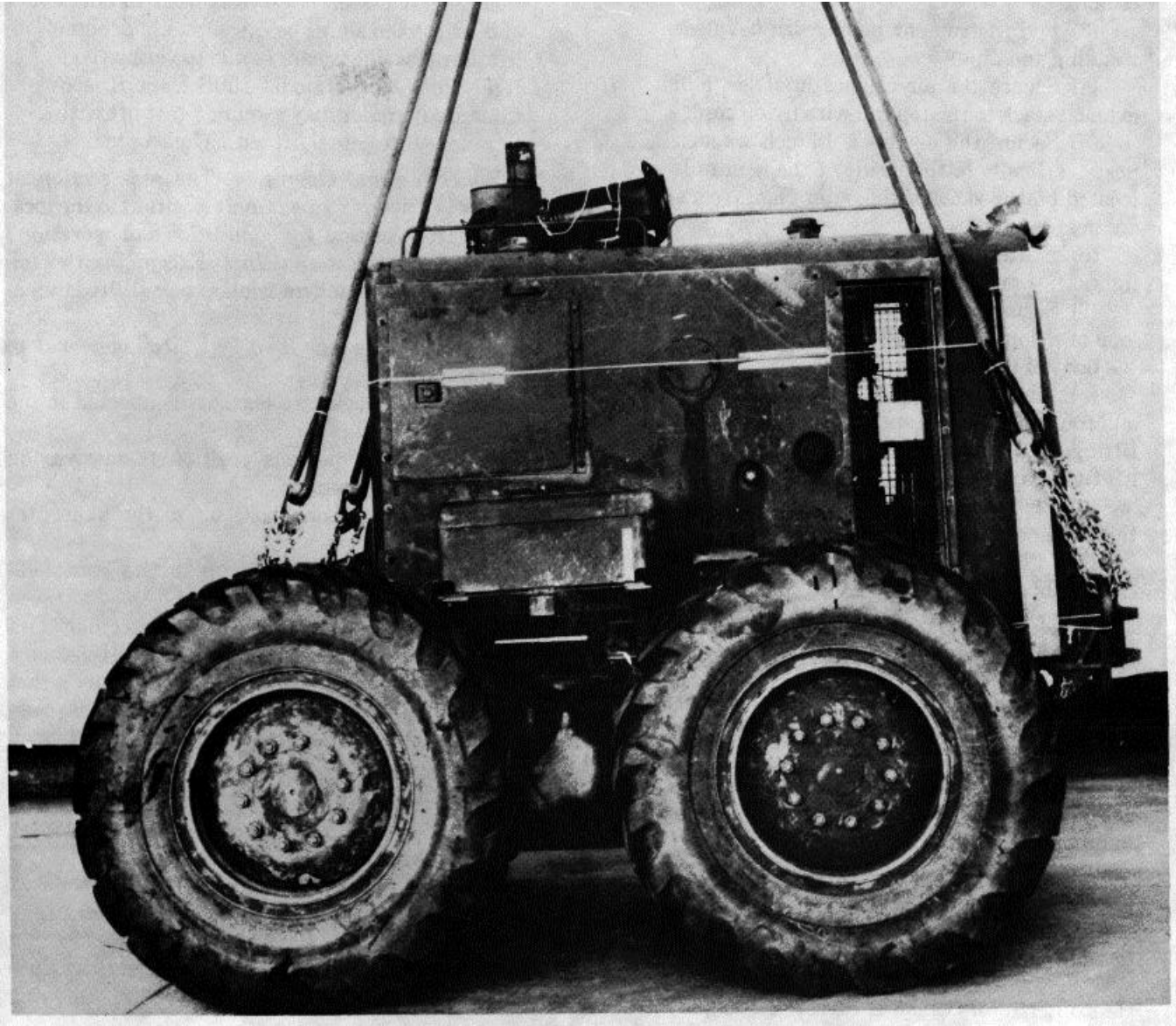


Figure 4-6. Front section of the model 130G Type II grader for external airlift by helicopter.





**Figure 4-7. Rear section of the model 130G Type II grader for external airlift by helicopter.**

(6) Cover all pivot points in the articulated hitch group with plastic bags or suitable substitute and tape securely to prevent fouling by sand and dirt.

(7) Place apex fitting on top of section, and route sling legs 1 and 2 through front lift fittings and sling legs 3 and 4 through the rear lift fittings. Sling legs 1 and 3 must be on the same side of the load.

(8) insert link 3 of sling legs 1 and 2 in the grabhook.

(9) Insert link 77 of sling legs 3 and 4 in the grabhook.

(10) Secure excess chain with 2-inch tape.

(11) Cluster and tape sling legs together in a breakaway technique to prevent fouling during initial lift.

*e. Rear Section Preparation for Single-Hook Lift.*

(1) Cover all pivot points in the articulated hitch group with plastic bags, or suit-

able substitute, and tape.

(2) Remove throttle handle and secure in toolbox.

(3) Pad instrument panel with cellulose wadding and tape.

(4) Secure the air cleaner, muffler, and exhaust stack to the top rail with nylon cord.

(5) Secure the 4- x 4- x 48-inch wooden posts vertically to the inside of the handrails located on the sides of the outer engine compartment.

(6) Pad and tape rear worklights and tail-lights.

(7) Secure engine cowling doors with one loop of nylon cord placed horizontally around the body of the unit.

(8) Place apex fitting on top of section, and route sling legs 1 and 2 through front lift fittings and sling legs 3 and 4 through rear lift fittings.

(9) Place link 46 of sling legs 1 and 3 in the grabhook.

(10) Place link 56 of sling legs 3 and 4 in the grabhook.

(11) Secure excess chain with 2-inch tape.

(12) Pull sling legs on top of load and tie with cotton webbing. Be sure the rear sling legs are located outside the 4- x 4- x 48-inch wooden posts.

(13) Cluster and tape all sling legs together in a breakaway technique to prevent fouling during initial lift.

*f. Hook up.* The hookup person stands on top of the item of equipment for hook up.

*g. Derigging.* Derigging is the reverse of these procedures.

#### CAUTION

**Helicopter rotors cause in excess of 100-knot winds. Loose items and unnecessary personnel should be out of the hookup area. Prolonged hovering may cause equipment to be moved about by the downdraft. The helicopter will come to a hover; approach the load from the downwind, heading into the wind; hook up; and depart as expeditiously as possible.**

#### NOTE

**This external lift method has been tested and certified. A 20-ton crane was used to check and adjust the slings before actual helicopter lift. Large weight changes due to various configurations of the model 130G Type II (sectionalized) grader may require a test lift with a crane before actual lift with a helicopter.**

*h. Connection and Operation.* The rear section of the grader is driven from a remote position to the location of the front section, for connection and operation.

*i. Tandem-Hook External Lift.* Except for the following procedures, tandem-hook external lift is identical to single-hook lift.

(1) Front slings legs (two legs) are connected to the apex fitting.

(2) Rear sling legs (two legs) are connected to the second apex fitting.

