

TIEDOWN INSTRUCTIONS FOR RAIL MOVEMENTS

MI 19 Rail

Eighth Edition

August 2021



**Military Surface Deployment and Distribution Command
Transportation Engineering Agency
Scott AFB, IL**

DISTRIBUTION STATEMENT C. Distribution authorized to U.S. Government agencies and their contractors; Operational Use; 5 Aug 21. Other requests for this document shall be referred to SDDCTEA-DPE, 1 Soldier Way, Bldg 1900, Scott AFB, IL 62225



TIEDOWN INSTRUCTIONS FOR RAIL MOVEMENTS

Eighth Edition

August 2021

**MILITARY SURFACE DEPLOYMENT AND DISTRIBUTION COMMAND
TRANSPORTATION ENGINEERING AGENCY (SDDCTEA)
SCOTT AIR FORCE BASE, IL**

This document is published by the Military Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA), Scott Air Force Base, IL, under the authority of DoDI 4540.07, “Operation of the DoD Engineering for Transportability and Deployability Program”, August 31, 2018 and AR 70-47, “Engineering for Transportability Program”, January 11, 2019, as the Secretariat for the DoD Engineering for Transportability and Deployability Program.

DISTRIBUTION STATEMENT C. Distribution authorized to U.S. Government agencies and their contractors; Operational Use; 5 Aug 21. Other requests for this document shall be referred to SDDCTEA-DPE, 1 Soldier Way, Bldg 1900, Scott AFB, IL 62225

Director
Military Surface Deployment and Distribution Command
Transportation Engineering Agency
ATTN: SDTE - DPE
One Soldier Way, Building 1900W
Scott AFB, IL 62225-5006

Telephone: DSN 770-5271, 618-220-5271, or 1-800-722-0727

FAX: DSN 770-5551 or 618-220-5551

E-mail: usarmy.scott.sddc.mbx.tea-dpe@mail.mil;

Make requests for additional copies or latest updated copy of these references can be downloaded from our website:

<http://www.sddc.army.mil/sites/TEA/Functions/Deployability/TransportabilityEngineering/Pages/default.aspx>

This instruction is part of the series started with MTMCTEA PAM 55-19, *Tiedown Handbook for Rail Movements*. The books in the series are:

Modal Instructions for Military Movements

MI 19 Rail, *Tiedown Instructions for Rail Movements*

MI 20 Truck, *Tiedown Instructions for Truck Movements*

MI 21 Helicopter, *Lifting and Tiedown Instructions for Helicopter Movements*

MI 22 Sealift, *Lifting and Lashing Instructions for Sealift*

MI 23 Containerization, *Tiedown Instructions for Containerized Movements*

MI 24 Airlift, *Vehicle and Equipment Preparation Instructions for Fixed Wing Air Movements*

Planning and Users' Guides

Transportability Instruction 70-1 *Transportability for Better Deployability*

MI 2 *Logistics Handbook for Strategic Mobility Planning (electronic copies only)*

MI 5 *Deployment Planning Guide (electronic copies only)*

MI 6 *Large, Medium Speed, Roll-On/Roll-Off Ships Users' Manual*

MI 7 *Fast Sealift Ship Users' Manual*

Preface

This edition supersedes the seventh edition update (September 2018). It contains some changes and improvements over the previous editions. The SDDCTEA series of “Handbooks” or “Pamphlets” have been renamed “Modal Instructions” (MI) per AR 70-47, Engineering for Transportability Program, January 2019. This edition contains new guidance on commercial rail chains, proper securement of chain anchors and load binders, use of tarpaulins, and new loading figures for equipment including the M1A2 SEPv3, JLTV, Modular Fuel System, M200A1 Trailer, Bradley / AMPV tiedown details, M109A7, ABV Secondary Turret Restraint, and HIPPO. The MI will aid the soldier in meeting the Association of American Railroads (AAR) rules ensuring safe rail transport of equipment.

This MI covers minimum standards; the local railroad may require additional securement based on the condition of the railcar or other factors that cannot be standardized. The MI is not designed to cover every vehicle in the U.S. Army inventory. The vehicles covered in this MI are those most commonly transported by rail. When in doubt, check the AAR Open Top Loading Rules or check with the mechanical department of the railroad moving the equipment.

In this edition, we have continued to show the chain-tiedown information from the earlier editions. Blocking and wire rope (as a primary tiedown) methods of vehicle securement are rarely used for military vehicles within the U.S., since chain equipped flatcars have become widely available. Wire rope continues as a secondary tiedown material for items such as gun turrets and secondary loads. We will maintain an electronic copy of the fifth edition on our web site for blocking and wire rope reference. Blocking and wire rope methods of vehicle securement are still used for NATO rail transport. On each tiedown figure, the pertinent figure and section numbers from the AAR Open Top Loading Rules are identified.

The earlier editions lack the above changes, but they may still be useful, since some of the chain tiedown methods are unchanged. Compare the eighth edition with the earlier editions to annotate changes in earlier pamphlets, but please note, the page numbers are different. Because of printing costs, only a limited supply of the eighth edition will be produced. Please feel free to make copies of the modal instruction for local use.

We invite users of this modal instruction to recommend changes and submit comments at usarmy.scott.sddc.mbx.tea-dpe@mail.mil. This and other publications are available on our web page in Adobe Acrobat Reader (.pdf) format at <http://www.sddc.army.mil/sites/TEA/Functions/Deployability/TransportabilityEngineering>

<g/Pages/default.aspx>. Between editions, electronic updates will be available online.

Contents

| | <u>Page</u> |
|--|-------------|
| Preface | iii |
| List of Illustrations | viii |
| What is That Called? | x |
| Section I. Requirements for All Equipment | 1 |
| Chain Table 1 – Unarmored Wheeled Vehicles | 15 |
| Chain Table 2 – Armored Wheeled Vehicles | 16 |
| Section II. Wheeled Vehicles | 19 |
| Section III. Tracked Vehicles | 24 |
| Section IV. Tools for Rail Loading | 28 |
| Table 1. Suggested CONUS Rail Loading Toolkit | 28 |
| Section V. Tips and Common Mistakes | 32 |
| Section VI. Comparison of the Rail Shock Environment | 36 |
| Section VII. Spanners | 38 |
| Section VIII. Loading Ramp | 42 |
| Section IX. Flatcar Types | 43 |
| Table 2. Flatcar Fleet | 50 |
| Section X. Safety Checklist | 51 |
| Section XI. Loading and Tiedown Checklist | 52 |
| Section XII. Practical Tips | 53 |
| Section XIII. Wood Stanchions | 57 |
| Section XIV. Battle Damaged or Retrograde Equipment | 60 |
| Table 3. Bill of Materials for Rail Cribbing for M1 Missing Tracks | 66 |
| Section XV. Tarpaulins | 69 |
| Appendix A. Trucks and Trailers | A-1 |
| Trucks, Unarmored, Weighing up to 75,850 Pounds | A-3 |
| Trucks, Armored, Weighing up to 75,850 Pounds | A-4 |
| M1074/M1075 PLS and M1120 HEMTT LHS Truck | A-5 |
| M1076 Palletized Load System (PLS) Trailer | A-6 |
| Modular Fuel System | A-7 |
| M1070 Tractor on TTX cars | A-8 |

Contents (Continued)

| | <u>Page</u> |
|--|-------------|
| M1070A1 Tractor on DODX cars | A-9 |
| M1000 Trailer on HTTX cars | A-10 |
| M1000 Trailer on DODX and TPDX cars | A-11 |
| Logistics Vehicle System | A-12 |
| Trailer Attached to Prime Mover | A-13 |
| Semitrailer Attached to Prime Mover | A-14 |
| Single Axle Trailers | A-15 |
| M200A1 Trailer | A-16 |
| Next Generation Shop Equipment Welding (NG-SEW) | A-17 |
| Two-Axle Trailers | A-18 |
| Trailer on Flat Car (TOFC) | A-19 |
| Trailers, M872, Double Stacked | A-20 |
| M129A4 and M1063 Semitrailers | A-21 |
| M119A2/A3 105MM Towed Howitzer | A-22 |
| M777A2 155MM Towed Howitzer | A-23 |
| Appendix B. Tracked and Wheeled Armored Vehicles | B-1 |
| Tracked Vehicles up to 30,000 lbs | B-3 |
| M577 and M1068 Ramp Securement | B-4 |
| Tanks and Similar Units 30,000 to 60,000 lbs | B-5 |
| Tanks and Similar Units 60,000 to 100,000 lbs | B-6 |
| Bradley Tiedown Detail | B-7 |
| Armored Multipurpose Vehicles (AMPVs) | B-8 |
| DODX 40000-Series Flatcar Checklist | B-9 |
| Tracked Vehicles Over 100,000 lbs | B-10 |
| M1 Tanks with Optional Link (Ring) and M88 | B-11 |
| Tracked Vehicles Over 100,000 lbs without the Link | B-12 |
| M1 with Mine Clearing Blade System | B-13 |
| Proper Securement of Ballistic Skirts | B-14 |
| M60 Tanks, AVLB, and Rear of M728 | B-15 |
| M728 Front | B-15 |

Contents (Continued)

| | Page |
|---|------|
| M1A2 SEPv3 or Later Abrams Tank on DODX 40000s | B-16 |
| M109A6 Paladin Howitzer | B-18 |
| M109A7 Paladin Howitzer (PIM) | B-19 |
| Amphibious Assault Vehicle (AAV) | B-20 |
| Flat-Bottom Strykers Weighing up to 44,900 lbs | B-21 |
| Flat-Bottom Strykers Weighing 44,900 lbs up to 60,000 lbs | B-22 |
| Strykers with Double V-Hulls (DVH) | B-23 |
| MRAP Caiman MTV | B-24 |
| MRAP FPI Buffalo MPCV | B-25 |
| VMMD MKIII (USMC model or Army model with Lift/Tiedown Kit) | B-26 |
| VMMD Red Pack (USMC version only) | B-27 |
| VMMD Mine Detonation Trailers (USMC version only) | B-28 |
| Assault Breacher Vehicle (ABV) | B-30 |
| Shackle-less Provisions on M1 Chassis | B-32 |
| Joint Light Tactical Vehicle (JLTV) | B-33 |
| HIPPO | B-34 |
| Appendix C. Materials Handling and Construction Equipment and | |
| Non-Vehicles | C-1 |
| Variable Reach Forklift Truck | C-2 |
| Wheel-Mounted Crane (25- and 35-ton) | C-4 |
| Tractors, Forklifts, Loaders, and so forth | C-5 |
| Motor Grader | C-6 |
| Motor Grader, Armored | C-7 |
| Scraper (Earthmover) | C-8 |
| Scraper (Earthmover), Armored on DODX car | C-9 |
| D-7 Caterpillar Dozer | C-10 |
| D-7R Caterpillar Dozer Type I and Type II | C-11 |
| CONEX or ISU Container on 5-Ton Trucks | C-14 |
| Kalmar Rough Terrain Container Handler (RTCH) | C-15 |
| Improved Ribbon Bridge (IRB) | C-17 |

Contents (Continued)

| | <u>Page</u> |
|--|-------------|
| IRB M30 Bridge Erection Boats | C-23 |
| Hydraulic Excavators (HYEX), Armored Cab | C-24 |
| S280 Shelters Single Quadcons or Tricons, 10,000 lbs or Less | C-26 |
| Concrete Mixer Trailer | C-27 |
| Index | Index-1 |

List of Illustrations

| | <i>Page</i> |
|--|-------------|
| Figure 1. Brake wheel clearance | 2 |
| Figure 2. Angle of 45 degrees in the side view | 5 |
| Figure 3. Inverted tiedown on vehicle | 6 |
| Figure 4. Complete loop wire rope assembly | 6 |
| Figure 5. Chain hoist and cable gripper | 6 |
| Figure 6. Commercial rail chain tiedown assemblies | 8 |
| Figure 7. DODX rail chain tiedown assemblies | 9 |
| Figure 8. Proper securement of chain anchors on commercial heavy-duty or DODX chain assemblies | 10 |
| Figure 9. Proper securement of chain anchors on commercial multipurpose chain assemblies | 11 |
| Figure 10. Proper securement of grabhook and chain link | 13 |
| Figure 11. Turnbuckle | 13 |
| Figure 12. Turnbuckle locking sleeves | 13 |
| Figure 13. Securement of load binders for chain less than 45° | 14 |
| Figure 14. Chain anchor and chain anchor channel | 14 |
| Figure 15. Flat tires can catch on fire during rail transit | 19 |
| Figure 16. Shackle-less tiedown provisions..... | 20 |
| Figure 17. Uni-level cars use chock/web straps restraint system | 22 |
| Figure 18. Grate/Lock Chock | 23 |
| Figure 19. Two-hole shackle-less tiedown provisions | 25 |
| Figure 20. Wire rope tiedown of gun tube on turret | 26 |
| Figure 21. Slip hooks with the point down | 27 |
| Figure 22. Correct position of chain anchor winch | 35 |
| Figure 23. Dunnage for unequal height railcars | 38 |
| Figure 24. Securing spanners with straps | 39 |
| Figure 25. Securing spanners with rail chain | 39 |
| Figure 26. Six -foot aluminum spanner | 40 |
| Figure 27. Ten -foot aluminum spanner | 41 |
| Figure 28. Steel end ramp for wheeled and heavy tracked vehicles | 42 |
| Figure 29. DODX 41000 -series 68 -foot flatcar | 43 |
| Figure 30. DODX 42000-series 89 -foot flatcar..... | 44 |
| Figure 31. DODX 40000 -series 68 -foot flatcar..... | 44 |
| Figure 32. OTTX 60 -foot flatcar | 45 |
| Figure 33. ITTX 89 -foot flatcar with side rails | 45 |
| Figure 34. ITTX 89 -foot flatcar with wood deck | 46 |

Illustrations (Continued)

| | <u>Page</u> |
|--|-------------|
| Figure 35. HTTX 60 -foot flatcar | 46 |
| Figure 36. TTDX 89 -foot flatcar | 47 |
| Figure 37. TPDX 89-foot flatcar with deck layout similar to DODX 42000 flatcar | 47 |
| Figure 38. STTX prototype 89-foot flatcar | 48 |
| Figure 39. 89-foot flatcar with anchor holes | 49 |
| Figure 40. Wood stanchion pattern 90 from AAR OTLRs | 57 |
| Figure 41. Wood stanchion pattern 91 from AAR OTLRs | 58 |
| Figure 42. Wood stanchion construction details for a 18,000 lbs semi-trailer | 59 |
| Figure 43. Possibly use gondola railcars for damaged equipment | 60 |
| Figure 44. Vehicles with shredded tires will likely require axle blocking | 62 |
| Figure 45. M1 Abrams tank cradle made with off-the-shelf parts | 63 |
| Figure 46. M1 cradle chained to railcar and then M1 lowered onto cradle | 63 |
| Figure 47. M1 tank chained down to railcar using normal chain pattern as specified in on page B-10 and B-11 | 64 |
| Figure 48. Rail cradle for M1 missing track(s) | 65 |
| Figure 49. Steel piece parts for rail cradle | 67 |
| Figure 50. Thru hole location on rail cradle for M1 missing track(s) | 68 |
| Figure 51. Tarp worked loose and got caught on overhead electrical lines in Europe . | 69 |

What is *That* Called?



Slip hook



Grab hook



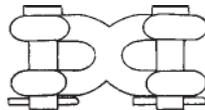
Claw hook



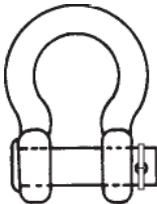
Adjustable double grab hook



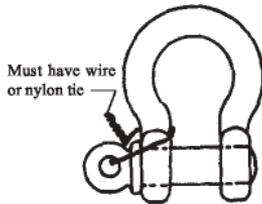
Coupling link



Double clevis chain link

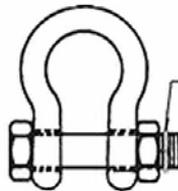


Round pin anchor shackle
(not recommend for rail tiedown & not authorized for new equipment design)



Must have wire or nylon tie

Screw pin anchor shackle
(not authorized for new equipment design)



Must have nut and cotter pin.
[To meet MIL-STD-209K, the nut must be welded on.]

Safety anchor shackle
(not authorized for new equipment design)

Note: *Shackle-less tiedown provisions will be required on all new design of vehicles (see Section II, paragraph B).*

Notes

Section I. Requirements for All Equipment

A. This modal instruction (MI) provides users with the proper methods for securing wheeled and tracked vehicles on the chain-equipped flatcars that are now widely available to the military. It contains basic information from the Association of American Railroads (AAR)¹ and from experience gained through monitoring many military rail load-outs during deployments.

B. All equipment loaded onto flatcars must be properly secured to counteract longitudinal, lateral, and vertical forces. Flatcars loaded with equipment will not move until the railroad inspects and accepts them as safe loads. The AAR rules are mandatory for Government shippers. The AAR rules are divided into two categories: “General Rules” (Section No. 1) covering the approved materials and methods of load securement and “figures” in Sections No. 2 through 7 covering specific commodities including items such as military vehicles and equipment (Section No. 6). AAR General Rules require the shipper (see footnote 1, AAR rule 1.2.4, Section No. 1) to load, secure, and inspect shipments for compliance with all applicable loading rules and applicable loading figures. The rail carrier (see footnote 1, AAR rule 1.2.5, Section No. 1) can refuse a load that does not comply with the loading rules. The railroad inspector has the final word if a specific figure is not involved. This modal instruction was published in accordance with the AAR Loading Rules when it was last updated; however, follow the AAR Loading Rules if any conflict arises with this modal instruction.¹ If the MI and the AAR rules conflict or for a clarification of a rule, contact the DOD AAR Representative at usarmy.scott.sddc.mbx.tea-dpe@mail.mil or (618) 220-5271 / DSN 770-5271.

C. The following general procedures apply to all types of flatcars.

1. Vehicle Gearshift Levers and Brakes

Place gearshift levers of automatic or manual 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. Generally, set the brakes after the chains are tightened; however, some vehicles require

¹AAR *Open Top Loading Rules Manual* (OTLRM), Section No. 1, General Rules for Loading All Commodities; Section No. 3, Rules for Loading Construction and Farm Machinery; Section No. 6, Rules for Loading Military Equipment and Material; and Section No. 7, Rules for Loading All Commodities on Open Top Trailers and Containers for Rail Transport. Toll free 877-999-8824 (Pueblo, CO: AAR, Revised Annually). Reference is made throughout this tiedown instruction to the underlying provisions in the AAR OTLRM.

engine power to set the brakes, which may be set once the vehicle is spotted. Never set the test item brakes when performing the MIL-STD-810 rail impact test. This verifies that brakes are not part of the securement.

2. Railcar Brake Wheel

Allow a 12-inch minimum clearance from the end of the car, 6 inches around and above the brake wheel, and 4 inches below the brake wheel (Figure 1). Note that side-mounted brake lever clearance need not be taken into account (see footnote 1, page 1, AAR rule 2.1, Section No. 1).

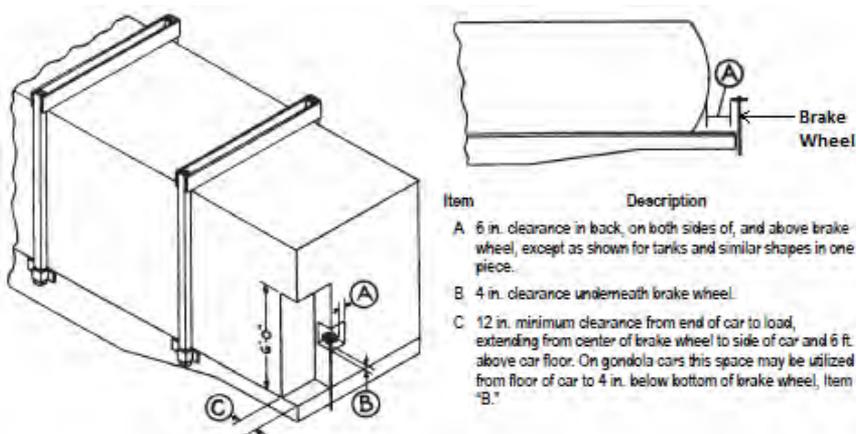


Figure 1. Brake wheel clearance.

3. Vehicle Spacing

The AAR rules state:

“1.2.23 Separate piles or units loaded on one car may be secured to different specific figures or General Rules and located not closer than 2 feet to the adjacent pile or unit. Vehicles with spring suspensions secured to different figures or General Rules may be loaded closer than 2 feet but not less than 10 inches apart.

1.2.24 Cargo such as trailers and fork trucks may be loaded with the tongue or forks beneath the next vehicle, provided that points where the vehicles may touch are separated by a

minimum horizontal distance of 10 inches and the tongue or forks are secured against vertical displacement.

2.4 Handholds & other safety appliances must be accessible and must have a minimum of 2 inches of clearance as cited in 49 CFR Part 231.”

4. Securing Movable Structures

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 a minimum of 1/2-in. diameter wire rope (AAR rules 6.1 to 6.3). Certain loading figures allow wire rope less than 1/2-in. diameter if it was validated by a rail impact test. Use of wire rope prevents the parts from rotation, swing-out or displacement during rail movement. **AAR rule 6.3 further states vehicle doors must be adequately secured.** Doors opening on retrograde military vehicles have occurred in route (see Section XIV on Battle-Damaged or Retrograde Vehicles in this instruction for more information). Serious accidents can result from parts striking bridges, structures, or passing trains and well as damage to military and railroad equipment. Recommend edge protection when using web straps to secure doors on vehicle cabs.

5. Forty-Five Degree Tiedown Angle

Place vehicles or equipment on the flatcar so that the appropriate number and size tiedown chains or wire rope can be applied at approximately a 45-degree angle with the flatcar deck when viewed from the side. Measuring by eye is usually good enough. If desired, layout the correct angle with a tape measure, make the longitudinal distance from the point the tiedown attaches to the flatcar deck to the tiedown provision on the vehicle equal to the vertical distance from the deck to the provision (Figure 2). In general, do not cross the tiedowns as it will reduce longitudinal chain load capacity.

6. Inverted Tiedowns

Inverted tiedowns are tiedown chain assemblies or wire ropes that are secured under the vehicle rather than outward, away from the vehicle (Figure 3). Inverted tiedowns are only appropriate in cases when the tiedown does not contact any part of the vehicle except the tiedown provision. Do not use inverted tiedowns if the tiedown bears on the bottom of the bumper or understructure of the vehicle. Interference of the tiedown on part a vehicle will make it more difficult to properly tension the chain assembly and it could cause the bumper or understructure to yield or fail and therefore lose safe restraint. One example where inverted tiedowns could be used is if trailers have tiedown provisions that are mounted below the frame. Another consideration is vehicle ground clearance. To use inverted tiedowns, there

must be enough space under the vehicle for a soldier to adequately secure the tiedowns.

7. Tiedown Provisions

The procedures in this modal instruction generally cover equipment that was manufactured to meet MIL-STD-209, *Interface Standard for Lifting and Tiedown Provisions*. MIL-STD-209 provides for adequate strength tiedown provisions for all modes of transport including rail. Some equipment requires specialized procedures, which will be described on a MIL-STD-209 data plate attached to the equipment. A copy of MIL-STD-209 is available at:

<http://www.sddc.army.mil/sites/TEA/Functions/Deployability/TransportabilityEngineering/Pages/default.aspx>

D. WIRE ROPE

Wire rope can be used to secure equipment to flatcars, but is primarily used to secure movable parts on equipment, such as the barrel and turret on the M1 tank and the rear door (ramp) on the M577 tracked vehicle. It is also used to secure booms and various attachments on construction equipment. Wire rope loops can also be used to extend the length of chains such as on containers/shelters or on boats. Wire rope along with nailed blocking is the primary method of restraint of vehicles on NATO railcars. Secure the wire rope using a minimum of four clamps. Apply the clamps, also called clips, fist distance apart, with the saddle against the tension-bearing side of the wire rope and the U-bolt against the dead end. The clamp must be the same size as the wire rope being used (Figure 4). Tension the wire rope by pulling tight by hand for movable parts mentioned above. For secondary loads, tension the wire rope using a hoist (chain or wire rope) with two cable grippers, as shown in Figure 5. A properly tensioned tiedown will deflect no more than about an inch with the weight of a person standing on it. Be sure that at least 24 inches of wire rope overlap to allow proper application of cable clamps. Alternately tighten the nuts and torque cable clamps to the following guideline values:

45 foot-pounds for 3/8-inch wire rope

65 foot-pounds for 1/2-inch wire rope

130 foot-pounds for 5/8-inch wire rope

If the clamps break before reaching the above torques, use six instead of four clamps for a complete loop and torque to a value just below the breaking point.

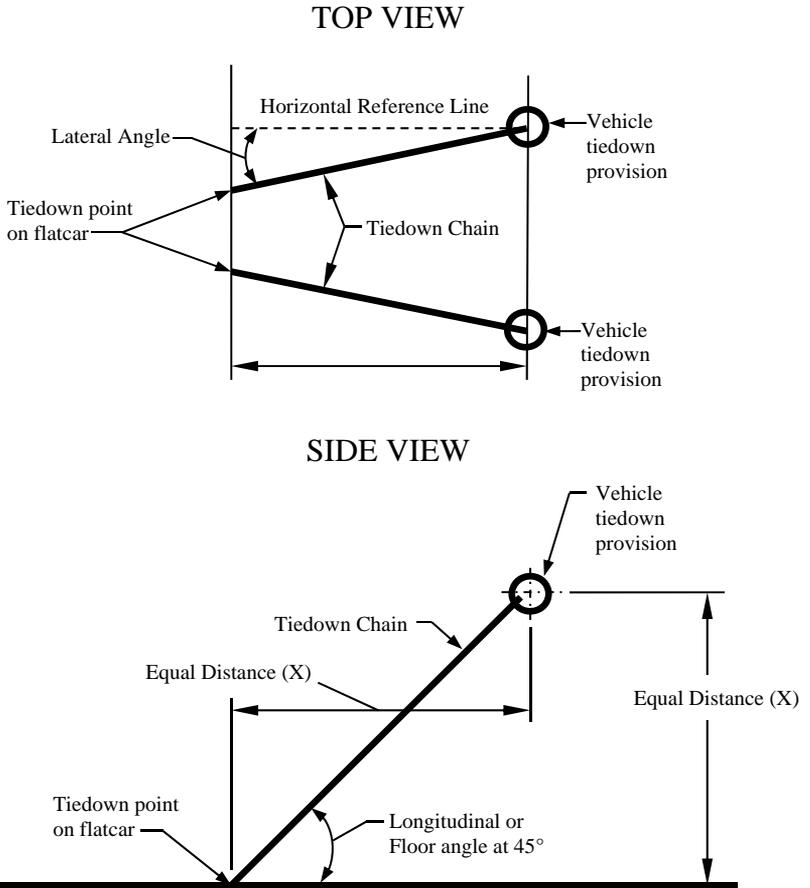




Figure 3. Inverted tiedown on vehicle.

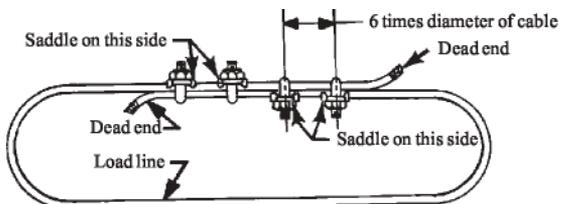


Figure 4. Complete loop wire rope assembly.

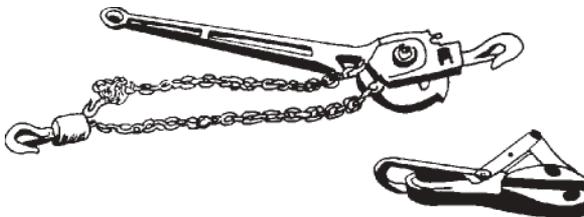


Figure 5. Chain hoist and cable gripper.

E. CHAIN TIEDOWN

1. Chain Assemblies on Flatcars

CONUS chain-equipped flatcars have either 3/8- or 1/2-inch diameter steel alloy chains. Figure 6 shows the three different types of chain assemblies found on commercial TTX 60-foot and 89-foot long flatcars. DODX flatcars are equipped with 1/2-inch chains (shown in Figure 7). Note that these chain assemblies have similar components used on the commercial 1/2-inch chains (such as the floor anchor, load binder, compression unit, and claw hook) but are equipped with a large slip hook on the end instead of an adjustable double grab hook.

Inspect all chain assemblies prior to loading for signs of stretching, gouging, or other damage to include the compression units. Do not use damaged chains and notify the flatcar owner of the defective chain assembly for repair or replacement. For DODX flatcars, contact the SDDC Chief of the Rail Fleet Branch at Army.SDDC.OPS.DODX@mail.mil or at 618-220-5416.

NOTE: When all chains are not used or transporting an empty flatcar, ensure unused chains are secured to the railcar deck to prevent displacement over the railcar side which is a potential hazard when the railcar is in motion. Secure used chains by placing them into the chain anchor channels. When preparing railcars for loading, ensure the chains are in the chain anchor channels or between the chain anchor channels to prevent rollover damage from wheeled or tracked vehicles.

All rail chain assemblies need to have the chain winch anchor, swivel anchor or floor anchor properly secured into the railcar tiedown channels. Sliding an anchor lock down bar or locking bars outward on opposite corners of the chain anchors secures them in the channels. This keeps the anchor engaged into the top of the notched tiedown channels until the chains are applied to the vehicle or system and tensioned. These sliding locks are also essential for chains securement during the rail movement. Vehicles suspensions can compress if the railcar experiences a shock from a hard start or stop. During the compressing of the suspensions, the chain anchors can drop out of the railcar channels if the chain anchor locks are not properly slid over. This can lead to loose chains or unsecured vehicles!

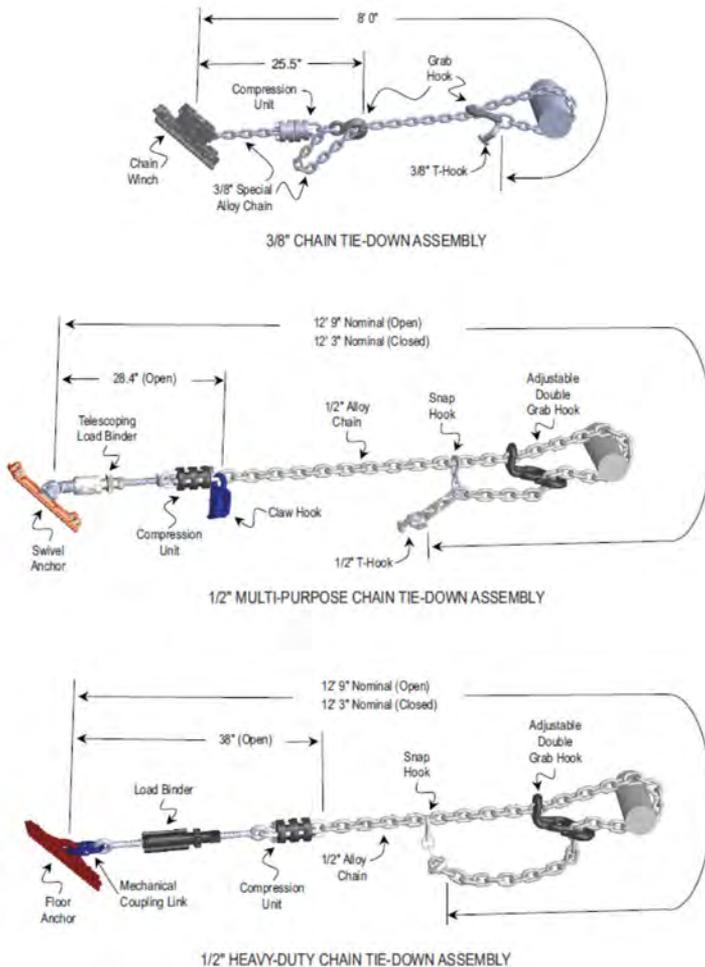


Figure 6. Commercial rail chain tiedown assemblies.

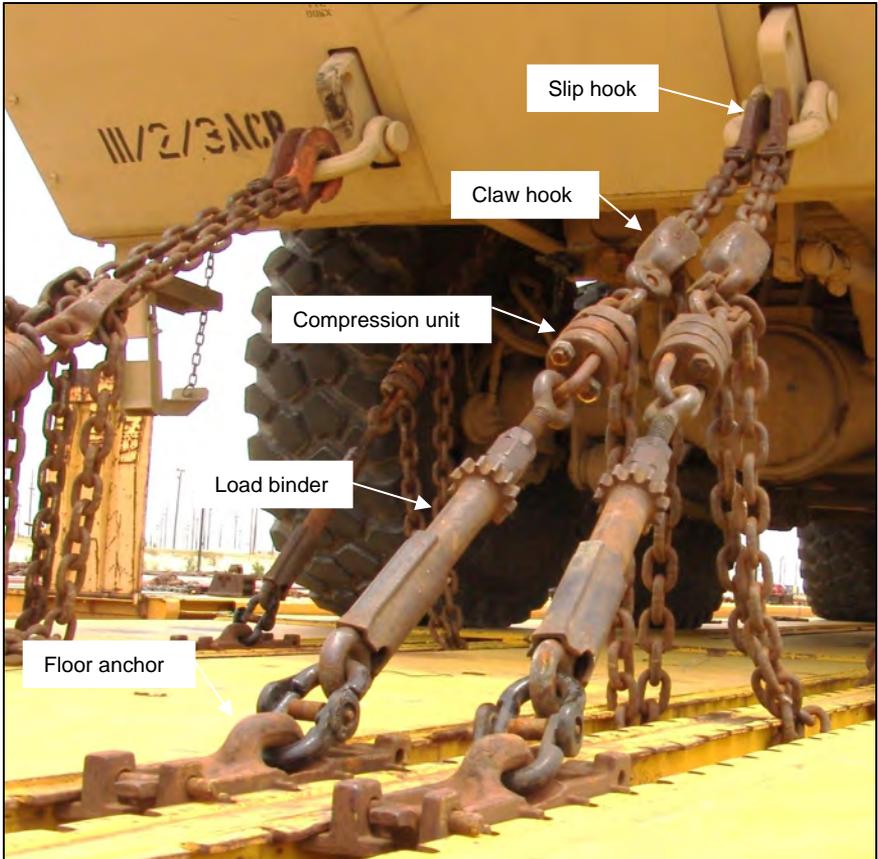


Figure 7. DODX rail chain tiedown assemblies.

