Closed Car Loading Guide

Part 10
(formerly Pamphlet No. 37)

Minimum Loading Standards for Primary Metal Products in Closed Cars
Minimum Loading Standards for
PRIMARY METAL PRODUCTS
IN CLOSED CARS

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1.0 INTRODUCTION

1.1 Overview

1.1.1 The purpose of this guide is to relate basic good car loading procedures that have been developed through laboratory and field testing, engineering studies, and accumulated experience in rail transportation. Compliance with the “Minimum Loading Standards” contained herein will ensure conformance with Circular No. 42-K rules and provide adequate protection for lading from sources of damage in the normal railroad environment.

1.1.2 The general rules contained in Circular No. 42-K or supplements thereto issued by the AAR are formulated for the purpose of providing safe methods of loading boxcars and must be observed.

1.1.3 The loading rules and/or practices apply to shipments transported in the USA, Canada, and Mexico.

1.1.4 The loading methods in individual closed car loading publications issued by AAR’s Damage Prevention and Loading Services are minimum standards that have been evaluated and approved by the AAR Damage Prevention and Freight Claim Committee. The minimum standards offer practical guidelines on the subjects covered. Because these are minimum standards, it may be necessary to supplement the methods in some instances.

1.1.5 Securement standards in AAR closed car loading publications are intended for safe transit of the railcar from origin to destination and for the prevention of lading and equipment damage. The standards do not address unloading practices.

1.1.6 Loading and bracing methods not currently approved may receive consideration for approval and publication under the Damage Prevention and Loading Services General Information Bulletin, No. 2, “Procedures Governing Evaluation and Acceptance of New Closed Car Loading and Bracing Methods and Materials.” Submit requests to Director, Damage Prevention and Loading Services, Association of American Railroads, Transportation Technology Center, Inc., 55500 DOT Road, Pueblo, CO 81001.

1.1.7 CAUTION: Car rocking motion caused by lift equipment entering and/or exiting the railcar may cause unsupported packages or articles with a high center of gravity to fall to the floor. Minimize access to the car. Exercise caution when inside a partially loaded car. Lift operators should stay on lift equipment, whenever possible, while inside a partially loaded car.

1.2 Reference Documents

1.2.1 Circular No. 42-K (or supplements thereto)
“General Rules Covering Loading of Carload Shipments of Commodities in Closed Cars”—These requirements must be observed in all closed car loading activities to ensure safe transit of the railcar from origin to destination, thereby eliminating hazard to railroad operation.

1.2.2 Circular No. 43-E (or supplements thereto)
“Rules Governing the Loading, Blocking, and Bracing of Freight in Closed Trailers and Containers for TOFC/COFC Service”—This publication contains the requirements covering loads in trailers or containers.
1.3 Rail Transportation Environment

1.3.1 There are inherent characteristics of the rail environment that must be understood to recognize the need for many of the requirements identified in this publication.

1.3.2 Forces encountered within the rail vehicle are induced by shock and/or vibration. In most instances, the force is a complex result of both shock and vibration. Force input due to shock is mainly a result of impacts during switching and train slack action (run-in and run-out during train movement). Force input due to vibration is a result of the movement of the railcar’s wheels on the rails. This vibration force can act either in a vertical or lateral plane. These forces are due to the movement of the car wheels on the rails, the truck geometry, rail joints, rail elasticity, nonuniformities of the rail and wheels, and overall track condition. When all these factors are acting on a rail vehicle, the resultant force is very complex.

1.3.3 The lading in a rail vehicle can also generate forces; for instance, in canned commodities, the metal cans can act as springs. For multilayer loads in the rail vehicle, any vertical force input in the bottom layers can be greatly amplified as it travels to the top layers. This is the transmissibility factor due to the harmonics of a particular stack or column of containers.

1.3.4 Uncontrolled movement and/or displacement of the lading in a rail vehicle can cause safety problems, equipment failure, damage, and unloading problems. The following minimum loading standards in conjunction with proper packaging will provide safe arrivals.
2.0 SELECTION AND PREPARATION OF CAR

2.1 Overview

2.1.1 With the exception of customer-owned or leased cars and cars assigned to specific customers, it is the carrier's responsibility to inspect cars before placing for loading. Shippers are responsible for inspecting interiors of cars to see that they are suitable to carry lading safely and damage-free.

2.1.2 Before attempting to open the doors of any railcar, check to make sure that all hardware is intact so that the doors open safely. Check the door tracks to make sure they are equipped with stops on the ends so that the doors do not fall off when opened.
   - It is critical to check locking bars and related hardware to make sure you can safely open plug doors.
   - Make sure the doors are operating correctly before fully opening them. There is always the possibility that material or lading may be leaning against the inside doors or is applying pressure.
   - Use extreme care when opening any type of railcar door to protect against injury.