(3) Two hookup persons position themselves on opposite ends of the item.

(4) The front person hooks up to the helicopter first.

(5) The rear person hooks up to the rear, helicopter hook last.

*j. Hookup to CH-54 Flying Crane Helicopter.* Two hookup men are required because the CH-54 is a single-hook helicopter with a free-swinging hook that weighs about 75 pounds. After the hook has been grounded to bleed off static electricity, one person holds the hook steady while the other person makes the hookup.

#### NOTE

**Rigging and hookup personnel should be trained in accordance with FM 55-450-1, Army Helicopter External Load Operations.**

#### 4-9. Low Altitude Parachute Extraction System (LAPES)

The model 130G Types I and II graders are in the process of being certified for LAPES and low velocity air-drop (LVAD) operations. These procedures will be carried out in accordance with instructions published by the US Airborne Special Operations Test Board, Fort Bragg, North Carolina 28307-5000, telephone-AUTOVON 236-5985.

## CHAPTER 5

## HIGHWAY TRANSPORTABILITY GUIDANCE

## Section I. GENERAL

**5-1. Scope**

This chapter provides highway transportability guidance for movement of the model 130G-series graders. It covers technical and physical characteristics, as well as safety considerations, and prescribes the materials and guidance required to prepare, load, tie down, and unload the vehicle.

**5-2. Safety**

In addition to the safety precautions in chapter 3, movement is subject to all safety laws, rules, and regulations applicable to commercial carriers. Overseas

such movements are governed by theater regulations.

**CAUTION**

**Vehicles must not exceed 3 miles per hour during loading or unloading.**

**5-3. General**

The model 130G grader can move throughout the United States without size and weight limitations. The grader's maximum speed is 24.5 miles per hour. This limits the distance for deployment and will prevent movement on some highways.

## Section II. TRANSPORT BY SEMITRAILER

**5-4. Transport of the Model 130G Grader by Semitrailer**

The model 130G grader can be transported over the highways on the M870 semitrailer. The M870 semitrailer is moved by the M916 and M920 tractors. This tractor-trailer combination is normally not in the same unit as the grader.

**5-5. Preparation of the Model 130G Grader for Highway Transport**

a. Reduce height of the graders by removing the ROPS from the Types I and II graders and the cab from the MIL grader; also the air cleaner, muffler, and exhaust pipe from all.

**NOTE**

**ROPS will have to be transported by a separate vehicle because of a lack of space on the M870 trailer.**

b. Ensure all items are stowed, and secure with nylon cord or a suitable substitute.

c. Weigh vehicle to verify total weight, front and rear axles weights.

**5-6. Transport of the Model 130G Grader by the M870 Semitrailer Towed by the M920 Truck Tractor**

a. *General.* The combined length of the tractor and semitrailer (61.25 feet) exceeds the generally accepted CONUS and overseas unrestricted length of 55 feet. The width and height of the model 130G grader/semitrailer in the reduced configuration are within

legal limits for CONUS. Table 5-1 shows the transport characteristics of the model 130G grader.

b. *Bridge Limitations.* Most States allow tandem axle loads up to 50,000 pounds on bridges. Based on the Bridge Gross Weight Formula of the Federal Highway Administration, the heaviest allowable tandem axle load for the model 130G Type II Grader is 42,250 pounds. The 36,825-pound tandem axle load is well within this limit and should present little trouble in obtaining permits for axle loads when required for highway movement.

c. *Loaded Characteristics.* The model 130G Types I and II graders are slightly larger than the model 130G MIL grader. The model 1.30G grader loaded on the M870 semitrailer is described in figures 5-1 and 5-2.

d. *Materials.* The bill of materials for blocking and tiedown of the model 130G grader on the M870 semitrailer is depicted in table 5-2.

*e. Loading.*

(1) The model 130G grader may be driven to the tiedown position on the M870 semitrailer, or it can be winched on.

(2) The blade and scarifier should be in the full up position during loading. Before the blade is lowered, it should be turned so it fits within the width of the grader. Parking shoring should be placed under the blade to protect the semitrailer bed.

(3) After the grader is placed at the tiedown position, the transmission must be placed in the neutral position and brakes set, if appropriate. Doors should be wired shut to preclude opening en route.

