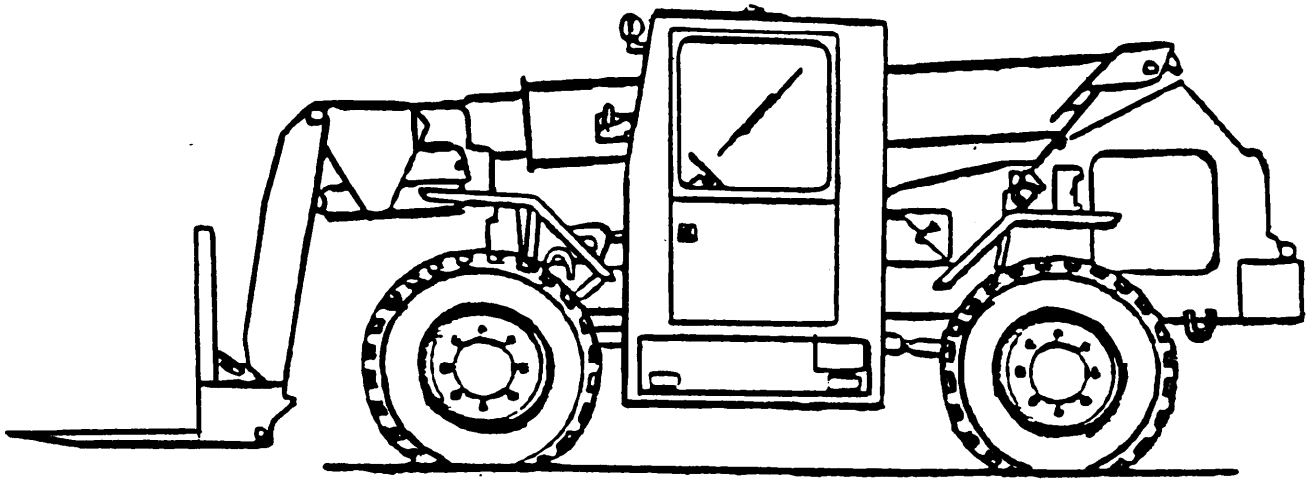
TECHNICAL MANUAL

TRANSPORT GUIDANCE FORKLIFT, 6000-LB, VARIABLE REACH, ROUGH-TERRAIN (NSN 3930-01-158-0849) (ARMY MODEL MHE-269)



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HEADQUARTERS, DEPARTMENT OF THE ARMY

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TECHNICAL MANUAL

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HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, *31 July 1991*

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TRANSPORT GUIDANCE FORKLIFT, 6,000-LB, VARIABLE REACH, ROUGH-TERRAIN, MODEL 6000M (NSN 3930-01-158-0849) (ARMY MODEL MHE-269)

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Purpose and Scope

This manual is for transportation officers and other personnel responsible for safe transport of the 6,000-pound-capacity, variable reach, rough-terrain forklift (6K VRRTFL). It provides data for planning and executing movement of the forklift worldwide. Included are the physical characteristics of the forklift, safety precautions, technical data on transport modes, and lifting and tiedown procedures.

The major dimensions and weights given in this manual are in US customary and equivalent SI (metric) units. Approximate values appear in parentheses following the customary-unit value.

Transport modes are presented in chapter 2, "Highway Transport"; chapter 3, "Rail Transport"; chapter 4, "Marine Transport"; and chapter 5, "Air Transport."

1-2. Related Publications

Additional information on transport procedures can be found in:

FM 55-65, *Strategic Deployment by Surface Transportation.*

TB 9-2300-281-35, *Standards for Overseas Shipment or Domestic Issue of Special Purpose Vehicles.*

TM 38-250/AFR 71-4, *Preparation of Hazardous Materials for Military Air Shipment.*

1-3. User Comments

Please send comments and recommendations for improving this manual. Send them by letter, on DA Form 2028, or on a marked copy of a page or pages of the manual to Commander, MTMC Transportation Engineering Agency, ATTN: MTTE-TR, PO Box 6276, Newport News, VA 23606-0276.

1-4. Definitions

a. Technical terms that may be helpful while using this manual include:

(1) *Axle Limits.* A load limit set by highway officials or designers of ship decks and aircraft as the maximum axle (or group of axles) weight that can be supported.

(2) *Center of Gravity (CG).* The balance point of a suspended item. The VRRTFL counterweight is used to shift the CG to the rear. CG location is indicated by. . .

(3) *Curb Weight (CW).* Total weight of operable 6K VRRTFL including fuel, all system fluids, and on-vehicle basic issue items (BII). CW does not include crew weight, which in this case is less than 1 percent of the gross vehicle weight.

(4) *Gross Vehicle Weight (GVW)* CW plus payload. For transport purposes, a forklift has no payload. Therefore, the GVW equals the CW.

(5) *Safe Working Load (SWL).* The SWL is the maximum recommended load that should be exerted on an item. SWL is also referred to as "working load," "working load limit," and "resultant safe working load." Such rated load values are for in-line pull.

(6) *Loading Restraint Factors (LRF).* The LRF given (app B) for the surface and air modes are considered to be the "G" factors that can be expected in military transport.

b. Warnings, Cautions, and Notes. Throughout this manual, warnings, cautions, and notes emphasize important or critical information.

*****WARNING*****

Instructions that must be followed to prevent serious injury to or death of personnel.

****CAUTION****

Instructions that must be followed to avoid health hazards, or to prevent equipment damage.

NOTE

An operating procedure that should receive special attention.

Section II. SAFETY

1-6. General

Even though the 6K VRRTFL has no special hazardous or dangerous characteristics during exposure to normal transportation environments, several general safety considerations and precautions are important.

a. Check the entire vehicle to be sure loose items are properly secured.

b. Have fire extinguishers readily available when operating the forklift.

c. Make sure only qualified personnel operate the forklift.

d. Never permit riders, this is a one-person machine.

e. Do not leave the forklift unattended when the engine is running.

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

g. Do not drive the forklift on public highways without appropriate safety equipment.

h. Adhere to all local, State, Federal, and/or host-nation safety laws and regulations applying to commercial carriers.

1-7. Hazardous Material Considerations

The basic 6K VRRTFL does not contain hazardous material. Regulations or transportation procedures covering diesel-fuel-powered vehicles will apply.

Section III. EQUIPMENT DESCRIPTION

1-8. General

The 6K VRRTFL is used in support of ammunition and quartermaster units. It can load and unload palletized material from the ground or from trailer-mounted ISO/MILVAN containers. The 6,000-pound rated load (24-inch load center) is at a reach of up to 15 feet. At the maximum reach of 23.5 feet, the lift capacity is 4,000 pounds.

This forklift has a special lifting tool for handling multiple launcher rocket system (MLRS) pods.

The operator position has built-in rollover protective structure (ROPS) and falling objects protective structure (FOPS).

The 6K VRRTFL has a six-cylinder, turbocharged diesel engine rated at 160 horsepower. The hydraulically powered steering is operable in three modes: two-wheel, four-wheel, and crab. Both axles are full-time, all-wheel drive. The front axle is equipped with limited slip differential.

More information is available in the 6K VRRTFL Operator's Manual, TM 10-3930-660-10.