2.1.3 Always check the car to see if water entry is possible. Make sure that the car is watertight. Look for light leaks or evidence of new or large amounts of rust, which may indicate recent water entry into the car.
   (Note to customers: Notify appropriate carriers immediately if railcars are received with water damage to ensure that the car is shopped and repaired before the car is used again.)

2.1.4 Check the car floors for any holes or rough surfaces that may result in leakage or damage to the product.

2.1.5 If the car supplied is not suitable for loading and the shipper elects to load the car rather than reject it, it is the shipper's responsibility to properly prepare the car.

2.1.6 The loading methods illustrated in this guide have a proven track record of success in specific car types. Please note the type of car for which each method is used. Failure to use the proper loading method in the proper type of equipment will result in damage to the product and a dissatisfied customer (i.e., if a loading method is shown for use in a cushion equipped car, use that loading method only in cushion-equipped cars).

2.1.7 Boxcars used for loading and transporting heavy concentrated weight (e.g., metal) must be inspected by the originating carrier (either before they are placed for loading or at loading point) for suitability to safely carry such loads to their destination.

2.1.8 When ordering boxcars for loading concentrated weights of heavy commodities, shippers are responsible for notifying serving carriers of the heavy-weight conditions and if the cars were not inspected by the originating carrier for these conditions.

2.1.9 Boxcars furnished for loading and transporting heavy concentrated weight (e.g., tin plate, copper anodes, lead ingots, cathodes, zinc slabs, spelters, and all other high-density commodities) must meet the following requirements:

2.1.9.1 Cars must be stenciled 25K, 50K, 70K, or 80K adjacent to door opening, indicating floor loading capacity.

2.1.9.2 Wood floors must be 2¼ in. thick in sound condition supported by at least three metal floor stringers on each side of the center sill the full length of the car.

2.1.9.3 If equipped with sliding sill underframe, wood floors must be 2¼ in. thick in sound condition supported by at least two metal floor stringers on each side of the center sill the full length of the car.
2.1.9.4 If equipped with steel floors or special-type wooden flooring the full length of the car, the overall strength of the floor must be not less than that of a floor with three stringers as specified above.

2.1.9.5 Boxcar must be checked by the shipper to see that the floors and supporting structure are in good condition. If the shipper has any doubts concerning the condition of the car, the serving railroad should be contacted.

2.1.9.6 Shippers have the responsibility of attaching a concentrated floor loading card, shown in Figure 2.1, to the routing or placard board on each side of the boxcar loaded with metals with densities exceeding 400 lb/ft³ and/or 800 lb/ft² floor-bearing area.

2.1.9.7 Loads occupying less than the total floor space that could cause unbalanced distribution within the car must be secured to prevent movement.

2.2 Clearance at Side Bearing—Loaded Cars

For cars not equipped with constant-contact-type side bearings (zero clearance normal), clearance must be maintained at side bearings to permit free curvature of trucks.

2.3 Maximum Load Weight

2.3.1 Load weight in the car must not exceed the load limit stenciled on the car.

2.3.2 Load weight on one truck must not exceed one-half of the load limit stenciled on the car.

2.4 Distribution of Weight Lengthwise in Cars

2.4.1 For all boxcars, except for those with staggered double-doors built before 1966, the percentages of stenciled load limits shown in Figure 2.2 must not be exceeded for loads located between truck centers, measured to full length of the car, unless car owners have otherwise noted in the Official Railway Equipment Register.
2.4.2 For staggered double-door boxcars built before 1966, the percentages listed in Figure 2.2 are shown in Table 2.1:

Table 2.1 Length of load versus percentage of stenciled load limit

<table>
<thead>
<tr>
<th>Length of Load</th>
<th>Inside Length of Car</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 ft to 20 ft</td>
<td>40%</td>
</tr>
<tr>
<td>20 ft 1 in. to 24 ft</td>
<td>45%</td>
</tr>
<tr>
<td>24 ft 1 in. to truck centers</td>
<td>75%</td>
</tr>
<tr>
<td>Truck centers to full length of car</td>
<td>100%</td>
</tr>
</tbody>
</table>

If the maximum load is 40% of stenciled load limit, the provisions in paragraphs 2.3.1 and 2.3.2 would not apply.

2.4.3 Weight of material loaded in either end between truck centers and end of car must not exceed 15% of stenciled load limit for boxcars built before January 1, 1966, and 25% for cars built after January 1, 1966.

