TEA PAMPHLET 55-23
SECOND EDITION

Tiedown Handbook for **Containerized** Movements

TEA **PAMPHLET 55-23**

TRANSPORTATION AND TRAVEL

TIEDOWN HANDBOOK
for
CONTAINERIZED MOVEMENTS

SECOND EDITION

September 2003

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NEWPORT NEWS, VIRGINIA
www.tea.army.mil

This is the second edition of this handbook. It supercedes the first edition, *Containerization of Military Vehicles* (August 1996). However, copies of the first edition still have value, and you may continue to use any copies you have.

Preface

This publication provides users with the proper methods for securing military equipment in International Organization for Standardization (ISO) containers. It comprises basic information from experiences gained through participating in many military exercises and actual deployments. This publication includes information on both ISO dry cargo containers (enclosed boxes) and platform containers (flatracks).

This publication focuses on container and flatrack intermodal movements. For tiedown procedures on flatracks transported solely by sea refer to TEA PAM 55-22, *Marine Lifting and Lashing Handbook*.

All tiedown procedures in this book are appropriate for highway and marine movement. Some tiedown methods are also approved for general rail service and are so noted, but the remaining procedures are only approved for specialized rail moves that will require special care.

TEA welcomes comments and recommendations. Please prepare comments on a memo using the same format as DA Form 2028 or a marked copy of the page(s) of this publication. Forward to:

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Tiedown Handbook for Containerized Movements
Contents

Section I. Containers and Container Handling

A. Containers

Equipment Size/Weight Limits for Container Transport
Maximum Item Dimensions

External Container Dimensions (ft)	Width	Height	Length	Gross Weight
8 by 8 by 20	85 in. 2 159 mm	80 2 032	219 5 563	52,900 pounds 24 metric tons
8 by 8.5 by 20	85 2 159	85 2 159	219 5 563	52,900 24
8 by 8 by 40	85 2 159	80 2 032	460 11 684	67,200 30.5
8 by 8.5 by 40	85 2 159	85 2 159	460 11 684	67,200 30.5
8 by 9.5 by 40	85 2 159	102 2 591	460 11 684	67,200 30.5
*Cargo weight plus container weight				

Average Container Tare Weights (weight varies by manufacturer)

8 by 8 by 20	4,806 pounds 2 180 kg
8 by 8.5 by 20	4,911 2 228
8 by 8.5 by 40	8,265 3 749
8 by 9.5 by 40	8,775 3 980

B. Container Handling

1. Normal Container Handling: Containers are designed for lifting by ISO container top-handling spreader bars. When Flatrack (Platform Container) cargo extends above the ***top corners***, post-extensions are added to the corners for lifting and stacking in the container cell. Cable pendants connected near the ISO spreader corners are also used for lifting over-height Flatrack cargo. In all cases the lifting and stacking forces act vertically through the corner castings.

2. Crane Lifting ISO 20 and 40-foot Containers: When an ISO container spreader is not available, crane lifting with cable pendants and proper procedures/hardware can be used. Dry cargo boxes and flatracks can be sling lifted by either the top four corner castings or the lower four corners.

3. Non-vertical lifting: Industry standards (ISO 3874:1997/Amd 2:2002 *Vertical tandem lifting*) prohibit non-vertical top lifting of ***loaded*** containers. Containers are ***not*** designed to withstand the stresses caused by improper sling lifting.

Non-vertical lifting of ***empty*** dry cargo boxes is acceptable as long as the slings are within 40^0 of vertical.

Non-vertical lifting from the ***top four corner castings***, of ***empty*** Flatracks (Platform Containers) is ***not*** acceptable.

4. Lifting from top four corners: To limit the sling-leg angle, maintain a safe lift, and avoid container damage, *top-corner* lifting requires a suitable longitudinal spreader (Figure 1-1). Lifting forces on a container should be nearly vertical to the top corner casting - but no more than 10^0 from the vertical.

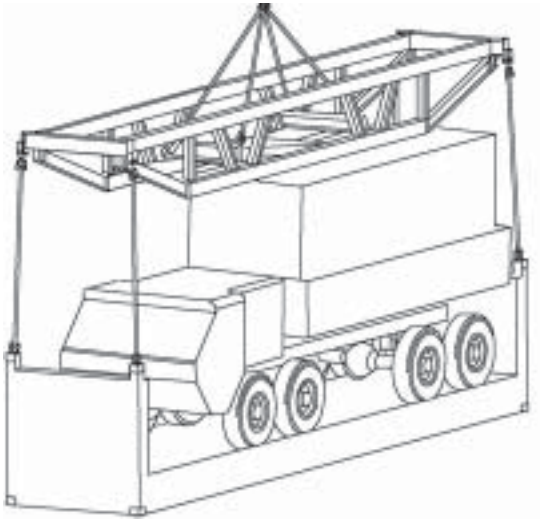


Figure 1-1. Flatrack (Platform Container), 4m Load with a Low-Apex lifting-frame connected to top four corners

5. Lifting from lower four corners: Lower-corner lifting requires a pair of lateral spreader bars, longer sling-legs and suitable bottom-lift hooks. To clear a 15-foot high loaded flatrack (4m truck + Flatrack deck), the four sling-legs below the lateral spreader bars need to be about 26 feet long - allowing for 'hook-up' slack and reasonable sling angles (Figure 1-2). When crane lifting, the lower four corners the container structure acts as a spreader.

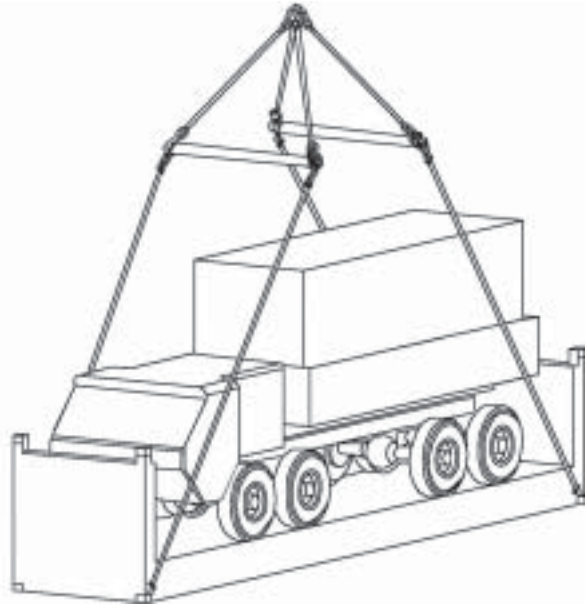


Figure 1-2. Correct lower-corner lift for a flatrack (Platform Container) 4m load

6. Unacceptable top-corner lifting: Figure 1-3 shows a prohibited lifting procedure. Flatrack end-walls are ***not*** intended to support the side loads this lifting arrangement causes. The hinge locking devices would especially be subject to damage/failure if used in this manner. "Field Experience" is not reason to resort to this approach.

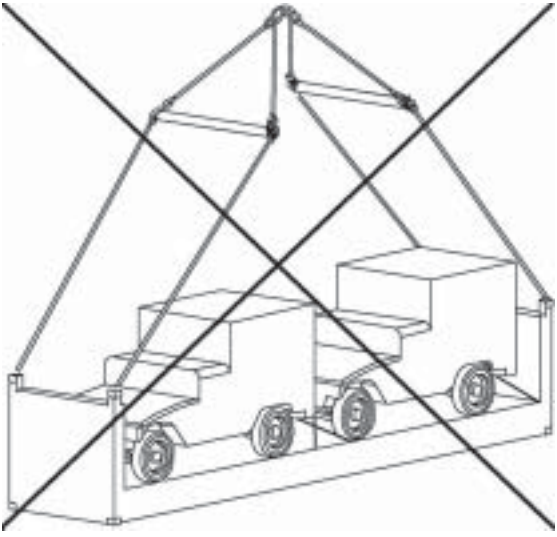


Figure 1-3. Unacceptable/Unsafe top corner lift for a flatrack (Platform Container)

Section II. General Cargo and Loading Principles

All equipment loaded into intermodal containers and flatracks must be firmly and properly secured to counteract longitudinal (fore and aft), lateral (side-to-side), and vertical (up and down) forces. All hazardous material must comply with the Code of Federal Regulations (CFR) Title 49 and the International Maritime Dangerous Goods (IMDG) code. This section presents general principles for securing cargo, and is based on:

A Shipper's Guide to Stowage of Cargo in Marine Containers - Published by the U.S. Department of Transportation Maritime Administration (1982), Stock No. 050-015-0004-1 [this reference is out of print]

AAR Open Top Loading Rules Manual - ***Section No. 7, Rules for Loading All Commodities on Open Top Trailers and Containers for Rail Transport,*** published by the AAR and ***Intermodal Loading Guide for Products in Closed Trailers and Containers,*** [Circular No. 43-D, Pamphlet No. 45, BOE Pamphlet No. 6C, June 2001]. Available from the Association of American Railroads at (877) 999-8824 [toll free].

Dry cargo containers (and flatracks) commonly transport general cargo. General cargo can be loose, palletized, liquids in drums, boxed, crated, or otherwise configured. Because each cargo load is different, this pamphlet cannot show tiedown patterns for all possible loads. Instead, this pamphlet presents general principles for securing cargo.

Army Materiel Command (AMC) ***19-48-Series Container Outloading Drawings***. The U.S. Army Defense Ammunition Center (USADAC), publishes these detailed drawings. Refer to these drawings when shipping ammunition. The drawings are available from:

Director
U.S. Army Defense Ammunition Center
ATTN: SJMAC-DE
1C Tree Road
McAlester, OK 74501-9053
DSN 956-8923
Commercial (918) 420-8923

Container inspection: Before loading, inspect containers to ensure they comply with IMDG, Title 49 CFR, and MIL-HDBK-138B *Guide to Container Inspection for Commercial and Military Intermodal Containers* requirements. Although each ISO container should have a valid Convention for Safe Containers (CSC) Safety Approval Plate, its serviceability should be further verified with a visual examination prior to each use.

HAZMAT: For intermodal transportation, shippers must secure cargo and comply with administrative requirements to satisfy the most demanding mode. Preparation and documentation of HAZMAT cargo should be adequate for all modes that will be encountered between orgin and destination. This means HAZMAT must comply with Title 49 CFR and the IMDG code. Securement methods must meet the requirements of all modes that will be used throughout the journey. If any mode requires battery terminals to be disconnected, then this should be accomplished at the origin of the intermodal shipment.