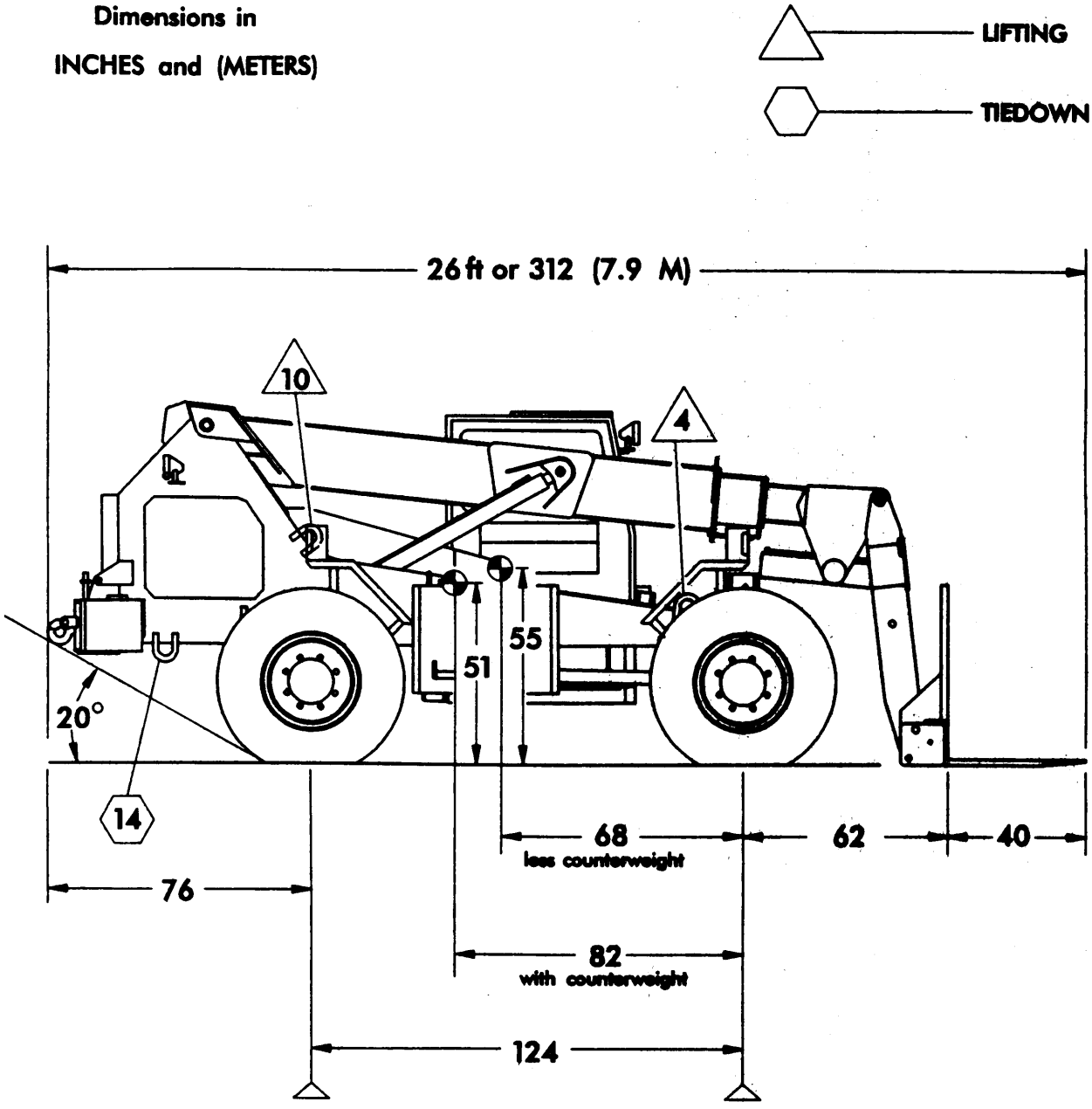
1-9. Technical Data

The following forklift characteristics and data apply to the specific model with NSN 3930-01-158-0849. Changes in the model or NSN may alter the data and guidance as presented in this manual.

Line item number (LIN)	T48944
Gross vehicle weight (GVW)	27,100 lb (12 290 kg)
Length:	
Operational	312 in. (7.9 m)
Without forks	272 in. (6.9 m)
Width	102 in. (2.59 m)
Height	101 in. (2.57 m)
Floor area:	
Operational	220 ft^2 (20 m^2)
Without forks	190 ft^2 (18 m^2)
Volume:	
Operational	1,860 ft^3 (52 m^3)
Without forks	1,620 ft^3 (46 m^3)
Turning radius (four-wheel steering):	
Curb level	15 ft (4.5 m)
Entire vehicle	18 ft (5.5 m)
Turning lane width	10 ft (3 m)
Tires:	
Size	17.5 x 25 L2
Pressure:	
Front	45 psi (310 KPa)
Rear	40 psi (280 KPa)
Ground pressure (at 27,100 pounds GVW):	
Front wheel	36 lb/$in.^2$ (2.5 kg/cm^2)
Gear wheel	30 lb/$in.^2$ (2.1 kg/cm^2)