The anchors on the commercial 3/8" and the 1/2" heavy duty chain tiedown assemblies, as well as the anchors on the 1/2" chain tiedown assemblies on DODX cars have a locking bar handle that is rotated down and captured in an anchor slot as shown in Figure 8 when the

locking bar is properly slid outward. When properly secured, the locking bar handle will be level and extend away from the anchor. The newer 1/2" multipurpose tiedown assemblies also have locking bars, but when those are extended, the locking bar handles are level but face inward to engage the slots in the anchor as shown in Figure 9.

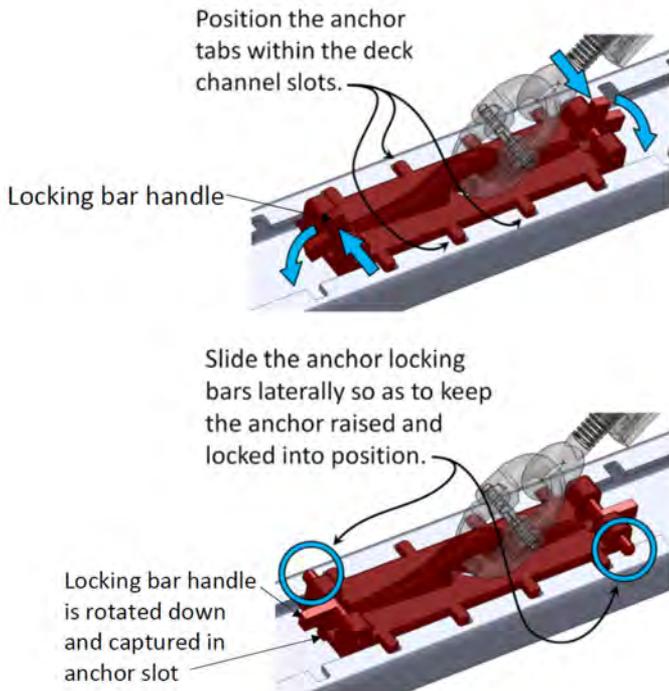


Figure 8. Proper securing of chain anchors on commercial heavy-duty or DODX chain assemblies.

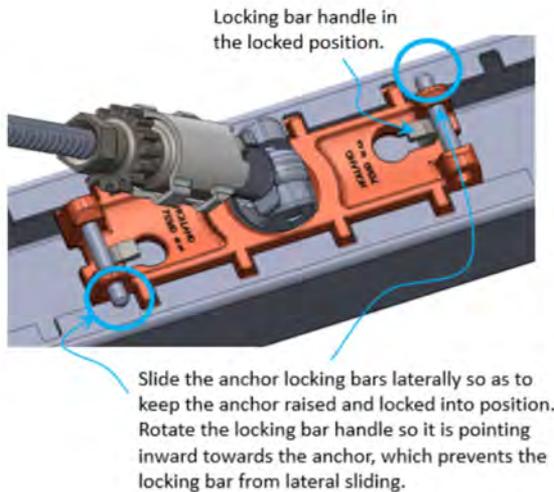
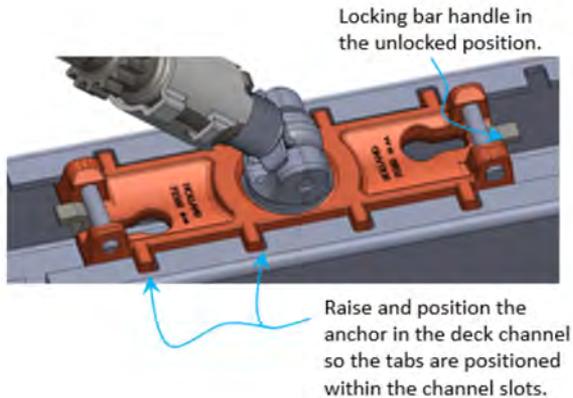


Figure 9. Proper securement of chain anchors on commercial multipurpose chain assemblies.

Apply tiedown chains symmetrically around the vehicle with an angle from deck to chain of about 45 degrees. Due to the reduced longitudinal restraint capacity, do not cross the chains unless directed by the specific tiedown instruction figure for that vehicle. When attaching chains to the vehicle, secure the shortest chains first and then the longer chains last.

The application and securement of the chain assemblies differ. On commercial TTX flatcars, feed the chain hook through the vehicle tiedown provision and apply chain grabhook over chain, rather than under as shown in Figure 10. Wire (or secure by other suitable means such as nylon tie straps) the grab hook to the chain link, as shown in Figure 8, to prevent disengagement (as this is required by the AAR OTRs Section 1). This applies to all the chains depicted in Figure 6.

The chains on the DODX cars have the large slip hooks that connect directly to the vehicle tiedown provisions. Slip hooks that have been supplied in the past on DODX flatcars are Holland part numbers SS00634790 and 71298 and Peck & Hale part number H304-55P. When the vehicle provision openings are horizontal, place the slip hooks in with points down. When the vehicle provision openings are vertical, place the slip hooks with the points either from the left or the right, the orientation does not matter. On the DODX assemblies, neither the claw hook at the base of the chain nor the slip hook engaging the tiedown provision are required to be secured with wire or nylon tie wrap, although additional securement is certainly acceptable.

All tiedown chains must be free from twisted or kinked links prior to their application. All chain assemblies must be sufficiently tightened. If turnbuckles (used to tighten chains) are not equipped with jamnuts (Figure 11) or a locking device, they must be wired to prevent them from loosening. Tighten turnbuckles or tensioners of front and rear tiedown chains at the same time to prevent uneven tensioning. If a tiedown is equipped with both a lock nut and a turnbuckle locking sleeve as shown in Figure 12, the lock nut need not be tightened if the locking sleeve is properly applied.

Once initially tightened, eliminate any possible misalignment of chain links, strike the chains with a hammer or bar. Then re-tension the chains to assure proper tension in all chains. A properly tensioned tiedown will deflect about an inch with the weight of a person standing on it. For a compression unit shown in Figure 7, if the compression gap is zero (solid) after tensioning, the device becomes a chain link and provides no shock mitigation. Tighten chain assemblies with this type of compression unit until only 1/8 inch of rubber is visible between the metal rings of the unit. If the chain assembly has solid rubber shock mitigator rather than a compression unit, tighten the chain until the mitigator is slightly deformed.

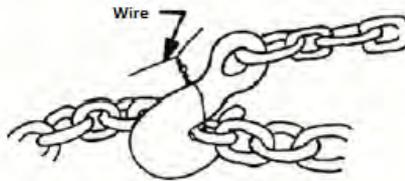


Figure 10. Proper securement of grabhook and chain link.

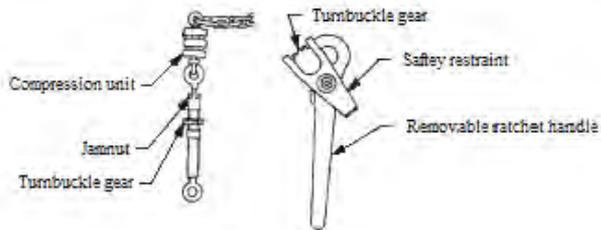


Figure 11. Turnbuckle.

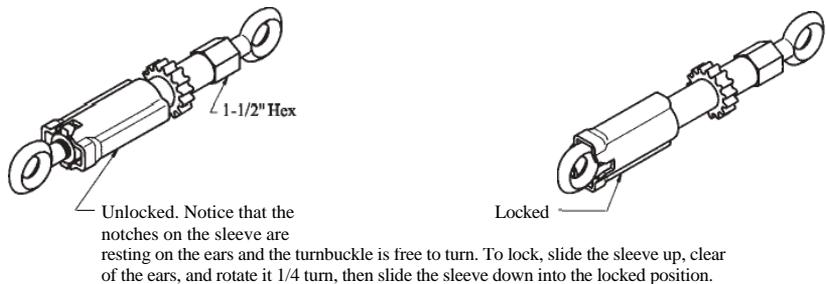


Figure 12. Turnbuckle locking sleeves.

For railcars equipped with 1/2” chain tiedown assemblies, AAR Rule 21.7.9 requires securement of load binder locking sleeves when chains are applied at an angel less than 45°. The can be secured with wire, 16 gauge minimum, or plastic zip ties, minimum of 120 lb/in² as shown in Figure 13.

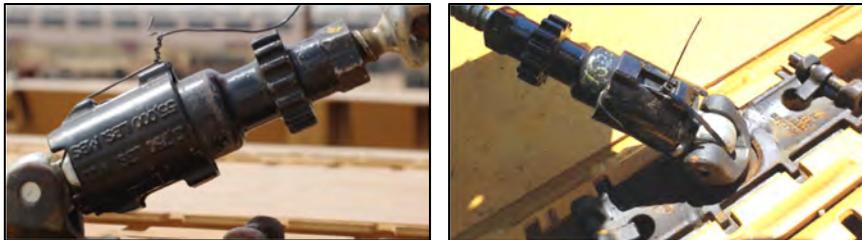


Figure 13. Securement of load binders for chain less than 45°.

Commercial railcars equipped with 3/8” chains must have all winch assemblies adequately locked in position with locked racket pawls and the winch assembly correctly raised and locked in the track as shown in Figure 14.

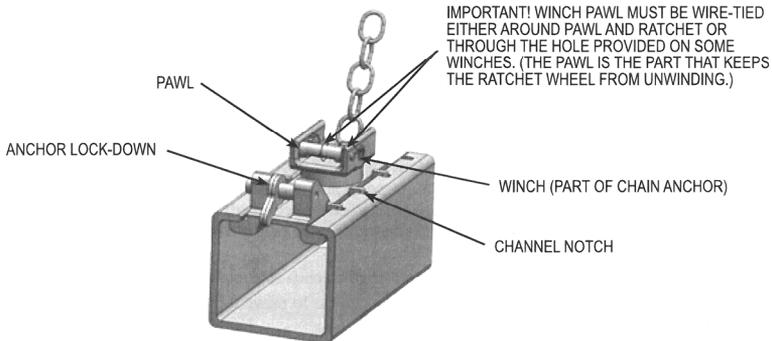


Figure 14. Chain anchor and chain anchor channel.

When a specific figure does not exist for an **unarmored** wheeled vehicle use the general guidelines for securing wheeled vehicles on chain-equipped cars by diameter of chains given in Chain Table 1 (see footnote 1, page 1, Figure 88-B, Section No. 6):

| Chain Table 1 – Unarmored Wheeled Vehicles | | | |
|---|-------------------|--------------------------------------|---------------------------------------|
| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
| | Dia (in.) | Minimum Breaking Strength (MBS) (lb) | Number of Chains Required Per Vehicle |
| 0 - 12,400 | 3/8 | 36,000 | 4 |
| 12,400 - 24,800 | 3/8 | 36,000 | 8 |
| 24,800 - 40,000 | 3/8 | 36,000 | 12 |
| 0 - 20,650 | 1/2 | 55,000 | 4 |
| 0 - 25,250 | 1/2 | 55,000 | 4 |
| 25,250 - 50,550 | 1/2 | 55,000 | 8 |
| 50,550 - 75,850 | 1/2 | 55,000 | 12 |

Check the SDDCTEA Rail Tiedown Lessons Learned webpage for possible guidance for vehicles without a loading figure or for proper securement of secondary cargo. The web page address is:

<http://www.sddc.army.mil/sites/TEA/Functions/Deployability/TransportabilityEngineering/MODES/RailTransport/Pages/LessonsLearned.aspx>

When a specific figure does not exist for an **armored** wheeled vehicle use the general guidelines for securing wheeled vehicles on chain-equipped cars by diameter of chains given in Chain Table 2 (see footnote 1, page 1, Figure 88-F, Section No. 6):

| Chain Table 2 – Armored Wheeled Vehicles | | | |
|---|-------------------|--------------------------------------|---------------------------------------|
| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
| | Dia (in.) | Minimum Breaking Strength (MBS) (lb) | Number of Chains Required Per Vehicle |
| 0 - 9,300 | 3/8 | 36,000 | 4 |
| 9,300 - 18,500 | 3/8 | 36,000 | 8 |
| 18,500 - 27,950 | 3/8 | 36,000 | 12 |
| 0 - 15,500 | 1/2 | 55,000 | 4 |
| 0 - 18,950 | 1/2 | 55,000 | 4 |
| 18,950 - 37,900 | 1/2 | 55,000 | 8 |
| 37,900 - 56,850 | 1/2 | 55,000 | 12 |
| 56,850 - 75,850 | 1/2 | 55,000 | 16 |

The weight of Army equipment is printed on bar-code labels applied to both the front and side of each item. The minimum breaking [force] strength (MBS) of most 1/2" alloy chain assemblies issued on DODX railcars is four times the working load limit (WLL), and the proof load is typically two times the WLL. Chain-equipped flatcars used to be stenciled with the proof [test] load of the chains and the AAR figures were often in terms of proof loads. If you have a known proof load for a chain, multiply the proof load by two to get the MBS for that chain. Some commercial railcars may be equipped with older 3/8" chain assemblies where the MBS is only three times the WLL. Verify the MBS for the chain assemblies prior to determining the number of chains required.

Chain Tables 1 and 2 are based on assuming either 3G longitudinal restraint for unarmored wheeled vehicles or 4Gs for armored wheeled vehicles with chains applied at 45° longitudinally and an average lateral angle of 12°. The chain tables provided with the figures in Appendix A, B, or C are based on calculations for compound angles (see footnote 1, page 1, rule 5.3.1, rule 5.4.2, and Appendix E, Section No. 1), or from actual test results.

For vehicles not covered in the Chain Tables 1 and 2 or with a specific figure in Appendix A, B, or C of this modal instruction, use the AAR guidance found in rule 5.3.1, rule 5.4.2 and Appendix E of Section No. 1 (see footnote 1, page 1) for restraint requirements and breaking strength adjustments for compound angles. Most vehicles have four tiedown provisions, and

each provision must have the same number of chains attached to it. Also, the number of chains restraining movement in one direction (either longitudinal or lateral) must equal the number in the opposite direction (this is called symmetry). This usually results in the number of chains required being a multiple of four that is 4, 8, 12, 16, and so forth. If the AAR restraint calculations state that enough restraint is met by using a non-symmetrical number of chains, round up and add more chains so each tiedown provision has the same number and equal numbers of chains opposing each other. For example, if the AAR calculations determine that 9 chains are sufficient, use 12 chains to establish symmetry about the 4 tiedown provisions.

When unloading vehicles secured with chain tiedown assemblies:

- a. **Do not start the vehicle engine and stretch chain tiedown assemblies on end of the vehicle in order to slacken the assemblies of the opposite end.** Doing so damages both the chain assemblies and the railcar tiedown track.
- b. **Place the chain tiedown assemblies removed from the vehicles toward the center of the railcar so that the vehicles wheels or tracks will not roll over any part of the chain assemblies.** The chain assemblies are susceptible to roll over damage. If necessary to avoid rolling over them, remove the anchors of the chain assemblies from the flatcar tiedown channel. If loading or unloading from a side ramp, remove the assemblies from the area of the flatcar(s) used for driving between flatcar and side ramp; replace after the loading or unloading is complete.
- c. **Chain tiedown assemblies on empty railcars and unused tiedown assemblies on loaded railcars must be placed in the tiedown channels so that no part of an assembly can hang over the side or end of a railcar.** Chain tiedown assemblies hanging off the deck of a railcar have caused deaths, injuries, and derailments.

F. STEEL BANDING/STRAPPING

Steel banding can be used to secure secondary loads and to prevent some items from extending out over the flatcar sides. For instance, expansible vans are often banded to prevent the sides from expanding during rail transport. AAR rule 17 in Section No. 1 (see footnote 1, page 1) explains the requirements for banding. A new part of the rule requires users to inspect equipment and joint performance and perform tensile testing any time the equipment is modified to make sure they continue to produce joints of adequate strength. AAR rules 17.7.1

through 17.7.3 requires users to ensure joint performance is adequate. AAR rules 17.8.1 – 17.8.11 covers users’ responsibilities for inspections and required testing for steel banding. AAR rules 17.9.1-17.9.7 covers proper identification and marking of the steel banding. The following excerpt gives some of the detailed requirements:

“**17.7.2** It is the responsibility of the user(s) to ensure that the tools being used for tensioning and sealing are compatible with the type of banding and seals being applied and are in good working condition and capable of producing a properly formed joint.”

“**17.8.1** The compatibility and condition of the materials and joint-making tools and equipment for load securement bands must be verified by the user during initial application of the banding.”

“**17.8.5** At the beginning of every shift or comparable use period, a visual inspection shall be made of each joint-making apparatus and the first seal joints made with the inspected apparatus. The inspection shall determine that there are no apparent defects in the joint-making process or apparatus and that its components are in good working condition and maintained for optimum performance and endurance. Joints shall be inspected for proper band and seal orientation and application and to ensure that the deformations (crimps or notches) are properly oriented, spaced, shaped, and made to acceptable depths according to the equipment and product manufacturers’ specifications. If defects are found, the tool is to be removed from service until repaired.”

“**17.8.6** Tensile testing is required any time such equipment undergoes repair or replacement on any component or portion of the apparatus directly affecting its joint-making capability. Acceptable results from such testing will suffice as annual testing verification provided documentation is maintained as required in AAR rule 17.8.9.”

Section II. Wheeled Vehicles

A. PROPER TIRE INFLATION

The AAR rule 6.5.1 in Section No. 1 (see footnote 1, page 1) states **“Tires must be inflated as uniformly as possible to the tire manufacturer’s recommended pressures.”** All wheeled vehicles must have their tires fully inflated to highway pressure for rail transport. 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 tiedown chains loose and the vehicle unsecure. Also, flat tires have started fires on moving trains by rubbing of the wheel on pinched double layer of tire rubber against the rail deck (Figure 15). Repair or replace leaking tires.



Figure 15. Flat tires can catch on fire during rail transit.

As a last resort, block up the axle with solid hardwood blocking so no load rests on the tire. More than likely, axle blocking will require the use of a wood deck flatcar to nail the blocking to the railcar deck. Several AAR rules in Section No. 1 (see footnote 1, page 1) are applicable when axle blocking is required:

10.1 Hardwoods must be used.

11.2.1 Bearing pieces must be of uniform thickness and width for the entire length and all bearing pieces are to be untreated.

11.2.2 The width of the base must not be less than its height.

11.2.3 For General Rule loads, bearing pieces must be secured to the car floor.

11.9.3 For every 16 inches of blocking length, secure with at least one nail for each 2 inches of block width, or any fraction thereof, plus one additional nail.

11.9.4 Block securement nails must penetrate the car deck or other attaching member of a minimum of 2 inches.

11.9.8 When steel-floored cars are furnished in lieu of wood-floored cars, any floor blocking or metal-anchor plates required under figures or rules to be nailed to wood floors must be bolted to steel floors.

If blocking is required on steel deck cars, the servicing railroad(s) will have to be consulted if a particular blocking design can avoid being bolted to the floors as stated in **11.9.8**. If that is desired, contact all the servicing railroads for the load and route for pre-approval/acceptance of the blocking design. If assistance is needed in reaching the railroads, contact the DOD AAR Representative at usarmy.scott.sdcc.mbx.tea-dpe@mail.mil or (618) 220-5271 / DSN 770-5271. In general, welding securement devices to commercial steel deck flatcars is not encouraged. Welding on DODX steel deck flatcars is not authorized.

B. SHACKLE-LESS PROVISIONS

Per MIL-STD-209K, use of shackles as part of the lift and tiedown provisions on new vehicle designs is discouraged. Tiedown provisions on new vehicles will be equipped to allow either 3/8" or 1/2" chains on commercial flatcars to be fed through the provision opening and fastened back to the chain with the grab hook or allow the slip hooks used on 1/2" chains on DODX flatcars to attach directly to the tiedown provision opening (Figure 16).



Figure 16. Shackle-less tiedown provisions examples.

C. TRAILERS AND SEMITRAILERS

Units prefer to transport trailers attached to their prime mover as shown in Appendix A (pages A-12 and A-15). This minimizes the loading and unloading time and generally simplifies the tiedown procedure and reduces costs by eliminating any blocking required to support the lunette or kingpin. Unless specifically verified by a rail impact test, semitrailer landing legs cannot bear the shock of rail movement and must be raised at least 4 inches above the deck of the flatcar.

New trailer and semitrailer designs must follow requirements in MIL-STD-209K and MIL-STD-1366E that prohibit using blocking or stanchions. MIL-STD-209K in paragraph 4.1 states that the vehicle tiedown provisions shall provide the entire restraint of the item without any other restraint such as blocking, vehicle brakes, or other added material. MIL-STD-1366E in paragraph 5.2.1 states that preparation of a vehicle for rail transport must be kept to a minimum and does not permit adding items, including lumber or hardware, which is not a basic issue item for the vehicle. New trailer designs must consider how trailers would be moved by rail in retrograde when they may be separated from their prime mover.

Semitrailers that do not have dedicated prime movers can be shipped on specialized flatcars with retractable hitches or stanchions (page A-16). The entire restraint is provided by the hitch being locked on the semitrailer kingpin. This method of loading is called trailer-on-flatcar (TOFC). The hitches can only accommodate 2-inch kingpins and semitrailer gross weights up to 40,000 pounds. Trailers shipped by TOFC must meet AAR specification M-931, “Highway Trailers, All Types, for TOFC Service.” Trailers meeting the latest version of M-931-04, will have a “certification plate” adjacent to the DOT certification label. Some semitrailers can exceed the weight limit and may have 3-1/2-inch kingpins, and thus, cannot be shipped by TOFC.

The M969A2, M969A3, and the M967A2 are the only semitrailer tankers that are capable of rail transport loaded with fuel. Shipment of tankers by TOFC with fuel requires special permission from the Federal Railroad Administration (FRA) through SDDC Operations.

D. VEHICLES ON UNI-LEVEL RAILCARS

Uni-level railcars are designed for commercial vehicles and may only be used for the smallest tactical vehicles like unarmored HMMWVs. The uni-level cars (UTTX) use a wheel chock restraint system which consists of small metal wheel chocks and a web strap tire harness. The restraint system is design to hold 25” – 50” diameter tires. Some tactical

wheel tires are under 50" diameter, but are still too wide for the tire harness to properly fit (Figure 17). The inside of the uni-level cars measure 125" W x 176" H and 81'-5" L with a door opening of 120' W. Uni-level cars have a 127,000 pound load limit. Sufficient clearance is needed between the vehicle and the inside of the uni-level to allow the driver to exit the vehicle.



Figure 17. Uni-level cars use chock/web strap restraint system that does not fit most tactical vehicle tires.

E. VEHICLES ON BI-LEVEL RAILCARS

Bi-level railcars (BTTX) are used for smaller commercial vehicles. Due to size and weight constraints, the only tactical vehicle that realistically can use bi-level railcars are unarmored HMMWVs. The tiedown procedure is the same as for single-deck chain-tiedown flatcars. The types of chain assemblies on bi-level railcars vary widely. The local railroad can provide details about the chain assemblies and on the dimensions of bi-level flatcars. Before using bi-level railcars, check their dimensions to be sure sufficient clearance exists for the driver to get into or out of the vehicle after the vehicle is loaded on the flatcar. Typical loading dimensions are 108" W x 95" H on 89-foot long cars. Make certain your destination has ramps to unload the railcars in use. When ordering bi-level railcars, make certain that the railroad knows they will be used for military vehicles. Many bi-level cars are equipped with restraint devices such as frame tiedown T-hooks that are not suitable for most military vehicles. Make certain that the total load on each deck of the bi-level car does not exceed 40,000 pounds (typically 10,000 lbs maximum per vehicle).

F. GRATE/LOCK CHOCKING SYSTEM (GLCS) ON BI-LEVEL CARS

The GLCS (Figure 18) has been tested and approved by the AAR for HMMWVs without trailers. Use four chocks per HMMWV, carefully following the instructions posted

inside the bi-level car. In addition to those instructions, the HMMWV brakes must be set hard, the engine must be in neutral, and the transfer case must be in four wheel drive, low range.

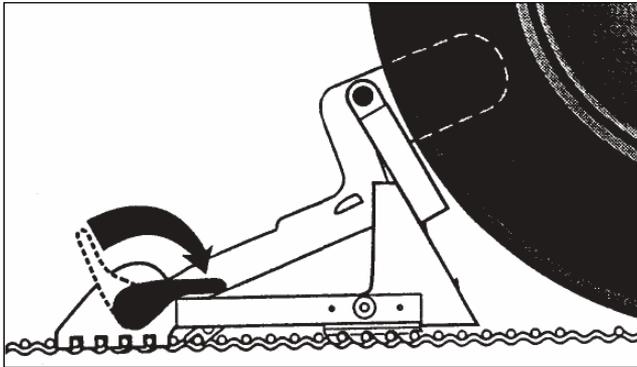


Figure 18. Grate/Lock Chock.

Section III. Tracked Vehicles

A. SHACKLES

Many tracked vehicles do not have tiedown shackles as basic issue items (BII). The towing hooks are not suitable for rail securement. Pack the towing hooks and use the towing lugs for tiedown by equipping them with shackles. Select the largest and strongest shackles that will fit the towing lugs.

TACOM has developed a special shackle suitable for light tracked vehicles. The national stock number (NSN) is 4030-01-369-7612, which is a 1-inch shackle, labeled 'WLL 12.5 T' (25,000 pounds, working load limit (WLL)), on which the pin has been replaced with a 1-inch grade 8 coarse thread bolt. The end of the bolt must be wired or secured by other suitable means to prevent the nut from vibrating off during rail transport. Note: Using lower rated shackles with 1-inch diameter pins is not acceptable.

For medium-sized vehicles, use the shackles developed for the Bradley, NSN 4030-01-187-0964. These shackles have a 1-3/8-inch-diameter pin and are labeled WLL 21 T. The 21 T shackle (210,000 lbs min breaking strength) is a 1-1/4 inch size safety anchor shackle with a 1-1/4-inch body, a 3-1/4-inch-diameter opening at the bow, and a 1-3/8-inch bolt pin. No wire tying is necessary on this shackle if the cotter pin is in place.

Heavy vehicles require either the special unmarked (by unmarked we mean no WLL, manufacturer, nor size marking; many are indeed marked "Japan") military shackles developed for the DODX 40000-series flatcar or the 21 T shackles. Some vehicles may still need the link ring (donut) in the pintle as a tiedown provision. The unmarked military shackles have a 1-1/2-inch body, a 4-inch-diameter opening at the bow, and a 1-3/8-inch-diameter screw-pin. Any tiedown point that requires three chains requires the 4-inch-diameter or larger opening shackle. For tiedown points that require no more than two chains, the 21 T shackle may be used. The above numbers of chains allowed per shackle are based on DODX flatcars that have a slip hook at the free end of each chain assembly. On flatcars such as HTTX on which the chain assemblies have no slip hook, the chain is passed through the tiedown shackle and secured to itself with an adjustable double grabhook. Up to four 1/2-inch chains can be passed through the 21 T shackle. The unmarked military shackles are in the supply system (NSN 4030-01-391-2790), but they are not stocked and are expensive. They may be obtained quicker and more cheaply commercially. Acceptable commercial shackles have the following manufacturers' part numbers:

Shackle: MacLean-Fogg 61284 or Midland Forge MK0267

Link or Ring: MacLean-Fogg 61283

(The link/ring is no longer essential for rail transport, but is still required by the Air Force for air transport)

The suppliers of the MK0267 shackle is Columbus McKinnon Corp., Midland Forge (319) 362-1111.

Suppliers of the MacLean-Fogg 61284 shackle and MacLean-Fogg 61283 link/ring:

Holland Company (708) 672-2300 extension 779

John Sakash Company (630) 833-3940

Shackles will not be permitted on future/new designs of vehicles. It is too costly to SDDC keep replenishing shackles that go missing from vehicles. The next paragraph describes a shackle-less provision that will become more common on newly designed vehicles.

B. SHACKLE-LESS TIEDOWN PROVISIONS

Per MIL-STD-209K, use of shackles on new vehicle design is discouraged. Tiedown provisions on new vehicles allow the slip hook used on 1/2" chain assemblies to attach directly to the tiedown provision opening (see page B-25). For vehicles over 50,000 lbs, MIL-STD-209K allows for a two-hole provision to be used to meet restraint requirements provided the tiedown provision openings are at least 3-1/2" in diameter (Figure 19). Use a maximum of two chains per 3-1/2" diameter provision opening.

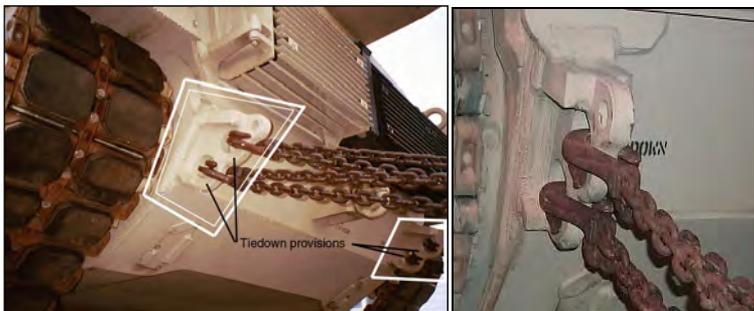


Figure 19. Two-hole shackle-less tiedown provisions.

C. TRACKED VEHICLE TURRET RESTRAINT AND SIDE OVERHANG

Once the tracked vehicle is in place on the flatcar, tie the gearshift lever in the neutral position. Set the brakes if available. Wire the turret lock and elevating mechanisms in place, and engage any hull-mounted barrel lock. Ensure that two complete wire rope loops have been put around the barrel and secured one to each side of the hull (details given below). This procedure provides positive visible protection against the barrel elevating or the turret turning.

If applicable, wrap cushioning material (waterproof paper, burlap, or plastic—to protect the paint) around the gun tube, and secure the gun tube with one complete loop of 3/8-inch wire rope, with two clamps, to a lifting eye on each side of the gun tube (a total of 2 complete loops) as shown in Figure 20. On the M1 tank, use the engine hatch cover lifting eyes as the hull attachment points for the wire rope loops. Hand tension the wire rope, but fully torque the clamps. This must be checked at the flatcar loading site, but will be easier to apply at the motor pool before loading begins.

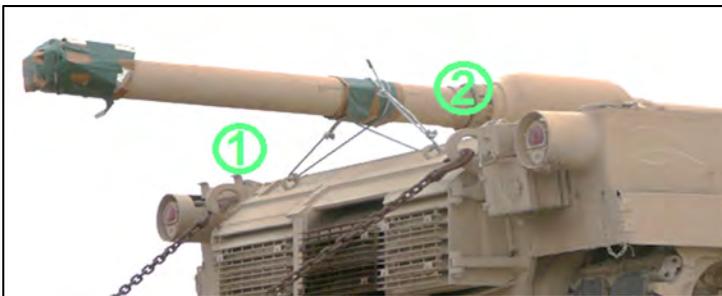


Figure 20. Wire rope tiedown of gun tube on turret.

Many tracked vehicles are wider than the flatcar. Therefore, when loading tracked vehicles onto flatcars, be sure to center the vehicle on the flatcar. The overhang of the vehicle on each side of the flatcar must be equal to avoid rail clearance difficulties. Measure the overhang on both sides from the car side to the edge of the vehicle's track. The allowable variation is when the two measurements, one subtracted from the other, have a difference of 1-inch or less. This results in the longitudinal centerline of the load being no more than 1/2-inch away from the flatcar longitudinal centerline.

The bridge sections of tracked vehicles used as bridge launchers normally must be removed and shipped separately. Additional transportation guidance can be found on the

vehicle data plate, operator's manual, or (for older vehicles) the transportability guidance technical manual applicable for the vehicle being secured.

D. TRACKED VEHICLES ON CHAIN-EQUIPPED FLATCARS

The size and number of chains required will depend on the size and weight of the vehicle. Slip hooks as used on the DODX 40000-, 41000-, and 42000-series flatcars should be applied to tiedown provisions with the point down (Figure 21). If the hooks are placed horizontally, they can point either direction.

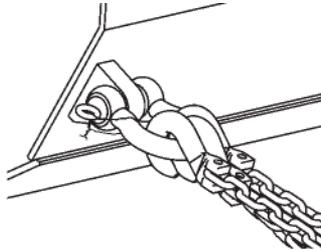


Figure 21. Slip hooks with the point down.

NOTE

As most rail shipments are charged per car, it is usually best to use the longest car that can be fully loaded with the weight and width of the vehicles being shipped. In addition, because there are more commercial than DODX chain flatcars, commercial cars should be used in preference to DODX when either car can carry the same number of vehicles. For some examples, most armored personnel carrier variants are narrow and light enough that they can fully load a TTDX 89' commercial chain flatcar. The lighter M2/M3 Bradley variants can be shipped 3 to a DODX 42000-series flatcar; the heaviest can be shipped 2 to a HTTX commercial chain flatcar. Two M1 Abrams tanks can be shipped only on a 6-axle DODX 40000-series flatcar, but the DODX 41000-series flatcar can carry a single tank (see also "Section IX. Flatcar Types" on page 43). Tracked construction equipment that do have rubber pads on the track tread should be loaded on HTTX cars to avoid metal on metal on DODX flatcars. This will also make the circus loading operation safer.