Special preparations: The following are necessary for ocean or intratheater movement and should be accomplished once the cargo is secured in the container at origin. Some examples of special preparations needed for ocean transport (but not usually required by railroads in CONUS) are:

1. Disconnecting vehicle batteries.

2. Folding in or removing overwidth mirrors (such as so-called "California mirrors").

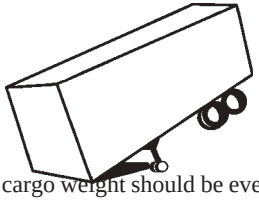
3. Removing compressed gas canisters/bottles.

Good practices: Dry cargo containers can carry many types of cargo - boxes, palletized/ unitized loads, bags and sacks, drums of liquid, and other items. Regardless of the cargo type there are general practices which improve container movements. Such practices include:

1. Cargo must be stowed and secured so that it cannot move while in transit and must not contact the doors. The doors must not be used to restrain cargo.

2. Cargo should be stowed to have good cube usage.

3. Forklift tine openings in pallets should face the door of the container.



Containers should not be overloaded or loaded unevenly.

4. Cargo and cargo weight should be evenly distributed throughout the container.

5. Cargo weight plus the container tare weight (gross weight) should not exceed acceptable limits.

Actual container weight may be restricted by physical or legal limits of specific transportation modes or any additional limitations established by the supported Combatant Commander.

For example: The M872 semitrailer is rated to transport a 40-foot container at a gross weight of 67,200 pounds. However, to be within the legal highway weight limits in the United States, the M915/M872 tractor-trailer combination is limited to about 44,000 pounds of cargo. Maximum container weights in other countries and with other prime movers may also vary.

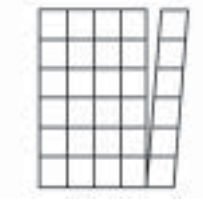
NOTE

The Palletized Load System (PLS) can handle containers up to 33,000 pounds, when transported on a flatrack, or up to 35,000 pounds when handled with the container handling unit (CHU).

Good practices for specific types of cargo.

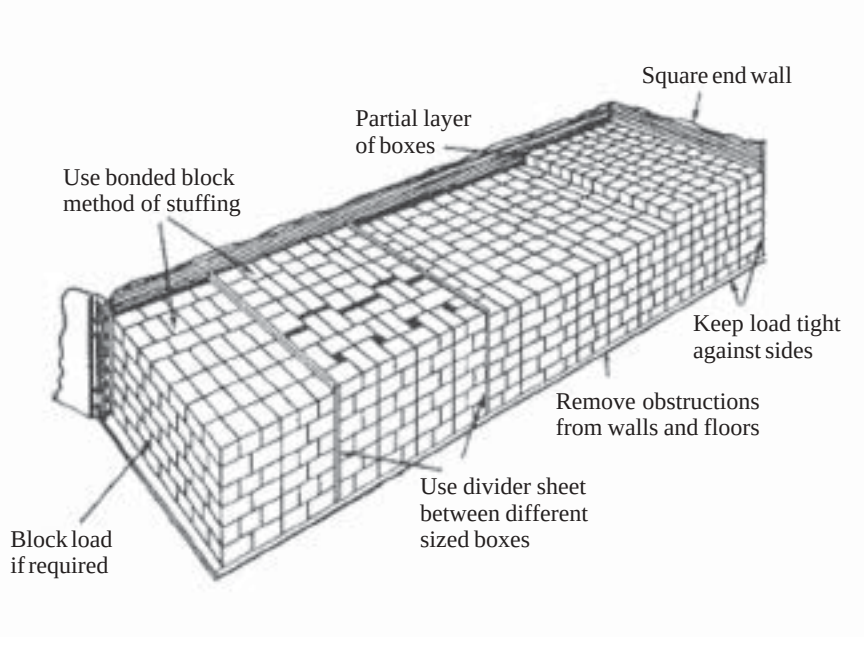
A. Cardboard Boxes and Cartons

Cardboard boxes and cartons should not be loaded in pure vertical stacks (shown below), which have a tendancy to shift.



Pure vertical stacks shift more easily.

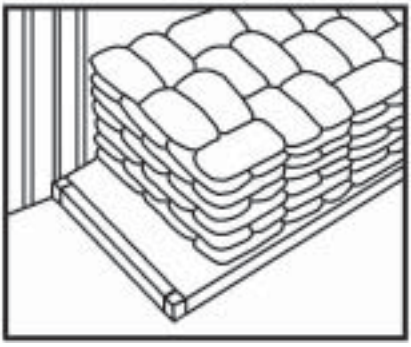
The laced pattern of the bonded block method should be used. It provides more resistance to load shifting than simply stacking the cartons vertically. The load should be tight and square from front to back and from wall to wall. Different sized cartons should be separated with divider sheets of quarter inch or thicker plywood, oriented strand board (OSB), or 80 point solid fiberboard. Employ each of the steps below for a safe and efficient load.



B. Unitized/Palletized Loads

Cartons and cases that are unitized usually contribute to efficient operations. Forklifts can rapidly stuff containers with palletized loads. As with a manually stacked load, the cases should be interlocked in each unit to reduce shifting. Unitized loads should be secured with banding or shrink wrap. If cargo is stacked no more than 43 inches high on a pallet, it will be possible to load two tiers of pallets in the container.

C. Bagged, Sacked, and Baled Cargo



Cargo consisting of bags, sacks, and bales should normally be placed on dunnage - either racks, pallets, or packing material. You should load the cargo in cross-tiers as shown on the right. The cross-tier method provides the most stability. It is used to reduce the risk of cargo shifting. Container loads of bagged material should be braced across the door to prevent the bags from falling out when the container door is opened.

Additional loading considerations:

1. Use sufficient dunnage layer on container deck to provide area for condensate drainage.

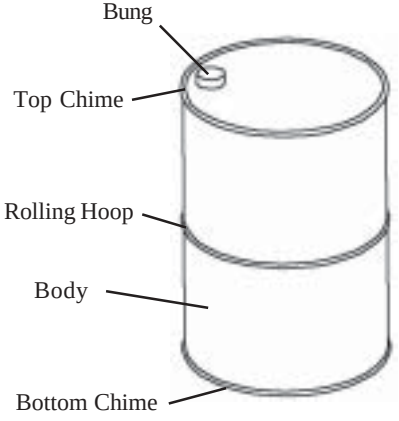
2. Separate bags, sacks, or bales from other cargo by using divider sheets or auxiliary decks.

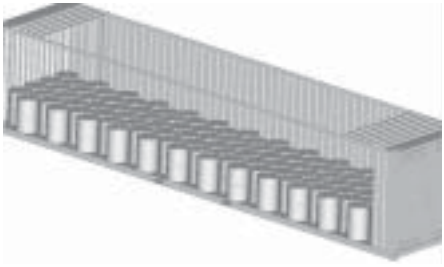
3. When stuffing bales, provide dividers between rows and tiers to prevent chafing and friction between metal bands or strapping.

4. Flatten bags.

D. Drums

Drums and barrels containing petroleum products cannot be shipped in the same container with general cargo. Drums and barrels should be placed tightly against each other to avoid shifting as shown on the following page. It may be possible to stow drums with rolling hoops more tightly by elevating alternating rows on risers.





Drums should be placed upright with the bungs on top, packed tightly, and, preferably, palletized.

If you are double-tiering drums with ridged chimes, you should load them so that the chimes interlock. Tiers of drums without interlocking chimes should be separated with dunnage. Of course, drums should not be double-tiered if this will overload the container.

Drums secured with steel straps should be protected with 1/2-inch fiberboard at points where the straps press against the drums.

NOTE

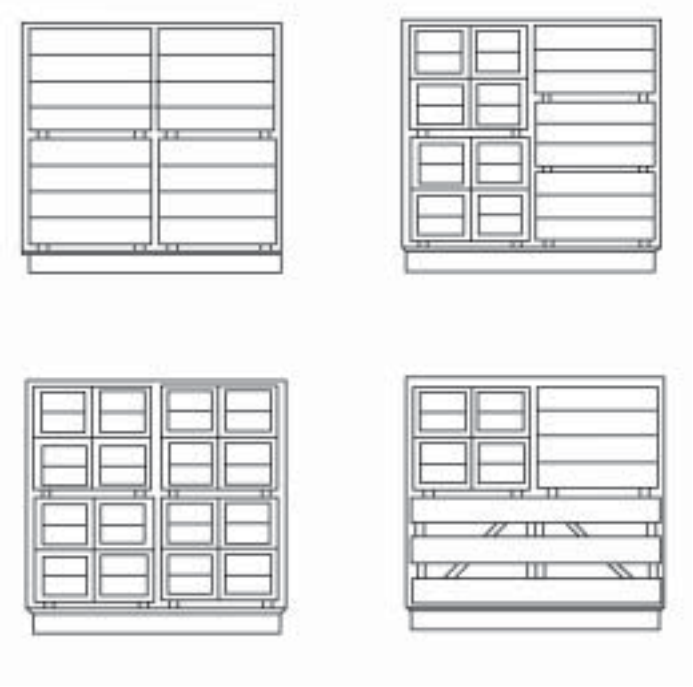
Some drums are made of light gauge metal and are designed for only one trip. These drums should *not* be re-used.

Refer to the AAR ***Intermodal Loading Guide for Products in Closed Trailers and Containers*** [Circular No. 43-D, Pamphlet No. 45, BOE Pamphlet No. 6C, June 2001]**,** for specific guidance on using some commercially available securing devices for shipping drums.

E. Wood Boxes and Crates

You can stuff small unpalletized boxes and crates by following the same procedures used for shipping cartons. Crates and boxes may be placed on their sides or ends to maximize space provided vendor instructions on the box do not prohibit it. A heavy box or crate should never be placed so that it rests on top and inside the four corners of the box beneath it. You should place heavy items on the container floor with pallet access openings facing the container door. Place boxes or crates containing liquids on the bottom level of the load. Install bracing so that the boxes and crates will not shift in transit or fall out when the container door is opened at the destination.