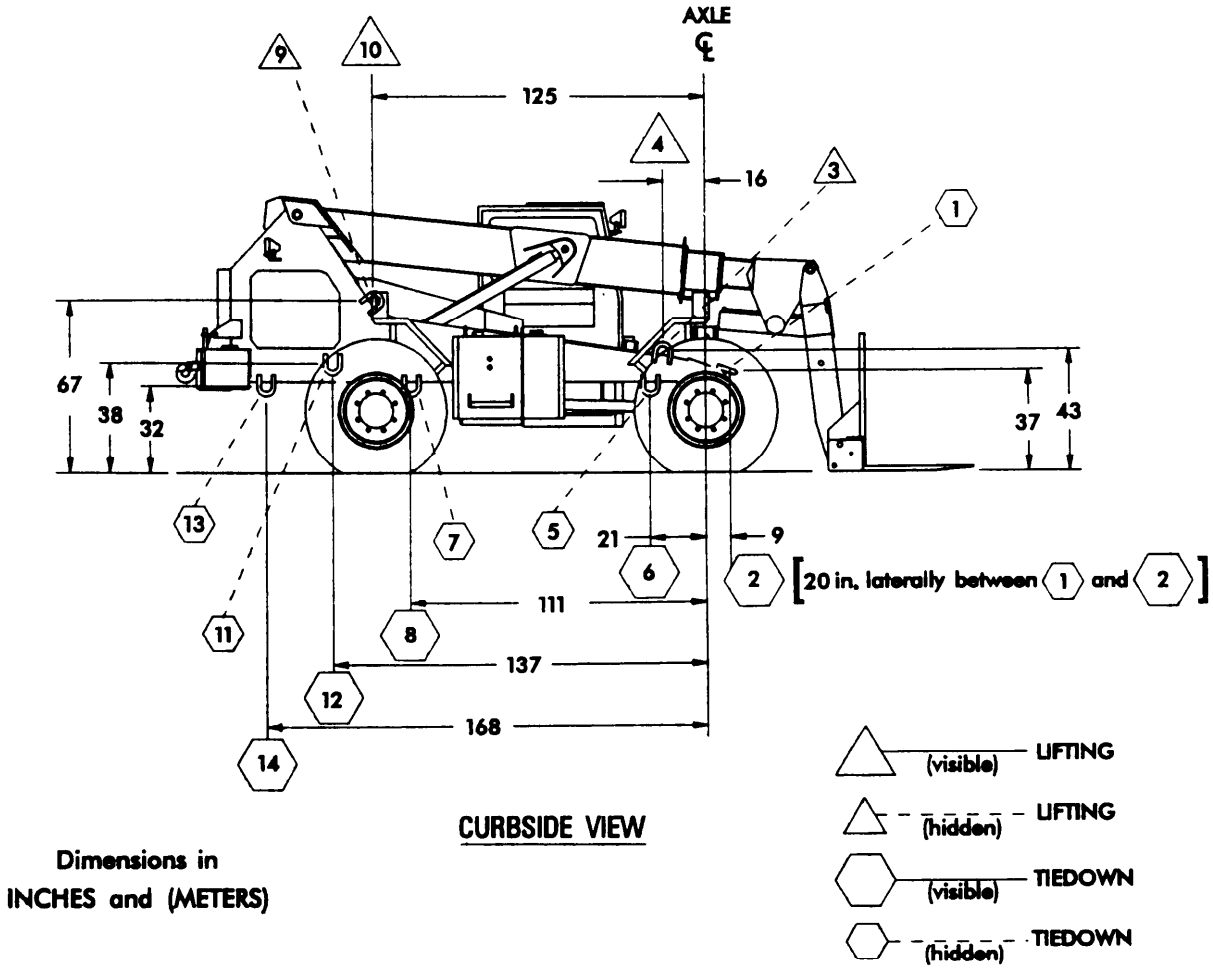
1-10. Reduced Configuration

There are no recommended ways to reduce the VRRTFL physical dimensions for transport. A cost saving is obtainable by reducing deck space or overall volume needed to transport an item. With most forklift trucks, configuration reduction usually involves removing the forklift tines and securing them to the vehicle. Because of the amount of disassembly required, this is not advisable with the VRRTFL.



CURBSIDE VIEW

Figure 1-1. Technical data on 6K VRRTFL



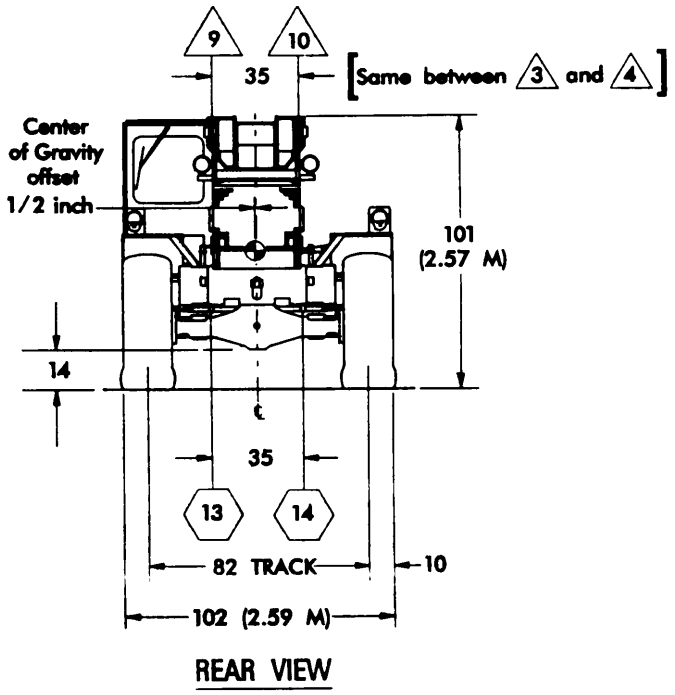


Figure 1-2. Lifting and tiedown provisions.

CHAPTER 2
HIGHWAY TRANSPORT

Section I. GENERAL

2-1. General

The 6K VRRTFL is highway transportable with a minimum of restrictions. However, because of its 102-inch width, the forklift exceeds the maximum legal limit of 96 inches for most States' noninterstate highways. Permit requirements will vary depending on local regulations and conditions, but in general the shipper must:

a. Submit DD Form 1266 to the installation transportation officer (ITO) 2 weeks before the planned movement.

b. Be aware that travel may be restricted to daylight hours on normal workdays.

c. Be prepared to use "wide load" signs, amber lights, and escorts.

d. Determine if blanket permits are available for specific prime movers, such as a heavy-equipment transporter.

2-2. Self-Delivery

With a maximum road speed of about 23 mph, the 6K VRRTFL can move over highways for short distances under its own power. With the power train disconnected, it can be towed. See the 6K VRRTFL Operator's Manual for towing procedures.

Section II. MOTOR VEHICLE TRANSPORT

2-3. Prime Mover Selection

The physical size and weight of the 6K VRRTFL allow highway transport of the forklift by a variety of vehicles. In selecting a transporter, the proposed route and local availability of wide load permits must be considered. Table 2-1 presents a comparison of military semitrailers.

Table 2-1. Evaluation of Prime Movers

Semi-trailers	Load Rating (tons)	Comments
M747 HET	60	Much too large.
M870 Lowbed	40	Larger than needed, but usable.
M872 Flatbed	34	Not well suited. Larger than needed, but usable. Deck height is 58 in.
M172A1 Lowbed	25	Best. Deck is 115 in. wide and 40 in. high.
M871 Flatbed	22.5	Usable. Deck is 96 in. wide x 55 in. high. Slight overhang of 3 in. per side.
M127A2C Stake	12	Not well suited. Deck height is 57 in. VRRTFL counterweight must be removed and shipped separately.
M345 Flatbed	10	Payload too small.

When properly loaded on an M172A1 or M871, the 6K VRRTFL will not overload the transporter or exceed axle limits in most geographic areas.

2-4. Preparation

Reparation for highway transport includes:

a. Filling fuel tank (or defueling) to one-quarter of its capacity.

b. Removing all trash and mud from the VRRTFL.

c. Ensuring the MLRS pod lifting tool is properly positioned in its storage location on the machine.

d. Checking for fluid leaks and repairing any defects.

e. Securing battery.

f. Ensuring the VRRTFL is in good mechanical order, with usable tiedowns, operating engine, brakes, and proper tire pressure.

g. Disconnecting the ether canister used for cold engine starting.

h. If required, removing the 3,600-pound counterweight to reduce the total weight of the forklift (see Operator's Manual).

2-5. Loading Procedures

a. Material. Table 2-2 shows the bill of materials for blocking and tiedown on a flatbed trailer.

Table 2-2. Bill of Materials for Transport by Semitrailer

Item	Quantity	Description
Chain	8	Chain assemblies, 3/8-in. by 10-ft high-test welded steel, 8,250-pound safe working load (16,500-pound breaking strength); equipped with matching grabhooks NSN 4010-00-803-8858
Load binders	8	Heavyduty, double grabhook, Type 4, 3/8- to 1/2-in. (26,000-pound breaking strength) NSN 3990-01-213-1746

NOTE

Chain assemblies and load binders are basic issue items (BII) for the M172 trailer.

Load binders are generally marked with an ultimate breaking strength rating. Depending on manufacturer, breaking strength is about three times the safe working load.

Chain is generally rated by proof test load, or about two times the safe working load.

b. Loading. To place the forklift in the tiedown position on the semitrailer, use a crane of adequate capacity (see para 4-4 for lifting guidance), or drive the forklift onto a semitrailer if a suitable ramp is available. Position the forklift so its weight is distributed relatively equal over the tractor and trailer axles. Set the parking brake. Place the transmission in neutral. Lower the forks to rest on trailer deck.

c. Tiedown. See figure 2–1 and table 2-3 for instructions on restraining the forklift against forces encountered at normal speeds and operating conditions. Wheel blocking of the VRRTFL is not required. The highway loading restraint factors (LRF) used in figure 2-1 are listed in appendix B.