Section IV. Tools for Rail Loading

Table 1 outlines the suggested rail loading toolkit needed by personnel conducting a rail load out in CONUS. Specific information on some items follows the table.

| Table 1. Suggested CONUS Rail Loading Toolkit | | | |
|--|-----------------------------|---|---|
| <i>Quantity</i> | <i>Item</i> | <i>Remarks</i> | <i>National Stock Number</i> |
| 1 pair | Pliers | Side cutting or slip -joint (8-inch) | 5120-00-239- 8251 5120-00-059-6711 |
| 2 | Puller, Hoist | Cable puller (used with cable grips), 4000-pound capacity | 5120-01-337-6485 |
| 2 | Ratchet | 1/2-inch square drive, reversible | 5120-00-230-6385 |
| 1 | Removable Turnbuckle Handle | To rapidly tighten turnbuckles with turnbuckle gear | Available from Portec Rail Products, Inc. Phone 630-573-4778 |
| 1 | Screwdriver | Common, 8-inch | 5120-00-596-9364 |
| 2 | Socket | 1/2-inch square drive, 3/4-inch (12-point) | 5120-00-189-7985 |
| 2 | Socket | 1/2-inch square drive, 7/8-inch (12-point) | 5120-00-189-7934 |
| 2 | Socket | 1/2-inch square drive, 15/16-inch (12-point) | 5120-00-189-7935 |
| 2 | Tape Measure | Steel, 12-foot, recoil type | 5210-00-182-4797 |
| 1 | Wire Cutter | Steel wire cutter | 5110-01-473-9293 |
| 1 | Nail Puller | If not on pliers | 5120-00-542-4828 |
| 1 | Wire Rope Cutter | Hydraulic, 1-1/8-inch cable capacity | 5110-00-224-7058 |

Table 1- Continued

| <i>Quantity</i> | <i>Item</i> | <i>Remarks</i> | <i>National Stock Number</i> |
|-----------------|---------------------------------|--|--|
| 1 | Brace and Bit or Electric Drill | To pre-drill lumber for spikes, if needed | 5130-00-935-7354 |
| 1 | Drill set, Twist | Sizes 1/16 to 1/2-inch by 16ths | 5133-00-293-0982 |
| 4 | Cable Grip | .162 to .552-inch capacity .5 to .75-inch capacity | 5120-00-238-4436 5120-00-224-2661 |
| 1 | Chain Saw | Gasoline-engine-driven, 10-inch bar(requires chain lubricating oil and gas/oil fuel mixture for two-cycle engines) | NA |
| 2 | Claw & Pinch Bar | 30-inch length | NA |
| 1 | Drift or Pin Punch | 1/8-inch point, .313 stock diameter, 8-inch length | 5120-00-240-8898 |
| 1 | Flex Handle (Breaker Bar) | 3/4-inch square drive, 20 inches long | 5120-00-221-7959 |
| 1 | Torque Wrench | 1/2-inch square drive, for wire rope clips | 5120-00-640-6364 |
| 3 | Hammers | 1-pound 2-pound 3-pound | 5120-00-061-8543 5120-00-061-8546 5120-00-900-6111 |
| 2 | Marker Crayon | One black, one yellow (no stock info) | NA |
| 2 | Monkey Wrench | Lightweight, 10.25 to 13.75 inches long, 2.125-inch capacity | 5120-00-293-3009 |

Table 1- Continued

| <i>Quantity</i> | <i>Item</i> | <i>Remarks</i> | <i>National Stock Number</i> |
|-----------------|------------------------------------|---|------------------------------|
| 1 | Hard Hat or Soldier Issued Helmet | Commercial Safety Hard Hat or Ballistic Helmet | 8415-00-935-3135 |
| 1 | Eye Protection | Safety Glasses/Goggles or Face shield Visor for Hard Hats | NA |
| 10 pair | Gloves, Work | Leather or leather-palm | NA |
| 1 | Steel-toed or Soldier Issued Boots | “Lace-up” footwear that covers ankles and has a defined heel. | NA |
| 1 | Safety Vest | Reflective, Lime, or Orange | NA |

A. SOCKET

Users must check socket sizes against actual hardware that will be used. The nut size used on wire rope clamps varies by manufacturer and by clamp size.

B. FLEX HANDLE (COMMONLY CALLED “BREAKER BAR”)

For tightening the chain and the anchor block of a chain-tiedown assembly, this tool is more effective than a 3/4-inch drive ratchet. It costs much less than a ratchet and is less likely to be pilfered. An even more cost-effective substitute would be a locally fabricated tool made of 3/4-inch square bar stock, cut into 20-inch lengths, and bent 90 degrees on the end (2 or 1-1/2 inches) of each bar. This would form, in effect, a huge Allen wrench, and would be as effective as a more expensive tool since the chain winch usually requires only one-half to three quarters of a turn to tension the chain. Do not use a cheater bar or pipe extension handle on the wrenches, or you could over tension and break the chain assembly or break the wrench.

C. MONKEY WRENCH

Some chain tiedowns are tensioned by a turnbuckle (see Figure 11) with a tubular body in the chain assembly, rather than by a winch in the anchor block. Although the slack can be

taken out of the chain by manually twisting the turnbuckle (which gives the tiedown the appearance of being tight), additional tension is necessary and can be applied with a wrench, since one end of the turnbuckle body has a 1-1/2-inch hexagonal section. A 15-inch adjustable wrench is the smallest that will open to 1-1/2 inches. However, a much smaller (11-inch) and less expensive monkey wrench will open to 2-1/2 inches, for turning the turnbuckle and for other uses requiring a general-purpose wrench. Two wrenches are needed, one to hold the turnbuckle and one to set the jam nut.

D. GLOVES

Leather or leather-palm work gloves must be worn by persons loading flatcars. The gloves may be included in the toolkit or issued by the unit supply section. Regardless, gloves must be worn for safety reasons. Leather gloves must be locally purchased.

E. CHAIN SAW

A small gasoline-engine-driven chain saw with a 10-inch cutter bar is useful for cutting lumber at the loading area. One saw with a qualified operator is sufficient at each loading site (not one saw per toolkit). With the use of blocking diminishing, the chain saw may not be needed at the loading site. Minimal blocking may be required for retrograde equipment. Movement of retrograde equipment typically requires use of wood deck railcars.

Any lumber items needed should be delivered to the loading site in precut, usable lengths. This allows the chainsaw to be used only for cutting special blocking and bracing pieces for unusual equipment or for special cases. Handsaws are far too slow and are usually kinked by inexperienced “carpenters.”

Section V. Tips and Common Mistakes

A. SAFETY

1. Provide proper safety briefing (see Section X for checklist).
2. Ensure proper personnel protection equipment is worn (helmets, vests, boots, gloves, safety glasses, etc).
3. Ensure there are an adequate number of ground guides.

B. PREPARING VEHICLES PRIOR TO LOADING

1. **Be sure that all lifting and tiedown shackles are attached to the vehicle.** Do not use bumperettes, axles, towing pintles, or towing hooks as points of attachment, except where specifically shown in a figure.

2. Make sure fuel tanks are no more than three-quarters full. Jerry cans are either DOT 5 metal or POP (performance oriented packaging) certified plastic 5 gallon containers. The safest transport is empty and purged of fuel. The POP certified containers are less likely to leak than the metal ones and are, therefore, the preferred type if you must transport fuel.

3. Remove or band canvas and bows to prevent wind damage.

4. Protect windshields from thrown rocks (if needed; this is a local decision). Notched plywood banded in place works well. Remember, what you use will have to withstand sustained high wind in either direction on the moving train.

5. Reduce vehicles to their lowest transport configuration.

6. Secure any materials or equipment loaded in the beds of trucks by banding or other means. Such loads are called nested or secondary loads. Bands (also called steel strapping) should be at least 3/4 by 0.020 inches and must be AAR approved. Bands must be applied with the AAR approval marking facing out. Make certain the band sealing tool inspection and testing records are up to date (see page 17). You may also use wire rope properly secured with clamps, see pages 5 and 6. Nylon straps are not AAR approved. Hemp, sisal, manila, and other natural and man-made fiber rope are not an approved tiedown for secondary loads. Polyester webbing is approved for vertical tiedown only; lateral and longitudinal restraint must be by other approved materials. Do not load secondary loads on non-cargo areas of

equipment such as van tops and vehicle sides.

7. Make certain that hood and door latches are functional and secure (wind and vibration can tear hoods off or allow/cause doors to open during transport). Secure doors internally with combat locks or externally with web straps with edge protectors, security seals, or wire tie as appropriate. Vehicles may travel facing forward or backward or both on a particular rail journey.

8. Inflate tires to highway pressure. Repair or replace leaking tires. As a last resort, block up the axle with solid blocking so no load rests on the flat tire. **A flat tire on a truck loaded on a moving train can cause a fire due to the rubbing of the wheel on the pinched double layer of tire rubber against the deck.**

9. Install the rail transport locking pins on all PLS and LHS flattracks loaded on the trucks and trailers on both sides (see pages A-5 and A-6).

C. PREPARING FLATCARS FOR LOADING

1. Inspect flatcars to verify deck suitability. Holes in decking, bad order safety appliances, and so forth, must be repaired by the railroad prior to loading, or the car must be rejected by the installation transportation officer (ITO) or his representative at a port or activity. On chain equipped cars, anchor channels should not be bent, and all chains and tightening devices should be operative (including the compression units in the chain assemblies). Loading teams should have rust retardant oil available to free frozen locking devices.

2. Ensure blue signal/flags are posted to alert workers are on the rail line. Switch will be lined and locked for non-working track.

3. Chock flatcar wheels to prevent movement while loading.

4. Store unused chains in the channels to prevent damage when loading vehicles. This is also a safety precaution, as chains left on deck can vibrate over and hang off the car causing a potential for a derailment.

5. Clean debris from anchor channels on chain-equipped cars to allow locking devices to be moved the length of the channel. Remove any protruding nails from the deck of the car (they are a tripping hazard).

D. LOADING VEHICLES

1. Use flatcar and ground guides when loading vehicles. Guides should keep one

flatcar distance between them and the vehicle being loaded. **A guide should never walk backwards on a flatcar onto which a vehicle is being loaded.** Before directing the loading of a second vehicle, the flatcar guide should mount the previously loaded vehicle to avoid being crushed between the vehicles.

2. When loading wheeled vehicles, use spanners strong enough to support the heaviest load anticipated and properly position them (wood spanners are generally not strong enough for military vehicles) (see pages 38-41). **Spanners are designed for one-way travel only; ensure kick plate is oriented in the direction of travel.** When loading vehicles between flatcars of unequal deck heights, be sure to place dunnage under the spanner to prevent it from slipping. When driving on spanners, try to maintain a constant speed; avoid four-wheel drive, jamming on brakes, and reversing. For added safety, use nylon straps to secure spanners between flatcars.

3. Be sure to leave at least 10 inches between vehicles to avoid damage in transit and to obtain a proper angle of tiedown.

4. When loading wheeled vehicles on multilevel flatcars, exercise care when going from one flatcar to another. Loading decks may be set at different heights, thereby causing the top of the vehicle to strike the upper deck. Load bottom decks first since the upper deck ramps may block the lower deck.

5. **Do not overload railcars.** Check the weight on each car against the load limit stenciled on the side of the car. Try to keep the loaded center of gravity on each carload below 98 inches. This is not an issue with most military equipment, but can arise with heavy secondary loads. Speed restrictions apply if the combined center of gravity is above 98 inches. **Lower vehicle to the bump stops, if required, once in place.**

6. Ensure no overhead electric power lines exist near loading area. If lower lying power lines are present, ensure all antennas are removed or securely tied down. Personnel have died from contacting or from being within close proximity to power wires. Personnel should avoid climbing on top of vehicles when overhead power lines are present in the loading area.

E. SECURING VEHICLES

1. Turn turntable-type winches in the proper direction so that the chain is taken up on the underside of the ratchet wheel (Figure 22).

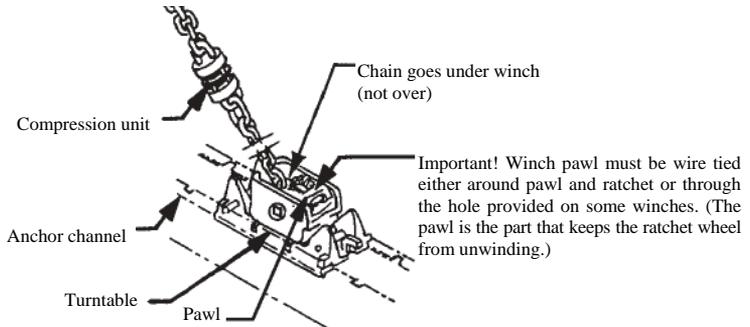


Figure 22. Correct position of chain anchor winch.

2. Vehicles equipped with air suspensions shall have the suspensions bled prior to application of chains to restrain it properly for transport. This is done to prevent air suspensions from leaking and losing pressure causing the vehicle to lower significantly in transit and introduce an unsafe amount of chain slack. Vehicles that have a mix of spring suspensions and air suspensions can leave the air suspension intact as long as there is at least one axle with a spring suspension on the front and back of the vehicle.

3. Be sure proper tension of wire rope or chains exists. Tension wire rope to allow no more than 1-inch deflection when supporting the weight of a full grown man. Tension chains to achieve a moderate deflection of the vehicle's suspension. After initially tensioning each chain, strike it sharply with a hammer or bar and retighten. Repeat this step if necessary. This helps the links seat in their longest length and helps prevent loose chains in transit.

4. Stow unused (excess) chain in the anchor channel. Failure to stow unused chains allows the chains hang over the side or end of the railcar where injury to personnel, damage to equipment, or even train derailment could result.

5. On chain devices, secure open hooks (grab hooks) to the chain link with wire or nylon zip tie (this does not apply to claw hooks or to slip hooks applied directly to a tiedown provision).

6. Lock chain-tightening devices with wire. Turnbuckles must have jamnuts tightened wrench-tight with two wrenches or must have locking sleeves, which must be lowered to eyebolt (see Figure 12).

Section VI. Comparison of the Rail Shock Environment

In North America, Europe, and Korea

Railcars in North America use automatic couplers, while in Europe, railcars are linked together manually. Automatic couplers tend to encourage impacts to ensure engagement of the coupler mechanism. The railroad companies admonish their employees not to impact cars faster than 4 mph, but higher impacts sometimes occur. The Association of American Railroads (AAR) rail impact test, used to verify the safe loading procedures for most commodities, calls for impacts of 4, 6, and 8 mph and then 8 mph in the opposite direction. Military vehicles must pass the MIL-STD-810 version of the AAR test to receive transportability approval.

The European cars do not have automatic couplers. Instead, they are coupled by hand using a turnbuckle-like device that draws the cars together. European cars have buffers, one at each corner on the ends, which are pulled together and compressed by the coupling device. This arrangement limits the slack in European trains. The Korean railroad uses automatic couplers similar to those in North America, but the flatcars are typically loaded and unloaded as a unit train, so the cars are not as likely to be uncoupled and coupled as in North America.

The automatic couplers are attached to the car frame through a draft gear that may be standard or cushioned. The division between standard and cushioned is travel of less than 5 inches for standard and greater than 5 inches for cushioned. Standard draft gear travel is usually about 2 to 3.5 inches. Cushioned draft gear travel is usually about 9 to 15 inches. Cushioned cars are typically used for military moves. The draft gear provides shock mitigation in buff (compression), and if not extended, in draft (tension) but also adds slack to a train. Slack is the difference in length of a train between being bunched together and being stretched out.

Railroads in North America operate significantly longer trains than in Europe. The longer trains, combined with the major difference in coupling systems, lead to higher shocks in moving North American trains. As a train goes up and down hills, accelerates, and applies the brakes, the slack runs in and out, propagating shocks as the cars rapidly change velocity. European trains usually consist of 20 to 40 cars. Korean trains are typically limited to 22 cars due to the length of passing sidings, so in-train shocks due to slack would be significantly less than in North America.

Heavier loads are transported on trains in North America. Allowable railcar axle loads in North America are roughly 50 percent higher than those in Europe and Korea. That means that the mass (weight) of each car in North America may be significantly higher than in Europe or

Korea, thereby contributing to higher shock levels. This is true of military trains, since a North American 89-foot car will hold more vehicles than a typically used European 61-foot (18 500-mm) flatcar with the same number of axles. Korean cars are shorter than North American cars, also having the effect of lowering the total mass of a train.

Hump operations can also cause severe shocks. A hump is a hill, which cars pass over and are allowed to roll into one of multiple tracks and is used to sort cars based on destination. Several humps do exist in Europe. The biggest difference between the humps in North America and Europe is that in North America the cars are expected to couple, while in Europe excess impact could cause the cars to bounce apart.

The distances traveled by rail in North America are vastly greater than those in Europe and Korea, therefore, the cumulative effect of shocks is greater.

Former Soviet Union (FSU) railroads use a similar coupling system to the one used in North America, so the shock environment will fall somewhere between that in North America and in Korea depending on the length and speed of the trains (see page 55).

Rail tiedown in North America requires the highest level of restraint of all modes of transport. The procedures in this tiedown instruction are suitable for North American and possibly FSU rail transportation but will be excessive for rail transportation in other countries.

Section VII. Spanners

Spanners are bridge plates that allow wheeled vehicles to roll from one flatcar to the next. The military has never standardized nor officially recognized the need for spanners, so they continue to be a locally produced or purchased item. Spanners can be wooden, steel, or aluminum, and there are many opinions about the relative advantages of one type over another. Be sure the spanner has the capacity needed for the vehicles being loaded. Wood spanners may not have enough capacity for loading military vehicles.

Ensure safe use of spanners. Spanners are designed as a one-way piece of equipment. Spanner kick plates must be oriented in the direction of travel. Spanners must not move during movement of vehicles on railcars. Do not stop vehicles on spanners. Do not take running start to get over spanners. Do not back up after crossing a spanner. When loading vehicles between flatcars of unequal deck heights, be sure to place dunnage under the spanner to prevent it from slipping as shown in Figure 23.



Figure 23. Dunnage for unequal height railcars.

Spanners need to be secured properly prior to loading to avoid damaging a vehicle or equipment or injuring personnel during loading operations. Spanners can generally be secured to the railcars using grab handles on the end of the cars. Utilize sufficient strength straps or chains (either additional or from railcars) to secure the spanners. Keep in mind the equipment being loaded and try to avoid any roll over damage if using railcar chains. Figures 24 and 25 show examples of securing spanners to commercial railcars

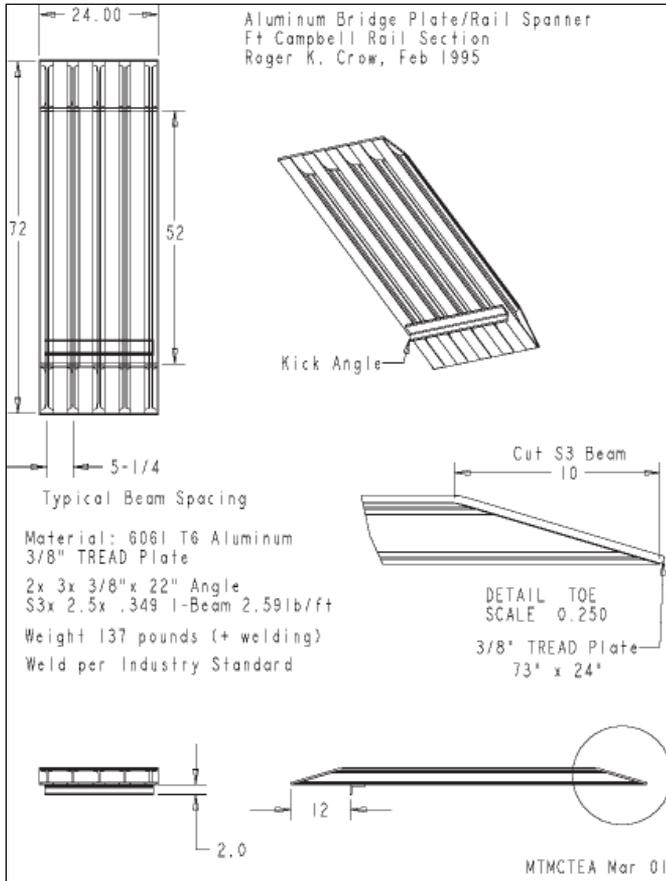


Figure 24. Securing spanners with straps



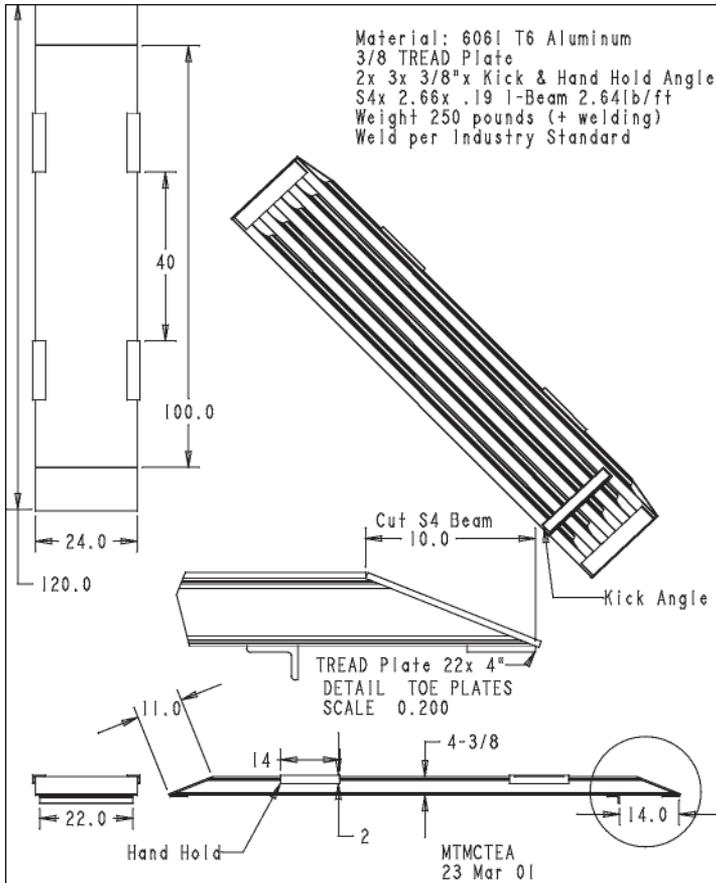
Figure 25. Securing spanners with rail chain

We have looked in some detail at an aluminum spanner design and it is presented here as one option (Figures 26 and 27). The choice of design remains with the local unit. Most spanners will be the 6-foot size, but most installations will also need some 10-foot size spanners.



**Figure 26. Six-foot aluminum spanner.
(Dimensions in inches)**

The 10-foot spanners are needed to accommodate flatcars with sliding cushioned center sills. The spanners shown here are good for vehicle loads up to and including the palletized load system (PLS), that is, axle weights up to 20,000 pounds.



**Figure 27. Ten-foot aluminum spanner.
 (Dimensions in inches)**

Section VIII. Loading Ramp

The military often uses an end ramp for circus-loading flatcars. Below (Figure 28) is a steel ramp that can be locally fabricated to provide some flexibility in the choice of loading sites. An engineering/manufacturing drawing for the ramp can be found on our web site: <http://www.sddc.army.mil/sites/TEA/Pages/default.aspx>

Specifically under railcar equipment at:

<http://www.sddc.army.mil/sites/TEA/Functions/Deployability/TransportabilityEngineering/Modeling/Pages/3DModeling.aspx>

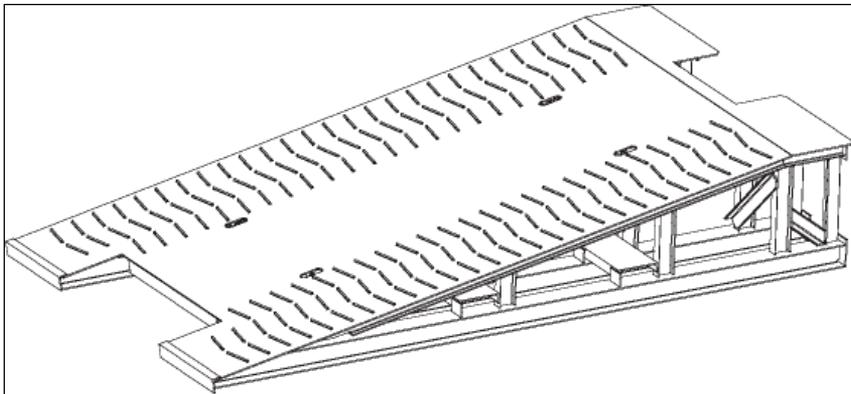


Figure 28. Steel end ramp for wheeled and heavy tracked vehicles.

Section IX. Flatcar Types

A relatively few types of chain-equipped flatcars serve the bulk of the military's needs. Flatcar lengths fall into two main categories: 60 to 68 feet and 89 feet. The shorter cars are typically about 10 to 10-1/2 feet wide and the 89-foot cars are 9 to 9-1/2 feet wide. Most of the commercial flatcars are nominally 70-ton capacity cars, while the DOD-owned cars (DODX) are 100-ton cars for the DODX 41000- and 42000-series (Figures 29 and 30) and 150-ton cars for the DODX 40000-series (Figure 31). The weight each flatcar can actually carry, and which you must not exceed, is stenciled on the side as the load limit (LD LMT). Additional information is published in MIL-STD-1366 available at our web site under the "Transportability Engineering Publications" tab:

<http://www.sddc.army.mil/sites/TEA/Functions/Deployability/TransportabilityEngineering/Pages/default.aspx>



Figure 29. DODX 41000-series 68-foot flatcar.



Figure 30. DODX 42000-series 89-foot flatcar.



Figure 31. DODX 40000-series 68-foot flatcar (note three-axle trucks).

Among the commercial flatcars, the majority are owned by TTX Company with the others being owned by the various railroads. The OTTX (Figure 32), most ITTX (Figure 33 and 34), and similar flatcars are equipped with 3/8-inch chains, which are suitable for the generally lighter military vehicles. The HTTX (Figure 35), TTDX (Figure 36), and some ITTX cars are equipped with 1/2-inch chains suitable for all military vehicles that will fit on each car type. These TTX cars will reach the end of their 50-year life starting in 2015. To replenish those cars, TTX is issuing some TPAX cars that are 60-foot long similar to the HTTX cars. Additionally, TPDX (Figure 37) are 89-foot long with steel decks with a 200,000 lb capacity. Both the TPAX and TPDX cars are issued with new style 1/2-inch chains.



Figure 32. OTTX 60-foot flatcar.



Figure 33. ITTX 89-foot flatcar with side rails.



Figure 34. ITTX 89-foot flatcar with wood deck.



Figure 35. HTTX 60-foot flatcar.



Figure 36. TTX 89-foot flatcar with deck layout similar to the ITTX flatcar.



Figure 37. TPDX 89-foot flatcar with deck layout similar to DODX 42000 flatcar.

TTX has a few STTX flatcars issued for trial use (Figure 33). It's an 89-foot long flatcar that attempts to duplicate the functionality of the DODX 42000- series car. It has deck level chain tiedown channels similar to the ITTX cars but they are not fully recessed like the DODX series cars. They are equipped with 70-ton railcar trucks. As older TTX rail cars hit the end of their 50-year service life, TTX may supply some railcars like this to meet future commercial and military rail transportation requirements.



Figure 38. STTX Prototype 89-foot flatcar.

TTX also has some flatcars, not normally used by the military, equipped with deck holes that enable them carry military vehicles and ISO containers. These 89' flatcars are stenciled with PTTX and XTTX reporting marks. They can transport military vehicles provided that specialized 1/2" chain assemblies are used and any deck dunnage is removed. As shown in Figure 38, these flatcars have columns of circular anchor holes in the deck for these chain assemblies to secure into the deck. The specialized 1/2" chain assemblies must be equipped with approved AAR removable chain anchors (see footnote 1, page 1, Rule 21.8.5, Section No. 1). Each of the specialized 1/2" chain assemblies are equipped with two approved removable chain anchors, one located at the end of the assembly below the turnbuckle and one on the other end near the slip hook.

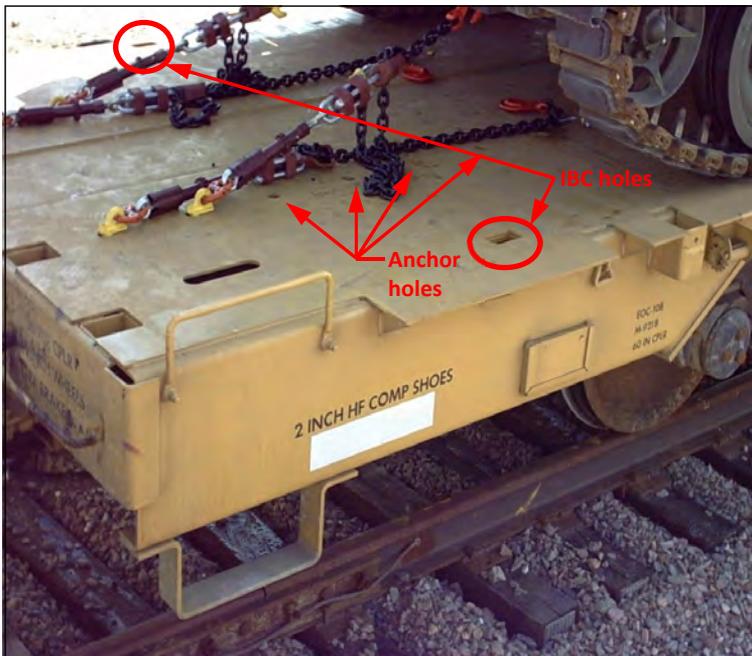


Figure 39. 89-foot flatcar with anchor holes.

At origin, vehicles can be circus loaded onto the flatcars and secured using the same number of chains required on flatcars that use the typical notched channels and anchors. As there are no channels to store unused chain assemblies, each unused assembly must be stretched out and fastened to a nearby open anchor hole using the second anchor near the hook. Each unused chain assembly must be stretched enough to eliminate any chance that it could hang over the side or end of the railcar that could result in injury to personnel, damage to equipment, or even derail the train.

At destination, as usual, the chain assemblies are removed from the vehicles and moved toward the center of the flatcar. Vehicles can then be driven off without rolling over the chain assemblies. After unloading the vehicles and prior to departing to a new

destination, again, each unused chain assembly must be stretched out and both chain anchors secured into deck anchor holes.

These flatcars can be equipped to rail transport 20- and 40-foot ISO containers. The flatcars must be equipped with ISO container inter box connectors (IBCs) in the holes provided for then in the deck. In Figure 39, the IBCs would be inserted in the small rectangular holes near the track of the vehicle. Table 2 provides a summary of the flatcar fleet. For questions on these flatcars, contact the DOD AAR Representative at usarmy.scott.sddc.mbx.tea-dpe@mail.mil or (618) 220-5271 or DSN 770-5271.

Table 2. Flatcar Fleet

| <i>Flatcar Type</i> | <i>Length (feet)</i> | <i>Capacity (pounds)</i> | <i>Chain Dia. (inches)</i> | <i>Number of chains per car</i> | <i>Approximate Quantity Till 2030</i> |
|---------------------|----------------------|--------------------------|-----------------------------|---------------------------------|---------------------------------------|
| DODX 40000 | 68 | 298,000 | 1/2 | 36 | 560 |
| DODX 41000 | 68 | 180,000 | 1/2 | 36 | 250 |
| DODX 42000 | 89 | 164,000 | 1/2 | 36 | 530 |
| ITTX | 89 | 140,000 | 3/8 or 1/2 | 36 | 1,500 |
| TTDX | 89 | 140,000 | 1/2 | 40 | |
| TPDX | 89 | 200,000 | 1/2 | 36 | |
| OTTX | 60 | 144,000 | 1/2 | 36 | 1,100 |
| HTTX/TPAX | 60 | 146,000 | 1/2 | 36 | |
| STTX | 89 | 140,000 | Must add anchor hole chains | | 4 |

Section X. Safety Checklist

For Rail Load Outs

- Are Blue Flags in place alerting rail crews that workers are present?
- Are railcars properly chock blocked at the end?
- Any adverse weather conditions (poor visibility, wet, icy)?
- Is there a safety team tasked within the unit comprised of experienced personnel to watch over rail operations?
- Are ground guides and personnel securing the vehicles to the railcar wearing proper personal protection equipment?
- Remind soldiers to stay alert – no sleeping, resting, or standing around under, on, or between railcars.
- Remind soldiers to remove rings, watches, and secure ID tags.
- Remind soldiers to use proper railcar steps and handholds when getting on and off the railcar.
- Have ground guides been instructed to never walk backwards?
- Have ground guides been instructed not to stand on the same railcar that the guided vehicle is on?
- Are spanners of strong enough capacity to handle vehicles being loaded?
- Are spanners placed in the correct direction and secured from popping out and off?
- Loading in area with low power lines? If so, secure antennas and keep personnel from climbing on top of vehicles.
- Is proper shade/shelter/food/water provided?

See TM 4-14.21 Rail Safety for more safety instructions.

Section XI. Loading and Tiedown Checklist

For Vehicles on Chain Tiedown Flatcars

NOTE: Copies of this page should be distributed to loading teams.

- Make certain all hood latches are secured (to avoid wind damage).
- Leave at least 10 inches between vehicles.
- Check for proper brake wheel clearance (see Figure 1, page 2).
- Ensure tires are properly inflated.
- Do not cross the chains.
- Use symmetrical tiedown patterns (multiples of 4).
- Secure tiedowns at approximately 45° angles. If chains are less than 45° angles, secure load binders with wire or zip ties.
- Seat and lock chain anchor or winch.
- Secure shackle in tiedown provision with wire tie or cotter pin.
- Pull chain tight and attach hook above the compression unit.
- Use appropriate tools.
- Make sure chain is not kinked or binding by striking chain with a hammer or bar and retighten the chain as needed.
- Secure hooks with wire or nylon zip tie.
- Make sure turnbuckles are wired or locked.
- Lower locking sleeves, if present. Otherwise, tighten jamnuts with two wrenches.
- Do not secure chains to axles or springs unless indicated by a figure.
- Make certain turrets and guns, side skirts, outriggers, crane booms, expandable van bodies, movable parts, vehicle doors and mirrors, and secondary loads are secured from extending up or out over the side of the flatcar during transport.
- Secure unused chains in tiedown channels.

Section XII. Practical Tips

For Units Deploying by Rail

By Chief, Rail Fleet Branch
Military Surface Deployment and Distribution Command
1 Soldier Way, Scott AFB, IL 62225
Army.SDDC.OPS.DODX@mail.mil
618-220-6870 (DSN 770)

A. INSTALLATION TRANSPORTATION OFFICE (ITO)

1. Keep the ITO up-to-date on changes in quantities/types of equipment being shipped.
2. Military Surface Deployment and Distribution Command (SDDC) and your ITO are accustomed to dealing with each other; ask your ITO to pass on to you any information they receive from SDDC about your movement.

B. FLATCAR SUPPLY

1. The railcar fleet contains both DODX and non-DODX flatcars.
2. DODX 40000-series flatcars (6-axle, 68') can carry two heavy tracked vehicles and DODX 41000-series flatcars (4-axle, 68') can carry one; these are the only flatcars authorized to carry heavy tracked vehicles.
3. DODX 40000-, 41000-, and 42000-series (4-axle, 89') flatcars all have 1/2-inch chain tiedown assemblies for vehicles and container attachment points for 20-foot ISO containers. DODX 48000-series flatcars (4-axle, 89') have only container attachment points.
4. Most non-DODX chain tiedown flatcars have the following reporting marks: OTTX (60', 3/8" chains), HTTX (60', 1/2" chains), ITTX (89', 3/8" chains), TPAX (60', 1/2" chains), TPDY (89', 1/2" chains), and TTDX (89', 1/2" chains). For peacetime moves, commercial cars should be used unless moving heavy tracked vehicles that require the capacity of the DODX 40000-series flatcars.