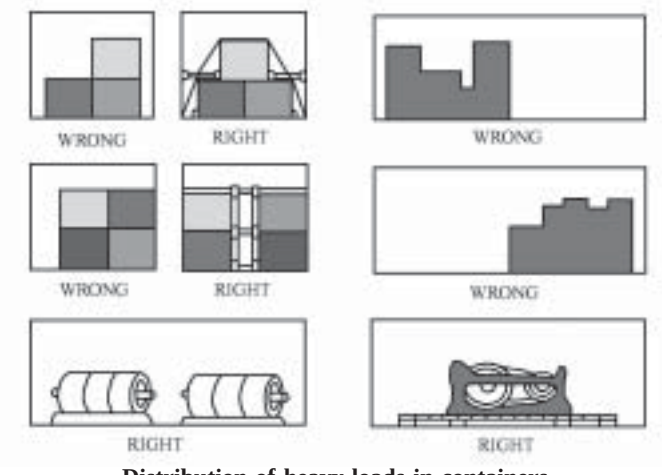
Examples of acceptable container stuffing arrangements include:



F. Machinery and Heavy-End Items

Heavy cargo must be securely braced and blocked on all sides to prevent any lateral or lengthwise motion, since its concentrated weight will cause major damage to the container or other contents if load shifting occurs. Specific procedures for securing certain vehicles are shown in the next chapter. However, this section presents general procedures for loading and securing heavy loads. In general terms, the container should be loaded such that the cargo's center of gravity is centered longitudinally on the container floor. Loads bearing on the floor must not exceed 2,500 pounds per linear foot (running longitudinally). It is very important

to minimize concentrated loads that can damage the container floor. With extra heavy loads, load spreading shoring or skids will be necessary. All shoring and bracing must bear on a structural member of the container and not on the panel sides of the container alone. In some instances extremely dense items may need to be bolted to the container decks. You should get permission from the container owner for this method of securing. The illustration below shows right and wrong methods for loading heavy equipment.

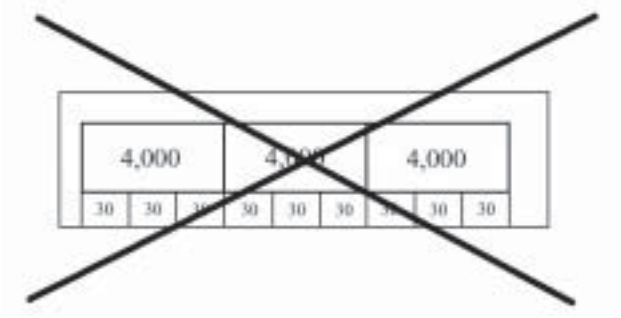


Distribution of heavy loads in containers

G. Mixed Commodities

To achieve unit integrity or maximum cube utilization, there will be many occasions when more than one commodity is stuffed into the same container. Along with the general stuffing techniques listed throughout this section, the following guidelines should be followed when stuffing mixed commodities:

1. Do ***not*** load heavier cargo on top of light cargo.



2. A commodity giving off an odor should never be stuffed with a commodity that would be affected by an odor.

3. When stuffing commodities with different packaging (cartons with crates), be sure to use divider sheets between the different kinds to separate them and prevent damage.

4. It is generally best to avoid shipping liquids with dry cargo. If wet and dry cargoes are stuffed in the same containers, use dunnage to separate the commodities.

5. Container doors are not to be used to secure loads. You can use bullboards wedged in container door posts and plywood sheets or pallets to prevent mixed or boxed cargo from contacting the container door. To protect doors from ammunition shipments refer to specific 19-48 series container outloading drawings.

6. Do not stow hazardous materials of different classes in the same container if any segregation requirements are shown in the IMDG code for the different classes involved.

Section III. Vehicles in Dry Cargo Containers

High Mobility Multipurpose Wheeled Vehicles (HMMWVs), Commercial Utility Cargo Vehicles (CUCVs), and single axle trailers make up the majority of containerizable vehicles.

This publication documents the techniques initially developed and used during the 1993 Team Spirit Intermodal Initiative and the shipment of M119 howitzers from Rock Island, Illinois, to Hawaii. The procedures which follow can be used in any size container.

As a general rule, two HMMWVs or three single axle trailers can be stuffed into a standard 40-foot container. Depending on the trailer dimensions, it may be possible to stuff four trailers into a 40-foot container by allowing the trailers to overlap.

NOTE

Securing procedures covered in this pamphlet are sufficient for marine and highway shipment only. These procedures may be sufficient for special rail transport when extra gentle handling such as unit trains or double stack service is guaranteed by the railroad. The only procedures sufficient for standard carload rail transport are the ones illustrated for the M119 Howitzer.

A. Stuffing Requirements

Vehicles should be loaded into the container facing out to allow for quick unloading. All batteries must be disconnected and the terminals taped. All secondary loads must be secured to the vehicle to prevent movement and damage. The vehicle fuel levels should be no more than 1/4 tank. When motor vehicles with fuel in their tanks are stowed in a closed freight container, the following warning must be affixed to the access doors:

WARNING

"MAY CONTAIN EXPLOSIVE MIXTURES WITH AIR - KEEP IGNITION SOURCES AWAY WHEN OPENING."

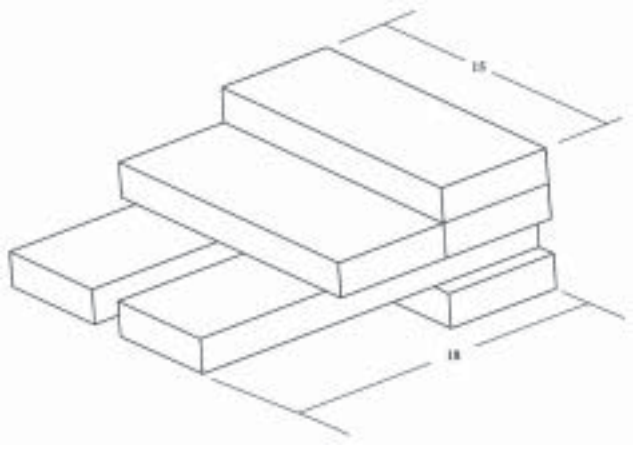
This warning must be on a contrasting background and must be legible from a distance of 8 meters (26 feet).

When loading, if a loading dock of equal height to the container on chassis is unavailable, the container should be removed from the chassis and placed on the ground. A small ramp 8 feet wide x 6 inches high and 16 to 24 inches long will simplify loading, see figure 3-1 for an example.

Chock blocks: If time and space allow, chock blocks should be laid out in pairs, and the four securing nails should be partially driven in. Also, predrilling these four holes in the chocks will save time when nailing and reduce the amount of damage done to the chock block. Duplex (double headed) nails should be used to allow for easy removal. See figure 3-2 for chock block dimensions and nailing requirements. Flashlights may be necessary when nailing the chock blocks inside the container. Gloves should be worn at all times. Initially, lumber 4-inch x 4-inch can be placed along the side or sides of the container to act as guides for the vehicles. Ground guides should be used at all times. Allow 6 inches of clearance between the vehicles and the ends of the container. Use commercially approved seal-locks to secure the container doors.

NOTE

There should be an ambulance or some type of emergency medical facilities set up at the stuffing site



Materials

1 - 2 x 6 x 96 per ramp

All dimensions are in inches

Figure 3-1. Wheel ramps for loading container on ground.

B. Tool List

The following tools should be sufficient for most stuffing operations:

Gloves - for all operations
Safety Glasses - for all operations
Hard Hats/Kevlar Helmet - for all operations
Flashlights - for nighttime/inside containers
Wrenches - sizes required for disconnecting batteries
Pliers - for getting terminals off battery post
Rags - for cleaning grease off terminals
Tape - for taping terminals
Hammers - for nailing chock blocks
Ear Plugs - for soldiers nailing chock blocks
Pry Bars - for removing chock blocks
Bolt Cutters/Wire Cutters - for cutting seals off containers

C. Lumber Requirements

Blocking may be fabricated using dressed lumber of the nominal sizes indicated on each drawing. For example, a dressed 2 x 4 is really 1-1/2 by 3-1/2 inches and may be used where a 2 x 4 is required. Lumber required for each vehicle is as follows:

Item	Type Lumber	Board Feet
HMMWV/	2 x 6	20
CUCV	6 x 8	8
Trailer	2 x 6	24
Restrained	6 x 8	8
With 9 Gauge	2 x 4	1.33
Wire	1 x 4	.65
Howitzer	2 x 4	1.33
	2 x 6	16
	2 x 10	18.8
	4 x 4	2.4
	4 x 6	5.6

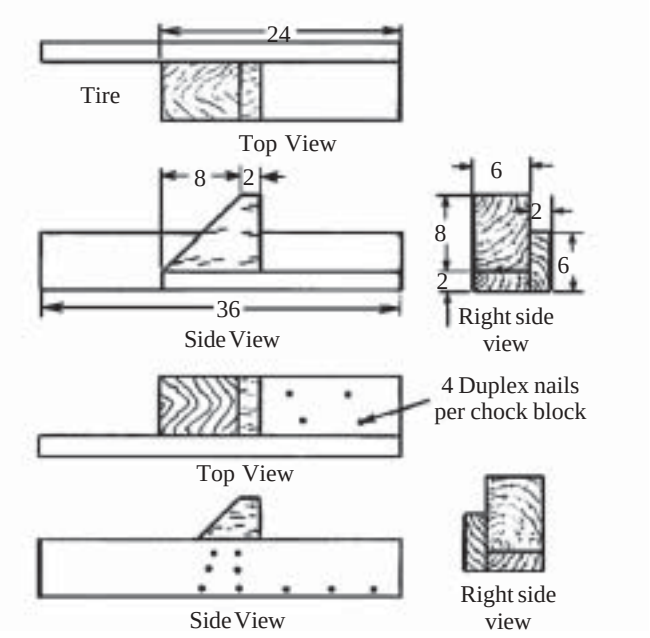
D. HMMWVs

Before loading, remove or loosen the cab canvas back to allow the driver to exit the vehicle after it is loaded. Remove all doors and stow in the vehicle. Remove all antennas - along with side mount brackets - and fold mirrors. Vehicles should be backed into the container until the driver's door opening reaches the container door. Turn off engine, disconnect the batteries and tape the terminals. With the driver still in the vehicle, manually push the HMMWV into place. Set the parking brake, leave the vehicle in neutral, and nail the chock blocks in place. See figures 3-2 through 3-4 for chock block construction and placement. Use caution when climbing over the HMMWV to avoid damaging the hood and cooling grill.

E. CUCVs

CUCVs should be centered in the container or closer to the curb side to allow maximum room for exiting the vehicle once it is in place. Back the CUCV in until the back of the cab is even with the container door opening, turn off the engine, disconnect the batteries and tape the terminals. With the driver still in the vehicle, manually push the CUCV into place. Set the parking brake, leave the vehicle in neutral, and nail the chock blocks in place. Chock blocks will be placed in the same configuration as for the HMMWV in figures 3-3 and 3-4.