Table 2-3. Tiedown Procedures for Securing VRRTFL to a Semitrailer (Fig 2-1)

Item	Procedure
Chains/load binders (8 required)	Properly rated chains and load binders must be available for tiedown. Install at indicated locations as shown in figure 2-1. Wheel blocking is not required.

NOTE

All military trucks and trailers are equipped with basic issue item (BII) load binders and chain.

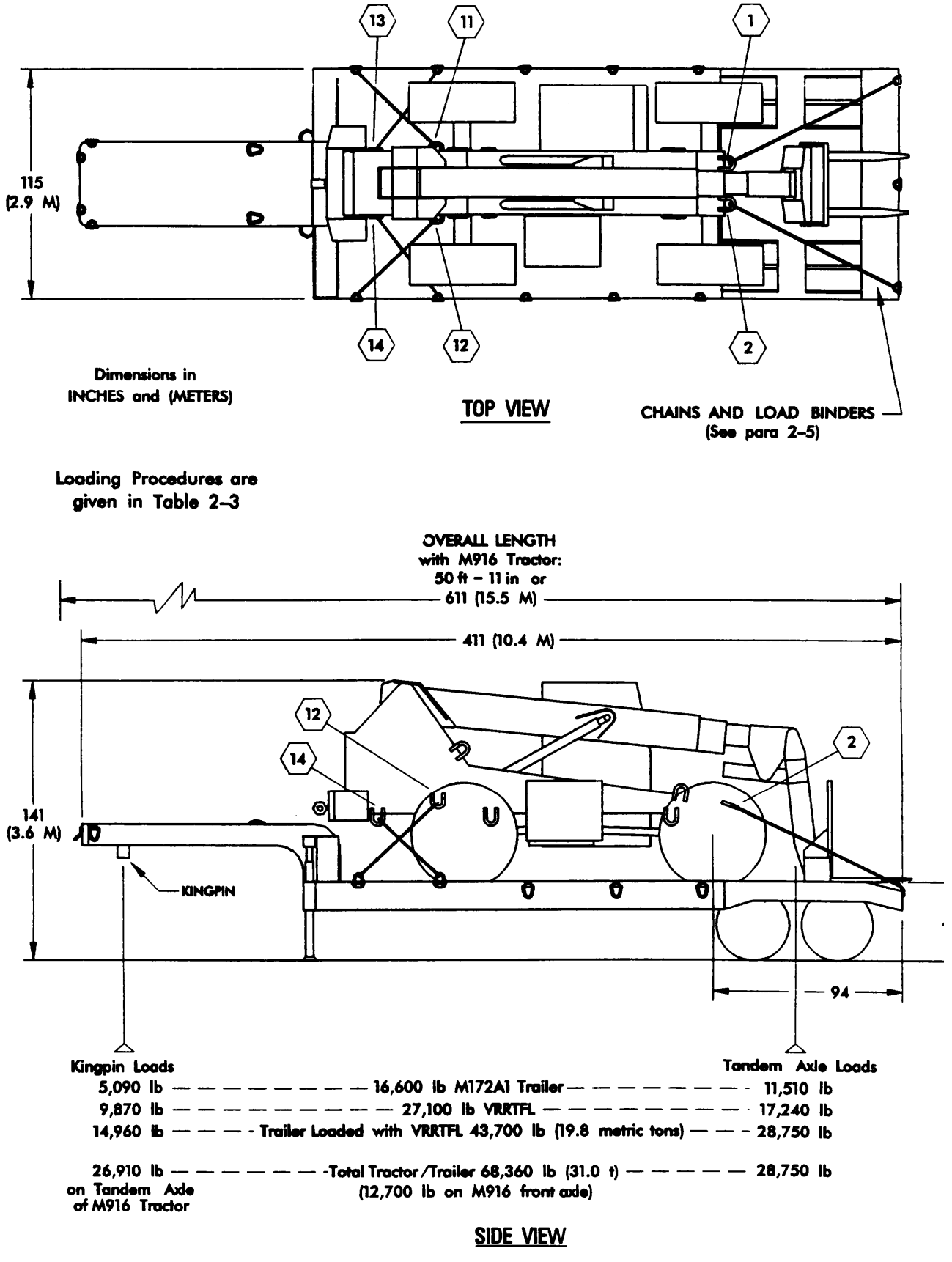


Figure 2-1. Tiedown of 6K VRRTFL on a flatbed semitrailer.

CHAPTER 3

RAIL TRANSPORT

Section I. GENERAL

3-1. General

The 6K VRRTFL is transportable on most general-purpose, standard deck-height flatcars. The railcar may have a wood or steel deck and standard or cushioned-draft couplers. It must have suitable tiedown points, such as stake pockets or chain-tiedown anchor channels. (Contact MTMCTEA (see address in para 1–3) for a pamphlet on rail loading MTMCTEA Pamphlet 55–19, *Tiedown Handbook for Rail Movements.)*

NOTE

Only qualified equipment drivers/operators should move a VRRTFL.

Do not ride on, mount, or dismount a moving VRRTFL.

Section II. RAIL LOADING

3-2. Railcar Selection

Because of its size and weight, the 6K VRRTFL is rail transportable by a variety of railcars. Table 3-1 presents features of commonly available military and commercial railcars.

3-3. Preparation

Preparation for rail movement includes:

a. Filling fuel tank to one-quarter full.

b. Removing trash and mud from the VRRTFL.

Table 3-1. Evaluation of Railcars

Railcar	Features	Comments
DODX 140-ton	Steel-deck, cushioned-draft*, 1/2-in. chain-tiedown	Designed and intended for M1 Abrams and other tracked vehicles.
DODX 50-ton	Wood-deck, 1/2-in. chain-tiedown	Suitable, 8 chains required
General-purpose flatcar	Wood-deck, standard-draft **	Suitable, 5/8-in. cable and blocking required
Trailer Train: HTTX	Wood-deck cushioned-draft, 1/2-in. chain-tiedown	Suitable, 8 chains required
OTTX	Wood-deck, cushioned-draft, 3/8-in. chain-tiedown	Suitable, 12 chains required
ITTX, TTDX	Steel-deck, cushioned-draft, 3/8 in. chain-tiedown	Suitable, 12 chains required

*Couplers are hydraulically "cushioned."

**Couplers have stiff mechanical snubbers only.

c. Ensuring MLRS pod lifting tool is properly positioned in its storage location on the machine.

d. Checking for fluid leaks and repairing any defects.

e. Securing battery.

f. Ensuring the VRRTFL is in good mechanical order, with usable tiedowns, operating engine, brakes, and proper tire pressure.

3-4. Loading Procedures

a. Material. When chain-tiedown cars are unavailable, the shipper must supply materials for blocking and tiedown on the railcar. Table 3–2 is a listing of such materials. Note that either four loops of 5/8-inch wire rope or eight loops of 1/2-inch wire rope can be used.

b. Loading. To place the VRRTFL in the tiedown position on the railcar, use a crane of adequate capacity (see para 4-4 for lifting guidance), or drive the forklift onto the railcar if a suitable ramp is available. Position the forklift so that sufficient railcar tiedown points are available. Set the parking brake. Place the transmission in neutral. Rest the forks on shoring, or leave them in a raised position. Generally, on wood-deck railcars, rest the forks on the deck (or shoring), and on steel-deck railcars, simply leave the forks raised 18 to 24 inches above the deck.

c. Tiedowns and Blocking. Figure 3-1 and table 3-3 provide instructions for restraining the forklift against forces encountered in normal rail operations. The rail loading restraint factors (LRF) used in figure 3–1 are listed in appendix B.