2.4.4 When crosswise bearing pieces are used, the distance between the outside bearing pieces (center-to-center) must exceed the minimum distances specified in paragraphs 2.4.1 and 2.4.2 for that percentage of the stenciled load limit being loaded and be in sufficient number to ensure uniform distribution of lading on the car floor.

2.4.5 Bearing pieces lengthwise of the car, extending beyond the lading, may be used to spread weight distribution over a greater area. In such cases, “Length of Bearing Pieces” is substituted for “Length of Load” in paragraphs 2.4.1 and 2.4.2. Bearing pieces must be of suitable strength in relation to percentages stated and must be continuous and in sufficient number to ensure uniform distribution of lading on the car floor.

2.4.6 When the length of load is less than the distance between truck centers, and the load is not located in the center of the car, the center of load weight must not be nearer to either truck center than that shown in Table 2.2:

Table 2.2 Load weight as percentage of load limit

<table>
<thead>
<tr>
<th>Load weight as percentage of load limit</th>
<th>Position between truck centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% of load limit or less</td>
<td>Any place between truck centers</td>
</tr>
<tr>
<td>60%</td>
<td>One-sixth distance between truck centers</td>
</tr>
<tr>
<td>66.6%</td>
<td>One-fourth distance between truck centers</td>
</tr>
<tr>
<td>75%</td>
<td>One-third distance between truck centers</td>
</tr>
<tr>
<td>87%</td>
<td>Three-sevenths distance between truck centers</td>
</tr>
<tr>
<td>90%</td>
<td>Nine-twentieths distance between truck centers</td>
</tr>
</tbody>
</table>
2.5 Distribution of Weight Crosswise in Cars

2.5.1 The load must be located so that the weight along both sides of the car is approximately equal for the entire length of the load.

2.5.2 When the load is such that it cannot be placed to obtain equal distribution of weight crosswise of the car, use properly secured and suitable ballast to equalize the weight.

2.5.3 In boxcars, lading must be secured to prevent tipping or moving toward the sides of the car where the vacant space across the car exceeds a total of 12 in. between lading and car sides.

2.6 Concentrated Weight
Observe the concentrated load restrictions stenciled on the side of the car adjacent to the doors; e.g., 50K or 75K, which indicate the maximum front axle load for lift trucks entering the railcar.
3.0 LOAD PLANNING

3.1 General Load Planning

3.1.1 When the individual commodities are not specifically described or covered, load as nearly as possible to the best example that can be located in these loading standards.

3.1.2 Load, block, or brace commodities tightly lengthwise and crosswise to eliminate all void spaces, which are primary reasons for damage. Take up any void spaces remaining in a car. Use blocking, fillers, and other suitable materials, and secure them in accordance with the methods outlined in this guide and other guides listed on the back cover of this book.

3.1.3 Load and secure lading to permit unloading from either side of the railcar, except when dimensions of individual units of freight prohibit unloading from either side of the car.

3.1.4 Inspect lading before loading car. Do not load damaged lading.

3.1.5 Evenly distribute the weight of loads from side-to-side and end-to-end in the car and to a uniform height of lading insofar as lading permits. Always center the units in the doorway area along the lengthwise centerline of the car.

3.1.6 Stow lading in a manner to prevent contact with doorposts.

3.1.7 Fill all lengthwise space with lading and with lading and filler material, or appropriately block and brace.

3.1.8 When there is a possibility of lading falling or rolling out of the doorway or coming in contact with sliding or plug-type side doors, protect openings with wood doorway protection, steel straps, or other material of sufficient strength and number, and adequately secure it.

3.1.9 Apply temporary bracing in partly loaded or unloaded cars that will be switched during the process of loading or unloading.

3.2 Loading Partial and Incomplete Layers

3.2.1 Where necessary to load a partial or incomplete layer of bundles of ingots, secure against shifting.

3.2.2 Where the incomplete layer is secured in the ends of the car, place approximately the same amount in each end to balance the car. Check the car’s load limit to ensure that you do not overload one or both sets of trucks. Place end loads behind full-height gates of 2 in. × 6 in. lumber extending from the top of floor bundles to the top of the incomplete layer and secured with steel straps to alternating vertical wall anchors at least 3 ft from face of load.

3.2.3 The number, size, and strength of steel straps required will vary depending upon the weight and dimensions of the bundles loaded. Never use steel straps having a minimum breaking strength of less than 4,750 lb.
4.0 PACKAGING

To facilitate handling, ingots are usually unitized into packages/bundles for handling by mechanical fork truck handling equipment.