NOTE
Do not operate the engine in the container.



Nine, 20-D nails into side of chock block. Also four, 20-D nails in bottom, driven through 2 x 6 up into chock block.

NOTES:
1. Both blocks have the same dimensions.
2. They are opposing blocks and should be constructed and applied in pairs.
3. All dimensions are in inches.

Figure 3-2. Chock blocks with side bracing.

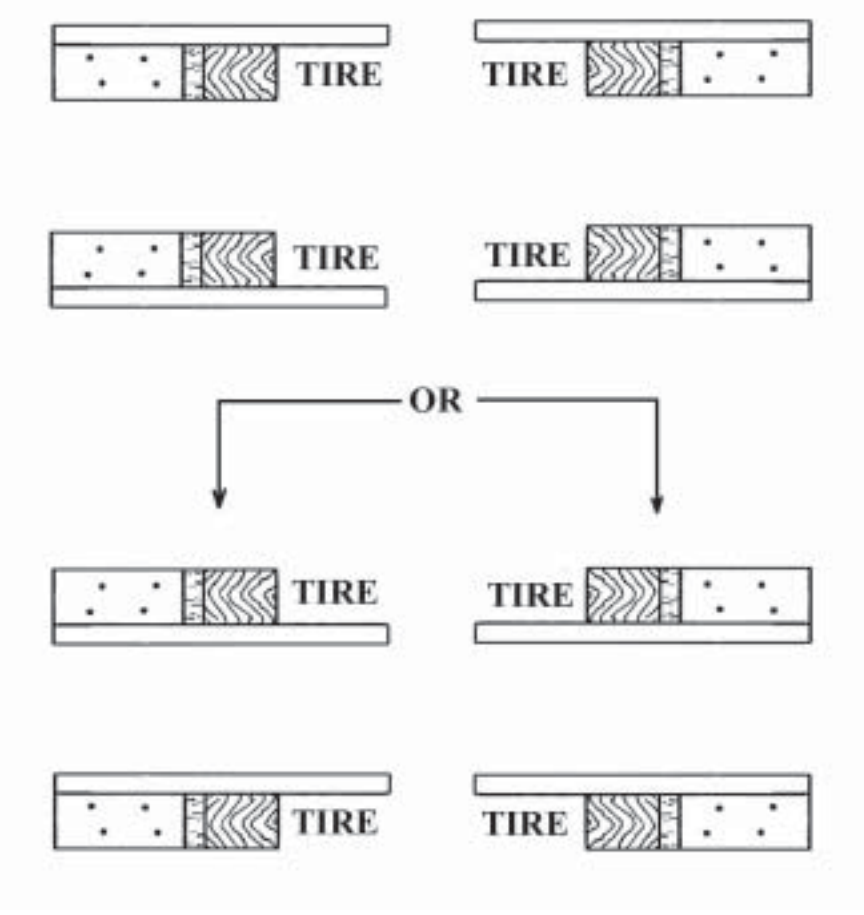


Figure 3-3. Two-axle vehicle tire chocking patterns.

Figure 3-4. HMMWV front wheels with chock blocks.

F. Trailers Without Prime Movers

NOTE

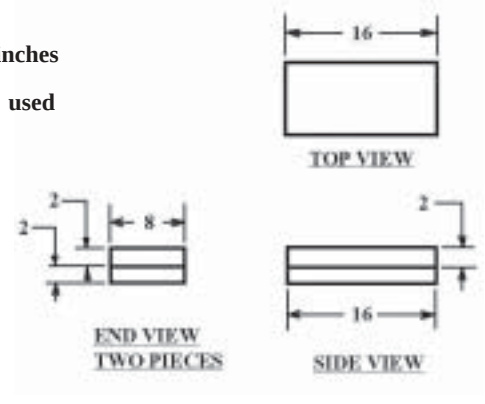
Do not stow trailers more tightly than necessary when containerizing. Three trailers should fit within each container, but the trailers should be spaced so that the tongue of the front trailer is about 6 to 12 inches from the container door. This reduces the chance of damaging the tongue of the second trailer while unloading the front trailer from the container.

All batteries on trailers should be disconnected and the terminals taped before they reach the loading site. Prime movers or forklifts with pintle attachments can be used to push trailers partially into containers. Once the wheels are in the container, the brake should be set, the jack or landing leg should be set in place, the trailer removed from the prime mover or forklift, and the prime mover driven out of the way. Trailers can be pushed in manually if a loading dock equal in height to the container on chassis is available. Otherwise, place the container on the ground and use figure 3-1 to construct necessary wheel ramps. The trailer can now be manually pushed into place, the brakes set, and the chock blocks nailed into place. See figure 3-5 for chock block placement. Make sure all hoses and wires are out of the way before lowering the tongue. Next, the jack or landing leg should be retracted and the tongue placed on shoring. The dimensions of the shoring are also in figure 3-5. If a solid block is used, four duplex nails should be used to toenail the block in place. If the shoring is constructed out of two blocks, the first block should be secured to the container floor using four, 20-D nails. The second block is then secured on top of the first using four duplex nails. Ensure that web straps or #9 wire will not pinch or damage any hoses or wires before applying tension. The trailer tongue must be secured (figs 3-6 and 3-7) with web straps or #9 tempered wire.

NOTES:

All dimensions are in inches

One solid piece may be used instead of two pieces



Trailer tongue shoring

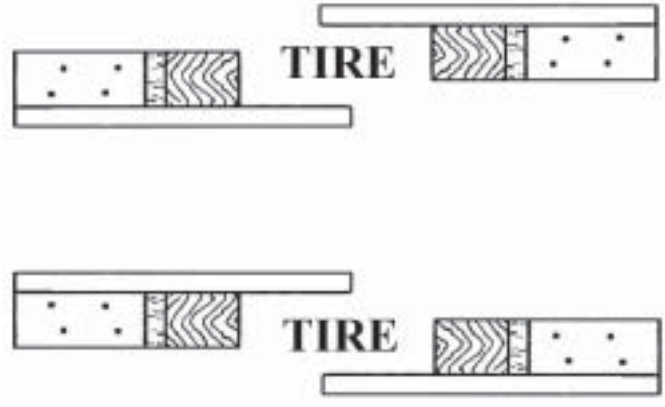
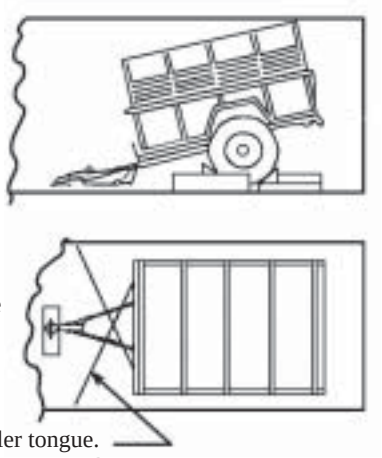


Figure 3-5. Single axle trailer blocking and shoring diagram.



NOTES:

1. Four chock blocks required per trailer. See Figure 3-5 for details. This applies for trailers shipped alone or coupled to prime mover.

2. #9 tempered or annealed wire can be used in place of ratchet straps. See Figure 3-8 for application of #9 wire.

3. To ensure adequate vertical clearance for some trailers, it may be necessary to add shoring under the tongue.

Figure 3-6. Securement of single axle trailer without prime mover.

NOTE

2-inch web strap assembly (5,000 lb breaking strength)

[General Purpose Cargo Strap NSN 3990-01-204-3009]

Figure 3-7. Single axle trailer tongue lashings.

G. Use of Number 9 Gauge Wire

Make a complete loop with the wire through a provision on the front of the trailer. Ensure that the loop is long enough to reach the container floor at approximately 45 degrees. Construct the cleat as shown in figure 3-8 by nailing the two short boards to the long board. Place the cleat in the wire loop. Nail one end of the cleat to the floor with one nail so that the cleat can be rotated. Start a nail in the opposite end of the cleat. Push the free end of the cleat away from the vehicle to tighten up the wire loop. Once the wire is pulled tight, the nail should be driven in and five more nails added per end. Repeat this process for the other side of the trailer. If web straps are used, they can be secured first, then tightened using the ratchet assembly. Straps can be fastened directly into the container D-rings, if available (fig 3-7).

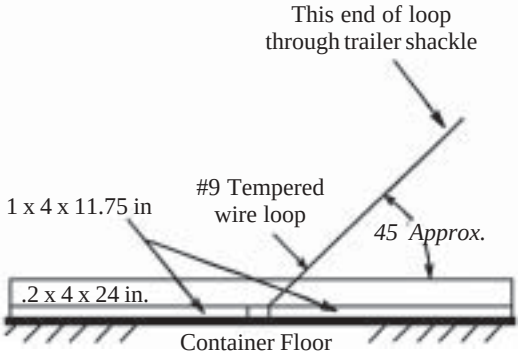


Figure 3-8. Application of number 9 gauge wire or strap as tiedown.

H. Trailer Attached to Prime Mover

The trailer should be loaded as above, but instead of lowering the tongue, a prime mover would be loaded and the trailer attached to the prime mover. Nail the chock blocks in place after the trailer has been attached to the pintle. The pintle must be secured for shipment. Do not try to load the vehicles as a combination. The trailer and prime mover must be secured with the same blocking and lashing patterns as if they were being secured separately. Remember to use ground guides.

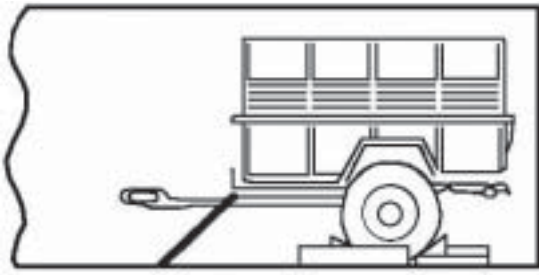


Figure 3-9. Securement of single axle trailer when coupled to prime mover.

I. M119 Howitzers

These howitzers require a forklift with pintle attachment that is capable of traveling into a container. The howitzers are too tongue heavy to manhandle into position. The drawings depict a different type of chock block and side bracing (figs 3-10 through 3-12) than is used for other vehicles. This tiedown arrangement is approved for rail shipment by container-on-flatcar (COFC), trailer-on-flatcar (TOFC) or double stack rail service. If highway and marine are the only modes used, the other simpler chock blocks (fig 3-2) with side bracing may be used. Figure 3-13 depicts the use of banding. The tongue will be secured as shown in figure 3-14 with two side braces and a piece of dunnage 2" x 4" x 24". Figure 3-15 is a side view of a single howitzer secured in a standard container. Detailed container outloading procedures may be obtained from the U.S. Army Defense Ammunition Center, ATTN: SJMAC-DE, McAlester, OK; procedural drawing number 1948-8105-15WE1.