Table 3-2. Bill of Materials for Transport by Railcar (Fig 3-1)

Item	Quantity	Description
Wire rope (8 loops required)	About 160 ft	1/2-in., improved plow steel, 6X19 class, IWRC (independent wire rope core) or wire-strand core, nominal breaking strength 23,00 pounds; Fed Spec RR-W-410 NSN 4010-00-272-8848
Cable clamps (clips)	16	5/8-in., Type I, single-saddle, wire-rope clamp, Fed Spec FF-C-450
	32	1/2-in., Crosby heavy-duty or one that exceeds Fed Spec FF-C-450 strength requirements.
Thimbles	16	1/2-in., Type III (heavy) split oval construction (open pattern); Fed Spec FF-T-276
Lumber (nominal sizes)		Douglas-fir, or comparable; Fed Spec MM-L-751
2 x 4 in.	36 ft*	
2 x 6 in.	12 ft*	
2 x 8 in.	96 ft*	
2 x 10 in.	32 ft*	
Nails		Common, steel, flathead;
16d	4 pounds	bright or cement-coated; Fed
20d	2 pounds	Spec FF-N-105
Protective Material	About 12 ft²	Waterproof paper (tar paper)
Strapping	About 25 ft	Nonmetallic banding
When 5/8-in. cable is used, the following quantitites apply:		
Wire rope (4 loops required)	About 70 ft	5/8-in., improved plow steel, 6x19 class, IWRC (independent wire rope core) or wire-strand core, nominal breaking strength 35,800 pounds; Fed Spec RR-W-410 NSN 4010-763-5602
Cable clamps (clips)	8	3/4-in., Type I, single-saddle, wire-rope clamp, Fed Spec FF-C-450
	16	5/8-in., Crosby heavy duty or one that exceeds Fed Spec FF-C-450 strength requirements.
Thimbles	8	5/8-in., Type III (heavy) split oval construction (open pattern); Fed Spec FF-T-276. Use of thimbles is optional on the VRRTFL fittings.

*Linear

Table 3-3. Tiedown Procedures for Securing 6K VRRTFL on Flatcar (Fig 3-1)

Item	Procedure
Chain tiedowns	Install at indicated locations. The number of chains used will depend on chain size/strength. Use eight 1/2-in. chains (4 in each direction), or twelve 3/8-in. chains (6 in each direction).

NOTE

When chain-tiedown-equipped railcars are not available, wire rope and wooden blocking must be used.

Wire rope loops	Each tiedown is made from one piece of 1/2-in. wire rope (8 required), or 5/8-in. wire rope (4 required). Length as required (12 to 16 feet). Form a complete loop between forklift-truck tiedown provision and railcar stake pocket. The angle between the cables and railcar deck (as viewed from the side) should be as close to 45° as possible. The wire rope ends must overlap at least 24 inches. Tension the wire rope by using two cable grippers and a chain-hoist (3-ton) or "come-along."
Cable clamps	Space clamps 3-3/4-in. apart as shown. With 1/2-in. wire rope, use 1/2-in. cable clamps and alternately torque nuts to 65 ft-lb. (With 5/8-in. wire rope, use 5/8-in. cable clamps torqued to 95 ft-lb.)
Thimbles	Use thimbles to protect cable at sharp bends. Attach to cable with cable clamps (5/8-in. clamps on 1/2-in. thimbles and 3/4-in. clamps on 5/8-in. thimbles). Thimbles are optional for the VRRTFL fittings.
Blocking Strapping	Position and nail blocking to railcar. Band operators' cab to keep door closed in-transit.

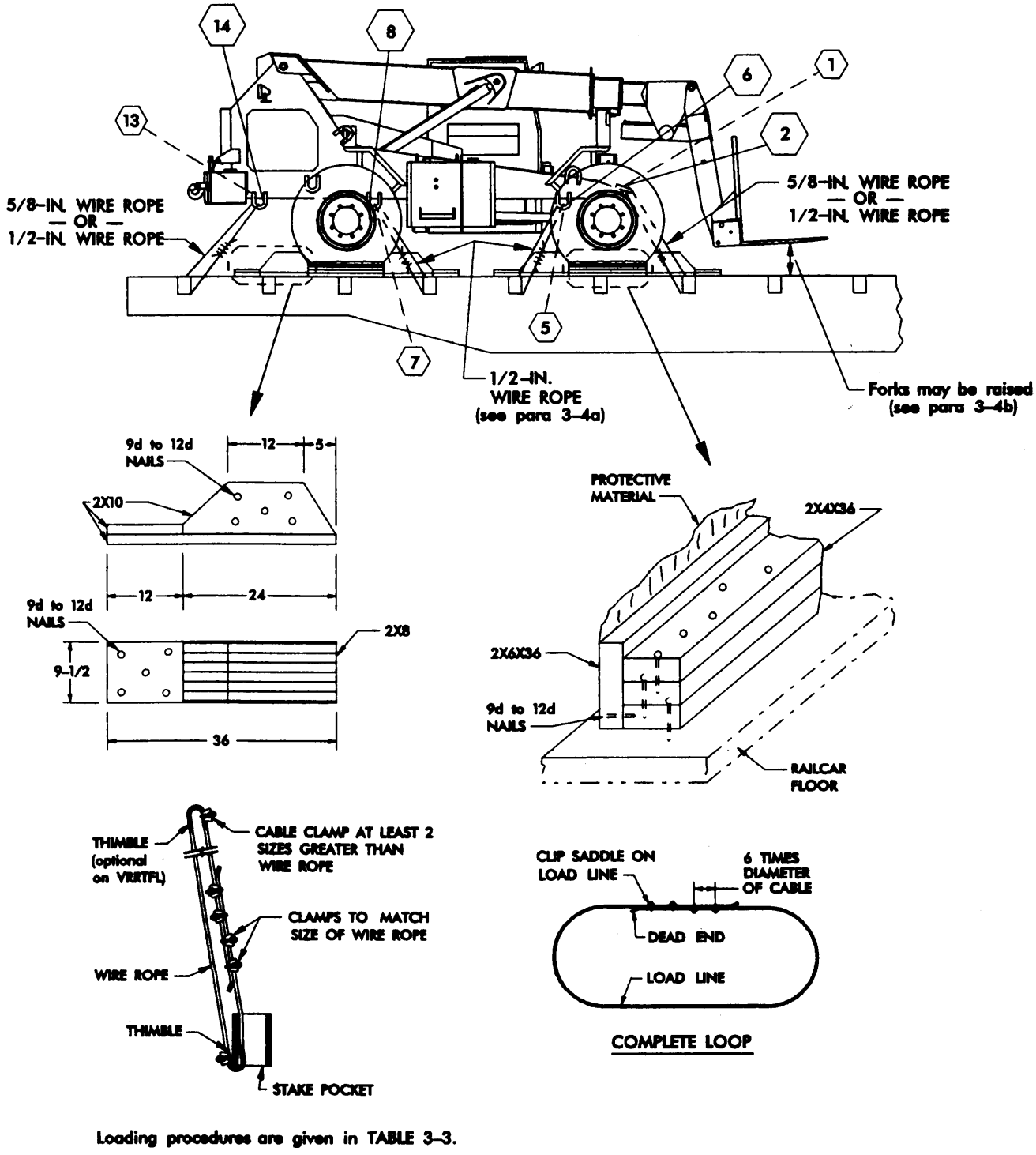
NOTE

To develop full cable loop working strength, cable clamp nuts must be torqued to:

65 ft-lb on 1/2-in. clamp nuts.