4.1 Aluminum Ingot Packaging

Figure 4.1 is an example of two typical aluminum ingot packages. Stow individual ingots in a nested pattern. The package may or may not be covered by a plastic shroud. Unitize the package by applying four 3/4 in. × 0.50 in. Type IV polyester plastic straps with a minimum break strength\(^a\) of 2,250 lb. (75% minimum joint strength). Apply two straps per package side, 2 × 2.

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5.0 BLOCKING AND BRACING MATERIALS

5.1 Steel Strapping

5.1.1 Use the proper combination of steel straps, seals, sealing tools, notches, or crimps to provide a minimum breaking strength of 4,725 lb and 75% joint efficiency for all doorway protection straps.

5.1.2 Use metal protectors, such as corner guards or plates, sufficient to provide a suitable radius to protect straps at all points on lading having sharp edges and/or sharp corners.

5.1.3 Use tensioning and sealing equipment properly. Check the tools periodically to ensure their efficiency.

5.1.4 More detailed information regarding steel strapping is available in the Closed Car Loading Guide, Part 1, (formerly Pamphlet No. 14), “Minimum Loading Standards for Freight in General Purpose Boxcars.”

NOTE: For the latest updates of approved strapping, go to the TTCI Web site at http://www.aar.com/standards/open_top_loading_approvals.php.

5.2 Nonmetallic Strapping

5.2.1 Use the proper combination of nonmetallic straps, seals, and sealing tools to provide a minimum breaking strength of 3,285 lb and 75% joint efficiency for all doorway protection straps.

5.2.2 More detailed information regarding nonmetallic strapping is available in the Closed Car Loading Guide, Part 1, (formerly Pamphlet No. 14), “Minimum Loading Standards for Freight in General Purpose Boxcars.”

NOTE: For the latest updates of approved strapping, go to the TTCI Web site at http://www.aar.com/standards/open_top_loading_approvals.php.

5.3 Lumber


5.4 Pneumatic Dunnage

5.4.1 Table 5.1 defines five levels of performance for pneumatic dunnage:
- Level 1 for pneumatic dunnage as lateral void fillers (and load securement in certain intermodal applications)
- Levels 2 to 5 for pneumatic dunnage as lengthwise void fillers in flat platen-type applications with varied performance requirements

Pneumatic dunnage meeting Level 2 to 5 requirements fulfills all Level 1 requirements.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>For filling lateral voids, primarily in intermodal loads</td>
</tr>
<tr>
<td>Level 2</td>
<td>For filling lengthwise voids in loads weighing up to 75,000 lb</td>
</tr>
<tr>
<td>Level 3</td>
<td>For filling lengthwise voids in loads weighing up to 160,000 lb</td>
</tr>
<tr>
<td>Levels 4 and 5</td>
<td>For filling lengthwise voids in loads weighing up to 216,000 lb</td>
</tr>
</tbody>
</table>

5.4.2 Usage guidelines: follow the manufacturer’s instructions on care and storage of bags prior to use. Inflate bags with an approved inflator, in accordance with the manufacturer’s instructions.

5.4.3 After inflation, check to see that dunnage bags are approximately the same size as the face of the load. Do not extend the dunnage bag beyond the face of the load. See Figure 5.1.
5.4.4 Use buffer material of sufficient strength to prevent it from conforming to dunnage bag contour, to prevent chafing, to prevent dunnage bag from crushing load at proper inflation pressure, and to prevent lading from damaging dunnage bags.

5.4.5 Use buffer material equal or slightly larger in size than face of lading. Have lading adjacent to bag(s) nearly equal in height on each side of bag.

5.4.6 Inflation pressure may vary from 2 psig to 10 psig depending on the nature of lading and the level of air bag used.

5.4.7 Void size after inflation will be from 4 in. to 12 in. See applicable commodity publications for possible exceptions to this limitation.

5.4.8 Install bag(s) so that the bottom(s) will be a minimum of 1 in. above the floor after inflation. Apply protective material (e.g., fiberboard) between the bag and floor.

5.4.9 Use hold-down methods when necessary to prevent bag displacement from the void area.

5.4.10 Use an air gauge to ensure prescribed air pressure at inflation. Recheck air pressure one-half hour after inflation for leakage.

5.4.11 Use clean and dry air to fill dunnage bags.

5.4.12 Do not use bags in tandem (back-to-back). Do not use dunnage bags to fill more than one lengthwise void in a car.

5.4.13 Use two bag systems unless otherwise specified.

5.4.14 For further information, refer to AAR General Information Bulletin No. 9, “Product Performance Profile for Pneumatic Dunnage.”