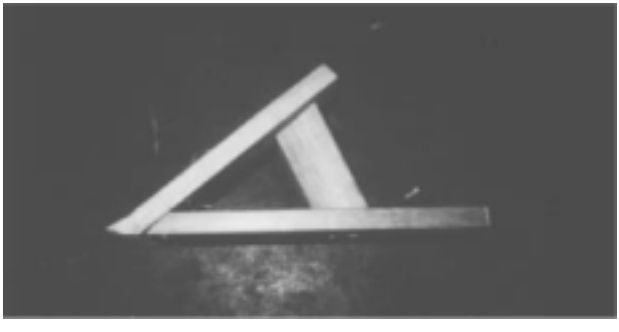


Figure 3-10. Howitzer chock block for rail transport.

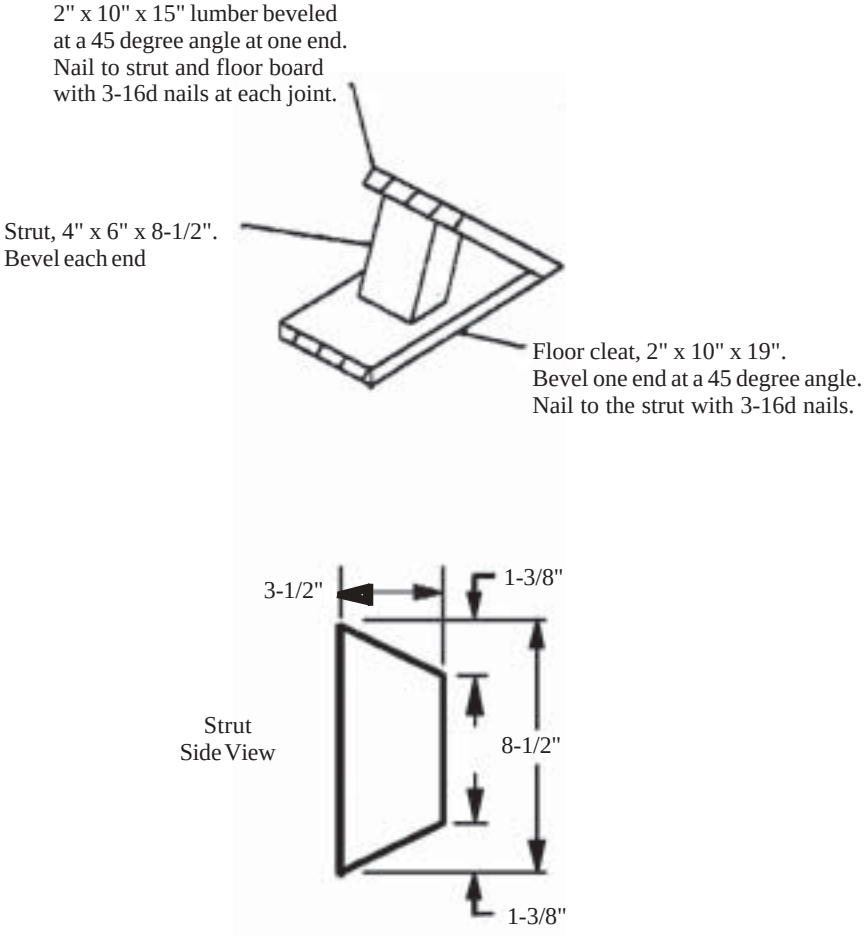
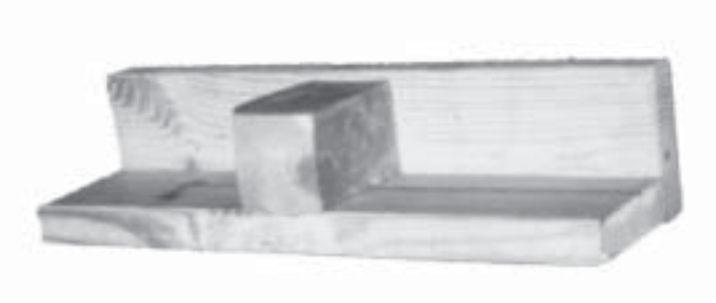


Figure 3-11. Howitzer chock block construction.



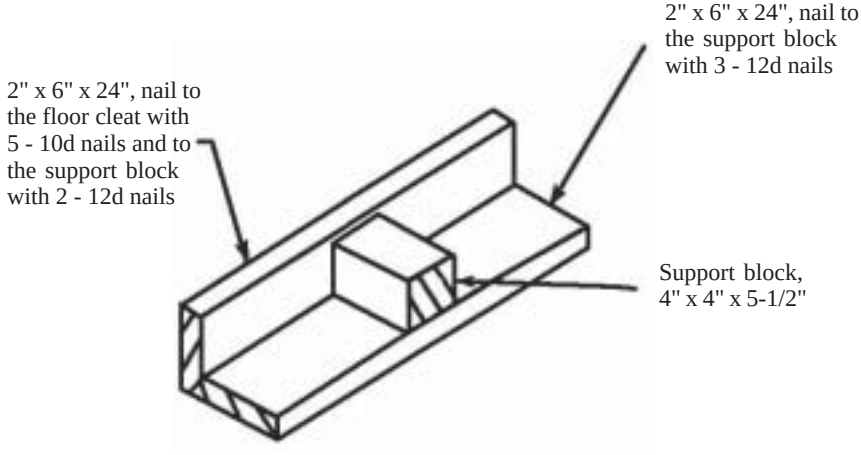


Figure 3-12. Side bracing for howitzer wheels and lunette.

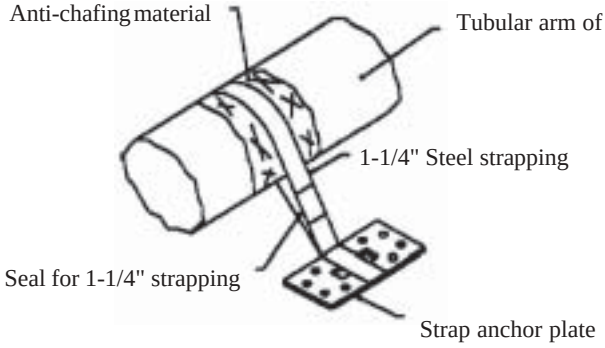


Figure 3-13. Use of banding.

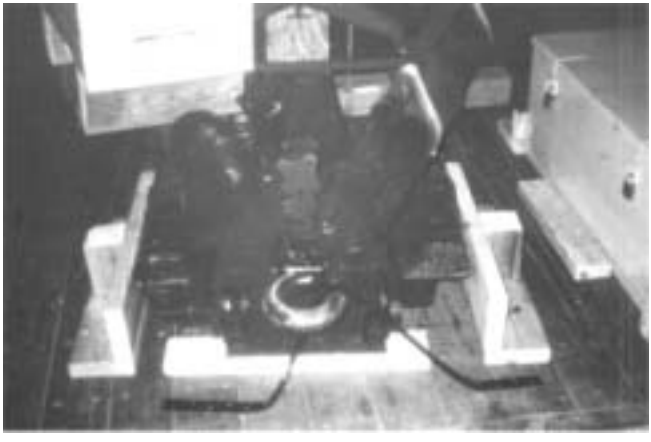


Figure 3-14. Detail of tongue securement.

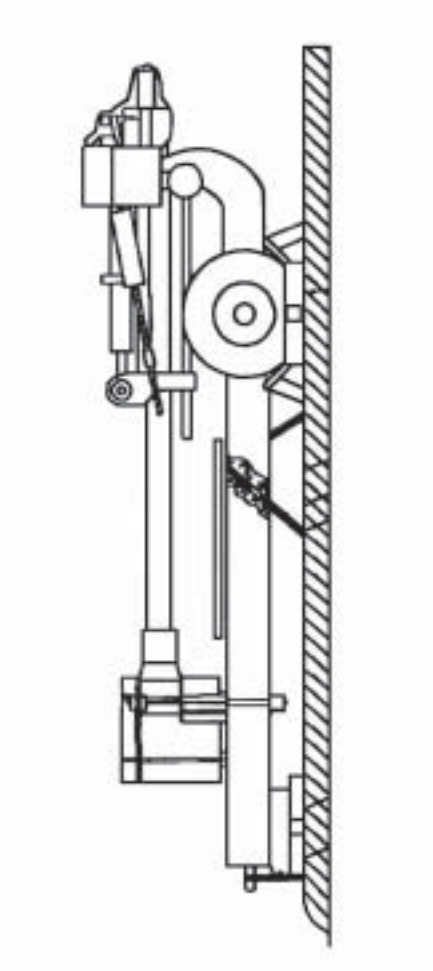


Figure 3-15. Side view of howitzer secured in container.

Section IV. Unstuffing and Stripping

NOTE
Tanker pry bars are the most efficient tool for removing chock blocks. Try not to damage the chock blocks as they may be needed for redeployment. Also, store them in a secure place to prevent pilferage.

As chock blocks are removed, make sure nails are not left in the floor of the container. They are a hazard to people as well as equipment.

A. HMMWVs and CUCVs

First, the front chock blocks must be removed. A driver must climb into the vehicle before the vehicle is manually pulled and pushed out of the container. The batteries should then be reconnected and the vehicle driven to a staging area or coupled to a trailer and then driven to the staging area. If a vehicle will not start, make sure it is pushed clear before the next vehicle is unloaded. Remember to use ground guides.

B. Trailers

The tongue tiedowns should be removed and the jack or landing leg set in place. This allows more room for chock block removal. Once the chock blocks are removed the trailer can be manually pulled out of the container. Caution must be used when the tires roll down the ramp or just out of the door. The trailers can be manually positioned clear of the container door for unloading the next trailer or they can be coupled to a prime mover and towed to a staging area. For trailers coupled to prime movers, you must remove all of the prime mover's chock blocks and the front chock blocks and tiedowns of the trailer before unloading. If a forklift with pintle attachment is available, it may be used to remove the trailers from the container. Use care when unloading trailers, especially when they are closely spaced. The first trailer to be unloaded can snag the cap on the hydraulic cylinder reservoir on the tongue of the trailer behind it, damaging the cap.