95 ft-lb on 5/8-in. clamp nuts.

To ensure proper torque, alternately torque both nuts.



Loading procedures are given in TABLE 3-3.

Figure 3-1. Blocking and tiedown of 6K VRRTFL on rail flatcar.

CHAPTER 4

MARINE TRANSPORT

Section I. GENERAL

4-1. General

The 6K VRRTFL is marine transportable aboard most general-purpose or roll-on/roll-off (RORO) ships. Most ships under the Military Sealift Command charter have tiedown points such as D-rings or other lashing anchors. When suitable lashing points are unavailable, wood blocking becomes necessary. Marine loading restraint depends on the expected sea state, ship size, and stow location on the ship. Generally, the amount of restraint increases for locations high and forward (or aft) in the ship. The most severe conditions occur on exposed "weather-decks" (a ship's crew may require additional lashing). Below-deck locations that are closer to the vessel's centers of gravity and rotation, will experience less severe loading. The blocking and tiedown procedures presented (fig 4-1) allow for severe, below-deck conditions. (Contact MTMCTEA (see address in para 1-3) for a pamphlet on marine loading: MTMCTEA Pamphlet 56-1, *Marine Terminal Lifting Guidance.)*

****CAUTION****

Ear protection (plugs) is needed when working on RORO ships with loud ventilator systems.

NOTE

The entire vehicle must be checked to be sure that loose items are properly secured. Maximum VRRTFL speed on ship loading ramps or decks is 3 mph or less.

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

Section II. SHIP LOADING

4-2. Preparation

Preparation for sealift includes:

a. Preservation as required by TB 9-2320-281-35 for expected stowage (above or below deck).

b. Filling fuel tank between one-quarter and three-quarters full for RORO operations

NOTE

Because of limited cargo-hold ventilation, most general cargo ships will require that the fuel tank be drained and battery disconnected.

c. Ensuring MLRS pod lifting tool is properly positioned in its storage location on the machine.

d. Checking for fluid leaks and repairing any defects.

e. Ensuring the VRRTFL is in good mechanical order, with usable tiedowns, operating engine, brakes, and proper tire pressure.

f. Disconnecting the ether canister used for cold engine starting.

4-3. Loading Procedures

a. Material. When ship's lashing gear is unavailable, the shipper must supply tiedown materials. The VRRTFL is shown in figure 4-1 aligned fore and aft with the ship. The loading restraint factors (LRF) used in figure 4-1 are listed in appendix B. Table 4-1 is a listing of such materials.

Table 4-1. Bill of Materials for Transport by Ship

Item	Quantity	Description
Wire rope	About 80-ft	1/2-in., improved plow steel, 6x19 class, IWRC (independent wire rope core) or wire-strand core, nominal breaking strength 23,000 pounds; Fed Spec RR-W-410 NSN 4010-00-272-8848
Cable clamps (clips)	8	5/8-in., Type I, single-saddle, wire-rope clamp, Fed Spec FF-C-450
	16	1/2-in., Crosby heavy-duty or one that exceeds Fed Spec FF-C-450 strength requirements.
Thimbles	8	1/2-in., Type III (Heavy) split oval construction (open pattern); Fed Spec FF-T-276
When suitable ship's lashing points are unavailable, blocking becomes required.		
Lumber (nominal sizes)		Douglas-fir, or comparable; Fed Spec MM-L-751
2 x 6 in.	20 ft*	
4 x 6 in.	140 ft*	
Nails		Common, steel, flathead; bright or cement-coated; Fed Spec FF-N-105
16d	1 pound	
40d	2 pounds	

*Linear

b. Loading. Position the VRRTFL as indicated in the stow plan, so sufficient tiedown points are available. Set the parking brake. Place the transmission in neutral. Rest the forks on shoring, or leave them raised about 10 inches off the deck. Disconnect the battery (if required by the ship's master) once the VRRTFL is positioned aboard ship.

c. Tiedoum and Blocking. Figure 4-1 and table 4-2 provide instructions for restraining the forklift against forces encountered in severe marine conditions (para 4-1).

Table 4-2. Tiedown Procedures for Securing 6K VRRTFL in a Cargo Ship Hold (Fig 4-1)

Item	Procedure
Wire rope loops (4 required)	Each tiedown is made from one piece of 1/2-in. wire rope. Length as required. Form a complete loop between forklift-truck and ship tiedown provisions. The angle between the cables and deck (as viewed from the side) should be as close to 45° as possible. The wire rope ends must overlap at least 24 inches. Tension the wire rope by using two cable grippers and a chain hoist (3-ton) or "come-along."
Cable clamps	Space clamps 3-3/4 inches apart as shown. Use 1/2-in. cable clamps and alternately torque nuts to 65 ft.-lb.
Thimbles	Use thimbles to protect cable at sharp bends. Attach to cable with 5/8-in. cable clamp. Thimbles are optional for the VRRTFL fittings.
Blocking	Position and nail blocking.

NOTE

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

To develop full cable-loop working strength, torque 1/2-in. cable clamp nuts to 65 ft-lb. To ensure proper torque, alternately torque both nuts.

Cable-loop working strength (two loaded cables) is 80 percent of the cable breaking strength. Example: 23,000 x 2 x 0.8 = 36,800 lb for 1/2-in. cable.

4-4. Lifting Operations

Shiploading will often require lifting of the VRRTFL into position aboard ship. Shipside and shoreside cranes are usually rated in long tons (LTON), 2,240 pounds, and/or metric tons, 1000 kilograms. To lift the VRRTFL, a crane and sling-set capacity of at least 12 LTON or 13 metric tons is needed. See figure 4–2.

****WARNING****

Crane lifting operations are inherently dangerous. Avoid being under overhead loads.