C. EMPTY FLATCAR DELIVERY

1. The railroads have the right to make substitutions if the flatcars ordered are not available; for example, if you order ten 89-foot flatcars you may get fifteen 60-foot flatcars instead. If this would cause problems based on what you are loading, make sure the ITO knows this before he orders flatcars.

2. Keep in touch with the ITO, so as not to be surprised by delivery of flatcars earlier or later than expected.

D. RAMP SPOTTING GUIDELINES FOR LOADING

1. Flatcars for heavy tracked vehicle loading should be next to the ramp, so that the vehicles are not run over cars that can't take their weight.

2. Shorter flatcars are wider than longer flatcars; loading will go faster if the shorter flatcars are next to the ramp.

3. Some commercial flatcars have side sills, handholds, and so forth, that project above the deck. These hinder loading and may prevent loading these flatcars with central tire inflation system (CTIS) vehicles. Flatcars without projections above the deck should be placed next to the ramp, so that CTIS vehicles can be loaded on them without being damaged.

4. The above guidelines can be ignored and loading simplified significantly if you have enough ramps available to place different flatcar types at different ramps.

E. TIEDOWN

1. Get copies of this tiedown instruction for all of the tiedown supervisors. See <http://www.sddc.army.mil/sites/TEA/Functions/Deployability/TransportabilityEngineering/Lists/Deployability%20Publications%20Order%20Form/DeployabilityPublicationsOrderForm.aspx> to order additional copies.

2. Make sure sufficient spanners (see pages 38-41) are on hand and that they are sturdy enough for what you have to load.

3. Tiedown provisions on military vehicles are strong enough to be used for loading all vehicles, except most heavy tracked vehicles have no tiedown provisions and require shackles attached to the towing lugs (newer vehicles may have shackle-less provisions shown on page 25). The ITO should have a supply of shackles for such vehicles.

4. If desired, most railroads will arrange for a subcontractor experienced with military loadings to help you to tiedown loads correctly. Let your ITO know before he requests a rate if you want this service. The additional cost will be built into the transportation charge.

5. Railroad inspectors must approve the tiedown work before the railroad will move the flatcars. If the inspector requires additional work beyond the book, do it so you can proceed with the deployment. If the inspector says that you do not have to do work required by this

instruction, complete the work anyway; otherwise you will not properly train your tiedown crews and your trains may be delayed in route, especially if the trains are interchanged to another railroad that does follow the rules.

F. TRACKING

1. In transit visibility is based on a flatcar's reporting marks, that is, DODX, ITTX, and so forth, and the number.
2. Record at least the reporting marks and number of all flatcars carrying critical equipment (equipment you need unloaded first, and so forth). If all flatcars are not tracked en route, at least track these.

G. UNLOADING

1. The first train to leave may not be the first train to arrive. The flatcars on the front of the train when it leaves maybe on the rear when it arrives. If you need to give the railroad special instructions for unloading, specify the reporting marks and numbers of the flatcars involved.
2. If traveling to the National Training Center (NTC) or Joint Reserve Training Center (JRTC), integrate the arrival with another unit's departure, or vice versa. If a train must be held short of the destination because it would otherwise congest the railhead, it will lose its crew and possibly its locomotive to other assignments. Try to schedule (along with the ITO) departures to prevent this from happening; if it does, take into account that the railroad will have to get a locomotive and crew back out to the train when calculating how much lead time is needed to give when ordering the train into the railhead.
3. The flatcars that brought the equipment out may not be the same flatcars that take it back. Do not take tiedown assemblies, and so forth, off the flatcars during unloading. On the other hand, do not leave shackles, and so forth, on the flatcars expecting that they will be there when your unit returns.

H. DOWN THE (RAIL)ROAD

1. Future deployments may involve using railroads of the former Soviet Union (FSU).
2. FSU railroads use a similar coupling system to the one used in North America, so in the absence of detailed instructions from the local railroads, use the tiedown instructions in this document.

I. CONSIDER THE FOLLOWING IN SEQUENCE

1. Safety Brief
2. Internal and Secondary (Nested) Loads
3. Hazardous Materials Markings and Documents
4. Vehicle Preparation
5. Tools
6. Flatcar Preparation
7. Loading the Flatcars and Securing the Vehicles
8. Final Inspection

Section XIII. Wood Stanchions

According to MIL-STD-209 (paragraph 4.1) and MIL-STD-1366 (paragraph 5.2.1), the use of additional material, such as lumber, for blocking and bracing is not permitted. However, wood stanchions are sometimes required for transport of legacy trailers without prime movers, typically in retrograde. Single and two-axle trailers are typically rail impact tested attached to the prime mover which represents how they will initially be deployed. When these trailers are returning from theater, they may not have a prime mover to connect to and therefore require a wood stanchion under the draw bar frame or lunette of the trailer. Patterns 90 and 91 (Figures 40 and 41) are common stanchions that have been used in the past on wood deck rail cars. If wood stanchions are required, only a wood deck rail car (OTTX, HTTX, and some ITTX flatcars) will be used so that the stanchions can be nailed down to the railcar deck. Since wood stanchions cannot be nailed down to steel deck cars, they have the potential of shifting and coming free from the railcar. Damage or injury to passing objects or personnel could be the result. For this reason, wood stanchions are only allowed on wood deck railcars unless a specific figure in the AAR OTLRs and/or this instruction shows a tested and accepted loading procedure. Future/new single and two axle trailers will be required to move by rail without the use of stanchions. Landing legs or other BII equipment will be needed to support uncoupled trailers for rail movement.

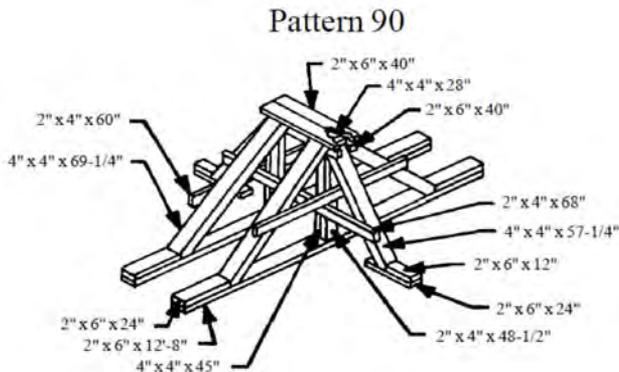


Figure 40. Wood stanchion pattern 90 from AAR Rules.

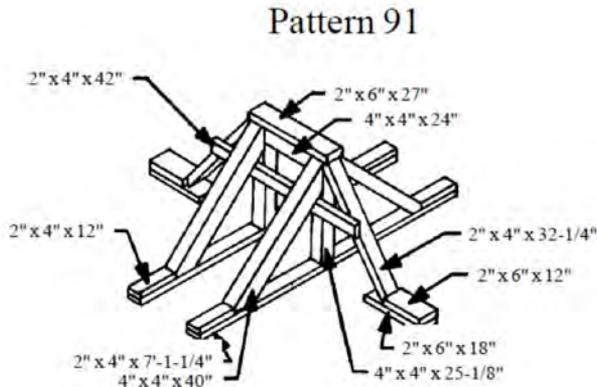


Figure 41. Wood stanchion pattern 91 from AAR Rules.

Unless directed by a specific figure that approves a trailer to use a wood stanchion with payload, the flatbed trailers shall always be rail transported empty; no cargo (payload) shall be loaded on the flatbed trailers. Ensure chains are secured to the lunette in addition to the trailer tiedown provisions to ensure enough lateral and vertical restraint is applied to the front of the trailer (see pages A-16, A-17, or A-18). This will keep the lunette on the wood stanchion during rail transport. The use of wood stanchions with empty single or two-axle trailers will be at the discretion of the individual rail carriers. Approved trailers were typically tested coupled to the prime mover so rail transport of uncoupled trailers with a wood stanchion has likely not been verified with a rail impact test. In general, semi-trailers should not use wood stanchions and should be moved by Trailer on Flatcar (TOFC) as shown on page A-19.

The Pattern 90 and 91 stanchions are constructed using lumber with the dimensions shown. Pattern 90 will be about 51.5" high and pattern 91 will be about 28.125" high. The length of the support members and other components may vary to suit the particular trailer type and height. Figure 42 shows the construction details of a stanchion used on trailers weighing up to 18,000 lbs for reference. For questions on stanchions, contact the DODAAR Representative at usarmy.scott.sddc.mbx.tea-dpe@mail.mil or (618) 220-5271 or DSN 770-5271.

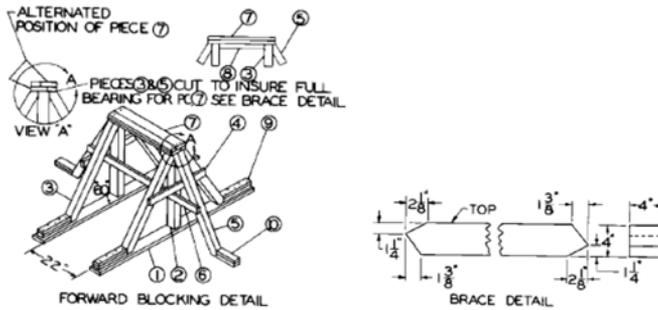


Figure 42. Wood stanchion construction details for a 18,000 lbs semi-trailer.

| Item | No. of Pcs. | Description |
|------|-------------|---|
| 1 | 2 | 2 in. x 6 in. x 92 in. Nail to car floor with one 30-D nail every 8 in. |
| 2 | 2 | 4 in. x 4 in., length to suit. Toenail to Piece 1 with four 16-D nails. |
| 3 | 4 | 4 in. x 4 in., length to suit, per Brace Detail. Cut to ensure full bearing for Piece 7. Toenail to Pieces 1 and 2 with two 16-D nails at each end. |
| 4 | 2 | 2 in. x 4 in. x 30 in. Nail to pieces 2 and 3 with three 12-D nails at each joint. |
| 5 | 2 | 4 in. x 4 in., length to suit, per Brace Detail. Cut to insure full bearing for Piece 7. Toenail to Piece 2 and to car floor with two 16-D nails each end. |
| 6 | 1 | 2 in. x 4 in. x 62 in. Nail to pieces 2 and 5 with three 12-D nails at each joint. |
| 7 | 2 | Each to consist of one piece of 2 in. x 4 in. x 37 in., and one piece of 2 in. x 6 in. x 37 in. Nail lower pieces to Pieces 2, 3, and 5 with two 12-D nails at each joint. Offset vertical joints as shown in the Forward Blocking Detail, View A and laminate top pieces to lower with six 12-D nails. |
| 8 | 1 | 2 in. x 6 in. x 24 in. Nail to Piece 7 with six 12-D nails. |
| 9 | 4 | Each to consist of two pieces of 2 in. x 4 in. x 18 in. Nail first piece to Piece 1 with four 30-D nails. Nail second piece on top in a like manner. |
| 10 | 2 | Each to consist of two pieces of 2 in. x 4 in. x 12 in. Nail first piece to car floor, against Piece 5 with three 30-D nails. Nail second piece on top of first piece in a like manner. |

Section XIV. Battle-Damaged or Retrograde Vehicles

Vehicles returning from theater may be damaged or worn out and therefore require extra attention when securing to flatcars. Vehicles may be damaged or worn differently so each one should be evaluated on a case-by-case basis. This section outlines some basic techniques that can be used to secure damaged or worn out vehicles. This is not meant to be an exhaustive list, but merely some general techniques that could be used to ensure safe rail transport.

The first thing to determine is whether the vehicle has functioning equipment lift and tiedown provisions and if the structural integrity of the vehicle is intact. If the tiedown provisions or the structural integrity of the vehicle is in question, it should not be secured for transport on a flatcar for rail transit. Consider rail transporting vehicles damaged in this manner in a gondola railcar if the dimensions of the vehicle permit it. Use wood dunnage on the inside of the railcar to eliminate shifting of the damaged equipment. Use AAR approved steel banding and tarps to secure the top of the load.

If the integrity of the lift provisions is questionable, use extra caution and use lifting and rigging equipment that sling the vehicle from the bottom instead of using the lift provisions to get the equipment into the gondola railcar (Figure 43).



Figure 43. Possibly use gondola railcars for vehicles with damaged provisions or questionable structural integrity.

If the vehicle has sufficient equipment tiedown provisions and sound structural integrity, secure the vehicle to a flatcar with the normal tiedown guidance provided for the vehicle. Ensure the doors of the vehicle properly shut and latch. Vehicles with add-on-armor kits are susceptible to having the doors open during rail transport. This can create a very dangerous situation where passing trains can get hit by the open doors. Recommend securing the doors externally with web straps and the door handles with wire tie for vehicles with field installed add-on-armor kits. SDDCTEA has gotten reports of the web straps being cut during rail transit when just using bare web straps. Use edge protectors or protective strap sleeves where ever web straps may interface with door edges and corners of vehicles is advisable. Vehicles with damaged or missing door handles may require the use of wire rope rather than web straps for more strength in order to properly secure the weight of the heavier doors on HET and HEMTT/PLS variants.

As mentioned in Section II, paragraph A of this instruction, all wheeled vehicles must have tires inflated to highway pressure for rail transport. The tires must be capable of holding that pressure for at least the length of the trip. Repair or replace flat tires. In the case of retrograde vehicles with shredded tires (see Figure 44), the rail inspectors may allow shredded tires on vehicles with three or more axles provided the vehicle is stable and does not lean. If the vehicle is not stable, apply solid wood blocking and bracing under the axle so that no load rests on the tires. Design the blocking and bracing so it will not shift or topple over when exposed to hump operations or the vibration / lateral rocking the vehicle will experience on the trip. Do not merely shim pieces of wood under the vehicle. Nail all pieces of wood blocking together.

Several AAR rules in Section No. 1 (see footnote 1, page 1) are applicable when axle blocking or dunnage is required:

10.1 Hardwoods must be used.

11.2.1 Bearing pieces must be of uniform thickness and width for the entire length and all bearing pieces are to be untreated.

11.2.2 The width of the base must not be less than its height.

11.2.3 For General Rule loads, bearing pieces must be secured to the car floor.

11.9.3 For every 16 inches of blocking length, secure with at least one nail for each 2 inches of block width, or any fraction thereof, plus one additional nail.

11.9.4 Block securement nails must penetrate the car deck or other attaching member

of a minimum of 2 inches.

11.9.8 When steel-floored cars are furnished in lieu of wood-floored cars, any floor blocking or metal-anchor plates required under figures or rules to be nailed to wood floors must be bolted to steel floors.

If blocking is required on steel deck cars, the servicing railroad(s) will have to be consulted if a particular blocking design can avoid being bolted to the floors as stated in 11.9.8. If that is desired, contact all the servicing railroads for the load and route for pre-approval/acceptance of the blocking design. If assistance is needed in reaching the railroads, contact the DODAAR Representative at usarmy.scott.sddc.mbx.tea-dpe@mail.mil or (618) 220-5271 / DSN 770-5271. In general, welding securement devices to commercial steel deck flatcars is not encouraged. Welding on DODX steel deck flatcars **is not authorized**. Due to these facts, recommend special ordering appropriate commercial wood deck TTX flatcars when moving damaged vehicles.



Figure 44. Vehicles with shredded tires will likely require axle blocking.

Battle damaged tanks and other tracked vehicles can move by rail using special cradles designed by the 842nd Transportation Battalion. Cradles made from 12" x 12" timbers, ¼" steel plate, ¼" x 4" x 4" angle iron, and 3/8" diameter lag bolts (as shown in Figures 45-48) can be secured directly to the rail car by use of rail chains and then the tracked vehicle is lowered onto the cradles (Figure 46) and chained

down using its normal rail tiedown guidance (Figure 47) as given in this instruction on pages B-10 through B-14. A similar cradle design has been developed for



Figure 45. M1 Abrams tank cradle made with off-the-shelf parts.



Figure 46. M1 cradle chained to railcar and then M1 lowered onto cradle.



Figure 47. M1 tank chained down to railcar using normal chain pattern as specified in on page B-10 and B-11.

use with the M113 and M577. These cradles save significant costs over moving these vehicles by truck over highway. The cradles are reusable and can be returned from the receiving activity and returned either by truck or re-routing of the DODX car back to the origination point.

This section described techniques that might be applicable to retrograde vehicles moving by rail. Each vehicle will be different and must be assessed on a case-by-case basis to determine how to properly secure the vehicle for safe rail transport. For assistance in determining the proper rail securement needed for battle-damaged or worn out equipment, contact the DODAAR Representative at usarmy.scott.sddc.mbx.tea-dpe@mail.mil or (618) 220-5271 or DSN 770-5271.

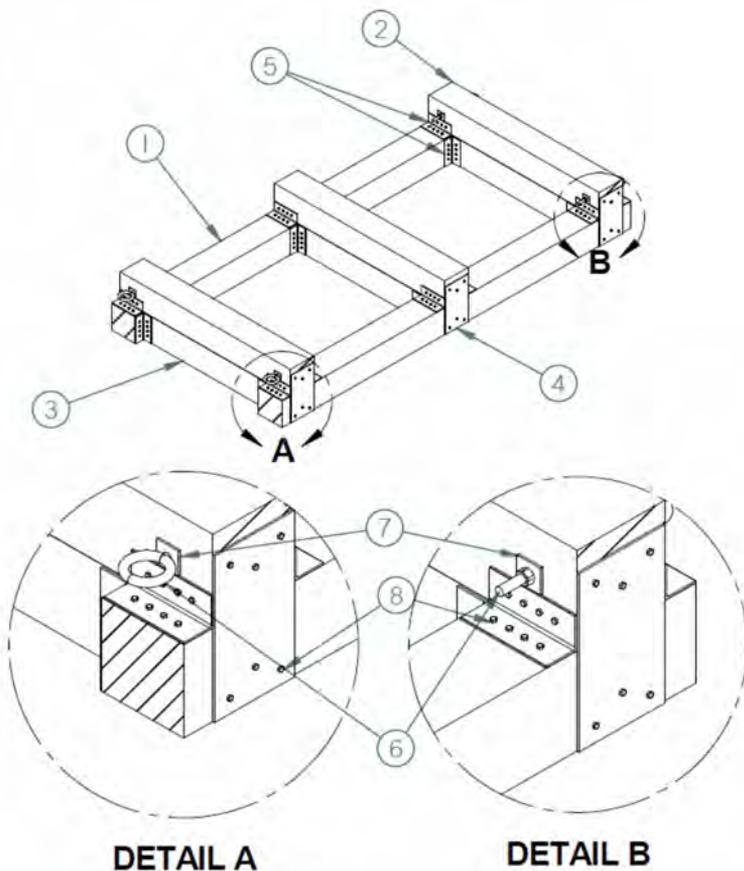


Figure 48. Rail cradle for M1 missing track(s).
 (Design created by SDDC 842nd Transportation Battalion)

Table 3. Bill of Materials for Rail Cradle for M1
Missing Tracks

| BILL OF MATERIALS | | | |
|-------------------|-----|--|------------------|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | 2 | 12"x12" Timber cut to 14' long* | Oak |
| 2 | 3 | 12"x12" Timber cut to 82" long* | Oak |
| 3 | 3 | 12"x12" Timber cut to 58" long* | Oak |
| 4 | 6 | 1/4" thick plate, 11" x 20" | Steel |
| 5 | 24 | 1/4" thick angle iron 4"x4"x11" | Steel |
| 6 | 4 | Eye bolt 1" x 18" with nut, US Cargo Control Part # GVEB1X18 | Galvanized Steel |
| 7 | 8 | 3"x3"x1/4" thick plate with 1-1/16" dia hole in center | Steel |
| 8 | 228 | 3/8"x3" lag screws | Galvanized Steel |

*12"x12" Timbers have nominal dimensions of 11-1/4"x 11-1/4"

Assembly Instructions:

1. Place items 3 between items 1 as shown.
2. Place items 2 on top of items 1 and 3.
3. Use item 4 to trace bolt hole locations. Pre-drill 1/4" dia. holes in items 1 and 3 for item 8 (lag screws). Install item 4 using 6 lag screws for each plate.
4. Use item 5 to trace screw hole locations. Pre-drill 1/4" dia. holes in items 1, 2, & 3 for item 8 (lag screws). Install item 5 using 4 lag screws on each face of the angle iron to secure items 1, 2 and 3 together.
5. Drill 1-1/16" dia. hole on each end of item 2 as shown in item 2 description to allow installation of eye bolts (item 6).
6. Install eye bolts (item 6) with backing plates (item 7) on the front and back of item 1.

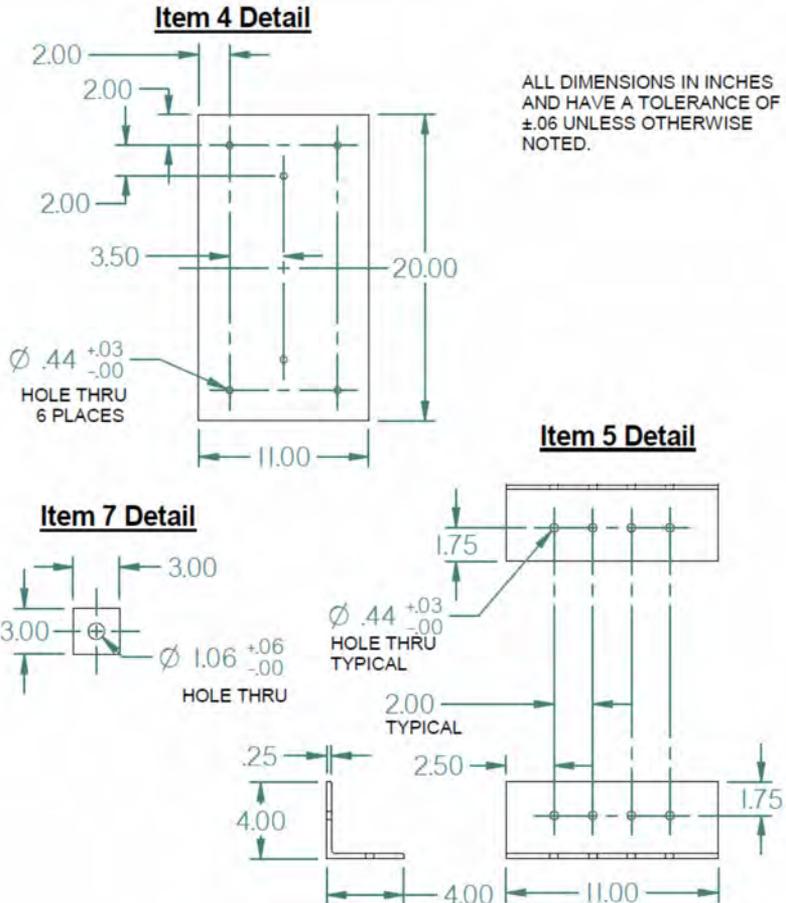
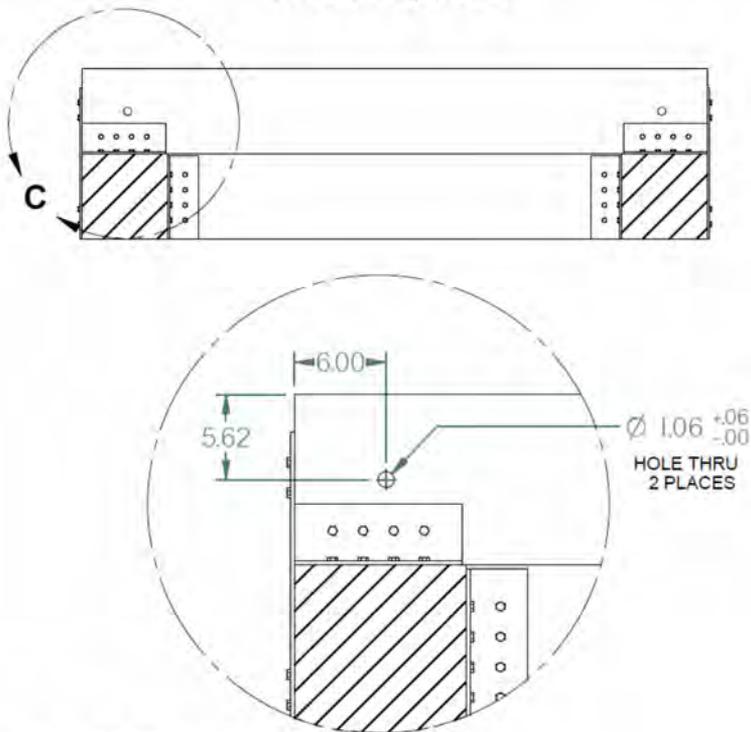


Figure 49. Steel piece parts for rail cradle.
(Design created by 842nd Transportation Battalion)

Holes for Eye bolts



ALL DIMENSIONS IN INCHES
AND HAVE A TOLERANCE OF
 ± 0.06 UNLESS OTHERWISE
NOTED.

DETAIL C

Figure 50. Thru hole locations on rail cradle for M1 missing track(s).
(Design created by 842nd Transportation Battalion)

Section XV. Tarpaulins

Vehicles equipped with tarp kits specifically designed to cover the cargo area of the vehicle should only be used when mission required (non-routine, limited use) for rail transport. Consult the rail carrier(s) to ensure they will accept the load with vehicle tarp kits installed over cargo bed areas. Vehicles with empty cargo beds must have tarp kits reduced and properly stored for rail transport. When vehicle tarp kits are required, ensure the vehicle tarp kits are properly secured and prevent them from working loose at the speed of rail transport. Vehicles could be loaded on railcars facing or opposing the direction of train travel; therefore, ensure the tarp is secure in all directions.

Using tarpaulins to cover the entire vehicle should also only be used when mission required (non-routine, limited use) for rail transport. Consult the rail carrier(s) to ensure they will accept the load with tarpaulins. Tarpaulins are more difficult to secure than tarp kits in order to avoid damage and prevent them from working loose at the speed of rail transport. Additionally, tarpaulin securement must work in conjunction with the load and must not obstruct railcar ladders, handholds, grab irons, hand brakes, or other safety appliances. Tarpaulins must be made of material resistant to wind, vibration, movement, and abrasion. Consult the AAR rules 1.2.27, 1.2.28, and 1.2.29 for additional guidance of protective coverings and tarpaulins.

Tarpaulins may not be suitable for rail transport in Europe or on rail routes that have exposure to overhead electrified lines. Tarpaulins have come loose and got caught in overhead electrified lines.



Figure 51. Tarp worked loose and got caught on overhead electrical lines in Europe.

Appendix A. Trucks and Trailers

Trucks, **Unarmored**, Weighing up to 75,850 Pounds A-3

Trucks, **Armored**, Weighing up to 75,850 Pounds A-4

M1074/M1075 PLS and M1120 HEMTT LHS TruckA-5

M1076 Palletized Load System (PLS) TrailerA-6

Modular Fuel System A-7

M1070 Tractor on TTX carsA-8

M1070A1 Tractor on DODX cars A-9

M1000 Trailer on HTTX carsA-10

M1000 Trailer on DODX and TPDx cars A-11

Logistics Vehicle SystemA-12

Trailer Attached to Prime MoverA-13

Semitrailer Attached to Prime MoverA-14

Single-Axle Trailers A-15

M200A1 Trailer A-16

Next Generation Shop Equipment Welding (NG-SEW) A-17

Two-Axle Trailers A-18

Trailer on Flat Car (TOFC)A-19

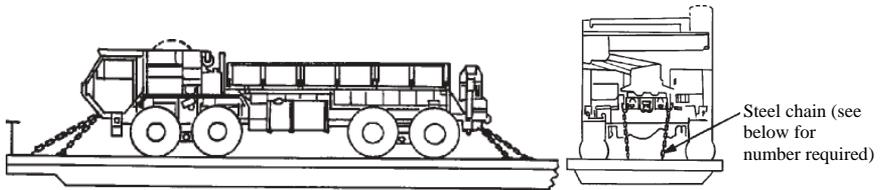
Trailers, M872, Double StackedA-20

M129A4 and M1063 SemitrailersA-21

M119A2/A3 105 MM Towed Howitzer A-22

M777A2 155 MM Towed Howitzer A-23

Trucks, Unarmored, Weighing up to 75,850 Pounds

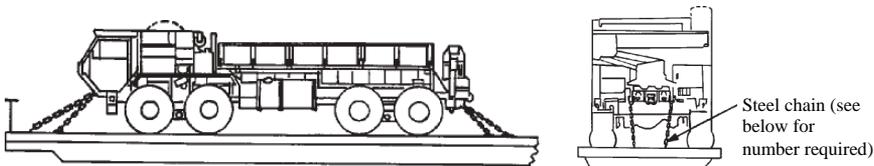


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-12,400 | 3/8 | 36,000 | 4 |
| 12,400-24,800 | 3/8 | 36,000 | 8 |
| 24,800-40,000 | 3/8 | 36,000 | 12 |
| 0-20,650 | 1/2 | 55,000 | 4 |
| 0-25,250 | 1/2 | 55,000 | 4 |
| 25,250-50,550 | 1/2 | 55,000 | 8 |
| 50,550-75,850 | 1/2 | 55,000 | 12 |

Notes:

1. From Figure 88-B, Section No. 6.
2. The HEMTT wrecker must have the locking pins secured in the outriggers to prevent them from settling down and out. Outriggers extending past the side of the car can cause serious accidents.
3. The secondary load must be secured to 3 Gs longitudinally (fore and aft) and 2 Gs laterally and vertically.
4. Vehicles equipped with air suspensions shall have the suspensions bled prior to application of chains to restrain it properly for transport. This is done to prevent air suspensions from leaking and losing pressure causing the vehicle to lower significantly in transit and introduce an unsafe amount of chain slack.
5. Vehicles that have a mix of spring suspensions and air suspensions can leave the air suspension intact as long as there is at least one axle with a spring suspension on the front and back of the vehicle.

Trucks, Armored, Weighing up to 75,850 Pounds



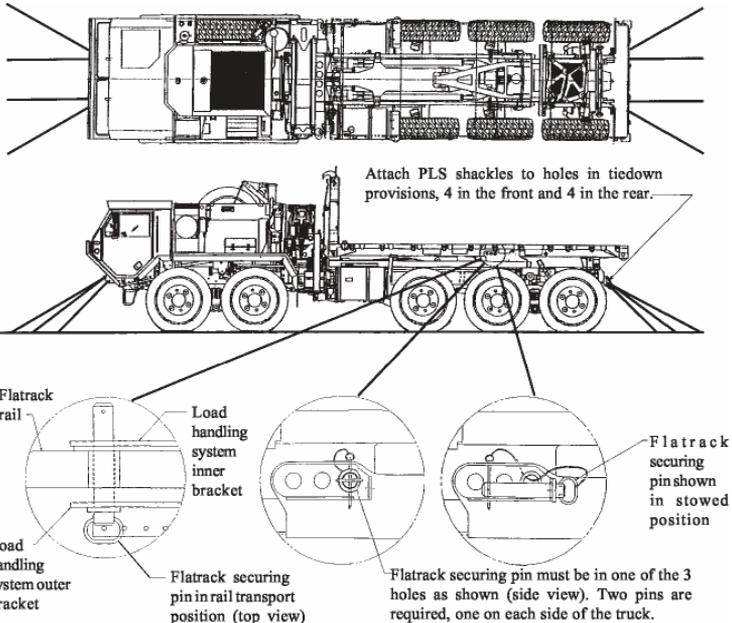
| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-9,300 | 3/8 | 36,000 | 4 |
| 9,300-18,500 | 3/8 | 36,000 | 8 |
| 18,500-27,950 | 3/8 | 36,000 | 12 |
| 0-15,500 | 1/2 | 55,000 | 4 |
| 0-18,950 | 1/2 | 55,000 | 4 |
| 18,950-37,900 | 1/2 | 55,000 | 8 |
| 37,900-56,850 | 1/2 | 55,000 | 12 |
| 56,850-75,850 | 1/2 | 55,000 | 16 |

Notes:

1. From Figure 88-F, Section No. 6.
2. The HEMTT wrecker must have the locking pins secured in the outriggers to prevent them from settling down and out. Outriggers extending past the side of the car can cause serious accidents.
3. The secondary load must be secured to 3 Gs longitudinally (fore and aft) and 2 Gs laterally and vertically.
4. Refer to vehicle's technical manual (TM) for proper stowage of all over cab gunner positions (Objective Gunner's Protection Kits, Common Remotely Operated Weapon Station, etc) for transport.
5. Vehicles equipped with air suspensions shall have the suspensions bled prior to application of chains to restrain it properly for transport. This is done to prevent air suspensions from leaking and losing pressure causing the vehicle to lower significantly in transit and introduce an unsafe amount of chain slack.
6. Vehicles that have a mix of spring suspensions and air suspensions can leave the air suspension intact as long as there is at least one axle with a spring suspension on the front and back of the vehicle.

M1074/M1075 PLS and M1120 HEMTT LHS Truck

PLS = Palletized Load System, LHS = Load Handling System

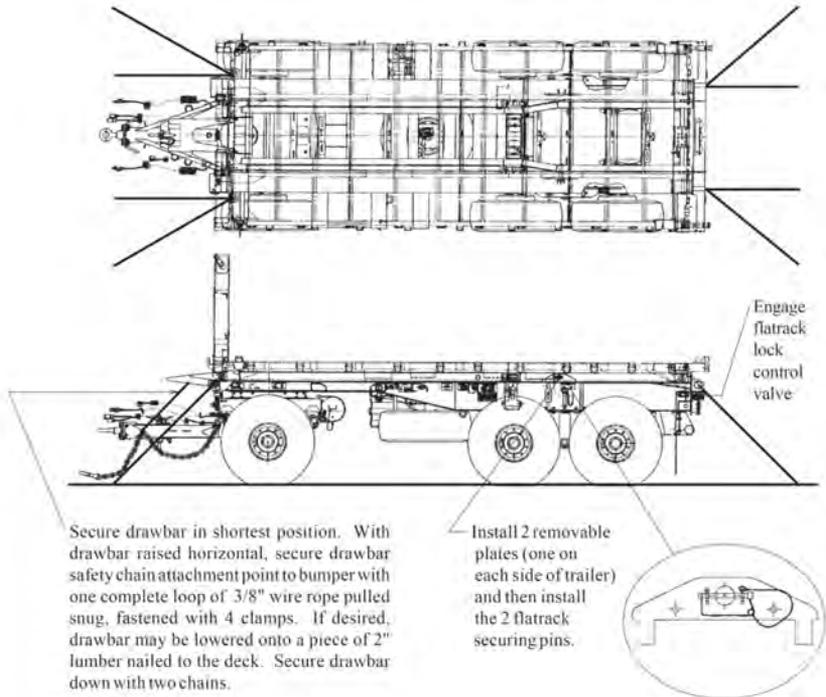


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 49,500 - 82,000 | 1/2 | 55,000 | 12 |
| 82,000 - 95,000 | 1/2 | 55,000 | 16 |

Notes:

1. The majority of the chains should go to the center tiedown channels.
2. From Figure 88-C, Section No. 6.
3. The secondary load must be secured to 3 Gs longitudinally (fore and aft) and 2 Gs laterally and vertically.