C. Howitzers

All blocking and bracing must be removed before pulling the howitzer out using a forklift with pintle attachment.

Section V. Flatracks

This section provides users with the proper methods for securing vehicles on platform containers (flatracks) for shipment. It shows proper tiedown methods when military equipment will be shipped by platform containers via two or more modes (rail, highway, or marine). For true intermodal shipment of the cargo, it must fit entirely within the flatrack's internal dimensions; thus, it can be loaded onto the flatrack at origin and remain attached to it until it reaches its destination.

Flatracks can also be used purely for marine transport by providing "false decks" in support of lift-on/lift-off operations using containerships. When used in this way, the flatracks can support marine transport of wider and heavier loads by stretching the item across two or more flatracks. Flatracks are portable open-top, 'tween deck containers. They provide the capability to stow aircraft, vehicles, and outsize and breakbulk cargo, which cannot be placed into containers. This publication does not contain tiedown procedures for flatracks configured as false decks. These tiedown procedures are found in: TEA PAM 55-22***, Marine Lifting and Lashing Handbook*****.**

All equipment loaded onto flatracks for intermodal movement must be firmly and properly secured to counteract longitudinal, lateral, and vertical forces that might be encountered in the rail, highway, or marine modes, or during terminal handling. The longitudinal (forward and back) forces that may be encountered during rail transport are the most severe forces during any transport. Therefore, this section contains basic information from the AAR and from experience gained through the monitoring of military rail loadouts during exercises.

A. Thirty-Five-Foot Fast Sealift Ship (FSS) flatrack

Three types of flatracks have been installed on the FSSs. The dimensions, weights, and capabilities are listed in table 5-1. These flatracks may be used as individual units or combined horizontally in sets of two or more. When placed side by side, an integral folding flap is positioned between the flatracks creating a flush deck. This flap provides the capability to stow cargo on more than one flatrack at a time (fig 5-2).

Special arrangements will be necessary if these flatracks are to be transported commercially. Railcars do not have container pedestals positioned for transporting 35-foot containers, and commercial containerships are no longer configured for this size container.

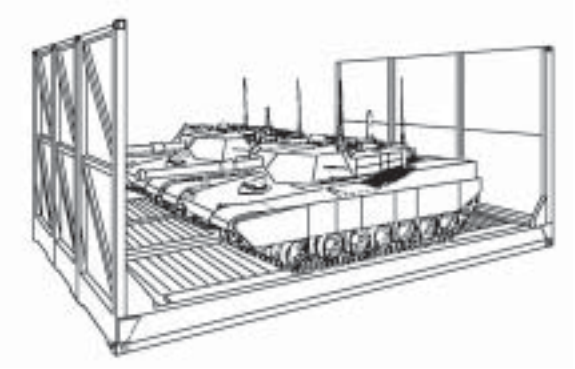
Figure 5-1. Thirty-five-foot open-top, open-sided flatrack.

Table 5-1. FSS Flatrack Characteristics

	Type I	Type II	Type III
Dimensions (External)			
Length	35'-0"	35'-0"	35'-0"
Width	8'-0"	8'-0"	8'-0"
Height	15'-3"	12'-0"	10'-3"
Dimensions (Internal) Maximum			
Length	33'-9"	33'-9"	33'-9"
Width	8'-0"	8'-0"	8'-0"
Height	13'-6"	10'-3"	8'-6"
Weight of Flatrack	19,300 lb	17,841 lb	17,511 lb
Area of Flatrack	270 sq ft	270 sq ft	270 sq ft
Volume of Flatrack	3,645 cu ft	2,768 cu ft	2,295 cu ft
Weight Capacities			
Lifting (note 1)	35,700 lb	37,159 lb	37,489 lb
Max (note 2)	134,000 lb	134,000 lb	134,000 lb

Note 1: Maximum cargo weight on FSS flatrack that is to be lifted with a container spreader.

Note 2: Weight that can be placed on a flatrack that has been positioned in a cargo hold.



Three adjacent FSS flatracks can accommodate two M1tanks

Figure 5-2. Flatracks used as a temporary 'tween deck.

B. Forty-Foot Heavy Duty Flatrack

The 40-foot heavy duty flatrack was developed to provide a breakbulk capacity to containerships for the transport of tanks and other heavy and/or outsized cargo. The 40-foot heavy duty flatrack is basically a steel frame decked over and fitted with tiedowns. The two types of flatracks are shown in figure 5-3. When used as false-decks, heavy loads may be placed on three adjacent flatracks. When lifted with a container spreader bar, both flatracks are limited to 30 long tons.

Titan
- Max spreader lift: 67,200 pounds
- Tare weight: 22,000 pounds
- Internal length: 38-1/2 feet
- Adjustable telescoping corner posts
  - Cargo heights: 8-1/2 to 13-1/2 feet
  - Overall heights: 11 to 16 feet
- Max cargo weight (false-deck): 134,400 lbs

DeNardi
- Max spreader lift: 67,200 pounds
- Tare weight: 18,000 pounds
- Internal length: 38-1/2 feet
- Fixed corner posts
  - Cargo height: 10-1/2 feet
  - Overall height: 13 feet
- Max cargo weight (false-deck): 144,000 lbs

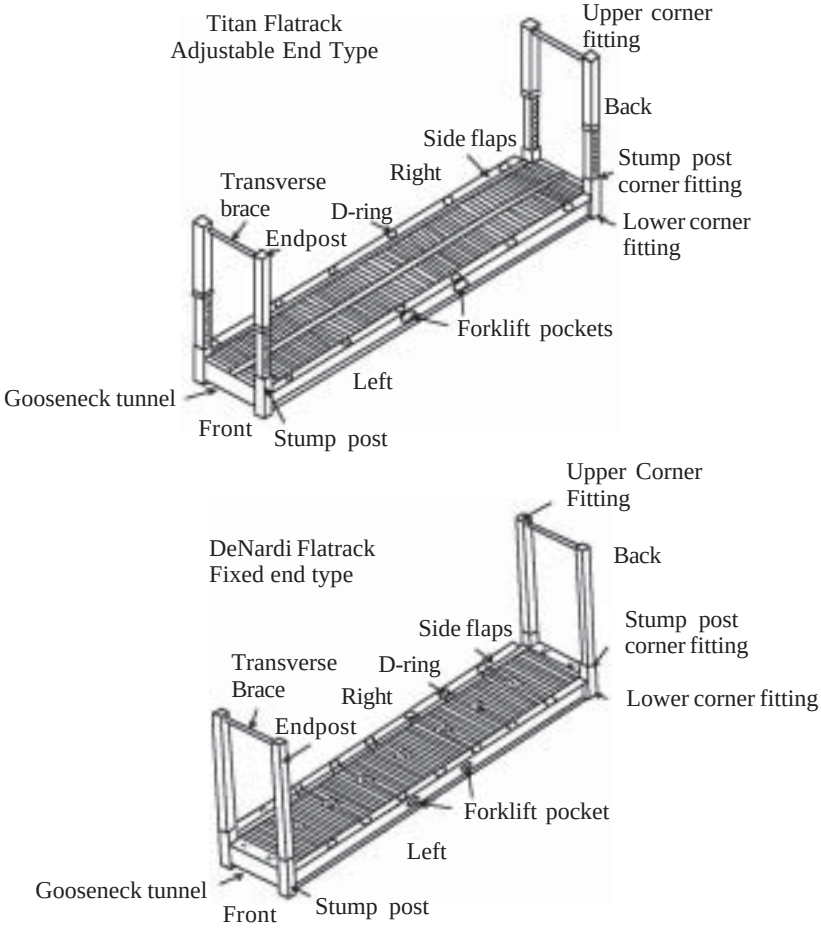


Figure 5-3. Forty-foot heavy duty flatracks.

C. Intermodal Flatracks

The following "general procedures" apply to vehicles on intermodal flatracks:

1. Gearshift Levers

Place gearshift levers of automatic or conventional transmissions in neutral and secure with wire. Set all parking brakes and then wire tie or block the hand levers. Setting the brakes is a precaution against the vehicle rolling inadvertently and not part of the securement.

2. Vehicle Spacing

It may be possible to fit two or more relatively small vehicles on the same flatrack. However, enough space must be kept between vehicles to allow tiedowns to be secured properly. In general, a 2-foot spacing between vehicles on flatracks will be adequate. However, trailers may sometimes be placed much closer together. The AAR rules for flatcars state: "Cargo such as trailers and fork trucks may be loaded with the tongue or forks beneath the next vehicle, providing points where the vehicles may touch are separated by a minimum horizontal distance of ten inches and the tongue or forks are secured against vertical displacement." These conditions are also appropriate for intermodal transport on flatracks.

3. Securing Movable Structure

Equipment with rotating parts, such as tank turrets, and movable parts, such as crane outriggers and booms, must have those parts positively secured, usually with wire rope. This prevents the parts from moving out or up during shipment. Serious accidents can result from parts striking bridges or passing trains.

4. Vehicle Weight

The maximum gross weight of a 40-foot platform container **cannot** exceed 67,200 pounds for intermodal transport.

Since the flatrack itself will weigh about 17,500 pounds, a vehicle that weighs over about ***49,500 pounds*** cannot be shipped using intermodal flatracks.

NOTE

Verify the vehicle and container weights before each intermodal shipment. Ensure the vehicle (including its cargo) has been accurately weighed.

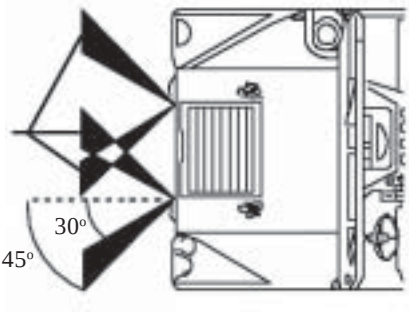
5. Vertical Tiedown Angle

Place the vehicles on the flatrack so the tiedown chain makes an angle of approximately 45° with the floor of the flatrack when viewed from the side. Measuring by eye is usually good enough. If you want to lay out the correct angle with a tape measure, make the longitudinal distance from the point the tiedown attaches to the deck to the tiedown provision on the vehicle equal to the vertical distance from the deck to the provision.

6. Lateral Tiedown Angle

Add tiedown chains so that they make an angle of 30° to 45° with the vehicle centerline when viewed from the top. Measuring by eye is usually good enough, but the tiedown pattern must be symmetrical in shape. Tiedowns do not have to be crossed; however, crossed tiedowns are acceptable provided they make the 30° to 45° angles.