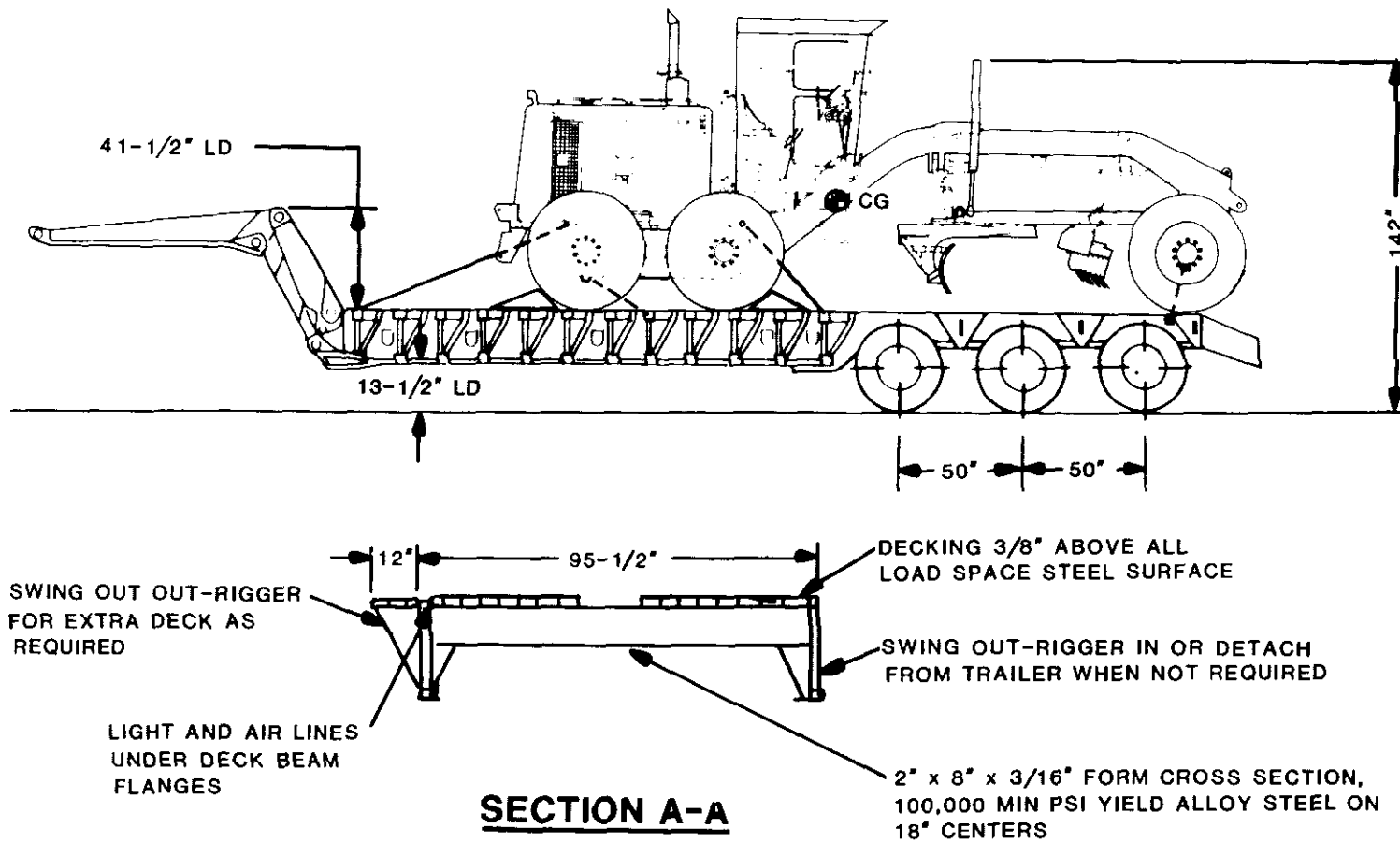


Figure 5-1. Model 130G grader loaded on an M870 semitrailer.

Table 5-1. Highway Transport Characteristics of the Model 130 Graders

Configuration	Length (in.)	Width (in.)	Height (in.)	Gross (lb)	Front Axle (lb)	Tandem Axle (lb)	Semi-trailer Tandem Axle (lb)
<i>CCE</i>							
Operational	327	95.5	127	31,300	9,680	21,620	
Reduced	327	95.5	106G	29,450	9,470	19,980	
Highway load	7365	96.0	131	75,170	7,525	31,280	36,365
<i>Type I</i>							
Operational	331	95.5	127	31,540	10,230	21,310	
Reduced	331	95.5	106*	29,918	9,650	20,268	
Highway load	735	96.0	1.11	75,410	7,535	31,330	36,545
<i>Type II</i>							
Operational	3:31	95.5	127	31,870	10,270	21,600	
Reduced	331	95.5	106*	30,830	10,3:80	20,450	
Highway load	7:15	96.0	131	75,740	7,540	31,375	36,825

\*Hydraulic lift cylinders not reduced.

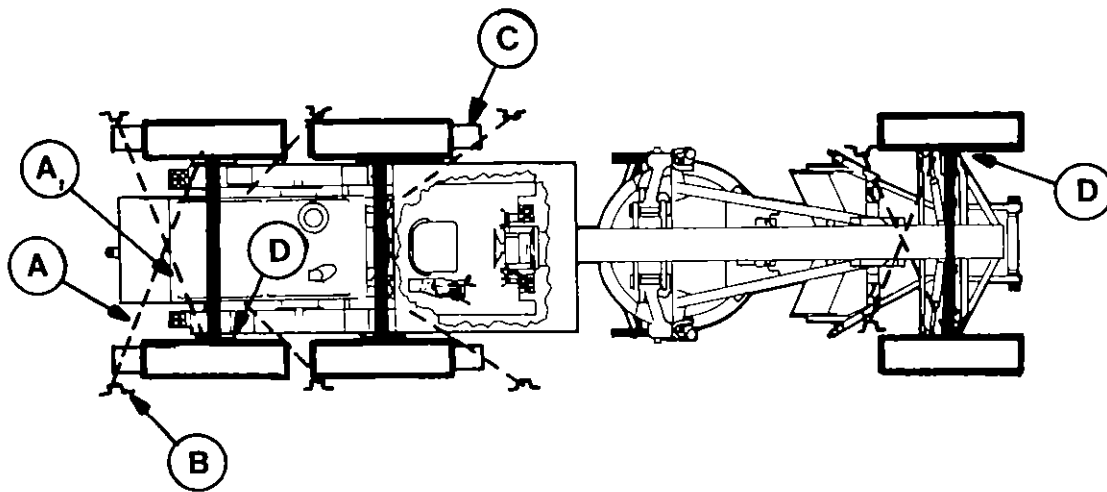


Figure 5-2. Blocking, chocking, and tiedown diagram for the model 130G grader on the M870 semitrailer.

(4) Blocking, bracing, shoring, and tiedowns are described in figure 5-2 and listed in table 5-2. This material is furnished by the shipper.

**NOTE**

The M870 semitrailer is required to carry only 10 chain assemblies, each 174 inches long with 3/8-inch links and a 6,000-pound workload.

(5) A tiedown diagram compatible with standard loading practices that will offer adequate restraint against the forces encountered during movements at normal speeds is provided in figure 5-2. Details of the blocking, bracing, and tiedowns are given in figure 5-3.

(6) The turning radius of the tractor trailer combination is 89.5 feet curb to curb.

Table 5-2. Materials for Blocking, Bracing, and Tiedown of the Model 130G Grader on M870 Semitrailer.

Item	No. Required	Application
A*	8	Wire rope, 5/8 inch. Pass in complete loop through vehicle lifting eyes or tiedowns, as shown in figure 5 2.
B*	32	Clamp, 5/8-inch. Place four on each wire rope loop.
C*	8	Thimbles. Place six on bottom of stake pockets and two on rear tiedowns of trailer.
D	4	Chock block Pattern as shown in detail 1, figure 5-3
E	-1	Side block Pattern as shown in detail 2. figure 5-3.
F	4 pieces or as required	Chafing pad, 14 x :32-inch. made of black roofing paper, burlap. or a similar material. Place between side blocks and tires.

\*Chains and load binders of adequate capacity may be substituted when available.