5.4.15 Go to http://www.aar.com/standards/dpls/pfds/PPPPD_Verification_List.pdf for the most current “Product Performance Profile for Pneumatic Dunnage Product Verification List.”
6.0 LOADING PROCEDURES

6.1 Unitized Ingots Braced with Dunnage Bags

6.1.1 This method is for unitized ingots braced by a disposable inflatable dunnage (D.I.D.) bag. Figure 6.1 is an example. The number of rows and stacks may vary depending on the dimensions of the ingots.

Figure 6.1 Unitized ingots braced by pneumatic dunnage

6.1.2 Ingots are unitized using an approved polyester plastic strapping.

6.1.3 Load units from the ends of the car to the doorway area, and center from side to side in the car. If the vacant space across the car exceeds a total of 12 in. between lading and lading and car sides, use guide rails as shown. Guide rails are a minimum 2 in. × 4 in. lumber secured to the floor with 4 in. nails staggered not more than 18 in. apart.

6.1.4 Place a sheet of single-wall (double-faced) corrugated board between the last stack in each end of the car and the doorway units. Load doorway units so that the void filled by the D.I.D. bag is 4 in. to 12 in. after inflation of the bag. It may be necessary to turn doorway units.

6.1.5 Lumber or wood gates may also be used to reduce the lengthwise void. Do not place lumber used as void filler adjacent to the D.I.D. bag. If cylindrical ingots are being loaded, orient the doorway units so that the flat ends of the ingots are against the buffer sheets.

6.1.6 Use triple-wall corrugated fiberboard ½ in. thick as a buffer material on each side of the D.I.D. bag. Use buffer sheets large enough to cover the entire face of the lading adjacent to the bag.
6.1.7 Fold a large sheet of single-wall (double-faced) corrugated board in half in a “V” shape and place the D.I.D. bag lengthwise in the “V.” Use a D.I.D. bag approximately the same size as the face of the lading. Position the fiberboard and bag between the buffer sheets as shown in Figure 6.1. Inflate the bag to a minimum 8 psi. Recheck the bag pressure 30 minutes after inflation to check for leakage.

6.1.8 Use minimum 2 in. × 4 in. lumber as doorway protection on both side of the car. Secure to the floor with 4 in. nails staggered not more than 18 in. apart.

6.2 Rigidly Braced Large Ingots in a Single Layer

6.2.1 Load units from the ends of the car to the doorway area and center from side to side in the car. If the vacant space across the car exceeds a total of 12 in. between lading and lading and car sides, use guide rails as shown in Figure 6.2. Guide rails are a minimum 2 in. × 4 in. lumber secured to the floor with 4 in. nails staggered not more than 18 in. apart.

![Figure 6.2 Large ingots in a single layer](image)

6.2.2 Use backup cleats as necessary to extend from guide rails to car sidewall.

6.2.3 Use 4 in. × 4 in. lumber or laminated 2 in. × 4 in. lumber to fill remaining lengthwise space in the doorway. Nail crossmembers to doorway guide rails on both sides of car.
6.3 Rigidly Braced Bar Ingots or “T” Ingots

6.3.1 Load units from the ends of the car to the doorway area and center from side to side in the car. If the vacant space across the car exceeds a total of 12 in. between lading and lading and car sides, use guide rails as shown in Figure 6.3. Guide rails are a minimum 2 in. × 4 in. lumber secured to the floor with 4 in. nails staggered not more than 18 in. apart.

Figure 6.3 Bar ingots or “T” ingots

6.3.2 Use backup cleats as necessary to extend from guide rails to car sidewall.

6.3.3 Unitize the doorway stacks with 1 ½ in. × 0.029 in. steel strapping. Use corner protectors as needed to protect the strap from sharp edges.

6.3.4 If crosscar void exceeds a total of 12 in., unitizing straps and guide rails or full-height side bracing is required to prevent shifting of the second layer.
6.3.5 Construct a center gate from minimum 2 in. × 4 in. lumber of appropriate size to fill remaining lengthwise space in the doorway. Examples of center gates are shown in Figure 6.4.

Figure 6.4 Center gates

6.3.6 Apply doorway protection, 2 in. × 4 in. lumber minimum, on both sides of doorway stacks and nail to car floor.
6.4 Rigidly Braced Bar Ingots—Alternative Method

6.4.1 Load units from the ends of the car to the doorway area, alternately placing each stack against the opposite sidewall, as shown in Figure 6.5.