M1076 Palletized Load System (PLS) Trailer

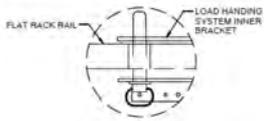
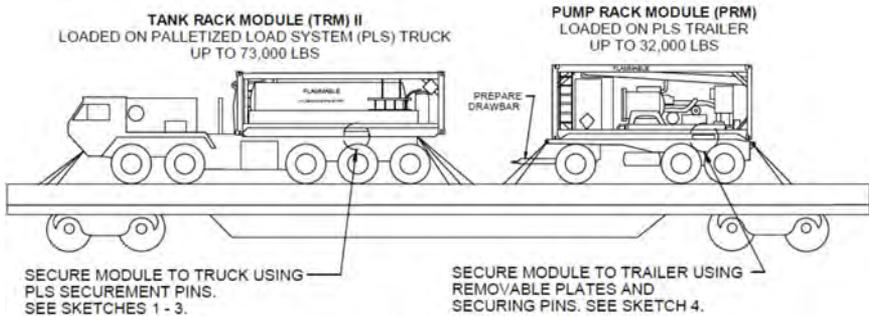


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 16,500 – 25,250 | 1/2 | 55,000 | 4 |
| 25,250 – 50,550 | 1/2 | 55,000 | 8 |

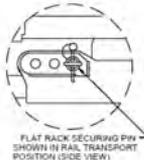
Notes:

1. The secondary load must be secured to 3 Gs longitudinally (fore to aft) and 2 Gs laterally and vertically.
2. From Figure 88-C, Section No. 6.

Modular Fuel System



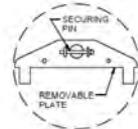
SKETCH 1



SKETCH 2



SKETCH 3



SKETCH 4

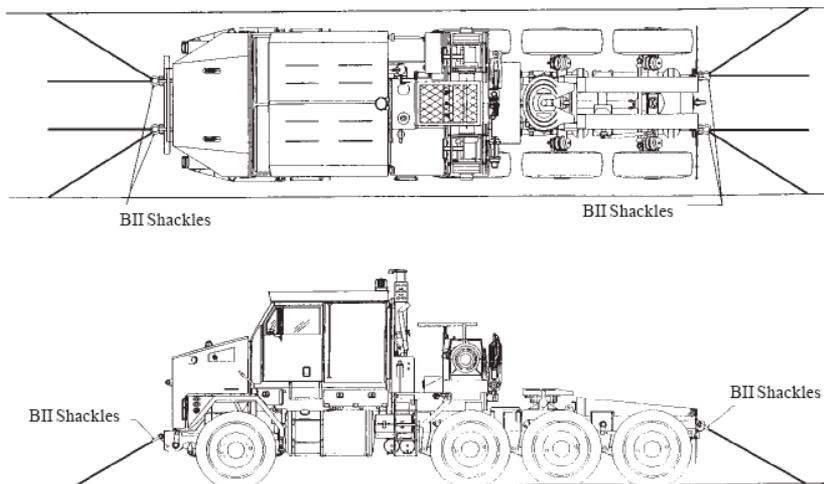
| Modular Fuel System | Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|---------------------|----------------------------|-------------------|--------------------------------|------------------------------|
| | | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Per Vehicle |
| PLS Truck w/ TRM | 49,500 - 82,000 | 1/2 | 55,000 | 4 |
| PLS Trailer w/ PRM | 25,250 – 50,550 | 1/2 | 55,000 | 8 |

Notes:

1. The TRM is approved with partial or full fuel levels on the PLS truck and as a COFC load.
2. The PRM is approved with full fuel on the PLS trailer and as a COFC load.
3. Ensure all valves are closed on the TRM and PRM.
4. Put PLS trailer drawbar into the shortest position. With the drawbar raised horizontally, secure the drawbar safety chain attachment point to the bumper with one complete loop of 3/8" wire rope pulled snug, fastened with 4 clamps.
5. From pending Figure 91, Section No. 6.

M1070 Tractor on TTX cars

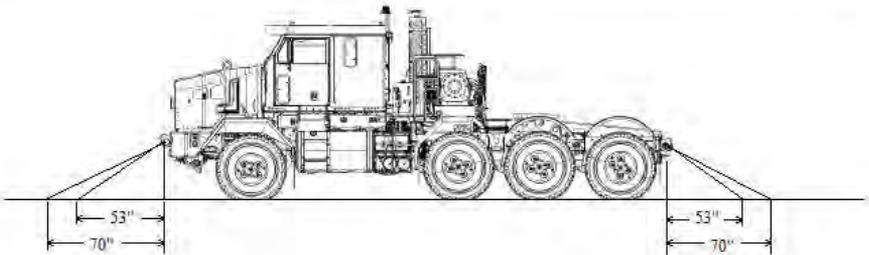
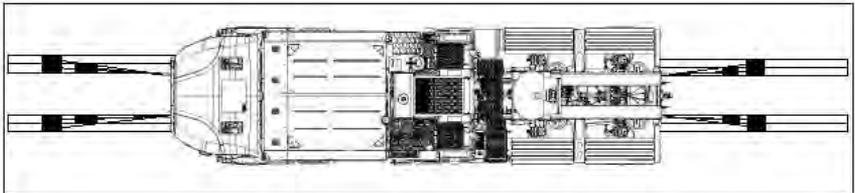
(41,000 lb)



Notes:

1. 1/2" steel chain [55,000 lb breaking strength], **8 required**.
2. BII shackles, NSN: 4030-0 1-408-2774, WLL 17T, 1-3/8" screw pin anchor shackle with cotter pin.
3. From Figure 88-B, Section No. 6.
4. Prior to tensioning of chains, pneumatic rear suspension system must be bled to ensure rear chains do not lose tension during transport. See TM 9-2320-360-10 for instructions.

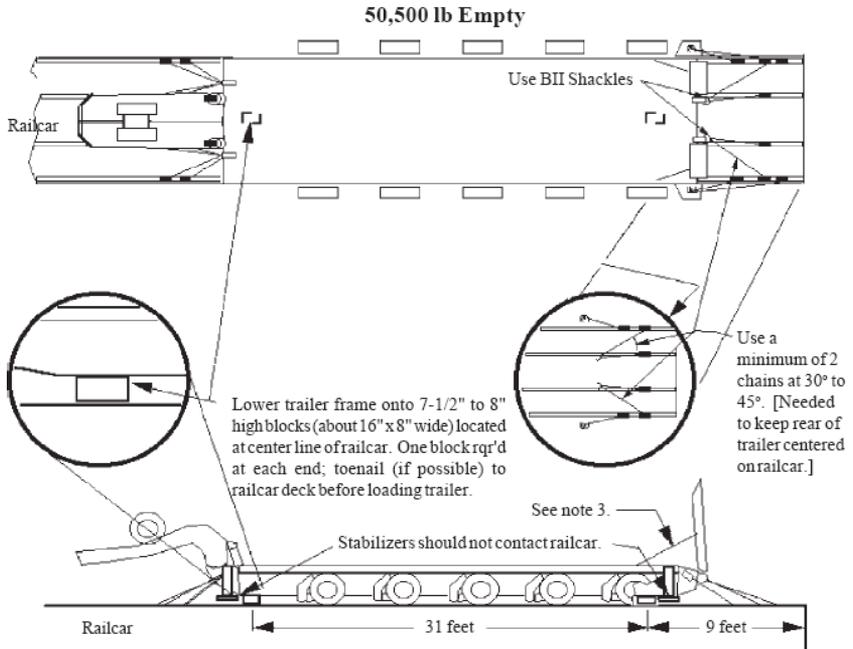
M1070A1 Tractor on DODX cars (51,050 LBS)



Notes:

1. 1/2" steel chain (55,000 lb breaking strength), **12 required**.
2. BII shackles, NSN: 4030-0 1-408-2774, WLL 17T, 1-3/8" screw pin anchor shackle with cotter pin.
3. From Figure 88-F, Section No. 6.
4. Prior to tensioning of chains, pneumatic rear suspension system must be bled to ensure rear chains do not lose tension during transport. See TM 9-2320-360-10 for instructions.

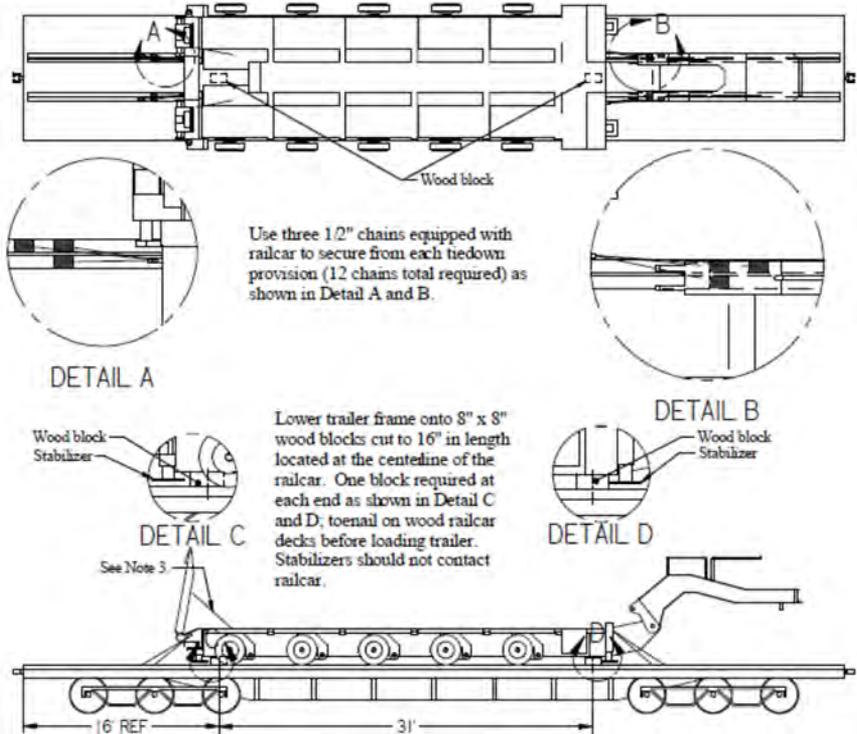
M1000 Trailer on HTTX cars



Notes:

1. HTTX railcars equipped with 1/2" chain: **16 chains** (8 at each end) may be used for empty M1000.
2. From General Rules, Section 1 and Figure 88-H, Section 6.
3. Onboard chains.

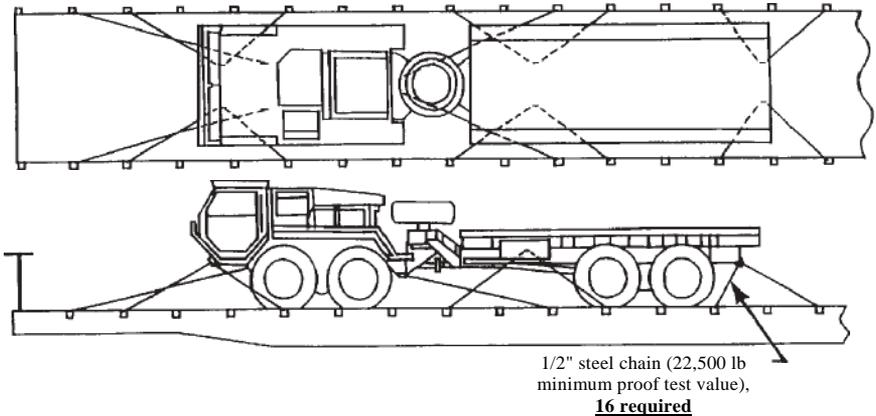
M1000 Trailer on DODX and TPDx cars
(50,500 LBS EMPTY)



Notes:

1. Use the basic issue item chains on the trailer to secure the end ramps.
2. Prior to lowering trailer onto railcar deck and securing with **12 of the 1/2" chains**, ensure trailer deck is lowered appropriately for railcar transport and the wood blocks shown in Detail C and Detail D are placed on the railcar as shown.
3. Onboard chains.
4. From Figure 88-H, Section 6

Logistics Vehicle System

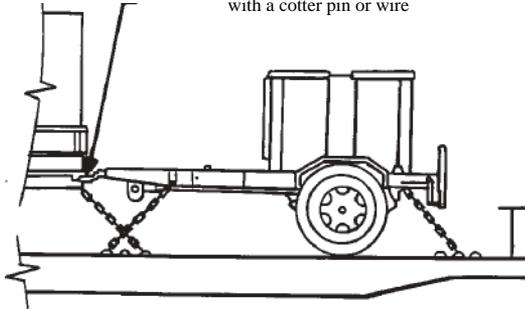


Notes:

1. Install and secure the lockout strut to prevent articulation.
2. From General Rules, Section No. 1.
3. This figure (requiring more than 4 tiedown provisions for the vehicle) is a procedural fix for a vehicle with inadequate transportability. Do not use this figure as a basis of design for new or rebuy vehicles.

Trailer Attached to Prime Mover

Pintles must have pintle lock secured with a cotter pin or wire



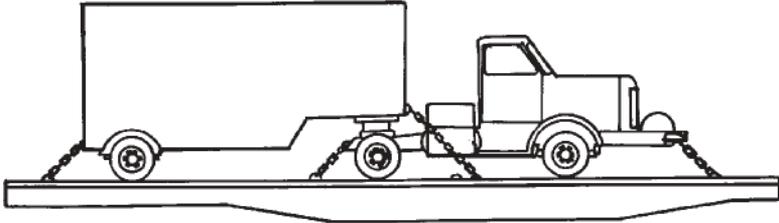
Notes:

1. Tie down trailer as shown. Refer to table below for chain requirements.
2. The prime mover will be chained as if it were being loaded alone. Check the specific diagram in the wheeled vehicles part of the appendix.
3. Treat each vehicle as if it was being tied down separately, except omit the front support and towing ring tiedowns on the trailer. Each vehicle must have at least 4 tiedowns with equal numbers pulling fore and aft.
4. From General Rules, Section No. 1, using the restraint requirements for general commodities.

THIS TABLE IS FOR THE TRAILER ONLY

| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-12,400 | 3/8 | 36,000 | 4 |
| 12,400-24,800 | 3/8 | 36,000 | 8 |
| 24,800-40,000 | 3/8 | 36,000 | 12 |
| 0-20,650 | 1/2 | 55,000 | 4 |
| 0-25,250 | 1/2 | 55,000 | 4 |
| 25,250-50,550 | 1/2 | 55,000 | 8 |
| 50,550-75,850 | 1/2 | 55,000 | 12 |
| 75,850-101,100 | 1/2 | 55,000 | 16 |

Semitrailer Attached to Prime Mover



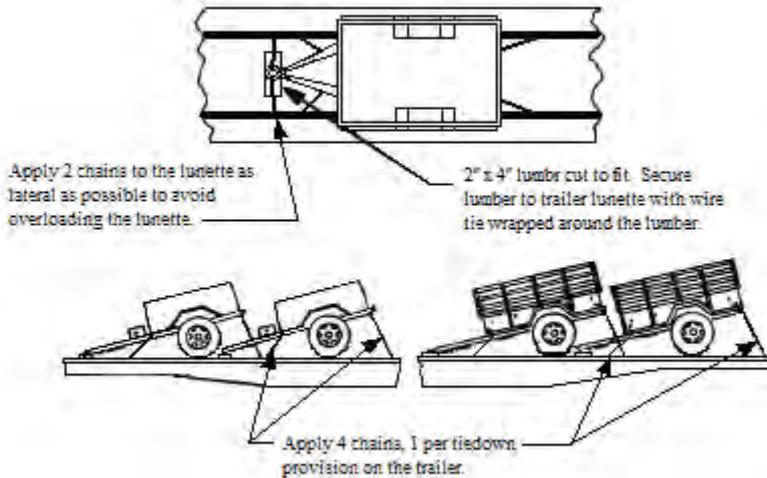
Notes:

1. Secure the semitrailer as shown using the table below to determine the chain requirements.
2. Chain the prime mover as if it were alone, using the appropriate figure from this appendix.
3. From General Rules, Section No. 1, using the restraint requirements for general commodities.

THIS TABLE IS FOR THE TRAILER ONLY

| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-12,400 | 3/8 | 36,000 | 4 |
| 12,400-24,800 | 3/8 | 36,000 | 8 |
| 24,800-40,000 | 3/8 | 36,000 | 12 |
| 0-20,650 | 1/2 | 55,000 | 4 |
| 0-25,250 | 1/2 | 55,000 | 4 |
| 25,250-50,550 | 1/2 | 55,000 | 8 |
| 50,550-75,850 | 1/2 | 55,000 | 12 |
| 75,850-101,100 | 1/2 | 55,000 | 16 |

**Single-Axle Trailers
(EMPTY)**

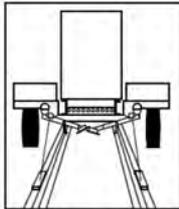
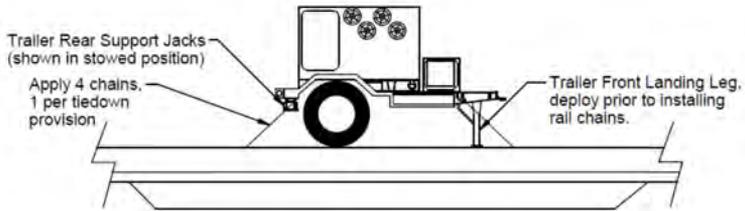


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-12,400 | 3/8 | 36,000 | 4 |
| 0-20,650 | 1/2 | 55,000 | 4 |
| 0-25,000 | 1/2 | 55,000 | 4 |

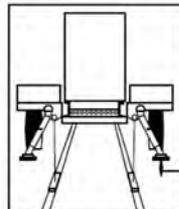
Notes:

1. Toe nail the 2" x 4" lumber under the lunette with appropriate sized nails.
2. If the front trailer tiedown provisions are less than 2-ft high from the rail car deck, use a tiedown procedure using a wood stanchion as shown in the Two-Axle Trailer guidance on the next page.
3. From Figure 63-A, Section No. 6.

**M200A1 Trailer
UP TO 6,900 LBS**



On DODX Railcars
Stow trailer rear support jack to avoid chain interference with underside of trailer.



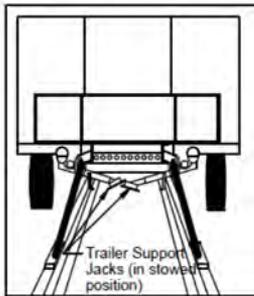
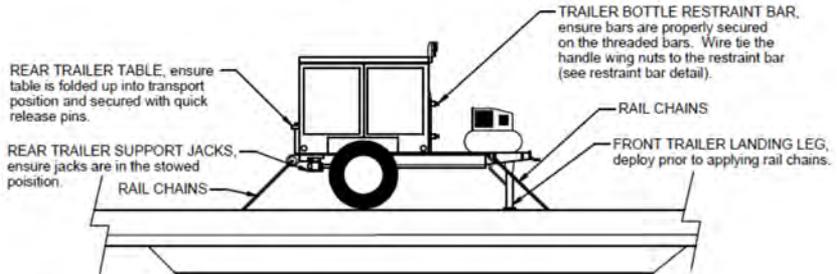
On Commercial Railcars
Deploy the trailer rear support jacks to avoid chain interference with underside of trailer. Adjust height to leave 2 inches of clearance from rail deck.

| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-12,400 | 3/8 | 36,000 | 4 |
| 0-25,000 | 1/2 | 55,000 | 4 |

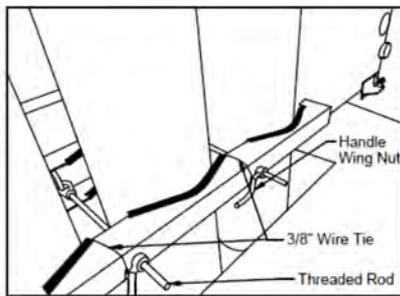
Notes:

- NOTE: The M200A1 trailer is only approved to rail moved separately.** If rail moved coupled to a prime mover, the trailer lunette can be damaged.
- From Figure 63-B, Section No. 6.

Next Generation Shop Equipment Welding (NG-SEW)



Support Jacks Detail



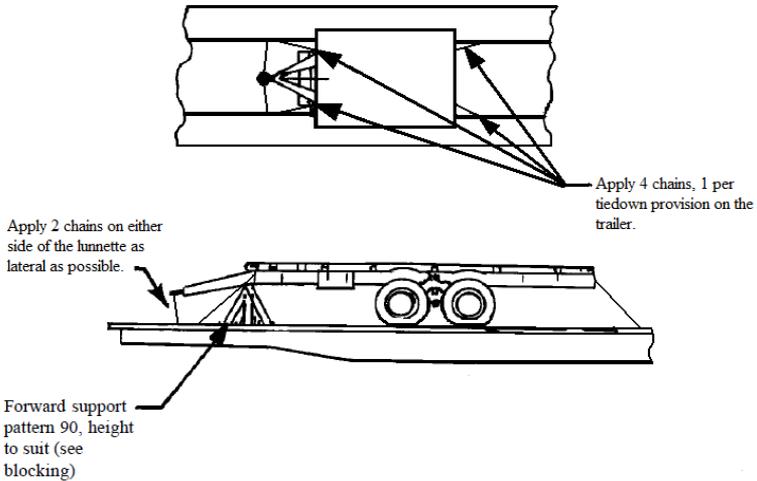
Restraint Bar Detail

| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-12,400 | 3/8 | 36,000 | 4 |
| 0-25,000 | 1/2 | 55,000 | 4 |

Notes:

1. The NG-SEW is on a modified M200A1 trailer with rear tiedowns points that extend beyond the trailer support jacks. Put jacks in stowed position, regardless of commercial or DODX railcar.
2. From Figure 63-C, Section No. 6.

**Two-Axle Trailers
(EMPTY)**

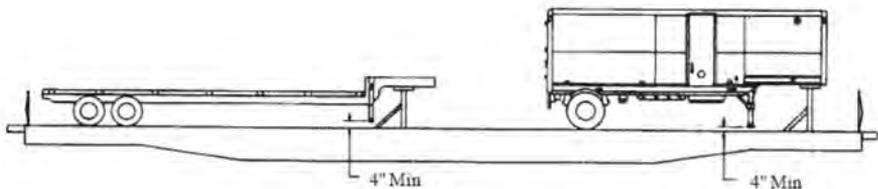


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0-12,400 | 3/8 | 36,000 | 4 |
| 0-20,650 | 1/2 | 45,000 | 4 |
| 0-25,250 | 1/2 | 55,000 | 4 |

Notes:

1. Use only on a wood deck commercial railcar (OTTX, HTTX, and wood deck ITTX).
2. The Pattern 90 forward support detail is shown in Section XIII that precedes this Appendix.
3. Nail the forward support to the railcar deck. If the trailer is secured to a steel deck car, modify top of forward support so that it is captured within draw bar frame to prevent shifting or over turning during rail transport.
4. From General Rules, Section No. 1.

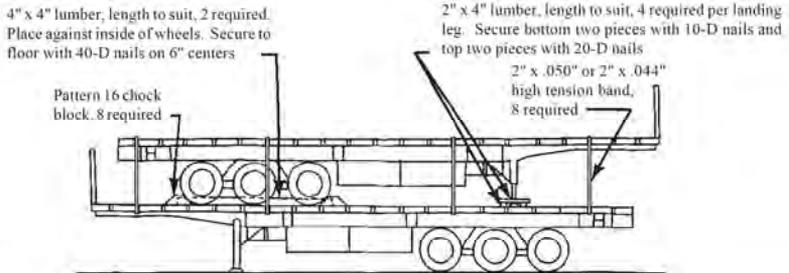
Trailer on Flat Car (TOFC) Semitrailers on Flatcars with Stanchions



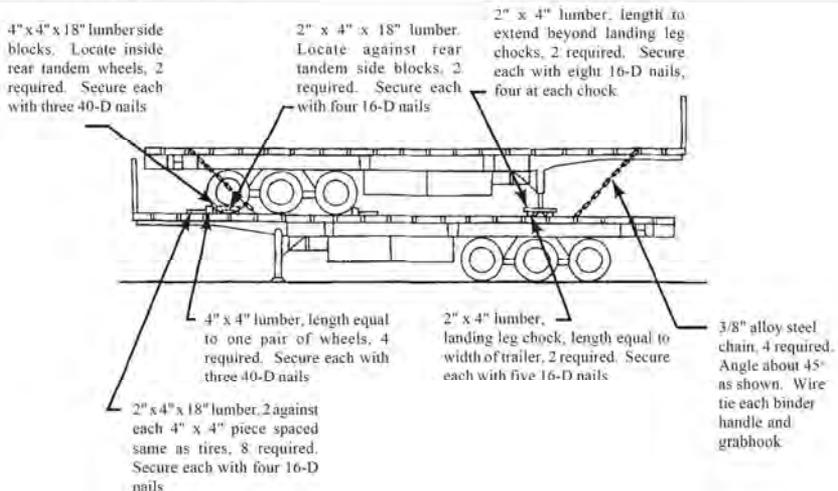
Notes:

1. Be sure hitch is securely locked in "UP" position.
2. Be sure trailer kingpin is locked in place on the hitch.
3. Set parking brake (if it's available and operational) to prevent the trailer from inadvertently moving during the securement and unloading processes.
4. Trailer landing gear shall be raised to provide a minimum of 4 in. of clearance between the landing gear and car.
5. Applies to vehicles up to 40,000 lb as long as kingpin height is between 47 inches minimum and 52 inches maximum.
6. The hitches will only fit 2-inch kingpins.
7. From Figure 202, Section No. 6.

Trailers, M872, Double Stacked Two Separate Methods



Note: From figure 434, Section No. 7.

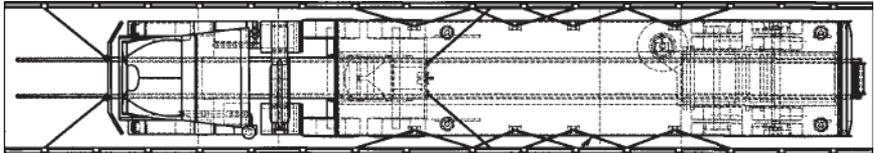


Notes:

1. From Figure 432, Section No. 7.
2. Tie bottom trailer same as single trailer, trailer attached to prime mover, or as trailer on flatcar with retractable stanchion.
3. Some trailers have partial steel decking preventing the direct nailing of blocking. On these trailers the blocking must be secured to side stakes or fastened by other means.

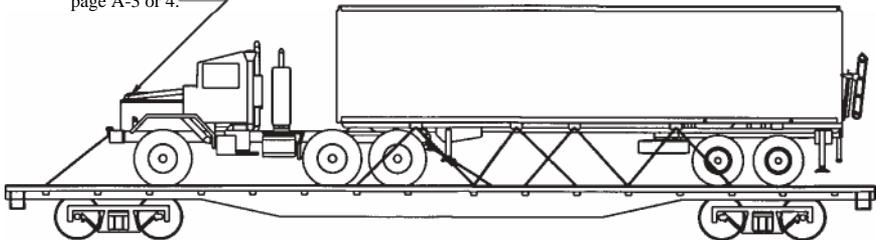
**M129A4 and M1063 Semitrailers
(If trailer on flat car service (TOFC) Is Not Available)**

SEMITRAILER 16,000 LBS EMPTY TO 41,000 LBS FULLY LOADED



Secure semitrailer with 16 chains, as shown, regardless of chain size. Use 3/8-inch or larger chain.

Tiedown tractor as if it is by itself, see page A-3 or 4.



Notes:

1. From General Rules, Section No. 1.
2. This may also be used for all semitrailers with bar tiedown provisions built into the semitrailer underframe.
3. This semitrailer figure (requiring more than 4 tiedown chains for the semitrailer) is a procedural fix for a vehicle with inadequate transportability. Do not use this figure as a basis of design for new or rebuy vehicles.

M119A2/A3 105MM Towed Howitzer



Notes:

1. From Section 6, Figure 1A
2. Four 1/2" diameter chains (55,000 lbs minimum breaking strength) required.
3. Rear tie-down chains may be crossed (only if *absolutely* necessary) to fixed tie-down points on the rail bed. If chains are crossed, they **MUST** be separated with non-conducting material.
4. Ensure the cannon tube is secured by using the cannon tube clamp.
5. See TM 9-1015-260-10 for more information.

M777A2 155MM Towed Howitzer



Notes:

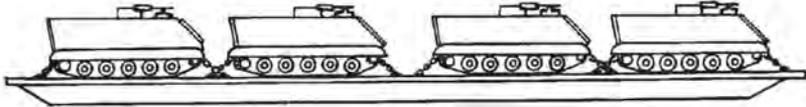
1. From Section 6, Figure 1-B
2. M777A2 must be in tow configuration (suspension bump stops removed and stabilizers stowed).
3. Third wheel (landing leg) under muzzle is required. Two lateral chains attached near the muzzle are optional.
4. Four 1/2" diameter chains (55,000 lb minimum breaking strength) required.
5. Plywood can be used to prevent metal-to-metal contact of the base of the M777A2 and the flatcar deck.
6. For more information about preparing the M777A2 for shipment and proper securement, contact the LW155 HELP LINE at 1-888-M777-411.

Appendix B. Tracked and Wheeled Armored Vehicles

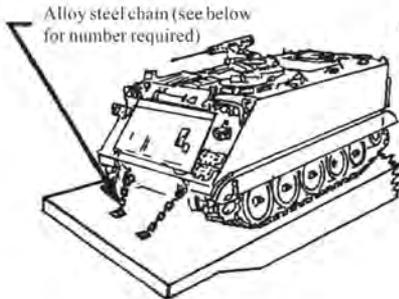
| | |
|--|------|
| Tracked Vehicles up to 30,000 lbs | B-3 |
| M577 and M1068 Ramp Securement | B-4 |
| Tanks and Similar Units 30,000 to 60,000 lbs | B-5 |
| Tanks and Similar Units 60,000 to 100,000 lbs | B-6 |
| Bradley Tiedown Detail | B-7 |
| Armored Multipurpose Vehicles (AMPVs) | B-8 |
| DODX 40000-Series Flatcar Checklist | B-9 |
| Tracked Vehicles Over 100,000 lbs | B-10 |
| M1 Tanks with Optional Link (Ring) and M88 | B-11 |
| Tracked Vehicles Over 100,000 lbs without the Link | B-12 |
| M1 with Mine Clearing Blade System | B-13 |
| Proper Securement of Ballistic Skirts | B-14 |
| M60 Tanks, AVLB, and Rear of M728 | B-15 |
| M728 Front | B-15 |
| M1A2 SEPv3 or Later Abrams Tanks | B-16 |

| | |
|--|------|
| M109A6 Paladin Howitzer | B-18 |
| M109A7 Paladin Howitzer | B-19 |
| Amphibious Assault Vehicle (AAV) | B-20 |
| Flat-Bottom Strykers Weighing up to 49,400 lbs | B-21 |
| Flat-Bottom Strykers Weighing 49,400 to 60,000 lbs | B-22 |
| Strykers with Double V-Hulls (DVH) | B-23 |
| MRAP Caiman MTV | B-24 |
| MRAP FPI Buffalo | B-25 |
| VMMD MKIII Husky (USMC or Army with Tiedown Kit) | B-26 |
| VMMD Red Pack (USMC version only) | B-27 |
| VMMD Mine Detonation Trailers (USMC version only) | B-28 |
| Assault Breacher Vehicle (ABV) | B-30 |
| Shackle-Less Provisions on the M1 Chassis | B-32 |
| Joint Light Tactical Vehicle (JLTV) | B-33 |
| HIPPO | B-34 |

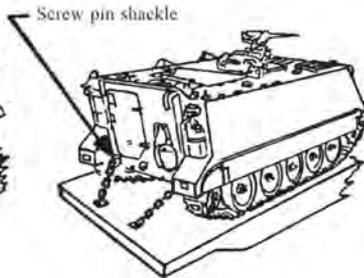
Tracked Vehicles up to 30,000 lbs



SIDE VIEW



FRONT VIEW



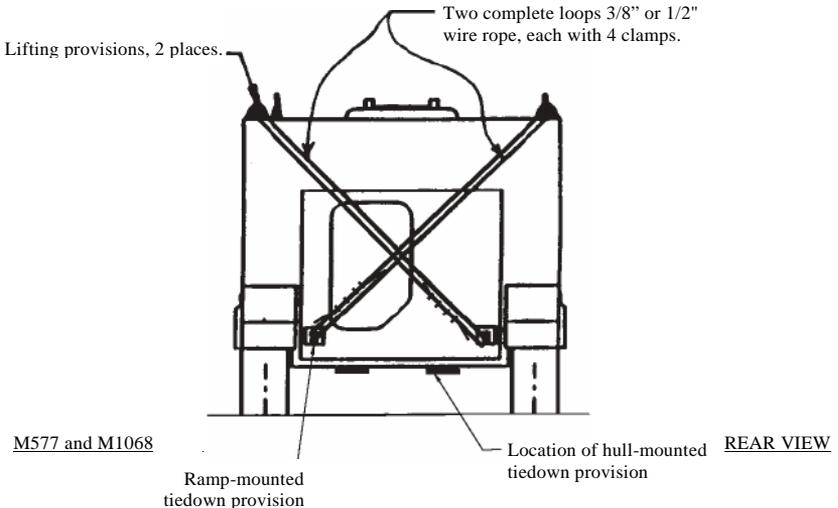
REAR VIEW

| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0 – 16,000 | 3/8 | 36,000 | 4 |
| 16,000-30,000 | 3/8 | 36,000 | 8 |
| 0 – 25,000 | 1/2 | 55,000 | 4 |
| 25,000-30,000 | 1/2 | 55,000 | 4 |

Notes:

1. Use the WLL 12.5 ton special shackle NSN 4030-01-369-7612 for tiedown. Wire-tie the nut on the bolt or drill the bolt and install a cotter pin. The railroad does not provide shackles.
2. The M577 and the M1068 (all series) must have an X pattern of 1/2" or 3/8" dia. wire rope to secure the ramp (see p. B-4).
3. From Figure 87-B, Section No. 6.