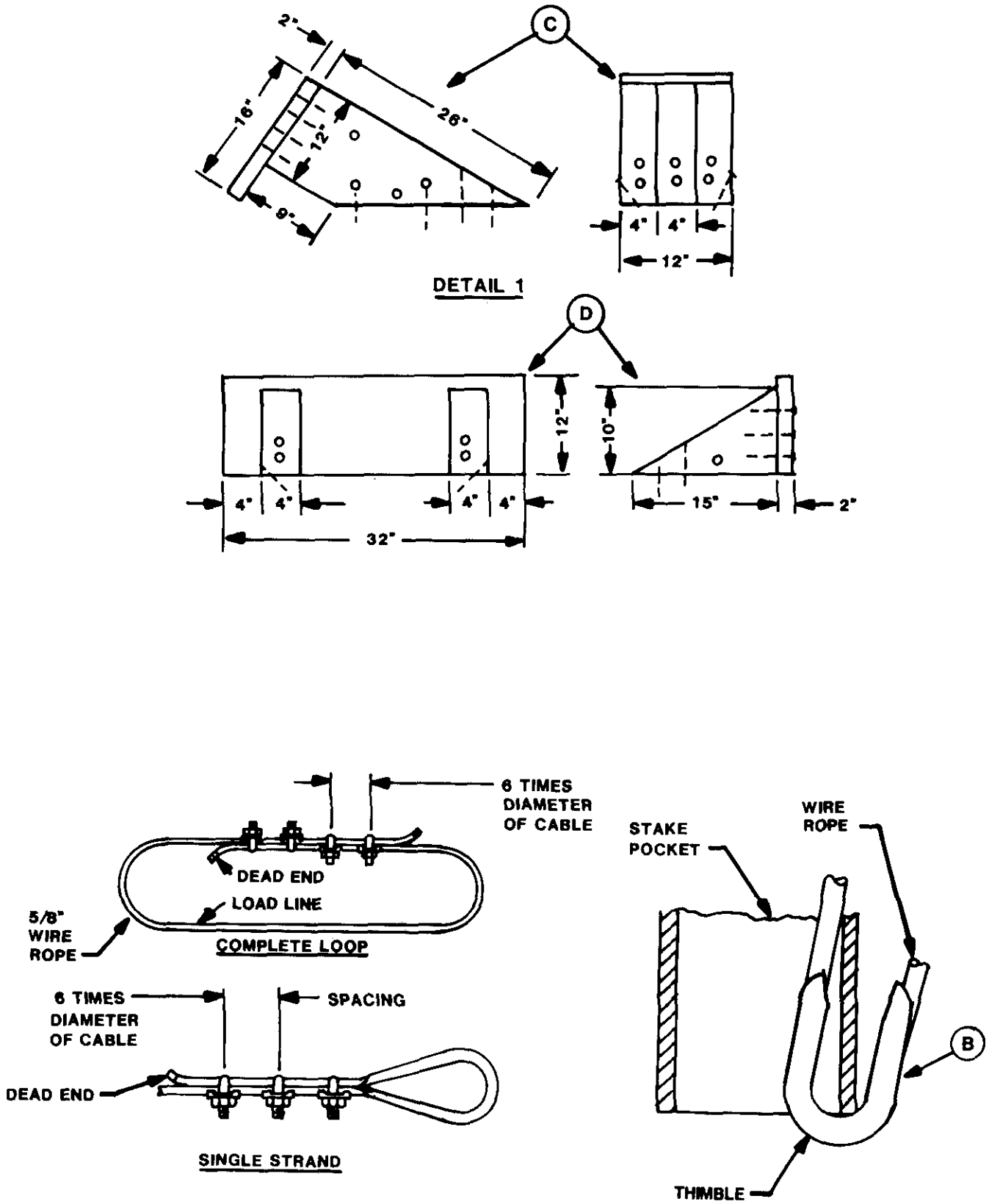


Figure 5-3. Details of blocking, bracing, and tiedowns for highway transport of the model 130G grader.

## CHAPTER 6

## MARINE AND TERMINAL TRANSPORTABILITY

## Section I. GENERAL

**6-1. Scope**

This chapter provides marine and terminal transportability guidance for movement of the model 130G grader. It covers technical and physical characteristics as well as safety considerations. It also prescribes the materials and guidance required to prepare and load the vehicle.

**6-2. Safety**

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

- a. All vessel equipment and gear should be inspected before use.
- b. All stevedore slings and other items used in loading and unloading operations should be checked for their conditions and capacity.
- c. All other precautionary measures and safety regulations peculiar to the loading/unloading site or terminal will be adhered to.
- d. Vehicle fuel tanks must be drained and battery terminals must be disconnected.

- e. Hydraulic cylinder piston rods exposed to salt spray should be coated with protective coating to prevent corrosion.

**NOTE**

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

**6-3. Water Shipment**

The model 130G grader can be transported by a variety of inland-waterway carriers and lighters and by all seagoing cargo vessels.

**NOTE**

**The methods described in this chapter for lifting the model 130G grader are recommended procedures. Other methods of handling and stowing may be used provided they will ensure safe delivery without damage.**

## Section II. LOADING AND SECURING

**6-4. General Rules for Stowing Vehicles**

a. *General.* Whenever possible, vehicles should be provided the protection of below-deck stowage. In general, good stowage of vehicles means vehicles are placed fore and aft as close together as practical, with minimum spacing between outer vehicles and the sweatboards. The following points should be considered:

- (1) Breakable parts are protected, and spare parts are stowed in or near the vehicle for ready access.
- (2) Vehicles are stowed in neutral with brakes off.
- (3) Battery terminals are disconnected.
- (4) Vehicles are adequately blocked, braced, and lashed.

b. *Lifting.* The correct lifting points on the vehicle are the lift eye provisions located above the rear axle and on the front of the grader blade support beam. A typical lifting diagram for the model 130G grader is shown in figure 6-1.

c. *Loading.* Vehicles are normally loaded onto vessels in their minimum configuration. Commercial shipping and handling charges are based on weight and

cubic feet. Therefore, a vehicle in its reduced configuration and loaded with cargo is the least expensive method of shipping military vehicles on civilian cargo vessels. The model 130G grader can be driven or lifted onto most cargo vessels to include landing craft, beach discharge and amphibious lighters, and landing ship tanks.

d. *Materials.*

(1) Table 6-1 is the approximate bill of materials for blocking and tiedown of the model 130G grader in the hold of a general cargo vessel. Required amounts will vary as to type of vessel configuration and location aboard the vessel.

(2) Figure 6-2 shows typical blocking and tiedown details of the model 130G grader in the hold of a general cargo vessel.

(3) Table 6-2 provides data concerning the application of materials to restrain the vehicle.

e. *Special Design.* Seatrain trailer vessels, roll-on/roll-off vessels, landing ships, and attack-cargo vessels are equipped with patented lashing gear and pre-positioned fittings in the deck. By proper application

Table 6-1. Bill of Materials for Blocking and Tiedown of the Model 130G Grader in Hold of General Cargo Vessel (Fig 6-2)

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight-grain, free from material defect; Fed Spec MM-L-751H: 4-x4-inch	80 linear feet
Nails	Common, steel: flathead; bright or cement-coated; par :3.6 11 2, Fed Spec FF-N 105B:	20d 40
		50d 40
Wire rope	Type I, general purpose; class 2, 6 x 19, improved plow steel, wire strand core of IWRC; Fed Spec RR-W-410C: 5/8 -inch	80 feet
Clamps	Wire rope, U-bolt clips, saddled, single-grip, forged steel, Crosby heavy-duty, or equal; Fed Spec FF-C-450D: 5/8-inch	24