![Figure 6.5 Bar Ingots or “T” ingots—alternative method](image)

6.4.2 Unitize the doorway stacks with 1 ¼ in. × 0.029 in. steel strapping. Use corner protectors as needed to protect the strap from sharp edges.

6.4.3 If crosscar void exceeds a total of 12 in., unitizing straps and guide rails or full-height side bracing is required to prevent shifting of the second layer.

6.4.4 Construct a center gate from minimum 2 in. × 4 in. lumber of appropriate size to fill remaining lengthwise space in the doorway. Examples of center gates are shown in Figure 6.4.

6.4.5 Apply doorway protection, 2 in. × 4 in. lumber minimum, on both sides of doorway stacks and nail to car floor.
6.5 Cylindrical Billets

6.5.1 Load billets crosswise in each end of the car, elevating one end on minimum 4 in. × 4 in. lumber floor risers or equivalent, as shown in Figure 6.6. Load each end of the car against opposite sidewalls.

![Figure 6.6 Cylindrical billets](image)

6.5.2 Use two 4 in. × 4 in. risers placed crosswise in the doorway to load lengthwise doorway billets. Place one 4 in. × 4 in. piece of lumber across the off-loading door on top of the ends of the risers and nail in position.

6.5.3 When doorway billets are loaded, secure another 4 in. × 4 in. piece of lumber across the loading doorway and nail to the ends of the doorway risers.

6.5.4 Unitize all doorway billets, including the 4 in. × 4 in. lumber, with two 1 ¼ in. × 0.029 in. steel straps.
6.6  Unitized Aluminum Ingots Braced with Dunnage Bags

6.6.1  This method is for unitized ingots braced by a disposable inflatable dunnage (D.I.D.) bag. Figure 6.7 is an example. The number of the rows and stacks may vary depending on the weight and dimensions of the ingots.

![Figure 6.7 Unitized aluminum ingots braced with dunnage bags](image)

6.6.2  Unitize ingots using an approved polyester plastic strapping. See Figure 4.1.

6.6.3  Load bundles from the ends of the car to the doorway area. When loading partial or incomplete layers, secure them against shifting as described in paragraph 6.6.10. If the cumulative vacant crosscar space exceeds 12 in., use side blocking as shown adjacent to single layers and use full-height honeycomb fillers when bundles are stowed over one high. Guide rails are a minimum 2 in. × 4 in. lumber secured to the floor with 4 in. nails staggered not more than 18 in. apart.

6.6.4  Place a sheet of single-wall (double-faced) corrugated board between each stack and horizontally between each layer when stowed more than one layer high. Load doorway units so that the void filled by the D.I.D. bag is 4 in. to 12 in. after inflation of the bag. It may be necessary to turn doorway and/or adjacent units.

6.6.5  Use ½ in. plywood or equivalent as a buffer on each side of the D.I.D. bag. Use buffer sheets large enough to cover the entire face of the lading adjacent to the bag.

6.6.6  Use a D.I.D. bag approximately the same size as the face of the lading. Place dunnage bag in the void so that after inflation it is 1 in. above the car floor. Inflate the bag to a minimum 10 psi. Recheck the bag pressure 30 minutes after inflation to check for leakage.
LOADING PROCEDURES

6.6.7 Use minimum 2 in. × 4 in. lumber as doorway protection on both sides of the car. Secure to the floor with 4 in. nails staggered not more than 18 in. apart.

6.6.8 If loading partial or incomplete layers, install a wood gate as described in paragraph 6.6.10 after the dunnage bag has been fully inflated and the load tightened as a result of inflation.

6.6.9 List of Materials

6.6.9.1 Stack separators—Place corrugated fiberboard or equivalent material across the car between each stack of packages (bundles).

6.6.9.2 Pneumatic dunnage bag—Use appropriate size and level for the weight of the load. Do not extend beyond load face. Void space taken up by the bag after inflation is to be not less than 4 in. or greater than 12 in. Place dunnage bag in the void so that after inflation it is 1 in. above the car floor. Inflate to 10 psi.

6.6.9.3 Buffer material—Place a sheet of ½ in. plywood (or equivalent) on each side of dunnage bag and covering entire load face.

6.6.9.4 Gate—One required for each end when loading incomplete layers.

6.6.9.5 Horizontal retaining straps—Five 1¼ in. × .029 in. (or equivalent) high-tension steel straps are required for each end. Two seals are required for each strap, each seal to be crimped or notched twice.