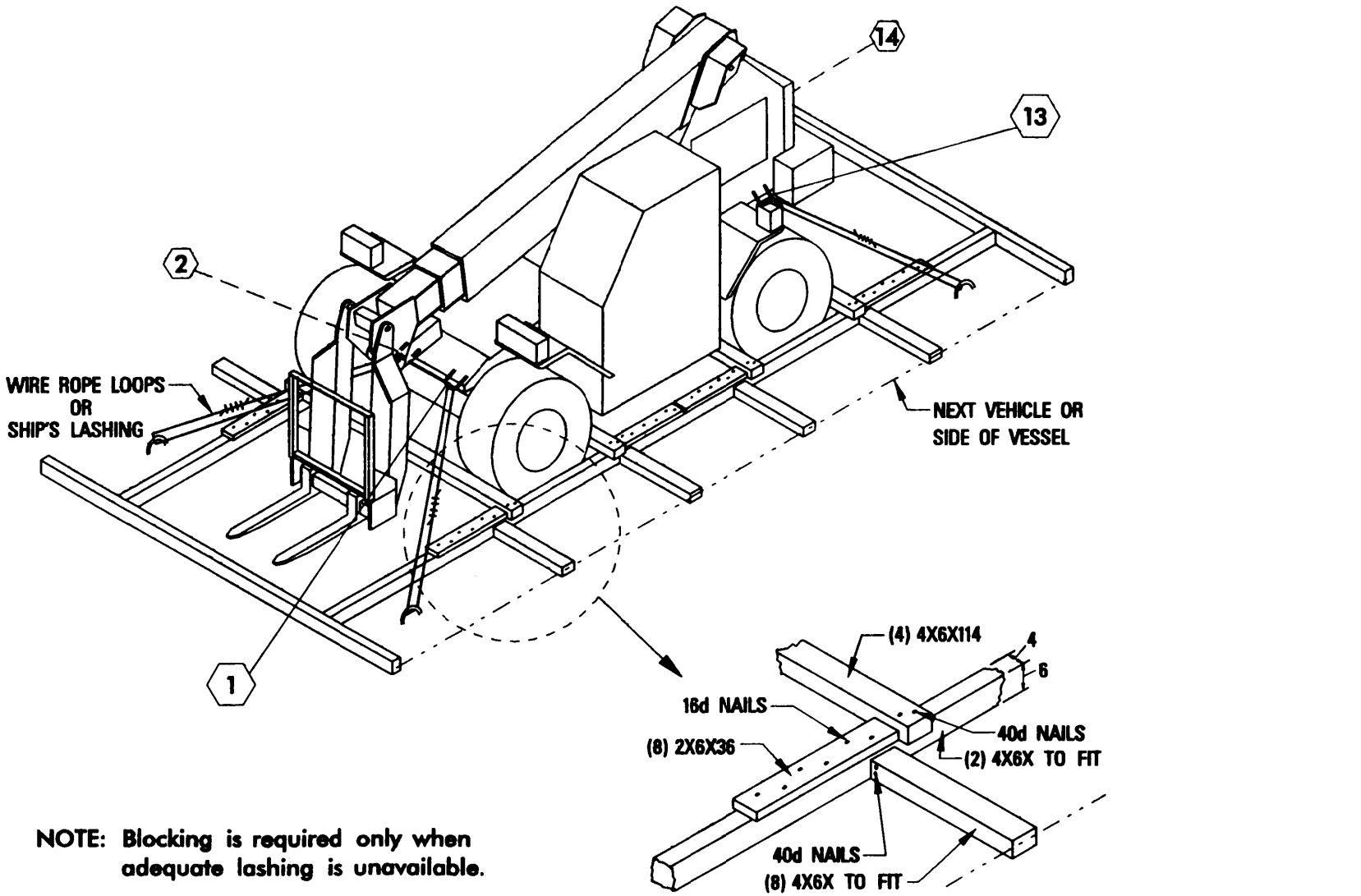


Figure 4–1. Blocking and tiedown of 6K VRRTFL in the hold of a general cargo ship.

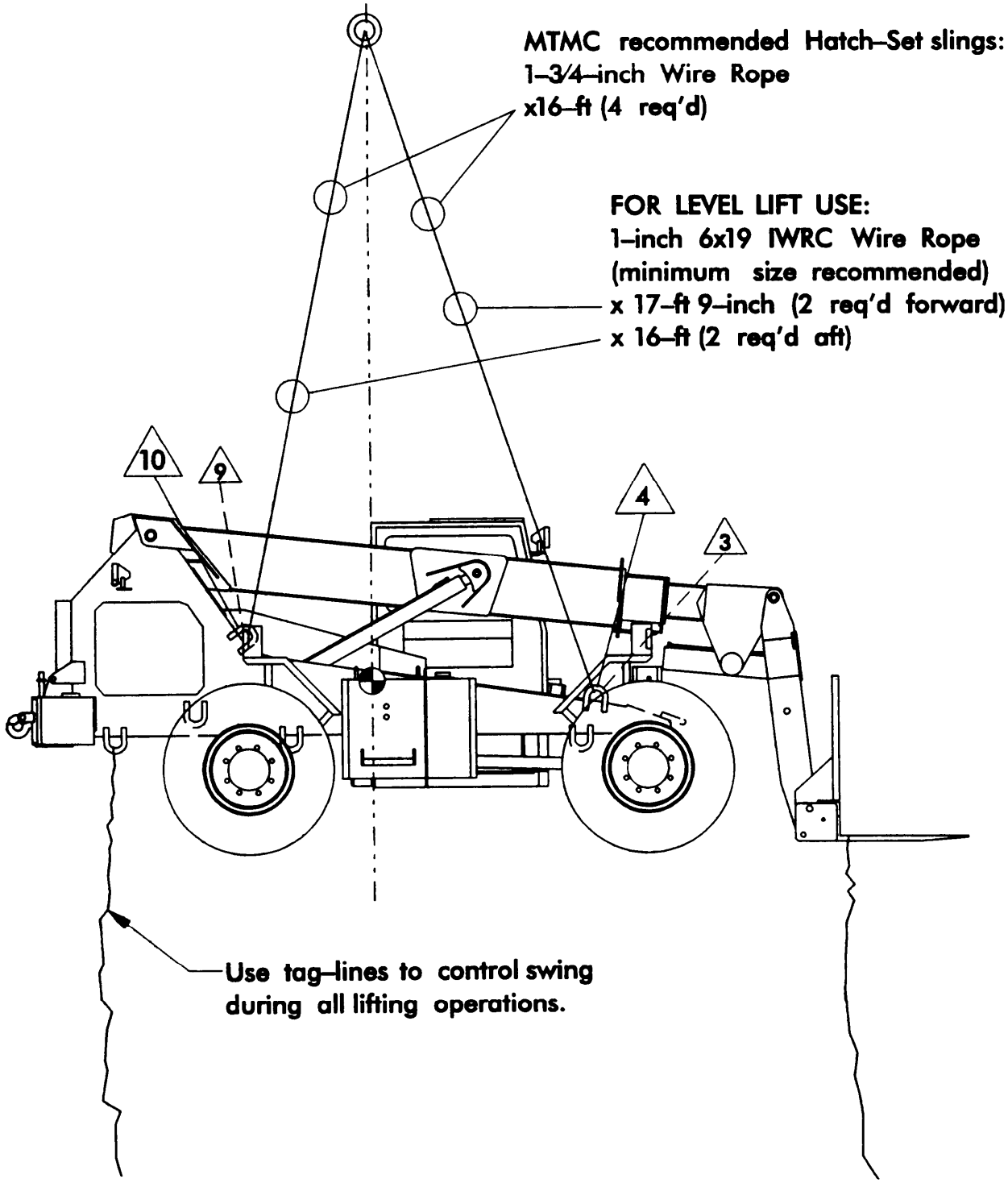


Figure 4-2. Crane lifting of the 6K VRRTFL.

CHAPTER 5

AIR TRANSPORT

Section I. GENERAL

5-1. General

The 6K VRRTFL is air transportable. The shipping unit must ensure that the VRRTFL is properly prepared for air transport before reaching the marshaling area. The shipping unit will assist the aircraft loadmaster/crew in loading and tying down the VRRTFL. The loadmaster-prepared load plan for the actual aircraft mission will determine specific loading limitations, tiedown patterns, and troop seating availability. The loading restraint factors (LRF) used in aircraft tiedown are listed in appendix B.

5-2. Safety

Safety considerations and precautions for the 6K VRRTFL air transport are:

****CAUTION****

Personnel must wear ear protection (plugs) at all times while working on the flightline.

Members of loading teams should not wear rings.