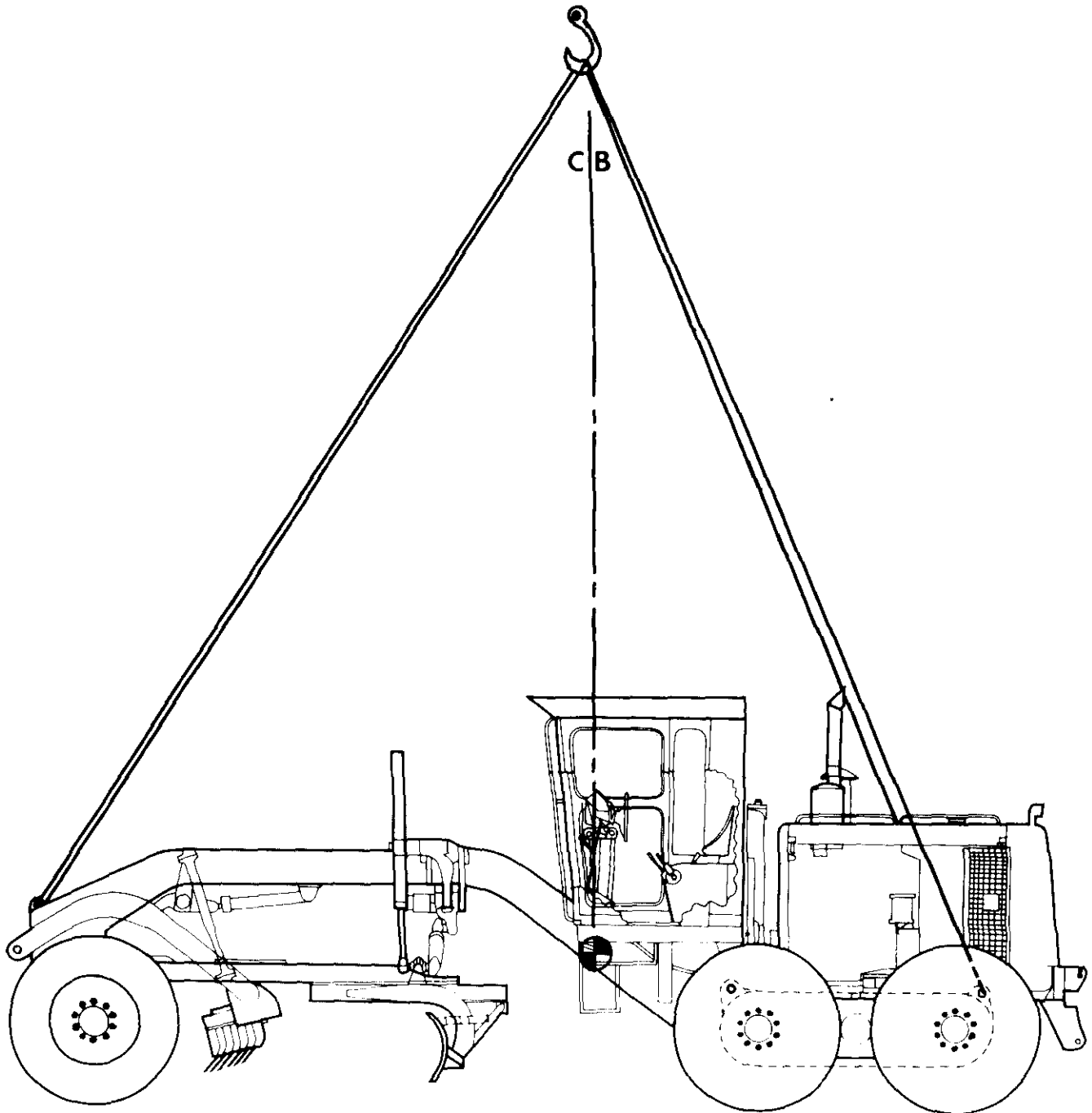


Figure 6-1. Typical lifting method for loading the model 130G grader onto a general cargo vessel.



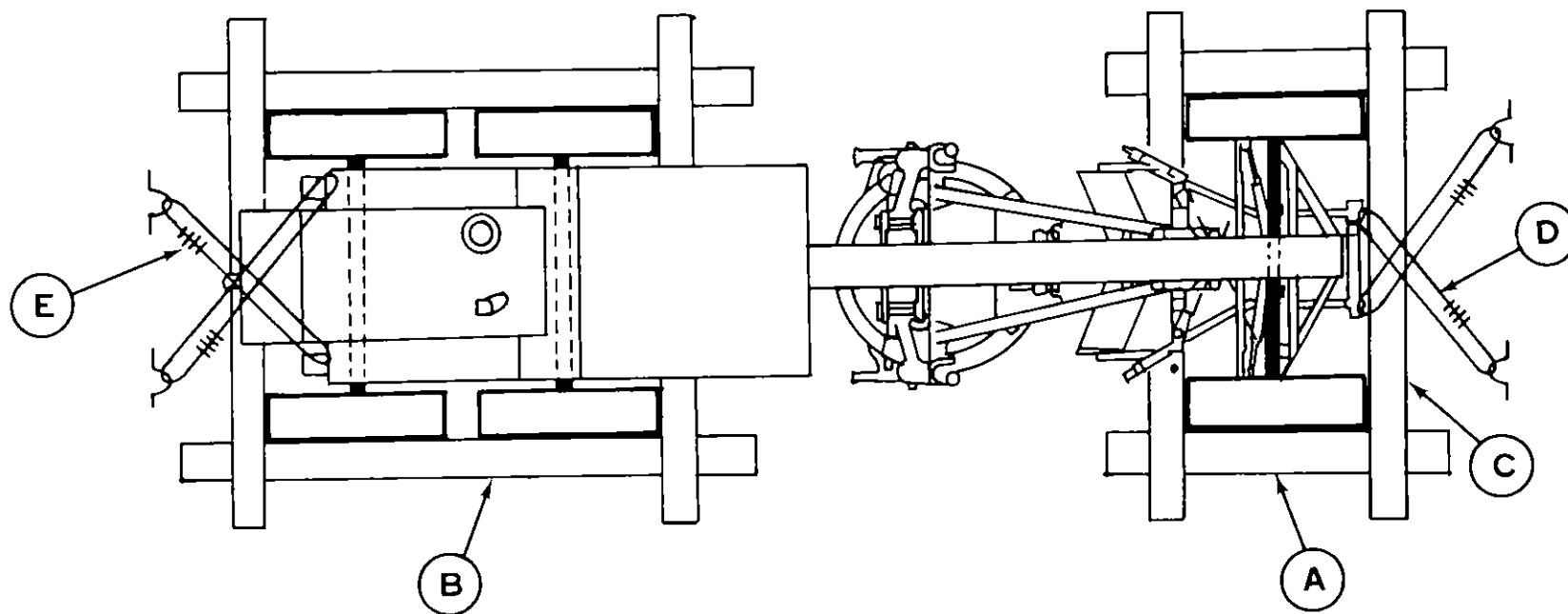


Figure 6-2. Typical blocking and tiedown details of a model 130G grader in a general cargo vessels.

Table 6-2. Application of Materials for Blocking and Tiedown of the Model 130G Grader in Hold of General Cargo Vessel (Fig 6-2).

Item	No. Required	Application
A	2	Side blocking for front wheels, 4- x 4- x 80-inch lumber. Locate at each side of front wheels; position so that the side blocking extends slightly beyond the front and rear of the tires.
B	2	Side blocking for rear wheels, 4- x 4- x 145-inch lumber. Locate at each side of rear wheels; position so that the side blocking extends slightly beyond the front and rear of the tires.
C	4	End blocking, 4- x 4- x 120-inch lumber. Locate one piece in front and back of front wheels and one piece in front and back of rear wheels. Secure on top of side blocking (items A and B) with five 50d nails. Toenail over-lap areas with two 20d nails.
D	4	Wire rope, 5/8-inch. Run each cable, in a complete loop, through vehicle tiedown points and deck padeyes. Ensure sufficient overlap for clamps.
E	24	Clamp, 5/8-inch. Place six clamps over each cable loop overlap area and space 3-3/4 inches apart, with a minimum of 6 inches from ends of cable. Apply 65 foot-pounds of torque to the clamp nuts.

of two 35,000-pound chain lashing gear to each end, the model 130G grader will require only sleeper shoring under the blade to prevent metal-to-metal contact with the vessel's deck.