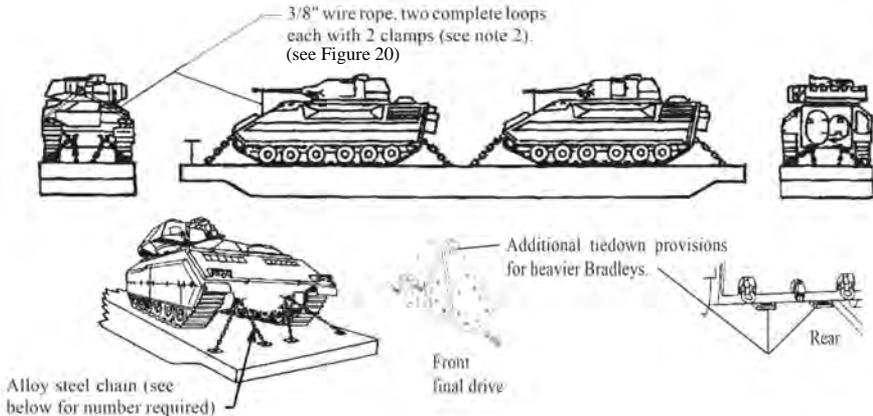
M577 and M1068 Ramp Securement



Notes:

1. This applies to all series of M577 and M1068 vehicles on which the tiedown provisions used to secure the vehicle are mounted on the ramp. The wire rope is not required on vehicles that have the rear tiedown provisions mounted on the hull used for securement rather than those on the ramp.
2. Fully engage ramp latches.
3. The wire rope must be crossed as shown. The wire ropes are routed from the lifting provision to the tiedown shackle. The point where the two wire rope loops touch must be protected from chafing. Scrap rubber hose or sheet metal fastened in place will meet this requirement.
4. This (laced wire rope) is a procedural fix for vehicles with inadequate transportability. Do not use this figure as a basis of design for new or rebuy vehicles.
5. From AAR circular letter C-7824 (M577), 20 April 92, and Figures 87, 87-A, and 87-B, Section No. 6.

Tanks and Similar Units 30,000 to 60,000 lbs

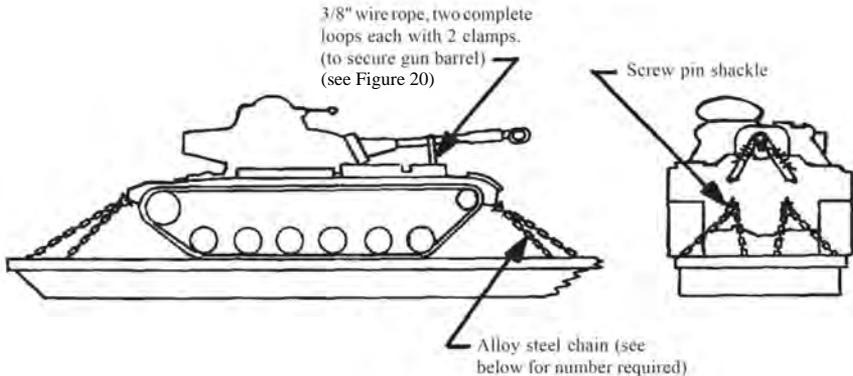


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 30,000 – 55,000 | 1/2 | 55,000 | 8 |
| 55,000 - 60,000 | 1/2 | 55,000 | 12 |

Notes:

1. Shackle - use the 21-ton, 1-1/4-inch (1-3/8-inch pin), bolt-pin safety anchor shackle, NSN 4030-01-187-0964. **The unit should provide their own shackles. The railroad does not provide shackles.**
2. If the gun barrel is installed or if the rotating turret can extend beyond the side of the vehicle, the turret must be secured from rotation with two complete loops of 3/8" wire rope each with 2 clamps, one to each side from the gun or turret to the hull.
3. From Figure 78-B, Section No. 6.

Tanks and Similar Units 60,000 to 100,000 lbs

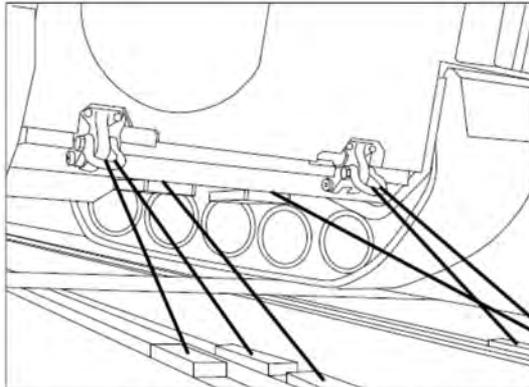


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 60,000 – 82,500 | 1/2 | 55,000 | 12 |
| 82,500 – 100,000 | 1/2 | 55,000 | 16 |

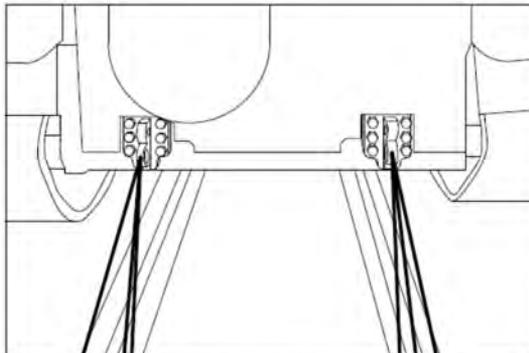
Notes:

1. Shackle - for most vehicles, use the 21-ton, 1-1/4-inch (1-3/8-inch pin), bolt-pin safety anchor shackle, NSN 4030-01-187-0964. If a towing lug requires more than two chains, put two chains in the first shackle and add another shackle for up to two more chains. Add a third shackle if a fifth chain is required. Another approach, if the tiedown provisions are not too high, is to feed the slip hook and chain through the shackle in the towing lug and hook the chain into the claw hook on the same chain assembly. One slip hook and four chains will fit in the 21-ton shackle. Put the hook in last, but tension it first to make certain it is seated properly on the shackle. **The unit should provide their own shackles. The railroad does not provide shackles.** The AAAV has four of its own shackles, each of which will accept 4 chains.
2. From Figure 78-B, Section No. 6.

**Bradley Tiedown Detail
UP TO 82,500 LBS**

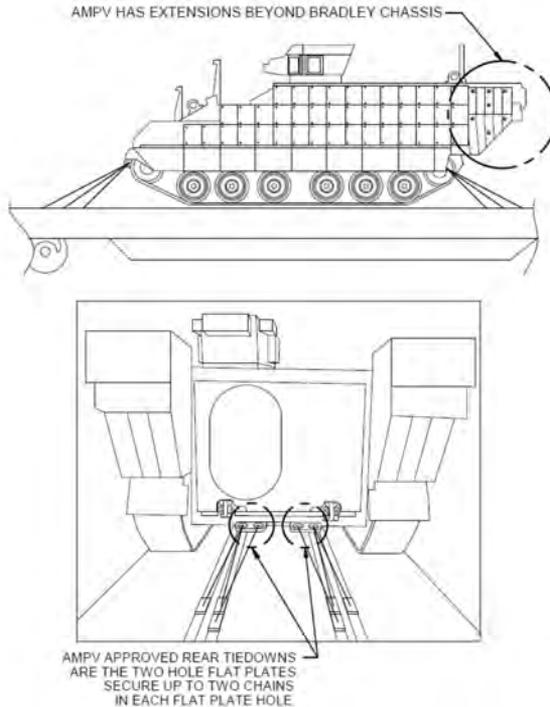


M2A3 AND PRIOR BRADLEYS ATTACH TWO CHAINS TO EACH SHACKLE AND UP TO TWO CHAINS TO EACH FLAT PLATE TIEDOWN POINT.



M2A4 BRADLEYS HAVE TWO SHACKLE-LESS PROVISIONS ON THE REAR. ATTACH ALL CHAINS TO THE LARGER HOLE ON THE PROVISION. THE SMALLER TOP HOLE IS FOR TOWING ONLY.

**Armored Multipurpose Vehicles (AMPVs)
UP TO 83,260 LBS**



| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 55,000 – 83,260 | 1/2 | 55,000 | 12 |

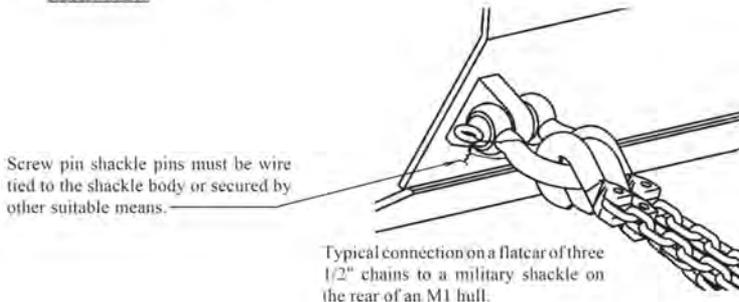
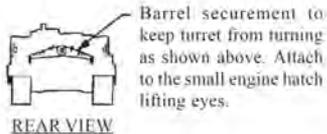
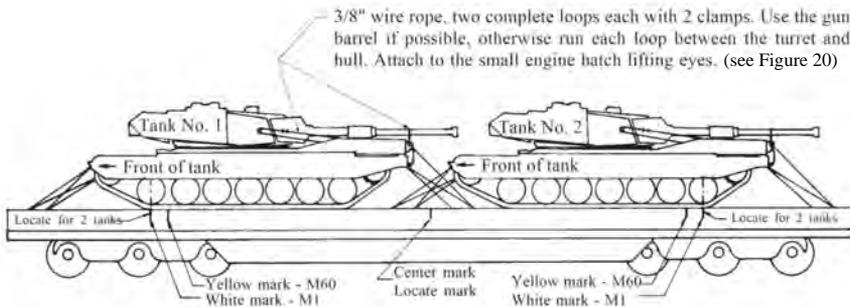
Note: Number of chains consistent with Figure 78-B, Section No. 6

DODX 40000-Series Flatcar Checklist

Note: Copies of this page should be distributed to loading teams.

- Locate chain anchors as indicated.
- Extend turnbuckles.
- Position tanks on flatcar.
- Install shackles (and links (rings), if required, on tanks).
- Pull chain tight and attach claw hook.
- Tighten until 1/8 inch of rubber shows at compression unit.
- Ensure anchor locking tabs are down in recess.
- Wire tie shackle screw pins (or secure by other suitable means).
- Secure pintle lock with cotter pin, if the pintle is used.
- Two-wrench tighten jamnuts or properly apply locking device.
- Make certain turret and gun, radiator door, side skirts, and so forth, are secured from extending over the side of the flatcar.
- Lock turret and secure the handle.

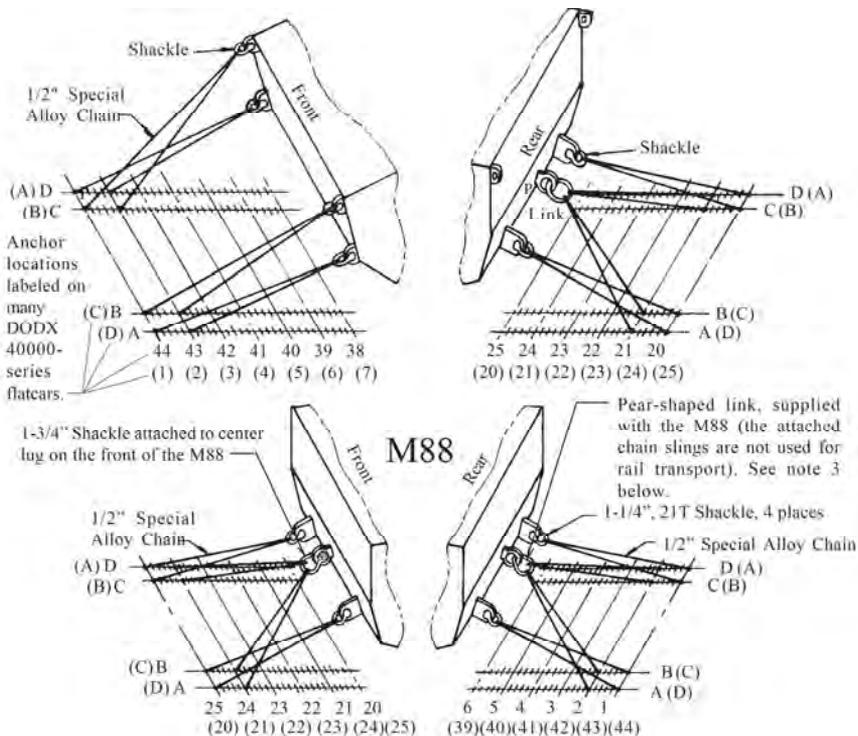
**Tracked Vehicles Over 100,000 lbs
DODX 40000-Series Flatcar**



Note: From Figure 83, Section No. 6.

M1 Tanks with Optional Link (Ring) and M88

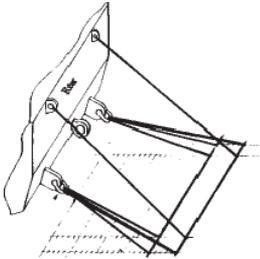
(See the next page (B-10) for procedure without link (ring))



Notes:

1. **Sixteen (16) chains required per tank:** use 1/2" dia extra strength special alloy chain, 55,000 lbs minimum breaking strength.. Use 200,000-lb minimum breaking strength links (rings). See pages 19 and 20 for approved shackles and shackle and link sources.
2. For the center front of the M88 use an alloy, 1-3/4-inch, 40-ton safety anchor shackle, NSN 4030-00-369-2955.
3. If the pear-shaped link (NSN 4010-00-133-6517) is not available on the M88, you may use the MacLean-Fogg part number 61283 ring (link) or any other master link having a minimum breaking strength of 200,000 pounds, a maximum nominal bar size of 1-3/4 inches, and a clear opening of about 5 inches to accommodate four chain assembly slip hooks.
4. From Figure 83, Section No. 6.

Tracked Vehicles Over 100,000 lbs without the Link



This procedure is approved as an option in Figure 83, Section No.6.

Use the same anchor locations on the flatcar as shown on page B-9 and reroute the chains as shown to the left. Unmarked military shackle, see pages 19 and B-8.

M1 with Mine Clearing Blade System (Mine Plow)

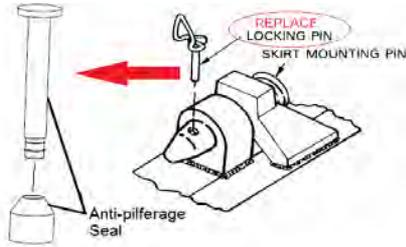
**Caution: Rail Transport of Abrams Tank with Mine Plow
Attached is Not Authorized**



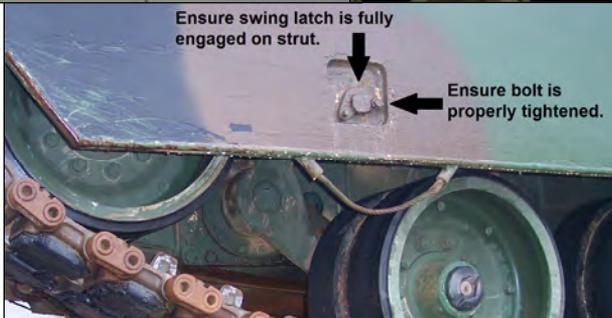
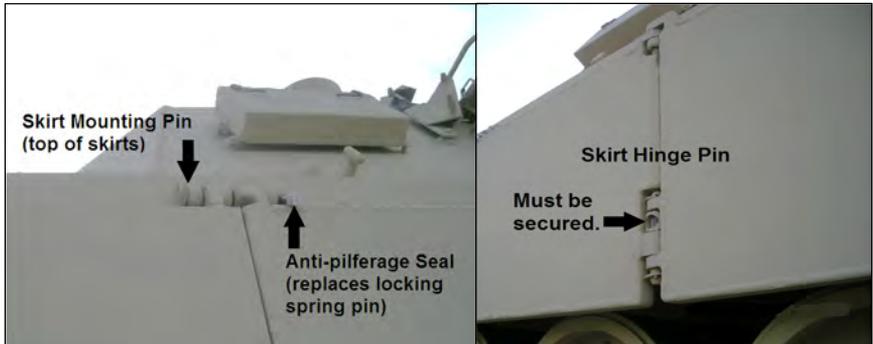
Notes:

1. Due to a 2015 rail impact test which resulted in structural damage to the mine plow, the mine plow can no longer be rail transported attached to the tank. The mine plow must be transported as a separate item when moved by rail. The Abrams program office will likely release a safety message to inform the field of this issue.
2. Refer to TM 9-2590-509-23&P for guidance on how to properly remove the plow and prepare it for shipment. The mine plow is not equipped with approved MIL-STD-209 provisions and therefore it securing directly to a flatcar deck is not recommended.
3. Figure 83, Section No. 6 guidance for the transport of the mine plow attached to the tank is rescinded.

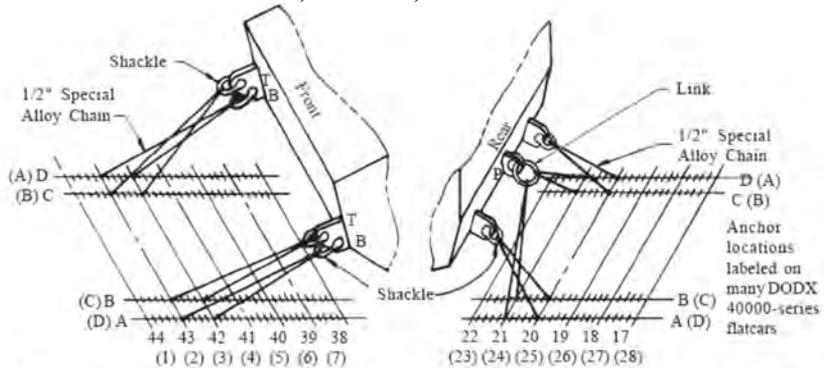
Proper Securement of Ballistic Skirts



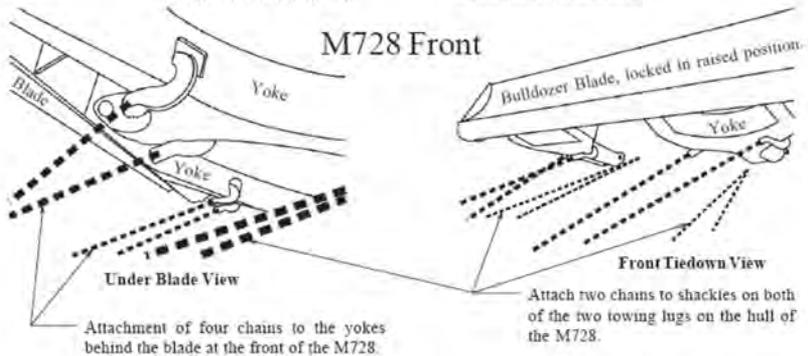
1. Replace six spring locking pins on the end of the skirt mounting pins with approved anti-pilferage seals.
2. The approved anti-pilferage seals for purchase are identified as NSN 5340-01-260-9935 and cost roughly \$2.
3. Ensure vertical skirt hinge pins are present and secure.
4. Ensure the bolt on the swing latch on skirt one is tensioned properly.
5. See TMs 9-2350-264-20-1-1 or 9-2350-388-23-1-2 for more details.



M60 Tanks, AVLB, and Rear of M728



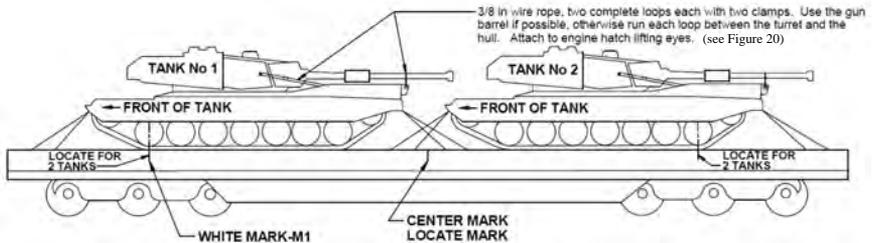
M728 Front



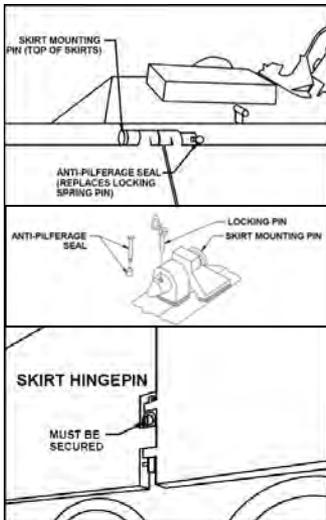
Notes:

1. The rear of the M728 is the same as the M60, but the M728 has its own master link that may be used in the pintle.
2. On the M728, wire tie the blade latches to ensure the blade is secured in the raised position, and don't forget to lock the turret lock and wire rope tie the boom and turret to prevent rotation.
3. Sixteen chains required per tank; use 1/2" dia extra strength special alloy chain, minimum breaking strength 55,000 lbs. Use 200,000-lb minimum breaking strength links (rings). See pages 19 and 20 for approved shackles and shackle and link sources.
4. From Figure 83, Section No. 6.

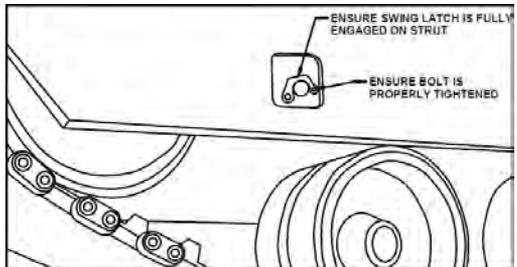
**M1A2 SEPv3 or Later Abrams Tanks on DODX 40000s
UP TO 144,000 LBS**



Proper Securement of Ballistic Skirts



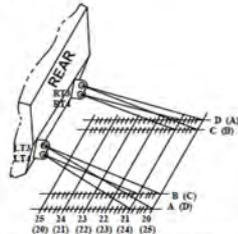
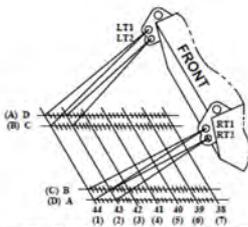
1. Replace six spring locking pins on the end of the skirt mounting pins with approved anti-pilferage seals.
2. The approved anti-pilferage seals for purchase are identified as NSN 5340-01-260-9935 and cost roughly \$2.
3. Ensure vertical skirt hinge pins are present and secure.
4. Ensure the bolt on the swing latch on skirt one is tensioned properly.
5. See TMs 9-2350-264-20-1-1 or 9-2350-388-23-1-2 for more details.



**M1A2 SEPv3 or Later Abrams Tanks on DODX 40000s
UP TO 144,000 LBS**

TWO M1A2 SEPv3 OR LATER TANKS

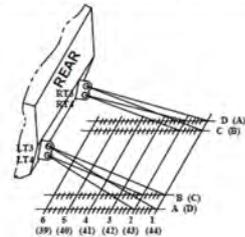
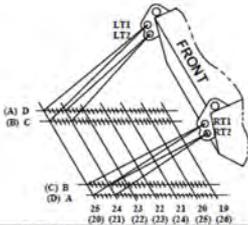
TANK No 1



| CHAIN ATTACHMENT POINTS FRONT OF TANK No 1 | | | |
|---|------------|------|------------|
| TANK | CAR DECK | TANK | CAR DECK |
| LT1 | A-44 (D-1) | RT1 | C-44 (B-1) |
| LT1 | B-44 (C-1) | RT1 | D-44 (A-1) |
| LT2 | A-43 (D-2) | RT2 | C-43 (B-2) |
| LT2 | B-43 (C-2) | RT2 | D-43 (A-2) |

| CHAIN ATTACHMENT POINTS REAR OF TANK No 1 | | | |
|--|-------------|------|-------------|
| TANK | CAR DECK | TANK | CAR DECK |
| LT3 | A-20 (D-25) | RT3 | C-20 (A-25) |
| LT3 | B-20 (C-25) | RT3 | C-20 (B-25) |
| LT4 | A-21 (D-24) | RT4 | D-21 (A-24) |
| LT4 | B-21 (C-24) | RT4 | C-21 (B-24) |

TANK No 2



| CHAIN ATTACHMENT POINTS FRONT OF TANK No 2 | | | |
|---|-------------|------|-------------|
| TANK | CAR DECK | TANK | CAR DECK |
| LT1 | A-25 (D-20) | RT1 | C-25 (B-20) |
| LT1 | B-25 (C-20) | RT1 | D-25 (A-20) |
| LT2 | A-24 (D-21) | RT2 | C-24 (B-21) |
| LT2 | B-24 (C-21) | RT2 | D-24 (A-21) |

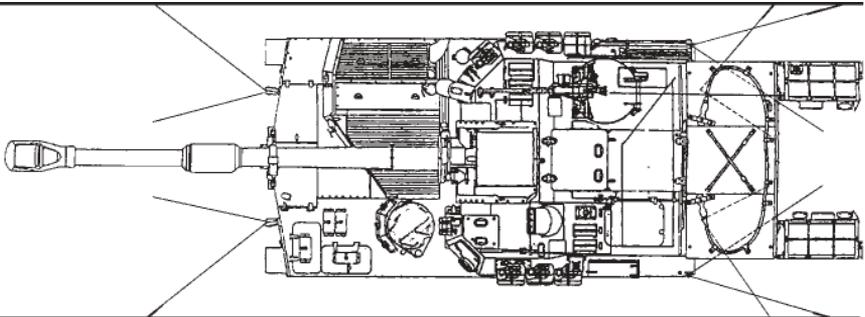
| CHAIN ATTACHMENT POINTS REAR OF TANK No 2 | | | |
|--|------------|------|------------|
| TANK | CAR DECK | TANK | CAR DECK |
| LT3 | A-44 (D-1) | RT3 | C-44 (B-1) |
| LT3 | B-44 (C-1) | RT3 | D-44 (A-1) |
| LT4 | A-43 (D-2) | RT4 | C-43 (B-2) |
| LT4 | B-43 (C-2) | RT4 | D-43 (A-2) |

Notes:

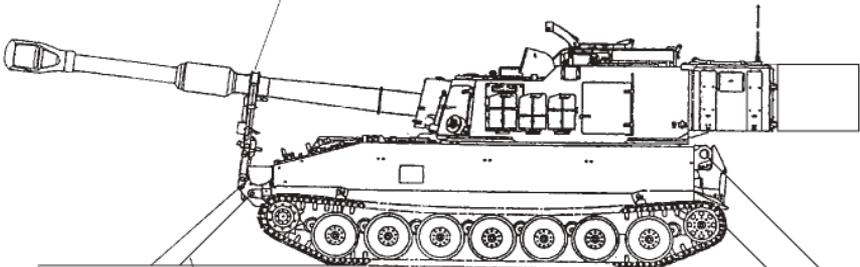
1. SEPv3 and later tanks have shackle-less tiedown provisions that can accept all 16 chains.
2. Installation of armor reactive tiles, force protection kits, or active protection systems will cause clearance and weight issues. See TM 9-2350-412-10-4 for "DoD Rail" transport configuration.
3. From pending Figure 83-A, Section No 6.

M109A6 Paladin Howitzer

56,800 TO 100,000 LBS



Barrel securement to keep turret from turning side to side during transport. Barrel brace/travel lock must be fully secured. If brace is not functional, secure barrel with two complete loops of 3/8" wire rope, each with two clamps (see Figure 20). Also ensure internal cab lock is in locked position and wire tied in place. See TM 9-2350-314-10 for more details.



Twelve (12) chains required per howitzer up to 82,500 lbs; 1 chain to each lower and 2 chains to each upper of the eight tiedown provisions; use 1/2" special alloy chain with a minimum breaking strength of 55,000 lbs. (The eight provisions each require a shackle such as for the Bradley, NSN 4030-01-187-0964.) When weight exceeds 82,500 lbs, Sixteen (16) chains are required, 2 chains in each tiedown provision.

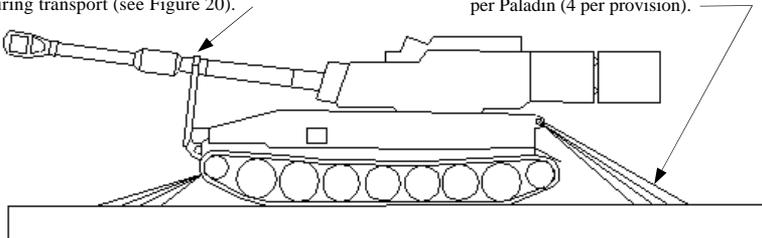
Note: From Figure 78-B, Section No. 6.

M109A7 Paladin Howitzer (PIM)

UP TO 100,000 LBS

Barrel brace must be fully secured. If brace is not functional, secure barrel with two complete loops of 3/8" wire rope, each secured with two clamps to keep turret from turning side to side during transport (see Figure 20).

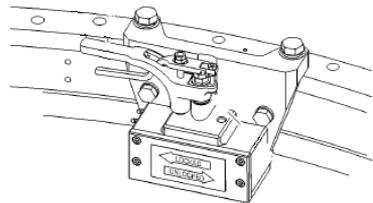
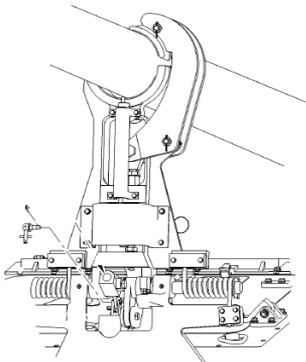
Twelve (12) 1/2" chains required per Paladin (3 per provision) up to 82,500 lbs. Above 82,500 lbs., sixteen (16) 1/2" chains required per Paladin (4 per provision).



Notes:

- 1) Equipped with four shackle-less tiedown provisions
- 2) From Figure 78B, Section No. 6

Paladin Barrel Brace/Internal Cab Lock



Consult TM 9-2350-401-10 for details on proper securement of the external barrel brace and ensuring the internal cab lock is secured into the lock position with wire tie.

Amphibious Assault Vehicle (AAV)

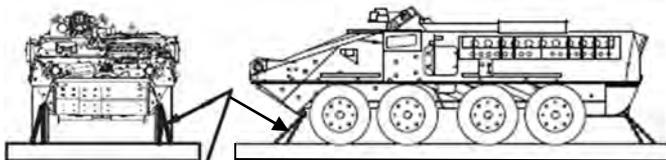
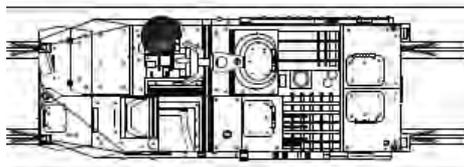
UP TO 55,150 LBS



Notes:

1. From Figure 78-C, Section No. 6.
2. Requires two 1/2" diameter chains (minimum breaking strength of 55,000 lbs) for each tiedown provision (eight total).
3. Requires one 5/8" diameter wire rope complete loop with one 1/2" chain (minimum breaking strength 55,000 lbs) for each lift provision (four total).
4. 5/8" diameter wire rope is made into a complete loop and then folded over to form a double looped. Secured loops with 6 wire rope saddle clamps, three facing outward and three facing inward.

Flat-Bottom Strykers Weighing up to 44,900 lbs



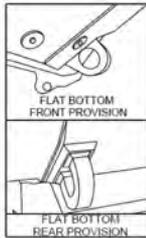
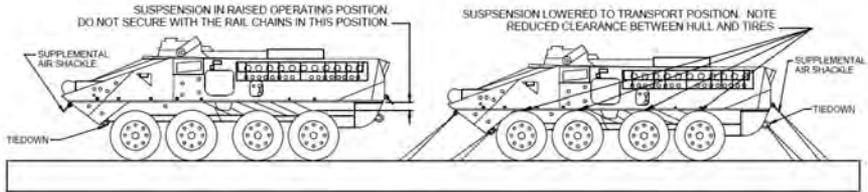
Chains: **Eight (8) 1/2" chains** 55,000 lbs minimum breaking strength (MBS) **for vehicles up to 44,900 lbs**. Do not attach to supplemental air tiedown shackles.

NOTE: On TPDX cars: apply on chains to each tiedown and one chain to each supplemental air tiedown shackle as field has reported difficulty installing two chains per provision.

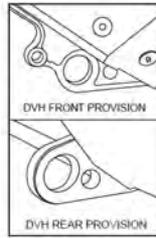
Notes:

1. From, Figure No. 58-A, Section No.6.
2. Use the fixed, solid tiedown provisions for tiedown rather than the shackles, which may be present.
3. If equipped, the remote weapon station and TOW missile launcher should be reduced for rail transport.
4. After driving the vehicle onto the flatcar, the **vehicle suspension must be reduced to the transport position** (i.e. on the suspension bump-stops) using the vehicle's integral height management system. This reduces vehicle transport height and lateral/vertical movement. When the vehicle is on the bump stops, there is about one inch distance between the top of each tire and the bottom of the overhanging hull.
5. Following rail shipment and chain removal, restore the vehicle suspension to the highway setting using the vehicle's integral height management system.
6. Stryker vehicles can be loaded or unloaded without spanners provided the space between the flatcars or between flatcar and ramp is limited to a maximum of 39 inches (34 inches is better). Use all-wheel drive, and the height management system can be in transport (lowered) or nominal (highway) position. Other wheeled and band tracked vehicles require spanners.
7. ESV front attachments such as mine plows or blades are not approved attached and must be rail transported separately.
8. When loading on a TPDX railcar, apply one chain to each tiedown provision and one chain to each supplemental tiedown shackle as the field has reported provision/chain interference issues with the T-hook on the new universal commercial rail chains on TPDX cars.

Flat-Bottom Strykers Weighing 44,900 lbs up to 60,000 lbs



If the vehicle has these flat bottom hull tiedown provisions, use this loading figure.