Correct angle for tiedown



For ***conventional*** rail shipment same-side tiedowns are preferred, while for marine transport, crossed tiedowns are preferred. For intermodal shipment, a tiedown that primarily restrains longitudinally, but has a significant lateral component is best. This achieves adequate longitudinal restraint during the rail portion and adequate lateral restraint during the marine portion of the journey.

7. Wheeled Vehicles

All wheeled vehicles must have their tires fully inflated to highway pressure. The tires must be capable of holding that pressure for at least the length of the trip. Tires are a part of the securement of the vehicle in that, if a tire goes flat, it will leave the tiedowns loose. Flat tires have started fires on moving trains by rubbing on the flatcar deck. This could also occur during intermodal shipment on flatracks. Also remember to fold in or remove overwidth mirrors.

8. Chock Blocks

Vehicles that are properly secured to intermodal flatracks with chains do **not** need any chock blocks.

9. Batteries

Disconnect vehicle batteries and tape terminals.

10. Optional Loading Procedure

If cranes are not continuously available, flatracks can be positioned next to each other to allow the vehicles to drive into position. A ramp can be improvised using platform flatracks or commercial flatracks with ends folded flush as shown in figure 5-4. Figure 5-5 shows the overall arrangement of flatracks if vehicles will be driven on. Staggering the flatracks makes it easier to manuever the vehicles.

Figure 5-4. Improvised flatrack ramp.

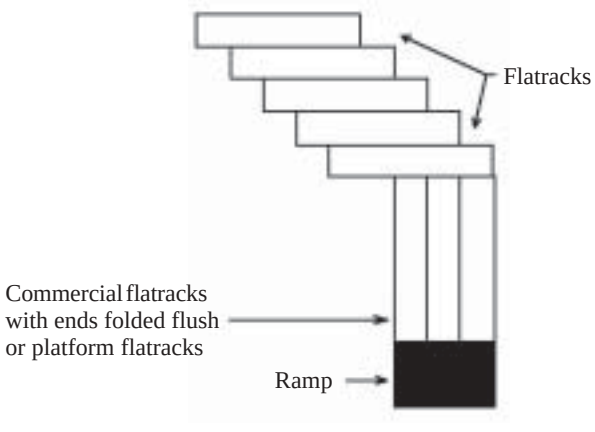


Figure 5-5. Top view of flatracks.

11. Tiedown Procedure

Apply chain hooks over the vehicles' tiedown shackles, rather than under. Wire (or secure by other suitable means such as nylon tie straps) the grabhook to the chain link, as figure 5-6 shows, to prevent disengagment. If turnbuckles (used to tighten chains) are not equipped with jamnuts or a locking device, they must be wired to prevent them from loosening (fig 5-7). When using nylon straps, always look for sharp edges or rough surfaces that a strap will be pulled over. If this is necessary, put a piece of tire innertube between the strap and the sharp surface. This will prevent cutting, shaving, and sliding.

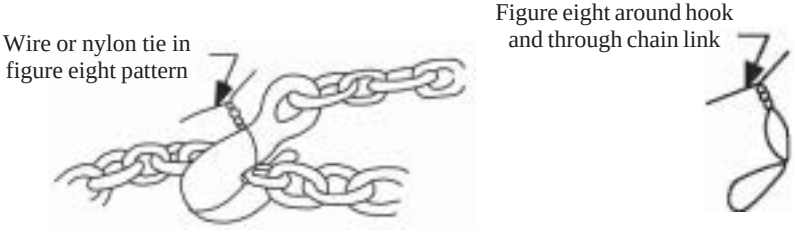


Figure 5-6. Proper securement of grabhook and chain link.

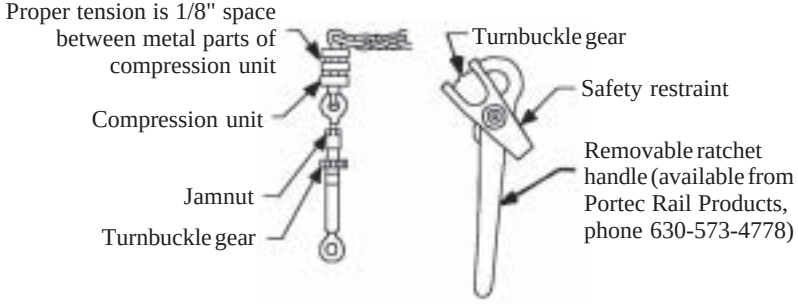


Figure 5-7. Turnbuckle.

Section VI. Lashing Vehicles on Flatracks

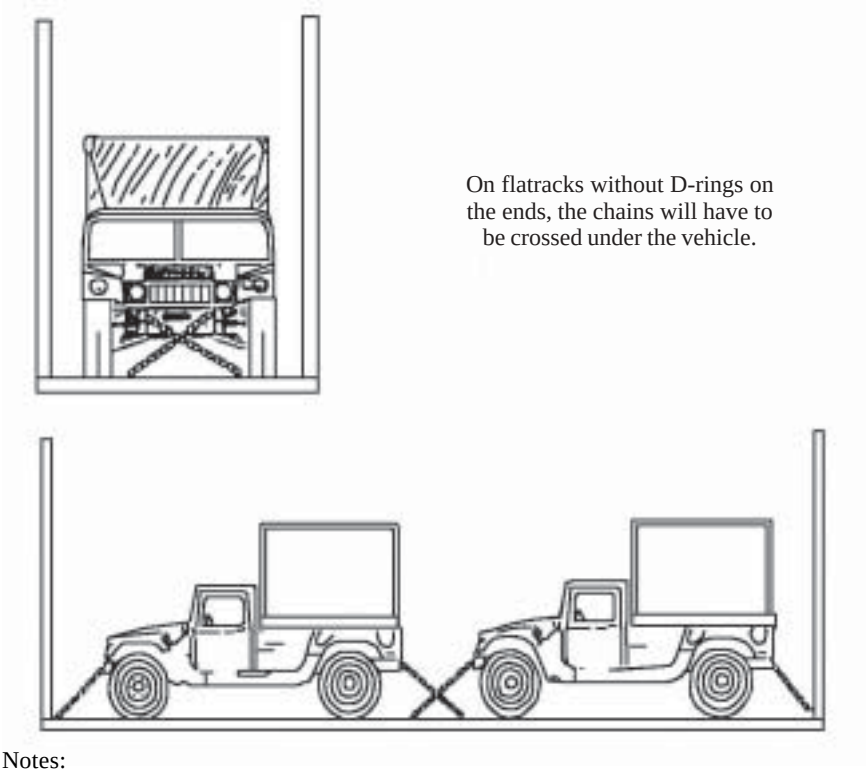
Apply tiedown chains symmmetrically around the vehicle with an angle from deck to chain of about 45 degrees. The angles the chains make with the vehicle centerline when viewed from the top should be about 30 to 45 degrees. Measuring by eye is usually good enough. When attaching chains to the vehicle, secure the shortest chains first and the longest chains last. A properly tensioned tiedown will deflect no more than about an inch with the weight of a person standing on it. Tiedown patterns are shown in figures 6-1 to 6-3.

The general guidelines for securing wheeled vehicles on flatracks by the size of chain is as follows:

Vehicle Weight Ranges (lb)	Alloy Steel Chain		
	Dia. (in)	Minimum Working Load Limit (lb)	Number of Chains Required per Vehicle
0-8,500	3/8	6,600	4
8,500-16,000	3/8	9,000*	4
16,000-25,000	3/8	9,000*	8
16,000-25,000	1/2	11,250	4
25,000-40,000	1/2	13,750*	4
40,000-55,000	1/2	13,750*	8
*These chains are made with higher grade special steel.			

NOTE

Maximum gross weight of platform container and vehicle must be less than 67,200 pounds.



Notes:
Do not use wheel-blocking.

Do not use frame-blocking (blocking between the flatrack deck and vehicle frame/axle).

Vehicles with large, low-pressure tires (6k-VRRTFL, M10 FkT, tactical trucks with leaking CTIS, and others) may need frame-blocking to maintain lashing-chain tension. When used, frame-blocking must be securely attached to the vehicle to prevent shifting out of position.

Figure 6-1. Two-axle vehicles.

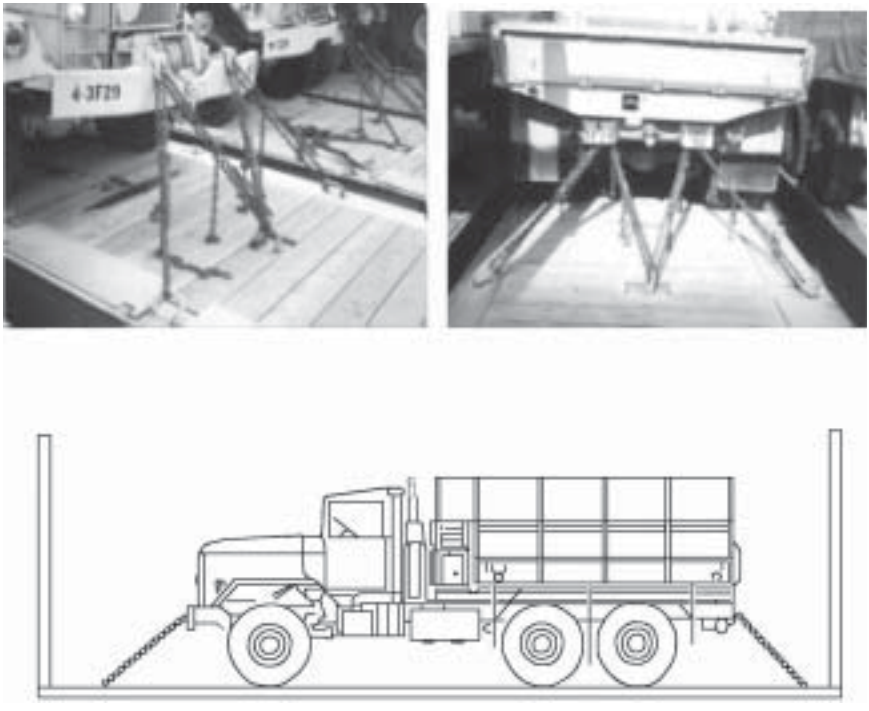


Figure 6-2. Three-axle vehicles.