**6-5. Barges and Lighters**

When the model 130G grader is moved by barge or similar lighterage to or from vessels secured to piers or sheltered anchorages, tiedowns and sleeper shoring are required under the blades. When the vehicle is moved extended distances or through rough waters, tiedowns, blocking, and sleeper shoring must be used under the blade.

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

Most of these vessels are equipped with turnbuckle tiedowns with a sheep's foot on one end that fits into a deck cloverleaf. The model 130G grader should be tied down with sleeper shoring under the blade. For extended distances on rough waters, blocking and bracing should be used.

**6-7. Lighter Aboard Ship (LASH)**

When the model 130G grader is transported by LASH-type ships, blocking, bracing, sleeper shoring, and tiedowns should be used.

CHAPTER 7

RAIL TRANSPORTABILITY GUIDANCE

Section I. GENERAL

7-1. Scope

This chapter provides rail transportability guidance for movement of the model 130G grader. It covers technical and physical characteristics as well as safety considerations. The chapter also prescribes the materials and guidance required to prepare, load, tie down,

and unload the vehicle.

7-2. Maximum Utilization of Railcars

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

Section II. TRANSPORT ON CONUS RAILWAYS

7-3. General

The transportability guidance contained in this section is applicable when the model 130G grader is transported on CONUS railways. Figure 7-1 shows the model 130G grader loaded on a wooden deck, general-pur-

pose railcar. Table 7-1 is the bill of materials for the blocking and tiedown of the model 130G grader. Table 7-2 provides data for the application of materials required to restrain the vehicle.

Table 7-1. Bill of Materials for Blocking and Tiedown of the Model 130G Grader on a General Purpose Flatcar  
Approximate

Item	Description	Approximate Quantity
Lumber	Douglas-fir, or comparable, straight-grain. free from material defects; Fed Spec MM-L-751C:	
	2- x 4-inch	22 linear feet
	4- x 4-inch	2 linear feet
	1- x 8-inch	24 linear feet
	4- x 8-inch	8 linear feet
Nails	Common, steel; flathead; bright or cement-coated; para 3.6.11.2, Fed Spec FF-N-105B:	
	40d	160
Wire rope	6 x 19, IWRC; improved plow steel: preformed. regular-lay; table X, Fed Spec RR-W-410:	
	5/8-inch	60 feet
Clamps	Wire rope, U-bolt clips, saddled, single-grip, steel, Crosby heavy-duty, or equal; MIL-STD-16842: 5/8-inch	24
Thimbles	Standard, open-type: 5/8-inch	8

Table 7-2. Application of Materials for Blocking and Tiedown of the Model 130G Grader on a General Purpose Flatcar  
(Fig 7-1)

Item	No. Required	Application
A		Brake-wheel clearance. Minimum clearance required is 6 inches above, in back of, and on both sides of and 4 inches underneath wheel.
B	6	Side blocks. Each to consist of 4- x 8- x 1 -inch lumber shaped to pattern B. Locate one inside of each wheel. Secure to car floor with five 40d nails in heel and one 40d nail in each side of block.
C	16	Chock blocks. Each to consist of a piece of 1- x 8-inch lumber cut to dimensions as shown, and one face plate of 2- x 4- x 16-inch lumber. Locate completed blocks against wheels in the pattern depicted. Secure each to car floor with five 40d nails in each heel and one 40d nail in each side of block.
D	2	Bearing pieces. 4. x 4- x 12-inch lumber. Locate under scraper blade, each side, and secure each to car floor with three 40d nails.
	8	Thimble, open-type, 5/8-inch. Place one at bottom of each stake pocket, and one each on front and rear tiedowns of grader

Table 7-2. Continued

Item	No. Required	Application
E	4	Wire rope, 5/8-inch. Attach through thimbles on vehicle tiedown points in a complete loop and through the thimble in each stake pocket on the same side of the car at an approximate 45° angle. On chain tiedown cars, chains may be used in lieu of cables.
	24	Clamps, 5/8-inch. Secure the ends of the wire rope with four clamps each. Secure the thimbles with one clamp each.