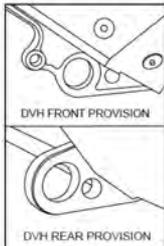
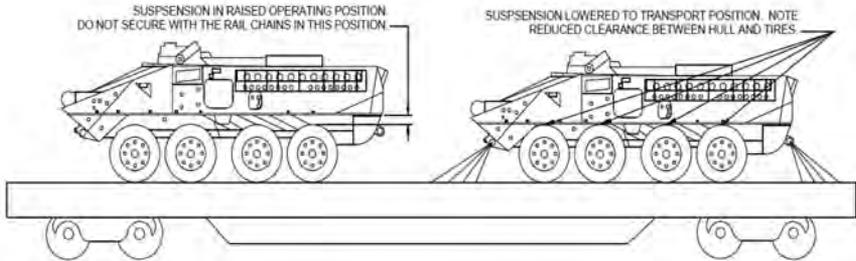
If the vehicle has these double v hull tiedown provisions, use DVH loading figure.

| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 44,900 – 60,100 | 1/2 | 55,000 | 12 |
| 60,100 – 63,000 | 1/2 | 55,000 | 16 |

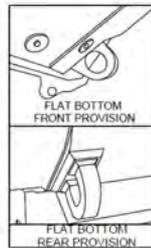
Notes:

- When 12 chains are required, apply 2 chains to each tiedown provision and 1 chain to each supplemental tiedown shackle.
- NOTE:** When loading on TPDx cars and when 12 chains are required per Stryker, apply 2 chains to each supplemental tiedown shackle and 1 chain to each tiedown. The field has reported having provision/chain interference issues with T-hook on the new universal commercial rail chains on TPDx cars. SDDCTEA recommends ordering HTTX cars for Strykers that require 16 chains.
- Please consult Notes 3-6 from *Stryker Weighing up to 44,900 lbs* on previous page for proper preparation and securement of the vehicle.
- ESV front attachments such as mine plows or blades are not approved attached and must be rail transported separately.

Strykers with Double V-Hull (DVH)



If the vehicle has these DVH tiedown provisions, use this loading figure.



If the vehicle has these flat bottom hull tiedown provisions, use Flat-Bottom loading figure.

| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0 - 44,900 | 1/2 | 55,000 | 8 |
| 44,900 – 60,100 | 1/2 | 55,000 | 12 |
| 60,100 – 63,000 | 1/2 | 55,000 | 16 |

Note: Pending Figure 58-D, Section No. 6

Mine Resistant Ambush Protected (MRAP) Caiman Multi-Theater Vehicle (MTV)

UP TO 72,000 LBS

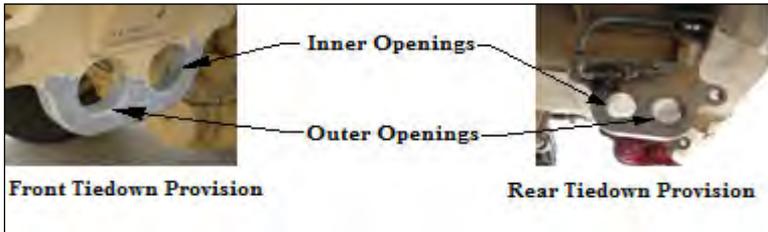
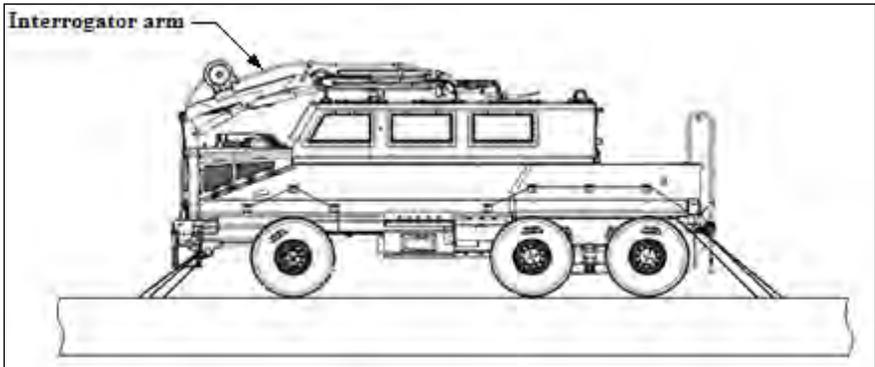


Notes:

1. **Twelve 1/2" diameter chains** (minimum breaking strength of 55,000 lbs) (**3 chains per tiedown provision**).
2. Refer to vehicle technical manual (TM) for proper stowage/locking of the Objective Gunner's Protection Kit (OGPK) for transport.
3. From Figure 88-G, Section No. 6.

Mine Resistant Ambush Protected (MRAP) Force Protection Industries (FPI) Buffalo Mine Protection Clearance Vehicle (MPCV)

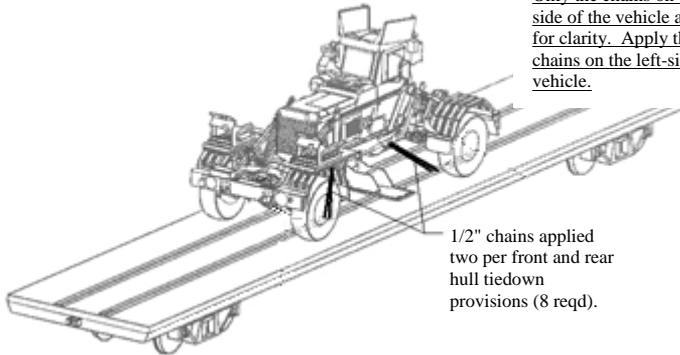
UP TO 65,700 LBS



Notes:

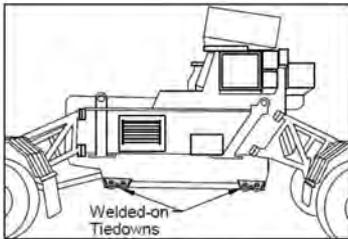
1. **Twelve 1/2" diameter chains** (minimum breaking strength of 55,000 lbs) are required to restrain the vehicle for rail transport; **three chains per tiedown provision**. On the front tiedown provisions secure two chains in the outer provision opening and the remaining chain on the inner tiedown provision opening. Similarly on the rear tiedown provisions, secure one chain on the inner provision opening and the remaining two chains on the outer tiedown provision opening.
2. Refer to vehicle technical manual (TM) for proper stowage of the interrogator arm for transport. Secure interrogator arm with two complete loops of 3/8" wire rope, each with two clamps.

Vehicle Mounted Mine Detector (VMMD) MKIII Husky (USMC model or Army model with Lift/Tiedown Kit)⁴

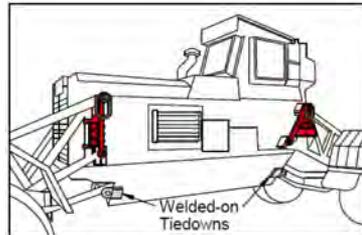


Only the chains on the right-side of the vehicle are shown for clarity. Apply the same chains on the left-side of the vehicle.

1/2" chains applied two per front and rear hull tiedown provisions (8 reqd).



USMC Version



Army with Lift and Tiedown Kit

Notes:

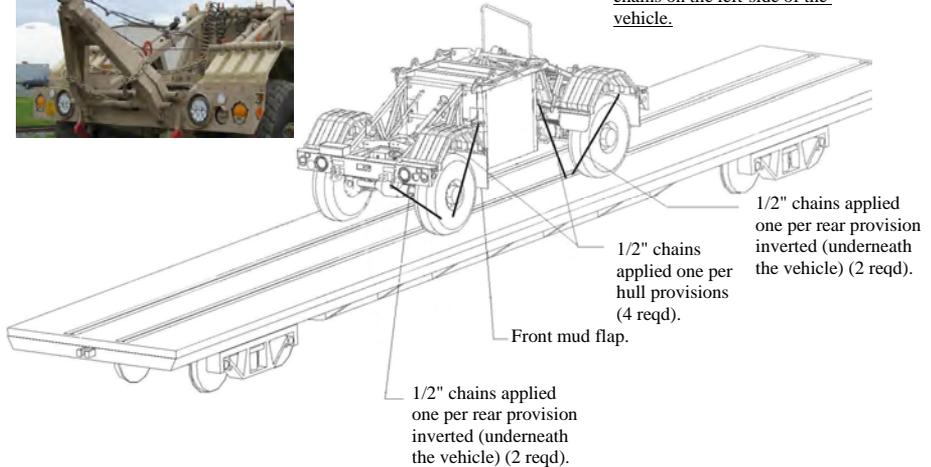
1. Husky is equipped with easily repairable wheel assemblies.
2. **Eight 1/2" diameter chains** (minimum breaking strength of 55,000 lbs) are required for rail transport.
3. See the vehicle technical manual for more information on proper stowing of detector heads.
4. **NOTE: TO USE THIS GUIDANCE, VEHICLE MUST HAVE WELD-ON HULL TIEDOWN PROVISIONS. THE ARMY HUSKY WITHOUT THE LIFT AND TIEDOWN KIT INSTALLEDD MUST BE DISASSEMBLED AND PACKED INTO AN ISO CONTAINER.**
5. From Figure 101, Section No. 6.

Vehicle Mounted Mine Detector (VMMD) MKIII (USMC version only) ⁶



Red Pack UP TO 12,640 LBS

Only the chains on the right-side of the vehicle are shown for clarity. Apply the same chains on the left-side of the vehicle.

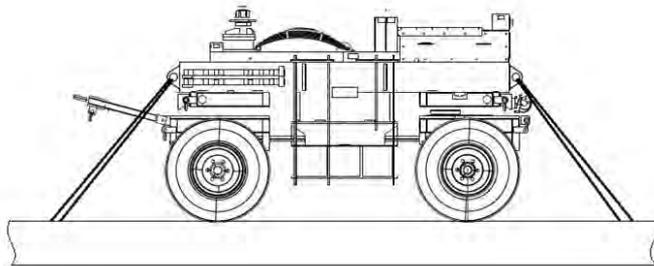


Notes:

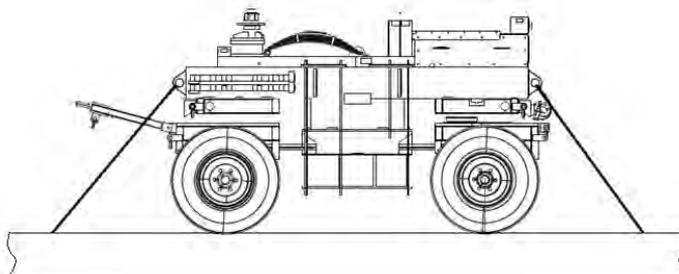
1. Redpack is equipped with easily repairable wheel assemblies.
2. **Eight 1/2" diameter chains** (minimum breaking strength of 55,000 lbs) required for rail transport.
3. When applying the inverted chains on front and rear bumper tiedown provisions, **ensure the chains do not come in contact with the understructure of the vehicle.**
4. Remove front mud flaps to provide clearance to secure chains to front hull tiedown provisions.
5. Secure front towbar in upright position with complete loop of 3/8" wire rope with four clamps.
6. **THE ARMY VERSION OF THE VMMD CANNOT BE SECURED TO A RAILCAR IN THIS MANNER AND MUST BE DISASSEMBLED AND PACKED INTO AN ISO CONTAINER FOR RAIL TRANSPORT.**
7. From Figure 101-A, Section No. 6.

Vehicle Mounted Mine Detector (VMMD) MKIII (USMC version only)²

First Mine Detonation Trailer (FMDT) UP TO 18,300 LBS



Second Mine Detonation Trailer (SMDT) UP TO 17,740 LBS

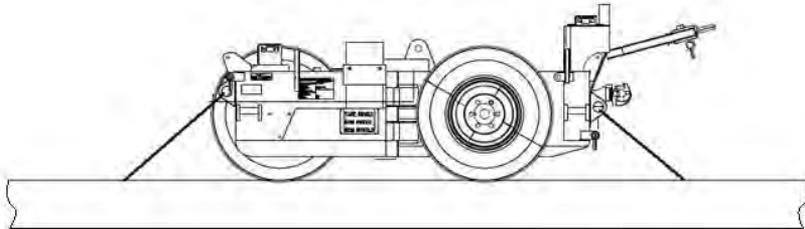


Notes:

1. **Eight 1/2" diameter chains** minimum breaking strength of 55,000 lbs required to restrain the FMDT for rail transport. **Four 1/2" diameter chains** required to restrain the SMDT for rail transport.
2. **THE ARMY VERSION OF THE VMMD CANNOT BE SECURED TO A RAILCAR IN THIS MANNER AND MUST BE DISASSEMBLED AND PACKED INTO AN ISO CONTAINER FOR RAIL TRANSPORT.**
3. From Figure 101-B, Section No. 6.

Vehicle Mounted Mine Detector (VMMD) MKIII
(USMC version only)²

Third Mine Detonation Trailer (TMDT)
UP TO 14,020 LBS



Notes:

1. **Four 1/2" diameter chains** (minimum breaking strength of 55,000 lbs) are required for rail transport.
2. **THE ARMY VERSION OF THE VMMD CANNOT BE SECURED TO A RAILCAR IN THIS MANNER AND MUST BE DISASSEMBLED AND PACKED INTO AN ISO CONTAINER FOR RAIL TRANSPORT.**
3. From Figure 101-B, Section No. 6.

Assault Breacher Vehicle (ABV)



Front view, two chains per shackle.

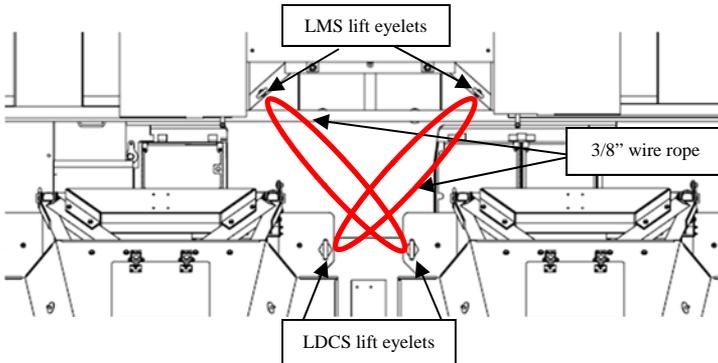
The ABV is based on the M1 Abrams chassis and uses a similar tiedown pattern. The ABV is only approved for rail transport at Vehicle Curb Weight (VCW) and was rail impact tested at a weight of 110,510 lbs. **Do not rail transport the ABV with a front attachment.** Any attachments must be removed and shipped separately. **Sixteen (16) chains required per vehicle;** use 1/2" dia extra strength special alloy chain, 55,000 lbs minimum breaking strength. See pages 19 and 20 for approved shackles and shackle and link sources.



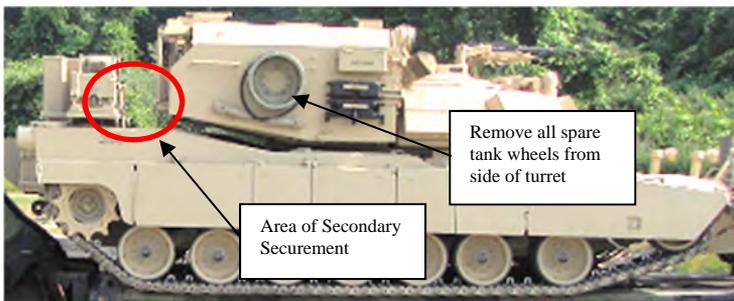
Rear view, three chains per shackle (bottom) and one chain each on the lift provisions.

Assault Breacher Vehicle (ABV) Secondary Turret Securement

3/8" wire rope, with two clamps to the lift eyelet on the LDCS (turret) frame and the lift eyelet on the LMS (Gipsy Rack). A total of two complete loops on each set of lift eyelets, hand tension wire rope, but fully torque the clamps.



Location of Secondary Securement - Top View

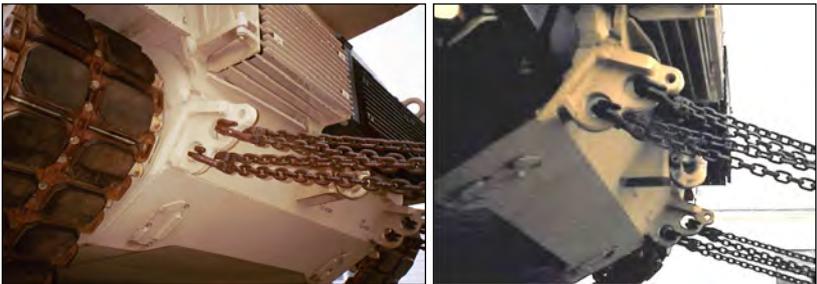


Location of Secondary Securement - Side View

Shackle-Less Provisions on the M1 Chassis



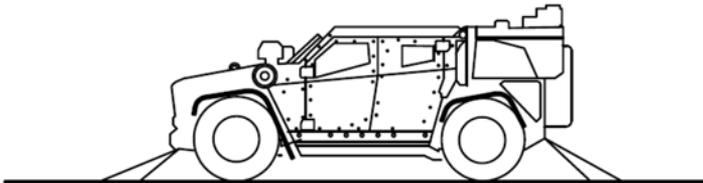
Front shackle-less provision on the M1 chassis, two chains per opening.



Rear shackle-less provision on the M1 chassis, two chains per opening.

JOINT LIGHT TACTICAL VEHICLE (JLTV)

UP TO 24,000 LBS



| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|--|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0 – 17,500 | 1/2 | 55,000 | 4 |
| 17,500-24,000 | 1/2 | 55,000 | 8* |
| *JTLVs that require 8 chains have provision/chain interference issue with T-hook on the new universal commercial rail chains on TPDx cars. SDDCTEA recommends loading these JTLVs on HTTX cars | | | |

Notes:

1. From Figure 88-K, Section No.6.
2. Transmission shall be in neutral. Set parking brake (if it is operational) to prevent the vehicle from inadvertently moving during the securement and unloading process.
3. Place vehicle suspension in lowest setting.
4. Remove shelters and transport them separately for rail transport or if lifting operations for sealift are required.

HIPPO (LOAD HANDLING SYSTEM COMPATIBLE WATER TANK RANK SYSTEM)



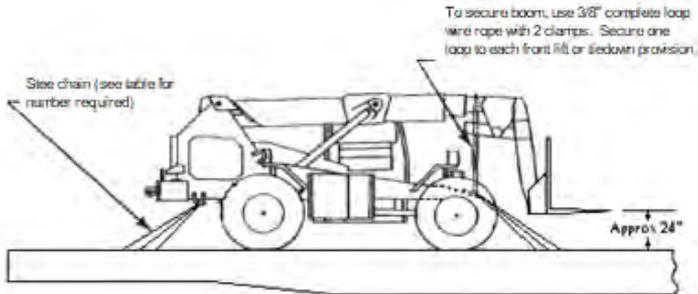
Notes:

1. The HIPPO is approved for movement directly loaded to the ISO pedestals on DODX, TPDx, or other commercial cars equipped for COFC. When loaded on these cars, the HIPPO can be empty or full. A crane is required both at the point of loading and offloading the railcar.
2. The HIPPO is NOT APPROVED for rail movement when directly mounted on the M1120, M1074, M1075, or M1076. The HIPPO is not equipped to accept the flatrack securing pin that is an integral part for securing flatracks during rail transport.
3. An empty HIPPO can be moved on the M1120, M1074, M1075, or M1076 if the HIPPO is secured to a M1077 flatrack with the ISO twist locks. The M1077 flatrack with an empty HIPPO attached can then be loaded onto the PLS/LHS truck or trailer using the securing methods normally used to secure a flatrack to a truck (shown in A5) or trailer (shown in A-6).

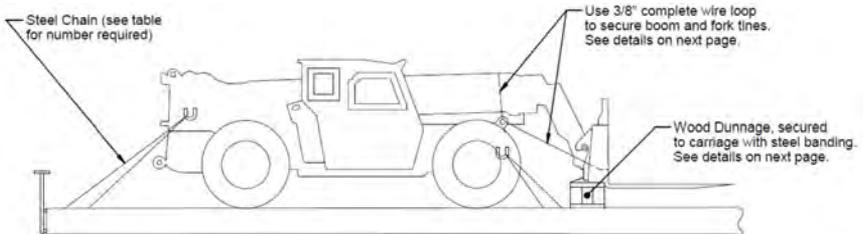
Appendix C. Materials Handling and Construction Equipment and Non-Vehicles

| | |
|--|------|
| Variable Reach Forklift Truck | C-2 |
| Wheel-Mounted Crane (25- and 35-ton) | C-4 |
| Tractors, Forklifts, Loaders, and so forth | C-5 |
| Motor Grader | C-6 |
| Motor Grader, Armored | C-7 |
| Scraper (Earthmover) | C-8 |
| Scraper (Earthmover), Armored on DODX Cars | C-9 |
| D-7 Caterpillar Dozer | C-10 |
| D-7R Caterpillar Dozer Type I & Type II | C-11 |
| CONEX or ISU Container on 5-Ton Trucks | C-14 |
| Kalmar Rough Terrain Container Handler (RTCH) | C-15 |
| Improved Ribbon Bridge (IRB) | C-17 |
| IRB M30 Bridge Erection Boat | C-23 |
| Hydraulic Excavator, Armored | C-24 |
| S280 Shelters, Single Quadcons or Tricons, 10,000 lbs or Less | C-26 |
| Concrete Mixer Trailer | C-27 |

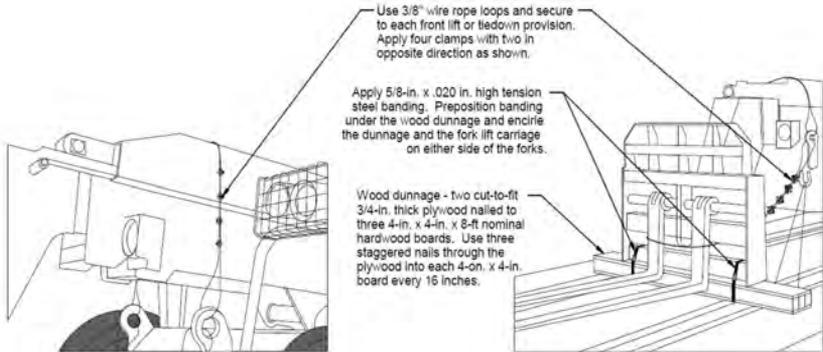
**Variable Reach Forklift Truck
40,000 LBS AND UNDER**



Alternative Tiedown Using Blocking Under Forks



Variable Reach Forklift Truck Continued

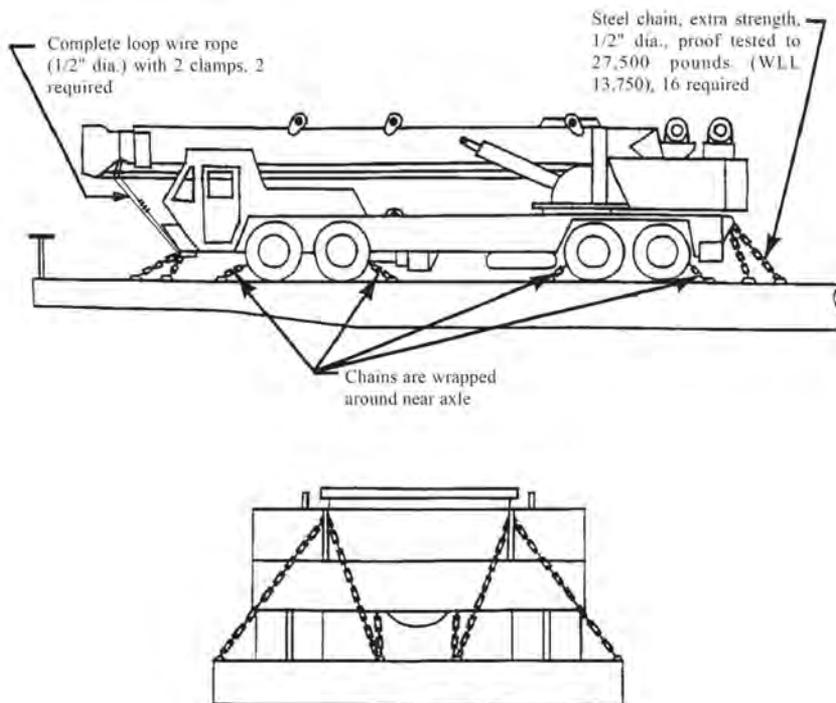


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0 – 24,800 | 3/8 | 36,000 | 12 |
| 0 – 40,000 | 1/2 | 55,000 | 8 |

Notes:

1. Transmission shall be in neutral. Set the parking brake (if it's available and operational) to prevent the vehicle from inadvertently moving during the securement and loading process.
2. Upper portion of operator's cab door must be secured.
3. Forklifts having rotating booms or turrets are prohibited in this scenario.
4. From Figure 54-C, Section No. 6.
5. Original ATLAS forklifts that have four rear tiedown points must use Figure 54-A, Section No. 6.

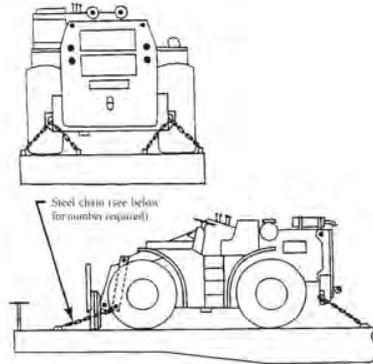
Wheel-Mounted Crane (25- and 35-ton) UNDER 72,000 LBS



Notes:

1. **Sixteen 1/2" chains** 55,000 lbs minimum breaking strength (MBS) are required.
2. From General Rules, Section No. 1.

**Tractors, Forklifts, Loaders, and so forth
(Rough Terrain Forklift Truck, and so forth)**

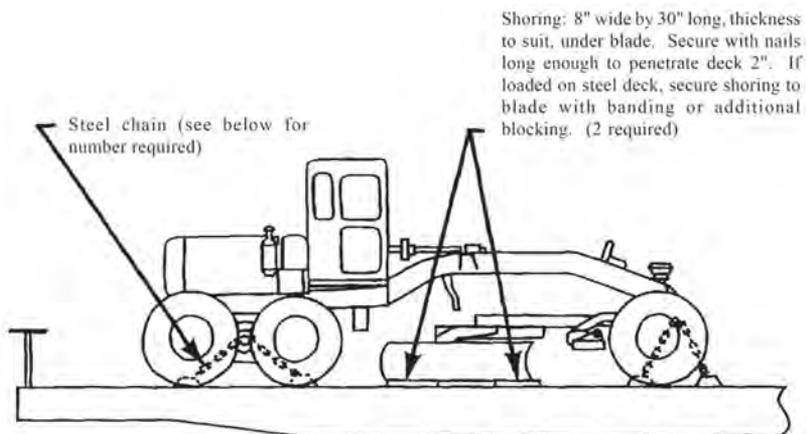


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0 - 15,000 | 1/2 | 55,000 | 4 |
| 15,000 - 30,000 | 1/2 | 55,000 | 8 |
| 30,000 - 45,000 | 1/2 | 55,000 | 12 |
| 45,000 - 60,000 | 1/2 | 55,000 | 16 |
| 60,000 - 75,000 | 1/2 | 55,000 | 20 |

Notes:

1. Additional chains may be added for lateral stability.
2. **Articulating units must be made rigid by use of a lock out bar. Lock out bar pins must be secured to prevent displacement.**
3. On vehicles equipped with movable booms, apply a 3/8-in. IWRC IPS wire rope, doubled (complete loop) around the boom and secure to vehicle to prevent movement. Protection must be applied at tiedown points when sharp edges are present. Secure with two cable clips. Substitution with wire or banding is not authorized.
4. From Figure 48-C, Section No. 6

Motor Grader

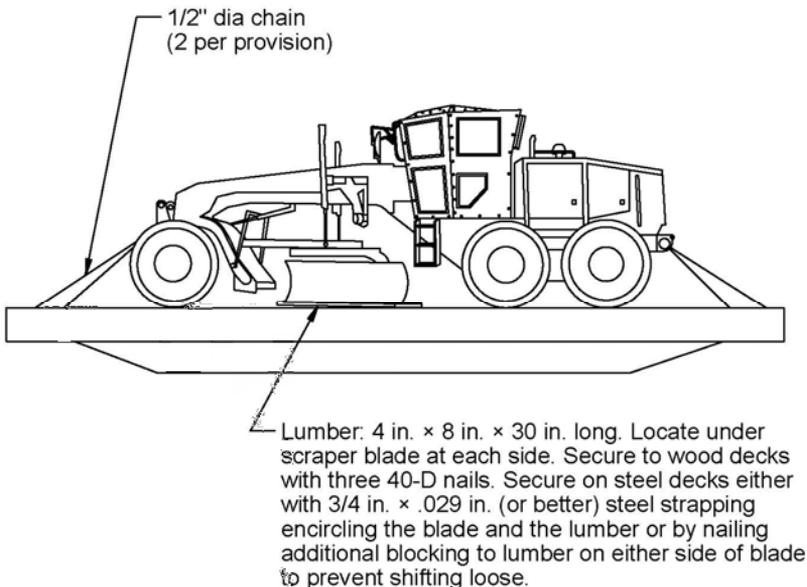


| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0 - 15,000 | 1/2 | 55,000 | 4 |
| 15,000 - 30,000 | 1/2 | 55,000 | 8 |

Note: From Figure 110, Section No. 3.

Motor Grader, Armored

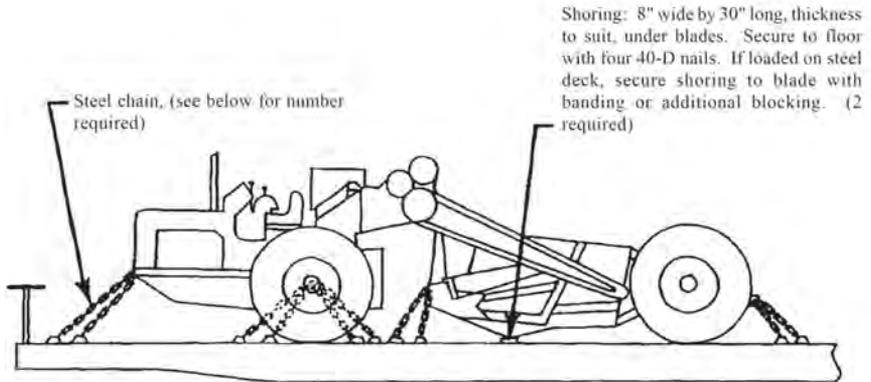
Up to 45,300 lbs



Notes:

1. From Figure 48-H, Section No. 6.
2. Transmission shall be positioned in neutral. Set the parking brake (if it is available and operational) to prevent the vehicle from inadvertently moving during the securement and unloading process.

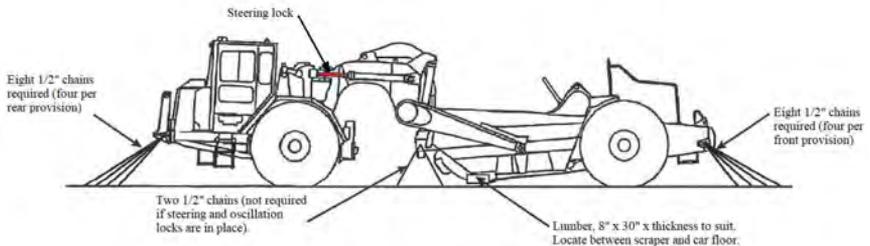
Scraper (Earthmover)



| Vehicle Weight Ranges (lb) | Alloy Steel Chain | | |
|----------------------------|-------------------|--------------------------------|---------------------------------------|
| | Dia (in.) | Minimum Breaking Strength (lb) | Number of Chains Required Per Vehicle |
| 0 - 15,000 | 1/2 | 55,000 | 4 |
| 15,000 - 30,000 | 1/2 | 55,000 | 8 |
| 30,000 - 45,000 | 1/2 | 55,000 | 12 |
| 45,000 - 60,000 | 1/2 | 55,000 | 16 |
| 60,000 - 75,000 | 1/2 | 55,000 | 20 |

Note: From Figure 48-D, Section No 6.

Scrapper (Earthmover), Armored on DODX Cars Up to 80,000 lbs



Steering Lock Detail



Oscillation Lock Detail

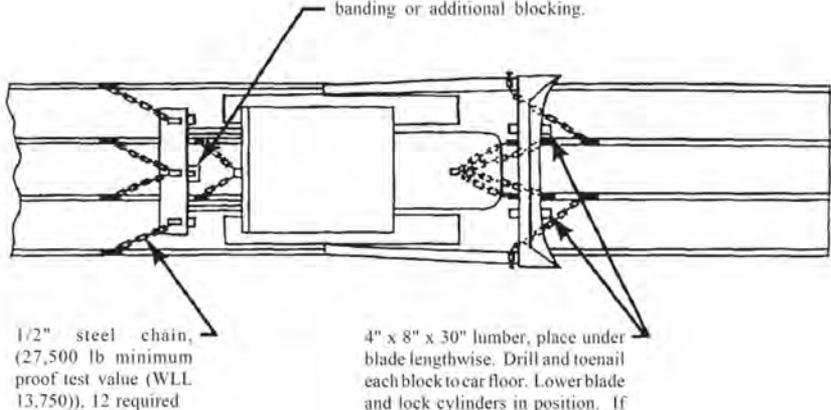
Notes:

1. Tie-downs in the inboard and outboard channels are to be in line across the car. The angle of the tie-downs must be as close to 45° as possible.
2. Turnbuckles not equipped with self-locking devices must be wired or locked to prevent loosening.
3. Additional chains may be added for lateral stability.
4. Tie-down chains must be free from twisted or kinked links prior to their application to the vehicle.
5. Open hooks must be secured with wire over the opening to prevent hook from becoming disengaged from the chain link to which it is secured.
6. Transmission shall be in neutral. Set the parking brake (if it is available and operational) to prevent the vehicle from inadvertently moving during the securement and unloading processes.
7. Blade must rest on lumber.
8. Locking devices (two steering locks and one oscillation lock) must be in place for rail transport and lifting operations. See Steering Lock and Oscillation Lock detail photos.
9. From Figure 87-E, Section No. 6.

D-7 Caterpillar Dozer

UP TO 82,000 LBS

4" x 8" x 30" lumber (2 required) stacked under center ripper. Drill and toenail first block to car floor with four 30-D nails. Then nail second block to first in same manner. Lower ripper onto blocks. If loaded on steel deck, secure shoring with banding or additional blocking.



Note: From General Rules, Section No. 1.

D-7R Type I and II Caterpillar Dozer
UP TO 71,175 LBS



Type I Dozer with Winch
(Secured with twelve 1/2" chains)



Front Tiedown with Winch or Ripper



Rear Tiedown with Winch



Type II Dozer with Ripper Attachment



Rear Tiedown with Ripper Attached

Notes:

- 1. Cab is removed for transport. Details on cabs shown on next page (C-10).
- 2. From Figure 48-G, Section No.6.