NOTE

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

The vehicle maximum speed within 25 feet of any aircraft is 5 mph. On loading ramps or inside the aircraft, the vehicle should not exceed 3 mph.

Personnel must not refuel or otherwise service the VRRTFL within 50 feet of an aircraft.

5-3. Hazardous Material

Shippers must provide written notification before shipping dangerous or hazardous materials aboard military or DOD contract aircraft. Details are covered in TM 38-250/AFR 71-4, *Preparation of Hazardous Materials for Military Air Shipment.*

Section II. TRANSPORT by CARGO AIRCRAFT

5-4. USAF Cargo Aircraft

The 6K VRRTFL is certified for airlift aboard all Military Airlift Command (MAC) prime mission cargo aircraft. Airlift on the C-130 will require removal of the 3,600-pound counterweight to reduce axle load.

5-5. Civil Reserve Air Fleet (CRAF)

The 6K VRRTFL exceeds the capability of all aircraft in the CRAF.

5-6. Preparation

The deploying unit must prepare the VRRTFL for airlift. Preparation will include:

a. Cleaning dirt, mud, snow, ice, and trash from the VRRTFL.

b. Ensuring the VRRTFL has no fluid leaks (oil, fuel, hydraulic, and coolant).

c. Ensuring the VRRTFL is in good mechanical order, with usable tiedowns; operating engine, brakes, and hydraulic system; and proper tire pressure.

d. Marking the shipping weight and center of balance location on both sides of VRRTFL.

e. Securing battery, and tightening battery caps.

f. Filling the VRRTFL fuel tank between one-quarter and one-half full, and securely closing fuel tank to prevent spillage.

NOTE

Fuel tank can be no more than one-half full on other than contingency flights.

g. When required, remove and palletize the counterweight. The VRRTFL Unit, Direct Support, and General Support Maintenance Manual, TM 10-3930-660-24, provides details on counterweight removal and installation.

NOTE

A second forklift truck is needed to remove the VRRTFL counterweight. Removal requires lifting the 3,600-pound counterweight on the fork ends. A forklift truck with a minimum capacity of 5,000 pounds (using standard forks) will be needed to handle the counterweight.

APPENDIX A

REFERENCES

A-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
55-355	Defense Traffic Management Regulation
70-44	DOD Engineering for Transportability
70-47	Engineering for Transportability
746-1	Packaging of Army Material for Shipment and Storage

A-2. Field Manuals (FM)

5-34	Engineer Field Data
5-36	Route Reconnaissance and Classification
55-15	Transportation Reference Data
55-17	Terminal Operations Coordinator's Handbook

A-3. Supply Bulletins (SB)

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

A-4. Technical Bulletins (TB)

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

A-5. Technical Manuals (TM)

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	Transportability Guidance: Application of Blocking, Bracing, and Tiedown Materials for Rail Transport

A-6. Air Force Manuals

TO IC-5A-9 Loading Instructions, USAF Series C-5 Aircraft
TO IC-130E-9 Loading Instructions, USAF Series C-130 Aircraft
TO IC-141B-9 Loading Instructions, USAF Series C-141 Aircraft

A-7. Other publications

a. Code of Federal Regulation, Title 49—Transportation Parts, 107-179 and Title 46-Shipping, Part 146
Available from: Superintendent of Documents
US Government Printing Offices
Washington, DC 20402

b. Association of American Railroads, *Rules of Governing the Loading of Commodities on Open-Top Cars and Trailers*
Section No. 1–General Rules
Section No. 6–Rules Governing the Loading of Department of Defense Materiel on Open-Top Cars
Available from: Association of American Railroads

50 F Street, NW
Washington, DC 20001-1564

c. 4th Transportation Command Pamphlet 55-2, *Tiedown Guide of Rail Movement*
Available from: Commander
1st Transportation Movement Control Agency
ATTN: AEUTR-MCA-TA
APO New York 09451-4000

APPENDIX B

LOADING RESTRAINT FACTORS

The loading restraint factors (LRFs) used for surface and air modes are the "G" (acceleration of gravity) loading factors that can be expected in military transport. The tiedown arrangements shown in the 6K VRRTFL TGTM are based on the following:

—restraint factors are applied independently in each direction.

—restraint load (GVW times the LRF) was resolved into resultant lashing loads, allowing for tiedown angle.

–lashing loads are less than safe working load (SWL) of the restraint (that is, wire rope).

Highway:

The Transportation Engineering Agency highway LRFs are:
0.7 in the forward direction (relative to the transporter).
0.3 in the aft and vertical directions.
0.1 in the lateral direction.

Rail:

The Association of American Railroads recommended rail LRFs are:
3.0 in the longitudinal direction (relative to the railcar).
2.0 in the lateral and vertical directions.

Marine:

The Military Sealift Command (MSC) design LRFs are:
1.2 in the lateral direction (relative to the ship).
0.7 in the longitudinal direction.
0.2 in the vertical direction.
MSC LRFs are for severe conditions.

Actual marine LRFs vary. Marine tiedown restraint depends on the size of ship (decreasing on larger vessels), the expected sea state to be encountered, and the stow location on a given ship. Generally, the restraint required will increase for locations high and forward (or aft) in the ship. The most severe conditions occur on exposed “weather decks,” where strong wind and wet conditions add to the problem. A ship’s crew may require additional lashing on exposed decks. Below-deck locations that are closer to the vessel’s centers of gravity and rotation will experience less severe motion. The blocking and tiedown procedures presented (fig 4–1) will allow for severe, below-deck conditions.

Air:

The USAF aircraft LRFs are:
3.0 in the forward direction (relative to the aircraft).
2.0 in the vertical direction.
1.5 in the aft and lateral directions.

APPENDIX C

ESTIMATING TIEDOWNS

The number of lashings required to safely tie down the VRRTFL for highway transport on a typical truck/semitrailer can be estimated in the following manner:

STEP 1 – Determine the amount of longitudinal restraint needed. [With this method, the required vertical and lateral restraint is covered by the longitudinal factor or factors.]

–The highway loading restraint factor (LRF) is 0.7 (from app B) in the forward direction:

27,100 (VRRTFL GVW) x 0.7 = 18,970 pounds

–The highway LRF is 0.3 in the aft direction:

27,100 X 0.3 = 8,130 pounds

STEP 2 – Determine the number of chains needed.

–The angle to semitrailer deck and the angle to the side are assumed to be 45°. [cos 45 x cos 45 = 0.5]

–The SWL of 3/8-in. chain (from table 2-2) is 8,250 pounds:

$$\text{No. of forward loading chains} = \frac{18{,}970}{8{,}250 \times 0.5} = 4.6 \text{ (rounded up to 5)}$$

While 5 chains satisfy the equation, 6 chains are needed for a symmetric (side-to-side) tiedown arrangement. Therefore, use 6 chains to prevent the VRRTFL from moving forward on the semitrailer.

$$\text{No. of aft loading chains} = \frac{8{,}130}{8{,}250 \times 0.5} = 1.9 \text{ (rounded up to 2)}$$

Use 2 chains to prevent the VRRTFL from moving aft on the semitrailer.

NOTE:

This method is more conservative than the “Highway Transport” chapter. Fewer chains are used in Figure 2-1, “Tiedown of 6K VRRTFL on a flatbed semitrailer,” because the figure is based on the actual tiedown-lashing angles [angle to semitrailer deck (side view) and angle to the side (top view)].

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