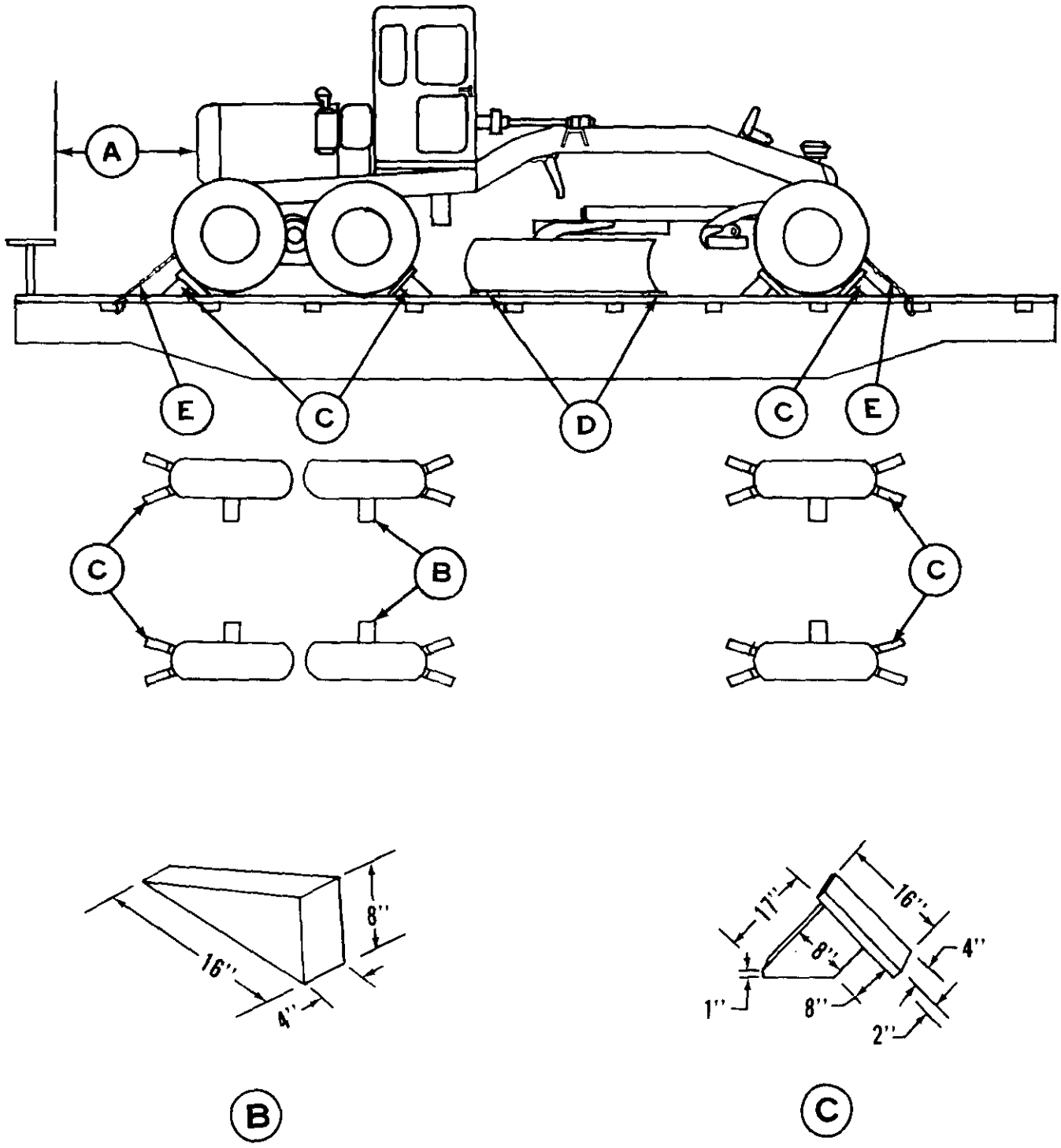


Figure 7-1. Model 130G grader loaded on a general purpose flatcar.

**7-4. Loading and Securing the Model 130G Grader on Open-Top Flatcars**

a. *Preparation for Loading.* The following steps should be taken to prepare the grader for movement by rail:

- (1) Fuel tanks should be no more than three-fourths full.
- (2) Equipment should be checked to ensure that there are no leaks.
- (3) Tires should have 35 psi of air.
- (4) All loose equipment should be secured.
- (5) The blade should be raised to its maximum height.
- (6) Scarifier blades should be reversed, and the scarifier should be raised to its maximum height.

b. *Loading.* The model 130G grader is driven onto the open-top flatcar from a ramp. If the grader is towed onto the flatcar, provisions must be made for the towing vehicle to depart the flatcar or to be loaded. Loading sequence is in the following order:

- (1) Use a qualified, experienced driver to check the brakes. Secure the scarifier in the up position.
- (2) Ensure that the articulating pivot pin and the front wheel lean locking bolt are engaged.
- (3) Use an experienced guide. The guide should be on the next car over from the car to be loaded; never on the same car. Also, the guide should never back up.
- (4) Use ground guides on each side of the grader, in clear view of the primary guide on the car.
- (5) Use only the guide on the car to signal the driver.
- (6) After the grader is stopped in the loading position on the flatcar, place the transmission shift lever in the neutral position and set and wire the handbrake.

(7) Lower the blade onto the sleeper shoring to protect the top of the flatcar. Make sure the blade is turned well within the width of the flatcar.

(8) Have the rail inspector check the positioning of the grader. The center of balance and position of other loaded equipment must be considered.

c. *Securing.* The procedures for securing the grader on the flatcar (fig 7-1) are in accordance with the American Association of Railroads. The sequence of securing the grader is as follows: (1) Place wire rope or chains or tiedowns but leave them loose.

(2) Make sure the blade is positioned firmly on the bearing pieces.

(3) Place chocks in front of front and middle tires, and nail the chocks in place.

(4) Tighten front wire rope or chains.

(5) Place chocks in back of front and rear tires, and nail the chocks in place.

(6) Tighten rear wire rope or chains.

(7) Double check to make sure bearing pieces are secure under the blade. Nail shoring in place.

(8) Check to make sure wire rope or chain tiedowns are tight.

(9) Make sure all windows are secured, and wire the door handle shut from the outside.

(10) Have the rail inspector check before considering the job complete.

d. The model 130G grader can be transported also on flatcars equipped with center tiedown rails. Figure 7-2 shows the grader on a chain tiedown flatcar. Table 7-3 is the bill of materials and general instructions for the tiedown of the grader on a chain tiedown flatcar.

*Table 7-3. Bill of Materials and General instructions for Tiedown of the Model 130G Grader on a Chain tiedown Flatcar*

Item	Description	Approximate Quantity
A	Brake-wheel clearance. Minimum clearance required is 6 inches above, in back of, and on both sides of and 4 inches underneath wheel.	
B	1/2-inch diameter steel chain, extra strength, proof-tested to minimum of 27,500 lbs.	4 (each unit)

**GENERAL INSTRUCTIONS**

(1) Shippers should specify cars equipped with tiedown devices in the quantity shown in Item "B" when ordering specialized railway equipment. When carriers 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.

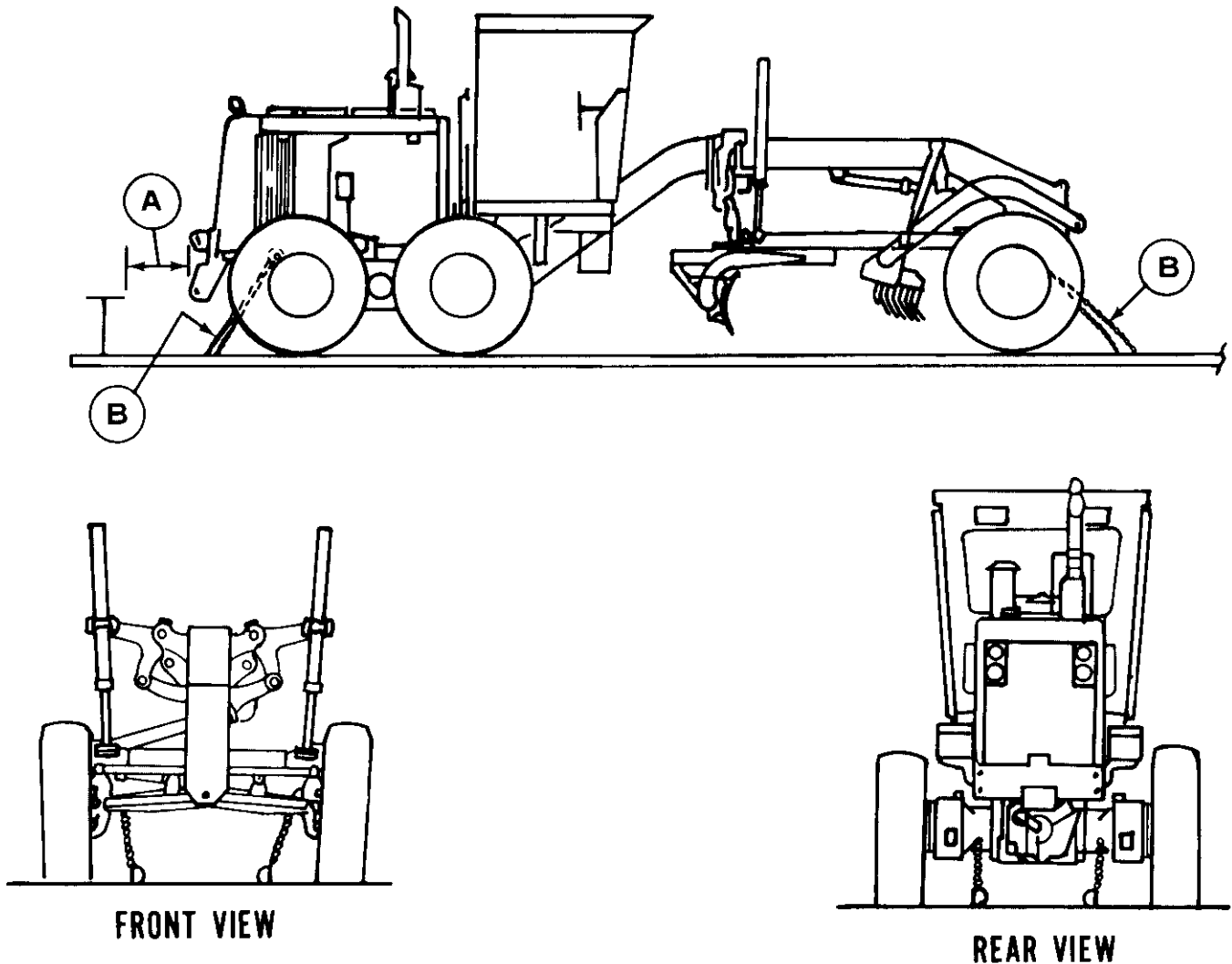
(2) Vehicles must face in the same direction and be uniformly spaced along the length of the car to allow sufficient space of each end of the car and between the vehicles for securement. Apply tiedowns parallel to each other at the same end of the vehicle and from the vehicle and from the vehicle tiedown point to the car tiedown facility. The angle of the tiedown must be as close to 45° as possible. When length of vehicles loaded on a 75-foot car preclude facing in the same direction, one vehicle may be reversed to ensure application of tiedown at a floor angle of 45°.