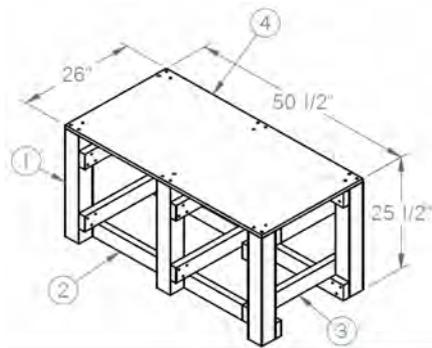
D-7R Type I and II Caterpillar Dozer Continued



Armor Cab Secured to Shipping Frame in TRICON
(TRICON Secured with four 1/2" chains and 5/8" dia wire rope loops)



Unarmored Cab
(Secured with four 1/2" chains)



Unarmored Cab Dunnage

| Parts List | | | |
|------------|----------------------|----------|----------|
| Item | Description | Material | Quantity |
| 1 | 4" x 4" x 24-3/4" | Hardwood | 6 |
| 2 | 2" x 4" x 50-1/2" | Hardwood | 4 |
| 3 | 2" x 4" x 26" | Hardwood | 6 |
| 4 | 26" x 50-1/2" x 3/4" | Plywood | 1 |
| Nails | 16d | N/A | 90 |

AAR OTRs, Section I, Appendix D1 Hardwoods

NOTE: Secure dunnage to cab using two 3/4" x .022" or thicker steel banding.

D-7R Type I and II

Caterpillar Dozer Continued



D7R Blade Secured with Four 1/2" Chains



D7R Push Beam Secured with Four 1/2" Chains



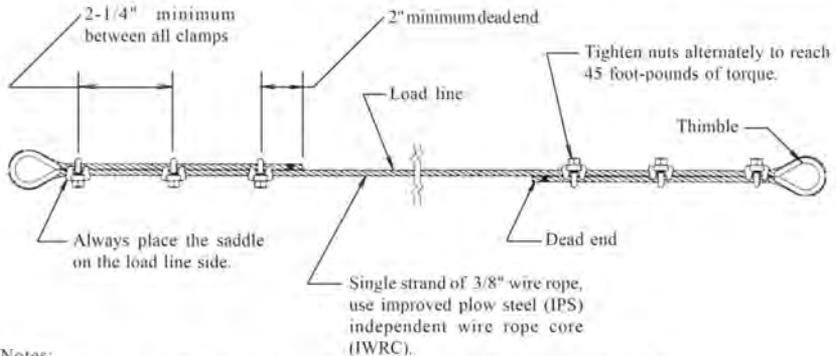
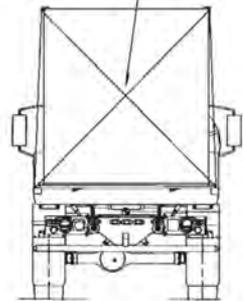
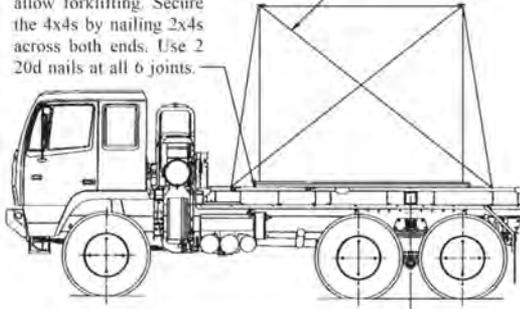
D7R ROPS Secured with Four 1/2" Chains

CONEX or ISU Container on 5-Ton Trucks

Single strand of 3/8-inch wire rope with a loop and thimble at both ends, each secured with 3 wire rope clamps (8 places, see details below).

Place 3 4x4s along the truck bed to protect the bottom of the ISU and to allow forklifting. Secure the 4x4s by nailing 2x4s across both ends. Use 2 20d nails at all 6 joints.

Protect the wire ropes from chafing where they cross with rubber hose, soft sheet metal, or other means secured to stay in place (4 places).



Notes:

1. From General Rules, Section No. 1. See page A-2 for tiedown of the truck to the flatcar.
2. If you use shackles to attach the wire rope to the tiedown rings, use at least 1/2-inch, 2-ton working load limit (WLL) safety anchor shackles and make certain the nut is secured with the cotter pin.
3. Use the same procedure for each container loaded on a flatbed semitrailer.

Kalmar Rough Terrain Container Handler (RTCH)



Figure 1. Twenty 1/2" chains required total (16 on the main vehicle and 4 on the tophandler unit).



Figure 2. Two chains per provision required on the rear and the front of the RTCH.

Kalmar Rough Terrain Container Handler (RTCH) Continued

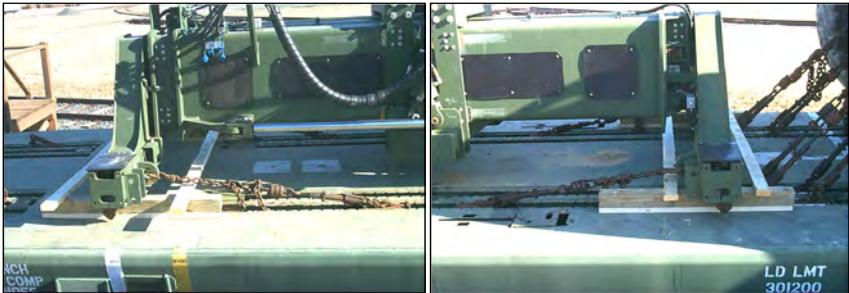


Figure 3. Shoring is required on front and rear the of the tophandler unit.

Notes:

1. When ordering flatcars, shippers should specify HTTX-type cars, DODX 40000- or 41000-series cars, or similar equipped with tiedown devices in the quantity and strength shown above.
2. To correctly distribute the weight on the flatcar, the top handler must be retracted to within approximately 20 in. of the front tires (96.5 in. on the vehicle's ECS display screen), and the far end located within 1-ft of the car end sill. The RTCH weighs about 120,000 pounds.
3. On DODX flatcars, the pair of tiedowns in the outboard channels are to be relocated to the inboard channels.
4. Shackles are not needed, nor should they be used on the vehicle tiedowns.
5. Place four pieces of shoring (4 x 4, 6 x 6, etc.) under tophandler. DO NOT set under sensor plungers next to twistlock or place on tophandler transport support block.
6. See TM 10-3930-675-10 ROUGH TERRAIN CONTAINER HANDLER (RTCH); RT 240; 53,000 LB CAPACITY; 4X4 (NSN 3930-01-473-3998) starting on page 0007 00-1 for preparation for shipment.
7. From Figure 54-B, Section No. 6.

Improved Ribbon Bridge

M15 Bridge Adapter Pallet (BAP) and Standard and Improved Ribbon Bridge (IRB) Bays

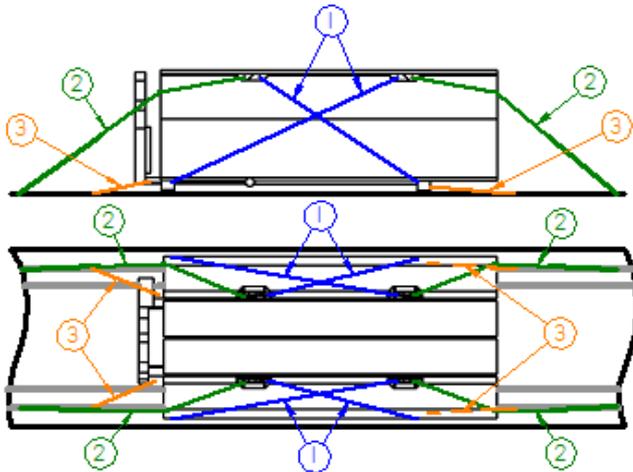


Figure 1. BAP and Bridge Bay (Side and Top View)

Tiedown Instructions: The procedure for securing and transporting the standard ribbon bridge bays and the improved ribbon bridge bays is identical.

1) The BAP should be secured to the bridge bay (ramp or interior) by 5/8" wire rope. The wire rope should run from the lifting provisions on the "legs" of the BAP to the interior lifting eyes on the top of the bridge bay for a total of four tiedowns (Figure 1).

2) The bridge bay is then secured to the railcar with four 5/8" wire rope loops connected to chains from the railcar deck (Figures 1 and 2). They should be run from the outside lifting eyes on the top of the bridge bay (Figure 3). Chains from the outermost tiedown channel of the railcar are then secured to the wire rope loops (Figure 4).

3) For additional longitudinal restraint, four more chains should run from the tiedown provisions on the BAP to the outermost tiedown channel of the railcar (Figure 4).

**Improved Ribbon Bridge (cont)
CBT BAP and Standard and IRB Bays (cont)**



Figure 2. BAP and Bridge Bay from Actual Rail Impact Test (RIT).



Figure 3. Close Up of the Top Lifting Eyes of the Bridge Bay Used for Tiedowns.

**Improved Ribbon Bridge (cont)
CBT BAP and Standard and IRB Bays (cont)**



Figure 4. Front View of Tiedowns from Actual RIT.



Figure 5. Rear View of Tiedowns from Actual RIT.

Improved Ribbon Bridge (cont) M14 Improved Boat Cradle (IBC) and Bridge Erection Boat



Figure 6. IBC and Boat from Actual RIT.

Tiedown Instructions: The IBC is secured to the railcar (Figure 6) by attaching chains from the outside stake pockets to the four tiedown provisions on the IBC, two in the front and two in the back (Figures 7 – 9). Additionally, the Bridge Erection Boat is secured to the railcar with chains attached to 5/8" wire rope loops (similar to those used in the BAP bridge bay). The wire rope loops are attached to the Bridge Erection Boat on the front lifting provisions (Figures 9 and 10). **The keel pin located at the bottom of the IBC is not to be used to secure the Bridge Erection Boat to the IBC for rail transport. Damage could result to the boat if the keel pin is used.**



Figure 7. Chain Tiedowns on the Front of the IBC.

**Improved Ribbon Bridge (cont)
CBT IBC and Bridge Erection Boat (cont)**



Figure 8. Chain Tiedowns on the Rear of the IBC and the Front of the Boat.



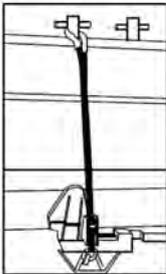
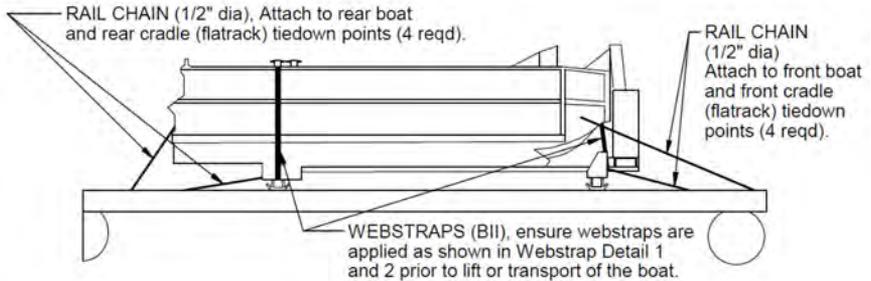
Figure 9. Chain Tiedowns on the Rear of the IBC and the Front of the Boat.

**Improved Ribbon Bridge (cont)
CBT IBC and Bridge Erection Boat (cont)**

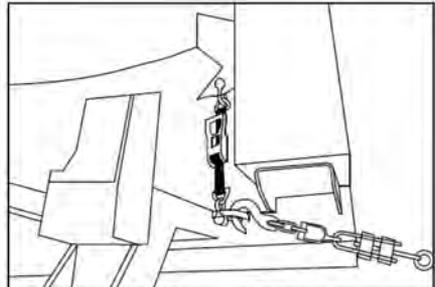


Figure 10. Chain Tiedowns on the Front of the IBC.

**Improved Ribbon Bridge (cont)
M30 Improved Boat Cradle (IBC) and Bridge Erection Boat**



Webstrap Detail 1



Webstrap Detail 2

Notes:

1. Ensure rail chains connecting to lower cradle (flatrack) have locking sleeves wire tied in accordance with General Rule 21.7.9.
2. From Figure 21-E, Section No. 6.

**Hydraulic Excavator (HYEX), Armored Cab
UP TO 67,300 LBS**

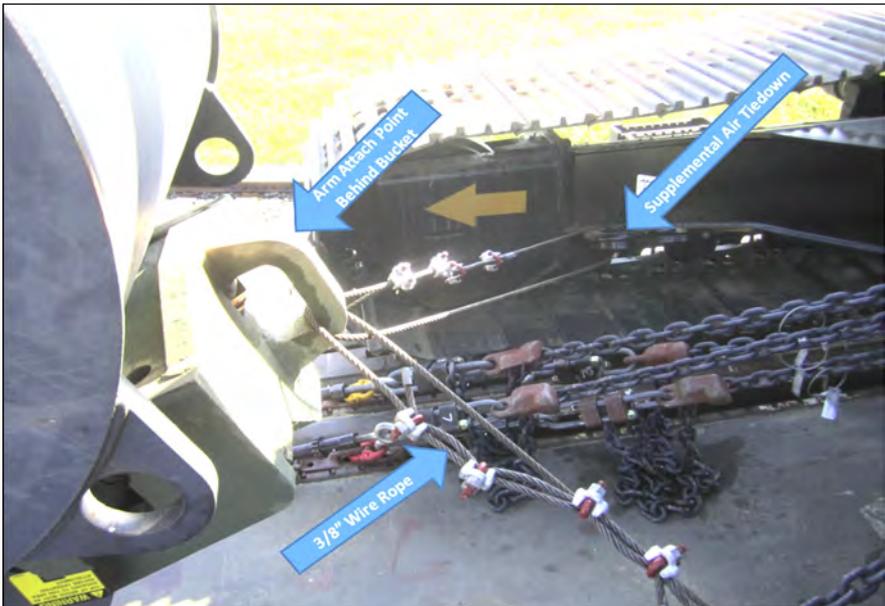


FRONT VIEW



REAR VIEW

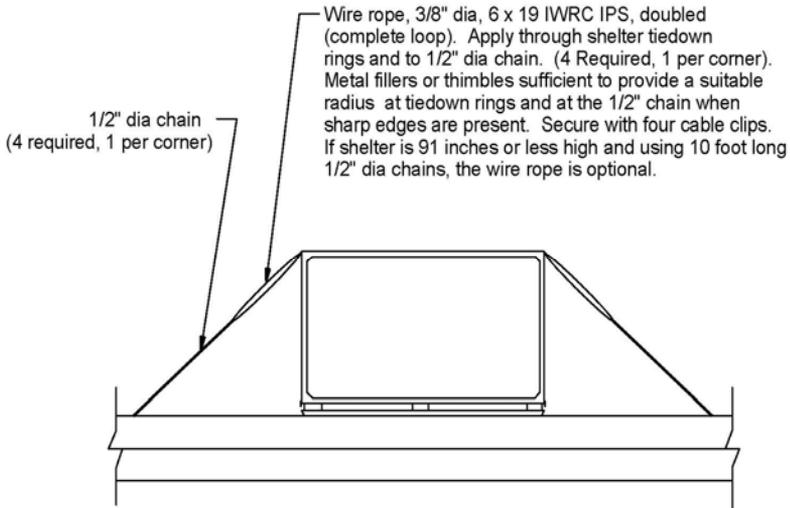
Hydraulic Excavator (HYEX), Armored Cab (Continued)

**SECURE REAR OF BUCKET**

Notes:

1. From Figure 48-F, Section No. 6.
2. **Sixteen 1/2" diameter chains** (minimum breaking strength of 55,000 lbs) required. Four chains per provision.
3. Rear of bucket is secured to HYEX supplemental air tiedown provisions with complete loops of 3/8" diameter wire rope secured with four wire rope saddle clamps (two facing inward and two facing outward).
4. This figure was based on testing on the John Deere 240 LCR and 250 GR HYEX models.

S280 Shelters, Single Quadcons or Tricons, 10,000 lbs or Less

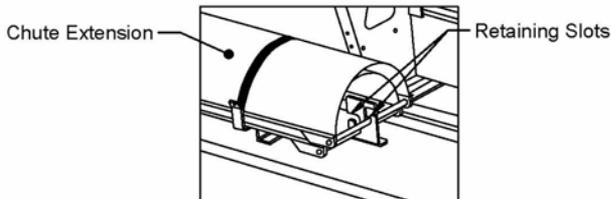
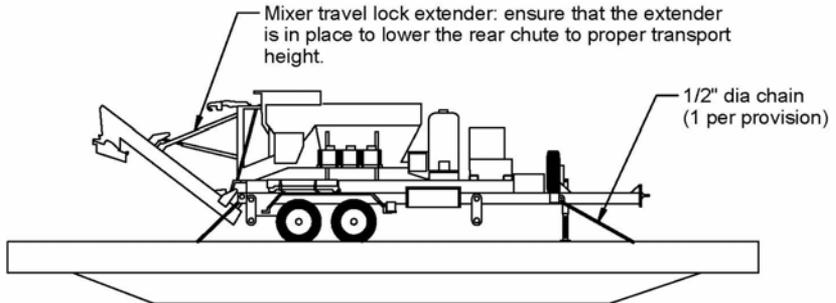


Notes:

- 1) From Figure 36-B, Section No.6.
- 2) For quadcons and tricons the 3/8" dia, 6 x 19 IWRC IPS is required as chain slip hooks or chain links are not designed to interface with ISO corner fittings.

Concrete Mixer Trailer

UP TO 11,580 LBS



Sketch

Notes:

4. From Figure 48-I, Section No. 6.
2. Ensure that the chute extensions that are stored above the fender are properly secured in retaining slots as shown in Sketch 1. Ensure that both straps are secured over the two chute extensions.
3. The fuel tank in the mixer trailer must be empty prior to rail transport.

Index

A

| | |
|---|--|
| AAR | iii, 1-3, 12, 14, 16-21, 32, 36, 48, 57-58, 60-62, 64, 69 |
| Amphibious Assault Vehicle (AAV) | B-20 |
| Anchor holes, 89-foot flatcar | 48-50 |
| Angle of 45 degrees in the side view | 5 |
| Anti-Tank Guided Missile (Stryker) | B-21-23 |
| Armored Vehicle Launched Bridge (AVLB), M60 | B-15 |
| Assault Breacher Vehicle (ABV) | B-30 |
| Association of American Railroads (AAR) | iii, 1-3, 12, 14, 16-22, 32, 36, 48, 50, 57-58, 60-62, 64, 69 |
| ATVV (Stryker) | B-23 |
| AVLB | B-15 |
| Axle blocking, vehicles with flat or shredded tires | 19-20, 33, 52, 61-62 |

B

| | |
|---|-----------------------------|
| Banding | 17-18, 32, 60 |
| Ballistic Skirts, Proper Securement | 52, B-9, B-14, B-16 |
| Battle-Damaged or Retrograde Vehicles | 60-68 |
| Bi-level Flatcars | 22-23 |
| Bill of Materials for Rail Cradle for M1 Missing Tracks | 66 |
| Blue signal/flags | 33, 51 |
| Brakes | 1-2, 21, 23, 26, 34, 36, 69 |
| Brake Wheel | 2, 52 |
| Brake wheel clearance | 2, 52 |
| “Breaker Bar” | 29-30 |
| Bridge plates (Spanners) | 34, 38-41, 51, 54, B-21 |
| BTTX | 22 |
| Buffalo, MRAP FPI MPCV | B-25 |

C

| | |
|--|--|
| Cable clamps | 4, 26, 30, 32, A-7, B-4-5, B-18-20, B-25, B-27, B-31, C-25 |
| Caiman, MRAP MTV | B-24 |
| Caterpillar D-7 | C-10 |
| Caterpillar D-7R | C-11-13 |
| Chain anchor and chain anchor channel | 7, 10-11, 14, 35, 48, 50, 52, B-9 |
| Chain assemblies | 3, 7-12, 14, 16-17, 22, 24-25, 33, 48-49, 53, 55 |
| Chain hoist and cable gripper | 4, 6, 28 |
| Chain saw | 29, 31 |
| Chain table, Armored Wheeled Vehicles | 16 |
| Chain table, Unarmored Wheeled Vehicles | 15 |
| Checklist, DODX-40000-Series Flatcars | B-9 |
| Checklist, Loading and Tiedown | 52 |
| Clamps | 4, 26, 30, 32, A-7, B-4-5, B-18-20, B-25, B-27, B-31, C-25 |
| Clips | 4, 29, C-5 |
| Combat Engineer Vehicle, M728 | B-15 |
| Commander's Vehicle (Stryker) | B-21-23 |
| Common Mistakes | 32-35 |
| Comparison of the Rail Shock Environment | 36 |
| Complete loop wire rope assembly | 4, 6, A-7, B-20, B-27, C-5 |
| Concrete Mixer Trailer | C-27 |
| CONEX | C-14 |
| Construction Equipment Appendix | C-1 |
| Container-on-flatcar (COFC) | A-7, B-35 |
| Correct position of chain anchor winch | 35 |
| Cradle, M1 | 62-68 |
| Crane | C-4 |
| CVV (Stryker) | B-23 |

D

| | |
|---|--|
| D-7 Caterpillar Dozer | C-10 |
| D-7R Caterpillar Dozer Type I and Type II | C-11-13 |
| DODX | 7, 9, 10, 12, 16, 20, 24, 27, 43-44, 47, 50, 53, 55, 62, 64, |

| | |
|---|-----------------------|
| A-9, A-11, A-17, B-9-10, B-16-17, B-34, C-9, C-16 | |
| DODX 40000-series 68-foot flatcar | 24, 27, 43-34, 50, 53 |
| DODX 40000-Series Flatcar Checklist | B-9 |
| DODX 41000-series 68-foot flatcar | 27, 43, 50 |
| DODX 42000-series 89-foot flatcar | 27, 44, 47, 50 |
| Doors, vehicle | 4, 33, 61 |
| Dozer, D-7 | C-10 |
| Dozer, D-7R | C-11-13 |
| Dunnage for unequal height railcars | 34, 38 |
| DVH, Stryker | B-23 |

E

| | |
|---|---------|
| Earthmover (Scraper) | C-8 |
| Earthmover (Scraper), Armored on DODX Car | C-9 |
| End ramp | 42 |
| Engineer Squad Vehicle (Stryker) | B-21-23 |
| Environment, Rail Shock | 36-37 |
| ESVV (Stryker) | B-23 |
| Excavator, Hydraulic | C-24-25 |

F

| | |
|---------------------------------------|----------|
| Fuel, Modular System | A-7 |
| Fire Support Vehicle (Stryker) | B-21-23 |
| Flat tires | 19, 61 |
| Flex Handle | 29, 30 |
| FPI, MRAP Buffalo MPCV | B-25 |
| Forklifts | C-2, C-5 |
| Former Soviet Union (FSU) | 37, 55 |
| Forty-Five Degree Tiedown Angle | 3, 5 |
| FSVV (Stryker) | B-18 |
| FSU | 37, 55 |

G

| | |
|--|-------|
| Gearshift Levers and Brakes | 1, 26 |
| Gondola, possible use for damaged vehicles | 60 |
| Gloves | 30-32 |
| Grader (Motor) | C-6 |
| Grader (Motor, Armored) | C-7 |
| Grate/Lock Chocking System (GLCS) | 22-23 |
| Gun Tube | 26 |

H

| | |
|---------------------------------------|---|
| HEMTT LHS, M1120 | 61, A-5 |
| HET, M1000 Trailer | A-10-11 |
| HET, M1070 Tractor | A-8 |
| HET, M1070A1 Tractor | A-9 |
| HIPPO | B-34 |
| Hooks, Slip | ix, 7, 12, 20, 27, 35, B-11, C-26 |
| Howitzer, Paladin, M109A6 | B-18 |
| Howitzer, Paladin, M109A7 (PIM) | B-19 |
| Howitzer, Towed, M119A2/A3 | A-22 |
| Howitzer, Towed, M777A2 | A-23 |
| HTTX 60-foot flatcar | 24, 27, 45-46, 50, A-10, A-18, B-22, B-33, C-16 |
| Hump operations | 37, 61 |
| Hydraulic Excavator (HYEX) | C-24-25 |

I

| | |
|--|-----------|
| ICCV (Stryker) | B-23 |
| Improved Ribbon Bridge | C-17-22 |
| Infantry Carrier Vehicle (Stryker) | B-21-23 |
| Inverted tiedown on vehicle | 3, 6 |
| Installation Transportation Office (ITO) | 33, 53-55 |
| ISU Container | C-14 |
| ITO | 33, 53-55 |

| | |
|--|-----------------------------|
| ITTX | 45-47, 50, 53, 55, 57, A-18 |
| ITTX 89-foot flatcar with side rails | 45 |
| ITTX 89-foot flatcar with wood deck | 46 |

J

| | |
|---|------|
| Joint Light Tactical Vehicle (JLTV) | B-33 |
|---|------|

K

| | |
|---|---------|
| Kalmar Rough Terrain Container Handler (RTCH) | C-15-16 |
|---|---------|

L

| | |
|--------------------------------|---------|
| LHS, HEMTT M1120 | 61, A-5 |
| Loaders | C-5 |
| Loading Ramp | 42 |
| Logistics Vehicle System | A-12 |

M

| | |
|---|---------|
| M1 Abrams Tank Cradle (made with off-the-shelf parts) | 62-68 |
| M1 Tanks with Optional Link | B-11 |
| M1 with Mine Clearing Blade System | B-13 |
| M1000 Trailer, HET | A-10-11 |
| M1063 Semitrailers | A-21 |
| M1068 Ramp Securement | B-4 |
| M1070 Tractor, HET | A-8 |
| M1070A1 Tractor, HET | A-9 |
| M1074, PLS | A-5 |
| M1075, PLS | A-5 |
| M1076, PLS | A-6 |
| M109A6 Paladin Howitzer | B-18 |
| M109A7 Paladin Howitzer | B-19 |
| M119A2/A3 Towed Howitzer | A-22 |
| M1120, HEMTT LHS | 61, A-5 |

| | |
|--|---------|
| M129A4 and M1063 Semitrailers | A-21 |
| M577 and M1068 Ramp Securement | B-4 |
| M60 Tanks, AVLB, and Rear of M728 | B-15 |
| M728 Combat Engineer Vehicle..... | B-15 |
| M777A2 Towed Howitzer | A-23 |
| M872 Trailers, Double Stacked | A-20 |
| Materials Handling Equipment (MHE) | C-1 |
| MCVV (Stryker) | B-23 |
| Medical Evacuation Vehicle (Stryker) | B-21-23 |
| MEVV (Stryker) | B-23 |
| Mine Clearing Blade System, M1 | B-13 |
| Mine Protection Clearance Vehicle (MPCV), MRAP FPI Buffalo | B-25 |
| Mine Resistant Ambush Protected (MRAP) Caiman MTV | B-24 |
| Mine Resistant Ambush Protected (MRAP) FPI Buffalo MPCV | B-25 |
| Minimum breaking strength (MBS) | 15-16 |
| Mixer, Concrete Trailer | C-27 |
| Modular Fuel System | A-7 |
| Monkey wrench | 29-30 |
| Mortar Carrier Vehicle (Stryker) | B-21-23 |
| Motor Grader | C-6-7 |
| MRAP Caiman MTV | B-24 |
| MRAP FPI Buffalo MPCV | B-25 |
| Multi-Theater Vehicle (MTV), MRAP Caiman | B-24 |

O

| | |
|----------------------------|----------------------|
| OTTX 60-foot flatcar | 45, 50, 53, 57, A-18 |
|----------------------------|----------------------|

P

| | |
|--------------------------------------|------|
| Paladin, Howitzer M109A6 | B-18 |
| Paladin, Howitzer M109A7 (PIM) | B-19 |
| PLS Trucks (M1074/M1075) | A-5 |
| PLS Trailer (M1076) | A-6 |
| Portal Concrete Mixer Trailers | C-27 |
| Practical Tips | 53 |

| | |
|--|--|
| Preparing Vehicles Prior to Loading | 32 |
| PRM | A-7 |
| Proof load | 16 |
| Proper securement of grabhook and chain link | 12-13 |
| Proper Tire Inflation | 19, 33, 52, 61 |
| Provisions, Tiedown | 3-5, 12, 16-17, 20-21, 25, 27, 35, 52, 54, 58, 60-61 |
| PTTX 89-foot flatcar | 48 |
| Pump Rack Module | A-7 |

R

| | |
|--|---------|
| Rail cradle for M1 missing track(s) | 62-68 |
| Rail Shock Environment | 36-37 |
| Ramp, Loading | 42 |
| Ramp Securement, M577 and M1068 | B-4 |
| Retrograde Vehicles | 60-68 |
| Rough Terrain Container Handler (RTCH), Kalmar | C-15-16 |
| Rough Terrain Forklift Truck (RTFL) | C-5 |

S

| | |
|---|--|
| Safety Checklist | 51 |
| Scraper (Earthmover) | C-8 |
| Scraper (Earthmover) | C-9 |
| Securing Movable Structure | 3-4, 52 |
| Semitrailer Attached to Prime Mover | A-14 |
| Semitrailers | 21, A-14, A-19, A-21 |
| Semitrailers, M129A4 and M1063 | A-18 |
| Side Overhang, Tracked Vehicles | 26 |
| Shackles | 20, 24-25, 32, 54-55, A-8, A-9, B-3, B-5-6, B-9, B-11, B-15, B-21, B-30, C-16 |
| Shackle-Less Tiedown Provisions | 20, 25, 54, B-17, B-19, B-32 |
| Shelters | C-26 |
| Single Axle Trailers | A-15 |
| Six-foot aluminum spanner | 40 |

| | |
|--|-----------------------------------|
| Skirt, Ballistic, Proper Securement | B-14 |
| Slip hooks | ix, 7, 12, 20, 27, 35, B-11, C-26 |
| Slip hooks with the point down | 27 |
| Spanners | 34, 38-41, 51, 54, B-21 |
| Stanchions, Wood | 57-59 |
| Steel Banding | 17-18, 32, 60 |
| Steel end ramp for wheeled and heavy tracked vehicle | 42 |
| Steel piece parts for rail cradle | 67 |
| Strapping, Steel | 17-18, 32, 60 |
| Strapping, Web | 3, 21-22, 32-33, 61 |
| Stryker up to 44,900 lbs | B-21 |
| Stryker 44,900 lbs to 60,000 lbs | B-22 |
| Strykers with Double V-Hulls (DVH) | B-23 |
| STTX 89-foot flatcar | 42 |
| Suspensions, Vehicle | 2, 7, 35, A-3-4 |

T

| | |
|--|--|
| Tanks and Similar Units 30,000 to 60,000 lb | B-5 |
| Tanks and Similar Units 60,000 to 100,000 lb | B-6 |
| Tank Rack Modular (TRM) | A-7 |
| Ten-foot aluminum spanner | 41 |
| Thru hole locations on rail cradle for M1 missing track(s) | 68 |
| Tiedown of gun tube on turret | 26 |
| Tiedown Provisions | 3-5, 12, 16-17, 20-21, 25, 27, 35, 52, 54, 58, 60-61 |
| Tips and Common Mistakes | 32-35 |
| Tips, Practical | 53-56 |
| Tire Inflation, Proper | 19, 33, 52, 61 |
| Tires | 19, 21-22, 33, 52, 61-62 |
| Tires, Flat | 19, 61 |
| TOFC | 21, 58, A-19, A-21 |
| Tools for Rail Loading | 28-30 |
| Towed Howitzer (M119A2/A3 & M777A2) | A-22-23 |
| TPAX 60-foot flatcar | 45, 50, 53 |

| | |
|--|--|
| TPDX 89-foot flatcar | 45, 47, 50, 53, A-11, B-21-22, B-33-34 |
| Tracked and Wheeled Armored Vehicles | B-1 |
| Tracked Vehicles | 24-27, B-3, B-5, B-10, |
| Tracked Vehicles Over 100,000 lb | B-10 |
| Tracked Vehicles Over 100,000 lb without the Link | B-12 |
| Tracked Vehicle Turret Restraint and Side Overhang | 26 |
| Tracked Vehicles up to 30,000 lb | B-3 |
| Tractors | C-5 |
| Trailer Attached to Prime Mover | A-13 |
| Trailer, Concrete Mixer | C-27 |
| Trailer on Flat Car (TOFC) | 21, 58, A-19, A-21 |
| Trailers | 21, 57-59, A-10-11, A-14-16, A-18-21 |
| Trailers, M872, Double Stacked | A-20 |
| Trailers, Single-Axle | A-15 |
| Trailers, Two-Axle | A-18 |
| TRM | A-7 |
| Trucks and Trailers | A-1 |
| Trucks, Unarmored, Weighing up to 75,850 Pounds | A-3 |
| Trucks, Armored, Weighing up to 75,850 Pounds | A-4 |
| TTDX 89-foot flatcar | 27, 45, 47, 50, 53 |
| Tube, Gun | 26 |
| Turnbuckle | 12-13, 28, 30-31, 35-36, 48, 52, B-9, C-9 |
| Turnbuckle locking sleeves | 12-13 |
| Turret | 26, 52, B-5, B-9, B-15, B-18-19, B-31, C-3 |
| Two-Axle Trailers | A-18 |
| Two-hole shackle-less tiedown provisions | 20, 25, 54, B-17, B-19, B-32 |

U

| | |
|---------------------------------------|----------------------|
| Uni-Level Railcar | 21-22 |
| Universal Commercial Rail Chain | 8, 11, B-21-22, B-33 |
| UTTX | 21 |

V

| | |
|-------------------------------------|-----------------|
| Variable Reach Forklift Truck | C-2 |
| Vehicle doors | 4, 33, 61 |
| Vehicle spacing | 2 |
| Vehicle suspensions | 2, 7, 35, A-3-4 |

W

| | |
|--|--|
| Wheel-Mounted Crane | C-4 |
| Wheeled Vehicles | 19-23 |
| Wire Rope | 3-6, 26, 28, 29, 30, 32, 35, 61, A-7, B-3-5, B-15, B-18-20, B-25, B-31, C-5, C-17, C-20, C-25, C-26 |
| Wood Stanchions..... | 57-59 |
| Wood stanchion pattern 90 from AAR rules | 57 |
| Wood stanchion pattern 91 from AAR rules | 58 |
| Wood stanchion construction details for a 18,000 lb semi-trailer | 59 |
| Working Load Limit (WLL) | 16, 24 |

X

| | |
|----------------------------|----|
| XTTX 89-foot flatcar | 48 |
|----------------------------|----|