6.6.9.6 Honeycomb fiberboard void fillers—Extend to load height when bundles are stowed over one high.

6.6.9.7 Side blocking—Nail 2 in. × 4 in. boards to floor adjacent to single-stack bundles.

6.6.9.8 Horizontal separators—Place corrugated fiberboard or equivalent material between each layer of bundles when more than one high.
6.6.10 Loading of Partial and Incomplete Layers

6.6.10.1 Where necessary to load a partial or an incomplete layer of bundles of ingots, secure against shifting.

6.6.10.2 Where the incomplete layer is secured in the ends of the car, place approximately the same amount in each end to balance the car. Check the car’s load limit to ensure that you do not overload one or both sets of trucks. Place these end loads behind full-height gates of 2 in. × 6 in. lumber extending from the top of floor bundles to the top of the incomplete layer and secure with steel straps to alternating vertical wall anchors at least 3 ft from face of load. See Figure 6.8.

Figure 6.8 Bracing incomplete layers of unitized aluminum ingots

6.6.10.3 The number, size, and strength of steel straps required with this method of loading will vary depending upon the weight and dimensions of the bundles loaded. Never use steel straps having a minimum breaking strength of less than 4,750 lb. Make the combined joint strength of the number of steel straps equal to or greater than the weight of the bundles in the incomplete layer.
6.6.10.4 Figure 6.9 shows a gate with truss block construction.

Figure 6.9 Gate construction for bracing incomplete layers
6.7 Unitized Zinc Slabs in a Through Load

6.7.1 This method is for rigidly braced unitized zinc slabs. The load is illustrated, as tested, Figure 6.10.

6.7.2 Unitize the zinc slabs using four 1 ¼ in. × .029 in. steel straps. To prevent slabs working loose from the units in transit and resulting in damage or unloading problems, place package straps around both the length and width of the unit to prevent the slabs from coming loose.

6.7.3 Place a solid wood or equivalent end wall filler at each end of the car. The width of the end wall filler will be dependent on the inside car length and the dimensions of the zinc units. Size the end wall fillers so that the lengthwise void in the doorway after loading is no more than 2 in. to 4 in.

6.7.4 Load units crosswise from the ends of the car to the doorway area in the pattern shown. The total weight of units loaded in the two-wide stacks in the end of the car is not to exceed 25% of the total load weight. The total crosswise void at the three-wide stacks is not to exceed 12 in.

6.7.5 Load units in the doorway area lengthwise of the car. The lengthwise doorway stacks are to extend beyond the doorposts as shown in Figure 6.10.

Figure 6.10 Unitized zinc slabs in a through load
LOADING PROCEDURES

6.7.6 Fill the remaining lengthwise void in the doorway area with a floating gate constructed from 2 in. × 4 in. lumber. An example of a floating gate is shown in Figure 6.11.

![Figure 6.11 Example of a floating center gate](image)

6.7.7 Use minimum 2 in. × 4 in. lumber guide rails as doorway protection on both sides of the car. Cut guide rails so that their ends are 8 in. away from the crosswise units in the ends of the car. Secure to the floor with 4 in. nails staggered not more than 18 in. apart. Backup cleats are 24 in. long and secured to the floor with three 4 in. nails each.

6.8 Controlled Floating Loads of Lead Ingots Using Rubber Floor Mats in Boxcars

6.8.1 This loading method is intended for use with “jumbo” lead ingots, approximately 25 in. × 25 in. at the top and tapered to a smaller base, and unitized bar ingots in bundles measuring approximately 22 in. × 22 in. Load planning is key to the success of the loading method. Locate the load so that the weight along both sides of the car is about equal for the entire length of the load. Doorway protection is required to prevent the lading from entering the door recess. Shipments of unitized bar ingots in bundles require side blocking be applied to extend down the outer edges of the outside rows in each end of the car to restrict crosswise movement. The side blocking is applied prior to the application of rubber mats, so as not to secure the mats to the floor. Side blocking is not required when loading “jumbo” lead ingots where the cumulative lateral void space after loading is 14 in. or less.

6.8.2 Nail strips of lumber, 2 in. × 4 in. minimum, to the car floor as side blocking approximately 2 in. from the outside edge of each outside row of bundles of bar ingots in each end of the car. Secure the side blocking with 4 in. nails staggered not more than 18 in. apart. The side blocking should extend from end wall to doorpost.