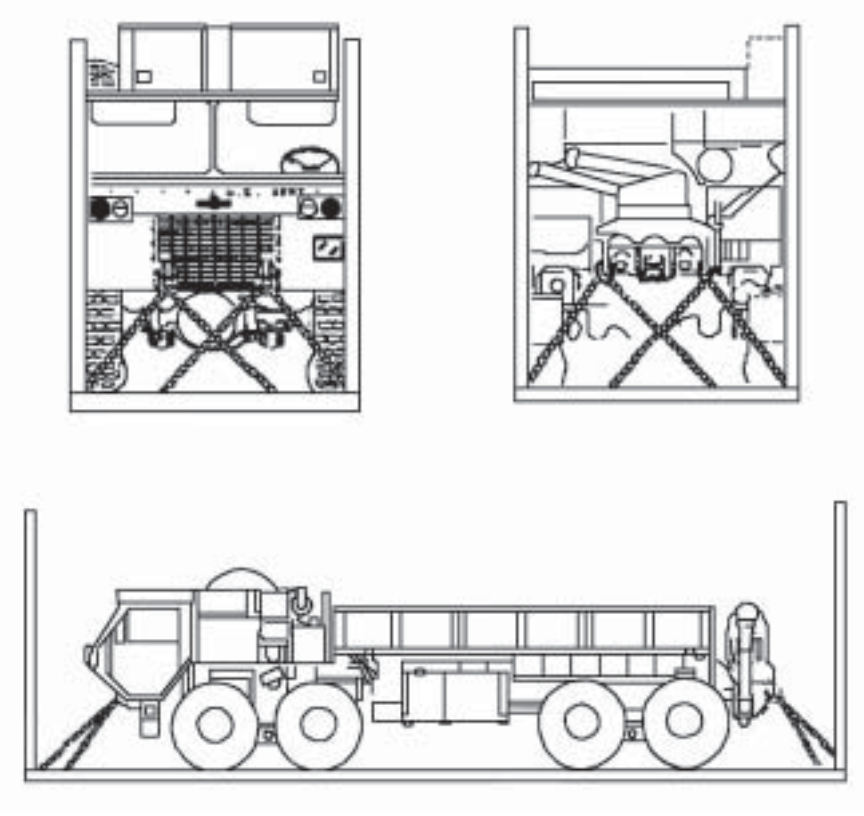


Figure 6-3. Four-axle vehicles.

Appendix A. Palletized Load System Flatracks

[Excerpted from MIL-STD-1366]

1. PLS M1077 flatrack

The M1077 flatrack is typically referred to as the A-frame flatrack. The M1077 is equipped with ISO corner fittings and can transport a 20-foot (6.10 m) ISO container.

External Dimensions:	Length	240 inches, 6096 mm
	Width	96 inches, 2438 mm
	Height	68.4 inches, 1737 mm
Internal Dimensions:	Length	230.4 inches, 5852 mm
(cargo maximums, other than	Width	90.5 inches, 2299 mm
ISO container)	Height	72.3 inches, 1836 mm
Tare weight:		3,190 pounds, 1447 kg
Gross weight:		36,250 pounds, 16 443 kg

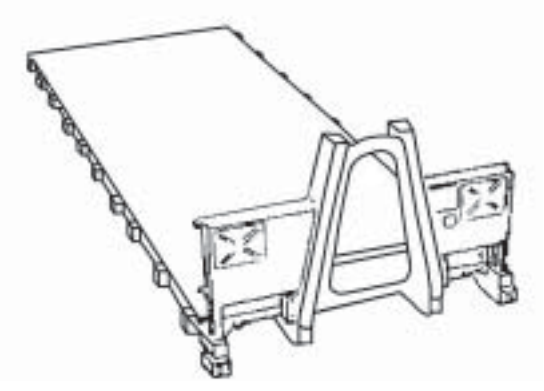


Figure A-1. M1077 (A-Frame Flatrack).

2. PLS M1 flatracks

The M1 flatrack is transportable throughout the intermodal system as a flatrack or on the PLS truck without the use of additional equipment.

External Dimensions:	Length	240 inches, 6096 mm
	Width	96 inches, 2438 mm
	Height	82 inches, 2083 mm
Internal Dimensions:	Length	228 inches, 5791 mm
(cargo maximums)	Width	96 inches, 2438 mm
	Height	70 inches, 2083 mm
Tare weight:		7,300 pounds, 3311 kg
Gross weight:		36,250 pounds, 16 443 kg

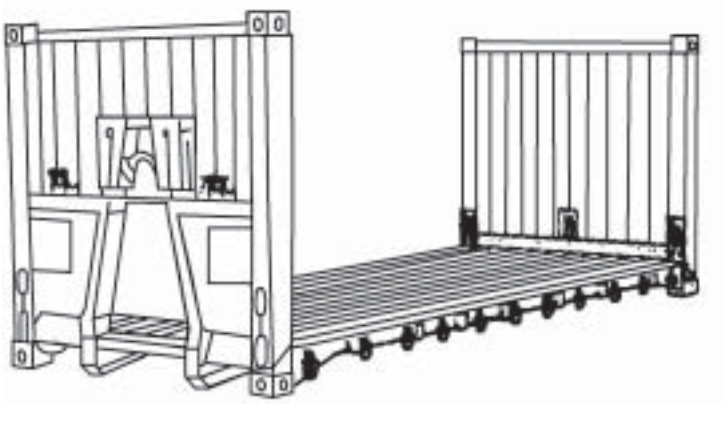


Figure A-2. M1 (Intermodal) Flatrack.

3. PLS M3 flatracks (CROP)

The M3 or CROP is a cargo-carrying platform capable of being transported on the PLS truck and trailer and inside any 8 by 8.5 by 20-foot dry cargo container.

External Dimensions:	Length	230 inches, 5842 mm
	Width	91.5 inches, 2324 mm
	Height	10.5 inches, 267 mm (to top of deck) 64 inches, 1626 mm (to top of A-frame)
Internal Dimensions: (cargo maximums)	Length	217 inches, 5519 mm
	Width	89 inches, 2261 mm
	Height	74 inches, 1880 mm
Tare weight maximum:		4,000 pounds, 1814 kg
Gross weight:		36,250 pounds, 16 443 kg

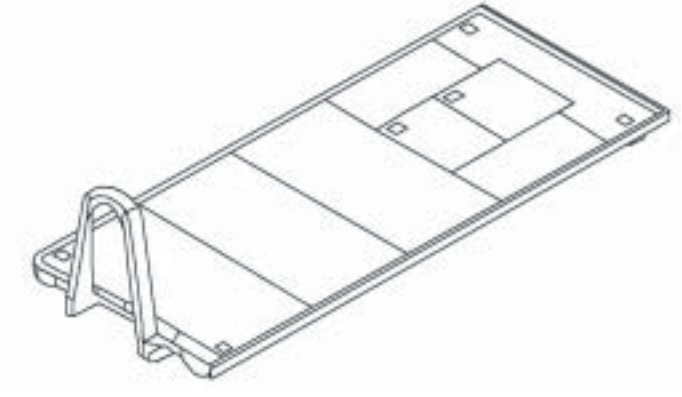


Figure A-3. M3 (CROP) Flatrack.

Appendix B. Privately Owned Vehicles (POV)

Polyester straps may be used to restrain POVs in containers for marine shipment. The straps should be inspected to ensure they are free of wear, tears, or burns. Straps are required to have ratchet handles.

Weight of POV	Number of Straps	Minimum Breaking Strength of Strap
Up to 3,000 pounds	4	5,000 pounds
3,001 to 6,200	4	10,000
Above 6,200	8	10,000

Note: The minimum breaking strength of straps made in the U.S. is 3 times the working load limit.

Figure B-1. POV loaded in container.

Appendix C. Air Transport of Containers

[Excerpted from the Defense Transportation Regulation Part VI Management and Control of Intermodal Containers and Systems 463-L Equipment]

PROCEDURES

1. Air movement subjects containers to rapid acceleration and deceleration. Contents must be adequately secured to preclude shifting of center of gravity of the container during flight.

2. Containers and shelters must be prepared for air movement IAW AFJI 24-108/FM 55-12/FM 4-6, *Movement of Units in Air Force Aircraft*.

3. HAZMAT installed or stowed in containers may be moved aboard DOD aircraft. Shippers must obtain packaging and compatibility waivers according to Chapter 2, AFMAN 24-204(I), TM 38-250, MCO P4030.19H, NAVSUP Pub 505, and DLAI 4145.3.

4. Joint inspections will be performed by shipping unit and supporting Tanker Airlift Control Element/Mission Support Team (TALCE/MST). Containers will be opened and verified for adequate security of cargo and compliance with hazardous cargo restrictions at the discretion of supporting TALCE/MST.

5. Containers prepared for air movement are restricted by weight based on pallet configuration, type aircraft, and load plan location. Maximum gross planning weights are provided in table C-1.

*Table C-1. Maximum Gross Container Weights**

	C-130 E & H	C-130 E & H	C-141B	C-5	C-17
Container Loading	Low Strength Floor Area	High Strength Floor Area	Any Floor Location	Any Floor Location	ADS Rail System (Centerline)
20-foot Container 2 pallet train	37,328	42,672	50,560	33,000	32,000
20-foot Container 3 pallet train	44,800**	44,800**	72,680***	44,700	48,000

NOTES:

* Weights shown represent maximum gross weight in pounds of a standard ISO container and contents that the aircraft roller conveyer system is capable of supporting under flying conditions. The working gross weight limit is influenced by several other factors to include weight carrying capability of aircraft loading equipment, allowable cabin load for mission range, and localized loading of individual rollers caused by non-uniform container loading.

** This value is the design limit for ISO surface mode containers and it is also the maximum payload for a C-130 in peacetime operation. Present air-land containers are design limited to 25,000 pounds gross weight.

*** Operationally not feasible (MHE limited).

6. 463L pallets, which have a tare weight of 290 pounds, are formed into trains to accomplish container loading. A 2-pallet train has an effective contact length of 14 feet, a 3-pallet train has a length of 19 feet. These pallets interface with the aircraft rollers, the roller load limits are given in table C-2.

Table C-2. Container loading using pallets

Low-strength loading limits C-130 - 2,333 lbs per roller contact	High strength loading limits C-130 - 2,667 lbs per roller contact C-141 - 1,580 lbs per roller contact C-17 - 2,000 lbs per roller contact
C-5 roller limits (pounds per foot) 1 & 2 roller conveyors contacted - 1200 3 & 4 roller conveyors contacted - 2400	