(3) Handbrakes must be set.

(4) Gearshift levers on vehicles equipped with automatic or standard transmissions must have the gearshift lever wired in the neutral position.

(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.

(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.



**Figure 7-2. Model 130G grader loaded on a chain tiedown flatcar.**

e. *Unloading.* Unloading of the model 130G grader is in reverse order of loading. The following are some of the precautionary measures to be aware of:

- (1) Make sure a suitable ramp is available to off-load from the flatcar.
- (2) Remove all tiedowns, chocks, blocking, and bracing.

- (3) Remove all wires that secure the gearshift lever and door.

- (4) Check all fluid levels before starting. Use only a qualified driver to unload the vehicle.

- (5) Use ground guides when unloading the vehicle.

- (6) Check brakes before unloading the vehicle.

### Section III. TRANSPORT ON FOREIGN RAILWAYS

#### 7-5. General

The transportability guidance contained in this section is applicable when the model 130G grader is transported on foreign railways. The shortest European flatcar is 31 feet 2 inches long. This length is adequate for the model 130G grader, which is 331 inches or 27.59 feet long. However, the height of the grader will need to be reduced to meet the European Passe-Part-out International (PPI) profile for rail transport. For planning purposes, flatcars long enough to carry the

grader plus the ROPS should be considered. This also applies to most of the countries in the Middle East, South America, Australia, India, and Pakistan.

#### 7-6. Procedures for Foreign-Service Rail Loading

Preparation, loading, tiedown, and unloading procedures are basically the same for all countries as they are outlined for CONUS rail procedures. Slight variations in blocking and bracing designs and nail size may

be encountered. Close coordination with foreign-country rail officials may be required to ensure compliance with local policy. The 4th Transportation Command, APO 09451, will provide a publication entitled

4th TRANSCOM Pamphlet No. 55-2, *Tiedown Guide for Rail Movements*, dated 15 May 1982. This publication provides information on European rail equipment and procedures.

## APPENDIX

## REFERENCES

- 
- A-1. Army Regulations (AR)**
- 310-3 Preparation, Coordination, and Approval of Department of the Army Publications
- 55-80 Highways for National Defense
- 55-162 Permits for Oversize, Overweight, or Other Special Military Movements on Public Highways in the United States
- 55-355 Military Traffic Management Regulation
- 70-44 DOD Engineering for Transportability
- 70-47 Engineering for Transportability
- 746-1 Packaging of Army Materiel for Shipment and Storage
- A-2. Army Field Manuals (FM)**
- 5-34 Engineer Field Data
- 5-36 Route Reconnaissance and Classification
- 55-9 Unit Air Movement
- 55-15 Transportation Reference Data
- 55-17 Terminal Operations Coordinator's Handbook
- 55-30 Army Motor Transport Units and Operations
- 55-450-1 Army Helicopter External Load Operations
- A-3. Army Supply Bulletins (SB)**
- 700-20 Army Adopted/Other Items Selected for Authorization/List of Reportable Items
- A-4. Army Technical Bulletins (TB)**
- 55-46-1 Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outsize/Overweight Equipment
- A-5. Technical Manuals (TM)**
- 55-2330-360-14 Operator's, Organizational, Direct Support and General Support Maintenance Manual Semitrailer, Low Bed: 40-Ton Construction Equipment Transporter M870 (CCE) (CMI/LOAD King Model 4031F)
- 55-405-9 Army Aviation Maintenance Engineering Manual: Weight and Balance
- 55-500 Marine Equipment Characteristics and Data
- 55-220-001-12 Transportability Guidance for Application of Blocking, Bracing and Tie-down Materials for Rail Transport
- A-6. Technical Orders (TO) (Air Force)**
- 1 - 1 B-40 Handbook of Weight and Balance Data
- 1C-5A-9 Loading Instructions, USAF Series C-5A Aircraft
- 1C- 130A-9 Loading Instructions, USAF Series C- 130 Aircraft
- 1C-1 41A-9 Loading Instructions, USAF Series C- 141 Aircraft
- A-7. Other Publications and Sources of Procurement**
- a. Code of Federal Regulations, Title 49-Transportation Parts 170-179  
Available from: Superintendent of Documents  
US Government Printing Office  
Washington, DC 20402



b. Association of American Railroads, *Rules Governing the Loading of Commodities on Open-Top Cars and Trailers.*

Section No. 1-General Rules

Section No. 6-Rules Governing the Loading of Department of Defense Materiel in Open-Top Cars.

Available from: Association of American Railroads

59 E Van Buren Street

Chicago, IL 60605

c. American Association of State Highway and Transportation Officials (AASHTO) *Legal Maximum Dimensions and Weight of Motor Vehicles Compared with AASHTO Standards.*

Available from: American Association of State Highway and Transportation Officials

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# The Metric System and Equivalents

## Linear Measure

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

## Weights

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

## Liquid Measure

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

## Square Measure

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

## Cubic Measure

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

## Approximate Conversion Factors

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

## Temperature (Exact)

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