6.8.3 Load the bundles down the center of the car as shown below. Place the ingots on two 4-ft-wide rubber mats centered in the railcar and covering the car floor from end wall to at least 12 in. beyond the doorway side of the lading. Maintain a 26 in. void at each end wall. The rebonded rubber mats have the following specifications:

<table>
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<th>Table 6.1 Specifications of rebonded rubber mats used with lead ingots</th>
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<td>Hardness Shore A Pts</td>
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<td>Tear</td>
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<td>Coefficient of Friction</td>
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</tbody>
</table>
6.8.4 Depending on the number of ingots to be loaded in the doorway area, center the doorway units on one or two 4-ft-wide rubber mats. The rubber mat(s) should be centered and extend at least 12 in. beyond the edge of the lading.

6.8.5 Nail strips of lumber, 2 in. × 4 in. minimum, to the car floor as doorway protection. Secure to the floor with 4 in. nails staggered not more than 18 in. apart.

Figure 6.12 Controlled floating load of lead ingots
LOADING PROCEDURES

6.9 Unitized Bundles of Cathodes Loaded on Rubber Mats in Non-Cushioned Boxcars

6.9.1 This method is for unitized bundles of cathodes loaded on rubber mats. The load illustrated Figure 6.13 is one example. The number of bundles may vary depending on the dimensions of the cathodes. This loading method was tested in a non-cushioned rail car.

Figure 6.13 Unitized bundles of cathodes on rubber mats

6.9.2 Unitize bundles of cathodes using ¾ in. steel bands, two in each direction.
6.9.3 Load bundles from the ends of the car to the doorway area. Place one rubber mat 24 in. × 24 in. under each bundle. The rebonded rubber mats have the following specifications:

| Specifications of rebonded rubber mats used with unitized bundles of cathodes |
|---|---|---|
| Density | ASTM D-3676 | 46.7 lb./ft³ minimum |
| Thickness | | 0.125 in. |
| Tensile | ASTM D-412 | 200 psi minimum |
| Elongation | ASTM D-412 | 65% minimum |
| Hardness | ASTM D-2240 | Shore A240-60 (porous) |
| Tear | ASTM D-624 | 50 PPI (Die C) minimum |
| Compression Set B | ASTM D-395 | 40 maximum (25% deflection, 158°F/22 hours) |
| Compression Set (Foam) | ASTM D-3676 | 30 maximum (50% deflection, 158°F/22 hours) |
| Compression Properties | ASTM F-36 | 100 psi—15-25% |
| | | 200 psi—30-40% |
| | | 300 psi—40-50% |
| | | 400 psi—45-55% |
| Coefficient of Friction | ASTM D-1894 | 1.20 |

6.9.4 Start loading with one bundle placed squarely in each corner of the rail car at the end walls. Place the next two bundles, turned 45°, on the centerline of the rail car against the end wall bundles. Load the remaining bundles against each sidewall in a diamond pattern as shown in Figure 6.13. The last bundles in the doorway are to be loaded squarely on the centerline of the rail car against the last bundles in the ends of the rail car.

6.9.5 Nail strips of lumber, 2 in. × 4 in. minimum, to the car floor across each door opening as doorway protection. Cut strips to allow at least 8 in. to extend beyond the doorposts on each end. Secure to the floor with 4 in. nails staggered not more than 18 in. apart.
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7.0 DOORWAY PROTECTION

7.1 Overview

7.1.1 Doorway protection is required to prevent lading from falling or shifting out of the doorway or coming in contact with sliding doors. Protect opening with wooden guide rails, steel straps, or other materials of sufficient strength, and adequately secure.

7.1.2 Use flush doorway protection in boxcars with sliding doors to prevent the lading from coming into contact with the side doors or to prevent the weight of the lading bearing against the side doors.

7.2 Unit Loads
To keep lading in position, secure openings with 1 1/4 in. × 0.029 in. steel straps or equivalent, covered with corrugated fiberboard (see paragraph 5.1). If lading is unitized by stretch wrap, shrink film, gluing, or other means, one strap is required for the bottom-layer units and two straps are required for the top-layer units.

7.3 Single-Layer Loads
For single layer loads, nail guide rails, minimum 2 in. × 4 in. lumber, across the doorway with minimum 16d nails, one every 12 in.
## CLOSED CAR LOADING STANDARDS

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<td>1</td>
<td>Minimum Loading Standards for <strong>Freight</strong> in General Purpose Boxcars</td>
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<td>Minimum Loading Standards for <strong>Primary Metal Products</strong> in Closed Cars</td>
<td></td>
<td>Pamphlet No. 37, Minimum Standards for the Safe Loading of Ingots, Pigs, Anodes, Rods and Similar High Density Metallic Commodities in Closed Cars (11/84)</td>
</tr>
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See also:  
*Intermodal Loading Guide for Products in Closed Trailers and Containers (7/2011)*  
*Open Top Loading Rules Manual, Sections 1–7*